

SLOVENSKI STANDARD
SIST-TP CLC/TR 62061-1:2010
01-december-2010

Navodilo za uporabo ISO 13849-1 in IEC 62061 pri načrtovanju z varnostjo povezanih nadzornih sistemov za strojno opremo (IEC/TR 62061-1:2010)

Guidance on the application of ISO 13849-1 & IEC 62061 in the design of safety-related control systems for machinery (IEC/TR 62061-1:2010)

Anleitung zur Anwendung von ISO 13849-1 und IEC 62061 bei der Gestaltung von sicherheitsbezogenen Steuerungen von Maschinen (IEC/TR 62061-1:2010)

Directives relatives à l'application de l'ISO 13849-1 et de la CEI 62061 dans la conception des systèmes de commande des machines relatifs à la sécurité (CEI/TR 62061-1:2010)

<https://standards.iteh.ai/catalog/standards/sist/0276d6d3-9e79-434f-9731-3d59447a5830/sist-tp-clc-tr-62061-1-2010>

Ta slovenski standard je istoveten z: CLC/TR 62061-1:2010

ICS:

13.110	Varnost strojev	Safety of machinery
25.040.40	Merjenje in krmiljenje industrijskih postopkov	Industrial process measurement and control

SIST-TP CLC/TR 62061-1:2010 en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST-TP CLC/TR 62061-1:2010

<https://standards.iteh.ai/catalog/standards/sist/0276d6d3-9e79-434f-9731-3d59447a5830/sist-tp-clc-tr-62061-1-2010>

TECHNICAL REPORT
RAPPORT TECHNIQUE
TECHNISCHER BERICHT

CLC/TR 62061-1

August 2010

ICS 13.110; 25.040.99; 29.020

English version

**Guidance on the application of ISO 13849-1 and IEC 62061 in the design
of safety-related control systems for machinery**
(IEC/TR 62061-1:2010)

Directives relatives à l'application
de l'ISO 13849-1 et de la CEI 62061
dans la conception des systèmes
de commande des machines relatifs
à la sécurité
(CEI/TR 62061-1:2010)

Anleitung zur Anwendung von ISO 13849-1
und IEC 62061 bei der Gestaltung
von sicherheitsbezogenen Steuerungen
von Maschinen
(IEC/TR 62061-1:2010)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

This Technical Report was approved by CENELEC on 2010-07-26.
<https://standards.iteh.ai/catalog/standards/sist/0276d6d3-9e79-434f-9731-7af591715870/technical-report/62061-1-2010>

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

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 44/598/DTR, future edition 1 of IEC/TR 62061-1, prepared by IEC TC 44, Safety of machinery - Electrotechnical aspects, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as CLC/TR 62061-1 on 2010-07-26.

Endorsement notice

The text of the Technical Report IEC/TR 62061-1:2010 was approved by CENELEC as a Technical Report without any modification.

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

IEC 62061	NOTE	Harmonized as EN 62061.
IEC 60947-5-1:2003	NOTE	Harmonized as EN 60947-5-1:2004 ([not] modified).
IEC 61511-1	NOTE	Harmonized as EN 61511-1.
IEC 61508 series	NOTE	Harmonized in EN 61508 series (not modified).
IEC 61800-5-2	NOTE	Harmonized as EN 61800-5-2.
ISO 13849-1	NOTE	Harmonized as EN ISO 13849-1.
ISO 13849-2	NOTE	Harmonized as EN ISO 13849-2.
ISO 14121-1	NOTE	Harmonized as EN ISO 14121-1.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST-TP CLC/TR 62061-1:2010](https://standards.iteh.ai/catalog/standards/sist/0276d6d3-9e79-434f-9731-3d59447a5830/sist-tp-clc-tr-62061-1-2010)

<https://standards.iteh.ai/catalog/standards/sist/0276d6d3-9e79-434f-9731-3d59447a5830/sist-tp-clc-tr-62061-1-2010>



IEC/TR 62061-1

Edition 1.0 2010-07

TECHNICAL REPORT

RAPPORT TECHNIQUE

Guidance on the application of ISO 13849-1 and IEC 62061 in the design of safety-related control systems for machinery
(standards.Iteh.ai)

Lignes directrices relatives à l'application de l'ISO 13849-1 et de la CEI 62061 dans la conception des systèmes de commande des machines relatifs à la sécurité
3d59447a5830/sist-tp-clc-tr-62061-1-2010

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

R

ICS 13.110; 25.040.99; 29.020

ISBN 978-2-88912-042-0

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 General.....	6
3 Comparison of standards.....	6
4 Risk estimation and assignment of required performance.....	7
5 Safety requirements specification.....	7
6 Assignment of performance targets: PL versus SIL.....	8
7 System design.....	9
7.1 General requirements for system design using IEC 62061 and ISO 13849-1.....	9
7.2 Estimation of PFH _D and MTTF _d and the use of fault exclusions.....	9
7.3 System design using subsystems or SRP/CS that conform to either IEC 62061 or ISO 13849-1.....	10
7.4 System design using subsystems or SRP/CS that have been designed using other IEC or ISO standards.....	10
8 Example.....	10
8.1 General.....	10
8.2 Simplified example of the design and validation of a safety-related control system implementing a specified safety-related control function.....	11
8.3 Conclusion.....	18
Bibliography.....	19
Figure 1 – Example implementation of the safety function.....	11
Figure 2 – Safety-related block diagram.....	13
Figure 3 – Safety-related block diagram for calculation according to ISO 13849-1.....	13
Figure 4 – Logical representation of subsystem D.....	15
Table 1 – Relationship between PLs and SILs based on the average probability of dangerous failure per hour.....	8
Table 2 – Architectural constraints on subsystems' maximum SIL CL that can be claimed for an SRCF using this subsystem.....	17

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**GUIDANCE ON THE APPLICATION OF ISO 13849-1 AND IEC 62061
IN THE DESIGN OF SAFETY-RELATED CONTROL SYSTEMS
FOR MACHINERY**
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.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 62061-1, which is a technical report, has been prepared jointly by Technical Committee ISO/TC 199, *Safety of machinery*, and Technical Committee IEC/TC 44, *Safety of machinery – Electrotechnical aspects*. The draft was circulated for voting to the national bodies of both ISO and IEC. These technical committees have agreed that no modification will be made to this Technical Report except by mutual agreement¹.

¹ This Technical Report is published at the ISO as ISO/TR 23849.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
44/598/DTR	44/608/RVC

Full information on the voting for the approval of this technical report 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.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site 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.

iTeh STANDARD PREVIEW **(standards.iteh.ai)**

[SIST-TP CLC/TR 62061-1:2010](#)

<https://standards.iteh.ai/catalog/standards/sist/0276d6d3-9e79-434f-9731-3d59447a5830/sist-tp-clc-tr-62061-1-2010>

INTRODUCTION

This Technical Report has been prepared by experts from both IEC/TC 44/WG 7 and ISO/TC 199/WG 8 in response to requests from their Technical Committees to explain the relationship between IEC 62061 and ISO 13849-1. In particular, it is intended to assist users of these International Standards in terms of the interaction(s) that can exist between the standards to ensure that confidence can be given to the design of safety-related systems made in accordance with either standard.

It is intended that this Technical Report be incorporated into both IEC 62061 and ISO 13849-1 by means of corrigenda that reference the published version of this document. These corrigenda will also remove the information given in Table 1, *Recommended application of IEC 62061 and ISO 13849-1*, provided in the common introduction to both standards, which is now recognized as being out of date. Subsequently, it is intended to merge ISO 13849-1 and IEC 62061 by means of a JWG of ISO/TC 199 and IEC/TC 44.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST-TP CLC/TR 62061-1:2010](https://standards.iteh.ai/catalog/standards/sist/0276d6d3-9e79-434f-9731-3d59447a5830/sist-tp-clc-tr-62061-1-2010)

<https://standards.iteh.ai/catalog/standards/sist/0276d6d3-9e79-434f-9731-3d59447a5830/sist-tp-clc-tr-62061-1-2010>

GUIDANCE ON THE APPLICATION OF ISO 13849-1 AND IEC 62061 IN THE DESIGN OF SAFETY-RELATED CONTROL SYSTEMS FOR MACHINERY

1 Scope

This Technical Report is intended to explain the application of IEC 62061 and ISO 13849-1²⁾ in the design of safety-related control systems for machinery.

2 General

2.1 Both IEC 62061 and ISO 13849-1 specify requirements for the design and implementation of safety-related control systems of machinery³⁾. The methods developed in both of these standards are different but, when correctly applied, can achieve a comparable level of risk reduction.

2.2 These standards classify safety-related control systems that implement safety functions into levels that are defined in terms of their probability of dangerous failure per hour. ISO 13849-1 has five Performance Levels (PLs), a, b, c, d and e, while IEC 62061 has three safety integrity levels (SILs), 1, 2 and 3.

2.3 Product standards (type-C) committees specify the safety requirements for safety-related control systems and it is recommended that these committees classify the levels of confidence required for them in terms of PLs and SILs.

2.4 Machinery designers may choose to use either IEC 62061 or ISO 13849-1 depending on the specific features of the application.

2.5 The selection and use of either standard is likely to be determined by, for example:

- previous knowledge and experience in the design of machinery safety-related control systems based upon the concept of categories described in ISO 13849-1:1999 can mean that the use of ISO 13849-1:2006 is more appropriate;
- safety-related control systems based upon media other than electrical can mean that the use of ISO 13849-1 is more appropriate;
- customer requirements to demonstrate the safety integrity of a machine safety-related control system in terms of a SIL can mean that the use of IEC 62061 is more appropriate;
- safety-related control systems of machinery used in, for example, the process industries, where other safety-related systems (such as safety instrumented systems in accordance with IEC 61511) are characterized in terms of SILs, can mean that the use of IEC 62061 is more appropriate.

3 Comparison of standards

3.1 A comparison of the technical requirements in ISO 13849-1 and IEC 62061 has been carried out in respect of the following aspects:

2) This Technical Report considers ISO 13849-1:2006 rather than ISO 13849-1:1999, which has been withdrawn.

3) These standards have been adopted by the European standardization bodies CEN and CENELEC as ISO 13849-1 and EN 62061, respectively, where they are published with the status of transposed harmonized standards under the Machinery Directive (98/37/EC and 2006/42/EC). Under the conditions of their publication, the correct use of either of these standards is presumed to conform to the relevant essential safety requirements of the Machinery Directive (98/37/EC and 2006/42/EC).

- terminology;
- risk estimation and performance allocation;
- safety requirements specification;
- systematic integrity requirements;
- diagnostic functions;
- software safety requirements.

3.2 Additionally, an evaluation of the use of the simplified mathematical formulae to determine the probability of dangerous failures (PFH_D) and $MTTF_D$ according to both standards has been carried out.

3.3 The conclusions from this work are the following.

- Safety-related control systems can be designed to achieve acceptable levels of functional safety using either of the two standards by integrating non-complex⁴⁾ SRECS (safety-related electrical control system) subsystems or SRP/CS (safety-related parts of a control system) designed in accordance with IEC 62061 and ISO 13849-1, respectively.
- Both standards can also be used to provide design solutions for complex SRECS and SRP/CS by integrating electrical/electronic/programmable electronic subsystems designed in accordance with IEC 61508.
- Both standards currently have value to users in the machinery sector and benefits will be gained from experience in their use. Feedback over a reasonable period on their practical application is essential to support any future initiatives to move towards a standard that merges the contents of both IEC 62061 and ISO 13849-1.
- Differences exist in detail and it is recognized that some concepts (e.g. functional safety management) will need further work to establish equivalence between respective design methodologies and some technical requirements.

[https://standards.iteh.ai/catalog/standards/sist/0276d6d3-9e79-434f-9731-](https://standards.iteh.ai/catalog/standards/sist/0276d6d3-9e79-434f-9731-3d59447a5830/sist-tp-clc-tr-62061-1-2010)

4 Risk estimation and assignment of required performance

4.1 A comparison has been carried out on the use of the methods to assign a SIL and/or PL_r to a specific safety function. This has established that there is a good level of correspondence between the respective methods provided in Annex A of each standard.

4.2 It is important, regardless of which method is used, that attention be given to ensure that appropriate judgements are made on the risk parameters to determine the SIL and/or PL_r that is likely to apply to a specific safety function. These judgements can often best be made by bringing together a range of personnel (e.g. design, maintenance, operators) to ensure that the hazards that may be present at machinery are properly understood.

4.3 Further information on the process of risk estimation and the assignment of performance targets can be found in ISO 14121-1 and IEC 61508-5.

5 Safety requirements specification

5.1 A first stage in the respective methodologies of both ISO 13849-1 and IEC 62061 requires that the safety function(s) to be implemented by the safety-related control system are specified.

5.2 An assessment should have been performed relevant to each safety function that is to be implemented by a control circuit by, for example, using ISO 13849-1, Annex A, or IEC 62061, Annex A. This should have determined what risk reduction needs to be provided

4) Although there is no definition for the term “non-complex” SRECS or SRP/CS this should be considered equivalent to low complexity in the context of IEC 62061:2005, 3.2.7.