



NSAI
Standards

Irish Standard
I.S. EN 50126-1:2017

Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process

I.S. EN 50126-1:2017

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:

EN 50126-1:2017

Published:

2017-10-13

*This document was published
under the authority of the NSAI
and comes into effect on:*

2017-11-01

ICS number:

29.280

45.020

NOTE: If blank see CEN/CENELEC cover page

NSAI
1 Swift Square,
Northwood, Santry
Dublin 9

T +353 1 807 3800
F +353 1 807 3838
E standards@nsai.ie
W NSAI.ie

Sales:
T +353 1 857 6730
F +353 1 857 6729
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

National Foreword

I.S. EN 50126-1:2017 is the adopted Irish version of the European Document EN 50126-1:2017, Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

For relationships with other publications refer to the NSAI web store.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This page is intentionally left blank

EUROPEAN STANDARD

EN 50126-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2017

ICS 29.280; 45.020

Supersedes EN 50126-1:1999

English Version

Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process

Applications ferroviaires - Spécification et démonstration de
la fiabilité, de la disponibilité, de la maintenabilité et de la
sécurité (FDMS) - Partie 1: Processus FDMS générique

Bahnanwendungen - Spezifikation und Nachweis von
Zuverlässigkeit, Verfügbarkeit, Instandhaltbarkeit und
Sicherheit (RAMS) - Teil 1: Generischer RAMS Prozess

This European Standard was approved by CENELEC on 2017-07-03. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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



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

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

EN 50126-1:2017 (E)**Contents****Page**

European foreword	6
Introduction	7
1 Scope	8
2 Normative references	9
3 Terms and definitions	9
4 Abbreviations	20
5 Railway RAMS	20
5.1 Introduction	20
5.2 Multi-level System approach	21
5.2.1 Concepts of system hierarchy	21
5.2.2 System requirements and characteristics	22
5.2.3 Defining a system	23
5.3 Railway system overview	23
5.3.1 Introduction	23
5.3.2 Stakeholders involved in a railway system	23
5.3.3 Railway system structure and apportionment of RAMS requirements	24
5.4 Railway RAMS and quality of service	24
5.5 Elements of railway RAMS	24
5.6 Factors influencing railway RAMS	27
5.6.1 General	27
5.6.2 Classes of failures	27
5.6.3 Derivation of detailed railway specific influencing factors	27
5.6.4 Human factors	32
5.7 Specification of railway RAMS requirements	34
5.7.1 General	34
5.7.2 RAMS specification	34
5.8 Risk based approach	34
5.9 Risk reduction strategy	35
5.9.1 Introduction	35
5.9.2 Reduction of risks related to safety	35
5.9.3 Reduction of risks related to RAM	36
6 Management of railway RAMS – general requirements	37
6.1 Introduction	37
6.2 Life cycle for the system under consideration	37
6.3 Risk assessment	45
6.4 Organisational requirements	46
6.4.1 Introduction	46
6.4.2 Requirements	47
6.5 Application of this standard and adaptability to project scope and size	47
6.5.1 General requirements	47
6.5.2 Case of complex systems with different hierarchical levels	49
6.5.3 Renewal within existing systems	50

6.5.4	Re-use or adaptation of a system with previous acceptance.....	50
6.6	General requirements on RAMS documentation.....	51
6.7	Verification and Validation	52
6.7.1	Introduction.....	52
6.7.2	Verification.....	52
6.7.3	Validation.....	52
6.8	Independent Safety Assessment.....	53
6.8.1	Objectives.....	53
6.8.2	Activities	54
7	RAMS life cycle	55
7.1	General	55
7.2	Phase 1: Concept	55
7.2.1	Objectives.....	55
7.2.2	Activities	56
7.2.3	Deliverables.....	56
7.3	Phase 2: System definition and operational context	56
7.3.1	Objectives.....	56
7.3.2	Activities	56
7.3.3	Deliverables.....	60
7.4	Phase 3: Risk analysis and evaluation	60
7.4.1	Objectives.....	60
7.4.2	Activities	61
7.4.3	Deliverables.....	64
7.5	Phase 4: Specification of system requirements	64
7.5.1	Objectives.....	64
7.5.2	Activities	65
7.5.3	Deliverables.....	66
7.5.4	Specific validation tasks.....	66
7.6	Phase 5: Architecture and apportionment of system requirements	67
7.6.1	Objectives.....	67
7.6.2	Activities	67
7.6.3	Deliverables.....	68
7.7	Phase 6: Design and Implementation.....	68
7.7.1	Objectives.....	68
7.7.2	Activities	68
7.7.3	Deliverables.....	69
7.7.4	Specific verification tasks.....	70
7.8	Phase 7: Manufacture	70
7.8.1	Objectives.....	70
7.8.2	Activities	70
7.8.3	Deliverables.....	71
7.9	Phase 8: Integration	71
7.9.1	Objectives.....	71
7.9.2	Activities	71
7.9.3	Deliverables.....	72
7.9.4	Specific verification tasks.....	72
7.10	Phase 9: System Validation	73
7.10.1	Objectives.....	73

EN 50126-1:2017 (E)

7.10.2	Activities	73
7.10.3	Deliverables	73
7.11	Phase 10: System acceptance	74
7.11.1	Objectives	74
7.11.2	Activities	75
7.11.3	Deliverables	75
7.12	Phase 11: Operation, maintenance and performance monitoring	75
7.12.1	Objectives	75
7.12.2	Activities	75
7.12.3	Deliverables	78
7.12.4	Specific verification tasks	79
7.13	Phase 12: Decommissioning	79
7.13.1	Objectives	79
7.13.2	Activities	79
7.13.3	Deliverables	79
8	Safety Case	79
8.1	Purpose of a safety case	79
8.2	Content of a safety case	80
Annex A (informative)	RAMS plan	82
A.1	General	82
A.2	Procedure	82
A.3	Basic RAMS plan example	82
A.4	List of techniques	84
Annex B (informative)	Examples of parameters for railway	86
B.1	General	86
B.2	Reliability parameters	86
B.3	Maintainability parameters	86
B.4	Availability parameters	87
B.5	Logistic support parameters	89
B.6	Safety parameters	89
Annex C (informative)	Risk matrix calibration and risk acceptance categories	90
C.1	General	90
C.2	Frequency of occurrence categories	90
C.3	Severity categories	92
C.4	Risk acceptance categories	93
Annex D (informative)	Guidance on system definition	95
D.1	General	95
D.2	System Definition in an iterative system approach	95
D.3	Method for defining the structure of a system	95
D.3.1	General	95
D.3.2	Function List	95
D.3.3	Functional breakdown	95
D.4	Parties/stakeholders/boundaries of systems	96
D.5	Guidance on the content of a system definition	96

Annex ZZ (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC	98
Bibliography	102
Table 1 — RAMS tasks along life-cycle phases (1 of 4)	41
Table A.1 – Example of a basic RAMS plan outline (part 1 of 2)	83
Table B.1 – Examples of reliability parameters	86
Table B.2 – Examples of maintainability parameters	86
Table B.3 – Examples of availability parameters	87
Table B.4 – Examples of logistic support parameters	90
Table B.5 – Examples of safety performance parameters	90
Table C.1 – Frequency of occurrence of hazardous events with examples for quantification (time based)	91
Table C.2 – Frequency of occurrence of events with examples for quantification (distance based)	92
Table C.3 – Severity categories (example related to RAM)	93
Table C.4 – Severity categories (example 1 related to RAMS)	93
Table C.5 – Severity categories (example 2 related to Safety)	94
Table C.6 – Financial severity categories (example)	94
Table C.7 – Risk acceptance categories (example 1 for binary decisions)	94
Table C.8 – Risk acceptance categories (example 2)	94
Table C.9 – Risk acceptance categories (example related to safety)	95
Table D.1 – Typical examples for a functional breakdown	97

EN 50126-1:2017 (E)

European foreword

This document (EN 50126-1:2017) has been prepared by CLC/TC 9X "Electrical and electronic applications for railways".

The following dates are fixed:

- latest date by which this document has (dop) 2018-07-03
to be implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2020-07-03
standards conflicting with this document
have to be withdrawn

This document supersedes EN 50126-1:1999 which has been technically revised.

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

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

- Part 1: Generic RAMS process;
- Part 2: System approach to safety.

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

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

Introduction

EN 50126-1:1999 was aimed at introducing the application of a systematic RAMS management process in the railway sector. Through the application of this standard and the experiences gained over the last years, the need for revision and restructuring became apparent with a need to deliver a systematic and coherent approach to RAMS applicable to all the railway application fields Command, Control and Signalling (Signalling), Rolling Stock and Electric power supply for Railways (Fixed Installations).

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

This European Standard provides railway duty holders and the railway suppliers, 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 promotes a common understanding and approach to the management of RAMS.

EN 50126 forms part of the railway sector specific application of IEC 61508. Meeting the requirements in this European Standard together with the requirements of other suitable standards is sufficient to ensure that additional compliance to IEC 61508 does not need to be demonstrated.

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

EN 50126-1 and EN 50126-2 are independent from the technology used. As far as safety is concerned, EN 50126 takes the perspective of safety with a functional approach.

The application of this standard can be adapted to the specific requirements for the system under consideration.

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

This European Standard promotes co-operation between the stakeholders of Railways 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.

In accordance with CENELEC editing rules ¹⁾, mandatory requirements in this standard are indicated with the modal verb “shall”. Where justifiable, the standard permits process tailoring.

Specific guidance on the application of this standard for Safety aspects is provided in EN 50126-2. EN 50126-2 provides various methods for use in the safety management process. Where a particular method is selected for the system under consideration, the mandatory requirements for this method are by consequence mandatory for the safety management of the system under consideration.

This European Standard consists of the main part (Clause 1 to Clause 8) and Annexes A, B, C, D and ZZ. The requirements defined in the main part of the standard are normative, whilst Annexes are informative.

1) CEN/CENELEC Internal Regulations Part 3: Rules for the structure and drafting of CEN/CENELEC Publications (2017-02), Annex H.

EN 50126-1:2017 (E)**1 Scope**

This part 1 of EN 50126

- considers RAMS, understood as reliability, availability, maintainability and safety and their interaction;
- considers the generic aspects of the RAMS life cycle. The guidance in this part can still be used in the application of specific standards;
- defines:
 - a process, based on the system life cycle and tasks within it, for managing RAMS;
 - a systematic process, tailorable to the type and size of the system under consideration, for specifying requirements for RAMS and demonstrating that these requirements are achieved;
- addresses railway specifics;
- enables conflicts between RAMS elements to be controlled and managed effectively;
- does not define:
 - RAMS targets, quantities, requirements or solutions for specific railway applications;
 - rules or processes pertaining to the certification of railway products against the requirements of this standard;
 - an approval process for the railway stakeholders.

This part 1 of EN 50126 is applicable to railway application fields, namely Command, Control and Signalling, Rolling Stock and Fixed Installations, and specifically:

- to the specification and demonstration of RAMS for all railway applications and at all levels of such an application, as appropriate, from complete railway systems to major systems and to individual and combined subsystems and components within these major systems, including those containing software; in particular:
 - to new systems;
 - to new systems integrated into existing systems already accepted, but only to the extent and insofar as the new system with the new functionality is being integrated. It is otherwise not applicable to any unmodified aspects of the existing system;
 - as far as reasonably practicable, to modifications and extensions of existing systems already accepted, but only to the extent and insofar as existing systems are being modified. It is otherwise not applicable to any unmodified aspect of the existing system;
- at all relevant phases of the life cycle of an application;
- for use by railway duty holders and the railway suppliers.

It is not required to apply this standard to existing systems which remain unmodified, including those systems already compliant with any former version of EN 50126.

The process defined by this European Standard assumes that railway duty holders and railway suppliers 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 EN ISO 9001.

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- Looking for additional Standards? Visit Intertek Inform Infostore
 - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-