IEC/PAS 62255-1

Edition 1.0
2001-06

PRE-STANDARD

Multi-pair cables used in high bit rate digital access telecommunication networks –

Part 1: Outdoor cables

PUBLICLY AVAILABLE SPECIFICATION

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public and established in an organization operating under given procedures.

IEC-PAS 62255-1 has been processed 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 PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document:

Draft PAS	Report on voting
46C/432/PAS	46C/473/RVD

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MULTI-PAIR CABLES USED IN HIGH BIT RATE DIGITAL ACCESS TELECOMMUNICATION NETWORKS –

Part 1: Outdoor cables

1 Scope

This specification defines outdoor multi-pair cables for use in high bit rate digital telecommunication networks with their relative definitions and requirements
It covers water tight cables, with an overall screen, characterised up to 30 MHz, to be used in outdoor networks (for example in the subscriber access loop).
The electrical, mechanical, transmission performance characteristics of the screened cables, related to their reference test methods, are detailed.

1.1 Normative references

This standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the cited publications are listed hereafter. For dated references, subsequent amendments to or revisions of these publications apply to this PAS only when incorporated in it by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

IEC 61156-1, *Multicore and Symmetrical Pair/Quad Cables for Digital Communications :Part 1: Generic specification*

IEC 60028:1925, *International standard of resistance for copper*
IEC 60050, *International Electrotechnical Vocabulary (IEV)*
IEC 60068, *Environmental testing*
IEC 60304:1982, *Standard colours for insulation for low-frequency cables and wires*
IEC 60344:1980, *Guide to the calculation of resistance of plain and coated copper conductors of low-frequency cables and wires*
IEC 60811-1, *Common test methods for insulating and sheathing materials of electric cables - Part 1: Methods for general application*
IEC 60811-1-2:1985, *Common test methods for insulating and sheathing materials of electric cables - Part 1: Methods for general application - Section Two: Thermal ageing methods*
EN 50289: *Communication cables – Specifications for test methods (Series)*
EN 50290: *Basic Reference Standard for Communication Cables (Series)*

1.2 Terminology

For the purpose of this PAS, the definitions of IEC 61156-1 apply in addition to the following ones.

- Subscriber loop.
- Bit Rate
- ADSL Asymmetric Digital Subscriber Lines
- ATM Asynchronous Transfer Mode
- DSL Digital Subcriber Line
- EMC Electro-Magnetic Compatibility
- EMI Electro-Magnetic Interference
- FSAN Full Service Access Network
- HDSL High-bit-rate Digital Subscriber Lines
- ISDN Integrated Digital Services Network

- ISDN-BRA ISDN – Basic Rate Access
- ISDN-PRA ISDN – Primary Rate Access
- Mbps Mega-bits per second
- TBD to be determined
- VDSL Very-high-bit-rate Digital Subscriber Lines
- xDSL Generic term referring to all DSLs, ISDN, HDSL, ADSL, VDSL, ...

2 General information

2.1 General cable description

These cables are designed for outdoor telecommunication networks, therefore they are water-tight cables
Since these cables are specifically designed for new, various existing and emerging, telecommunication applications that involve high frequency spectrum up to 30 MHz, they include an overall screen to improve the electromagnetic behaviour.
These cables contain from one pair up to 150 pairs that can be either in pairs or quads.

2.2 Environment and product safety requirement

2.3 Testing

For all test procedures described in this section, the test conditions shall be the standard atmospheric conditions (23 ± 5 °C, and 20-70 % relative humidity), unless otherwise stated. All measured and computed values are to be rounded to the number of decimal places given in the corresponding requirement.
The parameters specified in this standard may be affected by measurement uncertainty arising either from measurement errors or calibration errors due to a lack of suitable standards. Acceptance criteria shall be interpreted with respect to this consideration.

3 REQUIREMENTS FOR CONDUCTOR

3.1 Construction and dimensions.

The conductor shall consist of annealed copper, uniform in quality and free from defects. The properties of the copper shall be in accordance with IEC 60028.

The conductor shall be solid, circular in section. Normally the conductor shall be drawn in one piece. Joints in the conductor are permitted, provided that the tensile strength of a joint is not less than 85 % of the un-jointed solid conductor.

The diameter of the conductor shall be between 0.4 mm to 0.8 mm.

3.2 Mechanical requirements.

The conductor elongation at break shall be tested according to IEC 61156-1 subclause 3.4.2 and shall be between 15 and 20 % depending on the conductor size.

3.3 Electrical requirements.

3.3.1 Conductor resistance

The conductor d.c. resistance, when measured according to IEC 61156-1 subclause 3.2.1 shall meet the values calculated in accordance with IEC 60344.

3.3.2 Conductor resistance unbalance

The conductor d.c. resistance unbalance, when measured according to IEC 61156-1 clause 3.2.2 shall be less than 2 %

4 REQUIREMENTS FOR INSULATION

4.1 Construction material and dimensions.

Conductor insulation shall be composed of solid, cellular or composite (e.g. foam skin) polyolefin.

The insulation shall be continuous, having a thickness as uniform as possible. The minimum thickness of the insulation shall be measured in accordance with the method specified in 2.2.1.1 of IEC 60189-1.

The insulation shall be applied to fit closely to the conductor. The stripping properties of the insulation shall be checked in accordance with the method specified in 3.4 of IEC 60189-1. It shall be possible to strip the insulation from the conductor easily and without damage to the insulation or the conductor.

When required the insulated conductors shall be coloured for identification. Colours shall correspond reasonably with the standard colours shown in IEC 60304.

4.1.1 Colour code

The colour code shall be agreed between the customer and the manufacturer.

4.2 Mechanical requirements.

Shrinkage of insulation shall be checked against IEC 61156-1 clause 3.5.1. The shrinkage shall be less than 5 % in the temperature range –40 °C +70 °C.

4.3 Electrical requirements.

4.3.1 Insulation resistance

Insulation resistance IEC 61156-1 clause 3.2.4 5 000 Mohm.km under 500 V

5 REQUIREMENTS FOR CABLE ELEMENT

5.1 Construction and dimensions.

The cable element is:

- a pair consisting of two insulated conductors twisted together and designated wire "a" and wire "b", or
- a quad consisting of four insulated conductors twisted together and designated wire "a", wire "c", wire "b" and wire "d" in order of rotation.

The choice of the twist configuration (SZ or helical) and the maximum average length of lay in the finished cable shall be made with respect to the specified electrical requirements, handling performance and the pair or quad integrity

NOTE - Forming the element with a variable lay can lead to the infrequent but acceptable occurrence of the maximum lay being longer than that may be specified.

5.1.1 Screening of the cable element

Where a screen is required over the pair or quad, to improve the external and internal immunity, it may consist of the following:

a) an aluminium tape laminated to a plastic tape;

b) an aluminium tape laminated to a plastic tape and a metal-coated or plain copper drain wire whereby the metal tape is in contact with the drain wire;

A protective wrapping may be applied under or/and over the screen.

5.1.2 Spare cable elements

The cable may be equipped with spare pairs or quads in accordance with the basic cable structure.

The number of spare cable elements is depending upon agreement between the customer and the manufacturer

6 REQUIREMENTS FOR CABLE CORE.

6.1 Design

The cable elements may be laid up (SZ or helical) in concentric layers or in units screened or unscreened.

6.1.1 Interstitial fillers

In order to provide a compact and reasonably circular cable, fillers may be used.

7 REQUIREMENTS FOR FILLING COMPOUNDS

When required the interstices of the cable core shall be filled continuously with a compound suitable to prevent water penetration within the cable. The filling compound shall meet the requirements specified in the relevant part of EN 50290-2

7.1.1 Moisture barriers

To prevent water penetration through the cable when continuous filling is not used, water swellable elements, water swellable non-toxic powder or a combination of materials may be used.

8 REQUIREMENTS FOR THE SCREENING OF THE CABLE CORE

The cable core may be screened by:

a) an aluminium tape laminated to a plastic tape;

b) an aluminium tape laminated to a plastic tape and a metal-coated or plain copper drain wire whereby the metal tape is in contact with the drain wire;

A protective wrapping may be applied under or/and over the screen.

9 REQUIREMENTS FOR THE SHEATH.

The sheath shall have adequate mechanical strength and elasticity. These properties shall stay sufficiently constant during normal use.

The sheath shall be continuous, having a thickness as uniform as possible. The minimum thickness of the sheath shall be determined in accordance with the method specified in IEC 60811. The thickness of the sheath shall be agreed between the customer and the manufacturer.

The sheath shall be applied to fit closely to the core of the cable. In the case of screened cables, the sheath shall not adhere to the screen except when it is intentionally bonded to it.

The sheath material shall meet the requirements specified in the relevant part of EN 50290-2-.

9.1 Colour of sheath

The colour of the sheath shall be agreed between the customer and the manufacturer. For cables other than buried cables or cables laid in duct, attention should be paid to the U.V. resistance.

9.2 Mechanical requirements.

The abrasion resistance of the sheath marking shall be tested according to EN 50289-3-8.

10 Identification

10.1 Cable marking

Each length of cable shall bear the name of the manufacturer and, when required, the year of manufacture, the cable type using one of the following methods:

a) coloured threads or tapes;

b) printed tape;

c) printing on the core wrappings;

d) marking on the sheath.

Additional markings may be required on the sheath depending upon agreement between the customer and the manufacturer.

11 REQUIREMENTS FOR FINISHED CABLE

11.1 Mechanical requirements

11.2 Environmental requirements

11.2.1 Temperature range.

The temperature range of these cables is –40 °C +70 °C.

11.2.2 Fauna proofing

Depending upon agreement between the customer and the manufacturer fauna proofing may be required to protect the cable against attack by fauna (such as rodents or insects). The protection may be a choice of armouring, special wrapping tape, a choice of outer sheath material, or any combination of these.

11.2.3 Moisture barriers

To minimise moisture permeation through the sheath a longitudinal overlapped metallic foil shall be used which is bonded to the inner surface of an extruded plastic sheath.
The cable shall be tested for water penetration test according to EN 50289-4-2 method 5A

12 Electrical requirements

12.1 Dielectric strength

Dielectric strength should be in accordance with IEC 61156-1 clause 3.2.3.
The test shall be performed on conductor/conductor and, where screen(s) are present, conductor/screen with 1 kV d.c. for one minute or, alternately, with 2,5 kV for 2 seconds. An a.c. voltage may be used. The a.c. voltage levels in these cases shall be 0.7 kV for one minute or, alternately, 1.7 kV for 2 seconds. (ffc).

12.2 Mutual capacitance

Mutual capacitance IEC 61156-1 clause 3.2-5, according to customer requirements.

12.3 Capacitance unbalance

Capacitance unbalance IEC 61156-1 clause 3.2.6

pair to pair	less than 440 pF/km
pair to earth	less than 1400 pF/km

12.4 Velocity of propagation

Velocity of propagation IEC 61156-1 clause 3.3.1, greater than 60% at 1 MHz

12.5 Attenuation

Attenuation IEC 61156-1 clause 3.3.2 depending on cable design.

12.6 Longitudinal conversion loss (LCL)

Longitudinal conversion loss (LCL) IEC 61156-1 clause 3.3.3 > 40 dB at 1 MHz.

12.7 Near End Crosstalk (NEXT)

Crosstalk IEC 61156-1 clause 3.3.4 (see table in subclause 12.9)

12.8 Equal Level Far-end crosstalk (ELFEXT)

Far-end crosstalk (FEXT) IEC 61156-1 clause 3.3.5 (see table in subclause 12.9).