SIST

SLOVENSKI STANDARD
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Železniške naprave - Komunikacijski, signalni in procesni sistemi - Programska oprema za železniške krmilne in zaščitne sisteme

Railway applications - Communication, signalling and processing systems - Software for railway control and protection systems

Bahnanwendungen - Telekommunikationstechnik, Signaltechnik und Datenverarbeitungssysteme - Software für Eisenbahnsteuerungs- und Überwachungssysteme

Applications ferroviaires - Systèmes de signalisation, de télécommunication et de traitement - Logiciels pour systèmes de commande et de protection ferroviaire

Ta slovenski standard je istoveten z: **EN 50128:2011**

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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Railway applications - Communication, signalling and processing systems - Software for railway control and protection systems

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC 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 CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

This European Standard was prepared by SC 9XA, Communication, signalling and processing systems, of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways. .

It was submitted to the Formal Vote and was approved by CENELEC as EN 50128 on 2011-04-25.

This document supersedes EN 50128:2001.

The main changes with respect to EN 50128:2001 are listed below:

- requirements on software management and organisation, definition of roles and competencies, deployment and maintenance have been added;
- a new clause on tools has been inserted, based on EN 61508-2:2010;
- tables in Annex A have been updated.

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

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2012-04-25

– latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2014-04-25

This European Standard should be read in conjunction with EN 50126-1:1999 "*Railway applications – The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Part 1: Basic requirements and generic process*" and EN 50129:2003 "*Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling*".

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Introduction

This European Standard is part of a group of related standards. The others are EN 50126-1:1999 "*Railway applications – The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Part 1: Basic requirements and generic process*" and EN 50129:2003 "*Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling*".

EN 50126-1 addresses system issues on the widest scale, while EN 50129 addresses the approval process for individual systems which can exist within the overall railway control and protection system. This European Standard concentrates on the methods which need to be used in order to provide software which meets the demands for safety integrity which are placed upon it by these wider considerations.

This European Standard provides a set of requirements with which the development, deployment and maintenance of any safety-related software intended for railway control and protection applications shall comply. It defines requirements concerning organisational structure, the relationship between organisations and division of responsibility involved in the development, deployment and maintenance activities. Criteria for the qualification and expertise of personnel are also provided in this European Standard.

The key concept of this European Standard is that of levels of software safety integrity. This European Standard addresses five software safety integrity levels where 0 is the lowest and 4 the highest one. The higher the risk resulting from software failure, the higher the software safety integrity level will be.

This European Standard has identified techniques and measures for the five levels of software safety integrity. The required techniques and measures for software safety integrity levels 0-4 are shown in the normative tables of Annex A. In this version, the required techniques for level 1 are the same as for level 2, and the required techniques for level 3 are the same as for level 4. This European Standard does not give guidance on which level of software safety integrity is appropriate for a given risk. This decision will depend upon many factors including the nature of the application, the extent to which other systems carry out safety functions and social and economic factors.

It is within the scope of EN 50126-1 and EN 50129 to define the process of specifying the safety functions allocated to software.

This European Standard specifies those measures necessary to achieve these requirements.

EN 50126-1 and EN 50129 require that a systematic approach be taken to

a) identify hazards, assessing risks and arriving at decisions based on risk criteria,

b) identify the necessary risk reduction to meet the risk acceptance criteria,

c) define an overall System Safety Requirements Specification for the safeguards necessary to achieve the required risk reduction,

d) select a suitable system architecture,

e) plan, monitor and control the technical and managerial activities necessary to translate the System Safety Requirements Specification into a Safety-Related System of a validated safety integrity.

As decomposition of the specification into a design comprising safety-related systems and components takes place, further allocation of safety integrity levels is performed. Ultimately this leads to the required software safety integrity levels.

The current state-of-the-art is such that neither the application of quality assurance methods (so-called fault avoiding measures and fault detecting measures) nor the application of software fault tolerant approaches can guarantee the absolute safety of the software. There is no known way to prove the absence of faults in reasonably complex safety-related software, especially the absence of specification and design faults.

The principles applied in developing high integrity software include, but are not restricted to

- top-down design methods,
- modularity,
- verification of each phase of the development lifecycle,
- verified components and component libraries,
- clear documentation and traceability,
- auditable documents,
- validation,
- assessment,
- configuration management and change control and
- appropriate consideration of organisation and personnel competency issues.

The System Safety Requirements Specification identifies all safety functions allocated to software and determines their system safety integrity level. The successive functional steps in the application of this European Standard are shown in Figure 1 and are as follows:

a) define the Software Requirements Specification and in parallel consider the software architecture. The software architecture is where the safety strategy is developed for the software and the software safety integrity level (7.2 and 7.3);

b) design, develop and test the software according to the Software Quality Assurance Plan, software safety integrity level and the software lifecycle (7.4 and 7.5);

c) integrate the software on the target hardware and verify functionality (7.6);

d) accept and deploy the software (7.7 and 9.1);

e) if software maintenance is required during operational life then re-activate this European Standard as appropriate (9.2).

A number of activities run across the software development. These include testing (6.1), verification (6.2), validation (6.3), assessment (6.4), quality assurance (6.5) and modification and change control (6.6).

Requirements are given for support tools (6.7) and for systems which are configured by application data or algorithms (Clause 8).

Requirements are also given for the independence of roles and the competence of staff involved in software development (5.1, 5.2 and Annex B).

This European Standard does not mandate the use of a particular software development lifecycle. However, illustrative lifecycle and documentation sets are given in 5.3, Figure 3 and Figure 4 and in 7.1.

Tables have been formulated ranking various techniques/measures against the software safety integrity levels 0-4. The tables are in Annex A. Cross-referenced to the tables is a bibliography giving a brief description of each technique/measure with references to further sources of information. The bibliography of techniques is in Annex D.

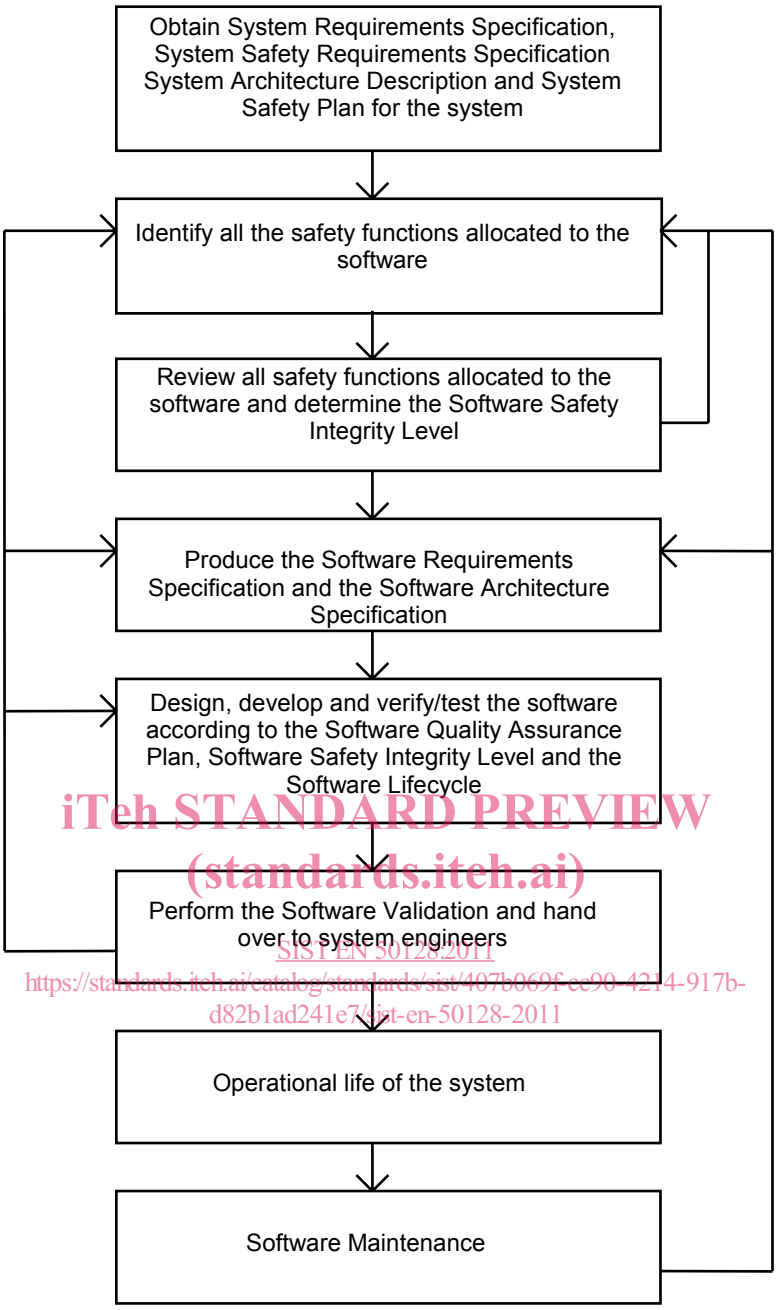

Figure 1 – Illustrative Software Route Map

1 Scope

1.1 This European Standard specifies the process and technical requirements for the development of software for programmable electronic systems for use in railway control and protection applications. It is aimed at use in any area where there are safety implications. These systems can be implemented using dedicated microprocessors, programmable logic controllers, multiprocessor distributed systems, larger scale central processor systems or other architectures.

1.2 This European Standard is applicable exclusively to software and the interaction between software and the system of which it is part.

1.3 This European Standard is not relevant for software that has been identified as having no impact on safety, i.e. software of which failures cannot affect any identified safety functions.

1.4 This European Standard applies to all safety related software used in railway control and protection systems, including

- application programming,
- operating systems,
- support tools,
- firmware.

Application programming comprises high level programming, low level programming and special purpose programming (for example: Programmable logic controller ladder logic).

1.5 This European Standard also addresses the use of pre-existing software and tools. Such software may be used, if the specific requirements in 7.3.4.7 and 6.5.4.16 on pre-existing software and for tools in 6.7 are fulfilled.

1.6 Software developed according to any version of this European Standard will be considered as compliant and not subject to the requirements on pre-existing software.

1.7 This European Standard considers that modern application design often makes use of generic software that is suitable as a basis for various applications. Such generic software is then configured by data, algorithms, or both, for producing the executable software for the application. The general Clauses 1 to 6 and 9 of this European Standard apply to generic software as well as for application data or algorithms. The specific Clause 7 applies only for generic software while Clause 8 provides the specific requirements for application data or algorithms.

1.8 This European Standard is not intended to address commercial issues. These should be addressed as an essential part of any contractual agreement. All the clauses of this European Standard will need careful consideration in any commercial situation.

1.9 This European Standard is not intended to be retrospective. It therefore applies primarily to new developments and only applies in its entirety to existing systems if these are subjected to major modifications. For minor changes, only 9.2 applies. The assessor has to analyse the evidences provided in the software documentation to confirm whether the determination of the nature and scope of software changes is adequate. However, application of this European Standard during upgrades and maintenance of existing software is highly recommended.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50126-1:1999	Railway applications – The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Part 1: Basic requirements and generic process
EN 50129:2003	Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling
EN ISO 9000	Quality management systems – Fundamentals and vocabulary (ISO 9000:2005)
EN ISO 9001	Quality management systems – Requirements (ISO 9001:2008)
ISO/IEC 90003:2004	Software engineering – Guidelines for the application of ISO 9001:2000 to computer software
ISO/IEC 9126 series	Software engineering – Product quality

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
assessment
process of analysis to determine whether software, which may include process, documentation, system, subsystem hardware and/or software components, meets the specified requirements and to form a judgement as to whether the software is fit for its intended purpose. Safety assessment is focused on but not limited to the safety properties of a system

3.1.2
assessor
entity that carries out an assessment

3.1.3
commercial off-the-shelf (COTS) software
software defined by market-driven need, commercially available and whose fitness for purpose has been demonstrated by a broad spectrum of commercial users

3.1.4
component
a constituent part of software which has well-defined interfaces and behaviour with respect to the software architecture and design and fulfils the following criteria:

- it is designed according to “Components” (see Table A.20);
- it covers a specific subset of software requirements;
- it is clearly identified and has an independent version inside the configuration management system or is a part of a collection of components (e. g. subsystems) which have an independent version

3.1.5
configuration manager
entity that is responsible for implementing and carrying out the processes for the configuration management of documents, software and related tools including change management

3.1.6
customer
entity which purchases a railway control and protection system including the software

3.1.7
designer
entity that analyses and transforms specified requirements into acceptable design solutions which have the required safety integrity level

3.1.8
entity
person, group or organisation who fulfils a role as defined in this European Standard

3.1.9
error, fault
defect, mistake or inaccuracy which could result in failure or in a deviation from the intended performance or behaviour

3.1.10
failure
unacceptable difference between required and observed performance

3.1.11
fault tolerance
built-in capability of a system to provide continued correct provision of service as specified, in the presence of a limited number of hardware or software faults

3.1.12
firmware
software stored in read-only memory or in semi-permanent storage such as flash memory, in a way that is functionally independent of applicative software

3.1.13
generic software
software which can be used for a variety of installations purely by the provision of application-specific data and/or algorithms

3.1.14
implementer
entity that transforms specified designs into their physical realisation

3.1.15
integration
process of assembling software and/or hardware items, according to the architectural and design specification, and testing the integrated unit

3.1.16
integrator
entity that carries out software integration

3.1.17
pre-existing software
software developed prior to the application currently in question, including COTS (commercial off-the shelf) and open source software

3.1.18
open source software
source code available to the general public with relaxed or non-existent copyright restrictions

3.1.19
programmable logic controller
solid-state control system which has a user programmable memory for storage of instructions to implement specific functions

3.1.20
project management
administrative and/or technical conduct of a project, including safety aspects

3.1.21
project manager
entity that carries out project management

3.1.22
reliability
ability of an item to perform a required function under given conditions for a given period of time

3.1.23
robustness
ability of an item to detect and handle abnormal situations

3.1.24
requirements manager
entity that carries out requirements management

3.1.25
requirements management
the process of eliciting, documenting, analysing, prioritising and agreeing on requirements and then controlling change and communicating to relevant stakeholders. It is a continuous process throughout a project

3.1.26
risk
combination of the rate of occurrence of accidents and incidents resulting in harm (caused by a hazard) and the degree of severity of that harm

3.1.27
safety
freedom from unacceptable levels of risk of harm to people

3.1.28
safety authority
body responsible for certifying that safety related software or services comply with relevant statutory safety requirements

3.1.29
safety function
a function that implements a part or whole of a safety requirement

3.1.30
safety-related software
software which performs safety functions

3.1.31
software
intellectual creation comprising the programs, procedures, rules, data and any associated documentation pertaining to the operation of a system

3.1.32
software baseline
complete and consistent set of source code, executable files, configuration files, installation scripts and documentation that are needed for a software release. Information about compilers, operating systems, pre-existing software and dependent tools is stored as part of the baseline. This will enable the organisation to