PLEXIGLAS®

PLEXIGLAS®
Solid sheet, block, multi-skin sheet, corrugated sheet, tube and rod

PLEXIGLAS® GS/XT

PLEXIGLAS® GS/XT is cast or extruded acrylic (polymethylmethacrylate, PMMA).

PLEXIGLAS® GS	PLEXIGLAS® XT
cast	extruded
absolutely colorless and clear	absolutely colorless and clear
break-resistant to impact-resistant (PLEXIGLAS® Resist)	break-resistant to impact-resistant (PLEXIGLAS® Resist 45–100)
unequalled resistance to weathering and aging	unequalled resistance to weathering and ageing
high-quality surface and planarity; high-gloss, matt (PLEXIGLAS® Satinice)	very good surface; high-gloss, textured or matt (PLEXIGLAS® Satinice)
solid sheets, blocks and round rods	solid sheets, tubes, round rods, multi-skin sheets, corrugated sheets
2 mm to 160 mm solid sheet/block thicknes	1.5 to 25 mm solid sheet thickness, multi-skin sheets 8, 16 and 32 mm thick
standard size 3050 x 2030 mm up to 25 mm thick standard size 3000 x 2000 mm from 30 mm thick	standard size for solid sheets 3050 x 2050 mm (+ extra lengths)
over 40 standard colours	over 20 standard colours
good resistance to diluted acids and to alkalis, limited resistance to organic solvents	good resistance to diluted acids and to alkalis, limited resistance to organic solvents.
very easy to work, similar to hardwood	easy to work, similar to hardwood
easy to thermoform over a wide range of conditions	very easy to thermoform under optimum, constant conditions
easily and firmly bonded, e.g. with reaction adhesives (e.g. ACRIFIX® 2R 0190, 1R 0192)	very easily bonded, also with solvent adhesives (e.g. ACRIFIX® 1S 0116, 1S 0117)
burns more or less like hardwood; very little smoke generation; combustion gases are non-toxic and non-corrosive	burns more or less like hardwood; very little smoke generation; combustion gases are non-toxic and non-corrosive
max. service temperature approx. 80°C	max. service temperature approx. 70°C

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Survey of PLEXIGLAS® grades and relevant product groups

PLEXIGLAS® GS	
PLEXIGLAS® GS 0F00 Standard solid sheet (and also rod) grade from 2 to 25 mm thickness, largely UV-absorbing.	**PLEXIGLAS® GS 0F00** Standard grade for blocks from 30 mm thickness, UV-absorbing.
PLEXIGLAS® LED (for backlighting) UV-absorbing grades especially for backlighting, with LED-optimised properties, such as maximum transmission and optimum light diffusion.	**PLEXIGLAS® LED (for edge lighting)** Transparent, UV-absorbing, "forward-diffusing" special grades for edge-lit and ultra-slim illuminated signs and light objects.
PLEXIGLAS® Resist Special solid sheet grade with greater impact strength and lower rigidity, with high-gloss or matt surfaces, UV absorbing, for windscreens on two-wheeled vehicles, trade show booth construction and store fixtures, protective glazing.	**PLEXIGLAS® Satinice** Colourless and coloured standard grades with one (SC) and two (DC) satin surfaces for furniture, displays, illuminated signs and light objects.
PLEXIGLAS® GS Colours Transparent, translucent, opaque, fluorescent standard and special grades.	**PLEXIGLAS® GS 0A31** UV-absorbing special grade for applications requiring high UV protection, as well as for areas with strong sunlight.
PLEXIGLAS® GS 0Z09 UV-absorbing special grade with increased heat deflection temperature and better chemical resistance.	**PLEXIGLAS® GS 0Z18** UV-transmitting special grade for exacting demands (e.g. for fibre-optic cables).
PLEXIGLAS® GS 241, 245, 249 Special grades approved for aircraft glazing, UV-absorbing, of high optical quality.	**PLEXIGLAS® GS 2458** [1] UV-transmitting, highly UV-resistant colourless and transparent-coloured special grades for tanning beds.
PLEXIGLAS® Soundstop GS UV-absorbing special solid sheet grade, complies with ZTV-Lsw 06, EN 1793 and EN 1794 for noise barriers.	**PLEXIGLAS® Soundstop GS CC** UV-absorbing solid sheets with integrated PA threads, complies with ZTV-Lsw 06, EN 1793 and EN 1794 for noise barriers.
PARAPAN® High-gloss solid acrylic sheets in 18 mm main thickness with special opaque standard and special colours for furniture fronts.	

[1] Europ. Patent EP 1 164 633

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Survey of PLEXIGLAS® Grades and Relevant Product Groups

PLEXIGLAS® XT	
PLEXIGLAS® XT 0A000 Standard solid sheet grade; largely UV-absorbing. Special grade (0A000 HQ) with high quality suitable for mirror coating.	**PLEXIGLAS® XT 0A070** Standard grades of tubes and round rods; UV-transmitting.
PLEXIGLAS® XT 0A370 UV-transmitting and highly UV-resistant colourless solid sheet grade (e.g. for conservatories, sun terraces).	**PLEXIGLAS® XT 0A770** UV-transmitting, highly UV-resistant colourless special grade for tanning bed canopies; thickness max. 3 mm.
PLEXIGLAS® XT 0A570 (UV 100) Family of UV-absorbing and UV-protecting standard grades for glazing of pictures and exhibits.	**PLEXIGLAS® XT Colours** Transparent, translucent, opaque, standard and special grades.
PLEXIGLAS® Hi-Gloss A noble appearance and special deep-view effect are the characteristics of these high-gloss solid sheets, which are available in various colours.	**PLEXIGLAS® LED (for edge lighting)** UV-absorbing, "forward-diffusing" special grade for edge-lit and ultra-slim illuminated signs.
PLEXIGLAS® Optical Transparent solid sheets with a non-scratch coating and very good abrasion and chemical resistance. Available with a high-gloss (HC) or matt (HCM) surface finish.	**PLEXIGLAS® Reflections** Attractively mirror-coated and reflective solid sheets with a metallic, high-gloss or satin-finished surface.
PLEXIGLAS® Satinice 0D010 DF Solid sheets and tubes satin-finished on both sides and with diffuser beads evenly distributed throughout the material, for light objects, signs and illuminated signs.	**PLEXIGLAS® Satinice SC/DC** Colourless and coloured (multi-coloured), co-extruded standard and special grades with one (SC) and two (DC) satin surfaces for furniture, displays, illuminated signs and light objects.
PLEXIGLAS® Resist [6] 45, -65, -75, -100 Standard grades of solid sheets with higher, graded impact strength and reduced rigidity, UV-absorbing.	**PLEXIGLAS® Textures** Solid sheets with a variety of classical surface textures, combined with trendy colours.
PLEXIGLAS® Heatstop XT / SP / WP [3] IR-reflecting standard grades that greatly reduce incident solar radiation of solid sheets, multi-skin sheets with a water-dispersing NO DROP [4] coating on one side, and corrugated sheets; for domed and continuous rooflights, patio and conservatory roofs, etc.; UV-absorbing.	**PLEXIGLAS® Alltop SP [2]** Group of multi-skin sheets with a water-dispersing coating on both surfaces. **PLEXIGLAS® Resist SP / WP [5]** Groups of multi-skin sheets with higher impact strength, with a water-dispersing NO DROP coating on one side, and corrugated sheets; UV-absorbing.
PLEXIGLAS® Soundstop XT [7] UV-absorbing special grades of solid sheet, complies with ZTV-Lsw 06, EN 1793 and EN 1794 for noise barriers.	

[2] Europ. Patent EP 530 617
[3] Europ. Patent EP 548 822
[4] Europ. Patent EP 149 182
[5] Europ. Patent EP 733 754
[6] Europ. Patent EP 776 931
[7] Europ. Patent EP 600 332

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Typical property values (at 23°C and 50% relative humidity)

Mechanical properties					
	PLEXIGLAS® GS 0F00; 0Z09	**PLEXIGLAS® XT 0A000; 0A070**	**PLEXIGLAS® Resist 45; 65; 75; 100**	**Unit**	**Test standard**
Density ρ	1.19	1.19	1.19	g/cm³	ISO 1183
Impact strength a_{cU} (Charpy)	15	15	45; 65; 75; no break	kJ/m²	ISO 179/1fu
Notched impact strength a_{iN} (Izod)	1.6	1.6	2,5; 4,5; 6,0; 6,5	kJ/m²	ISO 180/1 A
Notched impact strength a_{cN} (Charpy)	-	-	3,5; 6,5; 7,5; 8,0	kJ/m²	ISO 179/1eA
Tensile strength σ_M				MPa	ISO 527-2/1B/5
– 40 °C	110	100	-		
23 °C	80	72	60; 50; 45; 40		
70 °C	40	35	-		
Elongation at break ε_B	5.5	4.5	-	%	ISO 527-2/1B/5
Nominal elongation at break ε_{tB}	-	-	10; 15; 20; 25	%	ISO 527-2/1B/50
Flexural strength σ_{bB} Standard test specimen (80 x 10 x 4 mm³)	115	105	95; 85; 77; 69	MPa	ISO 178
Compressive yield stress σ_{dF}	110	103	-	103	ISO 604
Max. safety stress $\sigma_{max.}$ (up to 40 °C)	5–10	5–10	5–10	MPa	-
Modulus of elasticity E_t (short-term value)	3300	3300	2700; 2200; 2000; 1800	MPa	ISO 527-2/1B/1
Min. cold bending radius	330 x thickness	330 x thickness	270 x thickness; 210 x thickness; 180 x thickness; 150 x thickness	-	-
Dynamic shear modulus G at approx. 10 Hz	1700	1700	-	MPa	ISO 537
Indentation hardness $H_{961/30}$	175	175	145; 130; 120; 100	MPa	ISO 2039-1
Abrasion resistance in Taber abrader test (100 rev.; 5.4 N; CS-10F)	20 –30	20 –30	20 –30; 30 –40; 30 –40; 30 –40	% Haze	ISO 9352
Coefficient of friction μ				-	-
plastic / plastic	0.8	0.8	-		
plastic / steel	0.5	0.5	-		
steel / plastic	0.45	0.45	-		
Poisson's ratio μ_b (dilatation speed of 5% per min; up to 2% dilatation; at 23 °C)	0.37	0.37	0.41; 0.42. 0.41; 0.43	-	ISO 527-1
Resistance to puck impact from thickness	-	-	-; from 5mm; -; -	-	Similar to DIN 18 032. Part 3

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Thermal properties					
	PLEXIGLAS® GS 0F00; 0Z09	**PLEXIGLAS® XT 0A000; 0A070**	**PLEXIGLAS® Resist 45; 65; 75; 100**	**Unit**	**Test standard**
Coefficient of linear thermal expansion α for 0 – 50 °C	$7 \cdot 10^{-5}$ (= 0,07)	$7 \cdot 10^{-5}$ (= 0,07)	$7 \cdot 10^{-5}$; $8 \cdot 10^{-5}$; $9 \cdot 10^{-5}$; $11 \cdot 10^{-5}$ (0,07; 0,08; 0,09; 0,11)	1/K (mm/m °C)	DIN 53752-A
Possible expansion due to heat and moisture	5	5	5; 6; 6; 8	mm/m	-
Thermal conductivity λ	0.19	0.19	-	W/mK	DIN 52612
U-value k for thickness				W/m^2K	DIN 4701
1 mm	5.8	5.8	5.8		
3 mm	5.6	5.6	5.6		
5 mm	5.3	5.3	5.3		
10 mm	4.4	4.4	4.4		
Specific heat c	1.47	1.47	1.47	J/gK	-
Forming temperature	160 – 175	150 – 160	150 – 160; 140 – 150; 140 – 150; 140 – 150	°C	-
Max. surface temperature (IR radiator)	200	180	-	°C	-
Max. permanent service temperature	80	70	70; 70; 70; 65	°C	-
Reverse forming temperature	> 80; > 90	> 70; > 70	> 80; > 80; > 75; > 70	°C	-
Ignition temperature	425	430	-	°C	DIN 51794
Smoke gas volume	very little	very little	very little	-	DIN 4102
Smoke gas toxicity	none	none	none	-	DIN 53436
Smoke gas corrosiveness	none	none	none	-	-
Building material class	B2	B2	B2	-	DIN 4102
Combustion behavior	Class 3 E	Class 3 E	- E	- -	BS 476, Part 7 + 6 DIN EN 13501
Vicat softening temperature	115	103	102; 100; 100; 97	°C	ISO 306, Method B 50
Heat deflection temperature under load (HDT)	-	-	-	°C	ISO 75
deflection 1.8 MPa	105; 107	95	94; 93; 92; 90	-	-
deflection 0.45 MPa	113; 115	100	99; 98; 96; 93	-	-

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Acoustical properties					
	PLEXIGLAS® GS 0F00; 0Z09	**PLEXIGLAS® XT 0A000; 0A070**	**PLEXIGLAS® Resist 45; 65; 75; 100**	**Unit**	**Test standard**
Sound velocity (at room temperature)	2700 – 2800	2700 – 2800	-	m/s	-
Weight sounded reduction index R_w at thickness				dB	-
4 mm	26	26	-		
6 mm	30	30	-		
10 mm	32	32	-		

Optical properties					
Transmittance τ_{D65}	~ 92	~ 92	~ 91	%	DIN 5036, Part 3
UV transmission	no; no	no; yes	no; no; no; no	-	-
Reflecion loss the visible range (for each surface)	4	4	4	%	-
Total energy transmittance g	85	85	85	%	DIN EN 410
Adsorption in the visible range	< 0.05	< 0.05	< 0.05	%	-
Refractive index n_{D}^{20}	1.491	1.491	1.491	-	ISO 489

Electrical properties					
Volume resistivity ρ_D	$> 10^{15}$	$> 10^{15}$	$> 10^{14}$	Ohm · cm	DIN VDE 0303, Part 3
Surface resistivity σ R_{OA}	$5 \cdot 10^{13}$	$5 \cdot 10^{13}$	$> 10^{14}$	Ohm	DIN VDE 0303, Part 3
Dielectric strength E_d (1 mm thickness)	~ 30	~ 30	-	kV/mm	DIN VDE 0303, Part 2
Dielectric constant ε					DIN VDE 0303, Part 4
at 50 Hz	3.6	3.7	-	-	
at 0.1 MHz	2.7	2.8	-	-	
Dissipation factor tan δ					DIN VDE 0303, Part 4
at 50 Hz	0.06	0.06	-	-	
at 0.1 MHz	0.02	0.02	-	-	
Tracking, CTI-Value	600	600	-	-	DIN VDE 0303, Part 1

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Behaviour towards water					
	PLEXIGLAS® GS 0F00; 0Z09	**PLEXIGLAS® XT 0A000; 0A070**	**PLEXIGLAS® Resist 45; 65; 75; 100**	**Unit**	**Test standard**
Water absorption (24 hrs, 23 °C) from dry state; specimen 60 x 60 x 2 mm³	41	38	41; 45; 46; 49	mg	ISO 62, Method 1
Max. weight gain during immersion	2,1	2,1	2,1	%	ISO 62, Method 1
Permeability to				g cm / cm^2 h Pax	-
water vapour	$2{,}3 \cdot 10^{-10}$	$2{,}3 \cdot 10^{-10}$	-		
N_2	$4{,}5 \cdot 10^{-15}$	$4{,}5 \cdot 10^{-15}$	-		
O_2	$2{,}0 \cdot 10^{-14}$	$2{,}0 \cdot 10^{-14}$	-		
CO_2	$1{,}1 \cdot 10^{-13}$	$1{,}1 \cdot 10^{-13}$	-		
air	$8{,}3 \cdot 10^{-15}$	$8{,}3 \cdot 10^{-15}$	-		

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