DRAFT TANZANIA STANDARD

(Draft for comments only)

Multicore and symmetrical pair/quad cables for digital communications – Part 5: Symmetrical pair/quad cables with transmission characteristics up to 1000MHz- horizontal floor wiring section specification

TANZANIA BUREAU OF STANDARDS
1 National Foreword

This draft Tanzania Standard is being prepared by the Telecommunications and Information Technology Technical Committee, under the supervision of the Electrotechnical divisional standards committee (EDC)

This draft Tanzania Standard is an adoption of the International Standard IEC 61156-5 Multicore and symmetrical pair/quad cables for digital communications – Part 5: Symmetrical pair/quad cables with transmission characteristics up to 1000MHz- horizontal floor wiring section specification, Which has been prepared by the International Electrotechnical Commission.

2 Terminology and conventions

Some terminologies and certain conventions are not identical with those used in Tanzania standards; attention is drawn especially to the following: -

1) The comma has been used as a decimal marker for metric dimensions. In Tanzania Standards, it is current practice to use “full point” on the baseline as the decimal marker.

2) Where the words “International Standard(s)” appear, referring to this standard they should read “Tanzania Standard(s)".

Draft for stakeholders' comments only.
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
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scope</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Normative references</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Terms and definitions</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Installation considerations</td>
<td>8</td>
</tr>
<tr>
<td>4.1</td>
<td>General remarks</td>
<td>8</td>
</tr>
<tr>
<td>4.2</td>
<td>Bending radius of installed cable</td>
<td>8</td>
</tr>
<tr>
<td>4.3</td>
<td>Climatic conditions</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Materials and cable construction</td>
<td>8</td>
</tr>
<tr>
<td>5.1</td>
<td>General remarks</td>
<td>8</td>
</tr>
<tr>
<td>5.2</td>
<td>Cable construction</td>
<td>8</td>
</tr>
<tr>
<td>5.2.1</td>
<td>Conductor</td>
<td>8</td>
</tr>
<tr>
<td>5.2.2</td>
<td>Insulation</td>
<td>8</td>
</tr>
<tr>
<td>5.2.3</td>
<td>Cable element</td>
<td>9</td>
</tr>
<tr>
<td>5.2.4</td>
<td>Cable make-up</td>
<td>9</td>
</tr>
<tr>
<td>5.2.5</td>
<td>Screening of the cable core</td>
<td>9</td>
</tr>
<tr>
<td>5.2.6</td>
<td>Sheath</td>
<td>9</td>
</tr>
<tr>
<td>5.2.7</td>
<td>Identification</td>
<td>9</td>
</tr>
<tr>
<td>5.2.8</td>
<td>Finished cable</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Characteristics and requirements</td>
<td>10</td>
</tr>
<tr>
<td>6.1</td>
<td>General remarks</td>
<td>10</td>
</tr>
<tr>
<td>6.2</td>
<td>Electrical characteristics and tests</td>
<td>10</td>
</tr>
<tr>
<td>6.2.1</td>
<td>Conductor resistance</td>
<td>10</td>
</tr>
<tr>
<td>6.2.2</td>
<td>Resistance unbalance</td>
<td>10</td>
</tr>
<tr>
<td>6.2.3</td>
<td>Dielectric strength</td>
<td>10</td>
</tr>
<tr>
<td>6.2.4</td>
<td>Insulation resistance</td>
<td>10</td>
</tr>
<tr>
<td>6.2.5</td>
<td>Mutual capacitance</td>
<td>10</td>
</tr>
<tr>
<td>6.2.6</td>
<td>Capacitance unbalance</td>
<td>10</td>
</tr>
<tr>
<td>6.2.7</td>
<td>Transfer impedance</td>
<td>11</td>
</tr>
<tr>
<td>6.2.8</td>
<td>Coupling attenuation</td>
<td>11</td>
</tr>
<tr>
<td>6.2.9</td>
<td>Current-carrying capacity</td>
<td>12</td>
</tr>
<tr>
<td>6.3</td>
<td>Transmission characteristics</td>
<td>12</td>
</tr>
<tr>
<td>6.3.1</td>
<td>Velocity of propagation (phase velocity)</td>
<td>12</td>
</tr>
<tr>
<td>6.3.2</td>
<td>Phase delay and differential delay (delay skew)</td>
<td>12</td>
</tr>
<tr>
<td>6.3.3</td>
<td>Attenuation ($\alpha$)</td>
<td>12</td>
</tr>
<tr>
<td>6.3.4</td>
<td>Unbalance attenuation ($TCL$)</td>
<td>13</td>
</tr>
<tr>
<td>6.3.5</td>
<td>Near-end crosstalk ($NEXT$)</td>
<td>14</td>
</tr>
<tr>
<td>6.3.6</td>
<td>Far-end crosstalk ($FEXT$)</td>
<td>14</td>
</tr>
<tr>
<td>6.3.7</td>
<td>Alien (exogenous) near-end crosstalk ($ANEEXT$)</td>
<td>15</td>
</tr>
<tr>
<td>6.3.8</td>
<td>Alien (exogenous) far-end crosstalk ($AFEXT$)</td>
<td>15</td>
</tr>
<tr>
<td>6.3.9</td>
<td>Alien (exogenous) crosstalk of bundled cables</td>
<td>16</td>
</tr>
<tr>
<td>6.3.10</td>
<td>Impedance</td>
<td>16</td>
</tr>
<tr>
<td>6.3.11</td>
<td>Return loss ($RL$)</td>
<td>17</td>
</tr>
<tr>
<td>6.4</td>
<td>Mechanical and dimensional characteristics and requirements</td>
<td>17</td>
</tr>
<tr>
<td>6.4.1</td>
<td>Dimensional requirements</td>
<td>17</td>
</tr>
<tr>
<td>6.4.2</td>
<td>Elongation at break of the conductors</td>
<td>18</td>
</tr>
</tbody>
</table>
6.4.3 Tensile strength of the insulation ...................................................... 18
6.4.4 Elongation at break of the insulation .................................................. 18
6.4.5 Adhesion of the insulation to the conductor .......................................... 18
6.4.6 Elongation at break of the sheath .......................................................... 18
6.4.7 Tensile strength of the sheath .............................................................. 18
6.4.8 Crush test of the cable .......................................................................... 18
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 a cable ................................................ 19

6.5 Environmental characteristics .................................................................. 19
6.5.1 Shrinkage of insulation ......................................................................... 19
6.5.2 Wrapping test of insulation after thermal ageing ..................................... 19
6.5.3 Bending test of insulation at low temperature ......................................... 19
6.5.4 Elongation at break of the sheath after ageing ........................................ 19
6.5.5 Tensile strength of the sheath after ageing ............................................ 19
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 (UV test) ...................................................................... 19
6.5.11 Solvents and contaminating fluids ...................................................... 19
6.5.12 Salt mist and sulphur dioxide ............................................................... 20
6.5.13 Water immersion ............................................................................... 20
6.5.14 Hygroscopicity .................................................................................. 20
6.5.15 Wicking ............................................................................................. 20
6.5.16 Flame propagation characteristics of a single cable ................................ 20
6.5.17 Flame propagation characteristics of bunched cables ......................... 20
6.5.18 Halogen gas evolution ........................................................................ 20
6.5.19 Smoke generation ............................................................................. 20
6.5.20 Toxic gas emission ............................................................................. 20
6.5.21 Integrated fire test ............................................................................. 20

7 Category 5e multipair cable .......................................................................... 20
7.1 General .................................................................................................... 20
7.2 Transmission ............................................................................................ 21

8 Introduction to the blank detail specification ............................................. 21

Annex A (informative) Acronyms for common cable constructions .................... 22

Bibliography ..................................................................................................... 24

Figure 1 – Impedance template .................................................................... 17
Figure A.1 – Common cable construction examples ..................................... 23
Table 1 – Cable categories ................................................................. 7
Table 2 – Transfer impedance ............................................................ 11
Table 3 – Coupling attenuation ......................................................... 11
Table 4 – Attenuation equation constants ........................................ 13
Table 5 – Near-end unbalance attenuation ........................................ 14
Table 6 – Worst-pair PS NEXT(1) values ......................................... 14
Table 7 – Worst-pair PS EL FEXT(1) values ..................................... 15
Table 8 – PS ANEXT ......................................................................... 15
Table 9 – PS AACR-F ................................................................. 16
Table 10 – Return loss .................................................................... 17
Table A.1 – Cable construction acronyms ........................................ 22
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.

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 Cat6A and Cat7A 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.

**IMPORTANT** – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.
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>
<thead>
<tr>
<th>Cable designation</th>
<th>Maximum referenced frequency MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 5e</td>
<td>100</td>
</tr>
<tr>
<td>Category 6</td>
<td>250</td>
</tr>
<tr>
<td>Category 6A</td>
<td>500</td>
</tr>
<tr>
<td>Category 7</td>
<td>600</td>
</tr>
<tr>
<td>Category 7A</td>
<td>1 000</td>
</tr>
</tbody>
</table>

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.