REPORT NUMBER: NCAP-MGA-21-036

NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test

KIA MOTORS MANUFACTURING GEORGIA, INC.
2021 Kia Sorento LX AWD 5-Door SUV
NHTSA No.: O20214209

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: April 14, 2021

Final Report Date: July 27, 2021

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
1200 New Jersey Ave, SE
Room W43-410
Washington, DC 20590

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Approval Date: July 27, 2021

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: _____

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16. Abstract

A 56.3 km/h NCAP Frontal Rigid Barrier Impact Test was conducted on a 2021 Kia Sorento LX AWD 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 April 14, 2021.

The impact velocity of the vehicle was 56.23 km/h and the ambient temperature at the barrier face at the time of impact was 21.8°C. The target vehicle post-test maximum crush was 610 mm located at 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	334	700	390
Maximum Chest Compression	mm	63	25	52	12
Nij		1	0.21	1	0.53
Neck Tension	N	4170	747	2620	706
Neck Compression	N	4000	100	2520	394
Left Femur Force	N	10008	945	6805	360
Right Femur Force	N	10008	1802	6805	851

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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 2021 Kia Sorento LX AWD 5-Door SUV at a velocity of 56.23 km/h. The test was performed at MGA Research Corporation on April 14, 2021. 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 belt and driver's and passenger's shoulder belts 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. DH1659) 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 leakage after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 610 mm located at 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 and knee bolster.
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})	334	0.21	747	100	54.6	25	945	1802
Passenger (5^{th})	390	0.53	706	394	49.2	12	360	851

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

TEST NOTES

Passenger Lap Belt was not installed.
Barrier C-01 Fx recorded no valid data.
Barrier C-01 Mz recorded questionable data.
Barrier C-02 Fx recorded no valid data.
Barrier C-02 My recorded no valid data.
Barrier I-05 My recorded no valid data.
Barrier K-03 Fx recorded questionable data.
Barrier K-15 My recorded no valid data.

Low level cyclical noise observed throughout many of the data channels.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV NHTSA No.: O20214209
Test Program: NCAP Frontal Barrier Impact Test Test Date: 4/14/2021

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20214209	Traction Control System (TCS)	Yes
Model Year	2021	Power Steering	Yes
Make	Kia	Power Window Auto-Reverse	Yes
Model	Sorento LX	Driver Frontal Airbag	Yes
Body Style	5-Door SUV	Driver Curtain Airbag	Yes
VIN	5XYRGDLC5MG001449	Driver Head/Torso Airbag	No
Body Color	Gravity Gray	Driver Torso Airbag	No
Odometer (km/mi)	232 km / 144 mi	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	2.5 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	8	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	AWD	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof/T-Top	No	Front Pass. Knee Airbag	No
Running Boards	Yes	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	No	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 MOTORS MANUFACTURING GEORGIA, INC.
Date of Manufacture	SEP/25/20

GVWR (kg)	2480
GAWR Front (kg)	1300
GAWR Rear (kg)	1350

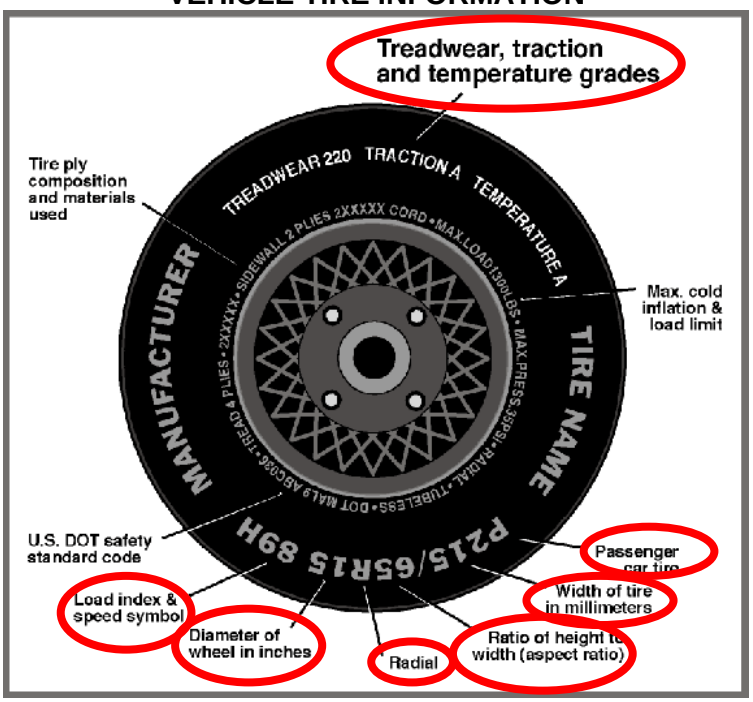
VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench	Split Bench	
Designated Seating Capacity (DSC)	2	3	2	7
Capacity Weight (VCW) (kg)				546
Cargo Weight (RCLW) (kg)				70

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

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20214209
Test Date: 4/14/2021

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	235/65R17	235/65R17
Tire Size on Vehicle	235/65R17	235/65R17
Tire Manufacturer	Continental	Continental
Tire Model	CrossContact	CrossContact
Treadwear	480	480
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 2 Steel, 1 Polyamide	1 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	104H	104H
Tire Material	Rubber	Rubber
DOT Safety Code Left	1A3 03HD5A 3420	1A3 03HD5A 3420
DOT Safety Code Right	1A3 03HD5A 3420	1A3 03HD5A 3420

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

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV NHTSA No.: O20214209
Test Program: NCAP Frontal Barrier Impact Test Test Date: 4/14/2021

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	506.5	387.0		543.5	462.0	
Right	kg	471.0	398.5		497.0	463.5	
Ratio	%	55.4%	44.6%		52.9%	47.1%	
Totals	kg	977.5	785.5	1763.0	1040.5	925.5	1966.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1763.0
Weight of 1 P572E ATD & 1 P572O ATD	kg	141
Rated Cargo/Luggage Weight (RCLW)	kg	70
Calculated Test Vehicle Target Weight (TVTW)	kg	1974.0

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	810	812	832	832	1256
As Tested	mm	803	806	802	811	1328
Post Test	mm	865	865	805	809	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2820
Total Vehicle Length at Left Side	mm	4660
Total Vehicle Length at Centerline	mm	4823
Total Vehicle Length at Right Side	mm	4660
Weight of Ballast in Cargo Area	kg	15
Weight of Vehicle Components Removed	kg	11
Amount of Stoddard Solvent in Fuel Tank	L	62.5

List of components removed to meet test weight: None.

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

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

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV NHTSA No.: O20214209
Test Program: NCAP Frontal Barrier Impact Test Test Date: 4/14/2021

TARGET VEHICLE STRUCTURAL MEASUREMENT

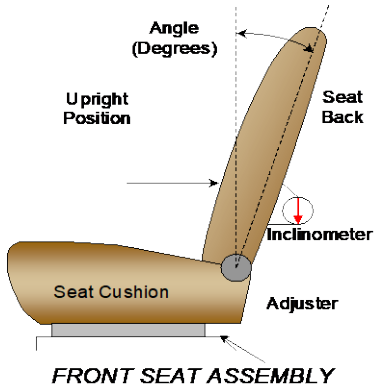
	Elements	Pre-Test (mm)
1	Total Length	4823
2	Total Width	1944
3	Bumper Top Height	611
4	Bumper Bottom Height	503
5	Longitudinal Member Top Height	626
6	Distance between Longitudinal Members	956
7	Longitudinal Member Width	60
8	Engine Top Height	952
9	Engine Bottom Height	250
10	Engine and Gearbox Width	792
11	Front Bumper-Engine Distance	N/A
12	Front Shock Absorber Fixing Height	1011
13	Bonnet Leading Edge Height	985
14	Front Shock Absorber Fixing Width	130
15	Front Bumper – Front Axle Distance	969
16	Front Axle – A-Pillar Distance	432
17	A-Pillar – B-Pillar Distance	1120
18	B-Pillar – Rear Axle Distance	1254
19	B-Pillar – C-Pillar Distance	712
20	Roof Sill Bottom Height	1549
21	Roof Sill Top Height	1674
22	Floor Sill Bottom Height	272
23	Floor Sill Top Height	428

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

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20214209
Test Date: 4/14/2021

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	1.1° on outboard headrest post
Passenger Seat Back Angle	1.7° on outboard headrest post

SEAT FORE/AFT POSITIONS

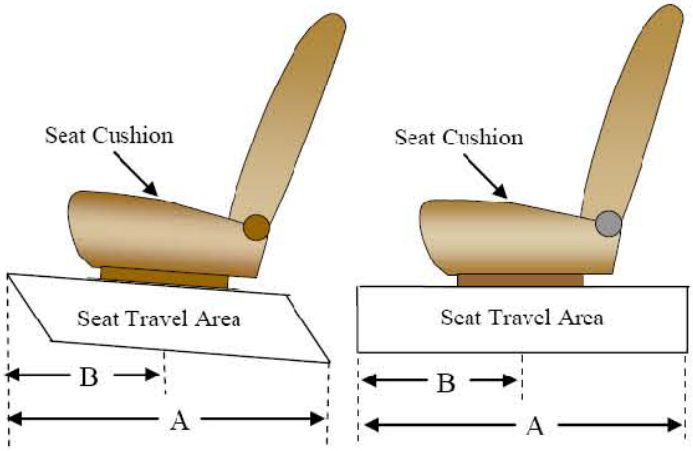
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated May 2018.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	288 mm / 35 detents (1st as 1)	144 mm / 12th detent (1st as 0)
Passenger Seat	240 mm / 38 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	4 (1st as 1)	0 (1st as 0)
Passenger Seat	4 (1st as 1)	0 (1st as 0)



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

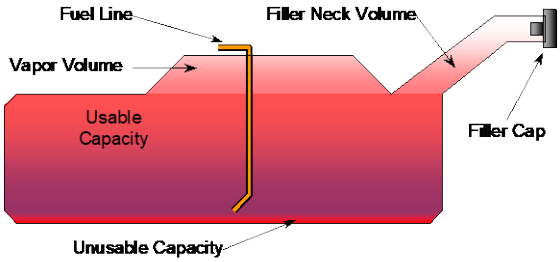
Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV NHTSA No.: O20214209
Test Program: NCAP Frontal Barrier Impact Test Test Date: 4/14/2021

FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	67.0
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	61.6 to 63.0
Actual Amount of Solvent used	62.5
1/3 of Usable Capacity	22.3

FUEL PUMP

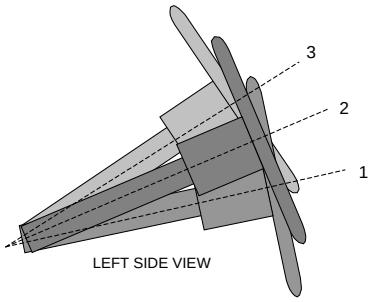
The vehicle is equipped with an electronic fuel pump. The fuel pump will run when the engine is running. Fuel pump is operated for 1.5 seconds when the key is positioned to ignition on. After that, the fuel pump is operated continuously with engine starting. The filler neck is located on the driver's 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.



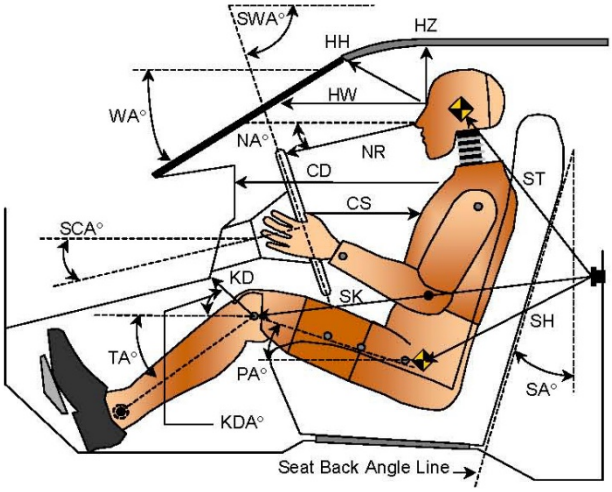
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	65.3	
Geometric Center Position 2	63.3	
Uppermost Position 3	61.3	
Telescoping Steering Wheel Travel		49
Test Position	63.3	25

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20214209
Test Date: 4/14/2021

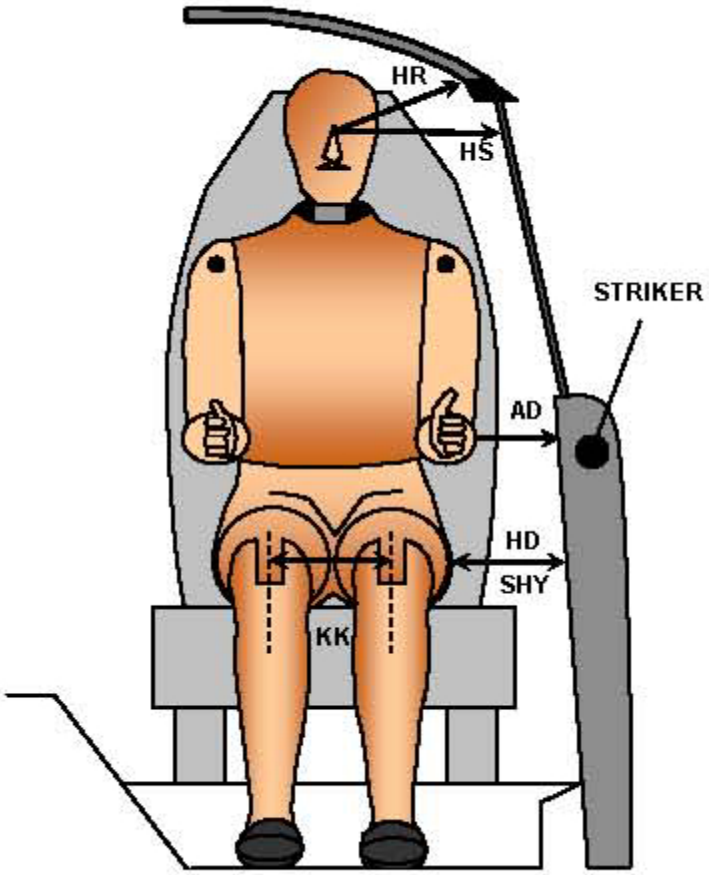


LEFT SIDE VIEW

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		25.1		
SWA°	Steering Wheel Angle		63.3		
SCA°	Steering Column Angle		26.7		
SA°	Seat Back Angle		1.1		1.7
HZ	Head to Roof (Z)	234	90	271	90
HH	Head to Header	373	26.5	358	41.4
HW	Head to Windshield	724	0	740	0
NR	Nose to Rim	396	14.1		
CD	Chest to Dash	531		421	
CS	Chest to Steering Hub	303	0.4		
RA	Rim to Abdomen	180	0		
KDL	Left Knee to Dash	172	21.4	128	29.5
KDR	Right Knee to Dash	154	35.8	129	30.7
PA°	Pelvic Angle		24.1		21.6
TA°	Tibia Angle		49.4		44.4
SK	Striker to Knee	562	118.5	681	102.6
ST	Striker to Head	376	14.6	386	38.4
SH	Striker to H-Point	352	157.3	414	126.0

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20214209
Test Date: 4/14/2021

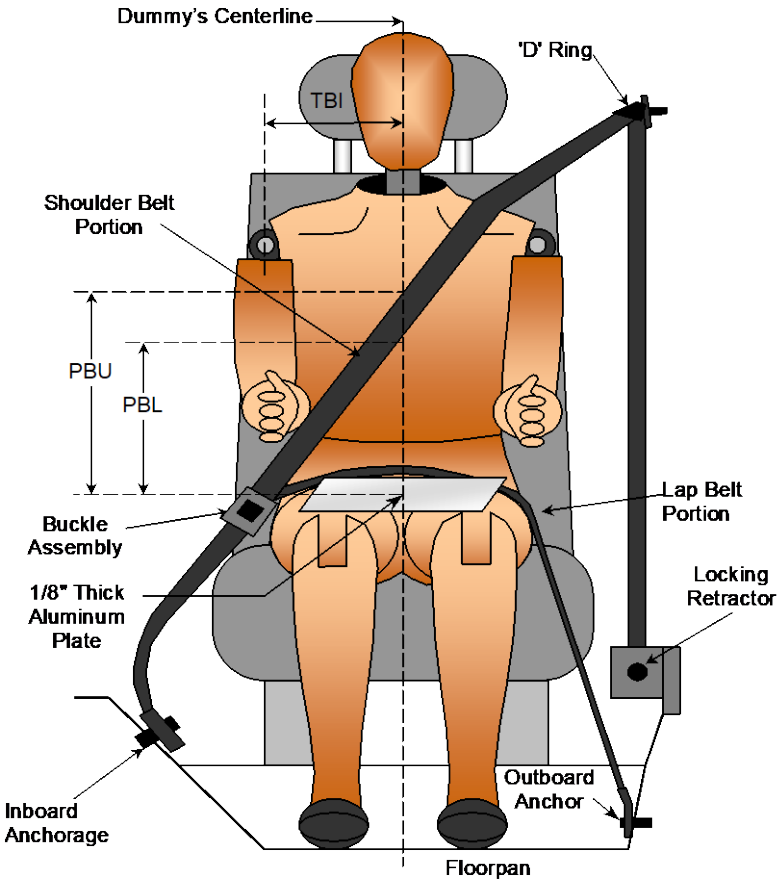


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
AD	Arm to Door	53	83
HD	H-Point to Door	171	246
HR	Head to Side Header	237	294
HS	Head to Side Window	333	370
KK	Knee to Knee	346	227
SHY	Striker to H-Point (Y Direction)	280	303
AA	Ankle to Ankle	315	161

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle:	2021 Kia Sorento LX AWD 5-Door SUV	NHTSA No.:	O20214209
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	4/14/2021



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	360	340
PBL - Top surface of reference to belt lower edge	mm	280	250

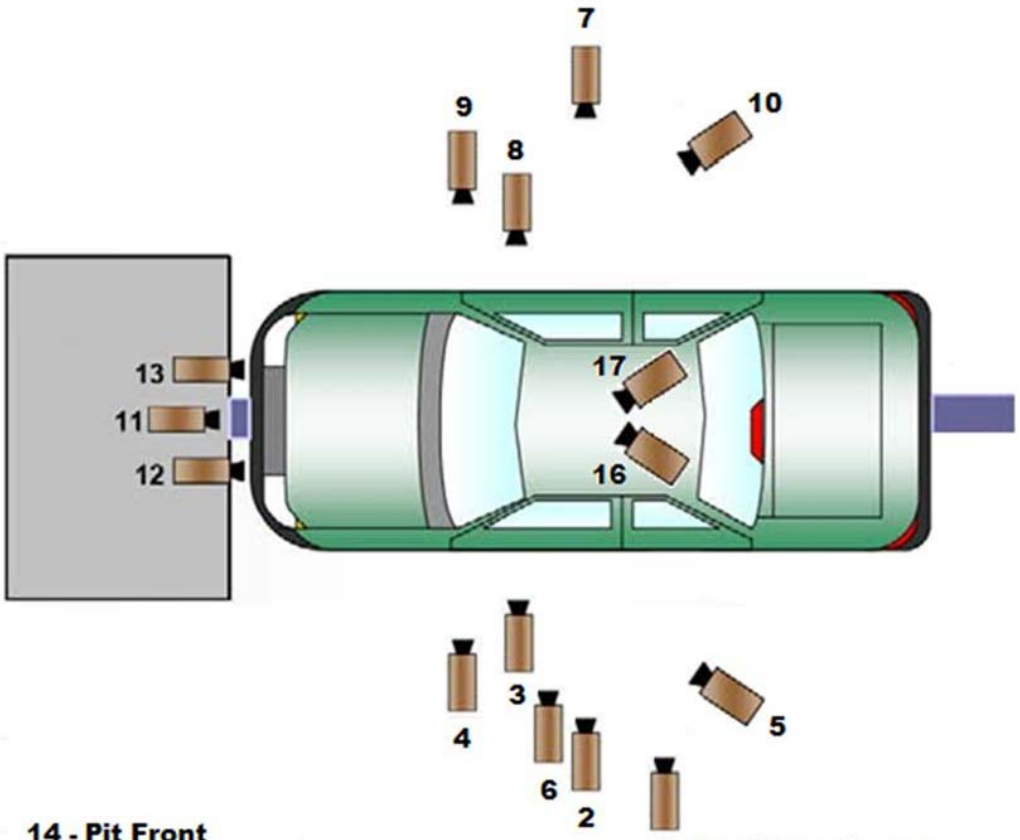
BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	880	940
Lap Belt Length as measured on ATD	mm	670	765
Remainder of belt on reel	mm	510	355
Total Belt Length for Continuous Webbing Systems	mm	2760	2760

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

Test Vehicle:	2021 Kia Sorento LX AWD 5-Door SUV	NHTSA No.:	O20214209
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	4/14/2021

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: 2021 Kia Sorento LX AWD 5-Door SUV NHTSA No.: O20214209
Test Program: NCAP Frontal Barrier Impact Test Test Date: 4/14/2021

CAMERA LOCATIONS

No.	Camera View	Coordinates* (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall					30
2	Left Overall	-2320	-5800	-1340	12	1000
3	Driver Close-Up	-1530	-6480	-1760	50	1000
4	Left Front Half	-1350	-5260	-1280	24	1000
5	Left Angle	-7400	-5700	-1790	75	1000
6	Steering Column	-1010	-5460	-1250	50	1000
7	Right Overall	-2200	5870	-1300	12	1000
8	Passenger Close-Up	-1610	6530	-1800	50	1000
9	Right Front Half	-1140	5420	-1230	24	1000
10	Right Angle	-7380	5480	-1820	75	1000
11	Windshield	80	0	-2310	12	1000
12	Driver Windshield	60	-370	-2230	25	1000
13	Passenger Windshield	60	370	-2230	25	1000
14	Pit Front	-870	0	3340	24	1000
15	Pit Rear	-2890	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: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
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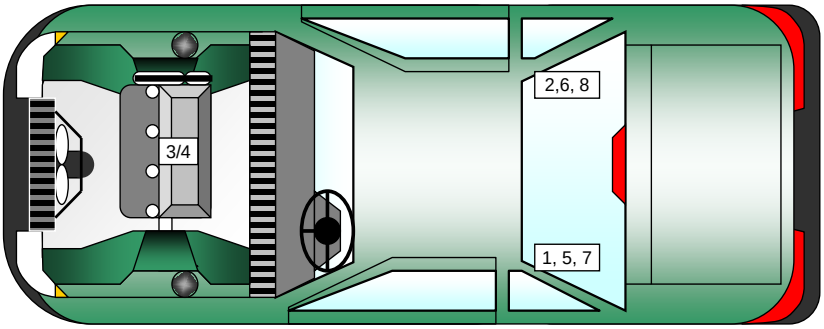
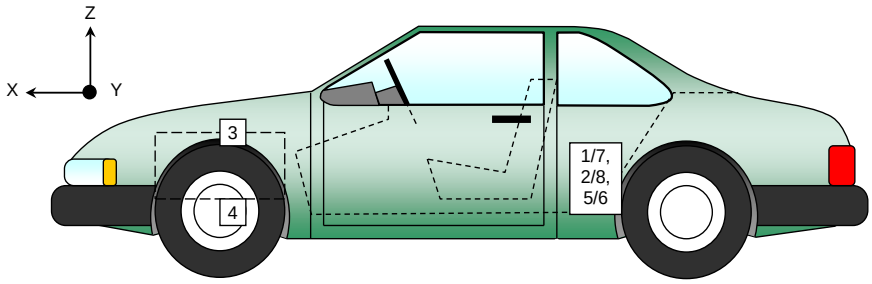
Test Date: 4/14/2021





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	1971	-454	-360
2	Right Rear Crossmember Accelerometer – X Direction	1971	454	-365
3	Engine Top X	4043	192	-928
4	Engine Bottom X	4003	76	-242
5	Left Rear Crossmember Accelerometer – Z Direction	1971	-454	-360
6	Right Rear Crossmember Accelerometer – Z Direction	1971	454	-365
7	Left Rear Crossmember Accelerometer Redundant – X Direction	1971	-485	-360
8	Right Rear Crossmember Accelerometer Redundant – X Direction	1971	485	-365

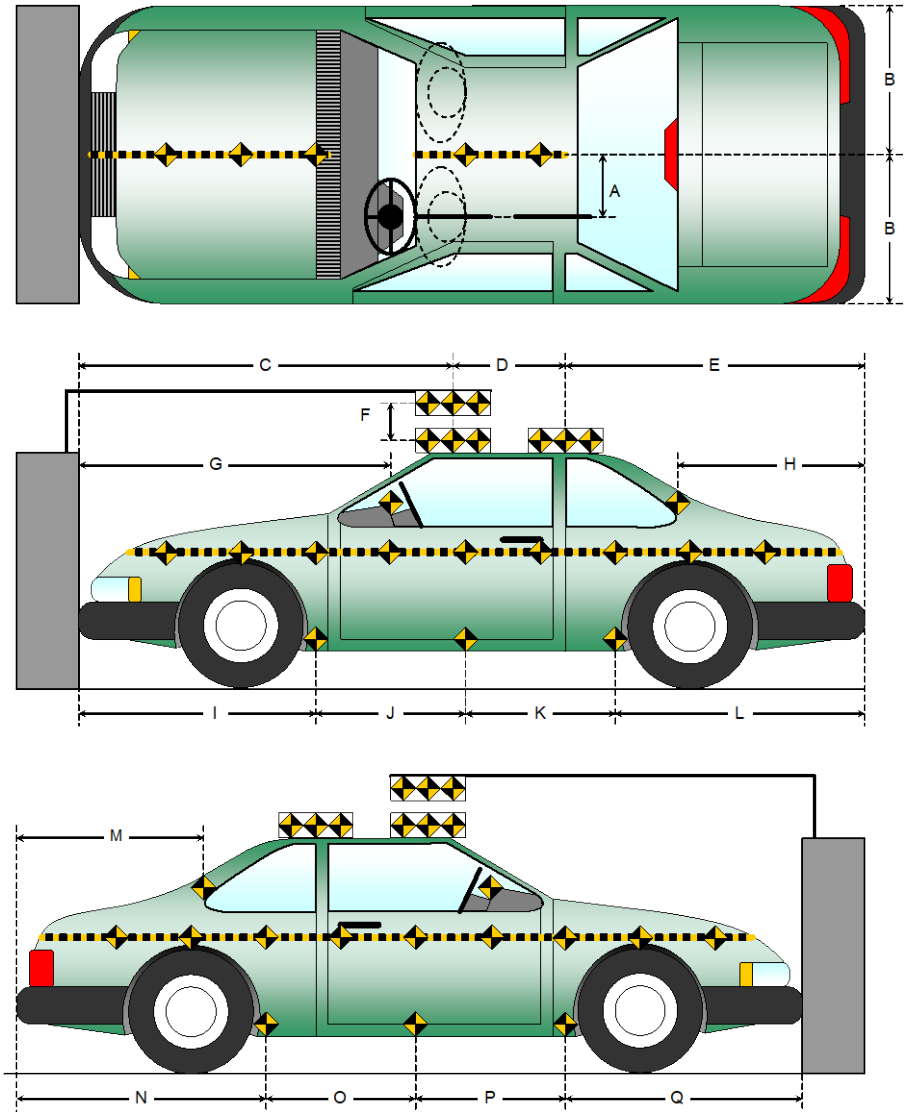
Reference Points: X - Rear Surface of Vehicle (+ forward)
Y - Vehicle Centerline (+ to right)
Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20214209
Test Date: 4/14/2021

Item	Value (mm)
A	385
B	972
C	2295
D	610
E	1918
F	165
G	
H	1385
I	1470
J	892
K	892
L	1569
M	1385
N	1569
O	892
P	892
Q	1470



DATA SHEET NO. 9
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20214209
Test Date: 4/14/2021

ADVANCED RESEARCH LOAD CELL BARRIER

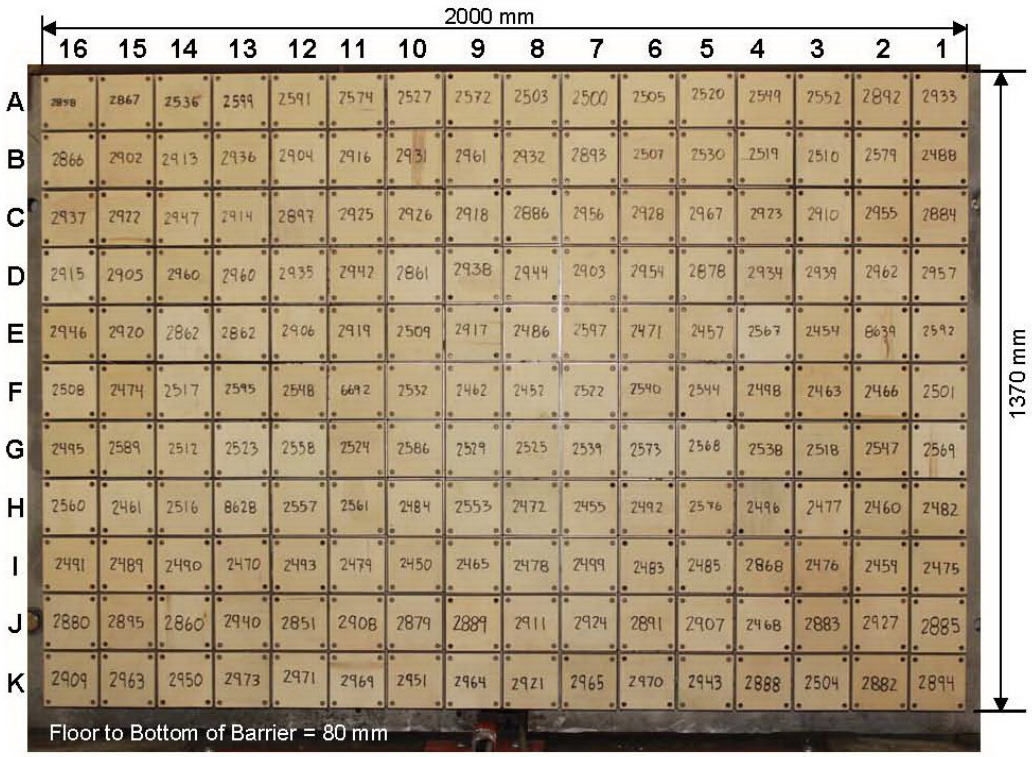


Photo for Reference Only

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: 2021 Kia Sorento LX AWD 5-Door SUV NHTSA No.: O20214209
Test Program: NCAP Frontal Barrier Impact Test Test Date: 4/14/2021

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: 2021 Kia Sorento LX AWD 5-Door SUV NHTSA No.: O20214209
Test Program: NCAP Frontal Barrier Impact Test Test Date: 4/14/2021

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 351	HIII 5% / DH1659
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, Knee Bolster	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 by passenger airbag
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

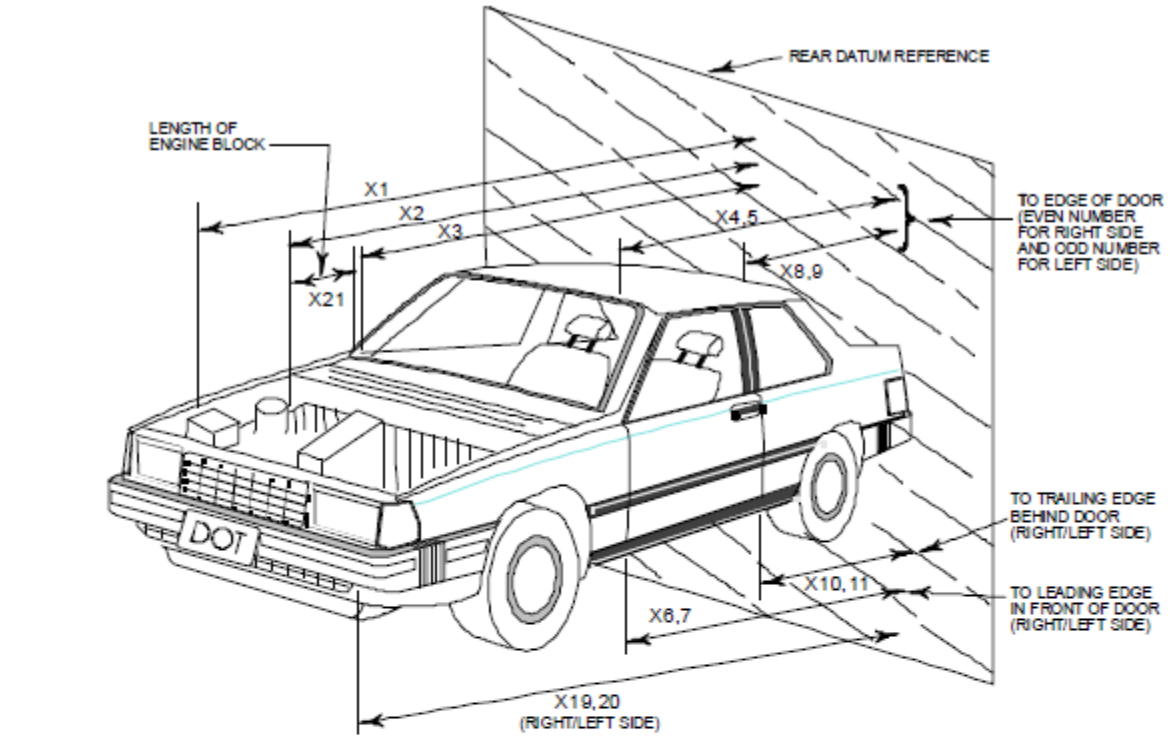
Measured Parameter	Units	Value
Left Side	mm	5180
Center	mm	5170
Right Side	mm	5115
Average	mm	5155

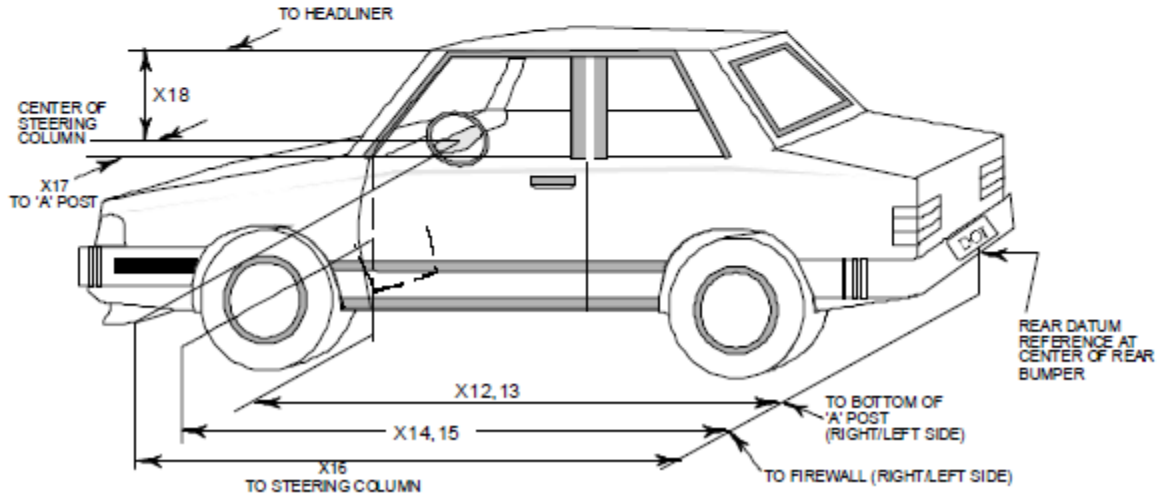
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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:	2021 Kia Sorento LX AWD 5-Door SUV	NHTSA No.:	O20214209
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	4/14/2021





DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20214209
Test Date: 4/14/2021

No.	Measurement Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4823	4213	610
2	RSOV to Front of Engine	4315	4123	192
3	RSOV to Firewall	3756	3731	25
4	RSOV to Upper Leading Edge of Right Door	3314	3300	14
5	RSOV to Upper Leading Edge of Left Door	3314	3315	-1
6	RSOV to Lower Leading Edge of Right Door	3301	3302	-1
7	RSOV to Lower Leading Edge of Left Door	3301	3303	-2
8	RSOV to Upper Trailing Edge of Right Door	2258	2240	18
9	RSOV to Upper Trailing Edge of Left Door	2258	2255	3
10	RSOV to Lower Trailing Edge of Right Door	2290	2285	5
11	RSOV to Lower Trailing Edge of Left Door	2290	2284	6
12	RSOV to Bottom of “A” Post of Right Side	3316	3314	2
13	RSOV to Bottom of “A” Post of Left Side	3316	3316	0
14	RSOV to Firewall, Right Side	3760	3749	11
15	RSOV to Firewall, Left Side	3760	3748	12
16	RSOV to Steering Column	2875	2927	-52
17	Center of Steering Column to “A” Post	402	382	20
18	Center of Steering Column to Headliner	450	442	8
19	RSOV to Right Side of Front Bumper	4660	4183	477
20	RSOV to Left Side of Front Bumper	4660	4188	472
21	Length of Engine Block	510	510	0
RD	RSOV to Right Side of Dash Panel	3126	3134	-8
CD	RSOV to Center of Dash Panel	3108	3082	26
LD	RSOV to Left Side of Dash Panel	3148	3132	16

All Dimensions in mm

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

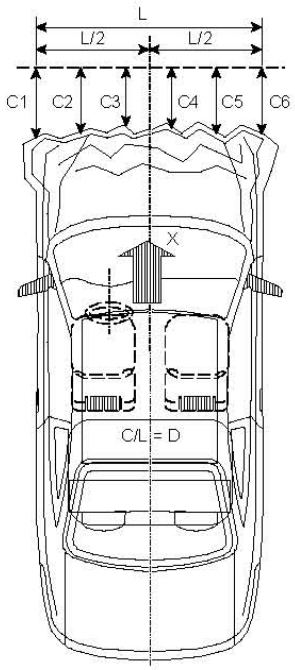
Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20214209
Test Date: 4/14/2021

VEHICLE INFORMATION

VIN:	5XYRGDLC5MG001449	Wheelbase (mm):	2820
Vehicle Size Category:	MPV	Test Weight (kg):	1966.0

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):	56.23
Velocity Change (km/h):	65.6
Time of Separation (msec)	98



CRUSH PROFILE

Collision Deformation Classification:	12FDEW3
Midpoint of Damage:	Centerline
Damage Region Length (mm):	1320
Impact Mode:	Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4660	4188	472
C2	Crush zone 2 at left side	mm	4736	4204	532
C3	Crush zone 3 at left side	mm	4767	4215	552
C4	Crush zone 4 at right side	mm	4767	4221	546
C5	Crush zone 5 at right side	mm	4736	4210	526
C6	Crush zone 6 at right side	mm	4660	4183	477
L	C1 TO C6	mm	1320	1306	14

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

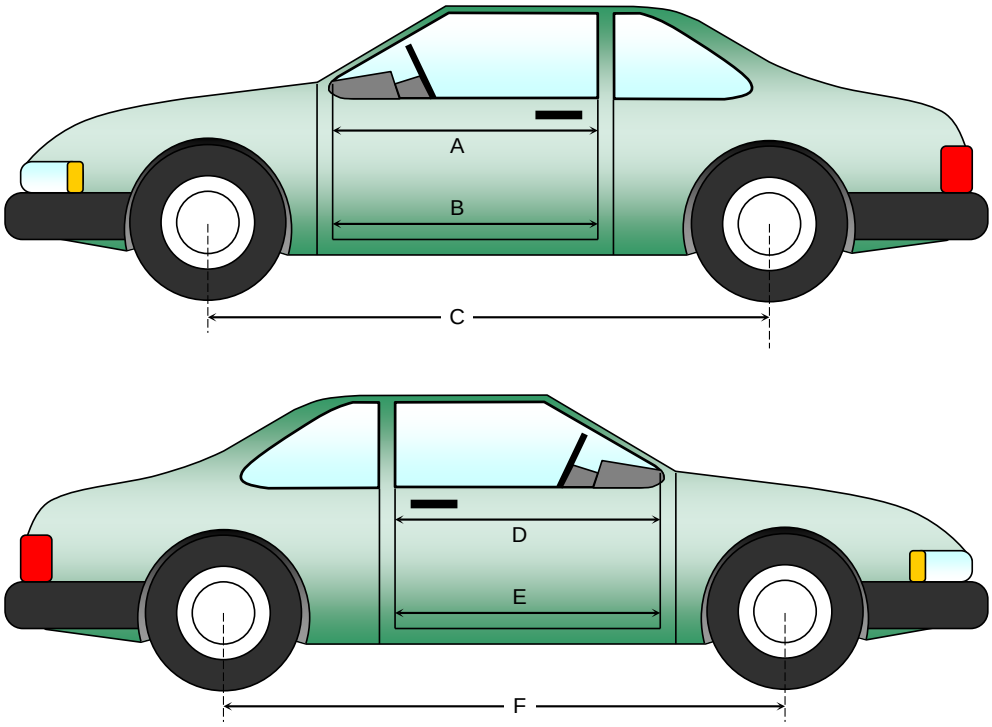
Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20214209
Test Date: 4/14/2021

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	964	964	0
B	Left Side Lower	mm	880	880	0
D	Right Side Upper	mm	963	963	0
E	Right Side Lower	mm	885	885	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2820	2746	74
F	Right Side Wheelbase	mm	2820	2740	80



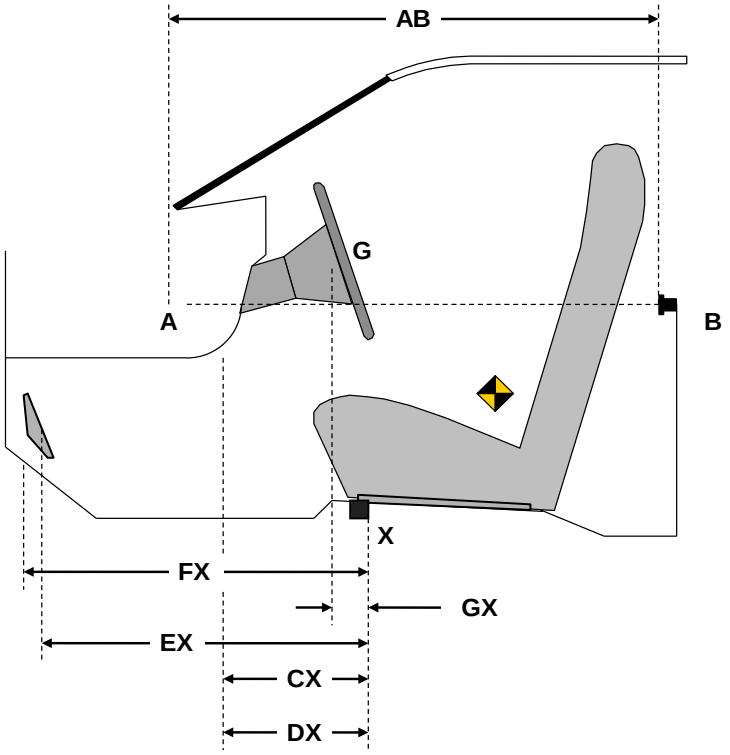
DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20214209
Test Date: 4/14/2021

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	700	700	0
CX	Left Knee Bolster to X	mm	300	299	1
DX	Right Knee Bolster to X	mm	296	296	0
EX	Brake Pedal to X	mm	515	513	2
FX	Foot Rest to X	mm	510	512	-2
GX	Center of Steering Column Wheel Hub to X	mm	55	57	-2

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

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

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV NHTSA No.: O20214209
Test Program: NCAP Frontal Barrier Impact Test Test Date: 4/14/2021

WINDSHIELD MOUNTING DETAILS

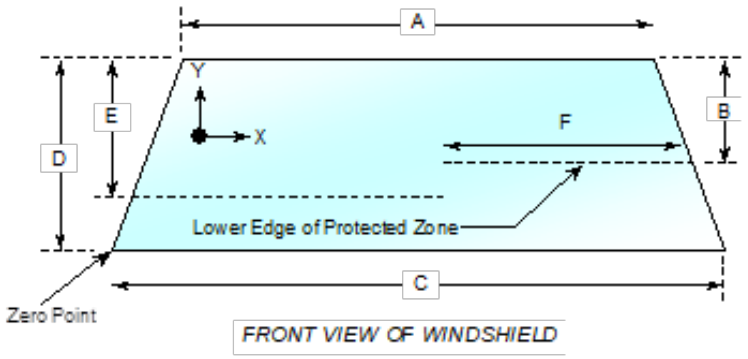
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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: 21.8°C.

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2266	2266	100
Right Side	2266	2266	100
Total	4532	4532	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1254
B	mm	462
C	mm	1446
D	mm	916
E	mm	543
F	mm	565

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: 2021 Kia Sorento LX AWD 5-Door SUV NHTSA No.: O20214209
Test Program: NCAP Frontal Barrier Impact Test Test Date: 4/14/2021

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21.8°C Test Time: 11:41 a.m.

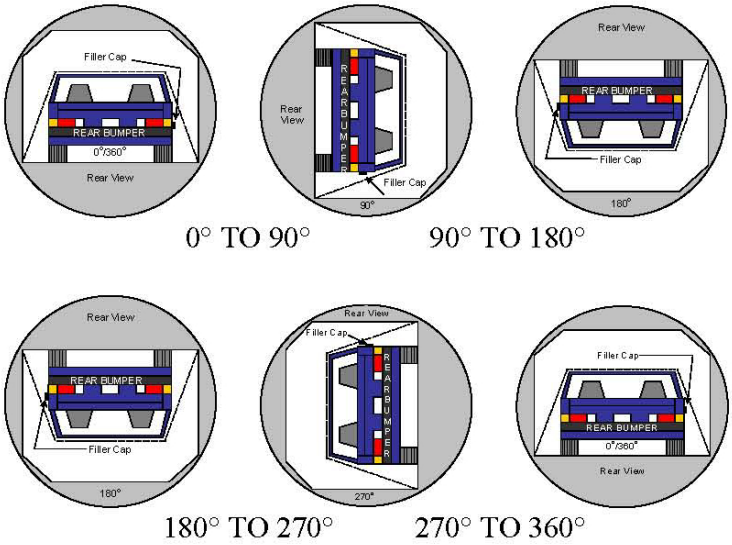
A. From impact until vehicle motion ceases: (Maximum Allowable = 1 ounce) 0.0 oz.

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°	109	300	409
270° to 360°	111	300	411

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

Test Vehicle: 2021 Kia Sorento LX AWD 5-Door SUV NHTSA No.: O20214209
Test Program: NCAP Frontal Barrier Impact Test Test Date: 4/14/2021

FMVSS 301 SPILLAGE TABLE (UNITS IN OUNCES)

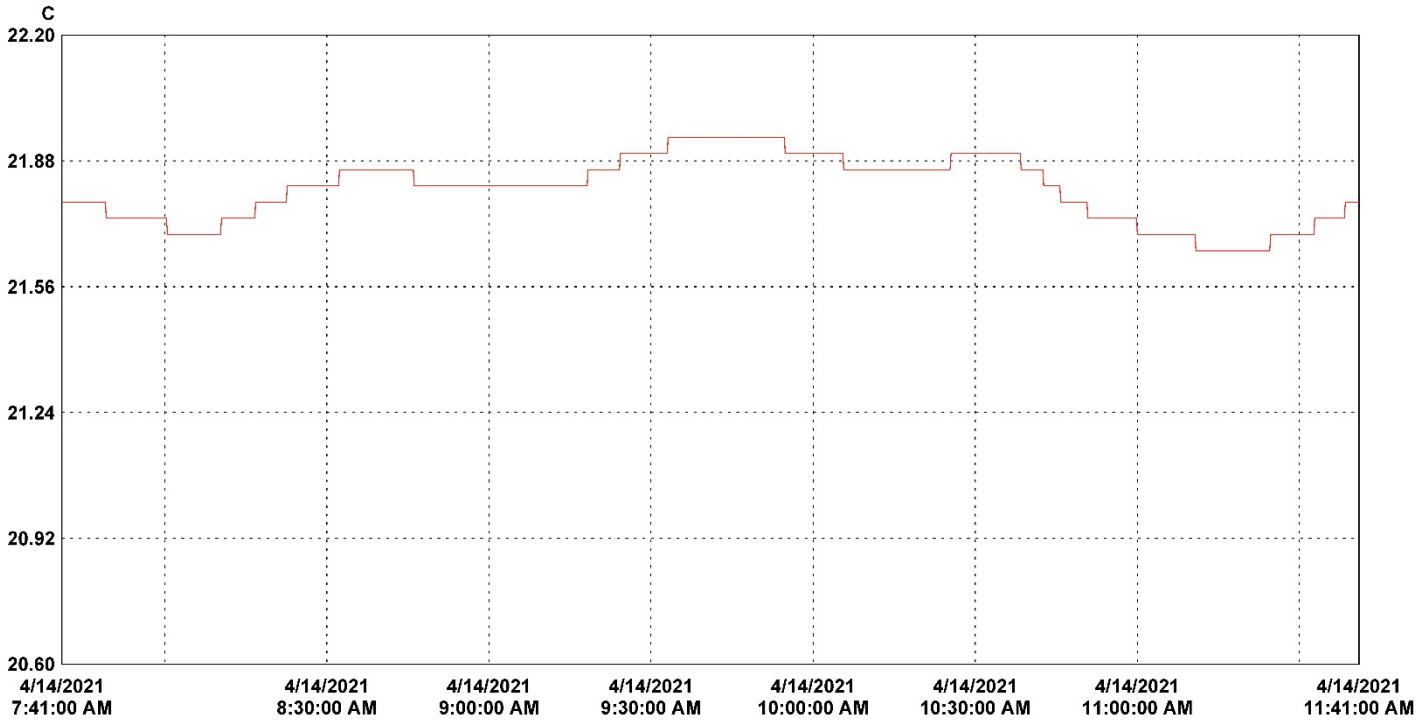
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

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: 2021 Kia Sorento LX AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20214209
Test Date: 4/14/2021



30 minutes/div 4 hours (M/d/yyyy h:mm:ss tt) Central Time Graph file (truncated): O20214209 2021 Kia Sorento LX AWD 5-Door SUV NCAP.spg

LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	18352041	VSC_Prep_Room	1		21.94	21.81	21.65	C	Temperature	18352041_VSC_Prep_Room.spl

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PHOTOGRAPHS

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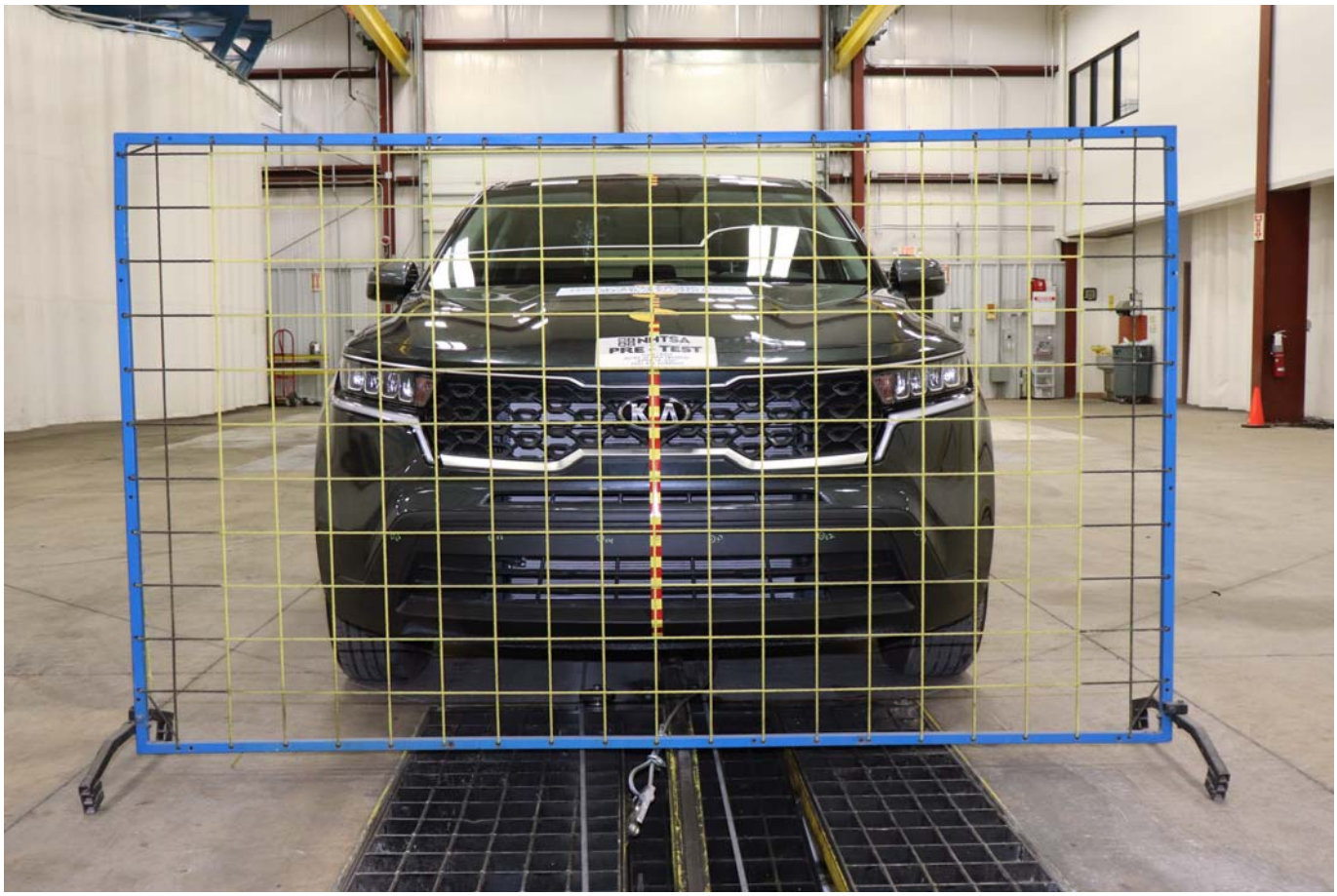

Photo No. 001 - Load Cell Location

Photo No. 002 - Pre-Test Load Cell Wall

Photo No. 003 - Post-Test Load Cell Wall

Photo No. 004 - Manufacturer Label

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Photo No. 006 - 2021 Kia Sorento LX AWD 5-Door SUV Frontal As Delivered

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

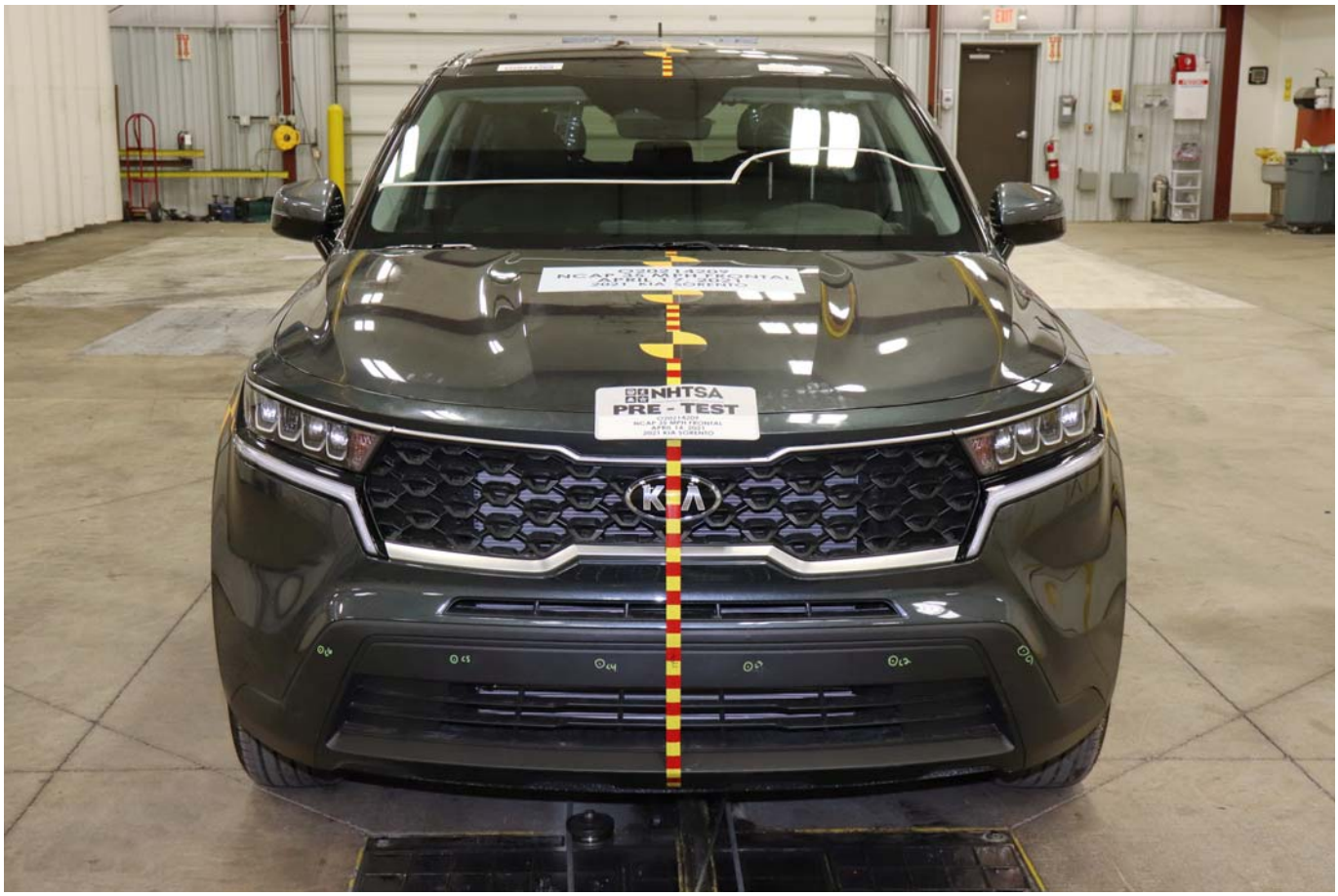

Photo No. 008 - Pre-Test Front View of Test Vehicle

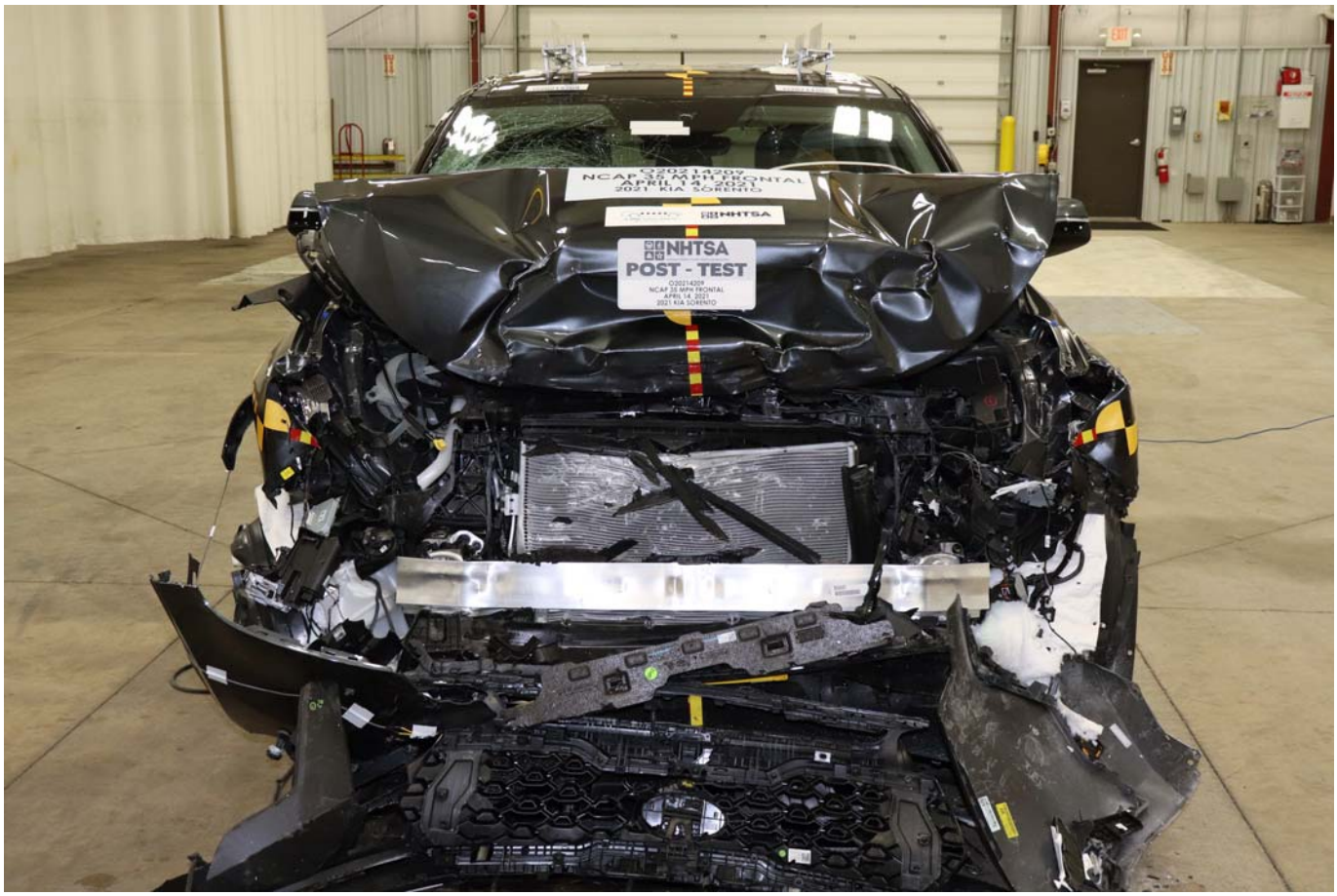

Photo No. 009 - Post-Test Front View of Test Vehicle

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

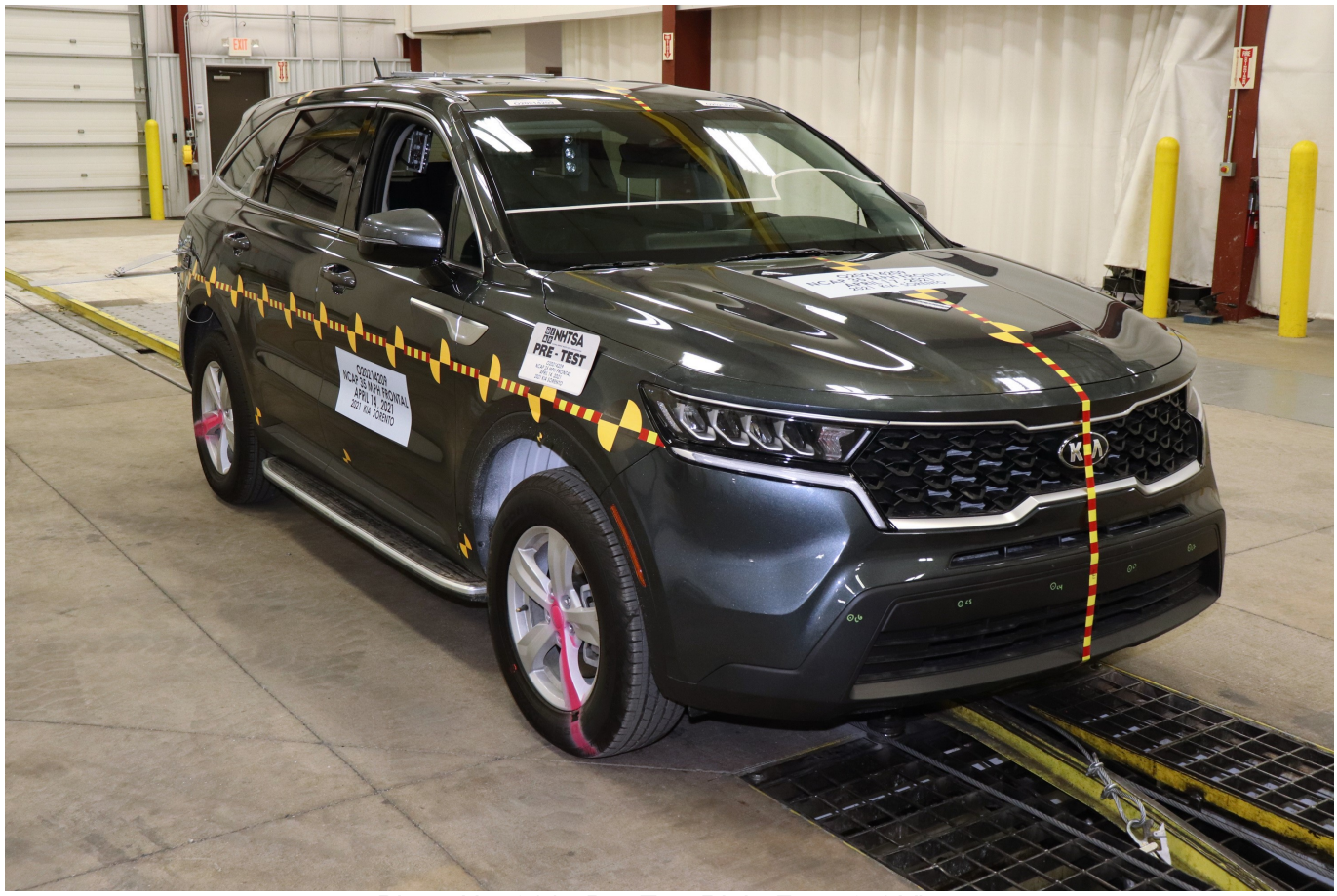

Photo No. 014 - Pre-Test Right Front 3-4 View

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

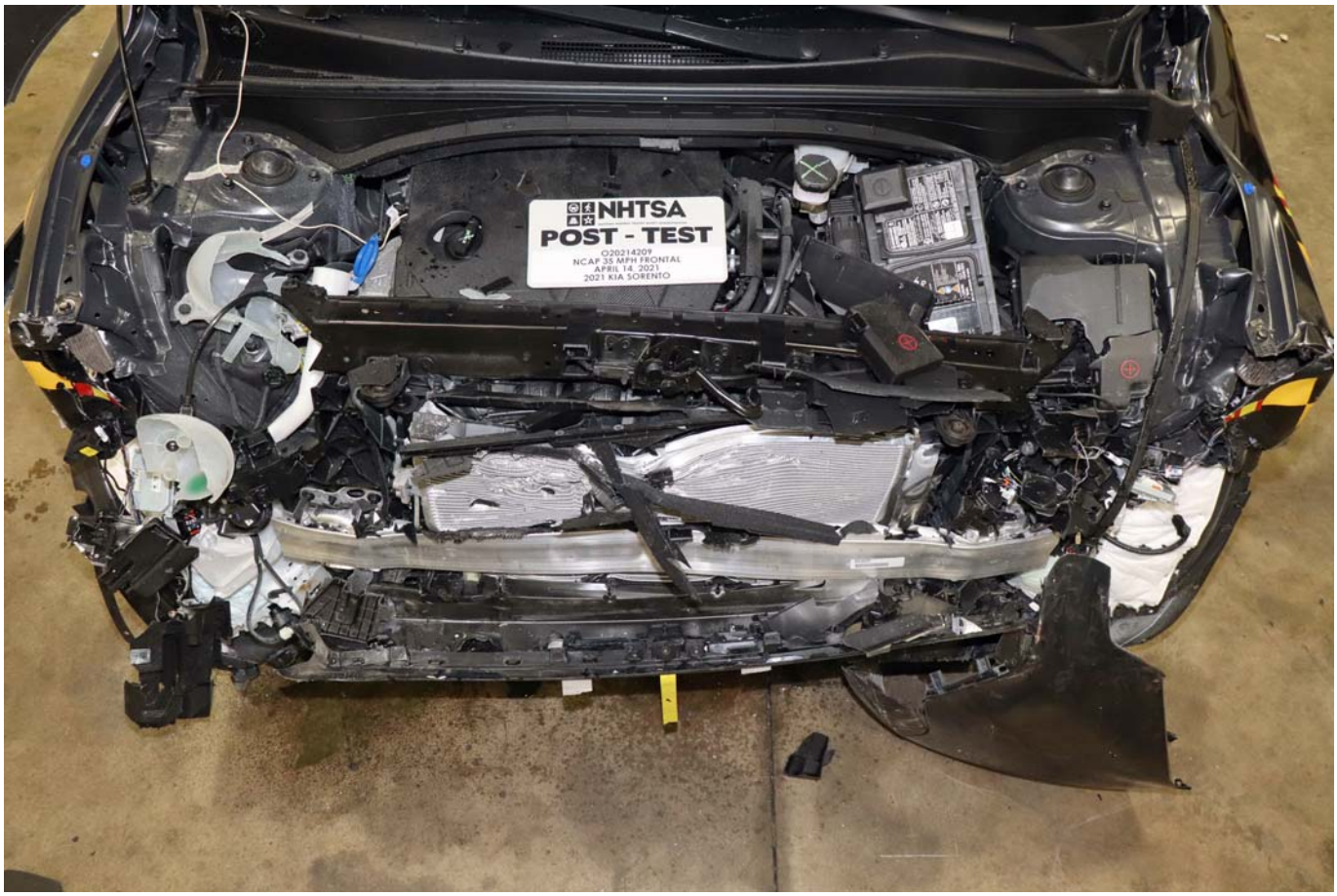

Photo No. 021 - Post-Test Engine Compartment View

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

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

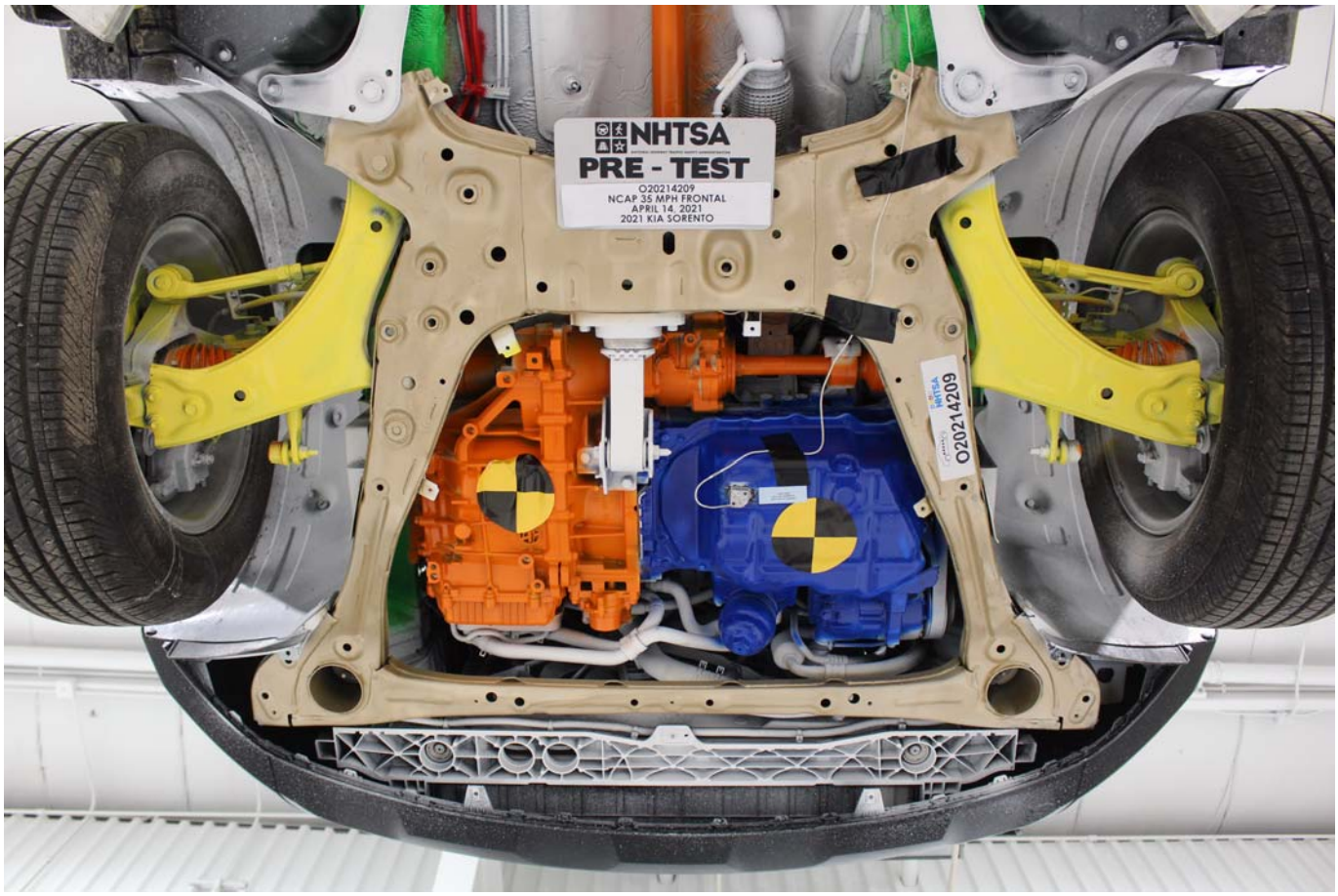

Photo No. 024 - Pre-Test Front Underbody View

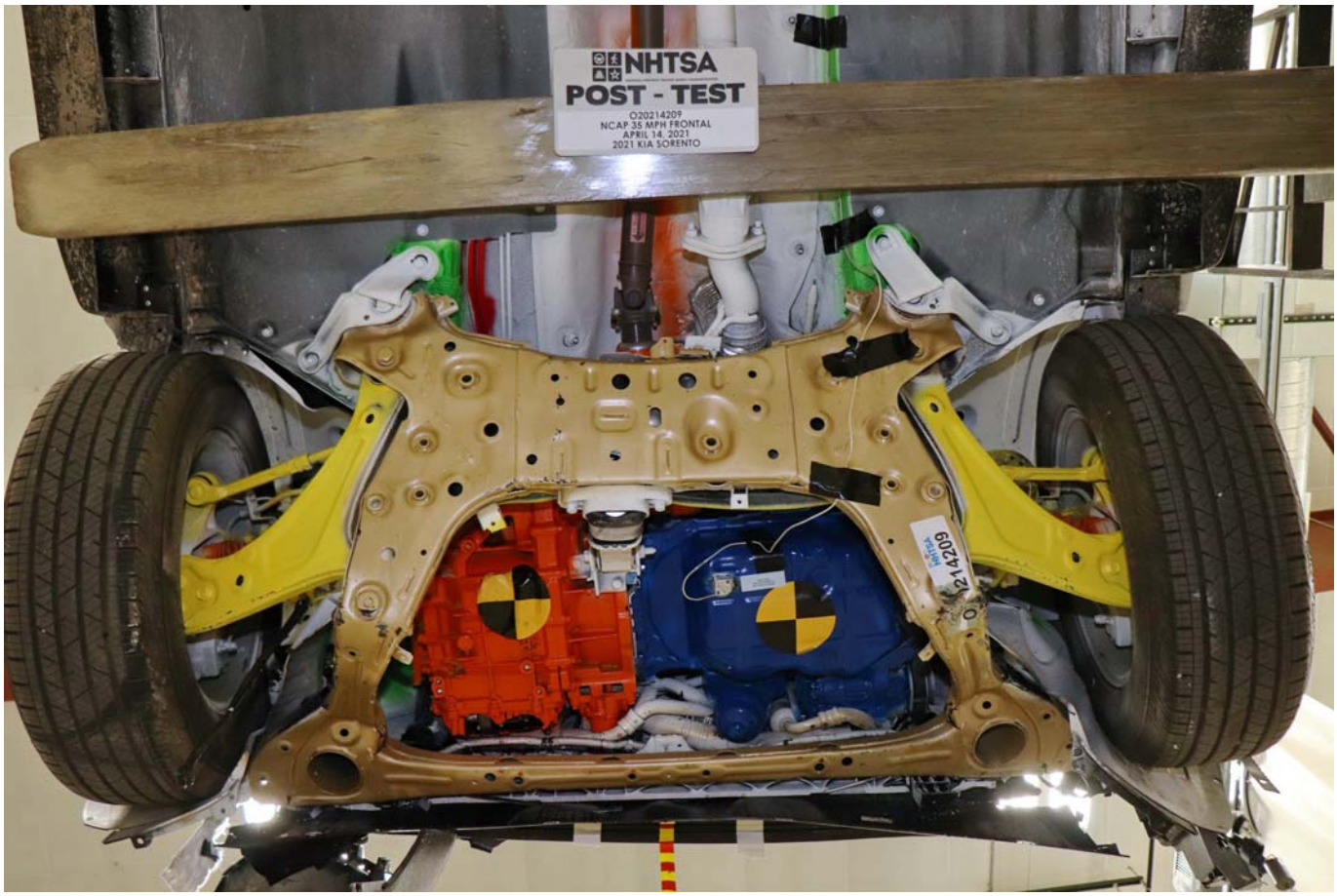

Photo No. 025 - Post-Test Front Underbody View

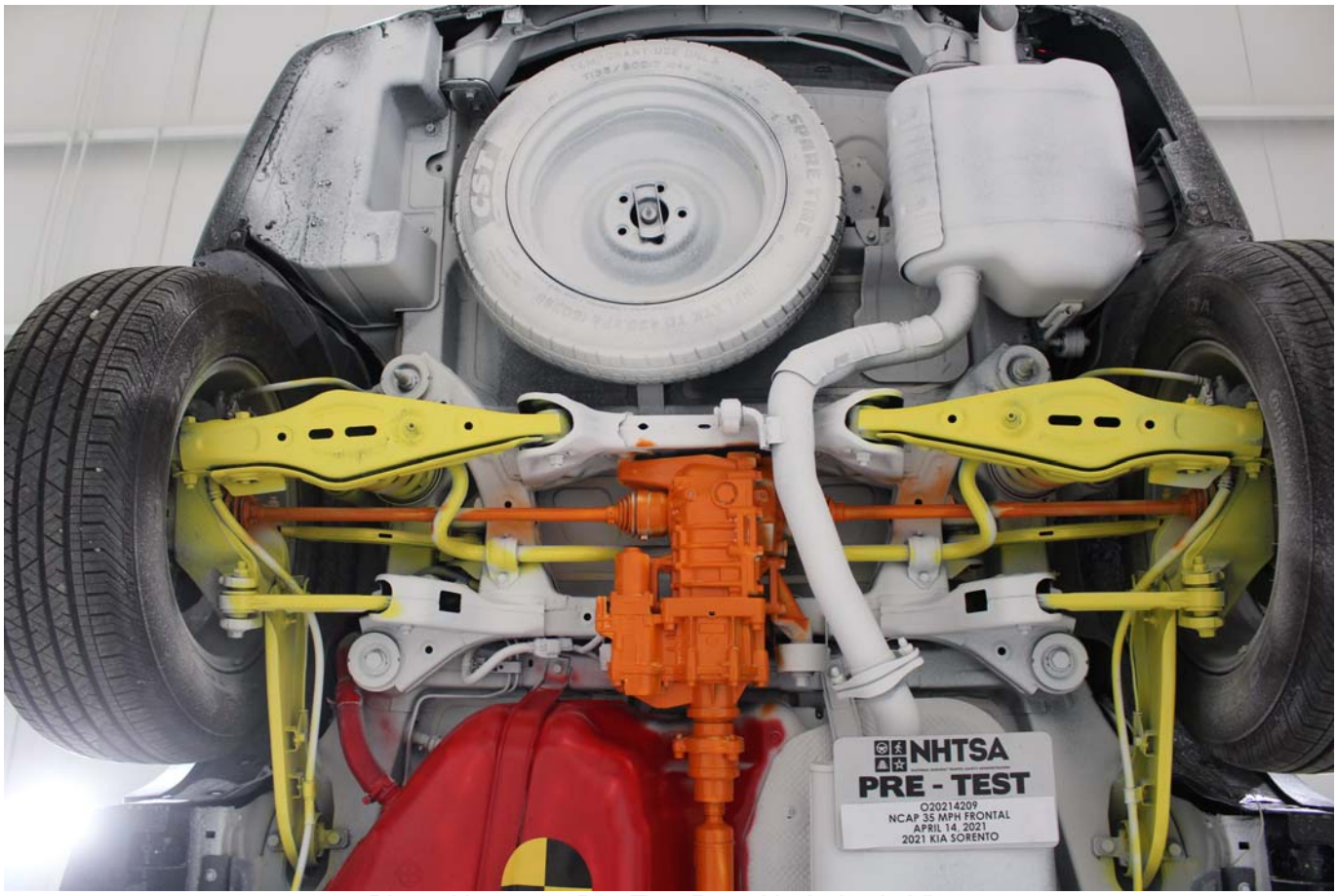

Photo No. 026 - Pre-Test Rear Underbody View

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. 036 - Pre-Test Driver Seat Fore-Aft Markings

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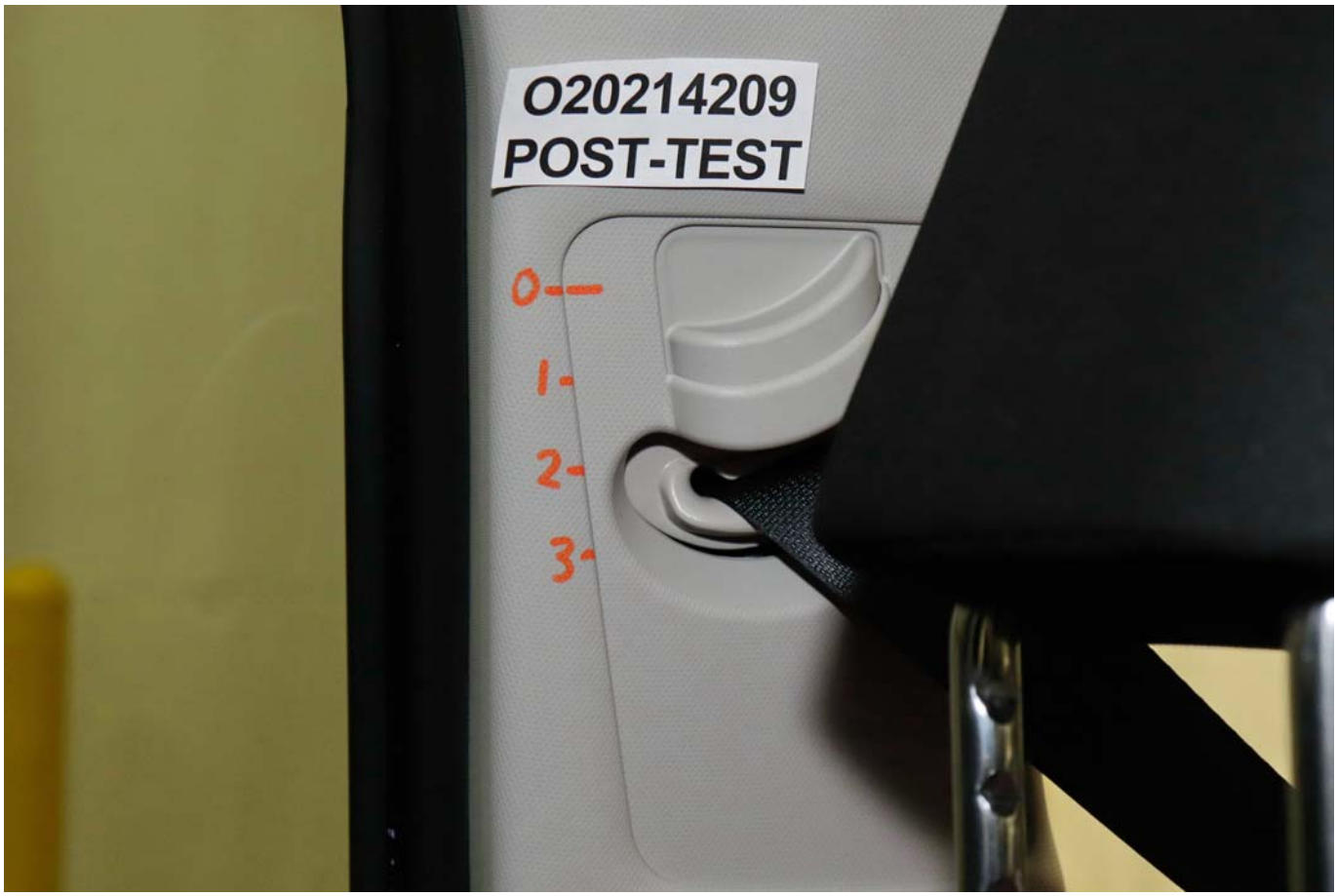

Photo No. 039 - Post-Test View of Belt Anchorage for Driver Dummy

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

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Photo No. 043 - Post-Test Driver Dummy Feet

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

Photo No. 046 - Pre-Test Driver Side Floorpan

Photo No. 047 - Post-Test Driver Side Floorpan

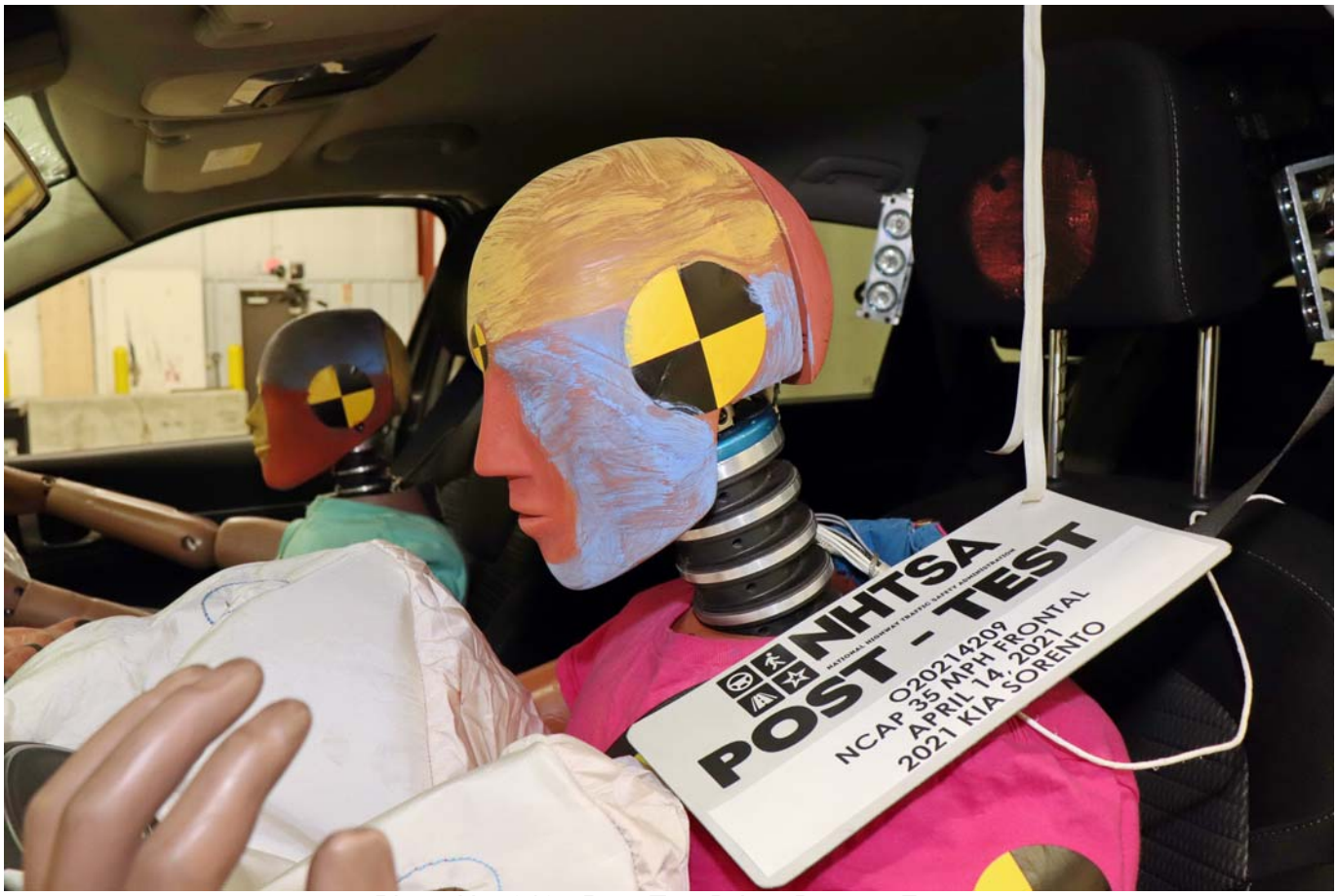

Photo No. 048 - Post-Test Driver Dummy Face

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

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

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PHOTOGRAPH NOT APPLICABLE

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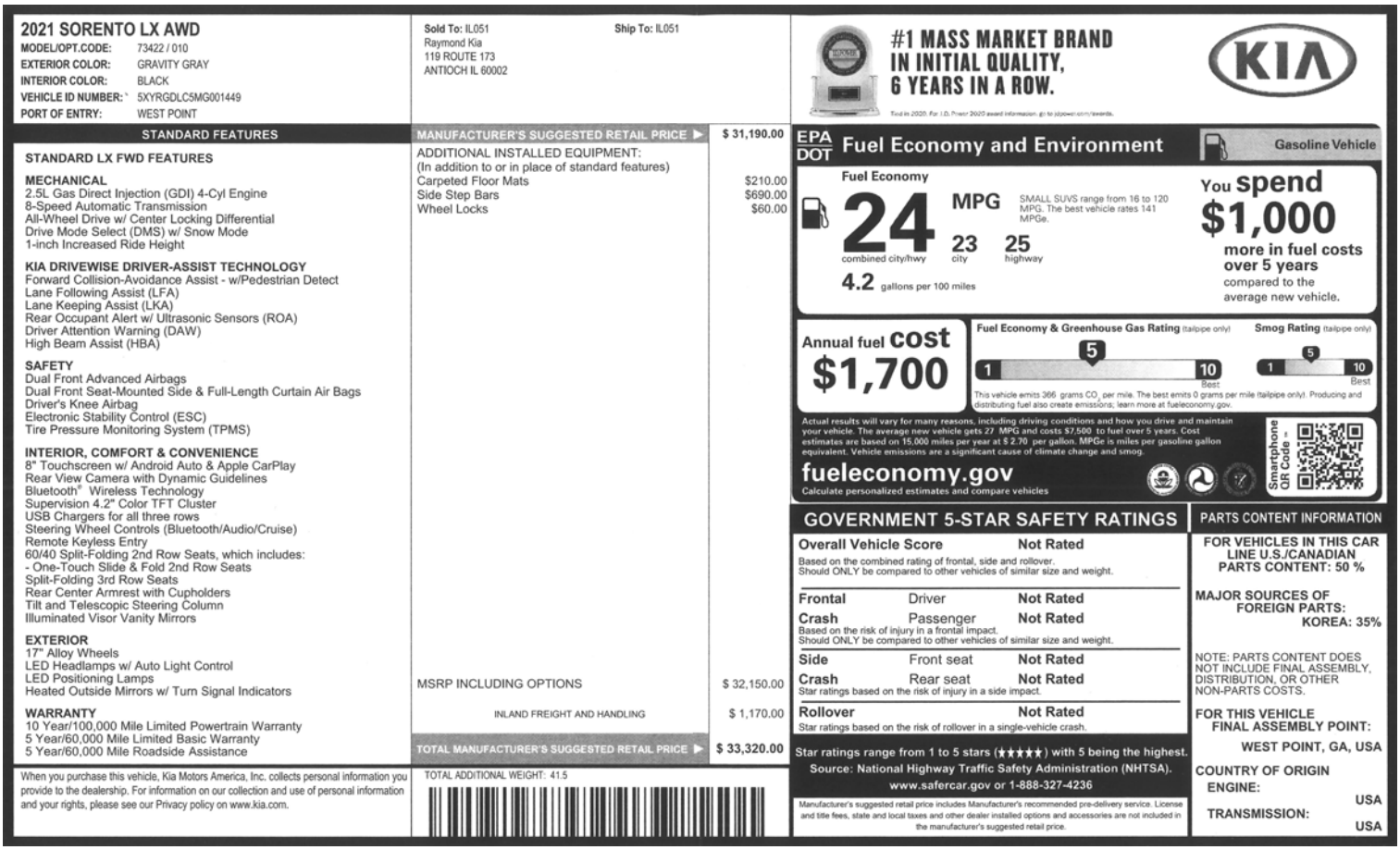
Photo No. 081 - Vehicle at 360 Degrees on Static Rollover Device

Photo No. 082 - 2021 Kia Sorento LX AWD 5-Door SUV Frontal Impact Event



2021 SORENTO LX AWD

MODEL/OPT.CODE: 73422 / 010
EXTERIOR COLOR: GRAVITY GRAY
INTERIOR COLOR: BLACK
VEHICLE ID NUMBER: 5XYRGDLC5MG001449
PORT OF ENTRY: WEST POINT

Sold To: IL051
Raymond Kia
119 ROUTE 173
ANTIOCH IL 60002

Ship To: IL051

#1 MASS MARKET BRAND IN INITIAL QUALITY, 6 YEARS IN A ROW.

KIA

STANDARD FEATURES

STANDARD LX FWD FEATURES

MECHANICAL
2.5L Gas Direct Injection (GDI) 4-Cyl Engine
8-Speed Automatic Transmission
All-Wheel Drive w/ Center Locking Differential
Drive Mode Select (DMS) w/ Snow Mode
1-inch Increased Ride Height

KIA DRIVEWISE DRIVER-ASSIST TECHNOLOGY
Forward Collision-Avoidance Assist - w/Pedestrian Detect
Lane Following Assist (LFA)
Lane Keeping Assist (LKA)
Rear Occupant Alert w/ Ultrasonic Sensors (ROA)
Driver Attention Warning (DAW)
High Beam Assist (HBA)

SAFETY
Dual Front Advanced Airbags
Dual Front Seat-Mounted Side & Full-Length Curtain Air Bags
Driver's Knee Airbag
Electronic Stability Control (ESC)
Tire Pressure Monitoring System (TPMS)

INTERIOR, COMFORT & CONVENIENCE
8" Touchscreen w/ Android Auto & Apple CarPlay
Rear View Camera with Dynamic Guidelines
Bluetooth® Wireless Technology
Supervision 4.2" Color TFT Cluster
USB Chargers for all three rows
Steering Wheel Controls (Bluetooth/Audio/Cruise)
Remote Keyless Entry
60/40 Split-Folding 2nd Row Seats, which includes:
- One-Touch Slide & Fold 2nd Row Seats
Split-Folding 3rd Row Seats
Rear Center Armrest with Cupholders
Tilt and Telescopic Steering Column
Illuminated Visor Vanity Mirrors

EXTERIOR
17" Alloy Wheels
LED Headlamps w/ Auto Light Control
LED Positioning Lamps
Heated Outside Mirrors w/ Turn Signal Indicators

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

When you purchase this vehicle, Kia Motors 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 ▶	$ 31,190.00
ADDITIONAL INSTALLED EQUIPMENT: (In addition to or in place of standard features)	
Carpeted Floor Mats	$210.00
Side Step Bars	$690.00
Wheel Locks	$60.00
MSRP INCLUDING OPTIONS	$ 32,150.00
INLAND FREIGHT AND HANDLING	$ 1,170.00
TOTAL MANUFACTURER'S SUGGESTED RETAIL PRICE ▶	$ 33,320.00

TOTAL ADDITIONAL WEIGHT: 41.5

EPA DOT Fuel Economy and Environment — Gasoline Vehicle

Fuel Economy
24 MPG combined city/hwy
23 city
25 highway
4.2 gallons per 100 miles

SMALL SUVS range from 16 to 120 MPG. The best vehicle rates 141 MPGe.

You spend $1,000 more in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost $1,700

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 5 (1 – 10 Best)
Smog Rating (tailpipe only): 5 (1 – 10 Best)

This vehicle emits 366 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 27 MPG and costs $7,500 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $ 2.70 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: 50 %

MAJOR SOURCES OF FOREIGN PARTS: KOREA: 35%

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

FOR THIS VEHICLE FINAL ASSEMBLY POINT: WEST POINT, GA, USA

COUNTRY OF ORIGIN
ENGINE: USA
TRANSMISSION: USA

Photo No. 083 - Monroney Label Photograph

APPENDIX B
DUMMY RESPONSE DATA TRACES

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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

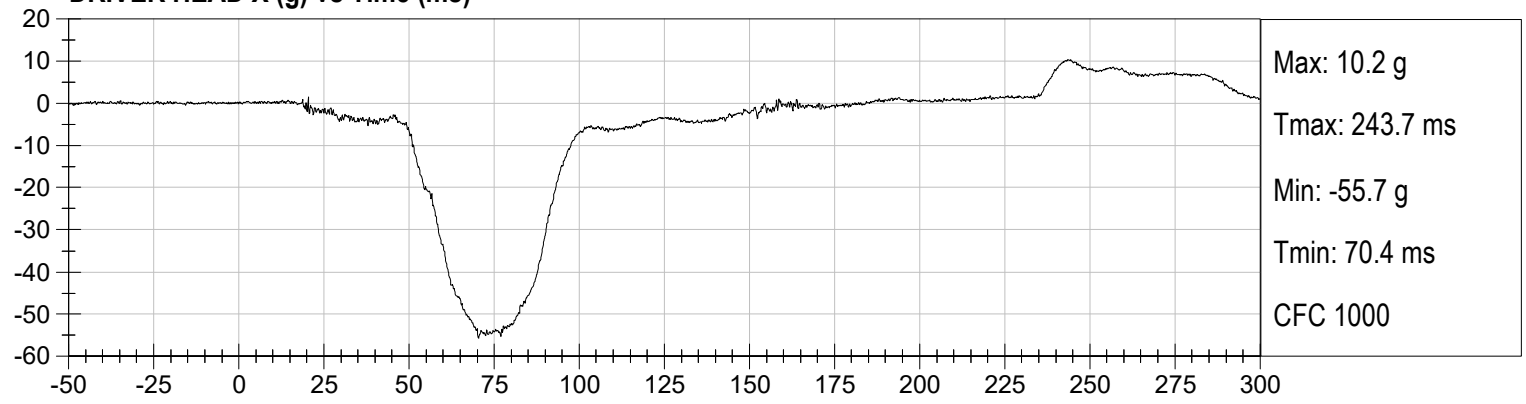
Right Rear Seat Crossmember Z

Left Rear Seat Crossmember Xr

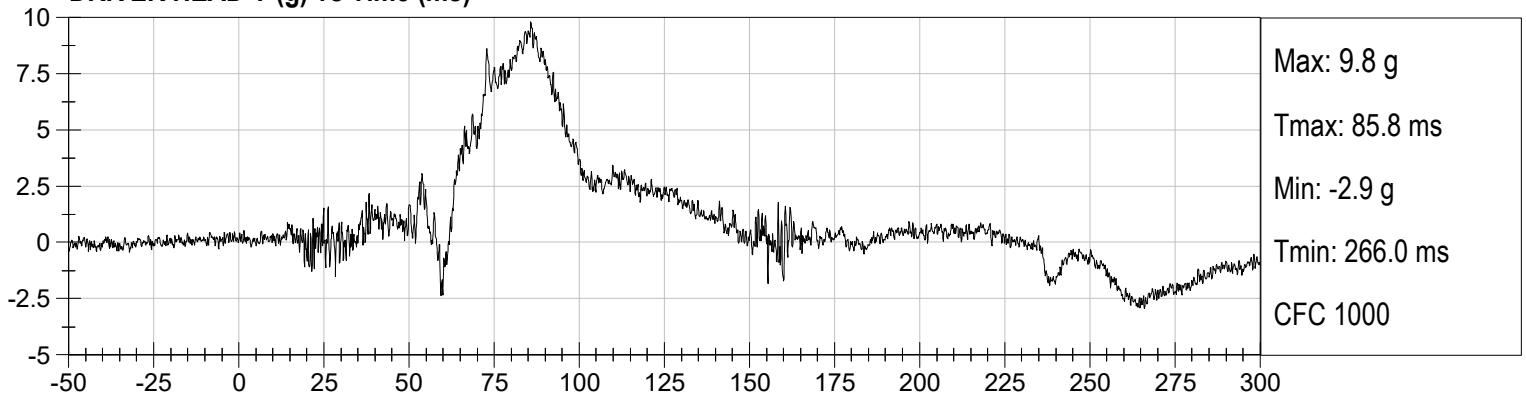
Right Rear Seat Crossmember Xr

Advanced Research Load Cell Barrier – 528 channels

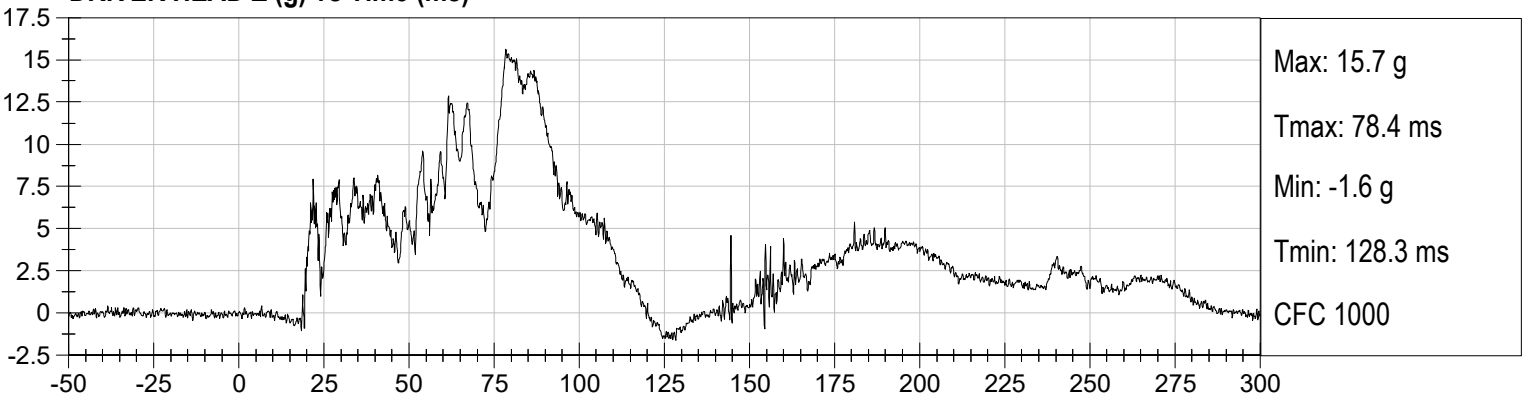
DRIVER HEAD X (g) vs Time (ms)



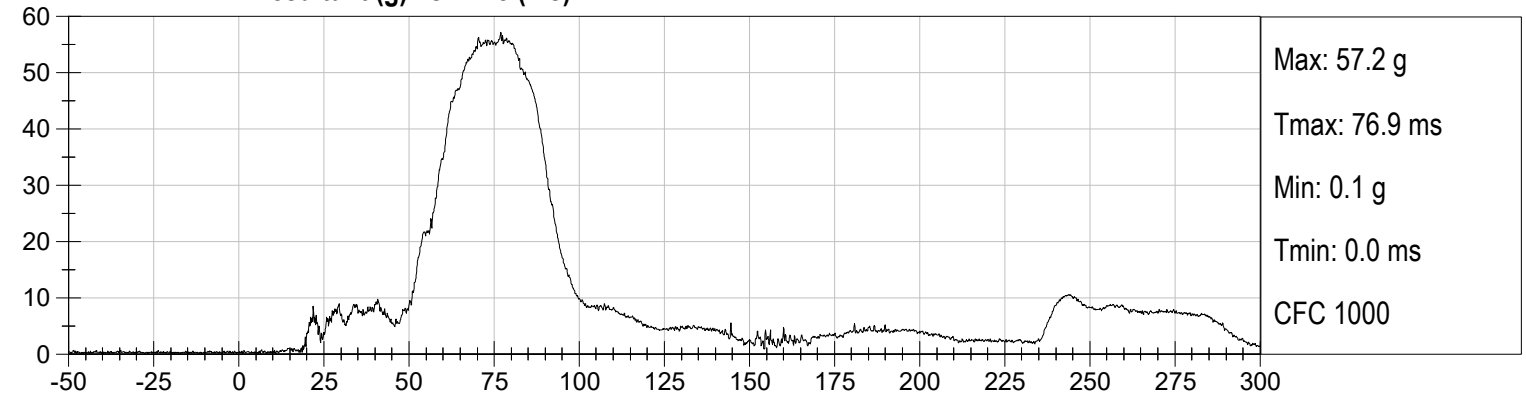
DRIVER HEAD Y (g) vs Time (ms)



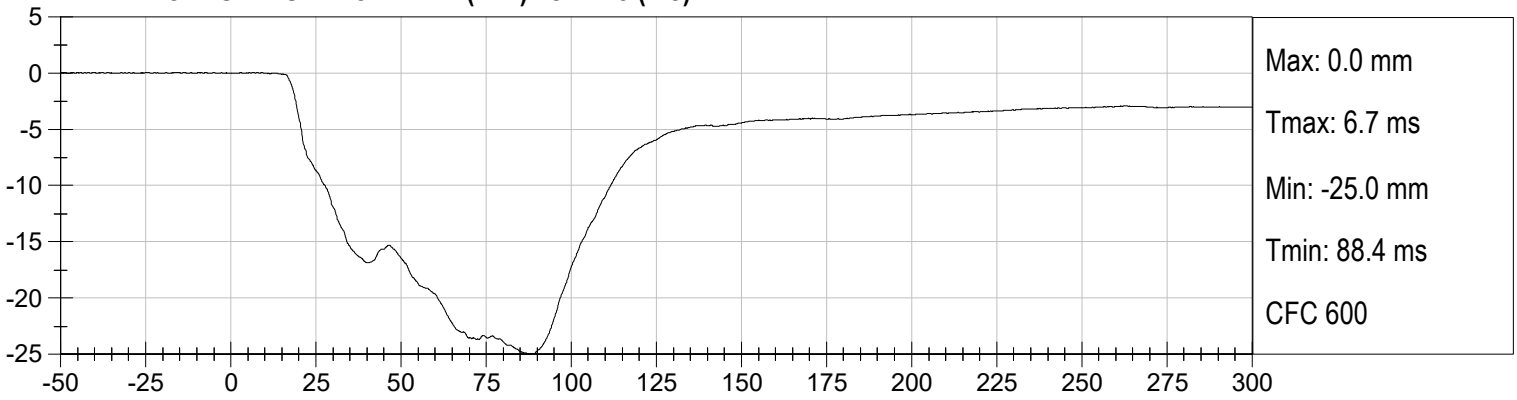
DRIVER HEAD Z (g) vs Time (ms)



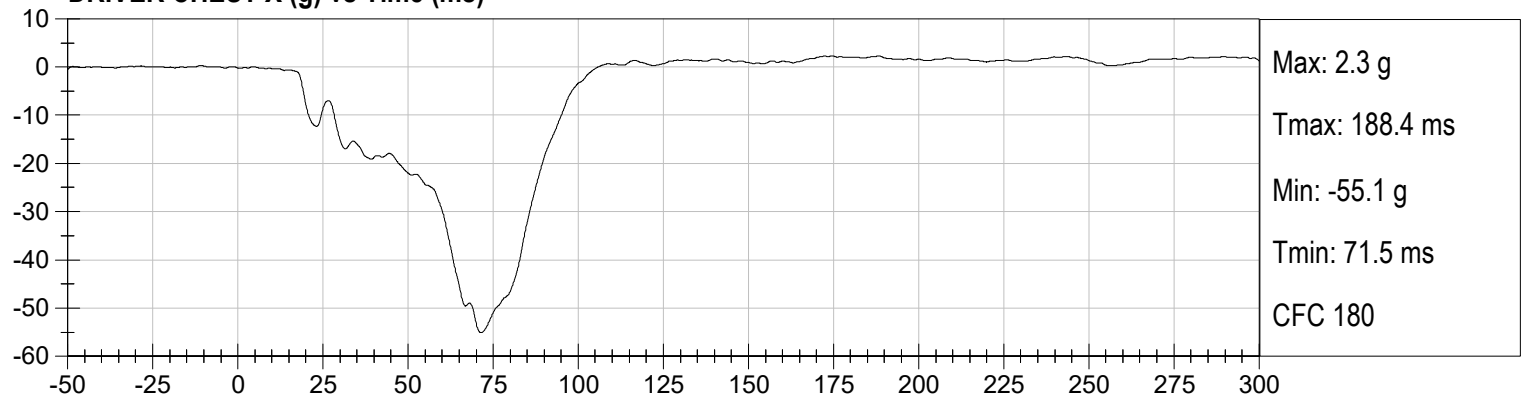
DRIVER HEAD Resultant (g) vs Time (ms)



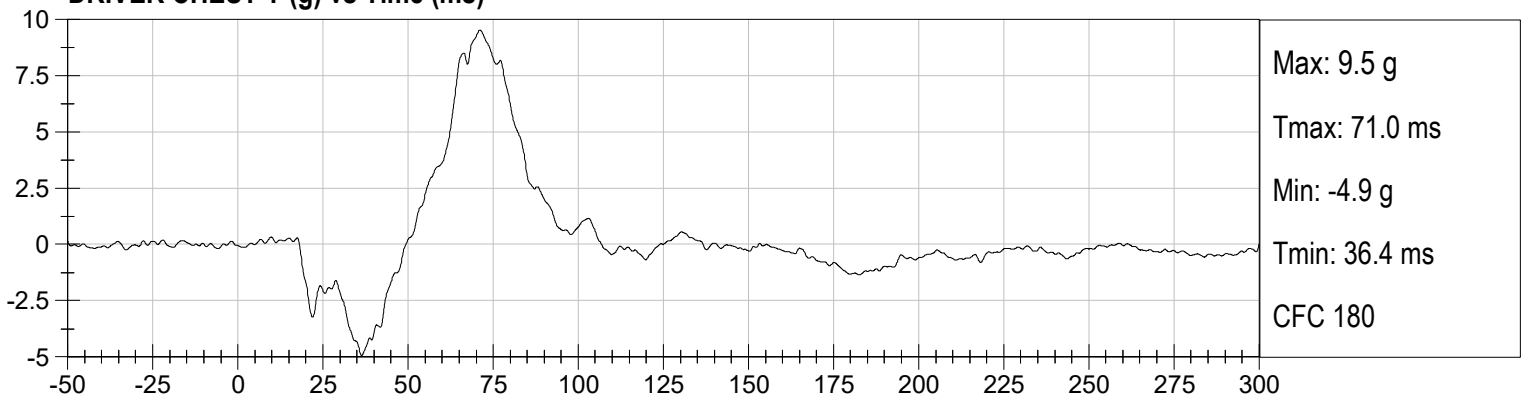
DRIVER CHEST DISPLACEMENT (mm) vs Time (ms)



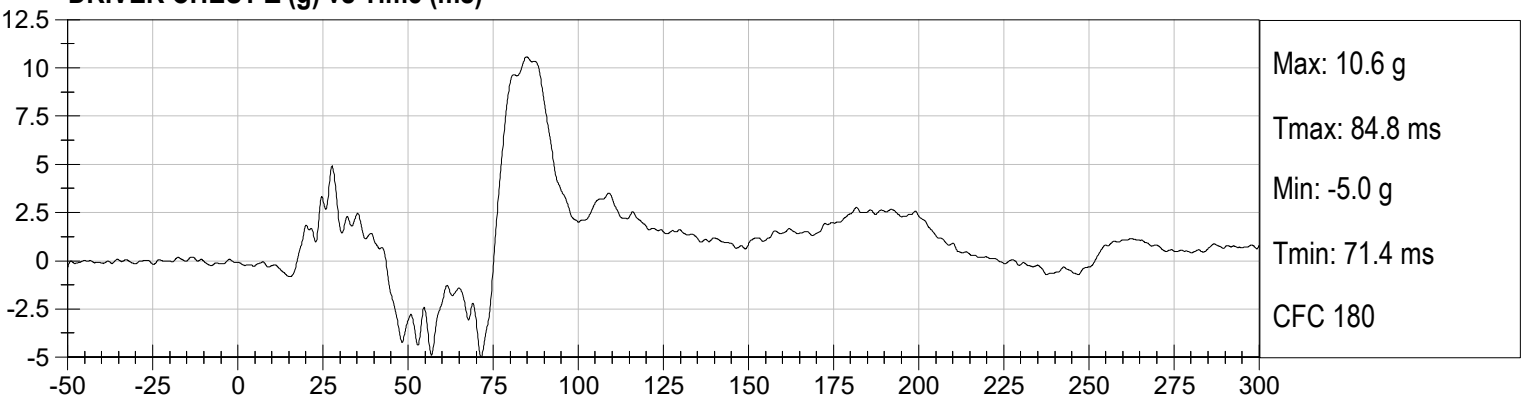
DRIVER CHEST X (g) vs Time (ms)



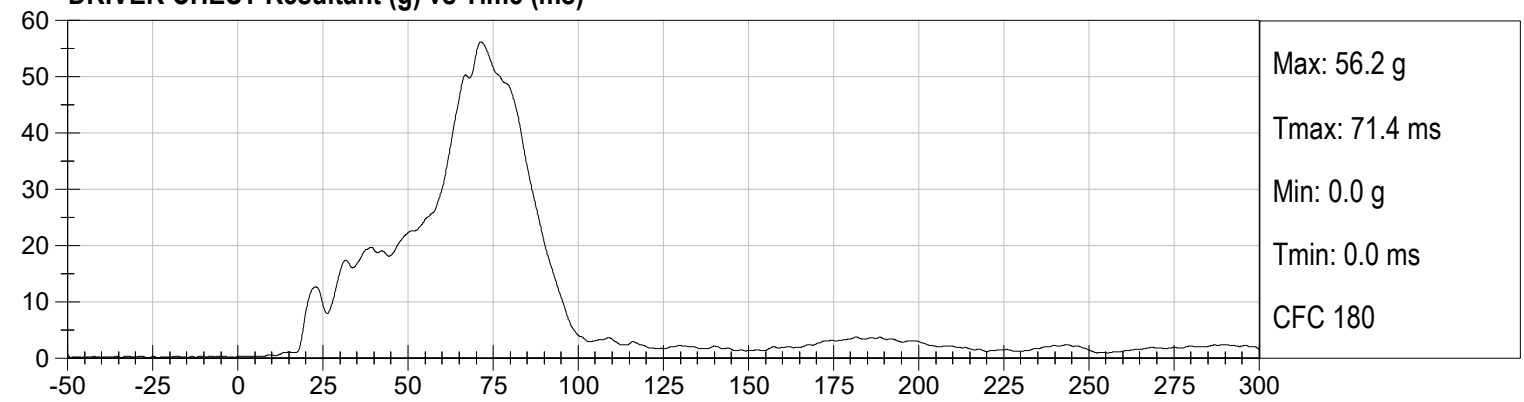
DRIVER CHEST Y (g) vs Time (ms)



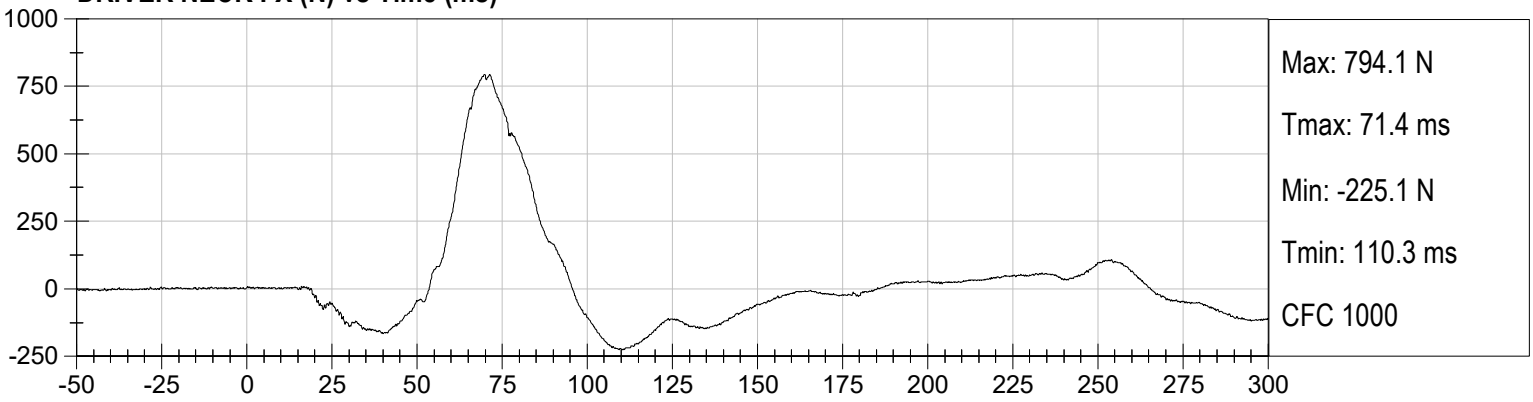
DRIVER CHEST Z (g) vs Time (ms)



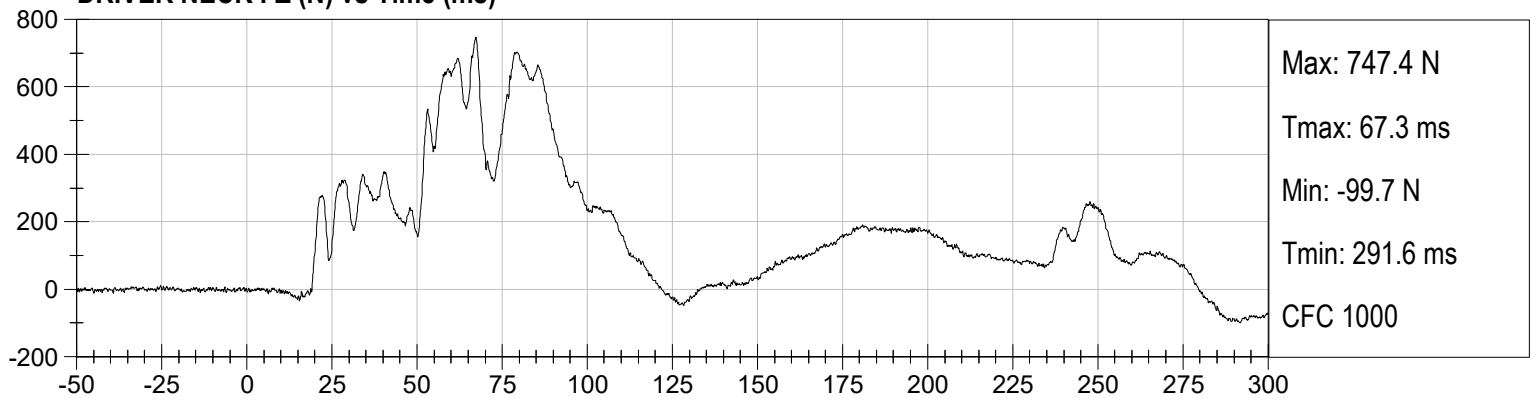
DRIVER CHEST Resultant (g) vs Time (ms)



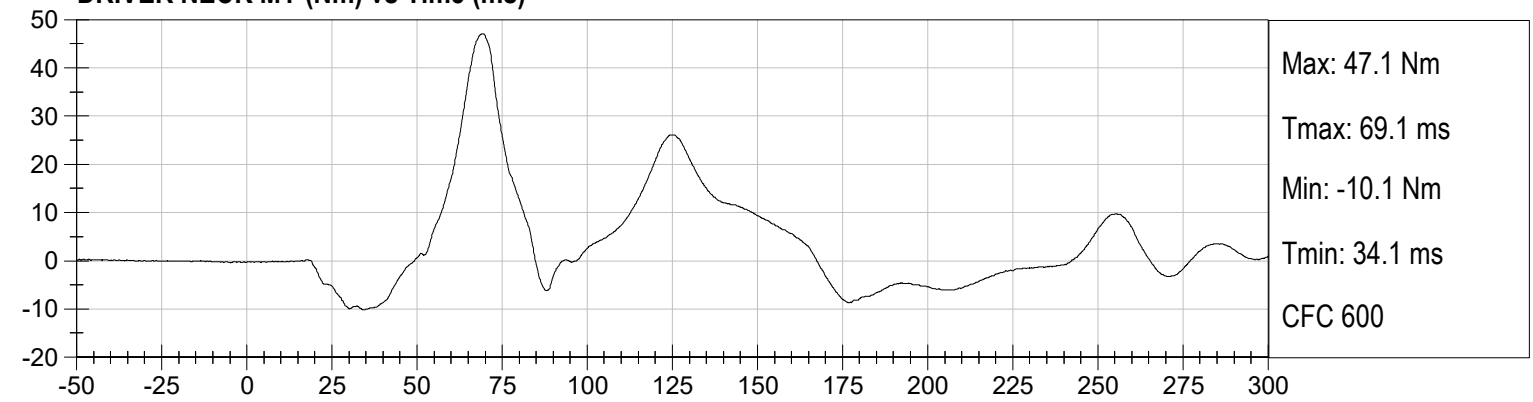
DRIVER NECK FX (N) vs Time (ms)



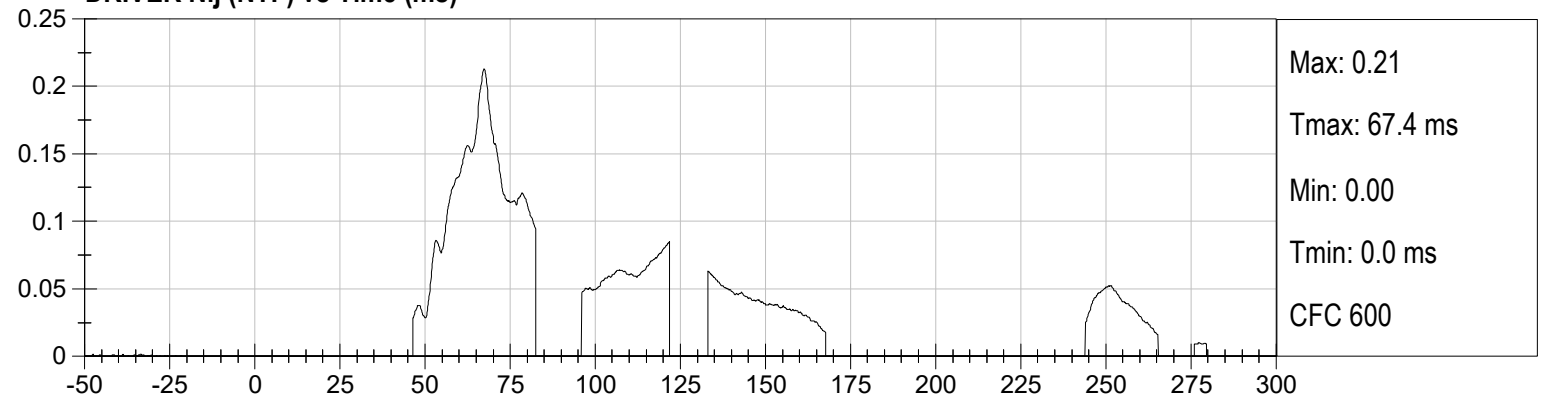
DRIVER NECK FZ (N) vs Time (ms)



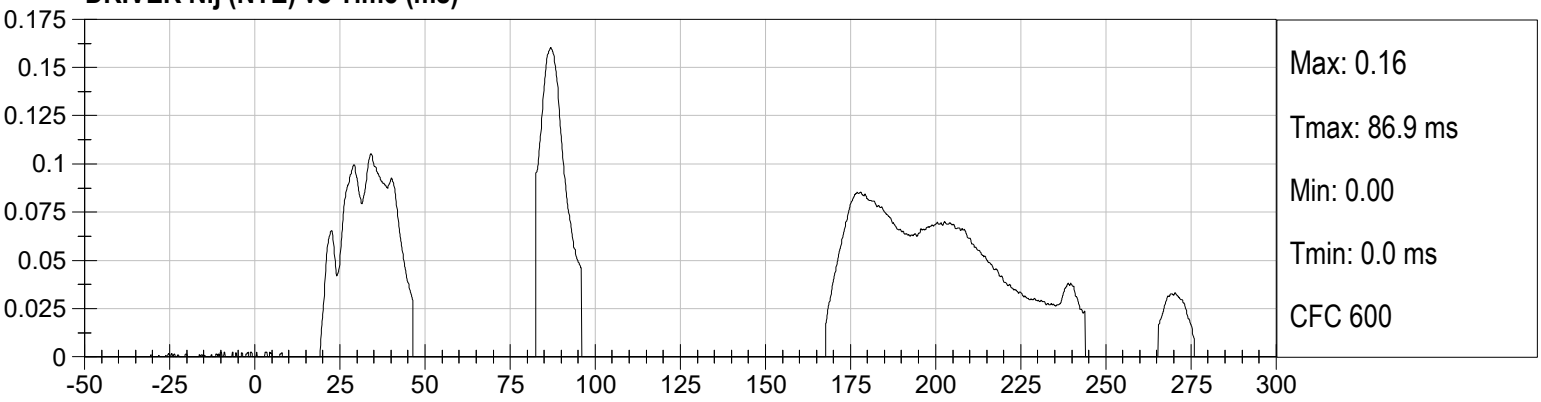
DRIVER NECK MY (Nm) vs Time (ms)



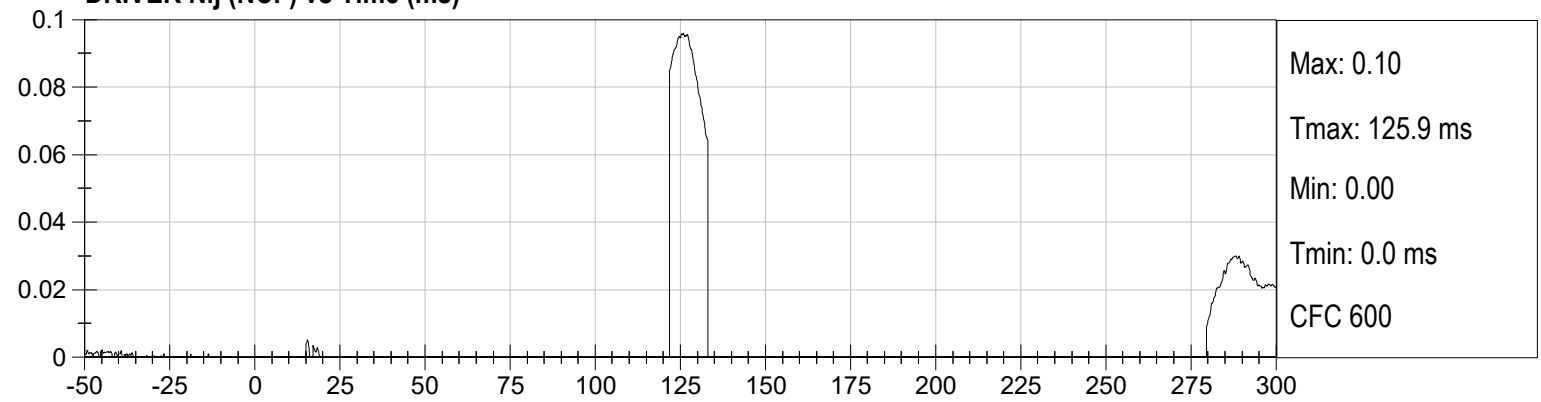
DRIVER Nij (NTF) vs Time (ms)



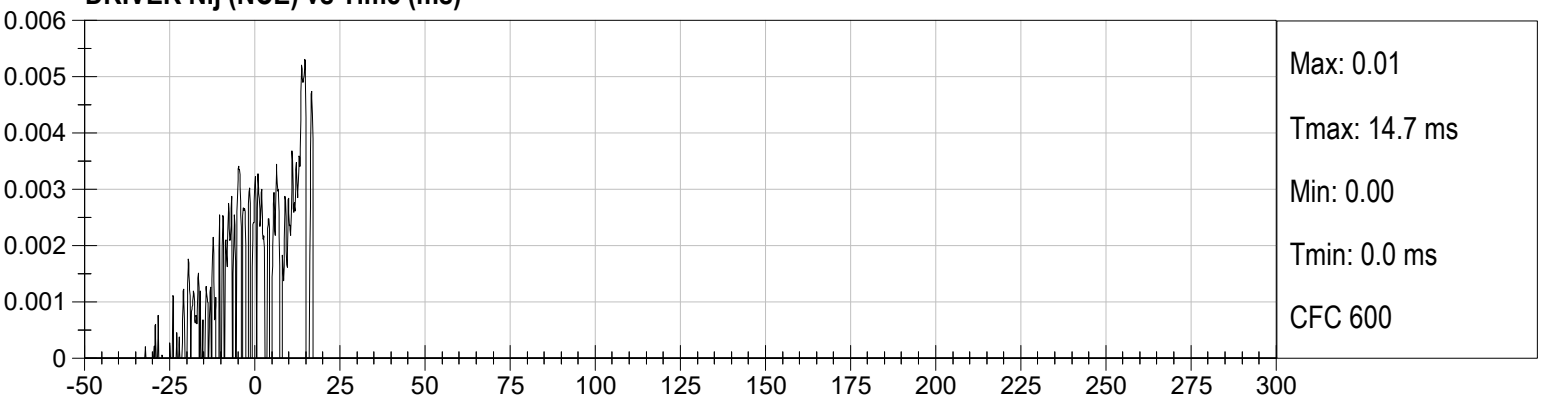
DRIVER Nij (NTE) vs Time (ms)



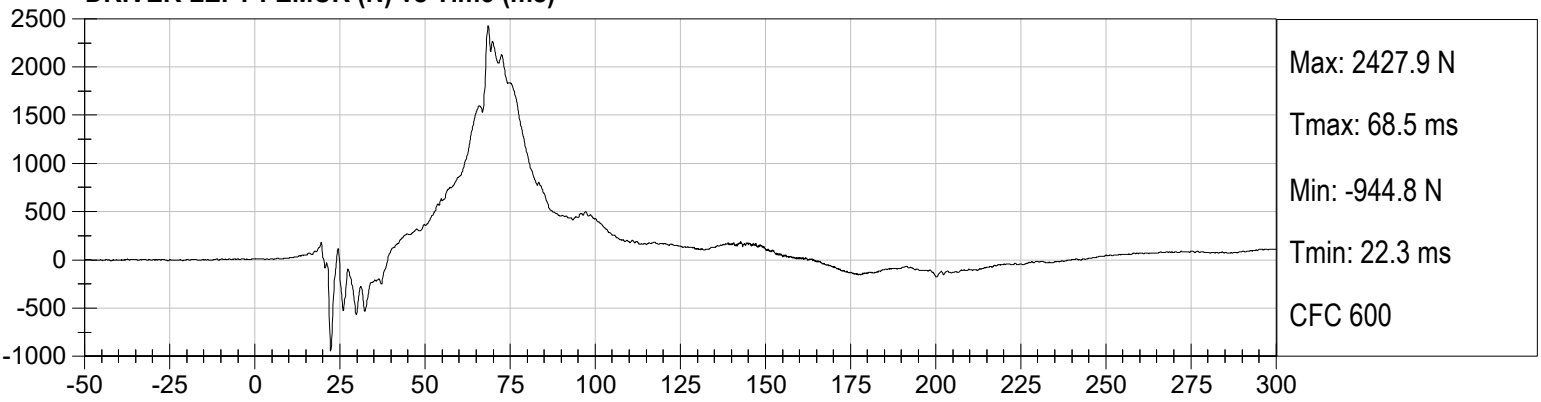
DRIVER Nij (NCF) vs Time (ms)



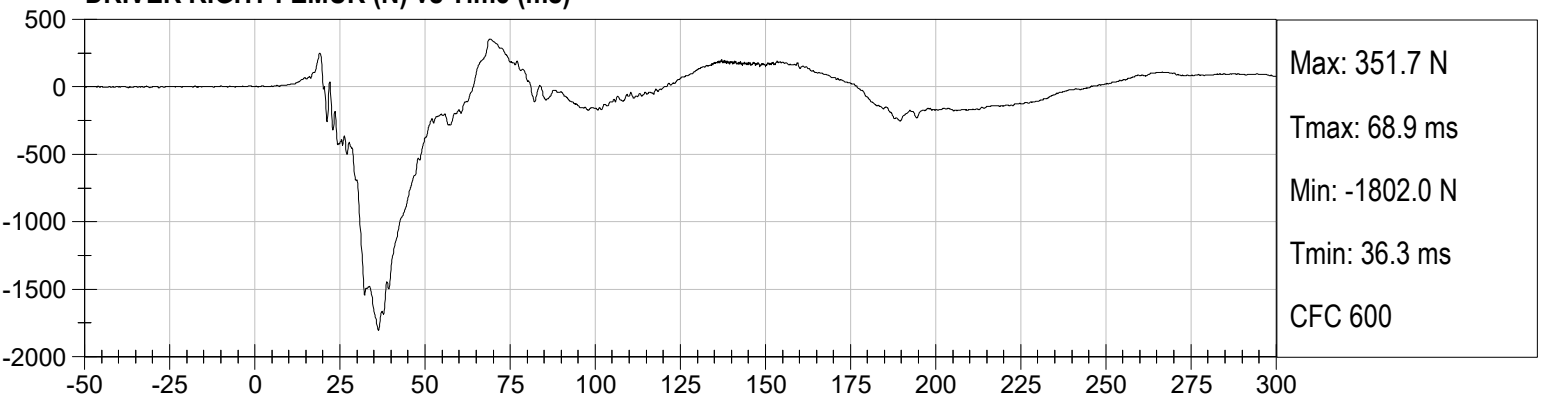
DRIVER Nij (NCE) vs Time (ms)



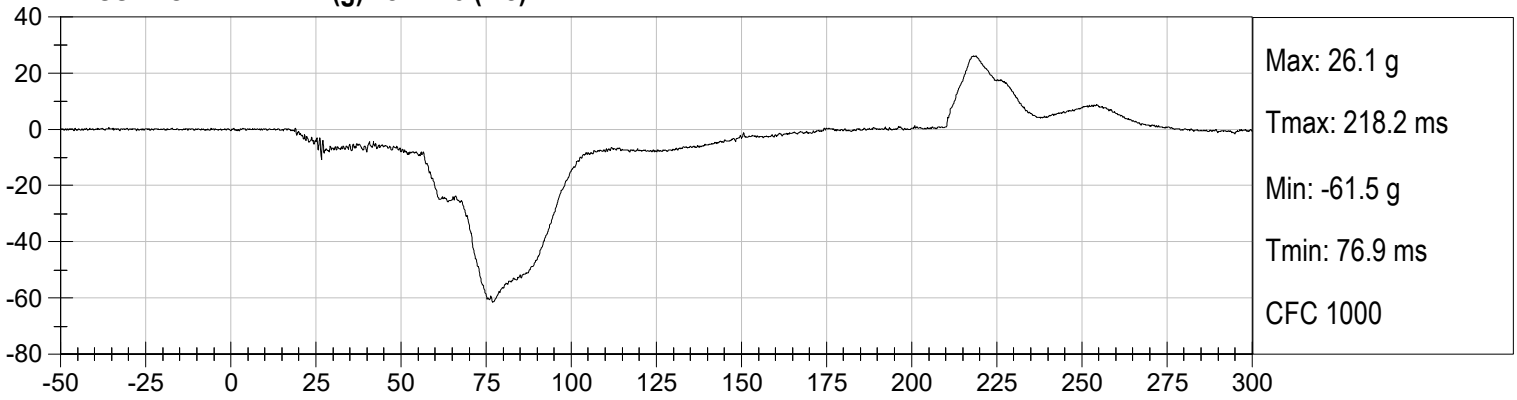
DRIVER LEFT FEMUR (N) vs Time (ms)



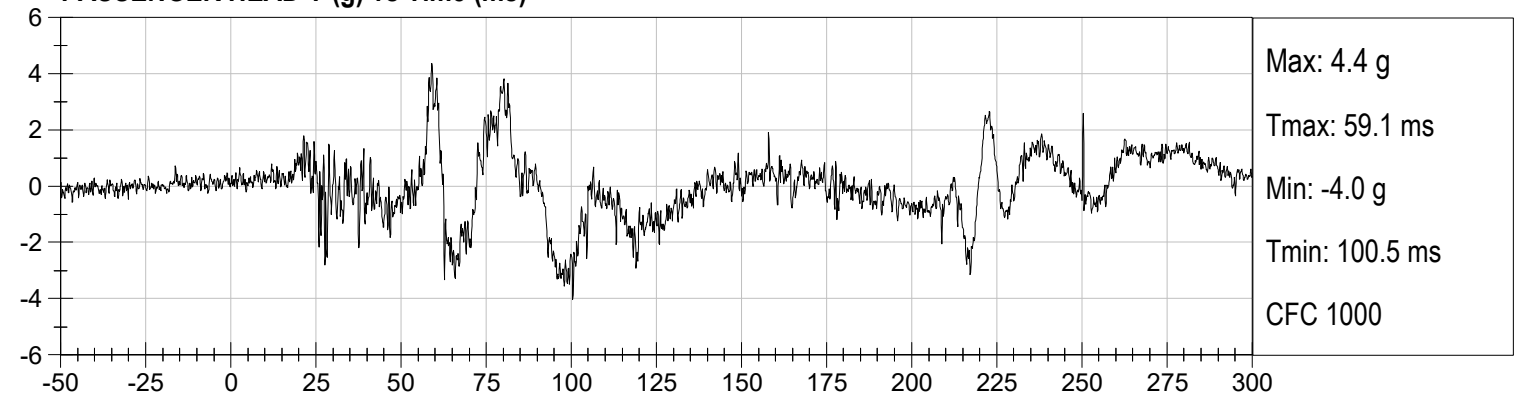
DRIVER RIGHT FEMUR (N) vs Time (ms)



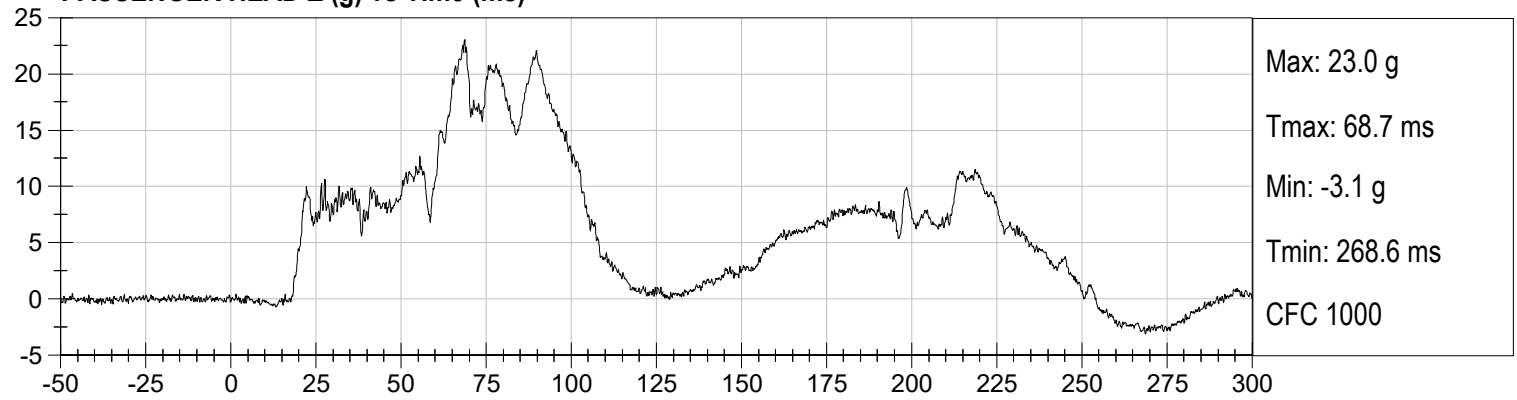
PASSENGER HEAD X (g) vs Time (ms)



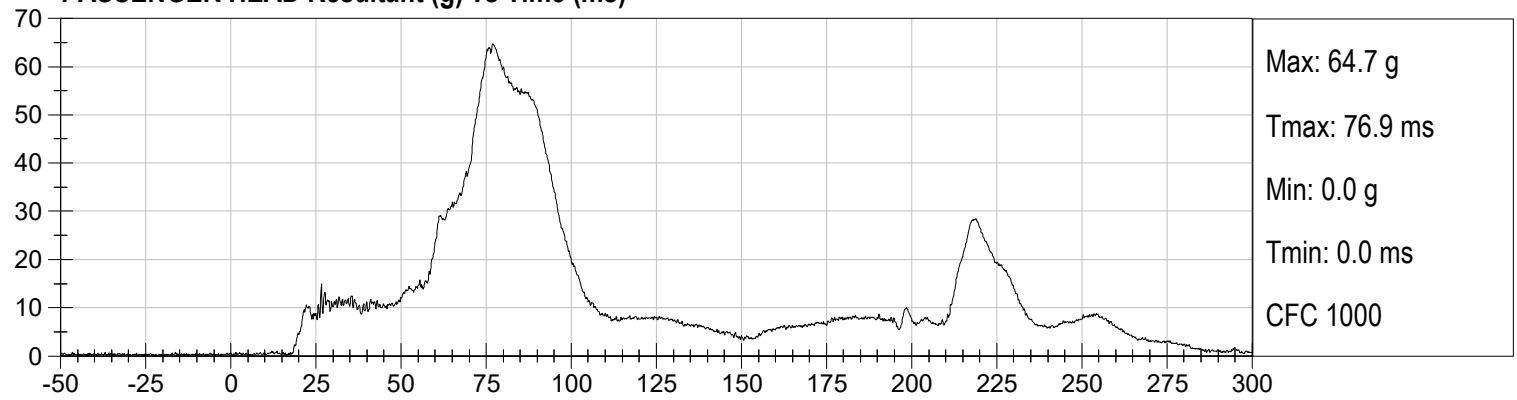
PASSENGER HEAD Y (g) vs Time (ms)



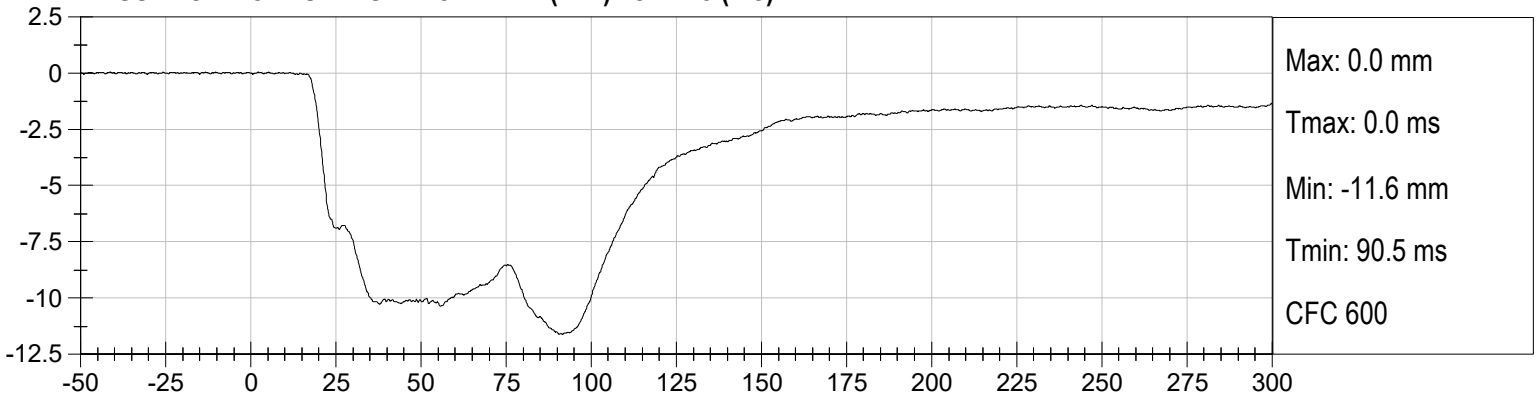
PASSENGER HEAD Z (g) vs Time (ms)



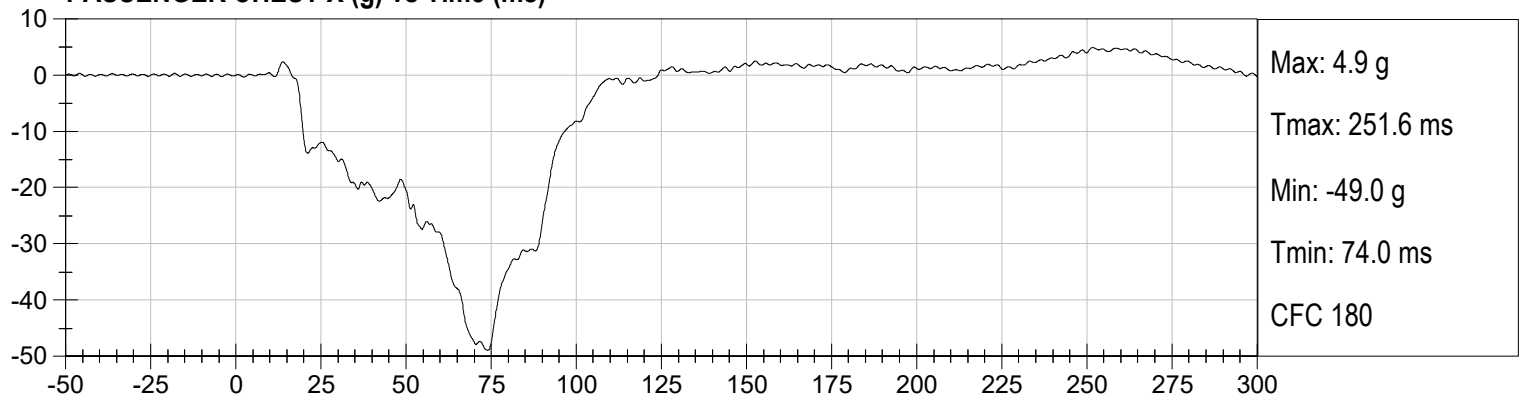
PASSENGER HEAD Resultant (g) vs Time (ms)



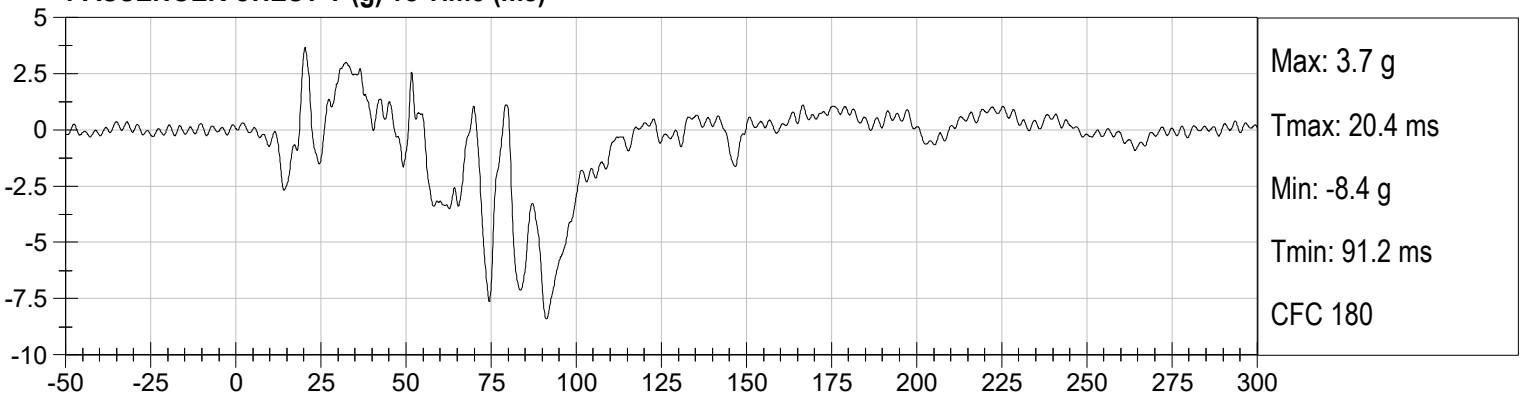
PASSENGER CHEST DISPLACEMENT (mm) vs Time (ms)



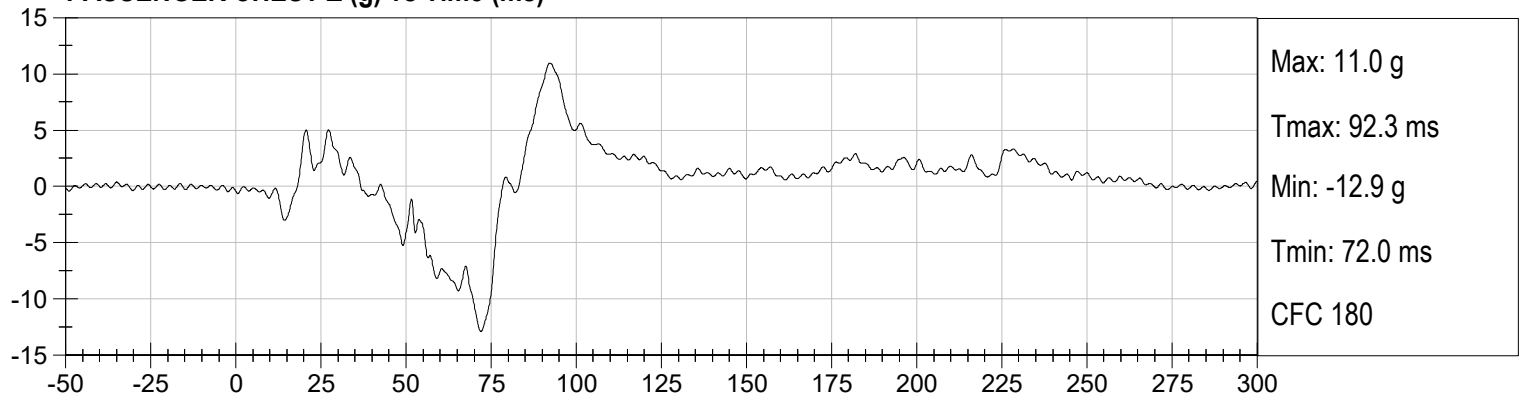
PASSENGER CHEST X (g) vs Time (ms)



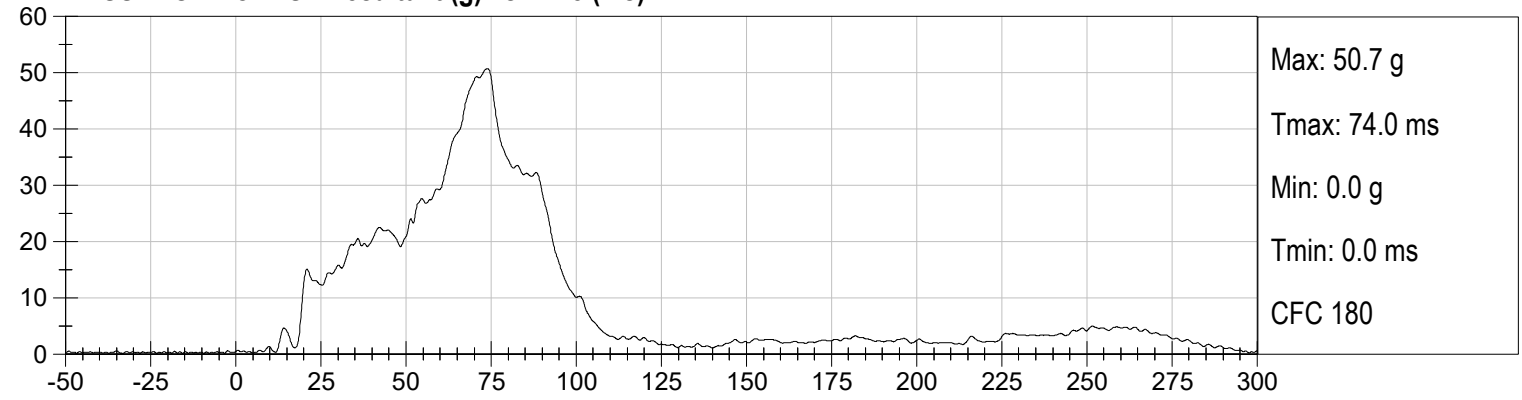
PASSENGER CHEST Y (g) vs Time (ms)



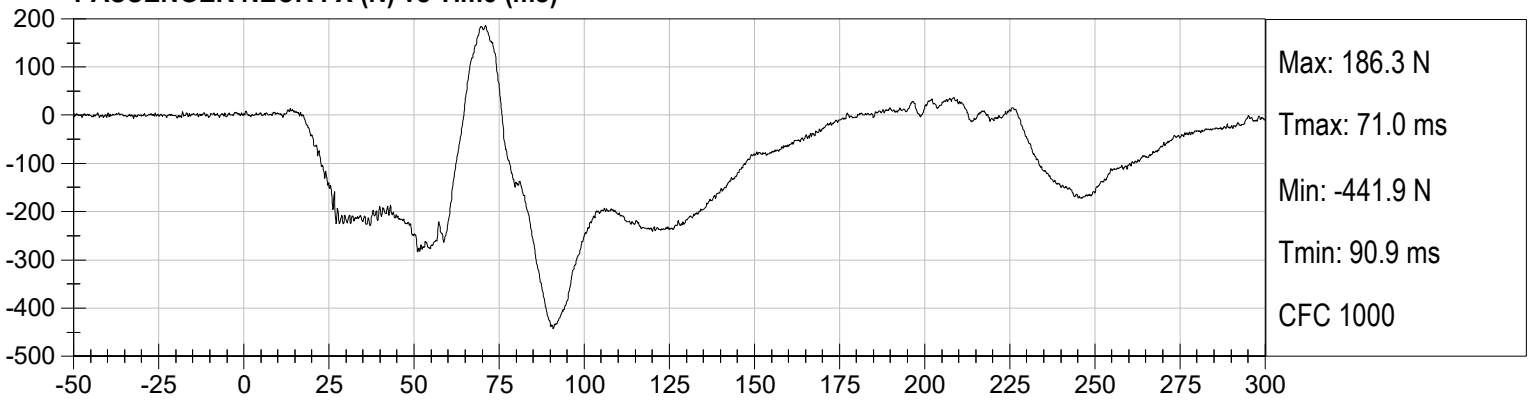
PASSENGER CHEST Z (g) vs Time (ms)



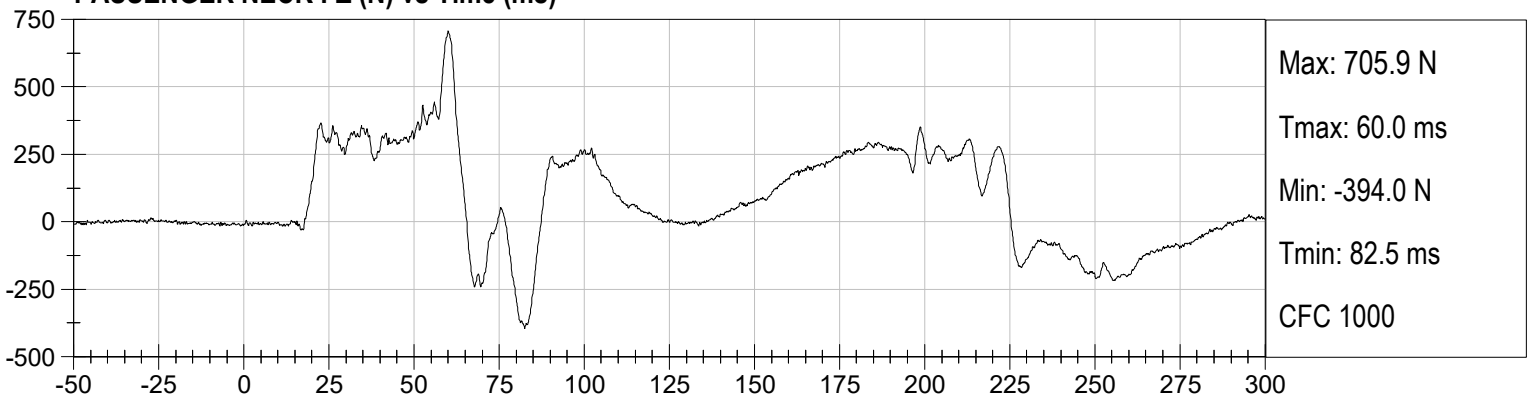
PASSENGER CHEST Resultant (g) vs Time (ms)



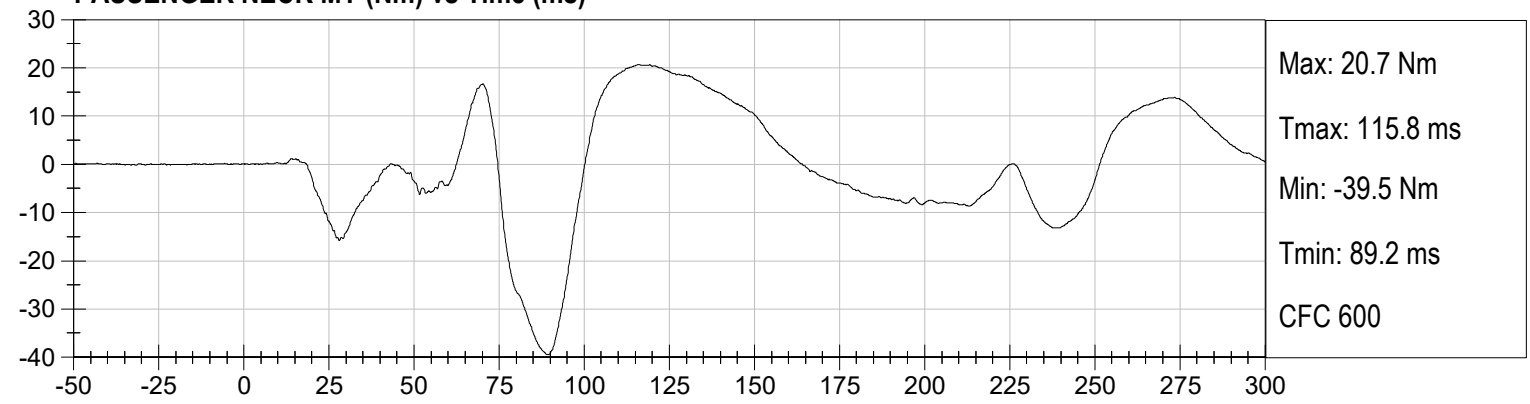
PASSENGER NECK FX (N) vs Time (ms)



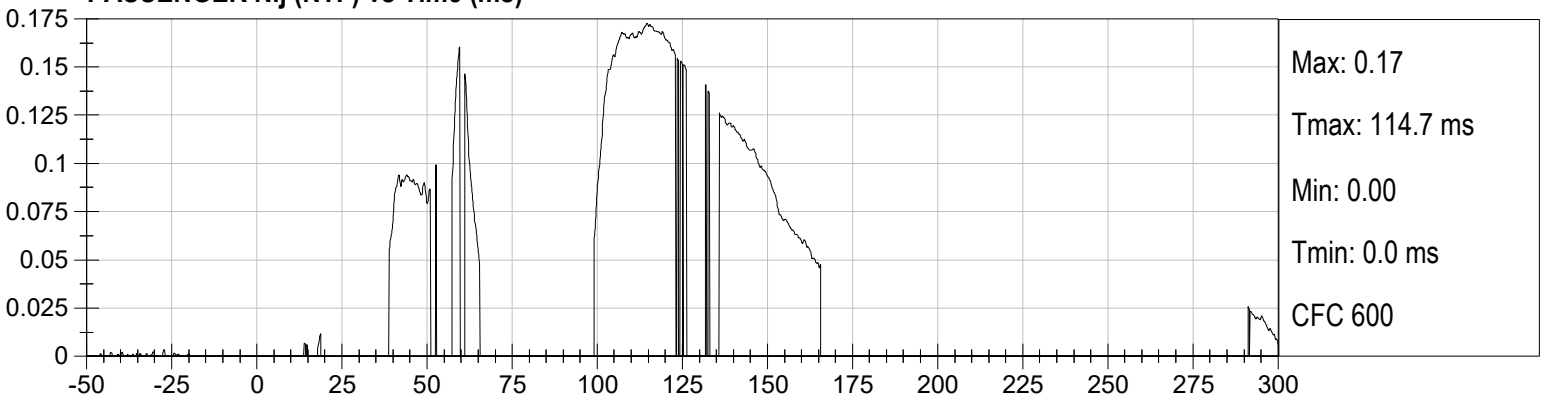
PASSENGER NECK FZ (N) vs Time (ms)



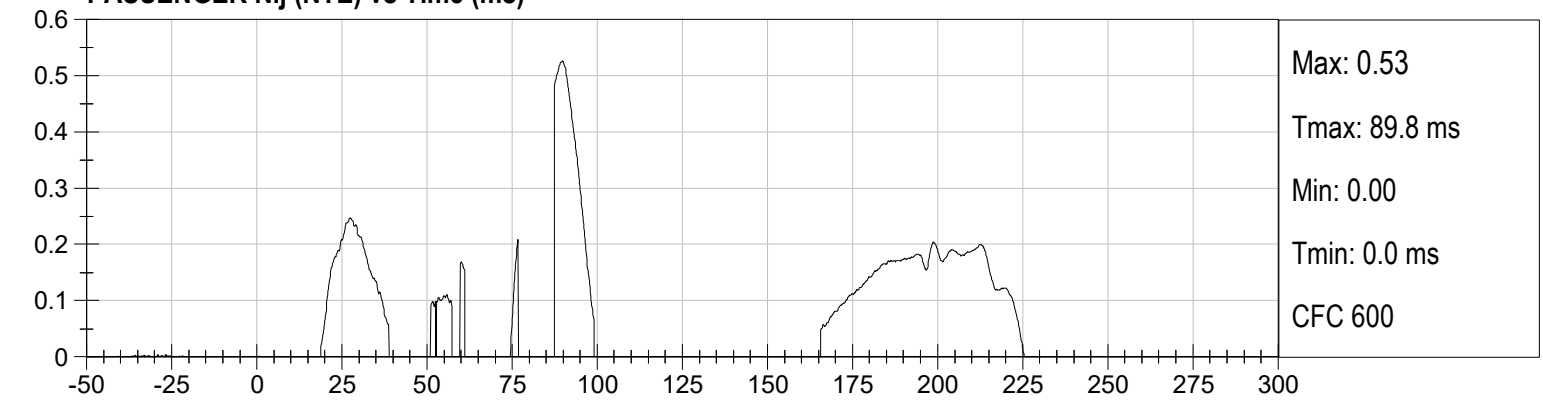
PASSENGER NECK MY (Nm) vs Time (ms)



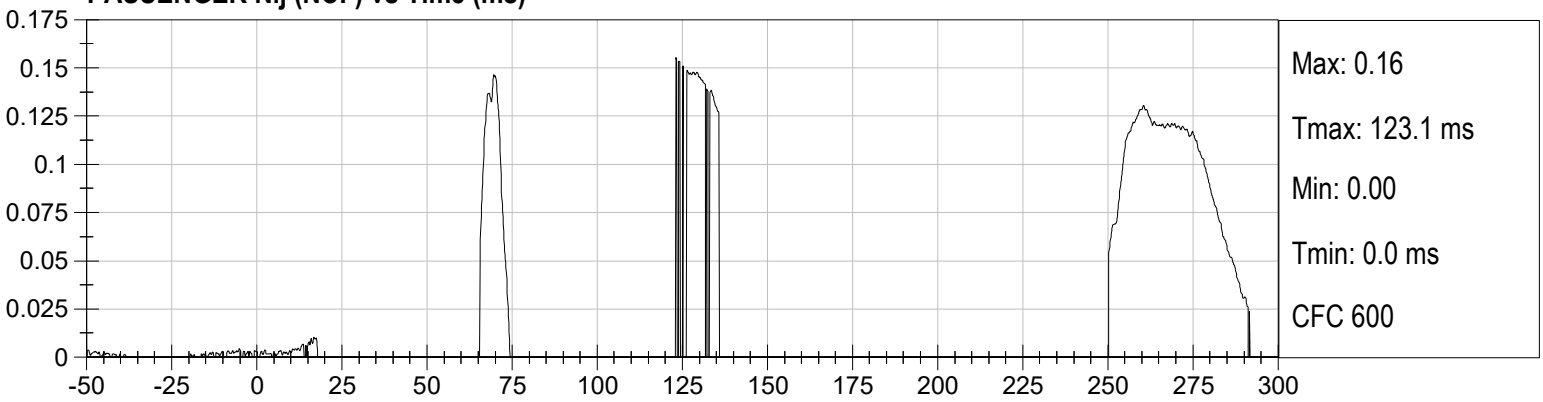
PASSENGER Nij (NTF) vs Time (ms)



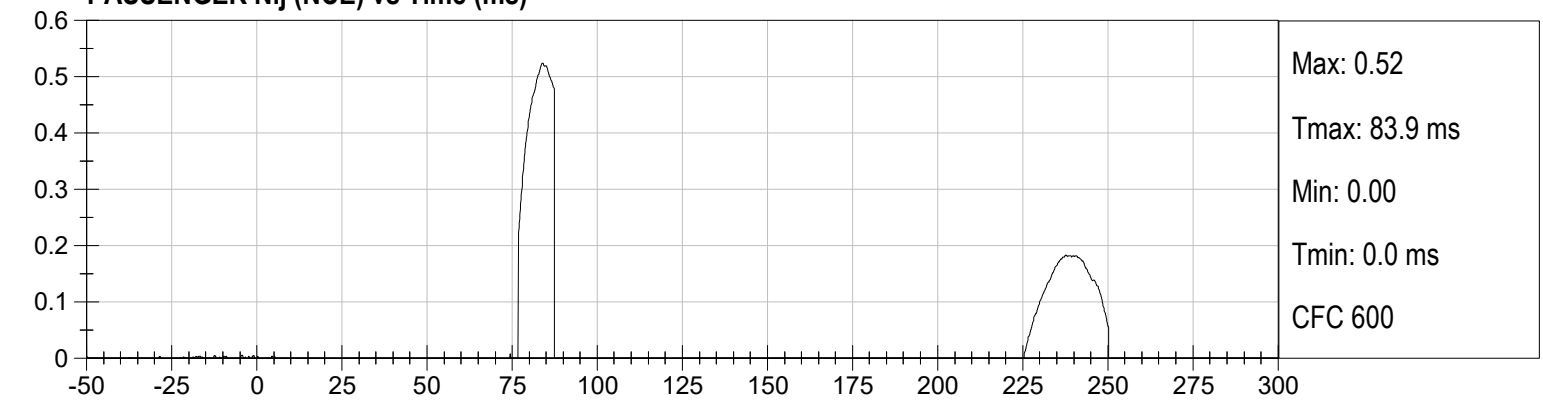
PASSENGER Nij (NTE) vs Time (ms)



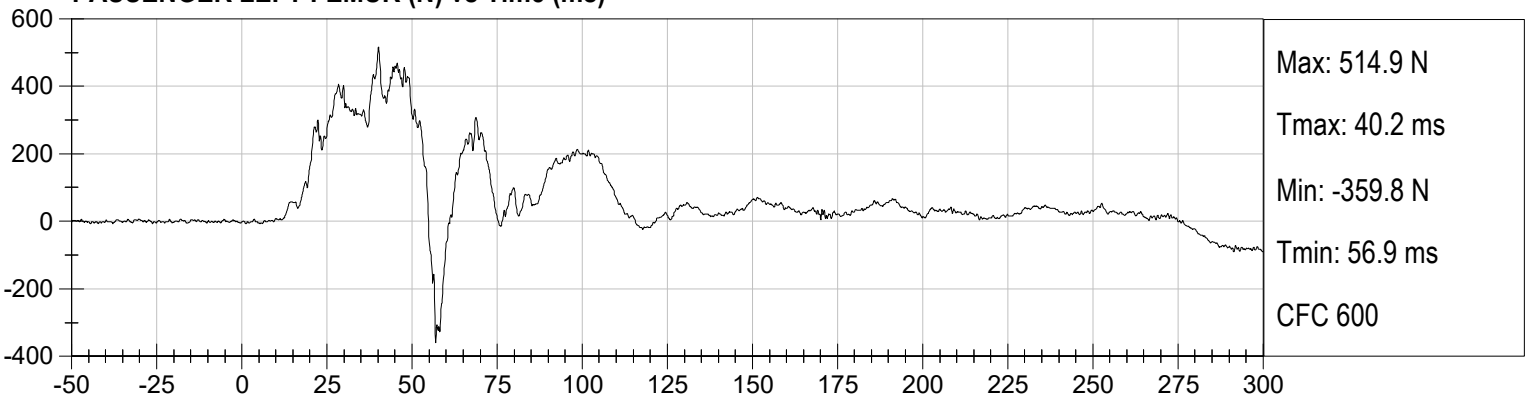
PASSENGER Nij (NCF) vs Time (ms)



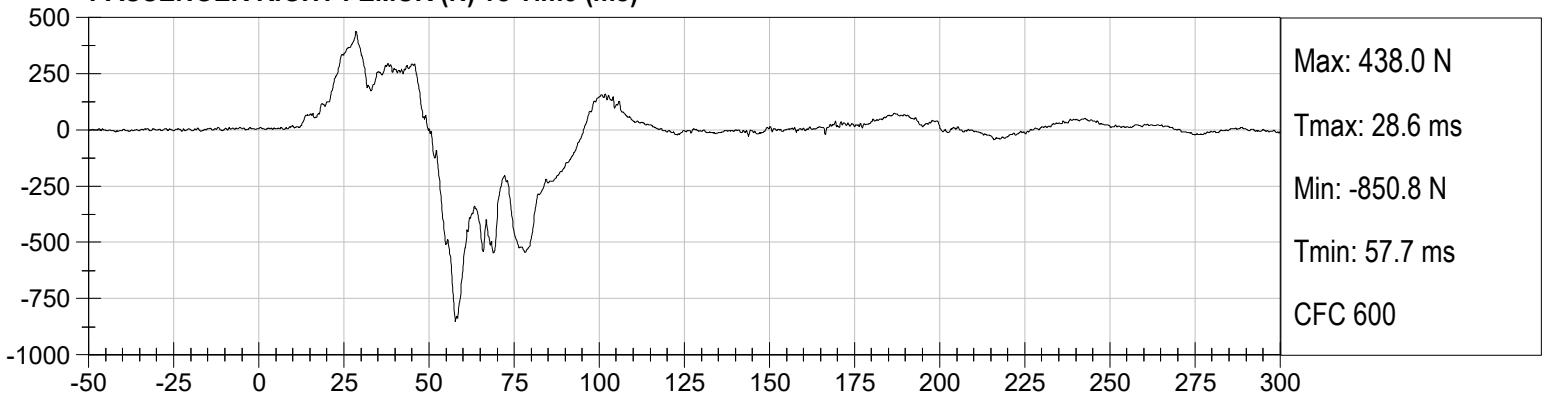
PASSENGER Nij (NCE) vs Time (ms)



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:** D211091

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Peak Resultant Acceleration	G's	225 to 275	256	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-3.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

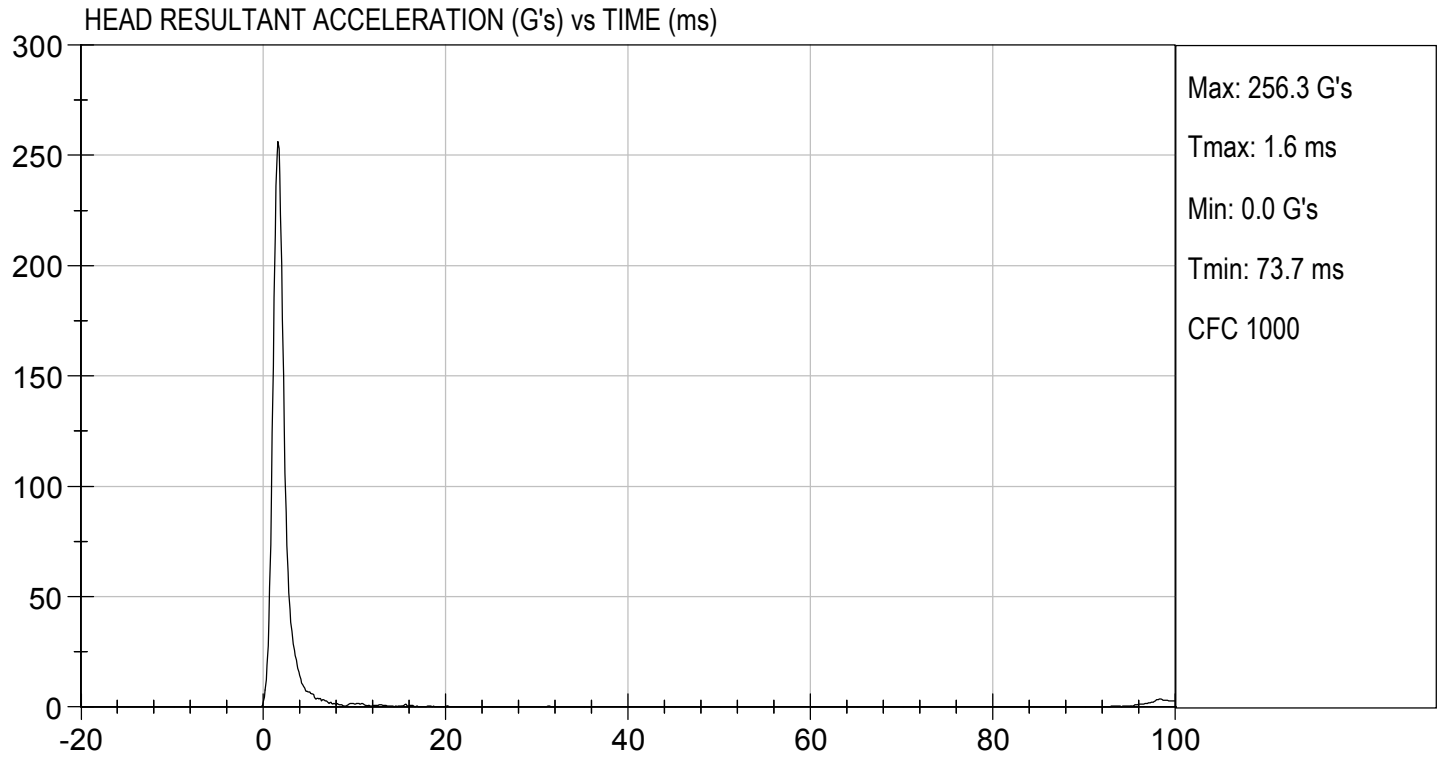
Laboratory Technician

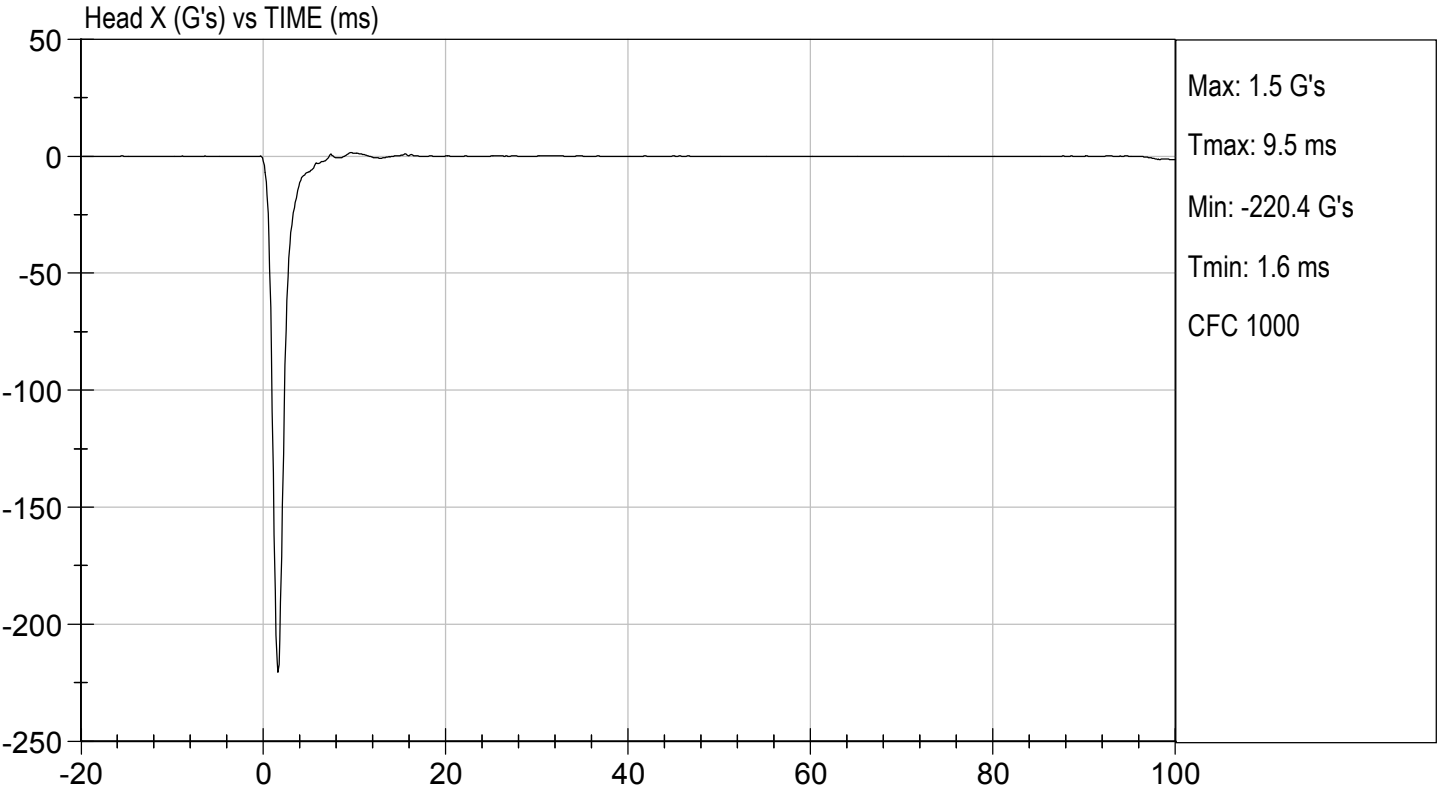
03/31/2021
Test Date

Approved By

TEST DESC: HEAD DROP

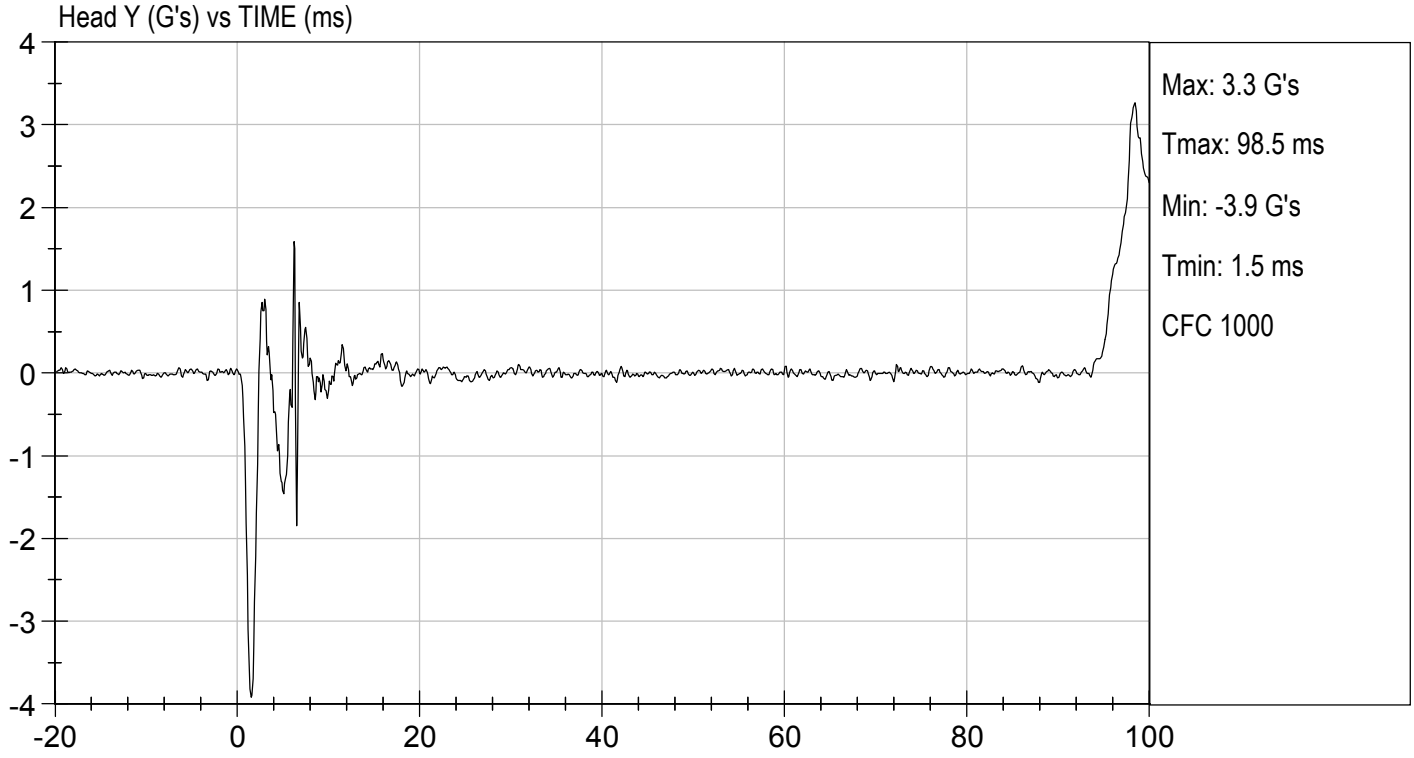
TEST DATE: 03/31/2021
TEST #: D211091

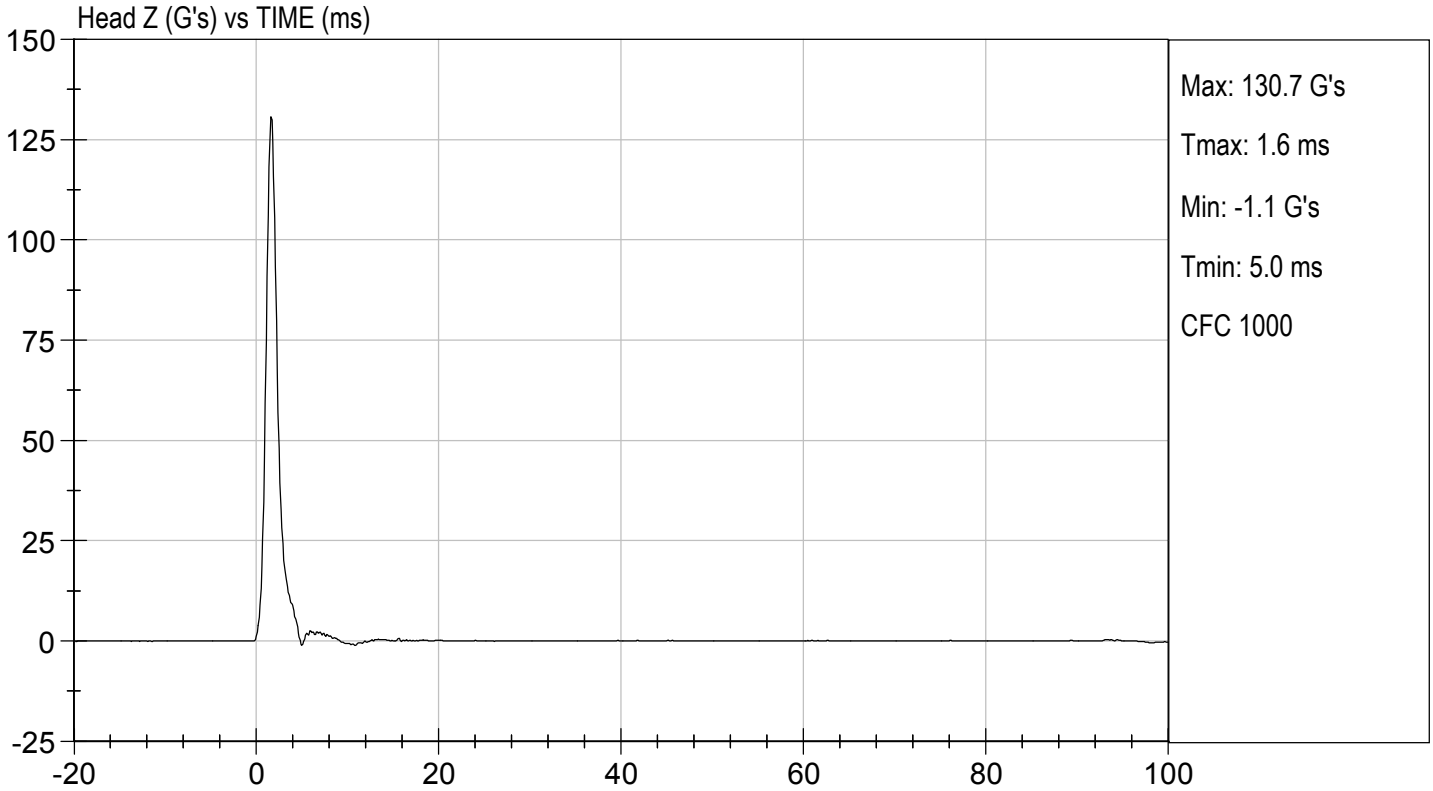




TEST DESC: HEAD DROP

TEST DATE: 03/31/2021
TEST #: D211091





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211092

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	22	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.62	Pass
	20 ms	G's	17.60 to 22.60	20.38	Pass
	30 ms	G's	12.50 to 18.50	14.73	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.7	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	36.4	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	73.2	Pass
	Time	ms	57.0 to 64.0	60.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	118.6	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	90.1	Pass
	Time	ms	47.0 to 58.0	48.6	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	101.1	Pass
			Overall Test Results		Pass

Alex Thomas

Laboratory Technician

03/31/2021

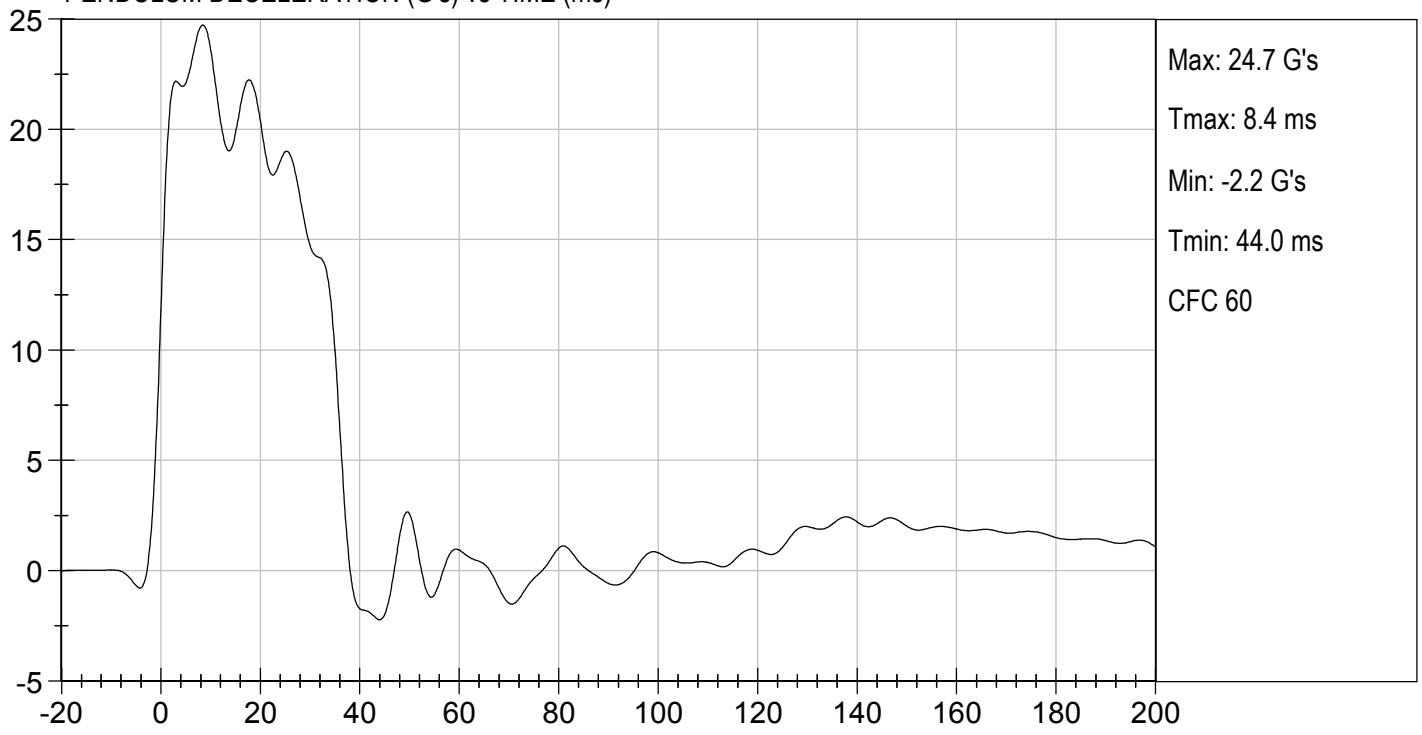
Test Date

Approved By

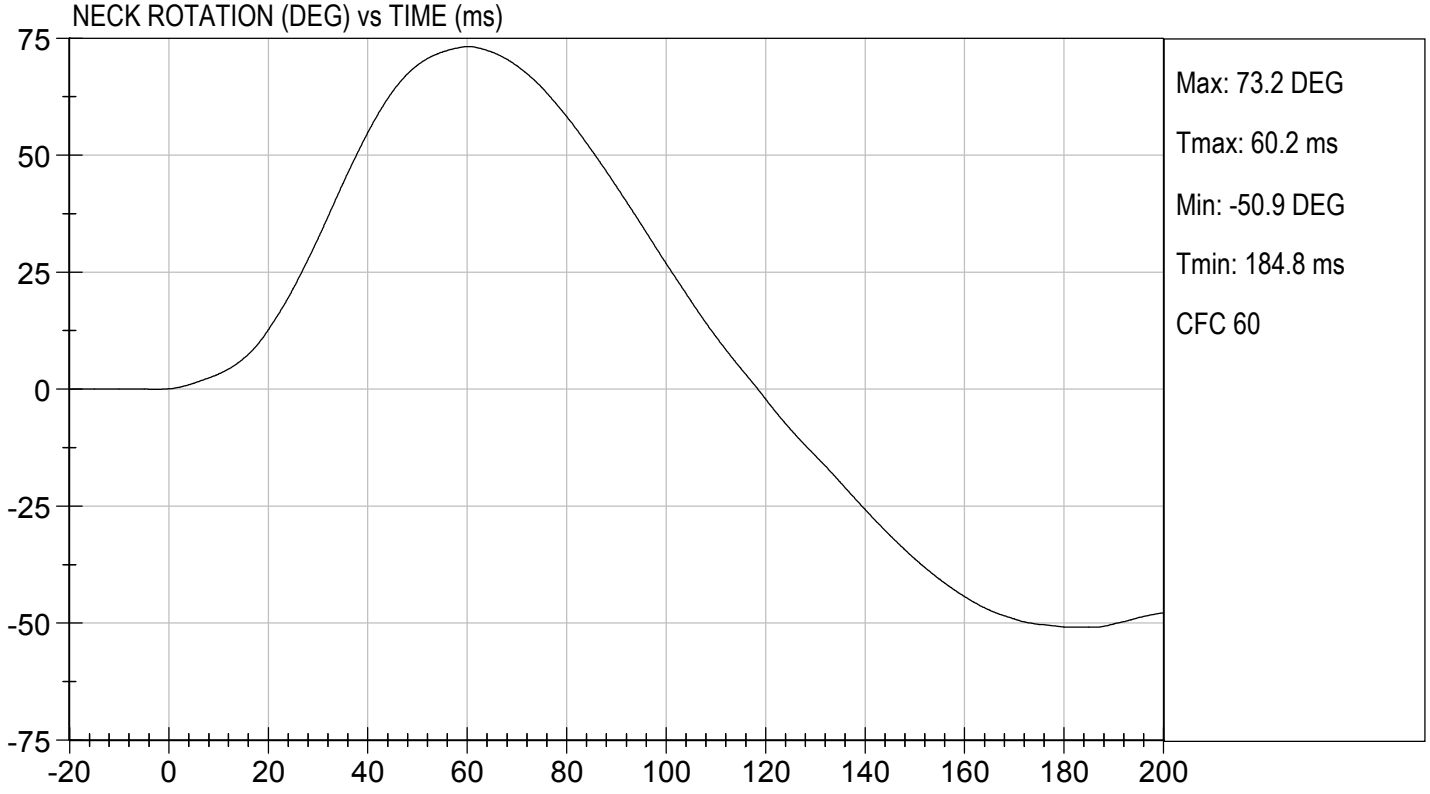
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 03/31/2021
TEST #: D211092

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

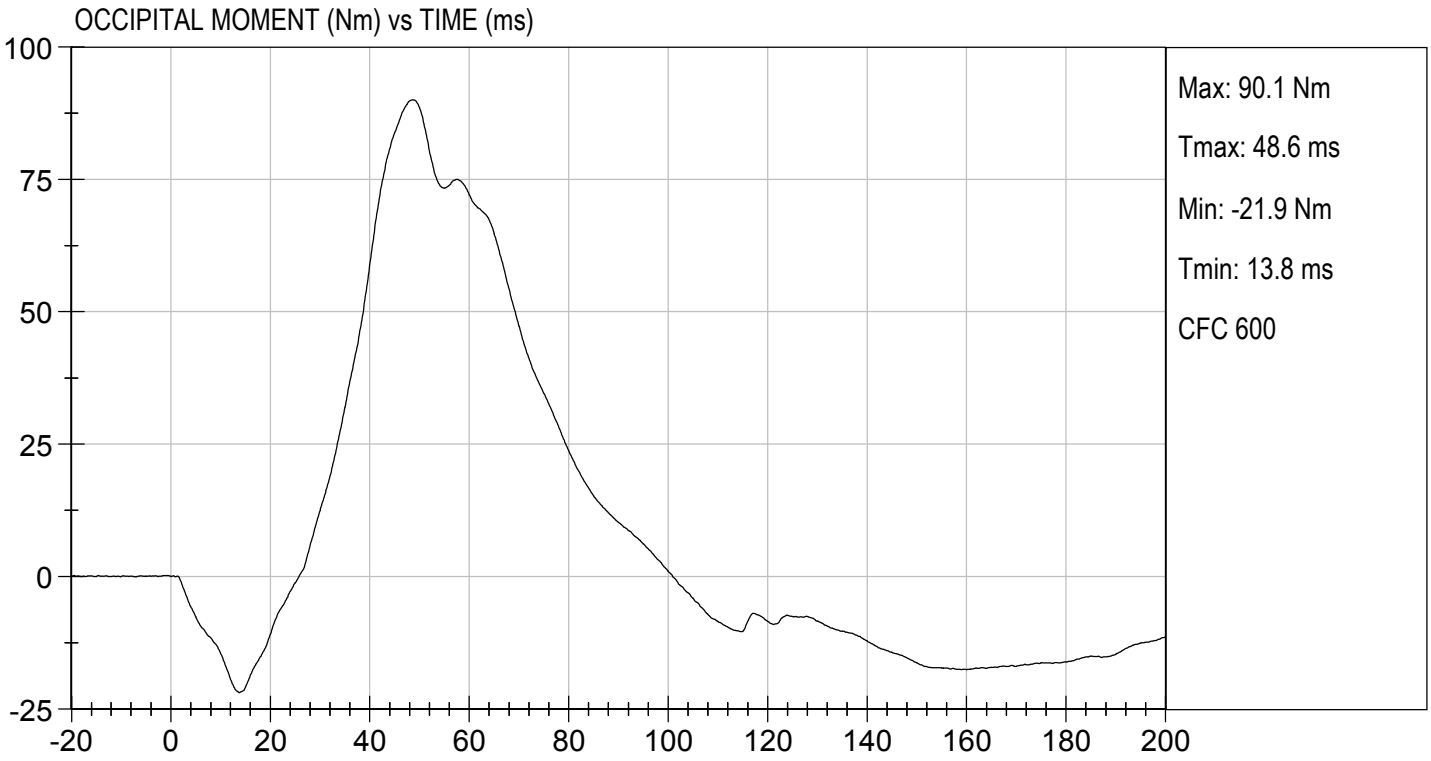


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 03/31/2021
TEST #: D211092



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211093

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	22	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.25	Pass
	20 ms	G's	14.00 to 19.00	15.82	Pass
	30 ms	G's	11.00 to 16.00	12.84	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	39.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	97.7	Pass
	Time	ms	72.0 to 82.0	79.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	161.4	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-63.8	Pass
	Time	ms	65.0 to 79.0	71.2	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	143.5	Pass
			Overall Test Results		Pass

Alex Thomas

Laboratory Technician

03/31/2021

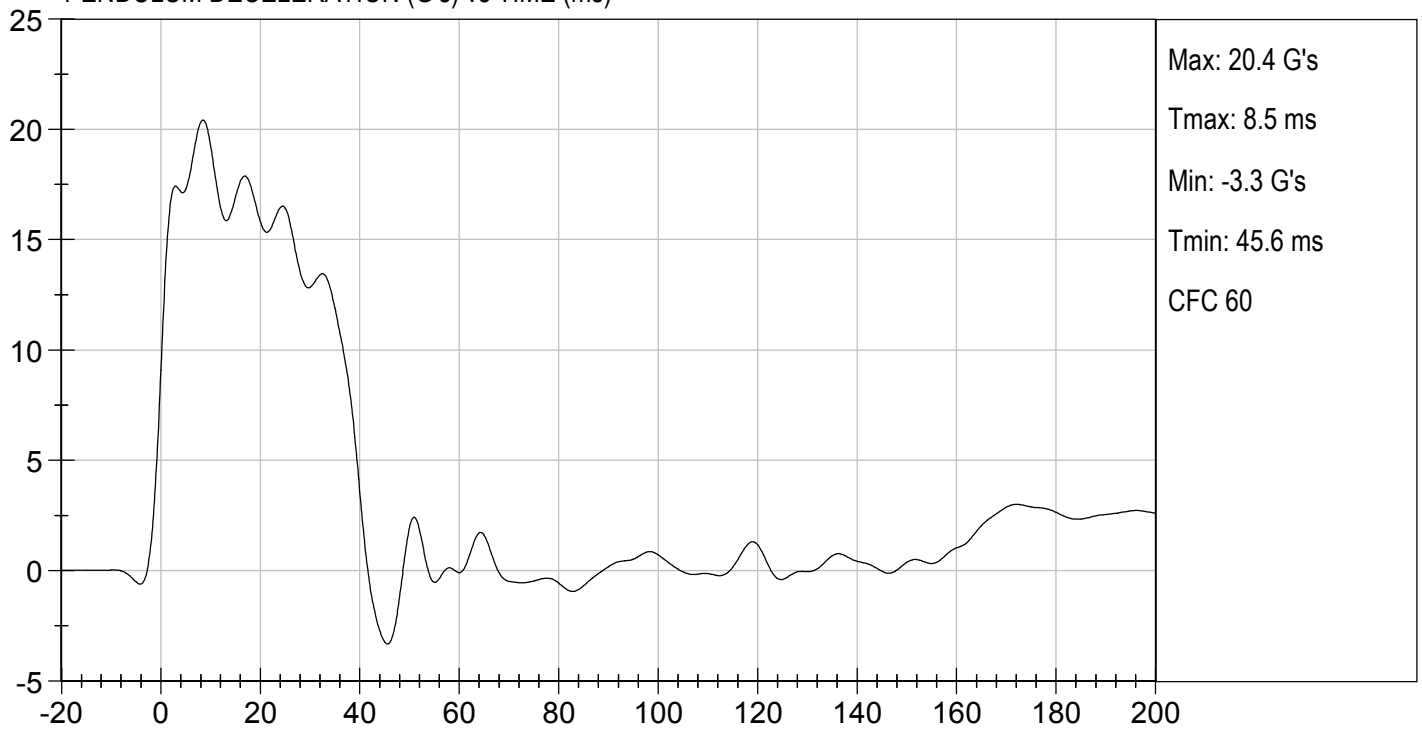
Test Date

Approved By

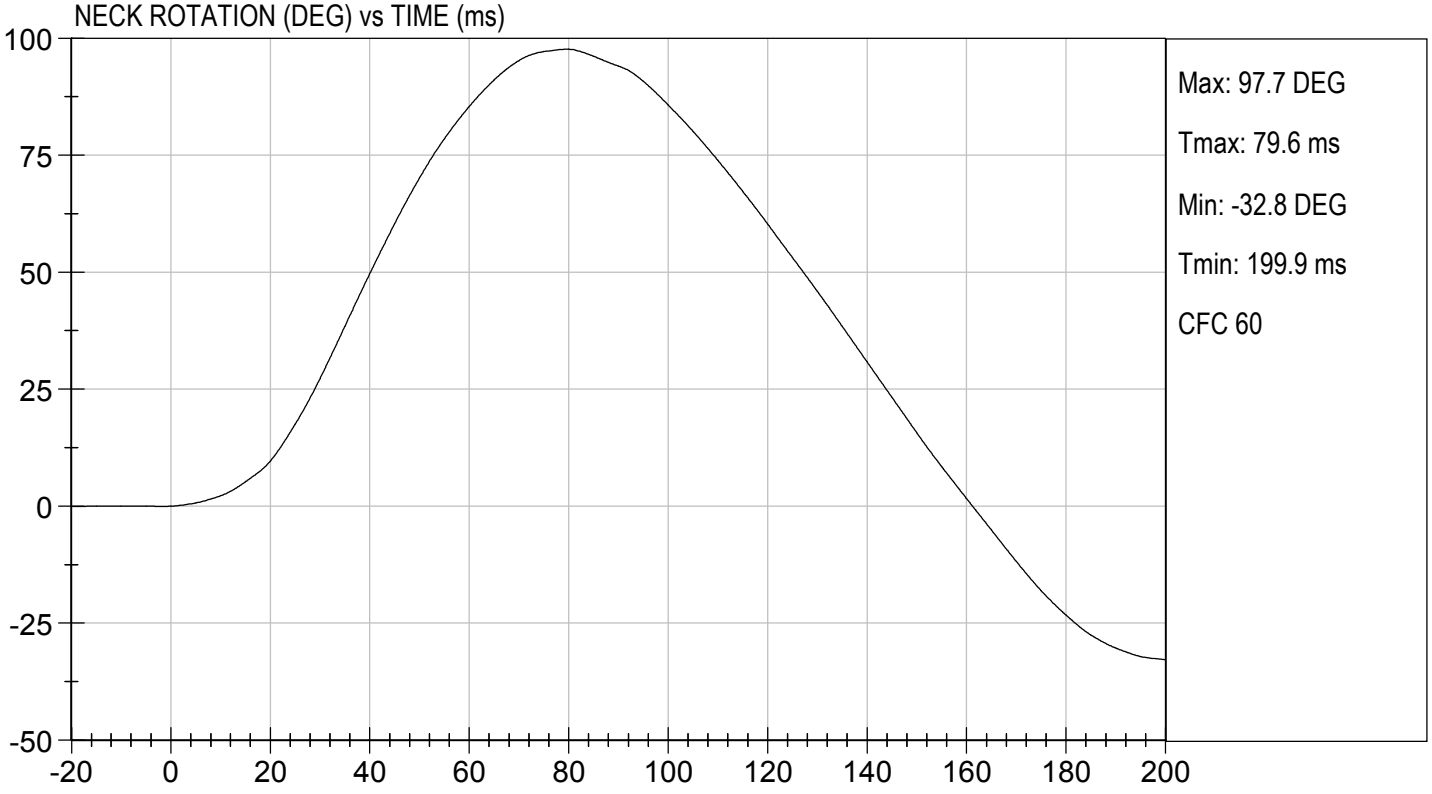
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 03/31/2021
TEST #: D211093

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

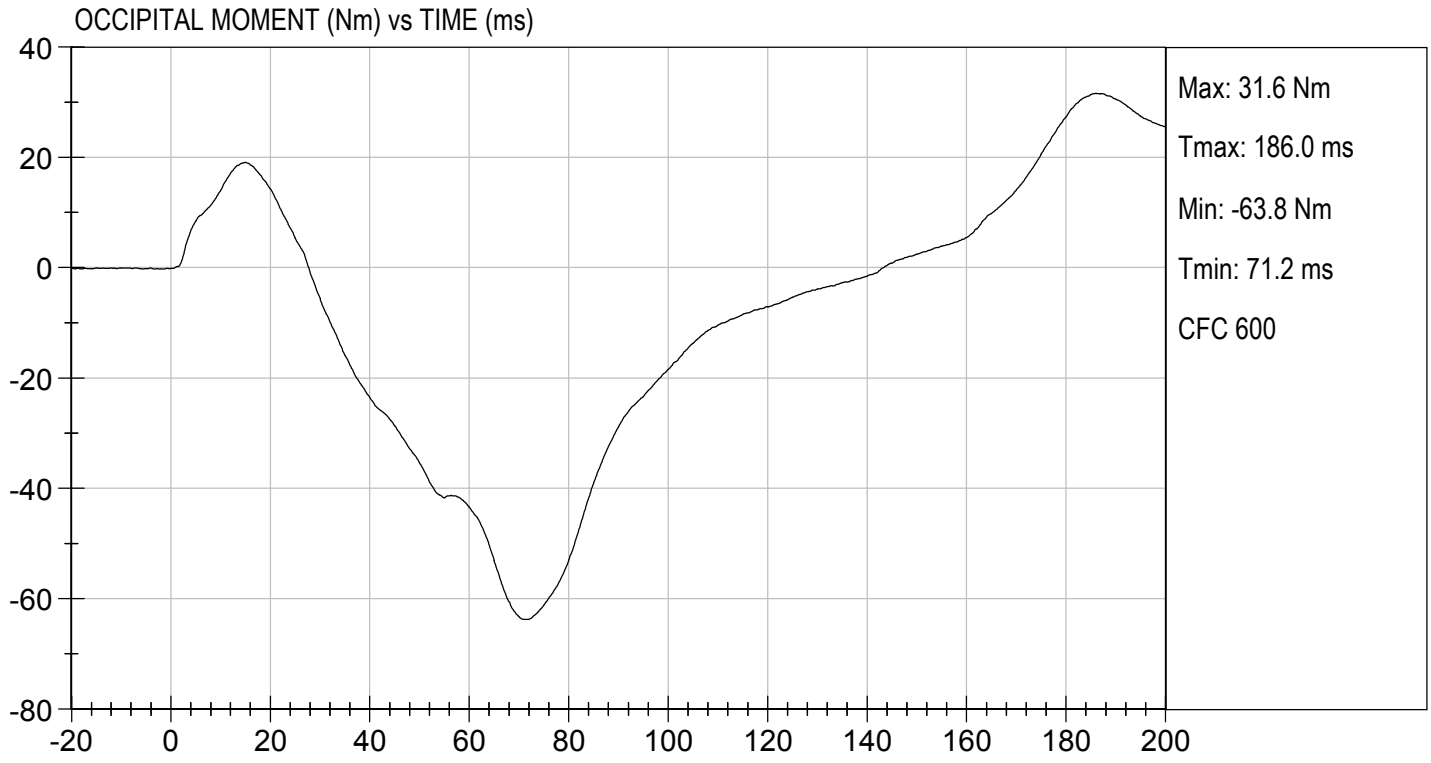


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 03/31/2021
TEST #: D211093



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211094

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	33	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,314	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	7.02	Pass
Internal Hysteresis	%	69 to 85	70	Pass
		Overall Test Results		Pass

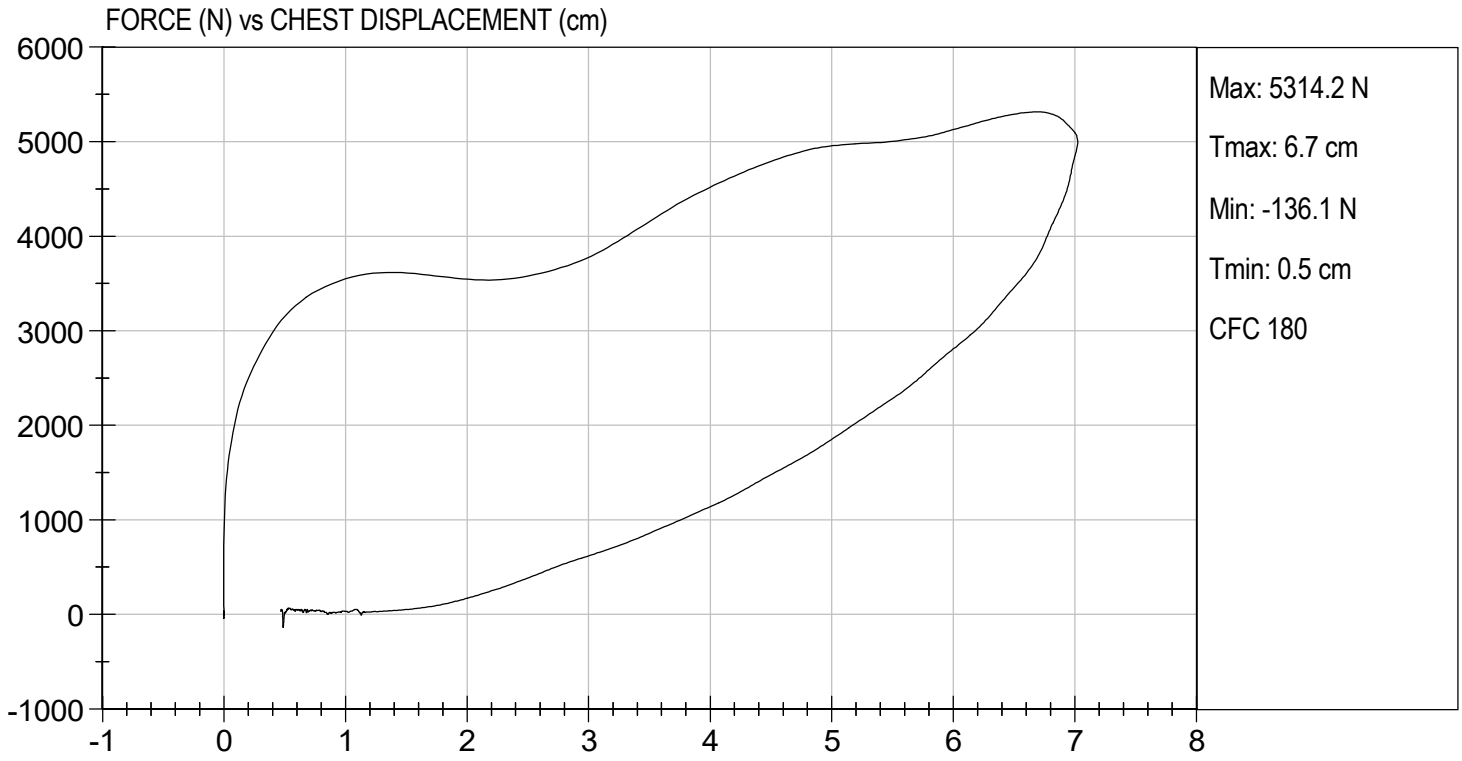
Laboratory Technician

03/30/2021
Test Date

Approved By

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

TEST DATE: 03/30/2021
TEST #: D211094



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211095

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	33	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,240	Pass
		Overall Test Results		Pass

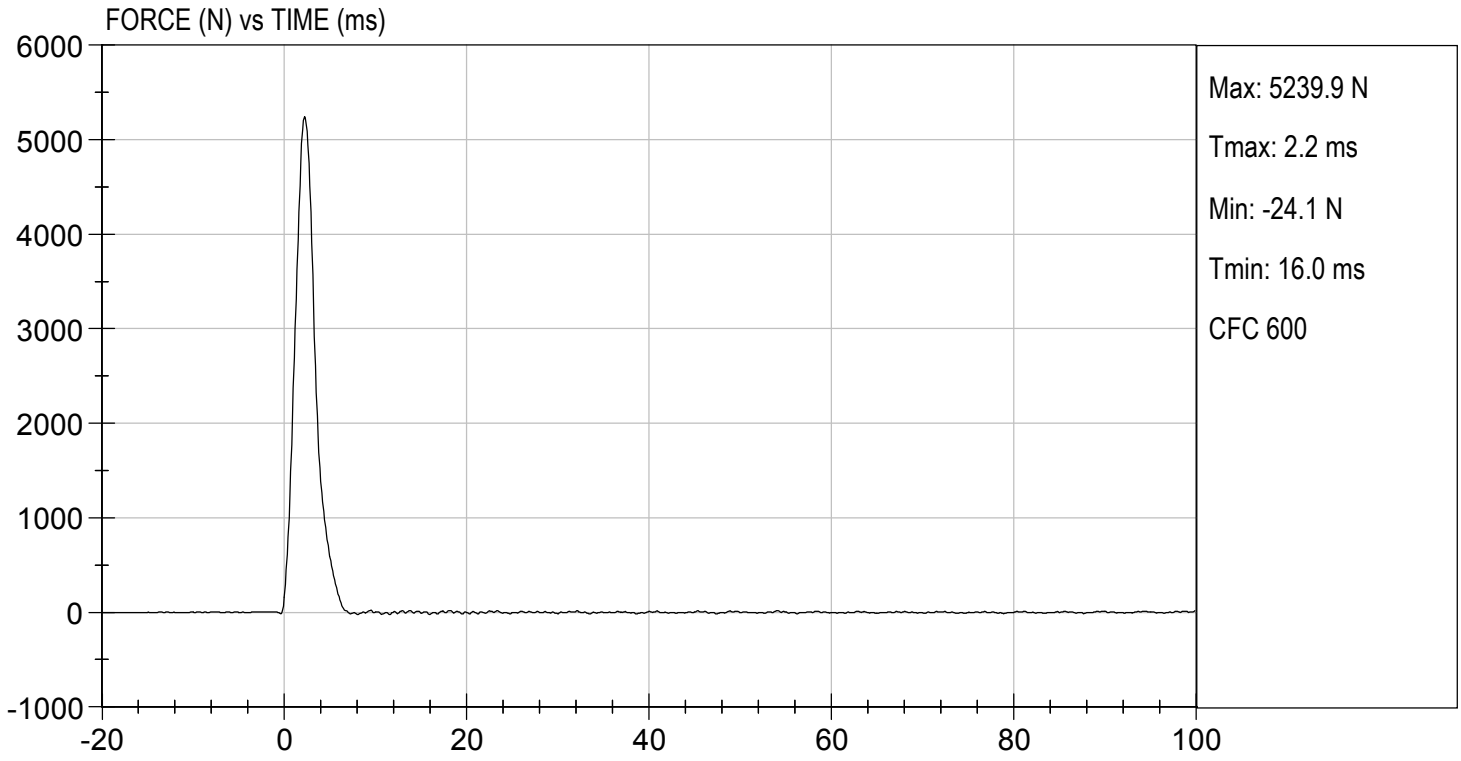
Laboratory Technician

03/30/2021
Test Date

Approved By

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

TEST DATE: 03/30/2021
TEST #: D211095



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211096

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	33	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	5,185	Pass
		Overall Test Results		Pass

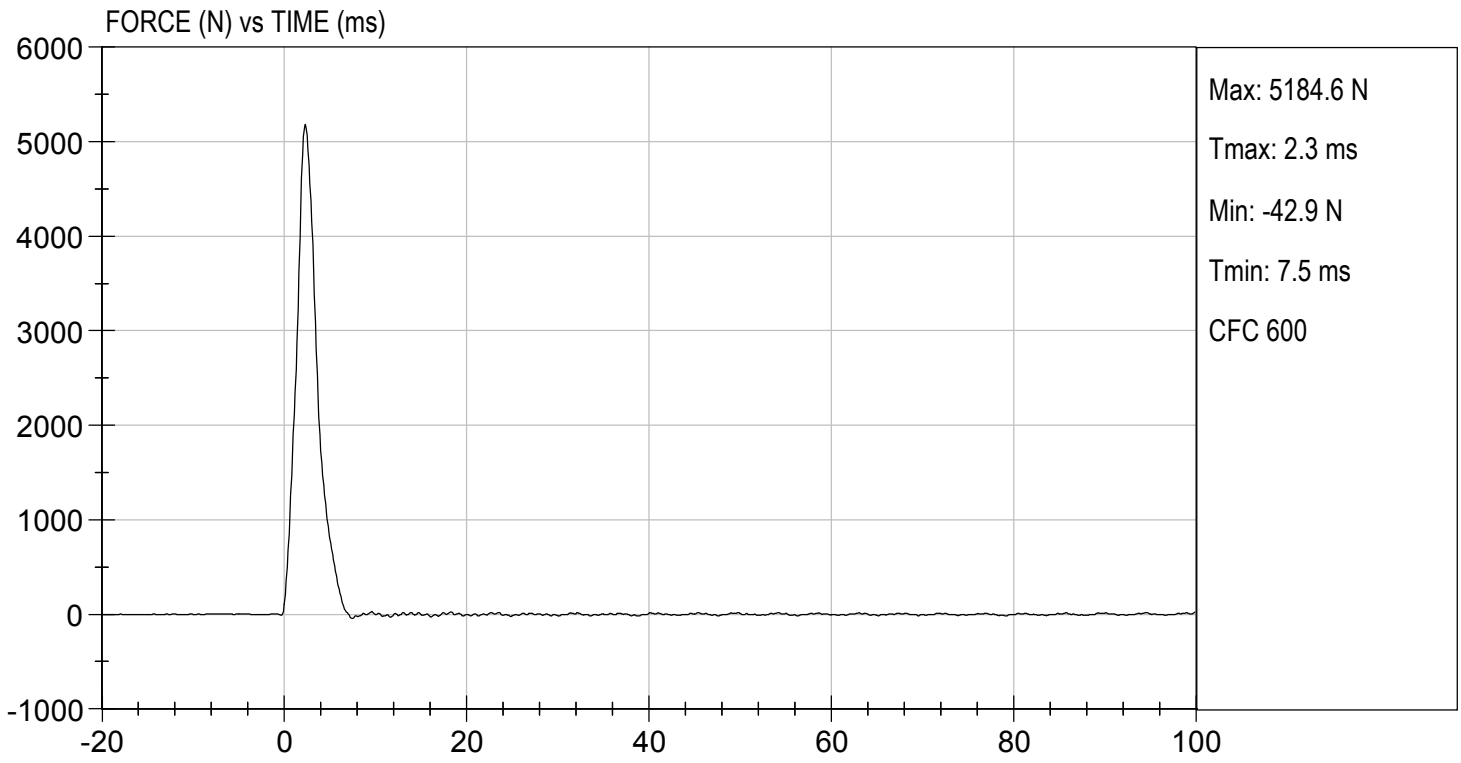
Laboratory Technician

03/30/2021
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.92 ft/s, 2.11 m/s

TEST DATE: 03/30/2021
TEST #: D211096



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211090

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.3	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	22	22	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.4	Pass
30 Degrees	Nm	94.9 Nm Max	87.3	89.2	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	43.7	43.9	Pass
		Overall Test Results			Pass

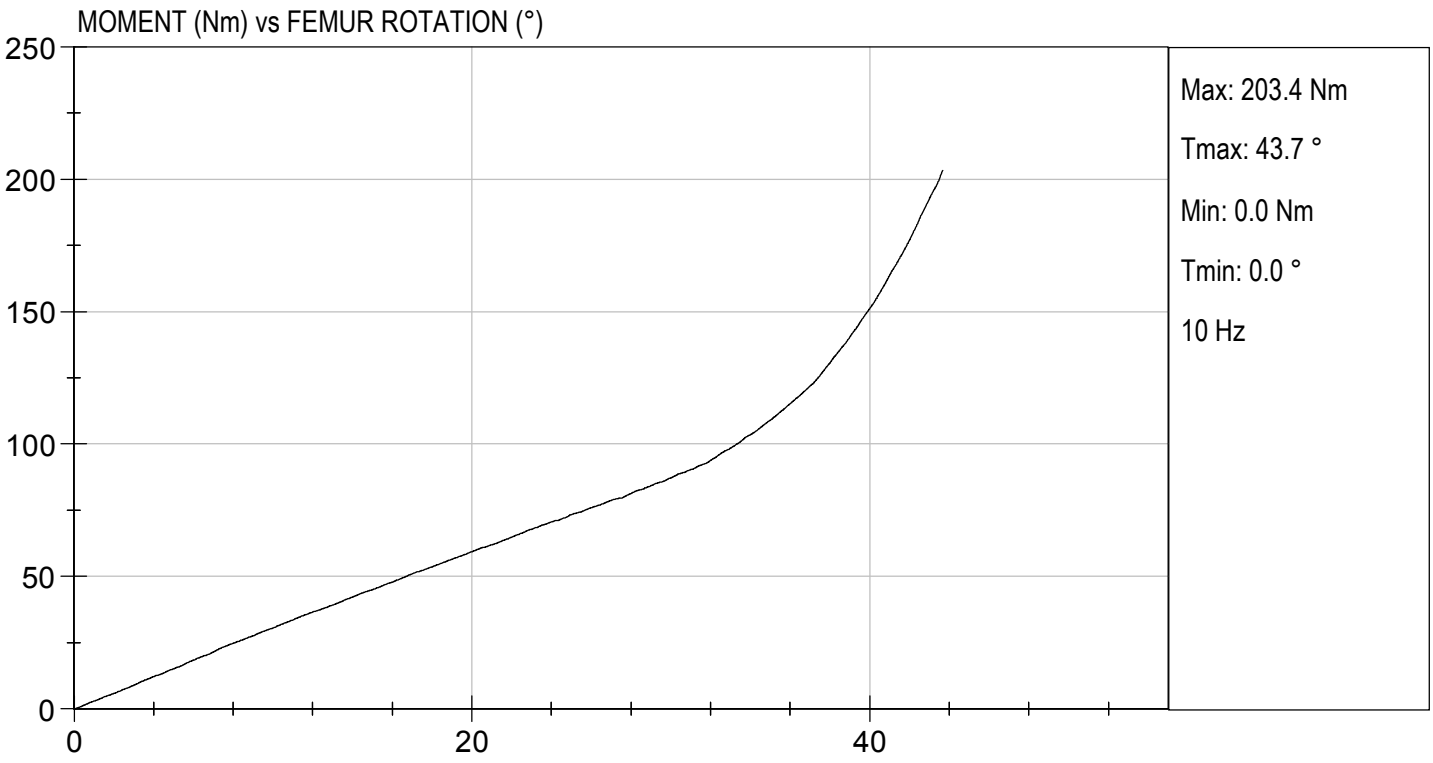
Laboratory Technician

03/31/2021
Test Date

Approved By

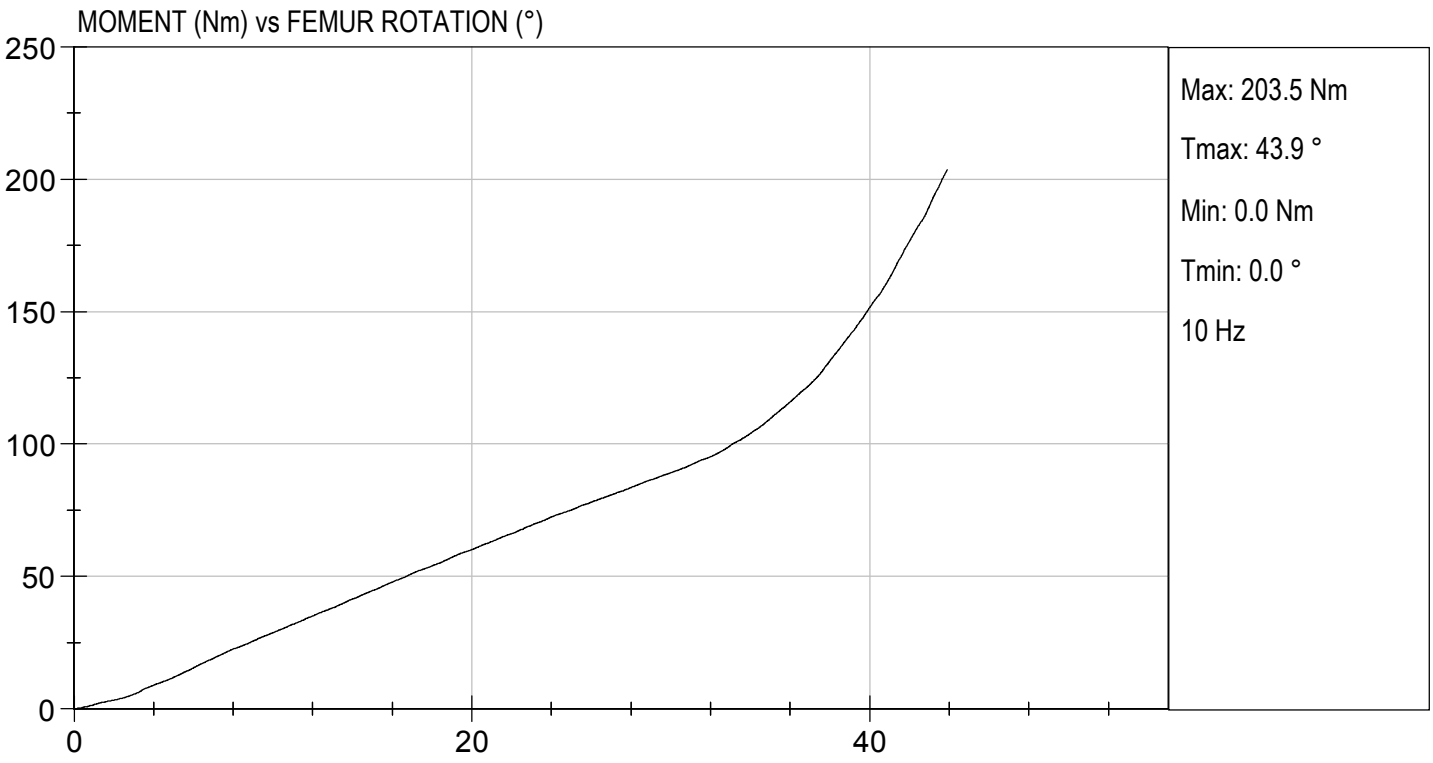
TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 03/31/2021
TEST #: D211099



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 03/31/2021
TEST #: D211090



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:** D211321

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Peak Resultant Acceleration	G's	225 to 275	255	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	4.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

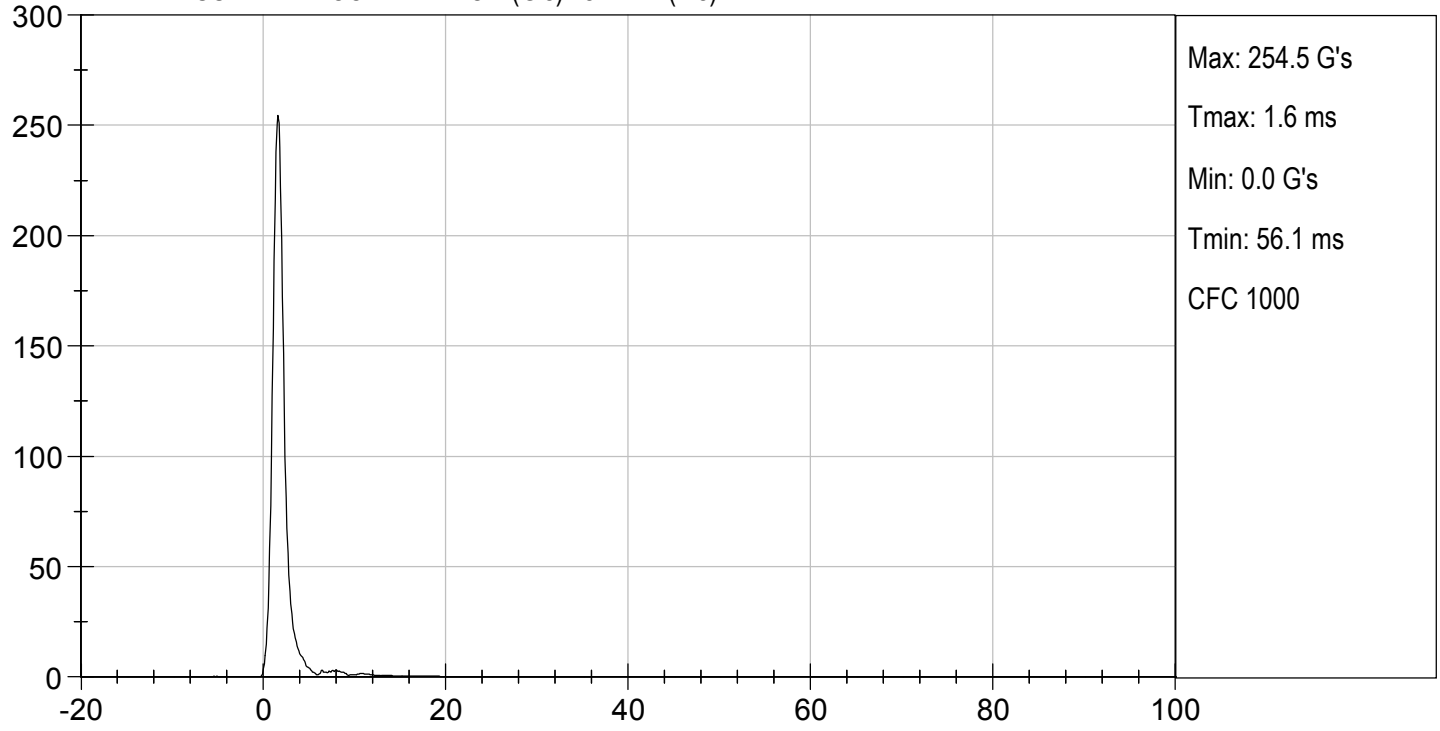
04/15/2021
Test Date

Approved By

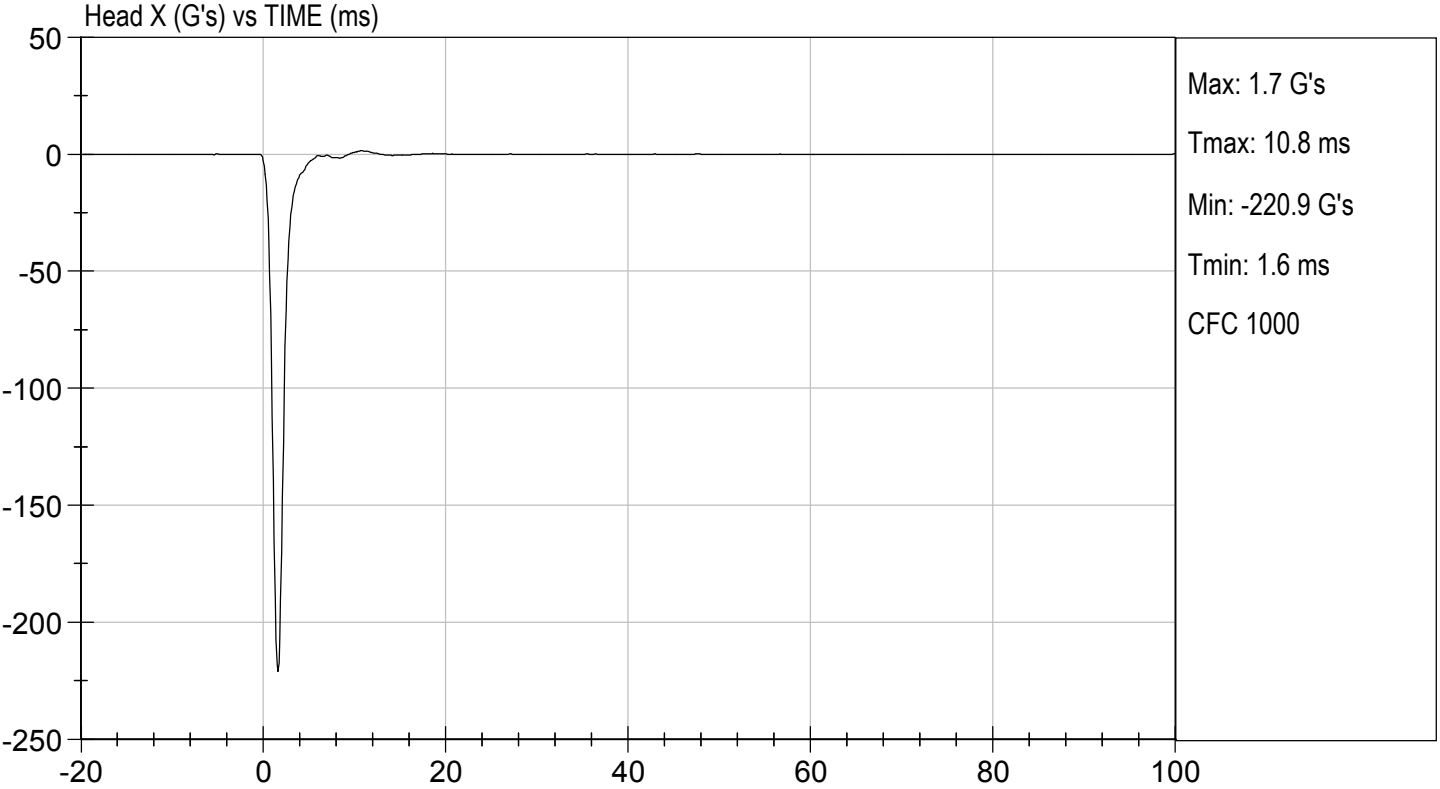
TEST DESC: HEAD DROP

TEST DATE: 04/15/2021
TEST #: D211321

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

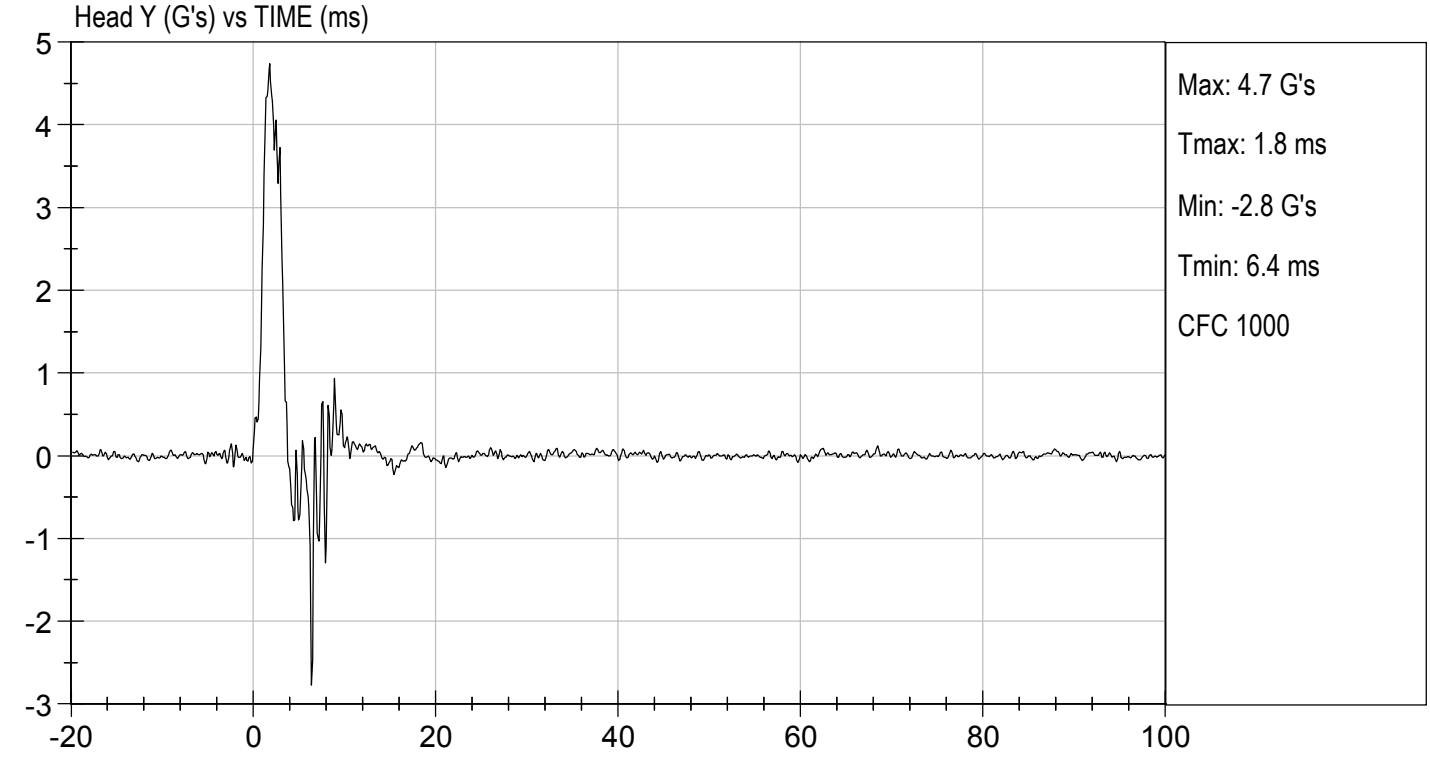


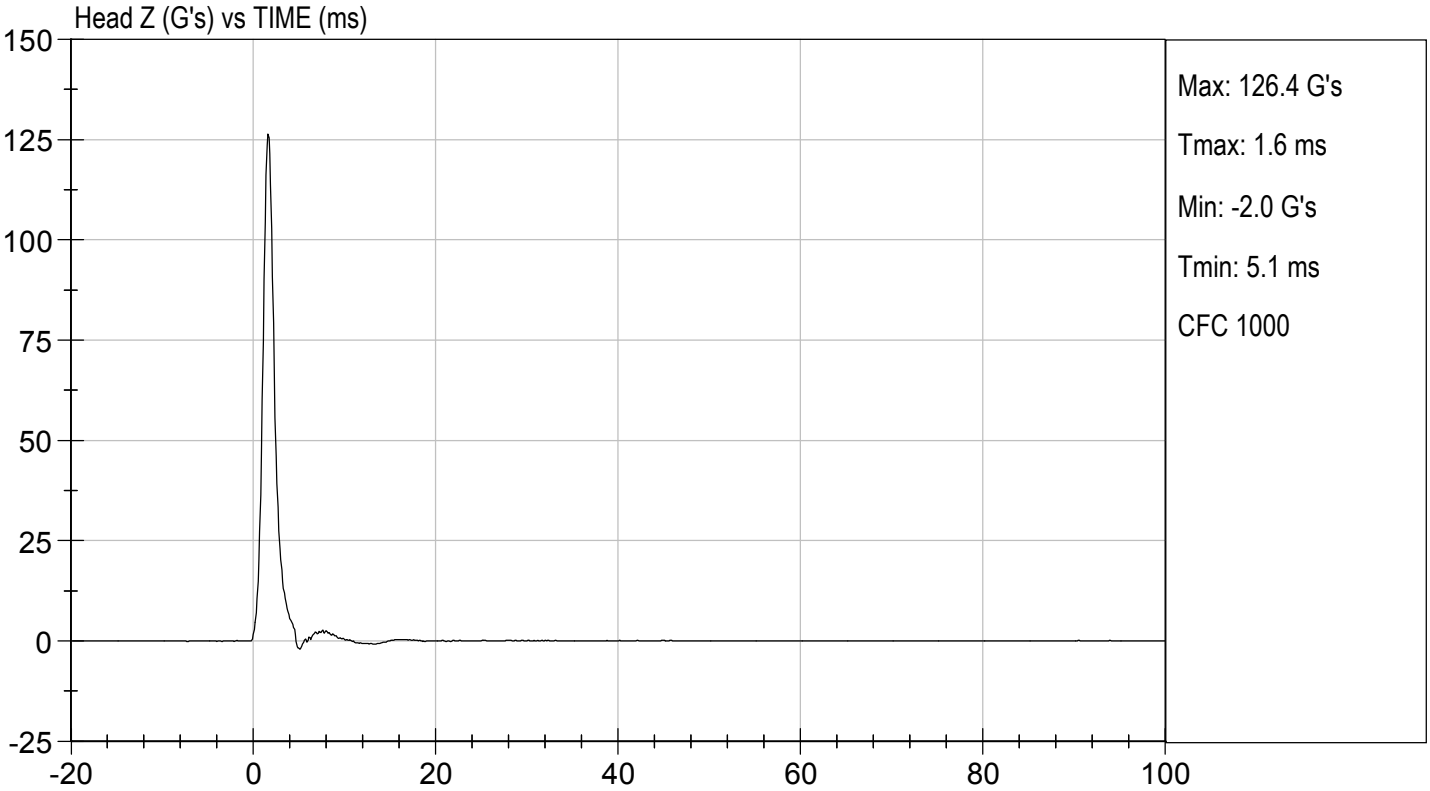
Head X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 04/15/2021
TEST #: D211321





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211322

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21	Pass
Laboratory Relative Humidity		%	10 to 70	28	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.34	Pass
	20 ms	G's	17.60 to 22.60	20.95	Pass
	30 ms	G's	12.50 to 18.50	16.29	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	16.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.7	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	64.2	Pass
	Time	ms	57.0 to 64.0	60.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	123.1	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	91.5	Pass
	Time	ms	47.0 to 58.0	47.5	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	102.8	Pass
			Overall Test Results		Pass

Laboratory Technician

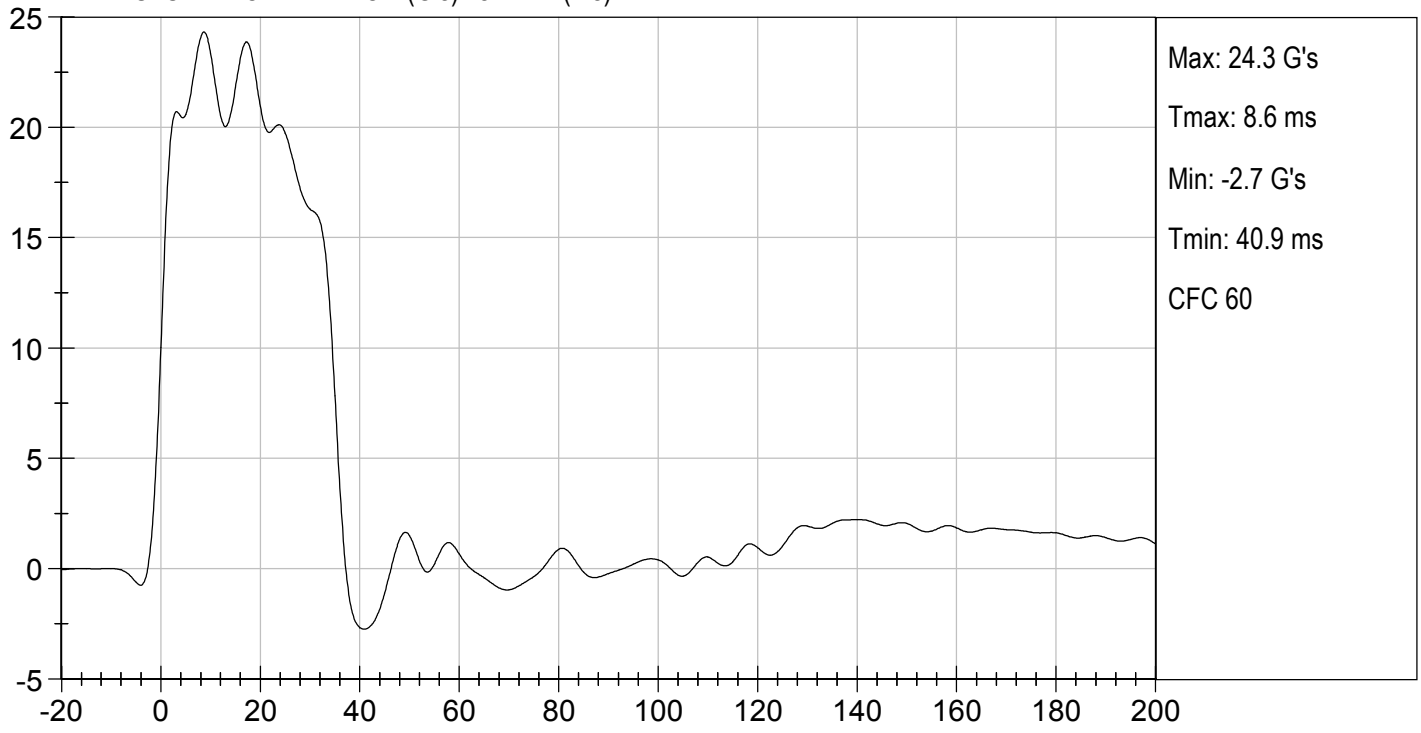
04/16/2021
Test Date

Approved By

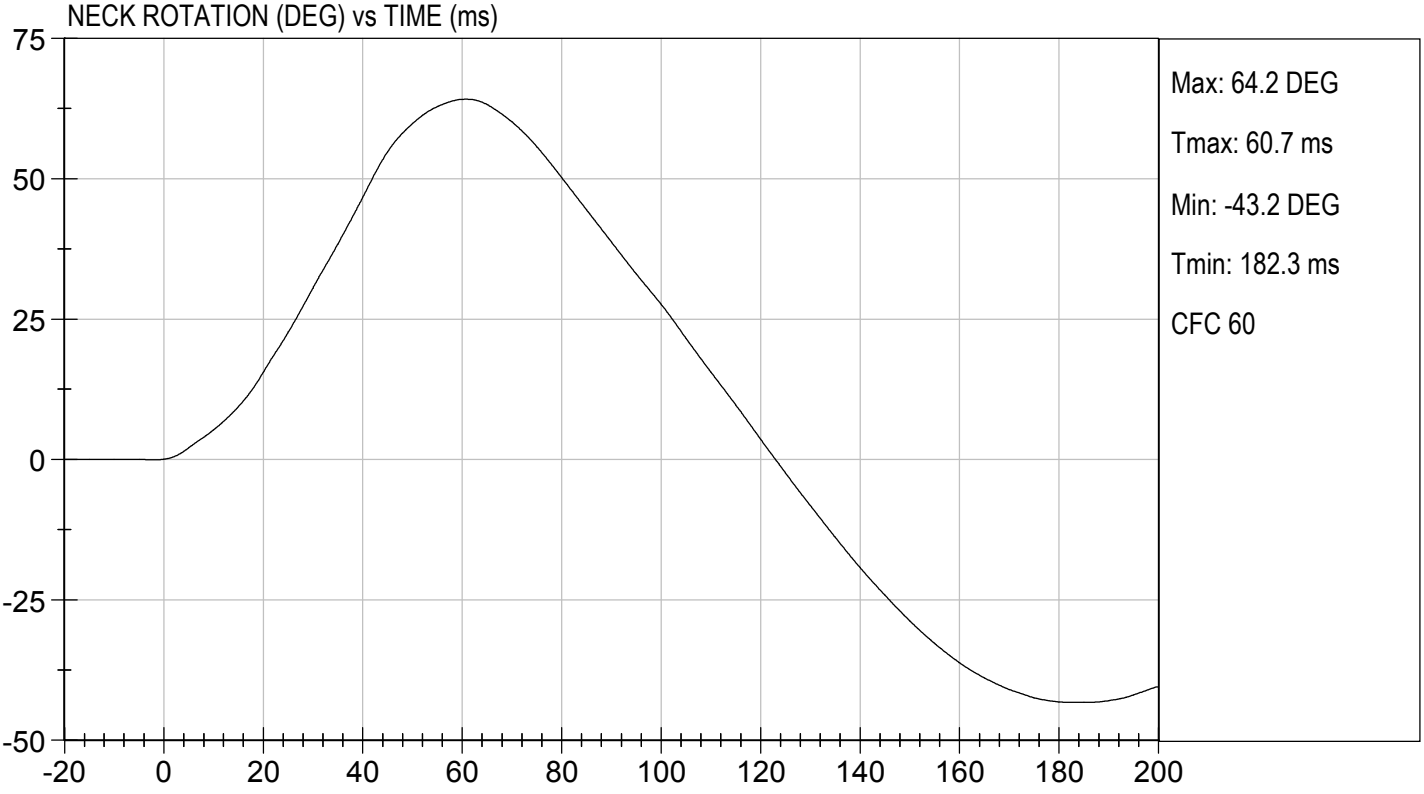
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 04/16/2021
TEST #: D211322

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

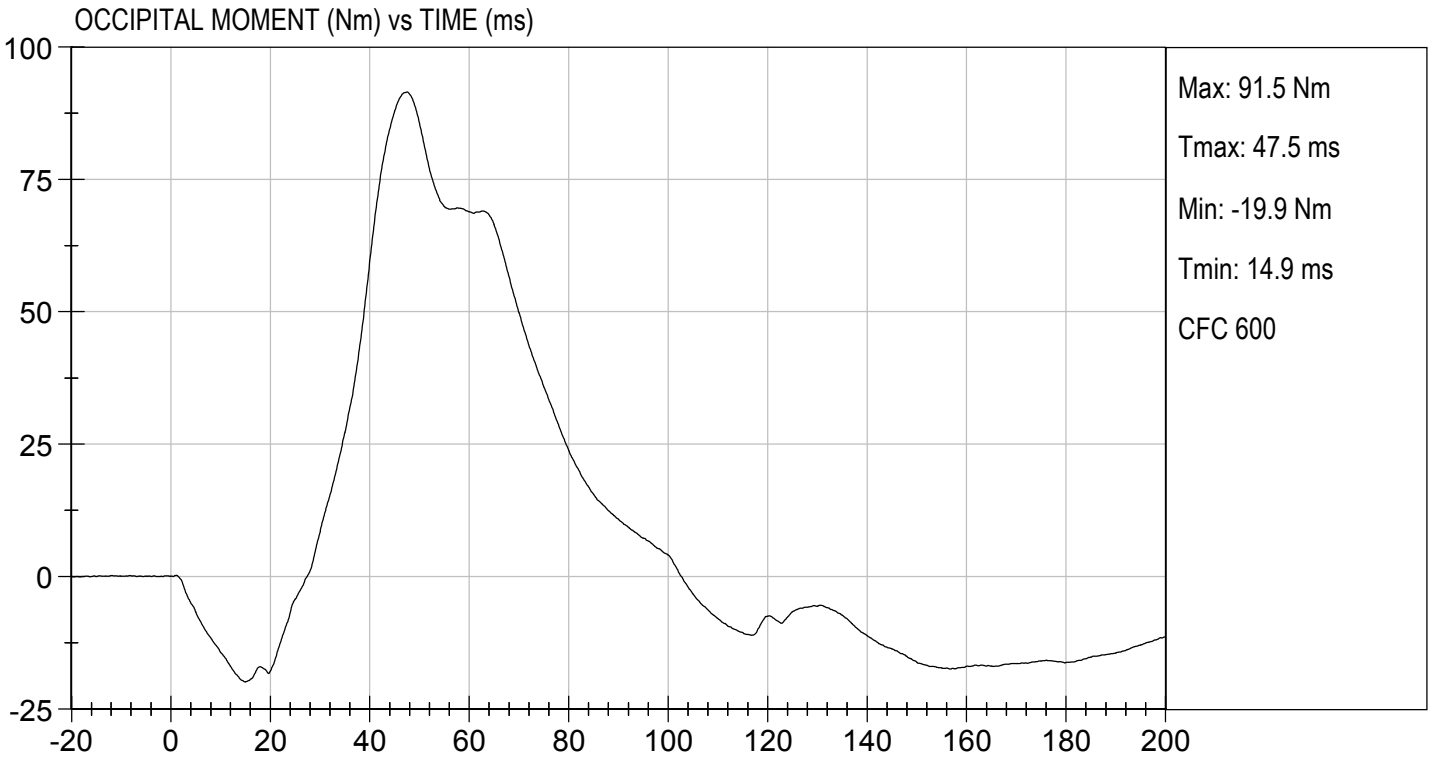


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 04/16/2021
TEST #: D211322



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211323

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21	Pass
Laboratory Relative Humidity		%	10 to 70	28	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.00	Pass
	20 ms	G's	14.00 to 19.00	15.94	Pass
	30 ms	G's	11.00 to 16.00	13.22	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.7	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	40.6	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	91.9	Pass
	Time	ms	72.0 to 82.0	80.8	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	166.2	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-60.8	Pass
	Time	ms	65.0 to 79.0	76.1	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.7	Pass
			Overall Test Results		Pass

Laboratory Technician

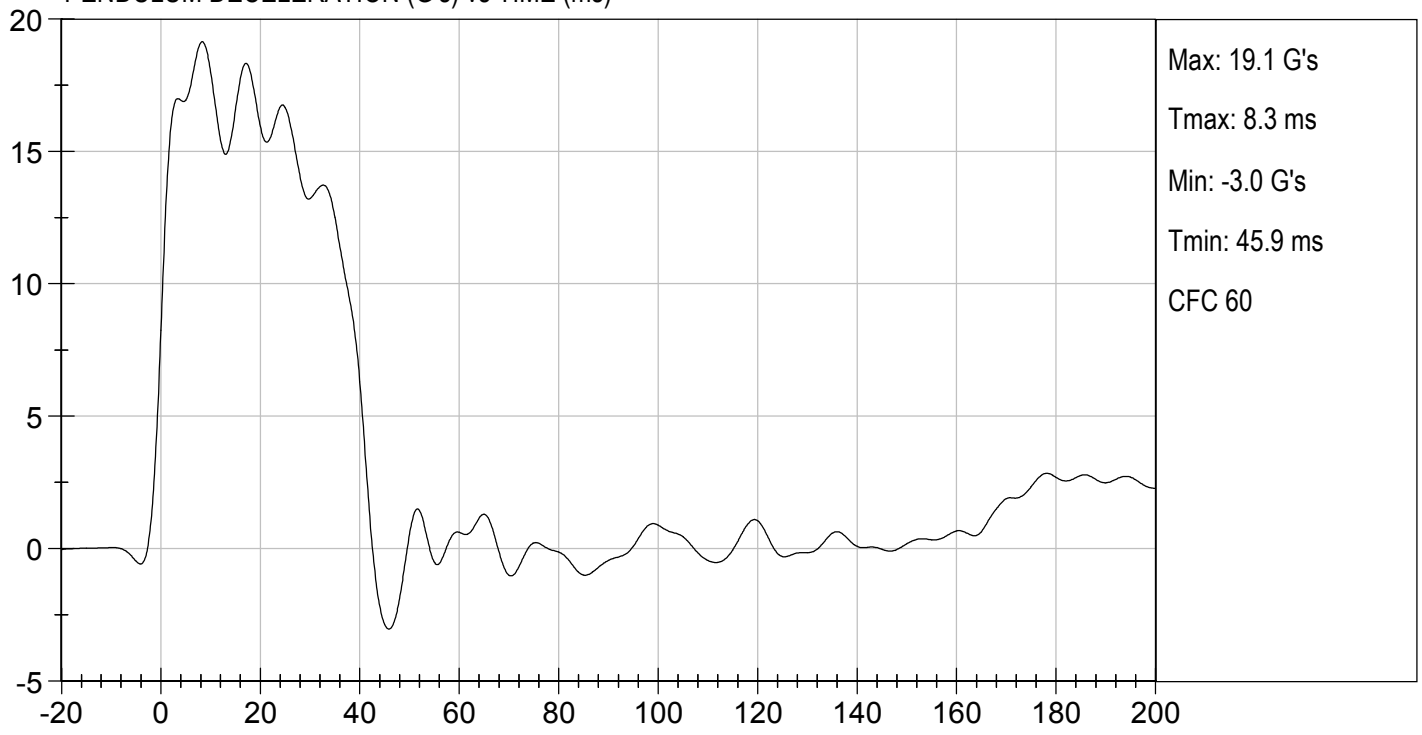
04/16/2021
Test Date

Approved By

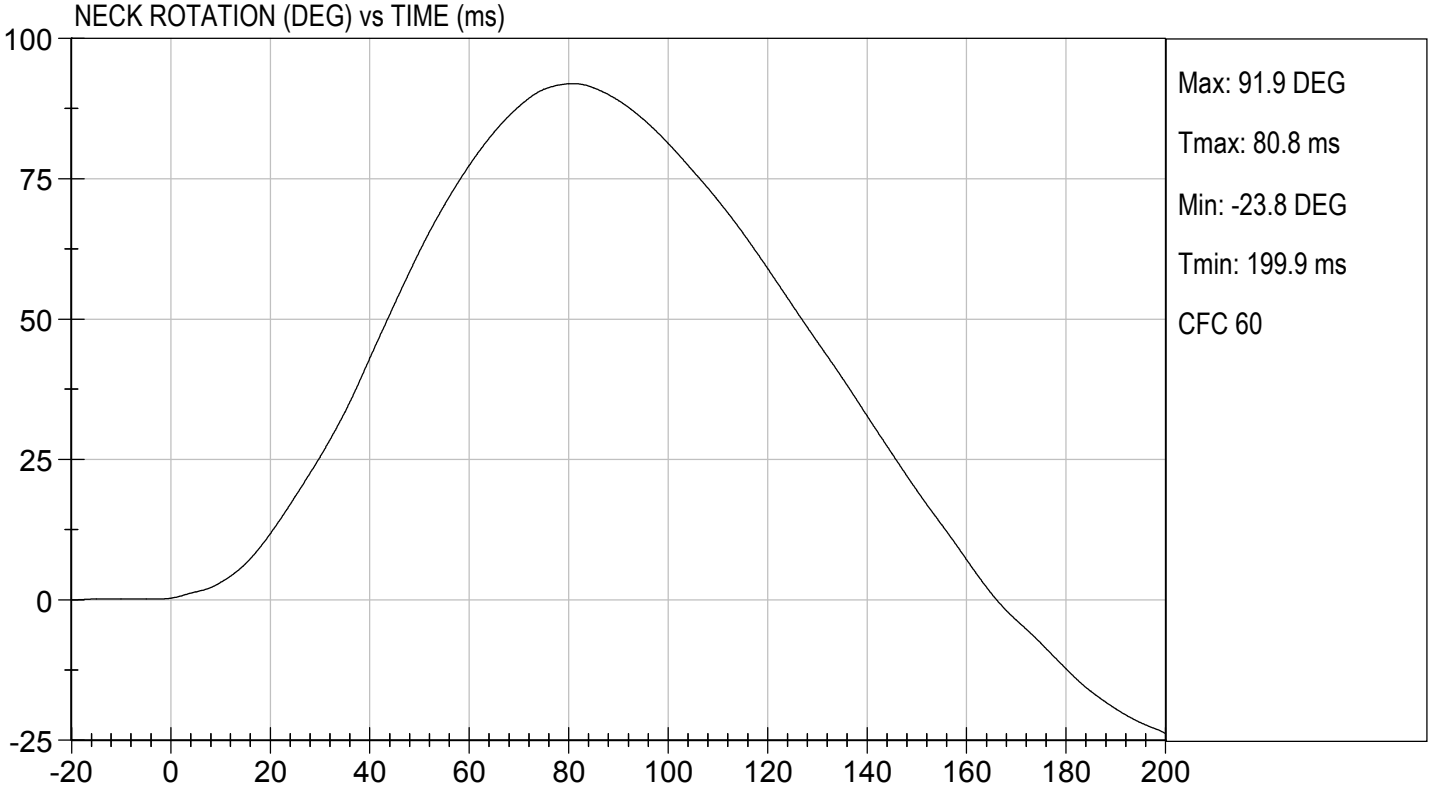
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 04/16/2021
TEST #: D211323

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

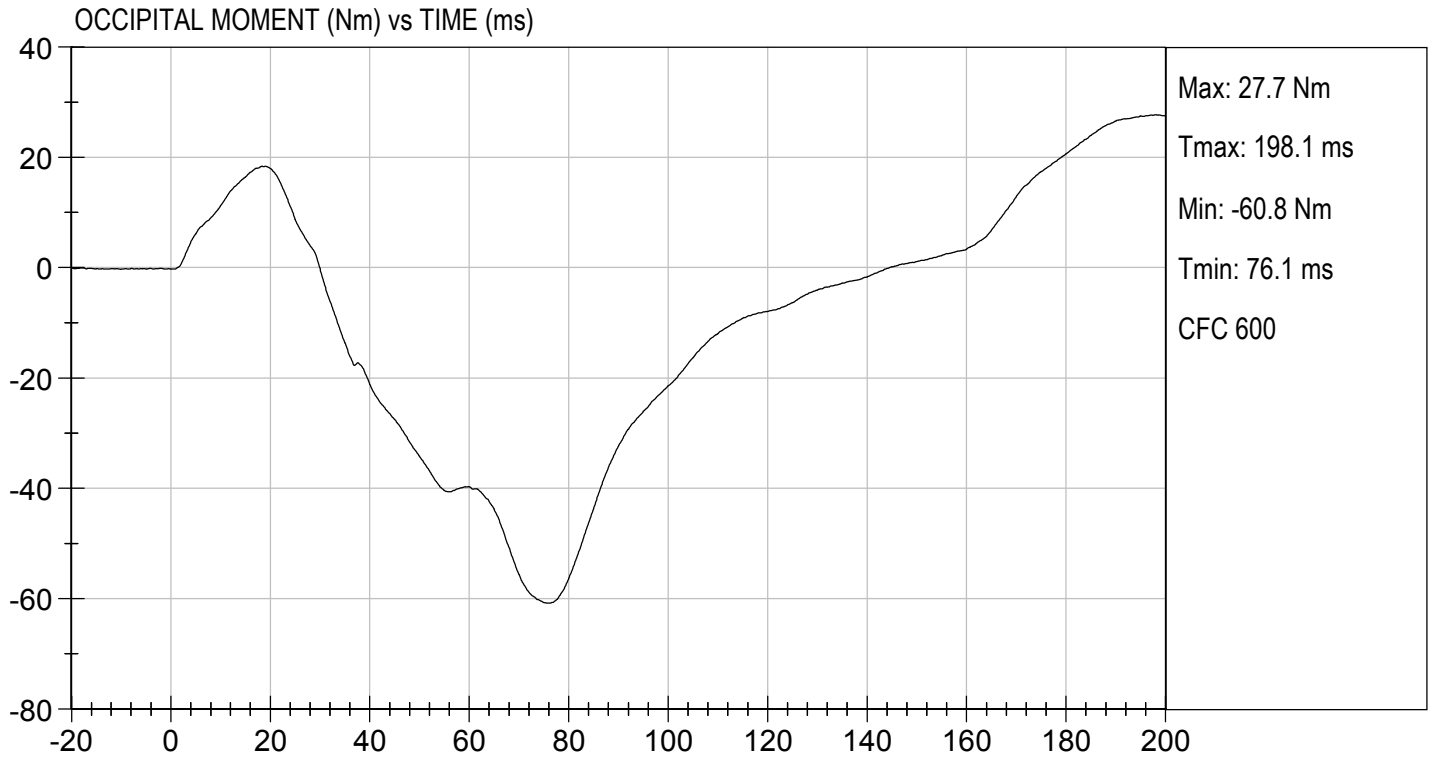


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 04/16/2021
TEST #: D211323



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211324

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21	Pass
Laboratory Relative Humidity	%	10 to 70	26.8	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,381	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.70	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

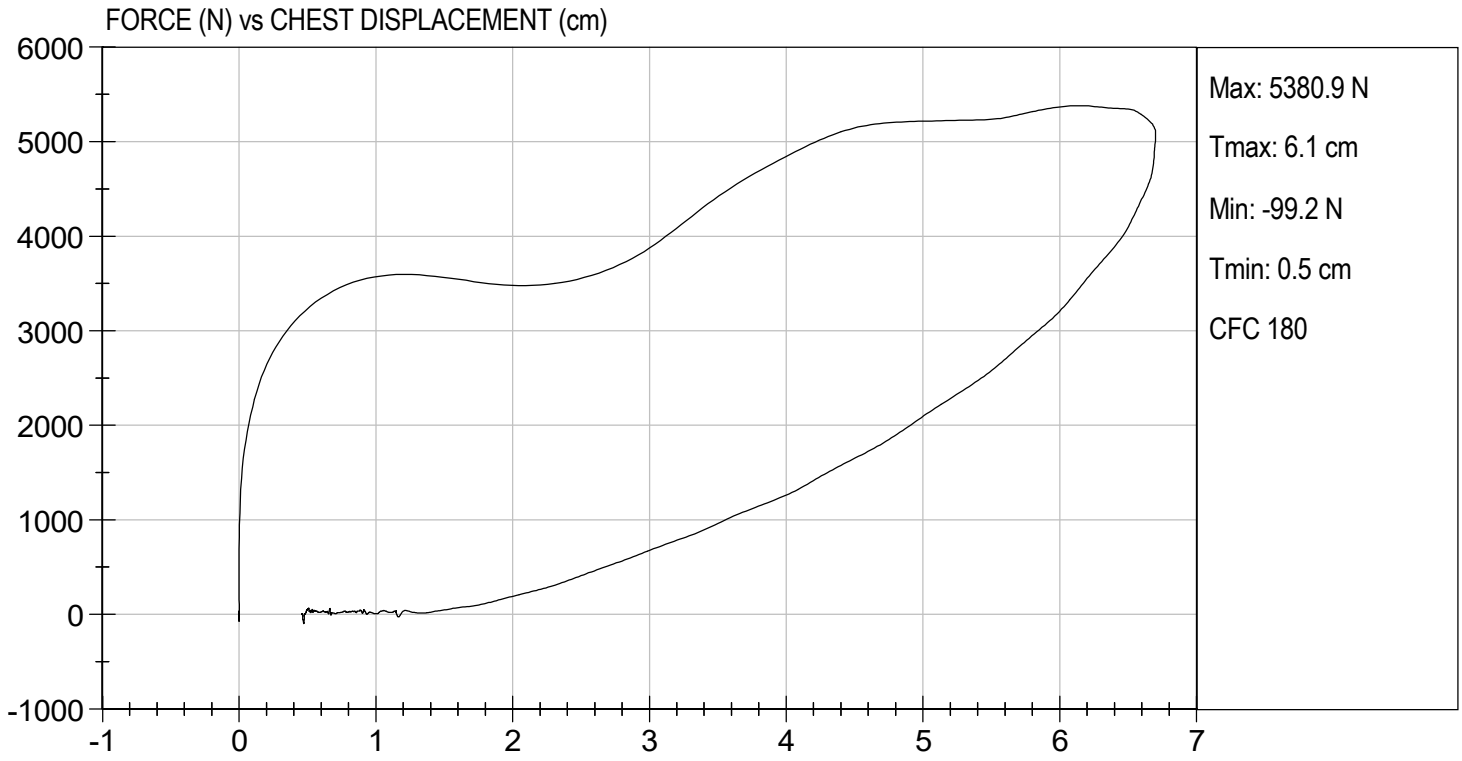
Laboratory Technician

04/19/2021
Test Date

Approved By

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

TEST DATE: 04/19/2021
TEST #: D211324



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211325

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	5,386	Pass
		Overall Test Results		Pass

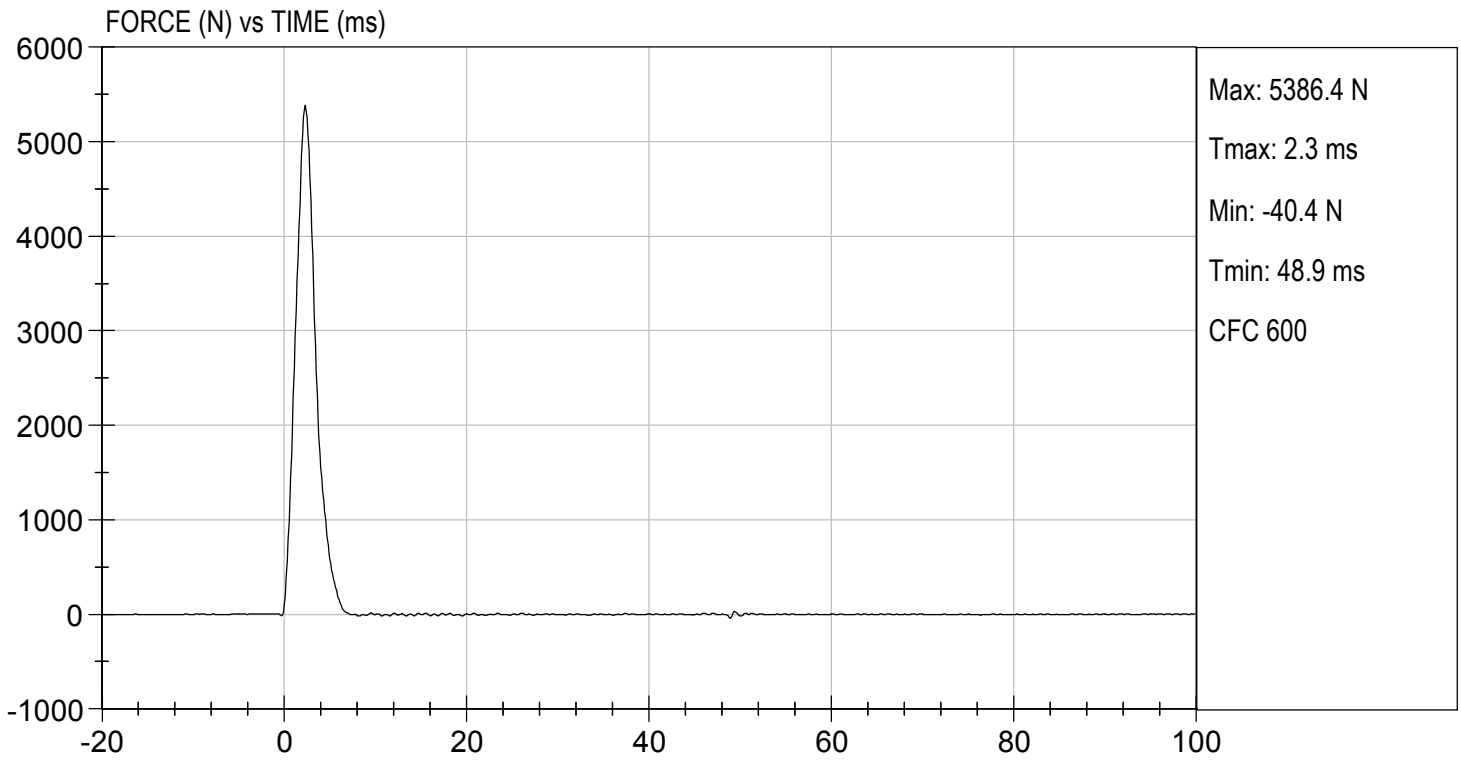
Laboratory Technician

04/15/2021
Test Date

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.92 ft/s, 2.11 m/s

TEST DATE: 04/15/2021
TEST #: D211325



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211326

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	4,755	Pass
		Overall Test Results		Pass

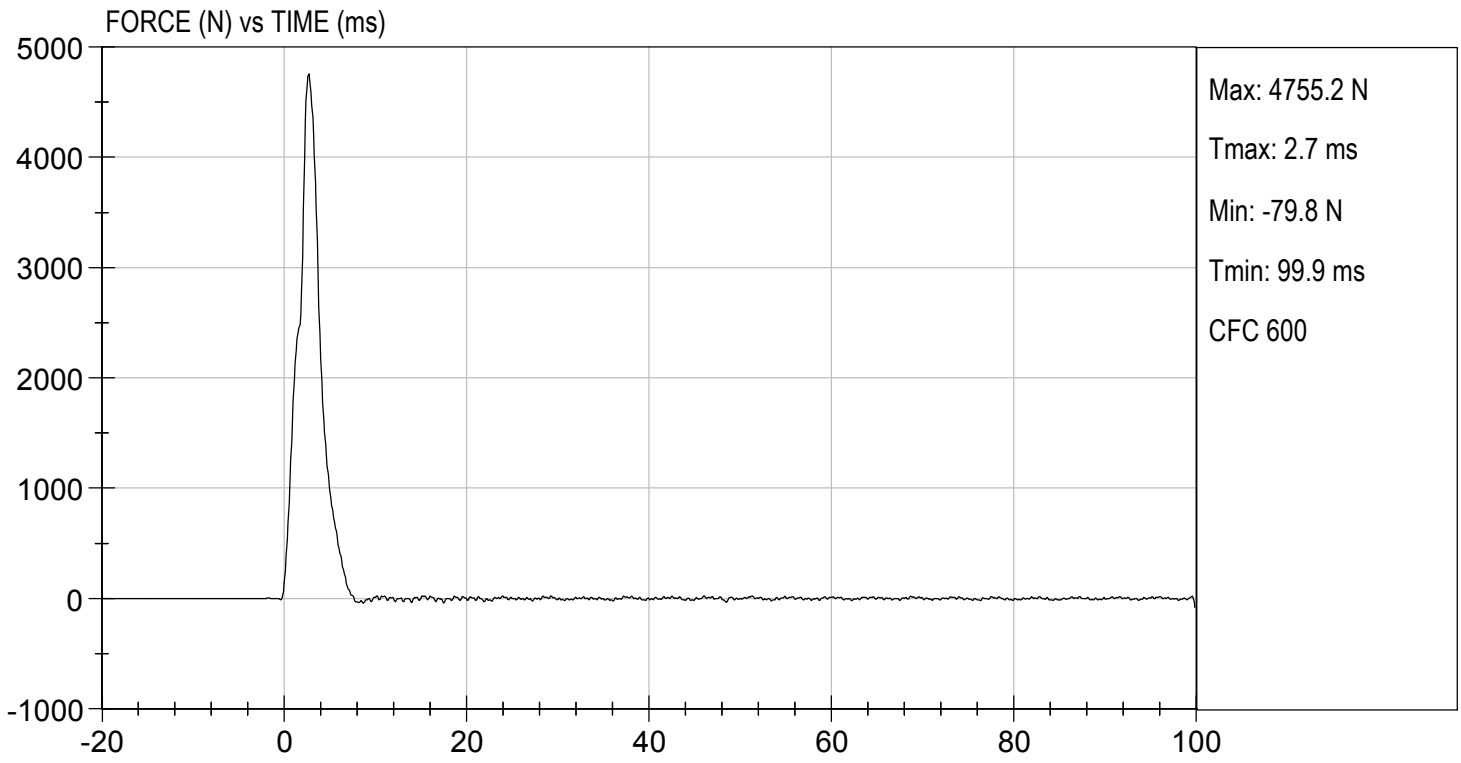
Laboratory Technician

04/15/2021
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.92 ft/s, 2.11 m/s

TEST DATE: 04/15/2021
TEST #: D211326



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D211320

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.9	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	29	29	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.4	Pass
30 Degrees	Nm	94.9 Nm Max	92.5	89.0	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	44.1	44.8	Pass
		Overall Test Results			Pass

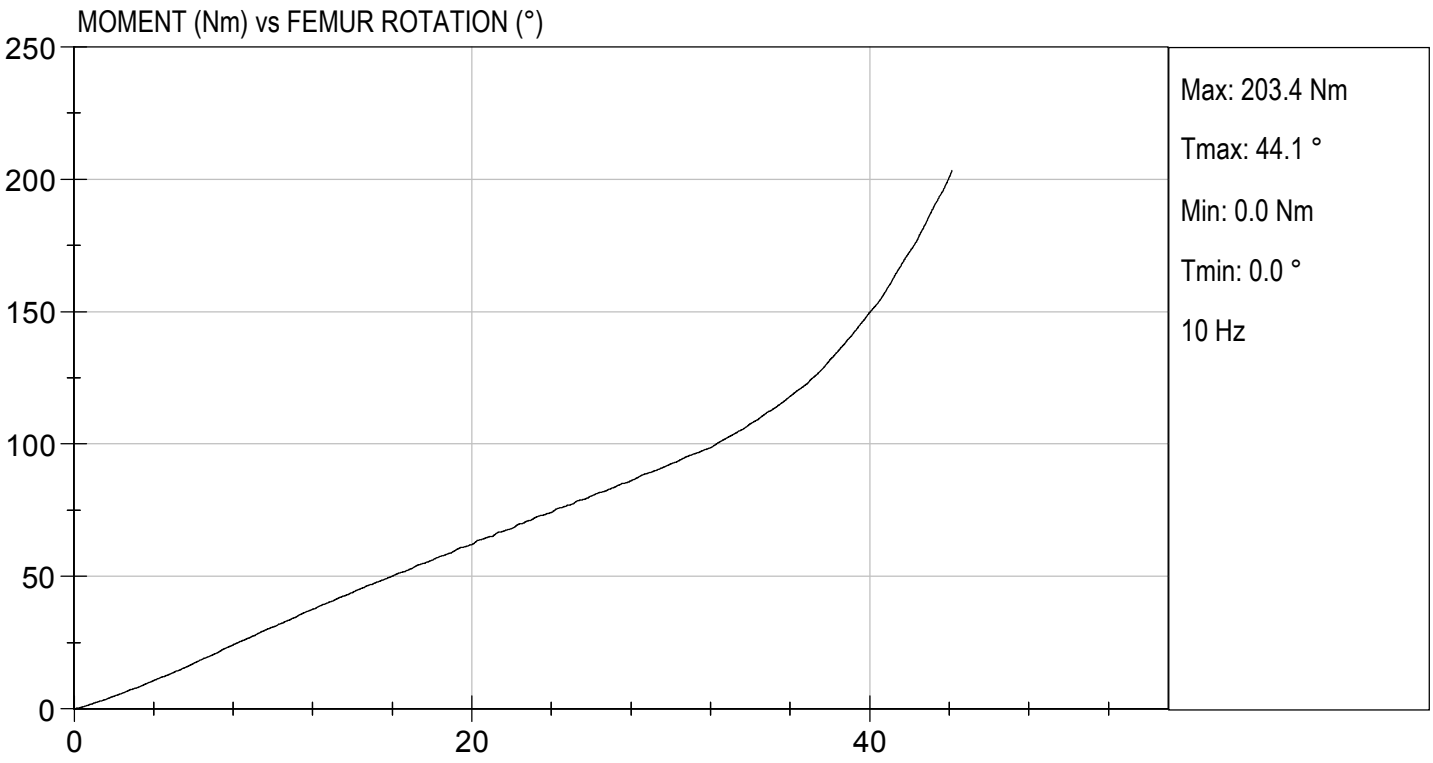
Laboratory Technician

04/15/2021
Test Date

Approved By

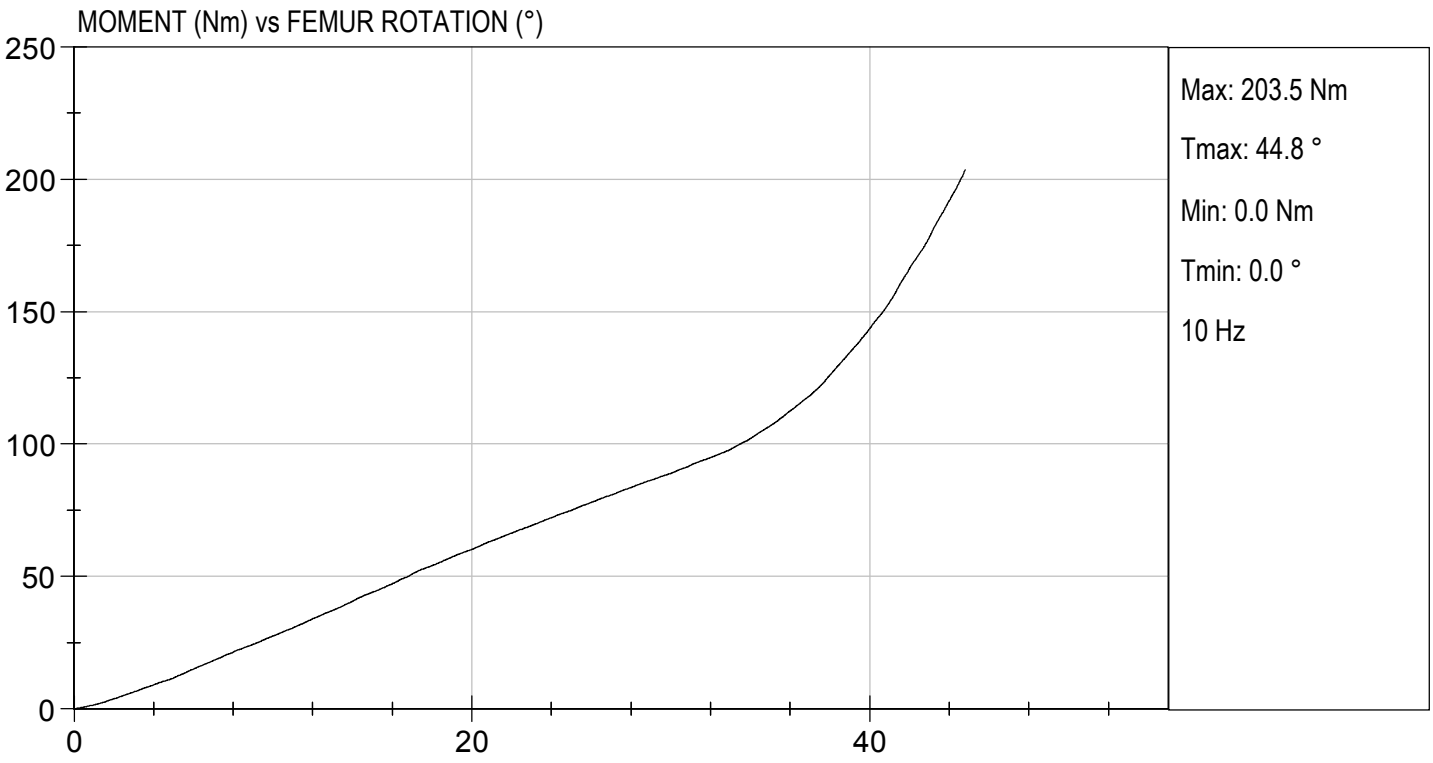
TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 04/15/2021
TEST #: D211329



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 04/15/2021
TEST #: D211320



CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

Hybrid III, 5th External Measurements
SN: DH1659

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	778
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	440
C	H-POINT HEIGHT	Reference	81.3-86.3	85
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	147
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	82
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	130
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	251
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45
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	285
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	189
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	543
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376	357
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	398
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

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	182
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	221
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	469
S	HEAD BREADTH	The widest part of the head	137.1-147.3	141
T	HEAD DEPTH	Back of the head to the forehead	177.8-188	182
U	HIP BREADTH	The widest part of the hip	299.7-314.9	306
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	357
W	FOOT BREADTH	The widest part of the foot	78.8-94	83
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. “T”	528.3-548.7	542
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	865
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	785
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test ID:** D211101

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	15	Pass
Peak Resultant Acceleration	G's	250 to 300	291	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-14.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Alex Thomas
Laboratory Technician

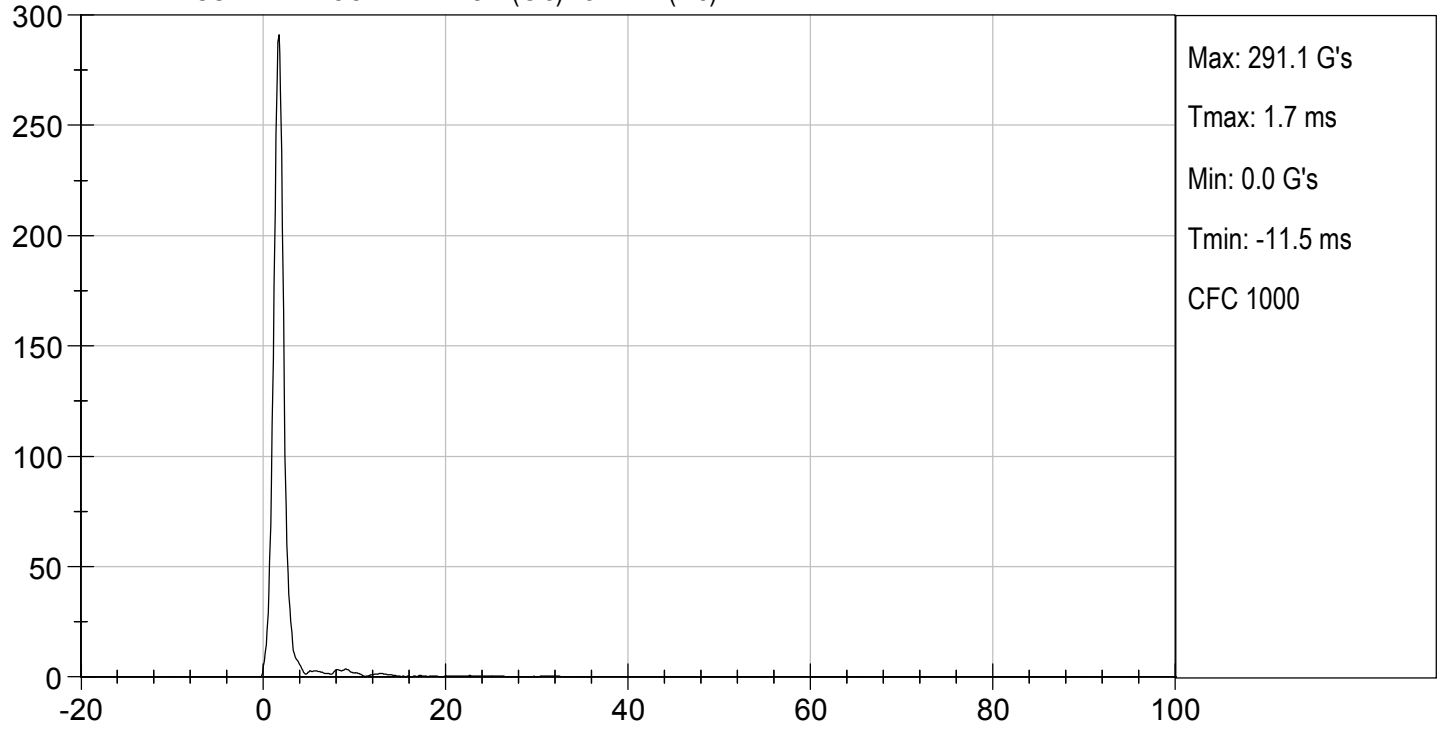
04/01/2021
Test Date

Approved By

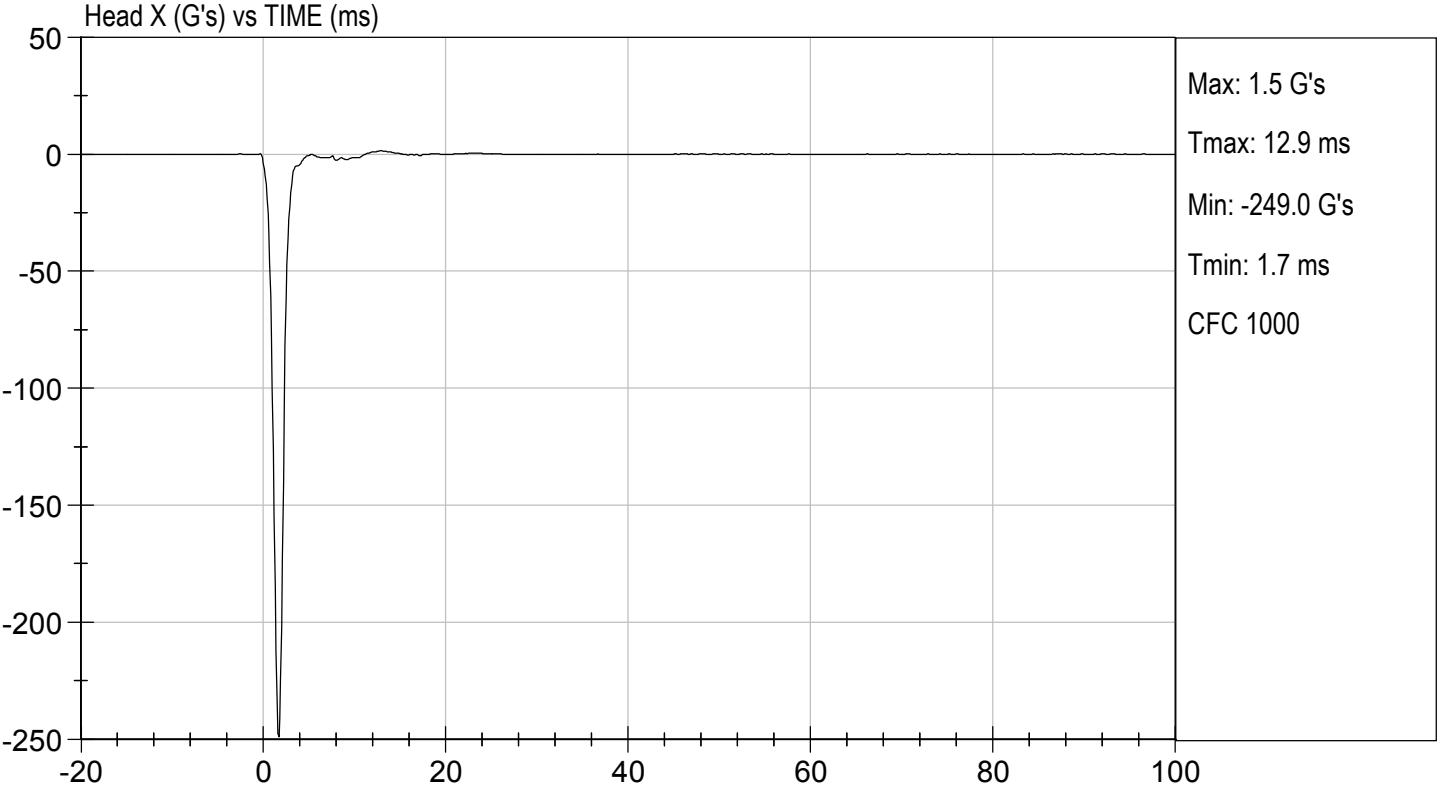
TEST DESC: HEAD DROP

TEST DATE: 04/01/2021
TEST #: D211101

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

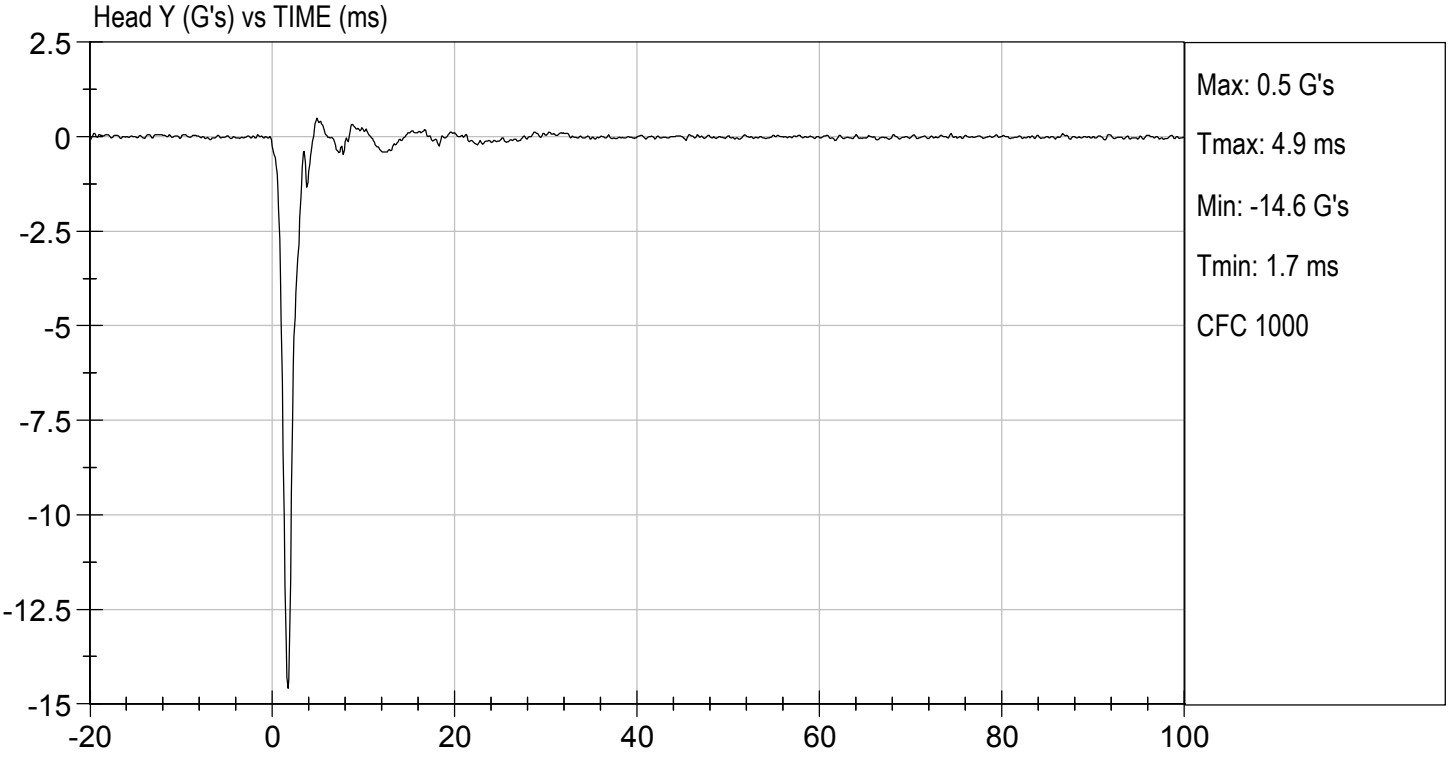


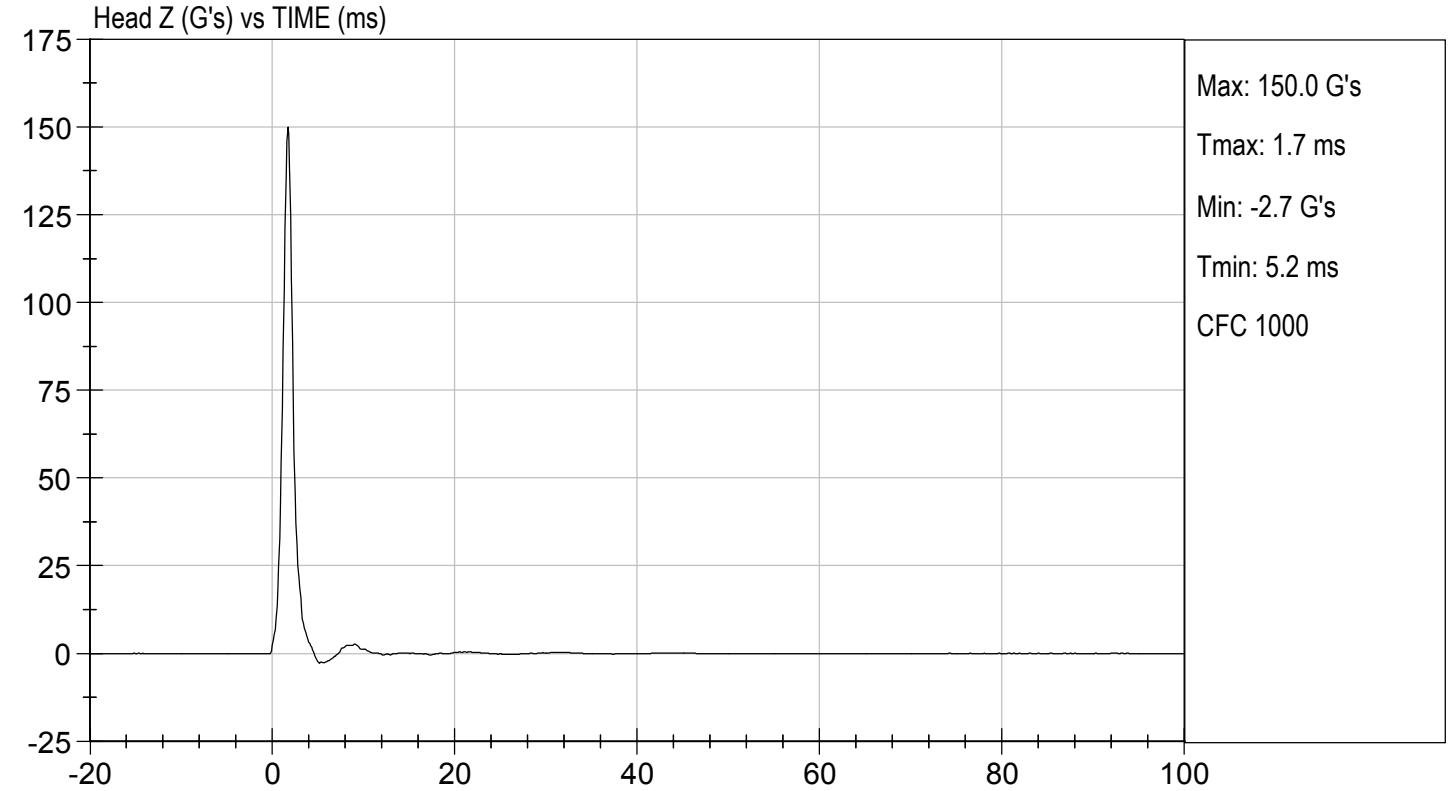
Head X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 04/01/2021
TEST #: D211101





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211102

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	17	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	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.7	Pass
D Plane Rotation	Max	deg	77 to 91	82	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

Alex Thomas

Laboratory Technician

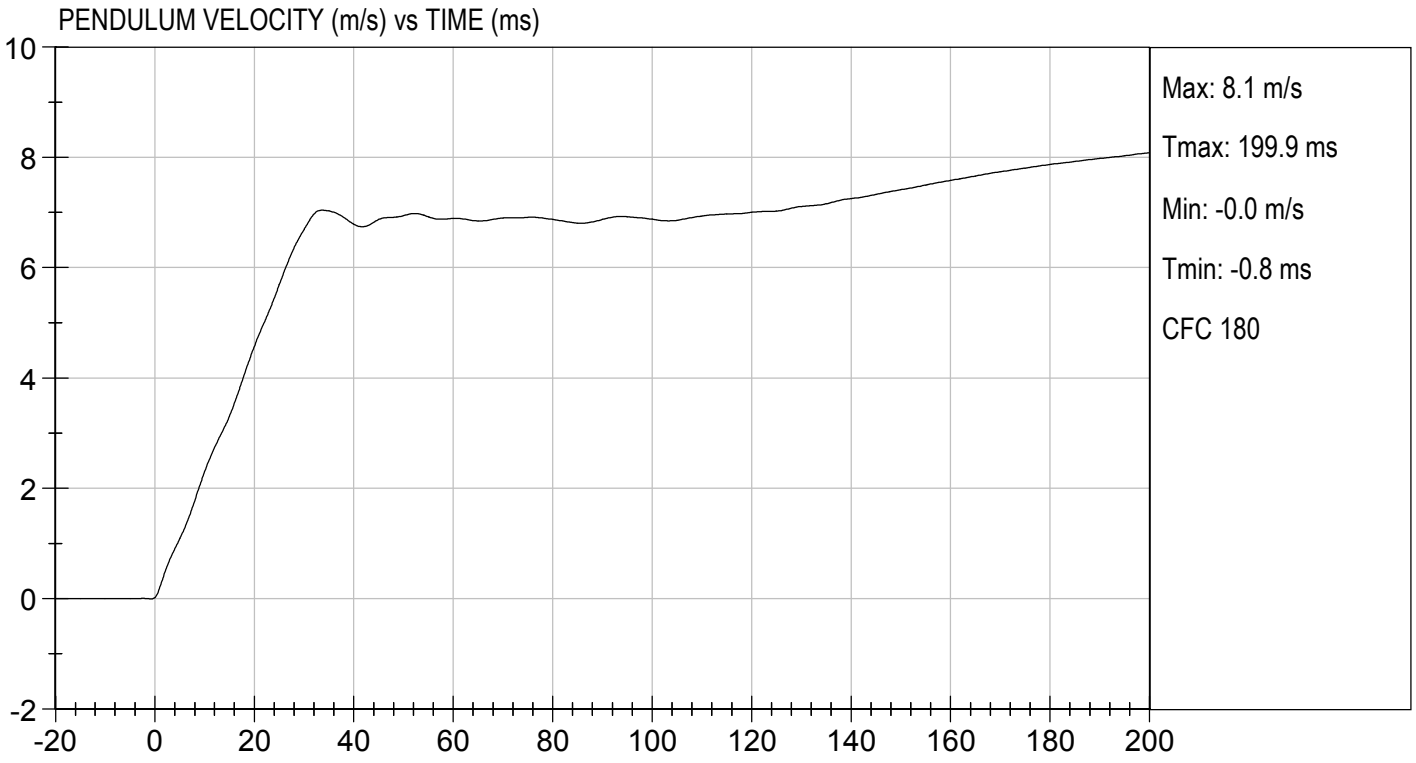
04/01/2021

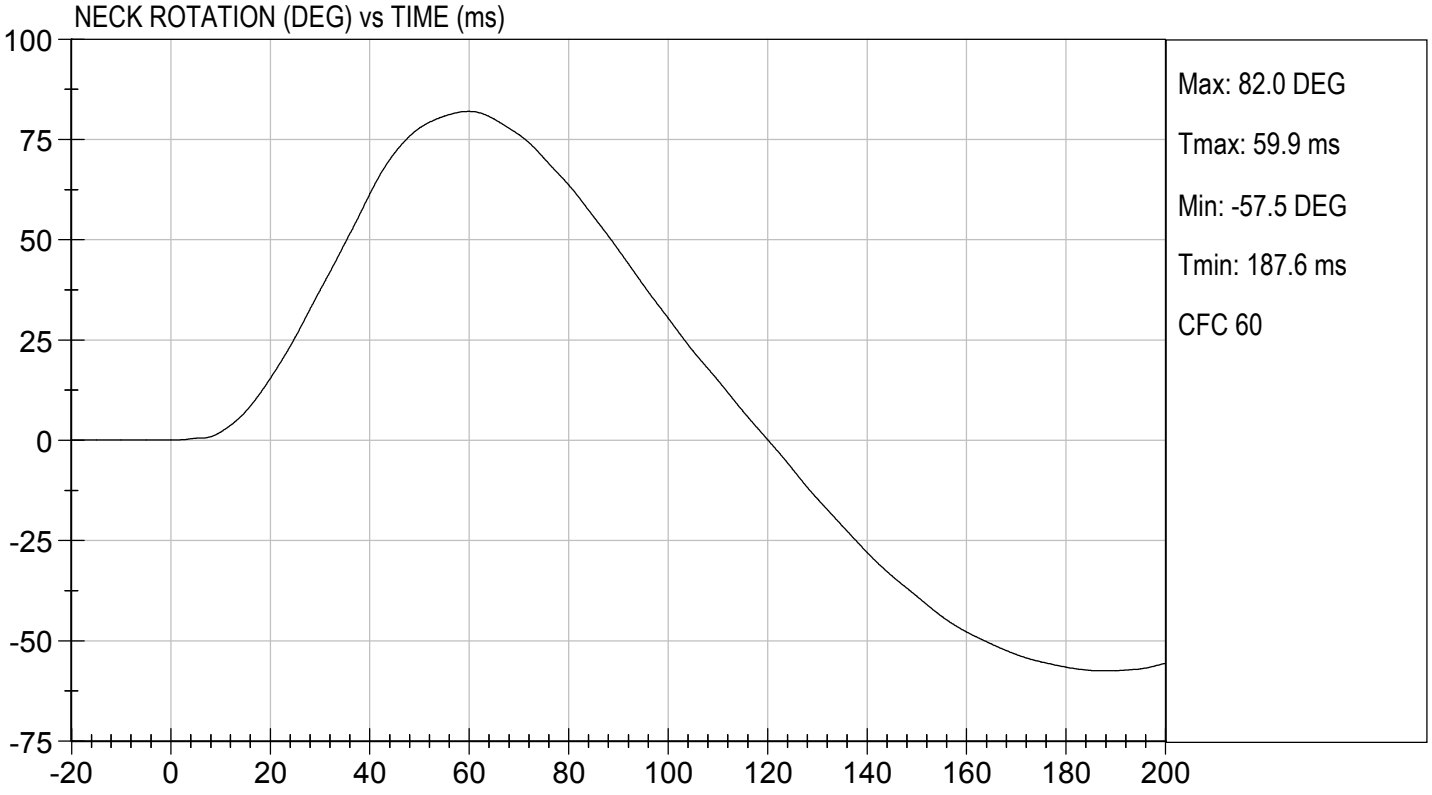
Test Date

Approved By

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

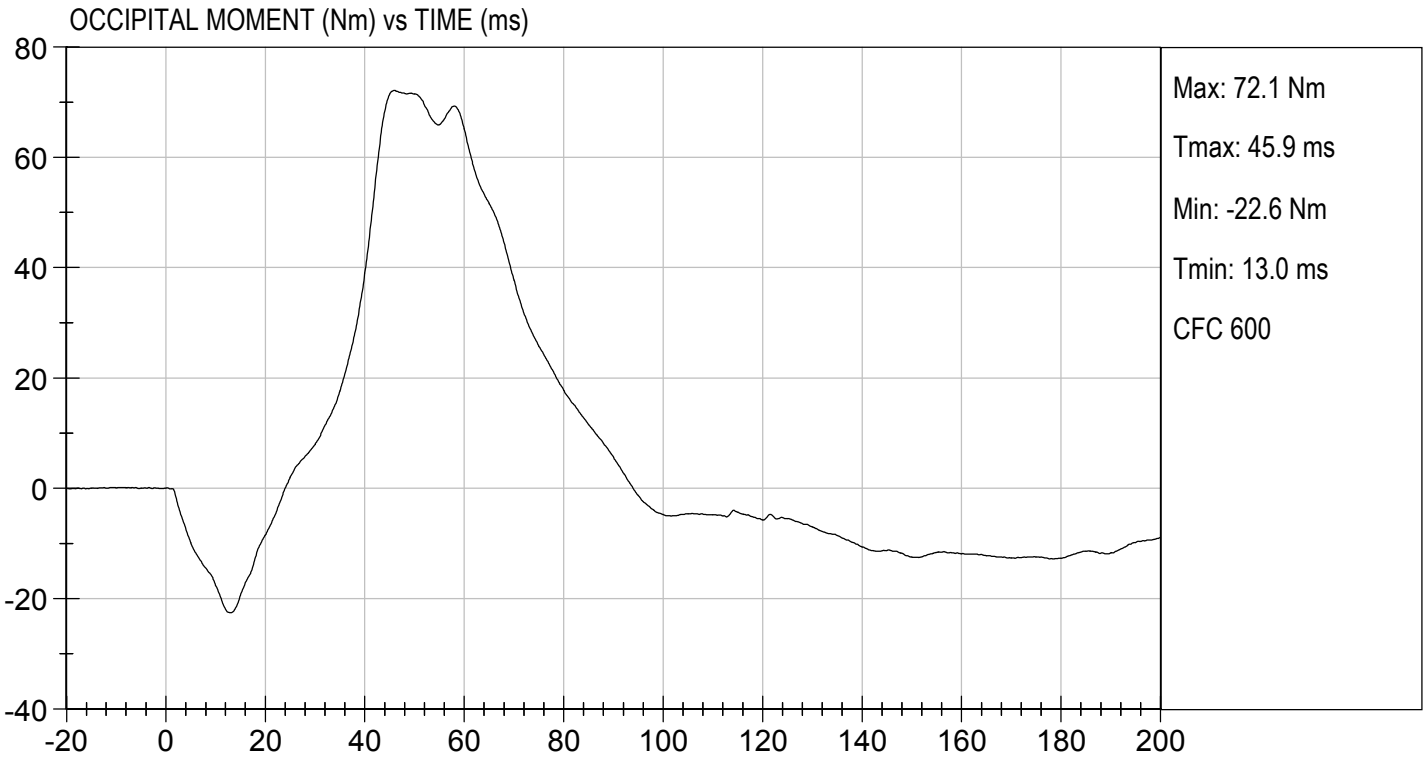
TEST DATE: 04/01/2021
TEST #: D211102





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

TEST DATE: 04/01/2021
TEST #: D211102



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211103

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	15	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.17	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.6	Pass
	20 ms	m/s	3.1 to 3.9	3.4	Pass
	30 ms	m/s	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	107	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-55	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	106	Pass
			Overall Results		Pass

Alex Thomas

Laboratory Technician

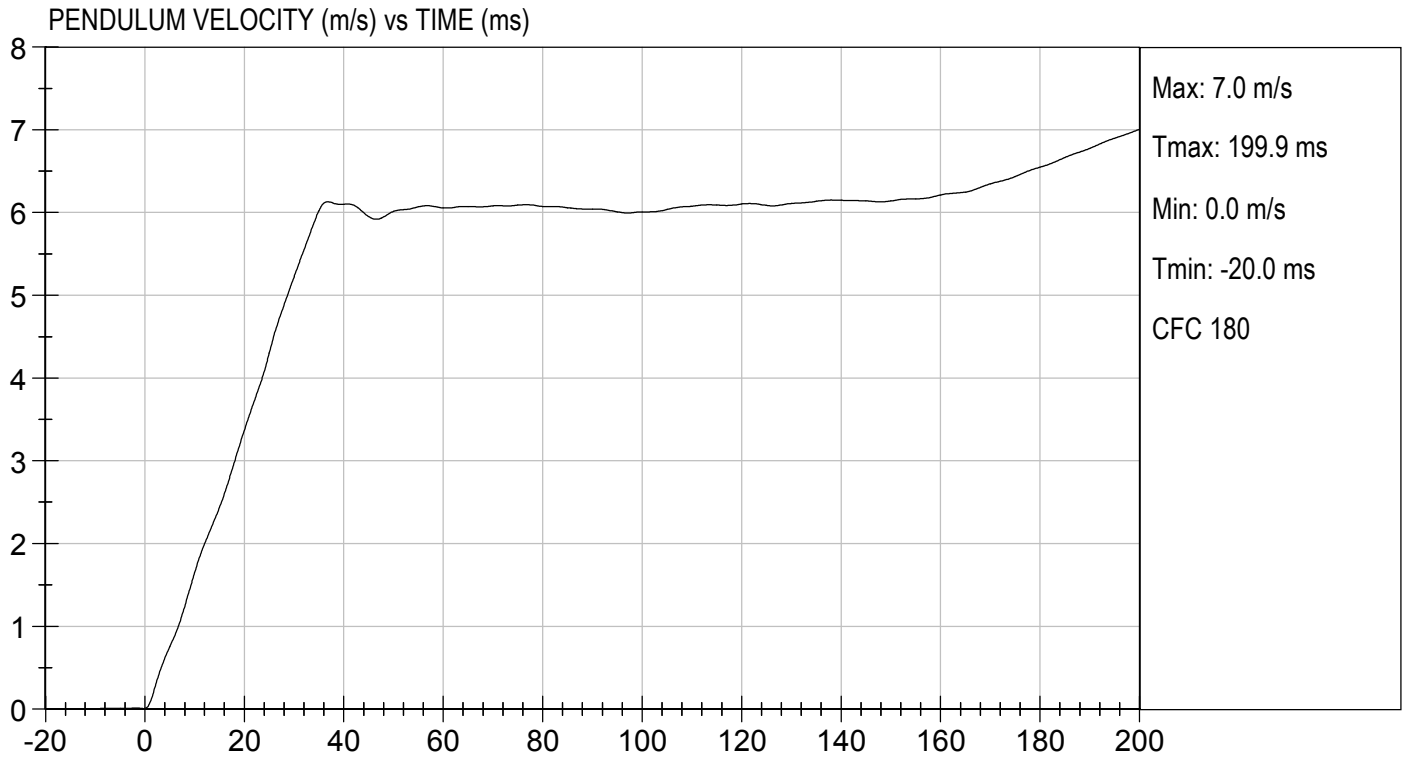
04/01/2021

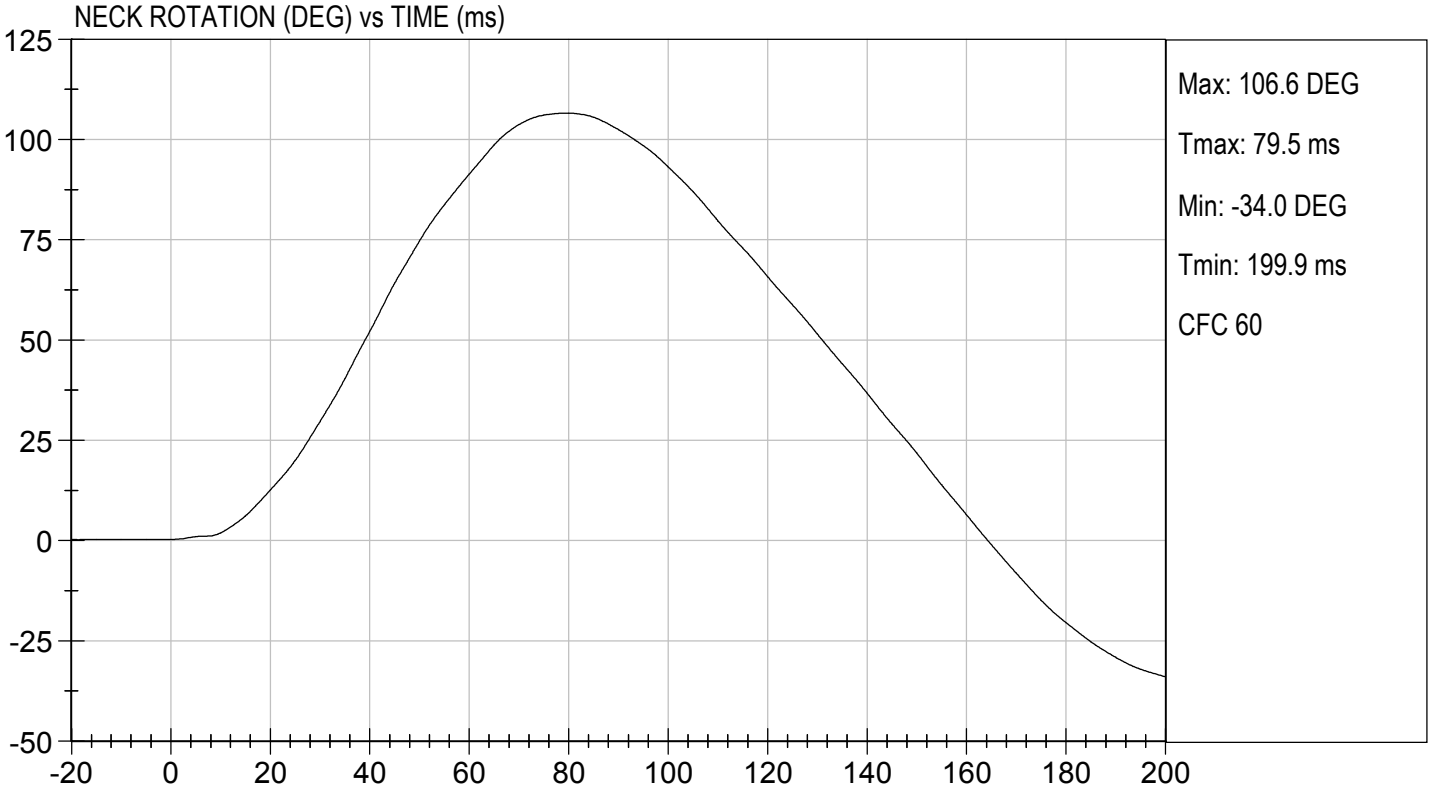
Test Date

Approved By

TEST DESC: NECK EXTENSION
VELOCITY: 20.24 ft/s, 6.17 m/s

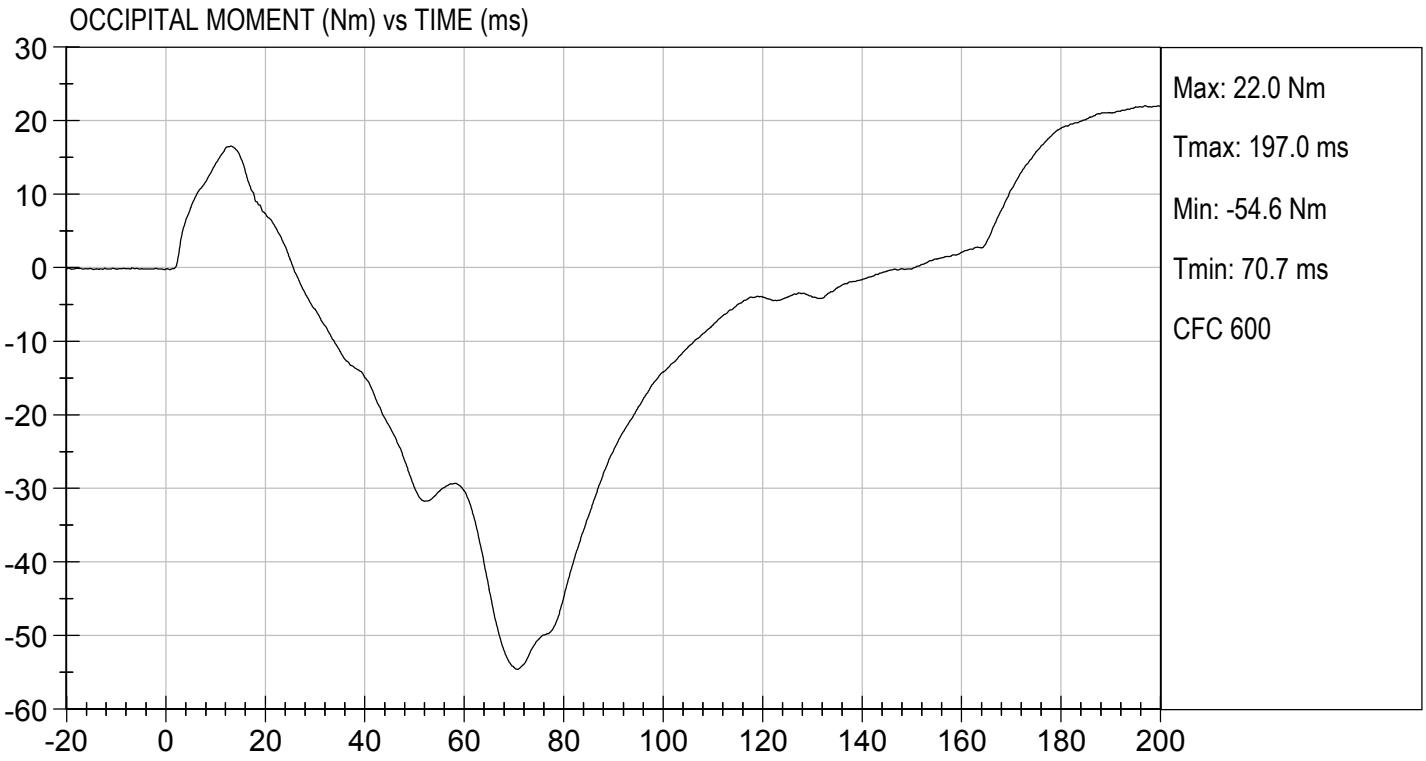
TEST DATE: 04/01/2021
TEST #: D211103





TEST DESC: NECK EXTENSION
VELOCITY: 20.24 ft/s, 6.17 m/s

TEST DATE: 04/01/2021
TEST #: D211103



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211104

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22	Pass
Relative Humidity	%	10 to 70	23	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4260	Pass
Internal Hysteresis	%	69 to 85	74	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4475	Pass
		Overall Test Results		Pass

Laboratory Technician

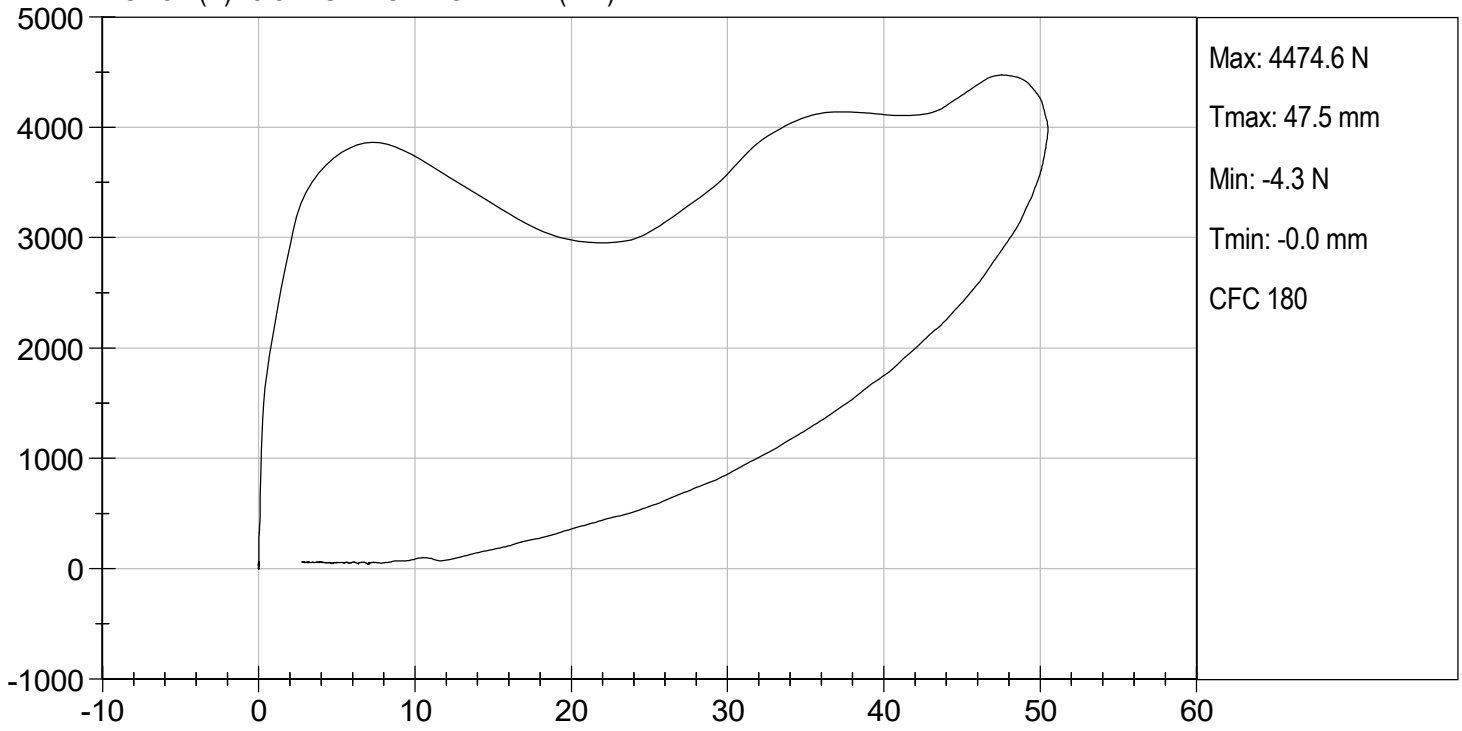
03/31/2021
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 03/31/2021
TEST #: D211104

FORCE (N) vs CHEST DISPLACEMENT (mm)



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211105

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	N	3450 to 4060	3732	Pass
		Overall Test Results		Pass

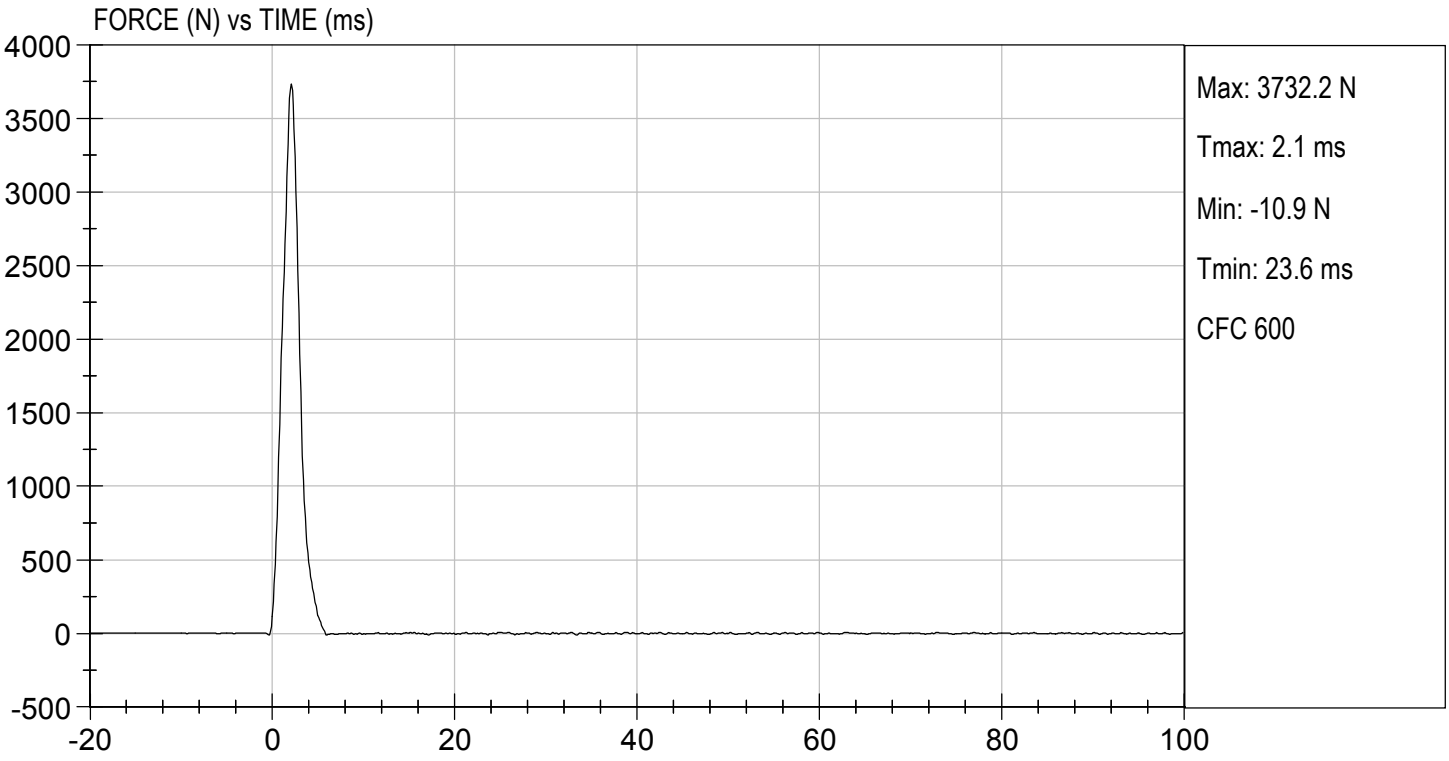
Laboratory Technician

04/01/2021
Test Date

Approved By

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

TEST DATE: 04/01/2021
TEST #: D211105



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211106

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	N	3450 to 4060	3630	Pass
		Overall Test Results		Pass

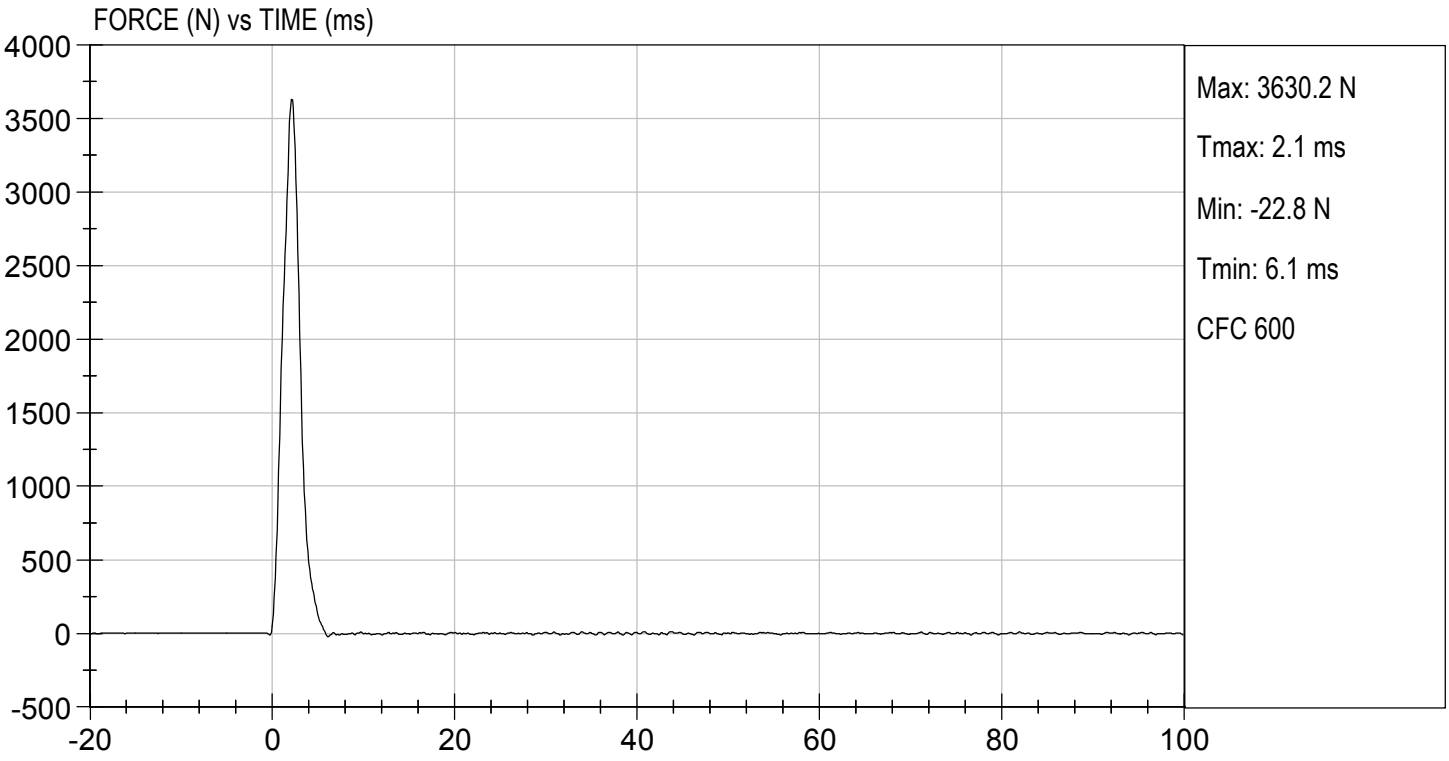
Laboratory Technician

04/01/2021
Test Date

Approved By

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

TEST DATE: 04/01/2021
TEST #: D211106



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211107

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	15	Pass
Initial Angle	deg	0 to 20	20	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	328	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
		Overall Result		Pass

Laboratory Technician

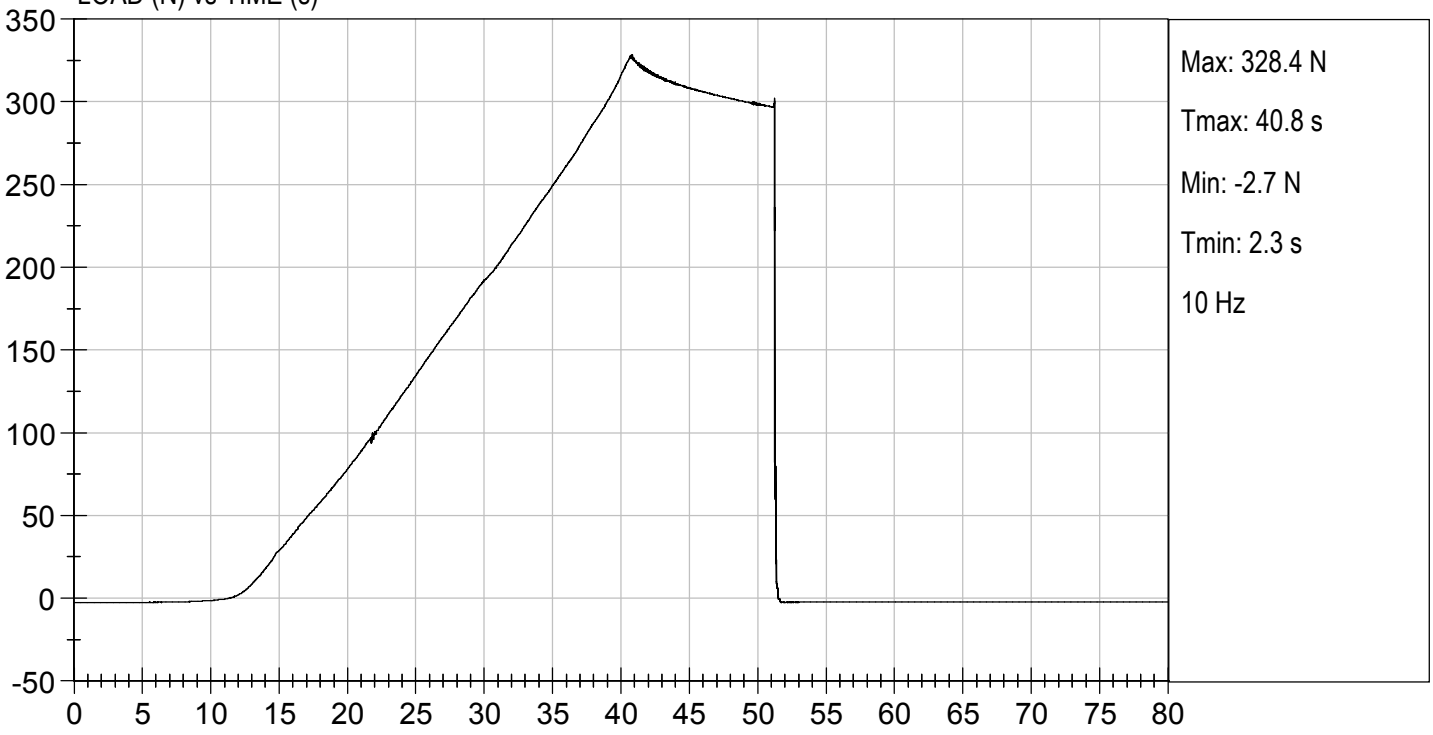
04/01/2021
Test Date

Approved By

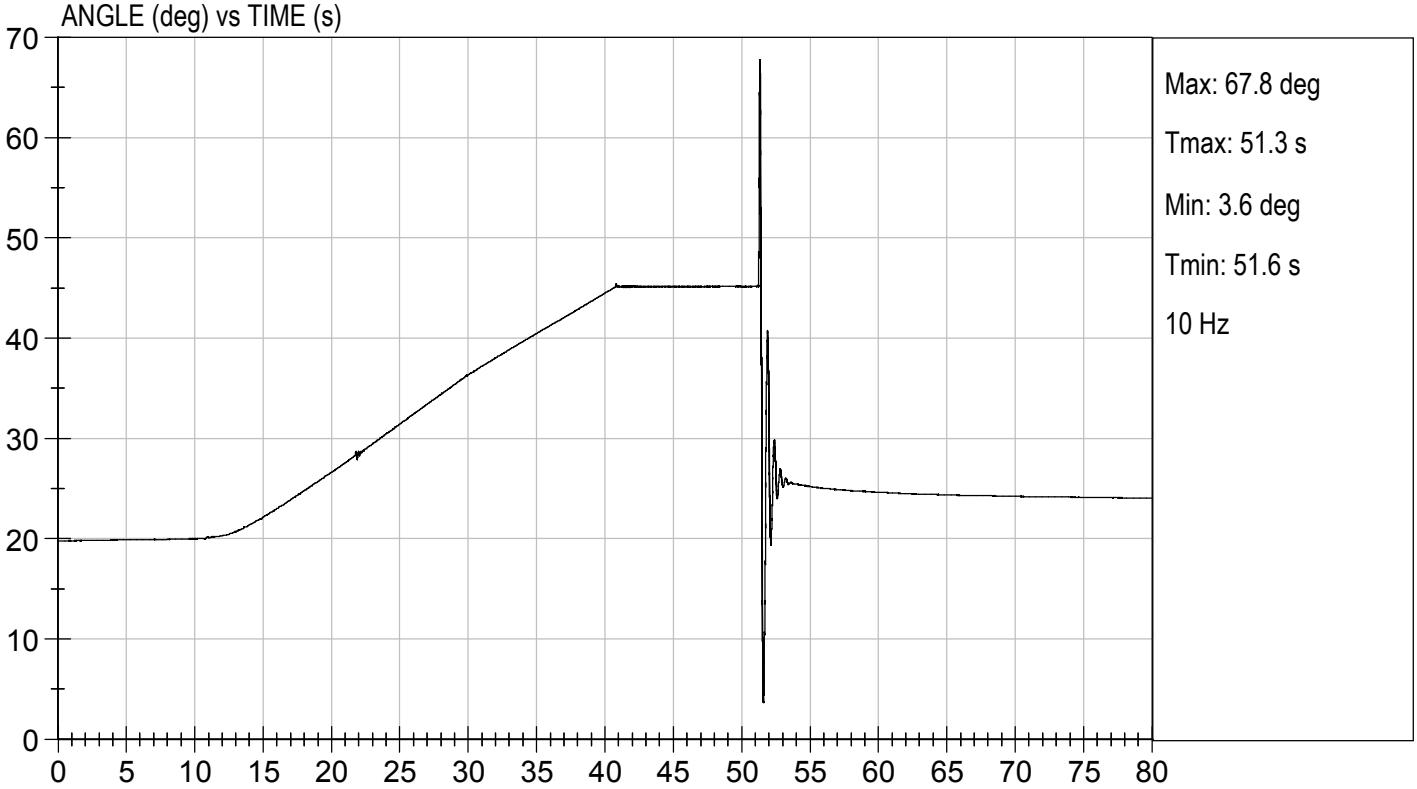
TEST DESC: LUMBAR FLEXION

TEST DATE: 04/01/2021
TEST #: D211107

LOAD (N) vs TIME (s)



ANGLE (deg) vs TIME (s)



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: DH1659 **Test ID:** D211331

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Peak Resultant Acceleration	G's	250 to 300	278	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

Gerald Guerrero
Laboratory Technician

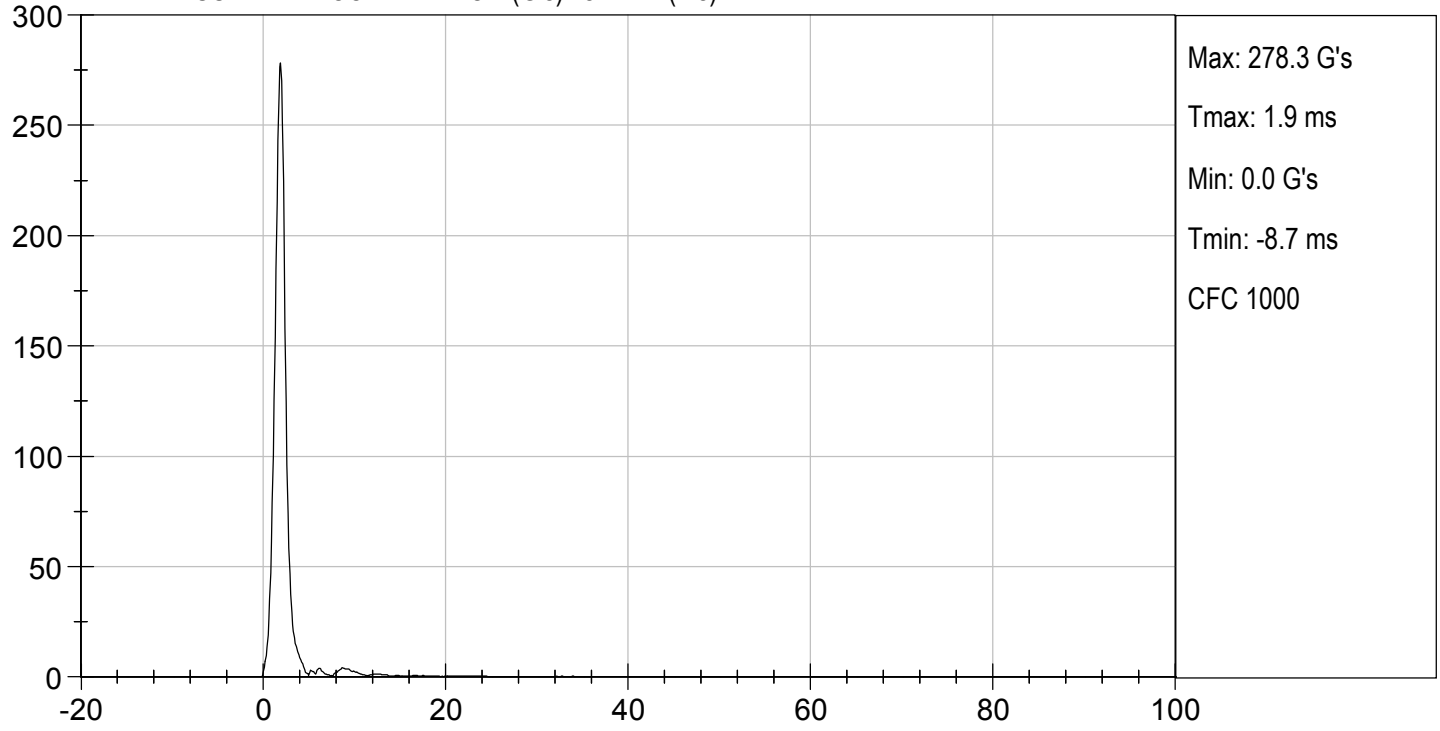
04/15/2021
Test Date

Approved By

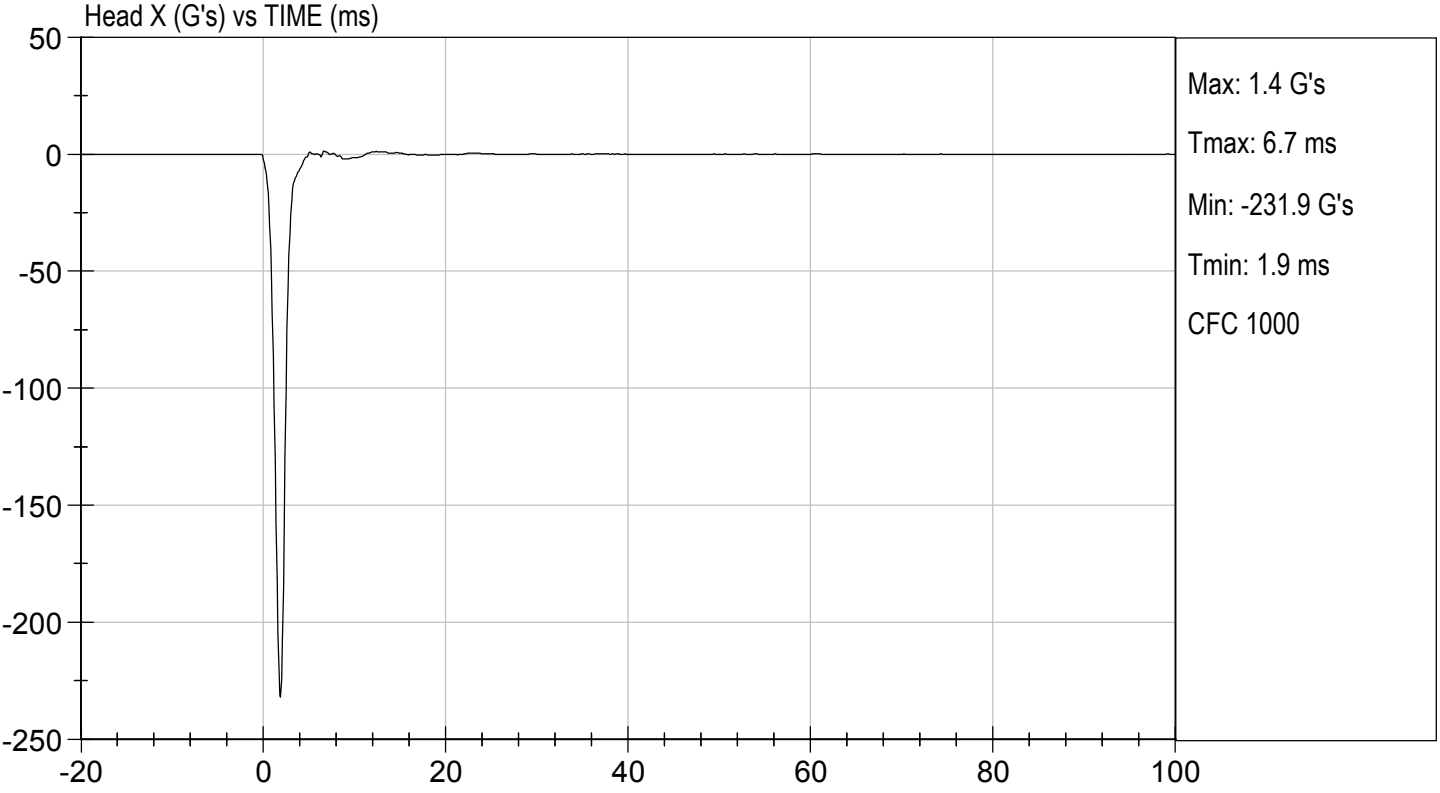
TEST DESC: HEAD DROP

TEST DATE: 04/15/2021
TEST #: D211331

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

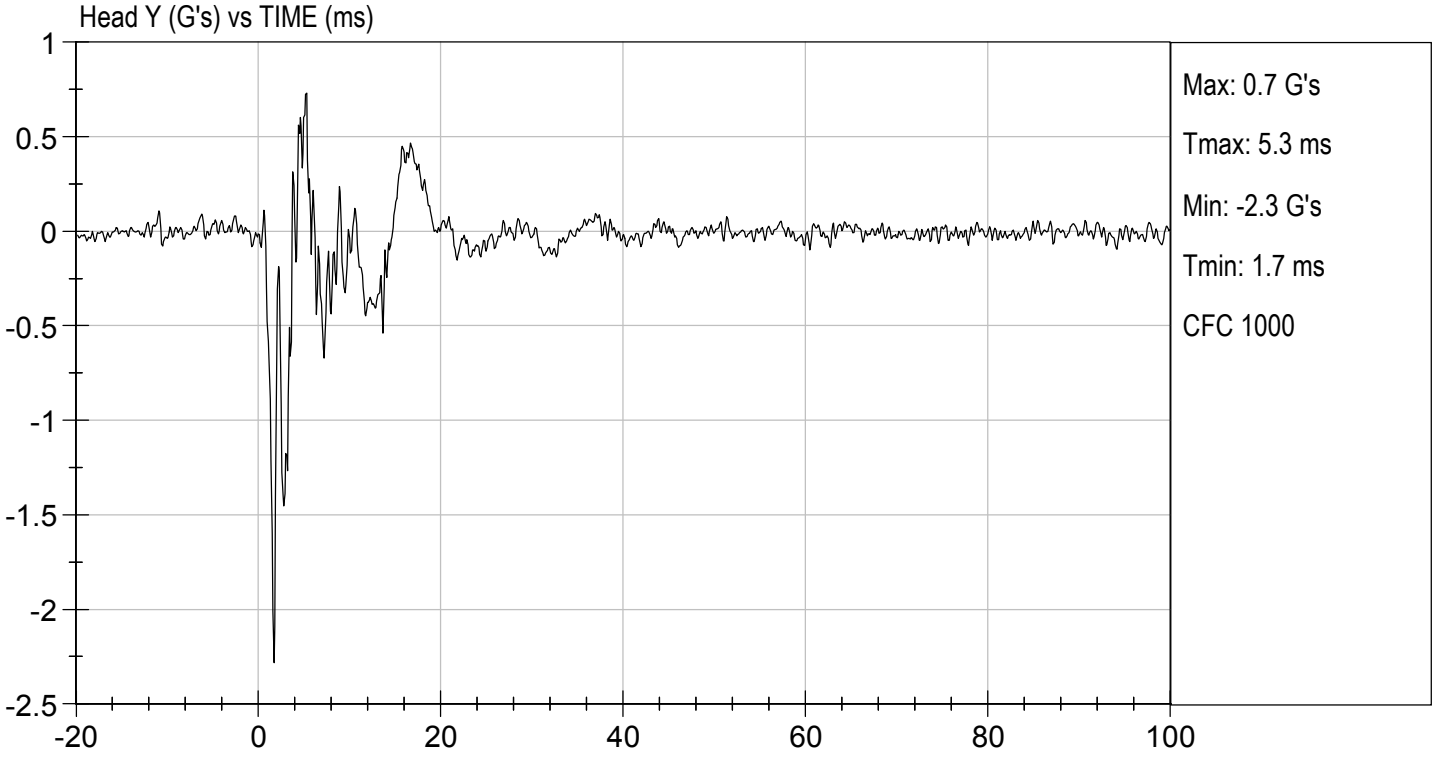


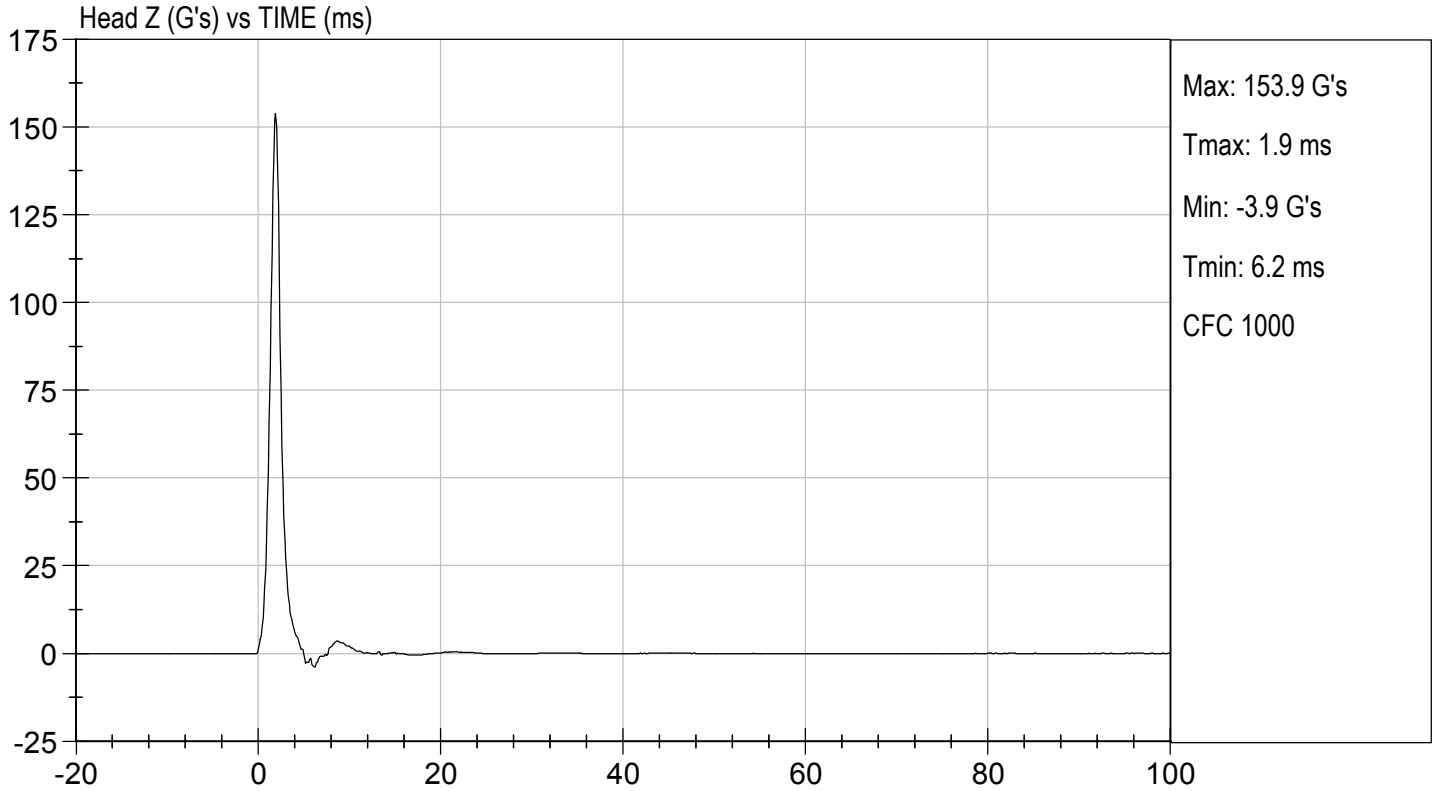
Head X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 04/15/2021
TEST #: D211331





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211332

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	29	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.2	Pass
	20 ms	m/s	4.0 to 5.0	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.5	Pass
D Plane Rotation	Max	deg	77 to 91	80	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	86	Pass
			Overall Results		Pass

Gerald Guerrero
Laboratory Technician

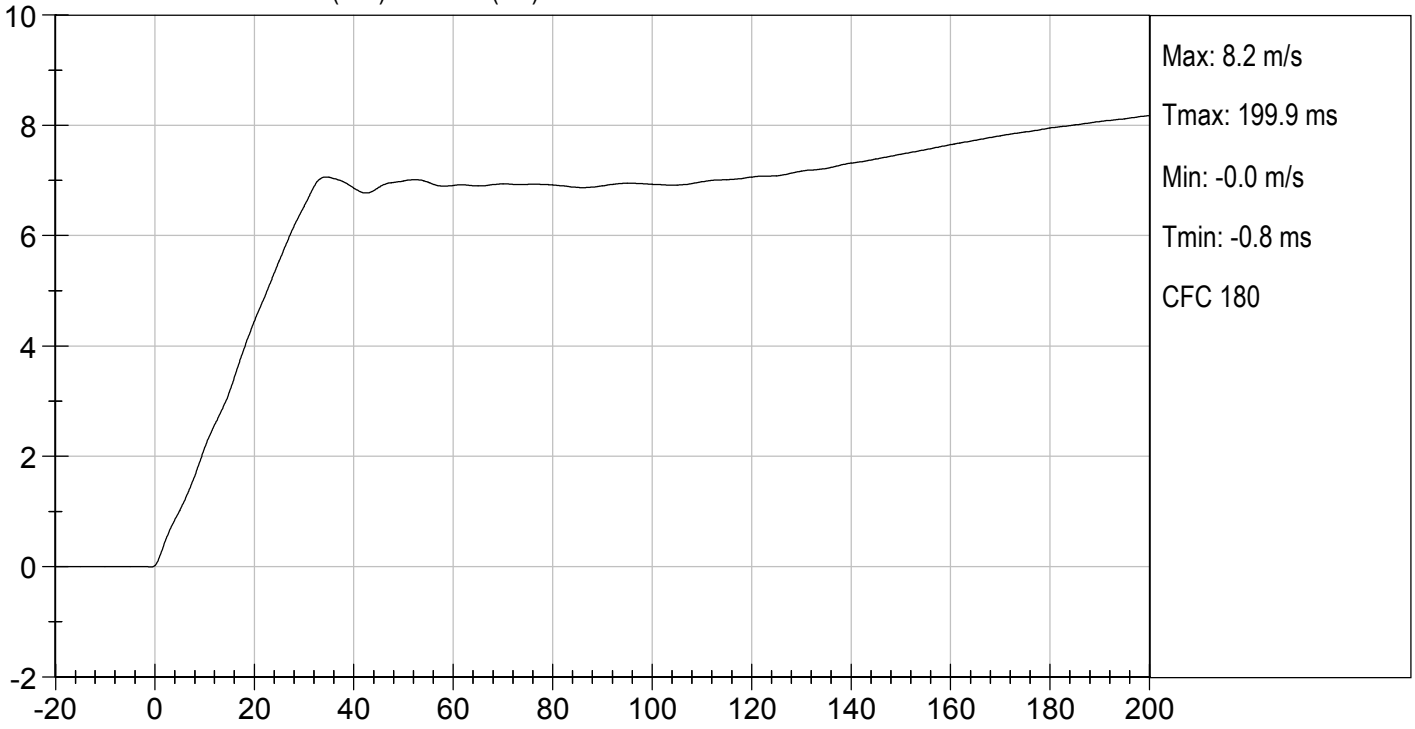
04/15/2021
Test Date

Approved By

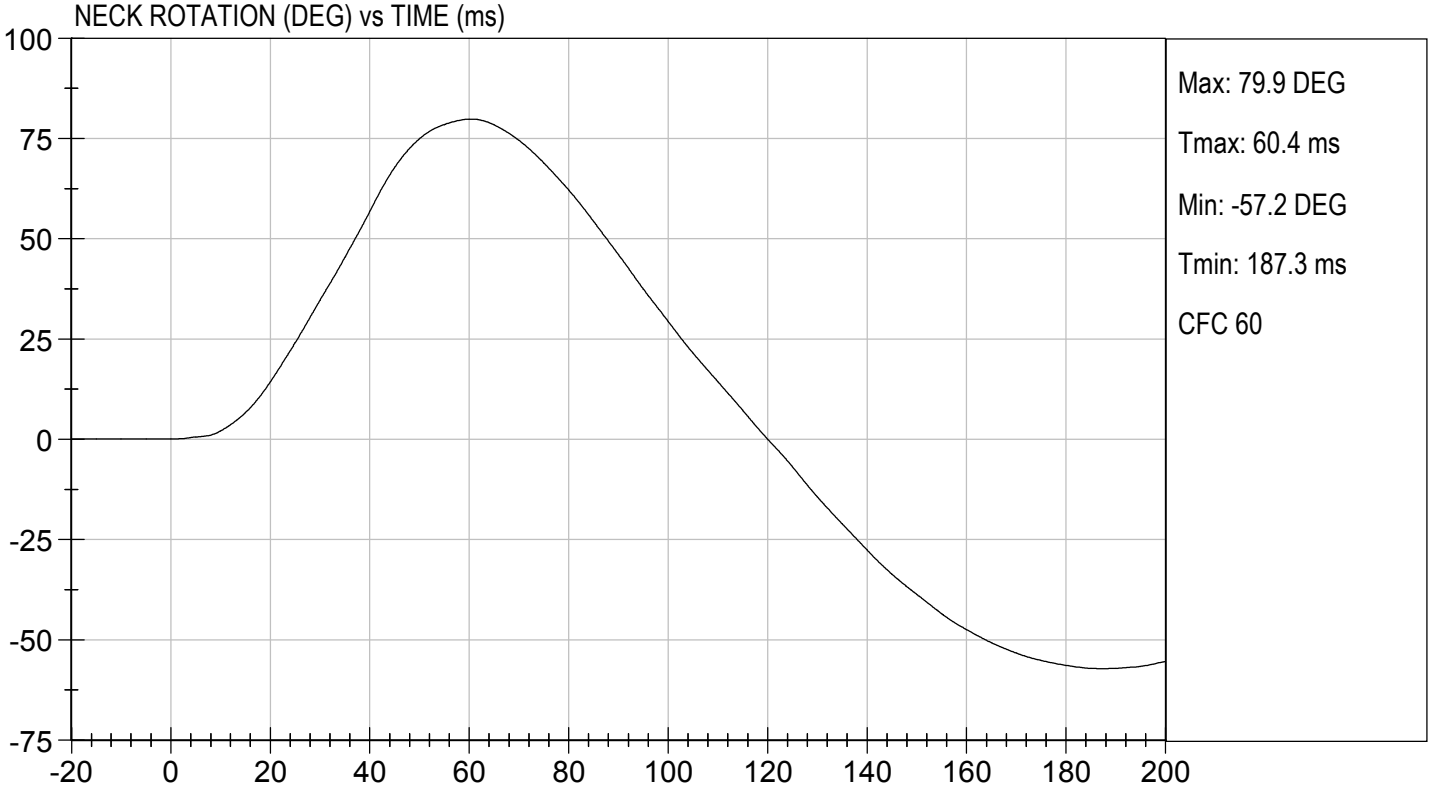
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 04/15/2021
TEST #: D211332

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

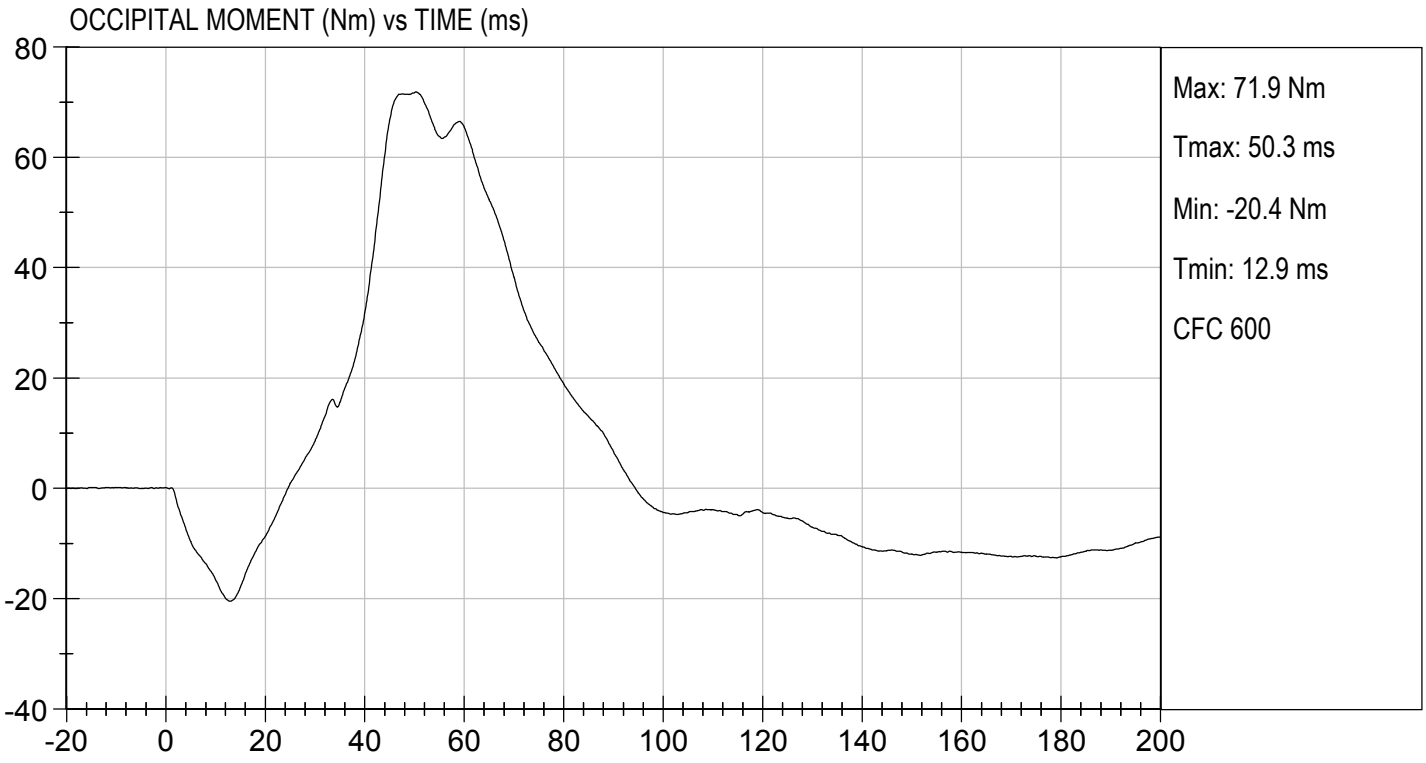


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 04/15/2021
TEST #: D211332



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211333

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	29	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	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	5.4	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-58	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	106	Pass
			Overall Results		Pass

Gerald Guerrero
Laboratory Technician

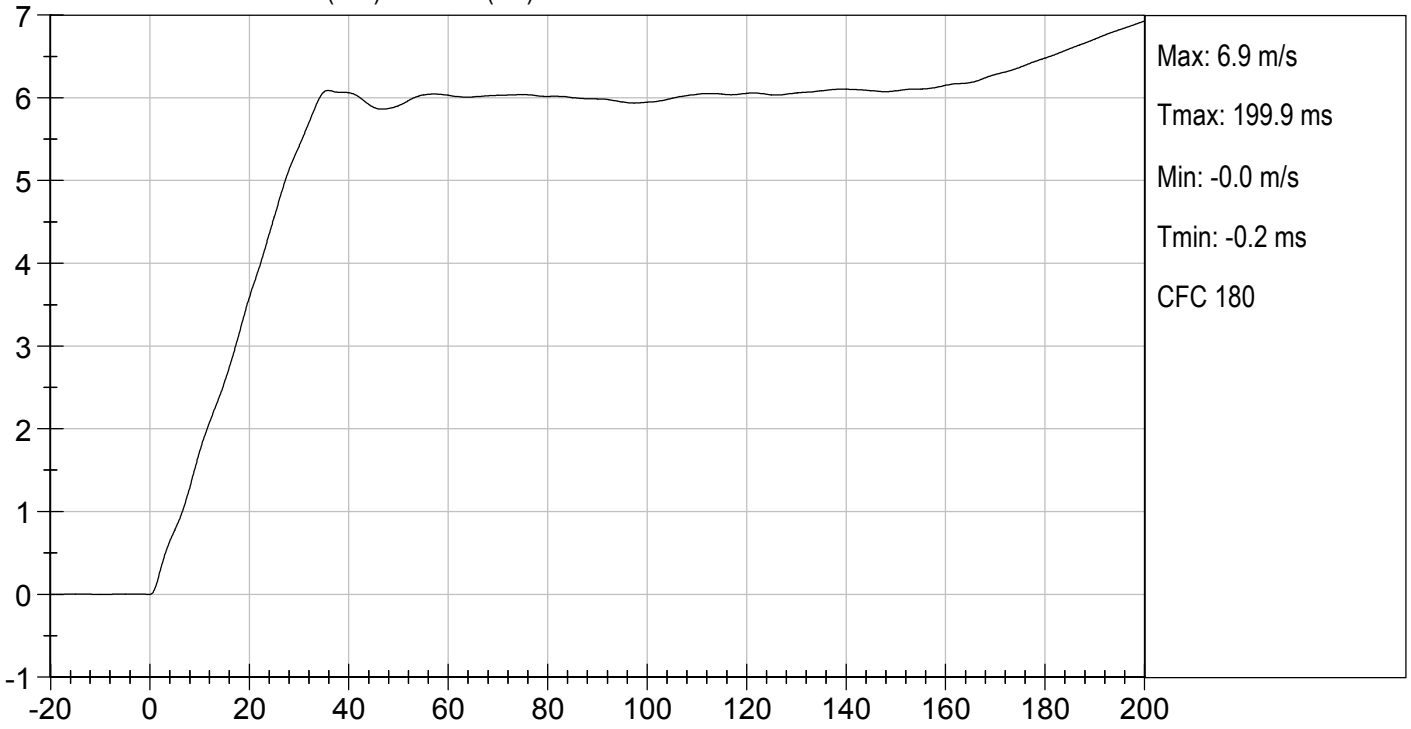
04/15/2021
Test Date

Approved By

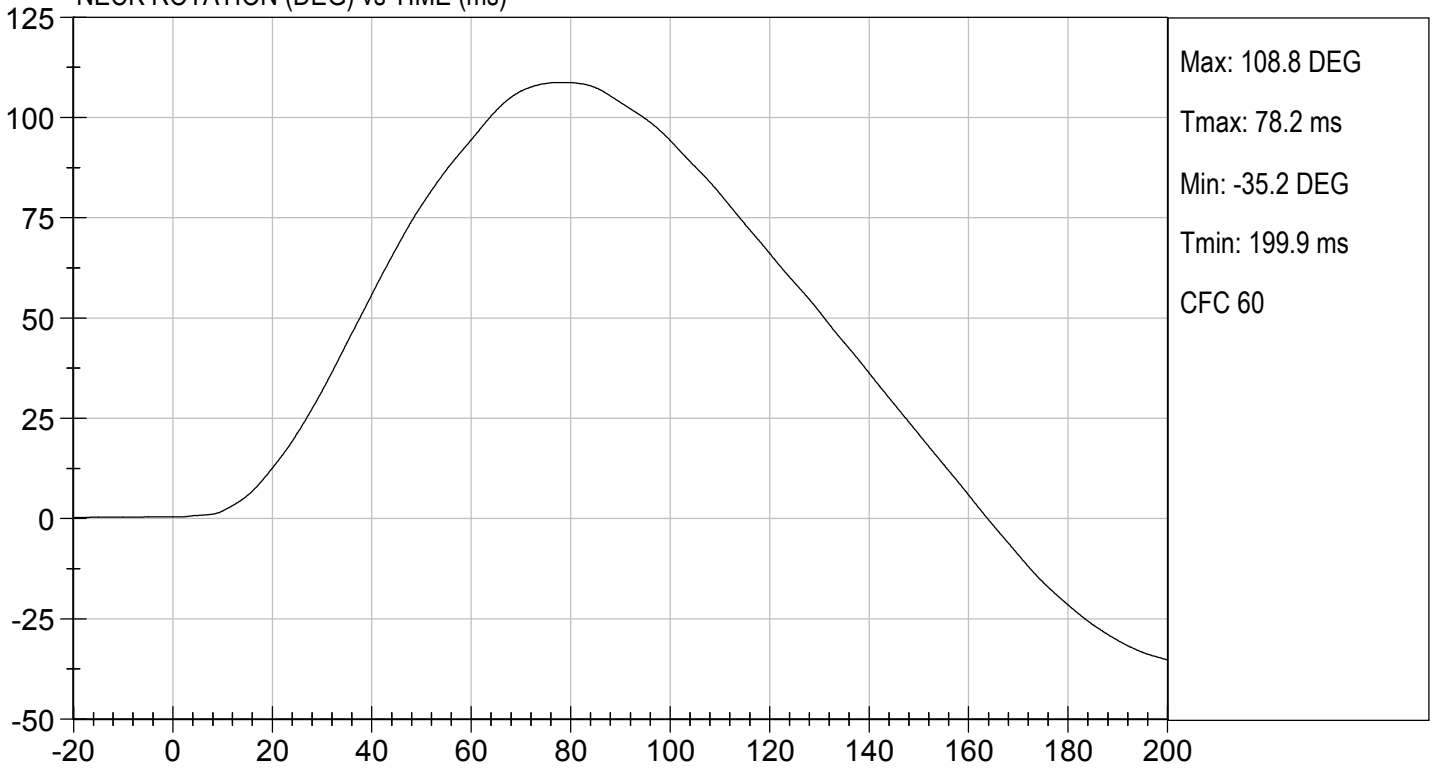
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 04/15/2021
TEST #: D211333

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

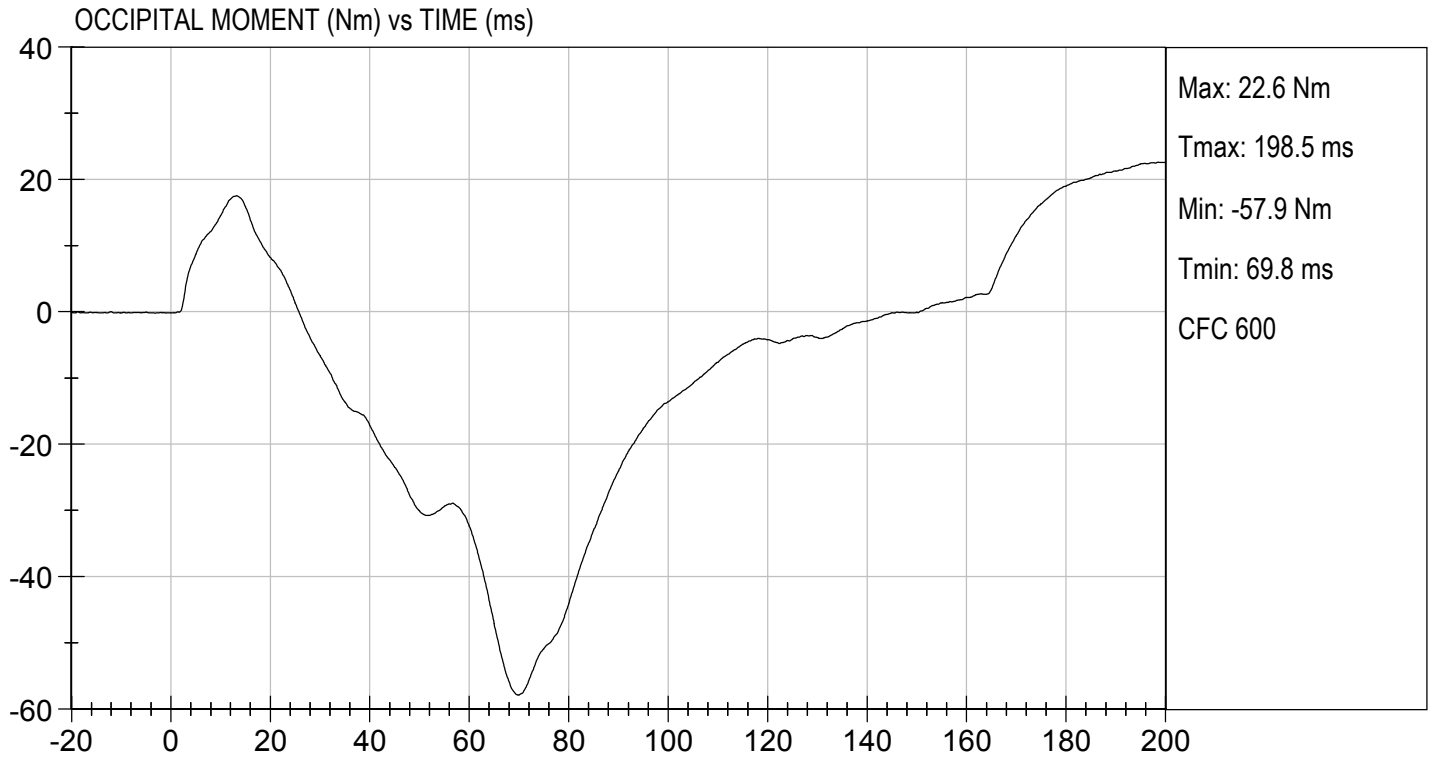


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 04/15/2021
TEST #: D211333



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211334

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21	Pass
Relative Humidity	%	10 to 70	28	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4329	Pass
Internal Hysteresis	%	69 to 85	74	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4422	Pass
		Overall Test Results		Pass

Gerald Guerrero
Laboratory Technician

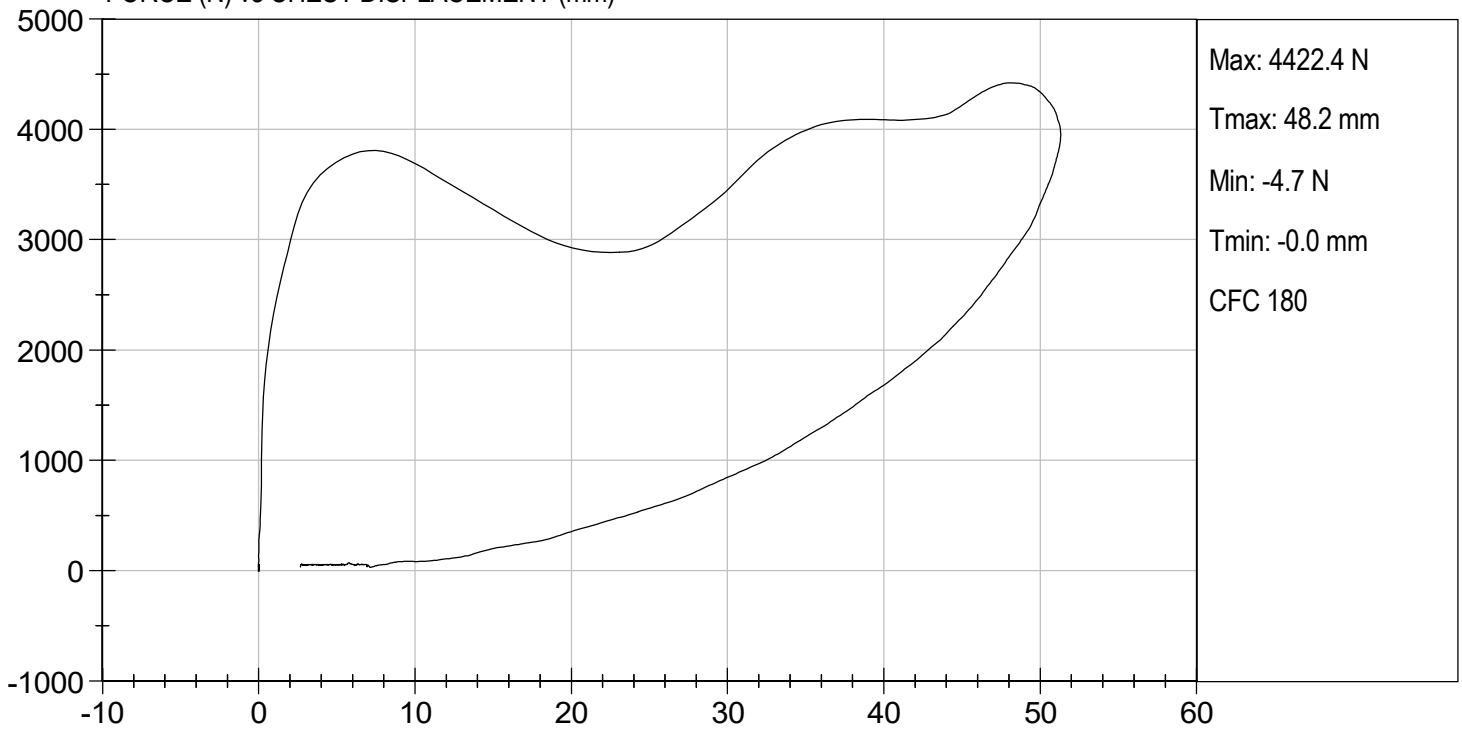
04/16/2021
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 04/16/2021
TEST #: D211334

FORCE (N) vs CHEST DISPLACEMENT (mm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211335

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3925	Pass
		Overall Test Results		Pass

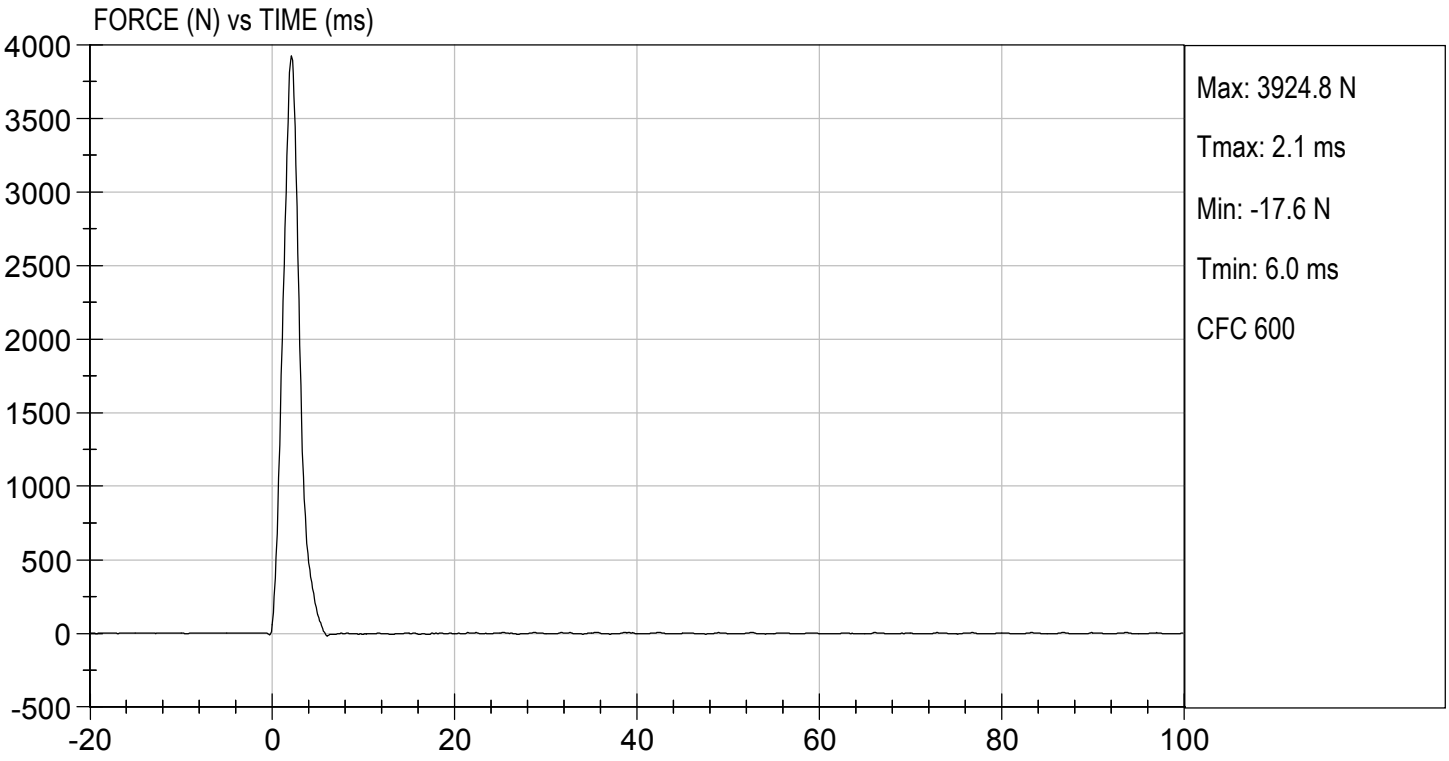
Gerald Guerrero
Laboratory Technician

04/15/2021
Test Date

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 04/15/2021
TEST #: D211335



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D211336

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3735	Pass
		Overall Test Results		Pass

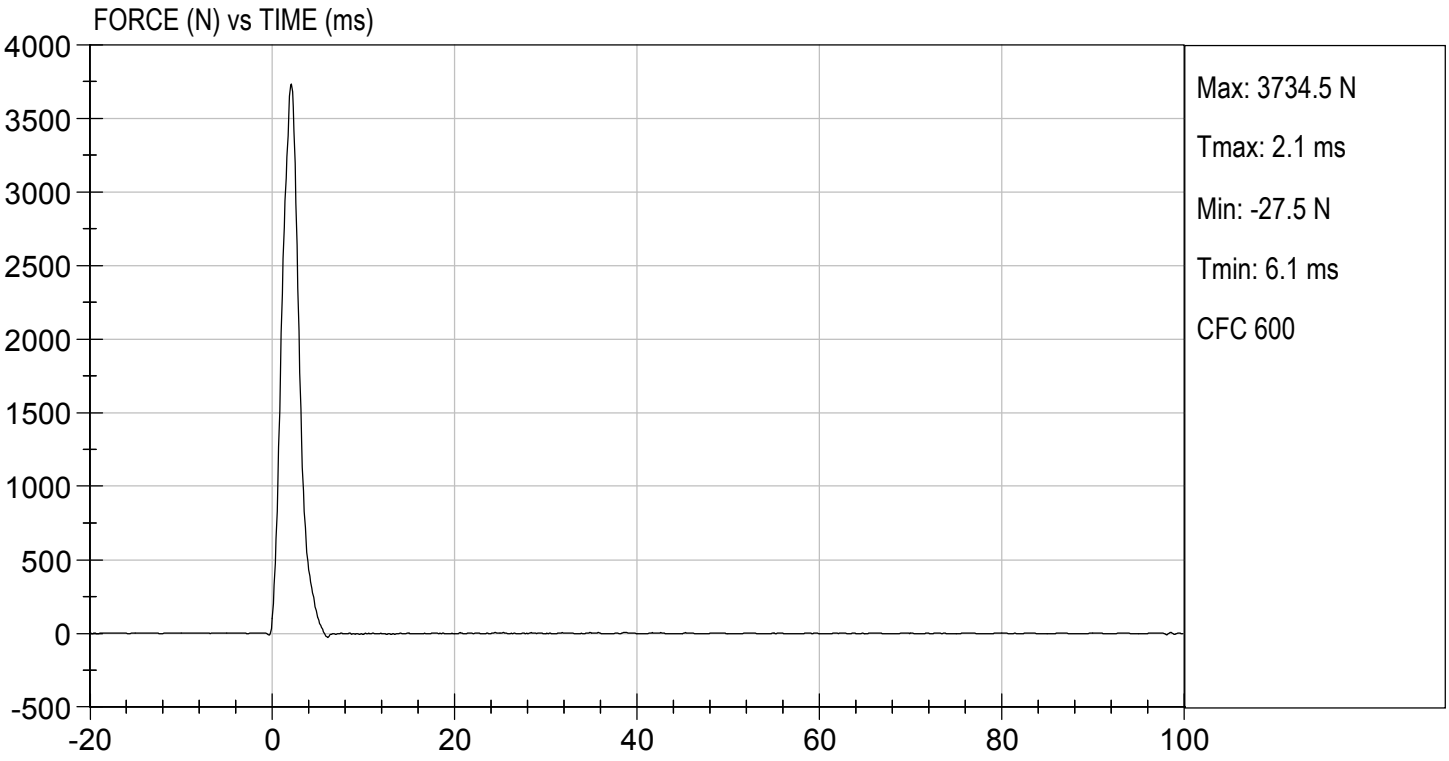
Gerald Guerrero
Laboratory Technician

04/15/2021
Test Date

Approved By

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

TEST DATE: 04/15/2021
TEST #: D211336



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

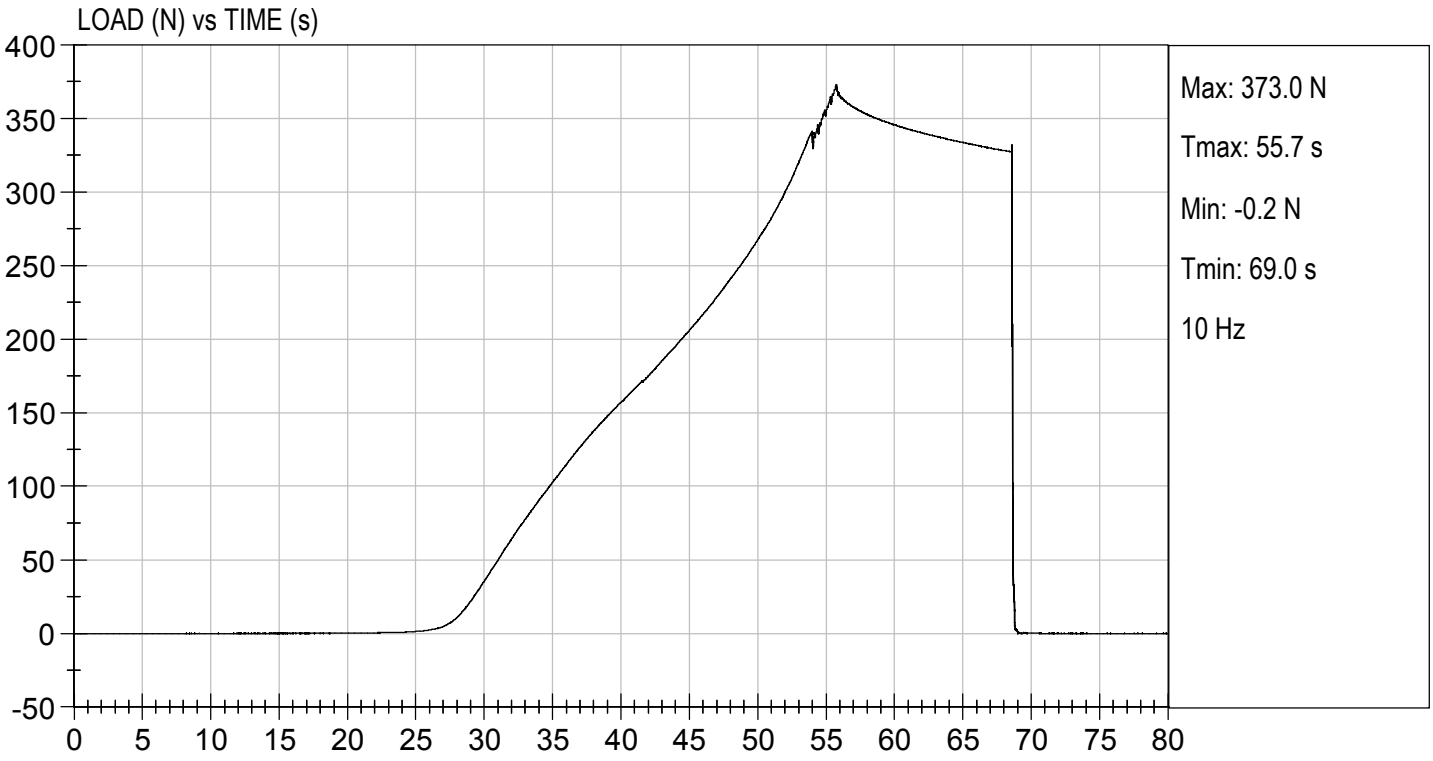
ATD Serial No: DH1659 **Test I.D:** D211337

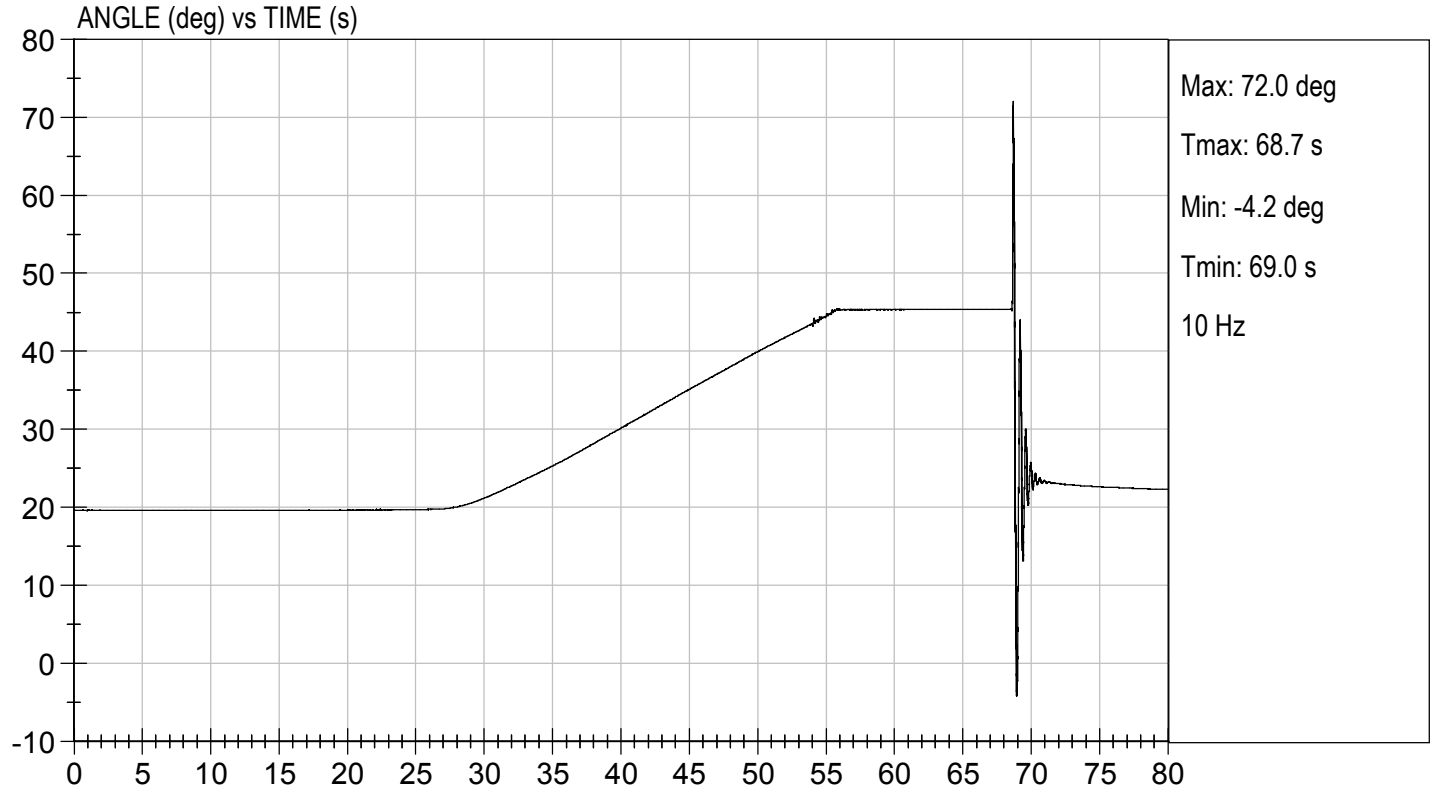
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Initial Angle	deg	0 to 20	20	Pass
Return Angle	deg	+/- 8	2	Pass
Force at 45 deg	N	320 to 390	373	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
		Overall Result		Pass

Gerald Guerrero
Laboratory Technician

04/15/2021
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: 373.0 N
Tmax: 55.7 s
Min: -0.2 N
Tmin: 69.0 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: 72.0 deg
Tmax: 68.7 s
Min: -4.2 deg
Tmin: 69.0 s
10 Hz

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	03/01/2021
			Y	P79743	Endevco	03/01/2021
			Z	P79744	Endevco	03/01/2021
		Redundant	X	P94834	Endevco	03/01/2021
			Y	P94856	Endevco	03/01/2021
			Z	P97412	Endevco	03/01/2021
Head Angular Rate Sensors			X	ARS7402	DTS	08/04/2020
			Y	ARS7416	DTS	08/04/2020
			Z	ARS7366	DTS	08/04/2020
Upper Neck Load Cell			Fx, Fy, Fz Mx, My, Mz	NG2203	Denton	02/10/2021
Chest Accelerometers		Primary	X	P86792	Endevco	03/01/2021
			Y	P86793	Endevco	03/01/2021
			Z	P88348	Endevco	03/01/2021
		Redundant	X	P88666	Endevco	03/01/2021
			Y	P88667	Endevco	03/01/2021
			Z	P94109	Endevco	03/01/2021
Chest Potentiometer			X	351	Servo	03/02/2021
Pelvis Accelerometers			X	P95526	Endevco	03/01/2021
			Y	P96038	Endevco	03/01/2021
			Z	P97742	Endevco	03/01/2021
Femur Load Cells	Right	Primary	Z	FG121	Denton	03/02/2021
		Redundant	Z	FG121	Denton	03/02/2021
	Left	Primary	Z	FG122	Denton	03/02/2021
		Redundant	Z	FG122	Denton	03/02/2021
Tibia Load Cells	Right	Upper	Mx, My, Fz	TG408	Denton	02/09/2021
		Lower	Mx, My, Fz	AG116	Denton	02/09/2021
	Left	Upper	Mx, My, Fz	TG480	Denton	02/09/2021
		Lower	Mx, My, Fz	AG502	Denton	02/09/2021
Foot Accelerometers	Right	Rear	X	t22486	Endevco	03/01/2021
			Z	P97382	Endevco	03/01/2021
		Front	Z	P82120	Endevco	03/01/2021
	Left	Rear	X	T16468	Endevco	03/01/2021
			Z	T16496	Endevco	03/01/2021
		Front	Z	T16501	Endevco	03/01/2021
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 DH1659		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers		Primary	X	P97377	Endevco	02/10/2021
			Y	P94800	Endevco	02/10/2021
			Z	P94802	Endevco	02/10/2021
		Redundant	X	P94799	Endevco	02/10/2021
			Y	P94801	Endevco	02/10/2021
			Z	P94803	Endevco	02/10/2021
Head Angular Rate Sensors			X	ARS7340	DTS	08/04/2020
			Y	ARS7357	DTS	08/04/2020
			Z	ARS7442	DTS	08/04/2020
Upper Neck Load Cell			Fx, Fy, Fz Mx, My, Mz	NG2256	Denton	05/04/2020
Chest Accelerometers		Primary	X	P94793	Endevco	02/10/2021
			Y	P95322	Endevco	02/10/2021
			Z	P88719	Endevco	02/10/2021
		Redundant	X	P94794	Endevco	02/10/2021
			Y	P95370	Endevco	02/10/2021
			Z	P94785	Endevco	02/10/2021
Chest Potentiometer			X	DH1659	Servo	02/10/2021
Pelvis Accelerometers			X	P94798	Endevco	02/10/2021
			Y	P97705	Endevco	02/10/2021
			Z	P82646	Endevco	02/10/2021
Femur Load Cells	Right	Primary	Z	FG126	Denton	02/10/2021
		Redundant	Z	FG126	Denton	02/10/2021
	Left	Primary	Z	FG127	Denton	02/10/2021
		Redundant	Z	FG127	Denton	02/10/2021
Tibia Load Cells	Right	Upper	Mx, My, Fz	TG467	Denton	05/04/2020
		Lower	Mx, My, Fz	AG491	Denton	05/04/2020
	Left	Upper	Mx, My, Fz	TG478	Denton	05/04/2020
		Lower	Mx, My, Fz	AG500	Denton	05/04/2020
Foot Accelerometers	Right	Rear	X	P94795	Endevco	02/10/2021
			Z	P94796	Endevco	02/10/2021
		Front	Z	P94797	Endevco	02/10/2021
	Left	Rear	X	P83167	Endevco	02/10/2021
			Z	P83168	Endevco	02/10/2021
		Front	Z	P83169	Endevco	02/10/2021
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	A340712	MSI	02/08/2021
			Z	A305694	MSI	02/08/2021
		Redundant	X	A356247	MSI	12/14/2020
	Right	Primary	X	A377301	MSI	03/12/2021
			Z	A370380	MSI	03/11/2021
		Redundant	X	A370390	MSI	03/11/2021
Engine Accelerometers		Top	X	A377278	MSI	03/10/2021
		Bottom	X	T22576	Endevco	02/19/2021