INTERNATIONAL STANDARD

# IEC 60874-10-1

QC 910003XX0001

First edition
1997-06



## Connectors for optical fibres and cables –

## Part 10-1:
## Detail specification for fibre optic connector type BFOC/2,5 terminated to multimode fibre type A1

Reference number
IEC 60874-10-1: 1997(E)

## Validité de la présente publication

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- **Bulletin de la CEI**
- **Annuaire de la CEI**
  Publié annuellement
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  Publié annuellement et mis à jour régulièrement

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– la CEI 60027: *Symboles littéraux à utiliser en électrotechnique;*

– la CEI 60417: *Symboles graphiques utilisables sur le matériel. Index, relevé et compilation des feuilles individuelles;*

– la CEI 60617: *Symboles graphiques pour schémas;*

et pour les appareils électromédicaux,

– la CEI 60878: *Symboles graphiques pour équipements électriques en pratique médicale.*

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- **IEC Bulletin**
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  Published yearly
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## Terminology

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary* (IEV), which is issued in the form of separate chapters each dealing with a specific field. Full details of the IEV will be supplied on request. See also the IEC Multilingual Dictionary.

The terms and definitions contained in the present publi-cation have either been taken from the IEV or have been specifically approved for the purpose of this publication.

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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;*

– 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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International Electrotechnical Commission
Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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# CONNECTORS FOR OPTICAL FIBRES AND CABLES –

# Part 10-1: Detail specification for fibre optic connector type BFOC/2,5 terminated to multimode fibre type A1

## 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 60874-10-1 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/868/FDIS | 86B/998/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 10-1: Detail specification for fibre optic connector type BFOC/2,5 terminated to multimode fibre type A1**

| NATIONAL STANDARDS ORGANIZATION: | ..... Date: ..... |
|---|---|

DETAIL SPECIFICATION IEC QC 910003XX0001.
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: BFOC/2.5
Configuration: plug-adaptor-plug
Coupling: bayonet
Control dimensions:
– Plug: see figures 1, 2 and 3
– Adaptor: see IEC 60874-10-3
Arrangement: patchcord arrangement

Style: Fibre retention: as required
Cable retention: as required
Optical coupling: butting

Variants: see page 7

Climatic category: 10/60/4

Environmental category: 4

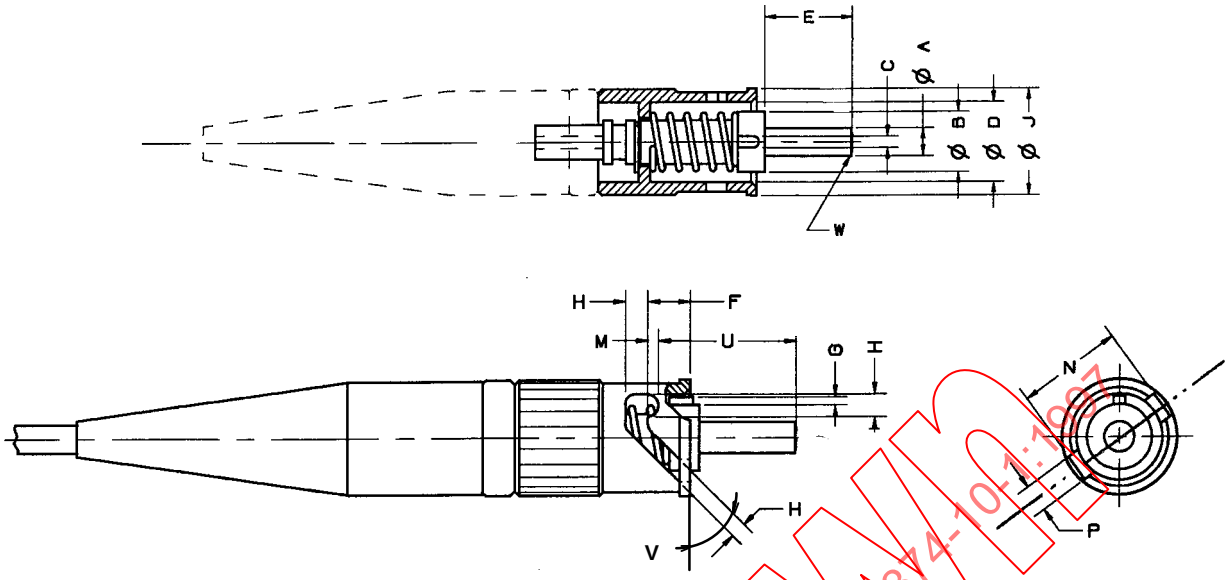
Assessment level: A

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 | |
|---|---|
| Core 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 |

Additional information
– Attenuation in random connection;
• less than 0,75 dB (95 % probability)
• less than 0,35 dB (average)




IEC 664/97

| Reference | Dimensions | | |
|---|---|---|---|
| | Minimum | Maximum | Notes |
| A | 2,494 mm | 2,500 mm | |
| B | 5,25 mm | 5,46 mm | |
| C | 0,91 mm | 1,07 mm | |
| D | 7,06 mm | 7,24 mm | |
| E | 7,75 mm | 8,00 mm | |
| F | 2,56 mm | 4,50 mm | |
| G | 0,58 mm | 0,76 mm | |
| H | 1,60 mm | 3,2 mm | |
| J | 9,40 mm | 9,65 mm | |
| K | 0,60 mm | 0,89 mm | |
| M | 0,58 mm | 1,12 mm | |
| N | 3,56 mm | | |
| P | 1,60 mm | 3,2 mm | |
| U | 9,54 mm | 11,11 mm | 1 |
| V | 37° | 90° | |

NOTES

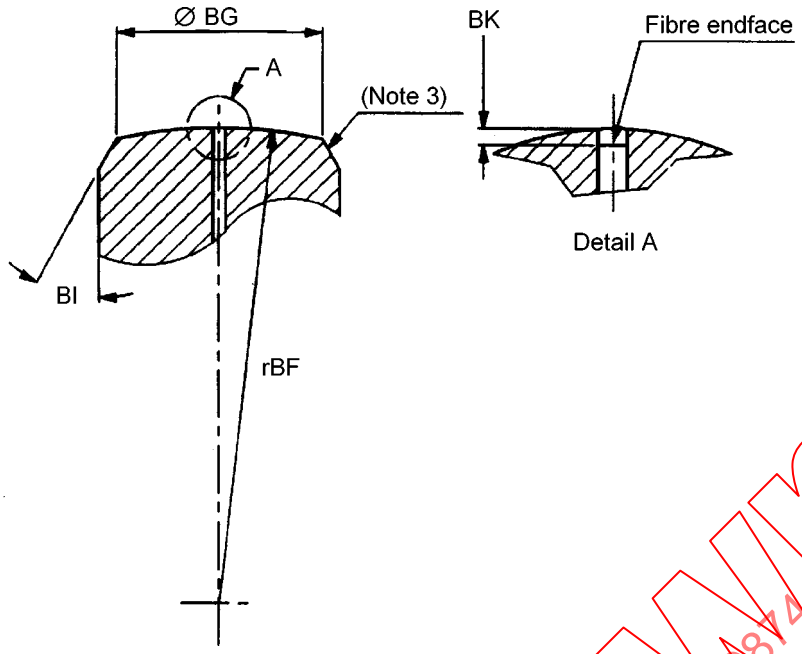
1 Ferrule compression forces shall be from 7,0 N to 15 N when the ferrule is compressed to a point where U is in the range specified.

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

3 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.

4 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 outline and mating face dimensions**




IEC 648/97

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

NOTES

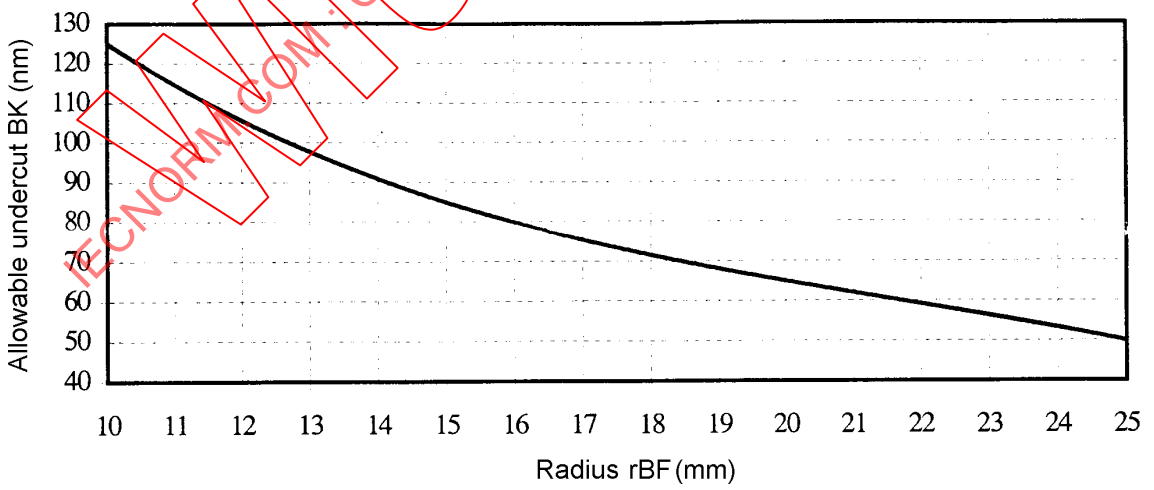
1 Eccentricity of a spherical polished ferrule endface is less than 50 µm.

2 The negative dimension refers to the fibre protrusion.

3 Break edge.

4 Dimension BK should be measured according to IEC 61300-3-23.

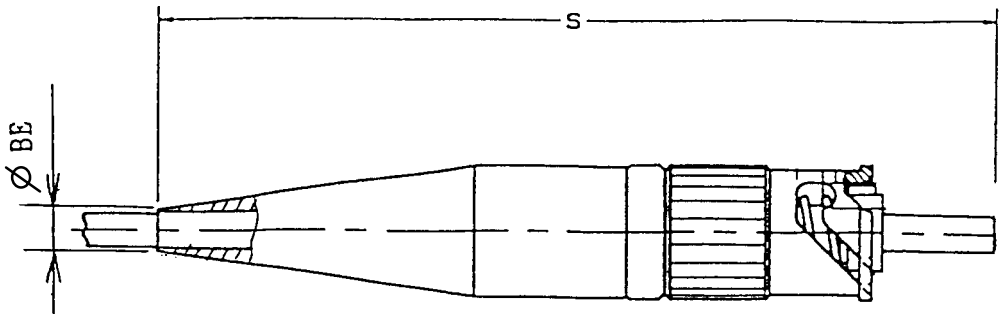
**Figure 2a – Ferrule endface geometry after termination**




IEC 649/97

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

**Figure 2b – Allowable undercut BK versus radius rBF**




IEC 665/97

| Reference | Dimensions mm | | Notes |
|---|---|---|---|
| | Minimum | Maximum | |
| S | | 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 3 – Plug dimension**

| VARIANT IDENTIFICATION NUMBERS<br>Number: QC 910X01/0004-ZZZZ | | | |
|---|---|---|---|
| ZZZZ | Component name | Variant feature | |
| | | Applicable cable jacket diameter | Ferrule material |
| 1001 | Plug | 2,0 mm | Ceramic |
| 1002 | Plug | 2,4 mm | Ceramic |
| 1003 | Plug | 2,7 mm | Ceramic |
| 1004 | Plug | 3,0 mm | Ceramic |

| SUPPLEMENTARY INFORMATION |
|---|
| Component marking: |
| The name and manufacturer's identification mark shall be permanently identified. |

**TABLE 1**

**FIXED SAMPLE TEST SCHEDULE FOR QUALIFICATION APPROVAL**

| Test sequence | Reference IEC 60874-1 (IEC 61300) | *n* |
|---|---|---|
| Group 0<br>– Visual examination<br>– Dimensions | <br>4.4.1 (3-1)<br>4.4.2 (3-1) | 20 |
| Group 1<br>– Attenuation<br>– Ferrule compression force | <br>4.4.7 (3-4)<br>(3-22) | 20 |
| Group 2<br>– Cold<br>– Dry heat<br>– Damp heat (steady state) | <br>4.5.17 (2-17)<br>4.5.18 (2-18)<br>4.5.19 (2-19) | 6 |
| Group 3<br>– Drop<br>– Engagement and separation force<br>– Mechanical endurance | <br>4.5.14 (2-12)<br>4.4.5 (3-11)<br>4.5.32 (2-2) | 6 |
| Group 4<br>– Vibration<br>– Change of temperature (test Nb) | <br>4.5.1 (2-1)<br>4.5.22 (2-22) | 4 |
| Group 5<br>– Strength of coupling mechanism<br>– Cable pulling<br>– Cable torsion | <br>4.5.6 (2-6)<br>4.5.4 (2-4)<br>4.5.5 (2-5) | 4 |
| Group 6<br>– Fibre or ferrule retention | <br>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<br>– Visual examination<br>Radius<br>Undercut/protrusion<br>Eccentricity of spherical polished endface | 4.4.1 (3-1)<br>4.4.2 (3-1)<br>(3-23)<br>(3-25) | II | 4 % |
| Group B<br>– Attenuation | 4.4.7 (3-4) | 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 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<br>– Visual examination<br>– Dimension<br>– Ferrule compression force | 4.4.1 (3-1)<br>4.4.2 (3-1)<br>(3-22) | 18 | 24 |
| Group C1<br>– Attenuation | 4.4.7 (3-4) | 18 | 24 |
| Group C2<br>– Cold<br>– Dry heat<br>– Damp heat, steady state | 4.5.17 (2-17)<br>4.5.18 (2-18)<br>4.5.19 (2-19) | 6 | 24 |
| Group D0<br>– Visual examination<br>– Dimensions<br>– Ferrule compression force | 4.4.1 (3-1)<br>4.4.2 (3-1)<br>(3-22) | 20 | 48 |
| Group D1<br>– Attenuation | 4.4.7 (3-4) | 20 | 48 |
| Group D2<br>– Cold<br>– Dry heat<br>– Damp heat, steady state | 4.5.17 (2-17)<br>4.5.18 (2-18)<br>4.5.19 (2-19) | 6 | 48 |
| Group D3<br>– Drop<br>– Engagement and separation force<br>– Mechanical endurance | 4.5.14 (2-12)<br>4.4.5 (3-11)<br>4.5.2 (2-2) | 6 | 48 |
| Group D4<br>– Vibration<br>– Change of temperature (test Nb) | 4.5.1 (2-1)<br>4.5.22 (2-22) | 4 | 48 |
| Group D5<br>– Strength of coupling mechanism<br>– Cable pulling<br>– Cable torsion | 4.5.6 (2-6)<br>4.5.4 (2-4)<br>4.5.5 (2-5) | 4 | 48 |
| Group D6<br>– Fibre or ferrule retention | 4.5.2 (2-4) | NA | NA |

NOTES

1 *n* = sample size (number of plugs), *p* = periodicity in months.

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.

3 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.

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

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)
(61300-3-15)
(61300-3-18)

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 plugs are as follows:
  • Ferrule outer diameter is 2,489 ± 0,0005 mm.
  • Concentricity of the fibre core with the outer diameter of the ferrule is less than 1 µm
  • Eccentricity of a spherical polished ferrule endface is less than 30 µm
– Adaptor shall be in accordance with IEC 60874-10-3
– Number of measurements to be averaged: 5
– Source: LED
– Equilibrium mode condition
– Peak wavelength: 1,3 µm
– Preconditioning procedure: the ferrule endface of the reference plug shall be cleaned using lint-free material

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

*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 60874-10-3
– Monitoring method of attenuation shall be in accordance with IEC 61300-3-20
– Change in attenuation during test: less than 0,2 dB

*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 60874-10-3
– Monitoring method of attenuation shall be in accordance with IEC 61300-3-20
– Change in attenuation during test: less than 0,2 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 60874-10-3
– Monitoring method of attenuation shall be in accordance with IEC 61300-3-20
– Change in attenuation during test: less than 0,2 dB

*(continued)*