UNIVERSITY OF ŽILINA
Faculty of Civil Engineering

Department of Building Engineering and Urban Planning

TEST REPORT OF THE CONSTRUCTION PRODUCT

Product: **GLASSFLOOR Pure**

Subject: Measurement in climatic chambers

Customer: Heliobus AG, Sittertalstrasse 34, 9014 St. Gallen, Switzerland

Activity: **Air permeability with reference to standard EN 1026**

Watertightness with reference to standard EN 1027

Thermal transmittance (U-value) with reference to standard EN ISO 12567-2

Results:

Product	**GLASSFLOOR Pure**	
Size	800 mm x 800 mm	**Test standart**
Properties	Classification	Classification norm
Air permeability	**Class 4**	EN 12 207
Waterproof	**Class 9A**	EN 12 208
U-value vertical	**0,60 W/(m^2.K)**	EN ISO 12567-2

Basis:
Catalogue leaflet – Produkteinfo – GF - pure
EN 1026:2016 Windows and doors. Air permeability. Test method.
EN 1027:2016 Windows and doors - Water tightness - Test method.
EN ISO 12567-2:2005 Thermal performance of windows and doors — Determination of thermal transmittance by hot box method — Part 2: Roof windows and other projecting windows.
EN 12207:2016 Windows and doors - Air permeability – Classification.
EN 12208:2016 Windows and doors – Watertightness - Classification

In Zilina, 12th December 2022

Chief Executive Officer

prof. Eng. Pavol Ďurica, PhD.

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<u>Test specimen description</u>

Walk-on floor glazing made to measure. Stainless steel frame profile, thermally insulated, in a filigree stainless steel frame (0.5 cm). Walkable, depending on in private as well as in public areas.

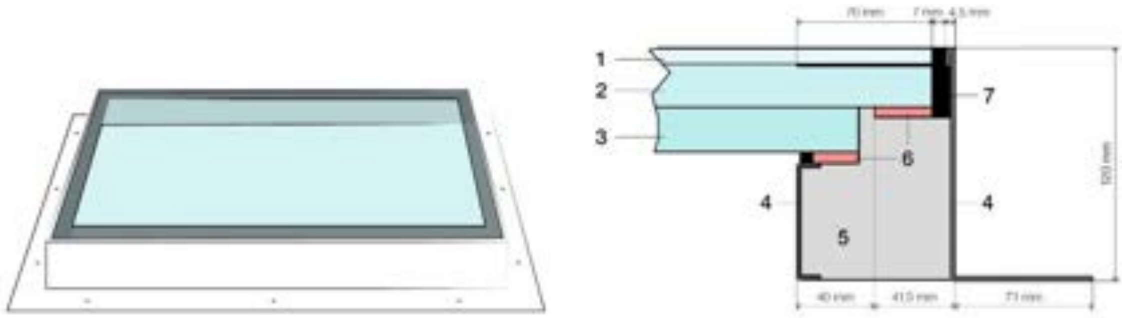

Fig. 1 Glassfloor Pure, isolated: 1 - coverglass, 2 - static LSG, 3 - Interior ISO LSG, 4 - Stainless steel frame, 5 – Insulated stainless steel profile, 6 - Glass support, 7 - Seal/joint , (LSG - Measurement of air permeability under pressure)

Product characteristics

Tab. 1 Test specimen description

Sample positioning			
Size of lighthouse	800x800 mm	Area:	0.64 m^2
Size of glass	720x720	Area:	0.5184 m^2
Perimeter of joints			
Tightness			
Fittings			
Glass	tripple	Ug = 0.5 W/(m^2.K)	

Customer-specific marking: un-specified

Date of manufacture: un-specified

Place and date of collection: un-specified

Collection made: by customer

Place and date of receipt: VC UNIZA

Test method

Climate chambers

Climate chambers have a 2.0 m wide and 2.0 m high interior space. The chamber envelope is made of sheet metal filled with polyurethane foam up to 200 mm thick. The inner surface of the chambers is made of stainless steel. It is only because it has a low emission and the radiant heat flow is then smaller. Inside surface temperatures can vary around doors and otherwise they are similar everywhere. Direct sunlight can pass into the hall and heat the outer surface of the climatic chamber. Therefore, the outer surface of envelope is white. Outdoor chamber allows simulate temperature up to - 40.0 °C and still have good temperature homogeneity inside. The convection heat transfer on the sample can be varied by simulating the flow around the sample with variable velocity from 0.5 m/s to 3.0 m/s.

The climate chamber allows the simulation of the external environment with the measurement of the effect of rain on the measured sample, thus allowing not only the simulation of temperature, flow, and solar radiation and thus the measurement of the properties of materials in the heat transfer, but also the spraying of the sample in accordance with EN 1027. This makes it possible to use it, for example, for the measurement of the watertightness of windows, but also for the experimental verification of structures against the influence of wind-driven rain.

Fig. 2 View of the climate chamber of Department of Building Engineering and Urban Planning

Hotbox

The hotbox is placed in the indoor chamber. It has a 1.3 m wide and 1.5 m high interior space. It is considerable smaller than the calibration panel. This ensures that the heat flow through the calibration panel to the hotbox is not affected by the edges of the calibration panel. The inner surface is painted black. The convection heat transfer on the sample can be varied by simulating the flow around the sample with variable velocity level.

A metal cover panel with a thin tube was created to measure air flow during overpressure. A thermo-anemometric probe is usually placed in the tube to measure the flow speed, from which the air flow through the sample is derived.

Measurement of air permeability under positive pressure

Fig. 3 Air permeability apparatus

Tab. 2 Measurement of air permeability under pressure EN 1026

Pressure	**Air flow**		**Class EN 12207**
[Pa]	**Total**	**Refered to the total area**	
	[m^3/h]	[$m^3/h.m^2$]	
50	0.543	0.85	**4** *very airtight* building height > 50 m The requirements for outdoor windows and doors were **fulfilled**
100	0.832	1.30	
150	1.049	1.64	
200	1.266	1.98	
250	1.556	2.43	
300	1.809	2.83	
450	2.316	3.62	
600	2.605	4.07	

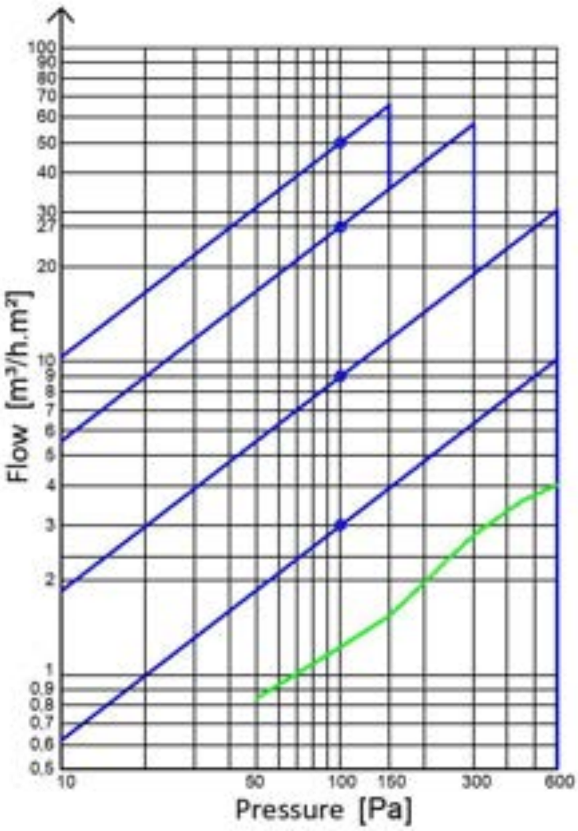

Fig. 4 Graph of air permeability under pressure

Measurement of water tightness under pressure

Fig. 5 Water tightness test in progress

Tab. 3 Measurement of waterproof under pressure EN 1027

Pressure	**Time**	**Status**	**Class EN 12208**
[Pa]	[min]		
0	15:00	without water penetration	**9A** *the maximum possible with the given device* applicable to building height 40 - 50 m
50	5:00	without water penetration	
100	5:00	without water penetration	
150	5:00	without water penetration	
200	5:00	without water penetration	
250	5:00	without water penetration	
300	5:00	without water penetration	
450	5:00	without water penetration	
600	5:00	without water penetration	

Designated class 9A indicates the glazing system that was unprotected and withstood 600 Pa of water pressure for 55 minutes.

Fig. 6 Indoor chamber during water tightness test

Measurement of thermal transmittance by hot-box method (U-value)

Fig. 7 Placement of the sample in the outdoor chamber (left), in the indoor chamber (right)

Tab. 4 Environmental conditions in the hall during test

Atmospheric pressure	1031 ±10 hPa
Temperature in the hall	18 ±1 °C
Relative humidity in the hall	40 ±5 %

Surround panel:

- 15 mm OSB board
- 15 mm laminated plywood
- 40 mm extruded polystyrene EXP

For practical reasons, vertical mounting of the specimen is acceptable for product declaration purpose according to the ISO 12567-2 standard.

The transmittance requirement for windows varies from country to country. The German Passivhaus Institut in Darmstadt recommends the U-value smaller than 0.8 W/(m²K).

Tab. 5 Measurement data

Area of window	m^2	0.64
Area of surround panel	m^2	1.18
Hot box metering area	m^2	1.82
Perimeter length	m	3.2
Cold temperatures, measured		
Air	°C	-11
Surface baffle	°C	-11
Surface window	°C	-7.7
Surface surround panel	°C	-8.4
Warm temperatures, measured		
Air	°C	21.7
Surface baffle	°C	21.6
Surface window	°C	18
Surface reveal panel	°C	20.3
Surface surround panel	°C	19.7
Input power to hot box	W	41
Air flow warm side, down	m/s	0.1
Air flow cold side, down	m/s	1.4

Tab. 6 Calculation of the thermal transmittance of window

Temperature mean surround panel	°C	4.0
Thermal resistance of the surround panel	$(m^2.K)/W$	1.7
Thermal conductivity of surround panel	W/(m.K)	0.035
Ψ_{edge} for w = 40 mm	W/(m.K)	0.0262
Temperature difference surface, surround panel	K	28.1
Temperature difference air	K	32.7
Input power to hot box	W	31.5
Power through surround panel	W	16.5
Edge zone heat flow	W	2.5
Heat flow density through specimen	W/m^2	19.5
Warm side convective fraction	-	0.3
Cold side convective fraction	-	0.85
Mean radiant temperature warm side	°C	21.2
Mean radiant temperature cold side	°C	-11.0
Warm side environmental temperature	°C	21.3
Cold side environmental temperature	°C	-11.0
Environmental temperature difference	K	32.3
Environmental temperature mean	°C	5.2
U-value measured	**$W/(m^2.K)$**	**0.60**
Uncertainty	$W/(m^2.K)$	± 0.03

Conclusion

The values obtained during the measurement of thermal transmittance were in the vertical installation of the sample. For a building product such as a skylight, it is typical to install it in a horizontal direction. It is assumed there, that the value of thermal transmittance on the glazing will deteriorate. During the hot-box test, the heat flux in the center of the glazing was also measured. Based on this, the U-value of the glass can be derived of about 0.5 W/(m^2.K).

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