

# INTERNATIONAL STANDARD

---

**Multicore and symmetrical pair/quad cables for digital communications –  
Part 6: Symmetrical pair/quad cables with transmission characteristics  
up to 1 000 MHz – Work area wiring – Sectional specification**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 33.120.20

ISBN 978-2-8322-7971-7

<p><b>Warning! Make sure that you obtained this publication from an authorized distributor.</b></p>
---

## 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 .....	9
5.2.1 Conductor.....	9
5.2.2 Insulation.....	9
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.....	10
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.....	11
6.2.4 Insulation resistance.....	11
6.2.5 Mutual capacitance.....	11
6.2.6 Capacitance unbalance .....	11
6.2.7 Transfer impedance.....	11
6.2.8 Coupling attenuation.....	11
6.2.9 Current-carrying capacity.....	12
6.3 Transmission characteristics .....	12
6.3.1 Velocity of propagation (phase velocity).....	12
6.3.2 Phase delay and differential delay (delay skew).....	12
6.3.3 Attenuation .....	12
6.3.4 Unbalance attenuation ( <i>TCL</i> ) .....	13
6.3.5 Near-end crosstalk ( <i>NEXT</i> ).....	14
6.3.6 Attenuation to crosstalk ratio far end ( <i>PS ACR-F</i> ).....	15
6.3.7 Alien (exogenous) near end crosstalk .....	15
6.3.8 Alien (exogenous) far-end crosstalk ( <i>AACR-F</i> ) .....	16
6.3.9 Alien (exogenous) crosstalk of bundled cables .....	16
6.3.10 Impedance.....	16
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 .....	18
6.4.10	Bending under tension .....	18
6.4.11	Repeated bending of the cable .....	18
6.4.12	Tensile performance of the cable .....	18
6.4.13	Shock-test requirements of the cable .....	18
6.4.14	Bump-test requirements of the cable .....	18
6.4.15	Vibration-test requirements of the cable.....	18
6.5	Environmental characteristics .....	18
6.5.1	Shrinkage of the insulation .....	18
6.5.2	Wrapping test of the insulation after thermal ageing .....	18
6.5.3	Bending test of the 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 .....	19
6.5.7	Cold bend test of the cable .....	19
6.5.8	Heat shock test.....	19
6.5.9	Damp heat steady state .....	19
6.5.10	Solar radiation .....	19
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.....	20
6.5.20	Toxic gas emission .....	20
6.5.21	Integrated fire test .....	20
7	Introduction to the blank detail specification .....	20
Annex A (informative)	Blank detail specification .....	21
Bibliography	.....	26
Table 1	Cable categories .....	7
Table 2	Transfer impedance .....	11
Table 3	Coupling attenuation in dB .....	12
Table 4	Attenuation, constant values .....	13
Table 5	Near-end unbalance attenuation.....	14
Table 6	Worst pair <i>PS NEXT</i> (1) values .....	14
Table 7	Worst pair <i>PS ACR-F</i> (1).....	15
Table 8	<i>PS ANEXT</i> .....	15

Table 9 – <i>PS AACR-F</i> .....	16
Table 10 – Return loss .....	17

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MULTICORE AND SYMMETRICAL PAIR/QUAD  
CABLES FOR DIGITAL COMMUNICATIONS –****Part 6: Symmetrical pair/quad cables with transmission  
characteristics up to 1 000 MHz – Work area 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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 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 61156-6 has been prepared by subcommittee 46C: Wires and symmetric cables, of IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories.

This fourth edition cancels and replaces the third edition published in 2010 and Amendment 1:2012. This edition constitutes a technical revision.

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

- a) additional balance levels with respect to MICE implementation by certain cabling specifications;

- b) reference to current standards and technical reports with respect to measurement techniques and remote powering.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
46C/1141/FDIS	46C/1145/RVD

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

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

This International Standard is to be used in conjunction with IEC 61156-1:2007 and IEC 61156-1:2007/AMD1:2009.

A list of all parts in the IEC 61156 series, published 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 document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

## MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES FOR DIGITAL COMMUNICATIONS –

### Part 6: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz – Work area wiring – Sectional specification

#### 1 Scope

This part of IEC 61156 describes the cables intended primarily for working area wiring as defined in ISO/IEC 11801 (all parts).

It covers cable designs comprising individually screened, common screened and unscreened pairs or quads. 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 <sub>A</sub>	500
Category 7	600
Category 7 <sub>A</sub>	1 000

These cables can be used for various communication channels which use as many as four pairs simultaneously. In this sense, this document provides the cable characteristics required by system developers to evaluate new systems.

The cables covered by this document 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 remote powering applications such as IEEE 802.3af (Power over Ethernet) or further developments for example according to IEEE 802.3at or IEEE 802.3bt. More information on the capacity to support these applications according to the installation practices are given in IEC 61156-1-4, IEC TR 61156-1-6 and ISO/IEC TS 29125.

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 61156-1:2007, *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*  
IEC 61156-1:2007/AMD1:2009

IEC 62153-4-3, *Metallic communication cables test methods – Part 4-3: Electromagnetic compatibility (EMC) – Surface transfer impedance – Triaxial method*

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*