

PRODUCT TECHNICAL DATA

Saflex® Solar (S series) – Polyvinyl Butyral 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.

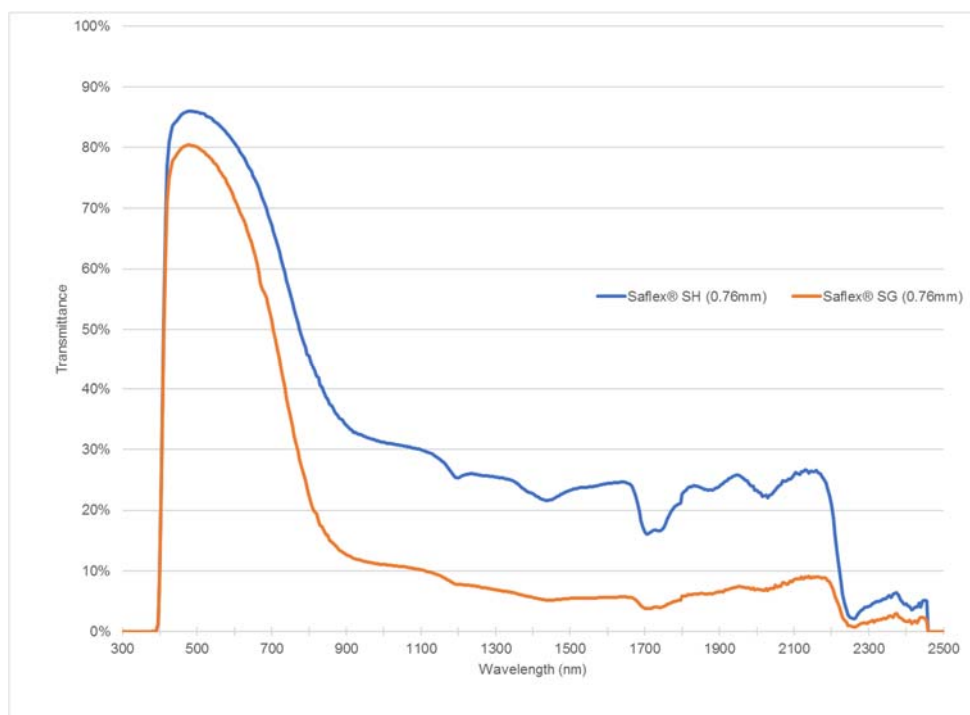


Figure 1: Spectral Data for Saflex® Solar interlayers: Configuration 3 mm (1/8 in) clear glass – 0.76 mm (0.030 in) Saflex Solar – 3 mm (1/8 in) clear glass; Formulations SG and SH.

Available Forms:

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

Saflex Solar interlayers for the architectural market are supplied in two formulations (SG and SH). They are available 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). Saflex Solar 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.

Saflex® Solar interlayer		
Product Designation	SG41	SH41
Thickness	0.76 mm (0.030 inch)	0.76 mm (0.030 inch)
Performance (VT SHGC)	76 0.55	83 0.65

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 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 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.

Saflex® Solar – Select Properties¹:

Test	Property	Test Method	Units	Conditions	Saflex® Solar interlayer
Flammability	Extent of Burning	ASTM D635	mm	Class CC1	0 ²
	Heat of Combustion	ASTM E1354 ISO 1716	MJ/kg	-	31
	Rate of Burning	ASTM D 635	mm/min °C	-	n/a ²
	Self-Ignition	ASTM D1929	°C	-	410
	Smoke Density	ASTM D2843	%	-	12.5
Mechanical	Elongation at Failure	ISO 527-3	%	50 mm/min 23°C 50% RH	266
		JIS K6771	%	20 mm/min 23°C 50% RH	242
	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	25
		JIS K6771	MPa	20 mm/min 23°C 50% RH	23
	Young's Modulus; E(t)	EN 16613	MPa	Relaxation	See Table Below

Test	Property	Test Method	Units	Conditions	Saflex® Solar interlayer
Optical	Haze	ASTM D1003	%	0.76 mm Clear 3 mm Glass	n/a
	Refractive Index	ASTM D542	-	23°C	1.479
	Yellowness Index	ASTM E313	YI	0.76 mm Clear 3 mm Glass	n/a
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	56
	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	54°C	2125
	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 3006, 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)	0.76 mm ³	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® Solar interlayer	
				SG	SH
Solar ⁴	Solar Transmittance	LBNL WINDOW 7.0 NFRC 100	%	37	51
	Solar Reflectance		%	6	6
	Solar Absorptance		%	57	43
	Visible Transmittance		%	76	83
	Visible Reflectance		%	8	8
	Solar Heat Gain Coefficient	NFRC 300	SHGC g value	0.55	0.65
	Sun Protection Factor	Calculated	SPF ⁵	50+	50+
	Light to Solar Gain	Calculated	LSG	1.38	1.28
	U Factor	NFRC 100	W/m ² -K	5.68	5.68
	UV Factors	Damage Weighted (Tdw-K)	300 - 500 nm	0.21	0.22
		Damage Weighted (Tdw-ISO)	300 - 600 nm	0.49	0.53
		Transmitted UV	300 - 380 nm	<1%	<1%
Test	Property	Test Method	Units	Conditions	Saflex® Solar interlayer
Thermal	Coefficient of Thermal Expansion	ASTM E831	ppm/°C	-60°C to 40°C	178
	Thermal Conductivity	ASTM D5930	W/m*K	62°C	0.18
	Emissivity	ASTM C1371	-	19.5°C	0.94
1 - Data based on NOA for Saflex formulation					
2 - ASTM D635 product self-extinguished, no values for extent or rate of burn could be obtained.					
3 - Safety Glazing impact - 0.76 mm used for Class B - Cat I as this is the thinnest product available in this formulation.					
4 - Solar, Thermal, Optical and Color data based on 0.76 mm clear Saflex Solar PVB interlayer with clear nominal 3 mm glass. Calculations performed using OPTIC and WINDOW 7.0 by Lawrence Berkeley National Laboratory.					
5 - SPF is a calculated value based on the spectral data from the laminate and not a result of direct testing.					

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

The relaxation modulus and calculated Young's modulus for Saflex Solar (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® Solar 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® Solar 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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