

## Data Updates

Make-up Name	Visible Light				Solar Energy						Thermal Properties
	Transmittance	Reflectance		General Colour Rendering Index (R <sub>a</sub> )	Transmittance	Reflectance		Absorptance	Solar Factor (g%)	Shading Coefficient (sc)	U-Value
		Visible (τ <sub>v</sub> %)	ρ <sub>v</sub> % out			ρ <sub>v</sub> % in	Solar (τ <sub>e</sub> %)				ρ <sub>e</sub> % out
GL-01	89.8	8.3	8.3	98.8	79.0	7.4	7.4	13.6	82.2	0.94	5.6

Calculation Standard: EN 410:2011 / EN 673:2011

### GL-01

Outdoors	
GLASS 1	Guardian ExtraClear (CE) #1 ----- Thickness = 3mm #2 -----
INTERLAYER 1	PVB Clear 0.38mm (CE)
GLASS 2	Guardian ExtraClear (CE) #3 ----- Thickness = 3mm #4 -----
Total Unit (Nominal) = 6.381 mm Slope = 90°	
Estimated Nominal Glazing Weight: 15.4 kg/m <sup>2</sup>	
Indoors	

### Important Notes

Calculations and terms in this report are based on EN 410:2011/EN 673:2011. The performance values shown above represent nominal values for the center of glass with no spacer system or framing. Solar Factor (g) and Secondary Heat Transfer (qi) are not available for sloped glazing, as no calculation method is prescribed by the standard for these attributes.

The KIWA logo and KIWA Validation Report MD - 14/477/GL are provided as evidence of validation of the Guardian Performance Calculator software, program version 4.1, for execution of calculations of luminous and solar characteristics of glazing and thermal transmittance, according to EN 410:2011 and EN 673:2011.

Embodied CO<sub>2</sub> [eq. kg/m<sup>2</sup>] A1-A3 is estimated based on material Embodied Carbon Factor (ECF), derived from Guardian Glass Regional third-party independently verified and published / current Environmental Product Declarations (EPDs) which are produced to EN 15804 and are compliant with the requirements of ISO 14044, the International Life Cycle Assessment (LCA) standard, and ISO 14025 and ISO 21930, the international standards covering EPD for construction products. The A1-A3 ECF is an estimate of the embodied carbon due to production of that material. The resulting material value should then be multiplied by the square area of glazing to provide an estimate of embodied carbon of the material at the project scale. Embodied CO<sub>2</sub> estimates provided by Guardian represent only values associated with the glass components manufactured by Guardian. The estimated values do not represent in any way a plant-specific and/or product specific guarantee.

#### Laminated products:

The Performance Calculator allows the user to model a wide variety of laminated glass makeups using different float glass substrates, coatings and interlayer material, including those makeups where the coating faces the interlayer. It is the user's responsibility to assess whether the laminated glass makeup meets relevant regional standards and complies with applicable laminated glass safety regulations.

In addition, when the laminated glass makeup includes a coating facing the interlayer material, there may be a loss of thermal insulation performance and a color change compared to non-embedded coated class.

#### Non-specular products (translucent or diffuse):

The performance measurement for non-specular (translucent or diffuse) materials such as translucent interlayers or acid etched glass surface, or surface with ceramic frit is limited by the current experimental technologies. Since measurements

capture physically only a part of the resulting radiation, calculated performance results provided herein and based on such measurements are not compliant with any standard (including EN 410) and may only be used as a general reference. Actual values may vary significantly based upon exact fabrication process, as well as type, thickness and color of used non-specular material.

#### Explanation of Terms according to EN 410:2011/EN 673:2011

**Visible Light Transmittance (Tv, %)** is the percentage of incident light in the wavelength range of 380 nm to 780 nm that is transmitted by the glass.

**Ultraviolet (UV) Transmittance (Tuv, %)** is the percentage of the incident UV component of the solar radiation in the wavelength range of 280 nm to 380 nm that is transmitted by the glass.

**Solar Energy Direct Transmittance (Te, %)** is the percentage of incident solar energy in the wavelength range of 300 nm to 2500 nm that is directly transmitted by the glass.

**Visible Light Reflectance Outdoors/Indoor (Rv out/in, %)** is the percentage of incident visible light directly reflected by the glass.

**Solar Direct Reflectance Outdoors/Indoors (Re out/in, %)** is the percentage of incident solar energy directly reflected by the glass.

**Solar Energy Absorptance (Ae, %)** is the percentage of the sun's energy that is absorbed by glass.

**U-Value (Ug, W/m<sup>2</sup> K)** is the glazing parameter that characterizes the heat transfer through the central part of the glazing, i.e. without edge effects, and expresses the steady-state density of heat transfer rate per temperature difference between the environmental temperatures on each side. Temperature differential according to standard conditions:  $\Delta T=15K^{\circ}$ . The lower the value, the greater is the insulating value. EN 673 defines the value with 1 decimal place. The value is also provided with 3 decimal places for informational purposes.

**Solar Factor or Total Solar Energy Transmittance or g-value (g%)** is the total solar radiation transmitted by the glass.

**Shading Coefficient (sc)** is Solar Factor divided by 0.87. It is a measure of the solar heat gain referenced to 3 mm clear glass which has the designated value of 1.00.

**Secondary Heat Transfer Coefficient (q<sub>i</sub>)** is the result of heat transfer by convection and longwave IR-radiation of that part of the incident solar radiation which has been absorbed by the glazing.

**Colour Rendering Index in transmission, D65 (R<sub>a</sub>)** is the change in colour of an object as a result of the light being transmitted through the glass.

#### Disclaimer

This performance analysis is provided for the limited purpose of assisting the user in evaluating the performance of the glass products identified on this report.

Spectral data for products manufactured by Guardian reflect nominal values derived from typical production samples or CE Initial Type Testing and subject to variations due to manufacturing and calculation tolerances. Spectral data for products not manufactured by Guardian were derived from the LBNL International Glazing Database and have not been independently verified by Guardian. Guardian recommends a full-size mock-up be approved.

The values provided herein are generated according to established engineering practices and applicable calculation standards. Many factors may affect glazing characteristics, including glass size, building orientation, shading, wind speed, type of installation, production process and others. The applicability and results of the analysis are directly related to user inputs and any changes in actual conditions can have a significant effect on the results. It is the responsibility of the users of the analysis to ensure that the intended application is appropriate and complies with all relevant laws, regulations, standards, codes of practices, processing guidelines and other requirements. Guardian makes no guarantee that any glazing modeled herein is available from Guardian or any other manufacturer. The user has the responsibility to check with the manufacturer regarding availability of any glass type or make-up.

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## PERFORMANCE CALCULATOR

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Program Version: 4.1.0.9850  
Database Version: 20240214