



Edition 2.0 2020-04 REDLINE VERSION

INTERNATIONAL STANDARD



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

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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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 33.180.10

ISBN 978-2-8322-8188-8

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CONTENTS

1 Scope .5 2 Normative references .5 3 Terms and definitions .6 4 Test .6 5 Test report. .7 6 Performance requirements. .7 6.1 Sample size .7 6.2 Test details and requirements. .7 6.1 Sample size .7 6.2 Test details and requirements. .7 Annex A (normative) Sample size .18 Annex B (normative) High power test procedure of fibre optic isolators .19 B.1 General. .19 B.2 Forward input test set-up .19 B.2.1 Forward input test set-up .19 B.2.2 Forward input test procedure .19 B.3 Backward input test set-up .20 B.3.1 Backward input test procedure .20 B.4 Both direction input test set-up .20 B.4.1 Both direction input test set-up .20 B.4.2 Both direction input test set-up .20 B.4.2 Both	FOREWO	RD	3
2 Normative references .5 3 Terms and definitions .6 4 Test .6 5 Test report .7 6 Performance requirements .7 6.1 Sample size .7 6.2 Test details and requirements .7 6.1 Sample size .7 6.2 Test details and requirements .7 Annex A (normative) Sample size .18 Annex B (normative) High power test procedure of fibre optic isolators .19 B.1 General .19 B.2 Forward input test .19 B.2.1 Forward input test procedure .19 B.2.2 Forward input test procedure .19 B.3.1 Backward input test procedure .20 B.3.2 Backward input test procedure .20 B.3.1 Backward input test procedure .20 B.4.1 Both direction input test procedure .20 B.4.2 Both direction input test procedure .20 B.4.3 Both direction input test procedure <	1 Scope	э	5
3 Terms and definitions 6 4 Test 6 5 Test report 7 6 Performance requirements 7 6.1 Sample size 7 6.2 Test details and requirements 7 6.1 Sample size 7 6.2 Test details and requirements 7 Annex A (normative) Sample size 18 Annex B (normative) High power test procedure of fibre optic isolators 19 B.1 General. 19 B.2 Forward input test 19 B.2.1 Forward input test set-up 19 B.2.2 Forward input test procedure 20 B.3.1 Backward input test set-up 20 B.3.2 Backward input test procedure 20 B.3.1 Backward input test procedure 20 B.4.1 Both direction input test procedure 20 B.4.2 Both direction input test procedure 20 B.4.3 Both direction input test procedure 20 B.4.4 Both direction input test procedure 20	2 Norm	ative references	5
4 Test 6 5 Test report. 7 6 Performance requirements. 7 6.1 Sample size 7 6.2 Test details and requirements. 7 7 6.2 Test details and requirements. 7 7 6.2 Test details and requirements. 7 7 Annex A (normative) Sample size 18 Annex B (normative) High power test procedure of fibre optic isolators 19 B.1 General 19 B.2 Forward input test 19 B.2.1 Forward input test set-up 19 B.2.2 Forward input test procedure 19 B.3.1 Backward input test procedure 20 B.3.2 Backward input test procedure 20 B.3.1 Backward input test procedure 20 B.4.2 Both direction input test procedure 20 B.4.3 Both direction input test procedure 20 B.4.4 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test details and requirements <t< td=""><td>3 Terms</td><td>s and definitions</td><td>6</td></t<>	3 Terms	s and definitions	6
5 Test report. 7 6 Performance requirements. 7 6.1 Sample size 7 6.2 Test details and requirements. 7 Annex A (normative) Sample size 18 Annex B (normative) High power test procedure of fibre optic isolators 19 B.1 General 19 B.2 Forward input test 19 B.2.1 Forward input test set-up 19 B.2.2 Forward input test set-up 20 B.3.1 Backward input test procedure 20 B.3.2 Backward input test procedure 20 B.3.1 Backward input test procedure 20 B.3.2 Backward input test procedure 20 B.3.3 Backward input test procedure 20 B.4.3 Both direction input test procedure 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test details and requirements 22 Bibliography. 22 24 Figure B.1 – Test set-up of forward input test. 20 Figure B.	4 Test.		6
6 Performance requirements. 7 6.1 Sample size 7 6.2 Test details and requirements 7 Annex A (normative) Sample size 18 Annex B (normative) High power test procedure of fibre optic isolators 19 B.1 General. 19 B.2 Forward input test. 19 B.2.1 Forward input test set-up 19 B.2.2 Forward input test procedure 19 B.3.1 Backward input test set-up 20 B.3.2 Backward input test procedure 20 B.3.1 Backward input test set-up 20 B.4.2 Both direction input test procedure 20 B.4.1 Both direction input test set-up 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test 22 Bibliography 22 24 Provisionaria 20 24 Figure B.1 – Test set-up of forward input test. 20 Figure B.2 – Test set-up of the backward input test. 20 Figure B.3 – Test set-up of t	5 Test i	eport	7
6.1 Sample size 7 6.2 Test details and requirements 7 Annex A (normative) Sample size 18 Annex B (normative) High power test procedure of fibre optic isolators 19 B.1 General 19 B.2 Forward input test 19 B.2.1 Forward input test set-up 19 B.2.2 Forward input test set-up 19 B.3 Backward input test set-up 20 B.3.1 Backward input test set-up 20 B.3.2 Backward input test set-up 20 B.3.3 Backward input test procedure 20 B.3.4 Both direction input test procedure 20 B.4 Both direction input test procedure 20 B.4 Both direction input test procedure 20 B.4.1 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test 22 Bibliography 22 24 Provident Standard Sta	6 Perfo	rmance requirements	7
6.2 Test details and requirements 7 Annex A (normative) Sample size 18 Annex B (normative) High power test procedure of fibre optic isolators 19 B.1 General 19 B.2 Forward input test 19 B.2.1 Forward input test set-up 19 B.2.2 Forward input test procedure 19 B.3.3 Backward input test procedure 20 B.3.1 Backward input test procedure 20 B.3.2 Backward input test procedure 20 B.4.1 Both direction input test procedure 20 B.4.2 Both direction input test procedure 20 B.4.3 Both direction input test procedure 20 B.4.4 Both direction input test procedure 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test details and requirements 22 Bibliography 10 10 10 Figure B.1 – Test set-up of forward input test 20 20 Figure B.2 – Test set-up of the backward input test 20 Figur	6.1	Sample size	7
Annex A (normative) Sample size 18 Annex B (normative) High power test procedure of fibre optic isolators 19 B.1 General 19 B.2 Forward input test 19 B.2.1 Forward input test set-up 19 B.2.2 Forward input test procedure 19 B.3.3 Backward input test procedure 20 B.3.1 Backward input test set-up 20 B.3.2 Backward input test procedure 20 B.4.4 Both direction input test procedure 20 B.4.1 Both direction input test procedure 20 B.4.2 Both direction input test procedure 20 B.4.3 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test details and requirements 22 Bibliography 22 24 Providences inclusions including standards/iecc4 act 8600-176a-425e-actH-559d81637309/iec-61753-061-2-2020 24 Providences inclusions input test 20 Figure B.1 – Test set-up of forward input test 20 Figure B.2 – Test set-up of the backward input test 20 Figure B	6.2	Test details and requirements	7
Annex B (normative) High power test procedure of fibre optic isolators 19 B.1 General 19 B.2 Forward input test 19 B.2.1 Forward input test set-up 19 B.2.2 Forward input test procedure 19 B.3 Backward input test procedure 20 B.3.1 Backward input test set-up 20 B.3.2 Backward input test procedure 20 B.4 Both direction input test procedure 20 B.4.1 Both direction input test set-up 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test details and requirements 22 Bibliography 24 Provision and the backward input test 20 Figure B.1 – Test set-up of forward input test 20 Figure B.2 – Test set-up of the backward input test 20 Figure B.3 – Test set-up of both direction input test 20 Figure B.3 – Test set-up of the backward input test 20 Figure B.3 – Test set-up of both direction input test 20 Figure B.3 – Test set-up of both direction input test	Annex A (I	normative) Sample size	
B.1 General	Annex B (I	normative) High power test procedure of fibre optic isolators	
B.2 Forward input test 19 B.2.1 Forward input test set-up 19 B.2.2 Forward input test procedure 19 B.3 Backward input test procedure 20 B.3.1 Backward input test set-up 20 B.3.2 Backward input test procedure 20 B.3.1 Backward input test procedure 20 B.3.2 Backward input test procedure 20 B.4 Both direction input test procedure 20 B.4.1 Both direction input test set-up 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test details and requirements 22 Bibliography IEC 61753-061-2:2020 24 ps://standards.ten.accat.og/standards.tec/4actscoor/roa-42se-acdr-b3/dstes/30/rec-61/53-061-2:2020 24 Figure B.1 – Test set-up of forward input test 20 Figure B.2 – Test set-up of the backward input test 20 Figure B.3 – Test set-up of both direction input test 20 Figure B.3 – Test set-up of both direction input test 20	B.1	General	
B.2.1 Forward input test set-up 19 B.2.2 Forward input test procedure 19 B.3 Backward input test 20 B.3.1 Backward input test set-up 20 B.3.2 Backward input test procedure 20 B.3.3 Backward input test set-up 20 B.3.2 Backward input test procedure 20 B.4 Both direction input test procedure 20 B.4.1 Both direction input test set-up 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test details and requirements 22 Bibliography EC 61753-061-2:2020 24 Pst/standards inch arcatalog/standards/icc/4ac/Sc00-176a-425c-aed1-b59d81e37309/icc-61753-061-2:2020 24 Figure B.1 – Test set-up of forward input test 19 Figure B.2 – Test set-up of the backward input test 20 Figure B.3 – Test set-up of both direction input test 20 Figure B.3 – Test set-up of both direction input test 21	B.2	Forward input test	
B.2.2 Forward input test procedure 19 B.3 Backward input test 20 B.3.1 Backward input test set-up 20 B.3.2 Backward input test procedure 20 B.4 Both direction input test procedure 20 B.4.1 Both direction input test procedure 20 B.4.2 Both direction input test procedure 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test details and requirements 22 Bibliography IEC 61753-061-2:2020 24 ps//standards.teh.arcatalog/standards/ec/4aclSc00-176a-425e-aedt-b59d81e37309/ec-61753-061-2:2020 19 Figure B.1 – Test set-up of forward input test 20 Figure B.2 – Test set-up of the backward input test 20 Figure B.3 – Test set-up of both direction input test 20 Figure B.3 – Test set-up of both direction input test 20	B.2.1	Forward input test set-up	19
B.3 Backward input test 20 B.3.1 Backward input test set-up 20 B.3.2 Backward input test procedure 20 B.4 Both direction input test 20 B.4.1 Both direction input test set-up 20 B.4.2 Both direction input test procedure 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test 22 Bibliography 24 Pst/standards.iteh arcatalog/standards/icc/4ac/8c00-176a-425e-acdf-b59d8fe37309/icc-61753-061-2-2020 24 Figure B.1 – Test set-up of forward input test 19 Figure B.2 – Test set-up of the backward input test 20 Figure B.3 – Test set-up of both direction input test 20	B.2.2	Forward input test procedure	19
B.3.1 Backward input test set-up 20 B.3.2 Backward input test procedure 20 B.4 Both direction input test 20 B.4.1 Both direction input test set-up 20 B.4.2 Both direction input test procedure 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test details and requirements 22 Bibliography IEC 61753-061-2:2020 24 Pst/standards.iteh.ar/catalog/standards/iec/4act8c00-1/6a-425e-aed1-b59d81e37309/iec-61753-061-2:2020 24 Figure B.1 – Test set-up of forward input test 19 Figure B.2 – Test set-up of the backward input test 20 Eigure B.3 – Test set-up of both direction input test 20	B.3	Backward input test	20
B.3.2 Backward input test procedure 20 B.4 Both direction input test 20 B.4.1 Both direction input test set-up 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test 22 Bibliography EC 61753-061-2:2020 24 ps://standards.teh.a/catalog/standards/icc/4ac/8c00-176a-425e-acdFb59d8fe37309/icc-61753-061-2:2020 24 Figure B.1 – Test set-up of forward input test 19 Figure B.2 – Test set-up of the backward input test 20 Eigure B.3 – Test set-up of both direction input test 20	B.3.1	Backward input test set-up	20
B.4 Both direction input test 20 B.4.1 Both direction input test set-up 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test 22 Bibliography EC 61753-061-2:2020 24 ps/standards.ich.al/catalog/standards/icc/4act8c00-176a-425e-acdf-b59d8fe37309/icc-61753-061-2:2020 19 Figure B.1 – Test set-up of forward input test 19 Figure B.2 – Test set-up of the backward input test 20 Eigure B.3 – Test set-up of both direction input test 21	B.3.2	Backward input test procedure	20
B.4.1 Both direction input test set-up 20 B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test 22 details and requirements 22 Bibliography EC 61753-061-2:2020 24 ps://standards.iteh.ar/catalog/standards/iec/4actSc00-1/6a-425e-aedf-b59d81e37309/iec-61753-061-2:2020 19 Figure B.1 – Test set-up of forward input test 19 Figure B.2 – Test set-up of the backward input test 20 Eigure B.3 – Test set-up of both direction input test 21	B.4	Both direction input test	20
B.4.2 Both direction input test procedure 21 Annex C (informative) Example of detailed measurement conditions including test 22 details and requirements 22 Bibliography IEC 61753-061-2:2020 24 ps:/standards.ich.ai/catalog/standards/iec/4act8c00-f76a-425e-aedf-b59d8fe37309/iec-61753-061-2:2020 19 Figure B.1 – Test set-up of forward input test 19 Figure B.2 – Test set-up of the backward input test 20 Eigure B.3 – Test set-up of both direction input test 21	B.4.1	Both direction input test set-up	20
Annex C (informative) Example of detailed measurement conditions including test details and requirements	B.4.2	Both direction input test procedure	
Bibliography <u>IEC 61753-061-2:2020</u> 24 ps://standards.itch.ai/catalog/standards/iec/4act8c00-176a-425e-acdFb59d81e37309/iec-61753-061-2-2020 19 Figure B.1 – Test set-up of forward input test. 19 Figure B.2 – Test set-up of the backward input test. 20 Eigure B.3 – Test set-up of both direction input test. 21	Annex C (i details and	Informative) Example of detailed measurement conditions including te	est
Figure B.1 – Test set-up of forward input test. 19 Figure B.2 – Test set-up of the backward input test. 20 Eigure B.3 – Test set-up of both direction input test. 21	Bibliograp	hv <u>IEC 61753-061-2:2020</u>	24
Figure B.1 – Test set-up of forward input test	ps://standards.	iteh.ai/catalog/standards/iec/4acf8c00-f76a-425e-aedf-b59d8fe37309/iec	-61753-061-2-2020
Figure B.2 – Test set-up of the backward input test	Figure B.1	 Test set-up of forward input test 	19
Figure B 3 – Test set up of both direction input test 21	Figure B.2	- Test set-up of the backward input test	20
	Figure B.3	- Test set-up of both direction input test	21

Table 1 – Single-mode spectral bands	7
Table - Test details and requirements	
Table 2 – Test details and requirements for category C	11
Table 3 – Test details and requirements for category C ^{HD}	14
Table A.1 – Sample size	18
Table C.1 – Example of detailed measurement conditions	22
Table C.2 – Example of detailed measurement conditions for before, during (if required) and after the environmental tests	23

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 061-2: <u>Non-connectorized</u> 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.
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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.

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 061-2: <u>Non-connectorized</u> 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-<u>non-connectorized</u> 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 61300-2-14⁴, 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-<u>connectors</u> 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.

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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.

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- <mark>[1]²</mark> .				

Table 1 – Single-mode spectral bands

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 **Document Preview**

6.1 Sample size

Sample sizes for the tests are defined in Annex A. 2000

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

Γ	No	Tests	Requirements		Details
Γ	4	Attenuation	<mark>≤ 0,7 dB (single stage)</mark>	Launch fibre length:	≥ 2,0 m
		(Insertion loss)	≤ 0,8 dB (double stage)	Polarization state	Any polarization
		120 01000-0-1		Measurement uncertainty	± 0,1 dB
ſ	2	Isolation	≥ 20 dB (single stage)	Launch fibre length:	<u>≥ 2,0 m</u>
		IEC 61300-3-7	≥4 <mark>0 dB (double stage)</mark>	Polarization state	Any polarization
				Measurement uncertainty	± 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
ſ	3	Return loss	<u>≥ 55 dB</u>	Launch fibre length:	≥ 2,0 m
		IEC 61300-3-7	iTeh Sta	Polarization state	Any polarization
			(https://stand	Measurement uncertainty	±1 dB . a1)
			Document	Preview	All ports not under test shall be optically terminated to avoid unwanted reflections contributing to the measurement
tps	4 ://sta1	Polarization dependent.ai/cat loss IEC-61300-3-2	<mark>≤ 0,10 dB (single stage)</mark> ≤ 0,15 dB (double stage)	Launch fibre length: Measurement uncertainty	≥ 2,0 m 81637309/iec-61753-061-2-2 ± 0,02 dB
Ē	5	Polarization	<mark>≤0,20 ps (single stage)</mark>	Launch fibre length:	<u>≥-2,0 m</u>
		mode dispersion	≤0,10 ps (double stage)	Measurement uncertainty	± 0,05 ps
	6	High optical	Before and after the test, the limits	Optical power	300 m₩
		power I EC 61300-2-14	return loss of test no. 1, 2 and 3 shall be met	Wavelength	1 550 nm
			During the test, the insertion loss change is monitored. During and	Duration of the optical power exposure	30 min
			after the test, the insertion loss change shall be within ± 0,3 dB of the initial value.	Temperature:	60 °C ± 2° C
			During the test, the isolation change is monitored. The sum of the initial value and the change of the isolation shall be within the	Relative humidity: Note	93 % +2 RH
			value defined at test no. 2. During the test, the return loss		negotiation between customer and supplier
			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		
	7	Cold	Before and after the test, the limits	Temperature:	-10° C ± 2° C
		IEC 61300-2-17	return loss of test no. 1, 2 and 3	Duration of exposure:	96 h

Table 2 – Test details and requirements

IEC 61753-061-2:2020 RLV © IEC 2020 - 9 -

ſ			shall be met.		
			The insertion loss change after the test shall be within \pm 0,3 dB of the initial value		
	8	High temperature endurance	Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3 shall be met.	Temperature: Duration of exposure:	+60° C ± 2° C 96 h
		IEC 61300-2-18	The insertion loss change after the test shall be within \pm 0,3 dB of the initial value		
	ð	Damp-heat (steady state)	Before and after the test, the limits of insertion loss, isolation and return loss of test no. 1, 2 and 3 shall be met.	Temperature: Relative humidity:	$+40 \pm 2 \degree C$ 93 % + 2 RH -3
			During the test, the insertion loss change is monitored. During and after the test, the insertion loss change shall be within \pm 0,3 dB of the initial value.	Duration of exposure:	 96 h
			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		
	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.	High temperature:	+60 ± 2 °C -10 ± 2 °C
			During the test, the insertion loss change is monitored. During and after the test, the insertion loss change shall be within \pm 0,3 dB of the initial value.	Number of cycles: Duration at extreme temperature: Rate of change:	Cycles 5 60 min 1 °C/min
)S	://star	dards.iteh.ai/cat	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	<u>61-2:2020</u> 5a-425e-aedf-b59d8	{fe37309/iec-61753-061-2-
	44	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.	Frequency range: Number of axes: Number of sweeps:	10 Hz - 55 Hz 3 orthogonal axes 15 /axis
			During the test, the insertion loss change is monitored. During and after the test, the insertion loss change shall be within \pm 0,3 dB of the initial value.	Sweep rate: Amplitude:	1 octavo/min 0,75 mm
			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		
	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.	Acceleration: Duration: Number of axis:	5 000 m/s ² 1 ms, half sine pulse 3 axes in 2 directions
			The insertion loss change after the test shall be within \pm 0,3 dB of the initial value	Number of shocks:	2 shocks per axis, 12 shock in total
ľ	13	Optical fibre	Before and after the test, the limits	Tensile force:	2 N for reinforced cable

– 10 – IEC 61753-061-2:2020 RLV © IEC 2020

	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 \pm 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 \pm 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:	$\begin{array}{l} (10\pm1)\mathrm{N} \mbox{ at 5 N/s for reinforced} \\ \mbox{cables.} \\ (5,0\pm0,5)\mathrm{N} \mbox{ at 0,5 N/s for} \\ \mbox{secondary coated fibres.} \\ (2,0\pm0,2)\mathrm{N} \mbox{ at 0,5 N/s for} \\ \mbox{primary coated fibres.} \\ \mbox{120 s duration at 0,5 N/s for} \\ \mbox{120 s duration at 10 N.} \\ \mbox{60 s duration at 2 N or 5 N.} \\ \mbox{0,3 m from the exit point of the} \\ \mbox{fibre / cable from the specimen.} \\ \mbox{The sample shall be rigidly} \\ \mbox{mounted such that the load is} \\ \mbox{only applied to the fibre/cable} \\ \mbox{retention mechanism} \end{array}$
15	Static side load	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 \pm 0,3 dB of the initial value	Magnitude and duration of the tensile load: Direction of application: Preview	1 N for 1 h for reinforced cable 0,2 N for 5 min for secondary coated fibres Two mutually perpendicular directions

IEC 61753-061-2:2020

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No	Tests	Requirements	Details	
1	Insertion loss	≤ 0,7 dB (single stage)	Launch fibre length:	≥ 2,0 m
	(attenuation) IEC 61300-3-7 IEC 61300-3-2	≤ 0,8 dB (double stage)	Condition:	Insertion loss (attenuation) shall be met over operating wavelength range and all state of polarization (SOP)
	Refer Table C.1, No.1.		Measurement uncertainty:	≤ 0,1 dB
2	Isolation	≥ 20 dB (single stage)	Launch fibre length:	≥ 2,0 m
	IEC 61300-3-7 IEC 61300-3-2	≥ 40 dB (double stage)	Condition:	Isolation shall be met over operating wavelength range and all
	Refer Table C.1, No.2.		Measurement uncertainty:	≤ 0,3 dB (single stage) ≤ 0.5 dB (double stage)
		iToh St	andarda	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	≥ 55 dB	Launch fibre length:	≥ 2,0 m
	IEC 61300-3-7 Refer Table C 1	(https://stan	Condition: S. 116	Return loss shall be met over operating wavelength range.
	No.3.	Documen	Measurement uncertainty:	≤ 1 dB
	lards.iteh.ai/cata	<u>IEC 61753</u> log/standards/iec/4acf8c00-	<u>-061-2:2020</u> (76a-425e-aedf-b:	The port not under test shall be optically terminated to avoid unwanted reflections contributing to the measurement.
4	Polarization	≤ 0,10 dB (single stage)	Launch fibre length:	≥ 2,0 m
	dependent loss	≤ 0,15 dB (double stage)	Condition:	PDL shall be met over operating wavelength range.
	IEC 61300-3-2		Measurement uncertainty:	≤ 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

Table 2 – Test details and requirements for category C

– 12 – IEC 61753-061-2:2020 RLV © IEC 2020

No	Tests	Requirements		Details
6	High optical power	Before and after the test, the limits of insertion loss	Test set-up and procedure:	Annex B
	IEC 61300-2-14	(attenuation), isolation, return loss and PDL of test no. 1, 2, 3	Optical power:	300 mW
	IEC 61300-3-3	and 4 shall be met. During the forward input test	SOP of the light source:	Average SOP (depolarized)
	Relet Alliex D.	the insertion loss (attenuation)	Wavelength:	1 550 nm for C-band
		and after the test, the insertion	-	1 580 nm for L-band
		loss change shall be within ±0,3 dB of the initial value.		NOTE A different wavelength is acceptable when there is a
		the isolation change is		supplier.
		initial value and the change of the isolation shall be within the value defined at test no. 2.	Duration of the optical power exposure:	30 min
		During the forward input test,	Temperature:	60 °C ± 2 °C
		the return loss change is monitored. The sum of the initial value and the change of	Relative humidity:	93 % ⁺² ₋₃ RH
		the return loss shall be within the value defined at test no. 3.		NOTE This test condition focuses to standard optical isolators.
['] stan 7	lards.iteh.ai/cata	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. Before and after the test, the limits of insertion loss	andards dards.ite dards.ite t Previe -061-2:2020 176a-425e-aedf-b: Temperature:	h.ai) W 9d8fe37309/iec-61753-061-2- -10 °C ± 2 °C
	IEC 61300-2-17	(attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met.	Duration of exposure:	96 h
		The insertion loss change after the test shall be within $\pm 0,3$ dB of the initial value.		
8	Dry heat – High	Before and after the test, the	Temperature:	+60 °C ± 2 °C
	endurance IEC 61300-2-18	(attenuation), isolation, return loss and PDL of test no. 1, 2, 3 and 4 shall be met.	Duration of exposure:	96 h
		The insertion loss (attenuation) change after the test shall be within ±0,3 dB of the initial value.		
9	Damp heat	Before and after the test, the	Temperature:	+40°C ± 2 °C
	(steady state)	limits of insertion loss (attenuation), isolation, return	Relative humidity:	93 % +2 RH -3
	IEC 61300-2-19	loss and PDL of test no. 1, 2, 3 and 4 shall be met.	Duration of	96 h
	Refer Annex C	During and after the test, the insertion loss (attenuation) change shall be within ±0.3 dB	exposure:	50 H