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Safety of machinery - Functional safety of safety-related control systems (IEC 62061:2021 + IEC 62061:2021/AMD1:2024)

EVS
EESTI STANDARDIMIS- JA AKREDITEERIMISKESKUS
ESTONIAN CENTRE FOR STANDARDISATION AND ACCREDITATION

EESTI STANDARDI EESSÕNA	NATIONAL FOREWORD
See Eesti standard EVS-EN IEC 62061:2021 +A1:2024 sisaldab Euroopa standardi EN IEC 62061:2021 ja selle muudatuse A1:2024 ingliskeelset teksti.	This Estonian standard EVS-EN IEC 62061:2021+A1:2024 consists of the English text of the European standard EN IEC 62061:2021 and its amendment A1:2024.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas. Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 23.07.2021, muudatus A1 28.06.2024.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation. Date of Availability of the European standard is 23.07.2021, for A1 28.06.2024.
Muudatusega A1 lisatud või muudetud teksti algus ja lõpp on tekstis tähistatud sümbolitega A1〉 〈A1. Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	The start and finish of text introduced or altered by amendment A1 is indicated in the text by tags A1〉 〈A1. The standard is available from the Estonian Centre for Standardisation and Accreditation.

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ICS 13.110; 25.040.99; 29.020

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 62061 + A1

July 2021, June 2024

ICS 13.110; 25.040.99; 29.020

Supersedes EN 62061:2005 and all of its amendments and corrigenda (if any)

English Version

Safety of machinery - Functional safety of safety-related control systems (IEC 62061:2021 + IEC 62061:2021/AMD1:2024)

Sécurité des machines - Sécurité fonctionnelle des systèmes de commande relatifs à la sécurité (IEC 62061:2021 + IEC 62061:2021/AMD1:2024)

Sicherheit von Maschinen - Funktionale Sicherheit sicherheitsbezogener Steuerungssysteme (IEC 62061:2021 + IEC 62061:2021/AMD1:2024)

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

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Ref. No. EN IEC 62061:2021 E
+ EN IEC 62061:2021/A1:2024 E

European foreword

The text of document 44/885/FDIS, future edition 2 of IEC 62061, prepared by IEC/TC 44 "Safety of machinery - Electrotechnical aspects" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62061:2021.

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)	2022-01-26
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2024-04-26

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IEC 60068 (series)	NOTE	Harmonized as EN 60068 (series)
IEC 60364-4-41:2005	NOTE	Harmonized as HD 60364-4-41:2017
IEC 60529	NOTE	Harmonized as EN 60529
IEC 60721 (series)	NOTE	Harmonized as EN 60721-3-9:1993/A1 (series)
IEC 60812	NOTE	Harmonized as EN IEC 60812
IEC 60947-4-1:2018	NOTE	Harmonized as EN IEC 60947-4-1:2019 (not modified)
IEC 60947-5-1	NOTE	Harmonized as EN 60947-5-1
IEC 60947-5-3	NOTE	Harmonized as EN 60947-5-3
IEC 60947-5-5	NOTE	Harmonized as EN 60947-5-5
IEC 60947-5-8	NOTE	Harmonized as EN IEC 60947-5-8
IEC 61000-6-7	NOTE	Harmonized as EN 61000-6-7
IEC 61025:2006	NOTE	Harmonized as EN 61025:2007 (not modified)
IEC 61131-2:2017	NOTE	Harmonized as EN 61131-2:2017 (not modified) to be published
IEC 61131-6:2012	NOTE	Harmonized as EN 61131-6:2012 (not modified)

IEC 61140:2016	NOTE	Harmonized as EN 61140:2016 (not modified)
IEC 61165	NOTE	Harmonized as EN 61165
IEC 61204-7:2016	NOTE	Harmonized as EN IEC 61204-7:2018 (not modified)
IEC 61310 (series)	NOTE	Harmonized as EN 61310 (series)
IEC 61326-3-1	NOTE	Harmonized as EN 61326-3-1
IEC 61496 (series)	NOTE	Harmonized as EN IEC 61496 (series)
IEC 61508-1:2010	NOTE	Harmonized as EN 61508-1:2010 (not modified)
IEC 61508-4:2010	NOTE	Harmonized as EN 61508-4:2010 (not modified)
IEC 61508-5:2010	NOTE	Harmonized as EN 61508-5:2010 (not modified)
IEC 61508-6:2010	NOTE	Harmonized as EN 61508-6:2010 (not modified)
IEC 61508-7:2010	NOTE	Harmonized as EN 61508-7:2010 (not modified)
IEC 61511 (series)	NOTE	Harmonized as EN 61511 (series)
IEC 61511-1:2016	NOTE	Harmonized as EN 61511-1:2017 (not modified)
IEC 61511-1:2016/A1:2017	NOTE	Harmonized as EN 61511-1:2017/A1:2017 (not modified)
IEC 61511-3:2016	NOTE	Harmonized as EN 61511-3:2017 (not modified)
IEC 61649	NOTE	Harmonized as EN 61649
IEC 61709:2017	NOTE	Harmonized as EN 61709:2017 (not modified)
IEC 61784-3 (series)	NOTE	Harmonized as EN 61784-3 (series)
IEC 61784-3:2016	NOTE	Harmonized as EN 61784-3:2016 (not modified)
IEC 61800-5-2	NOTE	Harmonized as EN 61800-5-2
IEC 61810 (series)	NOTE	Harmonized as EN 61810 (series)
IEC 62443 (series)	NOTE	Harmonized as EN IEC 62443 (series)
IEC 62477 (series)	NOTE	Harmonized as EN IEC 62477 (series)
IEC 62502	NOTE	Harmonized as EN 62502
ISO/IEC 27001:2013	NOTE	Harmonized as EN ISO/IEC 27001:2017 (not modified)
ISO 4413:2010	NOTE	Harmonized as EN ISO 4413:2010 (not modified)
ISO 4414:2010	NOTE	Harmonized as EN ISO 4414:2010 (not modified)
ISO 11161:2007	NOTE	Harmonized as EN ISO 11161:2007 (not modified)
ISO 13850:2015	NOTE	Harmonized as EN ISO 13850:2015 (not modified)
ISO 13851:2019	NOTE	Harmonized as EN ISO 13851:2019 (not modified)
ISO 13855:2010	NOTE	Harmonized as EN ISO 13855:2010 (not modified)
ISO 14118:2017	NOTE	Harmonized as EN ISO 14118:2018 (not modified)
ISO 14119:2013	NOTE	Harmonized as EN ISO 14119:2013 (not modified)
ISO/TR 22100-4:2018	NOTE	Harmonized as CEN ISO/TR 22100-4:2020 (not modified)

A1⟩ Amendment A1 European foreword

The text of document 44/1020/FDIS, future Amendment 1 of IEC 62061, prepared by IEC/TC 44 "Safety of machinery - Electrotechnical aspects" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62061:2021/A1:2024.

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) 2024-12-28
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For the relationship with EU Legislation, see informative Annex ZZ, which is an integral part of this document.

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EC 61784-3:2021	NOTE	Approved as EN IEC 61784-3:2021 (not modified)
IEC/TS 63074:2023	NOTE	Approved as CLC IEC/TS 63074:2024 (not modified)
IEC/TS 63394:2023	NOTE	Approved as CLC IEC/TS 63394:2024 (not modified)

⟨A1

IEC 62061

Edition 2.1 2024-03
CONSOLIDATED VERSION

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Safety of machinery – Functional safety of safety-related control systems

IEC 62061:2021-03+AMD1:2024-03 CSV(en)

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IEC 62061

Edition 2.1 2024-03
CONSOLIDATED VERSION

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Safety of machinery – Functional safety of safety-related control systems

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 13.110; 25.040.99; 29.020

ISBN 978-2-8322-8675-3

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SAFETY OF MACHINERY –
FUNCTIONAL SAFETY OF SAFETY-RELATED CONTROL SYSTEMS

FOREWORD

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IEC 62061 has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects. It is an International Standard.

This second edition cancels and replaces the first edition, published in 2005, Amendment 1:2012 and Amendment 2:2015. This edition constitutes a technical revision.

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

– structure has been changed and contents have been updated to reflect the design process of the safety function,

– standard extended to non-electrical technologies,

– definitions updated to be aligned with IEC 61508-4,

– functional safety plan introduced and configuration management updated (Clause 4),

– requirements on parametrization expanded (Clause 6),

– reference to requirements on security added (Subclause 6.8),

– requirements on periodic testing added (Subclause 6.9),

- various improvements and clarification on architectures and reliability calculations (Clause 6 and Clause 7),
- shift from "SILCL" to "maximum SIL" of a subsystem (Clause 7),
- use cases for software described including requirements (Clause 8),
- requirements on independence for software verification (Clause 8) and validation activities (Clause 9) added,
- new informative annex with examples (Annex G),
- new informative annexes on typical MTTF_D values, diagnostics and calculation methods for the architectures (Annex C, Annex D and Annex H).

The text of this International Standard is based on the following documents:

Draft	Report on voting
44/885/FDIS	44/888/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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A1 Amendment A1 FOREWORD

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Amendment 1 to IEC 62061:2021 has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects.

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

Draft	Report on voting
44/1020/FDIS	44/1024/RVD

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

The language used for the development of this Amendment is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications/.

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- reconfirmed,
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INTRODUCTION

As a result of automation, demand for increased production and reduced operator physical effort, Safety-related Control Systems (referred to as SCS) of machines play an increasing role in the achievement of overall machine safety. Furthermore, the SCS themselves increasingly employ complex electronic technology.

IEC 62061 specifies requirements for the design and implementation of safety-related control systems of machinery. This document is machine sector specific within the framework of IEC 61508.

NOTE While IEC 62061 and ISO 13849-1 are using different methodologies for the design of safety related control systems, they intend to achieve the same risk reduction.

This International Standard is intended for use by machinery designers, control system manufacturers and integrators, and others involved in the specification, design and validation of an SCS. It sets out an approach and provides requirements to achieve the necessary performance and facilitates the specification of the safety functions intended to achieve the risk reduction.

This document provides a machine sector specific framework for functional safety of an SCS of machines. It only covers those aspects of the safety lifecycle that are related to safety requirements allocation through to safety validation. Requirements are provided for information for safe use of SCS of machines that can also be relevant to later phases of the lifecycle of an SCS.

There are many situations on machines where SCS are employed as part of safety measures that have been provided to achieve risk reduction. A typical case is the use of an interlocking guard that, when it is opened to allow access to the danger zone, signals the safety related parts of the machine control system to stop hazardous machine operation. In automation, the machine control system that is used to achieve correct operation of the machine process often contributes to safety by mitigating risks associated with hazards arising directly from control system failures. This document gives a methodology and requirements to:

- assign the required safety integrity for each safety function to be implemented by SCS;
- enable the design of the SCS appropriate to the assigned safety (control) function(s);
- integrate safety-related subsystems designed in accordance with other applicable functional safety-related standards (see 6.3.4);
- validate the SCS.

This document is intended to be used within the framework of systematic risk reduction, in conjunction with risk assessment described in ISO 12100. Suggested methodologies for a safety integrity assignment are given in informative Annex A.

SAFETY OF MACHINERY –
FUNCTIONAL SAFETY OF SAFETY-RELATED CONTROL SYSTEMS

1 Scope

This International Standard specifies requirements and makes recommendations for the design, integration and validation of safety-related control systems (SCS) for machines. It is applicable to control systems used, either singly or in combination, to carry out safety functions on machines that are not portable by hand while working, including a group of machines working together in a co-ordinated manner.

This document is a machinery sector specific standard within the framework of IEC 61508 (all parts).

The design of complex programmable electronic subsystems or subsystem elements is not within the scope of this document. This is in the scope of IEC 61508 or standards linked to it; see Figure 1.

NOTE 1 Elements such as systems on chip or microcontroller boards are considered complex programmable electronic subsystems.

The main body of this sector standard specifies general requirements for the design, and verification of a safety-related control system intended to be used in high/continuous demand mode.

This document:

- is concerned only with functional safety requirements intended to reduce the risk of hazardous situations;
- is restricted to risks arising directly from the hazards of the machine itself or from a group of machines working together in a co-ordinated manner;

  NOTE 2 Requirements to mitigate risks arising from other hazards are provided in relevant sector standards. For example, where a machine(s) is part of a process activity, additional information is available in IEC 61511.

This document does not cover

- electrical hazards arising from the electrical control equipment itself (e.g. electric shock – see IEC 60204-1);
- other safety requirements necessary at the machine level such as safeguarding;
- specific measures for security aspects – see ⟦A1⟩ IEC TS 63074 ⟨A1⟧.

This document is not intended to limit or inhibit technological advancement.

Figure 1 illustrates the scope of this document.

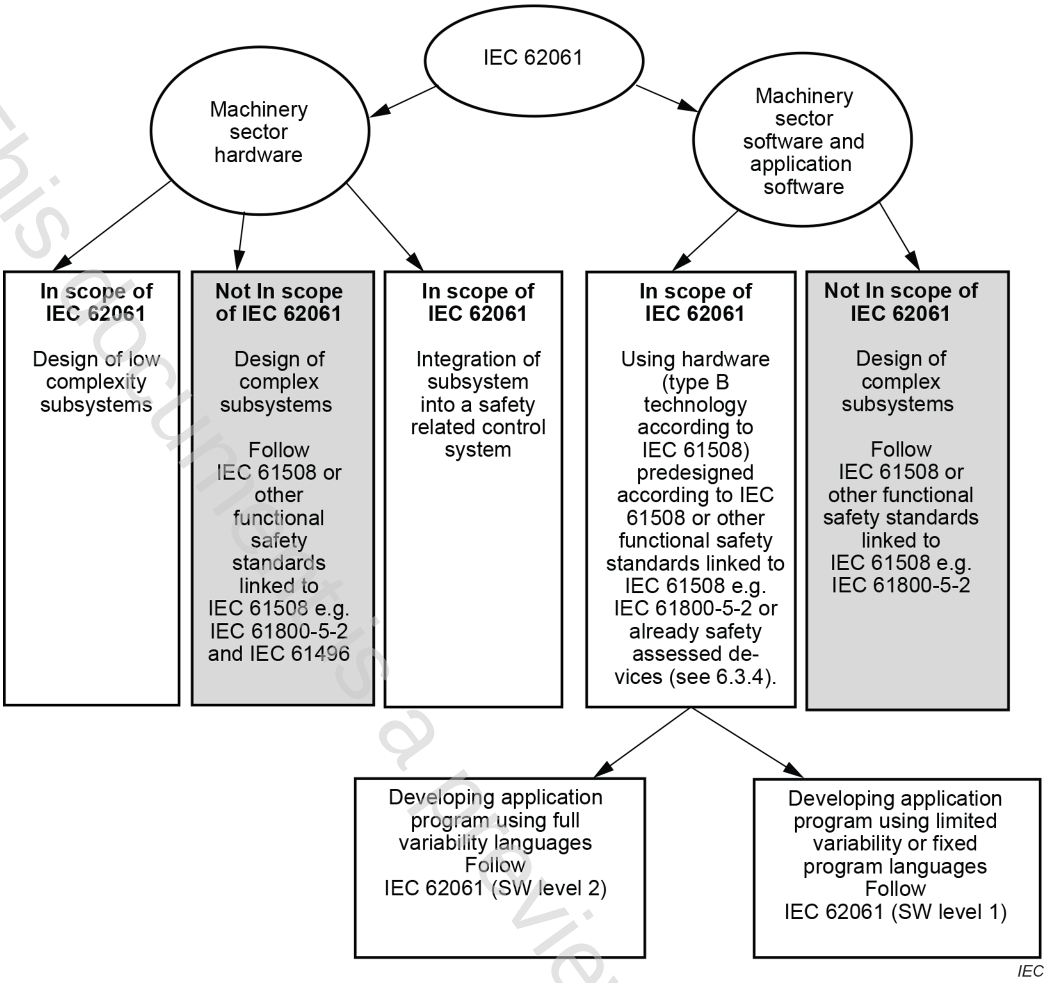
IEC 62061
Machinery sector hardware
Machinery sector software and application software
In scope of IEC 62061
Design of low complexity subsystems
Not In scope of IEC 62061
Design of complex subsystems
Follow IEC 61508 or other functional safety standards linked to IEC 61508 e.g. IEC 61800-5-2 and IEC 61496
In scope of IEC 62061
Integration of subsystem into a safety related control system
In scope of IEC 62061
Using hardware (type B technology according to IEC 61508) predesigned according to IEC 61508 or other functional safety standards linked to IEC 61508 e.g. IEC 61800-5-2 or already safety assessed devices (see 6.3.4).
Not In scope of IEC 62061
Design of complex subsystems
Follow IEC 61508 or other functional safety standards linked to IEC 61508 e.g. IEC 61800-5-2
Developing application program using full variability languages Follow IEC 62061 (SW level 2)
Developing application program using limited variability or fixed program languages Follow IEC 62061 (SW level 1)
IEC

Figure 1 – Scope of this document

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 60204-1:2016, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 61000-1-2:2016, *Electromagnetic compatibility (EMC) – Part 1-2: General – Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems*

IEC 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements*

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

ISO 13849 (all parts), *Safety of machinery – Safety-related parts of control systems*

ISO 13849-1:2015, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*

ISO 13849-2:2012, *Safety of machinery – Safety-related parts of control systems – Part 2: Validation*

3 Terms, definitions and abbreviations

3.1 Alphabetical list of definitions

Terms used throughout IEC 62061 are given in Table 1. Also included are some common abbreviations related to machinery safety.

Table 1 – Terms used in IEC 62061

Term	Definition number
application software	3.2.59
architectural constraint	3.2.46
architecture	3.2.45
average frequency of dangerous failure per hour (PFH)	3.2.29
average probability of dangerous failure on demand (PFD_{avg})	3.2.31
baseline (configuration)	3.2.67
bypass	3.2.17
common cause failure (CCF)	3.2.56
complex component	3.2.8
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diagnostic test interval	3.2.50
embedded software	3.2.60
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