

Multimode Attenuation Measurement Method



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Optical
Fiber

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Scope

This information describes the current reference method for measuring the attenuation of Corning® multimode optical fibers.

General

One of the most fundamental and important parameters for describing optical fiber performance is the attenuation, or optical power loss in decibels (dB), of the fiber. Attenuation is the result of a variety of scattering and absorption mechanisms and, generally, is wavelength dependent.

Measurement Description

Multimode attenuation is measured by the cutback method. A narrow spectral band of light is launched into the full length of fiber and the transmitted intensity is measured. The measurement is repeated for the first two meters of the same fiber without disturbing the input end of the fiber. The optical power exiting the two meter section of fiber is then used as the reference input power for the long length of fiber. The attenuation rate is calculated by taking the ratio of the output power to the input power and normalizing for length as follows:

$$\text{Attenuation Rate } (\lambda) = \frac{-10}{L} \log_{10} \left[\frac{P_L(\lambda)}{P_S(\lambda)} \right] \text{ [dB/km]}$$

where: P_L = power exiting the long length of fiber
 P_S = power exiting the 2 meter length of fiber
 L = fiber length in km

Measurement Conditions

The fiber is wound with near zero tension onto a large diameter (≥ 36 cm) measurement spool to provide a measurement condition which will not influence the accuracy of the measurement result. The fiber ends are stripped of coating and prepared with end angles less than 2° with near perfect mirror surfaces. Mode stripping is provided to assure the removal of cladding modes.

The measurement system launch optics are designed to create a limited phase space condition (LPS), in which the launch spot size and numerical aperture are equal to 70 percent of the core diameter and numerical aperture of the test fiber.

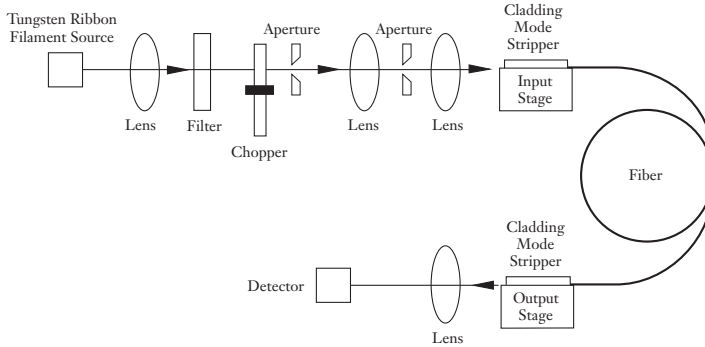
The table below lists the proper test conditions used when measuring the attenuation of Corning® multimode fibers.

Core Size [μm]	Fiber Numerical Aperture	Launch Numerical Aperture	Launch Spot Size [μm]	Launch Method
50.5	0.200	0.14	35	LPS
62.5	0.275	0.19	44	LPS

- Fiber Length: Full length and 2.0 ± 0.2 meters
- Source Spectral Width: ≤ 10 nm Full Width at Half Maximum (FWHM)
- Measurement Wavelength: 850 ± 10 nm and 1300 ± 10 nm

Apparatus to Measure Attenuation

The apparatus used to measure the cutback attenuation in Corning® multimode fibers is shown below.



References

EIA/TIA-455-46A (FOTP-46), Spectral Attenuation Measurement For Long-Length, Graded-Index Optical Fibers, Procedure B.

EIA-455-50A (FOTP-50), Light Launch Conditions For Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements, Procedure B.

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