

INTERNATIONAL STANDARD

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Fibre optic interconnecting devices and passive components – Performance standard –

Part 141-2: Fibre optic passive chromatic dispersion compensator using single-mode dispersion compensating fibre for category C – Controlled environments

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Dispositifs d'interconnexion et composants passifs à fibres optiques – Norme de performance –

Partie 141-2: Compensateur de dispersion chromatique passif à fibres optiques utilisant une fibre à compensation de dispersion unimodale pour la catégorie C – Environnements contrôlés



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING DEVICES
AND PASSIVE COMPONENTS –
PERFORMANCE STANDARD –**

**Part 141-2: Fibre optic passive chromatic dispersion compensator using
single-mode dispersion compensating fibre for category C –
Controlled environments**

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International Standard IEC 61753-141-2 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components of IEC technical committee 86: Fibre optics.

The text of this standard is based on the following documents:

FDIS	Report on voting
86B/3162/FDIS	86B/3200/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.

This publication 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.

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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- withdrawn,
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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 141-2: Fibre optic passive chromatic dispersion compensator using single-mode dispersion compensating fibre for category C – Controlled environments

1 Scope

This part of IEC 61753 contains the minimum test and measurement requirements and severity levels that a fibre optic passive chromatic dispersion compensator (PCDC) using single-mode dispersion compensating fibre (DCF) must satisfy in order to be categorised as meeting the IEC standard, Category C – Controlled Environments. Generally, PCDCs are used to reduce the magnitude of chromatic dispersion (CD) between regenerators by adding CD to the span that has a sign opposite to the total CD of the cabled fibre and components. The requirements cover non-connectorised PCDCs with single-mode fibre at both ends used in single-channel transmission and wavelength division multiplexing (WDM) transmission in single mode fibres (SMF) (IEC60793-2-50, B1/B2/B4).

2 Normative references

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The following referenced documents are indispensable for the application 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 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 61300-2-17, *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 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, *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 61300-3-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

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 61300-3-32, *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/PAS 61300-3-38, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-38: Examinations and measurements – Group delay and chromatic dispersion*

IEC 61753-021-2, *Fibre optic interconnecting devices and passive components – Part 021-2: Grade C/3 single-mode fibre optic connectors for category C – Controlled environment*

IEC 61978-1, *Fibre optic interconnecting devices and passive components – Fibre optic passive dispersion compensators – Part 1: Generic specification*

ITU-T Recommendation G.Supp39, *Optical system design and engineering considerations*
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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

chromatic dispersion

CD

derivative of group delay with respect to wavelength or frequency. A typical unit is ps/nm or ps/GHz. The chromatic dispersion generally varies with the operating wavelength

3.2

polarisation dependent loss

PDL

the maximum variation of insertion loss due to a variation of the state of polarization (SOP) over all the SOPs

3.3

wavelength dependent loss

WDL

the maximum variation of the insertion loss over operating wavelength range

3.4

polarisation mode dispersion

PMD

the change in the shape and width of the pulse due to the average delay of the travelling time between the two principal states of polarization (PSP), differential group delay (DGD), and/or

to the waveform distortion for each PSP, when an optical signal passes through an optical fibre, component or subsystem

NOTE PMD, together with polarization dependent loss (PDL) and polarization dependent gain (PDG), when applicable, may introduce waveform distortion leading to unacceptable bit error rate increase.

4 Test

The samples shall be terminated onto SMF as per the same fibre type to be specified according to the relevant IEC classification for SMF (IEC 60793-2-50).

All tests are to be carried out to validate performance over the required operating wavelength range. As shown in IEC 61978-1, the operating wavelength range of DCF is either single channel application or multi channel WDM application and each range is shown in Tables 1 to 3 of Clause 6.

5 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.

6 Performance requirements

6.1 Reference components

The testing for these components does not require the use of reference components.

6.2 Dimensions

Dimensions shall comply with either an appropriate IEC interface standard or with those given in appropriate manufacturers drawings, where the IEC interface standard does not exist or cannot be used.

6.3 Test details and requirements

The requirements are given only for pigtailed devices. For connectorised components, the connector performances shall be in compliance with IEC 61753-021-2.

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Table 1 – Test and requirements for single channel application

No.	Tests	Requirements	Details
1	Operating wavelength range	1 550 nm ± 20nm	
2	CD deviation	CD shall be specified for the operating wavelength range. The deviation of CD: ≤3 % of the nominal (target) CD value	IEC 61300-3-38 The deviation of CD shall be determined as the worst case over the operating wavelength range.
3	Insertion loss	≤1,5 + 5,5 × CD × 10 ⁻³ dB CD is the nominal chromatic dispersion with a unit of ps/nm.	IEC 61300-3-4 IEC 61300-3-7 insertion method C Fibre length of PCDC pigtail: ≥ 1,5 m. The insertion loss shall be determined as the worst case over the wavelength range.
4	PDL	≤0,1 dB	IEC 61300-3-2 method 1 The PDL shall be determined as the worst case over all polarization states for the operating wavelength range.
5	WDL	NA	
6	PMD ^a	≤0,2 + 0,03 × (CD) ^{1/2} ps CD is the nominal chromatic dispersion with a unit of ps/nm.	IEC 61300-3-32
^a The equation was introduced from a survey of commercial products.			

Table 2 – Test and requirements for C-band WDM application

No.	Tests	Requirements	Details
1	Operating wavelength range	1 530 to 1 565 nm within C-band ^a	
2	CD deviation	CD shall be specified for the operating wavelength range. The deviation of CD: ≤5 % of the nominal (target) CD value	IEC 61300-3-38 The deviation of CD shall be determined as the worst case over the operating wavelength range.
3	Insertion loss	≤1,5 + 5,5 × CD × 10 ⁻³ dB Applies for the full wavelength range. CD is the nominal chromatic dispersion at the centre of the operating wavelength range with a unit of ps/nm.	IEC 61300-3-4 IEC 61300-3-7 insertion method C Fibre length of PCDC pigtail: ≥ 1,5 m. The insertion loss shall be determined as the worst case over the wavelength range.
4	PDL	≤0,1 dB	IEC 61300-3-2 method 1 The PDL shall be determined as the worst case over all polarization states for the operating wavelength range.
5	WDL	≤1,0 dB	IEC 61300-3-4 IEC 61300-3-7 Fibre length of PCDC pigtail: ≥ 1,5 m.
6	PMD ^b	≤0,2 + 0,03 × (CD) ^{1/2} ps CD is the nominal chromatic dispersion at the centre wavelength of the operating wavelength range with a unit of ps/nm.	IEC 61300-3-32
^a C-band range is defined in ITU-T Supplement G.39. ^b The equation was introduced from a survey of commercial products.			

Table 3 – Test and requirements for L-band WDM application

No.	Tests	Requirements	Details
1	Operating wavelength range	1 565 to 1 610 nm within L-band ^a	
2	CD deviation	CD shall be specified for the operating wavelength range. The deviation of CD: ≤5 % of the nominal (target) CD value	IEC 61300-3-38 The deviation of CD shall be determined as the worst case over the operating wavelength range.
3	Insertion loss	≤1,5 + 5,5 × CD × 10 ⁻³ dB Applies for the full wavelength range. CD is the nominal chromatic dispersion at the centre of the operating wavelength range with a unit of ps/nm.	IEC 61300-3-4 insertion method C IEC 61300-3-7 Fibre length of PCDC pigtail: ≥ 1,5 m. The insertion loss shall be determined as the worst case over the wavelength range.
4	PDL	≤0,1 dB	IEC 61300-3-2 method 1 The PDL shall be determined as the worst case over all polarization states for the operating wavelength range.
5	WDL	≤1,0 dB	IEC 61300-3-4 insertion method C IEC 61300-3-7 Fibre length of PCDC pigtail: ≥ 1,5 m.
6	PMD ^b	≤0,2 + 0,03 × (CD) ^{1/2} ps CD is the nominal chromatic dispersion at the centre wavelength of the operating wavelength range with a unit of ps/nm.	IEC 61300-3-32

^a L-band range is defined in ITU-T Supplement G.39 as 1 565 to 1 625 nm, but due to technical limitations, 1 565 to 1 610 nm is applied to PCDC using DCF.

^b The equation was introduced from a survey of commercial products.