SLOVENSKI STANDARD
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Ģelezniģke naprave - Stabilne naprave elektriļ ne vleke - Kontaktni vodniki elektriļ ne vleke

Railway applications - Fixed installations - Electric traction overhead contact lines

Bahnanwendungen - Ortsfeste Anlagen - Oberleitungen für den elektrischen Zugbetrieb

Applications ferroviaires - Installations fixes - Lignes aériennes de contact pour la traction électrique

Ta slovenski standard je istoveten z: EN 50119:2009

ICS:

29.280 Elektriļ na vleļ na oprema Electric traction equipment

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EUROPEAN STANDARD

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English version

Railway applications - Fixed installations - Electric traction overhead contact lines

Applications ferroviaires -
Installations fixes -
Lignes aériennes de contact
pour la traction électrique

Bahnanwendungen -
Ortsfeste Anlagen -
Oberleitungen
für den elektrischen Zugbetrieb

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

This European Standard was prepared by SC 9XC, Electric supply and earthing systems for public transport equipment and ancillary apparatus (Fixed installations), of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50119 on 2009-04-01.

This European Standard supersedes EN 50119:2001.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2010-04-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	–

References to definitions in IEC 60050-811 in Clause 3 are included for user reference and in some cases may update or modify the current definition.

National Standards implementing EN 50119:

The National Standards implementing EN 50119 will comprise the full text of the Eurocode (including any annexes), as published by CENELEC, which may be preceded by a national title page and national foreword, and may be followed by a National Annex.

A National Annex, if included, may contain information on those parameters or statements in EN 50119 which are not normative, e.g.

— values where alternative values or informative values only are given in the standard,

— country specific data (e.g. geographical, climatic, etc.), e.g. ice loads or temperature limits,

— the procedure to be used where alternative procedures are given in the standard.

It may also contain

— decisions on the use of informative annexes, and

— references to non-contradictory complementary information to assist the user to apply the standard.

The National Annex shall not alter any provisions of the European Standard.

Contents

Page

Figures

Tables

1 Scope

This European Standard applies to electric traction overhead contact line systems in heavy railways, light railways, trolley busses and industrial railways of public and private operators.

It applies to new installations of overhead contact line systems and for the complete reconstruction of existing overhead contact line systems.

This standard contains the requirements and tests for the design of overhead contact lines, requirements for structures and their structural calculations and verifications as well as the requirements and tests for the design of assemblies and individual parts.

This standard does not provide requirements for conductor rail systems where the conductor rails are located adjacent to the running rails.

2 Normative references

The following referenced documents are indispensable for the application 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 206-1, *Concrete – Part 1: Specification, performance, production and conformity*

EN 485-1, *Aluminium and aluminium alloys – Sheet, strip and plate – Part 1: Technical conditions for inspection and delivery*

EN 755-1, *Aluminium and aluminium alloys- Extruded rod/bar, tube and profiles – Part 1: Technical conditions for inspection and delivery*

EN 755-2, *Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 2: Mechanical properties*

EN 1536, *Execution of special geotechnical work – Bored piles*

EN 1537, *Execution of special geotechnical work – Ground anchors*

EN 1991-1-4:2005, *Eurocode 1: Actions on structures – Part 1-4: General actions – Wind actions*

ENV 1991-2-4:1995, *Eurocode 1: Basis of design and actions on structures – Part 2-4: Actions on structures – Wind actions*

EN 1992 (all parts), *Eurocode 2 – Design of concrete structures*

EN 1993 (all parts), *Eurocode 3: Design of steel structures*

EN 1993-1-1:2005, *Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings*

EN 1995 (all parts), *Eurocode 5: Design of timber structures*

EN 1997-1:2004, *Eurocode 7: Geotechnical design – Part 1: General rules*

EN 1997-2:2007, *Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing*

EN 1998 (all parts), *Eurocode 8: Design of structures for earthquake resistance*

EN 1999 (all parts), *Eurocode 9: Design of aluminium structures*

EN 10025 (all parts), *Hot rolled products of structural steels*

EN 10149 (all parts), *Hot-rolled flat products made of high yield strength steels for cold forming*

EN 10164, *Steel products with improved deformation properties perpendicular to the surface of the product – Technical delivery conditions*

EN 10210 (all parts), *Hot finished structural hollow sections of non-alloy and fine grain steels*

EN 12510, *Wood poles for overhead lines – Strength grading criteria*

EN 12699, *Execution of special geotechnical work – Displacement piles*

EN 12843, *Precast concrete products – Masts and poles*

EN 20898-2, *Mechanical properties of fasteners – Part 2: Nuts with specified proof load values – Coarse thread* (ISO 898-2)

EN 50121-2, *Railway applications – Electromagnetic compatibility – Part 2: Emission of the whole railway system to the outside world*

EN 50122 (all parts) [1)], *Railway applications – Fixed installations – Electrical safety, earthing and bonding*

EN 50123 (all parts), *Railway applications – Fixed installations – D.C. switchgear*

EN 50124 (all parts), *Railway applications – Insulation coordination*

EN 50125-2, *Railway applications – Environmental conditions for equipment – Part 2: Fixed electrical installations*

EN 50149, *Railway applications – Fixed installations – Electric traction – Copper and copper alloy grooved contact wires*

EN 50151, *Railway applications – Fixed installations – Electric traction – Special requirements for composite insulators*

EN 50152-2, *Railway applications – Fixed installations – Particular requirements for a.c. switchgear – Part 2: Single-phase disconnectors, earthing switches and switches with U_n above 1 kV*

EN 50163, *Railway applications – Supply voltages of traction systems*

EN 50182, *Conductors for overhead lines – Round wire concentric lay stranded conductors*

EN 50183, *Conductors for overhead lines – Aluminium-magnesium-silicon alloy wires*

EN 50189, *Conductors for overhead lines – Zinc coated steel wires*

EN 50206-1:1998, *Railway applications – Rolling stock – Pantographs: Characteristics and tests – Part 1: Pantographs for main line vehicles*

EN 50206-2:1999, *Railway applications – Rolling stock – Pantographs: Characteristics and tests – Part 2: Pantographs for metros and light rail vehicles*

EN 50317, *Railway applications – Current collection systems – Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line*

EN 50318, *Railway applications – Current collection systems – Validation of simulation of the dynamic interaction between pantograph and overhead contact line*

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1) At draft stage.

EN 50326, *Conductors for overhead lines – Characteristics of greases*

EN 50341-1:2001, *Overhead electrical lines exceeding AC 45 kV – Part 1: General requirements – Common specifications*

EN 50345, *Railway applications – Fixed installations – Electric traction – Insulating synthetic rope assemblies for support of overhead contact lines*

EN 50367:2006, *Railway applications – Current collection systems – Technical criteria for the interaction between pantograph and overhead line (to achieve free access)*

EN 60071 (all parts), *Insulation co-ordination* (IEC 60071, all parts)

EN 60099 (all parts), *Surge arresters* (IEC 60099, all parts, mod.)

EN 60168, *Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1 kV* (IEC 60168)

EN 60265-1, *High-voltage switches – Part 1: Switches for rated voltages above 1 kV and less than 52 kV* (IEC 60265-1)

EN 60305, *Insulators for overhead lines with a nominal voltage above 1 kV – Ceramic or glass insulator units for a.c. systems – Characteristics of insulator units of the cap and pin type* (IEC 60305)

EN 60383 (all parts), *Insulators for overhead lines with a nominal voltage above 1 kV* (IEC 60383, all parts)

EN 60433, *Insulators for overhead lines with a nominal voltage above 1 kV – Ceramic insulators for a.c. systems – Characteristics of insulator units of the long rod type* (IEC 60433)

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

EN 60660, *Insulators – Tests on indoor post insulators of organic material for systems with nominal voltages greater than 1 kV up to but not including 300 kV* (IEC 60660)

EN 60672 (all parts), *Ceramic and glass insulating materials* (IEC 60672, all parts)

EN 60889, *Hard-drawn aluminium wire for overhead line conductors* (IEC 60889)

EN 60947-1, *Low-voltage switchgear and controlgear – Part 1: General rules* (IEC 60947-1)

EN 61109, *Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage > 1 000 V - Definitions, test methods and acceptance criteria* (IEC 61109)

EN 61232, *Aluminium-clad steel wires for electrical purposes* (IEC 61232, mod.)

EN 61284:1997, *Overhead lines – Requirements and tests for fittings* (IEC 61284:1997)

EN 61325, *Insulators for overhead lines with a nominal voltage above 1 kV – Ceramic or glass insulator units for d.c. systems – Definitions, test methods and acceptance criteria* (IEC 61325)

EN 61773, *Overhead lines – Testing of foundations for structures* (IEC 61773)

EN 61952, *Insulators for overhead lines - Composite line post insulators for A.C. systems with a nominal voltage > 1 000 V - Definitions, test methods and acceptance criteria* (IEC 61952)

EN 62271-102:2002, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches* (IEC 62271-102:2001 + corrigendum April 2002 + corrigendum May 2003)

EN ISO 898-1:1999, *Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs* (ISO 898-1:1999)

EN ISO 1461:1999, *Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods* (ISO 1461:1999)

HD 578, *Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1 kV* (IEC 60273)

IEC 60050-811, *International Electrotechnical Vocabulary (IEV) – Chapter 811: Electric traction*

IEC/TR 61245, *Artificial pollution tests on high-voltage insulators to be used on d.c. systems*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC 60050-811 and the following apply.

3.1 Systems

3.1.1
contact line system
support network for supplying electrical energy from substations to electrically powered traction units, which covers overhead contact line systems and conductor rail systems; the electrical limits of the system are the feeding point and the contact point to the current collector

NOTE The mechanical system may comprise

— the contact line,
— structures and foundations,
— supports and any components supporting or registering the conductors,
— head and cross spans,
— tensioning devices,

— along-track feeders, reinforcing feeders, and other lines like earth wires and return conductors as far as they are supported from contact line system structures,
— any other equipment necessary for operating the contact line,
— conductors connected permanently to the contact line for supply of other electrical equipment such as lights, signal operation, point control and point heating.

3.1.2
contact line
conductor system for supplying traction units with electrical energy via current-collection equipment

NOTE This includes all current-collecting conductors and conducting rails or bars, including the following:

— reinforcing feeders;
— cross-track feeders;
— disconnectors;
— section insulators;
— over-voltage protection devices;
— supports that are not insulated from the conductors;
— insulators connected to live parts;

but excluding other conductors, such as the following:

— along-track feeders;
— earth wires and return conductors.

3.1.3
overhead contact line system
contact line system using an overhead contact line to supply current for use by traction units

3.1.4
overhead contact line
contact line placed above or beside the upper limit of the vehicle gauge, supplying traction units with electrical energy via roof-mounted current collection equipment

3.1.5
conductor rail system
contact line system using a conductor rail for current collection

3.1.6
overhead conductor rail
rigid overhead contact line, of simple or composite section, mounted above or beside the upper limit of the vehicle gauge, supplying traction units with electrical energy via roof-mounted current collection equipment

3.1.7
conductor rail
contact line made of a rigid metallic section or rail, mounted on insulators located near the running rails

3.1.8
supporting assembly
assembly of components attached to the main support structure that supports and registers the overhead contact line

3.1.9
static load gauge
maximum cross-sectional profile of the vehicles using the railway line

3.1.10
kinematic load gauge
static load gauge enlarged to allow for dynamic movements of the vehicle, e.g. suspension travel and bounce

3.1.11
kinematic envelope
kinematic load gauge further enlarged to allow for possible tolerances in the position of the track

3.1.12
swept envelope
kinematic envelope enlarged to allow for centre and end throw of the vehicles on horizontal and vertical curves

3.1.13
tensioning device
device to maintain the tension of conductors within the system design parameters

3.1.14
urban mass transportation system
light rail, trolleybus and tramway system, operating in urban areas, excluding heavy rail systems

3.2 Conductors

3.2.1
along-track feeder
overhead conductor mounted on the same structure as the overhead contact line to supply successive feeding points

3.2.2
reinforcing feeder
overhead conductor mounted adjacent to the overhead contact line, and directly connected to it at frequent intervals, in order to increase the effective cross sectional area of the overhead contact line

3.3 Electrical

3.3.1
nominal voltage
voltage by which an installation or part of an installation is designated

NOTE The voltage of the contact line may differ from the nominal voltage by a quantity within permitted tolerances given in EN 50163.

3.3.2
feeding section
electrical section of the route fed by individual track feeder circuit breakers within the area supplied by the substation

3.3.3
fault current
maximum current passed through the overhead contact line system under fault conditions between live equipment and earth, within a short defined time period

3.3.4
short-circuit
accidental or intentional conductive path between two or more points in a circuit forcing the voltages between these points to be relatively low. Any such conductive path whether between conductors or between conductor and earth is regarded as a short-circuit

3.3.5
short-circuit current
electric current flowing through the short-circuit

3.3.6
continuous current rating
permanent rated current carrying capacity of the overhead contact line within the system operating parameters

3.3.7
feeding point
point at which the feeding system is connected to the contact line

3.3.8
isolation
disconnection of a section of overhead contact line from the source of electrical energy, either in an emergency or to facilitate maintenance

3.4 Geometrical

3.4.1
tension length
length of overhead contact line between two terminating points

3.4.2
gradient
ratio of the difference in height of the overhead contact line above top of rail (or road surface for overhead contact line system for trolleybus applications) at two successive supports to the length of the span

3.4.3
contact wire height
distance from the top of the rail (or road surface for overhead contact line system for trolleybus applications) to the lower face of the contact wire, measured perpendicular to the track

3.4.4
minimum contact wire height
minimum value of the contact wire height in the span in order to avoid the arcing between one or more contact wires and the vehicles in all conditions

3.4.5
minimum design contact wire height
theoretical contact wire height including tolerances, designed to ensure that the minimum contact wire height is always achieved

3.4.6
nominal contact wire height
nominal value of the contact wire height at a support in the normal conditions

3.4.7
maximum contact wire height
maximum possible contact wire height which the pantograph is required to reach, in all conditions

3.4.8
maximum design contact wire height
theoretical contact wire height taking account of tolerances, movements etc, designed to ensure the maximum contact wire height is not exceeded

3.4.9
contact wire uplift
vertical upward movement of the contact wire due to the force produced from the pantograph

3.5 Foundations

3.5.1
gravity foundation
shallow foundation installed by excavation and backfilling

3.5.2
pile foundation
foundation which is flexible enough to show both rotation and deformations in the pile element itself subjected to horizontal loading or overturning moments. The cross section may be circular or non-circular and it is installed by boring and/or ramming

3.5.3
sidebearing foundation
relatively short, rigid foundation installed by excavation or boring which is subjected to horizontal loading or overturning moments. The cross section may be circular or rectangular

3.6 Symbols and abbreviated terms

A_{ins}	projected area of an insulator
A_K	characteristic value of accidental actions
A_{lat}	effective area of the elements of a lattice structure
A_{str}	projected area of a structure
AACSR	Aluminium alloy conductor steel reinforced
ACSR	Aluminium conductor steel reinforced
a.c.	alternating current
C	compression amplitude for dropper test
C_C	drag factor of a conductor
C_{ins}	drag factor for insulators
C_{lat}	drag factor for lattice structures
C_{str}	drag factor of a structure
d.c.	direct current
E_d	total design value of actions
EMI	electromagnetic interference
EMC	electromagnetic compatibility
F_{Bmin}	minimum breaking load of stranded conductors and ropes
F_d	design value of an action
F_K	characteristic value of an action
F_L	internal force for dropper test
F_{max}	maximum or failure force for test specimens
F_{nom}	nominal force
$F_{perm.op.}$	permissible operating force
F_w	permissible tensile loading of stranded conductors & ropes
G_C	structural response factor for conductors
G_{ins}	structural resonance factor for insulator sets
G_K	characteristic value of permanent actions
G_{lat}	structural resonance factor for lattice structures
G_q	gust response factor
G_{str}	structural resonance factor for a structure
G_t	terrain factor
g_{IK}	characteristic ice loads
M_{dyy}, M_{dzz}	design bending moments
N_{dax}	internal axial force of an element
n	safety factor for calculating the permissible loading in wires
OCS	overhead contact line system
OCL	overhead contact line
P_{prim}	externally applied heat
Q_{CK}	conductor tensile forces depending on the temperatures and climate related loads