INTERNATIONAL STANDARD

IEC 60874-14-7

QC 910004XX0007

First edition
1997-06

Connectors for optical fibres and cables –

Part 14-7:
Detail specification for fibre optic connector type SC-APC 9° tuned terminated to single-mode fibre type B1

Reference number
IEC 60874-14-7: 1997(E)

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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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Международная Электротехническая Комиссия

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CONNECTORS FOR OPTICAL FIBRES AND CABLES –

Part 14-7: Detail specification for fibre optic connector type SC-APC 9° 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 60874-14-7 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/877/FDIS	86B/1005/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 14-7: Detail specification for fibre optic connector type SC-APC 9° tuned terminated to single-mode fibre type B1

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

DETAIL SPECIFICATION IEC QC 910004XX0007.

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/APC

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, 3 and 4
– 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)	

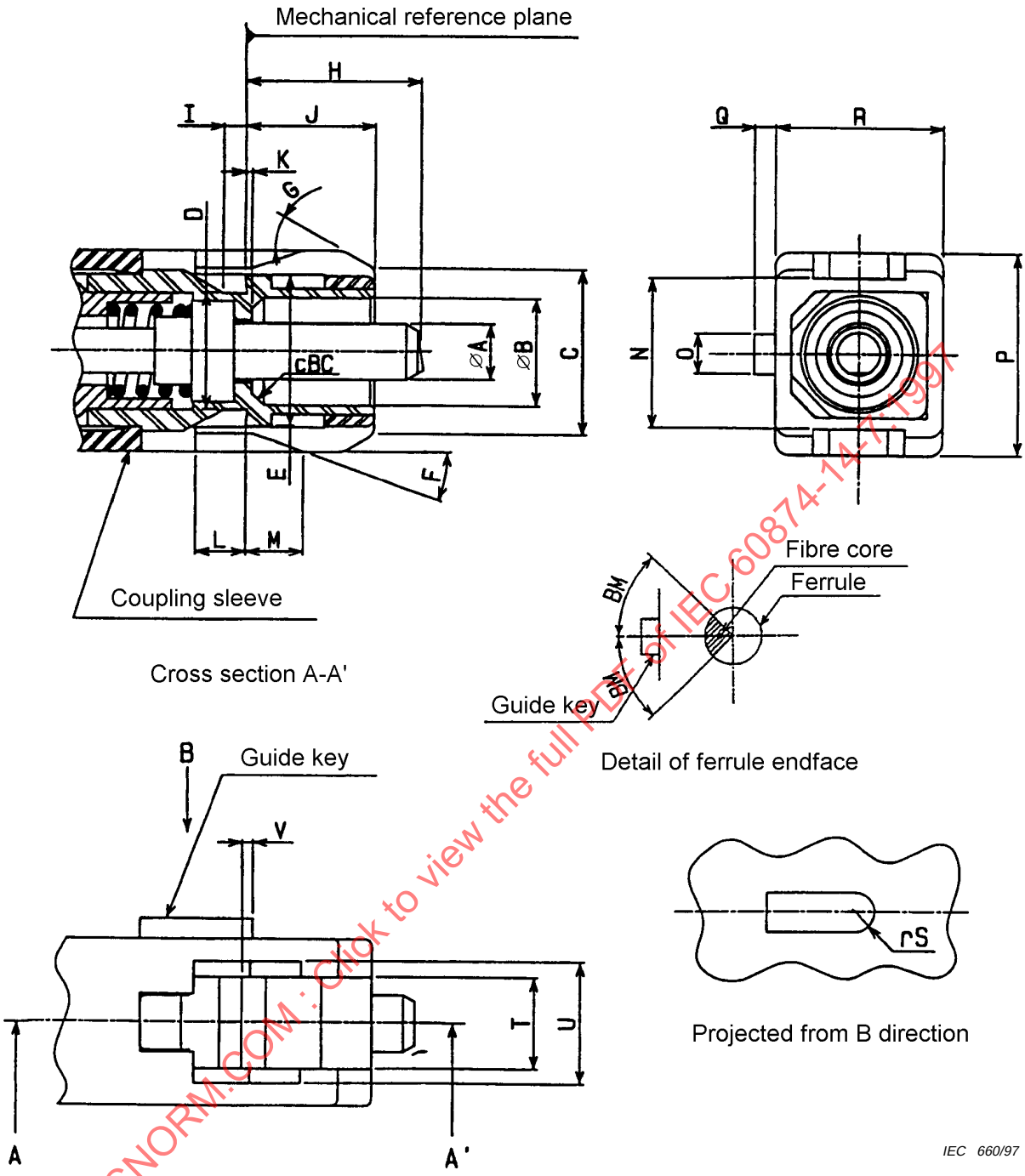


Figure 1 – Plug mating face dimensions

Reference	Dimensions			Notes
	Minimum	Nominal	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 indicates that the position of the inside bottom plane is left-direction relative to the mechanical reference plane.

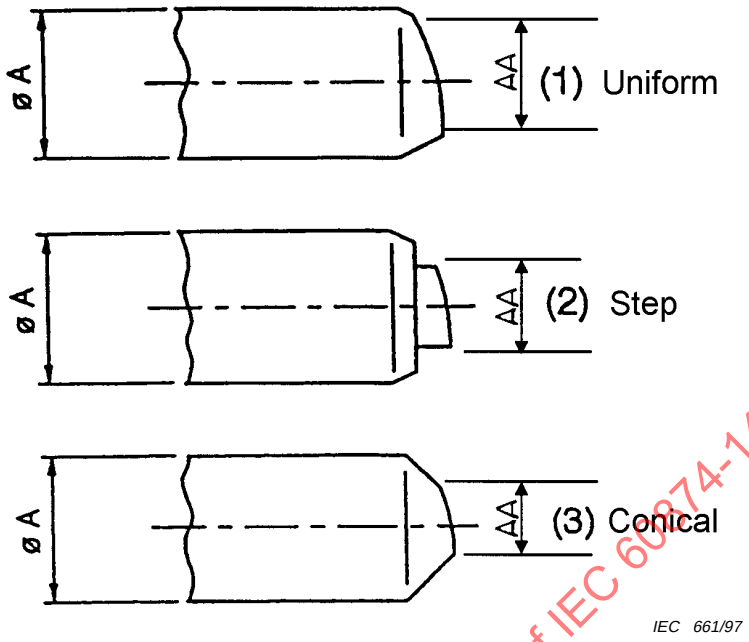
4 The dimension “BM” means the adjusting angle of the core centre to the ferrule centre relative to the key direction. These dimensions shall be measured according to IEC 61300-2-41.

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.

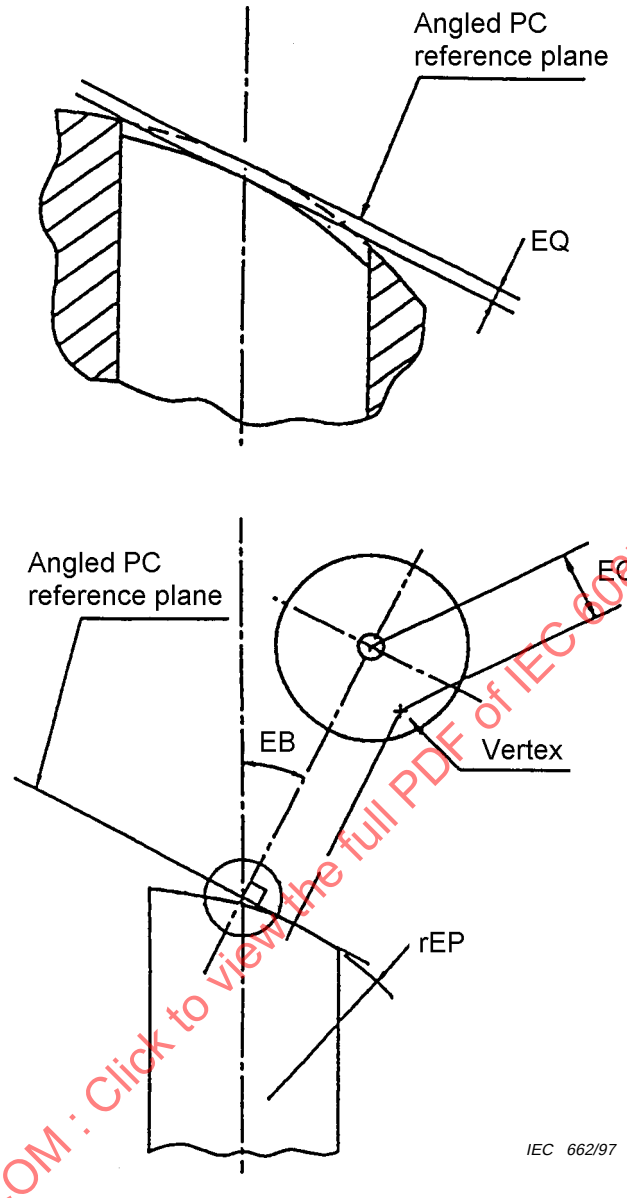
7 Where perpendicular features (features shown at right angles) have no geometric tolerance of orientation or run out specified, the limits of the dimensions for a feature control the orientation tolerance as well as the size.

Figure 1 – Plug mating face dimensions



Reference	Dimensions mm		Notes
	Minimum	Maximum	
AA	0,80	1,70	diameter

Figure 2 – Ferrule endface radius and typical shape



Reference	Dimensions			Notes
	Minimum	Nominal	Maximum	
EB		9°		1
EO	0 mm		0,050 mm	2
rEP	5 mm		12 mm	3
EQ	–0,0001 mm		0,0001 mm	4

NOTES

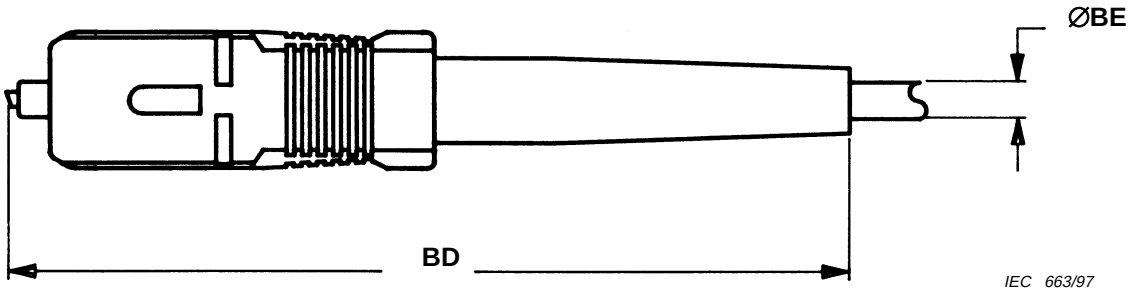
1 When used with 1 300 nm zero dispersion single-mode fibre this range of endface angle will ensure return loss of greater than 65 dB at wavelengths of 1 310 nm or 1 550 nm even when the connector is unmated. However, when applied to dispersion shifted fibre lesser return loss values in the unmated condition will be seen.

2 The dome eccentricity EO is defined as a distance between the ferrule centre and the vertex of the spherically polished endface relative to the angled reference plane. This dimension shall be measured in both extreme positions when the ferrule is rotated in the connector.

3 The radius shall be measured over a diameter of 0,25 mm.

4 The negative dimension refers to the fibre protrusion. The dimension shall be measured according to IEC 61300-3-23.

Figure 3 – Ferrule endface geometry after termination



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 number –1001.

2 This value is applicable to the variant number –1002.

3 This value is applicable to the variant number –1003.

4 This value is applicable to the variant number –1004.

Figure 4 – Plug dimension

VARIANT IDENTIFICATION NUMBERS Number: QC 910X01/0006-ZZZZ			
ZZZZ	Component name	Variant feature	
		Applicable cable jacket diameter	Ferrule material
1001	Plug	2,0 mm	Zirconia
1002	Plug	2,4 mm	Zirconia
1003	Plug	2,7 mm	Zirconia
1004	Plug	3,0 mm	Zirconia

SUPPLEMENTARY INFORMATION

Colour:

Colour of the coupling sleeve shall be green according to: RAL 6029

Colour of the coupling boot shall be green according to: RAL 6018

Component marking:

The name and/or manufacturer's identification mark may be permanently identified. Figure 5 shows an example of the location of the component marking.

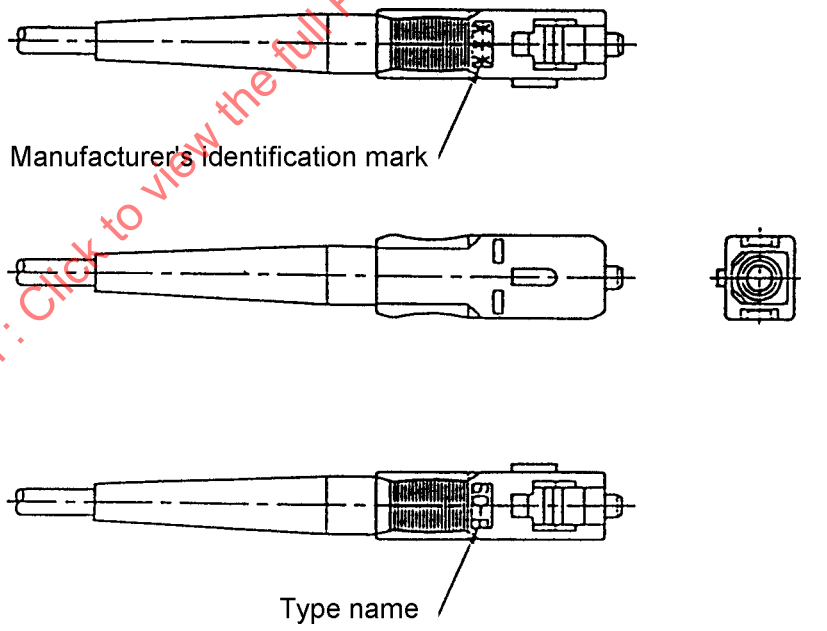


Figure 5 – Example of component marking

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	(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 a 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 a relevant group at random.

TABLE 3

PERIODIC QUALITY CONFORMANCE INSPECTION SCHEDULE
GROUPS C AND D

Test sequence	Reference 60874-1 (IEC 61300)	Assessment level A	
		n	*p*
Group C0 – Visual examination – Dimensions – Ferrule compression force	 4.4.1 (3-1) 4.4.2 (3-1) (3-22)	18	24
Group C1 – Attenuation – Return loss	 4.4.7 (3-4) 4.4.12 (3-6)	18	24
Group C2 – Cold – Dry heat – Damp heat (steady state)	 4.5.17 (2-17) 4.5.18 (2-18) 4.5.19 (2-19)	6	24
Group D0 – Visual examination – Dimensions – Ferrule compression force	 4.4.1 (3-1) 4.4.2 (3-1) (3-22)	20	48
Group D1 – Attenuation – Return loss	 4.4.7 (3-4) 4.4.12 (3-6)	20	48
Group D2 – Cold – Dry heat – Damp heat (steady state)	 4.5.17 (2-17) 4.5.18 (2-18) 4.5.19 (2-19)	6	48
Group D3 – Drop – Engagement and separation force – Mechanical endurance	 4.5.14 (2-12) 4.4.5 (3-11) 4.5.2 (2-2)	6	48
Group D4 – Vibration – Change of temperature (test Nb)	 4.5.1 (2-1) 4.5.22 (2-22)	4	48
Group D5 – Strength of coupling mechanism – Cable pulling – Cable torsion	 4.5.6 (2-6) 4.5.4 (2-4) 4.5.5 (2-5)	4	48
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 a 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 procedures: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: none

Requirements:

– Allowable return loss: more than 55 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.
– 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
– Preconditioning procedures: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: after tests, specimens shall be maintained at room temperature condition for 2 h. Clean ferrule endface and inside of alignment sleeve using lint free material

Initial measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Return loss: more than 55 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 55 dB

Final measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 55 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
– 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
– Preconditioning procedures: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: after tests, specimens shall be maintained at room temperature condition for 2 h. Clean ferrule endface and inside of alignment sleeve using lint free material

Initial measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Return loss: more than 55 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 55 dB

Final measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 55 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
– 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
– Preconditioning procedures: clean ferrule endface and inside of alignment sleeve using lint free material
– Recovery procedure: after tests, specimens shall be maintained at room temperature condition for 2 h. Clean ferrule endface and inside of alignment sleeve using lint free material

Initial measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Return loss: more than 55 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 55 dB

Final measurements and performance requirements:

– Attenuation: less than 0,60 dB
– Change in attenuation: less than 0,2 dB
– Return loss: more than 55 dB

(continued)