Australian Standard™

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

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Department of Industrial Relations (QLD)
Department of Primary Industries, Mine Safety (NSW)
Electrical Regulatory Authorities Council
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PREFACE

This Standard was prepared by the Standards Australia Committee EL-017, Electrical Equipment of Industrial Machinery.

The objective of this Standard is to provide guidance and criteria on the use of safety-related electrical control systems, with the goal of ensuring a suitably high level of performance. More information is given in the Introduction.

This Standard is technically identical with, and has been reproduced from IEC 62061, Ed. 1.0 (2005), *Safety of machinery—Functional safety of safety-related electrical, electronic and programmable electronic control systems*.

Editorial variations to IEC 62061, Ed. 1.0 (2005) are indicated at the appropriate places throughout this standard. Strikethrough (~~example~~) identifies IEC text, tables and figures which, for the purposes of this Australian Standard, are deleted. Where text, tables or figures are added, each is set in its proper place and identified by shading (example). Added figures are not themselves shaded, but are identified by a shaded border.

As this Standard is reproduced from an International Standard, the following applies:

(a) Its number does not appear on each page of text and its identity is shown only on the cover and title page.

(b) In the source text ‘IEC 62061’ should read ‘AS 62061’.

(c) A full point should be substituted for a comma when referring to a decimal marker.

The terms ‘normative’ and ‘informative’ are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

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INTRODUCTION

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

Previously, in the absence of standards, there has been a reluctance to accept SRECS in safety-related functions for significant machine hazards because of uncertainty regarding the performance of such technology.

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 a SRECS. It sets out an approach and provides requirements to achieve the necessary performance.

This standard is machine sector specific within the framework of IEC 61508. It is intended to facilitate the specification of the performance of safety-related electrical control systems in relation to the significant hazards (see 3.8 of ISO 12100-1) of machines.

This standard provides a machine sector specific framework for functional safety of a SRECS 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 SRECS of machines that can also be relevant to later phases of the life of a SRECS.

There are many situations on machines where SRECS 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 electrical control system to stop hazardous machine operation. Also in automation, the electrical 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 standard gives a methodology and requirements to

- assign the required safety integrity level for each safety-related control function to be implemented by SRECS;
- enable the design of the SRECS appropriate to the assigned safety-related control function(s);
- integrate safety-related subsystems designed in accordance with ISO 13849 ;
- validate the SRECS.

This standard is intended to be used within the framework of systematic risk reduction described in ISO 12100-1 and in conjunction with risk assessment according to the principles described in ISO 14121 (EN 1050). A suggested methodology for safety integrity level (SIL) assignment is given in informative Annex A.

Measures are given to co-ordinate the performance of the SRECS with the intended risk reduction taking into account the probabilities and consequences of random or systematic faults within the electrical control system.

Figure 1 shows the relationship of this standard to other relevant standards.

Table 1 gives recommendations on the recommended application of this standard and the revision of ISO 13849-1.

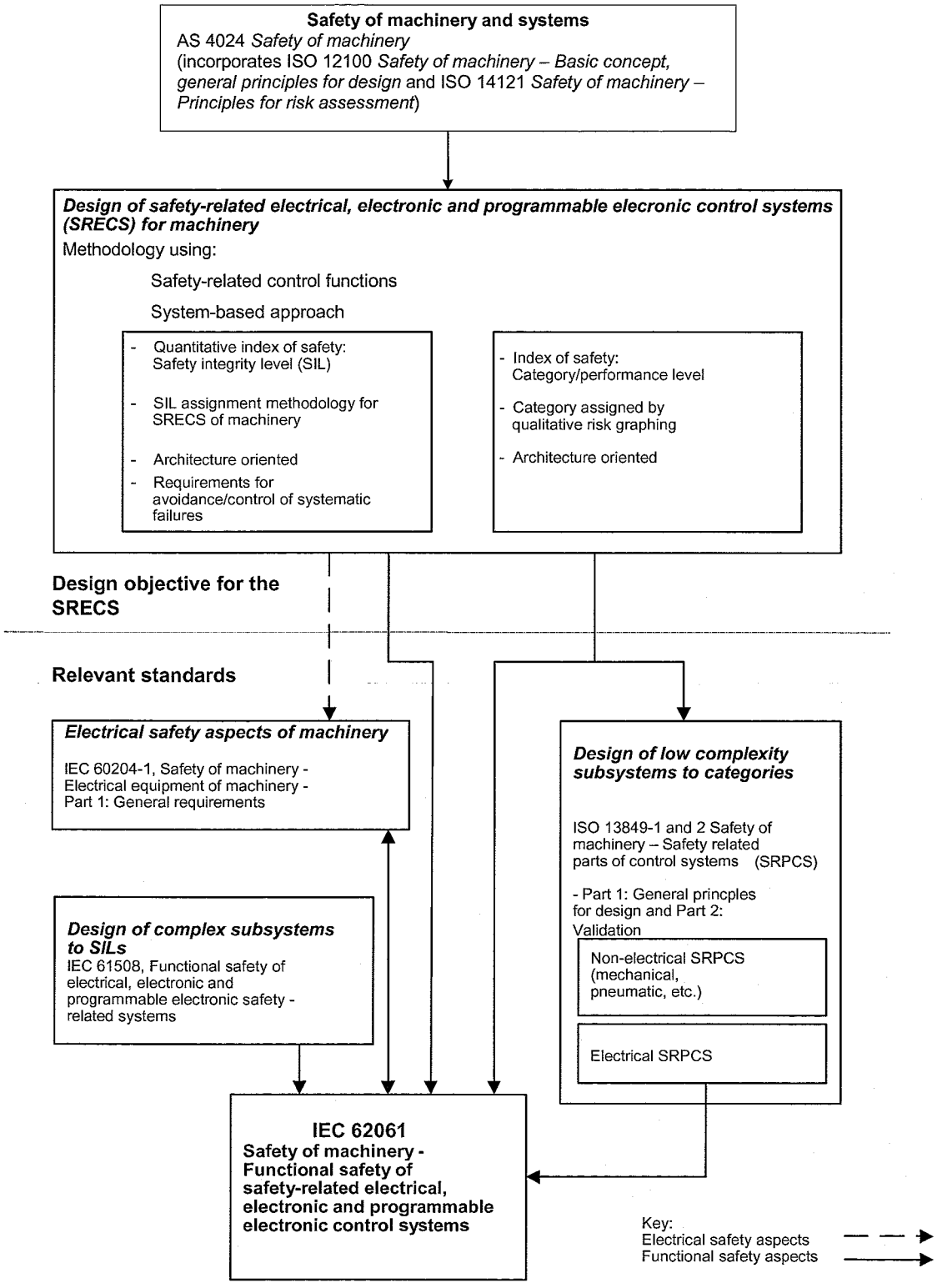

Figure 1 – Relationship of IEC 62061 to other relevant standards

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

IEC 62061 and ISO 13849-1 (under revision) specify requirements for the design and implementation of safety-related control systems of machinery. The use of either of these standards, in accordance with their scopes, can be presumed to fulfil the relevant essential safety requirements. Table 1 summarises the scopes of IEC 62061 and ISO 13849-1(under revision).

NOTE ISO 13849-1 is currently under preparation by ISO TC 199 and CEN TC 114.

Table 1 – Recommended application of IEC 62061 and ISO 13849-1(under revision)

	Technology implementing the safety-related control function(s)	**ISO 13849-1 (under revision)**	**IEC 62061**
A	Non electrical, e.g. hydraulics	X	Not covered
B	Electromechanical, e.g. relays, or non complex electronics	Restricted to designated architectures (see Note 1) and up to PL=e	All architectures and up to SIL 3
C	Complex electronics, e.g. programmable	Restricted to designated architectures (see Note 1) and up to PL=d	All architectures and up to SIL 3
D	A combined with B	Restricted to designated architectures (see Note 1) and up to PL=e	X see Note 3
E	C combined with B	Restricted to designated architectures (see Note 1) and up to PL=d	All architectures and up to SIL 3
F	C combined with A, or C combined with A and B	X see Note 2	X see Note 3

"X" indicates that this item is dealt with by the standard shown in the column heading.

NOTE 1 Designated architectures are defined in Annex B of EN ISO 13849-1(rev.) to give a simplified approach for quantification of performance level.

NOTE 2 For complex electronics: Use of designated architectures according to EN ISO 13849-1(rev.) up to PL=d or any architecture according to IEC 62061.

NOTE 3 For non-electrical technology use parts according to EN ISO 13849-1(rev.) as subsystems.

NOTES

STANDARDS AUSTRALIA

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Any table, figure or text of the international standard that is struck through is not part of this standard. Any Australian/New Zealand table, figure or text that is added is part of this standard and is identified by shading.

1 Scope

This International Standard specifies requirements and makes recommendations for the design, integration and validation of safety-related electrical, electronic and programmable electronic control systems (SRECS) for machines (see Notes 1 and 2). It is applicable to control systems used, either singly or in combination, to carry out safety-related control functions on machines that are not portable by hand while working, including a group of machines working together in a co-ordinated manner.

NOTE 1 In this standard, the term “electrical control systems” is used to stand for ”Electrical, Electronic and Programmable Electronic (E/E/PE) control systems” and “SRECS” is used to stand for “safety-related electrical, electronic and programmable electronic control systems”.

NOTE 2 In this standard, it is presumed that the design of complex programmable electronic subsystems or subsystem elements conforms to the relevant requirements of IEC 61508. This standard provides a methodology for the use, rather than development, of such subsystems and subsystem elements as part of a SRECS.

This standard is an application standard and is not intended to limit or inhibit technological advancement. It does not cover all the requirements (e.g. guarding, non-electrical interlocking or non-electrical control) that are needed or required by other standards or regulations in order to safeguard persons from hazards. Each type of machine has unique requirements to be satisfied to provide adequate safety.

This standard:

– is concerned only with functional safety requirements intended to reduce the risk of injury or damage to the health of persons in the immediate vicinity of the machine and those directly involved in the use of the machine;

– 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 3 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, the machine electrical control system functional safety requirements should, in addition, satisfy other requirements (e.g. IEC 61511) insofar as safety of the process is concerned.

– does not specify requirements for the performance of non-electrical (e.g. hydraulic, pneumatic) control elements for machines;

  NOTE 4 Although the requirements of this standard are specific to electrical control systems, the framework and methodology specified can be applicable to safety-related parts of control systems employing other technologies.

– does not cover electrical hazards arising from the electrical control equipment itself (e.g. electric shock – see IEC 60204–1).

The objectives of specific Clauses in IEC 62061 are as given in Table 2.

