

Aviation

PLEXIGLAS® Sheet Products for
Aircraft Transparencies



The Performance Polymers business unit of Evonik Industries is the worldleader in polymethyl methacrylate sheet products. Our PLEXIGLAS® offers outstanding optical properties, is lightweight, resists temperature changes and shows unsurpassed weather resistance. Therefore, PLEXIGLAS® has been used in the most varied types of aircraft glazing for many years.

For this purpose we offer the following specially developed materials:

PLEXIGLAS® GS 249: crosslinked high-quality cast acrylic sheet, certified to MIL-P-8184 Type I, Class 2.

PLEXIGLAS® GS 245: cast acrylic sheet of high optical quality

PLEXIGLAS® GS 241: cast acrylic sheet tested to high optical standards for aviation glazing that does not specify material certified to any particular aviation standard.

Together with our products we offer our customers competent application-oriented advice, custom-tailored solutions and compliance with all relevant standards and specifications.

Evonik Röhm GmbH is certified to DIN EN ISO 9001.

Typical Applications of Our Products

PLEXIGLAS® GS 249

is stretchable and ideally suited for:

- commercial aircraft cabin windows
- fighter canopies and windshields
- laminated windshields



Eurofighter Typhoon, windshield and canopy made from PLEXIGLAS® GS 249 Stretched



Eurocopter EC 135, glazing parts made from PLEXIGLAS® GS 245

PLEXIGLAS® GS 245

- Helicopter glazing
- Glider canopies
- General aircraft glazing
- Trainer canopies

PLEXIGLAS® GS 241

- ultralight (ULA) and very light (VLA) aircrafts
- Glider canopies



The Products

PLEXIGLAS® GS 249

- is a cast acrylic specially developed to meet the high demands by the aviation industry, but is additionally cross-linked.
- UV-transmittance less than 1 %.
- offers higher resistance to media that cause stress cracking and a higher heat deflection temperature.
- is classified as a material with "improved moisture absorption resistance" with less than 2.2 % water absorption after long-term exposure.
- is also excellently suited for stretching, which makes it possible to improve its properties even further over the unstretched state.
- can be supplied in both clear-transparent and transparent colored grades.

PLEXIGLAS® GS 245

- is a cast acrylic with specially developed to meet the high optical requirements of the aviation industry.
- UV-transmittance less than 1 %.
- can be supplied in both clear-transparent and transparent colored grades.

PLEXIGLAS® GS 241

- is a cast acrylic tested to high optical standards for aviation glazing but not certified to any particular aviation standard.
- UV-transmittance less than 1 %.
- can be supplied in both clear-transparent and transparent colored grades.

JAS 39 Gripen, windshield made from PLEXIGLAS® GS 249 Stretched



Sales Range

Thickness	(mm)	(inches)
PLEXIGLAS® GS 241	2 to 6	.08 to 0.24
PLEXIGLAS® GS 245	2 to 25	.08 to 1.00
PLEXIGLAS® GS 249	2 to 85	.08 to 3.35
Standard Sizes		
PLEXIGLAS® GS 241	3050 x 2030	120 x 80
PLEXIGLAS® GS 245	up to 3050 x 2030	120 x 80
PLEXIGLAS® GS 249 (2 to 29 mm) (.08 to 1.14 inches)	up to 3050 x 2030	120 x 80
(30 to 85 mm) (1.18 to 3.35 inches)	1220 x 1220	48 x 48
	1830 x 1830	72 x 72
	1670 x 1300	65.7 x 51.2
	2400 x 1200	94.5 x 47.2

Overages

All sheet supplied net trim (no overage). Untrimmed sheets are available. No guarantee is given as to the additional area obtained by ordering untrimmed sheet. For information on intermediate thicknesses and sizes please contact our sales department.

Edge Preparation

Edge-prepared billets are available upon request.

Color

PLEXIGLAS® GS aircraft-grade acrylic sheet is available in a variety of transparent colors. Please contact our sales department for further information.

Tolerances

PLEXIGLAS® GS aircraft-grade acrylic sheets and blocks are supplied within the tolerance limits of the applicable specification.

Fabrication

PLEXIGLAS® GS aviation grade has excellent mechanical properties, is easy to form and polish and thus the ideal product for glazing applications in the aviation industry.

PLEXIGLAS® GS 245 and PLEXIGLAS® GS 241 sheets can be fabricated by the same techniques as standard acrylic sheet.

Most fabrication techniques can also be used for PLEXIGLAS® GS 249 sheet, with slight modifications.

Our guidelines for workshop practice give useful tips and proper advice on fabricating PLEXIGLAS® GS acrylic sheet and are available from our technical service department.

Product Properties of Cast PLEXIGLAS® Sheet

Which properties are important to you? What must the material be able to do?
We have compiled the most important properties of our products in the table below.
Further information and additional properties on request.

Property	Test Method	Unit	Typical Value*	
			PLEXIGLAS® GS 245	PLEXIGLAS® GS 249
Specific gravity	ISO 1183; (ASTM D 792)	g/cm ³	1.19	1.19
Tensile strength	ISO 527-2/1B/5; (ASTM D 638)	MPa; (psi)	80; (11600)	80; (11600)
Tensile elongation	ISO 527-2/1B/5; (ASTM D 638)	%	5.5	5
Internal strain	(160°C, 16 min, thickness 6.35 mm) MIL-P-8184	%	approx. 1.5	–
- preshrunk		%	–	< 1
- unshrunk		%	–	approx. 1.5
Refractive index	ISO 489; (ASTM D 542)	–	1.49	1.49
Light transmittance	EN 2155-5; (ASTM D 1003) ASTM D 1003	%	91	91
- initial				
- after accelerated weathering			89	89
Haze	EN 2155-9; (ASTM D 1003) EN 2155-9; (ASTM D 1003)	%	0.5	1.5
- initial				
- after accelerated weathering			1.0	2.2
Ultraviolet transmittance	(I= 290 - 330 nm)	%	< 1	< 1
Angular deviation	EN 2155-7; (ASTM D 637)	minutes	< 4	< 4
Thermal expansion	EN 2155-12 ASTM D 696	1/K in./in./°F	7 x 10 ⁻⁵ 3.9 x 10 ⁻⁵	7 x 10 ⁻⁵ 3.9 x 10 ⁻⁵
Heat deflection temperature	ISO 75 -2Ae; (ASTM D 648)	°C; (°F)	105; (222)	113; (236)
Vicat softening temperature	ISO 306-B 50	°C	115	118
Flammability	EN 3844-2; (ASTM D 635)	mm/min; (in./min.)	36; (1.4)	20; (0.6)
Water absorption	MIL-P-8184 MIL-P-8184	%	–	0.2
- standard				
- long-term			–	2.1
Crazing resistance	MIL-P-8184 MIL-P-8184 MIL-P-8184 MIL-P-8184 EN 2155-19	psi psi psi psi MPa	– – – – –	2880 2328 2486 1925 16
- dry: isopropyl alcohol				
lacquer thinner				
- wet: isopropyl alcohol				
lacquer thinner				
isopropyl alcohol				

*some values may vary with thickness

Product Properties of Stretched PLEXIGLAS® Sheet

Property	Test Method	Unit	Typical Value*
PLEXIGLAS® GS 249 properly stretched			
Tensile strength	ISO 527-2/1B/5; (ASTM D 638)	MPa; (psi)	80; (11600)
Tensile elongation	ISO 527-2/1B/5; (ASTM D 638)	%	30
Resistance to crack propagation			
- at 23° C (73° F)	EN 2155-21 (MIL-P-25690)	N/mm ^{3/2} (lbs./in. ^{3/2})	118 (3400)
- at -17.8° C (0° F)	EN 2155-21 (MIL-P-25690)	N/mm ^{3/2} (lbs./in. ^{3/2})	56 (1600)
- after weathering	MIL-P-25690	lbs./in. ^{3/2}	3350
Shear strength	MIL-P-25690	psi	4500
Thermal relaxation			
- at 110° C (230° F)	EN 2155-22; (MIL-P-25690)	%	5
- at 145° C (293° F)	EN 2155-22; (MIL-P-25690)	%	42
Crazing resistance			
- dry: isopropyl alcohol lacquer thinner	MIL-PP-25690	psi	3700
	MIL-PP-25690	psi	3350
- wet: isopropyl alcohol lacquer thinner	MIL-PP-25690	psi	3550
	MIL-PP-25690	psi	2850

*some values may vary with thickness

Approvals and Specifications

	Germany	France	Great Britain	AECMA	U.S.	Russia
PLEXIGLAS® GS 245	meets WL 5.1412 DIN 65321	meets AIR 9106/A Type I	type approved to DTD 5592 A	meets pr EN 4364	corresponds to MIL-P-5425 ¹⁾	meets or exceeds GOST 10667-90
PLEXIGLAS® GS 249	meets WL 5.1415 DIN 65321	meets AIR 9106/A Type II	type approved to DTD 5592 A	meets pr EN 4365	qualified to MIL-P-8184 Type I; Class II	meets or exceeds GOST 10667-90
PLEXIGLAS® GS 249 properly stretched	meets or exceeds WL 5.1416	meets or exceeds AIR 9106/A Type III		meets or exceeds pr EN 4366	meets or exceeds MIL-P-25690	

¹⁾ usable to WL 5.1412

Flammability

PLEXIGLAS® GS 245 and PLEXIGLAS® GS 249 meet the requirements of FAR 25.853 (a) (1) (iv) (corresponds to JAR, Part 25, Paragraph 25.853 (b-2) and AITM 2003)

® = registered trademark

PLEXIGLAS
is a registered trademark of
Evonik Röhm GmbH, Darmstadt, Germany.

Certified to DIN EN ISO 9001 (quality)
and DIN EN ISO 14001 (environment)

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Ref. No. 122-2 December 2007
xx/1207/09373 (en)



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