Optima Ballistic Glass Colombia S.A., Armor Protection Ballistic Resistance Test

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4603B Compass Point Road
Belcamp, MD 21017

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Further dissemination only as directed by
Optima Ballistic Glass Colombia S.A., January 2021.

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OPTIMA BALLISTIC GLASS COLOMBIA S.A. PROPRIETARY INFORMATION

1 Introduction

Optima Ballistic Glass Colombia S.A., provided three armor samples to NTS-Chesapeake Testing for ballistic resistance testing on 13 January 2021.

2 Threats and Instrumentation

2.1 Threats

- 7.62 x 39-mm, 123-grain PS Ball projectiles

*All projectiles were fired from a universal receiver which was fitted with the appropriate barrel and mounted on a NTS-Chesapeake Testing mount.

*The threat projectiles were required to have no greater than 5° total yaw. Projectile yaw was measured to ensure that the test impacts were within this constraint by placing a yaw card at the appropriate gun-to-target range during velocity verification shots.

2.2 Instrumentation

Projectile velocity measurements were obtained using Oehler Research model No. 57 infrared screens with Y.I.S. Cowden Group Chrono-USB chronographs. Calibration data is provided in Attachment A.

3 Details of Test

The objective of this test was to conduct a ballistic resistance test on the transparent armor samples in accordance with VPAM Level 6 and the customer's request. Shot spacing between multiple impacts against a single sample was in accordance with the reference performance standard. Shots against the transparent armor samples were performed at 0.0° obliquity and ambient range temperature (68 ±1 °F).

For each shot, the target was mounted in a rigid frame and clamped to a rigid test fixture. A piece of 0.0254 mm thick (0.001 in) aluminum foil with splinter box was mounted along the shotline, approximately 500 mm ±13 mm (19.680 in ±0.5 in) behind the target, to verify complete penetrations. A complete penetration was scored only when the witness material was perforated (i.e., light was visible through the material). All firings were conducted at 32.750 ft from the target. The projectile velocities used for the test were in accordance with the referenced performance standard.

4 Summary of Results

The results of the ballistic resistance test are shown in Table 1. The round-by-round ballistic data sheets for all testing performed are provided on the following pages.

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Table 1. Summary of Ballistic Resistance Testing

Job No.	Sample No.	Size (in)	Weight (lbs)	Threat	Target Obliq. (deg)	Shot No.	Penetration Data	
							Velocity (ft/s)	Result
3350-018-1	9351-116	15.00 x 15.00	24.72	7.62 x 39-mm, 123-grain PS Ball	0.0	1	2382	None
						2	2378	None
						3	2365	None
3350-018-2	9351-117	15.00 x 15.00	24.76	7.62 x 39-mm, 123-grain PS Ball	0.0	1	2375	None
						2	2369	None
						3	2375	None
3350-018-3	9351-118	15.00 x 15.00	24.63	7.62 x 39-mm, 123-grain PS Ball	0.0	1	2389	None
						2	2375	None
						3	2368	None

BALLISTIC RESISTANCE TEST

NTS-Chesapeake Testing
4603B Compass Point Road
Belcamp, MD 21017

Client: Optima Ballistic Glass Columbia S.A.
Job No.: 3350-018-1
Test Date: 1/13/2021

Test Panel

Description: Transparent Armor.

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: 9351-116

Size: 15.00 x 15.00 in Avg. Thick: 1.376 in Thickness: 1.379 in; 1.379 in; 1.372 in; 1.375 in	Weight: 24.72 lbs Plies/Laminates: NA	Date Received: 1/12/2021 Via: FedEx Returned: FedEx

Setup

Shot Spacing: VPAM Level 06 Witness Panel: .001 in Aluminum foil with splinter box Backing Material: NA Condition: Ambient	Primary Vel. Screens (ft): 20.000, 20.333, 29.667, 30.000 Primary Vel. Location (ft): 25.000 Range to Target (ft): 32.750 Target to Witness (in): 19.680	Range No.: 2 Temp: 68.9 °F BP: 40.2 inHg RH: 41.6% Barrel/Gun: Test Barrel Gunner: Glenn Snyder Recorder: Bret DeMond

Ammunition

Projectile	Lot No.	Powder
(1) 7.62 x 39-mm, 123-grain PS Ball	Russian 3-58	N 110

Applicable Standards or Procedures

(1) VPAM Level 06
(2) Customer request

Shot No.	Ammo	Weight (gr)	Time 1 (µs)	Vel. 1 (ft/s)	Time 2 (µs)	Vel. 2 (ft/s)	Avg. Vel. (ft/s)	Penetration	Obliq. (°)	Footnotes
1	1	121.4	4198	2382	3917	2383	2382	None	0.0	
2	1	121.4	4208	2376	3922	2380	2378	None	0.0	
3	1	121.5	4230	2364	3944	2366	2365	None	0.0	

Remarks:
Required Velocity: 2362 ± 32 ft/s.

Footnotes:

OPTIMA BALLISTIC GLASS COLOMBIA S.A. PROPRIETARY INFORMATION

BALLISTIC RESISTANCE TEST

NTS-Chesapeake Testing
4603B Compass Point Road
Belcamp, MD 21017

Client: Optima Ballistic Glass Columbia S.A.
Job No.: 3350-018-2
Test Date: 1/13/2021

Test Panel

Description: Transparent Armor.

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: 9351-117

Size: 15.00 x15.00 in Avg. Thick: 1.378 in Thickness: 1.379 in; 1.379 in; 1.376 in; 1.379 in	Weight: 24.76 lbs Plies/Laminates: NA	Date Received: 1/12/2021 Via: FedEx Returned: FedEx

Setup

Shot Spacing: VPAM Level 06 Witness Panel: .001 in Aluminum foil with splinter box Backing Material: NA Condition: Ambient	Primary Vel. Screens (ft): 20.000, 20.333, 29.667, 30.000 Primary Vel. Location (ft): 25.000 Range to Target (ft): 32.750 Target to Witness (in): 19.680	Range No.: 2 Temp: 68.6 °F BP: 40.9 inHg RH: 42.5% Barrel/Gun: Test Barrel Gunner: Glenn Snyder Recorder: Bret DeMond

Ammunition

Projectile	Lot No.	Powder
(1) 7.62 x 39-mm, 123-grain PS Ball	Russian 3-58	N 110

Applicable Standards or Procedures

(1) VPAM Level 06
(2) Customer request

Shot No.	Ammo	Weight (gr)	Time 1 (µs)	Vel. 1 (ft/s)	Time 2 (µs)	Vel. 2 (ft/s)	Avg. Vel. (ft/s)	Penetration	Obliq. (°)	Footnotes
1	1	121.5	4212	2374	3927	2377	2375	None	0.0	
2	1	121.5	4225	2367	3937	2371	2369	None	0.0	
3	1	121.6	4212	2374	3929	2375	2375	None	0.0	

Remarks:
Required Velocity: 2362 ± 32 ft/s.

Footnotes:

OPTIMA BALLISTIC GLASS COLOMBIA S.A. PROPRIETARY INFORMATION

BALLISTIC RESISTANCE TEST

NTS-Chesapeake Testing
4603B Compass Point Road
Belcamp, MD 21017

Client: Optima Ballistic Glass Columbia S.A.
Job No.: 3350-018-3
Test Date: 1/13/2021

Test Panel

Description: Transparent Armor.

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: 9351-118

Size: 15.00 x 15.00 in Avg. Thick: 1.371 in Thickness: 1.369 in; 1.372 in; 1.372 in; 1.372 in	Weight: 24.63 lbs Plies/Laminates: NA	Date Received: 1/12/2021 Via: FedEx Returned: FedEx

Setup

Shot Spacing: VPAM Level 06 Witness Panel: .001 in Aluminum foil with splinter box Backing Material: NA Condition: Ambient	Primary Vel. Screens (ft): 20.000, 20.333, 29.667, 30.000 Primary Vel. Location (ft): 25.000 Range to Target (ft): 32.750 Target to Witness (in): 19.680	Range No.: 2 Temp: 67.9 °F BP: 40.6 inHg RH: 49.8% Barrel/Gun: Test Barrel Gunner: Glenn Snyder Recorder: Bret DeMond

Ammunition

Projectile	Lot No.	Powder
(1) 7.62 x 39-mm, 123-grain PS Ball	Russian 3-58	N 110

Applicable Standards or Procedures

(1) VPAM Level 06
(2) Customer request

Shot No.	Ammo	Weight (gr)	Time 1 (µs)	Vel. 1 (ft/s)	Time 2 (µs)	Vel. 2 (ft/s)	Avg. Vel. (ft/s)	Penetration	Obliq. (°)	Footnotes
1	1	121.9	4188	2388	3905	2390	2389	None	0.0	
2	1	121.9	4212	2374	3927	2377	2375	None	0.0	
3	1	122.0	4225	2367	3939	2369	2368	None	0.0	

Remarks:
Required Velocity: 2362 ± 32 ft/s.

Footnotes:

OPTIMA BALLISTIC GLASS COLOMBIA S.A. PROPRIETARY INFORMATION

ATTACHMENT A
CALIBRATION DATA

Job Number: 3350-018

Customer: Optima Ballistics Glass **Date:** 01/13/21

Range: 2 **Range Lead:** BAD

Equipment	Serial Number	NTS I.D. #	Cal. Date	Due Date	Range Lead Initials
Chronograph 1	103	WC027146	8/14/2020	8/14/2021	BAD
Chronograph 2	113	WC067023	8/14/2020	8/14/2021	BAD
Powder Scale	A06233026	WC060532	12/7/2020	12/7/2021	BAD
Floor Scale	25459071	WC060652	12/9/2019	12/9/2021	BAD
100 ft. Tape Measure	103	WC060412	7/1/2019	7/1/2021	BAD
25 ft. Tape Measure	WC074972	WC074972	8/24/2020	8/24/2021	BAD
Thermometer	192140234	WC067353	4/27/2019	4/27/2021	BAD
BFD Tool	19/010036	WC067357	7/20/2020	7/20/2021	BAD
BFD Bridge	12/450046	WC064227	12/9/2020	12/9/2021	BAD
Angle Block	840	WC027021	5/19/2020	5/19/2021	BAD
Environmental Sensor	200597950	WC075050	10/06/2020	10/06/2022	BAD

OPTIMA BALLISTIC GLASS COLOMBIA S.A. PROPRIETARY INFORMATION

END OF REPORT

OPTIMA BALLISTIC GLASS COLOMBIA S.A. PROPRIETARY INFORMATION