

TEST REPORT No. 430060

Customer

CARBOPLAK SRL

Linia De Centură, 16 - ȘTEFĂNEȘTI DE JOS (Ilfov) - Romania

Item#

**multiwall polycarbonate sheet named
"CARBOPLAK 10 mm 2W"**

Activity

**determination of hail impact resistance
according to VKF ACFI test protocol**



Results

Ice average projectile diameter	30 mm	
Ice average projectile mass	12,7 g	
Ice average projectile speed	25,8 m/s	92,9 km/h
Class	HW3	
Average impact energy	4,2 J	

Order:

105740

Item origin:

sampled and supplied by the customer

Identification of item received:

105740 dated 12 June 2025

Activity date:

18 June 2025

Activity site:

Istituto Giordano S.p.A. - Strada Erbosa Uno, 72 -
47043 Gatteo (FC) - Italy

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(#) according to that stated by the customer.

Bellaria-Igea Marina - Italy, 24 June 2025

Chief Executive Officer

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The results relate only to the item examined, as received, and are valid only in the conditions in which the activity was carried out.

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Chief Test Technician:

Dott. Andrea Bruschi

Head of Security and Safety Laboratory:

Dott. Andrea Bruschi

Compiler: Dott. Marina Bonito

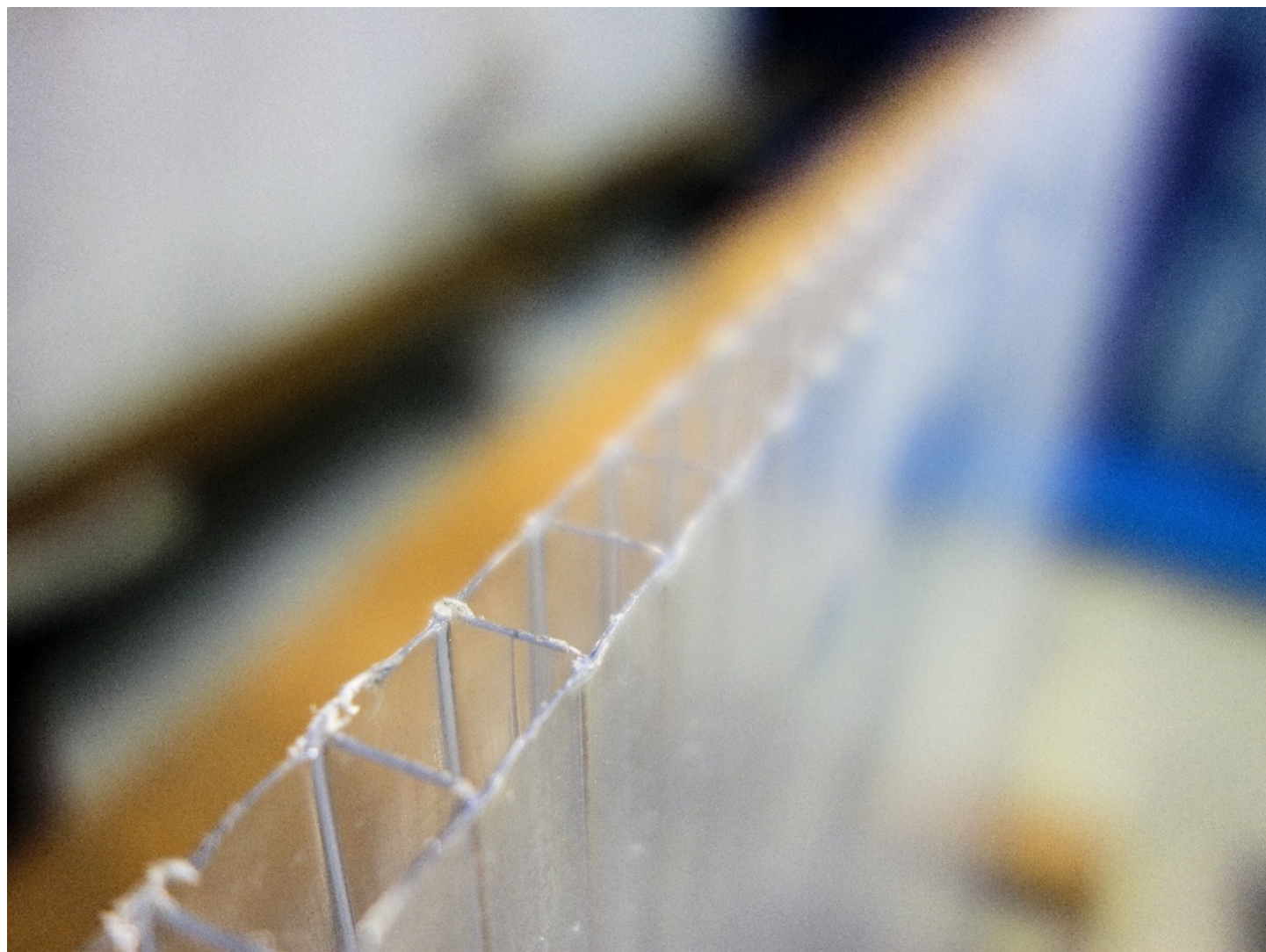
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Description of item[#]

The item under examination consists of a two-wall polycarbonate sheet, nominal dimensions 1500 mm × 2100 mm and nominal thickness 10 mm.

The thicknesses of the various layers constituting the sheet are expressed in the following table.

Polycarbonate nominal thickness	external wall	0,62 mm
	vertical inner walls	0,35 mm
	external wall	0,50 mm



Item photograph

Normative references

Document/Standard	Title
VKF ACFI ^{##} No. 00a version 1.03	Test specifications - Hail Register (HR)
VKF ACFI ^{##} No. 00b version 1.02	Test specifications - Hail Register (HR)

(^{##}) VKF = Vereinigung Kantonaler Feuerversicherungen (*Association of Cantonal Fire Insurance Companies*).

ACFI = Association of Cantonal Fire Insurance Companies.

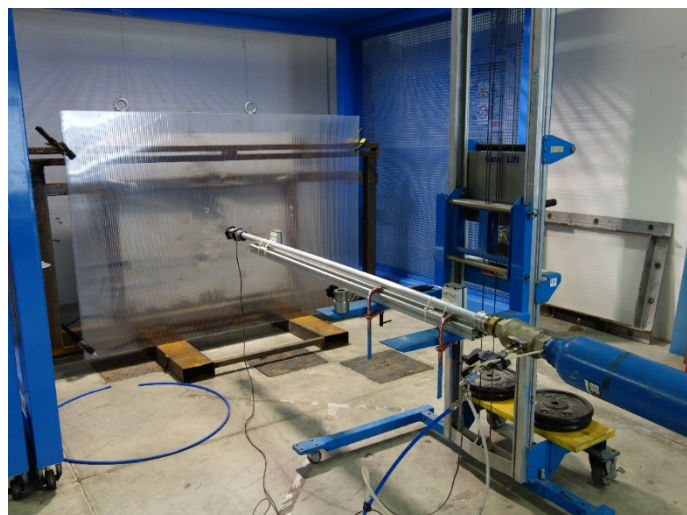
([#]) according to that stated by the customer; Istituto Giordano declines all responsibility for the information and data provided by the customer that may influence the results.

Apparatus

Description	In-house identification code
pneumatic vertical launch tube equipped with pressurization tank, loading and launch solenoid valves and pressure gauge for controlling the loading pressure	EDI118e + EDI118
ice spheres, nominal diameter $(30 \pm 0,5)$ mm and average mass $(12,7 \pm 5\%)$ g	//
high-speed camera model "Chronos 1.4 High-Speed Camera" from Kron Technologies Inc.	EDI182
digital meter model "TD-S551D1 216-452" by Mitutoyo Corporation, measuring range $0 \div 5,5$ m and resolution 0,1 mm	FT364
digital thermo-hygrometer model "WS8009" by La Crosse Technology	EDI111
precision balance model "KERN PNS 12000-1" from Kern & Sohn GmbH, measuring range $0 \div 12000$ g and accuracy 0,1 g	EDI175
digital electronic caliper model "CDEP15" by Borletti, measuring range $0 \div 150$ mm and resolution 0,01 mm	EDI066
support frame for panels	//

Method

Standard reference	Activity	Description
clause 0.4.8 of test protocol VKF ACFI No. 00a	conditioning	temperature: (20 ± 3) °C relative humidity: (50 ± 10) % duration: 24 h
clause 0.4 of test protocol VKF ACFI No. 00a	performance class determination	The polycarbonate sheet was placed and fastened at 90° inclination angle and was subjected to impact with the speed and the ice sphere diameter corresponding to the hypothesized performance class. At the end of each impact, a visual and instrumental assessment of the damage was carried out. With a positive assessment, the impacts were repeated 4 more times and if the result remained the same, the corresponding performance class would be determined, otherwise it would be carried out a series of impacts corresponding to a lower class.



Photograph of test setup



Photograph of an ice sphere

Environmental conditions

Atmospheric pressure	(1010 ± 10) Pa
Temperature	(22 ± 2) °C
Relative humidity	(50 ± 5) %

Results

Impact [n.]	Angle	Projectile velocity		Impact energy [J]	Notes
		[m/s]	[km/h]		
1	90°	25,2	90,4	4,0	slight circular deformation of the planarity barely visible
2		24,2	94,3	4,4	slight circular deformation of the planarity barely visible
3		26,3	94,7	4,4	slight circular deformation of the planarity barely visible
4		26,1	94,0	4,3	slight circular deformation of the planarity barely visible
5		25,1	90.4	4,0	slight circular deformation of the planarity barely visible



Detail of the damage caused to a sheet

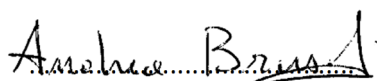
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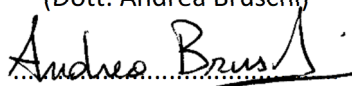
([#]) According to clause 0.2.3 of VKF ACFI specification No. 00a, five performance classes are specified depending on the diameter of the ice projectile with which the object remains unharmed.

Class	Nominal diameter	Reference velocity “v _R ”	Minimal energy “E _{min} ”	Maximum energy “E _{max} ”
	[mm]	[m/s]	[J]	[J]
HW 1	10	13,77	≥0,04	≤0,09
HW 2	20	19,48	≥0,69	≤1,00
HW 3	30	23,85	≥3,50	≤4,40
HW 4	40	27,54	≥11,10	≤13,20
HW 5	50	30,79	≥27,00	≤31,50

Chief Test Technician
(Dott. Andrea Bruschi)



Head of
Security and Safety Laboratory
(Dott. Andrea Bruschi)



ALLEGATO "A"
AL TEST REPORT No. 430060

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(#) secondo le dichiarazioni del cliente.

Bellaria-Igea Marina - Italia, 24 June 2025

This annex is made up of 3 pages.

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Description

Carboplak 10mm 2W is a two-walls polycarbonate sheet, 10 mm thickness, one side UV protected, obtained by extrusion from Lexan® Resin and Makrolon® Resin. Produced with 100% virgin resin and manufactured using the highest standards of quality Carboplak sheets guaranteed excellent performance on your project.

10mm 2W Carboplak® Multi-wall Sheet offers:

- Twin wall sheet rectangular structure
- Recommended for curved installations.
- Excellent light transmission
- Light weight, easy installation
- Long term weather resistance
- High impact strength
- Outstanding thermal insulation properties

UV Resistance

The polycarbonate sheets have UV coextruded protection on the exterior surface. The UV layer protects the sheets from discoloration and degradation preventing the sheet to become brittle and lose light transmission.

Carboplak sheets have an excellent degree of resistance to the actions of the solar rays, keeping its brightness for more than 10 years.

Fire Test Performance

CARBOPLAK sheet have good fire behavior characteristics and receives high ratings in several major European fire performance tests including EN13501.

Impact strength

CARBOPLAK sheet has outstanding impact performance over a wide temperature range, -40°C to +130°C, and after prolonged outdoor exposure.

Warranty

The CARBOPLAK SRL offers a Ten (10) Year Limited Warranty on Carboplak 10mm sheet covering discoloration, loss of light transmission and loss of strength due to weathering.



Application area/Typical uses

Carboplak® 10 mm 2W is best used in:

- Domes and verandahs, balconies, solar panels, etc
- Curtain walls for industrial and civil buildings
- False ceilings, expo stands, partition walls for offices, architectural constructions
- Greenhouses
- Many kinds of roofs: public transport stations, parking lots, service stations, gas fueling stations, markets, passage, and transport corridors

Availability

Standard specifications:

Widths	Lengths	Standard Colours
2100 mm	3000 mm	Clear, Opal, Bronze, Blue, Green, Silver
2100 mm	6000 mm	

Typical Properties

Property	Test Method	Unit	Value
Weight	EN 16153:2013+A1:2015	g/m ²	1600
Sound Insulation	DIN 52210	dB	19
Light transmittance	EN 14500:2008 EN 410:2011	%	Clear 81*
			White 47*
			Silver 16*
Total solar energy transmittance		%	Silver $g = 41^*$
Solar direct transmittance	EN 410:2011	%	Silver $\tau_e = 31^*$
Hail impact resistance (Hail simulation test, 20mm plastic bullet)	EN ISO 6603-1:2000	J	24
Thermal transmittance (U)	EN ISO 10077-2	W/m ² K	3**
Reaction to fire	EN 13501-1	class	Bs1d0***
The minimum cold-bending radius	EN 16153:2013+A1:2015	mm	1500

* Values measured at GIORDANO ISTITUTO (Italy)

** Values measured at FRAUNHOFER INSTITUTE (Germany)

*** Value measured at EMI (Hungary)