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General rules of optical fibers

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry based on the provision of Article 14, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act in response to a proposal for revision of Japanese Industrial Standard with a draft being attached, submitted by Japanese Standards Association (JSA), an accredited standards development organization. This edition replaces the previous edition (**JIS C 6820** : 2018), which has been technically revised.

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General rules of optical fibers

Introduction

This Japanese Industrial Standard has been prepared based on **IEC 60793-1-1** : 2022, Edition 5, and **IEC 60793-2** : 2019, Edition 9, with some modifications of the technical contents to meet the specific needs in Japan, including adoption of categorization according to the material of multimode optical fibers and type names of optical fibers used in Japan that are different from the said **IEC** Standards, and addition of requirement items not included in the said **IEC** Standards.

Annexes JA to JC are unique to **JIS** and not given in the corresponding International Standard. The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JD.

1 Scope

This Standard specifies general requirements for optical fibers, jacketed optical fibers and optical fiber codes that are intended for optical transmission.

NOTE The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

IEC 60793-1-1 : 2022 *Optical fibres — Part 1-1 : Measurement methods and test procedures — General and guidance*

IEC 60793-2 : 2019 *Optical fibres — Part 2 : Product specifications — General* (Overall evaluation: MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

There are no normative references in this Standard.

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

Terms and definitions related to construction, transmission properties and measurement of optical fibers are given in Annex JA.

3.1

optical fiber

fiber made of derivatives which transmits light

Note 1 to entry It is a generic term for bare optical fibers, optical fibers as defined in 3.3, jacketed optical fibers and optical fiber cords.

3.2

bare optical fiber

optical fiber composed only of glass core and glass cladding

3.3

optical fiber

quartz-based optical fiber made by directly covering the glass cladding of a bare optical fiber with plastic primary coating of one, two or multiple layers including the coloured layer, optical fiber consisting of quartz-based glass core and plastic cladding, or optical fiber consisting of plastic core and plastic cladding

Note 1 to entry The primary coating of quartz-based optical fibers is usually applied at the same time as drawing of bare optical fibers to preserve integrity of the glass cladding surface.

3.4

primary coating

coating applied directly to the bare optical fiber, in order to protect its surface from direct contact with outside objects which can leave fine flaws

3.5

secondary coating

coating applied on the optical fiber to reinforce the protection and ease of handling of the jacketed optical fiber during handling or cabling

3.6

jacketed optical fiber

optical fiber with glass core, whose single core or multiple cores are coated with a suitable secondary coating

Note 1 to entry A secondary coating is applied to reinforce the protection of the jacketed optical fibers during handling and cabling.

3.7

optical fiber cord

optical fiber with tensile strength, made by coating jacketed optical fiber or all plastic multimode optical fiber with plastic sheath

4 Categorization

4.1 General requirements

Optical fibers are roughly divided by the number of propagation modes, and further categorized as shown in 4.2 to 4.5.

4.2 Multimode optical fibers

Multimode optical fibers are categorized based on the material and the refractive index profile. Table 1 shows the categories based on material, Table 2 shows the categories based on refractive index profile, and Table 3 shows category symbols and types of multimode optical fibers.

For categories of multimode optical fibers, see Annex JB.

Table 1 Categories of multimode optical fibers based on material

Category based on material	Material (core/cladding)
Silica-based	Silica-based glass/silica-based glass
Multi-component	Multi-component glass/multi-component glass
Plastic cladding	Silica-based glass/plastic
All plastic	Plastic/plastic

Table 2 Categories of multimode optical fibers based on refractive index profile

Category based on refractive index profile	Material (core/cladding)	Refractive index profile parameter $g^a)$
Graded index	Silica-based glass/silica-based glass	$1 \leq g < 3$
Quasi step index and step index	Silica-based glass/silica-based glass	$3 \leq g < \infty$
Step index and graded index	Silica-based glass/plastic	$10 \leq g < \infty$ $1 \leq g < 3$
Graded index and step index	Plastic/plastic	$1 \leq g < \infty$
Note ^{a)} See Annex JA.		

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Table 3 Category symbols and types of multimode optical fibers

Category symbol	Designation by material	Type of optical fiber based on refractive index profile, size and numerical aperture (NA)	IEC category symbol (informative)
<u>SGI</u>	Silica-based	Graded index, classified into the following ten types according to size, bandwidth, etc. : SGI-50/125-A1a SGI-50/125-A1b SGI-50/125-A2a SGI-50/125-A2b SGI-50/125-A3a SGI-50/125-A3b SGI-50/125-A4a SGI-50/125-A4b SGI-62.5/125 SGI-100/140	<u>A1-OM2a</u> <u>A1-OM2b</u> <u>A1-OM3a</u> <u>A1-OM3b</u> <u>A1-OM4a</u> <u>A1-OM4b</u> <u>A1-OM5a</u> <u>A1-OM5b</u> <u>A1-OM1</u> <u>A1d</u>
<u>SSI</u>	Silica-based	Step index	<u>A2</u>
<u>SQI</u>	Silica-based	Quasi step index	<u>A2</u>
<u>CSI</u>	Multi-component	Step index	<u>None</u>
<u>RSI</u>	Plastic cladding	Step index, classified into the following seven types according to size, theoretical numerical aperture (NA), etc. : RSI-200/300 RSI-200/380 RSI-200/230-A RSI-200/230-B RSI-200/230-C RSI-50/230 RSI-62.5/230	<u>A3a</u> <u>A3b</u> <u>A3c</u> <u>A3d</u> <u>A3e</u> <u>A3f</u> <u>A3g</u>
<u>PSI</u>	All plastic	Step index PSI-980/1000-A1	<u>A4a.1</u>
	All plastic	Step index PSI-980/1000-A2	<u>A4a.2</u>
	All plastic	Step index PSI-735/750	<u>A4b</u>
	All plastic	Step index PSI-485/500	<u>A4c</u>
	All plastic	Step index PSI-980/1000-B	<u>A4d</u>
<u>PGI</u>	All plastic	Graded index PGI-500/750	<u>A4e</u>
	All plastic	Graded index PGI-200/490	<u>A4f</u>
	All plastic	Graded index PGI-120/490	<u>A4g</u>
	All plastic	Graded index PGI-62.5/245	<u>A4h</u>

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4.3 Single-mode optical fibers

Single-mode optical fibers are only made of silica-based materials. Category symbols and types of silica-based single-mode optical fibers are shown in Table 4.

For categories of single-mode optical fibers, see Annex JC.

Table 4 Category symbols and types of silica-based single-mode optical fibers

Category symbol	Type of optical fiber	Description	IEC category symbol (informative)
<u>SMA</u>	1 310 nm dispersion-unshifted	This category of fiber is optimized for use in the 1 310 nm region but can be used in the 1 550 nm and 1 625 nm regions.	<u>B-652.B</u>
<u>SMA·T</u>	1 550 nm cut-off shifted	This category of 1 310 nm dispersion-unshifted fiber is optimized for low loss transmission in the 1 550 nm region. Five sub-categories are recognized (SMA·T□-A, SMA·T□-B, SMA·T□-C, SMA·T□-D and SMA·T□-E) differing in chromatic dispersion coefficient and mode field diameter.	<u>B-654.A</u> <u>B-654.B</u> <u>B-654.C</u> <u>B-654.D</u> <u>B-654.E</u>
<u>SMA·U</u>	1 310 nm dispersion-unshifted and low OH	This category of 1 310 nm dispersion-unshifted fiber can be used over the extended wavelength range from 1 260 nm to 1 625 nm.	<u>B-652.D</u>
<u>SMB</u>	1 550 nm dispersion-shifted	This category of fiber is optimized for single-channel transmission in the 1 550 nm region. Two sub-categories are recognized (SMB□-A and SMB□-B) differing in size tolerance, mode field diameter and chromatic dispersion coefficient.	<u>B-653.A</u> <u>B-653.B</u>
<u>SMC</u>	<u>Dispersion-flattened</u>	<u>This category of fiber is optimized for low dispersion over a wide range of wavelengths.</u>	<u>None</u>
<u>SMD</u>	Non-zero dispersion-shifted	This category of dispersion-shifted fiber is optimized for multiple channel transmission in the wavelength range of 1 550 nm. The dispersion coefficient is required to be non-zero throughout the band from 1 530 nm to 1 565 nm. Three sub-categories are recognized (SMB4□-C, SMB4□-D and SMB4□-E) differing in chromatic dispersion coefficient.	<u>B-655.C</u> <u>B-655.D</u> <u>B-655.E</u>
<u>SME</u>	Wideband non-zero dispersion-shifted	This category of dispersion-shifted fiber is optimized for multiple channel transmission in the wavelength range of 1 460 nm to 1 625 nm. This fiber can be used for both CWDM and DWDM systems.	<u>B-656</u>
<u>SMF·A</u>	Low OH and bending loss insensitive	This category of fiber is optimized for improved bending performance and transmission in the wavelength range of 1 260 nm to 1 625 nm, and have the same transmission and connection properties as SMA·U fibers. Two sub-categories are recognized (SMF·A□-A1 and SMF·A□-A2) differing in minimum bending radius.	<u>B-657.A1</u> <u>B-657.A2</u>

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Table 4 (concluded)

Category symbol	Type of optical fiber	Description	IEC category symbol (informative)
SMF·B	Bending loss insensitive	This category of fiber is optimized for improved bending performance, and for transmission in the wavelengths of 1 310 nm, 1 550 nm and 1 625 nm. It has different connection properties than SMA·U, and has lower bending loss characteristics than SMF·A. Two sub-categories are recognized (SMF·B-□-B2 and SMF·B-□-B3) differing in minimum bending radius.	B-657.B2 B-657.B3
NOTE The square “□” in the above type names of optical fibers, such as SMB-□-A, SMB-□-B, is to be replaced by the optical fiber size (mode field diameter/cladding diameter). Example SMB-8/125-A			

4.4 Intraconnection optical fibers

Intraconnection optical fibers are used for connections between optical parts in optical components and optical systems. Category symbols and types of intraconnection optical fibers are shown in Table 5.

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