

STN	Funkčná bezpečnosť Systémy súvisiace s bezpečnosťou sektora priemyselných procesov Časť 2: Návod na použitie časti 1	STN EN 61511-2 18 0303
------------	---	--

Functional safety - Safety instrumented systems for the process industry sector - Part 2: Guidelines for the application of IEC 61511-1

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 08/17

Obsahuje: EN 61511-2:2017, IEC 61511-2:2016

Oznámením tejto normy sa od 21.04.2020 ruší
STN EN 61511-2 (18 0303) z novembra 2005

125398

Úrad pre normalizáciu, metrológiu a skúšobníctvo Slovenskej republiky, 2017
Podľa zákona č. 264/1999 Z. z. o technických požiadavkách na výrobky a o posudzovaní zhody a o zmene a doplnení niektorých zákonov v znení neskorších predpisov sa slovenská technická norma a časti slovenskej technickej normy môžu rozmnožovať alebo rozširovať len so súhlasom slovenského národného normalizačného orgánu.

EUROPEAN STANDARD

EN 61511-2

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2017

ICS 13.110; 25.040.01

Supersedes EN 61511-2:2004

English Version

**Functional safety - Safety instrumented systems for the process
industry sector - Part 2: Guidelines for the application of IEC
61511-1
(IEC 61511-2:2016)**

Sécurité fonctionnelle - Systèmes instrumentés de sécurité
pour le secteur des industries de transformation - Partie 2:
Lignes directives pour l'application de l'IEC 61511-1
(IEC 61511-2:2016)

Funktionale Sicherheit - PLT-Sicherheitseinrichtungen für
die Prozessindustrie - Teil 2: Anleitungen zur Anwendung
des Teils 1
(IEC 61511-2:2016)

This European Standard was approved by CENELEC on 2016-09-01. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 65A/783/FDIS, future edition 2 of IEC 61511-2, prepared by SC 65A "System aspects" of IEC/TC 65 "Industrial process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61511-2:2017.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-10-21
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2020-04-21

This document supersedes EN 61511-2:2004.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61511-2:2016 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60880:2006	NOTE	Harmonized as EN 60880:2009.
IEC 61025:2006	NOTE	Harmonized as EN 61025:2007.
IEC 61078:2006	NOTE	Harmonized as EN 61078:2006.
IEC 61131-3:2013	NOTE	Harmonized as EN 61131-3:2013.
IEC 61165:2006	NOTE	Harmonized as EN 61165:2006.
IEC 61508-1:2010	NOTE	Harmonized as EN 61508-1:2010.
IEC 61508-2:2010	NOTE	Harmonized as EN 61508-2:2010.
IEC 61508-3:2010	NOTE	Harmonized as EN 61508-3:2010.
IEC 61508-6:2010	NOTE	Harmonized as EN 61508-6:2010.
IEC 61508-6:2010	NOTE	Harmonized as EN 61508-6:2010.
IEC 62061:2005	NOTE	Harmonized as EN 62061:2005.
IEC 62502:2010	NOTE	Harmonized as EN 62502:2010.
IEC 62551:2012	NOTE	Harmonized as EN 62551:2012.
ISO 9000:2015	NOTE	Harmonized as EN ISO 9000:2015.

ISO 10418:2003	NOTE	Harmonized as EN ISO 10418:2003.
ISO/TR 12489:2013	NOTE	Harmonized as CEN ISO/TR 12489:2016.
ISO 17776:2000	NOTE	Harmonized as EN ISO 17776:2002.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61511-1	2016	Functional safety - Safety instrumented systems for the process industry sector - Normative (uon) -- Part 1: Framework, definitions, system, hardware and software requirements	EN 61511-1	2016



INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Functional safety – Safety instrumented systems for the process industry sector –
Part 2: Guidelines for the application of IEC 61511-1: 2016**

**Sécurité fonctionnelle – Systèmes instrumentés de sécurité pour le secteur des industries de transformation –
Partie 2: Lignes directrices pour l'application de l'IEC 61511-1:2016**





THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2016 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, 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 either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

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

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.



INTERNATIONAL STANDARD

NORME INTERNATIONALE



Functional safety – Safety instrumented systems for the process industry sector –

Part 2: Guidelines for the application of IEC 61511-1: 2016

Sécurité fonctionnelle – Systèmes instrumentés de sécurité pour le secteur des industries de transformation –

Partie 2: Lignes directrices pour l'application de l'IEC 61511-1:2016

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 13.110; 25.040.01

ISBN 978-2-8322-3227-9

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	9
INTRODUCTION.....	11
1 Scope.....	13
2 Normative references	13
3 Terms, definitions, and abbreviations	13
Annex A (informative) Guidance for IEC 61511-1.....	14
A.1 Scope	14
A.2 Normative references	14
A.3 Terms, definitions and abbreviations.....	14
A.4 Conformance to the IEC 61511-1:–.....	14
A.5 Management of functional safety	14
A.5.1 Objective	14
A.5.2 Guidance to "Requirements".....	14
A.6 Safety life-cycle requirements.....	23
A.6.1 Objectives.....	23
A.6.2 Guidance to "Requirements".....	23
A.6.3 Guidance to "Application program SIS safety life-cycle requirements"	24
A.7 Verification.....	25
A.7.1 Objective	25
A.7.2 Guidance to "Requirements".....	25
A.8 Process hazard and risk assessment (H&RA)	27
A.8.1 Objectives.....	27
A.8.2 Guidance to "Requirements".....	27
A.9 Allocation of safety functions to protection layers	30
A.9.1 Objective	30
A.9.2 Guidance to "Requirements of the allocation process".....	30
A.9.3 Guidance to "Requirements on the basic process control system as a protection layer".....	32
A.9.4 Guidance to "Requirements for preventing common cause, common mode and dependent failures"	35
A.10 SIS safety requirements specification	36
A.10.1 Objective	36
A.10.2 Guidance to "General requirements".....	36
A.10.3 Guidance to "SIS safety requirements"	36
A.11 SIS design and engineering.....	40
A.11.1 Objective	40
A.11.2 Guidance to "General requirements".....	40
A.11.3 Guidance to "Requirements for system behaviour on detection of a fault".....	47
A.11.4 Guidance to "Hardware fault tolerance"	47
A.11.5 Guidance to "Requirements for selection of devices".....	50
A.11.6 Field devices	53
A.11.7 Interfaces	53
A.11.8 Guidance to "Maintenance or testing design requirements"	55
A.11.9 Guidance to "Quantification of random failure".....	56
A.12 SIS application program development.....	62

A.12.1	Objective	62
A.12.2	Guidance to "General requirements"	62
A.12.3	Guidance to "Application program design"	64
A.12.4	Guidance to "Application program implementation"	66
A.12.5	Guidance to "Requirements for application program verification (review and testing)"	67
A.12.6	Guidance to "Requirements for application program methodology and tools"	70
A.13	Factory acceptance testing (FAT)	73
A.13.1	Objectives.....	73
A.13.2	Guidance to "Recommendations".....	73
A.14	SIS installation and commissioning.....	73
A.14.1	Objectives.....	73
A.14.2	Guidance to "Requirements".....	73
A.15	SIS safety validation	74
A.15.1	Objective	74
A.15.2	Guidance to "Requirements".....	74
A.16	SIS operation and maintenance.....	74
A.16.1	Objectives.....	74
A.16.2	Guidance to "Requirements".....	75
A.16.3	Proof testing and inspection	76
A.17	SIS modification.....	78
A.17.1	Objective	78
A.17.2	Guidance to "Requirements".....	79
A.18	SIS decommissioning.....	79
A.18.1	Objectives.....	79
A.18.2	Guidance to "Requirements".....	79
A.19	Information and documentation requirements.....	80
A.19.1	Objectives.....	80
A.19.2	Guidance to "Requirements".....	80
Annex B (informative)	Example of SIS logic solver application program development using function block diagram.....	81
B.1	General.....	81
B.2	Application program development and validation philosophy	81
B.3	Application description	82
B.3.1	General	82
B.3.2	Process description.....	82
B.3.3	Safety instrumented functions	83
B.3.4	Risk reduction and domino effects	84
B.4	Application program safety life-cycle execution.....	84
B.4.1	General	84
B.4.2	Inputs to application program SRS development.....	84
B.4.3	Application program design and development	87
B.4.4	Application program production	101
B.4.5	Application program verification and testing.....	101
B.4.6	Validation	101
Annex C (informative)	Considerations when converting from NP technologies to PE technologies.....	102

Annex D (informative) Example of how to get from a piping and instrumentation diagram (P&ID) to application program	104
Annex E (informative) Methods and tools for application programming	107
E.1 Typical toolset for application programming	107
E.2 Rules and constraints for application program design	108
E.3 Rules and constraints for application programming	108
Annex F (informative) Example SIS project illustrating each phase of the safety life cycle with application program development using relay ladder language	110
F.1 Overview	110
F.2 Project definition	110
F.2.1 General	110
F.2.2 Conceptual planning	111
F.2.3 Process hazards analysis	111
F.3 Simplified process description	111
F.4 Preliminary design	113
F.5 IEC 61511 application	113
F.5.1 General	113
F.5.2 Step F.1: Hazard & risk assessment	117
F.5.3 Hazard identification	117
F.5.4 Preliminary hazard evaluation	117
F.5.5 Accident history	117
F.6 Preliminary process design safety considerations	120
F.7 Recognized process hazards	120
F.8 Process design definitions strategy	121
F.9 Preliminary hazard assessment	124
F.9.1 General	124
F.9.2 Step F.2: Allocation of safety functions	128
F.10 SIF safety integrity level determination	129
F.11 Layer of protection analysis (LOPA) applied to example	129
F.12 Tolerable risk criteria	130
F.13 Step F.3: SIS safety requirements specifications	133
F.13.1 Overview	133
F.13.2 Input requirements	133
F.13.3 Safety functional requirements	134
F.13.4 Safety integrity requirements	135
F.14 Functional description and conceptual design	136
F.14.1 Narrative for example reactor system logic	136
F.15 SIL verification calculations	137
F.16 Application program requirements	144
F.17 Step F.4: SIS safety life-cycle	151
F.18 Technology and device selection	151
F.18.1 General	151
F.18.2 Logic solver	151
F.18.3 Sensors	152
F.18.4 Final elements	152
F.18.5 Solenoid valves	152
F.18.6 Emergency vent valves	153
F.18.7 Modulating valves	153
F.18.8 Bypass valves	153

F.18.9	Human-machine interfaces (HMIs).....	153
F.18.10	Separation.....	154
F.19	Common cause and systematic failures.....	155
F.19.1	General.....	155
F.19.2	Diversity.....	155
F.19.3	Specification errors.....	155
F.19.4	Hardware design errors.....	155
F.19.5	Software design errors.....	156
F.19.6	Environmental overstress.....	156
F.19.7	Temperature.....	156
F.19.8	Humidity.....	156
F.19.9	Contaminants.....	157
F.19.10	Vibration.....	157
F.19.11	Grounding.....	157
F.19.12	Power line conditioning.....	157
F.19.13	Electro-magnetic compatibility (EMC).....	157
F.19.14	Utility sources.....	158
F.19.15	Sensors.....	159
F.19.16	Process corrosion or fouling.....	159
F.19.17	Maintenance.....	159
F.19.18	Susceptibility to mis-operation.....	159
F.19.19	SIS architecture.....	159
F.20	SIS application program design features.....	160
F.21	Wiring practices.....	161
F.22	Security.....	161
F.23	Step F.5: SIS installation, commissioning, validation.....	162
F.24	Installation.....	162
F.25	Commissioning.....	163
F.26	Documentation.....	164
F.27	Validation.....	164
F.28	Testing.....	165
F.29	Step F.6: SIS operation and maintenance.....	178
F.30	Step F.7: SIS Modification.....	181
F.31	Step F.8: SIS decommissioning.....	181
F.32	Step F.9: SIS verification.....	181
F.33	Step F.10: Management of functional safety and SIS FSA.....	182
F.34	Management of functional safety.....	183
F.34.1	General.....	183
F.34.2	Competence of personnel.....	183
F.35	Functional safety assessment.....	183
Annex G (informative)	Guidance on developing application programming practices.....	184
G.1	Purpose of this guidance.....	184
G.2	Generic safe application programming attributes.....	184
G.3	Reliability.....	184
G.3.1	General.....	184
G.3.2	Predictability of memory utilisation.....	185
G.3.3	Predictability of control flow.....	186
G.3.4	Accounting for precision and accuracy.....	188
G.3.5	Predictability of timing.....	190

G.4	Predictability of mathematical or logical result.....	190
G.5	Robustness.....	191
G.5.1	General	191
G.5.2	Controlling use of diversity	191
G.5.3	Controlling use of exception handling	192
G.5.4	Checking input and output.....	193
G.6	Traceability	194
G.6.1	General	194
G.6.2	Controlling use of built-in functions.....	194
G.6.3	Controlling use of compiled libraries	194
G.7	Maintainability.....	194
G.7.1	General	194
G.7.2	Readability.....	195
G.7.3	Data abstraction.....	198
G.7.4	Functional cohesiveness	199
G.7.5	Malleability	199
G.7.6	Portability	199
	Bibliography	201
	Figure 1 – Overall framework of IEC 61511 series	12
	Figure A.1 – Application program V-Model.....	25
	Figure A.2 – Independence of a BPCS protection layer and an initiating source in the BPCS	34
	Figure A.3 – Independence of two protection layers allocated to the BPCS	35
	Figure A.4 – Relationship of system, SIS hardware, and SIS application program.....	39
	Figure A.5 – Illustration of uncertainties on a reliability parameter.....	60
	Figure A.6 – Illustration of the 70 % confidence upper bound	61
	Figure A.7 – Typical probabilistic distribution of target results from Monte Carlo simulation.....	62
	Figure B.1 – Process flow diagram for SIF 02.01	83
	Figure B.2 – Process flow diagram for SIF 06.02	84
	Figure B.3 – Functional specification of SIF02.01 and SIF 06.02.....	85
	Figure B.4 – SIF 02.01 hardware functional architecture	85
	Figure B.5 – SIF 06.02 hardware functional architecture	86
	Figure B.6 – Hardware specification for SOV extracted from piping and instrumentation diagram.....	86
	Figure B.7 – SIF 02.01 hardware physical architecture	87
	Figure B.8 – SIF 06.02 hardware physical architecture	87
	Figure B.9 – Hierarchical structure of model integration	91
	Figure B.10 – Hierarchical structure of model integration including models of safety properties and of BPCS logic	93
	Figure B.11 – State transition diagram	94
	Figure B.12 – SOV typical block diagram.....	95
	Figure B.13 – SOV typical model block diagram	96
	Figure B.14 – Typical model block diagram implementation – BPCS part.....	98
	Figure B.15 – SOV application program typical model implementation – SIS part	99

Figure B.16 – Complete model for final implementation model checking	101
Figure D.1 – Example of P&ID for an oil and gas separator	104
Figure D.2 – Example of (part of) an ESD cause & effect diagram (C&E).....	105
Figure D.3 – Example of (part of) an application program in a safety PLC function block programming	106
Figure F.1 – Simplified flow diagram: the PVC process	112
Figure F.2 – SIS safety life-cycle phases and FSA stages.....	114
Figure F.3 – Example of the preliminary P&ID for PVC reactor unit	123
Figure F.4 – SIF S-1 Bubble diagram showing the PFD_{avg} of each SIS device.....	139
Figure F.5 – S-1 Fault tree	140
Figure F.6 – SIF S-2 Bubble diagram showing the PFD_{avg} of each SIS device.....	141
Figure F.7 – SIF S-2 fault tree.....	142
Figure F.8 – SIF S-3 Bubble diagram showing the PFD_{avg} of each SIS device.....	143
Figure F.9 – SIF S-3 fault tree.....	144
Figure F.10 – P&ID for PVC reactor unit SIF.....	145
Figure F.11 – Legend (1 of 5).....	146
Figure F.12 – SIS for the VCM reactor.....	160
Table B.1 – Modes of operation specification.....	88
Table B.2 – State transition table	93
Table F.1 – SIS safety life-cycle overview	115
Table F.2 – SIS safety life-cycle – Box 1	117
Table F.3 – Some physical properties of vinyl chloride.....	119
Table F.4 – What-If/Checklist	125
Table F.5 – HAZOP	126
Table F.6 – Partial summary of hazard assessment for SIF strategy development	127
Table F.7 – SIS safety life-cycle – Box 2	129
Table F.8 – Tolerable risk ranking	131
Table F.9 – VCM reactor example: LOPA based integrity level.....	132
Table F.10 – SIS safety life-cycle – Box 3	133
Table F.11 – Safety instrumented functions and SILs.....	133
Table F.12 – Functional relationship of I/O for the SIF(s)	134
Table F.13 – SIS sensors, normal operating range & trip points	134
Table F.14 – Cause and effect diagram	137
Table F.15 – MTTFd figures of SIS F.1 devices	138
Table F.16 – SIS safety life-cycle – Box 4	151
Table F.17 – SIS safety life-cycle – Box 5	162
Table F.18 – List of instrument types and testing procedures used.....	166
Table F.19 – Interlock check procedure bypass/simulation check sheet.....	178
Table F.20 – SIS safety life-cycle – Box 6	178
Table F.21 – SIS trip log	179
Table F.22 – SIS device failure log.....	179
Table F.23 – SIS safety life-cycle – Box 7	181

Table F.24 – SIS safety life-cycle – Box 8	181
Table F.25 – SIS safety life-cycle – Box 9	182
Table F.26 – SIS safety life-cycle – Box 10.....	182

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FUNCTIONAL SAFETY –
SAFETY INSTRUMENTED SYSTEMS
FOR THE PROCESS INDUSTRY SECTOR –****Part 2: Guidelines for the application of IEC 61511-1:2016**

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.
- 2) The formal decisions or agreements of 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 IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61511-2 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2003. This edition constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition:

- guidance examples based on all phases of the safety life cycle provided based on usage experience with IEC61511 1st edition;
- annexes replaced to address transition from software to application programming.

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

FDIS	Report on voting
65A/783/FDIS	65A/787/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.

This International Standard is to be read in conjunction with IEC 61511-1. It is based on the second edition of that standard.

A list of all parts in the IEC 61511 series, published under the general title *Functional safety – Safety instrumented systems for the process industry sector*, 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Safety instrumented systems (SISs) have been used for many years to perform safety instrumented functions (SIFs) in the process industries. If instrumentation is to be effectively used for SIFs, it is essential that this instrumentation achieves certain minimum standards.

The IEC 61511 series addresses the application of SISs for the process industries. It also deals with the interface between SISs and other safety systems in requiring that a process H&RA be carried out. The SIS includes sensors, logic solvers and final elements.

The IEC 61511 series has two concepts, which are fundamental to its application; SIS safety life-cycle and the safety integrity level (SIL). The SIS safety life-cycle forms the central framework which links together most of the concepts in this International Standard.

The SIS logic solvers addressed include Electrical (E)/Electronic (E)/ and Programmable Electronic (PE) technology. Where other technologies are used for logic solvers, the basic principles of this standard can be applied to ensure the functional safety requirements were met. The IEC 61511 series also addresses the SIS sensors and final elements regardless of the technology used. The IEC 61511 series has been developed as a process sector implementation of the IEC 61508 series. The IEC 61511 series is process industry specific within the framework of the IEC 61508 series.

The IEC 61511 series sets out an approach for SIS safety life-cycle activities to achieve these minimum standards. This approach has been adopted in order that a rational and consistent technical policy is used. The objective of this part of IEC 61511 is to provide guidance on how to comply with IEC 61511-1:2016.

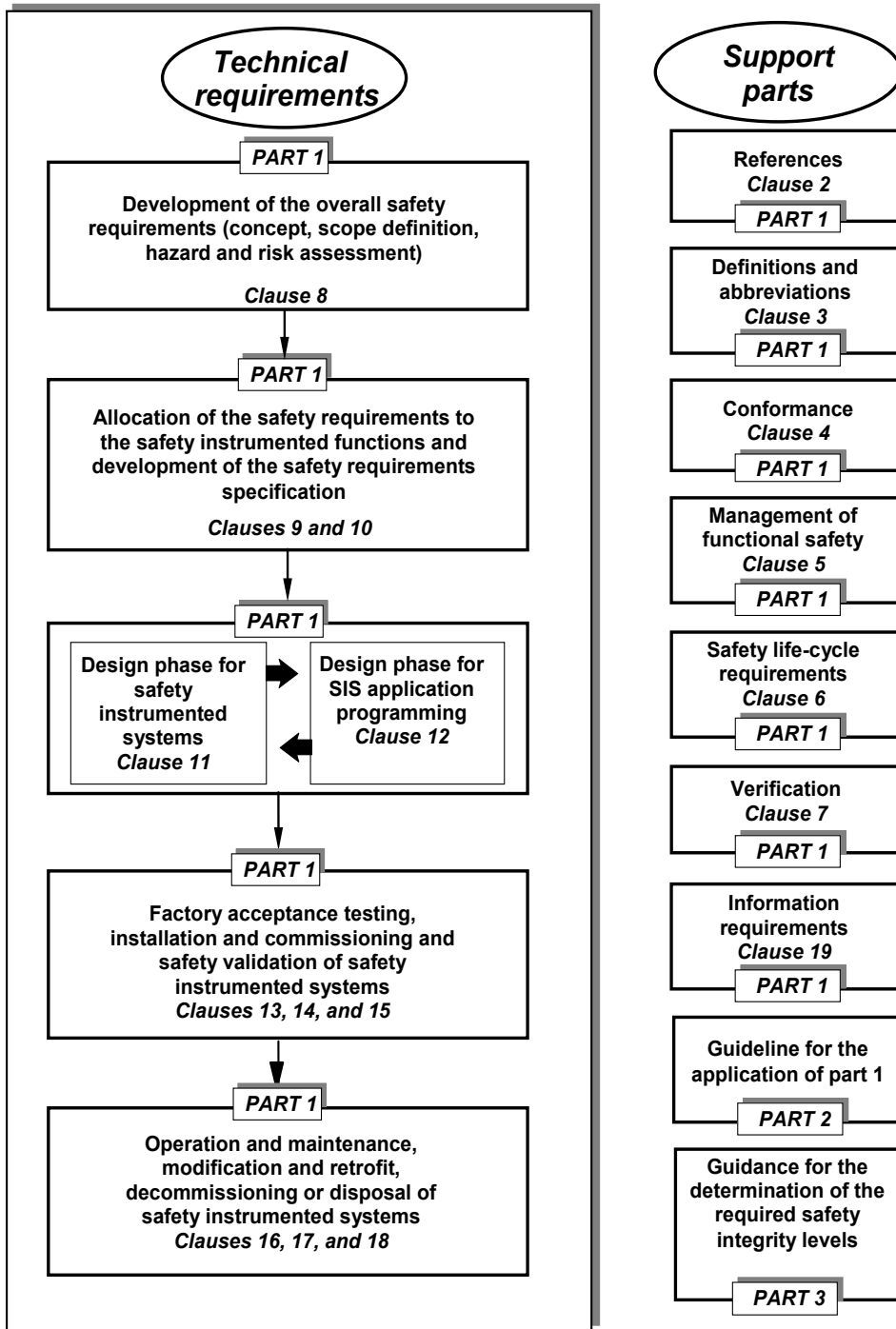
To facilitate use of IEC 61511-1:2016, the clause numbers provided in Annex A (informative) are identical to the corresponding normative text in IEC 61511-1:2016 except for the “A” notation.

In most situations, safety is best achieved by an inherently safe process design whenever practicable, combined, if necessary, with a number of protective systems which rely on different technologies (e.g., chemical, mechanical, hydraulic, pneumatic, electrical, electronic, thermodynamic (e.g., flame arrestors), programmable electronic) which manage any residual identified risk. Any safety strategy considers each individual SIS in the context of the other protective systems. To facilitate this approach, IEC 61511-1:2016:

- requires that a H&RA is carried out to identify the overall safety requirements;
- requires that an allocation of the safety requirements to the safety functions and related safety systems, such as the SIS(s), is carried out;
- works within a framework which is applicable to all instrumented methods of achieving functional safety;
- details the use of certain activities, such as safety management, which may be applicable to all methods of achieving functional safety.
- addresses relevant SIS safety life-cycle stages from initial concept, through design, implementation, operation and maintenance and decommissioning;
- enables existing or new country specific process industry standards to be harmonized with this standard.

The IEC 61511 series is intended to lead to a high level of consistency (e.g., of underlying principles, terminology, information) within the process industries. This should have both safety and economic benefits.

Figure 1 below shows the overall framework of the IEC 61511 series.



IEC

Figure 1 – Overall framework of IEC 61511 series

FUNCTIONAL SAFETY – SAFETY INSTRUMENTED SYSTEMS FOR THE PROCESS INDUSTRY SECTOR –

Part 2: Guidelines for the application of IEC 61511-1:2016

1 Scope

This part of IEC 61511 provides guidance on the specification, design, installation, operation and maintenance of SIFs and related SIS as defined in IEC 61511-1:2016.

NOTE 1 Annex A (informative) has been organized so that each clause and subclause number therein addresses the corresponding clause and subclause number in IEC 61511-1:2016 except for being preceded by "A".

NOTE 2 Annex A now contains material previously in the body of the first edition. These changes are required for compliance with IEC rules which prohibit a standard being wholly informative.

NOTE 3 To achieve maximum use of this guideline;

- review the section guidance as well as the specific clause guidance. (e.g., when looking for guidance on 5.2.6.1.3, consider guidance in 5.2.6);
- when specific clause guidance is not provided (e.g.; no further guidance provided), consider reviewing the section guidance as well, as it can be applicable).

NOTE 4 Examples given in the Annexes of this Standard are intended only as case specific examples of implementing IEC 61511 requirements in a specific instance, and the user should satisfy themselves that the chosen methods and techniques are appropriate to their situation.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61511-1:2016, *Functional safety – Safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and application programming requirements*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN