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

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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 9 September 2019.

2 Threats and Instrumentation

2.1 Threats

- 7.62 x 51-mm, 149-grain M80 full metal jacketed (FMJ) 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 (69 ± 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 (19.680 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 32.800 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
3350-013-1	6077-109	19.75 x 19.75	45.02	7.62 x 51-mm, 149-grain M80 FMJ	0.0	1	2726	None
						2	2705	None
						3	2721	None
3350-013-2	6077-110	19.75 x 19.75	45.30	7.62 x 51-mm, 149-grain M80 FMJ	0.0	1	2742	None
						2	2737	None
						3	2768	None
3350-013-3	6077-111	19.75 x 19.75	45.14	7.62 x 51-mm, 149-grain M80 FMJ	0.0	1	2723	None
						2	2769	None
						3	2745	None

BALLISTIC RESISTANCE TEST

NTS-Chesapeake Testing

4603B Compass Point Road
Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.

Job No.: 3350-013-1

Test Date: 9/9/2019

Test Panel

Description: Transparent armor sample.

Manufacturer: Optima Ballistic Glass Colombia S.A.

Sample No.: 6077-109

Size: 19.75 x 19.75 in
Avg. Thick: 1.462 in
Thickness: 1.464 in; 1.464 in;
1.460 in; 1.462 in

Weight: 45.02 lbs
Plies/Laminates: NA

Date Received: 9/6/2019
Via: ABF Freight
Returned: NA

Setup

Shot Spacing: BS EN 1063 Level BR6
Witness Panel: .002 in Aluminum foil
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): 32.800
Target to Witness (in): 19.680

Range No.: 4
Temp: 69.6 °F
BP: 30.0 inHg
RH: 45.3%
Barrel/Gun: NA
Gunner: J. McDowell
Recorder: J. McDowell

Ammunition

Projectile	Lot No.	Powder
(1) 7.62 x 51-mm, 149-grain M80 FMJ	Military	N133

Applicable Standards or Procedures

- (1) BS EN 1063 Level 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	148.1	3663	2730	3414	2734	2732	2726	None	0.0	
2	1	148.2	3692	2709	3441	2712	2710	2705	None	0.0	
3	1	148.0	3675	2721	3417	2731	2726	2721	None	0.0	

Remarks:

Required velocity: 2691 to 2755 ft/s

Footnotes:

BALLISTIC RESISTANCE TEST

NTS-Chesapeake Testing

4603B Compass Point Road
Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.
Job No.: 3350-013-2
Test Date: 9/9/2019

Test Panel Description: Transparent armor sample.

Manufacturer: Optima Ballistic Glass Colombia S.A.

Sample No.: 6077-110

Size: 19.75 x 19.75 in
Avg. Thick: 1.467 in
Thickness: 1.469 in; 1.467 in;
1.465 in; 1.468 in

Weight: 45.30 lbs
Plies/Laminates: NA

Date Received: 9/6/2019
Via: ABF Freight
Returned: NA

Setup

Shot Spacing: BS EN 1063 Level BR6
Witness Panel: .002 in Aluminum foil
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): 32.800
Target to Witness (in): 19.680

Range No.: 4
Temp: 69.9 °F
BP: 30.0 inHg
RH: 47.8%
Barrel/Gun: NA
Gunner: J. McDowell
Recorder: J. McDowell

Ammunition

Projectile	Lot No.	Powder
(1) 7.62 x 51-mm, 149-grain M80 FMJ	Military	N133

Applicable Standards or Procedures

- (1) BS EN 1063 Level 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	150.1	3641	2746	3395	2749	2748	2742	None	0.0	
2	1	150.2	3649	2740	3400	2745	2743	2737	None	0.0	
3	1	150.2	3607	2772	3363	2775	2774	2768	None	0.0	

Remarks:

Required velocity: 2691 to 2755 ft/s

Footnotes:

BALLISTIC RESISTANCE TEST

NTS-Chesapeake Testing

4603B Compass Point Road
Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.
Job No.: 3350-013-3
Test Date: 9/9/2019

Test Panel Description: Transparent armor sample.

Manufacturer: Optima Ballistic Glass Colombia S.A.

Sample No.: 6077-111

Size: 19.75 x 19.75 in
Avg. Thick: 1.465 in
Thickness: 1.461 in; 1.468 in;
1.466 in; 1.466 in

Weight: 45.14 lbs
Plies/Laminates: NA

Date Received: 9/6/2019
Via: ABF Freight
Returned: NA

Setup

Shot Spacing: BS EN 1063 Level BR6
Witness Panel: .002 in Aluminum foil
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): 32.800
Target to Witness (in): 19.680

Range No.: 4
Temp: 69.6 °F
BP: 30.0 inHg
RH: 45.6%
Barrel/Gun: NA
Gunner: J. McDowell
Recorder: J. McDowell

Ammunition

Projectile	Lot No.	Powder
(1) 7.62 x 51-mm, 149-grain M80 FMJ	Military	N133

Applicable Standards or Procedures

- (1) BS EN 1063 Level 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	148.0	3666	2728	3419	2730	2729	2723	None	0.0	
2	1	147.8	3607	2772	3360	2778	2775	2769	None	0.0	
3	1	147.8	3636	2750	3392	2752	2751	2745	None	0.0	

Remarks:

Required velocity: 2691 to 2755 ft/s

Footnotes: