

National Technical Systems Test Report for Ballistic Resistance Testing

Project No.: OH000005457 **Tested:** 21-24 October 2022 **Purchase Order No.:** Signed quote

Prepared For

Optima Ballistic Glass Colombia S.A.S | Zona Franca La Cayena Mz K Lote In 45 A. | Barranquilla, Colombia

Prepared By

National Technical Systems | 4603B Compass Point Road | Belcamp, MD 21017 | p: 410.297.8154 f: 410.297.8160 | www.nts.com

Attention: Mr. Julio Rodriguez

Laura Deptol Technical Writer

(Laura, Deptol@nts.com)

Kyle North Project Manager (kyle.north@nts.com)

Matthew Rixham Quality Assurance (matt.rixham@nts.com)

Natt Rikuw

Further dissemination only as directed by Optima Ballistic Glass Colombia S.A.S, 1 November 2022.

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



Revision History

Rev.	Description	Issue Date
0	Initial Release	1 November 2022



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1 Introduction

Optima Ballistic Glass Colombia S.A.S provided 16 armor samples to NTS-Chesapeake Testing for ballistic testing on 21-24 October 2022.

2 Threats and Instrumentation

2.1 Threats*

• 7.62 x 51-mm, 150-grain M80 cooper jacketed lead core (CJLC) projectiles

*All projectiles were fired from a universal receiver which was fitted with the appropriate barrel and mounted on an 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. The Calibration checklist is presented in Attachment A. A digital still camera was used to document the test. Photographs are presented in Attachment B.

3 Details of Test

The objective of this test was to conduct a ballistic resistance test on the armor samples in accordance with STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified) and the customer's request. Shot spacing between multiple impacts on a single sample was 3 shots on a 120 mm triangle. Shots against the armor samples were performed at 0° obliquity and ambient range temperature ($18 \pm 1^{\circ}$ C).

Each sample was conditioned to specific parameters prior to testing as referenced on each data sheet. For each shot, 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 $152 \text{ mm} \pm 13 \text{ mm}$ (6 in ± 0.5 in) behind the inside surface of the strike face, 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 7.620 m from the target. The projectile velocity for each armor sample was in accordance with the referenced performance standard.

4 Summary of Results

The results of the ballistic resistance test are summarized in Table 1. The detailed ballistic data sheets for all testing performed are provided on the following pages.



Table 1. Summary of Ballistic Resistance Results

Project	Sample				Target	Shot	Penetra	tion Data
No.	No.	Size	Weight	Threat	Obliq.	No.	Velocity	Result
		(mm)	(kg)		(deg)	110.	(m/s)	
	(M90, V0, Cold)			7.62 x 51-mm,		1	854.35	None
ОН000005457-1	(M80, V0, Cold) OFC-14161-101	381 x 381	14.530	150-grain M80 CJLC	0	2	864.11	None
	01.6-14101-101			130-grain Wioo CJLC		3	847.34	None
	(M80, V0, Cold)			7.62 x 51-mm,		1	854.66	None
ОН000005457-2	OFC-14161-102	381 x 381	14.440	150-grain M80 CJLC	0	2	848.26	None
	OFC-14101-102			130-grain Wioo CJLC		3	854.66	None
	(M80, V0, Cold)			7.62 x 51-mm,		1	854.66	None
ОН000005457-3	(M80, V0, Cold)	381 x 381	14.500	150-grain M80 CJLC	0	2	851.31	None
				130-grain Wioo CJLC		3	847.65	None
			14.540	7.62 x 51-mm,		1	855.88	None
ОН000005457-4		381 x 381		150-grain M80 CJLC	0	2	855.27	None
				150-grain woo este		3	854.35	None
	(M80, V0, Hot)			7.62 x 51-mm,		1	856.79	None
ОН000005457-5	OFC-14161-105	381 x 381	14.460	150-grain M80 CJLC	0	2	848.87	None
	01 0-14101-103					3	856.18	None
	(M80, V0, Hot)			7.62 x 51-mm,		1	853.74	None
ОН000005457-6	OFC-14161-106	381 x 381	14.430	150-grain M80 CJLC	0	2	860.15	None
	01 0-14101-100			130-grain Woo CILC		3	876.30	None
	(M80, V0, Hot)			7.62 x 51-mm,		1	858.93	None
ОН000005457-7	OFC-14161-107	381 x 381	14.490	150-grain M80 CJLC	0	2	854.05	None
	01 0-14101-107			130-grain Wioo CJEC		3	854.66	None
	(M80 V0 Hot)		14.420	7.62 x 51-mm,		1	855.27	None
ОН000005457-8	(M80, V0, Hot) OFC-14161-108			150-grain M80 CJLC	0	2	845.82	None
	01 0-14101-100			150-grain with CJLC		3	848.26	None



Table 1. Summary of Ballistic Resistance Results (continued)

Project	Sample				Target	C1 4	Penetra	tion Data
No.	No.	Size (mm)	Weight (kg)	Threat	Obliq. (deg)	Shot No.	Velocity (m/s)	Result
	(M90, V0) OEC			7.60 v.51 mm		1	856.79	None
ОН000005457-9	(M80, V0) OFC- 14154-109	381 x 381	14.520	7.62 x 51-mm, 150-grain M80 CJLC	0	2	856.18	None
	14134-109			150-grain Wiou CILC		3	853.74	None
	(M80, V0) OFC-			7.62 x 51-mm,		1	854.35	None
ОН000005457-10	14154-110	381 x 381	14.480	150-grain M80 CJLC	0	2	855.27	None
	14134-110			150-grain Wiou CILC		3	861.06	None
	(M90, V0) OEC			7.62 x 51-mm,		1	849.78	None
ОН000005457-11	(M80, V0) OFC- 14154-111	381 x 381	14.420	150-grain M80 CJLC	0	2	860.15	None
	14134-111			150-grain Wioo CJLC		3	857.40	None
	(M80, V0) OFC-			7.62 x 51-mm,		1	857.40	None
ОН000005457-12	(M80, V0) OFC- 14154-112 (M80, V0) OFC- 14154-113	381 x 381	14.490	150-grain M80 CJLC	0	2	851.00	None
				150-grain Wioo CJLC		3	854.66	None
				7.62 x 51-mm,	0	1	847.65	None
ОН000005457-13		381 x 381	14.490	150-grain M80 CJLC		2	855.88	None
	14154-115			130-grain Moo CJLC		3	855.88	None
	(M80, V0) OFC-			7.62 x 51-mm,		1	852.53	None
ОН000005457-14	14154-114	381 x 381	14.520	150-grain M80 CJLC	0	2	859.54	None
	14134-114			130-grain Wioo CILC		3	852.22	None
	(M80, V0) OFC-			7.62 x 51-mm,		1	856.79	None
OH000005457-15	14154-115	381 x 381	14.510	150-grain M80 CJLC	0	2	860.15	None
	14134-113			130-grain Woo CILC		3	856.79	None
	(M80, V0) OEC			7.62 x 51-mm,		1	855.27	None
OH000005457-16	(M80, V0) OFC- 14154-116	381 x 381 1	14.420	150-grain M80 CJLC	0	2	858.62	None
	17157 110			150 grain 19100 CJEC		3	849.48	None

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017 Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-1 Test Date: 10/24/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 3)

Manufacturer: Optima Ballistic Glass Colombia S.A.S | Sample No.: (M80, V0, Cold) OFC-14161-101

Size: 381 x 381 mm

Avg. Thickness: 45.288 mm

Thicknesses: 45.491 mm, 45.161

mm, 45.491 mm.

45.491 mm, 45.161 mm, 45.491 mm, 45.009 mm

Weight: 14.530 kg
Plies/Laminates: N/A

Plies/Laminates: N/A

Date Received: 10/14/2022
Received Via: FEDEX Ground
Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A

Condition: -10 F for 12 hours

Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.8 °C

RH: 47.2 % Barrel/Gun: CT-4035 Gunner: Justin Long Recorder: William Ellis

BP: 30.1 inHg

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	147.7	3559	856.5	3321	856.5	856.49	854.35	None	0	
2	1	41.0	147.7	3516	866.9	3286	865.6	866.24	864.11	None	0	
3	1	41.0	147.7	3585	850.1	3351	848.9	849.48	847.34	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017 Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-2 Test Date: 10/24/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 3)

Manufacturer: Optima Ballistic Glass Colombia S.A.S | Sample No.: (M80, V0, Cold) OFC-14161-102

Size: 381 x 381 mm

Avg. Thickness: 45.047 mm

Thicknesses: 44.882 mm, 44.983

mm, 45.161 mm,

Plies/Laminates: N/A

Date Received: 10/14/2022 Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

45.161 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A

Condition: -10 F for 12 hours

Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Weight: 14.440 kg

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.7 °C

RH: 51.9 % Barrel/Gun: CT-4035 Gunner: Justin Long Recorder: William Ellis

BP: 30.1 inHg

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	147.8	3555	857.4	3321	856.5	857.1	854.66	None	0	
2	1	41.0	147.8	3590	849.2	3338	852.2	850.7	848.26	None	0	
3	1	41.0	147.8	3555	857.4	3321	856.5	857.1	854.66	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017 Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-3 Test Date: 10/24/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 3)

Manufacturer: Optima Ballistic Glass Colombia S.A.S | Sample No.: (M80, V0, Cold) OFC-14161-103

Size: 381 x 381 mm

Avg. Thickness: 45.231 mm

Thicknesses: 45.466 mm, 45.517

mm, 44.958 mm,

45.466 mm, 45.517 mm, 44.958 mm, 44.983 mm

Weight: 14.500 kg

Plies/Laminates: N/A

Date Received: 10/14/2022

Received Via: FEDEX Ground
Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A

Condition: -10 F for 12 hours

Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.7 °C

BP: 30.1 inHg RH: 48.5 % Barrel/Gun: CT-4035 Gunner: Justin Long

Gunner: Justin Long Recorder: William Ellis

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	147.9	3555	857.4	3321	856.5	857.10	854.66	None	0	
2	1	41.0	148.0	3568	854.4	3334	853.1	853.74	851.31	None	0	
3	1	41.0	148.0	3585	850.1	3347	849.8	850.09	847.65	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017 Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-4 Test Date: 10/24/2022 Page 1 of 1

Test Panel Description: Transparent Armor (Group 3)

Manufacturer: Optima Ballistic Glass Colombia S.A.S | Sample No.: (M80, V0, Cold) OFC-14161-104

Size: 381 x 381 mm

Avg. Thickness: 45.314 mm

Thicknesses: 45.542 mm, 45.212

mm, 45.466 mm,

45.542 mm, 45.212 mm, 45.466 mm, 45.034 mm

Weight: 14.540 kg

Plies/Laminates: N/A

Date Received: 10/14/2022

Received Via: FEDEX Ground

Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A

Condition: -10 F for 12 hours

Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.6 °C

RH: 46.9 %
Barrel/Gun: CT-4035
Gunner: Justin Long
Recorder: William Ellis

BP: 30.1 inHg

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	IAmmo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq.	Footnotes
1	1	41.0	147.7	3551	858.3	3316	858.0	858.01	855.88	None	0	
2	1	41.0	147.7	3555	857.4	3316	858.0	857.71	855.27	None	0	
3	1	41.0	147.7	3559	856.5	3321	856.5	856.49	854.35	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-5 Test Date: 10/24/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 3)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0, Hot) OFC-14161-105

Size: 381 x 381 mm Avg. Thickness: 45.180 mm Thicknesses: 45.212 mm, 45.314

mm, 45.110 mm. 45.085 mm

Weight: 14.460 kg Date Received: 10/14/2022 Plies/Laminates: N/A Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A

Condition: 130 F for a minimum

of 12 hours

Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.7 °C

RH: 47.2 % Barrel/Gun: CT-4035 Gunner: Justin Long Recorder: William Ellis

BP: 30.1 inHg

Ammunition

Projectile		Lot No.	Manufacturer	Powder		
	(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Sho No.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	147.0	3546	859.5	3312	858.9	859.23	856.79	None	0	
2	1	41.0	147.1	3581	851.3	3342	851.3	851.31	848.87	None	0	
3	1	41.0	147.2	3551	858.3	3312	858.9	858.62	856.18	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-6 Test Date: 10/24/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 3)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0, Hot) OFC-14161-106

Size: 381 x 381 mm Avg. Thickness: 45.041 mm Thicknesses: 44.907 mm, 44.831

mm, 45.212 mm, 45.212 mm

Weight: 14.430 kg

Date Received: 10/14/2022 Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A

Condition: 130 F for a minimum

of 12 hours

Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Plies/Laminates: N/A

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.8 °C

BP: 30.1 inHg RH: 50.5 % Barrel/Gun: CT-4035 Gunner: Justin Long Recorder: William Ellis

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	147.6	3559	856.5	3325	855.6	855.88	853.74	None	0	
2	1	41.0	147.6	3533	862.6	3299	862.3	862.58	860.15	None	0	
3	1	41.0	147.6	3468	879.0	3238	878.4	878.74	876.30	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-7 Test Date: 10/24/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 3)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0, Hot) OFC-14161-107

Size: 381 x 381 mm Avg. Thickness: 45.187 mm Thicknesses: 45.161 mm, 45.060 mm, 45.288 mm.

Weight: 14.490 kg Plies/Laminates: N/A

Date Received: 10/14/2022 Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

45.237 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A

Condition: 130 F for a minimum

of 12 hours

Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.7 °C

BP: 30.1 inHg RH: 47.4 % Barrel/Gun: CT-4035 Gunner: Justin Long Recorder: William Ellis

Ammunition

Projectile		Lot No.	Manufacturer	Powder		
	(1) 7.62 x 51-mm, 150-grain M80 CJLC	N/A	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	147.6	3538	861.4	3303	861.4	861.36	858.93	None	0	
2	1	41.0	147.6	3555	857.4	3325	855.6	856.49	854.05	None	0	
3	1	41.0	147.6	3555	857.4	3321	856.5	857.10	854.66	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017 Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-8 Test Date: 10/24/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 3)

Manufacturer: Optima Ballistic Glass Colombia S.A.S | Sample No.: (M80, V0, Hot) OFC-14161-108

Size: 381 x 381 mm

Avg. Thickness: 45.015 mm

Thicknesses: 44.958 mm, 44.933 mm, 45.034 mm, 45.136 mm

Weight: 14.420 kg Plies/Laminates: N/A Date Received: 10/14/2022 Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A

Condition: 130 F for a minimum

of 12 hours

Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.7 °C

BP: 30.1 inHg RH: 47 % Barrel/Gun: CT-4035 Gunner: Justin Long

Recorder: William Ellis

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

not lo.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	147.3	3555	857.4	3316	858.0	857.71	855.27	None	0	
2	1	41.0	147.5	3594	848.0	3355	848.0	847.95	845.82	None	0	
3	1	41.0	147.6	3581	851.3	3347	849.8	850.39	848.26	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017 Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-9 Test Date: 10/21/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 1)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0) OFC-14154-109

Size: 381 x 381 mm Avg. Thickness: 45.244 mm Thicknesses: 45.288 mm, 45.288 mm, 45.187 mm, Weight: 14.520 kg Plies/Laminates: N/A Date Received: 10/14/2022 Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

45.212 mm

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A Condition: Ambient Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620 Target to Witness (mm): 152.400 Range No.: Range 6
Temp: 18.8 °C
BP: 30.1 inHg
RH: 46.8 %
Barrel/Gun: CT-4035
Gunner: Justin Long

Gunner: Justin Long Recorder: William Ellis

Ammunition

Projectile		Lot No.	Manufacturer	Powder		
	(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	148.2	3546	859.5	3312	858.9	859.23	856.79	None	0	
2	1	41.0	148.2	3551	858.3	3312	858.9	858.62	856.18	None	0	
3	1	41.0	148.3	3559	856.5	3325	855.6	855.88	853.74	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-10 Test Date: 10/21/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 1)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0) OFC-14154-110

Size: 381 x 381 mm Avg. Thickness: 45.212 mm Thicknesses: 45.237 mm, 45.212

mm, 45.187 mm, 45.212 mm

Weight: 14.480 kg Plies/Laminates: N/A

Date Received: 10/14/2022 Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A Condition: Ambient Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.7 °C

RH: 45.9 % Barrel/Gun: CT-4035 Gunner: Justin Long Recorder: William Ellis

BP: 30.1 inHg

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Sho	IAmmo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	148.3	3559	856.5	3321	856.5	856.49	854.35	None	0	
2	1	41.0	148.3	3555	857.4	3316	858.0	857.71	855.27	None	0	
3	1	41.0	148.3	3529	863.8	3295	863.2	863.50	861.06	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017 Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-11 Test Date: 10/21/2022 Page 1 of 1

Test Panel Description: Transparent Armor (Group 1)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0) OFC-14154-111

Size: 381 x 381 mm Avg. Thickness: 44.990 mm Thicknesses: 44.882 mm, 44.831 mm, 45.136 mm,

Plies/Laminates: N/A

Date Received: 10/14/2022 Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

45.110 mm

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A Condition: Ambient Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Weight: 14.420 kg

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620 Target to Witness (mm): 152.400 Range No.: Range 6 Temp: 18.8 °C BP: 30.1 inHg RH: 49.7 % Barrel/Gun: CT-4035 Gunner: Justin Long

Recorder: William Ellis

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Sho No.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	148	3577	852.2	3338	852.2	852.22	849.78	None	0	
2	1	41.0	148	3533	862.6	3299	862.3	862.58	860.15	None	0	
3	1	41.0	148	3546	859.5	3308	859.8	859.84	857.40	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-12 Test Date: 10/21/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 1)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0) OFC-14154-112

Size: 381 x 381 mm Avg. Thickness: 45.174 mm Thicknesses: 45.237 mm, 45.136

mm, 45,161 mm, 45.161 mm

Weight: 14.490 kg Date Received: 10/14/2022 Plies/Laminates: N/A Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A Condition: Ambient Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.9 °C

RH: 50.9 % Barrel/Gun: CT-4035 Gunner: Justin Long Recorder: William Ellis

BP: 30.1 inHg

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	IAmmo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	148.0	3546	859.5	3308	859.8	859.84	857.40	None	0	
2	1	41.0	148.0	3572	853.4	3334	853.1	853.14	851.00	None	0	
3	1	41.0	148.1	3555	857.4	3321	856.5	857.10	854.66	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017 Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-13 Test Date: 10/21/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 1)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0) OFC-14154-113

Size: 381 x 381 mm Avg. Thickness: 45.199 mm Thicknesses: 45.212 mm, 45.212

mm, 45.136 mm, 45.237 mm Weight: 14.490 kg

Plies/Laminates: N/A

Date Received: 10/14/2022

Received Via: FEDEX Ground

Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A Condition: Ambient Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620 Target to Witness (mm): 152.400 Range No.: Range 6 Temp: 18.7 °C BP: 30.1 inHg RH: 46.1 % Barrel/Gun: CT-4035 Gunner: Justin Long

Recorder: William Ellis

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq.	Footnotes
1	1	41.0	148.7	3585	850.1	3347	849.8	850.09	847.65	None	0	
2	1	41.0	148.7	3551	858.3	3316	858.0	858.01	855.88	None	0	
3	1	41.0	148.7	3551	858.3	3316	858.0	858.01	855.88	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017 Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-14 Test Date: 10/21/2022 Page 1 of 1

Test Panel Description: Transparent Armor (Group 1)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0) OFC-14154-114

Size: 381 x 381 mm Avg. Thickness: 45.326 mm Thicknesses: 45.441 mm, 45.415

mm, 45.110 mm, 45.339 mm Weight: 14.520 kg
Plies/Laminates: N/A

Date Received: 10/14/2022
Received Via: FEDEX Ground
Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A Condition: Ambient Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.7 °C

RH: 45.5 % Barrel/Gun: CT-4035 Gunner: Justin Long Recorder: William Ellis

BP: 30 inHg

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	IAmmo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	148.7	3564	855.3	3329	854.7	854.96	852.53	None	0	
2	1	41.0	148.7	3533	862.6	3303	861.4	861.97	859.54	None	0	
3	1	41.0	149.1	3568	854.4	3329	854.7	854.35	852.22	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-15 Test Date: 10/21/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 1)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0) OFC-14154-115

Size: 381 x 381 mm Avg. Thickness: 45.244 mm Thicknesses: 45.314 mm, 45.237 mm, 45.237 mm.

Plies/Laminates: N/A

Date Received: 10/14/2022 Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

45.187 mm

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A Condition: Ambient Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Weight: 14.510 kg

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620

Target to Witness (mm): 152.400

Range No.: Range 6 Temp: 18.8 °C BP: 30.1 inHg

RH: 47.2 % Barrel/Gun: CT-4035 Gunner: Justin Long Recorder: William Ellis

Ammunition

Projectile	Lot No.	Manufacturer	Powder		
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133		

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	IAmmo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	148.5	3546	859.5	3312	858.9	859.23	856.79	None	0	
2	1	41.0	148.5	3533	862.6	3299	862.3	862.58	860.15	None	0	
3	1	41.0	148.7	3546	859.5	3312	858.9	859.23	856.79	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: 0° yaw on all shots.

Footnotes:

NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017 Client: Optima Ballistic Glass Colombia S.A.S.

Project No.: OH000005457-16 Test Date: 10/21/2022 Page 1 of 1

Test Panel | **Description:** Transparent Armor (Group 1)

Manufacturer: Optima Ballistic Glass Colombia S.A.S Sample No.: (M80, V0) OFC-14154-116

Size: 381 x 381 mm

Avg. Thickness: 44.965 mm

Thicknesses: 44.958 mm, 44.958 mm, 45.009 mm, 44.933 mm

Plies/Laminates: N/A

Date Received: 10/14/2022 Received Via: FEDEX Ground Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm

triangle

Witness Panel: 0.02 in 2024-T3 Al

Backing Material: N/A Condition: Ambient Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100

Weight: 14.420 kg

Primary Vel. Location (m): 4.573 Range to Target (m): 7.620 Target to Witness (mm): 152.400 Range No.: Range 6 Temp: 18.9 °C BP: 30.1 inHg RH: 49.5 %

Barrel/Gun: CT-4035 Gunner: Justin Long Recorder: William Ellis

Ammunition

Projectile	Lot No.	Manufacturer	Powder	
(1) 7.62 x 51-mm, 150-grain M80 CJLC	NA	Military	N133	

Applicable Standards or Procedures

- (1) STANAG 4569 KE Level 1, AEP-55 Vol. 1 Ed. 2 (modified)
- (2) Customer Request

Shot No.	Ammo	Powder/ Seating	Weight (gr)	Time 1 (µs)	Vel. 1 (m/s)	Time 2 (µs)	Vel.2 (m/s)	Avg. Vel. (m/s)	Striking Vel. (m/s)	Penetration	Obliq. (°)	Footnotes
1	1	41.0	148.4	3555	857.4	3316	858.0	857.71	855.27	None	0	
2	1	41.0	148.4	3542	860.5	3303	861.4	860.76	858.62	None	0	
3	1	41.0	148.5	3581	851.3	3338	852.2	851.61	849.48	None	0	

Remarks:

Required Velocity: 838-868.7 m/s

Projectile yaw check: $0\,^\circ$ yaw on all shots.

Footnotes:



ATTACHMENT A CALIBRATION CHECKLIST

NCR = No Calibration Required. Range 6

EQUIPMENT INVENTORY							
Work Center #	Serial Number	Make	Model	Description	Assigned To	Calibration Date	Calibration Due Date
WC067373	202	YIS/Cowd en Group, Inc	Chrono USB	Chronograph 1	Range 6	8/4/2022	8/4/2023
WC067372	203	YIS/Cowd en Group, Inc	Chrono USB	Chronograph 2	Range 6	8/4/2022	8/4/2023
WC067323	A18117177	RCBS	1500	Powder Scale	Range 6	11/22/2021	11/22/2022
WC060228	AE201509171 07	Sartorius	Combics	Floor scale	Range 6	12/6/2021	12/6/2022
NA	NA	Control Company	4040	Therm./Clock/Humid ity Monitor	Range 6	NA	NA
WC067365	WC067365	Starrett	530-100	100 ft Tape Measure	Range 6	6/23/2022	6/23/2024
WC078631	WC078631			25 ft Tape Measure	Range 6	9/1/2021	9/1/2023
WC078620	WC078620	Dewalt Industrial Tool	DWHT361 07	25 ft Tape Measure	Range 6	6/25/2021	6/25/2023
WC075094	200741201	Control Company	4378	Thermometer	Range 6	11/20/2020	11/20/2022
WC075095	200741175	Control Company	4371	Thermometer	Range 6	11/20/2020	11/20/2022
WC079392	18/060036	Starrett	3753A- 6/150	BFD Tool	Range 6	7/13/2022	7/13/2023
WC079404	21/320015	Starrett	3753A- 6/150	BFD Bridge	Range 6	7/29/2022	7/29/2023
WC075110	M21050300	Omega Engineerin g	ZW-CM- BTH	Temp/ Humidity/BP Sensor	Range 6	3/18/2021	3/18/2023
WC064273	844	SPI	91-317-8	Angle Block	Range 6	1/8/2022	1/8/2024



END OF REPORT