GLASS UNLIMITED

Technical Data Sheet – Thermobel

02/2012

1 INTRODUCTION

This Technical Datasheet gives information about the range of insulating glass units Thermobel (double and triple glazing).

2 NORMATIVE REFERENCES

Thermobel products conform to:

- EN 1279-1 – Glass in building – Insulating glass units – Part 1: Generalities, dimensional tolerances and rules for the system description
- EN 1279-2 – Glass in building – Insulating glass units – Part 2: Long term test method and requirements for moisture penetration
- EN 1279-3 – Glass in building – Insulating glass units – Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances
- EN 1279-4 – Glass in building – Insulating glass units – Part 4: Methods of test for the physical attributes of edge seals
- EN 1279-5 + A1 – Glass in building – Insulating glass units – Part 5: Evaluation of the conformity
- EN 1279-6 – Glass in building – Insulating glass units – Part 6: Factory production control and periodic test

All Thermobel products are CE-marked following EN 1279-5; CE-Marking declarations are available from www.yourglass.com/CE.

3 COMPOSITION AND PROPERTIES OF THE GLASS

The basis glass used for Thermobel production are float glass conform to EN 572-1 & 2 (or related processed products as coating, laminated glass, …). The properties of the float glass are listed hereunder.

3.1 CHEMICAL COMPOSITION

The EN 572-1 defines the magnitude of the proportions by mass of the principal constituents of float glass is as following.

SiO_2	69 to 74 %
Na_2O	10 to 16 %
CaO	5 to 14 %
MgO	0 to 6 %
Al_2O_3	0 to 3 %
Others	0 to 5 %

3.2 MECHANICAL PROPERTIES

- Weight (at 18°C): $\rho = 2\ 500$ kg/m³
- Density: 2,5
- Young's Modulus (modulus of Elasticity): E = 70 000 N/mm²
- Poisson Ratio: $\mu = 0,2$
- Shear Modulus: $G = E/ [2 (1+\nu)] \approx 29\ 166$ N/mm²
- Knoop Hardnes: 6 GPa
- Mohs Hardness: 6
- Characteristic bending strength: 45 N/mm²

3.3 THERMAL PROPERTIES

- Softening point: ≈ 600 °C
- Fusion temperature: ≈ 1500 °C
- Linear expansion coefficient: $\alpha = 9.10^{-6}$/K (between 20° and 300°)
- Specific heat capacity: C = 720 J/(kg.K)

3.4 OPTICAL PROPERTIES

- Refractive index N to visible radiation (380 to 780 nm):
  - air/glass: 0,67
  - glass/air: 1,50

3.5 ELECTRICAL PROPERTIES

- Specific resistance: 5.10^7 Ω.m at 1 000 Hz and 25°C
- Dielectric constant: 7,6 at 1 000 Hz and 25°C

4 DURABILITY OF THERMOBEL

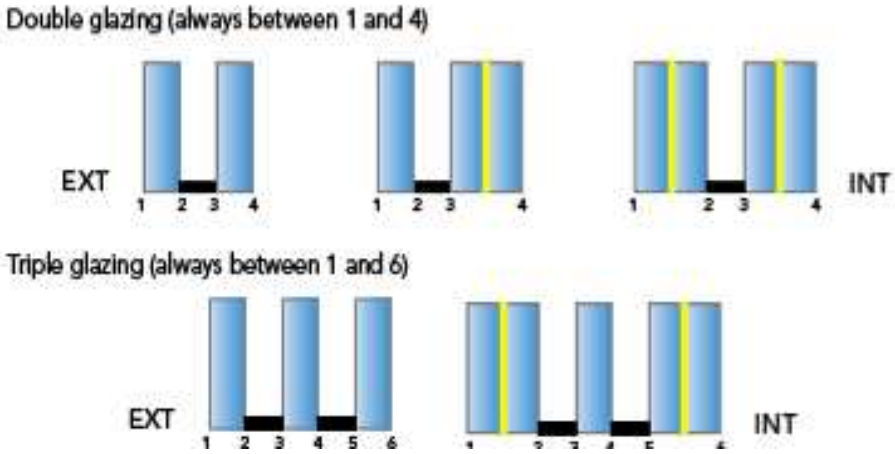
Thermobel products succeed the durability test:

- Moisture penetration following EN 1279-2
- Gas leakage (for gas filled units) following EN 1279-3
- Sealing adherence following EN 1279-4.

5 LIGHT, SOLAR AND THERMAL PROPERTIES

5.1 CONVENTION FOR COATING POSITION

The following conventions are used for the numbering of the glass faces and the position of the coating.

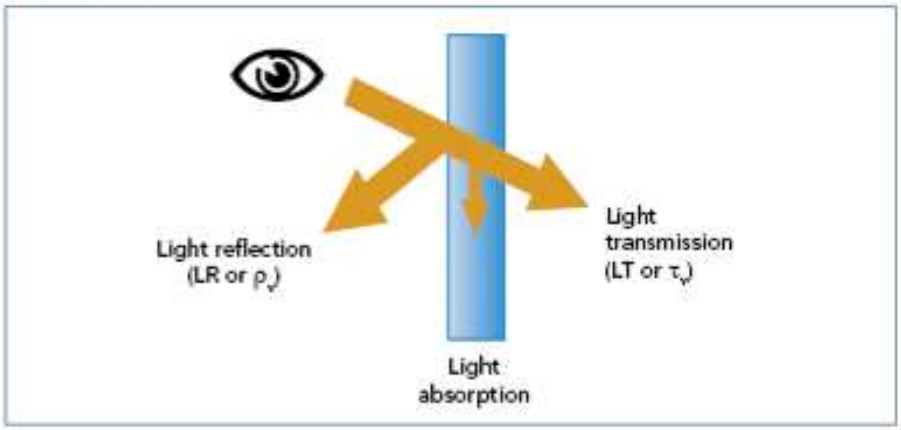


5.2 LIGHT AND SOLAR PROPERTIES

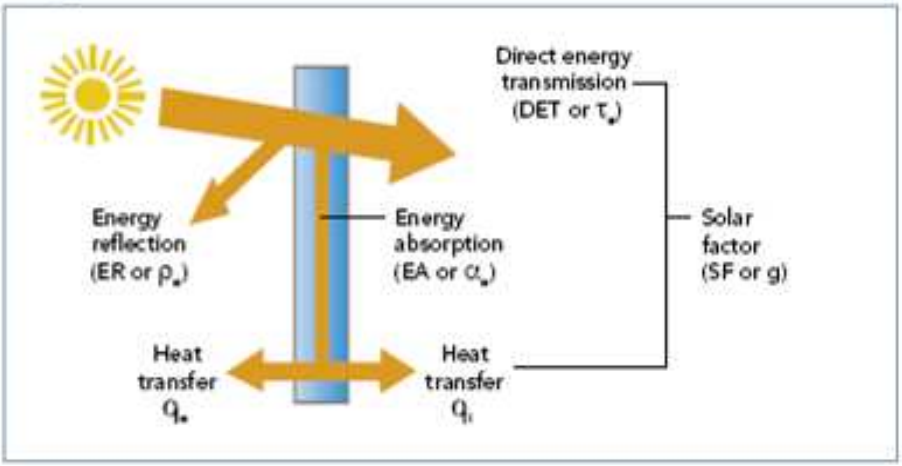
The light and solar properties are calculated using spectral measurement that conforms with standards EN 410 and WIS/WINDAT. The following properties are given:

- LT (τ_v): Light transmission
- LR (ρ_v): Light reflection on external side
- LRi (ρ_{vi}): Internal light reflection
- DET (τ_e): Direct energy transmission
- ER (ρ_e): Energy reflection
- ERi (ρ_{ei}): Internal energy reflection
- EA (α_e): Energy absorption
- SF (g): Solar factor
- SC: Shading coefficient

Light factors



Energy factors



5.3 THERMAL PROPERTIES

The thermal transmittance Ug (W/m²K) is calculated according EN 673. The emissivity measurement complies with EN 673 and EN 12898.

5.4 PERFORMANCES OF THERMOBEL PRODUCTS

The light, solar and thermal performances of the Thermobel products can be calculated from the Glass Configurator on www.YourGlass.com.

6 ACOUSTIC PROPERTIES

The acoustic performances of the Thermobel products can be calculated from the Glass Configurator on www.YourGlass.com.

7 TOLERANCES ON THICKNESS

7.1 DOUBLE GLAZING UNIT

The actual thickness shall be measured between the outside glass surface of the unit, at each corner and at the approximate centre points of the edges. The values shall be measured to the nearest 0,1 mm. The measured thicknesses shall not vary from the nominal thickness more than the tolerance shown in the table.

First pane	Second pane	DGU thickness tolerance
Annealed glass	Annealed glass	± 1,0 mm
Annealed glass	Toughened or strengthened glass	± 1,5 mm
Annealed glass	Laminated glass	± 1,5 mm
Annealed glass	Patterned glass	± 1,5 mm
Toughened or strengthened glass	Toughened or strengthened glass	± 1,5 mm
Toughened or strengthened glass	Patterned glass	± 1,5 mm
Laminated glass	Laminated glass	± 1,5 mm
Laminated glass	Patterned glass	± 1,5 mm
Note: Pane thicknesses are expressed as nominal values		

7.2 TRIPLE GLASS UNIT

The thickness tolerances of triple glass units are obtained using the following rules:
1) Determine the tolerance of each composition glass/cavity/glass in accordance with the table of § 7.1.1
2) Calculate the square of those values
3) Sum the squares values
4) Calculate the square root of the sum.

8 QUALITY REQUIREMENTS

8.1 GENERALITY

The quality requirements of each pane composing the IGU apply. For these requirements, see the related AGC Technical datasheet or European standard.

8.2 COLOR DIFFERENCE IN FAÇADES

8.2.1 METHOD AND CONDITION OF OBSERVATION

When coated glasses are installed on façades, some variations of color can appear between the panes. The document of Glass for Europe "Code of practice for in-situ measurement and evaluation of the color of coated glass used in façades" (available at www.glassforeurope.com/images/cont/91_19807_file.pdf) describes the way to measure and evaluate these differences of color.

8.2.2 REQUIREMENTS

The values of ΔL*, Δa* and Δb* determined in accordance with 8.6.1 shall met the following requirement.

ΔL*	≤ 4,0
Δa*	≤ 3,0
Δb*	≤ 3,0

8.3 PHENOMENONS SPECIFIC TO IGU

8.3.1 COLOURING OF 'CLEAR' GLASS

'Clear' glass always has a slight colour when light is transmitted through it. This is inherent to its basic composition.

The thicker the glass, the more pronounced the colour. Slight variations between different runs of glass production are normal and acceptable.

This phenomenon can be avoided by using special extra clear glass Planibel Clearvision.

8.3.2 VARIATION IN TINT OF COLOURED AND/OR COATED GLASSES

Coloured and/or coated glasses also have their own colouring. This is visible when light is transmitted or reflected. Slight variations in the colouring of the coating and the glass are inherent to the manufacturing system.

8.3.3 EXTERIOR CONDENSATION

When using low-e insulating glazing, condensation may appear on the exterior of the glass. Given the insulating glazing's high level of thermal insulation performance, the outside sheet cools down so much that condensation formed on the outside. Such condensation is temporary and disappears during the day. It is simply evidence of how well the glazing insulates.

8.3.4 OPTICAL DISTORTIONS

Optical distortions in glazing are caused by three main factors:

- Thermal treatment of the glass (toughened, hardened): This treatment causes deformations in the surface of the glass. They are inherent to the process and cannot be avoided.
- Setting systems: If the edges of the glazing are too tight or if the frame is not flat (plane), this can cause distortions.
- Variation in the barometric pressure and temperature in the space in insulating glazing: The two panes in insulating glazing are separated by a space of dry air or gas, **vacuum closed**, sealed in the factory at the barometric pressure and temperature of the manufacturing workshop. Then, following atmospheric variations (pressure and temperature), the volume of air enclosed in the insulating glazing will:
    - expand (atmospheric pressure falls, temperature increases);
    - compress (atmospheric pressure increases, temperature decreases).

  The glass panes will then deform depending on this expansion (convex volume) or compression (concave volume).

Optical distortions connected with this phenomenon are inevitable. Their perception may be influenced by the environment of the building and by observation conditions.

8.3.5 INTERFERENCE

Insulating glazing has four surfaces that reflect light.

Under certain lighting conditions, optical phenomena can occur due to a combination of reflected rays and cause coloured fringes on the surface of the glass called **interference fringes**. This phenomenon is due to the flatness of the glass surfaces.

The interference fringes move when pressure is applied to the centre of insulating glazing. Interference fringes cannot be considered to be a fault in the glazing.

The risk of apparition decreases when using two glass of different thickness in insulating glass.

9 OTHER RELATED DOCUMENTS

Following documents are also available from www.YourGlass.com:

- Cleaning and Maintenance Guide for Façade glazing
- Glazing Instruction
- CE-Marking declarations

Some countries have published national information about defects in IGU, for example:

- België: VGI-Nota 03 - Uitzicht van transparante beglazingen voor gebouwen: methodes en aanvaardingscriteria – VGI
- Belgique: Note FIV 03 – Méthodes et critères d'acceptabilité d'aspect des vitrages transparents du bâtiment - FIV
- Deutschland: Richtlinie zur Beurteilung der visuellen Qualität von Glas für das Bauwesen
- France: Critères d'appréciation de l'aspect des vitrages isolants – FFPV, FFB, Union Fenêtre et SNFA
- Italia: UNI/TR 11404 – Vetrate isolanti per impiego in edilizia – Qualità ottica e visiva per serramenti
- Nederland: Kwaliteitsbeoordeling van vlakglasproducten – KGB, GBO
- UK: Appearance/Visual Quality specifications for insulating glass units - GGF