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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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## **1 Introduction**

Optima Ballistic Glass Colombia S.A., provided three armor samples to NTS-Chesapeake Testing for ballistic resistance testing on 16 August through 26 September 2019.

## **2 Threats and Instrumentation**

### **2.1 Threats**

- 5.56 x 45-mm, 62-grain M855 ball projectiles were provided by NTS-Chesapeake Testing.

\*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 BR5 and the customer's request for Job No. 3350-012-1 and 2; and in accordance with EN 1063 BR6 and the customer's request for Job No. 3350-012-3. 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 ( $69 \pm 1$  °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 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.

**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	5319-113	19.50 x 19.50	39.67	5.56 x 45-mm, 62-grain M855 ball	0.0	1	3127	None
						2	3126	None
						3	3182	None
3350-012-2	5319-115	19.50 x 19.50	39.85	5.56 x 45-mm, 62-grain M855 ball	0.0	1	3119	None
						2	3154	None
						3	3131	None
3350-012-3	6228-114	19.50 x 19.50	39.63	5.56 x 45-mm, 62-grain M855 ball	0.0	1	3114	None
						2	3128	None
						3	3149	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.:** 5319-113

Size: 19.50 x 19.50 in  
Avg. Thick: 1.294 in  
Thickness: 1.294 in; 1.297 in;  
1.297 in; 1.290 in

Weight: 39.67 lbs  
Plies/Laminates: NA

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

## Setup

Shot Spacing: EN 1063 BR5  
Witness Panel: .01 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): 19.666

Range No.: 2  
Temp: 69.8 °F  
BP: 29.8 inHg  
RH: 49.3%  
Barrel/Gun: CT-6026  
Gunner: C. Peddicord  
Recorder: Jesse Fulk

## Ammunition

Projectile	Lot No.	Powder
(1) 5.56 x 45-mm, 62-grain M855 ball	Military	N 110

## Applicable Standards or Procedures

(1) EN 1063 BR5

Shot No.	Ammo	Weight (gr)	Time 1 (µs)	Vel. 1 (ft/s)	Time 2 (µs)	Vel. 2 (ft/s)	Avg. Vel. (ft/s)	Striking Vel. (ft/s)	Penetration	Obliq. (°)	Footnotes
1	1	62.0	3190	3135	2977	3135	3135	3127	None	0.0	
2	1	62.0	3191	3134	2978	3134	3134	3126	None	0.0	
3	1	62.0	3138	3187	2923	3193	3190	3182	None	0.0	

### Remarks:

Required velocity: 3117 ±32 ft/s  
The projectiles were provided by NTS-Chesapeake Testing.

### 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.:** 5319-115

Size: 19.50 x 19.50 in  
Avg. Thick: 1.300 in  
Thickness: 1.300 in; 1.307 in;  
1.295 in; 1.300 in

Weight: 39.85 lbs  
Plies/Laminates: NA

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

## Setup

Shot Spacing: EN 1063 BR5  
Witness Panel: .01 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): 19.666

Range No.: 2  
Temp: 69.6 °F  
BP: 29.8 inHg  
RH: 48.9%  
Barrel/Gun: CT-6026  
Gunner: C. Peddicord  
Recorder: Jesse Fulk

## Ammunition

Projectile	Lot No.	Powder
(1) 5.56 x 45-mm, 62-grain M855 ball	Military	N 110

## Applicable Standards or Procedures

(1) EN 1063 BR5

Shot No.	Ammo	Weight (gr)	Time 1 (µs)	Vel. 1 (ft/s)	Time 2 (µs)	Vel. 2 (ft/s)	Avg. Vel. (ft/s)	Striking Vel. (ft/s)	Penetration	Obliq. (°)	Footnotes
1	1	NA	3197	3128	2985	3127	3127	3119	None	0.0	
2	1	NA	3165	3160	2950	3164	3162	3154	None	0.0	
3	1	NA	3187	3138	2972	3140	3139	3131	None	0.0	

### Remarks:

Required velocity: 3117 ±32 ft/s  
The projectiles were provided by NTS-Chesapeake Testing.

### Footnotes:

# BALLISTIC RESISTANCE TEST

## NTS-Chesapeake Testing

4603B Compass Point Road  
Belcamp, MD 21017

Client: Optima Ballistic Glass Columbia S.A.  
Job No.: 3350-012-3  
Test Date: 9/26/2019

**Test Panel** Description: Transparent armor.

Manufacturer: Optima Ballistic Glass Columbia S.A. Sample No.: 6228-114

Size: 19.50 x 19.50 in Avg. Thick: 1.303 in Thickness: 1.300 in; 1.304 in; 1.306 in; 1.301 in	Weight: 39.63 lbs Plies/Laminates: NA	Date Received: 8/19/2019 Via: FedEx Returned: FedEx
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## Setup

Shot Spacing: EN 1063 BR6 Witness Panel: .01 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): 19.666	Range No.: 5 Temp: 69.4 °F BP: 29.6 inHg RH: 48.1% Barrel/Gun: NA Gunner: Bret DeMond Recorder: T. Contreras
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## Ammunition

Projectile	Lot No.	Powder
(1) 5.56 x 45-mm, 62-grain M855 ball	Military	N 110

## Applicable Standards or Procedures

- (1) EN 1063 BR6
- (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)	Striking Vel. (ft/s)	Penetration	Obliq. (°)	Footnotes
1	1	62.4	3203	3122	2989	3123	3122	3114	None	0.0	
2	1	62.6	3190	3135	2976	3136	3135	3128	None	0.0	
3	1	62.2	3168	3157	2956	3157	3157	3149	None	0.0	

Remarks:  
 Required velocity: 3085 to 3148 ft/s  
 The projectiles were provided by NTS-Chesapeake Testing.

Footnotes: