REPORT NUMBER: NCAP-MGA-23-009

NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test

KIA CORPORATION
2023 Kia Niro EX Touring 5-Door SUV
NHTSA No.: M20234211

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: March 1, 2023

Final Report Date: December 27, 2023

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
1200 New Jersey Ave, SE
Washington, DC 20590

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Approval Date: December 27, 2023

FINAL REPORT ACCEPTANCE BY OCWS:

_____
Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

_____
COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

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4. Title and Subtitle	5. Report Date
Final Report of New Car Assessment Program Frontal Impact Testing and FMVSS No. 305 Indicant Testing of a 2023 Kia Niro EX Touring 5-Door SUV, NHTSA No.: M20234211	December 27, 2023
	6. Performing Organization Code MGA
7. Author(s) Ben Fischer, Program Manager	**8. Performing Organization Report No.** NCAP-MGA-23-009
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105	**10. Work Unit No.**
	11. Contract or Grant No. 693JJ919D000006
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE Washington, D.C. 20590	**13. Type of Report and Period Covered** Final Test Report March 1, 2023 to December 27, 2023
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15. Supplementary Notes

16. Abstract

A 56.3 km/h NCAP Frontal Rigid Barrier Impact Test was conducted on a 2023 Kia Niro EX Touring 5-Door SUV in accordance with the specifications of the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on March 1, 2023.

The impact velocity of the vehicle was 56.24 km/h and the ambient temperature at the barrier face at the time of impact was 22.0°C. The target vehicle post-test maximum crush was 623 mm located to the left of the vehicle centerline. The test vehicle's performance was as follows:

Measurement Description	Units	Driver ATD		Passenger ATD	
		Threshold	Result	Threshold	Result
Head Injury Criteria (HIC_{15})		700	240.640	700	362.194
Maximum Chest Compression	mm	63	28.898	52	12.179
Nij		1	0.290	1	0.291
Neck Tension	N	4170	894.890	2620	477.931
Neck Compression	N	4000	254.160	2520	535.559
Left Femur Force	N	10008	473.376	6805	2673.722
Right Femur Force	N	10008	682.876	6805	573.735

17. Key Words	18. Distribution Statement
56.3 km/h (35 mph) Full Frontal Rigid Barrier Impact Test New Car Assessment Program (NCAP)	Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division 1200 New Jersey Ave, SE Washington, DC 20590

19. Security Classification of Report	20. Security Classification of Page	21. No. of Pages	22. Price
Unclassified	Unclassified	209	

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SECTION 1
PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number 693JJ919D000006. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact was conducted in accordance with the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing.

SUMMARY

A load cell barrier consisting of 176 load cells was impacted by a 2023 Kia Niro EX Touring 5-Door SUV at a velocity of 56.24 km/h. The test was performed at MGA Research Corporation on March 1, 2023. Pre-test and post-test photographs of the vehicle and dummies can be found in Appendix A.

Two (2) real-time cameras and sixteen (16) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

One Part 572E 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5th percentile female test device (ATD) was placed in the right-front passenger seating position according to dummy placement instructions specified in the Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, right/left femur load cells, and lower leg instrumentation. Seat belt load cells were installed on the driver's lap and shoulder belts and passenger's shoulder belt to measure dummy torso and pelvic section loading.

The driver (position 1) ATD (Serial No. 351) and the right-front passenger (position 2) ATD (Serial No. 142) were qualified previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 633 channels of data were recorded on a data acquisition system. Appendix B contains the dummy response data traces.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was no Stoddard Solvent or battery electrolyte leakage and no loss of high-voltage battery isolation after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 623 mm located to the left of the vehicle centerline and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: The driver's head contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee airbag.
The passenger's visible contact points were as follows: The passenger's head contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC_{15}	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (g)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50^{th})	240.640	0.290	894.890	254.160	44.662	28.898	473.376	682.876
Passenger (5^{th})	362.194	0.291	477.931	535.559	47.426	12.179	2673.722	573.735

The test data can be found on the NHTSA website at www.nhtsa.gov

TEST NOTES

Passenger Lap Belt load cell was not installed.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20234211	Traction Control System (TCS)	Yes
Model Year	2023	Power Steering	Yes
Make	Kia	Power Window Auto-Reverse	Yes
Model	Niro EX Touring HEV	Driver Frontal Airbag	Yes
Body Style	5-Door SUV	Driver Curtain Airbag	Yes
VIN	KNDCR3LE6P5058543	Driver Head/Torso Airbag	No
Body Color	Cityscape Green	Driver Torso Airbag	No
Odometer (km/mi)	77 km / 48 mi	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	1.6 L	Driver Pelvis Airbag	No
Type/No. Cylinders	Inline 4	Driver Knee Airbag	Yes
Engine Placement	Lateral	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	6	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	FWD	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof/T-Top	Yes	Front Pass. Knee Airbag	No
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	Yes	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Other	N/A

Does owner's manual provide instructions to turn off automatic door locks?	No

DATA FROM CERTIFICATION LABEL

Manufactured By	KIA CORPORATION
Date of Manufacture	10/22

GVWR (kg)	1910
GAWR Front (kg)	1065
GAWR Rear (kg)	1050

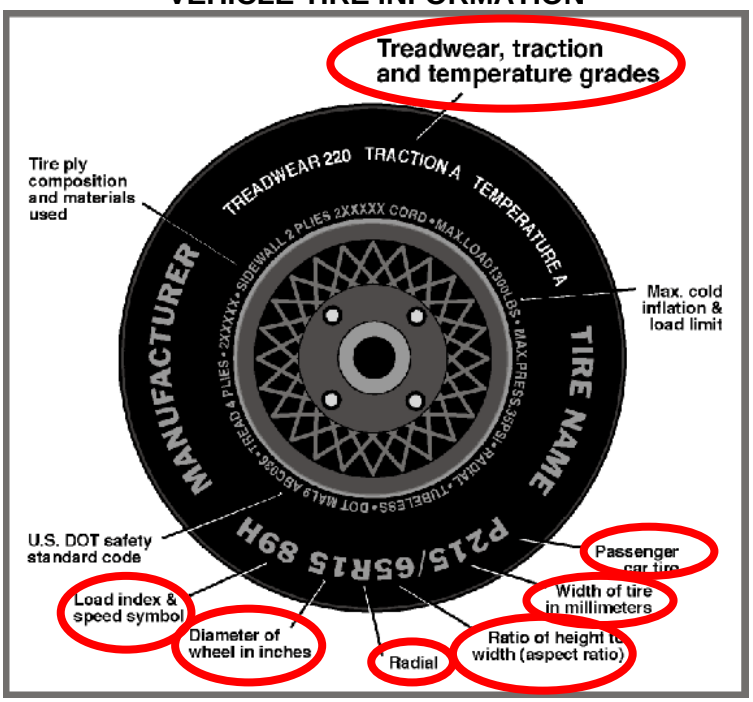
VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Contoured		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				390
Cargo Weight (RCLW) (kg)				50

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	250	250
Recommended Tire Size	225/45R18	225/45R18
Tire Size on Vehicle	225/45R18	225/45R18
Tire Manufacturer	Continental	Continental
Tire Model	ProContact RX	ProContact RX
Treadwear	400	400
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	1 Polyester, 2 Steel, 1 Polyamide	1 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	95V	95V
Tire Material	Rubber	Rubber
DOT Safety Code Left	036 OFBERX	036 OFBERX
DOT Safety Code Right	036 OFBERX	036 OFBERX

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	447.5	286.0		479.5	353.5	
Right	kg	421.0	295.0		444.5	357.0	
Ratio	%	59.9%	40.1%		56.5%	43.5%	
Totals	kg	868.5	581.0	1449.5	924.0	710.5	1634.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1449.5
Weight of 1 P572E ATD & 1 P572O ATD	kg	141
Rated Cargo/Luggage Weight (RCLW)	kg	50
Calculated Test Vehicle Target Weight (TVTW)	kg	1640.5

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	723	722	717	722	1092
As Tested	mm	701	705	683	696	1185
Post Test	mm	764	759	675	698	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2725
Total Vehicle Length at Left Side	mm	4298
Total Vehicle Length at Centerline	mm	4427
Total Vehicle Length at Right Side	mm	4298
Weight of Ballast in Cargo Area	kg	0
Weight of Vehicle Components Removed	kg	10
Amount of Stoddard Solvent in Fuel Tank	L	39.0

List of components removed to meet test weight: LR/RR taillight.

List of components removed for instrumentation, data box, and equipment installation: Cargo area carpet/trim/divider, jack and tools.

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

TARGET VEHICLE STRUCTURAL MEASUREMENT

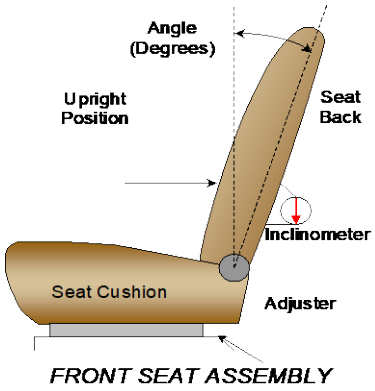
	Elements	Pre-Test (mm)
1	Total Length	4427
2	Total Width	1857
3	Bumper Top Height	572
4	Bumper Bottom Height	453
5	Longitudinal Member Top Height	564
6	Distance between Longitudinal Members	948
7	Longitudinal Member Width	71
8	Engine Top Height	818
9	Engine Bottom Height	326
10	Engine and Gearbox Width	896
11	Front Bumper-Engine Distance	414
12	Front Shock Absorber Fixing Height	869
13	Bonnet Leading Edge Height	901
14	Front Shock Absorber Fixing Width	178
15	Front Bumper – Front Axle Distance	733
16	Front Axle – A-Pillar Distance	435
17	A-Pillar – B-Pillar Distance	1132
18	B-Pillar – Rear Axle Distance	1155
19	B-Pillar – C-Pillar Distance	1088
20	Roof Sill Bottom Height	1468
21	Roof Sill Top Height	1508
22	Floor Sill Bottom Height	352
23	Floor Sill Top Height	204

DATA SHEET NO. 2
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

NOMINAL DESIGN RIDING POSITION

The driver seat back is positioned as close as possible to the manufacturer's design angle. For the passenger seat back, seat back is adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated May 2018.



	Degrees
Driver Seat Back Angle	2.1° on outboard headrest post
Passenger Seat Back Angle	-1.8° on outboard headrest post

SEAT FORE/AFT POSITIONS

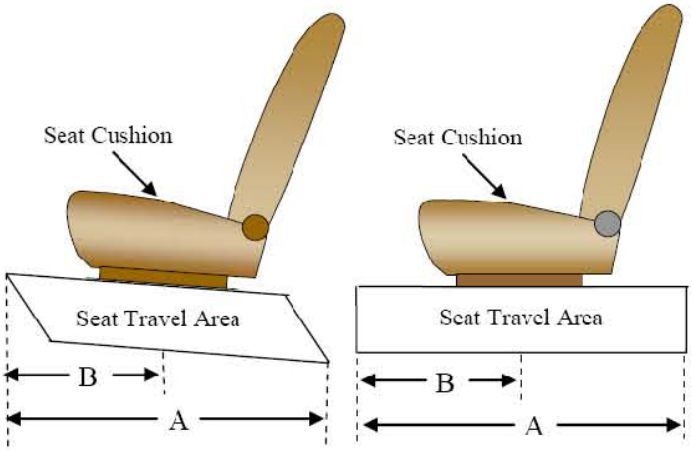
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated May 2018.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	322 mm	161 mm
Passenger Seat	260 mm / 66 detents (1st as 1)	0 mm / 0th detent (1st as 0)

SEAT BELT UPPER ANCHORAGES

The seat belt upper anchorages are set following the manufacturer's specified position as listed in Form 1.

	Total # of Positions	Placed in Position #
Driver Seat	3 (1st as 1)	0 (1st as 0)
Passenger Seat	3 (1st as 1)	0 (1st as 0)



DATA SHEET NO. 2 (CONTINUED)
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

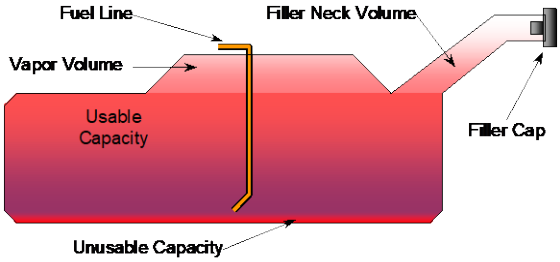
Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test
Test Date: 3/1/2023

FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	42.0
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	38.6 to 39.5
Actual Amount of Solvent used	39.0
1/3 of Usable Capacity	14.0

FUEL PUMP

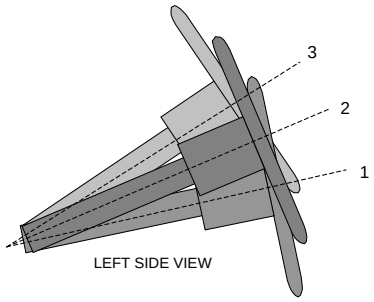
The vehicle is equipped with an electronic fuel pump. The fuel pump normally operates when the vehicle's electrical system is activated. The filler neck is located on the driver's side.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured.



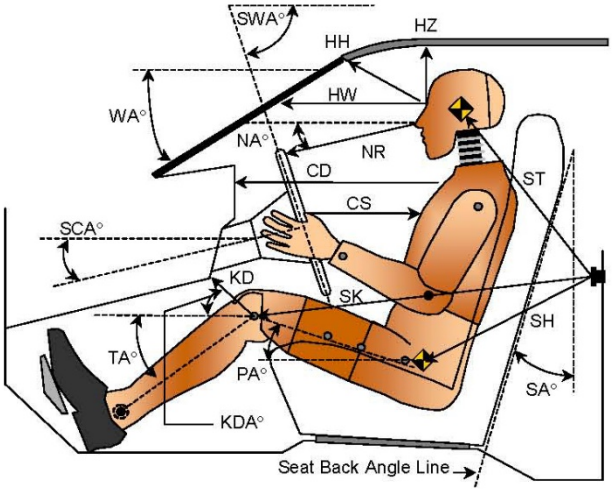
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	65.7	
Geometric Center Position 2	63.1	
Uppermost Position 3	60.4	
Telescoping Steering Wheel Travel		54
Test Position	63.1	27

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

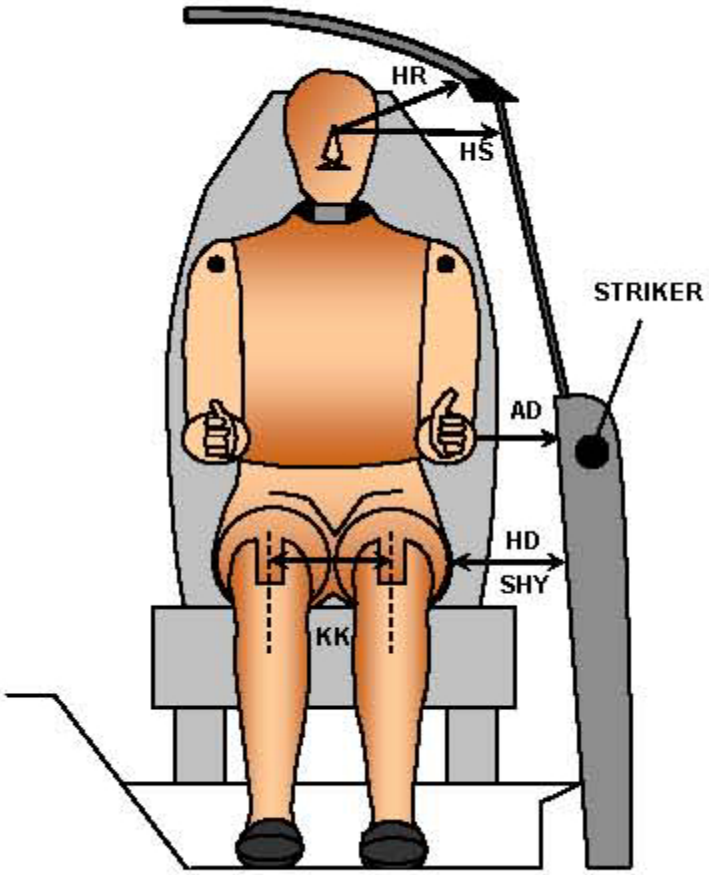


LEFT SIDE VIEW

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		26.0		
SWA°	Steering Wheel Angle		63.1		
SCA°	Steering Column Angle		26.9		
SA°	Seat Back Angle		2.1		-1.8
HZ	Head to Roof (Z)	198	90	216	90
HH	Head to Header	361	19.7	308	47.4
HW	Head to Windshield	670	0	650	0
NR	Nose to Rim	411	14.2		
CD	Chest to Dash	585		413	
CS	Chest to Steering Hub	332	8.2		
RA	Rim to Abdomen	213	0		
KDL	Left Knee to Dash	220	31.8	139	39.5
KDR	Right Knee to Dash	225	32.6	137	39.5
PA°	Pelvic Angle		23.9		21.1
TA°	Tibia Angle		50.3		56.7
SK	Striker to Knee	615	12.4	710	103.3
ST	Striker to Head	432	16.6	415	34.1
SH	Striker to H-Point	336	48.1	418	110.5

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

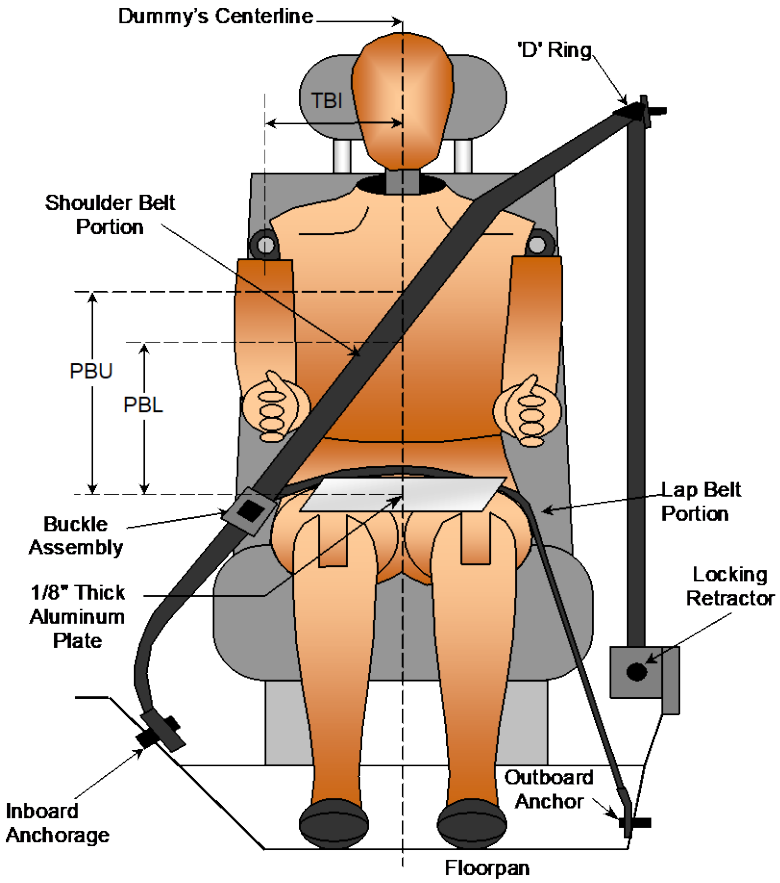


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
AD	Arm to Door	148	83
HD	H-Point to Door	153	208
HR	Head to Side Header	232	257
HS	Head to Side Window	340	357
KK	Knee to Knee	375	228
SHY	Striker to H-Point (Y Direction)	250	309
AA	Ankle to Ankle	385	165

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle:	2023 Kia Niro EX Touring 5-Door SUV	NHTSA No.:	M20234211
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	3/1/2023



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	360	345
PBL - Top surface of reference to belt lower edge	mm	270	260

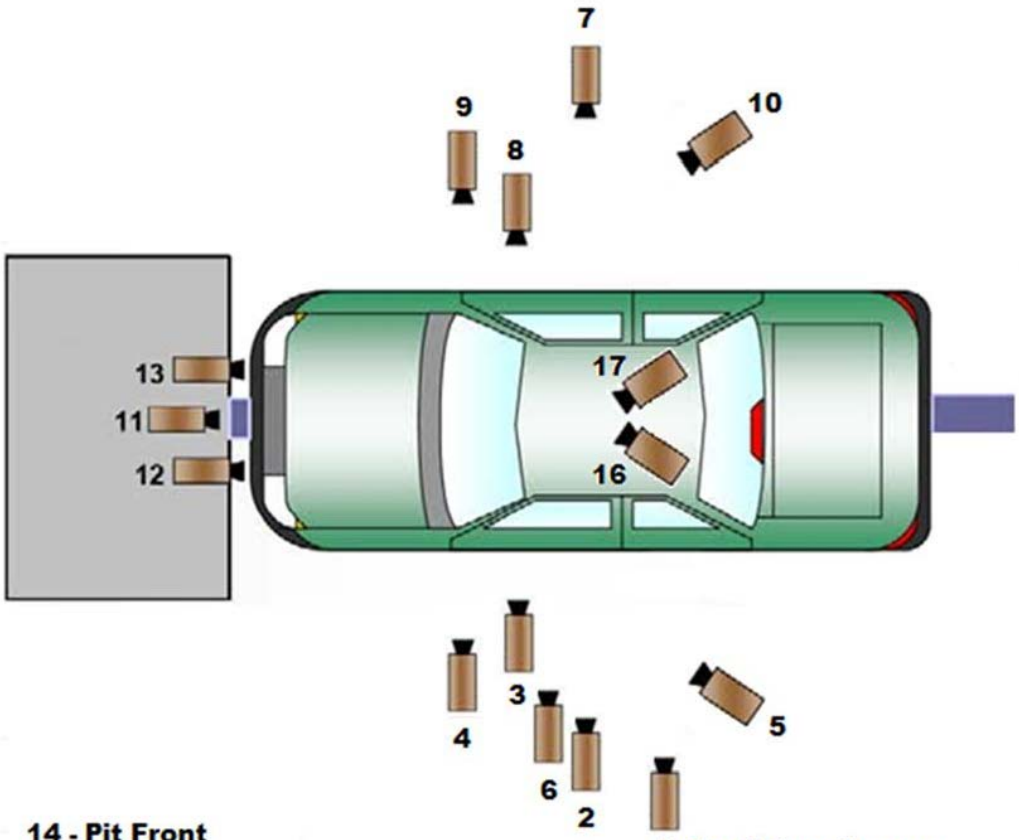
BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	865	940
Lap Belt Length as measured on ATD	mm	845	900
Remainder of belt on reel	mm	990	860
Total Belt Length for Continuous Webbing Systems	mm	3300	3300

DATA SHEET NO. 6
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle:	2023 Kia Niro EX Touring 5-Door SUV	NHTSA No.:	M20234211
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	3/1/2023

CAMERA POSITIONS FOR FRONTAL IMPACTS



14 - Pit Front
15 - Pit Rear
16 & 17 - Driver and Passenger Onboard

***Camera locations are approximate and not to scale*

DATA SHEET NO. 6 (CONTINUED)
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

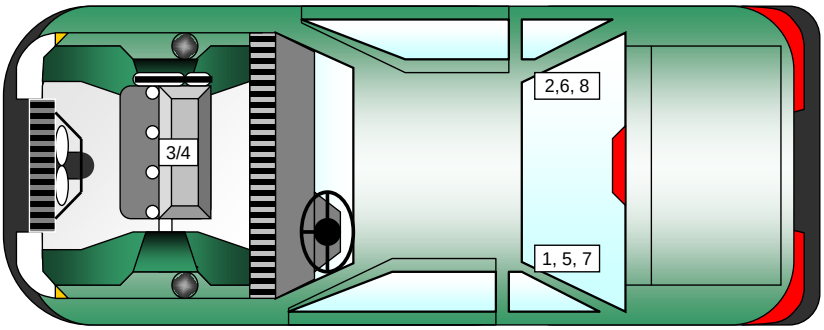
CAMERA LOCATIONS

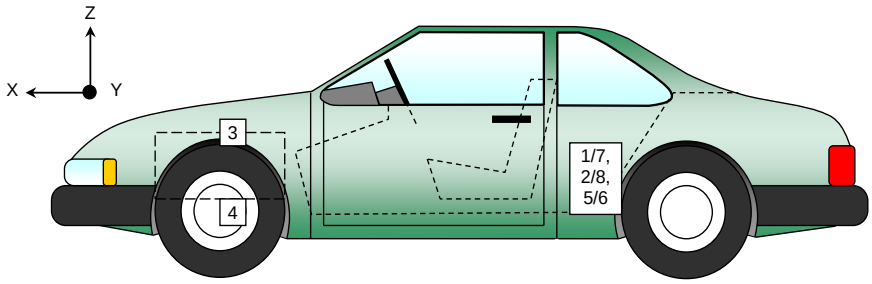
No.	Camera View	Coordinates* (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall					30
2	Left Overall	-2215	-5570	-1360	12	1000
3	Driver Close-Up	-1885	-6925	-1760	50	1000
4	Left Front Half	-1390	-5405	-1290	24	1000
5	Left Angle	-7220	-5725	-1820	75	1000
6	Steering Column	-950	-5510	-1225	50	1000
7	Right Overall	-2105	5550	-1410	12	1000
8	Passenger Close-Up	-1700	6920	-1800	50	1000
9	Right Front Half	-1240	5400	-1500	24	1000
10	Right Angle	-7240	5480	-1825	75	1000
11	Windshield	45	0	-2310	12	1000
12	Driver Windshield	165	-370	-2230	25	1000
13	Passenger Windshield	165	370	-2230	25	1000
14	Pit Front	-1095	0	3340	24	1000
15	Pit Rear	-2800	0	3340	24	1000
16	Driver Onboard				12	1000
17	Passenger Onboard				12	1000
18	Real-Time Pan View					30

*COORDINATES:
+X = forward of impact plane
+Y = right of monorail centerline
+Z = below ground level

DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	1605	-385	-234
2	Right Rear Crossmember Accelerometer – X Direction	1605	385	-234
3	Engine Top X	3724	362	-818
4	Engine Bottom X	3761	365	-326
5	Left Rear Crossmember Accelerometer – Z Direction	1605	-385	-234
6	Right Rear Crossmember Accelerometer – Z Direction	1605	385	-234
7	Left Rear Crossmember Accelerometer Redundant – X Direction	1605	-343	-234
8	Right Rear Crossmember Accelerometer Redundant – X Direction	1605	343	-234

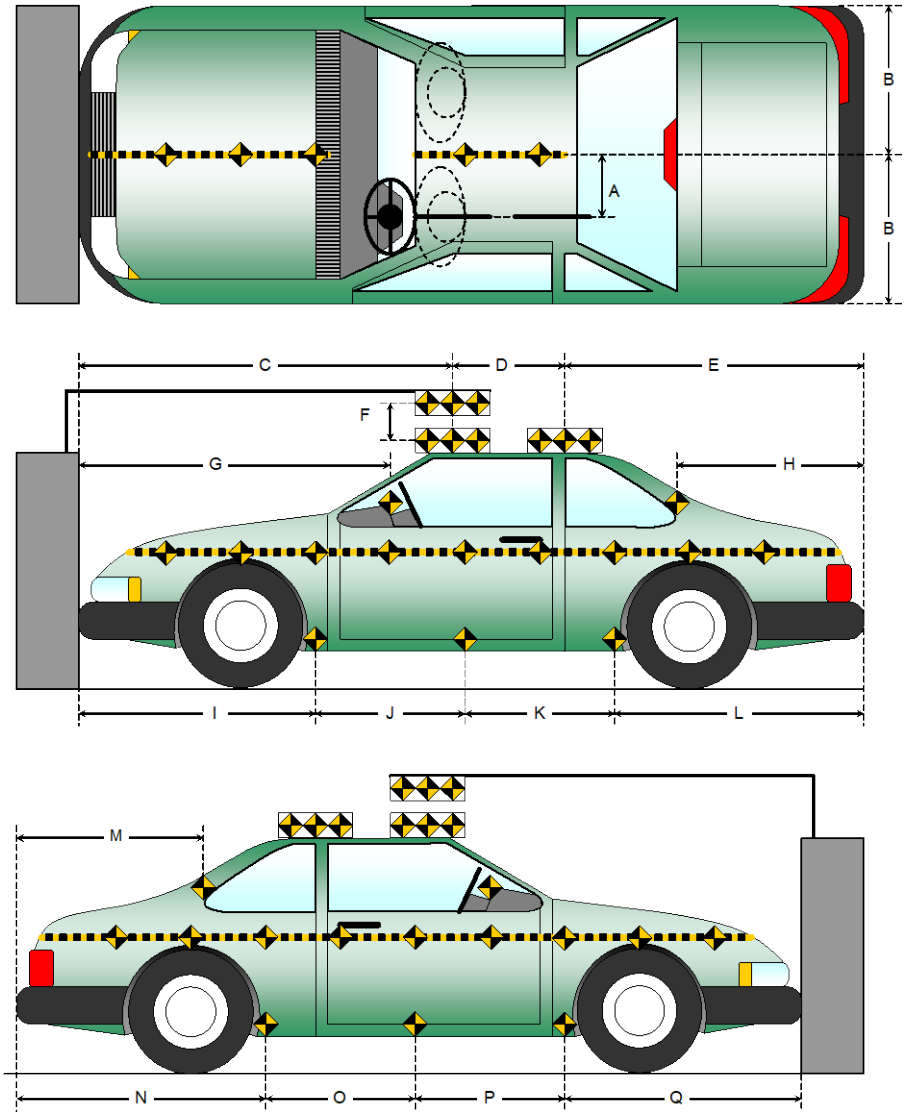
Reference Points: X - Rear Surface of Vehicle (+ forward)
Y - Vehicle Centerline (+ to right)
Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20234211
Test Date: 3/1/2023

Item	Value (mm)
A	350
B	929
C	2305
D	610
E	1512
F	150
G	
H	758
I	1361
J	930
K	930
L	1206
M	758
N	1206
O	930
P	930
Q	1361



DATA SHEET NO. 9
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

ADVANCED RESEARCH LOAD CELL BARRIER

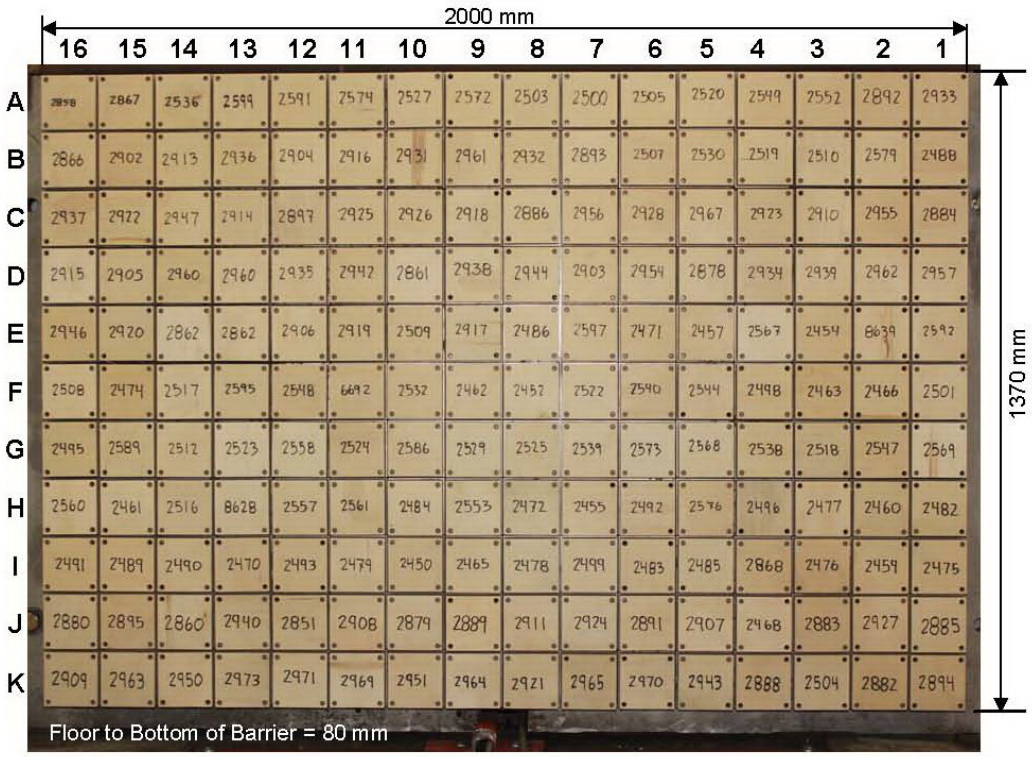


Photo for Reference Only

Centerline

A-16	A-15	A-14	A-13	A-12	A-11	A-10	A-09	A-08	A-07	A-06	A-05	A-04	A-03	A-02	A-01
B-16	B-15	B-14	B-13	B-12	B-11	B-10	B-09	B-08	B-07	B-06	B-05	B-04	B-03	B-02	B-01
C-16	C-15	C-14	C-13	C-12	C-11	C-10	C-09	C-08	C-07	C-06	C-05	C-04	C-03	C-02	C-01
D-16	D-15	D-14	D-13	D-12	D-11	D-10	D-09	D-08	D-07	D-06	D-05	D-04	D-03	D-02	D-01
E-16	E-15	E-14	E-13	E-12	E-11	E-10	E-09	E-08	E-07	E-06	E-05	E-04	E-03	E-02	E-01
F-16	F-15	F-14	F-13	F-12	F-11	F-10	F-09	F-08	F-07	F-06	F-05	F-04	F-03	F-02	F-01
G-16	G-15	G-14	G-13	G-12	G-11	G-10	G-09	G-08	G-07	G-06	G-05	G-04	G-03	G-02	G-01
H-16	H-15	H-14	H-13	H-12	H-11	H-10	H-09	H-08	H-07	H-06	H-05	H-04	H-03	H-02	H-01
I-16	I-15	I-14	I-13	I-12	I-11	I-10	I-09	I-08	I-07	I-06	I-05	I-04	I-03	I-02	I-01
J-16	J-15	J-14	J-13	J-12	J-11	J-10	J-09	J-08	J-07	J-06	J-05	J-04	J-03	J-02	J-01
K-16	K-15	K-14	K-13	K-12	K-11	K-10	K-09	K-08	K-07	K-06	K-05	K-04	K-03	K-02	K-01

Load Cells are 121 mm x 121 mm with a 7 mm gap in between each load cell.

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Data Channels	49
Passenger Dummy Data Channels	48
Vehicle Structure Accelerometers	8
Barrier Channels	528
Total	633

CAMERA COVERAGE

Type of Camera	Number Used in this Test
High-Speed Vehicle Onboard	2
High-Speed Offboard	14
Real-Time	2
Total	18

DATA SHEET NO. 11
POST-TEST OBSERVATIONS

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 351	HIII 5% / 142
Head Contact	Frontal Airbag, Headrest	Frontal Airbag, Headrest
Upper Torso Contact	Frontal Airbag	Frontal Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Airbag	Glove Box
Right Knee Contact	Knee Airbag	Glove Box

DOOR OPENING, TRUNK OPENING, AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were locked	Doors were locked
Front Door Opening	Remained closed and unlocked; opened without tools	Remained closed and unlocked; opened without tools
Rear Door Opening	Remained closed and unlocked; opened without tools	Remained closed and unlocked; opened without tools
Trunk/Hatch/Tailgate Opening	Remained closed; opened without tools	
Seat Track Shift (mm)	0	0
Seat Back Movement	None	None

OTHER VEHICLE POST-TEST OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	Cracked
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

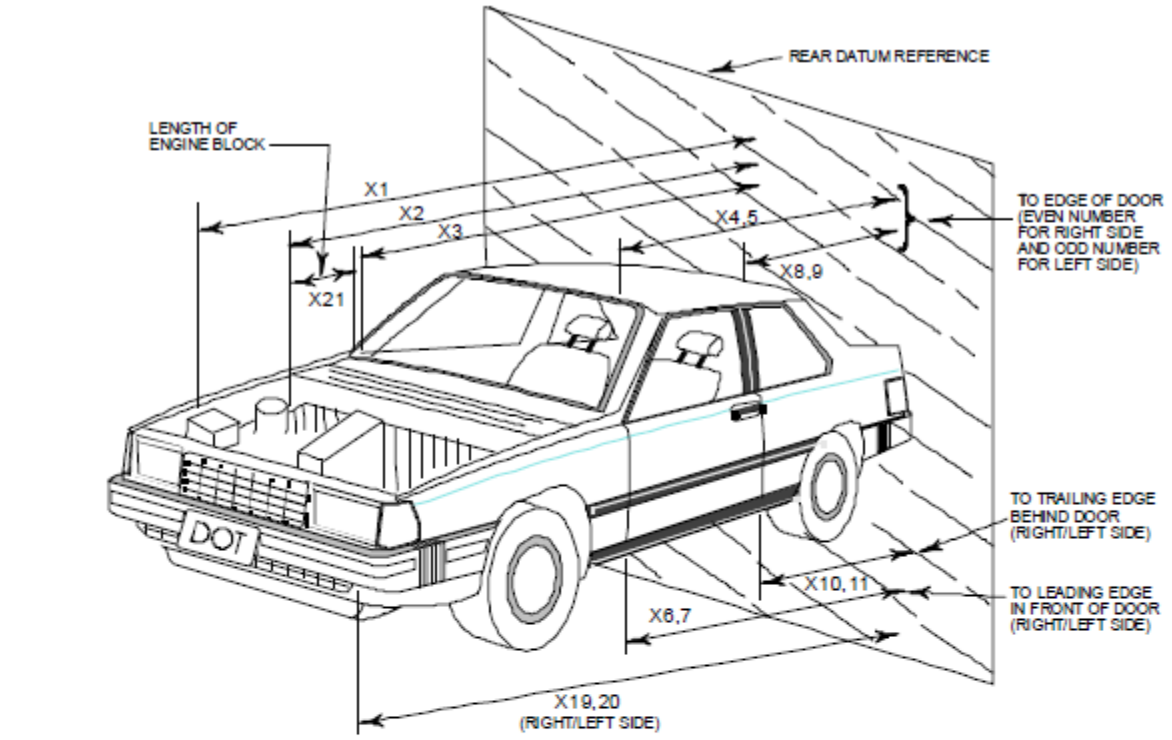
Measured Parameter	Units	Value
Left Side	mm	4790
Center	mm	4770
Right Side	mm	4750
Average	mm	4770

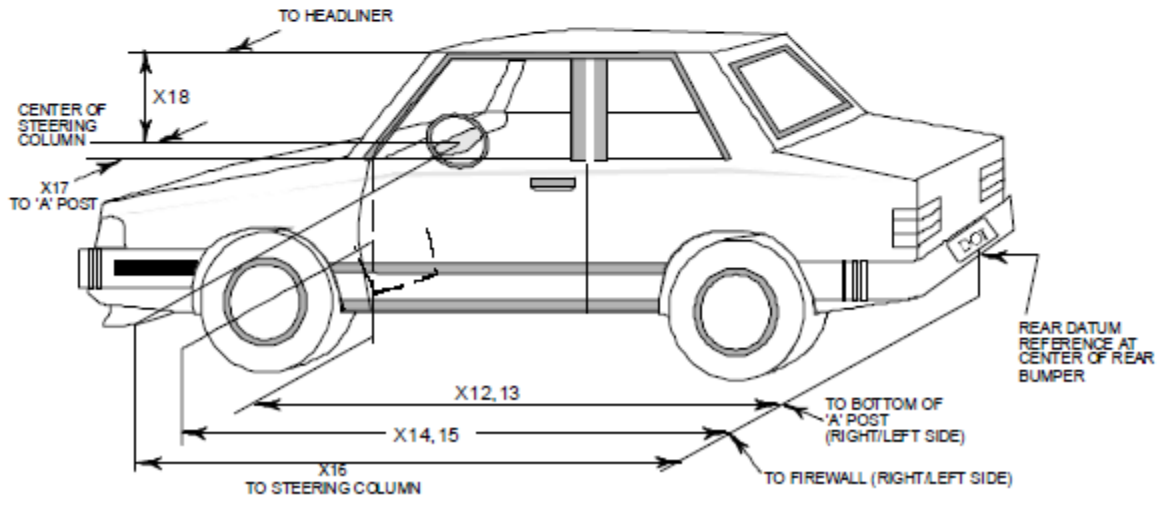
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver		Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Curtain Side Airbag	Yes	No	Yes	No
Torso/Pelvis Side Airbag	Yes	No	Yes	No
Knee Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	
Other				

DATA SHEET NO. 12
VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2023 Kia Niro EX Touring 5-Door SUV	NHTSA No.:	M20234211
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	3/1/2023





DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

No.	Measurement Description	Pre-Test	Post-Test	Change
1	Total Length of Vehicle at Centerline	4427	3821	-606
2	RSOV to Front of Engine	3742	3516	-226
3	RSOV to Firewall	3471	3432	-39
4	RSOV to Upper Leading Edge of Right Door	3021	3042	21
5	RSOV to Upper Leading Edge of Left Door	3018	3013	-5
6	RSOV to Lower Leading Edge of Right Door	3013	3021	8
7	RSOV to Lower Leading Edge of Left Door	3015	3010	-5
8	RSOV to Upper Trailing Edge of Right Door	1921	1921	0
9	RSOV to Upper Trailing Edge of Left Door	1918	1912	-6
10	RSOV to Lower Trailing Edge of Right Door	1945	1951	6
11	RSOV to Lower Trailing Edge of Left Door	1948	1940	-8
12	RSOV to Bottom of “A” Post of Right Side	3026	3012	-14
13	RSOV to Bottom of “A” Post of Left Side	3036	3010	-26
14	RSOV to Firewall, Right Side	3414	3381	-33
15	RSOV to Firewall, Left Side	3413	3385	-28
16	RSOV to Steering Column	2572	2615	43
17	Center of Steering Column to “A” Post	383	380	-3
18	Center of Steering Column to Headliner	434	450	16
19	RSOV to Right Side of Front Bumper	4298	3830	-468
20	RSOV to Left Side of Front Bumper	4298	3800	-498
21	Length of Engine Block	412	412	0
RD	RSOV to Right Side of Dash Panel	2753	2790	37
CD	RSOV to Center of Dash Panel	2836	2804	-32
LD	RSOV to Left Side of Dash Panel	2757	2760	3

All dimensions in mm

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

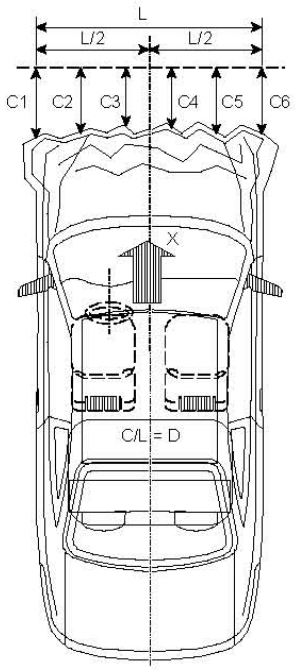
Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

VEHICLE INFORMATION

VIN: KNDCR3LE6P5058543
Vehicle Size Category: MPV
Wheelbase (mm): 2725
Test Weight (kg): 1634.5

ACCELEROMETER DATA

Accelerometer Locations: As per Data Sheet No. 7
Cal. Procedure/Interval: MGA Procedure / 6 month
Integration Algorithm: Trapezoidal
Linearity: > 99%
Impact Velocity (km/h): 56.24
Velocity Change (km/h): 66.9
Time of Separation (msec) 103



CRUSH PROFILE

Collision Deformation Classification: 12FDEW4
Midpoint of Damage: Centerline
Damage Region Length (mm): 1380
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Exterior Crush
C1	Crush zone 1 at left side	mm	4298	3800	498
C2	Crush zone 2 at left side	mm	4401	3818	583
C3	Crush zone 3 at left side	mm	4423	3837	586
C4	Crush zone 4 at right side	mm	4423	3820	603
C5	Crush zone 5 at right side	mm	4401	3820	581
C6	Crush zone 6 at right side	mm	4298	3830	468
L	C1 TO C6	mm	1380	1371	9

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

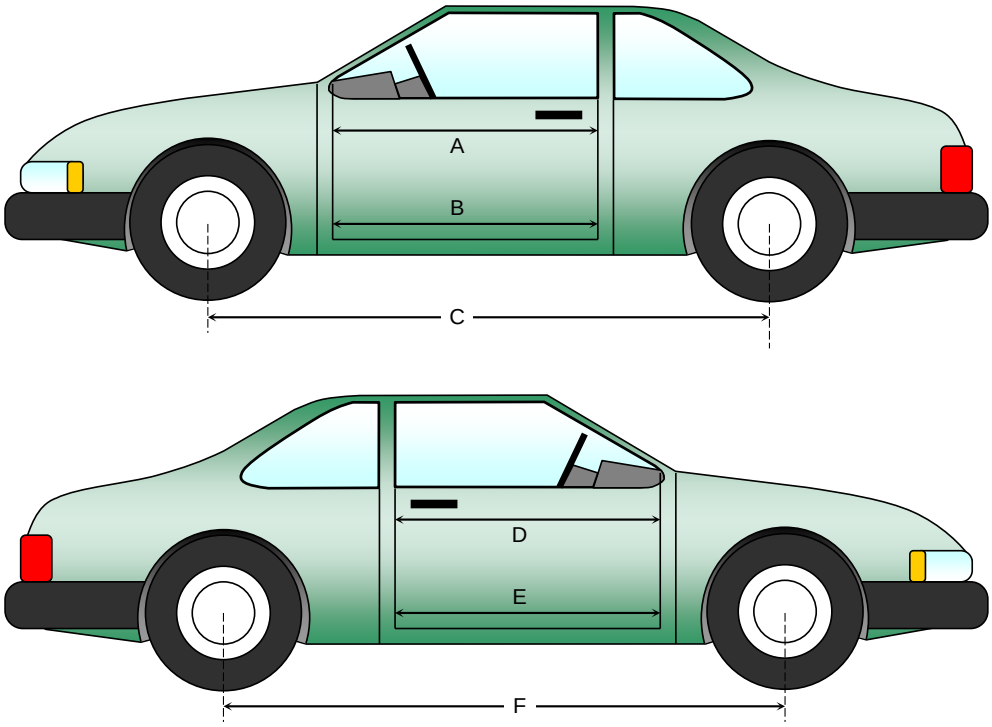
Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Change
A	Left Side Upper	mm	1017	1017	0
B	Left Side Lower	mm	943	952	9
D	Right Side Upper	mm	1020	1020	0
E	Right Side Lower	mm	940	937	-3

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Change
C	Left Side Wheelbase	mm	2725	2670	-55
F	Right Side Wheelbase	mm	2725	2669	-56



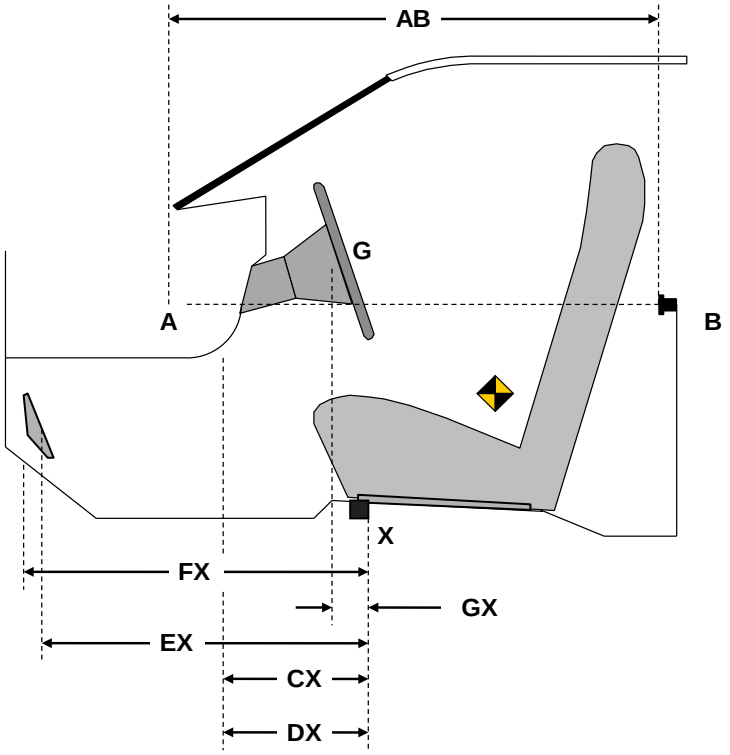
DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Change
AB	Door Opening (Inside Window Jam)	mm	773	774	1
CX	Left Knee Bolster to X	mm	336	324	-12
DX	Right Knee Bolster to X	mm	339	331	-8
EX	Brake Pedal to X	mm	561	541	-20
FX	Foot Rest to X	mm	565	440	-125
GX	Center of Steering Column Wheel Hub to X	mm	58	60	2

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 15
SUMMARY OF FMVSS 212 AND FMVSS 219 (PARTIAL) DATA

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

WINDSHIELD MOUNTING DETAILS

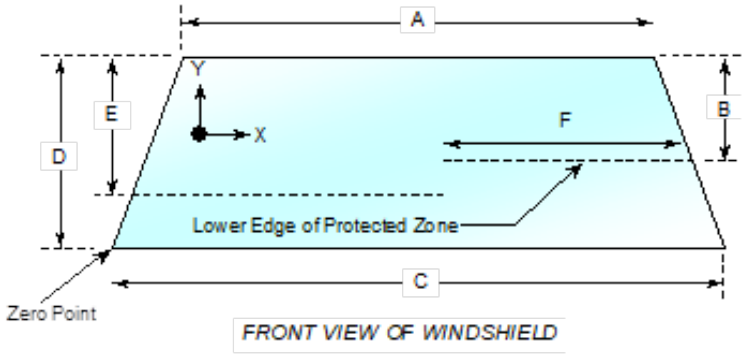
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

The standard requires that the post-test retention measurement be a minimum of 75 percent of the pre-test total periphery measurement for vehicles not equipped with occupant passive restraints and 50 percent for each side of the windshield for vehicles which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 22.0°C.

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2192	4790	218.5
Right Side	2192	4750	216.7
Total	4384	9540	217.6



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1196
B	mm	487
C	mm	1456
D	mm	866
E	mm	540
F	mm	522

AREA OF PROTECTED ZONE FAILURES

A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 inches by a vehicle component other than one that is normally in contact with the windshield. **None**

X	Y

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component. **None**

X	Y

DATA SHEET NO. 16
FMVSS 301 BARRIER IMPACT AND STATIC ROLLOVER

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 22.0°C Test Time: 11:19 a.m.

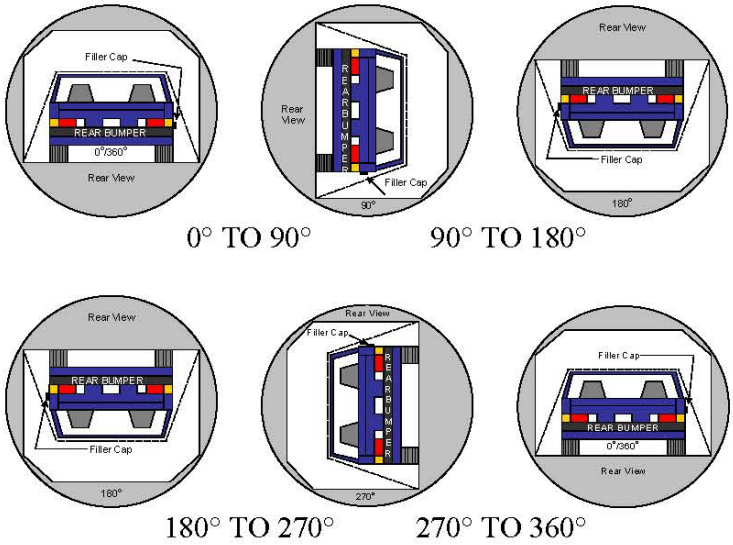
A. From impact until vehicle motion ceases: (Maximum Allowable = 1 ounce) 0.0 oz.

B. For the 5 minute period after motion ceases: (Maximum Allowable = 5 ounces) 0.0 oz.

C. For the following 25 minutes: (Maximum Allowable = 1 ounce / minute) None

D. Spillage Details: None

FMVSS 301 STATIC ROLLOVER RESULTS



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage: **None**

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	111	300	411
90° to 180°	111	300	411
180° to 270°	108	300	408
270° to 360°	111	300	411

DATA SHEET NO. 16 (CONTINUED)
FMVSS 301 BARRIER IMPACT AND STATIC ROLLOVER

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

FMVSS 301 SPILLAGE TABLE (UNITS IN OUNCES)

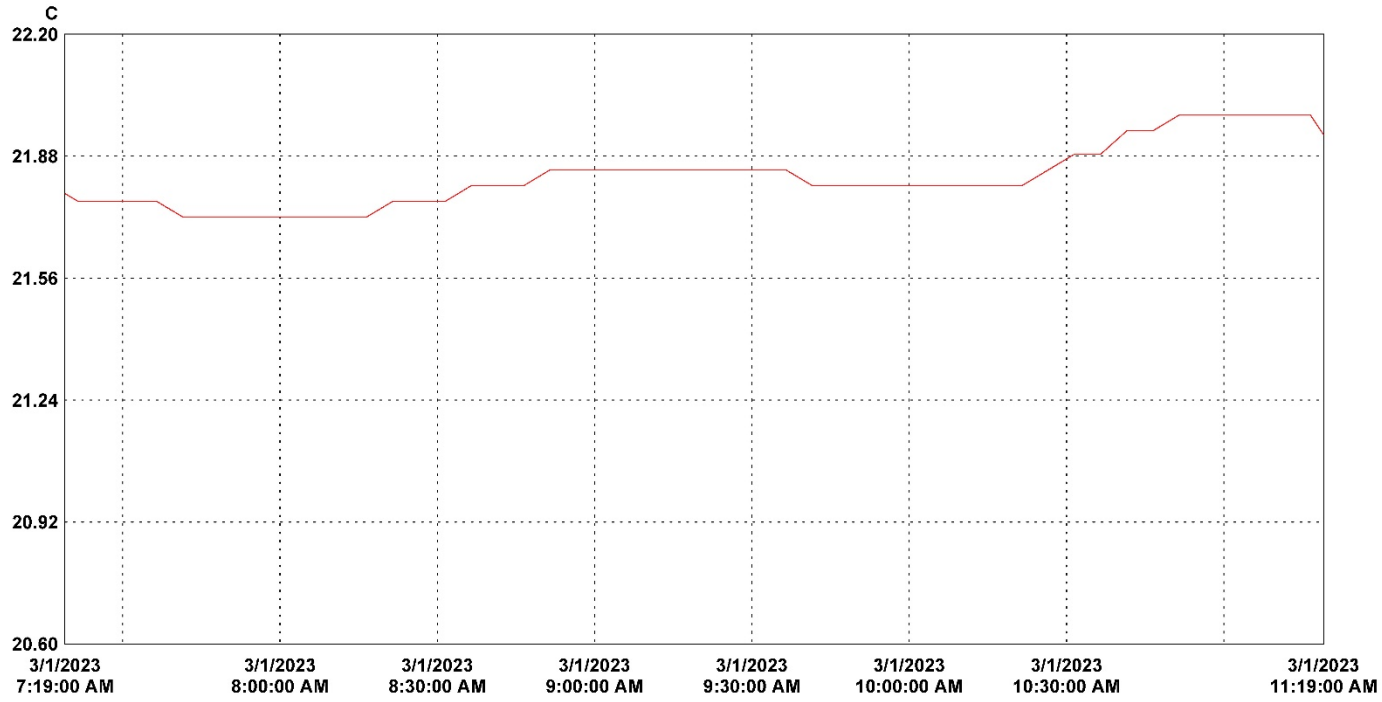
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	
90° to 180°	
180° to 270°	
270° to 360°	

DATA SHEET NO. 17
DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test
Test Date: 3/1/2023



30 minutes/div 4 hours (M/d/yyyy h:mm:ss tt) Central Time Graph file (truncated): M20234211 2023 Kia Niro EX Touring 5-Door SUV NCAP.spg

LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	18352040	VSC_Prep_Room	1		21.99	21.82	21.72	C	Temperature	18352040_VSC_Prep_Room.spl

DATA SHEET NO. 305-1
GENERAL TEST AND VEHICLE PARAMETER DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

ELECTRIC VEHICLE PROPULSION SYSTEM

	Units	Observations and Conclusions
Type of Electric Vehicle		Gasoline / Electric Hybrid
Propulsion Battery Type		Lithium-Ion
Nominal Voltage	V	240
Physical Location of Automatic Propulsion Battery Disconnect		Under rear seat
Auxiliary Battery Type		Lithium-Ion

PROPULSION BATTERY SYSTEM DATA

	Units		Observations and Conclusions
Electrolyte Fluid Type			LiPF6 salt, carbonate solvent
Electrolyte Fluid Specific Gravity	g/L		1.23
Electrolyte Fluid Kinematic Viscosity	cSt		3.0
Electrolyte Fluid Color			Transparent & pale yellow
Propulsion Battery Coolant Type, Color, Specific Gravity (if applicable)			Air-Cooled
Location of Battery Modules		X	Inside Passenger Compartment
			Outside Passenger Compartment
			The high-voltage battery is located below the 2nd row seat cushion.

PROPULSION BATTERY STATE OF CHARGE

For all battery types:	
Voltage range corresponding to **useable energy** of the battery:	
Minimum State of Charge	
Maximum State of Charge	
95% of Maximum State of Charge	
Test Voltage - No less than 95% of maximum State of Charge	
For batteries that are rechargeable ONLY by an energy source on the vehicle:	
Voltage range corresponding to **useable energy** of the battery:	
Minimum State of Charge	160.0 V
Maximum State of Charge	275.2 V
Test Voltage – Maximum practicable State of Charge within Normal Operating Range	240.3 V

DATA SHEET NO. 305-2
PRE-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2023 Kia Niro EX Touring 5-Door SUV	NHTSA No.:	M20234211
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	3/1/2023

VEHICLE CHASSIS GROUND POINT(S) LOCATION(S)

Details of Vehicle Chassis Ground Point(s) & Location(s)	Vehicle chassis ground near high voltage battery pack

PROPULSION BATTERY SYSTEM

Details of Electric Energy Storage/Conversion System Test Points	Connected at + and – terminal ends of propulsion system
Additional Comments	None

DATA SHEET NO. 305-3
PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		Fluke
Model		177
Serial Number		57580164
Internal Impedance Value	MΩ	> 10 MΩ < 100 pF
Resolution	V	0.001
Last Calibration Date		6/21/2022

PROPULSION BATTERY VOLTAGE

Measurement shall be made with Energy Storage/Conversion System connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion system energized) position.

NOTE: If voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.

Vb	V	240.3

ELECTRIC ISOLATION MEASUREMENTS
PROPULSION BATTERY TO VEHICLE CHASSIS

Vehicle chassis point(s) determined and supplied to contractor by COTR.

V1	V	143.6
V2	V	144.0

PROPULSION BATTERY TO VEHICLE CHASSIS ACROSS RESISTOR

The known resistance Ro (in ohms) should be approximately 500 times the normal operating voltage of the vehicle (in volts) per SAE J1766.

Ro	Ω	146,000

V1' Pre-Impact	V	3.5
V2' Pre-Impact	V	3.7

DATA SHEET NO. 305-3 (CONTINUED)
PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2023 Kia Niro EX Touring 5-Door SUV	NHTSA No.:	M20234211
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	3/1/2023

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record “Zero Volts”.
This “zero voltage” condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1’)/V1’]		
Ri1 Pre-Impact	Ω	11,704,622
Ri2 = Ro (1 + V1/V2) [(V2-V2’)/V2’]		
Ri2 Pre-Impact	Ω	11,056,946
Ri = The lesser of Ri1 and Ri2		
Ri Pre-Impact	Ω	11,056,946
Ri / Vb = Electrical Isolation Value / Nominal Battery Voltage		
Ri / Vb Pre-Impact	Ω	46,013

NOTE: The minimum Electrical Isolation Value is 500 Ω/V.

	Yes	No (Fail)
Is the measured Electrical Isolation Value ≥ 500 Ω/V?	X	
Additional Comments	None	

DATA SHEET NO. 305-4
POST-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		Fluke
Model		177
Serial Number		57580164
Internal Impedance Value	MΩ	> 10 MΩ < 100 pF
Resolution	V	0.001
Last Calibration Date		6/21/2022

ELECTRICAL ISOLATION MEASUREMENTS

Vb Post-Impact	V	0.0

V1 Post-Impact	V	0.0	Impact Time	1	Minutes	15	Seconds
V2 Post-Impact	V	0.0		1	Minutes	18	Seconds
V1' Post-Impact	V	0.0		1	Minutes	27	Seconds
V2' Post-Impact	V	0.0		1	Minutes	22	Seconds

DATA SHEET NO. 305-4 (CONTINUED)
POST-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2023 Kia Niro EX Touring 5-Door SUV	NHTSA No.:	M20234211
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	3/1/2023

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']							
Ri1 Post-Impact	Ω	Zero Volts	Impact Time	1	Minutes	27	Seconds
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']							
Ri2 Post-Impact	Ω	Zero Volts	Impact Time	1	Minutes	22	Seconds
Ri = The lesser of Ri1 and Ri2							
Ri Post-Impact	Ω	Zero Volts	Impact Time	1	Minutes	27	Seconds
Ri / Vb = Electrical Isolation Value / Nominal Battery Voltage							
Ri / Vb Post-Impact	Ω	Zero Volts	Impact Time	1	Minutes	27	Seconds

NOTE: The minimum Electrical Isolation Value is 500 Ω/V.

	Yes	No (Fail)
Is the measured Electrical Isolation Value ≥ 500 Ω/V?	X	
Additional Comments	None	

DATA SHEET NO. 305-4 (CONTINUED)
POST-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

PROPULSION BATTERY SYSTEM COMPONENTS

Describe any Propulsion Battery Module movement within the passenger compartment [Supply photographs as appropriate]:
Not Applicable

	Yes (Fail)	No
Has the Propulsion Battery Module moved within the passenger compartment?		X

Describe intrusion of an outside Propulsion Battery Component into the passenger compartment [Supply photographs as appropriate]:
No Intrusion

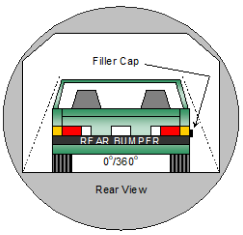
	Yes (Fail)	No
Has an outside Propulsion Battery Component intruded into the passenger compartment?		X

	Yes (Fail)	No
Is the Propulsion Battery Electrolyte Spillage visible in the passenger compartment?		X

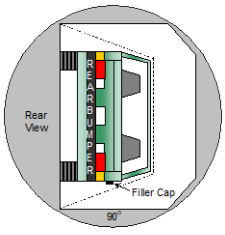
DATA SHEET NO. 305-5
STATIC ROLLOVER TEST DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20234211
Test Date: 3/1/2023

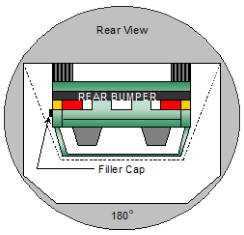
PROPULSION BATTERY SYSTEM COMPONENTS



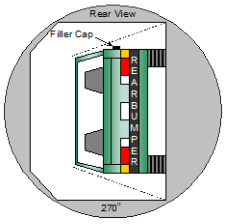
0°/360°



90°



180°



270°

PROPULSION BATTERY ELECTROLYTE COLLECTION TIME PERIOD

Test Phase	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	1	min	51	sec	5	min	6	min	51	sec	7	min
90° - 180°	1	min	51	sec	5	min	6	min	51	sec	7	min
180° - 270°	1	min	48	sec	5	min	6	min	48	sec	7	min
270° - 360°	1	min	51	sec	5	min	6	min	51	sec	7	min

TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE

NOTE: The maximum allowable Propulsion Battery Electrolyte Spillage is 5.0 Liters.

Test Phase	Propulsion Battery Electrolyte Spillage (L)	Spillage Location
0° to 90°	0	Not Applicable
90° to 180°	0	Not Applicable
180° to 270°	0	Not Applicable
270° to 360°	0	Not Applicable
Total Spillage	0	

	Yes (Fail)	No
Is the total Propulsion Battery Electrolyte Spillage greater than 5.0 Liters?		X
Is the Propulsion Battery Electrolyte Spillage visible in the passenger compartment?		X

DATA SHEET NO. 305-5 (CONTINUED)
STATIC ROLLOVER TEST DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		Fluke
Model		177
Serial Number		57580164
Internal Impedance Value	MΩ	> 10 MΩ < 100 pF
Resolution	V	0.001
Last Calibration Date		6/21/2022

ELECTRICAL ISOLATION MEASUREMENTS

Vb Post-Impact	V	0.0

Record V1, V2, V1', V2' voltage measurements at the start of each successive increment of 90°, 180°, 270°, and 360° of the static rollover test.

	Voltage	Units	Test Phase	Time			
V1	0.0	V	0°		min		sec
	0.0		90°	2		52	
	0.0		180°	2		36	
	0.0		270°	2		26	
	0.0		360°	2		22	
V2	0.0	V	0°		min		sec
	0.0		90°	2		56	
	0.0		180°	2		39	
	0.0		270°	2		31	
	0.0		360°	2		26	
V1'	0.0	V	0°		min		sec
	0.0		90°	3		7	
	0.0		180°	2		51	
	0.0		270°	2		41	
	0.0		360°	2		36	
V2'	0.0	V	0°		min		sec
	0.0		90°	3		2	
	0.0		180°	2		44	
	0.0		270°	2		36	
	0.0		360°	2		31	

DATA SHEET NO. 305-5 (CONTINUED)
STATIC ROLLOVER TEST DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 Kia Niro EX Touring 5-Door SUV NHTSA No.: M20234211
Test Program: NCAP Frontal Barrier Impact Test Test Date: 3/1/2023

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

	Voltage	Units	Test Phase	Time			
Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']							
Ri1	Zero Volts	Ω	0°		min		sec
	Zero Volts		90°	3		7	
	Zero Volts		180°	2		51	
	Zero Volts		270°	2		41	
	Zero Volts		360°	2		36	
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']							
Ri2	Zero Volts	Ω	0°		min		sec
	Zero Volts		90°	3		2	
	Zero Volts		180°	2		44	
	Zero Volts		270°	2		36	
	Zero Volts		360°	2		31	
Ri = The lesser of Ri1 and Ri2							
Ri	Zero Volts	Ω	0°		min		sec
	Zero Volts		90°	3		7	
	Zero Volts		180°	2		51	
	Zero Volts		270°	2		41	
	Zero Volts		360°	2		36	
Ri / Vb = Electrical Isolation Value / Nominal Battery Voltage							
Ri / Vb	Zero Volts	Ω/V	0°		min		sec
	Zero Volts		90°	3		7	
	Zero Volts		180°	2		51	
	Zero Volts		270°	2		41	
	Zero Volts		360°	2		36	

NOTE: The minimum Electrical Isolation Value is 500 Ω/V.

	Yes	No (Fail)
Is the measured Electrical Isolation Value ≥ 500 Ω/V?	X	
Additional Comments	None	

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

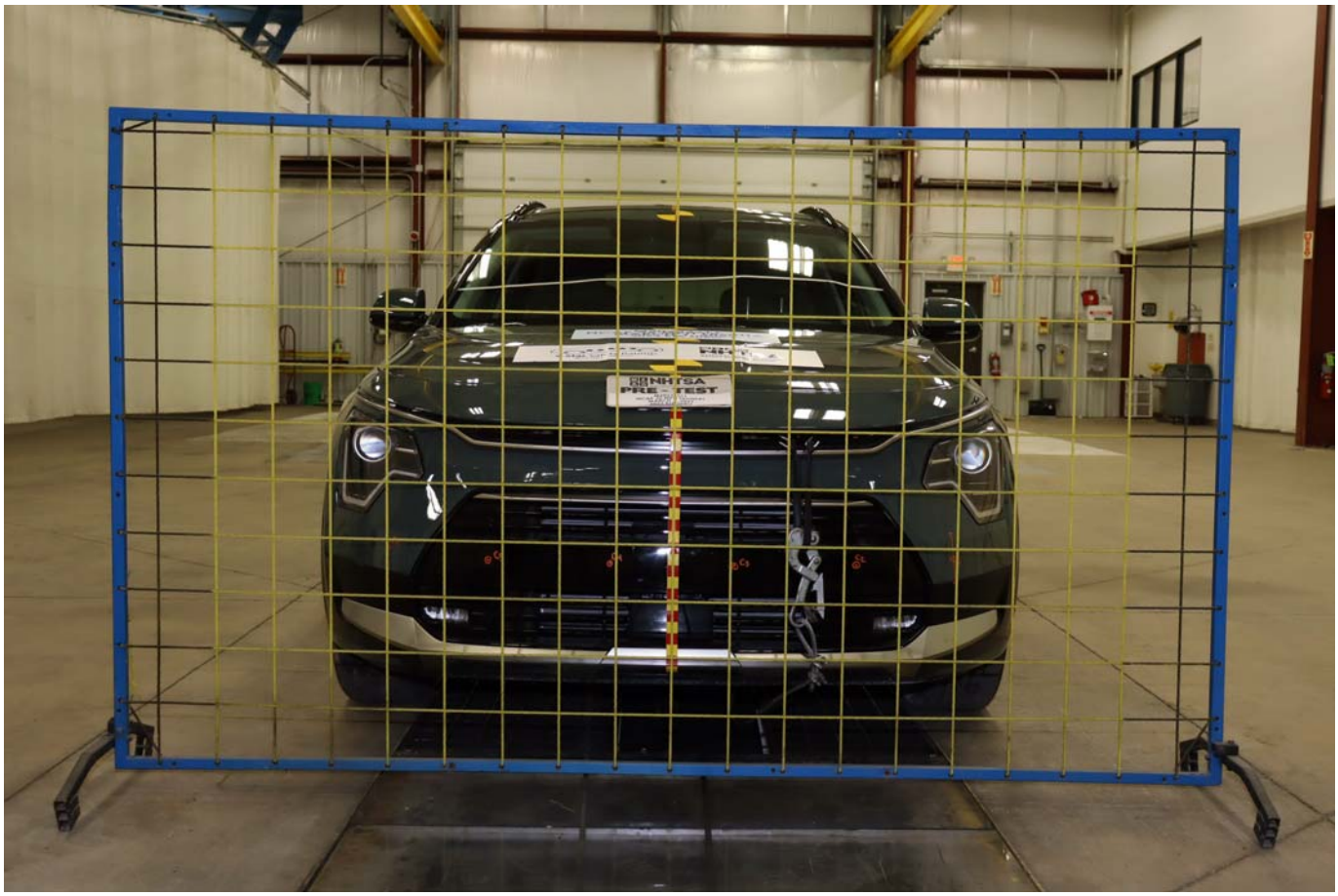


Photo No. 001 - Load Cell Location

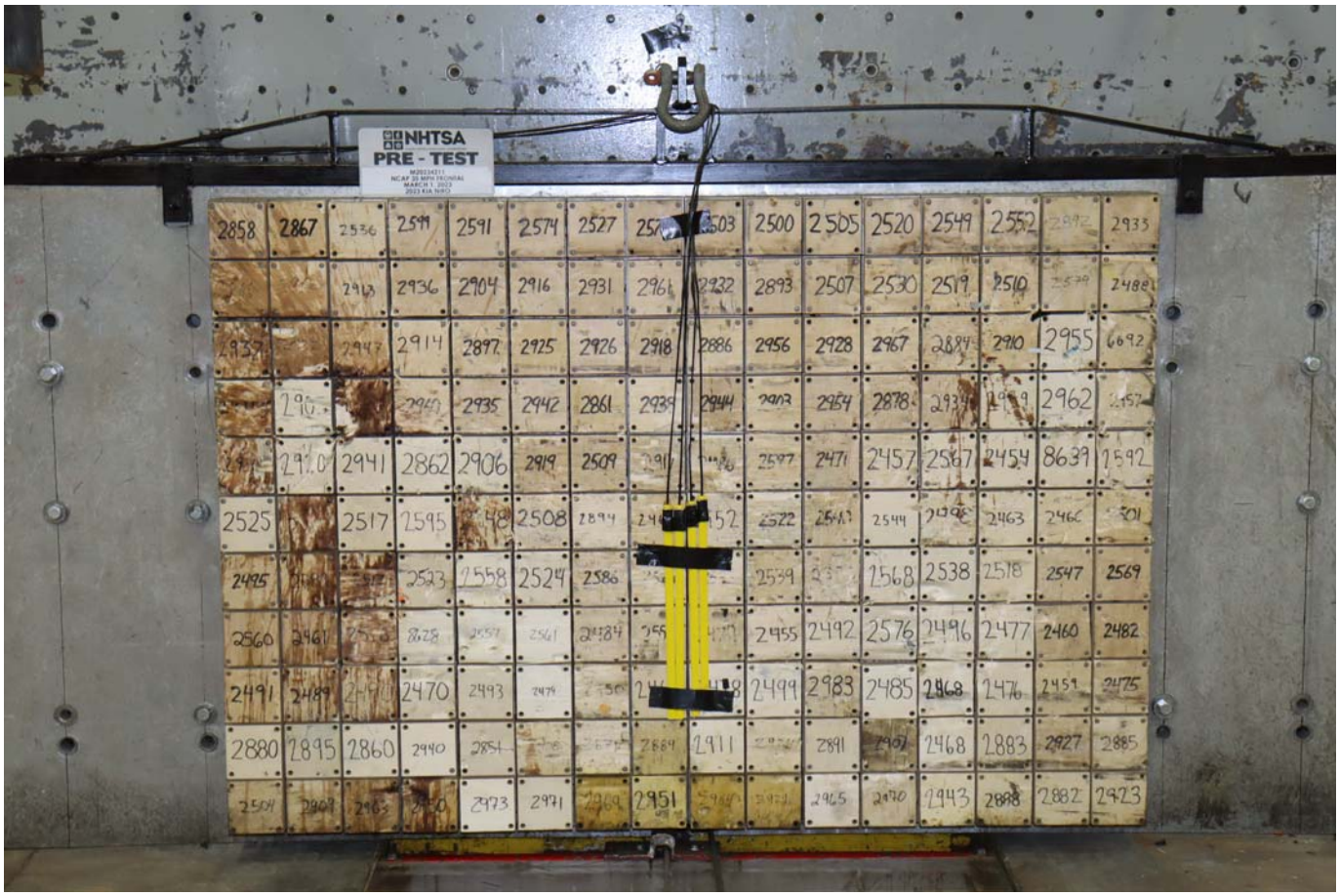


Photo No. 002 - Pre-Test Load Cell Wall

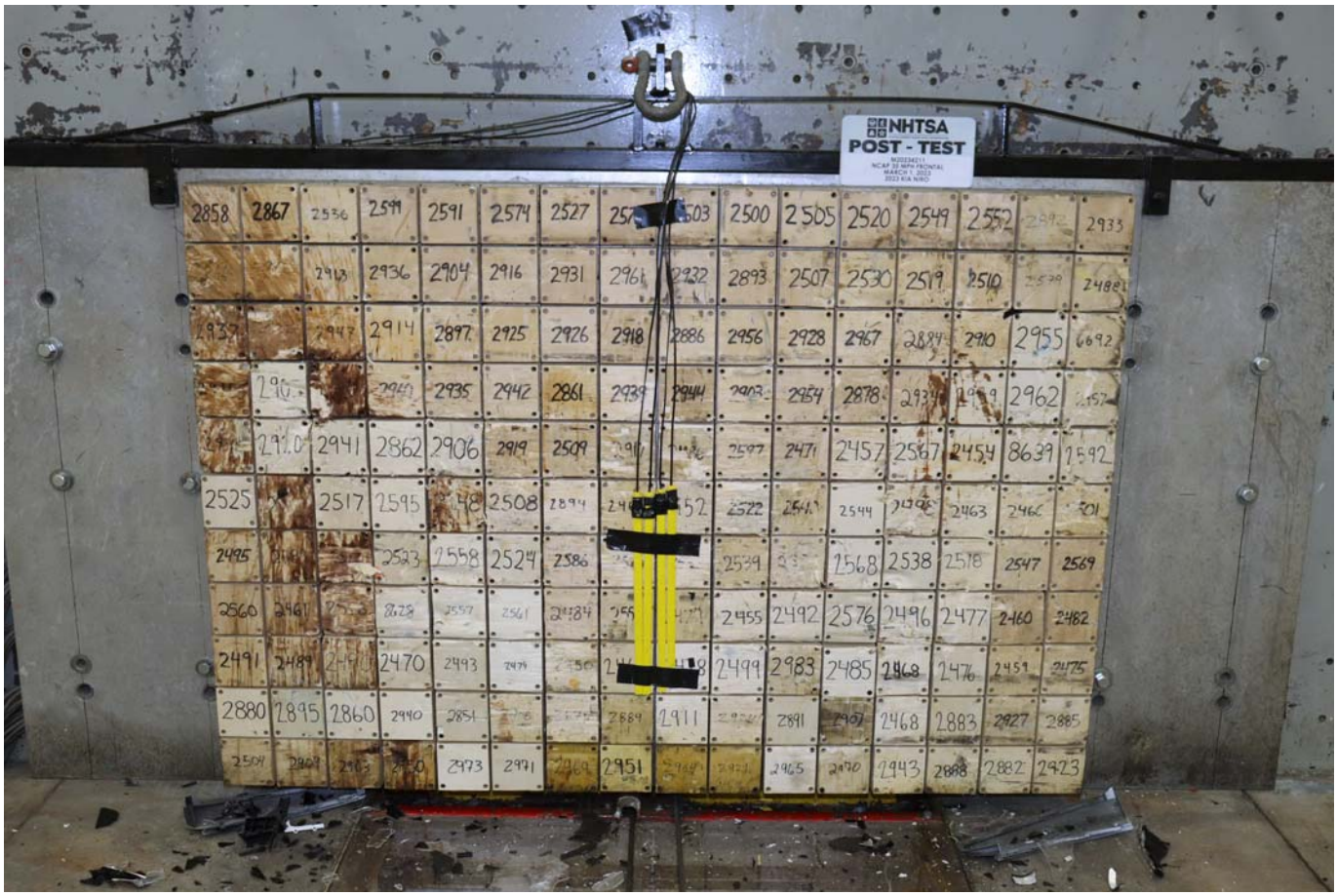


Photo No. 003 - Post-Test Load Cell Wall

Photo No. 004 - Manufacturer's Label

Photo No. 005 - Tire Placard


Photo No. 006 - 2023 Kia Niro EX Touring 5-Door SUV Frontal As Delivered

Photo No. 007 - Left Rear 3-4 View, As Received

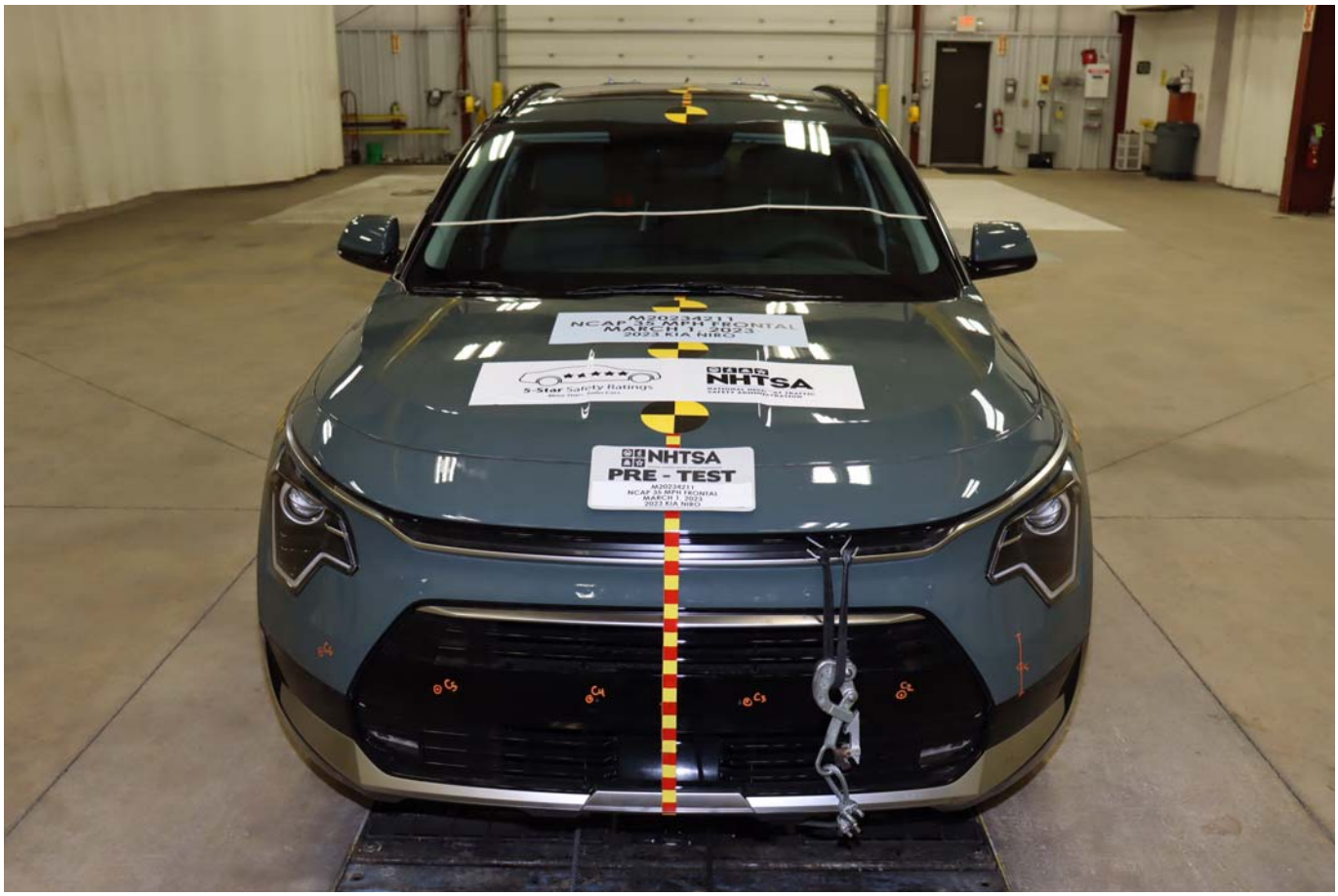


Photo No. 008 - Pre-Test Front View of Test Vehicle

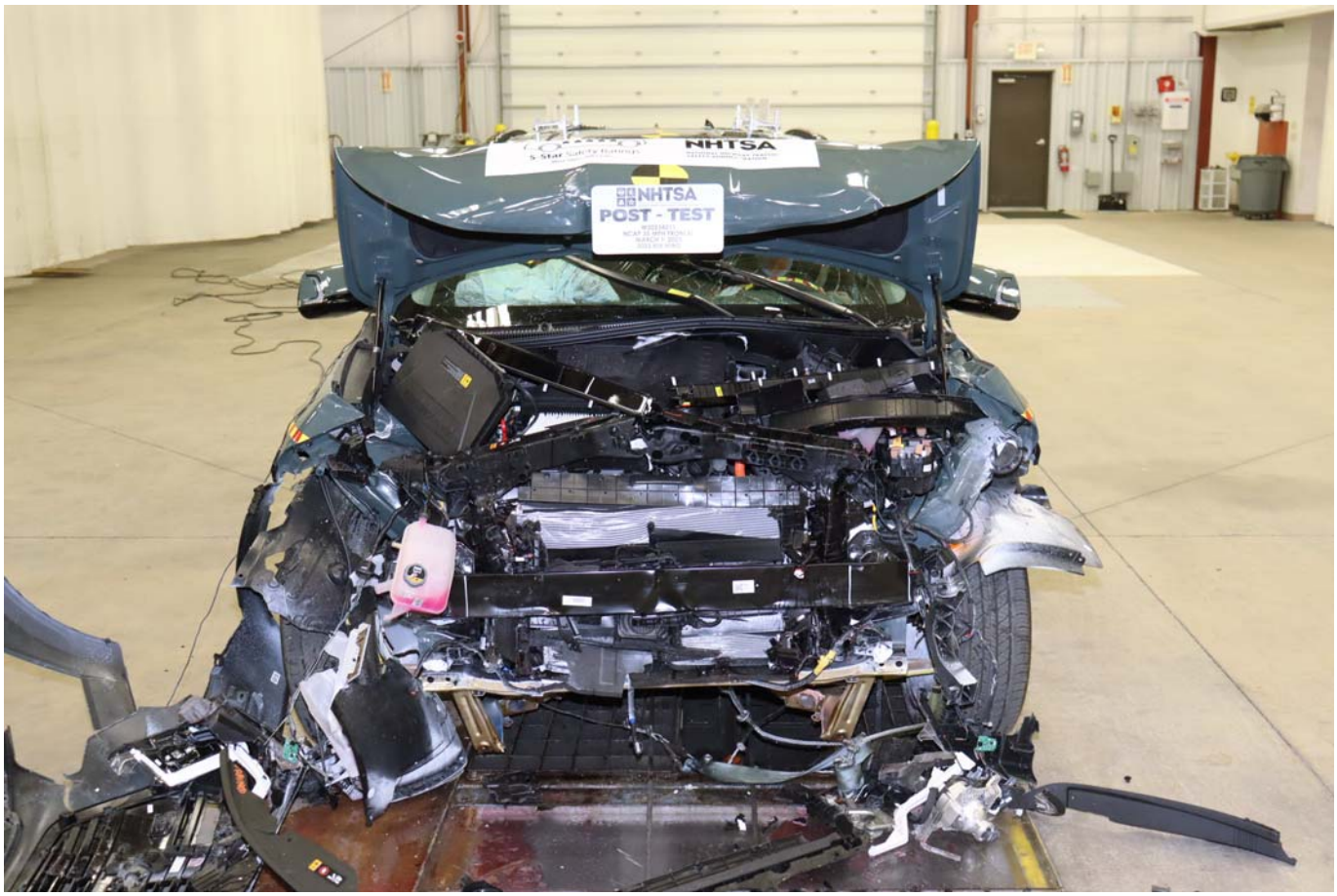


Photo No. 009 - Post-Test Front View of Test Vehicle

Photo No. 010 - Pre-Test Left View of Test Vehicle

Photo No. 011 - Post-Test Left View of Test Vehicle

Photo No. 012 - Pre-Test Right View of Test Vehicle

Photo No. 013 - Post-Test Right View of Test Vehicle

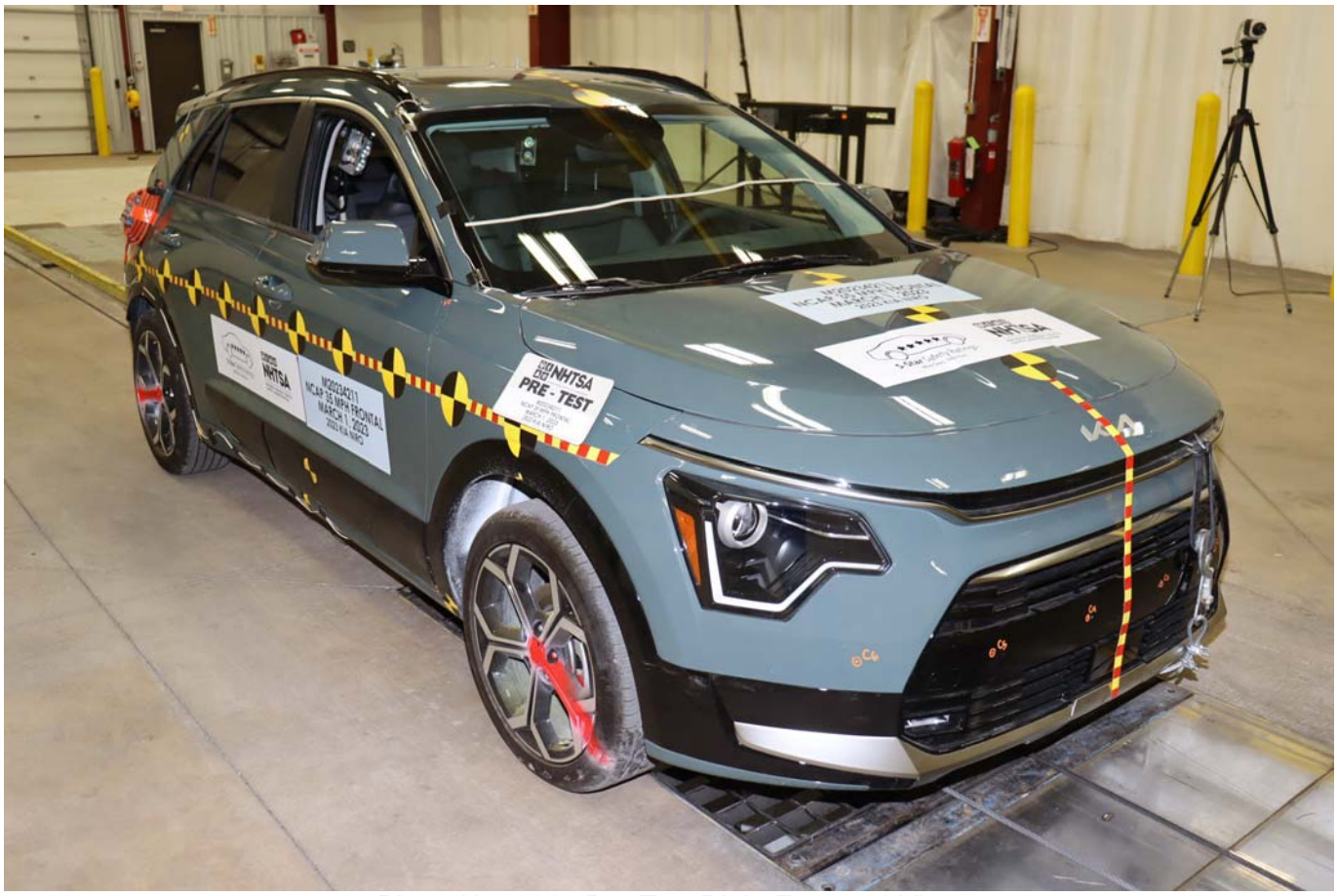


Photo No. 014 - Pre-Test Right Front 3-4 View

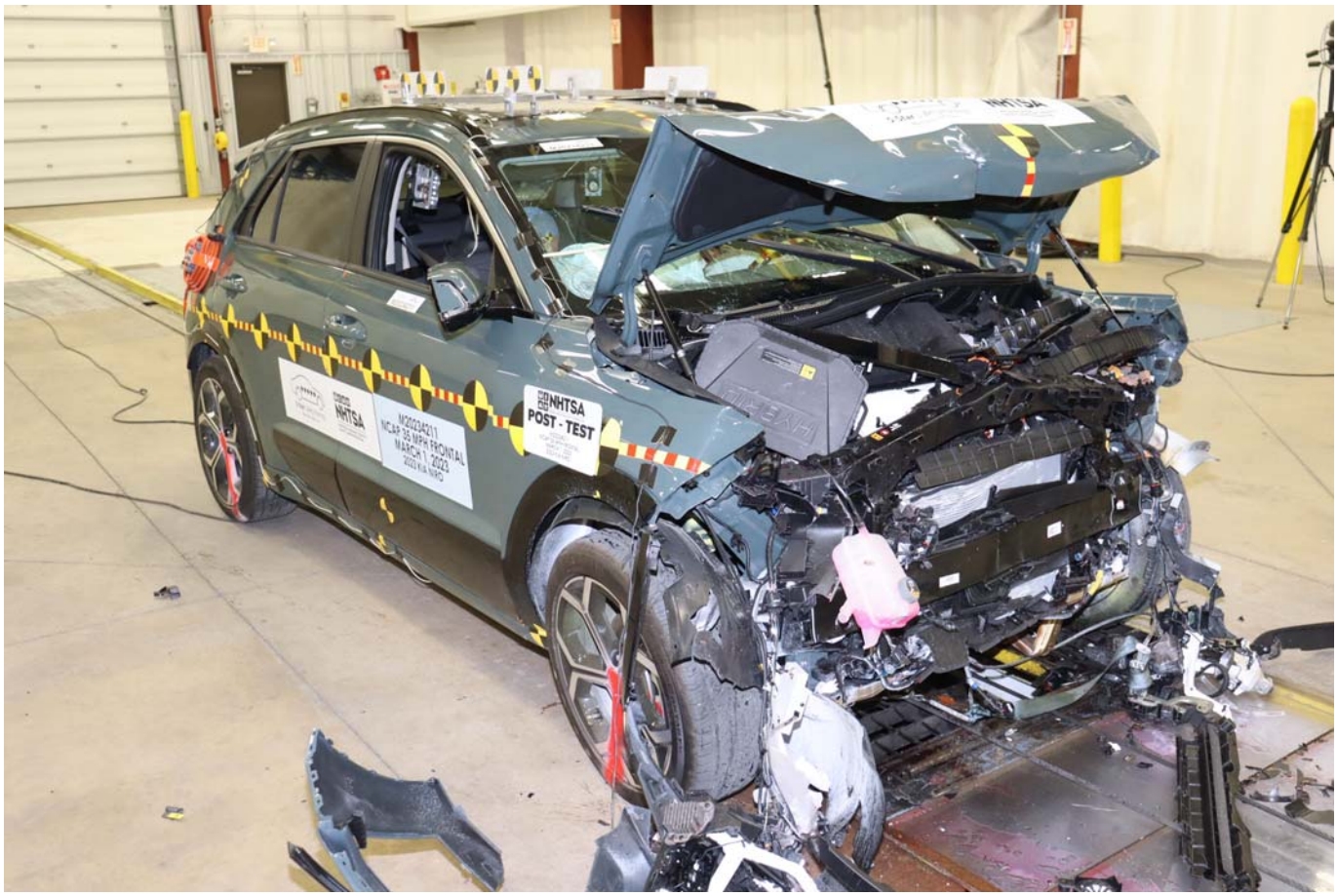


Photo No. 015 - Post-Test Right Front 3-4 View

Photo No. 016 - Pre-Test Left Rear 3-4 View

Photo No. 017 - Post-Test Left Rear 3-4 View

Photo No. 018 - Pre-Test Windshield View

Photo No. 019 - Post-Test Windshield View

Photo No. 020 - Pre-Test Engine Compartment View

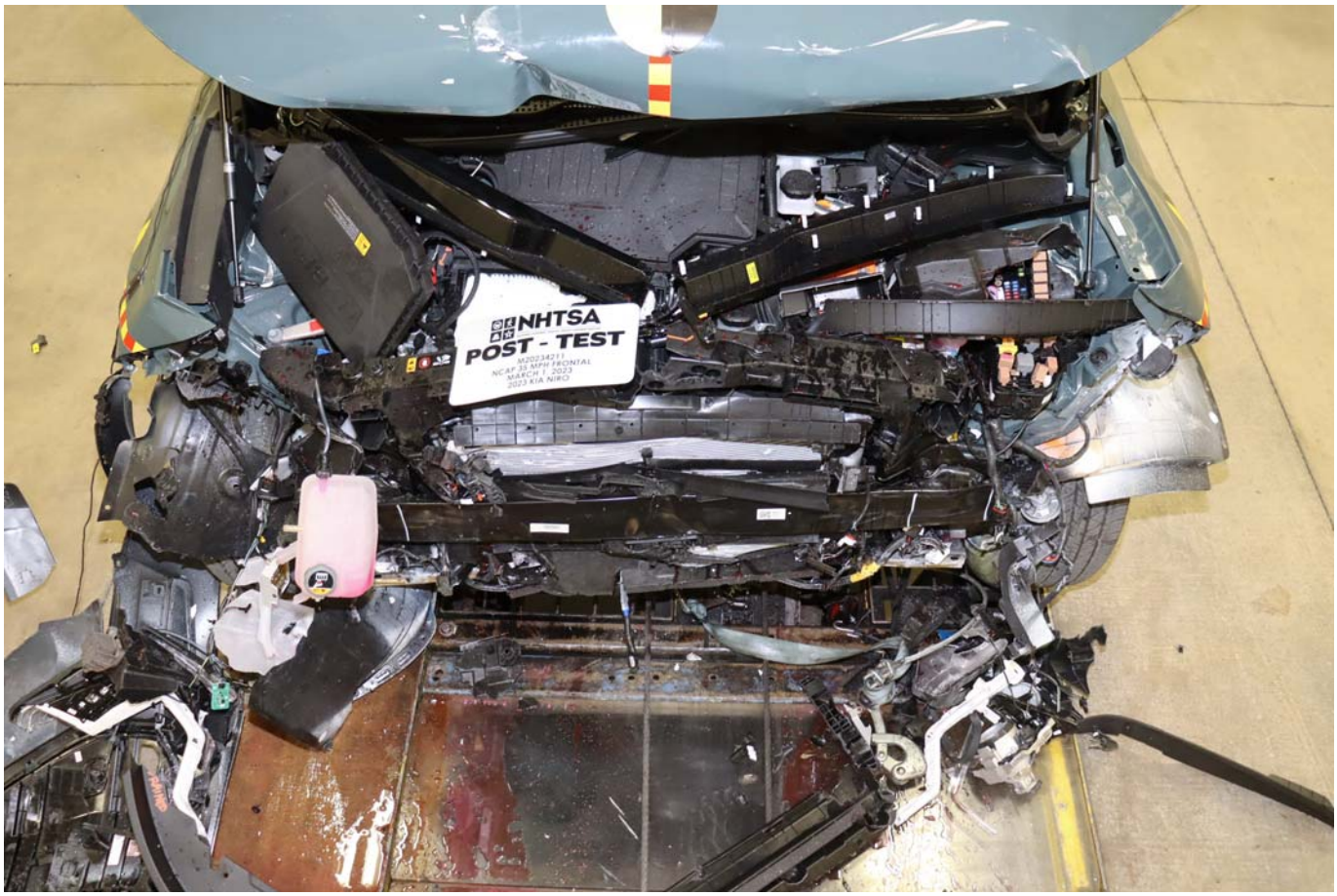


Photo No. 021 - Post-Test Engine Compartment View

Photo No. 022 - Pre-Test Fuel Filler Cap View

Photo No. 023 - Post-Test Fuel Filler Cap View

Photo No. 024 - Pre-Test Front Underbody View

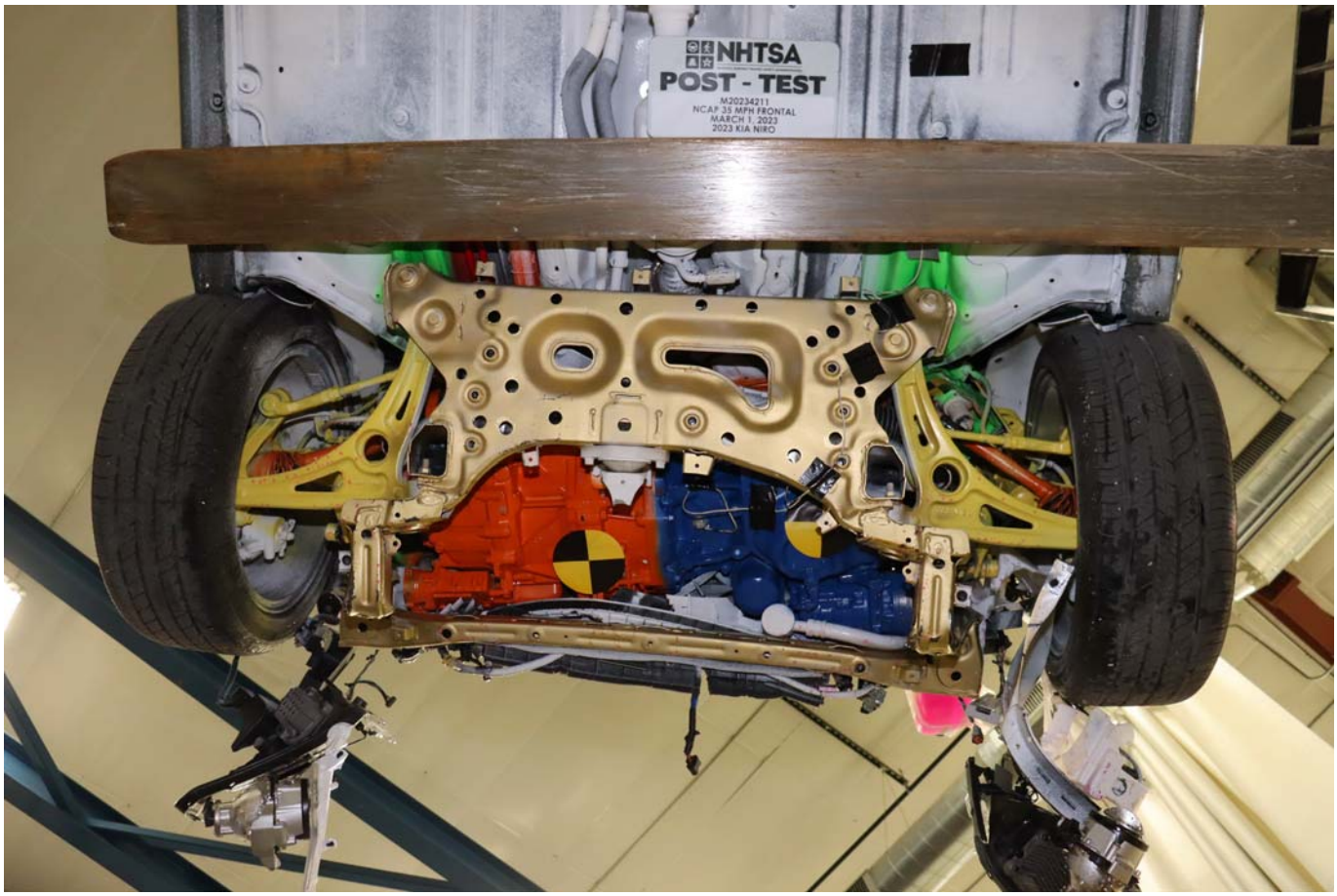


Photo No. 025 - Post-Test Front Underbody View

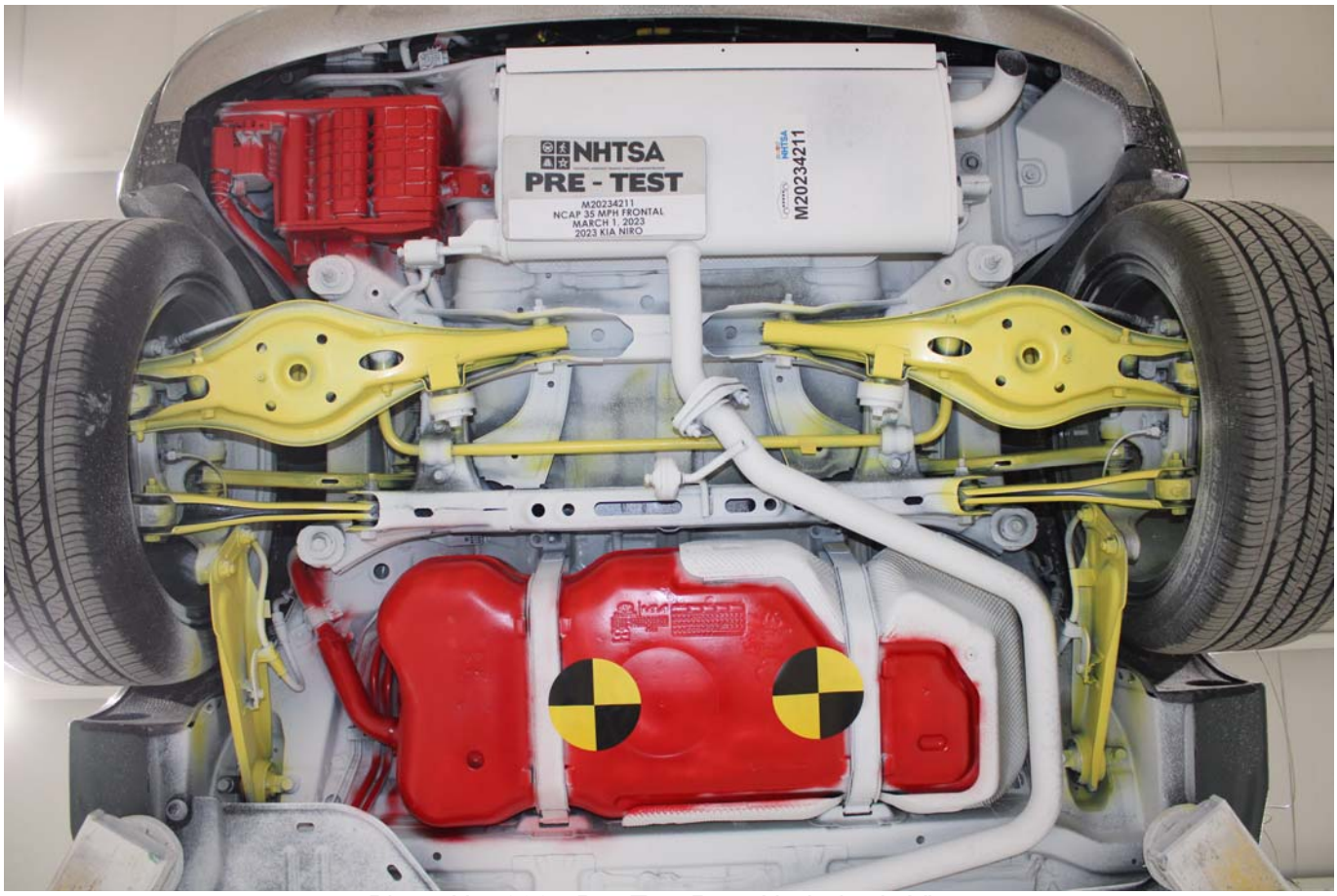


Photo No. 026 - Pre-Test Rear Underbody View

Photo No. 027 - Post-Test Rear Underbody View

Photo No. 028 - Pre-Test Dummy Cable Routing

Photo No. 029 - Post-Test Dummy Cable Routing

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Photo No. 033 - Post-Test Driver Dummy Window View

Photo No. 034 - Pre-Test Driver Dummy and Vehicle Interior View

Photo No. 035 - Post-Test Driver Dummy and Vehicle Interior View

Photo No. 036 - Pre-Test Driver's Seat Fore-Aft Markings

Photo No. 037 - Post-Test Driver's Seat Fore-Aft Markings

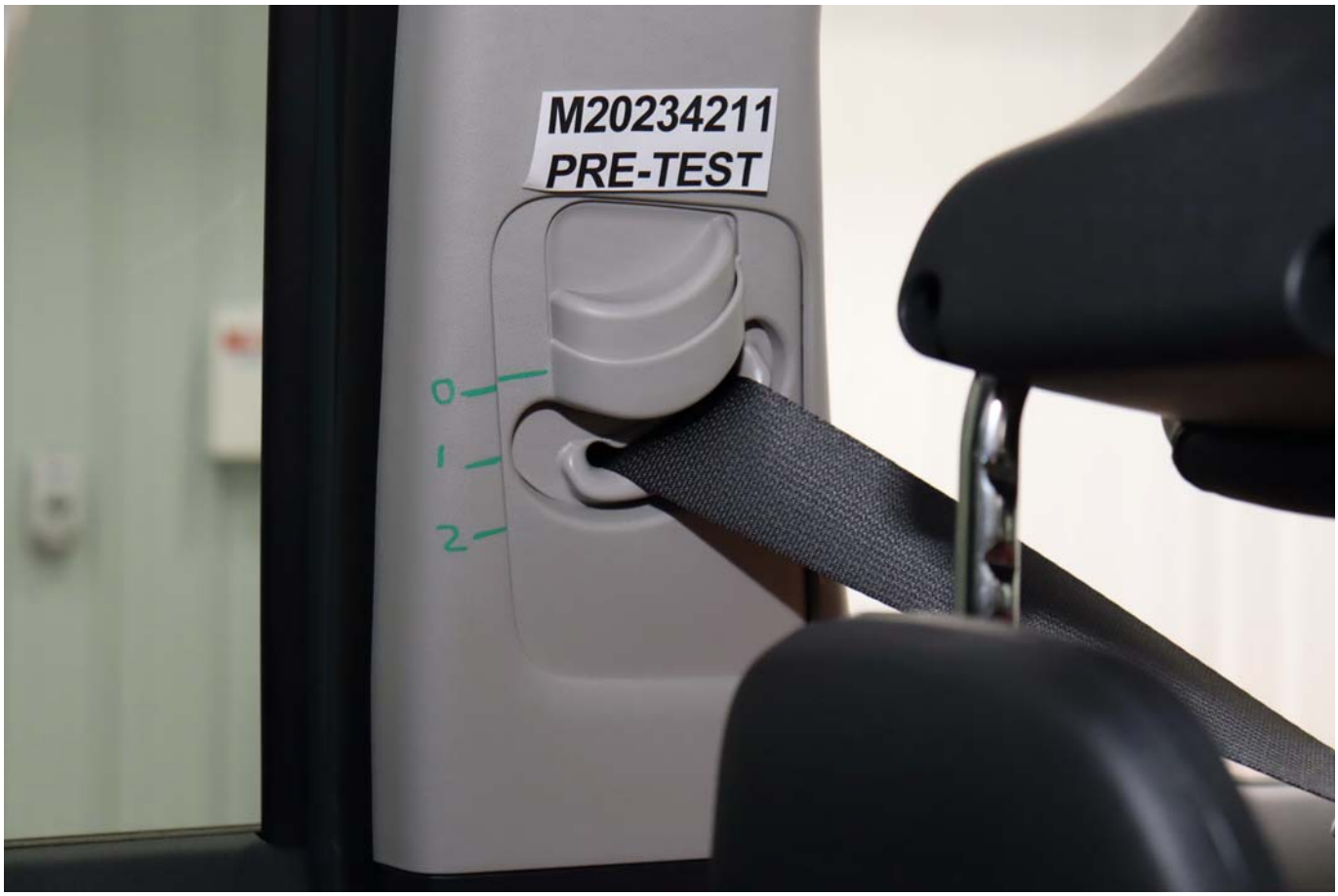

Photo No. 038 - Pre-Test View of Belt Anchorage for Driver Dummy

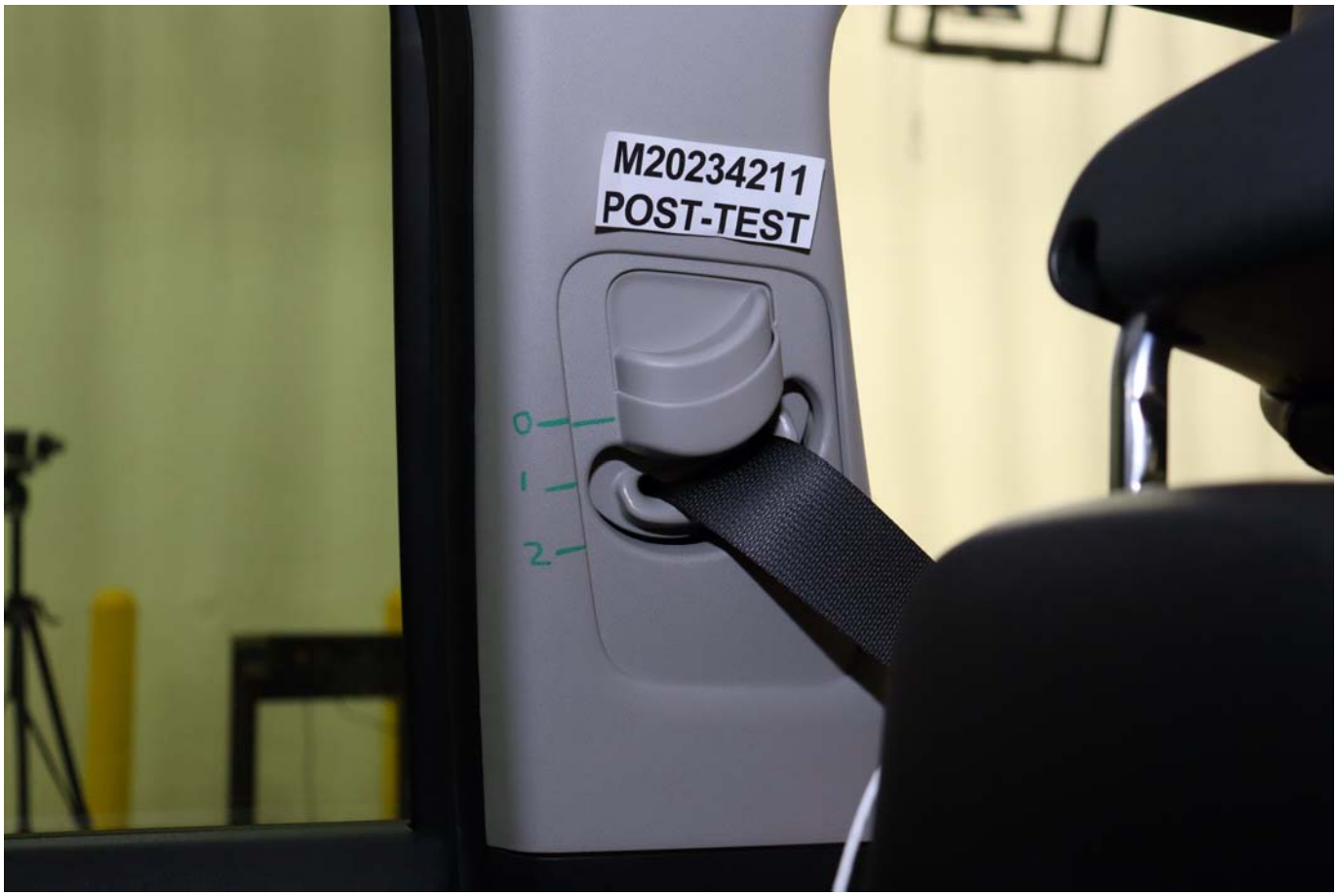

Photo No. 039 - Post-Test View of Belt Anchorage for Driver Dummy

Photo No. 040 - Pre-Test View of Belt Buckle and Latch Plate for Driver Dummy

Photo No. 041 - Post-Test View of Belt Buckle and Latch Plate for Driver Dummy

Photo No. 042 - Pre-Test Driver Dummy Feet

Photo No. 043 - Post-Test Driver Dummy Feet

Photo No. 044 - Pre-Test Driver's Side Knee Bolster

Photo No. 045 - Post-Test Driver's Side Knee Bolster

Photo No. 046 - Pre-Test Driver's Side Floorpan

Photo No. 047 - Post-Test Driver's Side Floorpan

Photo No. 048 - Post-Test Driver Dummy Face

Photo No. 049 - Post-Test Driver Dummy Contact with Airbag

Photo No. 050 - Post-Test Driver Dummy Contact with Headrest

Photo No. 051 - Pre-Test View of the Steering Wheel

Photo No. 052 - Post-Test View of the Steering Wheel

Photo No. 053 - Pre-Test Passenger Dummy Front View

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Photo No. 056 - Post-Test Passenger Dummy Window View

Photo No. 057 - Pre-Test Passenger Dummy and Vehicle Interior View

Photo No. 058 - Post-Test Passenger Dummy and Vehicle Interior View

Photo No. 059 - Pre-Test Passenger's Seat Fore-Aft Markings

Photo No. 060 - Post-Test Passenger's Seat Fore-Aft Markings

Photo No. 061 - Pre-Test View of Belt Anchorage for Passenger Dummy

Photo No. 062 - Post-Test View of Belt Anchorage for Passenger Dummy

Photo No. 063 - Pre-Test View of Belt Buckle and Latch Plate for Passenger Dummy

Photo No. 064 - Post-Test View of Belt Buckle and Latch Plate for Passenger Dummy

Photo No. 065 - Pre-Test Passenger Dummy Feet

Photo No. 066 - Post-Test Passenger Dummy Feet

Photo No. 067 - Pre-Test Passenger's Side Knee Bolster

Photo No. 068 - Post-Test Passenger's Side Knee Bolster

Photo No. 069 - Pre-Test Passenger's Side Floorpan

Photo No. 070 - Post-Test Passenger's Side Floorpan

Photo No. 071 - Post-Test Passenger Dummy Face

Photo No. 072 - Post-Test Passenger Dummy Contact with Airbag

Photo No. 073 - Post-Test Passenger Dummy Contact with Headrest

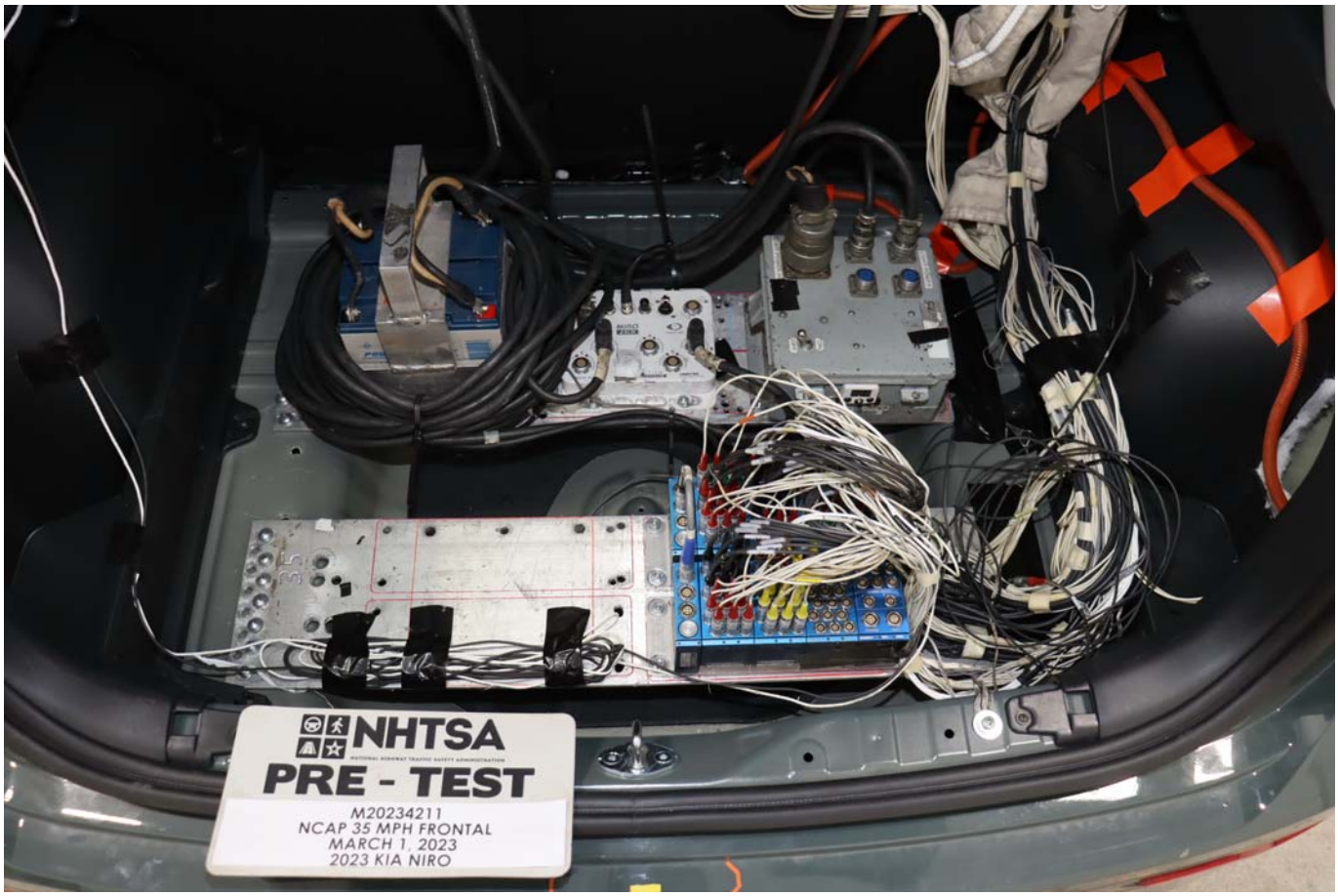


Photo No. 074 - Photograph of Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

Photo No. 075 - Post-Test Stoddard Solvent Spillage Location View

Photo No. 076 - Post-Test Speed Trap Read-Out

Photo No. 077 - Vehicle at 0 Degrees on Static Rollover Device

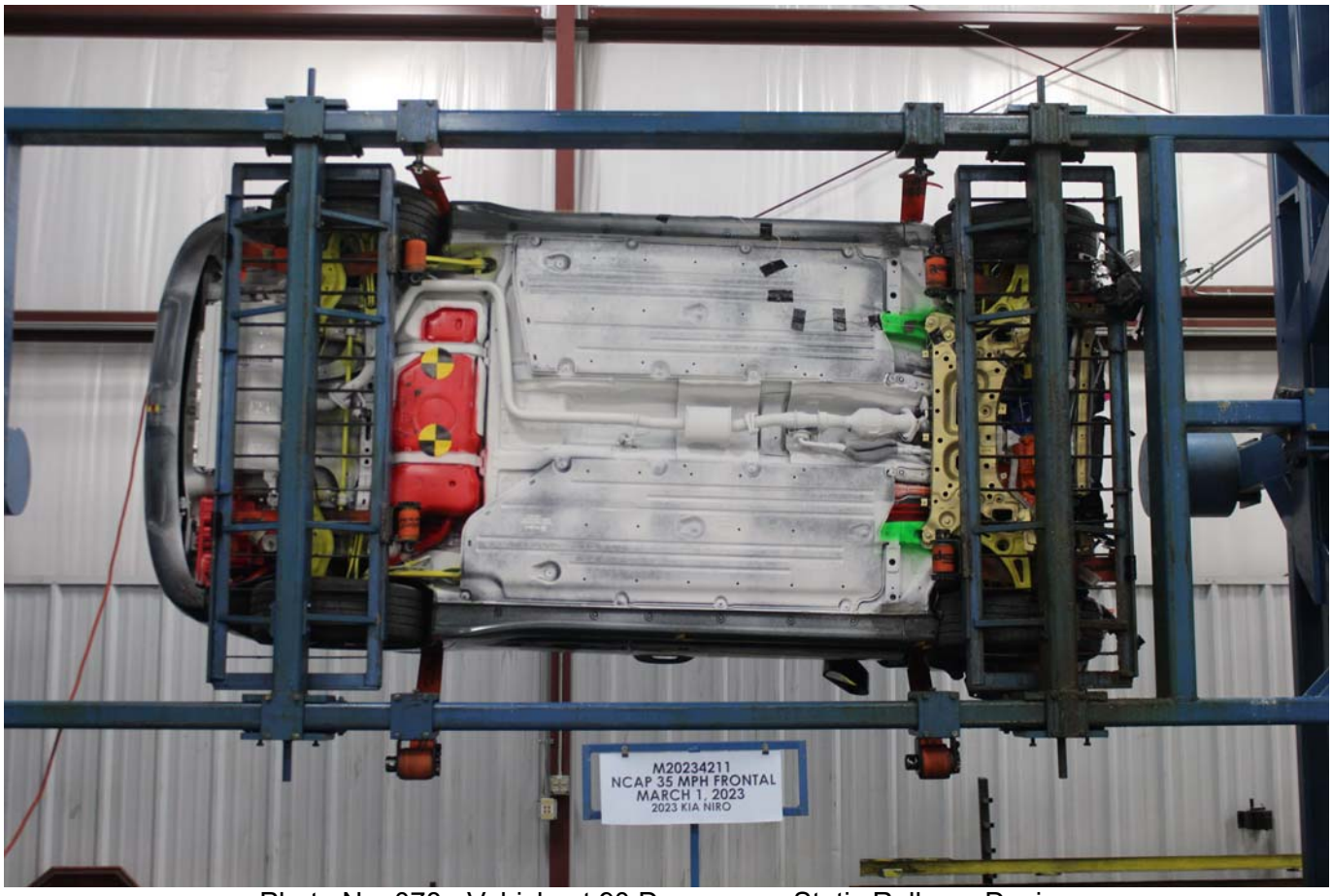


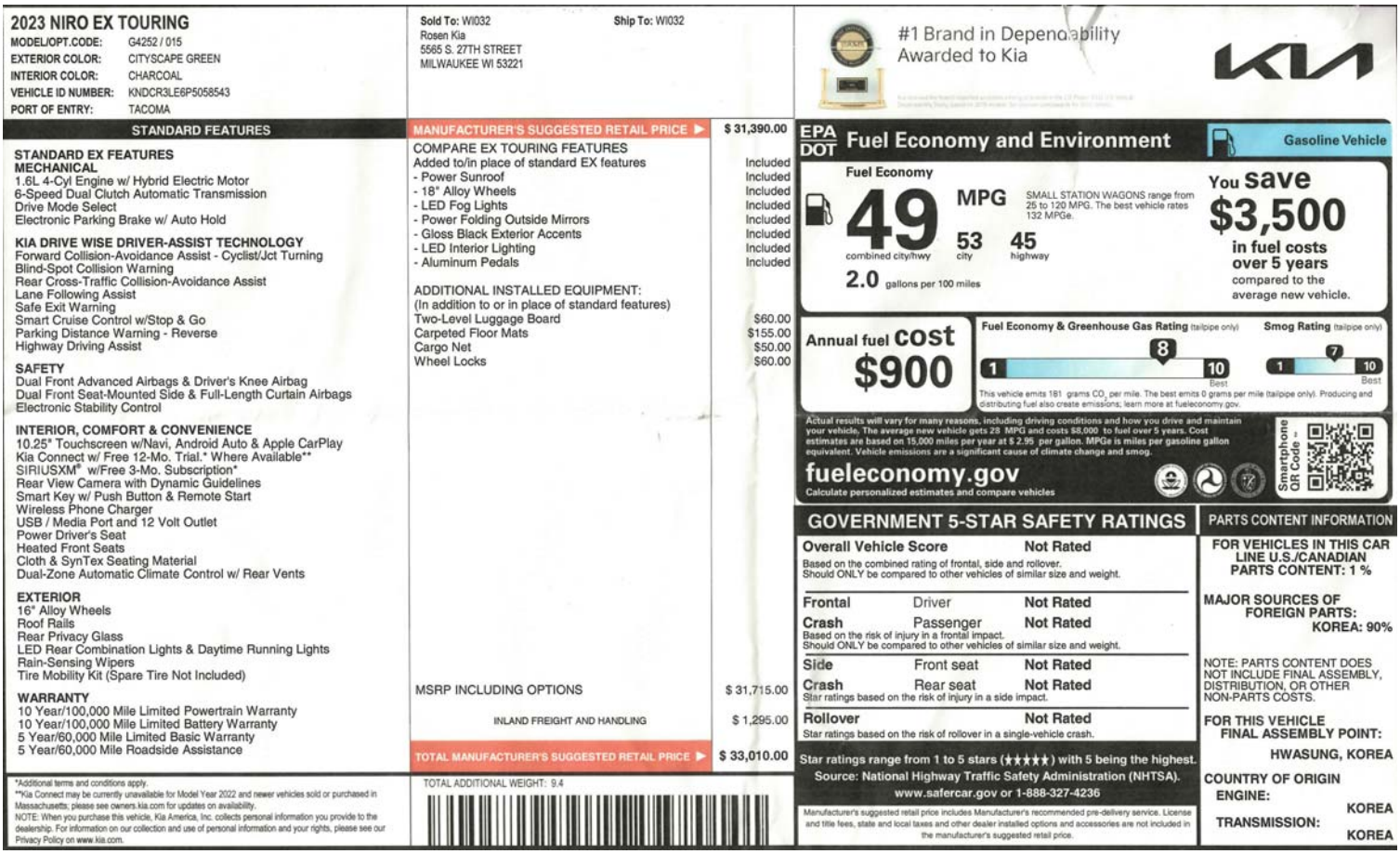
Photo No. 078 - Vehicle at 90 Degrees on Static Rollover Device

Photo No. 079 - Vehicle at 180 Degrees on Static Rollover Device

Photo No. 080 - Vehicle at 270 Degrees on Static Rollover Device

Photo No. 081 - Vehicle at 360 Degrees on Static Rollover Device

Photo No. 082 - 2023 Kia Niro EX Touring 5-Door SUV Frontal Impact Event



2023 NIRO EX TOURING

MODEL/OPT.CODE: G4252 / 015
EXTERIOR COLOR: CITYSCAPE GREEN
INTERIOR COLOR: CHARCOAL
VEHICLE ID NUMBER: KNDCR3LE6P5058543
PORT OF ENTRY: TACOMA

Sold To: WI032
Rosen Kia
5565 S. 27TH STREET
MILWAUKEE WI 53221

Ship To: WI032

#1 Brand in Dependability
Awarded to Kia

KIA

STANDARD FEATURES

STANDARD EX FEATURES
MECHANICAL
1.6L 4-Cyl Engine w/ Hybrid Electric Motor
6-Speed Dual Clutch Automatic Transmission
Drive Mode Select
Electronic Parking Brake w/ Auto Hold

KIA DRIVE WISE DRIVER-ASSIST TECHNOLOGY
Forward Collision-Avoidance Assist - Cyclist/Jct Turning
Blind-Spot Collision Warning
Rear Cross-Traffic Collision-Avoidance Assist
Lane Following Assist
Safe Exit Warning
Smart Cruise Control w/Stop & Go
Parking Distance Warning - Reverse
Highway Driving Assist

SAFETY
Dual Front Advanced Airbags & Driver's Knee Airbag
Dual Front Seat-Mounted Side & Full-Length Curtain Airbags
Electronic Stability Control

INTERIOR, COMFORT & CONVENIENCE
10.25" Touchscreen w/Navi, Android Auto & Apple CarPlay
Kia Connect w/ Free 12-Mo. Trial.* Where Available**
SIRIUSXM® w/Free 3-Mo. Subscription*
Rear View Camera with Dynamic Guidelines
Smart Key w/ Push Button & Remote Start
Wireless Phone Charger
USB / Media Port and 12 Volt Outlet
Power Driver's Seat
Heated Front Seats
Cloth & SynTex Seating Material
Dual-Zone Automatic Climate Control w/ Rear Vents

EXTERIOR
16" Alloy Wheels
Roof Rails
Rear Privacy Glass
LED Rear Combination Lights & Daytime Running Lights
Rain-Sensing Wipers
Tire Mobility Kit (Spare Tire Not Included)

WARRANTY
10 Year/100,000 Mile Limited Powertrain Warranty
10 Year/100,000 Mile Limited Battery Warranty
5 Year/60,000 Mile Limited Basic Warranty
5 Year/60,000 Mile Roadside Assistance

*Additional terms and conditions apply.
**Kia Connect may be currently unavailable for Model Year 2022 and newer vehicles sold or purchased in Massachusetts; please see owners.kia.com for updates on availability.
NOTE: When you purchase this vehicle, Kia America, Inc. collects personal information you provide to the dealership. For information on our collection and use of personal information and your rights, please see our Privacy Policy on www.kia.com.

MANUFACTURER'S SUGGESTED RETAIL PRICE ▶	$ 31,390.00
COMPARE EX TOURING FEATURES	
Added to/in place of standard EX features	Included
- Power Sunroof	Included
- 18" Alloy Wheels	Included
- LED Fog Lights	Included
- Power Folding Outside Mirrors	Included
- Gloss Black Exterior Accents	Included
- LED Interior Lighting	Included
- Aluminum Pedals	Included
ADDITIONAL INSTALLED EQUIPMENT: (In addition to or in place of standard features)	
Two-Level Luggage Board	$60.00
Carpeted Floor Mats	$155.00
Cargo Net	$50.00
Wheel Locks	$60.00
MSRP INCLUDING OPTIONS	$ 31,715.00
INLAND FREIGHT AND HANDLING	$ 1,295.00
TOTAL MANUFACTURER'S SUGGESTED RETAIL PRICE ▶	$ 33,010.00

TOTAL ADDITIONAL WEIGHT: 9.4

EPA DOT Fuel Economy and Environment — Gasoline Vehicle

Fuel Economy
49 MPG
combined city/hwy
53 city
45 highway
2.0 gallons per 100 miles

SMALL STATION WAGONS range from 25 to 120 MPG. The best vehicle rates 132 MPGe.

You save **$3,500** in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost **$900**

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 8 (1 – 10 Best)
Smog Rating (tailpipe only): 7 (1 – 10 Best)

This vehicle emits 181 grams CO_2 per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fueleconomy.gov.

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 28 MPG and costs $8,000 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $ 2.95 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fueleconomy.gov
Calculate personalized estimates and compare vehicles

Smartphone QR Code

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score: Not Rated
Based on the combined rating of frontal, side and rollover.
Should ONLY be compared to other vehicles of similar size and weight.

Frontal Crash — Driver: Not Rated; Passenger: Not Rated
Based on the risk of injury in a frontal impact.
Should ONLY be compared to other vehicles of similar size and weight.

Side Crash — Front seat: Not Rated; Rear seat: Not Rated
Star ratings based on the risk of injury in a side impact.

Rollover: Not Rated
Star ratings based on the risk of rollover in a single-vehicle crash.

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.
Source: National Highway Traffic Safety Administration (NHTSA).
www.safercar.gov or 1-888-327-4236

Manufacturer's suggested retail price includes Manufacturer's recommended pre-delivery service. License and title fees, state and local taxes and other dealer installed options and accessories are not included in the manufacturer's suggested retail price.

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CAR LINE U.S./CANADIAN PARTS CONTENT: 1 %

MAJOR SOURCES OF FOREIGN PARTS: KOREA: 90%

NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.

FOR THIS VEHICLE FINAL ASSEMBLY POINT: HWASUNG, KOREA

COUNTRY OF ORIGIN
ENGINE: KOREA
TRANSMISSION: KOREA

Photo No. 083 - Monroney Label Photograph

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-01 - Auxiliary Power Module Warning Label

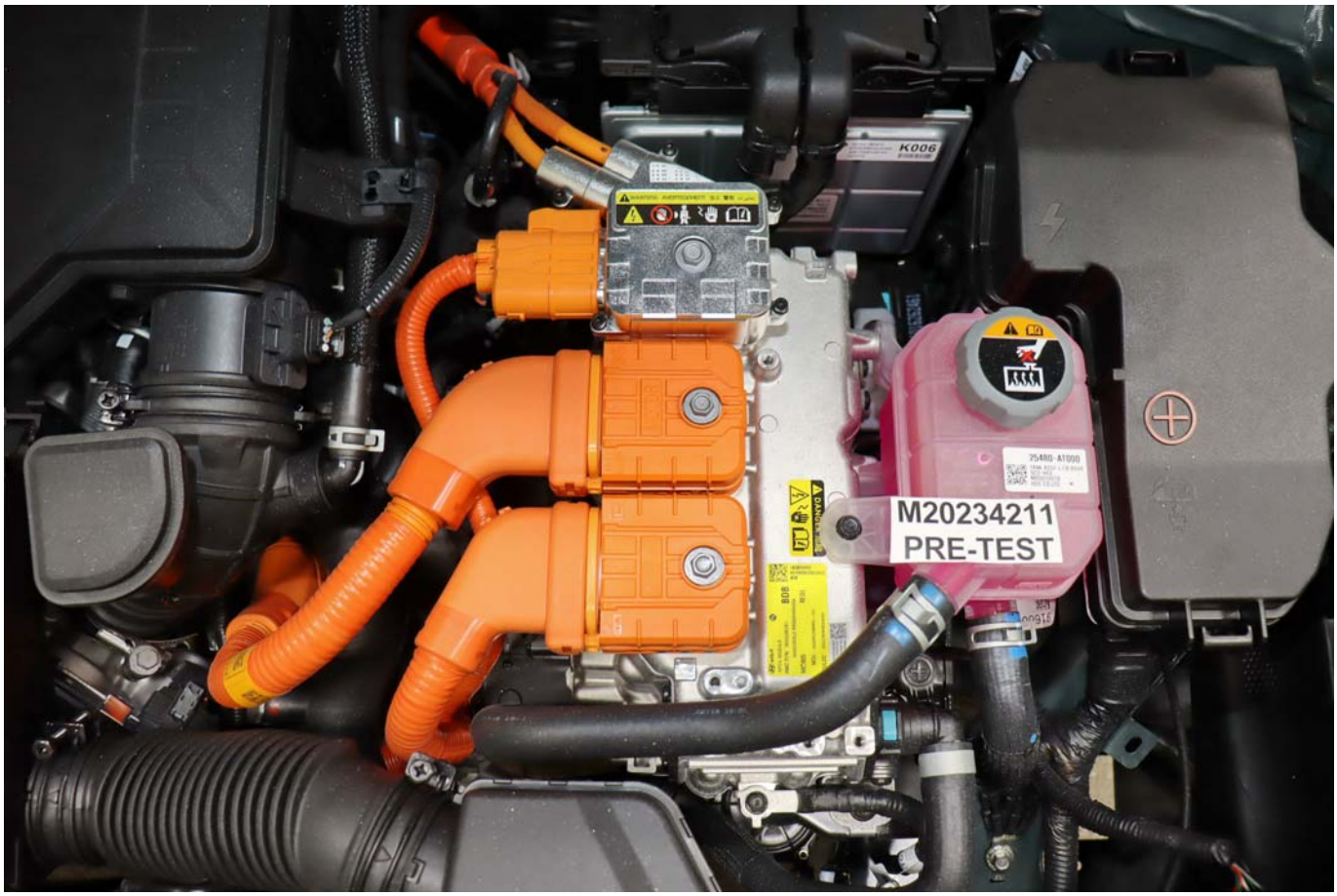


Photo No. 305-02 - Power Inverter Warning Label

Photo No. 305-03 - First Responder Warning Label

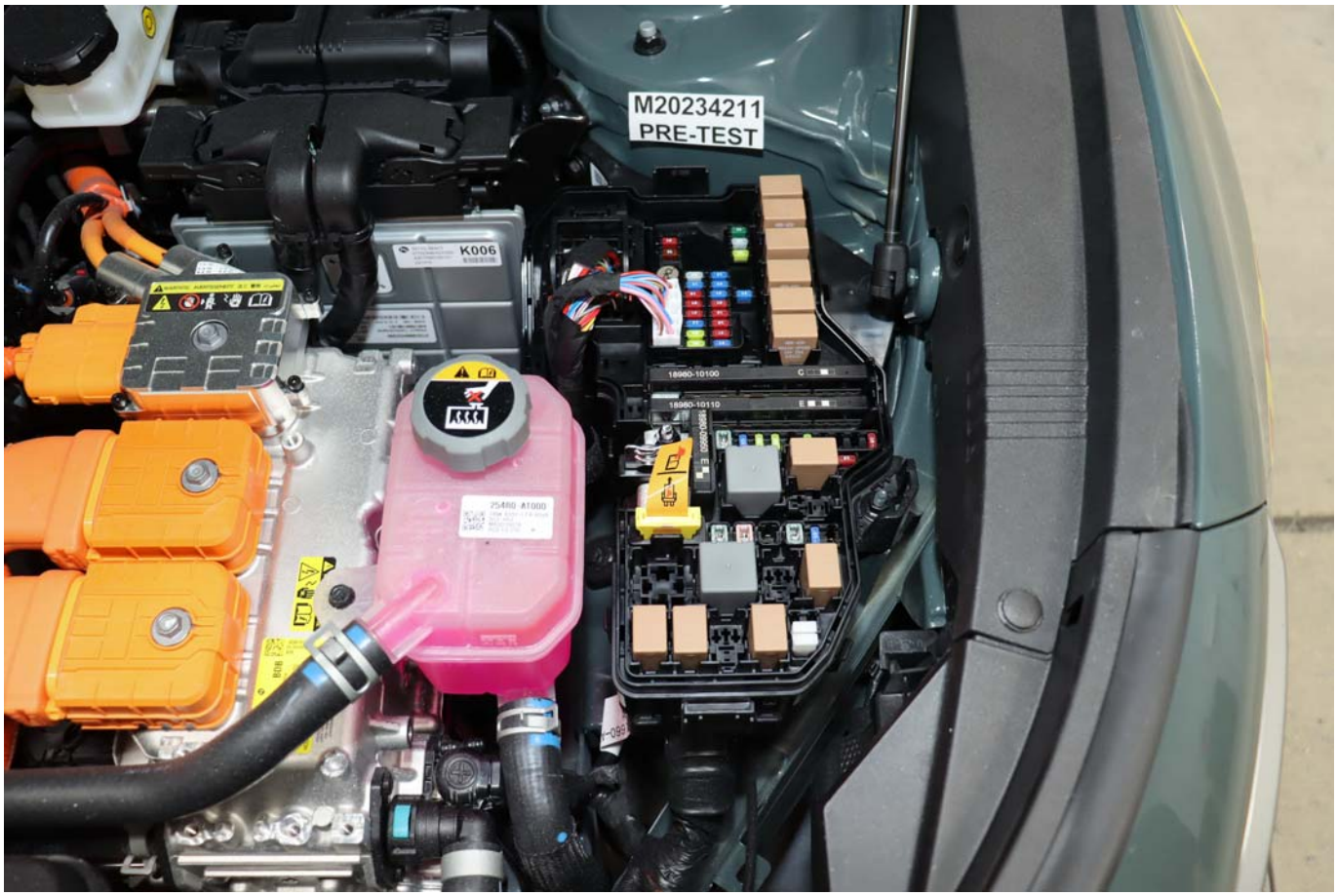


Photo No. 305-04 - First Responder Warning Location

Photo No. 305-05 - Other Vehicle Label(s) Related to Electrical Propulsion System

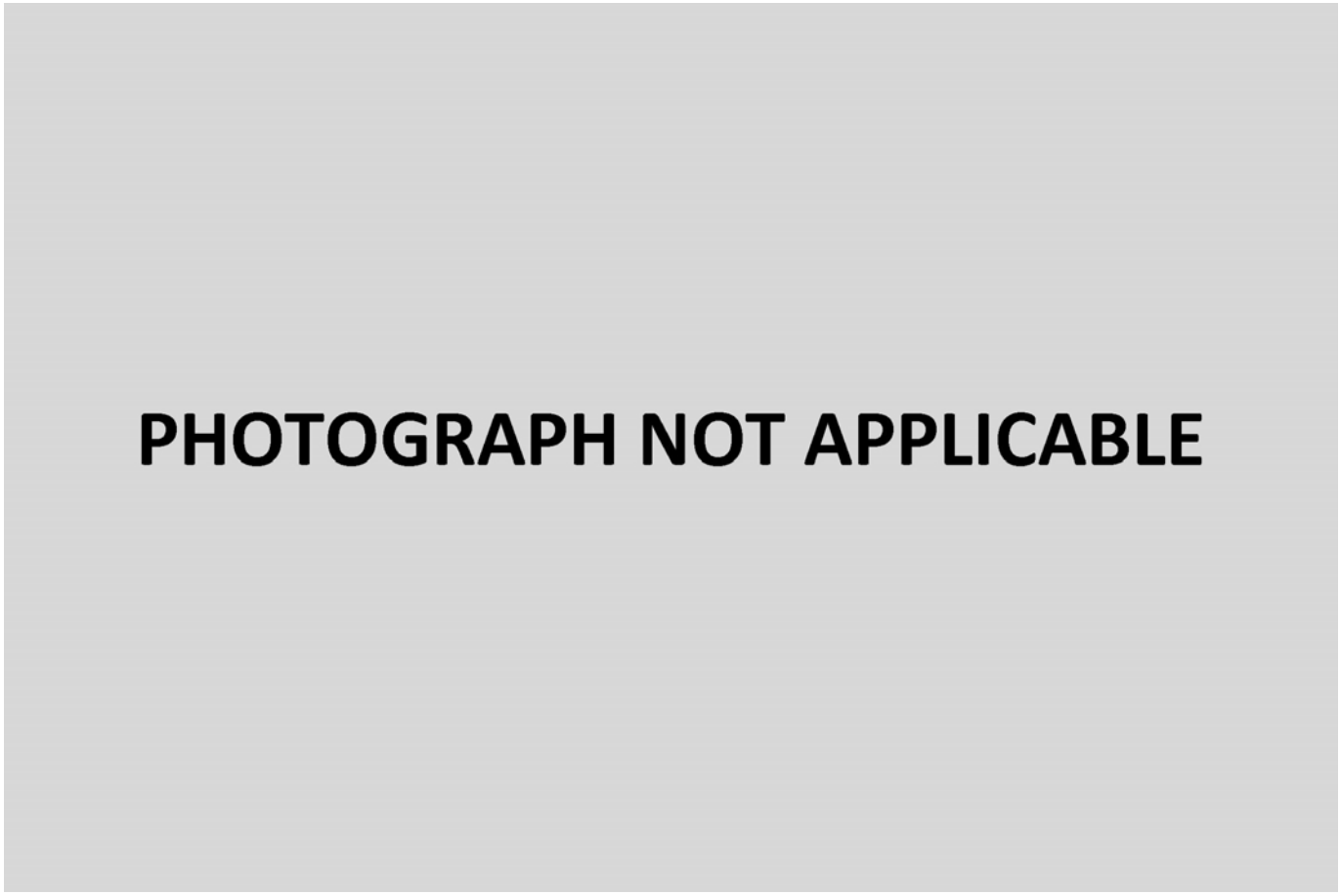


Photo No. 305-06 - Manual High Voltage Service Disconnect in Place

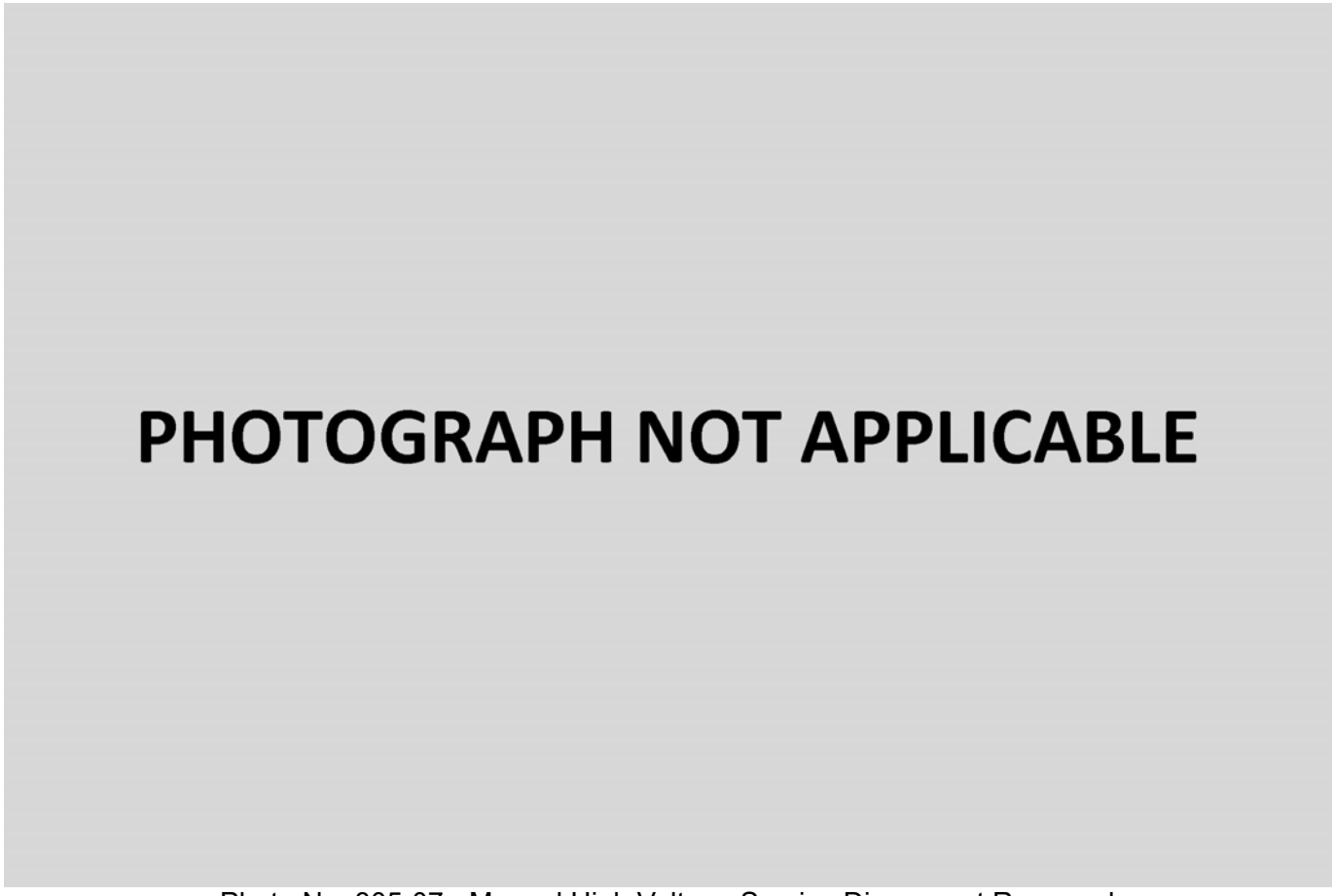


Photo No. 305-07 - Manual High Voltage Service Disconnect Removed

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-08 - Manual High Voltage Service Disconnect Removed

Photo No. 305-09 - Pre-Impact View of Propulsion Battery

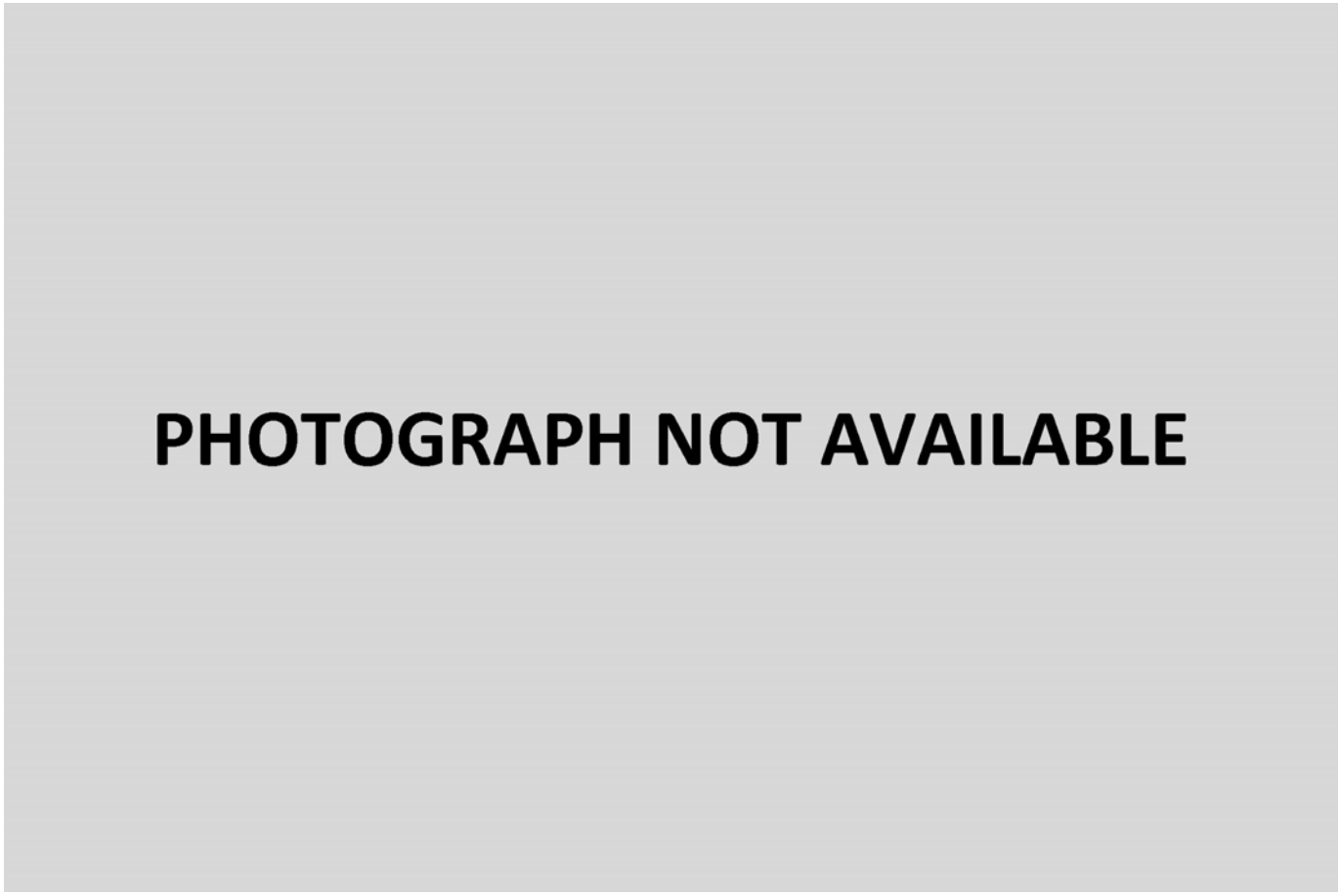


Photo No. 305-10 - Post-Impact Front View of Propulsion Battery

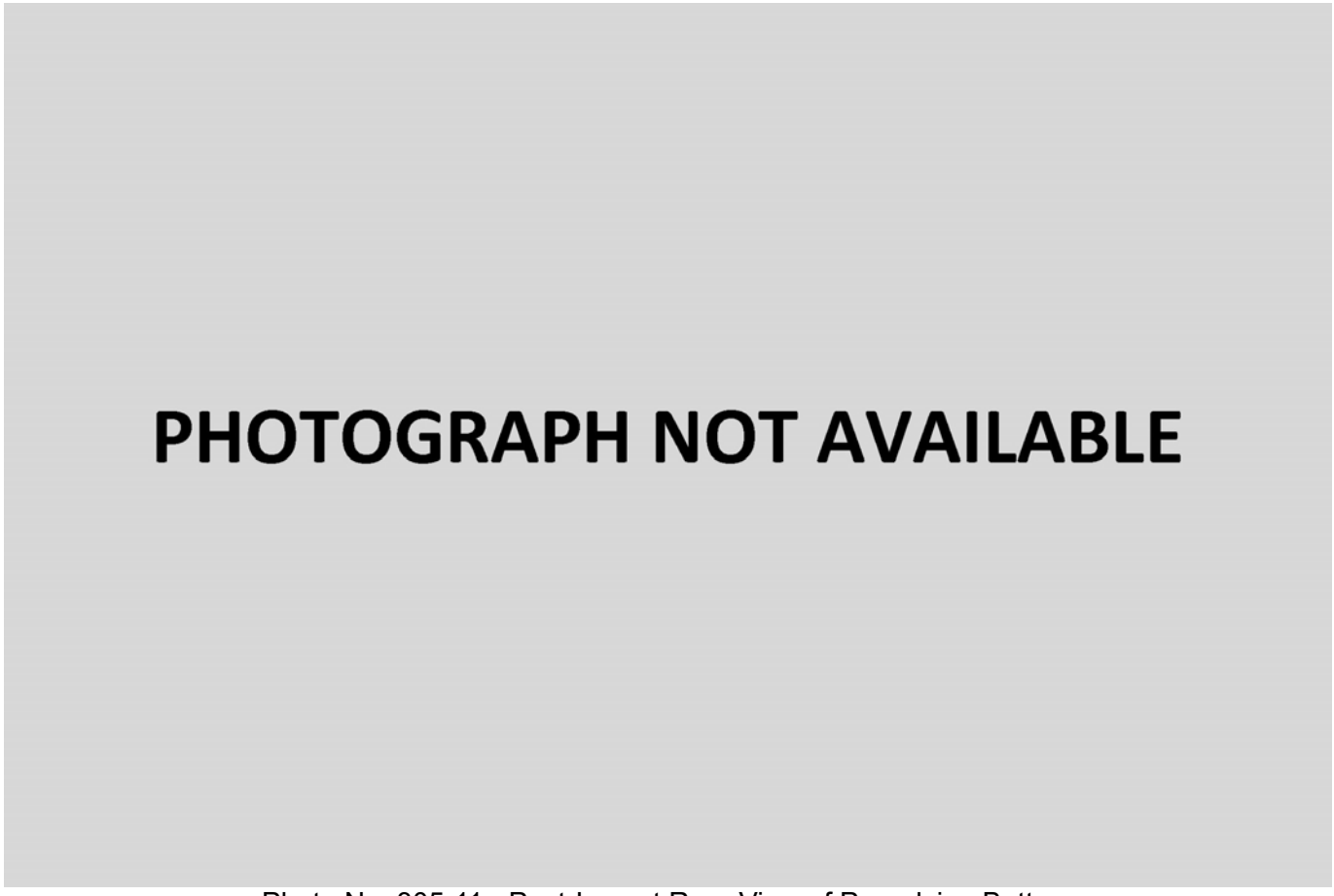


Photo No. 305-11 - Post-Impact Rear View of Propulsion Battery

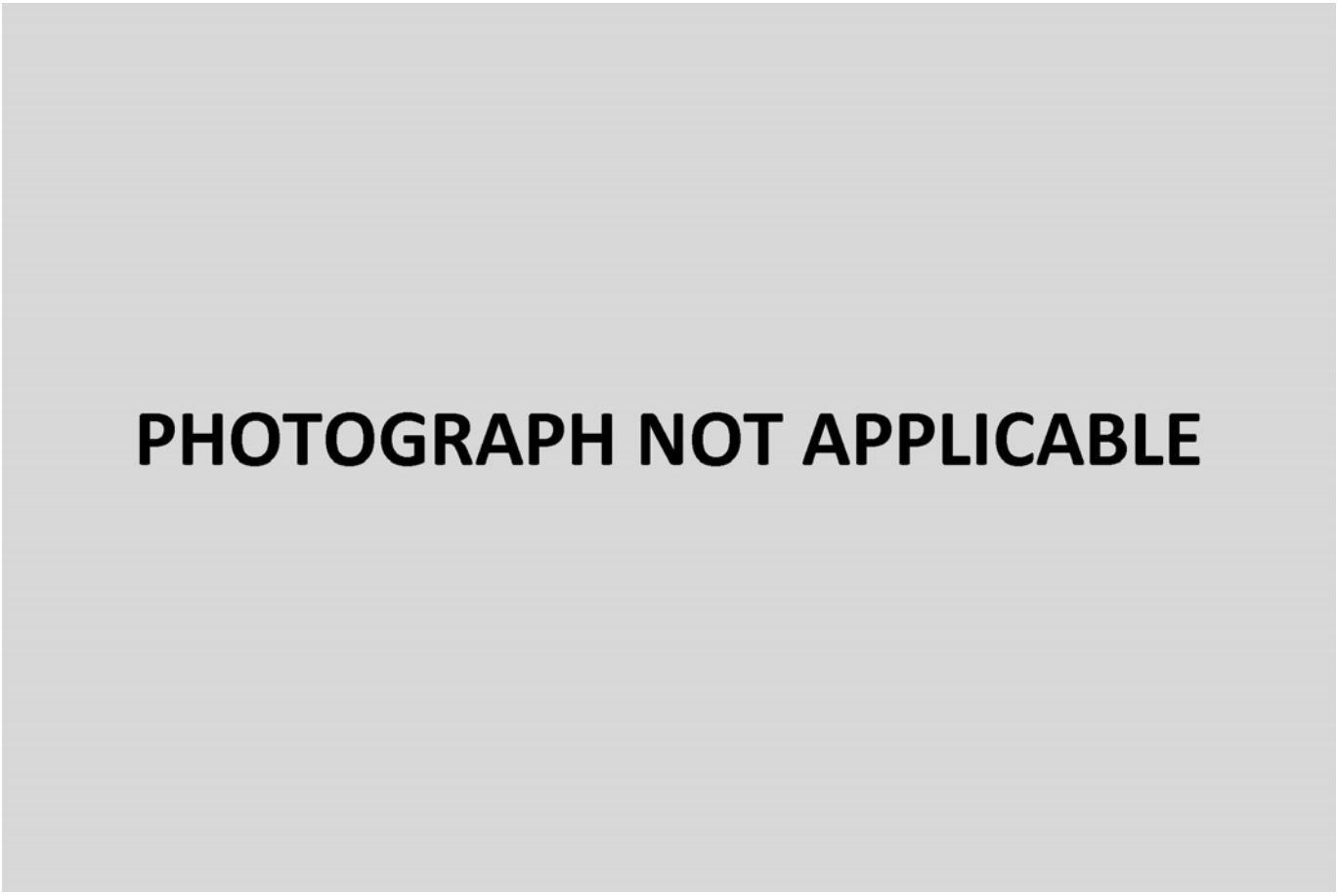


Photo No. 305-12 - Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

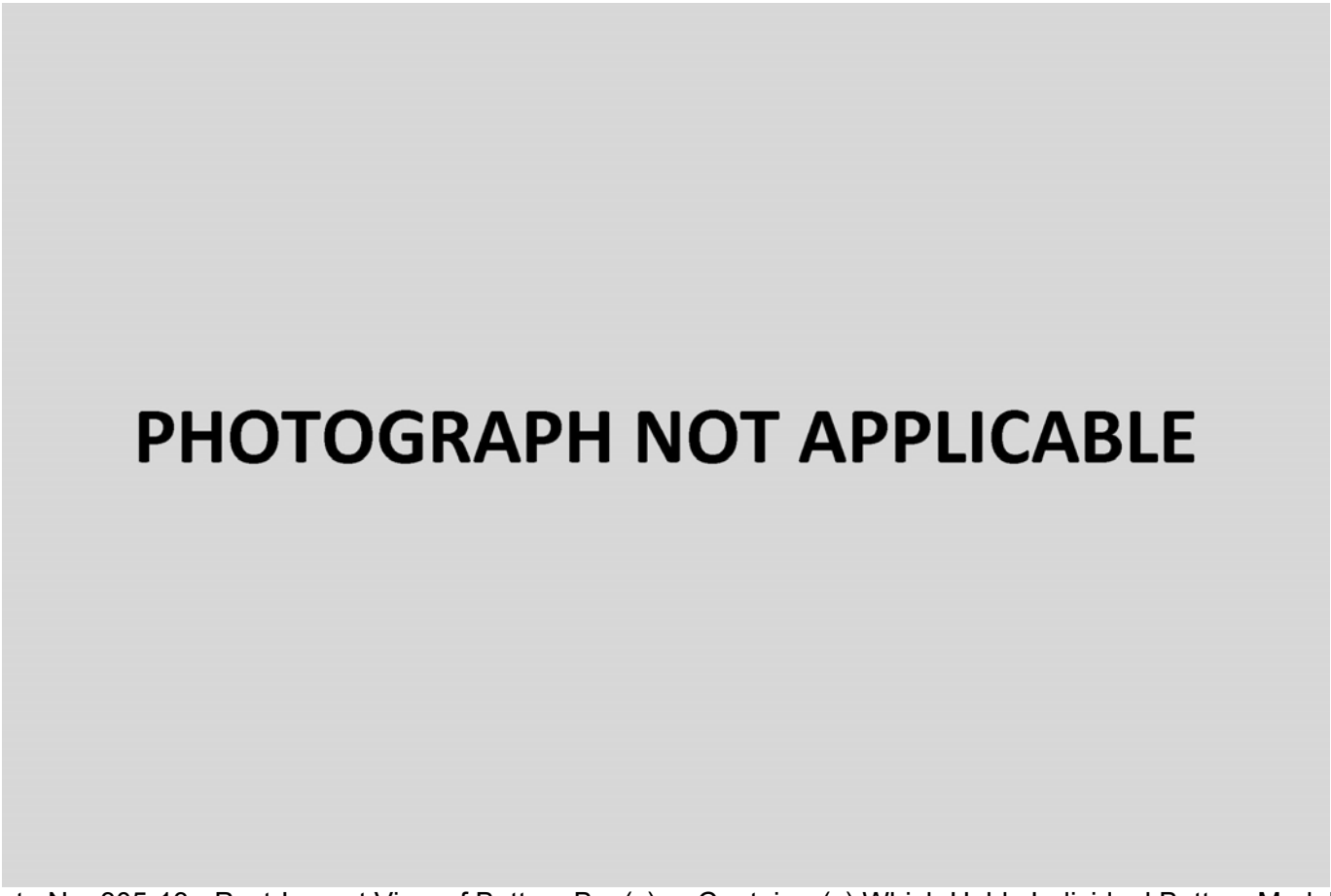


Photo No. 305-13 - Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

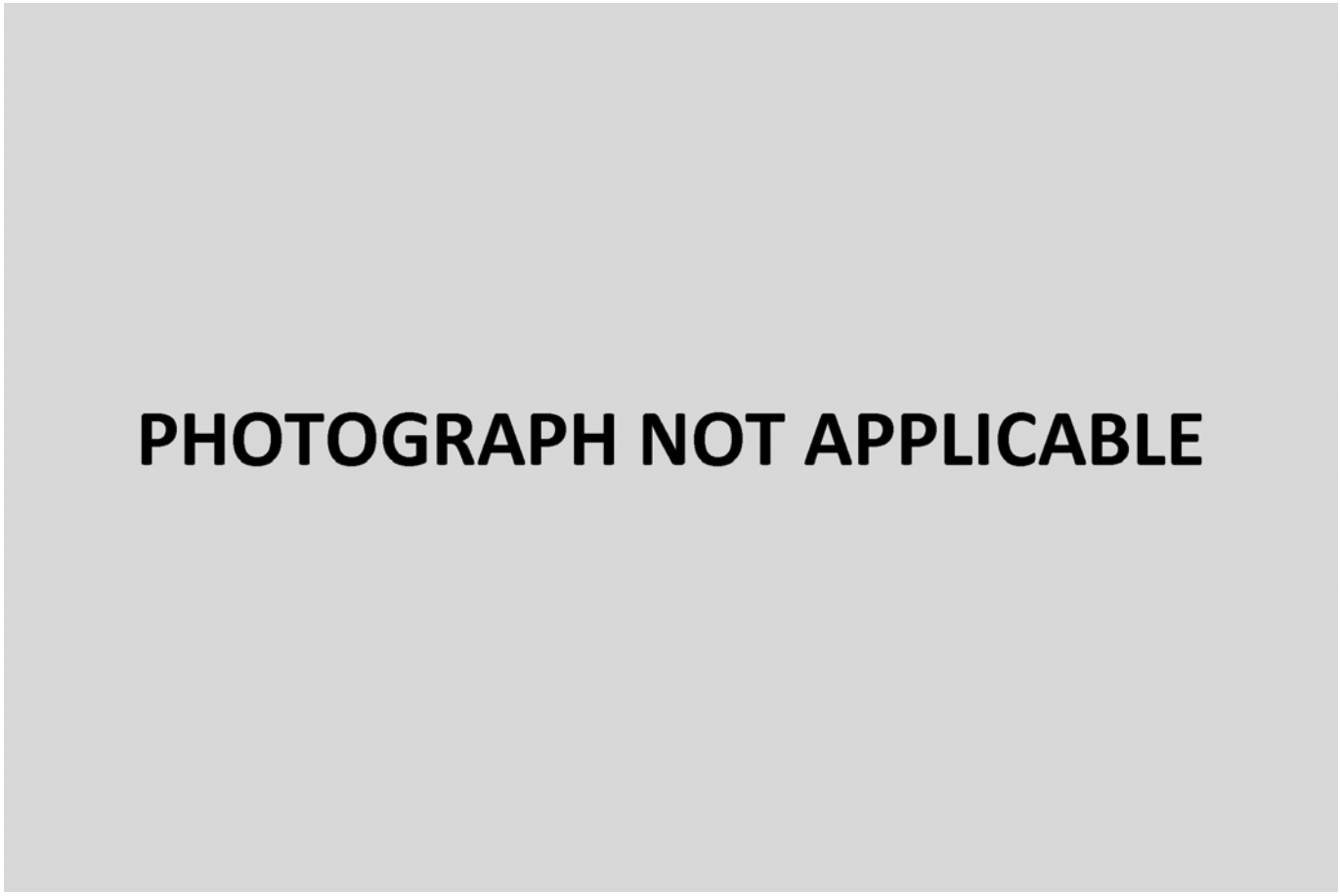


Photo No. 305-14 - Pre-Impact View of Propulsion Battery Module(s)

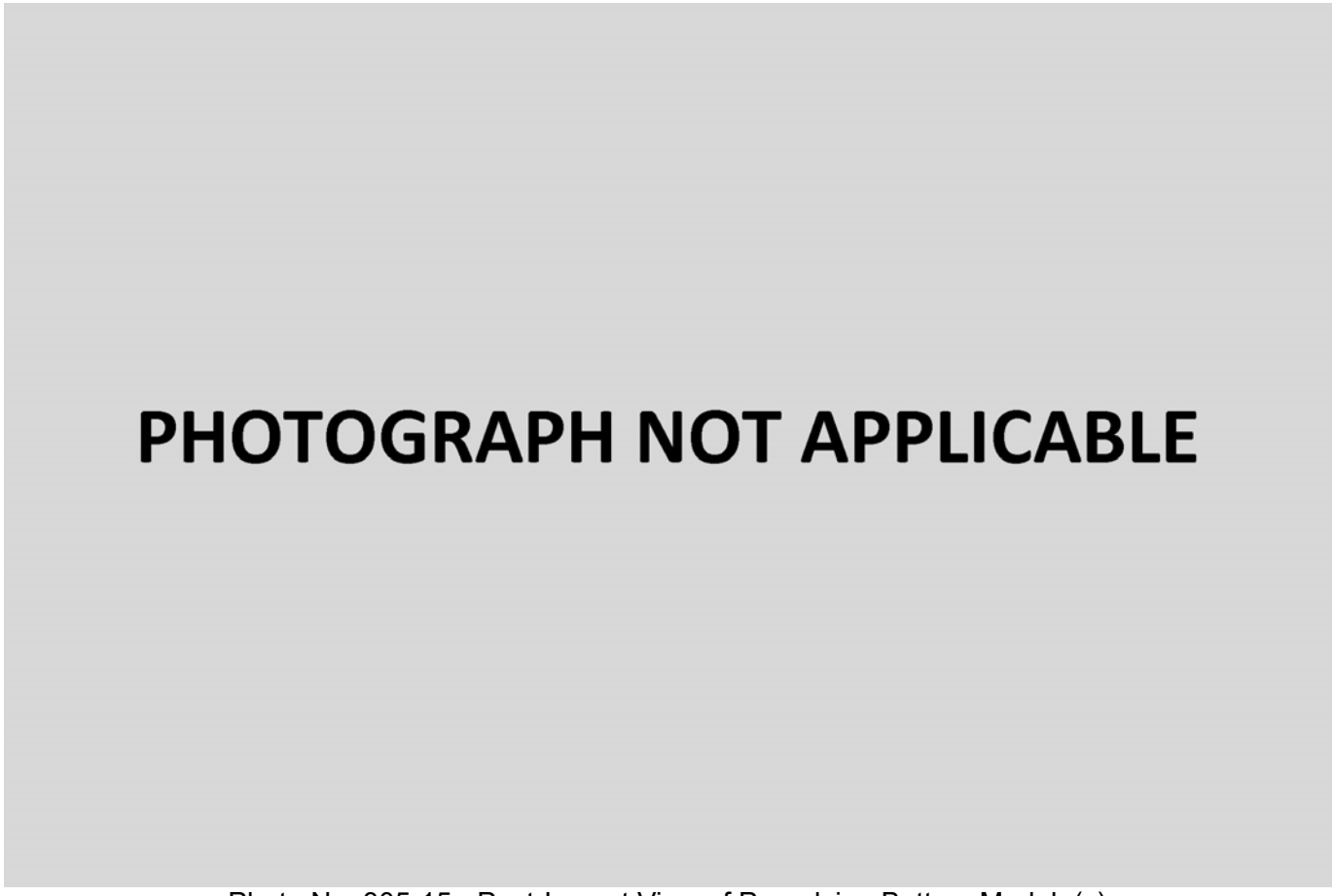


Photo No. 305-15 - Post-Impact View of Propulsion Battery Module(s)

Photo No. 305-16 - Pre-Impact View of Electric Propulsion Drive

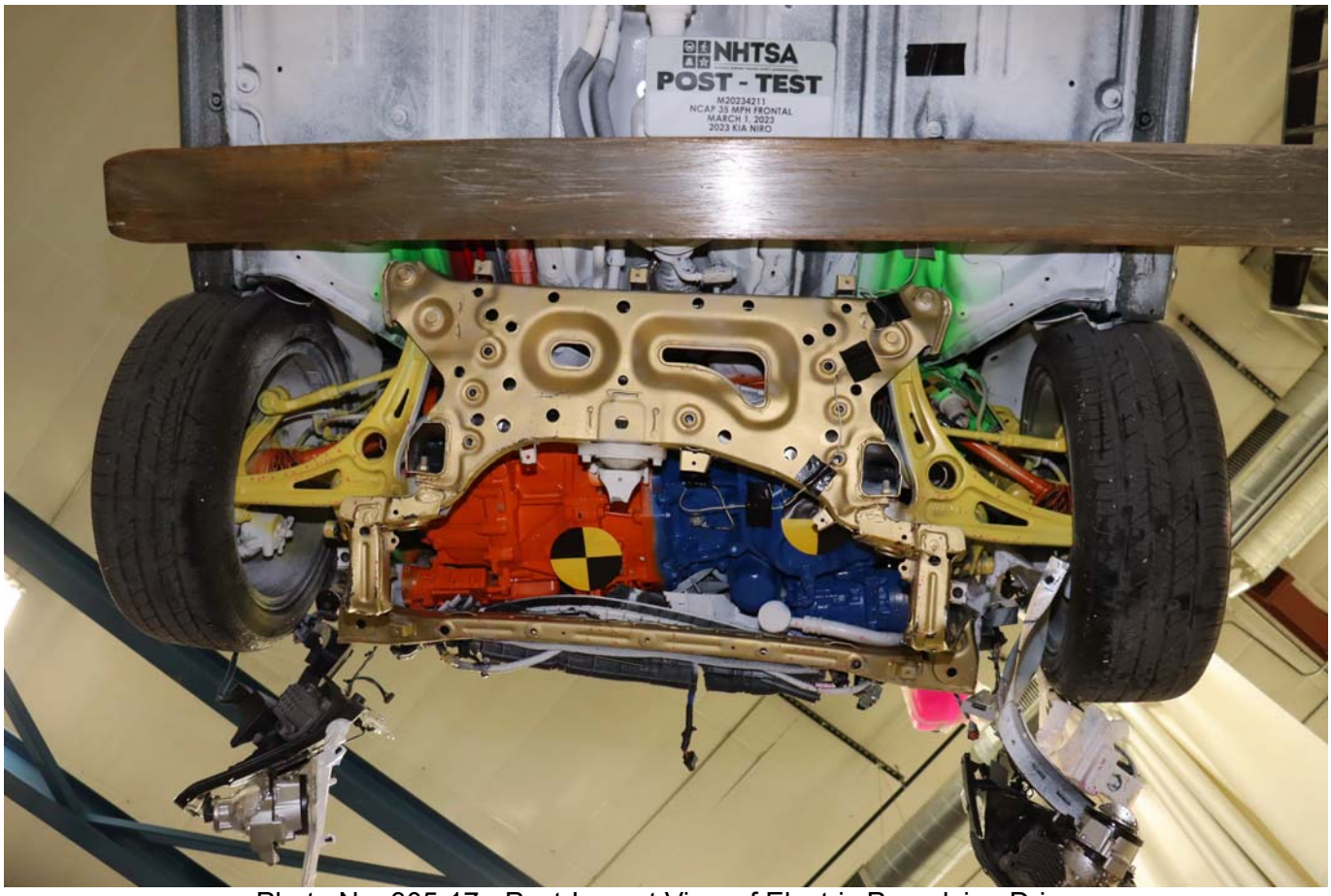


Photo No. 305-17 - Post-Impact View of Electric Propulsion Drive

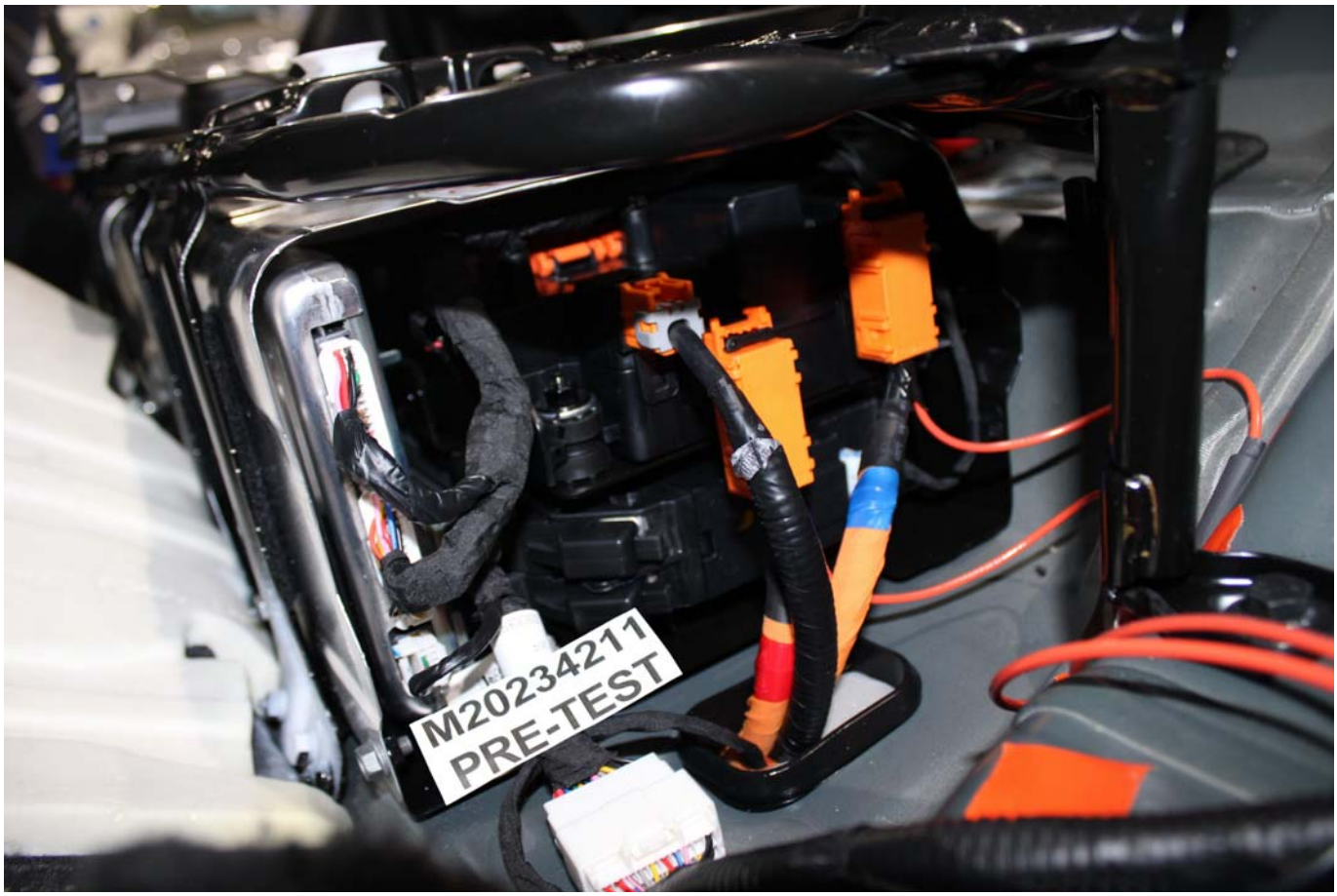


Photo No. 305-18 - Pre-Impact View of High Voltage Interconnect(s)

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-19 - Pre-Impact View Propulsion Battery Venting System(s)

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-20 - Pre-Impact View of Other Visible Electric Propulsion Components

Photo No. 305-21 - Pre-Impact View of Ground Lead Attached

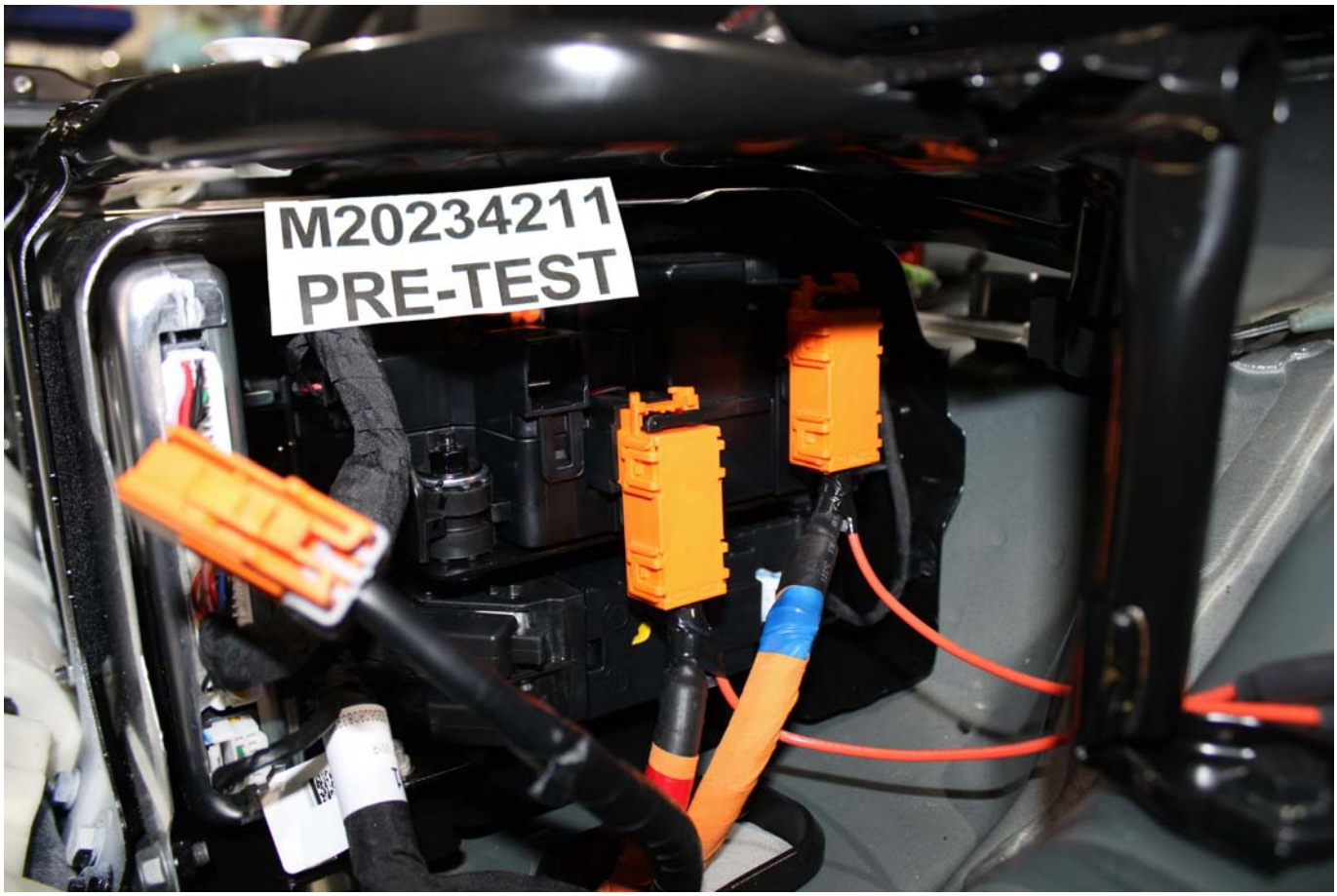


Photo No. 305-22 - Pre-Impact View of High Voltage Leads Attached

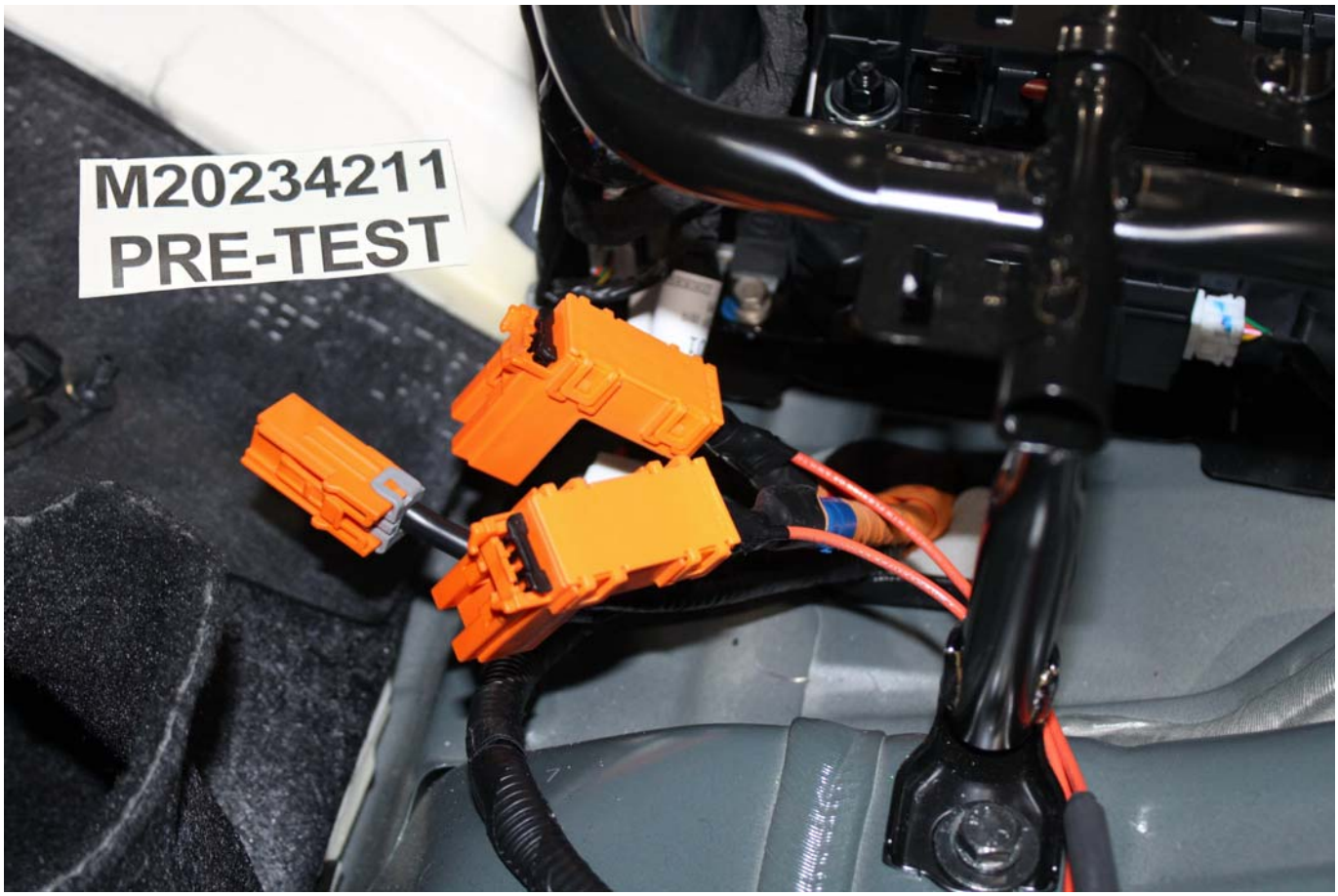


Photo No. 305-23 - Pre-Impact Close-Up View of High Voltage Leads Attached

Photo No. 305-24 - Pre-Impact View of Installed Test Interface Port

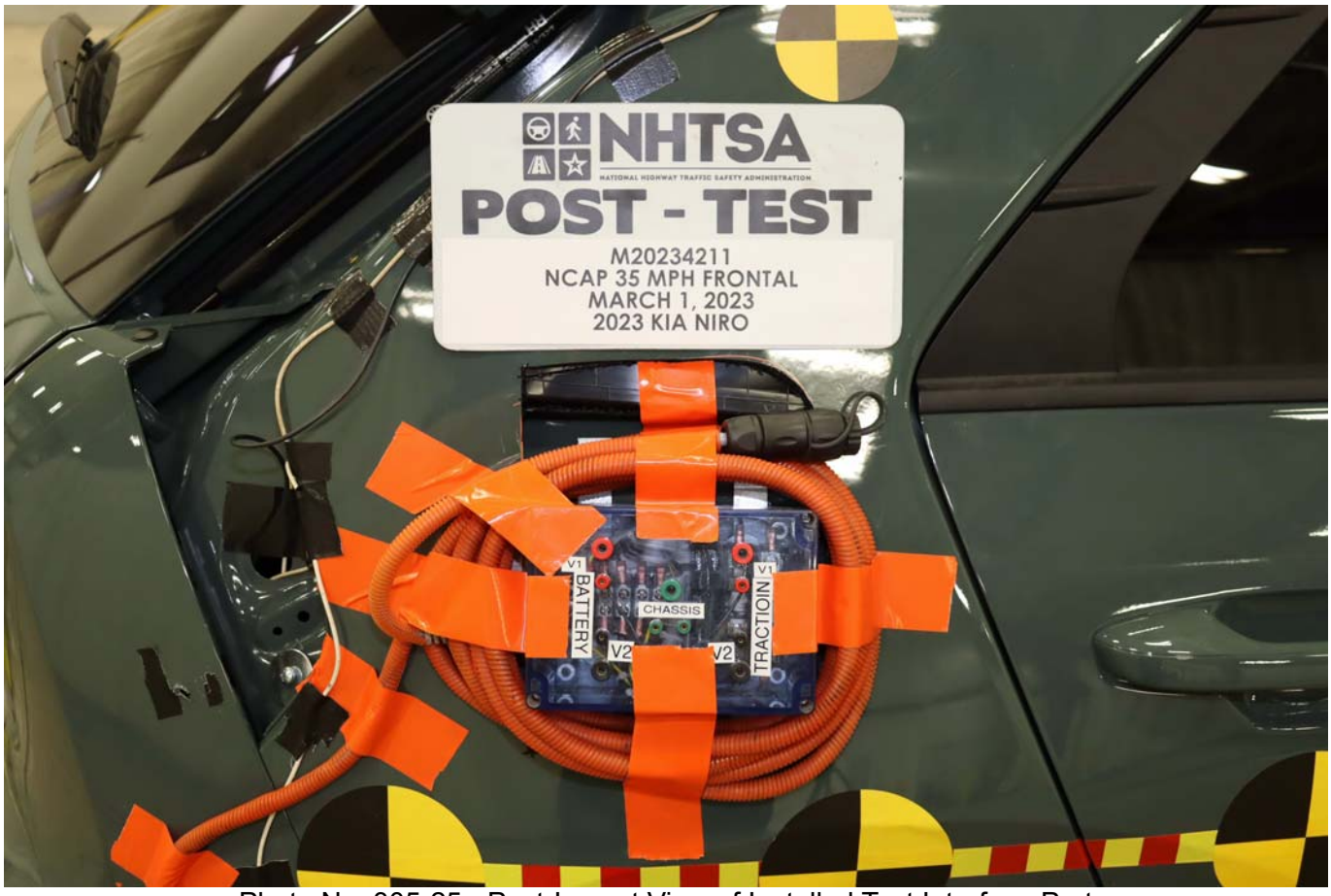


Photo No. 305-25 - Post-Impact View of Installed Test Interface Port

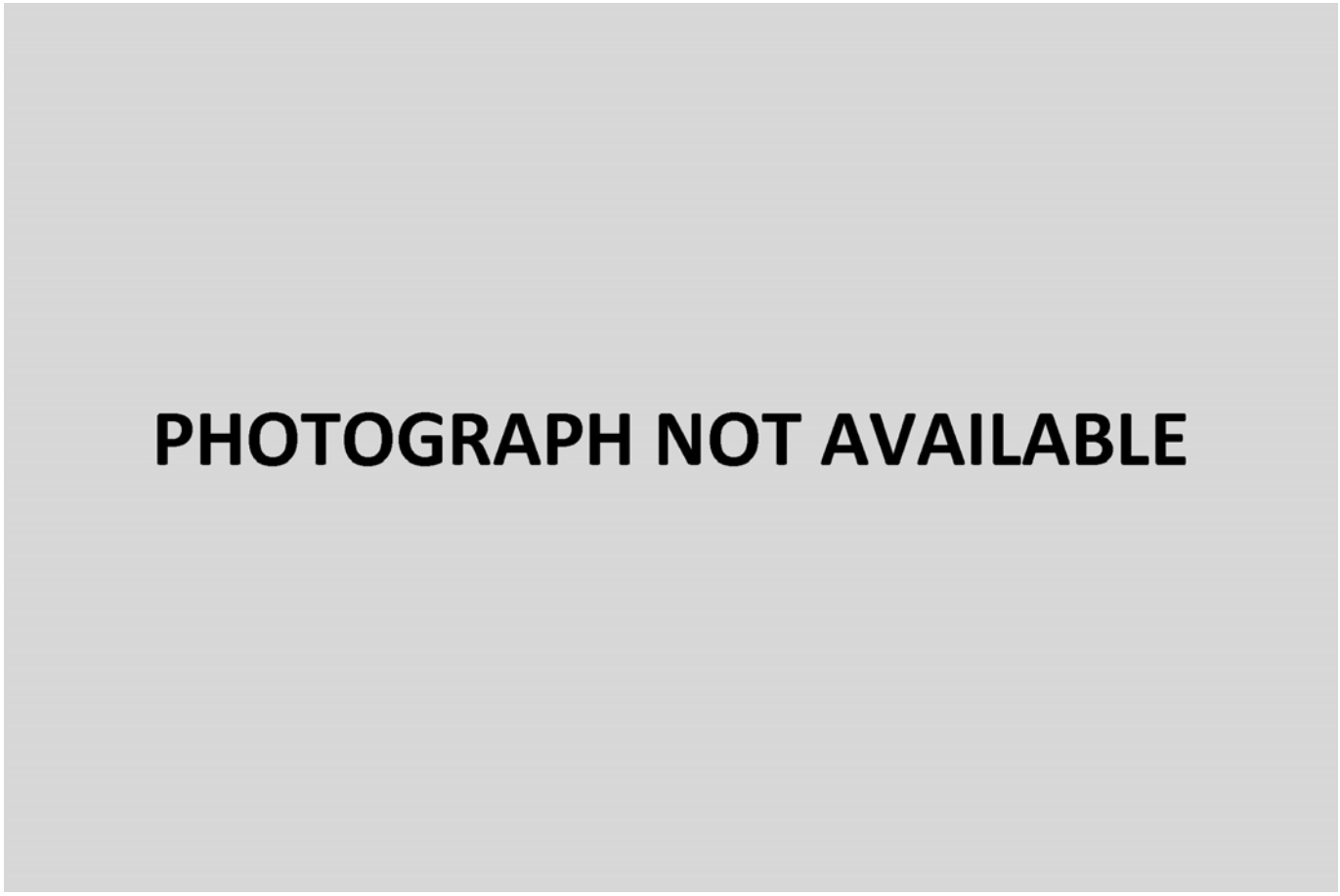


Photo No. 305-26 - Pre-Impact View of Other Test Devices

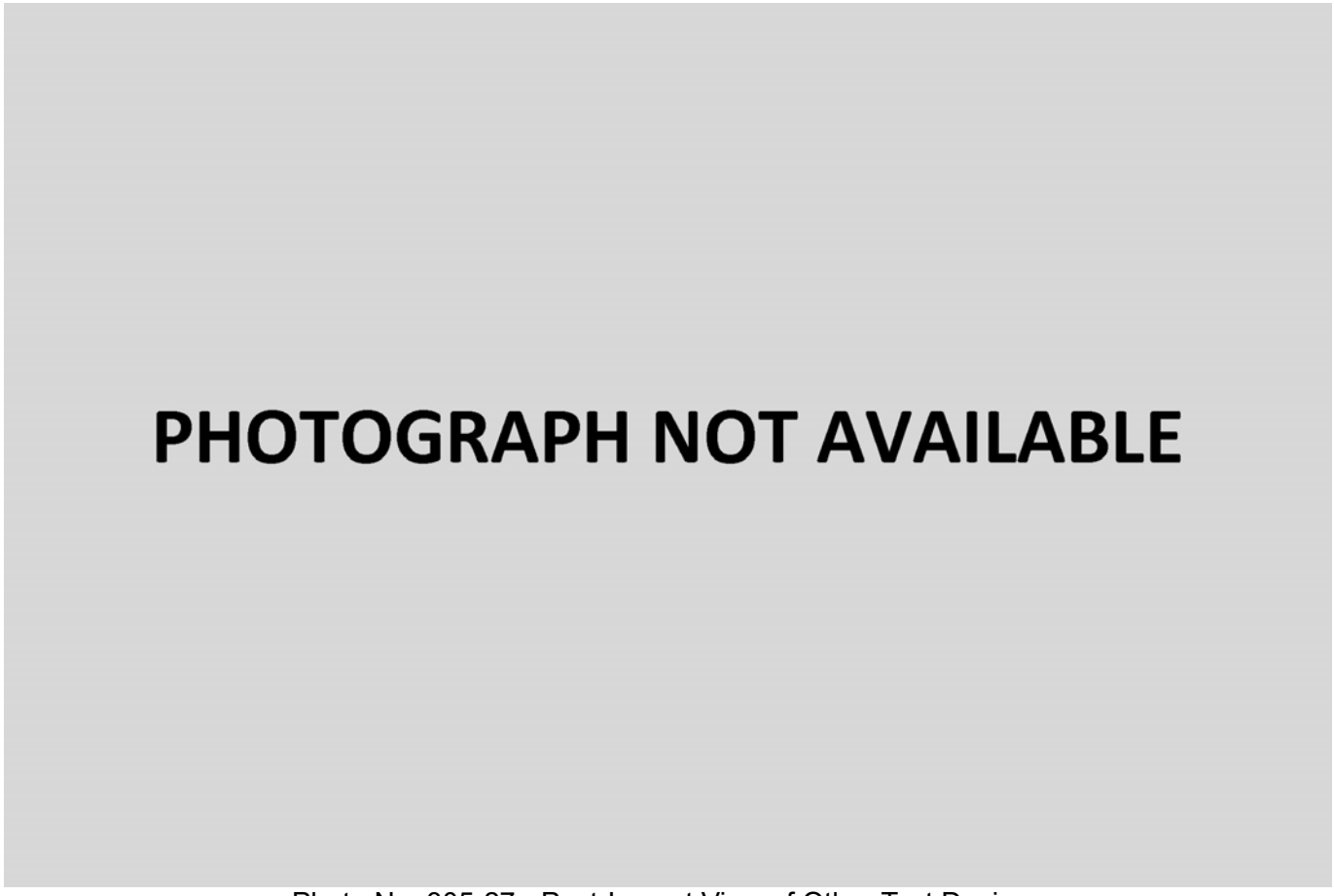


Photo No. 305-27 - Post-Impact View of Other Test Devices

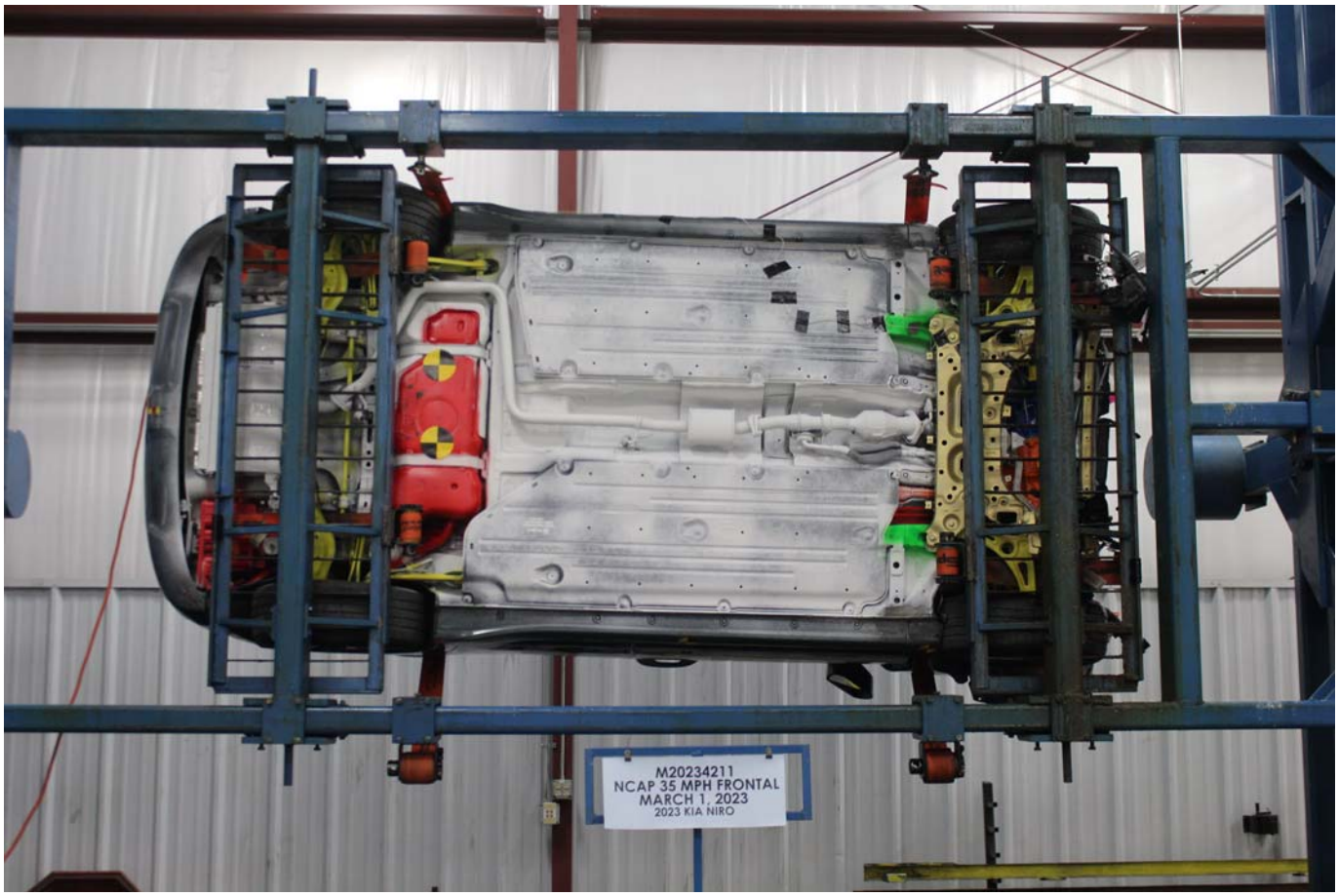


Photo No. 305-28 - FMVSS No. 305 Static Rollover at 90 Degrees

Photo No. 305-29 - FMVSS No. 305 Static Rollover at 180 Degrees

Photo No. 305-30 - FMVSS No. 305 Static Rollover at 270 Degrees

Photo No. 305-31 - FMVSS No. 305 Static Rollover at 360 Degrees

Photo No. 305-32 - Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

Photo No. 305-33 - Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

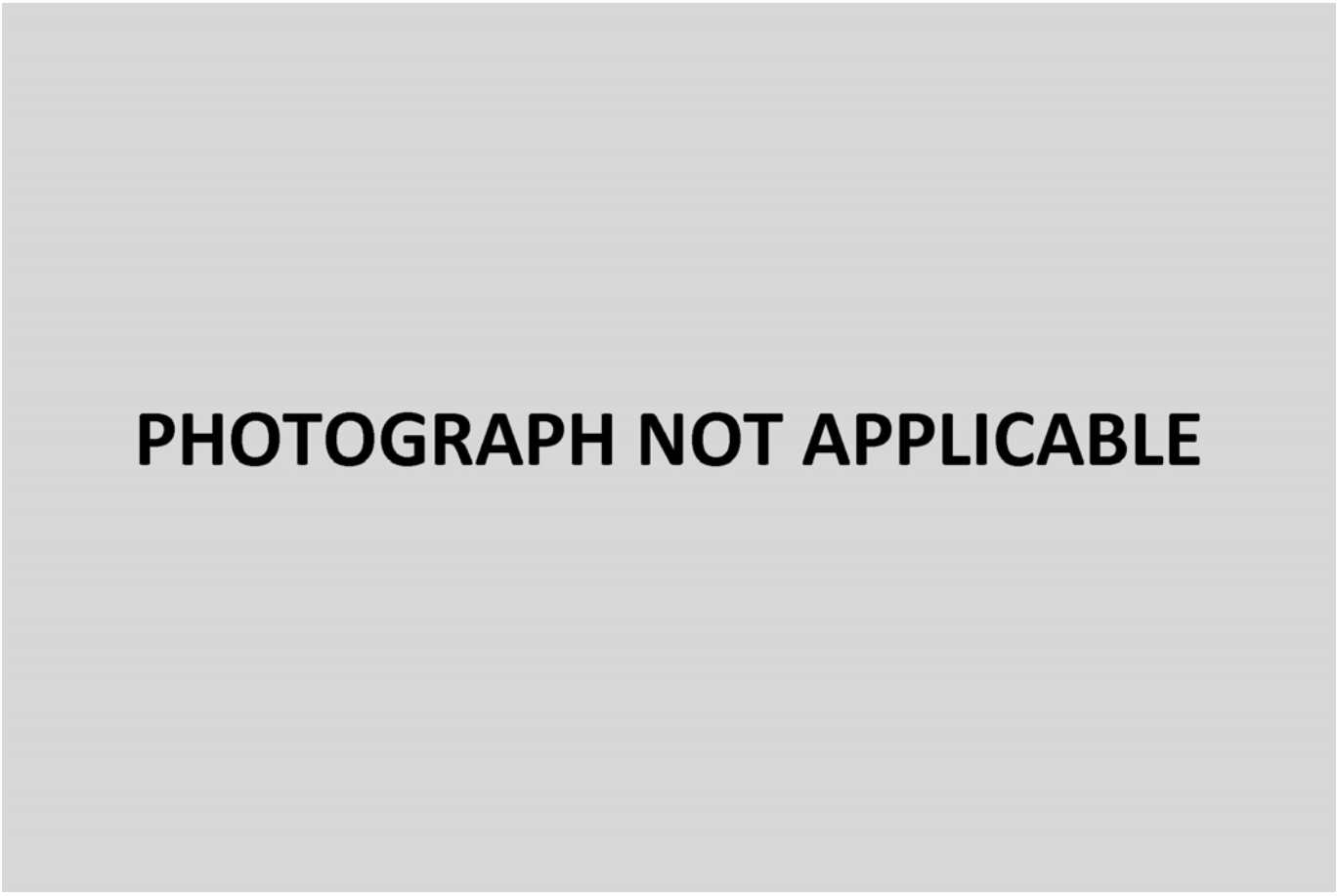


Photo No. 305-34 - Post-Impact Propulsion Battery System Mounting and-or Intrusion Failure(s)

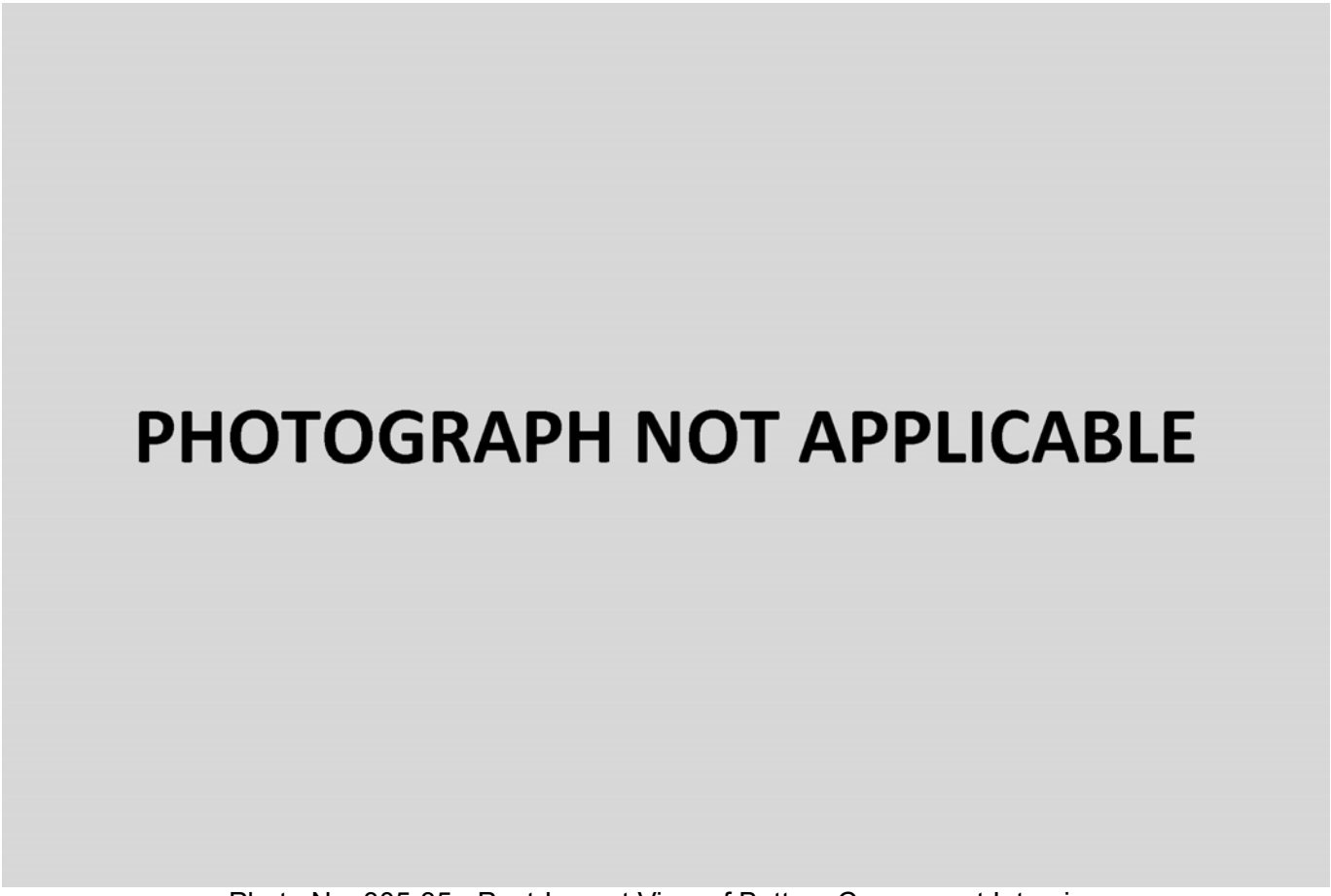


Photo No. 305-35 - Post-Impact View of Battery Component Intrusion

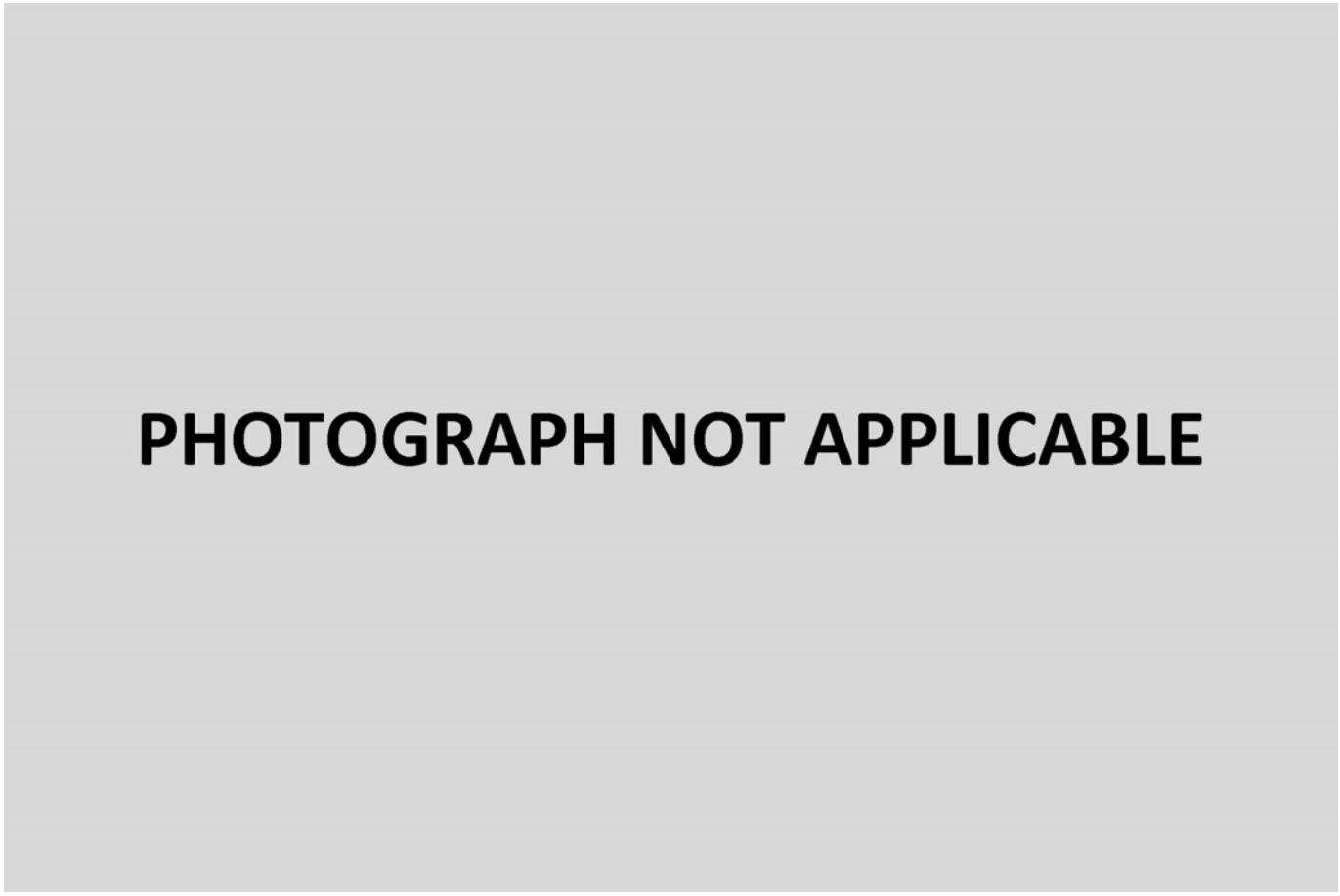


Photo No. 305-36 - Post-Impact View of Battery Module Movement or Retention Loss

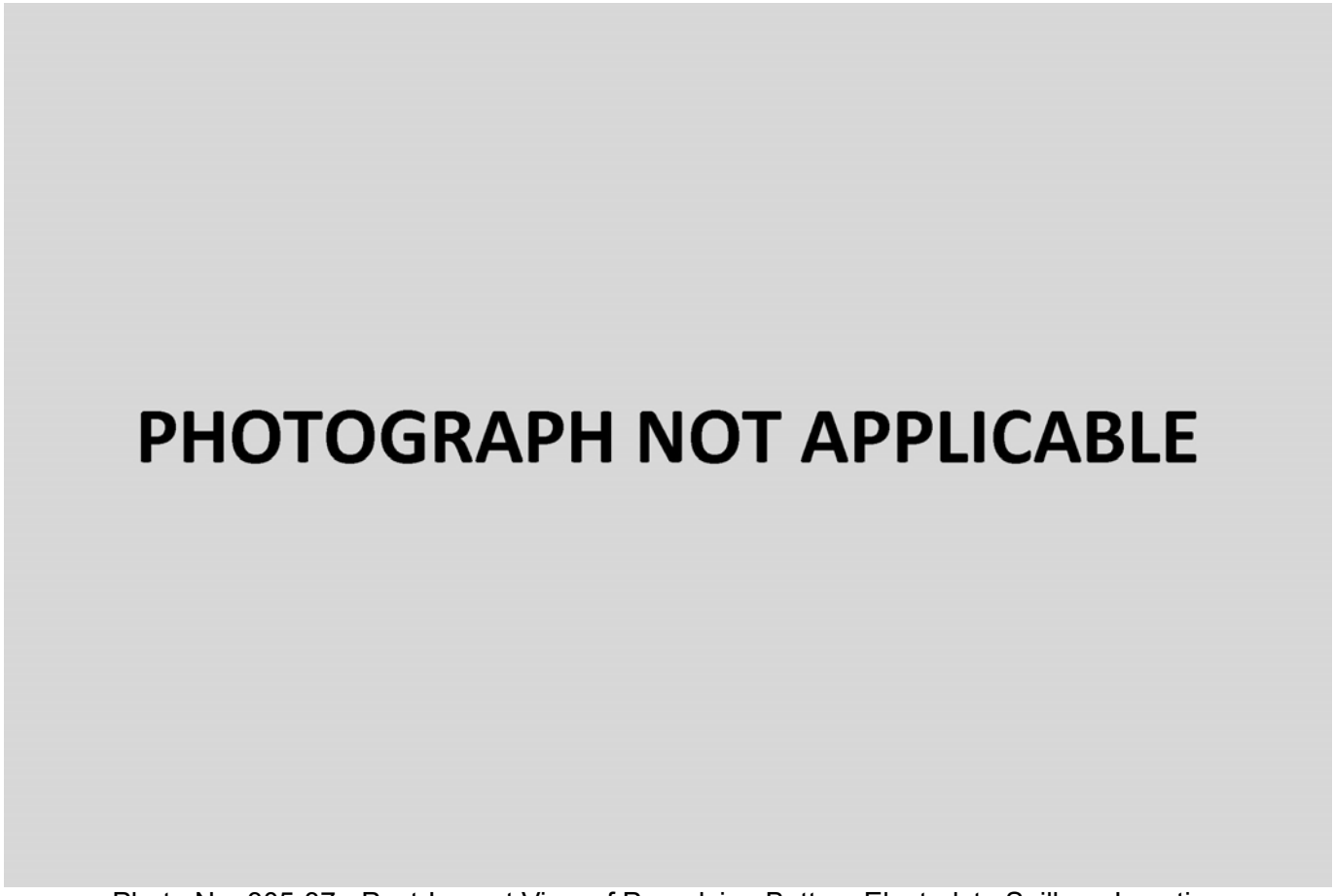


Photo No. 305-37 - Post-Impact View of Propulsion Battery Electrolyte Spillage Location

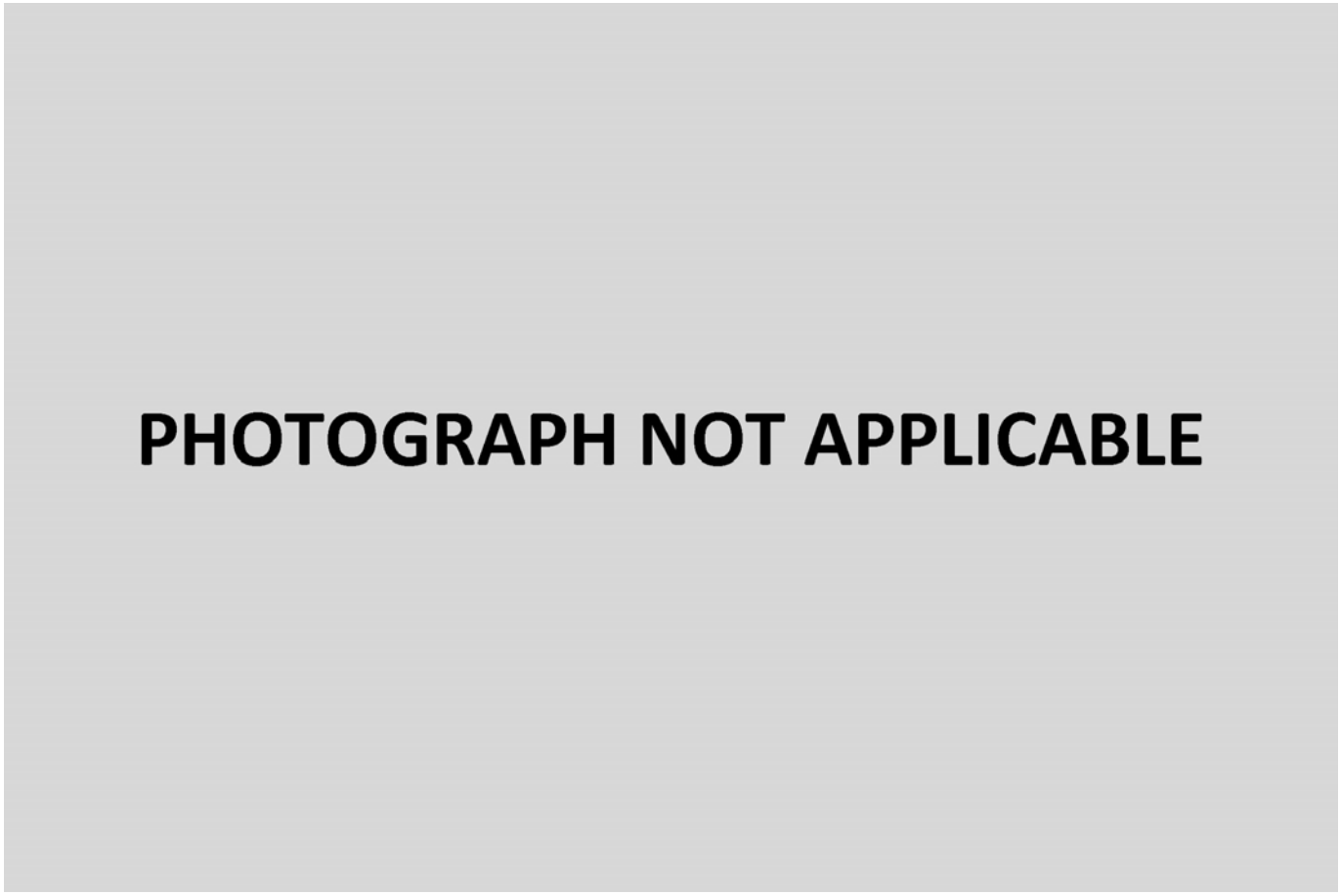


Photo No. 305-38 - Post-Test View of Propulsion Battery Electrolyte Spillage Location

APPENDIX B
DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.gov

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Head Angular Velocity X

Driver Head Angular Velocity Y

Driver Head Angular Velocity Z

Driver Upper Neck Force Y

Driver Upper Neck Moment X

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

Driver Left Femur Redundant

Driver Right Femur Redundant

Driver Left Upper Tibia Moment X

Driver Left Upper Tibia Moment Y

Driver Left Upper Tibia Force Z

Driver Left Lower Tibia Moment X

Driver Left Lower Tibia Moment Y

Driver Left Lower Tibia Force Z

Driver Right Upper Tibia Moment X

Driver Right Upper Tibia Moment Y

Driver Right Upper Tibia Force Z

Driver Right Lower Tibia Moment X

Driver Right Lower Tibia Moment Y

Driver Right Lower Tibia Force Z

Driver Left Foot Fore Z

Driver Left Foot Aft X

Driver Left Foot Aft Z

Driver Right Foot Fore Z

Driver Right Foot Aft X

Driver Right Foot Aft Z

Driver Lap Belt Force

Driver Shoulder Belt Force

Passenger Head X Redundant

Passenger Head Y Redundant

Passenger Head Z Redundant

Passenger Head Angular Velocity X

Passenger Head Angular Velocity Y

Passenger Head Angular Velocity Z

Passenger Upper Neck Force Y

Passenger Upper Neck Moment X

Passenger Upper Neck Moment Z

Passenger Chest X Redundant

Passenger Chest Y Redundant

Passenger Chest Z Redundant

Passenger Pelvis X

Passenger Pelvis Y

Passenger Pelvis Z

Passenger Left Femur Redundant

Passenger Right Femur Redundant

Passenger Left Upper Tibia Moment X

Passenger Left Upper Tibia Moment Y

Passenger Left Upper Tibia Force Z

Passenger Left Lower Tibia Moment X

Passenger Left Lower Tibia Moment Y

Passenger Left Lower Tibia Force Z

Passenger Right Upper Tibia Moment X

Passenger Right Upper Tibia Moment Y

Passenger Right Upper Tibia Force Z

Passenger Right Lower Tibia Moment X

Passenger Right Lower Tibia Moment Y

Passenger Right Lower Tibia Force Z

Passenger Left Foot Fore Z

Passenger Left Foot Aft X

Passenger Left Foot Aft Z

Passenger Right Foot Fore Z

Passenger Right Foot Aft X

Passenger Right Foot Aft Z

Passenger Lap Belt Force

Passenger Shoulder Belt Force

Left Rear Seat Crossmember X

Right Rear Seat Crossmember X

Vehicle Engine Top X

Vehicle Engine Bottom X

Left Rear Seat Crossmember Z

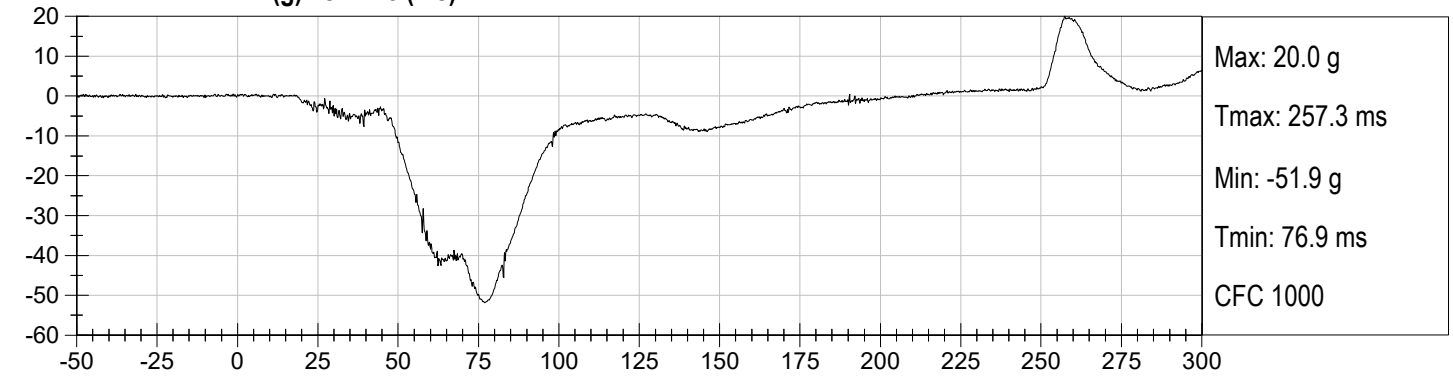
Right Rear Seat Crossmember Z

Left Rear Seat Crossmember Xr

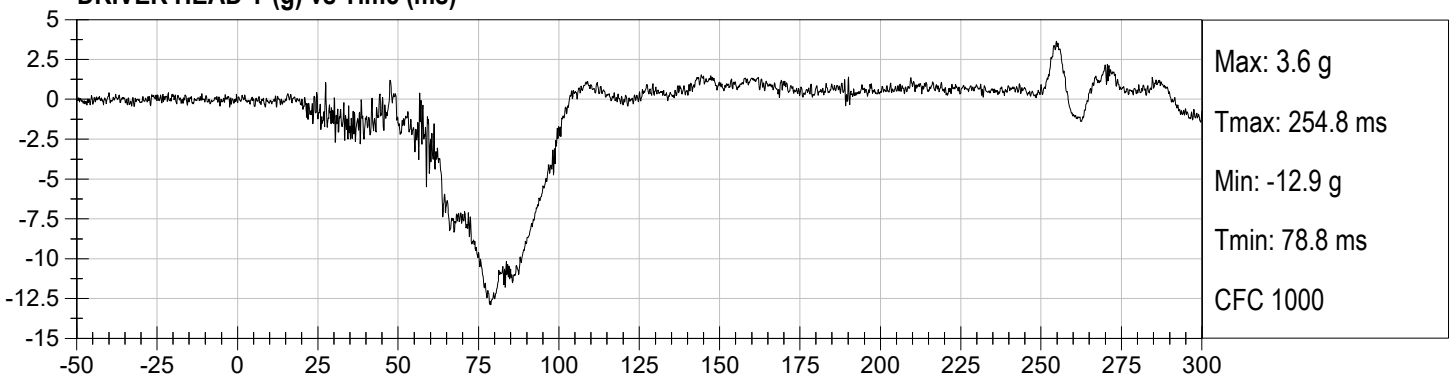
Right Rear Seat Crossmember Xr

Advanced Research Load Cell Barrier – 528 channels

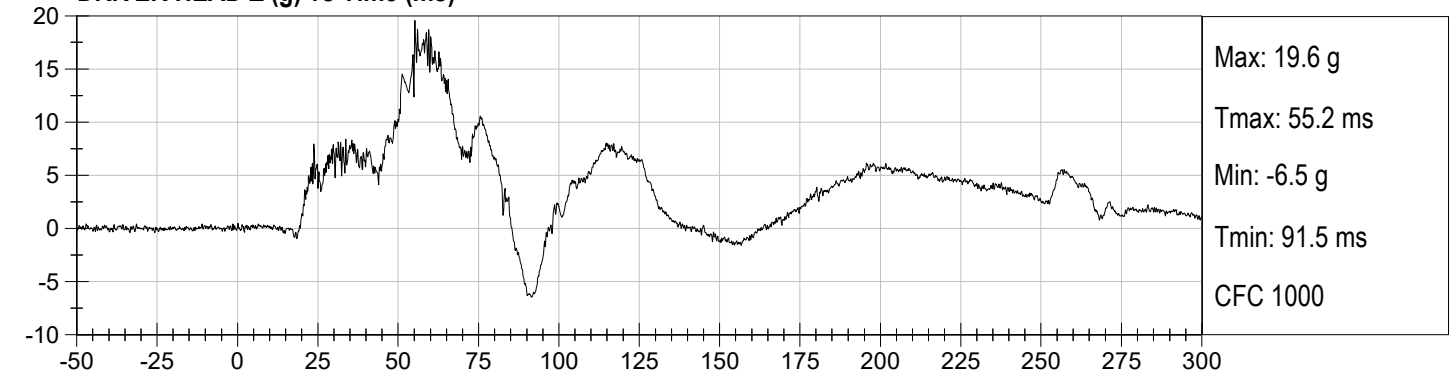
DRIVER HEAD X (g) vs Time (ms)



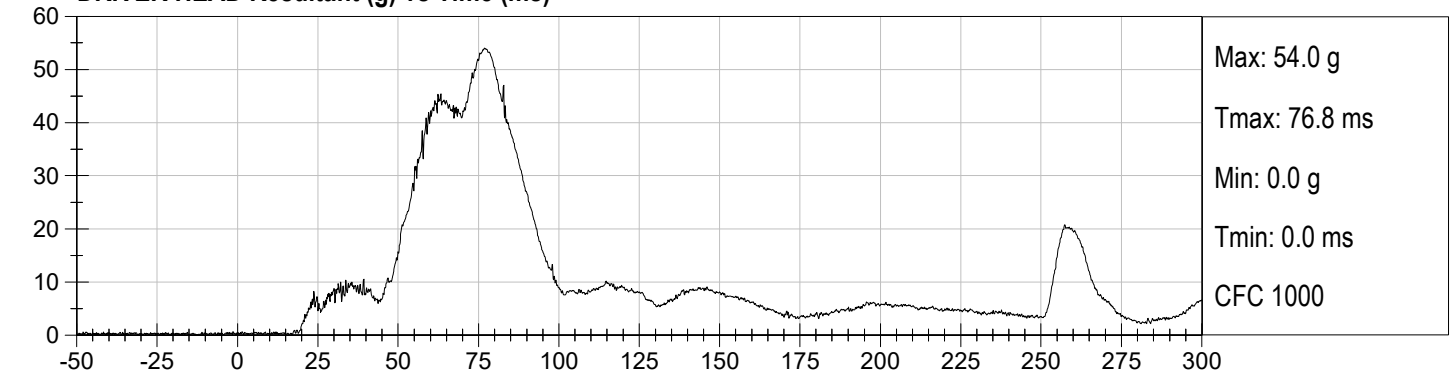
DRIVER HEAD Y (g) vs Time (ms)



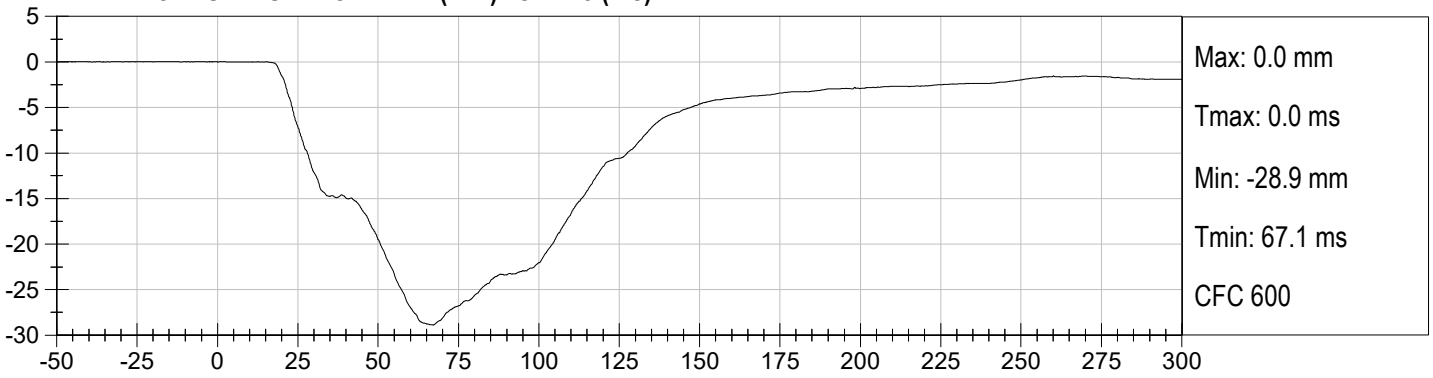
DRIVER HEAD Z (g) vs Time (ms)



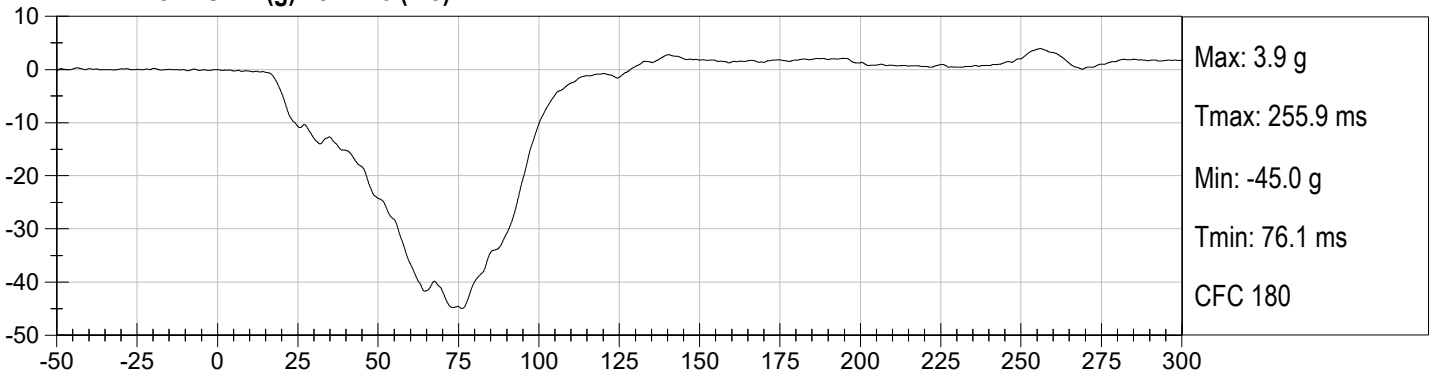
DRIVER HEAD Resultant (g) vs Time (ms)



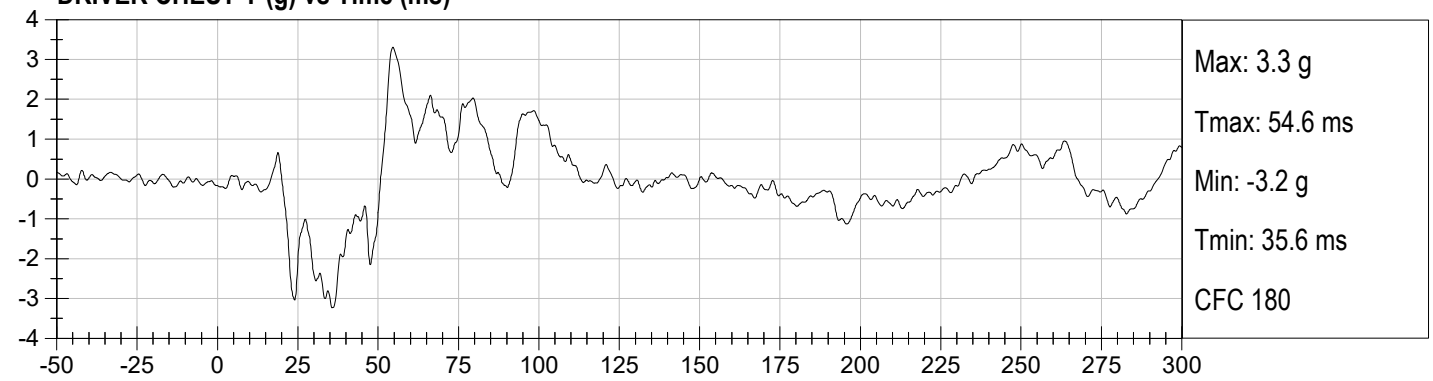
DRIVER CHEST DISPLACEMENT (mm) vs Time (ms)



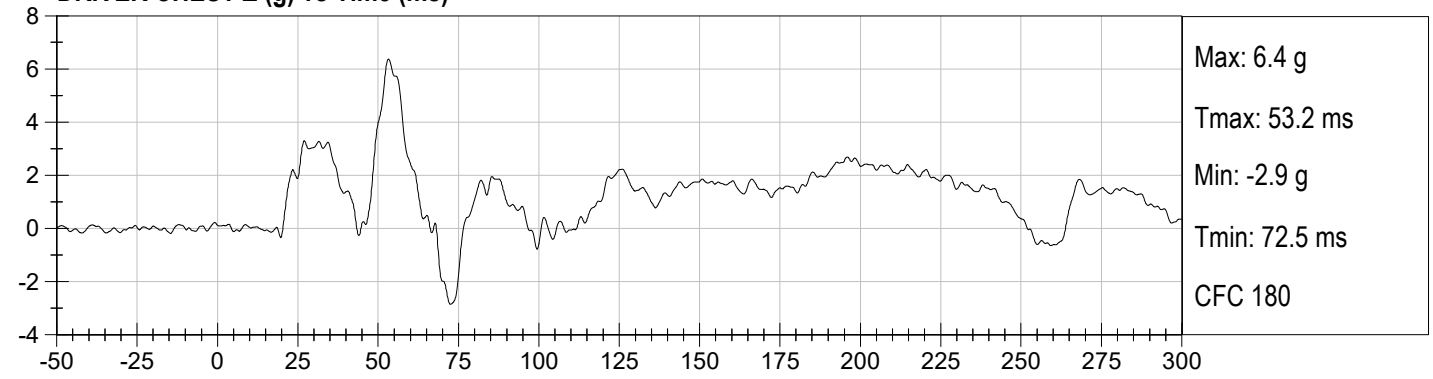
DRIVER CHEST X (g) vs Time (ms)



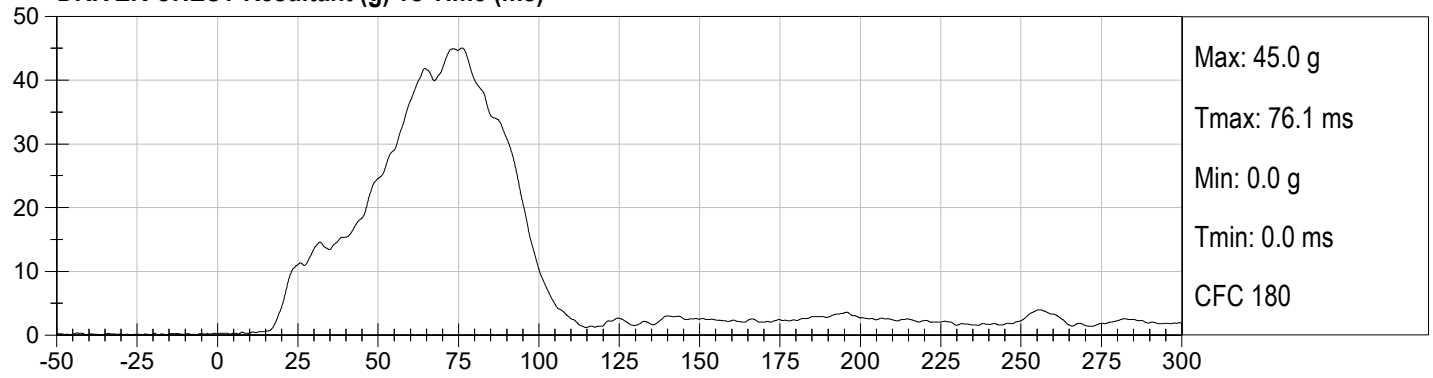
DRIVER CHEST Y (g) vs Time (ms)



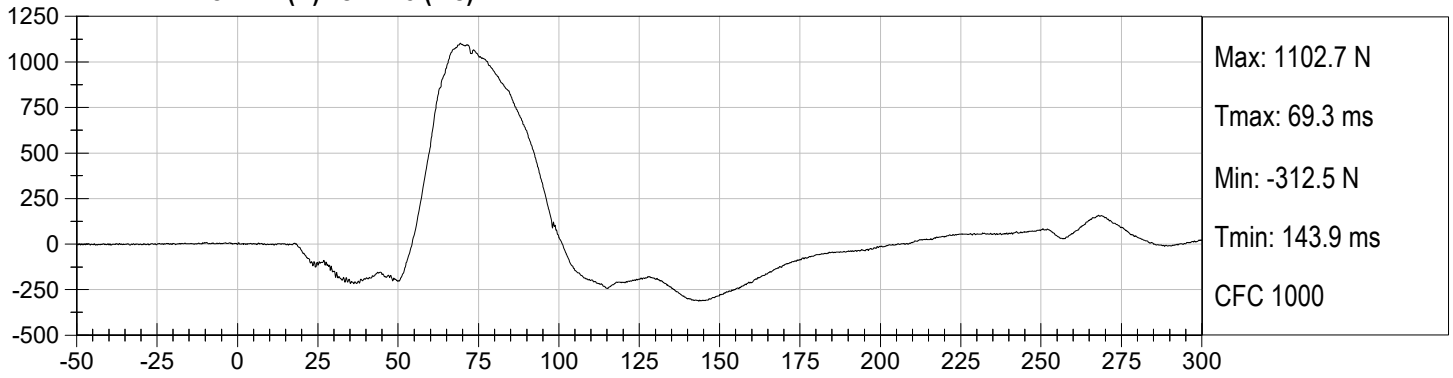
DRIVER CHEST Z (g) vs Time (ms)



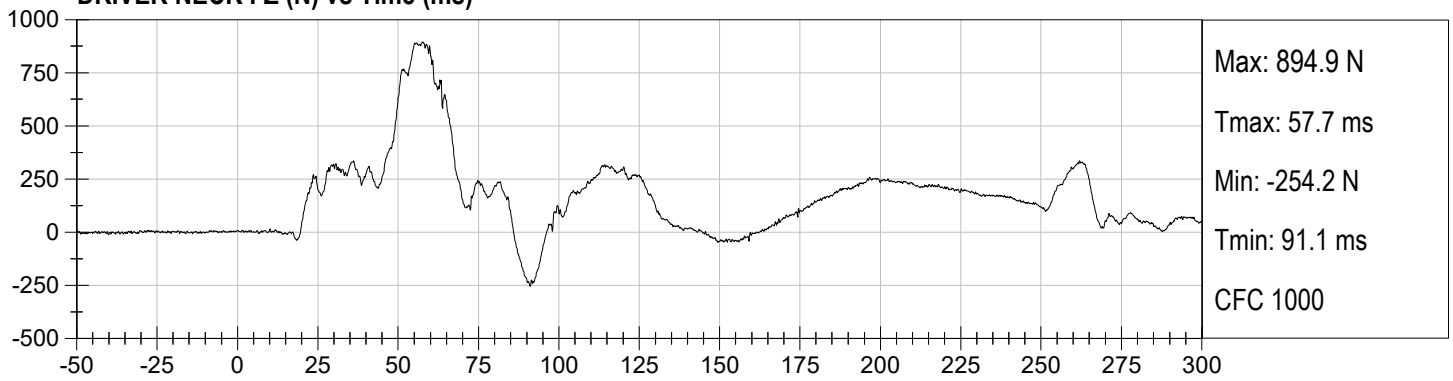
DRIVER CHEST Resultant (g) vs Time (ms)



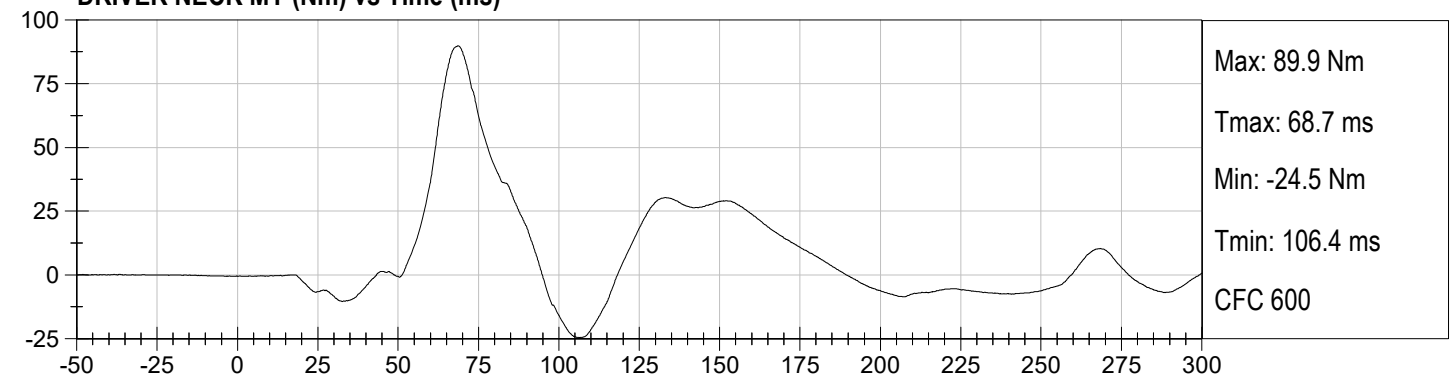
DRIVER NECK FX (N) vs Time (ms)



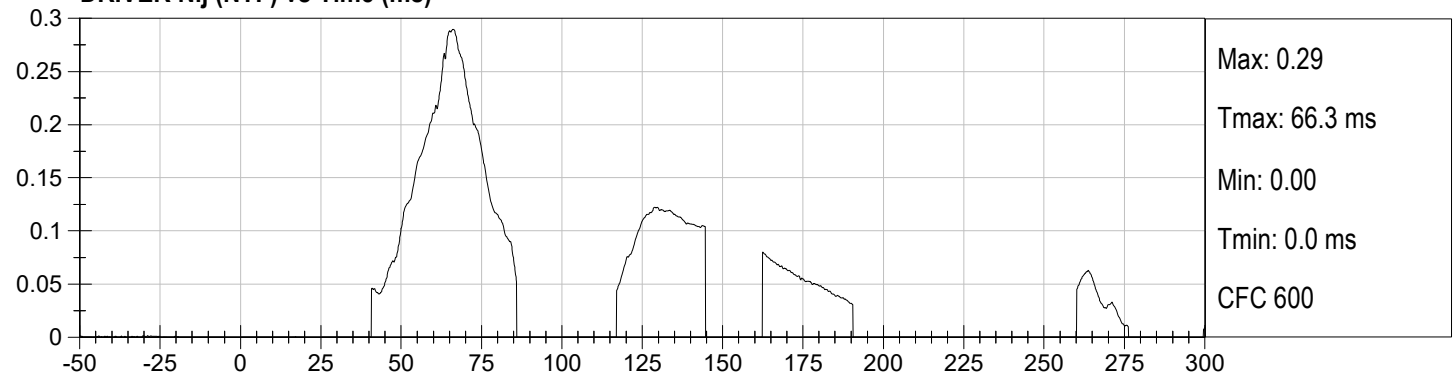
DRIVER NECK FZ (N) vs Time (ms)



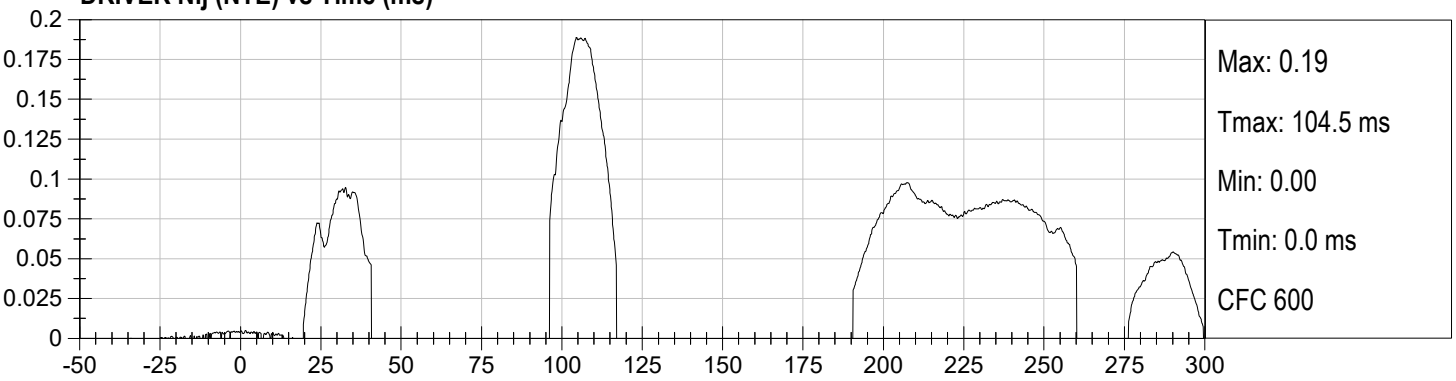
DRIVER NECK MY (Nm) vs Time (ms)



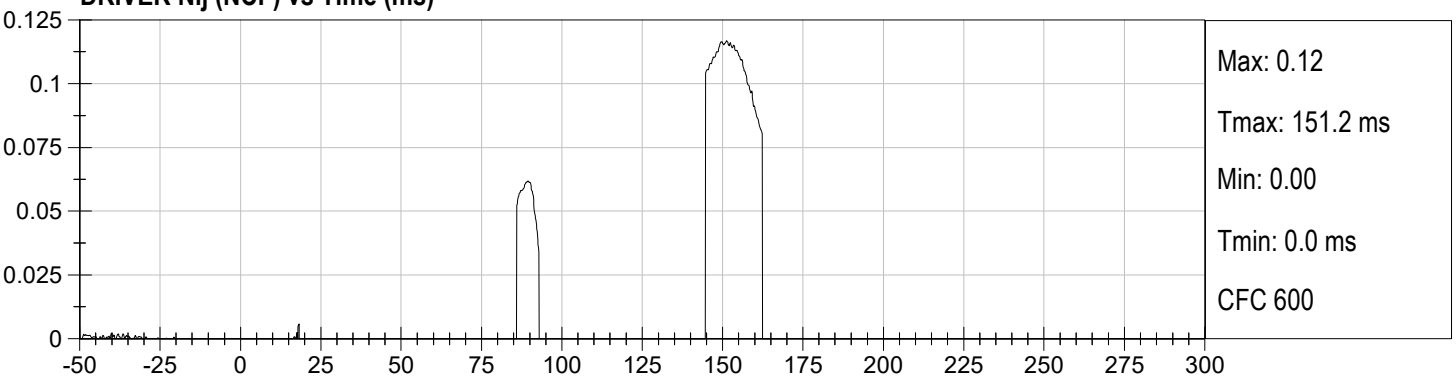
DRIVER Nij (NTF) vs Time (ms)



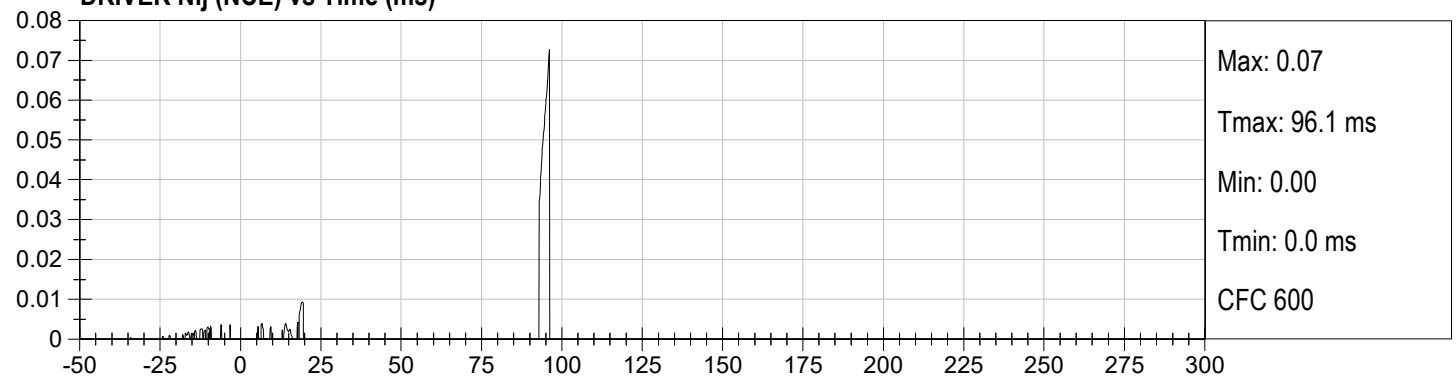
DRIVER Nij (NTE) vs Time (ms)



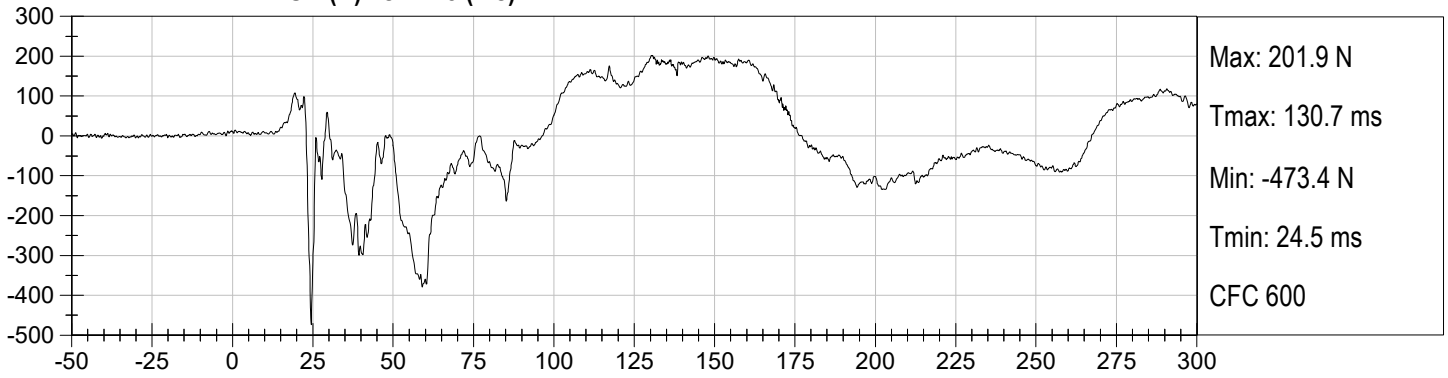
DRIVER Nij (NCF) vs Time (ms)



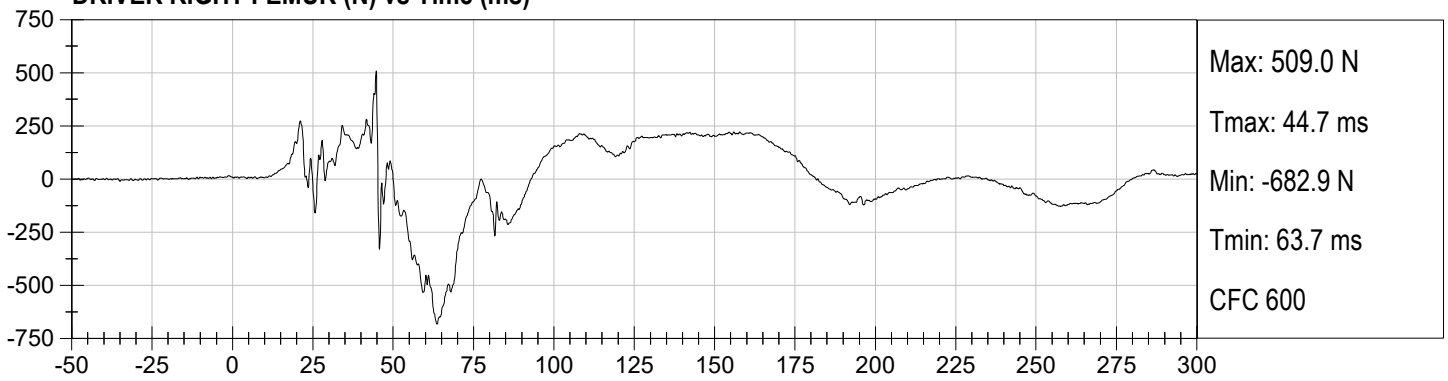
DRIVER Nij (NCE) vs Time (ms)



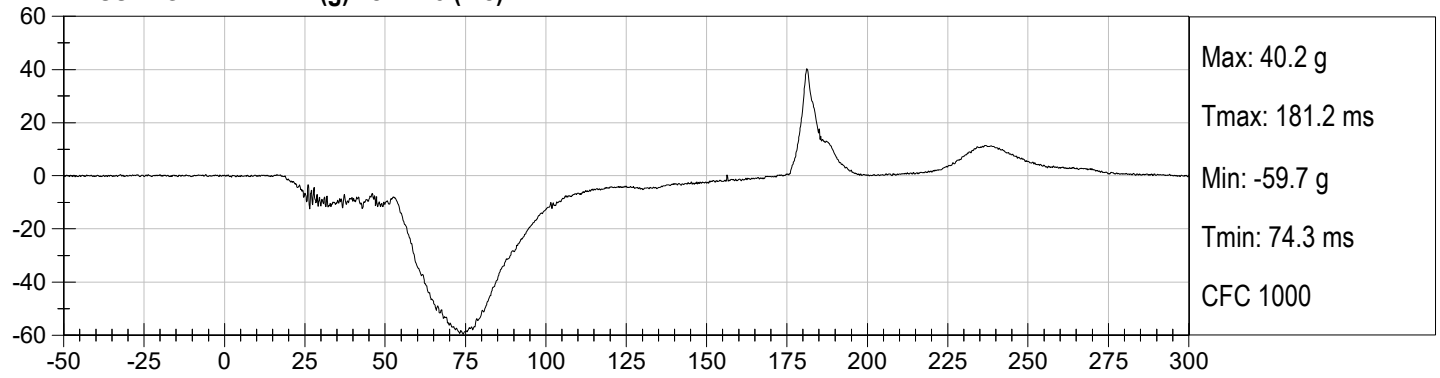
DRIVER LEFT FEMUR (N) vs Time (ms)



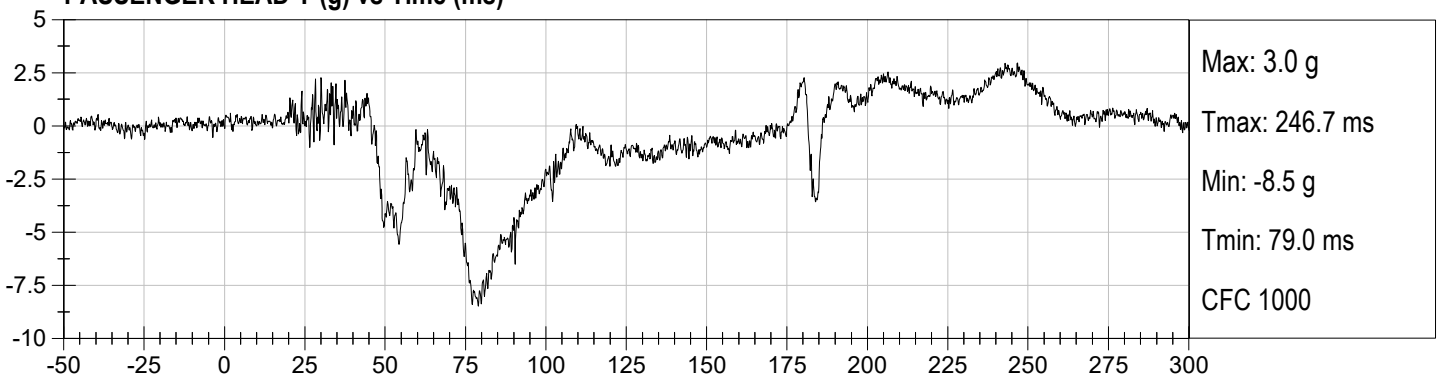
DRIVER RIGHT FEMUR (N) vs Time (ms)



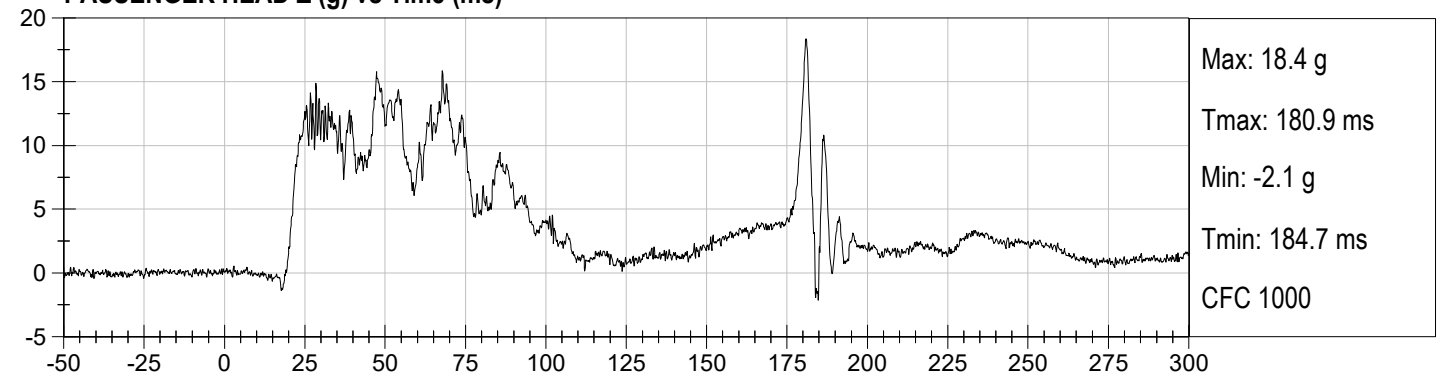
PASSENGER HEAD X (g) vs Time (ms)



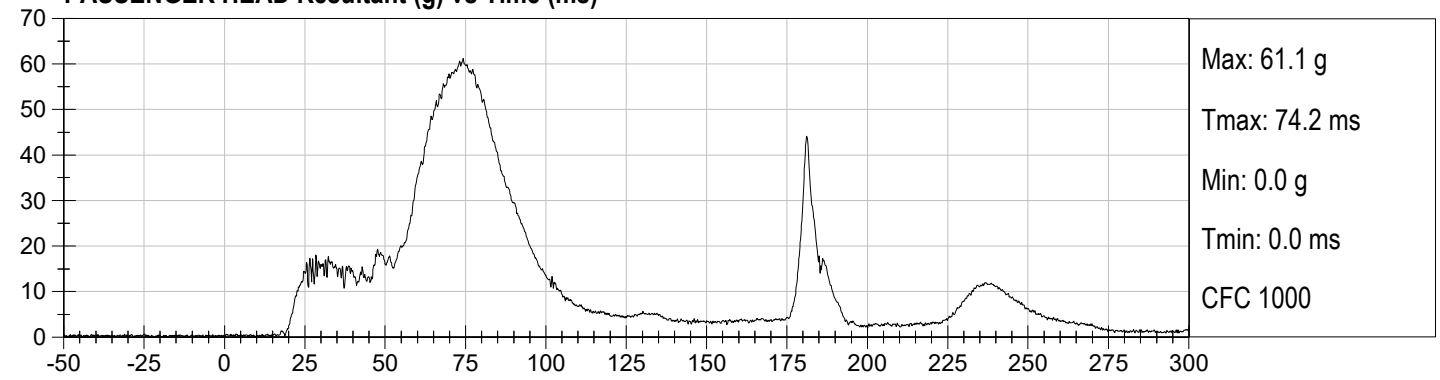
PASSENGER HEAD Y (g) vs Time (ms)



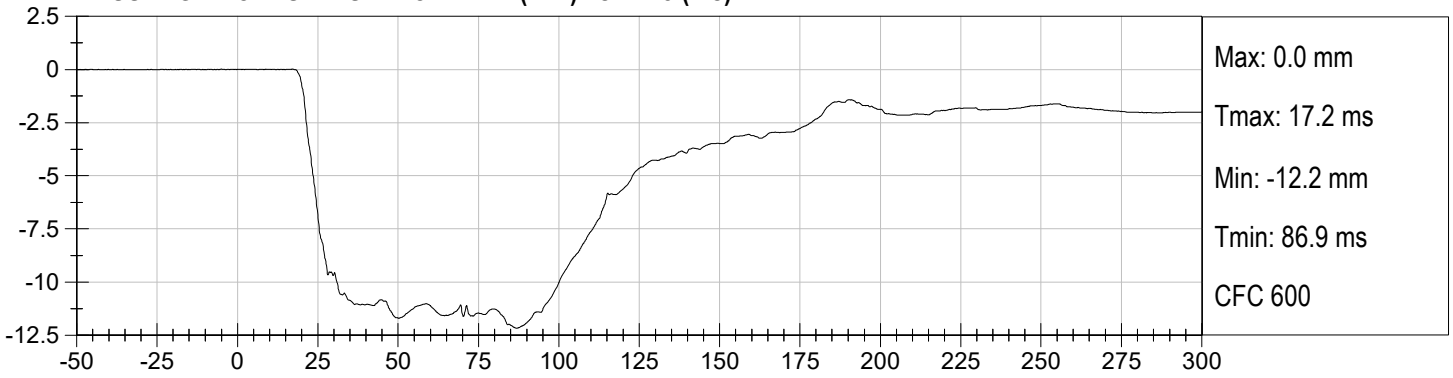
PASSENGER HEAD Z (g) vs Time (ms)



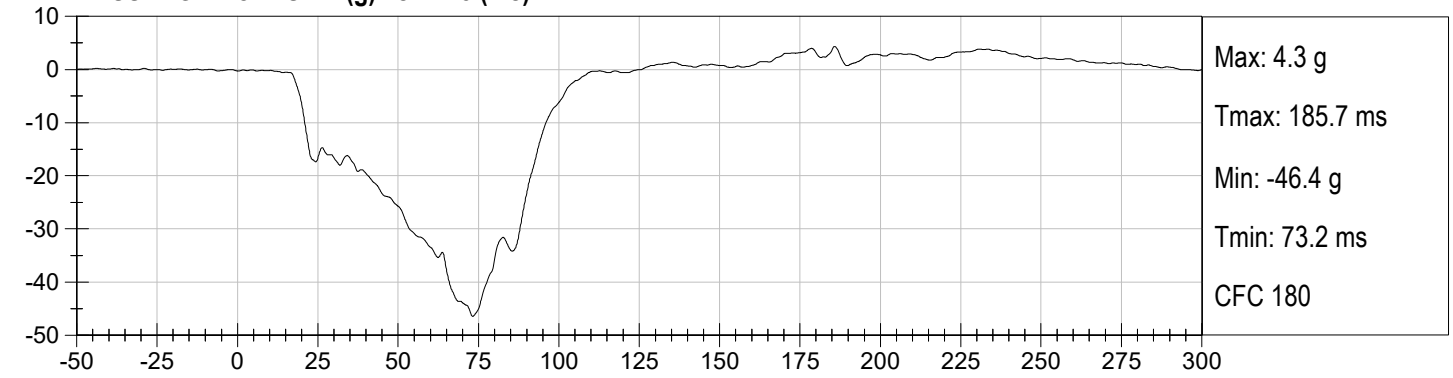
PASSENGER HEAD Resultant (g) vs Time (ms)



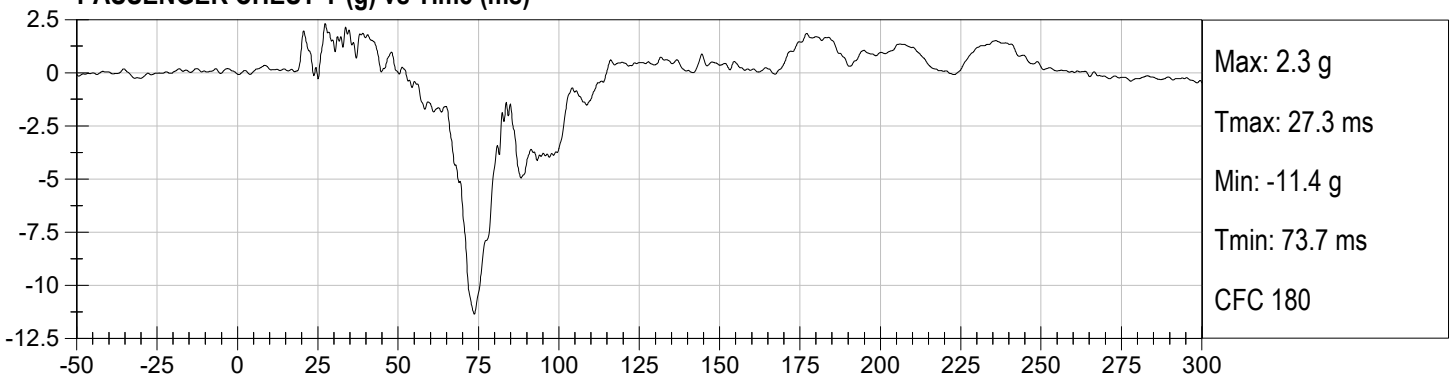
PASSENGER CHEST DISPLACEMENT (mm) vs Time (ms)



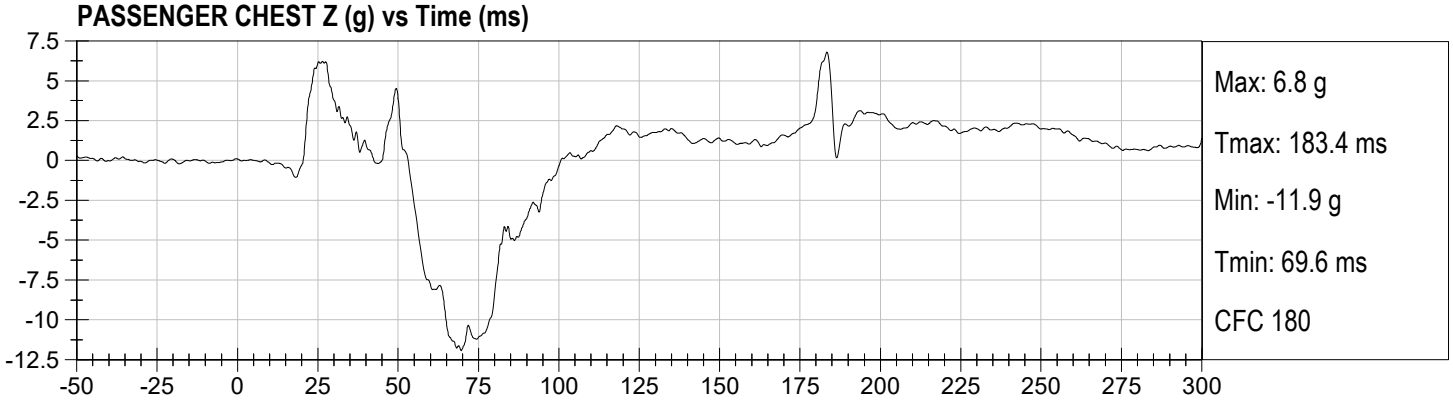
PASSENGER CHEST X (g) vs Time (ms)



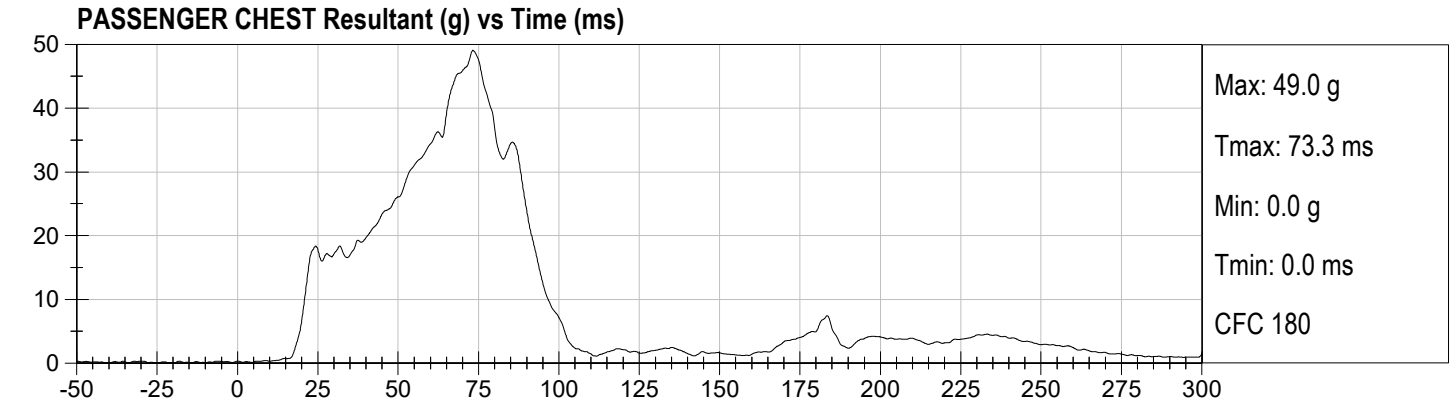
PASSENGER CHEST Y (g) vs Time (ms)



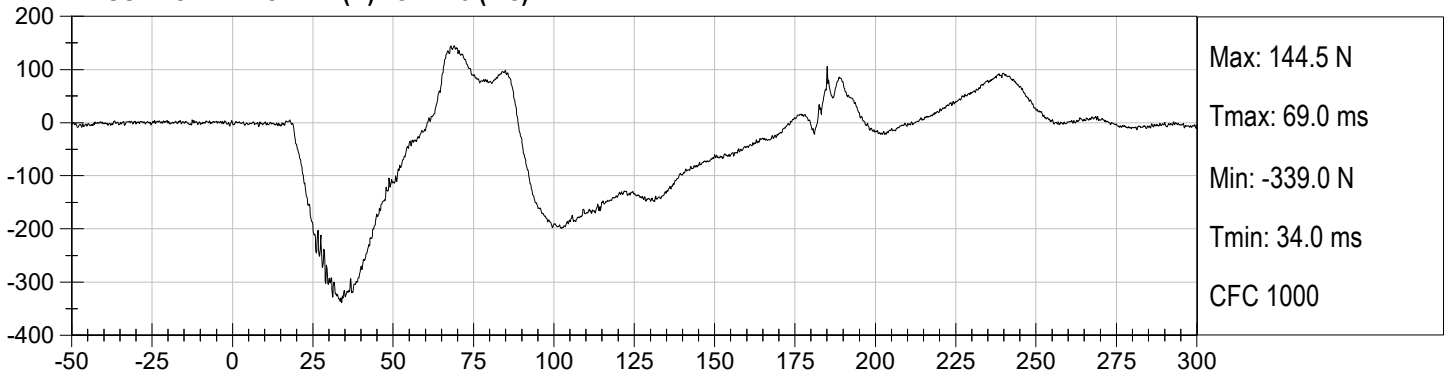
PASSENGER CHEST Z (g) vs Time (ms)



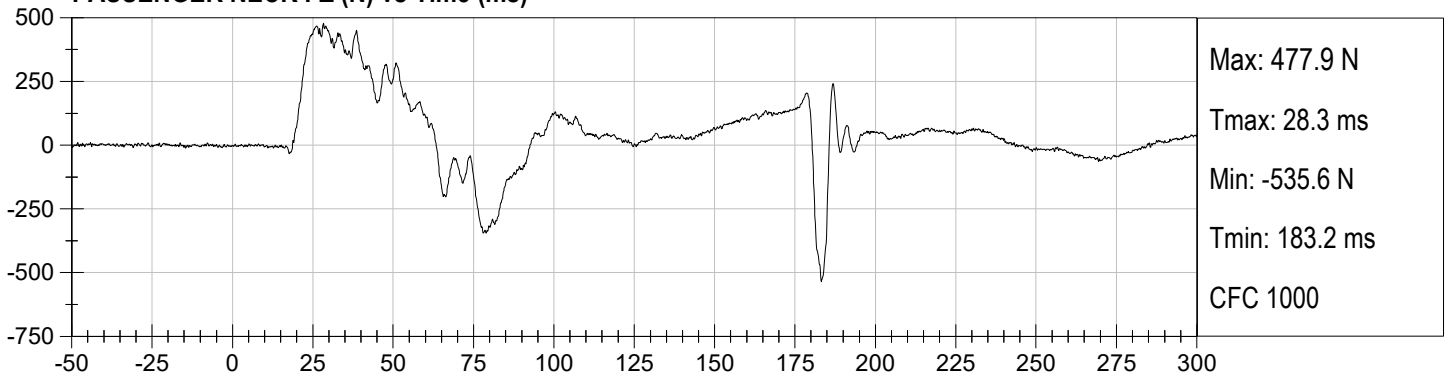
PASSENGER CHEST Resultant (g) vs Time (ms)



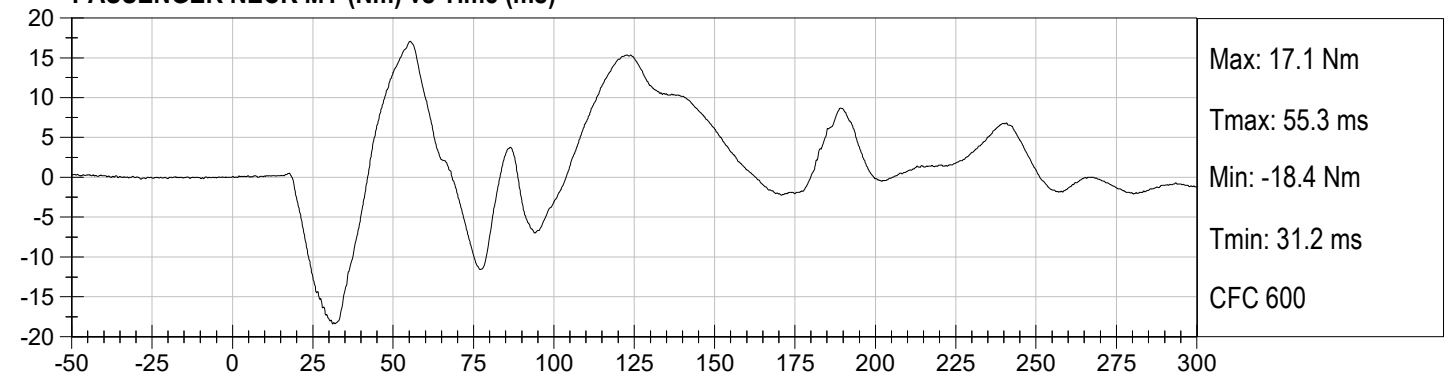
PASSENGER NECK FX (N) vs Time (ms)



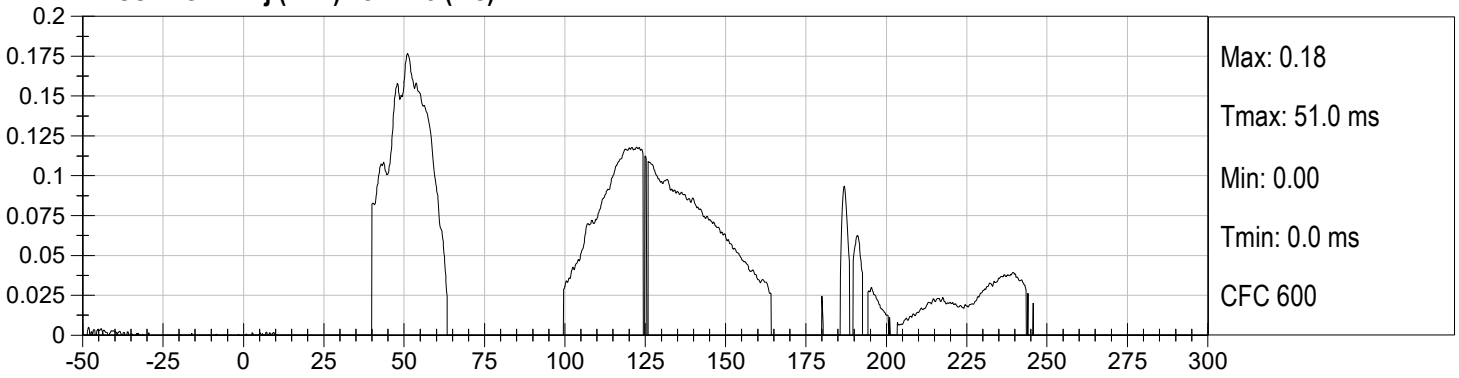
PASSENGER NECK FZ (N) vs Time (ms)



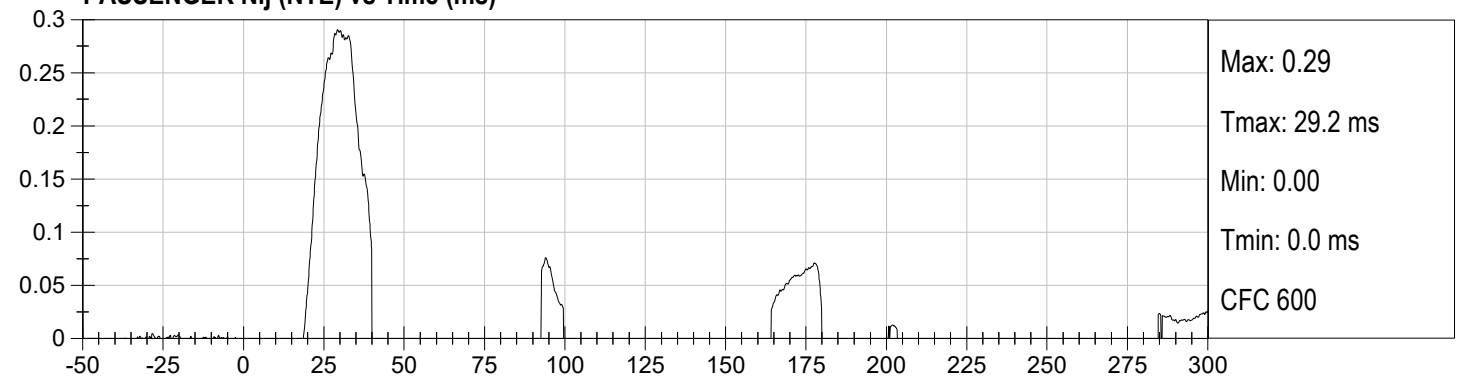
PASSENGER NECK MY (Nm) vs Time (ms)



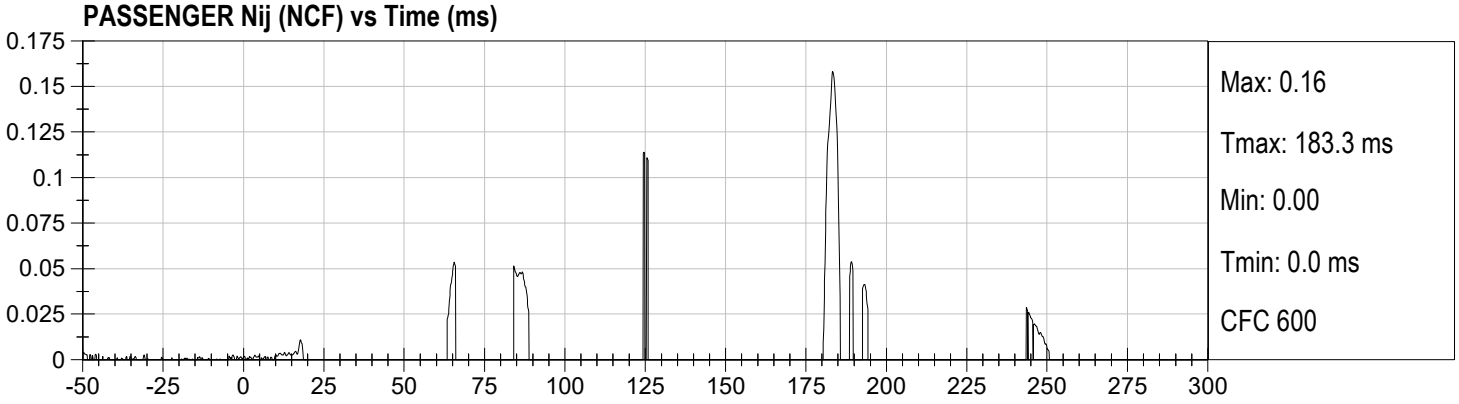
PASSENGER Nij (NTF) vs Time (ms)



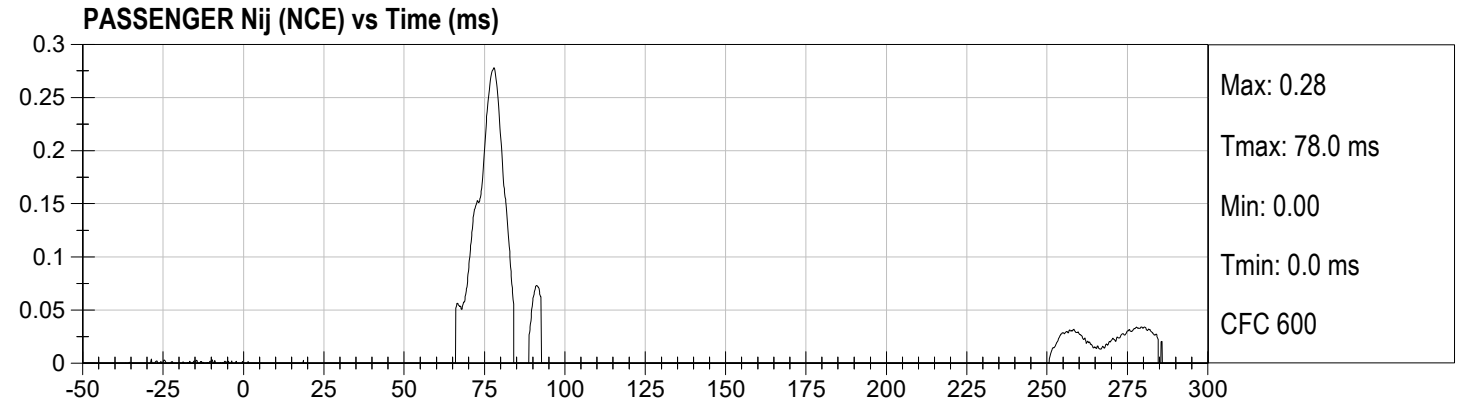
PASSENGER Nij (NTE) vs Time (ms)



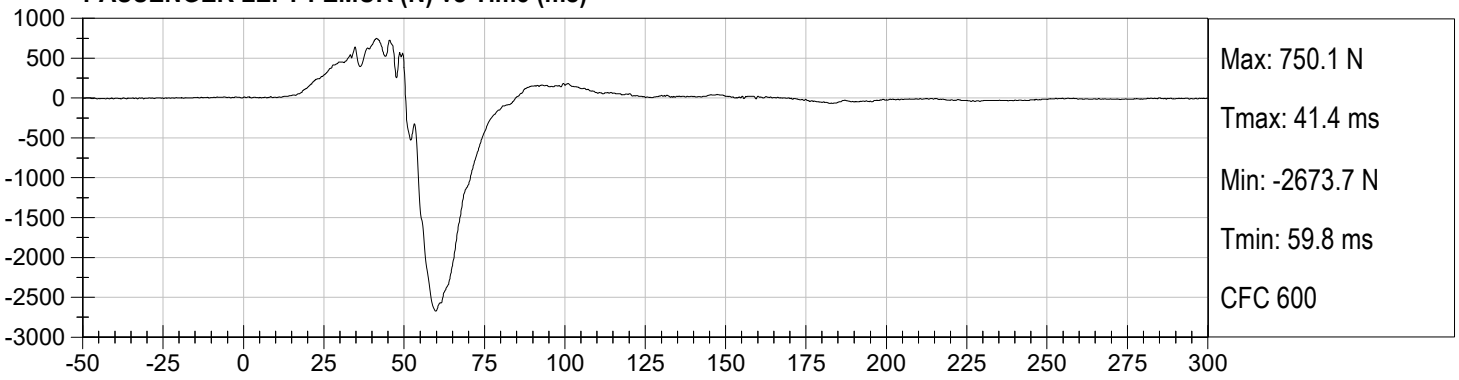
PASSENGER Nij (NCF) vs Time (ms)



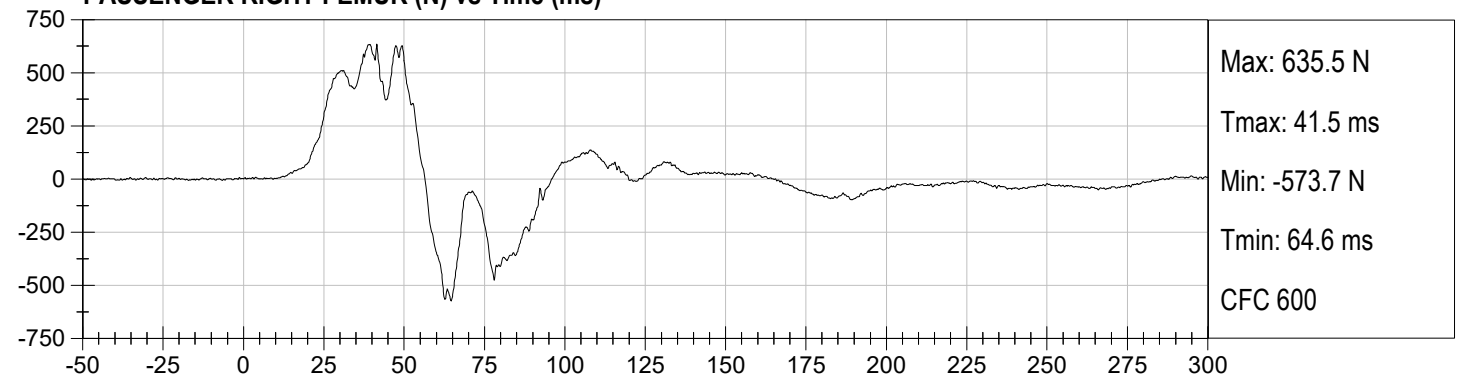
PASSENGER Nij (NCE) vs Time (ms)



PASSENGER LEFT FEMUR (N) vs Time (ms)



PASSENGER RIGHT FEMUR (N) vs Time (ms)



APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

Hybrid III, 50th External Measurements
SN: 351

HYBRID III, PART 572, SUBPART E EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (inches)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	34.6–35.0	34.8
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	19.9-20.5	20.0
C	H-POINT HEIGHT	Reference	3.3-3.5	3.4
D	H-POINT LOCATION FROM BACKLINE	Reference	5.3-5.5	5.5
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	3.3-3.7	3.5
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	5.5-6.1	6.0
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	11.4-12.0	11.8
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	1.6-1.8	1.7
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	13.0-13.6	13.3
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	7.5-8.3	7.8
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	22.8-23.8	23.8
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	16.9-17.9	17.0
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	19.1-19.7	19.5
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. “K”.	17.8-18.8	18.8

HYBRID III, SUBPART E EXTERIOR DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS		ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 16.9-17.1 in. above seat surface	8.4-9.0	8.5
P	FOOT LENGTH	Tip of toe to rear of heel	9.9-10.5	10.3
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	16.3-17.2	16.5
W	FOOT BREADTH	The widest part of the foot	3.6-4.2	4.0
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 16.9-17.1 in. above seat surface	38.2-39.4	39.2
Z	WAIST CIRCUMFERENCE	Measured 8.9-9.1 in. above seat surface	32.9-34.1	33.7
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	16.9-17.1	17.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	8.9-9.1	9.0

NOTE: THE H-POINT IS LOCATED 1.83 INCHES FORWARD AND 2.57 INCHES DOWN FROM THE CENTER OF THE PELVIS ANGLE REFERENCE HOLE.

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test ID:** D230391

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Peak Resultant Acceleration	G's	225 to 275	252	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Nathaniel Benjamin
Laboratory Technician

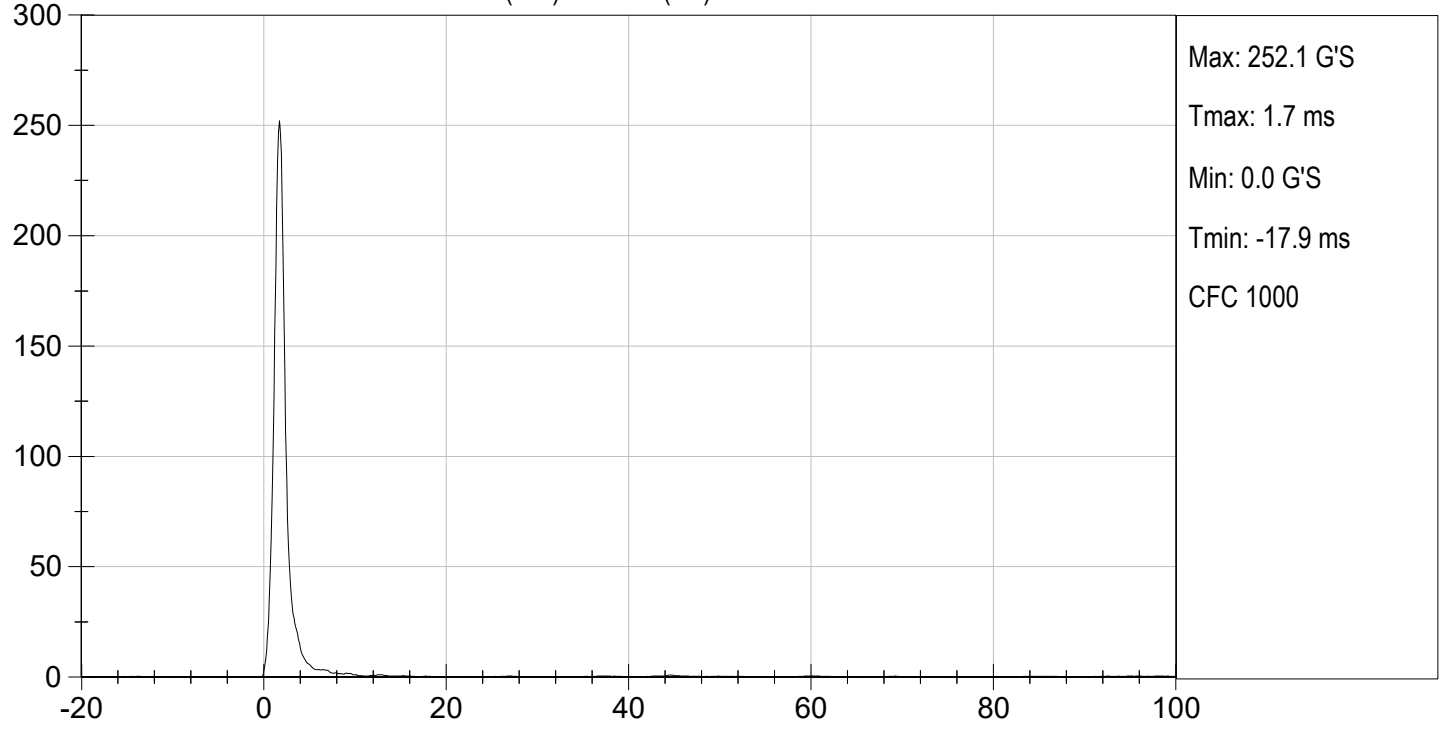
02/07/2023
Test Date

Approved By

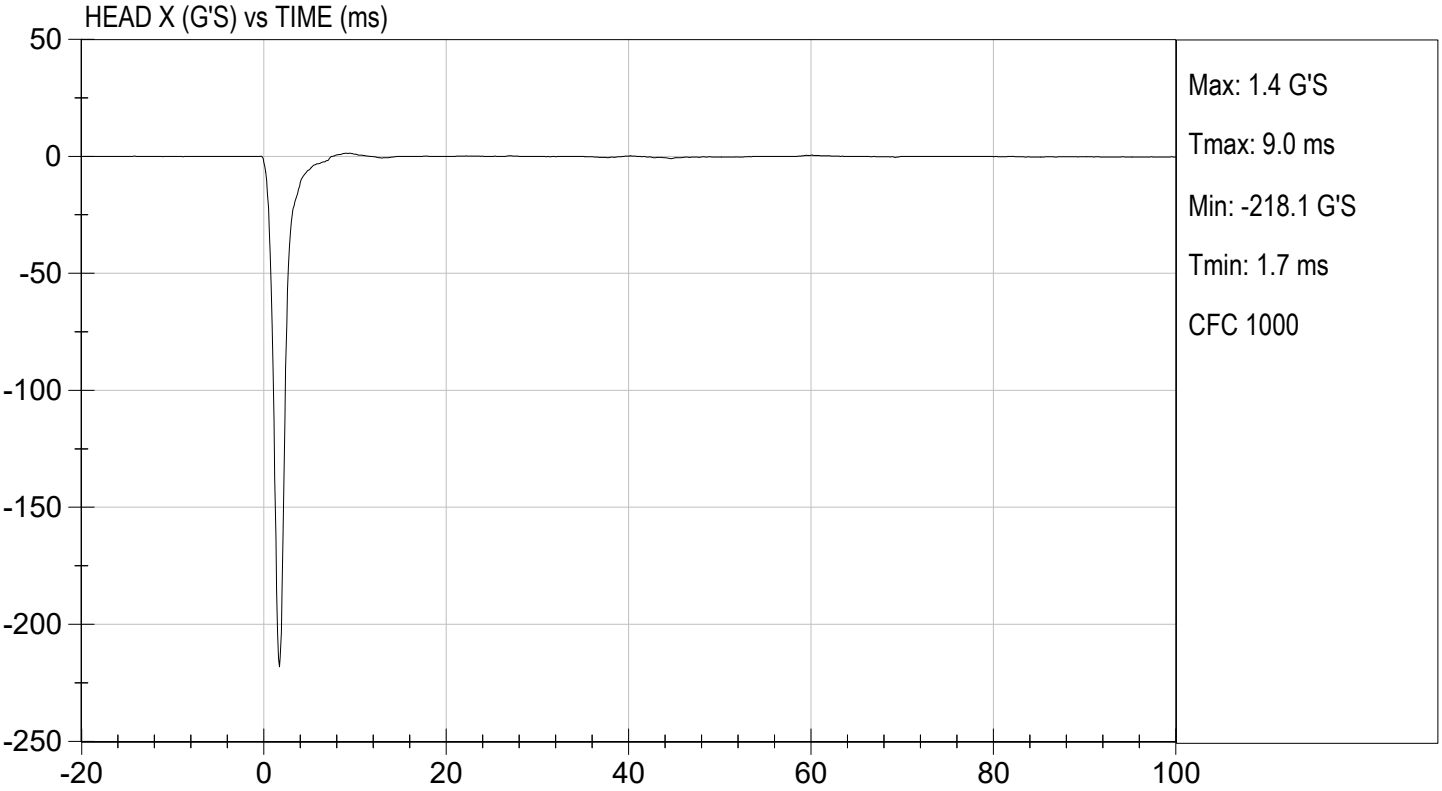
TEST DESC: HEAD DROP

TEST DATE: 02/07/2023
TEST #: D230391

HEAD RESULTANT ACCELERATION (G'S) vs TIME (ms)

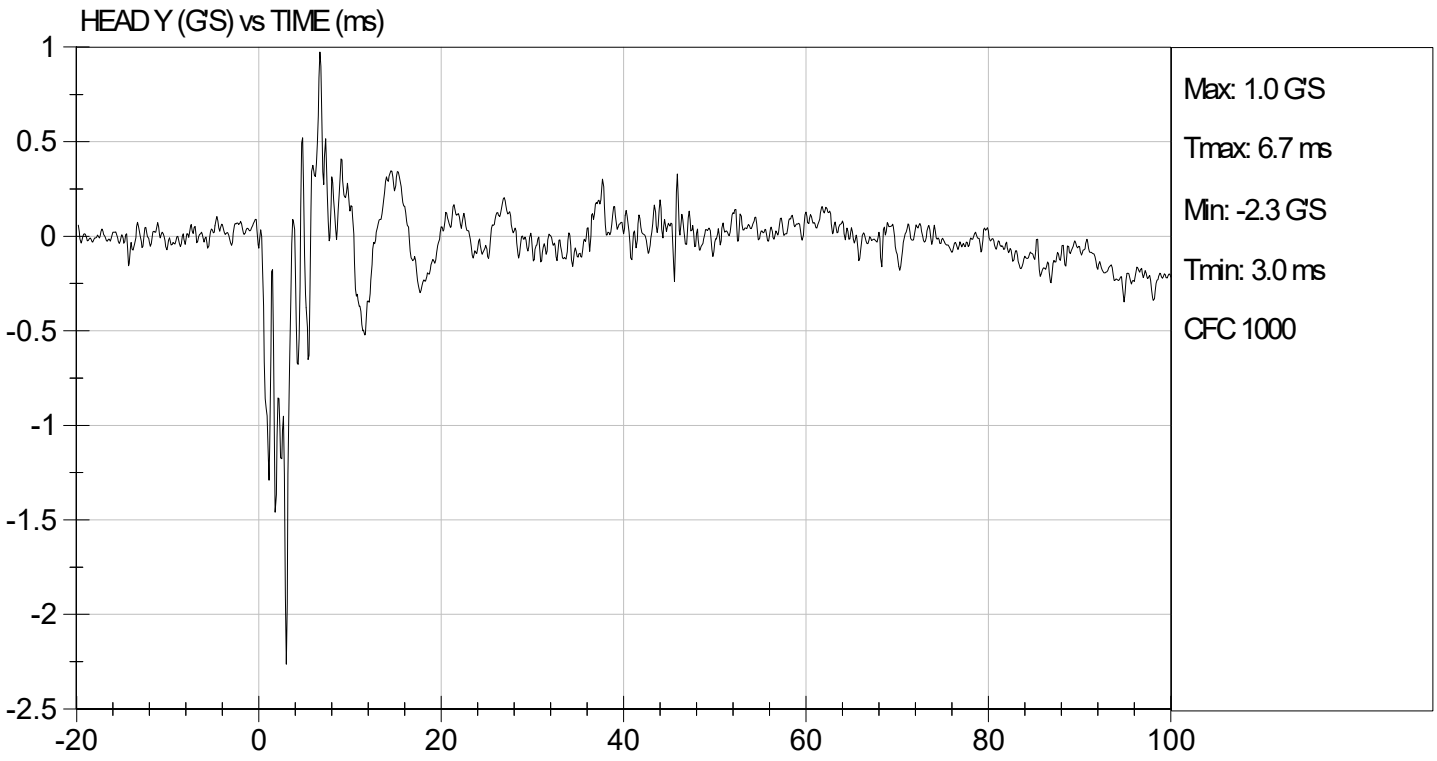


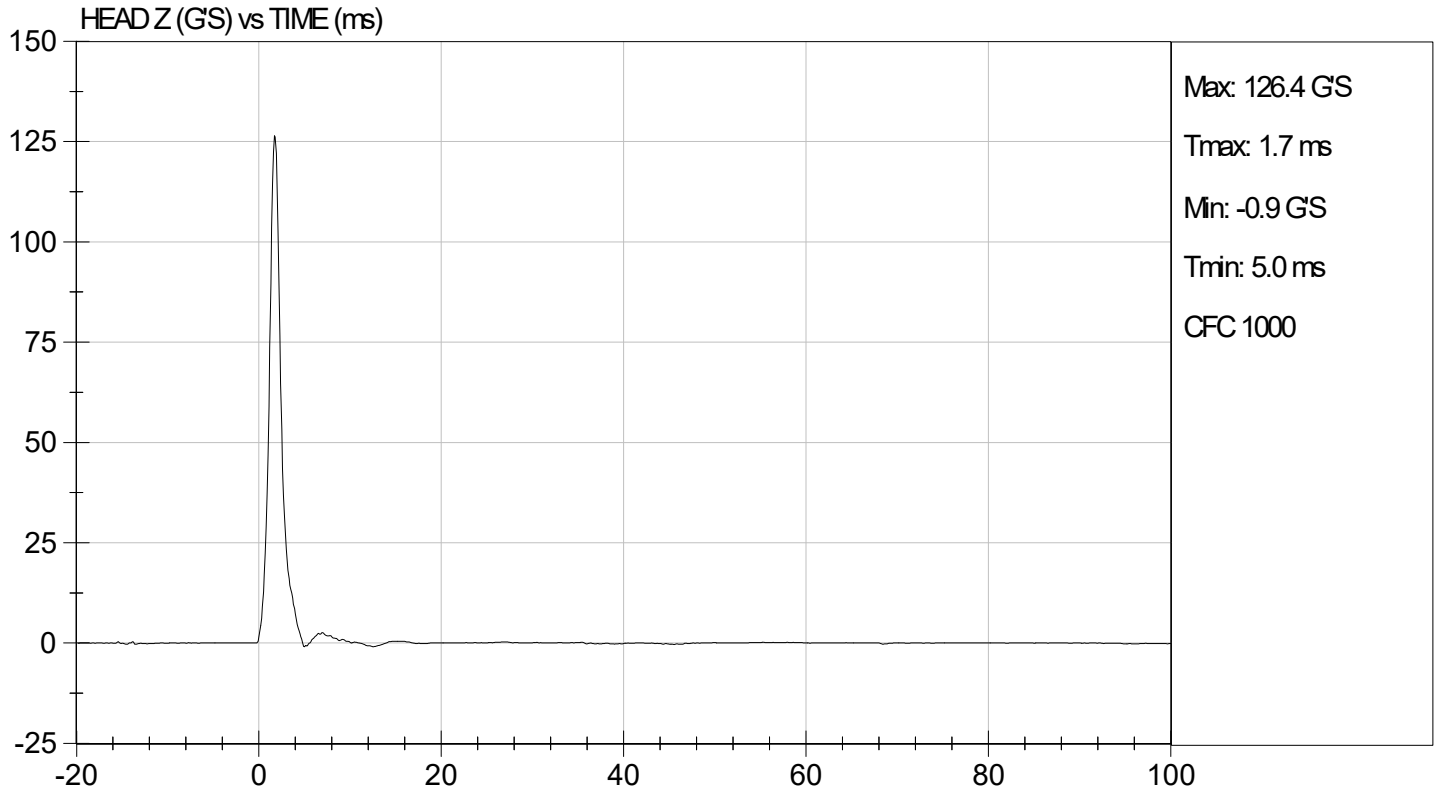
HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 02/07/2023
TEST #: D230391





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230392

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	27	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.25	Pass
	20 ms	G's	17.60 to 22.60	21.02	Pass
	30 ms	G's	12.50 to 18.50	14.90	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	37.7	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	68.7	Pass
	Time	ms	57.0 to 64.0	61.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	116.2	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	92.7	Pass
	Time	ms	47.0 to 58.0	49.1	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	99.8	Pass
			Overall Test Results		Pass

Nathaniel Bajamin
Laboratory Technician

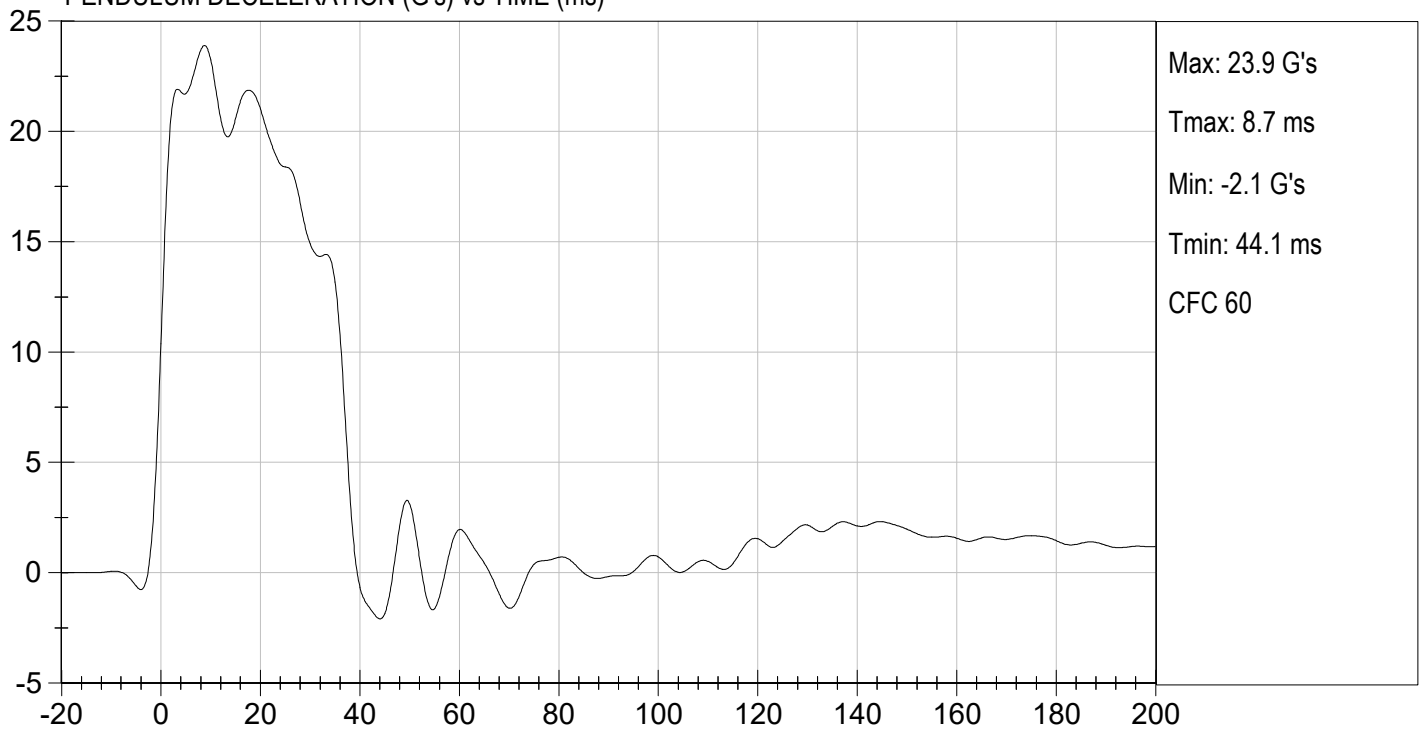
02/07/2023
Test Date

Approved By

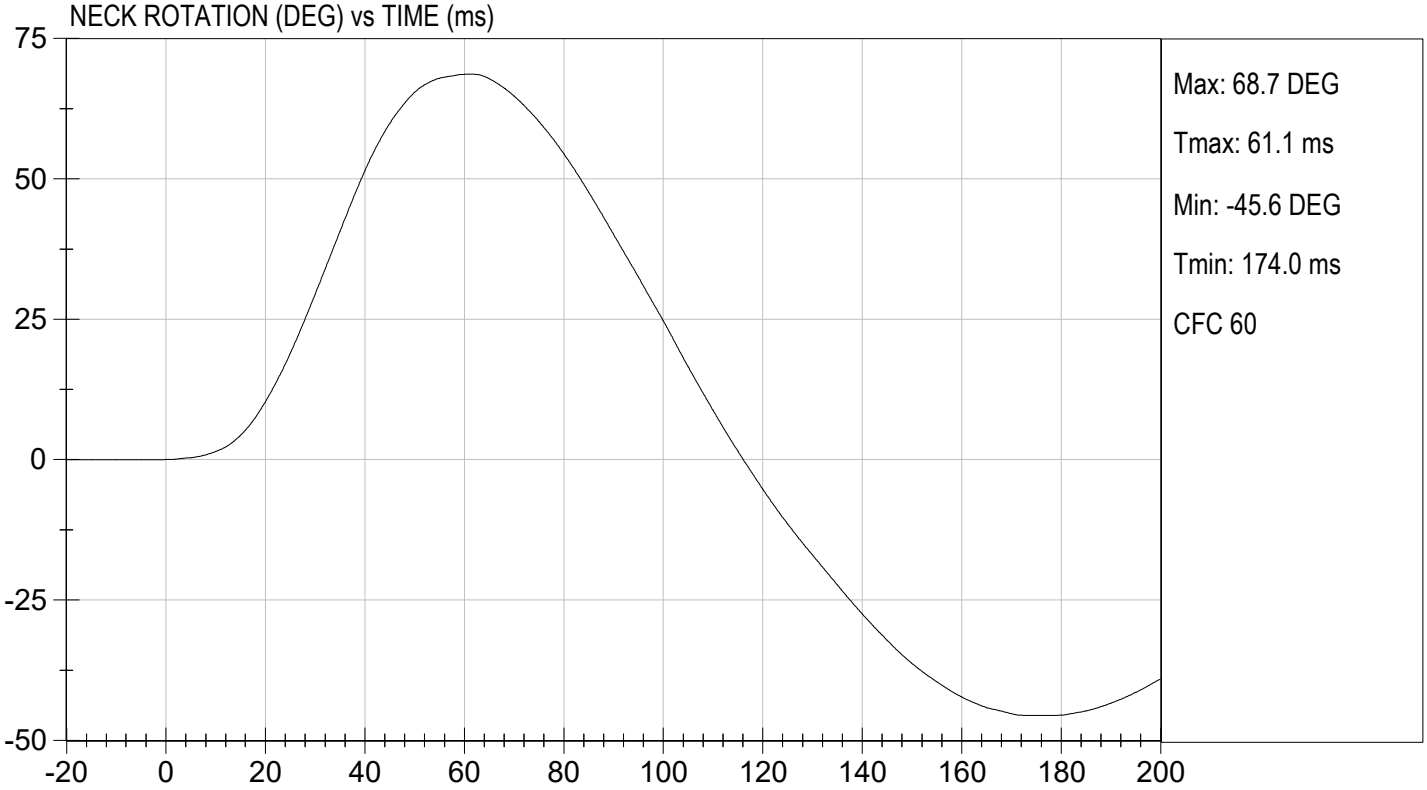
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 02/07/2023
TEST #: D230392

PENDULUM DECELERATION (G's) vs TIME (ms)

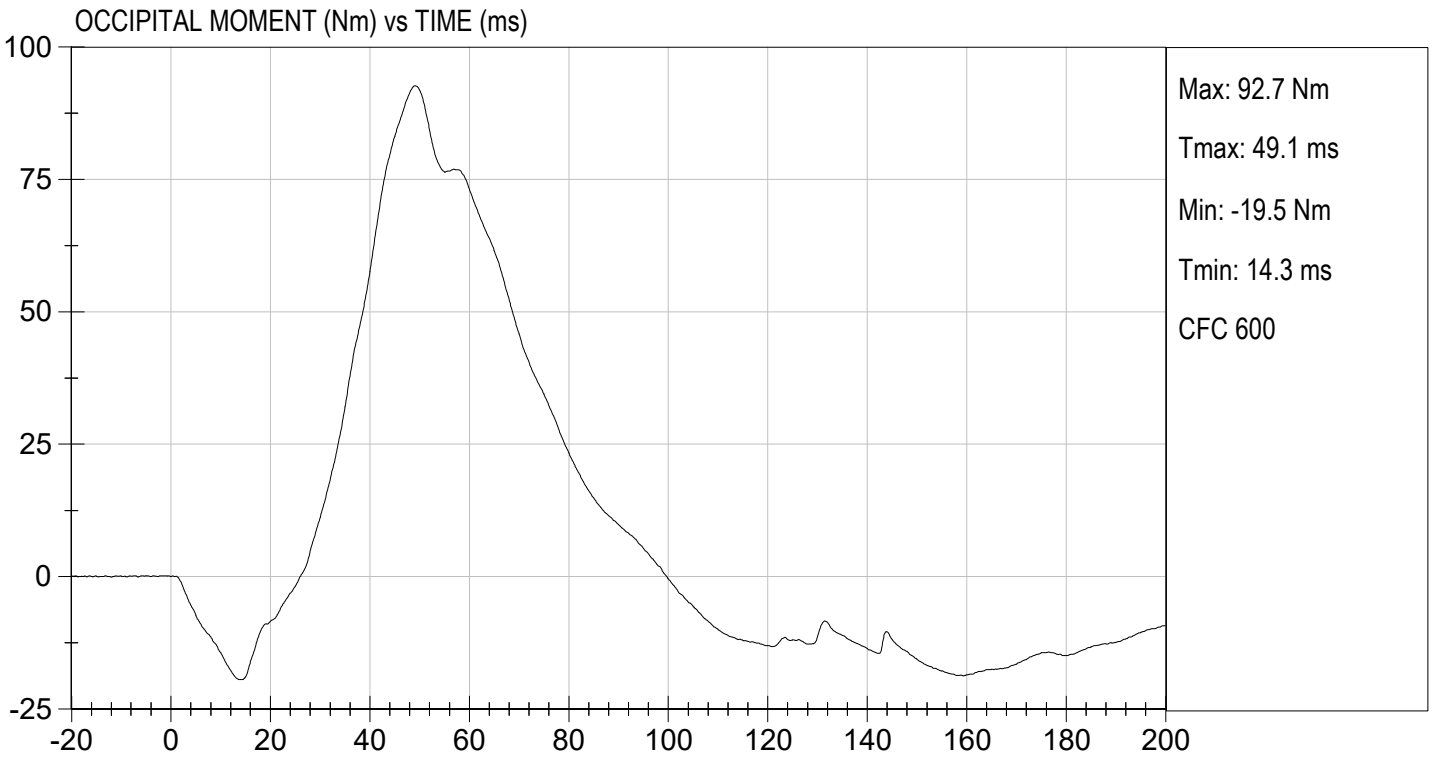


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 02/07/2023
TEST #: D230392



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230393

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	27	Pass
Pendulum Velocity		m/s	5.95 to 6.19	5.98	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.87	Pass
	20 ms	G's	14.00 to 19.00	14.98	Pass
	30 ms	G's	11.00 to 16.00	12.68	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.9	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	45.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.5	Pass
	Time	ms	72.0 to 82.0	80.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	161.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-56.3	Pass
	Time	ms	65.0 to 79.0	74.4	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	143.4	Pass
			Overall Test Results		Pass

Nathaniel Bajamin

Laboratory Technician

02/07/2023

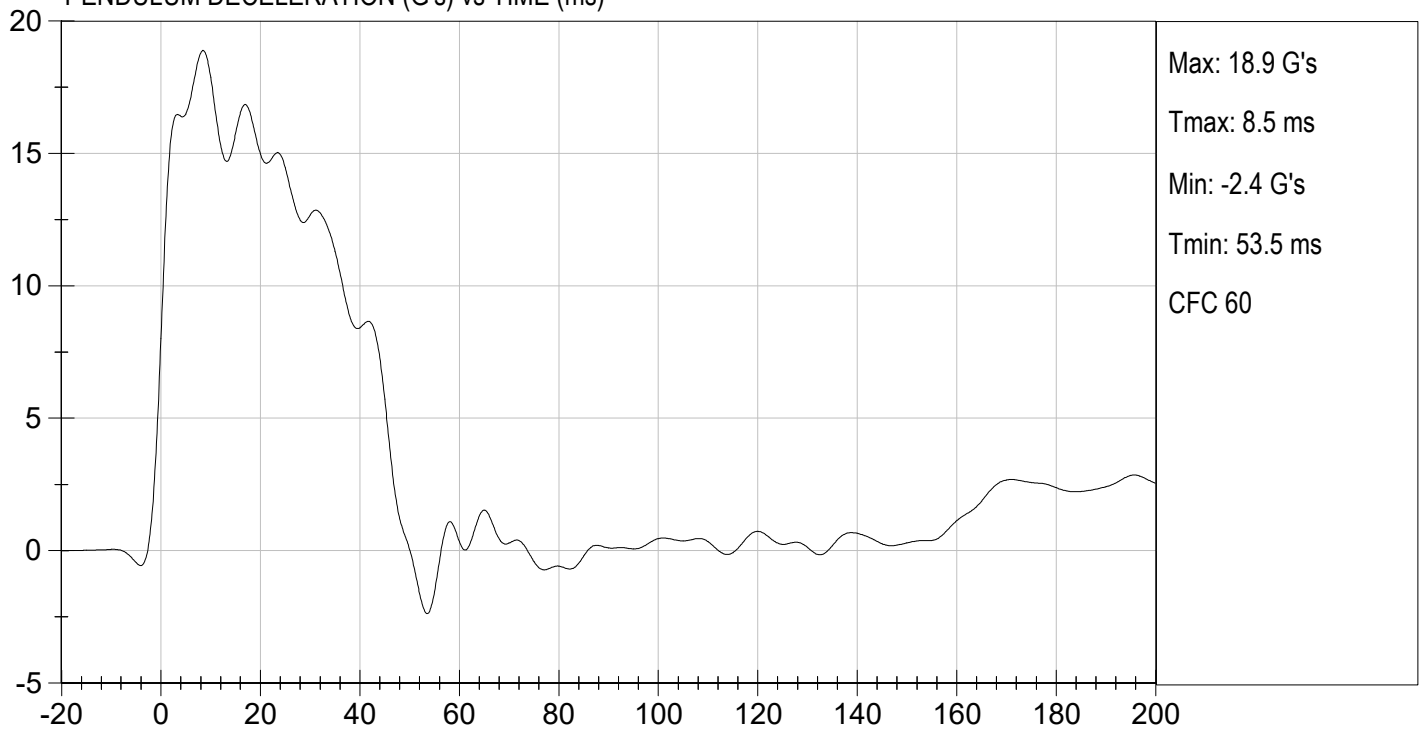
Test Date

Approved By

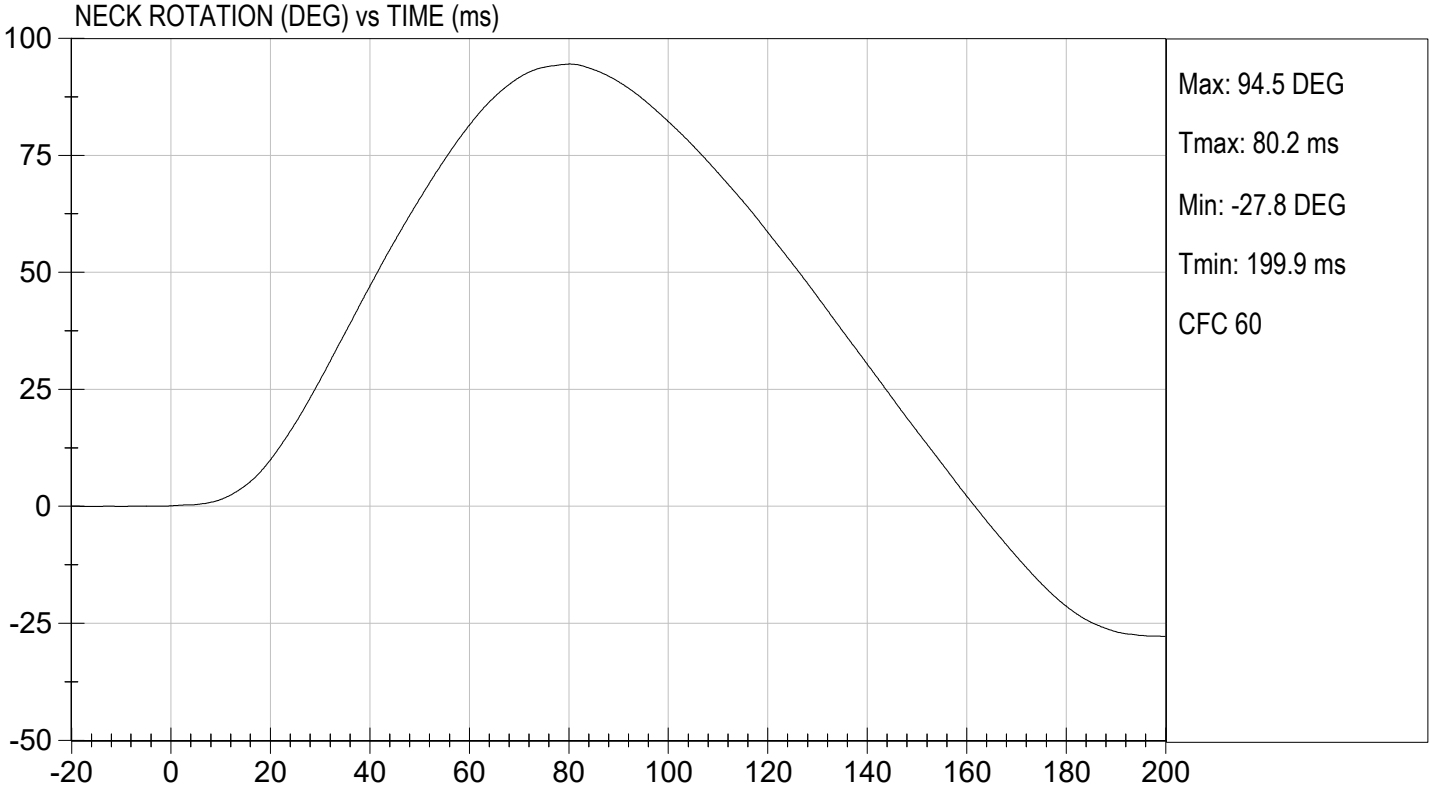
TEST DESC: NECK EXTENSION
VELOCITY: 19.61 ft/s, 5.98 m/s

TEST DATE: 02/07/2023
TEST #: D230393

PENDULUM DECELERATION (G's) vs TIME (ms)

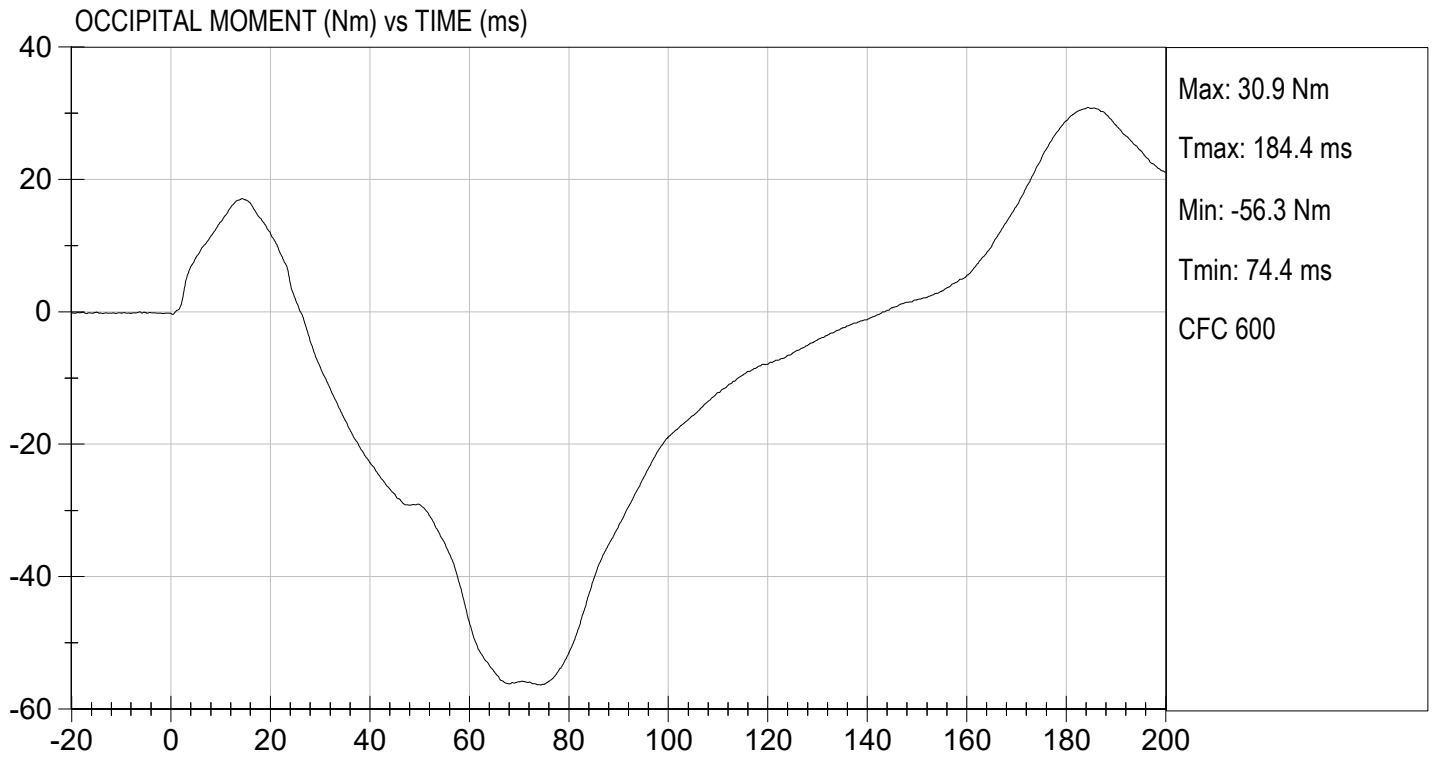


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 19.61 ft/s, 5.98 m/s

TEST DATE: 02/07/2023
TEST #: D230393



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230394

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,622	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.53	Pass
Internal Hysteresis	%	69 to 85	72	Pass
		Overall Test Results		Pass

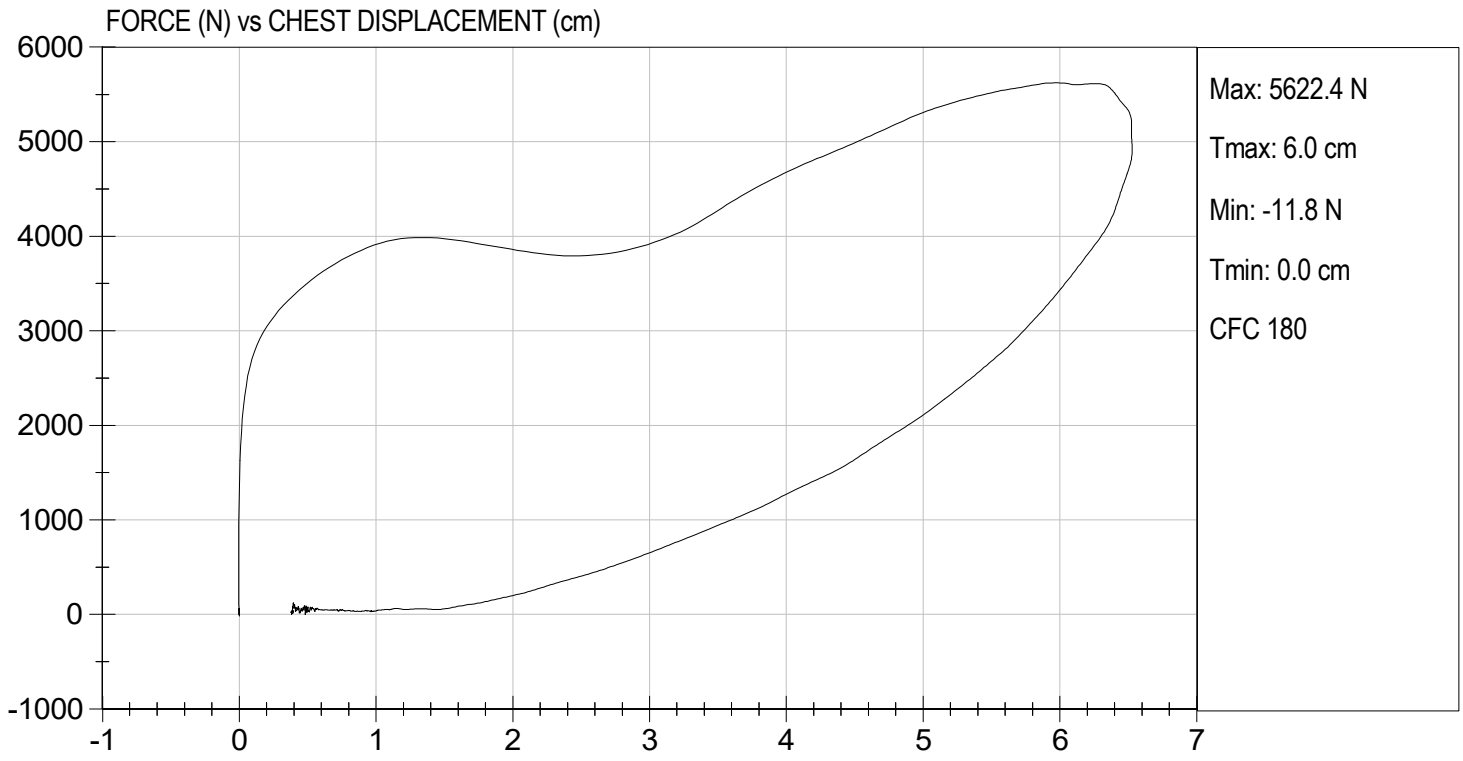
Nathaniel Bajamin
Laboratory Technician

02/09/2023
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 02/09/2023
TEST #: D230394



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230395

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Probe Velocity	m/s	2.07 to 2.13	2.09	Pass
Peak Probe Force	N	4715 to 5782	5,451	Pass
		Overall Test Results		Pass

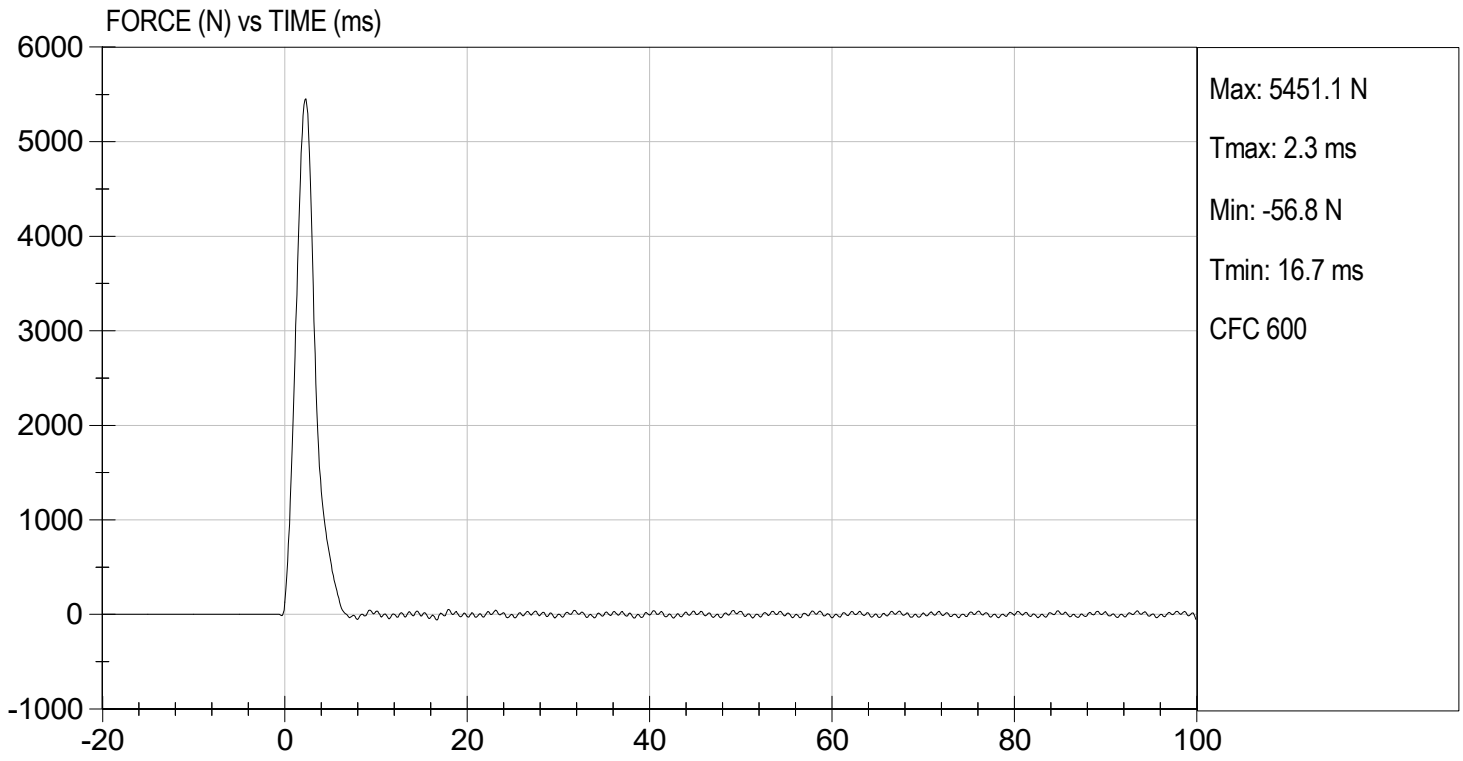
Nathaniel Bajamin
Laboratory Technician

02/09/2023
Test Date

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.86 ft/s, 2.09 m/s

TEST DATE: 02/09/2023
TEST #: D230395



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230396

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Velocity	m/s	2.07 to 2.13	2.07	Pass
Peak Probe Force	N	4715 to 5782	4,974	Pass
		Overall Test Results		Pass

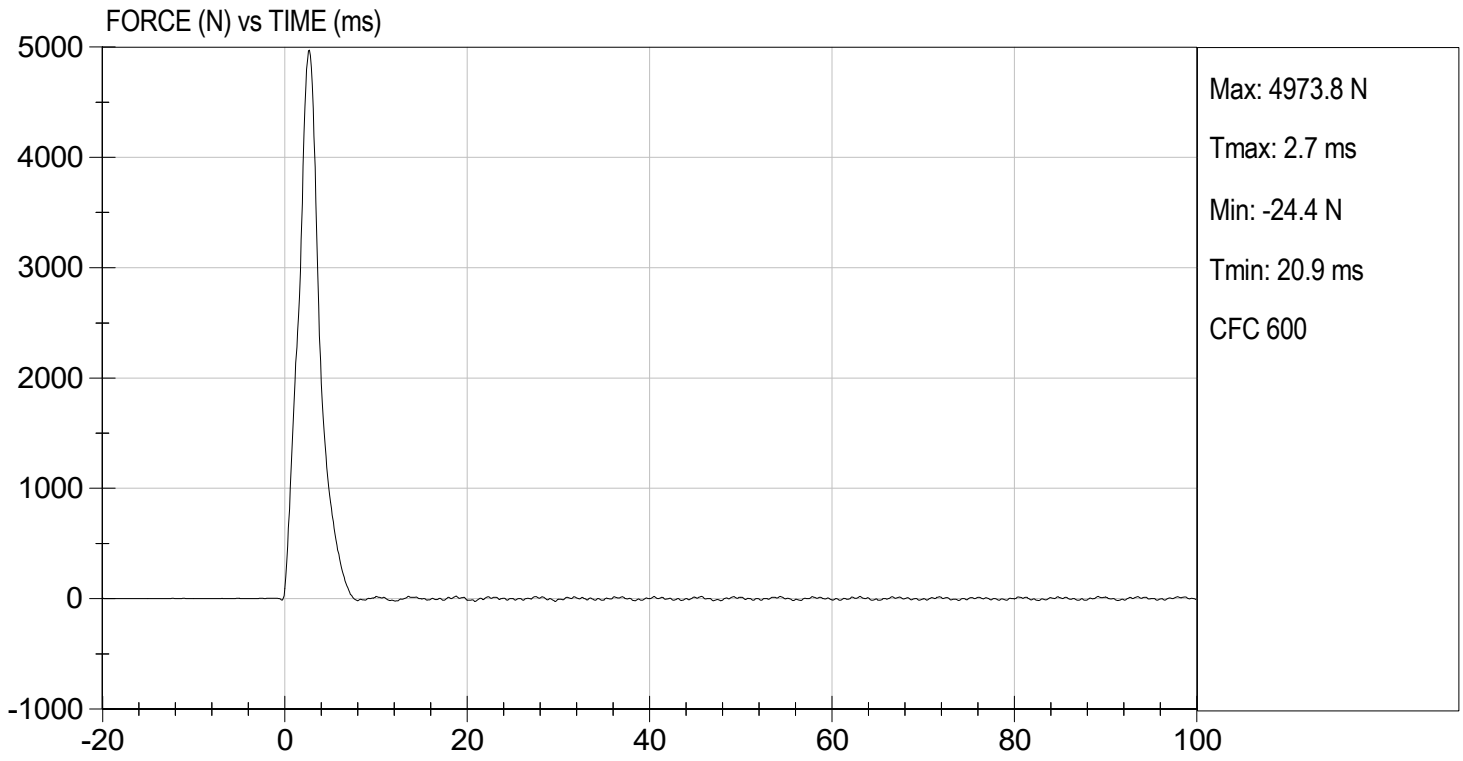
Nathaniel Bajamin
Laboratory Technician

02/09/2023
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.78 ft/s, 2.07 m/s

TEST DATE: 02/09/2023
TEST #: D230396



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230390

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.7	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	26	26	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.6	6.5	Pass
30 Degrees	Nm	94.9 Nm Max	71.1	69.9	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	45.7	48.5	Pass
		Overall Test Results			Pass

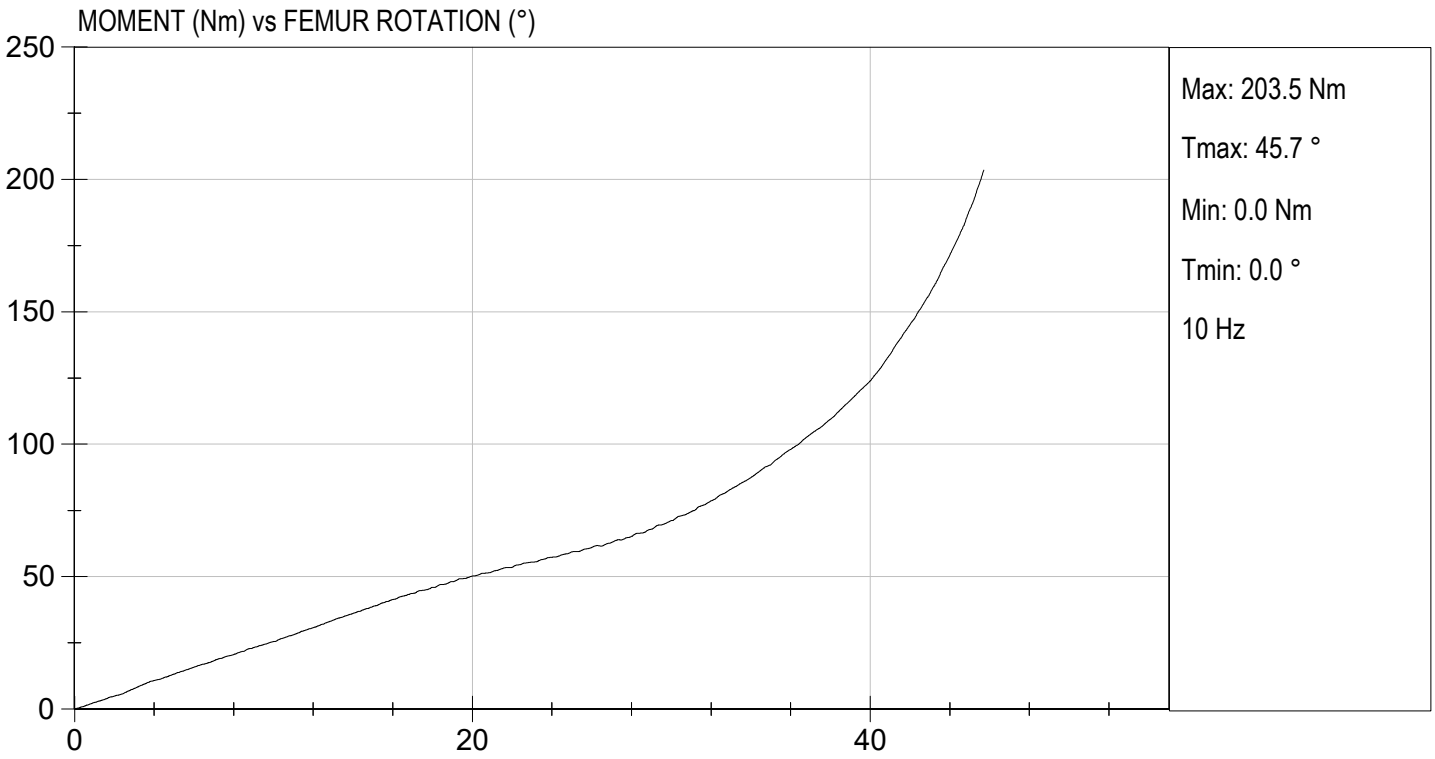
Nathaniel Benjamin
Laboratory Technician

02/09/2023
Test Date

Approved By

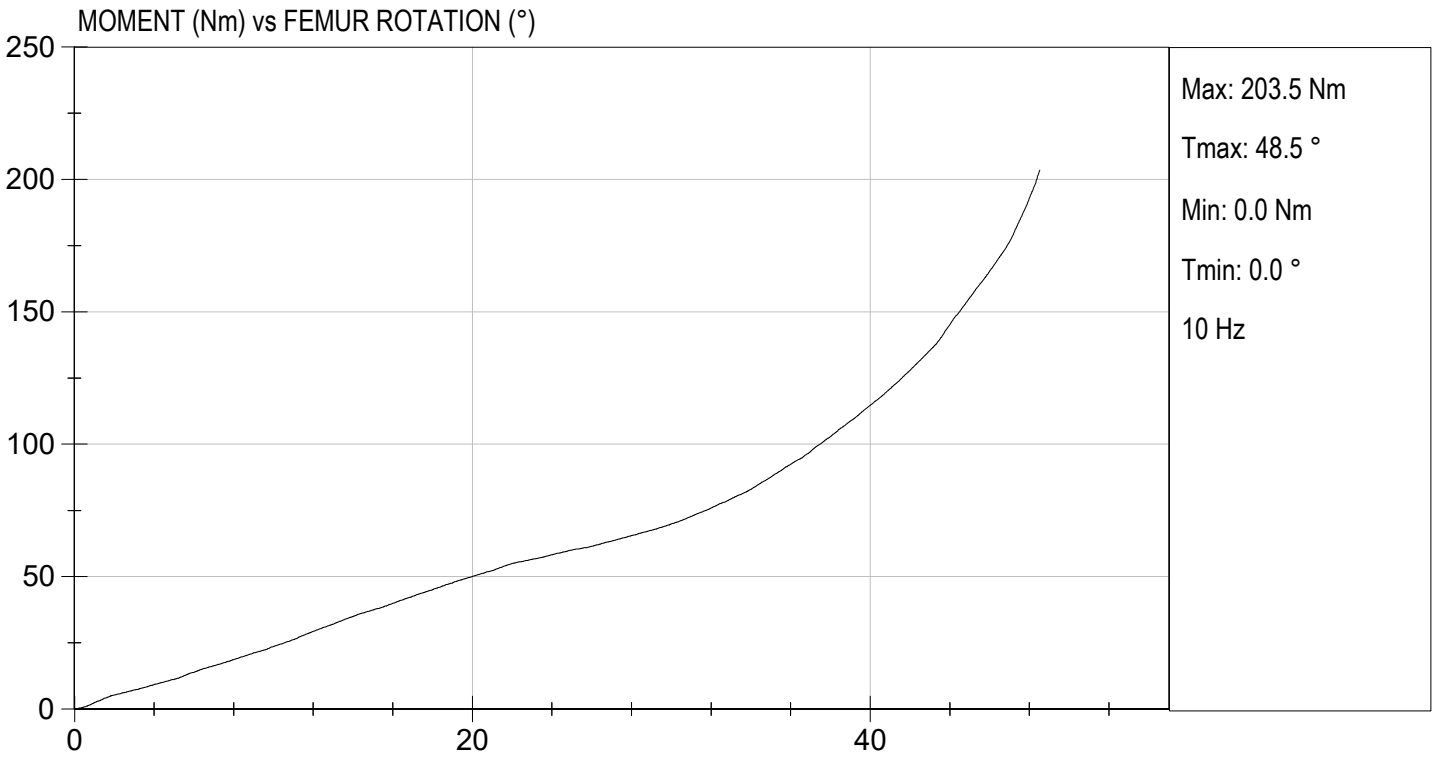
TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 02/09/2023
TEST #: D230399



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 02/09/2023
TEST #: D230390



CALIBRATION TEST RESULTS

POST-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test ID:** D230551

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Peak Resultant Acceleration	G's	225 to 275	264	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	4.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Nathaniel Bajamin
Laboratory Technician

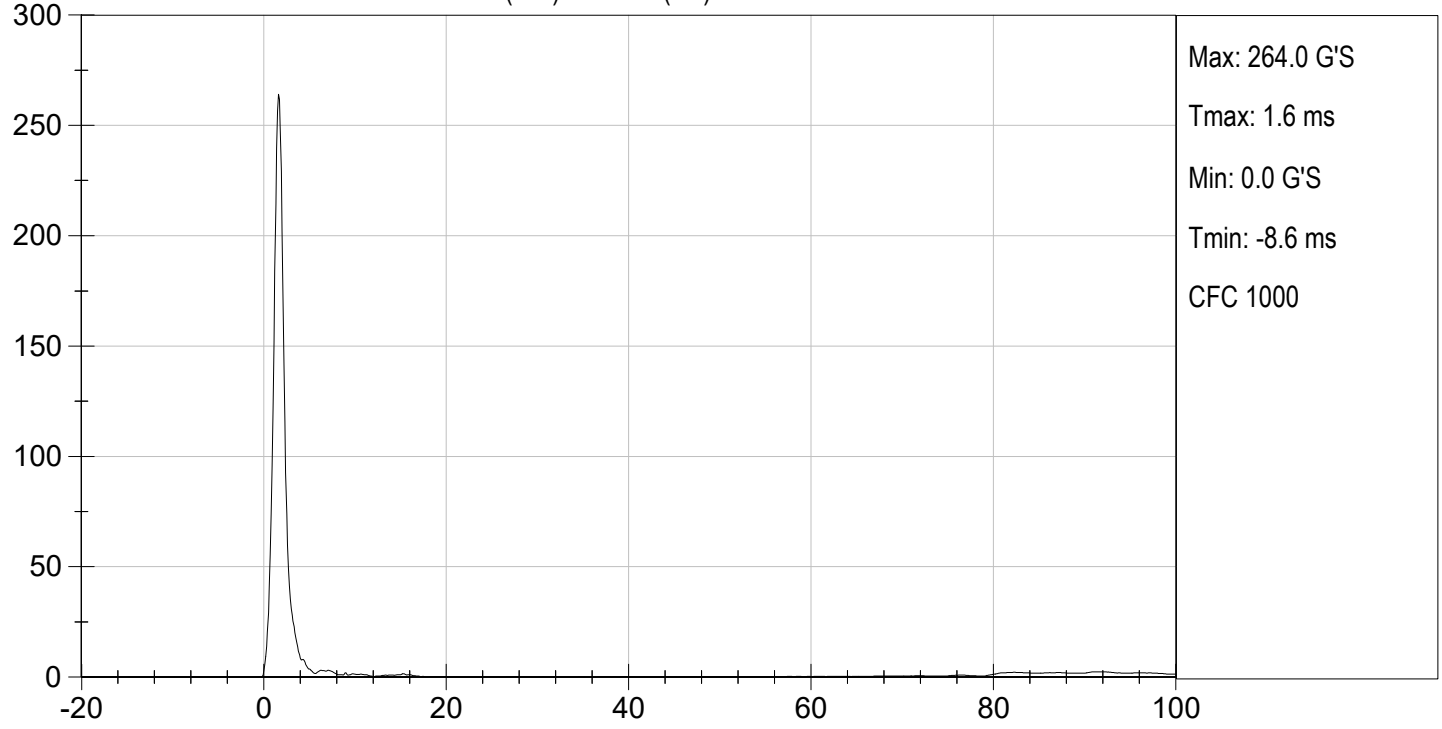
03/03/2023
Test Date

Approved By

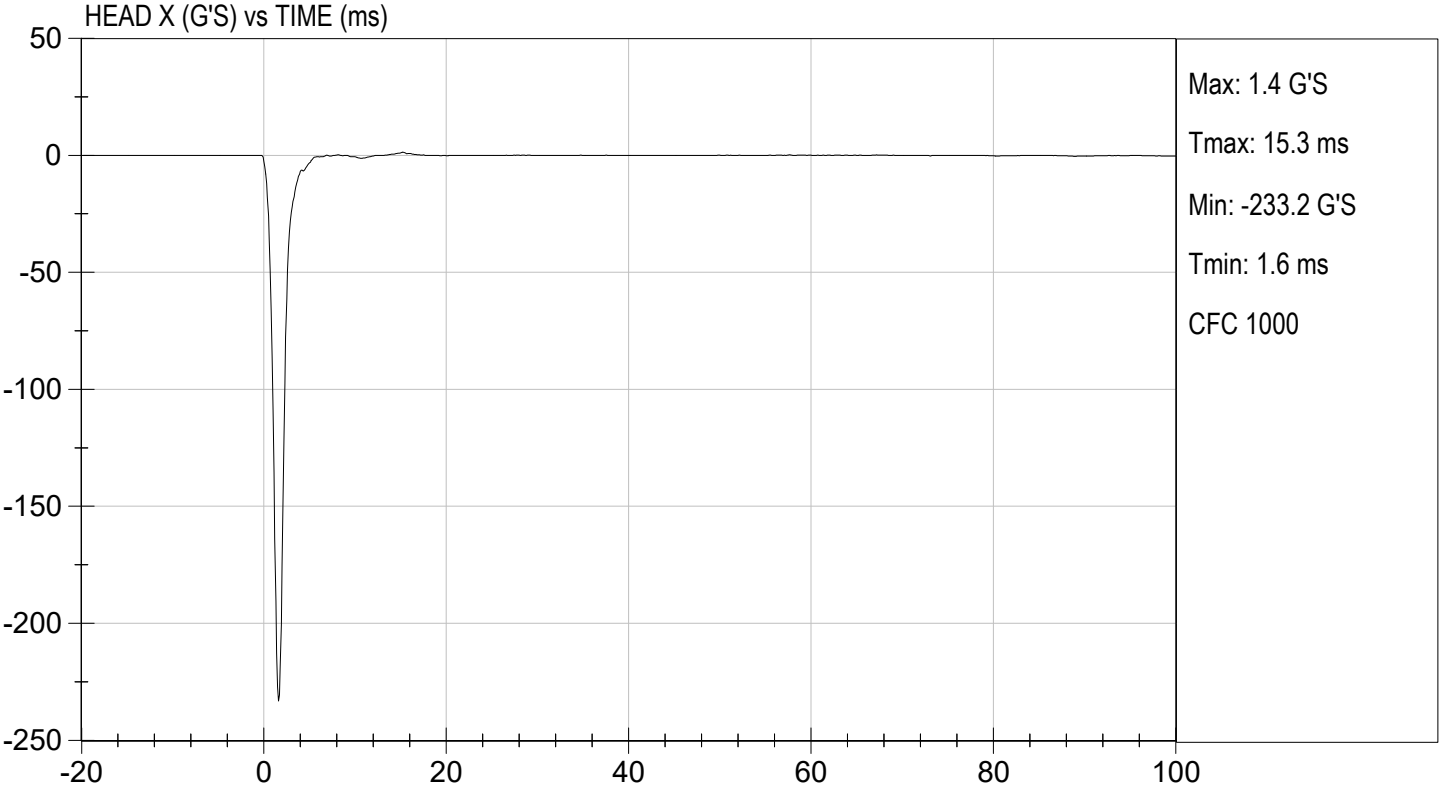
TEST DESC: HEAD DROP

TEST DATE: 03/03/2023
TEST #: D230551

HEAD RESULTANT ACCELERATION (G'S) vs TIME (ms)

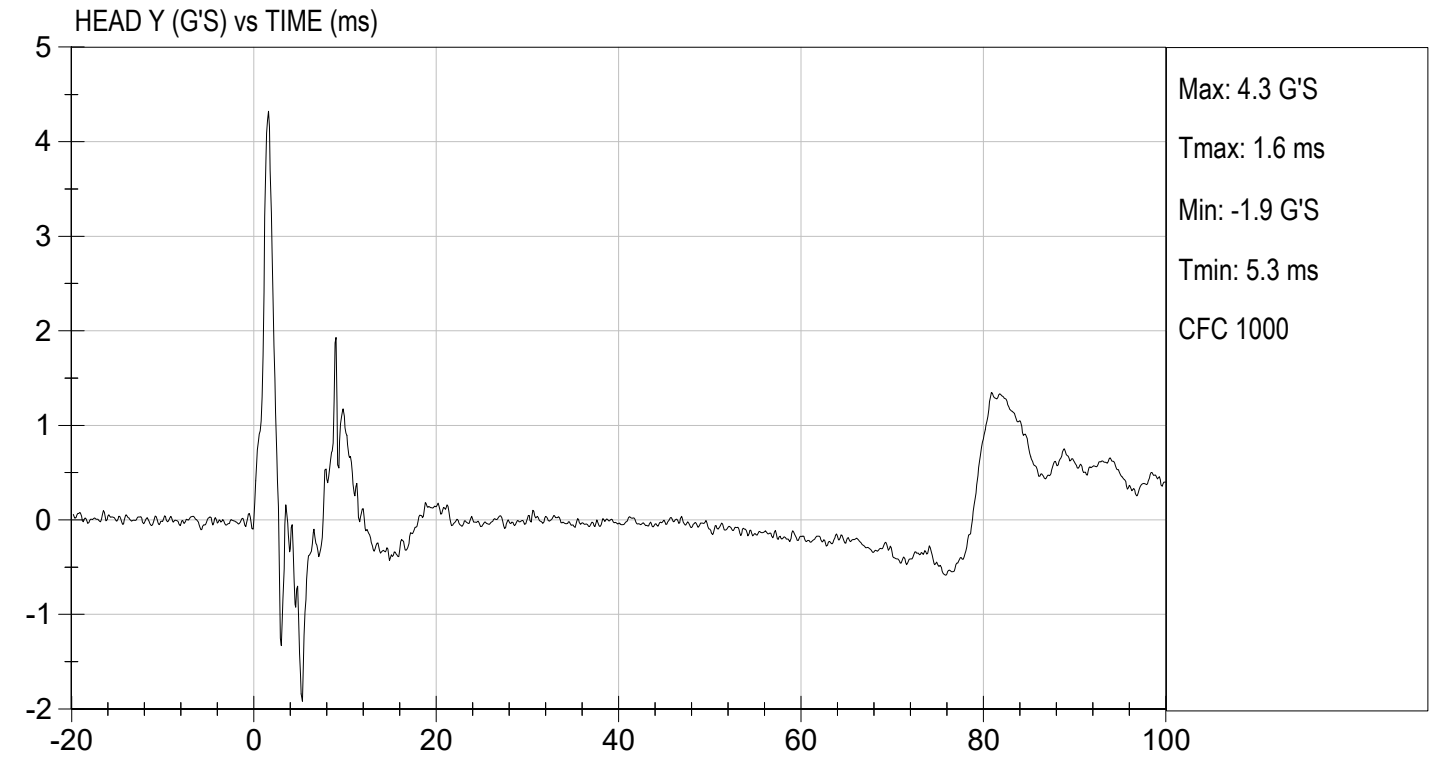


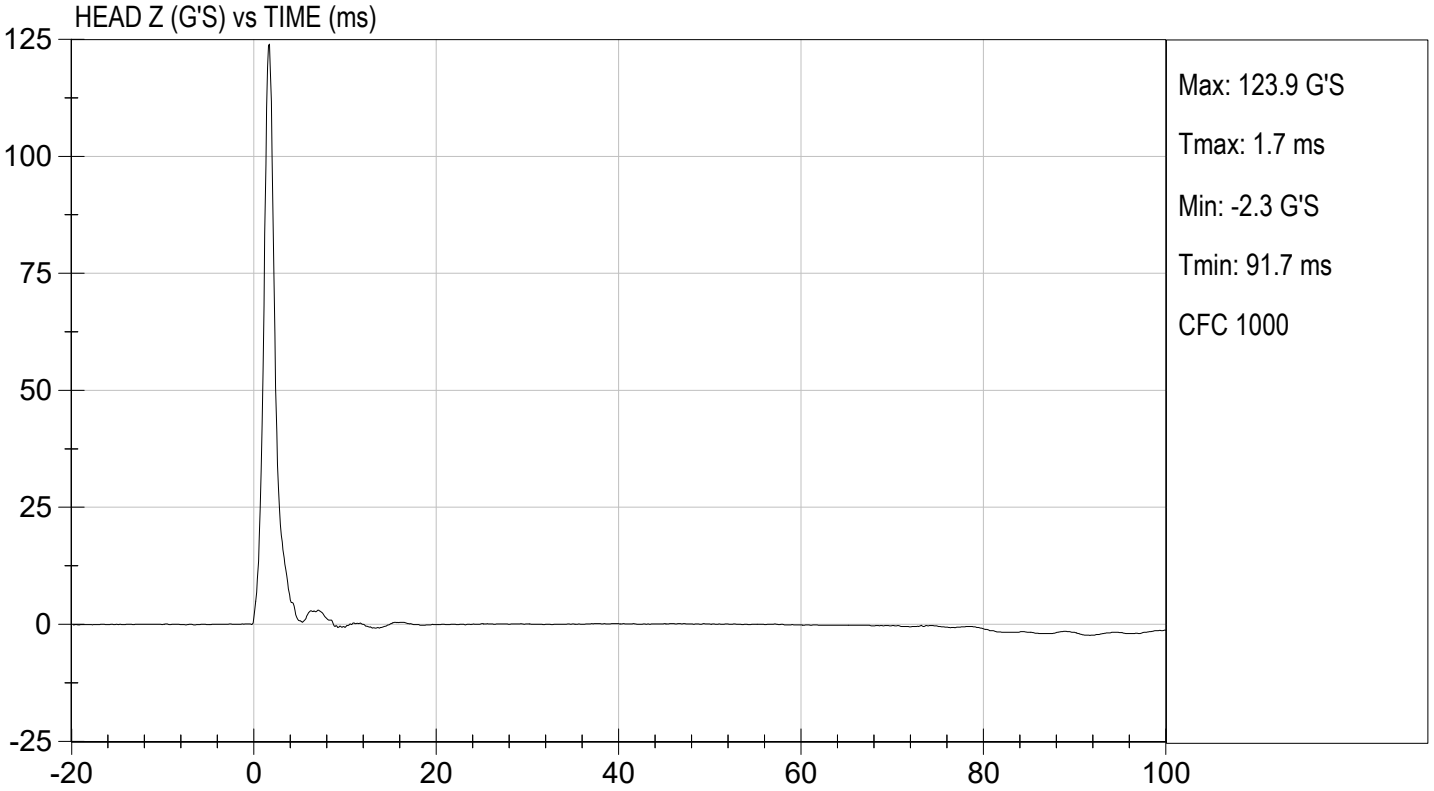
HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 03/03/2023
TEST #: D230551





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230552

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	29	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.54	Pass
	20 ms	G's	17.60 to 22.60	20.07	Pass
	30 ms	G's	12.50 to 18.50	15.04	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	15.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	38.0	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	70.1	Pass
	Time	ms	57.0 to 64.0	58.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	116.4	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	91.3	Pass
	Time	ms	47.0 to 58.0	49.5	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	99.0	Pass
			Overall Test Results		Pass

Nathaniel Bajamin
Laboratory Technician

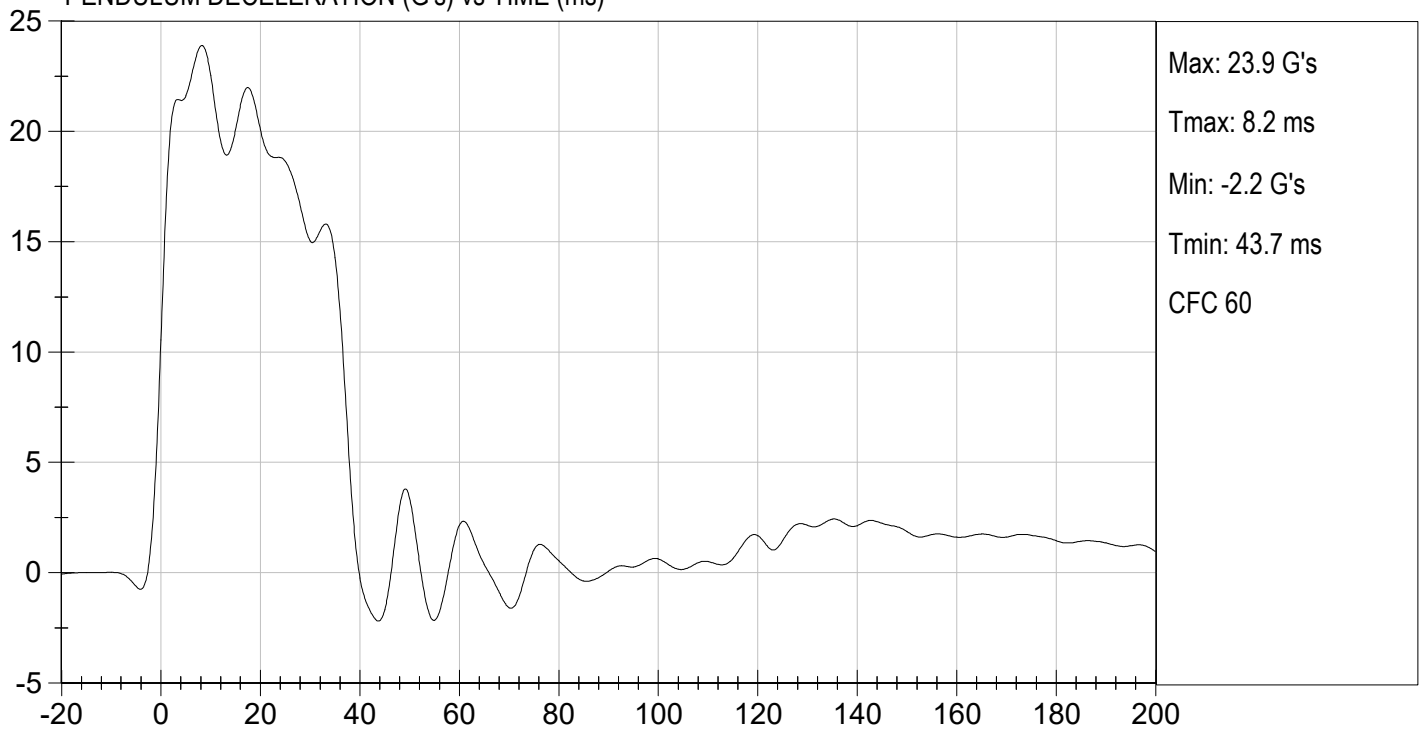
03/06/2023
Test Date

Approved By

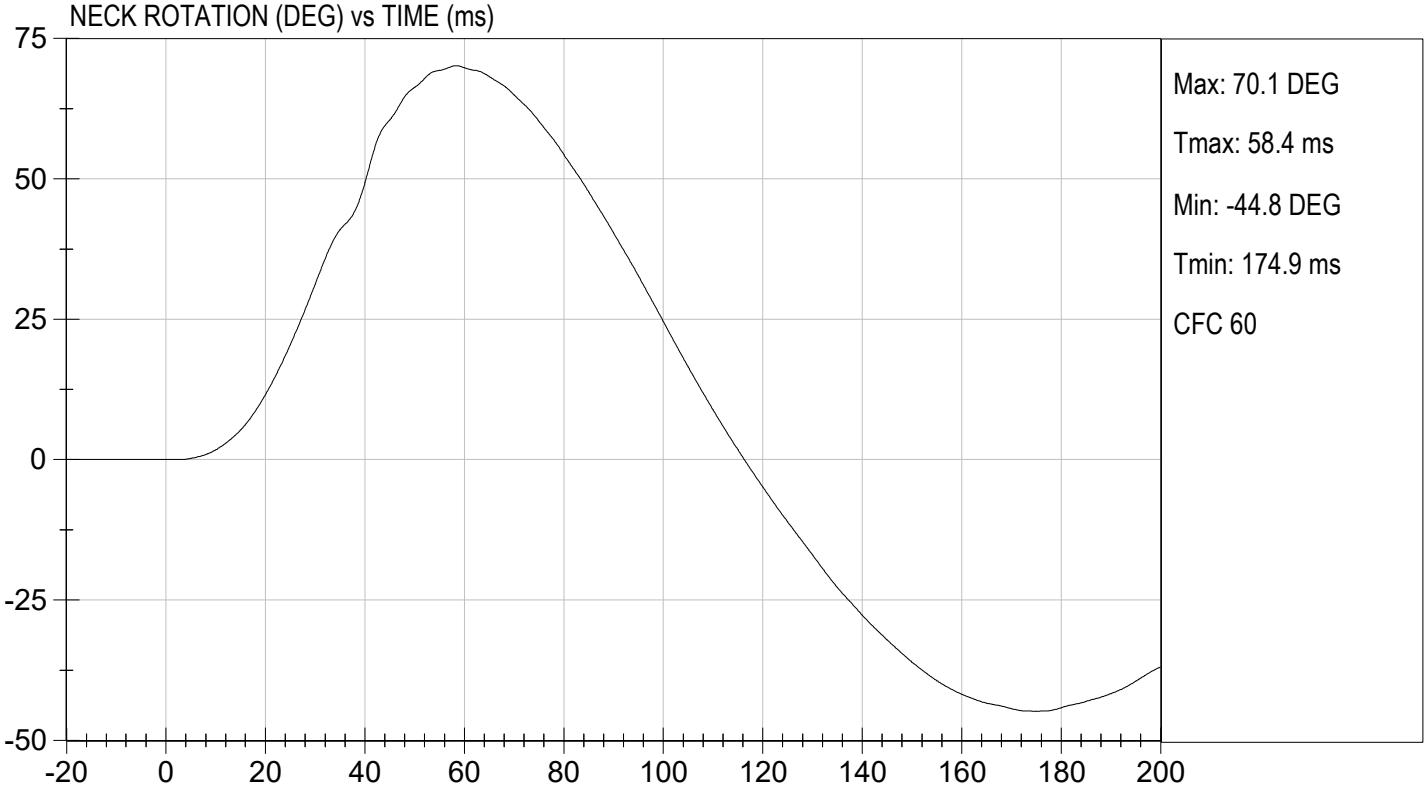
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 03/06/2023
TEST #: D230552

PENDULUM DECELERATION (G's) vs TIME (ms)

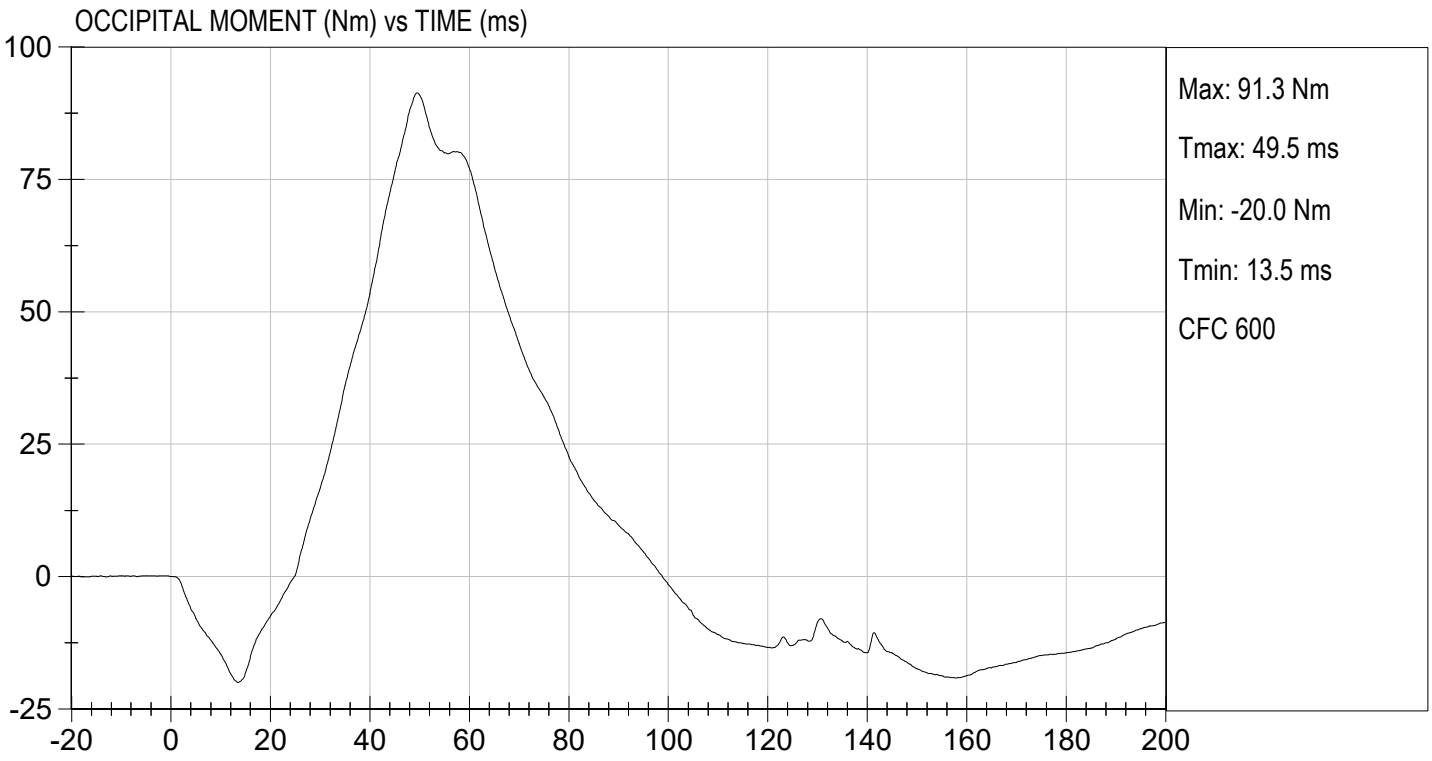


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 03/06/2023
TEST #: D230552



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230553

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.41	Pass
	20 ms	G's	14.00 to 19.00	15.86	Pass
	30 ms	G's	11.00 to 16.00	12.32	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	41.9	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	93.2	Pass
	Time	ms	72.0 to 82.0	75.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	157.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-59.3	Pass
	Time	ms	65.0 to 79.0	71.3	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	141.3	Pass
			Overall Test Results		Pass

Nathaniel Bajamin
Laboratory Technician

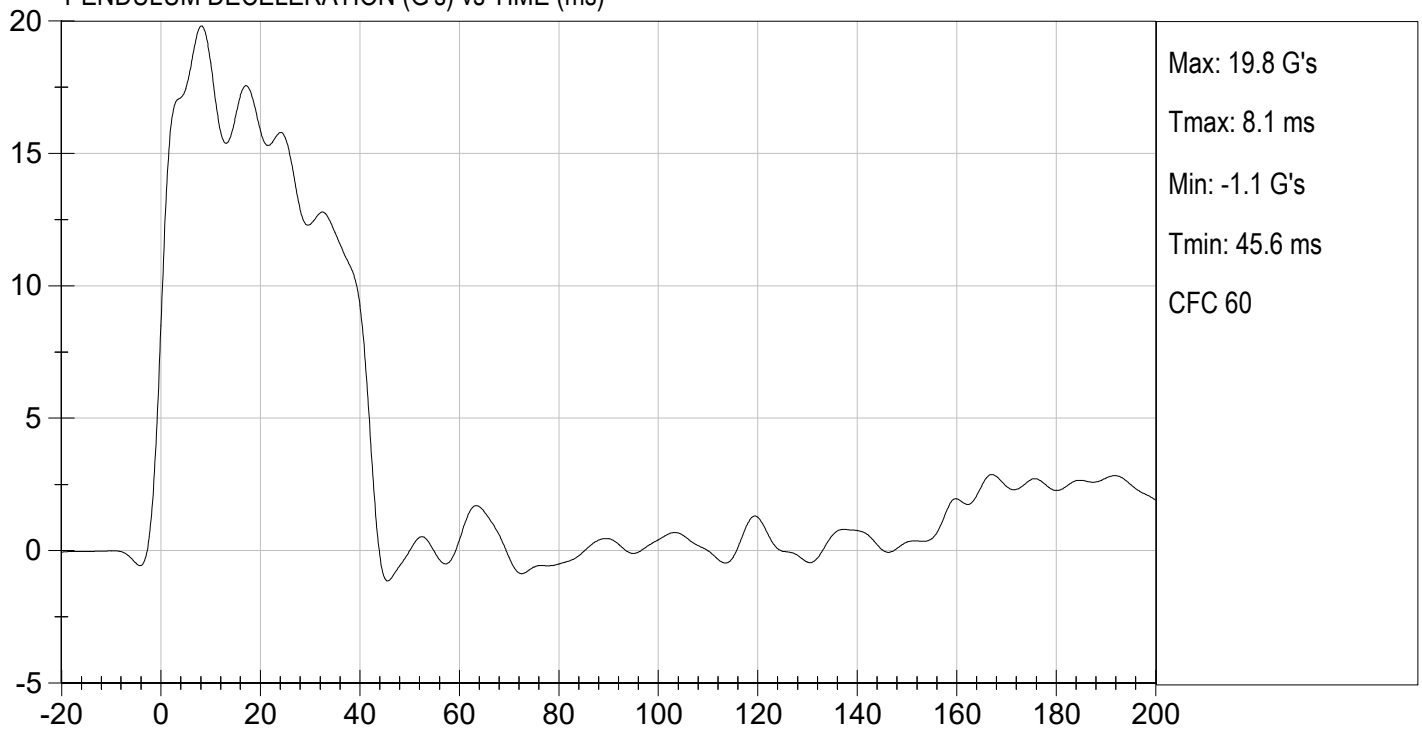
03/06/2023
Test Date

Approved By

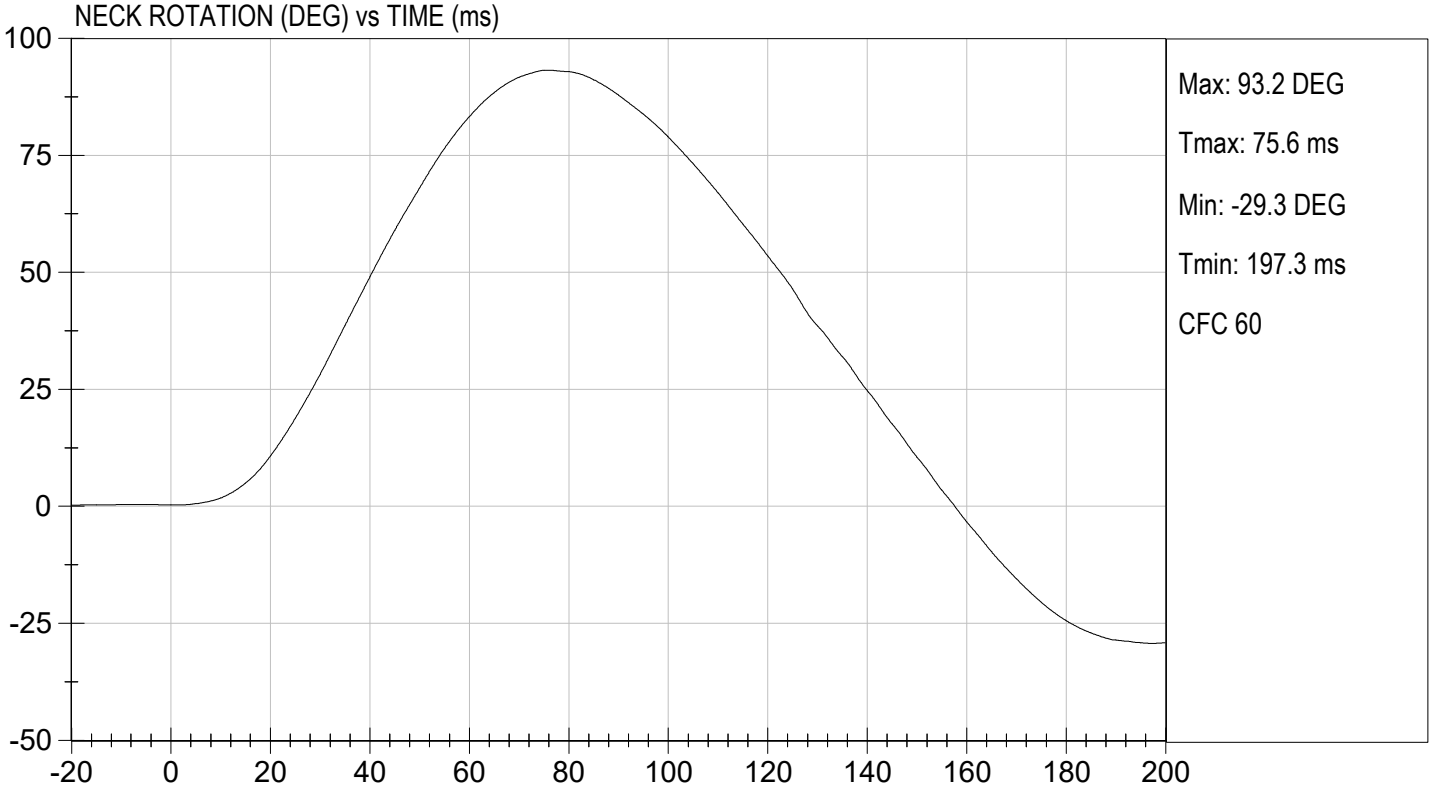
TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 03/06/2023
TEST #: D230553

PENDULUM DECELERATION (G's) vs TIME (ms)

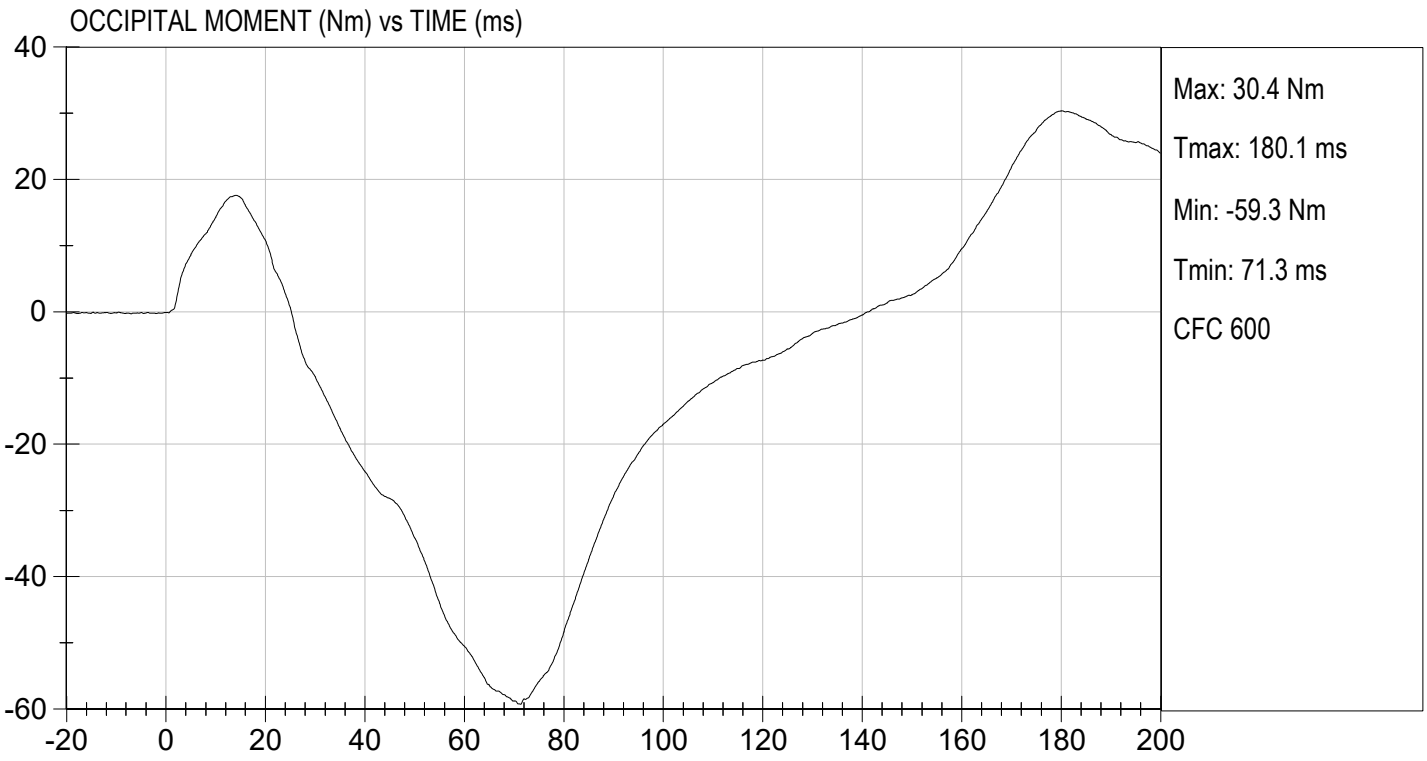


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 03/06/2023
TEST #: D230553



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230554

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	27	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,744	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.56	Pass
Internal Hysteresis	%	69 to 85	73	Pass
		Overall Test Results		Pass

Nathaniel Benjamin
Laboratory Technician

03/02/2023
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 03/02/2023
TEST #: D230554

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230555

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Probe Velocity	m/s	2.07 to 2.13	2.13	Pass
Peak Probe Force	N	4715 to 5782	4,864	Pass
		Overall Test Results		Pass

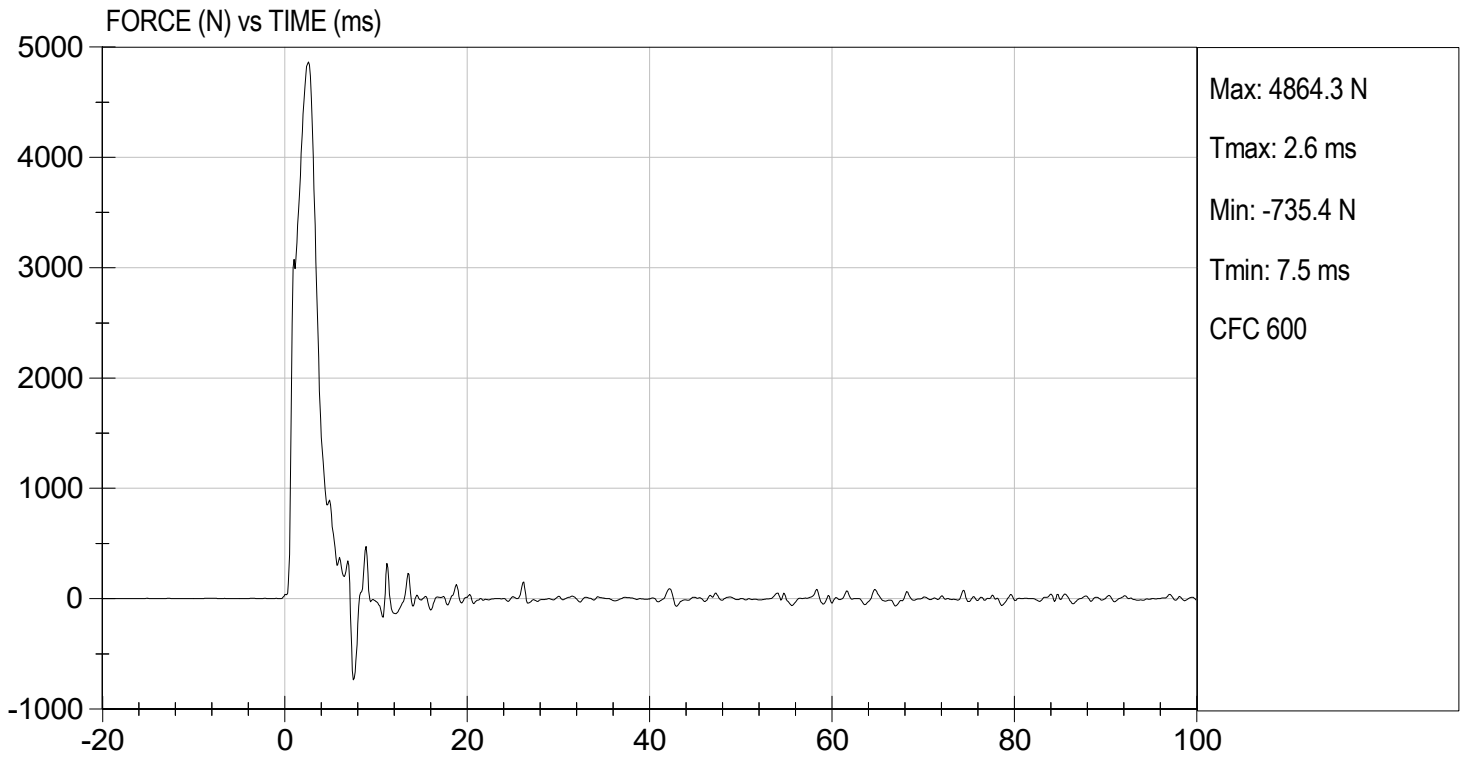
Nathaniel Bajamin
Laboratory Technician

03/06/2023
Test Date

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 03/06/2023
TEST #: D230555



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230556

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,082	Pass
		Overall Test Results		Pass

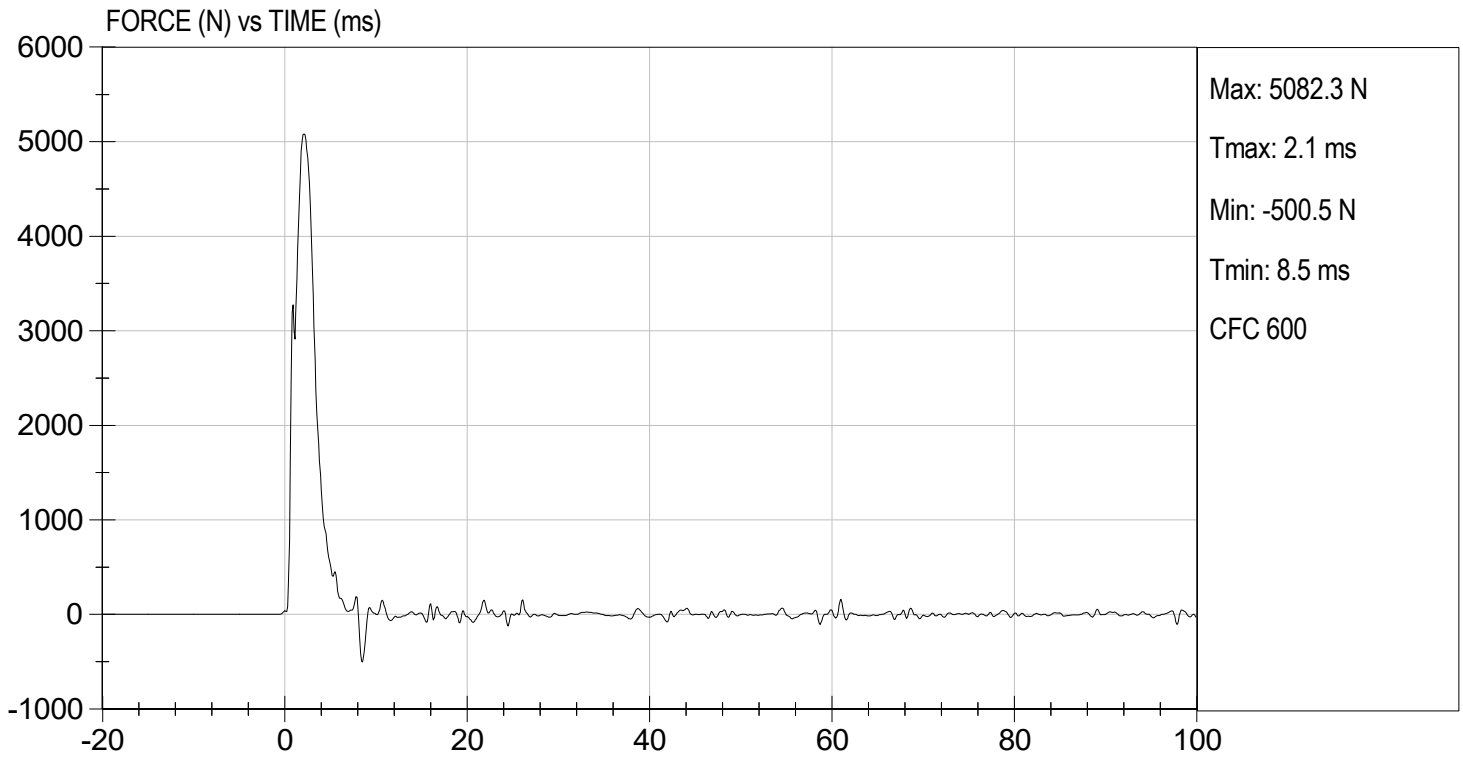
Nathaniel Bajamin
Laboratory Technician

03/06/2023
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.94 ft/s, 2.12 m/s

TEST DATE: 03/06/2023
TEST #: D230556



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D230550

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	31	31	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.5	6.5	Pass
30 Degrees	Nm	94.9 Nm Max	69.6	74.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	47.6	48.0	Pass
		Overall Test Results			Pass

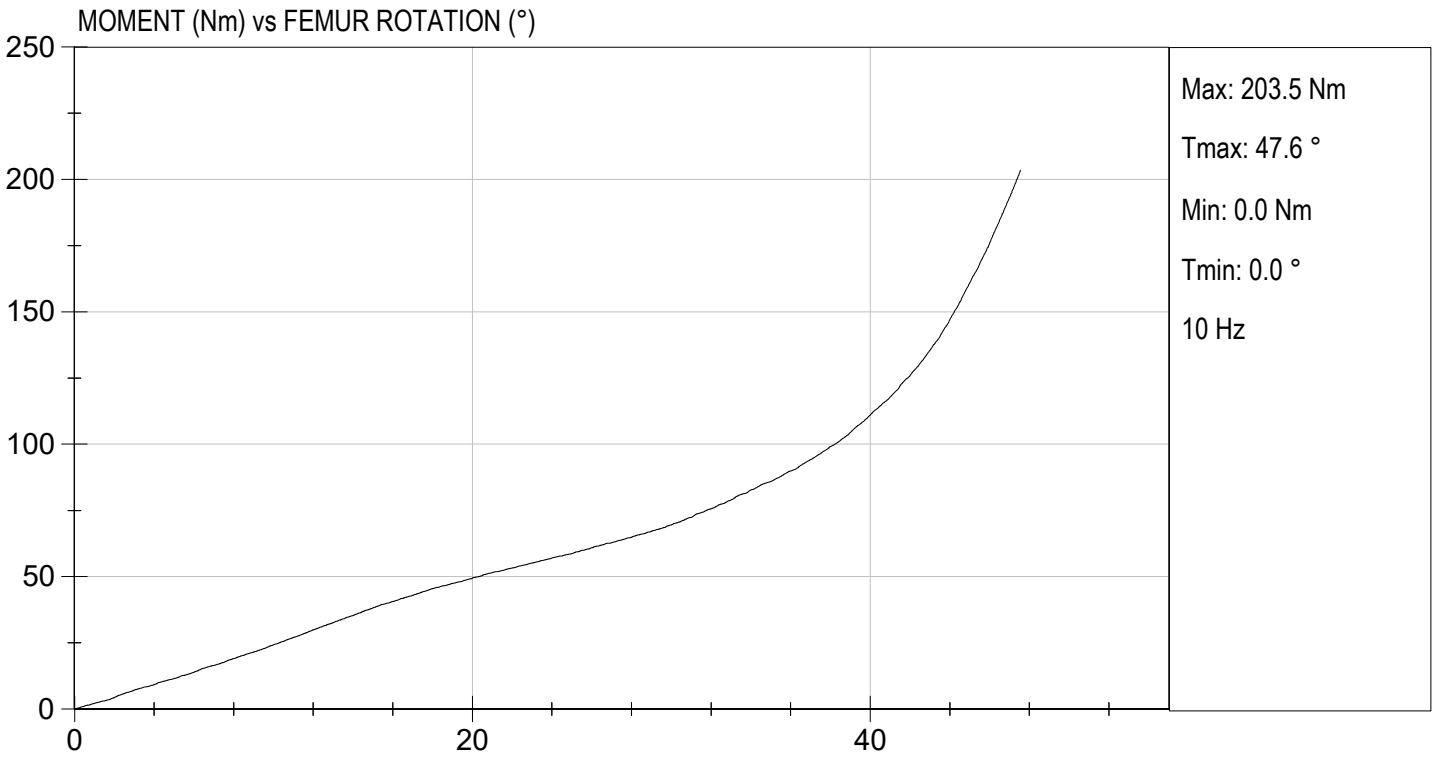
Nathaniel Bajamin
Laboratory Technician

03/06/2023
Test Date

Approved By

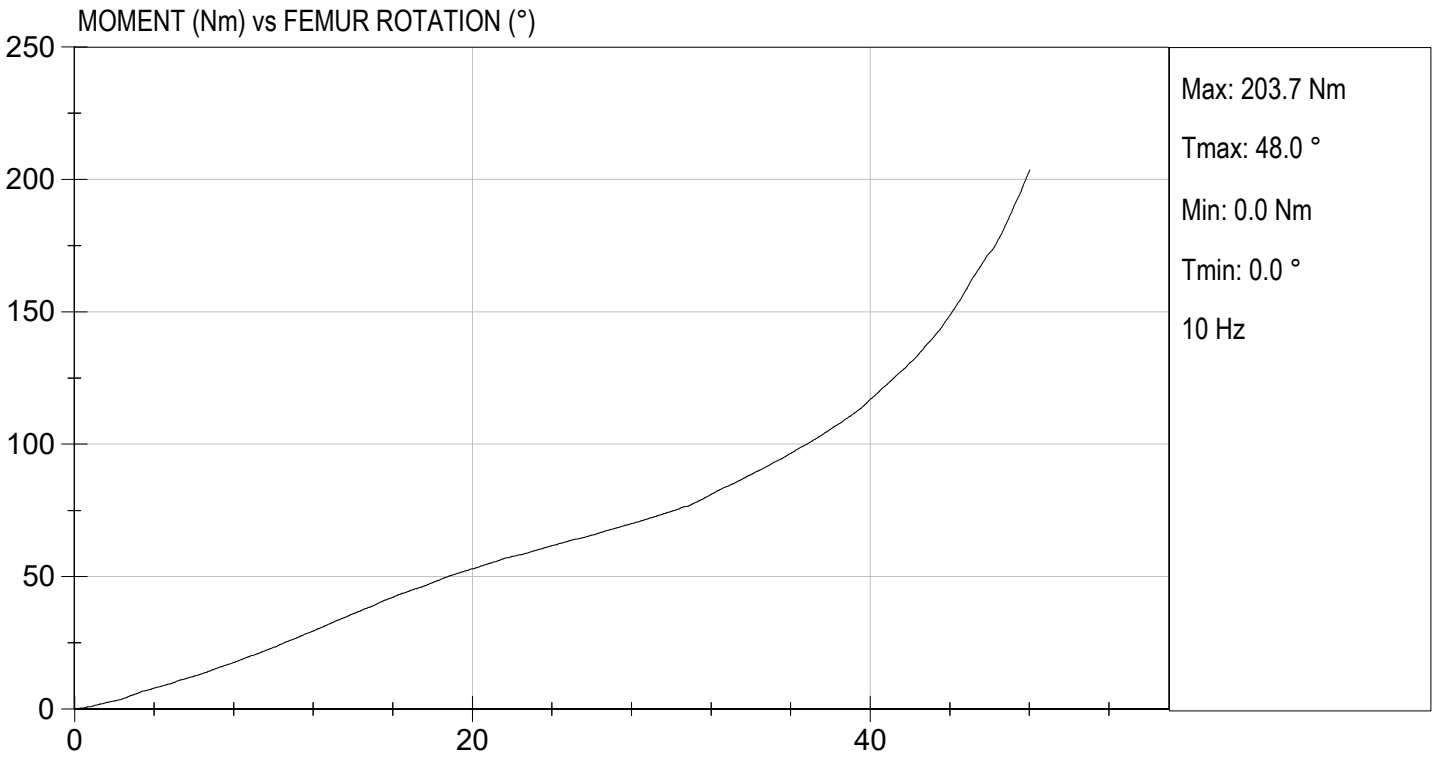
TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 03/06/2023
TEST #: D230559



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 03/06/2023
TEST #: D230550



CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

Hybrid III, 5th External Measurements
SN: 142

HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	775.0
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	438.2
C	H-POINT HEIGHT	Reference	81.3-86.3	81.8
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	148.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	83.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	124.4
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	245.2
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	43.4
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	281.1
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	197.2
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	537.2
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376	358.8
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	403.1
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. “K”.	414-439.4	435.2

HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	181.2
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	227.3
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	475.0
S	HEAD BREADTH	The widest part of the head	137.1-147.3	138.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188	181.0
U	HIP BREADTH	The widest part of the hip	299.7-314.9	308.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	362.1
W	FOOT BREADTH	The widest part of the foot	78.8-94	82.8
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. “T”	528.3-548.7	545.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	870.7
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	779.9
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	350.1
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	170.0

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test ID:** D230381

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Peak Resultant Acceleration	G's	250 to 300	292	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	1.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Nathaniel Bajamin
Laboratory Technician

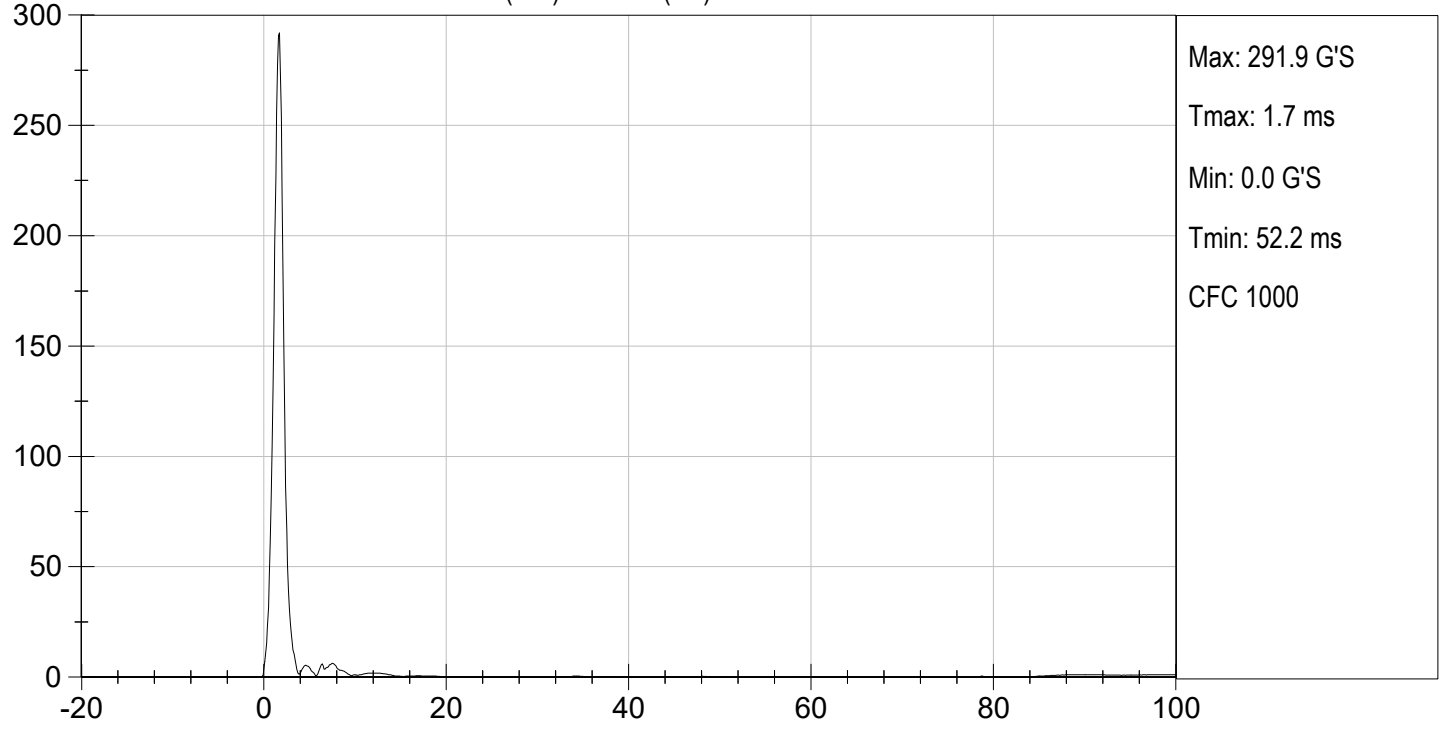
02/08/2023
Test Date

Approved By

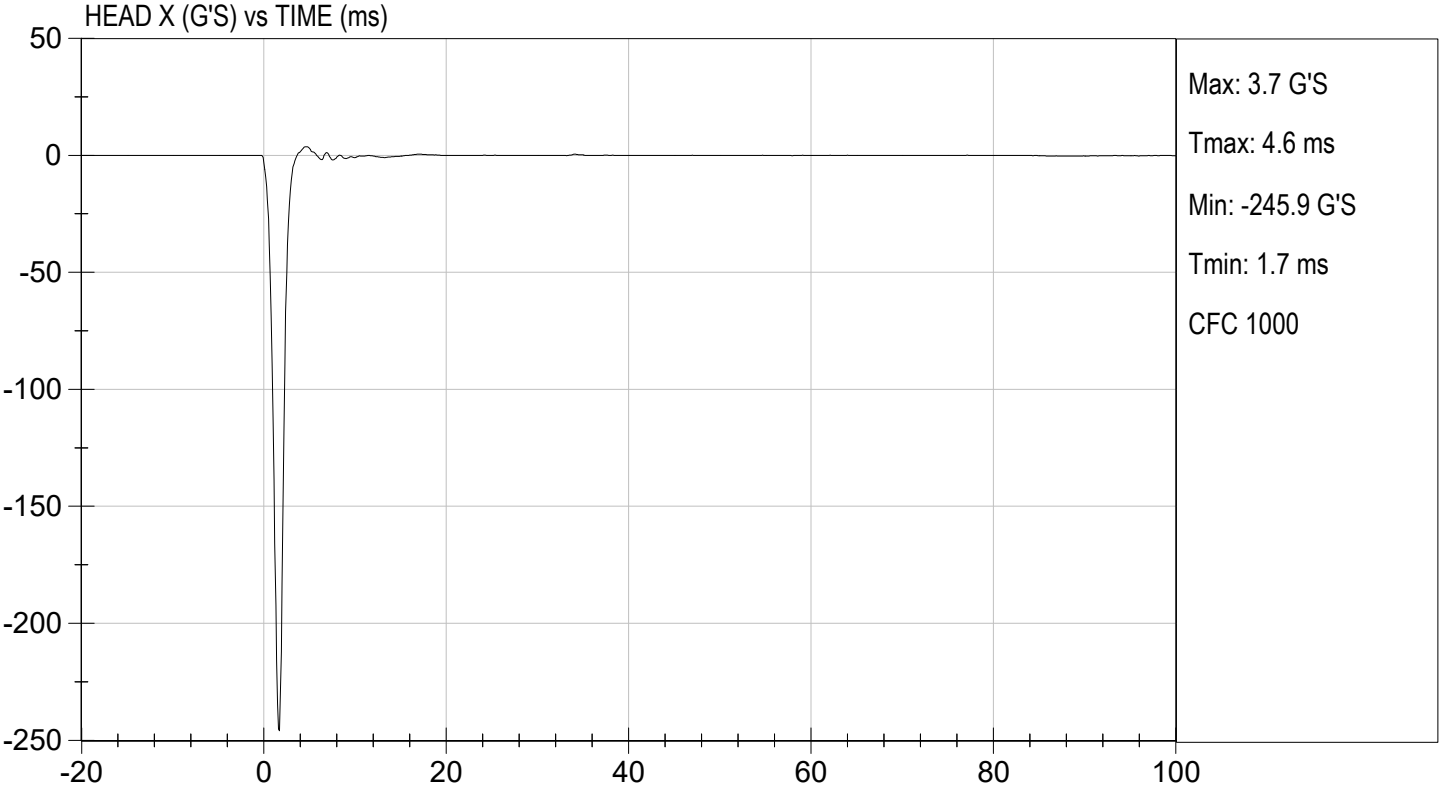
TEST DESC: HEAD DROP

TEST DATE: 02/08/2023
TEST #: D230381

HEAD RESULTANT ACCELERATION (G'S) vs TIME (ms)

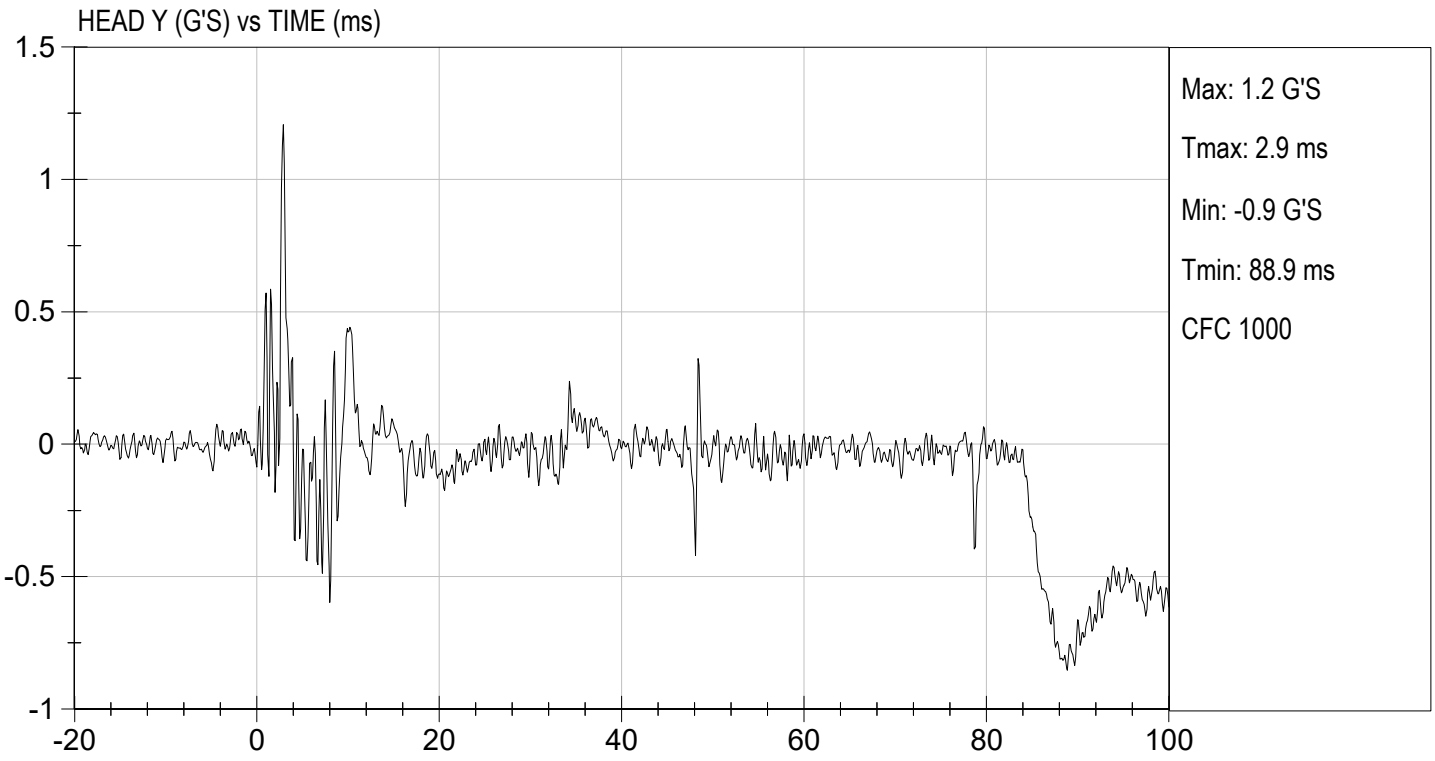


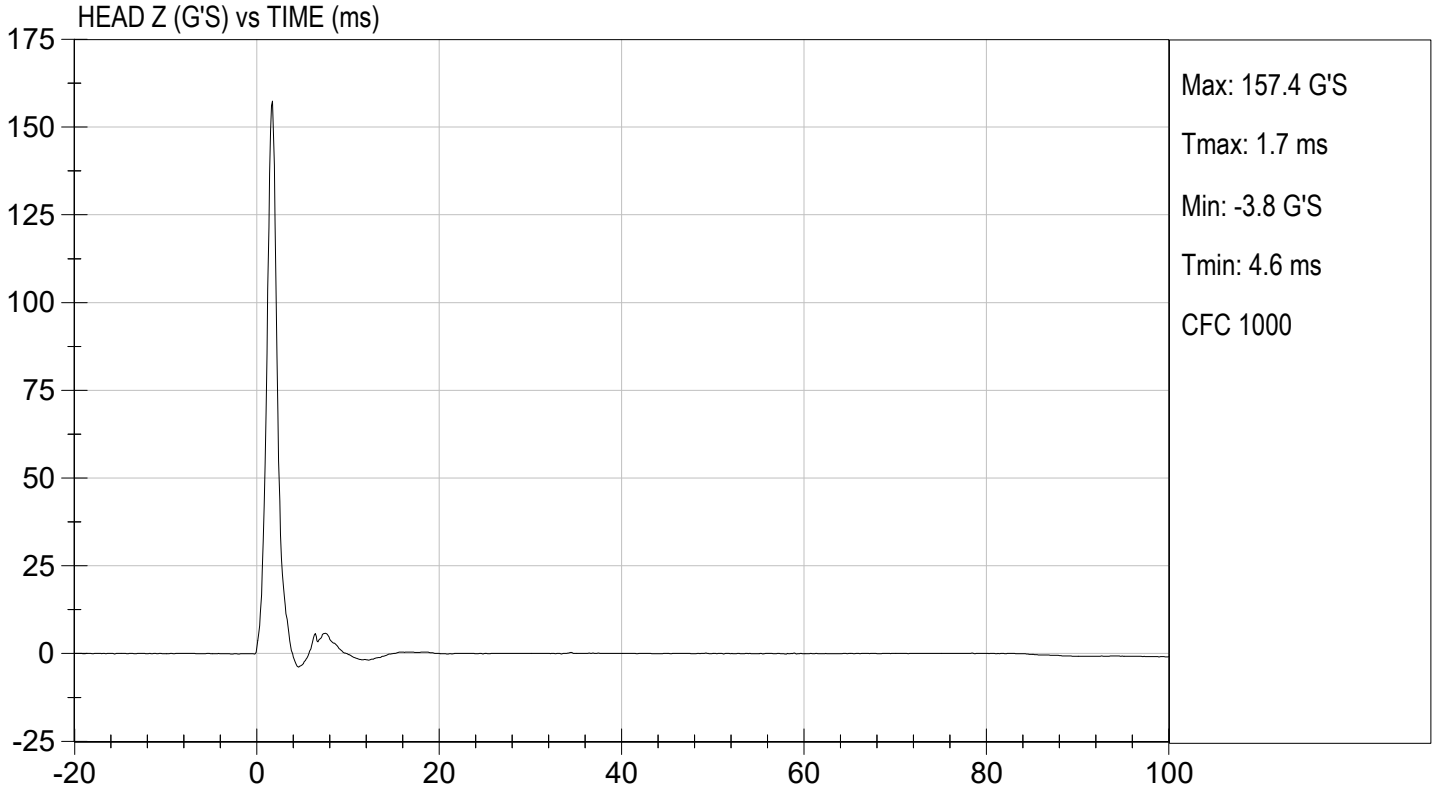
HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 02/08/2023
TEST #: D230381





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230382

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	27	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.7	Pass
D Plane Rotation	Max	deg	77 to 91	80	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	72	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
			Overall Results		Pass

Nathaniel Bajamin

Laboratory Technician

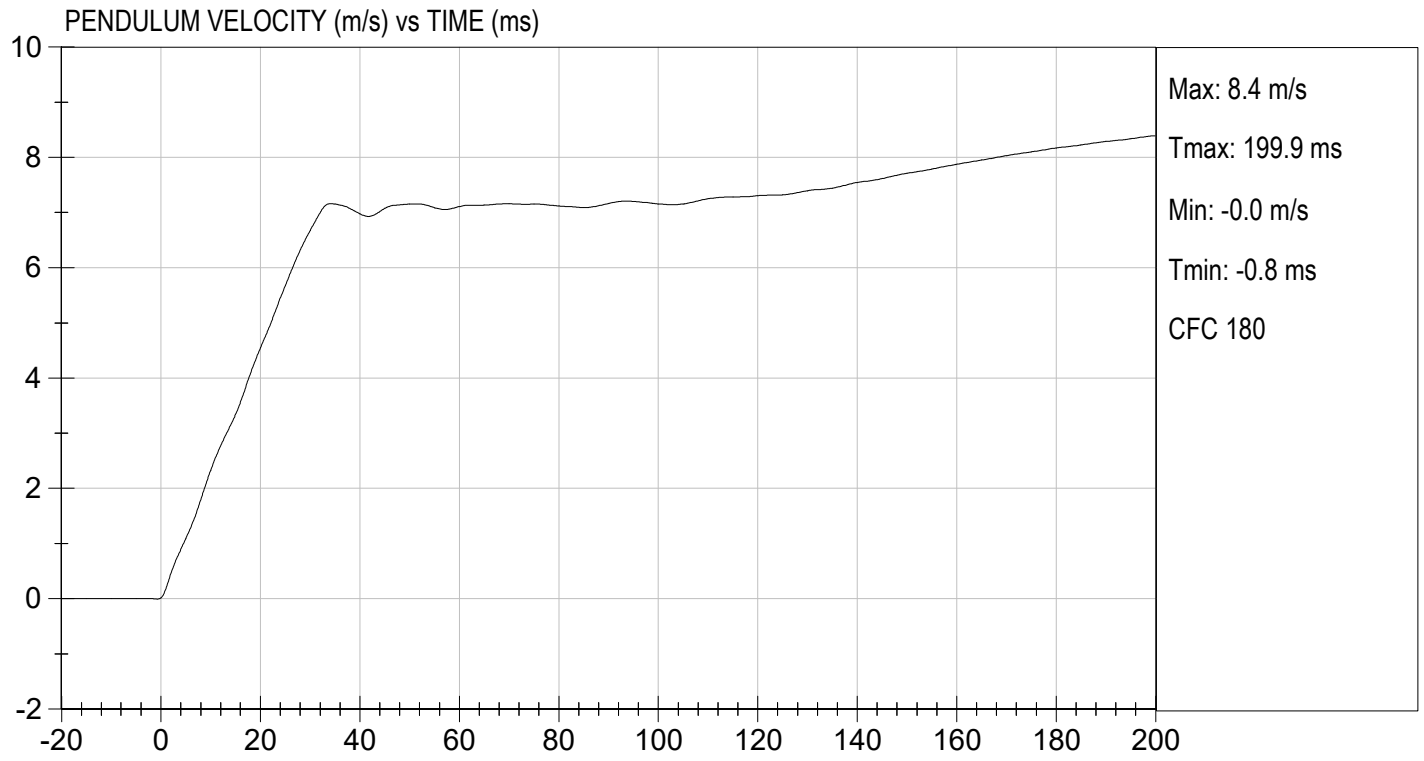
02/07/2023

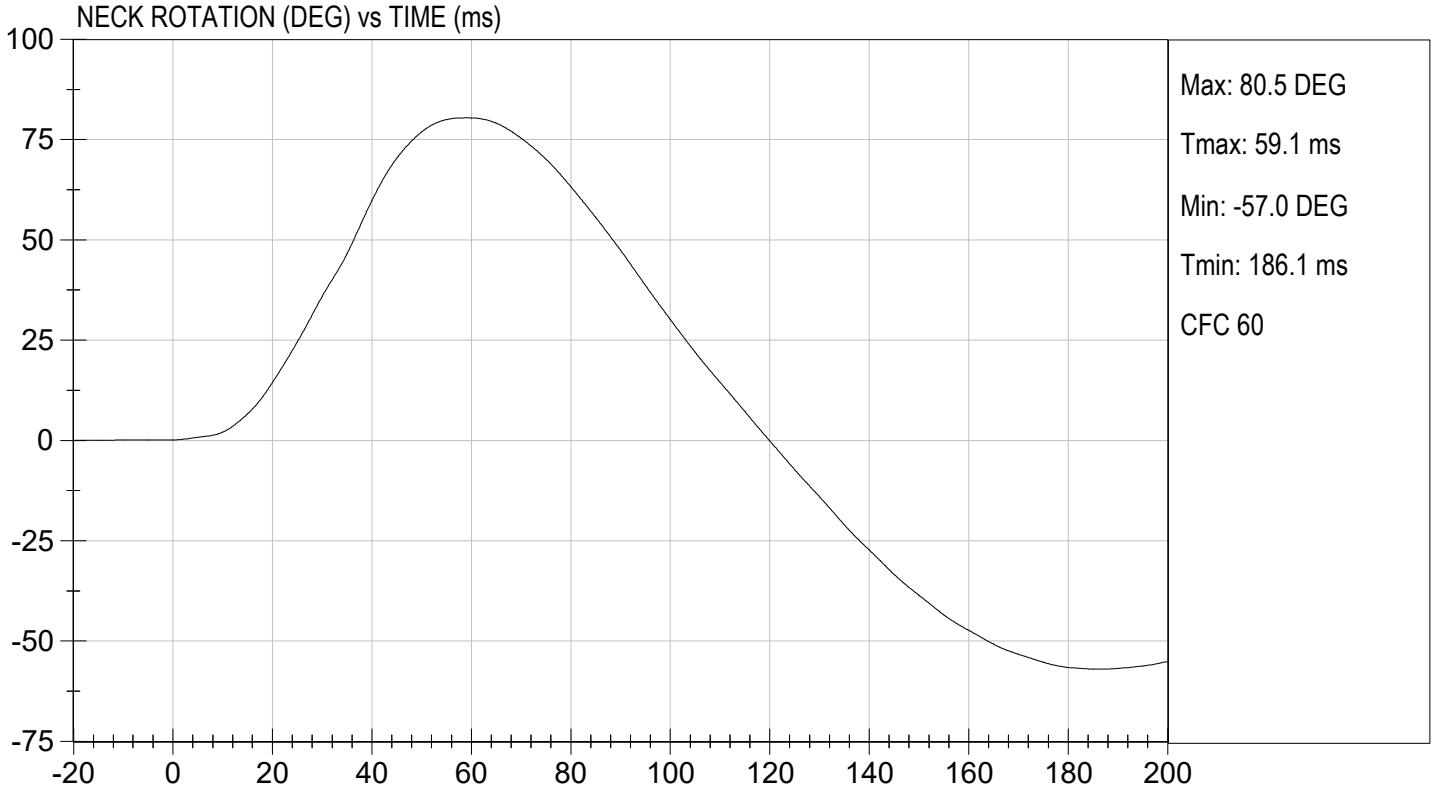
Test Date

Approved By

TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

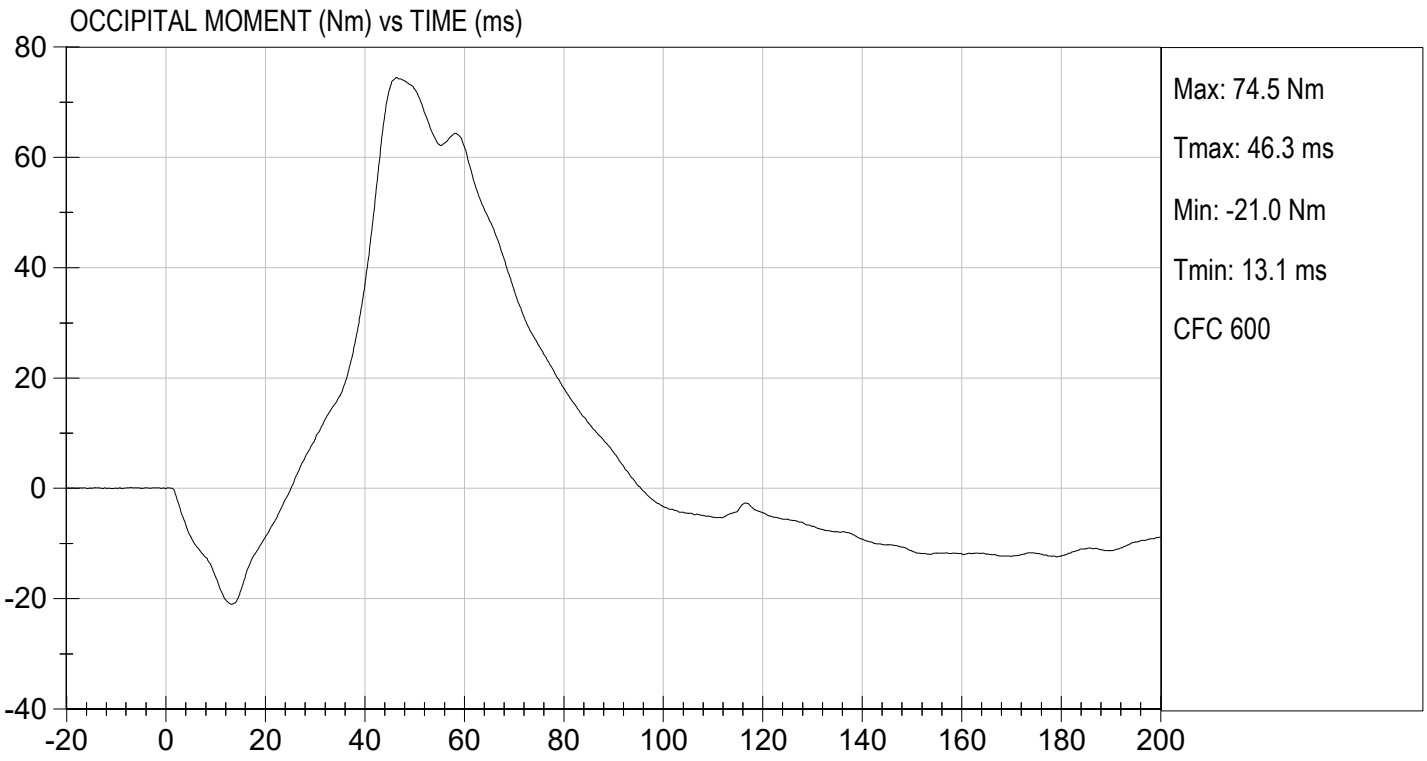
TEST DATE: 02/07/2023
TEST #: D230382





TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 02/07/2023
TEST #: D230382



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230383

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	27	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.05	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	110	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	103	Pass
			Overall Results		Pass

Nathaniel Bajamin
Laboratory Technician

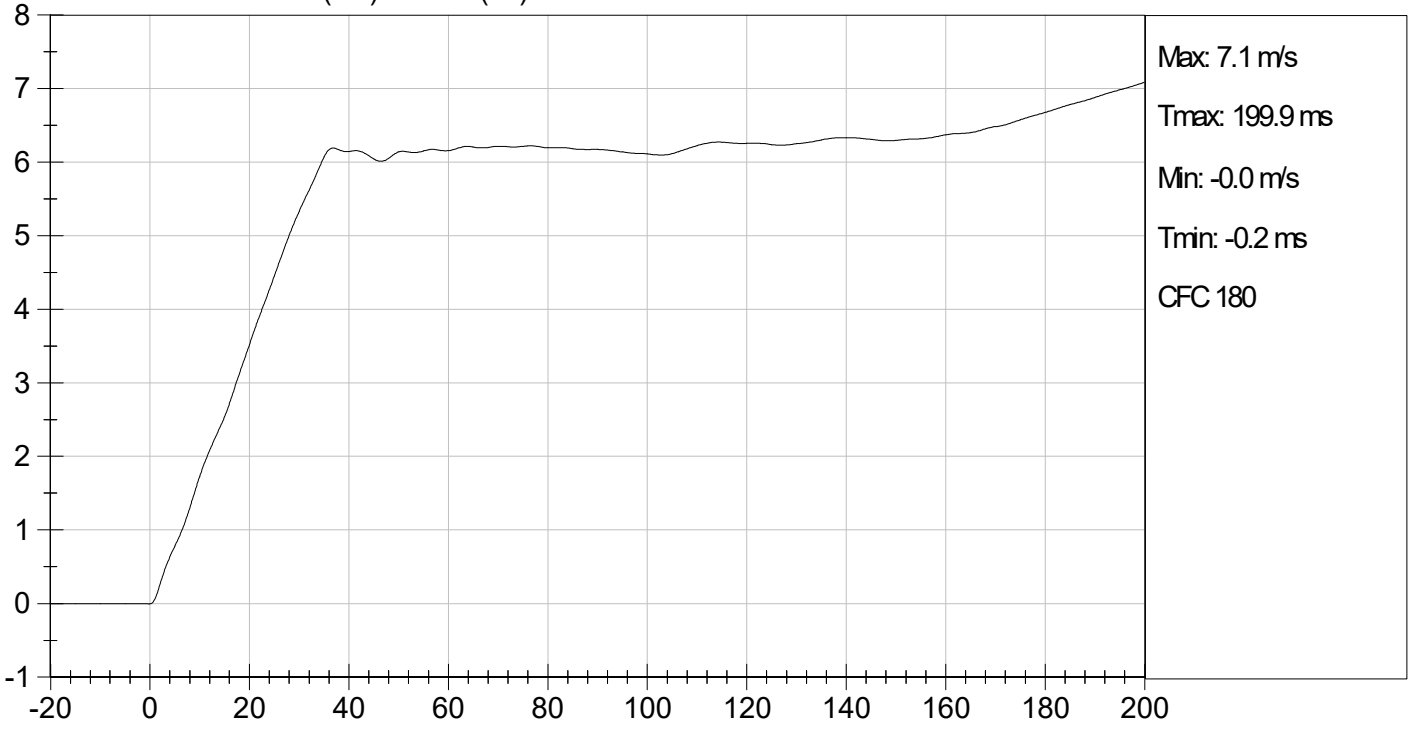
02/07/2023
Test Date

Approved By

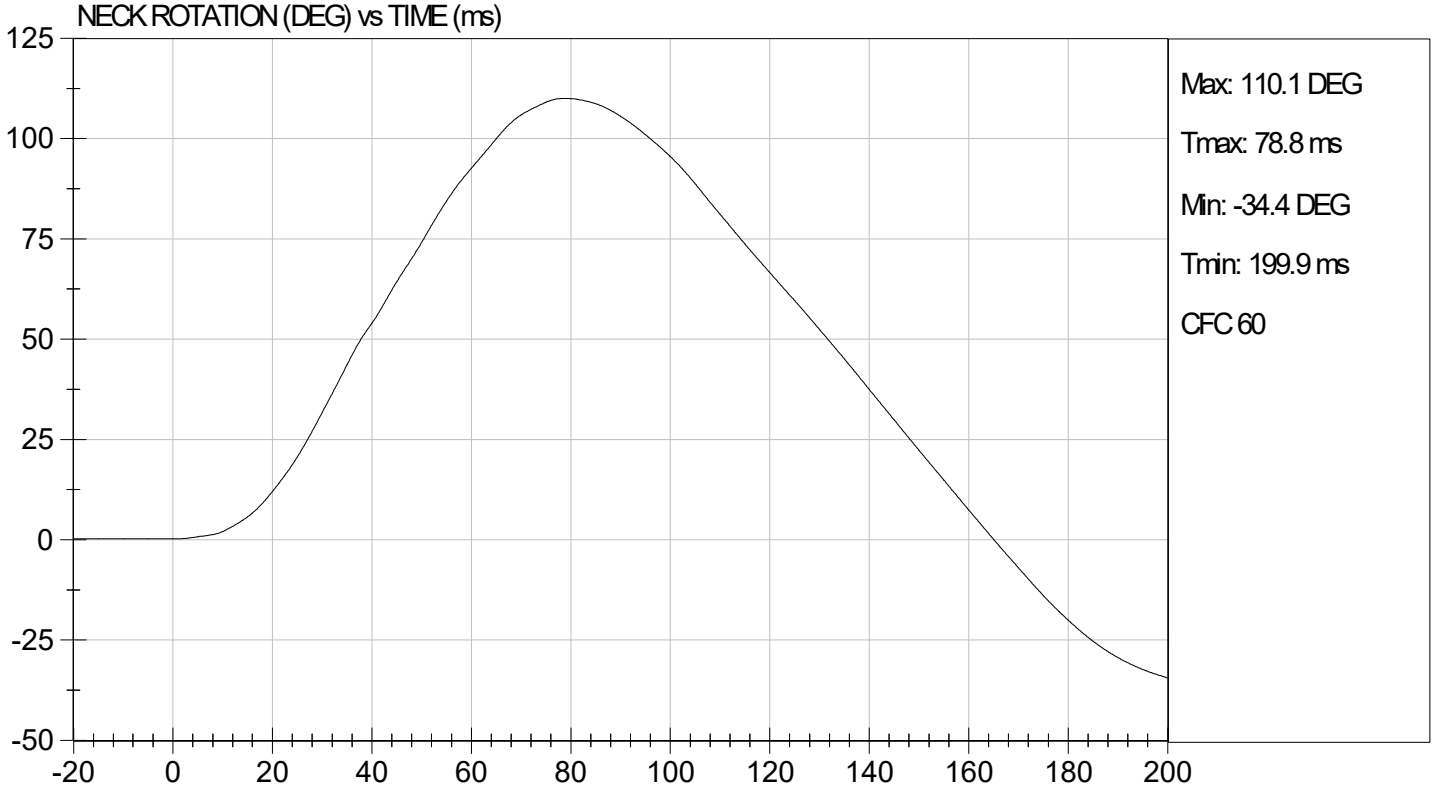
TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 02/07/2023
TEST #: D230383

PENDULUM VELOCITY (m/s) vs TIME (ms)

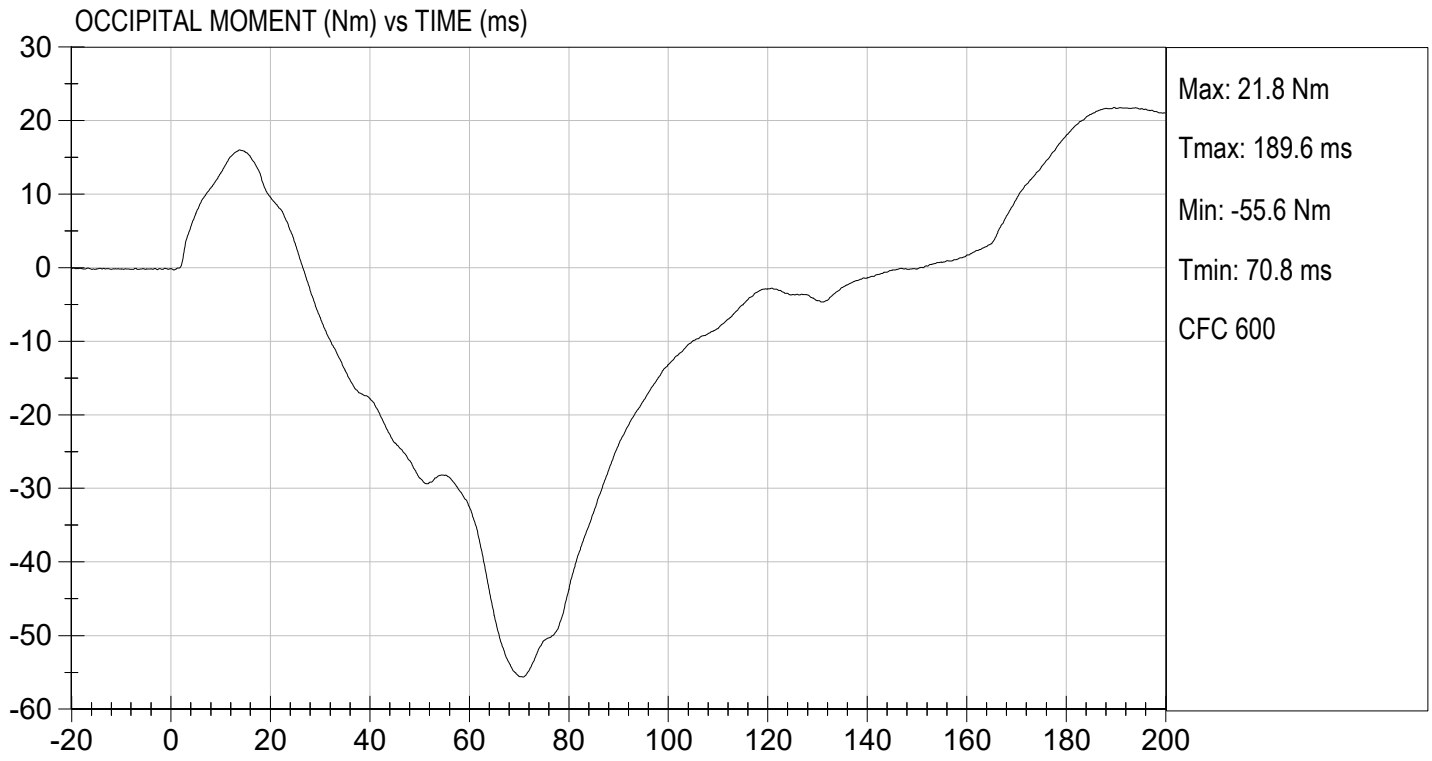


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 02/07/2023
TEST #: D230383



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230384

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Relative Humidity	%	10 to 70	29	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	50	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4148	Pass
Internal Hysteresis	%	69 to 85	76	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4382	Pass
		Overall Test Results		Pass

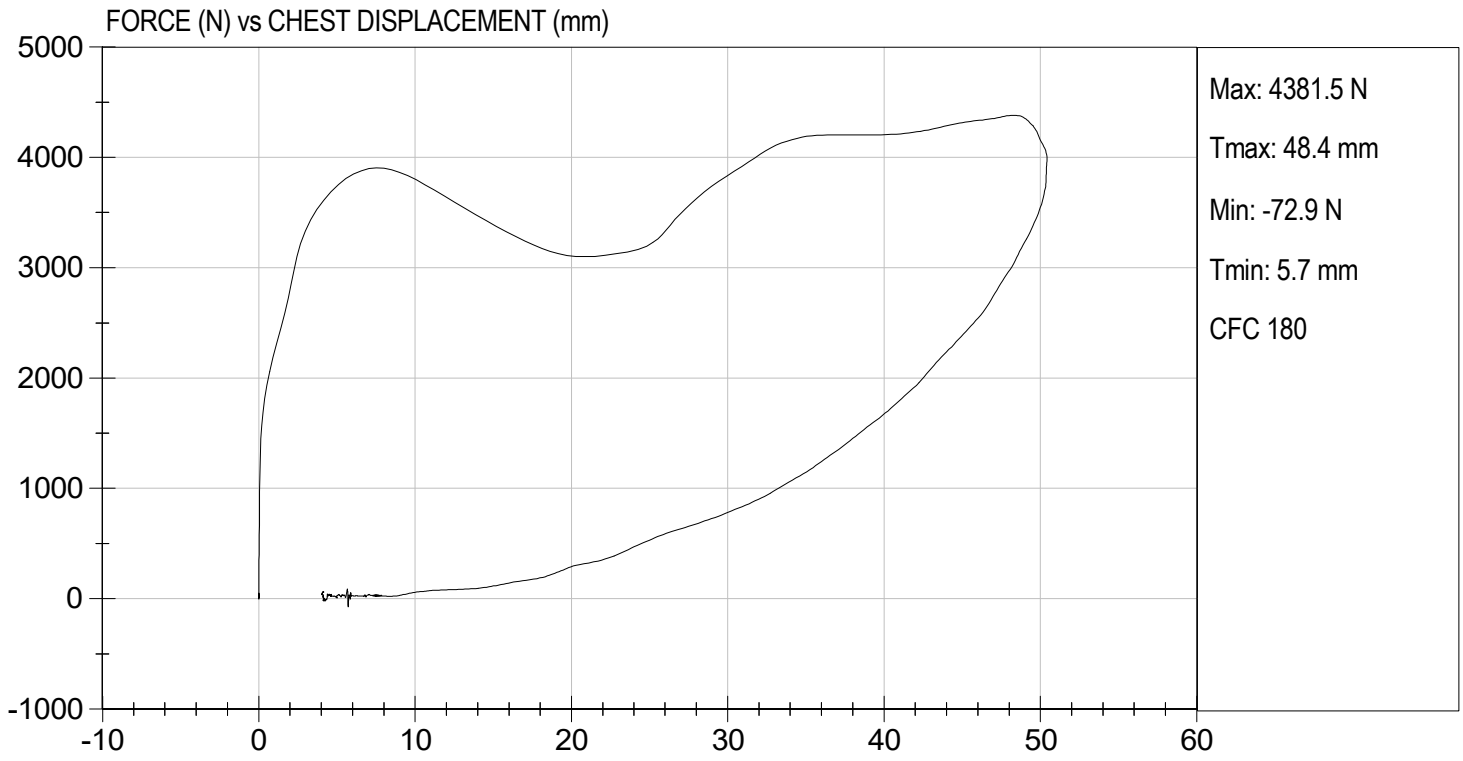
Nathaniel Bajamin
Laboratory Technician

02/09/2023
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 02/09/2023
TEST #: D230384



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230385

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3856	Pass
		Overall Test Results		Pass

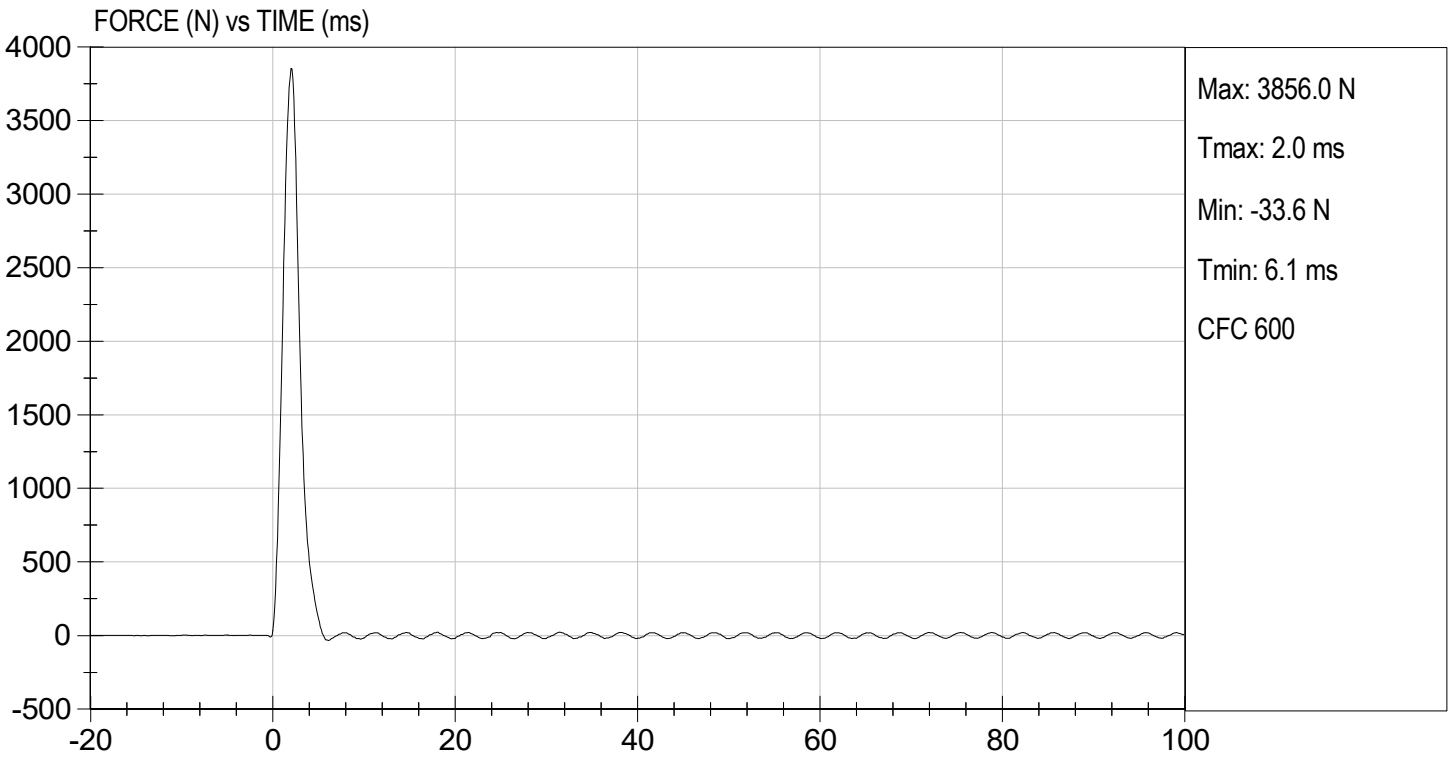
Nathaniel Bajamin
Laboratory Technician

02/08/2023
Test Date

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.94 ft/s, 2.12 m/s

TEST DATE: 02/08/2023
TEST #: D230385



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230386

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	3450 to 4060	3691	Pass
		Overall Test Results		Pass

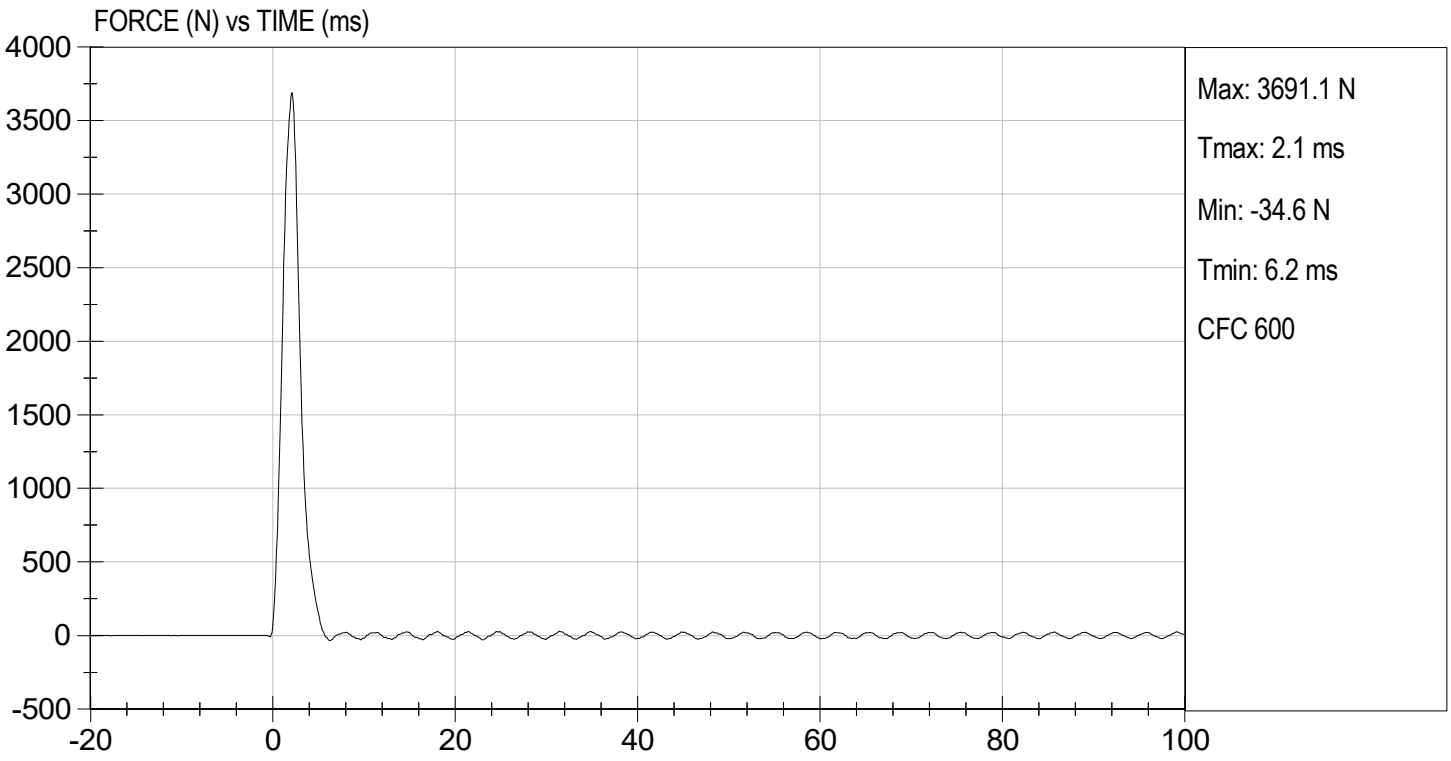
Nathaniel Bajamin
Laboratory Technician

02/08/2023
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 02/08/2023
TEST #: D230386



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

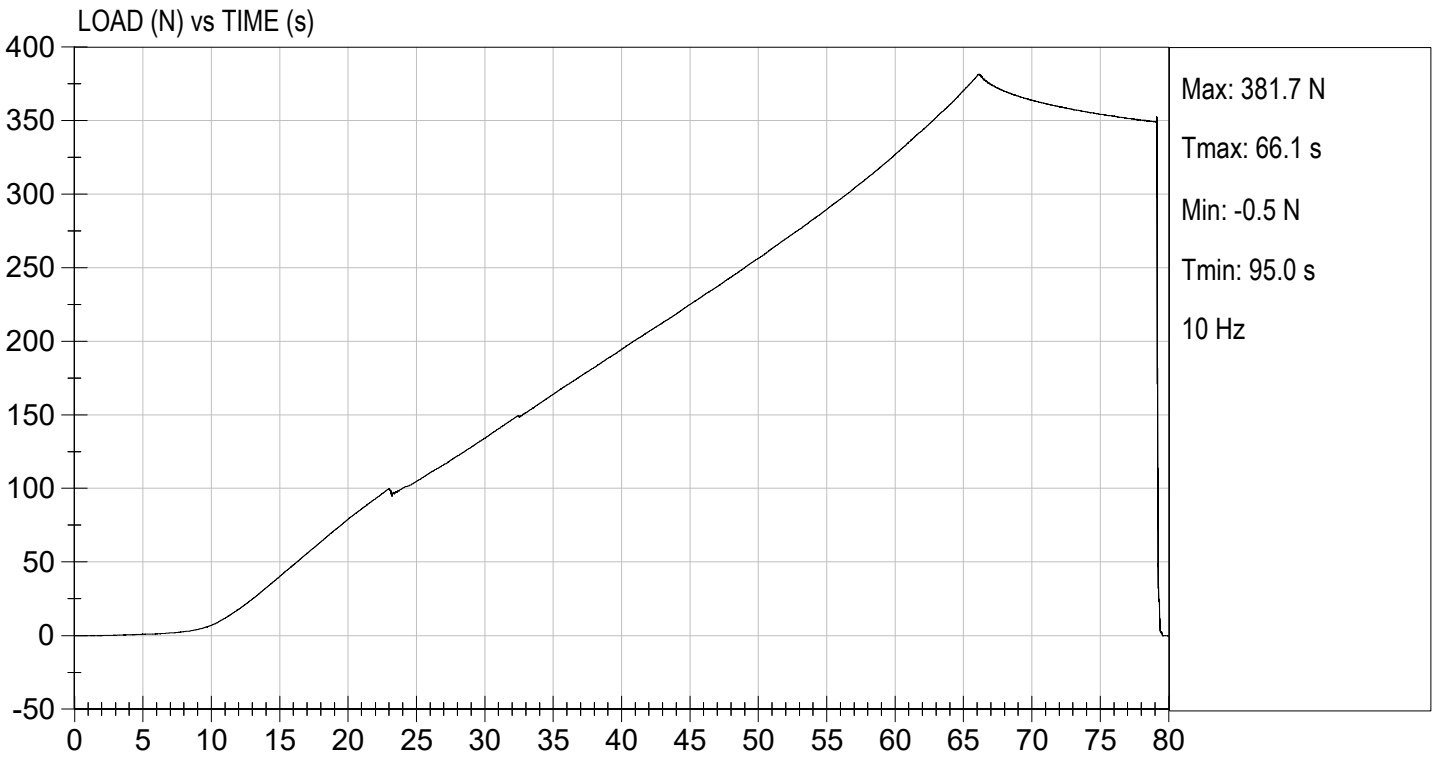
ATD Serial No: 142 **Test I.D:** D230387

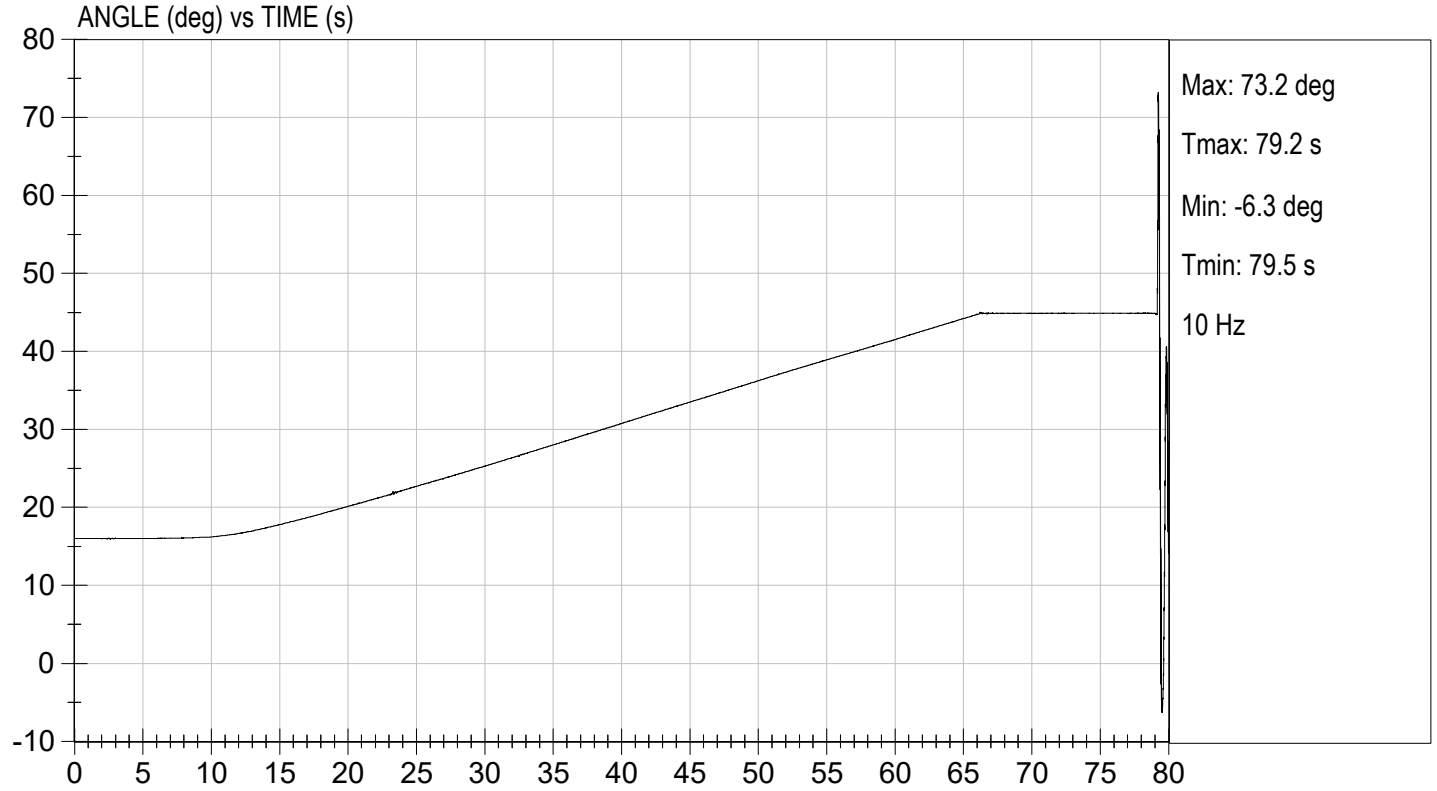
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	3	Pass
Force at 45 deg	N	320 to 390	382	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.5	Pass
		Overall Result		Pass

Nathaniel Bajamin
Laboratory Technician

02/08/2023
Test Date

Approved By


LOAD (N) vs TIME (s)
400
350
300
250
200
150
100
50
0
-50
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80
Max: 381.7 N
Tmax: 66.1 s
Min: -0.5 N
Tmin: 95.0 s
10 Hz


ANGLE (deg) vs TIME (s)
80
70
60
50
40
30
20
10
0
-10
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80
Max: 73.2 deg
Tmax: 79.2 s
Min: -6.3 deg
Tmin: 79.5 s
10 Hz

CALIBRATION TEST RESULTS

POST-TEST

HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test ID:** D230541

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Peak Resultant Acceleration	G's	250 to 300	292	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	1.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Nathaniel Bajamin
Laboratory Technician

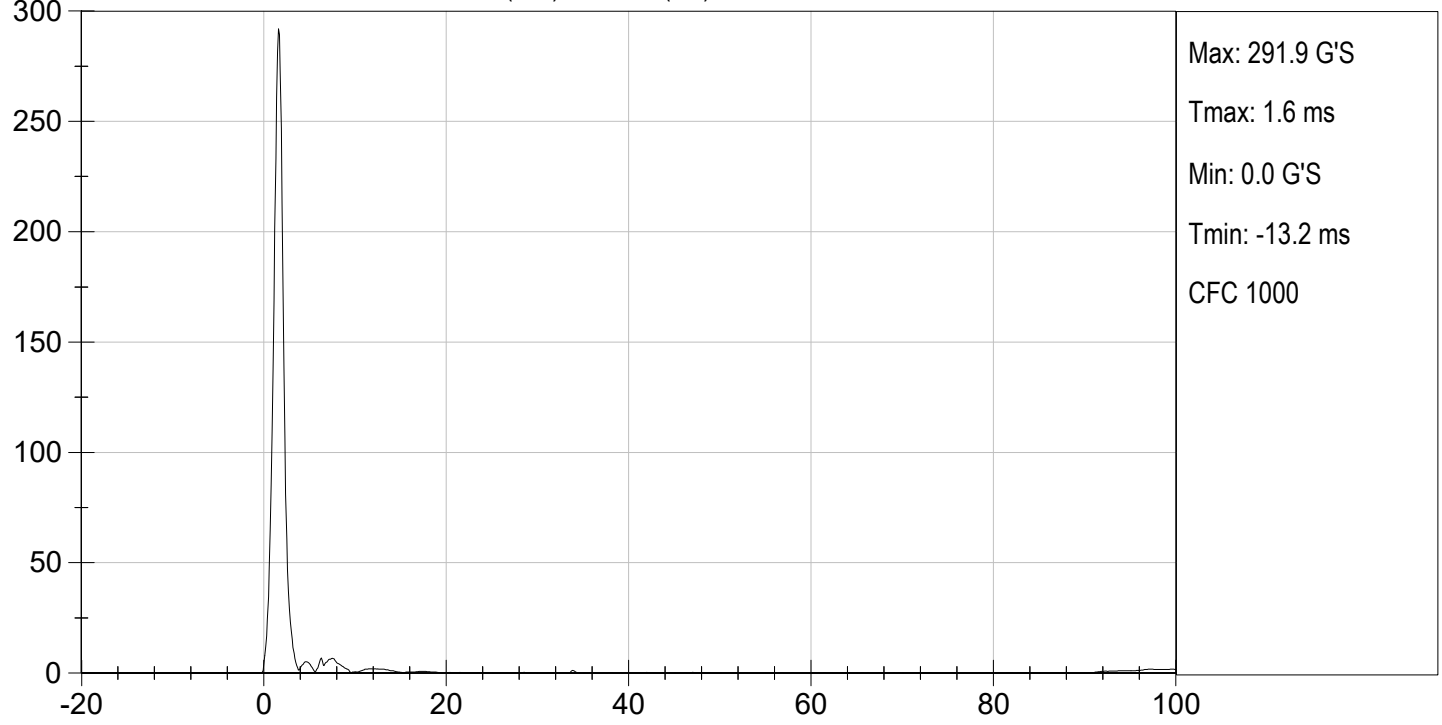
03/03/2023
Test Date

Approved By

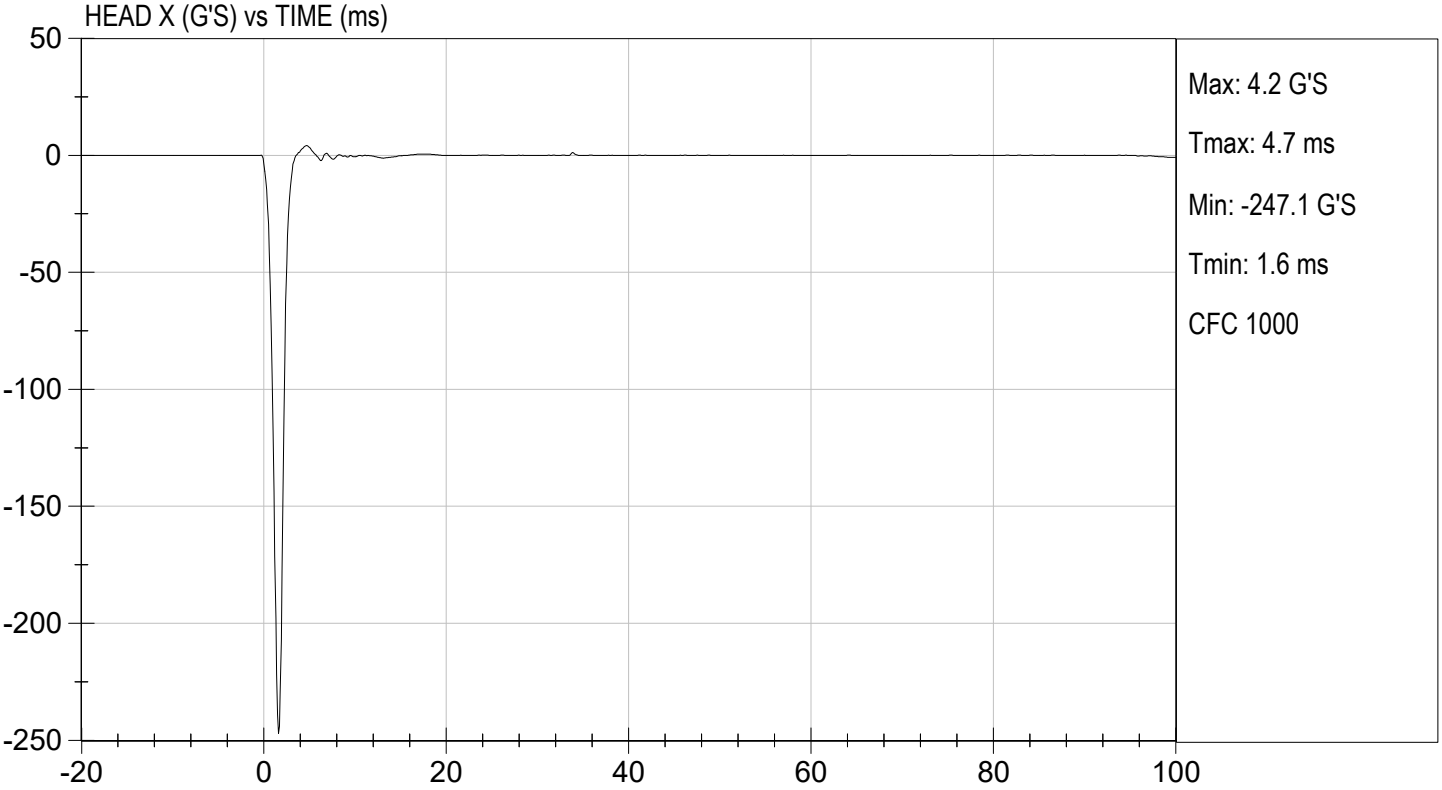
TEST DESC: HEAD DROP

TEST DATE: 03/03/2023
TEST #: D230541

HEAD RESULTANT ACCELERATION (G'S) vs TIME (ms)

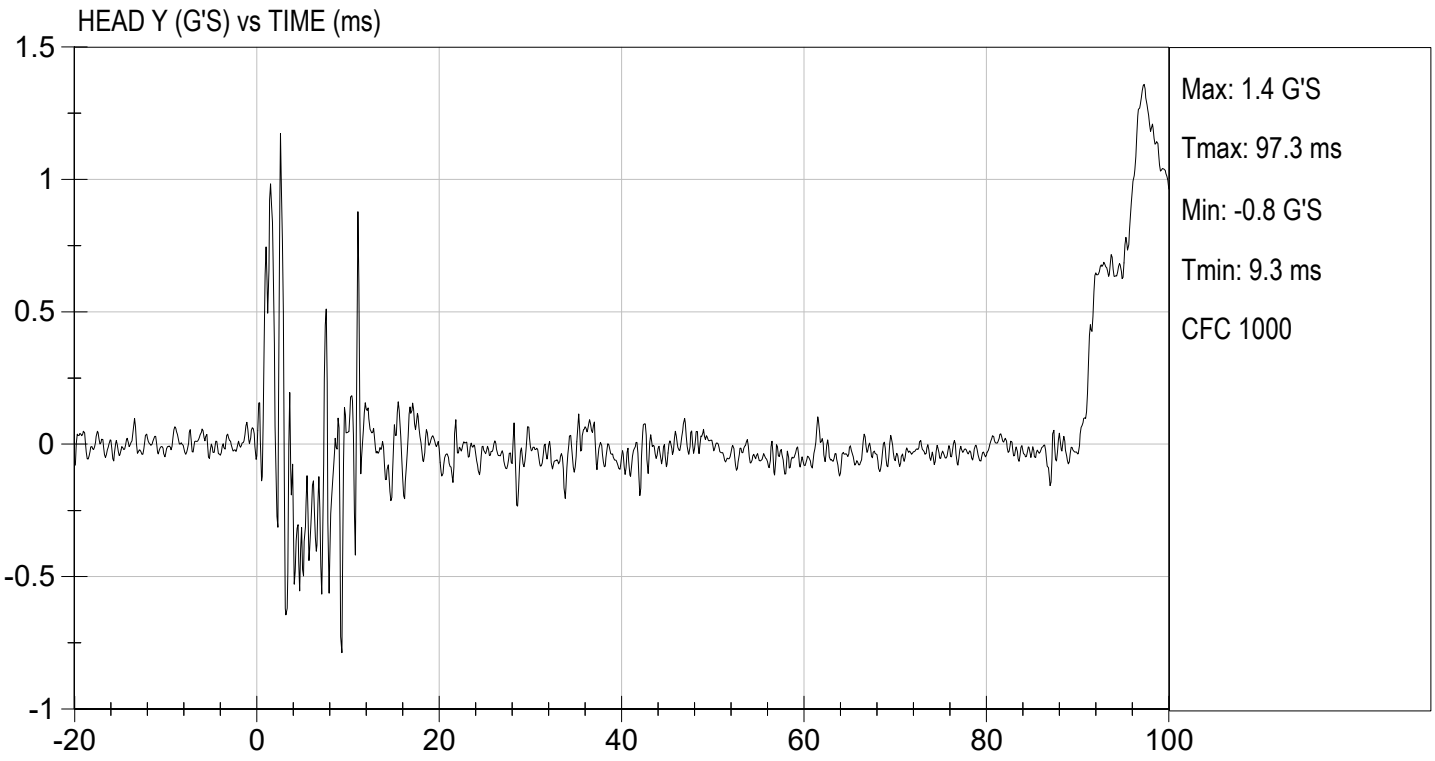


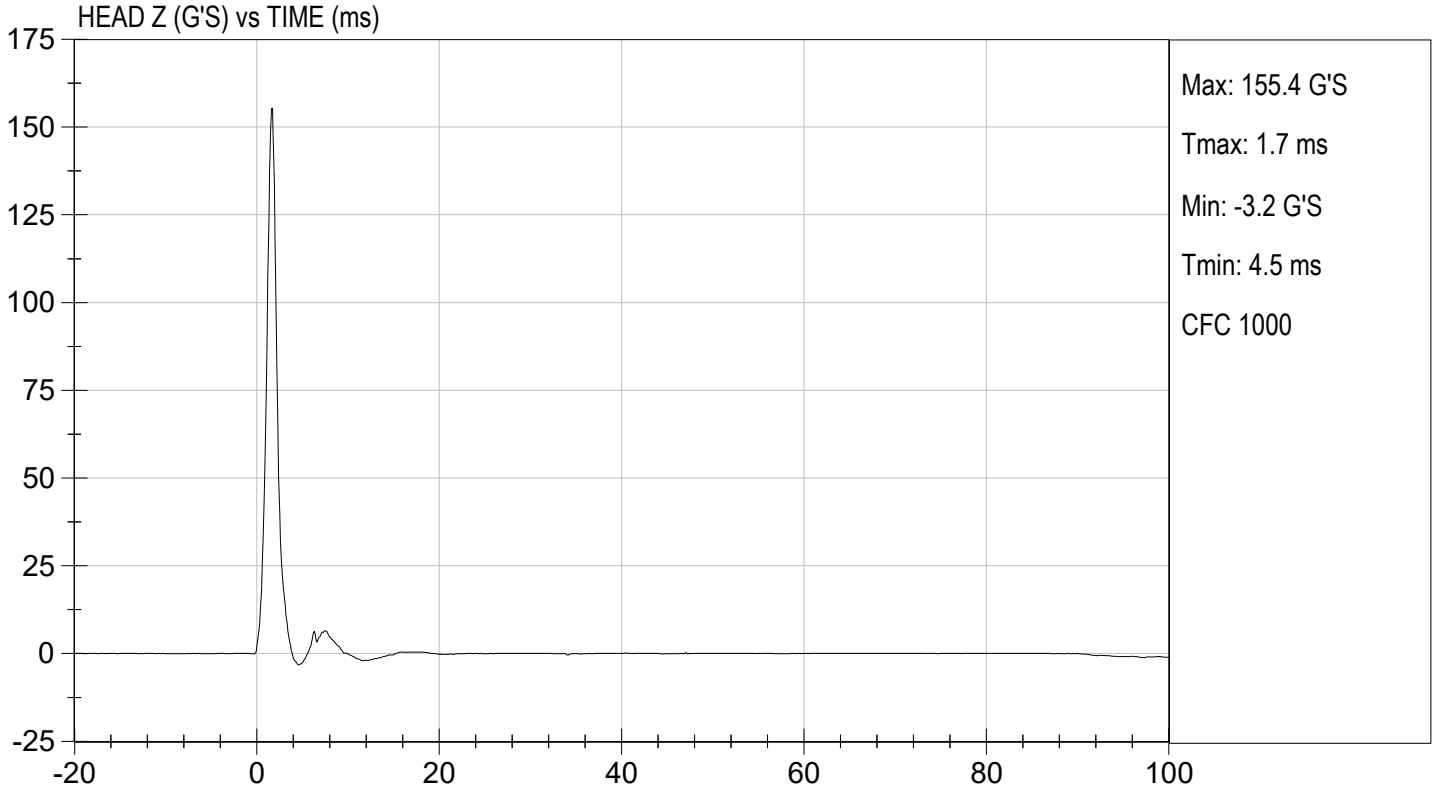
HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 03/03/2023
TEST #: D230541





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230542

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity		%	10 to 70	26	Pass
Pendulum Speed		m/s	6.89 to 7.13	6.89	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.6	Pass
D Plane Rotation	Max	deg	77 to 91	79	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	69	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
			Overall Results		Pass

Nathaniel Bajamin

Laboratory Technician

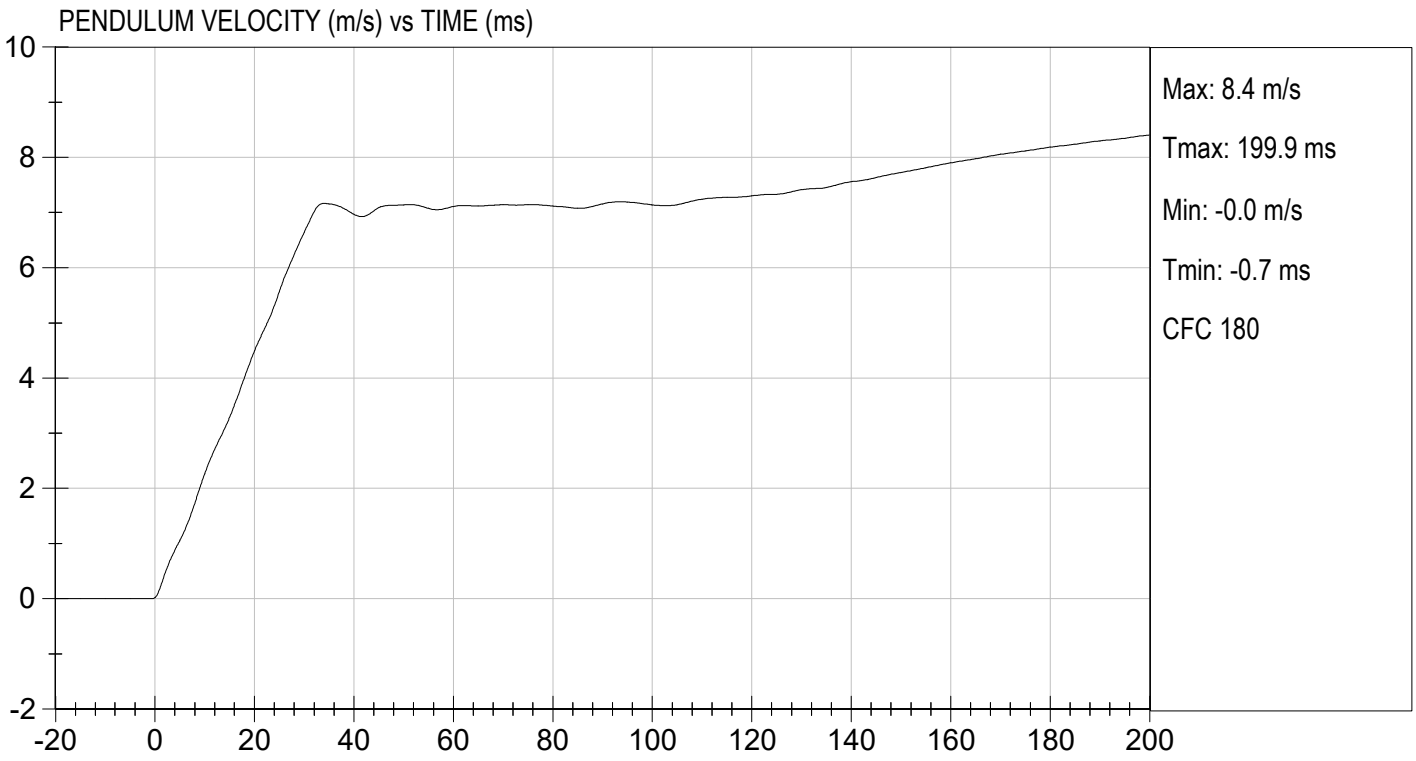
03/03/2023

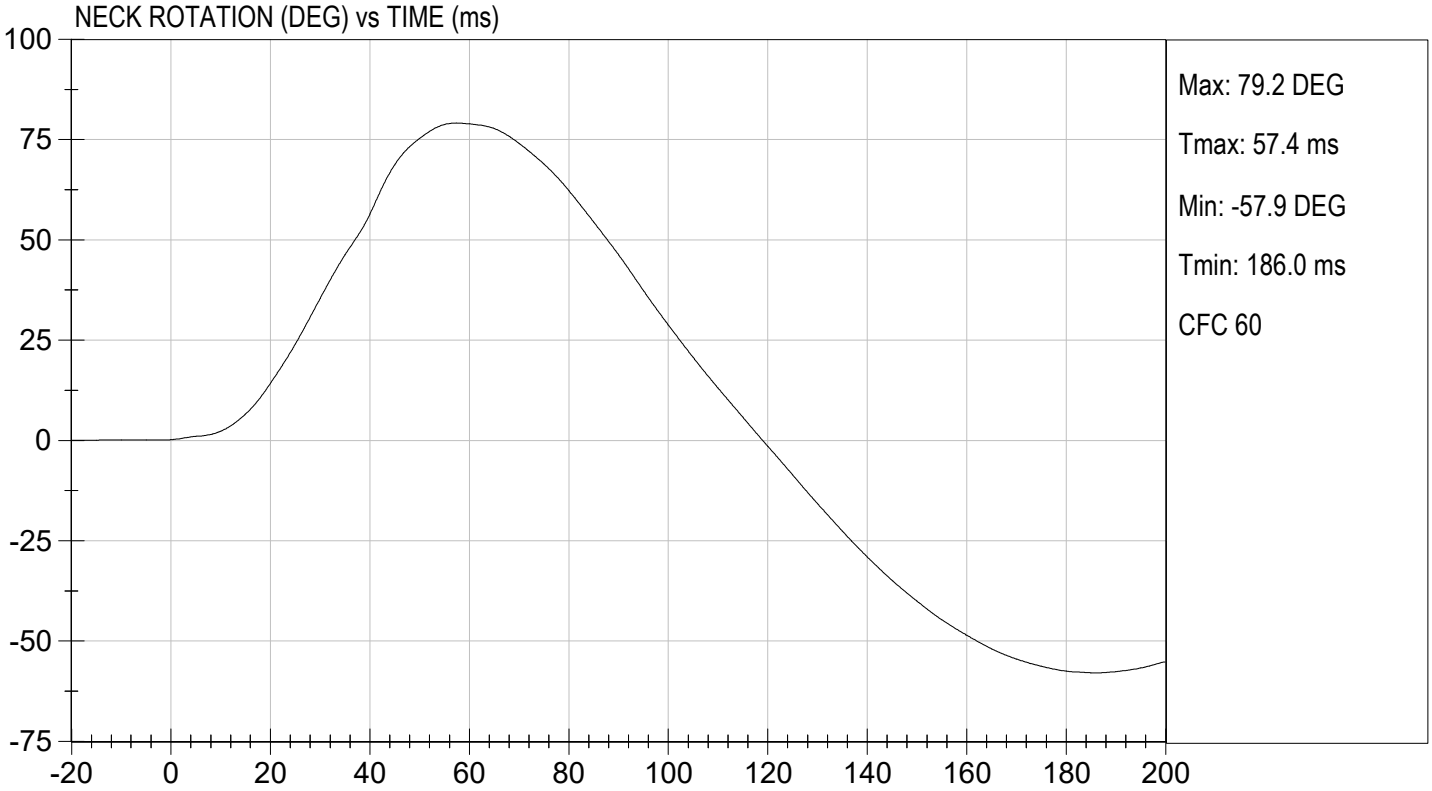
Test Date

Approved By

TEST DESC: NECK FLEXION
VELOCITY: 22.60 ft/s, 6.89 m/s

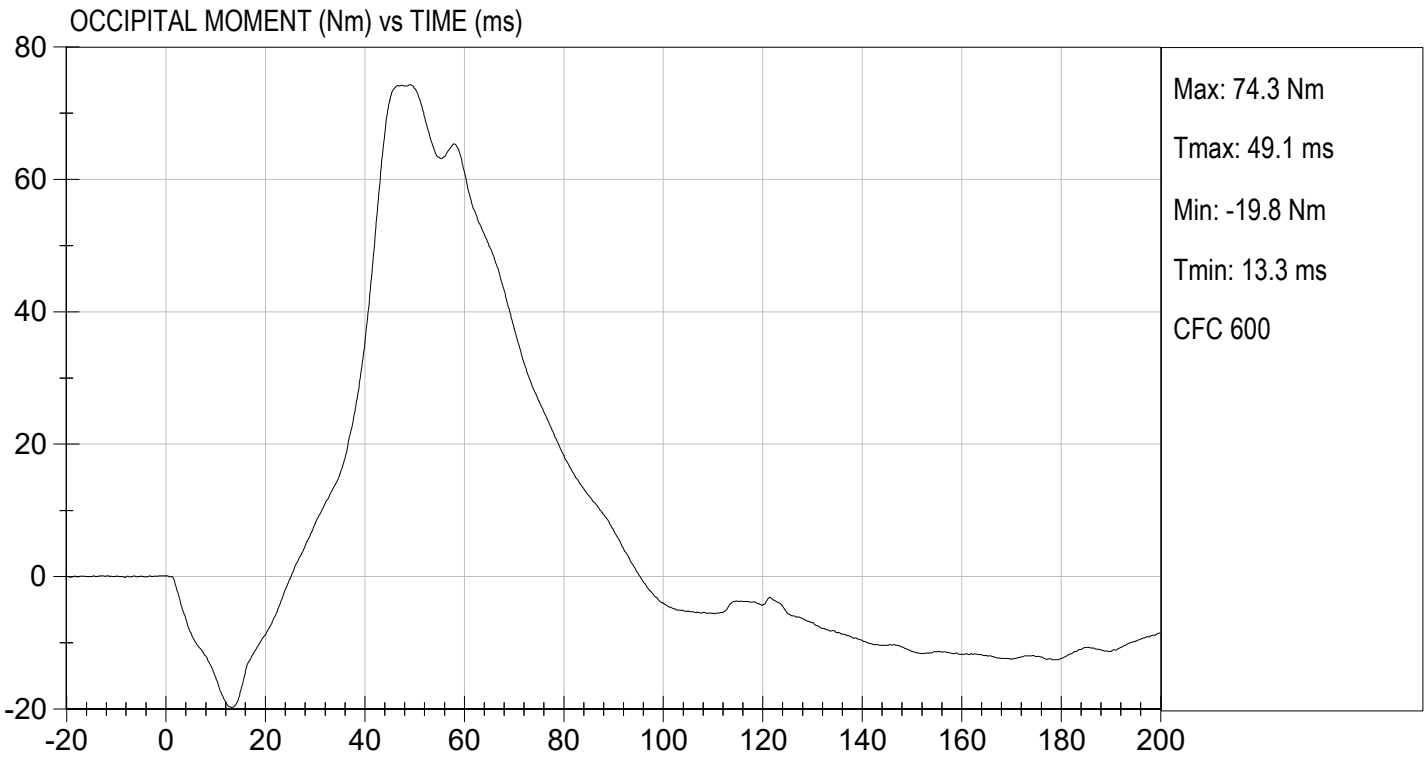
TEST DATE: 03/03/2023
TEST #: D230542





TEST DESC: NECK FLEXION
VELOCITY: 22.60 ft/s, 6.89 m/s

TEST DATE: 03/03/2023
TEST #: D230542



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230543

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	26	Pass
Pendulum Speed		m/s	5.95 to 6.19	5.96	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	108	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	104	Pass
			Overall Results		Pass

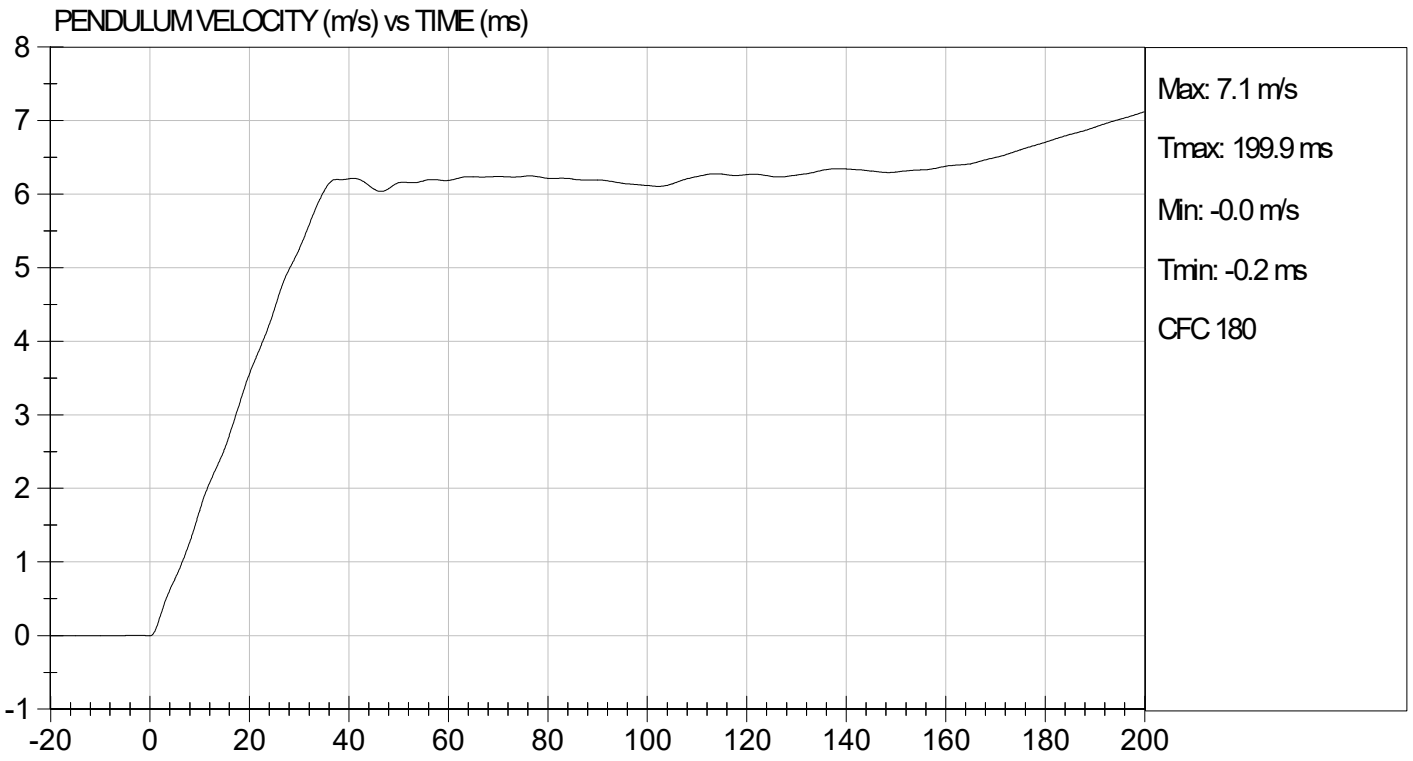
Nathaniel Bajamin
Laboratory Technician

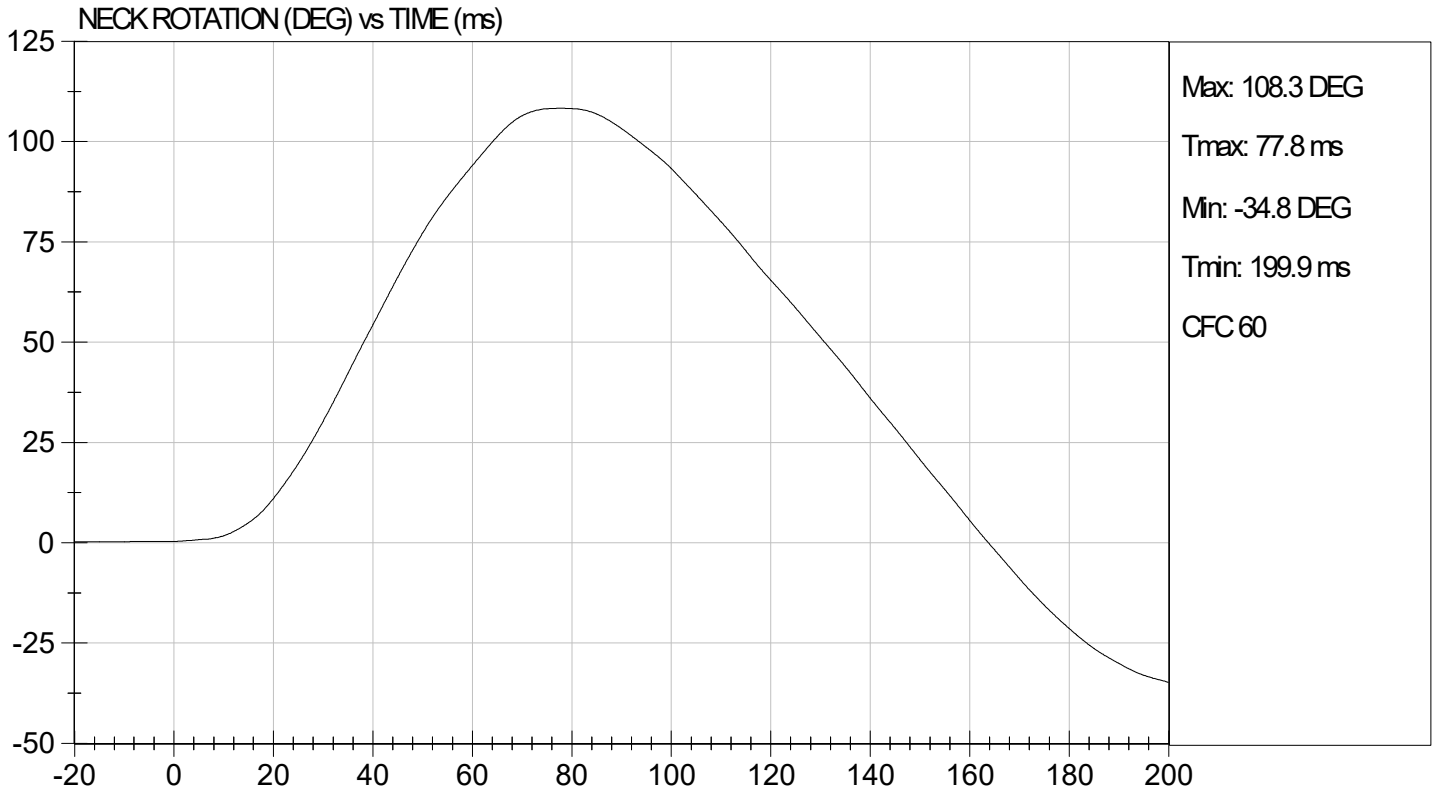
03/03/2023
Test Date

Approved By

TEST DESC: NECK EXTENSION
VELOCITY: 19.56 ft/s, 5.96 m/s

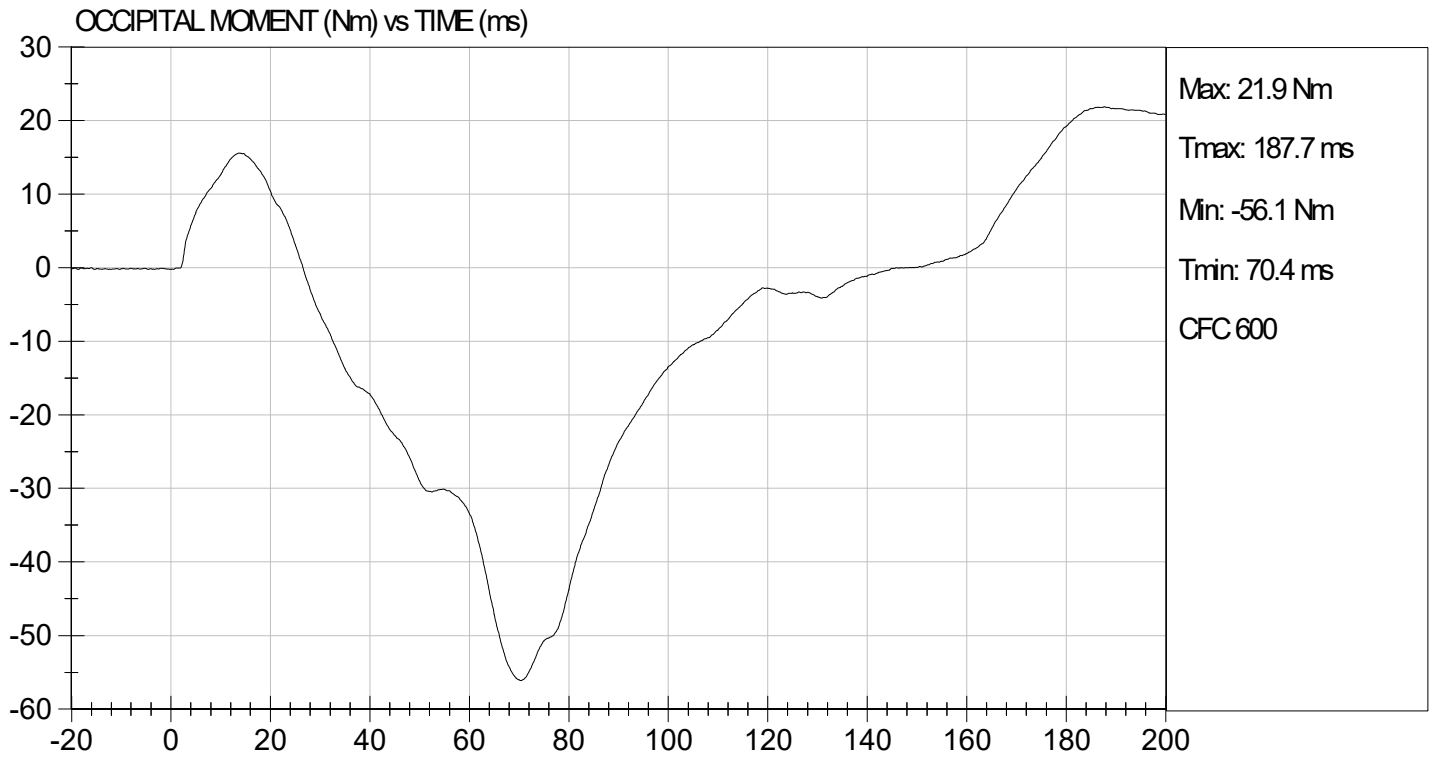
TEST DATE: 03/03/2023
TEST #: D230543





TEST DESC: NECK EXTENSION
VELOCITY: 19.56 ft/s, 5.96 m/s

TEST DATE: 03/03/2023
TEST #: D230543



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230544

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Relative Humidity	%	10 to 70	27	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4231	Pass
Internal Hysteresis	%	69 to 85	76	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4378	Pass
		Overall Test Results		Pass

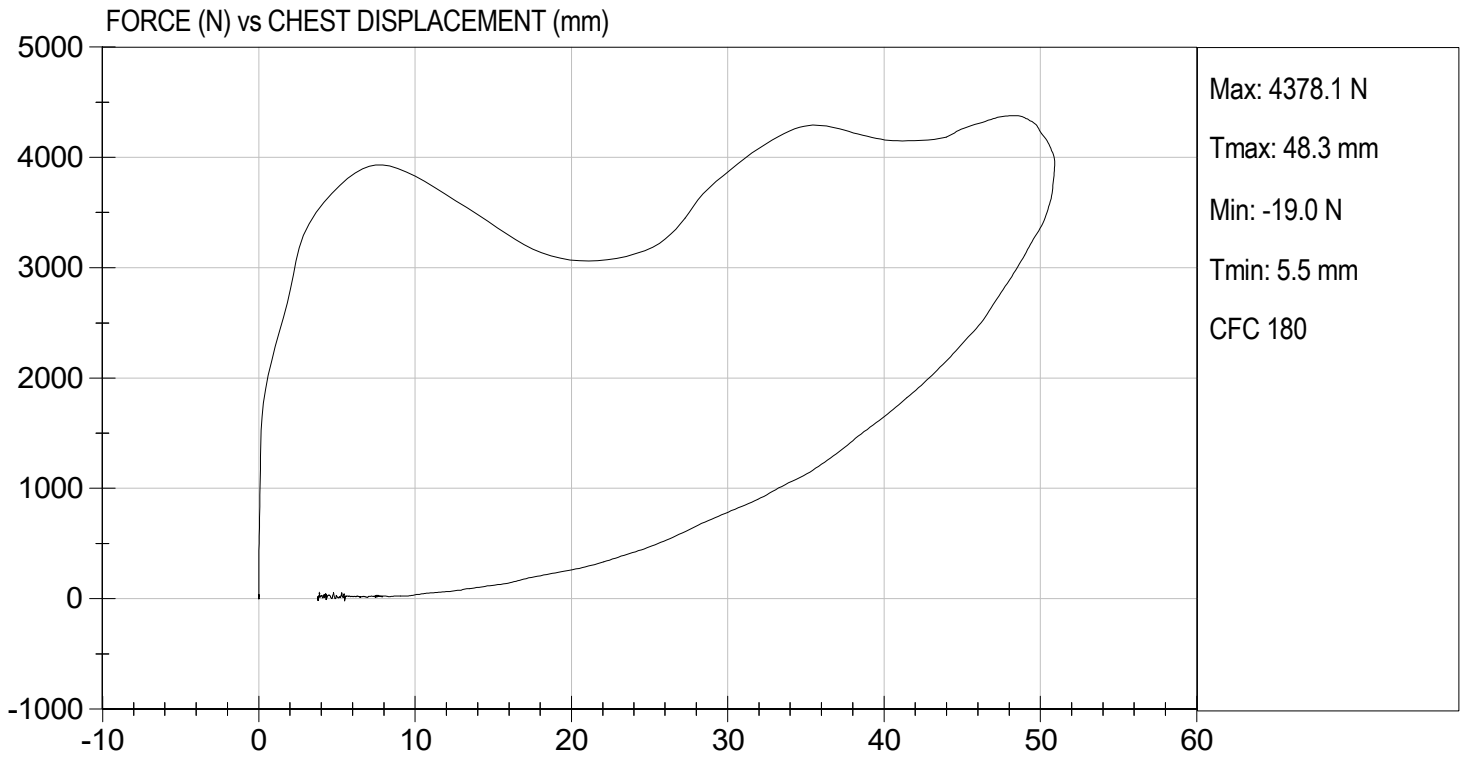
Nathaniel Bajamin
Laboratory Technician

03/02/2023
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 03/02/2023
TEST #: D230544



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230545

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	N	3450 to 4060	3663	Pass
		Overall Test Results		Pass

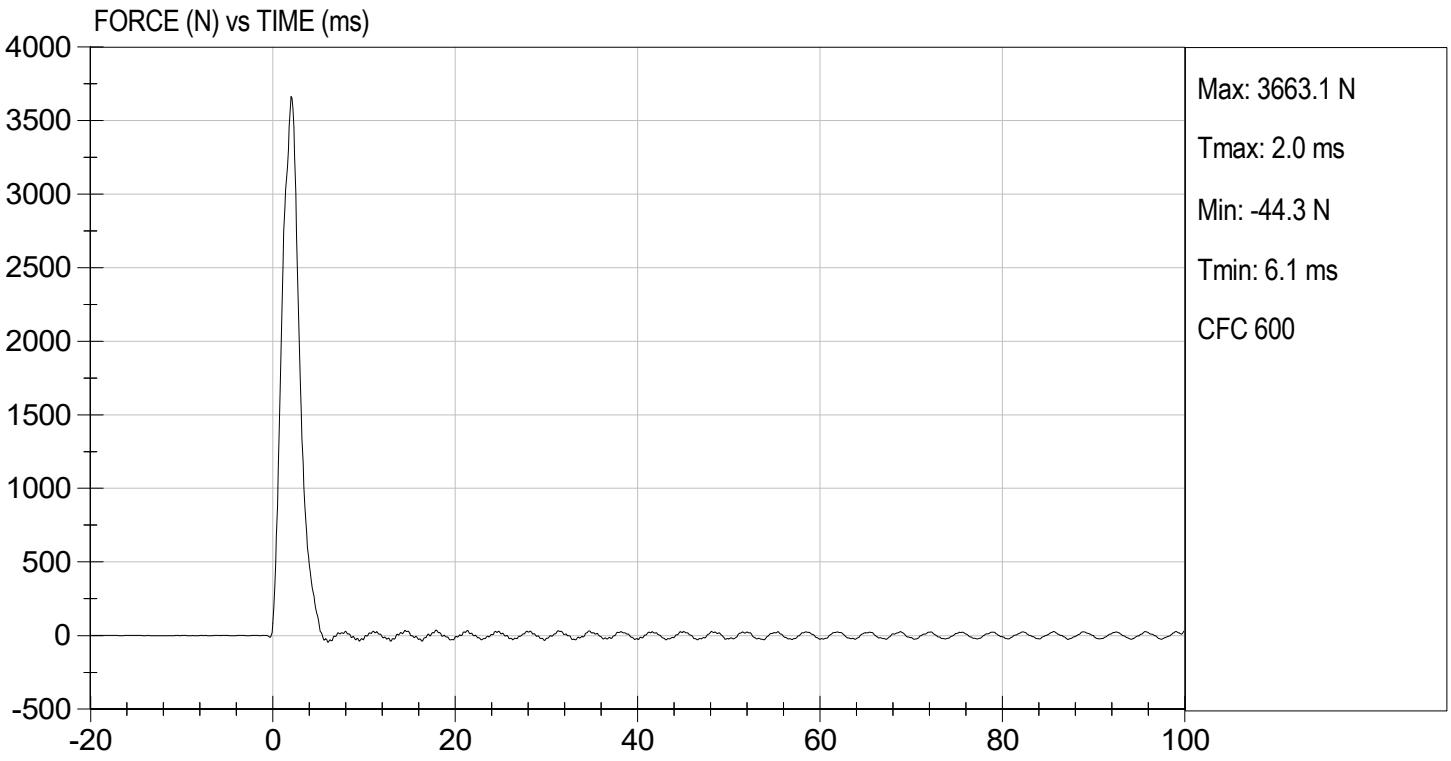
Nathaniel Bajamin
Laboratory Technician

03/02/2023
Test Date

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.83 ft/s, 2.08 m/s

TEST DATE: 03/02/2023
TEST #: D230545



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230546

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	N	3450 to 4060	3696	Pass
		Overall Test Results		Pass

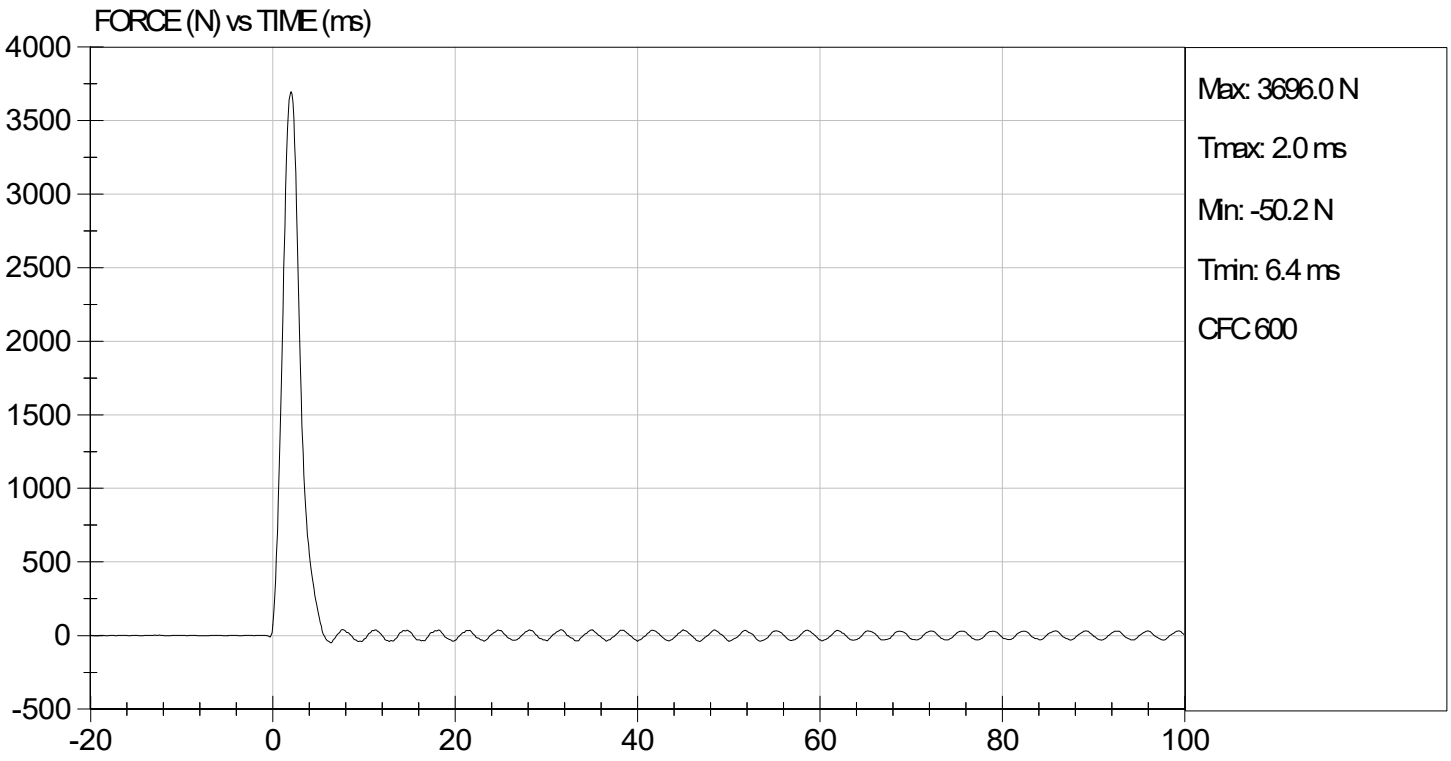
Nathaniel Bajamin
Laboratory Technician

03/02/2023
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.83 ft/s, 2.08 m/s

TEST DATE: 03/02/2023
TEST #: D230546



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142 **Test I.D:** D230547

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	27	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle	deg	+/- 8	3	Pass
Force at 45 deg	N	320 to 390	369	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.5	Pass
		Overall Result		Pass

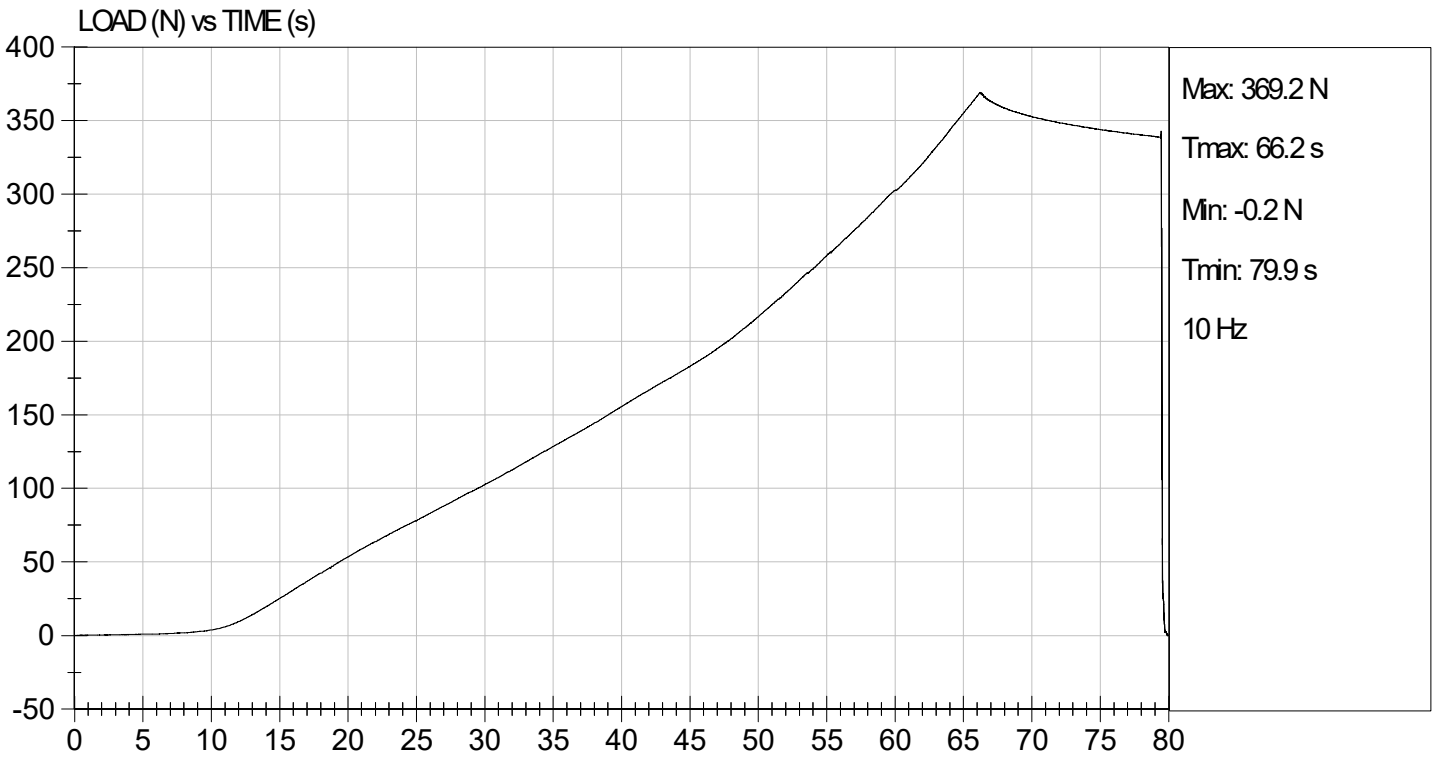
Nathaniel Benjamin
Laboratory Technician

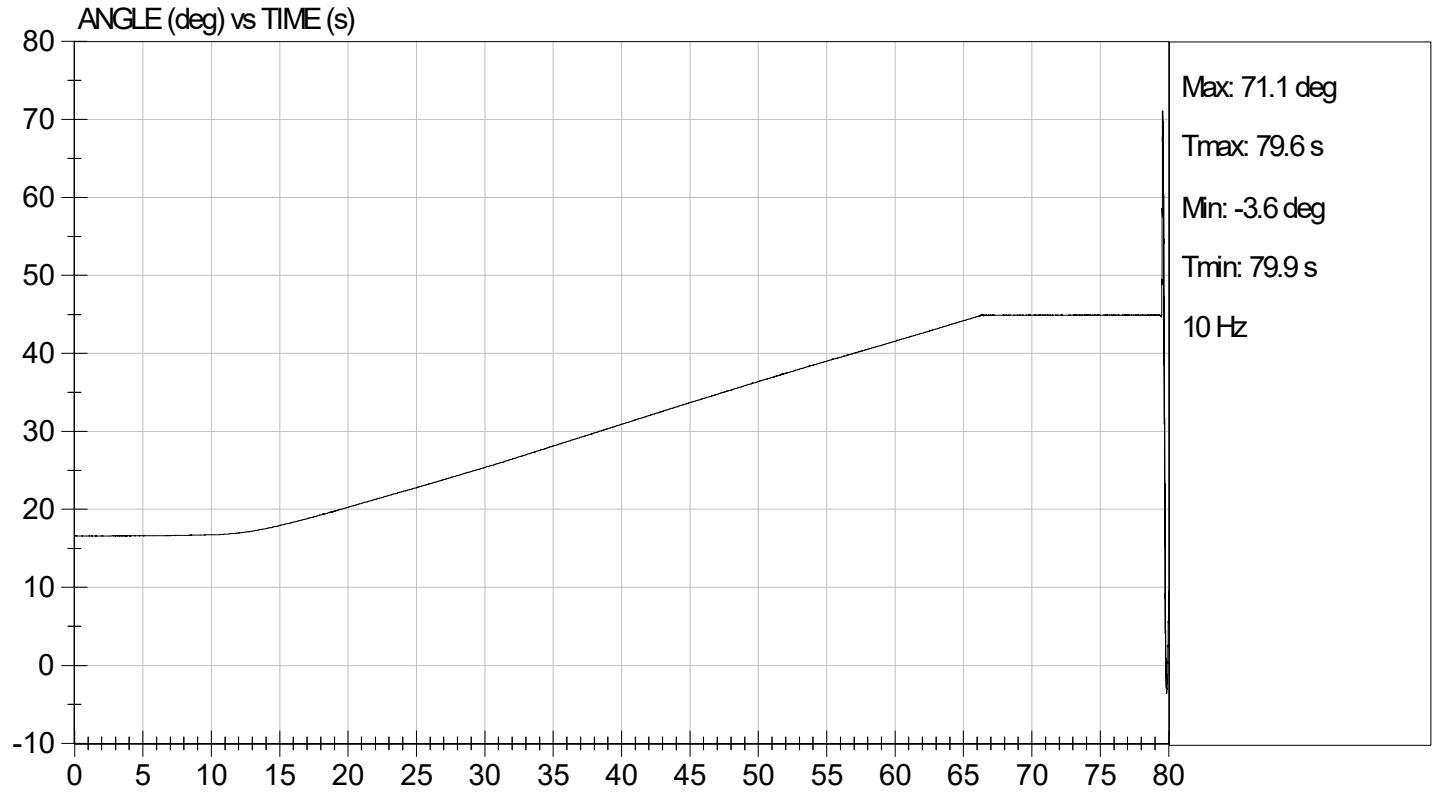
03/02/2023
Test Date

Approved By

TEST DESC: LUMBAR FLEXION

TEST DATE: 03/02/2023
TEST #: D230547





APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

TABLE 1 – DRIVER DUMMY INSTRUMENTATION

Instrument Location			Axis	Hybrid III 50th S/N 351		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers		Primary	X	P79741	Endevco	12/29/2022
			Y	P79743	Endevco	12/29/2022
			Z	P79744	Endevco	12/29/2022
		Redundant	X	P94834	Endevco	12/29/2022
			Y	P94856	Endevco	12/29/2022
			Z	P97412	Endevco	12/29/2022
Head Angular Rate Sensors			X	ARS7442	DTS	09/06/2022
			Y	ARS7475	DTS	09/06/2022
			Z	ARS7516	DTS	09/06/2022
Upper Neck Load Cell			Fx, Fy, Fz Mx, My, Mz	NG2022	Denton	09/21/2022
Chest Accelerometers		Primary	X	P86792	Endevco	12/29/2022
			Y	P88348	Endevco	12/29/2022
			Z	P86793	Endevco	12/29/2022
		Redundant	X	P88666	Endevco	12/29/2022
			Y	P94109	Endevco	12/29/2022
			Z	P88667	Endevco	12/29/2022
Chest Potentiometer			X	351	Humanetics	12/29/2022
Pelvis Accelerometers			X	P95526	Endevco	12/29/2022
			Y	P96038	Endevco	12/29/2022
			Z	P97742	Endevco	12/29/2022
Femur Load Cells	Right	Primary	Z	FG121P	Denton	12/29/2022
		Redundant	Z	FG121R	Denton	12/29/2022
	Left	Primary	Z	FG122P	Denton	12/29/2022
		Redundant	Z	FG122R	Denton	12/29/2022
Tibia Load Cells	Right	Upper	Mx, My, Fz	TG467	Denton	12/21/2022
		Lower	Mx, My, Fz	AG491	Denton	12/21/2022
	Left	Upper	Mx, My, Fz	TG478	Denton	12/21/2022
		Lower	Mx, My, Fz	AG500	Denton	12/21/2022
Foot Accelerometers	Right	Rear	X	T22486	Endevco	12/29/2022
			Z	P97382	Endevco	12/29/2022
		Front	Z	P82120	Endevco	12/29/2022
	Left	Rear	X	T16468	Endevco	12/29/2022
			Z	T16496	Endevco	12/29/2022
		Front	Z	T16501	Endevco	12/29/2022
Seat Belt Load Cells		Lap		SBG161	FTSS	11/13/2019
		Shoulder		SBG157	FTSS	11/13/2019

TABLE 2 – FRONT PASSENGER DUMMY INSTRUMENTATION

Instrument Location			Axis	Hybrid III 5th S/N 142		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers		Primary	X	P94799	Endevco	10/10/2022
			Y	P94800	Endevco	10/10/2022
			Z	P94801	Endevco	10/10/2022
		Redundant	X	P94802	Endevco	10/10/2022
			Y	P94803	Endevco	10/10/2022
			Z	P97377	Endevco	10/10/2022
Head Angular Rate Sensors			X	ARS7325	DTS	09/06/2022
			Y	ARS7340	DTS	09/06/2022
			Z	ARS7354	DTS	09/06/2022
Upper Neck Load Cell			Fx, Fy, Fz Mx, My, Mz	NG2203	Denton	03/23/2022
Chest Accelerometers		Primary	X	P88719	Endevco	10/10/2022
			Y	P94785	Endevco	10/10/2022
			Z	P94793	Endevco	10/10/2022
		Redundant	X	P95322	Endevco	10/10/2022
			Y	P95370	Endevco	10/10/2022
			Z	T30901	Endevco	10/10/2022
Chest Potentiometer			X	142	Humanetics	10/11/2022
Pelvis Accelerometers			X	P82646	Endevco	10/10/2022
			Y	P94798	Endevco	10/10/2022
			Z	P97705	Endevco	10/10/2022
Femur Load Cells	Right	Primary	Z	FG126P	Denton	10/11/2022
		Redundant	Z	FG126R	Denton	10/11/2022
	Left	Primary	Z	FG127P	Denton	10/11/2022
		Redundant	Z	FG127R	Denton	10/11/2022
Tibia Load Cells	Right	Upper	Mx, My, Fz	TG408	Denton	03/23/2022
		Lower	Mx, My, Fz	AG116	Denton	03/23/2022
	Left	Upper	Mx, My, Fz	TG480	Denton	03/23/2022
		Lower	Mx, My, Fz	AG502	Denton	03/23/2022
Foot Accelerometers	Right	Rear	X	P94795	Endevco	10/10/2022
			Z	P94796	Endevco	10/10/2022
		Front	Z	P94797	Endevco	10/10/2022
	Left	Rear	X	P83167	Endevco	10/10/2022
			Z	P83168	Endevco	10/10/2022
		Front	Z	P83169	Endevco	10/10/2022
Seat Belt Load Cells		Lap				
		Shoulder		SBG272	FTSS	11/13/2019

TABLE 3 – VEHICLE INSTRUMENTATION

Instrument Location			Axis	Serial Number	Manufacturer	Calibration Date
Crossmember / Rear Seat Accelerometers	Left	Primary	X	T30604	Endevco	02/09/2023
			Z	A383139	MSI	01/17/2023
		Redundant	X	A411493	MSI	12/21/2022
	Right	Primary	X	A416945	MSI	02/15/2023
			Z	P94848	Endevco	02/15/2023
		Redundant	X	A370352	MSI	02/15/2023
Engine Accelerometers		Top	X	A305708	MSI	11/10/2022
		Bottom	X	A403812	MSI	02/15/2023