BS EN 50411-6-1:2011

BSI Standards Publication

Fibre organisers and closures to be used in optical fibre communication systems — Product specifications -

Part 6-1: Unprotected microduct for category S and A

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National foreword

This British Standard is the UK implementation of EN 50411-6-1:2011.

The UK participation in its preparation was entrusted to Technical Committee GEL/86/2, Fibre optic interconnecting devices and passive components.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Fibre organisers and closures to be used in optical fibre communication systems - Product specifications - Part 6-1: Unprotected microduct for category S and A

LWL-Spleißkassetten und -Muffen für die Anwendung in LWL-Kommunikationssystemen - Produktnormen - Teil 6-1: Ungeschützte Mikrorohre für die Kategorien S und A

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 86BXA, Fibre optic interconnects, passive and connectorised components.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50411-6-1 on 2011-03-21.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2012-03-21
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2014-03-21

Contents

1 Scope

Product definition

This specification contains the initial, start of life dimensional, mechanical and environmental performance requirements which an unprotected microduct must meet. It does not address the installation capability of these products which must be agreed between the user and supplier.

Operating environment

The tests selected combined with the severities and duration are representative of an outside plant for subterranean and/or aerial environment defined by:

— ETS 300 019 : class 8.1: underground locations (without earthquake requirement)

— EN 61753-1 : category S: subterranean environment, category A: aerial environment

Quality assurance

Compliance with this specification does not guarantee the manufacturing consistency of the product. This should be maintained using a recognised quality assurance programme.

Allowed product types

This standard covers all European Standard on optical fibre unprotected microducts. This includes, but is not limited to, EN 60794-5, *Optical fibre cables - Part 5: Sectional specification - Microduct cabling for installation by blowing*.

Allowed microduct connector types

This microduct standard allows the use of all European Standard on microduct connectors, including: straight, reducer/enlarger stem, reducer/enlarger, close down, liquid block, liquid block with barb end, and end stop connectors. This includes EN 50411-2-8, *Fibre organisers and closures to be used in optical fibre communication systems - Product specifications - Part 2-8: Microduct connectors, for air blown optical fibres, Type 1*.

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.

EN 60793-1-51 Optical fibres - Part 1-51: Measurement methods and test procedures - Dry heat (IEC 60793-1-51)

EN 60794-1-2 Optical fibre cables - Part 1-2: Generic specification - Basic optical cable test procedures (IEC 60794-1-2)

EN 61300-2-34 Part 2-34: Tests - Resistance to solvents and contaminating fluids of interconnecting components and closures (IEC 61300-2-34)

EN 61300-3-1 Part 3-1: Examinations and measurements - Visual examination (IEC 61300-2-31)

3 Terms, definitions and abbreviations

3.1 Terms and definitions

3.1.1
unprotected microduct
small, flexible, lightweight tube with an outer diameter typically less than or equal to 16 mm

NOTE Unprotected microducts are designed to be contained within a loose or tight outer layer to form a protected microduct.

3.1.2
protected microduct
one or more microducts surrounded by a protective sheath and/or protected by a duct/sub-duct

NOTE Alternatively a microduct may be regarded as protected if it has a sufficiently high wall a thickness.

3.1.3
microduct optical fibre cable
optical fibre cable suitable for installation by blowing into a microduct

3.1.4
microduct fibre unit
fibre unit that is suitable for installation by blowing into a microduct

NOTE It differs from microduct optical fibre cables in that it provides less protection to the fibres that it contains.

3.1.5
burst pressure
point at which the microduct fails to contain pressure

3.1.6
low friction surface
smooth or ribbed internal layer with the purpose to reduce the friction coefficient between microduct and cable/fibre unit

3.1.7
anti static surface
internal layer with the purpose to reduce the antistatic forces between the microduct and the cable/fibre unit

3.2 Abbreviations

PS Product Specification

MD Microduct

PM Protected Microduct

ABF Air Blown Fibre

ID Inside Diameter

OD Outside Diameter

4 Description

4.1 Unprotected microduct

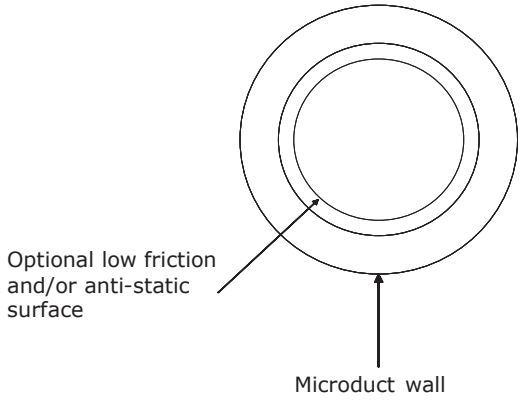

Figure 1 − Cross section of typical unprotected microduct

4.2 Microduct functions

An unprotected microduct contains one or more fibre units or optical cables.

5 Dimensions unprotected microduct

5.1 Outer and inner diameters

The OD and ID of the unprotected microduct shall be in accordance with Table 1. The tolerance of outer and inner diameters shall be ± 0,1 mm for microducts with an outer diameter of ≤ 8 mm and ± 0,2 mm for the outer diameters of microducts > 8 mm up to and including 16 mm outer diameter (the inner diameter tolerance remains at ± 0,1 mm). The method used to determine microduct size shall not disturb the geometry of the product.

Table 1 – Unprotected microduct dimensions

Nominal size (OD/ID) mm	OD (min.) mm	OD (max.) mm	Wall (min.) mm	ID (min.) mm
3/2,1	2,9	3,1	0,45	2,0
4/2,5	3,9	4,1	0,75	2,4
4/2,8 and 4/3	3,9	4,1	0,60	2,7
5/3,5	4.9	5,1	0,75	3.4
6/4	5,9	6,1	1,00	3,9
7/4	6,8	7,2	1,45	3,9
7/5,5	6,9	7,1	0,75	5,4
8/6	7,9	8,1	1,00	5,9
10/6 (see Note)	9,8	10,2	1,95	5,9
10/8	9,8	10,2	0,95	7,9
12/8 (see Note)	11,8	12,2	1,95	7,9
12/9	11,8	12,2	1,45	8,9
12/9,4	11,8	12,2	1,25	9,3
12/9,8	11,8	12,2	1,05	9,7
12/10	11,8	12,2	0,95	9,9
14/10 (see Note)	13,8	14,2	1,95	9,9
14/11	13,8	14,2	1,45	10,9
15/12	14,8	15,2	1,45	11,9
16/13	15,8	16,2	1,45	12,9

NOTE These sizes are for reference only as they are thick walled products and may be used as protected microduct (wall ≥ 2 mm); they are provided in this table for interfacing with microduct connectors EN 50411-2-8:2008.

The outer and inner dimensions may be measured using the methods shown in Annex A.

5.2 Unprotected microduct ovality

Microduct Ovality (E) shall be determined by the following equation:

$$E = [(OD_{max} – \min OD_{min})/OD_{mean}] \times 100\ \%$$

where

OD_{max} is the maximum outer diameter;

OD_{min} is the minimum outer diameter;

OD_{mean} is the mean outer diameter.

Before coiling onto the drum the maximum ovality shall be 5 % when measured prior to coiling. After dispensing product from the drum the maximum ovality shall be 15 %.

6 Materials

Unprotected microducts are typically produced from virgin LDPE, LLDPE, MDPE, HDPE or PP (no re-grind content). Other materials may be used subject to compatibility testing. Internal and external coatings may be applied to the wall material provided the tolerances and performance criteria of this specification are maintained.

7 Tests

7.1 Dimensional and marking requirements

Dimensions and marking of the product shall be in accordance with the requirements of the product specifications listed in Clause 5, and shall be measured and inspected using the appropriate EN test method.

7.2 Burst pressure

The instantaneous burst pressure for any microduct shall be a minimum of 18 bar (1,8 MPa) measured at 20 °C.

7.3 Performance requirements

The unprotected microduct shall meet the following performance tests.

Table 2 − Performance requirements

No.	Test	Requirement	Details	
1	Visual Examination	Product shall be free from water splash marks, die marks, pin holes cracks or other defects. Product shall meet the dimensional requirements of Clause 5	Method:	EN 61300-3-1
			Examination	Product shall be checked with naked eye without magnification.
2	Burst pressure	(See Annex B)	Method:	Annex B
			Temperature:	(23 ± 2) °C
			Pressure:	1,8 MPa (18 bar)
			Duration:	30 min
3	Tensile performance	Visual examination (test 1). There shall be no damage after the test	Method:	EN 60794-1-2, Method E1
			Length:	0,2 m minimum
			Load:	Sufficient to cause 7 % elongation
			Rate:	5 mm/min
4	Kink	Visual examination (test 1). There shall be no damage to the microducts after the test. During the test, the microduct shall attain the required minimum diameter without kinking	Method:	EN 60794-1-2, Method E10
			Temperature:	(23 ± 3) °C
			Minimum diameter:	20 times the OD of the microduct
5	Crush	Visual examination (test 1). There shall be no damage to the microduct. The imprint of the plate is not considered as mechanical damage.	Method:	EN 60794-1-2, Method E3
			Sample length	250 mm
			Load:	50 × OD N (OD in millimetres) or 450 N, whichever is lower, for 1 min
			Recovery time:	1 h
6	Impact	Visual examination (test 1) after the recovery time. There shall be no damage to the microduct. The imprint of the striking surface is not considered as mechanical damage.	Method:	EN 60794-1-2, Method E4
			Striking surface radius	10 mm
			Impact energy:	1 J for ≥ 5 mm OD microduct; 0,5 J for < 5 mm OD microduct
				1
			Recovery time:	1 h
			Number of impacts	One in three different places spread not less than 500 mm apart

Table 2 − Performance requirements *(continued)*

No.	Test	Requirement	Details	
7	Bending	Visual examination (test 1). There shall be no damage to the microduct and no reduction in diameter of > 15 %.	Method:	EN 60794-1-2, Method E11
			Diameter of mandrel:	≦ 40 × OD
			Number of turns/helix	10
			Number of cycles:	3
8	Ageing	After exposure to the test condition the microduct shall meet the burst pressure and dimensional requirements of Clause 6	Method:	EN 60793-1-51 dry heat
			Temperature:	60 °C
			Duration:	Three months
9	Resistance to solvents and contaminating fluids	After exposure to the test condition the microduct shall meet the burst pressure and dimensional requirements of Clause 6	Method:	EN 61300-2-34
			Test temperatures:	(23 ± 3) °C
			Submersion in:	HCl at pH 2 NaOH at pH 12 Kerosene (lamp oil) ISO 1998/I 1.005 Petroleum jelly Diesel fuel for cars EN 590
			Immersion depth:	Just underneath surface, but fully immersed or covered by fluid.
			Duration:	Five days
			Drying time:	None
10	Resistance to solvents and contaminating fluids-stress cracking solvent	After exposure to the test condition the microduct shall meet the burst pressure (test 2) and dimensional requirements of Clause 6	Method:	EN 61300-2-34
			Test temperatures:	(50 ± 2) °C
			Submersion in:	10 % detergent solution of Nonyl Phenol Ethoxylate (Igepal)
			Immersion depth:	Just underneath surface, but fully immersed.
			Duration:	Five days
			Drying time:	None

Annex A
(normative)

Methods to determine microduct dimensions

A.1 Outer Dimensions

The outer diameter is measured with a snap gauge.

Figure A.1

The measurement is done as follows:

- clamp a piece of tube in the apparatus;
- turn the tube carefully around;
- note the lowest reading (D_{min}) and the highest reading (D_{max}) the average outside diameter is calculated and shown in the appropriate column;
- the lowest reading may never be lower than the lower specification for the tubing.

A.2 Inner dimensions

A plug gauge is used to check that the internal diameter of the tube is correct. The illustration shows a multiple tube size gauge, single size gauges may also be used.

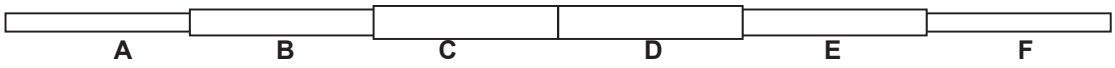

Figure A.2

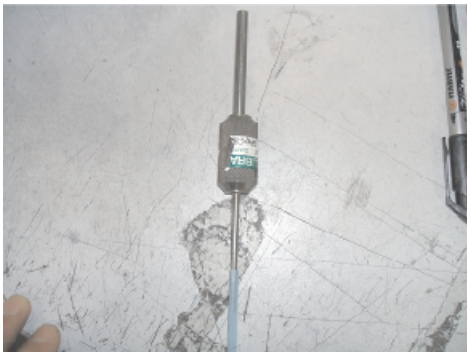

Figure A.3

Gently place the plug gauge into the tube until it stops. **DO NOT FORCE IT**.

Attention: Be sure you have the correct end of the gauge.

There are various plug gauges made for different size tubes.

The tube must fit over the relevant plug gauge without forcing.

Annex B
(normative)

Test methods – High pressure resistance – Safety

B.1 Object

The purpose of this test is to verify that a microduct is capable of withstanding the maximum internal pressure used for blowing of microduct cable or fibre unit.

B.2 General

This test ensures safe operation at the test temperatures.

Using water or other suitable medium increased internal pressure is used.

B.3 Samples

Two equal lengths of microduct approximately 1 m long are cut from a production length.

The ends should be cut carefully, ensuring that they are not crushed. This will prevent air leaks from around the connectors. This test must be conducted in a controlled area so that there is no danger from flying fragments should the microduct fail.

The microduct, and microduct connector samples, should be conditioned at the test temperature for a minimum of four hours before testing.

B.4 Procedure

One end of the microduct is connected to the pressure test equipment, and the other end, to the microduct connector. Where required the second length of microduct is inserted into the connector, and a fully blocking end cap (usually metal) is fitted to the opposite open end.

The pressurising device is activated and the pressure increased at a rate of 1,8 MPa/min (18 bar/min) to the specified level. The sample is left pressurised for 30 min (unless otherwise stated in the PS).

B.5 Requirements

All samples should withstand the applied pressure with no leakage during test and no visible damage after test.

Bibliography

EN 50411-2-8 Fibre organisers and closures to be used in optical fibre communication systems - Product specifications - Part 2-8: Microduct connectors, for air blown optical fibres, Type 1

EN 60794-5 Optical fibre cables - Part 5: Sectional specification - Microduct cabling for installation by blowing (IEC 60794-5)

EN 61300 series Fibre optic interconnecting devices and passive components - Basic test and measurement procedures (IEC 61300 Series)

EN 61753-1 Fibre optic interconnecting devices and passive components performance standard - Part 1: General and guidance for performance standards (IEC 61753-1)

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