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Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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RAILWAY APPLICATIONS – COMMUNICATION, SIGNALLING AND PROCESSING SYSTEMS – SAFETY RELATED ELECTRONIC SYSTEMS FOR SIGNALLING

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This commented version (CMV) of the official standard IEC 62425:2025 edition 2.0 provides the user with comments from IEC TC 9 experts to explain the reasons of the most relevant changes made to the previous IEC 62425:2007 edition 1.0.

Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 62425 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways. It is an International Standard.

EN 50129:2018 has served as a basis for the development of this document.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) a better alignment with the life cycle phases defined in IEC 62278-1 has been made;
b) Clause 5 describes the requirements that apply to the development of safety-related electronic systems (until phase 9 of the life cycle);
c) Clause 8 focuses on the requirements for safety acceptance and approval of safety-related electronic systems and subsequent phases;
d) requirements and guidance have been added in Clause 6 on the following topics:
    1) reuse of pre-existing systems,
    2) safety-related tools,
    3) impact of cybersecurity threats on functional safety,
    4) specific application safety cases;
e) requirements for the structure and content of the safety case are now defined in a dedicated Clause 7;
f) Annex A has been updated for the specification and allocation of safety integrity requirements;
g) the content of former Annex D has been merged with Annex B, and the content has been changed from informative to normative;
h) the status of Annex E has been changed from informative to normative;
i) an Annex F has been added as an informative annex on User Programmable Integrated Circuits.

A more detailed comparison of changes between IEC 62425:2007 and this document can be found in Annex G.

The text of this International Standard is based on the following documents:

Draft	Report on voting
9/3113/FDIS	9/3141/RVD

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

The language used for the development of this International Standard is English.

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

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

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

This International Standard defines requirements for the development and acceptance of safety-related electronic systems in the railway signalling field.

Safety-related electronic systems for signalling include hardware and software aspects. To develop complete safety-related systems, both aspects need to be taken into account throughout the whole life cycle of the system. The requirements for the overall safety-related electronic system and for its hardware aspects are defined in this document. Other requirements are defined in associated IEC and CENELEC standards. For safety-related systems which include software, additional conditions are defined in IEC 62279:2015.

NOTE 1 IEC 62279:2015 is derived from the European Standard EN 50128:2011.

Additional requirements for safety-related communication are defined in IEC 62280:2014.

This document is the common base for safety acceptance and approval of electronic systems for railway signalling applications. The aim of railway authorities and railway industry is to develop railway systems based on common standards. The safety authorities having jurisdiction can apply this document to the relevant matters they choose. On this basis, cross-acceptance of safety approvals for sub-systems and equipment can be applied by the different national safety authorities.

Cross-acceptance is applicable to generic approval, not to specific applications.

This document is concerned with the evidence to be presented for the acceptance of safety-related systems. However, it specifies not only those life cycle activities which need to be completed before the acceptance stage, but also the additional planned activities to be carried out afterwards. In this way, safety justification will cover the whole life cycle.

This document is concerned with what evidence is to be presented. Except where considered appropriate, it does not specify who carries out the necessary work. The necessary work can be carried out by different people, in different circumstances or organisational structures, provided that independence of roles is respected.

This document consists of Clauses 1 to 8, which form the main part, and Annexes A, B, C, D, E, F and G. The requirements defined in Clauses 5 to 8 and in Annexes A, B, C and E are normative, whilst Annexes D, F and G are informative.

This document is in line with, and contain references to IEC 62278-1:—[1] and IEC 62278-2:—[1].

NOTE 2 IEC 62278-1:— and IEC 62278-2:— are derived from the European Standards EN 50126-1:2017 and EN 50126-2:2017 respectively.

This document is based on the system life cycle described in IEC 62278 series and is in line with the IEC 61508 series. IEC 62278, IEC 62279 and IEC 62425 comprise the railway sector equivalent of the IEC 61508 series so far as railway communication, signalling and processing systems are concerned. Given that compliance with these documents has been demonstrated, there are no requirements in this document for further evaluation of compliance with the IEC 61508 series.

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1 Under preparation. Stage at the time of publication: IEC/FDIS 62278-1:2025 and IEC/FDIS 62278-2:2025.

RAILWAY APPLICATIONS – COMMUNICATION, SIGNALLING AND PROCESSING SYSTEMS – SAFETY RELATED ELECTRONIC SYSTEMS FOR SIGNALLING

1 Scope

This document is applicable to safety-related electronic systems (including subsystems and equipment) for railway signalling applications.

This document applies to generic systems (i.e. generic products or systems defining a class of applications), as well as to systems for specific applications.

The scope of this document, and its relationship with other IEC and CENELEC standards, are shown in Figure 1.

This document is applicable only to the functional safety of systems. It does not deal with other aspects of safety such as the occupational health and safety of personnel. While functional safety of systems clearly can have an impact on the safety of personnel, there are other aspects of system design which can also affect occupational health and safety and which are not covered by this document. Cybersecurity aspects of functional safety are addressed only to a limited extent. **1**

This document applies to all the phases of the life cycle of a safety-related electronic system, focusing in particular on phases 5 (architecture and apportionment of system requirements) to 10 (system acceptance) as defined in IEC 62278-1:—.

Requirements for systems which are not related to safety are outside the scope of this document.

This document is not applicable to existing systems, subsystems or equipment which had already been accepted prior to the development of this document. However, so far as reasonably practicable, it is applicable to modifications and extensions to existing systems, subsystems and equipment.

This document is primarily applicable to systems, subsystems or equipment which have been specifically designed and manufactured for railway signalling applications. It is also applicable, so far as reasonably practicable, to general-purpose or industrial equipment (e.g. power supplies, display screens or other commercial off the shelf items), which is procured for use as part of a safety-related electronic system.

This document is aimed at railway duty holders, railway suppliers, and assessors as well as at safety authorities, although it does not define an approval process to be applied by the safety authorities.

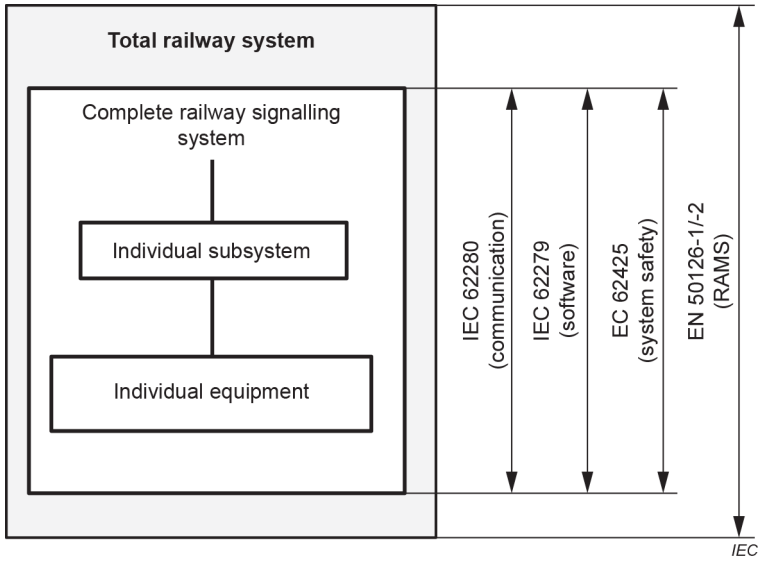


Figure 1 – Scope of the main IEC and CENELEC railway application standards

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 62278-1:—[2], *Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Part 1: Generic RAMS Process*

IEC 62278-2:—[2], *Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Part 2: Systems Approach to Safety*

IEC 62279:2015, *Railway applications – Communication, signalling and processing systems – Software for railway control and protection systems*

IEC 62280:2014, *Railway applications – Communication, signalling and processing systems – Safety related communication in transmission systems*

IEC 62497-1[3]:2010, *Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment*
IEC 62497-1:2010/AMD1:2013

IEC 62498-1:2010, *Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock*

IEC 62498-3:2010, *Railway applications – Environmental conditions for equipment – Part 3: Equipment for signalling and telecommunications*

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2 Under preparation. Stage at the time of publication: IEC/FDIS 62278-1:2025 and IEC/FDIS 62278-2:2025.

3 There exists a consolidated edition 1.1:2013 that includes IEC 62497-1:2010 and its Amendment 1:2013.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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RAILWAY APPLICATIONS – COMMUNICATION, SIGNALLING AND PROCESSING SYSTEMS – SAFETY RELATED ELECTRONIC SYSTEMS FOR SIGNALLING

FOREWORD

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IEC 62425 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways. It is an International Standard.

EN 50129:2018 has served as a basis for the development of this document.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) a better alignment with the life cycle phases defined in IEC 62278-1 has been made;
b) Clause 5 describes the requirements that apply to the development of safety-related electronic systems (until phase 9 of the life cycle);

c) Clause 8 focuses on the requirements for safety acceptance and approval of safety-related electronic systems and subsequent phases;

d) requirements and guidance have been added in Clause 6 on the following topics:

   1) reuse of pre-existing systems,

   2) safety-related tools,

   3) impact of cybersecurity threats on functional safety,

   4) specific application safety cases;

e) requirements for the structure and content of the safety case are now defined in a dedicated Clause 7;

f) Annex A has been updated for the specification and allocation of safety integrity requirements;

g) the content of former Annex D has been merged with Annex B, and the content has been changed from informative to normative;

h) the status of Annex E has been changed from informative to normative;

i) an Annex F has been added as an informative annex on User Programmable Integrated Circuits.

A more detailed comparison of changes between IEC 62425:2007 and this document can be found in Annex G.

The text of this International Standard is based on the following documents:

Draft	Report on voting
9/3113/FDIS	9/3141/RVD

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

The language used for the development of this International Standard is English.

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

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

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This International Standard defines requirements for the development and acceptance of safety-related electronic systems in the railway signalling field.

Safety-related electronic systems for signalling include hardware and software aspects. To develop complete safety-related systems, both aspects need to be taken into account throughout the whole life cycle of the system. The requirements for the overall safety-related electronic system and for its hardware aspects are defined in this document. Other requirements are defined in associated IEC and CENELEC standards. For safety-related systems which include software, additional conditions are defined in IEC 62279:2015.

NOTE 1 IEC 62279:2015 is derived from the European Standard EN 50128:2011.

Additional requirements for safety-related communication are defined in IEC 62280:2014.

This document is the common base for safety acceptance and approval of electronic systems for railway signalling applications. The aim of railway authorities and railway industry is to develop railway systems based on common standards. The safety authorities having jurisdiction can apply this document to the relevant matters they choose. On this basis, cross-acceptance of safety approvals for sub-systems and equipment can be applied by the different national safety authorities.

Cross-acceptance is applicable to generic approval, not to specific applications.

This document is concerned with the evidence to be presented for the acceptance of safety-related systems. However, it specifies not only those life cycle activities which need to be completed before the acceptance stage, but also the additional planned activities to be carried out afterwards. In this way, safety justification will cover the whole life cycle.

This document is concerned with what evidence is to be presented. Except where considered appropriate, it does not specify who carries out the necessary work. The necessary work can be carried out by different people, in different circumstances or organisational structures, provided that independence of roles is respected.

This document consists of Clauses 1 to 8, which form the main part, and Annexes A, B, C, D, E, F and G. The requirements defined in Clauses 5 to 8 and in Annexes A, B, C and E are normative, whilst Annexes D, F and G are informative.

This document is in line with, and contain references to IEC 62278-1:—[1] and IEC 62278-2:—[1].

NOTE 2 IEC 62278-1:— and IEC 62278-2:— are derived from the European Standards EN 50126-1:2017 and EN 50126-2:2017 respectively.

This document is based on the system life cycle described in IEC 62278 series and is in line with the IEC 61508 series. IEC 62278, IEC 62279 and IEC 62425 comprise the railway sector equivalent of the IEC 61508 series so far as railway communication, signalling and processing systems are concerned. Given that compliance with these documents has been demonstrated, there are no requirements in this document for further evaluation of compliance with the IEC 61508 series.

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1 Under preparation. Stage at the time of publication: IEC/FDIS 62278-1:2025 and IEC/FDIS 62278-2:2025.

RAILWAY APPLICATIONS – COMMUNICATION, SIGNALLING AND PROCESSING SYSTEMS – SAFETY RELATED ELECTRONIC SYSTEMS FOR SIGNALLING

1 Scope

This document is applicable to safety-related electronic systems (including subsystems and equipment) for railway signalling applications.

This document applies to generic systems (i.e. generic products or systems defining a class of applications), as well as to systems for specific applications.

The scope of this document, and its relationship with other IEC and CENELEC standards, are shown in Figure 1.

This document is applicable only to the functional safety of systems. It does not deal with other aspects of safety such as the occupational health and safety of personnel. While functional safety of systems clearly can have an impact on the safety of personnel, there are other aspects of system design which can also affect occupational health and safety and which are not covered by this document. Cybersecurity aspects of functional safety are addressed only to a limited extent.

This document applies to all the phases of the life cycle of a safety-related electronic system, focusing in particular on phases 5 (architecture and apportionment of system requirements) to 10 (system acceptance) as defined in IEC 62278-1:—.

Requirements for systems which are not related to safety are outside the scope of this document.

This document is not applicable to existing systems, subsystems or equipment which had already been accepted prior to the development of this document. However, so far as reasonably practicable, it is applicable to modifications and extensions to existing systems, subsystems and equipment.

This document is primarily applicable to systems, subsystems or equipment which have been specifically designed and manufactured for railway signalling applications. It is also applicable, so far as reasonably practicable, to general-purpose or industrial equipment (e.g. power supplies, display screens or other commercial off the shelf items), which is procured for use as part of a safety-related electronic system.

This document is aimed at railway duty holders, railway suppliers, and assessors as well as at safety authorities, although it does not define an approval process to be applied by the safety authorities.

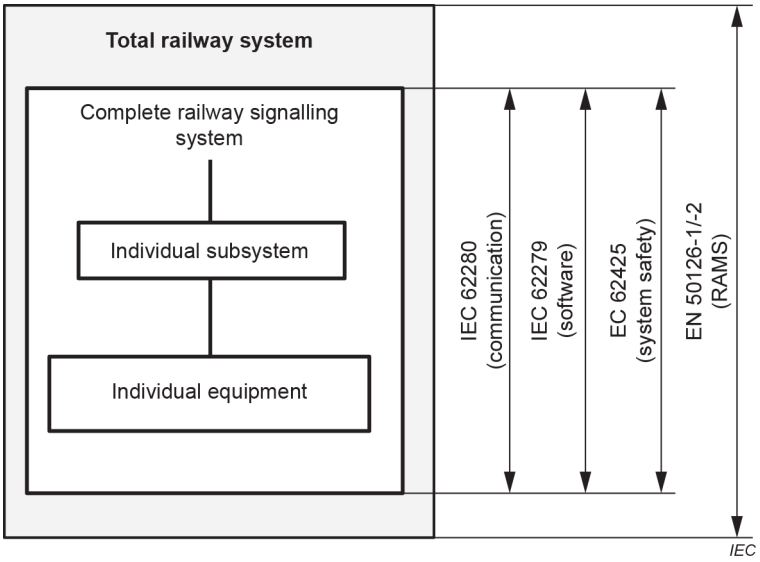


Figure 1 – Scope of the main IEC and CENELEC railway application standards

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 62278-1:—[2], *Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Part 1: Generic RAMS Process*

IEC 62278-2:—[2], *Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Part 2: Systems Approach to Safety*

IEC 62279:2015, *Railway applications – Communication, signalling and processing systems – Software for railway control and protection systems*

IEC 62280:2014, *Railway applications – Communication, signalling and processing systems – Safety related communication in transmission systems*

IEC 62497-1[3]:2010, *Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment*
IEC 62497-1:2010/AMD1:2013

IEC 62498-1:2010, *Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock*

IEC 62498-3:2010, *Railway applications – Environmental conditions for equipment – Part 3: Equipment for signalling and telecommunications*

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2 Under preparation. Stage at the time of publication: IEC/FDIS 62278-1:2025 and IEC/FDIS 62278-2:2025.

3 There exists a consolidated edition 1.1:2013 that includes IEC 62497-1:2010 and its Amendment 1:2013.