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TECHNICAL REPORT

colour inside

Guidelines for combining different single-mode fibre sub-categories

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GUIDELINES FOR COMBINING DIFFERENT SINGLE-MODE FIBRE SUB-CATEGORIES

FOREWORD

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IEC TR 62000 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics. It is a Technical Report.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

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

a) global uniformity of terminology concerning fibre classes, categories and sub-categories throughout the document;
b) updating and aligning to the new naming convention of IEC 60793-2-50 for class B fibre categories and sub-categories;
c) updating and aligning with IEC 60793-2-50 as per supported fibre sub-categories;
d) additional guidelines concerning combination of fibre parameters: chromatic dispersion and slope, polarization mode dispersion;
e) additional guidelines concerning non-linear affects;
f) updating of bibliographical references.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
86A/2114/DTR	86A/2129/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under 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- withdrawn,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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GUIDELINES FOR COMBINING DIFFERENT SINGLE-MODE FIBRE SUB-CATEGORIES

1 Scope

This document provides guidelines concerning single-mode fibre inter-compatibility.

A given category of single-mode fibre, for example B-655, can have different implementations by suitably optimising several of the following parameters: mode field diameter (hence effective area), chromatic dispersion coefficient, slope of the chromatic dispersion curve, cable cut-off wavelength.

These guidelines indicate the items that are taken into account when planning to connect

1) different implementations of single-mode fibres of the same category, for example different implementations of Class B single-mode fibres, and
2) single-mode fibres of different sub-categories, for example B-652.B with B-655.C.

See IEC 60793-2-50 for the attributes and definitions of single-mode fibre. The attributes and definitions of fibres covered in this document are given in Table 1.

Table 1 – Correspondence table of various single-mode fibres

Common name	Use (IEC 60793-2-50)	IEC sub-category	ITU-T Recommendation
Dispersion unshifted fibre	Optimised for use in the 1 310 nm region but can be used in the 1 550 nm region.	B-652.B	G.652.B
Extended band dispersion unshifted fibre	Optimised for use in the 1 310 nm region but can be used in the O, E, S, C and L-band (i.e. throughout the 1 260 nm to 1 625 nm range).	B-652.D	G.652.D
Dispersion shifted fibre	Optimised for single channel transmission in the 1 550 nm region. Multiple channels can only be transmitted if care is taken to avoid non-linear effects such as four wave mixing by, for example, moderating the power levels or appropriate spacing or placement of the channels.	B-653.A	G.653.A
		B-653.B	G.653.B
Cut-off shifted fibre	Optimised for low loss in the 1 550 nm region, with cut off wavelength shifted above the 1 310 nm region.	B-654.A	G.654.A
		B-654.B	G.654.B
		B-654.C	G.654.C
		B-654.D	G.654.D
		B-654.E	G.654.E
Non-zero dispersion-shifted fibre	Optimised for multiple channel transmission in the 1 530 to 1 625 nm region with a positive or negative, non-zero chromatic dispersion and a cut off wavelength that can be shifted above the 1 310 nm region.	B-655.C	G.655.C
		B-655.D	G.655.D
		B-655.E	G.655.E
Wideband non-zero dispersion-shifted fibre	Optimised for multiple channel transmission in the wavelength range of 1 460 nm to 1 625 nm with the positive value of the chromatic dispersion coefficient that is greater than some non-zero value over the same wavelength range.	B-656	G.656

Common name	Use (IEC 60793-2-50)	IEC sub-category	ITU-T Recommendation
Bending loss insensitive fibre	Bending loss insensitive single-mode fibre suitable for use in the access networks, including inside buildings at the end of these networks. They are suitable to be used in the O, E, S, C and L-band (i.e. throughout the 1 260 nm to 1 625 nm range) and, in the case of B-657.A1 and B-657.A2, meet the requirements of B-652.D fibres. Subcategories B-657.B2 and B-657.B3 fibres are intended to be used for restricted distances (less than 1 000 m) at the end of access networks, in particular inside buildings or near buildings (e.g. outside building riser cabling).	B-657.A1	G.657.A1
		B-657.A2	G.657.A2
		B-657.B2	G.657.B2
		B-657.B3	G.657.B3

This document does not consider the connection of fibres with the same category from different manufacturers, which is already considered by the standardisation procedure.

2 Normative references

There are no normative references in this document.

3 Abbreviated terms

OTDR optical time domain reflectometer
PMD polarization mode dispersion
DWDM dense wavelength division multiplexing
NRZ non return to zero
RZ return to zero

4 System issues

The different characteristics of class B optical fibres can be explicitly combined to optimise system performance in terms of the dispersion characteristic (global dispersion coefficients, slope) of the link. It is in fact possible to combine fibres with opposite signs of the dispersion coefficient in a given wavelength range to bring the total link dispersion to near-zero in that range. The final result will however depend on the accuracy of individual fibre dispersion measurements and the ability to match lengths.

The process of combining fibres with different dispersion coefficient characteristics can be one of the ways to make dispersion management in a transmission line (the most common one being the periodical insertion of dispersion compensating modules).

Combining fibres with different effective areas is also a possible way to minimise the overall impact of non-linear effects. For instance, it is possible to place large effective area fibres in the initial section of a link, where the propagating power is relatively large. In this case, the large core reduces the associated non-linear effects. For link sections away from the source, where power levels are reduced, fibres with smaller effective area can be used, to take advantage of a possible reduction of the dispersion slope or to increase the efficiency of Raman amplification. The relative size and placement of fibres with large effective area versus fibres with smaller effective area can be critical issues in design of the highest performing optical networks.