

## PRODUCT TECHNICAL DATA

### Saflex® Clear – 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 TS29584.

#### 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 glasses. 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. 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:

Eastman makes available to our fabricating customers, a Saflex Laminating Guide which details nominal methods for storage, handling, and lamination. 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.

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

Test	Technical Data Property	Test Method	Units	Conditions	Saflex® Clear interlayer
Flammability	Extent of Burning	ASTM D635	mm	-	7.9
	Flame Spread Index	ASTM E84	-	-	10
	Heat of Combustion	ASTM E1354	Joules/Kg	-	37
	Rate of Burning	ASTM D 635	mm/min °C	-	<25
	Self-Ignition	ASTM D1929	°C	-	760
	Smoke Density	ASTM D2843	%	-	5
Mechanical	Coefficient of Thermal Expansion	ASTM E831	ppm/°C	30-100°C	155
	Conductivity, Thermal, K	ASTM F433	W/m-°K	65°C	0.20
	Elongation at Failure	JIS K6771	%	23°C/50% RH	205
	Emissivity	ASTM C1371		19.5°C	0.94
	Modulus of Elasticity (E)	Calculated	MPa	60°C/1 Hz	1.56
	Poisson's Ratio	ASTM D638		23°C/50% RH	0.5
	Shear Modulus (G') <sup>2</sup>	See Table Below			
	Tear Resistance	ASTM D1004	N/cm	-	112
	Tensile strength	JIS K6771	MPa	23°C/50% RH	27
	Young's Modulus (E) <sup>2</sup>	See Table Below			

1 - Data supplied on Saflex RB (0.76 mm) formulation in 3 mm clear glass unless otherwise specified.

2 - Shear modulus (G) and Young's modulus data for other temperatures and durations are provided in a separate table at the end of this document.

Technical Data	Property	Test Method	Units	Test Conditions	Saflex® Clear interlayer
Optical	Haze	ASTM D1003	-	Clear 3 mm Glass	<1
	Refractive Index	ASTM D542		23°C	1.478
	Visible Transmittance	NFRC 300	D65	Clear 3 mm Glass	89%
	Yellowness Index	ASTM E313	-	Clear 3 mm Glass	<1
Physical	Glass Transition Temperature	---	°C	Frequency 1 Hz Heating Rate 3° C/min	30°C±1
	Hardness	ASTM2240	Shore D	cut/stacked to 12.5 mm	52
	Moisture	EMN	%	-	Target ± 0.05
	Plasticizer	EMN	PHR	-	Target ± 2
	Roll Length	EMN	m	-	ordered minimum
	Specific Gravity/Density	ASTM D792	g/cm <sup>3</sup>	23°C	1.07
	Specific Heat	ASTM E1269	Joules/Kg -°K	50°C	1980
	Thickness	EMN	mm	0.38, 0.76 & 1.14 mm 1.52 mm	±0.025 mm ±0.038 mm
Width	EMN	cm	-	Ordered minimum	

### Impact Data<sup>3</sup>

Test	Test Method	Conditions	Saflex® Clear interlayer
5-lb (2,227g) Ball Impact	ANSI Z26.1; ASTM F3006; ECE R43	ANSI Z26.1; ASTM F3006; ECE R43	Comply
Twin Tyre	ISO 29584; EN12600	1B1	Comply
100 lb (45,359g) Shot Bag Impact	ANSI Z97.1; CPSC 16 CFR 1201	Class B; Cat I 667 N (150 ftlb)	Comply
100 lb (45,359g) Shot Bag Impact	ANSI Z97.1; CPSC 16 CFR 1201	Class A; Cat II 1779 N (400 ftlb)	Comply

3 - Impact data tested on nominal 0.76 mm Saflex R series interlayer.

### Solar Data<sup>4</sup>

Property	Test Method	Visible	Solar
Transmittance	ISO 9050/EN410	89%	72%
Reflectance	ISO 9050/EN410	8%	7%
Absorptance	ISO 9050/EN410	4%	21%
Property	Test Method	Units	Performance Value
Solar Heat Gain Coefficient (SHGC; G value)	NFRC 300	n/a	0.79
Sun Protection Factor (SPF)	Calculated	n/a	50+
Light to Solar Gain (LSG)	Calculated	n/a	1.12
U Factor	NFRC 100	W/m <sup>2</sup> -K	5.66
UV Factors	Damage Weighted (Tdw-K)	300-500 nm	0.30
	Damage Weighted (Tdw-ISO)	300 – 600 nm	0.62
	Transmitted UV NFRC 300	300 - 380 nm	<1%

4 - Solar, Thermal, Optical and Color data based on 0.76 mm clear Saflex R interlayer with clear nominal 3 mm glass. Calculations performed using OPTIC and WINDOW 6.0 by Lawrence Berkeley National Laboratory.

**Saflex® Clear - PVB interlayer Shear Storage Modulus**

Load Duration	Temperature								
	20°C	25°C	30°C	35°C	40°C	45°C	50°C	55°C	60°C
	MPa								
1 sec	26	6.9	2.1	1	0.7	0.6	0.5	0.5	0.4
3 sec	14	3.4	1.2	0.8	0.6	0.5	0.5	0.4	0.4
30 sec	3.5	1.1	0.7	0.5	0.5	0.4	0.4	0.3	0.3
1 min	2.4	1	0.6	0.5	0.5	0.4	0.4	0.3	0.3
5 min	1.1	0.6	0.5	0.4	0.4	0.3	0.3	0.2	0.2
10 min	0.9	0.6	0.5	0.4	0.4	0.3	0.2	0.2	0.2
30 min	0.7	0.5	0.4	0.4	0.3	0.2	0.2	0.2	0.1
1 hour	0.6	0.5	0.4	0.4	0.3	0.2	0.2	0.1	0.1
6 hours	0.5	0.4	0.4	0.3	0.2	0.1	0.1	0.1	0.1
12 hours	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	--
1 day	0.5	0.4	0.3	0.2	0.1	0.1	0.1	--	--
5 days	0.4	0.3	0.2	0.1	0.1	--	--	--	--
1 week	0.4	0.3	0.2	0.1	0.1	--	--	--	--
3 weeks	0.3	0.2	0.1	0.1	0.1	--	--	--	--
1 month	0.3	0.2	0.1	0.1	--	--	--	--	--
1 year	0.2	0.1	0.1	--	--	--	--	--	--
10 years	0.1	0.1	--	--	--	--	--	--	--
15 years	0.1	0.1	--	--	--	--	--	--	--
50 years	0.1	--	--	--	--	--	--	--	--

**Saflex® Clear - PVB interlayer Young's Modulus<sup>5</sup>**

Load Duration	Temperature								
	20°C	25°C	30°C	35°C	40°C	45°C	50°C	55°C	60°C
	MPa								
1 sec	78	21	6.3	3.0	2.1	1.8	1.5	1.5	1.2
3 sec	42	10	3.6	2.4	1.8	1.5	1.5	1.2	1.2
30 sec	11	3.3	2.1	1.5	1.5	1.2	1.2	0.9	0.9
1 min	7.2	3.0	1.8	1.5	1.5	1.2	1.2	0.9	0.9
5 min	3.3	1.8	1.5	1.2	1.2	0.9	0.9	0.6	0.6
10 min	2.7	1.8	1.5	1.2	1.2	0.9	0.6	0.6	0.6
30 min	2.1	1.5	1.2	1.2	0.9	0.6	0.6	0.6	0.3
1 hour	1.8	1.5	1.2	1.2	0.9	0.6	0.6	0.3	0.3
6 hours	1.5	1.2	1.2	0.9	0.6	0.3	0.3	0.3	0.3
12 hours	1.5	1.2	0.9	0.6	0.6	0.3	0.3	0.3	--
1 day	1.5	1.2	0.9	0.6	0.3	0.3	0.3	--	--
5 days	1.2	0.9	0.6	0.3	0.3	--	--	--	--
1 week	1.2	0.9	0.6	0.3	0.3	--	--	--	--
3 weeks	0.9	0.6	0.3	0.3	0.3	--	--	--	--
1 month	0.9	0.6	0.3	0.3	--	--	--	--	--
1 year	0.6	0.3	0.3	--	--	--	--	--	--
10 years	0.3	0.3	--	--	--	--	--	--	--
15 years	0.3	0.3	--	--	--	--	--	--	--
50 years	0.3	--	--	--	--	--	--	--	--

<sup>5</sup> - Young's modulus E' is calculated using formula  $E' = 2G'(1+\nu)$  where  $\nu$  = Poisson's ratio of approximately 0.50 for isotropic polymeric material.

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