IEC 61753-061-2

Edition 2.0 2020-04
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

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

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

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC 61753-061-2

Edition 2.0 2020-04
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.10

ISBN 978-2-8322-8188-8

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 061-2: ~~Non-connectorized~~ 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 ~~should satisfy~~ 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 ~~non-connectorized~~ single-mode ~~fibre optic~~ 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~~:2008~~, *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~~[1]~~, *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*

~~[1] A new third edition is due to be published.~~

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 ~~connectors~~ 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~~:2008~~ category ~~B1.1, B1.3 or B6~~ 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 ~~[1]~~[2].		

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 ~~included in~~ prepared for all ~~climatic and environmental~~ 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).

~~2 Numbers in square brackets refer to the Bibliography~~

Table 2 – Test details and requirements

No	Tests	Requirements	Details	
1	Attenuation (insertion loss) IEC 61300-3-7	≤ 0,7 dB (single stage) ≤ 0,8 dB (double stage)	Launch fibre length: Polarization state Measurement uncertainty	≥ 2,0 m Any polarization ± 0,1 dB
2	Isolation IEC 61300-3-7	≥20 dB (single stage) ≥40 dB (double stage)	Launch fibre length: Polarization state Measurement uncertainty Note	≥ 2,0 m Any polarization ± 0,3 dB (single stage) ± 0,5 dB (double stage) 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	≥ 55 dB	Launch fibre length: Polarization state Measurement uncertainty Note	≥ 2,0 m Any polarization ± 1 dB All ports 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: Measurement uncertainty	≥2,0 m ± 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
6	High optical power IEC 61300-2-14	Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3 shall be met. During the test, the insertion loss change is monitored. During and after the test, the insertion loss change shall be within ± 0,3 dB of the initial value. During the 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 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	Optical power Wavelength Duration of the optical power exposure Temperature: Relative humidity: Note	300 mW 1 550 nm 30 min 60 °C ± 2° C 93 % $^{+2}_{-3}$ RH A different wavelength is acceptable when there is a negotiation between customer and supplier
7	Cold IEC 61300-2-17	Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3	Temperature: Duration of exposure:	-10° C ± 2° C 96 h

		shall be met. The insertion loss change after the test shall be within ± 0,3 dB of the initial value		
8	High temperature endurance IEC 61300-2-18	Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3 shall be met. The insertion loss change after the test shall be within ± 0,3 dB of the initial value	Temperature: Duration of exposure:	+60° C ± 2° C 96 h
9	Damp heat (steady state) IEC 61300-2-19	Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3 shall be met. During the test, the insertion loss change is monitored. During and after the test, the insertion loss change shall be within ± 0,3 dB of the initial value. During the 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	Temperature: Relative humidity: Duration of exposure:	+40 ± 2 °C 93 % $^{+2}_{-3}$ RH 96 h
10	Change of temperature IEC 61300-2-22	Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3 shall be met. During the test, the insertion loss change is monitored. During and after the test, the insertion loss change shall be within ± 0,3 dB of the initial value. During the 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	High temperature: Low temperature: Number of cycles: Duration at extreme temperature: Rate of change:	+60 ± 2 °C -10 ± 2 °C Cycles 5 60 min 1 °C/min
11	Vibration IEC 61300-2-1 IEC 61300-3-28	Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3 shall be met. During the test, the insertion loss change is monitored. During and after the test, the insertion loss change shall be within ± 0,3 dB of the initial value. During the 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	Frequency range: Number of axes: Number of sweeps: Sweep rate: Amplitude:	10 Hz - 55 Hz 3 orthogonal axes 15 /axis 1 octave/min 0,75 mm
12		Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3 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 shock in total
13	Optical fibre	Before and after the test, the limits	Tensile force:	2 N for reinforced cable

	cable flexing IEC 61300-2-44	of insertion loss, isolation and return loss of test no. 1, 2 and 3 shall be met. The insertion loss change after the test shall be within ± 0,3 dB of the initial value	Number of cycles:	30 cycles ± 90°
14	Fibre/cable retention IEC 61300-2-4	Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3 shall be met. The insertion loss change after the test shall be within ± 0,3 dB of the initial value	Magnitude and rate of application: Duration of the test Point of application of tensile load: Method of mounting:	(10 ± 1) N at 5 N/s for reinforced cables. (5,0 ± 0,5) N at 0,5 N/s for secondary coated fibres. (2,0 ± 0,2) N at 0,5 N/s for primary coated fibres. 120 s duration at 10 N. 60 s duration at 2 N or 5 N. 0,3 m from the exit point of the fibre / cable from the specimen. The sample shall be rigidly mounted such that the load is only applied to the fibre/cable retention mechanism
15	Static side load IEC 61300-2-42	Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3 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

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: Optical power: SOP of the light source: Wavelength: Duration of the optical power exposure: Temperature: Relative humidity:	Annex B 300 mW Average SOP (depolarized) 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. 30 min 60 °C ± 2 °C 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: Duration of exposure:	−10 °C ± 2 °C 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: Duration of exposure:	+60 °C ± 2 °C 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: Relative humidity: Duration of exposure:	+40°C ± 2 °C 93 % $^{+2}_{-3}$ RH 96 h