SVENSK STANDARD
SS-EN ISO 13849-1:2016

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Maskinsäkerhet – Säkerhetsrelaterade delar av styrsystem – Del 1: Allmänna konstruktionsprinciper (ISO 13849-1:2015)

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

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Europastandarden EN ISO 13849-1:2015 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO 13849-1:2015.

Denna standard ersätter SS-EN ISO 13849-1:2008, utgåva 2 och SS-EN ISO 13849-1:2008/AC:2009, utgåva 1.

The European Standard EN ISO 13849-1:2015 has the status of a Swedish Standard. This document contains the official English version of EN ISO 13849-1:2015.

This standard supersedes the Swedish Standard SS-EN ISO 13849-1:2008, edition 2 and SS-EN ISO 13849-1:2008/AC:2009, edition 1.

Förhållandet till övriga delar under samma huvudtitel - Utdrag ur Förord i ISO 13849-1:2015/
Relations to other parts under the same general title - Extract from the Foreword of ISO 13849-1:2015

ISO 13849 consists of the following parts, under the general title *Safety of machinery — Safety-related parts of control systems:*

- Part 1: General principles for design
- Part 2: Validation

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Maskinsäkerhet, SIS/TK 282.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 13849-1

December 2015

ICS 13.110

Supersedes EN ISO 13849-1:2008

English Version

Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)

Sécurité des machines - Parties des systèmes de commande relatives à la sécurité - Partie 1: Principes généraux de conception (ISO 13849-1:2015)

Sicherheit von Maschinen - Sicherheitsbezogene Teile von Steuerungen - Teil 1: Allgemeine Gestaltungsleitsätze (ISO 13849-1:2015)

This European Standard was approved by CEN on 20 June 2015.

CEN 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 CEN 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 CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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

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European foreword

This document (EN ISO 13849-1:2015) has been prepared by Technical Committee ISO/TC 199 “Safety of machinery” in collaboration with Technical Committee CEN/TC 114 “Safety of machinery” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2016, and conflicting national standards shall be withdrawn at the latest by June 2016.

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

This document supersedes EN ISO 13849-1:2008.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 13849-1:2015 has been approved by CEN as EN ISO 13849-1:2015 without any modification.

Introduction

The structure of safety standards in the field of machinery is as follows.

a) Type-A standards (basis standards) give basic concepts, principles for design and general aspects that can be applied to machinery.

b) Type-B standards (generic safety standards) deal with one or more safety aspect(s), or one or more type(s) of safeguards that can be used across a wide range of machinery:

   — type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);

   — type-B2 standards on safeguards (e.g. two-hands controls, interlocking devices, pressure sensitive devices, guards).

c) Type-C standards (machinery safety standards) deal with detailed safety requirements for a particular machine or group of machines.

This part of ISO 13849 is a type-B-1 standard as stated in ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e. g. for maintenance (small, medium and large enterprises);

— consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

In addition, this document is intended for standardization bodies elaborating type-C standards.

The requirements of this document can be supplemented or modified by a type-C standard.

For machines which are covered by the scope of a type-C standard and which have been designed and built according to the requirements of that standard, the requirements of that type-C standard take precedence.

When provisions of a type-C standard are different from those which are stated in type-A or type-B standards, the provisions of the type-C standard take precedence over the provisions of the other standards for machines that have been designed and built according to the provisions of the type-C standard.

This part of ISO 13849 is intended to give guidance to those involved in the design and assessment of control systems, and to Technical Committees preparing type-B2 or type-C standards which are presumed to comply with the Essential Safety Requirements of Annex I of the Directive 2006/42/EC on machinery. It does not give specific guidance for compliance with other EC directives.

As part of the overall risk reduction strategy at a machine, a designer will often choose to achieve some measure of risk reduction through the application of safeguards employing one or more safety functions.

Parts of machinery control systems that are assigned to provide safety functions are called safety-related parts of control systems (SRP/CS) and these can consist of hardware and software and can either be separate from the machine control system or an integral part of it. In addition to providing safety functions, SRP/CS can also provide operational functions (e.g. two-handed controls as a means of process initiation).

The ability of safety-related parts of control systems to perform a safety function under foreseeable conditions is allocated one of five levels, called performance levels (PL). These performance levels are defined in terms of probability of dangerous failure per hour (see Table 2).

The probability of dangerous failure of the safety function depends on several factors, including hardware and software structure, the extent of fault detection mechanisms [diagnostic coverage (DC)], reliability of components [mean time to dangerous failure ($MTTF_D$), common cause failure (CCF)], design process, operating stress, environmental conditions and operation procedures.

In order to assist the designer and facilitate the assessment of achieved PL, this document employs a methodology based on the categorization of structures according to specific design criteria and specified behaviours under fault conditions. These categories are allocated one of five levels, termed Categories B, 1, 2, 3 and 4.

The performance levels and categories can be applied to safety-related parts of control systems, such as

— protective devices (e.g. two-hand control devices, interlocking devices), electro-sensitive protective devices (e.g. photoelectric barriers), pressure sensitive devices,

— control units (e.g. a logic unit for control functions, data processing, monitoring, etc.), and

— power control elements (e.g. relays, valves, etc.),

as well as to control systems carrying out safety functions at all kinds of machinery — from simple (e.g. small kitchen machines, or automatic doors and gates) to manufacturing installations (e.g. packaging machines, printing machines, presses).

This part of ISO 13849 is intended to provide a clear basis upon which the design and performance of any application of the SRP/CS (and the machine) can be assessed, for example, by a third party, in-house or by an independent test house.

Information on the recommended application of IEC 62061 and this part of ISO 13849

IEC 62061 and this part of ISO 13849 specify requirements for the design and implementation of safety-related control systems of machinery. The use of either of these International Standards, in accordance with their scopes, can be presumed to fulfil the relevant essential safety requirements. ISO/TR 23849 gives guidance on the application of this part of ISO 13849 and IEC 62061 in the design of safety-related control systems for machinery.

As with ISO/TR 23849, ISO/TR 22100-2 has been added to the list of normative references given in Clause 2 — the latter owing to its importance for an understanding of the relationship between this part of ISO 13849 and ISO 12100.

Safety of machinery — Safety-related parts of control systems —

Part 1: General principles for design

1 Scope

This part of ISO 13849 provides safety requirements and guidance on the principles for the design and integration of safety-related parts of control systems (SRP/CS), including the design of software. For these parts of SRP/CS, it specifies characteristics that include the performance level required for carrying out safety functions. It applies to SRP/CS for high demand and continuous mode, regardless of the type of technology and energy used (electrical, hydraulic, pneumatic, mechanical, etc.), for all kinds of machinery.

It does not specify the safety functions or performance levels that are to be used in a particular case.

This part of ISO 13849 provides specific requirements for SRP/CS using programmable electronic system(s).

It does not give specific requirements for the design of products which are parts of SRP/CS. Nevertheless, the principles given, such as categories or performance levels, can be used.

NOTE 1 Examples of products which are parts of SRP/CS: relays, solenoid valves, position switches, PLCs, motor control units, two-hand control devices, pressure sensitive equipment. For the design of such products, it is important to refer to the specifically applicable International Standards, e.g. ISO 13851, ISO 13856-1 and ISO 13856-2.

NOTE 2 For the definition of *required performance level*, see 3.1.24.

NOTE 3 The requirements provided in this part of ISO 13849 for programmable electronic systems are compatible with the methodology for the design and development of safety-related electrical, electronic and programmable electronic control systems for machinery given in IEC 62061.

NOTE 4 For safety-related embedded software for components with PL_r = e, see IEC 61508–3:1998, Clause 7.

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.

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

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

IEC 60050-191:1990, *International electrotechnical vocabulary — Chapter 191: Dependability and quality of service.* Amended by IEC 60050-191-am1:1999 and IEC 60050-191-am2:2002:1999

IEC 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 3: Software requirements.* Corrected by IEC 61508-3/Cor.1:1999

IEC 61508-4:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 4: Definitions and abbreviations.* Corrected by IEC 61508-4/Cor.1:1999

IEC 62061:2012, *Safety of machinery — Functional safety of safety–related electrical, electronic and programmable electronic control systems*

ISO/TR 22100-2:2013, *Safety of machinery — Relationship with ISO 12100 — Part 2: How ISO 12100 relates to ISO 13849-1*

ISO/TR 23849, *Guidance on the application of ISO 13849-1 and IEC 62061 in the design of safety-related control systems for machinery*