



POC: Mr. Julio Rodriguez
P.O. No.: Prepaid
Test Date: 18 February 2021
Job No.: 3350-019

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

Prepared by:

Craig A. Thomas
Colleen D. Hallock

NTS-Chesapeake Testing

*4603B Compass Point Road
Belcamp, MD 21017*

10 March 2021

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

This report shall not be used to claim product certification, approval or endorsement. The results of the testing relate only to the samples submitted for testing. This test report shall not be interpreted as an endorsement by NTS-Chesapeake Testing as to the continued quality or performance of any items of the same or similar design.

The information contained in this report is subject to the provisions of the Export Administration Act (50 USC 2401 et seq.), the Export Administration Regulations (15 CFR 768-799), or the U.S. Arms Export Control Act (22USC 2778 et seq.) and the International Traffic in Arms Regulations (22 CFR 120-130). These statutes and regulations impose restrictions on import, export and transfer to foreign entities and persons, whether within the U.S. or abroad, of certain data and articles without approved licenses from the U.S. Department of State and/or the U.S. Department of Commerce.

NTS-Chesapeake Testing is an independent testing facility and has no affiliation with
Optima Ballistic Glass Colombia S.A.

2 of 13



POC: Mr. Julio Rodriguez
P.O. No.: Prepaid
Test Date: 18 February 2021
Job No.: 3350-019

TABLE OF CONTENTS		Page(s)
DELIVERY LETTER	.....	1
COVER PAGE	.....	2
TABLE OF CONTENTS	.....	3
SECTION 1	INTRODUCTION	4
SECTION 2	THREATS AND INSTRUMENTATION	4
SECTION 3	DETAILS OF TEST (OBJECTIVE/STANDARDS/PROCEDURES)	4
SECTION 4	RESULTS	4
TABLE 1	SUMMARY OF OVERALL RESULTS	5
TEST RESULTS (DATA SHEETS)	.....	6-11
ATTACHMENT A (CALIBRATION DATA)	.....	12
END OF REPORT	.....	13



1 Introduction

Optima Ballistic Glass Colombia S.A., provided six armor samples to NTS-Chesapeake Testing for ballistic resistance testing on 18 February 2021.

2 Threats and Instrumentation

2.1 Threats

- .44-mag., 240-grain semi-wadcutter gas checked (SWCGC) projectiles
- .44-mag., 240-grain full metal case-flat nosed (FMC-FN) 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 NIJ-STD-0108.01 Level IIIA and the customer's request for Job No. 3350-019-1 through -3 and in accordance with EN 1063 BR4 and the customer's request for Job No. 3350-019-4 through -6. 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 Job No. 3350-019-1 through -3, the target was clamped to a rigid test fixture. A piece of 0.508 mm thick (0.020 in) type 2024 T3 aluminum was mounted along the shotline, approximately 152 mm ±13 mm (6 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). For Job No. 3350-019-4 through -6, 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 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 (mm)	Weight (lbs)	Threat	Target Obliq. (deg)	Shot No.	Penetration Data	
							Velocity (ft/s)	Result
3350-019-1	9456-108	500 x 500	22.30	.44-mag., 240-grain SWCGC	0.0	1	1430	None
						2	1420	None
						3	1412	None
						4	1429	None
						5	1423	None
3350-019-2	9456-109	500 x 500	22.32	.44-mag., 240-grain SWCGC	0.0	1	1450	None
						2	1425	None
						3	1429	None
						4	1417	None
						5	1423	None
3350-019-3	9457-108	500 x 500	22.31	.44-mag., 240-grain SWCGC	0.0	1	1409	None
						2	1421	None
						3	1416	None
						4	1415	None
						5	1414	None
3350-019-4	9456-110	500 x 500	22.39	.44-mag., 240-grain FMC-FN	0.0	1	1459	None
						2	1460	None
						3	1450	None
3350-019-5	9457-109	500 x 500	22.34	.44-mag., 240-grain FMC-FN	0.0	1	1467	None
						2	1463	None
						3	1458	None
3350-019-6	9457-110	500 x 500	22.29	.44-mag., 240-grain FMC-FN	0.0	1	1431	None
						2	1450	None
						3	1475	None

BALLISTIC RESISTANCE TEST

NTS-Chesapeake Testing

4603B Compass Point Road
Belcamp, MD 21017

Client: Optima Ballistic Glass Columbia S.A.

Job No.: 3350-019-1

Test Date: 2/18/2021

Test Panel

Description: Transparent Armor

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: 9456-108

Size: 500 x 500 mm
Avg. Thick: 0.774 in
Thickness: 0.781 in; 0.771 in;
0.770 in; 0.772 in

Weight: 22.30 lbs
Plies/Laminates: NA

Date Received: 2/15/2021
Via: DHL
Returned: NA

Setup

Shot Spacing: NIJ-STD-0108.01 Level IIIA
Witness Panel: 0.02 in 2024-T3 Aluminum
Backing Material: NA
Condition: Ambient

Primary Vel. Screens (ft): 6.500, 9.500
Primary Vel. Location (ft): 8.000
Range to Target (ft): 16.400
Target to Witness (in): 6.000

Range No.: 4
Temp: 67.7 °F
BP: 30.1 inHg
RH: 30.0%
Barrel/Gun: Test Barrel
Gunner: Mike Hinder
Recorder: Craig Thomas

Ammunition

Projectile	Lot No.	Powder
(1) .44-mag., 240-grain SWCGC	Rim Rock Bullets	HP-38

Applicable Standards or Procedures

- (1) NIJ-STD-0108.01 Level IIIA
- (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	245.5	2098	1430	2098	1430	1430	None	0.0	
2	1	244.1	2113	1420	2113	1420	1420	None	0.0	
3	1	243.4	2125	1412	2123	1413	1412	None	0.0	
4	1	243.5	2101	1428	2098	1430	1429	None	0.0	
5	1	246.3	2108	1423	2108	1423	1423	None	0.0	

Remarks:

Required velocity: 1400 ± 50 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.: 3350-019-2

Test Date: 2/18/2021

Test Panel

Description: Transparent Armor

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: 9456-109

Size: 500 x 500 mm
Avg. Thick: 0.774 in
Thickness: 0.771 in; 0.776 in;
0.776 in; 0.771 in

Weight: 22.32 lbs
Plies/Laminates: NA

Date Received: 2/15/2021
Via: DHL
Returned: NA

Setup

Shot Spacing: NIJ-STD-0108.01 Level IIIA
Witness Panel: 0.02 in 2024-T3 Aluminum
Backing Material: NA
Condition: Ambient

Primary Vel. Screens (ft): 6.500, 9.500
Primary Vel. Location (ft): 8.000
Range to Target (ft): 16.400
Target to Witness (in): 6.000

Range No.: 4
Temp: 67.5 °F
BP: 30.5 inHg
RH: 30.0%
Barrel/Gun: Test Barrel
Gunner: Mike Hinder
Recorder: Craig Thomas

Ammunition

Projectile	Lot No.	Powder
(1) .44-mag., 240-grain SWCGC	Rim Rock Bullets	HP-38

Applicable Standards or Procedures

- (1) NIJ-STD-0108.01 Level IIIA
- (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	243.6	2069	1450	2069	1450	1450	None	0.0	
2	1	243.3	2106	1425	2106	1425	1425	None	0.0	
3	1	246.7	2089	1436	2111	1421	1429	None	0.0	
4	1	243.0	2118	1416	2115	1418	1417	None	0.0	
5	1	243.3	2098	1430	2120	1415	1423	None	0.0	

Remarks:

Required velocity: 1400 ± 50 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.: 3350-019-3

Test Date: 2/18/2021

Test Panel

Description: Transparent Armor

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: 9457-108

Size: 500 x 500 mm
Avg. Thick: 0.772 in
Thickness: 0.775 in; 0.771 in;
0.770 in; 0.772 in

Weight: 22.31 lbs
Plies/Laminates: NA

Date Received: 2/15/2021
Via: DHL
Returned: NA

Setup

Shot Spacing: NIJ-STD-0108.01 Level IIIA
Witness Panel: 0.02 in 2024-T3 Aluminum
Backing Material: NA
Condition: Ambient

Primary Vel. Screens (ft): 6.500, 9.500
Primary Vel. Location (ft): 8.000
Range to Target (ft): 16.400
Target to Witness (in): 6.000

Range No.: 4
Temp: 67.5 °F
BP: 30.1 inHg
RH: 30.0%
Barrel/Gun: Test Barrel
Gunner: Mike Hinder
Recorder: Craig Thomas

Ammunition

Projectile	Lot No.	Powder
(1) .44-mag., 240-grain SWCGC	Rim Rock Bullets	HP-38

Applicable Standards or Procedures

- (1) NIJ-STD-0108.01 Level IIIA
- (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	246.7	2130	1408	2128	1410	1409	None	0.0	
2	1	243.7	2111	1421	2111	1421	1421	None	0.0	
3	1	243.2	2118	1416	2118	1416	1416	None	0.0	
4	1	246.9	2120	1415	2120	1415	1415	None	0.0	
5	1	243.5	2123	1413	2120	1415	1414	None	0.0	

Remarks:

Required velocity: 1400 ± 50 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.: 3350-019-4
Test Date: 2/18/2021

Test Panel

Description: Transparent Armor

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: 9456-110

Size: 500 x 500 mm
Avg. Thick: 0.772 in
Thickness: 0.773 in; 0.776 in;
0.770 in; 0.769 in

Weight: 22.39 lbs
Plies/Laminates: NA

Date Received: 2/15/2021
Via: DHL
Returned: NA

Setup

Shot Spacing: EN 1063 BR4
Witness Panel: .01 in Aluminum foil with
splinter box
Backing Material: NA
Condition: Ambient

Primary Vel. Screens (ft): 6.500, 6.833,
11.166, 11.500
Primary Vel. Location (ft): 9.000
Range to Target (ft): 16.400
Target to Witness (in): 19.680

Range No.: 4
Temp: 68.0 °F
BP: 30.1 inHg
RH: 30.0%
Barrel/Gun: Test Barrel
Gunner: Mike Hinder
Recorder: Craig Thomas

Ammunition

Projectile	Lot No.	Powder
(1) .44-mag., 240-grain FMC-FN	Magtech	HP-38

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	3426	1459	2970	1459	1459	None	0.0	
2	1	239.7	3426	1459	2967	1460	1460	None	0.0	
3	1	240.1	3448	1450	2989	1450	1450	None	0.0	

Remarks:

Required velocity: 1411-1475 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.: 3350-019-5
Test Date: 2/18/2021

Test Panel

Description: Transparent Armor

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: 9457-109

Size: 500 x 500 mm
Avg. Thick: 0.774 in
Thickness: 0.772 in; 0.775 in;
0.771 in; 0.777 in

Weight: 22.34 lbs
Plies/Laminates: NA

Date Received: 2/15/2021
Via: DHL
Returned: NA

Setup

Shot Spacing: EN 1063 BR4
Witness Panel: .01 in Aluminum foil with
splinter box
Backing Material: NA
Condition: Ambient

Primary Vel. Screens (ft): 6.500, 6.833,
11.166, 11.500
Primary Vel. Location (ft): 9.000
Range to Target (ft): 16.400
Target to Witness (in): 19.680

Range No.: 4
Temp: 68.4 °F
BP: 30.1 inHg
RH: 30.0%
Barrel/Gun: Test Barrel
Gunner: Mike Hinder
Recorder: Craig Thomas

Ammunition

Projectile	Lot No.	Powder
(1) .44-mag., 240-grain FMC-FN	Magtech	HP-38

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	239.5	3409	1467	2955	1466	1467	None	0.0	
2	1	239.4	3417	1463	2963	1462	1463	None	0.0	
3	1	239.6	3431	1457	2972	1458	1458	None	0.0	

Remarks:

Required velocity: 1411-1475 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.: 3350-019-6
Test Date: 2/18/2021

Test Panel

Description: Transparent Armor

Manufacturer: Optima Ballistic Glass Columbia S.A.

Sample No.: 9457-110

Size: 500 x 500 mm
Avg. Thick: 0.770 in
Thickness: 0.775 in; 0.770 in;
0.770 in; 0.767 in

Weight: 22.29 lbs
Plies/Laminates: NA

Date Received: 2/15/2021
Via: DHL
Returned: NA

Setup

Shot Spacing: EN 1063 BR4
Witness Panel: .01 in Aluminum foil with
splinter box
Backing Material: NA
Condition: Ambient

Primary Vel. Screens (ft): 6.500, 6.833,
11.166, 11.500
Primary Vel. Location (ft): 9.000
Range to Target (ft): 16.400
Target to Witness (in): 19.680

Range No.: 4
Temp: 67.7 °F
BP: 30.1 inHg
RH: 30.0%
Barrel/Gun: Test Barrel
Gunner: Mike Hinder
Recorder: Craig Thomas

Ammunition

Projectile	Lot No.	Powder
(1) .44-mag., 240-grain FMC-FN	Magtech	HP-38

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	239.1	3495	1431	3028	1431	1431	None	0.0	
2	1	240.1	3448	1450	2987	1451	1450	None	0.0	
3	1	239.2	3390	1475	2938	1475	1475	None	0.0	

Remarks:

Required velocity: 1411-1475 ft/s

Footnotes:



POC: Mr. Julio Rodriguez
P.O. No.: Prepaid
Test Date: 18 February 2021
Job No.: 3350-019

ATTACHMENT A
CALIBRATION DATA

Job Number: <u>3350-019</u>					
Customer: <u>Optima</u>			Date: <u>02/18/2021</u>		
Range: <u>4</u>		Range Lead: <u>Craig Thomas</u>			
Equipment	Serial Number	NTS I.D. #	Cal. Date	Due Date	Range Lead Initials
Chronograph 1	108	WC067007	9/17/2020	9/17/2021	CT
Chronograph 2	104	WC027149	9/17/2020	9/17/2021	CT
Powder Scale	A12119286	WC060414	12/08/2020	6/08/2021	CT
Floor Scale	25459070	WC060403	12/09/2020	12/09/2021	CT
100 ft. Tape Measure	WC075066	WC075066	11/10/2020	11/10/2022	CT
25 ft. Tape Measure	WC067253	WC067253	8/20/2019	8/20/2021	CT
Thermometer	200175459	WC074982	3/9/2020	3/9/2022	CT
BFD Tool	19/090027	WC067358	7/20/2020	7/20/2021	CT
BFD Bridge	19/190036	WC075059	11/10/2020	11/10/2021	CT
Angle Block	570001	WC060650	7/22/2020	7/22/2021	CT
Temp/Humidity Monitor	192291518	WC067386	6/29/2019	6/29/2021	CT



POC: Mr. Julio Rodriguez
P.O. No.: Prepaid
Test Date: 18 February 2021
Job No.: 3350-019

END OF REPORT