INTERNATIONAL STANDARD

IEC 61156-5

First edition
2002-03

Multicore and symmetrical pair/quad cables for digital communications –

Part 5: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz– Horizontal floor wiring – Sectional specification

Câbles multiconducteurs à paires symétriques et quartes pour transmissions numériques –

Partie 5: Câbles à paires symétriques et quartes avec caractéristiques de transmission allant jusqu'à 600 MHz – Câble capillaire – Spécification intermédiaire

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES FOR DIGITAL COMMUNICATIONS –

Part 5: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Horizontal floor wiring – Sectional specification

FOREWORD

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International Standard IEC 61156-5 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	Report on voting
46C/511/FDIS	46C/517/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 standard should be read in conjunction with IEC 61156-1.

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- withdrawn;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.

MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES FOR DIGITAL COMMUNICATIONS –

Part 5: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Horizontal floor wiring – Sectional specification

1 General

1.1 Scope

This sectional specification relates to IEC 61156-1: *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*. The cables described herein are specifically intended for horizontal floor wiring in class D, E and F channels, as defined in ISO/IEC 11801:2000, *Information technology – Generic cabling for customer premises* (see Table 1).

It covers individually screened (STP), common screened (FTP) and unscreened (UTP) pairs or quads having a pair count of four pairs or less. The transmission characteristics of the cables are specified at 20 °C. See Annex A for a discussion of cable performance at temperatures higher than 20 °C.

The designation "Category 5e" is used herein to describe an enhanced Category 5 cable and is used in the same context as "Category 5" in ISO/IEC 11801. This enhanced cable is designated Category 5e to differentiate it from the Category 5 cables described in IEC 61156-2, 61156-3, and 61156-4. Although both Category 5 and 5e cables are characterized to 100 MHz and can be used in Class D channels, Category 5e has additional requirements, as compared to Category 5, which make it preferred for use in systems utilizing four pairs transmitting simultaneously in both directions.

Table 1 – Cable categories

Cable designation	Maximum reference frequency MHz	Channel designation
Category 5e	100[a]	D
Category 6	250	E
Category 7	600	F

[a] Some characteristics are measured up to 125 MHz in order to comply with IEEE's request to specify the electrical performances up to a frequency 25 % higher than the referenced frequency.

These cables can be used for various communication systems that are under development and which use as many as four pairs simultaneously. In this sense, this sectional specification provides the cable characteristics required by system developers to evaluate new systems.

The cables covered by this sectional specification are intended to operate with voltages and currents normally encountered in communication systems. These cables are not intended to be used in conjunction with low impedance sources, for example, the electric power supplies of public utility mains.

Though the recommended temperature range during installation is 0 °C +50 °C, the actual temperature range during installation should be indicated in the detail specification.

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.

ISO/IEC 11801:2000, *Information technology – Generic cabling for customer premises*

Publications cited in IEC 61156-1 also apply.

1.3 Installation considerations

Installation considerations will be addressed in a future revision of 1.3 of IEC 61156-1.

1.4 Climatic conditions

Under static conditions, the cables shall operate in the temperature range from –40 °C to +60 °C. The temperature dependence of the cables is specified for screened and unscreened cables, and should be taken into account for the design of an actual cabling systems.

2 Definitions, materials and cable construction

2.1 Definitions

See 2.1 of IEC 61156-1.

2.2 Materials and cable construction

2.2.1 General remarks

The choice of materials and cable construction shall be suitable for the intended application and installation of the cable. Particular care shall be taken to meet any special requirements for the fire performance (such as burning properties, smoke generation, evolution of halogen gas, etc.).

2.2.2 Cable construction

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

2.2.3 Conductor

The conductor shall be a solid annealed copper conductor, in accordance with 2.2.3 of IEC 61156-1 and shall have a nominal diameter between 0,5 mm and 0,65 mm. Conductor diameter up to 0,8 mm may be used if compatible with the connecting hardware.

2.2.4 Insulation

The conductor shall be insulated with a suitable thermoplastic material. Examples of suitable materials are:

– polyolefin;
– fluoropolymer;
– low-smoke zero-halogen thermoplastic material.

The insulation may be solid or cellular with or without a solid dielectric skin. The insulation shall be continuous and shall have a thickness such that the completed cable meets the specified requirements. The nominal thickness of the insulation shall be compatible with the method of conductor termination.

2.2.5 Colour code of insulation

The colour code is not specified but shall be indicated in the relevant detail specification. The colours shall be readily identifiable and shall correspond reasonably with the standard colours shown in IEC 60304.

NOTE It is acceptable to mark or stripe the "a" wire with the colour of the "b" wire to facilitate pair identification.

2.2.6 Cable element

The cable element shall be a pair or quad adequately twisted.

2.2.7 Screening of cable element

When required, the screen for the cable element shall be in accordance with 2.2.7 of IEC 61156-1.

2.2.8 Cable make-up

A cross web or any other spacer may be used to separate the cable elements. The cable elements, including cross webs or spacers, shall be assembled to form the cable core.

The core of the cable may be wrapped with a protective layer of non-hygroscopic material.

2.2.9 Screening of cable core

When required by the relevant detail specification, a screen for the cable core shall be provided.

The screen shall be in accordance with 2.2.9 of IEC 61156-1.

2.2.10 Sheath

The sheath material shall consist of a suitable thermoplastic material.

Examples of suitable materials are

– polyolefin;
– PVC;
– fluoropolymer;
– low-smoke zero-halogen thermoplastic material.

The sheath shall be continuous, having a thickness as uniform as possible. A non-metallic ripcord may be provided. When provided, the ripcord shall be non-hygroscopic.

2.2.11 Colour of sheath

The colour of the sheath is not specified, but it should be stated in the relevant detail specification.

2.2.12 Identification

Each length of cable shall be identified as to the manufacturer, and when required, the year of manufacture, using one of the following methods:

a) appropriately coloured threads or tapes;
b) with a printed tape;
c) printing on the cable core wrapping;
d) marking on the sheath.

Additional markings, such as length marking, etc., are permitted on the cable sheath. If used, such markings should be indicated in the relevant detail specification.

2.2.13 Finished cable

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

3 Characteristics and requirements

3.1 General remarks

This clause lists the characteristics and minimum requirements of a cable complying with this sectional specification. Test methods shall be in accordance with clause 3 of IEC 61156-1. A detail specification may be prepared to identify a specific product and its performance capabilities (see clause 4).

3.2 Electrical characteristics

The tests shall be carried out on a cable length of not less than 100 m, unless otherwise specified.

3.2.1 Conductor resistance

When measured in accordance with 5.1 of IEC 60189-1, the maximum loop resistance shall not exceed 19,0 Ω/100 m of cable.

3.2.2 Resistance unbalance

The conductor resistance unbalance shall not exceed 2 %.

3.2.3 Dielectric strength

The test shall be performed on conductor/conductor and, where screen(s) are present, conductor/screen with 1,0 kV d.c. for 1 min or, alternately, with 2,5 kV d.c. for 2 s. An a.c. voltage may be used. The a.c. voltage levels in these cases shall be 0,7kV a.c. for 1 min or, alternately, 1,7 kV a.c. for 2 s.

3.2.4 Insulation resistance

The test shall be performed both on

– conductor/conductor;
– conductor/screen (when present).

The minimum insulation resistance at 20 °C shall not be less than 5 000 MΩ/km.

3.2.5 Mutual capacitance

The mutual capacitance is not specified but may be indicated in the relevant detail specification.

3.2.6 Capacitance unbalance pair to ground

The maximum capacitance unbalance pair to ground shall not exceed 1 600 pF/km at a frequency of 1 kHz.

3.2.7 Transfer impedance

For cables containing a screen or screens, two grades of performance are recognized for transfer impedance. The transfer impedance shall not exceed the values shown in Table 2 at the discrete frequencies indicated for each grade.

Table 2 – Transfer impedance

Frequency MHz	Maximum surface transfer impedance mΩ/m	
	Grade 1	Grade 2
1	10	50
10	10	100
30	30	200
100	60	1 000

3.2.8 Resistance of the screen

The d.c. resistance of the individual screens or an overall screen is not specified but may be indicated in the relevant detail specification.

3.3 Transmission characteristics

All the tests shall be carried out on a cable length of 100 m, unless otherwise specified.

3.3.1 Velocity of propagation, delay and differential delay (delay skew)

3.3.1.1 Velocity of propagation

The minimum velocity of propagation for any pair within the cable is equal to or greater than $0,6 \times c$ for all frequencies between 4 MHz and the maximum referenced frequency. Value below 4 MHz are given only for information purposes (see 3.3.2).

NOTE The velocity of propagation, group velocity and phase velocity are approximately equal for frequencies greater than 4 MHz when measured on symmetric cables, i.e. when the cables are operated in a balanced mode.

3.3.1.2 Delay and differential delay (delay skew)

The delay for a specified length of cable is understood as the inverse of the velocity of propagation. The delay shall be less than or equal to:

$$\text{delay} = 534 + \frac{36}{\sqrt{f}} \quad (\text{ns} / 100\,\text{m}) \qquad (1)$$

where f is the frequency in MHz.

Differential delay (delay skew) is the difference in delay between any two pairs.

3.3.1.3 Differential delay (delay skew)

When the delay is measured at 10 ± 2 °C and 40 ± 1 °C, the maximum delay skew between any two pairs at a given temperature shall not be greater than 45 ns/100 m for cat5e and cat6 cables and 25 ns/100 m for cat7 cables in the frequency range from 4,0 MHz to the maximum referenced frequency.

3.3.1.4 Environmental effects

The differential delay (delay skew) between any two pairs due to temperature shall not vary by more than ±10 ns/100 m over the temperature range from –40 °C to +60 °C within the differential delay (delay skew) of 3.3.1.3.