



IEC 61156-5

Edition 2.0 2009-02

INTERNATIONAL STANDARD

Multicore and symmetrical pair/quad cables for digital communications –

**Part 5: Symmetrical pair/quad cables with transmission characteristics up to
1 000 MHz-horizontal floor wiring – Sectional specification**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

T

ICS 33.120.20

ISBN 2-8318-1032-2

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Installation considerations	8
4.1 General remarks.....	8
4.2 Bending radius of installed cable.....	8
4.3 Climatic conditions	8
5 Materials and cable construction	8
5.1 General remarks.....	8
5.2 Cable construction	8
5.2.1 Conductor.....	8
5.2.2 Insulation.....	8
5.2.3 Cable element	9
5.2.4 Cable make-up	9
5.2.5 Screening of the cable core	9
5.2.6 Sheath.....	9
5.2.7 Identification.....	9
5.2.8 Finished cable	10
6 Characteristics and requirements	10
6.1 General remarks.....	10
6.2 Electrical characteristics and tests	10
6.2.1 Conductor resistance.....	10
6.2.2 Resistance unbalance	10
6.2.3 Dielectric strength	10
6.2.4 Insulation resistance.....	10
6.2.5 Mutual capacitance.....	10
6.2.6 Capacitance unbalance	11
6.2.7 Transfer impedance.....	11
6.2.8 Coupling attenuation.....	11
6.2.9 Current-carrying capacity.....	11
6.3 Transmission characteristics	11
6.3.1 Velocity of propagation (phase velocity)	11
6.3.2 Phase delay and differential delay (delay skew)	12
6.3.3 Attenuation (α).....	12
6.3.4 Unbalance attenuation (<i>TCL</i>)	13
6.3.5 Near-end crosstalk (<i>NEXT</i>).....	13
6.3.6 Far-end crosstalk (<i>FEXT</i>)	14
6.3.7 Alien (exogenous) near-end crosstalk (<i>ANEXT</i>).....	14
6.3.8 Alien (exogenous) far-end crosstalk (<i>AFEXT</i>)	15
6.3.9 Alien (exogenous) crosstalk of bundled cables	15
6.3.10 Impedance.....	15
6.3.11 Return loss (<i>RL</i>)	16
6.4 Mechanical and dimensional characteristics and requirements	17
6.4.1 Dimensional requirements	17
6.4.2 Elongation at break of the conductors.....	17

6.4.3	Tensile strength of the insulation	17
6.4.4	Elongation at break of the insulation	17
6.4.5	Adhesion of the insulation to the conductor	17
6.4.6	Elongation at break of the sheath	17
6.4.7	Tensile strength of the sheath	17
6.4.8	Crush test of the cable	17
6.4.9	Impact test of the cable	17
6.4.10	Bending under tension.....	17
6.4.11	Repeated bending of the cable	17
6.4.12	Tensile performance of the cable.....	17
6.4.13	Shock-test requirements of the cable.....	17
6.4.14	Bump-test requirements of the cable	18
6.4.15	Vibration-test requirements of a cable	18
6.5	Environmental characteristics.....	18
6.5.1	Shrinkage of insulation	18
6.5.2	Wrapping test of insulation after thermal ageing	18
6.5.3	Bending test of insulation at low temperature	18
6.5.4	Elongation at break of the sheath after ageing.....	18
6.5.5	Tensile strength of the sheath after ageing	18
6.5.6	Sheath pressure test at high temperature	18
6.5.7	Cold bend test of the cable.....	18
6.5.8	Heat shock test.....	18
6.5.9	Damp heat steady state	18
6.5.10	Solar radiation (UV test)	18
6.5.11	Solvents and contaminating fluids.....	19
6.5.12	Salt mist and sulphur dioxide.....	19
6.5.13	Water immersion	19
6.5.14	Hygroscopicity.....	19
6.5.15	Wicking	19
6.5.16	Flame propagation characteristics of a single cable.....	19
6.5.17	Flame propagation characteristics of bunched cables.....	19
6.5.18	Halogen gas evolution	19
6.5.19	Smoke generation	19
6.5.20	Toxic gas emission	19
6.5.21	Integrated fire test.....	19
7	Category 5e multipair cable	19
7.1	General.....	19
7.2	Transmission.....	20
8	Introduction to the blank detail specification	20
	Annex A (informative) Acronyms for common cable constructions	21
	Bibliography.....	23
	Figure 1 – Impedance template.....	16
	Figure A.1 – Common cable construction examples	22
	Table 1 – Cable categories	7
	Table 2 – Transfer impedance	11
	Table 3 – Coupling attenuation	11

Table 4 – Attenuation equation constants	12
Table 5 – Near-end unbalance attenuation.....	13
Table 6 – Worst-pair PS NEXT(1) values	14
Table 7 – Worst-pair PS EL FEXT(1) values	14
Table 8 – <i>PS ANEXT</i>	15
Table 9 – <i>PS AACR-F</i>	15
Table 10 – Return loss.....	16
Table A.1 – Cable construction acronyms	21

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES
FOR DIGITAL COMMUNICATIONS –****Part 5: Symmetrical pair/quad cables
with transmission characteristics up to
1 000 MHz-horizontal floor wiring –
Sectional specification**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61156-5 has been prepared by subcommittee 46C: Wires and symmetric cables, of IEC technical committee 46: Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories.

This part of IEC 61156 is to be read in conjunction with IEC 61156-1.

This second edition cancels and replaces the first edition published in 2002. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) new requirements for new Cat6_A and Cat7_A cables;

b) revised requirements and tests for Cat5e, Cat6 and Cat7 cables.

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

FDIS	Report on voting
46C/878 /FDIS	46C/888/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.

A list of all parts of the IEC 61156 series, under the general title *Multicore and symmetrical pair/quad cables for digital communications* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

A bilingual version of this publication may be issued at a later date.

MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES FOR DIGITAL COMMUNICATIONS –

Part 5: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz-horizontal floor wiring – Sectional specification

1 Scope

This part of IEC 61156 describes the cables intended primarily for horizontal floor wiring as defined in ISO/IEC 11801.

It covers individually screened, common screened and unscreened pairs or quads (see Annex A). The transmission characteristics and the frequency range (see Table 1) of the cables are specified at 20 °C.

Table 1 – Cable categories

Cable designation	Maximum referenced frequency MHz
Category 5e	100
Category 6	250
Category 6 _A	500
Category 7	600
Category 7 _A	1 000

These cables can be used for various communication channels 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 standard are intended to operate with voltages and currents normally encountered in communication systems. While these cables are not intended to be used in conjunction with low impedance sources, for example, the electric power supplies of public utility mains, they are intended to be used to support the delivery of low voltage and power applications such as IEEE 802.3af (Power over Ethernet) and IEEE 802.3at (Power over Ethernet Plus).

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 61156-1, *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*

IEC 61156-5-1, *Multicore and symmetrical pair/quad cables for digital communications – Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz – Horizontal floor wiring – Blank detail specification*

IEC 62153-4-5, *Metallic communication cables test methods – Part 4-5: Electromagnetic compatibility (EMC) – Coupling or screening attenuation – Absorbing clamp method*

IEC 62153-4-9, *Metallic communication cable test methods – Part 4-9: Electromagnetic compatibility (EMC) – Coupling attenuation of screened balanced cables, triaxial method*