



## Cardinal Coated Glass

Superior glass products  
for residential windows and doors

# LoE240

Note: All values calculated using Window 5.2. (See <http://windows.lbl.gov/software/window/window.html> and <http://windows.lbl.gov/materials/igdb/> for more information on glass optical data and the Windows 5.2 program.) Emittance of ordinary low-e is 0.20.

**Solar Heat Gain Coefficient** – (SHGC). The amount of solar radiation that enters a building as heat. The lower the number, the better the glazing is at preventing solar gain.

**Fading Transmission** – The portion of energy transmitted in a spectral region from 300 to 700 nanometers. This region includes all of the ultraviolet energy and most of the visible spectrum, and will give the best representation of relative fading rates. The lower the number, the better the glass is for reducing fading potential of carpets and interior furnishings.

**U-Factor** – This represents the heat flow rate through a window expressed in BTU/hr/ft<sup>2</sup>/°F, using winter weather conditions of 0°F outside and 70°F inside. The smaller the number, the better the window system is at reducing heat loss.

Cardinal actively supports and participates in The National Fenestration Rating Council (NFRC). Windows with LoE<sup>2</sup>-240 that are rated and certified by the NFRC can comply with Energy Star™ requirements for all climates in the country.

(See <http://www.energystar.gov/products/windows/> for more information on the Energy Star windows program.)

### GLASS PERFORMANCE

PRODUCT	VISIBLE LIGHT TRANSMITTANCE %	SOLAR HEAT GAIN COEFFICIENT	WINTER U-FACTOR (AIR/ARGON)	UV	FADING TRANSMISSION
Single-pane, tinted	68%	.73	1.04/---	.38	.58
Double-pane, tinted	61%	.63	.48/--	.32	.52
Double-pane, tint & low-e	57%	.57	.35/.31	.21	.45
<b>LoE<sup>2</sup>-240</b>	<b>40%</b>	<b>.25</b>	<b>.30/.26</b>	<b>.16</b>	<b>.35</b>



## Cardinal CG

A Cardinal Glass Industries Company

775 Prairie Center Drive,  
Eden Prairie, MN 55344  
[cardinalcorp.com](http://cardinalcorp.com)



GLARE CONTROL GLASS

## Glare back at the sun with

Wherever glare is a problem, Cardinal LoE<sup>2</sup>-240 glass is the ideal solution. It's a specially treated version of our finest LoE<sup>2</sup> glass. But LoE<sup>2</sup>-240 does much more than control glare. It also maintains year-round comfort. In summer, it blocks oppressive solar heat gain and maintains cool glass temperatures. Then when winter rolls around, it keeps inside glass temperatures warm. Control and year-round comfort – that's the Cardinal advantage.

# The science of glare control glass.

Clear glass transmits as much as 90% of the solar energy in all the regions and is ineffective at controlling glare or solar heat gain.

Bronze and gray-tinted glass absorb as much as 50% of all sunlight, but this varies with thickness. Large windows with thick glass will be dark, while small windows with thin glass will have little tint and minimal solar control. What's more, single-pane tinted glass temperatures can exceed 100°F, leading to serious discomfort near the window.

Reflective glass products are effective in rejecting solar gain, but their shiny appearance is undesirable in most homes and buildings.

To understand how LoE<sup>2</sup>-240 advances the science of glare control glass, let's review what sunlight is and how various glass products handle this energy.

Within the spectrum of solar energy, there are three distinct regions:

### 1. Ultraviolet (UV)

UV is invisible and makes up about 3% of the total solar energy. This region of wave lengths is typically associated with fading of fabrics, paints, etc.

### 2. Visible Light

This portion of the solar spectrum makes up about 45% of the total solar energy.

### 3. Near Infrared (NIR)

NIR is approximately 52% of the solar energy and invisible to the eye.

## is quite clear.

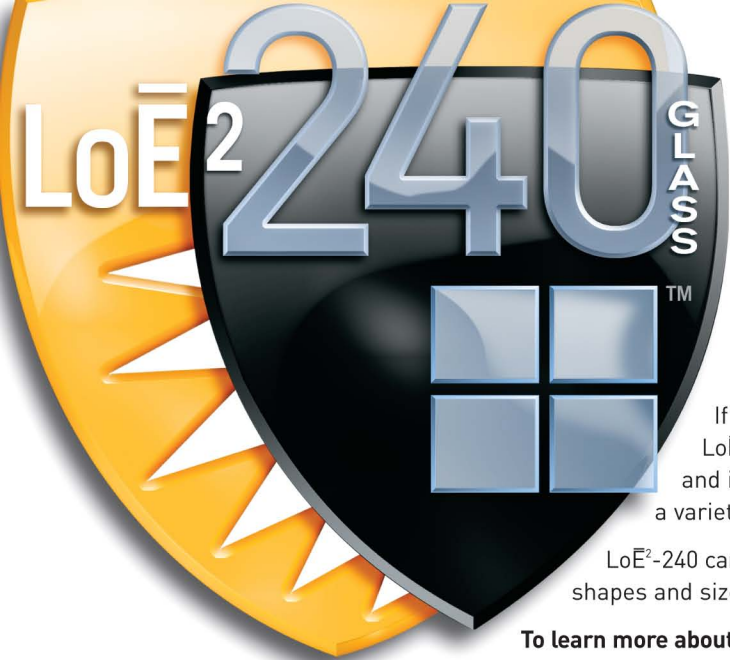
### Glass Comparisons

	Light Transmission	Reflectance	Color	Winter Comfort	Summer Comfort
Single-pane, tinted	Moderate	Low	Tinted	Poor	Poor
Double-pane, tinted	Moderate	Low	Tinted	Moderate	Moderate
Double-pane, tinted & low-e	Moderate	Low	Tinted	Good	Moderate
<b>LoE<sup>2</sup>-240</b>	<b>Moderate</b>	<b>Low</b>	<b>Tinted</b>	<b>Good</b>	<b>Good</b>



## the best solar control glass under the sun.

Other tinted glass comes with glaring deficiencies. Regular tinted glass works by absorbing sunlight. The color of the glass changes with the thickness and becomes hot in the sunlight. However, LoE<sup>2</sup>-240 is a coating that is applied to clear glass, so that the appearance and performance are the same regardless of the glass thickness.



## The best choice for glare control

If you envision your home's design benefiting from a tinted glass for glare control, LoE<sup>2</sup>-240 offers a great combination of aesthetic appeal along with energy performance and indoor comfort. The summary at right gives you a comparative ranking based on a variety of glass selection criteria.

LoE<sup>2</sup>-240 can also be purchased in hurricane-resistant laminated glass, in a variety of custom shapes and sizes.

**To learn more about LoE<sup>2</sup>-240 and other Cardinal glass products, ask your contractor or architect, or visit our website at [www.cardinalcorp.com](http://www.cardinalcorp.com).**

What makes multi-layer LoE<sup>2</sup>-240 different is its ability to handle each portion of the solar spectrum differently:

The **invisible** difference:  
LoE<sup>2</sup>, spectrally selective glass.

### 1. Ultraviolet (UV)

LoE<sup>2</sup>-240 blocks over 84% of the harmful UV radiation.

### 2. Visible Light

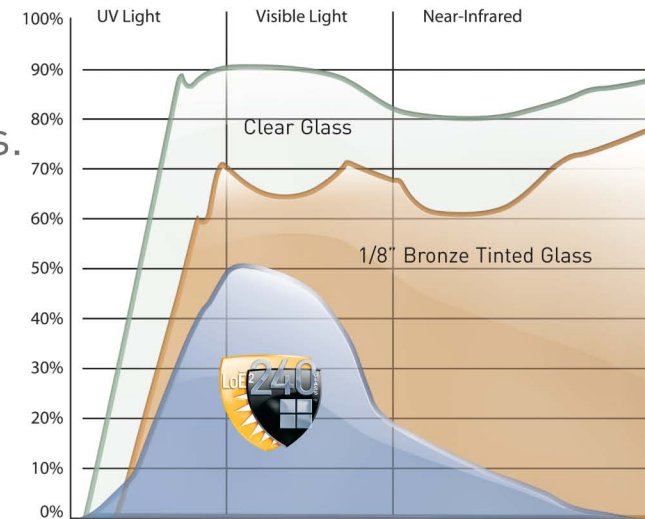
LoE<sup>2</sup>-240 absorbs 60% of the visible light, which gives the coating glare control and its soft muted blue color.

### 3. Near Infrared (NIR)

LoE<sup>2</sup>-240 reflects nearly all of the invisible solar infrared rays.

This graph compares the solar transmission of clear glass, bronze tinted glass and LoE<sup>2</sup>-240. Clear glass allows nearly all the solar energy through. Bronze glass reduces transmission by absorbing sunlight, but it's more effective at blocking light than heat. To match the glare control of LoE<sup>2</sup>-240, a tinted glass would have to be 1/4" thick.

Even at this heavy thickness, the solar blockage of tinted glass doesn't compare with LoE<sup>2</sup>-240. The LoE<sup>2</sup>-240 plot demonstrates the "selective" nature of the coating. Visible transmission is nearly twice the amount of solar gain. As a result, LoE<sup>2</sup>-240 provides effective glare control and maximum solar blockage in a softly tinted design - without the punishing discomfort of heat-absorbing glass or the visual disruption of highly reflective glass.



# All season comfort.

LoE<sup>2</sup>-240 is more than a solar control glass. Its advanced coating design also provides the lowest possible U-factor to deliver comfort and energy savings during cold winter weather.

Year-round thermal comfort is a result of warm glass temperatures in the winter, cool glass temperatures in the summer, and the blockage of oppressive solar heat gains. Comfort comparisons for various products are shown in the chart. Note that the solar blockage for single-pane tinted glass is marginal, and the extreme temperature fluctuations can lead to serious year-round comfort problems.

**Winter Night**  
55° inside glass temp



**Summer Day**  
86° inside glass temp



## Inside Glass Temperatures

	Winter Night	Summer Day	Solar Blockage
Single-pane, tinted	15°	100°	27%
Double-pane, tinted	44°	92°	37%
Double-pane, tinted & low-e	53°	100°	43%
<b>LoE<sup>2</sup>-240</b>	<b>55°</b>	<b>86°</b>	<b>75%</b>

Double glazing improves the winter comfort, especially when a low-emittance LoE<sup>2</sup> coating is used. A double-pane window with conventional tinted glass and low-e on the #3 surface (air-space side of indoor pane) improves the solar blockage, but exposes the building occupants to hot glass temperatures in the summer.

LoE<sup>2</sup>-240 is placed on the #2 surface (air-space side of outdoor pane) and provides the best comfort through all the seasons.