

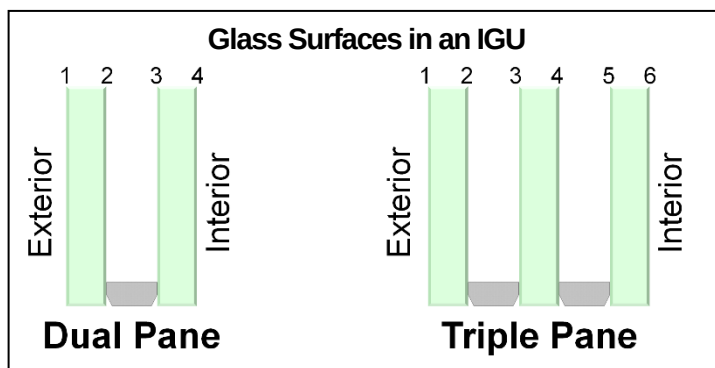
Insulating Glass Unit (IGU) Performance Data

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

Solar Control	LoE ² -240® LoE ³ -340® LoE ³ -340+™	Low solar heat gain coefficient (SHGC) with glare control. Both products maintain cool glass temperatures in warm climates.
	LoE-452+™	Low SHGC with some glare control, low exterior reflection, and 99% UV blocking. Comes standard with Neat+.
	LoE ³ -366®	Low SHGC with high visible light transmission while providing year-round comfort.
	LoE ² -272® LoE ² -270®	Moderate SHGC with high visible light transmission that provides year-round performance
	LoE-180® LoE-180 ESC™	High SHGC while preventing room heat loss to the outside. LoE-180 ESC was engineered to meet ENERGY STAR Canada criteria.
Passive Solar	LoE-Di89™	LoE-i89 coating on both sides of a single, interior pane, used to meet ENERGY STAR Canada criteria.
Interior (Roomside)	LoE-i89®	Enhanced cold climate performance by lowering the U-Factor further. LoE-i89 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 and 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.



The information in this Technical Service Bulletin is subject to the disclaimers and other limitations appearing in the TERMS AND CONDITIONS OF SALE that accompanies this Bulletin and at www.cardinalcorp.com.

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%	.78	.48	.46	58%
Clear	LoE-i89 (3)	80%	15%	14%	.75	.33	.29	55%
Clear	LoE-180 ESC (3)	79%	15%	15%	.71	.31	.26	25%
Clear	LoE-180 (3)	79%	15%	15%	.69	.31	.26	29%
Clear	LoE-Di89 (3 & 4)	79%	14%	14%	.71	.26	.23	52%
LoE-180 ESC (2)	Clear	79%	15%	15%	.67	.31	.26	25%
LoE-180 (2)	Clear	79%	15%	15%	.64	.31	.26	29%
LoE ² -272 (2)	Clear	72%	11%	12%	.41	.30	.25	16%
LoE ² -270 (2)	Clear	70%	12%	13%	.37	.29	.25	14%
LoE ³ -366 (2)	Clear	65%	11%	12%	.27	.29	.24	5%
LoE-452+ (2)	Clear	52%	10%	15%	.22	.29	.24	1%
LoE ² -240 (2)	Clear	40%	14%	11%	.25	.30	.25	15%
LoE ³ -340 (2)	Clear	39%	13%	16%	.18	.29	.24	2%
LoE ³ -340+ (2)	Clear	39%	13%	11%	.18	.29	.24	2%
LoE-180 ESC (2)	LoE-i89 (4)	78%	15%	14%	.64	.24	.21	24%
LoE-180 (2)	LoE-i89 (4)	77%	15%	14%	.62	.24	.21	27%
LoE ² -272 (2)	LoE-i89 (4)	70%	11%	11%	.41	.23	.20	16%
LoE ² -270 (2)	LoE-i89 (4)	68%	12%	13%	.36	.23	.20	14%
LoE ³ -366 (2)	LoE-i89 (4)	63%	11%	12%	.27	.23	.20	5%
LoE-452+ (2)	LoE-i89 (4)	51%	10%	14%	.21	.23	.19	1%
LoE ² -240 (2)	LoE-i89 (4)	39%	14%	10%	.24	.24	.20	14%
LoE ³ -340 (2)	LoE-i89 (4)	38%	13%	15%	.17	.23	.20	2%
LoE ³ -340+ (2)	LoE-i89 (4)	38%	13%	11%	.17	.23	.20	2%

Notes:

- Values are center of glass calculated using LBNL Window per NFRC 100, actual values may vary due to production tolerances.
- Argon calculations based on 90% gas fill level.
- (#) 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%	13%	15%	.59	.48	.46	34%
	LoE-i89 (3)	73%	13%	14%	.55	.33	.29	32%
	LoE-180 ESC (3)	72%	13%	15%	.52	.31	.26	15%
	LoE-180 (3)	72%	13%	15%	.51	.31	.26	18%
	LoE ² -272 (3)	64%	11%	10%	.41	.30	.25	10%
	LoE ² -270 (3)	64%	12%	12%	.39	.29	.25	9%
	LoE ³ -366 (3)	59%	11%	11%	.35	.29	.24	3%
Gray	Clear	55%	9%	14%	.58	.48	.45	32%
	LoE-i89 (3)	54%	9%	13%	.53	.33	.29	30%
	LoE-180 ESC (3)	53%	9%	14%	.50	.31	.26	14%
	LoE-180 (3)	53%	9%	14%	.49	.31	.26	17%
	LoE ² -272 (3)	47%	8%	10%	.36	.29	.25	9%
	LoE ² -270 (3)	47%	9%	11%	.34	.29	.25	9%
	LoE ³ -366 (3)	43%	8%	10%	.29	.29	.24	3%
Bronze	Clear	61%	10%	14%	.63	.48	.45	33%
	LoE-i89 (3)	59%	10%	13%	.58	.33	.29	32%
	LoE-180 ESC (3)	59%	10%	14%	.55	.31	.26	15%
	LoE-180 (3)	59%	10%	14%	.53	.31	.26	17%
	LoE ² -272 (3)	52%	9%	10%	.39	.29	.25	10%
	LoE ² -270 (3)	52%	10%	12%	.36	.29	.25	9%
	LoE ³ -366 (3)	48%	9%	11%	.31	.29	.24	3%

Notes:

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- Argon calculations based on 90% gas fill level.
- (#) 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%	14%	14%	.73	.47	.45	47%
Clear	LoE-i89 (3)	78%	14%	14%	.70	.33	.29	45%
Clear	LoE-180 ESC (3)	77%	14%	15%	.66	.31	.26	21%
Clear	LoE-180 (3)	77%	14%	15%	.64	.30	.26	24%
Clear	LoE-Di89 (3 & 4)	76%	14%	13%	.66	.26	.23	44%
LoE-180 ESC (2)	Clear	77%	15%	14%	.62	.31	.26	21%
LoE-180 (2)	Clear	77%	15%	14%	.61	.30	.26	24%
LoE ² -272 (2)	Clear	70%	10%	11%	.40	.29	.25	14%
LoE ² -270 (2)	Clear	67%	12%	13%	.36	.29	.24	12%
LoE ³ -366 (2)	Clear	63%	11%	12%	.27	.29	.24	4%
LoE-452+ (2)	Clear	51%	9%	15%	.22	.28	.24	1%
LoE ² -240 (2)	Clear	38%	14%	10%	.24	.30	.25	13%
LoE ³ -340 (2)	Clear	38%	13%	15%	.18	.29	.24	2%
LoE ³ -340+ (2)	Clear	38%	12%	11%	.18	.29	.24	2%
LoE-180 ESC (2)	LoE-i89 (4)	75%	15%	14%	.60	.24	.21	20%
LoE-180 (2)	LoE-i89 (4)	75%	15%	13%	.58	.24	.21	23%
LoE ² -272 (2)	LoE-i89 (4)	68%	10%	11%	.39	.23	.20	14%
LoE ² -270 (2)	LoE-i89 (4)	66%	12%	12%	.35	.23	.20	12%
LoE ³ -366 (2)	LoE-i89 (4)	61%	11%	11%	.26	.23	.19	4%
LoE-452+ (2)	LoE-i89 (4)	49%	9%	14%	.21	.23	.19	1%
LoE ² -240 (2)	LoE-i89 (4)	37%	14%	10%	.23	.23	.20	12%
LoE ³ -340 (2)	LoE-i89 (4)	37%	13%	14%	.17	.23	.20	2%
LoE ³ -340+ (2)	LoE-i89 (4)	37%	12%	10%	.17	.23	.20	2%

Notes:

- Values are center of glass calculated using LBNL Window per NFRC 100, actual values may vary due to production tolerances.
- Argon calculations based on 90% gas fill level.
- (#) 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	67%	12%	14%	.47	.47	.45	20%
	LoE-i89 (3)	65%	12%	13%	.42	.33	.29	20%
	LoE-180 ESC (3)	65%	12%	14%	.40	.31	.26	10%
	LoE-180 (3)	65%	12%	14%	.40	.30	.26	11%
	LoE ² -272 (3)	59%	10%	10%	.35	.29	.25	7%
	LoE ² -270 (3)	57%	11%	11%	.34	.29	.24	6%
	LoE ³ -366 (3)	53%	10%	10%	.31	.29	.24	2%
Gray	Clear	40%	7%	13%	.46	.47	.45	19%
	LoE-i89 (3)	39%	7%	12%	.41	.33	.29	19%
	LoE-180 ESC (3)	38%	7%	13%	.38	.31	.26	9%
	LoE-180 (3)	38%	7%	13%	.37	.30	.26	10%
	LoE ² -272 (3)	35%	6%	9%	.29	.29	.25	7%
	LoE ² -270 (3)	34%	7%	11%	.27	.29	.24	6%
	LoE ³ -366 (3)	31%	7%	10%	.23	.29	.24	2%
Bronze	Clear	48%	8%	13%	.51	.47	.45	20%
	LoE-i89 (3)	46%	8%	12%	.47	.33	.29	20%
	LoE-180 ESC (3)	46%	8%	14%	.44	.31	.26	9%
	LoE-180 (3)	46%	8%	14%	.43	.30	.26	11%
	LoE ² -272 (3)	42%	7%	9%	.32	.29	.25	7%
	LoE ² -270 (3)	40%	8%	11%	.30	.29	.24	6%
	LoE ³ -366 (3)	37%	7%	10%	.26	.29	.24	2%

Notes:

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- Argon calculations based on 90% gas fill level.
- (#) 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		UV Trans
			Trans	Reflectance Out	Reflectance In		U-Factor BTU/hr/ft ² /°F	Air Argon	
LoE-180 ESC (2)	Clear	LoE-180 ESC (5)	70%	21%	21%	0.58	.20	.16	10%
LoE-180 (2)	Clear	LoE-180 (5)	70%	20%	20%	0.56	.19	.15	13%
LoE ² -272 (2)	Clear	LoE-180 (5)	63%	15%	18%	0.37	.19	.15	8%
LoE ² -270 (2)	Clear	LoE-180 (5)	62%	16%	19%	0.33	.19	.15	7%
LoE ³ -366 (2)	Clear	LoE-180 (5)	57%	15%	18%	0.25	.19	.15	2%
LoE-452+ (2)	Clear	LoE-180 (5)	46%	12%	21%	0.20	.19	.15	1%
LoE ² -240 (2)	Clear	LoE-180 (5)	35%	16%	17%	0.22	.19	.15	7%
LoE ³ -340 (2)	Clear	LoE-180 (5)	34%	15%	21%	0.16	.19	.15	1%
LoE ³ -340+ (2)	Clear	LoE-180 (5)	34%	14%	18%	0.16	.19	.15	1%
LoE-180 ESC (2)	LoE-180 ESC (4)	LoE-i89 (6)	69%	21%	19%	0.55	.17	.14	9%
LoE-180 (2)	LoE-180 (4)	LoE-i89 (6)	68%	21%	19%	0.53	.17	.13	13%
LoE ² -272 (2)	LoE-180 (4)	LoE-i89 (6)	62%	15%	16%	0.36	.16	.13	8%
LoE ² -270 (2)	LoE-180 (4)	LoE-i89 (6)	60%	16%	18%	0.32	.16	.13	6%
LoE ³ -366 (2)	LoE-180 (4)	LoE-i89 (6)	56%	15%	17%	0.24	.16	.13	2%
LoE-452+ (2)	LoE-180 (4)	LoE-i89 (6)	45%	12%	19%	0.19	.16	.13	1%
LoE ² -240 (2)	LoE-180 (4)	LoE-i89 (6)	34%	16%	16%	0.21	.16	.13	6%
LoE ³ -340 (2)	LoE-180 (4)	LoE-i89 (6)	33%	15%	19%	0.15	.16	.13	1%
LoE ³ -340+ (2)	LoE-180 (4)	LoE-i89 (6)	34%	14%	16%	0.15	.16	.13	1%

Notes:

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- Argon calculations based on 90% gas fill level.
- (#) after coating is IGU coating surface number.

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 U-Factor BTU/hr/ft ² /°F		UV Trans
			Trans	Reflectance Out	Reflectance In		Air	Argon	
Cardinal	Clear	LoE-i89 (3)	78%	14%	14%	.70	.33	.29	45%
	Clear	LoE-180 ESC (3)	77%	14%	15%	.66	.31	.26	21%
	Clear	LoE-180 (3)	77%	14%	15%	.64	.30	.26	24%
	Clear	LoE-Di89 (3 & 4)	76%	14%	13%	.66	.26	.23	44%
	LoE ² -272 (2)	Clear	72%	11%	12%	.41	.30	.25	16%
	LoE ² -270 (2)	Clear	70%	12%	13%	.37	.29	.25	14%
	LoE ³ -366 (2)	Clear	65%	11%	12%	.27	.29	.24	5%
	LoE-452+ (2)	Clear	52%	10%	15%	.22	.29	.24	1%
	LoE ² -240 (2)	Clear	40%	14%	11%	.25	.30	.25	15%
	LoE ³ -340 (2)	Clear	39%	13%	16%	.18	.29	.24	2%
	LoE ³ -340+ (2)	Clear	39%	13%	11%	.18	.29	.24	2%
Guardian	ClimaGuard® 62/27 (2)	Clear	61%	12%	14%	.26	.29	.24	7%
	ClimaGuard® 55 (2)	Clear	55%	15%	19%	.26	.29	.24	15%
	ClimaGuard® 53/23 (2)	Clear	53%	13%	12%	.23	.29	.24	11%
	ClimaGuard® 70 (2)	Clear	69%	15%	16%	.35	.29	.24	20%
	Clear	ClimaGuard® 80/71 (3)	80%	14%	14%	.71	.31	.27	44%
Vistro	SolarBan® 70 (2)	Clear	63%	13%	14%	.26	.29	.24	4%
	SolarBan® 60 (2)	Clear	72%	11%	12%	.40	.29	.25	20%
	Clear	Sungate® 400 (3)	78%	14%	14%	.68	.32	.28	32%

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- (#) 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

Comparison of Coating Glass Products

	Exterior 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	
Cardinal	LoE ¹ -180 (2)	Clear	77%	15%	14%	.61	.30	.26	24%
	LoE ² -272 (2)	Clear	70%	10%	11%	.40	.29	.25	14%
	LoE ² -270 (2)	Clear	67%	12%	13%	.36	.29	.24	12%
	LoE ³ -366 (2)	Clear	63%	11%	12%	.27	.29	.24	4%
	LoE-452+ (2)	Clear	51%	9%	15%	.22	.28	.24	1%
	LoE ² -240 (2)	Clear	38%	14%	10%	.24	.30	.25	13%
	LoE ³ -340 (2)	Clear	38%	13%	15%	.18	.29	.24	2%
	LoE ³ -340+ (2)	Clear	38%	12%	11%	.18	.29	.24	2%
Guardian	ClimaGuard® 53/23 (2)	Clear	52%	13%	12%	.23	.29	.24	9%
	ClimaGuard® 55 (2)	Clear	54%	15%	19%	.26	.29	.24	13%
	Climaguard® 62/27 (2)	Clear	60%	12%	14%	.26	.29	.24	6%
	ClimaGuard® 70 (2)	Clear	67%	15%	16%	.34	.29	.24	18%
	SunGuard® HP Neutral 78/65 (2)	Clear	78%	13%	13%	.62	.31	.27	38%
	SunGuard® SNX 70+ (2)	Clear	66%	14%	15%	.27	.28	.24	13%
	SunGuard™ SN 54 (2)	Clear	54%	14%	20%	.28	.29	.24	16%
	SunGuard™ SN 68 (2)	Clear	68%	11%	12%	.37	.29	.25	30%
	SunGuard™ SNX 51/23 (2)	Clear	51%	14%	13%	.23	.29	.24	10%
	SunGuard™ SNX 62/27 (2)	Clear	62%	11%	12%	.26	.29	.24	6%
Vitro	SolarBan® 60 (2)	Clear	70%	11%	12%	.39	.29	.24	18%
	SolarBan® 70 (2)	Clear	64%	13%	14%	.27	.28	.24	6%
	SolarBan® 90 (2)	Clear	51%	12%	19%	.23	.29	.24	7%
	SolarBan® R100 (2)	Clear	42%	32%	14%	.23	.29	.25	12%
	SolarBan® R67 (2)	Clear	54%	19%	16%	.29	.29	.24	11%
	SolarBan® R77 (2)	Clear	47%	25%	16%	.24	.29	.24	13%
Viracon	VE1-2M (2)	Clear	71%	11%	12%	.38	.29	.25	10%
	VE1-48 (2)	Clear	47%	17%	11%	.37	.31	.26	20%
	VE1-85 (2)	Clear	76%	12%	13%	.55	.31	.27	27%
	VNE1-53 (2)	Clear	49%	19%	21%	.22	.29	.24	2%
	VNE1-63 (2)	Clear	63%	10%	11%	.28	.29	.24	5%
	VNG1-4022 (2)	Clear	40%	19%	16%	.21	.29	.24	6%
	VUE1-50 (2)	Clear	49%	11%	11%	.25	.29	.24	6%

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

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