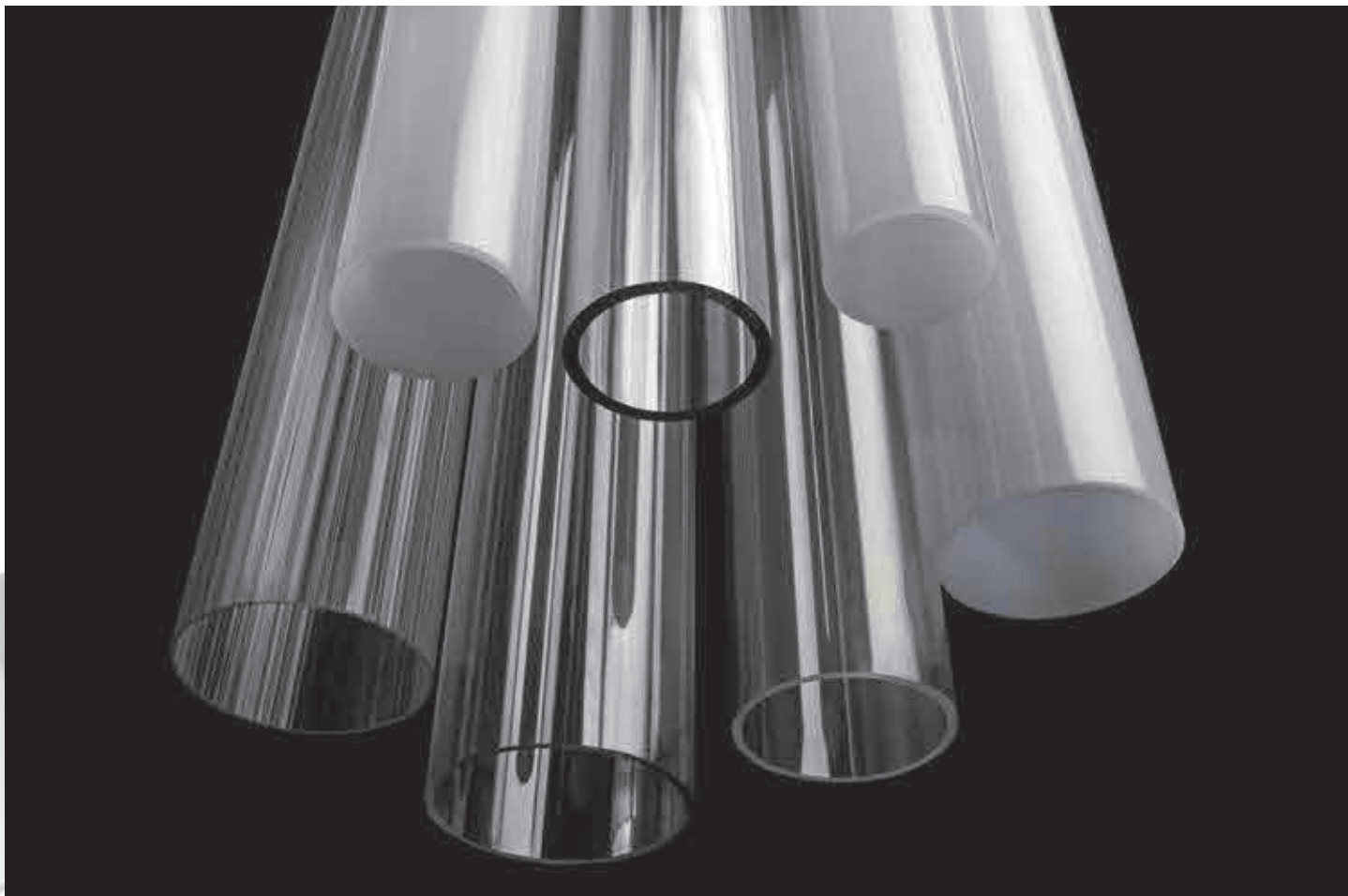


POLYCARBONATE TUBES



Polycarbonate Transparent and Opal Tubes are extruded in UV stabilized high mechanical resistance material. On request tubes are produced also in Polycarbonate Flame Retardant UL 94 V0 material.

DIMENSIONS

From Inside Diameter 6 mm to Outside Diameter 38 mm – Minimum Quantity 1000 mt

From Inside Diameter 40 mm to Outside Diameter 68 mm – Minimum Quantity 500 mt

From Inside Diameter 70 mm to Outside Diameter 300 mm – Minimum Quantity 250 mt

TECHNICAL MATERIAL PROPERTIES

Excellent light transmission values

UVstabilized

High Mechanical resistance

High service temperature

Good chemical resistance

Flame Retardant UL 94 V0 (on request)

TECHNICAL TUBES SPECIFICATIONS

Tolerances for roundness (in % of outer diameter):

\varnothing 6 mm to \varnothing 148 mm = $\pm 1,0$ %
 \varnothing 150 mm to \varnothing 300 mm = $\pm 1,5$ %

Tolerances for wall thickness (in %):

\varnothing 6 mm to \varnothing 98 mm = $\pm 5,0$ %
 \varnothing 100 mm to \varnothing 300 mm = $\pm 10,0$ %

Tolerances for length (in mm):

Production lengths up to 6.000 mm $\pm 30,0$ mm

Separate cutting service (manual cuts) for lengths (L)

$L \leq 1.000$ mm ± 1 mm

$1.000 < L \leq 2.000$ mm $\pm 1,5$ mm

$L > 2.000$ mm upon demand

A small recess of 0.3 mm may occur at the cut edges

Tolerances for straightness:

Maximum deviation: 3.0 mm on 1.000 mm chord length

Optical properties:

Extrusion marks and Optical rings are unavoidable due to the extrusion process

Tolerances for PC and PMMA Tubes:

The above manufacturing tolerances apply at a reference temperature of 20 °C

TECHNICAL DATA SHEET

POLYCARBONATE UV STABILIZED - ANTISHOCK

Physical	Nominal Value Unit	Test Method
Density	1.20 g/cm ³	ISO 1183
Apparent Density	0.66 g/cm ³	ISO 60
Melt Mass-Flow Rate (MFR) (300°C/1.2 kg)	3.0 g/10 min	ISO 1133
Melt Volume-Flow Rate (MVR) (300°C/1.2 kg)	3.00 cm ³ /10 min	ISO 1133
Molding Shrinkage		
Across Flow	0.60 to 0.80%	ISO 2577
Flow	0.60 to 0.80%	ISO 2577
Across Flow: 2.00 mm ²	0.75%	ISO 294-4
Flow: 2.00 mm ²	0.75%	ISO 294-4
Water Absorption		ISO 62
Saturation, 23°C	0.30%	
Equilibrium, 23°C, 50% RH	0.12%	
Mechanical	Nominal Value Unit	Test Method
Tensile Modulus (23°C)	2400 MPa	ISO 527-2/1
Tensile Stress		ISO 527-2/50
Yield, 23°C	67.0 MPa	
Break, 23°C	65.0 MPa	
Tensile Strain		ISO 527-2/50
Yield, 23°C	6.3%	
Break, 23°C	100%	
Nominal Tensile Strain at Break (23°C)	> 50%	ISO 527-2/50
Tensile Creep Modulus		ISO 899-1
1 hr	2200 MPa	
1000 hr	1900 MPa	
Flexural Modulus ³ (23°C)	2400 MPa	ISO 178
Flexural Strength ³		ISO 178
3.5% Strain, 23°C	74.0 MPa	
23°C	100 MPa	
Flexural Strain at Flexural Strength		ISO 179
23°C, 2 mm/min	7.3%	
Films	Nominal Value Unit	Test Method
Water Vapor Transmission Rate		ISO 15106-1
23°C, 100 µm, 85% RH	15 g/m ² /24 hr	
Carbon Dioxide Permeability		ISO 2556
25.4 µm	16900 cm ³ /m ² /bar/24 hr	
100.0 µm	4300 cm ³ /m ² /bar/24 hr	
Nitrogen Permeability		ISO 2556
25.4 µm	510 cm ³ /m ² /bar/24 hr	
100.0 µm	130 cm ³ /m ² /bar/24 hr	
Oxygen Permeability		ISO 2556
25.4 µm	2800 cm ³ /m ² /bar/24 hr	
100.0 µm	700 cm ³ /m ² /bar/24 hr	
Impact	Nominal Value Unit	Test Method
Charpy Notched Impact Strength ^{4,5}		ISO 7391
-30°C, Complete Break	16 kJ/m ²	
23°C, Partial Break	70 kJ/m ²	
Charpy Unnotched Impact Strength		ISO 179/1eU
-60°C	No Break	
-30°C	No Break	
23°C	No Break	
Notched Izod Impact Strength ⁶		ISO 180/A
-30°C, Complete Break	14 kJ/m ²	
23°C, Partial Break	80 kJ/m ²	
Multi-Axial Instrumented Impact Energy		ISO 6603-2
-30°C	65.0 J	
23°C	60.0 J	
Multi-Axial Instrumented Impact Peak Force		ISO 6603-2
-30°C	6500 N	
23°C	5600 N	
Hardness	Nominal Value Unit	Test Method
Ball Indentation Hardness	115 MPa	ISO 2039-1

TECHNICAL DATA SHEET

POLYCARBONATE UV STABILIZED - ANTISHOCK

Physical	Nominal Value Unit	Test Method
Density	1.20 g/cm ³	ISO 1183
Apparent Density	0.66 g/cm ³	ISO 60
Melt Mass-Flow Rate (MFR) (300°C/1.2 kg)	3.0 g/10 min	ISO 1133
Melt Volume-Flow Rate (MVR) (300°C/1.2 kg)	3.00 cm ³ /10 min	ISO 1133
Molding Shrinkage		
Across Flow	0.60 to 0.80%	ISO 2577
Flow	0.60 to 0.80%	ISO 2577
Across Flow: 2.00 mm ²	0.75%	ISO 294-4
Flow: 2.00 mm ²	0.75%	ISO 294-4
Water Absorption		ISO 62
Saturation, 23°C	0.30%	
Equilibrium, 23°C, 50% RH	0.12%	
Mechanical	Nominal Value Unit	Test Method
Tensile Modulus (23°C)	2400 MPa	ISO 527-2/1
Tensile Stress		ISO 527-2/50
Yield, 23°C	67.0 MPa	
Break, 23°C	65.0 MPa	
Tensile Strain		ISO 527-2/50
Yield, 23°C	6.3%	
Break, 23°C	100%	
Nominal Tensile Strain at Break (23°C)	> 50%	ISO 527-2/50
Tensile Creep Modulus		ISO 899-1
1 hr	2200 MPa	
1000 hr	1900 MPa	
Flexural Modulus ³ (23°C)	2400 MPa	ISO 178
Flexural Strength ³		ISO 178
3.5% Strain, 23°C	74.0 MPa	
23°C	100 MPa	
Flexural Strain at Flexural Strength		ISO 179
23°C, 2 mm/min	7.3%	
Films	Nominal Value Unit	Test Method
Water Vapor Transmission Rate		ISO 15106-1
23°C, 100 µm, 85% RH	15 g/m ² /24 hr	
Carbon Dioxide Permeability		ISO 2556
25.4 µm	16900 cm ³ /m ² /bar/24 hr	
100.0 µm	4300 cm ³ /m ² /bar/24 hr	
Nitrogen Permeability		ISO 2556
25.4 µm	510 cm ³ /m ² /bar/24 hr	
100.0 µm	130 cm ³ /m ² /bar/24 hr	
Oxygen Permeability		ISO 2556
25.4 µm	2800 cm ³ /m ² /bar/24 hr	
100.0 µm	700 cm ³ /m ² /bar/24 hr	
Impact	Nominal Value Unit	Test Method
Charpy Notched Impact Strength ^{4,5}		ISO 7391
-30°C, Complete Break	16 kJ/m ²	
23°C, Partial Break	70 kJ/m ²	
Charpy Unnotched Impact Strength		ISO 179/1eU
-60°C	No Break	
-30°C	No Break	
23°C	No Break	
Notched Izod Impact Strength ⁶		ISO 180/A
-30°C, Complete Break	14 kJ/m ²	
23°C, Partial Break	80 kJ/m ²	
Multi-Axial Instrumented Impact Energy		ISO 6603-2
-30°C	65.0 J	
23°C	60.0 J	
Multi-Axial Instrumented Impact Peak Force		ISO 6603-2
-30°C	6500 N	
23°C	5600 N	
Hardness	Nominal Value Unit	Test Method
Ball Indentation Hardness	115 MPa	ISO 2039-1

Thermal	Nominal Value Unit	Test Method
Heat Deflection Temperature		
0.45 MPa, Unannealed	138°C	ISO 75-2/B
1.8 MPa, Unannealed	127°C	ISO 75-2/A
Glass Transition Temperature	145°C	ISO 11357-2
Vicat Softening Temperature		
-	146°C	ISO 306/B50
-	147°C	ISO 306/B120
Ball Pressure Test (137°C)	Pass	IEC 60695-10-2
CLTE		ISO 11359-2
Flow: 23 to 55°C	0.000065 cm/cm/°C	
Transverse: 23 to 55°C	0.000065 cm/cm/°C	
Thermal Conductivity (23°C)	0.20 W/m/K	ISO 8302
Electrical	Nominal Value Unit	Test Method
Surface Resistivity	1.0E+16 ohms	IEC 60093
Volume Resistivity	1.0E+16 ohm cm	IEC 60093
Relative Permittivity		IEC 60250
23°C, 100 Hz	3.10	
23°C, 1 Mhz	3.00	
Dissipation Factor		IEC 60250
23°C, 100 Hz	0.00050	
23°C, 1 Mhz	0.0090	
Comparative Tracking Index		IEC 60112
Solution A	250 V	
Solution B	100 V	
Electric Strength (23°C, 1.00 mm)	34 kV/mm	IEC 60243-1
Flammability	Nominal Value Unit	Test Method
Flame Rating - UL		UL 94
1.50 mm, CL, NC, WT	HB	
3.00 mm, WT	V-2	
6.00 mm, CL, NC, WT	V-0	
Glow Wire Flammability Index		IEC 60695-2-12
1.00 mm	850°C	
1.50 mm	850°C	
2.00 mm	850°C	
3.00 mm	960°C	
4.00 mm	960°C	
Oxygen Index ⁷	27%	ISO 4589-2
Burning Rate (> 1.00 mm, US-FMVSS)	Passed	ISO 3795
Flash Ignition Temperature	480°C	ASTM D1929
Needle Flame Test		
1.50 mm Method F	60.0 sec	
1.50 mm Method K	5.0 sec	
2.00 mm Method K	5.0 sec	
2.00 mm Method F	60.0 sec	
3.00 mm Method F	120.0 sec	
3.00 mm Method K	10.0 sec	
Self Ignition Temperature	550°C	ASTM D1929
UL 746	Nominal Value Unit	Test Method
RTI Str (1.50 mm)	125°C	UL 746
RTI Imp (1.50 mm)	115°C	UL 746
RTI Elec (1.50 mm)	125°C	UL 746
Optical	Nominal Value Unit	Test Method
Refractive Index ⁸	1.587	ISO 489
Transmittance		ISO 13468-2
1.00 µm	89.0%	
2000 µm	88.0%	
3000 µm	88.0%	
4000 µm	87.0%	
Haze (3000 µm)	< 0.80%	ISO 14782
Additional Information	Nominal Value Unit	Test Method
Electrolytical corrosion	A1	IEC 60426
ISO Shortname	PC, ELS, (...)05-9	ISO 7391

TECHNICAL DATA SHEET

POLYCARBONATE FLAME RETARDANT

Physical	Nominal Value Unit	Test Method
Density	1.25 g/cm ³	ISO 1183
Melt Volume-Flow Rate (MVR)		ISO 1133
300°C/1.2 kg	3.00 cm ³ /10 min	
300°C/2.16 kg	5.50 cm ³ /10 min	
Molding Shrinkage - Flow ²	0.40 to 0.60%	Internal Method
Water Absorption		ISO 62
Saturation, 23°C	0.32%	
Equilibrium, 23°C, 50% RH	0.13%	
Mechanical	Nominal Value Unit	Test Method
Tensile Modulus	2350 MPa	ISO 527-2/1
Tensile Stress		ISO 527-2/50
Yield	65.0 MPa	
Break	70.0 MPa	
Tensile Strain		ISO 527-2/50
Yield	7.0%	
Break	> 70%	
Flexural Modulus ³	2350 MPa	ISO 178
Flexural Strength ^{3,4}	95.0 MPa	ISO 178
Taber Abrasion Resistance		Internal Method
1000 Cycles, 1000 g. CS-17 Wheel	9.00 mg	
Impact	Nominal Value Unit	Test Method
Charpy Notched Impact Strength ⁵		ISO 179/1eA
-30°C	10 kJ/m ²	
23°C	11 kJ/m ²	
Charpy Unnotched Impact Strength ⁵		ISO 179/1eU
-30°C	No Break	
23°C	No Break	
Notched Izod Impact Strength ⁶		ISO 180/1A
-30°C	10 kJ/m ²	
23°C	11 kJ/m ²	
Unnotched Izod Impact Strength ⁶		ISO 180/1U
-30°C	No Break	
23°C	No Break	
Hardness	Nominal Value Unit	Test Method
Ball Indentation Hardness (H 358/30)	95.0 MPa	ISO 2039-1
Thermal	Nominal Value Unit	Test Method
Heat Deflection Temperature ⁷		
0.45 MPa, Unannealed, 100 mm Span	148°C	ISO 75-2/Be
1.8 MPa, Unannealed, 100 mm Span	135°C	ISO 75-2/Ae
Vicat Softening Temperature		
-	155°C	ISO 306/B50
-	156°C	ISO 306/B120
Ball Pressure Test (125°C)	Pass	IEC 60695-10-2
CLTE-Flow (23 to 80°C)	0.000070 cm/cm/°C	ISO 11359-2
Thermal Conductivity	0.20 W/m/K	ISO 8302
Electrical	Nominal Value Unit	Test Method
Surface Resistivity	> 1.0E + 15 ohms	IEC 60093
Volume Resistivity	> 1.0E + 15 ohm cm	IEC 60093
Relative Permittivity		IEC 60250
50 Hz	2.70	
60 Hz	2.70	
1 MHz	2.70	
Dissipation Factor		IEC 60250
50 Hz	0.0010	
60 Hz	0.0010	
1 MHz	0.010	
Electric Strength (3,20 mm, in Oil)	17 kV/mm	IEC 60243-1

Flammability	Nominal Value Unit	Test Method
Flame Rating - UL (1.50 mm)	V-0	UL 94
Glow Wire Flammability Index (1.00 mm)	*850 °C *960 °C	IEC 60695-2-12
Optical	Nominal Value Unit	Test Method
Refractive Index	1.586	ISO 489
Transmittance (2540 μm)	88.0%	ASTM D1003
Haze (2540 μm)	< 0.80%	ASTM D1003
Optical	Nominal Value Unit	
Drying Temperature	120°C	
Drying Time	2.0 to 4.0 hr	
Hopper Temperature	100 to 120°C	
Cylinder Zone 1 Temp.	260 to 300°C	
Cylinder Zone 2 Temp.	260 to 290°C	
Cylinder Zone 3 Temp.	260 to 290°C	
Adapter Temperature	240 to 280°C	
Melt Temperature	260 to 300°C	
Die Temperature	240 to 300°C	
Calibration Temp, First	50.0 to 100°C	
NOTES		
¹ Typical properties: these are not to be construed as specifications		
² Tensile Bar		
³ 2.0 mm/min		
⁴ Yield		
⁵ 80*10*3 sp=62 mm		
⁶ 80*10*3		
⁷ 120*10*4 mm		

Polycarbonate UL 94 - V0 Material is used in conformity to the most requested certificates for Fire and Smoke: DIN 5510-2, NF-F 16-101, NF-P 92501, UNI-CEI 11170 and EN 45545.