SLOVENSKI STANDARD
SIST EN 50305:2002

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Railway applications - Railway rolling stock cables having special fire performance - Test methods

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Bahnanwendungen - Kabel und Leitungen für Schienenfahrzeuge mit verbessertem Verhalten im Brandfall - Prüfverfahren

Applications ferroviaires - Câbles pour matériel roulant ferroviaire ayant des performances particulières de comportement au feu - Méthodes d'essais

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Railway applications - Railway rolling stock cables having special fire performance - Test methods

Applications ferroviaires -
Câbles pour matériel roulant ferroviaire
ayant des performances particulières
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Kabel und Leitungen für Schienenfahrzeuge
mit verbessertem Verhalten im Brandfall -
Prüfverfahren

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

This European Standard was prepared for the Technical Committee CENELEC TC 20, Electric cables by WG 12, Railway cables, on behalf of the Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50305 on 2002-07-02.

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) 2003-07-01

- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2008-07-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annexes B and E are normative and annexes A, C and D are informative.

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Introduction

The railway industry is generally concerned with the movement of people as well as goods. It is therefore essential that a high level of safety is achieved, even when failures occur which may involve fire, howsoever caused, affecting railway rolling stock.

Hence it is necessary to provide cables for use in railway environments which minimise the hazard to people when a fire may damage the cable, irrespective of whether the fire is caused by an external source or from within the electrical system.

European Standards EN 50264 and EN 50306 specify cables which, in the event of fire will limit risk to people and improve the safety on railways in general. They cover cables based on halogen free materials, for use in railway rolling stock.

EN 50264 covers a range of sheathed and unsheathed cables, with standard wall thickness of insulation, rated at up to 3,6/6 kV with conductor sizes 1,0 mm^2 up to 400 mm^2.

EN 50306 covers a range of sheathed and unsheathed cables with thin wall insulation, and restricted to a rating of 300 V to earth and a maximum conductor size of 2,5 mm^2.

This standard EN 50305, gives particular test methods applicable to the cables at present covered by EN 50264 and EN 50306.

1 Scope

This standard specifies special test methods applicable to cables, and their constituent insulating and sheathing materials, for use in railway rolling stock. Such cables are specified in the various parts of EN 50264 and EN 50306.

Other test methods required for railway rolling stock cables and their insulating and sheathing materials are listed in Annex A.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 50264-1	Railway applications - Railway rolling stock cables having special fire performance - Standard wall -- Part 1: General requirements
EN 50266-2-4:2001	Common test methods for cables under fire conditions - Test for vertical flame spread of vertically-mounted bunched wires or cables -- Part 2-4: Procedures - Category C
EN 50267-1	Common test methods for cables under fire conditions – Test on gases evolved during combustion of materials from cables -- Part 1: Apparatus
EN 50306-1	Railway applications - Railway rolling stock cables having special fire performance - Thin wall -- Part 1: General requirements
EN 60216-1	Electrical insulating materials - Properties of thermal endurance -- Part 1: Ageing procedures and evaluation of test results (IEC 60216-1)
EN 60811-1-1	Insulating and sheathing materials of electric cables - Common test methods -- Part 1-1: General application - Measurement of thickness and overall dimensions - Tests for determining the mechanical properties (IEC 60811-1-1)
EN 60811-1-2	Insulating and sheathing materials of electric cables - Common test methods -- Part 1-2: General application - Thermal ageing methods (IEC 60811-1-2)
EN 60811-1-3	Insulating and sheathing materials of electric cables - Common test methods -- Part 1-3: General application - Methods for determining the density - Water absorption tests - Shrinkage test (IEC 60811-1-3)
EN 60811-1-4	Insulating and sheathing materials of electric cables - Common test methods -- Part 1-4: General application - Test at low temperature (IEC 60811-1-4)
EN 60811-3-1	Insulating and sheathing materials of electric cables - Common test methods -- Part 3-1: Methods specific to PVC compounds - Pressure test at high temperature - Tests for resistance to cracking (IEC 60811-3-1)
ISO 6349	Gas analysis - Preparation of calibration gas mixtures - Permeation method
ISO 8458-2	Steel wire for mechanical springs -- Part 2: Cold-drawn carbon steel wire

3 Definitions

The definitions given in EN 50264-1 and EN 50306-1, shall apply to this standard.

4 Applicability, sampling, test-piece preparation and test conditions

4.1 Applicable tests

Tests applicable to each type of cable are given in the particular cable standard.

4.2 Classification of tests

The classification of tests is given in the general requirements of the relevant cable standard.

4.3 Sampling

The size and number of samples for each particular test is given either in this EN or the relevant cable standard.

4.4 Test-piece preparation

The preparation of test pieces shall be as described in the particular test method or in the cable standard.

NOTE Attention is drawn to the fact that some insulation systems used for railway cables are composites (multilayer). In such cases special preparation techniques and requirements are given in the particular cable standard.

4.5 Test conditions

4.5.1 Ambient temperature

Tests shall be made at an ambient temperature within the range 5 °C to 35 °C, unless otherwise specified in the details for the particular test.

4.5.2 Tolerance on temperature values

The tolerances which shall apply to the temperature values are given in Table 1.

Table 1 – Tolerances for temperature values

Specified temperature (T) °C	Tolerance °C
-40 ≤ T ≤ 0	± 2
0 < T ≤ 50	According to relevant clause
50 < T ≤ 150	± 2
T > 150	± 3

4.5.3 Frequency and waveform of power frequency test voltages

Unless otherwise specified, the test voltage shall be a.c. 49 Hz to 61 Hz of approximately sine-wave form; the ratio peak value/r.m.s. value being equal to √2 with a tolerance of ± 7 %.

The values quoted are r.m.s. values.

4.5.4 Pre-conditioning

Unless otherwise stated the tests shall be carried out not less than 16 h after the extrusion or cross-linking, if any, of the insulating or sheathing compounds.

5 Mechanical tests

5.1 Impact test at low temperature

The impact test in accordance with 8.5 of EN 60811-1-4 shall be used except that the mass of hammer, intermediate test piece and height of drop shall be as given in Table 2.

Table 2 – Parameters for impact test at low temperature

Cable diameter (D) mm	Mass of hammer g	Mass of intermediate test piece g	Height of drop mm
$D \leq 15$	1 000	200	100
$15 < D \leq 25$	1 500	200	150
$D > 25$	2 000	200	200

The inside and outside of the sheath and the insulation of unsheathed cables shall then be examined with normal or corrected vision, without magnification. The insulation of sheathed cables shall be examined on the outside only.

5.2 Abrasion resistance

The test shall be carried out at a temperature of (20 ± 5) °C, using a machine similar to that shown in Figure 1.

The cutting edge shall be either a polished steel spring wire needle of (0,45 ± 0,01) mm diameter, and of material according to ISO 8458-2, held in a suitable support (Figure 1 b)), or a rectangular shaped steel blade (Figure 1 a)) mounted at 90° to the axis of the cable. The setting shall be arranged so as to wear the surface of the core or cable lengthwise over a distance of 10 mm to 20 mm, with a frequency of (55 ± 5) cycles per minute. The machine shall be fitted with a counter which shall stop automatically when the cutting edge touches the conductor or electrical screen.

For cables of diameter less than or equal to 6 mm the needle shall be used, and for cables with diameter greater than 6 mm the steel blade shall be used, unless otherwise specified in the particular cable standard.

The load on the cutting edge shall be defined in the cable standard.

The test specimen shall consist of a single 0,75 m sample of core or cable.

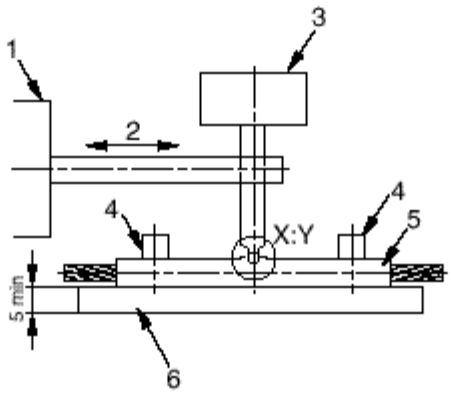
The test specimen shall be held securely on the plate by 2 cable clamps.

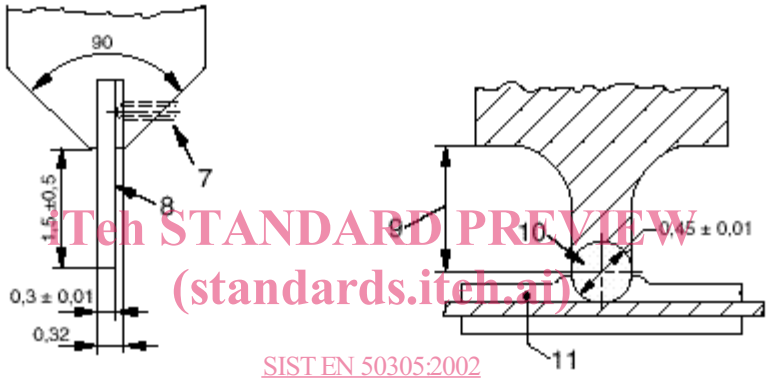
Each test specimen shall undergo four tests. After each single test it shall be moved approximately 100 mm and turned by a 90° angle, clockwise.

NOTE In the case of 2 core cables, 3 core cable or those cables not substantially circular, the cutting edge should be applied to the highest points on the circumference of the cable.

Each test is finished when the cutting edge touches the conductor or electrical screen.

The measure of abrasion resistance shall be the average value of the number of cycles in the four tests.





a) Detail X **b) Detail Y**

(edges not rounded; free of burr)

Dimensions in millimetres

Key

1	Stroke generator	7	Fastening screw
2	Stroke	8	Blade reamer
3	Loading weight	9	Shoulder of sufficient depth to clear insulation
4	Clamp		
5	Test specimen	10	Cutting edge - needle
6	Supporting plate	11	Cable under test

Figure 1 – Test arrangement for abrasion of insulation and sheath

5.3 Notch propagation

Three samples of the cable shall be notched, to a depth of 0,05 mm of the insulation or sheathing, at four points equally spaced with respect to one another around the circumference and 25 mm apart along the length, and in a plane mutually perpendicular to the conductor.

NOTE In the case of 2 core cable, 3 core cable or those cables not substantially circular, the notches should be made at the highest points on the circumference of the cable.

One of the samples shall be conditioned at -15 °C, one at ambient temperature and one at 85 °C, in all cases for 3 h, after which time they shall be wound on to a mandrel, (3 ± 0,3) times the minimum specified diameter of the cable, whilst at the conditioning temperature. The notched sample shall be wrapped around the mandrel such that at least one notch is on the outside of the cable.

The sample shall be allowed to return to ambient temperature and then subjected to the voltage test given in 6.2. but at half the rated voltage U_0.

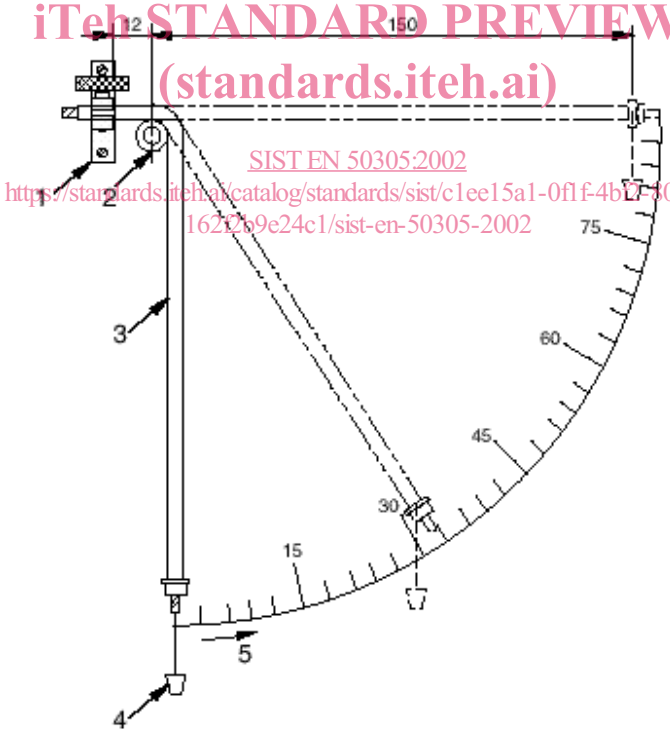
5.4 Pliability

From a single coil of cable cut consecutive test specimen lengths, each of approximately 200 mm.

Suspend each specimen vertically for 24 h in an oven with a mass attached to its free end. The applied mass and oven temperature shall be as stated in the cable specification. Immediately after removal from the oven, store the specimens at the temperature, relative humidity and period of time specified in the cable specification.

Test each specimen using the test rig shown in Figure 2; the diameter of the mandrel in the test rig shall be as the minimum bend diameter unless specified in the cable specification. Gradually apply a mass to the cable, at the position shown in Figure 2, sufficient to bend the cable downwards through $(90\ ^{0}_{-1})°$.

Ensure that the specimen remains in this position for 5 min and record the mass. After this time, remove the mass and allow the specimen to recoil towards its original position. At a time 5 min after removal of the mass, record the recoil distance.



Dimensions in millimetres

Key

1 Clamp
2 Mandrel
3 Test specimen
4 Mass container
5 Recoil

Figure 2 – Pliability test rig

5.5 Strippability and adhesion of insulation

5.5.1 Strippability

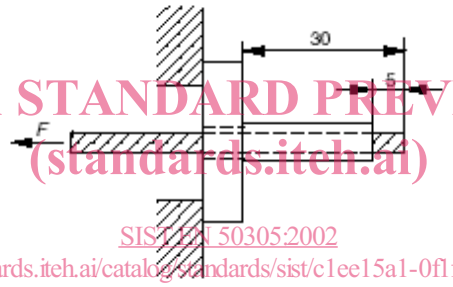
Stripping of 5 mm of insulation from each end of a 50 mm sample shall be easily carried out with normal stripping pliers.

5.5.2 Adhesion

Three test specimens, each of 50 mm length, shall be cut at regular intervals from a test sample of 3 m of core or cable.

On each specimen the insulation shall be cut 5 mm and 30 mm from one end. The insulation shall be stripped from the cuts to each end, so that insulation is left intact in-between the two cuts. The core shall then be passed through a calibrated hole the diameter of which is that of the core + 0,05 mm (see Figure 3).

Using a pulling speed of (100 ± 10) mm/min a force shall be applied to the conductor until it slips inside the insulation. The force (F) required to produce the slippage shall be recorded.



Dimensions in millimetres

Figure 3 – Assembly for adhesion test

5.6 Dynamic cut-through

A tensile tester (or equivalent apparatus) shall be operated in a compression mode and shall be equipped with a means to record the force necessary to drive the needle cutting edge (see Figure 1 b)) through the insulation or sheath of a finished sample of cable. A low voltage detection circuit, designed to stop the tester when the edge cuts through the cable insulation or sheath and contacts the conductor or electrical screen, shall be attached.

Carry out the test at the temperature specified in the individual cable specification. The force on the cutting edge driving it through the insulation or sheath shall be increased at the constant rate as specified in the product standard until contact with the conductor or metallic screen occurs. Perform four tests on each test sample, and record the force measured at electrical contact. Move the sample forward a minimum of 25 mm and rotate 90° clockwise between each test.

NOTE In the case of 2 core cables, 3 core cable or those cables not substantially circular, the cutting edge should be applied to the highest points on the circumference of the cable.

The average of the four results shall not be less than the specified minimum.