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

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

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 ±1°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 mm ±13 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 No.	Sample No.	Size (mm)	Weight (kg)	Threat	Target Obliq. (deg)	Shot No.	Penetration Data	
							Velocity (m/s)	Result
OH000005457-1	(M80, V0, Cold) OFC-14161-101	381 x 381	14.530	7.62 x 51-mm, 150-grain M80 CJLC	0	1	854.35	None
						2	864.11	None
						3	847.34	None
OH000005457-2	(M80, V0, Cold) OFC-14161-102	381 x 381	14.440	7.62 x 51-mm, 150-grain M80 CJLC	0	1	854.66	None
						2	848.26	None
						3	854.66	None
OH000005457-3	(M80, V0, Cold) OFC-14161-103	381 x 381	14.500	7.62 x 51-mm, 150-grain M80 CJLC	0	1	854.66	None
						2	851.31	None
						3	847.65	None
OH000005457-4	(M80, V0, Cold) OFC-14161-104	381 x 381	14.540	7.62 x 51-mm, 150-grain M80 CJLC	0	1	855.88	None
						2	855.27	None
						3	854.35	None
OH000005457-5	(M80, V0, Hot) OFC-14161-105	381 x 381	14.460	7.62 x 51-mm, 150-grain M80 CJLC	0	1	856.79	None
						2	848.87	None
						3	856.18	None
OH000005457-6	(M80, V0, Hot) OFC-14161-106	381 x 381	14.430	7.62 x 51-mm, 150-grain M80 CJLC	0	1	853.74	None
						2	860.15	None
						3	876.30	None
OH000005457-7	(M80, V0, Hot) OFC-14161-107	381 x 381	14.490	7.62 x 51-mm, 150-grain M80 CJLC	0	1	858.93	None
						2	854.05	None
						3	854.66	None
OH000005457-8	(M80, V0, Hot) OFC-14161-108	381 x 381	14.420	7.62 x 51-mm, 150-grain M80 CJLC	0	1	855.27	None
						2	845.82	None
						3	848.26	None

Table 1. Summary of Ballistic Resistance Results (continued)

Project No.	Sample No.	Size (mm)	Weight (kg)	Threat	Target Obliq. (deg)	Shot No.	Penetration Data	
							Velocity (m/s)	Result
OH000005457-9	(M80, V0) OFC-14154-109	381 x 381	14.520	7.62 x 51-mm, 150-grain M80 CJLC	0	1	856.79	None
						2	856.18	None
						3	853.74	None
OH000005457-10	(M80, V0) OFC-14154-110	381 x 381	14.480	7.62 x 51-mm, 150-grain M80 CJLC	0	1	854.35	None
						2	855.27	None
						3	861.06	None
OH000005457-11	(M80, V0) OFC-14154-111	381 x 381	14.420	7.62 x 51-mm, 150-grain M80 CJLC	0	1	849.78	None
						2	860.15	None
						3	857.40	None
OH000005457-12	(M80, V0) OFC-14154-112	381 x 381	14.490	7.62 x 51-mm, 150-grain M80 CJLC	0	1	857.40	None
						2	851.00	None
						3	854.66	None
OH000005457-13	(M80, V0) OFC-14154-113	381 x 381	14.490	7.62 x 51-mm, 150-grain M80 CJLC	0	1	847.65	None
						2	855.88	None
						3	855.88	None
OH000005457-14	(M80, V0) OFC-14154-114	381 x 381	14.520	7.62 x 51-mm, 150-grain M80 CJLC	0	1	852.53	None
						2	859.54	None
						3	852.22	None
OH000005457-15	(M80, V0) OFC-14154-115	381 x 381	14.510	7.62 x 51-mm, 150-grain M80 CJLC	0	1	856.79	None
						2	860.15	None
						3	856.79	None
OH000005457-16	(M80, V0) OFC-14154-116	381 x 381	14.420	7.62 x 51-mm, 150-grain M80 CJLC	0	1	855.27	None
						2	858.62	None
						3	849.48	None

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.530 kg	Date Received: 10/14/2022
Avg. Thickness: 45.288 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.491 mm, 45.161 mm, 45.491 mm, 45.009 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.8 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: -10 F for 12 hours	Target to Witness (mm): 152.400	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.	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:
N/A

BALLISTIC RESISTANCE TEST

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
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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	Weight: 14.440 kg	Date Received: 10/14/2022
Avg. Thickness: 45.047 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 44.882 mm, 44.983 mm, 45.161 mm, 45.161 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.7 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: -10 F for 12 hours	Target to Witness (mm): 152.400	RH: 51.9 %
		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	147.8	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.500 kg	Date Received: 10/14/2022
Avg. Thickness: 45.231 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.466 mm, 45.517 mm, 44.958 mm, 44.983 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.7 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: -10 F for 12 hours	Target to Witness (mm): 152.400	RH: 48.5 %
		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	147.9	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.540 kg	Date Received: 10/14/2022
Avg. Thickness: 45.314 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.542 mm, 45.212 mm, 45.466 mm, 45.034 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.6 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: -10 F for 12 hours	Target to Witness (mm): 152.400	RH: 46.9 %
		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	147.7	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.460 kg	Date Received: 10/14/2022
Avg. Thickness: 45.180 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.212 mm, 45.314 mm, 45.110 mm, 45.085 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.7 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: 130 F for a minimum of 12 hours	Target to Witness (mm): 152.400	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.	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.430 kg	Date Received: 10/14/2022
Avg. Thickness: 45.041 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 44.907 mm, 44.831 mm, 45.212 mm, 45.212 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.8 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: 130 F for a minimum of 12 hours	Target to Witness (mm): 152.400	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:
N/A

BALLISTIC RESISTANCE TEST

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
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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	Weight: 14.490 kg	Date Received: 10/14/2022
Avg. Thickness: 45.187 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.161 mm, 45.060 mm, 45.288 mm, 45.237 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.7 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: 130 F for a minimum of 12 hours	Target to Witness (mm): 152.400	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.420 kg	Date Received: 10/14/2022
Avg. Thickness: 45.015 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 44.958 mm, 44.933 mm, 45.034 mm, 45.136 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.7 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: 130 F for a minimum of 12 hours	Target to Witness (mm): 152.400	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

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	147.3	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.520 kg	Date Received: 10/14/2022
Avg. Thickness: 45.244 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.288 mm, 45.288 mm, 45.187 mm, 45.212 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.8 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: Ambient	Target to Witness (mm): 152.400	RH: 46.8 %
		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	148.2	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.480 kg	Date Received: 10/14/2022
Avg. Thickness: 45.212 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.237 mm, 45.212 mm, 45.187 mm, 45.212 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.7 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: Ambient	Target to Witness (mm): 152.400	RH: 45.9 %
		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	148.3	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.420 kg	Date Received: 10/14/2022
Avg. Thickness: 44.990 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 44.882 mm, 44.831 mm, 45.136 mm, 45.110 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.8 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: Ambient	Target to Witness (mm): 152.400	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

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	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.490 kg	Date Received: 10/14/2022
Avg. Thickness: 45.174 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.237 mm, 45.136 mm, 45.161 mm, 45.161 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.9 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: Ambient	Target to Witness (mm): 152.400	RH: 50.9 %
		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	148.0	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.490 kg	Date Received: 10/14/2022
Avg. Thickness: 45.199 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.212 mm, 45.212 mm, 45.136 mm, 45.237 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.7 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: Ambient	Target to Witness (mm): 152.400	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.520 kg	Date Received: 10/14/2022
Avg. Thickness: 45.326 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.441 mm, 45.415 mm, 45.110 mm, 45.339 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.7 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30 inHg
Condition: Ambient	Target to Witness (mm): 152.400	RH: 45.5 %
		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	148.7	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:
N/A

BALLISTIC RESISTANCE TEST

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
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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	Weight: 14.510 kg	Date Received: 10/14/2022
Avg. Thickness: 45.244 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 45.314 mm, 45.237 mm, 45.237 mm, 45.187 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.8 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: Ambient	Target to Witness (mm): 152.400	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.	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	148.5	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:
N/A

BALLISTIC RESISTANCE TEST

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

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	Weight: 14.420 kg	Date Received: 10/14/2022
Avg. Thickness: 44.965 mm	Plies/Laminates: N/A	Received Via: FEDEX Ground
Thicknesses: 44.958 mm, 44.958 mm, 45.009 mm, 44.933 mm		Returned Via: FEDEX Ground

Setup

Shot Spacing: 3 shots on a 120 mm triangle	Primary Vel. Screens (m): 3.050, 3.150, 5.990, 6.100	Range No.: Range 6
Witness Panel: 0.02 in 2024-T3 Al	Primary Vel. Location (m): 4.573	Temp: 18.9 °C
Backing Material: N/A	Range to Target (m): 7.620	BP: 30.1 inHg
Condition: Ambient	Target to Witness (mm): 152.400	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° yaw on all shots.

Footnotes:
N/A

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/Cowden Group, Inc	Chrono USB	Chronograph 1	Range 6	8/4/2022	8/4/2023
WC067372	203	YIS/Cowden 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	AE20150917107	Sartorius	Combics	Floor scale	Range 6	12/6/2021	12/6/2022
NA	NA	Control Company	4040	Therm./Clock/Humidity 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	DWHT36107	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 Engineering	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