IEC 61753-031-2

Edition 1.0 2014-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Performance standard –
Part 031-2: Non-connectorized single-mode 1 × N and 2 × N non-wavelength-selective branching devices for Category C – Controlled environment

Dispositifs d'interconnexion et composants passifs à fibres optiques – Norme de performance –
Partie 031-2: Dispositifs de couplage indépendants de la longueur d'onde 1 × N et 2 × N en unimodal, non-connectorisés, pour catégorie C – Environnement contrôlé

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 031-2: Non-connectorized single-mode 1 × N and 2 × N non-wavelength-selective branching devices for Category C – Controlled environment

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International Standard IEC 61753-031-2 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This bilingual version (2015-10) corresponds to the English version published in 2014-09. The text of this standard is based on the following documents:

FDIS	Report on voting
86B/3791/FDIS	86B/3823/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.

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The French version of this standard has not been voted upon.

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

A list of all parts in 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.

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

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Part 031-2: Non-connectorized single-mode 1×N and 2×N non-wavelength-selective branching devices for Category C – Controlled environment

1 Scope

This part of IEC 61753 contains the minimum initial tests and measurement requirements and severities which a non-wavelength selective branching device (NWBD) should satisfy in order to be categorized as meeting the requirement of this IEC standard.

The requirements cover balanced bidirectional non-connectorized single-mode 1 × N and 2 × N non wavelength-selective branching devices for use in an IEC Category C environment (N is the number of branching ports), especially but not exclusively used for PON application. For balanced NWBD two attenuation and uniformity performance classes are considered: class A (premium class) which meets more restrictive requirements (i.e. for extended reach PON application) and class B (standard class) for standard application (i.e. normal reach PON application).

The requirements also cover unbalanced bidirectional non-connectorized single-mode, non-wavelength-selective branching devices; however, the specifications of unbalanced branching devices are limited to 1 × 2 and 2 × 2 devices because they are the most commonly used.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60793-2-50:2012, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

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/cable retention*

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*

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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*

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 61300-3-2:2009, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examination and measurements – Polarization dependent loss in a single-mode fibre optic device*

IEC 61300-3-3:2009, *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 61300-3-6:2008, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss*

IEC 61300-3-7:2009, *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 61300-3-20, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-20: Examinations and measurements – Directivity of fibre optic branching devices*

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

3 Test

All test methods are selected within the IEC 61300 series.

The samples for tests shall be terminated onto single-mode fibres according to category B1.1, B1.3, or B.6 of IEC 60793-2-50:2012 in either coated fibres (primary and secondary) or reinforced cable format.

All tests shall be carried out to validate performance over one of the spectral bands listed below:

1) Spectral bands I:
   - 1 260 nm to 1 360 nm
   - 1 480 nm to 1 625 nm
2) Spectral bands II:
   - 1 260 nm to 1 360 nm
   - 1 480 nm to 1 660 nm

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4 Test report

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

5 Performance requirements

5.1 Dimensions

Dimensions shall comply with those given in appropriate manufacturer's drawings.

5.2 Sample size

Sample sizes for the tests are defined in Annex B.

5.3 Test details and requirements

Performance requirements and details are specified in Table 1.

All optical performances are given only for non-connectorized NWBD. During the environmental tests where monitoring of the NWBD is needed, all ports of the device shall be monitored.

In Annex A some numerical values of attenuation and uniformity requirements of Tests No.1 and 2 for the most commonly used NWBD are shown in Tables A.1, A.2 and A.3.

In Tables A.4 and A.5 the minimum attenuation requirements at room temperature are described by way of equations on the top of column, with the calculated values of the most commonly used NWBD listed below.

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Table 1 – Test details and requirements *(1 of 6)*

No.	Tests	Requirements					Details	
1	Attenuation (A) (Insertion loss) IEC 61300-3-7:2009 (Method A)	*Balanced NWBD*					Launch patchcord length	≥ 2 m
		Configuration	1 × N		2 × N		Source type	Unpolarized
		Performance class	A	B	A	B	Launch conditions	The wavelength of the source shall be longer than the cut-off wavelength of the fibre.
		Spectral band I	$\leq 0{,}5 + 3{,}3\log_2 N$ (dB)	$\leq 0{,}5 + 3{,}4\log_2 N$ (dB)	$\leq 0{,}7 + 3{,}4\log_2 N$ (dB)	$\leq 0{,}7 + 3{,}5\log_2 N$ (dB)		
		Spectral band II	$\leq 0{,}5 + 3{,}4\log_2 N$ (dB)	$\leq 0{,}5 + 3{,}5\log_2 N$ (dB)	$\leq 0{,}7 + 3{,}5\log_2 N$ (dB)	$\leq 0{,}7 + 3{,}6\log_2 N$ (dB)		
		Unbalanced NWBD					Uncertainty	≤ ± 0,05 dB
		Spectral band I Spectral band II	$\leq 22 - 10{,}5\log_{10} P$ (dB) where P is the nominal percentage of power associated with one port					The measurement should be performed with all combination of input/output ports See Tables A.1, A.2 and A.3 for example
2	Uniformity (U) IEC 61300-3-7:2009 (Method A)	*Balanced NWBD*					Launch patchcord length	≥ 2 m
		Configuration	1 × N		2 × N		Source type	Unpolarized
		Performance class	A	B	A	B	Launch conditions	The wavelength of the source shall be longer than the cut-off wavelength of the fibre.
		Spectral band I	$\leq 0{,}1 + 0{,}3\log_2 N$ (dB)	$\leq 0{,}2 + 0{,}3\log_2 N$ (dB)	$\leq 0{,}4 + 0{,}4\log_2 N$ (dB)	$\leq 0{,}5 + 0{,}4\log_2 N$ (dB)		
		Spectral band II	$\leq 0{,}1 + 0{,}4\log_2 N$ (dB)	$\leq 0{,}2 + 0{,}4\log_2 N$ (dB)	$\leq 0{,}4 + 0{,}5\log_2 N$ (dB)	$\leq 0{,}5 + 0{,}5\log_2 N$ (dB)	Uncertainty	≤ ± 0,05 dB The measurement should be performed with all combination of input/output ports. See Tables A.1 and A.2 for example

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Table 1 *(2 of 6)*

No.	Tests	Requirements	Details	
3	Directivity IEC 61300-3-20	≥ 55 dB	Launch patchcord length Source type Launch conditions Uncertainty	≥ 2 m LD The wavelength of the source shall be longer than the cut-off wavelength of the fibre. ≤ ± 1 dB The measurement should be made between all pairs of Input/output ports. All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement
4	Return loss (RL) IEC 61300-3-6:2008 (Method 1, OCWR)	≥ 55 dB	Launch patchcord length Source type Launch conditions Uncertainty	≥ 2 m LD The wavelength of the source shall be longer than the cut-off wavelength of the fibre. ≤ ± 1 dB The measurement should be performed with all combination of input/output ports. All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement
5	Polarization dependent loss (PDL) IEC 61300-3-2	For balanced NWBD: 1 × N / 2 × N N ≤ 4: ≤ 0,2 dB / ≤ 0,3 dB 4<N≤16: ≤ 0,3 dB / ≤ 0,4 dB N >16: ≤ 0,4 dB / ≤ 0,5 dB For unbalanced 1 × 2 and 2 × 2 NWBD and for any pair of input and output ports: $\leq 0{,}7 - 0{,}25\log_{10} P$ (DB) where P is the nominal percentage of the power associated with one port	Launch patchcord length Source type Uncertainty	≥ 2 m LD ≤ ± 0,05 dB The measurement should be performed with all combination of input/output ports

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Table 1 *(3 of 6)*

No.	Tests	Requirements	Details	
6	High optical power IEC 61300-2-14	P_{max}= 500 mW (+27 dBm) per port only one at the time. During the test the change in A shall be within ± 0,5 dB of the original value under ambient conditions, while on completion of the test the change in A shall be within ± 0,3 dB of the original value. During and on completion of the test the RL limit of test No. 4 shall be met	Launch patchcord length Source type Launch conditions Uncertainty A test Uncertainty RL test Test wavelength Spectral band I Test wavelength Spectral band II Duration of the optical power exposure at the each level	≥ 2 m Unpolarized. The wavelength of the source shall be longer than the cut-off wavelength of the fibre ≤ ± 0,05 dB ≤ ± 1 dB 1 310 nm ± 20 nm 1 550 nm ± 20 nm 1 310 nm ± 20 nm 1 625 nm ± 20 nm 30 min The measurement shall be performed between the common port (input port) and the output ports
7	Cold IEC 61300-2-17	For balanced and unbalanced NWBD before and on completion of the test the A limits of Test No. 1 shall be met. In addition during the test the change in A of balanced NWBD shall be within ± 0,3 dB for N ≤ 4 and within ± 0,5 dB for N > 4 of the original value under ambient conditions. For unbalanced NWBD the change in A during the test shall be within ± 0,3 dB for P % > 2 % and ±0,5 dB for P % ≤ 2 % of the original value. During and after the test the RL limit of test No. 4 shall be met	Temperature Duration of exposure	–10 °C ± 2 °C 96 h Specimens shall be optically functioning. A and RL shall be measured before the test, during the test at a maximum interval of 1 h and after the test by the Method 3 of IEC 61300-3-3:2009
8	Dry heat – High temperature endurance IEC 61300-2-18	For balanced and unbalanced NWBD before and on completion of the test the A limits of Test No. 1 shall be met. In addition, during the test the change in A of balanced NWBD shall be within ± 0,3 dB for N ≤ 4 and within ± 0,5 dB for N > 4 of the original value under ambient conditions. For unbalanced NWBD the change in A during the test shall be within ± 0,3 dB for P % > 2 % and ±0,5 dB for P % ≤ 2 % of the original value. During and after the test the RL limit of test No. 4 shall be met	Temperature Duration of exposure	+ 60 °C ± 2 °C. 96 h Specimens shall be optically functioning. A and RL shall be measured before the test, during the test at a maximum interval of 1 h and after the test by the Method 3 of IEC 61300-3-3:2009

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Table 1 *(4 of 6)*

No.	Tests	Requirements	Details	
9	Damp heat (steady state) IEC 61300-2-19	For balanced and unbalanced NWBD before and on completion of the test the A limits of Test No. 1 shall be met. In addition during the test the change in A of balanced NWBD shall be within ± 0,3 dB for N ≤ 4 and within ± 0,5 dB for N > 4 of the original value under ambient conditions. For unbalanced NWBD the change in A during the test shall be within ± 0,3 dB for P % > 2 % and ± 0,5 dB for P % ≤ 2 % of the original value. During and after the test the RL limit of Test No. 4 shall be met	Temperature Relative humidity Duration of exposure	+ 40 °C ± 2 °C 93 % + 2 % to –3 % 96 h Specimens shall be optically functioning. A and RL shall be measured before the test, during the test at a maximum interval of 10 min and after the test by the Method 3 of IEC 61300-3-3:2009
10	Change of temperature IEC 61300-2-22	For balanced and unbalanced NWBD before and on completion of the test the A limits of Test No. 1 shall be met. In addition during the test the change in A of balanced NWBD shall be within ± 0,3 dB for N ≤ 4 and within ± 0,5 dB for N > 4 of the original value under ambient conditions. For unbalanced NWBD the change in A during the test shall be within ± 0,3 dB for P % > 2 % and ± 0,5 dB for P % ≤ 2 % of the original value. During and after the test the RL limit of Test No. 4 shall be met.	High temperature Low temperature Duration at extreme temperature Temperature rate of change Number of cycles	+ 60 °C ± 2 °C –10 °C ± 2 °C 1 h 1 °C/min 5 Specimens shall be optically functioning. A and RL shall be measured before the test, during the test at a maximum interval of 10 min and after the test by the Method 3 of IEC 61300-3-3:2009

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