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EUROPEAN STANDARD

EN 50155

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July 2021

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Supersedes EN 50155:2017 and all of its amendments
and corrigenda (if any)

English Version

Railway applications - Rolling stock - Electronic equipmentApplications ferroviaires - Équipements électroniques
utilisés sur le matériel roulantBahnanwendungen - Fahrzeuge - Elektronische
Betriebsmittel

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Europäisches Komitee für Elektrotechnische Normung

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European foreword

This document (EN 50155:2021) has been prepared by CLC/SC 9XB, “Electrical, electronic and electromechanical material on-board rolling stock, including associated software”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2022-06-28
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2024-06-28

This document supersedes EN 50155:2017 and all of its amendments and corrigenda (if any).

EN 50155:2021 includes the following significant technical changes with respect to EN 50155:2017:

- a) Revision of Clause 1 Scope;
 - 1) Precision about definition of electronic equipment and his components;
 - 2) Precision about covered scopes;
 - 3) Precision about applicability of this standard to electronic equipment or systems performing safety-related functions. (standards.iteh.ai)
- b) Updating of Clause 2 Normative references;

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- c) Revision of Clause 3 Terms, definitions and abbreviations, new definitions and reorganisation of subclauses;
 - 1) Definition added for “performance”;
 - 2) Definition added for “adjacent circuit”;
 - 3) Definition added for “specification”;
 - 4) Definition added for “procedure”.
- d) Improvement of Clause 4 General requirements, in terms of better wording, requirement expansion and reorganisation of subclauses;
 - 1) Precision about concept of normal performance level and concept of deviation of the normal performance level;
 - 2) Wording improvements of 4.3.2 to 4.3.4 “Performance criterion A, B and C”;
 - 3) Wording improvement of “4.6.4 Thermal compatibility”;
 - 4) Wording improvement of “4.6.6 Cabling inside vehicle” and “4.6.7 Wiring inside equipment”.
- e) Improvement of Clause 5 Electrical service conditions, with reorganisation of subclauses;
 - 1) Subclause “DC supply” is renamed “5.1.1 DC Supply system”;

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- 2) Subclause “5.1.2 AC supply system” is added;
 - 3) Precisions added and editorial improvements of 5.2.1 to 5.2.8;
 - 4) Concept of “rated voltage” is clarified in 5.2.2;
 - 5) Wording improvement of subclause “5.2.6 Grouping of supply voltages”;
 - 6) Subclause added: “5.3 Supply by another source than the vehicle battery”.
- f) Improvement and simplification of Clause 6 Reliability, maintainability and expected useful life, with reorganization of subclauses and introduction of explicative figures;
 - g) Wording improvements and precision added to Clause 7 Design;
 - h) Clause 8 is renamed “Electronic equipment not designed for use on rolling stock application”;
 - i) Improvement of Clause 9 Components, revised requirement regarding the compliance with a quality system;
 - j) Wording improvements and precisions added for Clause 10 Construction;
 - k) Revision of Clause 11 Safety, reorganisation of subclauses;
 - l) Revision of Clause 12 Documentation:
 - 1) In addition to the datasheet and user manual, equipment installation and commissioning information have to be provided to the user;
 - 2) Typical content of the datasheet, is moved to Annex J;
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 - 3) The acronyms UPIC is used to designate User Programmable Integrated Circuit.
 - m) Improvements of texts and figures of Clause 13 Testing;
 - 1) Generation, access and delivery of type test and routine test reports, are clarified.
 - 2) Access or delivery of test reports, and tests subject to agreement must be agreed at tender stage.
 - 3) Equipment used for type tests shall be already submitted to routine test procedure and shall be identified in the type test report by its part number and serial number.
 - 4) Added : For “Prototype testing”, see Annex F – F.2.6
 - 5) Table 11 — List of tests is rearranged;
 - 6) Conditions during testing is moved in a new 13.3.2;
 - 7) Improvements and clarification of 13.4.3 DC Power supply test;
 - 8) Precisions added to 13.4.4 Low temperature test;
 - 9) Precisions added to 13.4.5 Dry heat test - including use of rated voltage;
 - 10) Precisions added to 13.4.7 Insulation test;
 - 11) Precisions added to 13.4.8 Cyclic damp heat test;

- 12) Precisions added to 13.4.10 Shock and vibration test;
- 13) Precisions added to 13.4.12 Rapid temperature variation test;
- 14) Precisions added to 13.4.13 Salt mist test.
- n) Improvement of the following informative Annexes:
- 1) Annex A - List of default requirements of EN 50155 and related subclauses;
 - 2) Annex B - System Testing approach;
 - 3) Annex C - Severity level of service conditions in different vehicle locations;
 - 4) Annex D - Example for a summary of equipment type test compliance;
 - 5) Annex E - User programmable integrated circuit life cycle example;
 - 6) Annex F - Design suggestions for electronic hardware used on rolling stock;
 - 7) Annex G - Electronic equipment not designed for use on rolling stock;
 - 8) Annex H – Paragraphs with agreement with the involved parties.
- o) Introduction of the following informative Annexes:
- 1) New Annex I – Electronic equipment supplied from AC supply system;
 - 2) New Annex J – Typical content of datasheets;
 - 3) New Annex K – Insulation test and testing matrix example.
- p) Bibliography (extended and corrected).

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.

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

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

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Introduction

This document specifies the requirements for the design, the manufacturing, the documentation and testing of any electronic equipment installed on-board of rolling stock.

It also describes the electrical and environmental operating conditions.

The aim of this document is not to be a detailed guideline for the design of the electronic equipment. The design is the supplier's responsibility, however some recommendations are given in informative annexes in order to draw the attention of the designer on known design aspects. The supplier should take into account the requirements resulting from the specific location of the on-board installation (see Annex C).

This document specifies the requirements for the design, the manufacturing, the documentation and testing of any electronic equipment installed on-board rolling stock.

The roles of user and/or supplier are shown in Figure 1 below.

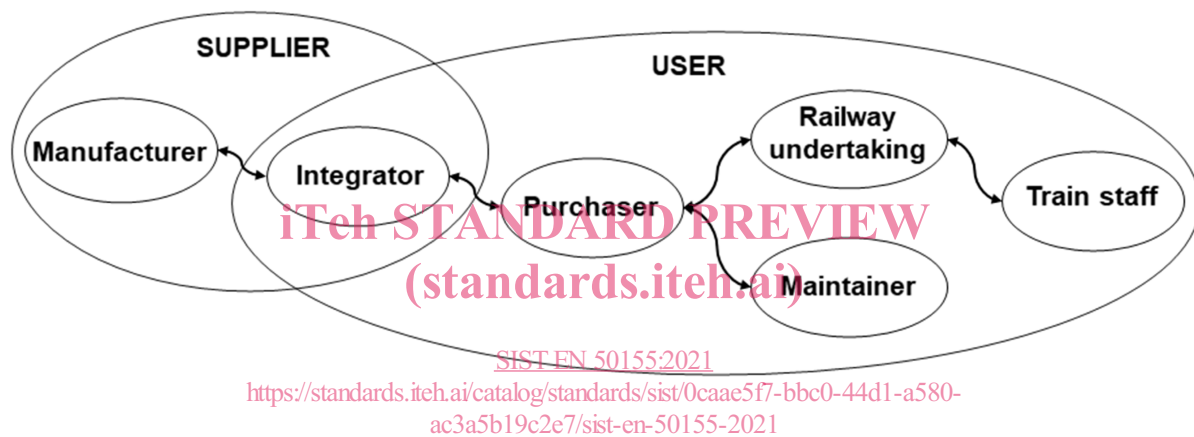


Figure 1 — Roles and relationship of user and/or supplier

1 Scope

This document applies to all electronic equipment for control, regulation, protection, diagnostic, energy supply, etc. installed on rail vehicles.

For the purpose of this document, electronic equipment is defined as equipment composed of electronic components (e.g. resistors, capacitors, transistors, diodes, integrated circuits, hybrids, application specific integrated circuits, wound components and relays), and recognized associated components (e.g. connectors, mechanical parts). These components are mainly mounted on printed circuit boards.

Sensors (e.g. current, voltage, speed) and semiconductor drive units for power electronic devices are covered by this standard. Complete semiconductor drive units and power converters are covered by EN 61287-1.

This document covers the requirements for operating conditions, design, documentation, testing and integration of electronic equipment, as well as hardware and software requirements considered necessary for compliant and reliable equipment.

Specific requirements related to practices necessary to ensure defined safety integrity level or functional safety are not covered by this document. Nevertheless, this document applies to the hardware of all rolling stock electronic equipment or systems performing safety-related functions.

The software requirements for on-board railway equipment are specified by EN 50657.

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.

NOTE 1 The IPC normative references are acceptable only until an equivalent standard from an official International or European Standardisation body will become available which cover the same requirements now covered by the referenced IPC standard.

NOTE 2 The version of IPC normative references, herein after listed, is identified by the last letter of the identification code, e.g. the letter J in IPC-A-600J identify the version J which was published in May 2016. However, the publication date is reported, even though implicit in the last letter. Consequently, the date is not repeated in the text of this document when the IPC normative references appear.

EN 45545-1:2013, *Railway applications - Fire protection on railway vehicles - Part 1: General*

EN 45545-2:2020, *Railway applications - Fire protection on railway vehicles - Part 2: Requirements for fire behavior of materials and components*

EN 45545-5:2013+A1:2015, *Railway applications - Fire protection on railway vehicles - Part 5: Fire safety requirements for electrical equipment including that of trolley buses, track guided buses and magnetic levitation vehicles*

EN 50121-3-2, *Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus*¹⁾, *Railway applications — Electromagnetic compatibility — Part 3-2: Rolling stock - Apparatus*

EN 50124-1:2017, *Railway applications - Insulation coordination - Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment*

EN 50125-1:2014, *Railway applications - Environmental conditions for equipment - Part 1: Rolling stock and on-board equipment*

1) Document impacted by EN 50121-3-2:2016/A1:2019.

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EN 50126-1:2017, *Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process*

EN 50153, *Railway applications - Rolling stock - Protective provisions relating to electrical hazards*²⁾

EN 50163, *Railway applications - Supply voltages of traction systems*³⁾

EN 50343, *Railway applications - Rolling stock - Rules for installation of cabling*⁴⁾

EN 50533, *Railway applications - Three-phase train line voltage characteristics*⁵⁾

EN 50657:2017, *Railways Applications - Rolling stock applications - Software on Board Rolling Stock*

EN 60068-2-1:2007, *Environmental testing - Part 2-1: Tests - Test A: Cold*

EN 60068-2-2:2007, *Environmental testing - Part 2-2: Tests - Test B: Dry heat*

EN IEC 60068-2-11:2021, *Environmental testing - Part 2: Tests - Test Ka: Salt mist*

EN 60068-2-30:2005, *Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

EN 60297-3-100:2009, *Mechanical structures for electronic equipment - Dimensions of mechanical structures of the 482,6 mm (19 in) series - Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets*

EN 60297-3-101:2004, *Mechanical structures for electronic equipment - Dimensions of mechanical structures of the 482,6 mm (19 in) series - Part 3-101: Subracks and associated plug-in units*

EN 60529, *Degrees of protection provided by enclosures (IP Code)*⁶⁾

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EN 61373, *Railway applications - Rolling stock equipment - Shock and vibration tests*⁷⁾

EN ISO 13732-1:2008, *Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1:2006)*

ISO/IEC/IEEE 15289:2019, *Systems and software engineering — Content of life-cycle information items (documentation)*

IPC-A-600J, *Acceptability of Printed Boards (Published date: May 2016)*

IPC-A-610G, *Acceptability of Electronic Assemblies (Published date: October 2017)*

IPC-7711C/7721C, *Rework, Modification and Repair of Electronic Assemblies (Published date: January 2017)*

2) Document impacted by EN 50153:2014/A1:2017 and EN 50153:2014/A2:2020.

3) Document impacted by EN 50163:2004/A1:2007 and EN 50163:2004/A2:2020.

4) Document impacted by EN 50343:2014/A1:2017.

5) Document impacted by EN 50533:2011/A1:2016.

6) Document impacted by EN 60529:1991/A1:2000 and EN 60529:1991/A2:2013.

7) Document impacted by EN 61373:2010/AC:2017-09.

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1

printed board
printed circuit board
PCB

base material which is cut to size containing all required holes and incorporating at least one conductive layer

Note 1 to entry: Printed circuit boards are typically subdivided according to:

- their structure (e.g. single and double sided, multilayers);
- the nature of the base material (e.g. rigid, flexible).

Note 2 to entry: In some standards instead of printed circuit board the synonym printed board is used.

[SOURCE: IEC 50155-1:2012, modified]

3.1.2

printed board assembly
PBA

printed circuit board with electrical and mechanical components and/or other printed board assemblies attached to it with all manufacturing processes, soldering, coating, etc., completed

3.1.3

operating temperature, <of electronic equipment>

temperature range in which the electronic equipment is operating (e.g. cubicle temperature, rack temperature, roof box temperature) in full conformity with its performance criteria

Note 1 to entry: Outside of the operating temperature range there can be temporary or permanent degradation of the equipment performances

3.1.4

plug-in unit

unit which plugs into a subrack and is supported by guides

Note 1 to entry: Plug-in units can be of various types, e.g. a PBA with or without enclosure designed with a plug-in connection to be inserted into a subrack.

3.1.5

subrack

structural unit for housing PBA/PBAs and plug-in units

3.1.6

rack

free-standing or fixed structure for housing electrical and electronic equipment

[SOURCE: IEC 50155-1:2012, modified]

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3.1.7

enclosure

adequate housing for electrical and/or electronic equipment, provided by the equipment manufacturer to mount the equipment and to protect it from accidental damage, and occasionally from electromagnetic fields or environmental effects

Note 1 to entry: The equipment housing can offer protection to personnel, e.g. from electric shock.

Note 2 to entry: Several enclosure types are given in Figure 2

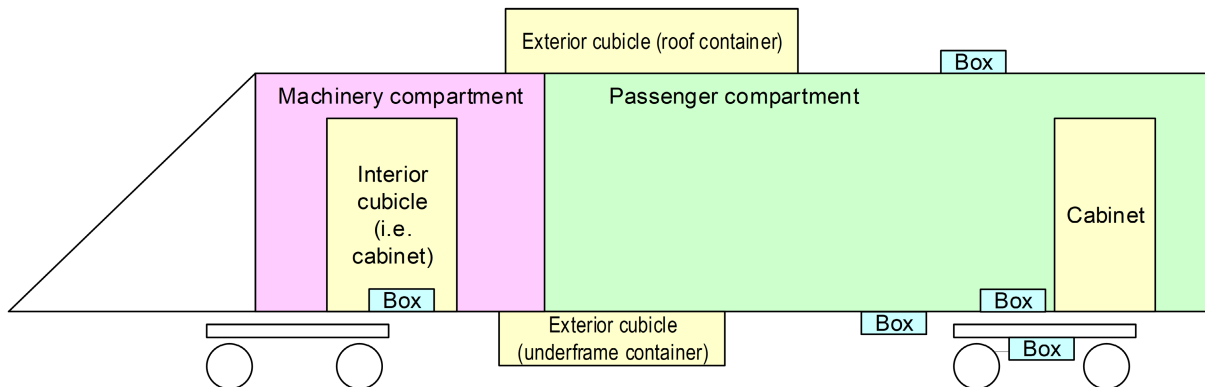


Figure 2 — Types of enclosures

3.1.8

cubicle

enclosure for whole equipment, including electrical, electronic and mechanical parts (e.g. converter, inverter)

EXAMPLE cabinet, roof container, underframe container

3.1.9

box

enclosure for smaller equipment, including electrical, electronic and mechanical parts

3.1.10

line replaceable unit**LRU**

unit which can be removed from a railway system and replaced by an operating unit with the same function in order to restore the operational capability of the system

3.1.11

performance test

test in which all functions of the equipment are stimulated and verified in accordance with the specified functional requirements

Note 1 to entry: The performance test is carried out according to the performance test specification and performance test procedure provided by the supplier.

3.1.12

operational check

tailored performance test which is carried out during and/or after environmental tests or stress screening sufficient to prove that the equipment is still functioning within its operational limits

Note 1 to entry: Each environmental test or stress screening can use a different operational check.

Note 2 to entry: Operational checks are carried out according to operational check specifications and operational check procedures provided by the supplier.

3.1.13**system power supply**

combination of vehicle battery and battery charger to provide the DC on-board supply voltage

Note 1 to entry: see Figure 3.

3.1.14**power supply**

unit used to supply the electronic equipment with electrical energy

Note 1 to entry: The power supply can be also part of the equipment

Note 2 to entry: see Figure 3 and Figure 4.

3.1.15**supply voltage <of electronic equipment>**

voltage at the supply terminals of the electronic equipment

3.1.16**vehicle cabling**

all cabling which can be connected to the power supply, and all other cabling outside of the electronic equipment

3.1.17**supply overvoltage**

disturbance to the system power supply (e.g. caused by battery charger malfunction or by load drop)

Note 1 to entry: A supply overvoltage will occur as an increase in the level of the supply voltage.

3.1.18**energetic transient pulses**

non-periodic and relatively short positive and negative pulse or sequence of pulses of voltage and/or current

3.1.19**failure**

loss of ability to perform as required

Note 1 to entry: "Failure" is an event, as distinguished from "fault", which is a state.

Note 2 to entry: Attention is drawn to the possibility of a consequential failure of a second item of equipment resulting from a temporary malfunction of an item of equipment connected to it.

Note 3 to entry: A temporary malfunction will not be considered as a failure provided that the equipment recovers normal operation automatically following malfunction.

[SOURCE: IEC 192-03-01, modified – other notes to entry]

3.1.20**damage <to an electronic equipment>**

change in visual appearance or alteration of electrical or mechanical integrity