CARDINAL CG
A CARDINAL GLASS INDUSTRIES COMPANY

TECHNICAL SERVICE BULLETIN Bulletin #CG09–10/22

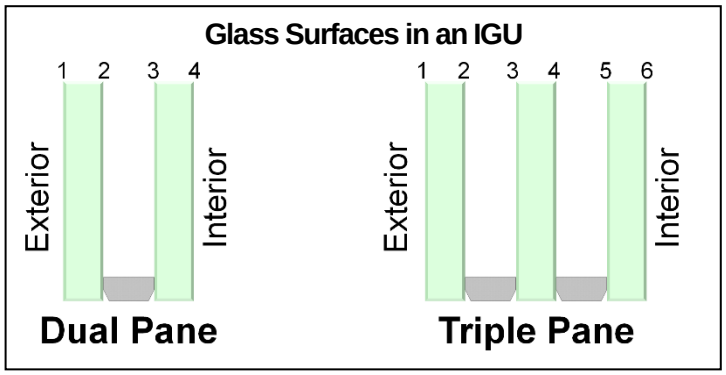
Insulating Glass Unit (IGU) Performance Data

Cardinal LoÉ™ glass sets the industry standard for energy-efficient coated glass products. Our patented, world-class, sputtered LoÉ 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.

Solar Control	LoÉ²-240® LoÉ³-340®	Low solar heat gain coefficient (SHCG) with glare control. Both products maintain cool glass temperatures in warm climates.
	LoÉ²-272® LoÉ²-270®	Mid SHGC with high visible light transmission that provides year-round performance and comfort.
	LoÉ³-366®	Balance of low SHGC and high visible light transmission while providing year-round comfort.
Passive Solar	LoÉ-180® LoÉ-180 ESC™	These coatings allow a high SHGC while preventing room heat loss to the outside. LoÉ-180 ESC was engineered to meet the ENERGY STAR Canada criteria.
	LoÉ-Di89™	LoÉ-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	LoÉ-i89®	For enhanced winter performance by further lowering the U-Factor. It can be combined with any Cardinal LoÉ.
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 LoÉ coatings to be used on the #3 glass surface of a dual pane IG unit with a clear outdoor lite. The potential for interior glass breakage resulting from thermal stress is increased. LoÉ²-240 & LoÉ³-340 should only be used on the #2 surface.

Cardinal LoÉ 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/ft²/°F)		UV Trans
		Trans	Reflectance Out	Reflectance In		Air	Argon	
Clear	Clear	82%	15%	15%	0.78	0.48	0.46	58%
Clear	LoĒ-i89 (3)	80%	15%	14%	0.75	0.33	0.29	55%
Clear	LoĒ-180 ESC (3)	79%	15%	15%	0.71	0.31	0.27	25%
Clear	LoĒ-180 (3)	79%	15%	15%	0.69	0.31	0.26	29%
Clear	LoĒ-Di89 (3 & 4)	79%	14%	14%	0.71	0.26	0.23	52%
LoĒ-180 ESC (2)	Clear	79%	15%	15%	0.67	0.31	0.27	25%
LoĒ-180 (2)	Clear	79%	15%	15%	0.64	0.31	0.26	29%
LoĒ²-272 (2)	Clear	72%	11%	12%	0.41	0.30	0.25	16%
LoĒ²-270 (2)	Clear	70%	12%	13%	0.37	0.30	0.25	14%
LoĒ³-366 (2)	Clear	65%	11%	12%	0.27	0.29	0.24	5%
LoĒ²-240 (2)	Clear	40%	14%	11%	0.25	0.30	0.26	16%
LoĒ³-340 (2)	Clear	39%	13%	16%	0.18	0.29	0.25	2%
LoĒ-180 ESC (2)	LoĒ-i89 (4)	78%	15%	14%	0.64	0.24	0.21	24%
LoĒ-180 (2)	LoĒ-i89 (4)	77%	15%	14%	0.62	0.24	0.21	27%
LoĒ²-272 (2)	LoĒ-i89 (4)	70%	11%	11%	0.41	0.23	0.20	16%
LoĒ²-270 (2)	LoĒ-i89 (4)	68%	12%	13%	0.36	0.23	0.20	14%
LoĒ³-366 (2)	LoĒ-i89 (4)	63%	11%	12%	0.27	0.23	0.20	5%
LoĒ²-240 (2)	LoĒ-i89 (4)	39%	14%	10%	0.24	0.24	0.21	15%
LoĒ³-340 (2)	LoĒ-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
⅛”	½”	⅛”

3mm - Double Pane IGU Tinted Glass Performance Data

Exterior Glass	Interior Glass	Visible Light			SHGC	Center of Glass U-Factor (BTU/hr/ft²/°F)		UV Trans
		Trans	Reflectance					
			Out	In		Air	Argon	
Green	Clear	75%	14%	15%	0.60	0.48	0.46	36%
	LoĒ-i89 (3)	74%	13%	14%	0.56	0.33	0.29	35%
	LoĒ-180 ESC (3)	73%	14%	15%	0.53	0.31	0.27	16%
	LoĒ-180 (3)	73%	13%	15%	0.52	0.31	0.26	19%
	LoĒ²-272 (3)	66%	11%	11%	0.42	0.30	0.25	11%
	LoĒ²-270 (3)	64%	12%	12%	0.39	0.30	0.25	10%
	LoĒ³-366 (3)	59%	11%	11%	0.35	0.29	0.24	3%
Gray	Clear	55%	9%	14%	0.58	0.48	0.46	32%
	LoĒ-i89 (3)	54%	9%	13%	0.53	0.33	0.29	30%
	LoĒ-180 ESC (3)	53%	9%	14%	0.50	0.31	0.27	14%
	LoĒ-180 (3)	53%	9%	14%	0.49	0.31	0.26	17%
	LoĒ²-272 (3)	48%	8%	10%	0.37	0.30	0.25	10%
	LoĒ²-270 (3)	47%	9%	11%	0.34	0.30	0.25	9%
	LoĒ³-366 (3)	43%	8%	10%	0.29	0.29	0.24	3%
Bronze	Clear	61%	10%	14%	0.63	0.48	0.46	33%
	LoĒ-i89 (3)	59%	10%	13%	0.58	0.33	0.29	32%
	LoĒ-180 ESC (3)	59%	10%	14%	0.55	0.31	0.27	15%
	LoĒ-180 (3)	59%	10%	14%	0.53	0.31	0.26	17%
	LoĒ²-272 (3)	53%	9%	10%	0.39	0.30	0.25	10%
	LoĒ²-270 (3)	52%	10%	12%	0.36	0.30	0.25	9%
	LoĒ³-366 (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
⅛”	½”	⅛”

6mm - Double Pane IGU Performance Data

Exterior Glass	Interior Glass	Visible Light			SHGC	Center of Glass U-Factor (BTU/hr/ft²/°F)		UV Trans
		Trans	Reflectance					
			Out	In		Air	Argon	
Clear	Clear	80%	15%	15%	0.72	0.47	0.45	48%
Clear	LoĒ-i89 (3)	78%	14%	14%	0.69	0.33	0.29	46%
Clear	LoĒ-180 ESC (3)	77%	14%	15%	0.66	0.31	0.26	21%
Clear	LoĒ-180 (3)	77%	14%	15%	0.64	0.30	0.26	24%
Clear	LoĒ-Di89 (3 & 4)	76%	14%	13%	0.66	0.26	0.23	44%
LoĒ-180 ESC (2)	Clear	77%	15%	14%	0.62	0.31	0.26	21%
LoĒ-180 (2)	Clear	77%	15%	14%	0.60	0.30	0.26	24%
LoĒ²-272 (2)	Clear	70%	11%	11%	0.40	0.29	0.25	14%
LoĒ²-270 (2)	Clear	68%	12%	13%	0.36	0.29	0.25	12%
LoĒ³-366 (2)	Clear	63%	11%	12%	0.27	0.29	0.24	4%
LoĒ²-240 (2)	Clear	37%	13%	10%	0.24	0.30	0.25	13%
LoĒ³-340 (2)	Clear	38%	13%	15%	0.18	0.29	0.24	2%
LoĒ-180 ESC (2)	LoĒ-i89 (4)	75%	15%	14%	0.60	0.24	0.21	20%
LoĒ-180 (2)	LoĒ-i89 (4)	75%	15%	13%	0.58	0.24	0.21	23%
LoĒ²-272 (2)	LoĒ-i89 (4)	68%	10%	11%	0.39	0.23	0.20	14%
LoĒ²-270 (2)	LoĒ-i89 (4)	66%	12%	12%	0.35	0.23	0.20	12%
LoĒ³-366 (2)	LoĒ-i89 (4)	61%	11%	11%	0.26	0.23	0.19	4%
LoĒ²-240 (2)	LoĒ-i89 (4)	37%	13%	9%	0.23	0.24	0.21	13%
LoĒ³-340 (2)	LoĒ-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
¼”	½”	¼”

6mm - Double Pane IGU Tinted Glass Performance Data

Exterior Glass	Interior Glass	Visible Light			SHGC	Center of Glass U-Factor (BTU/hr/ft²/°F)		UV Trans
		Trans	Reflectance					
			Out	In		Air	Argon	
Green	Clear	69%	12%	14%	0.50	0.47	0.45	25%
	LoĒ-i89 (3)	68%	12%	14%	0.45	0.33	0.29	24%
	LoĒ-180 ESC (3)	67%	12%	15%	0.43	0.31	0.26	11%
	LoĒ-180 (3)	67%	12%	15%	0.42	0.30	0.26	13%
	LoĒ²-272 (3)	61%	10%	10%	0.37	0.29	0.25	8%
	LoĒ²-270 (3)	59%	11%	12%	0.35	0.29	0.25	7%
	LoĒ³-366 (3)	55%	10%	11%	0.32	0.29	0.24	2%
Gray	Clear	40%	7%	13%	0.46	0.47	0.45	20%
	LoĒ-i89 (3)	39%	7%	12%	0.41	0.33	0.29	19%
	LoĒ-180 ESC (3)	38%	7%	13%	0.38	0.31	0.26	9%
	LoĒ-180 (3)	38%	7%	13%	0.37	0.30	0.26	10%
	LoĒ²-272 (3)	35%	6%	9%	0.29	0.29	0.25	7%
	LoĒ²-270 (3)	34%	7%	11%	0.27	0.29	0.25	6%
	LoĒ³-366 (3)	31%	7%	10%	0.23	0.29	0.24	2%
Bronze	Clear	48%	8%	13%	0.51	0.47	0.45	21%
	LoĒ-i89 (3)	47%	8%	13%	0.47	0.33	0.29	20%
	LoĒ-180 ESC (3)	46%	8%	14%	0.44	0.31	0.26	9%
	LoĒ-180 (3)	46%	8%	14%	0.43	0.30	0.26	11%
	LoĒ²-272 (3)	42%	7%	9%	0.32	0.29	0.25	7%
	LoĒ²-270 (3)	40%	8%	11%	0.30	0.29	0.25	6%
	LoĒ³-366 (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
¼”	½”	¼”

3mm - Triple Pane IGU Performance Data

Exterior Glass	Center Glass	Interior Glass	Visible Light			SHGC	Center of Glass U-Factor (BTU/hr/ft²/°F)		UV Trans
			Trans	Reflectance Out	Reflectance In		Air	Argon	
LoĒ-180 ESC (2)	Clear	LoĒ-180 ESC (5)	70%	21%	21%	0.58	0.19	0.15	10%
LoĒ-180 (2)	Clear	LoĒ-180 (5)	70%	20%	20%	0.56	0.19	0.15	13%
LoĒ-180 ESC (2)	Clear	LoĒ-Di89 (5 & 6)	69%	20%	19%	0.58	0.17	0.14	19%
LoĒ²-272 (2)	Clear	LoĒ-180 (5)	63%	15%	18%	0.37	0.19	0.15	8%
LoĒ²-270 (2)	Clear	LoĒ-180 (5)	62%	16%	19%	0.33	0.19	0.15	7%
LoĒ³-366 (2)	Clear	LoĒ-180 (5)	57%	15%	18%	0.25	0.19	0.14	2%
LoĒ²-240 (2)	Clear	LoĒ-180 (5)	35%	16%	17%	0.22	0.19	0.15	7%
LoĒ³-340 (2)	Clear	LoĒ-180 (5)	34%	15%	21%	0.16	0.19	0.14	1%
LoĒ-180 ESC (2)	LoĒ-180 ESC (4)	LoĒ-i89 (6)	68%	21%	19%	0.54	0.16	0.13	11%
LoĒ-180 (2)	LoĒ-180 (4)	LoĒ-i89 (6)	68%	21%	19%	0.53	0.16	0.13	13%
LoĒ²-272 (2)	LoĒ-180 (4)	LoĒ-i89 (6)	62%	15%	16%	0.36	0.16	0.13	8%
LoĒ²-270 (2)	LoĒ-180 (4)	LoĒ-i89 (6)	60%	16%	18%	0.32	0.16	0.13	6%
LoĒ³-366 (2)	LoĒ-180 (4)	LoĒ-i89 (6)	56%	15%	17%	0.24	0.16	0.13	2%
LoĒ²-240 (2)	LoĒ-180 (4)	LoĒ-i89 (6)	34%	16%	15%	0.21	0.16	0.13	7%
LoĒ³-340 (2)	LoĒ-180 (4)	LoĒ-i89 (6)	33%	15%	19%	0.15	0.16	0.13	1%

Notes:

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(2) Argon Calculations based on 90% gas fill level.
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(4) (#) after coating is IGU coating surface number.

Glass	Airspace	Glass	Airspace	Glass
3mm	9.8mm	3mm	9.8mm	3mm
⅛”	⅜”	⅛”	⅜”	⅛”

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/ft²/°F)		UV Trans
		Trans	Reflectance Out	Reflectance In		Air	Argon	
Low SHGC								
Cardinal LoÉ³-366 (2)	Clear	65%	11%	12%	0.27	0.29	0.24	5%
Cardinal LoÉ²-240 (2)	Clear	40%	14%	11%	0.25	0.30	0.26	16%
Cardinal LoÉ³-340 (2)	Clear	39%	13%	16%	0.18	0.29	0.25	2%
Vitro SolarBan® 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® 55/27 (2)	Clear	56%	17%	19%	0.28	0.29	0.25	20%
Guardian ClimaGuard® 53/23 (2)	Clear	53%	13%	12%	0.23	0.29	0.24	10%
Mid SHGC								
Cardinal LoÉ²-272 (2)	Clear	72%	11%	12%	0.41	0.30	0.25	16%
Cardinal LoÉ²-270 (2)	Clear	70%	12%	13%	0.37	0.30	0.25	14%
Vitro SolarBan® 60 (2)	Clear	73%	11%	12%	0.40	0.30	0.25	20%
Guardian ClimaGuard® 72/57 (2)	Clear	71%	14%	13%	0.47	0.30	0.25	26%
Guardian ClimaGuard® 70/36 (2)	Clear	70%	11%	12%	0.38	0.30	0.25	24%
High SHGC								
Clear	LoÉ-i89 (3)	80%	15%	14%	0.75	0.33	0.29	55%
Clear	LoÉ-180 ESC (3)	79%	15%	15%	0.71	0.31	0.27	25%
Clear	LoÉ-180 (3)	79%	15%	15%	0.69	0.31	0.26	29%
Clear	LoÉ-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%

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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
3mm	13.0mm	3mm
⅛”	½”	⅛”