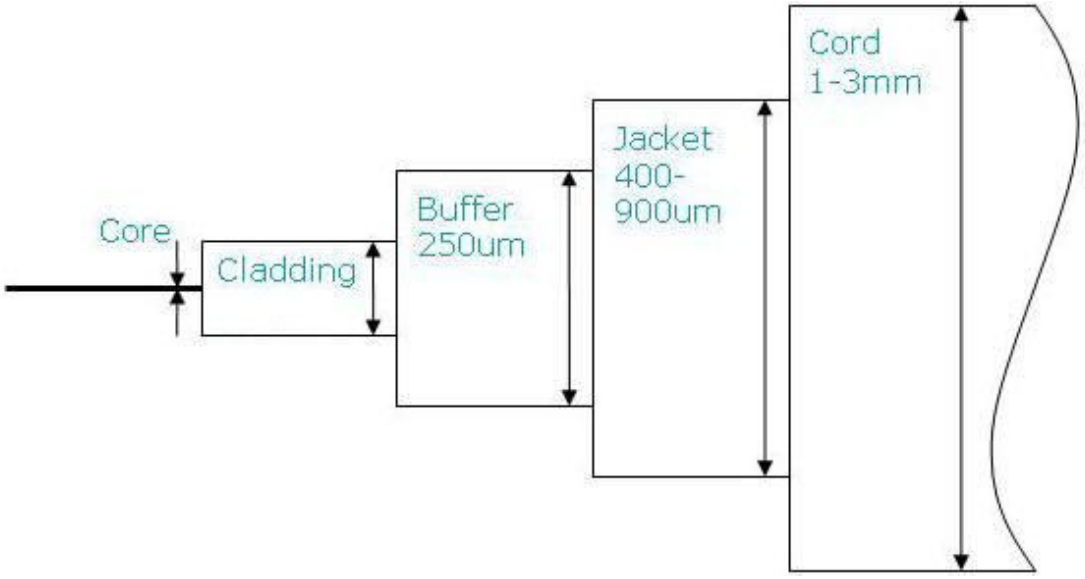
BBN International

Fibre Types Summary

Typical Glass Optical Fibre Cable Arrangement



Common Fibre Types

Glass Optical Fibre (GOF)

Class	Mode	Index	Core/Cladding Diameter (µm)	Loss (dB/Km)	Bandwidth (MHz.Km)	Application/Notes
Single mode @ 1310/1550nm						
OS1	SM	SI	8~9/125	0.4~0.25	~10^5	Telco/CATV/long high speed LANs
Multimode graded index @ 850/1300nm						
OM1	MM	GI	62.5/125	3~1	160~500	Most common LAN fibre
OM2	MM	GI	50/125	3~1	~500	Laser rated for GbE LANs
OM3	MM	GI	50/125	3~1	2,000~500	Optimised for 850nm VCSELs
			100/140	3~1	150~300	Obsolete
Multimode step index @ 850nm						

	MM	SI	200/240	4~6	50	Slow LANs and links

Plastic/Polymer Optical Fibre (POF)

Class	Material	Index	Core/ Cladding Diameter (μm)	Loss @ 650nm (dB/Km)	Loss @ 850nm (dB/Km)	Bandwidth @ 650nm (MHz.Km)	Bandwidth @ 850nm (MHz.Km)
A4a	PMMA	SI	/1000	≤400		≥1	
A4b	PF	SI	/750	≤400		≥1	≥100
A4c	PF	SI	/500	≤400		≥1	
A4d	PF	SI	/1000	≤400		≥10	≥100
A4e (0.3NA)	PMMA	GI	500/750	≤180		≥20	
A4f	PF	GI	200/490		≤40		150~400
A4g	PF	GI	120/490		≤33		188~500
A4h	PF	GI	62.5/250		≤33		188~500

Notes:

1) PMMA: polymethyl methacrylate

2) PF: perfluorinated fibre

3) SM: single mode

4) MM: multi-mode

5) SI: step index

6) GI: graded index

ITU Categories

ITU-T-G.:	Corning Equivalent	Attenuation (dB/Km @ 1550nm)	Chromatic Dispersion (ps/nm.Km @ 1550nm)	Applications
652 (NDSF)	SMF-28e	0.2	18	standard single mode fibre
653 (DSF)				superceded by G.655
654	Vascade EX1000	0.17	18.5	extended long-haul undersea

655 (NZDSF)	LEAF	0.22	4.5	long haul and high data rate metro networks

Fibre Parameters

Parameter	Notes
Mode	
Single	Telecom and high speed/long reach datacom
Multi	Datacom and short reach telecom including FFTX
Operating wavelength, λ (nm)	
1780~1690	See wavelength chart
~450	germanosilicate core has power limitations
~650	
Numerical aperture, NA	
	Higher = better (to maximise bandwidth and minimise bend-induced losses)
0.16	Standard
V value	
	Normalised frequency $V = \pi Ø_{core}(NA)/\lambda$
Mode field diameter, MFD (µm)	
	$MFD = Ø_{core}(0.65 + 1.619/V^{3/2} + 2.879/V^{6})$
Core diameter, $Ø_{core}$ (µm)	
9	Standard for telecom single mode
~5	For coupling fibre to high NA waveguides. The mode field diameter increases with wavelength
~12	
~62.5	Standard for multi mode fibre
Cladding diameter, (µm)	
80	Reduced cladding (RC) fibre for use in tight spaces to reduce bend-induced loss

125	Typical single mode fibre
130	Double cladding for high power operation
1000	Plastic optical fibre
Coating diameter, (µm)	
~250	Normally acrylate (<85°C)
~10	Polyimide for high temperatures (<400°C) also good for 'low profile' fibre sometimes needed in sensor applications to reduce matrix weakness in composites.
~400	
Cut-off wavelength, λ_{co} (nm)	
	$\lambda_{co}=\pi\varnothing_{core}(NA)/2.405$
Absorption, (dB/m)	
	For doped fibre defines the absorption efficiency of the pump light.
~1	Plastic optical fibre (POF)
~5	
~8	
Photosensitivity	
	High photosensitivity makes creating Bragg gratings easier (often achieved by increasing the germania content of fibre)
Polarisation maintaining	
	For maintaining the polarisation state of transmitted light. Often used in amplifiers and fibre optic gyros (FOG)
Birefringence, B (mm^{-1})	
	The measurement of refractive index difference in the 2 axes of PM fibre giving rise to the 'fast' (lowest refractive index) and 'slow' (highest refractive index) axes. Greater = better
Beat length, Lp (mm)	
	The distance over which a 2π phase difference occurs between the 2 axes. Shorter = better $Lp = \lambda/B$

Chromatic dispersion, (ps/nm.km)	
	Reduces the effect of wavelength dependent spreading of narrow pulses of light increasing the data rate and/or reach. Dispersion shifted fibres have zero dispersion at their Lambda zero (λ_0) wavelength. Dispersion increases with wavelength.
Doping	
Erbium (Er)	For use in fibre amplifiers. Can be pumped with 980 or 1480nm
Erbium/ Ytterbium (Er:Yb)	
Ytterbium (Yb)	For use in fibre amplifiers.
Material	
Silica glass	Most telecom and datacom fibre applications
PMMA	Polymethyl methacrylate used in plastic optical fibre (POF)
Index	
	The index of refraction of the core and cladding
Step	A sharp transition between core and cladding
Graded	A gradual transition between core and cladding

Glass Optical Fibre Dimensions

Multi-Mode			
Core/Cladding	50/125µm	62.5/125µm	100/140µm
Single Mode			

Core/Cladding	PM 9/125μm	9/125μm	RC 9/80μm