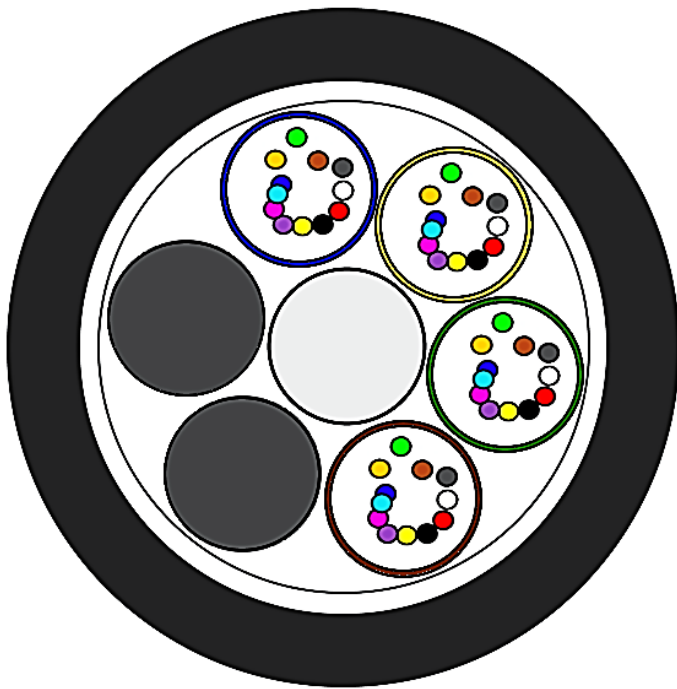


# Indoor/outdoor optical cable – Multi loose tube

## 24-96 Single mode and Multimode fibers



### Design

- Optical Fibers
- Buffer Tubes
- Non-metallic Central Member
- Water Blocked Dry Core
- Non-metallic Strength Elements
- Ripcords
- Low smoke/zero halogen (LSZH)
- Flame Retardant-Jacket

### Features

- All Dielectric Cable
- Dry Core Design – Cable core water blocked by means of dry “water swellable” technology for quicker, cleaner cable prep
- Individual colored tubes
- Meets the requirements of IEC 60332-1-2
- Meets CPR Euro Class E<sub>ca</sub> according to EN 13501-6

Version illustrated is the 48 Fiber Cable

## IDENTIFICATION

### Tube and Fiber Color Code:

1	Blue	2	Orange	3	Green	4	Brown	5	Grey	6	White
7	Red	8	Black	9	Yellow	10	Violet	11	Rose	12	Aqua

Alternative tube and fiber color code available on request

<b>Outer sheath:</b> (standard colours)	Indoor/Outdoor cable, LSZH - External nominal Ø 9,3 mm ± 0,2 mm (Containing up to 8 tubes per cable)
<b>Loose Tube:</b>	PBT Jacket filled with silicone - External nominal Ø 1,7 ± 0,2 mm (Containing up to 12 Fibers per tube, up to 8 tubes)
<b>County of origin</b>	Germany



## MECHANICAL TESTS

Tests according to IEC 60794

	Parameter	Requirement	Value
<b>Tensile performance:</b> IEC 60794-1-21-E1A and E1B	Long term load	- No attenuation increase - No fiber strain	Load: 500 N
	Short term load, during installation	- No changes in attenuation before versus after load - Max. fiber strain 0.5%	Load: 2.0 x Weight of cable
<b>Crush Performance:</b> IEC 60794-1-21-E3A	Long term load	- No attenuation increase	Load (Plate / Plate): 500 N
	Short term load	- No changes in attenuation before versus after load - No damage	Load (Plate / Plate): 1500 N
<b>Bending Performance:</b> IEC 60794-1-21-E11	Handling fixed installed	- No attenuation increase	Bend radius: 90 mm
	During installation (under load)	- No changes in attenuation before versus after load	Bend radius: 180 mm
<b>Temperatures:</b> IEC 60794-1-22-F1	Operation Installation Storage/Shipping	Single-mode Fibers: - No attenuation increase	-40 to +70°C -15 to +60°C -40 to +70°C

## SHIPPING INFORMATION

Cable Length	Drum Dimensions (approx.)		Shipping Weight (calc.)	
	Diameter(battened)	Width	Without lagging	With lagging
2000 m	1050 mm	790 mm	250 kg	270 kg
4000 m	1250 mm	790 mm	460 kg	500 kg
6000 m	1450 mm	790 mm	680 kg	720 kg
8000 m	1600 mm	1055 mm	890 kg	950 kg

## MULTI MODE FIBER PROPERTIES

Product Specifications	OM1 62.5 $\mu\text{m}$ Graded-Index (OM1)	LaserWave® FLEX G+ (OM2)	LaserWave® FLEX 300/550 (OM3/OM4)	LaserWave® WideBand (OM5)
<b>Physical Characteristics</b>				
Core diameter	62.5 $\pm$ 2.5 $\mu\text{m}$	50 $\pm$ 2.5 $\mu\text{m}$	50 $\pm$ 2.5 $\mu\text{m}$	50 $\pm$ 2.5 $\mu\text{m}$
Cladding diameter	125 $\pm$ 1 $\mu\text{m}$	125 $\pm$ 0.8 $\mu\text{m}$	125 $\pm$ 0.8 $\mu\text{m}$	125 $\pm$ 0.8 $\mu\text{m}$
Core non-circularity	$\leq$ 5 %	$\leq$ 5 %	$\leq$ 5 %	$\leq$ 5 %
Cladding non-circularity	$\leq$ 1 %	$\leq$ 0,7 %	$\leq$ 0,7 %	$\leq$ 0,7 %
Core/Cladding Offset	$\leq$ 1 $\mu\text{m}$	$\leq$ 1 $\mu\text{m}$	$\leq$ 1 $\mu\text{m}$	$\leq$ 1 $\mu\text{m}$
Coating Diameter	245 $\pm$ 10 $\mu\text{m}$	245 $\pm$ 5 $\mu\text{m}$	245 $\pm$ 5 $\mu\text{m}$	245 $\pm$ 5 $\mu\text{m}$
Tensile Proof Test	100 kpsi (0.69 GPa)	100 kpsi (0.69 GPa)	100 kpsi (0.69 GPa)	100 kpsi (0.69 GPa)
Coating Strip Force	Range: 0.22 - 2.0 lbf (1.0 - 8.9 N) Typical: 0.6 lbf (2.7 N)	Range: 0.22 - 2.0 lbf (1.0 - 8.9 N) Typical: 0.6 lbf (2.7 N)	Range: 0.22 - 2.0 lbf (1.0 - 8.9 N) Typical: 0.6 lbf (2.7 N)	Range: 0.22 - 2.0 lbf (1.0 - 8.9 N) Typical: 0.6 lbf (2.7 N)
<b>Optical Characteristics</b>				
Attenuation @ 850 nm @ 1300 nm	$\leq$ 2.9 dB/km $\leq$ 0.6 dB/km	$\leq$ 2.2 dB/km $\leq$ 0.6 dB/km	$\leq$ 2.2 dB/km $\leq$ 0.6 dB/km	$\leq$ 2.2 dB/km $\leq$ 0.6 dB/km
Overfilled Bandwidth @ 850 nm @ 1300 nm	$\geq$ 200 MHz-km $\geq$ 500 MHz-km	$\geq$ 700 MHz-km $\geq$ 500 MHz-km	$\geq$ 1500 / 3500 MHz-km $\geq$ 500 MHz-km	$\geq$ 3500 MHz-km $\geq$ 500 MHz-km
Laser Bandwidth/EMB @ 850 nm @ 1300 nm		$\geq$ 950 MHz-km $\geq$ 500 MHz-km	$\geq$ 2000 / 4700 MHz-km $\geq$ 500 MHz-km	$\geq$ 4700 MHz-km $\geq$ 500 MHz-km (1310nm) $\geq$ 2470 MHz-km (953nm)
Attenuation at 1380 nm minus attenuation at 1300nm	$\leq$ 1.0 dB/km	$\leq$ 1.0 dB/km	$\leq$ 1.0 dB/km	$\leq$ 1.0 dB/km
Attenuation Uniformity / Point Discontinuities at 850nm and 1300nm	$\leq$ 0.08 dB	$\leq$ 0.08 dB	$\leq$ 0.08 dB	$\leq$ 0.08 dB
Numerical Aperture	0.275 $\pm$ 0.015	0.200 $\pm$ 0.010	0.200 $\pm$ 0.010	0.200 $\pm$ 0.010
Chromatic Dispersion: Zero Dispersion Wavelength ( $\lambda_0$ ) Zero Dispersion Slope (S0)	1320 - 1365 nm $\leq$ 0.11 ps/nm <sup>2</sup> -km (1320 $\leq$ $\lambda_0$ $\leq$ 1348 nm) $\leq$ 0.001 x (1458 - $\lambda_0$ ) (1348 $\leq$ $\lambda_0$ $\leq$ 1365 nm)	1297 $\leq$ $\lambda_0$ $\leq$ 1328 nm So $\leq$ 4(-103) / (840(1-( $\lambda_0$ / 840)4))ps/nm <sup>2</sup> .km	1297 $\leq$ $\lambda_0$ $\leq$ 1328 nm So $\leq$ 4(-103) / (840(1-( $\lambda_0$ / 840)4))ps/nm <sup>2</sup> .km	1297 $\leq$ $\lambda_0$ $\leq$ 1328 nm So $\leq$ 4(-103) / (840(1-( $\lambda_0$ / 840)4))ps/nm <sup>2</sup> .km
Group Refractive Index @ 850 nm @ 1300 nm	1.496 1.491	1.483 1.479	1.483 1.479	1.483 1.479
Backscatter Coefficient @ 850 nm @ 1300 nm	-68.4 dB -72.1 dB	-68.4 dB -75.8 dB	-68.4 dB -75.8 dB	-68.4 dB -75.8 dB
Macro bend Attenuation	100 turns on a 75 mm mandrel @ 850 nm and 1300 nm: $\leq$ 0.5 dB	100 turns @ 37,5 mm 850nm $\leq$ 0.5, 1300 $\leq$ 0.5 2 turns @ 15 mm radius 850nm $\leq$ 0.1, 1300 $\leq$ 0.3 2 turns @ 7.5 mm radius 850nm $\leq$ 0.2, 1300 $\leq$ 0.5	100 turns @ 37,5 mm 850nm $\leq$ 0.5, 1300 $\leq$ 0.5 2 turns @ 15 mm radius 850nm $\leq$ 0.1, 1300 $\leq$ 0.3 2 turns @ 7.5 mm radius 850nm $\leq$ 0.2, 1300 $\leq$ 0.5	100 turns @ 37,5 mm 850nm $\leq$ 0.5, 1300 $\leq$ 0.5 2 turns @ 15 mm radius 850nm $\leq$ 0.1, 1300 $\leq$ 0.3 2 turns @ 7.5 mm radius 850nm $\leq$ 0.2, 1300 $\leq$ 0.5



## SINGLE MODE FIBER PROPERTIES

Product Specifications		
<b>Physical Characteristics</b>		
Cladding diameter	125.0 ± 0.7 μm	
Cladding Non-Circularity	≤ 0.7 %	
Core/Cladding Concentricity Error (Offset)	≤ 0.5 μm, < 0.2 μm typically	
Coating Diameter (Uncolored)	237 - 247 μm	
Coating/Cladding Concentricity Error (Offset)	≤ 12 μm	
Tensile Proof Test	100 kpsi (0.69 GPa)	
Coating Strip Force	Range: 1.0 N ≤ CSF ≤ 8.9 N	
Standard Reel Lengths	50.4 km (31.3 miles)	
<b>Optical Characteristics</b>		
Attenuation	Maximum	Typical
@ 1310 nm	≤ 0.34 dB/km	≤ 0.33 dB/km
@ 1385 nm	≤ 0.31 dB/km	≤ 0.27 dB/km
@ 1490 nm	≤ 0.24 dB/km	≤ 0.21 dB/km
@ 1550 nm	≤ 0.20 dB/km	≤ 0.19 dB/km
@ 1625 nm	≤ 0.24 dB/km	≤ 0.20 dB/km
Attenuation vs. Wavelength		
Range (nm)	Reference (nm) λ	α
1285 – 1330	1310	0.03
1360 – 1480	1385	0.04
1525 – 1575	1550	0.02
1460 – 1625	1550	0.04
The attenuation in a given wavelength range does not exceed the attenuation of the reference wavelength (λ) by more than the value α.		
Attenuation Uniformity / Point Discontinuities at 1310 nm and 1550 nm	≤ 0.05 dB	
Macrobending Attenuation:		
The maximum attenuation with bending does not exceed the specified values under the following deployment conditions:		
Deployment Condition	Wavelength	Induced Attenuation
1 turn on a 10 mm radius mandrel	1550 nm	≤ 0.75 dB
	1625 nm	≤ 1.5 dB
10 turns on a 15 mm radius mandrel	1550 nm	≤ 0.25 dB
	1625 nm	≤ 1.0 dB
100 turns on 30 mm radius mandrel	1550 nm	≤ 0.03 dB
	1625 nm	≤ 0.03 dB
Chromatic Dispersion	1302 - 1322 nm	
Zero Dispersion Wavelength (λ <sub>0</sub> )	≤ 0.090 ps/nm <sup>2</sup> -km	
Zero Dispersion Slope (S <sub>0</sub> )	0.087 ps/nm <sup>2</sup> -km	
Typical Dispersion Slope		
Cut-off Wavelength (λ <sub>CC</sub> )	≤ 1260 nm	
Group Refractive Index		
@ 1310 nm	1.467	
@ 1550 nm	1.468	
Mode Field Diameter		
@ 1310 nm	9.2 ± 0.4 μm	
@ 1550 nm	10.4 ± 0.5 μm (typical)	