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INTERNATIONAL STANDARD

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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

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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

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This consolidated version of IEC 61156-5 consists of the second edition (2009) [documents 46C/878/FDIS, 46C/888/RVD], its amendment 1 (2012) [documents 46C/954/CDV and 46C/967/RVC], its corrigenda of May 2009 and February 2010. It bears the edition number 2.1.

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.

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 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.

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 the base publication and its amendments will remain unchanged until the stability 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- withdrawn,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.

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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*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in IEC 61156-1 apply.

4 Installation considerations

4.1 General remarks

Installation considerations are defined in Clause 4 of IEC 61156-1.

4.2 Bending radius of installed cable.

The bending radius of the installed cable shall not be less than 4 times the outside diameter of the cable.

4.3 Climatic conditions

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

Other temperature ranges may be specified in the relevant detail specification.

5 Materials and cable construction

5.1 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 requirements for EMC and fire performance (such as burning properties, smoke generation, evolution of halogen gas, etc.).

5.2 Cable construction

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

5.2.1 Conductor

The conductor shall be a solid annealed copper conductor, in accordance with 5.2.1 of IEC 61156-1 and should have a nominal diameter between 0,4 mm and 0,65 mm. A conductor diameter of up to 0,8 mm may be used.

5.2.2 Insulation

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

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

The diameter of the insulated conductor shall be indicated in the relevant detail specification.

5.2.3 Cable element

The cable element shall be a twisted pair or quad.

5.2.3.1 Screening of the cable element

When required, the screen for the cable element shall be in accordance with 5.2.3.2 of IEC 61156-1.

5.2.4 Cable make-up

A spacer may be used to separate the cable elements. The cable elements, including spacers, shall be assembled to form the cable core.

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

5.2.5 Screening of the 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 5.2.5 of IEC 61156-1.

5.2.6 Sheath

The sheath material shall consist of a suitable 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 and non-wicking.

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

5.2.7 Identification

Each length of cable shall be identified as to the supplier, and when required, a traceability code, 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. If used, such markings should be indicated in the relevant detail specification.

5.2.8 Finished cable

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

6 Characteristics and requirements

6.1 General remarks

This clause lists the characteristics and minimum requirements of a cable complying with this standard. Test methods shall be in accordance with Clause 6 of IEC 61156-1.

6.2 Electrical characteristics and tests

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

NOTE For cat7_A, unless the test is performed with very sensitive test equipment, it is recommended to limit the cable length to 50 m for a better accuracy in high frequencies.

6.2.1 Conductor resistance

The maximum conductor resistance at or corrected to 20 °C shall not exceed 9,5 Ω for 100 m of cable.

6.2.2 Resistance unbalance

6.2.2.1 Resistance unbalance within a pair

The resistance unbalance shall not exceed 2 %.

~~**6.2.2.2Resistance unbalance between pairs**~~

~~The pair-to-pair resistance unbalance shall not exceed 4 %.~~

6.2.3 Dielectric strength

There shall be no failures when a test is performed on conductor/conductor and, where screen(s) are present, a 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 0,7 kV a.c. for 1 min or, alternately, 1,7 kV a.c. for 2 s.

6.2.4 Insulation resistance

The test shall be performed both on

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

The minimum insulation resistance at or corrected to 20 °C shall be not less thanb 5 000 MΩ·m.

6.2.5 Mutual capacitance

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

6.2.6 Capacitance unbalance

The maximum capacitance unbalance pair to ground shall not exceed 1 600 pF/km at a frequency of 800 Hz or 1 000 Hz.

6.2.7 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	100	1 000

NOTE The screen longitudinal d.c. resistance of 30 mΩ/m or less is an indicator for fulfilling transfer impedance requirement of Grade 2. A measurement of d.c. resistance cannot replace a transfer impedance measurement.

6.2.8 Coupling attenuation

~~Three types of performance are recognized for coupling attenuation. When measured using the absorbing clamp method (IEC 62153-4-5), the coupling attenuation in the frequency range from f = 30 MHz to 1 000 MHz shall meet the requirements indicated in Table 3. For screened cables the triaxial method (IEC 62153-4-9) may also be used.~~

~~**Table 3 – Coupling attenuation**~~

~~**Coupling attenuation type**~~	~~**Frequency range** MHz~~	~~**Coupling attenuation** dB~~
~~Type I~~	~~30 – 100~~	~~≥ 85~~
	~~100 – 1 000~~	~~≥ 85 – 20 × $\log_{10}$ (f/100)~~
~~Type II~~	~~30 – 100~~	~~≥55~~
	~~100 – 1 000~~	~~≥ 55 – 20 × $\log_{10}$ (f/100)~~
~~Type III~~	~~30 – 100~~	~~≥40~~
	~~100 – 1 000~~	~~≥ 40 – 20 × $\log_{10}$ (f/100)~~

Four types of performance are recognized for coupling attenuation. When measured using the absorbing clamp method (IEC 62153-4-5) or the triaxial method (IEC 62153-4-9), the coupling attenuation in the frequency range from f = 30 MHz to 1 000 MHz shall meet the requirements indicated in Table 3. For screened cables, Type II is the minimum coupling attenuation requirement.

Table 3 – Coupling attenuation

Coupling attenuation type	Frequency range MHz	Coupling attenuation dB
Type I	30 to 100	> 85
Type I	100 to 1 000	> 85 – 20 × $\log_{10}$ (f /100)
Type Ib	30 to 100	> 70
Type Ib	100 to 1 000	> 70 – 20 × $\log_{10}$ (f /100)
Type II	30 to 100	> 55
Type II	100 to 1 000	> 55 – 20 × $\log_{10}$ (f /100)
Type III	30 to 100	> 40
Type III	100 to 1 000	> 40 – 20 × $\log_{10}$ (f /100)

6.2.9 Current-carrying capacity

The maximum current-carrying capacity is not specified but may be indicated in the relevant detail specification.

6.3 Transmission characteristics

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

6.3.1 Velocity of propagation (phase velocity)

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

6.3.2 Phase delay and differential delay (delay skew)

The phase delay, τ , shall not exceed the value obtained from Equation (1) in the frequency range from 4 MHz to the maximum referenced frequency.

$$\tau = 534 + \frac{36}{\sqrt{f}} \quad (1)$$

where

τ is the phase delay in ns/100 m;

f is the frequency expressed in MHz.

6.3.2.1 Differential delay (delay skew)

When the delay is measured at (20 ± 1) °C, the maximum delay skew between any two pairs at a given temperature shall be not greater than 45 ns/100 m for Cat5e, Cat6 and Cat6_A cables and 25 ns/100 m for Cat7 and Cat7_A cables in the frequency range from 4 MHz to the maximum referenced frequency.

6.3.3 Attenuation (α)

6.3.3.1 Attenuation at 20 °C operating temperature

The maximum attenuation, α, of any pair in the frequency range indicated in Table 4 shall not exceed the value obtained from Equation (2).

$$\alpha = a \cdot \sqrt{f} + b \cdot f + \frac{c}{\sqrt{f}} \quad (2)$$

where

α is the attenuation expressed in dB/100 m;

a, b, c are constants indicated in Table 4;

f is the frequency expressed in MHz.

Table 4 – Attenuation equation constants

Cable designation	Frequency range MHz	Constants		
		a	b	c
Category 5e	1 – 100	1,967	0,023	0,100
Category 6	1 – 250	1,820	0,0169	0,250
Category 6_A	1 – 500	1,820	0,0091	0,250
Category 7	1 – 600	1,800	0,010	0,200
Category 7_A	1 – 1 000	1,800	0,005	0,250
The cable performance between 1 MHz and 4 MHz is achieved by design only and it is therefore not necessary to test for this performance below 4 MHz.				

6.3.3.2 Cat5e special consideration

The constants for Category 5e in Table 4 are based on the use of patch cables having up to 20 % higher attenuation than the horizontal cable. When patch cables having attenuation up to 50 % higher than the horizontal cable are used, the constants should be 1,910 8, 0,022 2 and 0,200 for a, b and c respectively.

6.3.3.3 Attenuation at elevated operating temperature

The increase in maximum attenuation obtained from Equation (2) due to elevated temperature above 20 °C, shall be as follows:

– for unscreened cables; 0,4 %/°C, for the temperature range from 20 °C to 40 °C and 0,6 %/°C for the temperature range 40 °C to 60 °C.

– for screened cables; 0,2 %/°C in the temperature range 20 °C to 60 °C.

6.3.4 Unbalance attenuation (*TCL*)

Two levels of performance are recognized for unbalance attenuation. The minimum near-end unbalance attenuation (transverse conversion loss or *TCL*) shall not be less than the value obtained from Equation (3) (Level 1) or from Equation (4) (Level 2), for all frequencies, f, in the frequency ranges indicated in Table 5.

$$TCL = 40{,}0 - 10 \times \log_{10}(f) \quad (3)$$

$$TCL = 50{,}0 - 10 \times \log_{10}(f) \quad (4)$$

Table 5 – Near-end unbalance attenuation

Cable category	Frequency range MHz
Category 5e	1 – 100
Category 6	1 – 250
Category 6_A	1 – 250
Category 7	1 – 250
Category 7_A	1 – 250

The minimum equal-level far-end unbalance attenuation (equal-level transverse conversion transfer loss or *EL TCTL*) for all categories shall not be less than the value obtained from Equation (5) for all frequencies, f, in the range from 1 MHz to 30 MHz.

$$EL\ TCTL = 35{,}0 - 20 \times \log_{10}(f) \quad (5)$$

6.3.5 Near-end crosstalk (*NEXT*)

The worst pair power sum near-end crosstalk, *PS NEXT*, at all frequencies, f, in the frequency range indicated in Table 6 shall not be less than the value obtained from Equation (6) using the corresponding value of PS NEXT(1) indicated in Table 6.

$$PS\ NEXT(f) = \text{PS NEXT}(1) - 15 \times \log_{10}(f) \quad (6)$$

Table 6 – Worst-pair PS NEXT(1) values

Cable designation	Frequency range MHz	PS NEXT(1) dB
Category 5e	1 – 100	62,3
Category 6	1 – 250	72,3
Category 6_A	1 – 500	72,3
Category 7	1 – 600	99,4
Category 7_A	1 – 1 000	102,4
NOTE The cable performance between 1 MHz and 4 MHz is achieved by design only and it is therefore not necessary to test for this performance below 4 MHz.		

For those frequencies where the calculated value of *PS NEXT* is greater than 75 dB, the requirement shall be 75 dB.

The minimum pair-to-pair *NEXT* for any pair combination shall be at least 3 dB better than the *PS NEXT* for any pair.

6.3.6 Far-end crosstalk (*FEXT*)

The worst-pair power-sum equal-level far-end crosstalk, *PS EL FEXT*, at all frequencies, f, in the frequency range indicated in Table 7 shall not be less than, the value obtained from Equation (7) using the corresponding value of PS EL FEXT(1) given in Table 7.

$$PS\ EL\ FEXT(f) = PS\ EL\ FEXT(1) - 20 \times \log_{10}(f) \quad (7)$$

Table 7 – Worst-pair *PS EL FEXT*(1) values

Cable designation	Frequency range MHz	*PS EL FEXT*(1) dB for 100 m
Category 5e	4 – 100	61,0
Category 6	4 – 250	65,0
Category 6_A	4 – 500	65, 0
Category 7	4 – 600	91
Category 7_A	4 – 1 000	92,3
NOTE 1 If *FEXT* loss is greater than 90 dB, *EL FEXT* loss may not be calculated. NOTE 2 The cable performance between 1 MHz and 4 MHz is achieved by design only and it is therefore not necessary to test for this performance below 4 MHz.		

For those frequencies where the calculated value of *PS EL FEXT* is greater than 75 dB, the requirement shall be 75 dB.

The minimum pair-to-pair *EL FEXT* for any pair combination shall be at least 3 dB better than the *PS EL FEXT* for any pair.

6.3.7 Alien (exogenous) near-end crosstalk (*ANEXT*)

Alien (exogenous) near-end crosstalk, *ANEXT*, is only a measurement consideration for Type III cables. For Type I and Type II screened cables as defined in Table 3, *ANEXT* is proven by design.

The *PS ANEXT* (power sum alien (exogenous) near-end crosstalk) of cable when tested in accordance with 6.3.7.1 of IEC 61156-1 shall be not less than the values obtained from Table 8.

Table 8 – *PS ANEXT*

Category	Frequency range MHz	Minimum *PS ANEXT* dB
$Cat6_A$	$1 \le f \le 500$	$92,5 - 15 \times \log_{10}(f)$
$Cat7_A$	$1 \le f \le 1\,000$	$107.5 - 15 \times \log_{10}(f)$
NOTE Calculated values greater than 67 dB revert to a value of 67 dB.		

6.3.8 Alien (exogenous) far-end crosstalk (*AFEXT*)

Alien (exogenous) far-end crosstalk, *AFEXT*, is only a measurement consideration for unscreened cables. For Type I and Type II screened cables as defined in Table 3, *AFEXT* is proven by design.

The *PS AACR-F* (power-sum alien attenuation to crosstalk ratio far-end) of the cable when tested in accordance with 6.3.8 of IEC 61156-1, shall not be less than the values obtained from Table 9.

Table 9 – *PS AACR-F*

Category	Frequency range MHz	Minimum *PS AACR-F* dB
$Cat6_A$	$1 \le f \le 500$	$78{,}2 - 20 \times \log_{10}(f)$
$Cat7_A$	$1 \le f \le 1\,000$	$93.2 - 20 \times \log_{10}(f)$
NOTE Calculated values greater than 67 dB revert to a value of 67 dB.		

6.3.9 Alien (exogenous) crosstalk of bundled cables

The minimum requirement is not specified but should be stated in the relevant detail specification.

6.3.10 Impedance

The impedance requirement is specified by either case A or case B below as specified in the relevant detail specification.

Case A (Fitted or mean characteristic impedance):

The impedance measured in accordance with 6.3.10.2 or 6.3.10.3 of IEC 61156-1 shall be 100 Ω ± 5 Ω at 100 MHz. In this case, the return loss shall also be measured.

Case B (Characteristic impedance):

The impedance measured in accordance with 6.3.10.1.1 of IEC 61156-1 shall fall within the impedance template limits given in Figure 1. The relevant template limits are derived using Equation (8) and Equation (9) for the corresponding cable category, frequency range and return loss requirement given in Table 10.

Cables that meet the requirements of the template are not required to be measured for return loss; alternately cables that meet the return loss requirements given in 6.3.11 are not required to be measured for characteristic impedance.

The upper impedance limit, Zu of the template is given by Equation (8),

$$Zu = Z_0 \cdot \frac{(1 + |\rho|)}{(1 - |\rho|)} \tag{8}$$

The lower impedance limit, Zl of the template is given by Equation (9),

$$Zl = Z_0 \cdot \frac{(1 - |\rho|)}{(1 + |\rho|)} \tag{9}$$

where

Z_0 is 100 Ω;

$|\rho|$ is the reflection coefficient magnitude calculated from Equation (10),

$$|\rho| = 10^{-\frac{RL}{20}} \tag{10}$$

where RL is the return loss given in 6.3.11.

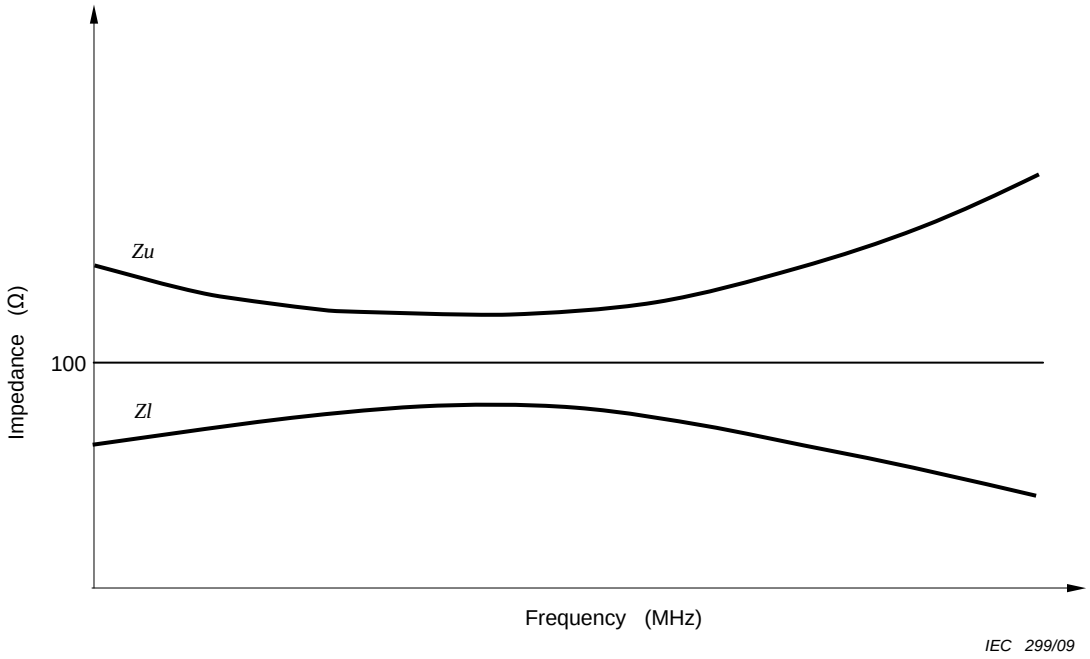

Figure 1 – Impedance template

6.3.11 Return loss (*RL*)

The minimum return loss of any pair in the frequency range indicated in Table 10 shall not be less than the values in Table 10 for the respective categories.

Table 10 – Return loss

Cable category	Frequency range MHz	Return loss dB
All	1 – 10	$20{,}0 + 5{,}0 \cdot \log_{10}(f)$
All	10 – 20	25,0
Category 5e	20 – 100	$25{,}0 - 7{,}0 \cdot \log_{10}(f/20)$
Category 6	20 – 250	$25{,}0 - 7{,}0 \cdot \log_{10}(f/20)$
Category 6_A	20 – 500	$25{,}0 - 7{,}0 \cdot \log_{10}(f/20)$ (*)
Category 7	20 – 600	$25{,}0 - 7{,}0 \cdot \log_{10}(f/20)$ (*)
Category 7_A	20 – 600	$25{,}0 - 7{,}0 \cdot \log_{10}(f/20)$ (*)
	600 – 1 000	$17{,}3 - 10 \cdot \log_{10}(f/600)$
(*) calculated values below 17,3 dB revert to a 17,3 dB plateau. NOTE The cable performance between 1 MHz and 4 MHz is achieved by design only and it is therefore not necessary to test for this performance below 4 MHz.		

6.4 Mechanical and dimensional characteristics and requirements

6.4.1 Dimensional requirements

The overall diameter of insulation, the nominal thickness of the sheath and the maximum overall diameter of the sheath are not specified, but shall be indicated in the relevant detail specification.

6.4.2 Elongation at break of the conductors

The minimum elongation of the conductor shall be not less than 8 %.

6.4.3 Tensile strength of the insulation

The tensile strength of the insulation is not specified, but may be indicated in the relevant detail specification.

6.4.4 Elongation at break of the insulation

The minimum value of the elongation at break of the insulation shall be not less than 100 %.

6.4.5 Adhesion of the insulation to the conductor

The adhesion of the insulation to the conductor is not specified, but may be indicated in the relevant detail specification.

6.4.6 Elongation at break of the sheath

The minimum value of the elongation at break of the sheath shall be not less than 100 %.

6.4.7 Tensile strength of the sheath

The minimum tensile strength of the sheath shall be not less than 9 MPa.

6.4.8 Crush test of the cable

The minimum force shall be 1 000 N.

6.4.9 Impact test of the cable

The impact resistance of the cable is not specified but may be indicated in the relevant detail specification.

6.4.10 Bending under tension

The bending performance of the cable is not specified but shall be indicated in the relevant detail specification.

6.4.11 Repeated bending of the cable

Not applicable.

6.4.12 Tensile performance of the cable

The tensile strength of the cable is not specified but may be indicated in the relevant detail specification.

6.4.13 Shock-test requirements of the cable

Not applicable.

6.4.14 Bump-test requirements of the cable

Not applicable.

6.4.15 Vibration-test requirements of a cable

Not applicable.

6.5 Environmental characteristics

6.5.1 Shrinkage of insulation

When tested at (100 ± 2) °C for 1 h, the shrinkage of the insulation shall not exceed 5 %. The length of the sample shall be 150 mm, and the shrink-back shall be measured as the sum from both ends.

6.5.2 Wrapping test of insulation after thermal ageing

Not applicable.

6.5.3 Bending test of insulation at low temperature

The bending test of the insulated conductor shall be carried out at (–20 ± 2) °C. The mandrel diameter shall be 6 mm. There shall be no cracks in the insulation.

6.5.4 Elongation at break of the sheath after ageing

The ageing regime shall be 7 days at (100 ± 2) °C. The tensile strength shall not be less than 50 % of the unaged value and shall in no case be less than 100 %.

6.5.5 Tensile strength of the sheath after ageing

The ageing regime shall be 7 days at (100 ± 2) °C. The elongation shall be not less than 70 % of the unaged value.

6.5.6 Sheath pressure test at high temperature

Not applicable.

6.5.7 Cold bend test of the cable

The bending test shall be carried out at (–20 ± 2) °C. The mandrel diameter shall be eight times the overall diameter of the cable. There shall be no cracks in the sheath.

6.5.8 Heat shock test

Not applicable.

6.5.9 Damp heat steady state

Not applicable.

6.5.10 Solar radiation (UV test)

The resistance to solar radiation is not specified but may be specified in the relevant detail specification.

6.5.11 Solvents and contaminating fluids

The resistance to solvents and contaminating fluids is not specified but may be specified in the relevant detail specification.

6.5.12 Salt mist and sulphur dioxide

Not applicable.

6.5.13 Water immersion

Not applicable.

6.5.14 Hygroscopicity

The amount of moisture gained after 3 h shall not exceed 1 % in weight.

6.5.15 Wicking

The test solution shall not wet the filter paper at the end of 6 h.

6.5.16 Flame propagation characteristics of a single cable

If required by local regulations and indicated in the relevant detail specification, the test shall be performed in accordance with the IEC 61156-1.

6.5.17 Flame propagation characteristics of bunched cables

If required by local regulations and indicated in the relevant detail specification, the test shall be performed in accordance with the IEC 61156-1.

6.5.18 Halogen gas evolution

If required by local regulations and indicated in the relevant detail specification, the test shall be performed in accordance with the IEC 61156-1.

6.5.19 Smoke generation

If required by local regulations and indicated in the relevant detail specification, the test shall be performed in accordance with the IEC 61156-1.

6.5.20 Toxic gas emission

If required by local regulations and indicated in the relevant detail specification, the test shall be performed in accordance with the IEC 61156-1.

6.5.21 Integrated fire test

If required by local regulations and indicated in the relevant detail specification, the test shall be performed in accordance with the IEC 61156-1.

7 Category 5e multipair cable

7.1 General

Multipair cables are cables which contain multipair units. Each unit shall contain a minimum of 4 pairs and a maximum of 25 pairs for use in the backbone cabling system. The conductors and the cable structure are defined in Clause 5. The units are assembled into binder groups of 25 pairs or part thereof following the standard colour code. The groups are identified by distinctly coloured binders and assembled to form the core. The core shall be covered by a protective sheath. The sheath consists of an overall thermoplastic jacket and may contain an underlying metallic shield and one or more layers of dielectric material applied over the core.

7.2 Transmission

The pairs are evaluated in groups of 4 pairs each (i.e. group 1 = pairs 1 to 4, group 2 = pairs 5 to 8, group 3 = pairs 9 to 12, group 4 = pairs 13 to 16, group 5 = pairs 17 to 20, group 6 = pairs 21 to 24, etc.). Groups are comprised of consecutive pairs, marked according to the standard colour code. For 25-pair and multiples of 25-pair binder groups, the twenty-fifth pair shall satisfy all other transmission parameters when used within any 4-pair group.

The cable performance between 1 MHz and 4 MHz is achieved by design only and it is therefore not necessary to test for this performance below 4 MHz.

All pairs within a unit shall meet the requirements of 6.2, 6.3.2, 6.3.3, 6.3.4, 6.3.10 and 6.3.11. In addition, for all frequencies from 1 MHz to 100 MHz, $NEXT$ loss between the twenty-fifth pair and all other pairs within the 25-pair binder group shall meet the values determined using the equation and values defined in 6.3.5.

The pair-to-pair resistance unbalance of the twenty-fifth pair shall be compatible with any of the groups.

The delay skew (differential delay) of the twenty-fifth pair shall be compatible with any of the groups.

8 Introduction to the blank detail specification

The blank detail specification for cables described in this standard is published as IEC 61156-5-1 and should be used to identify a specific product.

When completing the detail specification, the following information shall be supplied:

a) conductor size;
b) number of elements;
c) cable construction details;
d) category number (5e, 6, 6_A, 7, 7_A) to describe basic performance requirements;
e) nominal impedance of the cable;
f) mechanical requirements;
g) environmental requirements;
h) fire performance.

Annex A
(informative)

Acronyms for common cable constructions

The acronym structure for the cable name is defined in Table A.1.

Some common cable construction examples are given in Figure A.1.

Table A.1 – Cable construction acronyms

Acronym		
XX / ABB		
XX – Overall screen	A – Cable element screen	BB – Cable element type
U – Unscreened F – Foil screened S – Braid screened SF – Braid on foil screened	U – Unscreened F – Foil screened	TP – Twisted pair TQ – Twisted quad

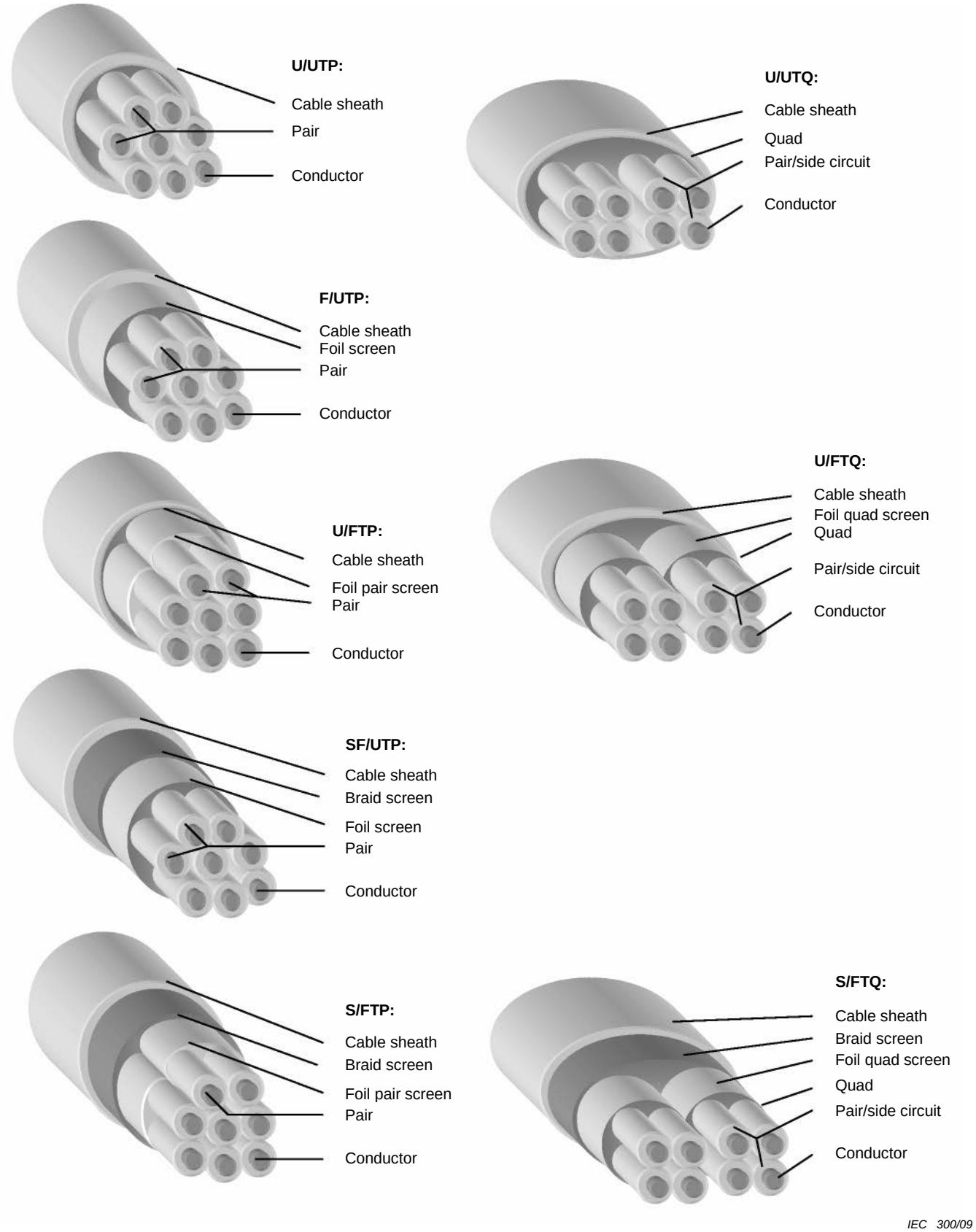

Figure A.1 – Common cable construction examples

Bibliography

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

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

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