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Railway applications - Railway rolling stock cables having special fire performance - Thin wall and standard wall - Guide to use

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Railway applications - Railway rolling stock cables having special fire performance - Thin wall and standard wall - Guide to use

Applications ferroviaires -
Câbles à comportement au feu spécifié pour matériel roulant ferroviaire -
Isolation mince et d'épaisseur normale -
Guide d'emploi

Bahnanwendungen -
Kabel und Leitungen für Schienenfahrzeuge mit verbessertem Verhalten im Brandfall -
Reduzierte Isolierwanddicken und Standard-Isolierwanddicken -
Leitfaden für die Verwendung

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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 for 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 Unique Acceptance Procedure and was approved by CENELEC as EN 50355 on 2003-06-01.

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) 2004-06-01

- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-06-01

Annexes designated "informative" are given for information only.
In this standard, Annexes A and B are informative.

Contents

Introduction

The railway industry is generally concerned with the movement of people as well as goods. It is therefore essential that 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.

The objects of this guide are

- to inform railway vehicle manufacturers, installers of cables and railway operators of the properties and limiting conditions of rolling stock cables in order to safeguard life and equipment,

- to avoid misuse of rolling stock cables.

The information is given as limiting values and illustrated by examples which cannot be exhaustive but nevertheless indicate ways by which safety (a tolerable level of risk) can be obtained.

It has been assumed in the preparation of this guide that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

This guide should be used in conjunction with:

EN 50264 Railway applications – Railway rolling stock cables having special fire performance – Standard wall

EN 50306 Railway applications – Railway rolling stock cables having special fire performance – Thin wall

EN 50343 Railway applications – Rolling stock – Rules for installation of cabling

1 Scope

This European Standard gives guidance in the safe use of rolling stock cables specified in EN 50264 and EN 50306.

NOTE EN 50355 will be extended in future to cover also EN 50382, which is currently under preparation.

These cables should only be used for the wiring of railway rolling stock and within the limits given in the manner described in this European Standard. All these cables are for fixed installation where there is no free movement of cable, except for stresses due to typical service.

This European Standard is to be applied in conjunction with the relevant product and installation standards. Stricter requirements than those given in this standard could be necessary; see in particular EN 50343.

This European Standard is not applicable to

- intercarriage jumpers,
- cables subject to continual flexing,
- pantograph cables,
- coaxial and fibre optic cables,
- wire wrap,
- cables rated at voltages greater than 3,6/6 kV,
- national types,
- applications other than the cabling of railway rolling stock.

Legal or statutory requirements do take precedence over the guidance given in this document.

In cases where no guidance exists or where it cannot be derived from general information, it is recommended that advice should be sought from the cable manufacturer.

2 Definitions

For the purposes of this European Standard the definitions given in EN 50264 and EN 50306 apply.

3 Requirements for safety

3.1 Fundamental requirements

3.1.1 Railway rolling stock cables are intended for the transmission and distribution of electricity in monitoring, control and power circuits. In the case of normal use they are to be regarded as safe. Safety of a cable means that the product does not present an unacceptable risk of danger to life or property whilst being used in its intended manner.

3.1.2 Unless otherwise stated in the appropriate part of EN 50264 and EN 50306, cables should not be used for any other purpose than the transmission and distribution of electricity in control, monitoring and power circuits.

3.1.3 The test parameters and requirements described in EN 50264 and EN 50306, and the test methods in EN 50305, are only for the purposes of checking with respect to safety and quality assurance. They should not be regarded as providing guidance that the cables are suitable for service under conditions equivalent to the test conditions.

3.2 General requirements

3.2.1 All cables should be selected so as to be suitable for the voltages and currents likely to occur under all conditions which are or should have been anticipated in the equipment or rolling stock or that part thereof in which they are used.

Care should be taken when selecting cables that will be subject to traction line voltages due to transient voltages that may occur (see EN 50163).

3.2.2 Cables should be so constructed, installed, protected, used and maintained to prevent danger so far as it is reasonably practical.

3.2.3 All cables should be selected so as to be suitable for both standard or special ambient conditions encountered in rolling stock (see EN 50125-1).

The limiting conditions under which the cables can be reasonably expected to operate under normal circumstances are given in Tables 1 to 10.

These conditions are those considered capable of ensuring a length of life in service which has been accepted as reasonable by experience of the particular type of cable and in particular conditions of use. The duration of acceptable performance of a particular type of cable depends upon the type of use, installation or electrical apparatus and on the particular combination of influences relating thereto. For example, the duration of acceptable performance considered as reasonable for a cable used in a fixed installation, for the distribution of electricity in rolling stock, is more than that for a cable subject to continual flexing.

For further information on lifetime of cables see 5.3 e).

EN 50264 and EN 50306 contain cables with a choice of properties:

Low temperature [1]	Fuel resistance [2]
Normal	Normal
Extra	Normal
Normal	Extra
Extra	Extra

[1] Normal low temperature cables are subject to test at –25 °C, extra low temperature cables at –40 °C.

[2] Normal fuel resistance cables are tested in the test fluid (IRM902). Extra fuel resistance cables are tested in two test fluids (IRM902 & IRM903) for longer periods of time, at increased temperature.

Although the sheaths of cables may be considered resistant to certain fluids the insulation used may not be, this should be taken into account where cables will be subject to prolonged exposure to fluids. Care should also be exercised where fluid can gain access to the cores at the termination. These cables are not suitable for continuous immersion in fluids, for this application the advice of the manufacturer should be sought.

3.2.4 Cables should be selected so that they are suitable for the operating conditions and equipment classification.

Examples of operating conditions are

- voltage,
- current,
- protective measures,
- grouping of cables,
- method of installation,
- accessibility.

3.2.5 Cables should be selected so that they are suitable for any external influences which may exist.

Examples of external influences are

- ambient temperature,
- presence of rain, steam or accumulation of water,
- presence of corrosive, chemical or polluting substances,
- mechanical stresses (such as through holes or sharp edges in metal work),
- radiation (such as sunlight).

In respect to solar radiation it should be noted that colour is important, black giving a higher degree of protection against degradation but higher heat absorption.

It should be noted that EN 50306-4 contains two classes of cables:

- **class E** is intended for use where the cable is installed such that it may be subject to mechanical damage and appropriate protection, in general, is not provided;
- **class P** is intended for use in locations where once installed the cable will be protected so that mechanical damage is unlikely to occur.

3.2.6 Consideration should be given to protection against aggressive agents other than those for which the cables are designed.

3.2.7 The colour combination of green/yellow, if used, is only to be used for earthing purposes.

3.3 Requirements for fixed cables

3.3.1 Cables should not be installed in contact with or close to hot surfaces unless the cables are intended for such conditions.

3.3.2 Cables should be adequately supported. Recommended maximum spacing of supports is given in EN 50343.

In deciding the actual spacing, the weight of the cable between the supports should be taken into account so that the limiting value of mechanical tension is not exceeded.

The cable should not be damaged by any mechanical restraint used for its support

3.3.3 Cables which have been in use for long periods may be damaged if they are disturbed. This can arise from the effect of natural ageing on the materials used for cable insulation and sheathing, which ultimately results in deterioration of the physical properties of these materials.

3.3.4 Cables should not be subject to excessive abrasion, crushing, kinking, and mechanical stress (see 5.4) particularly at the point of connection to the fixed equipment. Any strain relief or clamping device should not damage the cable.

3.3.5 An earthing core, if any, should be of such a length that in case of cable breakage due to tension applied to the cable this core breaks after all other cores.

3.3.6 It should be noted that the use of a class 5 conductor in cables to EN 50264 and EN 50306 does not indicate that the cable is suitable for repeated flexing.

3.4 Electromagnetic compatibility (EMC)

If essential circuits are liable to be subject to electromagnetic interference, screens or shielding should be provided. (See also EN 50121-1 and EN 50343).

4 Fire

4.1 General

Operational categories and hazard levels for railway rolling stock are set out in EN 45545-1, to which reference should be made. Attention should be given to the application for which the rolling stock will be used in order to determine the operational category, and the hazard level to be used, when assessing requirements of testing for fire.

Cables should be selected, located and installed so that they do not present a fire hazard to adjacent materials.

In the case of fire initiated elsewhere, cables can provide a source of fuel and a means of propagating a fire along its length.

In these circumstances the insulation and sheath materials of burning cables can give rise to smoke, and toxic and corrosive fumes. Account should be taken of these facts when selecting and installing cables (EN 50264 and EN 50306 specify materials which produce different levels of fire effluent).

In cases where it is considered that these facts constitute a hazard, and particularly where it is necessary to ensure safe evacuation when evacuation times can be long, cables having the lowest emission of smoke and toxic gases should be installed.

4.2 Resistance to fire

Where in the event of a fire, the integrity of a circuit is essential for personnel and equipment safety, fire resisting (limited circuit integrity) cable should be used.

Such cables should, in addition to meeting the requirements of EN 50264 and EN 50306 meet the requirements of EN 50200. (EN 50200 only covers cables up to 20 mm overall diameter; for cables larger than this the advice of the manufacturer should be sought.)

Cables to EN 50264 and EN 50306 series are not specifically designed for this purpose.

4.3 Reaction to fire

The insulating and sheathing materials referred to in EN 50264 and EN 50306 are specifically selected to give the spread of flame, emission of smoke and toxicity consistent with the required performance of the cable to suit the operational categories and hazard levels given in EN 45545-1. The requirements specified in these standards are repeated below for information.

4.3.1 Flame propagation (flame spread)

4.3.1.1 Flame propagation (flame spread) – single vertical cable

When tested to EN 50265-2-1 cables should conform to the recommended performance requirements given in Annex A of that standard.

4.3.1.2 Flame propagation (flame spread) - bunched cables

a) Cables with diameters more than or equal to 12 mm

When tested to EN 50266-2-4 cables should conform to the recommended performance requirements given in Annex B of that standard.

b) Cables with diameters greater than 6 mm and less than 12 mm

When tested to EN 50305, subclause 9.1.1, cables should conform to the performance requirements given in the applicable cable standard.

c) Cables with a diameter not greater than 6 mm

When tested to EN 50305 subclause 9.1.2, cables should conform to the performance requirements given in the applicable cable standard.

4.3.2 Smoke emission

For the hazard levels given in EN 45545-1, and when tested in accordance with EN 50268-2, cables should conform to the following values of light transmission:

- hazard level 1: not specified;
- hazard levels 2 & 3: 60 % minimum;
- hazard level 4: 70 % minimum.

4.3.3 Corrosive and acid gas emission (halogen-free materials)

When tested to the relevant standard, components of cables should conform to the performance requirements given below:

- maximum evolution of acid gas as HCl equivalent : 0,5 % to EN 50267-2-1;
- minimum pH: 4,3 to EN 50267-2-2;
- maximum conductivity: 5,0* µS/mm to EN 50267-2-2;
- maximum fluorine content: 0,1 % to EN 60684-2.

* or 10,0 µS/mm. See cable standards for additional information.

4.3.4 Toxicity

For the hazard levels given in EN 45545-1, and when tested in accordance with EN 50305, Subclause 9.2, components of cables should conform to the following values of toxicity index. The toxicity index value is dependent upon the material used in the construction of the cable (see EN 50264 and EN 50306 for additional information).

- Hazard level 1: not specified
- Hazard levels 2 & 3: 10 or 5 maximum
- Hazard level 4: 6 or 3 maximum

NOTE The applicability of the test method in EN 50306 is being reviewed following the conclusion of TC 89's work.

5 Limiting conditions

The influence of all factors as outlined in this section should be considered in combination, not separately.

5.1 Voltage

The rated voltage of a cable is the reference voltage for which the cable is designed and which serves to define the electrical tests (see Table 11).

The rated voltage is expressed by the combination of two values U_o/U, or three values U_o/U (U_m) expressed in volts:

U_o is the r.m.s. value between any insulated conductor and 'earth' (metal covering of the cable or the surrounding medium);

U is the r.m.s. value between any two phase conductors of a multicore cable or of a system of single core cables.

U_m is the maximum r.m.s. value of the 'highest system voltage' for which the equipment may be used.

In an alternating current system, the rated voltage of a cable shall be at least equal to the values U_o and U.

In a direct current system, the nominal voltage of the system shall be not higher than 1,5 times the a.c. rated voltage of the cable.

Thus, for a 600/1 000 (1 200) V cable, the maximum d.c. voltage would be 900 V conductor to earth and 1 500 V conductor to conductor.

In a centre-tapped system, this represents a practical limit of +750 V/-750 V.

In a d.c. system with one pole earthed, the maximum voltage would be 900 V.

Care should be taken when selecting cables that will be used in systems energised at traction line voltages.

Under any conceivable design fault condition if a voltage exists for more than 5 min it shall be considered to be a permanent voltage.

For specific railway rolling stock applications cables manufactured to EN 50264 and rated at 1,8/3 kV r.m.s. may be used on 3 kV d.c. systems.