



Ultra-Clear Solar Film

Product Data Sheet

March 2012

General Description

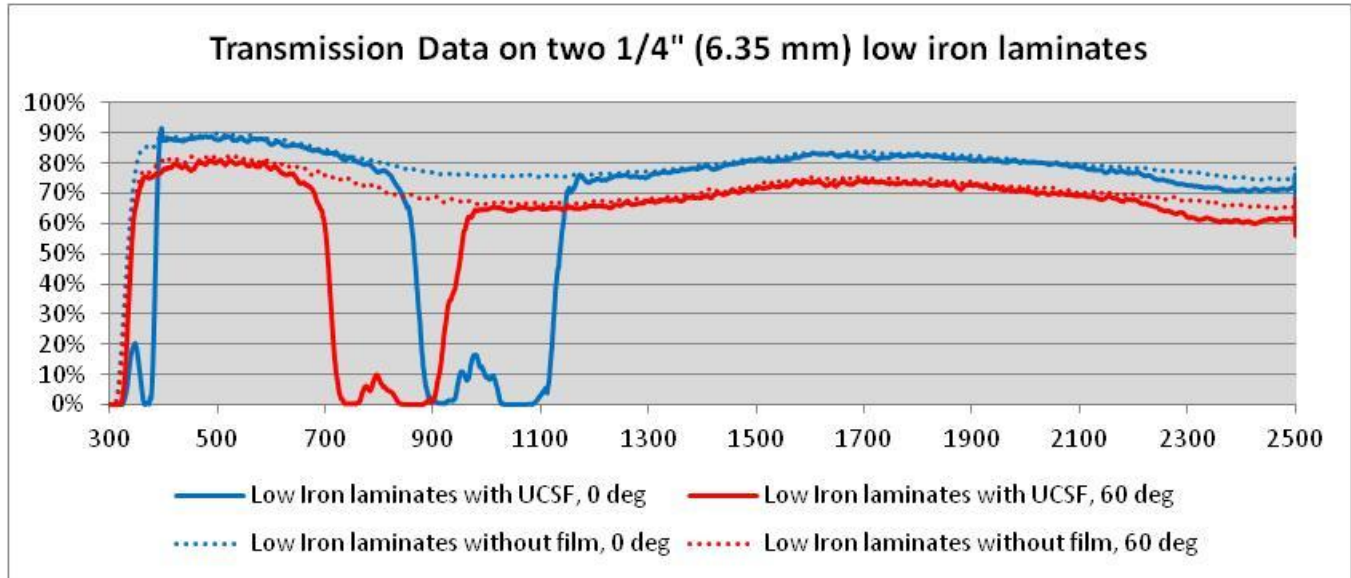
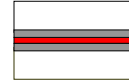
3M Ultra-Clear Solar Film (UCSF) is a non-metallic multi-layer film that reflects infrared solar energy with little or no effect on visible light transmission. 3M Ultra-Clear Solar Film is used in architectural laminated glass, sandwiched between typical interlayer materials (PVB, EVA, or SentryGlas®). 3M Ultra-Clear Solar Film is neutral in color and therefore can be used with a wide variety of colored or reflective glasses.

- High visible light transmission (< 2% reduction in VLT)
- Color Neutrality ($a^* = 0.25$; $b^* = -3.75$)
- Low Solar Energy Absorption
- Low Visible light reflectivity (changes R_{vis} by < 2% compared to laminates without film)
- Non Metallic (will not corrode on exposed edges)
- No Radio Frequency interference (< 5 dB attenuation ---in range of 100 – 2000 MHz)

Typical Physical Film Properties:		
	machine direction	cross direction
Nominal shrinkage, % (15 min. @ 150°C)	1.4	1.4
Nominal thickness:	50.0 microns (2.0 mils)	

Durability Testing:			
Laminate Construction: Clear (3.1 mm) glass/PVB/3M UCSF/PVB/Clear (3.1 mm) glass			
Test description:	Test Method	Results	
Compressive Shear	3M TP - 440	1085 N/cm ² (1575 lb/in ²) typical with PVB interlayer (comparable to 4-6 pummel units)	
Impact Tests	EN IS 12600	Passes Condition 1	
High Temperature test	EN IS 12543 – 4	Pass	
Humidity Test	EN IS 12543 – 4	Pass	
Radiation tests	EN IS 12543 – 4	Pass	
Accelerated weathering (ASTM G155; Xenon arc with daylight filters)		PVB only	PVB + film
	Total UV dosage equivalent to 5 yrs. Arizona UV exposure	$\Delta VLT = 0.2\%$ $\Delta a^* = -0.01$ $\Delta b^* = -0.14$ $\Delta E^* = 0.19$	$\Delta VLT = 0.2\%$ $\Delta a^* = -0.02$ $\Delta b^* = -0.15$ $\Delta E^* = 0.19$
	Total UV dosage equivalent to 8.5 years Arizona exposure	$\Delta VLT = 0.1\%$ $\Delta a^* = 0.11$ $\Delta b^* = -0.69$ $\Delta E^* = 0.71$	$\Delta VLT = 0.1\%$ $\Delta a^* = 0.24$ $\Delta b^* = -0.96$ $\Delta E^* = 0.99$

Typical Optical Performance in Laminates (6.3mm glass/interlayer/UCSF/interlayer/6.3mm Glass):



Solar Performance at 0 and 60 degree incidence:

At 0 deg from normal	Tvis	Rvis	Te	Re	Ae	LSG ¹	SC	SHGC
Low Iron Glass Laminates	89.0%	8.1%	82.7%	7.4%	9.8%	1.04	0.970	0.853
Low Iron Glass Laminates with 3M Film	87.6%	9.1%	67.4%	22.3%	10.3%	1.25	0.780	0.701
<i>Change in SHGC:</i>								18%
At 60 deg from Normal								
Low Iron Glass Laminates	81.1%	15.4%	74.2%	14.2%	11.7%	1.05	0.887	0.772
Low Iron Glass Laminates with 3M Film	79.6%	16.4%	56.6%	31.3%	12.2%	1.33	0.686	0.597
<i>Change in SHGC:</i>								23%

Solar Performance (nominal²) with various interlayers at normal (0 deg.) incidence:

With Saflex® AR 11 interlayer	Tvis	Rvis	Te	Re	Ae	LSG	SC	SHGC
Low Iron Laminated Glass	89.0%	8.1%	82.7%	7.4%	9.8%	1.04	0.970	0.853
Low Iron Laminated Glass with 3M Film	87.6%	9.1%	67.4%	22.3%	10.3%	1.25	0.780	0.701
With EVASafe™ EV4 interlayer								
Low Iron Laminated Glass	88.4%	9.7%	81.0%	9.1%	9.9%	1.05	0.964	0.839
Low Iron Laminated Glass with 3M Film	86.9%	10.9%	65.8%	23.8%	10.3%	1.26	0.792	0.689
With SentryGlas® interlayer								
Low Iron Glass Laminates	89.7%	8.3%	79.8%	7.5%	12.7%	1.07	0.960	0.835
Low Iron Glass Laminates with 3M Film	87.2%	10.5%	63.2%	24.1%	12.7%	1.30	0.769	0.669

Saflex® is a registered trademark of Solutia Corporation

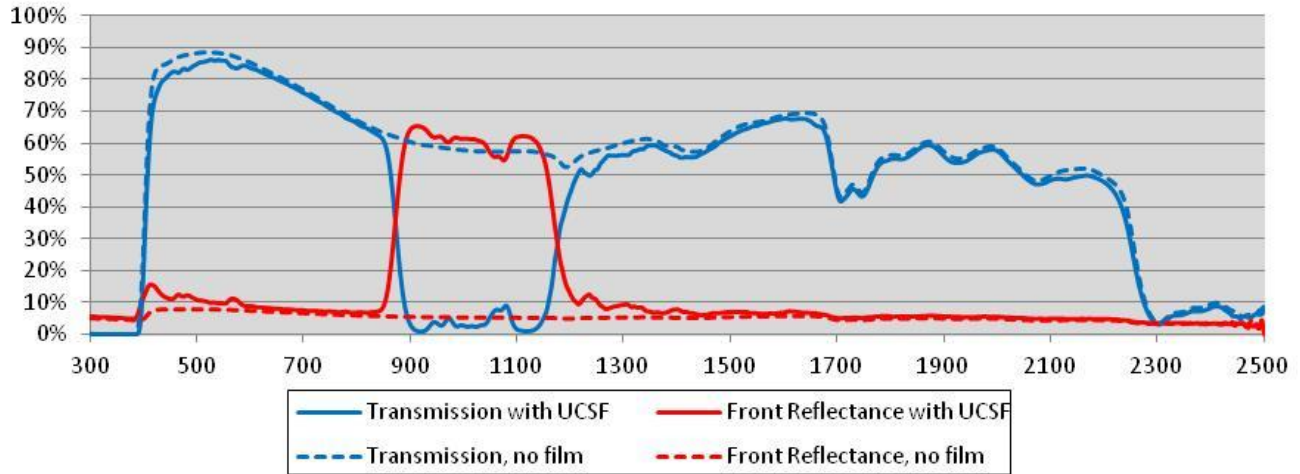
EVASafe™ is a trademark of Bridgestone Corporation

SentryGlas® is a registered trademark of E. I. du Pont de Nemours and Company or its affiliates

¹ LSG: light/solar gain ratio, Tvis/SHGC

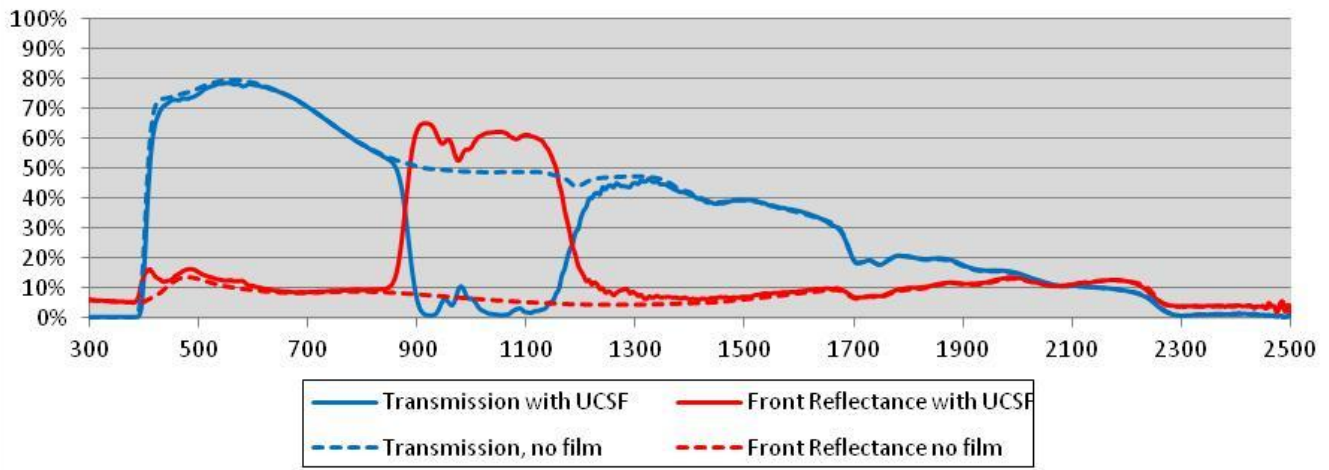
² Solar performance will vary based on the specific glass selected. 3M strongly recommends that specific glasses be measured for performance with and without UCSF in order to best predict performance.

Transmission and Reflectance for 1/4" - 1/4" Clear Glass laminate



At 0 deg from normal	Tvis	Rvis	Te	Re	Ae	LSG	SC	SHGC
Clear Glass Laminates	87.0%	7.8%	68.3%	6.4%	25.3%	1.15	0.87	0.757
Clear Glass Laminates with 3M Film	85.0%	10.0%	56.2%	18.3%	25.5%	1.32	0.74	0.644
<i>Change in SHGC:</i>								<i>14.9%</i>

Transmission and Reflectance for 1/4" Clear Glass to 1/4" Sungate 500²



²Sungate 500 is a trademark of PPG Industries

At 0 deg from normal	Tvis	Rvis	Te	Re	Ae	LSG	SC	SHGC
Laminate no film	79.0%	10.6%	57.0%	8.3%	34.7%	1.16	0.78	0.679
Laminate with 3M Film	78.0%	12.3%	48.0%	19.2%	32.8%	1.34	0.67	0.583
<i>Change in SHGC:</i>								<i>14.1%</i>

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