PURAVIS® glass optical fibers

SCHOTT is setting new standards for illumination fiber optics with PURAVIS® premium quality glass optical fibers. For the high purity optical glasses SCHOTT utilizes its unique manufacturing capabilities.

Features:
- Step-index multimode fiber for illumination applications with visible light.
- High purity optical glass without lead, arsenic or antimony.
- Different fiber types offer aperture angles of up to 70°, 85° and 120° , depending on fiber diameter, length and wavelength.

Advantages:
- Premium transmission.
- Excellent color rendering with low discoloration even for longer length.
- Transmission of white light which provides a more realistic appearance of the illuminated objects.
- Long term-use is ensured by significantly improved chemical stability as well as low solarization sensitivity.

Technical data

				GOF70	GOF85	GOF120
Numerical aperture Theoretical value at 587 nm				0.55	0.64	0.86
Typical aperture angles 2α Wavelength V(λ)-filter				50 µm 1 m length: ~ 71° 5 m length: ~ 65°	50 µm 1 m length: ~ 85° 5 m length: ~ 81°	30µm 1 m length: ~ 116° 5 m length: ~ 104°
Optical attenuation Measured according to DIN 58141 Part 1 with a single fiber diameter of 70 µm				at 450 nm ≤ 550 dB/km at 553 nm ≤ 250 dB/km	at 450 nm ≤ 500 dB/km at 553 nm ≤ 280 dB/km	at 550 nm ≤ 500 dB/km at 640 nm ≤ 500 dB/km
Correlated Color Temperature (CCT)	CIE standard illuminant	"A" (2856 K)	1m	2862 K	2856 K	2828 K
			3m	2874 K	2848 K	2791 K
			5m	2883 K	2842 K	2761 K
		D65 (6500K)	1m	6313 K	6275 K	6038 K
			3m	6033 K	5917 K	5487 K
			5m	5800 K	5655 K	5065 K
Temperature Stability						
Static applications (fibers only, may be limited by lubricant, epoxy resins or sheathing materials)					-20°C to 200°C / - 4 F to 392 F	
End surface with high temp. epoxy					Up to 200°C / 392 F	
End surface hot-fused					Up to 400°C / 752 F	
Single fiber diameter					30 µm, 50 µm, 70 µm (Tol. ± 4 µm)	
Lubricant					PURAVIS® glass optical fibers are available with SCHOTTs new versatile lubricant L10.	
Compliance					ROHS compliant without exemption	
Biocompatability					Cytotoxicity tested according to DIN/ISO 10993-5	

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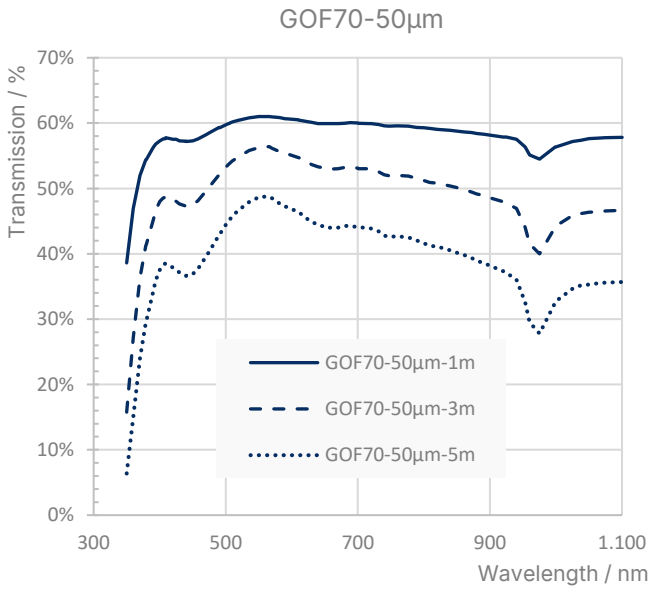
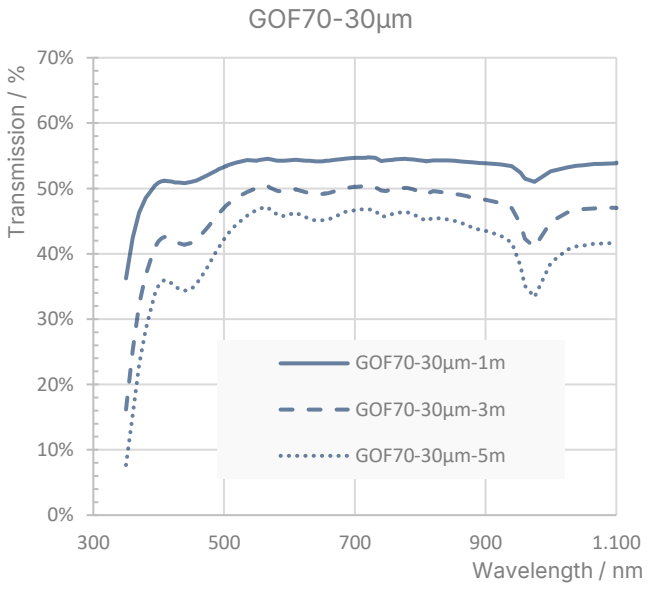
Optical properties of PURAVIS®

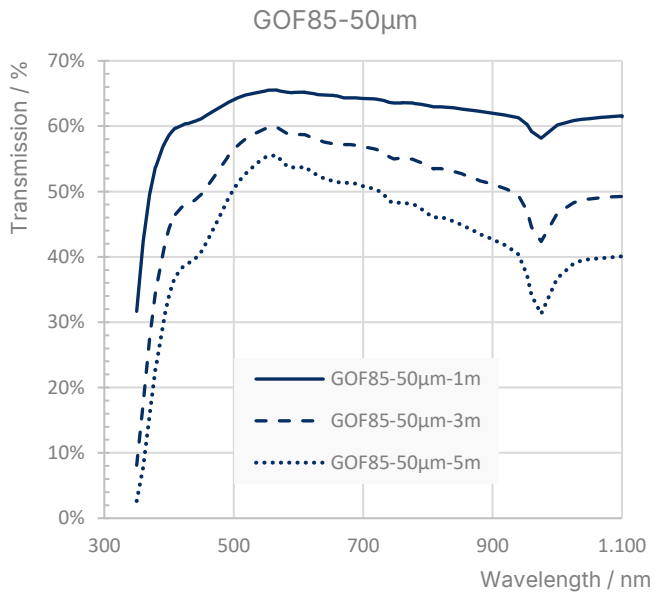
Transmission	(Measured according to DIN 58 141 Part 2)

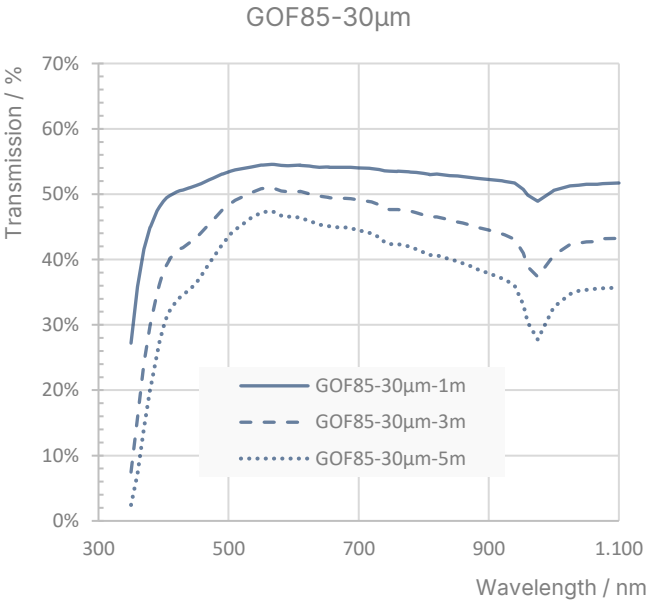
GOF70: Smaller angle fiber for focused areas





GOF85: Mid range angle fiber for versatile applications





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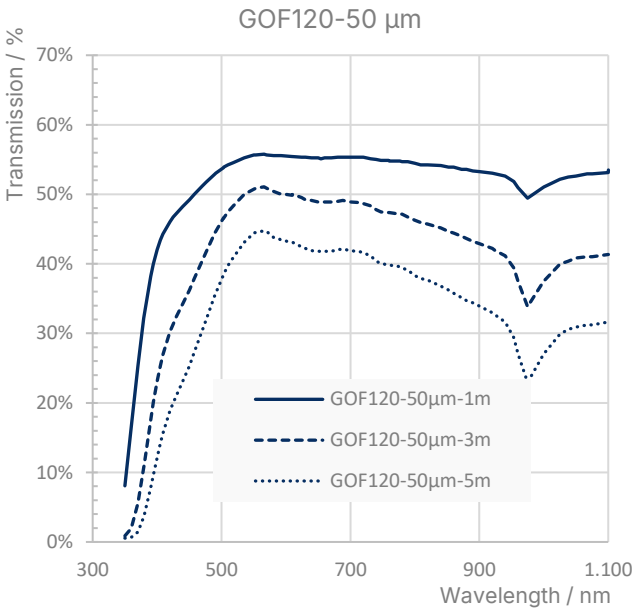
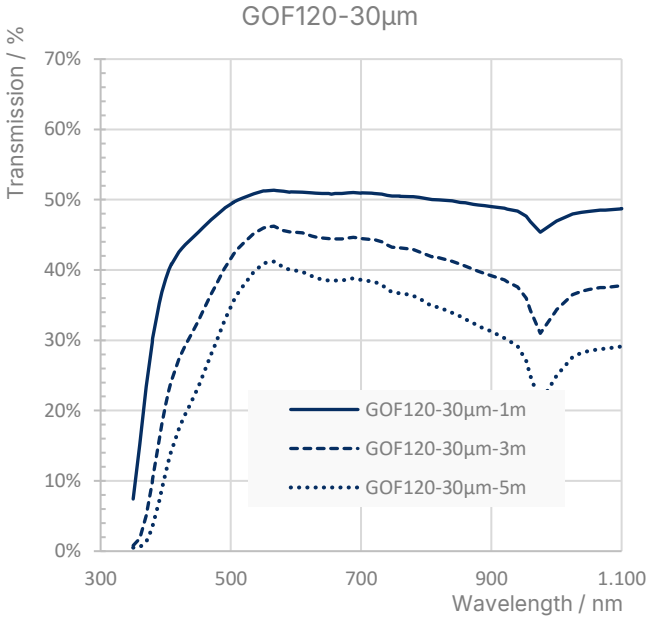
Optical properties of PURAVIS®

Transmission	(Measured according to DIN 58 141 Part 2)

GOF120: Wide angle fiber for larger areas





Transmission

Transmission of a fiber bundle depends on

- the intrinsic attenuation of the core glass,
- packing fraction of fibers,
- core/clad ratio,
- quality of end surface polish,
- Fresnel reflections at the end surfaces and
- length of the fiber bundle.

The displayed transmission curves represent SCHOTT's typical manufacturing level for fiber bundles with PURAVIS® fibers with 30 and 50 µm fiber diameter.

The curves for 50 µm also represent the transmission level for 70 µm fibers, due to the same core/clad ratio.

Solarization

The intrinsic attenuation of the PURAVIS® core glass materials can increase by induced attenuation due to photo-oxidation and other effects by short wavelength radiation.

Degree of solarization depends on

- wavelength (UV >> 400 nm > 450 nm),
- power density and length,
- coherency (laser light sources have stronger effects).

Solarization effects are partly reversible by temperature and time.

Depending on intensity levels and respective spectra each light source/fiber set-up must be tested individually.

Please contact your SCHOTT sales representative for further details.

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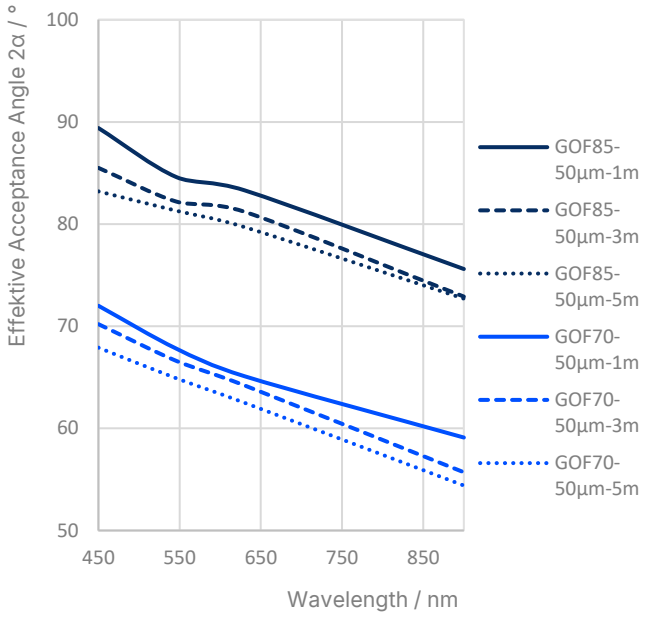
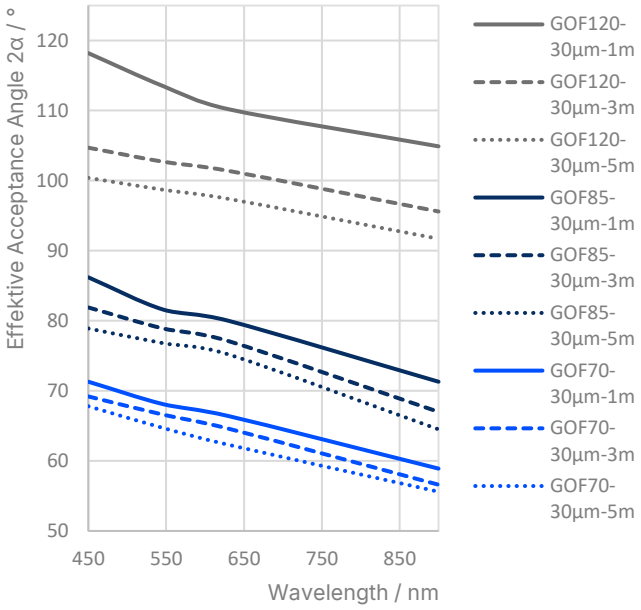
Optical properties of PURAVIS®

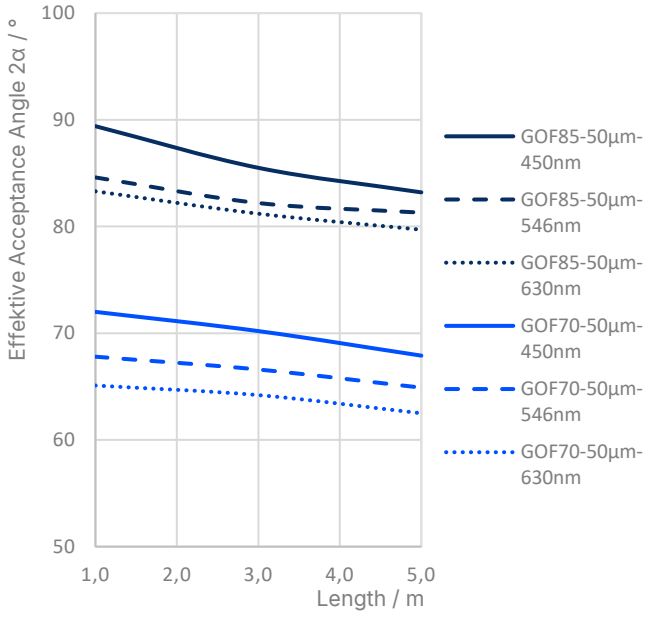
Numerical Aperture / Acceptance angle	(Measured according to DIN 58 141 Part 3)

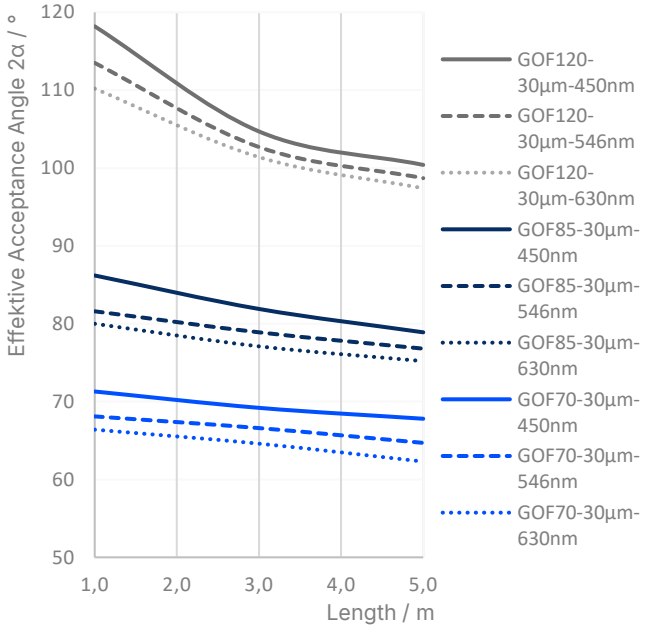
Wavelength dependency shown for length of 1 m, 3 m, 5 m





Length dependency shown for different wavelength





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Long term stability of PURAVIS® - Chemical stability

Core and cladding glasses have high chemical resistance classes, which ensure long-term stability over lifetime under repeated reprocessing cycles.

Sample preparation

- Samples: Fiber bundle Ø 2,4 mm, length 100 mm, bonded into stainless steel tube
- Prior to each measurement: cleaning of end surface with 5 % V/V acetic acid
- Rel. transmission measured according to DIN 58 141 Part 2;
  Aperture of light beam: NA 0.1
  Measurement wavelength: λ = 535 nm

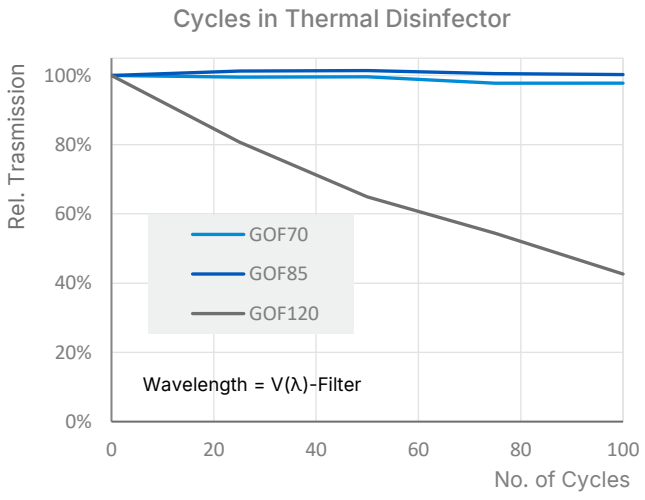
Chemical Resistance Classes	GOF70	GOF85	GOF120
Acid resistance class SR (acc. to ISO 8424:1996)	1.0	1.0	1.2
Alkali resistance class AR (acc. to ISO 10629:1996)	1.0	1.0	1.0
Climatic resistance class CR (acc. to proposed standard ISO/WD13384)	1.0	1.0	1.0
Stain resistance class: FR	0	0	0

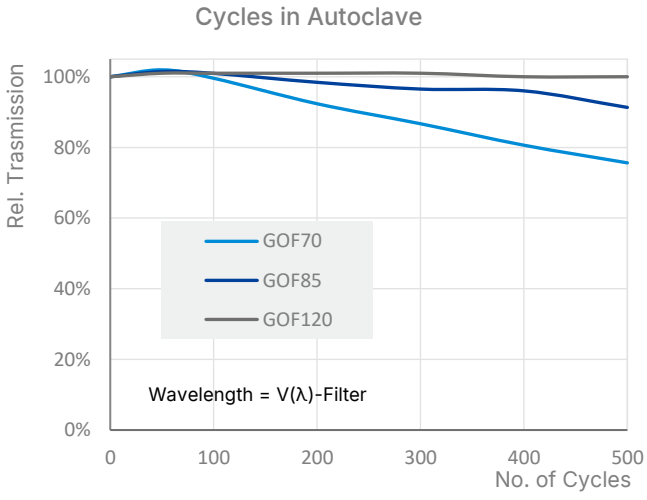
Thermal disinfection stability

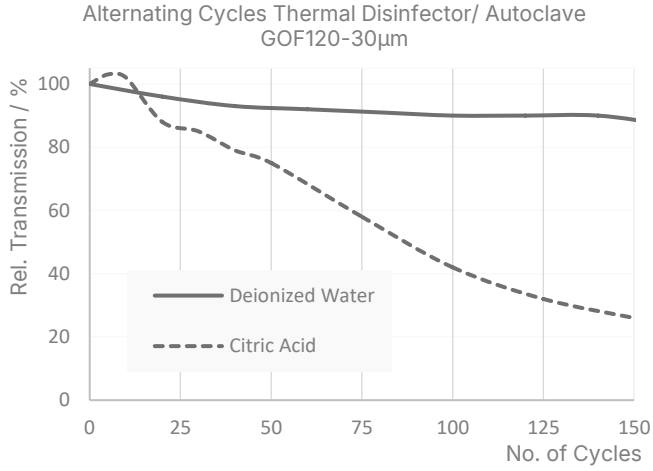
Device	Miele Disinfektor PG8536
Programm	Recommendation AKI (www.a-k-i.org)
Detergent	Neodisher FA 0,5 % V/V (5ml/l) pH11
Neutralizer	Neodisher Z (Citric Acid) 01, % V/V (1ml/l)

Autoclaving stability

Autoclave	Lautenschläger Protocert 839 134° C (3 bar)
Program	Sterilization time: 10 min Cycle time: 40 min







Featuring highest chemical resistance classes Puravis® fibers perform differently during reprocessing.

GOF70 and GOF85 show no decrease during block cycles in the thermal disinfector and slight decrease in the autoclave.

The GOF120 shows no decrease in the autoclave and a significant decrease in the thermal disinfector with citric acid as a neutralizer.

Tests of the GOF120 with different neutralization agents in thermal disinfector cleaning alternating with autoclaving show only a slight decrease when neutralized with deionized water.

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Long term stability of PURAVIS® - Mechanical stability

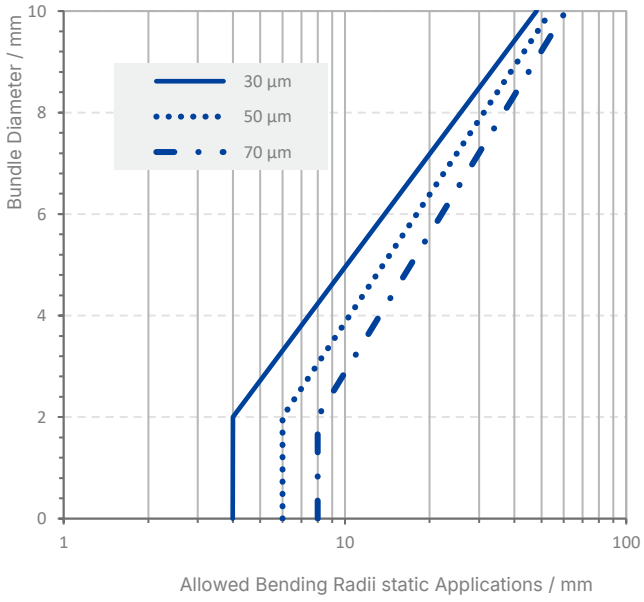
PURAVIS® glass optical fibers feature high mechanical stability enabling high flexibility and very small bending radii.

Loop bending tests of single fibers according to DIN 58 141- 6 show an average diameter of 1.0 mm before breakage for short term bends.

For long-term (permanent) bends in static applications the graph to the right shows the recommended bending angles depending on bundle diameter for 30 µm and 50 µm fiber diameter.

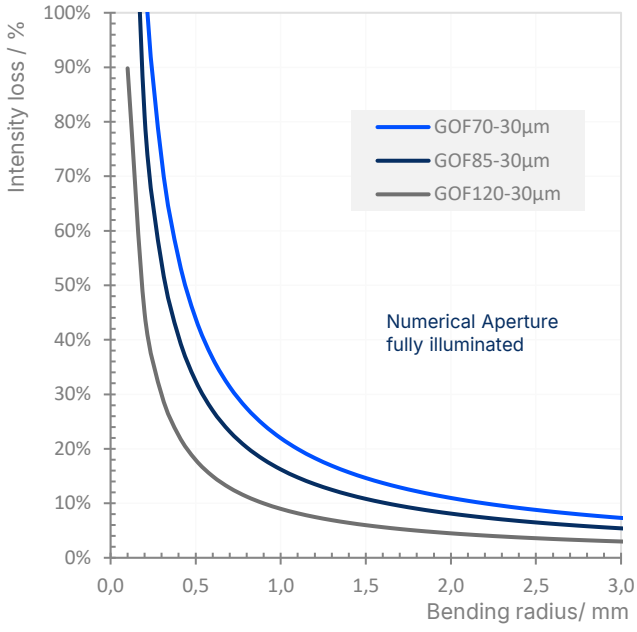
Applications, which combine small bending radii in combination with frequent movements (torsion or drag chain movements) require specific designs and individual testing.

Please contact your SCHOTT sales representative for further information.



In addition to the mechanical design constraints optical losses at small bending radii need to be considered.

The graph shows a simulation of intensity losses as a function of the bending radii for PURAVIS® fibers under the assumption that the numerical aperture is fully illuminated. Simulation wavelength 587 nm.



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