

Railway applications - High temperature power cables for railway rolling stock and having special fire performance - Part 2: Single core silicone rubber insulated cables for 120 C or 150 C

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Bahnanwendungen - Hochtemperaturkabel und -leitungen für Schienenfahrzeuge mit verbessertem Verhalten im Brandfall - Teil 2: Einadrige silikonisierte Leitungen für 120 °C oder 150 °C

Applications ferroviaires - Câbles pour matériel roulant ferroviaire ayant des performances particulières de comportement au feu - Partie 2: Câbles monoconducteurs isolés au silicone pour 120 °C ou 150 °C

Ta slovenski standard je istoveten z: EN 50382-2:2008

ICS:

13.220.40	Sposobnost vžiga in obnašanje materialov in proizvodov pri gorenju	Ignitability and burning behaviour of materials and products
29.060.20	Kabli	Cables
45.060.01	Železniška vozila na splošno	Railway rolling stock in general

SIST EN 50382-2:2008**en,fr,de**

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**Railway applications -
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having special fire performance -
Part 2: Single core silicone rubber insulated cables for 120 °C or 150 °C**

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CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This European Standard was prepared for the Technical Committee CENELEC TC 20, Electric cables, by Working Group 12, Railway Cables, as part of the overall programme of work in the 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 50382-2 on 2008-02-01.

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) 2009-02-01

- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2011-02-01

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Introduction

EN 50382 covers cables operating at high temperature with standard wall thickness of insulation, both sheathed and unsheathed, based upon halogen free materials, for use in railway rolling stock. It is divided into 2 parts:

- Part 1: General requirements;
- Part 2: Single core silicone rubber insulated cables for 120 °C or 150 °C.

Special test methods referred to in EN 50382 are given in EN 50305. A Guide to Use is given in EN 50355.

Information regarding selection and installation of cables, including current ratings can be found in EN 50355 and EN 50343. The procedure for selection of conductor cross-sectional area, including reduction factors for ambient temperature and installation type, is described in EN 50343.

NOTE Current ratings for inclusion in EN 50355 are under development for the next amendment.

Part 1, General requirements, contains a more extensive introduction to EN 50382, and should be read in conjunction with this Part 2.

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1 Scope

Part 2 of EN 50382 specifies requirements for, and constructions and dimensions of, single core cables of the following types and voltage ratings:

- 1,8/3 kV unscreened, unsheathed with or without textile braid (1,5 mm² to 400 mm²);
- 1,8/3 kV unscreened, sheathed (1,5 mm² to 400 mm²);
- 3,6/6 kV unscreened, unsheathed with or without textile braid (2,5 mm² to 400 mm²);
- 3,6/6 kV unscreened, sheathed (2,5 mm² to 400 mm²).

All cables have class 5 or class 6 tinned or plain copper conductors to EN 60228, halogen-free insulation and where applicable halogen-free sheath. They are for use in railway rolling stock as fixed wiring, or wiring where limited flexing in operation is encountered. The requirements provide for a continuous conductor temperature not exceeding 120 °C or 150 °C and a maximum temperature for short circuit conditions of either 250 °C or 350 °C based on a duration of 5 s. When the insulating compounds and sheath specified in this standard which are thermally capable of operating at 150 °C are used with tinned conductors, the maximum operating temperature is limited to 120 °C and, for the same technical reason, the maximum short circuit temperature is limited to 250 °C. The choice of sheath may also limit the maximum operating temperature to 120 °C.

A textile braid may be included in the insulation or applied at its surface to unsheathed cables.

Under fire conditions the cables exhibit special performance characteristics in respect of maximum permissible flame propagation (flame spread) and maximum permissible emission of smoke and toxic gases.

This Part 2 of EN 50382 should be used in conjunction with Part 1 “General requirements”.

2 Normative references

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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 10002-1	Metallic materials – Tensile testing – Part 1: Method of test (at ambient temperature)
EN 50266-2-4	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 50266-2-5	Common test methods for cables under fire conditions – Test for vertical flame spread of vertically-mounted bunched wires or cables – Part 2-5: Procedures – Small cables - Category D
EN 50305:2002	Railway applications – Railway rolling stock cables having special fire performance – Test methods
EN 50382-1	Railway applications – Railway rolling stock high temperature power cables having special fire performance – Part 1: General requirements
EN 50395:2005	Electrical test methods for low voltage energy cables
EN 60228	Conductors of insulated cables (IEC 60228)
EN 60332-1-2	Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame (IEC 60332-1-2)

EN 60811-1-1:1995	Insulating and sheathing materials of electric and optical cables – Common test methods – Part 1-1: General application – Measurement of thickness and overall dimensions – Tests for determining the mechanical properties (IEC 60811-1-1:1993)
EN 60811-1-2:1995	Insulating and sheathing materials of electric cables – Common test methods – Part 1-2: General application – Thermal ageing methods (IEC 60811-1-2:1985 + A1:1989 + corr. May 1986)
EN 60811-1-3:1995	Insulating and sheathing materials of electric and optical cables – Common test methods – Part 1-3: General application – Methods for determining the density – Water absorption tests – Shrinkage test (IEC 60811-1-3:1993)
EN 60811-1-4:1995	Insulating and sheathing materials of electric and optical cables – Common test methods – Part 1-4: General application – Tests at low temperature (IEC 60811-1-4:1985 + A1:1993 + corr. May 1986)
EN 60811-2-1:1998	Insulating and sheathing materials of electric and optical cables – Common test methods – Part 2-1: Methods specific to elastomeric compounds – Ozone resistance, hot set and mineral oil immersion tests (IEC 60811-2-1:1998)
EN 61034-2	Measurement of smoke density of cables burning under defined conditions – Part 2: Procedure and requirements (IEC 61034-2)
HD 308	Identification of cores in cables and flexible cords

3 Definitions

For the purposes of this document, the terms and definitions given in EN 50382-1 apply.

4 Rated voltage

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The rated voltage for single core silicone insulated cables shall be as follows:

- unsheathed: 1,8/3 kV; 3,6/6 kV;
- sheathed: 1,8/3 kV; 3,6/6 kV.

5 Marking and identification

5.1 Marking of cable

Cables shall be marked with the following:

- indication of origin;
- EN reference;
- voltage rating (U_0);
- number of conductors and their size;
- a code designation according to Annex A;
- conductor temperature.

An example of a complete mark for a sheathed cable is:

*** EN50382-2 3600V 1x400 OF 150°C

The marking shall conform to the requirements of EN 50382-1, Clause 5.

NOTE Other markings (e.g. batch number, year of manufacture) may be added upon agreement between manufacturer and user.

5.2 Colour identification

5.2.1 Insulation

The insulation of unsheathed cables shall be black and that of sheathed cables white or neutral unless otherwise agreed between the manufacturer and purchaser. If a colour other than white or neutral is specified it shall be a colour in accordance with HD 308.

The colour shall be clearly identifiable and durable. Durability shall be checked by the test given in EN 50305, 10.1.

Conformity with these requirements shall be verified by visual examination.

5.2.2 Sheath

The sheath shall be black unless otherwise agreed between the manufacturer and purchaser.

6 Construction of cables

6.1 General

The cable shall conform to the applicable general requirements given in EN 50382-1, and to the specific requirements of this part.

Conformity with the requirements shall be checked by inspection and by the tests given in Table 7.

The cable dimensions shall be as given in Tables 1 to 5 as appropriate to the cable type.

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6.2 Conductor

For cables rated at 120 °C conductors shall be tinned annealed copper, class 5 or class 6, according to EN 60228.

For cables rated at 150 °C conductors shall be plain annealed copper, class 5 or class 6, according to EN 60228.

When tested in accordance with EN 10002-1 the minimum average elongation of wires from the conductor shall be 15 %, with a minimum value of 10 % for an individual wire.

NOTE It is not necessary to test all individual wires. 5 % of wires or 10 wires, whichever is the fewer, should be selected at random.

6.3 Conductor screening

For cables in Tables 3 to 5 it is permitted to use a conductor screen. When used it shall be as given in EN 50382-1, 6.1.6.

6.4 Separator

It is permitted to place a non-hygroscopic separator tape of coloured material between the conductor and insulation if the cable construction does not include a conductor screen. If used, the separator tape shall be easily removable from the conductor.

A separator may be included between the insulation and sheath.

6.5 Insulation system

The insulation shall be one or more closely adherent layers of extruded material as defined in EN 50382-1, applied so as to meet the requirements of compound Type EI 111 or EI 112.

a) for unsheathed cables:

- Type EI 111: extra low temperature resistant, oil resistant;

b) for sheathed cables:

- Type EI 111: extra low temperature resistant, oil resistant;
- Type EI 112: extra low temperature resistant, non oil resistant.

The insulation shall be applied to meet the requirements of EN 50382-1, 6.2.

The insulation thickness shall conform to the specified value given in Tables 1 to 5.

6.6 Sheath

Sheath shall be an extruded material as defined in EN 50382-1 applied so as to meet the requirements of compound Type EM 105 or EM 106 or EM 107:

- Type EM 105: low temperature resistant, oil resistant;
- Type EM 106: extra low temperature resistant, oil resistant;
- Type EM 107: extra low temperature resistant, oil resistant.

If sheathing compounds EM 105 or EM 106 are used, the cable is rated at 120 °C.

If sheathing compound EM 107 is used, the cable is rated at 150 °C.

The sheath shall consist of one or more closely adherent layers of the same type.

The sheath shall be applied to meet the requirements of EN 50382-1, 6.4.

The sheath thickness shall conform to the specified value given in Tables 2 and 5.

6.7 Textile braid

It is permitted to include a textile braid, either within the insulation or at its surface.

When a textile braid is included in the construction of a cable, it shall consist of material compatible with the operating temperature (for example braid made of glass filaments shall be treated with a suitable substance in order to avoid fraying).

When a braid is applied to the surface of the insulation a separator may be included between the insulation and braid.

NOTE A braid may be included in the construction at the request of a customer.

6.8 Constructional components

6.8.1 Unsheathed cable (Table 1 – 1,8/3 kV 120 °C or 150 °C)

Cables in Table 1 shall be composed of the following components in the order given:

- conductor: flexible tinned or plain annealed copper, class 5, as given in 6.2;
- separator: optional; as given in 6.4;
- insulation: a compound as given in 6.5;
- braid (on request): a textile braid as given in 6.7. A separator may be included by the manufacturer between the insulation and braid.

6.8.2 Sheathed cable (Table 2 – 1,8/3 kV 120 °C or 150 °C)

Cables in Table 2 shall be composed of the following components in the order given:

- conductor: flexible tinned or plain annealed copper, class 5, as given in 6.2;
- separator: optional; as given in 6.4;
- insulation: a compound as given in 6.5;
- separator: optional; as given in 6.4;
- sheath: a compound as given in 6.6.

6.8.3 Unsheathed cable (Table 3 and Table 4 – 3,6/6 kV 120 °C or 150 °C)

Cables in Table 3 shall be composed of the following components in the order given:

- conductor: flexible tinned or plain annealed copper, class 5, as given in 6.2;
- conductor screening: optional; as given in EN 50382-1, 6.1.6;
- insulation: a compound as given in 6.5;
- braid (on request): a textile braid as given in 6.7.

Cables in Table 4 shall be composed of the following components in the order given:

- conductor: extra flexible tinned or plain annealed copper, class 6, as given in 6.2;
- separator: optional; as given in 6.4;
- insulation: a compound as given in 6.5;
- braid (on request): a textile braid as given in 6.7. It may be included in the insulation (between two layers) or applied at surface of the insulation.

6.8.4 Sheathed cable (Table 5 – 3,6/6 kV 120 °C or 150 °C)

Cables in Table 5 shall be composed of the following components in the order given:

- conductor: flexible tinned or plain annealed copper, class 5, as given in 6.2;
- conductor screening: optional; as given in EN 50382-1, 6.1.6;
- insulation: a compound as given in 6.5;
- separator: optional; as given in 6.4;
- sheath: a compound as given in 6.6.