

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

Järnvägsanläggningar – Installation av kablar och ledningssystem i rälfordon

Railway applications –

Rolling stock –

Rules for installation of cabling

Som svensk standard gäller europastandarden EN 50343:2014. Den svenska standarden innehåller den officiella engelska språkversionen av EN 50343:2014.

Nationellt förord

Tidigare fastställd svensk standard SS-EN 50343, utgåva 1, 2003, gäller ej fr o m 2017-01-27.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a säkerhet, prestanda, dokumentation, utförande och skötsel av elprodukter, elanläggningar och metoder. Genom att utforma sådana standarder blir säkerhetskraven 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 1284
164 29 Kista
Tel 08-444 14 00
www.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 2014-01-27. 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, 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

Contents

1	Scope	6
2	Normative references	6
3	Terms, definitions and abbreviations	8
3.1	Terms and definitions	8
3.2	Abbreviations	10
4	Technical requirements	10
4.1	General requirements	10
4.2	Selection of type and size of cables	11
4.2.1	General	11
4.2.2	Selection of cable size for control cables	12
4.2.3	Selection of cable size for cables for power distribution, on the basis of continuous load current	12
4.2.4	Selection of cable size for cables for power distribution, on the basis of rating of protection device	18
4.2.5	Motor cables	18
4.2.6	Cables for protective bonding	18
4.2.7	Cables used under short time current (below 5 s)	18
4.3	Bundling of cables	19
4.4	Flexibility of cables	19
4.5	Minimum cross-sectional area of conductors	20
4.6	Use of green and yellow colour	20
4.7	Bending radii and other mechanical requirements	20
4.8	Re-termination	22
4.9	Busbars	22
4.10	Connections to busbars	23
4.11	Separation of cables with different voltage levels and for safety reasons	23
4.12	Provisions for refurbishment and maintenance, including inspection and repair	24
4.13	Fire prevention, cable laying and cabling behaviour in case of fire	25
4.14	Provision of spares	26
4.14.1	Provision of spares for control cabling	26
4.14.2	Provision of spares for auxiliary power distribution cabling	26
4.15	Requirements for fixing	26
4.16	Clearances and creepage distances	27
4.17	Requirements for electrical terminations	27
4.17.1	General	27
4.17.2	Electrical terminations at the cable ends	28
4.17.3	Electrical terminations at the terminal or device side	28
4.18	Use of heat-shrinkable sleeves	30
4.19	Connections for return current	30
4.20	Storage of cables	30
4.21	Cable conduits	31
4.22	Electrical bolted connections	31
5	EMC requirements	33
5.1	General	33
5.2	Cable categories	34
5.3	Separation of cables	34
5.4	Return conductor	35
5.5	Use of conductive structure	35
5.6	Shielding and earthing	35
5.7	Supply connection from battery	35
5.8	Databus lines	36
6	Marking for identification	36
6.1	General	36
6.2	Marking for identification of cables and busbars	36
6.3	Marking for identification of terminal blocks, individual terminals, plugs and sockets	37
6.4	Marking of insulators	37
6.5	Marking for warning against electrical shock	37

6.6 Marking using heat-shrinkable sleeves	37
7 Testing.....	37
7.1 General concerning testing.....	37
7.2 Electrical insulation tests	38
7.2.1 General	38
7.2.2 Voltage withstand test.....	38
7.2.3 Insulation impedance test	40
Annex A (normative) Cable sizing – Calculation under short time current conditions	42
Annex B (informative) Cable sizing – Examples of current ratings	43
Annex C (normative) Cable sizing – Calculating current ratings for temperature classes other than 90 °C.....	45
Annex D (normative) Cable sizing – Correction factor k_1 for expected ambient temperature	46
Annex E (normative) Cable sizing – Prediction of cable lifetime	47
E.1 General cable lifetime considerations	47
E.2 Reducing cable lifetime	48
E.3 Increasing cable lifetime	49
Annex F (informative) Cable sizing – Calculation examples	50
Annex G (informative) Terminations	54
G.1 Methods of terminating cables	54
G.2 Tensile strength test values.....	60
Annex H (normative) Tests on marking when using heat-shrinkable sleeves	62
H.1 General.....	62
H.2 Preparation of specimens.....	62
H.3 Testing of specimens	63
H.4 Result of test.....	63
Annex I (informative) Effects of the number of earth connections to a cable screen.....	64
Annex J (informative) Differences of electrochemical potentials between some conductive materials.....	65
Electrolyte: water with 2 % NaCl salt.....	65
Source: EN 3197:2010.	65
Annex K (informative) Locations on board rolling stock to be distinguished.....	66
Bibliography	68
Tables	
Table 1 – Modification factor k_5 for individual cores within a multi core cable	15
Table 2 – Modification factor k_2 for installation type (grouping and installation conditions)	16
Table 3 – Selection of cable conductor size on the basis of rating of protection device	18
Table 4 – Minimum internal bending radii R for static applications	21
Table 5 – Cable categories with respect to EMC	34
Table 6 – Minimum distances between cables of different EMC categories.....	34
Table 7 – Test voltages according to on-board voltages	40
Table 8 – Test voltages according to supply line voltages	40
Table A.1 – Modification factor k_4	42
Table B.1 – Examples of current ratings for standard wall cables, with 90 °C maximum conductor operating temperature	44
Table C.1 – Factor k^* , used when comparing current ratings for 90 °C maximum conductor operating temperature with other temperature classes	45

Table D.1 – Modification factor k_1	46
Table E.1 – Examples of values of correction factor k_3 to allow for decrease in predicted cable lifetime for a 90 °C cable	46
Table G.1 – Methods of terminating cables – Conductor side	54
Table G.2 – Methods of terminating cables – Terminal side – Crimp connections (1/2)	55
Table G.3 – Methods of terminating cables – Terminal side – Screwed and bolted connection	57
Table G.4 – Methods of terminating cables – Terminal side – Connection by clamping	58
Table G.5 – Methods of terminating cables – Terminal side – Connection by insulation displacement or penetration	59
Table G.6 – National standards for termination methods	60
Table G.7 – Pull out force for crimp connections	61
Table H.1 – Preparation of heat-shrinkable sleeve for test of marking quality.....	62
Table I.1 – Effects of shielding	64
Table J.1 – Differences of electrochemical potentials between some conductive materials (in mV).....	65

Foreword

This document (EN 50343:2014) 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) | 2015-01-27 |
| • latest date by which the national standards conflicting with this document have to be withdrawn | (dow) | 2017-01-27 |

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

This document supersedes EN 50343:2003.

EN 50343:2014 includes the following significant technical changes with respect to EN 50343:2003:

- references to other standards updated and harmonized;
- factor k_5 concerning sizing of multi core cables introduced;
- factor k_2 detailed, see Table 2;
- short time current detailed;
- mechanical aspects detailed;
- separation of cables due to safety reasons and EMC reasons harmonized;
- details added and changed concerning electrical and mechanical requirements for electrical terminations;
- cable lifetime considerations updated.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

1 Scope

This European Standard 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 European Standard 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 European Standard 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 European Standard 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 European Standard applies in conjunction with the relevant product and installation standards. Stricter requirements than those given in this European Standard may be necessary.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 45545-3 *Railway applications - Fire protection on railway vehicles - Part 3: Fire resistance requirements for fire barriers*

EN 45545-5, *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: Equipment on board rolling stock*

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

EN 50200, *Method of test for resistance to fire of unprotected small cables for use in emergency circuits*

EN 50215:2009, *Railway applications – Rolling stock – Testing of rolling stock on completion of construction and before entry into service*

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 50306-2, *Railway applications – Railway rolling stock cables having special fire performance – Thin wall – Part 2: Single core cables*

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

EN 50362, *Method of test for resistance to fire of larger unprotected power and control cables for use in emergency circuits*

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

EN 50467, *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 60684-3-216, *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)*

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 61180-1, *High-voltage test techniques for low-voltage equipment – Part 1: Definitions, test and procedure requirements (IEC 61180-1)*

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

EN 61310-2, *Safety of machinery – Indication, marking and actuation – Part 2: Requirements for marking (IEC 61310-2)*

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