REPORT NUMBER: NCAP-MGA-20-014

NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test

GENERAL MOTORS LLC
2020 GMC Acadia AWD SLE 5-Door SUV
NHTSA No.: M20200111

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: February 19, 2020

Final Report Date: May 19, 2020

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: May 19, 2020

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

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9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		10. Work Unit No. 11. Contract or Grant No. 693JJ919D000006
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C. 20590		13. Type of Report and Period Covered Final Test Report February 19, 2020 to May 19, 2020 14. Sponsoring Agency Code NRM-110
15. Supplementary Notes		

16. Abstract

A 56.3 km/h NCAP Frontal Rigid Barrier Impact Test was conducted on a 2020 GMC Acadia AWD SLE 5-Door SUV in accordance with the specifications of the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), and 301 performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on February 19, 2020.

The impact velocity of the vehicle was 56.34 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 478 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	285	700	319
Maximum Chest Compression	mm	63	18	52	16
Nij		1	0.21	1	0.43
Neck Tension	N	4170	850	2620	902
Neck Compression	N	4000	127	2520	442
Left Femur Force	N	10008	574	6805	933
Right Femur Force	N	10008	1705	6805	269

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

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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 2020 GMC Acadia AWD SLE 5-Door SUV at a velocity of 56.34 km/h. The test was performed at MGA Research Corporation on February 19, 2020. 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 and passenger's lap and should 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 634 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 478 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 and curtain airbag. The driver's knees contacted the knee airbag.
The passenger's visible contact points were as follows: The passenger's head contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC_{15}	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (g)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50^{th})	285	0.21	850	127	45	18	574	1705
Passenger (5^{th})	319	0.43	902	442	43	16	933	269

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

TEST NOTES

Driver Lap Belt load cell was not installed.
Bottom of Engine X recorded no valid data after 26 ms.
Barrier C-01 Fx recorded no valid data.
Barrier C-02 Fx, My, Mz recorded no valid data.
Barrier K-03 Fx recorded questionable data.
Barrier K-15 My recorded no valid data.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/19/2020

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20200111	Traction Control System (TCS)	Yes
Model Year	2020	Power Steering	Yes
Make	GMC	Power Window Auto-Reverse	Yes
Model	Acadia AWD SLE	Driver Frontal Airbag	Yes
Body Style	5-Door SUV	Driver Curtain Airbag	Yes
VIN	1GKKNRLS4LZ156199	Driver Head/Torso Airbag	No
Body Color	Red Mahogany Metallic	Driver Torso Airbag	No
Odometer (km/mi)	77 km / 48 mi	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	3.6 L	Driver Pelvis Airbag	No
Type/No. Cylinders	V6	Driver Knee Airbag	Yes
Engine Placement	Lateral	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	9	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	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	Yes	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Front Center Airbag	Yes

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

DATA FROM CERTIFICATION LABEL

Manufactured By	GENERAL MOTORS LLC
Date of Manufacture	12/19

GVWR (kg)	2722
GAWR Front (kg)	1350
GAWR Rear (kg)	1545

VEHICLE SEATING AND WEIGHT CAPACITY DATA

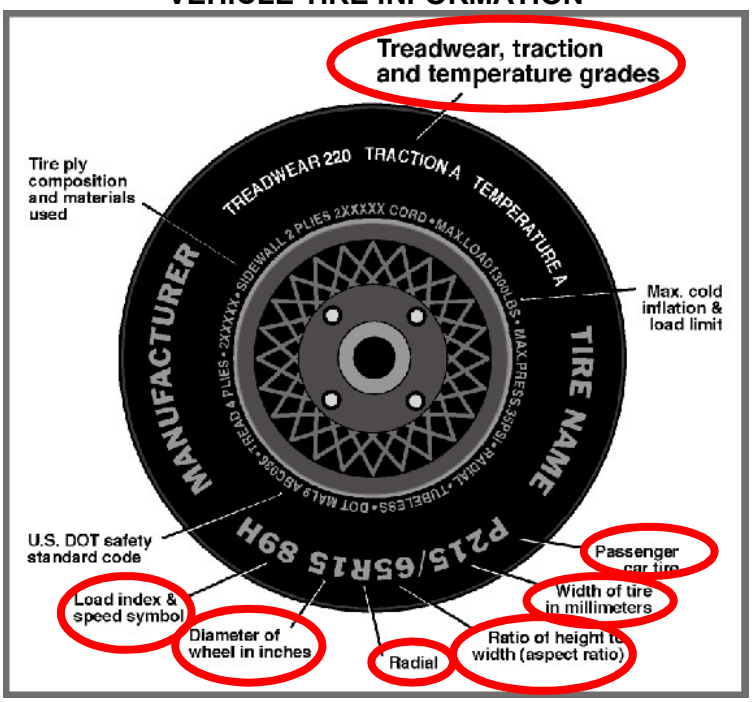
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bucket	Split Bench	
Designated Seating Capacity (DSC)	2	2	2	6
Capacity Weight (VCW) (kg)				749
Cargo Weight (RCLW) (kg)				136*

* Rated Cargo and Luggage Weight (RCLW) limited to maximum of 300 lbs (136 kg).

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

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	235/65R18	235/65R18
Tire Size on Vehicle	235/65R18	235/65R18
Tire Manufacturer	Continental	Continental
Tire Model	CrossContact	CrossContact
Treadwear	480	480
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	106H	106H
Tire Material	Rubber	Rubber
DOT Safety Code Left	A3LM WD30 4519	A3LM WD30 4519
DOT Safety Code Right	A3LM WD30 4519	A3LM WD30 4419

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

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/19/2020

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	572.5	429.0		595.5	549.5	
Right	kg	545.5	414.5		566.0	521.5	
Ratio	%	57.0%	43.0%		52.0%	48.0%	
Totals	kg	1118.0	843.5	1961.5	1161.5	1071.0	2232.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1961.5
Weight of 1 P572E ATD & 1 P572O ATD	kg	141
Rated Cargo/Luggage Weight (RCLW)	kg	136
Calculated Test Vehicle Target Weight (TVTW)	kg	2238.5

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	837	845	890	892	1230
As Tested	mm	834	834	854	840	1372
Post Test	mm	936	872	850	845	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2860
Total Vehicle Length at Left Side	mm	4718
Total Vehicle Length at Centerline	mm	4917
Total Vehicle Length at Right Side	mm	4718
Weight of Ballast in Cargo Area	kg	101
Weight of Vehicle Components Removed	kg	27
Amount of Stoddard Solvent in Fuel Tank	L	76.4

List of components removed to meet test weight: None.

List of components removed for instrumentation, data box, and equipment installation: Cargo area carpet / cover / trim, jack and tools, spare tire and cover, RR tail light.

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

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/19/2020

TARGET VEHICLE STRUCTURAL MEASUREMENT

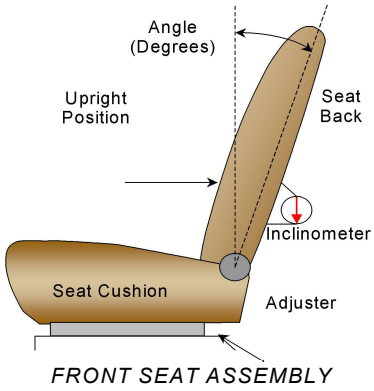
	Elements	Pre-Test (mm)
1	Total Length	4917
2	Total Width	1916
3	Bumper Top Height	620
4	Bumper Bottom Height	500
5	Longitudinal Member Top Height	N/A
6	Distance between Longitudinal Members	940
7	Longitudinal Member Width	N/A
8	Engine Top Height	1055
9	Engine Bottom Height	228
10	Engine and Gearbox Width	785
11	Front Bumper-Engine Distance	N/A
12	Front Shock Absorber Fixing Height	1031
13	Bonnet Leading Edge Height	965
14	Front Shock Absorber Fixing Width	70
15	Front Bumper – Front Axle Distance	952
16	Front Axle – A-Pillar Distance	471
17	A-Pillar – B-Pillar Distance	1138
18	B-Pillar – Rear Axle Distance	1265
19	B-Pillar – C-Pillar Distance	780
20	Roof Sill Bottom Height	1540
21	Roof Sill Top Height	1666
22	Floor Sill Bottom Height	300
23	Floor Sill Top Height	426

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

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV
NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test
Test Date: 2/19/2020

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	-16.5° on outboard headrest post
Passenger Seat Back Angle	-15.9° on outboard headrest post

SEAT FORE/AFT POSITIONS

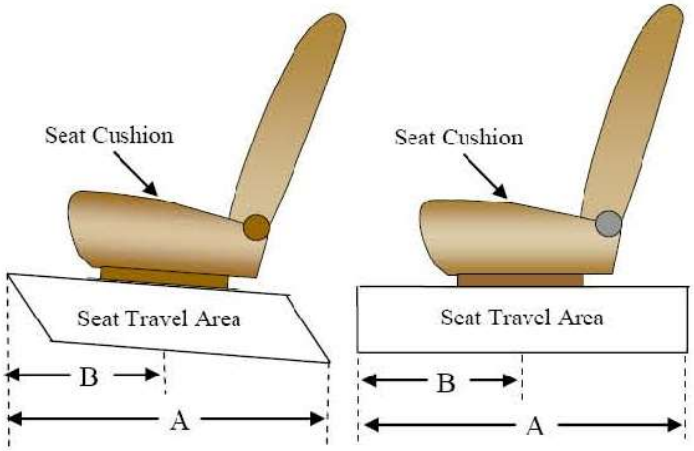
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated May 2018.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	308 mm	154 mm
Passenger Seat	240 mm / 25 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

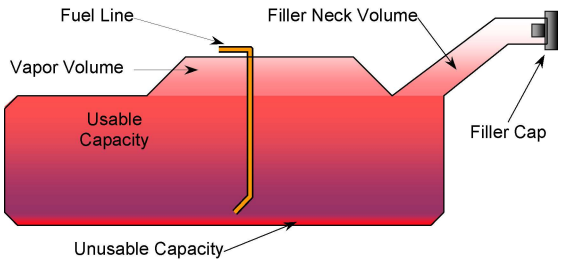
Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/19/2020

FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	73.4
Usable Capacity of "Optional Tank"	82.1
92-94% of Usable Capacity	75.5 to 77.2
Actual Amount of Solvent used	76.4
1/3 of Usable Capacity	27.4

FUEL PUMP

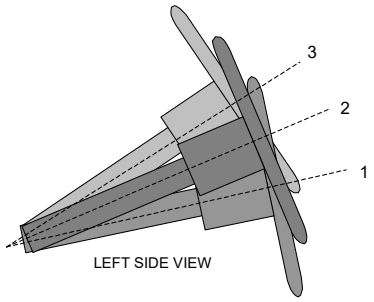
The vehicle is equipped with an electronic fuel pump. Pump will run for about 3 seconds when the key is turned on and then will not run unless the engine is cranking or running. The filler neck is located on the driver's side.



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.



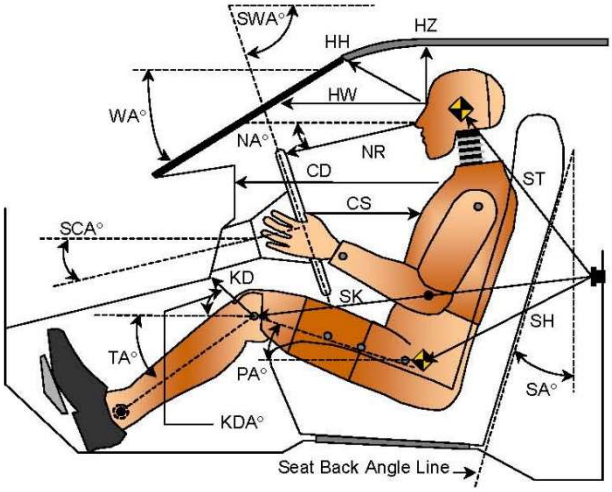
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	69.4	
Geometric Center Position 2	67.3	
Uppermost Position 3	65.1	
Telescoping Steering Wheel Travel		60
Test Position	67.3	30

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020

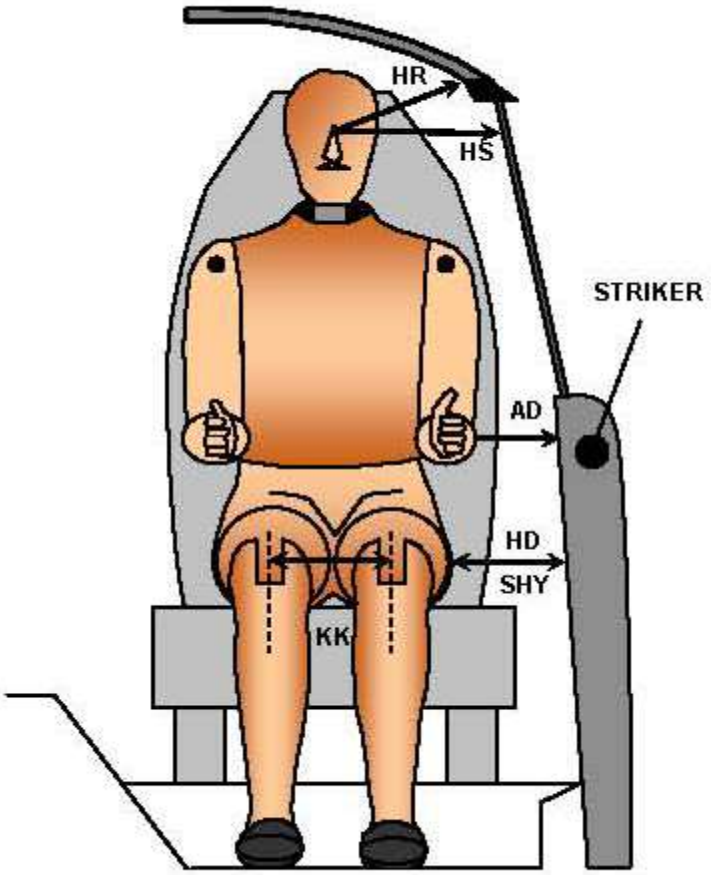


LEFT SIDE VIEW

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		23.9		
SWA°	Steering Wheel Angle		67.3		
SCA°	Steering Column Angle		22.7		
SA°	Seat Back Angle		-16.5		-15.9
HZ	Head to Roof (Z)	241	90	258	90
HH	Head to Header	437	30.2	361	35.3
HW	Head to Windshield	774	0	763	0
NR	Nose to Rim	432	1.5		
CD	Chest to Dash	567		442	
CS	Chest to Steering Hub	362	4.6		
RA	Rim to Abdomen	236	0		
KDL	Left Knee to Dash	227	29.5	155	30.9
KDR	Right Knee to Dash	215	30.0	158	32.4
PA°	Pelvic Angle		23.9		20.4
TA°	Tibia Angle		43.2		54.3
SK	Striker to Knee	572	92.1	642	90.7
ST	Striker to Head	538	8.8	510	23.0
SH	Striker to H-Point	228	124.4	322	104.2

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020

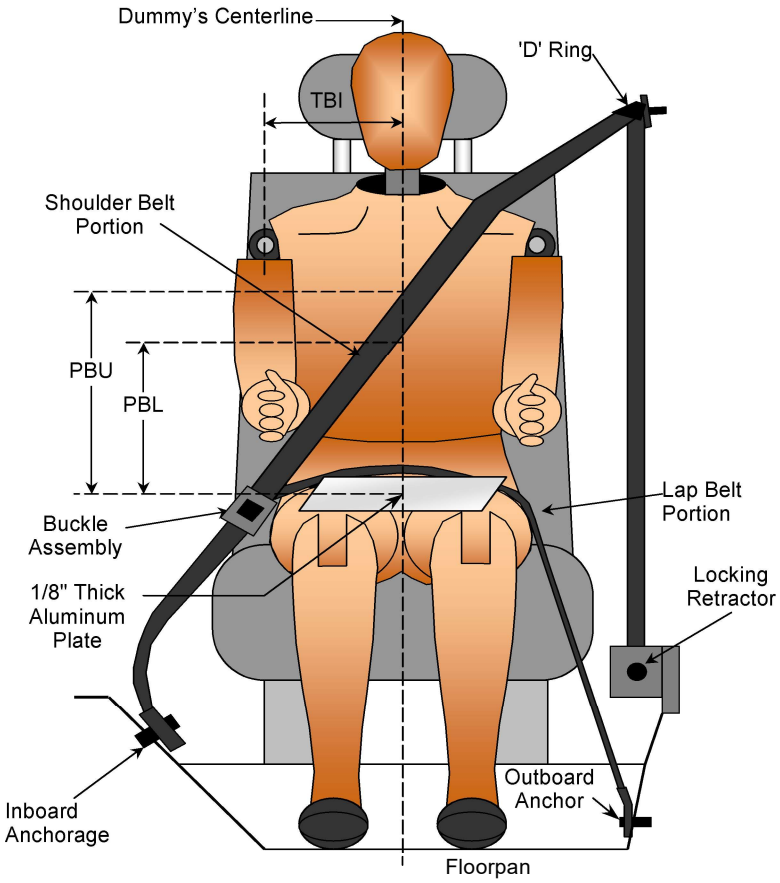


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
AD	Arm to Door	151	85
HD	H-Point to Door	147	182
HR	Head to Side Header	256	290
HS	Head to Side Window	374	385
KK	Knee to Knee	347	231
SHY	Striker to H-Point (Y Direction)	276	305
AA	Ankle to Ankle	335	168

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle:	2020 GMC Acadia AWD SLE 5-Door SUV	NHTSA No.:	M20200111
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	2/19/2020



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	370	305
PBL - Top surface of reference to belt lower edge	mm	280	220

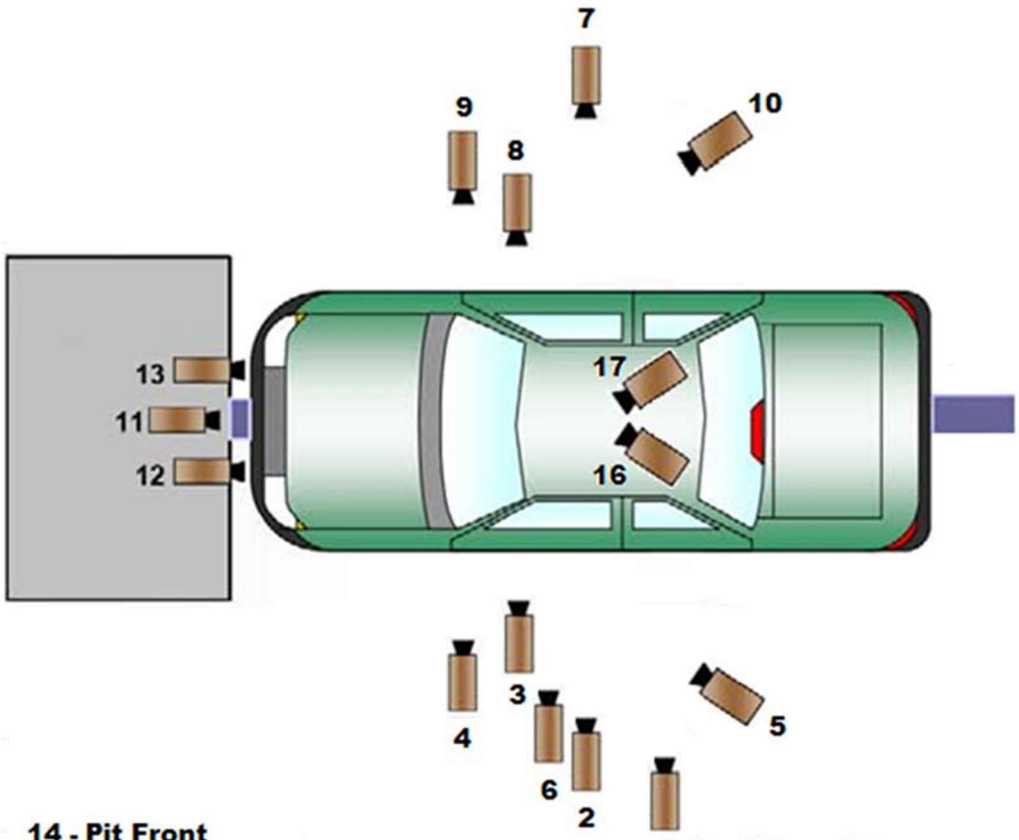
BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	860	940
Lap Belt Length as measured on ATD	mm	420	490
Remainder of belt on reel	mm	1020	870
Total Belt Length for Continuous Webbing Systems	mm	3000	3000

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

Test Vehicle:	2020 GMC Acadia AWD SLE 5-Door SUV	NHTSA No.:	M20200111
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	2/19/2020

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: 2020 GMC Acadia AWD SLE 5-Door SUV NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/19/2020

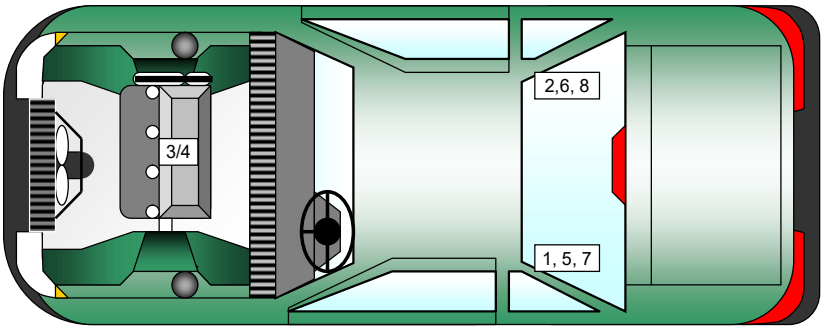
CAMERA LOCATIONS

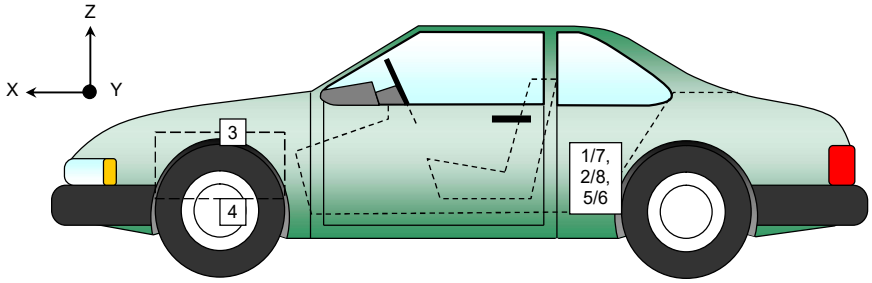
No.	Camera View	Coordinates* (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall					30
2	Left Overall	-2430	-6160	-1440	12	1000
3	Driver Close-Up	-1820	-6950	-1990	50	1000
4	Left Front Half	-1400	-5490	-1420	24	1000
5	Left Angle	-7420	-5830	-2020	75	1000
6	Steering Column	-1200	-6500	-1250	50	1000
7	Right Overall	-2240	-5100	-1450	12	1000
8	Passenger Close-Up	-1570	-6180	-1940	50	1000
9	Right Front Half	-1160	-5310	-1450	24	1000
10	Right Angle	-7420	-5500	-1920	75	1000
11	Windshield	100	0	-2310	12	1000
12	Driver Windshield	170	-370	-2230	25	1000
13	Passenger Windshield	170	-370	-2230	25	1000
14	Pit Front	-630	0	3340	24	1000
15	Pit Rear	-3150	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: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

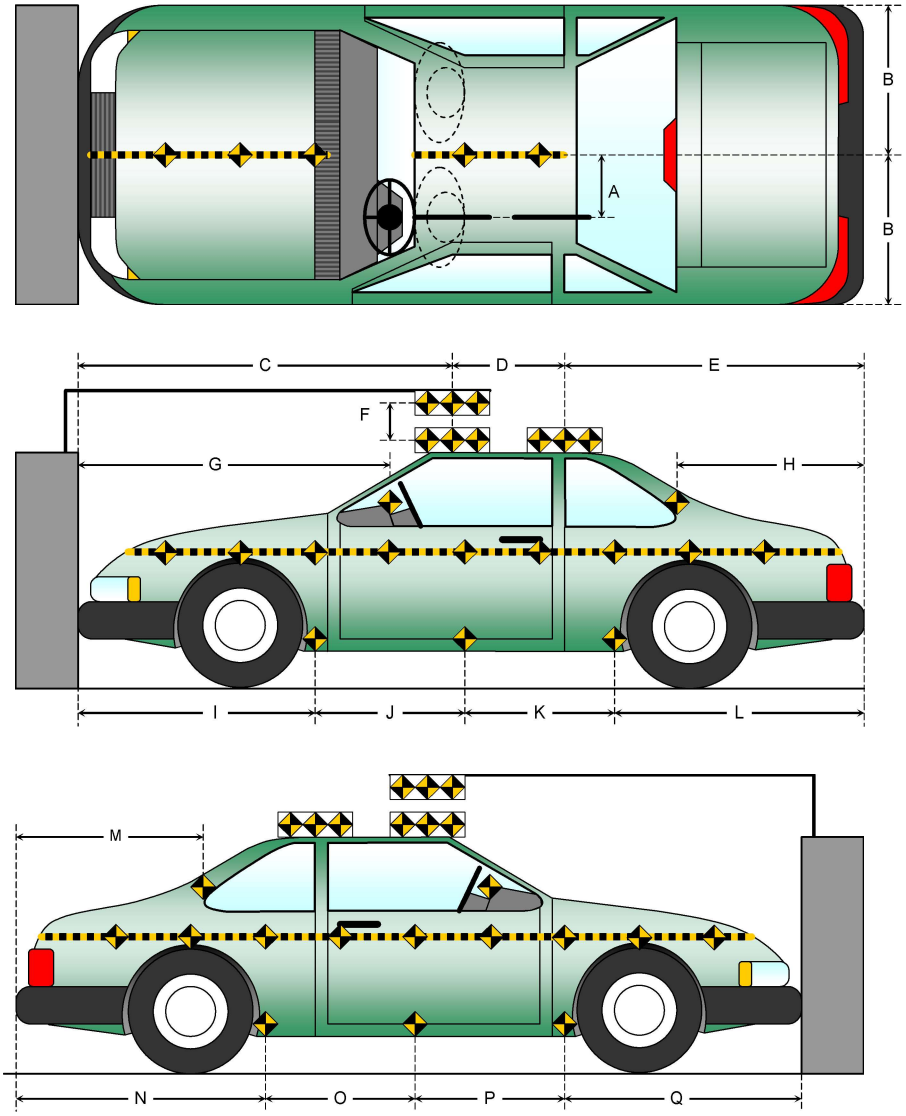
No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	2016	-690	-361
2	Right Rear Crossmember Accelerometer – X Direction	2016	690	-358
3	Engine Top X	4260	-54	-972
4	Engine Bottom X	4205	0	-233
5	Left Rear Crossmember Accelerometer – Z Direction	2016	-690	-361
6	Right Rear Crossmember Accelerometer – Z Direction	2016	690	-358
7	Left Rear Crossmember Accelerometer Redundant – X Direction	2016	-682	-361
8	Right Rear Crossmember Accelerometer Redundant – X Direction	2016	682	-358

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: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020

Item	Value (mm)
A	390
B	958
C	2400
D	610
E	1907
F	159
G	
H	1314
I	1458
J	950
K	950
L	1559
M	1314
N	1559
O	950
P	950
Q	1458



DATA SHEET NO. 9
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020

ADVANCED RESEARCH LOAD CELL BARRIER

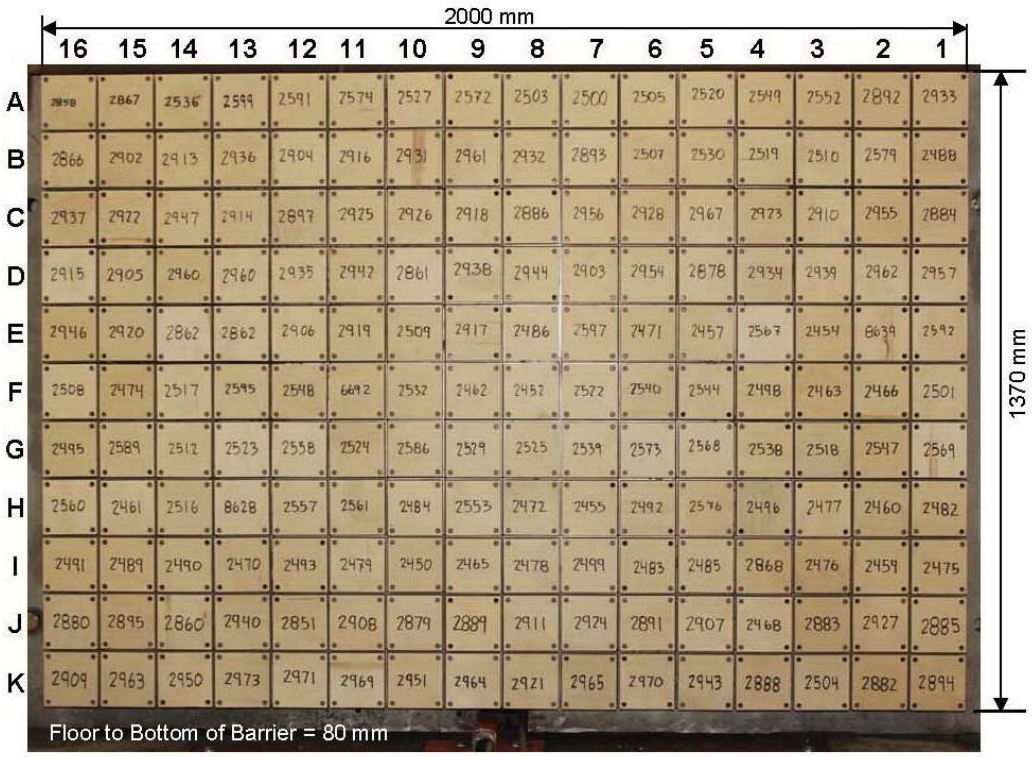


Photo for Reference Only

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: 2020 GMC Acadia AWD SLE 5-Door SUV NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/19/2020

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Data Channels	49
Passenger Dummy Data Channels	49
Vehicle Structure Accelerometers	8
Barrier Channels	528
Total	634

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: 2020 GMC Acadia AWD SLE 5-Door SUV NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/19/2020

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 351	HIII 5% / DH1659
Head Contact	Frontal & Curtain Airbag, Headrest	Frontal Airbag, Headrest
Upper Torso Contact	None	None
Lower Torso Contact	None	None
Left Knee Contact	Knee Airbag	Glove Box
Right Knee Contact	Knee Airbag	Glove Box

DOOR OPENING, TRUNK OPENING, AND SEAT TRACK INFORMATION

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

OTHER VEHICLE POST-TEST OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

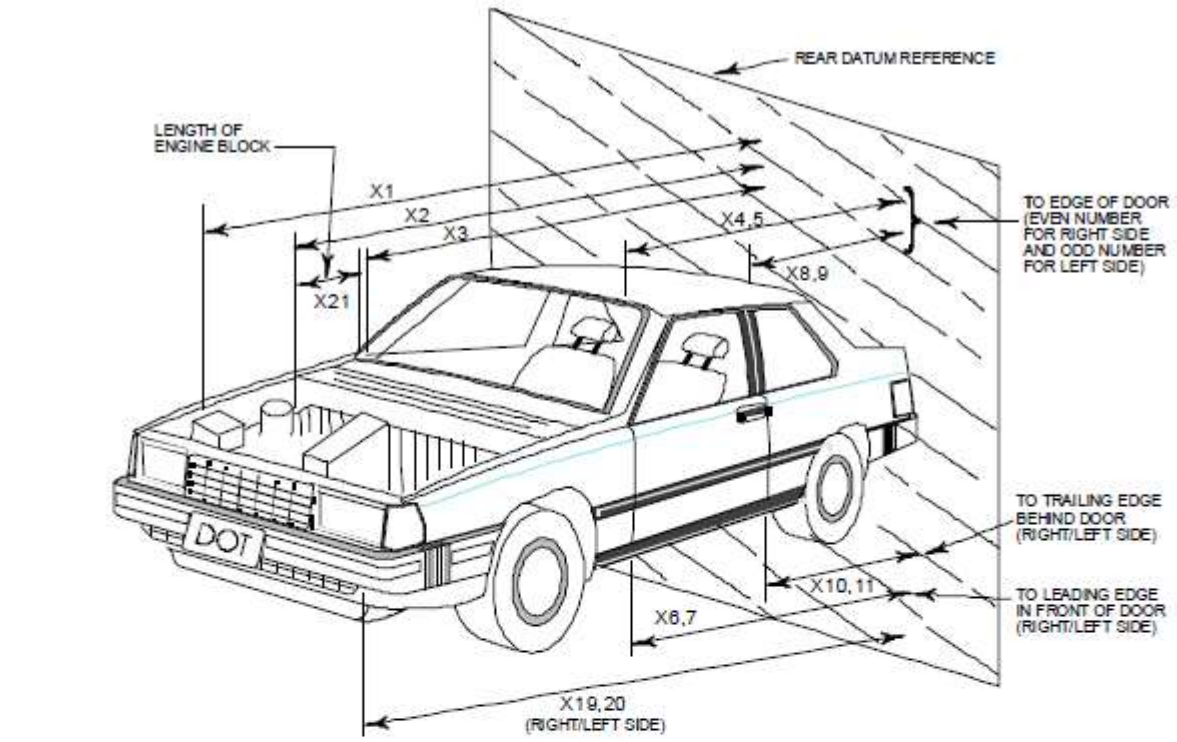
Measured Parameter	Units	Value
Left Side	mm	865
Center	mm	800
Right Side	mm	875
Average	mm	847

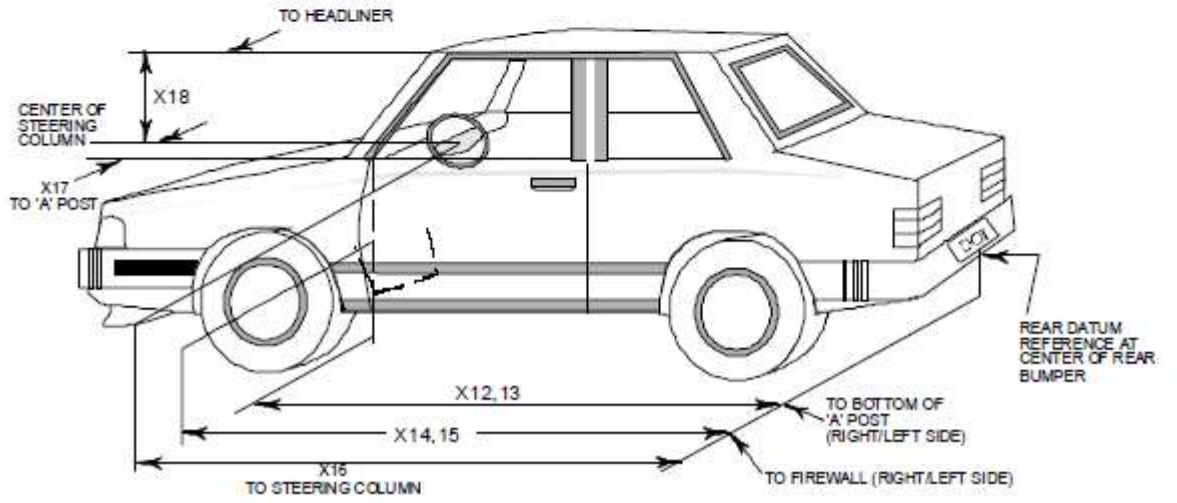
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver		Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Curtain Side Airbag	Yes	Yes	Yes	Yes
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: Front Center Airbag	Yes	No		

DATA SHEET NO. 12
VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2020 GMC Acadia AWD SLE 5-Door SUV	NHTSA No.:	M20200111
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	2/19/2020





DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020

No.	Measurement Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4917	4439	478
2	RSOV to Front of Engine	4450	4138	312
3	RSOV to Firewall	3902	3824	78
4	RSOV to Upper Leading Edge of Right Door	3420	3380	40
5	RSOV to Upper Leading Edge of Left Door	3420	3394	26
6	RSOV to Lower Leading Edge of Right Door	3412	3365	47
7	RSOV to Lower Leading Edge of Left Door	3412	3396	16
8	RSOV to Upper Trailing Edge of Right Door	2313	2269	44
9	RSOV to Upper Trailing Edge of Left Door	2313	2279	34
10	RSOV to Lower Trailing Edge of Right Door	2344	2308	36
11	RSOV to Lower Trailing Edge of Left Door	2344	2325	19
12	RSOV to Bottom of “A” Post of Right Side	3180	3287	-107
13	RSOV to Bottom of “A” Post of Left Side	3186	3309	-123
14	RSOV to Firewall, Right Side	3876	3823	53
15	RSOV to Firewall, Left Side	3876	3834	42
16	RSOV to Steering Column	2989	3035	-46
17	Center of Steering Column to “A” Post	387	409	-22
18	Center of Steering Column to Headliner	435	470	-35
19	RSOV to Right Side of Front Bumper	4718	4371	347
20	RSOV to Left Side of Front Bumper	4718	4344	374
21	Length of Engine Block	546	546	0
RD	RSOV to Right Side of Dash Panel	3201	3170	31
CD	RSOV to Center of Dash Panel	3180	3115	65
LD	RSOV to Left Side of Dash Panel	3204	3179	25

All Dimensions in mm

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

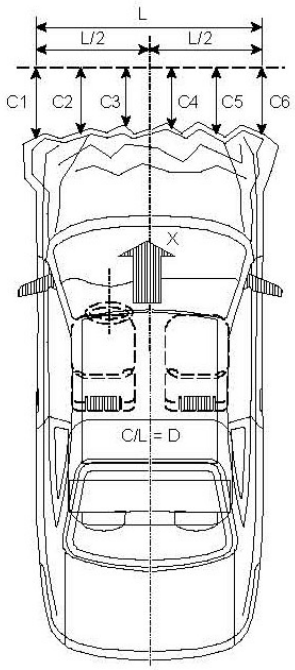
Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020

VEHICLE INFORMATION

VIN: 1GKKNRLS4LZ156199
Vehicle Size Category: MPV
Wheelbase (mm): 2860
Test Weight (kg): 2232.5

ACCELEROMETER DATA

Accelerometer Locations: As per Data Sheet No. 7
Cal. Procedure/Interval: MGA Procedure / 6 month
Integration Algorithm: Trapezoidal
Linearity: > 99%
Impact Velocity (km/h): 56.34
Velocity Change (km/h): 66.6
Time of Separation (msec) 104



CRUSH PROFILE

Collision Deformation Classification: 12FDEW2
Midpoint of Damage: Centerline
Damage Region Length (mm): 1512
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4718	4344	374
C2	Crush zone 2 at left side	mm	4822	4367	455
C3	Crush zone 3 at left side	mm	4864	4395	469
C4	Crush zone 4 at right side	mm	4864	4407	457
C5	Crush zone 5 at right side	mm	4822	4397	425
C6	Crush zone 6 at right side	mm	4718	4371	347
L	C1 TO C6	mm	1512	1500	12

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

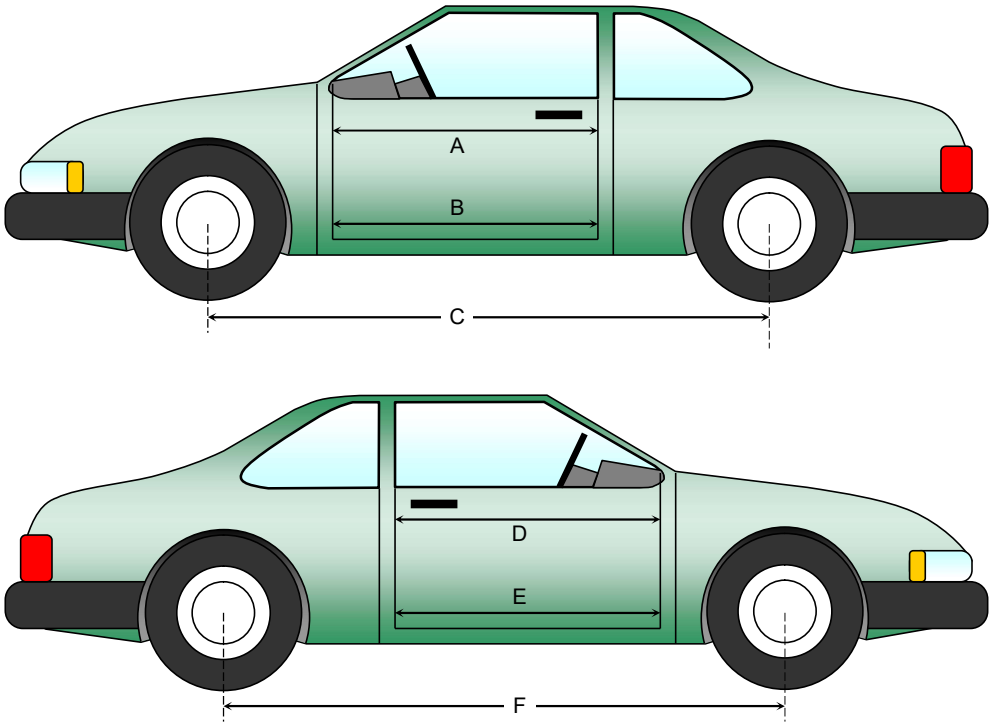
Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	982	982	0
B	Left Side Lower	mm	899	899	0
D	Right Side Upper	mm	982	982	0
E	Right Side Lower	mm	902	902	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2860	2770	90
F	Right Side Wheelbase	mm	2860	2754	106



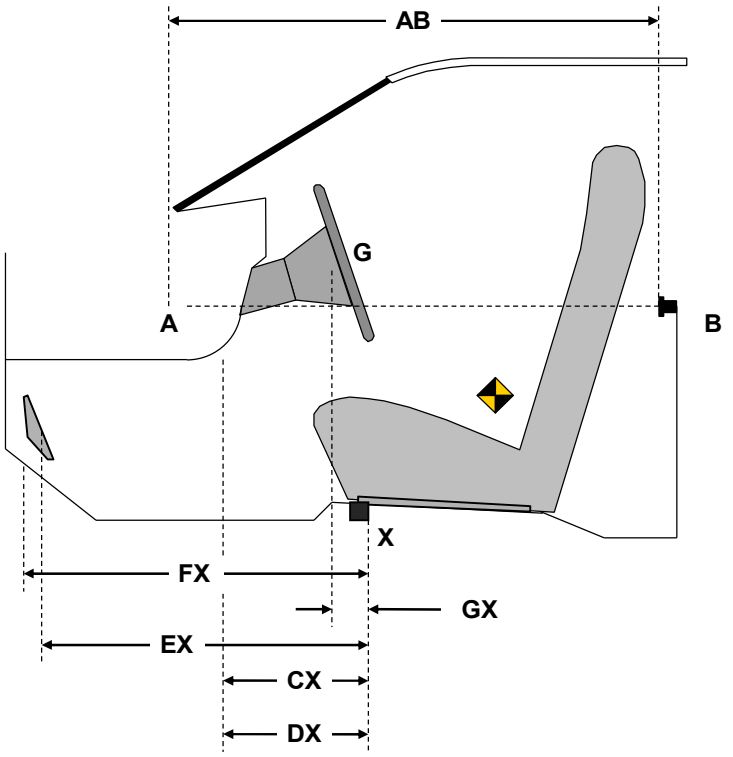
DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	811	811	0
CX	Left Knee Bolster to X	mm	356	355	1
DX	Right Knee Bolster to X	mm	354	360	-6
EX	Brake Pedal to X	mm	561	535	26
FX	Foot Rest to X	mm	601	597	4
GX	Center of Steering Column Wheel Hub to X	mm	84	166	-82

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

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

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/19/2020

WINDSHIELD MOUNTING DETAILS

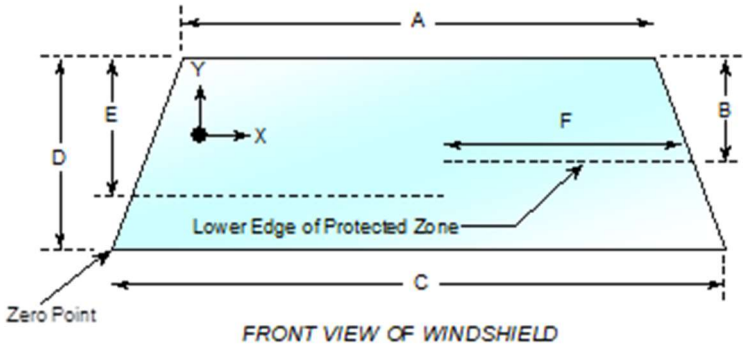
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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	2208	2208	100
Right Side	2208	2208	100
Total	4416	4416	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1284
B	mm	452
C	mm	1540
D	mm	796
E	mm	489
F	mm	520

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: 2020 GMC Acadia AWD SLE 5-Door SUV NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/19/2020

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21.8°C Test Time: 10:25 a.m.

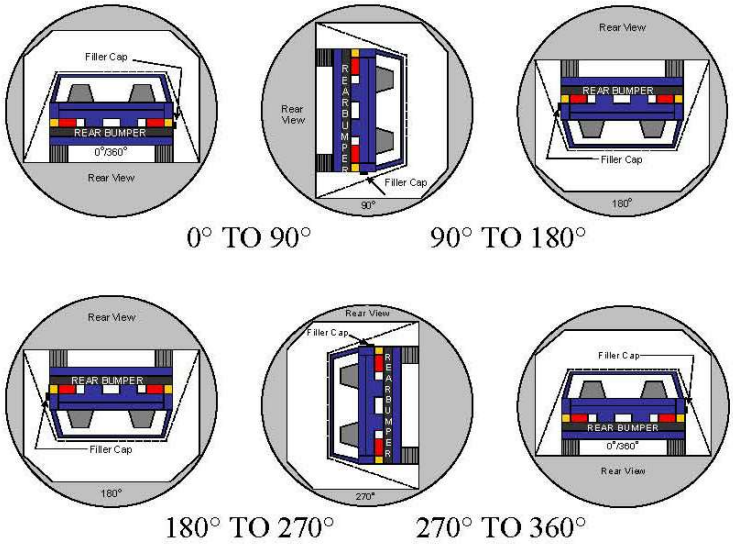
A. From impact until vehicle motion ceases: (Maximum Allowable = 1 ounce) 0.0 oz.

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°	107	300	407
270° to 360°	111	300	411

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

Test Vehicle: 2020 GMC Acadia AWD SLE 5-Door SUV NHTSA No.: M20200111
Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/19/2020

FMVSS 301 SPILLAGE TABLE (UNITS IN OUNCES)

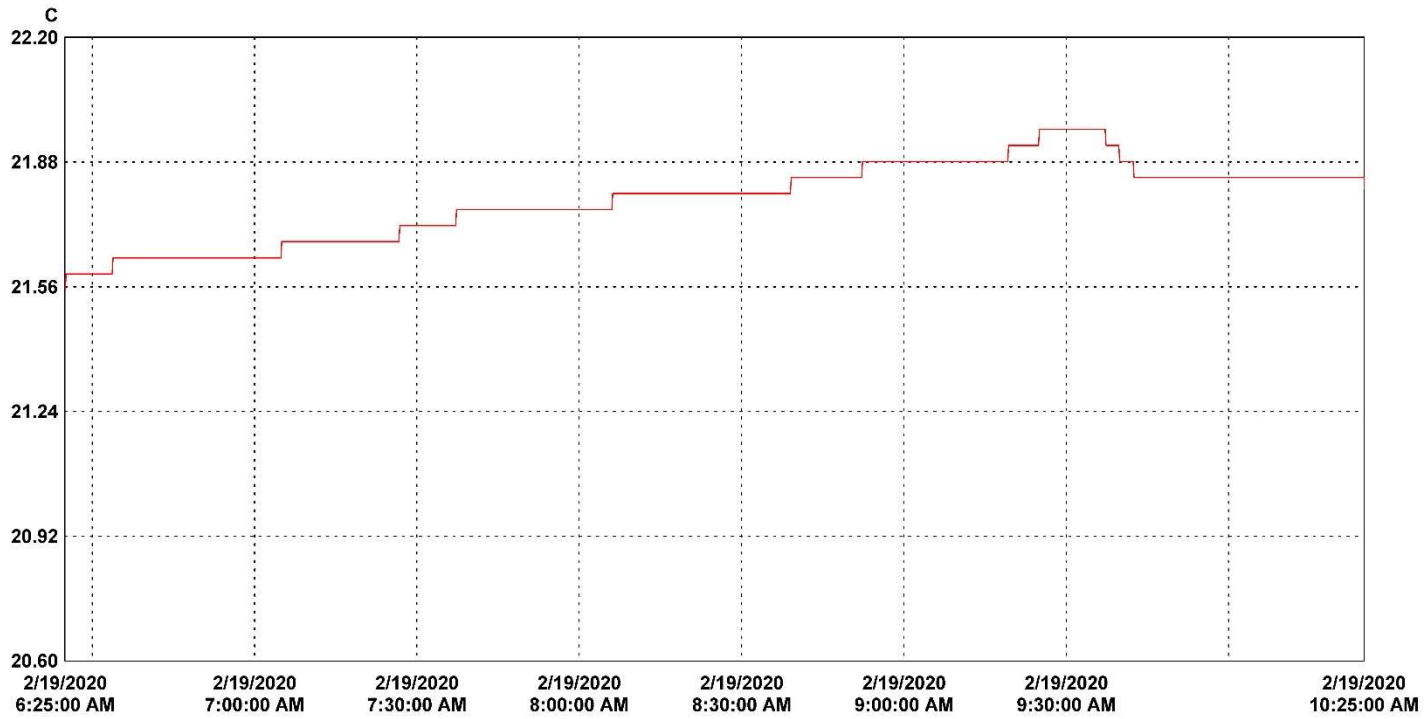
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

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: 2020 GMC Acadia AWD SLE 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20200111
Test Date: 2/19/2020



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	18352047	VSC_Prep_Room	1		21.96	21.78	21.55	C	Temperature	18352047_VSC_Prep_Room.spl

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

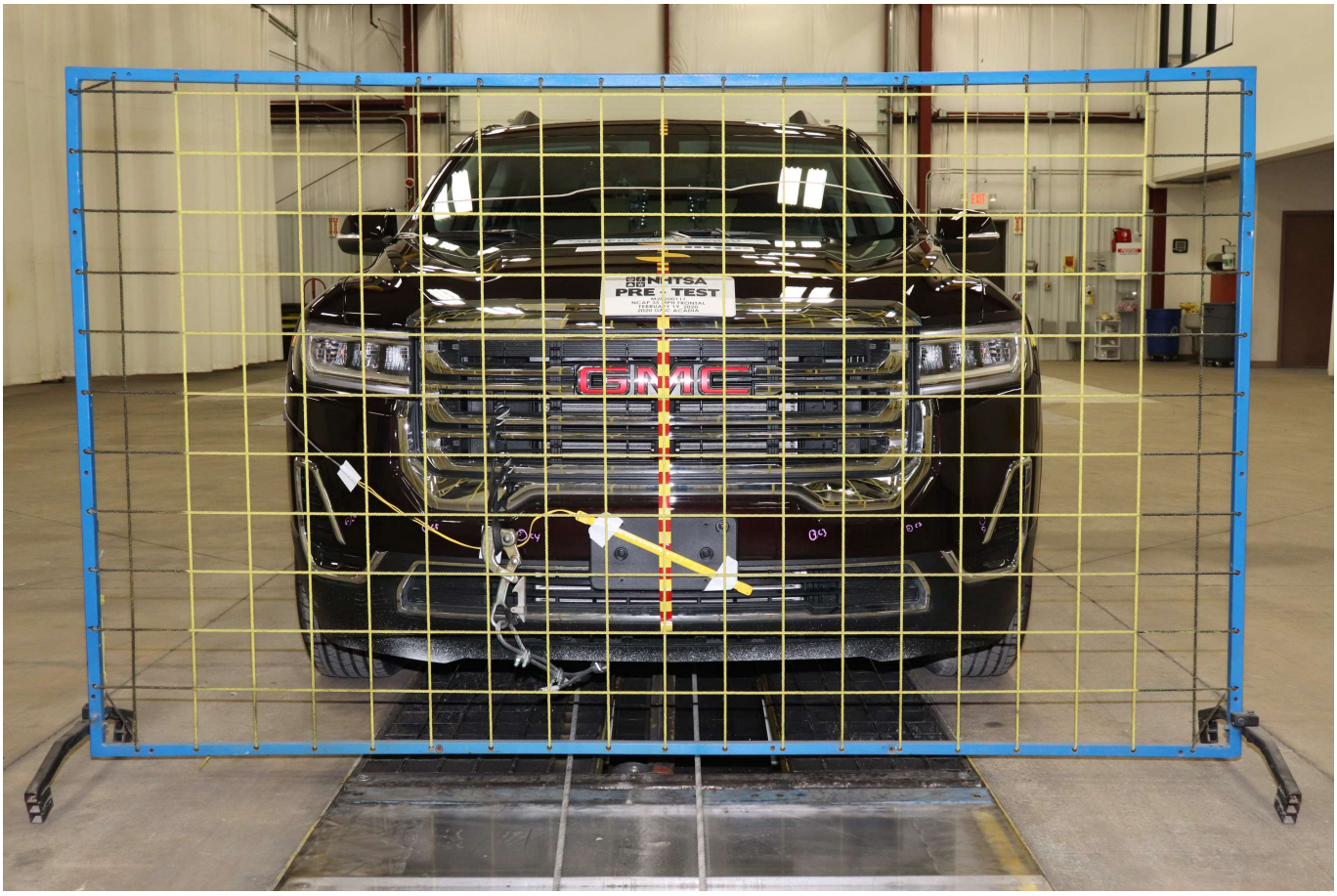


Photo No. 001 - Load Cell Location

Photo No. 002 - Pre-Test Load Cell Wall

Photo No. 003 - Post-Test Load Cell Wall

Photo No. 004 - Manufacturer Label

Photo No. 005 - Tire Placard

Photo No. 006 - 2020 GMC Acadia AWD SLE 5-Door SUV Frontal As Delivered

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

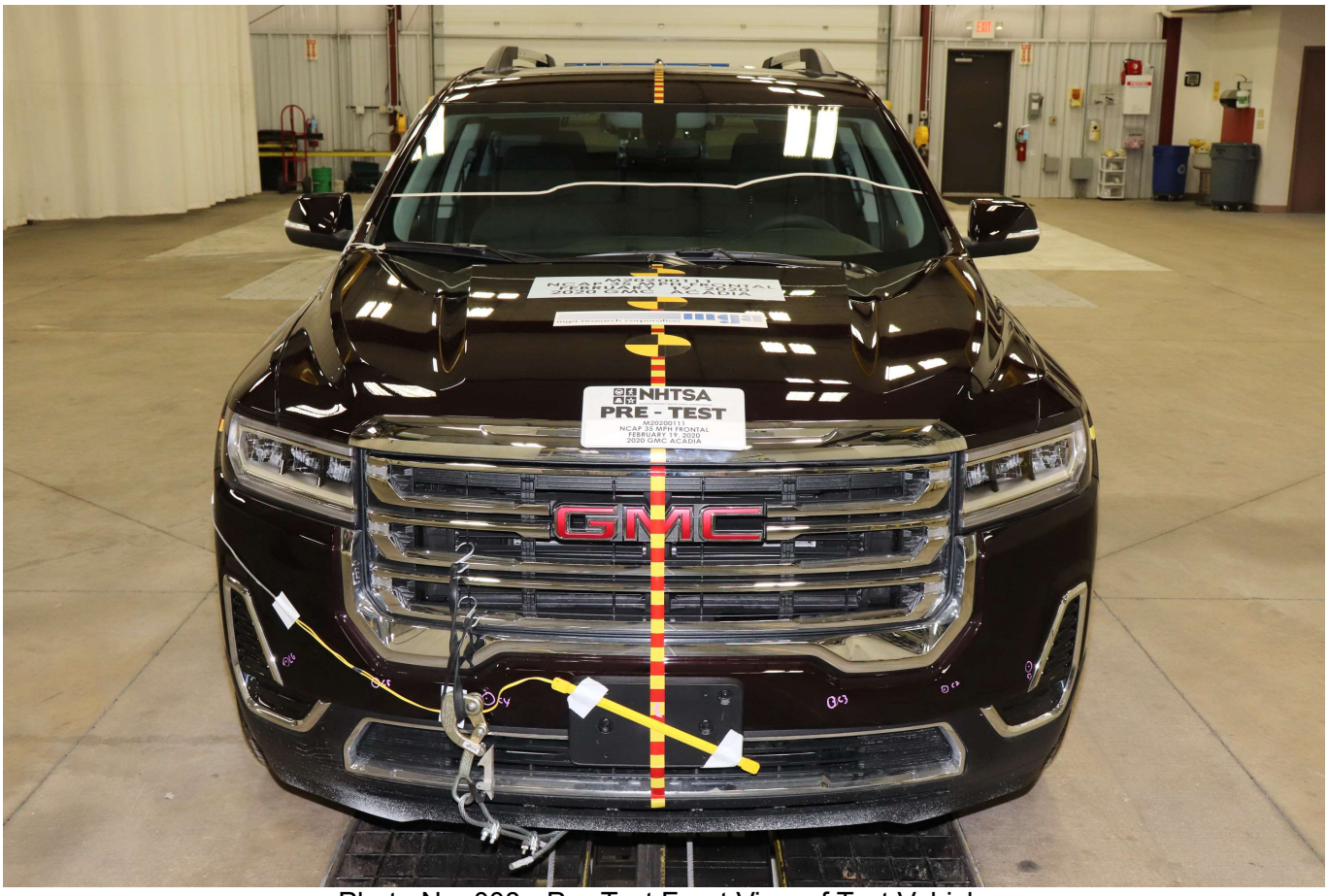


Photo No. 008 - Pre-Test Front View of Test Vehicle

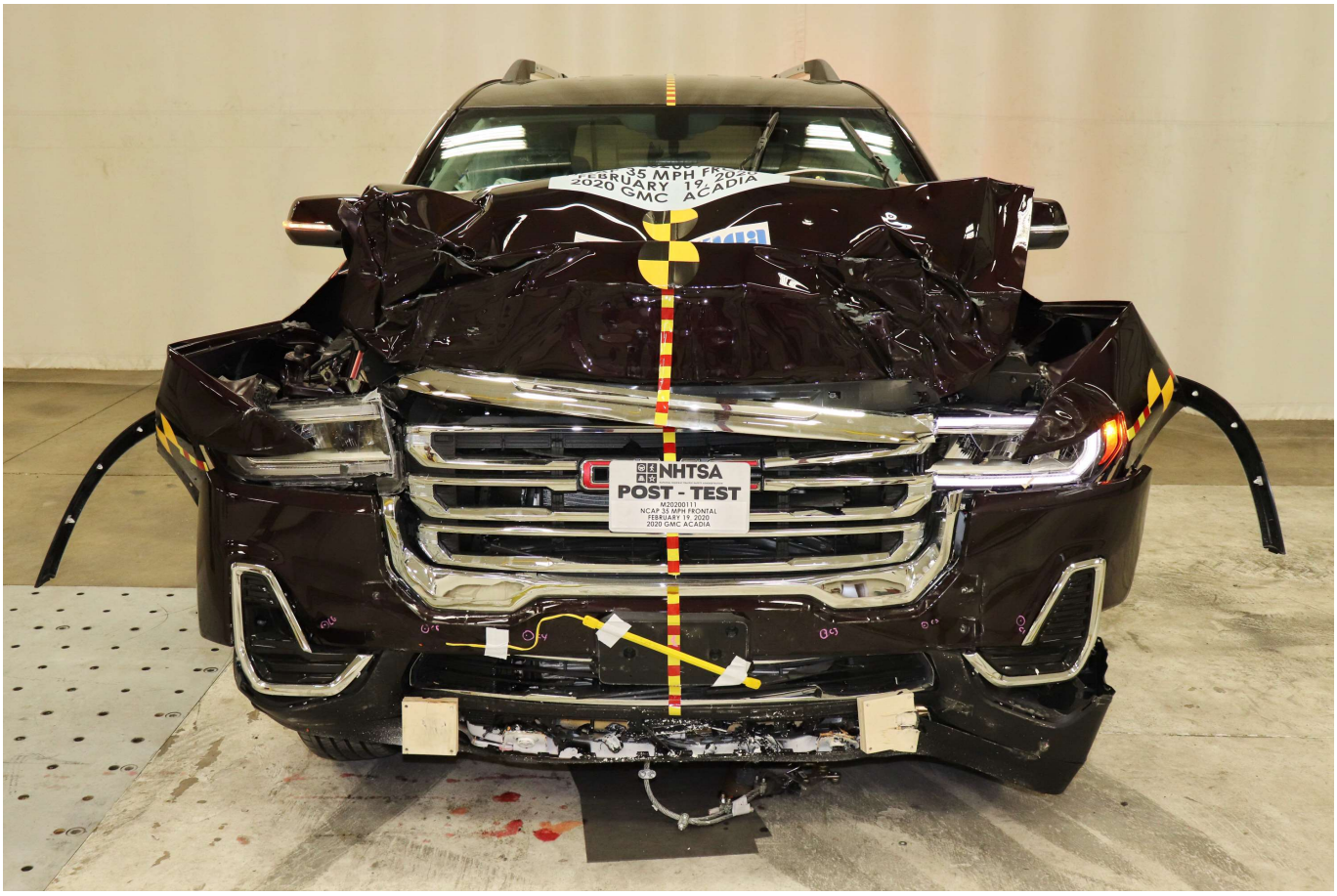


Photo No. 009 - Post-Test Front View of Test Vehicle

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

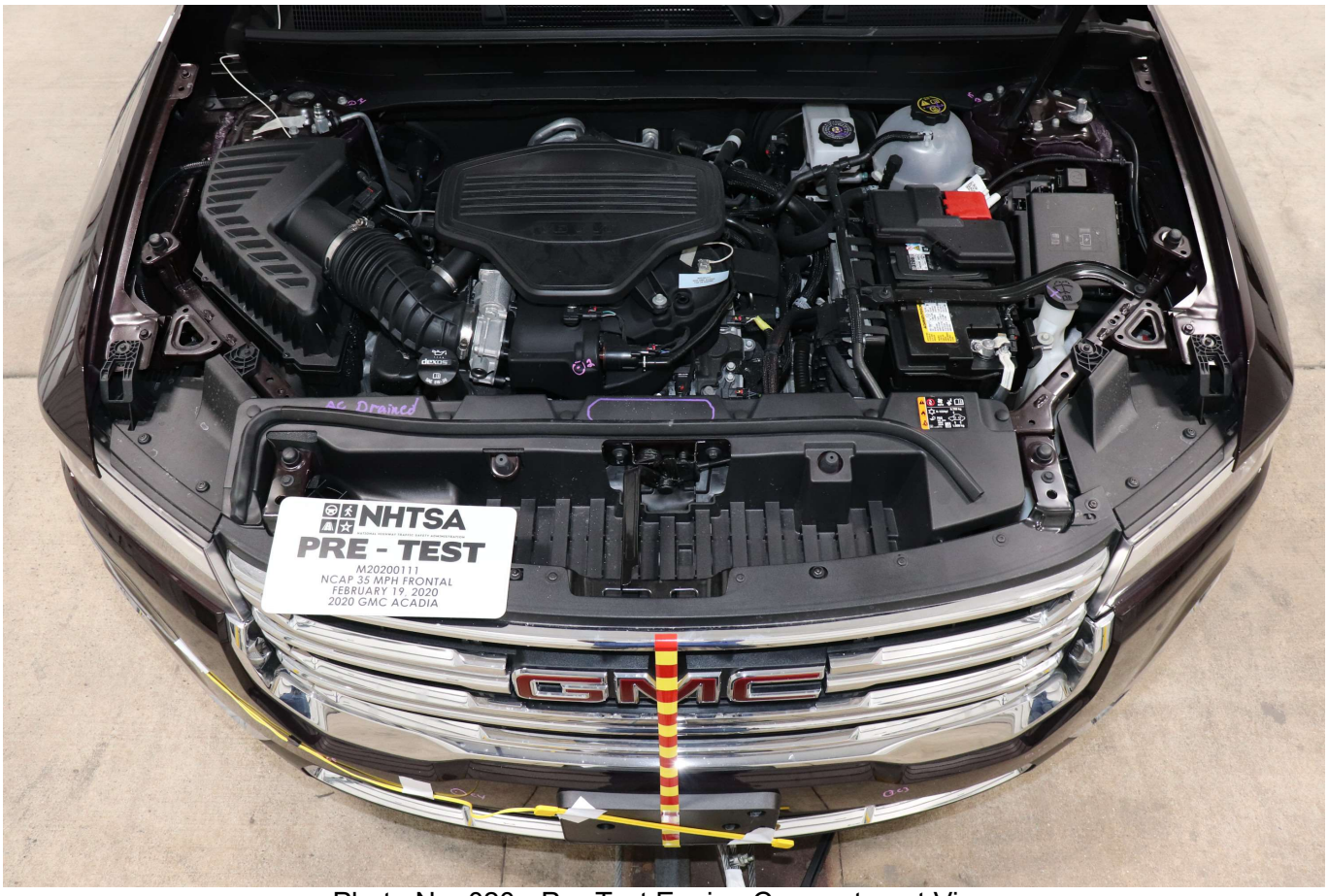


Photo No. 020 - Pre-Test Engine Compartment View

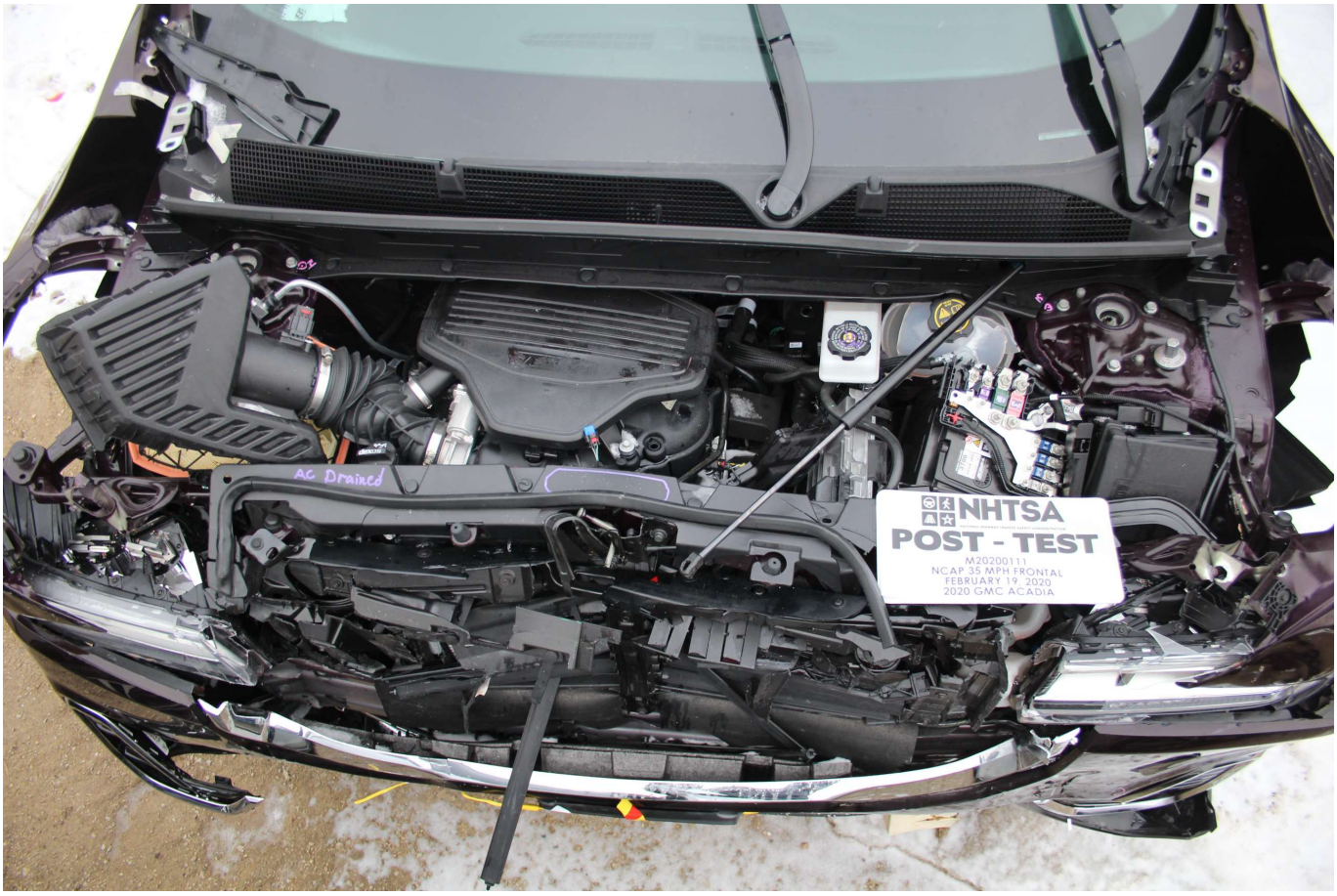


Photo No. 021 - Post-Test Engine Compartment View

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

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

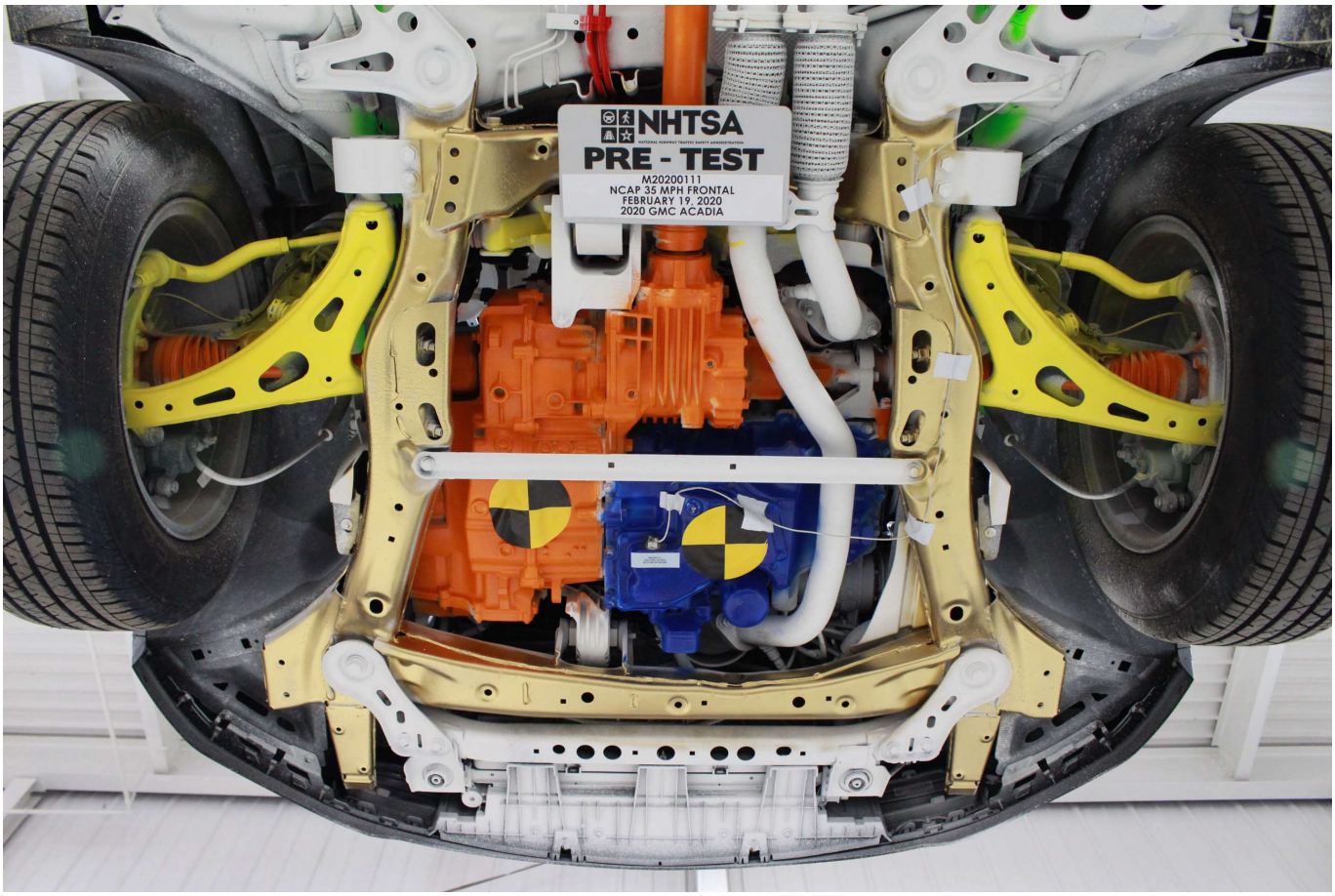


Photo No. 024 - Pre-Test Front Underbody View

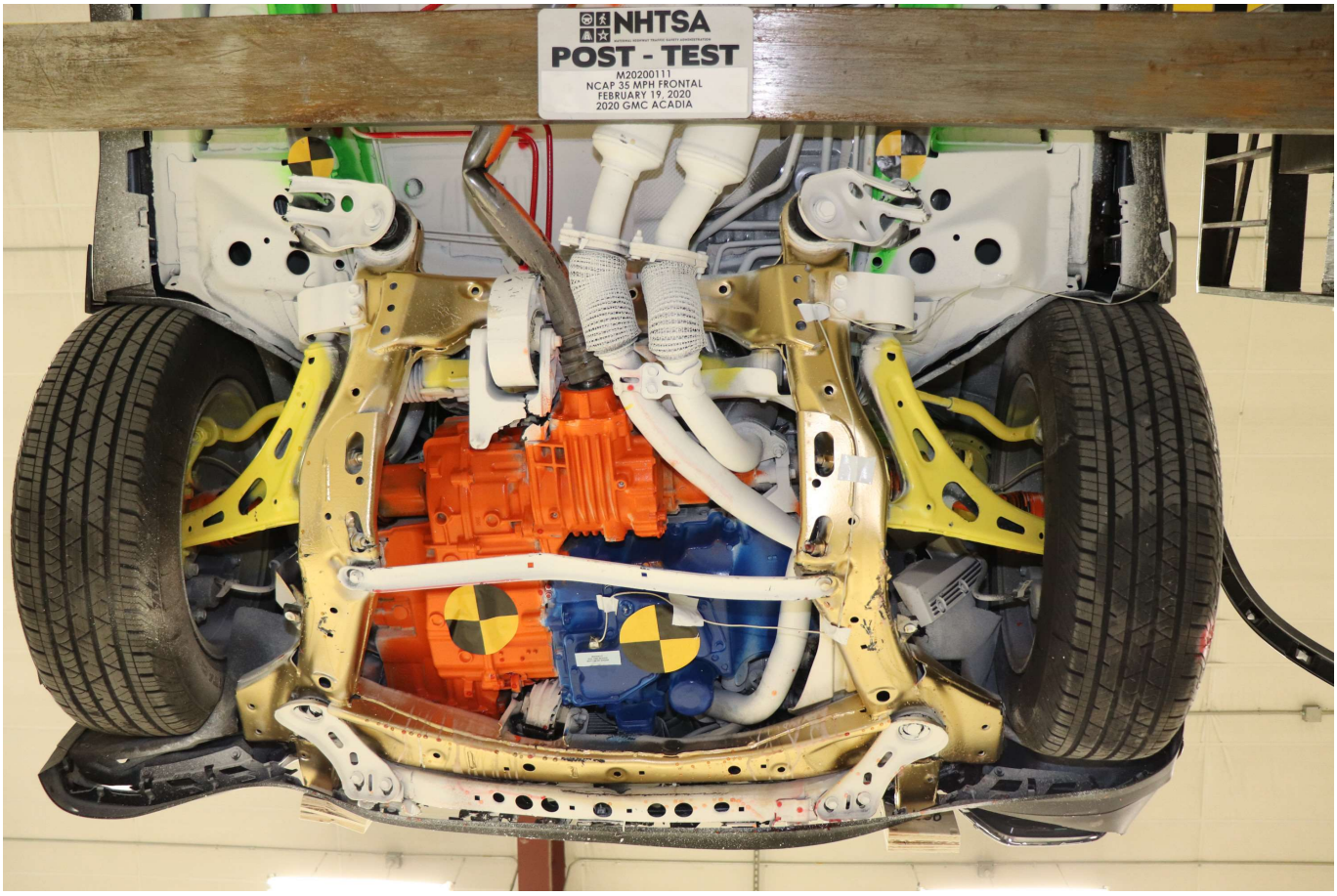


Photo No. 025 - Post-Test Front Underbody View

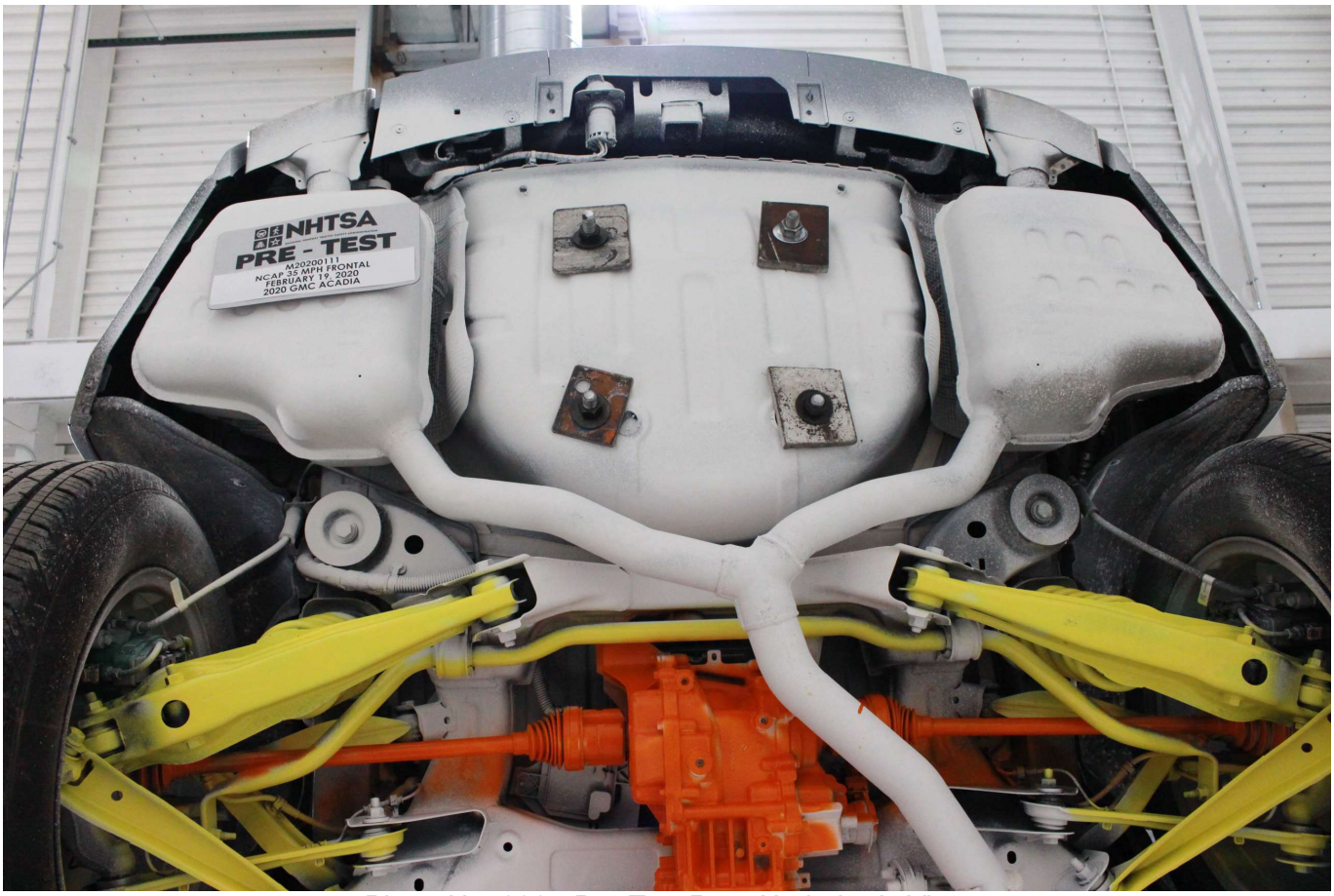


Photo No. 026 - Pre-Test Rear Underbody View

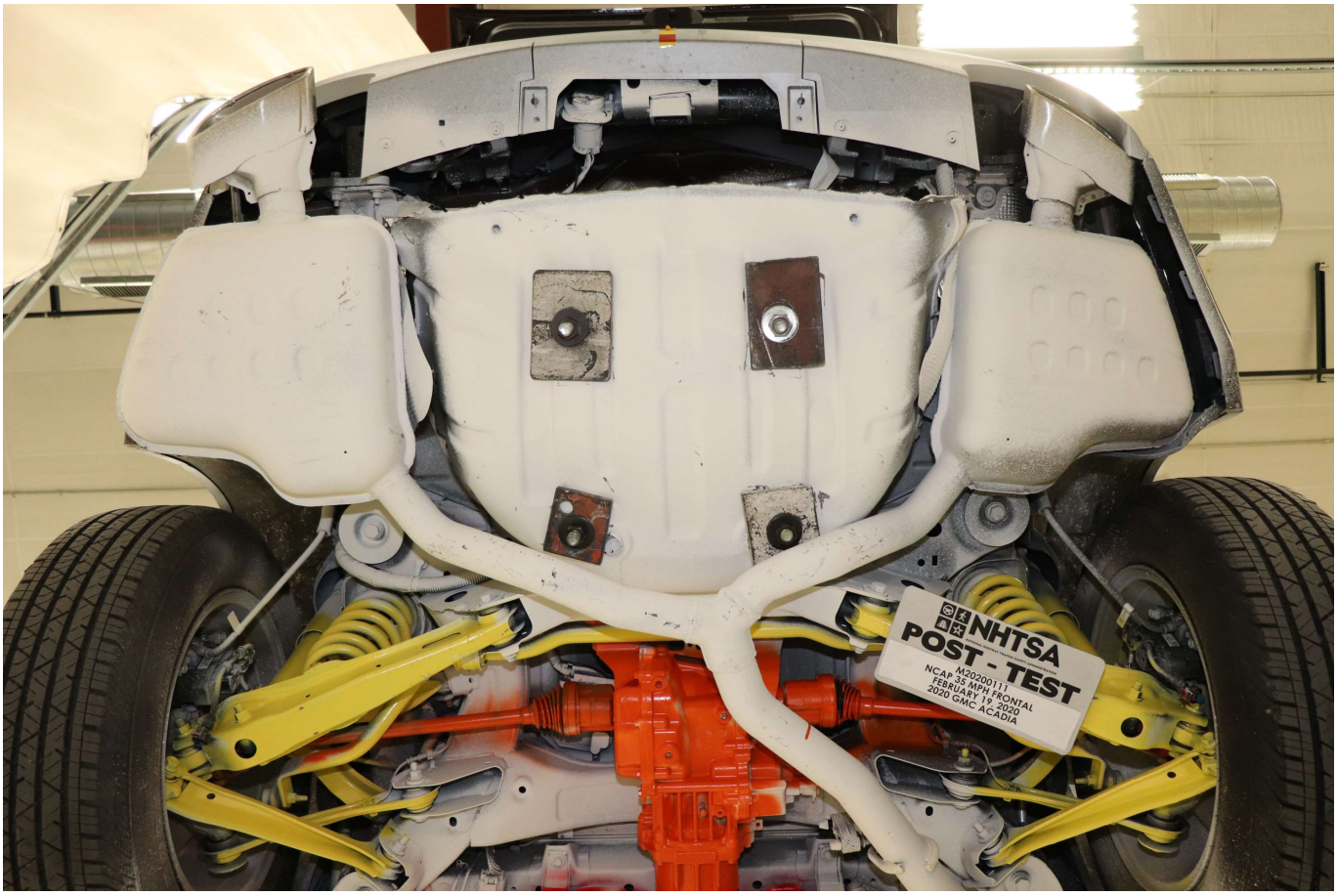


Photo No. 027 - Post-Test Rear Underbody View

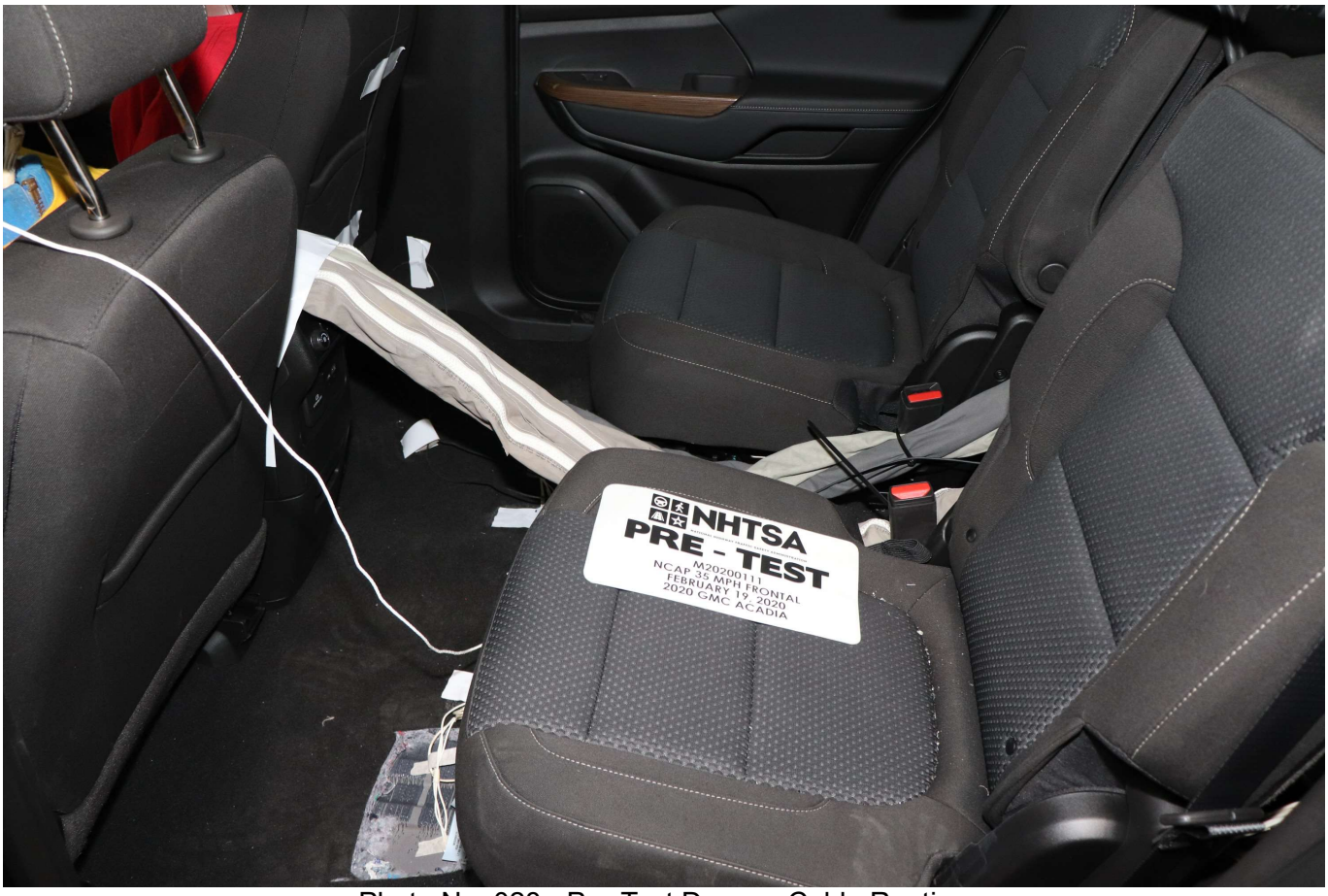


Photo No. 028 - Pre-Test Dummy Cable Routing

Photo No. 029 - Post-Test Dummy Cable Routing

Photo No. 030 - Pre-Test Driver Dummy Front View

Photo No. 031 - Post-Test Driver Dummy Front View

Photo No. 032 - Pre-Test Driver Dummy Window View

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

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

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

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

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

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

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

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

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

Photo No. 042 - Pre-Test Driver Dummy Feet

Photo No. 043 - Post-Test Driver Dummy Feet

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

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

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

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

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

Photo No. 054 - Post-Test Passenger Dummy Front View

Photo No. 055 - Pre-Test Passenger Dummy Window View

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

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

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

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

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

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

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

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

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

Photo No. 065 - Pre-Test Passenger Dummy Feet

Photo No. 066 - Post-Test Passenger Dummy Feet

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

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

Photo No. 069 - Pre-Test Passenger Side Floorpan

Photo No. 070 - Post-Test Passenger Side Floorpan

Photo No. 071 - Post-Test Passenger Dummy Face

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

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

Photo No. 074 - Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

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

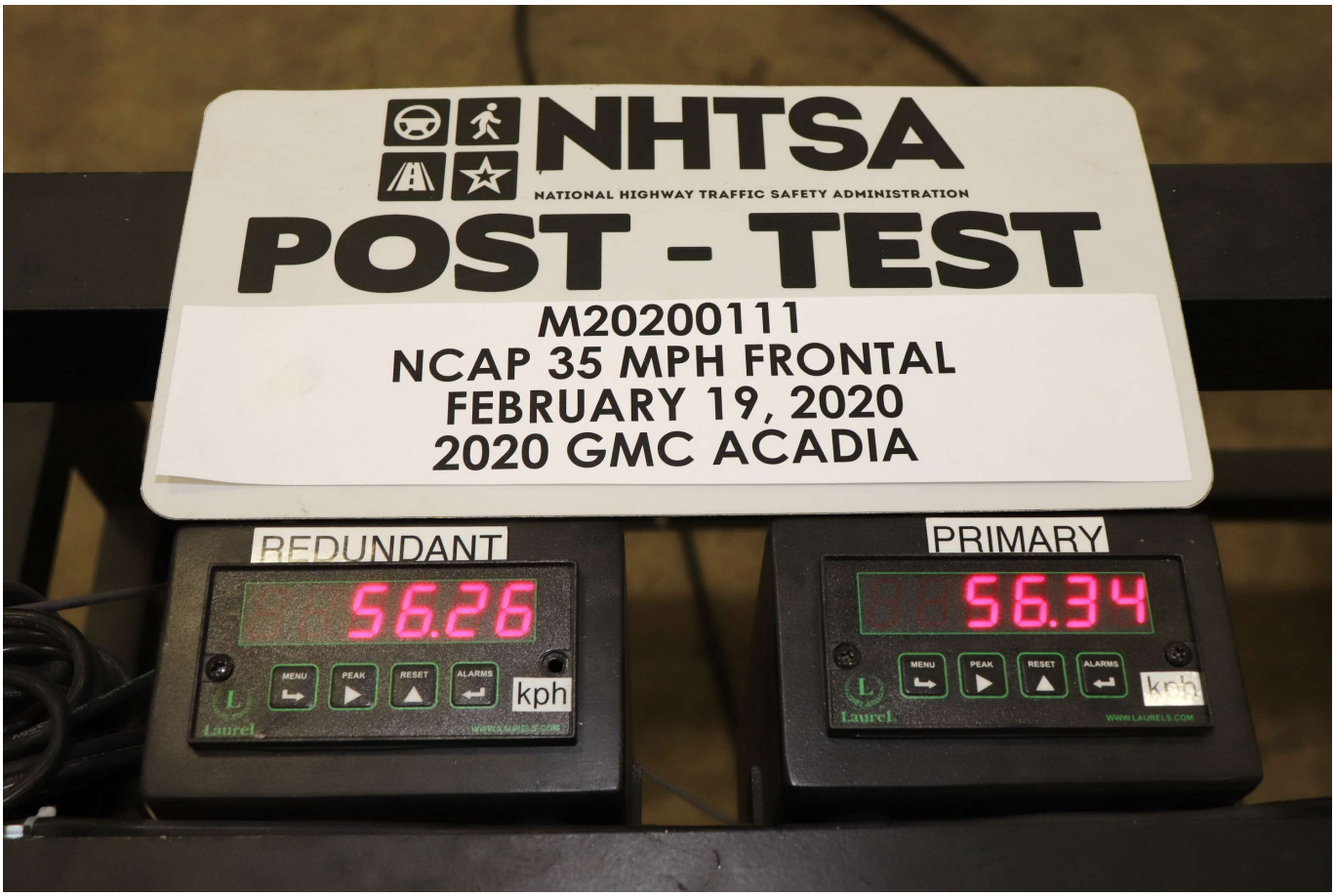


Photo No. 076 - Post-Test Speed Trap Read-Out

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

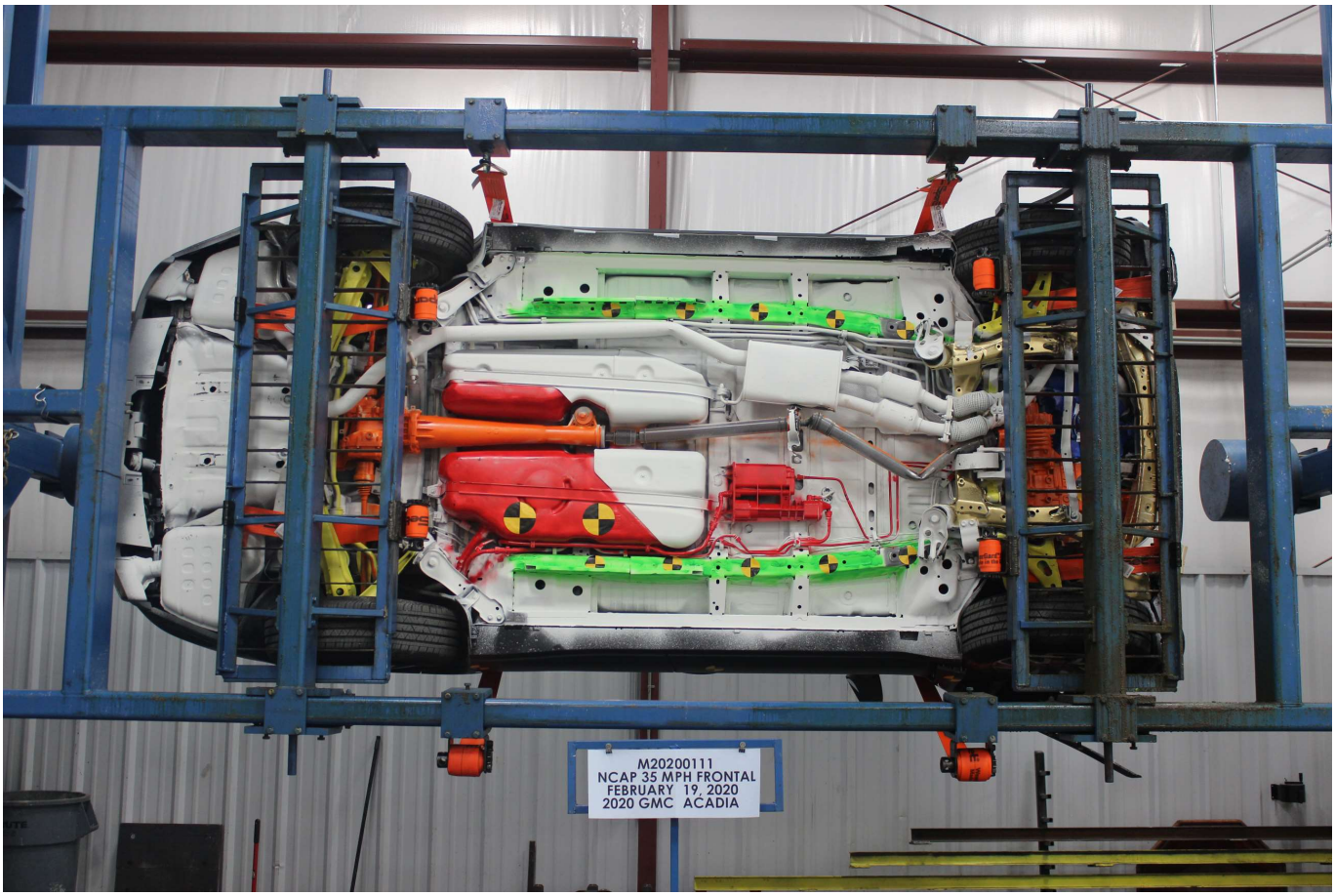


Photo No. 078 - Vehicle at 90 Degrees on Static Rollover Device

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

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

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

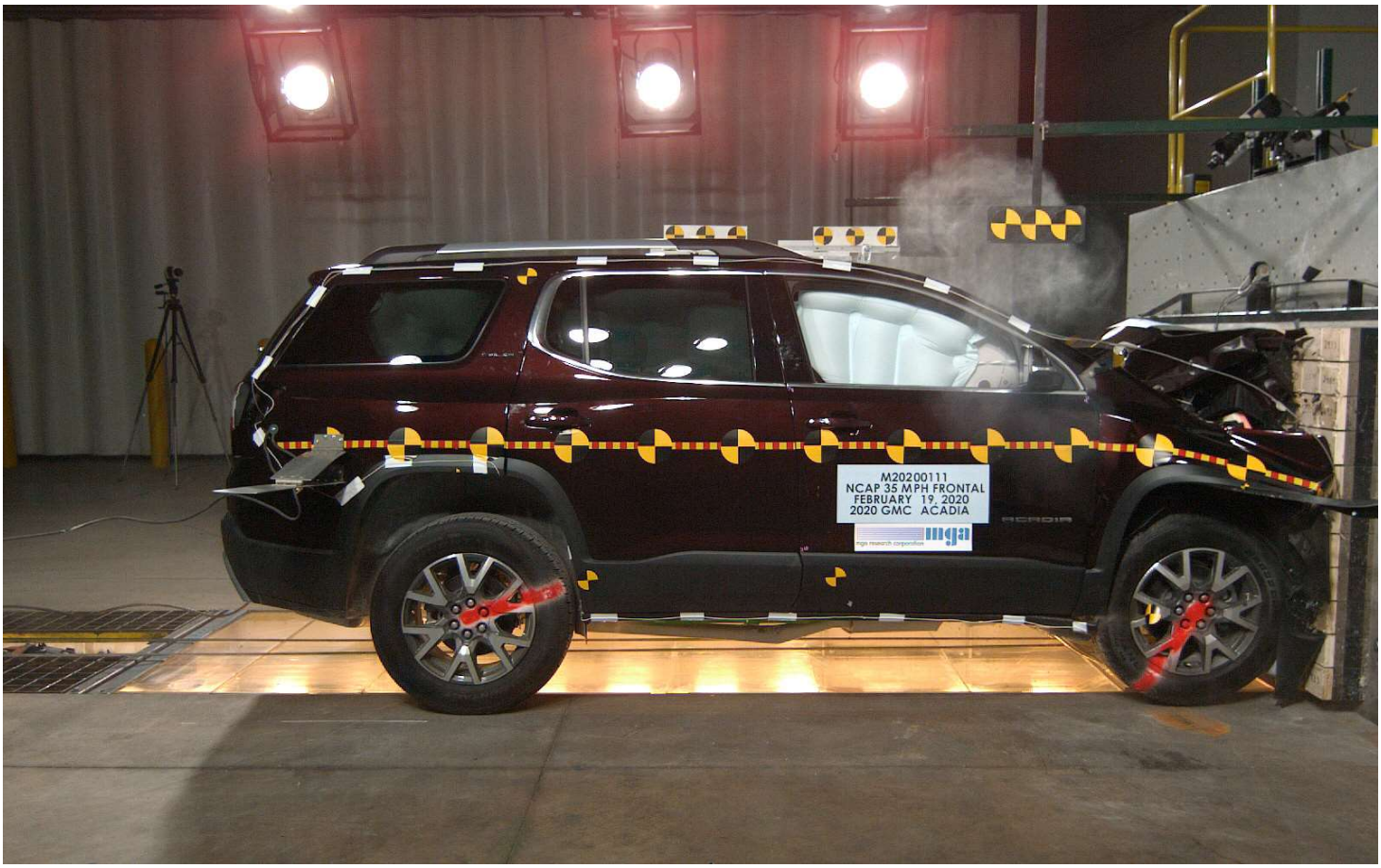


Photo No. 082 - 2020 GMC Acadia AWD SLE 5-Door SUV Frontal Impact Event

GMC

2020 ACADIA AWD SLE

EXTERIOR: RED MAHOGANY METALLIC
INTERIOR: JET BLACK

ENGINE, 3.6L V6, SIDI, DOHC, VVT
TRANSMISSION, 9-SPEED

312
20HN
47 Mi

Visit us at www.gmc.com

STANDARD EQUIPMENT

ITEMS FEATURED BELOW ARE INCLUDED AT NO EXTRA CHARGE IN THE STANDARD VEHICLE PRICE SHOWN

OWNER BENEFITS

- 3 YEAR/36,000 MILE* BUMPER-TO-BUMPER LIMITED WARRANTY
- 5 YEAR/ 60,000 MILE* POWERTRAIN LIMITED WARRANTY, ROADSIDE ASSISTANCE & COURTESY TRANSPORTATION
- FIRST MAINTENANCE VISIT
- * WHICHEVER COME FIRST SEE GMC.COM OR DEALER FOR TEAMS, DETAILS & LIMITS

PERFORMANCE & MECHANICAL

- ANTILOCK BRAKE SYSTEM, 4 WHEEL DISC
- ENG CONTROL STOP/START SYS
- WHEELS, 18" ALUMINUM WITH DARK ACCENTS
- WHEEL, SPARE, 18" STEEL

CONNECTIVITY & TECHNOLOGY

- GMC INFOTAINMENT SYSTEM, 8" DIA. COLOR MULTI-TOUCH DISPLAY, BLUETOOTH STREAMING AUDIO, ANDROID AUTO AND APPLE CARPLAY CAPABILITY FOR COMPATIBLE PHONES
- DISPLAY, MULTI-COLOR DRIVER INSTRUMENT INFO ENHANCED
- ACTIVE NOISE CANCELLATION
- KEYLESS OPEN AND START
- REAR SEAT REMINDER
- SIRIUSXM RADIO CAPABLE, ALL ACCESS TRIAL W/ SUBSCRIPTION SOLD SEPARATELY
- ONSTAR (R) SERVICES & 4G LTE WI-FI (R) AVAILABLE; SEE ONSTAR.COM FOR TERMS

INTERIOR

- SEATING, 7-PASSENGER
- LEATHER WRAP STEERING WHEEL
- STEERING COLUMN, TILT & TELESCOPING
- SEAT ADJUSTER, DRIVER 4-WAY MANUAL
- SEAT ADJUSTER, PASSENGER 4-WAY MANUAL
- AIR CONDITIONING, TRI ZONE AUTO CLIMATE CONTROL
- WINDOWS, POWER, DRIVER WITH EXPRESS UP/DOWN, FRONT PASSENGER EXPRESS DOWN

EXTERIOR

- MIRRORS, OUTSIDE HEATED, POWER ADJUSTABLE, BODY COLOR TURN SIGNAL INDICATORS
- HEADLAMPS, LED
- DAYTIME RUNNING LAMPS, LED

SAFETY & SECURITY

- REAR PARK ASSIST
- REAR CROSS TRAFFIC ALERT
- LANE CHANGE ALERT WITH SIDE BLIND ZONE ALERT
- HD REAR VISION CAMERA
- TEEN DRIVER

MANUFACTURER'S SUGGESTED RETAIL PRICE

STANDARD VEHICLE PRICE	**$36,200.00**

OPTIONS & PRICING

OPTIONS INSTALLED BY THE MANUFACTURER (MAY REPLACE STANDARD EQUIPMENT SHOWN)

RED MAHOGANY METALLIC	495.00
ENGINE, 3.6L V6, SIDI, DOHC, VVT	495.00
SEATING, 6-PASSENGER	INC.
DRIVER CONVENIENCE PACKAGE:	1,750.00
• SEAT ADJUSTER, DRIVER 8-WAY POWER	
• POWER LUMBAR, DRIVER SEAT	
• REMOTE VEHICLE START	
• DRIVER & FRONT PASSENGER HEATED SEATS	
• POWER OUTLET	
• LIFTGATE, POWER, HANDS FREE	
• ROOF RAILS, SILVER	
TRAILERING PACKAGE:	650.00
• HITCH GUIDANCE W/ HITCH VIEW	
• ALTERNATOR, 170 AMPS	
• COOLING SYSTEM, HEAVY DUTY	
TOTAL OPTIONS	$3,390.00
TOTAL VEHICLE & OPTIONS	$39,590.00
DESTINATION CHARGE	1,195.00
TOTAL VEHICLE PRICE*	**$40,785.00**

EPA DOT Fuel Economy and Environment

Gasoline Vehicle

Fuel Economy

21 MPG

Standard SUVs range from 13 to 93 MPG. The best vehicle rates 136 MPGe.

18 city | 25 highway

combined city/hwy

4.8 gallons per 100 miles

You **spend $2,250** more in fuel costs over 5 years compared to the average new vehicle.

G B H

Annual fuel cost $1,950

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 4 (1 – 10, Best)

This vehicle emits 433 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.

Smog Rating (tailpipe only): 6 (1 – 10, Best)

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 ratings 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**

Based on the risk of injury in a side impact.

Rollover — ★★★★

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

Equipped with the safety and security of OnStar®
Visit onstar.com for details.
onstar.com/privacy

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE:
U.S./CANADIAN PARTS CONTENT: 52%
MAJOR SOURCES OF FOREIGN PARTS CONTENT: MEXICO 21%

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

FOR THIS VEHICLE:
FINAL ASSEMBLY POINT:
SPRING HILL, TN U.S.A.
COUNTRY OF ORIGIN:
ENGINE: UNITED STATES
TRANSMISSION: UNITED STATES

This label has been applied pursuant to Federal law – Do not remove prior to delivery to the ultimate purchaser. *Includes Manufacturer's Recommended Pre-Delivery Service. Does not include dealer installed options and accessories not listed above, local taxes or license fees.

ORDER NO XGWH59 SALES CODE E
SALES MODEL CODE TNJ26
DEALER NO 12766
FINAL ASSEMBLY:
SPRING HILL, TN U.S.A.

VIN 1GKKNRLS4LZ156199

DEALER TO WHOM DELIVERED
BOUCHER BUICK GMC
1907 E MORELAND RD
WAUKESHA, WI 53186-4020

HL
1GA0762965

Photo No. 083 - Monroney Label Photograph

APPENDIX B
DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

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

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Head Angular Velocity X

Driver Head Angular Velocity Y

Driver Head Angular Velocity Z

Driver Upper Neck Force Y

Driver Upper Neck Moment X

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

Driver Left Femur Redundant

Driver Right Femur Redundant

Driver Left Upper Tibia Moment X

Driver Left Upper Tibia Moment Y

Driver Left Upper Tibia Force Z

Driver Left Lower Tibia Moment X

Driver Left Lower Tibia Moment Y

Driver Left Lower Tibia Force Z

Driver Right Upper Tibia Moment X

Driver Right Upper Tibia Moment Y

Driver Right Upper Tibia Force Z

Driver Right Lower Tibia Moment X

Driver Right Lower Tibia Moment Y

Driver Right Lower Tibia Force Z

Driver Left Foot Fore Z

Driver Left Foot Aft X

Driver Left Foot Aft Z

Driver Right Foot Fore Z

Driver Right Foot Aft X

Driver Right Foot Aft Z

Driver Lap Belt Force

Driver Shoulder Belt Force

Passenger Head X Redundant

Passenger Head Y Redundant

Passenger Head Z Redundant

Passenger Head Angular Velocity X

Passenger Head Angular Velocity Y

Passenger Head Angular Velocity Z

Passenger Upper Neck Force Y

Passenger Upper Neck Moment X

Passenger Upper Neck Moment Z

Passenger Chest X Redundant

Passenger Chest Y Redundant

Passenger Chest Z Redundant

Passenger Pelvis X

Passenger Pelvis Y

Passenger Pelvis Z

Passenger Left Femur Redundant

Passenger Right Femur Redundant

Passenger Left Upper Tibia Moment X

Passenger Left Upper Tibia Moment Y

Passenger Left Upper Tibia Force Z

Passenger Left Lower Tibia Moment X

Passenger Left Lower Tibia Moment Y

Passenger Left Lower Tibia Force Z

Passenger Right Upper Tibia Moment X

Passenger Right Upper Tibia Moment Y

Passenger Right Upper Tibia Force Z

Passenger Right Lower Tibia Moment X

Passenger Right Lower Tibia Moment Y

Passenger Right Lower Tibia Force Z

Passenger Left Foot Fore Z

Passenger Left Foot Aft X

Passenger Left Foot Aft Z

Passenger Right Foot Fore Z

Passenger Right Foot Aft X

Passenger Right Foot Aft Z

Passenger Lap Belt Force

Passenger Shoulder Belt Force

Left Rear Seat Crossmember X

Right Rear Seat Crossmember X

Vehicle Engine Top X

Vehicle Engine Bottom X

Left Rear Seat Crossmember Z

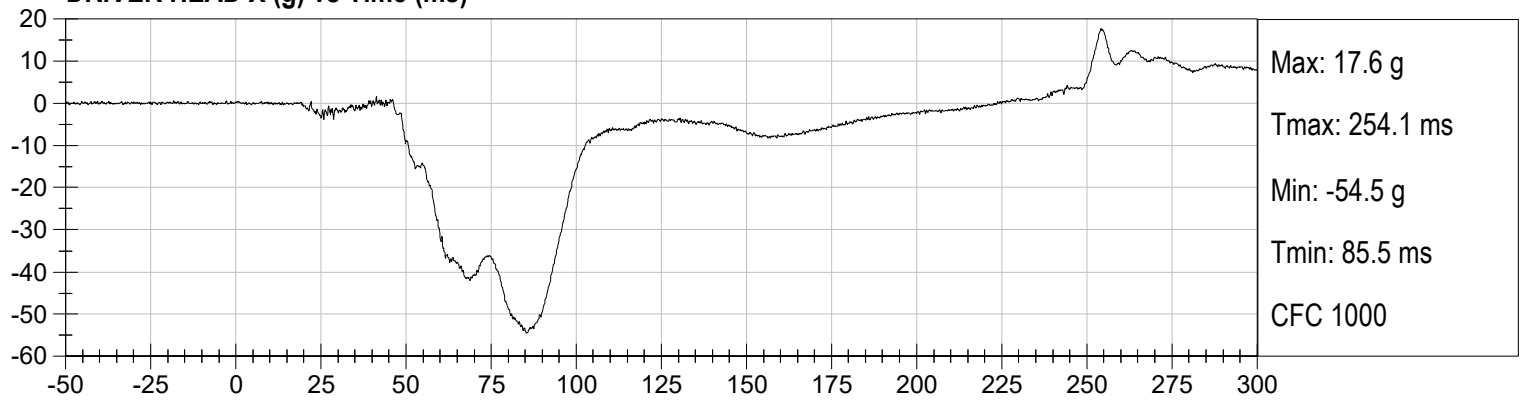
Right Rear Seat Crossmember Z

Left Rear Seat Crossmember Xr

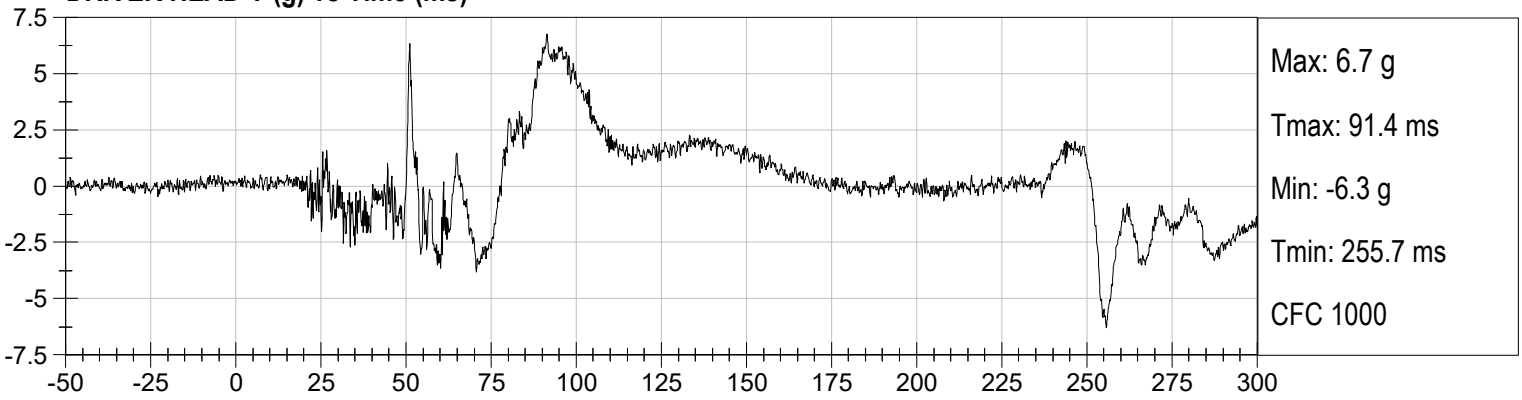
Right Rear Seat Crossmember Xr

Advanced Research Load Cell Barrier – 528 channels

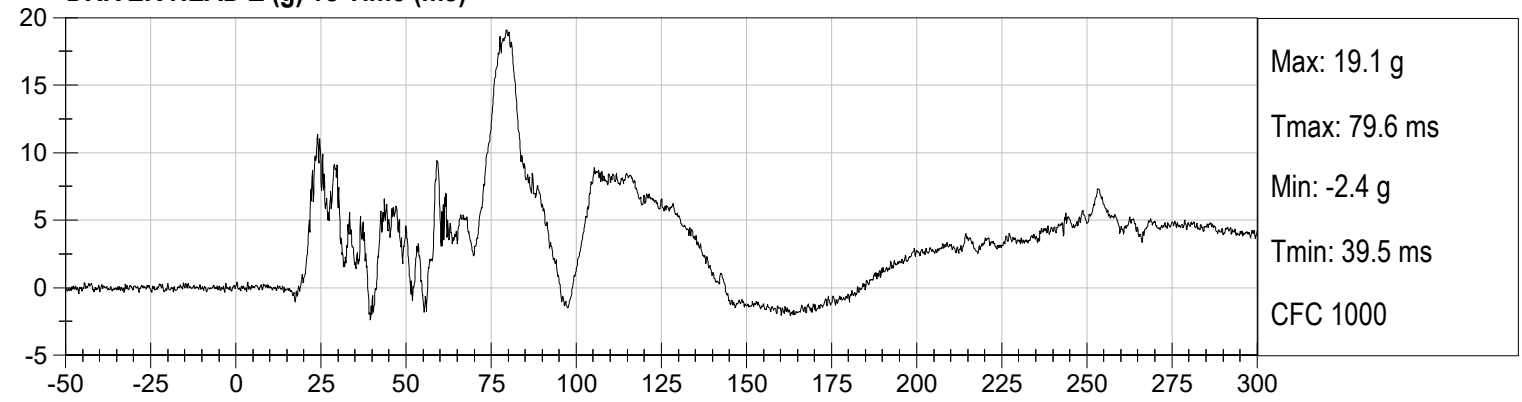
DRIVER HEAD X (g) vs Time (ms)



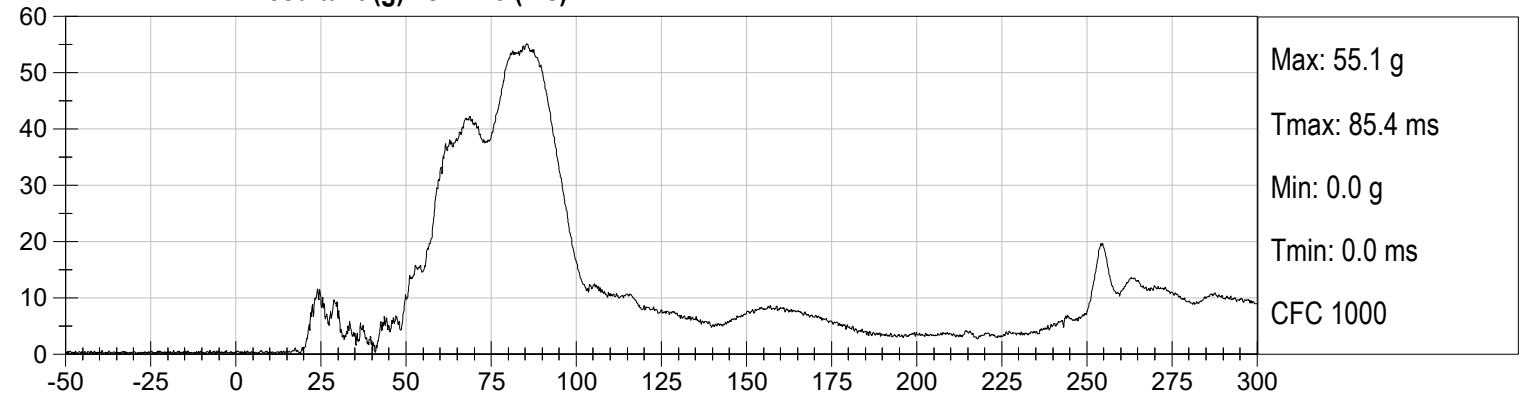
DRIVER HEAD Y (g) vs Time (ms)



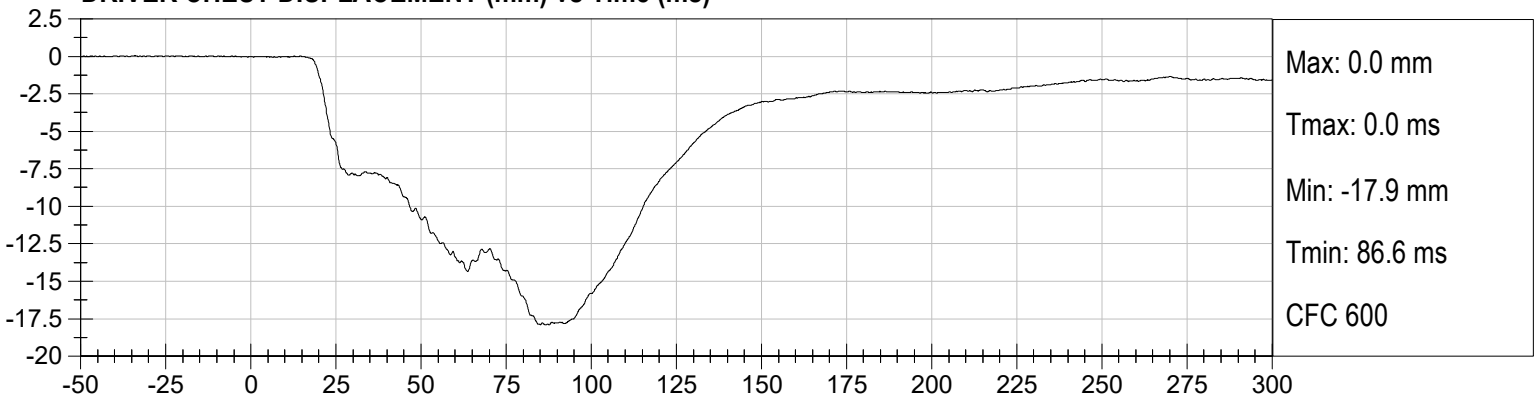
DRIVER HEAD Z (g) vs Time (ms)



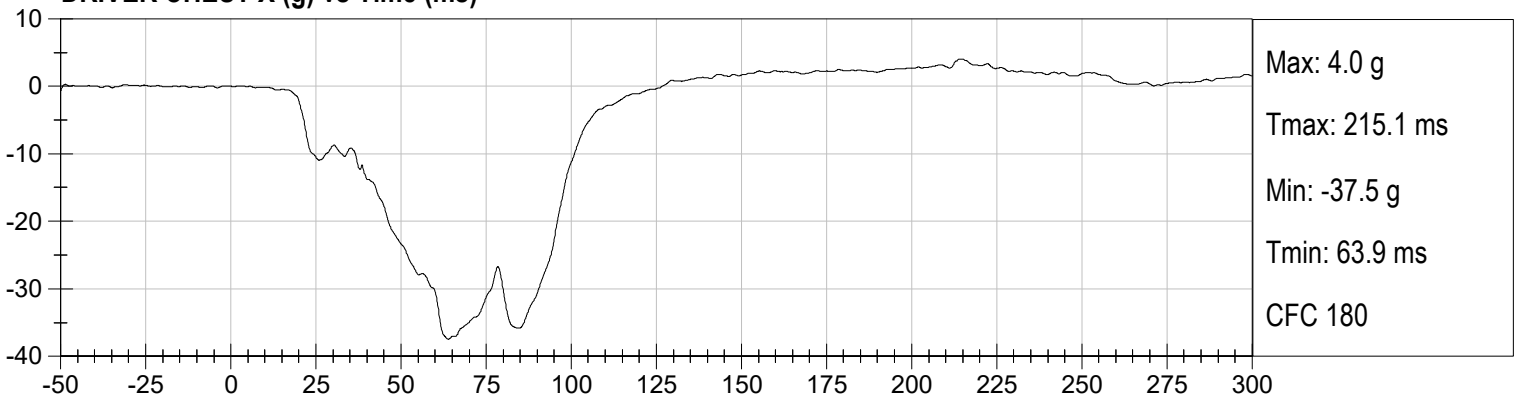
DRIVER HEAD Resultant (g) vs Time (ms)



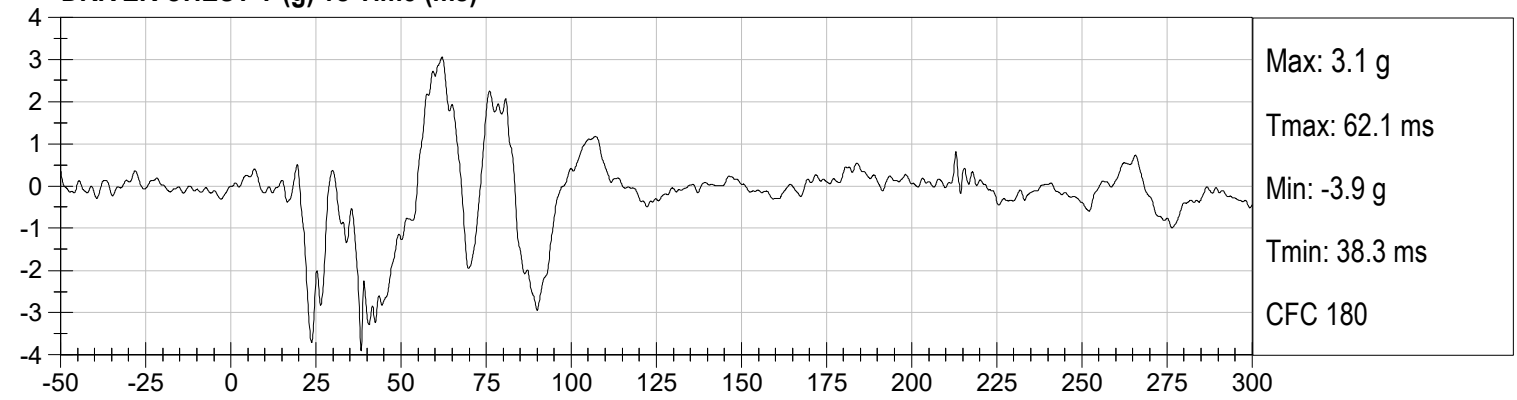
DRIVER CHEST DISPLACEMENT (mm) vs Time (ms)



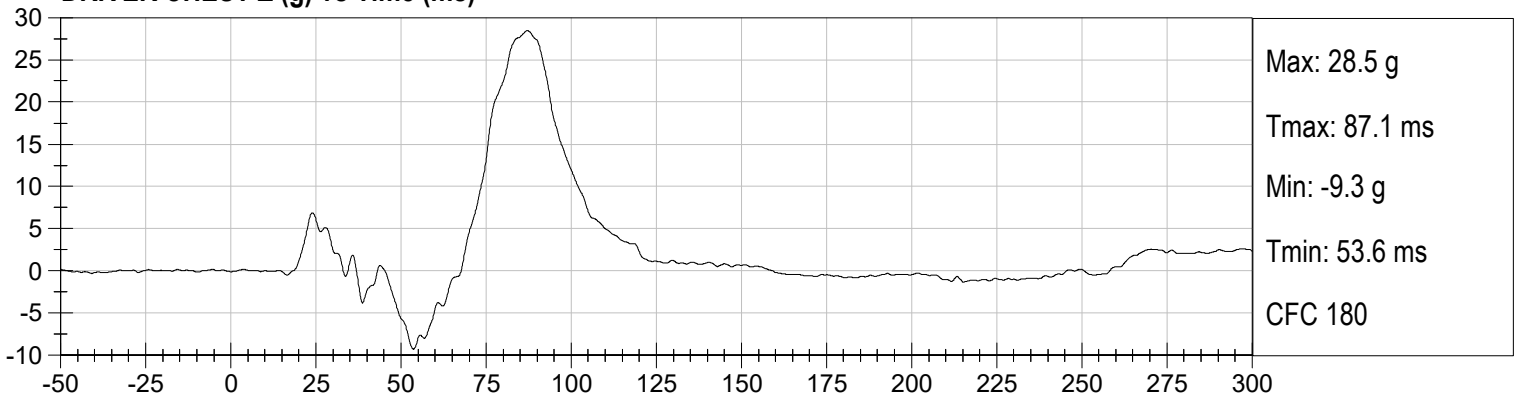
DRIVER CHEST X (g) vs Time (ms)



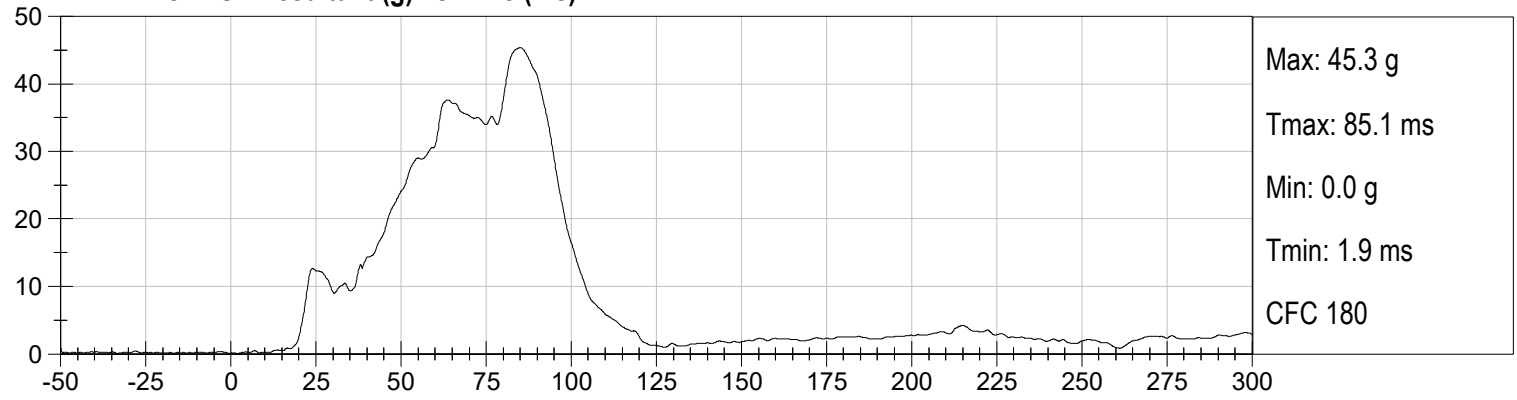
DRIVER CHEST Y (g) vs Time (ms)



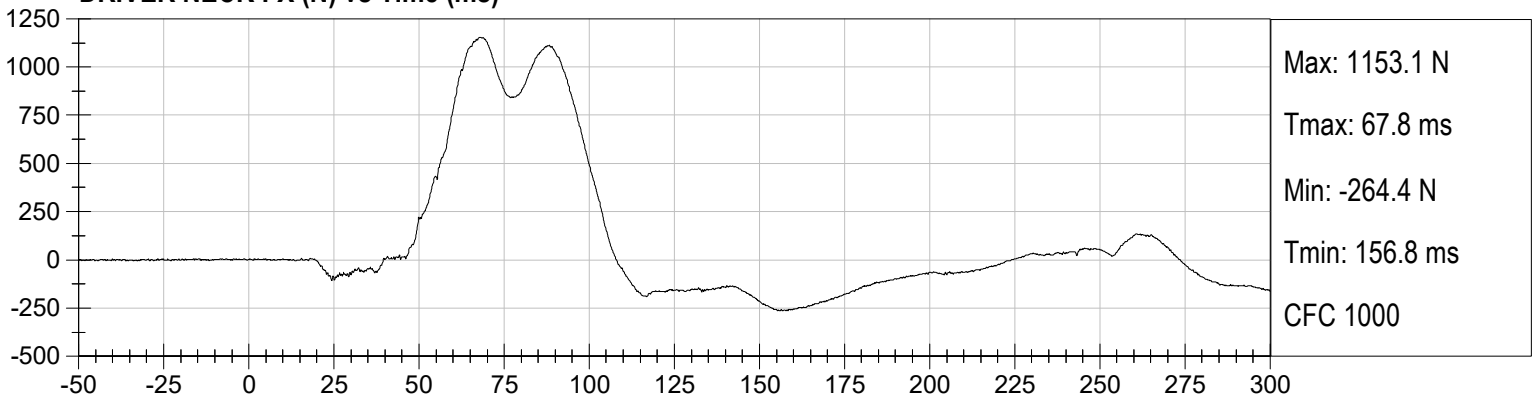
DRIVER CHEST Z (g) vs Time (ms)



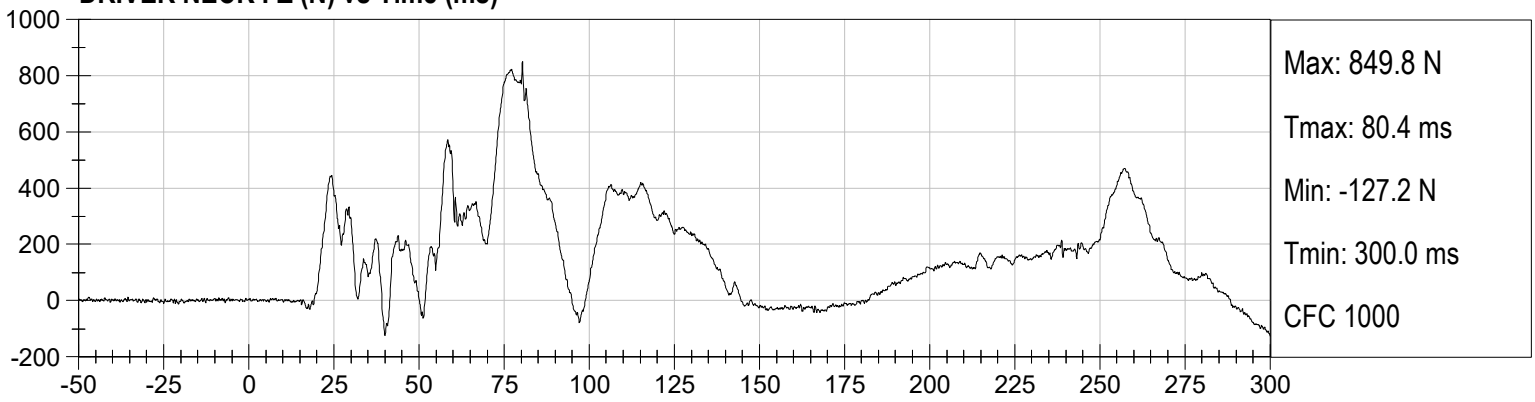
DRIVER CHEST Resultant (g) vs Time (ms)



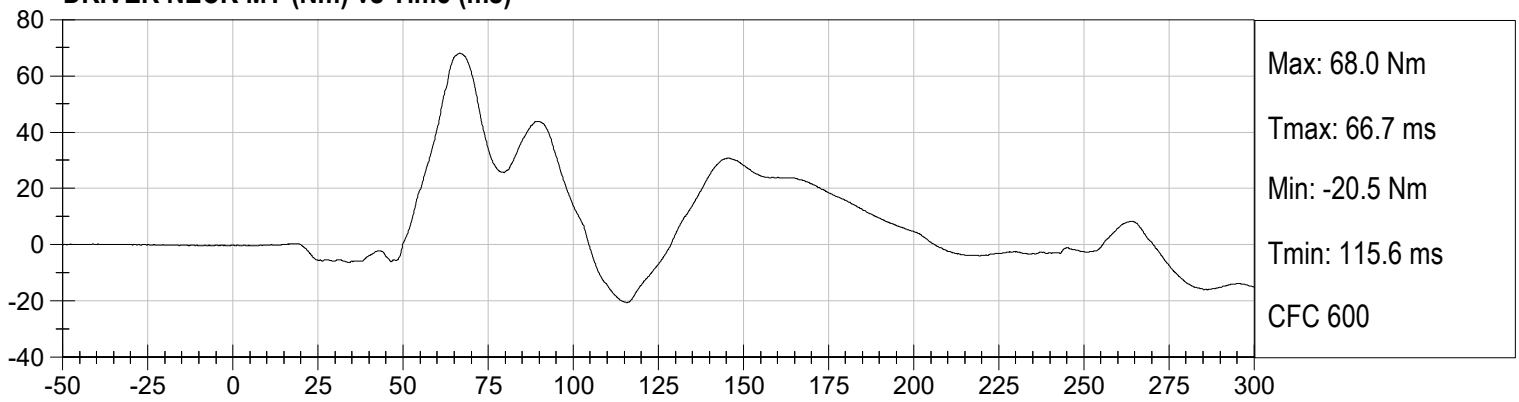
DRIVER NECK FX (N) vs Time (ms)



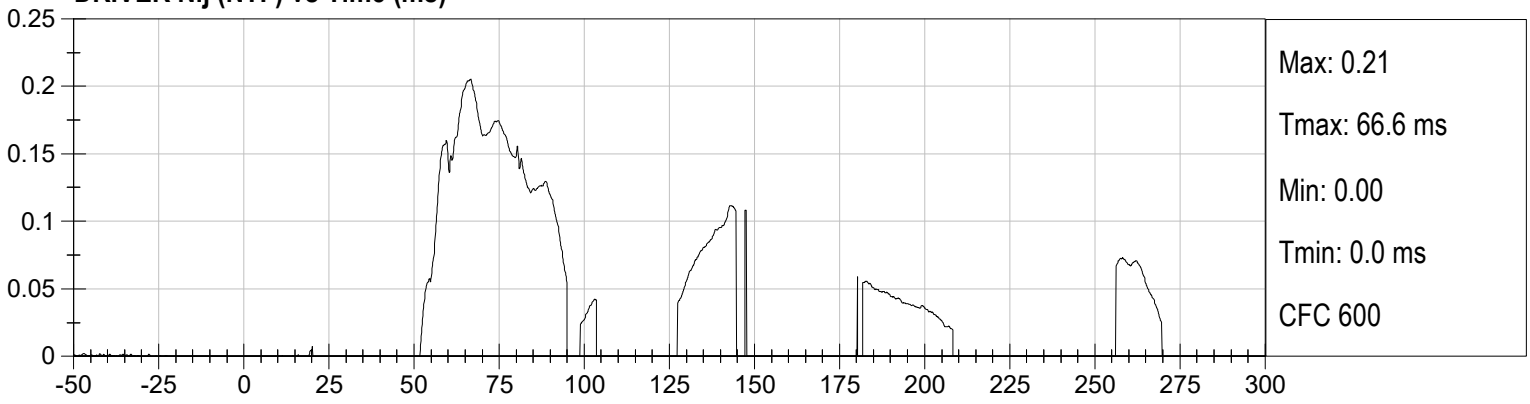
DRIVER NECK FZ (N) vs Time (ms)



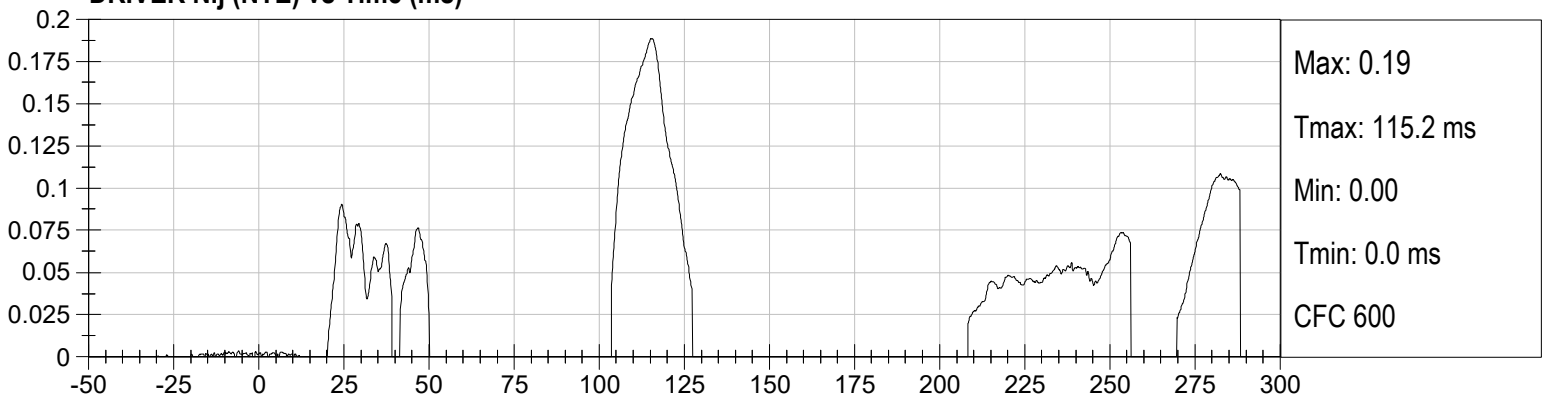
DRIVER NECK MY (Nm) vs Time (ms)



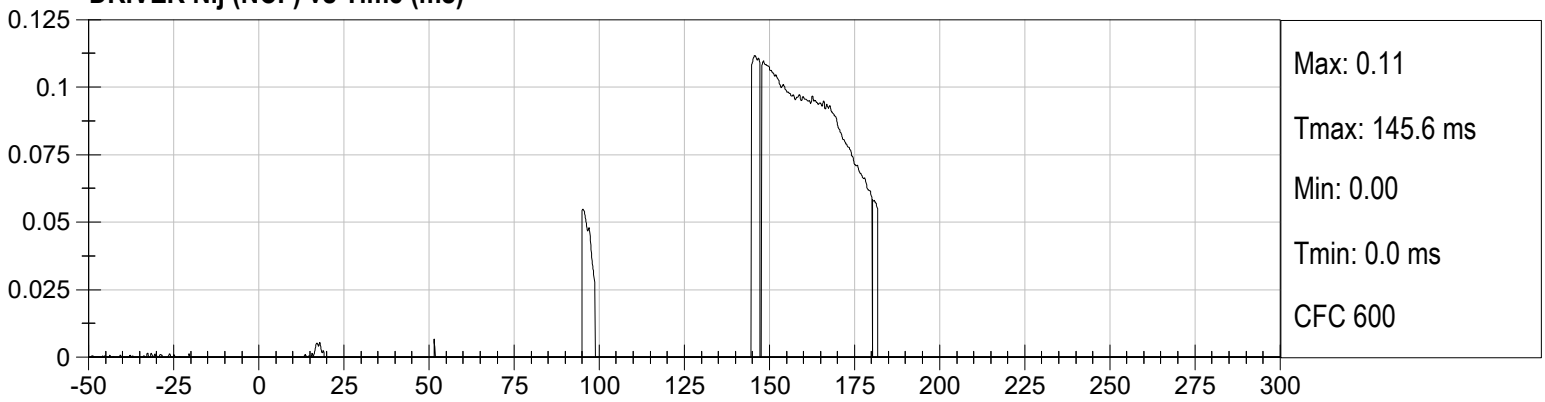
DRIVER Nij (NTF) vs Time (ms)



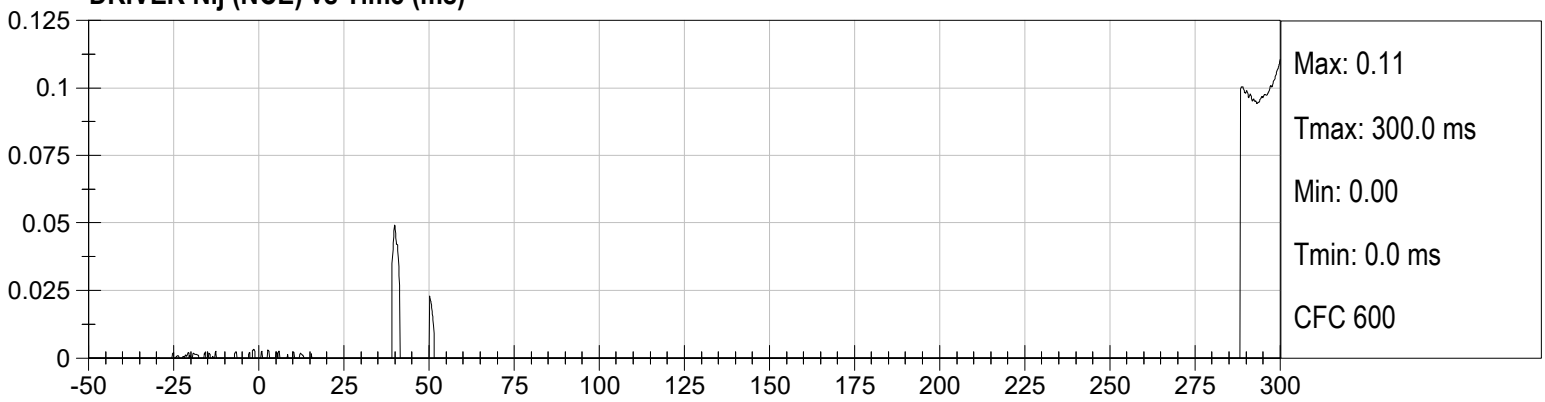
DRIVER Nij (NTE) vs Time (ms)



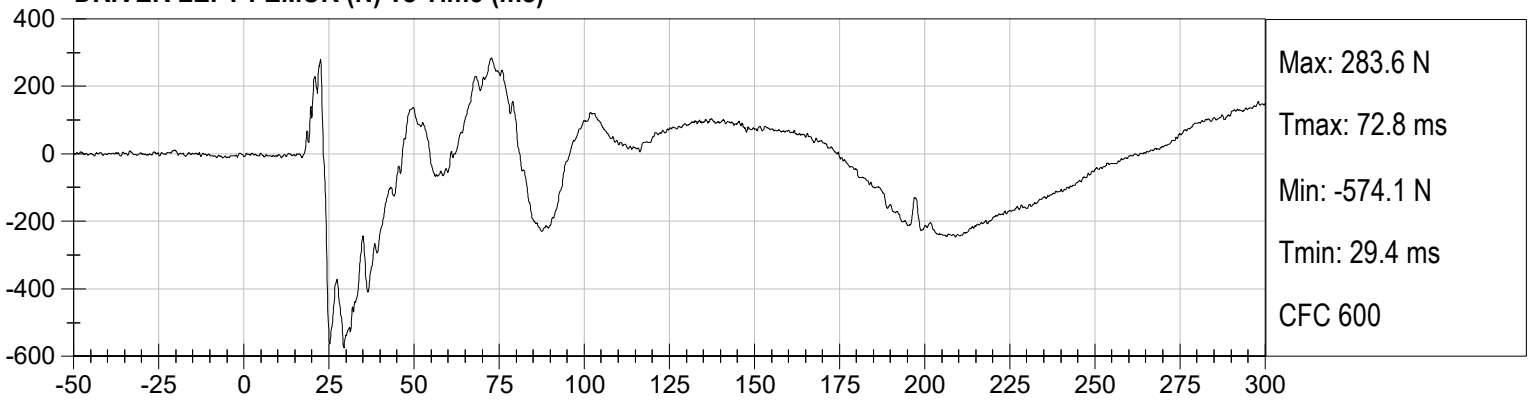
DRIVER Nij (NCF) vs Time (ms)



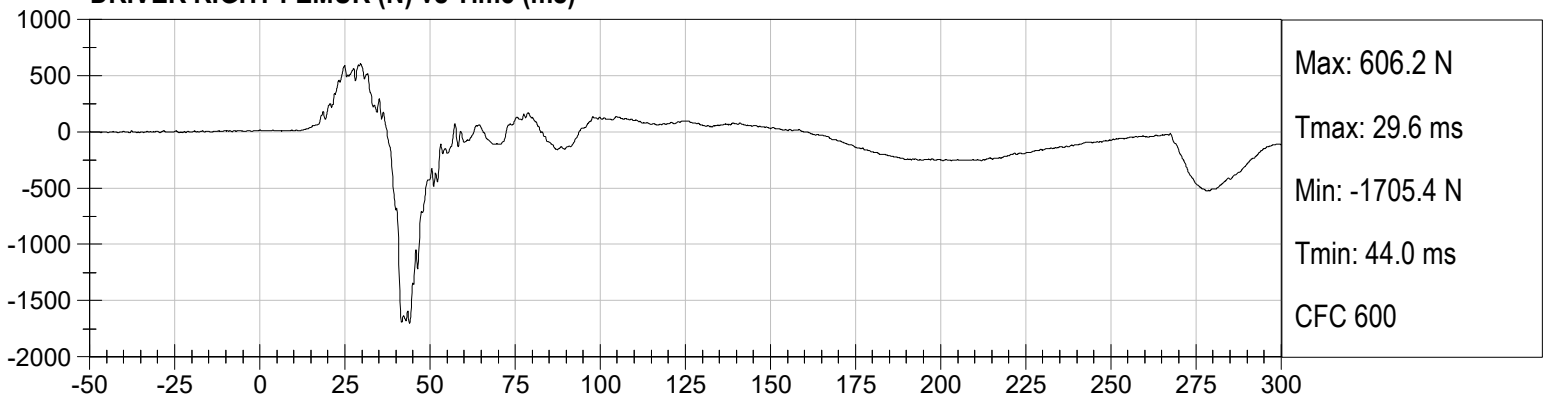
DRIVER Nij (NCE) vs Time (ms)



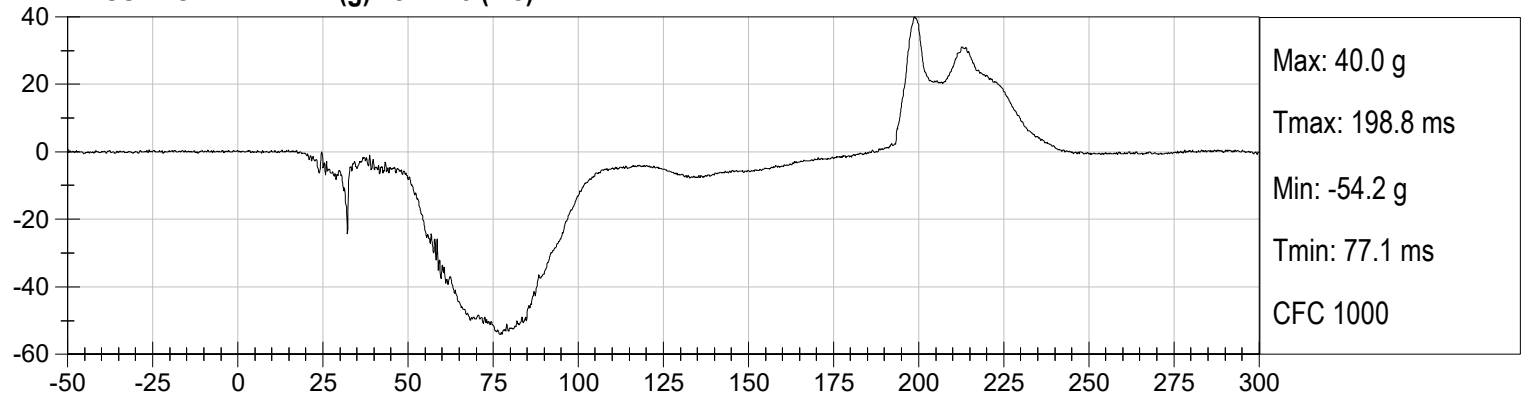
DRIVER LEFT FEMUR (N) vs Time (ms)



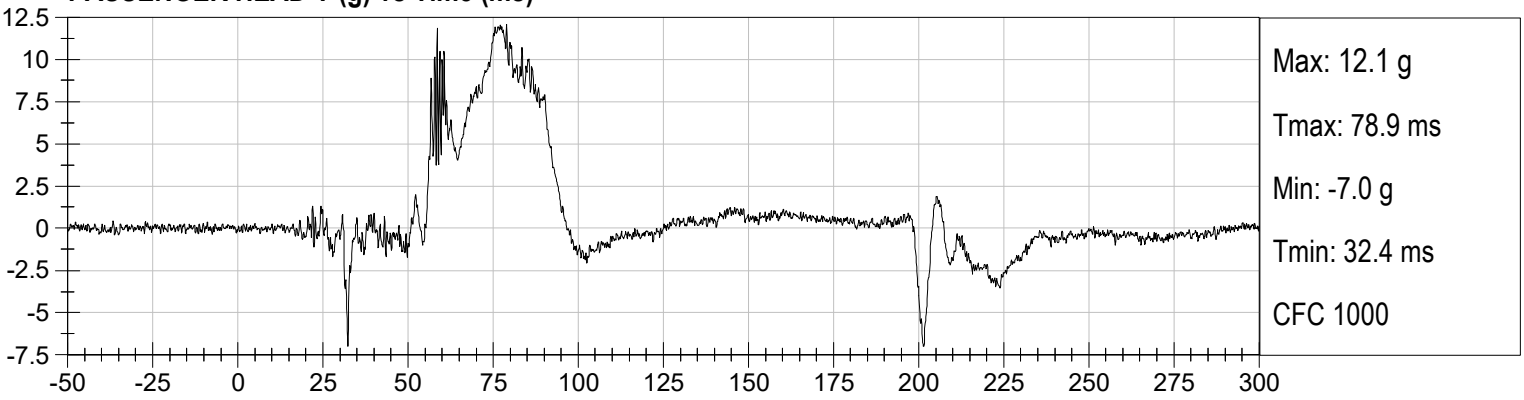
DRIVER RIGHT FEMUR (N) vs Time (ms)



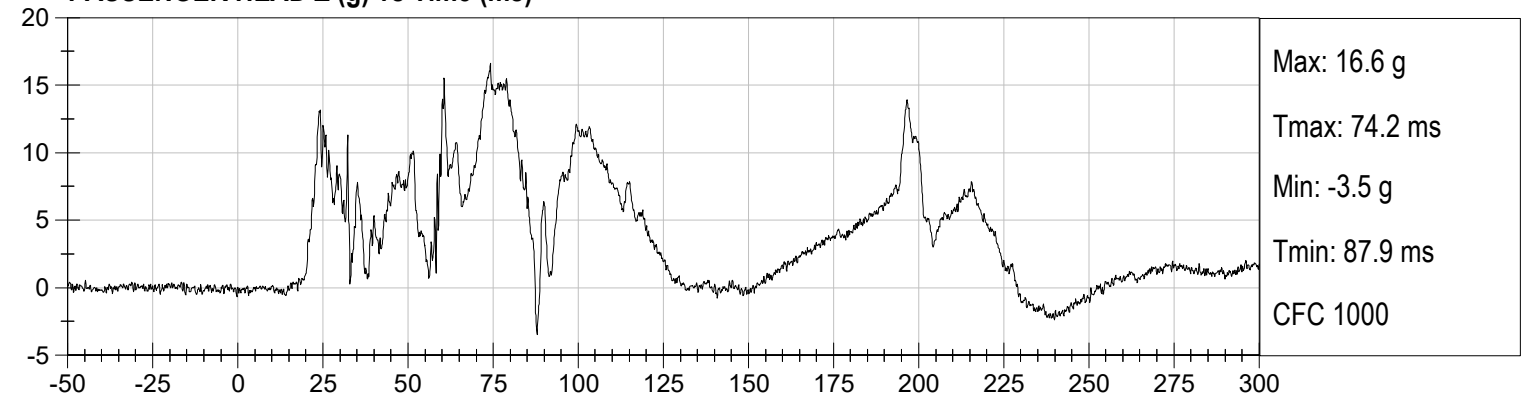
PASSENGER HEAD X (g) vs Time (ms)



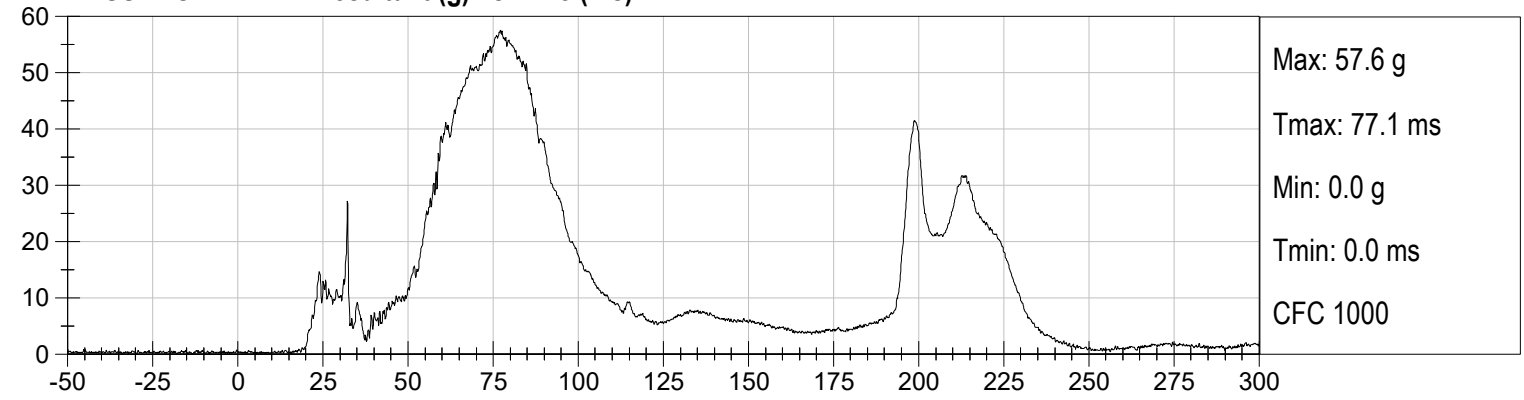
PASSENGER HEAD Y (g) vs Time (ms)



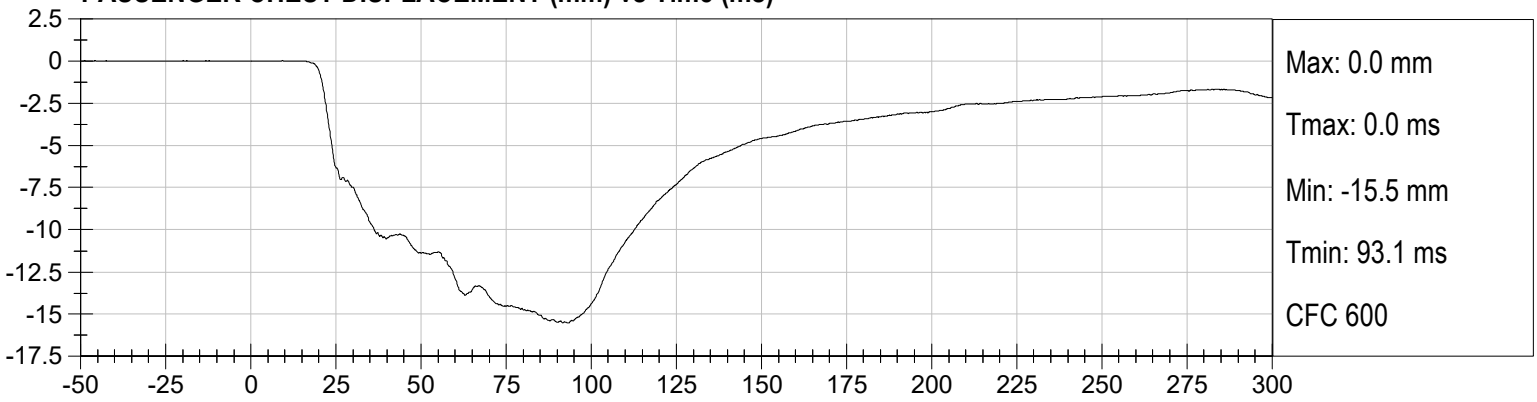
PASSENGER HEAD Z (g) vs Time (ms)



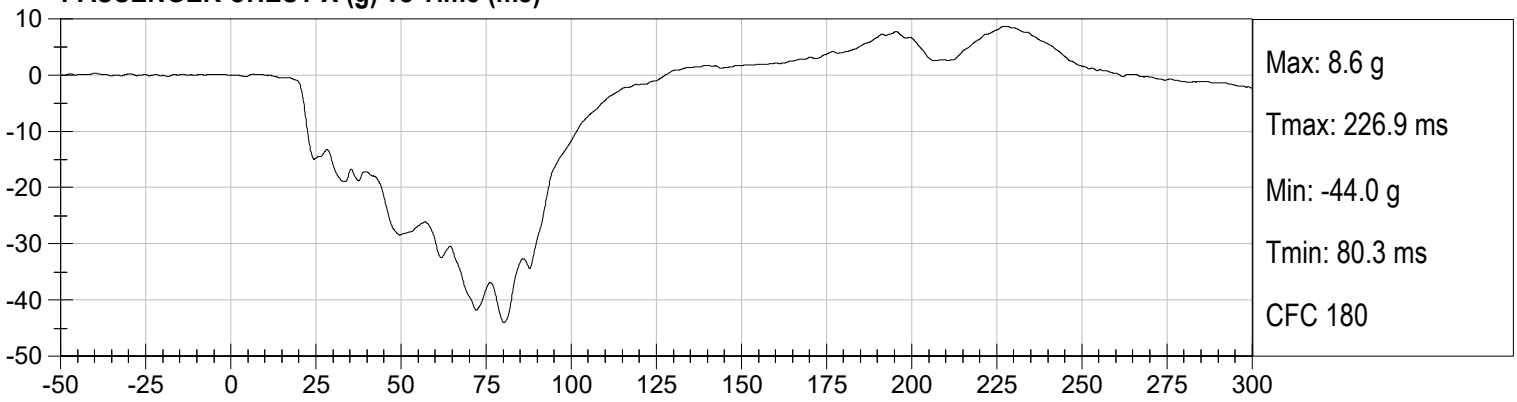
PASSENGER HEAD Resultant (g) vs Time (ms)



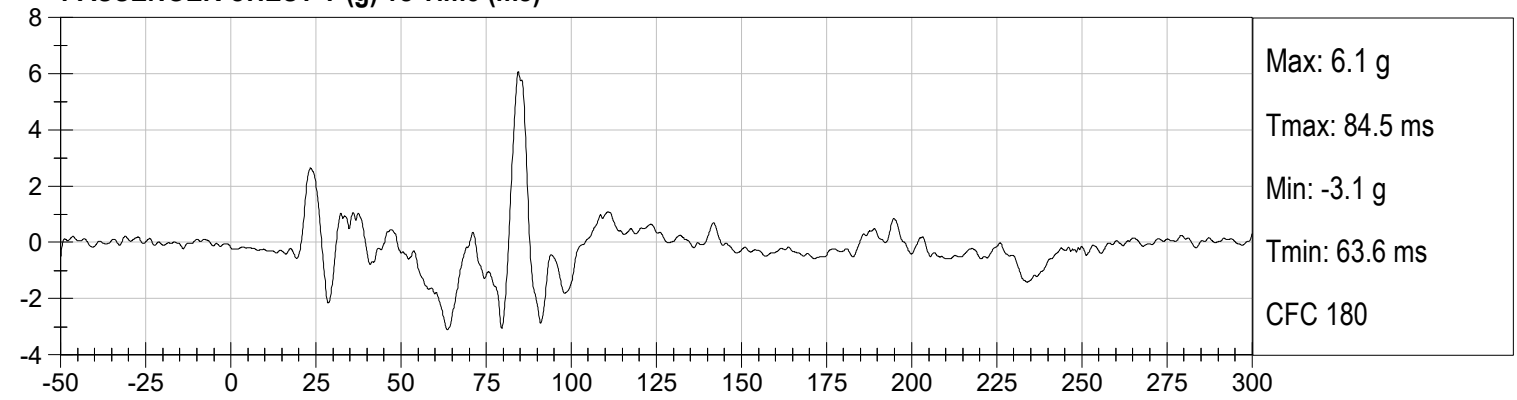
PASSENGER CHEST DISPLACEMENT (mm) vs Time (ms)



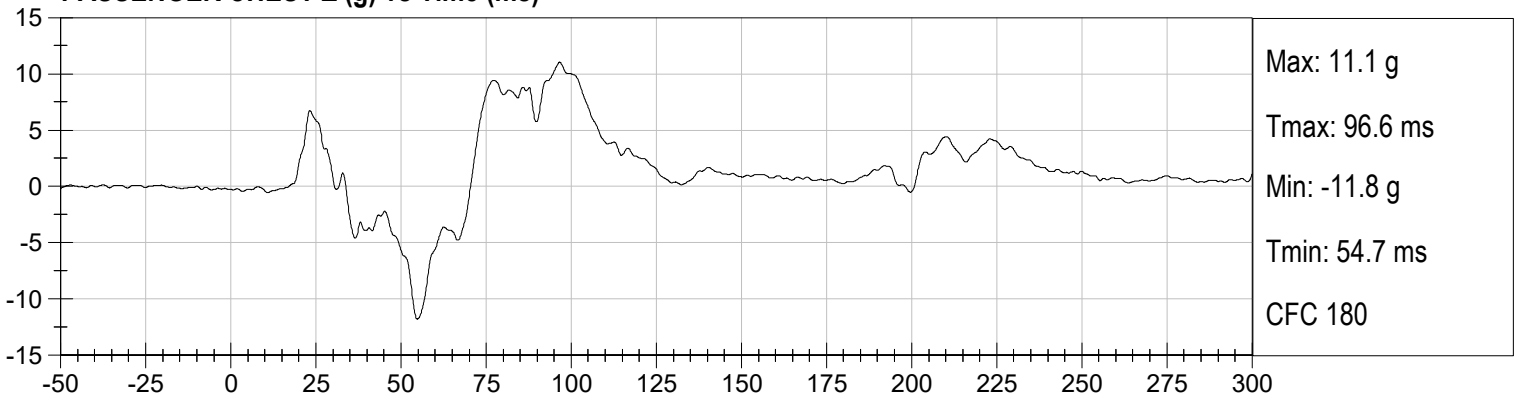
PASSENGER CHEST X (g) vs Time (ms)



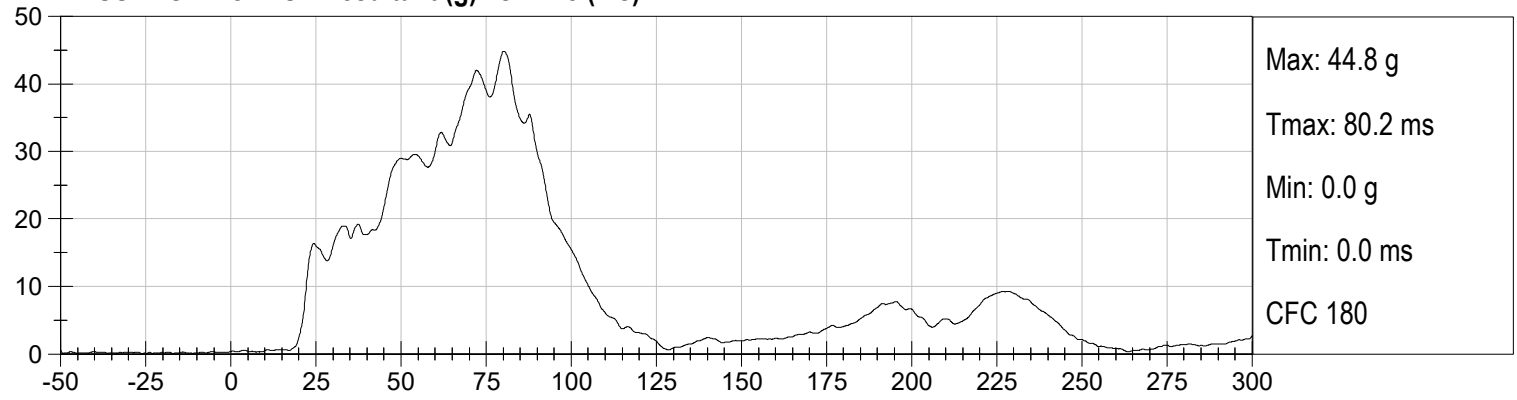
PASSENGER CHEST Y (g) vs Time (ms)



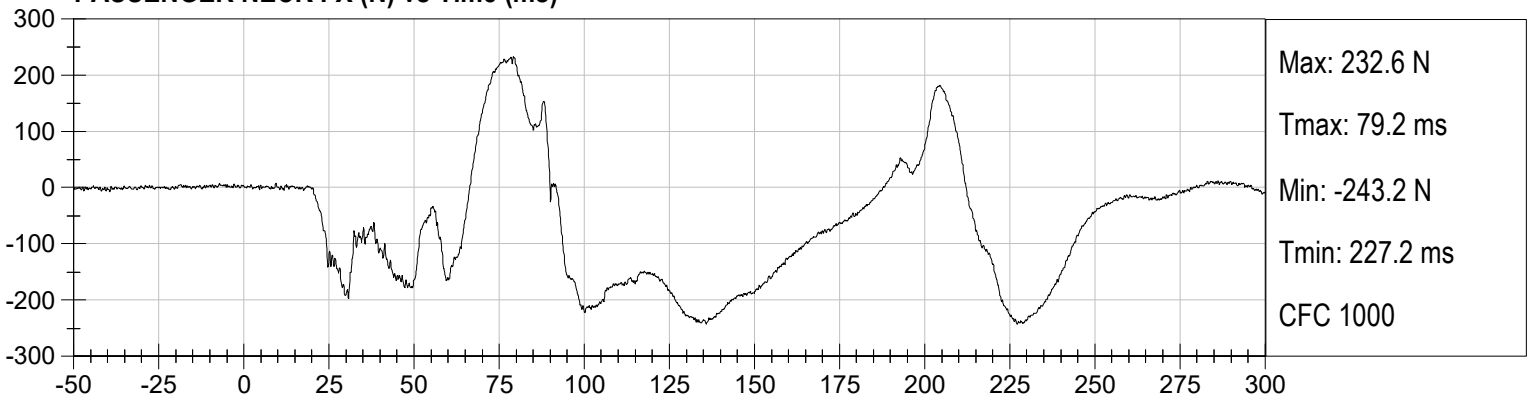
PASSENGER CHEST Z (g) vs Time (ms)



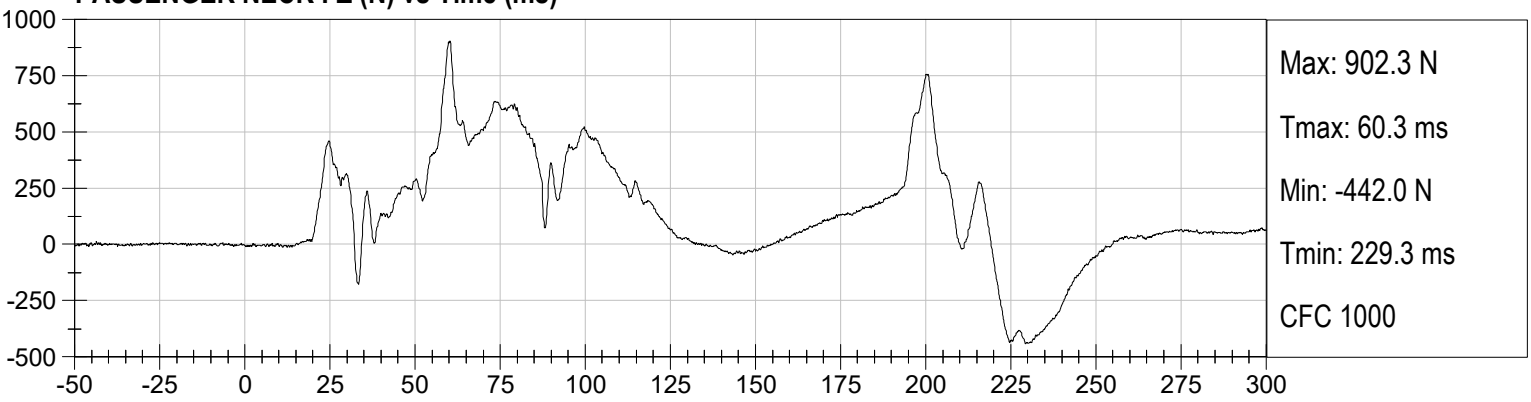
PASSENGER CHEST Resultant (g) vs Time (ms)



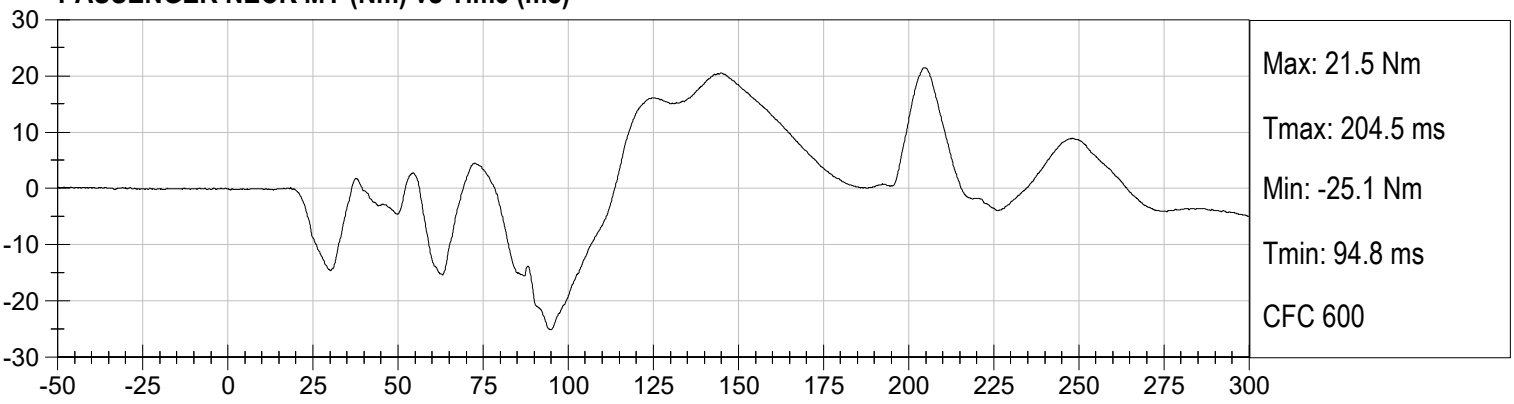
PASSENGER NECK FX (N) vs Time (ms)



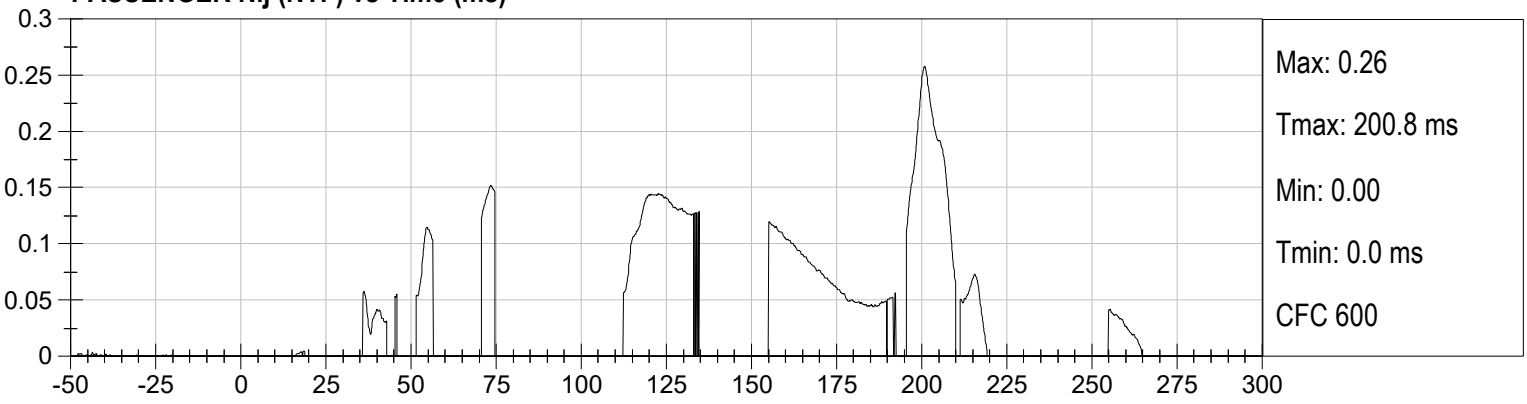
PASSENGER NECK FZ (N) vs Time (ms)



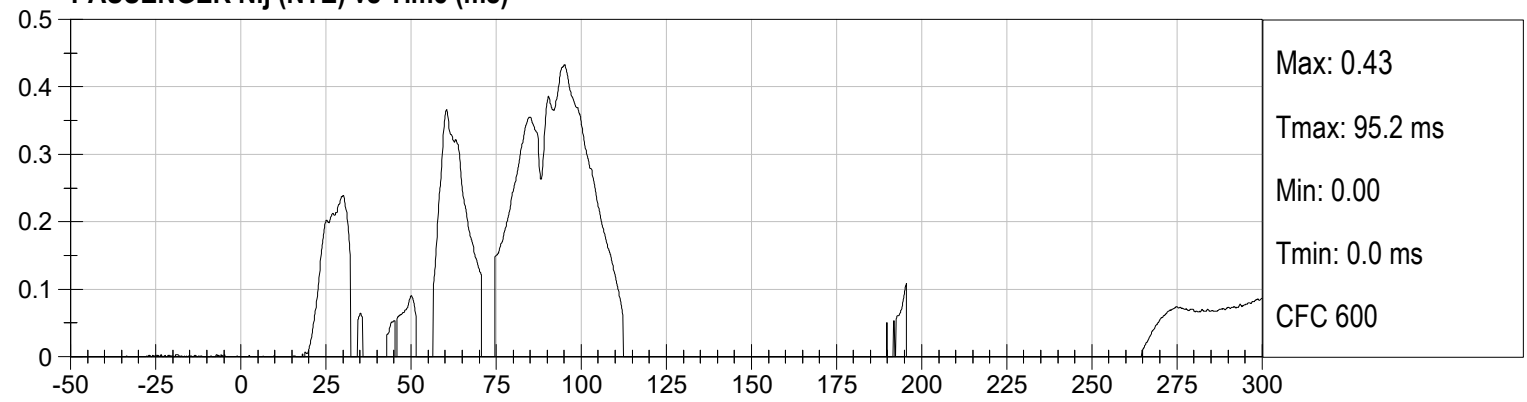
PASSENGER NECK MY (Nm) vs Time (ms)



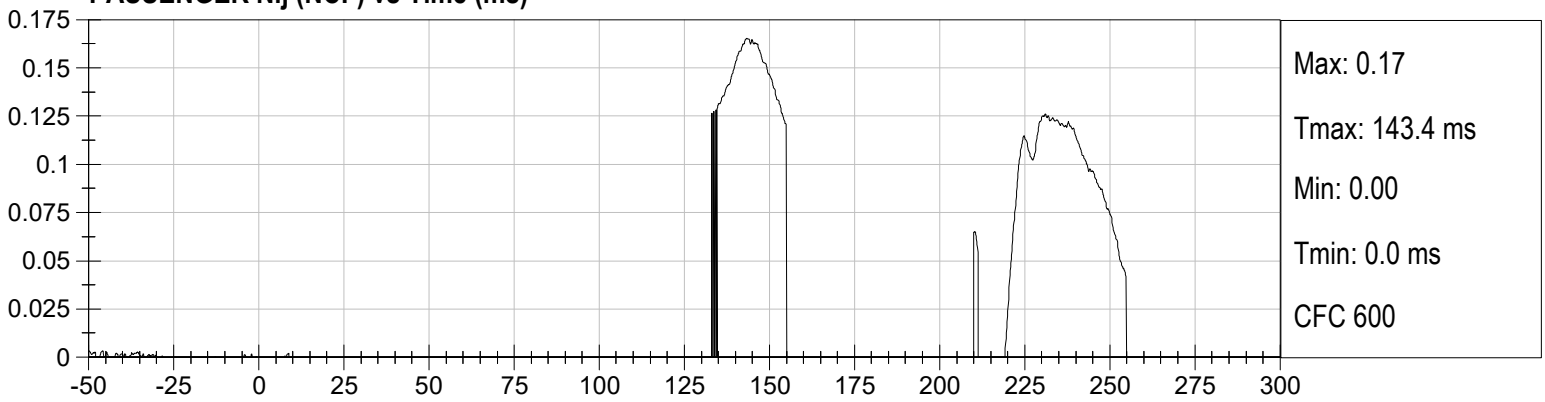
PASSENGER Nij (NTF) vs Time (ms)



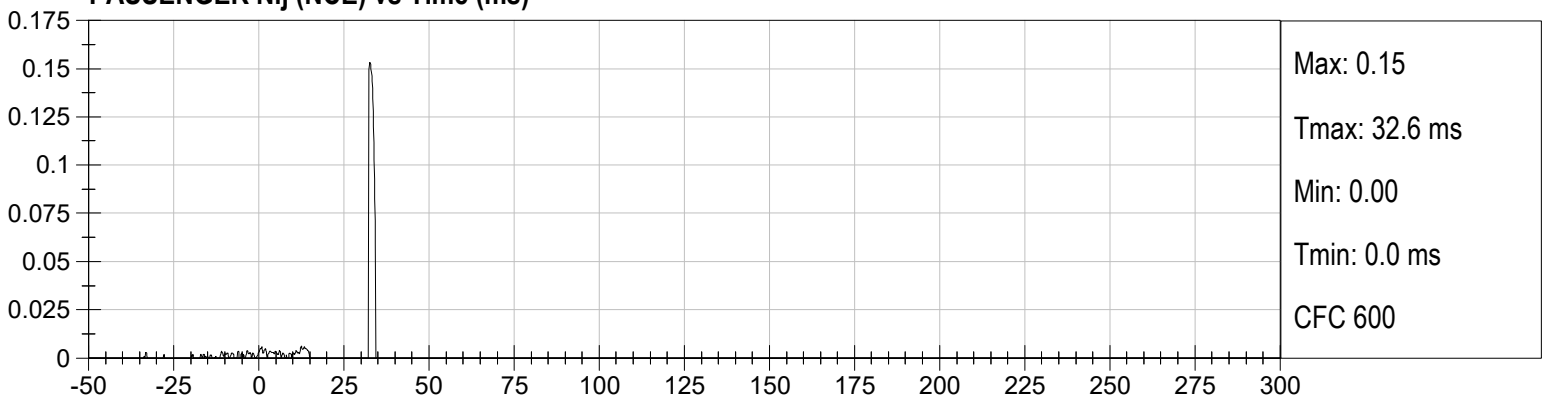
PASSENGER Nij (NTE) vs Time (ms)



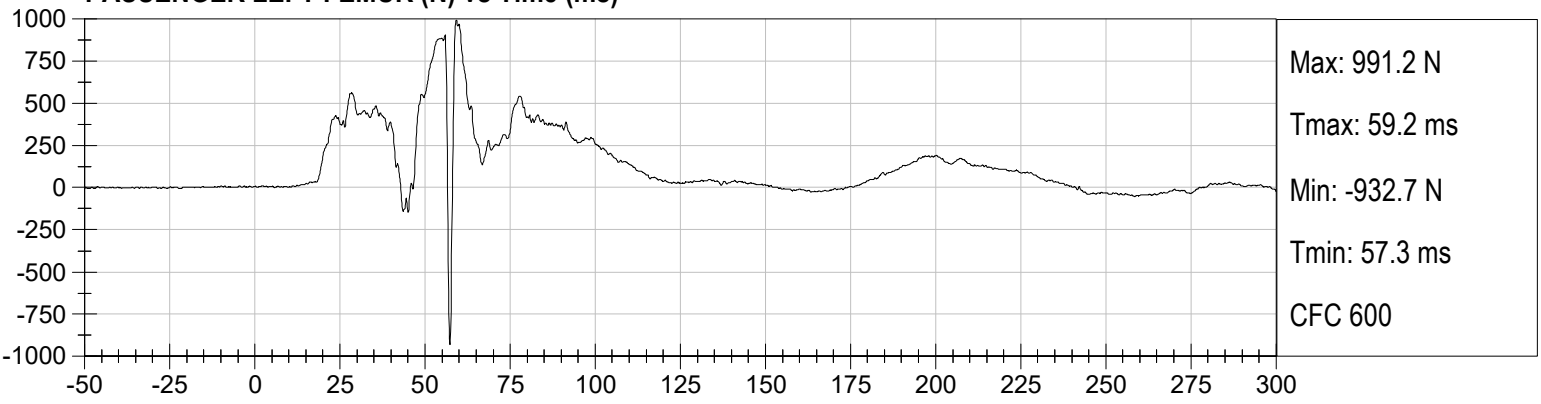
PASSENGER Nij (NCF) vs Time (ms)



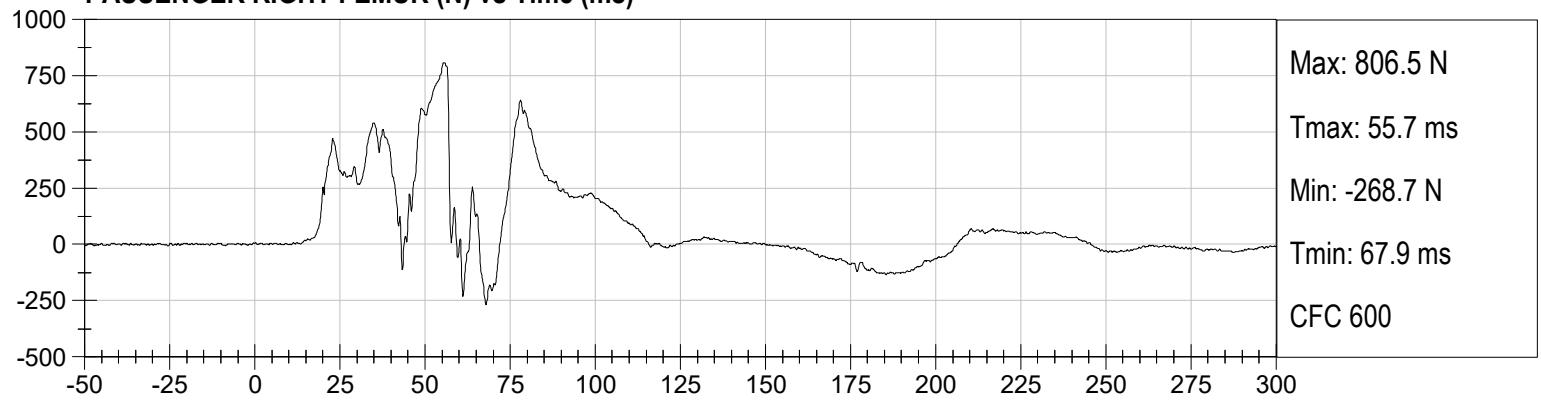
PASSENGER Nij (NCE) vs Time (ms)



PASSENGER LEFT FEMUR (N) vs Time (ms)



PASSENGER RIGHT FEMUR (N) vs Time (ms)



APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

Hybrid III, 50th External Measurements
SN: 351

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

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

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

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test ID:** D200401

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	25	Pass
Peak Resultant Acceleration	G's	225 to 275	240	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-1.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

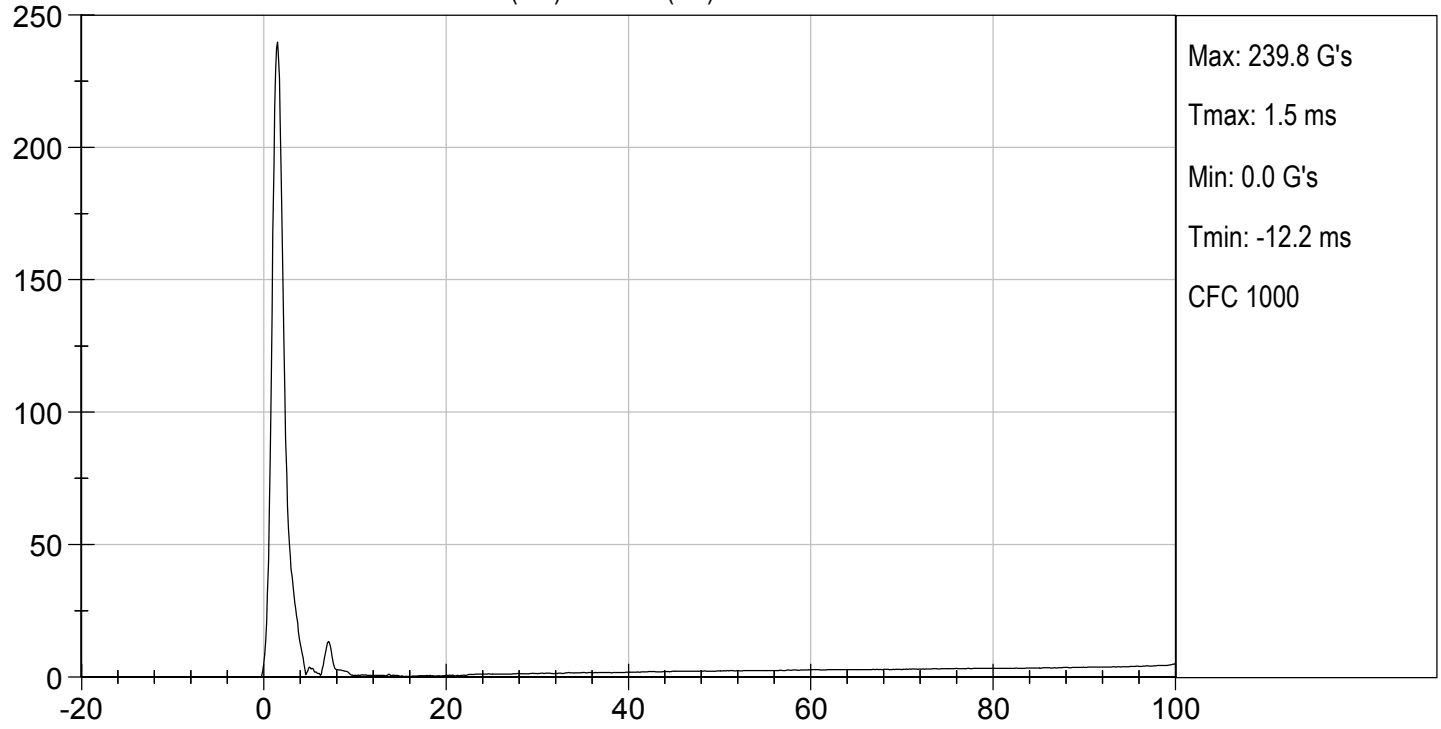
02/03/2020
Test Date

Approved By

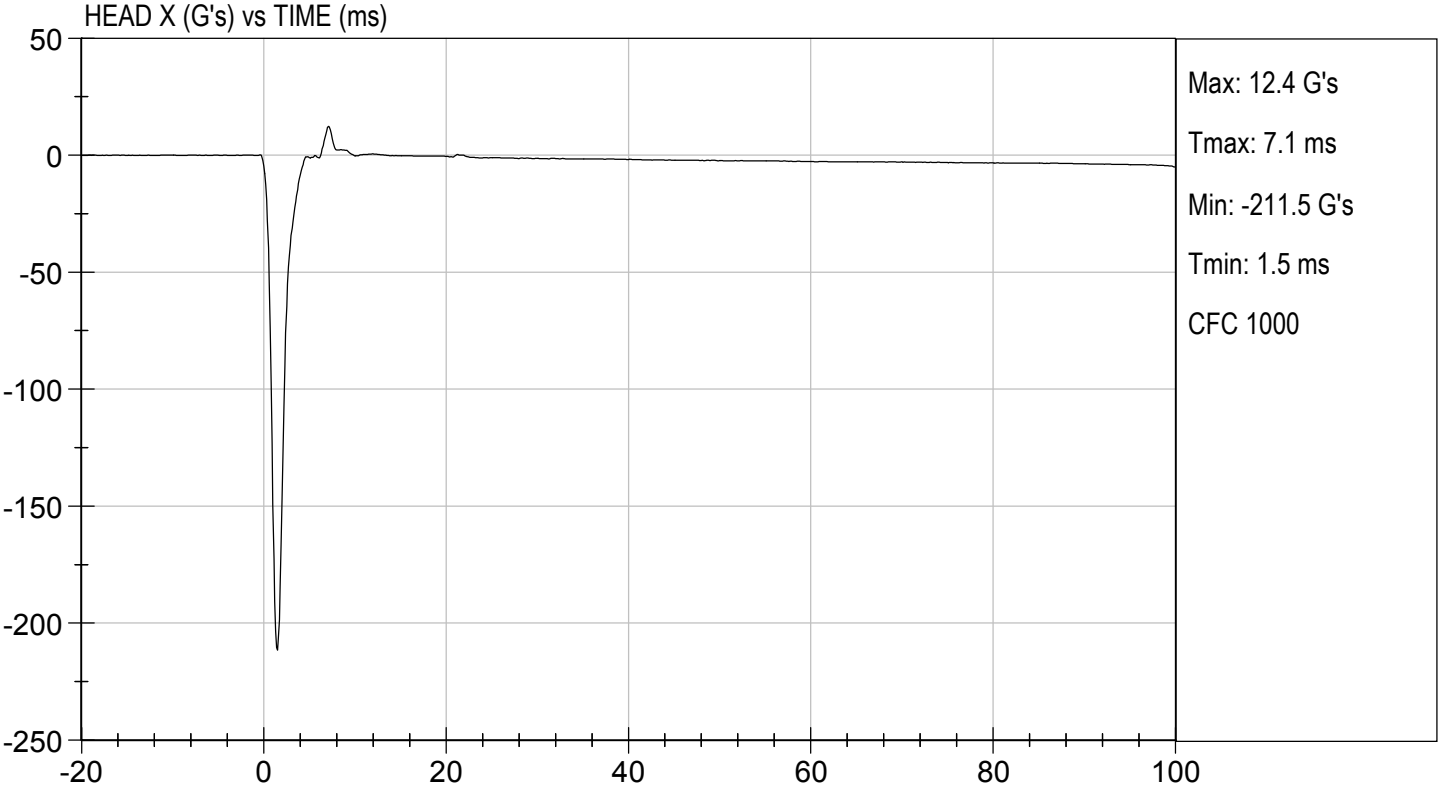
TEST DESC: HEAD DROP

TEST DATE: 02/03/2020
TEST #: D200401

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

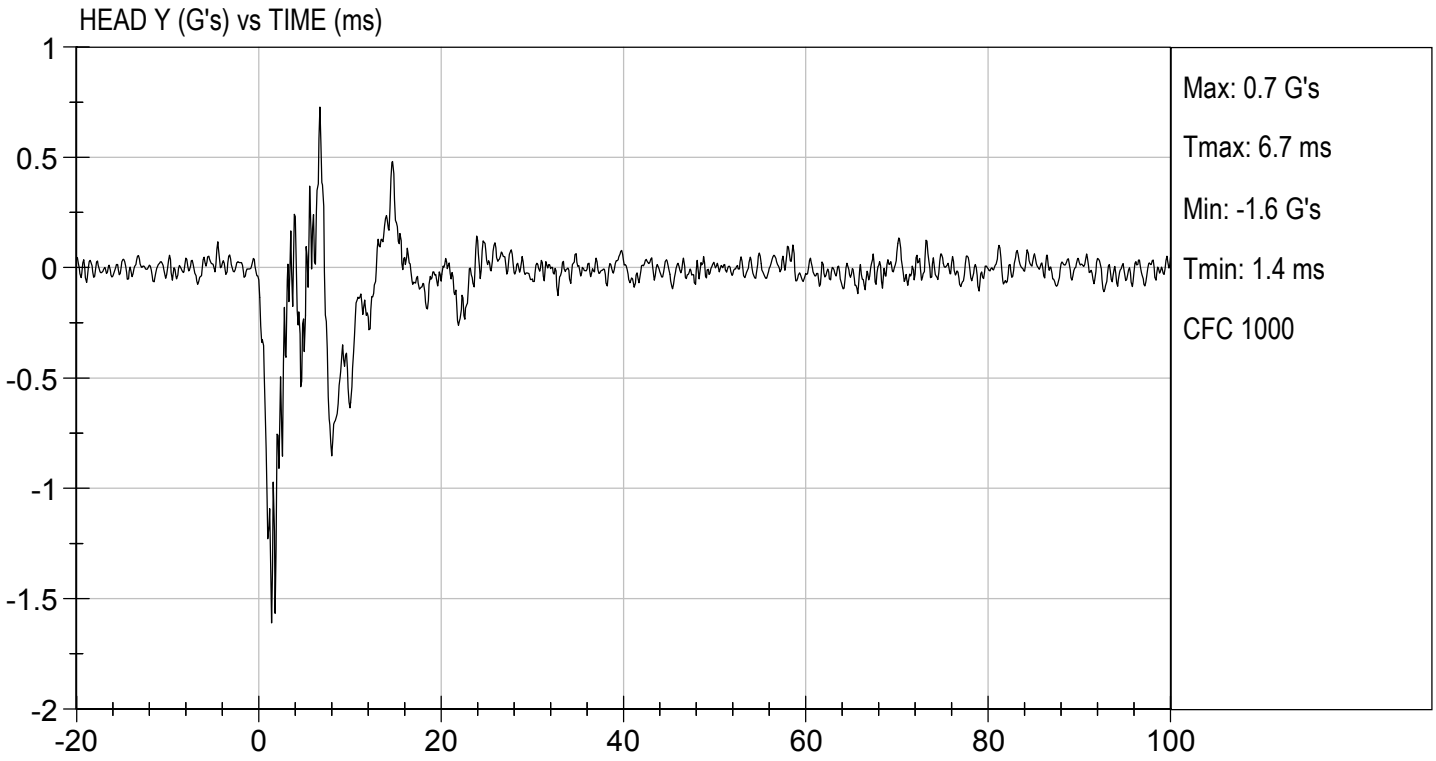


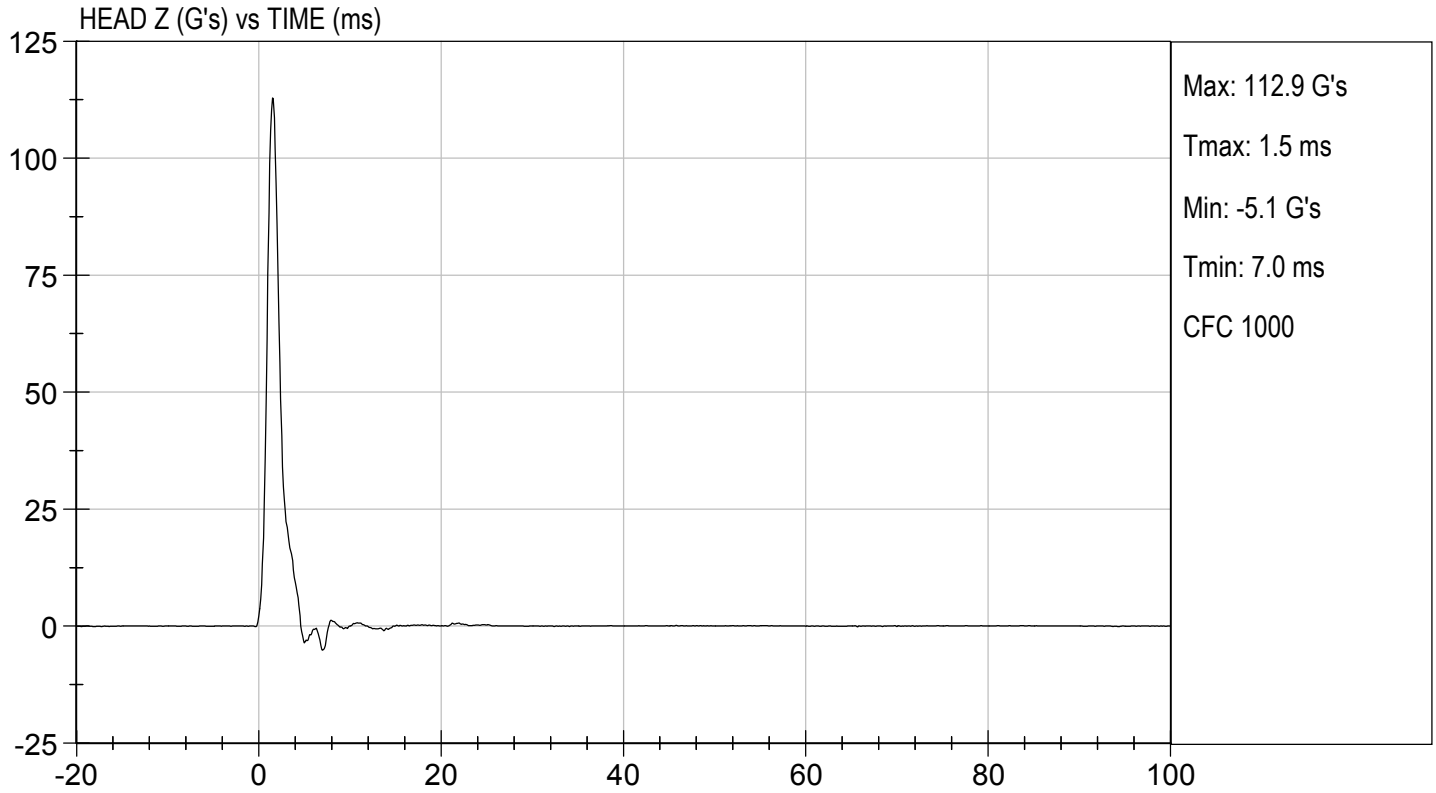
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 02/03/2020
TEST #: D200401





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200402

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	25	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.88	Pass
	20 ms	G's	17.60 to 22.60	20.60	Pass
	30 ms	G's	12.50 to 18.50	17.37	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	17.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	36.8	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	69.4	Pass
	Time	ms	57.0 to 64.0	59.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	117.8	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	90.6	Pass
	Time	ms	47.0 to 58.0	48.7	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	100.1	Pass
			Overall Test Results		Pass

Alex Thomas

Laboratory Technician

02/03/2020

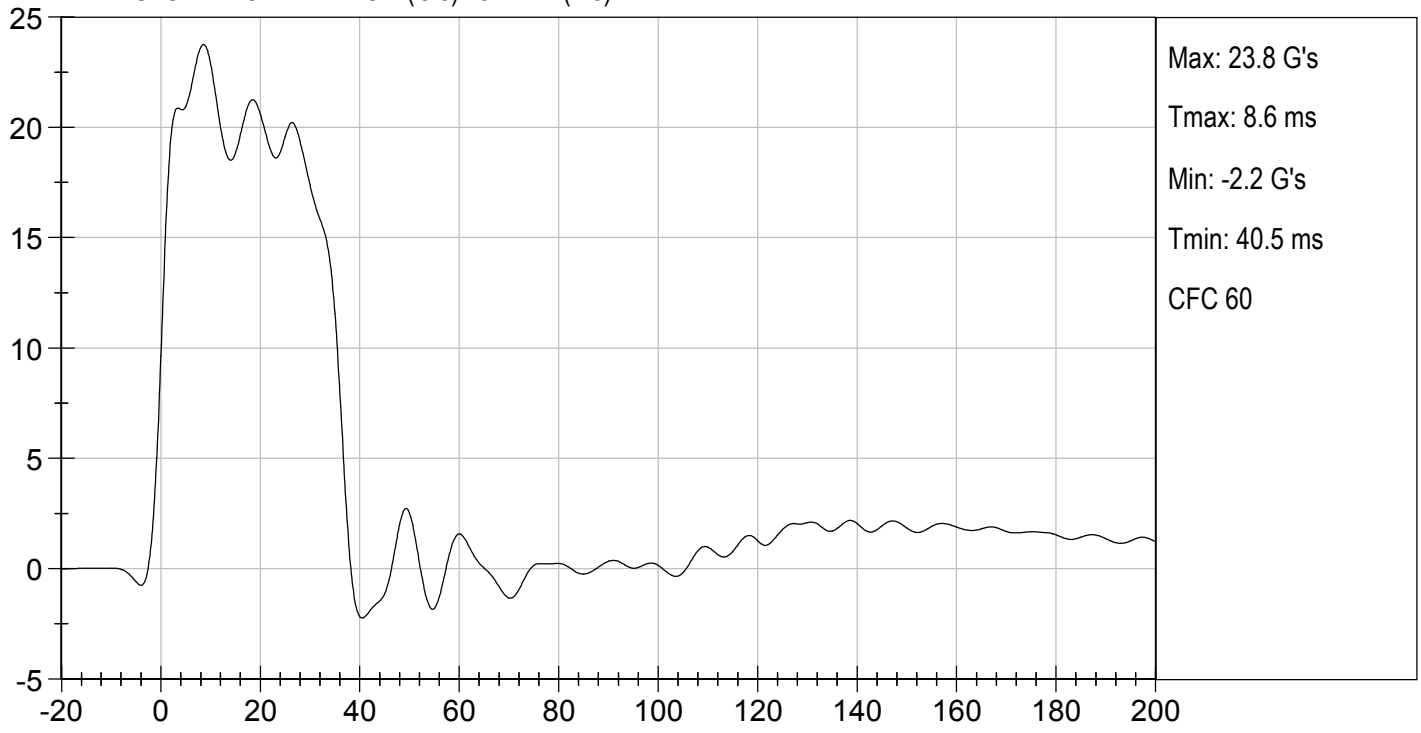
Test Date

Approved By

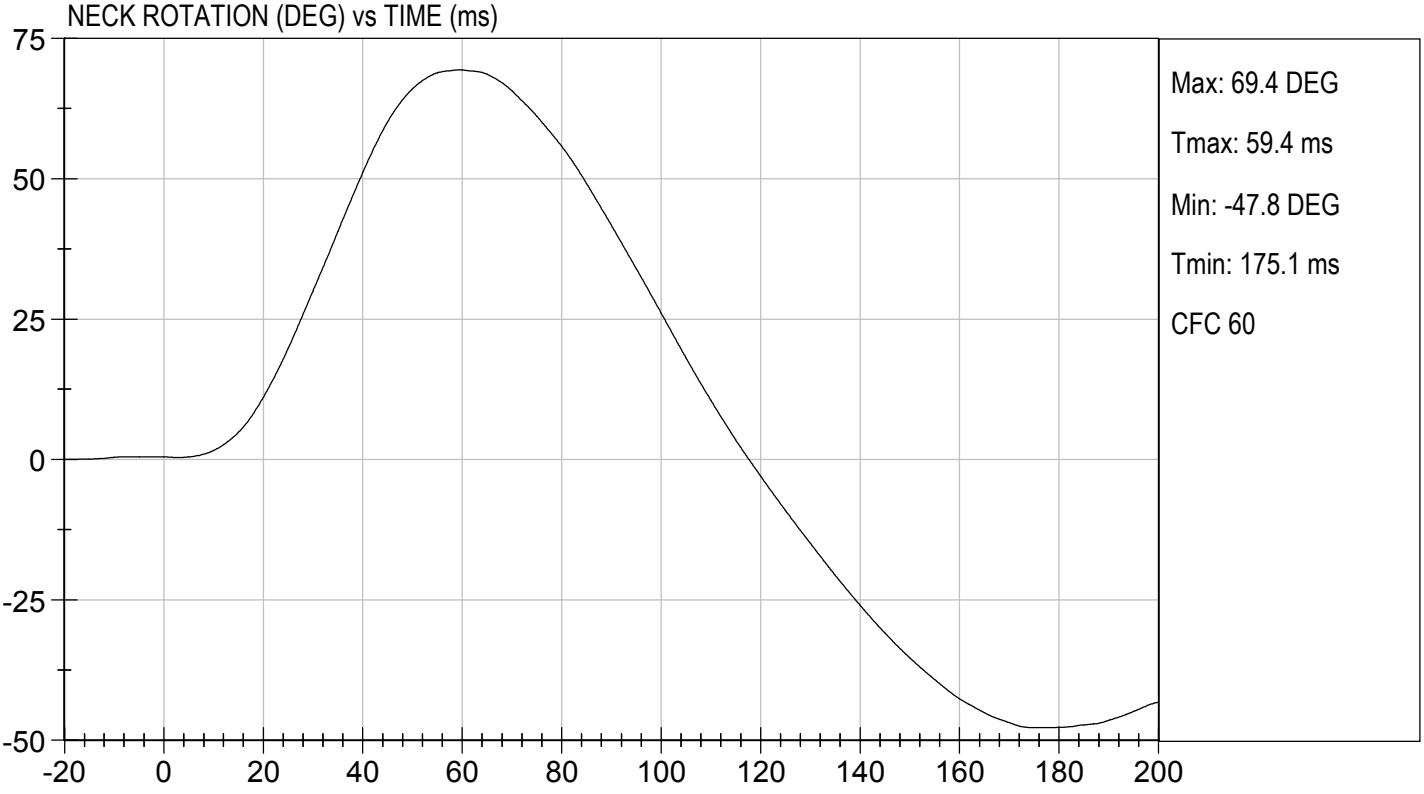
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 02/03/2020
TEST #: D200402

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

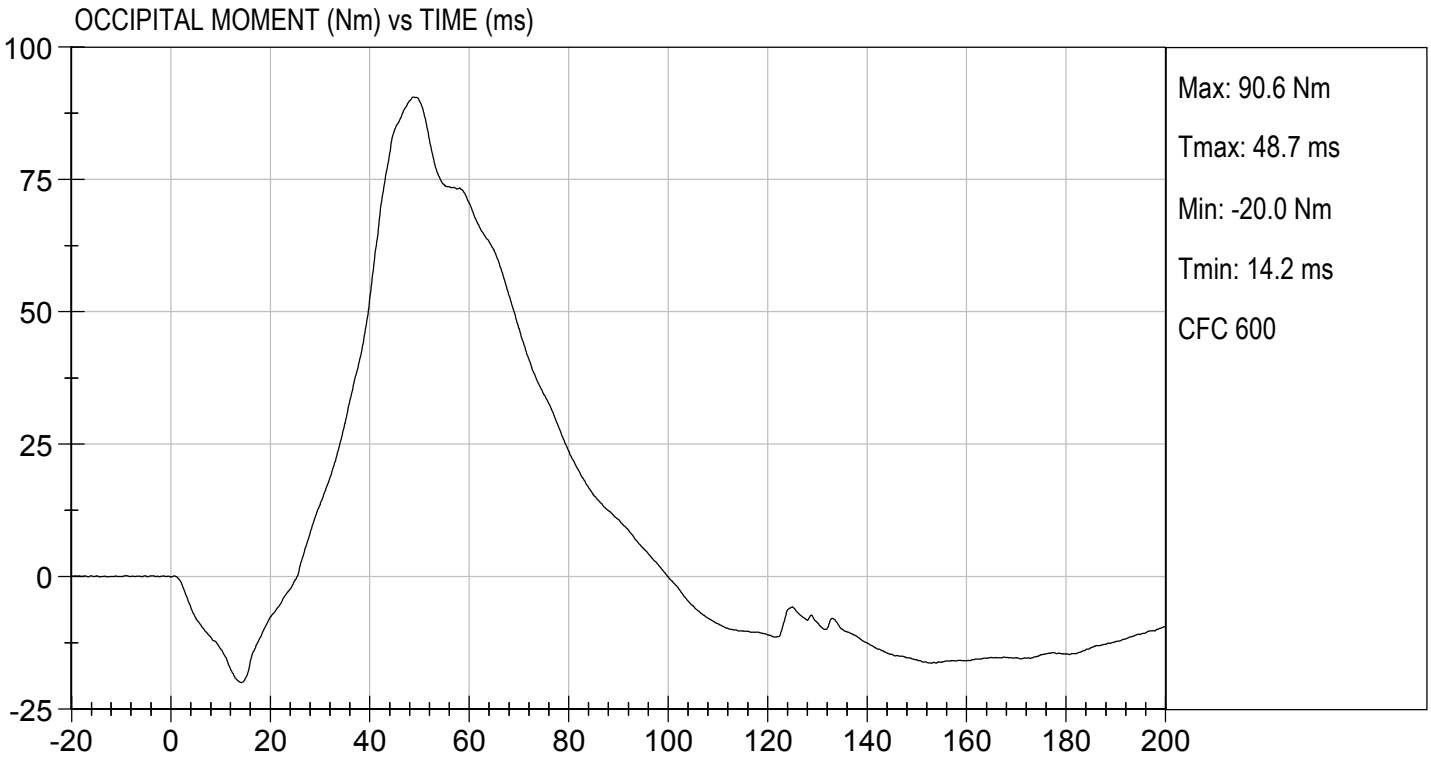


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 02/03/2020
TEST #: D200402



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200403

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	25	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.19	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.83	Pass
	20 ms	G's	14.00 to 19.00	17.04	Pass
	30 ms	G's	11.00 to 16.00	12.84	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.6	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	39.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	100.2	Pass
	Time	ms	72.0 to 82.0	78.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	160.6	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-64.4	Pass
	Time	ms	65.0 to 79.0	71.9	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	141.4	Pass
			Overall Test Results		Pass

Laboratory Technician

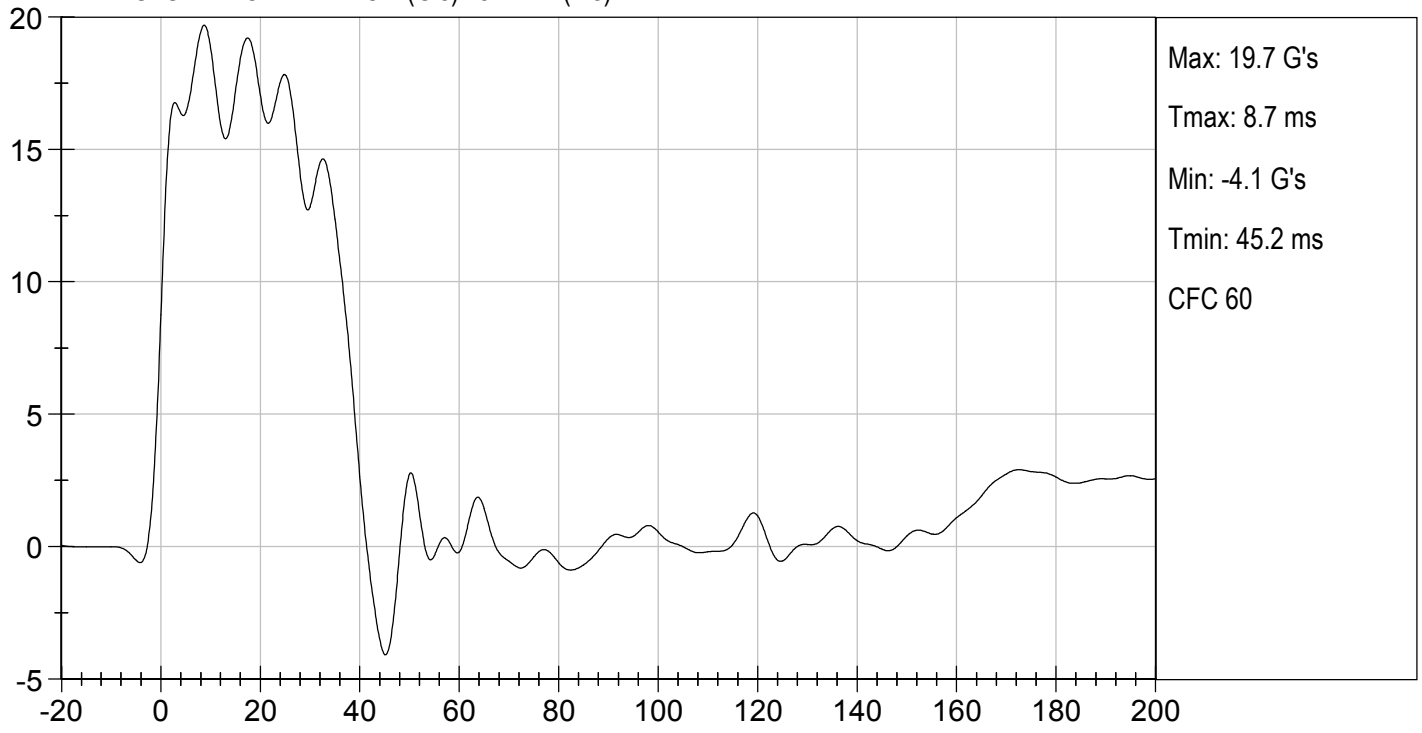
02/03/2020
Test Date

Approved By

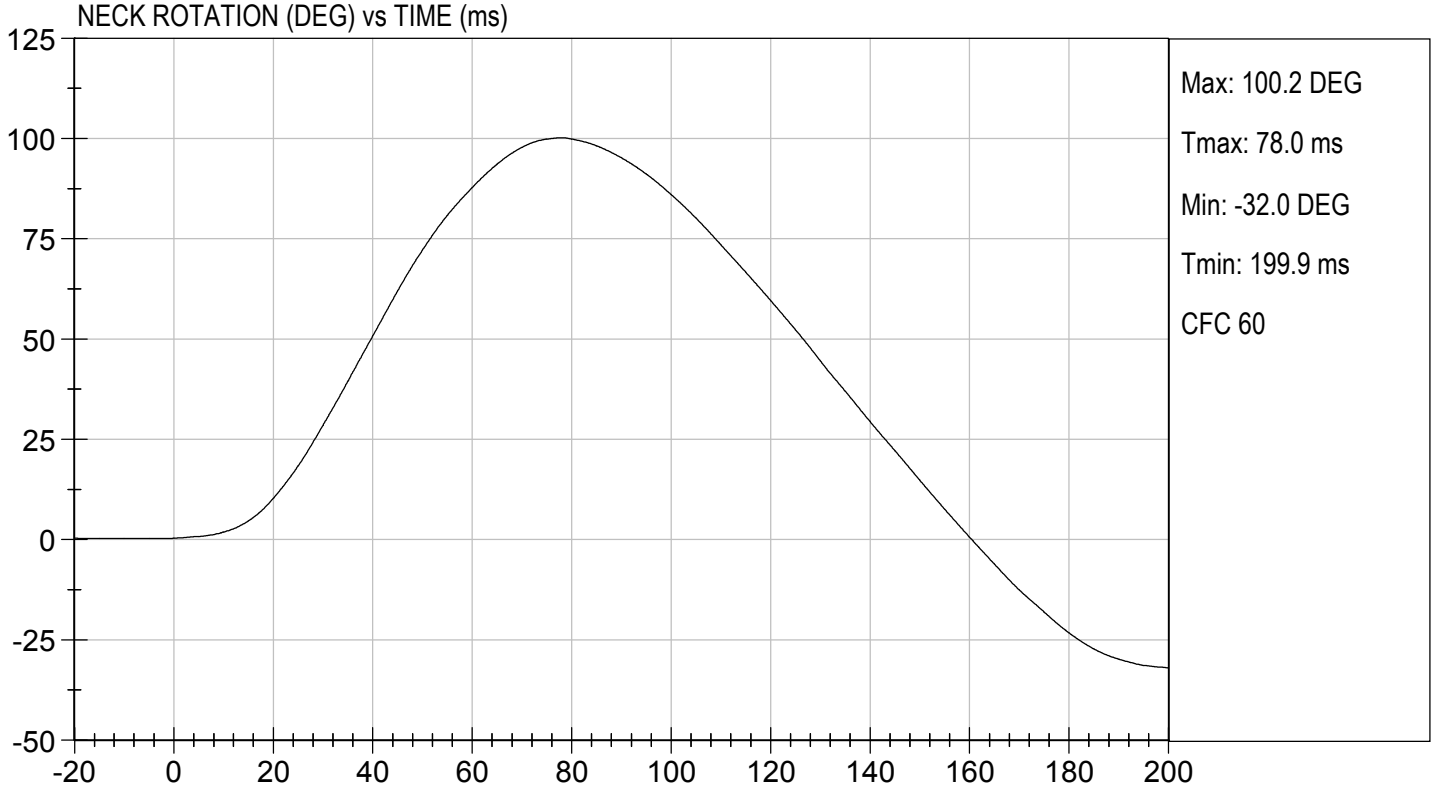
TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 02/03/2020
TEST #: D200403

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

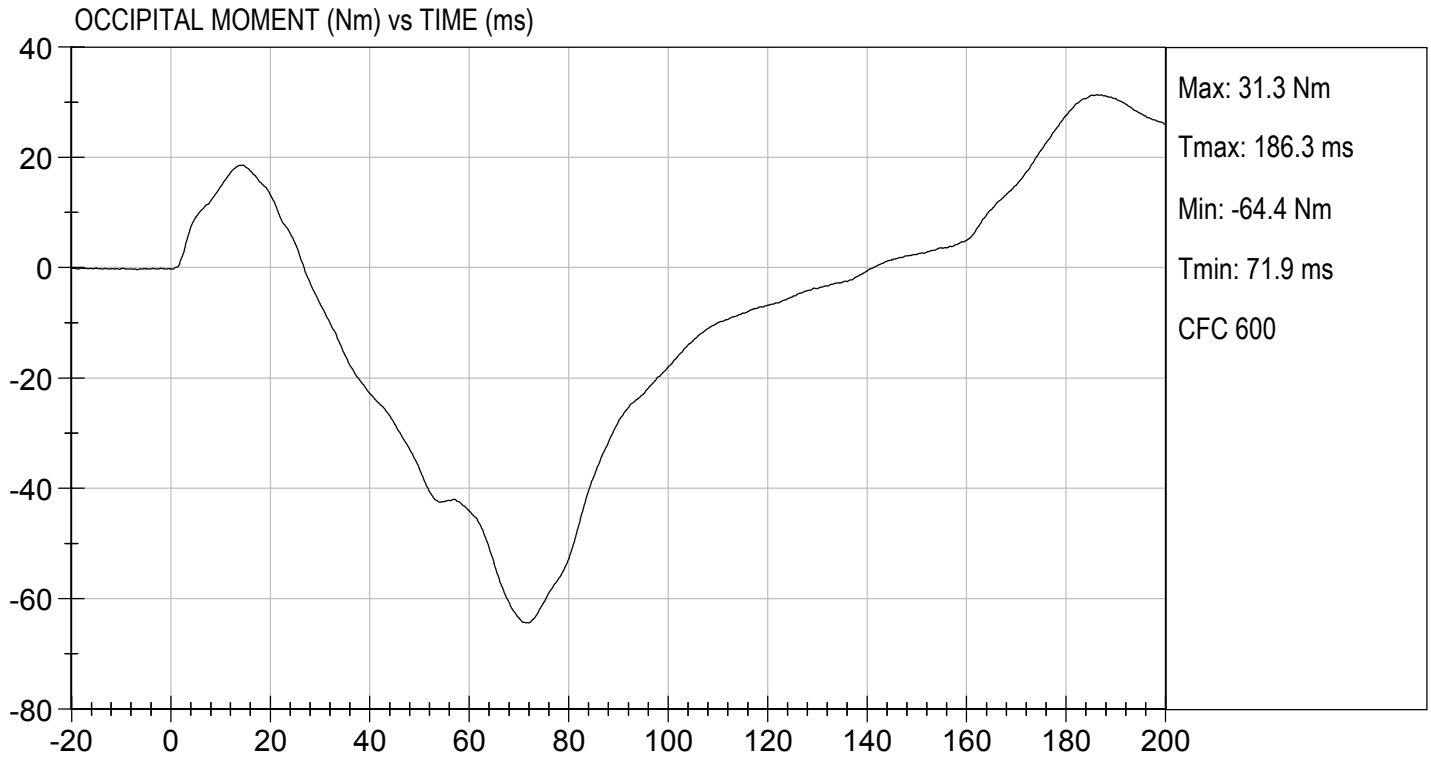


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 02/03/2020
TEST #: D200403



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200404

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,499	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.59	Pass
Internal Hysteresis	%	69 to 85	72	Pass
		Overall Test Results		Pass

Laboratory Technician

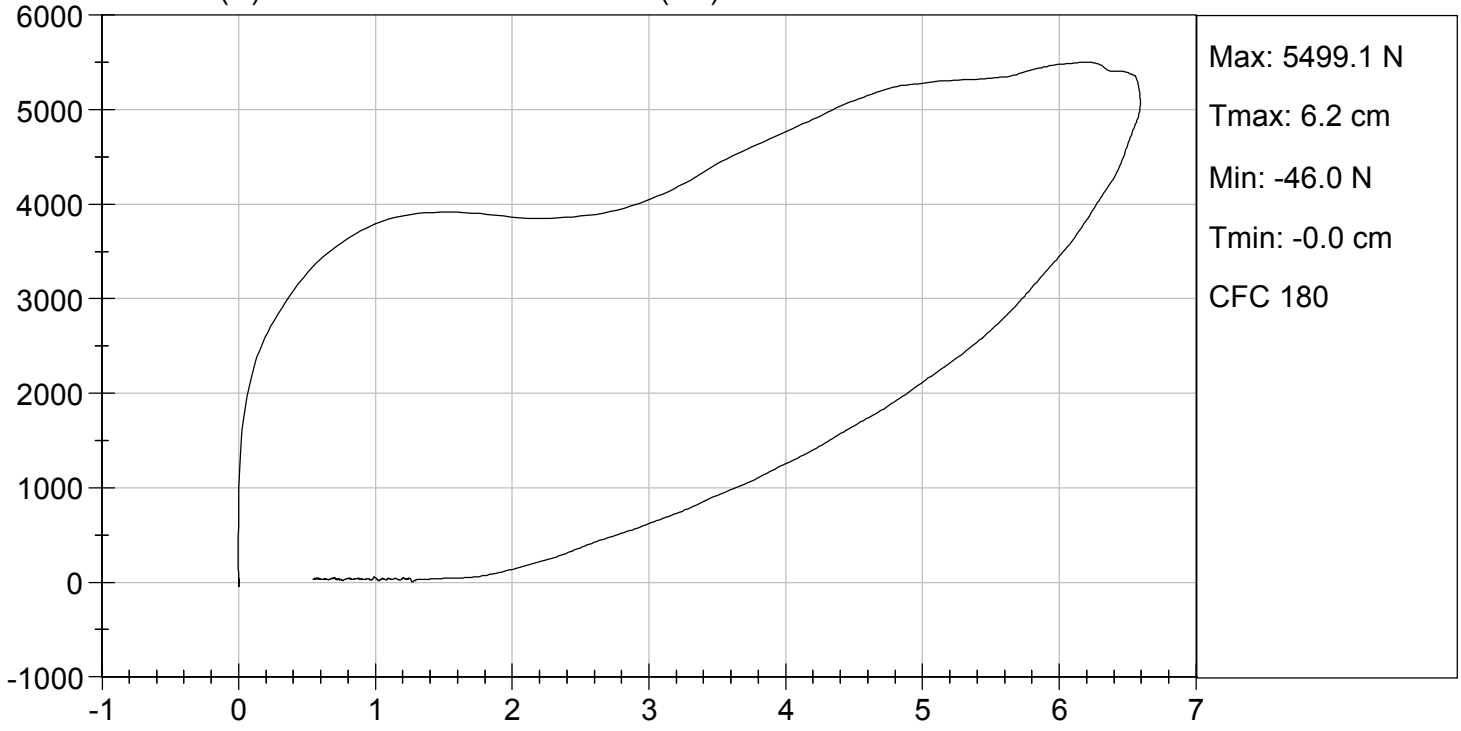
02/03/2020
Test Date

Approved By

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

TEST DATE: 02/03/2020
TEST #: D200404

FORCE (N) vs CHEST DISPLACEMENT (cm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200405

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	2.07 to 2.13	2.08	Pass
Peak Probe Force	N	4715 to 5782	5,286	Pass
		Overall Test Results		Pass

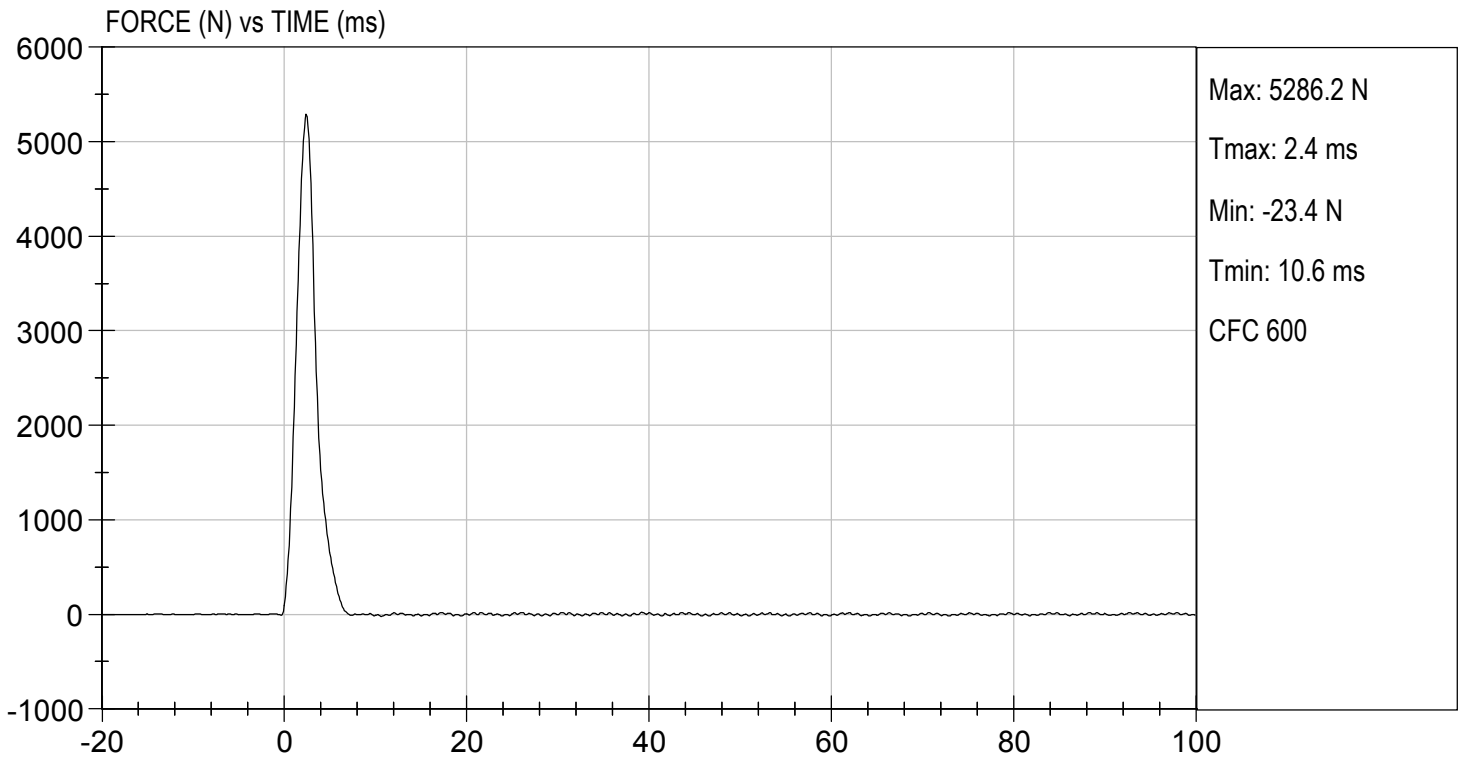
Laboratory Technician

02/04/2020
Test Date

Approved By

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

TEST DATE: 02/04/2020
TEST #: D200405



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200406

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	2.07 to 2.13	2.09	Pass
Peak Probe Force	N	4715 to 5782	4,962	Pass
		Overall Test Results		Pass

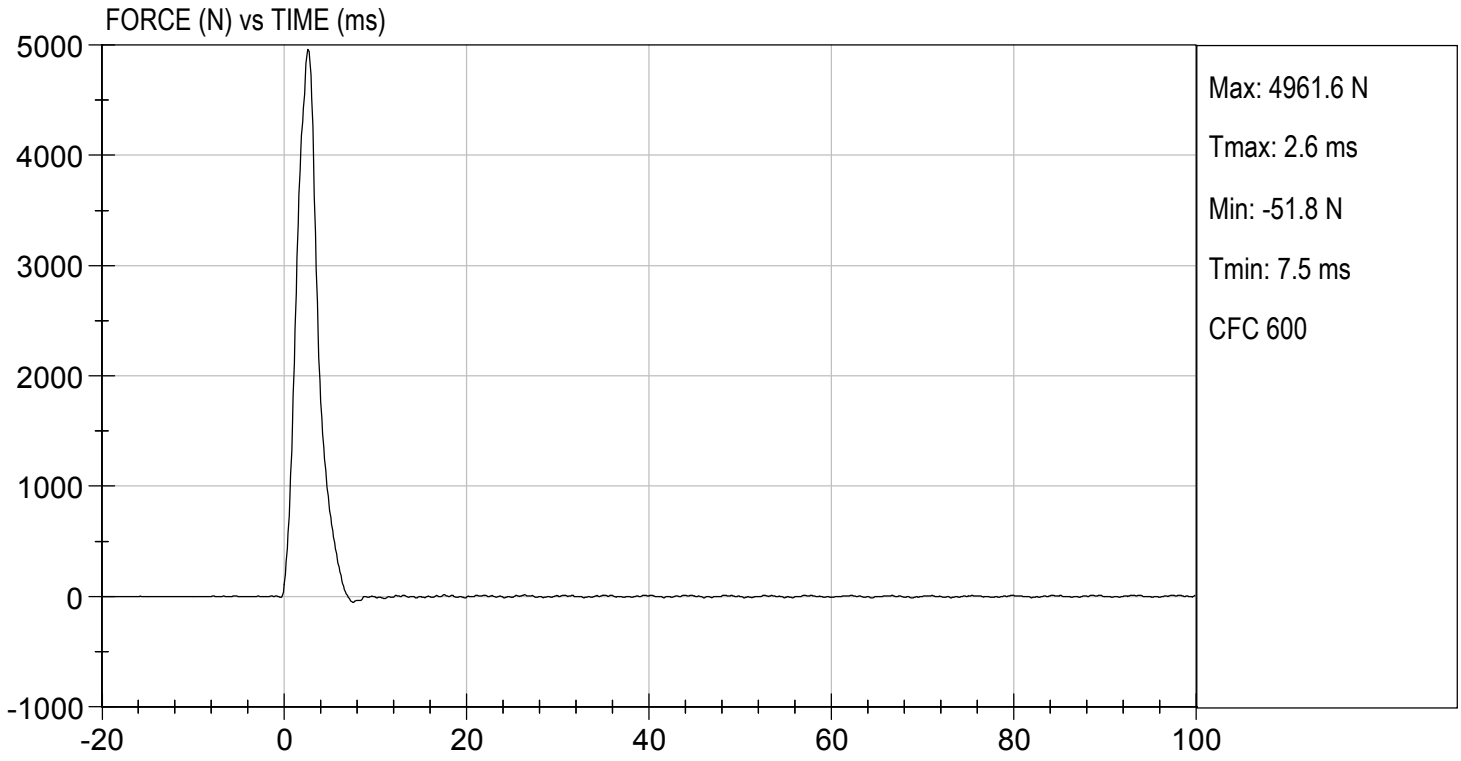
Laboratory Technician

02/04/2020
Test Date

Approved By

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

TEST DATE: 02/04/2020
TEST #: D200406



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200400

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	20.9	20.9	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	86.1	86.2	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	44.6	43.3	Pass
		Overall Test Results			Pass

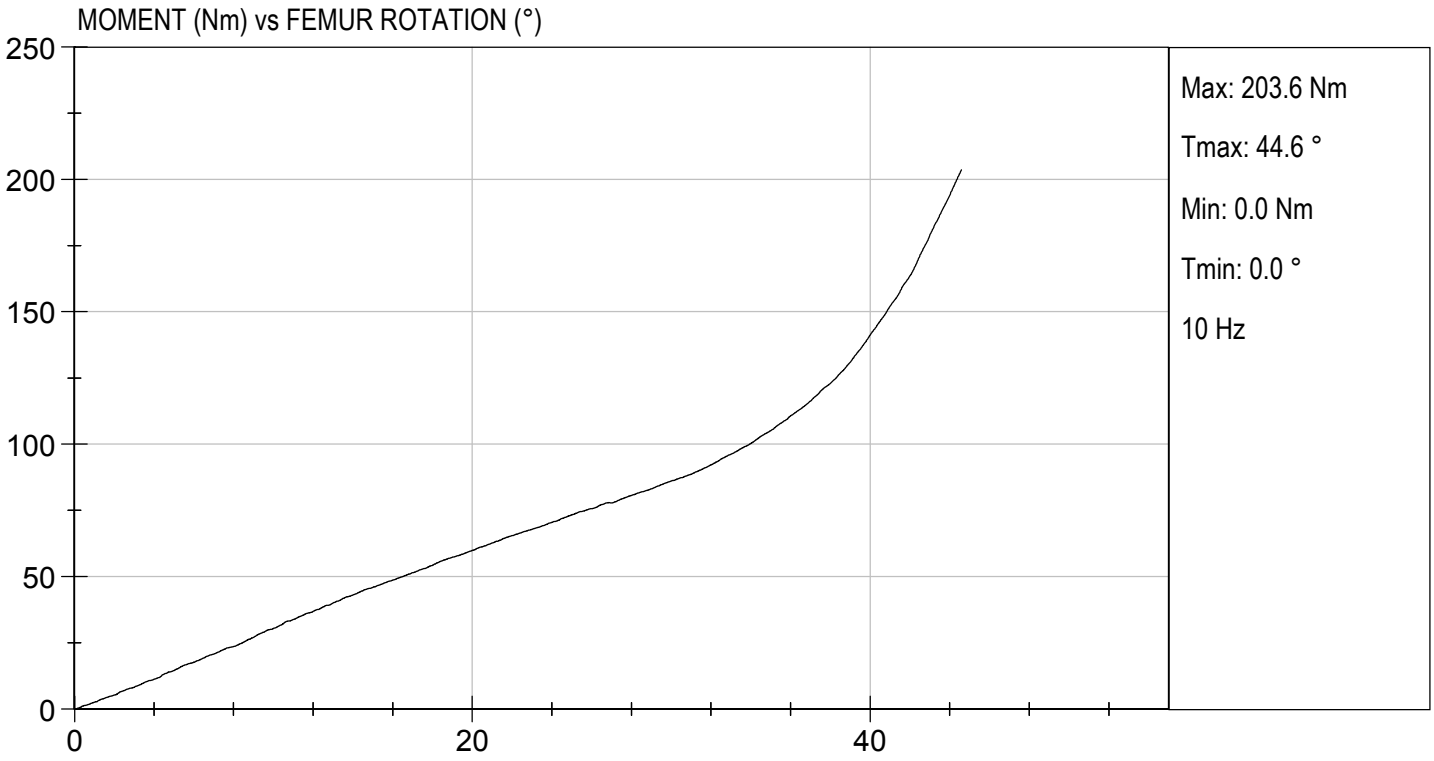
Laboratory Technician

02/04/2020
Test Date

Approved By

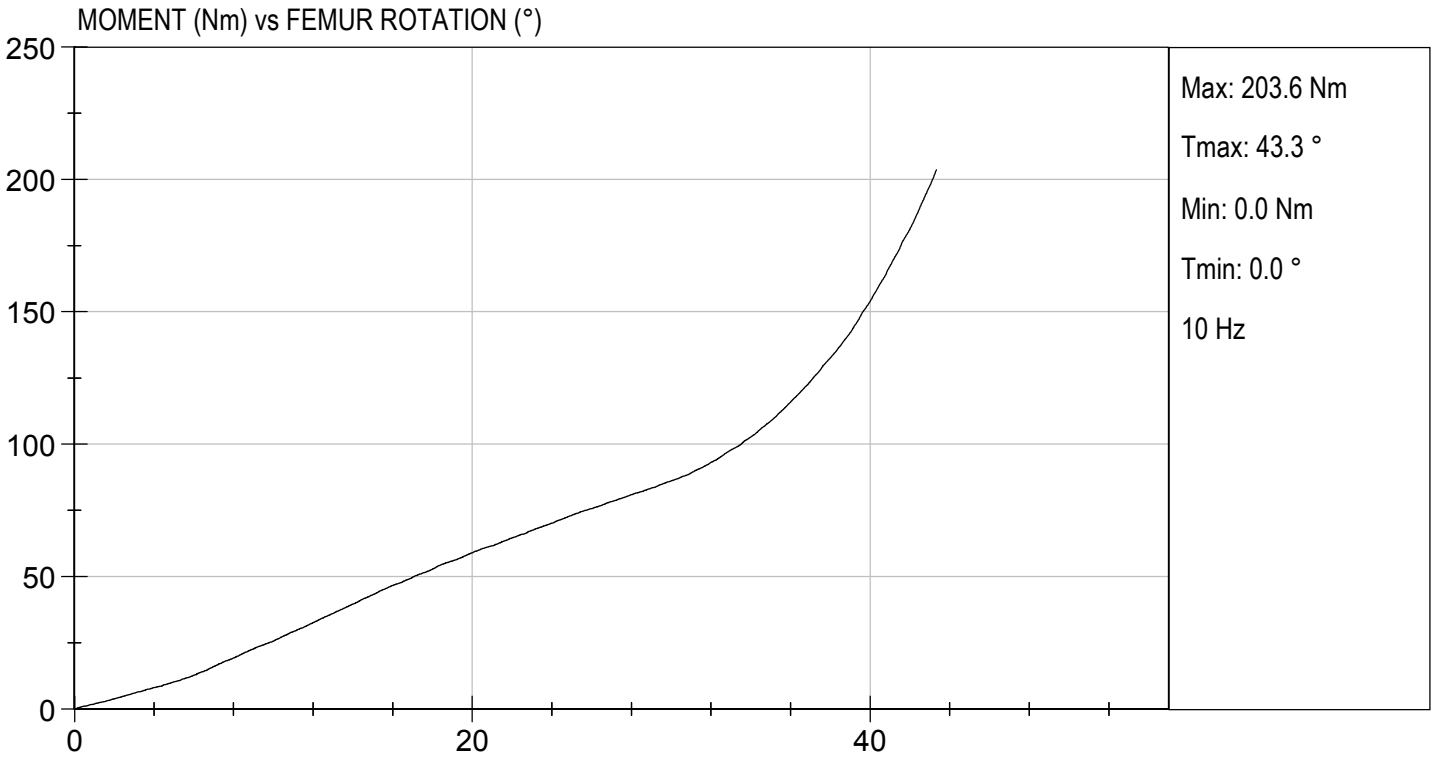
TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 02/04/2020
TEST #: D200409



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 02/04/2020
TEST #: D200400



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:** D200621

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Peak Resultant Acceleration	G's	225 to 275	244	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-6.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

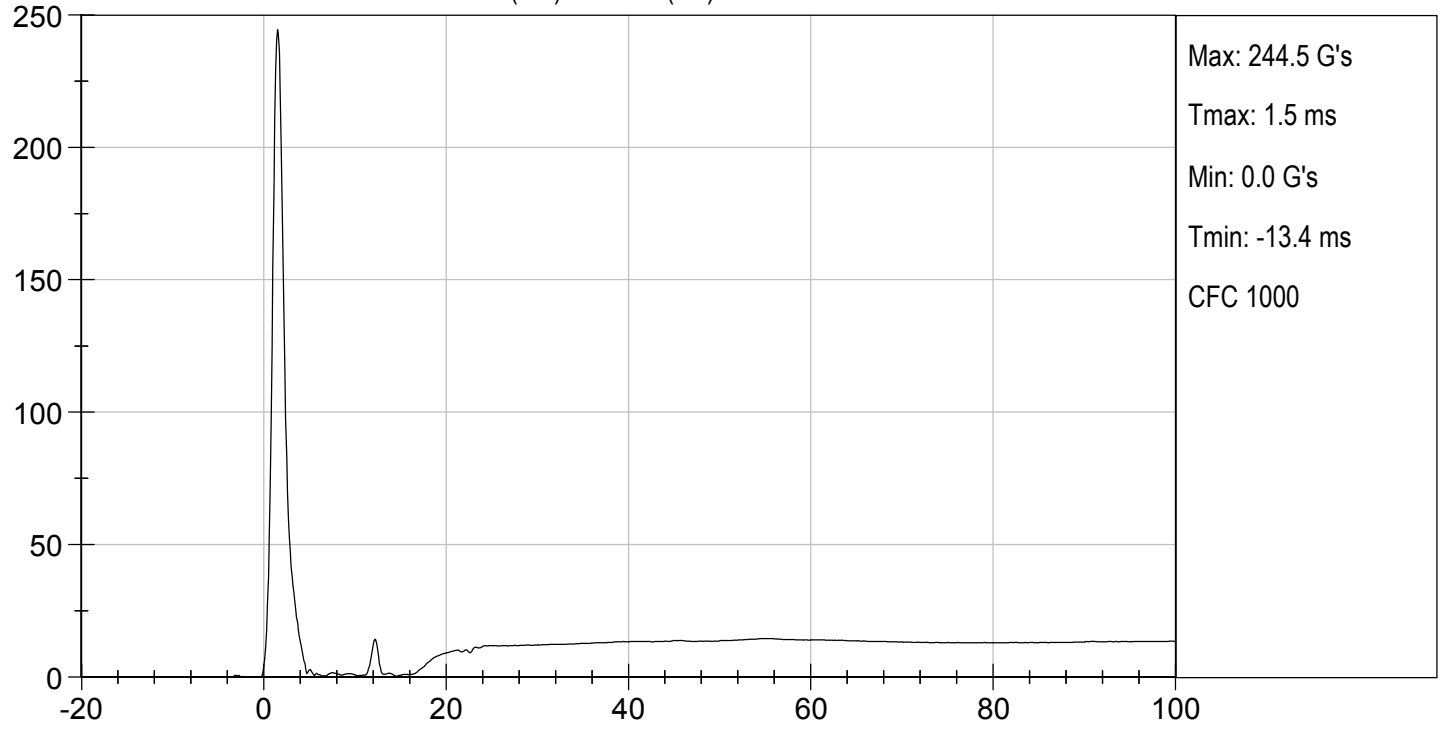
02/19/2020
Test Date

Approved By

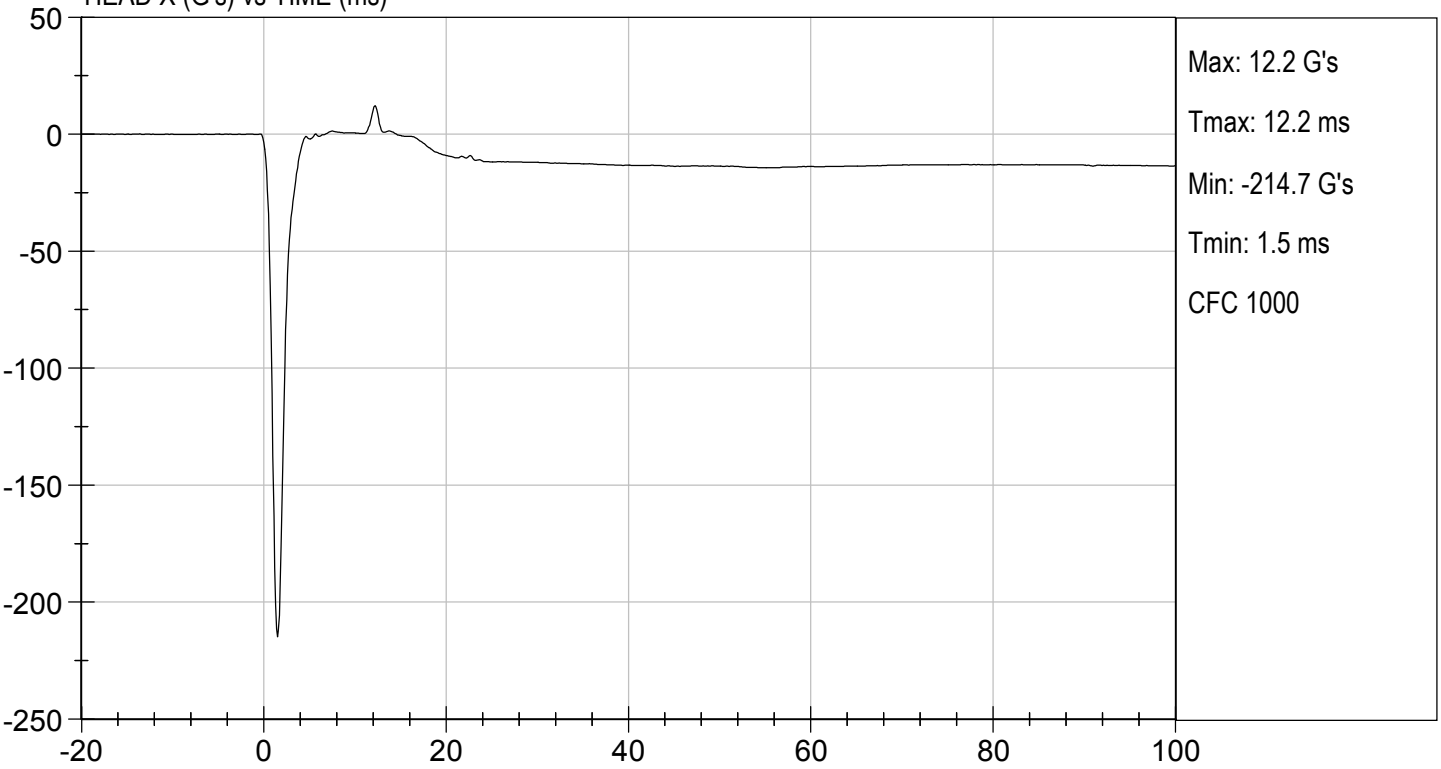
TEST DESC: HEAD DROP

TEST DATE: 02/19/2020
TEST #: D200621

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

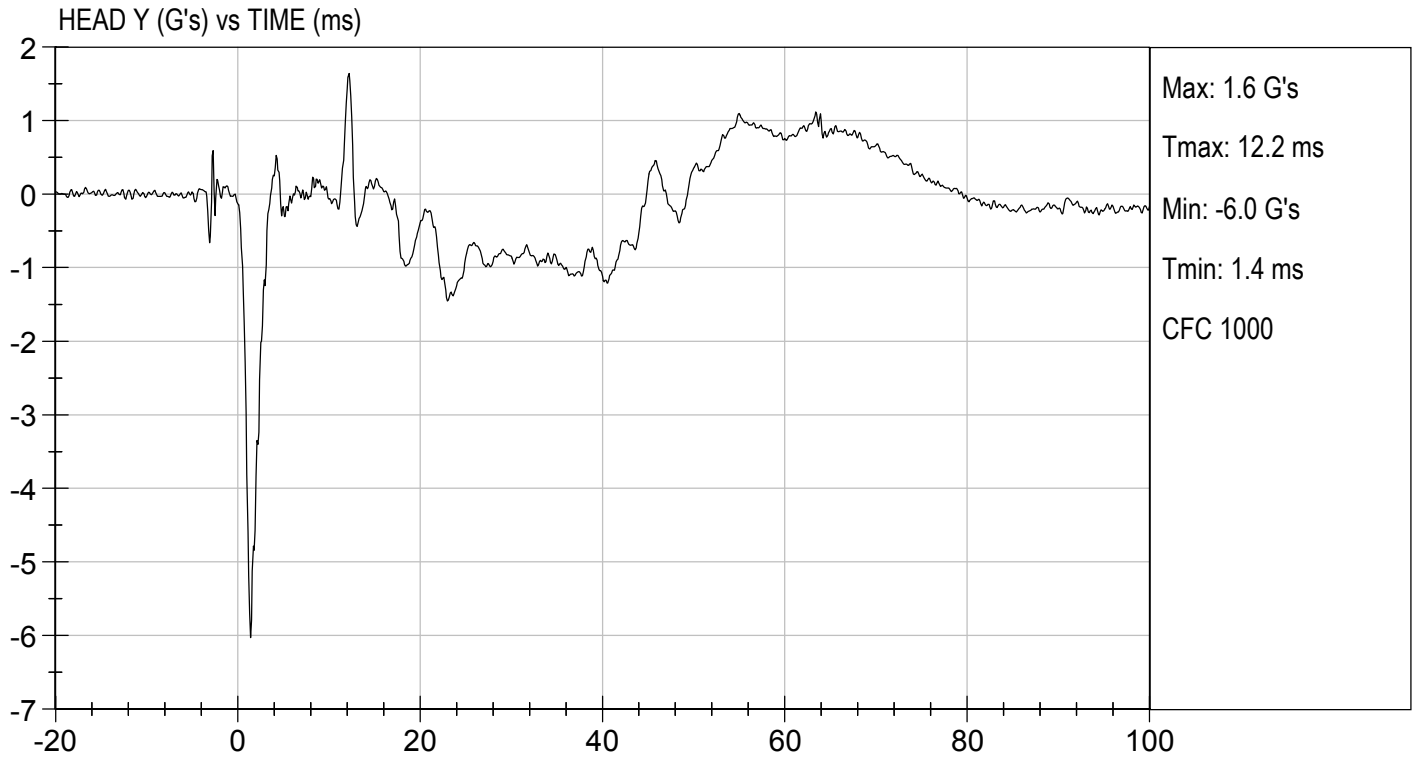


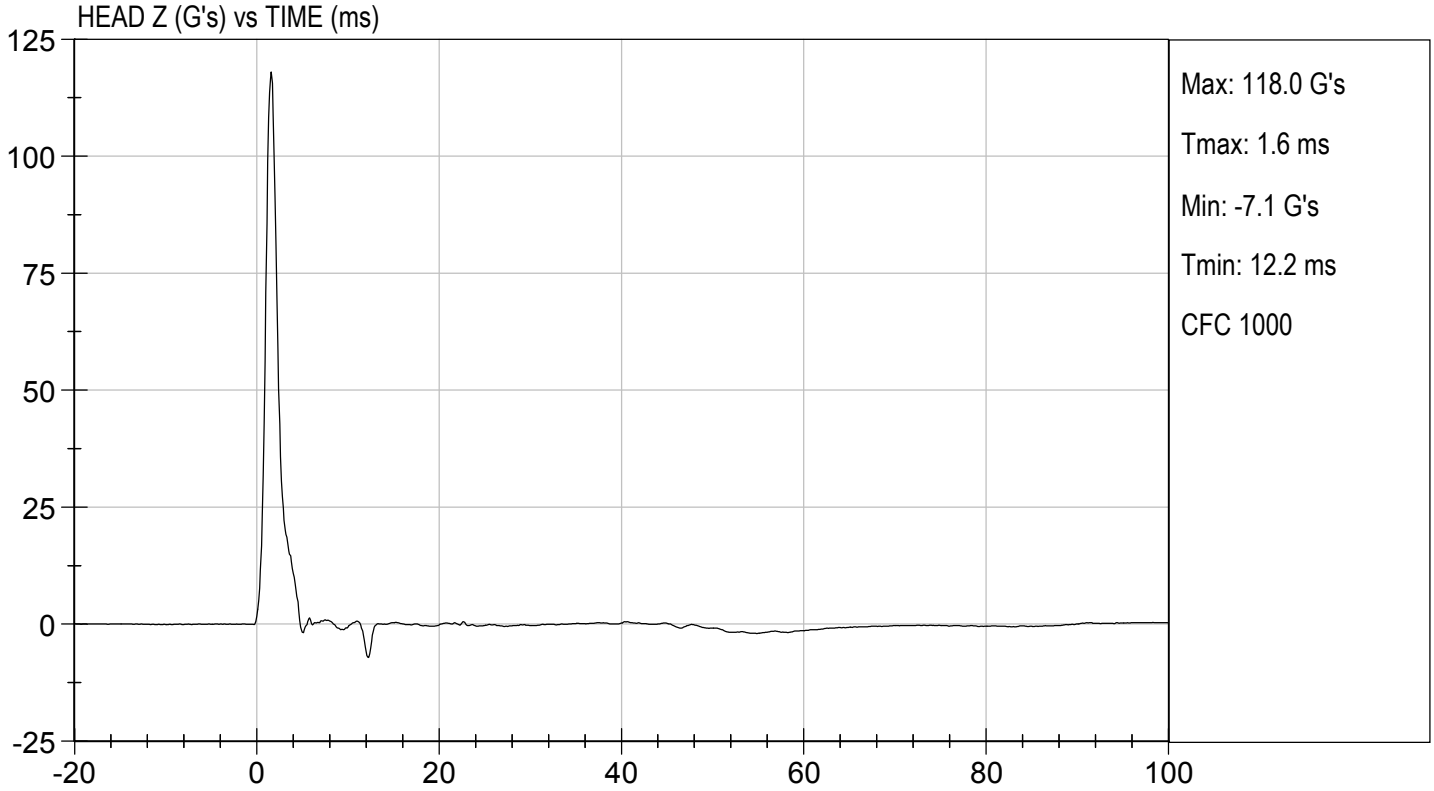
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 02/19/2020
TEST #: D200621





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200622

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	14	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.65	Pass
	20 ms	G's	17.60 to 22.60	21.02	Pass
	30 ms	G's	12.50 to 18.50	15.42	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	15.4	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	36.3	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	69.6	Pass
	Time	ms	57.0 to 64.0	58.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.6	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	94.2	Pass
	Time	ms	47.0 to 58.0	47.6	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.2	Pass
			Overall Test Results		Pass

Laboratory Technician

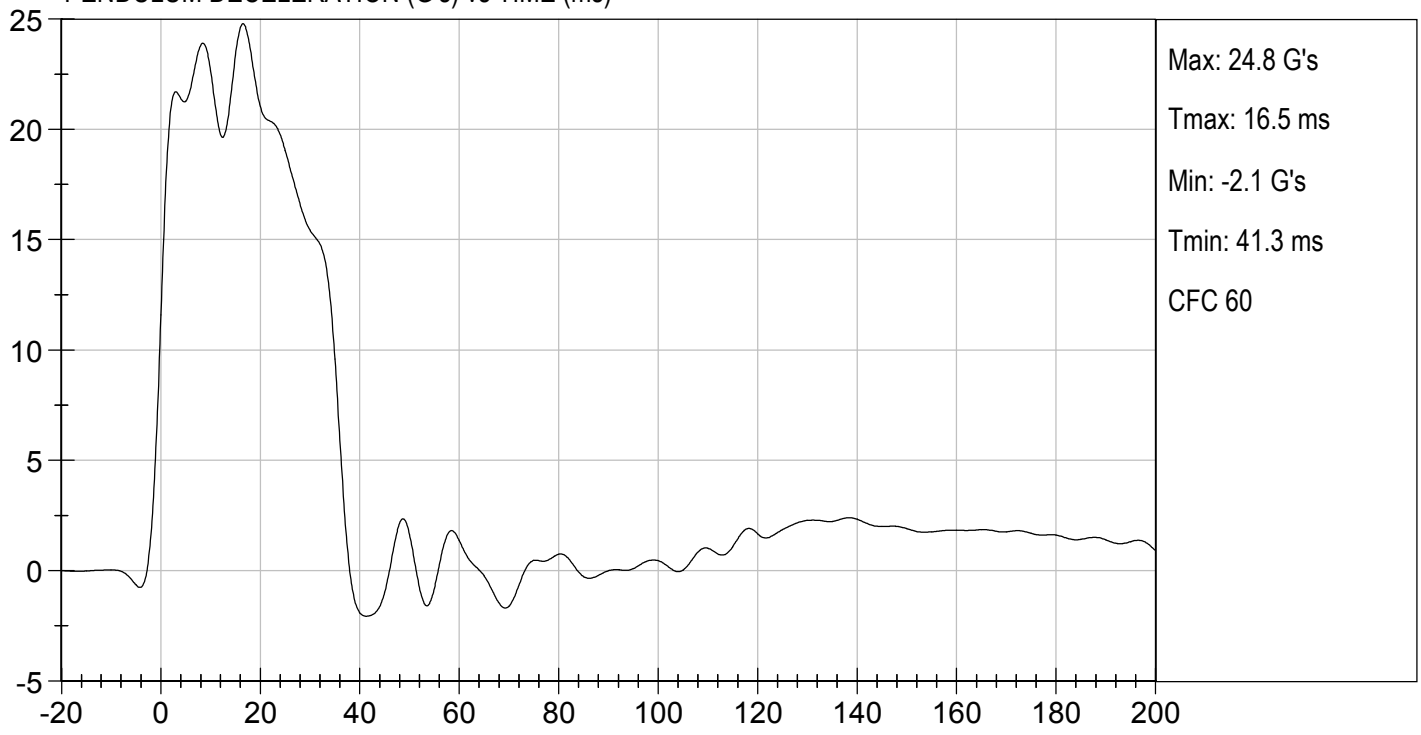
02/20/2020
Test Date

Approved By

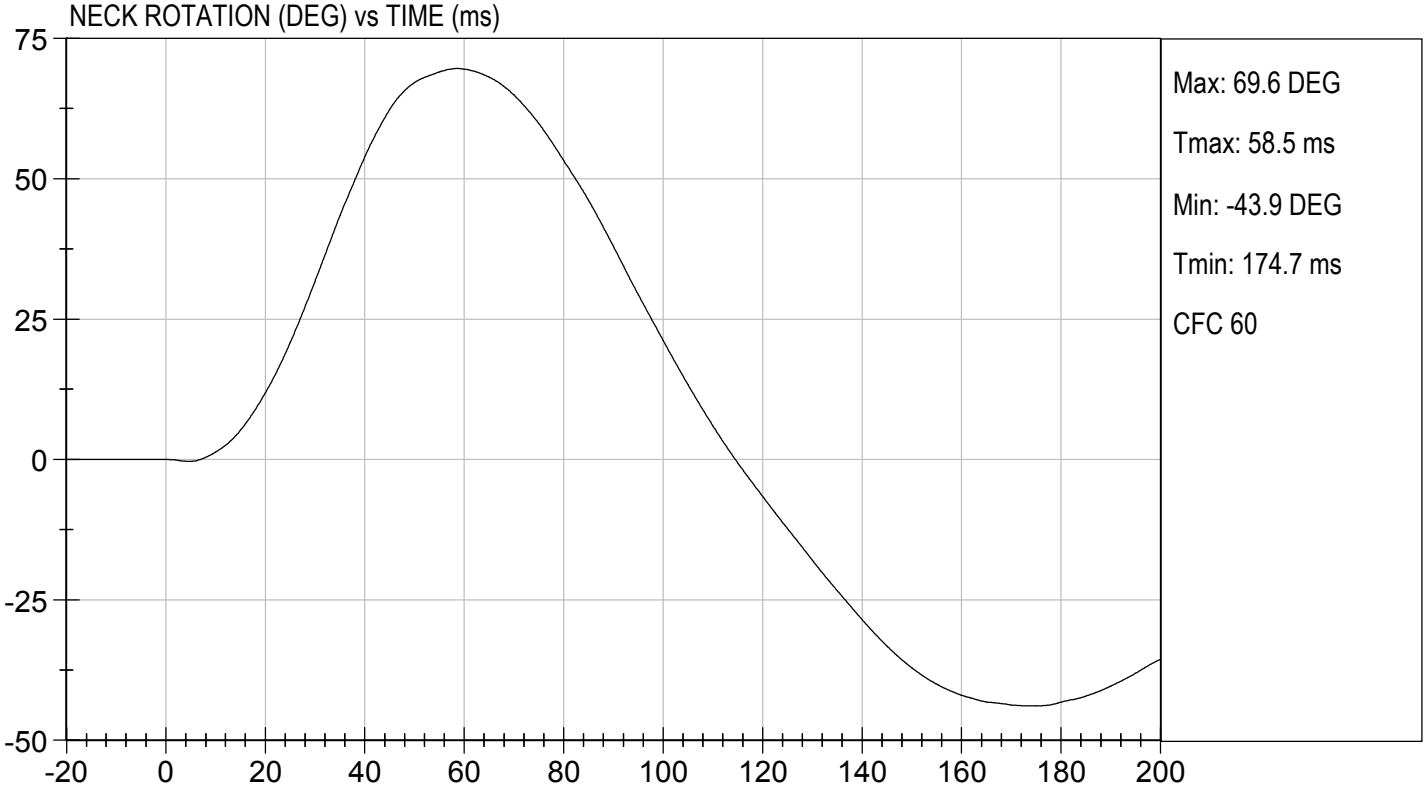
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 02/20/2020
TEST #: D200622

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

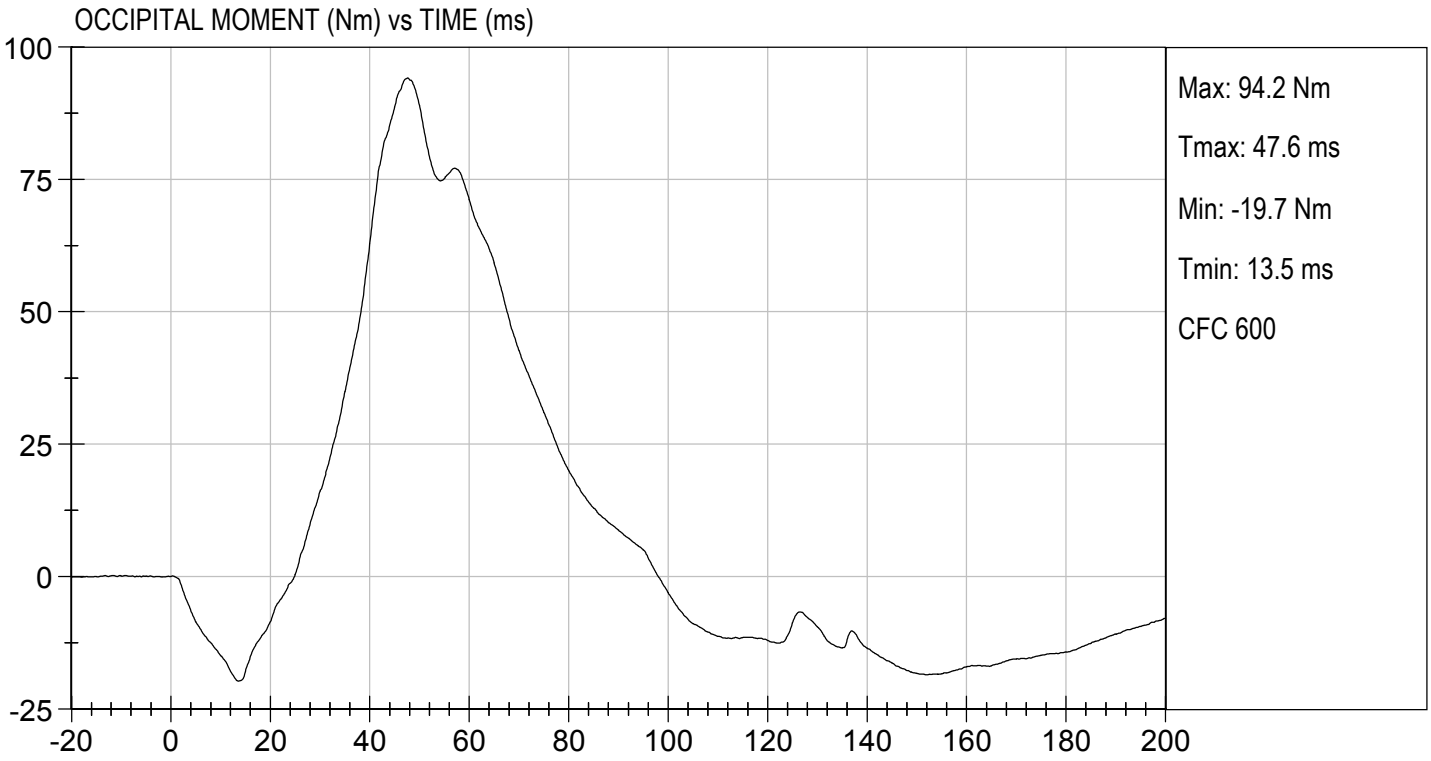


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 02/20/2020
TEST #: D200622



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200623

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	14	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.19	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.66	Pass
	20 ms	G's	14.00 to 19.00	16.29	Pass
	30 ms	G's	11.00 to 16.00	13.16	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.0	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.3	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	95.9	Pass
	Time	ms	72.0 to 82.0	75.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	153.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-63.9	Pass
	Time	ms	65.0 to 79.0	69.1	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	136.8	Pass
			Overall Test Results		Pass

Laboratory Technician

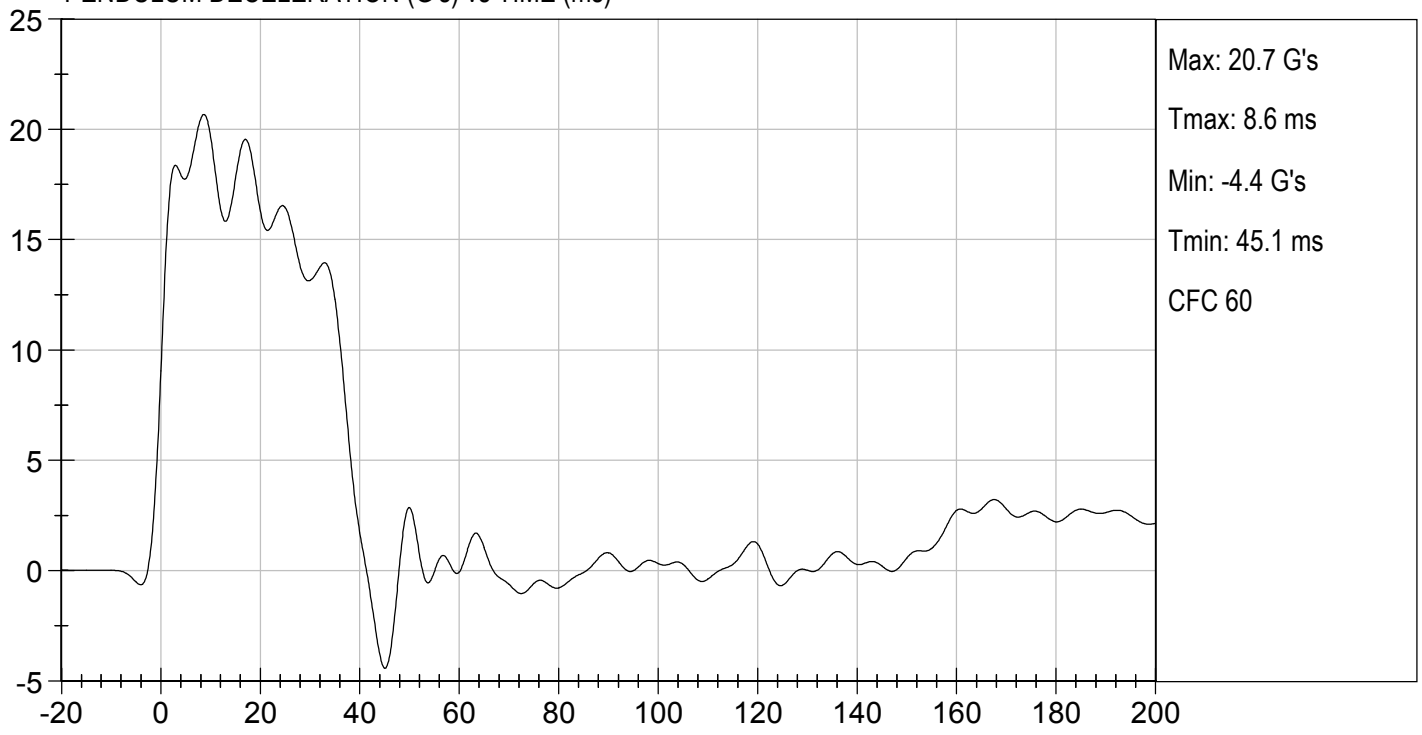
02/20/2020
Test Date

Approved By

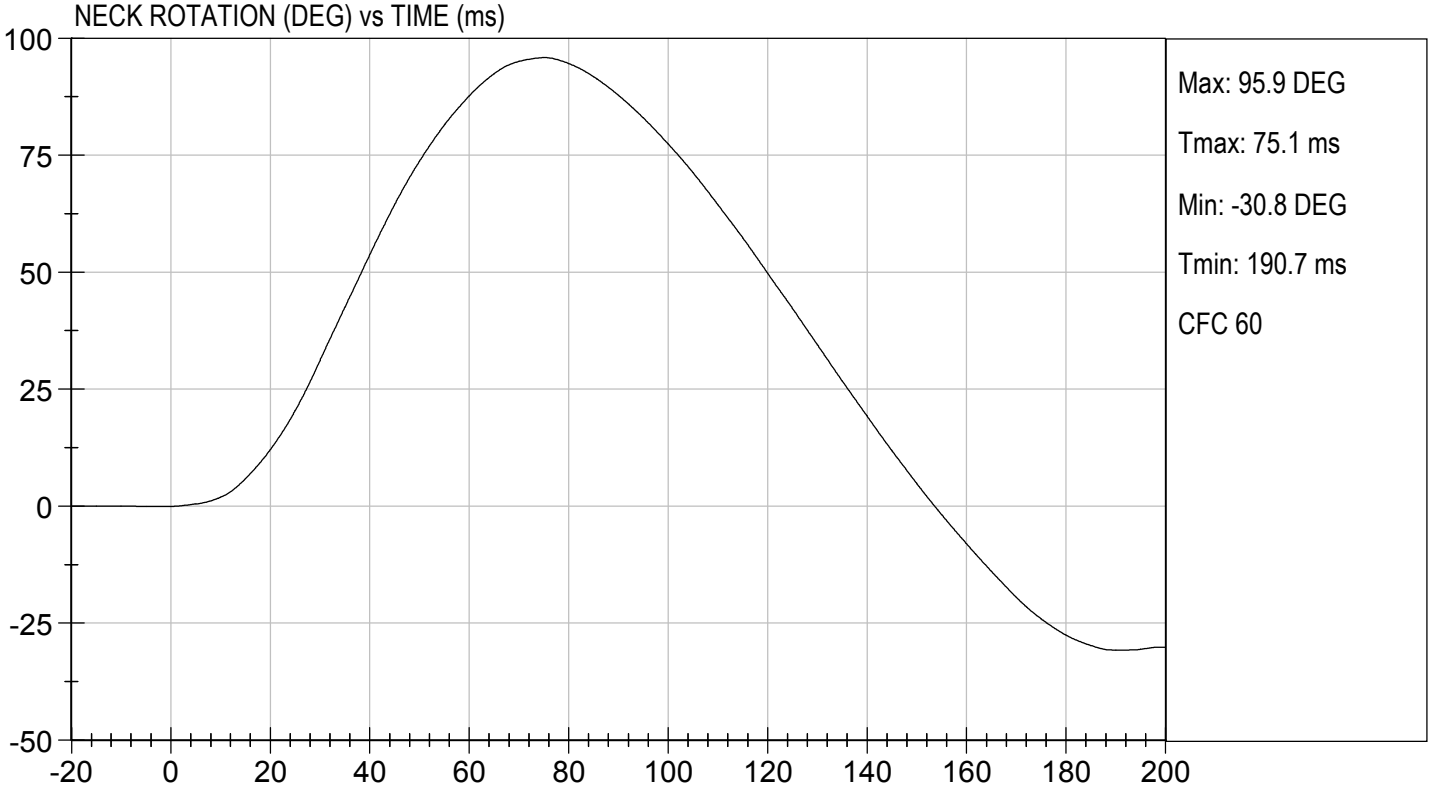
TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 02/20/2020
TEST #: D200623

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

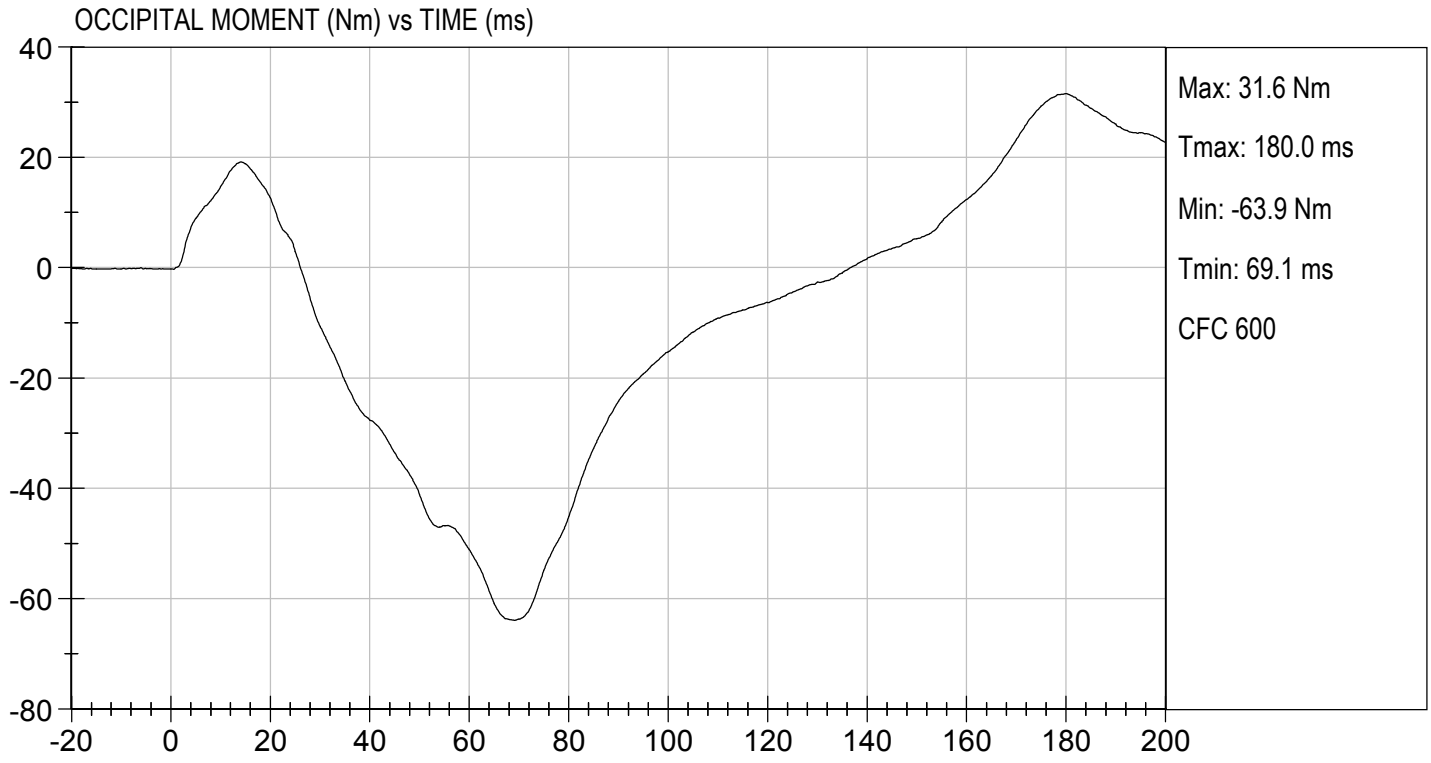


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 02/20/2020
TEST #: D200623



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 276 **Test I.D:** D200624

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,446	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.85	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

Laboratory Technician

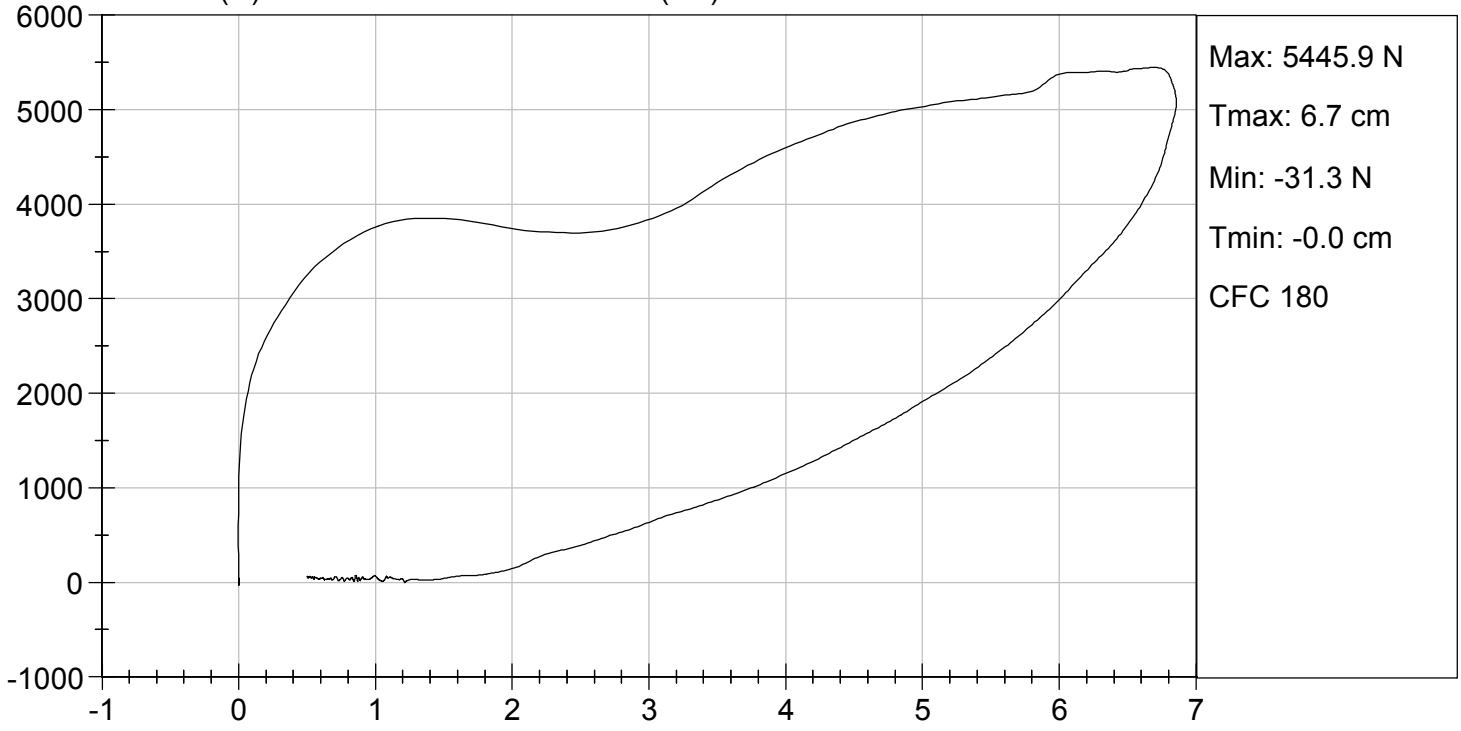
02/19/2020
Test Date

Approved By

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

TEST DATE: 02/19/2020
TEST #: D200624

FORCE (N) vs CHEST DISPLACEMENT (cm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200625

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	4,899	Pass
		Overall Test Results		Pass

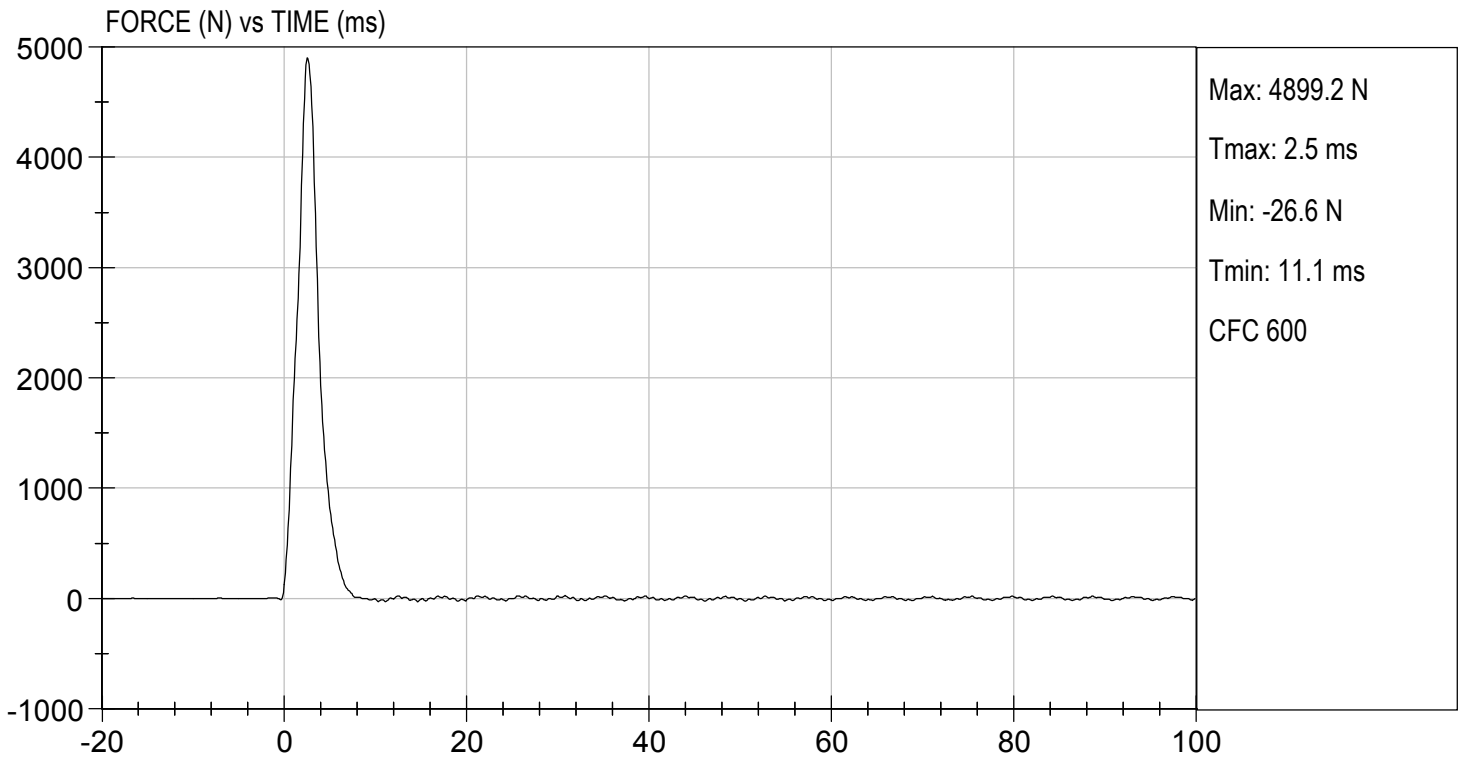
Laboratory Technician

02/20/2020
Test Date

Approved By

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

TEST DATE: 02/20/2020
TEST #: D200625



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200626

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Probe Velocity	m/s	2.07 to 2.13	2.07	Pass
Peak Probe Force	N	4715 to 5782	5,488	Pass
		Overall Test Results		Pass

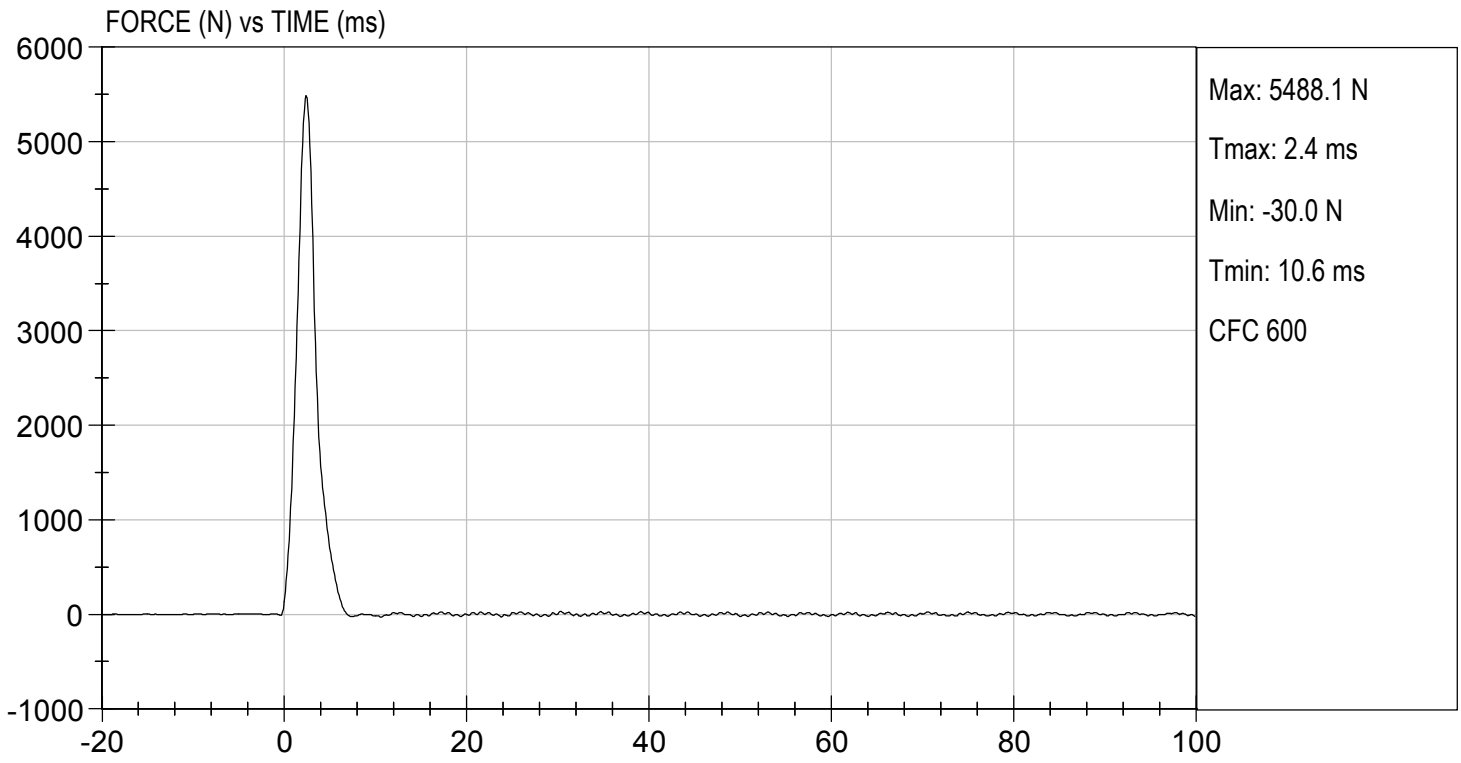
Laboratory Technician

02/20/2020
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.80 ft/s, 2.07 m/s

TEST DATE: 02/20/2020
TEST #: D200626



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D200620

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	20	20	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.4	Pass
30 Degrees	Nm	94.9 Nm Max	81.6	80.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	45.1	43.9	Pass
		Overall Test Results			Pass

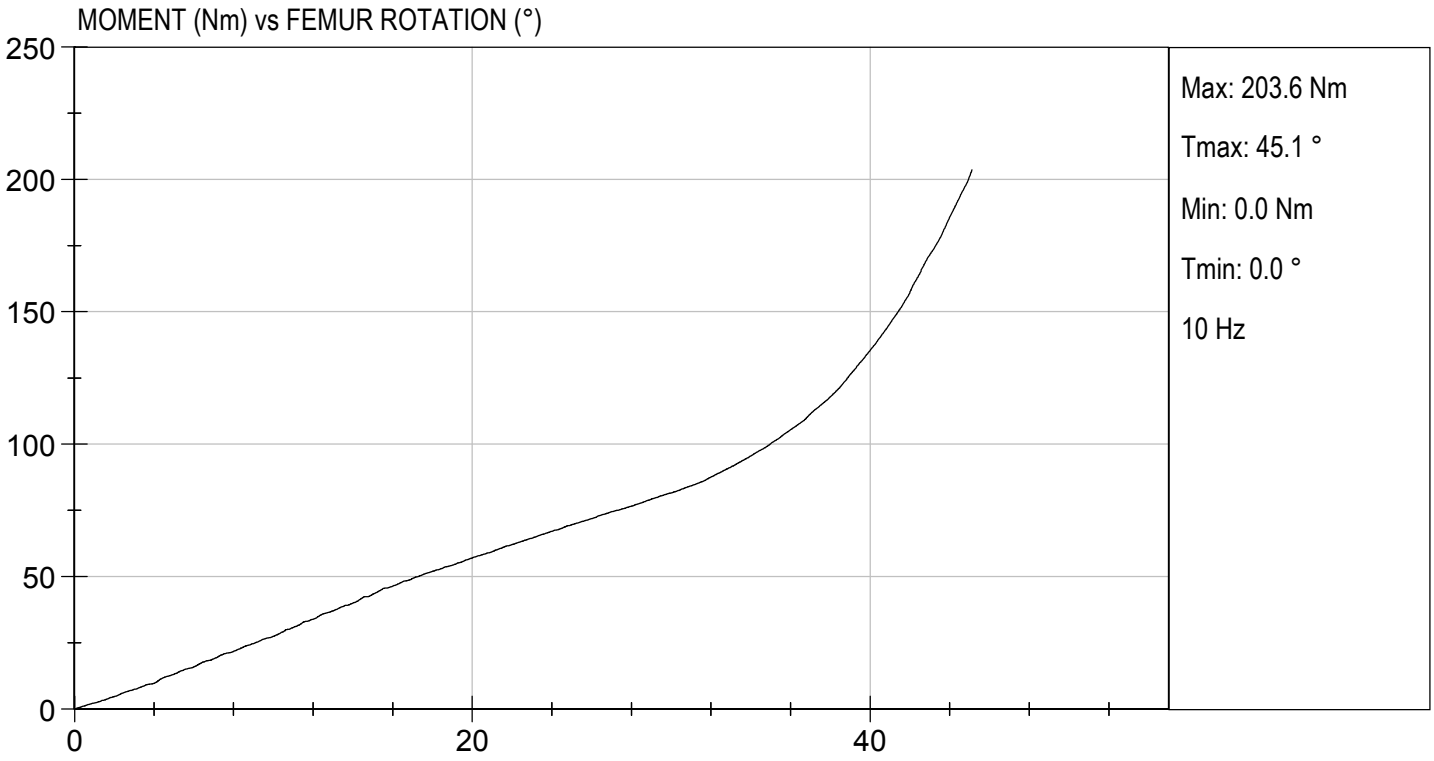
Laboratory Technician

02/19/2020
Test Date

Approved By

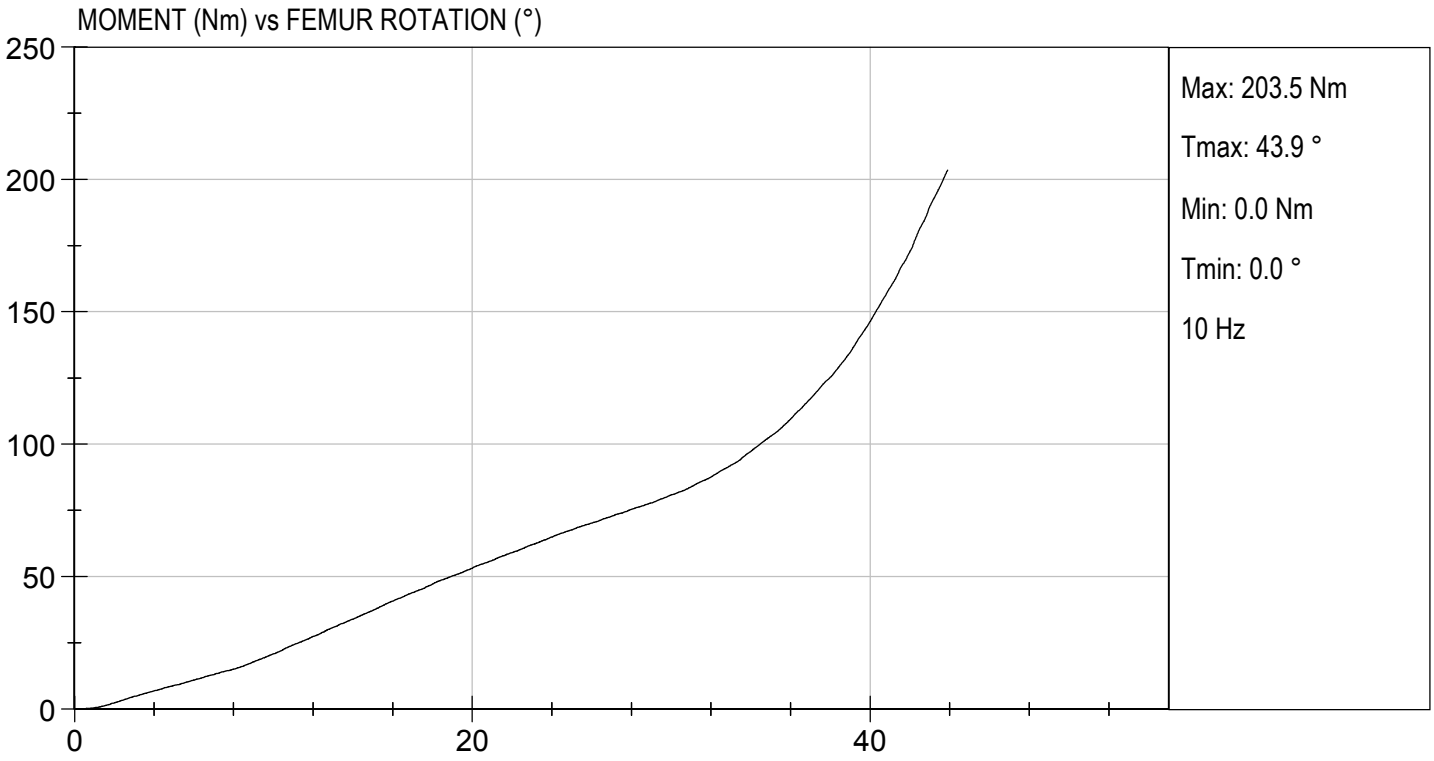
TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 02/19/2020
TEST #: D200629



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 02/19/2020
TEST #: D200620



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:** D200391

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	25	Pass
Peak Resultant Acceleration	G's	250 to 300	272	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	4.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

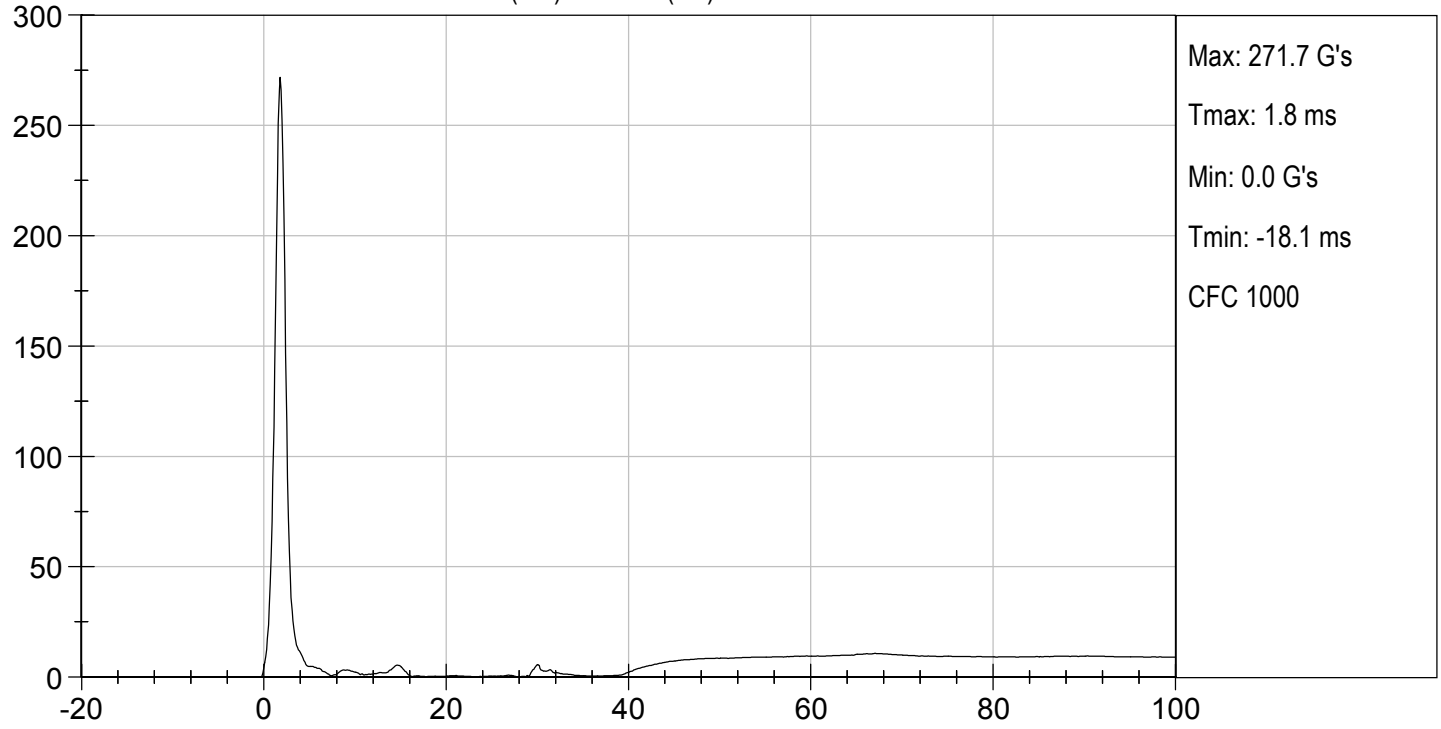
02/03/2020
Test Date

Approved By

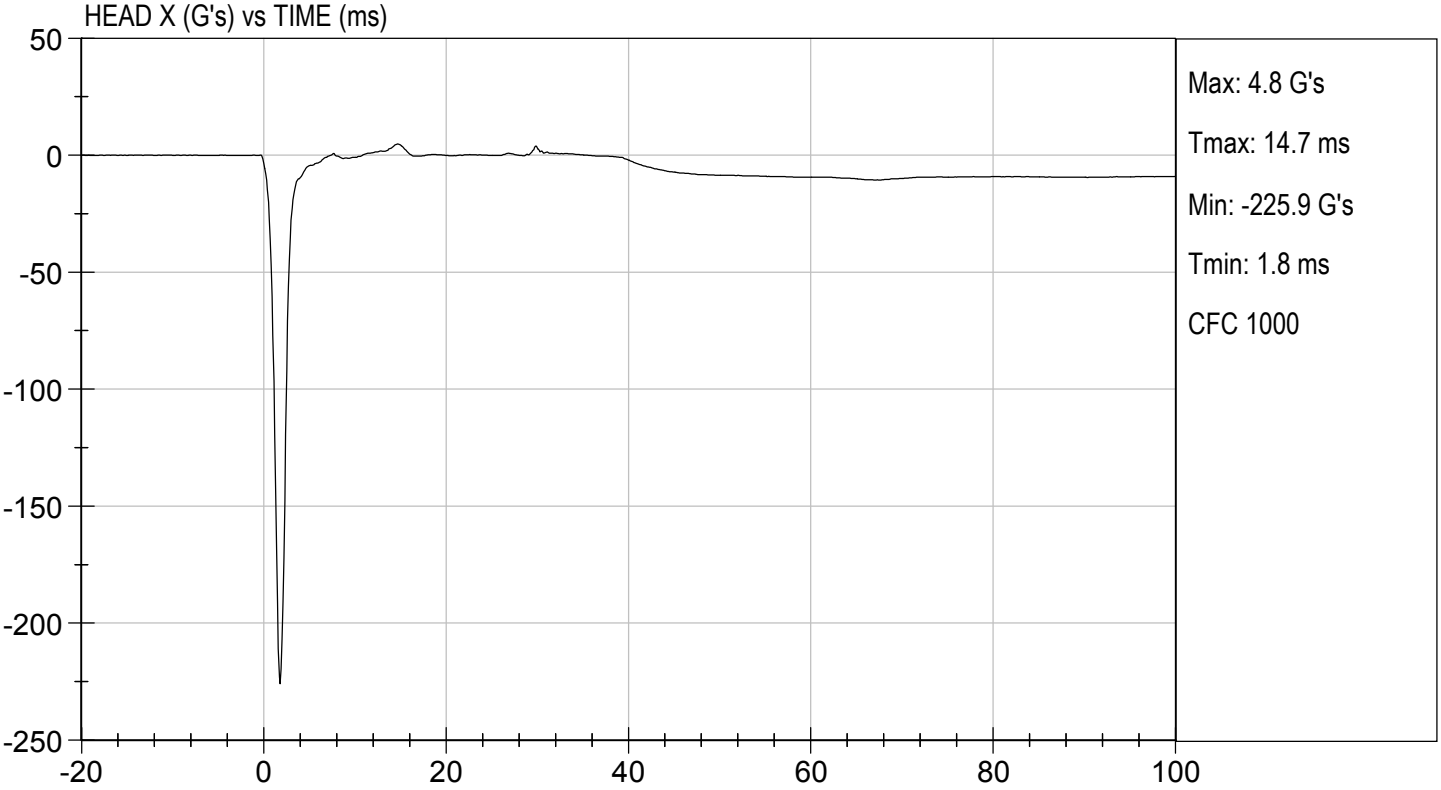
TEST DESC: HEAD DROP

TEST DATE: 02/03/2020
TEST #: D200391

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

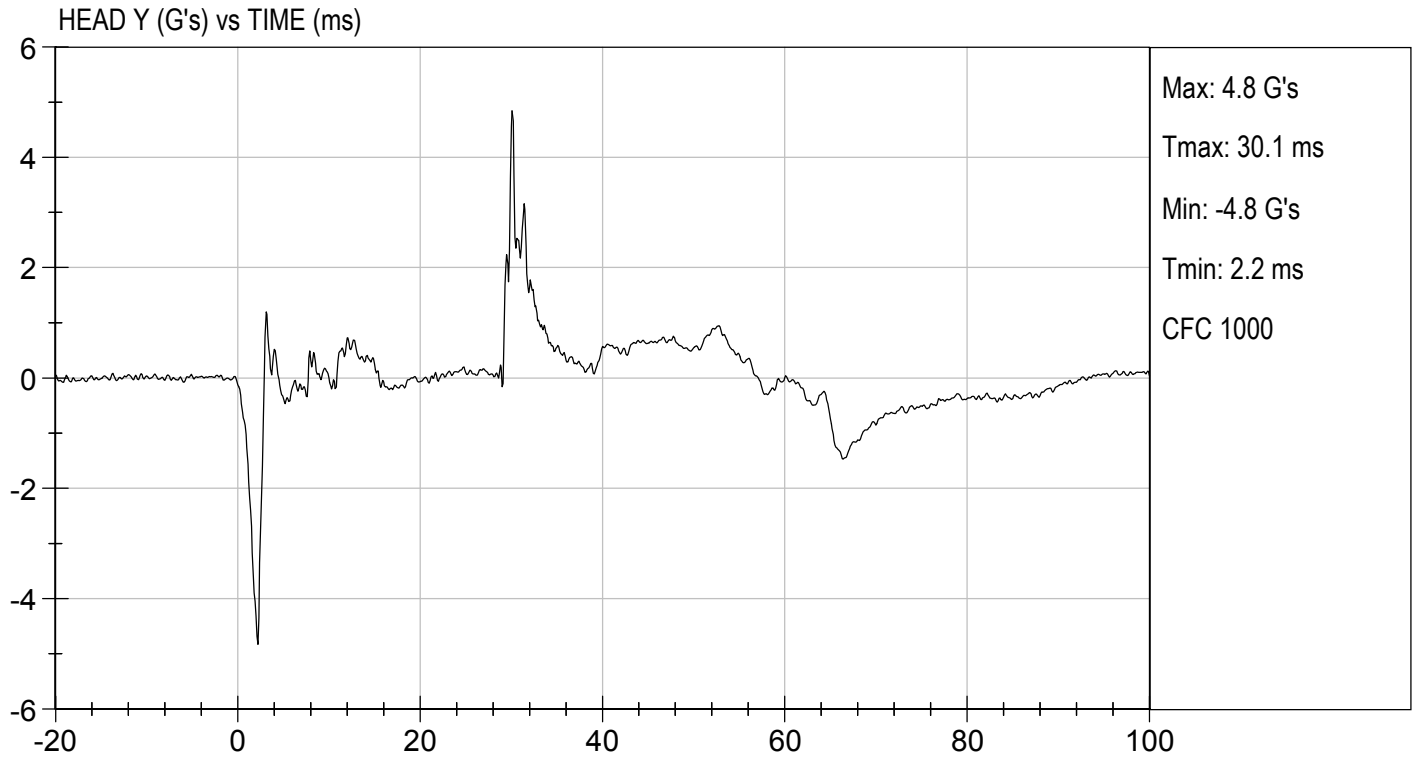


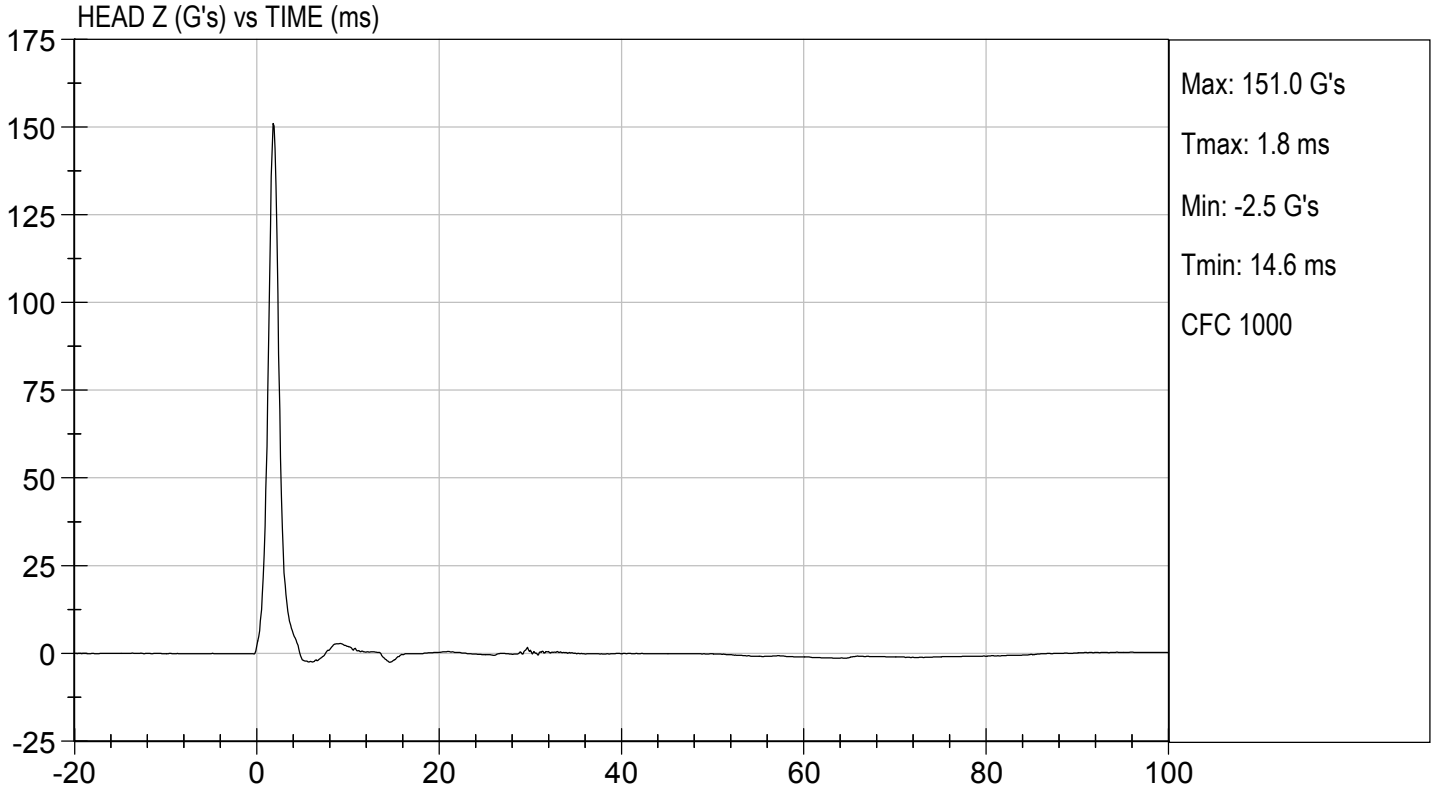
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 02/03/2020
TEST #: D200391





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200392

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	25	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.13	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.5	Pass
	20 ms	m/s	4.0 to 5.0	4.7	Pass
	30 ms	m/s	5.8 to 7.0	6.8	Pass
D Plane Rotation	Max	deg	77 to 91	81	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	75	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	82	Pass
			Overall Results		Pass

Laboratory Technician

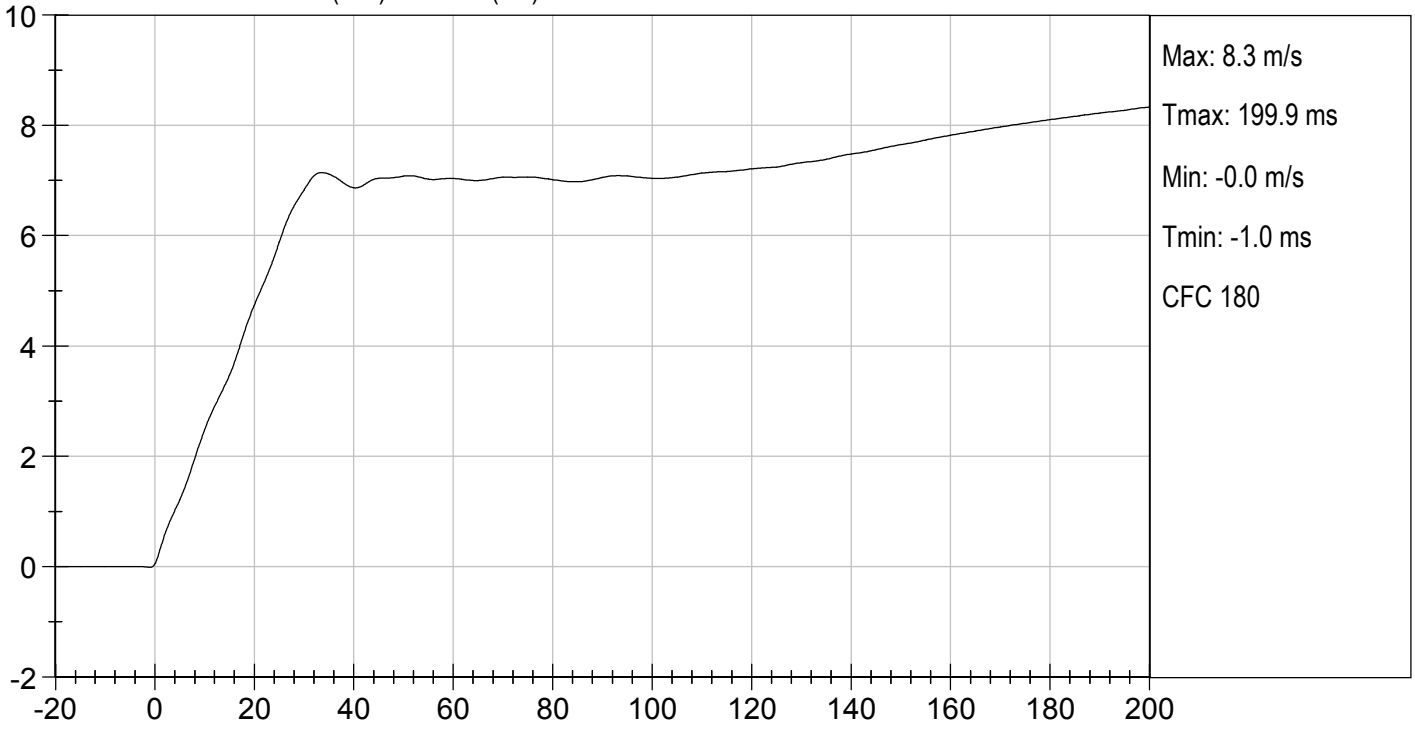
02/03/2020
Test Date

Approved By

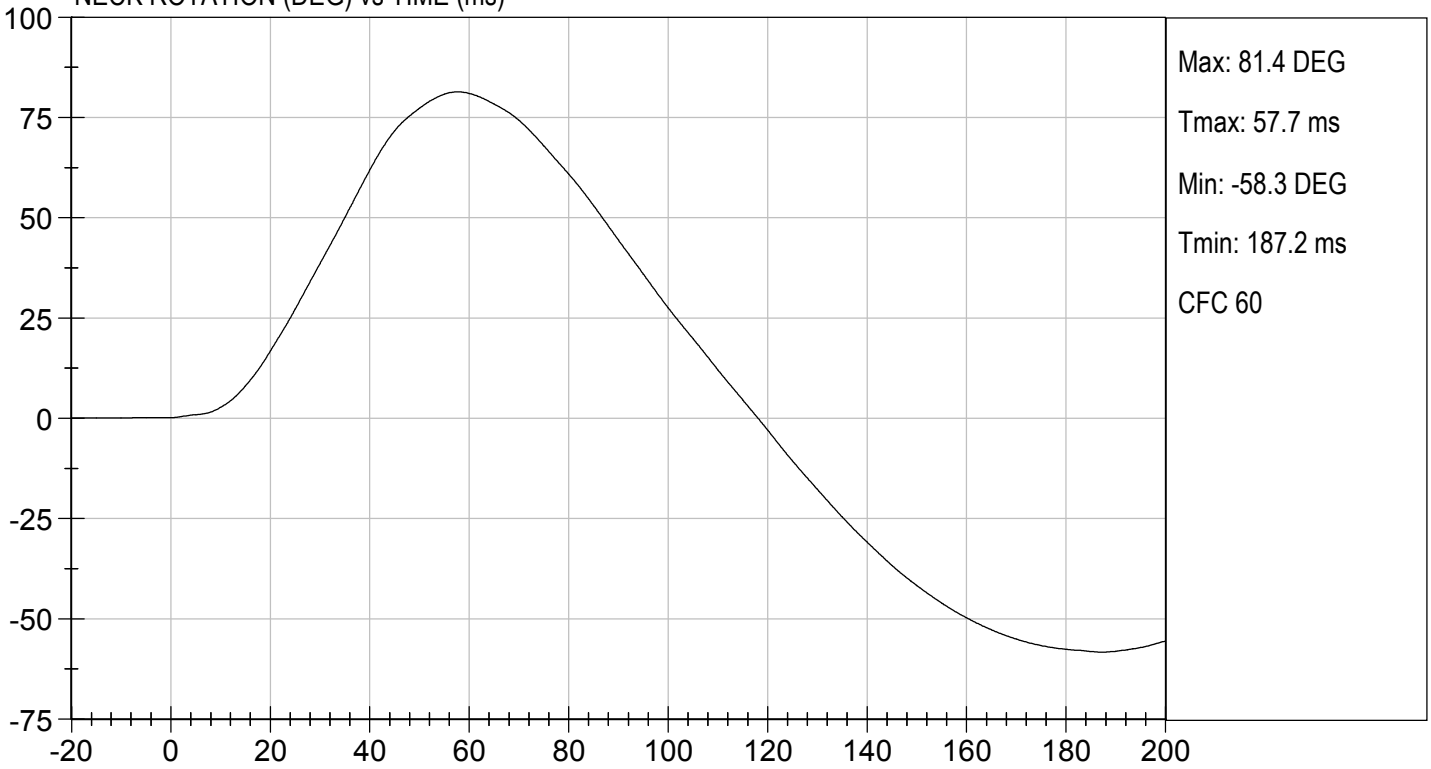
TEST DESC: NECK FLEXION
VELOCITY: 23.40 ft/s, 7.13 m/s

TEST DATE: 02/03/2020
TEST #: D200392

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

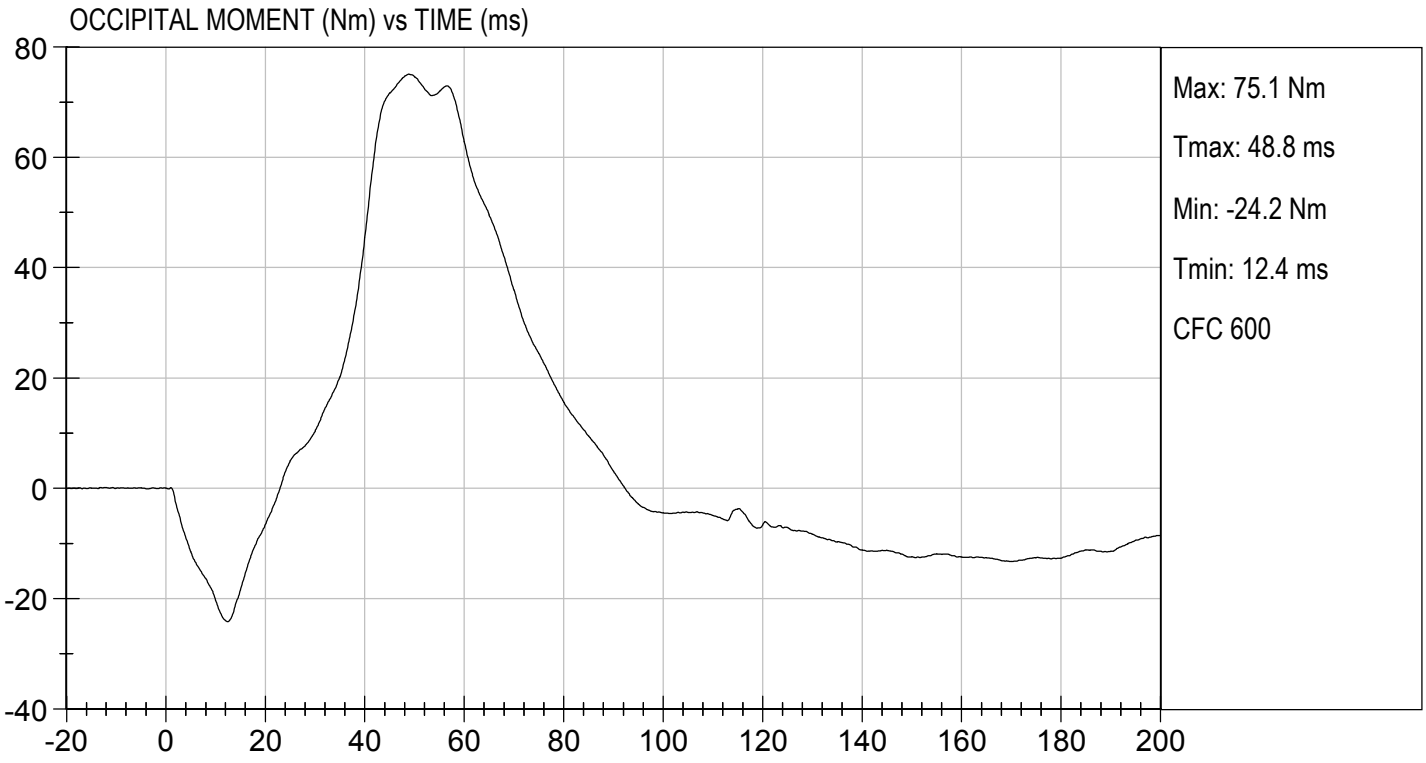


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 23.40 ft/s, 7.13 m/s

TEST DATE: 02/03/2020
TEST #: D200392



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200393

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	25	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.7	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	107	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	105	Pass
			Overall Results		Pass

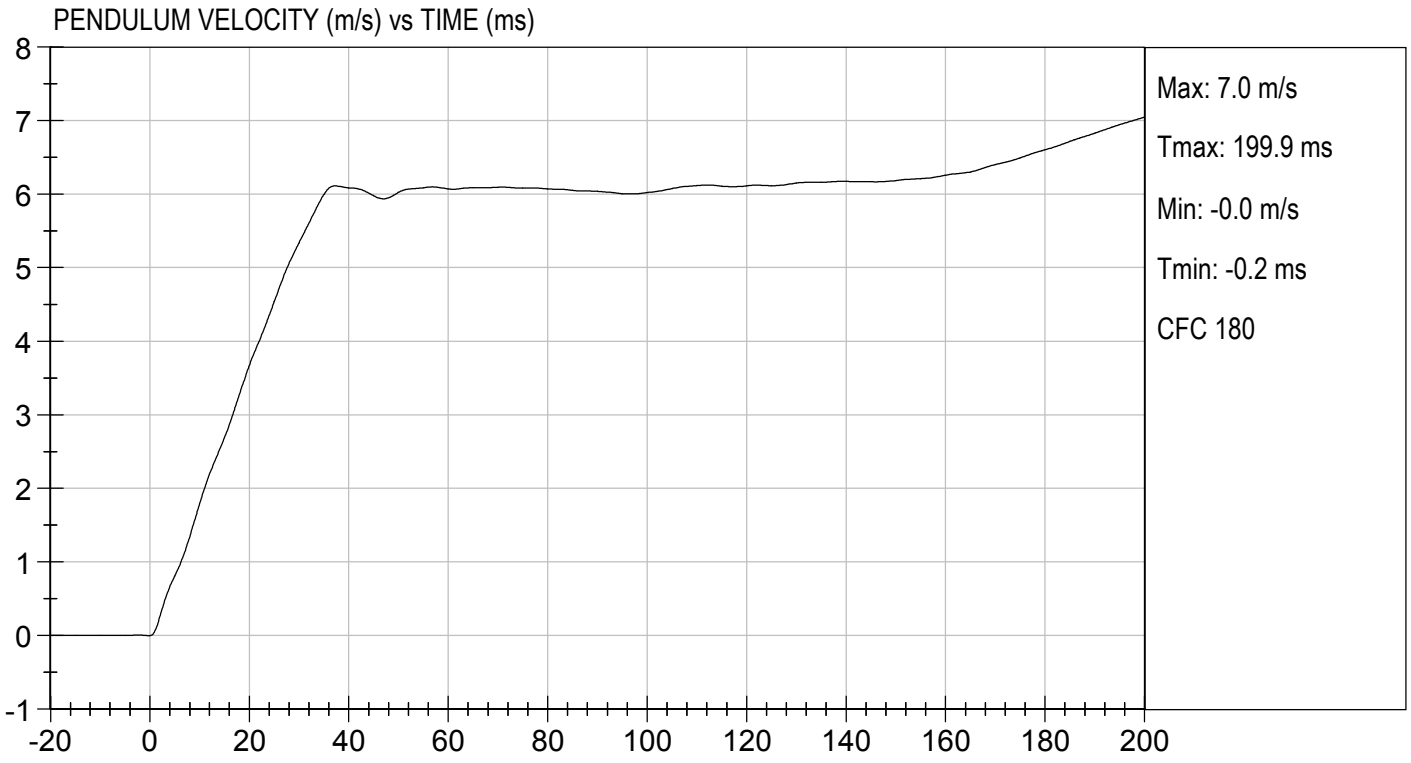
Laboratory Technician

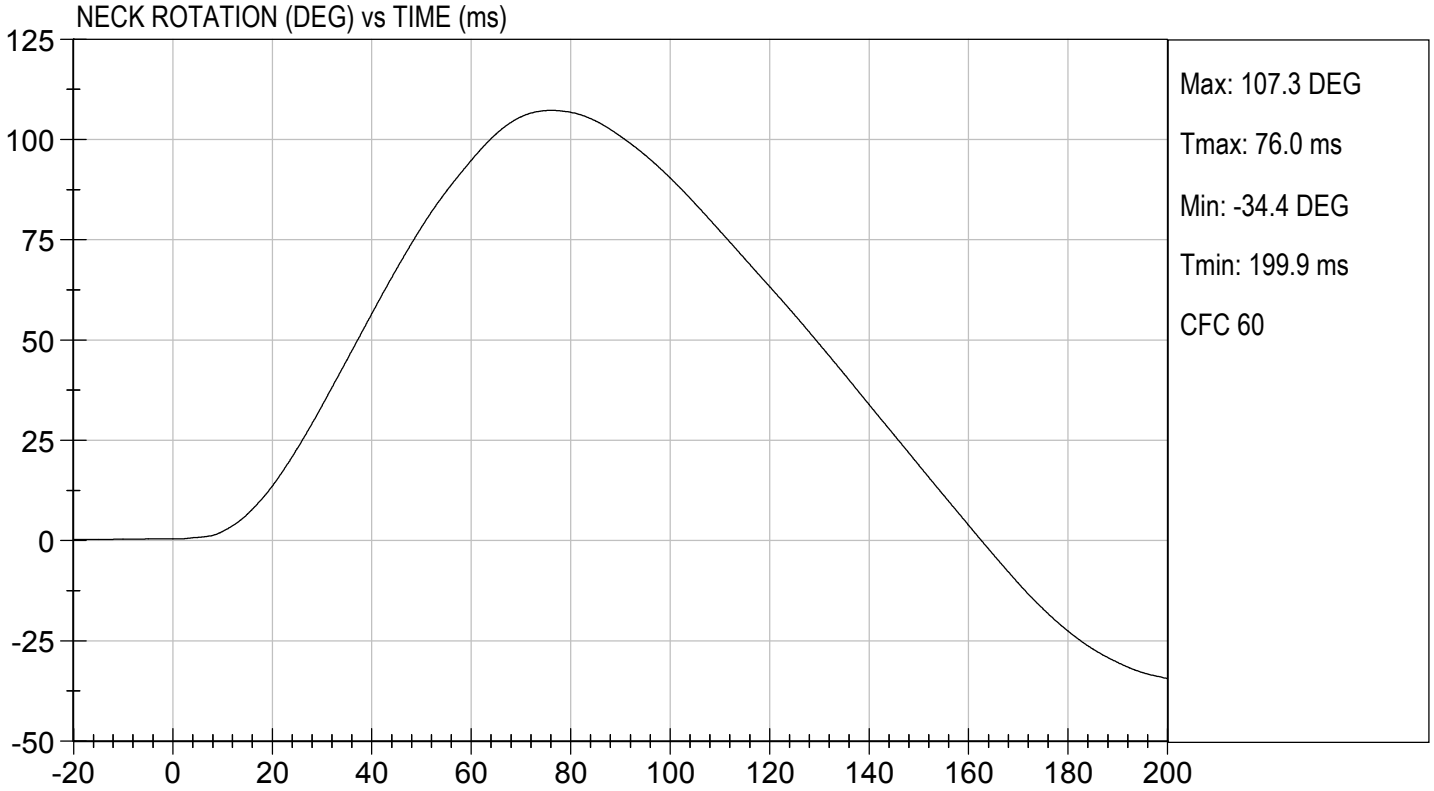
02/03/2020
Test Date

Approved By

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

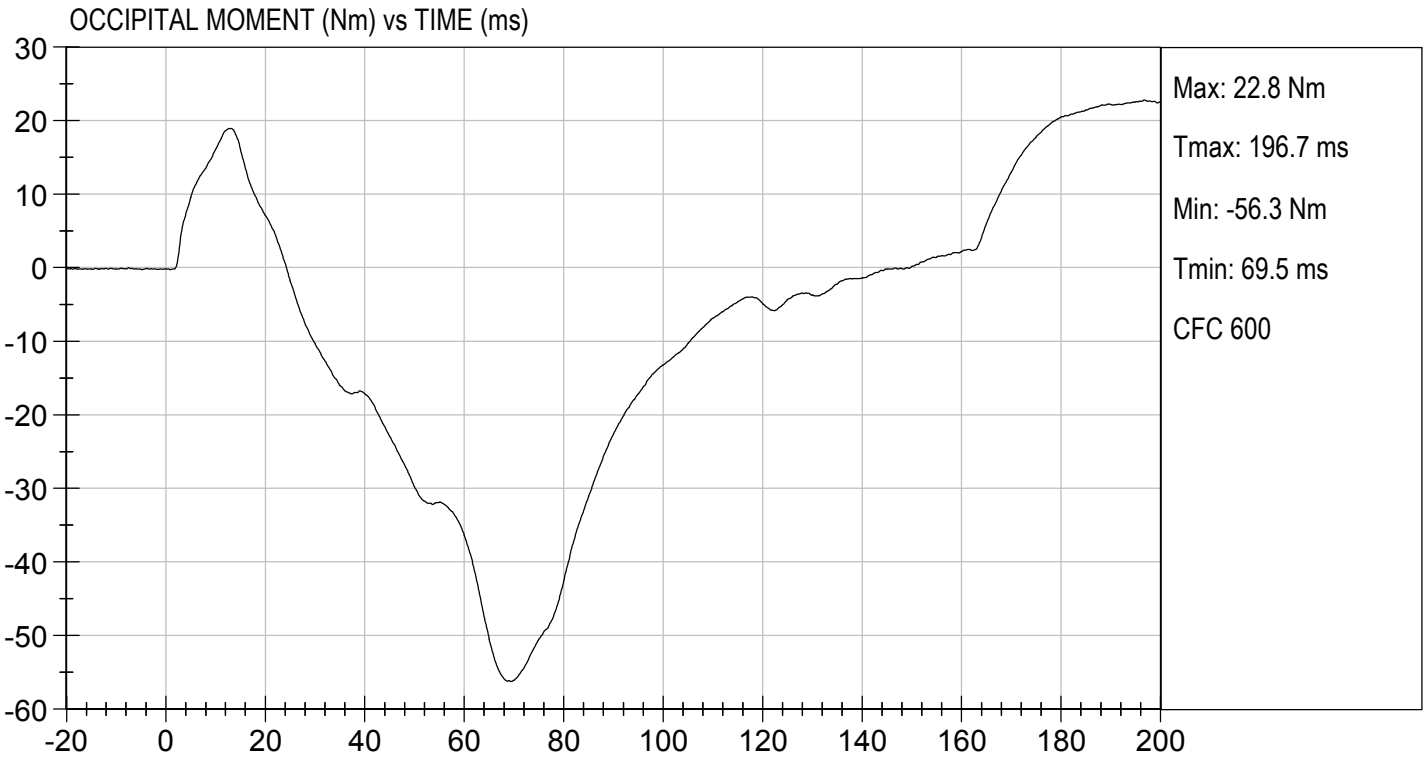
TEST DATE: 02/03/2020
TEST #: D200393





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

TEST DATE: 02/03/2020
TEST #: D200393



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200394

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Relative Humidity	%	10 to 70	25	Pass
Probe Speed	m/s	6.59 to 6.83	6.83	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4367	Pass
Internal Hysteresis	%	69 to 85	74	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4491	Pass
		Overall Test Results		Pass

Laboratory Technician

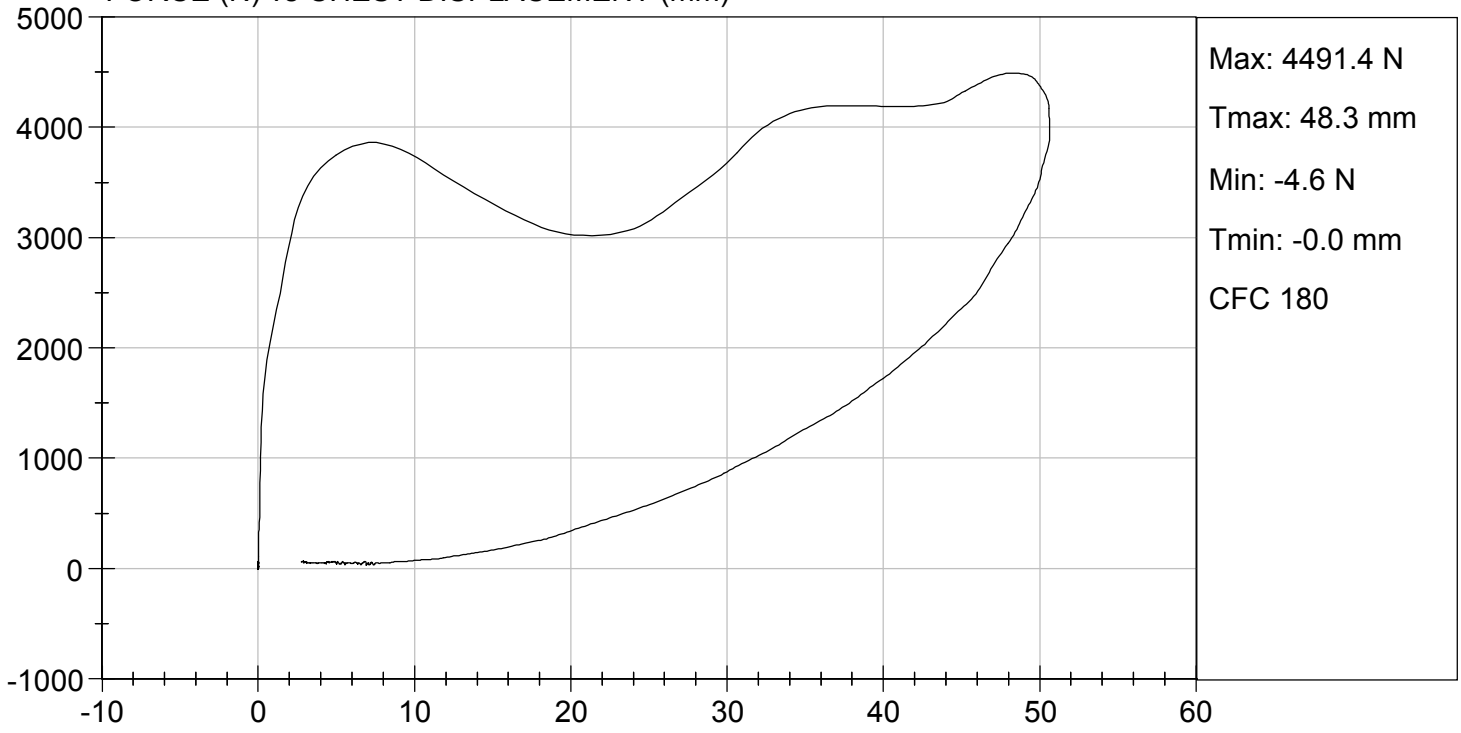
02/03/2020
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 22.40 ft/s, 6.83 m/s

TEST DATE: 02/03/2020
TEST #: D200394

FORCE (N) vs CHEST DISPLACEMENT (mm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200395

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	25	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3653	Pass
		Overall Test Results		Pass

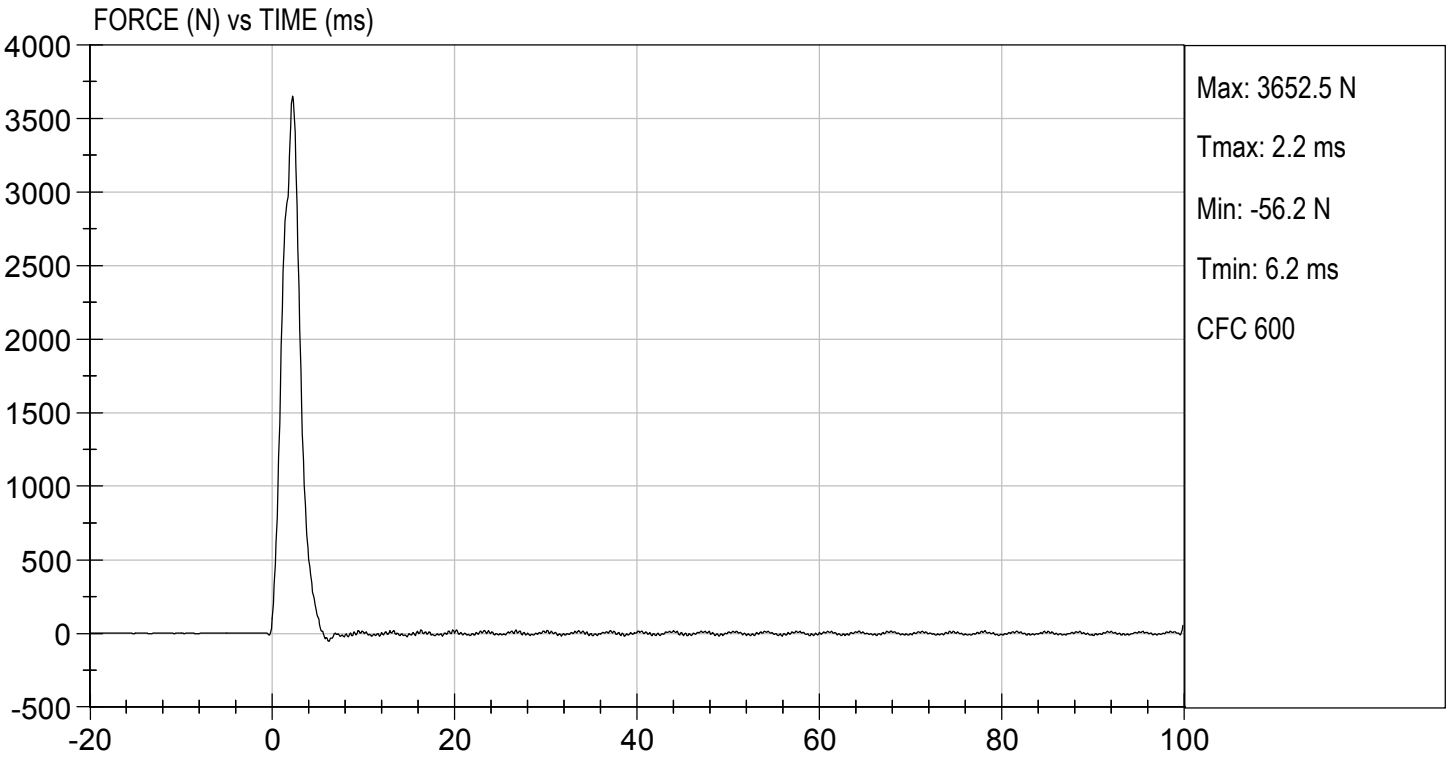
Laboratory Technician

02/03/2020
Test Date

Approved By

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

TEST DATE: 02/03/2020
TEST #: D200395



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200396

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	25	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3981	Pass
		Overall Test Results		Pass

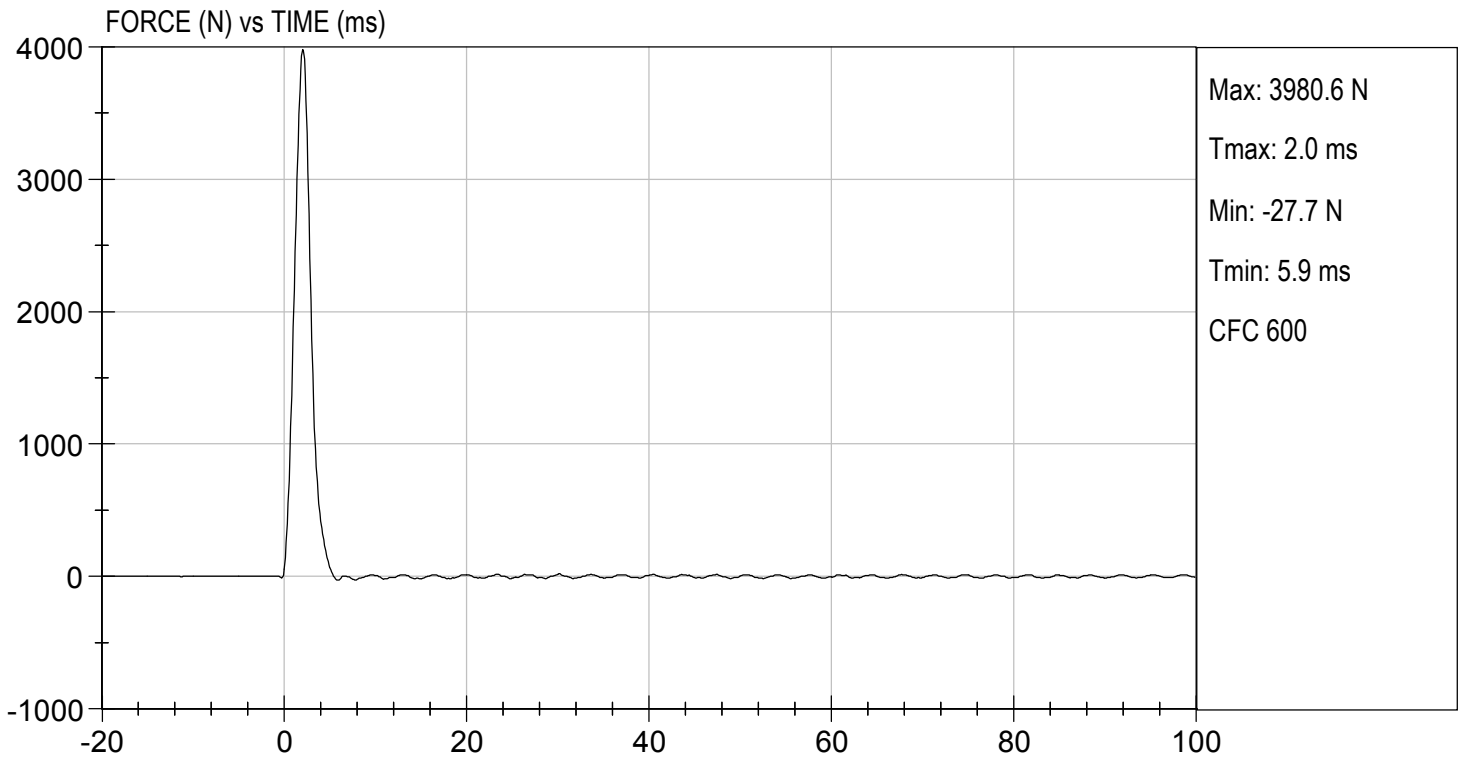
Laboratory Technician

02/03/2020
Test Date

Approved By

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

TEST DATE: 02/03/2020
TEST #: D200396



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200397

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	25	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	3	Pass
Force at 45 deg	N	320 to 390	347	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	1.0	Pass
		Overall Result		Pass

Laboratory Technician

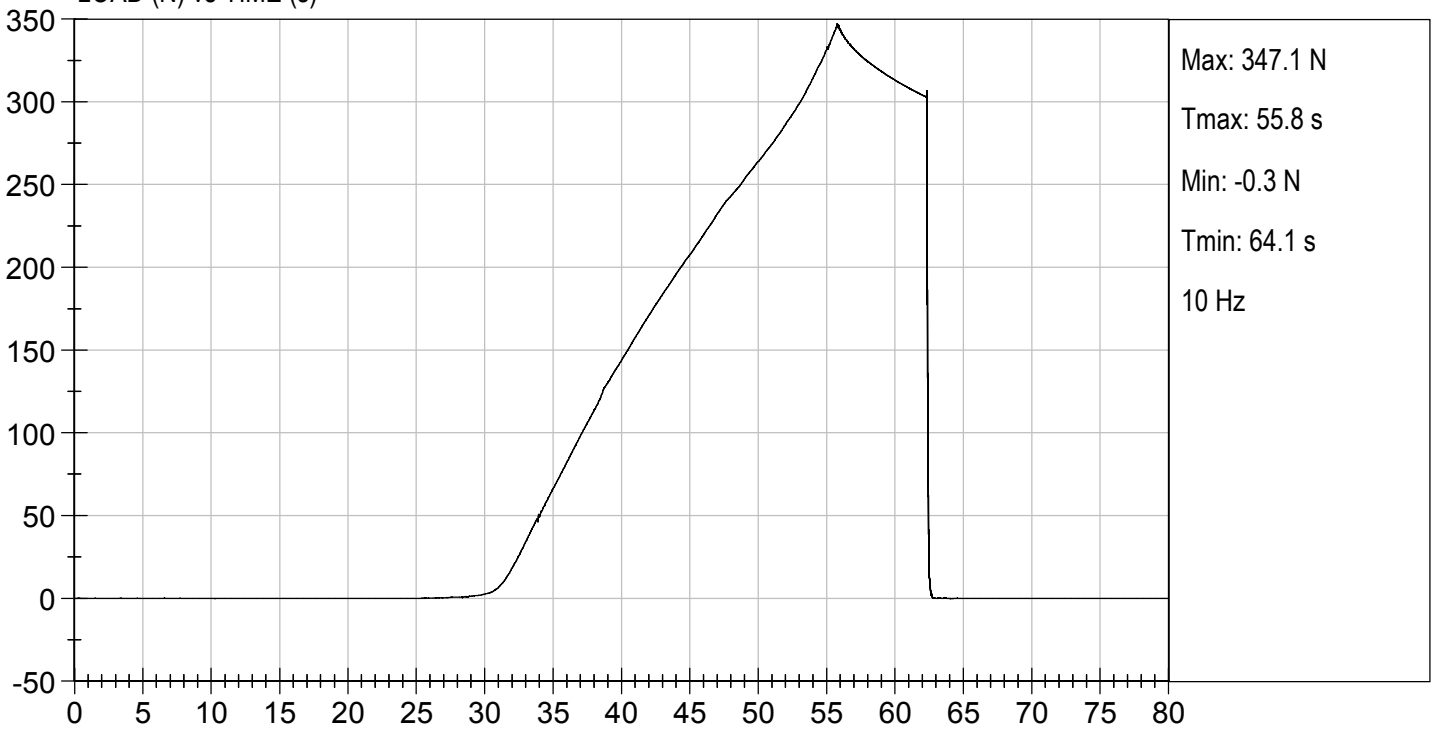
02/03/2020
Test Date

Approved By

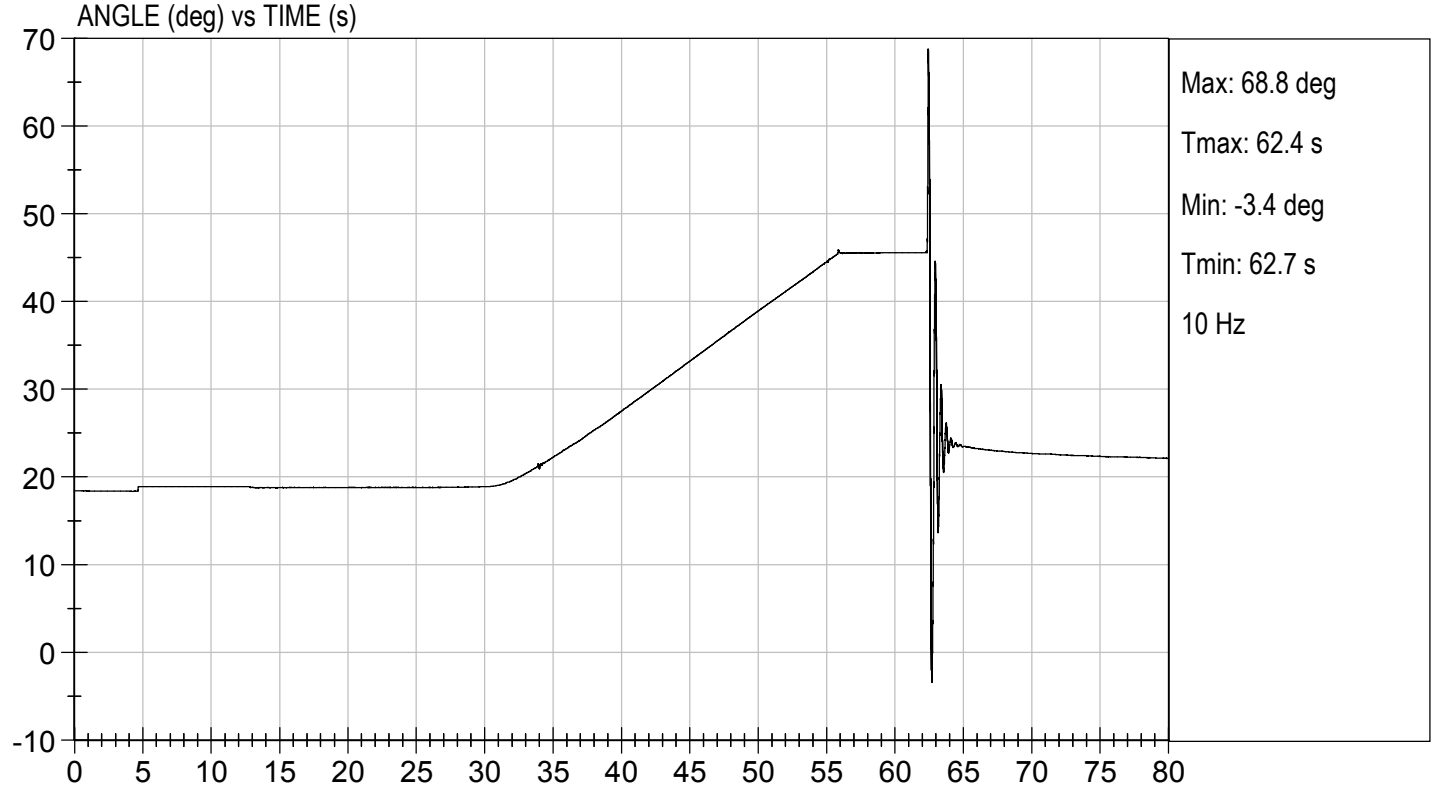
TEST DESC: LUMBAR FLEXION

TEST DATE: 02/03/2020
TEST #: D200397

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:** D200631

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Peak Resultant Acceleration	G's	250 to 300	272	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-7.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

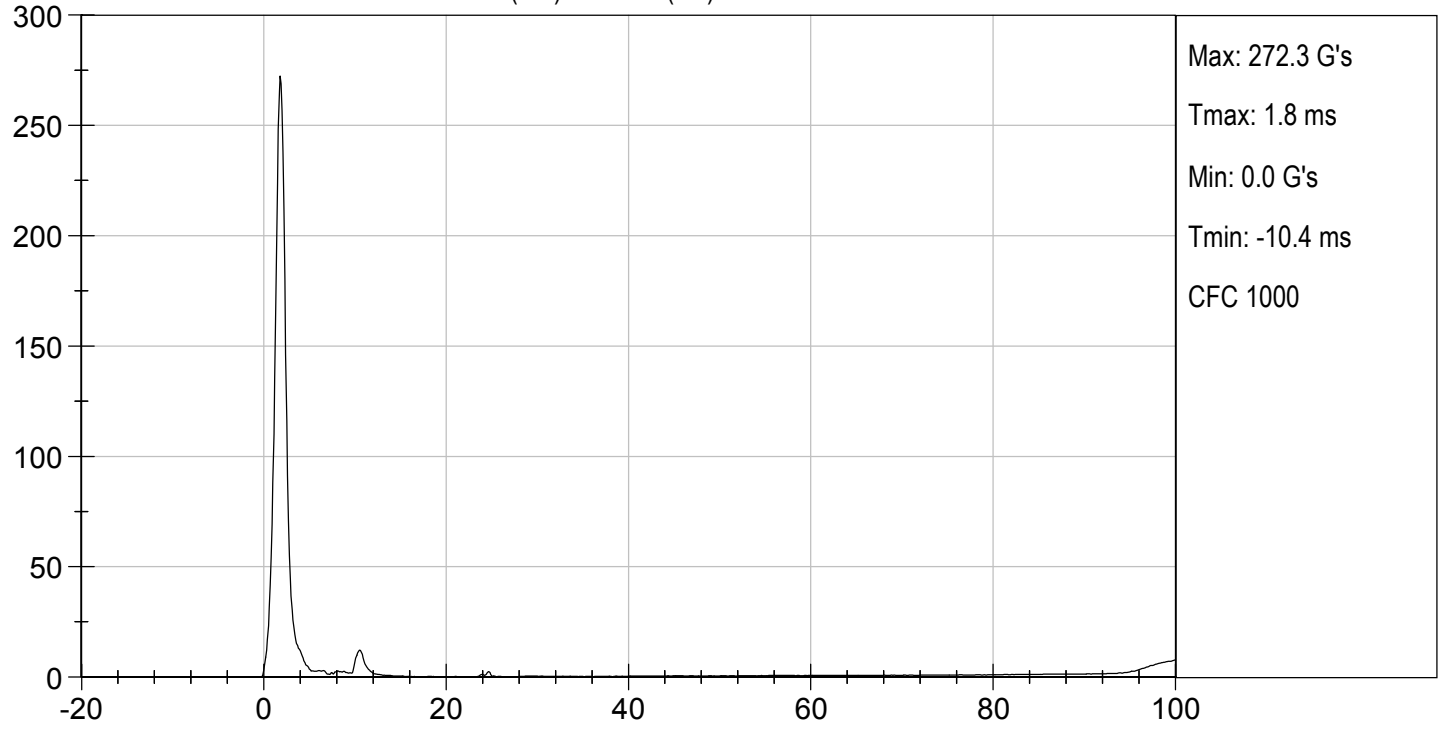
02/24/2020
Test Date

Approved By

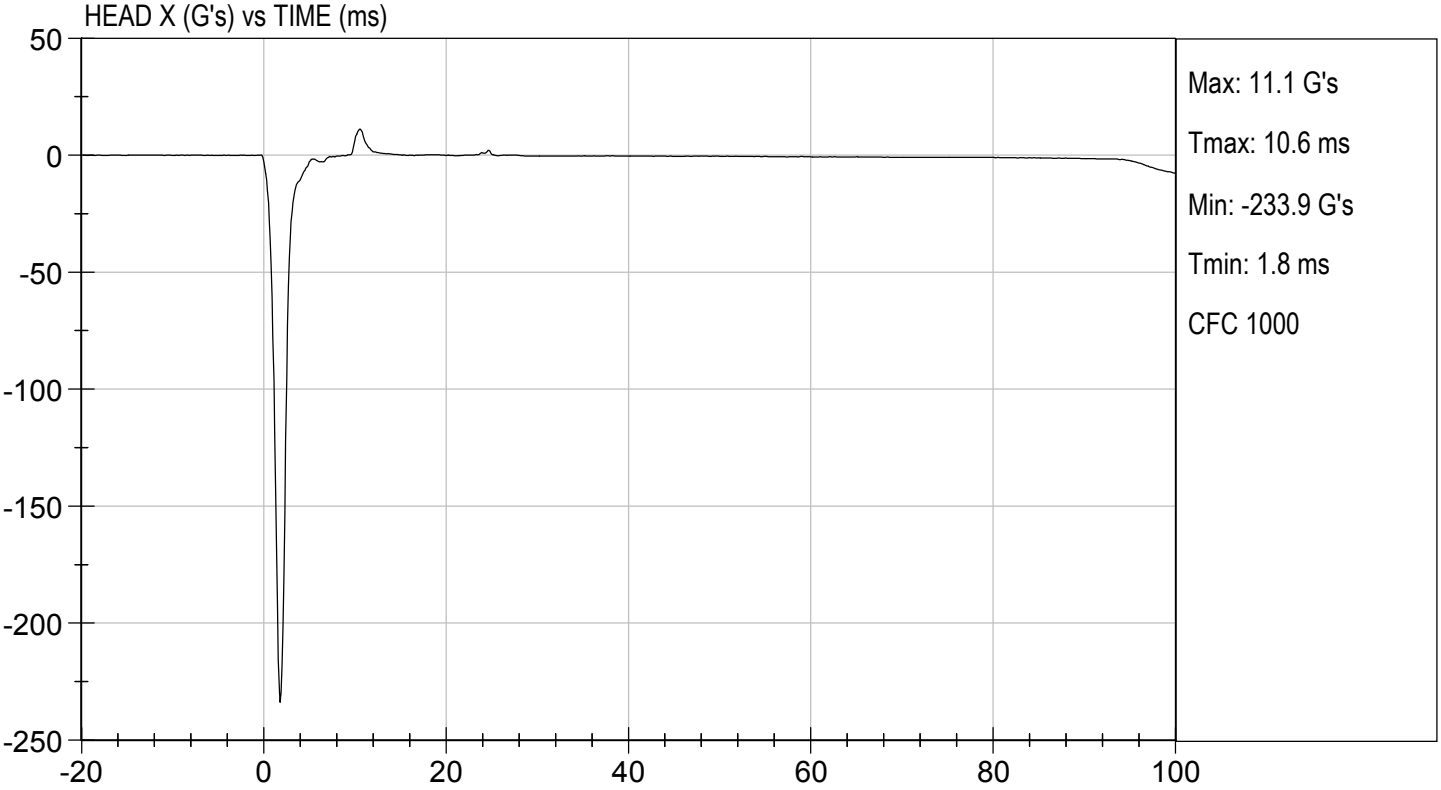
TEST DESC: HEAD DROP

TEST DATE: 02/24/2020
TEST #: D200631

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

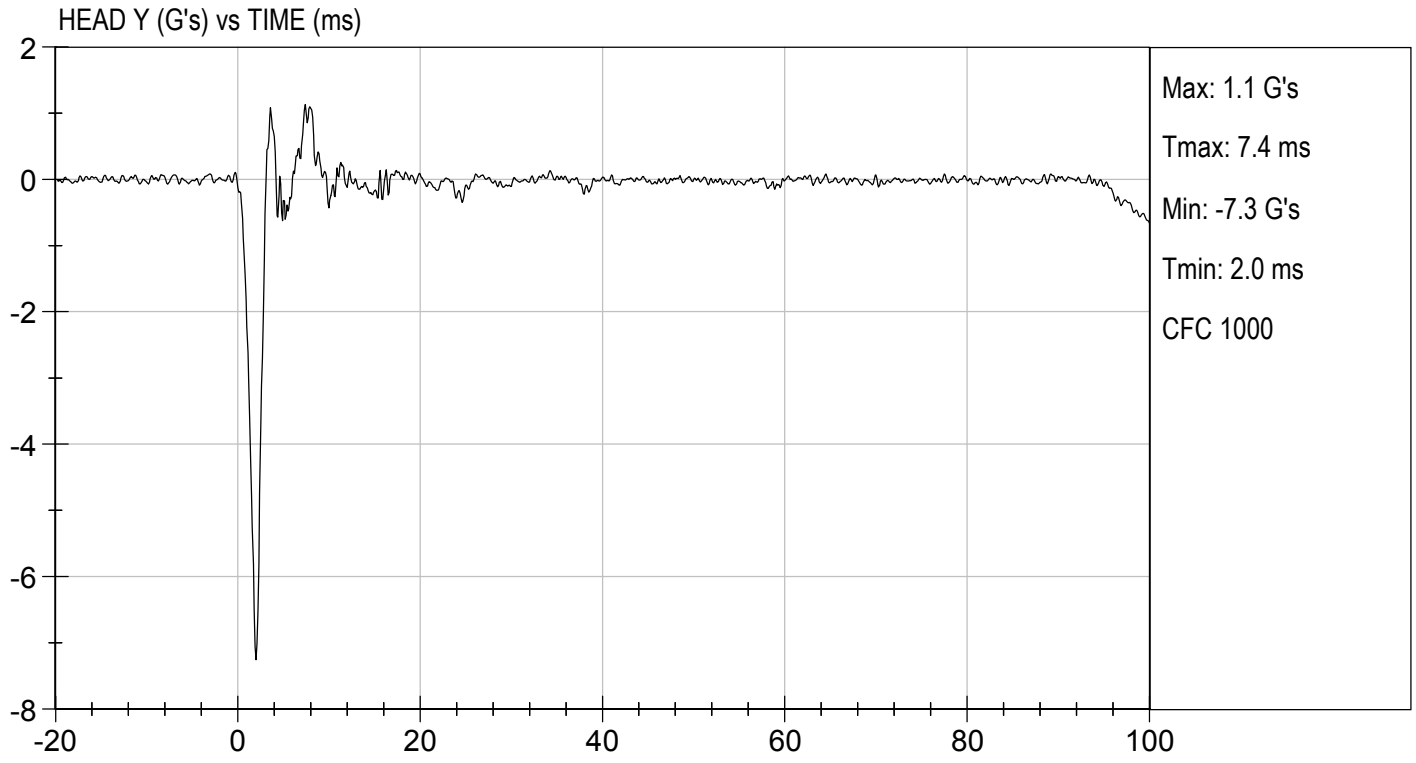


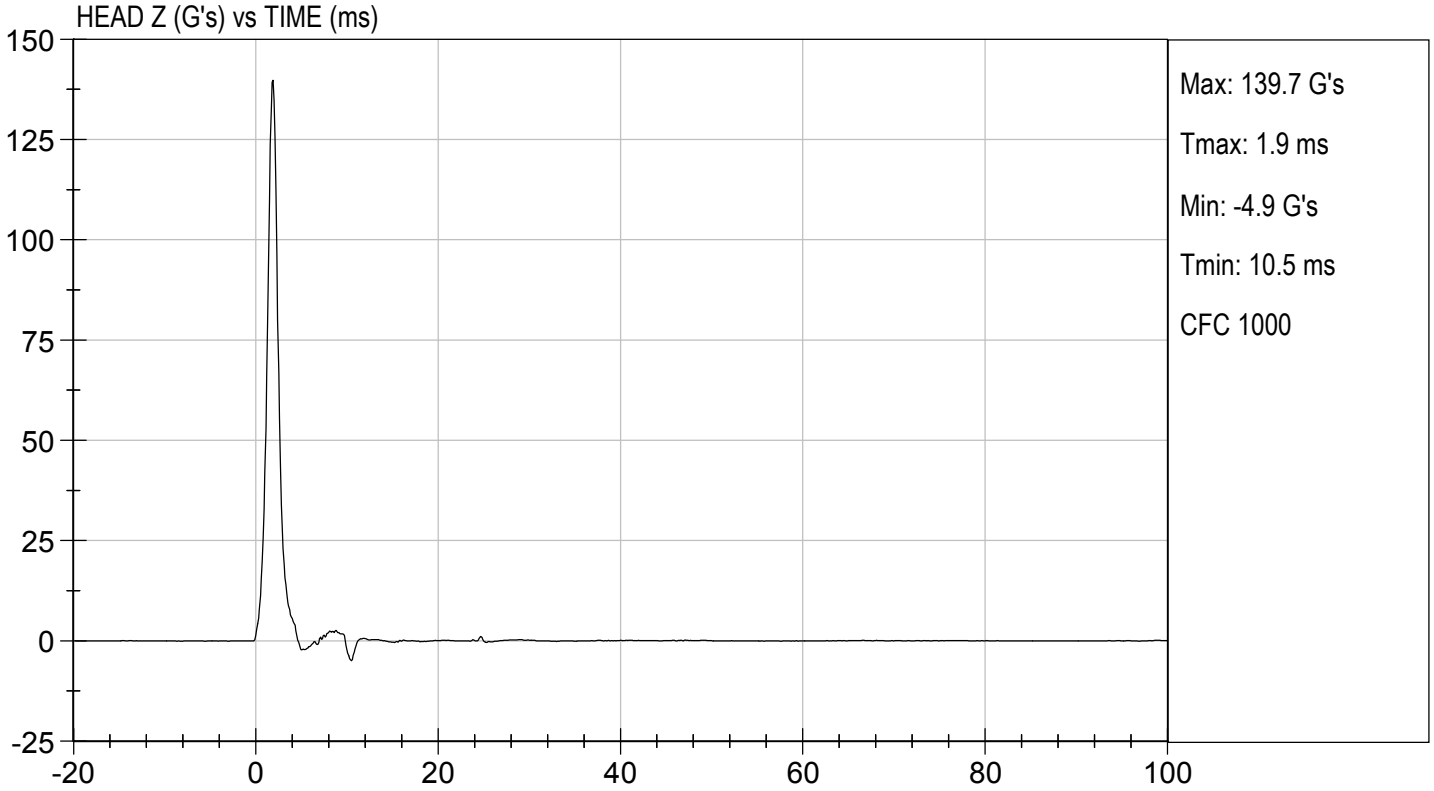
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 02/24/2020
TEST #: D200631





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200632

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	14	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.13	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.2	Pass
	20 ms	m/s	4.0 to 5.0	4.4	Pass
	30 ms	m/s	5.8 to 7.0	6.3	Pass
D Plane Rotation	Max	deg	77 to 91	80	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	71	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
			Overall Results		Pass

Laboratory Technician

02/21/2020

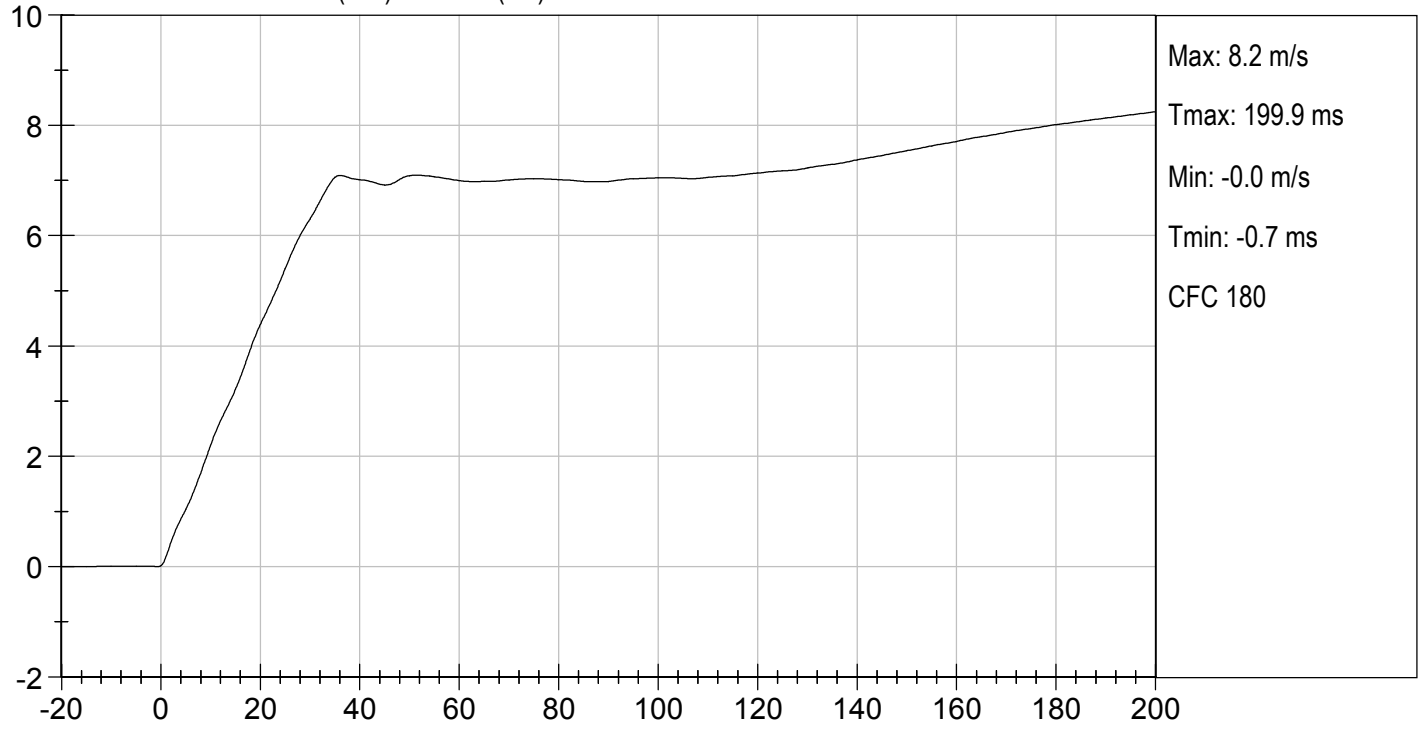
Test Date

Approved By

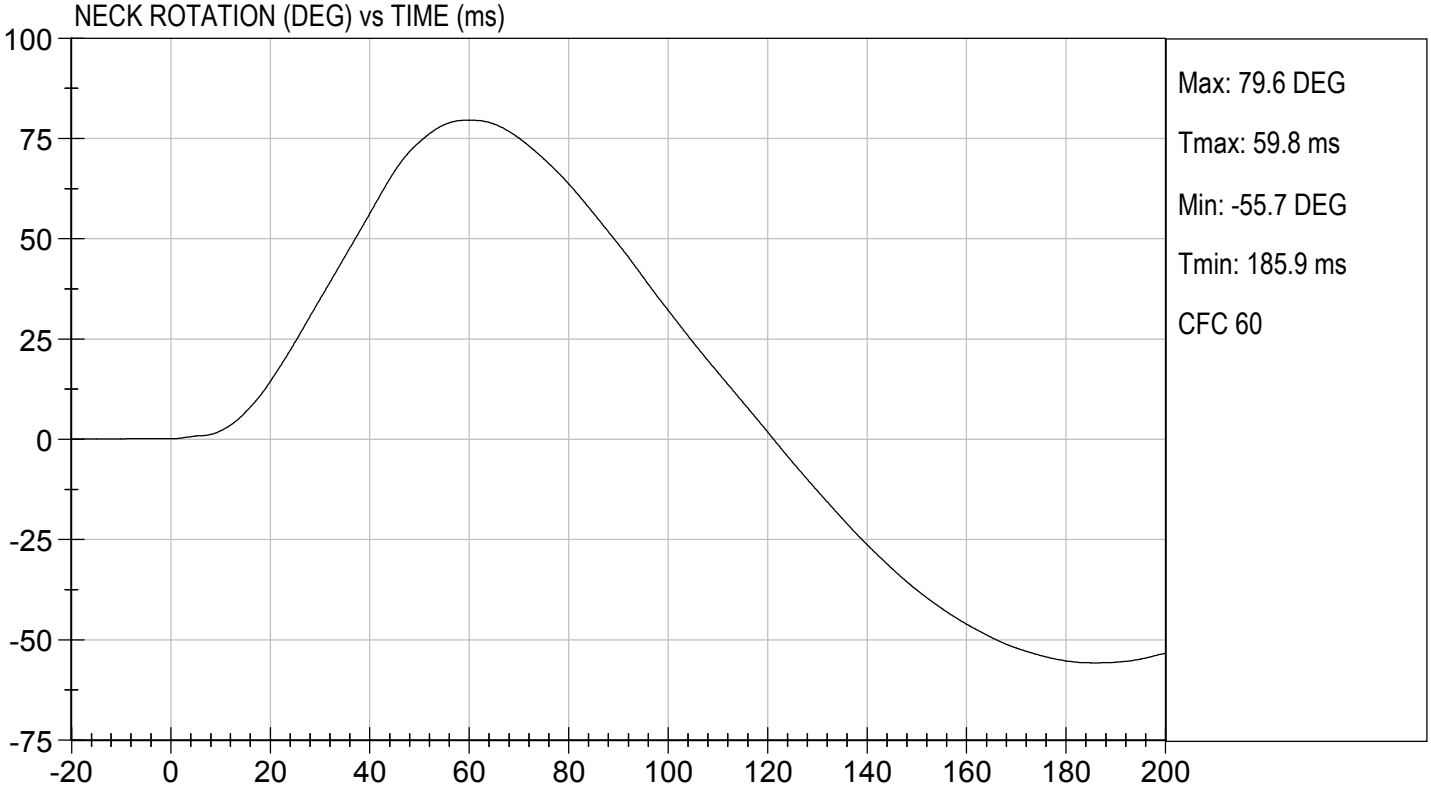
TEST DESC: NECK FLEXION
VELOCITY: 23.40 ft/s, 7.13 m/s

TEST DATE: 02/21/2020
TEST #: D200632

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

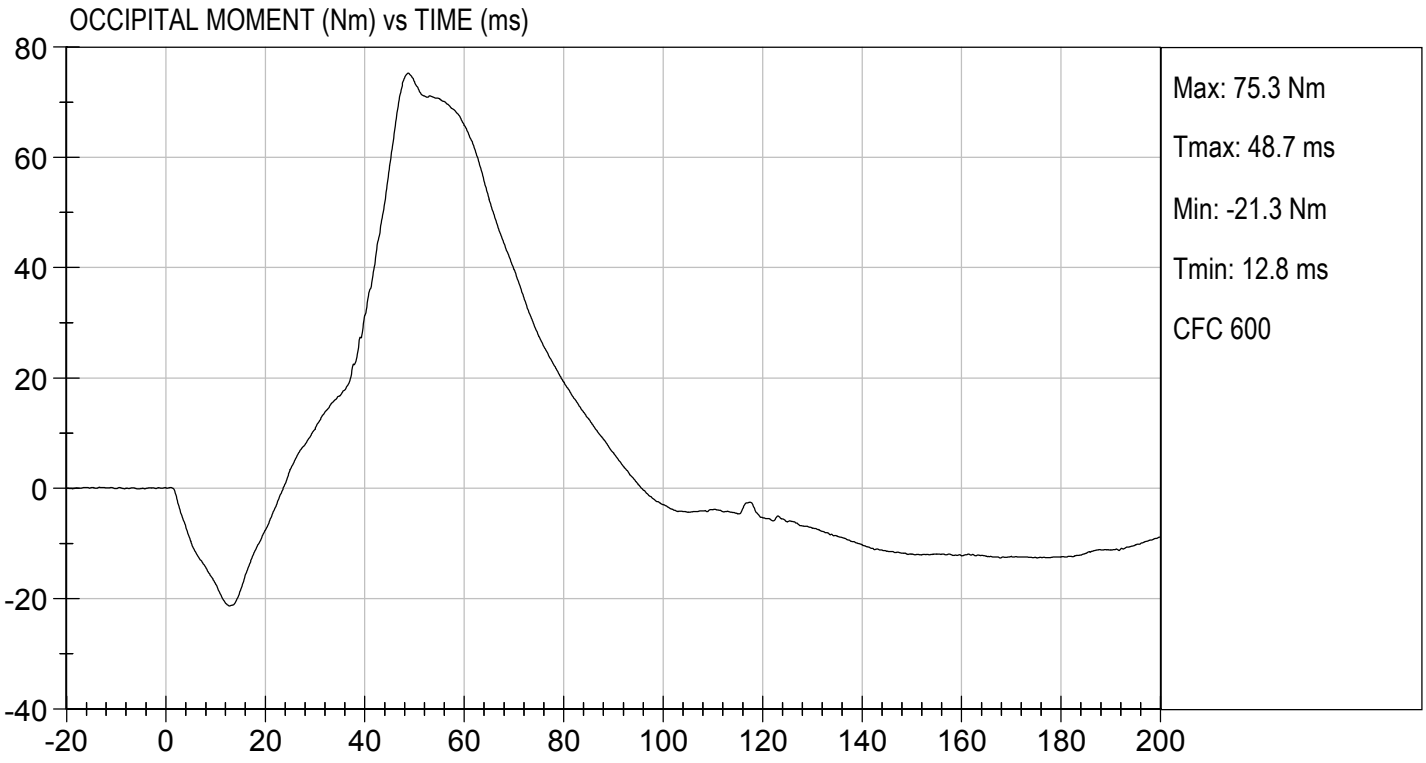


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 23.40 ft/s, 7.13 m/s

TEST DATE: 02/21/2020
TEST #: D200632



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200633

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	14	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.19	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-57	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	107	Pass
			Overall Results		Pass

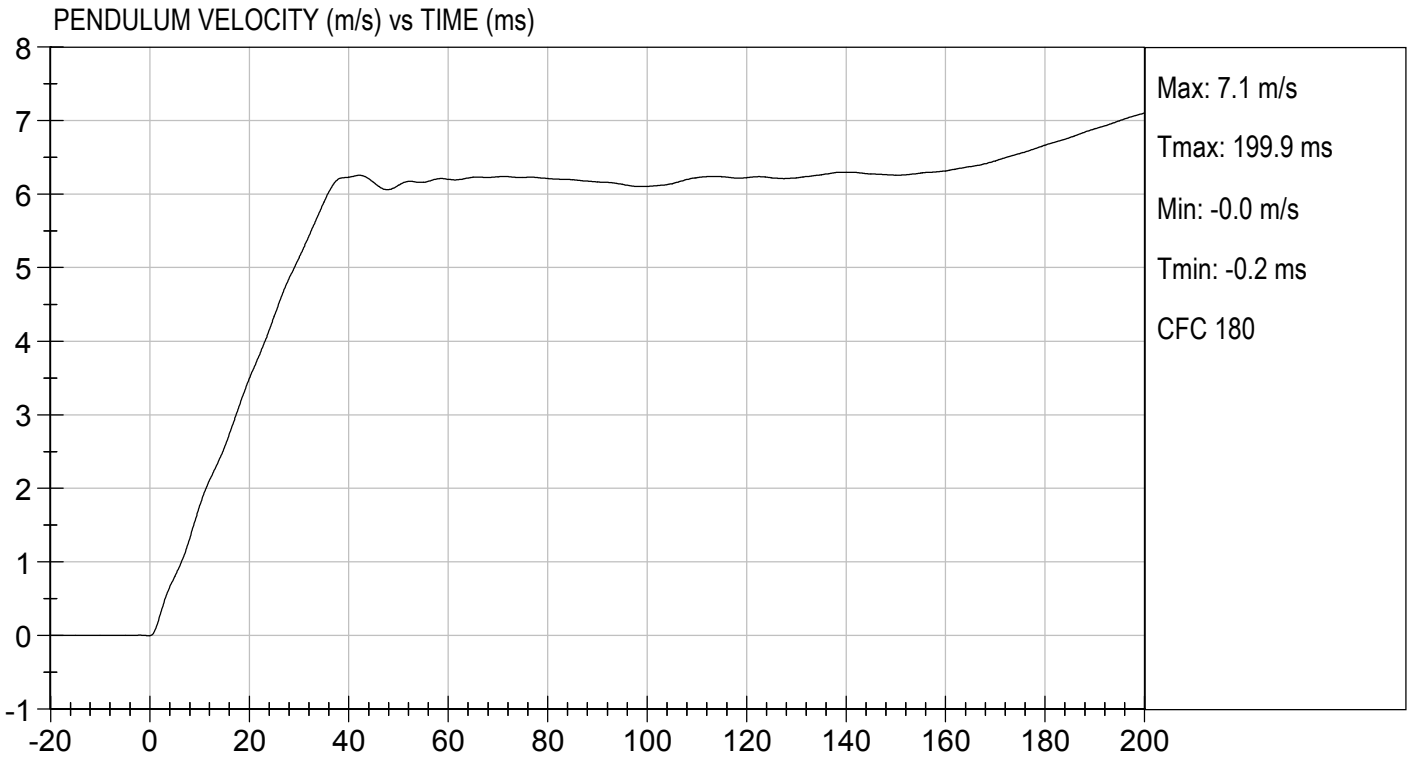
Laboratory Technician

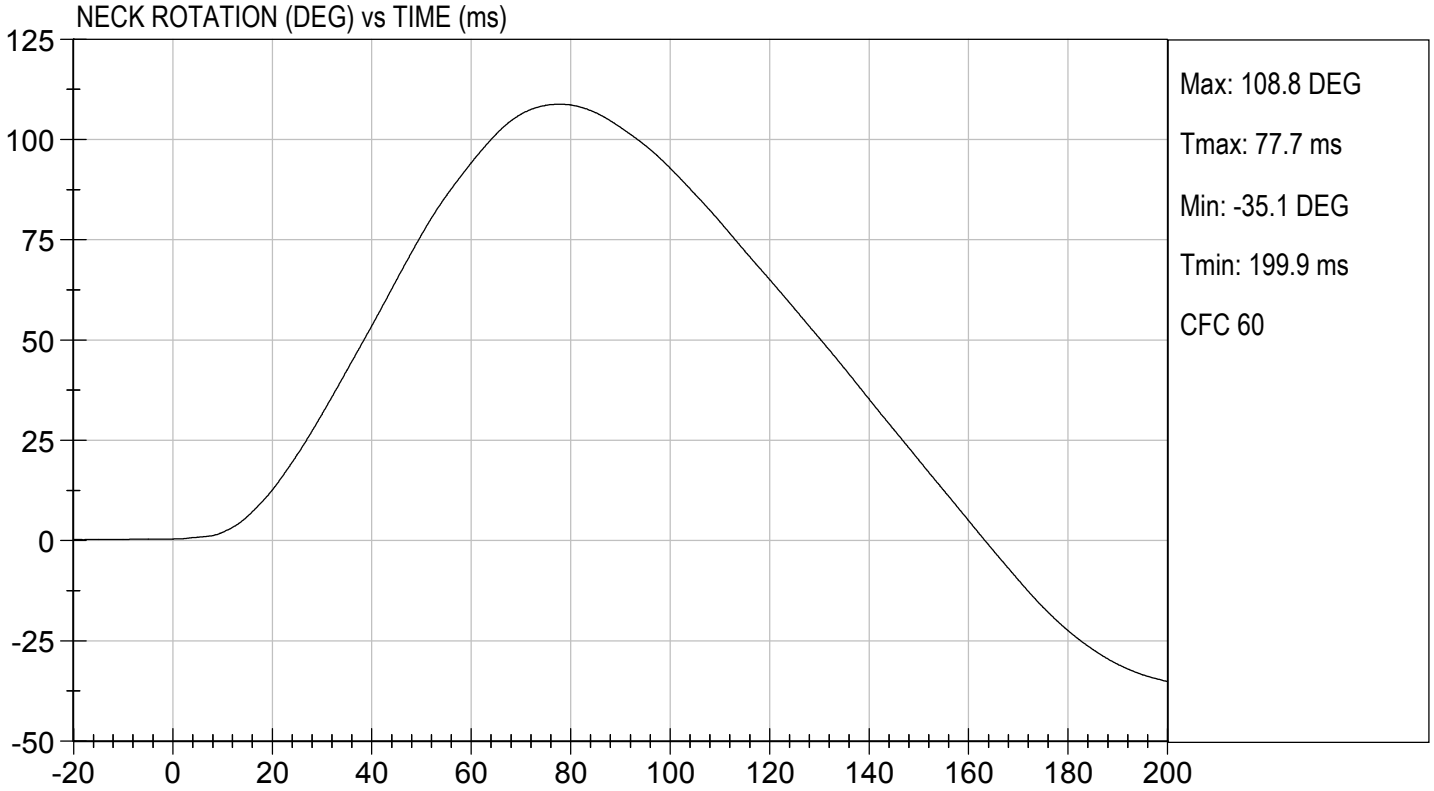
02/21/2020
Test Date

Approved By

TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

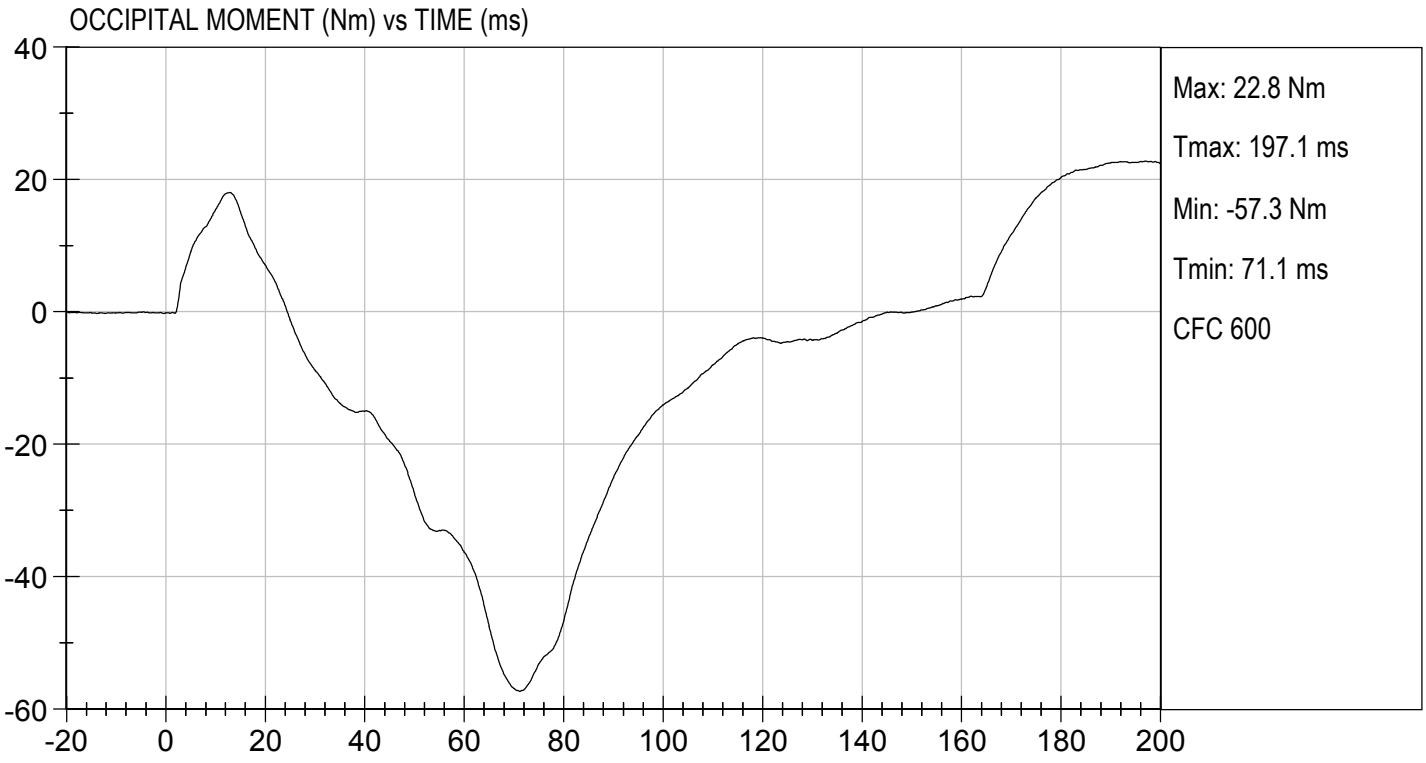
TEST DATE: 02/21/2020
TEST #: D200633





TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 02/21/2020
TEST #: D200633



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200634

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	6.59 to 6.83	6.83	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4382	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4450	Pass
		Overall Test Results		Pass

Laboratory Technician

02/24/2020

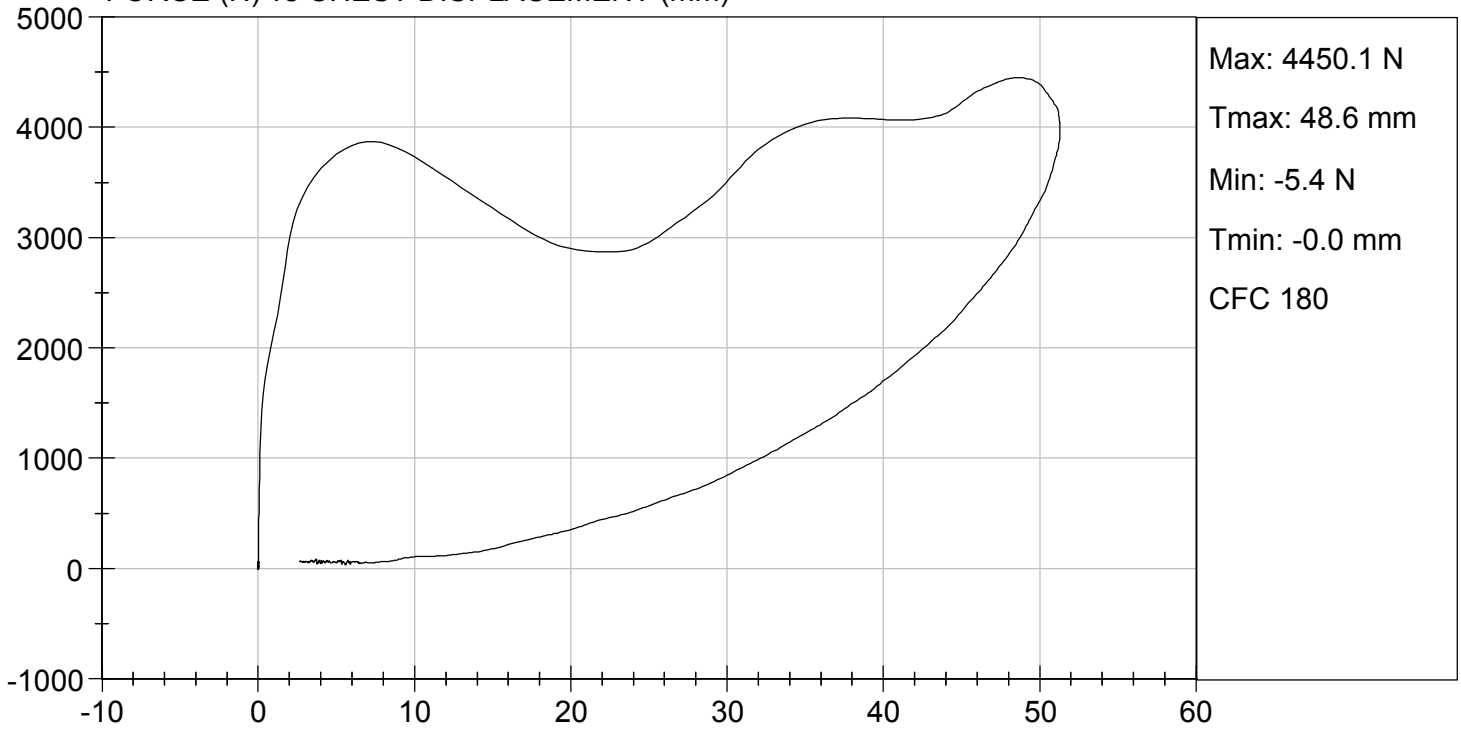
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 22.40 ft/s, 6.83 m/s

TEST DATE: 02/24/2020
TEST #: D200634

FORCE (N) vs CHEST DISPLACEMENT (mm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200635

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	17	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3837	Pass
		Overall Test Results		Pass

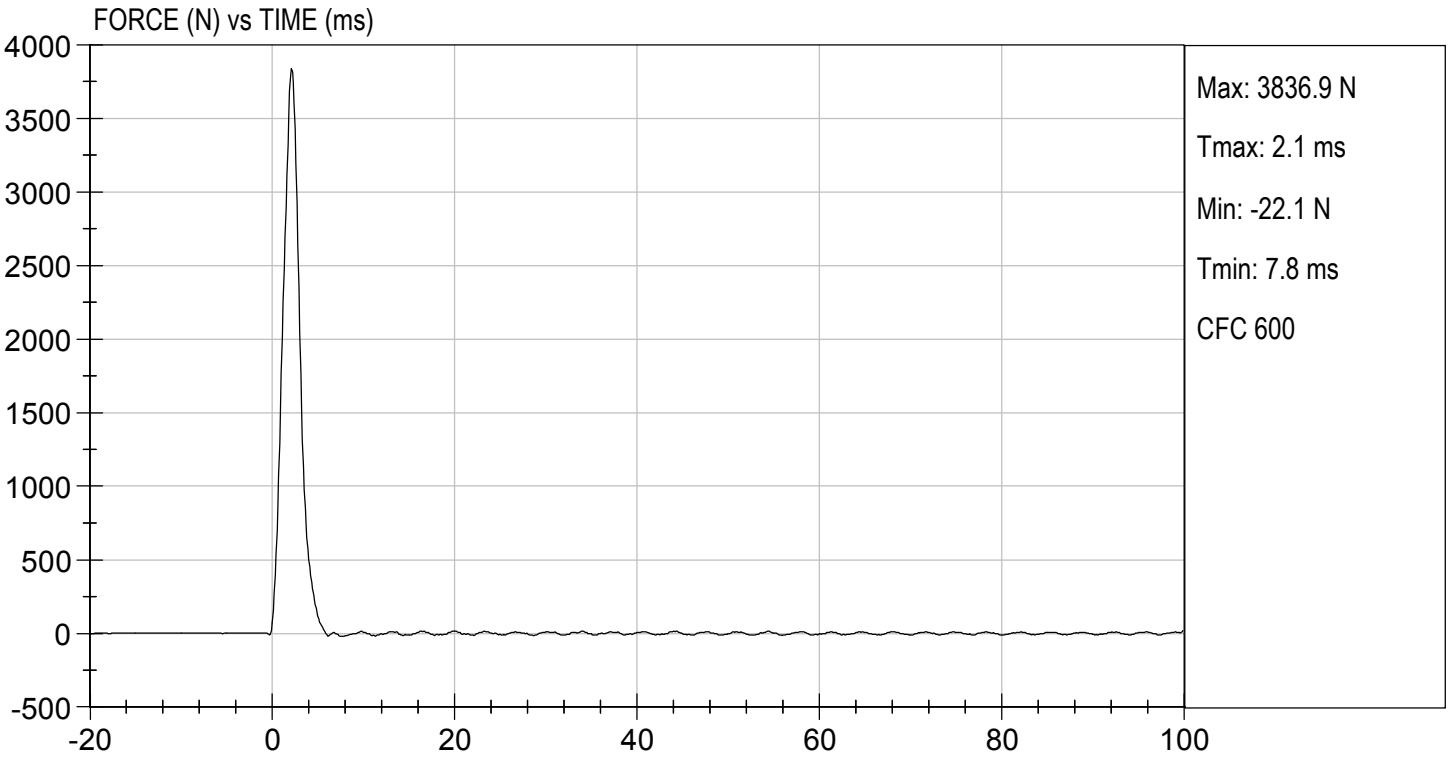
Laboratory Technician

02/20/2020
Test Date

Approved By

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

TEST DATE: 02/20/2020
TEST #: D200635



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200636

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	17	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	3450 to 4060	3798	Pass
		Overall Test Results		Pass

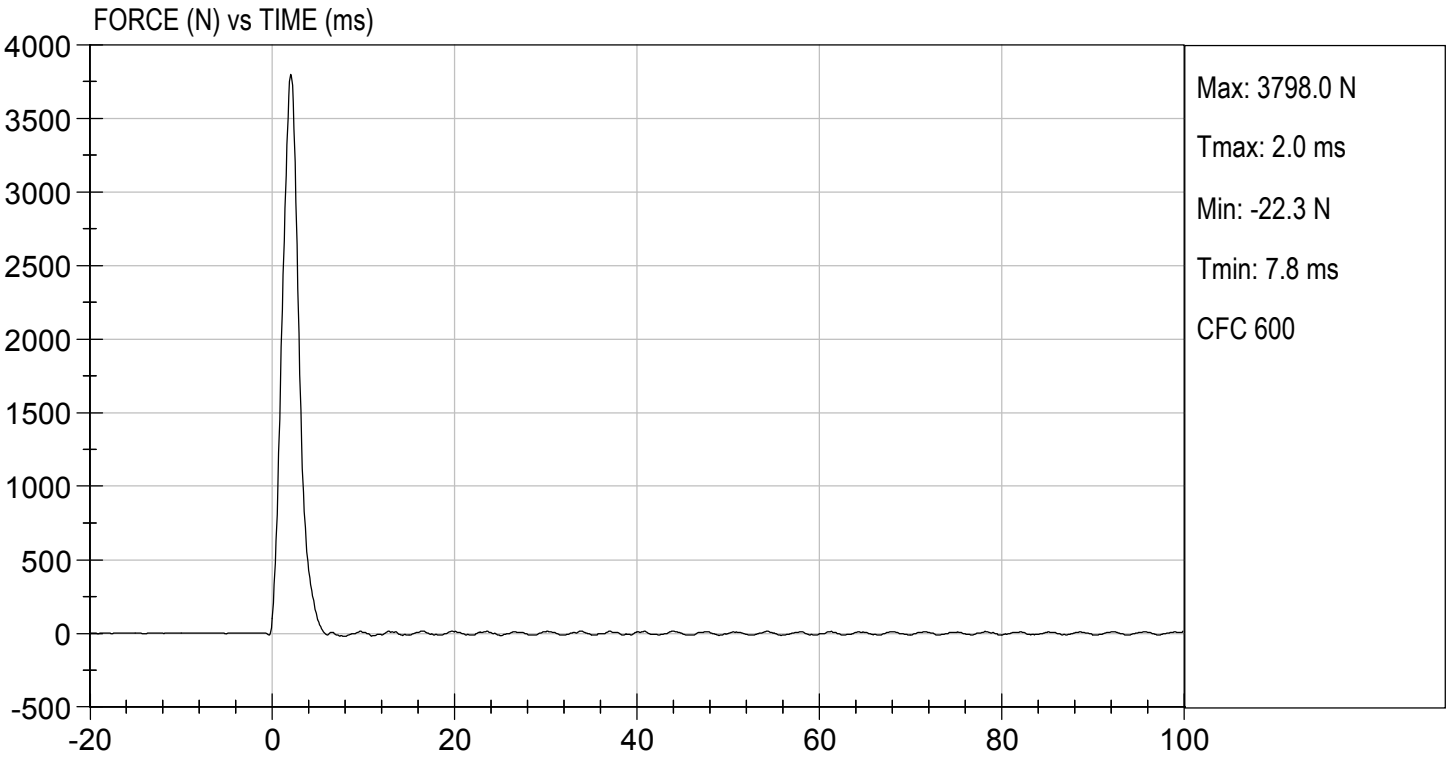
Laboratory Technician

02/20/2020
Test Date

Approved By

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

TEST DATE: 02/20/2020
TEST #: D200636



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: DH1659 **Test I.D:** D200637

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	352	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
		Overall Result		Pass

Laboratory Technician

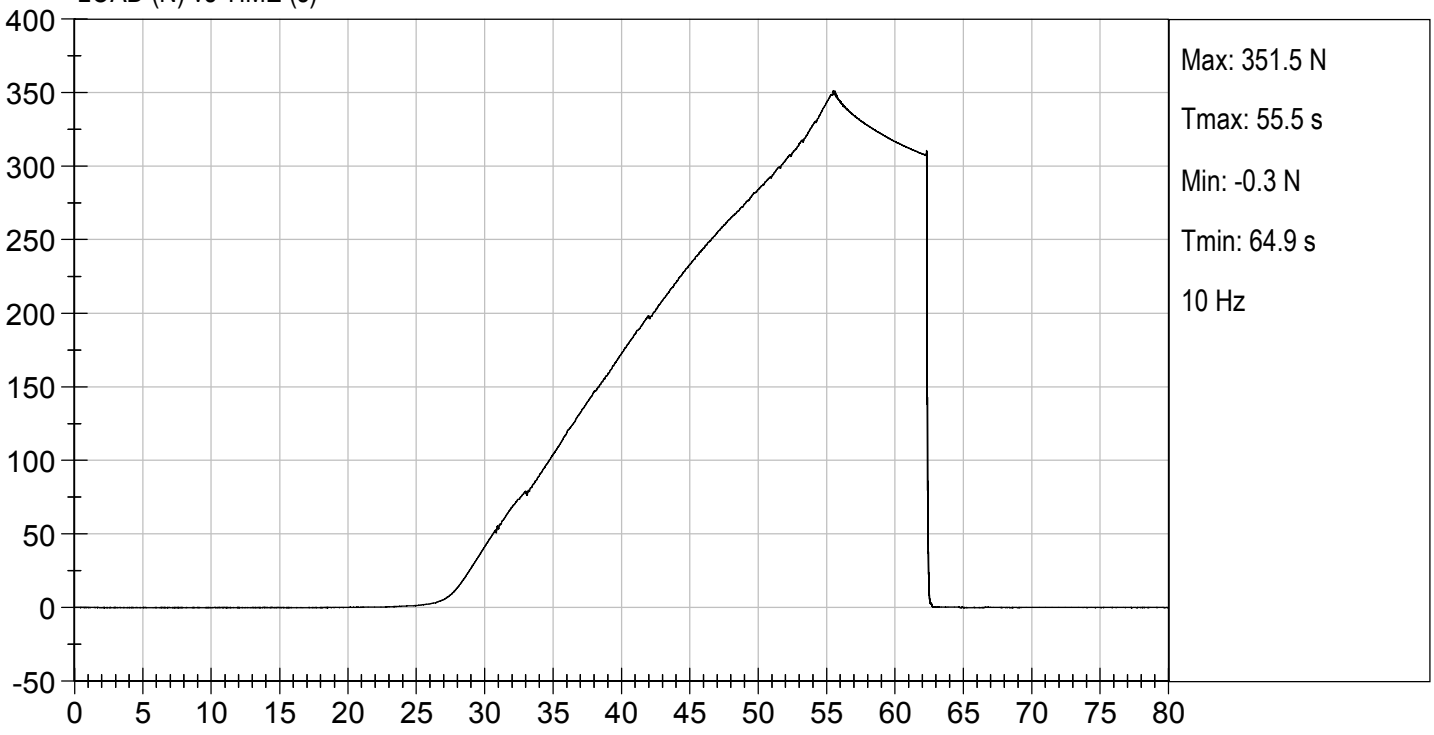
02/21/2020
Test Date

Approved By

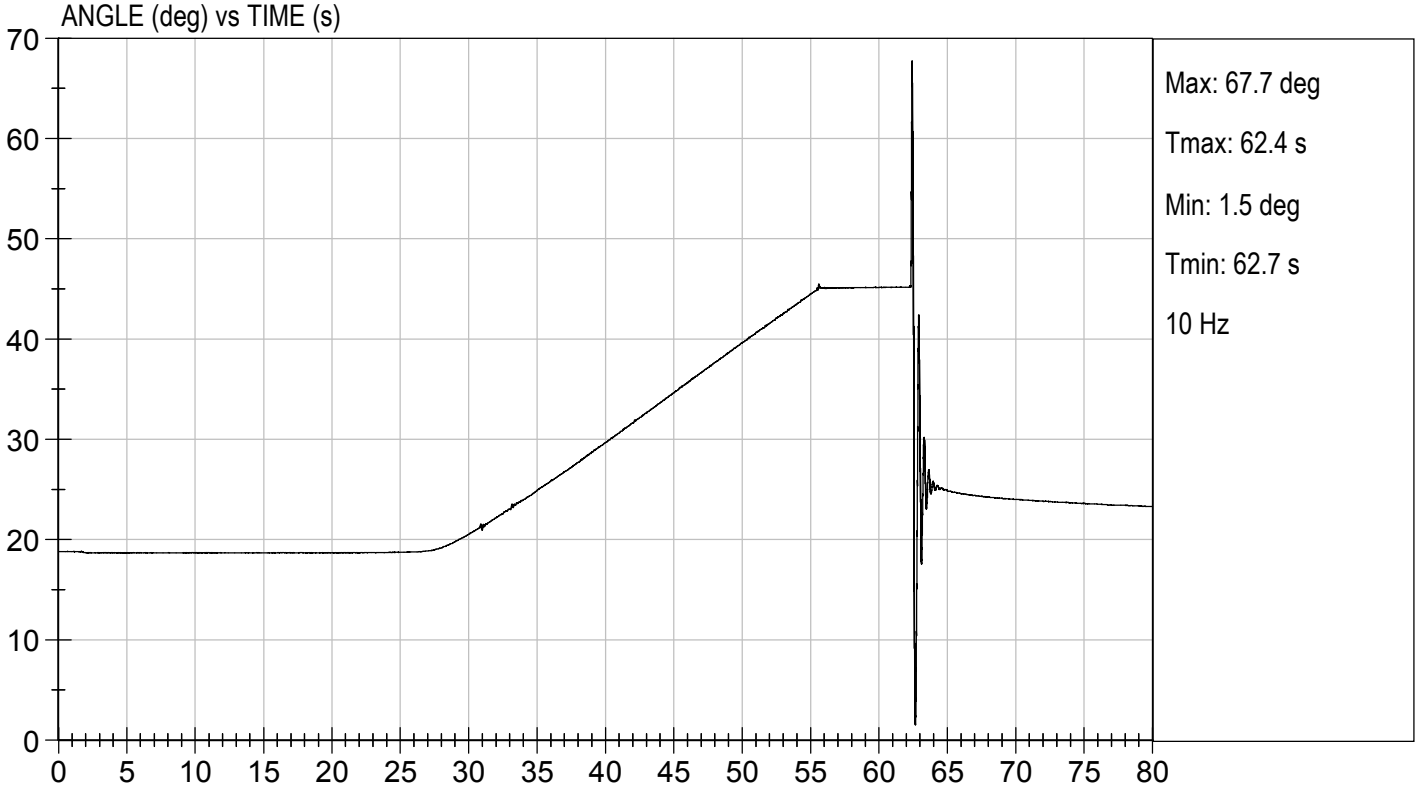
TEST DESC: LUMBAR FLEXION

TEST DATE: 02/21/2020
TEST #: D200637

LOAD (N) vs TIME (s)



ANGLE (deg) vs TIME (s)



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	9/12/2019
			Y	P79743	Endevco	9/12/2019
			Z	P79744	Endevco	9/12/2019
		Redundant	X	P94834	Endevco	9/12/2019
			Y	P94856	Endevco	9/12/2019
			Z	P97412	Endevco	9/12/2019
Head Angular Rate Sensors			X	ARS7325	DTS	7/8/2019
			Y	ARS7371	DTS	7/8/2019
			Z	ARS7391	DTS	7/8/2019
Upper Neck Load Cell			Fx, Fy, Fz Mx, My, Mz	NG174	FTSS	3/18/2019
Chest Accelerometers		Primary	X	P86792	Endevco	9/13/2019
			Y	P86793	Endevco	9/13/2019
			Z	P88348	Endevco	9/13/2019
		Redundant	X	P88666	Endevco	9/13/2019
			Y	P88667	Endevco	9/13/2019
			Z	P94109	Endevco	9/13/2019
Chest Potentiometer			X	351	Servo	9/13/2019
Pelvis Accelerometers			X	P95526	Endevco	9/12/2019
			Y	P96038	Endevco	9/12/2019
			Z	P97742	Endevco	9/12/2019
Femur Load Cells	Right	Primary	Z	FG121P	Denton	9/13/2019
		Redundant	Z	FG121R	Denton	9/13/2019
	Left	Primary	Z	FG122P	Denton	9/13/2019
		Redundant	Z	FG122R	Denton	9/13/2019
Tibia Load Cells	Right	Upper	Mx, My, Fz	TG405	Denton	3/18/2019
		Lower	Mx, My, Fz	AG368	Denton	3/18/2019
	Left	Upper	Mx, My, Fz	TG475	Denton	3/18/2019
		Lower	Mx, My, Fz	AG504	Denton	3/18/2019
Foot Accelerometers	Right	Rear	X	T22255	Endevco	1/21/2020
			Z	T16447	Endevco	9/12/2019
		Front	Z	P82120	Endevco	9/12/2019
	Left	Rear	X	T16468	Endevco	9/12/2019
			Z	T16496	Endevco	9/12/2019
		Front	Z	T16501	Endevco	9/12/2019
Seat Belt Load Cells		Lap				
		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	P82304	Endevco	2/13/2020
			Y	P88172	Endevco	2/13/2020
			Z	T16400	Endevco	2/13/2020
		Redundant	X	T16403	Endevco	2/13/2020
			Y	T16406	Endevco	2/13/2020
			Z	T16413	Endevco	2/13/2020
Head Angular Rate Sensors			X	ARS7340	DTS	7/8/2019
			Y	ARS7354	DTS	7/8/2019
			Z	ARS7357	DTS	7/8/2019
Upper Neck Load Cell			Fx, Fy, Fz Mx, My, Mz	NG2256	Denton	4/19/2019
Chest Accelerometers		Primary	X	T16415	Endevco	2/13/2020
			Y	T16416	Endevco	2/13/2020
			Z	T16420	Endevco	2/13/2020
		Redundant	X	T16423	Endevco	2/13/2020
			Y	T16426	Endevco	2/13/2020
			Z	T16433	Endevco	2/13/2020
Chest Potentiometer			X	DH1659	Servo	2/13/2020
Pelvis Accelerometers			X	T16434	Endevco	2/13/2020
			Y	T16435	Endevco	2/13/2020
			Z	T16436	Endevco	2/13/2020
Femur Load Cells	Right	Primary	Z	FG126P	Denton	2/13/2020
		Redundant	Z	FG126R	Denton	2/13/2020
	Left	Primary	Z	FG127P	Denton	2/13/2020
		Redundant	Z	FG127R	Denton	2/13/2020
Tibia Load Cells	Right	Upper	Mx, My, Fz	TG467	Denton	5/9/2019
		Lower	Mx, My, Fz	AG491	Denton	5/9/2019
	Left	Upper	Mx, My, Fz	TG478	Denton	5/9/2019
		Lower	Mx, My, Fz	AG500	Denton	5/9/2019
Foot Accelerometers	Right	Rear	X	T16437	Endevco	2/13/2020
			Z	T16438	Endevco	2/13/2020
		Front	Z	T22258	Endevco	2/13/2020
	Left	Rear	X	T16441	Endevco	2/13/2020
			Z	T16444	Endevco	2/13/2020
		Front	Z	T16445	Endevco	2/13/2020
Seat Belt Load Cells		Lap		SBG273	FTSS	11/13/2019
		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	T20776	Endevco	12/20/2019
			Z	T20772	Endevco	12/20/2019
		Redundant	X	T20748	Endevco	12/20/2019
	Right	Primary	X	A305719	MSI	11/19/2019
			Z	A305709	MSI	11/19/2019
		Redundant	X	A305693	MSI	11/19/2019
Engine Accelerometers		Top	X	T20780	Endevco	12/02/2019
		Bottom	X	T19976	Endevco	12/18/2019