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INTERNATIONAL STANDARD

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Dynamic modules –
Part 1-2: Performance standards – Tuneable chromatic dispersion compensator (non-connectorized)

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Modules dynamiques –
Partie 1-2: Normes de performance – Compensateur de dispersion chromatique réglable (non connectorisé)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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DYNAMIC MODULES –

Part 1-2: Performance standards – Tuneable chromatic dispersion compensator (non-connectorized)

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International Standard IEC 62343-1-2 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2007. It constitutes a technical revision.

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

a) substantial addition of definitions and removal of type C performances.
b) change in the title to reflect standard terminology.

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

FDIS	Report on voting
86C/1315/FDIS	86C/1336/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 in the IEC 62343 series, published under the general title *Dynamic modules*, 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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DYNAMIC MODULES –

Part 1-2: Performance standards – Tuneable chromatic dispersion compensator (non-connectorized)

1 Scope

This part of IEC 62343 contains the recommended minimum initialization test and measurement requirements and severities for optical tuneable chromatic dispersion compensators (TDC).

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 61300-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance*

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

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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 61300-3-29, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-29: Examinations and measurements – Spectral transfer characteristics of DWDM devices*

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

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

IEC 62074-1, *Fibre optic interconnecting devices and passive components – Fibre optic WDM devices – Part 1: Generic specification*

IEC 62343, *Dynamic modules – General and guidance*

ITU-T Recommendation G.671, *Transmission characteristics of optical components and subsystems*

ITU-T Recommendation G.692, *Optical interfaces for multichannel systems with optical amplifiers*

ITU-T G-series Recommendations – Supplement 39, *Optical system design and engineering considerations*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62074-1, IEC 62343 and the following apply.

3.1
group delay
time required by an optical pulse to transit an optical element

Note 1 to entry: Group delay that depends on optical wavelength (or frequencies) causes optical pulse distortion through the optical element.

Note 2 to entry: It is expressed as the derivation of the propagation constant with respect to angular frequency, $\partial\beta/\partial\omega$, through the optical element, where β is the propagation constant, and ω is the angular frequency equal to $2\pi c/\lambda$, where λ is the wavelength.

3.2
GDR
group delay ripple
maximum peak-to-peak variation of the group delay approximated by a desired function, typically a linear fit, within a channel wavelength (or frequency) range

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Note 1 to entry This note applies to the French languange only.

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3.3
phase ripple
standard deviation of the peak-to-peak variation in measured phase spectrum when compared to a quadratic fit within a channel wavelength (or frequencies) range

3.4
CD
chromatic dispersion
group delay difference between two closely spaced wavelengths inside an optical signal going through a pair of conducting ports of a DWDM device

Note 1 to entry: It corresponds to the difference between the arrival times of these two closely spaced wavelengths. Chromatic dispersion is defined as the variation (first order derivative) of this group delay over a range of wavelengths especially over the channel operating wavelength range at the given time, temperature, pressure and humidity. It is expressed in terms of units of ps/nm or ps/GHz and it is a predictor of the broadening of a pulse transmitted through the module.

Note 2 to entry: This note applies to the French languange only.

3.5
tuneable chromatic dispersion compensator
two-port in-line device that is capable of transforming, by internal or external automatic control, an input signal with time-varying dispersion into an output signal in which an output channel dispersion value is set for a required level of value

3.6
operating wavelength range
specified range of wavelengths from λ_{imin} to λ_{imax} about a nominal operating wavelength λ_I, within which a dynamic optical module is designed to operate with a specified performance

3.7
channel frequency range
frequency range within which a device is expected to operate with a specified performance

Note 1 to entry: For a particular nominal channel central frequency, f_{nomi}, this frequency range is from $f_{imin} = (f_{nomi} - \Delta f_{max})$ to $f_{imax} = (f_{nomi} + \Delta f_{max})$, where Δf_{max} is the maximum channel central frequency deviation.

3.8
passband ripple
maximum peak-to-peak variation of the insertion loss within a channel frequency (or wavelength) range

3.9
channel spacing
centre to centre difference in frequency (or wavelength) between adjacent channels in a device

4 Test

4.1 General

The characterization of a tuneable chromatic dispersion compensator requires demonstration that those components or features within the module, together with that of the module itself, are capable of yielding the performance requirements as defined in the relevant specification.

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Where it can be adequately demonstrated that components or features have previously met all of the requirements of a specific performance standard category, they may be declared as complying with that performance standard. This may obviate the need for repeat testing of components or features in such cases. Where this occurs, reference shall be made to the relevant test reports or documentation.

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4.2 Module

Unless otherwise specified, all TDC module test methods shall be in accordance with IEC 61300-1, IEC 61300-2-14, IEC 61300-3-2, IEC 61300-3-29, IEC 61300-3-32 and IEC 61300-3-38.

TDC modules used for each test are intended to be previously unstressed new samples but may be selected from previously used samples if desired. Each test defines the number of samples to be evaluated.

All measurements shall be carried out at standard test conditions as defined in IEC 61300-1, unless otherwise stated. If the module is provided with an active temperature control, this shall be set at the setpoint specified by the manufacturer.

The defined performance requirements apply to every combination of input and output port, over all polarization states and over all specified environmental conditions.

4.3 Spectral bands

All tests shall be carried out to validate performance over the required operating wavelength range. As a result, single or multiple spectral bands may be chosen for the qualification, and differing target specifications may be assigned to each spectral band.

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 – Spectral bands for single-mode systems (ITU-T G Suppl. 39)

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

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 Dimensions

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

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6.2 Sample size

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Three (3) TDC modules are used in each module test. The tests may be performed individually or in sequential order.

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The test sample size and sequencing requirements for the modules shall be defined in the relevant specification.

6.3 Test details and requirements

The requirements are given only for non-connectorized TDC modules. For connectorized modules, the connector performances shall be in compliance with IEC 61753-021-2.

A minimum length of fibre or cable of 1,5 m per port shall be included in all climatic and environmental tests.

The channel spacings, unless otherwise specified, shall be in accordance with ITU-T Recommendation G.692.

The test details of the performance standard are shown in Tables 2 and 3. These tables provide figures as a guideline of performance requirements and are not indicative of values that must be met in an operational environment.

Table 2 – Test and requirements for type A (Multi/single channel type TDC with large dispersion variable range)

No	Tests	Requirements	Details
1A	Channel frequency range	(ITU-T-grid) ±10 GHz (for 10 Gb/s) (ITU-T-grid) ±40 GHz (for 40 Gb/s)	ITU-T Recommendation G.671
2A	Dispersion variable range	–1 800 to +1 800 ps/nm (for 10 Gb/s) –400 to +400 (for 40 Gb/s)	IEC 61300-3-38
3A	Insertion loss	≤ 12 dB	IEC 61300-3-29
4A	Passband ripple	< 0,5 dB over the channel frequency range	IEC 61300-3-29
5A	Group delay ripple	≤ ±6 ps (for 10 Gb/s) ≤ ±2 ps (for 40 Gb/s)	IEC 61300-3-38
6A	Phase ripple	< 0,046 rad (eye opening penalty = 0,1 dB)	IEC 61300-3-38
7A	Polarization dependent loss	≤ 0,6 dB over the channel frequency range	IEC 61300-3-2
8A	Inter-channel loss uniformity	≤ 0,85 dB (only multi-channel type)	IEC 61300-3-29
9A	Polarization mode dispersion	≤ 3 ps (for 10 Gb/s) ≤ 1 ps (for 40 Gb/s)	IEC 61300-3-32
10A	Dispersion setting error	≤ ±5 ps/nm	IEC 61300-3-38
11A	Dispersion tuning time	≤ 30 s	Method under consideration
12A	Power consumption	≤ 10 W	Method under consideration
13A	High optical power	+23 dBm	IEC 61300-2-14

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