INTERNATIONAL STANDARD

IEC 60874-14-2

QC 910004XX0002

First edition
1997-06

Connectors for optical fibres and cables –

Part 14-2:
Detail specification for fibre optic connector type SC-PC tuned terminated to single-mode fibre type B1

Reference number
IEC 60874-14-2: 1997(E)

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– IEC 60617: *Graphical symbols for diagrams;*

and for medical electrical equipment,

– IEC 60878: *Graphical symbols for electromedical equipment in medical practice.*

The symbols and signs contained in the present publication have either been taken from IEC 60027, IEC 60417, IEC 60617 and/or IEC 60878, or have been specifically approved for the purpose of this publication.

IEC publications prepared by the same technical committee

The attention of readers is drawn to the end pages of this publication which list the IEC publications issued by the technical committee which has prepared the present publication.

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE P

Pour prix, voir catalogue en vigueur
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CONNECTORS FOR OPTICAL FIBRES AND CABLES –

Part 14-2: Detail specification for fibre optic connector type SC-PC tuned terminated to single-mode fibre type B1

FOREWORD

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3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 60874-14-2 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

The text of this standard is based on the following documents:

FDIS	Report on voting
86B/872/FDIS	86B/1001/RVD

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

The QC number that appears on the front cover of this publication is the specification number in the IEC Quality Assessment System for Electronic Components (IECQ).

The references to clauses or subclauses of IEC 60874-1 indicated in this part apply to the third edition of IEC 60874-1.

CONNECTORS FOR OPTICAL FIBRES AND CABLES

Part 14-2: Detail specification for fibre optic connector type SC-PC tuned terminated to single-mode fibre type B1

NATIONAL STANDARDS ORGANIZATION:	.... Date: .....

DETAIL SPECIFICATION IEC QC 910004XX0002.

FIBRE OPTIC COMPONENT OF ASSESSED QUALITY IN ACCORDANCE WITH

- GENERIC SPECIFICATION: QC 910000 (IEC 60874-1)
- BLANK DETAIL SPECIFICATION: QC 910001 (IEC 60874-1-1)

CONNECTOR SET FOR OPTICAL FIBRES AND CABLES

CLASSIFICATION:

Type: Name: SC

For use in datacom applications as specified in ISO/IEC International Standard 11801: "Generic cabling for customer premises"

Configuration: plug-adaptor-plug
Coupling: push-pull
Control dimensions:

– Plug: see figures 1, 2 and 3
– Adaptor: See IEC 60874-14-3

Arrangement: patchcord arrangement

Style: Fibre retention: as required
Cable retention: as required
Optical coupling: butting
Alignment: resilient sleeve alignment

Variants: see page 8

Climatic category: 10/60/4

Environmental category: 4

Assessment level: A

QUALIFICATION PROCEDURE: Fixed sample procedure

SAFETY WARNING: Take care when handling small diameter optical fibre to prevent puncturing the skin, especially in the eye area. Direct viewing of the end of an optical fibre when it is propagating energy is not recommended unless prior assurance is obtained as to the safe energy output level

Applicable fibre cable information	
Mode field diameter	In accordance with IEC 60793-2
Cladding diameter	In accordance with IEC 60793-2
Core/cladding concentricity error	In accordance with IEC 60793-2
Buffer diameter	250 ± 15, 500 ± 30, 900 ± 50 µm
Jacket outer diameter	As required per variant
Fibre cut-off wavelength	1 100 – 1 280 nm

Additional information

– Attenuation in random connection:
less than 0,60 dB (99 % probability)
less than 0,15 dB (average)

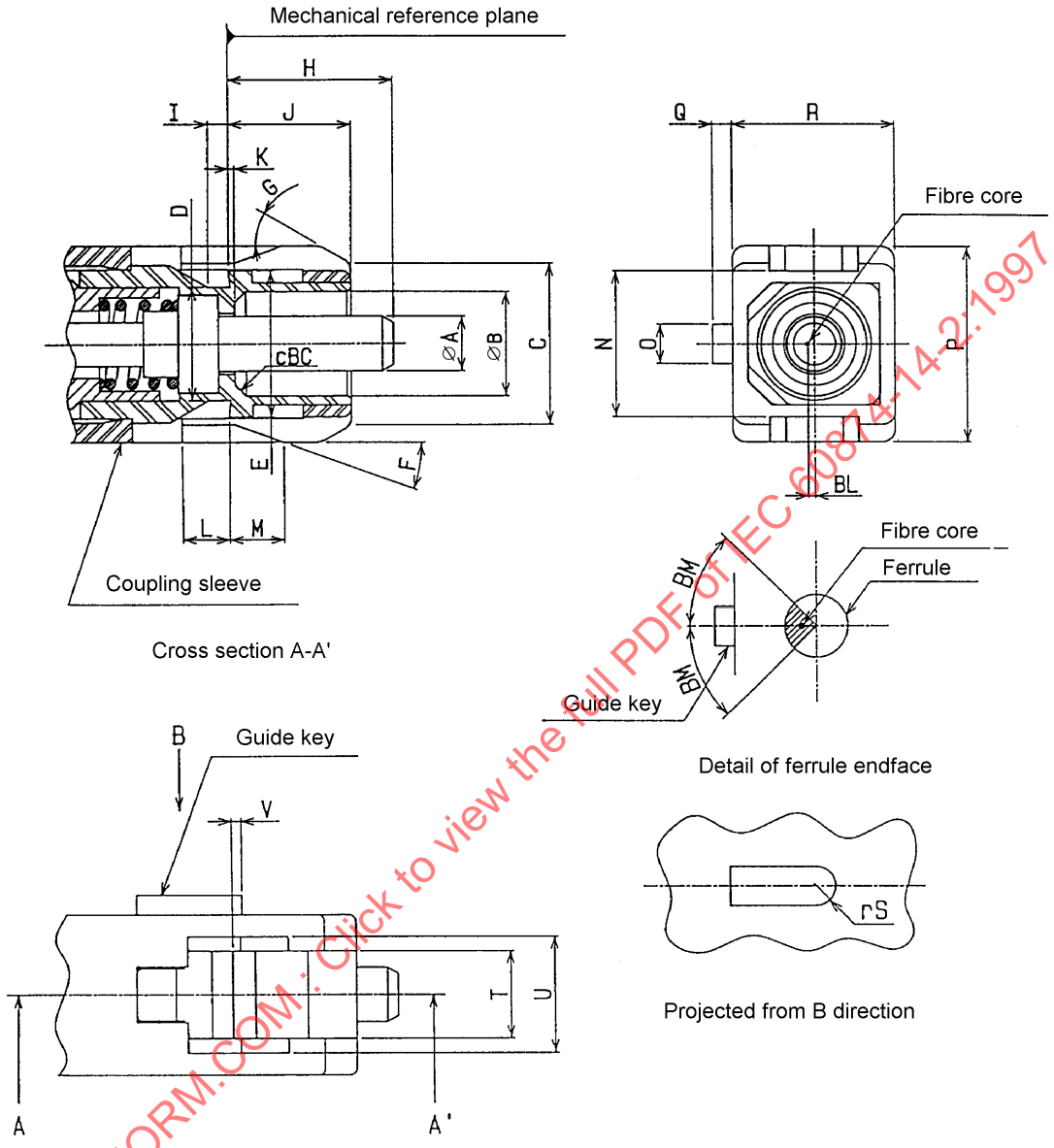


Figure 1 – Plug mating face dimensions

Reference	Dimensions		Notes
	Minimum	Maximum	
A	2,4985 mm	2,4995 mm	
B	4,8 mm	4,9 mm	
C	6,8 mm	7,4 mm	
D	4,9 mm	5,3 mm	
E	6,7 mm	6,8 mm	
F	19°	23°	
G	25°	35°	
H	7,15 mm	7,50 mm	1, 2
I	0,8 mm	1,2 mm	
J	5,3 mm	5,5 mm	
K	–0,1 mm	0,05 mm	3
L	2,11 mm	2,5 mm	
M	2,0 mm	2,8 mm	
N	6,6 mm	6,8 mm	
O	1,6 mm	1,8 mm	
P	8,89 mm	8,99 mm	
Q	0,8 mm	1,0 mm	
R	7,29 mm	7,39 mm	
rS	0,8 mm	0,9 mm	radius
T	4,05 mm	4,15 mm	
U	5,4 mm	5,6 mm	
V	0 mm	0,5 mm	
cBC	0 mm	0,5 mm	chamfer
BM	0°	45°	4

NOTES

1 Ferrule compression force shall be from 7,8 N to 11,8 N, when the ferrule is compressed to a point where H is 7 ± 0,1 mm.

2 This value shows the dimension after the ferrule is polished and in the unmated condition.

3 The negative dimension refers to that the position of the inside bottom plane is left-direction relative to the mechanical reference plane

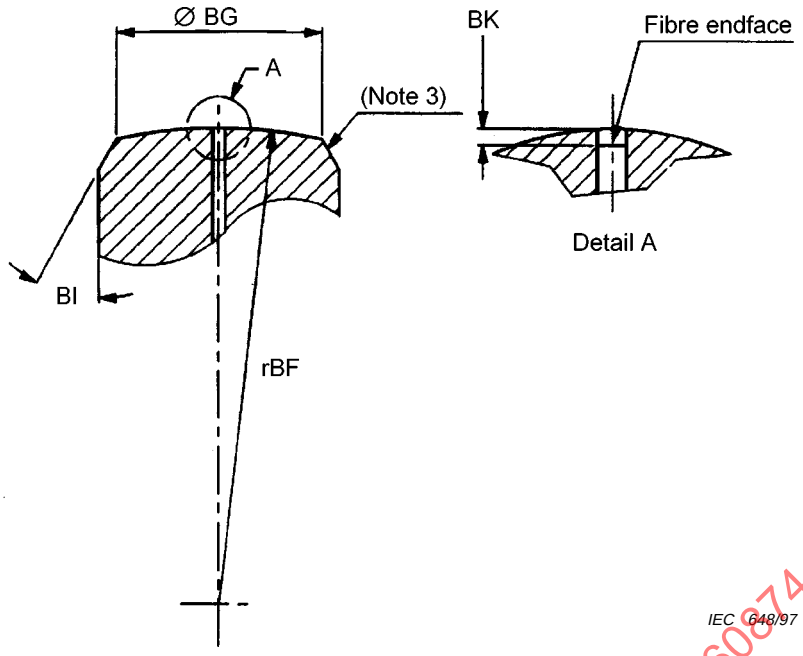
4 The dimensions “BM” means the adjusting angle of the core centre to the ferrule centre relative to the keying direction. These dimensions shall be measured according to IEC 61300-2-41.

5 Where a tolerance of form is not specified, the limits of the dimensions for a feature control the form as well as the size.

6 Where interrelated features of size (features shown with a common axis or centre plane) have no geometric tolerance of location or run out specified, the limits of the dimensions for a feature control the location tolerance as well as the size.

7 Where perpendicular features (features shown at right angles) have no geometric tolerance of orientation or run out specified, the limits of the dimensions for a feature control the orientation tolerance as well as the size.

Figure 1 – Plug mating face dimensions *(continued)*



Reference	Dimensions		Notes
	Minimum	Maximum	
rBF	10 mm	25 mm	1, radius
BK	–0,0001 mm	see graph	2
BG	1,76 mm	2,26 mm	diameter, 4
BG	1,90 mm	2,26 mm	diameter, 5
BI	25°	35°	

NOTES

1 Eccentricity of a spherical polished ferrule endface is less than 50 µm.

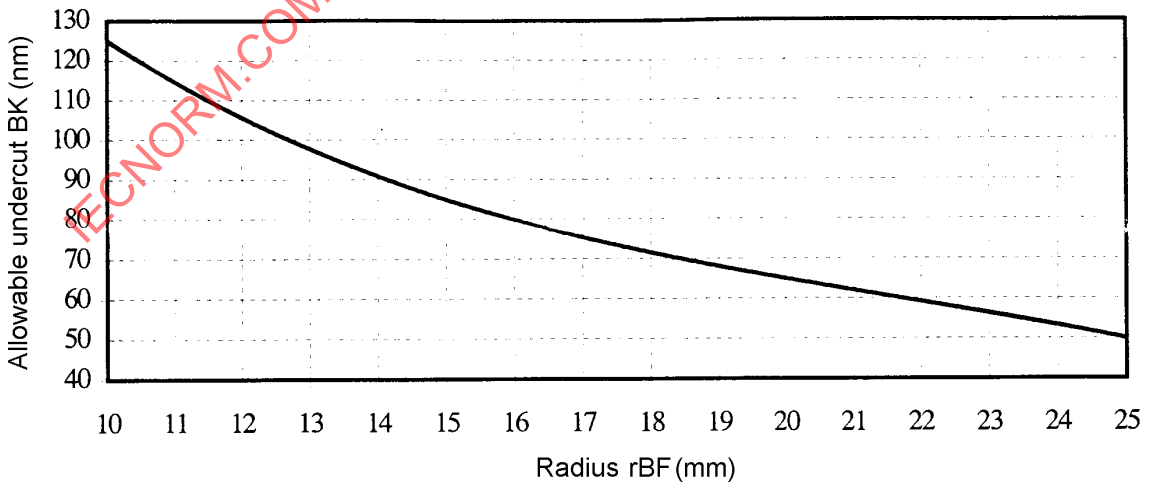
2 The negative dimension refers to the fibre protrusion.

3 Break edge.

4 This value is applicable to the variant numbers 1001, 1003, 1005 and 1007.

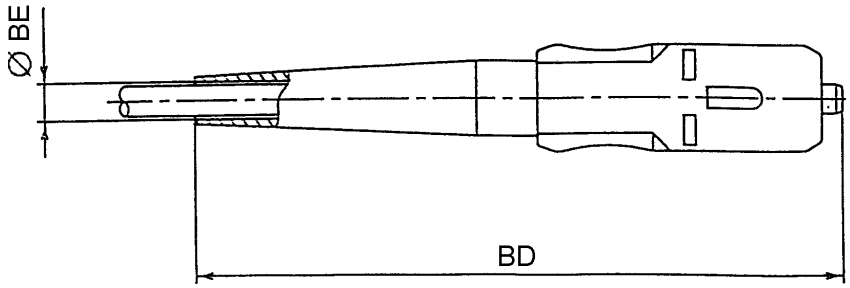
5 This value is applicable to the variant numbers 1002, 1004, 1006 and 1008.

Figure 2a – Ferrule endface geometry – after termination



Allowable undercut = $-0,02*Radius^3 + 1,3*Radius^2 - 31*Radius + 325$

Figure 2b – Allowable undercut BK versus radius rBF



IEC 650/97

Reference	Dimensions mm		Notes
	Minimum	Maximum	
BD		60	
BE	2,2		1
BE	2,6		2
BE	2,9		3
BE	3,2		4

NOTES

1 This value is applicable to the variant numbers –1001 and 1002.

2 This value is applicable to the variant numbers –1003 and –1004.

3 This value is applicable to the variant numbers –1005 and –1006.

4 This value is applicable to the variant numbers –1007 and –1008.

Figure 3 – Plug dimension

VARIANT IDENTIFICATION NUMBERS Number: QC 910X01/0002-ZZZZ				
ZZZZ	Component name	Variant feature		
		Applicable cable jacket diameter	Ferrule material	Dimension BG
1001	Plug	2,0 mm	Zirconia	1, 76 – 2,26
1002	Plug	2,0 mm	Zirconia	1, 90 – 2, 26
1003	Plug	2,4 mm	Zirconia	1, 76 – 2,26
1004	Plug	2,4 mm	Zirconia	1, 90 – 2, 26
1005	Plug	2,7 mm	Zirconia	1, 76 – 2,26
1006	Plug	2,7 mm	Zirconia	1, 90 – 2, 26
1007	Plug	3,0 mm	Zirconia	1, 76 – 2,26
1008	Plug	3,0 mm	Zirconia	1, 90 – 2, 26

SUPPLEMENTARY INFORMATION

Preferred colour:

Colour of the coupling sleeve and boot shall be blue according to: RAL 5015.

Component marking:

The name and/or manufacturer's identification mark may be permanently identified. Figure 4 shows an example of the location of the component marking.

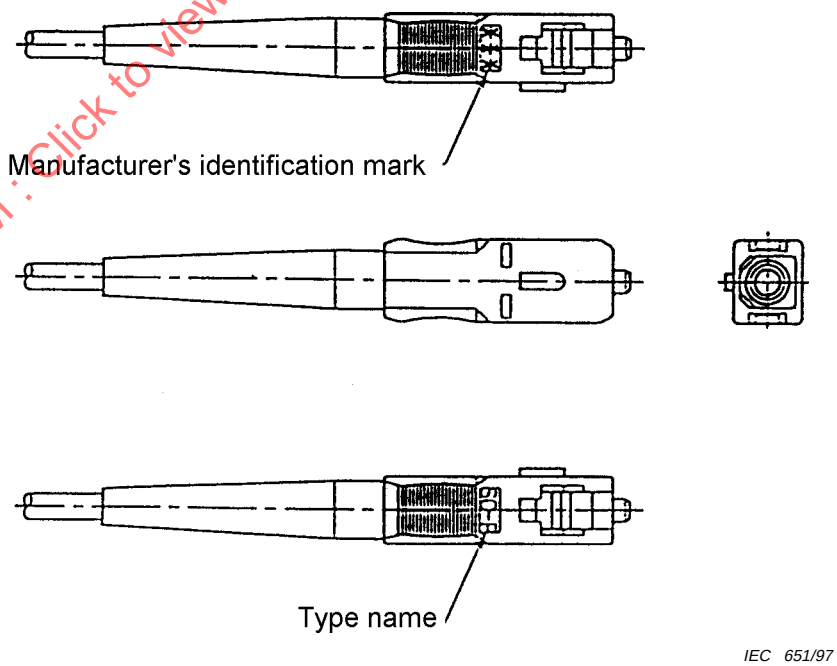


Figure 4 – Example of component marking

TABLE 1

FIXED SAMPLE TEST SCHEDULE FOR QUALIFICATION APPROVAL

Test sequence	Reference IEC 60874-1 (IEC 61300)	*n*
Group 0		
Visual examination	4.4.1 (3-1)	20
Dimensions	4.4.2 (3-1)	
Ferrule compression force	4.4.12 (3-22)	
Group 1		
Attenuation	4.4.7 (3-4)	20
Return loss	4.4.12 (3-6)	
Group 2		
Cold	4.5.17 (2-17)	
Dry heat	4.5.18 (2-18)	6
Damp heat (steady state)	4.5.19 (2-19)	
Group 3		
Drop	4.5.14 (2-12)	
Engagement and separation force	4.4.5 (3-11)	6
Mechanical endurance	4.5.32 (2-2)	
Group 4		
Vibration	4.5.1 (2-1)	4
Change of temperature (test Nb)	4.5.22 (2-22)	
Group 5		
Strength of coupling mechanism	4.5.6 (2-6)	4
Cable pulling	4.5.4 (2-4)	
Cable torsion	4.5.5 (2-5)	
Group 6		
Fibre or ferrule retention	4.5.2 (2-4)	NA

NOTES

1 *n* = sample size (number of plugs).

2 To satisfy the qualification approval requirements of the detail specification there shall be no failures of any in the sample groups for any test parameter. If a failure does occur, this shall be investigated and the cause of failure identified and corrected. The test which is affected shall then be repeated using the minimum sample size stated in this detail specification.

A fully documented test report and supporting data shall be prepared and shall be available for inspection. Failures and the corrective action taken to eliminate failures shall be documented and evidence shall be presented to show that the corrective action will have no detrimental effect on the performance in any of the other tests. Design changes, as opposed to improvements in quality control, will usually be deemed to necessitate a repeat of the full qualification programme.

3 Unless otherwise indicated, the test details, measurements and performance requirements are given in table 4.

4 Only group 1 tests shall be carried out using a reference connector. All other tests shall be carried out using the samples from the relevant group at random.

TABLE 2

LOT-BY-LOT QUALITY CONFORMANCE INSPECTION SCHEDULE
GROUPS A AND B

Test sequence	Reference IEC 60874-1 (IEC 61300)	Assessment level A	
		IL	AQL
Group A			
– Visual examination	4.4.1 (3-1)	II	4 %
Radius Undercut/Protrusion Eccentricity of spherical polished endface	4.4.2 (3-1) (3-23) (3-25)		
Group B			
– Attenuation – Return loss	4.4.7 (3-4) 4.4.12 (3-6)	II	4 %

NOTES

1 Unless otherwise indicated, the details, measurements and performance requirements are given in table 4.

2 IL = Inspection level; AQL = Acceptable quality level.

3 Only group B tests shall be carried out using a reference connector. All other tests shall be carried out using the samples from the relevant group at random.

TABLE 3

PERIODIC QUALITY CONFORMANCE INSPECTION SCHEDULE
GROUPS C AND D

Test sequence	Reference IEC 60874-1 (IEC 61300)	Assessment level A	
		n	*p*
Group C0			
– Visual examination	4.4.1 (3-1)	18	24
– Dimensions	4.4.2 (3-1)		
– Ferrule compression force	4.4.12 (3-22)		
Group C1			
– Attenuation	4.4.7 (3-4)	18	24
– Return loss	4.4.12 (3-6)		
Group C2			
– Cold	4.5.17 (2-17)		
– Dry heat	4.5.18 (2-18)	6	24
– Damp heat (steady state)	4.5.19 (2-19)		
Group D0			
– Visual examination	4.4.1 (3-1)	20	48
– Dimensions	4.4.2 (3-1)		
– Ferrule compression force	4.4.12 (3-22)		
Group D1			
– Attenuation	4.4.7 (3-4)	20	48
– Return loss	4.4.12 (3-6)		
Group D2			
– Cold	4.5.17 (2-17)		
– Dry heat	4.5.18 (2-18)	6	48
– Damp heat (steady state)	4.5.19 (2-19)		
Group D3			
– Drop	4.5.14 (2-12)		
– Engagement and separation force	4.4.5 (3-11)	6	48
– Mechanical endurance	4.5.2 (2-2)		
Group D4			
– Vibration	4.5.1 (2-1)	4	48
– Change of temperature (test Nb)	4.5.22 (2-22)		
Group D5			
– Strength of coupling mechanism	4.5.6 (2-6)		
– Cable pulling	4.5.4 (2-4)	4	48
– Cable torsion	4.5.5 (2-5)		
Group D6			
– Fibre or ferrule retention	4.5.2 (2-4)	NA	NA

NOTES

1 Unless otherwise indicated, the details, measurements and performance requirements are given in table 4.

2 To satisfy the qualification approval requirements of the detail specification there shall be no failures of any in the sample groups for any test parameter. If a failure does occur, this shall be investigated and the cause of failure identified and corrected. The test which is affected shall then be repeated using the minimum sample size stated in this detail specification.

A fully documented test report and supporting data shall be prepared and shall be available for inspection. Failures and the corrective action taken to eliminate failures shall be documented and evidence shall be presented to show that the corrective action will have no detrimental effect on the performance in any of the other tests. Design changes, as opposed to improvements in quality control, will usually be deemed to necessitate a repeat of the full qualification programme.

3 *n* = sample size (number of plugs); *p* = periodicity in months.

4 Only group C1 and D1 tests shall be carried out using a reference connector. All other tests shall be carried out using the samples from the relevant group at random.

TABLE 4

DETAILS, MEASUREMENTS AND PERFORMANCE REQUIREMENTS

Visual examination 4.4.1 (61300-3-1)

Requirements:

– Marking shall be clear
– Coupling sleeve shall be movable smoothly

Dimensions 4.4.2 (61300-3-1)

Requirements:

– All size dimensions shall be in accordance with this specification

Attenuation 4.4.7 (61300-3-4)

Details:

– Method No. 7
– Definitions of reference plug are as follows:
  • Ferrule outer diameter is 2,499 ± 0,0003 mm
  • Concentricity of the fibre core with the outer diameter of the ferrule is less than 0,6 µm
  • Eccentricity of a spherical polished ferrule endface is less than 30 µm
– Adaptor shall be in accordance with IEC 60874-14-3
– Number of measurements to be averaged: 5
– Source: LD
– Peak wavelength: 1,3 µm
– Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: none

Requirements:

– Allowable attenuation: less than 0,5 dB against reference plug using reference adaptor

Return loss 4.4.12 (61300-3-6)

Details:

– Method 3
– Source: LD
– Peak wavelength: 1,3 µm
– Adaptor shall be in accordance with IEC 60874-14-3
– Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: none

Requirements:

– Allowable return loss: more than 26 dB

Cold 4.5.17 (61300-2-17)

Details:

– Temperature: –10 °C
– Duration: 96 h
– Specimen optically functioning
– Conditioning procedure: specimen lowered to test temperature and returned to room temperature at a rate not to exceed 1 °/min
– Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: after test, specimens shall be maintained at room temperature condition for 2 h
  Clean ferrule endface and inside of alignment sleeve using lint free material before final measurement
– Deviations: none
– Adaptor shall be in accordance with IEC 60874-14-3
– Monitoring method of attenuation and return loss shall be in accordance with IEC 61300-3-20

Initial measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Return loss: more than 26 dB

Measurements and performance requirements during test:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 26 dB

Final measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 26 dB

(continued)

TABLE 4 (continued)

DETAILS, MEASUREMENTS AND PERFORMANCE REQUIREMENTS

Dry heat 4.5.18 (61300-2-18)

Details:

– Temperature: 60 °C
– Duration: 96 h
– Specimen optically functioning
– Conditioning procedure: specimen raised to test temperature and returned to room temperature at a rate not to exceed 1°/min
– Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: after test, specimens shall be maintained at room temperature condition for 2 h
Clean ferrule endface and inside of alignment sleeve using lint free material before final measurement.
– Deviations: none
– Adaptor shall be in accordance with IEC 60874-14-3
– Monitoring method of attenuation and return loss shall be in accordance with IEC 61300-3-20

Initial measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Return loss: more than 26 dB

Measurements and performance requirements during test:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 26 dB

Final measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 26 dB

Damp heat (steady state) 4.5.19 (61300-2-19)

Details:

– Temperature: 40 °C
– Relative humidity: 90-95 %
– Duration: 96 h
– Precautions regarding surface moisture removal: none
– Specimen optically functioning
– Conditioning procedure: specimen raised to test temperature and returned to room temperature at a rate not to exceed 1°/min
– Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: after test, specimens shall be maintained at room temperature condition for 2 h
Clean ferrule endface and inside of alignment sleeve using lint free material before final measurement
– Deviations: none
– Adaptor shall be in accordance with IEC 60874-14-3
– Monitoring method of attenuation and return loss shall be in accordance with IEC 61300-3-20

Initial measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Return loss: more than 26 dB

Measurements and performance requirements during test:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 26 dB

Final measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 26 dB

(continued)

TABLE 4 (continued)

DETAILS, MEASUREMENTS AND PERFORMANCE REQUIREMENTS

Cable pulling 4.5.4 (61300-2-4)

Details:

– Magnitude: 90 N
– Rate of application of the tensile load: 50N/min < load rate < 250 N/min
– Point of application of the tensile load: 22-28 cm from the connector
– Specimen optically non-functioning
– Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: none
– Deviations: none
– Adaptor shall be in accordance with IEC 60874-14-3

Initial measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Return loss: more than 26 dB

Final measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 26 dB
– The specimen has no mechanical damage.

Cable torsion 4.5.5 (61300-2-5)

Details:

– Tensile load: 1,5 kg (for the variants No. –1001 and –1002)
2,5 kg (for the variants No. –1003 to –1008)
– Application of load: twist the cable 2,5 turns in one direction with specified load applied. Then twist it 5 turns in other direction and back 5 turns for 5 cycles.
– Point of application of the tensile load: 22-28 cm from the connector
– Specimen optically non-functioning
– Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: none
– Deviations: none
– Adaptor shall be in accordance with IEC 60874-14-3

Initial measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Return loss: more than 26 dB

Final measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 26 dB
– The specimen has no mechanical damage

Strength of coupling mechanism 4.5.6 (61300-2-6)

Details:

– Magnitude: 68,6 N
– Rate of application of the tensile load: 50 N/min < load rate < 250 N/min
– Point of application of the tensile load: 22-28 cm from connector
– Specimen optically non-functioning
– Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: clean ferrule endface and inside of alignment sleeve using lint free material before final measurements
– Deviations: none
– Adaptor shall be in accordance with IEC 60874-14-3

Initial measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Return loss: more than 26 dB

Final measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 26 dB
– The specimen has no mechanical damage

(continued)