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

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Optima Ballistic Glass Colombia S.A., September 2019.***

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has no affiliation with Optima Ballistic Glass Colombia S.A.

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## **1 Introduction**

Optima Ballistic Glass Colombia S.A., provided three armor samples to NTS-Chesapeake Testing for ballistic resistance testing on 16 August 2019.

## **2 Threats and Instrumentation**

### ***2.1 Threats***

- .357-mag., 158-grain full metal jacketed-round nose (FMJ-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.

## **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 BR3 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 ( $70 \pm 1$  °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  $\pm$  13 mm (19.666 in  $\pm$  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
3350-012-1	5319-101	19.75 x 19.75	20.94	.357-mag, 158-grain, FMJ RN	0.0	1	1410	None
						2	1409	None
						3	1419	None
3350-012-2	5319-102	19.75 x 19.75	20.94	.357-mag, 158-grain, FMJ RN	0.0	1	1425	None
						2	1417	None
						3	1412	None
3350-012-3	5319-103	19.75 x 19.75	20.94	.357-mag, 158-grain, FMJ RN	0.0	1	1416	None
						2	1419	None
						3	1407	None

# BALLISTIC RESISTANCE TEST

## NTS-Chesapeake Testing

4603B Compass Point Road  
Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.

Job No.: 3350-012-1

Test Date: 8/16/2019

### Test Panel

Description: Transparent Armor.

Manufacturer: Optima Ballistic Glass Colombia S.A.

Sample No.: 5319-101

Size: 19.75 x 19.75 in  
Avg. Thick: 0.740 in  
Thickness: 0.738 in; 0.738 in;  
0.742 in; 0.742 in

Weight: 20.94 lbs  
Plies/Laminates: NA

Date Received: 8/12/2019  
Via: DHL  
Returned: DHL

### Setup

Shot Spacing: EN 1063 BR3  
Witness Panel: .001 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): 19.666

Range No.: 1  
Temp: 70.7 °F  
BP: 29.8 inHg  
RH: 47.7%  
Barrel/Gun: Test Barrel  
Gunner: Austin Blake  
Recorder: Lance Eveland

### Ammunition

Projectile	Lot No.	Powder
(1) .357-mag, 158-grain, FMJ RN	ARMSCOR	Accurate No. 2

### Applicable Standards or Procedures

1) EN 1063 BR3

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	158.0	3544	1411	3075	1409	1410	None	0.0	
2	1	158.0	3546	1410	3077	1408	1409	None	0.0	
3	1	158.0	3524	1419	3055	1418	1419	None	0.0	

#### Remarks:

Required velocity: 410 ±10 m/s

#### Footnotes:

# BALLISTIC RESISTANCE TEST

## NTS-Chesapeake Testing

4603B Compass Point Road  
Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.

Job No.: 3350-012-2

Test Date: 8/16/2019

### Test Panel

Description: Transparent Armor.

Manufacturer: Optima Ballistic Glass Colombia S.A.

Sample No.: 5319-102

Size: 19.75 x 19.75 in  
Avg. Thick: 0.742 in  
Thickness: 0.741 in; 0.740 in;  
0.741 in; 0.748 in

Weight: 20.94 lbs  
Plies/Laminates: NA

Date Received: 8/12/2019  
Via: DHL  
Returned: DHL

### Setup

Shot Spacing: EN 1063 BR3  
Witness Panel: .001 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): 19.666

Range No.: 1  
Temp: 70.7 °F  
BP: 29.8 inHg  
RH: 48.1%  
Barrel/Gun: Test Barrel  
Gunner: Austin Blake  
Recorder: Lance Eveland

### Ammunition

Projectile	Lot No.	Powder
(1) .357-mag, 158-grain, FMJ RN	ARMSCOR	Accurate No. 2

### Applicable Standards or Procedures

(1) EN 1063 BR3

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	158.0	3507	1426	3043	1424	1425	None	0.0	
2	1	158.0	3524	1419	3060	1416	1417	None	0.0	
3	1	158.0	3541	1412	3070	1411	1412	None	0.0	

#### Remarks:

Required velocity: 410 ±10 m/s

#### Footnotes:

# BALLISTIC RESISTANCE TEST

## NTS-Chesapeake Testing

4603B Compass Point Road  
Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.

Job No.: 3350-012-3

Test Date: 8/16/2019

### Test Panel

Description: Transparent Armor.

Manufacturer: Optima Ballistic Glass Colombia S.A.

Sample No.: 5319-103

Size: 19.75 x 19.75 in  
Avg. Thick: 0.742 in  
Thickness: 0.742 in; 0.739 in;  
0.744 in; 0.743 in

Weight: 20.94 lbs  
Plies/Laminates: NA

Date Received: 8/12/2019  
Via: DHL  
Returned: DHL

### Setup

Shot Spacing: EN 1063 BR3  
Witness Panel: .001 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): 19.666

Range No.: 1  
Temp: 70.8 °F  
BP: 29.8 inHg  
RH: 47.9%  
Barrel/Gun: Test Barrel  
Gunner: Austin Blake  
Recorder: Lance Eveland

### Ammunition

Projectile	Lot No.	Powder
(1) .357-mag, 158-grain, FMJ RN	ARMSCOR	Accurate No. 2

### Applicable Standards or Procedures

(1) EN 1063 BR3

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	158.0	3529	1417	3060	1416	1416	None	0.0	
2	1	158.0	3524	1419	3055	1418	1419	None	0.0	
3	1	158.0	3551	1408	3082	1406	1407	None	0.0	

#### Remarks:

Required velocity: 410 ±10 m/s

#### Footnotes: