INTERNATIONAL STANDARD

IEC 62012-1

First edition
2002-06

Multicore and symmetrical pair/quad cables for digital communications to be used in harsh environments –

Part 1: Generic specification

Câbles multiconducteurs à paires symétriques et quartes pour transmission numérique utilisés en environnement difficile –

Partie 1: Spécification générique

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES FOR DIGITAL COMMUNICATIONS TO BE USED IN HARSH ENVIRONMENTS –

Part 1: Generic specification

FOREWORD

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International Standard IEC 62012-1 has been prepared by subcommittee 46C: Wires and symmetric cables, of IEC technical committee 46: Cables, wires, waveguides, RF connectors and accessories for communication and signalling.

The text of this standard is based on the following documents:

FDIS	RVD
46C/503/FDIS	46C/535/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

INTRODUCTION

The cables used for customer premises cabling or other IT cabling may have to work in harsh environments. This can be in case of fire but also due to conditions of installation in industrial plant. This standard shall be supplemented by sectional specifications addressing a particular function as defined in 1.4. Detail specifications will refer to one or several sectional specifications depending upon the actual design of the cable.

MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES FOR DIGITAL COMMUNICATIONS TO BE USED IN HARSH ENVIRONMENTS –

Part 1: Generic specification

1 General

1.1 Scope

This part of IEC 62012 specifies the definitions and test methods, when used in harsh environment, of symmetrical pair and quad cables used in digital communication systems such as ISDN, local area networks and data communication systems. This standard gives guidance concerning the design and testing of these cables.

1.2 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.

IEC 60028:1925, *International standard of resistance for copper*

IEC 60050(701), *International Electrotechnical Vocabulary (IEV) – Chapter 701: Telecommunications, channels and networks*

IEC 60050(704), *International Electrotechnical Vocabulary (IEV) – Chapter 704: Transmission*

IEC 60050(722), *International Electrotechnical Vocabulary (IEV) – Chapter 722: Telephony*

IEC 60068-2 (all parts), *Environmental testing – Part 2: Tests*

IEC 60189-1:1986, *Low-frequency cables and wires with PVC insulation and PVC sheath – Part 1: General test and measuring methods*

IEC 60304:1982, *Standard colours for insulation for low-frequency cables and wires*

IEC 60332-1:1993, *Tests on electric cables under fire conditions – Part 1: Test on a single vertical insulated wire or cable*

IEC 60332-2:1989, *Tests on electric cables under fire conditions – Part 2: Test on a single small vertical insulated copper wire or cable*

IEC 60332-3 (all parts), *Tests on electric cables under fire conditions – Part 3: Tests on bunched wires or cables*

IEC 60754-1, *Test on gases evolved during combustion of materials from cables – Part 1: Determination of the amount of halogen acid gas*

IEC 60811-1-1:1993, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section 1: Measurement of thickness and overall dimensions – Tests for determining the mechanical properties*

IEC 60811-1-3:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Three: Methods for determining the density – Water absorption tests – Shrinkage test*

IEC 60811-1-4:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Four: Tests at low temperature*

IEC 61034-1, *Measurement of smoke density of cables burning under defined conditions – Part 1: Test apparatus*

IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements*

1.3 Definitions

For the purposes of this generic specification, the definitions given in IEC 60050-701, IEC 60050-704, IEC 60050-722 and IEC 61156-1 apply.

1.4 Environmental considerations

The cables shall be designed to perform in one or more of the following environmental condition.

It is the intention of this standard that any cables defined as compliant with one or more of the categories referred to in definitions of 1.3 shall also be compliant with the electrical, mechanical and environmental requirement given below when tested in accordance with Clauses 3 and 4.

1.4.1 Fire resistance

When subjected to fire according to the test described in 3.4.6, the cables shall be capable of transmitting the expected signal with or without degradation as described in the detail specification.

1.4.2 Temperature

When subjected to temperature according to the test described in 3.5, the cables shall be capable of transmitting the expected signal with or without degradation as described in the detail specification.

1.4.3 Nuclear radiations (α, β, γ)

When subjected to radiations according to the test described in 3.7, the cables shall be capable of transmitting the expected signal with or without degradation as described in the detail specification.

1.4.4 Chemical

When subjected to chemical agents accordingly to the test described in 3.6, the cables shall be capable of transmitting the expected signal with or without degradation as described in the detail specification.

2 Materials and cable construction

2.1 General remarks

The choice of materials and cable construction shall be suitable for the intended application and installation of the cable.

2.2 Cable construction

The cable construction shall be in accordance with the details and dimensions given in the relevant detail cable specification.

2.2.1 Conductor

The conductor may be either solid or stranded. The solid conductor shall be circular in section and may be plain or metal-coated. Normally, the solid conductor shall be drawn in one piece. Joints in the solid conductor are permitted, provided that the tensile strength of a joint is not less than 85 % of the unjointed solid conductor.

When the conductor consists of annealed copper, it shall be uniform in quality and free from defects. The properties of the copper shall be in accordance with IEC 60028.

The stranded conductor shall consist of strands circular in section and assembled without insulation between them by concentric stranding or bunched.

The individual strands of the conductor may be plain or metal-coated.

Normally, the individual strands shall be drawn in one piece. Joints in individual strands are permitted provided that the tensile strength of a joint is not less than 85 % of the tensile strength of the unjointed individual strand. Joints in the complete stranded conductor are not permitted unless allowed and specified in the relevant detail cable specification.

2.2.2 Insulation

Conductor insulation shall be composed of one or more suitable dielectric materials. The insulation may be solid, cellular or composite (e.g. foam skin)

The insulation shall be continuous, having a thickness as uniform as possible.

The insulation shall be applied to fit closely to the conductor. The stripping properties of the insulation shall be checked in accordance with the method specified in 3.4 of IEC 60189-1. It shall be possible to strip the insulation from the conductor easily and without damage to the conductor.

When required the insulated conductors shall be coloured for identification. Colours shall correspond reasonably with the standard colours shown in IEC 60304.

2.2.3 Colour code

The colour code for insulation is given in the relevant detail cable specification

2.2.4 Cable element

The cable element is

- a single insulated conductor, or
- a pair consisting of two insulated conductors twisted together and designated wire "a" and wire "b", or
- a quad consisting of four insulated conductors twisted together and designated wire "a", wire "c", wire "b" and wire "d" in order of rotation.

The choice of the maximum average length of lay in the finished cable shall be made with respect to the specified crosstalk requirements, handling performance and the pair or quad integrity.

NOTE Forming the element with a variable lay can lead to the infrequent but acceptable occurrence of the maximum lay being longer than the one that may be specified.

2.2.5 Screening of the cable element

If a screen is required over the pair or quad, it may consist of the following:

a) a metallic tape laminated to a plastic tape;
b) a metallic tape laminated to a plastic tape and a metal-coated or solid drain wire whereby the metal tape is in contact with the drain wire;
c) plain or metal-coated copper braid;
d) a metallic tape laminated to a plastic tape and a metal-coated or plain braid.

Care should be taken when putting dissimilar metals in contact with each other. Coatings or other methods of protection may be necessary to prevent galvanic interaction.

A protective buffer (wrapped or extruded) may be applied under and/or over the screen.

2.2.6 Cable make-up

The cable elements may be laid up in concentric layers or in unit construction. The cable core may be protected by a layer (wrappings of a non-hygroscopic tape or extruded).

NOTE Fillers may be used to maintain a circular formation.

2.2.7 Screening of the cable core

The cable core may be screened by

a) a metallic tape laminated to a plastic tape which is bonded to the sheath;
b) a metallic tape laminated to a plastic tape and a metal-coated, stranded or plain metallic drain wire whereby the metal tape is in contact with the drain wire;
c) plain or metal-coated copper braid;
d) a metallic tape laminated to a plastic tape and a metal-coated or plain metallic braid;
e) plain metallic tape;
f) a metallic tube.

Care should be taken when putting dissimilar metals in contact with each other. Coatings or other methods of protection may be necessary to prevent galvanic interaction.

A protective buffer (wrapped or extruded) may be applied under and/or over the screen.

2.2.8 Sheath

Where a sheath is required, it shall have adequate mechanical strength and elasticity.

The sheath shall be continuous, having a thickness as uniform as possible. The minimum thickness of the sheath shall be determined in accordance with the method specified in 2.2.1.2 of IEC 60189-1.

The sheath shall be applied to fit closely to the core of the cable. In the case of screened cables, the sheath shall not adhere to the screen except when it is intentionally bonded to it.

2.2.9 Colour of sheath

The colour of the sheath may be specified in the relevant detail cable specification.

2.3 Identification

2.3.1 Cable marking

Unless otherwise specified, each length of cable shall bear the name of the manufacturer and, when required, the year of manufacture, using one of the following methods:

a) coloured threads or tapes;

b) printed tape;

c) printing on the core wrappings;

d) marking on the sheath.

Additional markings may be required on the sheath as indicated in the relevant detail cable specification.

2.3.2 Labelling

Information shall be given either on a label attached to each length of finished cable or on the outside of the product packaging, as follows:

a) type of cable;

b) manufacturer's name or logo;

c) year of manufacture;

d) length of cable in metres.

2.4 Finished cable

The finished cable shall be adequately protected for storage and shipment.

3 Test methods

3.1 General remarks

Unless otherwise specified, all tests shall be carried out under the conditions specified in IEC 60068.

3.2 Electrical tests

Electrical tests are performed according to IEC 61156-1. The relevant sectional specification gives the applicable tests.

3.3 Mechanical and dimensional measurement tests

3.3.1 Measurement of dimensions

The measurement of thickness and diameter shall be carried out in accordance with Clause 8 of IEC 60811-1-1.

3.3.2 Elongation at break of the conductor

The method of measuring the elongation at break of the conductor is specified in 3.3 of IEC 60189-1.

3.3.3 Tensile strength of the insulation

When applicable, the measurement of the tensile strength of the insulation is performed in accordance with 9.1.7 of IEC 60811-1-1.

3.3.4 Elongation at break of the sheath

The method of measuring the elongation at break of the plastic sheath is specified in 9.2.7 of IEC 60811-1-1.

3.3.5 Tensile strength of the sheath

The method of measuring the tensile strength of the plastic sheath is specified in 9.2.7 of IEC 60811-1-1.

3.3.6 Crush test of the cable

3.3.6.1 Object

To determine the ability of a cable to withstand a transverse load (or a force) applied to any part of the cable.

3.3.6.2 Procedure

The test is performed at 1 m from the near end of a 100 m length of cable.

The load (*F*) as indicated in the relevant cable specification shall be applied gradually without any abrupt change for a duration of 2 min. If incremental loading is used the steps shall not exceed a ratio of 1,5.

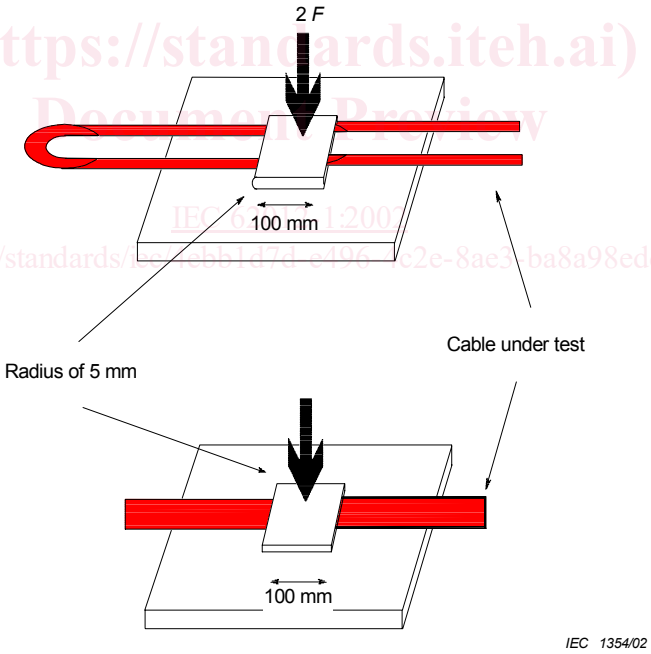

Figure 1 – Fixture for cable crushing test

3.3.6.3 Requirements

During the test, the transmission characteristics shall be within the limiting values specified in the detail specification.

The detail specification may, in addition, indicate other tests to be performed.

3.3.6.4 Information to be given in the detail specification

a) Value of the force *F*.

b) Distance from the test region to the test port.

c) Electrical tests and their requirements.

3.3.7 Bending under tension

3.3.7.1 Object

To determine the ability of a cable to withstand a number of reverse bends.

3.3.7.2 Procedure

The test is performed on the first 10 m from the near end of a 100 m length of cable.

The cable is subjected to a certain number of reverse bends using a pulling "go and return" arrangement over its entire length. The radius of the two pulleys shall be in accordance with the minimum dynamic bending radius of the cable as stated in the relevant detail specification. The pulleys shall be positioned so that the bending angle of the cable on each pulley is more than 90° as shown in Figure 2.

The cable is pulled forwards and backwards against a restraining force F_r which is set to ensure continuous contact between the cable and the pulleys.

The speed should not be less than 1 m/min.

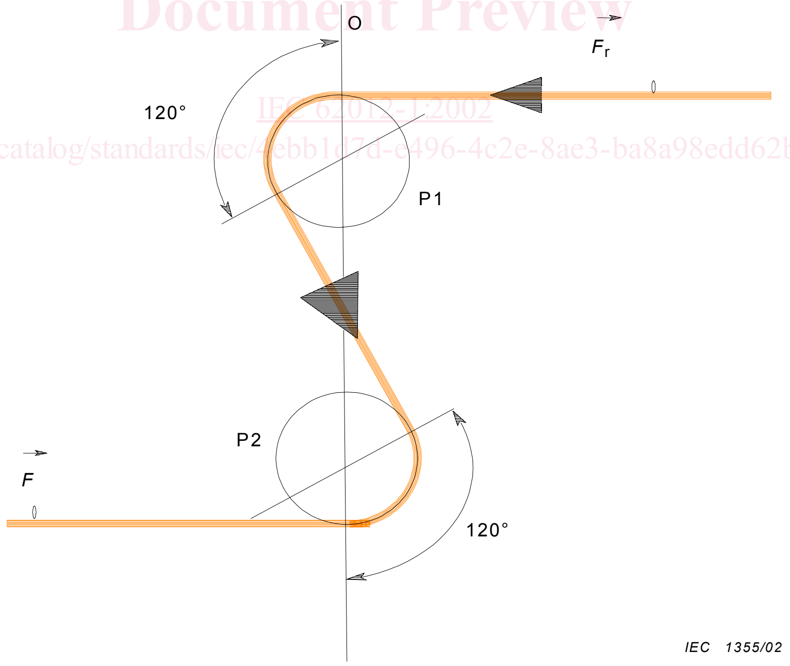

Figure 2 – Bending under tension

3.3.7.3 Requirements

After the test, the cable shall show no visual damage and the electrical requirements shall be satisfied.