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3M™ Window Film Product Lines

3M™ Sun Control Window Film Prestige Series

With 3M™ Window Film Prestige Series, you can enjoy the benefits of a world-class window film while leaving the beauty of your windows virtually unchanged. Because 3M™ Window Film Prestige Series use no metals, they are not susceptible to corrosion in coastal environments and do not interfere with mobile phone reception. Other window films that reject heat tend to have high reflectivity, but not Prestige Series Window Films. These films offer reflectivity that is actually Lower than glass. A final key technical feature of the Prestige line of products is that they were designed to perform best when the sun is high, at the hottest parts of the day, so when the sun is working hardest our films are performing their best.

3M™ Sun Control Window Films

These products normally have a thin adhesive for optimum clarity, and a micro layer of metal evenly coated on the film to reflect the infrared solar radiation. Their main task is to help reduce the amount of heat coming into a building through the windows. They help reduce glare, UV damage, can improve aesthetics of the building, and offer different levels of privacy depending on the product chosen.

3M™ Sun Control Window Films Night Vision Series

With 3M™ Night Vision Window Films, you get the exceptional performance of a reflective film while still being able to look through the film at night. Traditional metalized films reflect equally both inside and outside, becoming mirror-like at night. The Night Vision line reflects more to the outside, where you need it, and less to the inside. Our high technology, carbon impregnated polyester layer provides outstanding heat rejection performance as well and gives the film a warm bronze appearance.

3M™ Safety and Security Window Films Ultra Series

A patented micro-layer film with a superior strength adhesive system. These products are designed to hold broken glass onto the film thus reducing the possibility of injury or damage caused by flying glass shards. Because of the unique tear resistant properties of our micro-layer film it also provides security and impact resistance for TERRORIST BOMBINGS, HURRICANES, SMASH & GRAB CRIMES, EARTHQUAKES, and INDUSTRIAL EXPLOSIONS. Some versions of these films also provide sun control features.

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3M™ Window Film Product Lines

3M™ Crystalline Automotive Window Films

Superior in quality, the new 3M™ Crystalline Automotive Window Films are innovative, high-technology films that represent a clear breakthrough in automotive window films. Developed in our industry-leading laboratories, 3M Crystalline Automotive Window Films are produced using multilayer nanotechnology, the same advanced technology used to improve the brightness in flat panel LCD televisions. 3M™ Crystalline Automotive Window Films, has set a superior standard for enhanced protection, comfort and style in automotive window films.

Breakthrough multilayer nanotechnology • Metal-free design with zero electronic interference*
Much less reflectivity than traditional window films • Advanced heat rejection capability
Full 99.9% UV protection (SPF 1700+)
National lifetime manufacturer's warranty

*Will not interfere with cell phones, GPS systems or satellite radio **IR for wavelength range of 900-1000nm

3M™ Color Stable Automotive Window Films

These products have an exciting new technology that protects the film from changing color. These products also have an adhesive system designed to hold to curved automobile glass. They also have features that allow the installers to smooth the film to the glass with fewer wrinkles, bubbles or other problems, thus providing the car owner with a high quality application. All products feature a distinctive color that complements the automobile color and provides a sleek appearance.

3M™ Black Chrome Automotive Window Films

3M™ Black Chrome Automotive Window Films are a premium line of metallic window films that not only enhance your vehicle's appearance, but offer excellent heat rejection, glare control, privacy, and protection from the damaging UV effects of the sun. 3M™ Black Chrome Automotive Window Films come with a limited lifetime warranty against peeling, bubbling, blistering, fading or discoloration.

3M™ Automotive Window Films FX Series

3M now offers two additional automotive window film product lines: 3M™ FX-ST and 3M™ FX-HP Automotive Window Films. FX Standard Auto Film delivers great looks and great performance. FX High Performance Auto Film contains a metal coating that provides additional heat rejection qualities. Both product lines provide 99% UV protection, scratch resistant coating, and several different shading levels in an attractive charcoal hue.

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3M™ Window Film Product Lines

3M™ Decorative Films

3M™ Decorative Films will add a new dimension to your glass. Decorative films are applied to the glass creating a beautiful etched-glass appearance not typically found in window films. Light is dispersed softly, rendering an attractive, tranquil atmosphere. We have premium Interior Design films suited for interior glass partitions or inside surface of windows. Developed for the Asian market, the 3M™ Decorative Window Films offer the opportunity to immerse oneself in the aesthetic serenity while still maintaining the outstanding quality provided by 3M technology.

3M™ Safety & Security Window Films Anti Graffiti Series

Graffiti artists are changing their techniques to create their “works of art.” In place of using only spray paints and markers to deface glass and other smooth surfaces, vandals are also using glass-etching solutions and tungsten carbide styluses for scratching and defacing your property. 3M Anti Graffiti films will resist these and other types of graffiti while helping to safeguard your property. Once applied the film will also provide protection from broken glass by holding the glass together.

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3M™ Window Film Identification System

Prefix	Transmission	Color	Suffix	Impact Performance
CR - Crystalline Auto Film CS - Color Stable Auto Film	Percent Visible Light Transmission OR Thickness of Safety & Security Film	CL - Clear NI - Nickel NE - Neutral SI - Silver	AR -Abrasion Resistant	150 (ft. lbs.) 400 (ft. lbs.) of Impact Resistance
BC - Black Chrome Auto Film				
FX - Auto Film LE - Low E PR – Prestige		AM - Amber BR - Bronze		
RE - Reflective P - 18ARL SH - Shatter			L - Liner X - Exterior	
S - Ultra Safety and Security				
NV - Night Vision				
AG - Anti-Graffiti				

Example:
Neutral 35 (RE35NEARL) -A reflective film that will allow approximately 35 percent of the visible light through, neutral color with an abrasion resistant coating and has a liner.

Example:
Ultra S400 (SCLARL400) - Ultra high performance safety and security film that is clear in color, has an abrasion resistant coating, and a protective liner. It passes 400 ft lb. impact resistance performance criteria

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3M™ Window Film

Product Families

	Super Low Transmission	Low Transmission	Medium Transmission	High Transmission
1. Automotive Films	CS-5 BC-10 FX HP-5 FX ST-5	CS-20 BC-20 FX HP-20 FX HP-30 FX ST-20	CS-35 BC-35 FX HP-35 FX ST-35 FX ST-40	CR 40 CR 50 CR 60 CR 70 CS-50 BC-40 FX HP-50 FX ST-50

	High Performance	Medium Performance	High Transmission
2. Sun Control Films •			
• Neutral	PR 40 PR 50 PR 60 PR 70 Neutral 20 (RE20NEARL)	Neutral 35 (RE35NEARL)	Neutral 50 (RE50NEARL) Neutral 70 (RE70NEARL)
• Silver	Silver P18 (P-18ARL) Silver 15 Exterior (RE15SIARXL) Bronze 20 External (RE20BRARXL) Neutral 35 External (RE35NEARXL) Silver 35 External (RE 35SIARXL) Silver 35 (RE35SIARL) NV-15	NV-25 NV-35	NV-45
• Warm Bronze			
• Amber	Amber 35 (RE35AMARL) Amber Low E 35 (LE35AMARL)	AFFINITY 15 AFFINITY 30	
• Nickel		Nickel 50 (RE50NIARL)	

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3M™ Window Film

Product Families

	High Performance	Standard Performance
3. Safety and Security Films <ul style="list-style-type: none"> • Clear • Silver • Night Vision • Neutral 	Ultra S150 (SCLARL150) Ultra S400 (SCLARL400) Ultra S600 (ULTRA600) Ultra Prestige PRS50 Ultra Prestige PRS70 Ultra Silver S20 S20SIARL400 Ultra Night Vision S25 (S25NVAR400) Ultra Neutral S35 (S35NEARL400) Ultra Neutral S50 (S50NEARL400)	Safety S40 (SH4CLARL) Safety S70 (SH7CLARL) Safety S80 (SH8CLARL) Safety S140 (SH14CLARL)

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3M™ Flat Glass Window Film – Single Pane ¼" (6mm) Clear

Film	SHGC	VLT	Visible Reflection Exterior	Visible Reflection Interior	U Value	Luminous Efficacy	UV Block	SC	TSER	Glare Reduction	Heat Loss Reduction	Heat Gain Reduction
1/4" Clear	0.82	89%	8%	9%	1.03	1.1	38%	0.94	19%	NA	NA	NA
PR40	0.40	39%	7%	7%	0.99	1.0	99.9%	0.46	60%	55%	3%	50%
PR50	0.44	50%	8%	7%	0.99	1.1	99.9%	0.50	56%	44%	3%	46%
PR60	0.47	60%	8%	8%	0.99	1.3	99.9%	0.54	53%	32%	3%	42%
PR70	0.50	69%	9%	9%	0.99	1.4	99.9%	0.58	50%	22%	3%	38%
CM30	0.41	36%	17%	15%	1.02	0.9	99%	0.47	59%	60%	0%	50%
CM40	0.47	44%	14%	12%	1.03	0.9	99%	0.54	53%	50%	0%	43%
CM50	0.53	53%	12%	10%	1.03	1.0	99%	0.61	47%	40%	0%	35%
NV15	0.29	15%	39%	11%	0.98	0.5	99%	0.33	71%	83%	4%	64%
NV25	0.40	24%	20%	7%	1.00	0.6	99%	0.46	60%	73%	2%	51%
NV35	0.49	36%	13%	7%	1.03	0.7	99%	0.56	51%	59%	0%	40%
P18	0.23	17%	56%	58%	0.93	0.7	99%	0.26	77%	81%	9%	72%
Neutral 20	0.38	15%	21%	19%	0.99	0.4	99%	0.44	62%	83%	3%	53%
Neutral 35	0.44	36%	20%	18%	0.99	0.8	99%	0.51	56%	60%	4%	46%
Neutral 50	0.56	52%	12%	11%	1.03	0.9	98%	0.64	44%	41%	0%	31%
Neutral 70	0.68	69%	9%	8%	1.03	1.0	98%	0.78	32%	22%	0%	17%
Silver 35	0.36	35%	36%	40%	0.92	1.0	98%	0.41	64%	60%	10%	56%
Nickel 50	0.44	50%	24%	23%	0.92	1.1	99%	0.50	56%	44%	10%	46%
Affinity 15	0.21	9%	58%	25%	1.00	0.4	99%	0.24	79%	90%	2%	74%
Affinity 30	0.39	33%	29%	19%	0.94	0.8	99%	0.45	61%	63%	8%	52%
Amber35	0.25	30%	54%	60%	0.85	1.2	99%	0.29	75%	67%	17%	69%
Amber LowE 35	0.25	30%	52%	56%	0.76	1.2	99%	0.28	75%	66%	26%	70%
Ultra PR S50	0.44	50%	9%	8%	1.02	1.1	99%	0.51	56%	44%	1%	46%
Ultra PR S70	0.51	68%	12%	11%	1.00	1.4	99%	0.58	49%	23%	2%	38%
Ultra NV S25	0.38	27%	23%	12%	0.97	0.7	99%	0.43	63%	69%	6%	54%
Ultra Silver S20	0.23	17%	56%	58%	0.93	0.7	99%	0.26	77%	81%	9%	72%
Ultra Neutral S35	0.44	36%	20%	18%	0.99	0.8	99%	0.51	56%	60%	4%	46%
Ultra Neutral S50	0.56	52%	12%	11%	1.03	0.9	98%	0.64	44%	41%	0%	31%
Ultra S150	0.82	87%	11%	11%	1.03	1.1	98%	0.94	19%	2%	0%	0%
Ultra S400	0.79	86%	11%	11%	1.03	1.1	98%	0.91	21%	3%	0%	3%
Ultra S600	0.78	84%	10%	10%	1.03	1.1	99%	0.90	22%	5%	0%	4%
Safety S40	0.82	87%	8%	8%	1.03	1.1	99%	0.94	19%	2%	0%	0%
Safety S70	0.79	86%	9%	9%	1.03	1.1	98%	0.91	21%	3%	0%	3%
Safety S80	0.79	86%	9%	9%	1.03	1.1	99%	0.91	21%	3%	0%	3%
Safety S140	0.78	85%	10%	10%	1.03	1.1	99%	0.90	22%	4%	0%	4%
Silver 15 External	0.19	17%	61%	56%	1.02	0.9	99%	0.22	81%	81%	0%	77%
Bronze 20 External	0.22	23%	32%	33%	1.02	1.1	99%	0.25	78%	74%	0%	73%
Neutral 35 External	0.49	44%	10%	13%	1.02	0.9	99%	0.56	51%	50%	0%	40%
Silver 35 External	0.36	35%	35%	36%	1.02	1.0	99%	0.41	64%	60%	1%	56%
Safety S40 External	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A
Anti Graffiti 4	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A
Anti Graffiti 7	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A

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3M™ Flat Glass Window Film - Single Pane ¼" (6mm) Tinted Glass

Film	SHGC	VLT	Visible Reflection Exterior	Visible Reflection Interior	U Value	Luminous Efficacy	UV Block	SC	TSER	Glare Reduction	Heat Loss Reduction	Heat Gain Reduction
1/4" tint	0.63	47%	13%	9%	1.03	0.8	NA	0.72	37%	NA	NA	NA
PR40	0.37	24%	5%	6%	0.99	0.6	99.9%	0.42	63%	50%	3%	41%
PR50	0.39	30%	6%	6%	0.99	0.8	99.9%	0.45	61%	37%	3%	38%
PR60	0.41	36%	6%	7%	0.99	0.9	99.9%	0.47	59%	23%	3%	34%
PR70	0.43	42%	6%	7%	0.99	1.0	99.9%	0.50	57%	12%	3%	31%
CM30	0.38	21%	9%	15%	1.02	0.6	99%	0.43	63%	55%	0%	40%
CM40	0.41	27%	8%	11%	1.03	0.6	99%	0.47	59%	44%	0%	34%
CM50	0.45	32%	7%	9%	1.03	0.7	99%	0.52	55%	33%	0%	28%
NV15	0.31	9%	17%	11%	0.98	0.3	99%	0.35	70%	80%	4%	51%
NV25	0.38	14%	10%	7%	1.00	0.4	99%	0.43	63%	70%	2%	40%
NV35	0.43	22%	8%	6%	1.03	0.5	99%	0.49	57%	54%	0%	32%
P18	0.27	10%	23%	58%	0.93	0.4	99%	0.30	74%	79%	9%	58%
Neutral 20	0.32	9%	10%	19%	0.99	0.3	99%	0.37	68%	81%	3%	49%
Neutral 35	0.39	21%	10%	18%	0.99	0.5	99%	0.45	61%	55%	4%	38%
Neutral 50	0.47	31%	7%	10%	1.03	0.7	99%	0.54	53%	34%	0%	25%
Neutral 70	0.55	42%	6%	7%	1.03	0.8	99%	0.63	45%	12%	0%	13%
Silver 35	0.34	21%	16%	40%	0.92	0.6	99%	0.39	66%	56%	10%	46%
Nickel 50	0.38	30%	12%	22%	0.92	0.8	99%	0.44	62%	37%	10%	39%
Affinity 15	0.27	5%	24%	25%	1.00	0.2	99%	0.31	73%	89%	2%	57%
Affinity 30	0.37	20%	14%	19%	0.94	0.5	99%	0.43	63%	58%	8%	41%
Amber35	0.27	17%	22%	60%	0.85	0.7	99%	0.31	73%	63%	17%	57%
Amber LowE 35	0.25	18%	22%	56%	0.76	0.7	99%	0.29	75%	63%	26%	60%
Ultra PRS50	0.40	30%	6%	7%	1.02	0.8	99%	0.46	60%	37%	1%	37%
Ultra PRS70	0.44	41%	7%	10%	1.00	0.9	99%	0.50	57%	13%	2%	31%
Ultra NV S25	0.35	16%	11%	12%	0.97	0.5	99%	0.40	65%	66%	6%	44%
Ultra Silver S20	0.28	9%	23%	61%	0.98	0.3	99%	0.32	72%	81%	4%	56%
Ultra Neutral S35	0.39	21%	10%	18%	0.99	0.5	99%	0.45	61%	55%	4%	38%
Ultra Neutral S50	0.47	30%	8%	10%	1.03	0.7	99%	0.54	53%	36%	0%	25%
Ultra S150	0.59	47%	7%	7%	1.03	0.8	99%	0.68	41%	1%	0%	6%
Ultra S400	0.59	47%	6%	6%	1.03	0.8	99%	0.68	41%	1%	0%	6%
Ultra S600	0.59	47%	6%	6%	1.03	0.8	99%	0.68	41%	1%	0%	6%
Safety S40	0.59	47%	6%	6%	1.03	0.8	99%	0.68	41%	1%	0%	6%
Safety S70	0.59	47%	6%	6%	1.03	0.8	99%	0.68	41%	1%	0%	6%
Safety S80	0.59	47%	6%	6%	1.03	0.8	99%	0.68	41%	1%	0%	6%
Safety S140	0.59	47%	6%	6%	1.03	0.8	99%	0.68	41%	1%	0%	6%
Silver 15 External	0.16	10%	61%	23%	1.02	0.6	99%	0.18	84%	79%	0%	75%
Bronze 20 External	0.19	14%	32%	15%	1.02	0.7	99%	0.21	81%	71%	0%	70%
Neutral 35 External	0.41	27%	10%	8%	1.02	0.6	99%	0.47	59%	44%	0%	34%
Silver 35 External	0.30	21%	35%	16%	1.02	0.7	99%	0.34	70%	56%	1%	53%
Safety S40 External	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A
Anti Graffiti 4	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A
Anti Graffiti 7	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A

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3M™ Flat Glass Window Film – Double Pane ¼" (6mm) Clear Glass

Film	SHGC	VLT	Visible Reflection Exterior	Visible Reflection Interior	U Value	Luminous Efficacy	UV Block	SC	TSER	Glare Reduction	Heat Loss Reduction	Heat Gain Reduction
Dual 1/4" Clear	0.70	79%	15%	15%	0.47	1.1	NA	0.80	30%	NA	NA	NA
PR40	0.51	35%	14%	8%	0.47	0.7	99.9%	0.59	49%	55%	2%	27%
PR50	0.53	45%	15%	9%	0.47	0.8	99.9%	0.61	47%	44%	2%	25%
PR60	0.54	54%	15%	11%	0.47	1.0	99.9%	0.62	46%	32%	2%	22%
PR70	0.56	62%	15%	13%	0.47	1.1	99.9%	0.64	44%	22%	2%	21%
CM30	0.50	32%	22%	16%	0.47	0.6	99%	0.58	50%	60%	1%	28%
CM40	0.54	40%	20%	14%	0.47	0.7	99%	0.62	46%	50%	1%	23%
CM50	0.57	47%	18%	12%	0.47	0.8	99%	0.66	43%	40%	1%	18%
NV15	0.40	14%	40%	11%	0.46	0.4	99%	0.46	60%	82%	3%	43%
NV25	0.49	22%	24%	8%	0.47	0.4	99%	0.57	51%	72%	1%	29%
NV35	0.55	32%	19%	8%	0.47	0.6	99%	0.64	45%	60%	1%	21%
P18	0.33	15%	55%	58%	0.45	0.5	99%	0.37	67%	80%	5%	53%
Neutral 20	0.46	14%	25%	19%	0.47	0.3	99%	0.53	54%	83%	2%	34%
Neutral 35	0.51	32%	24%	19%	0.46	0.6	99%	0.59	49%	60%	2%	27%
Neutral 50	0.59	46%	18%	13%	0.48	0.8	99%	0.67	41%	41%	0%	16%
Neutral 70	0.64	62%	16%	12%	0.48	1.0	99%	0.74	36%	22%	0%	8%
Silver 35	0.43	32%	38%	41%	0.45	0.7	99%	0.49	57%	59%	6%	39%
Nickel 50	0.48	45%	28%	25%	0.45	0.9	99%	0.55	52%	43%	6%	31%
Affinity 15	0.32	8%	57%	26%	0.47	0.3	99%	0.37	68%	90%	1%	54%
Affinity 30	0.46	30%	32%	20%	0.45	0.7	99%	0.53	54%	62%	5%	34%
Amber35	0.32	28%	53%	61%	0.42	0.8	99%	0.37	68%	65%	11%	54%
Amber LowE 35	0.32	28%	51%	57%	0.39	0.9	99%	0.37	68%	65%	17%	55%
Ultra PRS50	0.53	44%	15%	10%	0.47	0.8	99%	0.61	47%	44%	1%	25%
Ultra PRS70	0.55	61%	18%	15%	0.47	1.1	99%	0.63	45%	23%	1%	21%
Ultra NV S25	0.47	25%	27%	13%	0.46	0.5	99%	0.54	53%	69%	3%	33%
Ultra Silver S20	0.33	15%	55%	58%	0.45	0.5	99%	0.37	67%	80%	5%	53%
Ultra Neutral S35	0.51	32%	24%	19%	0.46	0.6	99%	0.59	49%	60%	2%	27%
Ultra Neutral S50	0.59	46%	18%	13%	0.48	0.8	99%	0.67	41%	41%	0%	16%
Ultra S150	0.68	77%	17%	17%	0.47	1.1	99%	0.78	32%	3%	0%	3%
Ultra S400	0.68	75%	18%	18%	0.47	1.1	99%	0.78	32%	5%	0%	3%
Ultra S600	0.68	73%	18%	18%	0.47	1.1	99%	0.78	32%	8%	0%	3%
Safety S40	0.68	77%	15%	15%	0.47	1.1	99%	0.78	32%	3%	0%	3%
Safety S70	0.68	77%	16%	16%	0.47	1.1	99%	0.78	32%	3%	0%	3%
Safety S80	0.68	77%	16%	16%	0.47	1.1	99%	0.78	32%	3%	0%	3%
Safety S140	0.68	72%	16%	16%	0.47	1.1	99%	0.78	32%	9%	0%	3%
Silver 15 External	0.14	15%	61%	54%	0.47	1.1	99%	0.17	86%	81%	0%	79%
Bronze 20 External	0.17	21%	33%	35%	0.47	1.3	99%	0.19	84%	73%	0%	76%
Neutral 35 External	0.38	40%	12%	18%	0.47	1.1	99%	0.43	62%	50%	0%	46%
Silver 35 External	0.29	32%	36%	37%	0.47	1.1	99%	0.33	71%	59%	0%	59%
Safety S40 External	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A
Anti Graffiti 4	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A
Anti Graffiti 7	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A

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3M™ Flat Glass Window Film – Double Pane ¼" (6mm) Tinted Glass

Film	SHGC	VLT	Visible Reflection Exterior	Visible Reflection Interior	U Value	Luminous Efficacy	UV Block	SC	TSER	Glare Reduction	Heat Loss Reduction	Heat Gain Reduction
Dual 1/4" tint	0.51	47%	8%	13%	0.47	0.9	NA	0.58	49%	NA	NA	NA
PR40	0.45	13%	8%	6%	0.47	0.3	99.9%	0.52	55%	73%	2%	11%
PR50	0.46	16%	8%	7%	0.47	0.4	99.9%	0.53	54%	66%	2%	9%
PR60	0.40	19%	8%	7%	0.47	0.5	99.9%	0.46	60%	59%	2%	21%
PR70	0.40	22%	8%	8%	0.47	0.6	99.9%	0.46	60%	53%	2%	20%
CM30	0.38	19%	11%	16%	0.47	0.5	99%	0.44	62%	60%	1%	25%
CM40	0.40	24%	10%	13%	0.47	0.6	99%	0.46	60%	50%	1%	21%
CM50	0.43	28%	9%	11%	0.47	0.7	99%	0.49	58%	40%	1%	16%
NV15	0.32	8%	17%	11%	0.46	0.3	99%	0.37	68%	83%	3%	37%
NV25	0.37	13%	12%	8%	0.47	0.4	99%	0.43	63%	73%	1%	27%
NV35	0.42	19%	10%	8%	0.47	0.5	99%	0.48	59%	60%	1%	18%
P18	0.27	9%	23%	58%	0.45	0.3	99%	0.31	73%	81%	5%	47%
Neutral 20	0.36	8%	12%	19%	0.47	0.2	99%	0.41	64%	83%	2%	30%
Neutral 35	0.39	19%	12%	19%	0.46	0.5	99%	0.45	61%	60%	2%	23%
Neutral 50	0.44	28%	10%	13%	0.48	0.6	99%	0.50	57%	41%	0%	14%
Neutral 70	0.47	37%	9%	11%	0.48	0.8	99%	0.54	53%	22%	0%	7%
Silver 35	0.33	19%	16%	41%	0.45	0.6	99%	0.38	67%	60%	6%	34%
Nickel 50	0.36	27%	13%	24%	0.45	0.7	99%	0.42	64%	43%	6%	28%
Affinity 15	0.27	5%	23%	25%	0.47	0.2	99%	0.31	73%	89%	1%	47%
Affinity 30	0.36	18%	15%	20%	0.45	0.5	99%	0.41	64%	62%	5%	29%
Amber35	0.26	16%	22%	61%	0.42	0.6	99%	0.30	74%	66%	11%	48%
Amber LowE 35	0.26	16%	21%	57%	0.39	0.6	99%	0.29	74%	65%	17%	50%
Ultra PRS50	0.40	27%	9%	9%	0.47	0.7	99%	0.46	60%	44%	1%	21%
Ultra PRS70	0.41	37%	9%	14%	0.47	0.9	99%	0.47	59%	23%	1%	19%
Ultra NV S25	0.36	15%	13%	13%	0.46	0.4	99%	0.41	64%	69%	3%	29%
Ultra Silver S20	0.27	9%	23%	58%	0.45	0.3	99%	0.31	73%	81%	5%	47%
Ultra Neutral S35	0.39	19%	12%	19%	0.46	0.5	99%	0.45	61%	60%	2%	23%
Ultra Neutral S50	0.44	28%	10%	13%	0.48	0.6	99%	0.50	57%	41%	0%	14%
Ultra S150	0.46	45%	8%	8%	0.47	1.0	99%	0.53	54%	5%	0%	9%
Ultra S400	0.46	42%	8%	8%	0.47	0.9	99%	0.53	54%	11%	0%	9%
Ultra S600	0.46	41%	8%	8%	0.47	0.9	99%	0.53	54%	13%	0%	9%
Safety S40	0.46	45%	14%	14%	0.47	1.0	99%	0.53	54%	5%	0%	9%
Safety S70	0.46	43%	8%	8%	0.47	0.9	99%	0.53	54%	9%	0%	9%
Safety S80	0.46	43%	8%	8%	0.47	0.9	99%	0.53	54%	9%	0%	9%
Safety S140	0.46	43%	8%	8%	0.47	0.9	99%	0.53	54%	9%	0%	9%
Silver 15 External	0.11	9%	61%	27%	0.47	0.8	99%	0.13	89%	81%	0%	78%
Bronze 20 External	0.13	12%	32%	20%	0.47	1.0	99%	0.15	87%	74%	0%	75%
Neutral 35 External	0.29	24%	10%	14%	0.47	0.8	99%	0.34	71%	50%	0%	42%
Silver 35 External	0.22	19%	35%	21%	0.47	0.9	99%	0.25	78%	60%	0%	57%
Safety S40 External	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A
Anti Graffiti 4	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A
Anti Graffiti 7	N/A	N/A	N/A	N/A	N/A	N/A	99%	N/A	N/A	N/A	N/A	N/A

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3M™ Automotive Window Film – Single Pane ¼" (6mm) Clear Glass

Film	SHGC	VLT	Visible Reflection Exterior	Visible Reflection Interior	U Value	Luminous Efficacy	UV Block	SC	TSER	Glare Reduction	Heat Loss Reduction	Heat Gain Reduction
1/4" Clear	0.82	89%	8%	9%	1.03	1.1	38%	0.94	19%	NA	NA	NA
CR40	0.40	39%	7%	7%	0.99	1.0	99.9%	0.46	60%	55%	3%	50%
CR50	0.44	50%	8%	7%	0.99	1.1	99.9%	0.50	56%	44%	3%	46%
CR60	0.47	60%	8%	8%	0.99	1.3	99.9%	0.54	53%	32%	3%	42%
CR70	0.50	69%	9%	9%	0.99	1.4	99.9%	0.58	50%	22%	3%	38%
CM30	0.41	36%	17%	15%	1.02	0.9	99%	0.47	59%	60%	0%	50%
CM40	0.47	44%	14%	12%	1.03	0.9	99%	0.54	53%	50%	0%	43%
CM50	0.53	53%	12%	10%	1.03	1.0	99%	0.61	47%	40%	0%	35%
CS5	0.43	9%	5%	4%	1.03	0.2	99%	0.49	57%	90%	0%	47%
CS20	0.49	19%	5%	5%	1.03	0.4	99%	0.57	51%	79%	0%	39%
CS35	0.60	39%	5%	6%	1.03	0.6	98%	0.69	40%	56%	0%	27%
CS50	0.65	52%	5%	7%	1.03	0.8	98%	0.75	35%	42%	0%	20%
BC10	0.28	10%	22%	18%	0.97	0.4	99%	0.32	72%	88%	6%	66%
BC20	0.32	17%	20%	25%	0.97	0.5	99%	0.37	68%	81%	6%	60%
BC35	0.47	36%	13%	11%	0.97	0.8	99%	0.54	53%	60%	6%	43%
BC40	0.53	42%	9%	8%	0.97	0.8	99%	0.61	47%	53%	6%	35%
FXHP 5	0.45	3%	5%	5%	0.99	0.1	99%	0.51	55%	97%	3%	45%
FXHP 15	0.50	14%	6%	6%	0.99	0.3	99%	0.57	50%	84%	3%	39%
FXHP 20	0.50	23%	5%	9%	1.00	0.5	99%	0.57	50%	74%	3%	39%
FXHP 30	0.54	31%	6%	8%	1.00	0.6	99%	0.61	47%	65%	3%	34%
FXHP 35	0.57	41%	7%	8%	1.00	0.7	99%	0.66	43%	53%	2%	30%
FXHP 40	0.53	44%	8%	10%	1.02	0.8	99%	0.61	47%	50%	0%	34%
FXHP 50	0.59	49%	8%	8%	1.01	0.8	99%	0.68	41%	45%	2%	28%
FXST 5	0.54	4%	5%	4%	1.02	0.1	99%	0.62	46%	95%	0%	33%
FXST 20	0.60	23%	5%	5%	1.02	0.4	99%	0.69	40%	74%	0%	26%
FXST 35	0.64	33%	5%	5%	1.02	0.5	99%	0.73	37%	63%	0%	22%
FXST 40	0.66	41%	5%	5%	1.02	0.6	99%	0.75	35%	53%	0%	20%
FXST 50	0.69	54%	6%	6%	1.02	0.8	99%	0.80	31%	39%	0%	15%
FXST 70	0.72	70%	7%	7%	1.02	1.0	99%	0.83	28%	21%	0%	11%

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3M™ Automotive Window Film – Single Pane ¼" (6mm) Tinted

Film	SHGC	VLT	Visible Reflection Exterior	Visible Reflection Interior	U Value	Luminous Efficacy	UV Block	SC	TSER	Glare Reduction	Heat Loss Reduction	Heat Gain Reduction
1/4" tint	0.63	47%	13%	9%	1.03	0.8	NA	0.72	37%	NA	NA	NA
CR40	0.37	24%	5%	6%	0.99	0.6	99.9%	0.42	63%	50%	3%	41%
CR50	0.39	30%	6%	6%	0.99	0.8	99.9%	0.45	61%	37%	3%	38%
CR60	0.41	36%	6%	7%	0.99	0.9	99.9%	0.47	59%	23%	3%	34%
CR70	0.43	42%	6%	7%	0.99	1.0	99.9%	0.50	57%	12%	3%	31%
CM30	0.38	21%	9%	15%	1.02	0.6	99%	0.43	63%	55%	0%	40%
CM40	0.41	27%	8%	11%	1.03	0.6	99%	0.47	59%	44%	0%	34%
CM50	0.45	32%	7%	9%	1.03	0.7	99%	0.52	55%	33%	0%	28%
CS5	0.39	5%	5%	4%	1.03	0.1	99%	0.44	62%	89%	0%	39%
CS20	0.43	11%	5%	4%	1.03	0.3	99%	0.49	57%	76%	0%	32%
CS35	0.49	23%	5%	6%	1.03	0.5	99%	0.57	51%	51%	0%	21%
CS50	0.53	31%	5%	6%	1.03	0.6	99%	0.61	47%	34%	0%	16%
BC10	0.29	6%	11%	18%	0.97	0.2	99%	0.33	71%	87%	6%	54%
BC20	0.32	10%	10%	25%	0.97	0.3	99%	0.36	68%	79%	6%	50%
BC35	0.41	21%	8%	10%	0.97	0.5	99%	0.47	60%	55%	6%	36%
BC40	0.44	25%	6%	8%	0.97	0.6	99%	0.51	56%	47%	6%	29%
FXHP 5	0.40	2%	5%	5%	0.46	0.0	99%	0.46	60%	96%	55%	37%
FXHP 15	0.43	8%	6%	6%	0.99	0.2	99%	0.49	57%	83%	3%	32%
FXHP 20	0.43	14%	5%	9%	1.00	0.3	99%	0.49	57%	71%	3%	32%
FXHP 30	0.45	19%	5%	8%	1.00	0.4	99%	0.52	55%	60%	3%	28%
FXHP 35	0.47	25%	5%	8%	1.00	0.5	99%	0.54	53%	47%	2%	25%
FXHP 40	0.44	27%	6%	10%	1.02	0.6	99%	0.50	56%	44%	0%	30%
FXHP 50	0.49	29%	6%	7%	1.01	0.6	99%	0.56	51%	38%	2%	23%
FXST 5	0.46	3%	5%	4%	1.02	0.1	99%	0.53	54%	95%	0%	26%
FXST 20	0.50	14%	5%	4%	1.02	0.3	99%	0.58	50%	71%	0%	20%
FXST 35	0.52	20%	5%	5%	1.02	0.4	99%	0.60	48%	58%	0%	17%
FXST 40	0.53	25%	5%	5%	1.02	0.5	99%	0.61	47%	48%	0%	15%
FXST 50	0.56	32%	5%	5%	1.02	0.6	99%	0.64	44%	32%	0%	11%
FXST 70	0.56	42%	5%	6%	1.02	0.7	99%	0.64	44%	12%	0%	11%

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3M™ Sun Control Window Film





Amber 35 Low E (LE35AMARL)

Technical Data

Product Benefits

- Savings on heating costs.
- Stay warmer by retaining more heat in cooler months.
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Amber LowE 35								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Amber LowE 35	1/4" tint	Amber LowE 35	Dual 1/4" Clear	Amber LowE 35	Dual 1/4" tint	Amber LowE 35
Solar Heat Gain Coefficient	0.82	0.25	0.63	0.25	0.70	0.32	0.51	0.26
Visible Light Transmitted	89%	30%	47%	18%	79%	28%	47%	16%
Visible Light Reflected Interior	9%	56%	9%	56%	15%	57%	13%	57%
Visible Light Reflected Exterior	8%	52%	13%	22%	15%	51%	8%	21%
U Value	1.03	0.76	1.03	0.76	0.47	0.39	0.47	0.39
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	75%	37%	75%	30%	68%	49%	74%
Glare Reduction	NA	66%	NA	63%	NA	65%	NA	65%
Heat Loss Reduction	NA	26%	NA	26%	NA	17%	NA	17%
Solar Heat Reduction	NA	70%	NA	60%	NA	55%	NA	50%

Important:

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3M™ Sun Control Window Film





Silver P18 (P18ARL)

Technical Data

Product Benefits

- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

<u>Silver P18</u>								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	P18	1/4" tint	P18	Dual 1/4" Clear	P18	Dual 1/4" tint	P18
Solar Heat Gain Coefficient	0.82	0.23	0.63	0.27	0.70	0.33	0.51	0.27
Visible Light Transmitted	89%	17%	47%	10%	79%	15%	47%	9%
Visible Light Reflected Interior	9%	58%	9%	58%	15%	58%	13%	58%
Visible Light Reflected Exterior	8%	56%	13%	23%	15%	55%	8%	23%
U Value	1.03	0.93	1.03	0.93	0.47	0.45	0.47	0.45
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	77%	37%	74%	30%	67%	49%	73%
Glare Reduction	NA	81%	NA	79%	NA	80%	NA	81%
Heat Loss Reduction	NA	9%	NA	9%	NA	5%	NA	5%
Solar Heat Reduction	NA	72%	NA	58%	NA	53%	NA	47%

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


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3M™ Sun Control Window Film Silver 15 Exterior (RE15SIARXL) Technical Data

Product Benefits

- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Improves comfort by reducing excessive solar heat.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Silver 15 External								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Silver 15 External	1/4" tint	Silver 15 External	Dual 1/4" Clear	Silver 15 External	Dual 1/4" tint	Silver 15 External
Solar Heat Gain Coefficient	0.82	0.19	0.63	0.16	0.70	0.14	0.51	0.11
Visible Light Transmitted	89%	17%	47%	10%	79%	15%	47%	9%
Visible Light Reflected Interior	9%	56%	9%	23%	15%	54%	13%	27%
Visible Light Reflected Exterior	8%	61%	13%	61%	15%	61%	8%	61%
U Value	1.03	1.02	1.03	1.02	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	81%	37%	84%	30%	86%	49%	89%
Glare Reduction	NA	81%	NA	79%	NA	81%	NA	81%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	77%	NA	75%	NA	79%	NA	78%

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

Bronze 20 Exterior (RE20BRARXL)

Technical Data

Product Benefits

- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

<u>Bronze 20</u> <u>External</u>								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Bronze 20 External	1/4" tint	Bronze 20 External	Dual 1/4" Clear	Bronze 20 External	Dual 1/4" tint	Bronze 20 External
Solar Heat Gain Coefficient	0.82	0.22	0.63	0.19	0.70	0.17	0.51	0.13
Visible Light Transmitted	89%	23%	47%	14%	79%	21%	47%	12%
Visible Light Reflected Interior	9%	33%	9%	15%	15%	35%	13%	20%
Visible Light Reflected Exterior	8%	32%	13%	32%	15%	33%	8%	32%
U Value	1.03	1.02	1.03	1.02	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	78%	37%	81%	30%	84%	49%	87%
Glare Reduction	NA	74%	NA	71%	NA	73%	NA	74%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	73%	NA	70%	NA	76%	NA	75%

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


Neutral 35 Exterior (RE35NEARXL)

Technical Data

Product Benefits

- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Neutral 35 External								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Neutral 35 External	1/4" tint	Neutral 35 External	Dual 1/4" Clear	Neutral 35 External	Dual 1/4" tint	Neutral 35 External
Solar Heat Gain Coefficient	0.82	0.49	0.63	0.41	0.70	0.38	0.51	0.29
Visible Light Transmitted	89%	44%	47%	27%	79%	40%	47%	24%
Visible Light Reflected Interior	9%	13%	9%	8%	15%	18%	13%	14%
Visible Light Reflected Exterior	8%	10%	13%	10%	15%	12%	8%	10%
U Value	1.03	1.02	1.03	1.02	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	51%	37%	59%	30%	62%	49%	71%
Glare Reduction	NA	50%	NA	44%	NA	50%	NA	50%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	40%	NA	34%	NA	46%	NA	42%

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Silver 35 Exterior (RE35SIARXL)

Technical Data

Product Benefits

- Reduces air conditioning costs.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

<u>Silver 35</u> <u>External</u>								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Silver 35 External	1/4" tint	Silver 35 External	Dual 1/4" Clear	Silver 35 External	Dual 1/4" tint	Silver 35 External
Solar Heat Gain Coefficient	0.82	0.36	0.63	0.30	0.70	0.29	0.51	0.22
Visible Light Transmitted	89%	35%	47%	21%	79%	32%	47%	19%
Visible Light Reflected Interior	9%	36%	9%	16%	15%	37%	13%	21%
Visible Light Reflected Exterior	8%	35%	13%	35%	15%	36%	8%	35%
U Value	1.03	1.02	1.03	1.02	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	64%	37%	70%	30%	71%	49%	78%
Glare Reduction	NA	60%	NA	56%	NA	59%	NA	60%
Heat Loss Reduction	NA	1%	NA	1%	NA	0%	NA	0%
Solar Heat Reduction	NA	56%	NA	53%	NA	59%	NA	57%

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3M™ Sun Control Window Film





Prestige Series PR 40

Technical Data

Product Benefits

- High Visible Light Transmission, High Clarity, Competitive Total Solar Energy Rejection
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

PR40								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	PR40	1/4" tint	PR40	Dual 1/4" Clear	PR40	Dual 1/4" tint	PR40
Solar Heat Gain Coefficient	0.82	0.40	0.63	0.37	0.70	0.51	0.51	0.45
Visible Light Transmitted	89%	39%	47%	24%	79%	35%	47%	13%
Visible Light Reflected Interior	9%	7%	9%	6%	15%	8%	13%	6%
Visible Light Reflected Exterior	8%	7%	13%	5%	15%	14%	8%	8%
U Value	1.03	0.99	1.03	0.99	0.47	0.47	0.47	0.47
UV Block	38%	99.9%	NA	99.9%	NA	99.9%	NA	99.9%
Total Solar Energy Rejected	19%	60%	37%	63%	30%	49%	49%	55%
Glare Reduction	NA	55%	NA	50%	NA	55%	NA	73%
Heat Loss Reduction	NA	3%	NA	3%	NA	2%	NA	2%
Solar Heat Reduction	NA	50%	NA	41%	NA	27%	NA	11%

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
Prestige Series PR 50

Technical Data

Product Benefits

- High Visible Light Transmission, High Clarity, Competitive Total Solar Energy Rejection
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

PR50								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	PR50	1/4" tint	PR50	Dual 1/4" Clear	PR50	Dual 1/4" tint	PR50
Solar Heat Gain Coefficient	0.82	0.44	0.63	0.39	0.70	0.53	0.51	0.46
Visible Light Transmitted	89%	50%	47%	30%	79%	45%	47%	16%
Visible Light Reflected Interior	9%	7%	9%	6%	15%	9%	13%	7%
Visible Light Reflected Exterior	8%	8%	13%	6%	15%	15%	8%	8%
U Value	1.03	0.99	1.03	0.99	0.47	0.47	0.47	0.47
UV Block	38%	99.9%	NA	99.9%	NA	99.9%	NA	99.9%
Total Solar Energy Rejected	19%	56%	37%	61%	30%	47%	49%	54%
Glare Reduction	NA	44%	NA	37%	NA	44%	NA	66%
Heat Loss Reduction	NA	3%	NA	3%	NA	2%	NA	2%
Solar Heat Reduction	NA	46%	NA	38%	NA	25%	NA	9%

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Prestige Series PR 60

Technical Data

Product Benefits

- High Visible Light Transmission, High Clarity, Competitive Total Solar Energy Rejection
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

PR60								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	PR60	1/4" tint	PR60	Dual 1/4" Clear	PR60	Dual 1/4" tint	PR60
Solar Heat Gain Coefficient	0.82	0.47	0.63	0.41	0.70	0.54	0.51	0.40
Visible Light Transmitted	89%	60%	47%	36%	79%	54%	47%	19%
Visible Light Reflected Interior	9%	8%	9%	7%	15%	11%	13%	7%
Visible Light Reflected Exterior	8%	8%	13%	6%	15%	15%	8%	8%
U Value	1.03	0.99	1.03	0.99	0.47	0.47	0.47	0.47
UV Block	38%	99.9%	NA	99.9%	NA	99.9%	NA	99.9%
Total Solar Energy Rejected	19%	53%	37%	59%	30%	46%	49%	60%
Glare Reduction	NA	32%	NA	23%	NA	32%	NA	59%
Heat Loss Reduction	NA	3%	NA	3%	NA	2%	NA	2%
Solar Heat Reduction	NA	42%	NA	34%	NA	22%	NA	21%

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
Prestige Series PR 70

Technical Data

Product Benefits

- High Visible Light Transmission, High Clarity, Competitive Total Solar Energy Rejection
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

PR70								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	PR70	1/4" tint	PR70	Dual 1/4" Clear	PR70	Dual 1/4" tint	PR70
Solar Heat Gain Coefficient	0.82	0.50	0.63	0.43	0.70	0.56	0.51	0.40
Visible Light Transmitted	89%	69%	47%	42%	79%	62%	47%	22%
Visible Light Reflected Interior	9%	9%	9%	7%	15%	13%	13%	8%
Visible Light Reflected Exterior	8%	9%	13%	6%	15%	15%	8%	8%
U Value	1.03	0.99	1.03	0.99	0.47	0.47	0.47	0.47
UV Block	38%	99.9%	NA	99.9%	NA	99.9%	NA	99.9%
Total Solar Energy Rejected	19%	50%	37%	57%	30%	44%	49%	60%
Glare Reduction	NA	22%	NA	12%	NA	22%	NA	53%
Heat Loss Reduction	NA	3%	NA	3%	NA	2%	NA	2%
Solar Heat Reduction	NA	38%	NA	31%	NA	21%	NA	20%

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3M™ Sun Control Window Film - Night Vision Series





NV 15

Technical Data

Product Benefits

- Warm tones complement natural light and defend against solar rays.
- A warm natural hue invites warmth and beauty to any room.
- Low interior and exterior reflectivity, especially at night.
- Great heat rejection for dual pane windows.
- 3M technology enhances color stability.
- Reduce air conditioning costs and stay cooler by reducing excessive solar heat especially in hot sunny climates.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

NV15								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	NV15	1/4" tint	NV15	Dual 1/4" Clear	NV15	Dual 1/4" tint	NV15
Solar Heat Gain Coefficient	0.82	0.29	0.63	0.31	0.70	0.40	0.51	0.32
Visible Light Transmitted	89%	15%	47%	9%	79%	14%	47%	8%
Visible Light Reflected Interior	9%	11%	9%	11%	15%	11%	13%	11%
Visible Light Reflected Exterior	8%	39%	13%	17%	15%	40%	8%	17%
U Value	1.03	0.98	1.03	0.98	0.47	0.46	0.47	0.46
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	71%	37%	70%	30%	60%	49%	68%
Glare Reduction	NA	83%	NA	80%	NA	82%	NA	83%
Heat Loss Reduction	NA	4%	NA	4%	NA	3%	NA	3%
Solar Heat Reduction	NA	64%	NA	51%	NA	43%	NA	37%

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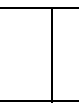


NV 25

Technical Data

Product Benefits

- Warm tones complement natural light and defend against solar rays.
- A warm natural hue invites warmth and beauty to any room.
- Low interior and exterior reflectivity, especially at night.
- Great heat rejection for dual pane windows.
- 3M technology enhances color stability.
- Reduce air conditioning costs and stay cooler by reducing excessive solar heat especially in hot sunny climates.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

NV25								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	NV25	1/4" tint	NV25	Dual 1/4" Clear	NV25	Dual 1/4" tint	NV25
Solar Heat Gain Coefficient	0.82	0.40	0.63	0.38	0.70	0.49	0.51	0.37
Visible Light Transmitted	89%	24%	47%	14%	79%	22%	47%	13%
Visible Light Reflected Interior	9%	7%	9%	7%	15%	8%	13%	8%
Visible Light Reflected Exterior	8%	20%	13%	10%	15%	24%	8%	12%
U Value	1.03	1.00	1.03	1.00	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	60%	37%	63%	30%	51%	49%	63%
Glare Reduction	NA	73%	NA	70%	NA	72%	NA	73%
Heat Loss Reduction	NA	2%	NA	2%	NA	1%	NA	1%
Solar Heat Reduction	NA	51%	NA	40%	NA	29%	NA	27%

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


NV 35

Technical Data

Product Benefits

- Warm tones complement natural light and defend against solar rays.
- A warm natural hue invites warmth and beauty to any room.
- Low interior and exterior reflectivity, especially at night.
- Great heat rejection for dual pane windows.
- 3M technology enhances color stability.
- Reduce air conditioning costs and stay cooler by reducing excessive solar heat especially in hot sunny climates.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

NV35								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	NV35	1/4" tint	NV35	Dual 1/4" Clear	NV35	Dual 1/4" tint	NV35
Solar Heat Gain Coefficient	0.82	0.49	0.63	0.43	0.70	0.55	0.51	0.42
Visible Light Transmitted	89%	36%	47%	22%	79%	32%	47%	19%
Visible Light Reflected Interior	9%	7%	9%	6%	15%	8%	13%	8%
Visible Light Reflected Exterior	8%	13%	13%	8%	15%	19%	8%	10%
U Value	1.03	1.03	1.03	1.03	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	51%	37%	57%	30%	45%	49%	59%
Glare Reduction	NA	59%	NA	54%	NA	60%	NA	60%
Heat Loss Reduction	NA	0%	NA	0%	NA	1%	NA	1%
Solar Heat Reduction	NA	40%	NA	32%	NA	21%	NA	18%

Important:

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


Nickel 50 (RE50NIARL)

Technical Data

Product Benefits

- Stay cooler by reducing excessive heat in warmer months.
- Maintains more natural appearance.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Nickel 50								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Nickel 50	1/4" tint	Nickel 50	Dual 1/4" Clear	Nickel 50	Dual 1/4" tint	Nickel 50
Solar Heat Gain Coefficient	0.82	0.44	0.63	0.38	0.70	0.48	0.51	0.36
Visible Light Transmitted	89%	50%	47%	30%	79%	45%	47%	27%
Visible Light Reflected Interior	9%	23%	9%	22%	15%	25%	13%	24%
Visible Light Reflected Exterior	8%	24%	13%	12%	15%	28%	8%	13%
U Value	1.03	0.92	1.03	0.92	0.47	0.45	0.47	0.45
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	56%	37%	62%	30%	52%	49%	64%
Glare Reduction	NA	44%	NA	37%	NA	43%	NA	43%
Heat Loss Reduction	NA	10%	NA	10%	NA	6%	NA	6%
Solar Heat Reduction	NA	46%	NA	39%	NA	31%	NA	28%

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Neutral 20 (RE20NEARL)

Technical Data

Product Benefits

- Reduce air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Neutral 20								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Neutral 20	1/4" tint	Neutral 20	Dual 1/4" Clear	Neutral 20	Dual 1/4" tint	Neutral 20
Solar Heat Gain Coefficient	0.82	0.38	0.63	0.32	0.70	0.46	0.51	0.36
Visible Light Transmitted	89%	15%	47%	9%	79%	14%	47%	8%
Visible Light Reflected Interior	9%	19%	9%	19%	15%	19%	13%	19%
Visible Light Reflected Exterior	8%	21%	13%	10%	15%	25%	8%	12%
U Value	1.03	0.99	1.03	0.99	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	62%	37%	68%	30%	54%	49%	64%
Glare Reduction	NA	83%	NA	81%	NA	83%	NA	83%
Heat Loss Reduction	NA	3%	NA	3%	NA	2%	NA	2%
Solar Heat Reduction	NA	53%	NA	49%	NA	34%	NA	30%

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Neutral 35 (RE35NEARL)

Technical Data

Product Benefits

- Reduce air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Neutral 35								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Neutral 35	1/4" tint	Neutral 35	Dual 1/4" Clear	Neutral 35	Dual 1/4" tint	Neutral 35
Solar Heat Gain Coefficient	0.82	0.44	0.63	0.39	0.70	0.51	0.51	0.39
Visible Light Transmitted	89%	36%	47%	21%	79%	32%	47%	19%
Visible Light Reflected Interior	9%	18%	9%	18%	15%	19%	13%	19%
Visible Light Reflected Exterior	8%	20%	13%	10%	15%	24%	8%	12%
U Value	1.03	0.99	1.03	0.99	0.47	0.46	0.47	0.46
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	56%	37%	61%	30%	49%	49%	61%
Glare Reduction	NA	60%	NA	55%	NA	60%	NA	60%
Heat Loss Reduction	NA	4%	NA	4%	NA	2%	NA	2%
Solar Heat Reduction	NA	46%	NA	38%	NA	27%	NA	23%

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Neutral 50 (RE50NEARL)

Technical Data

Product Benefits

- Reduce air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Neutral 50								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Neutral 50	1/4" tint	Neutral 50	Dual 1/4" Clear	Neutral 50	Dual 1/4" tint	Neutral 50
Solar Heat Gain Coefficient	0.82	0.56	0.63	0.47	0.70	0.59	0.51	0.44
Visible Light Transmitted	89%	52%	47%	31%	79%	46%	47%	28%
Visible Light Reflected Interior	9%	11%	9%	10%	15%	13%	13%	13%
Visible Light Reflected Exterior	8%	12%	13%	7%	15%	18%	8%	10%
U Value	1.03	1.03	1.03	1.03	0.47	0.48	0.47	0.48
UV Block	38%	98%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	44%	37%	53%	30%	41%	49%	57%
Glare Reduction	NA	41%	NA	34%	NA	41%	NA	41%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	31%	NA	25%	NA	16%	NA	14%

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Neutral 70 (RE70NEARL)

Technical Data

Product Benefits

- Reduce air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Neutral 70								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Neutral 70	1/4" tint	Neutral 70	Dual 1/4" Clear	Neutral 70	Dual 1/4" tint	Neutral 70
Solar Heat Gain Coefficient	0.82	0.68	0.63	0.55	0.70	0.64	0.51	0.47
Visible Light Transmitted	89%	69%	47%	42%	79%	62%	47%	37%
Visible Light Reflected Interior	9%	8%	9%	7%	15%	12%	13%	11%
Visible Light Reflected Exterior	8%	9%	13%	6%	15%	16%	8%	9%
U Value	1.03	1.03	1.03	1.03	0.47	0.48	0.47	0.48
UV Block	38%	98%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	32%	37%	45%	30%	36%	49%	53%
Glare Reduction	NA	22%	NA	12%	NA	22%	NA	22%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	17%	NA	13%	NA	8%	NA	7%

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


Amber 35 (RE35AMARL)

Technical Data

Product Benefits

- Reduce air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Amber35								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Amber 35	1/4" tint	Amber 35	Dual 1/4" Clear	Amber 35	Dual 1/4" tint	Amber 35
Solar Heat Gain Coefficient	0.82	0.25	0.63	0.27	0.70	0.32	0.51	0.26
Visible Light Transmitted	89%	30%	47%	17%	79%	28%	47%	16%
Visible Light Reflected Interior	9%	60%	9%	60%	15%	61%	13%	61%
Visible Light Reflected Exterior	8%	54%	13%	22%	15%	53%	8%	22%
U Value	1.03	0.85	1.03	0.85	0.47	0.42	0.47	0.42
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	75%	37%	73%	30%	68%	49%	74%
Glare Reduction	NA	67%	NA	63%	NA	65%	NA	66%
Heat Loss Reduction	NA	17%	NA	17%	NA	11%	NA	11%
Solar Heat Reduction	NA	69%	NA	57%	NA	54%	NA	48%

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
Silver 35 (RE35SIARL)

Technical Data

Product Benefits

- Reduce air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Silver 35								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Silver 35	1/4" tint	Silver 35	Dual 1/4" Clear	Silver 35	Dual 1/4" tint	Silver 35
Solar Heat Gain Coefficient	0.82	0.36	0.63	0.34	0.70	0.43	0.51	0.33
Visible Light Transmitted	89%	35%	47%	21%	79%	32%	47%	19%
Visible Light Reflected Interior	9%	40%	9%	40%	15%	41%	13%	41%
Visible Light Reflected Exterior	8%	36%	13%	16%	15%	38%	8%	16%
U Value	1.03	0.92	1.03	0.92	0.47	0.45	0.47	0.45
UV Block	38%	98%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	64%	37%	66%	30%	57%	49%	67%
Glare Reduction	NA	60%	NA	56%	NA	59%	NA	60%
Heat Loss Reduction	NA	10%	NA	10%	NA	6%	NA	6%
Solar Heat Reduction	NA	56%	NA	46%	NA	39%	NA	34%

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Affinity 15

Technical Data

Product Benefits

- Reduce air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Affinity 15								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Affinity 15	1/4" tint	Affinity 15	Dual 1/4" Clear	Affinity 15	Dual 1/4" tint	Affinity 15
Solar Heat Gain Coefficient	0.82	0.21	0.63	0.27	0.70	0.32	0.51	0.27
Visible Light Transmitted	89%	9%	47%	5%	79%	8%	47%	5%
Visible Light Reflected Interior	9%	25%	9%	25%	15%	26%	13%	25%
Visible Light Reflected Exterior	8%	58%	13%	24%	15%	57%	8%	23%
U Value	1.03	1.00	1.03	1.00	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	79%	37%	73%	30%	68%	49%	73%
Glare Reduction	NA	90%	NA	89%	NA	90%	NA	89%
Heat Loss Reduction	NA	2%	NA	2%	NA	1%	NA	1%
Solar Heat Reduction	NA	74%	NA	57%	NA	54%	NA	47%

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Affinity 30

Technical Data

Product Benefits

- Reduce air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Affinity 30								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Affinity 30	1/4" tint	Affinity 30	Dual 1/4" Clear	Affinity 30	Dual 1/4" tint	Affinity 30
Solar Heat Gain Coefficient	0.82	0.39	0.63	0.37	0.70	0.46	0.51	0.36
Visible Light Transmitted	89%	33%	47%	20%	79%	30%	47%	18%
Visible Light Reflected Interior	9%	19%	9%	19%	15%	20%	13%	20%
Visible Light Reflected Exterior	8%	29%	13%	14%	15%	32%	8%	15%
U Value	1.03	0.94	1.03	0.94	0.47	0.45	0.47	0.45
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	61%	37%	63%	30%	54%	49%	64%
Glare Reduction	NA	63%	NA	58%	NA	62%	NA	62%
Heat Loss Reduction	NA	8%	NA	8%	NA	5%	NA	5%
Solar Heat Reduction	NA	52%	NA	41%	NA	34%	NA	29%

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Ultra S150 (SCLARL150)

Technical Data

Product Benefits

- Increase personal safety from flying or broken glass.
- Increases protection from windstorms, hurricanes, blasts, and earthquakes.
- Deters smash and grab theft.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Ultra S150								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Ultra S150	1/4" tint	Ultra S150	Dual 1/4" Clear	Ultra S150	Dual 1/4" tint	Ultra S150
Solar Heat Gain Coefficient	0.82	0.82	0.63	0.59	0.70	0.68	0.51	0.46
Visible Light Transmitted	89%	87%	47%	47%	79%	77%	47%	45%
Visible Light Reflected Interior	9%	11%	9%	7%	15%	17%	13%	8%
Visible Light Reflected Exterior	8%	11%	13%	7%	15%	17%	8%	8%
U Value	1.03	1.03	1.03	1.03	0.47	0.47	0.47	0.47
UV Block	38%	98%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	19%	37%	41%	30%	32%	49%	54%
Glare Reduction	NA	2%	NA	1%	NA	3%	NA	5%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	0%	NA	6%	NA	3%	NA	9%

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Ultra S400 (SCLARL400)

Technical Data

Product Benefits

- Increase personal safety from flying or broken glass.
- Increases protection from windstorms, hurricanes, blasts, and earthquakes.
- Deters smash and grab theft.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Ultra S400								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Ultra S400	1/4" tint	Ultra S400	Dual 1/4" Clear	Ultra S400	Dual 1/4" tint	Ultra S400
Solar Heat Gain Coefficient	0.82	0.79	0.63	0.59	0.70	0.68	0.51	0.46
Visible Light Transmitted	89%	86%	47%	47%	79%	75%	47%	42%
Visible Light Reflected Interior	9%	11%	9%	6%	15%	18%	13%	8%
Visible Light Reflected Exterior	8%	11%	13%	6%	15%	18%	8%	8%
U Value	1.03	1.03	1.03	1.03	0.47	0.47	0.47	0.47
UV Block	38%	98%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	21%	37%	41%	30%	32%	49%	54%
Glare Reduction	NA	3%	NA	1%	NA	5%	NA	11%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	3%	NA	6%	NA	3%	NA	9%

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Ultra S600 (Ultra600)

Technical Data

Product Benefits

- Increase personal safety from flying or broken glass.
- Increases protection from windstorms, hurricanes, blasts, and earthquakes.
- Deters smash and grab theft and forced entry burglary.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Ultra S600								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Ultra S600	1/4" tint	Ultra S600	Dual 1/4" Clear	Ultra S600	Dual 1/4" tint	Ultra S600
Solar Heat Gain Coefficient	0.82	0.78	0.63	0.59	0.70	0.68	0.51	0.46
Visible Light Transmitted	89%	84%	47%	47%	79%	73%	47%	41%
Visible Light Reflected Interior	9%	10%	9%	6%	15%	18%	13%	8%
Visible Light Reflected Exterior	8%	10%	13%	6%	15%	18%	8%	8%
U Value	1.03	1.03	1.03	1.03	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	22%	37%	41%	30%	32%	49%	54%
Glare Reduction	NA	5%	NA	1%	NA	8%	NA	13%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	4%	NA	6%	NA	3%	NA	9%

Important:

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Prestige Series Ultra PR S50

Technical Data

Product Benefits

- Savings on heating costs.
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Increases protection from windstorms, blasts and earthquakes.
- Deter smash and grab theft.
- Low interior and exterior reflectivity, especially at night.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Ultra PRS50								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Ultra PRS50	1/4" tint	Ultra PRS50	Dual 1/4" Clear	Ultra PRS50	Dual 1/4" tint	Ultra PRS50
Solar Heat Gain Coefficient	0.82	0.44	0.63	0.40	0.70	0.53	0.51	0.40
Visible Light Transmitted	89%	50%	47%	30%	79%	44%	47%	27%
Visible Light Reflected Interior	9%	8%	9%	7%	15%	10%	13%	9%
Visible Light Reflected Exterior	8%	9%	13%	6%	15%	15%	8%	9%
U Value	1.03	1.02	1.03	1.02	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	56%	37%	60%	30%	47%	49%	60%
Glare Reduction	NA	44%	NA	37%	NA	44%	NA	44%
Heat Loss Reduction	NA	1%	NA	1%	NA	1%	NA	1%
Solar Heat Reduction	NA	46%	NA	37%	NA	25%	NA	21%

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3M™ Series Safety & Security Window Film





Prestige Series Ultra PR S70

Technical Data

Product Benefits

- Savings on heating costs.
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Increases protection from windstorms, blasts and earthquakes.
- Deter smash and grab theft.
- Low interior and exterior reflectivity, especially at night.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Ultra PRS70								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Ultra PRS70	1/4" tint	Ultra PRS70	Dual 1/4" Clear	Ultra PRS70	Dual 1/4" tint	Ultra PRS70
Solar Heat Gain Coefficient	0.82	0.51	0.63	0.44	0.70	0.55	0.51	0.41
Visible Light Transmitted	89%	68%	47%	41%	79%	61%	47%	37%
Visible Light Reflected Interior	9%	11%	9%	10%	15%	15%	13%	14%
Visible Light Reflected Exterior	8%	12%	13%	7%	15%	18%	8%	9%
U Value	1.03	1.00	1.03	1.00	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	49%	37%	57%	30%	45%	49%	59%
Glare Reduction	NA	23%	NA	13%	NA	23%	NA	23%
Heat Loss Reduction	NA	2%	NA	2%	NA	1%	NA	1%
Solar Heat Reduction	NA	38%	NA	31%	NA	21%	NA	19%

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Ultra Silver S20 (S20SIAR400)

Technical Data

Product Benefits

- Deters smash and grab theft.
- Increase protection from windstorms, blasts, and earthquakes.
- Increase daytime privacy.
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

<u>Ultra Silver S20</u>								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Ultra Silver S20	1/4" tint	Ultra Silver S20	Dual 1/4" Clear	Ultra Silver S20	Dual 1/4" tint	Ultra Silver S20
Solar Heat Gain Coefficient	0.82	0.23	0.63	0.28	0.70	0.33	0.51	0.27
Visible Light Transmitted	89%	17%	47%	9%	79%	15%	47%	9%
Visible Light Reflected Interior	9%	58%	9%	61%	15%	58%	13%	58%
Visible Light Reflected Exterior	8%	56%	13%	23%	15%	55%	8%	23%
U Value	1.03	0.93	1.03	0.98	0.47	0.45	0.47	0.45
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	77%	37%	72%	30%	67%	49%	73%
Glare Reduction	NA	81%	NA	81%	NA	80%	NA	81%
Heat Loss Reduction	NA	9%	NA	4%	NA	5%	NA	5%
Solar Heat Reduction	NA	72%	NA	56%	NA	53%	NA	47%

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Ultra Night Vision S25 (S25NVAR400)

Technical Data

Product Benefits

- Deters smash and grab theft.
- Increase protection from windstorms, blasts, and earthquakes.
- A warm, natural hue invites warmth and beauty to any room.
- Low interior and exterior reflectivity, especially at night.
- Great heat rejection for dual pane windows.
- Reduce air conditioning costs and stay cooler by reducing excessive solar heat.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Ultra NV S25								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Ultra NV S25	1/4" tint	Ultra NV S25	Dual 1/4" Clear	Ultra NV S25	Dual 1/4" tint	Ultra NV S25
Solar Heat Gain Coefficient	0.82	0.38	0.63	0.35	0.70	0.47	0.51	0.36
Visible Light Transmitted	89%	27%	47%	16%	79%	25%	47%	15%
Visible Light Reflected Interior	9%	12%	9%	12%	15%	13%	13%	13%
Visible Light Reflected Exterior	8%	23%	13%	11%	15%	27%	8%	13%
U Value	1.03	0.97	1.03	0.97	0.47	0.46	0.47	0.46
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	63%	37%	65%	30%	53%	49%	64%
Glare Reduction	NA	69%	NA	66%	NA	69%	NA	69%
Heat Loss Reduction	NA	6%	NA	6%	NA	3%	NA	3%
Solar Heat Reduction	NA	54%	NA	44%	NA	33%	NA	29%

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

Ultra Neutral S35 (S35NEAR400)

Technical Data

Product Benefits

- Deters smash and grab theft.
- Increase protection from windstorms, blasts, and earthquakes.
- Increase daytime privacy.
- Reduce air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduce glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Ultra Neutral S35								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Ultra Neutral S35	1/4" tint	Ultra Neutral S35	Dual 1/4" Clear	Ultra Neutral S35	Dual 1/4" tint	Ultra Neutral S35
Solar Heat Gain Coefficient	0.82	0.44	0.63	0.39	0.70	0.51	0.51	0.39
Visible Light Transmitted	89%	36%	47%	21%	79%	32%	47%	19%
Visible Light Reflected Interior	9%	18%	9%	18%	15%	19%	13%	19%
Visible Light Reflected Exterior	8%	20%	13%	10%	15%	24%	8%	12%
U Value	1.03	0.99	1.03	0.99	0.47	0.46	0.47	0.46
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	56%	37%	61%	30%	49%	49%	61%
Glare Reduction	NA	60%	NA	55%	NA	60%	NA	60%
Heat Loss Reduction	NA	4%	NA	4%	NA	2%	NA	2%
Solar Heat Reduction	NA	46%	NA	38%	NA	27%	NA	23%

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
Ultra Neutral S50 (S50NEAR400)

Technical Data

Product Benefits

- Deters smash and grab theft.
- Increase protection from windstorms, blasts, and earthquakes.
- Increase daytime privacy.
- Reduce air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduce glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Ultra Neutral S50								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Ultra Neutral S50	1/4" tint	Ultra Neutral S50	Dual 1/4" Clear	Ultra Neutral S50	Dual 1/4" tint	Ultra Neutral S50
Solar Heat Gain Coefficient	0.82	0.56	0.63	0.47	0.70	0.59	0.51	0.44
Visible Light Transmitted	89%	52%	47%	30%	79%	46%	47%	28%
Visible Light Reflected Interior	9%	11%	9%	10%	15%	13%	13%	13%
Visible Light Reflected Exterior	8%	12%	13%	8%	15%	18%	8%	10%
U Value	1.03	1.03	1.03	1.03	0.47	0.48	0.47	0.48
UV Block	38%	98%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	44%	37%	53%	30%	41%	49%	57%
Glare Reduction	NA	41%	NA	36%	NA	41%	NA	41%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	31%	NA	25%	NA	16%	NA	14%

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Safety S40 (SH4CLARL)

Technical Data

Product Benefits

- Increase protection from windstorms, blasts, and earthquakes.
- Deters smash and grab theft.
- Reduce fading from UV light.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Safety S40								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Safety S40	1/4" tint	Safety S40	Dual 1/4" Clear	Safety S40	Dual 1/4" tint	Safety S40
Solar Heat Gain Coefficient	0.82	0.82	0.63	0.59	0.70	0.68	0.51	0.46
Visible Light Transmitted	89%	87%	47%	47%	79%	77%	47%	45%
Visible Light Reflected Interior	9%	8%	9%	6%	15%	15%	13%	14%
Visible Light Reflected Exterior	8%	8%	13%	6%	15%	15%	8%	14%
U Value	1.03	1.03	1.03	1.03	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	19%	37%	41%	30%	32%	49%	54%
Glare Reduction	NA	2%	NA	1%	NA	3%	NA	5%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	0%	NA	6%	NA	3%	NA	9%

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


Safety S40 Exterior (SH4CLARXL)

Technical Data

Product Benefits

- Increase protection from windstorms, blasts, and earthquakes.
- Deters smash and grab theft.
- Reduce fading from UV light.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

<u>Safety S40 Exterior</u>								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Safety S40 External	1/4" tint	Safety S40 External	Dual 1/4" Clear	Safety S40 External	Dual 1/4" tint	Safety S40 External
Solar Heat Gain Coefficient	0.82	N/A	0.63	N/A	0.70	N/A	0.51	N/A
Visible Light Transmitted	89%	N/A	47%	N/A	79%	N/A	47%	N/A
Visible Light Reflected Interior	9%	N/A	9%	N/A	15%	N/A	13%	N/A
Visible Light Reflected Exterior	8%	N/A	13%	N/A	15%	N/A	8%	N/A
U Value	1.03	N/A	1.03	N/A	0.47	N/A	0.47	N/A
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	N/A	37%	N/A	30%	N/A	49%	N/A
Glare Reduction	NA	N/A	NA	N/A	NA	N/A	NA	N/A
Heat Loss Reduction	NA	N/A	NA	N/A	NA	N/A	NA	N/A
Solar Heat Reduction	NA	N/A	NA	N/A	NA	N/A	NA	N/A

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Safety S70 (SH7CLARL)

Technical Data

Product Benefits

- Increase protection from windstorms, blasts, and earthquakes.
- Deters smash and grab theft.
- Reduce fading from UV light.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Safety S70								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Safety S70	1/4" tint	Safety S70	Dual 1/4" Clear	Safety S70	Dual 1/4" tint	Safety S70
Solar Heat Gain Coefficient	0.82	0.79	0.63	0.59	0.70	0.68	0.51	0.46
Visible Light Transmitted	89%	86%	47%	47%	79%	77%	47%	43%
Visible Light Reflected Interior	9%	9%	9%	6%	15%	16%	13%	8%
Visible Light Reflected Exterior	8%	9%	13%	6%	15%	16%	8%	8%
U Value	1.03	1.03	1.03	1.03	0.47	0.47	0.47	0.47
UV Block	38%	98%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	21%	37%	41%	30%	32%	49%	54%
Glare Reduction	NA	3%	NA	1%	NA	3%	NA	9%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	3%	NA	6%	NA	3%	NA	9%

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Safety S80 (SH8CLARL)

Technical Data

Product Benefits

- Increase protection from windstorms, blasts, and earthquakes.
- Deters smash and grab theft and forced entry burglaries.
- Reduce fading from UV light.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Safety S80								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Safety S80	1/4" tint	Safety S80	Dual 1/4" Clear	Safety S80	Dual 1/4" tint	Safety S80
Solar Heat Gain Coefficient	0.82	0.79	0.63	0.59	0.70	0.68	0.51	0.46
Visible Light Transmitted	89%	86%	47%	47%	79%	77%	47%	43%
Visible Light Reflected Interior	9%	9%	9%	6%	15%	16%	13%	8%
Visible Light Reflected Exterior	8%	9%	13%	6%	15%	16%	8%	8%
U Value	1.03	1.03	1.03	1.03	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	21%	37%	41%	30%	32%	49%	54%
Glare Reduction	NA	3%	NA	1%	NA	3%	NA	9%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	3%	NA	6%	NA	3%	NA	9%

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


Safety S140 (SH14CLARL)

Technical Data

Product Benefits

- Increase protection from windstorms, blasts, and earthquakes.
- Deters smash and grab theft and forced entry burglaries.
- Reduce fading from UV light.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance & Technical Data

Safety S140								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	Safety S140	1/4" tint	Safety S140	Dual 1/4" Clear	Safety S140	Dual 1/4" tint	Safety S140
Solar Heat Gain Coefficient	0.82	0.78	0.63	0.59	0.70	0.68	0.51	0.46
Visible Light Transmitted	89%	85%	47%	47%	79%	72%	47%	43%
Visible Light Reflected Interior	9%	10%	9%	6%	15%	16%	13%	8%
Visible Light Reflected Exterior	8%	10%	13%	6%	15%	16%	8%	8%
U Value	1.03	1.03	1.03	1.03	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	22%	37%	41%	30%	32%	49%	54%
Glare Reduction	NA	4%	NA	1%	NA	9%	NA	9%
Heat Loss Reduction	NA	0%	NA	0%	NA	0%	NA	0%
Solar Heat Reduction	NA	4%	NA	6%	NA	3%	NA	9%

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
Anti Graffiti 4 (AG-4)

Technical Data





Product Benefits

- Helps protect glass from scratches, abrasion and acid etching
- Increase protection from windstorms, blasts, and earthquakes.
- Deters smash and grab theft.
- Reduce fading from UV light.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance

Safety S40 (SH4CLARL)	Single Pane 	SP Factory Tint 	Double Pane 	DP Factory Tint 
Solar Heat Reduction	NA	NA	NA	NA
Heat Loss Reduction	NA	NA	NA	NA
Glare Reduction	NA	NA	NA	NA
UV Blocked	99%	99%	99%	99%
Total Solar Energy Rejected	NA	NA	NA	NA

Technical Data

Glass Type 	Applied Product	Shading Coefficient	Visible Light		Emissivity	"U" Value
			Reflected	Light Transmitted		
	None	0.94	8%	8%	88%	0.84
	Anti Graffiti 4 (AG-4)	NA	NA	NA	NA	NA
	None	0.69	5%	5%	50%	0.84
	Anti Graffiti 4 (AG-4)	NA	NA	NA	NA	NA
	None	0.81	14%	14%	78%	0.84
	Anti Graffiti 4 (AG-4)	NA	NA	NA	NA	NA
	None	0.55	8%	8%	45%	0.84
	Anti Graffiti 4 (AG-4)	NA	NA	NA	NA	NA

Important:

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3M™ Safety & Security Window Film





Anti Graffiti 7 (AG-7)

Technical Data





Product Benefits

- Helps protect glass from scratches, abrasion and acid etching.
- Increase protection from windstorms, blasts, and earthquakes.
- Deters smash and grab theft.
- Reduce fading from UV light.
- Extend the life and vibrancy in the fabric of furniture and carpets.
- Reduces injury risk from flying glass.

Product Performance

Safety S70 (SH7CLARL)	Single Pane 	SP Factory Tint 	Double Pane 	DP Factory Tint 
Solar Heat Reduction	NA	NA	NA	NA
Heat Loss Reduction	NA	NA	NA	NA
Glare Reduction	NA	NA	NA	NA
UV Blocked	99%	99%	99%	99%
Total Solar Energy Rejected	NA	NA	NA	NA

Technical Data

Glass Type 	Applied Product	Shading Coefficient	Visible Light		Emissivity	"U" Value
			Reflected	Light Transmitted		
	None	0.94	8%	8%	88%	0.84
	Safety S70 (SH7CLARL)	NA	NA	NA	NA	NA
	None	0.69	5%	5%	50%	0.84
	Safety S70 (SH7CLARL)	NA	NA	NA	NA	NA
	None	0.81	14%	14%	78%	0.84
	Safety S70 (SH7CLARL)	NA	NA	NA	NA	NA
	None	0.55	8%	8%	45%	0.84
	Safety S70 (SH7CLARL)	NA	NA	NA	NA	NA

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3M™ Automotive Window Film

Crystalline 40



Technical Data

Product Benefits

- Breakthrough multilayer nanotechnology
- Metal-free design with zero electronic interference*
- Much less reflectivity than traditional window films
- Advanced heat rejection capability
- Full 99.9% UV protection (SPF 1700+)
- 97% infrared light rejected**
- Provides additional layer of safety and security
- National lifetime manufacturer's warranty***

*Will not interfere with cell phones, GPS systems or satellite radio **IR for wavelength range of 900-1000nm ***See lifetime warranty for full details. Ask dealer for warranty information.

Product Performance & Technical Data

CR40				
	Single Pane		Tinted	
Film	1/4" Clear	CR40	1/4" tint	CR40
Solar Heat Gain Coefficient	0.82	0.40	0.63	0.37
Visible Light Transmitted	89%	39%	47%	24%
Visible Light Reflected Interior	9%	7%	9%	6%
Visible Light Reflected Exterior	8%	7%	13%	5%
U Value	1.03	0.99	1.03	0.99
UV Block	38%	99.9%	NA	99.9%
Total Solar Energy Rejected	19%	60%	37%	63%
Glare Reduction	NA	55%	NA	50%
Heat Loss Reduction	NA	3%	NA	3%
Solar Heat Reduction	NA	50%	NA	41%

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3M™ Automotive Window Film

Crystalline 50



Technical Data

Product Benefits

- Breakthrough multilayer nanotechnology
- Metal-free design with zero electronic interference*
- Much less reflectivity than traditional window films
- Advanced heat rejection capability
- Full 99.9% UV protection (SPF 1700+)
- 97% infrared light rejected**
- Provides additional layer of safety and security
- National lifetime manufacturer's warranty***

*Will not interfere with cell phones, GPS systems or satellite radio **IR for wavelength range of 900-1000nm ***See lifetime warranty for full details. Ask dealer for warranty information.

Product Performance & Technical Data

CR50				
	Single Pane		Tinted	
Film	1/4" Clear	CR50	1/4" tint	CR50
Solar Heat Gain Coefficient	0.82	0.44	0.63	0.39
Visible Light Transmitted	89%	50%	47%	30%
Visible Light Reflected Interior	9%	7%	9%	6%
Visible Light Reflected Exterior	8%	8%	13%	6%
U Value	1.03	0.99	1.03	0.99
UV Block	38%	99.9%	NA	99.9%
Total Solar Energy Rejected	19%	56%	37%	61%
Glare Reduction	NA	44%	NA	37%
Heat Loss Reduction	NA	3%	NA	3%
Solar Heat Reduction	NA	46%	NA	38%

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3M™ Automotive Window Film

Crystalline 60



Technical Data

Product Benefits

- Breakthrough multilayer nanotechnology
- Metal-free design with zero electronic interference*
- Much less reflectivity than traditional window films
- Advanced heat rejection capability
- Full 99.9% UV protection (SPF 1700+)
- 97% infrared light rejected**
- Provides additional layer of safety and security
- National lifetime manufacturer's warranty***

*Will not interfere with cell phones, GPS systems or satellite radio **IR for wavelength range of 900-1000nm ***See lifetime warranty for full details. Ask dealer for warranty information.

Product Performance & Technical Data

CR60				
	Single Pane		Tinted	
Film	1/4" Clear	CR60	1/4" tint	CR60
Solar Heat Gain Coefficient	0.82	0.47	0.63	0.41
Visible Light Transmitted	89%	60%	47%	36%
Visible Light Reflected Interior	9%	8%	9%	7%
Visible Light Reflected Exterior	8%	8%	13%	6%
U Value	1.03	0.99	1.03	0.99
UV Block	38%	99.9%	NA	99.9%
Total Solar Energy Rejected	19%	53%	37%	59%
Glare Reduction	NA	32%	NA	23%
Heat Loss Reduction	NA	3%	NA	3%
Solar Heat Reduction	NA	42%	NA	34%

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3M™ Automotive Window Film

Crystalline 70



Technical Data

Product Benefits

- Breakthrough multilayer nanotechnology
- Metal-free design with zero electronic interference*
- Much less reflectivity than traditional window films
- Advanced heat rejection capability
- Full 99.9% UV protection (SPF 1700+)
- 97% infrared light rejected**
- Provides additional layer of safety and security
- National lifetime manufacturer's warranty***

*Will not interfere with cell phones, GPS systems or satellite radio **IR for wavelength range of 900-1000nm ***See lifetime warranty for full details. Ask dealer for warranty information.

Product Performance & Technical Data

CR70				
	Single Pane		Tinted	
Film	1/4" Clear	CR70	1/4" tint	CR70
Solar Heat Gain Coefficient	0.82	0.50	0.63	0.43
Visible Light Transmitted	89%	69%	47%	42%
Visible Light Reflected Interior	9%	9%	9%	7%
Visible Light Reflected Exterior	8%	9%	13%	6%
U Value	1.03	0.99	1.03	0.99
UV Block	38%	99.9%	NA	99.9%
Total Solar Energy Rejected	19%	50%	37%	57%
Glare Reduction	NA	22%	NA	12%
Heat Loss Reduction	NA	3%	NA	3%
Solar Heat Reduction	NA	38%	NA	31%

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3M™ Automotive Window Film

Color Stable 5



Technical Data

Product Benefits

- Lifetime warranty against color change**
- Distortion-free satellite transmission*
- Excellent heat rejection
- Low reflection
- Neutral black appearance
- Superior optical clarity
- Scratch-resistant coating
- Choice in degree of glare reduction
- Maximum UV protection
- Added shatter-resistance
- National lifetime manufacturer's warranty**

*Will not interfere with cellular phones, GPS, or satellite radio signals. **See lifetime warranty for full details. Ask dealer for warranty information.

Product Performance & Technical Data

CS5				
	Single Pane		Tinted	
Film	1/4" Clear	CS5	1/4" tint	CS5
Solar Heat Gain Coefficient	0.82	0.43	0.63	Application Not Recommended
Visible Light Transmitted	89%	9%	47%	
Visible Light Reflected Interior	9%	4%	9%	
Visible Light Reflected Exterior	8%	5%	13%	
U Value	1.03	1.03	1.03	
UV Block	38%	99%	NA	
Total Solar Energy Rejected	19%	57%	37%	
Glare Reduction	NA	90%	NA	
Heat Loss Reduction	NA	0%	NA	
Solar Heat Reduction	NA	47%	NA	

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3M™ Automotive Window Film

Color Stable 20



Technical Data

*Will not interfere with cellular phones, GPS, or satellite radio signals. **See lifetime warranty for full details. Ask dealer for warranty information.

Product Benefits

- Lifetime warranty against color change**
- Distortion-free satellite transmission*
- Excellent heat rejection
- Low reflection
- Neutral black appearance
- Superior optical clarity
- Scratch-resistant coating
- Choice in degree of glare reduction
- Maximum UV protection
- Added shatter-resistance
- National lifetime manufacturer's warranty**

Product Performance & Technical Data

<u>CS20</u>				
	Single Pane		Tinted	
Film	1/4" Clear	CS20	1/4" tint	CS20
Solar Heat Gain Coefficient	0.82	0.49	0.63	0.43
Visible Light Transmitted	89%	19%	47%	11%
Visible Light Reflected Interior	9%	5%	9%	4%
Visible Light Reflected Exterior	8%	5%	13%	5%
U Value	1.03	1.03	1.03	1.03
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	51%	37%	57%
Glare Reduction	NA	79%	NA	76%
Heat Loss Reduction	NA	0%	NA	0%
Solar Heat Reduction	NA	39%	NA	32%

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3M™ Automotive Window Film

Color Stable 35



Technical Data

Product Benefits

- Lifetime warranty against color change**
- Distortion-free satellite transmission*
- Excellent heat rejection
- Low reflection
- Neutral black appearance
- Superior optical clarity
- Scratch-resistant coating
- Choice in degree of glare reduction
- Maximum UV protection
- Added shatter-resistance
- National lifetime manufacturer's warranty**

*Will not interfere with cellular phones, GPS, or satellite radio signals. **See lifetime warranty for full details. Ask dealer for warranty information.

Product Performance & Technical Data

CS35				
	Single Pane		Tinted	
Film	1/4" Clear	CS35	1/4" tint	CS35
Solar Heat Gain Coefficient	0.82	0.60	0.63	0.49
Visible Light Transmitted	89%	39%	47%	23%
Visible Light Reflected Interior	9%	6%	9%	6%
Visible Light Reflected Exterior	8%	5%	13%	5%
U Value	1.03	1.03	1.03	1.03
UV Block	38%	98%	NA	99%
Total Solar Energy Rejected	19%	40%	37%	51%
Glare Reduction	NA	56%	NA	51%
Heat Loss Reduction	NA	0%	NA	0%
Solar Heat Reduction	NA	27%	NA	21%

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3M™ Automotive Window Film

Color Stable 50



Technical Data

Product Benefits

- Lifetime warranty against color change**
- Distortion-free satellite transmission*
- Excellent heat rejection
- Low reflection
- Neutral black appearance
- Superior optical clarity
- Scratch-resistant coating
- Choice in degree of glare reduction
- Maximum UV protection
- Added shatter-resistance
- National lifetime manufacturer's warranty**

*Will not interfere with cellular phones, GPS, or satellite radio signals. **See lifetime warranty for full details. Ask dealer for warranty information.

Product Performance & Technical Data

CS50				
	Single Pane		Tinted	
Film	1/4" Clear	CS50	1/4" tint	CS50
Solar Heat Gain Coefficient	0.82	0.65	0.63	0.53
Visible Light Transmitted	89%	52%	47%	31%
Visible Light Reflected Interior	9%	7%	9%	6%
Visible Light Reflected Exterior	8%	5%	13%	5%
U Value	1.03	1.03	1.03	1.03
UV Block	38%	98%	NA	99%
Total Solar Energy Rejected	19%	35%	37%	47%
Glare Reduction	NA	42%	NA	34%
Heat Loss Reduction	NA	0%	NA	0%
Solar Heat Reduction	NA	20%	NA	16%

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3M™ Automotive Window Film



Black Chrome 10

Technical Data

Product Benefits

- Excellent heat rejection
- Reduce interior damage.
- Reduce your eyestrain.
- Choice in degree of glare reduction
- Maximum UV protection
- Added shatter-resistance

Product Performance & Technical Data

BC10				
	Single Pane		Tinted	
Film	1/4" Clear	BC10	1/4" tint	BC10
Solar Heat Gain Coefficient	0.82	0.28	0.63	0.29
Visible Light Transmitted	89%	10%	47%	6%
Visible Light Reflected Interior	9%	18%	9%	18%
Visible Light Reflected Exterior	8%	22%	13%	11%
U Value	1.03	0.97	1.03	0.97
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	72%	37%	71%
Glare Reduction	NA	88%	NA	87%
Heat Loss Reduction	NA	6%	NA	6%
Solar Heat Reduction	NA	66%	NA	54%

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3M™ Automotive Window Film



Black Chrome 20

Technical Data

Product Benefits

- Excellent heat rejection
- Reduce interior damage.
- Reduce your eyestrain.
- Choice in degree of glare reduction
- Maximum UV protection
- Added shatter-resistance

Product Performance & Technical Data

<u>BC20</u>				
	Single Pane		Tinted	
Film	1/4" Clear	BC20	1/4" tint	BC20
Solar Heat Gain Coefficient	0.82	0.32	0.63	0.32
Visible Light Transmitted	89%	17%	47%	10%
Visible Light Reflected Interior	9%	25%	9%	25%
Visible Light Reflected Exterior	8%	20%	13%	10%
U Value	1.03	0.97	1.03	0.97
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	68%	37%	68%
Glare Reduction	NA	81%	NA	79%
Heat Loss Reduction	NA	6%	NA	6%
Solar Heat Reduction	NA	60%	NA	50%

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Black Chrome 35

Technical Data

Product Benefits

- Excellent heat rejection
- Reduce interior damage.
- Reduce your eyestrain.
- Choice in degree of glare reduction
- Maximum UV protection
- Added shatter-resistance

Product Performance & Technical Data

BC35				
	Single Pane		Tinted	
Film	1/4" Clear	BC35	1/4" tint	BC35
Solar Heat Gain Coefficient	0.82	0.47	0.63	0.41
Visible Light Transmitted	89%	36%	47%	21%
Visible Light Reflected Interior	9%	11%	9%	10%
Visible Light Reflected Exterior	8%	13%	13%	8%
U Value	1.03	0.97	1.03	0.97
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	53%	37%	60%
Glare Reduction	NA	60%	NA	55%
Heat Loss Reduction	NA	6%	NA	6%
Solar Heat Reduction	NA	43%	NA	36%

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3M™ Automotive Window Film



Black Chrome 40

Technical Data

Product Benefits

- Excellent heat rejection
- Reduce interior damage.
- Reduce your eyestrain.
- Choice in degree of glare reduction
- Maximum UV protection
- Added shatter-resistance

Product Performance & Technical Data

BC40				
	Single Pane		Tinted	
Film	1/4" Clear	BC40	1/4" tint	BC40
Solar Heat Gain Coefficient	0.82	0.53	0.63	0.44
Visible Light Transmitted	89%	42%	47%	25%
Visible Light Reflected Interior	9%	8%	9%	8%
Visible Light Reflected Exterior	8%	9%	13%	6%
U Value	1.03	0.97	1.03	0.97
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	47%	37%	56%
Glare Reduction	NA	53%	NA	47%
Heat Loss Reduction	NA	6%	NA	6%
Solar Heat Reduction	NA	35%	NA	29%

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FX HP 5

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXHP 5				
	Single Pane		Tinted	
Film	1/4" Clear	FXHP 5	1/4" tint	FXHP 5
Solar Heat Gain Coefficient	0.82	0.45	0.63	0.40
Visible Light Transmitted	89%	3%	47%	2%
Visible Light Reflected Interior	9%	5%	9%	5%
Visible Light Reflected Exterior	8%	5%	13%	5%
U Value	1.03	0.99	1.03	0.46
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	55%	37%	60%
Glare Reduction	NA	97%	NA	96%
Heat Loss Reduction	NA	3%	NA	55%
Solar Heat Reduction	NA	45%	NA	37%

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3M™ Automotive Window Film



FX HP 15

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXHP 15				
	Single Pane		Tinted	
Film	1/4" Clear	FXHP 15	1/4" tint	FXHP 15
Solar Heat Gain Coefficient	0.82	0.50	0.63	0.43
Visible Light Transmitted	89%	14%	47%	8%
Visible Light Reflected Interior	9%	6%	9%	6%
Visible Light Reflected Exterior	8%	6%	13%	6%
U Value	1.03	0.99	1.03	0.99
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	50%	37%	57%
Glare Reduction	NA	84%	NA	83%
Heat Loss Reduction	NA	3%	NA	3%
Solar Heat Reduction	NA	39%	NA	32%

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3M™ Automotive Window Film



FX HP 20

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXHP 20				
	Single Pane		Tinted	
Film	1/4" Clear	FXHP 20	1/4" tint	FXHP 20
Solar Heat Gain Coefficient	0.82	0.50	0.63	0.43
Visible Light Transmitted	89%	23%	47%	14%
Visible Light Reflected Interior	9%	9%	9%	9%
Visible Light Reflected Exterior	8%	5%	13%	5%
U Value	1.03	1.00	1.03	1.00
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	50%	37%	57%
Glare Reduction	NA	74%	NA	71%
Heat Loss Reduction	NA	3%	NA	3%
Solar Heat Reduction	NA	39%	NA	32%

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3M™ Automotive Window Film



FX HP 30

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXHP 30				
	Single Pane		Tinted	
Film	1/4" Clear	FXHP 30	1/4" tint	FXHP 30
Solar Heat Gain Coefficient	0.82	0.54	0.63	0.45
Visible Light Transmitted	89%	31%	47%	19%
Visible Light Reflected Interior	9%	8%	9%	8%
Visible Light Reflected Exterior	8%	6%	13%	5%
U Value	1.03	1.00	1.03	1.00
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	47%	37%	55%
Glare Reduction	NA	65%	NA	60%
Heat Loss Reduction	NA	3%	NA	3%
Solar Heat Reduction	NA	34%	NA	28%

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3M™ Automotive Window Film



FX HP 35

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXHP 35				
	Single Pane		Tinted	
Film	1/4" Clear	FXHP 35	1/4" tint	FXHP 35
Solar Heat Gain Coefficient	0.82	0.57	0.63	0.47
Visible Light Transmitted	89%	41%	47%	25%
Visible Light Reflected Interior	9%	8%	9%	8%
Visible Light Reflected Exterior	8%	7%	13%	5%
U Value	1.03	1.00	1.03	1.00
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	43%	37%	53%
Glare Reduction	NA	53%	NA	47%
Heat Loss Reduction	NA	2%	NA	2%
Solar Heat Reduction	NA	30%	NA	25%

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3M™ Automotive Window Film



FX HP 40

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXHP 40				
	Single Pane		Tinted	
Film	1/4" Clear	FXHP 40	1/4" tint	FXHP 40
Solar Heat Gain Coefficient	0.82	0.53	0.63	0.44
Visible Light Transmitted	89%	44%	47%	27%
Visible Light Reflected Interior	9%	10%	9%	10%
Visible Light Reflected Exterior	8%	8%	13%	6%
U Value	1.03	1.02	1.03	1.02
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	47%	37%	56%
Glare Reduction	NA	50%	NA	44%
Heat Loss Reduction	NA	0%	NA	0%
Solar Heat Reduction	NA	34%	NA	30%

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FX HP 50

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXHP 50				
	Single Pane		Tinted	
Film	1/4" Clear	FXHP 50	1/4" tint	FXHP 50
Solar Heat Gain Coefficient	0.82	0.59	0.63	0.49
Visible Light Transmitted	89%	49%	47%	29%
Visible Light Reflected Interior	9%	8%	9%	7%
Visible Light Reflected Exterior	8%	8%	13%	6%
U Value	1.03	1.01	1.03	1.01
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	41%	37%	51%
Glare Reduction	NA	45%	NA	38%
Heat Loss Reduction	NA	2%	NA	2%
Solar Heat Reduction	NA	28%	NA	23%

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3M™ Automotive Window Film



FX ST 5

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXST 5				
	Single Pane		Tinted	
Film	1/4" Clear	FXST 5	1/4" tint	FXST 5
Solar Heat Gain Coefficient	0.82	0.54	0.63	0.46
Visible Light Transmitted	89%	4%	47%	3%
Visible Light Reflected Interior	9%	4%	9%	4%
Visible Light Reflected Exterior	8%	5%	13%	5%
U Value	1.03	1.02	1.03	1.02
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	46%	37%	54%
Glare Reduction	NA	95%	NA	95%
Heat Loss Reduction	NA	0%	NA	0%
Solar Heat Reduction	NA	33%	NA	26%

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3M™ Automotive Window Film



FX ST 20

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

<u>FXST 20</u>				
	Single Pane		Tinted	
Film	1/4" Clear	FXST 20	1/4" tint	FXST 20
Solar Heat Gain Coefficient	0.82	0.60	0.63	0.50
Visible Light Transmitted	89%	23%	47%	14%
Visible Light Reflected Interior	9%	5%	9%	4%
Visible Light Reflected Exterior	8%	5%	13%	5%
U Value	1.03	1.02	1.03	1.02
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	40%	37%	50%
Glare Reduction	NA	74%	NA	71%
Heat Loss Reduction	NA	0%	NA	0%
Solar Heat Reduction	NA	26%	NA	20%

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3M™ Automotive Window Film



FX ST 35

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXST 35				
	Single Pane		Tinted	
Film	1/4" Clear	FXST 35	1/4" tint	FXST 35
Solar Heat Gain Coefficient	0.82	0.64	0.63	0.52
Visible Light Transmitted	89%	33%	47%	20%
Visible Light Reflected Interior	9%	5%	9%	5%
Visible Light Reflected Exterior	8%	5%	13%	5%
U Value	1.03	1.02	1.03	1.02
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	37%	37%	48%
Glare Reduction	NA	63%	NA	58%
Heat Loss Reduction	NA	0%	NA	0%
Solar Heat Reduction	NA	22%	NA	17%

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3M™ Automotive Window Film

FX ST 40

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXST 40	Single Pane		Tinted	
	1/4" Clear	FXST 40	1/4" tint	FXST 40
Film				
Solar Heat Gain Coefficient	0.82	0.66	0.63	0.53
Visible Light Transmitted	89%	41%	47%	25%
Visible Light Reflected Interior	9%	5%	9%	5%
Visible Light Reflected Exterior	8%	5%	13%	5%
U Value	1.03	1.02	1.03	1.02
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	35%	37%	47%
Glare Reduction	NA	53%	NA	48%
Heat Loss Reduction	NA	0%	NA	0%
Solar Heat Reduction	NA	20%	NA	15%

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3M™ Automotive Window Film

FX ST 50

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXST 50	Single Pane		Tinted	
	1/4" Clear	FXST 50	1/4" tint	FXST 50
Solar Heat Gain Coefficient	0.82	0.69	0.63	0.56
Visible Light Transmitted	89%	54%	47%	32%
Visible Light Reflected Interior	9%	6%	9%	5%
Visible Light Reflected Exterior	8%	6%	13%	5%
U Value	1.03	1.02	1.03	1.02
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	31%	37%	44%
Glare Reduction	NA	39%	NA	32%
Heat Loss Reduction	NA	0%	NA	0%
Solar Heat Reduction	NA	15%	NA	11%

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3M™ Automotive Window Film

FX ST 70

Technical Data

Product Benefits

- Reduce interior damage.
- Reduce your eyestrain.
- You pick the privacy level.

Product Performance & Technical Data

FXST 70	Single Pane		Tinted	
	1/4" Clear	FXST 70	1/4" tint	FXST 70
Solar Heat Gain Coefficient	0.82	0.72	0.63	0.56
Visible Light Transmitted	89%	70%	47%	42%
Visible Light Reflected Interior	9%	7%	9%	6%
Visible Light Reflected Exterior	8%	7%	13%	5%
U Value	1.03	1.02	1.03	1.02
UV Block	38%	99%	NA	99%
Total Solar Energy Rejected	19%	28%	37%	44%
Glare Reduction	NA	21%	NA	12%
Heat Loss Reduction	NA	0%	NA	0%
Solar Heat Reduction	NA	11%	NA	11%

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3M™ Sun Control Window Film





CM30

Technical Data

Product Benefits

- High Visible Light Transmission, High Clarity, Competitive Total Solar Energy Rejection
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.

Product Performance & Technical Data

CM30								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	CM30	1/4" tint	CM30	Dual 1/4" Clear	CM30	Dual 1/4" tint	CM30
Solar Heat Gain Coefficient	0.82	0.41	0.63	0.38	0.70	0.50	0.51	0.38
Visible Light Transmitted	89%	36%	47%	21%	79%	32%	47%	19%
Visible Light Reflected Interior	9%	15%	9%	15%	15%	16%	13%	16%
Visible Light Reflected Exterior	8%	17%	13%	9%	15%	22%	8%	11%
U Value	1.03	1.02	1.03	1.02	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	59%	37%	63%	30%	50%	49%	62%
Glare Reduction	NA	60%	NA	55%	NA	60%	NA	60%
Heat Loss Reduction	NA	0%	NA	0%	NA	1%	NA	1%
Solar Heat Reduction	NA	50%	NA	40%	NA	28%	NA	25%

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


CM40

Technical Data

Product Benefits

- High Visible Light Transmission, High Clarity, Competitive Total Solar Energy Rejection
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.

Product Performance & Technical Data

CM40								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	CM40	1/4" tint	CM40	Dual 1/4" Clear	CM40	Dual 1/4" tint	CM40
Solar Heat Gain Coefficient	0.82	0.47	0.63	0.41	0.70	0.54	0.51	0.40
Visible Light Transmitted	89%	44%	47%	27%	79%	40%	47%	24%
Visible Light Reflected Interior	9%	12%	9%	11%	15%	14%	13%	13%
Visible Light Reflected Exterior	8%	14%	13%	8%	15%	20%	8%	10%
U Value	1.03	1.03	1.03	1.03	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	53%	37%	59%	30%	46%	49%	60%
Glare Reduction	NA	50%	NA	44%	NA	50%	NA	50%
Heat Loss Reduction	NA	0%	NA	0%	NA	1%	NA	1%
Solar Heat Reduction	NA	43%	NA	34%	NA	23%	NA	21%

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


CM50

Technical Data

Product Benefits

- High Visible Light Transmission, High Clarity, Competitive Total Solar Energy Rejection
- Reduces air conditioning costs.
- Stay cooler by reducing excessive heat in warmer months.
- Reduces glare and eye discomfort.
- Extend the life and vibrancy in the fabric of furniture and carpets.

Product Performance & Technical Data

CM50								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	CM50	1/4" tint	CM50	Dual 1/4" Clear	CM50	Dual 1/4" tint	CM50
Solar Heat Gain Coefficient	0.82	0.53	0.63	0.45	0.70	0.57	0.51	0.43
Visible Light Transmitted	89%	53%	47%	32%	79%	47%	47%	28%
Visible Light Reflected Interior	9%	10%	9%	9%	15%	12%	13%	11%
Visible Light Reflected Exterior	8%	12%	13%	7%	15%	18%	8%	9%
U Value	1.03	1.03	1.03	1.03	0.47	0.47	0.47	0.47
UV Block	38%	99%	NA	99%	NA	99%	NA	99%
Total Solar Energy Rejected	19%	47%	37%	55%	30%	43%	49%	58%
Glare Reduction	NA	40%	NA	33%	NA	40%	NA	40%
Heat Loss Reduction	NA	0%	NA	0%	NA	1%	NA	1%
Solar Heat Reduction	NA	35%	NA	28%	NA	18%	NA	16%

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3M™ Decorative Films

Technical Data

FEATURES & BENEFITS

3M™ Decorative films from Japan will add a new dimension to space. Decorative films are applied to glass creating a beautiful etched-glass appearance without the etched-glass cost. The new films create a uniform rice paper appearance not typically found in window films. Light is dispersed softly, rendering an attractive, tranquil atmosphere. We have premium Interior Design films suited for interior glass partitions or the inside surface of windows. Developed for the Asian market, the Fasara™ films offer the opportunity to immerse oneself in aesthetic serenity while still maintaining the outstanding quality provided by 3M technology.

- Architectural applications
- Privacy and decorative
- Window graphic applications
- Unique rice paper designs
- Emulates etched or sand blasted glass
- All designs are uniform throughout the film
- Blocks up to 99% UV which assists in reducing fade on fabrics
- Glare and heat reduction
- Fingerprint resistant – Glass Shade Series
- Durable polyester film
- Reduces injury risk from flying glass
- Easy to clean
- Can be removed when required

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3M™ Decorative Films

Technical Data

SELLING TIPS

- Look for creative locations to apply decorative film while bidding on 3M™ Sun Control Window Film or 3M™ Safety and Security Window Film for interior glass and window applications.
 - Offices
 - Restaurants
 - Hotels
 - Retail Windows & Doors
- For unique graphic applications, establish a relationship with a sign company to create and cut the film to the customer's specifications.
- Etched-glass can be costly, difficult to clean, expensive and a hassle to replace if damaged.
- Etching can weaken glass. Film helps to reinforce the glass.

PRODUCT DESCRIPTION

The 3M™ Decorative films are recommended for application to interior glass and exterior glass (inside surface). These films are made of durable polyester with a decorative matte surface, perfect for privacy, decorative and architectural applications. The films are not recommended for use on glass substitutes (e.g. plastics). The total nominal thickness is between 3.0 and 3.5 mils, depending on film type. These films are manufactured with a silicone liner, which protects the clear pressure-sensitive adhesive, and, except for the absence of an overcoat, are applied using the same tools and techniques you are accustomed to using with other 3M™ Sun Control Window Film.

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3M™ Decorative Films

Technical Data

INSTALLATION TIPS & TECHNIQUES

- Customer should provide clear access to work areas
- Protect floor, carpet, window ledge, wall, etc., with suitable absorbent material (drop cloth)
- Turn off or cover heating / AC and ventilation ducts
- Wipe down window frame with damp cloth or sponge
- If window putty or seal is old and cracked, tape or seal prior to washing glass
- Using 90% water to 10% ammonia, clean glass with a blade scraper
- Thoroughly rinse glass from top to bottom with pressure spray tank
- Squeegee entire glass surface
- Dry glass edges and window frames using a lint-free towel
- Measure glass and precut film to fit or,
- Cut film to fit or cut 1" wider and 1" longer then trim film to size after first squeegee
- Spray slip solution, composed of one capful of Johnson® Baby Shampoo or Joy® Dishwashing Liquid to 1 gallon of water, to glass and film. Use no more soap than is needed to provide slip.
- Apply film to glass and lightly spray film with slip solution
- Squeegee to remove the water
- If you did not cut film to size, trim the film to size before you squeegee the second time
- Spray slip solution to the film and squeegee the second time
- Always use new blade tip after 3-4 cuts
- Bump film edge with a lint-free towel wrapped around the edge of a five-way tool
- Wipe frame edge dry
- Inspect installation to insure high quality of the application

WINDOW CARE

Window Films may be washed with common washing solutions, including ammonia-based cleaners, thirty (30) days after installation. Abrasive type cleaning agents and brushes, which would scratch the film, must not be used. These films may also be cleaned with a mild dishwashing soap such as Ivory Liquid® and a synthetic sponge, squeegee or soft cloth.

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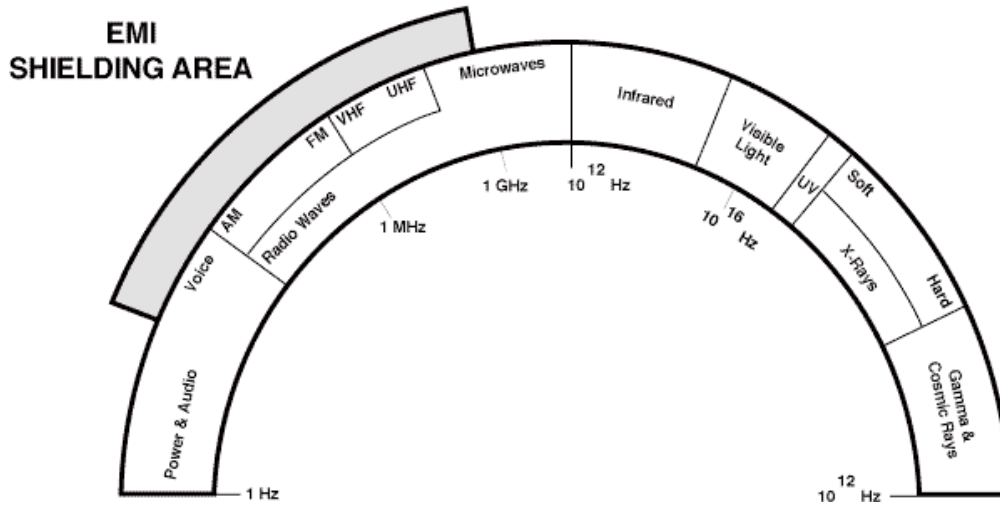
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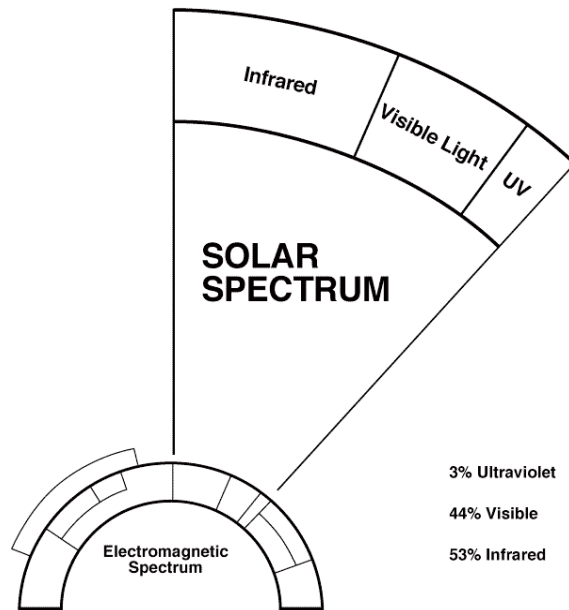
3M™ Window Film General Information

How Film Works

ELECTROMAGNETIC SPECTRUM



SOLAR SPECTRUM



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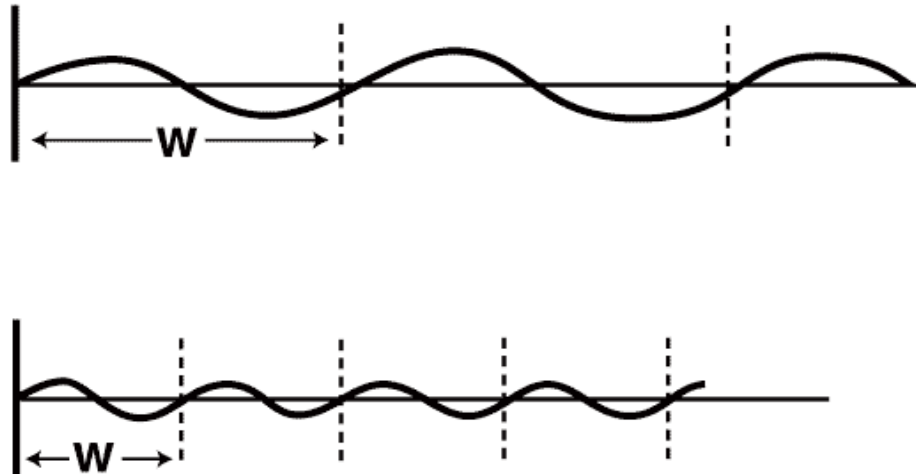
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General Information

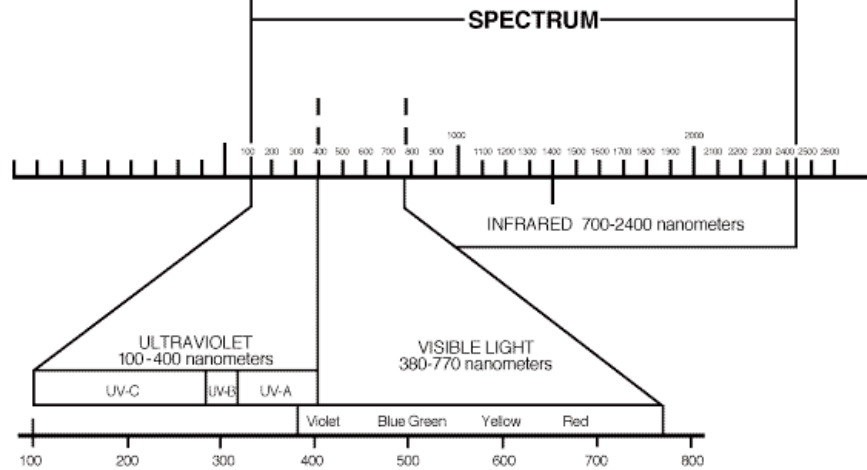
How Film Works

WAVELENGTH



One Nanometer = .000000001 meters

SOLAR RADIATION



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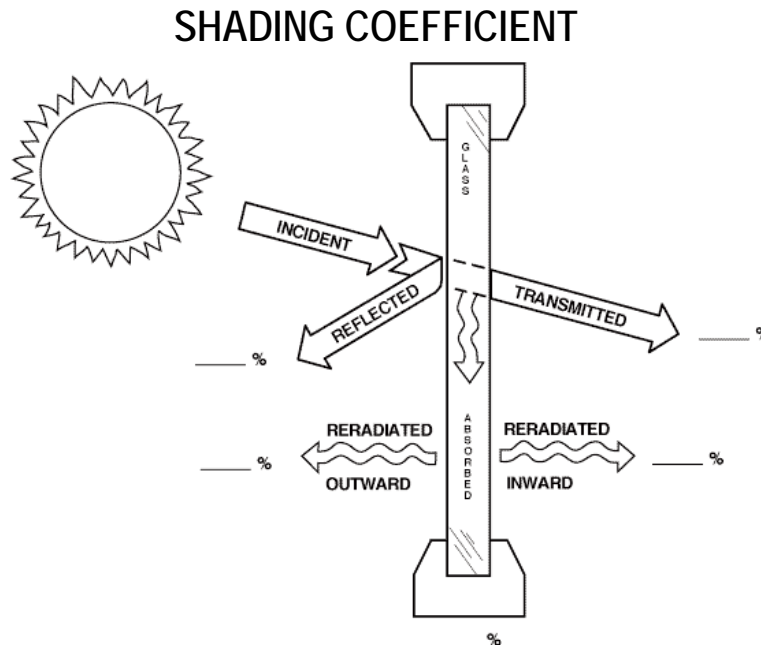
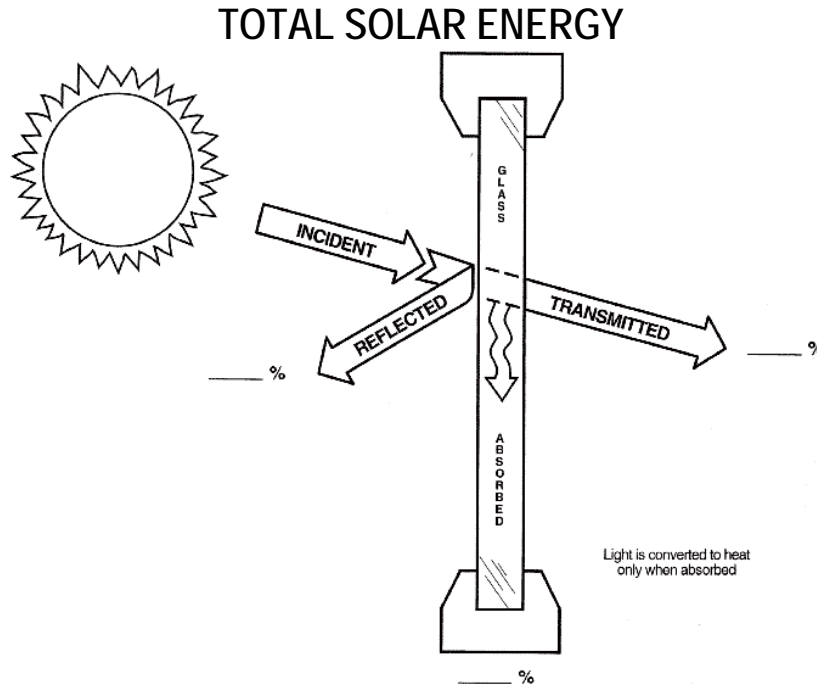
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General Information

How Film Works



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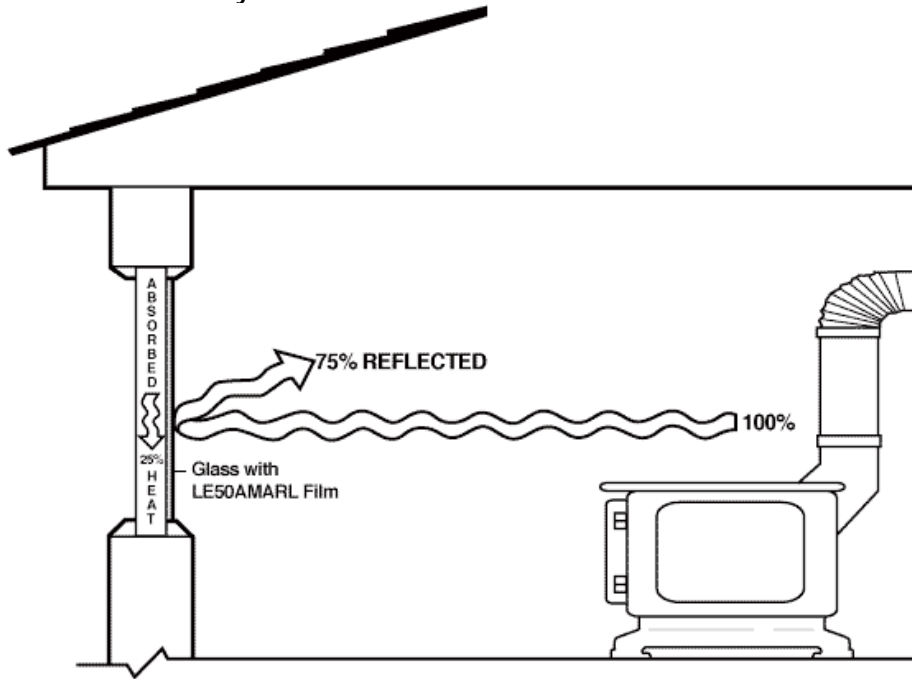
3M™ Window Film

General Information

How Film Works

EMISSIVITY

The ability of a surface to absorb heat and to reflect it



Emissivity of Some Materials

Gold, Polished	0.02
Silver, Polished	0.02
Aluminum, Polished	0.05
3M™ Sun Control Window Film Amber Low E 35 (LE35AMARL) Film	0.34
3M™ Sun Control Window Film Silver P18ARL (P-18ARL) Film	0.65
Glass	0.84
Paper	0.89
Wood	0.91
White Enamel	0.91
Flat Black Lacquer	0.96

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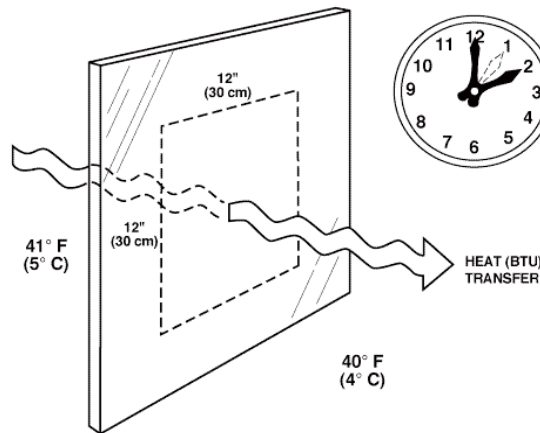
3M™ Window Film

General Information

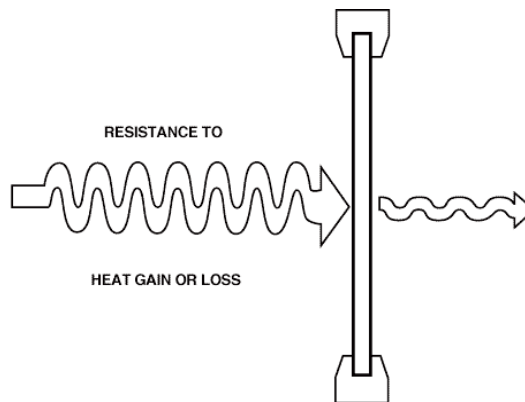
How Film Works

“U” VALUE/“K” VALUE

The amount of heat passing through 1 sq. ft. (.092 sq meters) of glass in 1 hour for every 1° F (0.47° C) temperature difference



“R” VALUE



Reciprocal of “U” Value

$$“R” = 1/“U”$$

$$“U” = 1/“R”$$

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How Film Works

CALCULATING SOLAR ENERGY REDUCTIONS

Formula	Example Amber Low E 35 (LE35AMARL)	
Solar Heat Reduction (Shading Coefficient of Glass) - (Shading Coefficient of Glass with Film)	<u>0.94 - 0.29</u>	= 69%
Shading Coefficient of Glass	0.94	
Heat Loss Reduction (U-Value of Glass) - (U-Value of Glass with Film)	<u>1.06 - 0.74</u>	= 30%
U-Value of Glass	1.06	
Glare Reduction (Visible Light Transmission of Glass) - (Visible Light Transmission of Glass with Film)	<u>88 - 31</u>	= 65%
Visible Light Transmission of Glass	88	
UV Blocked (100% Total Ultraviolet) - (UV Transmission of Glass with Film)	<u>100-1</u>	= 99%
100% Total Ultraviolet	100	

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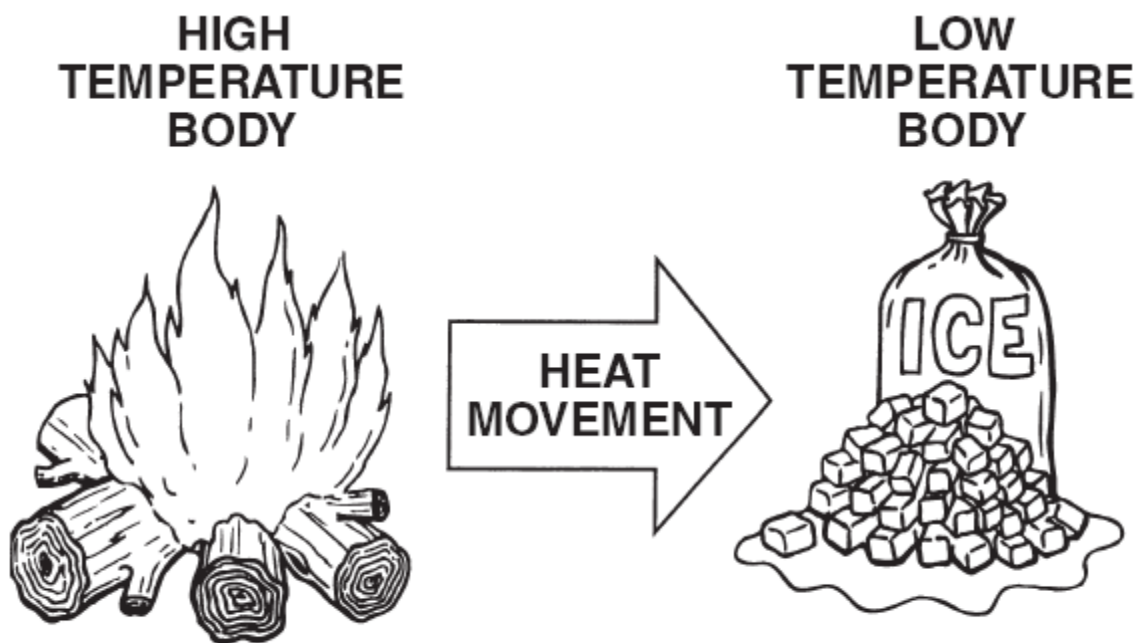
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How Film Works

HEAT TRANSFER



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BTU British Thermal Unit

The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

$$1 \text{ BTU} = 252 \text{ Calories (CAL)}$$

$$1 \text{ BTU} = 1054 \text{ Joules (J)}$$

$$1 \text{ KW} = 3412 \text{ BTU}$$

Methods of Heat Transfer

1. Radiation
2. Conduction
3. Convection

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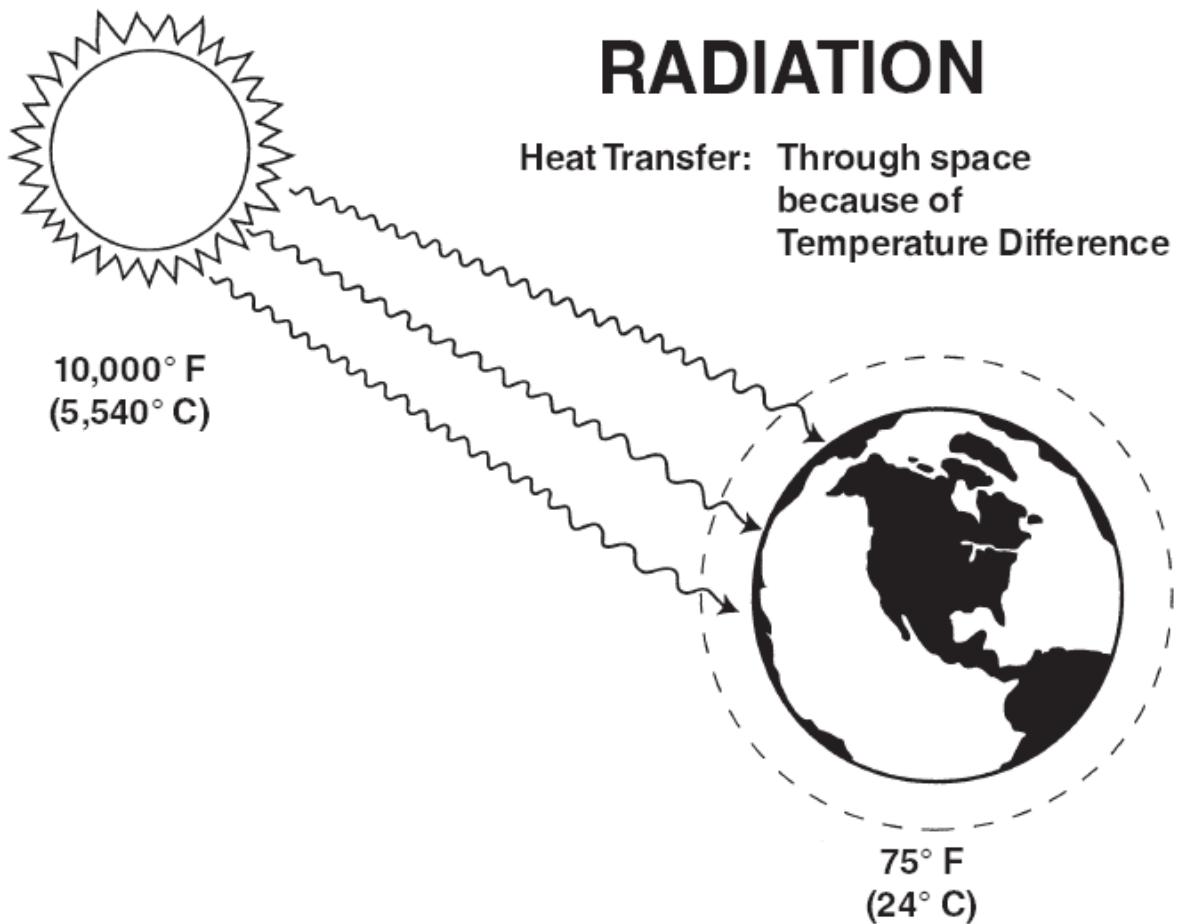
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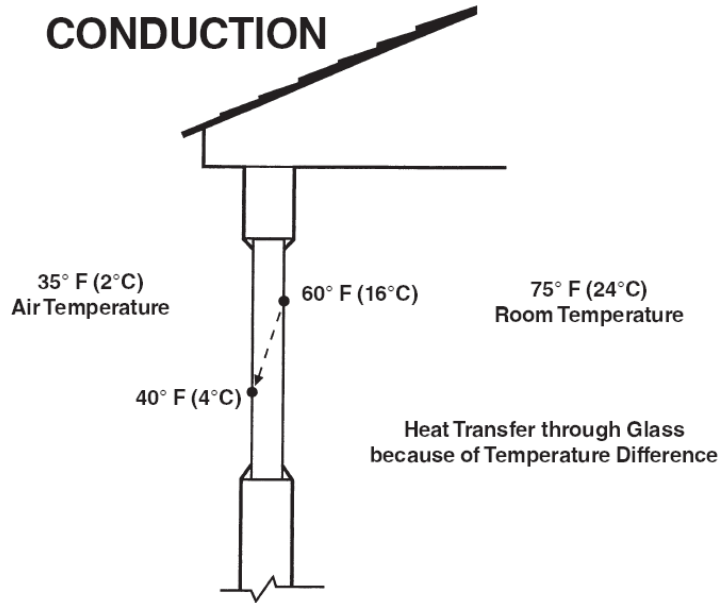
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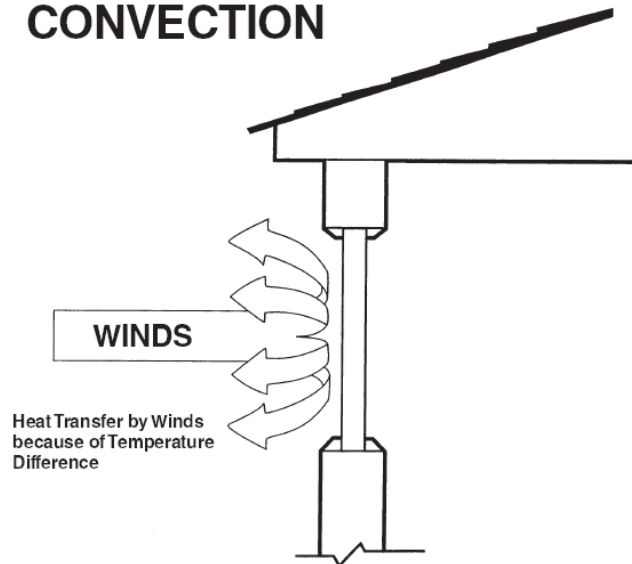
General Information

How Film Works

CONDUCTION



CONVECTION



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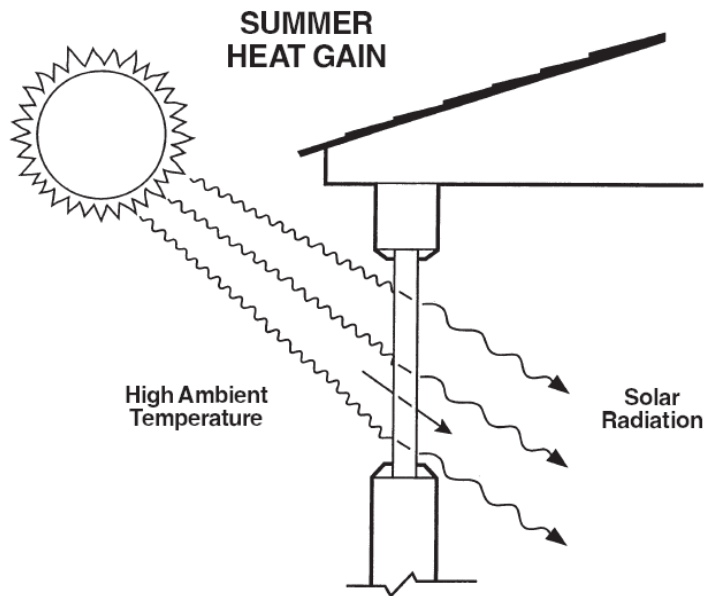
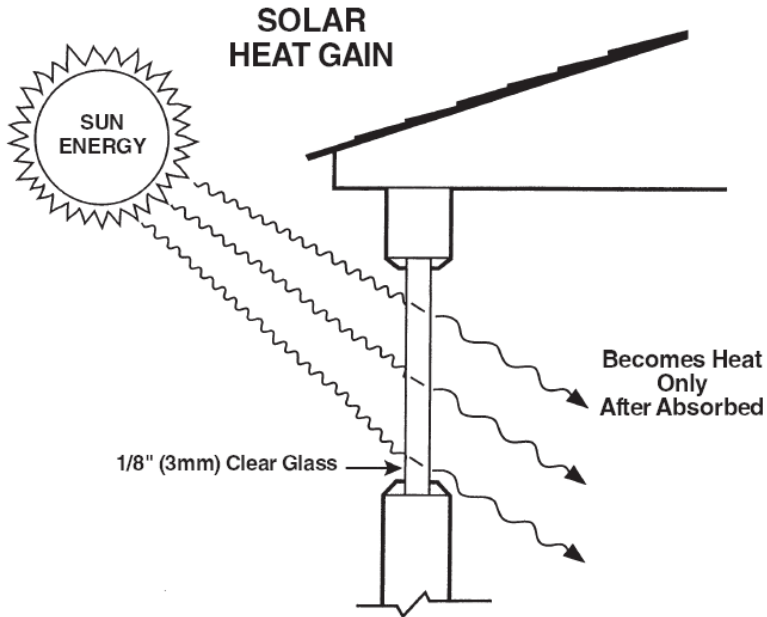
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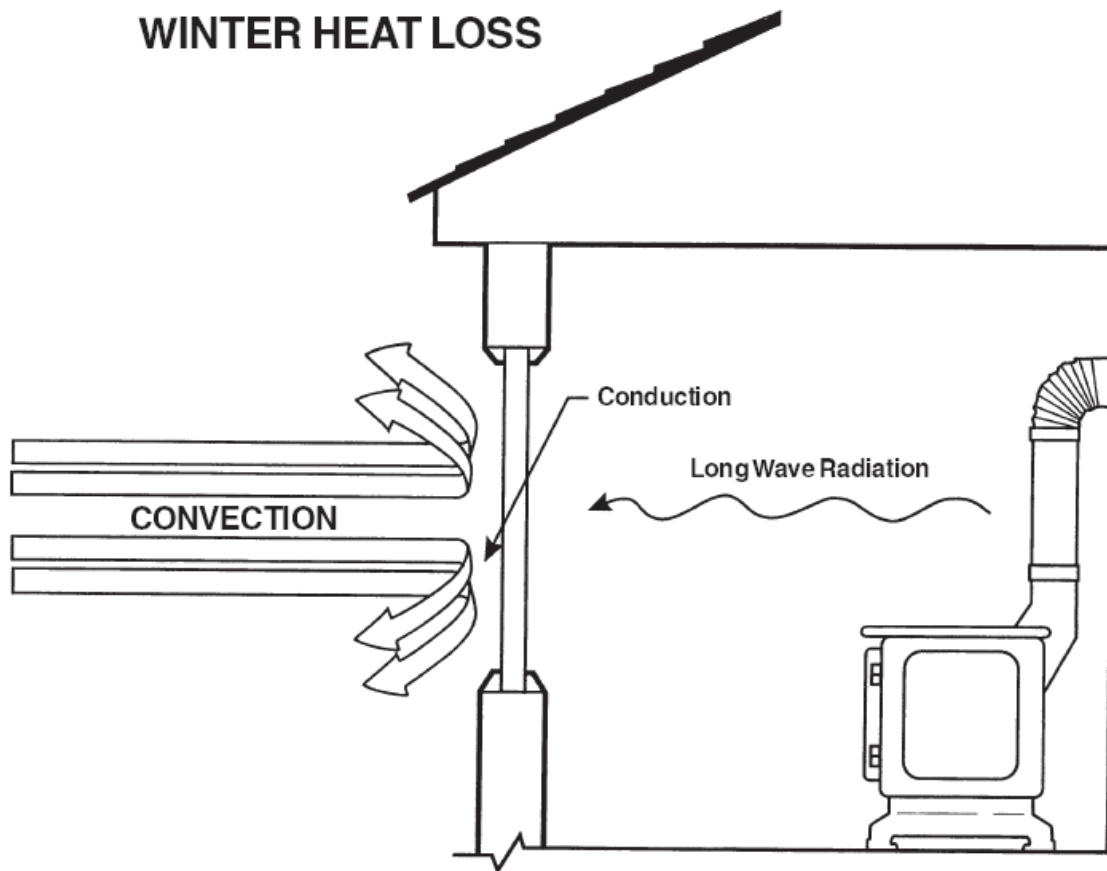
General Information

How Film Works

TON - HR

One Ton of Air Conditioning = 12,000 BTU/HOUR (3.52 kWh)

WINTER HEAT LOSS



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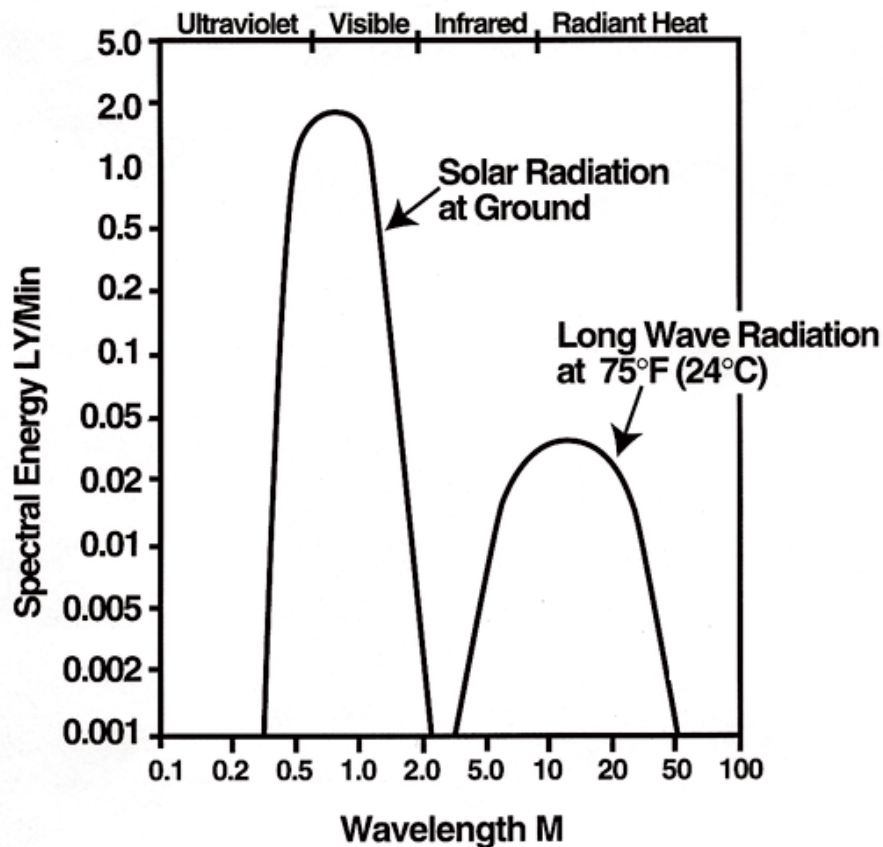
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General Information

How Film Works

GENERAL BACKGROUND

SOLAR RADIATION VS. LONG WAVE RADIATION



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3M™ Window Film

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3M™ Window Film

FAQ continued

1. How do 3M Sun Control Window Films work?

3M™ Sun Control Window Films are designed to help reduce the amount of solar heat transmission through window glass by increasing the solar reflection (not necessarily visible reflection) and solar absorption through the glass. Typical colored or dyed films work primarily through increased absorption. The color absorbs the solar energy at the glass, thus reducing the direct transmission into the room. These films offer only marginal performance when compared to reflective films.

Reflective films are films that have been precision coated with metals. These metalized films are designed to increase the solar energy reflection of the glass and some of the absorption. 3M™ Sun Control Window Film reflective films range from moderate to excellent in solar performance (heat gain reduction).

All 3M™ Sun Control Window Films are made to be transparent and optically clear. The ultraviolet protection in the adhesive system is there to protect the adhesive, the metals, the polyester film, and the abrasion resistant coating from UV degradation. This UV protection will also help protect what is behind the film (home and office furnishings), too.

All 3M™ Sun Control Window Films are protected with our patented abrasion resistant coating for long term durability and maintained appearance.

2. How do 3M™ Sun Control All Season (LE) Window Films work?

3M™ Sun Control All Season Window Films, or Low E films work much in the same way as the Sun Control Window Films except that they offer an increased performance against cold weather heat loss. The patented constructions of these films enable the metal coating to reflect more of the interior room heat back into the room where it is needed. This improves comfort by reducing potential draft feelings near the window, and may also save on energy costs, especially in commercial buildings. The LE films are also protected with our abrasion resistant coating for long term durability and maintained appearance.

3. Why do commercial customers have 3M™ Sun Control Window Film applied to their buildings?

- Improved tenant comfort
- Lower heating and cooling operating costs
- Lower utility demand costs
- Utility rebates
- Improved aesthetics, uniform appearance
- Improved safety and security
- Extended A/C equipment life
- Sustainable alternative to adding more A/C equipment

Quite often, our commercial customers will purchase 3M™ Sun Control Window Film window films for tenant comfort and justify the purchase on energy cost savings.

4. What is the typical energy pay back for 3M™ Sun Control Window Films?

Simple pay backs will vary depending upon the amount of sunlit glass exposure, the type of film, the type of glass, cost of fuel, cost of application, and other variables. However, we have often seen pay backs in the 2-5 year period, with some reported to be even less than 6 months.

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3M™ Window Film

FAQ continued

5. How are 3M™ Sun Control Window Film applied?

3M™ Sun Control Window Films are professionally applied by skilled, well-trained authorized 3M Dealer personnel. Almost all of our films are designed to be applied to the inside of your glass. The first step is to prepare the window area for the application, placing drop cloths on the floor protecting and/or moving furniture where necessary.

Next, the window glass is cleaned using simple cleaning solutions (often water and ammonia) and razor blade scrapers. Then the film is sprayed with a slip solution (detergent and water) for proper positioning, and applied to the window glass. Using a professional grade squeegee and following proper techniques, the application is completed by removing excess water, trimming the edges, and a final squeegee technique to dry the edges.

6. How long does it take for 3M™ Sun Control Window Films to dry?

We suggest allowing thirty days for the film to fully dry and cure. During this curing process, it is natural to have small water bubbles and/or a hazing milkiness appearance. These will disappear as the film dries; depending upon the film type and weather conditions, drying may take as much as 30 (or even 45) days, or as little as a few days. Once dried, 3M™ Sun Control Window Films will look great and perform well.

7. Can I install 3M™ Sun Control Window Film myself?

No, 3M™ Sun Control Window Films require professional application. Our authorized 3M™ Sun Control Window Film Dealer/Applicators are thoroughly trained and experienced in performing high quality work. In this way, our customers will enjoy the benefits of 3M™ Sun Control Window Films and have the comfort of the 3M™ Sun Control Window Film warranty.

8. How do I clean my 3M™ Sun Control Window Film?

After thirty (30) days, you may clean 3M™ Sun Control Window Films using normal household cleaning solutions, including ammonia based products like Windex®, and a soft, lint-free cloth or towel. You may also use a squeegee to clean the films. Abrasive products will scratch or damage the film and should never be used.

9. How long does 3M™ Sun Control Window Film last?

3M™ Sun Control Window Films are durable and made to last for many years. Just how long a particular film will last depends upon the type of film applied, type of glass it is applied to and the particular climate in which it is applied. Most applications last upwards of 12-15 years and several applications are still performing after 15 years. All applications have a minimum warranty period of 5 years (except exterior applications which are 2 years), and several films carry a 10 year commercial warranty, and even a lifetime residential warranty for as long as original purchaser owns the home.

10. How do I remove the old film from my windows?

3M™ Sun Control Window Films are designed to bond the film to the window glass for many years. Yet when it is time to remove the film, removal can be performed by following a relatively simple process.

- First, try to pull the film off by lifting and peeling the film from a corner. If removing the film is difficult, spray the film with a solution of detergent (Dawn™, Joy™) and water and cover with a plastic film (trash can liners work). Allow to soak for several hours or overnight. Now, try Step 1 again.
- Next, the adhesive residue left on the glass can be sprayed with a sudsy ammonia and water solution and scraped with a four inch razor blade tool.

Unfortunately, not all competitive films are designed for removal. They can prove to be particularly difficult to remove and may require more drastic measures.

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3M™ Window Film

FAQ continued

11. What is the warranty for 3M™ Sun Control Window Film?

3M™ Sun Control Window Films are warranted to maintain their solar properties without bubbling, peeling, cracking, or crazing. Many of our films are warranted against discoloration, too (those which do not use dyed polyesters). Should the product prove to be defective, 3M and the authorized 3M™ Sun Control Window Film dealer will replace the film and provide the reapplication labor free of charge.

In addition, the 3M™ Sun Control Window Film warranty includes 60 months glass breakage coverage for all qualified applications. Should your glass break due to thermal shock, 3M will replace the glass (maximum \$500.00 per window) and the dealer will replace the film.

The length of the warranty is determined by film type and market (residential or commercial). 3M commits to writing the terms of all film warranties in our brochures and consumer publications. For more details, please contact your local authorized 3M dealer/applicator and/or distributor.

12. Do 3M™ Sun Control Window Films cause glass to break?

3M™ Sun Control Window Films will increase the temperature of your sunlit glass, which will in turn; increase the stress on the glass edges. The quality of the glass edge and several other factors (external shading, interior shading, glass history, type of film, size/shape of glass, indoor/outdoor temperature) all contribute to the risk of glass breakage.

3M's forty plus years of experience with applying 3M™ Sun Control Window Films to different types of glass enables us to make proper film/glass recommendations and reduce the potential for glass breakage. In addition, we support these recommendations with our two year glass breakage warranty against thermal shock fracture. Should the glass break within two years of application, 3M will replace the glass (maximum \$500.00 per window), and the dealer will replace the film.

13. Do 3M™ Sun Control Window Films cause seal failure when applied to insulated (double-pane, Thermopane™) windows?

No, 3M™ Sun Control Window Films do not cause seal failure. We've been applying 3M™ Sun Control Window Films to insulated windows for over 40 years, having seen several millions of square feet of film applied to date.

When recommended films are applied to the inside pane of an insulated glass unit, there will be some absorption (except with clear safety films) of the sun's energy, which will increase the temperature of the glass pane. Some of this heat will transmit to the airspace, slightly raising the airspace temperature. However, even a 20 F degree increase (unusual for most films) will result in a less than 3% change in air pressure. Properly made windows are designed and tested to withstand 22% changes in air pressure.

Risk of seal failure is determined largely by the quality of workmanship and the quality of the materials that go into building the insulated glass units. The best guard against seal failure is to purchase well-made windows from reputable manufacturers that have solid experience and histories with insulated windows.

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3M™ Window Film

FAQ continued

14. Will 3M™ Sun Control Window Film stop my furnishings from fading?

Nothing stops fading. 3M™ Sun Control Window Films are designed to help reduce the major causes of fading (ultraviolet light, visible light, and solar heat), thus prolonging the life and preserving the appearance of your furnishings.

As a general rule of thumb, Ultraviolet (UV) is approximately 40% of the cause of furniture fading, visible light about 25%, and heat about 25%. The remaining 10% can be attributed to humidity, pollutants, interior lights, dye anchorage, and other causes.

15. Does the ultraviolet protection lose its effectiveness over time?

No, the ultraviolet (UV) protection that we use in our proprietary adhesive system does not lose its effectiveness over time. In fact, we tested an actual glass sample from The Dumbarton House, Washington, DC. This was a ten (10) year old application and the Ultraviolet transmission still measures <1%!

16. How do 3M™ Safety and Security Window Films work?

3M™ Safety and Security Window Films are designed to make glass shatter-resistant by holding the glass pieces together when broken. Different from 3M™ Sun Control Window Film, 3M™ Safety and Security Window Films are made with thicker polyester and a much thicker, more aggressive adhesive system. The 3M™ Safety and Security Window Films are unique in the industry: they are built using a special micro-layered polyester technology which increases the film's tear resistance significantly. The impact and tear resistance of 3M™ Ultra Safety and Security Window Films outperform other films of similar thickness known to 3M.

17. Are 3M™ Safety and Security Window Films hurricane-proof? Bullet-proof? Burglar-proof?

No, 3M™ Safety and Security Window Films are not hurricane-proof, earthquake-proof, bullet-proof, bomb-proof, nor burglar-proof. No films ever could be. They do, however, make the window glass more shatter-resistant. In the event of a wind storm, these films may have significant safety and security value. They can reduce the risk of injury from flying shards of broken glass, and possibly help prevent debris and water penetration through the window depending on the severity of the storm (and the type of glass, framing system, size and velocity of objects, and more).

In an earthquake, these films can reduce the risk of serious injury from flying shards of broken glass, and possibly prevent glass from falling out of a home or building. Again, much may depend upon the severity of the quake (and the type of glass, framing system, and more, too).

Bullets: these films are not designed to stop bullets.

3M films were originally developed due to the international concerns and needs for improved safety and security against terrorist acts of bombings. These films can significantly reduce the risk of serious injury from flying shards of glass due to blasts, however, much depends upon the severity of the blast and the proximity of the window glass to the blast (and glass type, framing system, and more too).

3M™ Safety and Security Window Films are a low-profile, high performance measure of security in the battle against 'smash and grab' crime. The tough, shatter-resistant qualities of the film can hold the window glass together even if a brick (or similar object) were actually to pass through the glass. The thief must now make a choice; continue to attack this window, try another window, or move on. Time is short, and often they move on. However, if they are determined to gain entry, they will get in. It is generally recommended that the property have proper alarm systems in addition to 3M™ Ultra Safety and Security Window Film.

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3M™ Window Film

FAQ continued

18. Will 3M™ Safety and Security Window Films keep my glass from breaking?

No, 3M™ Ultra Safety and Security Window Films are designed to hold broken pieces of glass together in the window opening after a break. This reduces the chance of injury from flying shards of glass, makes it more difficult to break in through a window, as well as increases safety and security in the event of a windstorm or bomb blast.

When glass breaks, 3M™ Safety and Security Window Film demonstrates its best performance!

19. How do I find the nearest authorized 3M™ Sun Control Window Film dealer? Or, is XYZ Tinting a 3M Sun Control Window Film dealer?

The simplest way is to contact 3M directly for the name of the nearest 3M Distributor 1-800-480-1704. We would be able to provide you with an up-to-date listing of the Authorized 3M™ Sun Control Window Film Dealer/Applicator in your area. They can confirm which businesses are Authorized 3M dealerships.

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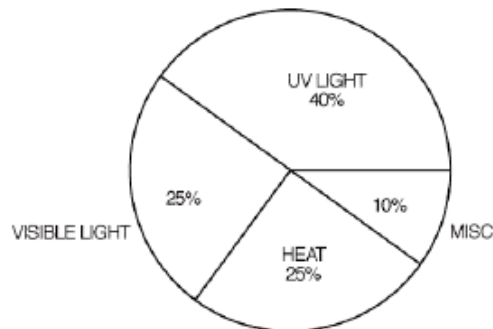


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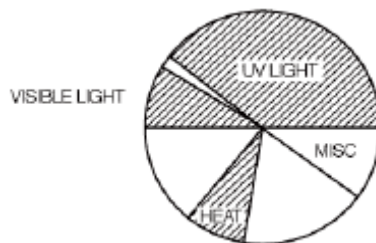
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3M™ Window Film Facts About Fading

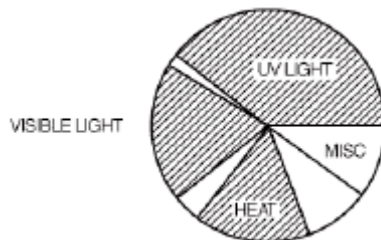
What Causes Fading? "As A Rule Of Thumb"



**3M™ Sun Control Window Films and 3M™ Safety and Security Window Films
Do Not Stop Fading. They Help Reduce Speed Of Fading.**
Approximate fade reduction with Neutral 35 (RE35NEARL)



Approximate fade reduction with Silver P18ARL



Shaded areas indicate approximate amount of fade reduction when applying the 3M™ Sun Control Window Films mentioned above.

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3M™ Window Film

STORAGE CONDITIONS

Recommended storage conditions for all films are printed on the box. They are 70° F (21° C) and 40 - 50% relative humidity. Avoid extreme temperature ranges in storage conditions.

The shelf life of film is dependent on many factors including but not limited to:

1. Film material
2. How tightly the film is kept on the roll
3. Storage conditions including
 - a. Heat
 - b. Light
 - c. Humidity
4. Keeping the original packaging
5. etc.

To ensure the longest shelf life possible be sure to store the film according to the guidelines given in each box of film. The 3M recommended shelf life for the film is 5 years, however, we would expect that the film will last much longer. A few best practices to determine whether a film has degraded over time would be to compare the old film to a newer roll, read the UV, Visible, and IR transmission of the film and compare to published specs, and to do a visual inspection in both reflected and transmitted light of the first 10 feet of film.

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3M™ Window Film

EMI

BACKGROUND AND DEFINITIONS

Basic Background Information

1. Why are we involved with EMI Shielding?
 - a. Customers have asked if our 3M™ Sun Control Window Films will block radio
 - b. waves or microwaves
 - c. Some of our current competitors claim that their products work for this application
2. What is EMC, EMI and EMIC?
 - a. EMC - Electromagnetic Compatibility - Electrical devices have EMC when the electrical noise generated by each device does not interfere with the normal performance of the other device
 - b. EMI - Electromagnetic Interference - EMI is said to exist when undesirable voltage or currents adversely affect the performance of a device
 - c. EMIC - Electromagnetic Interference Control - The process of making design changes or adjustments of signal or noise levels is called EMIC
3. What is EMI and EMIC?
 - a. When electricity flows it generates electromagnetic waves
 - b. The wavelength and frequency of the wave determines where these waves are classified in the Electromagnetic Spectrum
 - c. EM waves can interfere with the performance of electronic devices
 - d. All electronic devices generate EMI.
 - e. Grounding or adding filters is an EMIC method.
4. Why is EMIC necessary?
 - a. Protect electronic equipment from destructive outside interference such as:
 1. High power transmitters (radar, FM, etc.)
 2. Nuclear effects - electromagnetic pulse (EMP)
 3. Lighting
 - b. Protect electronic equipment from temporary equipment malfunctions
5. How is the EMI shielding achieved?
 - a. EM waves (fields) are reduced (attenuated) through absorption or reflection by conductive surfaces (shields)
 - b. The most effective shields are metallic and electrically conductive
 - c. How well the shield attenuates the field is called its shielding effectiveness (SE)

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3M™ Window Film

EMI

TEST RESULTS

Shielding Effectiveness For 3M™ Films

Tested according to ASTM D 4935, "Standard Test Method for Measuring the Electromagnetic Shielding Effectiveness of Planar Materials." This is a far field test measurement taken using a coaxial cell. The dynamic range indicates the maximum measurement capability of our test setup, in other words the response of a "perfect shield."

Frequency

Product	30 MHz	100 MHz	300 MHz	1 GHz	2.5 GHz	4.5 GHz
RE50AMARL	35 dB	33 dB	32 dB	34 dB	35 dB	36 dB
Amber Low E 35 (LE35AMARL)	37 dB	35 dB	34 dB	36 dB	36 dB	38 dB
Silver P18ARL (P-18ARL)	24 dB	22 dB	22 dB	24 dB	26 dB	27 dB
RE15SIXL	24 dB	23 dB	23 dB	25 dB	26 dB	28 dB
Neutral 35 (RE35NEARL)*	7 dB	7 dB	7 dB	7 dB	7 dB	8 dB
Amber 35 (RE35AMARL)	38 dB	35 dB	34 dB	36 dB	36 dB	38 dB
NV25*	11 dB	11 dB	13 dB	12 dB	13 dB	14 dB
Prestige series	No emi attenuation measured					
Dynamic Range	97 dB	97 dB	97 dB	97 dB	93 dB	86 dB

*Negligible shielding properties

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REDUCED SOLAR RADIATION EFFECTS ON HOUSE PLANTS

Effects On House Plants With 3M™ Sun Control Window Film Applied On Glass

KNOWN FACTS

1. Growth and development requirements vary with different plants
2. Growth and development depend upon light, temperature range, exposure, humidity, CO2 levels, etc.
3. For sufficient growth, the wavelength of 400-700 nm is important for photosynthesis (greening process)
4. 700-850 nm range is required for the photomorphogenic process (flOw Ering process)
5. Most greenhouses have artificial light to supplement natural light (day vs. night, summer vs. winter, cloudy vs. sunny)
6. UV is damaging to most green plants
7. Extreme temperature variations are detrimental to plant growth
8. 3M Sun Control Window Film will help reduce solar heat gain, temperature buildup and moisture loss (Plants may require less water after film is installed, so care should be taken not to drown plants from over watering.)

WHAT TO DO WHEN IN QUESTION?

Contact a local horticulturist, college or university extension office

- Provide type of plant(s)
- Provide percent reduction of visible light, UV and solar heat with specific 3M™ Sun Control Window Film applied to glass
- Consult your local Agricultural Extension agent

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Glass Types

Primary Glass Products

FLOAT GLASS

The Float Glass Process accounts for over 90% of the flat glass presently produced in the United States. In this process, molten glass is poured continuously from a furnace onto a large bed of molten tin. The molten glass literally floats on the tin, spreading and seeking a controlled level in the same manner as water poured onto a smooth, flat surface.

In the controlled level seeking process, the molten glass is allowed to spread to width of 90" to 140," depending upon the furnace size and glass thickness being produced. The glass slowly solidifies as it travels over the molten tin. It then enters an annealing lehr where the cooling process continues under controlled conditions. After several hundred feet of travel through the lehr, it emerges as a continuous ribbon of glass at essentially room temperature. The product is now flat, fire-finished, and with virtually parallel surfaces.

CLEAR GLASS

Clear glass consists of silica sand with added alkaline salts such as lime potash and soda. It is colorless and has a visible light transmittance ranging from 75% to 92%, depending upon thickness. It constitutes the bulk of the flat glass that is used.

TINTED/HEAT ABSORBING GLASS

Tinted or Heat Absorbing Glass is made by adding various colorants to the normal, clear glass batch to create a desired color. The four colors available by the Float Process are Bronze, Gray, Green and Blue. Visible light transmittance will vary from 14% to 83%, depending upon color and thickness. The color density is a function of thickness, and increases as the thickness increases; visible light transmittance will decrease as thickness increases.

Tinting reduces the solar transmittance of glass, has little effect upon solar reflectance, hence increases solar absorption (heat). This explains why heat strengthening or tempering is sometimes required for the thicker tinted glasses. Adding a metallic coating also has the same effect on thinner glasses.

ASTM Specification C1036-85 separates Heat Absorbing and Tinted (light reducing) glasses into separate categories based upon the maximum solar energy transmittance, by glass thickness. Nevertheless, all tinted glass is heat absorbent, to one degree or another. The Bronze, Gray, Green and Blue tints produced by the Float Process are all classed as heat absorbent.

SHEET GLASS

The Sheet Glass Process accounts for a very small portion of U.S. production. Some imported sheet glass will continue to be used, mainly in thickness of 1/8" and less.

PLATE GLASS

Plate Glass, manufactured by the grinding and polishing process, is no longer produced in the United States, and words referring to it have been eliminated from the ASTM Specification C103685. It has been replaced by the float glass process.

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Glass Types

Primary Glass Products

ROLLED GLASS

The Rolled Glass Process consists of pouring molten glass from a furnace, then feeding it through rollers to produce the desired thickness. The glass ribbon then enters a lehr where the cooling continues under controlled conditions. There are three general types of rolled glass: figured/patterned, wired and art/opalescent/cathedral glass.

FIGURED/PATTERNED GLASS

Figured/Patterned Glass is produced domestically by the continuous pour process in thickness of 1/8" to 7/32". A pattern etched on one or both of the rollers is reproduced on the glass. Colors are available but extremely limited.

This type of glass is frequently called "obscure" or "decorative" glass. The pattern diffuses detail of objects viewed through the glass, it does not obscure them. The degree of diffusion achieved is a function of the pattern and whether the pattern is on one or both sides.

Some patterns cannot be tempered for safety glazing use because of their depth.

WIRED GLASS

Wired Glass is produced on the same equipment as is Figured/Patterned glass. A welded wire netting or parallel wires are introduced into the molten glass just before entering the rolls, thus embedding the wire into the glass. Patterned wired glass has pattern on one or both sides, and is sometimes called "rough" wired glass. Polished wire glass is produced by grinding and polishing rolled wired glass blanks.

Tinted/Heat Absorbing wired glass is available only from suppliers outside the U.S. The heat absorbing characteristic in conjunction with the normally poor cut edges and the wire netting can cause a high rate of breakage from thermal stress, especially in non-vertical applications.

The major uses of wired glass is in institutional buildings and fire rated windows and doors. All wires must be completely embedded in the glass. Some misalignment of the wires may be noticeable, but this is not considered cause for rejection.

Wired glass cannot be tempered. From a windload standpoint, it is considered to be approximately 50% as strong as annealed glass of the same thickness.

The edges of wired glass should be sealed from water to prevent rusting of the embedded wires. This can be accomplished either by physically sealing the perimeter of the lite with a sealant or by glazing in such a manner that the glazing rabbet will always remain dry. The iron oxide molecule is larger than the iron molecule, so rusting of the wires will cause glass breakage.

Most Building Codes require that wired glass meet NFPA 80 or be classified by U.L. as fire resistant glazing when used in fire doors or windows.

Wire glass does not meet the requirements of CPSC 16 C.F.R. Section 12301, hence cannot be used as a safety glazing material in situations governed by that regulation.

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Glass Types

Primary Glass Products

ART/OPALESCEMENT/CATHEDRAL GLASS

Colored translucent glass, often called art glass, opalescent glass, cathedral glass or stained glass, is also produced by the rolling process, but generally in small, batch type operations. There are usually variegated colors within each sheet produced and no two sheets will match for hue. Thickness will vary within a sheet as well as from sheet to sheet. The maximum thickness produced is usually 1/8."

When used as a glazing material, art glass should be glazed in the same manner as tinted/heat absorbing glass. Art glass cannot be tempered.

Because leaded windows and other applications of art glass are separate subject, details will not be covered in this manual.

Fabricated Glass Products

INSULATING GLASS UNITS

Double insulating glass units consist of two panes of glass that enclose a hermetically sealed air space. The panes are held apart by a spacer around the entire perimeter. The spacer contains a moisture absorbent material called a desiccant that serves to keep the enclosed air free of visible moisture. The rubber-like material that produces the hermetic quality of the unit. Some manufacturers use non-curing sealant.

CERTIFICATION

The purpose of a certification program is to assure the user that the purchased product is a faithful replica of one that has successfully passed certain prescribed tests. Participants in a certification program must therefore, a) submit their products to independent testing laboratories for the prescribed tests b) agree to periodic, unannounced inspection of their regular production by an independent agency to insure that actual production employs the same materials and techniques as the tested specimen.

For insulating glass manufacturers there are two competing certification programs available. One is conducted by Associated Laboratories, Inc. (ALI), which also conducts a companion certification predominantly window and door manufacturers who fabricate insulating glass for use in their own products. The second program, the Insulating Glass Certification Council (IGCC), is an independent, non profit organization whose management is vested in a Board of Governors made up equally of industry and public interest members. All IGCC meetings are open to the public.

Further information can be obtained by writing or telephoning :

Insulating Glass Certification
Route 11 Industrial Park
Cortland, New York 13045
607-753-6711

Associated Laboratories, Inc
P.O. Box 15705
1323 Wall Street
Dallas, Texas 75215

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Glass Types

Fabricated Glass Products

DISTORTION

The air (or gas) sealed within an insulating glass unit will respond to the Gas Laws of Physics from the moment the unit is sealed. These laws govern the volume of gas as related to various temperature and pressure conditions. As the sealed-in air is heated or cooled, it expands or contracts. As the barometric pressure falls or rises, it likewise expands or contracts. This causes the two panes to bow away from or toward each other.

They will be in virtually constant motion, hence seldom ever parallel (flat). When the glass is in a reflecting mode, the objects reflected will appear distorted. There is no known method by which precisely the same internal temperature and barometric pressure can be simultaneously achieved for each and every insulating unit on a specific project and still have the advantages of a sealed unit.

RETROFIT

Several systems have been developed to convert single glass into insulating glass in existing buildings. These systems involve cleaning the interior of the existing glass, applying a desiccated spacer, a second (new) pane of glass and a perimeter sealant. This generally works best on fixed (non-operable) windows. Optimum performance is generally achieved by using reflective glass. Since every project is custom, warranties can vary as can capabilities of insulator since this is field, rather than factory assembly.

WARRANTIES

Since no two insulating glass manufacturers use the same combination of components and fabrication techniques, no two warranties are alike. Warranties usually require adherence to certain installation procedures or techniques and exclude glass breakage and the replacement glazing labor.

REFLECTIVE GLASS

Reflective glass is a clear or tinted glass coated with an extremely thin layer of metal or metallic oxide. The coatings are thin by design; otherwise they could not transmit light. Dependent upon the desired level to visible light transmission, the coating thickness is generally in the range of .000001" to .000004". Installed in a building, reflective glass imparts a mirror-like appearance to the exterior under most daytime conditions. It reduces heat gain and glare from the exterior and allows visible light transmission to the interior. The major advantages of reflective glass are

- a. **Aesthetic Appeal:** The various silver, copper, golden and earthtone reflective coatings, when combined with clear, bronze, gray, green or blue tinted float glass, allow the architect more flexibility in exterior design than with uncoated glass types alone.
- b. **Energy Savings:** Through its ability to reflect and absorb radiant solar heat, reflective glass will substantially reduce interior solar heat gain. The added cost of reflective glass will generally be offset by the size and cost reduction in the heating and cooling system.
- c. **Occupant Comfort:** Occupant comfort is improved when heat gain/loss differentials between sunny and shaded elevations are substantially reduced. Interior temperature variations are thus less and easier to control.

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Glass Types

Fabricated Glass Products

METHOD OF MANUFACTURE

There are three methods of coating deposition used in the manufacture of reflective glass:

- a. **Wet Chemical Deposition:** This is simply the precipitation of a metal from a chemical solution by a reagent. The reaction occurs uniformly in a thin film on a horizon piece of glass instead of in a laboratory test tube. The film thickness is closely controlled to produce a desired level of light transmission. Coatings produced by this method are generally fragile, and must be immediately protected, usually by incorporating into an insulation glass or laminated glass product.
- b. **Vacuum Deposition:** This method involves a large vacuum chamber, vacuum pressures, an inert gas atmosphere and electrical energy. The electrical energy imparts a negative charge to the atoms of inert gas. The vacuum pressure, which is on the order of .0006 to .000006 psi (compared to 14.7 psi, normal atmospheric pressure), allows the negatively charged gas atoms to move freely at a high velocity. When they strike a metal cathode, atoms of the metal are dislodged, also at a high velocity. When they strike a metal cathode, atoms of the metal are dislodged, also at a high velocity. The metal atoms then impinge upon the glass substrate, creating the thin, metallic coating. Coating hardness and adhesion is a function of the metal or alloy used and of the particle speed at impact. Many vacuum deposited coated glasses can be used monolithically; or can be readily shipped to another location to be fabricated into laminated or insulating glass product.

Coated glasses produced by wet chemical or vacuum deposition methods cannot be tempered or heat strengthened after coating since this would destroy the coating. When used on a tinted glass substrate, tempering or heat strengthening is required because the reflective coating increases the solar absorption. Some coatings make clear glass so highly absorbent that the need for heat strengthening or tempering should be investigated prior to specification and purchase. A good rule of thumb is to investigate the need to heat treat any glass where the absorption of radiant solar energy is greater than 50%.

- c. **Pyrolitic Deposition:** This process applies a metallic oxide coating to hot glass (usually tinted). Pyrolitic deposition can be accomplished in a properly equipped heat strengthening oven, or on a float glass line near the hot end of the lehr. The metallic oxide is literally impregnated into the soft, cherry-red surface of the glass. Annealed glass with a pyrolitic coating side to the weather (to the outdoors). Since the radiant solar energy is substantially rejected by the coating before it enters the glass substrate, heat strengthening or tempering may not be required in many instances where it would be required for other types of reflective glass.

PERFORMANCE

Another way to classify reflective coatings is by the degree to which they reject radiant solar energy. The coatings created by wet chemical or vacuum deposition are usually of higher performance (i.e., have Low Er shading coefficients) than the pyrolitically deposited coatings of equivalent visible light transmission.

Wet chemical or vacuum deposited coatings have a Low Er shading coefficient when installed on the second (2nd) surface (vs. the 3rd surface) of an insulating glass unit. Pyrolitic coated glass has the Low Est shading coefficient when installed on the 1st surface.

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Glass Types

Fabricated Glass Products

SPECIFICATION

All reflective glasses of the same general color and light transmission are not alike in reflectance level and other solar-optical properties, shading coefficient or U-value. The typical performance specification should state the primary type of glass, desired color of coating and maximum values of light transmission, shading coefficient and winter and summer U-values. Any alternate bids for glass having different values should have a companion alternate in the mechanical specifications if those glass values are sufficiently different as to affect the size (larger or smaller) of the mechanical system

The specifications should include a provision for construction of a full size mock-up incorporating the reflective glass and metal, for viewing and approval by the architect and owner. The mock-up should be located at the job site, thus giving a preview of the reflective qualities, distortions, etc., under real life conditions.

The pinholes, streaking and molting are generally process defects. The various coated glass manufacturers generally publish their criteria for coating quality or will supply their criteria upon request.

Monolithic coated glass, whether simply shipped to an insulating glass fabricator or to a jobsite for use “as-is” may be vulnerable to scuff or rub marks generated during shipment. The monolithically glazed, coated glass may also be subject to scuffs, rubs, cup marks and scratches during and after glazing as well as by building occupants who do not realize that the coating is softer than the glass itself. Glass so used should be handled with greater-than-normal care by the glaziers and protected from the other trades, after glazing, by hanging a clear plastic sheet several inches inboard from the glass.

Anything that scratches glass will scratch a pyrolytic coating; vacuum coatings are not as hard as glass, hence more susceptible to damage.

LOW EMISSIVITY GLASS

The reflective glass heretofore discussed reflects the solar spectrum, that part of the heat spectrum in the 300 to 2100 millimicron range of wavelengths. Low emissivity coatings (low E) reflect that part of the heat spectrum above 3000 millimicrons wavelength that is called “sensible heat”. The heat from hot water or steam radiators and the heat from hot air ducts from a furnace are typical examples of this kind of heat.

These coatings have high visible light transmission. In fact, they are nearly invisible on the glass. The visible light transmission is typically about 20 percentage points below that of an equivalent uncoated glass.

The major attribute of low E insulating units is their sensible heat reflecting character which is apparent from their low “u” values. In northern climates they admit winter sun while reflecting sensible indoor heat back into the building, when both lites are clear glass. In southern climates they reduce glare while reflecting the outdoor heat-of-the-day back out in summer with outboard lite bronze. Low E coatings are applied to glass by vacuum processes and by pyrolytic processes.

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Glass Types

Fabricated Glass Products

TEMPERED GLASS

Tempered glass is fabricated by subjecting annealed glass to a special heat-treating process. The most commonly used process is to heat the glass uniformly to approximately 1150°, then rapidly cool it by blowing air uniformly onto both surfaces simultaneously. The cooling process locks the outer surfaces of the glass in a state of high compression and the central portion, or core, in compensating tension.

The color, clarity, chemical composition and light transmission characteristics remain unchanged. Likewise, compression strength, hardness, specific gravity, expansion coefficient, softening point, thermal conductivity, thermal transmittance and stiffness are unchanged. The only physical property that changes is tensile or bending strength. Under uniform loading, tempered glass is about four times stronger than annealed glass of the same size and thickness, thus is more resistant to thermally induced stresses, cyclic windloading and hail stone impacts.

When broken, tempered glass breaks into a multitude of small fragments of more-or-less cubical shape. Therefore, it qualifies as a safety glazing material under the criteria of Federal Standard 16 CFR 1201 and the American National Standards Institute (ANSI) Z97.1-1984, when so labeled and certified. Spots or blotches may, at times, be visible on tempered glass, especially when viewed through polarizing lenses or in certain types of reflected light. The intensity will vary with lighting conditions and viewing angle. This is caused by the strain pattern induced during the cooling stage, and is not inherently a cause for rejection.

PRODUCTION

There are two basic methods for producing air quenched tempered glass. In one method the glass moves through the furnace and quench hung on tongs in a vertical position; in the other it moves on rollers of stainless steel or high strength ceramic, in a horizontal position. Each method produces some degree of bow and warp, which is an inherent characteristic of all tempered glass. Tong-held glass may exhibit a long arc or “S” curve plus some minor distortion at the tong points. Horizontally tempered glass will have characteristic waves or corrugations caused by the support rollers.

LIMITATIONS

Recommended maximum service temperature for tempered glass is approximately 500° F. Tempered glass, although four times stronger than annealed glass, should not be selected to meet a given design wind load simply because annealed glass of the same thickness will not so meet. The stiffness of annealed glass and tempered glass is the same. Excessive deflection can cause glazing sealant failure, glass breakage by contact of an edge or corner with the framing and occupant discomfort.

Some deep patterns of rolled glass cannot be tempered or, if tempered, will not break in the manner prescribed by 16 CFR 1201 or ANSI Z97.1-1984. Tempered glass cannot be cut, drilled or edged. It should not be sand-blasted or acid etched after tempering. Wired glass cannot be tempered.

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Glass Types

Fabricated Glass Products

HEAT STRENGTHENED GLASS

Heat strengthened glass is fabricated by a process similar to that for tempered glass. Some equipment can produce both. The glass is heated to approximately 1100°F and the cooling process is slower than for tempered glass. The strength developed is about twice that of annealed glass. Bow and warp generally are less evident to the eye than in tempered glass. Heat strengthened glass, compared to annealed glass, has greater resistance to solar-induced thermal stresses, cyclic windloading and hailstones. Heat strengthened glass does NOT meet the criteria for safety glazing materials under 16 CFR 1201 or ANSI Z97.1-1984. The break pattern is similar to that of annealed glass, hence it tends to remain in the opening when broken.

SPANDREL GLASS

Spandrel glass panels are heat strengthened or tempered glasses with a ceramic frit color permanently fused to one of the surfaces. Glass in spandrel areas is not subject to corrosion as are some other spandrel materials. Pleasing esthetics and economies can be obtained using a single framing system for an entire wall.

Glass spandrel panels can also save energy when insulation is placed behind them. The insulation can be adhered directly to the glass or spaced 1/2" to 1" away. When specifications require greater assurance that broken glass will remain in the opening, an open weave glass fiber cloth or a special tape can be adhered to the back of the spandrel panel. Some building codes require this. Test performance requirements can be found in Section 7.12 of ASTM C1048-85.

Scattered pinholes, screen marks and small opaque particles are permissible in the ceramic coating. Spandrel glass should not be used in areas subject to being viewed in transmission. Reflective glass spandrels need to be rendered opaque to prevent read-through of the building structure under certain light conditions. In order of effectiveness, the following methods are suggested:

- A reflective insulating glass unit with a dark gray or black frit on one of the surfaces of the inboard lite. Insulation can be attached directly to, or applied against, the unit.
- Mount dark gray or black rigid insulation a minimum of 1" inboard from the monolithic reflective spandrel glass, preferably 2" or more from the glass. The air space between glass and insulation should be well weeped to the exterior to avoid condensation and potential staining.
- Adhere a black polyester, fiberglass, or other type of film to the inboard face of the monolithic reflective spandrel glass. The adhesive must be thoroughly tested, insulation must be spaced back from the film at least 1", preferably 2". The space must be well vented to avoid heat build-up that might cause problems with the film or the adhesive.

NOTE: All glass in spandrel areas should be heat strengthened or tempered.

LAMINATED GLASS

Laminated glass consists of two or more plies of glass interleaved with clear or tinted polyvinyl butyl (PF). The application of heat and pressure bonds the glass and plastic interlayer into one unit. When laminated glass is fractured, the particles of glass tend to adhere to the plastic, affording protection against flying or falling particles. Some combinations of glass and plastic thicknesses do qualify as safety glazing materials under the criteria of ANSI Z97.1-1984 and CPSC 16 CFR 1201.

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Glass Types

Fabricated Glass Products

From a windload standpoint, laminated glass is generally considered to be approximately 60% as strong as annealed glass of the same total thickness. Recent studies, as yet unpublished, indicate that laminated glass may be virtually as strong as monolithic glass of the same thickness at normal temperatures, when subjected to wind loads. Additional research is in progress.

Laminates of glass and polycarbonates are available for special uses involving resistance to impacts of large magnitude. Laminated glass can be made in many combinations of clear, tinted or reflective glass, annealed, heat strengthened or tempered, with PF ranging from .015" to .090" or more, dependent upon desired usage. Some of the most common architectural uses are for safety glazing, burglar resistance, bullet resistance, sound transmission reduction, sloped glazing and space enclosures.

A relatively new process, called resin laminating, is finding use in the laminating of curved glass and other special short-run applications. The process requires that the two lites of glass be spaced apart the desired dimension, such as 0.030 or 0.060, and the perimeter dammed on three sides. The assembly is stood vertically and a liquid mixture of chemicals is poured into the space between the lites and allowed to cure at room temperature from two to ten hours before it is ready for use.

MIRRORS

Most mirrors are manufactured by the wet chemical deposition method, although a few, for specialized use, are made by vacuum deposition. These processes are described under the Reflective Glass Section. There is a wide range of thicknesses, qualities and sizes available with annealed glass.

Safety mirrors are available to meet various laws and building codes. A mirror made from tempered glass will have the inherent distortion from the tempering process hence cannot have the same quality in reflection as laminated one made from mirror quality annealed float glass.

Transparent, or two-way mirrors, are designed to allow vision through from one direction while presenting a mirror appearance from the opposite side. Their major application is to permit undetected observation for study or surveillance in places such as prisons, gambling casinos and psychiatric treatment centers. A difference in lighting level is necessary; in the room to be studied the lighting level should be at least five times greater than the lighting level in the observation room; ten times greater is even more effective. Two way mirrors are not intended for use in exterior walls.

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Thermal Stress

- All glass absorbs energy when exposed to solar radiation
- Tinted glass absorbs more energy than clear glass
- Occurs when there is a temperature differential between center of glass and shaded edges
- The ability of the glass not to break is determined by its edge strength
- Always starts at the edge of the glass at least 2 inches from a corner

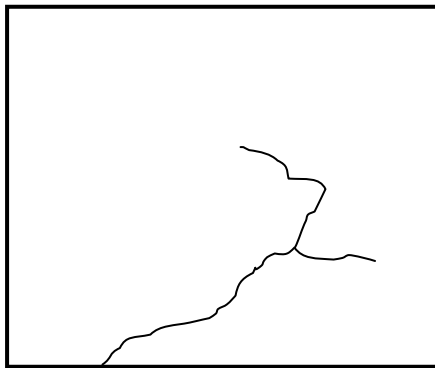
GLASS EDGE STRENGTH

1. Glass is made to withstand from between 3000 to 5000 psi (210 to 350 kg/cm) of edge stress
2. When edge stress exceeds edge strength, breakage occurs
3. Edge strength depends on glass size, thickness, how it is cut, and treatment of edge by glazier
4. A straight clean edge is the strongest
5. Damaged edges can reduce edge strength by up to 50%

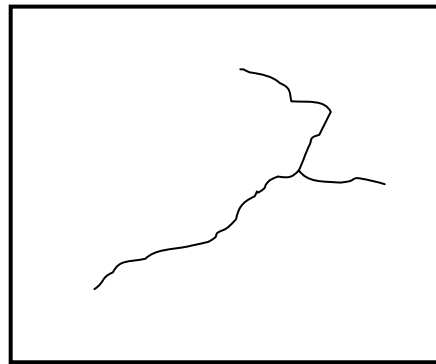
Will 3M™ Sun Control Window Film Break My Glass?

State The Facts When Answering

1. Partial shading patterns from overhangs or extensions
2. Tight fitting drapes or blinds
3. Painted signs, decal's or labels on glass
4. Heating and cooling vents directed at glass



Typical Thermal Stress Crack



Typical Impact Crack

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3M™ Window Film Information

Glass Checklist

Restricted Film and Glass Combinations

Film Type	Description	Single Pane Clear or Tinted	Double Pane Glass Clear/Clear or Tinted/Clear
PR40	Prestige Series		Conditional
AF15, AF30	Affinity Series		Restricted
Neutral 20 (RE20NEARL)	Neutral Series		Restricted
CS5, CS20	Color Stable	Restricted	No Coverage*
BC10, BC20	Black Chrome	Restricted	No Coverage*
BC35, BC40	Black Chrom		Restricted
FX ST5	FX Series	Restricted	Restricted
FX ST20	FX Series		Restricted
FX HP5, HP20	FX Series	Restricted	No Coverage*
FX HP30, HP35	FX Series		Restricted

*Warranty coverage is available for tempered glass.
See warranty terms and limitations below.

Conditional Situation (Prestige Series – PR 40)

Glass checklist is not needed if there are no blinds or drapes. Must perform glass checklist if blinds or drapes are present.

Restricted Situations (All Window Films)

1. Single pane glass larger than 100 square feet (9.3 square meters).
2. Double pane glass larger than 40 square feet (3.7 square meters).
3. Clear glass thicker than 3/8 inch (9.5mm).
4. Tinted glass thicker than 1/4 inch (6mm).
5. Architectural shading from exterior overhangs, extensions, columns, pillars, etc.
6. Window framing systems of concrete, solid aluminum or solid steel.
7. Glass where sealant or glazing compound has hardened.
8. Buildings with more than 1% previous glass breakage or problems over the last two (2) years.
9. Reflective glass.
10. Laminated glass in single pane or double pane.
11. Window where frame is damaged.
12. Architecturally odd-shaped windows (half moons, cathedral, etc.) larger than 20 square feet.

No Coverage - Do Not Submit Glass Checklist Form for the Following - No Glass Breakage Warranty

1. Wired, textured or patterned glass.
2. Triple pane glass or double pane glass in conjunction with a suspended film.
3. Partial applications of film to glass.
4. Applications of more than one tinted or reflective film to glass.
5. Visibly brittle, chipped, cracked or otherwise damaged glass.
6. Glass blocks.

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Glass Checklist

3M Glass Breakage Warranty

- Does Not apply to restricted film/glass combinations or situations without 3M's prior approval.
- Prior approval requires submitting glass checklist form to 3M.
- 3M will calculate expected edge stress and determine if application is recommended and return confirmation via e-mail, fax, or mail.
- Copy of 3M prior approval must be attached to warranty.
- Only applicable in continental U.S.
- Note that the warranty, if approved by 3M, covers glass failure caused only by thermal stress.

Note: Dealer failure to obtain 3M's prior approval will result in no glass breakage warranty

Instructions for Completing Glass Checklist Form

Customer-Dealer Information Section

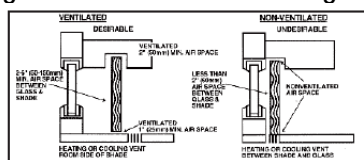
Complete the contact information for both the customer and dealer. This information is used on the report cover, and is helpful if any questions about the project are encountered while creating the report.

Building Information Section

1. Indicate the appropriate glass type.
2. If the window is single pane indicate if the glass is Annealed, Laminated, or Tempered (you must choose one).
3. If the window is double pane indicate if the glass is Annealed, Laminated, or Tempered for the interior and the exterior panes.
4. Provide the glass height and width in inches (mm).
5. List the proposed 3M Sun Control Window Film™ Window Film type(s).
6. If the window is single pane provide the glass thickness in inches (mm).
7. If the window is double pane provide the glass thickness in inches (mm) for both the interior pane and the exterior pane.
8. Indicate the number of windows in the building.
9. Provide the building age in years.
10. Has the building experienced glass breakage in the past (check either yes or no)? If there has been glass breakage what is the percent of the windows that break each year.

Indoor Shading Section

1. Indicate the type of indoor shading.
2. If drapes are used specify the color and the weave type.
3. If blinds are used specify the color.
4. Determine if the indoor shading is ventilated or non-ventilated by using the diagram below.
5. Indicate the space between the glass and the indoor shading.



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Glass Checklist

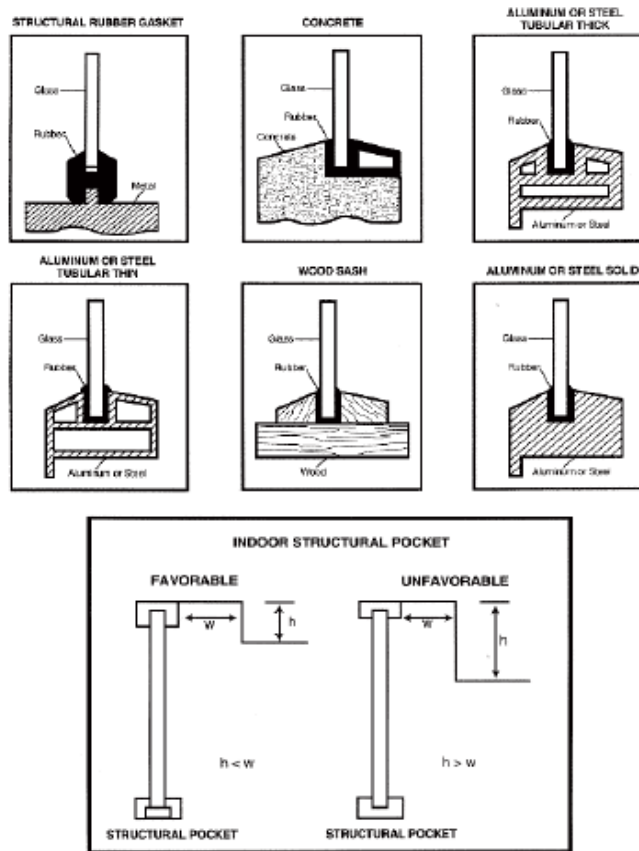
Instructions for Completing Glass Checklist Form

Outdoor Shading Section

1. Circle the outdoor shading pattern that indicates the most common shading pattern of the glass in this building.
2. If there is no shading pattern check the None box

Window Framing Section

1. Select the framing system used in the window from the choices shown below.
2. Specify the sealant type (i.e., rubber, neoprene, etc.).
3. Indicate the condition of the sealant.
4. indicate the condition of the frame.
5. Indicate the outdoor glazing stop color.
6. Determine if there is an indoor structural pocket present (see drawing below).



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Glass Checklist

Instructions for Completing Glass Checklist Form

Window Type Section

1. If the window is not square or rectangular circle the shape that most closely resembles the actual shape of the window, or describe the shape.
2. If the window is square or rectangular check **NONE**.
3. Is the window area greater than 20 square feet (1,86 square meters)? Check the appropriate box.

Heating Register Location Section

1. Determine the location of the heating/cooling register and its position in relationship to the glass and any indoor shading device.
2. Check one of the four choices.

Other Considerations Section

1. The Design Winter Temperature is the Low Est temperature expected at the building location. Select the proper temperature range from the three choices.
2. Select the appropriate altitude (above sea level) for the building.
3. An adjacent reflecting surface could be another building, a body of water, a hillside, etc. Indicate the color of this surface, if present.

Signatures Section

Obtain the requested signatures and date the form.

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3M™ Window Film Information Glass Checklist

3M Glass Checklist Form - page 1

Report Number
Date: MM/DD/YYYY

Customer-Dealer Information

Customer Name _____	Dealer Name _____	Date _____
Address _____	Address _____	
City _____ State _____ Zip _____	City _____ State _____ Zip _____	
Contact Name _____ Phone Number _____	Contact Name _____ Phone Number _____	

Building Information

Glass Type (Check One)	Glass Size in Inches (mm)
<input type="checkbox"/> (1) Clear Single Pane	Width _____ by height _____
<input type="checkbox"/> (2) Tinted or Reflective Single Pane	Proposed Scratchline Type(s) _____
<input type="checkbox"/> (3) Clear Double Pane	Glass Thickness - Inch (mm)
<input type="checkbox"/> (4) Tinted or Reflective Double Pane	Single _____
Single Pane	Glass Thickness - Double Pane - Inch (mm)
<input type="checkbox"/> Annealed <input type="checkbox"/> Laminated <input type="checkbox"/> Tempered	Exterior _____ Interior _____
Double Pane	Number of Windows _____
Exterior: <input type="checkbox"/> Annealed <input type="checkbox"/> Laminated <input type="checkbox"/> Tempered	Building Age _____ Years
Interior: <input type="checkbox"/> Annealed <input type="checkbox"/> Laminated <input type="checkbox"/> Tempered	Previous Glass Failure <input type="checkbox"/> Yes <input type="checkbox"/> No
	If Yes, Give Annual Percent _____

Indoor Shading

Type (Check One)	Ventilation of Indoor Shading
<input type="checkbox"/> (1) None <input type="checkbox"/> (2) Drapes <input type="checkbox"/> (3) Blinds	<input type="checkbox"/> (1) Ventilated <input type="checkbox"/> (2) Non-Ventilated
For Drapes	Space Between Glass and Shading (Check One)
Color: <input type="checkbox"/> (1) Light <input type="checkbox"/> (2) Dark	<input type="checkbox"/> (1) 2 to 6 inches (50-150 mm)
Weave Type: <input type="checkbox"/> (1) Open <input type="checkbox"/> (2) Closed	<input type="checkbox"/> (2) More than 6 inches (150 mm)
For Blinds	
Color: <input type="checkbox"/> (1) Light <input type="checkbox"/> (2) Dark	

Outdoor Shading

Type (Circle one) or Check if none

75% Shaded	Vertical (1)	Horizontal (2)	Diagonal (3)	75% Shaded	Vertical Diagonal (7)	Horizontal Diagonal (8)	Vertical Horizontal (9)	75% Shaded	Double Glazed (13)	(14)	(15)
25% Shaded	(4)	(5)	(6)	25% Shaded	(10)	(11)	(12)	25% Shaded	(16)	(17)	(18)

Note: 22-49-02 Easy-Drape Fast-Drape 44000-022-2

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3M™ Window Film Information

Glass Checklist

3M

Glass Checklist Form - page 2

Window Framing

Framing System (Check One)

- (1) Structural Rubber Gasket
 (2) Wood Sash
 (3) Aluminum or Steel Tubular Thin
 (4) Aluminum or Steel Tubular Thick
 (5) Concrete
 (6) Aluminum or Steel Solid

Condition of Sealant

- (1) Resilient (2) Hardened

Condition of Frame

- (1) Good (2) Fair (3) Poor

Outdoor Glazing Stop Color

- (1) Black (2) Dark (3) Light

Sealant Type (Specify)

Indoor Structural Pocket Yes No

Window Type

Architectural Window Type (Circle one) or Check if none



Window larger than 20 square feet Yes No

NOTE: To determine square footage, multiply the height by width as though it were a rectangle.

Heating Register Location

Room Side of Indoor Shading or No Shading

- (1) Directed Away From Glass
 (2) Directed Towards Glass

Between Glass and Indoor Shading

- (3) Directed Away From Glass
 (4) Directed Towards Glass

Other Consideration

Design Winter Temperature (1) Below 0°F (-18°C) (2) Up to 40°F (4°C) (3) Above 40°F (4°C)

Altitude (1) Below 5000 Ft. (1525m) (2) At or Above 5000 Ft. (1525m)

Adjacent Reflecting Surface (1) None (2) Dark (3) Medium (4) White (snow)

Signatures

Customer _____ Date _____ Dealer _____ Date _____

I would like to receive this form back by:

- E-mail to: _____
 Fax to phone number: _____
 Mail to address: _____

Win - 04/08/08

Cons - Customer

Mat - Date

18-0702-1122 (2)

Approved By _____ Date _____

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3M™ Window Film Information

Glass Checklist

Expected Edge Stress Report

What Information Is Contained On The Expected Edge Stress Report?

The Report is divided into four sections:

1. General Information Section:
 - a. Request Number and Date of Report
 - b. Customer and Dealer Information
 - c. General Glass Information Including:
 1. Glass type
 2. Typical glass size
 3. Glass edge area per window
 4. Total number of windows
 - d. Proposed 3M Sun Control Window Film type
2. Installation Conditions Section:
 - a. General Building Conditions as outlined on Checklist Form
 - b. Specific Description of Building Condition
 - c. Thermal Stress Factors for these Specific Building Conditions
3. Expected Edge Stress Section:

Specific Expected Edge Stress Calculation for the indicated 3M Sun Control Window Film
4. Acceptable Maximum Stress Section:
 - a. The Acceptable Maximum Stress for this situation
 - b. 3M™'s Recommendation: Accepted or Rejected

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3M™ Window Film Information

Energy Savings

3M™/ AIMCAL Demand Analyzer

Instructions for Demand Analyzer

****Two Steps Required****

Step 1 – Instructions → Demand Analyzer installation.

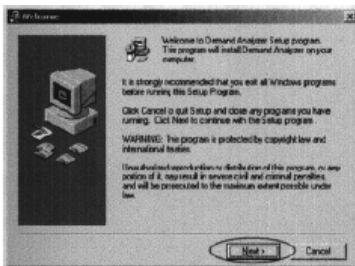
1. Close all applications on your PC.
2. Insert the Demand Analyzer CD into your CD ROM drive. This is an Auto Start CD, wait a few minutes for the installation to begin.

Note: If Auto Start is not functioning, please see instructions below for manual start.

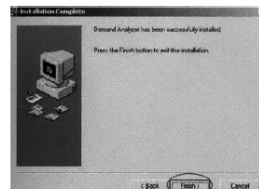
Manual Start Instructions

- A. Insert the Demand Analyzer CD into your CD ROM drive.
- B. Go to Start | Run and type in 'd:\setup.exe' and hit 'Enter'
Note: 'd' is the letter of the CD-ROM drive.

3. Press 'Next' to continue installation.



4. Accept defaults during the setup by pressing 'next' on each of the following screens.
 - End User License Agreement → 'Next'
 - Get Registration Information → 'Next'
 - Choose Destination Location → 'Next'
 - Select Program Manager Group → 'Next'
 - Start Installation → 'Next'
5. Installation will begin and the following screen will display as the files are copied.
6. Press 'Finish' to Complete Installation.



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3M™ Window Film Energy Savings

3M™/ AIMCAL Demand Analyzer

Step 2 – Instructions → 3M Components for Demand Analyzer installation.

- Got to Start | Run and type in 'd:\3M Setup\setup.exe' and hit 'Enter' Note: 'd' is the letter of the CD-ROM drive.
- The 3M components of Demand Analyzer will be installed and the window will disappear when finished.
Note: If you do not complete Step 2 of the installation, you will be missing the 3M components/products when you try to create a report.

Start Demand Analyzer

1. 'Click' on the Demand Analyzer icon on your desktop.



Easy Step-by-Step Instructions (Please read carefully) *Overview*

Demand Analyzer is an easy-to-use, Windows-based program that allows the user to quickly create an energy analysis report detailing the energy savings from applying solar control films to almost any building. Even though Demand Analyzer uses the most sophisticated energy analysis methods available, you will find that it takes only a few minutes to prepare a very detailed and accurate energy analysis report.

When using Demand Analyzer the user creates computer “models” of the building in question. These models are created by completely describing the building and its utility costs within the program. This is done by choosing values for several building “parameters.” These parameters are everything about the building affecting its energy use and its annual energy costs (such as building location and climate, type of windows, cost of electricity, square footage, number of stories, type of cooling and heating systems, etc.).

To create an energy analysis report showing the effect of adding solar film to a building, it is necessary to create two building models. First, a “Base Case” model of the building as it currently exists (without solar film) is produced. Second, a model is created of the building with solar film applied. The user can create any number of models with film applied to compare the effect of different films. Once these models have been created the energy analysis report is prepared.

To make the process as easy as possible, Demand Analyzer has several complete model templates built into the program for the 17 most common building types (Large Office, Hospital, Motel, College, Large Retail, Small Retail, High School, Residence, etc.). This simplifies the modeling process as the user only modifies a few select parameters from these templates and does not need to enter all of the model information for each analysis.

Included in this document are step by step instructions for using Demand Analyzer. It has been written for those not completely comfortable with using a computer and includes very specific, detailed instructions. More information on how to use the program (in a less detailed manner) can be found using the Help menu option in Demand Analyzer. Also, included in the Demand Analyzer Help section is a Tutorial. Once you have followed the steps below to create a few building models, and create and print a few reports and graphs, you should be able to refer to the less detailed instructions in the Demand Analyzer Help and Tutorial sections.

In the text below, menu choices from Demand Analyzer's or other program's menu bars (along the top of a screen) are shown in **Bold**. Demand Analyzer building parameters and the names of windows or popup menus that will appear in Demand Analyzer are shown as *italicized bold letters*. **IMPORTANT:** when describing the use of the computer mouse, the word “click” refers to clicking the left mouse button once. Do not double click or use the right mouse button unless specifically instructed to do so.

Again, the steps you will follow to create an energy analysis report using Demand Analyzer are:

1. Use Demand Analyzer Templates to create an Initial Base Case Model
2. Modify Initial Base Case Parameter Values to match existing building without film and create Final Base Case Model
3. Create Building Model With Film
4. Create Energy Analysis Report and Graphs (comparing Base Case to Model With Film)

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3M™ Window Film Energy Savings

3M™/ AIMCAL Demand Analyzer

1. Using Demand Analyzer Templates to create an Initial Base Case Model

After starting Demand Analyzer, from the menu bar choices at the top of the screen, click on File, then New, then Building.

The *New Building* window will appear on your screen. Options are shown for Category, Building Type, Vintage, Description, Climate Zone, and Utility Rates.

The *Category* name is optional and is used to group together common buildings (for example models for a particular client). You can choose the default “No Category” if desired or type in an appropriate name. If you have previously entered a *Category* name, and wish to add the new model to this category, you can click on the down arrow to the right of the *Category* box and choose a *Category* name from the list that appears. In the list that appears, the name that is highlighted can be changed by moving the mouse up or down, or by using the PgUp, PgDn, , or keys. Click the mouse when you have highlighted the desired *Category*.

Next, click on the down arrow to the right of the box beside *Building Type*, and choose from the list that appears the type of building you wish to analyze. Click on the type of building desired. This step is critically important, as many of the parameters defining the building depend upon the *Building Type* chosen. If you do not choose the correct *Building Type* you cannot expect the resulting energy analysis to be accurate.

By clicking on the down arrow to the right of the box beside *Vintage*, you can choose the date corresponding to when the building was built. There are three sets of dates to choose from. Again, the *Vintage* will alter many of the model parameters used, so be certain that the choice made is correct. Next, click in the blank box next to *Description* and type a descriptive name for the building, such as “Building (without film).”

Clicking on the down arrow to the right of *Climate Zone*, choose the city nearest to the actual building location. Once you click on the down arrow, you can move quickly to the desired state or country by pressing the first letter of the state or country (or again you can move the mouse up or down, or use the PgUp, PgDn, , or keys). Finally, unless you read more about *Utility Rates* in the Demand Analyzer Help screens, and know what you are doing, leave the Utility Rate box set to “default.”

It is important to make sure you have made the proper choices for the parameters shown in the *New Building* window, BEFORE proceeding further. Once you leave this window you cannot change some of the parameters shown. So, once you are sure you have the correct choices in the *New Building* window, click on OK. When you do so, you will notice that the building model is added to the *Buildings in Database* window (normally on the left side of the screen). Buildings in this window are grouped first by *Category* and second by *Building Type and Vintage*.

Now you are ready to modify the building parameters to more closely match the building you are analyzing.

2. Modify Initial Base Case Parameter Values to match existing building without film and create Final Base Case Model

Once you have created an initial Base Case building model without film, you will need to modify some of the parameters within the model to match the specific building you are analyzing. When you first create the building model in Step 1 above, Demand Analyzer uses typical values for many of the parameters based on the *Building Type and Vintage* chosen.

The parameters that you may need to modify will depend on the *Building Type*. In Table 1 on the next page, is a summary of the different parameters you may need to modify by *Building Type*. If you do not have good information as to what value to enter for a given parameter, use the default value given by Demand Analyzer. Of course, the accuracy of the energy analysis will depend entirely upon the accuracy of the parameter values used.

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3M™ Window Film Energy Savings

3M™/ AIMCAL Demand Analyzer

2. Modify Initial Base Case Parameter Values to match existing building without film and create Final Base Case Mode - Continued

To change the values of a parameter in a building model, you will first need to open the building parameter list for a building. Buildings are selected from the *Buildings in Database* window. If the building name needed is not shown in the *Buildings in Database* window, click the + symbol to the left of the *Category* for that building. Buildings are also grouped by *Building Type and Vintage* so you may need to click on the + symbol beside any of the *Building Type/Vintage* listings shown to show all of the buildings in that particular group in order to find your building. Once the building name needed is shown, double clicking a building name or clicking the + symbol beside the building name will display a list of building parameter groups.

Double clicking on the name of a particular parameter group or clicking on the + symbol beside any of these parameter groups will show all of the individual parameters for that group. To change a parameter value, click on the parameter name. If the parameter is a simple Yes/No type, then the box is either checked (meaning Yes) or unchecked (meaning No). Otherwise, the parameter may be edited in the popup box that appears when you click on the parameter. Notice that as any parameter is changed to a non-default value, the box next to it is changed to have a blue background. Parameters that have a gray box are deactivated because of the selection of another parameter. A summary for the building being edited is displayed in a separate building window showing every parameter that is not set to the default value (the window title is the name of the building).

Be certain that you choose the correct *Window Glass Type* values for each orientation (North, South, East and West) in the *Envelope* parameter group. Only four orientations are allowed for windows, but it is possible to change the default N-E-S-W to NE-SE-SW-NW by simply changing the building azimuth to 45. That effectively rotates the entire building. Be sure to choose a *Window Glass Type* without film. You can also change a building's *Description, Climate Zone, or Utility Rates* after creating a model, by first single clicking on a building name in the *Buildings in Database* window to highlight a specific building.

Next, single click the highlighted building name and the *New Building* popup window will appear. Keep in mind that you will not be able to change the *Category Building Type or Vintage*. To read more about the parameters listed in the table on the next page and all available parameters, click on the Demand Analyzer Help menu option at the top of the screen, then click on Contents, General, and Index of Parameters. A screen will appear that shows every possible building parameter you can alter in Demand Analyzer. If you click on any of the parameters shown, a brief description will appear. To return to Demand Analyzer from the Help screen, click on the Close button (the X button) in the upper right corner of the Help screen.

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Table 1 - List of Parameters by Building Type (parameters that should be modified from template).

Note: Only those Parameter Groups and Parameters that are the most important to provide an accurate analysis are shown below. Other parameters may also be edited as necessary.

Parameter Group	Parameter	Large Scale Commercial								Small Scale Commercial								Residential	
		Large Office	Large Retail	Hospital	Nursing Home	High School	College	Hotel	Small Office	Small Retail	Site Rest	Fast Food	Grocery Store	Warehouse	Primary School	Motel	Single Res.	Multifamily Res.	
General																			
	Floor Area	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Number of Stories	X						X											
	Operating Schedule					X					X	X	X		X				
Utility Rates																			
	Electricity:																		
	Electricity cost per kWh	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Gas:																		
	Energy cost per Therm	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Thermostat Setting	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Envelope																			
	Adjustment Shading	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Window Area	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Window Setback	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Window Shading	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Window Glass Type	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Air Distribution																			
	Air Handler Type	X	X	X	X	X	X	X											
Central Plant																			
	Heating Plant	X	X	X	X	X	X	X											
	Cooling Plant	X	X	X	X	X	X	X											
	Cooling Tower	X	X	X	X	X	X	X											
HVAC System																			
	Heating System	X	X	X	X	X	X	X											
	Cooling System								X	X	X	X	X	X	X				
	Cooling Tower								X	X	X	X	X	X	X				
DHW & HVAC Systems																			
	HVAC System																		
	Heating System																X	X	
	Cooling System																X	X	

3. Creating Building Model with film

Once you have followed Steps 1 and 2 to create the Base Case building model without film, you are ready to create the building model with film. Demand Analyzer will allow you to copy the Base Case building model you have just created, saving you from editing most of the parameter values again. Of course, it will be necessary to change the *Window Glass Type* parameter for the model with film. This parameter will specify which film will be applied to the windows in the model with film.

To copy a building model, once you are sure you have modified all of the necessary building parameters for the Base Case model, collapse the building parameter list by clicking on the “-” symbol beside the building name you are working on. The name of the Base Case building without film should remain highlighted. If the correct building name is not highlighted, click on the correct name once. Then click on the Edit command on the menu list at the top of the screen. Then click Copy. Demand Analyzer will ask you if you are sure you want to copy the building chosen. Click Yes. A *Copy Building* popup window will appear showing a blank *Category* and the *Description* for the building copied. Click on the down arrow beside *Category* and choose the same *Category* as used for the Base Case building. Next, click on the *Description* box and edit the description to indicate that the new model includes film applied to the windows.

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3. Creating Building Model with film - Continued

For example: "Building (with film A)". It is a good idea to include the exact film name in the *Description* for buildings with film as you may want to compare several film types. So you may have "Building (with Film A)", "Building (with Film B)", etc. Keep in mind that each model will contain only information about the building for a single film type. If you want to compare different films, you will need to create a new model for each film. Also, the *Description* name will appear on any graphs or printouts created so adding film names will make it easy to compare the effect of different film types.

Once you have entered a *Description* for the building with film click on OK. You can create additional models for additional film types by copying the building again. Be sure to choose the same *Category* so that the models are grouped together in the *Buildings in Database* window.

Since the model or models you have just created are identical to the Base Case model without film, the only parameter you will need to change is the *Window Glass Type* parameter to add film to the building. Again, click on the + symbol beside the Building Name, then click on the + beside *Envelope*, then click on the *Window Glass Type* for a given orientation. From the popup box that appears, choose the appropriate window & film combination. For example, if you chose "Single Clear (no film)" for the model without film, be sure that when you choose a film name, the window type also is "Single Clear", such as "Single Clear with Film A". (Note: You can add film to any of the orientations or all of them. If you do not wish to add film to a given orientation such as North, do not edit the *Window Glass Type* for that orientation. You can also add different film types to different orientations).

Edit each building model with film, being sure to edit the *Window Glass Type* for ALL orientations desired. Now that you have created a Base Case Model without film and a model with film, you are ready to create the energy analysis report.

4. Creating Energy Analysis Report

Once you have created a Base Case model for your building without film and then a model with film, it is a simple matter to create a detailed report showing the energy and cost savings from adding film. From the menu choices at the top of the Demand Analyzer screen, click on File, then New, then Report.

When the "Report and Building Selection" popup window appears, choose "Economic Analysis" in the Report option box. Next use the building tree that is shown to choose the buildings for your report. You may need to expand the tree to find your buildings by clicking on the + symbol beside the *Category* for your buildings. If there is more than one *Building Type* in this *Category* click on the + symbol beside the *Building Type* for the models just created. Next click the box beside each building you wish to include in the report and click on Next.

Fill in the information on the "Report Parameters" screen and press Next. Make sure the building model name without film is identified as your "Base Case" by ensuring that the box beside the building model without film is checked. Using the Tab key, move the cursor so that you can now enter the total installed cost for the film for each building with film. This is the total quote for the entire job, NOT the cost per square foot. So if you are creating a report for a 10,000 square foot job and you are charging \$3.00 per square foot, you would enter \$30,000. Be sure to include a cost for each model with film. Then press Finish. At this point you may see a Demand Analyzer message that reads "One or more buildings with no simulation. Run required simulations?" Click on Yes. Depending on the number of models that will be simulated and the speed of your computer, this may take a few minutes. When the Simulation Progress meter is 100%, click on OK.

Demand Analyzer will create a report with a cover page, an Economic Analysis Summary Page, and a Buildings Parameter Summary. The cover page will show the annual savings and payback for the film with the greatest savings along with general information about Demand Analyzer. The Economic Analysis Summary Page will show the savings and payback for each film option chosen. The Buildings Parameter Summary lists all of the model parameters chosen for each model.

If you are using Microsoft Word, you can save the report by choosing File, Save As, choose a directory different from the default \Temp directory shown, and then click on Save. **IMPORTANT: DO NOT SAVE THE FILE TO THE \TEMP DIRECTORY EVEN THOUGH THIS IS THE DEFAULT DIRECTORY. ALL FILES FROM THE \TEMP DIRECTORY ARE ERASED WHEN DEMAND ANALYZER IS CLOSED. IT IS BEST TO USE A DIRECTORY COMPLETELY APART FROM ANY DEMAND ANALYZER DIRECTORY (SUCH AS USING C:\ENERGY REPORTS AS A DIRECTORY FOR ALL YOUR ANALYSIS REPORTS. ALSO, DO NOT CHANGE THE "SAVE AS TYPE" FROM "RICH TEXT FORMAT" TO "WORD DOCUMENT". LEAVE AS "RICH TEXT FORMAT."** Again, if using MS Word, you can print the report by choosing File, then Print

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5. Creating Graphs

You can easily create graphs that illustrate the energy savings from adding different solar films. These graphs can then be printed out and attached to the *“Economic Analysis Report.”* To create a graph, from the menu choices at the top of the Demand Analyzer screen, click on File, then New, then Graph. Next click on the Annual Cost option. There are several graph types to choose from and you will need to experiment with each of these to see which graphs would be the most useful for your needs. The most common graph, however, will certainly be the Annual Cost graph. This graph shows the total annual cost for each building model chosen.

Just as you did to create a report in step 4 above, you will next choose the buildings to be included in the graph. When the *Select Buildings to Graph* window appears, click on the + symbol beside the *Category* for the buildings to be included on the graph. If there is more than one *Building Type* in this *Category* click on the + symbol beside the *Building Type* for the models you wish to graph. Next click the box beside each building you wish to include in the report and click OK. The buildings will be shown on the graph from left to right in the order chosen. At this point you may see a Demand Analyzer message that reads “One or more buildings with no simulation. Run required simulations?” Click on Yes. Depending on the number of models that will be simulated and the speed of your computer, this may take a few minutes. When the Simulation Progress meter is 100%, click on OK. You will then be prompted for the Graph Title to use. You can accept the default title shown by clicking OK, or enter your own title and click OK. The graph will appear in a small window on your screen. Click on the Maximize button (the ■ symbol in the upper right section of the graph window that appears) to enlarge the graph.

From the graph window you can use the graph window menu options to change the appearance of the graph or simply print the graph by clicking on File, Print (be sure to use the File, Print command from the graph window menu option list, not the main Demand Analyzer menu options at the very top of the screen). If you have problems with the graph and legends appearing on separate pages, from the graph window, click on File, Print Preview, and under the “Options” box make certain that no check is in the box beside “Separate Legend”. Notice that you can also change the margins or orientation of your graph from this screen, if needed to improve the appearance of the printed graph.

6. Other Topics

A. English (Inch-Pound) or Metric (SI) Units

You can use either system of units by clicking on Options from the Demand Analyzer main menu bar, then choosing the system of units choice. You can switch between the two systems at any time.

B. Currency other than Dollars, \$

To have reports and graphs print a currency symbol other than \$, edit the default.ecn file in the Program Files\Demand Analyzer\Rates directory using Word or Notepad, or from Windows Explorer in this directory, double-click the default.ecn file to edit the file. The first few lines of this file should look like:

```
$ currency = $  
INPUT ECONOMICS ..  
ECONOMICS-REPORT SUMMARY (ES-D) ..
```

The symbol after “\$ currency =” on the first line is the symbol that will be used in reports and graphs. For example, to use British Pounds, you would edit the first line to read:

```
$ currency = £
```

Be careful not to change any other portion of this file. Save the file after making this change.

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6. Other Topics - Continued

C. Non-square buildings or buildings with more than four sides

The default building geometry for larger building types is a square building. If the building you are modeling is rectangular, you should change the Aspect Ratio parameter, which is a parameter within the General parameter group. Use the Demand Analyzer Help section to learn more about changing the Aspect Ratio. Similarly, if the building you are modeling does not face true North, South, East and West, you should edit the Building Azimuth parameter to rotate your model as needed. Again, see the Demand Analyzer Help section for assistance. If the building you are modeling has more than four sides, you will need to apportion the square footage of glass area in some manner to the four sides available in Demand Analyzer. For example, if you have glass facing North, South, East, West and Southwest, you could evenly divide the square footage of Southwestern facing windows between South and West.

D. Fuel Oil as a heating fuel source

Although rare, there are some buildings that may use Fuel Oil as a heating fuel. Due to the rarity of this situation, Demand Analyzer unfortunately does not permit choosing Fuel Oil as a heating fuel source. Therefore, if you are modeling a building where the heating fuel is fuel oil you will need to make the following modifications to your model.

If fuel oil is the heating fuel, you will need to enter a value for the Natural Gas *Energy Cost per Therm* under the *Utility Rates* parameter group. To do this, use Table 2 on the following page to convert the fuel oil cost per gallon to an equivalent Natural Gas *Energy Cost per Therm*. For example, if fuel oil costs 1.80 per gallon, you would enter 1.38 per therm as the Energy Cost per Therm for Natural Gas. The two costs shown take into account for the likely differences between the efficiencies of fuel oil versus natural gas systems, so you do not need to adjust the efficiency of the heating plant that Demand Analyzer uses. You should keep in mind that there is no way to change the appearance of the words "Natural Gas" or "therms" in graphs and reports, so be aware of this before presenting results to your customer. Since solar control film has a much greater effect on the cooling energy costs than heating fuel costs, this method of adjusting your model is reasonable.

Table 2 - Equivalent Fuel Oil and Natural Gas Price Values.

If Fuel Oil Cost per Gallon is	Enter this value for Natural Gas Energy Cost per therm	If Fuel Oil Cost per Gallon is	Enter this value for Natural Gas Energy Cost per therm
0.20	0.15	6.20	4.77
0.40	0.31	6.40	4.92
0.60	0.46	6.60	5.08
0.80	0.62	6.80	5.23
1.00	0.77	7.00	5.38
1.20	0.92	7.20	5.54
1.40	1.08	7.40	5.69
1.60	1.23	7.60	5.85
1.80	1.38	7.80	6.00
2.00	1.54	8.00	6.15
2.20	1.69	8.20	6.31
2.40	1.85	8.40	6.46
2.60	2.00	8.60	6.62
2.80	2.15	8.80	6.77
3.00	2.31	9.00	6.92
3.20	2.46	9.20	7.08
3.40	2.62	9.40	7.23
3.60	2.77	9.60	7.38
3.80	2.92	9.80	7.54
4.00	3.08	10.00	7.69
4.20	3.23	10.20	7.85
4.40	3.38	10.40	8.00
4.60	3.54	10.60	8.15
4.80	3.69	10.80	8.31
5.00	3.85	11.00	8.46
5.20	4.00	11.20	8.62
5.40	4.15	11.40	8.77
5.60	4.31	11.60	8.92
5.80	4.46	11.80	9.08
6.00	4.62	12.00	9.23

Or, use the following formula:
 (Fuel Oil Cost Per Gallon) divided by 1.30 = Energy Cost per therm for Natural Gas

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3M™ Window Film Installation

RED Technical Product Recommendations

The following Technical Product Recommendations chart is meant to be used as a guide to provide for improved installation quality and minimal confusion. We have seen that installing a film designed for flat glass application onto a vehicle can result in serious issues at times. Installing automotive films onto flat glass can cause problems as well.

Recommended (R)

Non Standard Application. Specifications may not meet customer requirements. (NSA)

Not Recommended. (NR)

Products	Automotive Category	Flat Glass Category		
	Automotive General Purpose	Commercial (Internal)	Residential (Internal)	All External Applications
3M™ Safety & Security Window Films 1,2				
Ultra S150 (SCLARL150), Ultra S400 (SCLARL400), Ultra S600 (SCLARL600) & all tinted safety films	NR	R	R	NR
SH4, SH7, SH8, & SH14	NSA	R	R	NR
SCLARL400D	NSA	R	R	NR
S50NEAR400D – New version in 2006	NSA	R	R	NR
3M™ Automotive Window Films				
Crystalline Series	R	NR	NR	NR
Color Stable Series 4,5,6	R	NSA	NSA	NR
FX XT Series 5	R	NR	NR	NR
FX XT HP Series 5	R	NSA	NSA	NR
FX XT 70	R	NR	NR	NR
Black Chrome Series 5	R	NSA	NSA	NR
Flat Glass Films 2				
Prestige Series	NR	R	R	NR
Night Vision Series	NR	R	R	NR
RE##NEARL Series	NR	R	R	NR
LE##ARL Series	NR	R	R	NR
RESL##ARL Series	NR	R	R	NR
REAM##ARL Series	NR	R	R	NR
External Series				
RE15SIARXL, RE35SIARXL, RE20BRARXL, & RE35NEARXL	NR	NR	NR	R

Footnotes:

- 1 – Safety films are “Non Standard” or “Not Recommended” in Automotive because of their thicker layer of adhesive.
- 2 – These films are a “Non Standard” in automotive applications because they have overcoat.
- 3 – The new version of this film will not have overcoat to make them suitable for overcoat.
- 4 – Color Stable used in Flat Glass is a “Non Standard Application” because of thermal stress factors.
- 5 – Black Automotive films have more color change than Flat Glass films and are therefore “Non Standard” or “Not Recommended” for Flat Glass.
- 6 – Appearance specifications and product design make Windshields a “Non Standard” or “Not Recommended” application.

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3M™ Window Film Installation

Flat Glass

Tools and Equipment

Available 3M Service Center - Authorized 3M Sun Control WF Distributor

- Film dispenser with spare cutter head assembly
- Replacement blades for film dispenser
- Three-gallon (11 liter) plastic PRESSURE spray tank - 8' - 10' (2-3m) plastic hose
- Replacement nozzle for three-gallon spray tank
- 8" (20 cm) Window cleaning squeegee with replacement rubbers
- 20" (50 cm) Window cleaning squeegee with replacement rubbers
- 5" (13 cm) Film application squeegee with replacement blades recommended for Safety Films
- 6" (15 cm) Film application squeegee with replacement blades
- 8" (20 cm) Film application squeegee with replacement blades
- 1" (25 cm) Window scraper with replacement blades
- 4" (10 cm) Window scraper with replacement blades
- Five-way tool
- Olfa knives with replacement break-away blades
- Positioning solution (see page)
- 36" (90 cm) and 72" (1,8 m) Straight ruler (metal)
- Miscellaneous metal or plastic trim guides

Miscellaneous Hardware & Equipment

Available locally

- 15' (5 m) or 25' (8 m) Flexible steel measuring ruler
- Waist apron
- Drop cloths (absorbent)
- Lint-free towels
- Scissors
- Screwdrivers
- Pliers
- Claw hammer
- Allen wrench set
- Vacuum cleaner (aqua-vac)
- Small paint brushes (for edge sealer)
- 3M™ Brand masking tape
- Sponges
- Edge Sealer - 3M™ Clear Auto Sealer - Part #08551 - for exterior and interior
- Step ladders and extension ladders
- Scaffolding or access equipment as required

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3M™ Window Film Installation

Tool and Equipment Inspection

Inspect Before Leaving For Application Site

1. Film Dispenser
 - a. New sharp blades
 - b. Alignment of horizontal cutter
 - c. Spare blades
 - d. Clamp bar - surface clean and positive grip
2. Plastic Pressure Spray Tank
 - a. No Leaks
 - b. Flush out before filling
3. Squeegees
 - a. Clean, Straight, Flat and Sharp
 - b. Blade edge - replace if worn or nicked
4. Application Squeegee Repair
 - a. Rub across edge with 400 or 600 grit 3M Wetordry™ brand sandpaper
 - b. Maintain good square edge
 - c. If nicks and chips are still present, use 200 or 300 grit 3M Wetordry™ brand sandpaper. Go back and finish off with 400 or 600 grit 3M Wetordry™ brand sandpaper.
5. Knives
 - a. Use break-away blades
 - b. Use new tip after 3 cuts
 - c. Use stainless steel blades

Film Inspection

Inspect Before Leaving For Application Site

1. Correct Film
2. Correct Sizes
3. Free of Visual Defects
 - a. Edge damage
 - b. Buckles
 - c. Wrinkles
4. Sufficient amount of film and proper run number

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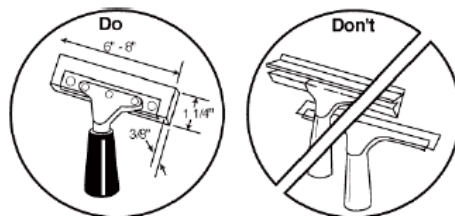
3M™ Window Film Installation

Clean Glass and Frame

- Wipe down window frame with damp cloth or sponge
- If window putty or seal is old and cracked, tape or seal prior to washing glass
- Wash window using pressure spray tank
- If glazing is in good condition, flush edges
- Scrape glass
- Thoroughly rinse glass from top to bottom with pressure spray tank
- Squeegee entire glass surface
- Dry glass edge and window frame

Film Application

1. Lightly Spray Liner Side with Slip Solution to reduce static.
 2. Cut Film 1" (2.5 cm) Wider and 1" (2.5 cm) Longer Than Glass Size.
 3. Spray Glass with slip solution and lay Film on Glass with Adhesive Side Toward You. Note, thoroughly wet the adhesive with slip solution.
 4. Remove Liner
 5. Wash Fingers if needed to remove any remaining adhesive on fingers. By removing any existing adhesive on fingers, when turning film on glass positioning of film will be easier to control.
 6. Turn Film Around and Apply to Glass.
 - A. Position right side and top, leaving 1/8" (3mm) border.
 - B. If window is not square, all edges might need trimming.
- I. First Squeegee
- A. Use proper squeegee



Note: Slip Solution – for all 3M Window Film Types. Slip Solution is defined as 1 ½ caps of Johnson Baby Shampoo per gallon of water. Modify slip solution if film sticks to glass or is too slippery.

It is extremely important to use the correct amount of slip solution in the spray water. Too much slip solution in the water can cause lack of adhesion, fingering, excess haziness, and slow drying.

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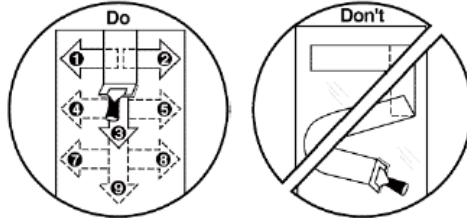
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3M™ Window Film Installation

Film Application

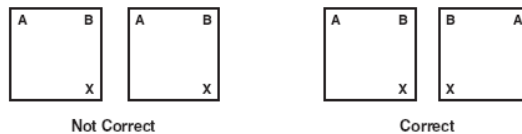
- B. Lightly spray film surface.
- C. Use proper squeegee pattern.



- D. Always keep squeegee blade lubricated during squeegeeing.
- II. Trim Film to Size
 - A. Use trimming guide.
 - B. Trim within 1/8" (3mm) of window edge.
 - o Water removal
 - o Reduce dirt entrapment at edge
 - o Prevent edge damage
 - o Prevent edge corrosion
 - C. Always use new blade tip after 3-4 cuts.
- III. Relubricate with Slip Solution and Squeegee (Using Squeegee and Squeegee Pattern Mentioned Above) Until All Water is Removed.
- IV. Dry Edges (Bumping).
 - A. Bump film edge with absorbent lint-free towel wrapped around edge of Five-Way tool.
 - B. Wipe frame edge dry.

Splicing

- Position and direction of splice must be determined by salesperson and customer prior to film installation.
- Leave instructions with customer that window washers should be aware of splice and squeegee window from direction of film that is on top.
- Always match factory edge to factory edge - Mark edge with masking tape.
- To reduce the risk of splice joint gap, squeegee parallel to the film edges to be joined



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3M™ Window Film Installation

Overlap Splice

1. Overlap splice pieces about 1" (25 mm) and draw back to 1/8" (3 mm)
 - a. Horizontal splice - Upper piece over Low Er
 - b. Vertical - Left-hand piece over right-hand piece
2. Slowly squeegee parallel to overlap splice - lubricate film as required
3. Squeegee out maximum amount of water
4. Always use overlap splice for Safety and Security films (overlap splice must be 1/8" - 1/4" (3-6 mm))

Butt Splice/Cut Through Splice

1. Overlap film pieces 1" (25 mm)
2. With new sharp blade and a straight edge, cut through both pieces in exact center of overlap
NOTE: Use a new blade for each and every splice cut
3. Remove small piece from top, lift corner of bottom panel and remove Low Er smaller piece (spray water on splice during this process)
4. Slowly squeegee parallel to splice - lubricate as required
5. Squeegee out maximum amount of water

Why Edge Seal?

1. Protect edges from moisture
2. Prevent corrosion
3. Protect during washing
4. Helps protect against vandalism

NOTE: Edge sealing is a MUST for ALL external film applications or no warranty claim will be accepted

How To Edge Seal

1. Use 3M Clear Auto Sealer (part #08551). Available through automotive paint and body equipment suppliers
2. Surface must be clean and dry
3. Apply with small paint brush or cotton swab
4. Avoid sealant running down surface of film

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3M™ Window Film Installation

Important Details About Your Installation Of 3M™ Sun Control Window Film

Dear Customer:

Congratulations! You have just purchased a superior sun control film. 3M has devoted 30 years to the development and improvement of 3M™ Sun Control Window Film so that today you may enjoy the sun without experiencing the full effects of its harmful rays.

As with all products containing an adhesive system, a drying time is necessary to achieve the proper bond to the window. During this process, some changes may be observed. So that you will understand these differences, we would like to note some of them for you. They are normal and should be expected. Listed below, by way of recap, are the points covered by your Authorized Dealer.

- Drying time will be approximately 30 days. Please do not wash your windows during this period.
- Any haziness you may see is water under the film. You will see less and less of this as the days pass.
- A milky appearance might be experienced, but it too disappears during the drying period.
- All water bubbles will dry out, but a few small particles or points may be apparent when dry. These points, generally seen from the outside, are very tiny and are inherent in the use of a pressure sensitive adhesive system. An adhesive of this type is used because it is the only one that will withstand high humidity, driving rains and window condensation. You will normally see these particles only if you get quite close to the glass, which is something we ordinarily do not do. They will not affect the films performance.

The 1/8" (3 mm) border you notice is a requirement of the application according to 3M.

- Cleaning should be done using normal household window cleaners* or any non-abrasive window cleaning solution and wiping with a soft towel or squeegee. Paper towels or natural sponges should not be used.

NOTE: Sometimes what seems to be a defect in the film is, in fact, an imperfection in the glass. It is quite natural that one should look closely at a new purchase, but at times we observe things that were always there but never noticed. A good rule to follow is to look at the installation from six feet away. This is the manner in which we normally look through a window and the way in which you should observe your 3M™ Sun Control Window Film — looking through it, not at it.

We and 3M hope you will enjoy your installation. With proper care, we know you will receive many years of benefit from its presence on your windows.

Very truly yours,

Authorized Dealer/Applicator

*See warranty for cleaning instructions.

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3M™ Window Film Installation

Care and Cleaning Instructions for 3M Films

1. CARE MUST TAKEN NOT TO SCRATCH THE FILM, DO NOT USE BRISTLE BRUSHES OR ABRASIVE CLEANING MATERIALS
2. Household window cleaning solutions, such as Windex, are recommended
3. A soft cloth or clean synthetic sponge is recommended for washing. Do not use the same towel or sponge for wiping sills or frames. Paper towels or newspapers not recommended
4. A soft squeegee is recommended for removal of cleaning solution from the film
5. Do not apply heavy pressure in any cleaning operation
6. TIPS:
 - a. Additional caution is recommended when cleaning spliced areas. Clean in the direction of the splice
 - b. Do not leave the film wet
 - c. Make sure you use a different sponge, cleaning cloth and water bucket for cleaning the outside and the inside of the windows
 - d. Use a little extra detergent for cleaning 3M™ Sun Control Window Film — it gives more ease to squeegeeing



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3M™ Window Film Installation

Film Removal

1. Lift edge and try to pull off in sheets
2. If film is wider than 1' to 2' (30 to 60 cm), carefully cut into 1' to 2' (30 to 60 cm) strips
OR
3. Spray solution of ammonia and water onto film
4. Apply plastic film or newspaper on film
5. After one to two hours of soaking, lift edge and pull off in sheets
6. Clean adhesive residue with scraper using solution of ammonia and water

Application Do's

1. Do apply film on clean glass
 - a. Better application
 - b. Use 3M™ Scotch brand Magic Mending Tape to test for adhesion
2. Do use a sufficient amount of positioning solution during application
 - a. Wash off overcoat
 - b. Cleaner application
3. Do use plastic or stainless steel pressure spray tanks
 - a. More consistent cleaner applications
4. Do use plenty of new sharp stainless steel blades during cutting and trimming
 - a. Less fingers
 - b. Film lays down better
 - c. Won't scratch glass
5. Do apply film on entire surface of glass
 - a. Partial application can cause breakage (added stress)
 - b. No glass breakage warranty on partial applications
6. Do squeegee out the maximum amount of water
 - a. Less drying time
 - b. Better adhesion
 - c. Better overall performance and visual appearance
7. Do allow 1/8" (3 mm) to 1/16" (1.5 mm) border between film and molding
 - a. Water removal
 - b. Reduce dirt entrapment at edge
 - c. Reduce edge damage
 - d. Reduce edge corrosion
8. Do apply film on clean glass
 - a. Protect against elements
 - b. Reduce edge corrosion
 - c. No warranty if not edge sealed
9. Do use absorbent lint-free towels
 - a. Cleaner application

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3M™ Window Film Installation

Application Don'ts

1. Don't use too much slip/positioning solution concentrate in the mixture with water
 - a. Less adhesion
 - b. More fingers
2. Don't use steel pressure spray tanks
 - a. Rust between film and glass
3. Don't install film when outside temperature is less than 40°F (5°C)
 - a. Longer drying times
 - b. Poor adhesion
4. Don't use silicone polish after installation
 - a. No emissivity with 3M™ Sun Control Plus Window Films
5. Don't add alcohol or other additives to slip/positioning solutions
 - a. Detackifies adhesive
 - b. Adhesive failure
6. Don't use double application of films
 - a. Heat build-up - glass breakage
 - b. Lack of adhesion
 - c. Longer drying times
7. Don't apply film on plastics
 - a. Heat and light cause outgassing
 - b. Bubbles occur
 - c. Can't remove adhesive
8. Don't apply film to chipped, broken or damaged glass
 - a. No warranty
9. Don't apply films onto glass on restricted list without submitting Glass Breakage Checklist
 - a. No warranty
10. Don't apply film in building under construction
 - a. High dust/dirt level
 - b. Drying time with temperature differences

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3M Automotive Tools and Equipment

Recommended Tools And Supplies

Having the proper tools and supplies for vehicle film applications is extremely important, not only in quality of the installation, but for productivity as well.

1. Cutting/Trimming Tool
 - a. Choose the most comfortable
 - b. Most widely used have replacement break-away blades
 - c. Stainless blade is mandatory over standard steel
 1. Will not scratch glass if proper pressure is applied
 2. Will lose sharpness quicker, so never use same tip for more than three cuts
2. Window Cleaning Scrappers
 - a. One inch (25mm) for smaller windows
 - b. Four inches (100mm) for most others
3. Trimming Guides
 - a. 5-Way tool (whole or cut-a-way)
 - b. Triangle with hole cutting guide
4. Application Squeegees
 - a. Yellow tube type (Turbo Squeegee) - most popular
 - b. Hard card tool with absorbent towel - to remove maximum amount of water
5. Window Cleaning Squeegee
 - a. Good for cleaning windows
 - b. Not good for applying film
6. Absorbent Towels
 - a. Need absorbency and lint free
7. Pressure Spray Tank and Hand Spray Bottle
 - a. Always use plastic or stainless steel containers instead of galvanized steel to prevent rust from coming between film and glass
 - b. Three-gallon (11 liters) pressure spray is best
 1. More volume of water
 2. More pressure to flush away dirt and dust
 3. Larger spray pattern
 4. Save time during application
 5. Less physical activity
 6. Save time refilling
 - c. Three-gallon (11 liters) replacement spray nozzle
 1. Contains plastic in-line filter
 2. Best spray pattern for cleaning and film application

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3M Automotive Tools and Equipment

Recommended Tools And Supplies Continued

- d. Install in-line filter onto hose of three-gallon (11 liters) pressure sprayer
 - 1. Use a clear casing to see amount of contamination from water supply
 - 2. Change often
- e. Do not add to water in tank. Empty tank and refill with clean water daily or more often.
- 8. Slip/Positioning Solution
 - a. Recommend product for use in the slip solution is Johnson's Baby Shampoo
 - b. Use of other types of detergents, especially grease cutters, may cause poor adhesion
 - c. Proper slip solution ratio is 5 drops/gallon (3.8 liter)
 - d. Too high a concentration level causes:
 - 1. Adhesive to detackify
 - 2. More fingers
 - 3. Film not to lay down properly
- 9. Adhesive Remover
 - a. 3M™ Glass Cleaner - available through Authorized 3M™ Sun Control Window Film Distributor
 - b. Use White 3M™ Scotch-brite™ pad when cleaning glass with heater lines
- 10. Portable Fluorescent Light
 - a. Provides light to shine through glass and film when cutting patterns
 - b. Cooler light:
 - 1. Easy on eyes
 - 2. Will not burn interior of vehicle
- 11. "Don't Roll Down Window" Notice or Stickers
 - a. Place onto switches for electric windows or on roll-down window handles
 - b. Reminds customers not to roll down window for 3 - 5 days

Optional

- 1. Heat Gun - for one piece (few piece) rear windows
- 2. Cutting Table
- 3. Heat Lamps
- 4. Isopropyl alcohol for logo removal

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3M Automotive Tools and Equipment

Automotive Process

Vehicle Application Recommendations

Take the proper amount of time and care up front to maintain a high quality dirt-free application, rather than lose production time because of redo's.

1. Have tools and supplies close to vehicle - saves production time
2. Clean inside of window
 - a. Scrape
 - b. Rinse
 - c. Squeegee
 - d. Repeat 2 or 3 times or until the window is absolutely clean.
3. Clean outside of window to eliminate dust/dirt coming into contact with film
4. Cut film pattern using only a stainless steel blade
 - a. Get film to conform to curvature of glass
 - b. Cut away excess film
 - c. Always break off blade after 3 cuts. Improperly cut edges will cause film to not lay down, or excessive fingers
5. Clean outside window again and leave a layer of water on glass to hold the film in place
6. Wet adhesive with mounting solution as liner is being pulled off
7. Using the slip/positioning solution wet the inside of the window
REMEMBER!! The more water between the film and the glass prior to squeegeeing, the cleaner the final application will be.
8. Place the film on the inside of the vehicle window and squeegee out the maximum amount of water. To remove water from edge, use a hard card with an absorbent towel covering the squeegee blade.

HELPFUL HINTS

1. You can't use too much water
2. You can use too much slip/positioning solution
3. You can't use too many blades
4. You never use silicone near adhesives
5. Always rinse and squeegee off any window cleaning solutions or adhesive removers prior to film application
6. Always start squeegeeing from the top of a finger and squeegee completely to edge of film

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3M Automotive Tools and Equipment

Automotive Process Continued

7. If film will not lay down, or you are experiencing excessive fingers, possible causes are:
 - a. Using improper slip/positioning solution with too much solvent or alcohol
 - b. Slip/positioning concentration too high
 - c. Edge of film cut with dull blade
 - d. Film cut too close to edge of window
 - e. Non-sticky substance on glass (silicone)
8. Remove all decal's
9. If too much dust/dirt is behind film and glass, possible causes are:
 - a. Did not thoroughly clean the inside and/or outside of the window
 - b. Not enough water was used
10. Use fluorescent light inside of vehicles when cutting pattern from outside
11. Always apply "Don't Roll Down" stickers on roll-down windows with film
12. Apply narrow piece of masking tape over fuzzy channel material on framed side windows - reduces amount of dust/dirt on glass
13. Rinse your fingers prior to touching adhesive
14. Always apply film below rubber molding on bottom of roll-down windows
15. When relief cutting, always cut twice the length of the finger
16. Always squeegee film on the flattest area of the glass first, then work toward the sides, and then the corners
17. The 3M logos can be easily removed using isopropyl alcohol and a clean, soft cloth or towel.

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3M™ Window Film Specifications

Specifications For 3M™ Sun Control Window Film Prestige Series

1.0 Scope

This specification is for an abrasion resistant solar control window film which when applied to the interior window surface will reduce the gain of solar heat energy through the window. The film shall contain no metals. The film shall be called 3M™ Prestige Sun Control Window Film _____ [Series or Product Number].

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

The 1997 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-26 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Materials

Window 5.2, A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material: The film shall be an optically clear polyester film containing at least 220 layers and incorporating an acrylic pressure sensitive adhesive on one side and an acrylic abrasion resistant coating on the other. The film shall also incorporate Infrared absorbing carbon and/or metal oxide particles. The film shall be uniform without noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects. The variation in total transmission across the width, at any portion along the length, shall not exceed 2% over the average. The film shall have a nominal thickness of 2.0 mils (0.002 inches). There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 Emissivity: The emissivity of the non-adhesive surface of the film shall be 0.78 nominal when measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1997 ASHRAE Handbook of Fundamentals, ch. 29, or Lawrence Berkeley Laboratory Window 5.2 Computer Program available from:
<http://windows.lbl.gov/software/window/windo/html>.

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3M™ Window Film Specifications

Specifications For 3M™ Sun Control Window Film Prestige Series

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be 1.0 nominal when measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible: When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

3.5 Reflection – Visible, Exterior: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

Reflection – Visible, Interior: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

3.6 Rejected – Ultraviolet Light: When applied to 1/4" (6mm) clear glass, the total rejection of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall be 99.9% minimum when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

3.7 Rejected – Infrared Light: Film shall have an IR transmission of not more than 3% when measured between 900-1000 nanometers.

3.8 Luminous Efficacy: When applied to 1/4" (6mm) clear glass, the luminous efficacy (Defined as the ratio of visible light transmission to shading coefficient) shall be _____ Nominal.

3.9 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be _____ nominal (_____ at 60 Degrees) as measured per ASTM E-903 and computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.10 Adhesive System: The film shall be supplied with an optically clear pressure sensitive weather able acrylic adhesive applied uniformly over the surface opposite the abrasion resistant coating.

3.11 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per ASTM E-84.

3.12 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 50 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

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3M™ Window Film Specifications

Specifications For 3M™ Sun Control Window Film Prestige Series

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is authorized by the Manufacturer to install window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's ADA Identification Number.

4.3 The ADA will provide a commercial building reference list of ____ (#) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

4.5 Upon request, the ADA will provide an application analysis to determine available energy cost reduction and savings.

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 Materials shall be manufactured by:

3M Renewable Energy Division
3M Center Building 235
St. Paul, MN 55144-1000

5.3 3M RED Point of Contact:

Bill Pettit LEED AP 651-736-1549

6.0 Application

6.1 **Examination:** Examine glass surfaces to receive new film and verify that they are free from defects and imperfections which will affect the final appearance. Correct and/or note all such deficiencies to the owner prior to commencing film application.

6.2 **Preparation:**

- a. The use of protective tarps and/or drop cloths to cover office interior furnishing near the window is a recommended practice.
- b. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminants.
- c. Toweling or other absorbent material shall be placed on the window sill or sash to absorb moisture generated by the film application process.

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3M™ Window Film Specifications

Specifications For 3M™ Sun Control Window Film Prestige Series

6.3 Installation: The film shall be applied as to the specifications of the Manufacturer by an ADA.

- a. Materials will be delivered to the job site with the manufacturer's labels intact and legible.
- b. Film edges shall be cut neatly and square at a uniform distance of 1/8" (3mm) to 1/16" (1,5mm) of the window sealing device.
- c. Edge Seal – None required. 3M Sun Control Window Film Prestige Series do not contain metals.
- d. Water and film slip solution only will be used on the window glass and adhesive to facilitate the proper positioning of the film.
- e. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- f. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- g. After installation, any left over material and/or debris will be removed and the work area will be returned to original condition. ADA will protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes which could scratch the film must not be used. Synthetic sponges or soft cloths are recommended.

8.0 Warranty

Films Covered: Prestige 70, Prestige 60, Prestige 50 & Prestige 40.

8.1 The application shall be warranted by the film manufacturer (3M) for a period of Fifteen (15) years in that the film will maintain solar reflective properties without cracking, crazing, delaminating, bubbling, peeling or discoloration. In the event that the product is found to be defective under warranty, the seller will replace such quantity of the film proved to be defective, and will additionally provide the removal and reapplication labor free of charge.

8.2 The film manufacturer (3M) also warrants against glass failure (maximum value \$500 per window) due to thermal shock fracture of glass provided the film is applied to recommended types of glass and the failure occurs within sixty (60) months from the start of application. Any glass failure must be reviewed by the film manufacturer (3M) prior to replacement.

Section	Title	3M Window Films			
		PR70	PR60	PR50	PR40
1	Film				
3.1	Thickness (mils)	>2.0	>2.0	>2.0	>2.0
	(inches)	0.002	0.002	0.002	0.002
3.3	U value	0.99	0.99	0.99	0.99
3.4	Visible Light Transmission	69%	60%	50%	39%
3.5	Visible Light Reflection - Exterior	9%	8%	8%	7%
	Visible Light Reflection - Interior	9%	8%	7%	7%
3.6	Ultraviolet Rejection	99.9%	99.9%	99.9%	99.9%
3.7	Infrared Rejection*	97%	97%	97%	97%
3.8	Luminous Efficacy	1.4	1.3	1.1	1.0
3.9	Shading Coefficient Coefficient - 90 degrees (normal incidence)	0.58	0.54	0.50	0.46
3.9.1	Total Solar Energy Rejected -90 degrees (normal incidence)	50%	53%	56%	60%
3.9.2	TSER - 60 Degree Angle	59%	61%	63%	66%

Note: Performance based upon ¼ clear glass *IR rejection measured from 900-1000nm

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3M™ Window Film Specifications

Specifications For 3M™ Sun Control Window Film Ceramic Series

1.0 Scope

This specification is for an abrasion resistant solar control window film which when applied to the interior window surface will reduce the gain of solar heat energy through the window. The film shall contain a ceramic coating. The film shall be called 3M™ Ceramic Sun Control Window Film _____ [Series or Product Number].

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

The 1997 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-26 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Materials

Window 5.2, A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material: The film material shall be an optically clear ceramic coated polyester film which may be laminated to a clear polyester film. There must be an acrylic abrasion resistant coating over the surface of the film for enhanced durability. The film color is derived from a ceramic coating and the product will not contain dyed polyester. The metallic coating shall be uniform without noticeable pin holes, streaks, thin spots, scratches or banding. The variation in total transmission across the width, at any portion along the length, shall not exceed 2% over the average. The film shall have a nominal thickness of _____ mils (_____ inches). The density of the film across the web is not to exceed plus or minus 2%. There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 Emissivity: The emissivity of the non-adhesive surface of the film shall be 0.78 nominal when measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1997 ASHRAE Handbook of Fundamentals, ch. 29, or Lawrence Berkeley Laboratory Window 5.2 Computer Program available from:
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3M™ Window Film Specifications

Specifications For 3M™ Sun Control Window Film Prestige Series

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be 1.0 nominal when measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible: When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

3.5 Reflection – Visible, Exterior: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

Reflection – Visible, Interior: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

3.6 Rejected – Ultraviolet Light: When applied to 1/4" (6mm) clear glass, the total rejection of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall be 99 % minimum when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

3.7 Luminous Efficacy: When applied to 1/4" (6mm) clear glass, the luminous efficacy (Defined as the ratio of visible light transmission to shading coefficient) shall be _____ Nominal.

3.8 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be _____ nominal (_____ at 60 Degrees) as measured per ASTM E-903 and computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.9 Adhesive System: The film shall be supplied with an optically clear pressure sensitive weather able acrylic adhesive applied uniformly over the surface opposite the abrasion resistant coating.

3.10 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per ASTM E-84.

3.11 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 50 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

Important:

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3M™ Window Film Specifications

Specifications For 3M™ Sun Control Window Film Ceramic Series

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is authorized by the Manufacturer to install window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's ADA Identification Number.

4.3 The ADA will provide a commercial building reference list of ____ (#) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

4.5 Upon request, the ADA will provide an application analysis to determine available energy cost reduction and savings.

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 Materials shall be manufactured by:

3M Renewable Energy Division
3M Center Building 235
St. Paul, MN 55144-1000

5.3 3M RED Point of Contact:

Bill Pettit LEED AP 651-736-1549

6.0 Application

6.1 **Examination:** Examine glass surfaces to receive new film and verify that they are free from defects and imperfections which will affect the final appearance. Correct and/or note all such deficiencies to the owner prior to commencing film application.

6.2 **Preparation:**

- d. The use of protective tarps and/or drop cloths to cover office interior furnishing near the window is a recommended practice.
- e. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminants.
- f. Toweling or other absorbent material shall be placed on the window sill or sash to absorb moisture generated by the film application process.

Important:

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3M™ Window Film Specifications

Specifications For 3M™ Sun Control Window Film Prestige Series

6.3 Installation: The film shall be applied as to the specifications of the Manufacturer by an ADA.

- h. Materials will be delivered to the job site with the manufacturer's labels intact and legible.
- i. Film edges shall be cut neatly and square at a uniform distance of 1/8" (3mm) to 1/16" (1,5mm) of the window sealing device.
- j. Edge Seal – None required. 3M Sun Control Window Film Prestige Series do not contain metals.
- k. Water and film slip solution only will be used on the window glass and adhesive to facilitate the proper positioning of the film.
- l. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- m. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- n. After installation, any left over material and/or debris will be removed and the work area will be returned to original condition. ADA will protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes which could scratch the film must not be used. Synthetic sponges or soft cloths are recommended.

8.0 Warranty

Films Covered: Ceramic 30, Ceramic 40, Ceramic 50.

8.1 The application shall be warranted by the film manufacturer (3M) for a period of ten (10) years in that the film will maintain solar reflective properties without cracking, crazing, delaminating, bubbling, peeling or discoloration. In the event that the product is found to be defective under warranty, the seller will replace such quantity of the film proved to be defective, and will additionally provide the removal and reapplication labor free of charge.

8.2 The film manufacturer (3M) also warrants against glass failure (maximum value \$500 per window) due to thermal shock fracture of glass provided the film is applied to recommended types of glass and the failure occurs within sixty (60) months from the start of application. Any glass failure must be reviewed by the film manufacturer (3M) prior to replacement.

Section	Title	3M Window Films		
		CM30	CM40	CM50
1	Film			
3.1	Thickness (mils)	2.5	2.5	2.5
	(inches)	0.0025	0.0025	0.0025
3.3	U value	1.02	1.03	1.03
3.4	Visible Light Transmission	36%	44%	53%
3.5	Visible Light Reflection - Exterior	17%	14%	12%
	Visible Light Reflection - Interior	15%	12%	10%
3.6	Ultraviolet Rejection	99%	99%	99%
3.7	Shading Coefficient Coefficient - 90 degrees (normal incidence)	0.47	0.54	0.61

Note: Performance based upon ¼ clear glass

Important:

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3M™ Window Film Specifications

Specifications For Sun Control Window Film

1.0 Scope

This specification is for an abrasion resistant solar control window film which when applied to the interior window surface will reduce the gain of solar heat energy through the window. The film shall be called 3M™ Sun Control Window Film _____.

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The 1985 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-90 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Materials

Window 4.0, A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material: The film material shall be an optically clear metallized polyester film which may be laminated to a clear polyester film. There must be an acrylic abrasion resistant coating over the surface of the film for enhanced durability. The film color is derived from a metal coating and the product will not contain dyed polyester. The metallic coating shall be uniform without noticeable pin holes, streaks, thin spots, scratches or banding. The variation in total transmission across the width, at any portion along the length, shall not exceed 2% over the average. The film shall have a nominal thickness of _____ mils (_____ inches). The density of the film across the web is not to exceed plus or minus 2%. There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 Emissivity: The emissivity of the non-adhesive surface of the film shall be _____ nominal when measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1985 ASHRAE Handbook of Fundamentals, ch. 27, or Lawrence Berkeley Laboratory Window 4.0 Computer Program.

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be _____ nominal when measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible: When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

Important:

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3M™ Window Film Specifications

Specifications For Sun Control Window Film

3.5 Reflection - Visible: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

3.6 Transmission - Ultraviolet Light: When applied to 1/4" (6mm) clear glass, the total transmission of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall not exceed _____ when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

3.7 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be _____ nominal when solar energy transmittance and reflection are measured per ASTM E-903 and the shading coefficient is computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.8 Adhesive System: The film shall be supplied with a pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coating. A water soluble detackifier shall be incorporated over the pressure sensitive adhesive to facilitate handling. The adhesive shall be essentially optically flat and shall meet the following criteria: a. Viewing the film from a distance of ten feet (3 m) at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.

3.9 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per ASTM E-84.

3.10 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is certified by the Manufacturer to install window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's 3M I.D. Number.

4.3 The ADA will provide a commercial building reference list of ten (10) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

4.5 Upon request, the ADA will provide an application analysis to determine available energy cost reduction and savings.

Important:

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3M™ Window Film Specifications

Specifications For Sun Control Window Film

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 The Manufacturer will, upon request and pre-approval, provide 100% financing for the complete installation of the window film to the end-user customer in either an installment purchase or lease purchase format to be decided upon by customer.

5.3 Materials shall be manufactured by:

3M Renewable Energy Division
3M Center Building 235
St. Paul, MN 55144-1000

6.0 Application

6.1 **Examination:** Examine glass surfaces to receive new film and verify that they are free from defects and imperfections which will affect the final appearance. Correct all such deficiencies before starting film application.

6.2 **Preparation:**

- a. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminant's.
- b. Toweling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

6.3 **Installation:** The film shall be applied as to the specifications of the Manufacturer by an ADA.

- a. Materials will be delivered to the job site with the manufacturer's labels intact and legible.
- b. To minimize waste, the film will be cut to specification utilizing a vertical dispenser designed for that purpose. Film edges shall be cut neatly and square at a uniform distance of 1/8" (3mm) to 1/16" (1,5mm) of the window sealing device.
- c. Clear, clean water will be used to remove the water soluble overcoat that protects the pressure sensitive adhesive. Water and film slip solution only will be used on the window glass to facilitate the proper positioning of the film.
- d. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- e. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- f. After installation, any left over material will be removed and the work area will be returned to original condition. Use all necessary means to protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes which could scratch the film must not be used. Synthetic sponges or soft cloths are recommended.

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3M™ Window Film Specifications

Specifications For Sun Control Window Film

8.0 Warranty

3M™ Sun Control Window Film Films Covered: Silver P18ARL (P-18ARL), Neutral 20 (RE20NEARL), Neutral 35 (RE35NEARL), Neutral 50 (RE50NEARL), Neutral 70 (RE70NEARL) and Amber 35 (RE35AMARL)

8.1 The application shall be warranted by the film manufacturer (3M) for a period of ten (10) years in that the film will maintain solar reflective properties without cracking, crazing, delaminating, bubbling, peeling or discoloration. In the event that the product is found to be defective under warranty, the seller will replace such quantity of the film proved to be defective, and will additionally provide the removal and reapplication labor free of charge.

8.2 The film manufacturer (3M) also warrants against glass failure due to thermal shock fracture of the glass and/or seal failure of the window unit (maximum value \$500 per window) provided the film is applied to recommended types of glass and the failure occurs within sixty (60) months from the start of application. Any glass failure or seal failure must be reviewed by the film manufacturer (3M) prior to replacement.

Section	Title	3M Window Films			
		P18	Amber35	Neutral 20	Neutral 35
1	Film				
3.1	Thickness (mils)	1.5	1.5	1.5	1.5
	(inches)	0.0015	0.0015	0.0015	0.0015
3.3	U value	0.93	0.85	0.99	0.99
3.4	Visible Light Transmission	17%	30%	15%	36%
3.5	Visible Light Reflection - Exterior	56%	54%	21%	20%
	Visible Light Reflection - Interior	58%	60%	19%	18%
3.6	Ultraviolet Rejection	99%	99%	99%	99%
3.7	Shading Coefficient Coefficient - 90 degrees (normal incidence)	0.26	0.29	0.44	0.51

Section	Title	3M Window Films	
		Neutral 50	Neutral 70
1	Film		
3.1	Thickness (mils)	1.5	1.5
	(inches)	0.0015	0.0015
3.3	U value	1.03	1.03
3.4	Visible Light Transmission	52%	69%
3.5	Visible Light Reflection - Exterior	12%	9%
	Visible Light Reflection - Interior	11%	8%
3.6	Ultraviolet Rejection	98%	98%
3.7	Shading Coefficient Coefficient - 90 degrees (normal incidence)	0.64	0.78

Note: Values on 1/4" Clear Glass

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3M™ Window Film Specifications

Specifications For Exterior Sun Control Window Film

1.0 Scope

This specification is for an abrasion resistant solar control window film which when applied to the exterior window surface will reduce the gain of solar heat energy through the window. The film shall be called 3M™ Sun Control Window Film _____.

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The 1985 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-90 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Materials

Window 4.0, A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material: The film material shall be an optically clear metallized polyester film which may be laminated to a clear polyester film. There must be an acrylic abrasion resistant coating over the surface of the film for enhanced durability. The film color is derived from a metal coating and the product will not contain dyed polyester. The metallic coating shall be uniform without noticeable pin holes, streaks, thin spots, scratches or banding. The variation in total transmission across the width, at any portion along the length, shall not exceed 2% over the average. The film shall have a nominal thickness of _____ mils (_____ inches). The density of the film across the web is not to exceed plus or minus 2%. There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 Emissivity: The emissivity of the non-adhesive surface of the film shall be _____ nominal when measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1985 ASHRAE Handbook of Fundamentals, ch. 27, or Lawrence Berkeley Laboratory Window 4.0 Computer Program.

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be _____ nominal when measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible: When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

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3M™ Window Film Specifications

Specifications For Exterior Sun Control Window Film

3.5 Reflection - Visible: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

3.6 Transmission - Ultraviolet Light When applied to 1/4" (6mm) clear glass, the total transmission of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall not exceed _____ when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

3.7 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be _____ nominal when solar energy transmittance and reflection are measured per ASTM E-903 and the shading coefficient is computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.8 Adhesive System: The film shall be supplied with a pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coating. A water soluble detackifier shall be incorporated over the pressure sensitive adhesive to facilitate handling. The adhesive shall be essentially optically flat and shall meet the following criteria: a. Viewing the film from a distance of ten feet (3 m) at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.

3.9 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per ASTM E-84.

3.10 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is certified by the Manufacturer to install window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's 3M I.D. Number.

4.3 The ADA will provide a commercial building reference list of ten (10) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

4.5 Upon request, the ADA will provide an application analysis to determine available energy cost reduction and savings.

Important:

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3M™ Window Film Specifications

Specifications For Exterior Sun Control Window Film

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 The Manufacturer will, upon request and pre-approval, provide 100% financing for the complete installation of the window film to the end-user customer in either an installment purchase or lease purchase format to be decided upon by customer.

5.3 Materials shall be manufactured by:

3M Renewable Energy Division
3M Center Building 235
St. Paul, MN 55144-1000

6.0 Application

6.1 **Examination:** Examine glass surfaces to receive new film and verify that they are free from defects and imperfections which will affect the final appearance. Correct all such deficiencies before starting film application.

6.2 **Preparation:**

- a. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminant's.
- b. Toweling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

6.3 **Installation:** The film shall be applied as to the specifications of the Manufacturer by an ADA.

- a. Materials will be delivered to the job site with the manufacturer's labels intact and legible.
- b. To minimize waste, the film will be cut to specification utilizing a vertical dispenser designed for that purpose. Film edges shall be cut neatly and square at a uniform distance of 1/8" (3mm) to 1/16" (1,5mm) of the window sealing device.
- c. Clear, clean water will be used to remove the water soluble overcoat that protects the pressure sensitive adhesive. Water and film slip solution only will be used on the window glass to facilitate the proper positioning of the film.
- d. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- e. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- f. After installation, any left over material will be removed and the work area will be returned to original condition. Use all necessary means to protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes which could scratch the film must not be used. Synthetic sponges or soft cloths are recommended.

Important:

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3M™ Window Film Specifications

Specifications For Exterior Sun Control Window Film

8.0 Warranty

3M™ Sun Control Window Film Films Covered: Silver P18ARL (P-18ARL), Neutral 20 (RE20NEARL), Neutral 35 (RE35NEARL), Neutral 50 (RE50NEARL), Neutral 70 (RE70NEARL) and Amber 35 (RE35AMARL)

8.1 The application shall be warranted by the film manufacturer (3M) for a period of ten (10) years in that the film will maintain solar reflective properties without cracking, crazing, delaminating, bubbling, peeling or discoloration. In the event that the product is found to be defective under warranty, the seller will replace such quantity of the film proved to be defective, and will additionally provide the removal and reapplication labor free of charge.

8.2 The film manufacturer (3M) also warrants against glass failure due to thermal shock fracture of the glass and/or seal failure of the window unit (maximum value \$500 per window) provided the film is applied to recommended types of glass and the failure occurs within sixty (60) months from the start of application. Any glass failure or seal failure must be reviewed by the film manufacturer (3M) prior to replacement.

Section	Title	3M Window Films			
		Silver 15 External	Bronze 20 External	Neutral 35 External	Silver 35 External
1	Film				
3.1	Thickness (mils) (inches)	1.5 0.0015	1.5 0.0015	1.5 0.0015	1.5 0.0015
3.3	U value	1.02	1.02	1.02	1.02
3.4	Visible Light Transmission	17%	23%	44%	35%
3.5	Visible Light Reflection - Exterior	61%	32%	10%	35%
	Visible Light Reflection - Interior	56%	33%	13%	36%
3.6	Ultraviolet Rejection	99%	99%	99%	99%
3.7	Shading Coefficient Coefficient - 90 degrees (normal incidence)	0.22	0.25	0.56	0.41

Note: Values on 1/4" Clear Glass

Important:

The information provided in this report is believed to be reliable; however, due to the wide variety of intervening factors, 3M does not warrant that the results will necessarily be obtained. All details concerning product specifications and terms of sale are available from 3M.



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3M™ Window Film

Specifications

Specifications For 3M Sun Control Window Films Night Vision Series

1.0 Scope

This specification is for an abrasion resistant solar control window film which when applied to the interior window surface will reduce the gain of solar heat energy through the window. The film shall be called 3M™ Sun Control Window Film Night Vision.

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The 1985 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-90 Standard Practice for Performing Accelerated Outdoor Weatherizing for Nonmetallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Materials

Window 4.0, A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material: The film material shall be an optically clear metallized polyester film which may be laminated to a clear polyester film. There must be an acrylic abrasion resistant coating over the surface of the film for enhanced durability. The film color is derived from a metal coating and the product will not contain dyed polyester. The metallic coating shall be uniform without noticeable pin holes, streaks, thin spots, scratches or banding. The variation in total transmission across the width, at any portion along the length, shall not exceed 2% over the average. The film shall have a nominal thickness of _____ mils (_____ inches). The density of the film across the web is not to exceed plus or minus 2%. There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 The emissivity of the non-adhesive surface of the film shall be _____ nominal when measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1985 ASHRAE Handbook of Fundamentals, ch. 27, or Lawrence Berkeley Laboratory Window 4.0 Computer Program.

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be _____ nominal when measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible: When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

3.5 Reflection - Visible: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

3.6 Transmission - Ultraviolet Light: When applied to 1/4" (6mm) clear glass, the total transmission of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall not exceed _____ when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

Important:

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3M™ Window Film Specifications

Specifications For 3M Sun Control Window Films Night Vision Series

3.7 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be ____ nominal when solar energy transmittance and reflection are measured per ASTM E-903 and the shading coefficient is computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.8 Adhesive System: The film shall be supplied with a pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coating. A water soluble detackifier shall be incorporated over the pressure sensitive adhesive to facilitate handling. The adhesive shall be essentially optically flat and shall meet the following criteria: a. Viewing the film from a distance of ten feet (3 m) at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.

3.9 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per ASTM E-84.

3.10 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is certified by the Manufacturer to install window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's 3M I.D. Number. 4.3 The ADA will provide a commercial building reference list of ten (10) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

4.5 Upon request, the ADA will provide an application analysis to determine available energy cost reduction and savings.

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 The Manufacturer will, upon request and pre-approval, provide 100% financing for the complete installation of the window film to the end-user customer in either an installment purchase or lease purchase format to be decided upon by customer.

5.3 Materials shall be manufactured by:

3M Renewable Energy Division
3M Center, Building 235
St. Paul, MN 55144-1000

Important:

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3M™ Window Film

Specifications

Specifications For 3M Sun Control Window Films Night Vision Series

6.0 Application

6.1 Examination: Examine glass surfaces to receive new film and verify that they are free from defects and imperfections which will affect the final appearance. Correct all such deficiencies before starting film application.

6.2 Preparation:

- a. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminant's.
- b. Toweling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

6.3 Installation: The film shall be applied as to the specifications of the Manufacturer by an ADA.

- a. Materials will be delivered to the job site with the manufacturer's labels intact and legible.
- b. To minimize waste, the film will be cut to specification utilizing a vertical dispenser designed for that purpose. Film edges shall be cut neatly and square at a uniform distance of 1/8" (3mm) to 1/16" (1,5mm) of the window sealing device.
- c. Clear, clean water will be used to remove the water soluble overcoat that protects the pressure sensitive adhesive. Water and film slip solution only will be used on the window glass to facilitate the proper positioning of the film.
- d. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- e. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- f. After installation, any left over material will be removed and the work area will be returned to original condition. Use all necessary means to protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes which could scratch the film must not be used. Synthetic sponges or soft cloths are recommended.

8.0 Warranty

3M Sun Control Window Films Covered: NV-15, NV-25, and NV-35

8.1 The application shall be warranted by the film manufacturer (3M) for a period of ten (10) years in that the film will maintain solar reflective properties without cracking, crazing, delaminating, bubbling, peeling or discoloration. In the event that the product is found to be defective under warranty, the seller will replace such quantity of the film proved to be defective, and will additionally provide the removal and reapplication labor free of charge.

8.2 The film manufacturer (3M) also warrants against glass failure due to thermal shock fracture of the glass and/or seal failure of the window unit (maximum value \$500 per window) provided the film is applied to recommended types of glass and the failure occurs within sixty (60) months from the start of application. Any glass failure or seal failure must be reviewed by the film manufacturer (3M) prior to replacement.

Section	Title	3M Window Films		
		NV15	NV25	NV35
1	Film			
3.1	Thickness (mils)	2.5	2.5	2.5
	(inches)	0.0025	0.0025	0.0025
3.3	U value	0.98	1.00	1.03
3.4	Visible Light Transmission	15%	24%	36%
3.5	Visible Light Reflection - Exterior	39%	20%	13%
	Visible Light Reflection - Interior	11%	7%	7%
3.6	Ultraviolet Rejection	99%	99%	99%
3.7	Shading Coefficient Coefficient - 90 degrees (normal incidence)	0.33	0.46	0.56

Note All values on 1/4" clear glass

Important:

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3M™ Window Film Specifications

Specifications For 3M Sun Control Window Film Low E

1.0 Scope

This specification is for an abrasion resistant Low E window film which when applied to the interior window surface will retard the flow of heat energy through the window. The film shall be called 3M™ Sun Control Window Film Low E.

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The 1985 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-90 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Material

Window 4.0, A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material: The film material shall be an optically clear metallized polyester film laminated to a clear polypropylene film with a durable acrylic abrasion resistant coating over the polypropylene film which will provide a low emissivity surface. The film color is derived from a metal coating and the product will not contain dyed polyester. The metallic coating shall be uniform without noticeable pinholes, streaks, thin spots, scratches or banding. The film shall have a nominal thickness of ____ mils (____ inches). The density of the film across the web is not to exceed plus or minus 2%. There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 Emissivity: The emissivity of the non-adhesive surface of the film shall be ____ nominal when measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1985 ASHRAE Handbook of Fundamentals, ch. 27, or Lawrence Berkeley Laboratory Window 4.0 Computer Program.

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be ____ nominal when measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible: When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be ____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

3.5 Reflection - Visible: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be ____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight

3.6 Transmission - Ultraviolet Light: When applied to 1/4" (6mm) clear glass, the total transmission of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall not exceed ____ when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

Important:

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3M™ Window Film Specifications

Specifications For 3M Sun Control Window Film Low E

3.7 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be _____ nominal when solar energy transmittance and reflection are measured per ASTM E-903 and the shading coefficient is computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.8 Adhesive System: The film shall be supplied with a pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the low emissivity surface. A water soluble detackifier shall be incorporated over the pressure sensitive adhesive to facilitate handling. The adhesive shall be essentially optically flat and shall meet the following criteria:

- a. Viewing the film from a distance of ten feet (3 m) at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.
- b. It shall not be necessary to seal around the edges of the applied film system with a lacquer or other substance in order to prevent moisture or free water from penetrating under the film system.

3.9 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per ASTM E-84.

3.10 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film has a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted scattered light and haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is certified by the Manufacturer to install window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's 3M I.D. Number.

4.3 The ADA will provide a commercial building reference list of ten (10) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

4.5 Upon request, the ADA will provide an application analysis to determine available energy cost reduction and savings.

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 The Manufacturer will, upon request and pre-approval, provide 100% financing for the complete installation of the window film to the end-user customer in either an installment purchase or lease purchase format to be decided upon by customer.

5.3 Materials shall be manufactured by:

3M Renewable Energy Division
3M Center, Building 235
St. Paul, MN 55144-1000

Important:

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3M™ Window Film Specifications

Specifications For 3M Sun Control Window Film Low E

6.0 Application

6.1 **Examination:** Examine glass surfaces to receive new film and verify that they are free from defects and imperfections which will affect the final appearance. Correct all such deficiencies before starting film application.

6.2 Preparation:

- a. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminant's.
- b. Toweling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

6.3 Installation:

The film shall be applied as to the specifications of the Manufacturer by an ADA.

- a. Materials will be delivered to the job site with the manufacturer's labels intact and legible
- b. To minimize waste, the film will be cut to specification utilizing a vertical dispenser designed for that purpose. Film edges shall be cut neatly and square at a uniform distance of 1/8" to 1/16" of the window sealing device.
- c. Clear, clean water will be used to remove the water soluble overcoat that protects the pressure sensitive adhesive. Water and film slip solution only will be used on the window glass to facilitate the proper positioning of the film.
- d. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- e. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- f. After installation, any left over material will be removed and the work area will be returned to original condition. Use all necessary means to protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes which could scratch the film must not be used. Synthetic sponges or soft cloths are recommended.

8.0 Warranty

8.1 The application shall be warranted by the film manufacturer (3M) for a period of five (5) years in that the film will maintain solar reflective properties without cracking, crazing, delaminating, bubbling or peeling. In the event that the product is found to be defective under warranty, the seller will replace such quantity of the film proved to be defective, and will additionally provide the removal and reapplication labor free of charge.

8.2 The film manufacturer (3M) also warrants against glass failure due to thermal shock fracture of the glass and/or seal failure of the window unit (maximum value \$500 per window) provided the film is applied to recommended types of glass and the failure occurs within sixty (60) months from the start of application. Any glass failure or seal failure must be reviewed by the film manufacturer (3M) prior to replacement.

Section	Title	3M Window Films
1	Film	Amber LowE 35
3.1	Thickness (mils)	1.5
	(inches)	0.0015
3.3	U value	0.76
3.4	Visible Light Transmission	30%
3.5	Visible Light Reflection - Exterior	52%
	Visible Light Reflection - Interior	56%
3.6	Ultraviolet Rejection	99%
3.7	Shading Coefficient Coefficient - 90 degrees (normal incidence)	0.28

Note: All values on 1/4" clear glass

Important:

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3M™ Window Film Specifications

Specifications For 3M Color-Stable Window Film

1.0 Scope

This specification is for an abrasion resistant solar control window film which when applied to the interior window surface will reduce the gain of solar heat energy through the window. The film shall be called 3M Sun Control Window Film Color-Stable_____.

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The 1985 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-90 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Materials

Window 4.0, A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material: The film material shall be an optically clear metallized polyester film which may be laminated to a clear polyester film. There must be an acrylic abrasion resistant coating over the surface of the film for enhanced durability. The film color is derived from a metal coating and the product will not contain dyed polyester. The metallic coating shall be uniform without noticeable pin holes, streaks, thin spots, scratches or banding. The variation in total transmission across the width, at any portion along the length, shall not exceed 2% over the average. The film shall have a nominal thickness of _____ mils (_____ inches). The density of the film across the web is not to exceed plus or minus 2%. There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 Emissivity: The emissivity of the non-adhesive surface of the film shall be _____ nominal when measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1985 ASHRAE Handbook of Fundamentals, ch. 27, or Lawrence Berkeley Laboratory Window 4.0 Computer Program.

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be _____ nominal when measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible:When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

3.5 Reflection - Visible:When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be _____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

3.6 Transmission - Ultraviolet Light: When applied to 1/4" (6mm) clear glass, the total transmission of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall not exceed _____ when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

Important:

The information provided in this report is believed to be reliable; however, due to the wide variety of intervening factors, 3M does not warrant that the results will necessarily be obtained. All details concerning product specifications and terms of sale are available from 3M.



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3M™ Window Film Specifications

Specifications For 3M Color-Stable Window Film

3.7 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be _____ nominal when solar energy transmittance and reflection are measured per ASTM E-903 and the shading coefficient is computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.8 Adhesive System: The film shall be supplied with a pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coating. A water soluble detackifier shall be incorporated over the pressure sensitive adhesive to facilitate handling. The adhesive shall be essentially optically flat and shall meet the following criteria:

- a. Viewing the film from a distance of ten feet (3 m) at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.

3.9 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per ASTM E-84.

3.10 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is certified by the Manufacturer to install window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's 3M I.D. Number.

4.3 The ADA will provide a commercial building reference list of ten (10) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

4.5 Upon request, the ADA will provide an application analysis to determine available energy cost reduction and savings.

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 The Manufacturer will, upon request and pre-approval, provide 100% financing for the complete installation of the window film to the end-user customer in either an installment purchase or lease purchase format to be decided upon by customer.

5.3 Materials shall be manufactured by:

3M Renewable Energy Division
3M Center, Building 223-02-S-24
St. Paul, MN 55144-1000

Important:

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04/08 DMR #

3M™ Window Film Specifications

Specifications For 3M Color-Stable Window Film

6.0 Application

6.1 Examination: Examine glass surfaces to receive new film and verify that they are free from defects and imperfections which will affect the final appearance. Correct all such deficiencies before starting film application.

6.2 Preparation:

- a. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminant's.
- b. Toweling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

6.3 Installation: The film shall be applied as to the specifications of the Manufacturer by an ADA.

- a. Materials will be delivered to the job site with the manufacturer's labels intact and legible.
- b. To minimize waste, the film will be cut to specification utilizing a vertical dispenser designed for that purpose. Film edges shall be cut neatly and square at a uniform distance of 1/8" (3mm) to 1/16" (1,5mm) of the window sealing device.
- c. Clear, clean water will be used to remove the water soluble overcoat that protects the pressure sensitive adhesive. Water and film slip solution only will be used on the window glass to facilitate the proper positioning of the film.
- d. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- e. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- f. After installation, any left over material will be removed and the work area will be returned to original condition. Use all necessary means to protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes which could scratch the film must not be used. Synthetic sponges or soft cloths are recommended.

8.0 Warranty

8.1 The application shall be warranted by the film manufacturer (3M) for a period of ten (10) years in that the film will maintain solar reflective properties without cracking, crazing, delaminating or peeling. Film manufacturer also warrants that SPCS films will not fade or discolor for a period of ten (10) years after installation. In the event that the product is found to be defective under warranty, the seller will replace such quantity of the film proved to be defective, and will additionally provide the removal and reapplication labor free of charge.

8.2 The film manufacturer (3M) also warrants against glass failure due to thermal shock fracture of the glass and/or seal failure of the window unit (maximum value \$500 per window) provided the film is applied to recommended types of glass and the failure occurs within sixty (60) months from the start of application. Any glass failure or seal failure must be reviewed by the film manufacturer (3M) prior to replacement.

Section Title	3M Window Films			
	CS5	CS20	CS35	CS50
1 Film				
3.1 Thickness (mils)	2.5	2.5	2.5	2.5
(inches)	0.0025	0.0025	0.0025	0.0025
3.3 U value	1.03	1.03	1.03	1.03
3.4 Visible Light Transmission	9%	19%	39%	52%
3.5 Visible Light Reflection - Exterior	5%	5%	5%	5%
Visible Light Reflection - Interior	4%	5%	6%	7%
3.6 Ultraviolet Rejection	99%	99%	98%	98%
3.7 Shading Coefficient Coefficient - 90 degrees (normal incidence)	0.49	0.57	0.69	0.75

Note: All values on 1/4" clear glass

Important:

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3M™ Window Film

Specifications

Specifications For 3M Safety and Security Window Film Ultra Series

1.0 Scope

This specification is for a shatter resistant and abrasion resistant window film which when applied to the interior window surface will help hold broken glass together and reduce the ultra-violet light that normally would enter through the window. Sun Control types additionally will provide heat and glare reduction. The film shall be called 3M™ Safety and Security Window Film Ultra Series.

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The 1985 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American National Standards Institute (ANSI).

ANSI Z97 Specification for Safety Glazing Material used in Buildings

Sec 5.1 Impact Test: 100-ft/lb. minimum

Sec 5.3 Intensified Weathering

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-90 Standard Practice for Performing Accelerated Outdoor Weathering for Non-metallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Materials
- ASTM D-1004 Standard Method of Test for Resistance of Transparent Plastics to Tearing (Graves Tear Test)
- ASTM F-1642-96 Standard Method of Test for Glazing and Glazing Systems Subject to Airblast Loadings, as adapted by the U.S. Government GSA Test Standard Protocols

The Consumer Products Safety Commission (CPSC) CFR16, Part 1201 Safety Standards for Architectural Glazing Material

Impact Performance

Accelerated Weathering

Window 4.1. A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material - Clear: The film material shall consist of an optically clear micro-layered polyester film (Ultra S150 (SCLARL150)), laminated to another clear micro-layered polyester film (Ultra S400 (SCLARL400)), and again laminated to a third micro-layered polyester film (ULTRA600), with a durable acrylic abrasion resistant coating over the surface. The film color is clear and will not contain dyed polyester. The film shall have a nominal thickness of ____ mils (____ inches). There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

Or

3.1 Film Material - Sun Control: The film material shall consist of an optically clear multi-layered polyester film laminated to a metallized multi-layered polyester film (Ultra Silver S20 (S20SIAR400), Ultra Neutral S35 (S35NEAR400), Ultra Neutral S50 (S50NEAR400)), with a durable acrylic abrasion resistant coating over the surface. The film color is derived from the metal coating and the product will not contain dyed polyester. The metallic coating shall be uniform without noticeable pinholes, streaks, thin spots, scratches or banding. The film shall have a nominal thickness of ____ mils (____ inches). There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

Important:

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3M™ Window Film

Specifications

Specifications For 3M Safety and Security Window Film Ultra Series

3.1 Film Material - Ultra Night Vision: The film material shall consist of an optically clear multilayered polyester film laminated to a metallized multi-layered polyester film. Another film layer is added for color and performance (Ultra Night Vision S25 (S25NVAR400)), with a durable acrylic abrasion resistant coating over the surface. The film color is derived from the metal coating and additional layer and is stable. The metallic coating shall be uniform without noticeable pinholes, streaks, thin spots, scratches or banding. The film shall have a nominal thickness of ____ mils (____ inches). There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 Emissivity: The emissivity of the non-adhesive surface of the film shall be ____ nominal when measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1985 ASHRAE Handbook of Fundamentals, Ch. 27., or Lawrence Berkeley Laboratory Window 4.0 Computer Program.

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be ____ nominal when measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible: When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be ____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

3.5 Reflection - Visible: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be ____ nominal when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

3.6 Transmission - Ultraviolet Light: When applied to 1/4" (6mm) clear glass, the total transmission of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall not exceed ____ when measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

3.7 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be ____ nominal when solar energy transmittance and reflection are measured per ASTM E-903 and the shading coefficient is computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.8 Adhesive System: The film shall be supplied with a high mass pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coated surface. A water soluble detackifier shall be incorporated over the pressure sensitive adhesive to facilitate handling. The adhesive shall be essentially optically flat and shall meet the following criteria:

- a. Viewing the film from a distance of ten feet at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.
- b. It shall not be necessary to seal around the edges of the applied film system with a lacquer or other substance in order to prevent moisture or free water from penetrating under the film system.

3.9 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoked Development Values per ASTM E-84.

3.10 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

3.11 Tear Resistance: The film shall meet a minimum tear resistance value of ____ (lbs. x %) when measured in accordance with ASTM D-1004 (Graves Area Tear Test) at 20 inches/minute (508 mm/minute).

3.12 Safety Glazing: The film, when applied to either side of the window glass, shall pass a ____ ft/lb. impact when tested according to CPSC CFR16, Part 1201 and shall pass the accelerated weathering test requirements for both tensile strength and peel strength.

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3M™ Window Film

Specifications

Specifications For 3M Safety and Security Window Film Ultra Series

3.13 Large Scale Explosive Blast Testing: The film, when applied to 1/4-inch (6 mm) glass shall meet a minimum performance level of 3 when open-air blast tested to a minimum of 4.0 PSI with 25/msp peak-over pressure and tested according to GSA Test Standard Protocols. This is an adaptation of ASTM F1642-96.

3.14 Tensile Strength: The film shall have an average tensile strength of 30,000 PSI when tested in accordance with ASTM D882-95a.

3.15 Young's Modulus (PSI): The film shall have a Young's Modulus of no greater than 500,000 PSI when tested in accordance with ASTM D-882-95a

3.16 PPT (Puncture Propagation Tear): The film shall have an average PPT value of _____ lbs. when tested in accordance with ASTM D-2582-93.

3.17 Elongation: The film shall have an average elongation of 140% when tested in accordance with ASTM D-2582-95a.

3.18 Break Strength (1 inch per width): The film shall have average break strength of 30 lbs. per mil of film thickness.

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is certified by the Manufacturer of the window film to install said window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's 3M ID Number.

4.3 The ADA will provide a commercial building reference list of ten (10) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

4.5 Upon request, the ADA will provide an application analysis to determine available energy cost reduction and savings.

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 The Manufacturer will, upon request and pre-approval, provide 100% financing for the complete installation of the window film to the end-user customer in either an installment purchase or lease purchase format to be decided upon by customer.

5.3 Materials shall be manufactured by:

3M Renewable Energy Division
3M Center, Building 235
St. Paul, MN 55144-1000

6.0 Application

6.1 Examination: Examine glass surfaces to receive new film and verify that they are free from defects and imperfections, which will affect the final appearance. Correct all such deficiencies before starting film application.

Important:

The information provided in this report is believed to be reliable; however, due to the wide variety of intervening factors, 3M does not warrant that the results will necessarily be obtained. All details concerning product specifications and terms of sale are available from 3M.



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3M™ Window Film

Specifications

Specifications For 3M Safety and Security Window Film Ultra Series

6.2 Preparation:

- a. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminant's.
- b. Toweling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

6.3 Installation: The film shall be applied as to the specifications of the Manufacturer by an ADA.

- a. Materials will be delivered to the job site with the manufacturer's labels intact and legible.
- b. To minimize waste, the film will be cut to specification utilizing a vertical dispenser designed for that purpose. Film edges shall be cut neatly and square at a uniform distance of 1/8" (3 mm) to 1/16" (1.6 mm) of the window-sealing device.
- c. Clear, clean water will be used to remove the water soluble overcoat that protects the pressure sensitive adhesive. Water and film slip solution only will be used on the window glass to facilitate the proper positioning of the film.
- d. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- e. Upon completion, the film shall have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- f. After installation, any left over material will be removed and the work area will be returned to original condition. Use all necessary means to protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes, which could scratch the film, must not be used. Synthetic sponges or soft cloths are recommended.

8.0 Warranty

8.1 The application shall be warranted by the film manufacturer (3M) for a period of ten (10) years in that the film will maintain solar reflective properties without cracking, crazing, delaminating, peeling, or discoloration. In the event that the product is found to be defective under warranty, the film manufacturer (3M) will replace such quantity of the film proved to be defective, and will additionally provide the removal and reapplication labor free of charge.

8.2 The film manufacturer (3M) also warrants against glass failure due to thermal shock fracture of the glass and/or seal failure of the window unit (maximum value \$500 per window) provided the film is applied to recommended types of glass and the failure occurs within sixty (60) months from the start of application. Any glass failure or seal failure must be reviewed by the film manufacturer (3M) prior to replacement.

Title - Clear

	Ultra S150 (SCLARL150)	Ultra S400 (SCLARL400)	Ultra S600 (Ultra600)	
1.0	Scope			
3.1	Thickness (mils) (inches)	2.0 0.0020	4.0 0.0040	6.0 0.0060
3.2	Emissivity	0.87	0.87	0.87
3.3	U Value	1.09	1.09	1.09
3.4	Transmission – Visible	87%	88%	85%
3.5	Reflection – Visible	11%	11%	10%
3.6	Transmission – Ultraviolet	<2%	<2%	<2%
3.7	Shading Coefficient	0.92	0.91	0.90
3.11	Tear Resistance	>350 lbs%	>780 lbs %	>1150 lbs %
3.12	Safety Glazing	150 ft/lbs Category 1	400 ft/lbs Category II	400 ft/lbs Category II
3.13	Air Blast Testing-Minimum Level 3 @ 4.0 PSI	N/A	Yes	Yes
3.14	Tensile Strength	30,000 PSI	30,000 PSI	30,000 PSI
3.15	Young's Modulus	<500k PSI	<500k PSI	<500k PSI
3.16	PPT (Puncture Propagation Tear)	2.0 lbs	7.5 lbs	19.2 lbs
3.17	Elongation	140%	140%	140%
3.18	Break Strength (Per inch width)	60 lbs	120 lbs	180 lbs

Important:

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3M™ Window Film Specifications

Specifications For 3M Safety and Security Window Film Ultra Series

Title – Sun Control

		Ultra Silver S20 (S20SIAR400)	Ultra Neutral S35 (S35NEAR400)	Ultra Neutral S50 (S50NEAR400)	Ultra Night Vision S25 (S25NVAR400)
1.0	Scope				
3.1	Thickness (mils) (inches)	4.0 0.0040	5.0 0.0050	5.0 0.0050	5.0 0.0050
3.2	Emissivity	0.79	0.87	0.87	0.72
3.3	U Value	1.02	1.09	1.09	0.82
3.4	Transmission – Visible	19%	37%	51%	24%
3.5	Reflection – Visible	58%	20%	15%	28%
3.6	Transmission – Ultraviolet	<1%	<1%	<1%	<1%
3.7	Shading Coefficient	0.26	0.51	0.66	0.43
3.11	Tear Resistance	>780 lbs%	>780 lbs %	>780 lbs %	>780 lbs %
3.12	Safety Glazing	400 ft/lbs Category I	400 ft/lbs Category II	400 ft/lbs Category II	400 ft/lbs Category II
3.13	Air Blast Testing-Minimum Level 3 @ 4.0 PSI	Yes	Yes	Yes	Yes
3.14	Tensile Strength	30,000 PSI	30,000 PSI	30,000 PSI	30,000 PSI
3.15	Young's Modulus (PSI)	<500k PSI	<500k PSI	<500k PSI	<500k PSI
3.16	PPT (Puncture Propagation Tear)	7.5 lbs	7.5 lbs	7.5 lbs	7.5 lbs
3.17	Elongation	140%	140%	140%	140%
3.18	Break Strength (Per inch width)	120 lbs	120 lbs	120 lbs	120 lbs

		Ultra PR S50	Ultra PR S70
1.0	Scope		
3.1	Thickness (mils) (inches)	6.0 0.0060	6.0 0.0060
3.2	Emissivity	0.79	0.87
3.3	U Value	1.02	1.00
3.4	Transmission – Visible	50%	68%
3.5	Reflection – Visible	08%	11%
3.6	Transmission – Ultraviolet	<1%	<1%
3.7	Shading Coefficient	0.51	0.58
3.11	Tear Resistance	>780 lbs%	>780 lbs %
3.12	Safety Glazing	400 ft/lbs Category II	400 ft/lbs Category II
3.13	Air Blast Testing-Minimum Level 3 @ 4.0 PSI	Yes	Yes
3.14	Tensile Strength	30,000 PSI	30,000 PSI
3.15	Young's Modulus (PSI)	<500k PSI	<500k PSI
3.16	PPT (Puncture Propagation Tear)	7.5 lbs	7.5 lbs
3.17	Elongation	140%	140%
3.18	Break Strength (Per inch width)	120 lbs	120 lbs

Important:

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3M™ Window Film

Specifications

Specifications For 3M Safety and Security Window Film Safety S70 (SH7CLARL)

1.0 Scope

This specification is for a shatter resistant and abrasion resistant window film which when applied to the interior window surface will help hold broken glass together and reduce the Ultra-violet light that normally would enter through the window. The film shall be called 3M™ Safety and Security Window Film.

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The 1985 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American National Standards Institute (ANSI).

ANSI Z97 Specification for Safety Glazing Material used in Buildings

Sec 5.1 Impact Test: 100-ft/lb. minimum

Sec 5.3 Intensified Weathering

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-90 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Materials
- ASTM D-1004 Standard Method of Test for Resistance of Transparent Plastics to Tearing (Graves Tear Test)
- ASTM F-1642-96 Standard Method of Test for Glazing and Glazing Systems Subject to Airblast Loadings, as adapted by the U.S. Government GSA Test Standard Protocols

The Consumer Products Safety Commission (CPSC)

CFR16, Part 1201 Safety Standards for Architectural Glazing Material

Impact Performance

Window 4.1. A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material - Clear: The film material shall consist of an optically clear polyester film, with a durable acrylic abrasion resistant coating over the surface. The color is clear. The film shall have a nominal thickness of 7 mils (0.007 inches). There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 Emissivity: The emissivity of the non-adhesive surface of the film shall be measured using a Devices & Services Emisometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1985 ASHRAE Handbook of Fundamentals, ch. 27, or Lawrence Berkeley Laboratory Window 4.0 Computer Program.

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible: When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

Important:

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3M™ Window Film

Specifications

Specifications For 3M Safety and Security Window Film Safety S70 (SH7CLARL)

3.5 Reflection - Visible: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

3.6 Transmission - Ultraviolet Light: When applied to 1/4" (6mm) clear glass, the total transmission of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall not exceed measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

3.7 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be measured per ASTM E-903 and the shading coefficient is computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.8 Adhesive System: The film shall be supplied with a high mass pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coated surface. The adhesive shall be essentially optically flat and shall meet the following criteria:

- a. Viewing the film from a distance of ten feet at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.
- b. It shall not be necessary to seal around the edges of the applied film system with a lacquer or other substance in order to prevent moisture or free water from penetrating under the film system.

3.9 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per ASTM E-84.

3.10 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

3.11 Tear Resistance: The film shall meet a minimum tear resistance value of when measured in accordance with ASTM D-1004 (Graves Area Tear Test) at 20 inches/minute (508 mm/minute).

3.12 Safety Glazing: The film, when applied to either side of the window glass, shall pass a 400 ft/lb. impact when tested according to CPSC CFR16, Part 1201 and shall pass the accelerated weathering test requirements for both tensile strength and peel strength.

3.13 Large Scale Explosive Blast Testing: The film, when applied to 1/4-inch (6mm) glass shall meet a minimum performance level of 3 when open-air blast tested to a minimum of 4.0 PSI with 25/msp peak-over pressure and tested according to GSA Test Standard Protocols. This is an adaptation of ASTM F1642-96.

3.14 Tensile Strength: The film shall have an average tensile strength of 25,000 PSI when tested in accordance with ASTM D882-95a.

3.15 Elongation: The film shall have an average elongation of 130% when tested in accordance with ASTM D882-95a.

3.16 Break Strength (1 inch per width): The film shall have an average break strength of 25 lbs. per mil of film thickness.

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is certified by the Manufacturer of the window film to install said window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's 3M I.D. Number.

Important:

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3M™ Window Film

Specifications

Specifications For 3M Safety and Security Window Film Safety S70 (SH7CLARL)

4.3 The ADA will provide a commercial building reference list of ten (10) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 The Manufacturer will, upon request and pre-approval, provide 100% financing for the complete installation of the window film to the end-user customer in either an installment purchase or lease purchase format to be decided upon by customer.

5.3 Materials shall be manufactured by:

3M Renewable Energy Division
3M Center, Building 235
St. Paul, MN 55144-1000

6.0 Application

6.1 **Examination:** Examine glass surfaces to receive new film and verify that they are free from defects and imperfections which will affect the final appearance. Correct all such deficiencies before starting film application.

6.2 **Preparation:**

- a. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminant's.
- b. Toweling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

6.3 **Installation:** The film shall be applied as to the specifications of the Manufacturer by an ADA.

- a. Materials will be delivered to the job site with the manufacturer's labels intact and legible.
- b. To minimize waste, the film will be cut to specification utilizing a vertical dispenser designed for that purpose. Film edges shall be cut neatly and square at a uniform distance of 1/8" (3mm) to 1/16" (1.6mm) of the window-sealing device.
- c. Clear, clean water will be used to remove the water soluble overcoat that protects the pressure sensitive adhesive. Water and film slip solution only will be used on the window glass to facilitate the proper positioning of the film.
- d. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- e. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- f. After installation, any left over material will be removed and the work area will be returned to original condition. Use all necessary means to protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes, which could scratch the film, must not be used. Synthetic sponges or soft cloths are recommended.

Important:

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3M™ Window Film Specifications

Specifications For 3M Safety and Security Window Film

Safety S70 (SH7CLARL)

1 Thickness

- Base film (mils) 7.0 (inches) 0.007
- Applied product 7.8

2 Emissivity 0.89

3 U Value 1.04

4 Transmission

- Visible 85%
- Solar 75%

5 Reflection

- Visible 10%
- Solar 12%

6 Transmission - Ultraviolet <2%

7 Shading Coefficient 0.91

8 Tear Resistance N/A

9 Safety Glazing

- ANSI Z97.1 400 ft/lbs.
- CPSC Category II 400 ft/lbs

10 Tensile Strength 25,000 PSI

11 Elongation 130%

12 Break Strength (Per inch width) 175 lbs.

13 Surface burn: Class A interior use

14 Large Scale Explosive open air blast test per GSA Security Criteria at 4 psi blast load

- Daylite level 3
- 4 side mechanical level 3
- 4 side Ultraflex level 3

Important:

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3M™ Window Film Specifications

Specifications For 3M Safety and Security Window Film Safety S80 (SH8CLARL)

1.0 Scope

This specification is for a shatter resistant and abrasion resistant window film which when applied to the interior window surface will help hold broken glass together and reduce the Ultra-violet light that normally would enter through the window. The film shall be called 3M™ Safety and Security Window Film.

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The 1985 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American National Standards Institute (ANSI).

ANSI Z97 Specification for Safety Glazing Material used in Buildings

Sec 5.1 Impact Test: 100-ft/lb. minimum

Sec 5.3 Intensified Weathering

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-90 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Materials
- ASTM D-1004 Standard Method of Test for Resistance of Transparent Plastics to Tearing (Graves Tear Test)
- ASTM F-1642-96 Standard Method of Test for Glazing and Glazing Systems Subject to Airblast Loadings, as adapted by the U.S. Government GSA Test Standard Protocols

The Consumer Products Safety Commission (CPSC)

CFR16, Part 1201 Safety Standards for Architectural Glazing Material

Impact Performance

Window 4.1. A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material - Clear: The film material shall consist of an optically clear polyester film, with a durable acrylic abrasion resistant coating over the surface. The color is clear. The film shall have a nominal thickness of 8 mils (0.008 inches). There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 Emissivity: The emissivity of the non-adhesive surface of the film shall be measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1985 ASHRAE Handbook of Fundamentals, ch. 27, or Lawrence Berkeley Laboratory Window 4.0 Computer Program.

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible: When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

Important:

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3M™ Window Film

Specifications

Specifications For 3M Safety and Security Window Film Safety S80 (SH8CLARL)

3.5 Reflection - Visible: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

3.6 Transmission - Ultraviolet Light: When applied to 1/4" (6mm) clear glass, the total transmission of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall not exceed measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

3.7 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be measured per ASTM E-903 and the shading coefficient is computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.8 Adhesive System: The film shall be supplied with a high mass pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coated surface. The adhesive shall be essentially optically flat and shall meet the following criteria:

- a. Viewing the film from a distance of ten feet at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.
- b. It shall not be necessary to seal around the edges of the applied film system with a lacquer or other substance in order to prevent moisture or free water from penetrating under the film system.

3.9 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per ASTM E-84.

3.10 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

3.11 Tear Resistance: The film shall meet a minimum tear resistance value of when measured in accordance with ASTM D-1004 (Graves Area Tear Test) at 20 inches/minute (508 mm/minute).

3.12 Safety Glazing: The film, when applied to either side of the window glass, shall pass a 400 ft/lb. impact when tested according to CPSC CFR16, Part 1201 and shall pass the accelerated weathering test requirements for both tensile strength and peel strength.

3.13 Large Scale Explosive Blast Testing: The film, when applied to 1/4-inch (6mm) glass shall meet a minimum performance level of 3 when open-air blast tested to a minimum of 4.0 PSI with 25/msp peak-over pressure and tested according to GSA Test Standard Protocols. This is an adaptation of ASTM F1642-96.

3.14 Tensile Strength: The film shall have an average tensile strength of 25,000 PSI when tested in accordance with ASTM D882-95a.

3.15 Elongation: The film shall have an average elongation of 130% when tested in accordance with ASTM D882-95a.

3.16 Break Strength (1 inch per width): The film shall have an average break strength of 25 lbs. per mil of film thickness.

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is certified by the Manufacturer of the window film to install said window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's 3M I.D. Number.

Important:

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3M™ Window Film

Specifications For 3M Safety and Security Window Film Safety S80 (SH8CLARL)

4.3 The ADA will provide a commercial building reference list of ten (10) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 The Manufacturer will, upon request and pre-approval, provide 100% financing for the complete installation of the window film to the end-user customer in either an installment purchase or lease purchase format to be decided upon by customer.

5.3 Materials shall be manufactured by:

3M Renewable Energy Division
3M Center, Building 235
St. Paul, MN 55144-1000

6.0 Application

6.1 **Examination:** Examine glass surfaces to receive new film and verify that they are free from defects and imperfections which will affect the final appearance. Correct all such deficiencies before starting film application.

6.2 **Preparation:**

- a. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminant's.
- b. Toweling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

6.3 **Installation:** The film shall be applied as to the specifications of the Manufacturer by an ADA.

- a. Materials will be delivered to the job site with the manufacturer's labels intact and legible.
- b. To minimize waste, the film will be cut to specification utilizing a vertical dispenser designed for that purpose. Film edges shall be cut neatly and square at a uniform distance of 1/8" (3mm) to 1/16" (1.6mm) of the window-sealing device.
- c. Clear, clean water will be used to remove the water soluble overcoat that protects the pressure sensitive adhesive. Water and film slip solution only will be used on the window glass to facilitate the proper positioning of the film.
- d. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- e. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- f. After installation, any left over material will be removed and the work area will be returned to original condition. Use all necessary means to protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes, which could scratch the film, must not be used. Synthetic sponges or soft cloths are recommended.

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3M™ Window Film

Specifications For 3M Safety and Security Window Film Safety S80 (SH8CLARL)

8.0 Warranty

8.1 In that the film will maintain solar reflective properties without cracking, crazing, delaminating peeling or discoloration. In the event that the product is found to be defective under warranty, the film manufacturer (3M) will replace such quantity of the film proved to be defective. The application shall be warranted by the film manufacturer (3M) for a period of ten (10) years additionally provide the removal and reapplication labor free of charge.

Safety S80 (SH8CLARL)

1 Thickness

- Base film (mils) 8.0 (inches) 0.008
- Applied product 8.9

2 Emissivity 0.89

3 U Value 1.04

4 Transmission

- Visible 84%
- Solar 74%

5 Reflection

- Visible 10%
- Solar 12%

6 Transmission - Ultraviolet <2%

7 Shading Coefficient 0.91

8 Tear Resistance N/A

9 Safety Glazing

ANSI Z97.1 400 ft/lbs., CPSC Category II 400 ft/lbs

10 Tensile Strength 25,000 PSI

11 Elongation 130%

12 Break Strength (Per inch width) 200 lbs.

13 Surface burn: Class A interior use

14 Large Scale Explosive open air blast test per GSA Security Criteria at 4 psi blast load

- Day-lite level 3
- 4 side mechanical level 3
- 4 side Ultraflex level 3

Important:

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3M™ Window Film

Specifications

Specifications For 3M Safety and Security Window Film Safety S140 (SH14CLARL)

1.0 Scope

This specification is for a shatter resistant and abrasion resistant window film which when applied to the interior window surface will help hold broken glass together and reduce the Ultra-violet light that normally would enter through the window. The film shall be called 3M™ Safety and Security Window Film.

2.0 Applicable Documents

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The 1985 American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

The American National Standards Institute (ANSI).

ANSI Z97 Specification for Safety Glazing Material used in Buildings

Sec 5.1 Impact Test: 100-ft/lb. minimum

Sec 5.3 Intensified Weathering

The American Society for Testing and Materials (ASTM) publication:

- ASTM E-308 Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
- ASTM E-903 Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres
- ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)
- ASTM G-90 Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight
- ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Materials
- ASTM D-1004 Standard Method of Test for Resistance of Transparent Plastics to Tearing (Graves Tear Test)
- ASTM F-1642-96 Standard Method of Test for Glazing and Glazing Systems Subject to Airblast Loadings, as adapted by the U.S. Government GSA Test Standard Protocols

The Consumer Products Safety Commission (CPSC)

CFR16, Part 1201 Safety Standards for Architectural Glazing Material

Impact Performance

Window 4.1. A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory

3.0 Requirements of the Film

3.1 Film Material - Clear: The film material shall consist of an optically clear polyester film, with a durable acrylic abrasion resistant coating over the surface. The color is clear. The film shall have a nominal thickness of 14 mils (0.014 inches). There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin (hereafter to be called Manufacturer).

3.2 Emissivity: The emissivity of the non-adhesive surface of the film shall be measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1985 ASHRAE Handbook of Fundamentals, ch. 27, or Lawrence Berkeley Laboratory Window 4.0 Computer Program.

3.3 U Value: The U Value of the film applied to 1/4" (6mm) clear glass shall be measured in accordance with test procedures described in 3.2 for Emissivity.

3.4 Transmission - Visible: When applied to 1/4" (6mm) clear glass, the luminous transmittance shall be measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard Source "C" for average daylight.

Important:

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3M™ Window Film Specifications

Specifications For 3M Safety and Security Window Film Safety S140 (SH14CLARL)

3.5 Reflection - Visible: When applied to 1/4" (6mm) clear glass, the total luminous reflection from the glass surface shall be measured with an integrating sphere spectrophotometer as referenced by ASTM E-903 and calculated per ASTM E-308 using Standard CIE Source "C" for average daylight.

3.6 Transmission - Ultraviolet Light: When applied to 1/4" (6mm) clear glass, the total transmission of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall not exceed measured with an integrating sphere spectrophotometer as referenced by ASTM E-903.

3.7 Shading Coefficient: When applied to 1/4" (6mm) clear glass, the shading coefficient shall be measured per ASTM E-903 and the shading coefficient is computed in accordance with the established procedures defined by The ASHRAE Handbook of Fundamentals.

3.8 Adhesive System: The film shall be supplied with a high mass pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coated surface. The adhesive shall be essentially optically flat and shall meet the following criteria:

- a. Viewing the film from a distance of ten feet at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.
- b. It shall not be necessary to seal around the edges of the applied film system with a lacquer or other substance in order to prevent moisture or free water from penetrating under the film system.

3.9 Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per ASTM E-84.

3.10 Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

3.11 Tear Resistance: The film shall meet a minimum tear resistance value of when measured in accordance with ASTM D-1004 (Graves Area Tear Test) at 20 inches/minute (508 mm/minute).

3.12 Safety Glazing: The film, when applied to either side of the window glass, shall pass a 400 ft/lb. impact when tested according to CPSC CFR16, Part 1201 and shall pass the accelerated weathering test requirements for both tensile strength and peel strength.

3.13 Large Scale Explosive Blast Testing: The film, when applied to 1/4-inch (6mm) glass shall meet a minimum performance level of 3 when open-air blast tested to a minimum of 4.0 PSI with 25/msp peak-over pressure and tested according to GSA Test Standard Protocols. This is an adaptation of ASTM F1642-96.

3.14 Tensile Strength: The film shall have an average tensile strength of 25,000 PSI when tested in accordance with ASTM D882-95a.

3.15 Elongation: The film shall have an average elongation of 130% when tested in accordance with ASTM D882-95a.

3.16 Break Strength (1 inch per width): The film shall have an average break strength of 25 lbs. per mil of film thickness.

4.0 Requirements of the Authorized Dealer/Applicator (ADA)

4.1 The ADA shall provide documentation that the ADA is certified by the Manufacturer of the window film to install said window film as per the Manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the customer.

4.2 Authorization of dealership may be verified through the company's 3M I.D. Number.

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3M™ Window Film Specifications

Specifications For 3M Safety and Security Window Film Safety S140 (SH14CLARL)

4.3 The ADA will provide a commercial building reference list of ten (10) properties where the ADA has installed window film. This list will include the following information:

- * Name of building
- * The name and telephone number of a management contact
- * Type of glass
- * Type of film
- * Amount of film installed
- * Date of completion

4.4 Upon request, the ADA will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

5.0 Requirements of the Manufacturer

5.1 The Manufacturer will insure proper quality control during production, shipping and inventory, clearly identify and label each film core with the product designation and run number.

5.2 The Manufacturer will, upon request and pre-approval, provide 100% financing for the complete installation of the window film to the end-user customer in either an installment purchase or lease purchase format to be decided upon by customer.

5.3 Materials shall be manufactured by:

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3M Center, Building 235
St. Paul, MN 55144-1000

6.0 Application

6.1 **Examination:** Examine glass surfaces to receive new film and verify that they are free from defects and imperfections which will affect the final appearance. Correct all such deficiencies before starting film application.

6.2 **Preparation:**

- a. The window and window framing will be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminant's.
- b. Towing or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

6.3 **Installation:** The film shall be applied as to the specifications of the Manufacturer by an ADA.

- a. Materials will be delivered to the job site with the manufacturer's labels intact and legible.
- b. To minimize waste, the film will be cut to specification utilizing a vertical dispenser designed for that purpose. Film edges shall be cut neatly and square at a uniform distance of 1/8" (3mm) to 1/16" (1.6mm) of the window-sealing device.
- c. Clear, clean water will be used to remove the water soluble overcoat that protects the pressure sensitive adhesive. Water and film slip solution only will be used on the window glass to facilitate the proper positioning of the film.
- d. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.
- e. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
- f. After installation, any left over material will be removed and the work area will be returned to original condition. Use all necessary means to protect the film before, during and after the installation.

7.0 Cleaning

The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes, which could scratch the film, must not be used. Synthetic sponges or soft cloths are recommended.

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3M™ Window Film Specifications

Specifications For 3M Safety and Security Window Film Safety S140 (SH14CLARL)

Safety S140 (SH14CLARL)

1 Thickness

- Base film (mils) 14.0 (inches) 0.014
- Applied product 14.8

2 Emissivity 0.89

3 U Value 1.04

4 Transmission

- Visible 82%
- Solar 74%

5 Reflection

- Visible 10%
- Solar 12%

6 Transmission - Ultraviolet <2%

7 Shading Coefficient 0.89

8 Tear Resistance N/A

9 Safety Glazing

- ANSI Z97.1 400 ft/lbs.
- CPSC Category II 400 ft/lbs

10 Tensile Strength 25,000 PSI

11 Elongation 130%

12 Break Strength (Per inch width) 350 lbs.

13 Surface burn: Class A interior use

14 Large Scale Explosive open air blast test per GSA Security Criteria at 4 psi blast load

- Day-lite level 3
- 4 side mechanical level 3
- 4 side Ultraflex level 3

Important:

The information provided in this report is believed to be reliable; however, due to the wide variety of intervening factors, 3M does not warrant that the results will necessarily be obtained. All details concerning product specifications and terms of sale are available from 3M.



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3M™ Attachment System Impact Protection Profile Installation Instructions

3M™ Impact Protection Profile improves the overall performance of 3M™ Safety and Security Window Films. This unique window protection system combines the toughness of 3M's patented micro-layer safety film with 3M's world-class expertise in adhesives to help shield against impact energy from severe weather, earthquakes, bomb blasts or forced entry events. The 3M™ Impact Protection System also helps protect against personal injury from flying glass

The IPP product and tool can be obtained only through your 3M Window Film distributor
The following procedure describes the materials and steps that are necessary to install the 3M™ Impact Protection Profile attachment system.

Recommended Products:

- 3M™ Citrus Base Cleaner
- 3M™ Adhesive Remover, Citrus Base
- 3M™ Foaming Glass Cleaner
- 3M™ Super Fine Synthetic Steel Wool Pad
- 3M™ 94 Tape Primer

Window Preparation

Glass panel shall be uniform in appearance. No fractures, holes or what is considered contaminated glass, or damaged glass, to be present.

Window frame to be uniform in appearance and free from dents, holes and cracks within two inches of the glass. A thorough cleaning of the glazing and frame systems before applying film and attachment is required to remove all foreign matter and contaminants such as adhesives, grease, oil, dust, water, surface dirt, old sealant or glazing compounds by using 3M Citrus Base Cleaner, alcohol or commercial cleaning solution. Detergent or soap and water treatments are not recommended for this step.

1. IPP does not require the glazing stop to be trimmed. Note: If the glazing stop overlaps frame, trimming the glazing stop is optional. (Reference Detail 1.)
2. Spray the glazing bead, glass and frame surface with an appropriate cleaning product and remove with a lint free cloth. Repeat if necessary to remove all foreign materials from the glass and inside window frame surfaces. If the area is particularly dirty, a light scrub with a 3M 0000 Super Fine Synthetic Steel Wool Pad is recommended to loosen contaminants. Finish with a final cleaning if needed.
3. Spray the glass with 3M Foaming Glass Cleaner or a soap and water solution. Flush the glazing bead to glass area starting at the top and working down to drain or remove any remaining contaminant from the area. Scrape the glass with a razor to remove all foreign matter. Thoroughly clean the glass a final time with soapy water and a window cleaning squeegee. Wipe around the glazing bead and frame area one final time to remove all of the soap and water solution.

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3M™ Attachment System Impact Protection Profile

Installation Instructions

The 3M Profile application tool is a dual-purpose tool. There are two sides of the tool. Each side has a specific purpose. The guide plate side locates the 3M Profile into position and the roller side provides pressure to completely bond the adhesive to the window and frame.

Make sure areas of the window film and frame are cleaned and primed prior to 3M Profile installation. Use either a citrus-based or a non residue forming window cleaner to clean the film and frame. Allow 5–10 minutes before applying the 3M™ Profile. If glass panel framing is painted (latex, oil, polished or powder coated), 3M™ 94 Tape Primer is required.

Film Installation

1. _Apply the 3M™ Safety & Security Window Film Ultra Series to the glass, making sure that the film is installed as far into the glazing channel as possible. Cut film as you normally would around the remaining glazing bead. Remember to leave enough spacing between film and glazing bead to facilitate the removal of the slip solution.

2. _Squeegee the film to the glass by pressing firmly to remove as much of the slip solution as possible, especially at the edges of the film. Two “edge-drying” methods can be used before applying the Impact Protection attachment system.

A. _The panels can be left for a few weeks to ensure proper drying of the film before the IPP system is applied.

– OR –

B. _Using a hair dryer, gently heat and bump the edges of the film to hasten the removal and drying of the water from the edges. Make sure that all of the soap and water solution has been removed from the

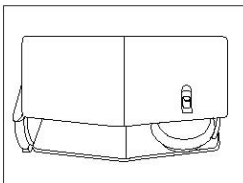


Figure 1

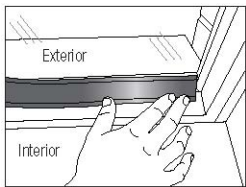


Figure 2

3M Profile Application Procedure

1. _Measure horizontal length of window and cut a piece of the 3M Profile to this length.

2. Remove both liners from 3M Profile and discard.

3. _Position 3M Profile against the window and frame in one corner by hand in the approximate finished position. (Figure 2)

4. _With the guide plate side away from the corner of the window, position the guide plate over the 3M Profile. Make sure to locate the tool so that the sliding surfaces on the guide plate side stay flush against the window and frame. (Figure 3)

5. _Move the tool forward with one hand while holding the free end of the 3M Profile with your other hand. (For best results, hold the 3M Profile in line with the direction you are moving.)

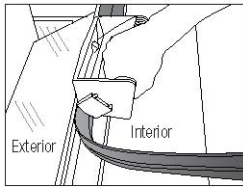
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3M™ Attachment System Impact Protection Profile Installation Instructions

Figure 3



6. _Continue forward until you reach the opposite corner.

7. Observe that the 3M Profile is straight. If not, carefully peel back and reapply taking care to hold the 3M Profile in line with the guide plate as you move forward.

8. _Observe the 3M Profile at the first corner. Since this was applied by hand to start, you may need to peel back a short section of this and run the guide plate side of the tool back toward the first corner to get it straight.

9. _Once you are satisfied that the 3M Profile is straight, turn the tool around so that the roller side is forward. Make sure to locate the tool so that the sliding surfaces on the roller side stay flush against the window and frame. (Figure 4)

10. _Move the tool forward along the 3M Profile while maintaining pressure to keep the sliding surfaces on the roller side of the tool against the window and frame. Go back and forth 2–4 times while maintaining this pressure for complete adhesive bond. (Figure 5)

Note: To press in last 1" of the 3M™ Impact Protection Profile, use a rounded and/or smooth plastic/rubber surface tool.

11. _Repeat steps 1–10 for the opposite side of the window.

12. _Repeat steps 1–10 for both adjacent sides of window. Work from top to bottom. (See separate 3M Profile trimming instructions to fit vertical 3M Profile ends to horizontal 3M Profiles.)

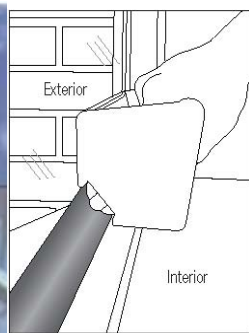
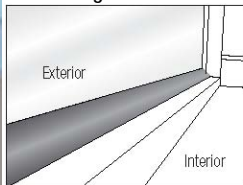


Figure 4

Figure 5



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3M™ Attachment System Impact Protection Adhesive Installation Instructions

IPA tubes and sausages are only available through your 3M Window Film distributor.

The following procedure describes the materials and steps that are necessary to install the 3M™ Impact Protection Adhesive attachment system.

Recommended Products:

- 3M™ Citrus Base Cleaner
- 3M™ Adhesive Remover, Citrus Base
- 3M™ Foaming Glass Cleaner
- 3M™ Super Fine Synthetic Steel Wool Pad
- 3M™ Scotch™ Safe Release™ Masking Tape
- 3M™ Scotch™ Long Mask™ Masking Tape
- 3M™ Impact Protection Adhesive

Window Preparation

Glass panel shall be uniform in appearance. No fractures, holes or what is considered contaminated glass, or damaged glass, to be present.

Window frame to be uniform in appearance and free from dents, holes and cracks within two inches of the glass.

A thorough cleaning of the glazing and frame systems before applying film and attachment is required to remove all foreign matter and contaminants such as adhesives, grease, oil, dust, water, surface dirt, old sealant or glazing compounds by using 3M Citrus Base Cleaner, alcohol or commercial cleaning solution.

Detergent or soap and water treatments are not recommended for this step.

1. IPA does not require the glazing stop to be trimmed. Note: If the glazing stop overlaps frame, trimming the glazing stop is optional. (Reference Detail 1 on back.)
2. Spray the glazing bead, glass and frame surface with an appropriate cleaning product and remove with a lint free cloth. Repeat if necessary to remove all foreign materials from the glass and inside window frame surfaces. If the area is particularly dirty, a light scrub with a 3M 0000 Super Fine Synthetic Steel Wool Pad is recommended to loosen contaminants. Finish with a final cleaning if needed.
3. Spray the glass with 3M Foaming Glass Cleaner or a soap and water solution. Flush the glazing bead to glass area starting at the top and working down to drain or remove any remaining contaminant from the area. Scrape the glass with a razor to remove all foreign matter. Thoroughly clean the glass a final time with soapy water and a window cleaning squeegee. Wipe around the glazing bead and frame area one final time to remove all of the soap and water solution.

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3M™ Impact Protection Adhesive Attachment System Installation Instructions

Film Installation

1. Apply the 3M™ Safety & Security Window Film Ultra Series to the glass, making sure that the film is installed as far into the glazing channel as possible. Cut film as you normally would around the remaining glazing bead. Remember to leave enough spacing between film and glazing bead to facilitate the removal of the slip solution.
2. Squeegee the film to the glass by pressing firmly to remove as much of the slip solution as possible, especially at the edges of the film. Two “edge-drying” methods can be used before applying the Impact Protection attachment system.
 - A. The panels can be left for a few weeks to ensure proper drying of the film before the IPA system is applied.
– OR –
 - B. Using a hair dryer, gently heat and bump the edges of the film to hasten the removal and drying of the water from the edges. Make sure that all of the soap and water solution has been removed from the film/glass/glazing channel before applying the IPA attachment system.

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3M™ Impact Protection Adhesive Attachment System

Installation Instructions

1. Apply a 1" (25mm) strip of 3M™ Scotch™ Safe Release™ White Masking Tape to the Ultra film surface 3/8" (9mm) in from the edge of the film to all four sides. Note: This dimension will depend on application—1/2" or 3/8".
2. Apply a 1" (25mm) strip of 3M Safe Release Blue Masking Tape to the window frame 3/8" (9mm) from the edge of the trimmed gasket. This will form a parallel sealant channel that will allow a uniform sealant bead to be applied to the glass/frame interface. Note: Use a clean drop cloth before proceeding to Step 3.
3. Apply a triangular bead of IPA Impact Protection Adhesive, and tool as needed to form an acceptable finish. Refer to Figure 1. Read and follow all product information and installation instructions provided by 3M Company. We recommend you start in a corner and apply the sealant bead out approximately 6". Then turn the gun and push the sealant bead to the next corner where the same method is repeated. Pushing the sealant bead will insure proper penetration and minimize the chances of air gaps in the bead. Pulling the gun can also be done if confident no air gaps are formed.
4. Smooth the sealant bead with an appropriate tool, if necessary, to give a finished look. Tooling should be completed in one continuous stroke immediately after adhesive application and before a skin forms.
5. Carefully remove the two masking strips from the glass/frame immediately after tooling. Do not allow the excess adhesive to contact the film, frame or flooring surfaces. A light colored drop cloth is needed to protect the work area. Be careful not to step on adhesive and transfer it to surrounding surfaces.

Note: Should you get some of the adhesive on the surrounding surfaces, an application and gentle wipe with a 3M Citrus Based Cleaner is recommended.

Curing time for the IPA will vary depending on temperature and relative humidity. It is not recommended to clean the film/IPA system for at least 36 hours following the installation. Full curing/adhesion can take up to 7 days, depending on conditions.

Property	Test Method Used	Units	3M IPA
Curing Time (25°C (77°F), 50% RH)		Days	3-7
Full Adhesion		Days	7-14
Tack-Free Time (25°C (77°F), 50% RH)	ASTM D5895	minutes	21
Flow, Sag or Slump		Inches	0
Working Time (25°C (77°F), 50% RH)		Minutes	10-20
Specific Gravity		n/a	1.403
VOC content		g/L	16
As Cured — After 21 Days at 25°C (77°F), 50% RH			
Ultimate Tensile Strength	ASTM D0412	psi (Mpa)	380 (2.62)
Ultimate Elongation	ASTM D0412	%	640
Durometer	ASTM D2240	points	38-39
Hardness, Shore A			
Tear Strength, Die B	ASTM D0624	ppi	72

Bomb Blast and Windstorm Testing results available upon request.

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Product Use: Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.

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Limitation of Liability: Except where prohibited by law, 3M will not be liable for any loss or damage arising from the 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

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TERMS AND DEFINITIONS

AAMA

American Architectural Manufacturers Association. A national trade association that establishes voluntary standards for the aluminum window, door, and skylight industry.

ABSORPTANCE

The fraction of incident radiation that is absorbed.

ACRYLIC (Plastic, Plexiglas)

A non crystalline thermoplastic with good weather resistance, shatter resistance, and optical clarity; sometimes used for glazing instead of glass.

ADHESION

The ability or level of a coating or sealant to stick or bond to the surface to which it is applied.

ADHESIVE FAILURE

Failure of a compound by pulling away from the surface with which it is in contact. (See cohesive failure.)

ALLOY

A metal to which another element has been added, generally another metal.

ANNEALED GLASS

Standard sheet or plate glass.

ANNEALING

To heat above the critical or re-crystallization temperature, then controlled cooling of glass or other materials to eliminate the effects of cold-working, relieve internal stresses or improve strength, ductility, or other properties.

ANSI

American National Standards Institute. Clearing house for all types of standards and specifications.

ASHRAE

Abbreviation for the American Society of Heating, Refrigerating and Air-conditioning Engineers.

ASTM

American Society for Testing and Materials. A society of engineers which sets standards for testing of materials.

BOCA

Building Officials and Code Administrators.

BRONZE

An alloy of copper and tin. Also a color.

BTU (British Thermal Unit)

The energy used for heating and cooling is measured by the number of BTUs needed to keep a building at a comfortable temperature. Scientifically, it is the amount of heat energy necessary to raise the temperature of one pound of water one degree Fahrenheit (1 Btu = 252 calories).

CABO

Council of American Building Officials.

CCF

An abbreviation for one hundred cubic feet. A unit of natural gas consumption. Equivalent to 100,000 Btu's (105.5 MJ) of energy or heat.

CLOUDINESS INDEX

The percent of extraterrestrial radiation that reaches the earth surface when measured on a horizontal plane.

COHESIVE FAILURE

Splitting and opening of a compound resulting from over-extension of the compound. (See adhesive failure)

COMPATIBILITY

The ability of two or more materials to exist in close and permanent association for an indefinite period with no adverse effect of one on the other.

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CONDENSATION

When water vapor, which is present in all but the driest air, comes in contact with a surface that is below the “dew point temperature,” the vapor becomes liquid and is called condensation. An example is as follows:

Condensation forms on a glass of ice water since the surface of the glass is down to the dew point temperature of the inside air.

CONDUCTION

Process to heat transfer through a material from a warm surface to a cool surface.

CONDUCTION FACTOR

The difference in the “U-values” before and after film application to glass multiplied by 24 hours/day. This factor is used in calculating heating energy savings.

CONVECTION

Heat transfer by the movement of fluid or air.

COOLING DAYS

The number of days in a year that the air conditioning equipment is used.

COOLING DEGREE-DAY

Cooling and heating engineers have found a way to relate the typical climate conditions of different areas to the amount of energy needed to cool and heat a building. The term is “Degree-Day” using a base temperature of 65°F (18°C). A cooling degree-day is counted for each degree above 65°F (18°C) reached by the average (between the highest and Low Est) daily outside temperatures in the summer. For example, if on a given summer day the high is 90°F (32°C) and the low is 70°F (21 °C), the daily average temperature is 80°F (26°C). This is 15°F (8°C) above the base temperature of 65°F (18°C difference). So, on that day, you would have gone through 15 (8) cooling degree-days.

CORROSION

The deterioration of metal by chemical or electro-chemical reaction resulting from exposure to weathering, moisture, chemicals, or other agents or media.

CRF (Condensation Resistance Factor)

Gives an indication of a window’s ability to resist condensation. The higher the CRF, the less likely condensation is to occur.

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CURTAIN WALL

An exterior building wall which carries no roof or floor loads and consists entirely or principally of metal, or a combination of metal, glass, and other surfacing materials supported by a metal framework. There are two basic types:

CUSTOM: Walls designed specifically for one project, and using parts and details specially made for this purpose.

STANDARD: Walls made up principally of parts and details standardized by their manufacturer and assembled in accord with either the architect’s design or the manufacturer’s stock patterns.

DEGREE-DAY

A unit that represents a 1°F (1°C) deviation from some fixed reference point (usually 65°F [18°C]) in the mean, daily outdoor temperature. (See heating degree-day and cooling degree day)

DESICCANT

An extremely porous crystalline substance used to absorb moisture from within the sealed air space of an insulating glass unit.

DEW POINT

The temperature at which the water vapor condenses to become liquid. Used in testing sealed insulated glass. The Low E_r the number, the higher the resistance to forming condensation.

DOUBLE GLAZING

In general, any use of two panes of glass, separated by an air space, within an opening, to improve insulation against heat transfer and/or sound transmission. In factory-made double glazing units the air between the glass sheets is thoroughly dried and the space is sealed airtight, eliminating possible condensation and providing superior insulating properties. (See sealed insulating glass.)

EDGE CLEARANCE

The distance between the edge of a unit of glass or panel and its surrounding frame, measured normal to the edge in the plane of the glass or panel.

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ELASTICITY

Pliability, ability to take up expansion and contraction; opposite of brittleness.

EMI

An abbreviation for Electromagnetic Interference.

EMISSIVITY

This is a measure of the ability of a surface to emit room temperature radiant heat energy. It is also a measure of the ability of the surface to reflect room radiant energy since, for window systems. The emissivity and the reflectivity of room radiant energy add up to unit. Low emissivity means a high reflectivity of room radiant energy.

EXTERIOR GLAZED

Glass set or installed from the exterior of the building.

FLOAT GLASS

Glass which has its bottom surfaces formed by floating on molten metal, the top surface being gravity formed, producing a high optical quality of glass with parallel surfaces and, without polishing and grinding, the fire-finished brilliance of the finest sheet glass. Float glass is replacing plate glass.

FOGGING

A deposit of contamination left on the inside surface of the sealed insulating glass unit due to extremes of temperatures. Usually happens with failed sealed insulated glass.

GLARE REDUCTION

This is the ratio of the difference in visible transmission of the glass before and after installing film to the visible transmission of the glass with no film. It is expressed as a percentage and is determined by the respective visible transmission values of the glass with and without film.

GLASS

A transparent, brittle substance formed by fusing sand with soda or potash or both; it often has lime, alumina or lead oxide.

GLASS EDGE STRESS

An amount of force in pounds per square inch (psi) (kg/cm²) experienced by the edge of the glass pane.

GLASS THERMAL STRESS

An applied force, caused by absorbed solar heat, that tends to strain or deform glass.

GLAZING

The work of installing glass in a frame.

GLAZING BEAD

A molding or stop around the inside of a frame to hold the glass in place.

GLAZING COMPOUND

A soft dough-like material used for filling and sealing the space between a pane of glass and its surrounding frame.

HEAT GAIN

The transfer of heat from outside to inside. Both heat loss and heat gain are measured in terms of the fuel consumption required to maintain a comfortable indoor temperature.

HEAT LOSS REDUCTION

This is the ratio of the difference in heat loss through the glass after installing film to the heat loss through the glass with no film. It is expressed as a percentage and is determined by the respective "U" values of the glass with and without film.

HEATING DAYS

The number of days in a year that the heating equipment is used.

HEATING DEGREE-DAY

Heating and cooling engineers have found a way to relate the typical climate conditions of different areas to the amount of energy needed to heat and cool a building. The term they use is "Degree-Days" using a base temperature of 65°F (18°C). A heating degree-day is counted for each degree below 65°F (18°C) reached by the average (between the highest and Low Est) daily outside temperatures in the winter. For example, if on a given winter day the high is 40°F (4°C) and the low is 20°F (-6°C), the daily average temperature is 30°F (-1°C). This is 35°F (19°C difference) below the base temperature of 65°F (18°C). So, on that day, you would have gone through 35 (19) heating degree-days.

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HEAT LOSS

The transfer of heat from inside to outside by means of conduction, convection, and radiation through all surfaces of the building.

HEAT STRENGTHENED GLASS

Glass which is reheated, after forming, just below melting point and then cooled. A compressed surface is formed which increases its strength. Often used for spandrel glass.

HERMETICALLY SEALED UNIT

An insulated glass unit made up of two lites of glass, separated by a roll formed aluminum spacer tube (at the full perimeter) which is filled with a moisture absorbing material. The unit is then completely sealed, creating a moisture free, clean, dead air space.

HUMIDITY, RELATIVE

The percentage of moisture in the air in relationship to the amount of moisture the air could hold at that given temperature. 100% relative humidity would be rain.

HVAC

An abbreviation for Heating, Ventilating, and Air Conditioning equipment.

ICBO

International Conference of Building Officials.

INFILTRATION (air)

The movement of outdoor air into the interior of a building through cracks around windows and doors or in walls, roofs, and floors.

INSULATING GLASS

Insulating glass refers to two pieces of glass spaced apart and hermetically sealed to form a single-glazed unit with an air space between. Heat transmission through this type of glass may be as low as half that without such an air space. It is also called Double Glazing.

INTERIOR GLAZED

Glass set from the interior of the building.

INTERIOR STOP

The removable glazing bead that holds the glass in place, when it is on the interior side of the lite, as contrasted to an exterior stop which is located on the exterior side of a glass or panel.

JALOUSIE

The jalousie window is made up of horizontally-mounted louvered glass that abut each other tightly when closed and extend outward when cranked open.

KWH

An abbreviation for kilowatt-hour. A unit of electric power consumption. Equivalent to 3413 Btu's of energy or heat. (1 kWh = 3.60 MJ)

LAMINATED GLASS

Two or more sheets with an inner layer of transparent plastic to which the glass adheres if broken. Used for overhead, safety glazing, and sound reduction.

LITE

Another term for a pane of glass used in a window. Frequently spelled "light" in the industry literature, but spelled "lite". In this text to avoid confusion with light as in "visible light".

LOW-EMISSIVITY GLASS

Glass which restricts the passage to radiant heat, in and out; a metal or metal oxide coating applied to the glass to provide low emissivity.

MAXIMUM HEAT GAIN

The maximum per hour amount of solar heat coming through one square foot of glass. Measured in units of Btu/hr/sq.ft. (W/m²).

MCF

An abbreviation of one thousand cubic feet. A unit of natural gas consumption. Equivalent to 1,000,000 Btu's (37,300 KJ/m³) of energy or heat.

MLB

An abbreviation for one thousand pounds. A unit of steam consumption. Equivalent to 1,000,000 Btu's (2330 kJ/kg) of energy or heat.

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MOISTURE CONTROL

The use of humidifiers, air conditioners, or ventilation to keep the humidity of the home at acceptable levels. Also refers to vapor barriers.

MONOLITHIC

A single piece of glass.

MULLION

An intermediate connecting member used to “marry” two or more windows or patio doors together in a single rough opening without sacrificing air or watertight performance. A mullion also can give added strength to the connection for structural stability.

MUNTINS

A decorative design in cut-ups of glass lites.

1) Painted muntin grids (enamelite) applied to an interior lite of glass in a sealed insulated glass unit to simulate cut-ups of glass lites either in colonial or diamond patterns.

2) Use of aluminum muntin bar between lites of glass in a sealed insulated glass unit to simulate glass cut-ups.

3) Use of actual vertical and horizontal bars to divide windows into smaller lites of glass. The bars are termed muntin bars.

A synthetic rubber having physical properties closely resembling those of natural rubber but not requiring sulphur for vulcanization. Extremely good weather resistance, both heat and cold, with ultraviolet stability.

NOAA

National Oceanic & Atmospheric Administration.

NON-FERROUS METALS

Metals or alloys that are free of iron, such as aluminum.

OBSCURE GLASS

Mainly used for decoration, diffusion, or privacy. The design is pressed into the glass during the rolling process. There are many patterns available.

ORGANIC COATING

A coating such as paint, lacquer, enamel, or plastic film in which the principal ingredients are derived from animal or vegetable matter or from some compound of carbon (which includes all plastics).

Important:

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PASSIVE SOLAR HEAT GAIN

Solar heat that passes through a material and is captured naturally, not by mechanical means. (ex Large windows facing south will take advantage of passive solar heat gain in Northern Hemisphere.)

PAYBACK

Savings from reducing energy cost and seeing this reflected in your heating/cooling bills

PERMEABILITY

The quality of permitting passage of water through openings without causing rupture or displacement

PLATE GLASS

Polished plate glass is a rolled, ground, and polished product with true flat parallel plane surfaces

POLYCARBONATE

Any of a family of thermoplastics characterized by a high softening temperature and high impact strength (Lexan).

POLYSULFIDE

Polysulfide liquid polymers are mercaptan terminated, long chain aliphatic polymers containing disulfide linkages. They can be converted to rubbers at room temperature without shrinkage upon addition of a curing agent. Used for exterior sealant and sealed insulating glass sealant.

PSF

Pounds per square foot (lbs/ft²) (kg/m²)

Abbreviation of pressure notation, used to describe wind pressure, barometric pressure.

PSI

Pounds per square inch - (lbs/in²) (kg/cm²) as above.

PSYCHROMETER

An apparatus used to determine the relative humidity by determining the wet bulb temperature of the air. It is a very accurate means of determining relative humidity.



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RADIATION

Transmission of heat through space by wave motion; passage of heat from one object to another without warming the space between, such as sun light.

REFLECTANCE

The fraction of the incident light that is reflected.

RELATIVE HEAT GAIN

The amount of conduction heat gain plus solar heat gain, measured in terms of energy units per hour per square foot (compare U-Value). (Btu/hr/sq.ft. or W/m²).

RFI

An abbreviation for Radio Frequency Interference.

ROI

Return on investment.

"R" VALUE

A measure of resistance to heat gain or loss (insulative ability). "R"-Values rather than thicknesses can be compared for different materials, since 6" (152mm) of fiberglass (R-19 [R-34]) might compare with 12" (305mm) of wood or 18' (15.5m) to stone. "R"-Value of some common substances of 1" (25mm) thickness:
Concrete 0.1 (0.018) Stucco and brick 1.2 (0.21) Plywood 1 (0.18) Sawdust 2 (0.36) Fiberglass batts 3 (0.54) Polystyrene 6.25 (1.10) Polyurethane foam 7.7 (1.36)

SBCC

Southern Building Code Congress International.

SEALANT

An elastomeric material with adhesive qualities that joins components of a similar to dissimilar nature to provide an effective barrier against the passage of the elements.

SHADING COEFFICIENT

This is a ratio of the solar energy entering through a window compared to that which enters through a window of clear 1/8" (3mm) double strength sheet glass. The solar energy which enters includes both that which is transmitted directly through the window and that portion of the energy absorbed in the window that is transferred to the interior.

SHEET GLASS

A transparent, flat glass whose surface has a characteristic waviness. There are three basic classifications of sheet glass

- 1) Single strength (S.S.): 3/32" (2.4mm) thick.
- 2) Double strength (D.S.): 1/8" (3.2mm) thick.
- 3) Heavy sheet which has three available thicknesses 3/16" (4.8mm), 7/32" (5.6mm), and 1/4" (6.4mm).

SHELF LIFE

The length of time that packaged materials such as adhesives and sealants can be stored under specific temperature conditions and still remain suitable for use.

SIG

(Sealed Insulated Glass) - See insulating glass.

SOLAR ENERGY SPECTRUM

Solar radiation is typically divided into three categories, namely, the ultraviolet, the visible and the near infrared portions of the spectrum. All three portions result in heat when the solar radiation is absorbed. At the earth's surface, approximately 3% of the solar energy is in the ultraviolet portion, 44% is in the visible portion and 53% is in the near infrared.

SOLAR HEAT GAIN

The amount per hour of solar heat coming through a square foot of glass Measured in units of Btu/hr/sqft. (W/m²).

SOLAR HEAT REDUCTION

This is the ratio of the difference in total solar energy entering before and after installing film on the glass to that entering through the glass with no film. It is expressed as a percentage and is determined by the respective shading coefficients of the glass with and without film.

SPANDREL GLASS

Heat-strengthened float glass with a colored-ceramic coating adhered to the back by a heat-fusing process. It has double the strength of annealed glass of the same size and thickness; enabling it to withstand greater uniform loads and

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thermal stresses. Spandrel glass cannot be re-cut after heat strengthening. It is used as fixed opaque colored glass on buildings in front of floor slabs and columns. It is available in a wide array of colors.

SPECTROPHOTOMETER

An instrument for measuring the transmittance and reflectance of surfaces and media as a function of wavelength.

SUNLIGHT

The portion of solar energy which is detectable by the human eye; it accounts for about 44% of the total solar energy. As with heat strengthened glass, it is re-heated to just below the melting point but suddenly cooled. When shattered, it breaks into small pieces. It is approximately five times stronger than standard annealed glass. It must be used as safety glazing in patio doors, entrance doors, side lites, and other hazardous locations. It can't be re-cut after tempering.

TENSILE STRENGTH (Also called ultimate strength)

The breaking strength of a material when subjected to a tensile (stretching) force. Usually measured by placing a standard piece in the jaws of a tensile machine gradually separating the jaws and measuring the stretching force necessary to break the test piece. Tensile strength is commonly expressed as pounds (or tons) per square inch (kg/m²) of original cross sectional area.

THERM

100,000 Btu's (105.5 MJ) to energy or heat.

TINTED GLASS

A mineral admixture is incorporated in the glass, resulting in a degree of tinting. Any tinting reduces both visual and radiant transmittance.

TON-HR

A unit to air conditioning consumption equivalent to 12,000 Btu's (3024kcal) to energy.

TOTAL SOLAR ENERGY

When solar radiant energy strikes the exterior surface of a window, the energy is reflected, absorbed and/or transmitted as defined above. The total of these three parameters must add up to 100%.

TOTAL SOLAR ENERGY ABSORBED

This is a ratio of the solar energy that is absorbed by the window and converted to heat in the window to the total solar energy impinging on the window. It is typically expressed as a percentage.

TOTAL SOLAR ENERGY REFLECTED

This is a ratio to the solar energy that is reflected directly away by the window to the total solar energy impinging on the window. It is typically expressed as a percentage.

TOTAL SOLAR ENERGY TRANSMITTED

This is a ratio to the solar energy that is transmitted directly through the window where it is absorbed by interior surfaces to the total solar energy impinging on the exterior window surface. It is typically expressed as a percentage.

TRIPLE GLAZED

Three panes of glass separated by air spaces.

UBC

Uniform Building Code.

UL

Underwriters Laboratory.

ULTRAVIOLET

The invisible rays to the spectrum which are outside of the visible spectrum at its violet end. UV rays are found in everyday sunlight and can cause fading or chalking to dark paint finishes. Extreme UV exposure can cause certain plastic materials to distort.

NOTE: On the basis to practical applications and the effect obtained, the ultraviolet region often is divided into the following wavelengths:

UV-A 315-400 nanometers

UV-B 280-315 nanometers

UV-C 100-280 nanometers

UV REDUCTION

This is the ratio to the difference in ultraviolet transmission of the glass before and after installing film to the ultraviolet transmission to the glass with no film. It is expressed as a percentage and is determined by the respective UV transmission values in the glass with and without film.

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“U”-VALUE

The measurement used in determining the ability of different structural components (such as windows) to conduct heat. The “U”-Value of a window is measured by the number of Btu's that will pass through each square foot of area per degree of temperature difference ($W/m^2\text{-}^\circ\text{C}$) from one side of the window to the other. “U”-Values can tell you how well your windows will hold in your heated or cooled air. The Lower the number the better.

VISCOSITY

The internal resistance to flow exhibited by a fluid. The higher the number, the thicker the fluid.

VISIBLE LIGHT REFLECTED

Visible light is defined as that portion of the solar energy spectrum under average daylight conditions that is visible to the human eye and the values given are based on the response of the human eye. The ratio of that which is reflected away from the surface of the window to that impinging on it is called the percent of visible light reflected.

VISIBLE LIGHT TRANSMITTED

This is a ratio of the human eye weighted average daylight that is transmitted through the window to that which is incident upon the window.

VISIBLE RADIATION

The spectrum containing radiation with wavelengths in a narrow band from about 400 nanometres (violet) to 750nm (red). At the earth's surface about half the solar energy is in the visible range.

WAVELENGTHS

Wavelength is the distance between two successive points to a periodic wave in the direction to propagation, in which the oscillation has the same phase. The three commonly used units are listed in the following table

Name	Symbol	Value
Micrometer	μm	1 $\mu\text{m} = 10^{-6}$ m
Nanometer	nm	1 nm = 10^{-9} m
Angstrom	Å	1 Å = 10^{-10} m

WINDOW TYPES

AWNING — A partially movable sash hinged at the top, and opening either outwards or inwards.

CASEMENT — A window sash hung by hinges fastened to the jamb to the window frame.

DOUBLE HUNG — Consists to a pair to vertical sliding sash, either sash opening independently of the other. Older type double hung sash operate through a system of weights, springs, or pulleys.

FIXED — A single sash fastened permanently in a frame so that it cannot be raised, Lowered, or swung open.

HOPPER — A partially movable sash hinged at the bottom and opening inwards.

PIVOTED — A sash that swings open or shut by revolving on pivots at either side of the sash or at top and bottom.

SINGLE HUNG — A window frame containing a pair to vertical sliding sashes in which only one sash is movable, usually the Lower in contrast to a double hung sash.

SLIDING — A sash which moves horizontally on a track.

STORM — A full length sash, either fixed or movable, fitted to the outside or inside of a window frame to afford protection during cold or stormy weather.

WIRE GLASS

Polished or clear glass, 1/4- (6mm) thick. Wire mesh is embedded within the glass such that the glass will not shatter when broken. The wire pattern is available in many types. It is frequently used in skylights, overhead glazing, and locations where a fire-retardant glass is required.

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