POC: Mr. Julio Rodriguez
P.O. No.: Prepaid
Test Date: 25 November 2020
Job No.: 3350-016

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

Prepared by:

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

9 December 2020

Further dissemination only as directed by
Optima Ballistic Glass Colombia S.A., December 2020.

1 Introduction

Optima Ballistic Glass Colombia S.A., provided three armor samples to NTS-Chesapeake Testing for ballistic resistance testing on 25 November 2020.

2 Threats and Instrumentation

2.1 Threats

- .44-mag., 240-grain full metal core-round nose (FMC-RN) 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 EN 1063 BR4 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 (69.4 °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 (19.666 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 16.400 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.

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
3350-016-1	SN 760044	19.75 x 19.75	25.57	.44-mag., 240-grain FMC-FN	0.0	1	1446	None
						2	1443	None
						3	1447	None
3350-016-2	SN 760046	19.75 x 19.75	25.55	.44-mag., 240-grain FMC-FN	0.0	1	1440	None
						2	1445	None
						3	1448	None
3350-016-3	SN 760047	19.75 x 19.75	25.54	.44-mag., 240-grain FMC-FN	0.0	1	1432	None
						2	1457	None
						3	1449	None

BALLISTIC RESISTANCE TEST

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

Client: Optima Ballistic Glass Columbia S.A.
Job No.: 3350-016-1
Test Date: 11/25/2020

Test Panel

Description: Transparent Armor. OFC-8775-195 ICONTEC-760044

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: SN 760044

Size: 19.75 x 19.75 in	Weight: 25.57 lbs	Date Received: 11/20/2020
Avg. Thick: 0.876 in	Plies/Laminates: NA	Via: DHL
Thickness: 0.876 in; 0.876 in; 0.877 in; 0.877 in		Returned: DHL

Setup

Shot Spacing: EN 1063 BR4	Primary Vel. Screens (ft): 6.500, 6.833, 11.166, 11.500	Range No.: 6
Witness Panel: .001 in Aluminum foil with splinter box	Primary Vel. Location (ft): 9.000	Temp: 69.4 °F
Backing Material: NA	Range to Target (ft): 16.400	BP: 33.0 inHg
Condition: Ambient	Target to Witness (in): 19.666	RH: 34.0%
		Barrel/Gun: NA
		Gunner: Brennan Heuer
		Recorder: Craig Thomas

Ammunition

Projectile	Lot No.	Powder
(1) .44-mag., 240-grain FMC-FN	Magtech 54908-18631	Accurate No. 5

Applicable Standards or Procedures

(1) EN 1063 BR4
(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	240.0	3453	1448	2999	1445	1446	None	0.0	
2	1	239.8	3463	1444	3006	1441	1443	None	0.0	
3	1	239.8	3451	1449	2997	1446	1447	None	0.0	

Remarks:
Required Velocity: 1410-1476 ft/s.

Footnotes:

BALLISTIC RESISTANCE TEST

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

Client: Optima Ballistic Glass Columbia S.A.
Job No.: 3350-016-2
Test Date: 11/25/2020

Test Panel

Description: Transparent Armor. OFC-8775-197 ICONTEC-760046

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: SN 760046

Size: 19.75 x 19.75 in	Weight: 25.55 lbs	Date Received: 11/20/2020
Avg. Thick: 0.874 in	Plies/Laminates: NA	Via: DHL
Thickness: 0.873 in; 0.874 in; 0.873 in; 0.874 in		Returned: DHL

Setup

Shot Spacing: EN 1063 BR4	Primary Vel. Screens (ft): 6.500, 6.833, 11.166, 11.500	Range No.: 6
Witness Panel: .001 in Aluminum foil with splinter box	Primary Vel. Location (ft): 9.000	Temp: 69.4 °F
Backing Material: NA	Range to Target (ft): 16.400	BP: 33.0 inHg
Condition: Ambient	Target to Witness (in): 19.666	RH: 35.0%
		Barrel/Gun: NA
		Gunner: Brennan Heuer
		Recorder: Craig Thomas

Ammunition

Projectile	Lot No.	Powder
(1) .44-mag., 240-grain FMC-FN	Magtech 54908-18631	Accurate No. 5

Applicable Standards or Procedures

(1) EN 1063 BR4
(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	240.1	3468	1442	3014	1438	1440	None	0.0	
2	1	239.8	3456	1447	3002	1443	1445	None	0.0	
3	1	239.6	3448	1450	2997	1446	1448	None	0.0	

Remarks:
Required Velocity: 1410-1476 ft/s.

Footnotes:

BALLISTIC RESISTANCE TEST

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

Client: Optima Ballistic Glass Columbia S.A.
Job No.: 3350-016-3
Test Date: 11/25/2020

Test Panel

Description: Transparent Armor. OFC-8776-195 ICONTEC-760047

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: SN 760047

Size: 19.75 x 19.75 in	Weight: 25.54 lbs	Date Received: 11/20/2020
Avg. Thick: 0.874 in	Plies/Laminates: NA	Via: DHL
Thickness: 0.874 in; 0.877 in; 0.872 in; 0.874 in		Returned: DHL

Setup

Shot Spacing: EN 1063 BR4	Primary Vel. Screens (ft): 6.500, 6.833, 11.166, 11.500	Range No.: 6
Witness Panel: .001 in Aluminum foil with splinter box	Primary Vel. Location (ft): 9.000	Temp: 69.4 °F
Backing Material: NA	Range to Target (ft): 16.400	BP: 33.0 inHg
Condition: Ambient	Target to Witness (in): 19.666	RH: 34.0%
		Barrel/Gun: NA
		Gunner: Brennan Heuer
		Recorder: Craig Thomas

Ammunition

Projectile	Lot No.	Powder
(1) .44-mag., 240-grain FMC-FN	Magtech 54908-18631	Accurate No. 5

Applicable Standards or Procedures

(1) EN 1063 BR4
(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	238.6	3490	1433	3028	1431	1432	None	0.0	
2	1	239.5	3429	1458	2977	1455	1457	None	0.0	
3	1	240.1	3448	1450	2994	1447	1449	None	0.0	

Remarks:
Required Velocity: 1410-1476 ft/s.

Footnotes:

ATTACHMENT A
CALIBRATION DATA

Job Number: 3350-016

Customer: Optima **Date:** 11/25/2020

Range: 6 **Range Lead:** Craig Thomas

Equipment	Serial Number	NTS I.D. #	Cal. Date	Due Date	Range Lead Initials
Chronograph 1	111	WC067021	9/9/2020	9/9/2021	CAT
Chronograph 2	100	WC060268	9/9/2020	9/9/2021	CAT
Powder Scale	A08317204	WC060606	12/10/2019	12/10/2020	CAT
Floor Scale	AE20150917107	WC060228	12/19/2019	12/19/2020	CAT
100 ft. Tape Measure	-	-	-	-	CAT
25 ft. Tape Measure	1486	WC060466	7/13/2020	7/13/2021	CAT
Thermometer	200175474	WC074975	3/9/2020	3/9/2022	CAT
BFD Bridge	19/190064	WC074145	11/10/2020	11/10/2021	CAT
Angle Block	00000841	WC060415	1/6/2020	1/6/2021	CAT
25 ft. Tape Measure	NA	WC074990	4/17/2020	4/17/2021	CAT

END OF REPORT