

## PRODUCT TECHNICAL DATA

### Saflex® Clear (R series) – Polyvinyl Butyral Interlayer

Saflex® interlayers are plasticized polyvinyl butyral (PVB) sheeting produced by Eastman and its affiliates. These interlayers are permanently bonded through a heat and pressure process to two or more pieces of glazing to produce laminates with impact and glass containment properties. Saflex R series formulations of PVB interlayers from Eastman Chemical Company, when in clear form, are branded as “Saflex Clear”. Laminated glasses with the properly selected type of Saflex interlayer are capable of being classified as safety glass in accordance with, but not limited to, various regulations such as ANSI Z26.1, ANSI Z97.1, AS/NZS 2208; CNS 1183, CPSC 16 CFR 1201, EN 12600 and ISO 29584.

#### Product Overview:

Saflex Clear interlayers, have demonstrably met or exceeded many regulations for laminated safety glazing (including those listed above) when properly selected, laminated, and installed. Saflex Clear interlayers were specifically formulated to provide exceptional durability when exposed to natural weathering, especially when laminate edges are left unprotected from the elements. Saflex Clear interlayers have been shown to be compatible and durable when laminated in intimate contact with most infrared reflective, metal coated, ceramic frit and printed glasses. Compatibility should always be verified through the coating or ink manufacturer. The level of adhesion should be selected in order to meet specific applications requirements. A more detailed listing of Saflex Clear formulations can be found at [www.saflex.com](http://www.saflex.com) or by contacting your local Eastman representatives.

#### Available Forms:

All Saflex interlayers are supplied in roll form on 15.2 cm (6 inch) diameter cores.

Saflex Clear interlayers are supplied in a variety of roll lengths and widths. Most common standard roll length is 250 meters (820 feet). The most common thicknesses are 0.38 mm (0.015 inch), 0.76mm (0.030 inch), 1.14mm (0.045 inch) and 1.52mm (0.060 inch).

Saflex Clear interlayers are produced in various adhesion levels to meet fabrication needs. Saflex Clear interlayers are available only as our conventional R series formulation in clear form. Saflex Clear is supplied in rolls as refrigerated or interleaved with polyethylene that do not require refrigeration (additional charge applies). Interleaving is not available for all products.

Please contact your Saflex Sales Manager, Technical Service Representative, Customer Service Representative or visit [www.saflex.com](http://www.saflex.com) for further information.

#### Storage Conditions:

Saflex Clear interlayers should be stored inside the moisture barrier bag that the roll is shipped in and maintained within the temperatures recommended in the Saflex Laminating Guide. It is recommended that the interlayer be used within a two-year period from purchase to minimize the sheet adhering to itself on the roll (blocking).

#### Laminating Conditions:

A Laminating Guide which details recommended practices for storage, handling and lamination is available to Eastman’s laminating partners. This technical guide is available only from a Saflex Technical Service (TS) Representative or Saflex Sales Manager. To find the name of the Saflex representative for your organization, call 1-800-636-8670.

**Saflex® Clear – Select Properties<sup>1</sup>:**

Test	Property	Test Method	Units	Conditions	Saflex® Clear interlayer
Flammability	Extent of Burning <sup>1</sup>	ASTM D635	mm	-	7.9
	Heat of Combustion	ASTM E1354 ISO 1716	MJ/kg	-	31
	Rate of Burning <sup>1</sup>	ASTM D 635	mm/min °C	-	<25
	Self-Ignition <sup>1</sup>	ASTM D1929	°C	-	404
	Smoke Density <sup>1</sup>	ASTM D2843	%	-	5
Mechanical	Elongation at Failure	ISO 527-3	%	50 mm/min 23°C 50% RH	270
		JIS K6771	%	20 mm/min 23°C 50% RH	265
	Poisson's Ratio	ASTM D638	-	23°C 50% RH	0.5
	Shear Modulus; G(t)	EN 16613	MPa	Relaxation	See Table Below
	Tear Resistance	ASTM D624	N/mm	23°C 50% RH	-
		ASTM D1004	N/cm	23°C 50% RH	112
	Tensile strength	ISO 527-3	MPa	50 mm/min 23°C 50% RH	23
		JIS K6771	MPa	20 mm/min 23°C 50% RH	20
	Young's Modulus; E(t)	EN 16613	MPa	Relaxation	See Table Below

Test	Property	Test Method	Units	Conditions	Saflex® Clear interlayer
Optical	Haze	ASTM D1003	%	Clear 3 mm	<1
	Refractive Index	ASTM D542	-	23°C	1.479
	Yellowness Index	ASTM E313	YI	Clear 3 mm Glass	<1
Physical	Glass Transition Temperature	-	°C	Frequency 1 Hz Heating Rate 3° C/min	25°C±1
	Hardness	ASTM D2240	Shore A	cut/stacked to 12.5 mm	77
	Moisture	EMN	%	-	Target ± 0.05
	Plasticizer	EMN	PHR	-	Target ± 2
	Roll Length	EMN	m	-	ordered minimum
	Specific Gravity/Density	ASTM D792	g/cm3	23°C	1.07
	Specific Heat	ASTM E1269	J/Kg -°K	50°C	1980
	Thickness	EMN	mm	0.76	±0.025 mm
	Width	EMN	cm	-	Ordered minimum
Safety Glazing Impact	2.2 kg (5 lb) Ball	ANSI Z26.1; ASTM F3006, ECE R43	-	0.76 mm	Comply
	Twin Tyre	EN 12600; ISO 29584	1B1	0.76 mm	Comply
	45 kg (100 lb) Shot Bag	ANSI Z97.1; CPSC 16 CFR 1201	Class B Cat I; 667 N (150 ftlb)	0.38 mm	Comply
	45 kg (100 lb) Shot Bag	ANSI Z97.1; CPSC 16 CFR 1201	Class A; Cat II; 1779 N (400 ftlb)	0.76 mm	Comply

Test	Property	Test Method	Units	Saflex® Clear interlayer	
Solar <sup>2</sup>	Solar Transmittance	LBNL WINDOW 7.0 NFRC 100	%	75	
	Solar Reflectance		%	4	
	Solar Absorptance		%	18	
	Visible Transmittance		%	89	
	Visible Reflectance		%	8	
	Solar Heat Gain Coefficient	NFRC 300	SHGC   g value	0.81	
	Sun Protection Factor	Calculated	SPF <sup>3</sup>	50+	
	Light to Solar Gain	Calculated	LSG	1.07	
	U Factor	NFRC 100	W/m <sup>2</sup> -K	5.68	
	UV Factors	Damage Weighted (Tdw-K)		300 - 500 nm	0.30
Damage Weighted (Tdw-ISO)			300 - 600 nm	0.62	
Transmitted UV			300 - 380 nm	<1%	
Test	Property	Test Method	Units	Conditions	Saflex® Clear interlayer
Thermal	Coefficient of Thermal Expansion	ASTM E831	ppm/°C	30°C to 100°C	155
	Thermal Conductivity	ASTM D5930	W/m*K	65°C	0.2
	Emissivity	ASTM C1371	-	19.5°C	0.94
1 - Data based on NOA for Saflex formulation					
2 - Solar, Thermal, Optical and Color data based on 0.76 mm clear Saflex Clear PVB interlayer with clear nominal 3 mm glass. Calculations performed using OPTIC and WINDOW 7.0 by Lawrence Berkeley National Laboratory.					
3 - SPF is a calculated value based on the spectral data from the laminate and not a result of direct testing.					

The relaxation modulus and calculated Young's modulus for Saflex Clear (R series PVB interlayer) based on relaxation modulus values for a given duration at temperature is provided for use in calculating structural capacity of laminated glass containing this product.

Load Duration	Saflex® Clear shear relaxation modulus G(t) (MPa)										
	Temperature (°C)										
	10	15	20	25	30	35	40	45	50	55	60
3 sec	52	29	11	4.2	1.7	0.82	0.56	0.46	0.40	0.36	0.31
10 sec	36	16	6.1	2.1	0.94	0.61	0.47	0.40	0.36	0.31	0.25
30 sec	25	8.6	2.9	1.2	0.69	0.49	0.42	0.37	0.32	0.26	0.16
1 min	18	6.2	2.1	0.90	0.58	0.46	0.39	0.35	0.29	0.21	0.10
5 min	7.3	2.3	1.0	0.59	0.46	0.39	0.34	0.28	0.19	0.07	
10 min	5.0	1.7	0.77	0.51	0.42	0.37	0.32	0.24	0.13	0.02	
30 min	2.4	1.0	0.59	0.45	0.39	0.33	0.27	0.16	0.03		
1 hour	1.8	0.78	0.51	0.42	0.37	0.31	0.22	0.10			
6 hours	0.81	0.51	0.42	0.36	0.30	0.20	0.06				
12 hours	0.68	0.47	0.39	0.34	0.26	0.15	0.02				
1 day	0.57	0.44	0.37	0.31	0.22	0.08					
5 days	0.46	0.38	0.32	0.22	0.08						
1 week	0.44	0.37	0.31	0.20	0.05						
3 weeks	0.39	0.33	0.25	0.10							
1 month	0.38	0.32	0.22	0.07							
1 year*	0.30	0.17	0.02								
10 years*	0.14										
15 years*	0.10										
50 years*	0.02										

\*values not validated

Load Duration	Saflex® Clear Young's relaxation modulus E(t) (MPa)										
	Temperature (°C)										
	10	15	20	25	30	35	40	45	50	55	60
3 sec	156	86	33	13	5.2	2.5	1.7	1.37	1.19	1.07	0.93
10 sec	109	48	18	6.3	2.8	1.8	1.4	1.21	1.08	0.94	0.74
30 sec	75	26	8.7	3.7	2.1	1.5	1.3	1.11	0.97	0.77	0.49
1 min	53	19	6.2	2.7	1.7	1.4	1.2	1.04	0.88	0.64	0.29
5 min	22	6.8	2.9	1.8	1.4	1.2	1.0	0.85	0.58	0.21	
10 min	15	5.1	2.3	1.5	1.3	1.1	1.0	0.73	0.40	0.06	
30 min	7.3	2.9	1.8	1.4	1.2	1.0	0.80	0.48	0.10		
1 hour	5.4	2.3	1.5	1.3	1.1	0.93	0.67	0.29			
6 hours	2.4	1.5	1.3	1.1	0.90	0.61	0.19				
12 hours	2.1	1.4	1.2	1.0	0.79	0.44	0.06				
1 day	1.7	1.3	1.1	0.94	0.66	0.24					
5 days	1.4	1.1	1.0	0.67	0.23						
1 week	1.3	1.1	0.92	0.60	0.15						
3 weeks	1.2	1.00	0.74	0.31							
1 month	1.2	0.96	0.67	0.20							
1 year*	0.89	0.52	0.06								
10 years*	0.42										
15 years*	0.30										
50 years*	0.05										

\*values not validated

Values calculated using  $E = 3G$  as per EN 16613 par 5.1; for exact values of the Young's modulus available actual Poisson's ratio can be used

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