

**SLOVENSKI STANDARD**  
**oSIST prEN 50126-4:2013**  
**01-januar-2013**

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**Železniške naprave - Specifikacija in prikaz zanesljivosti, razpoložljivosti, vzdrževalnosti in varnosti (RAMS) - 4. del: Funkcionalna varnost - Električno/Elektronsko/Programabilni elektronski sistemi**

Railway applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 4: Functional Safety - Electrical/Electronic/Programmable electronic systems

Bahnanwendungen - Spezifikation und Nachweis von Zuverlässigkeit, Verfügbarkeit, Instandhaltbarkeit und Sicherheit (RAMS) - Teil 4: Funktionale Sicherheit - Elektrische/Elektronische/Programmierbare elektronische Systeme

Applications ferroviaires - Spécification et démonstration de la fiabilité, de la disponibilité, de la maintenabilité et de la sécurité (FDMS) - Partie 4: Sécurité fonctionnelle - Systèmes électriques/électroniques/électroniques programmables

**Ta slovenski standard je istoveten z: prEN 50126-4:2012**

**ICS:**

35.240.60	Uporabniške rešitve IT v transportu in trgovini	IT applications in transport and trade
45.020	Železniška tehnika na splošno	Railway engineering in general

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**en**

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NORME EUROPÉENNE  
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**prEN 50126-4**

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Will supersede EN 50129:2003

English version

**Railway applications -  
The Specification and Demonstration of Reliability, Availability,  
Maintainability and Safety (RAMS) -  
Part 4: Functional Safety -  
Electrical/Electronic/Programmable electronic systems**

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elektronische Systeme

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This draft European Standard is submitted to CENELEC members for CENELEC enquiry.  
Deadline for CENELEC: 2013-03-29.

It has been drawn up by CLC/TC 9X.  
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If this draft becomes a European Standard, CENELEC 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.

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**CENELEC**

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

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## 7157 **Foreword**

7158 This document [prEN 50126-4:2012] has been prepared by CLC/TC 9X "Electrical and electronic  
7159 applications for railways".

7160 This document is currently submitted to the Enquiry.

7161 EN 50126 "*Railway applications – The specification and demonstration of Reliability, Availability,  
7162 Maintainability and Safety (RAMS)*" consists of the following parts:

7163 – Part 1: Generic RAMS process;

7164 – Part 2: Systems approach to safety;

7165 – Part 4: Functional safety – Electrical/Electronic/Programmable electronic systems;

7166 – Part 5: Functional safety – Software.

7167 This new edition of EN 50126 (all parts) will supersede EN 50126-1:1999, CLC/TR 50126-2:2007,  
7168 CLC/TR 50126-3:2008, EN 50128:2011 and EN 50129:2003.

7169 This part of EN 50126 covers the functional safety for E/E/PE. It is mainly based on EN 50129:2003.

7170 This part of EN 50126 will supersede EN 50129:2003.

7171 This document has been prepared under a mandate given to CENELEC by the European Commission  
7172 and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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Modifications intended to be made, mainly for part4 and 5

WG14 intended to incorporate the following modifications prior to the CENELEC-Enquiry. Due to TC9X resolution 46/11 their incorporation must be postponed to post enquiry.

Therefore, for information purposes the list is included here. The list should not preclude commenting on these issues, but should inform the reader regarding the intended direction of further changes.

The order of the points does not indicate their importance.

1	The activity-based approach from parts 1+2 will be further implemented in parts 4+5. The relationship between “activities” and “roles” will be improved.
2	With regard to verification requirements, the approach from parts 1+2 will be used for parts 4+5 as well.
3	Safety case documentation: remaining inconsistencies within part 1 and between part 1 and parts 4/5 will be rectified.
4	E/E/PE System/Software Assurance Chapter 7 of parts 4/5 will be removed and the essence of the content moved to part 1.
5	Improve the consistency between part 4 chapter 8 and part1.
6	SIL0: the requirements will be reduced.
7	Improve consistency between part 1 and part 4 with regard to operation and maintenance.
8	Tailoring: the main text will better reflect the adaptability of the process according to the respective SIL.
9	Alignment of terms & definitions will be finalised.
10	Consistent use of terms & definitions will be improved.
11	The HW process defined in part 4 (e.g. in chapter9 and the annexes) will be revised and the same activity based approach as outlined in issues1 of this table will be applied.

## 7174 Introduction

7175 EN 50126-1:1999 was produced to introduce the application of a systematic RAMS management process  
7176 in the railway sector. For safety related electronic systems for signalling EN 50128:2011 and  
7177 EN 50129:2003 were produced. Through the application of these standards and the experiences gained  
7178 over the last years, the need for revision and restructuring became apparent with a need to deliver a  
7179 systematic and coherent approach to RAMS applicable to all the railway application fields Signalling,  
7180 Rolling Stock and Electric power supply for Railways (Fixed Installations).

7181 The revision work improved the coherency and consistency of the standards, the concept of safety  
7182 management and the practical usage of EN 50126, and took into consideration the existing and related  
7183 Technical Reports as well.

7184 This European Standard provides railway duty holders and the railway suppliers, throughout the  
7185 European Union, with a process which will enable the implementation of a consistent approach to the  
7186 management of reliability, availability, maintainability and safety, denoted by the acronym RAMS.

7187 Processes for the specification and demonstration of RAMS requirements are cornerstones of this  
7188 standard. This European Standard promotes a common understanding and approach to the management  
7189 of RAMS.

7190 EN 50126 is the railway sector specific application of IEC 61508. Meeting the requirements in this  
7191 European Standard is sufficient to ensure that additional compliance to IEC 61508 does not need to be  
7192 evaluated.

7193 With regard to safety, EN 50126-1 provides a Safety Management Process which is supported by  
7194 guidance and methods described in EN 50126-2.

7195 EN 50126-1 and EN 50126-2 are independent from the technology used. EN 50126-4 and EN 50126-5  
7196 provide guidance specific to safety related E/E/PE technology of railway applications. Their application is  
7197 determined through the application of the general RAMS process of EN 50126-1 and through the  
7198 outcome of the safety related methods described in EN 50126-2. As far as safety is concerned, EN 50126  
7199 takes the perspective of functional safety. This does not exclude other aspects of safety. However, these  
7200 are not the focus.

7201 The aims set for revision of the EN 50126 standard required a better understanding of the systems  
7202 approach and improved methods for applying the safety management process described in EN 50126-1.  
7203 EN 50126-2 provides this guidance.

7204 The application of this standard should be adapted to the specific requirements of the system under  
7205 consideration.

7206 This European Standard can be applied systematically by the railway duty holders and railway suppliers,  
7207 throughout all phases of the life cycle of a railway application, to develop railway specific RAMS  
7208 requirements and to achieve compliance with these requirements. The systems-level approach  
7209 developed by this European Standard facilitates assessment of the RAMS interactions between elements  
7210 of railway applications even if they are of complex nature.

7211 This European Standard promotes co-operation between the stakeholders of Railways in the  
7212 achievement of an optimal combination of RAMS and cost for railway applications. Adoption of this  
7213 European Standard will support the principles of the European Single Market and facilitate European  
7214 railway inter-operability.

7215 The process defined by this European Standard assumes that railway duty holders and railway suppliers  
7216 have business-level policies addressing Quality, Performance and Safety. The approach defined in this  
7217 standard is consistent with the application of quality management requirements contained within the  
7218 ISO 9000 series of International standards.

7219 **1 Scope**

7220 This part of EN 50126

- 7221 • is intended to apply to all safety-related electronic (E/E/PE) railway systems/sub-system/hardware.  
 7222 However, the hazard analysis and risk assessment processes defined in EN 50126-1 and in this part  
 7223 are necessary for all railway systems/sub-systems/hardware, in order to identify any safety  
 7224 requirements. The relevant methods are provided by EN 50126-2. If analysis reveals that no safety  
 7225 requirements exist (i.e.: that the situation is non-safety-related), and provided the conclusion is not  
 7226 revised as a consequence of later changes, this part of EN 50126 ceases to be applicable;
- 7227 • is applicable to safety-related electronic systems (including sub-systems and hardware) for railway  
 7228 applications;
- 7229 • is primarily applicable to systems/sub-systems/hardware which have been specifically designed and  
 7230 manufactured for railway applications. It should also be applied, as far as reasonably practicable, to  
 7231 general-purpose or industrial hardware (e.g.: power supplies, modems, etc.), which is procured for  
 7232 use as part of a safety-related railway system. As a minimum, evidence shall be provided in such  
 7233 cases to demonstrate:
- 7234 - either that the hardware is not relied on for safety,  
 7235 - or that the hardware can be relied on for those functions which relate to safety;
- 7236 • applies
- 7237 - to the specification, architecture, design, construction, implementation, integration,  
 7238 manufacturing, installation, acceptance, operation, maintenance and modification/extension  
 7239 phases of the system /subsystem and hardware, and also to individual sub-systems and  
 7240 hardware within the overall system as determined by the process in EN 50126-1 and supported  
 7241 by the methods in EN 50126-2.
- 7242 - to generic sub-systems and hardware (both application-independent and those intended for a  
 7243 particular class of application), and also to systems/sub-systems/hardware for specific  
 7244 applications;
- 7245 • addresses railway specifics;  
 7246 • does not define
- 7247 - RAMS targets, quantities, requirements or solutions for specific railway applications  
 7248 - rules or processes pertaining to the certification of railway products against the requirements of  
 7249 this standard  
 7250 - an approval process by the safety authority;
- 7251 • does not specify requirements for ensuring system security.

7252 This part of EN 50126 is applicable

- 7253 • to the specification and demonstration of safety for all railway applications and at all levels of such an  
 7254 application, as appropriate, from complete railway systems to major systems and to individual and  
 7255 combined sub-systems and hardware components within these major systems, including those  
 7256 containing software; in particular:
- 7257 - to new systems  
 7258 - to new systems integrated into existing systems in operation prior to the creation of this standard,  
 7259 although it is not generally applicable to other aspects of the existing system;
- 7260 - for modifications of existing systems in operation prior to the creation of this standard, although it  
 7261 is not generally applicable to other aspects of the existing system.
- 7262 - at all relevant phases of the life cycle of an application;
- 7263 - for use by railway duty holders, railway suppliers, assessors and safety authorities.

7264 Application of EN 50126-4 follows from SIL allocation to system/subsystem/hardware through applying  
7265 the processes described in EN50126-1 and methods described by EN 50126-2. Given the relative  
7266 maturity of most electrical systems, this part of EN 50126 is largely applicable to Electronic and  
7267 Programmable Electronic sub-systems, systems and hardware.

7268 NOTE Guidance on the applicability is given in the requirements of this standard.

7269 Existing systems compliant with any version of former EN 50126, EN 50128 or EN 50129 shall not be  
7270 subject of reconsideration and are considered as compliant with this standard.

7271 Railway applications mean Command, Control & Signalling, Rolling Stock and Fixed Installations for  
7272 Railways (e.g. Electric Power Supply).

## 7273 2 Normative references

7274 The following documents, in whole or in part, are normatively referenced in this document and are  
7275 indispensable for its application. For dated references, only the edition cited applies. For undated  
7276 references, the latest edition of the referenced document (including any amendments) applies.

7277 prEN 50126-1:2012, *Railway applications – The Specification and Demonstration of Reliability,*  
7278 *Availability, Maintainability and Safety (RAMS) – Part 1: Generic RAMS process*

7279 EN 50121 (all parts), *Railway applications – Electromagnetic compatibility*

7280 EN 50124 (all parts), *Railway applications – Insulation coordination*

7281 EN 50125 (all parts), *Railway applications – Environmental conditions for equipment*

7282 EN 50155, *Railway applications – Electronic equipment used on rolling stock*

7283 EN 50159, *Railway applications – Communication, signalling and processing systems – Safety-related*  
7284 *communication in transmission systems*

7285 ISO 9001, *Quality management systems – Requirements*

7286 ISO/IEC GUIDE 51, *Safety aspects – Guidelines for their inclusion in standards*  
<https://standards.iteh.ai/catalog/standards/sist/8a75241a-ccb-4789-8749-35bdec4e3d43/osist-pren-50126-4-2012>

## 7287 3 Terms and definitions

7288 For the purposes of this document, the terms and definitions given in prEN 50126-1:2012 and the  
7289 following apply:

### 7290 3.1

#### 7291 **change control board**

7292 entity that supervises and authorises change throughout the life cycle

### 7293 3.2

#### 7294 **hardware component**

7295 hardware component is a constituent part of a sub-system which has well-defined interfaces and  
7296 behaviour with respect to the system/sub-system architecture and design and fulfils the following criteria:

- 7297 a) an electrical/electronic component or assembly delivering a specific function;  
7298 b) it covers a specific subset of sub-system requirements;  
7299 c) it is clearly identified and has an independent version inside the configuration management system  
7300 or is a part of a collection of components (e. g. subsystems) which have an independent version

### 7301 3.3

#### 7302 **maintenance manager**

7303 entity responsible for implementation and upkeep of maintenance procedures and standards ensuring  
7304 safe and reliable performance of the system.

### 7305 3.4

#### 7306 **release note**

7307 documented record of all application and maintenance conditions for safe operation, across life cycle  
7308 phases

7309 **3.5**  
 7310 **safety manager**  
 7311 entity that is responsible for the correct accomplishment of the safety management

## 7312 **4 Abbreviations**

7313 For the purposes of this document, the following abbreviations apply.

7314 **4.1 ASR: assessor**

7315 **4.2 BPA: Bent Pin Analysis**

7316 **4.3 CA: Contingency Analysis**

7317 **4.4 CCD: Cause Consequence Diagrams**

7318 **4.5 CCF: Common Cause Failures**

7319 **4.6 CCFA: Common Cause Failure Analysis**

7320 **4.7 CFMA: Cable Failure Matrix Analysis**

7321 **4.8 CID: Class Diagram**

7322 **4.9 CoD: Component Diagram**

7323 **4.10 COTSH Commercial off the Shelf Hardware**

7324 **4.11 CPLD : Complex Programmable Logic Device**

7325 **4.12 CPU: Central Processing Unit**

7326 **4.13 CT: Certified Tool / Certified Translator**

7327 **4.14 DA: Design Analysis** oSIST prEN 50126-4:2012  
<https://standards.iteh.ai/catalog/standards/sist/8a75241a-ee6b-4789-8749-35bdec4e3d43/osist-pren-50126-4-2012>

7328 **4.15 DC: Direct Current**

7329 **4.16 DES: Designer**

7330 **4.17 DIA: Design Interface Analysis**

7331 **4.18 DRC: Design Rule Check**

7332 **4.19 DSL: Domain Specific Language**

7333 **4.20 EAM: Error Avoiding Method**

7334 **4.21 EPLD : Erasable Programmable Logic Device**

7335 **4.22 ESD: Electrostatic Discharge**

7336 **4.23 ETA: Event Tree Analysis**

7337 **4.24 ETBA: Energy Trace and Barrier Analysis**

7338 **4.25 FET: Transistors-Field Effect**

7339 **4.26 FI: Fagan Inspection**

7340 **4.27 FPGA: Field-programmable Gate Array**

7341 **4.28 FT: Fault Tree**

7342 **4.29 GD: Graceful Degradation**

7343	<b>4.30</b>	<b>HAZOP:</b>	<b>Hazard and Operability Study</b>
7344	<b>4.31</b>	<b>HOL:</b>	<b>Higher Order Logic</b>
7345	<b>4.32</b>	<b>HW:</b>	<b>Hardware</b>
7346	<b>4.33</b>	<b>IC:</b>	<b>Integrated Circuit</b>
7347	<b>4.34</b>	<b>ID:</b>	<b>Identifier</b>
7348	<b>4.35</b>	<b>IMP:</b>	<b>implementer</b>
7349	<b>4.36</b>	<b>INT:</b>	<b>integrator</b>
7350	<b>4.37</b>	<b>LCA:</b>	<b>Logic Cell Array</b>
7351	<b>4.38</b>	<b>LED:</b>	<b>Light-emitting Diode</b>
7352	<b>4.39</b>	<b>LRU:</b>	<b>Line Replaceable Unit</b>
7353	<b>4.40</b>	<b>MBT:</b>	<b>Model Based Testing</b>
7354	<b>4.41</b>	<b>MCS:</b>	<b>Monte-Carlo Simulation</b>
7355	<b>4.42</b>	<b>O&amp;SHA:</b>	<b>Operating and Support Hazard Analysis</b>
7356	<b>4.43</b>	<b>ORR:</b>	<b>Operational Readiness Review</b>
7357	<b>4.44</b>	<b>PAL:</b>	<b>Programmable Array Logic</b>
7358	<b>4.45</b>	<b>PD:</b>	<b>Programmable Device</b>
7359	<b>4.46</b>	<b>PDH</b>	<b>Previously Developed Hardware</b>
7360	<b>4.47</b>	<b>PHA:</b>	<b>Preliminary Hazard Analysis</b>
7361	<b>4.48</b>	<b>PHL:</b>	<b>Preliminary Hazard List</b>
7362	<b>4.49</b>	<b>PJM:</b>	<b>project manager</b>
7363	<b>4.50</b>	<b>PLA:</b>	<b>Programmable Logic Array</b>
7364	<b>4.51</b>	<b>PLD :</b>	<b>Programmable Logic Device</b>
7365	<b>4.52</b>	<b>RBD:</b>	<b>Reliability Block Diagram</b>
7366	<b>4.53</b>	<b>RCA:</b>	<b>Root Cause Analysis</b>
7367	<b>4.54</b>	<b>RPN:</b>	<b>Risk Priority Number</b>
7368	<b>4.55</b>	<b>RQM:</b>	<b>requirements manager</b>
7369	<b>4.56</b>	<b>SB:</b>	<b>Safety Bag</b>
7370	<b>4.57</b>	<b>SCA:</b>	<b>Sneak Circuit Analysis</b>
7371	<b>4.58</b>	<b>SCD:</b>	<b>State Chart Diagram</b>
7372	<b>4.59</b>	<b>SCR:</b>	<b>Silicon-controlled Rectifier</b>
7373	<b>4.60</b>	<b>SeD:</b>	<b>Sequence Diagram</b>
7374	<b>4.61</b>	<b>SoPC:</b>	<b>System on Programmable Chip</b>
7375	<b>4.62</b>	<b>SRAC:</b>	<b>Safety Related Application Conditions</b>

STANDARD PREVIEW  
(standards.iteh.ai)

oSIST prEN 50126-4:2012

[https://standards.iteh.ai/catalog/standards/sist/8a75241a-ee6b-4789-8749-](https://standards.iteh.ai/catalog/standards/sist/8a75241a-ee6b-4789-8749-37114143/osist-pren-50126-4-2012)

[37114143/osist-pren-50126-4-2012](https://standards.iteh.ai/catalog/standards/sist/8a75241a-ee6b-4789-8749-37114143/osist-pren-50126-4-2012)

7376	<b>4.63</b>	<b>SSA:</b>	<b>System Safety Analysis</b>
7377	<b>4.64</b>	<b>STA:</b>	<b>Static Timing Analysis</b>
7378	<b>4.65</b>	<b>SW:</b>	<b>Software</b>
7379	<b>4.66</b>	<b>TL:</b>	<b>Temporal Logic</b>
7380	<b>4.67</b>	<b>TO:</b>	<b>Test Oracle</b>
7381	<b>4.68</b>	<b>TPN:</b>	<b>Time Petri Nets</b>
7382	<b>4.69</b>	<b>TST:</b>	<b>tester</b>
7383	<b>4.70</b>	<b>UML:</b>	<b>Unified Modelling Language</b>
7384	<b>4.71</b>	<b>VAL:</b>	<b>validator</b>
7385	<b>4.72</b>	<b>VDR:</b>	<b>Voltage-dependent Resistor</b>
7386	<b>4.73</b>	<b>VER:</b>	<b>verifier</b>
7387	<b>4.74</b>	<b>VHDL:</b>	<b>Verilog Hardware Description Language</b>
7388	<b>4.75</b>	<b>WDR:</b>	<b>Walkthrough / Design Review</b>

7389

## 7390 **5 Overall Framework of the Part 4**

7391 This part of the EN 50126 suite of standards addresses the application of the safety life cycle to electronic  
 7392 hardware and integrated systems comprising electrical, electronic and programmable electronic hardware  
 7393 and software. The principal purpose of this suite of standards is to support the design, development,  
 7394 production and operation of acceptably safe products, systems and processes aimed at railway  
 7395 applications. In this spirit, the approval, acceptance or certification constitute a secondary potential  
 7396 benefit arising from compliance with this suite of standards. EN 50126-4 and EN 50126-5 of the standard  
 7397 suite address technology specific safety requirements and are complementary to the requirements and  
 7398 the framework developed in EN 50126-1 and EN 50126-2 which shall also be complied with. The  
 7399 standard addresses the management, organisation and overall electronic systems assurance including  
 7400 the safety requirements applicable to generic and configurable hardware. The system aspects of  
 7401 electronic system development are also addressed together with the requirements for manufacturing,  
 7402 deployment, operation and maintenance.

7403 The overall scope of this standard includes electrical, electronic and programmable electronic hardware  
 7404 with fixed embedded logic, configurable hardware, integrated electronic systems comprising hardware  
 7405 and software and electronic sub-systems with fixed or configurable logic.

7406 A part from hardware, sub-systems and integrated systems, this standard places requirements for  
 7407 management, organisation and the competency of the people who assume various roles in the safety life  
 7408 cycle of electronic hardware and systems. This is in recognition of the major impact of the organisational  
 7409 and competency aspects on the overall reduction of the systematic errors which are otherwise likely to  
 7410 remain embedded in the design and production of electronic hardware and systems.

7411 The overall structure of this standard addresses key safety life cycle requirements in the design,  
 7412 development, deployment and maintenance of electrical, electronic and programmable electronic  
 7413 systems and hardware. Where appropriate, the structure in this standard is aligned with the software  
 7414 standard in EN 50126-5 to provide a familiar and systematic approach across the related disciplines.

7415 Clauses 6 and 7 of this standard set out the common requirements for life cycle phases defined in  
 7416 Clauses 8-11. The chapters are structured to state the objectives, inputs, requirements and the outputs  
 7417 pertinent to each phase of the life cycle.