

Insulating Glass Unit (IGU) Performance Data

Cardinal LoE™ glass sets the industry standard for energy-efficient coated glass products. Our patented, world-class, sputtered LoE coatings remain unmatched for their quality, aesthetics and performance. These coatings control solar heat gain while optimizing light transmission. This helps to limit heating/cooling loads while protecting interior furnishings from UV damage.

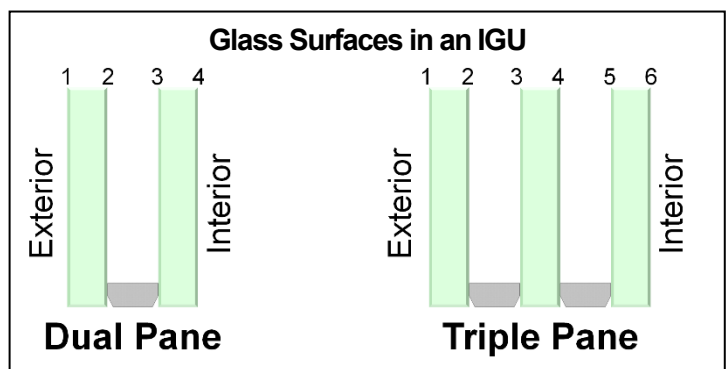
	LoE ² -240® LoE ³ -340®	Low solar heat gain coefficient (SHGC) with glare control. Both products maintain cool glass temperatures in warm climates.
Solar Control	LoE ² -272® LoE ² -270®	Mid SHGC with high visible light transmission that provides year-round performance and comfort.
	LoE ³ -366®	Balance of low SHGC and high visible light transmission while providing year-round comfort.
	LoE-452+™	Low SHGC with some glare control, low exterior reflection, and 99% UV blocking. Comes standard with Neat+.
Passive Solar	LoE-180® LoE-180 ESC™	These coatings allow a high SHGC while preventing room heat loss to the outside. LoE-180 ESC was engineered to meet the ENERGY STAR Canada criteria.
	LoE-Di89™	LoE-i89 coating on both sides of a single, interior pane, used to optimize Energy Ratings (ER) values to meet the ENERGY STAR Canada criteria.
Interior	LoE-i89®	For enhanced winter performance by further lowering the U-Factor. It can be combined with any Cardinal LoE.
Exterior	Neat+™	Keeps the exterior glass surface cleaner longer than uncoated glass. Neat+ will not change the IGU performance and is available with all Cardinal LoE products.

Cardinal does not recommend solar control LoE coatings to be used on the #3 glass surface of a dual pane IGU with a clear outdoor lite. The potential for interior glass breakage resulting from thermal stress is increased. It's recommended that LoE-452+, LoE²-240 & LoE³-340 only be used on the #2 surface.

Cardinal LoE coatings may also be combined with tinted glass which can alter color, reduce glare, and add provide additional solar control benefits.

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3mm - Double Pane IGU Performance Data

Exterior Glass	Interior Glass	Visible Light			SHGC	Center of Glass U-Factor BTU/hr/ft ² /°F		UV Trans
		Trans	Reflectance Out	In		Air	Argon	
Clear	Clear	82%	15%	15%	0.78	0.48	0.46	58%
Clear	LoE-i89 (3)	80%	15%	14%	0.75	0.33	0.29	55%
Clear	LoE-180 ESC (3)	79%	15%	15%	0.71	0.31	0.27	25%
Clear	LoE-180 (3)	79%	15%	15%	0.69	0.31	0.26	29%
Clear	LoE-Di89 (3 & 4)	79%	14%	14%	0.71	0.26	0.23	52%
LoE-180 ESC (2)	Clear	79%	15%	15%	0.67	0.31	0.27	25%
LoE-180 (2)	Clear	79%	15%	15%	0.64	0.31	0.26	29%
LoE ² -272 (2)	Clear	72%	11%	12%	0.41	0.30	0.25	16%
LoE ² -270 (2)	Clear	70%	12%	13%	0.37	0.30	0.25	14%
LoE ³ -366 (2)	Clear	65%	11%	12%	0.27	0.29	0.24	5%
LoE-452+ (2)	Clear	52%	10%	15%	0.22	0.29	0.24	1%
LoE ² -240 (2)	Clear	40%	14%	11%	0.25	0.30	0.25	15%
LoE ³ -340 (2)	Clear	39%	13%	16%	0.18	0.29	0.25	2%
LoE-180 ESC (2)	LoE-i89 (4)	78%	15%	14%	0.64	0.24	0.21	24%
LoE-180 (2)	LoE-i89 (4)	77%	15%	14%	0.62	0.24	0.21	27%
LoE ² -272 (2)	LoE-i89 (4)	70%	11%	11%	0.41	0.23	0.20	16%
LoE ² -270 (2)	LoE-i89 (4)	68%	12%	13%	0.36	0.23	0.20	14%
LoE ³ -366 (2)	LoE-i89 (4)	63%	11%	12%	0.27	0.23	0.20	5%
LoE-452+ (2)	LoE-i89 (4)	51%	10%	14%	0.21	0.23	0.19	1%
LoE ² -240 (2)	LoE-i89 (4)	39%	14%	10%	0.24	0.24	0.21	15%
LoE ³ -340 (2)	LoE-i89 (4)	38%	13%	15%	0.17	0.23	0.20	2%

Notes:

- (1) Data was calculated using LBNL Window computer program with winter & summer NFRC environmental conditions.
- (2) Argon Calculations based on 90% gas fill level.
- (3) Shading Coefficient (SC) can be calculated by dividing SHGC by 0.87.
- (4) (#) after coating is IGU coating surface number.

Glass	Airspace	Glass
3mm	13.0mm	3mm
1/8"	1/2"	1/8"

3mm - Double Pane IGU Tinted Glass Performance Data

Exterior Glass	Interior Glass	Visible Light			SHGC	Center of Glass U-Factor BTU/hr/ft ² /°F		UV Trans
		Trans	Reflectance Out	In		Air	Argon	
Green	Clear	75%	14%	15%	0.60	0.48	0.46	36%
	LoE-i89 (3)	74%	13%	14%	0.56	0.33	0.29	35%
	LoE-180 ESC (3)	73%	14%	15%	0.53	0.31	0.27	16%
	LoE-180 (3)	73%	13%	15%	0.52	0.31	0.26	19%
	LoE ² -272 (3)	66%	11%	11%	0.42	0.30	0.25	11%
	LoE ² -270 (3)	64%	12%	12%	0.39	0.30	0.25	10%
	LoE ³ -366 (3)	59%	11%	11%	0.35	0.29	0.24	3%
Gray	Clear	55%	9%	14%	0.58	0.48	0.46	32%
	LoE-i89 (3)	54%	9%	13%	0.53	0.33	0.29	30%
	LoE-180 ESC (3)	53%	9%	14%	0.50	0.31	0.27	14%
	LoE-180 (3)	53%	9%	14%	0.49	0.31	0.26	17%
	LoE ² -272 (3)	48%	8%	10%	0.37	0.30	0.25	10%
	LoE ² -270 (3)	47%	9%	11%	0.34	0.30	0.25	9%
	LoE ³ -366 (3)	43%	8%	10%	0.29	0.29	0.24	3%
Bronze	Clear	61%	10%	14%	0.63	0.48	0.46	33%
	LoE-i89 (3)	59%	10%	13%	0.58	0.33	0.29	32%
	LoE-180 ESC (3)	59%	10%	14%	0.55	0.31	0.27	15%
	LoE-180 (3)	59%	10%	14%	0.53	0.31	0.26	17%
	LoE ² -272 (3)	53%	9%	10%	0.39	0.30	0.25	10%
	LoE ² -270 (3)	52%	10%	12%	0.36	0.30	0.25	9%
	LoE ³ -366 (3)	48%	9%	11%	0.31	0.29	0.24	3%

Notes:

- (1) Data was calculated using LBNL Window computer program with winter & summer NFRC environmental conditions.
- (2) Argon Calculations based on 90% gas fill level.
- (3) Shading Coefficient (SC) can be calculated by dividing SHGC by 0.87.
- (4) (#) after coating is IGU coating surface number.

Glass	Airspace	Glass
3mm	13.0mm	3mm
1/8"	1/2"	1/8"

6mm - Double Pane IGU Performance Data

Exterior Glass	Interior Glass	Visible Light			SHGC	Center of Glass U-Factor BTU/hr/ft ² /°F		UV Trans
		Trans	Reflectance Out	In		Air	Argon	
Clear	Clear	80%	15%	15%	0.72	0.47	0.45	48%
Clear	LoE-i89 (3)	78%	14%	14%	0.69	0.33	0.29	46%
Clear	LoE-180 ESC (3)	77%	14%	15%	0.66	0.31	0.26	21%
Clear	LoE-180 (3)	77%	14%	15%	0.64	0.30	0.26	24%
Clear	LoE-Di89 (3 & 4)	76%	14%	13%	0.66	0.26	0.23	44%
LoE-180 ESC (2)	Clear	77%	15%	14%	0.62	0.31	0.26	21%
LoE-180 (2)	Clear	77%	15%	14%	0.60	0.30	0.26	24%
LoE ² -272 (2)	Clear	70%	11%	11%	0.40	0.29	0.25	14%
LoE ² -270 (2)	Clear	68%	12%	13%	0.36	0.29	0.25	12%
LoE ³ -366 (2)	Clear	63%	11%	12%	0.27	0.29	0.24	4%
LoE-452+ (2)	Clear	51%	9%	15%	0.22	0.28	0.24	1%
LoE ² -240 (2)	Clear	38%	14%	10%	0.24	0.30	0.25	13%
LoE ³ -340 (2)	Clear	38%	13%	15%	0.18	0.29	0.24	2%
LoE-180 ESC (2)	LoE-i89 (4)	75%	15%	14%	0.60	0.24	0.21	20%
LoE-180 (2)	LoE-i89 (4)	75%	15%	13%	0.58	0.24	0.21	23%
LoE ² -272 (2)	LoE-i89 (4)	68%	10%	11%	0.39	0.23	0.20	14%
LoE ² -270 (2)	LoE-i89 (4)	66%	12%	12%	0.35	0.23	0.20	12%
LoE ³ -366 (2)	LoE-i89 (4)	61%	11%	11%	0.26	0.23	0.19	4%
LoE-452+ (2)	LoE-i89 (4)	50%	9%	14%	0.21	0.23	0.19	1%
LoE ² -240 (2)	LoE-i89 (4)	37%	13%	9%	0.23	0.24	0.21	13%
LoE ³ -340 (2)	LoE-i89 (4)	37%	13%	14%	0.17	0.23	0.20	2%

Notes:

- (1) Data was calculated using LBNL Window computer program with winter & summer NFRC environmental conditions.
- (2) Argon Calculations based on 90% gas fill level.
- (3) Shading Coefficient (SC) can be calculated by dividing SHGC by 0.87.
- (4) (#) after coating is IGU coating surface number.

Glass	Airspace	Glass
6mm	13.0mm	6mm
1/4"	1/2"	1/4"

6mm - Double Pane IGU Tinted Glass Performance Data

Exterior Glass	Interior Glass	Visible Light			SHGC	Center of Glass U-Factor BTU/hr/ft ² /°F		UV Trans
		Trans	Reflectance Out	In		Air	Argon	
Green	Clear	69%	12%	14%	0.50	0.47	0.45	25%
	LoE-i89 (3)	68%	12%	14%	0.45	0.33	0.29	24%
	LoE-180 ESC (3)	67%	12%	15%	0.43	0.31	0.26	11%
	LoE-180 (3)	67%	12%	15%	0.42	0.30	0.26	13%
	LoE ² -272 (3)	61%	10%	10%	0.37	0.29	0.25	8%
	LoE ² -270 (3)	59%	11%	12%	0.35	0.29	0.25	7%
	LoE ³ -366 (3)	55%	10%	11%	0.32	0.29	0.24	2%
Gray	Clear	40%	7%	13%	0.46	0.47	0.45	20%
	LoE-i89 (3)	39%	7%	12%	0.41	0.33	0.29	19%
	LoE-180 ESC (3)	38%	7%	13%	0.38	0.31	0.26	9%
	LoE-180 (3)	38%	7%	13%	0.37	0.30	0.26	10%
	LoE ² -272 (3)	35%	6%	9%	0.29	0.29	0.25	7%
	LoE ² -270 (3)	34%	7%	11%	0.27	0.29	0.25	6%
	LoE ³ -366 (3)	31%	7%	10%	0.23	0.29	0.24	2%
Bronze	Clear	48%	8%	13%	0.51	0.47	0.45	21%
	LoE-i89 (3)	47%	8%	13%	0.47	0.33	0.29	20%
	LoE-180 ESC (3)	46%	8%	14%	0.44	0.31	0.26	9%
	LoE-180 (3)	46%	8%	14%	0.43	0.30	0.26	11%
	LoE ² -272 (3)	42%	7%	9%	0.32	0.29	0.25	7%
	LoE ² -270 (3)	40%	8%	11%	0.30	0.29	0.25	6%
	LoE ³ -366 (3)	37%	7%	10%	0.26	0.29	0.24	2%

Notes:

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- (2) Argon Calculations based on 90% gas fill level.
- (3) Shading Coefficient (SC) can be calculated by dividing SHGC by 0.87.
- (4) (#) after coating is IGU coating surface number.

Glass	Airspace	Glass
6mm	13.0mm	6mm
1/4"	1/2"	1/4"

3mm - Triple Pane IGU Performance Data

Exterior Glass	Center Glass	Interior Glass	Visible Light			SHGC	Center of Glass U-Factor BTU/hr/ft ² /°F		UV Trans
			Trans	Reflectance Out	Reflectance In		Air	Argon	
LoE ⁻¹⁸⁰ ESC (2)	Clear	LoE ⁻¹⁸⁰ ESC (5)	70%	21%	21%	0.58	0.20	0.16	10%
LoE ⁻¹⁸⁰ (2)	Clear	LoE ⁻¹⁸⁰ (5)	70%	20%	20%	0.56	0.19	0.15	13%
LoE ⁻¹⁸⁰ ESC (2)	Clear	LoE ^{-Di89} (5 & 6)	69%	20%	19%	0.58	0.17	0.14	19%
LoE ⁻²⁻²⁷² (2)	Clear	LoE ⁻¹⁸⁰ (5)	63%	15%	18%	0.37	0.19	0.15	8%
LoE ⁻²⁻²⁷⁰ (2)	Clear	LoE ⁻¹⁸⁰ (5)	62%	16%	19%	0.33	0.19	0.15	7%
LoE ⁻³⁻³⁶⁶ (2)	Clear	LoE ⁻¹⁸⁰ (5)	57%	15%	18%	0.25	0.19	0.15	2%
LoE ⁻⁴⁵²⁺ (2)	Clear	LoE ⁻¹⁸⁰ (5)	46%	12%	21%	0.20	0.19	0.15	1%
LoE ⁻²⁻²⁴⁰ (2)	Clear	LoE ⁻¹⁸⁰ (5)	35%	16%	17%	0.22	0.19	0.15	7%
LoE ⁻³⁻³⁴⁰ (2)	Clear	LoE ⁻¹⁸⁰ (5)	34%	15%	21%	0.16	0.19	0.15	1%
LoE ⁻¹⁸⁰ ESC (2)	LoE ⁻¹⁸⁰ ESC (4)	LoE ⁻ⁱ⁸⁹ (6)	69%	21%	19%	0.55	0.17	0.14	9%
LoE ⁻¹⁸⁰ (2)	LoE ⁻¹⁸⁰ (4)	LoE ⁻ⁱ⁸⁹ (6)	68%	21%	19%	0.53	0.17	0.13	13%
LoE ⁻²⁻²⁷² (2)	LoE ⁻¹⁸⁰ (4)	LoE ⁻ⁱ⁸⁹ (6)	62%	15%	16%	0.36	0.16	0.13	8%
LoE ⁻²⁻²⁷⁰ (2)	LoE ⁻¹⁸⁰ (4)	LoE ⁻ⁱ⁸⁹ (6)	60%	16%	18%	0.32	0.16	0.13	6%
LoE ⁻³⁻³⁶⁶ (2)	LoE ⁻¹⁸⁰ (4)	LoE ⁻ⁱ⁸⁹ (6)	56%	15%	17%	0.24	0.16	0.13	2%
LoE ⁻⁴⁵²⁺ (2)	LoE ⁻¹⁸⁰ (4)	LoE ⁻ⁱ⁸⁹ (6)	45%	12%	19%	0.19	0.16	0.13	1%
LoE ⁻²⁻²⁴⁰ (2)	LoE ⁻¹⁸⁰ (4)	LoE ⁻ⁱ⁸⁹ (6)	34%	16%	15%	0.21	0.16	0.13	7%
LoE ⁻³⁻³⁴⁰ (2)	LoE ⁻¹⁸⁰ (4)	LoE ⁻ⁱ⁸⁹ (6)	33%	15%	19%	0.15	0.16	0.13	1%

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Glass	Airspace	Glass	Airspace	Glass
3mm	9.8mm	3mm	9.8mm	3mm
1/8"	3/8"	1/8"	3/8"	1/8"

3mm - Double Pane IGU Performance Data Comparison of Coating Glass Products

Exterior Glass	Interior Glass	Visible Light			SHGC	Center of Glass		UV Trans
		Trans	Reflectance Out	Reflectance In		U-Factor BTU/hr/ft ² /°F Air	U-Factor BTU/hr/ft ² /°F Argon	
Low SHGC								
Cardinal LoE ³ -366 (2)	Clear	65%	11%	12%	0.27	0.29	0.24	5%
Cardinal LoE ² -452+ (2)	Clear	52%	10%	15%	0.22	0.29	0.24	2%
Cardinal LoE ² -240 (2)	Clear	40%	14%	11%	0.25	0.30	0.25	15%
Cardinal LoE ³ -340 (2)	Clear	39%	13%	16%	0.18	0.29	0.25	2%
Vitro SolarBar [®] 70 (2)	Clear	63%	12%	14%	0.26	0.29	0.24	4%
Guardian ClimaGuard [®] 62/27 (2)	Clear	62%	11%	12%	0.28	0.29	0.25	8%
Guardian ClimaGuard [®] 55 (2)	Clear	55%	15%	19%	0.26	0.29	0.24	15%
Guardian ClimaGuard [®] 53/23 (2)	Clear	53%	13%	12%	0.23	0.29	0.24	10%
Mid SHGC								
Cardinal LoE ² -272 (2)	Clear	72%	11%	12%	0.41	0.30	0.25	16%
Cardinal LoE ² -270 (2)	Clear	70%	12%	13%	0.37	0.30	0.25	14%
Vitro SolarBar [®] 60 (2)	Clear	73%	11%	12%	0.40	0.30	0.25	20%
Guardian ClimaGuard [®] 70 (2)	Clear	69%	15%	16%	0.35	0.29	0.24	20%
High SHGC								
Clear	LoE-i89 (3)	80%	15%	14%	0.75	0.33	0.29	55%
Clear	LoE-180 ESC (3)	79%	15%	15%	0.71	0.31	0.27	25%
Clear	LoE-180 (3)	79%	15%	15%	0.69	0.31	0.26	29%
Clear	LoE-Di89 (3 & 4)	79%	14%	14%	0.71	0.26	0.23	52%
Clear	Guardian ClimaGuard [®] 80/71 (3)	80%	14%	14%	0.70	0.31	0.27	44%
Clear	Vitro Sungate [®] 400 (3)	79%	14%	14%	0.69	0.32	0.28	32%
Clear	Pilkington Energy Adv.™ (3)	77%	17%	17%	0.74	0.34	0.30	51%

Notes:

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- (4) (#) after coating is IGU coating surface number.

Glass	Airspace	Glass
3mm	13.0mm	3mm
1/8"	1/2"	1/8"