IEC 61753-061-2

Edition 2.0 2020-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Performance standard –
Part 061-2: Single-mode fibre optic pigtailed style polarization independent isolators for category C – Controlled environments

Dispositifs d'interconnexion et composants passifs fibroniques – Norme de performance –
Partie 061-2: Isolateurs fibroniques à fibres unimodales munis de fibres amorces non connectorisées pour la catégorie C – Environnements contrôlés

IEC 61753-061-2:2020-04(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 33.180.10

ISBN 978-2-8322-8108-6

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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International Standard IEC 61753-061-2 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2012 and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) addition of the detail high optical power test procedures and the condition in Annex B;
b) change of test conditions harmonizing with IEC 61753-1:2018;
c) addition of category C^{HD};
d) addition of the detailed measurements conditions in Annex C;
e) change of clause structure accordance with the latest ISO/IEC Directives, Part 2.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
86B/4270/FDIS	86B/4284/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61753 series, published under the general title *Fibre optic interconnecting devices and passive components – Performance standard*, can be found on the IEC website.

Future standards will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 061-2: Single-mode fibre optic pigtailed style polarization independent isolators for category C – Controlled environments

1 Scope

This part of IEC 61753 contains the minimum test and measurement requirements and severities which a fibre optic isolator as specified by IEC 61202-1 satisfies in order to be categorized as meeting the requirements of isolators used in controlled environments as specified in IEC 61753-1. The requirements cover single-mode pigtailed style polarization independent isolators for category C used in controlled environments.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 60794-2-50, *Optical fibre cables – Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies*

IEC 61202-1, *Fibre optic interconnecting devices and passive components – Fibre optic isolators – Part 1: Generic specification*

IEC 61300-2-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*

IEC 61300-2-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre or cable retention*

IEC 61300-2-5, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion*

IEC 61300-2-9, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock*

IEC 61300-2-14, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-14: Tests – High optical power*

IEC 61300-2-17, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-17: Tests – Cold*

IEC 61300-2-18, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat – High temperature endurance*

IEC 61300-2-19, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

IEC 61300-2-22, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-2-42, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-42: Tests – Static side load for strain relief*

IEC 61300-2-44, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-44: Tests – Flexing of the strain relief of fibre optic devices*

IEC 61300-3-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examinations and measurements – Polarization dependence loss in a single-mode fibre optic device*

IEC 61300-3-3, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss*

IEC 61300-3-7, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-7: Examinations and measurements – Wavelength dependence of attenuation and return loss of single mode components*

IEC 61300-3-28, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-28: Examinations and measurements – Transient loss*

IEC 61300-3-32, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-32: Examinations and measurements – Polarization mode dispersion measurement for passive optical components*

IEC TS 62627-09, *Fibre optic interconnecting devices and passive components – Vocabulary for passive optical devices*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61202-1 and IEC TS 62627-09 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Test

All test methods are in accordance with a specific standard of the IEC 61300 series, of which parts applicable to this document are mentioned in 6.2 (see Table 2 and Table 3).

The samples shall be terminated onto single-mode fibres as per IEC 60793-2-50 category B-652.B, B-652.D or B-657 in either coated fibres (primary and secondary) or reinforced cable format as per IEC 60794-2-50.

Table 1 is intended to provide guidance on the wavelength ranges of the various spectral bands. It is not intended for specification. Values of operating wavelength used in performance verification shall be specified between the customer and supplier or shall be as defined in the manufacturer's specification.

Table 1 – Single-mode spectral bands

Band	Descriptor	Range nm
O-band	Original	1 260 to 1 360
E-band	Extended	1 360 to 1 460
S-band	Short wavelength	1 460 to 1 530
C-band	Conventional	1 530 to 1 565
L-band	Long wavelength	1 565 to 1 625
U-band	Ultralong wavelength	1 625 to 1 675
Source: ITU-T G.Supplement 39.		

5 Test report

Fully documented test reports and supporting evidence shall be prepared and be available for inspections as evidence that the tests have been carried out and complied with.

6 Performance requirements

6.1 Sample size

Sample sizes for the tests are defined in Annex A.

6.2 Test details and requirements

A minimum length of fibre or cable of 2,0 m per port shall be prepared for all tests.

Test details and requirements for category C and C^{HD} are shown in Table 2 and Table 3, respectively. An example of test details and requirements including detailed measurements conditions is shown in Annex C (informative).

Table 2 – Test details and requirements for category C

No	Tests	Requirements	Details	
1	Insertion loss (attenuation) IEC 61300-3-7 IEC 61300-3-2 Refer Table C.1, No.1.	≤ 0,7 dB (single stage) ≤ 0,8 dB (double stage)	Launch fibre length: Condition: Measurement uncertainty:	≥ 2,0 m Insertion loss (attenuation) shall be met over operating wavelength range and all state of polarization (SOP). ≤ 0,1 dB
2	Isolation IEC 61300-3-7 IEC 61300-3-2 Refer Table C.1, No.2.	≥ 20 dB (single stage) ≥ 40 dB (double stage)	Launch fibre length: Condition: Measurement uncertainty:	≥ 2,0 m Isolation shall be met over operating wavelength range and all SOP. ≤ 0,3 dB (single stage) ≤ 0,5 dB (double stage) NOTE IEC 61300-3-7 is the test method to measure the wavelength dependence of attenuation. However, it can apply to the measurement of isolation, because in the case of an isolator, isolation is the wavelength dependent attenuation measured in the opposite direction to test no. 1.
3	Return loss IEC 61300-3-7 Refer Table C.1, No.3.	≥ 55 dB	Launch fibre length: Condition: Measurement uncertainty:	≥ 2,0 m Return loss shall be met over operating wavelength range. ≤ 1 dB The port not under test shall be optically terminated to avoid unwanted reflections contributing to the measurement.
4	Polarization dependent loss PDL IEC 61300-3-2	≤ 0,10 dB (single stage) ≤ 0,15 dB (double stage)	Launch fibre length: Condition: Measurement uncertainty:	≥ 2,0 m PDL shall be met over operating wavelength range. ≤ 0,02 dB
5	Polarization mode dispersion PMD IEC 61300-3-32	≤ 0,20 ps (single stage) ≤ 0,10 ps (double stage)	Launch fibre length: Measurement uncertainty:	≥ 2,0 m ≤ 0,05 ps

No	Tests	Requirements	Details	
6	High optical power IEC 61300-2-14 IEC 61300-3-3 Refer Annex B.	Before and after the test, the limits of insertion loss (attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met. During the forward input test, the insertion loss (attenuation) change is monitored. During and after the test, the insertion loss change shall be within ±0,3 dB of the initial value. During the backward input test, the isolation change is monitored. The sum of the initial value and the change of the isolation shall be within the value defined at test no. 2. During the forward input test, the return loss change is monitored. The sum of the initial value and the change of the return loss shall be within the value defined at test no. 3. The insertion loss (attenuation), isolation and return loss shall be measured after launching an optical power of 300 mW simultaneously in both forward and backward directions. After the test, the insertion loss change shall be within ±0,3 dB of the initial value. After the test, the sum of the initial value and the change of the isolation shall be within the value defined at test no. 2. After the test, the sum of the initial value and the change of the return loss shall be within the value defined at test no. 3.	Test set-up and procedure:	Annex B
			Optical power:	300 mW
			SOP of the light source:	Average SOP (depolarized)
			Wavelength:	1 550 nm for C-band 1 580 nm for L-band NOTE A different wavelength is acceptable when there is a negotiation between customer and supplier.
			Duration of the optical power exposure:	30 min
			Temperature:	60 °C ± 2 °C
			Relative humidity:	93 % $^{+2}_{-3}$ RH
				NOTE This test condition focuses to standard optical isolators.
7	Cold IEC 61300-2-17	Before and after the test, the limits of insertion loss (attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met. The insertion loss change after the test shall be within ±0,3 dB of the initial value.	Temperature:	−10 °C ± 2 °C
			Duration of exposure:	96 h
8	Dry heat – High temperature endurance IEC 61300-2-18	Before and after the test, the limits of insertion loss (attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met. The insertion loss (attenuation) change after the test shall be within ±0,3 dB of the initial value.	Temperature:	+60 °C ± 2 °C
			Duration of exposure:	96 h
9	Damp heat (steady state) IEC 61300-2-19 IEC 61300-3-3 Refer Annex C	Before and after the test, the limits of insertion loss (attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met. During and after the test, the insertion loss (attenuation) change shall be within ±0,3 dB of the initial value.	Temperature:	+40°C ± 2 °C
			Relative humidity:	93 % $^{+2}_{-3}$ RH
			Duration of exposure:	96 h

No	Tests	Requirements	Details	
10	Change of temperature IEC 61300-2-22 IEC 61300-3-3 Refer Annex C	Before and after the test, the limits of insertion loss (attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met. During and after the test, the insertion loss (attenuation) change shall be within ±0,3 dB of the initial value. The sum of the initial value and the change of the isolation shall be within the value defined at test no. 2.	High temperature: Low temperature: Number of cycles: Duration at extreme temperature: Rate of change:	+60°C ± 2 °C −10°C ± 2 °C Cycles 5 60 min 1 °C /min
11	Vibration IEC 61300-2-1 IEC 61300-3-28 Refer Annex C	Before and after the test, the limits of insertion loss (attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met. During and after the test, the insertion loss (attenuation) change shall be within ±0,3 dB of the initial value.	Frequency range: Number of axes: Number of sweeps: Sweep rate: Amplitude:	10 Hz to 55 Hz 3 orthogonal axes 15 /axis 1 octave/min 0,75 mm
12	Shock IEC 61300-2-9	Before and after the test, the limits of insertion loss (attenuation) , isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met. The insertion loss change after the test shall be within ±0,3 dB of the initial value.	Acceleration: Duration: Number of axis: Number of shocks:	5 000 m/s^2 1 ms, half sine pulse 3 axes in 2 directions 2 shocks per axis, 12 shocks in total
13	Flexing of the strain relief of fibre optic devices IEC 61300-2-44	Before and after the test, the limits of insertion loss (attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met. The insertion loss (attenuation) change after the test shall be within ±0,3 dB of the initial value	Tensile force: Number of cycles: Angle:	2 N for reinforced cable 50 cycles ±90°
14	Fibre/cable retention IEC 61300-2-4	Before and after the test, the limits of insertion loss (attenuation), isolation and return loss of test no. 1, 2, 3 and 4 shall be met. During and after the test, insertion loss (attenuation) change shall be within ±0,3 dB of the initial value.	Magnitude and rate of application: Duration of the test:	10 N ± 1 N at 5 N/s for reinforced cables 5,0 N ± 0,5 N at 0,5 N/s for secondary coated fibres 2,0 N ± 0,2 N at 0,5 N/s for primary coated fibres 60 s
15	Static side load IEC 61300-2-42	Before and after the test, the limits of insertion loss (attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met. The insertion loss change after the test shall be within ±0,3 dB of the initial value.	Magnitude and duration of the tensile load: Direction of application:	1 N for 1 h for reinforced cable 0,2 N for 5 min for secondary coated fibres Two mutually perpendicular directions
16	Torsion IEC 61300-2-5	Before and after the test, the limits of insertion loss (attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met. The insertion loss (attenuation) change after the test shall be within ±0,3 dB of the initial value.	Magnitude of the torsion/twist: Angle and cycles: Test condition:	Load: 5 N for cables 2,0 N for primary coated and buffered fibres Angle: ±180° Number of cycles: 10 Fibre/cable clamping distance: 25 cm ± 5 cm

Table 3 – Test details and requirements for category C^{HD}

No	Tests	Requirements	Details	
1	Insertion loss (attenuation) IEC 61300-3-7 IEC 61300-3-2 Refer Table C.1, No.1.	≤ 0,7 dB (single stage) ≤ 0,8 dB (double stage)	Launch fibre length: Condition: Measurement uncertainty:	≥ 2,0 m Attenuation (insertion loss) shall be met over operating wavelength range and all state of polarization (SOP). ≤ 0,1 dB
2	Isolation IEC 61300-3-7 IEC 61300-3-2 Refer Table C.1, No.2.	≥ 20 dB (single stage) ≥ 40 dB (double stage)	Launch fibre length: Condition: Measurement uncertainty:	≥ 2,0 m Isolation shall be met over operating wavelength range and all SOP. ≤ 0,3 dB (single stage) ≤ 0,5 dB (double stage) NOTE IEC 61300-3-7 defines the method to measure insertion loss. However, it can apply to the measurement of isolation, because in the case of an isolator, isolation is the insertion loss measured in the opposite direction to test no. 1.
3	Return loss IEC 61300-3-7 Refer Table C.1, No.3.	≥ 55 dB	Launch fibre length: Condition: Measurement uncertainty:	≥ 2,0 m Return loss shall be met over operating wavelength range. ≤ 1 dB The port not under test shall be optically terminated to avoid unwanted reflections contributing to the measurement
4	Polarization dependent loss IEC 61300-3-2	≤ 0,10 dB (single stage) ≤ 0,15 dB (double stage)	Launch fibre length: Condition: Measurement uncertainty:	≥ 2,0 m PDL shall be met over operating wavelength range. ≤ 0,02 dB
5	Polarization mode dispersion IEC 61300-3-32	≤ 0,20 ps (single stage) ≤ 0,10 ps (double stage)	Launch fibre length: Measurement uncertainty:	≥ 2,0 m ≤ 0,05 ps