



Handläggande organ

Svenska Elektriska Kommissionen, SEK

Fastställd

1999-10-29

Utgåva

1

Sida

1 (1+76)

Ingår i

SEK Översikt 9

Reg 481 01 56

© Copyright SIS. Reproduction in any form without permission is prohibited.

Järnvägsanläggningar – Specifikation av tillförlitlighet, funktionssannolikhet, driftsäkerhet, tillgänglighet, underhållsmässighet och säkerhet (RAMS)

Railway specifications –

The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS)

Som svensk standard gäller europastandarden EN 50126:1999. Den svenska standarden innehåller den officiella engelska språkversionen av EN 50126:1999.

ICS 29.280; 45.020

Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.
Postadress: SIS Förlag AB, Box 6455, 113 82 STOCKHOLM
Telefon: 08 - 610 30 60. Telefax: 08 - 30 18 50

Upplysningar om **sakinnehållet** i standarden lämnas av SEK.
Telefon: 08 - 444 14 00. Telefax: 08 - 444 14 30
E-post: sek@sekom.se
Prisgrupp T

Tryckt i november 1999

EUROPEAN STANDARD

EN 50126

NORME EUROPÉENNE

EUROPÄISCHE NORM

September 1999

ICS 29.280; 45.020

English version

Railway applications - The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS)

Applications ferroviaires - Spécification et démonstration de la fiabilité, de la disponibilité, de la maintenabilité et de la sécurité (FDMS)

Bahnanwendungen - Spezifikation und Nachweis der Zuverlässigkeit, Verfügbarkeit, Instandhaltbarkeit, Sicherheit (RAMS)

This European Standard was approved by CENELEC on 1998-10-01. 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.

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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 9X, Electrical and electronic applications in railways.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50126 on 1998-10-01.

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) 2000-04-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2000-04-01

Annexes designated “normative” are part of the body of the standard.

Annexes designated “informative” are given for information only.

In this standard, annexes A to E are informative.

Content

	Page
Introduction	5
1 Scope	6
2 Normative references	7
3 Definitions	8
4 Railway RAMS	11
4.1 Introduction	11
4.2 Railway RAMS and quality of service	11
4.3 Elements of railway RAMS	12
4.4 Factors influencing railway RAMS	14
4.4.1 General	14
4.4.2 Categories of factors	14
4.4.3 Management of factors	18
4.5 The means to achieve railway RAMS requirements	19
4.5.1 General	19
4.5.2 RAMS specification:	19
4.6 Risk	20
4.6.1 Risk concept:	20
4.6.2 Risk analysis:	20
4.6.3 Risk evaluation and acceptance	21
4.7 Safety integrity	22
4.8 Fail-safe concept	24
5 Management of railway RAMS	25
5.1 General	25
5.2 System lifecycle	25
5.3 Application of this standard	31
6 RAMS lifecycle	34
6.1 Phase 1: Concept	34
6.2 Phase 2: System definition and application conditions	36
6.3 Phase 3: Risk analysis	39
6.4 Phase 4: System requirements	41
6.5 Phase 5: Apportionment of system requirements	45
6.6 Phase 6: Design and implementation	47
6.7 Phase 7: Manufacturing	50
6.8 Phase 8: Installation	52
6.9 Phase 9: System validation (including safety acceptance and commissioning)	54
6.10 Phase 10: System acceptance	56
6.11 Phase 11: Operation and maintenance	57
6.12 Phase 12: Performance monitoring	58
6.13 Phase 13: Modification and retrofit	59
6.14 Phase 14: Decommissioning and disposal	60
Annex A (informative) Outline of RAMS specification - example	61
Annex B (informative) RAMS programme	66
Annex C (informative) Examples of parameters for railway	71
Annex D (informative) Examples of some risk acceptance principles	73
Annex E (informative) Responsibilities within the RAMS process throughout the lifecycle	76

Figures

Figure 1: Quality of Service and Railway RAMS	12
Figure 2: Inter-relation of Railway RAMS elements.....	12
Figure 3: Effects of Failures Within a System	13
Figure 4: Influences on RAMS	14
Figure 5: Factors Influencing Railway RAMS	17
Figure 6: Example of a Cause/Effect Diagram.....	18
Figure 7: Certified Products in Safety Systems.....	23
Figure 8: System Lifecycle	26
Figure 9: Project Phase Related Tasks (Sheet 1 of 2)	27
Figure 9: Project Phase Related Tasks (Sheet 2 of 2)	28
Figure 10: The V Representation	31
Figure 11: Verification and Validation	31
Figure 12:RAMS Eng. and Manag't Implemented within a System Realisation Process.....	33

Tables

Table 1: RAM Failure Categories	19
Table 2: Frequency of Occurrence of Hazardous Events	20
Table 3: Hazard Severity Level	21
Table 4: Frequency - Consequence Matrix	21
Table 5: Qualitative Risk Categories	22
Table 6: Typical Example of Risk Evaluation and Acceptance.....	22
Table B.1: Example of a Basic RAMS Programme Outline	67
Table C.1: Examples of Reliability Parameters	71
Table C.2: Examples of Maintainability Parameters.....	71
Table C.3: Examples of Availability Parameters.....	72
Table C.4: Examples of Logistic Support Parameters.....	72
Table C.5: Examples of Safety Performance Parameters.....	72

Introduction

This European Standard provides Railway Authorities and the railway support industry, throughout the European Union, with a process which will enable the implementation of a consistent approach to the management of reliability, availability, maintainability and safety, denoted by the acronym RAMS. Processes for the specification and demonstration of RAMS requirements are cornerstones of this standard. This European Standard aims to promote a common understanding and approach to the management of RAMS.

This European Standard can be applied systematically by a railway authority and railway support industry, throughout all phases of the lifecycle of a railway application, to develop railway specific RAMS requirements and to achieve compliance with these requirements. The systems-level approach defined by this European Standard facilitates assessment of the RAMS interactions between elements of complex railway applications.

This European Standard promotes co-operation between a railway authority and railway support industry, within a variety of procurement strategies, in the achievement of an optimal combination of RAMS and cost for railway applications. Adoption of this European Standard will support the principles of the European Single Market and facilitate European railway inter-operability.

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

1 Scope

1.1 This European Standard:

- defines RAMS in terms of reliability, availability, maintainability and safety and their interaction;
- defines a process, based on the system lifecycle and tasks within it, for managing RAMS;
- enables conflicts between RAMS elements to be controlled and managed effectively;
- defines a systematic process for specifying requirements for RAMS and demonstrating that these requirements are achieved;
- addresses railway specifics;
- does not define RAMS targets, quantities, requirements or solutions for specific railway applications;
- does not specify requirements for ensuring system security;
- does not define rules or processes pertaining to the certification of railway products against the requirements of this standard;
- does not define an approval process by the safety regulatory authority.

1.2. This European Standard is applicable:

- to the specification and demonstration of RAMS for all railway applications and at all levels of such an application, as appropriate, from complete railway routes to major systems within a railway route, and to individual and combined sub-systems and components within these major systems, including those containing software; in particular:
 - to new systems;
 - to new systems integrated into existing systems in operation prior to the creation of this standard, although it is not generally applicable to other aspects of the existing system;
 - to modifications of existing systems in operation prior to the creation of this standard, although it is not generally applicable to other aspects of the existing system.
- at all relevant phases of the lifecycle of an application;
- for use by Railway Authorities and the railway support industry.

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