

INTERNATIONAL STANDARD

IEC
60874-14-9

QC 910004XX0009

First edition
1999-09

Connectors for optical fibres and cables –

Part 14-9:

Fibre optic connector type SC-APC tuned 8° terminated on single mode fibre type B1 – Detail specification

Connecteurs pour câbles et fibres optiques –

Partie 14-9:

*Connecteur pour fibres optiques de type SC-APC 8° (réglé)
terminé sur une fibre monomodale de type B1 –
Spécification particulière*



Reference number
IEC 60874-14-9:1999(E)

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For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary (IEV)*.

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

* See web site address on title page.

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Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CONNECTORS FOR OPTICAL FIBRES AND CABLES –
Part 14-9: Fibre optic connector type SC-APC tuned 8°
terminated on single mode fibre type B1 –
Detail specification**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60874-14-9 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/1223/FDIS	86B/1259/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.

This publication has not been drafted in complete accordance with the ISO/IEC Directives, Part 3.

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.

The committee has decided that the contents of this publication will remain unchanged until 2012. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this standard may be issued at a later date.

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CONNECTORS FOR OPTICAL FIBRES AND CABLES

Part 14-9: Fibre optic connector type SC-APC tuned 8° terminated on single mode fibre type B1 – Detail specification

NATIONAL STANDARDS ORGANIZATION:

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Date

DETAIL SPECIFICATION IEC QC 910004XX0009
 FIBRE OPTIC COMPONENT OF ASSESSED QUALITY IN ACCORDANCE WITH

- GENERIC SPECIFICATION: QC 910000 (IEC 60874-1)
- BLANK DETAIL SPECIFICATION: QC 910004 (IEC 60874-1-1)

CONNECTOR SET FOR OPTICAL FIBRES AND CABLES

CLASSIFICATION:

Type: Name: SC/APC 8° angle (tuned)
 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 10

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
Buffer diameter	(250 ± 15) µm, (500 ± 30) µm, (900 ± 50) µm
Jacket outer diameter	As required per variant
Fibre cut-off wavelength	1 100 nm – 1 280 nm

Additional information

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

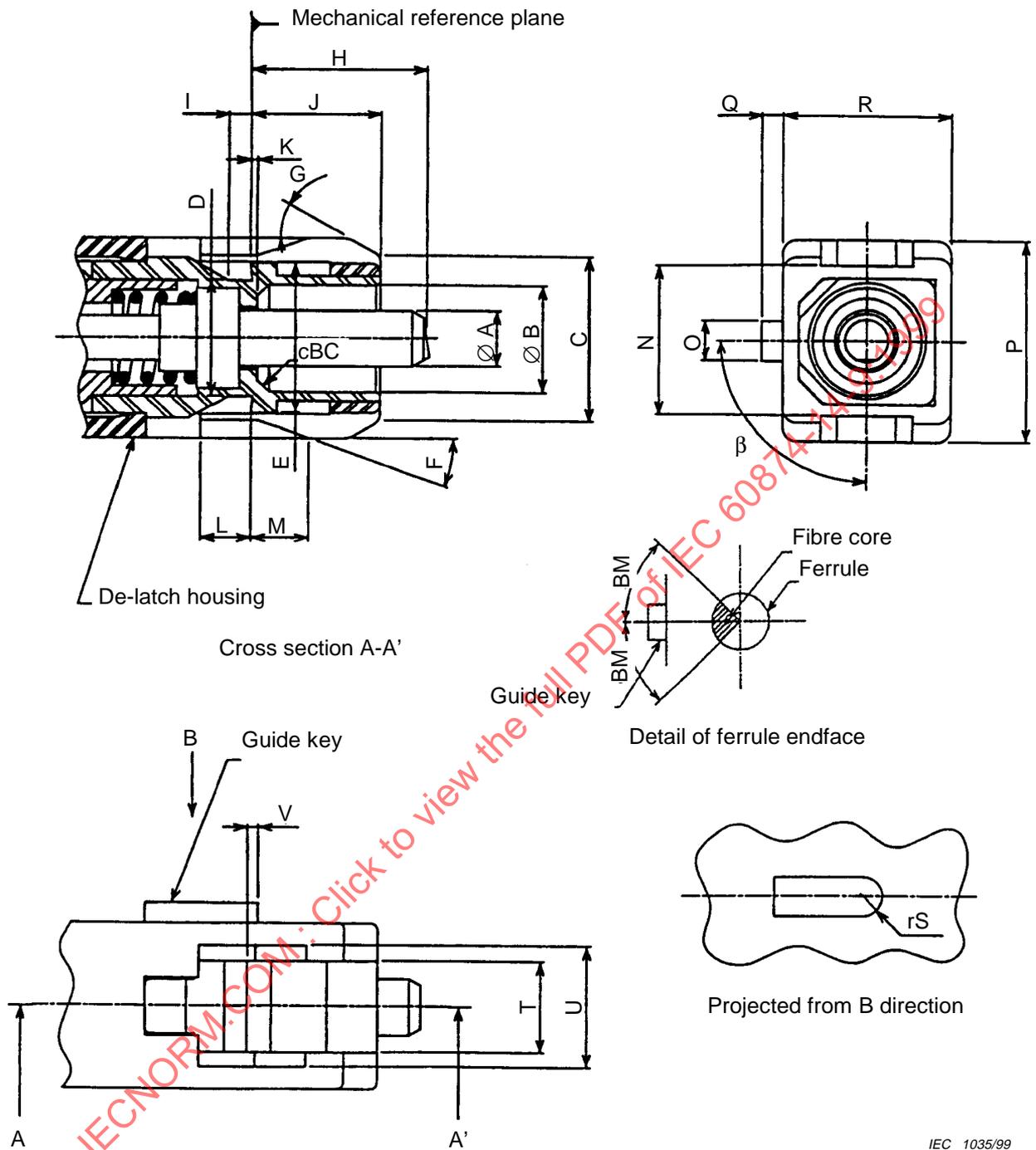


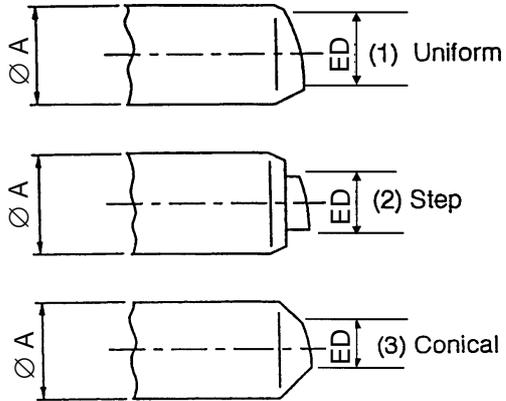
Figure 1 – Plug mating face dimensions

Reference	Dimensions		Notes
	Minimum	Maximum	
A	2,4985 mm	2,4995 mm	
B	4,80 mm	4,90 mm	
C	6,80 mm	7,40 mm	
D	4,90 mm	5,30 mm	
E	6,70 mm	6,80 mm	
F	19°	23°	
G	25°	35°	
H	7,15 mm	7,50 mm	1, 2
I	0,80 mm	1,20 mm	
J	5,30 mm	5,50 mm	
K	- 0,10 mm	0,05 mm	
L	2,11 mm	2,50 mm	
M	2,00 mm	2,80 mm	
N	6,60 mm	6,80 mm	
O	1,60 mm	1,80 mm	
P	8,89 mm	8,99 mm	
Q	0,80 mm	1,00 mm	
R	7,29 mm	7,39 mm	
rS	0,80 mm	0,90 mm	Radius
T	4,05 mm	4,15 mm	
U	5,40 mm	5,60 mm	
V	0 mm	0,50 mm	
cBC	0 mm	0,50 mm	Chamfer
BM	0 mm	45°	6

NOTES

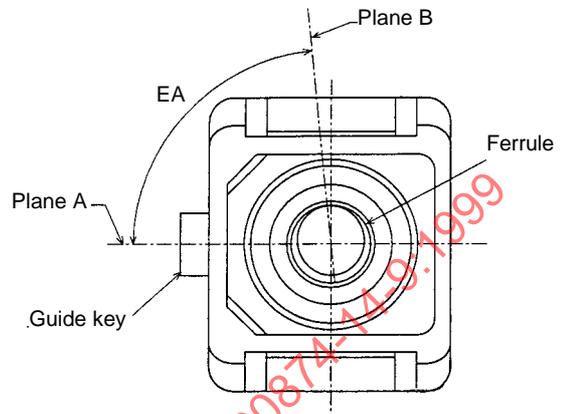
- Ferrule compression force shall be from 7,8 N to 11,8 N, when the ferrule is compressed to a point where H is 7 mm ± 0,1 mm.
- This value shows the dimension after the ferrule is polished and in the unmated condition.
- Where a tolerance of form is not specified, the limits of the dimensions for a feature control the form as well as the size.
- 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.
- 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.
- The dimension "BM" means the adjusting angle of the core centre ferrule centre relative to the keying direction. These dimensions shall be measured according to IEC 61300-2-41.

Figure 1 – Plug mating face dimensions (concluded)



IEC 1036/99

Figure 2a – Expanded view of ferrule endface



IEC 1037/99

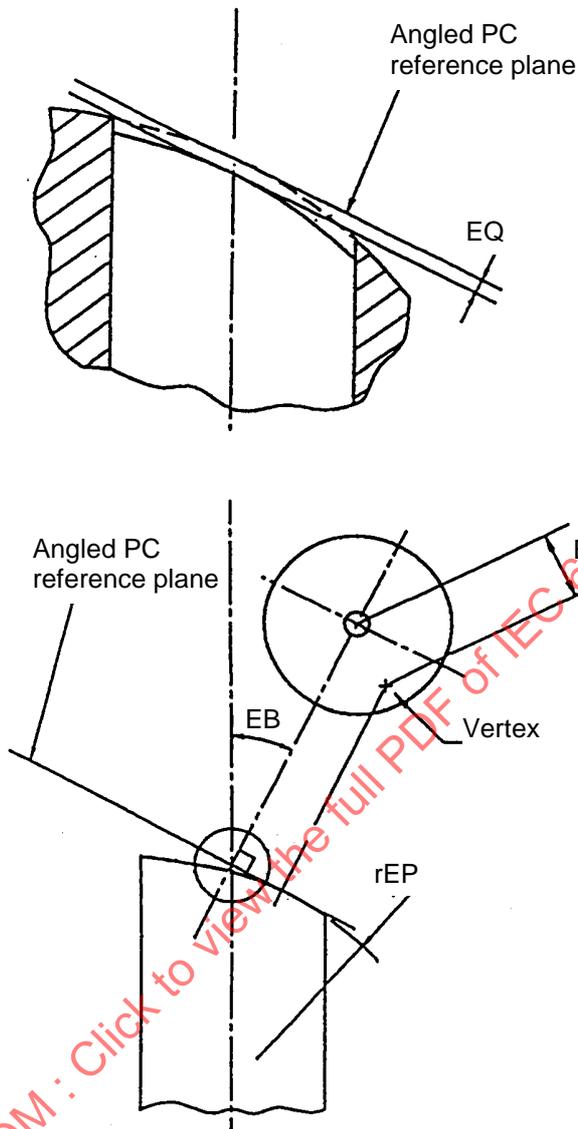
Figure 2b – Expanded view from C direction

Reference	Dimensions mm			Notes
	Minimum	Nominal	Maximum	
EA		90°		1
ED	0,80		1,70	Diameter, 2

NOTES

- The dimension EA is defined as an angle between two planes: one plane, plane A, through the axis of the ferrule and the axis of symmetry of the guide key. The other plane, plane B, passes through the axis of the ferrule and the normal to the angle PC reference plane.
- The shape of the ferrule end shall be one of shape (1), (2) or (3).

Figure 2 – Ferrule endface radius and typical shape



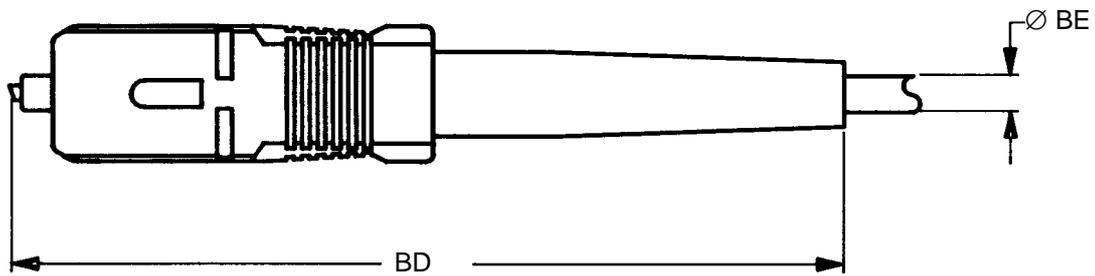
IEC 1038/99

Reference	Dimension			Notes
	Minimum	Nominal	Maximum	
EB		8°		1
EO	0 mm		0,05 mm	2
rEP	5,00 mm		12,00 mm	3, radius
EQ	-0,0001 mm		0,0001 mm	3 and 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 55 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 PC reference plane. This dimension shall be measured in both extreme positions when the ferrule is rotated in the connector.
- 3 The radius and fibre undercut shall be measured in all directions over a diameter of 0,25 mm. The minimum as well as the maximum value shall be within specified limits.
- 4 The negative dimension refers to the fibre protrusion.

Figure 3 – Ferrule endface geometry after termination



IEC 1039/99

Reference	Dimension mm			Notes
	Minimum	Nominal	Maximum	
BD			60	
BE	2,20			1
BE	2,60			2
BE	2,90			3
BE	3,20			4

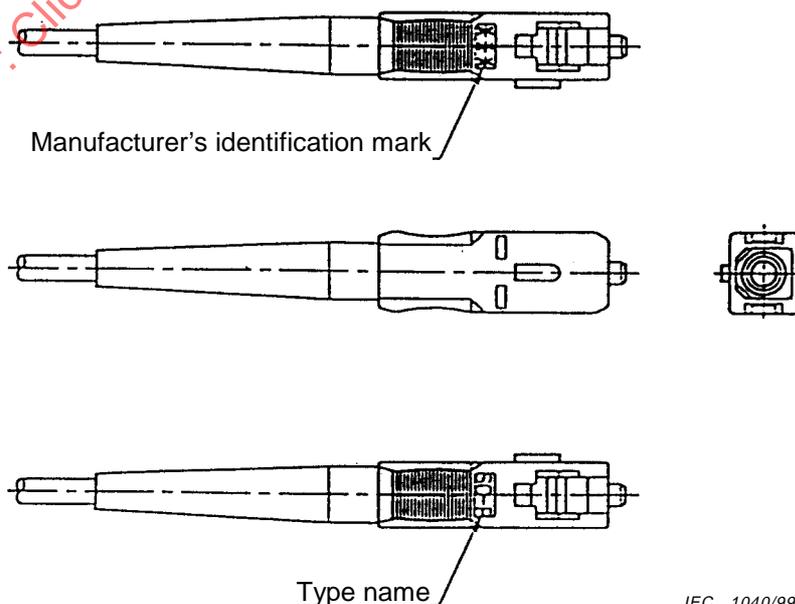
NOTES

- 1 This value is applicable to the variant number 1001 and 1002.
- 2 This value is applicable to the variant number 1003 and 1004.
- 3 This value is applicable to the variant number 1005 and 1006.
- 4 This value is applicable to the variant number 1007 and 1008.

Figure 4 – Plug dimension

VARIANT IDENTIFICATION NUMBERS			
NUMBER: XXXXXXXXXXXXXXX			
ZZZZ	Component name	Variant feature	
		Applicable cable jacket diameter mm	Ferrule material
1001	Plug	2,00	Zirconia
1002	Plug	2,00	Metal
1003	Plug	2,40	Zirconia
1004	Plug	2,40	Metal
1005	Plug	2,70	Zirconia
1006	Plug	2,70	Metal
1007	Plug	3,00	Zirconia
1008	Plug	3,00	Metal
SUPPLEMENTARY INFORMATION			
Colour:			
Colour of the de-latch housing shall be green according to RAL 6029			
Colour of the 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.			

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IEC 1040/99

Figure 5 – Example of component marking

TABLE 1
FIXED SAMPLE TEST SCHEDULE FOR QUALIFICATION APPROVAL

Test sequence	Reference IEC QC 910000 (IEC 60874-1) (IEC 61300)	<i>n</i>
Group 0 – Visual examination – Dimensions – Ferrule compression	4.4.1 (3-1) 4.4.2 (3-1) (3-22)	20
Group 1 – Attenuation – Return loss	4.4.7 (3-4) 4.4.12 (3-6)	20
Group 2 – Cold – Dry heat – Damp heat (steady state)	4.5.17 (2-17) 4.5.18 (2-18) 4.5.19 (2-19)	6
Group 3 – Drop – Engagement and separation force – Mechanical endurance	4.5.14 (2-12) 4.4.5 (3-11) 4.5.32 (2-2)	6
Group 4 – Vibration – Change of temperature (test Nb)	4.5.1 (2-1) 4.5.22 (2-22)	4
Group 5 – Strength of coupling mechanism – Cable pulling – Cable torsion	4.5.6 (2-6) 4.5.4 (2-4) 4.5.5 (2-5)	4
Group 6 – Fibre or ferrule retention	4.5.2 (2-4)	NA
<p>NOTES</p> <p>1 <i>n</i> = sample size (number of plugs).</p> <p>2 To satisfy the qualification approval requirements of the detail specification, there shall be no failures 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.</p> <p>A fully documented test report and supporting data shall be prepared and made available for inspection. Failures and the corrective action taken to eliminate failures shall be documented and evidence 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 necessitate a repeat of the full qualification programme.</p> <p>3 Unless otherwise indicated, the test details, measurements and performance requirements are given in table 4.</p> <p>4 Only group 1 test shall be carried out using a reference connector. All other tests shall be carried out using the samples from the relevant group at random.</p>		

TABLE 2 LOT-BY-LOT QUALITY CONFORMANCE INSPECTION SCHEDULE GROUPS A AND B			
Test sequence	Reference IEC 60874-1 (IEC QC 910000) (IEC 61300)	Assessment level A	
		IL	AQL
Group A – Visual examination	4.4.1 (3-1)	II	4 %
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 attenuation and return loss 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.			

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TABLE 3
PERIODIC QUALITY CONFORMANCE INSPECTION SCHEDULE
GROUPS C AND D

Test sequence	Reference IEC QC 910000 (IEC 61300)	Assessment level A	
		<i>n</i>	<i>p</i>
Group C0 – Visual examination – Dimensions – Ferrule compression	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	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 must 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 made available for inspection. Failures and the corrective action taken to eliminate failures must be documented and evidence must 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 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
<p>Visual examination 4.4.1 (61300-3-1)</p> <p>Requirements:</p> <ul style="list-style-type: none"> – Marking shall be clear – De-latch housing shall be movable smoothly
<p>Dimensions 4.4.2 (61300-3-1)</p> <p>Requirements:</p> <ul style="list-style-type: none"> – All size dimensions shall be in accordance with this specification
<p>Attenuation 4.4.7 (61300-3-4)</p> <p>Details:</p> <ul style="list-style-type: none"> – Method No. 7 – Definitions of reference plug are as follows: <ul style="list-style-type: none"> – 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 and or 1,55 µm – Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint-free cloth – Recovery procedure: none <p>Requirements:</p> <ul style="list-style-type: none"> – Allowable attenuation: less than 0,5 dB against reference plug using reference adaptor
<p>Return loss 4.4.12 (61300-3-6)</p> <p>Details:</p> <ul style="list-style-type: none"> – Method No. 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 cloth – Recovery procedure: none <p>Requirements:</p> <ul style="list-style-type: none"> – Allowable return loss: more than 55 dB against reference plug using reference adaptor, with a maximum length of 2 m. Measurement equipment shall be compensated for the Rayleigh backscatter of the fibre in the reference lead.

TABLE 4 (continued)
DETAILS, MEASUREMENTS AND PERFORMANCE REQUIREMENTS
<p>Cold 4.5.17 (61300-2-17)</p> <p>Details:</p> <ul style="list-style-type: none"> – 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 °C/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 61300-3-30 – Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint-free cloth – Recovery procedure: after test, specimens shall be maintained in room temperature conditions for 2 h – Clean ferrule endface and inside of alignment sleeve using lint-free cloth <p>Requirements:</p> <ul style="list-style-type: none"> – Change in attenuation during test: less than 0,2 dB – Return loss during test: more than 55 dB
<p>Dry heat 4.5.18 (61300-2-18)</p> <p>Details:</p> <ul style="list-style-type: none"> – 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 °C/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 61300-3-30 – Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint-free cloth – Recovery procedure: after test, specimens shall be maintained in room temperature conditions for 2 h – Clean ferrule endface and inside of alignment sleeve using lint-free cloth <p>Requirements:</p> <ul style="list-style-type: none"> – Change in attenuation during test: less than 0,2 dB – Return loss during test: more than 55 dB
<p>Damp heat (steady state) 4.5.19 (61300-2-19)</p> <p>Details:</p> <ul style="list-style-type: none"> – Temperature: 40 °C – Relative humidity: 90 % – 95 % – Duration: 4 days – 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 °C/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 61300-3-30 – Preconditioning procedure: clean ferrule endface and inside of alignment sleeve using lint-free cloth – Recovery procedure: after test, specimens shall be maintained in room temperature conditions for 2 h – Clean ferrule endface and inside of alignment sleeve using lint-free cloth before final measurement <p>Requirements:</p> <ul style="list-style-type: none"> – Change in attenuation during test: less than 0,2 dB – Return loss during test: more than 55 dB