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Optični spojni elementi in pasivne komponente - Optični pasivni kompenzatorji barvne razpršenosti - 1. del: Splošna specifikacija

Fibre optic interconnecting devices and passive components - Fibre optic passive chromatic dispersion compensators - Part 1: Generic specification

Lichtwellenleiter - Verbindungselemente und passive Bauteile - Passive Lichtwellenleiter - Kompensatoren mit chromatischer Dispersion - Teil 1: Fachgrundspezifikation

Dispositifs d'interconnexion et composants passifs à fibres optiques - Compensateurs de dispersion chromatique passifs à fibres optiques - Partie 1: Spécification générique

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TITLE:

Fibre optic interconnecting devices and passive components - Fibre optic passive chromatic dispersion compensators - Part 1: Generic specification

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NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING DEVICES
 AND PASSIVE COMPONENTS – FIBRE OPTIC PASSIVE
 CHROMATIC DISPERSION COMPENSATORS –**

Part 1: Generic specification

FOREWORD

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International Standard IEC 61978-1 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This fourth edition cancels and replaces the third edition, published in 2014, and constitutes a technical revision.

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

- a) harmonization of terms and definitions with IEC TS 62627-09;
- b) change of Clause 4 regarding requirements.

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

CDV	Report on voting
86B/xxxx/FDIS	86B/xxxx/RVD

120
121 Full information on the voting for the approval of this standard can be found in the report on
122 voting indicated in the above table.

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

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

125 A list of all parts in the IEC 61978 series, published under the general title *Fibre optic*
126 *interconnecting devices and passive components – Fibre optic passive chromatic dispersion*
127 *compensators*, can be found on the IEC website.

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

- 131 • reconfirmed,
132 • withdrawn,
133 • replaced by a revised edition, or
134 • amended.

135

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138 **FIBRE OPTIC INTERCONNECTING DEVICES**
 139 **AND PASSIVE COMPONENTS – FIBRE OPTIC PASSIVE**
 140 **CHROMATIC DISPERSION COMPENSATORS –**

141
 142 **Part 1: Generic specification**
 143

144 **1. Scope**

145 This part of IEC 61978 applies to fibre optic passive chromatic dispersion compensators, all
 146 exhibiting the following features:

- 147 – they are optically passive;
- 148 – they have an optical input and an optical output for transmitting optical power;
- 149 – the ports are optical fibres or optical fibre connectors;
- 150 – they are wavelength sensitive;
- 151 – they may be polarization sensitive.

152 This document establishes uniform requirements for the passive chromatic dispersion
 153 compensator.

154 **2. Normative references**

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

159 IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

160 IEC 60050-731, *International Electrotechnical Vocabulary – Chapter 731: Optical fibre*
 161 *communication*

162 IEC 60617 (all parts), *Graphical symbols for diagrams*

163 IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method –*
 164 *Apparatus, confirmatory test arrangement and guidance*

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

167 IEC 61300 (all parts), *Fibre optic interconnecting devices and passive components – Basic test*
 168 *and measurement procedures*

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

172 IEC TR 61930, *Fibre optic graphical symbology*

173 IEC TS 62627-09, *Fibre optic interconnecting devices and passive components - Vocabulary*
 174 *for passive optical devices*

175 ISO 129-1, *Technical drawings – Indication of dimensions and tolerances – Part 1: General*
176 *principles*

177 ISO 286-1, *Geometrical product specifications (GPS) – ISO coding system for tolerances of*
178 *linear sizes – Part 1: Bases of tolerances and fits*

179 ISO 1101, *Geometrical Product Specifications (GPS) – Geometrical tolerancing – Tolerances*
180 *of form, orientation, location and run-out*

181 ISO 8601-1, *Date and time — Representations for information interchange — Part 1: Basic rules*

182 **3. Terms and definitions**

183 For the purposes of this document, the terms and definitions given in IEC 60050-731 and IEC
184 TS 62627-09, as well as the following definitions apply.

185 **3.1 Component terms**

186 **3.1.1**

187 **passive chromatic dispersion compensator**

188 PCDC

189 two-port in-line passive device used to perform chromatic dispersion compensation

190 Note 1 to entry: PCDCs are commonly used to compensate the chromatic dispersion of an optical path by adding
191 the opposite sign chromatic dispersion.

192 Note 2 to entry: The typical optical paths comprise single-mode fibre, dispersion shifted fibre and/or non-zero
193 dispersion shifted fibre. PCDCs have either negative or positive chromatic dispersion values depending on the
194 chromatic dispersion sign of the optical path.

195 [SOURCE: IEC TS 62627-09:2016, 3.2,17].

196 **3.1.2**

197 **dispersion compensating fibre**

198 DCF

199 speciality fibre to compensate for the chromatic dispersion of an optical path

200 **3.1.3**

201 **passive DCF based dispersion compensator**

202 PCDC which constitutes DCF; realised by having chromatic dispersion characteristics of
203 opposite sign to that of the optical path which are controlled the refractive index profile of the
204 fibre

205 **3.1.4**

206 **fibre Bragg grating**

207 FBG

208 fibre type optical device which has periodically modulated refractive index profile in the core

209 **3.1.5**

210 **passive FBG based dispersion compensator**

211 PCDC which constitutes a FBG; PCDC is realised by a chirped FBG which has gradual change
212 in modulation period and/or refractive index along the fibre axis

213 **3.1.6**

214 **virtually imaged phased array**

215 VIPA

216 optical device having a glass plate with a highly reflective mirror

217 Note 1 to entry: A VIPA has the same functions as a grating.

- 218 **3.1.7**
 219 **passive VIPA based dispersion compensator**
 220 PCDC which consisting of a VIPA, focusing lens and 3-dimensional mirror
- 221 Note 1 to entry: PCDC produces both positive and negative chromatic dispersion by the movement of the 3-
 222 dimensional mirror to compensate for the chromatic dispersion of an optical path.
- 223 **3.1.8**
 224 **etalon**
 225 optical cavity which consists of a pair of parallel reflective mirrors
- 226 **3.1.9**
 227 **Gires-Tournois etalon**
 228 GT etalon
 229 etalon having a highly reflective mirror and a half mirror
- 230 Note 1 to entry: The GT etalon is sometimes called a GT interferometer.
- 231 **3.1.10**
 232 **passive GT etalon based dispersion compensator**
 233 PCDC which comprises a GT etalon
- 234 **3.2 Performance terms**
- 235 **3.2.1**
 236 **chromatic dispersion compensation**
 237 process by which a specific amount of chromatic dispersion is removed in order to mitigate the
 238 system impairment caused by unwanted dispersion
- 239 **3.2.2**
 240 **group delay**
 241 time by which a pulse is delayed by an optical device
- 242 Note 1 to entry: The group delay generally varies with the operating wavelength.
- 243 **3.2.3**
 244 **chromatic dispersion**
 245 derivative of group delay with respect to wavelength or frequency
- 246 Note 1 to entry: A typical unit is ps/nm or ps/GHz. The chromatic dispersion generally varies with the operating
 247 wavelength.
- 248 Note 2 to entry: The units of ps/GHz are not commonly used; however, it is suitable for the evaluation of
 249 transmission system influence.
- 250 **3.2.4**
 251 **dispersion slope**
 252 derivative of chromatic dispersion with respect to wavelength or frequency
- 253 Note 1 to entry: A typical unit is ps/nm² or ps/GHz². The unit of ps/GHz² is not commonly used; however, it is
 254 suitable for the evaluation of transmission system influence.
- 255 Note 2 to entry: The dispersion slope generally varies with the operating wavelength
- 256 **3.2.5**
 257 **operating wavelength**
 258 nominal wavelength λ at which a passive device operates with the specified performance
- 259 Note 1 to entry: Operating wavelength includes the wavelength to be nominally transmitted, attenuated and isolated.

260 **3.2.6**
 261 **operating wavelength range**
 262 specified range of wavelengths including all operating wavelengths

263 Note 1 to entry: Operating wavelength range shall include all passbands when two or more the passbands are exist.

264 **3.2.7**
 265 **figure of merit**
 266 FoM
 267 ratio of the dispersion to the insertion loss of a PCDC at a particular operating wavelength

268 **3.2.8**
 269 **passband**
 270 wavelength range within which a passive optical device is required to operate with optical
 271 attenuation less than or equal to a specified optical attenuation value

272 Note 1 to entry: There may be one or more passbands for a PCDC.

273 **3.2.9**
 274 **passband ripple**
 275 maximum peak-to-peak variation of insertion loss in the passband

276 Note 1 to entry: The passband ripple of a PCDC is defined as the maximum passband ripple for all passbands.

277 **3.2.10**
 278 **group delay ripple**
 279 GDR
 280 maximum peak-to-peak variation of the group delay approximated by a desired function of
 281 wavelength (or frequency), typically a linear fit, within a channel wavelength (or frequency)
 282 range

283 **3.2.11**
 284 **phase ripple**
 285 maximum peak-to-peak variation in measured phase spectrum when compared to a quadratic
 286 fit within a channel wavelength (or frequency) range

287 Note 1 to entry: Phase ripple (unit: radian) is calculated as the product of a peak-to-peak group delay ripple (unit: s)
 288 and a period of group delay ripple (unit: Hz). Refer to IEC 61300-3-38.

289 **3.2.12**
 290 **insertion loss**
 291 reduction in optical power between an input and output port of a passive device

292 Note 1 to entry: expressed in decibels (dB).

293 Note 2 to entry: insertion loss is expressed as follows:

$$294 \quad a = -10 \log \frac{P_a}{P_0}$$

295 where

296 P_0 is the optical power launched into the input port;

297 P_a is the optical power received from the output port.

298 **3.2.13**
 299 **return loss**
 300 fraction of input power that is returned from a port of a passive device expressed in decibels

301 Note 1 to entry: The return loss is defined as follows: