

PRODUCT TECHNICAL DATA

Saflex® Solar (S series) PVB Interlayer

Saflex® interlayers are plasticized polyvinyl butyral (PVB) sheeting produced by Eastman Chemical Company and its affiliates. These interlayers are permanently bonded through a heat and pressure process to two or more pieces of glass to produce laminated glass with impact and glass containment properties, as well as other added features. 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 Solar interlayers, SG and SH formulations, are very effective, high visible light transmitting, solar control products designed to produce glass laminates with enhanced solar heat gain performance as compared to monolithic clear glass and laminates made with conventional clear polyvinyl butyral (PVB) interlayer. Saflex Solar interlayers have the capability to meet or exceed many regulations for laminated safety glazing (including those listed above) when properly selected, laminated, and installed. Saflex Solar interlayers were specifically formulated to provide exceptional durability when exposed to natural weathering.

Saflex Solar utilizes an absorbing technology that can be used alone, in conjunction with other Saflex and Vanceva® interlayers, with colored, spectrally select and coated glasses and as one or more lites in insulating glass units (IGU). The product is designed for use in exterior laminated glazing, especially in markets that require solar control configurations not easily adapted to the inclusion of low-e glazings or complex configurations. Laminated glass with Saflex Solar is ideal for use in retrofit applications where the overall thickness for the glass unit is limited, the glass is curved, or the framing system cannot accommodate an IGU or for historic reasons the frame cannot be modified. Saflex Solar provides a good level of solar control in thicknesses as low as 5 – 6 mm (3/16 inch – 1/4 inch). Saflex Solar interlayer also provides all the benefits of safety, glass shard retention, structural integrity, sound abatement, security and storm protection when used in the proper configurations. Other Saflex Solar benefits include:

- Solar Heat Gain Coefficient (SHGC; g value) in 3 mm (1/8 inch) clear glass below 0.65 – 0.55.
- Visible Light Transmittance in 3 mm clear glass of > 70%.
- Embedded interlayer performance reduces scratching and defect formation during processing
- Uniform and consistent dispersion (for uniform look across a façade)
- Reduces angular color concerns
- Edge deletion not required
- Digital signage

For more information on Saflex Solar, please contact your Eastman representative.

The ability to reduce radiation and thus solar heat gain through glazing can be measured and calculated. This measurement involves spectral transmittance scans being conducted within the Ultra-violet (UV), Visible (VT) and Near Infra-red (NIR) wavelengths. An optimum solar glazing for building use eliminates UV and NIR wavelengths while allowing as much visible light transmittance as possible. The spectral graph below shows the transmittance through the UV, Visible and NIR wavelengths of a laminate configured as 3 mm (1/8 in) clear glass – 0.76 mm (0.030 in) Saflex Solar – 3 mm (1/8 in) clear glass.

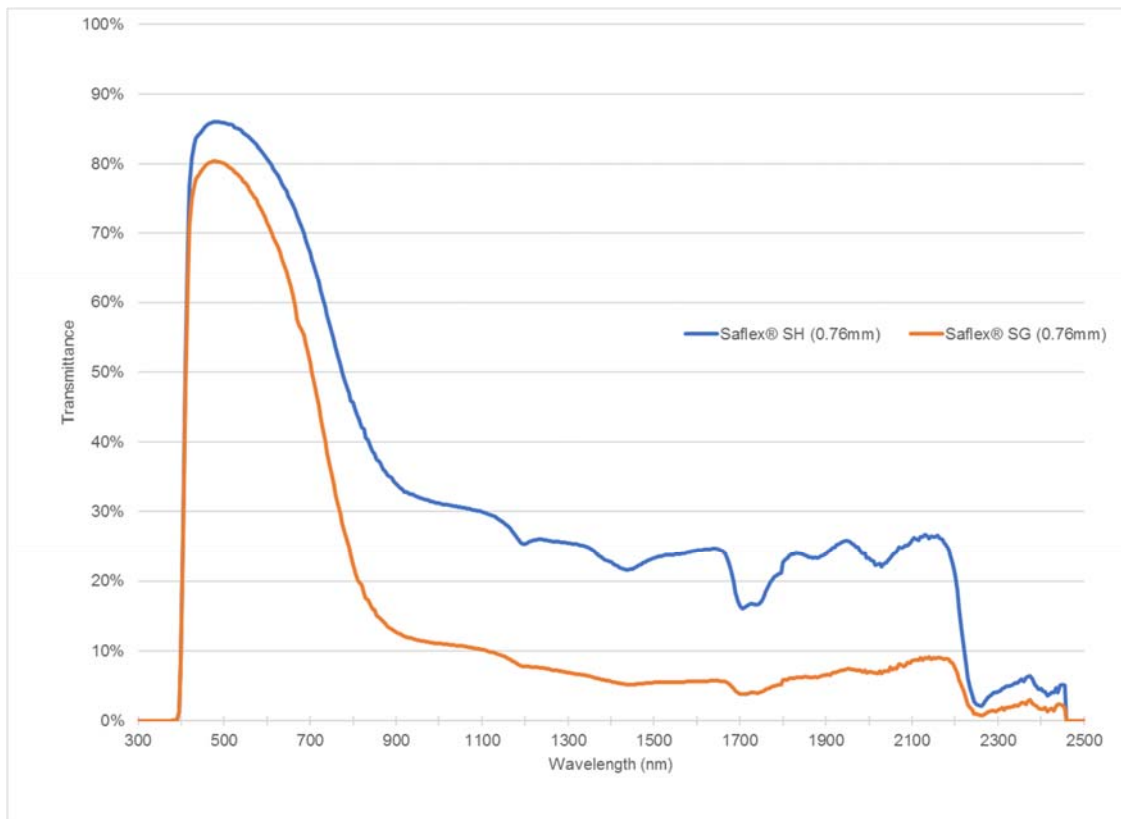


Figure 1: Spectral Data for Saflex® Solar interlayers: Configuration 3 mm (1/8 in) clear glass – 0.76 mm (0.030 in) Saflex Solar – 3 mm (1/8 in) clear glass; Formulations SG and SH.

Available Forms:

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

Saflex Solar interlayers are supplied in a variety of roll lengths and widths. Most common standard roll length is 250 meters (820 feet) in thicknesses of 0.76 mm (0.030 inch).

Please contact your Saflex Sales Manager, Customer Service Representative or visit www.saflex.com for further information.

Storage Conditions:

Saflex Solar interlayers should be stored inside the moisture barrier bag that the roll is shipped in. Saflex Solar interlayers are supplied as refrigerated rolls that must be stored between 5°C and 10°C (41°F to 50°F) to prevent the material from sticking to itself (blocking) or as rolls interleaved with polyethylene (additional charge applies) that do not require refrigeration. It is recommended that the interlayer be used within a two-year period from purchase to prevent the interlayer from blocking. Interleaved materials extend the “best if used by” date an additional 12 months.

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® Solar Properties¹:

Test	Technical Data Property	Test Method	Units	Conditions	Saflex® Solar 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	-	<25
	Self-Ignition	ASTM D1929	°C	-	760
	Smoke Density	ASTM D2843	%	-	5
Mechanical	Coefficient of Thermal Expansion	ASTM E831	ppm/°C	-40 °C -20°C	178
	Conductivity, Thermal, K	ASTM D 5930	W/m-°K	62°C	0.18
	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') ²	See Table Below			
	Tear Resistance	ASTM D1004	N/cm	-	112
	Tensile strength	JIS K6771	MPa	23°C/50% RH	27
	Young's Modulus (E) ²	See Table Below			

1 - Data supplied on Saflex RB (0.76 mm) formulation in 3 mm Solar 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® Solar 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	See below
	Yellowness Index	ASTM E313	-	Clear 3 mm Glass	n/a
Physical	Glass Transition Temperature	---	°C	Frequency 1 Hz Heating Rate 3° C/min	30°C±1
	Hardness	ASTM D 2240	Shore A	cut/stacked to 12.5 mm	56
	Moisture	EMN	%	-	Target ± 0.05
	Plasticizer	EMN	PHR	-	Target ± 2
	Roll Length	EMN	m	-	ordered minimum
	Specific Gravity/Density	ASTM D792	g/cm ³	23°C	1.07
	Specific Heat	ASTM E1269	Joules/Kg -°K	54°C	2125
	Thickness	EMN	mm	0.76	±0.025 mm
Width	EMN	cm	-	Ordered minimum	

Impact Data³

Test	Test Method	Conditions	Saflex® Solar 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.

Saflex® Solar Interlayer - Select Solar and Optical Data⁴

	Property	Test Method	Units	Test Conditions	Saflex® Solar interlayer	
					SG	SH
Solar	Total Solar Transmittance	NFRC 100, ISO 9050	%	Laminate 3 mm clear glass	37	51
	Solar Reflectance	NFRC 100, ISO 9050	%	Laminate 3 mm clear glass	6	6
	Solar Absorptance	NFRC, WINDOW	%	Laminate 3 mm clear glass	58	43
	Solar Heat Gain Coefficient (SHGC)	NFRC, WINDOW	--	Laminate 3 mm clear glass	0.55	0.64
	Shading Coefficient	NFRC, WINDOW	--	Laminate 3 mm clear glass	0.63	0.74
Thermal	Light to Solar Gain (LSG)	--	--	Laminate 3 mm clear glass	1.38	1.29
	U factor	NFRC, WINDOW	W/m2-K	Laminate 3 mm clear glass	5.68	5.68
			BTU/hr-ft2-F		1.00	1.00
UV	Transmitted UV	NFRC, WINDOW	%	Laminate 3 mm clear glass	<0.1%	<0.1%
	Damage Weighted Factor (Tdw)	NFRC, WINDOW	--	Laminate 3 mm clear glass	0.21	0.22
	SPF	NFRC OPTICS	--	Laminate 3 mm clear glass	>100	>100
	Skin Cancer Foundation	Seal of Approval	Recommended	Laminate 3 mm clear glass	Yes	Yes
Visible	Visible Light Transmittance	NFRC 100, ISO 9050	%	Laminate 3 mm clear glass	76	83
	Visible Light Reflectance	NFRC 100, ISO 9050	%	Laminate 3 mm clear glass	8	8

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

Saflex Solar CIE L*a*b* color properties are indicated below. The color depiction boxes simulate RGB converted values from transmittance values from a modeled 3 mm clear glass | Saflex 0.76 mm interlayer (as designated) | 3 mm clear glass. The values and diagram serve as a guide only, mock-up samples should be reviewed.

	Saflex Clear			Saflex Solar (SH)			Saflex Solar (SG)		
	L*	a*	b*	L*	a*	b*	L*	a*	b*
Transmittance	95.45	-1.59	0.48	93.15	-3.86	0.36	89.80	-5.70	-1.13
Reflectance	34.97	-0.90	-0.45	33.79	-1.54	-0.64	32.90	-1.98	-1.72

Saflex® Solar (SG and SH) 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	--	--	--	--	--	--	--	--

Applicable to Saflex Solar SG and SH formulations.

Saflex® Solar - PVB interlayer Young's Modulus⁵

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	--	--	--	--	--	--	--	--

⁵ - Young's modulus E' is calculated using formula $E' = 2G'(1+\nu)$ where ν = Poisson's ratio of approximately 0.50 for isotropic polymeric material. Applicable to Saflex Solar, SG and SH formulations.

Notes: Saflex SG41 0000S5, SH41 0000S2; ASTM - ASTM International, www.astm.org; ISO - International Organization for Standardization, www.iso.org; NFRC - National Fenestration Rating Council, www.nfrc.org; Window 6 - Lawrence Berkeley National Laboratories, www.window.lbl.gov

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