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Silica glass multimode optical fibers

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee as the result of proposal of revision of Japanese Industrial Standard submitted by Optoelectronic Industry and Technology Development Association (OITDA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS C 6832** : 1999 is replaced with this Standard.

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Silica glass multimode optical fibers

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of **IEC 60793-2-10** published in 2007 with some modifications of the technical contents.

The portions with dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies the dimensions, transmission requirements, mechanical requirements, environmental requirements and the test methods of silica glass multimode optical fibers using silica glass as a core and a cladding.

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

IEC 60793-2-10 : 2007 *Optical fibres—Part 2-10: Product specifications—Sectional specification for category A1 multimode fibres (MOD)*

The symbols which denote the degree of correspondence in the contents in the corresponding International Standard and **JIS** are IDT (identical), MOD (modified) and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS C 6820 *General rules of optical fibers*

NOTE : Corresponding International Standards : **IEC 60793-1-1** *Optical fibres — Part 1-1 : Measurement methods and test procedures — General and guidance* and **IEC 60793-2** *Optical fibres — Part 2 : Product specifications — General* (Overall evaluation: MOD)

JIS C 6821 *Test methods for mechanical characteristics of optical fibers*

JIS C 6822 *Test methods for structural parameters of multimode optical fibers*

JIS C 6823 *Measuring methods for attenuation of optical fibers*

JIS C 6824 *Test methods for bandwidth of multimode optical fibers*

JIS C 6827 *Test methods for chromatic dispersion of optical fibers*

NOTE : Corresponding International Standard : **IEC 60793-1-42** *Optical fibres — Part 1-42 : Measurement methods and test procedures — Chromatic dispersion* (MOD)

JIS C 6864 *Measurement methods and test procedures — Differential mode delay of multimode optical fibers*

NOTE : Corresponding International Standard : **IEC 60793-1-49** *Optical fibres—Part 1-49 : Measurement methods and test procedures—Differential mode delay (MOD)*

JIS C 60068-1 *Environmental testing Part 1: General and guidance*

NOTE : Corresponding International Standard—*IEC 60068-1 Environmental testing. Part 1 : General and guidance (IDT)*

IEC 60304 *Standard colours for insulation for low-frequency cables and wires*

IEC 60793-1-21 *Optical fibres—Part 1-21 : Measurement methods and test procedures—Coating geometry*

IEC 60793-1-22 *Optical fibres — Part 1-22 : Measurement methods and test procedures — Length measurement*

IEC 60793-1-47 *Optical fibres — Part 1-47 : Measurement methods and test procedures — Macrobending loss*

IEC 60793-1-49 *Optical fibres — Part 1-49 : Measurement methods and test procedures — Differential mode delay*

IEC 60793-1-50 *Optical fibres — Part 1-50 : Measurement methods and test procedures — Damp heat (steady state)*

IEC 60793-1-51 *Optical fibres — Part 1-51 : Measurement methods and test procedures — Dry heat*

IEC 60793-1-52 *Optical fibres — Part 1-52 : Measurement methods and test procedures — Change of temperature*

IEC 60793-1-53 *Optical fibres — Part 1-53 : Measurement methods and test procedures — Water immersion*

IEC 61280-1-4 *Fibre optic communication subsystem test procedures — Part 1-4 : General communication subsystems — Collection and reduction of two-dimensional nearfield data for multimode fibre laser transmitters*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS C 6820** apply.

4 Classification and type designations

The classification and type designations of silica glass multimode optical fibers, in accordance with the provision of **JIS C 6820**, are as shown in table 1.

Table 1 Classification and type designations

Classification	Type designation	Corresponding IEC designations
Silica glass multimode optical fibers 50/125	SGI-50/125-A1	A1a.1
Silica glass multimode optical fibers 50/125 (850 nm laser-optimized)	SGI-50/125-A2	A1a.2
Silica glass multimode optical fibers 62.5/125	SGI-62.5/125	A1b
Silica glass multimode optical fibers 100/140	SGI-100/140	A1d

5 Material, shape and dimensions

5.1 Material and shape

The material and shape of silica glass multimode optical fibers shall be as follows.

- A core shall use silica glass and its cross section shall be circular.
- A cladding shall use silica glass with refractive index lower than that of a core, and shall be arranged around the core in close contact with it in a concentric pattern.
- A primary coating shall use plastic material such as UV resin and silicon resin, and shall be arranged around the cladding in close contact with it in a concentric pattern.

The primary coating shall consist of one or more layers, and unless it is used as a reference plane, shall be removable for connection. The removal of the primary coating shall be as agreed between the supplier and the customer.

5.2 Dimensions

The dimensions of silica glass multimode optical fibers shall be as given in table 2.

Table 2 Dimensions

Type designation	SGI-50/125	SGI-62.5/125	SGI-100/140
Core diameter μm	50 ± 3	62.5 ± 3	100 ± 5
Cladding diameter μm	125 ± 2	125 ± 2	140 ± 4
Core-cladding concentricity error μm	3 max.	3 max.	6 max.
Core non-circularity %	6 max.	6 max.	6 max.
Cladding non-circularity %	2 max.	2 max.	4 max.
Optical fiber diameter (uncolored) μm	245 ± 10 ^{a)}	245 ± 10 ^{a)}	245 ± 25 ^{a)}
Optical fiber diameter (colored) μm	250 ± 15 ^{a)}	250 ± 15 ^{a)}	250 ± 15 ^{a)}
Primary coating-cladding concentricity error μm	12.5 max.	12.5 max.	12.5 max.
Fiber length km	b)	b)	b)
Notes ^{a)} The above limits on primary coating diameter are most commonly used in telecommunications cables. There are other applications, which use other primary coating diameters, and alternative nominal primary and secondary coating diameters and tolerance are as follows: $400 \pm 40 \mu\text{m}$ $500 \pm 50 \mu\text{m}$ $600 \pm 100 \mu\text{m}$ $700 \pm 100 \mu\text{m}$ $900 \pm 100 \mu\text{m}$ ^{b)} As agreed between the supplier and the customer.			

5.3 Color of primary coating

The primary coating may be colored by two or more different colors.

The color shall be in accordance with **IEC 60304**.

For example, the following colors can be used as monochrome.

- Natural color or white
- Yellow
- Blue
- Green

6 Transmission requirements

The transmission requirements of silica glass multimode optical fibers are given in table 3.

Table 3 Transmission requirements

Type designation		SGI-50/125-A1	SGI-50/125-A2	SGI-62.5/125	SGI-100/140
Attenuation coefficient dB/km	In the case of 850 nm	2.4 to 3.5 max.	2.5 max.	2.8 to 3.5 max.	3.5 to 7.0 max.
	In the case of 1 300 nm	0.7 to 1.5 max.	0.8 max.	0.7 to 1.5 max.	1.5 to 4.5 max.
Bandwidth MHz · km	In the case of 850 nm	200 to 800 min.	1 500 min.	100 to 800 min.	10 to 200 min.
	In the case of 1 300 nm	200 to 1 200 min.	500 min.	200 to 1 000 min.	100 to 300 min.
Effective bandwidth MHz · km (at 850 nm)		—	2 000 min.	—	—
Ensured by either (see Annex A)					
Differential mode delay ps/m (at 850 nm)		—	See A.1 and A.2 .	—	—
Calculated effective modal bandwidth (at 850 nm)		—	See A.1 and A.3 .	—	—
NA		0.20±0.015	0.20±0.015	0.275±0.015	0.26±0.03 or 0.29±0.03
Macrobending loss dB 75 mm diameter × 100 turns, 850 nm and 1 300 nm		0.5 max.	0.5 max.	0.5 max.	Under consideration.
Zero dispersion wavelength λ_0 nm		1 295 to 1 340		1 320 to 1 365	1 330 to 1 385
Zero dispersion slope S_0 ps/nm ² · km		For λ_0 1 295 nm to 1 310 nm, 0.105 max. For λ_0 1 310 nm to 1 340 nm, 0.000 375 × (1 590 – λ_0) max.		For λ_0 1 320 nm to 1 348 nm, 0.11 max. For λ_0 1 348 nm to 1 365 nm, 0.001 × (1 458 – λ_0) max.	For λ_0 1 330 nm to 1 365 nm, 0.105 max. For λ_0 1 365 nm to 1 385 nm, 0.000 5 × (1 575 – λ_0) max.
NOTE : In this table, specification of ranges, for example, “2.4 to 3.5 max.”, means that a value within the range is to be specified by agreement between the supplier and the customer, which shall be adopted as the maximum limit.					

For attenuation coefficient and modal bandwidth, the family specification contains specifiable values instead of fixed limits. The actual values of the maximum attenuation coefficient and minimum modal bandwidth, at both 850 nm and 1 300 nm (or just at one of these wavelengths) are to be agreed between the supplier and the customer within the ranges shown in table 3. For commercial purposes, the modal bandwidth is linearly normalized to 1 km.

For guidance purposes on bandwidth, table B.1 shows a number of internationally standardized applications supported by SGI-50/125 fibers and SGI-62.5/125 fibers, and table B.2 gives a (limited) number of frequently used commercial bandwidth specifications for SGI-50/125 fibers and SGI-62.5/125 fibers.

NOTE : For SGI-50/125 fibers and SGI-62.5/125 fibers, the bandwidth at 850 nm may be related to the bandwidth at 1 300 nm in a way shown in figure 1, depending on the refractive index parameter, g (see **JIS C 6820**). The shaded region under the curve of figure 1 can be defined as the dual window area. In this area, regions X, Y, and Z area examples where a fiber manufacturer may choose to optimize the process. That is, center the production at 850 nm, 1 300 nm, or between these two wavelengths.

Due to this optimization of the manufacturing process, there will be combinations of bandwidth that are not possible. For example, it is practically impossible to produce a fiber with the maximum of both indicated bandwidth ranges (e.g. 800 MHz-km at 850 nm, and 1 200 MHz-km at 1 300 nm for SGI-50/125-A1 multimode fibers).

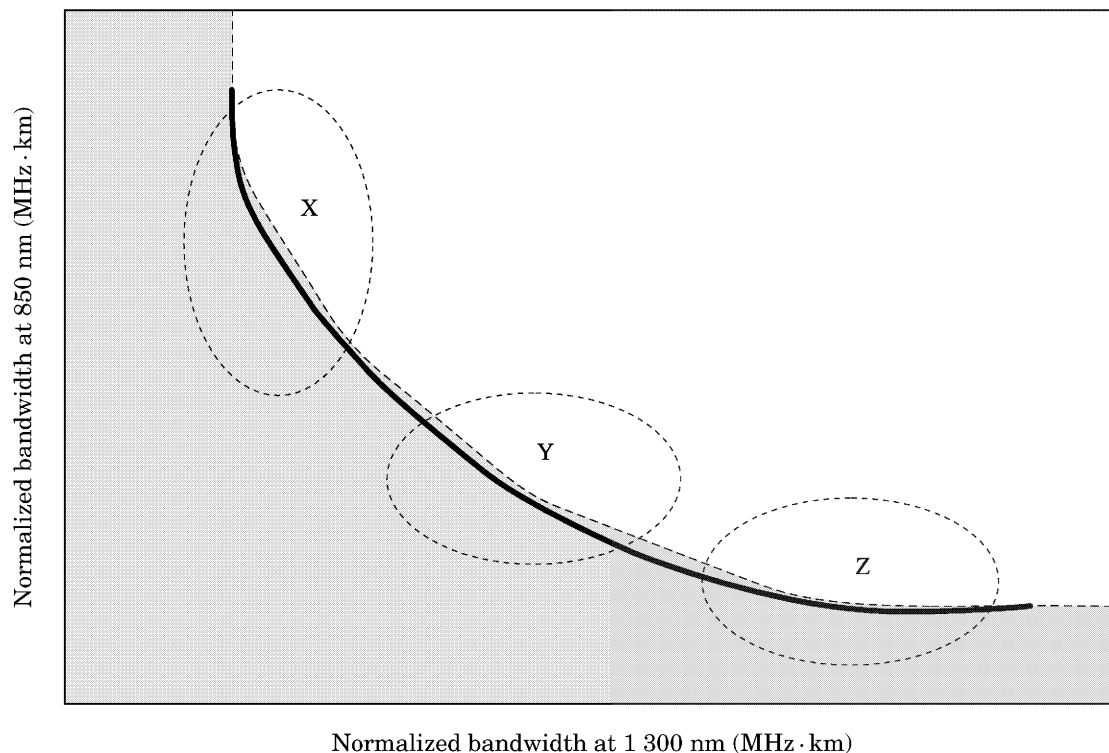


Figure 1 Relation between bandwidths at 850 nm and 1 300 nm

7 Mechanical requirements

The common mechanical requirements of silica glass multimode optical fibers are shown in table 4.

Table 4 Mechanical requirements

Attributes	Limits
Proof stress level GPa	0.69 min. ^{a)}
Strip force (average) ^{b)} N	1.0 to 5.0
Strip force (peak) ^{b)} N	1.0 to 8.9
Tensile strength (median) for 0.5 m specimen length GPa	3.8 min.
Stress corrosion susceptibility constant n_d	18 min.
Notes a) The proof test value of 0.69 GPa equals about 1 % strain or 8.8 N force, for SGI-50/125 and SGI-62.5/125 multimode optical fibers. b) Either average strip force or peak strip force, which are defined in the test procedure, may be specified by agreement between the supplier and the customer.	