



SLOVENSKI STANDARD
oSIST prEN IEC 61508-5:2025
01-april-2025

Funkcijska varnost električnih/elektronskih/elektronsko programirljivih varnostnih sistemov - 5. del: Primeri metod za ugotavljanje ravni celovite varnosti

Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 5: Examples of methods for the determination of safety integrity levels

Funktionale Sicherheit sicherheitsbezogener elektrischer/elektronischer/programmierbarer elektronischer Systeme - Teil 5: Beispiele zur Ermittlung der Stufe der Sicherheitsintegrität (safety integrity level)

Sécurité fonctionnelle des systèmes électriques / électroniques / électroniques programmables relatifs à la sécurité - Partie 5: Exemples de méthodes pour la détermination des niveaux d'intégrité de sécurité

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TITLE:

Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 5: Examples of methods for the determination of safety integrity levels

PROPOSED STABILITY DATE: 2028

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**FUNCTIONAL SAFETY OF ELECTRICAL/ELECTRONIC/
PROGRAMMABLE ELECTRONIC SAFETY-RELATED SYSTEMS –**

**Part 5: Examples of methods for the determination
of safety integrity levels**

FOREWORD

113 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising
114 all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international
115 co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and
116 in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports,
117 Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their
118 preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with
119 may participate in this preparatory work. International, governmental and non-governmental organizations liaising
120 with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for
121 Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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123 consensus of opinion on the relevant subjects since each technical committee has representation from all
124 interested IEC National Committees.

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135 6) All users should ensure that they have the latest edition of this publication.

136 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and
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138 other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and
139 expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC
140 Publications.

141 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is
142 indispensable for the correct application of this publication.

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

149 IEC 61508-5 has been prepared by subcommittee 65A: System aspects, of IEC technical
150 committee 65: Industrial-process measurement, control and automation. It is an International
151 Standard.

152 This third edition cancels and replaces the second edition published in 2010. This edition
153 constitutes a technical revision.

154 This edition has been subject to a thorough review and incorporates many comments received
155 at the various revision stages.

156 This edition includes the following significant technical changes with respect to the previous
157 edition (the following list does refer to this document; other parts do mention specific further
158 details):

- 159 a) Document was upgraded to the 2024 version of the ISO/IEC Directives; this does
 160 introduce a significant number of editorial changes, clause renumbering and rewording
 161 of the information provided in Notes;
- 162 b) Various minor editorial errors have been corrected, the normative references and the
 163 bibliography has been updated.

164 The text of this document is based on the following documents:

Draft	Report on voting
65A/XX/FDIS	65A/XX/RVD

165 Full information on the voting for its approval can be found in the report on voting indicated in
 166 the above table.
 167

168 The language used for the development of this document is English.

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

173 A list of all parts of the IEC 61508 series, published under the general title *Functional safety of*
 174 *electrical / electronic / programmable electronic safety-related systems*, can be found on the
 175 IEC website.

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

- 179 • reconfirmed,
- 180 • withdrawn,
- 181 • replaced by a revised edition, or
- 182 • amended.

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INTRODUCTION

186 Systems comprised of electrical and/or electronic elements have been used for many years to
187 perform safety functions in most application sectors. Computer-based systems (generically
188 referred to as programmable electronic systems) are being used in all application sectors to
189 perform non-safety functions and, increasingly, to perform safety functions. If computer system
190 technology is to be effectively and safely exploited, it is essential that those responsible for
191 making decisions have sufficient guidance on the safety aspects on which to make these
192 decisions.

193 This document sets out a generic approach for all safety lifecycle activities for systems
194 comprised of electrical and/or electronic and/or programmable electronic (E/E/PE) elements
195 that are used to perform safety functions. This unified approach has been adopted in order that
196 a rational and consistent technical policy be developed for all electrically-based safety-related
197 systems. A major objective is to facilitate the development of product and application sector
198 international standards based on the IEC 61508 series.

199 NOTE 1 Examples of product and application sector international standards based on the IEC 61508 series are
200 given in the Bibliography (see references [1], [2] and [3]).

201 In most situations, safety is achieved by a number of systems which rely on many technologies
202 (for example mechanical, hydraulic, pneumatic, electrical, electronic, programmable electronic).
203 Any safety strategy should therefore consider not only all the elements within an individual
204 system (for example sensors, controlling devices and actuators) but also all the safety-related
205 systems making up the total combination of safety-related systems. Therefore, while this
206 document is concerned with E/E/PE safety-related systems, it may also provide a framework
207 within which safety-related systems based on other technologies may be considered.

208 It is recognized that there is a great variety of applications using E/E/PE safety-related systems
209 in a variety of application sectors and covering a wide range of complexity, hazard and risk
210 potentials. In any particular application, the required safety measures will be dependent on
211 many factors specific to the application. This document, by being generic, will enable such
212 measures to be formulated in future product and application sector international standards and
213 in revisions of those that already exist.

214 This International Standard

- 215 – considers all relevant overall, E/E/PE system and software safety lifecycle phases (for
216 example, from initial concept, through design, implementation, operation and maintenance
217 to decommissioning) when E/E/PE systems are used to perform safety functions;
- 218 – has been conceived with a rapidly developing technology in mind; the framework is
219 sufficiently robust and comprehensive to cater for future developments;
- 220 – enables product and application sector international standards, dealing with E/E/PE safety-
221 related systems, to be developed; the development of product and application sector
222 international standards, within the framework of this standard, should lead to a high level of
223 consistency (for example, of underlying principles, terminology etc.) both within application
224 sectors and across application sectors; this will have both safety and economic benefits;
- 225 – provides a method for the development of the safety requirements specification necessary
226 to achieve the required functional safety for E/E/PE safety-related systems;
- 227 – adopts a risk-based approach by which the safety integrity requirements can be determined;
- 228 – introduces safety integrity levels for specifying the target level of safety integrity for the
229 safety functions to be implemented by the E/E/PE safety-related systems;
- 230 – The standard does not specify the safety integrity level requirements for any safety function,
231 nor does it mandate how the safety integrity level is determined. Instead it provides a risk-
232 based conceptual framework and example techniques.
- 233 – sets target failure measures for safety functions carried out by E/E/PE safety-related
234 systems, which are linked to the safety integrity levels;

- 235 – sets a lower limit on the target failure measures for a safety function carried out by a single
236 E/E/PE safety-related system. For E/E/PE safety-related systems operating in
- 237 • a low demand mode of operation, the lower limit is set at an average probability of a
238 dangerous failure on demand of 10^{-5} ;
 - 239 • a high demand or a continuous mode of operation, the lower limit is set at an average
240 frequency of a dangerous failure of 10^{-9} [h^{-1}];

241 NOTE 2 A single E/E/PE safety-related system does not necessarily mean a single-channel architecture.

242 NOTE 3 It may be possible to achieve designs of safety-related systems with lower values for the target safety
243 integrity for non-complex systems, but these limits are considered to represent what can be achieved for relatively
244 complex systems (for example programmable electronic safety-related systems) at the present time.

- 245 – sets requirements for the avoidance and control of systematic faults, which are based on
246 experience and judgement from practical experience gained in industry. Even though the
247 probability of occurrence of systematic failures cannot in general be quantified the standard
248 does, however, allow a claim to be made, for a specified safety function, that the target
249 failure measure associated with the safety function can be considered to be achieved if all
250 the requirements in the standard have been met;
- 251 – introduces systematic capability which applies to an element with respect to the confidence
252 that its systematic safety integrity meets the requirements of the specified safety integrity
253 level;
- 254 – adopts a broad range of principles, techniques and measures to achieve functional safety
255 for E/E/PE safety-related systems, but does not explicitly use the concept of fail safe
256 However, the concepts of “fail safe” and “inherently safe” principles may be applicable and
257 adoption of such concepts is acceptable providing the requirements of the relevant clauses
258 in the standard are met.

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FUNCTIONAL SAFETY OF ELECTRICAL/ELECTRONIC/ PROGRAMMABLE ELECTRONIC SAFETY-RELATED SYSTEMS –

Part 5: Examples of methods for the determination of safety integrity levels

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269 **1 Scope**

270 **1.1** This part of IEC 61508 provides information on

- 271 – the underlying concepts of risk and the relationship of risk to safety integrity (see Annex A);
- 272 – the criteria in selecting the most appropriate method for determining safety integrity level
- 273 requirements (see Annex B);
- 274 – a number of methods that will enable the safety integrity levels for the E/E/PE safety-related
- 275 systems to be determined (see Annexes C, D, E, F and G).

276 The method selected will depend upon the application sector and the specific circumstances
277 under consideration. Annexes C, D, E, F and G illustrate quantitative and qualitative approaches
278 and have been simplified in order to illustrate the underlying principles. These annexes have
279 been included to illustrate the general principles of a number of methods but do not provide a
280 definitive account.

281 NOTE 1 Those intending to apply the methods indicated in these annexes can consult the source material
282 referenced.

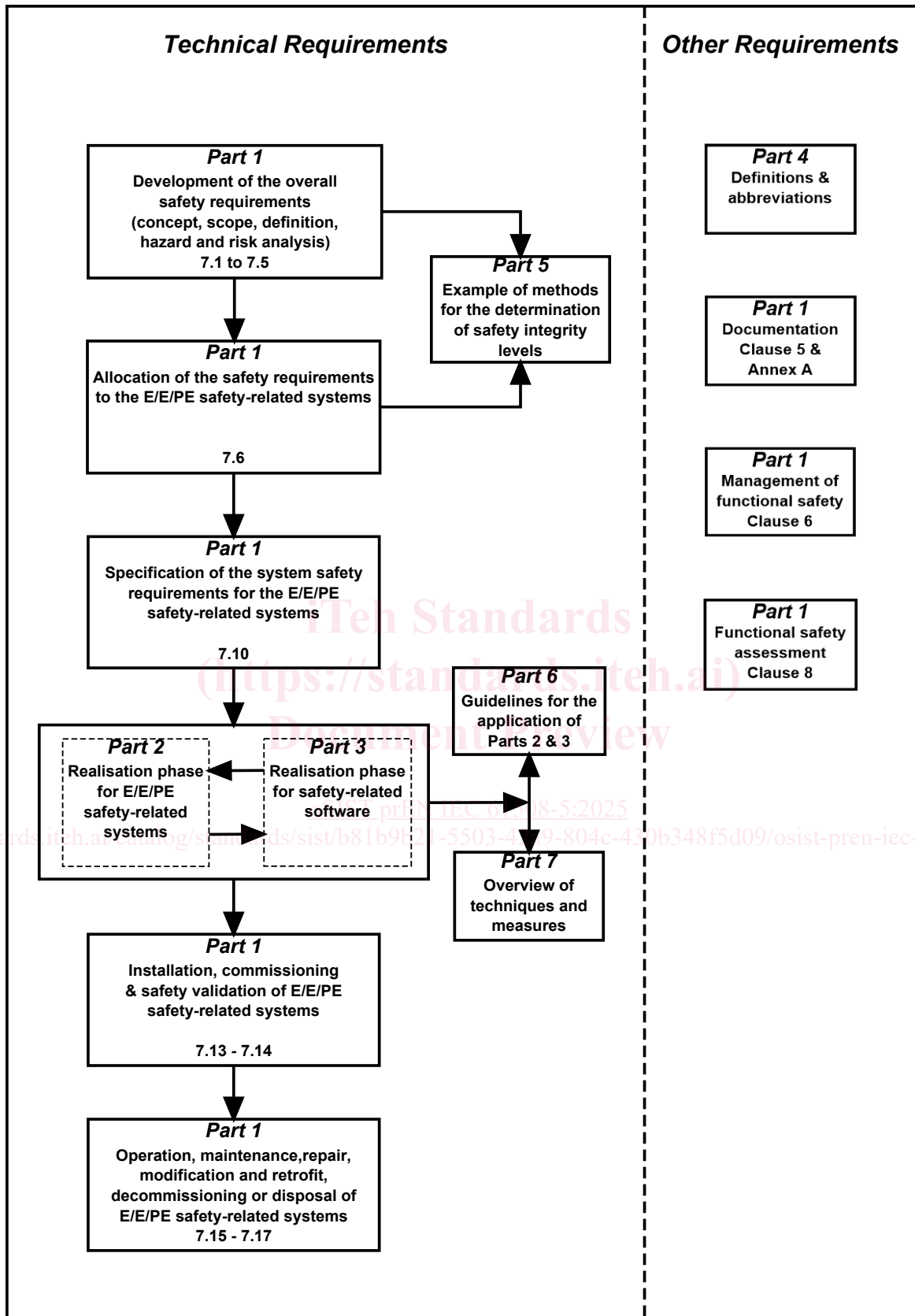
283 NOTE 2 For more information on the approaches illustrated in Annexes B, and E, see references [5] and [8] in the
284 Bibliography. See also reference [6] in the Bibliography for a description of an additional approach.

285 **1.2** IEC 61508-1, IEC 61508-2, IEC 61508-3 and IEC 61508-4 are basic safety publications,
286 although this status does not apply in the context of low complexity E/E/PE safety-related
287 systems (see 3.4.3 of IEC 61508-4). This document provides further information to complement
288 these basic safety publications.

289 **1.3** One of the responsibilities of a technical committee is, wherever applicable, to make use
290 of basic safety publications in the preparation of its publications. In this context, the
291 requirements, test methods or test conditions of this basic safety publication will not apply
292 unless specifically referred to or included in the publications prepared by those technical
293 committees.

294 **1.4** Figure 1 shows the overall framework of the IEC 61508 series and indicates the role that
295 IEC 61508-5 plays in the achievement of functional safety for E/E/PE safety-related systems.

296



297

298

Figure 1 – Overall framework of the IEC 61508 series

299 **2 Normative references**

300 The following documents are referred to in the text in such a way that some or all of their content
301 constitutes requirements of this document. For dated references, only the edition cited applies.
302 For undated references, the latest edition of the referenced document (including any
303 amendments) applies.

304 IEC 61508-1:20XX, *Functional safety of electrical/electronic/programmable electronic safety-*
305 *related systems – Part 1: General requirements*

306 IEC 61508-4:20XX, *Functional safety of electrical/electronic/programmable electronic safety-*
307 *related systems – Part 4: Definitions and abbreviations*

308 **3 Definitions and abbreviations**

309 For the purposes of this document, the definitions and abbreviations given in IEC 61508-4
310 apply.

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Annex A (informative)

Risk and safety integrity – General concepts

317 **A.1 General**

318 This annex provides information on the underlying concepts of risk and the relationship of risk
319 to safety integrity.

320 **A.2 Necessary risk reduction**

321 The necessary risk reduction is the reduction in risk that has to be achieved to meet the
322 tolerable risk for a specific situation (which may be stated either qualitatively¹ or
323 quantitatively²). The concept of necessary risk reduction is of fundamental importance in the
324 development of the safety requirements specification for the E/E/PE safety-related systems (in
325 particular, the safety integrity requirements part of the safety requirements specification). The
326 purpose of determining the tolerable risk for a specific hazardous event is to state what is
327 deemed reasonable with respect to both the frequency (or probability) of the hazardous event
328 and its specific consequences. Safety-related systems are designed to reduce the frequency
329 (or probability) of the hazardous event and/or the consequences of the hazardous event.

330 The tolerable risk will depend on many factors (for example, severity of injury, the number of
331 people exposed to danger, the frequency at which a person or people are exposed to danger
332 and the duration of the exposure). Important factors will be the perception and views of those
333 exposed to the hazardous event. In arriving at what constitutes a tolerable risk for a specific
334 application, a number of inputs are considered. These include:

- 335 – legal requirements, both general and those directly relevant to the specific application;
- 336 – guidelines from the appropriate safety regulatory authority;
- 337 – discussions and agreements with the different parties involved in the application;
- 338 – industry standards and guidelines;
- 339 – international discussions and agreements; the role of national and international standards
340 is becoming increasingly important in arriving at tolerable risk criteria for specific
341 applications;
- 342 – the best independent industrial, expert and scientific advice from advisory bodies.

343 In determining the safety integrity requirements of the E/E/PE safety-related system(s) and
344 other risk reduction measures, in order to meet the tolerable frequency of a hazardous event,
345 account needs to be taken of the characteristics of the risk that are relevant to the application.
346 The tolerable frequency will depend on the legal requirements in the country of application and
347 on the criteria specified by the user organisation. Issues that may need to be considered
348 together with how they can be applied to E/E/PE safety-related systems are discussed below.

¹ In achieving the tolerable risk, the necessary risk reduction will need to be established. Annexes E and G of this document outline qualitative methods, although in the examples quoted the necessary risk reduction is incorporated implicitly by specification of the SIL requirement rather than stated explicitly by a numeric value of risk reduction required.

² For example, that the hazardous event, leading to a specific consequence, can not occur with a frequency greater than one in 10⁸ h.