

PLEXIGLAS® GS/XT

Rods and Tubes

Product

PLEXIGLAS® XT rods and tubes are the clearest extruded tubes on the market today delivering brilliant quality, superior performance, and durability. PLEXIGLAS® XT rods and tubes are characterized by their flawless optics, and perfectly smooth surface free of striations.

White or frosted satin surface finishes provide excellent diffused light creating a velvety non-glare surface. High-quality, design-orientated applications within the architectural lighting industry can be easily created. (for information see PLEXIGLAS® Satinice). Create impressive lighting effects by end lighting our PLEXIGLAS® LED (EndLighten T) rods.

Colored extruded PLEXIGLAS® XT rods and tubes are also available and if additional impact strength is required they can be produced with our acrylic impact modified polymer. You will find more detailed information in the Sales Handbook.

PLEXIGLAS® GS round rods are made of casted semi-finished products and have polished surfaces.

Features & Benefits

- Excellent light transmission and brilliance
- Outstanding weather resistance
- Easy to fabricate
- High surface hardness
- Light weight – half of the weight of glass
- 100% recyclable
- 11 times more break resistant than glass

PLEXIGLAS® XT rods and tubes exhibit the following features:

- Excellent surface appearance
- Tight tolerances
- Conformity to food grade specifications (only applies to colorless)
- UV-transmitting

Cast rods have:

- Polished finish
- Higher molecular weight which results in a more solvent resistant product.

Applications

Due to the above characteristics PLEXIGLAS® rods and tubes are ideally suitable for.

- Architectural interior & exterior lighting.
- Contemporary furniture.
- Luxury brand merchandizing, store fixtures, P.O.P. & trade show displays
- Industrial pneumatic delivery and conveying systems
- Decorative architectural features

Processing

PLEXIGLAS® acrylic rods and tubes can be fabricated like standard PLEXIGLAS®.

The following fabricating guidelines for PLEXIGLAS® are available:

- Processing of PLEXIGLAS® (Nr. 311-1)
- Forming of PLEXIGLAS® (Nr. 311-2)

- Joining of PLEXIGLAS® (Nr. 311–3)
- Surface treatment of PLEXIGLAS® (Nr. 311–4)
- Fabricating tips of PLEXIGLAS® solid sheets (Nr. 311–5)

Machining

PLEXIGLAS® GS and XT tubes/rods can be cut, sanded, drilled etc. with the appropriate tools. They require high cutting speeds and effective cooling as their low heat conduction can easily lead to overheating and local thermal stress. Excess friction, especially with PLEXIGLAS® XT, can cause melting which leads to a tacky surface and difficulty machining. Drilling should never be performed without using some water-based cooling lubricant (i.e. an emulsion). For eliminating internal stress annealing may be necessary.

Bonding

Extruded XT and cast GS PLEXIGLAS® tubes/rods can be bonded together with themselves or with other materials. Annealing is necessary prior to bonding. Suitable adhesives are ACRIFIX® 1S 0116 or 1S 0117 for PLEXIGLAS® XT (with itself) and ACRIFIX® 2R 0190 (as well as ACRIFIX® 1R 0192 for transparent items) especially for PLEXIGLAS® GS to itself or GS+XT.

A second annealing after bonding will increase the strength and the durability of the bond.

Thermoforming

When warming accordingly, PLEXIGLAS® GS (160°C–170°C) and PLEXIGLAS® XT (150°C–160°C) become rubber-elastic. The rods/tubes can then be bent, shaped or thermoformed. When cooled down they will retain the new form. Overheated PLEXIGLAS® XT becomes viscous; therefore special attention has to be taken on obtaining the correct thermoforming temperatures.

You will find further information in the brochure “Forming of PLEXIGLAS®” Chapter 5.

Annealing

Annealing serves to remove stress of the material and to improve the quality of bonds i.e. prevent stress cracking. Annealing is done in convection ovens at approx. 80°C for GS and approx. 70°C for XT. The annealing time should be at least 2 hours or longer followed by slow cooling in the switched-off oven.

Tube connections

Screwed connections

Screwed connections are especially popular with liquid lines. Both metal and plastic fittings can be used, however plastics typically outperform metal e.g. polyamide.

Flanged connections

Flanged connections are mainly used for larger tube diameters. If flange and tube are bonded together, tubes made of PLEXIGLAS® XT need to be annealed to prevent stress cracking.

Scarfig

For producing scarf joints one end of the tube is heated and pushed over the beveled end of the other tube. It may then also be shrunk. For outdoor installation it is advisable to prefabricate the widening (tulip) in a workshop. The sealing is made by filling the tulip edge with the adhesive ACRIFIX® 2R 0190, by sealing with a PMMA-compatible silicone rubber or by inserting a rubber sealing ring. Bonding has certain disadvantages: a clean bond can only be obtained in the workshop. Furthermore the necessary indispensable annealing process makes it a rather tedious procedure. Bonding on site is only possible with vertically installed tubes.

Permissible inside pressure

Diameter		Wall thickness	Weight	Extruded Tube
Outside	Inside			Permissible inside pressure
mm	mm	mm	kg/m	Bar
5	3	1	0.015	7.8
6	3.5	1.25	0.022	8.0
6.5	4	1.25	0.025	7.6
7	5	1	0.022	5.9
8	4	2	0.044	9.2
10	7	1.5	0.047	6.2
	6	2	0.059	7.8
	4	3	0.078	10.3
12	10	1	0.041	3.6
	8	2	0.074	6.7
	6	3	0.100	9.2
13	10	1.5	0.064	4.9
	9	2	0.082	6.3
15	13	1	0.052	2.9
	11	2	0.096	5.6
	10	2.5	0.116	6.7
16	12	2	0.104	5.3
20	18	1	0.070	2.2
	16	2	0.133	4.3
	14	3	0.189	6.2
25	21	2	0.170	3.5
	19	3	0.245	5.1
30	26	2	0.207	2.6
	24	3	0.300	4.3
	22	4	0.385	5.6
	20	5	0.463	6.7
38	32	3	0.389	3.4
40	36	2	0.282	2.2
	34	3	0.411	3.3
	32	4	0.534	4.3
	30	5	0.648	5.3

50	46	2	0.356	1.7
	44	3	0.522	2.6
	42	4	0.682	3.5
	40	5	0.834	4.3
60	56	2	0.430	1.4
	54	3	0.634	2.2
	52	4	0.830	2.9
	50	5	1.019	3.6
70	64	3	0.745	1.9
	62	4	0.978	2.5
	60	5	1.204	3.1
80	74	3	0.856	1.6
	72	4	1.126	2.2
	70	5	1.389	2.7
90	84	3	0.967	1.4
	80	5	1.575	2.4
100	94	3	1.078	1.3
	92	4	1.423	1.7
	90	5	1.760	2.2
110	104	3	1.189	1.1
	100	5	1.945	2.0
120	114	3	1.301	1.0
	110	5	2.130	1.8
133	127	3	1.445	0.9
	123	5	2.371	1.6
150	144	3	1.634	0.8
	142	4	2.164	1.1
	140	5	2.686	1.4
180	172	4	2.608	0.9
200	194	3	2.190	0.5
	192	4	2.905	0.8
	190	5	3.613	1.0
230	222	4	3.380	0.7
	220	5	4.206	0.9
250	242	4	3.679	0.6
	240	5	4.580	0.8

300	292	4	4.426	0.5
	290	5	5.514	0.6
400	392	4	5.922	0.3
	390	5	7.383	0.4
450	442	4	6.669	0.2
	440	5	8.318	0.3
500	492	4	7.417	0.2
	490	5	9.253	0.3

Mechanical properties

Properties	Test standard	Unit	GS (0F00)	XT (0A070)
Density ρ	ISO 1183	g/cm ³	1.19	1.19
Impact strength a_{cU} (Charpy)	ISO 179/1 fu	kJ/m ²	15	15
Notched impact strength a_{iN} (IZod)	ISO 180/1A	kJ/m ²	1.6	1.6
Tensile strength σ_M	ISO 527-2/1B/5			
a) -40°C		MPa	110	110
b) 23°C		MPa	80	72
c) 70°C		MPa	40	35
Max. safety stress $\sigma_{max.}$ (up to 40°C)		MPa	5...10	5...10
Modulus of elasticity E_t (short-time value)		MPa	3300	3300
Min. cold-bending radius			330 x thickness	330 x thickness

Optical properties

Properties	Test standard	Unit	GS (0F00)	XT (0A070)
Optic			Polished	Glossy
Transmittance T_{D65}	DIN 5036	%	~ 92	~92
UV transmission		-	No	Yes
Yellowing	DIN 5036	%		< 0.5
Reflection loss in the visible range (for each surface)		%	4	4
Absorption in visible range		%	< 0.05	< 0.05

Thermal properties

Properties	Test standard	Unit	GS (0F00)	XT (0A070)
Coefficient of linear thermal expansion α for 0...50°C	DIN 53752-A	1 / K (mm/m°C)	7×10^{-5}	7×10^{-5}
Forming temperature		°C	160 ... 175	150 ... 160
Max. surface temperature (IR-radiator)		°C	200	180
Max. permanent service temperature		°C	80	70
Reverse forming temperature		°C	> 80	> 80
Ignition temperature	DIN 51794	°C	425	430
Smoke gas volume	DIN 4102		Very low	Very low
Smoke gas toxicity	DIN 53436		None	None
Smoke gas corrosiveness			None	None
Building material class (according to Baustoffklasse DIN 4102)	DIN 4102		B2	B2
Combustion behavior	BS 476. part 7+6 BS 2782, method 508A DIN EN 13501		Class 3 TP(b) E	Class 3 TP(b) E
Vicat softening temperature	ISO 306. method B50	°C	115	103

Moisture Properties

Properties	Standard test	Unit	GS (0F00)	XT (0A070)
Water absorption (24hrs. 23°C) from dry state. Specimen 60 x 60 x 2mm ³	ISO 62. method 1	Mg	41	38
Max. weight gain during immersion	ISO 62. method 1	%	2.1	2.1
Permeability to water vapor				
N ₂			2.3*10 ⁻¹⁰	2.3*10 ⁻¹⁰
O ₂		g cm	4.5*10 ⁻¹⁵	4.5*10 ⁻¹⁵
CO ₂			2.0*10 ⁻¹⁴	2.0*10 ⁻¹⁴
Air		cm ² h Pa	1.1*10 ⁻¹³	1.1*10 ⁻¹³
			8.3*10 ⁻¹⁵	8.3*10 ⁻¹⁵

You will find further details in the product description PLEXIGLAS® GS and XT (211-1).

Tolerances

Outer diameter and wall thickness

See section A. Sales range. PLEXIGLAS® rods and tubes

Length

Standard tolerances from production at ≤6000 mm length are as follows:

XT Tubes		-0/+5 mm
XT Rods	2-10 mm	-0/+40 mm
	12-60 mm	-0/+15 mm
GS Rods		-0/+100 mm

Special manufacturing tolerances:

Outer diameter in mm	Length 50-500 mm	Length 500-4.000 mm	Length 500-2.000 mm
8	+/- 2.0 mm	+/- 4.0 mm	
10-16	+/- 1.0 mm	+/- 2.0 mm	
20-160	+/- 0.5 mm	+/- 1.0 mm	
160-300		+/- 1.5 mm	
400-450			+/- 2.0 mm
500			+/- 3.0 mm

Straightness of tubes

Maximum Deviation per 1,000 mm length of chord length:

Diameter in mm	Deviation in mm
Up to 10	10
>10 to 20	8
>20 to 30	6.5
>30 to 50	5
>50 to 300	3
>300 to 500	2

Product Offering

PLEXIGLAS® tubes and rods are available in the following lengths and thicknesses:

Manufacturing process	Form	OD in mm	Wall thickness	Length
XT	Tube	5 – 500	2 mm – 5 mm	2,000 mm
XT	Rod	2 – 60		2,000 mm
GS	Rod	15 – 100		2,000 mm

You will find further details in the PLEXIGLAS® Sales Handbook.

Storage

Extruded tubes (OD >300mm) need to be stored vertically to prevent deformation due to proportion of net weight/volume.

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Certificated according to DIN EN ISO 9001 (quality) and DIN EN ISO 14001 (environment)

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