IEC 62061

Edition 2.2 2026-03

INTERNATIONAL STANDARD

CONSOLIDATED VERSION

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

ICS 13.110; 25.040.99; 29.020

ISBN 978-2-8327-1166-8

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch[. IEC/ shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

IEC 62061 edition 2.2 contains the second edition (2021-03) [documents 44/885/FDIS and 44/888/RVD], its amendment 1 (2024-03) [documents 44/1020/FDIS and 44/1024/RVD] and its amendment 2 (2026-03) [documents 44/1074/FDIS and 44/1081/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

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

This second 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 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.

The committee has decided that the contents of this document and its amendments will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

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.

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 IEC ~~TR~~ TS 63074.

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

Figure 1 illustrates the scope of this document.

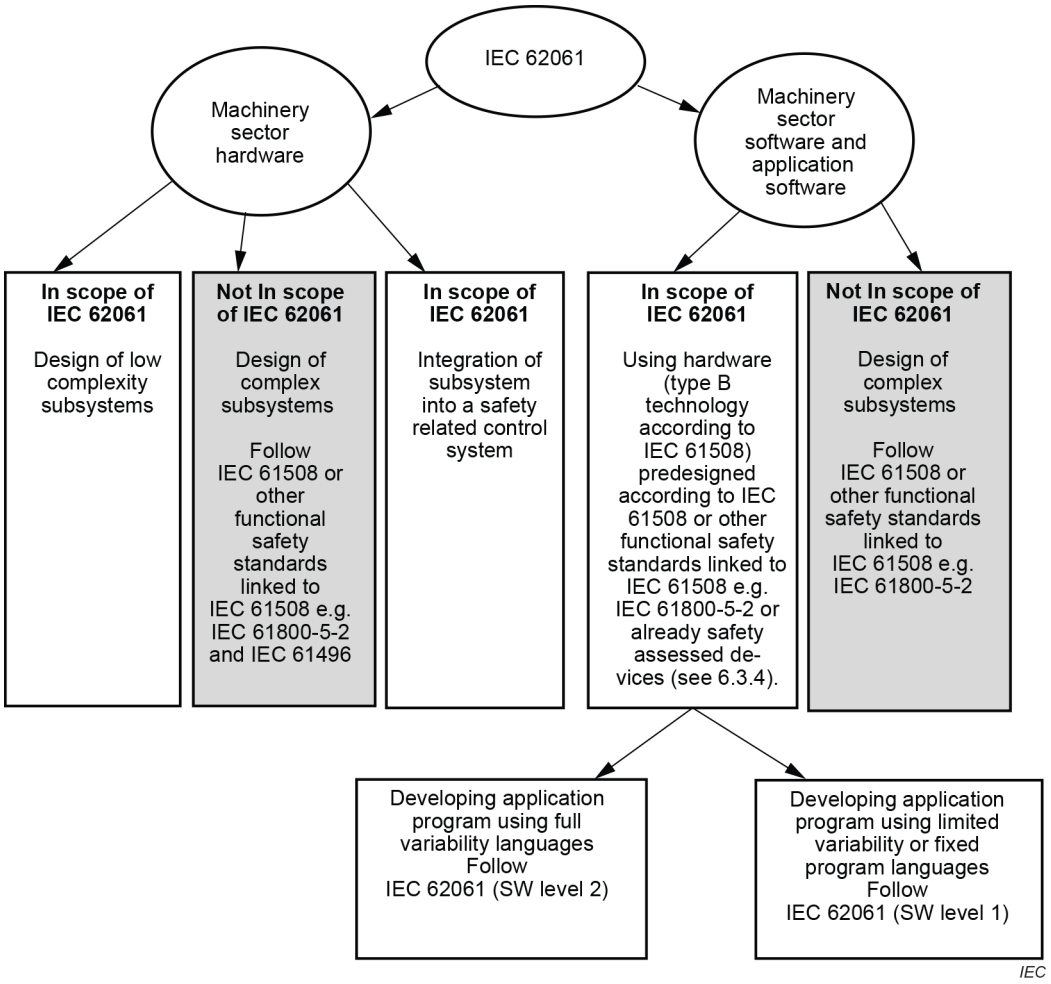

Figure 1 – Scope of this document

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*

Bibliography

IEC 60050-192:2015, *International Electrotechnical Vocabulary (IEV) – Part 192: Dependability*

IEC 60068 (all parts), *Environmental testing*

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*
IEC 60364-4-41:2005/AMD1:2017

IEC 60449:1973[1], *Voltage bands for electrical installations of buildings*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60721 (all parts), *Classification of environmental conditions*

IEC 60812, *Failure modes and effects analysis (FMEA and FMECA)*

IEC 60947 (all parts), *Low-voltage switchgear and controlgear*

IEC 60947-4-1:2018, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*

IEC 60947-5-1, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

IEC 60947-5-3, *Low-voltage switchgear and controlgear – Part 5-3: Control circuit devices and switching elements – Requirements for proximity devices with defined behaviour under fault conditions (PDDB)*

IEC 60947-5-5, *Low-voltage switchgear and controlgear – Part 5-5: Control circuit devices and switching elements – Electrical emergency stop device with mechanical latching function*

IEC 60947-5-8, *Low-voltage switchgear and controlgear – Part 5-8: Control circuit devices and switching elements – Three-position enabling switches*

IEC 60950-1, *Information technology equipment – Safety – Part 1: general requirements*

IEC 61000-6-7, *Electromagnetic compatibility (EMC) – Part 6-7: Generic standards – Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations*

IEC 61025:2006, *Fault tree analysis (FTA)*

IEC 61131-2:2017, *Industrial-process measurement and control – Programmable controllers – Part 2: Equipment requirements and tests*

IEC 61131-6:2012, *Programmable controllers – Part 6: Functional safety*

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

[1] Withdrawn.