

POC: Mr. Julio Rodriguez P.O. No.: Prepaid Test Date: 25 November 2020 Job No.: 3350-016

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

Prepared by:

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NTS-Chesapeake Testing

4603B Compass Point Road Belcamp, MD 21017

9 December 2020

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

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OPTIMA BALLISTIC GLASS COLOMBIA S.A. PROPRIETARY INFORMATION



1 Introduction

Optima Ballistic Glass Colombia S.A., provided three armor samples to NTS-Chesapeake Testing for ballistic resistance testing on 25 November 2020.

2 Threats and Instrumentation

2.1 Threats

• .44-mag., 240-grain full metal core-round nose (FMC-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. Calibration data is provided in Attachment A.

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 BR4 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 (69.4 °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 ± 13 mm (19.666 in ± 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.



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Job	Sample				Target	Shot	Penetra	enetration Data	
No.	No.	Size (in)	Weight (lbs)	Threat	Obliq. (deg)	No.	Velocity (ft/s)	Result	
3350-016-1	SN 760044	19.75 x 19.75	25.57			1	1446	None	
				.44-mag., 240-grain FMC-FN	0.0	2	1443	None	
						3	1447	None	
3350-016-2	SN 760046	19.75 x 19.75	25.55	.44-mag., 240-grain FMC-FN		1	1440	None	
					0.0	2	1445	None	
						3	1448	None	
3350-016-3		19.75 x 19.75	25.54	.44-mag., 240-grain FMC-FN		1	1432	None	
	SN 760047				0.0	2	1457	None	
						3	1449	None	

Table 1. Summary of Ballistic Resistance Testing

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BALLISTIC RESISTANCE TEST												
NTS-Chesapeake Testing 4603B Compass Point Road Belcamp, MD 21017								Client: Optima Ballistic Glass Columbia S.A. Job No.: 3350-016-1 Test Date: 11/25/2020				
Tes	t Pane	el	Descriptio	on: Transp	oarent Arn	nor. OFC-87	75-195 ICOI	NTEC-7600	44			
Manufacturer: Optima Ballistic Glass Columbia S.A. Sample No.: SN 760044												
Size: 19.75 x 19.75 in Avg. Thick: 0.876 in Thickness: 0.876 in; 0.876 in; 0.877 in; 0.877 in							Weight: 25.57 lbs Plies/Laminates: NA Keturned: DHL					11/20/2020 DHL DHL
Set	up											
Shot Spacing:EN 1063 BR4Primary VWitness Panel:.001 in Aluminum foil with splinter boxPrimary VeBacking Material:NARange Target						Primary Vel. Timary Vel. Range t Target to	Screens (ft): 6.500, 6.833, 11.166, 11.500 Range No.: 6 Location (ft): 9.000 BP: 33.0 inHg o Target (ft): 16.400 RH: 34.0% Witness (in): 19.666 Beren/Gun: NA Gunner: Brennan I Recorder: Craig The					6 69.4 °F 33.0 inHg 34.0% NA Brennan Heuer Craig Thomas
Am	munit	ion								1		
		Projec	ctile			Lot	No.			I	Powder	
(1) .	44-mag.	, 240-grai	n FMC-FN			Magtech 5	4908-18631			Асси	urate No	o. 5
Арр	olicabl	e Stan	dards o	r Proce	dures							
(1) E (2) (EN 1063 I Customer	3R4 [.] Request										
Shot No.	Ammo	Weight (gr)	Time 1 (µs)	Vel. 1 (ft/s)	Time 2 (µs)	Vel. 2 (ft/s)	Avg. Vel. (ft/s)	Penetrati	on Obliq. Footnote		Footnotes	
1 2 3	1 1 1	240.0 239.8 239.8	3453 3463 3451	1448 1444 1449	2999 3006 2997	1445 1441 1446	1446 1443 1447	None None None	0 0 0	.0 .0 .0		
<u>Rema</u> Requ	Required Velocity: 1410-1476 ft/s.											
Footnotes:												

BALLISTIC RESISTANCE TEST												
NTS-Chesapeake Testing 4603B Compass Point Road Belcamp, MD 21017								Client: Optima Ballistic Glass Columbia S.A. Job No.: 3350-016-2 Test Date: 11/25/2020				
Test Panel		Descriptio	on: Transp	oarent Arr	mor. OFC-87	75-197 ICOI	NTEC-7600	46				
Manufacturer: Optima Ballistic Glass Columbia S.A. Sample No.: SN 760046												
Avg. ⁻ Thicl	Size: Thick: kness:	19.75 x 19 0.874 in 0.873 in; (0.873 in; (9.75 in 0.874 in; 0.874 in		V Plies/Lam	Weight: 25.55 lbs Plies/Laminates: NA Date Received: 11/20 Via: DHL Returned: DHL					11/20/2020 DHL DHL	
Setup												
Shot Spac Witness Pa Backing Mate Condit	Primary Vel. rimary Vel. Range t Target to	Screens (ft) Location (ft) o Target (ft) Witness (in)): 6.500, 11.166,): 9.000): 16.400): 19.666	6.833, 11.500	Range T Barrel/ Gui Reco	e No.: emp: BP: RH: 'Gun: nner: rder:	6 69.4 °F 33.0 inHg 35.0% NA Brennan Heuer Craig Thomas					
Ammunitio	n								1			
	Projec	tile			Lot	No.			Ро	wder		
(1) .44-mag., 24	40-grai	n FMC-FN			Magtech 5	4908-18631			Accurate No. 5			
Applicable	Stan	dards o	r Proce	dures								
(1) EN 1063 BR4 (2) Customer Re	4 equest											
Shot No. Ammo W	Veight (gr)	Time 1 (µs)	Vel. 1 (ft/s)	Time 2 (µs)	Vel. 2 (ft/s)	Avg. Vel. (ft/s)	Penetrati	ion Obliq. Footnote		ootnotes		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	240.1 239.8 239.6	3468 3456 3448	1442 1447 1450	3014 3002 2997	1438 1443 1446	1440 1445 1448	None None None	0 0 0).0).0).0			
Required Velocity: 1410-1476 ft/s.												
Footnotes:												

BALLISTIC RESISTANCE TEST												
NTS-Chesapeake Testing 4603B Compass Point Road Belcamp, MD 21017								Client: Optima Ballistic Glass Columbia S.A. Job No.: 3350-016-3 Test Date: 11/25/2020				
Test Panel		Descriptio	on: Transp									
Manufacturer: Optima Ballistic Glass Columbia S.A. Sample No.: SN 760047												
Si Avg. Thi Thickne	19.75 x 19 0.874 in 0.874 in; (0.872 in; (V Plies/Lam	Weight: 25.54 lbs /Laminates: NA Date Received: 11/20/20 Via: DHL Returned: DHL					11/20/2020 DHL DHL				
Setup												
Shot Spacing:EN 1063 BR4Primary VelWitness Panel:.001 in Aluminum foil with splinter boxPrimary VelBacking Material:NARange Target to						Screens (ft) Location (ft) o Target (ft) Witness (in)): 6.500, 6 11.166,): 9.000): 16.400): 19.666	6.833, 11.500	Ranç Barre G Rec	ge No.: Temp: BP: RH: el/Gun: Gunner: corder:	6 69.4 °F 33.0 inHg 34.0% NA Brennan Heuer Craig Thomas	
Ammunition												
Pr	oject	tile			Lot	No.			F	Powder		
(1) .44-mag., 240-	grain	FMC-FN			Magtech 54	4908-18631			Αссι	urate No	o. 5	
Applicable St	tand	dards o	r Proce	dures								
(1) EN 1063 BR4 (2) Customer Requ	Jest											
Shot No. Ammo Weig (gr	ght ^r)	Time 1 (µs)	Vel. 1 (ft/s)	Time 2 (µs)	Vel. 2 (ft/s)	Avg. Vel. (ft/s)	Penetrati	on Ob	Dbliq. Footnotes (°)		ootnotes	
1 1 238 2 1 239 3 1 240	9.6 9.5 9.1	3490 3429 3448	1433 1458 1450	3028 2977 2994	1431 1455 1447	1432 1457 1449	None None None	0 0 0	.0 .0 .0			
Required Velocity: 1410-1476 ft/s.												
Footnotes:												



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ATTACHMENT A CALIBRATION DATA

3350-016											
Optima Date: 11/25/2020											
6	35										
					Range						
					Lead						
oment	Serial Number	NTS I.D. #	Cal. Date	Due Date	Initials						
graph 1	111	WC067021	9/9/2020	9/9/2021	CAT						
graph 2	100	WC060268	9/9/2020	9/9/2021	CAT						
er Scale	A08317204	WC060606	12/10/2019	12/10/2020	CAT						
Scale	AE20150917107	WC060228	12/19/2019	12/19/2020	CAT						
e Measure	-	-	-	-	CAT						
e Measure	1486	WC060466	7/13/2020	7/13/2021	CAT						
ometer	200175474	WC074975	3/9/2020	3/9/2022	CAT						
Bridge	19/190064	WC074145	11/10/2020	11/10/2021	CAT						
Block	00000841	WC060415	1/6/2020	1/6/2021	CAT						
e Measure	NA	WC074990	4/17/2020	4/17/2021	CAT						
			1								
	3350-016 Optima 6 oment graph 1 graph 2 er Scale Scale oe Measure e Measure ometer Block e Measure	3350-016Optima6Serial Numbergraph 1111graph 2100er ScaleA08317204ScaleAE20150917107ometer-e Measure-e Measure1486ometer200175474Block00000841e MeasureNA	3350-016OptimaC6Range LomentSerial NumberNTS I.D. #graph 1111WC067021graph 2100WC060268er ScaleA08317204WC0600606ScaleAE20150917107WC060228ne Measuree Measure1486WC060466ometer200175474WC074975Block00000841WC074145e MeasureNAWC074990	3350-016 Optima Date: 11/25/2020 6 Range Lead: Craig Thoma oment Serial Number NTS I.D. # Cal. Date graph 1 111 WC067021 9/9/2020 graph 2 100 WC060268 9/9/2020 graph 2 A08317204 WC0600606 12/10/2019 Scale AE20150917107 WC060228 12/19/2019 ve Measure - - - e Measure 1486 WC060466 7/13/2020 ometer 200175474 WC074975 3/9/2020 Block 00000841 WC060415 1/6/2020 e Measure NA WC074990 4/17/2020	3350-016 Date: 11/25/2020 6 Cail Date Craig Thomas Ament Serial Number NTS I.D. # Cal. Date Due Date graph 1 111 WC067021 9/9/2020 9/9/2021 graph 2 100 WC060268 9/9/2020 9/9/2021 er Scale A08317204 WC0600606 12/10/2019 12/10/2020 Scale AE20150917107 WC060228 12/19/2019 12/19/2020 e Measure - - - - e Measure 1486 WC060466 7/13/2020 3/9/2022 3ridge 19/190064 WC074145 11/10/2020 11/10/2021 Block 00000841 WC060415 1/6/2020 1/6/2021 e Measure NA WC074990 4/17/2020 4/17/2021						



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