



Technical Information

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THERMAL STRESS FOR PILKINGTON GLAZING COMBINATIONS

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**THERMAL STRESS FOR PILKINGTON GLASS COMBINATIONS
 INSTALLED IN U.S. AND CANADA**

Summary

The thermal stress for various 1/4" (6mm) thick glass combinations is found, as a percentage of a nominal allowable annealed glass stress, from the following decision trees when the glass types, site location, shadow condition and frame color are known.

The branching trees give the glass stress for the worst environmental condition encountered in normal service conditions as a percentage of a nominal allowable stress level in annealed glass for clean-cut, undamaged edges. When the allowable stress limit is exceeded then that light should typically be heat treated (heat strengthened or tempered) to reduce the probability of breakage to a rate less than a nominal 8 in 1000.

Thermal stress calculations for these and other Pilkington single glazed glasses, or when they are used in combination in an insulating glass unit with many other glass manufacturers products, can be found by running the Thermal Stress Calculator program at:
<http://www.pilkingtoncalculators.com/tsc.php>

Method

(1) Determine the glass type to be evaluated from the Index on pages 1 and 2, and the location type, shadow type and frame color from the following choices:

Location Types: "*Coastal*" includes the area from the sea coast to 100 miles inland and below 3,000 ft. It does not include the U.S. Great Lakes shores.
 "*Inland*" is over 100 miles from the sea coast and up to an altitude of 3,000 ft.
 "*Mountains*" include altitudes above 3,000 ft.

Shadow Types: Shadows are classified as "*None*" (**N**), "*Mobile*" (**M**), or "*Permanent*" (**P**) according to the following table:

Horizontal Depth	1"	2"	3"	4"	20"	30"	40"
Vertical Mullions	N			M	P	M	N
Horizontal Overhang	N	M		P			

Determine the most severe of the two shadow conditions, vertical or horizontal. ("*Mobile*" shadows cause more stress than "*None*", and "*Permanent*" shadows cause more stress than "*Mobile*" shadows).

The horizontal overhead shadows are based on locations between latitudes 20° and 50°.

Frames are made of aluminum and are either "*Light*" e.g. mill finish or clear anodized, or "*Dark*" color e.g. light bronze, or dark bronze.

(2) Proceed across the selected page from left to right, connecting the appropriate glass type, location type, shadow type, and frame color.

(3) Record the resulting percentage of nominal allowable stress for annealed glass.

Notes:

In all cases a conservative approach has been taken: It is assumed that light color blinds (Venetian or similar type) are used, in a lowered and closed position, with a 2" or greater gap between the blind slats and the facing glass.

Thermally broken frames are assumed.

It is assumed that the glass will be properly installed with undamaged, clean cut edges and with no unusual heat traps from insulating drapes, drop ceilings, etc.. HVAC air vents should be directed to blow away from the glass.

The added solar radiation by reflection at inside corners has not been considered in this simplified analysis.

Glass with damaged edges can have thermal fracture before the 100% stress limit is reached; while very high quality, polished edges can increase the allowable stress limit to 120% or more without breakage occurring.

The allowable annealed glass stress levels used in this bulletin are approximate. A stress level of 100% in this bulletin suggests that about 1 in 125 lights is at risk of breakage, while a higher thermal stress level of 200% suggests that about half of the stressed lights may break.

Architectural Technical Services can prepare similar sheets for other glass combinations upon request.

For more accuracy a set of drawings showing location, wall sections, frame type and color, building plan and elevations, and shadow patterns is needed to run an individual computer analysis of an individual project.

Example:

A double glazed sealed unit with second surface 1/4" Pilkington **Eclipse Advantage™** Bronze, #2 surface reflective, and a 1/4" clear inboard light is installed in New York City in a light color frame which projects 3" from the face of the glass at all 4 edges.

Based on the given conditions of a coastal location, a "mobile" shadow from the head of the frame (the mullions give "no shadow"), and a light frame, the resulting stress levels are: 97% and 56%, for the outer and inner light, of the nominal allowable limit for annealed glass. These values for both lights are within the allowable limits for clean-cut, undamaged, annealed glass.

Changing the inner light to Pilkington **Energy Advantage™** Low-E Glass changes the stress levels to 101% and 59%. This may require only the outer light to be heat treated.

Contact Pilkington North America, Inc. Architectural Technical Services, tel: 419 247 4448 for further information.

The information contained in this bulletin is offered for assistance in the application of Pilkington North America Inc. flat glass products, but **IT DOES NOT CONSTITUTE A WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.** Actual performance may vary in particular applications

Percent of Nominal Allowable Stress for Annealed Glass (See Notes on p.4 for details)

Outer Light	Glazing	Inner Light	Location	Shadow Color	Frame					
					Outer	Inner				
SINGLE GLAZED 1/4" Clear BLINDS:: Light color Venetian Closed			Coastal	None	Dark	35%				
			Coastal	None	Light	37%				
			Coastal	Mobile	Dark	38%				
			Coastal	Mobile	Light	41%				
			Coastal	Permanent	Dark	45%				
			Coastal	Permanent	Light	48%				
			Inland	None	Dark	36%				
			Inland	None	Light	38%				
			Inland	Mobile	Dark	40%				
			Inland	Mobile	Light	43%				
			Inland	Permanent	Dark	47%				
			Inland	Permanent	Light	50%				
			Mountain	None	Dark	37%				
			Mountain	None	Light	40%				
			Mountain	Mobile	Dark	41%				
			Mountain	Mobile	Light	44%				
			Mountain	Permanent	Dark	49%				
			Mountain	Permanent	Light	52%				
			DOUBLE GLAZED IG 1/4" Clear BLINDS: Light color Venetian Closed		1/4" Clear	Coastal	None	Dark	38%	43%
						Coastal	None	Light	40%	46%
Coastal	Mobile	Dark				42%	48%			
Coastal	Mobile	Light				45%	51%			
Coastal	Permanent	Dark				49%	56%			
Coastal	Permanent	Light				52%	60%			
Inland	None	Dark				40%	46%			
Inland	None	Light				43%	49%			
Inland	Mobile	Dark				45%	51%			
Inland	Mobile	Light				48%	55%			
Inland	Permanent	Dark				53%	60%			
Inland	Permanent	Light				56%	64%			
Mountain	None	Dark				43%	49%			
Mountain	None	Light				46%	52%			
Mountain	Mobile	Dark				48%	55%			
Mountain	Mobile	Light				51%	58%			
Mountain	Permanent	Dark				56%	64%			
Mountain	Permanent	Light				60%	68%			
DOUBLE GLAZED IG 1/4" Clear BLINDS: Light color Venetian Closed		1/4" Pilkington Energy Advantage™ Low-E Glass#3 surface				Coastal	None	Dark	42%	50%
						Coastal	None	Light	44%	53%
			Coastal	Mobile	Dark	46%	55%			
			Coastal	Mobile	Light	49%	59%			
			Coastal	Permanent	Dark	54%	65%			
			Coastal	Permanent	Light	58%	69%			
			Inland	None	Dark	45%	54%			
			Inland	None	Light	48%	57%			
			Inland	Mobile	Dark	50%	60%			
			Inland	Mobile	Light	53%	64%			
			Inland	Permanent	Dark	58%	70%			
			Inland	Permanent	Light	62%	75%			
			Mountain	None	Dark	48%	58%			
			Mountain	None	Light	51%	62%			
			Mountain	Mobile	Dark	53%	64%			
			Mountain	Mobile	Light	57%	69%			
			Mountain	Permanent	Dark	62%	75%			
			Mountain	Permanent	Light	66%	80%			

Percent of Annealed Glass Nominal Allowable Stress

GLAZING		LOCATION	SHADOW	FRAME COLOR	Outer	Inner
Outer Light	Inner Light					
SINGLE GLAZED		Coastal	None	Dark	60%	
6 mm Pilkington Optifloat™		Coastal	None	Light	64%	
Blue-Green, Green or Bronze		Coastal	Mobile	Dark	66%	
BLINDS:		Coastal	Mobile	Light	71%	
Light Venetian		Coastal	Permanent	Dark	78%	
Closed		Coastal	Permanent	Light	83%	
		Inland	None	Dark	64%	
		Inland	None	Light	68%	
		Inland	Mobile	Dark	71%	
		Inland	Mobile	Light	76%	
		Inland	Permanent	Dark	83%	
		Inland	Permanent	Light	89%	
		Mountain	None	Dark	69%	
		Mountain	None	Light	73%	
		Mountain	Mobile	Dark	76%	
		Mountain	Mobile	Light	81%	
		Mountain	Permanent	Dark	89%	
		Mountain	Permanent	Light	95%	
DOUBLE GLAZED IG		Coastal	None	Dark	71%	55%
6 mm Pilkington Optifloat™		Coastal	None	Light	75%	59%
Blue-Green, Green or Bronze		Coastal	Mobile	Dark	78%	62%
BLINDS		Coastal	Mobile	Light	84%	66%
Light Venetian		Coastal	Permanent	Dark	92%	72%
Closed		Coastal	Permanent	Light	98%	77%
		Inland	None	Dark	77%	60%
		Inland	None	Light	82%	64%
		Inland	Mobile	Dark	86%	67%
		Inland	Mobile	Light	91%	71%
		Inland	Permanent	Dark	100%	78%
		Inland	Permanent	Light	107%	83%
		Mountain	None	Dark	84%	65%
		Mountain	None	Light	90%	69%
		Mountain	Mobile	Dark	93%	72%
		Mountain	Mobile	Light	100%	76%
		Mountain	Permanent	Dark	109%	84%
		Mountain	Permanent	Light	117%	89%
DOUBLE GLAZED IG		Coastal	None	Dark	79%	53%
6 mm Pilkington Optifloat™		Coastal	None	Light	84%	56%
Blue-Green, Green or Bronze		Coastal	Mobile	Dark	87%	59%
BLINDS		Coastal	Mobile	Light	93%	63%
Light Venetian		Coastal	Permanent	Dark	102%	69%
Closed		Coastal	Permanent	Light	109%	73%
		Inland	None	Dark	86%	57%
		Inland	None	Light	92%	61%
		Inland	Mobile	Dark	96%	63%
		Inland	Mobile	Light	102%	68%
		Inland	Permanent	Dark	112%	74%
		Inland	Permanent	Light	119%	79%
		Mountain	None	Dark	94%	62%
		Mountain	None	Light	100%	66%
		Mountain	Mobile	Dark	104%	68%
		Mountain	Mobile	Light	111%	73%
		Mountain	Permanent	Dark	122%	80%
		Mountain	Permanent	Light	130%	85%

Percent of Nominal Allowable Stress for Annealed Glass (See Notes on p.4 for details)

Glazing		Location	Shadow	Frame	Outer	Inner
Outer Light	Inner Light			Color		
SINGLE GLAZED		Coastal	None	Dark	63%	
1/4" Pilkington Optifloat™ Grey		Coastal	None	Light	67%	
BLINDS::		Coastal	Mobile	Dark	70%	
Light color Venetian		Coastal	Mobile	Light	74%	
Closed		Coastal	Permanent	Dark	81%	
		Coastal	Permanent	Light	87%	
		Inland	None	Dark	67%	
		Inland	None	Light	72%	
		Inland	Mobile	Dark	75%	
		Inland	Mobile	Light	80%	
		Inland	Permanent	Dark	88%	
		Inland	Permanent	Light	94%	
		Mountain	None	Dark	72%	
		Mountain	None	Light	77%	
		Mountain	Mobile	Dark	80%	
		Mountain	Mobile	Light	86%	
		Mountain	Permanent	Dark	94%	
		Mountain	Permanent	Light	100%	
DOUBLE GLAZED IG		Coastal	None	Dark	74%	57%
1/4" Pilkington Optifloat™ Grey		Coastal	None	Light	79%	61%
		Coastal	Mobile	Dark	82%	63%
BLINDS:		Coastal	Mobile	Light	88%	67%
Light color Venetian		Coastal	Permanent	Dark	97%	74%
Closed		Coastal	Permanent	Light	103%	79%
		Inland	None	Dark	81%	61%
		Inland	None	Light	87%	65%
		Inland	Mobile	Dark	90%	68%
		Inland	Mobile	Light	96%	73%
		Inland	Permanent	Dark	106%	80%
		Inland	Permanent	Light	113%	85%
		Mountain	None	Dark	89%	66%
		Mountain	None	Light	95%	71%
		Mountain	Mobile	Dark	99%	73%
		Mountain	Mobile	Light	105%	78%
		Mountain	Permanent	Dark	115%	86%
		Mountain	Permanent	Light	123%	92%
DOUBLE GLAZED IG		Coastal	None	Dark	83%	53%
1/4" Pilkington Optifloat™ Grey		Coastal	None	Light	89%	56%
		Coastal	Mobile	Dark	92%	59%
BLINDS:		Coastal	Mobile	Light	98%	63%
Light color Venetian		Coastal	Permanent	Dark	108%	69%
Closed		Coastal	Permanent	Light	115%	73%
		Inland	None	Dark	91%	57%
		Inland	None	Light	97%	61%
		Inland	Mobile	Dark	101%	64%
		Inland	Mobile	Light	108%	68%
		Inland	Permanent	Dark	118%	74%
		Inland	Permanent	Light	126%	79%
		Mountain	None	Dark	99%	62%
		Mountain	None	Light	106%	66%
		Mountain	Mobile	Dark	110%	68%
		Mountain	Mobile	Light	118%	73%
		Mountain	Permanent	Dark	129%	80%
		Mountain	Permanent	Light	138%	86%

Percent of Nominal Allowable Stress for Annealed Glass (See Notes on p.4 for details)

Glazing		Location	Shadow	Color	Outer	Inner
Outer Light	Inner Light					
SINGLE GLAZED		Coastal	None	Dark	68%	
1/4" Pilkington Arctic Blue™		Coastal	None	Light	72%	
or 1/4" Pilkington EverGreen™		Coastal	Mobile	Dark	75%	
BLINDS::		Coastal	Mobile	Light	80%	
Light color Venetian		Coastal	Permanent	Dark	88%	
Closed		Coastal	Permanent	Light	94%	
		Inland	None	Dark	73%	
		Inland	None	Light	78%	
		Inland	Mobile	Dark	81%	
		Inland	Mobile	Light	87%	
		Inland	Permanent	Dark	95%	
		Inland	Permanent	Light	102%	
		Mountain	None	Dark	79%	
		Mountain	None	Light	84%	
		Mountain	Mobile	Dark	88%	
		Mountain	Mobile	Light	93%	
		Mountain	Permanent	Dark	103%	
		Mountain	Permanent	Light	109%	
DOUBLE GLAZED IG		Coastal	None	Dark	81%	59%
1/4" Pilkington Arctic Blue™		Coastal	None	Light	86%	63%
or 1/4" Pilkington EverGreen™		Coastal	Mobile	Dark	90%	66%
BLINDS:		Coastal	Mobile	Light	96%	70%
Light color Venetian		Coastal	Permanent	Dark	105%	77%
Closed		Coastal	Permanent	Light	112%	82%
		Inland	None	Dark	89%	64%
		Inland	None	Light	95%	68%
		Inland	Mobile	Dark	99%	71%
		Inland	Mobile	Light	105%	76%
		Inland	Permanent	Dark	115%	83%
		Inland	Permanent	Light	123%	89%
		Mountain	None	Dark	97%	69%
		Mountain	None	Light	103%	74%
		Mountain	Mobile	Dark	108%	77%
		Mountain	Mobile	Light	115%	82%
		Mountain	Permanent	Dark	126%	90%
		Mountain	Permanent	Light	134%	96%
DOUBLE GLAZED IG		Coastal	None	Dark	90%	53%
1/4" Pilkington Arctic Blue™		Coastal	None	Light	96%	57%
or 1/4" Pilkington EverGreen™		Coastal	Mobile	Dark	100%	59%
BLINDS:		Coastal	Mobile	Light	107%	63%
Light color Venetian		Coastal	Permanent	Dark	117%	69%
Closed		Coastal	Permanent	Light	125%	74%
		Inland	None	Dark	99%	58%
		Inland	None	Light	106%	61%
		Inland	Mobile	Dark	110%	64%
		Inland	Mobile	Light	117%	68%
		Inland	Permanent	Dark	129%	75%
		Inland	Permanent	Light	138%	80%
		Mountain	None	Dark	108%	62%
		Mountain	None	Light	116%	66%
		Mountain	Mobile	Dark	120%	69%
		Mountain	Mobile	Light	128%	74%
		Mountain	Permanent	Dark	141%	81%
		Mountain	Permanent	Light	150%	86%

Percent of Nominal Allowable Stress for Annealed Glass (See Notes on p.4 for details)

Glazing		Location	Shadow	Color	Outer	Inner
Outer Light	Inner Light					
SINGLE GLAZED		Coastal	None	Dark	89%	
1/4" Pilkington SuperGrey™		Coastal	None	Light	95%	
BLINDS::		Coastal	Mobile	Dark	99%	
Light color Venetian		Coastal	Mobile	Light	106%	
Closed		Coastal	Permanent	Dark	116%	
		Coastal	Permanent	Light	124%	
		Inland	None	Dark	97%	
		Inland	None	Light	104%	
		Inland	Mobile	Dark	108%	
		Inland	Mobile	Light	115%	
		Inland	Permanent	Dark	126%	
		Inland	Permanent	Light	135%	
		Mountain	None	Dark	105%	
		Mountain	None	Light	112%	
		Mountain	Mobile	Dark	117%	
		Mountain	Mobile	Light	125%	
		Mountain	Permanent	Dark	137%	
		Mountain	Permanent	Light	146%	
DOUBLE GLAZED IG		Coastal	None	Dark	107%	68%
1/4" Pilkington SuperGrey™		Coastal	None	Light	114%	73%
BLINDS::		Coastal	Mobile	Dark	119%	76%
Light color Venetian		Coastal	Mobile	Light	127%	81%
Closed		Coastal	Permanent	Dark	139%	89%
		Coastal	Permanent	Light	148%	95%
		Inland	None	Dark	118%	74%
		Inland	None	Light	126%	79%
		Inland	Mobile	Dark	131%	83%
		Inland	Mobile	Light	140%	88%
		Inland	Permanent	Dark	153%	97%
		Inland	Permanent	Light	164%	103%
		Mountain	None	Dark	129%	81%
		Mountain	None	Light	138%	86%
		Mountain	Mobile	Dark	144%	90%
		Mountain	Mobile	Light	153%	96%
		Mountain	Permanent	Dark	168%	105%
		Mountain	Permanent	Light	179%	112%
DOUBLE GLAZED IG		Coastal	None	Dark	118%	54%
1/4" Pilkington SuperGrey™		Coastal	None	Light	126%	58%
BLINDS::		Coastal	Mobile	Dark	131%	60%
Light color Venetian		Coastal	Mobile	Light	140%	64%
Closed		Coastal	Permanent	Dark	154%	71%
		Coastal	Permanent	Light	164%	75%
		Inland	None	Dark	131%	59%
		Inland	None	Light	140%	63%
		Inland	Mobile	Dark	145%	65%
		Inland	Mobile	Light	155%	70%
		Inland	Permanent	Dark	170%	77%
		Inland	Permanent	Light	181%	82%
		Mountain	None	Dark	144%	64%
		Mountain	None	Light	153%	68%
		Mountain	Mobile	Dark	159%	71%
		Mountain	Mobile	Light	170%	75%
		Mountain	Permanent	Dark	187%	83%
		Mountain	Permanent	Light	199%	88%

Percent of Nominal Allowable Stress for Annealed Glass (See Notes on p.4 for details)

Outer Light	Glazing	Inner Light	Location	Shadow	Frame Color	Outer	Inner	
SINGLE GLAZED 1/4" Pilkington Eclipse Advantage™ #2 Blue-Green or Bronze BLINDS:: Light color Venetian Closed			Coastal	None	Dark	79%		
			Coastal	None	Light	84%		
			Coastal	Mobile	Dark	87%		
			Coastal	Mobile	Light	93%		
			Coastal	Permanent	Dark	102%		
			Coastal	Permanent	Light	109%		
			Inland	None	Dark	85%		
			Inland	None	Light	91%		
			Inland	Mobile	Dark	94%		
			Inland	Mobile	Light	101%		
			Inland	Permanent	Dark	111%		
			Inland	Permanent	Light	118%		
			Mountain	None	Dark	92%		
			Mountain	None	Light	98%		
			Mountain	Mobile	Dark	102%		
			Mountain	Mobile	Light	109%		
			Mountain	Permanent	Dark	119%		
			Mountain	Permanent	Light	127%		
	DOUBLE GLAZED IG 1/4" Pilkington Eclipse Advantage™ #2 Blue-Green or Bronze BLINDS: Light color Venetian Closed		1/4" Clear	Coastal	None	Dark	82%	47%
				Coastal	None	Light	87%	50%
			Coastal	Mobile	Dark	91%	52%	
			Coastal	Mobile	Light	97%	56%	
			Coastal	Permanent	Dark	107%	61%	
			Coastal	Permanent	Light	114%	65%	
			Inland	None	Dark	90%	51%	
			Inland	None	Light	96%	54%	
			Inland	Mobile	Dark	100%	56%	
			Inland	Mobile	Light	106%	60%	
			Inland	Permanent	Dark	117%	66%	
			Inland	Permanent	Light	125%	70%	
			Mountain	None	Dark	98%	54%	
			Mountain	None	Light	105%	58%	
			Mountain	Mobile	Dark	109%	60%	
			Mountain	Mobile	Light	116%	64%	
			Mountain	Permanent	Dark	128%	71%	
			Mountain	Permanent	Light	136%	75%	
DOUBLE GLAZED IG 1/4" Pilkington Eclipse Advantage™ #2 Blue-Green or Bronze BLINDS: Light color Venetian Closed			1/4" Pilkington Energy Advantage™ Low-E Glass#3 surface	Coastal	None	Dark	85%	50%
				Coastal	None	Light	91%	53%
			Coastal	Mobile	Dark	94%	55%	
			Coastal	Mobile	Light	101%	59%	
			Coastal	Permanent	Dark	110%	64%	
			Coastal	Permanent	Light	118%	69%	
			Inland	None	Dark	93%	54%	
			Inland	None	Light	99%	57%	
			Inland	Mobile	Dark	103%	59%	
			Inland	Mobile	Light	110%	63%	
			Inland	Permanent	Dark	121%	70%	
			Inland	Permanent	Light	129%	74%	
			Mountain	None	Dark	102%	58%	
			Mountain	None	Light	109%	61%	
			Mountain	Mobile	Dark	113%	64%	
			Mountain	Mobile	Light	120%	68%	
			Mountain	Permanent	Dark	132%	75%	
			Mountain	Permanent	Light	141%	80%	

Percent of Nominal Allowable Stress for Annealed Glass (See Notes on p.4 for details)

Outer Light	Glazing	Inner Light	Location	Shadow	Frame	Color	Outer	Inner
SINGLE GLAZED			Coastal	None	Dark		86%	
1/4" Pilkington								
Eclipse Advantage™ #2 Grey			Coastal	None	Light		92%	
			Coastal	Mobile	Dark		96%	
BLINDS::			Coastal	Mobile	Light		102%	
Light color Venetian			Coastal	Permanent	Dark		112%	
Closed			Coastal	Permanent	Light		119%	
			Inland	None	Dark		94%	
			Inland	None	Light		100%	
			Inland	Mobile	Dark		104%	
			Inland	Mobile	Light		111%	
			Inland	Permanent	Dark		122%	
			Inland	Permanent	Light		130%	
			Mountain	None	Dark		101%	
			Mountain	None	Light		108%	
			Mountain	Mobile	Dark		112%	
			Mountain	Mobile	Light		120%	
			Mountain	Permanent	Dark		132%	
			Mountain	Permanent	Light		140%	
DOUBLE GLAZED IG			Coastal	None	Dark		90%	49%
1/4" Pilkington								
Eclipse Advantage™ #2 Grey			Coastal	None	Light		97%	52%
			Coastal	Mobile	Dark		100%	54%
BLINDS:		1/4" Clear	Coastal	Mobile	Light		107%	58%
Light color Venetian			Coastal	Permanent	Dark		118%	63%
Closed			Coastal	Permanent	Light		125%	67%
			Inland	None	Dark		99%	52%
			Inland	None	Light		106%	56%
			Inland	Mobile	Dark		110%	58%
			Inland	Mobile	Light		118%	62%
			Inland	Permanent	Dark		129%	68%
			Inland	Permanent	Light		138%	73%
			Mountain	None	Dark		109%	56%
			Mountain	None	Light		116%	60%
			Mountain	Mobile	Dark		121%	63%
			Mountain	Mobile	Light		129%	67%
			Mountain	Permanent	Dark		141%	73%
			Mountain	Permanent	Light		151%	78%
DOUBLE GLAZED IG			Coastal	None	Dark		93%	50%
1/4" Pilkington			Coastal	None	Light		100%	54%
Eclipse Advantage™ #2 Grey			Coastal	Mobile	Dark		104%	56%
BLINDS:		1/4" Pilkington	Coastal	Mobile	Light		111%	60%
Light color Venetian		Energy Advantage™	Coastal	Permanent	Dark		121%	65%
Closed		Low-E Glass#3 surface	Coastal	Permanent	Light		130%	70%
			Inland	None	Dark		103%	54%
			Inland	None	Light		110%	58%
			Inland	Mobile	Dark		114%	60%
			Inland	Mobile	Light		122%	64%
			Inland	Permanent	Dark		134%	71%
			Inland	Permanent	Light		142%	75%
			Mountain	None	Dark		112%	59%
			Mountain	None	Light		120%	63%
			Mountain	Mobile	Dark		125%	65%
			Mountain	Mobile	Light		133%	69%
			Mountain	Permanent	Dark		146%	76%
			Mountain	Permanent	Light		156%	81%

Percent of Nominal Allowable Stress for Annealed Glass (See Notes on p.4 for details)

Outer Light	Glazing	Inner Light	Location	Shadow	Frame Color	Outer	Inner
SINGLE GLAZED			Coastal	None	Dark	91%	
1/4" Eclipse Advantage™ #2			Coastal	None	Light	98%	
Arctic Blue or EverGreen			Coastal	Mobile	Dark	102%	
BLINDS::			Coastal	Mobile	Light	108%	
Light color Venetian			Coastal	Permanent	Dark	119%	
Closed			Coastal	Permanent	Light	127%	
			Inland	None	Dark	100%	
			Inland	None	Light	106%	
			Inland	Mobile	Dark	110%	
			Inland	Mobile	Light	118%	
			Inland	Permanent	Dark	129%	
			Inland	Permanent	Light	138%	
			Mountain	None	Dark	108%	
			Mountain	None	Light	115%	
			Mountain	Mobile	Dark	120%	
			Mountain	Mobile	Light	128%	
			Mountain	Permanent	Dark	140%	
			Mountain	Permanent	Light	150%	
DOUBLE GLAZED IG			Coastal	None	Dark	96%	50%
1/4" Pilkington			Coastal	None	Light	103%	53%
Eclipse Advantage™ #2			Coastal	Mobile	Dark	107%	55%
Arctic Blue or EverGreen			Coastal	Mobile	Light	114%	59%
BLINDS::			Coastal	Permanent	Dark	125%	64%
Light color Venetian			Coastal	Permanent	Light	134%	69%
Closed			Inland	None	Dark	106%	54%
			Inland	None	Light	113%	57%
			Inland	Mobile	Dark	118%	59%
			Inland	Mobile	Light	126%	63%
			Inland	Permanent	Dark	138%	70%
			Inland	Permanent	Light	147%	74%
			Mountain	None	Dark	116%	58%
			Mountain	None	Light	124%	61%
			Mountain	Mobile	Dark	129%	64%
			Mountain	Mobile	Light	137%	68%
			Mountain	Permanent	Dark	151%	75%
			Mountain	Permanent	Light	161%	80%
DOUBLE GLAZED IG			Coastal	None	Dark	99%	51%
1/4" Pilkington			Coastal	None	Light	106%	54%
Eclipse Advantage™ #2			Coastal	Mobile	Dark	110%	56%
Arctic Blue or EverGreen			Coastal	Mobile	Light	117%	60%
BLINDS::			Coastal	Permanent	Dark	129%	66%
Light color Venetian			Coastal	Permanent	Light	138%	70%
Closed			Inland	None	Dark	109%	55%
			Inland	None	Light	116%	58%
			Inland	Mobile	Dark	121%	61%
			Inland	Mobile	Light	129%	65%
			Inland	Permanent	Dark	142%	71%
			Inland	Permanent	Light	151%	76%
			Mountain	None	Dark	120%	59%
			Mountain	None	Light	127%	63%
			Mountain	Mobile	Dark	133%	65%
			Mountain	Mobile	Light	142%	70%
			Mountain	Permanent	Dark	155%	76%
			Mountain	Permanent	Light	166%	82%

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Percent of Nominal Allowable Stress for Annealed Glass (See Notes on p.4 for details)

Outer Light	Glazing	Inner Light	Location	Shadow	Frame Color	Outer	Inner	
SINGLE GLAZED 1/4" Pilkington Eclipse Advantage™ #2 Clear BLINDS: Light color Venetian Closed			Coastal	None	Dark	50%		
			Coastal	None	Light	53%		
			Coastal	Mobile	Dark	55%		
			Coastal	Mobile	Light	59%		
			Coastal	Permanent	Dark	64%		
			Coastal	Permanent	Light	69%		
			Inland	None	Dark	52%		
			Inland	None	Light	56%		
			Inland	Mobile	Dark	58%		
			Inland	Mobile	Light	62%		
			Inland	Permanent	Dark	68%		
			Inland	Permanent	Light	73%		
			Mountain	None	Dark	55%		
			Mountain	None	Light	59%		
			Mountain	Mobile	Dark	62%		
			Mountain	Mobile	Light	66%		
			Mountain	Permanent	Dark	72%		
			Mountain	Permanent	Light	77%		
	DOUBLE GLAZED IG 1/4" Pilkington Eclipse Advantage™ Clear #2 BLINDS: Light color Venetian Closed		1/4" Clear	Coastal	None	Dark	49%	40%
				Coastal	None	Light	52%	43%
			Coastal	Mobile	Dark	54%	45%	
			Coastal	Mobile	Light	58%	48%	
			Coastal	Permanent	Dark	64%	52%	
			Coastal	Permanent	Light	68%	56%	
			Inland	None	Dark	53%	43%	
			Inland	None	Light	56%	46%	
			Inland	Mobile	Dark	59%	48%	
			Inland	Mobile	Light	63%	51%	
			Inland	Permanent	Dark	69%	56%	
			Inland	Permanent	Light	73%	60%	
			Mountain	None	Dark	57%	46%	
			Mountain	None	Light	61%	49%	
			Mountain	Mobile	Dark	63%	51%	
			Mountain	Mobile	Light	67%	54%	
			Mountain	Permanent	Dark	74%	60%	
			Mountain	Permanent	Light	79%	64%	
DOUBLE GLAZED IG 1/4" Pilkington Eclipse Advantage™ Clear #2 BLINDS: Light color Venetian Closed			1/4" Pilkington Energy Advantage™ Low-E #3 surface	Coastal	None	Dark	51%	46%
				Coastal	None	Light	55%	49%
			Coastal	Mobile	Dark	57%	51%	
			Coastal	Mobile	Light	61%	55%	
			Coastal	Permanent	Dark	67%	60%	
			Coastal	Permanent	Light	71%	64%	
			Inland	None	Dark	56%	50%	
			Inland	None	Light	59%	53%	
			Inland	Mobile	Dark	62%	55%	
			Inland	Mobile	Light	66%	59%	
			Inland	Permanent	Dark	72%	65%	
			Inland	Permanent	Light	77%	69%	
			Mountain	None	Dark	60%	53%	
			Mountain	None	Light	64%	57%	
			Mountain	Mobile	Dark	67%	59%	
			Mountain	Mobile	Light	71%	63%	
			Mountain	Permanent	Dark	78%	70%	
			Mountain	Permanent	Light	83%	74%	

Percent of Annealed Glass Nominal Allowable Stress

GLAZING		LOCATION	SHADOW	FRAME COLOR	Outer	Inner
Outer Light	Inner Light					
SINGLE GLAZED						
6 mm Pilkington Eclipse™ Gold #2		Coastal	None	Dark	45%	
		Coastal	None	Light	48%	
		Coastal	Mobile	Dark	50%	
BLINDS:		Coastal	Mobile	Light	53%	
Light Venetian		Coastal	Permanent	Dark	59%	
Closed		Coastal	Permanent	Light	63%	
		Inland	None	Dark	48%	
		Inland	None	Light	51%	
		Inland	Mobile	Dark	53%	
		Inland	Mobile	Light	57%	
		Inland	Permanent	Dark	62%	
		Inland	Permanent	Light	66%	
		Mountain	None	Dark	51%	
		Mountain	None	Light	54%	
		Mountain	Mobile	Dark	56%	
		Mountain	Mobile	Light	60%	
		Mountain	Permanent	Dark	66%	
		Mountain	Permanent	Light	70%	
DOUBLE GLAZED IG						
6 mm Pilkington Eclipse™ Gold #2		6 mm Clear	Coastal	None	Dark	44%
			Coastal	None	Light	47%
			Coastal	Mobile	Dark	49%
BLINDS:			Coastal	Mobile	Light	53%
Light Venetian			Coastal	Permanent	Dark	58%
Closed			Coastal	Permanent	Light	62%
			Inland	None	Dark	48%
			Inland	None	Light	51%
			Inland	Mobile	Dark	53%
			Inland	Mobile	Light	56%
			Inland	Permanent	Dark	62%
			Inland	Permanent	Light	66%
			Mountain	None	Dark	51%
			Mountain	None	Light	54%
			Mountain	Mobile	Dark	56%
			Mountain	Mobile	Light	60%
			Mountain	Permanent	Dark	66%
			Mountain	Permanent	Light	70%
DOUBLE GLAZED IG						
6 mm Pilkington Eclipse™ Gold #2		6mm Pilkington Energy Advantage™ Low-E #3 surface	Coastal	None	Dark	45%
			Coastal	None	Light	48%
			Coastal	Mobile	Dark	50%
BLINDS:			Coastal	Mobile	Light	53%
Light Venetian			Coastal	Permanent	Dark	58%
Closed			Coastal	Permanent	Light	62%
			Inland	None	Dark	48%
			Inland	None	Light	52%
			Inland	Mobile	Dark	54%
			Inland	Mobile	Light	57%
			Inland	Permanent	Dark	63%
			Inland	Permanent	Light	67%
			Mountain	None	Dark	52%
			Mountain	None	Light	55%
			Mountain	Mobile	Dark	57%
			Mountain	Mobile	Light	61%
			Mountain	Permanent	Dark	67%
			Mountain	Permanent	Light	72%

Percent of Nominal Allowable Stress for Annealed Glass

Glazing		Location	Shadow	Color	Outer	Inner
Outer Light	Inner Light					
SINGLE GLAZED		Coastal	None	Dark	71%	
1/4" Pilkington Solar-E™ Clear #2		Coastal	None	Light	76%	
BLINDS::		Coastal	Mobile	Dark	79%	
Light color Venetian		Coastal	Mobile	Light	84%	
Closed		Coastal	Permanent	Dark	92%	
		Coastal	Permanent	Light	98%	
		Inland	None	Dark	76%	
		Inland	None	Light	82%	
		Inland	Mobile	Dark	85%	
		Inland	Mobile	Light	91%	
		Inland	Permanent	Dark	99%	
		Inland	Permanent	Light	106%	
		Mountain	None	Dark	82%	
		Mountain	None	Light	88%	
		Mountain	Mobile	Dark	91%	
		Mountain	Mobile	Light	97%	
		Mountain	Permanent	Dark	107%	
		Mountain	Permanent	Light	114%	
DOUBLE GLAZED IG		Coastal	None	Dark	74%	46%
1/4" Pilkington Solar-E™ Clear #2		Coastal	None	Light	79%	50%
BLINDS::		Coastal	Mobile	Dark	82%	52%
Light color Venetian		Coastal	Mobile	Light	88%	55%
Closed		Coastal	Permanent	Dark	96%	60%
		Coastal	Permanent	Light	103%	64%
		Inland	None	Dark	81%	50%
		Inland	None	Light	86%	53%
		Inland	Mobile	Dark	90%	55%
		Inland	Mobile	Light	96%	59%
		Inland	Permanent	Dark	105%	65%
		Inland	Permanent	Light	112%	69%
		Mountain	None	Dark	88%	54%
		Mountain	None	Light	94%	57%
		Mountain	Mobile	Dark	98%	60%
		Mountain	Mobile	Light	104%	64%
		Mountain	Permanent	Dark	115%	70%
		Mountain	Permanent	Light	122%	74%
DOUBLE GLAZED IG		Coastal	None	Dark	77%	50%
1/4" Pilkington Solar-E™ Clear #2		Coastal	None	Light	82%	54%
BLINDS::		Coastal	Mobile	Dark	86%	56%
Light color Venetian		Coastal	Mobile	Light	91%	60%
Closed		Coastal	Permanent	Dark	100%	66%
		Coastal	Permanent	Light	107%	70%
		Inland	None	Dark	85%	55%
		Inland	None	Light	90%	58%
		Inland	Mobile	Dark	94%	61%
		Inland	Mobile	Light	100%	65%
		Inland	Permanent	Dark	110%	71%
		Inland	Permanent	Light	117%	76%
		Mountain	None	Dark	92%	59%
		Mountain	None	Light	98%	63%
		Mountain	Mobile	Dark	102%	65%
		Mountain	Mobile	Light	109%	70%
		Mountain	Permanent	Dark	120%	76%
		Mountain	Permanent	Light	128%	81%

Percent of Annealed Glass Nominal Allowable Stress

GLAZING		LOCATION	SHADOW	FRAME COLOR	Outer	Inner
Outer Light	Inner Light					
SINGLE GLAZED		Coastal	None	Dark	98%	
6 mm Pilkington Solar-E™ Arctic Blue		Coastal	None	Light	105%	
#2 surface		Coastal	Mobile	Dark	109%	
BLINDS: Light Venetian Closed		Coastal	Mobile	Light	116%	
		Coastal	Permanent	Dark	128%	
		Coastal	Permanent	Light	136%	
		Inland	None	Dark	107%	
		Inland	None	Light	114%	
		Inland	Mobile	Dark	119%	
		Inland	Mobile	Light	127%	
		Inland	Permanent	Dark	139%	
		Inland	Permanent	Light	148%	
		Mountain	None	Dark	116%	
		Mountain	None	Light	124%	
		Mountain	Mobile	Dark	129%	
		Mountain	Mobile	Light	138%	
		Mountain	Permanent	Dark	151%	
		Mountain	Permanent	Light	161%	

DOUBLE GLAZED IG		LOCATION	SHADOW	FRAME COLOR	Outer	Inner
6 mm Pilkington Solar-E™ Arctic Blue	6 mm Clear	Coastal	None	Dark	107%	47%
		Coastal	None	Light	114%	50%
		Coastal	Mobile	Dark	119%	52%
BLINDS: Light Venetian Closed		Coastal	Mobile	Light	127%	56%
		Coastal	Permanent	Dark	139%	61%
		Coastal	Permanent	Light	148%	66%
		Inland	None	Dark	118%	51%
		Inland	None	Light	126%	54%
		Inland	Mobile	Dark	131%	57%
		Inland	Mobile	Light	139%	60%
		Inland	Permanent	Dark	153%	66%
		Inland	Permanent	Light	163%	71%
		Mountain	None	Dark	129%	55%
		Mountain	None	Light	138%	58%
		Mountain	Mobile	Dark	143%	61%
		Mountain	Mobile	Light	153%	65%
		Mountain	Permanent	Dark	168%	71%
		Mountain	Permanent	Light	179%	76%

DOUBLE GLAZED IG		LOCATION	SHADOW	FRAME COLOR	Outer	Inner
6 mm Pilkington Solar-E™ Arctic Blue	6mm Pilkington Energy Advantage™	Coastal	None	Dark	109%	49%
	Low-E #3 surface	Coastal	None	Light	116%	52%
BLINDS: Light Venetian Closed		Coastal	Mobile	Dark	120%	54%
		Coastal	Mobile	Light	129%	58%
		Coastal	Permanent	Dark	141%	63%
		Coastal	Permanent	Light	150%	68%
		Inland	None	Dark	120%	53%
		Inland	None	Light	128%	56%
		Inland	Mobile	Dark	133%	59%
		Inland	Mobile	Light	142%	62%
		Inland	Permanent	Dark	156%	69%
		Inland	Permanent	Light	166%	73%
		Mountain	None	Dark	131%	57%
		Mountain	None	Light	140%	61%
		Mountain	Mobile	Dark	146%	63%
		Mountain	Mobile	Light	155%	67%
		Mountain	Permanent	Dark	170%	74%
		Mountain	Permanent	Light	182%	79%

GLAZING		Percent of Annealed Glass Nominal Allowable Stress			FRAME	
Outer Light	Inner Light	LOCATION	SHADOW	COLOR	Outer	Inner
SINGLE GLAZED						
6 mm Pilkington Solar-E™ Blue-Green #2 surface		Coastal	None	Dark	89%	
		Coastal	None	Light	95%	
		Coastal	Mobile	Dark	98%	
BLINDS:		Coastal	Mobile	Light	105%	
Light Venetian		Coastal	Permanent	Dark	115%	
Closed		Coastal	Permanent	Light	123%	
		Inland	None	Dark	96%	
		Inland	None	Light	103%	
		Inland	Mobile	Dark	107%	
		Inland	Mobile	Light	114%	
		Inland	Permanent	Dark	125%	
		Inland	Permanent	Light	134%	
		Mountain	None	Dark	104%	
		Mountain	None	Light	111%	
		Mountain	Mobile	Dark	116%	
		Mountain	Mobile	Light	124%	
		Mountain	Permanent	Dark	136%	
		Mountain	Permanent	Light	145%	
DOUBLE GLAZED IG						
6 mm Pilkington Solar-E™ Blue-Green 6 mm Clear		Coastal	None	Dark	96%	46%
		Coastal	None	Light	103%	49%
		Coastal	Mobile	Dark	107%	51%
		Coastal	Mobile	Light	114%	55%
BLINDS:		Coastal	Permanent	Dark	125%	60%
Light Venetian		Coastal	Permanent	Light	133%	64%
Closed		Inland	None	Dark	106%	50%
		Inland	None	Light	113%	53%
		Inland	Mobile	Dark	117%	55%
		Inland	Mobile	Light	125%	59%
		Inland	Permanent	Dark	138%	65%
		Inland	Permanent	Light	147%	69%
		Mountain	None	Dark	116%	53%
		Mountain	None	Light	123%	57%
		Mountain	Mobile	Dark	128%	59%
		Mountain	Mobile	Light	137%	63%
		Mountain	Permanent	Dark	150%	70%
		Mountain	Permanent	Light	160%	74%
DOUBLE GLAZED IG						
6 mm Pilkington Solar-E™ Blue-Green 6mm Pilkington Energy Advantage™ Low-E #3 surface		Coastal	None	Dark	98%	49%
		Coastal	None	Light	105%	52%
		Coastal	Mobile	Dark	109%	54%
BLINDS:		Coastal	Mobile	Light	116%	58%
Light Venetian		Coastal	Permanent	Dark	128%	64%
Closed		Coastal	Permanent	Light	136%	68%
		Inland	None	Dark	108%	53%
		Inland	None	Light	115%	57%
		Inland	Mobile	Dark	120%	59%
		Inland	Mobile	Light	128%	63%
		Inland	Permanent	Dark	140%	69%
		Inland	Permanent	Light	150%	73%
		Mountain	None	Dark	118%	57%
		Mountain	None	Light	126%	61%
		Mountain	Mobile	Dark	131%	63%
		Mountain	Mobile	Light	140%	68%
		Mountain	Permanent	Dark	154%	74%
		Mountain	Permanent	Light	164%	79%

Percent of Annealed Glass Nominal Allowable Stress

GLAZING		LOCATION	SHADOW	FRAME COLOR	Outer	Inner
Outer Light	Inner Light					
SINGLE GLAZED		Coastal	None	Dark	94%	
6 mm Pilkington Solar-E™ Grey		Coastal	None	Light	100%	
#2 surface		Coastal	Mobile	Dark	104%	
BLINDS:		Coastal	Mobile	Light	111%	
Light Venetian		Coastal	Permanent	Dark	122%	
Closed		Coastal	Permanent	Light	130%	
		Inland	None	Dark	102%	
		Inland	None	Light	109%	
		Inland	Mobile	Dark	114%	
		Inland	Mobile	Light	121%	
		Inland	Permanent	Dark	133%	
		Inland	Permanent	Light	142%	
		Mountain	None	Dark	111%	
		Mountain	None	Light	119%	
		Mountain	Mobile	Dark	123%	
		Mountain	Mobile	Light	132%	
		Mountain	Permanent	Dark	144%	
		Mountain	Permanent	Light	154%	
DOUBLE GLAZED IG		Coastal	None	Dark	102%	47%
6 mm Pilkington Solar-E™ Grey		Coastal	None	Light	109%	50%
6 mm Clear		Coastal	Mobile	Dark	113%	52%
BLINDS:		Coastal	Mobile	Light	121%	55%
Light Venetian		Coastal	Permanent	Dark	133%	61%
Closed		Coastal	Permanent	Light	142%	65%
		Inland	None	Dark	113%	50%
		Inland	None	Light	120%	54%
		Inland	Mobile	Dark	125%	56%
		Inland	Mobile	Light	133%	60%
		Inland	Permanent	Dark	146%	65%
		Inland	Permanent	Light	156%	70%
		Mountain	None	Dark	123%	54%
		Mountain	None	Light	132%	58%
		Mountain	Mobile	Dark	137%	60%
		Mountain	Mobile	Light	146%	64%
		Mountain	Permanent	Dark	160%	70%
		Mountain	Permanent	Light	171%	75%
DOUBLE GLAZED IG		Coastal	None	Dark	104%	49%
6 mm Pilkington Solar-E™ Grey		Coastal	None	Light	111%	52%
6mm Pilkington		Coastal	Mobile	Dark	115%	54%
Energy Advantage™		Coastal	Mobile	Light	123%	58%
BLINDS:		Coastal	Permanent	Dark	135%	63%
Light Venetian		Coastal	Permanent	Light	144%	68%
Closed		Coastal	Permanent	Light	144%	68%
		Inland	None	Dark	115%	53%
		Inland	None	Light	122%	56%
		Inland	Mobile	Dark	127%	58%
		Inland	Mobile	Light	136%	62%
		Inland	Permanent	Dark	149%	68%
		Inland	Permanent	Light	159%	73%
		Mountain	None	Dark	125%	57%
		Mountain	None	Light	134%	60%
		Mountain	Mobile	Dark	139%	63%
		Mountain	Mobile	Light	149%	67%
		Mountain	Permanent	Dark	163%	74%
		Mountain	Permanent	Light	174%	79%