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Nadomeġļ a:

SIST EN 50345:2004

Ģelezniġke naprave - Stabilne naprave elektriļ ne vleke - Izolirne vrvi iz sintetiļ nih vlaken za pritrditev kontaktnih vodnikov

Railway applications - Fixed installations - Electric traction - Insulating synthetic rope assemblies for support of overhead contact lines

Bahnanwendungen - Ortsfeste Anlagen - Elektrischer Zugbetrieb - Baugruppen aus isolierenden Kunststoffseilen im Fahrleitungsbau

Applications ferroviaires - Installations fixes - Traction électrique - Montages mettant en oeuvre des câbles synthétiques pour le support des lignes aériennes de contact

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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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 50345 on 2009-05-01.

This European Standard supersedes EN 50345:2004.

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)	2010-05-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2012-05-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive 2001/16/EC. See Annex ZZ.

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Introduction

This European Standard has been prepared to provide general guidance and to define special requirements for the design and testing of insulating synthetic ropes, their sheaths and their terminations for use in electric traction overhead contact lines.

Special preferences will include such requirements as to comply with local procurement policies, working practices, compatibility with existing systems, to combat environmental pollution and to provide a supporting assembly with insulation which will give reliable service over its target life span.

These insulating synthetic ropes offer an alternative to the use of metallic cables associated with conventional insulators.

1 Scope

This European Standard applies to the insulating synthetic ropes used in overhead contact lines.

This European Standard specifies the characteristics of insulating synthetic rope assemblies and is applicable to electric traction overhead contact lines for railways, light railways, tramways, trolleybuses and other systems.

These insulating synthetic ropes are utilised to provide mechanical support and electrical insulation for overhead contact lines.

They are generally used in the following application fields:

— delta suspension of contact wires;

— catenary cable;

— mid point anchors;

— tie;

— dropper;

— headspan;

— noise and vibration damper;

— bridle- and pulley suspensions;

— cantilevers made of glass reinforced polymer (GRP).

This standard establishes the product characteristics, the test methods and checking procedures to be used with the insulating synthetic ropes, together with the ordering and delivery requirements.

The object of this standard is to stipulate the provisions for the design and to allow the provisions of the service indicated by the supplier to the purchaser or informed buyer.

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 50119:2009, *Railway applications - Fixed installations - Electric traction overhead contact lines*

EN 50124-1:2001, *Railway applications - Insulation coordination - Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment*

EN 50125-2:2002, *Railway applications - Environmental conditions for equipment - Part 2: Fixed electrical installations*

EN 50163:2004, *Railway applications - Supply voltages of traction systems*

EN 60695-11-10:1999 + A1:2003, *Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods* (IEC 60695-11-10:1999 + A1:2003)

EN 61109:2008, *Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V - Definitions, test methods and acceptance criteria* (IEC 61109:2008)

EN 62217:2006, *Polymeric insulators for indoor and outdoor use with a nominal voltage > 1 000 V - General definitions, test methods and acceptance criteria* (IEC 62217:2005)

HD 588.1 S1:1991, *High-voltage test techniques - Part 1: General definitions and test requirements* (IEC 60060-1:1989 + corrigendum March 1990)

3 Terms and definitions

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

3.1
insulating synthetic rope
insulating rope composed of a core protected by a sheath

3.1.1
core of the rope
consists of synthetic fibres and is the load carrying component of the rope

3.1.2
sheath of the rope
envelope to protect the fibres and made of synthetic material, usually of a continuous polymeric material with appropriate insulating qualities

3.2
termination
means to connect the ends of an insulating synthetic rope between two points

3.3
creepage distance
shortest distance along the surface of the insulating material between two conductive parts
[IEC 60050 (151-15-50)]

3.4
gauge length
distance between the centre lines of the termination anchoring pins or bolts

3.5
insulator
assembly of an insulating synthetic rope and its associated terminations

3.6
class of insulator
insulator which has a specific design end fitting and a specific core/sheath combination

4 Characteristics of the rope

4.1 General

4.1.1 Common characteristics

Two major fibre types are used actually to provide the load carrying core. These are polyester and polyaramid. Other fibre types having similar characteristics may also be used.

The fibre type is important in determining mechanical properties.

The sheath polymer type is important in determining durability, environmental performance and some electrical and mechanical properties.

4.1.2 Specific characteristics of core materials

Insulating synthetic ropes with polyaramid or similar core fibres have a smaller diameter, greater tensile fatigue resistance and smaller elongation (see B.1.1) than those of polyester or similar core fibres for a given load carrying capacity and axial stiffness.

Insulating synthetic ropes with polyester or similar core fibres have a higher impact resistance than those of polyaramid or similar core fibres, for example: from detached trolleybus poles.

Insulating synthetic ropes can operate within the following operational environmental temperatures:

— between –40 °C and +55 °C for polyester or similar;

— between –40 °C and +80 °C for polyaramid or similar.

4.1.3 Specific characteristics of sheath materials

The sheath may be composed of different materials. The type of material shall be chosen to withstand local conditions as:

— U.V. exposure (e.g. polyethylene);

— general environmental conditions (e.g. polyethylene);

— abrasion effects (e.g. polyester / elastomer);

— flex effects (e.g. polyester / elastomer).

When the rope is used in confined spaces (e.g. tunnels, stations, etc.) the sheath material shall have further properties as:

— electrical tracking resistance (e.g. crosslinked polyethylene);

— antiflammability (e.g. crosslinked polyethylene);

— self-extinguishing (e.g. crosslinked polyethylene).

4.2 Client requirements

The client shall provide a comprehensive and specific description of the overhead contact line service parameters and functioning requirements which may affect the design of the insulated synthetic rope.

This shall include, as appropriate, but not be limited to the following:

— electrical system service parameters;

— spatial and dimensional parameters;

— angular movement deflection limitations;

— maximum working loads required;

— environmental conditions;

— end fittings connection (terminations) requirements;

— any additional requirement for special tests;

— any special delivery or packaging requirements;

— identification of inspection and tests to be witnessed by the purchaser;

— service life of the insulator.

4.3 Electrical requirements

4.3.1 Voltages

Values of voltages are shown in Table 1. The rated insulation voltage and the test voltage levels are based on statistical and risk consideration, which may affect the insulator during its service life.

Table 1 — Voltages excerpt from EN 50124-1, Table A.2

Nominal voltages U_n [a]	Rated insulation voltage U_{Nm}	Rated impulse voltage U_{Ni} kV	Power frequency withstand voltage U_a [b] kV
600 V d.c.	720 V d.c.	8	3,6
750 V d.c.	900 V d.c.	12	5,5
1 500 V d.c.	1 800 V d.c.	18	8,3
3 000 V d.c.	3 600 V d.c.	40	18,5
15 kV a.c.	36 kV a.c.	200	95
25 kV a.c.	52 kV a.c.	250	95

a According to EN 50163.

b According to EN 50124-1, Table B.1.

4.3.2 Creepage distances

Creepage distances shall be determined to withstand the highest permanent voltage of the system. Consideration shall also be given to the type of insulating synthetic rope and its behaviour in polluted conditions related to the whole life of the equipment.

The minimum creepage distance, for nominal voltages equal to or below 1,5 kV d.c. or 1 kV a.c. shall be 1 m.

NOTE This distance is based on practical experience.

For nominal voltages exceeding 1,5 kV d.c. or 1 kV a.c., an additional creepage distance per extra kV of the nominal voltage shall be calculated from Table 2 and added to the minimum creepage distance.

EXAMPLE A 25 kV a.c. system with 45° inclination with no waterproof termination and for extreme unfavourable conditions requires a total creepage distance of 3 040 mm.

Table 2

Additional creepage distances	Waterproof termination		No waterproof termination	
	Horizontal mm/kV	45° inclination and vertical mm/kV	Horizontal mm/kV	45° inclination and vertical mm/kV
Normal operating conditions	30	35	45	55
Unfavourable operating conditions	40	45	60	70
Extreme unfavourable operating conditions	50	55	75	85

NOTE These values are based on practical experience.

The creepage distances may be reduced by agreement between purchaser and supplier.

The creepage distance values for nominal voltage up to 1,5 kV d.c. are valid for double insulation.

4.4 Mechanical requirements

4.4.1 Terminations

The dimensions and the minimum breaking loads of the insulating synthetic ropes shall be as presented in Table 3.

Table 3

Core fibre type	Nominal external diameter of the rope mm	Minimum specified breaking load of the rope and its associated termination kN
Polyaramid or similar [a]	4,0	7,5
	5,0	10,6
	7,0	15,0
	8,5	30,0
	9,0	45,0
	11,0	60,0
	13,5	105,0
Polyester or similar	5,0	3,0
	6,0	4,0
	7,0	5,0
	8,5	10,0
	9,0	15,0
	11,0	20,0
	13,5	35,0
	17	50,0
	20	75,0
Tolerances on external diameter may be specified at the purchasing stage by the supplier.		
[a] The aramid fibre is equivalent to polyaramid fibre.		

4.4.2 Permissible tensile loading

Refer to EN 50119:2009, 5.7.

4.4.3 Permissible tensile loading on a mid span connector (non-vertical load)

The maximum working load which can be applied to a mid span anchor shall not exceed 25 % of the breaking load of the rope and its associated termination.

The breaking load of the mid span connector and rope combination shall be determined experimentally. Account shall be taken of anticipated operating conditions and of the actual direction of applied loads.

4.4.4 Time dependant properties

The supplier shall provide information on the following insulating synthetic rope properties:

- fatigue behaviour (cycling loading);
- creep behaviour (under constant loading);
- stress relaxation behaviour (between two fixed anchors).