

When manufacturing the fibers, doped silica glass fibers are first coated with a layer of soft acrylate. This is followed by a second layer of harder acrylate. These two coating layers are called the primary coating. Depending on the type of cable the fiber is to be used in, the fibers are colour coded appropriately.

The fiber is subjected to an extensive qualification programme comprising a number of tests before the fiber is approved for production. These tests are important to verify the transmission, geometry, mechanical and environmental characteristics and requirements.

The parameters stated for each fiber type describes the different transmission and geometry characteristic necessary for minimum distortion and attenuation of the transmitted pulses. The mechanical and environmental tests guarantee the service life of the cable, which is normally given as 25-30 years. The environmental tests include tests with large variations in temperature, humidity and also the compatibility with filling gels.

There are two main fiber types available for different applications. These are:

- single-mode fibers
- multimode fibers

Within the single-mode category special types have been developed, in particular dispersion compensating and non-zero dispersion fibers.

Single-mode Fibers

Single-mode fibers are normally used in long distance telecommunication links. The dispersion of an optical pulse, normally defined as chromatic dispersion, is a function of the wavelength. For standard single-mode fibers, the lowest dispersion is around 1310nm and the lowest attenuation is around 1550nm. The dispersion-shifted fiber was developed to combine these two parameters; low attenuation and low dispersion at the same wavelength of 1550nm.

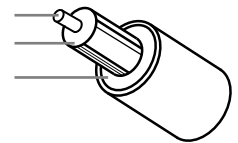
If the cut-off value and the mode field diameter are combined, an estimate of the fiber bend sensitivity can be obtained. High cut-off and a small mode field diameter will give a more bend resistant fiber.

Design

Core
Cladding
Primary coatings

Material

Doped silica glass
Pure silica glass
UV-cured acrylate



Standard Non-Shifted Single-mode Fibers

Transmission	Units	Typical values*
Attenuation average at 1310nm	dB/km	0.35
Attenuation max. at 1310nm	dB/km	0.40 max
Attenuation average at 1550nm	dB/km	0.22 max
Attenuation max. at 1550nm	dB/km	0.25 max
Max chromatic dispersion at 1550nm	ps/nm ² km	18
Zero dispersion wavelength range	nm	1300 - 1324
Zero dispersion slope	ps/nm ² km	0.093 max
Cutoff wavelength range	nm	1150 - 1330
Cable cut-off wavelength	nm	≤1260 max
Mode field diameter range at 1310nm	μm	8.8 - 9.6
PMD	ps/√km	0.2 max
Geometry		
Cladding, diameter	μm	125 ± 1
Cladding, non-circularity	%	2 max
Primary coating, diameter	μm	245 ± 5
Mode field concentricity error	μm	0.8 max
Curl on 3mm	μm	1.0 max

Mechanical

Proof test: Min 1.0% strain

* other values available on request

Multimode Fibers

The multimode fiber has a much larger core than the single-mode fiber and therefore many more light modes can be transmitted through this type of fiber. This fiber transmits signals differently and can be used for distances up to 10km.

Currently a multimode fiber with a core diameter of 62.5µm is being used. Other multimode fibers with different core diameters can also be quoted.

Multimode fibers are usually used in indoor networks. The large core diameter allows easier connection to transmission equipment. The 62.5µm fiber is used in data networks, sensor applications and it fulfills the requirements for FDDI (Fiber Distributed Data Interface) networks.

References

ITU Rec G.650

Definition and test methods for the relevant parameters of single-mode fibers.

ITU Rec G.651

Characteristics of a 50/125µm multimode graded index optical fiber cable.

ITU Rec G.652

Characteristics of a single-mode optical fiber and cable.

ITU Rec G.653

Characteristics of a dispersion-shifted single-mode optical fiber and cable.

ITU Rec G.655

Characteristics of a non-zero dispersion-shifted single-mode optical fiber and cable.

IEC 60793-1

Optical fibers - Generic specifications.

IEC 60793-2

Optical fibers - Product specifications.

IEC 60794-1

Optical fiber cables - Generic specifications.

Transmission

	Units	Typical values*
Attenuation at 850nm	dB/km	3.5 max
Bandwidth at 850nm	MHz.km	200 min

Attenuation at 1300nm	dB/km	1.0 max
Bandwidth at 1300nm	MHz.km	600 min

Geometry

	Units	Typical values
Core, diameter	µm	62.5 ± 3
Cladding diameter	µm	125 ± 2
Core, non-circularity	%	5 max
Cladding, non-circularity	%	2 max
Core, concentricity error	µm	3 max
Primary coating, diameter	µm	245 ± 10

Mechanical

Proof test: Min 1.0% strain

** other values available on request*