

© Copyright SEK Svensk Elstandard. Reproduction in any form without permission is prohibited.

Järnvägsanläggningar – Installation av kablar och ledningssystem i rälsfordon

Railway applications –

Rolling stock –

Rules for installation of cabling

Som svensk standard gäller europastandarden EN 50343:2024. Den svenska standarden innehåller den officiella engelska språkversionen av EN 50343:2024.

Nationellt förord

Tidigare fastställd svensk standard SS-EN 50343, utg 2:2014 med eventuella tillägg, ändringar och rättelser gäller ej fr o m 2027-08-12.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1042
172 21 Sundbyberg
Tel 08-444 14 00
elstandard.se

English Version

Railway applications - Rolling stock - Rules for installation of cabling

Applications ferroviaires - Matériel roulant - Règles
d'installation du câblage

Bahnanwendungen - Fahrzeuge - Regeln für die Installation
von elektrischen Leitungen

This European Standard was approved by CENELEC on 2024-08-12. 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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents

Page

European foreword	4
1 Scope	5
2 Normative references	5
3 Terms, definitions and abbreviations	7
3.1 Terms and definitions	7
3.2 Abbreviations	9
4 Technical requirements	9
4.1 General requirements	9
4.2 Selection of type and size of cables	10
4.3 Bundling of cables	17
4.4 Flexibility of cables	17
4.5 Minimum cross-sectional area of conductors	17
4.6 Use of green and yellow colour	18
4.7 Bending radii and other mechanical requirements	18
4.8 Re-termination	20
4.9 Busbars	20
4.10 Connections to busbars	20
4.11 Separation of cables with different voltage levels and for safety reasons	20
4.12 Provisions for refurbishment and maintenance, including inspection and repair	22
4.13 Fire prevention, cable laying and cabling behaviour in case of fire	23
4.14 Provision of spares	23
4.15 Requirements for fixing	24
4.16 Clearances and creepage distances	25
4.17 Requirements for electrical terminations	25
4.18 Use of heat-shrinkable sleeves	28
4.19 Connections for return current	28
4.20 Storage of cables	28
4.21 Cable conduits	29
4.22 Electrical bolted connections	29
5 EMC requirements	31
5.1 General	31
5.2 Cable categories	31
5.3 Separation of cables	32
5.4 Return conductor	32
5.5 Use of conductive structure	32
5.6 Shielding and earthing	33
5.7 Supply connection from battery	33
5.8 Databus lines	33
6 Marking for identification	33
6.1 General	33
6.2 Marking for identification of cables and busbars	34
6.3 Marking for identification of terminal blocks, individual terminals, plugs and sockets	34
6.4 Marking of insulators	34
6.5 Marking for warning against electrical shock	34
6.6 Marking using heat-shrinkable sleeves	35
7 Testing	35
7.1 General concerning testing	35
7.2 Electrical insulation tests	35
Annex A (normative) Cable sizing – Calculation under short time current conditions	39
Annex B (informative) Cable sizing – Examples of current ratings	40

Annex C (normative) Cable sizing — Calculating current ratings for temperature classes other than 90 °C	42
Annex D (informative) Cable sizing – Correction factor k_1 for expected ambient temperature	43
Annex E (normative) Cable sizing — Cable lifetime expectation	44
E.1 General cable lifetime considerations	44
E.2 Reducing cable lifetime	45
E.3 Increasing cable lifetime	45
Annex F (informative) Cable sizing — Calculation examples	46
F.1 Cables sizing calculation examples	46
F.2 Cables sizing calculation recommendation	48
Annex G (informative) Terminations.....	50
G.1 Methods of terminating cables	50
G.2 Tensile strength test values.....	57
Annex H (normative) Tests on marking when using heat-shrinkable sleeves.....	59
H.1 General.....	59
H.2 Preparation of specimens	59
H.3 Testing of specimens	59
H.4 Result of test	60
Annex I (informative) Effects of the number of earth connections to a cable screen	61
Annex J (informative) Differences of electrochemical potentials between some conductive materials	62
Annex K (informative) Locations on board rolling stock to be distinguished	64
Annex L (informative) Information about comparison between fire behaviour of cables in EN 45545-2 and IEC 62995	67
Bibliography	69

European foreword

This document (EN 50343:2024) has been prepared by CLC/SC 9XB “Electromechanical material on board rolling stock”.

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) 2025-08-12
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2027-08-12

This document supersedes EN 50343:2014 and all of its amendments and corrigenda (if any).

EN 50343:2024 includes the following significant technical changes with respect to EN 50343:2014:

- references to EN standards updated and harmonized;
- modification based on IEC 62995;
- mechanical aspects detailed;
- cable lifetime considerations in accordance with Arrhenius.

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 addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

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.

1 Scope

This document specifies requirements for the installation of cabling on railway vehicles and within electrical enclosures on railway vehicles, including magnetic levitation trains and trolley buses.

NOTE With respect to trolley buses, this document applies to the whole electric traction system, including current collecting circuits, power converters and the respective control circuits. The installation of other circuits is covered by street vehicle standards for example those for combustion driven buses.

This document covers cabling for making electrical connections between items of electrical equipment, including cables, busbars, terminals and plug/socket devices. It does not cover special effect conductors like fibre optic cables or hollow conductors (waveguides).

The material selection criteria given here are applicable to cables with copper conductors.

This document is not applicable to the following:

- special purpose vehicles, such as track-laying machines, ballast cleaners and personnel carriers;
- vehicles used for entertainment on fairgrounds;
- vehicles used in mining;
- electric cars;
- funicular railways.

As the field of cabling in rolling stock is also dealt with in the cable makers' standard, references are made to EN 50264 series, EN 50306 series, EN 50382 series and EN 50355.

This document applies in conjunction with the relevant product and installation standards and describes minimum requirements.

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.

EN 45545 (all parts), *Railway applications — Fire protection on railway vehicles*

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

EN 45545-2, *Railway applications — Fire protection on railway vehicles — Part 2: Requirements for fire behaviour 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 50121-3-1, *Railway applications — Electromagnetic compatibility — Part 3-1: Rolling stock — Train and complete vehicle*

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

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

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

EN 50153, *Railway applications — Rolling stock — Protective provisions relating to electrical hazards*

EN 50264 (all parts), *Railway applications — Railway rolling stock power and control cables having special fire performance*

EN 50306 (all parts), *Railway applications — Railway rolling stock cables having special fire performance — Thin wall*

EN 50355:2013, *Railway applications — Railway rolling stock cables having special fire performance — Guide to use*

EN 50382 (all parts), *Railway applications — Railway rolling stock high temperature power cables having special fire performance*

EN 50467:2011, *Railway applications — Rolling stock - Electrical connectors, requirements and test methods*

EN 50553, *Railway applications — Requirements for running capability in case of fire on board of rolling stock*

EN 60228, *Conductors of insulated cables (IEC 60228)*

EN 60423, *Conduit systems for cable management - Outside diameters of conduits for electrical installations and threads for conduits and fittings (IEC 60423)*

EN 60684-3-212, *Flexible insulating sleeving — Part 3: Specifications for individual types of sleeving — Sheet 212: Heat-shrinkable polyolefin sleeveings (IEC 60684-3-212)*

EN 60684-3-271, *Flexible insulating sleeving — Part 3: Specifications for individual types of sleeving — Sheet 271: Heat-shrinkable elastomer sleeveings, flame retarded, fluid resistant, shrink ratio 2:1 (IEC 60684-3-271)*

EN 61180, *High-voltage test techniques for low-voltage equipment — Definitions, test and procedure requirements, test equipment (IEC 61180)*

EN 61386-1, *Conduit systems for cable management — Part 1: General requirements (IEC 61386-1)*

EN IEC 60331-1, *Tests for electric cables under fire conditions - Circuit integrity - Part 1: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter exceeding 20 mm (IEC 60331-1)*

EN IEC 60684-3-216, *Flexible insulating sleeving — Part 3: Specifications for individual types of sleeving — Sheet 216: Heat-shrinkable, flame- retarded, limited-fire-hazard sleeving (IEC 60684-3-216)*

IEC 60331-2, *Tests for electric cable under fire conditions — Circuit integrity — Part 2: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter not exceeding 20 mm*

HD 60364-5-54:2011¹, *Low-voltage electrical installations — Part 5-54: Selection and erection of electrical equipment — Earthing arrangements and protective conductors (IEC 60364-5-54:2011)*

¹ As impacted by HD 60364-5-54:2011/A1:2022.