

NTS Technical Systems Test Report for Ballistic Resistance Testing

Project No.: PH00008382 **Tested:** 14 September 2023 **P.O. No.:** Signed Quote OH13248

Prepared For

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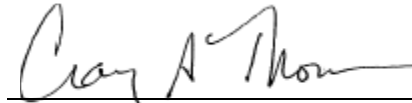
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Further dissemination only as directed by Optima Ballistic Glass Colombia S.A.S., 5 October 2023.

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Revision History

Rev.	Description	Issue Date
0	Initial Release	5 October 2023

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1 Introduction

Optima Ballistic Glass Colombia S.A.S. provided two armor samples to NTS-Belcamp for ballistic testing on 14 September 2023.

2 Threats and Instrumentation

2.1 Threats*

- 7.62 x 39-mm, 123-grain PS Ball projectiles

*The projectiles were fired from a universal receiver which was fitted with the appropriate barrel and mounted on an NTS-Belcamp 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 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 VPAM Level 06 and the customer's request. Shot spacing between multiple impacts on each sample was 3 shots on a 120 mm triangle. Shots against the armor samples were performed at 0.0° obliquity and ambient range temperature (68 ± 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 data sheets for all testing performed are provided on the following pages.

Table 1. Summary of Ballistic Resistance Test

Project No.	Sample No.	Size (in)	Weight (lbs)	Threat	Target Obliq. (deg)	Shot No.	Penetration Data	
							Velocity (ft/s)	Result
PH00008382-1	OFC-17022-105	19.75 x 19.75	39.160	7.62 x 39-mm, 123-grain PS Ball	0.0	1	2369	None
						2	2362	None
						3	2365	None
PH00008382-2	OFC-17024-105	19.75 x 19.75	39.640	7.62 x 39-mm, 123-grain PS Ball	0.0	1	2342	None
						2	2365	None
						3	2372	None

BALLISTIC RESISTANCE TEST

NTS-Belcamp
 4603B Compass Point Road
 Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.S.
 Project No.: PH00008382-1
 Test Date: 09/14/2023
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Test Panel Description: Transparent armor.

Manufacturer: Optima Ballistic Glass Colombia S.A. **Sample No.:** (PS Ball, V0) OFC-17022-105

Size: 19.75 x 19.75 in
 Avg. Thickness: 1.262 in
 Thicknesses: 1.266 in, 1.263 in,
 1.259 in, 1.259 in

Weight: 39.160 lbs
 Plies/Laminates: N/A

Date Received: 09/11/2023
 Received Via: FEDEX, Express
 Saver
 Returned Via: FEDEX, Express
 Saver

Setup

Shot Spacing: 3 shots on 120 mm
 triangle
 Witness Panel: .001 in Aluminum
 foil with splinter
 box
 Backing Material: N/A
 Condition: Ambient

Primary Vel. Screens (ft): 20.000, 20.333,
 29.666, 30.000
 Primary Vel. Location (ft): 25.000
 Range to Target (ft): 32.800
 Target to Witness (in): 19.680

Range No.: Range 6
 Temp: 68.2 °F
 BP: 30 inHg
 RH: 49 %
 Barrel/Gun: WC067279
 Gunner: Cody Schilling
 Recorder: William Ellis

Ammunition

Projectile	Lot No.	Manufacturer	Powder
(1) 7.62 x 39-mm, 123-grain PS Ball	R52-86-711	Russian	N 110

Applicable Standards or Procedures

- (1) VPAM Level 06
- (2) Customer Request

Shot No.	Ammo	Powder/ Seating	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	19.8	121.9	4210	2375	3924	2378	2377	2369	None	0.0	
2	1	19.8	122.0	4223	2368	3937	2371	2369	2362	None	0.0	
3	1	19.8	122.1	4219	2370	3932	2374	2372	2365	None	0.0	

Remarks:
 Required Velocity: 2330-2394 ft/s.
 Projectile Yaw Check: 0° Yaw on all Impacts.

Footnotes:
 N/A

BALLISTIC RESISTANCE TEST

NTS-Belcamp
 4603B Compass Point Road
 Belcamp, MD 21017

Client: Optima Ballistic Glass Colombia S.A.S.
 Project No.: PH00008382-2
 Test Date: 09/14/2023
 Page 1 of 1

Test Panel Description: Transparent armor

Manufacturer: Optima Ballistic Glass Colombia S.A. **Sample No.:** (PS Ball, V0) OFC-17024-105

Size: 19.75 x 19.75 in
 Avg. Thickness: 1.287 in
 Thicknesses: 1.290 in, 1.284 in,
 1.287 in, 1.285 in

Weight: 39.640 lbs
 Plies/Laminates: N/A

Date Received: 09/11/2023
 Received Via: FEDEX, Express
 Saver
 Returned Via: FEDEX, Express
 Saver

Setup

Shot Spacing: 3 shots on 120 mm
 triangle
 Witness Panel: .001 in Aluminum
 foil with splinter
 box
 Backing Material: N/A
 Condition: Ambient

Primary Vel. Screens (ft): 20.000, 20.333,
 29.666, 30.000
 Primary Vel. Location (ft): 25.000
 Range to Target (ft): 32.800
 Target to Witness (in): 19.680

Range No.: Range 6
 Temp: 67.5 °F
 BP: 30 inHg
 RH: 51 %
 Barrel/Gun: WC067279
 Gunner: Cody Schilling
 Recorder: William Ellis

Ammunition

Projectile	Lot No.	Manufacturer	Powder
(1) 7.62 x 39-mm, 123-grain PS Ball	R52-86-711	Russian	N 110

Applicable Standards or Procedures

- (1) VPAM Level 06
- (2) Customer Request

Shot No.	Ammo	Powder/ Seating	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	19.8	122.3	4258	2349	3972	2350	2349	2342	None	0.0	
2	1	19.8	122.3	4219	2370	3932	2374	2372	2365	None	0.0	
3	1	19.8	122.3	4206	2378	3919	2381	2380	2372	None	0.0	

Remarks:
 Required Velocity: 2330-2394 ft/s.
 Projectile Yaw Check: 0° Yaw on all Impacts.

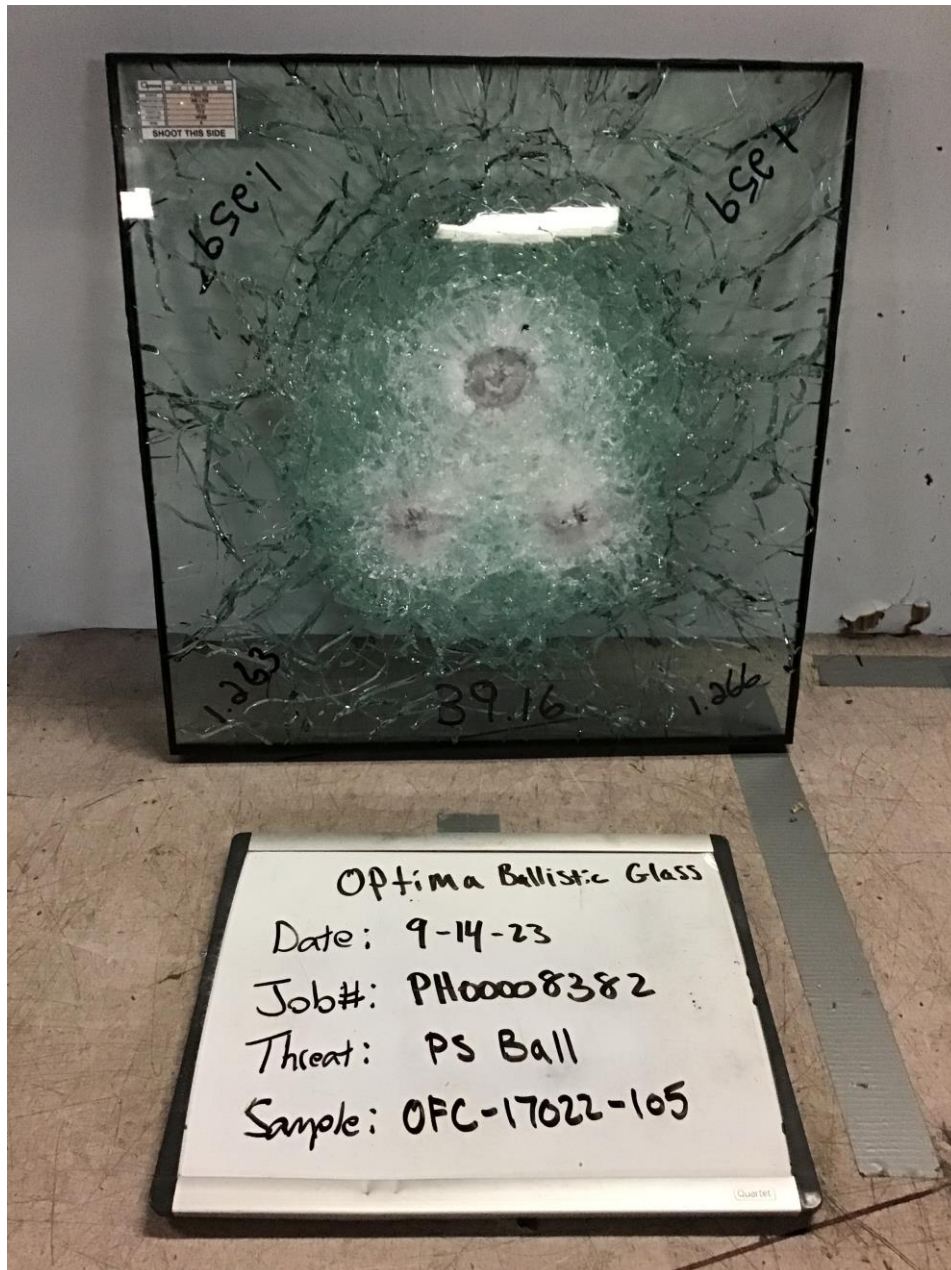
Footnotes:
 N/A

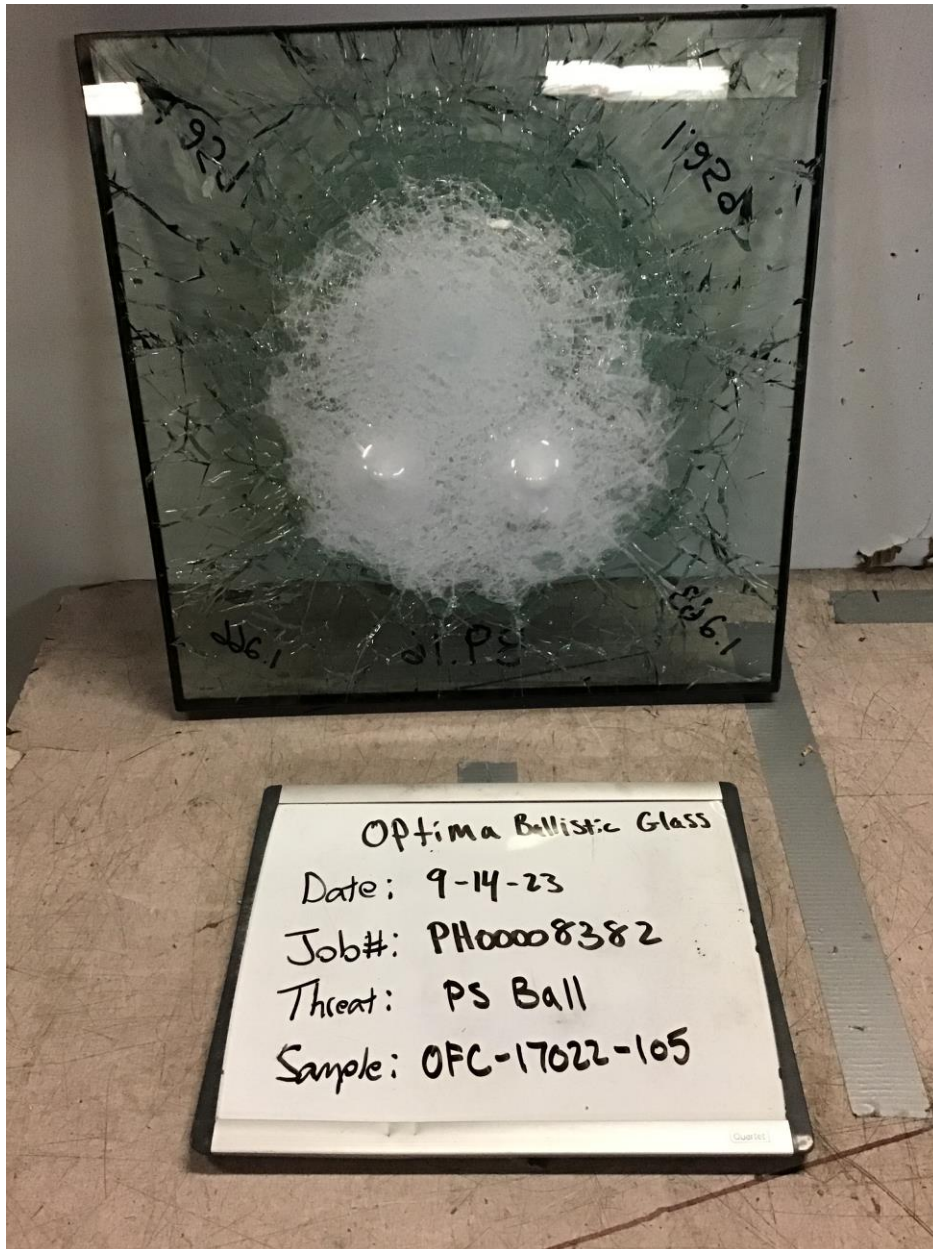
ATTACHMENT A CALIBRATION DATA

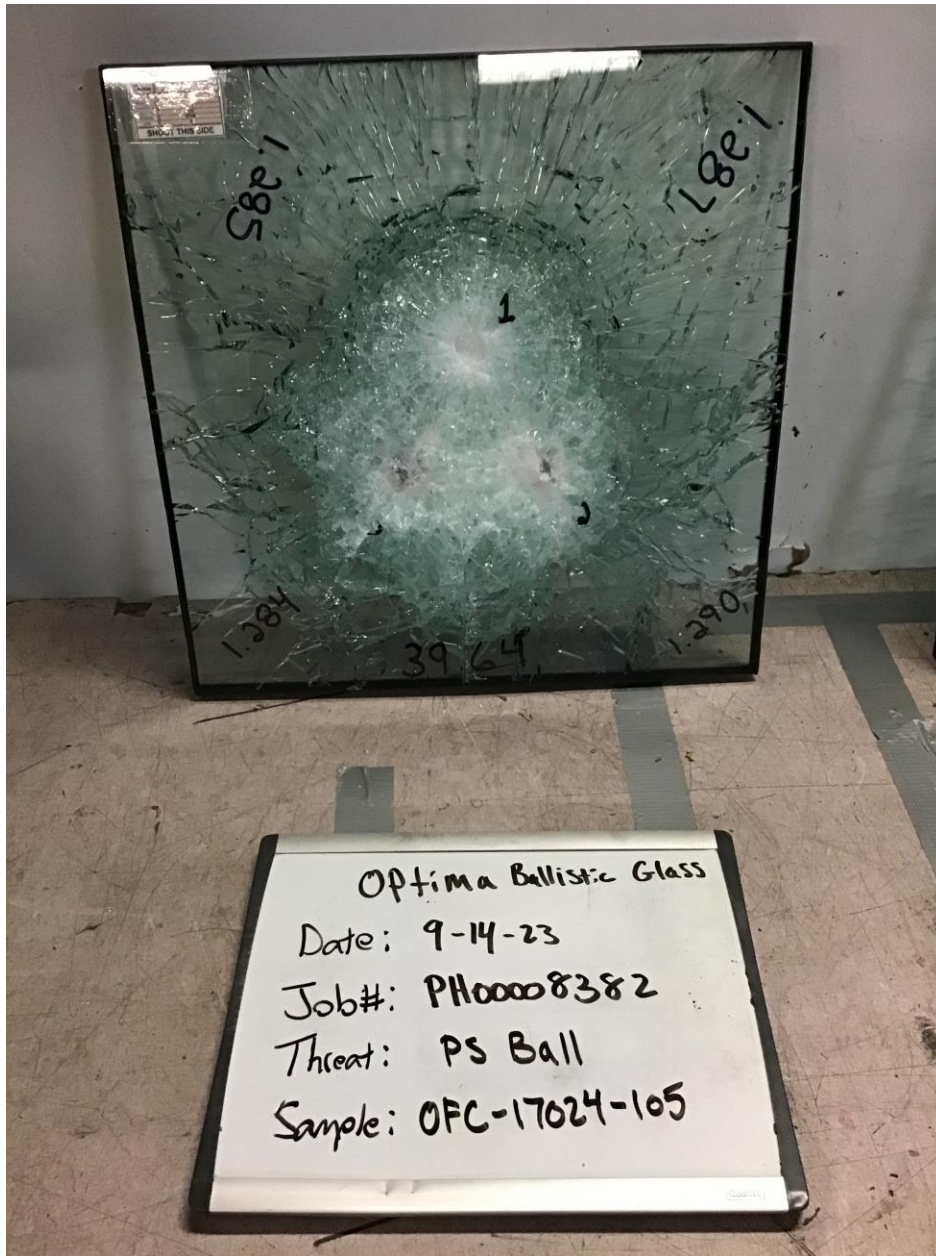
NCR = No Calibration Required.

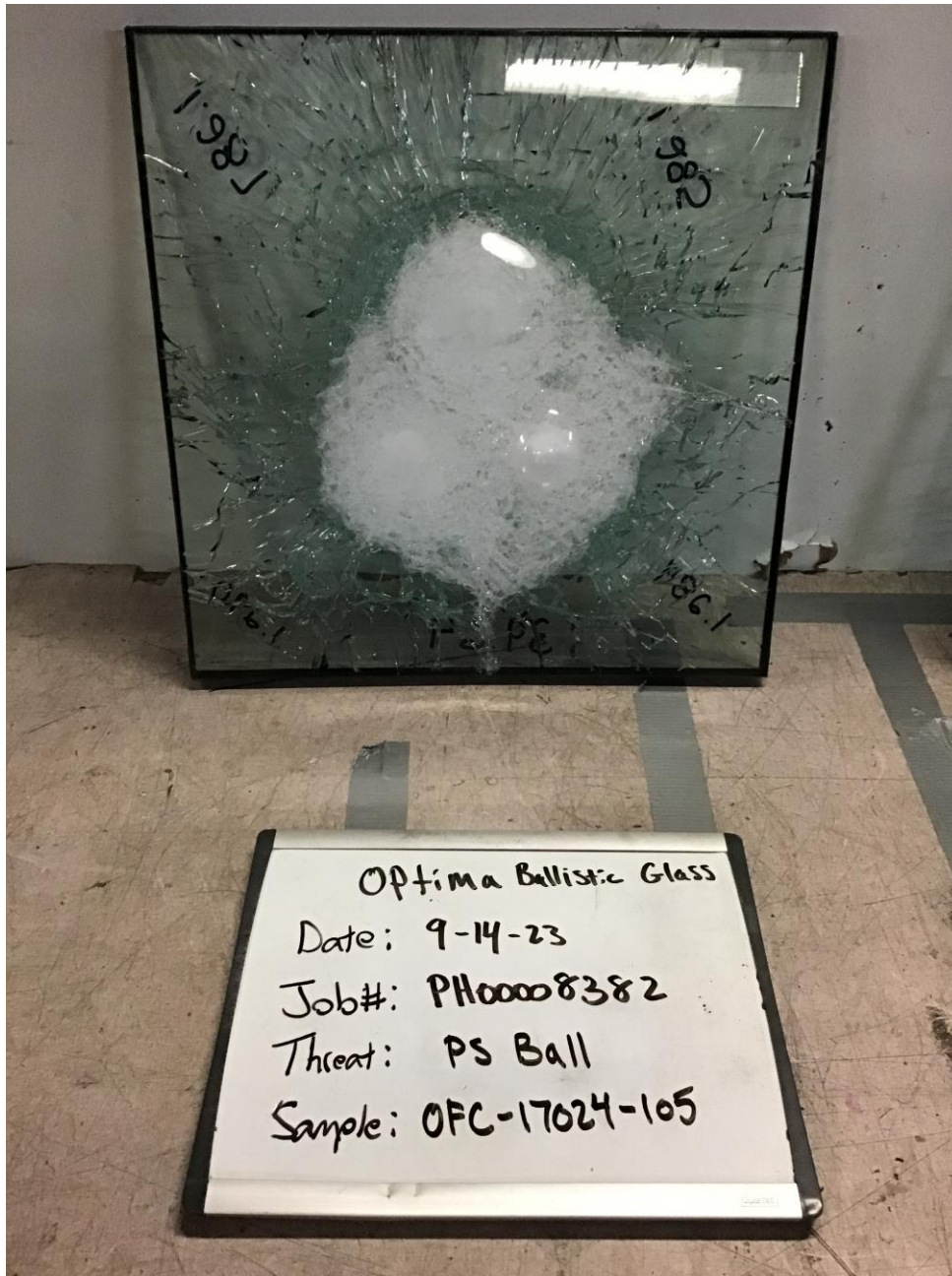
Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC024531	Barrel (gun)	Bill Wiseman & Company	NA	NCR	NCR
WC060805	Range (shooting)	NA	NA	NCR	NCR
WC064273	Measurement Tools (Angle Gauge)	SPI	91-316-0	01/08/2022	01/08/2024
WC067365	Measurement Tools (Tape Measure)	Starrett	530-100	06/23/2022	06/23/2024
WC079392	Gauge (Depth)	Starrett	3753A-6/150	09/07/2023	09/07/2024
WC079404	Gauge (Depth)	Starrett	3753A-6/150	NCR	NCR
WC079408	Chronograph 1	YIS/Cowden Group, Inc	Chrono USB	9/15/2023	9/15/2024
WC079407	Chronograph 2	YIS/Cowden Group, Inc	Chrono USB	9/15/2023	9/15/2024
WC079246	Powder Scale	RCBS	1500	11/29/2022	11/29/2023
WC060228	Floor scale	Sartorius	Combics	1/9/2023	1/9/2024
WC067382	Therm./Clock/Humidity Monitor	Control Company	4040	10/28/2022	10/28/2023
WC078619	25 ft Tape Measure	Craftsman	CMHT37525	7/27/2023	7/27/2025
EL00004011	25 ft Tape Measure	Craftsman	CMHT37565	5/11/2023	5/11/2025
EL00000204	Thermometer	Control Company	4378	6/1/2023	6/1/2025
WC075101	BFD Bridge	Starrett	3753A-6/150	10/27/2022	10/27/2023

**ATTACHMENT B
PHOTOGRAPHS**









END OF REPORT