

**REPORT NUMBER: NCAP-MGA-22-006**

**NEW CAR ASSESSMENT PROGRAM (NCAP)  
Frontal Barrier Impact Test**

**HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC  
2022 Hyundai Tucson SEL 5-Door SUV  
NHTSA No.: M20224206**

**MGA RESEARCH CORPORATION  
5000 Warren Road  
Burlington, WI 53105**



**Test Date: December 2, 2021**

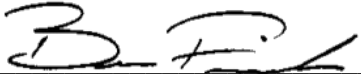
**Final Report Date: January 6, 2022**

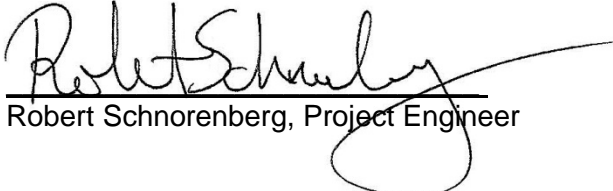
**FINAL REPORT**

**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: January 6, 2022

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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<b>7. Author(s)</b> Ben Fischer, Program Manager		<b>8. Performing Organization Report No.</b> NCAP-MGA-22-006																																																							
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<b>12. Sponsoring Agency Name and Address</b> 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		<b>13. Type of Report and Period Covered</b> Final Test Report December 2, 2021 to January 6, 2022																																																							
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<b>15. Supplementary Notes</b>																																																									
<b>16. Abstract</b> A 56.3 km/h NCAP Frontal Rigid Barrier Impact Test was conducted on a 2022 Hyundai Tucson SEL 5-Door SUV in accordance with the specifications of the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on December 2, 2021.  The impact velocity of the vehicle was 56.02 km/h and the ambient temperature at the barrier face at the time of impact was 21.6°C. The target vehicle post-test maximum crush was 522 mm located to the left of the vehicle centerline. The test vehicle's performance was as follows:																																																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">Driver ATD</th> <th colspan="2">Passenger ATD</th> </tr> <tr> <th>Threshold</th> <th>Result</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC<sub>15</sub>)</td> <td></td> <td>700</td> <td>268</td> <td>700</td> <td>348</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>29</td> <td>52</td> <td>17</td> </tr> <tr> <td>Nij</td> <td></td> <td>1</td> <td>0.19</td> <td>1</td> <td>0.46</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>909</td> <td>2620</td> <td>604</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>170</td> <td>2520</td> <td>185</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>344</td> <td>6805</td> <td>90</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>322</td> <td>6805</td> <td>356</td> </tr> </tbody> </table>						Measurement Description	Units	Driver ATD		Passenger ATD		Threshold	Result	Threshold	Result	Head Injury Criteria (HIC <sub>15</sub> )		700	268	700	348	Maximum Chest Compression	mm	63	29	52	17	Nij		1	0.19	1	0.46	Neck Tension	N	4170	909	2620	604	Neck Compression	N	4000	170	2520	185	Left Femur Force	N	10008	344	6805	90	Right Femur Force	N	10008	322	6805	356
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## **SECTION 1 PURPOSE AND SUMMARY OF TEST**

### **PURPOSE**

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

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

### **SUMMARY**

A load cell barrier consisting of 176 load cells was impacted by a 2022 Hyundai Tucson SEL 5-Door SUV at a velocity of 56.02 km/h. The test was performed at MGA Research Corporation on December 2, 2021. Pre-test and post-test photographs of the vehicle and dummies can be found in Appendix A.

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

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

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

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

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

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was no Stoddard Solvent leakage after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 442 mm located at the vehicle centerline and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: The driver's head contacted the airbag. The driver's head also contacted the headrest.

The 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:

<b>ATD position</b>	<b>HIC<sub>15</sub></b>	<b>Nij</b>	<b>Neck Tension (N)</b>	<b>Neck Comp. (N)</b>	<b>3ms Chest Clip (g)</b>	<b>Chest Disp. (mm)</b>	<b>Left Femur (N)</b>	<b>Right Femur (N)</b>
Driver (50 <sup>th</sup> )	268	0.19	909	170	45.3	29	344	322
Passenger (5 <sup>th</sup> )	348	0.46	604	185	44.6	17	90	356

The test data can be found on the NHTSA website at [www.nhtsa.gov](http://www.nhtsa.gov)

### **TEST NOTES**

Passenger Lap Belt load cell was not installed.

Barrier C-01 Fx recorded no valid data.

Barrier C-02 Fx, My recorded no valid data.

Barrier K-03 Fx recorded questionable data.

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

**SECTION 2**  
**OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS**

**DATA SHEET NO. 1  
GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**TEST VEHICLE INFORMATION AND OPTIONS**

NHTSA No.	M20224206	Traction Control System (TCS)	Yes
Model Year	2022	Power Steering	Yes
Make	Hyundai	Power Window Auto-Reverse	Yes
Model	Tucson SEL	Driver Frontal Airbag	Yes
Body Style	5-Door SUV	Driver Curtain Airbag	Yes
VIN	5NMJB3AE6NH049429	Driver Head/Torso Airbag	No
Body Color	Quartz White	Driver Torso Airbag	No
Odometer (km/mi)	332 km / 206 mi	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	2.5 L	Driver Pelvis Airbag	No
Type/No. Cylinders	Inline 4	Driver Knee Airbag	No
Engine Placement	Lateral	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	8	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	FWD	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	Yes	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	Other	N/A

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

**DATA FROM CERTIFICATION LABEL**

Manufactured By	HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC	GVWR (kg)	2100
		GAWR Front (kg)	1260
Date of Manufacture	Sep/23/21	GAWR Rear (kg)	1200

**VEHICLE SEATING AND WEIGHT CAPACITY DATA**

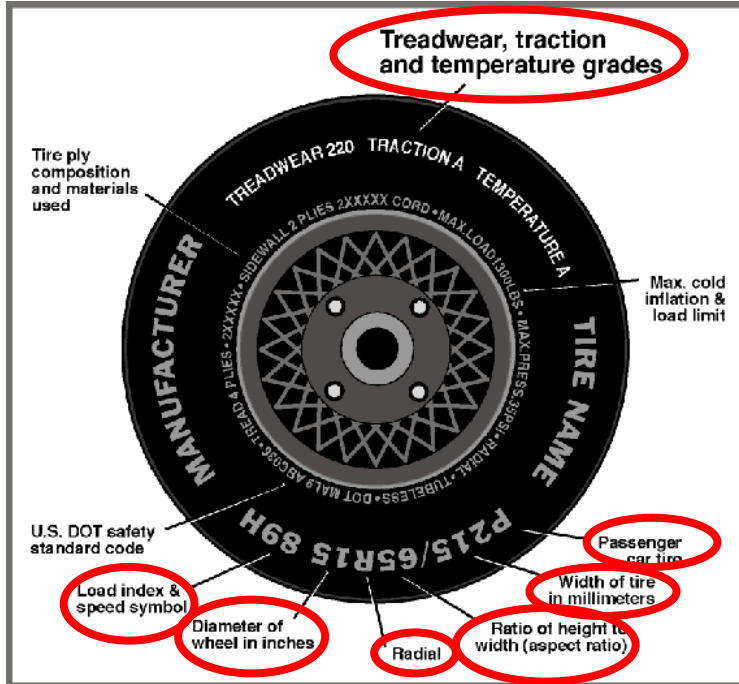
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Contoured		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				420
Cargo Weight (RCLW) (kg)				80

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

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**VEHICLE TIRE INFORMATION**



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	235/65R17	235/65R17
Tire Size on Vehicle	235/65R17	235/65R17
Tire Manufacturer	Nexen	Nexen
Tire Model	Rodian GTX	Rodian GTX
Treadwear	600	600
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Nylon	2 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	104H	104H
Tire Material	Rubber	Rubber
DOT Safety Code Left	1UA9Y CAEL 1221	1UA9Y BMHL 1221
DOT Safety Code Right	1UA9Y CAEL 1221	1UA9Y BMHL 1221

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

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**TEST VEHICLE WEIGHTS**

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	450.5	329.5		483.0	413.0	
Right	kg	468.5	297.0		488.0	376.5	
Ratio	%	59.5%	40.5%		55.2%	44.8%	
Totals	kg	919.0	626.5	1545.5	971.0	789.5	1760.5

**TARGET TEST WEIGHT CALCULATION**

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1545.5
Weight of 1 P572E ATD & 1 P572O ATD	kg	141
Rated Cargo/Luggage Weight (RCLW)	kg	80
Calculated Test Vehicle Target Weight (TVT <sub>W</sub> )	kg	1766.5

**TEST VEHICLE ATTITUDES AND CG**

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	778	781	802	798	1117
As Tested	mm	770	773	764	771	1236
Post Test	mm	856	901	764	780	

**GENERAL TEST VEHICLE DATA**

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2756
Total Vehicle Length at Left Side	mm	4504
Total Vehicle Length at Centerline	mm	4637
Total Vehicle Length at Right Side	mm	4504
Weight of Ballast in Cargo Area	kg	46
Weight of Vehicle Components Removed	kg	31
Amount of Stoddard Solvent in Fuel Tank	L	50.3

List of components removed to meet test weight: None.

List of components removed for instrumentation, data box, and equipment installation: Cargo area carpet/trim/divider, LR/RR floor mat, jack and tools, spare tire and cover, underbody plastic, roof rail cross bars.

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

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**TARGET VEHICLE STRUCTURAL MEASUREMENT**

	<b>Elements</b>	<b>Pre-Test (mm)</b>
1	Total Length	4637
2	Total Width	1860
3	Bumper Top Height	576
4	Bumper Bottom Height	470
5	Longitudinal Member Top Height	571
6	Distance between Longitudinal Members	940
7	Longitudinal Member Width	60
8	Engine Top Height	945
9	Engine Bottom Height	227
10	Engine and Gearbox Width	860
11	Front Bumper-Engine Distance	N/A
12	Front Shock Absorber Fixing Height	982
13	Bonnet Leading Edge Height	880
14	Front Shock Absorber Fixing Width	120
15	Front Bumper – Front Axle Distance	920
16	Front Axle – A-Pillar Distance	412
17	A-Pillar – B-Pillar Distance	1046
18	B-Pillar – Rear Axle Distance	1185
19	B-Pillar – C-Pillar Distance	695
20	Roof Sill Bottom Height	1536
21	Roof Sill Top Height	1620
22	Floor Sill Bottom Height	412
23	Floor Sill Top Height	280

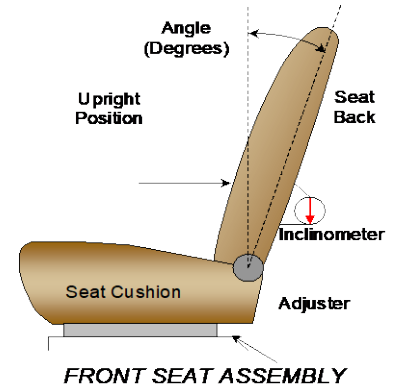
**DATA SHEET NO. 2**  
**SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**NOMINAL DESIGN RIDING POSITION**

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



	Degrees
Driver Seat Back Angle	0.9° on outboard headrest post
Passenger Seat Back Angle	-3.3° on outboard headrest post

**SEAT FORE/AFT POSITIONS**

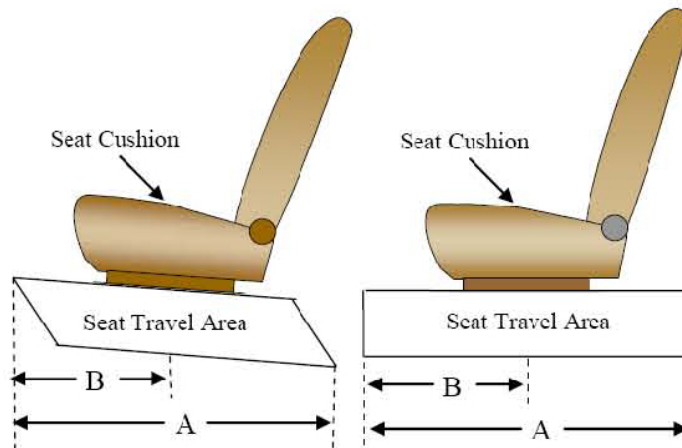
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated May 2018.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	304 mm	152 mm
Passenger Seat	240 mm / 38 detents (1 <sup>st</sup> as 1)	0 mm / 0 <sup>th</sup> detent (1 <sup>st</sup> 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 (1 <sup>st</sup> as 1)	0 (1 <sup>st</sup> as 0)
Passenger Seat	4 (1 <sup>st</sup> as 1)	0 (1 <sup>st</sup> as 0)



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

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

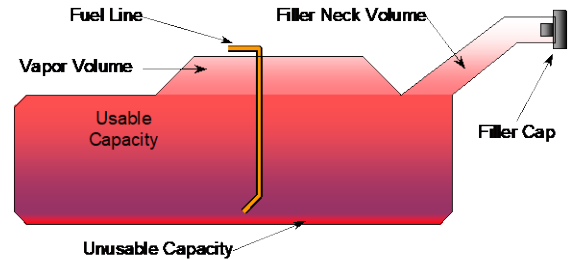
NHTSA No.: M20224206  
 Test Date: 12/2/2021

**FUEL TANK CAPACITY DATA**

	<b>Liters</b>
Usable Capacity of "Standard Tank"	54.1
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	49.8 to 50.9
Actual Amount of Solvent used	50.3
1/3 of Usable Capacity	18.0

**FUEL PUMP**

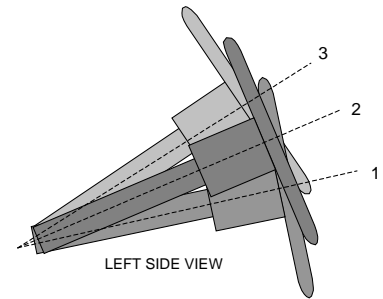
The vehicle is equipped with an electronic fuel pump. The fuel pump will run when the engine is running. The pump will also briefly run when the ignition key is turned to the "on" position. The filler neck is located on the driver's side.



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

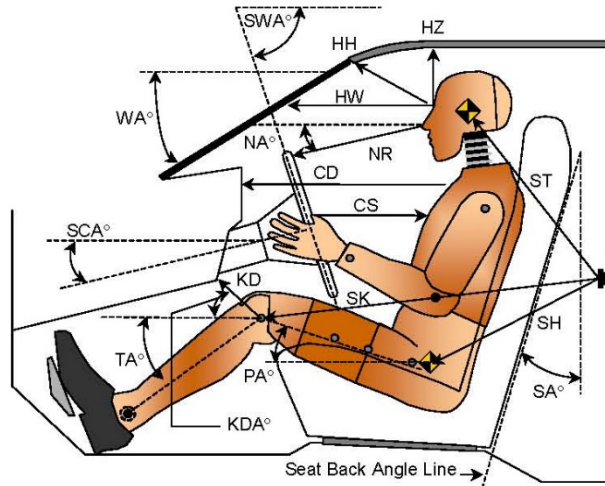
**STEERING COLUMN POSITION**

	<b>Degrees</b>	<b>Fore/Aft Position (mm)</b>
Lowermost Position 1	66.5	
Geometric Center Position 2	64.0	
Uppermost Position 3	61.5	
Telescoping Steering Wheel Travel		50
Test Position	64.0	25

**DATA SHEET NO. 3  
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
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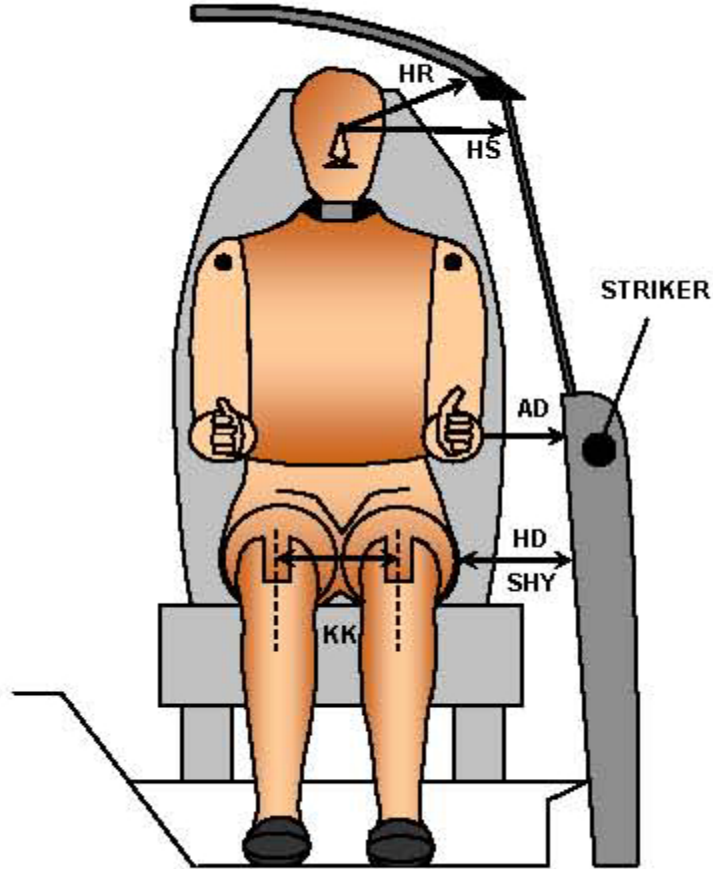
**LEFT SIDE VIEW**

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		23.8		
SWA°	Steering Wheel Angle		64.0		
SCA°	Steering Column Angle		26.0		
SA°	Seat Back Angle		0.9		-3.3
HZ	Head to Roof (Z)	195	90	229	90
HH	Head to Header	350	23.4	318	50.1
HW	Head to Windshield	647	0	680	0
NR	Nose to Rim	392	15.1		
CD	Chest to Dash	526		411	
CS	Chest to Steering Hub	301	6.5		
RA	Rim to Abdomen	188	0		
KDL	Left Knee to Dash	175	28.5	139	33.0
KDR	Right Knee to Dash	182	28.2	130	33.0
PA°	Pelvic Angle		23.8		21.5
TA°	Tibia Angle		50.7		54.5
SK	Striker to Knee	600	99.4	669	100.5
ST	Striker to Head	440	11.7	455	29.8
SH	Striker to H-Point	271	119.4	370	118.8

**DATA SHEET NO. 4**  
**DUMMY LATERAL CLEARANCE DIMENSIONS**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
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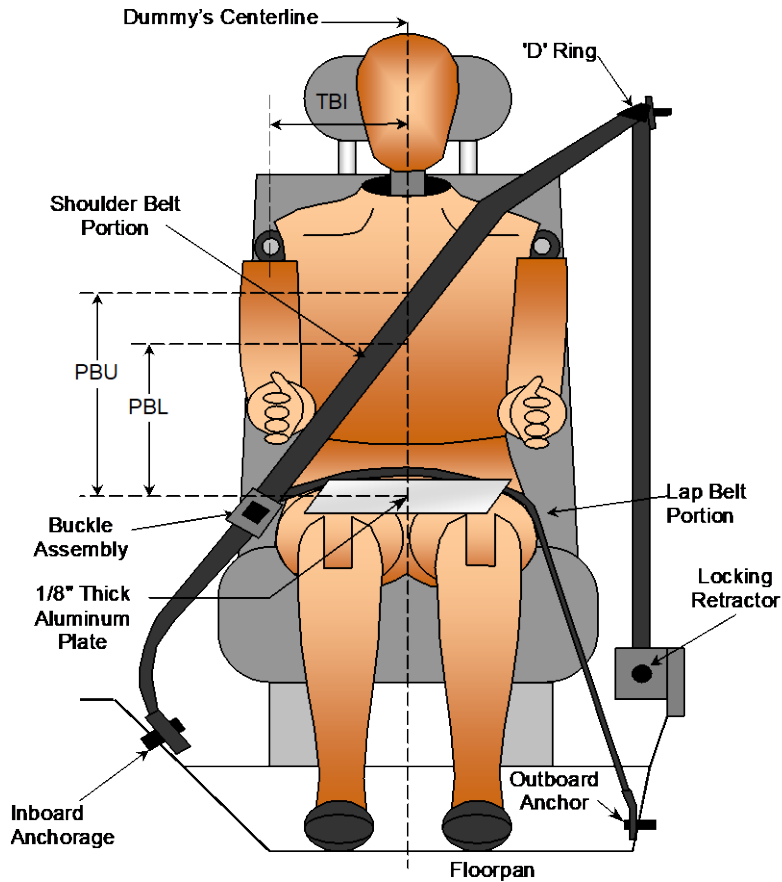
**FRONT VIEW OF DUMMY**

Code	Measurement Description	Driver	Passenger
		Length (mm)	
AD	Arm to Door	130	65
HD	H-Point to Door	144	207
HR	Head to Side Header	217	264
HS	Head to Side Window	330	367
KK	Knee to Knee	365	228
SHY	Striker to H-Point (Y Direction)	284	310
AA	Ankle to Ankle	344	165

**DATA SHEET NO. 5  
SEAT BELT POSITIONING DATA**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021



**FRONT VIEW OF DUMMY**

**SEAT BELT POSITIONING MEASUREMENTS**

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	370	295
PBL - Top surface of reference to belt lower edge	mm	295	205

**BELT LENGTH DATA**

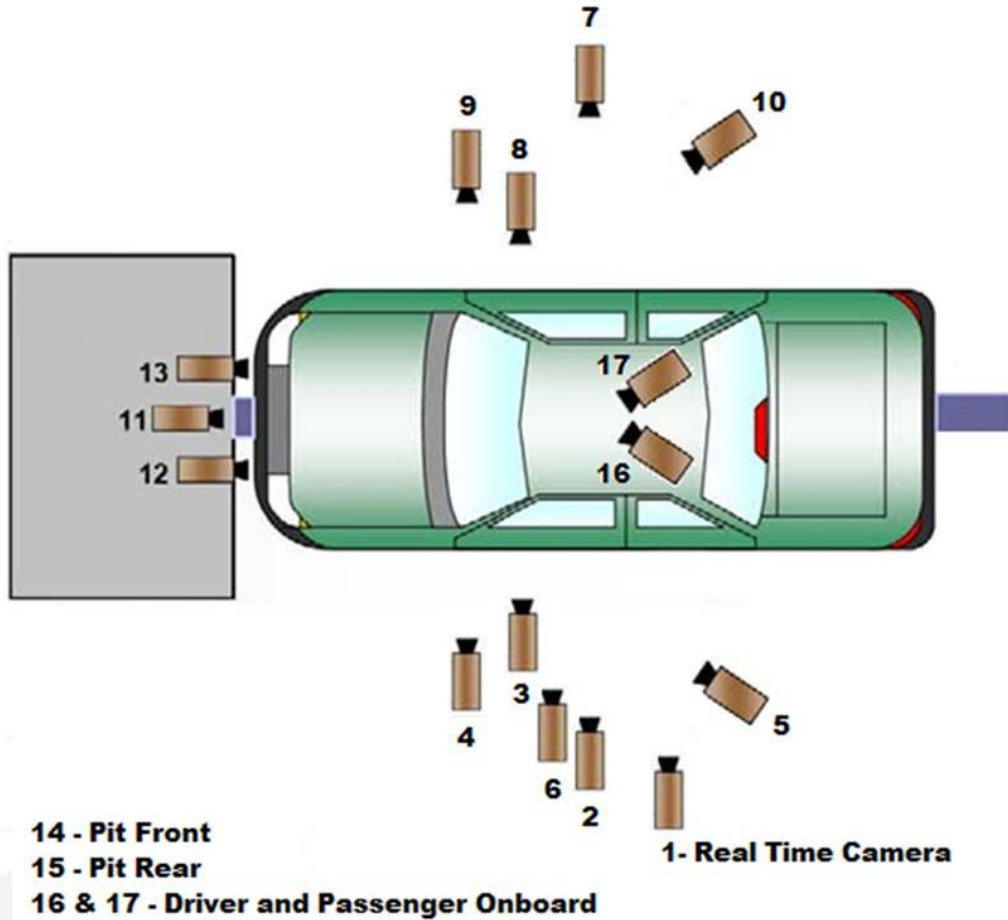
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	905	930
Lap Belt Length as measured on ATD	mm	585	880
Remainder of belt on reel	mm	710	590
Total Belt Length for Continuous Webbing Systems	mm	3000	3200

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

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
Test Date: 12/2/2021

**CAMERA POSITIONS FOR FRONTAL IMPACTS**



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

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

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**CAMERA LOCATIONS**

No.	Camera View	Coordinates* (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall					30
2	Left Overall	-2220	-5920	-1380	12	1000
3	Driver Close-Up	-1630	-6760	-1820	50	1000
4	Left Front Half	-1350	-5560	-1350	24	1000
5	Left Angle	-7250	-5840	-2010	75	1000
6	Steering Column	-920	-5540	-1270	50	1000
7	Right Overall	-2260	5970	-1390	12	1000
8	Passenger Close-Up	-1650	7120	-1850	50	1000
9	Right Front Half	-1240	5480	-1380	24	1000
10	Right Angle	-7480	5390	-2000	75	1000
11	Windshield	130	0	-2310	12	1000
12	Driver Windshield	180	-370	-2230	25	1000
13	Passenger Windshield	180	370	-2230	25	1000
14	Pit Front	-930	0	3340	24	1000
15	Pit Rear	-2820	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

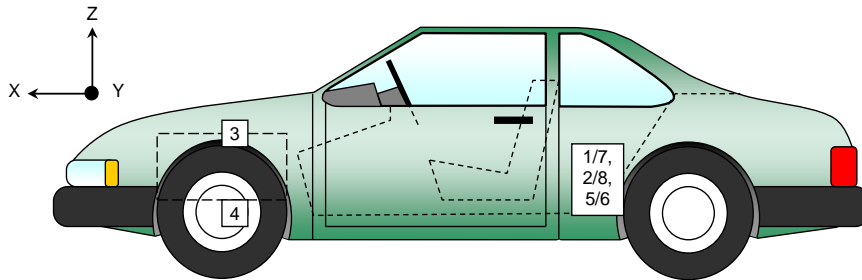
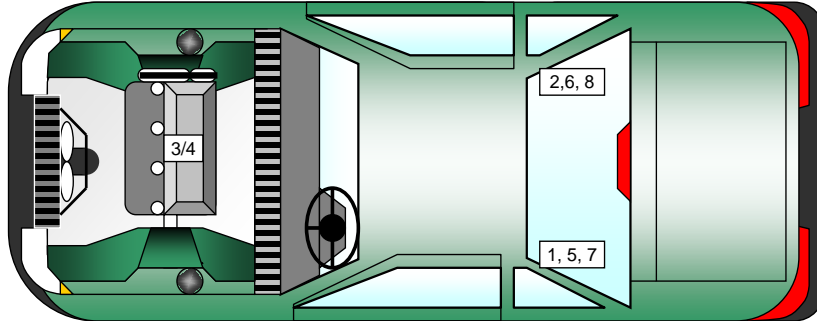
+Y = right of monorail centerline

+Z = below ground level

**DATA SHEET NO. 7  
VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021



**VEHICLE ACCELEROMETER PRE-TEST LOCATIONS**

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	1776	-342	-345
2	Right Rear Crossmember Accelerometer – X Direction	1776	342	-350
3	Engine Top X	3825	165	-920
4	Engine Bottom X	3894	126	-222
5	Left Rear Crossmember Accelerometer – Z Direction	1776	-342	-345
6	Right Rear Crossmember Accelerometer – Z Direction	1776	342	-350
7	Left Rear Crossmember Accelerometer Redundant – X Direction	1776	-370	-345
8	Right Rear Crossmember Accelerometer Redundant – X Direction	1776	370	-350

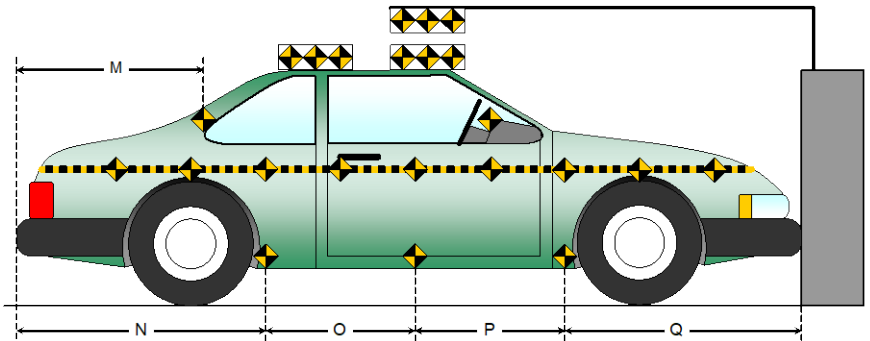
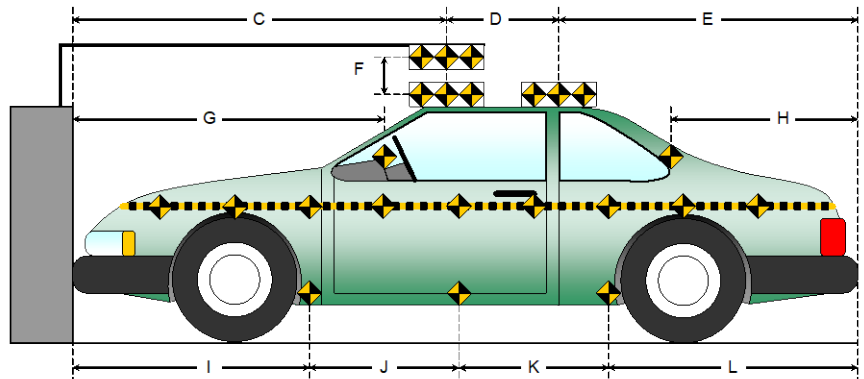
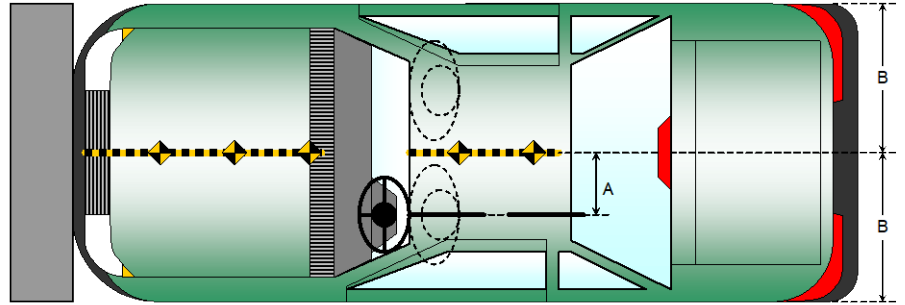
Reference Points: X - Rear Surface of Vehicle (+ forward)  
 Y - Vehicle Centerline (+ to right)  
 Z - Ground Plane (+ down)

**DATA SHEET NO. 8**  
**PHOTOGRAPHIC REFERENCE TARGET LOCATIONS**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

Item	Value (mm)
A	360
B	930
C	2275
D	610
E	1752
F	140
G	
H	1309
I	1421
J	865
K	865
L	1486
M	1309
N	1486
O	865
P	865
Q	1421



**DATA SHEET NO. 9  
LOAD CELL LOCATIONS ON FIXED BARRIER**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**ADVANCED RESEARCH LOAD CELL BARRIER**

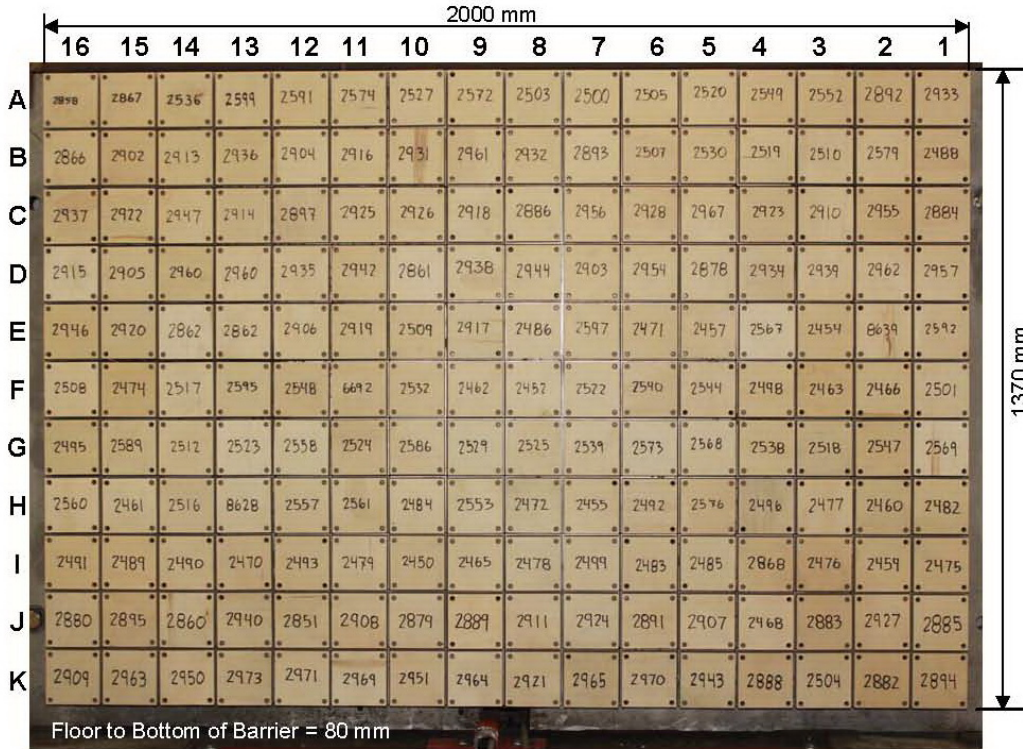


Photo for Reference Only

Centerline

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

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

**DATA SHEET NO. 10**  
**TEST VEHICLE SUMMARY OF RESULTS**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
Test Date: 12/2/2021

**INSTRUMENTATION**

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

**CAMERA COVERAGE**

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

**DATA SHEET NO. 11  
POST-TEST OBSERVATIONS**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**TEST DUMMY INFORMATION AND CONTACT LOCATIONS**

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

**DOOR OPENING, TRUNK OPENING, AND SEAT TRACK INFORMATION**

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

**OTHER VEHICLE POST-TEST OBSERVATIONS**

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

**VEHICLE REBOUND FROM BARRIER**

Measured Parameter	Units	Value
Left Side	mm	2840
Center	mm	2865
Right Side	mm	2860
Average	mm	2855

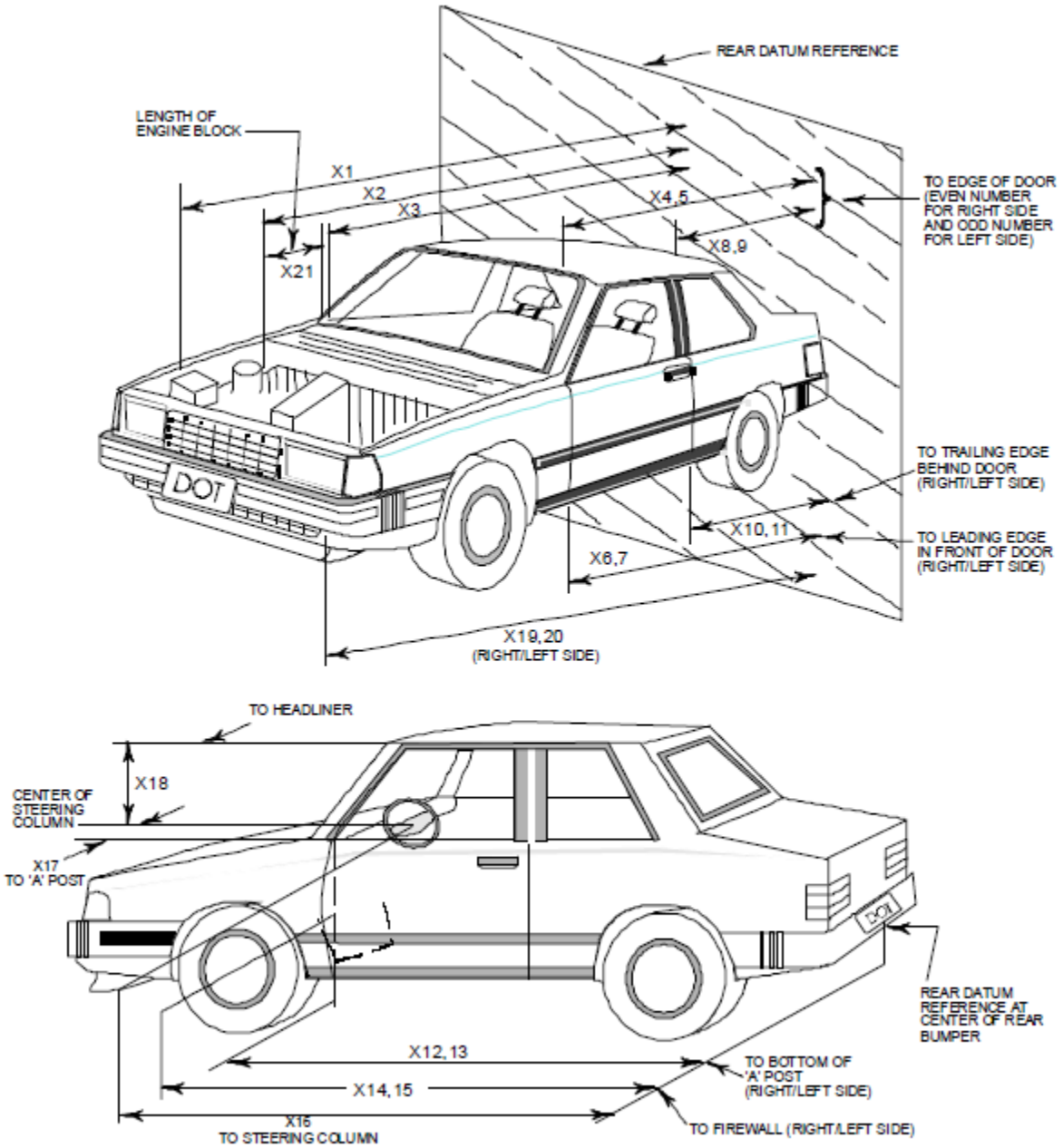
**SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION**

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

**DATA SHEET NO. 12**  
**VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021



**DATA SHEET NO. 12 (CONTINUED)**  
**VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

No.	Measurement Description	Pre-Test	Post-Test	Change
1	Total Length of Vehicle at Centerline	4637	4195	-442
2	RSOV to Front of Engine	4226	3965	-261
3	RSOV to Firewall	3619	3616	-3
4	RSOV to Upper Leading Edge of Right Door	3180	3172	-8
5	RSOV to Upper Leading Edge of Left Door	3180	3170	-10
6	RSOV to Lower Leading Edge of Right Door	3170	3170	0
7	RSOV to Lower Leading Edge of Left Door	3170	3166	-4
8	RSOV to Upper Trailing Edge of Right Door	2116	2105	-11
9	RSOV to Upper Trailing Edge of Left Door	2116	2103	-13
10	RSOV to Lower Trailing Edge of Right Door	2136	2133	-3
11	RSOV to Lower Trailing Edge of Left Door	2136	2125	-11
12	RSOV to Bottom of "A" Post of Right Side	3175	3150	-25
13	RSOV to Bottom of "A" Post of Left Side	3175	3151	-24
14	RSOV to Firewall, Right Side	3630	3602	-28
15	RSOV to Firewall, Left Side	3630	3612	-18
16	RSOV to Steering Column	2735	2770	35
17	Center of Steering Column to "A" Post	384	383	-1
18	Center of Steering Column to Headliner	442	475	33
19	RSOV to Right Side of Front Bumper	4504	4184	-320
20	RSOV to Left Side of Front Bumper	4504	4143	-361
21	Length of Engine Block	522	522	0
RD	RSOV to Right Side of Dash Panel	2990	2950	-40
CD	RSOV to Center of Dash Panel	3010	2860	-150
LD	RSOV to Left Side of Dash Panel	2982	2950	-32

All dimensions in mm

\* The post-test measurements presented in this table were revised on 12/27/2023 due to the original values being affected by a measurement setup error.

**DATA SHEET NO. 13**  
**ACCIDENT INVESTIGATION DIVISION DATA**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
Test Program: NCAP Frontal Barrier Impact Test

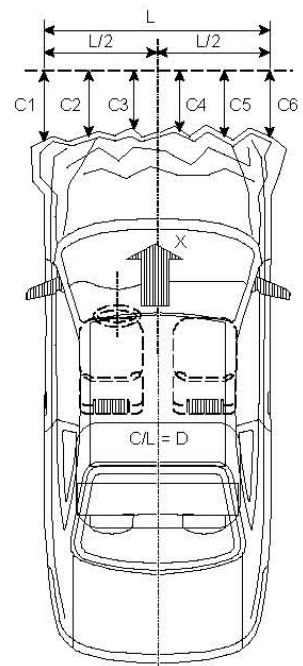
NHTSA No.: M20224206  
Test Date: 12/2/2021

**VEHICLE INFORMATION**

VIN:	<u>5NMJB3AE6NH049429</u>	Wheelbase (mm):	<u>2756</u>
Vehicle Size Category:	<u>MPV</u>	Test Weight (kg):	<u>1760.5</u>

**ACCELEROMETER DATA**

Accelerometer Locations:	<u>As per Data Sheet No. 7</u>
Cal. Procedure/Interval:	<u>MGA Procedure / 6 month</u>
Integration Algorithm:	<u>Trapezoidal</u>
Linearity:	<u>&gt; 99%</u>
Impact Velocity (km/h):	<u>56.02</u>
Velocity Change (km/h):	<u>66.1</u>
Time of Separation (msec)	<u>90</u>



**CRUSH PROFILE**

Collision Deformation Classification:	<u>12FDEW3</u>
Midpoint of Damage:	<u>Centerline</u>
Damage Region Length (mm):	<u>1250</u>
Impact Mode:	<u>Frontal</u>

No.	Measurement Description	Units	Pre-Test	Post-Test	Exterior Crush
C1	Crush zone 1 at left side	mm	4504	4143	361
C2	Crush zone 2 at left side	mm	4579	4167	412
C3	Crush zone 3 at left side	mm	4596	4184	412
C4	Crush zone 4 at right side	mm	4596	4204	392
C5	Crush zone 5 at right side	mm	4579	4205	374
C6	Crush zone 6 at right side	mm	4504	4184	320
L	C1 TO C6	mm	1250	1234	16

\* The post-test measurements presented in this table were revised on 12/27/2023 due to the original values being affected by a measurement setup error.

**DATA SHEET NO. 14**  
**VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
Test Program: NCAP Frontal Barrier Impact Test

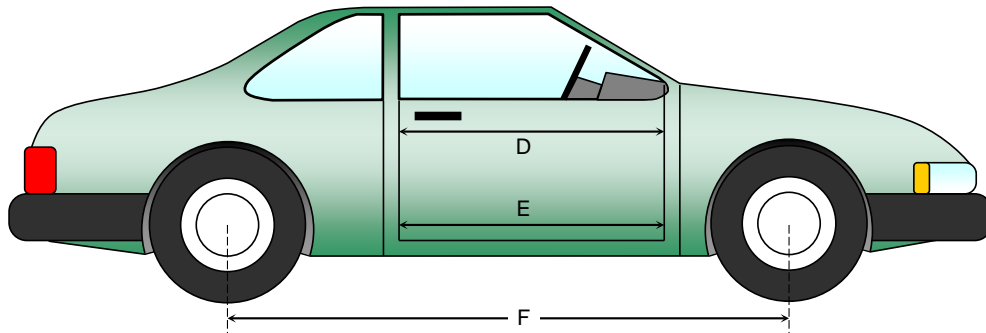
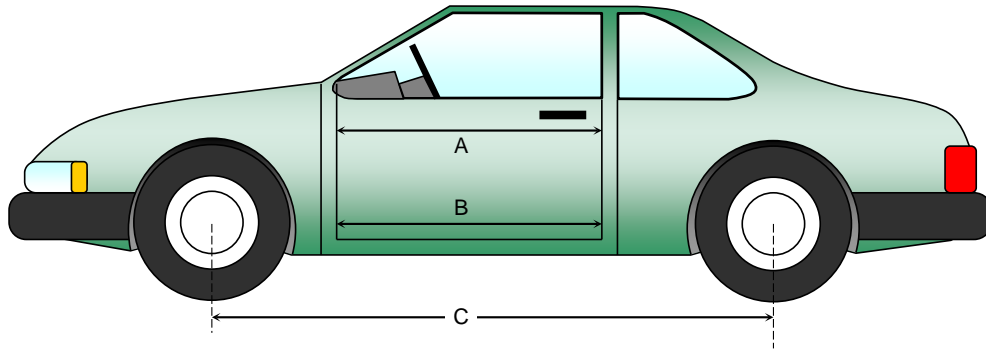
NHTSA No.: M20224206  
Test Date: 12/2/2021

**DOOR OPENING WIDTH**

Item	Description	Units	Pre-Test	Post-Test	Change
A	Left Side Upper	mm	969	965	-4
B	Left Side Lower	mm	882	881	-1
D	Right Side Upper	mm	967	966	-1
E	Right Side Lower	mm	894	890	-4

**WHEELBASE MEASUREMENTS**

Item	Description	Units	Pre-Test	Post-Test	Change
C	Left Side Wheelbase	mm	2756	2684	-72
F	Right Side Wheelbase	mm	2756	2678	-78



**DATA SHEET NO. 14 (CONTINUED)  
VEHICLE INTRUSION MEASUREMENTS**

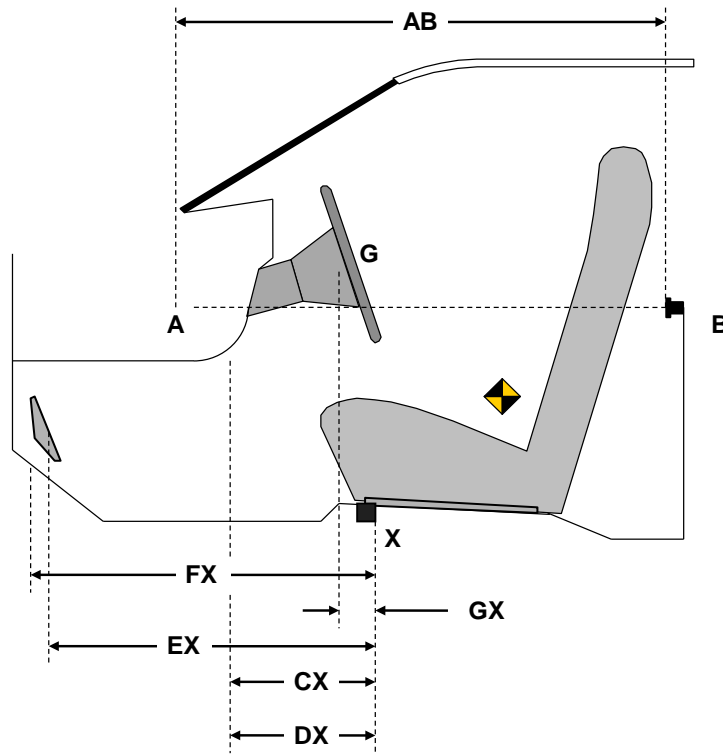
Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**DRIVER COMPARTMENT INTRUSION**

Item	Description	Units	Pre-Test	Post-Test	Change
AB	Door Opening (Inside Window Jam)	mm	789	783	-6
CX	Left Knee Bolster to X	mm	310	294	-16
DX	Right Knee Bolster to X	mm	305	296	-9
EX	Brake Pedal to X	mm	526	511	-15
FX	Foot Rest to X	mm	540	521	-19
GX	Center of Steering Column Wheel Hub to X	mm	39	43	4

X = Front of Seat Track (stationary)



**DRIVER COMPARTMENT**

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

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**WINDSHIELD MOUNTING DETAILS**

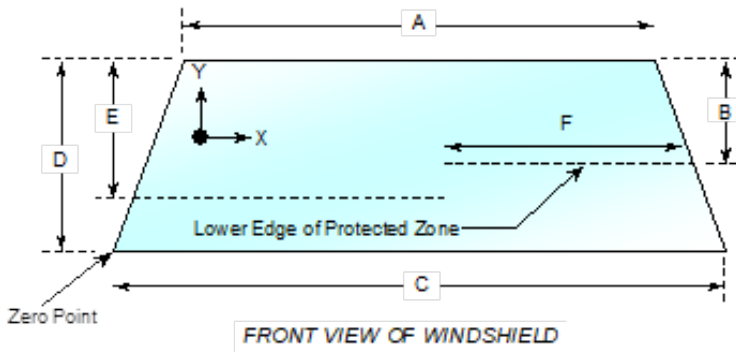
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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

Temperature of windshield molding during test: 21.6°C.

**WINDSHIELD PERIPHERY MEASUREMENTS**

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2232	2232	100
Right Side	2232	2232	100
Total	4464	4464	100



Item	Units	Value
A	mm	1244
B	mm	492
C	mm	1584
D	mm	818
E	mm	494
F	mm	490

**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: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

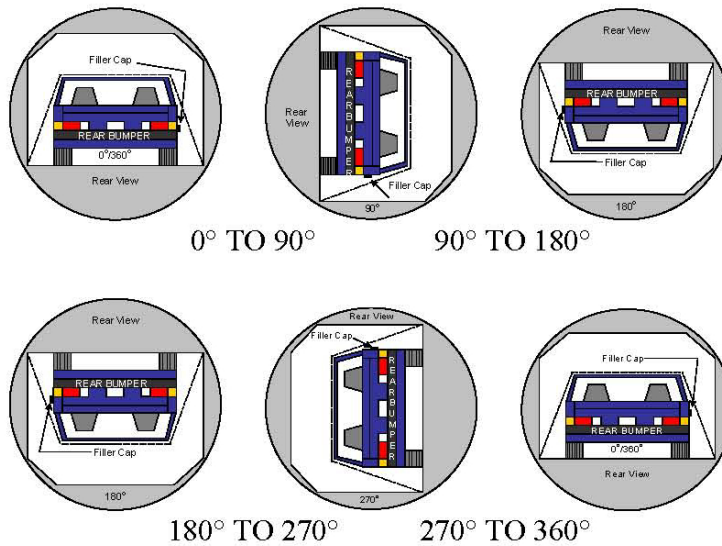
**FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA**

Temperature at Time of Impact: 21.6°C

Test Time: 10:46 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°	112	300	412
90° to 180°	110	300	410
180° to 270°	108	300	408
270° to 360°	112	300	412

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

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021

**FMVSS 301 SPILLAGE TABLE (UNITS IN OUNCES)**

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

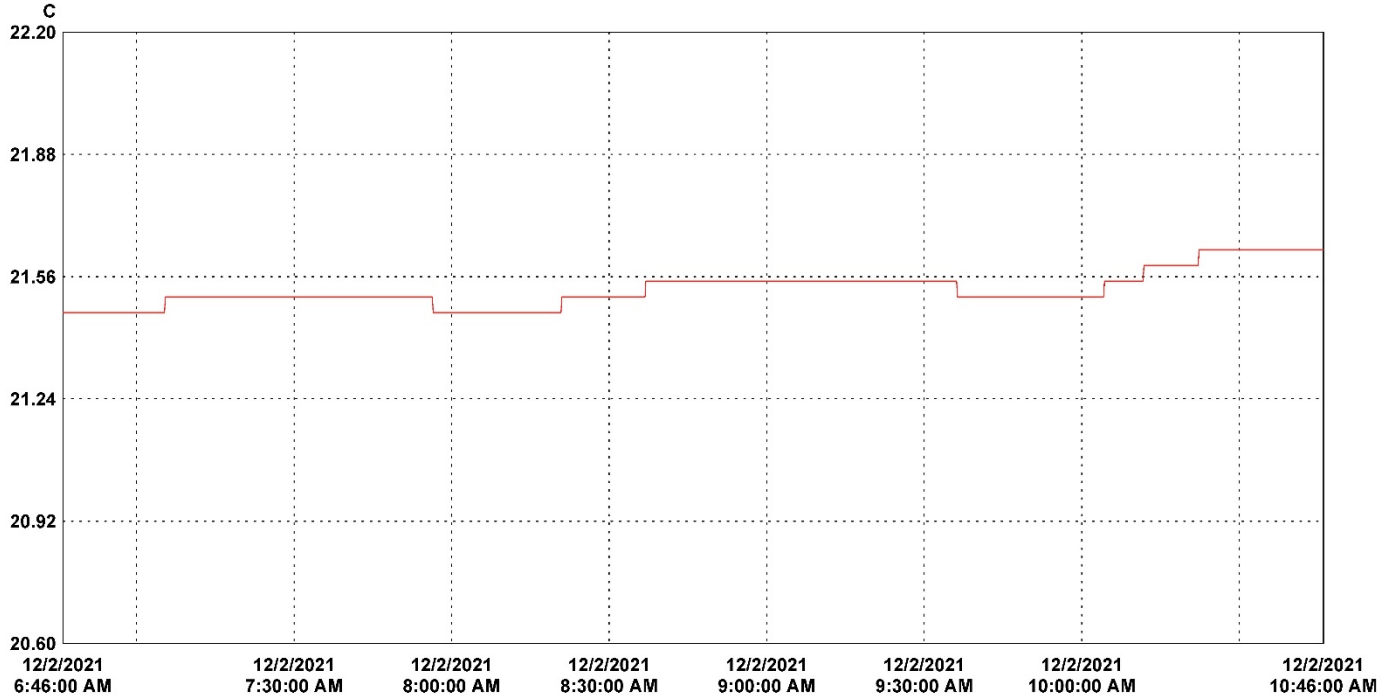
**SOLVENT SPILLAGE LOCATION TABLE**

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

**DATA SHEET NO. 17**  
**DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA**

Test Vehicle: 2022 Hyundai Tucson SEL 5-Door SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224206  
 Test Date: 12/2/2021



30 minutes/div 4 hours (M/d/yyyy h:mm:ss tt) Central Time Graph file (truncated): M20224206 2022 Hyundai Tucson SEL 5-Door SUV NCAP.spg

LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	18352041	VSC_Prep_Room	1	21.63	21.53	21.47	C	Temperature	18352041_VSC_Prep_Room.spl	

**APPENDIX A  
PHOTOGRAPHS**

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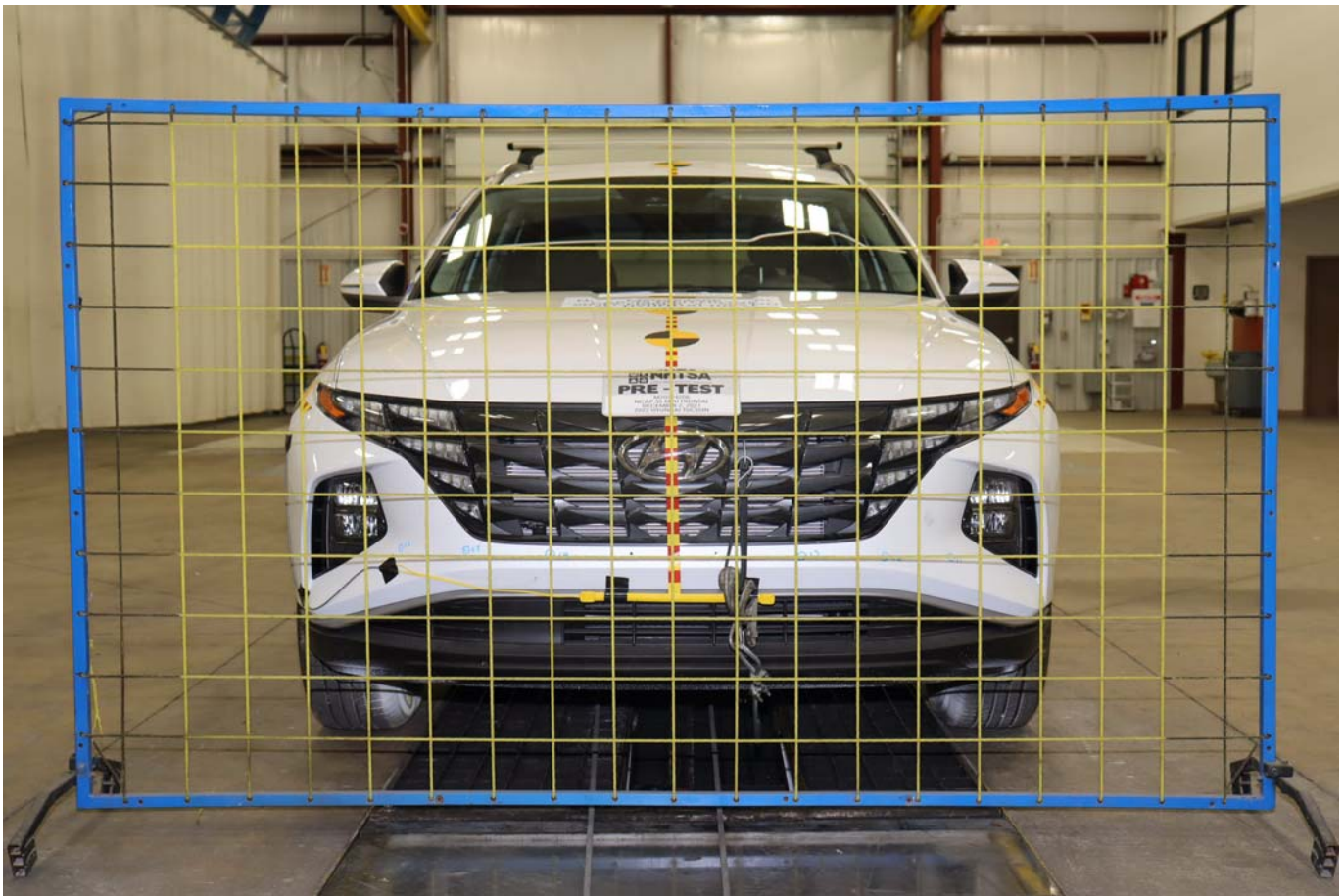


Photo No. 001 - Load Cell Location



Photo No. 002 - Pre-Test Load Cell Wall



Photo No. 003 - Post-Test Load Cell Wall



Photo No. 004 - Manufacturer's Label



Photo No. 005 - Tire Placard



Photo No. 005a - Vehicle Load Carrying Capacity Reduction Label



Photo No. 006 - 2022 Hyundai Tucson SEL 5-Door SUV Frontal As Delivered



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

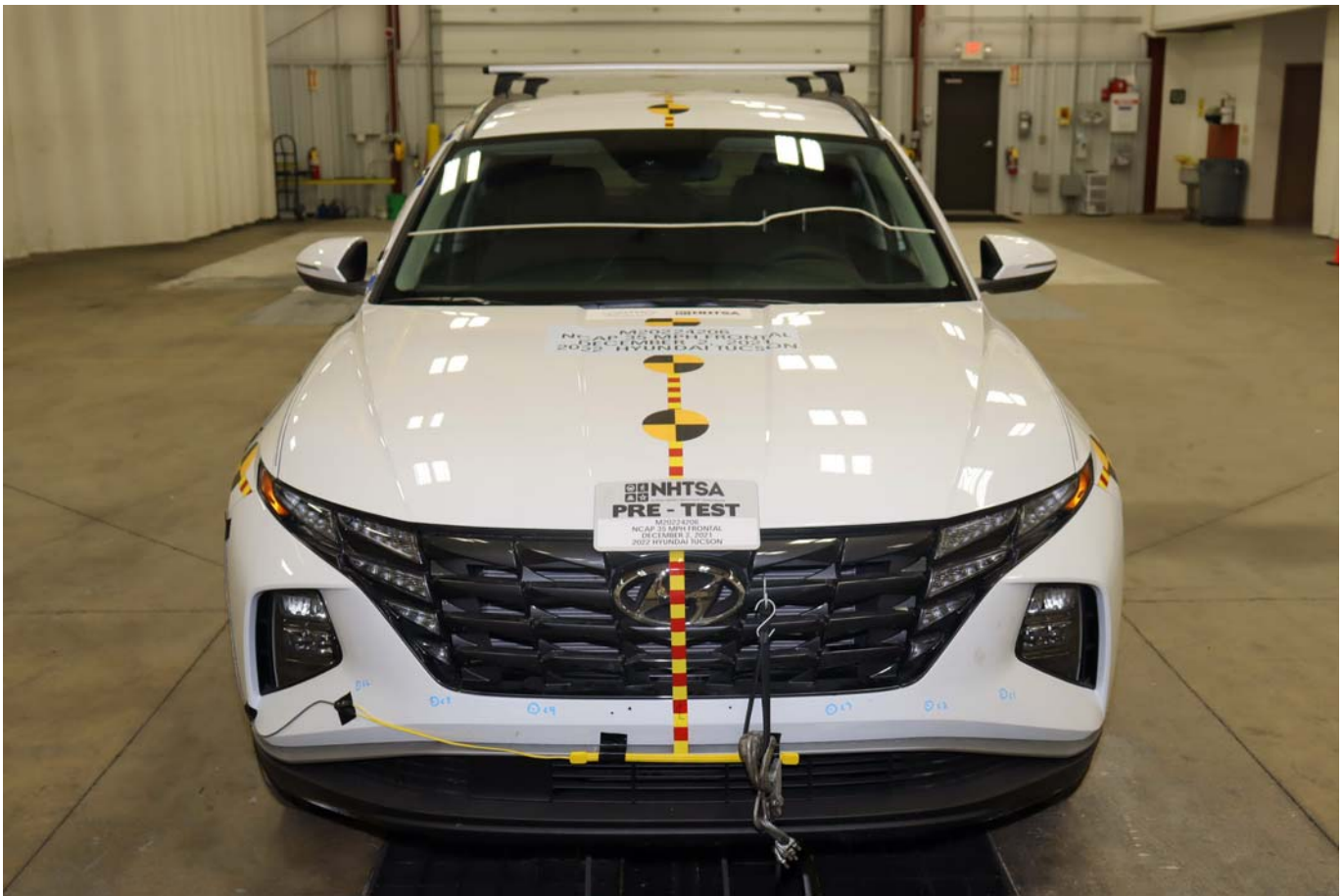


Photo No. 008 - Pre-Test Front View of Test Vehicle

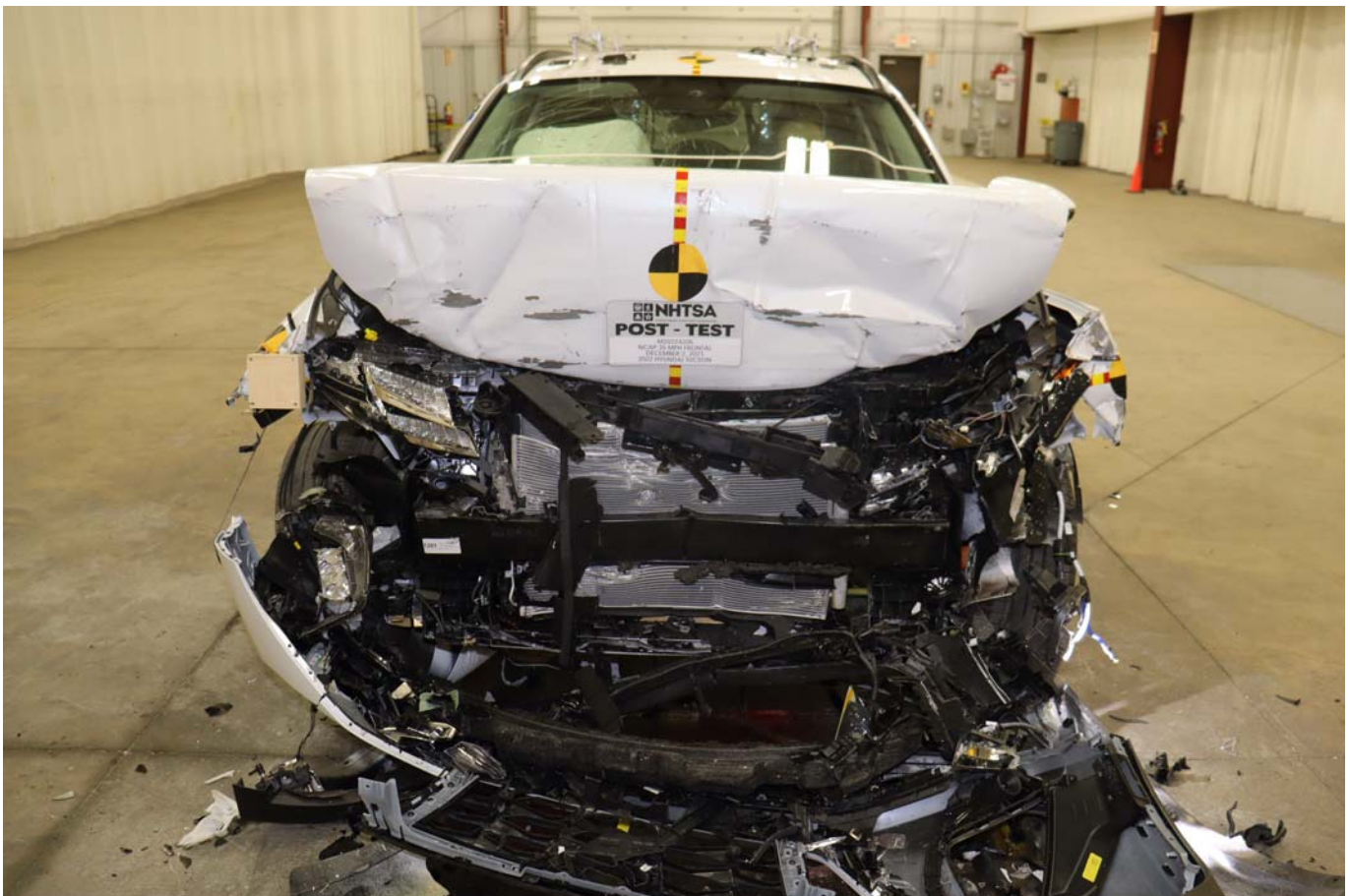


Photo No. 009 - Post-Test Front View of Test Vehicle



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

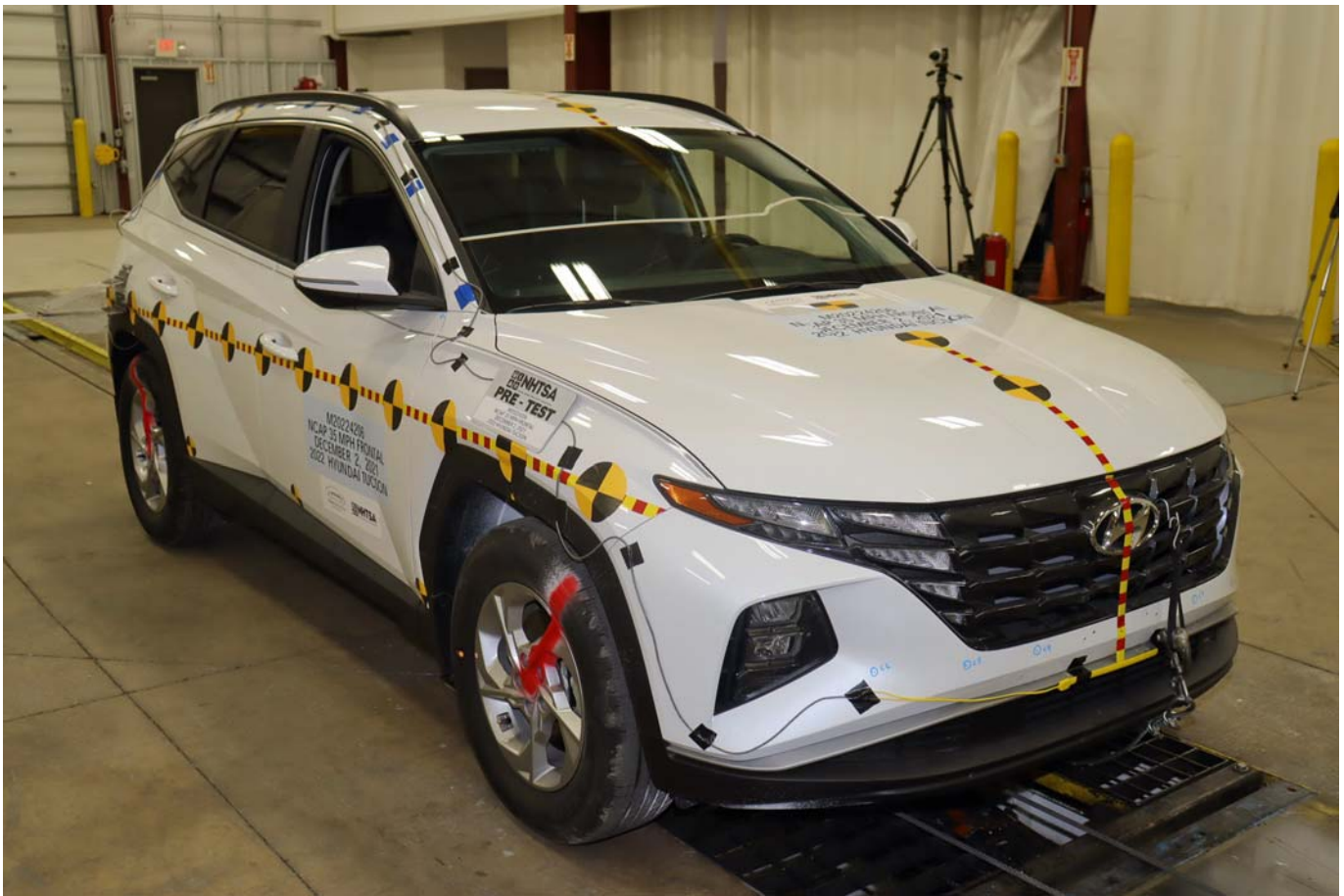


Photo No. 014 - Pre-Test Right Front 3-4 View

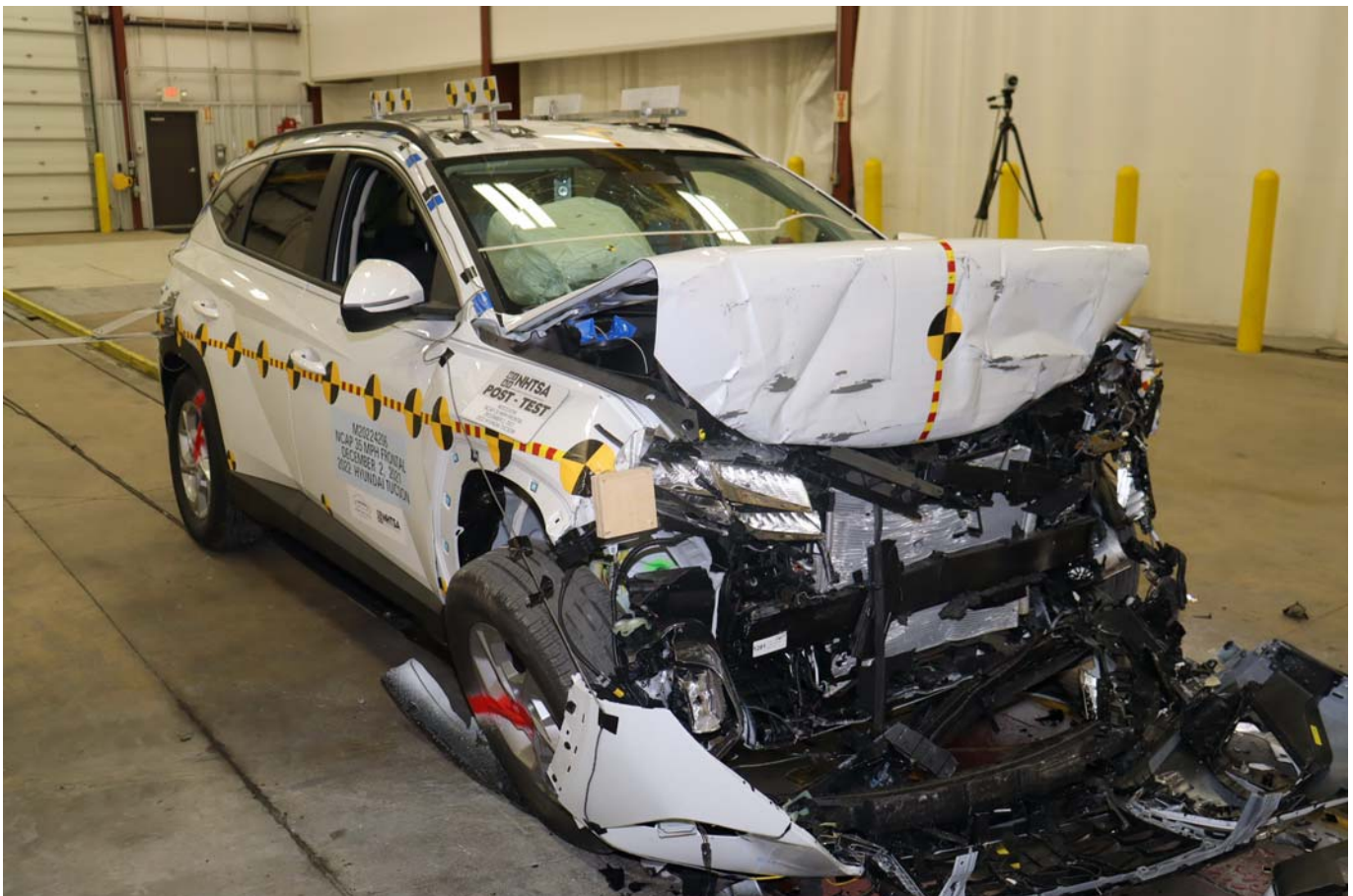


Photo No. 015 - Post-Test Right Front 3-4 View



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

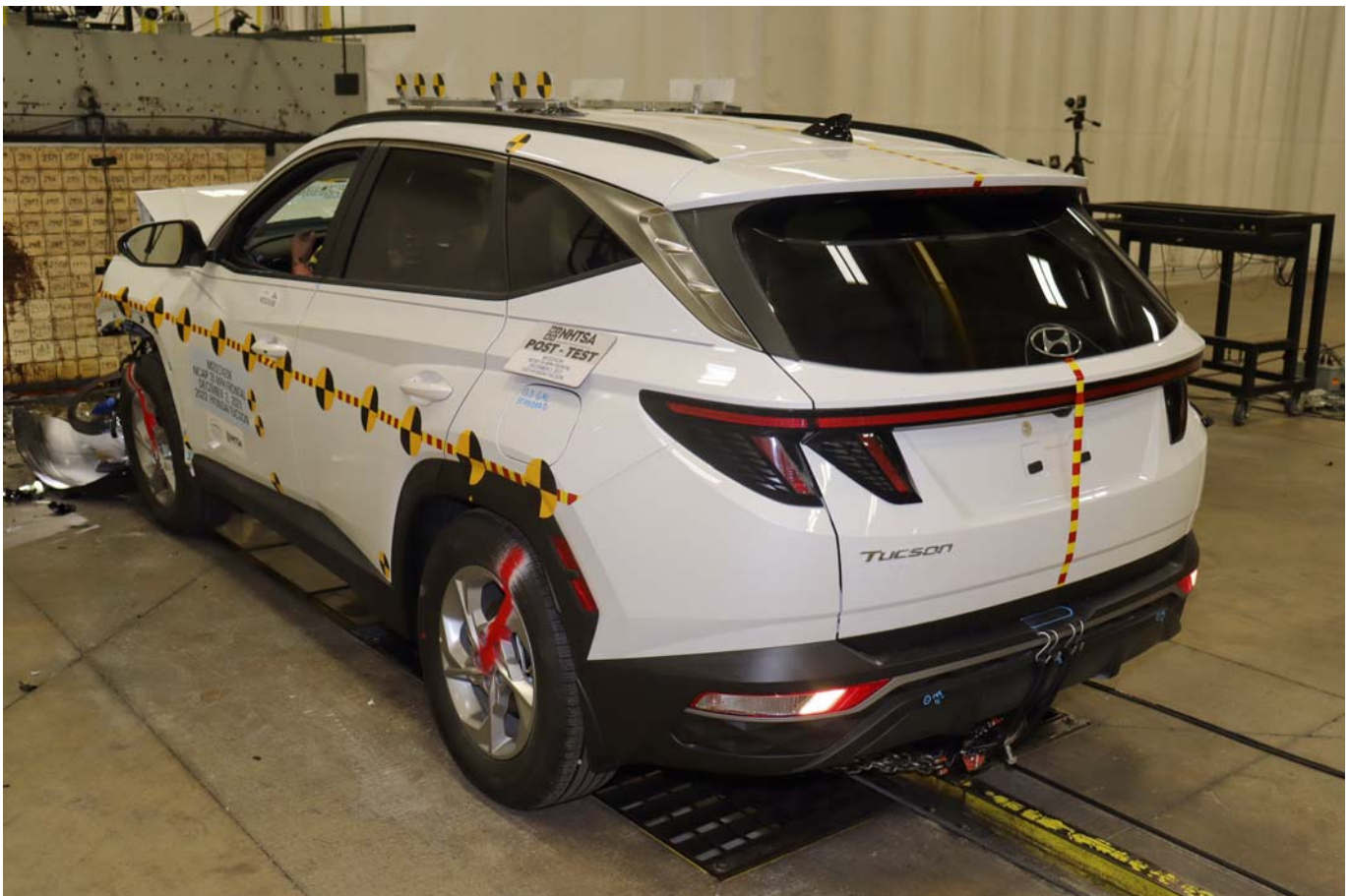


Photo No. 017 - Post-Test Left Rear 3-4 View



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

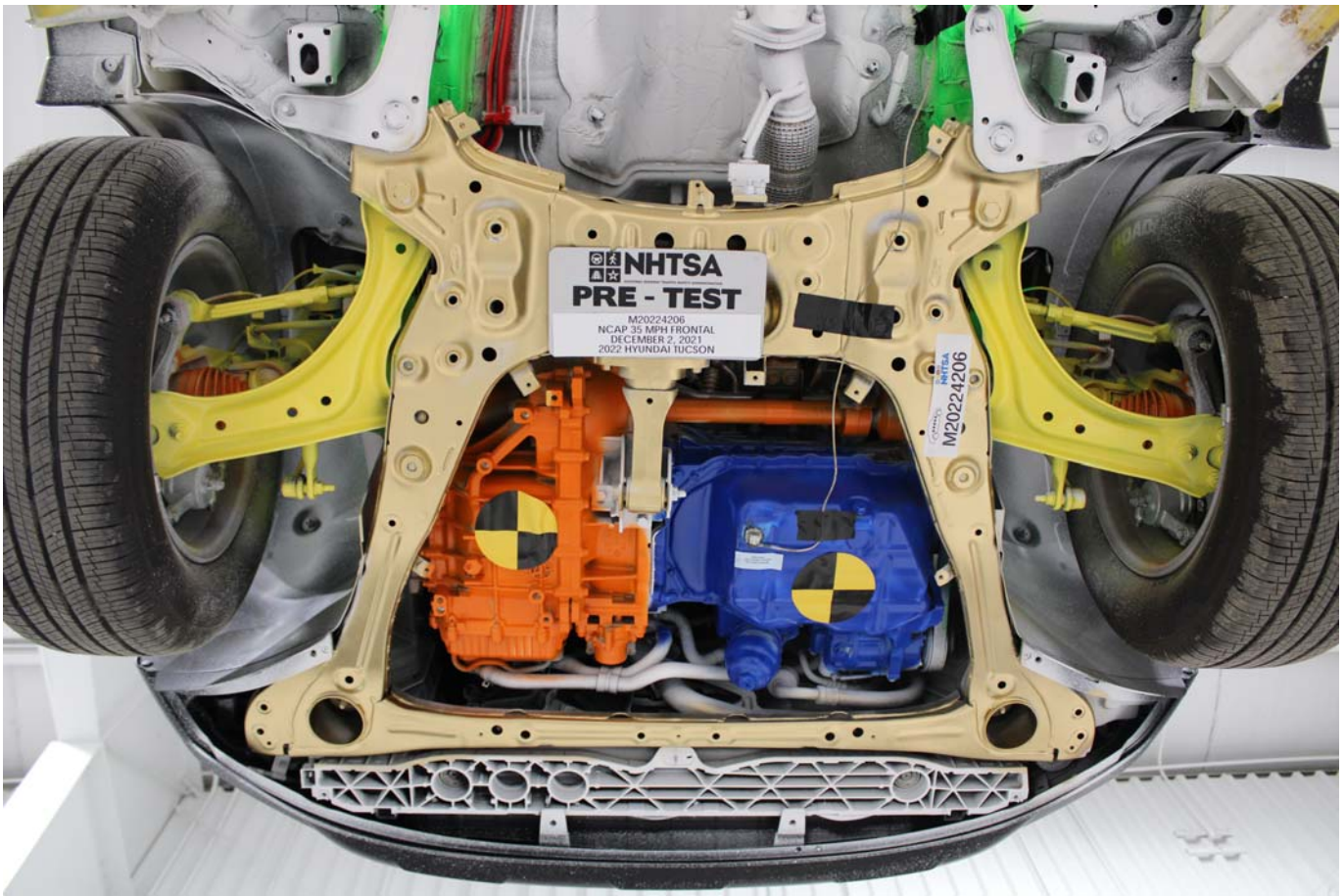


Photo No. 024 - Pre-Test Front Underbody View

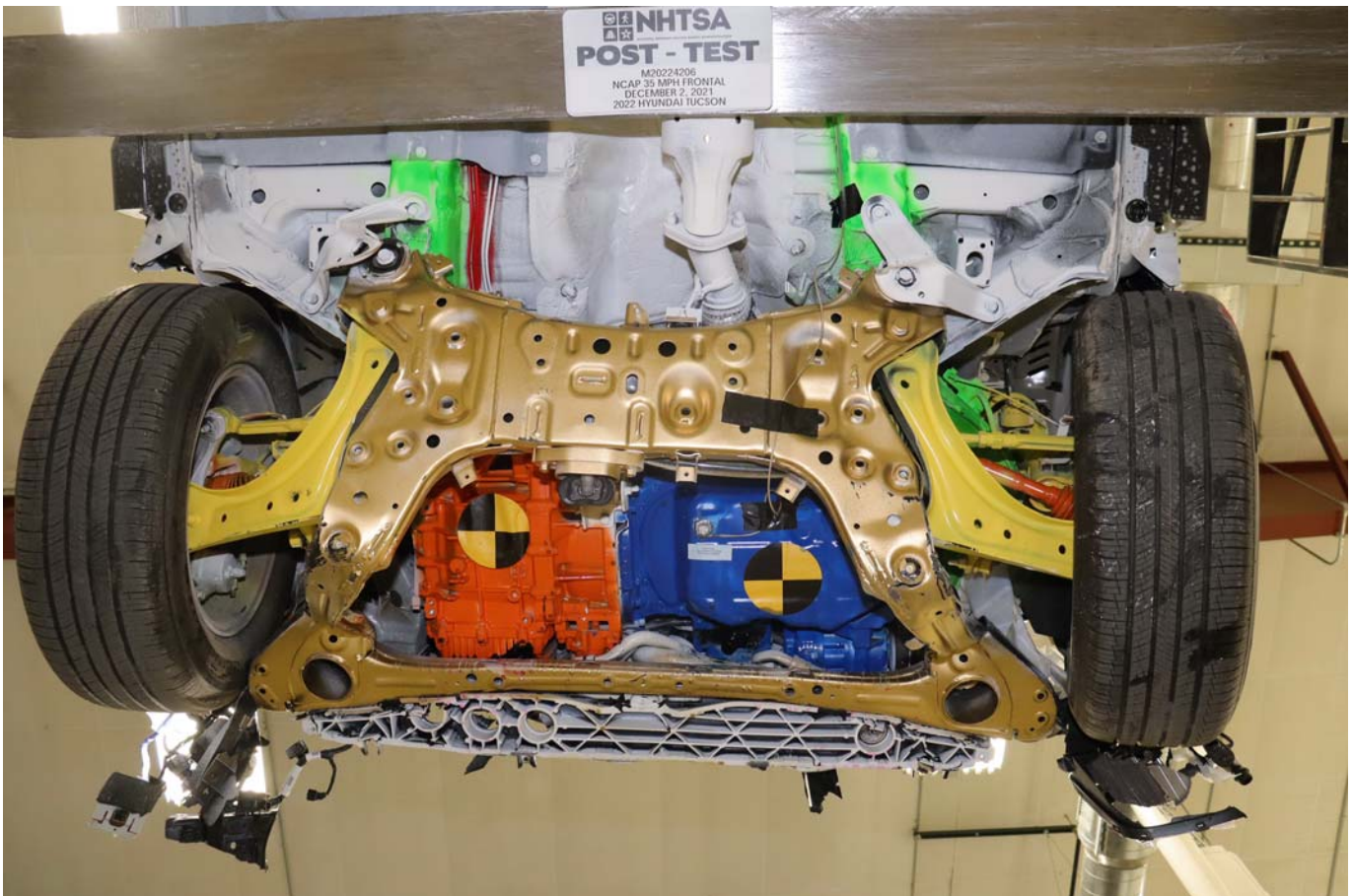


Photo No. 025 - Post-Test Front Underbody View

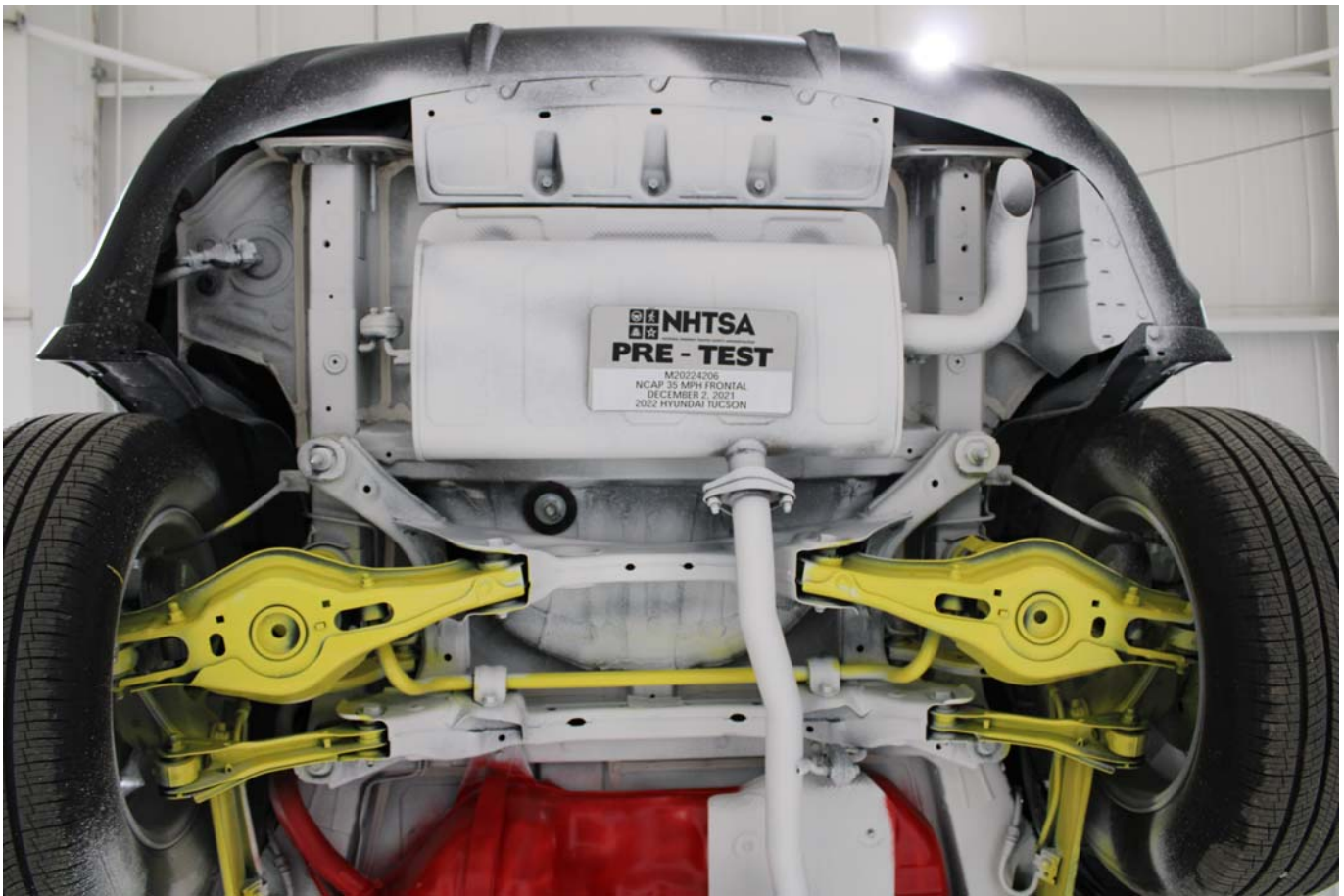


Photo No. 026 - Pre-Test Rear Underbody View



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 View

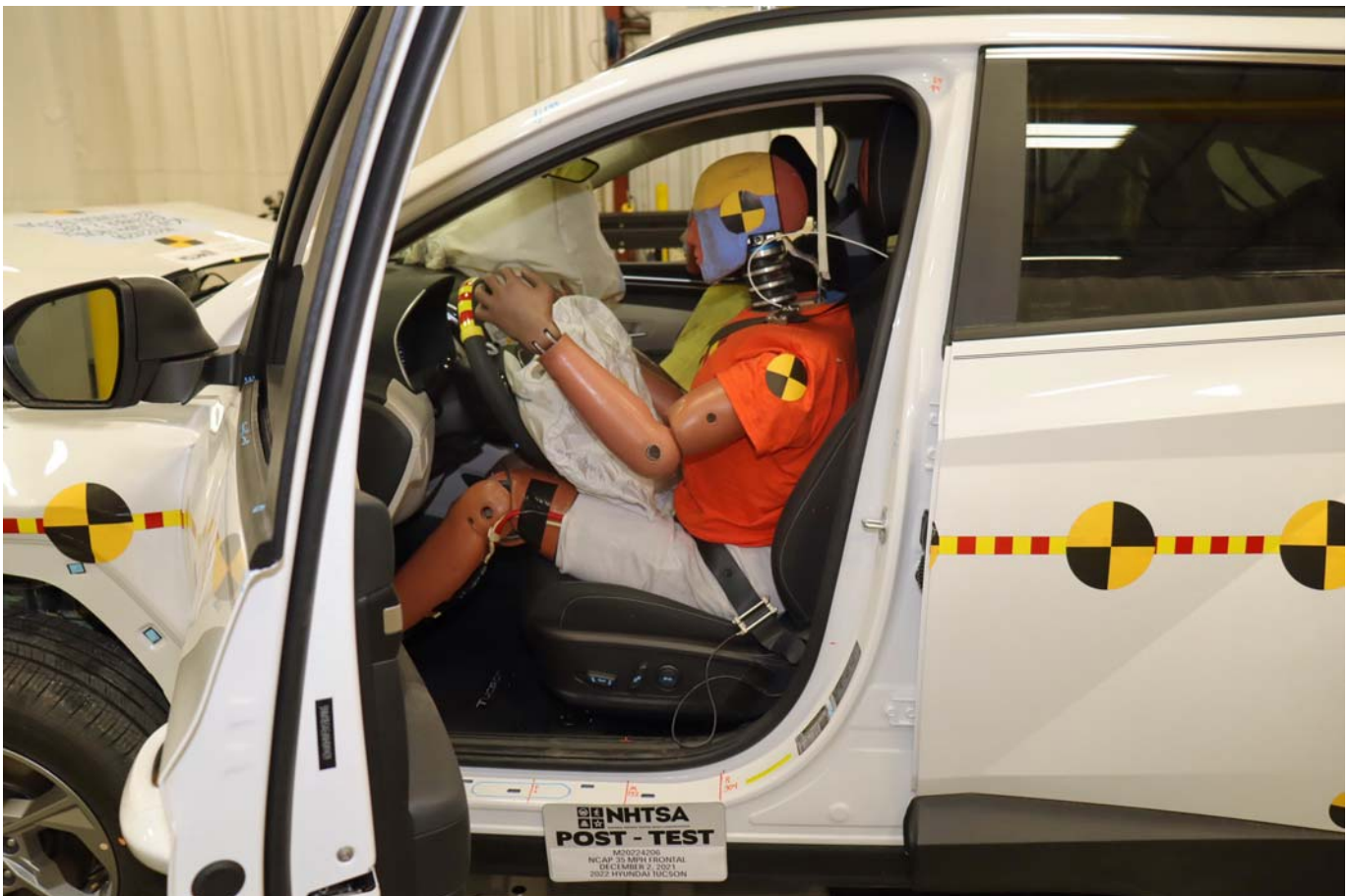


Photo No. 035 - Post-Test Driver Dummy and Vehicle Interior View



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

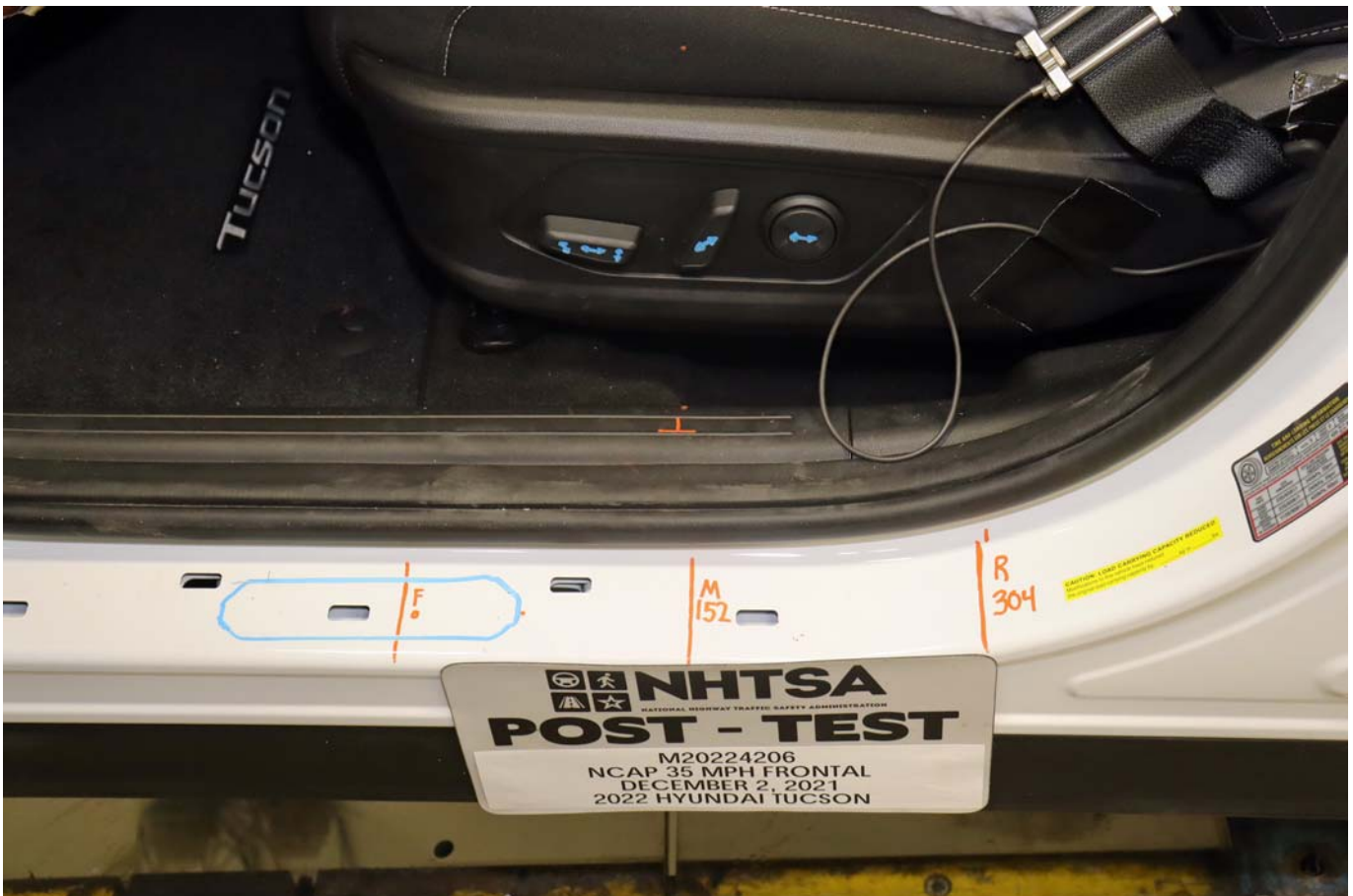


Photo No. 037 - Post-Test Driver's Seat Fore-Aft Markings



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

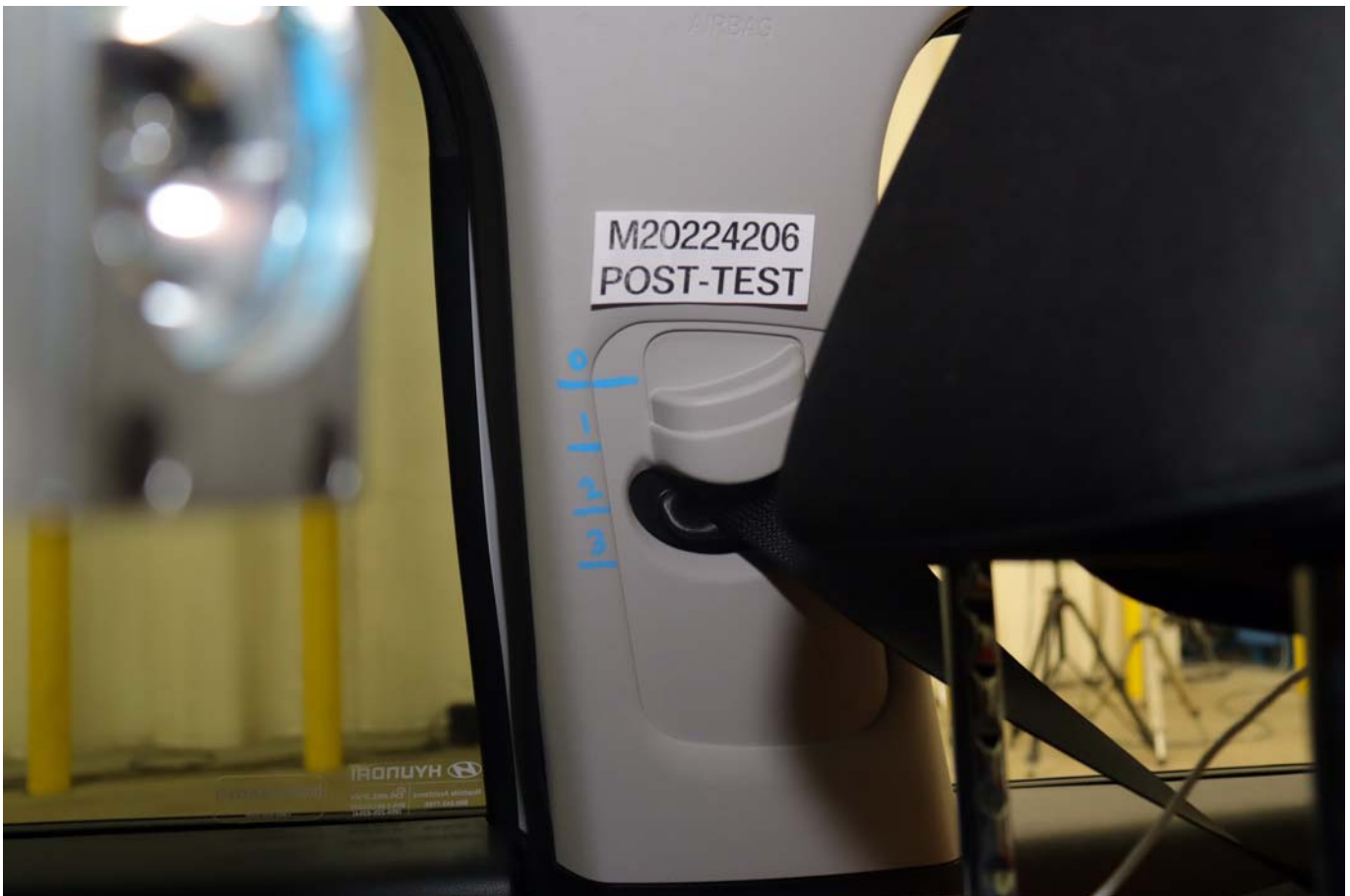


Photo No. 039 - Post-Test View of Belt Anchorage for Driver Dummy



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



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



Photo No. 042 - Pre-Test Driver Dummy Feet



Photo No. 043 - Post-Test Driver Dummy Feet



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



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



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



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



Photo No. 048 - Post-Test Driver Dummy Face



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



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



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



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



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



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 View



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



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

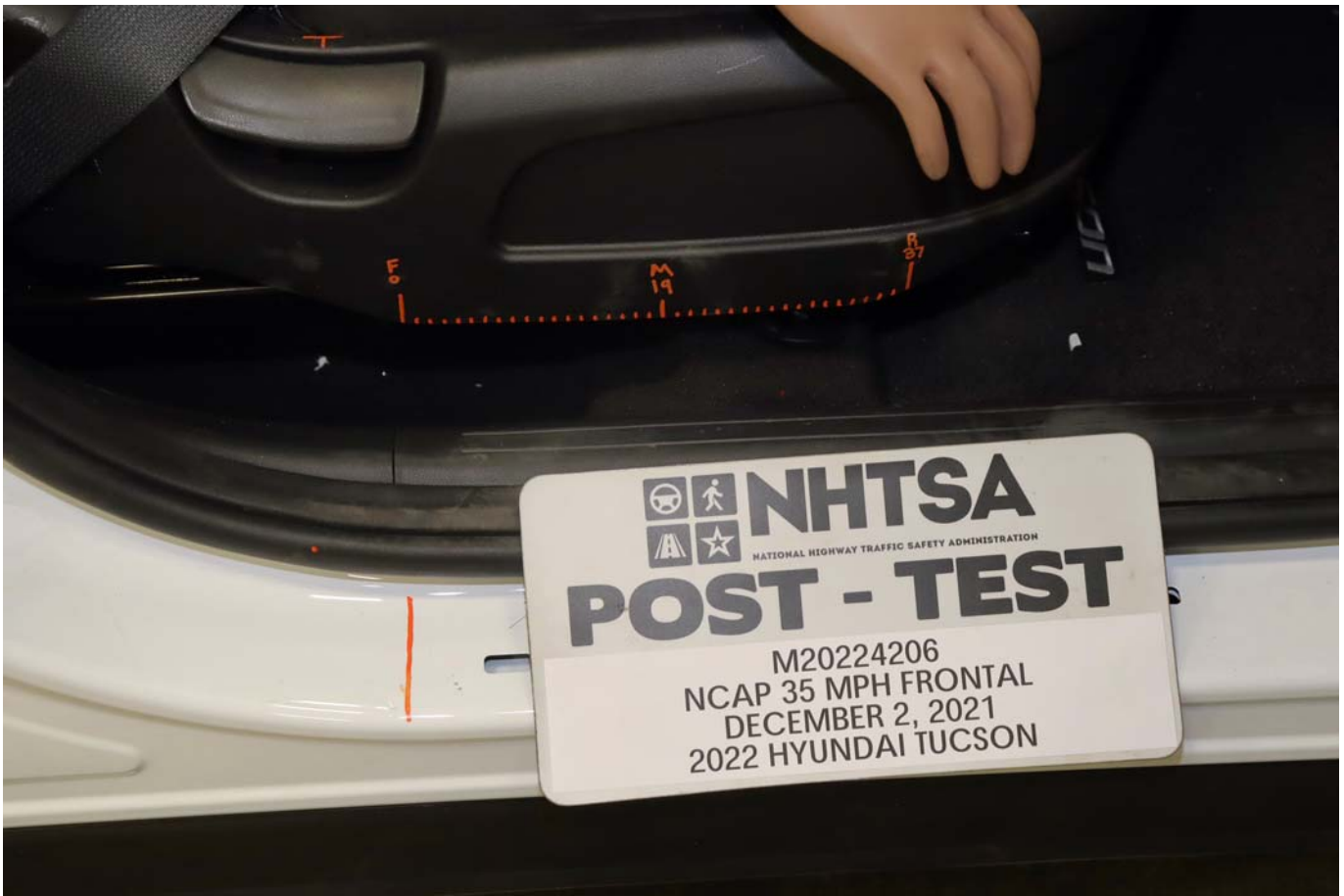


Photo No. 060 - Post-Test Passenger's Seat Fore-Aft Markings



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



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



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



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



Photo No. 065 - Pre-Test Passenger Dummy Feet



Photo No. 066 - Post-Test Passenger Dummy Feet



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



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



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



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



Photo No. 071 - Post-Test Passenger Dummy Face

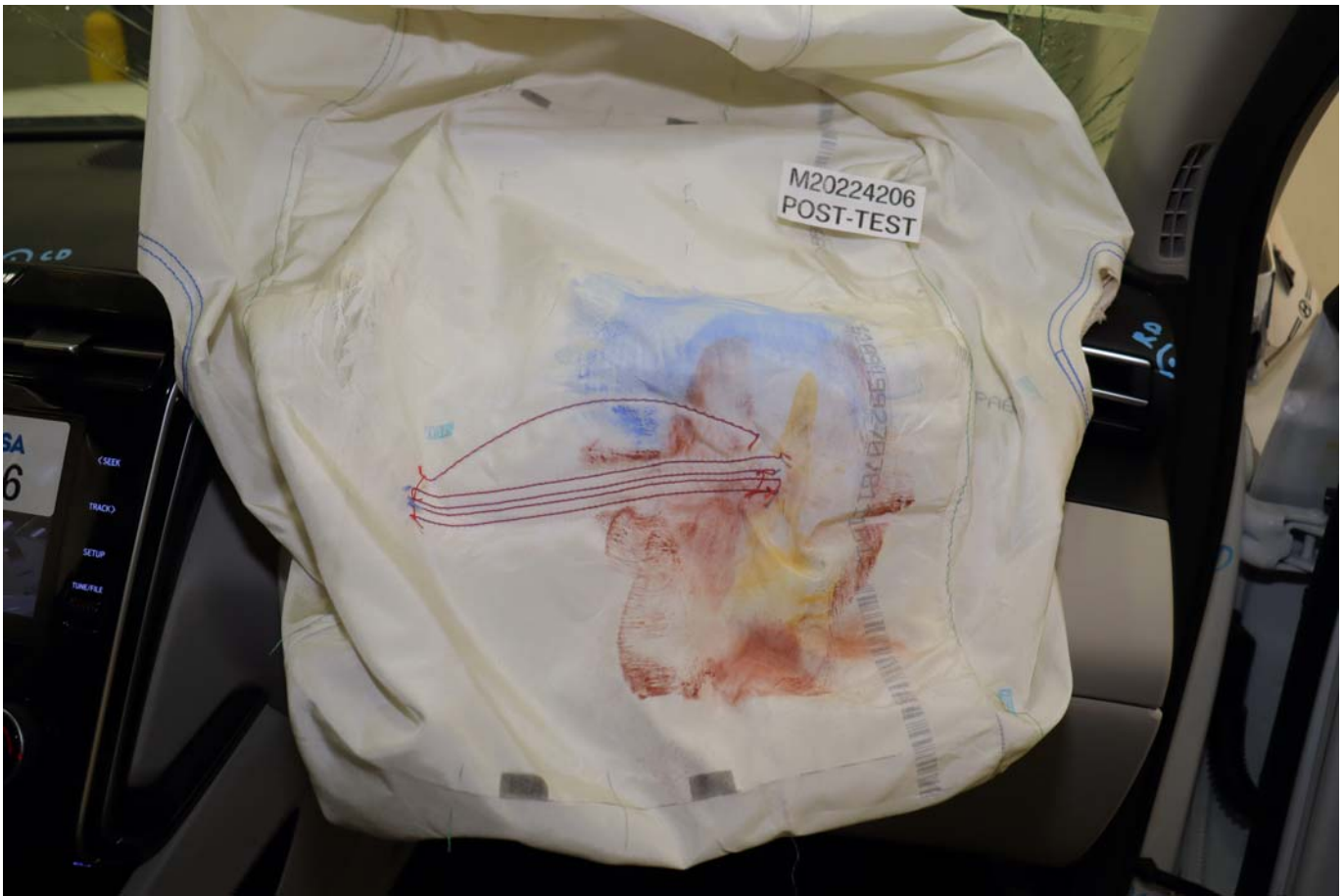


Photo No. 072 - Post-Test Passenger Dummy Contact with Airbag



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



Photo No. 074 - Photograph of Ballast Installed in Vehicle

**PHOTOGRAPH NOT APPLICABLE**

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



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



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



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



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



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



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



Photo No. 082 - 2022 Hyundai Tucson SEL 5-Door SUV Frontal Impact Event



2022 TUCSON SEL FWD

**SOLD TO:** TX112  
 RANDALL NOE HYUNDAI  
 100 HIGHWAY 205  
 TERRELL TX 75160

**SHIPPED TO:** TX112

**VIN:** 5NMJ33AE6NH049429  
**MODEL:** 85432F45  
**ENGINE:** G4KNMK232493  
**PORT OF ENTRY:** MA  
**EXTERIOR COLOR:** QUARTZ WHITE  
**INTERIOR/SEAT COLOR:** GRAY/GRAY  
**TRANSPORT:** TRUCK  
**ACCESSORY WEIGHT:** 24 lbs./ 11 kgs.  
**EMISSIONS:** This vehicle is certified to meet emission requirements in all 50 states

GOVERNMENT 5-STAR SAFETY RATINGS

This vehicle has not been rated by the government for overall vehicle score, frontal crash, side crash or rollover risk.

Source: National Highway Traffic Safety Administration (NHTSA).  
[www.safercar.gov](http://www.safercar.gov) or 1-888-327-4236

**STANDARD FEATURES:**  
**AMERICA'S BEST WARRANTY**  
 5-year/60,000-mile New Vehicle Warranty\*  
 10-year/100,000-mile Powertrain Warranty\*  
 7-year/Unlimited-mile Anti-perforation Warranty\*  
 3-year/36,000-mile Complimentary Maintenance\*  
 5-year/Unlimited-mile Roadside Assistance  
 \*Limited warranties, see dealer for details

**ADVANCED SAFETY TECHNOLOGY**  
 Forward Collision-Avoidance Assist  
 Lane Keeping Assist, Lane Following Assist  
 Driver Attention Warning, Rear Occupant Alert  
 Blind Spot Collision-Avoidance Assist  
 Rear Cross-Traffic Collision-Avoidance Assist  
 Safe Exit Warning  
 Electronic Stability Control (ESC) w/ Traction Control  
 ABS w/ Electronic Brake-Force Distribution & Brake Assist  
 Downhill Brake Control, Hillstart Assist Control  
 Front, Front Side & Side-Curtain Airbags w/ Rollover Sensors  
 Tire Pressure Monitoring System w/ Individual Tire Indicator

**POWERTRAIN TECHNOLOGY**  
 Smartstream 2.5L 4-Cylinder Engine w/ GDI & MPI  
 8-Speed Automatic Transmission w/ SHIFTRONIC®  
 Idle, Stop & Go, Electric Parking Brake  
 Drive Mode Select

**EXTERIOR**  
 17-inch Alloy Wheels; Temporary Compact Spare Tire  
 LED Daytime Running Lights  
 Automatic LED Headlights; High Beam Assist  
 LED Tail Lamps; Roof Side Rails  
 Rear Privacy Glass  
 Bodycolor Rear Spoiler w/ LED Brake Light

**COMFORT & CONVENIENCE**  
 Air Conditioning w/ Cabin Air Filter  
 Proximity Key w/ Push Button Start  
 Power Driver's Seat w/ Lumbar Support  
 Heated Front Seats  
 Heated Side Mirrors w/ Turn Signals  
 Illuminated Sunroofs w/ Sliding Arm Extender  
 Tilt-and-Telescopic Steering Wheel w/Audio, Cruise & Phone Controls  
 Smart Cruise Control w/ Stop & Go  
 60/40 Split Folding Rear Seat w/ Recline & Center Armrest  
 Cargo Area Remote Folding Release Seatback  
 Rear Air Vents; Dual Rear USB Outlets  
 4.2-inch LCD Multi-Information Display

**COMFORT & CONVENIENCE(Cont.)**  
 8-inch Display Audio w/ Android Auto (TM) & Apple CarPlay (TM)  
 Rearview Monitor w/ Parking Guidance  
 AMP/FM/HD Radio® Audio System  
 Dual Front USB Outlets; 2 12V DC Power Outlets  
 SiriusXM® Radio w/90 Day Platinum trial subscription;  
 Not Available in AK & HI  
 Blue Link® Connected Services 3-years Standard (enrollment req)  
 Blue Link Remote Start (3-year Complimentary Service)  
 Full Tank of Fuel

**Manufacturer's Suggested Retail Price:** \$26,500.00

**ADDED FEATURES:**

*QUARTZ WHITE(WWB) Paint	\$400.00
*Carpeted Floor Mats	\$195.00
*Cargo Net	\$55.00
*Reversible Cargo Tray	\$115.00
*First Aid Kit	\$30.00
*Mud Guards	\$120.00
*CROSS Rails	\$315.00

**Total Price:** \$28,955.00

2021 Insurance Institute for Highway Safety  
 TOP SAFETY PICK+



**EPA DOT Fuel Economy and Environment** Gasoline Vehicle

**Fuel Economy**  
 29 MPG combined city/hwy  
 26 city  
 33 highway  
 3.4 gallons per 100 miles

Small SUVs range from 16 to 125 MPG. The best vehicle rates 142 MPGe.

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

**Annual fuel cost \$1,200**

**Fuel Economy & Greenhouse Gas Rating** (tailpipe only) 6 (Best)

**Smog Rating** (tailpipe only) 5 (Best)

This vehicle emits 314 grams CO<sub>2</sub> per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions. Learn more at [fuel economy.gov](http://fuel economy.gov).

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 27 MPG and costs \$6,500 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$ 2.35 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

**fuel economy.gov**  
 Calculate personalized estimates and compare vehicles

Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. Gasoline license and title fees state and local taxes and dealer installed options and accessories are not included in the manufacturer's suggested retail price. This label has been affixed to this vehicle by Hyundai Motor America, pursuant to the requirements of 15 U.S.C. 1231 et seq. which prohibits its removal or alteration prior to delivery to the ultimate purchaser.

**PARTS CONTENT INFORMATION FOR VEHICLE IN THIS CARLINE:**  
 U.S./CANADIAN PARTS CONTENT: 49 %  
 MAJOR SOURCES OF FOREIGN PARTS CONTENT: KOREA: 34 %

Note: Parts content does not include final assembly, distribution, or other non-parts costs.

**FOR THIS VEHICLE:**  
 FINAL ASSEMBLY POINT: MONTGOMERY, ALABAMA U.S.A.  
 COUNTRY OF ORIGIN: ENGINE: U.S.A.  
 TRANSMISSION: U.S.A.

267 A 1

Photo No. 083 - Monroney Label Photograph

**APPENDIX B**  
**DUMMY RESPONSE DATA TRACES**

## TABLE OF DATA PLOTS

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Figure No. 3.	Driver Head Z Acceleration vs. Time	B-1
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Figure No. 14.	Driver Nij (NTE) vs. Time	B-5
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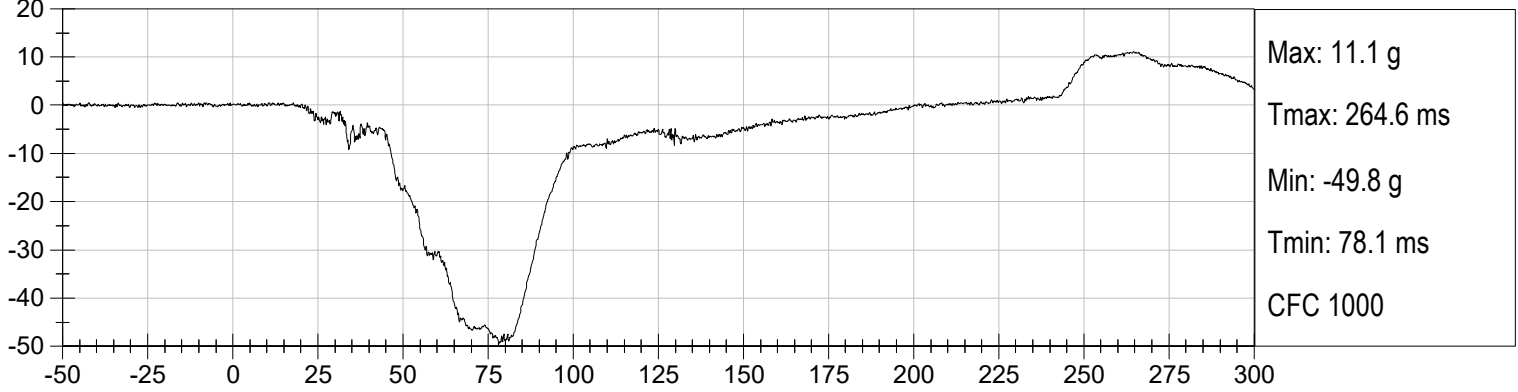
**The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at [www.nhtsa.gov](http://www.nhtsa.gov)**

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

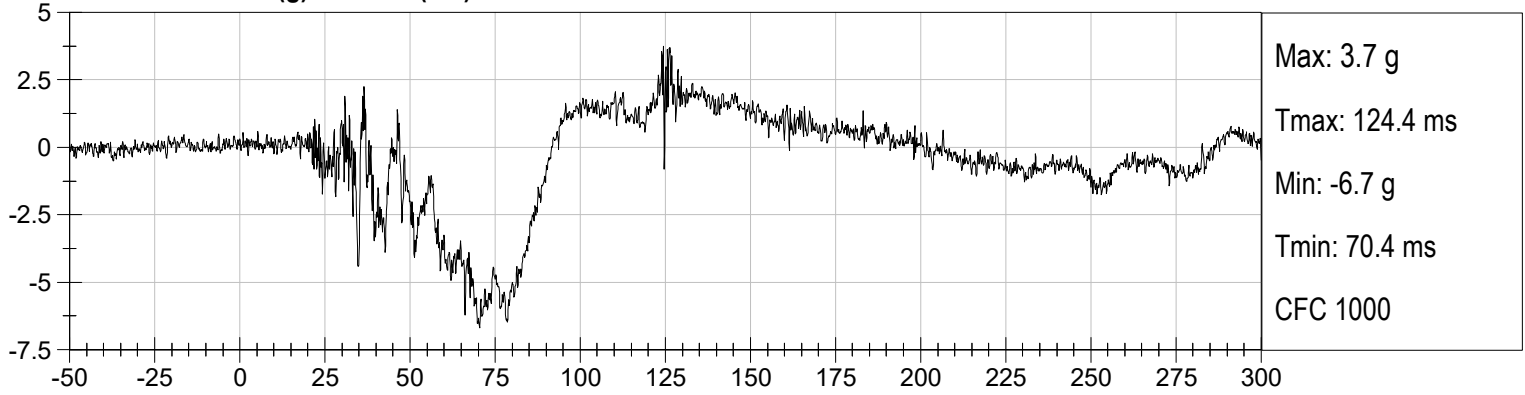
Driver Left Upper Tibia Force Z  
Driver Left Lower Tibia Moment X  
Driver Left Lower Tibia Moment Y  
Driver Left Lower Tibia Force Z  
Driver Right Upper Tibia Moment X  
Driver Right Upper Tibia Moment Y  
Driver Right Upper Tibia Force Z  
Driver Right Lower Tibia Moment X  
Driver Right Lower Tibia 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  
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Left Rear Seat Crossmember Xr  
Right Rear Seat Crossmember Xr  
Advanced Research Load Cell Barrier – 528 channels

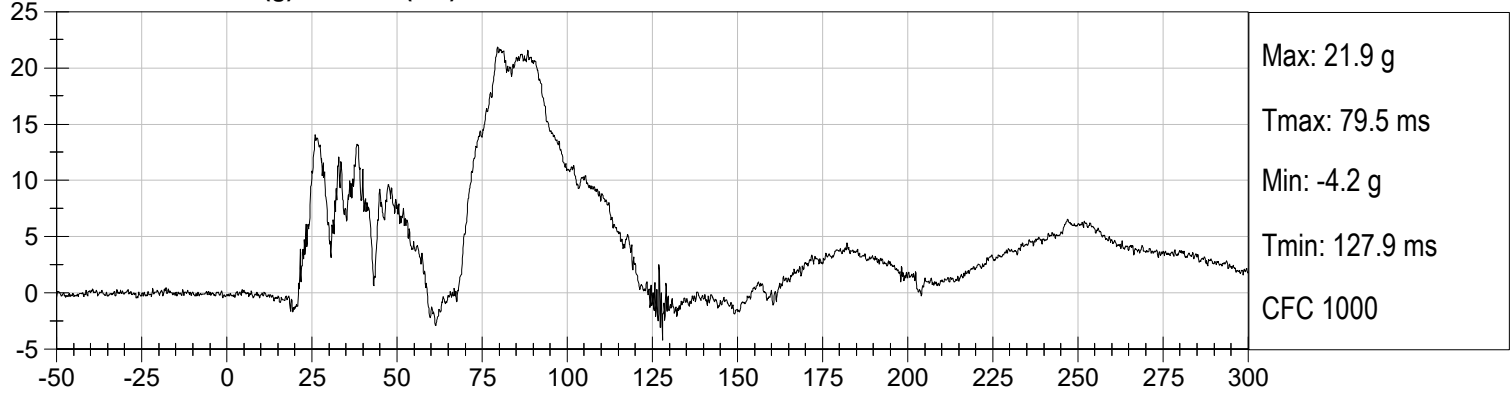
**DRIVER HEAD X (g) vs Time (ms)**



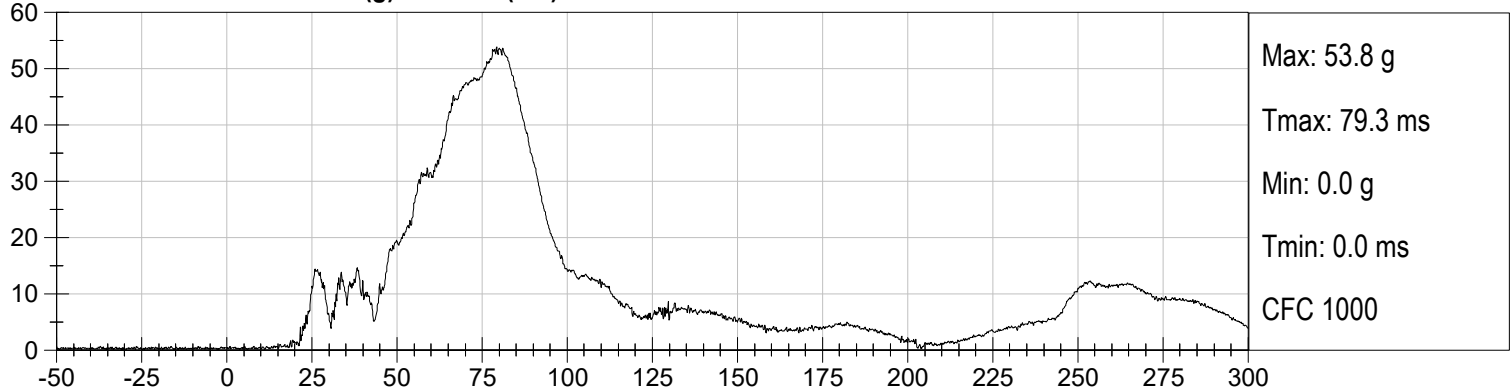
**DRIVER HEAD Y (g) vs Time (ms)**



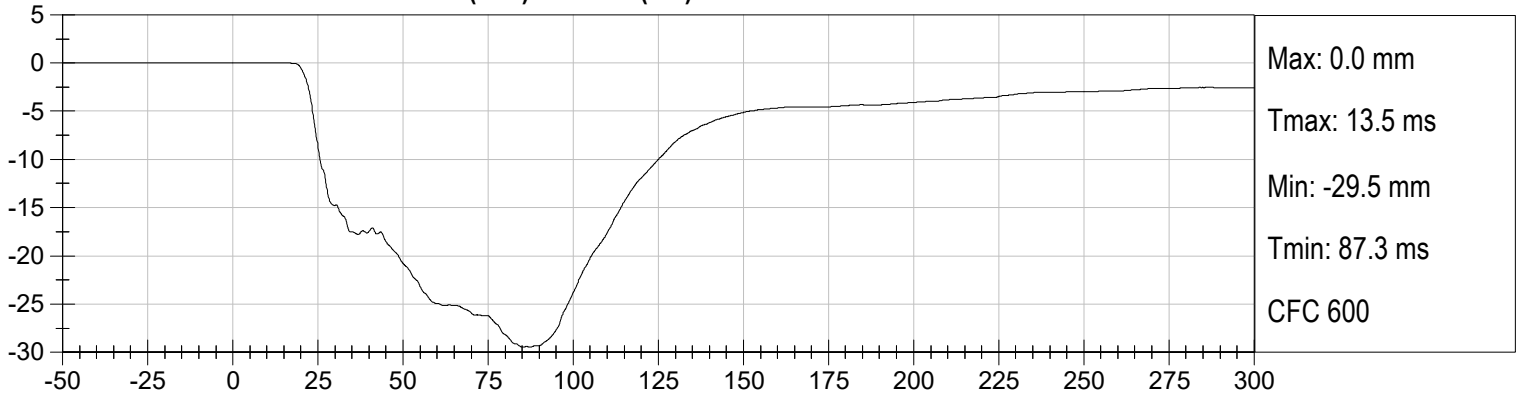
**DRIVER HEAD Z (g) vs Time (ms)**

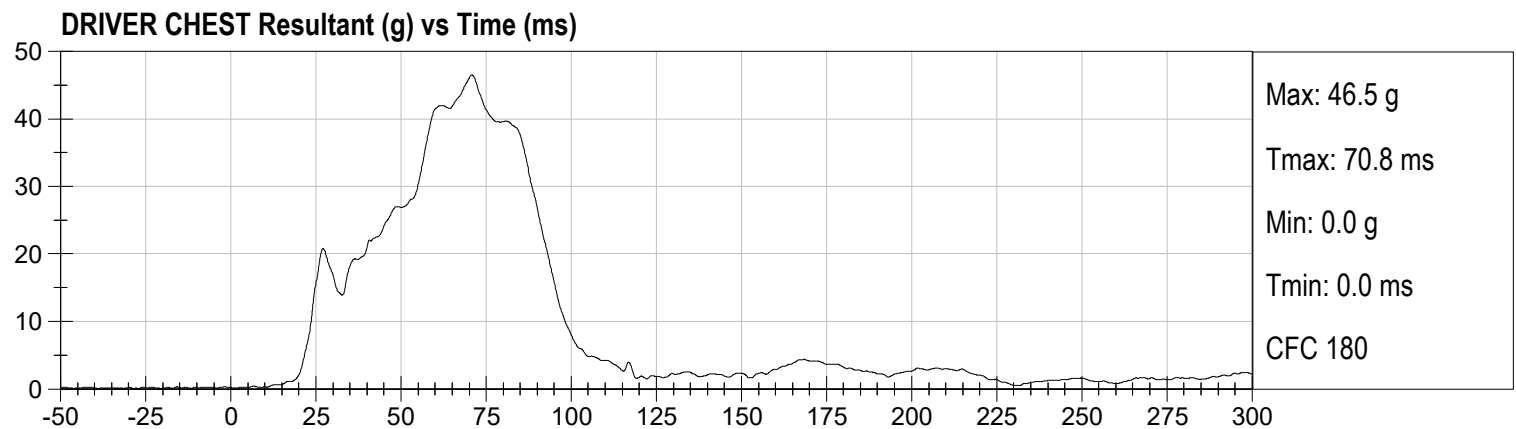
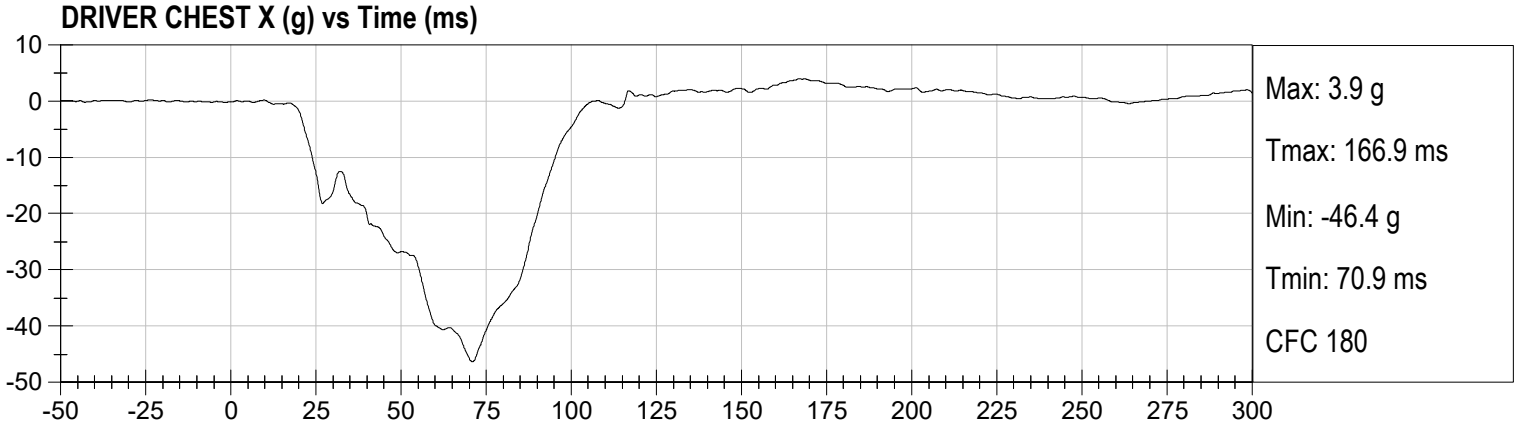


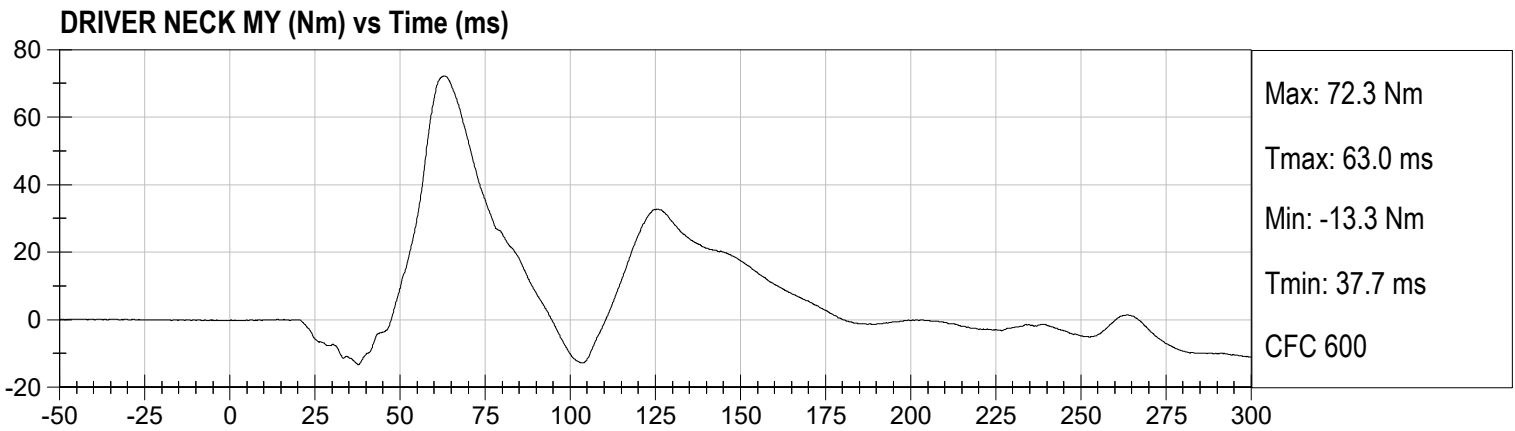
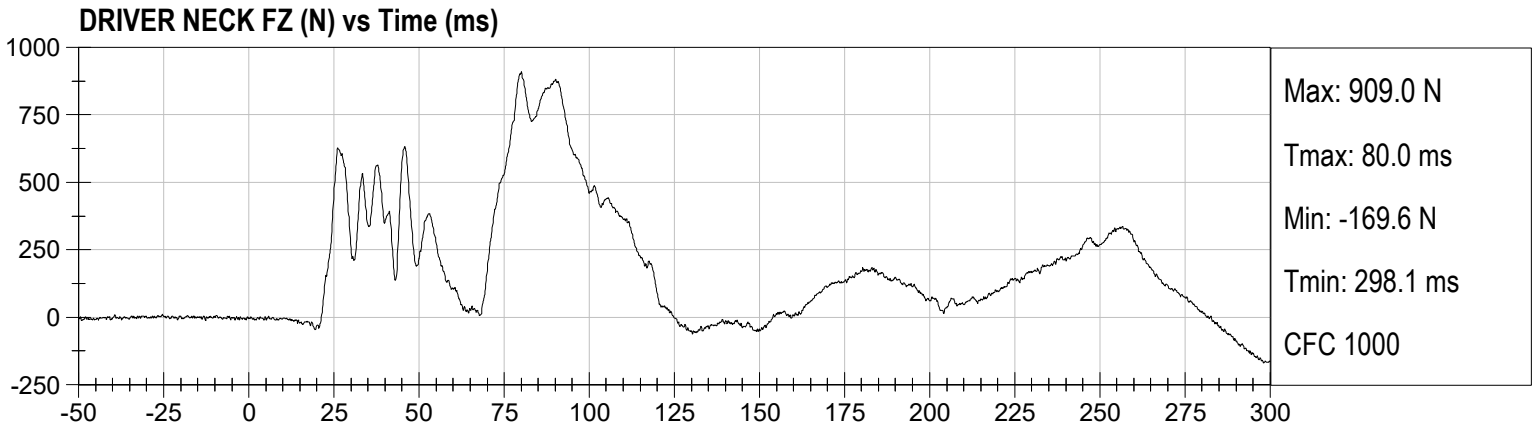
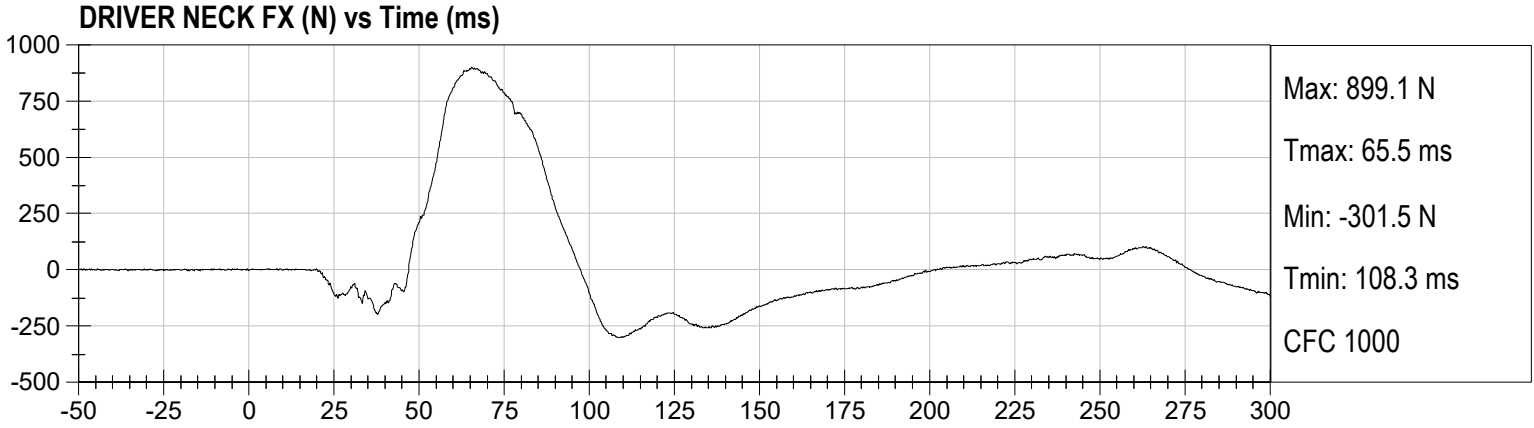
**DRIVER HEAD Resultant (g) vs Time (ms)**



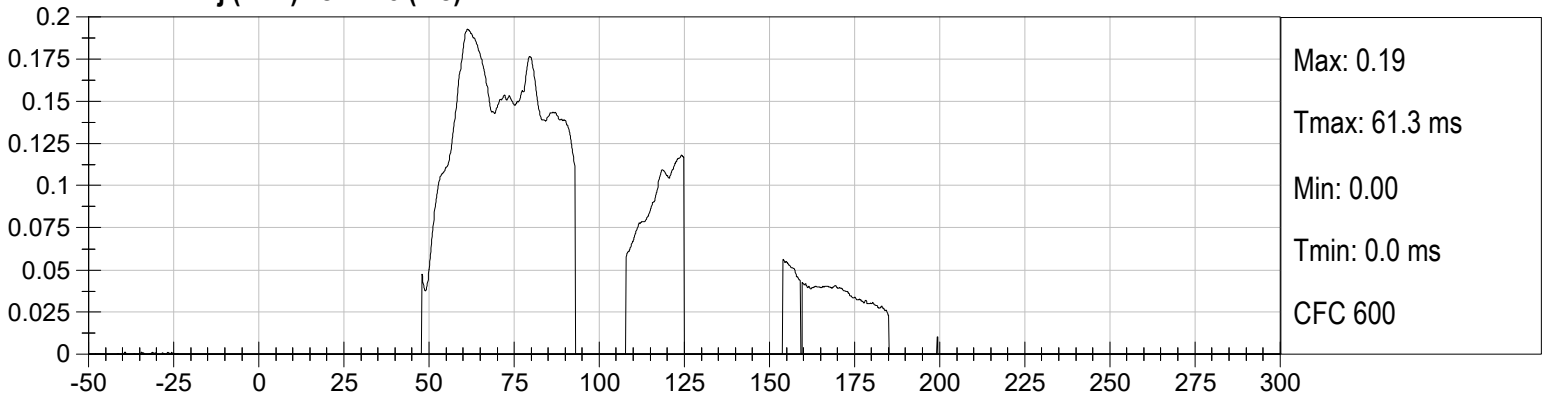
**DRIVER CHEST DISPLACEMENT (mm) vs Time (ms)**



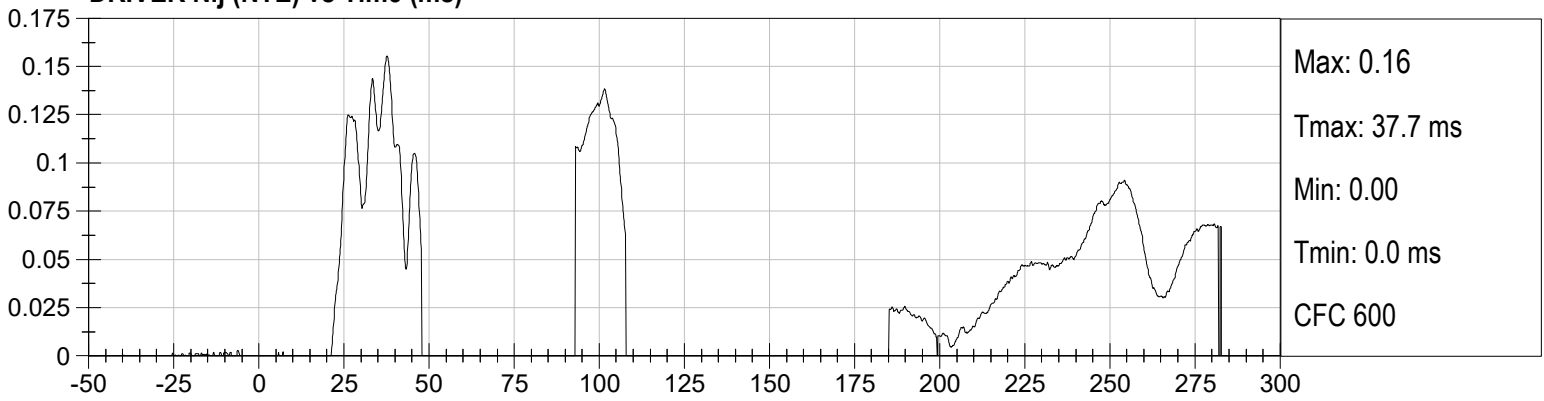




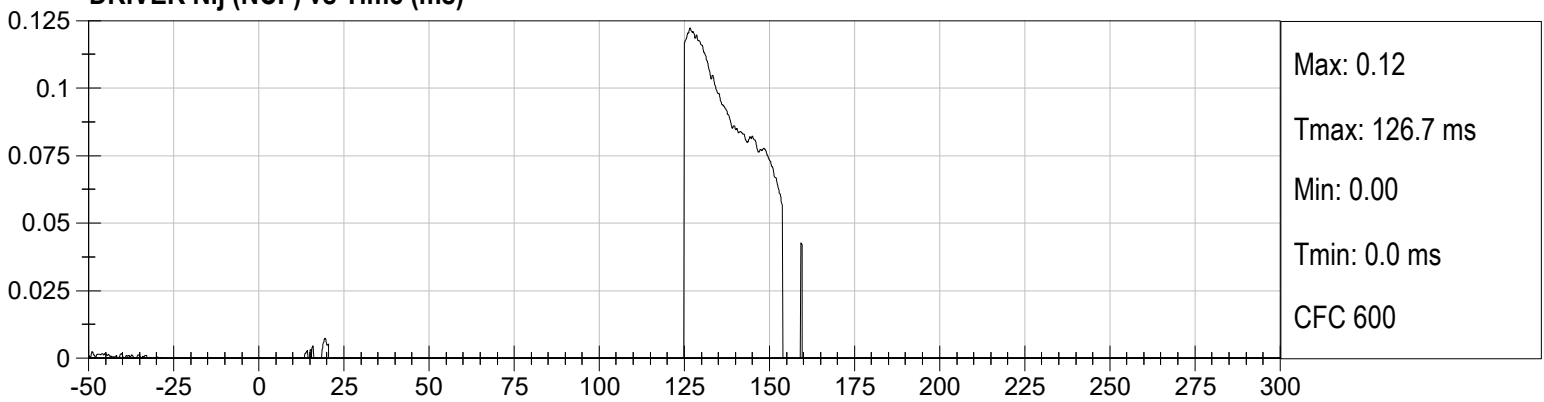
**DRIVER Nij (NTF) vs Time (ms)**



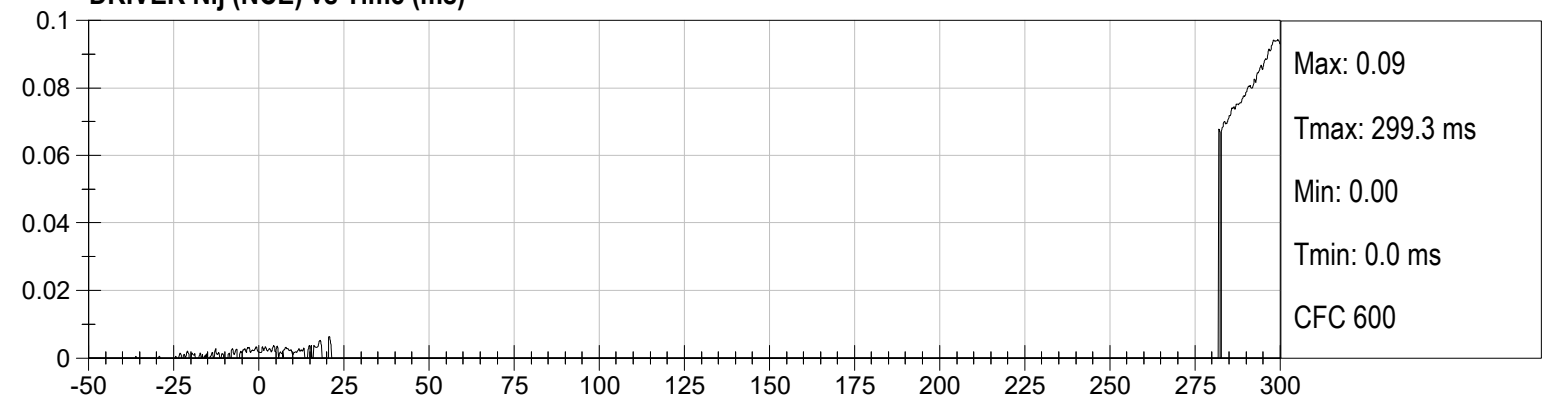
**DRIVER Nij (NTE) vs Time (ms)**



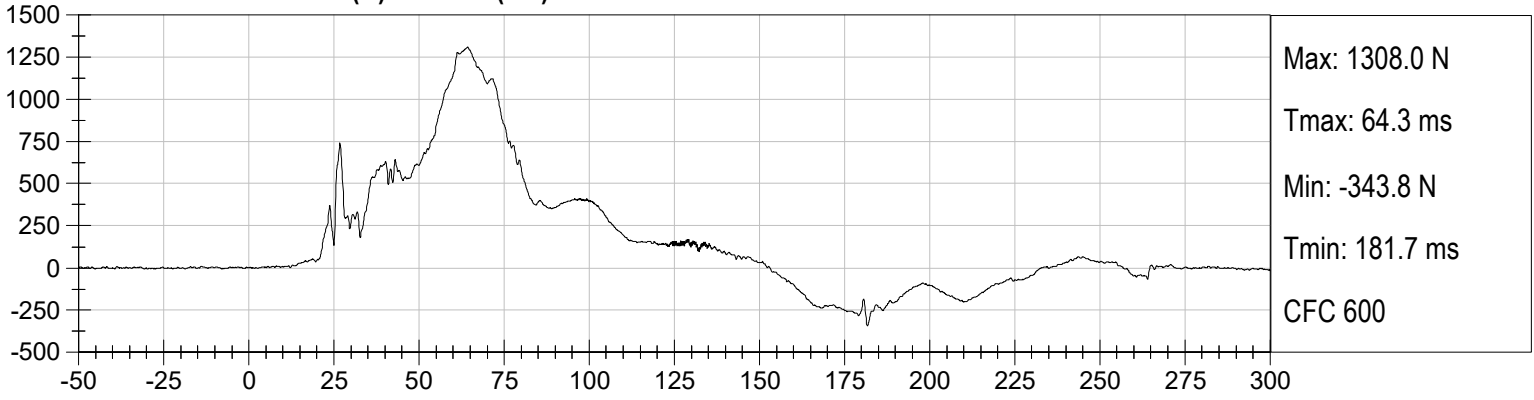
**DRIVER Nij (NCF) vs Time (ms)**



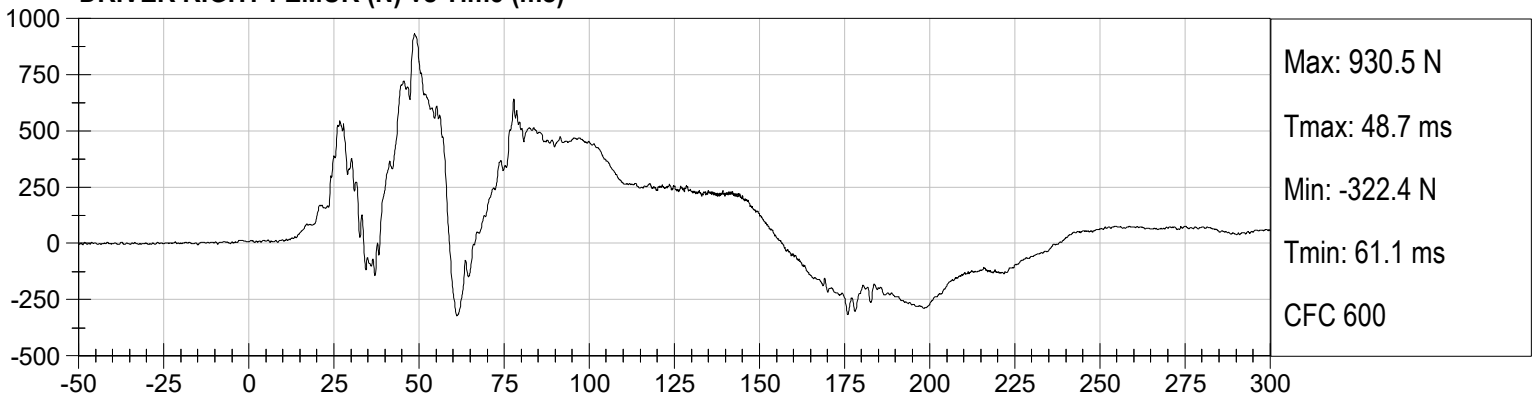
**DRIVER Nij (NCE) vs Time (ms)**



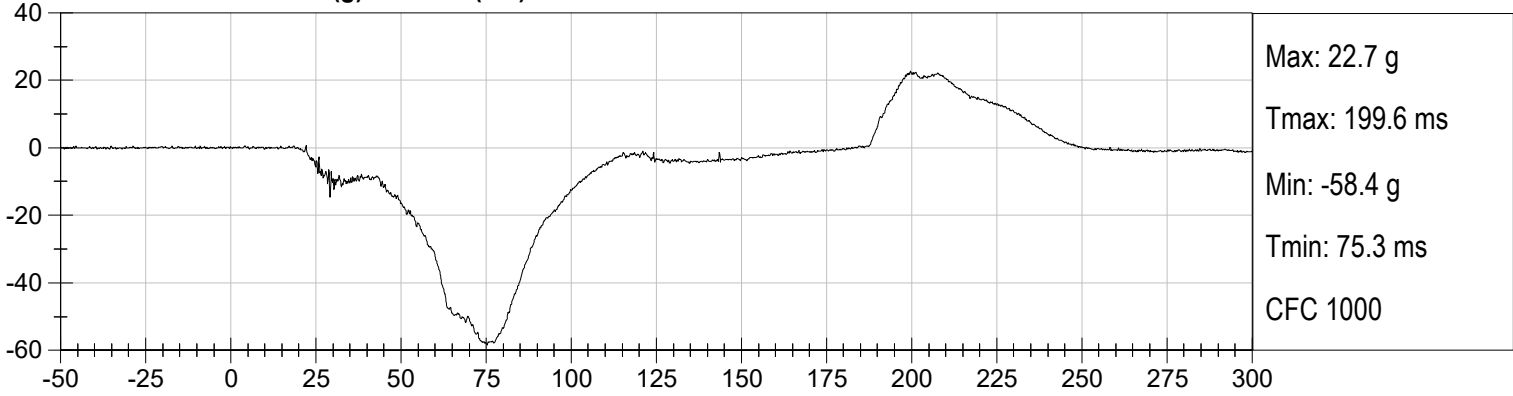
**DRIVER LEFT FEMUR (N) vs Time (ms)**



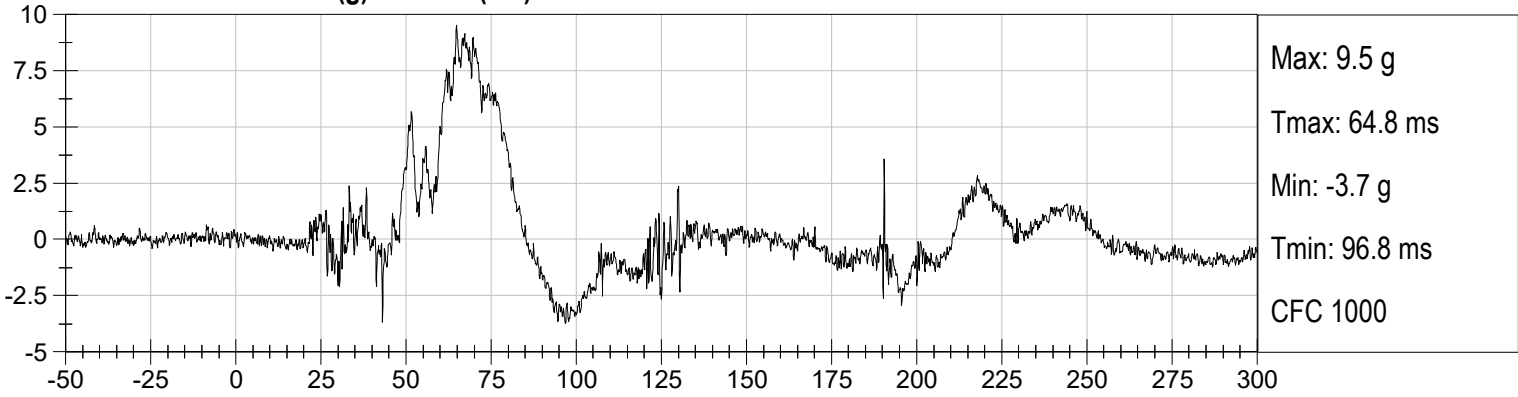
**DRIVER RIGHT FEMUR (N) vs Time (ms)**



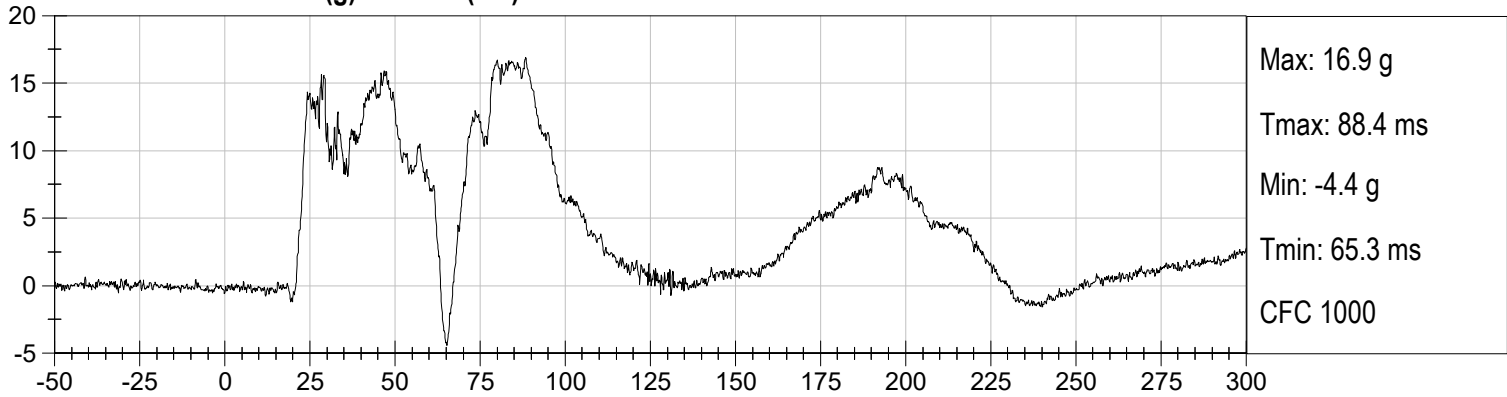
**PASSENGER HEAD X (g) vs Time (ms)**



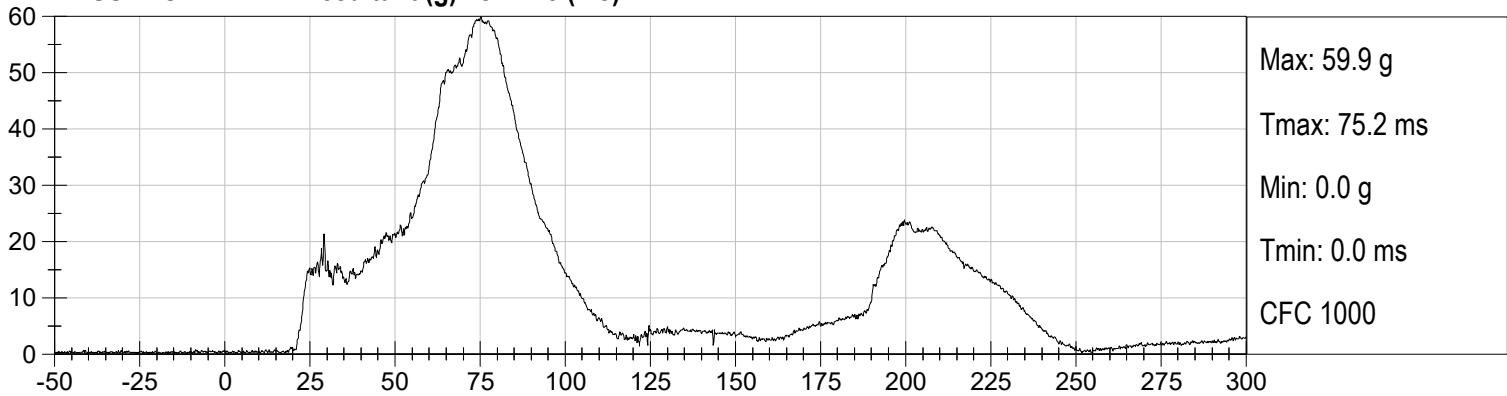
**PASSENGER HEAD Y (g) vs Time (ms)**



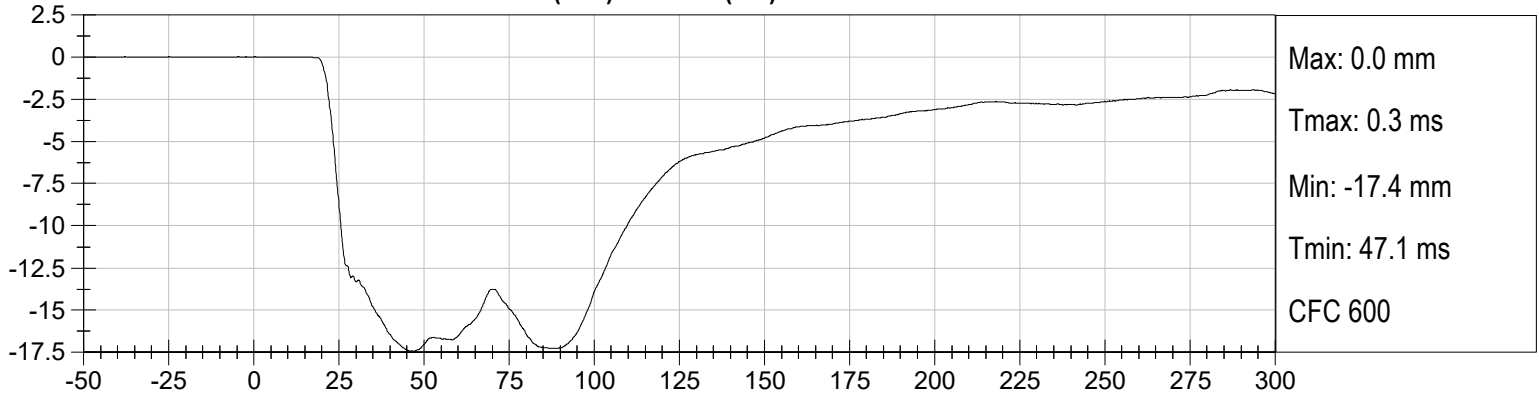
**PASSENGER HEAD Z (g) vs Time (ms)**



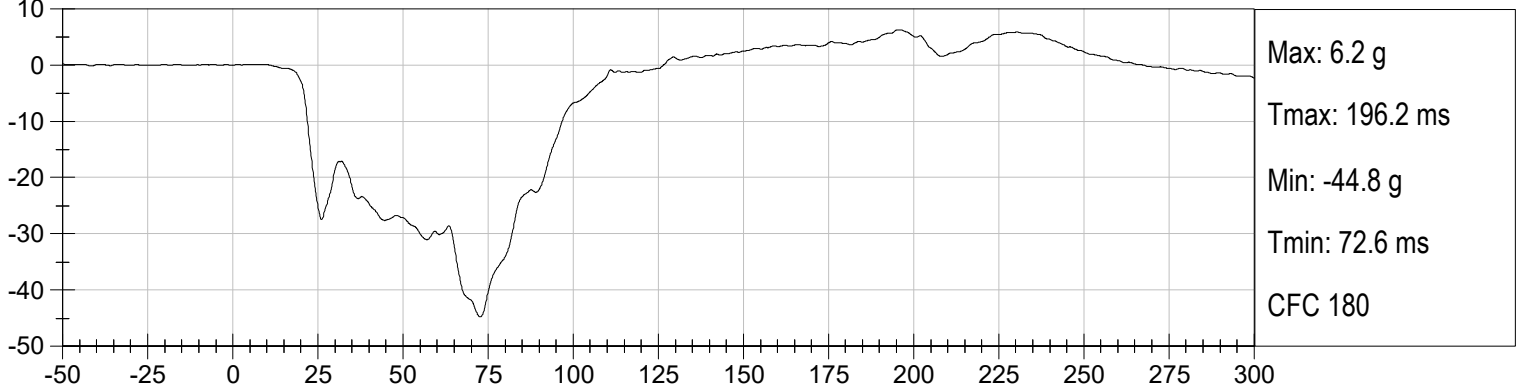
**PASSENGER HEAD Resultant (g) vs Time (ms)**



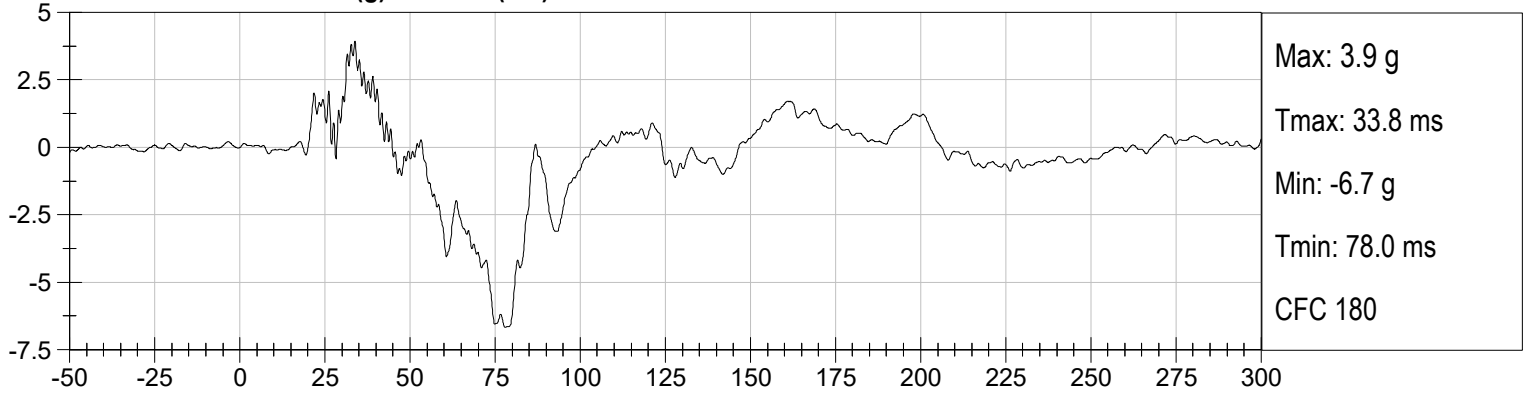
PASSENGER CHEST DISPLACEMENT (mm) vs Time (ms)



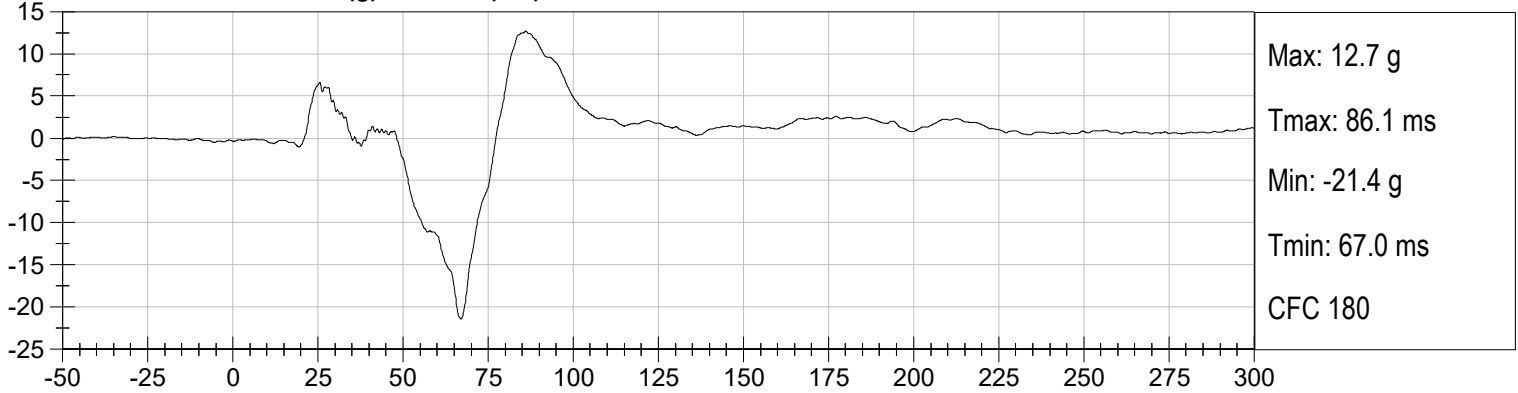
**PASSENGER CHEST X (g) vs Time (ms)**



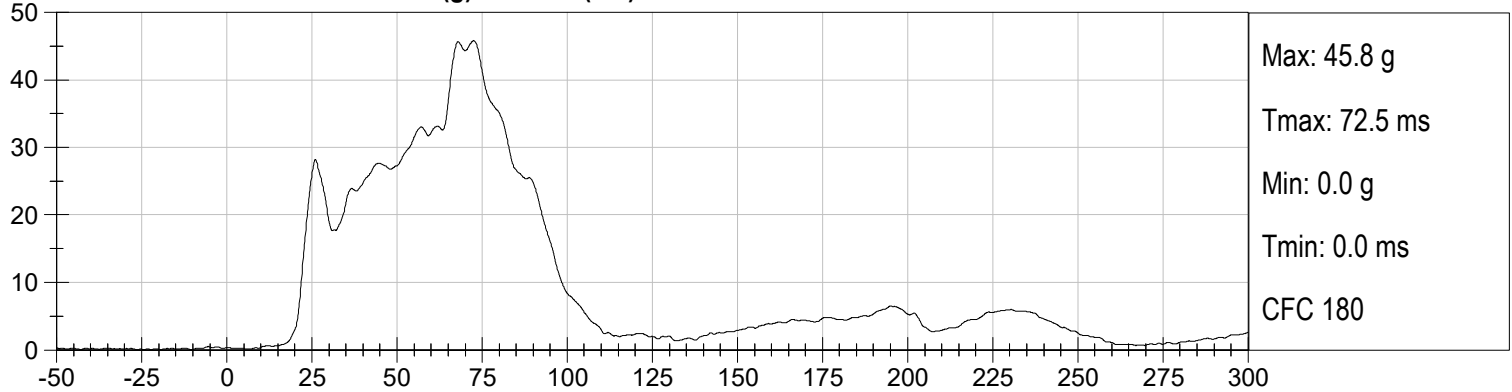
**PASSENGER CHEST Y (g) vs Time (ms)**



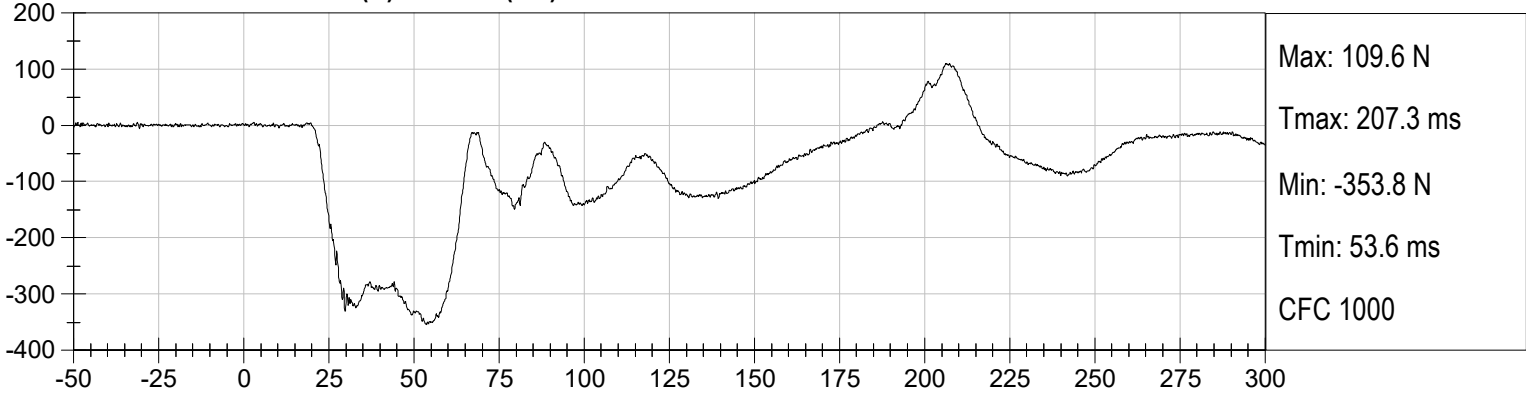
**PASSENGER CHEST Z (g) vs Time (ms)**



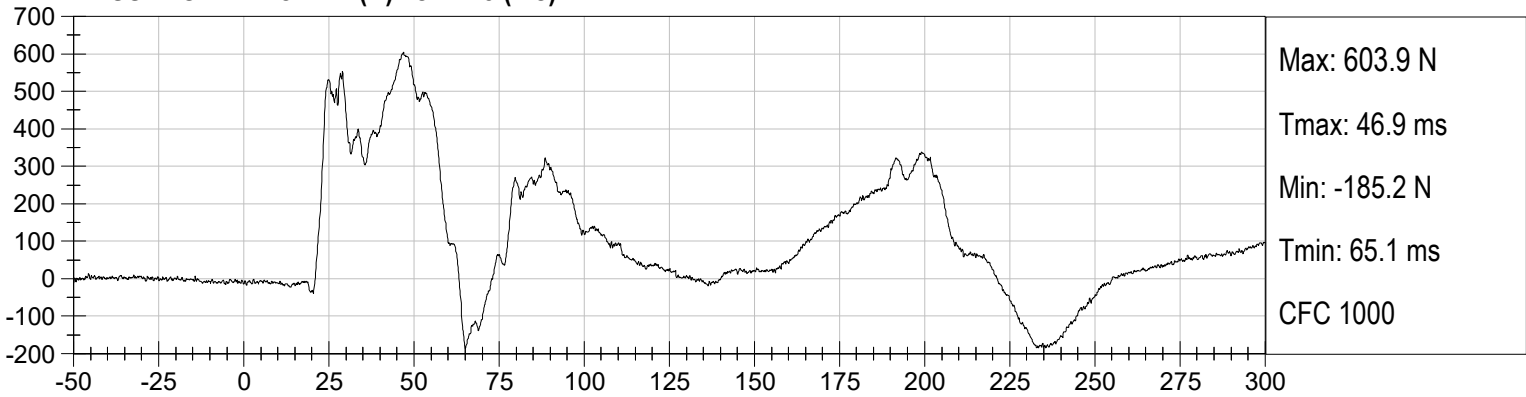
**PASSENGER CHEST Resultant (g) vs Time (ms)**



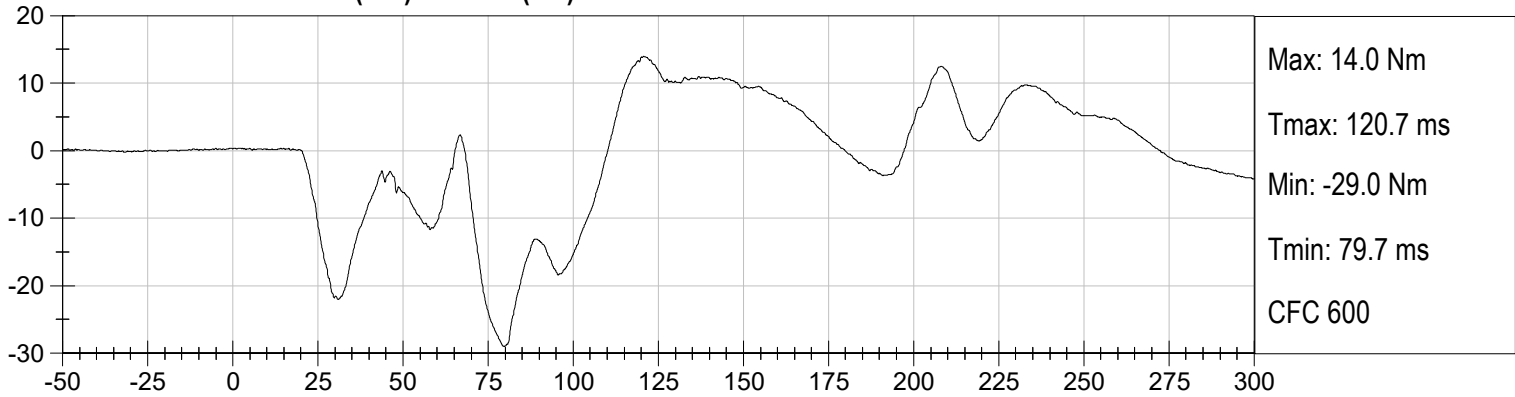
**PASSENGER NECK FX (N) vs Time (ms)**



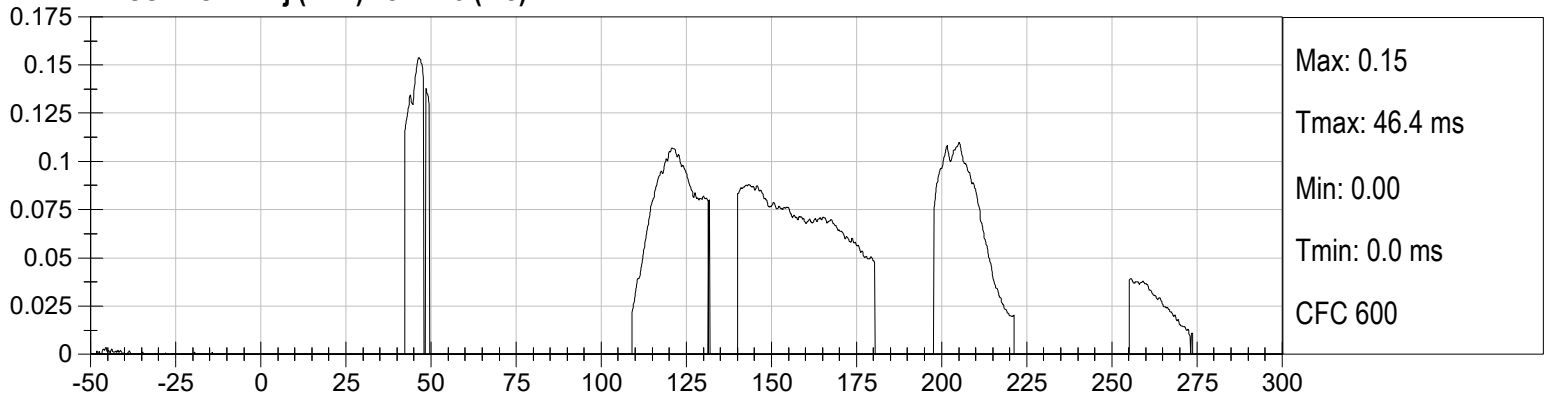
**PASSENGER NECK FZ (N) vs Time (ms)**



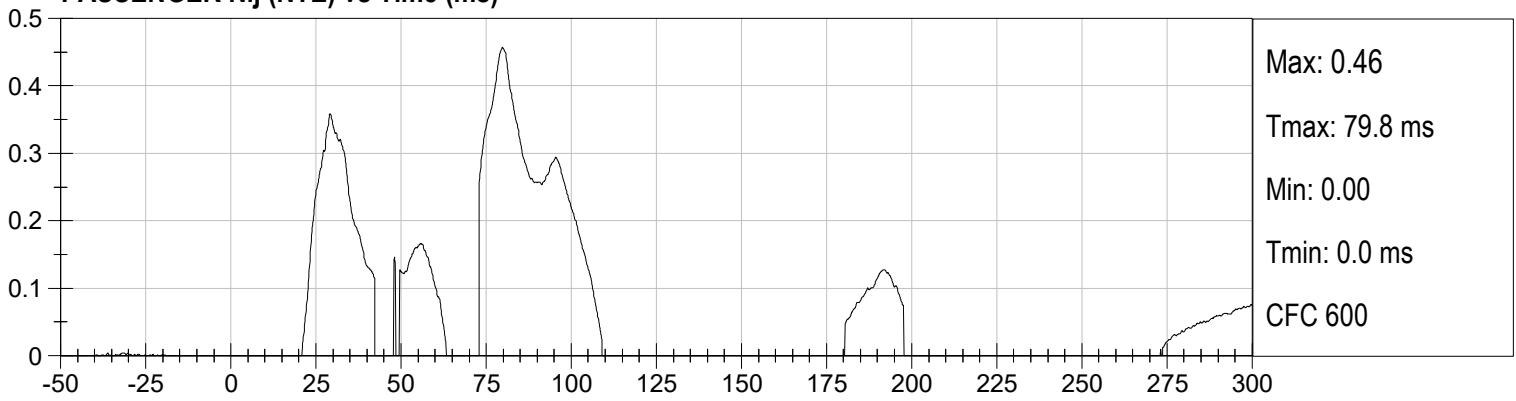
**PASSENGER NECK MY (Nm) vs Time (ms)**



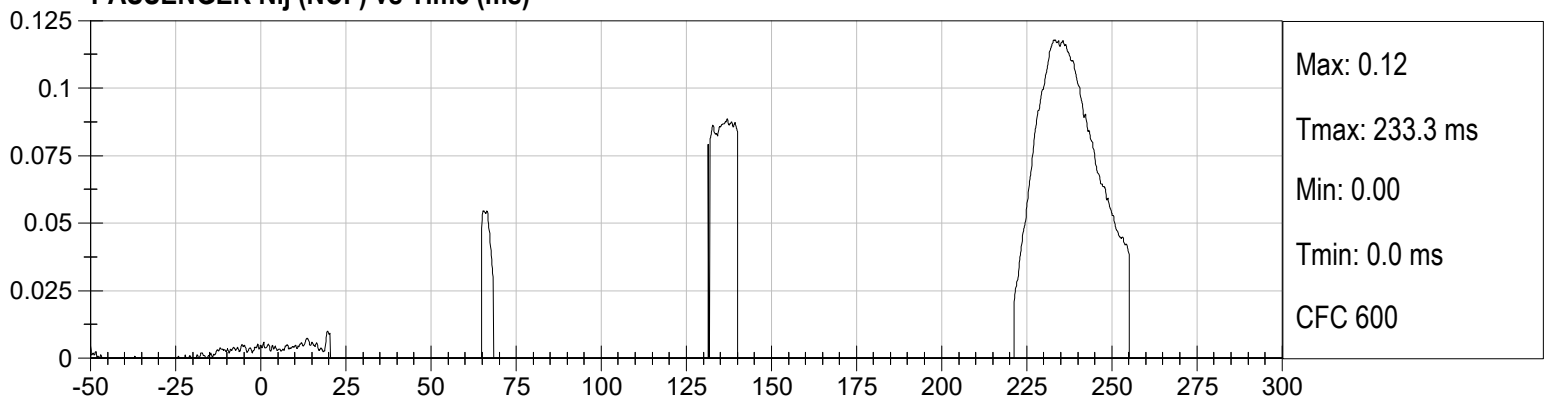
**PASSENGER Nij (NTF) vs Time (ms)**



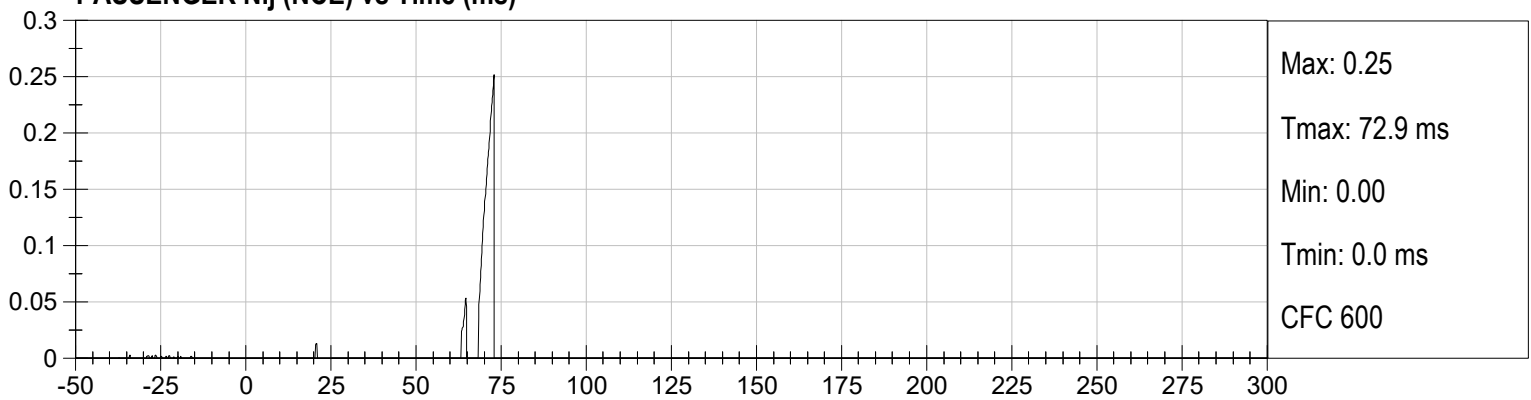
**PASSENGER Nij (NTE) vs Time (ms)**



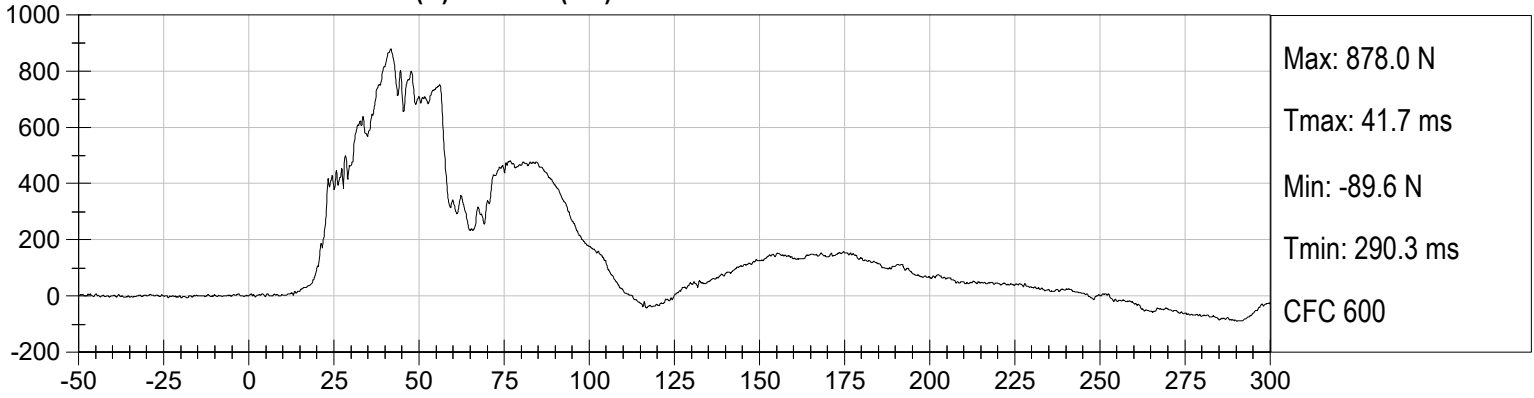
**PASSENGER Nij (NCF) vs Time (ms)**



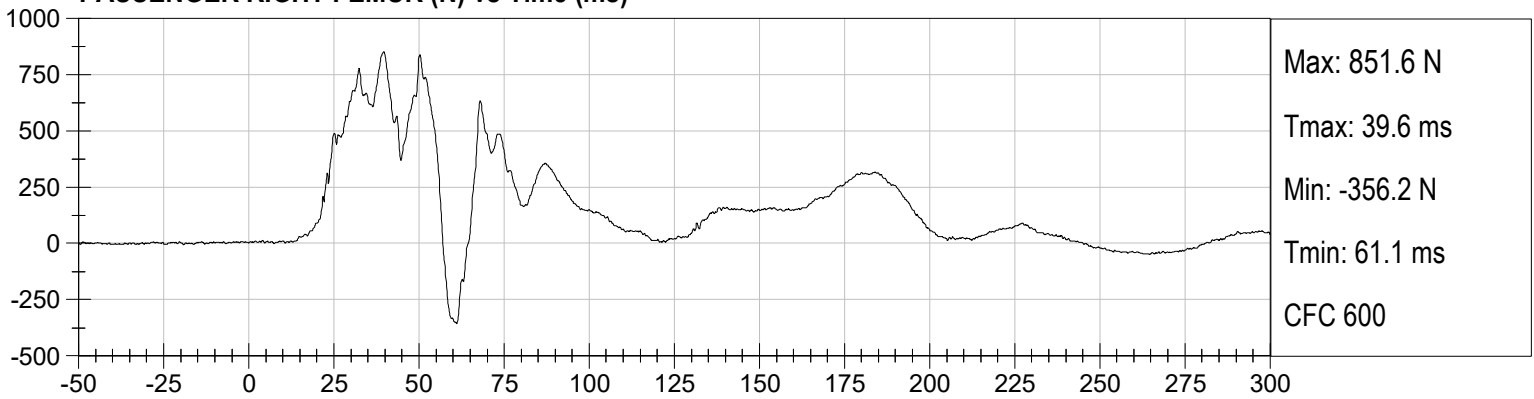
**PASSENGER Nij (NCE) vs Time (ms)**



**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 50<sup>TH</sup> 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**

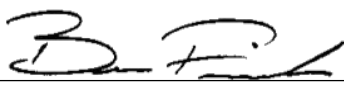
ATD Serial No: 351

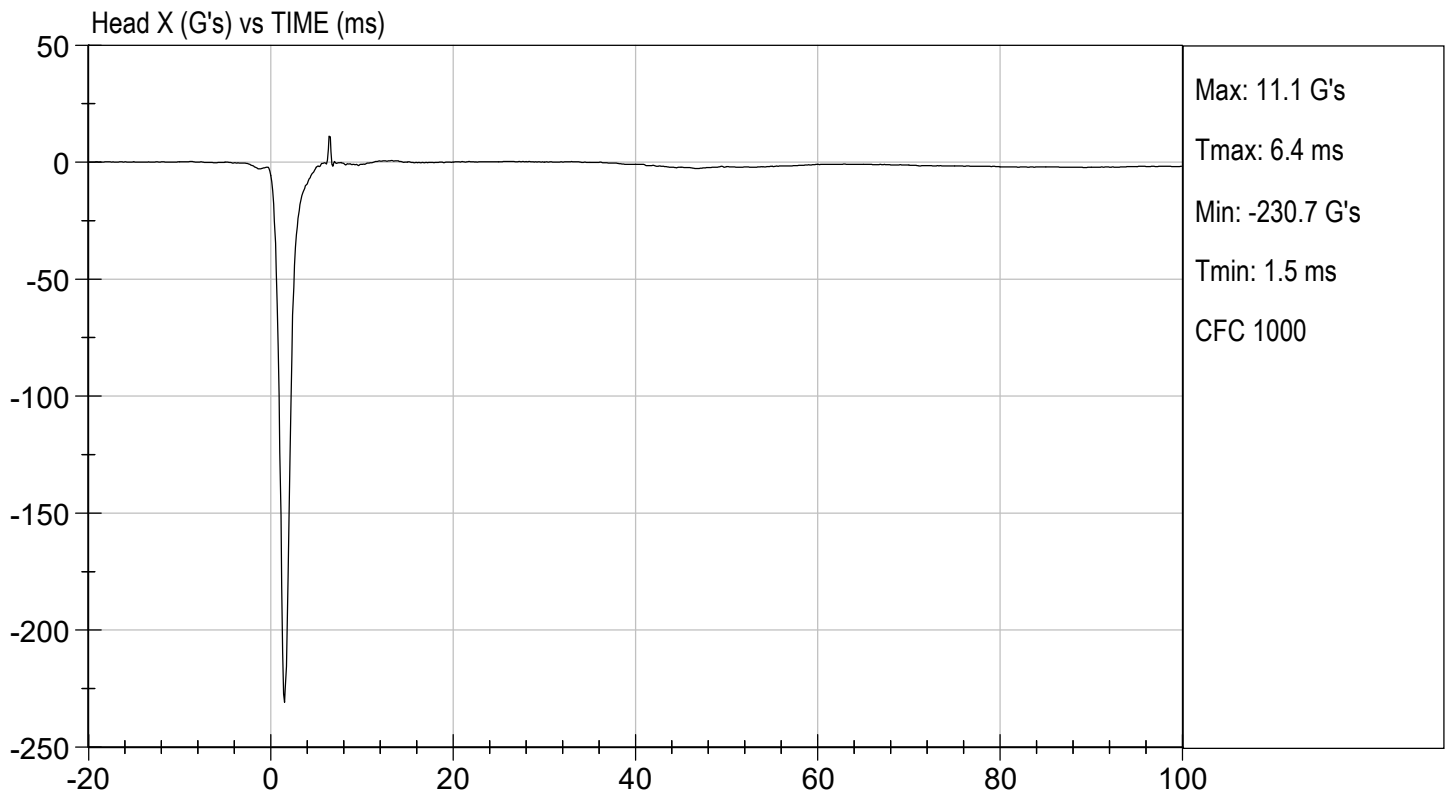
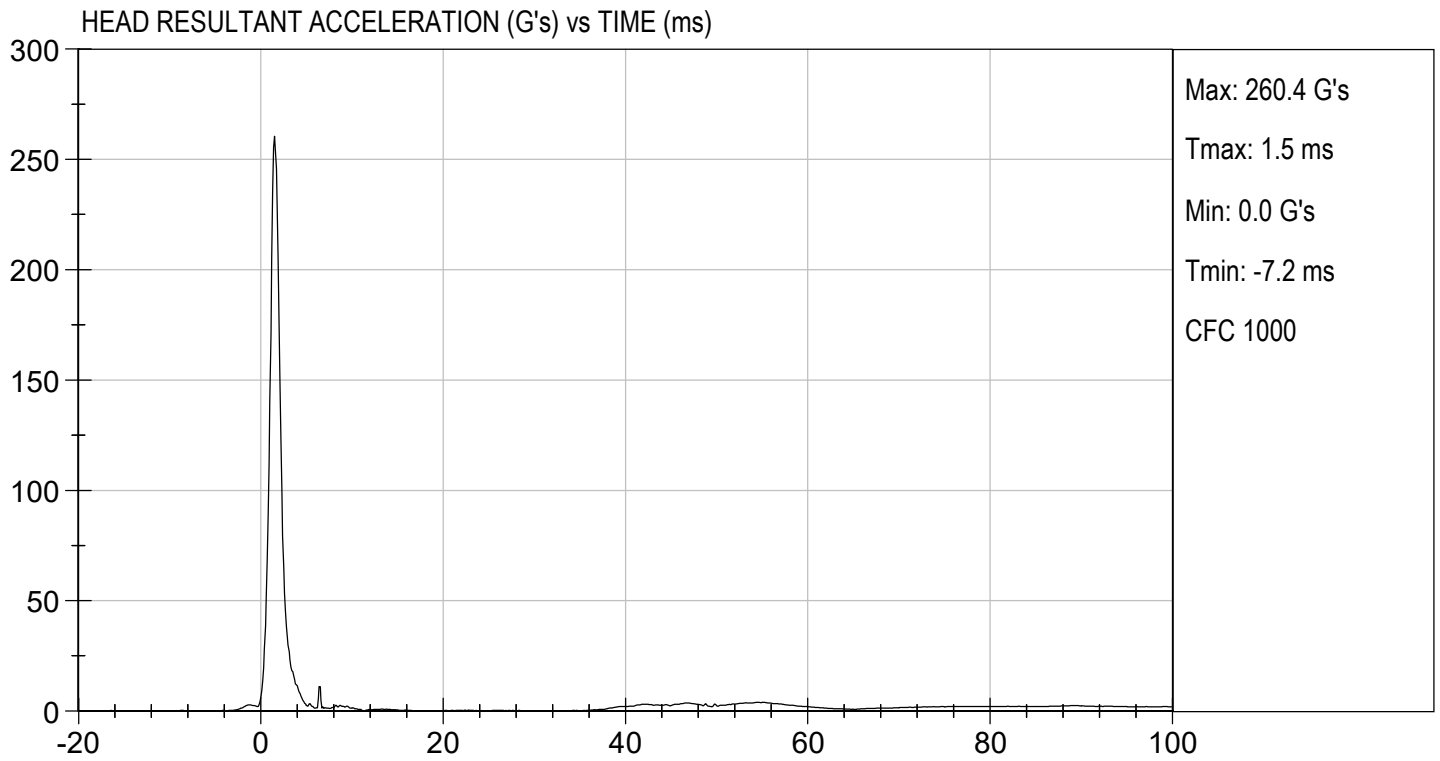
Test ID: D213411

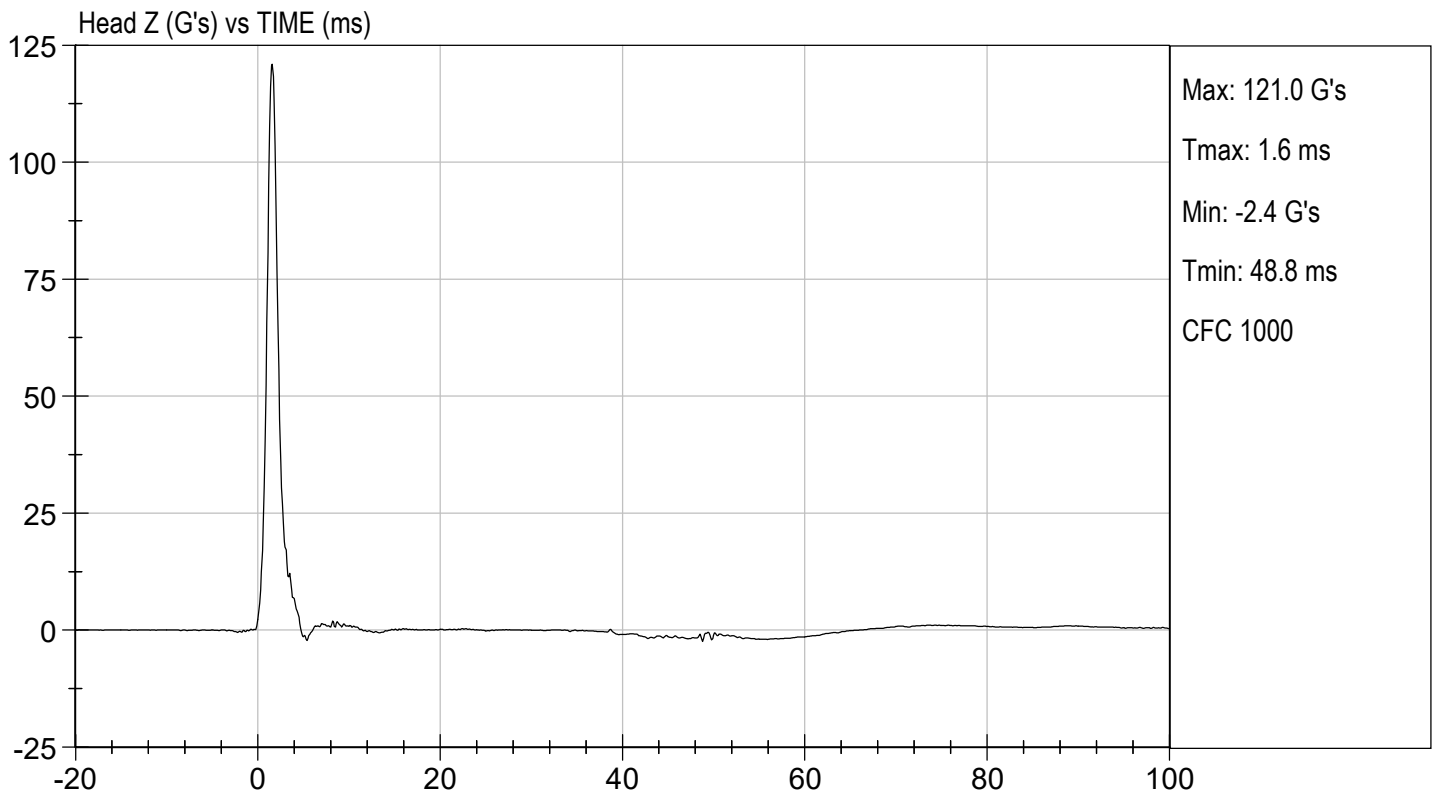
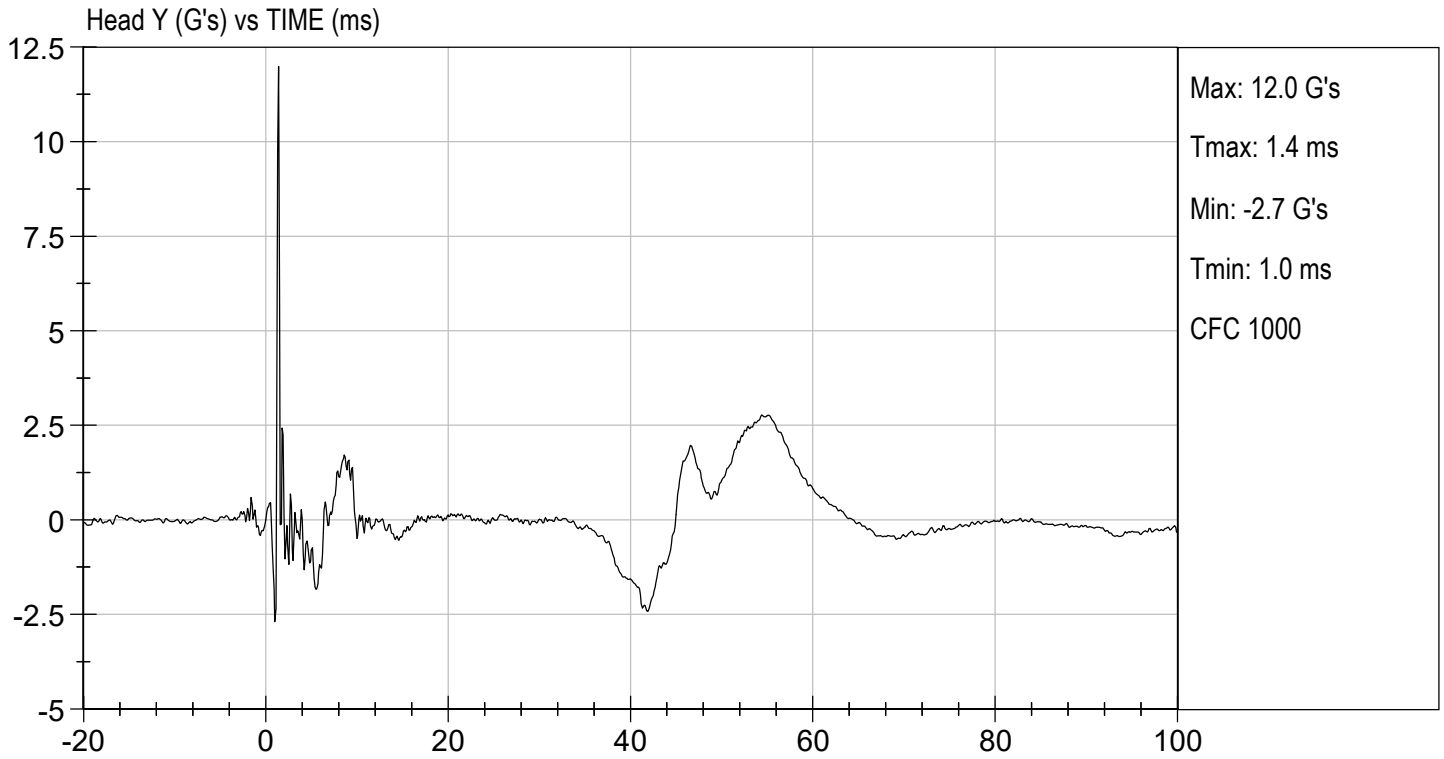
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Peak Resultant Acceleration	G's	225 to 275	260	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	12.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

  
 Laboratory Technician

10/28/2021  
 Test Date

  
 Approved By






**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 50TH PERCENTILE MALE**

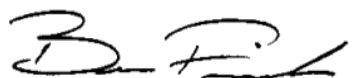
**ATD Serial No:** 351

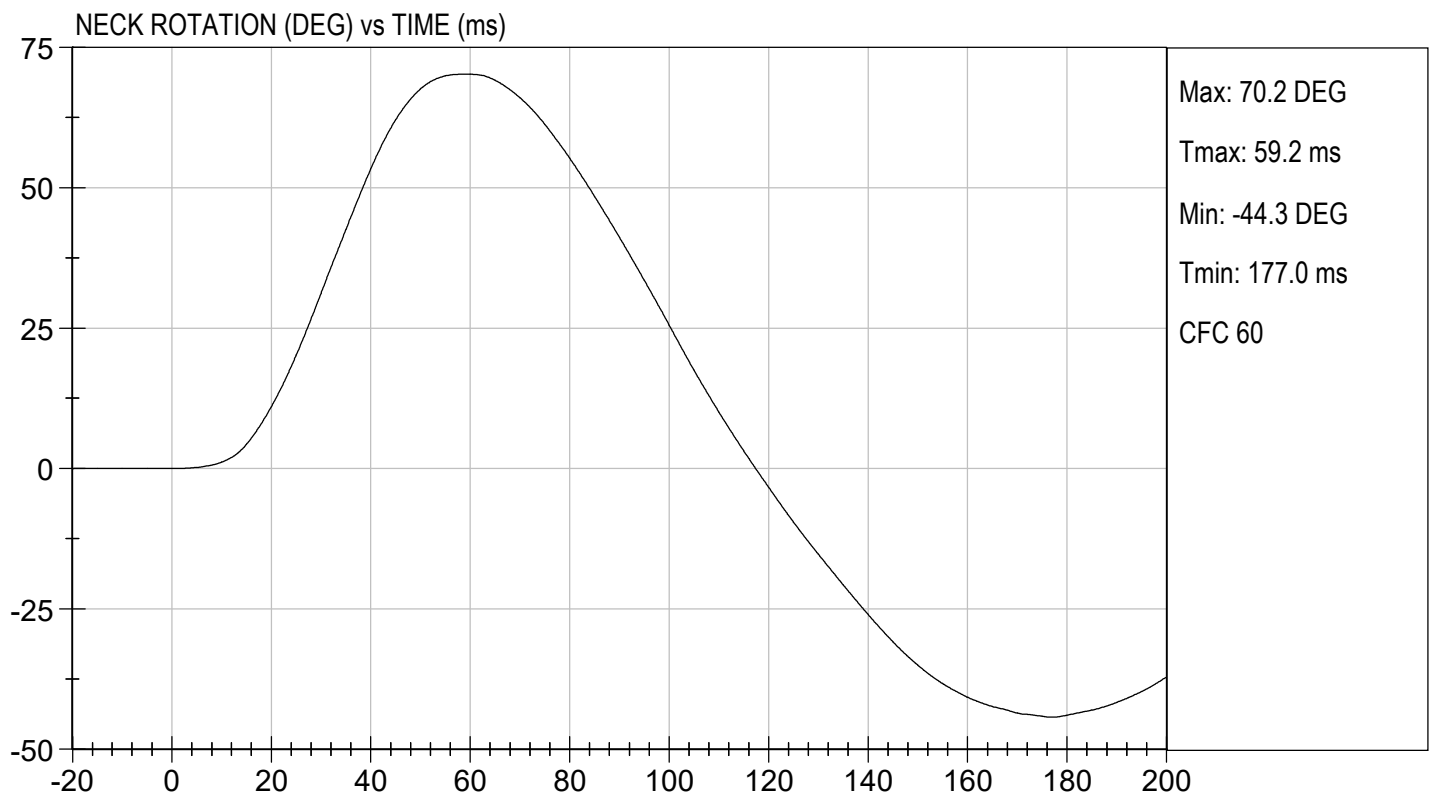
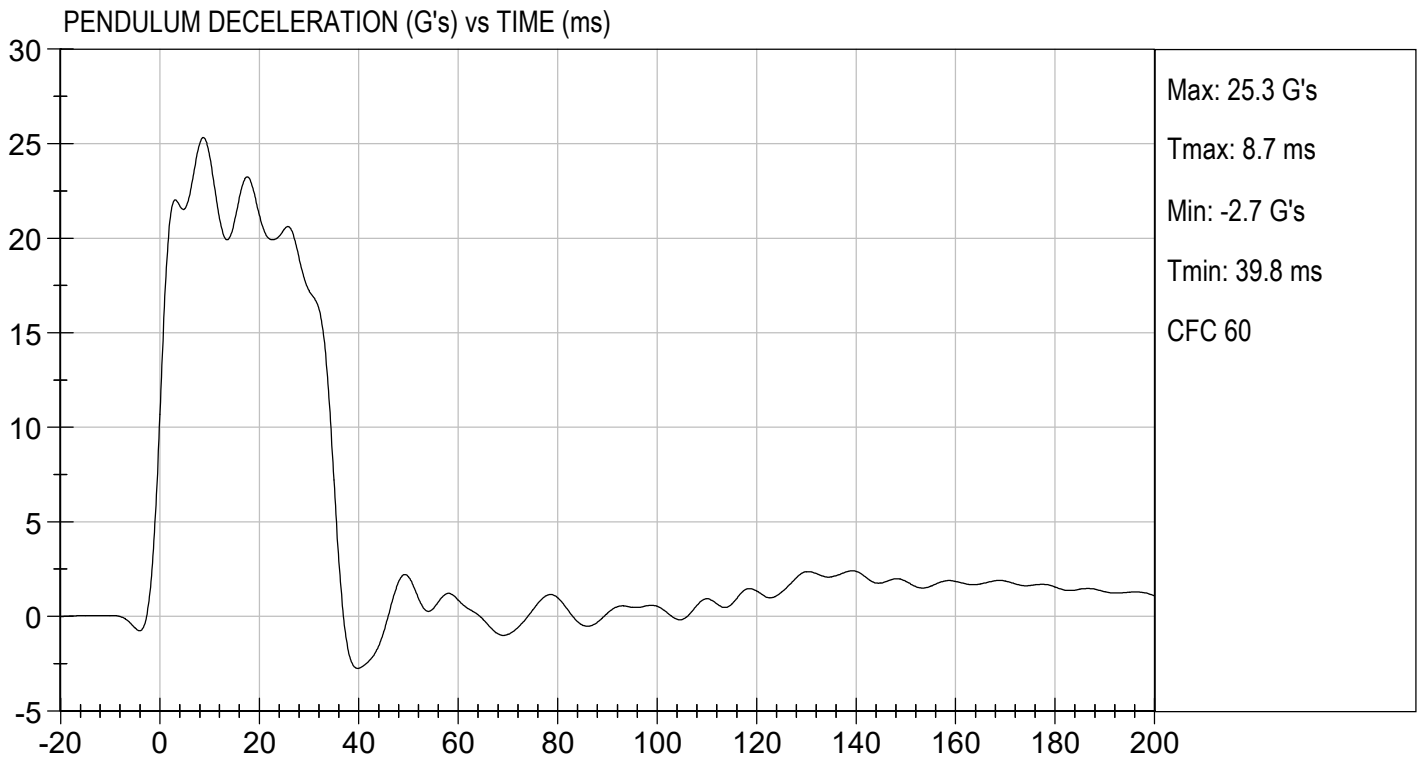
**Test I.D:** D213412

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	33	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.05	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.34	Pass
	20 ms	G's	17.60 to 22.60	21.21	Pass
	30 ms	G's	12.50 to 18.50	17.22	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	17.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.6	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	70.2	Pass
	Time	ms	57.0 to 64.0	59.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	117.5	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	94.6	Pass
	Time	ms	47.0 to 58.0	47.3	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.7	Pass
<b>Overall Test Results</b>					<b>Pass</b>

  
 \_\_\_\_\_  
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 \_\_\_\_\_  
 Test Date

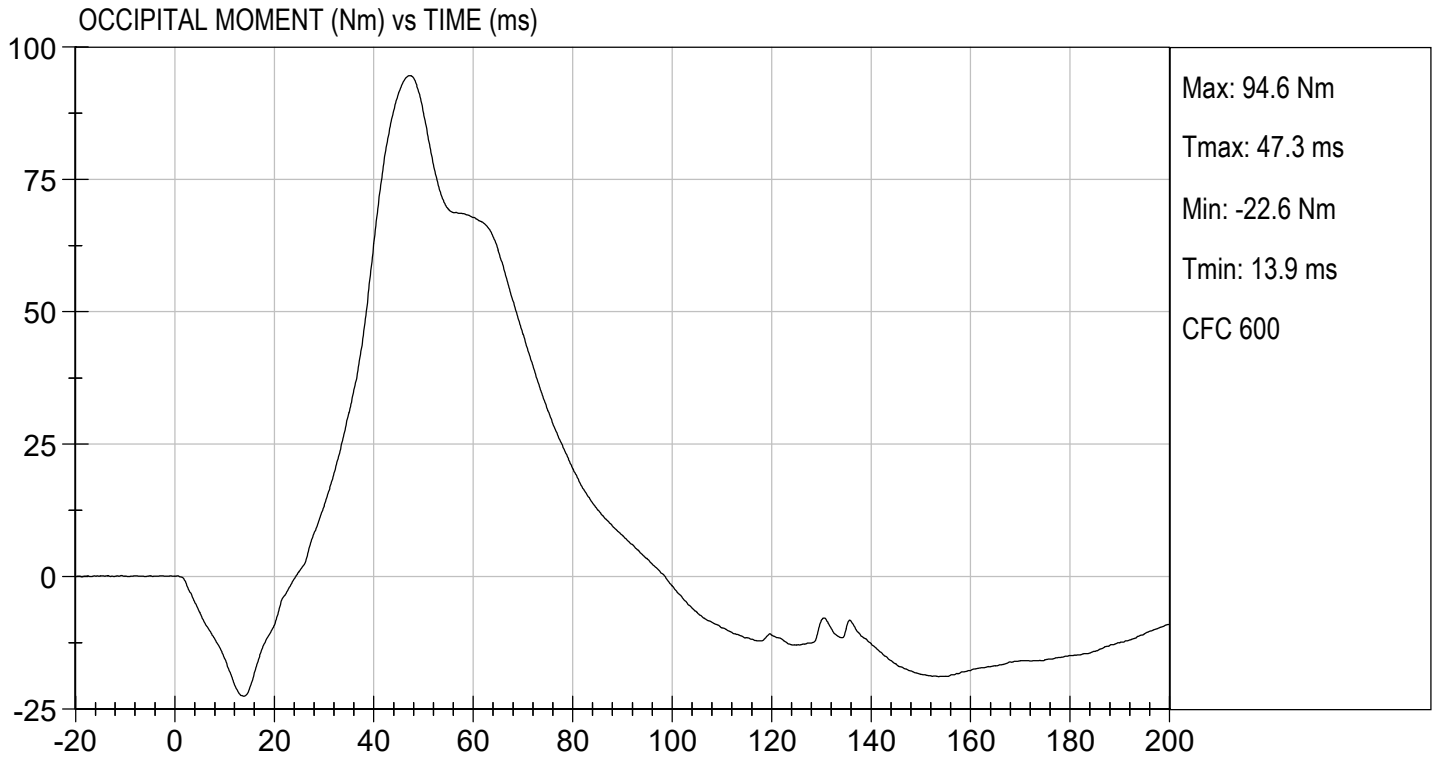
  
 \_\_\_\_\_  
 Approved By





TEST DESC: NECK FLEXION  
VELOCITY: 23.14 ft/s, 7.05 m/s

TEST DATE: 10/28/2021  
TEST #: D213412



**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 50TH PERCENTILE MALE**

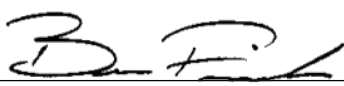
ATD Serial No: 351

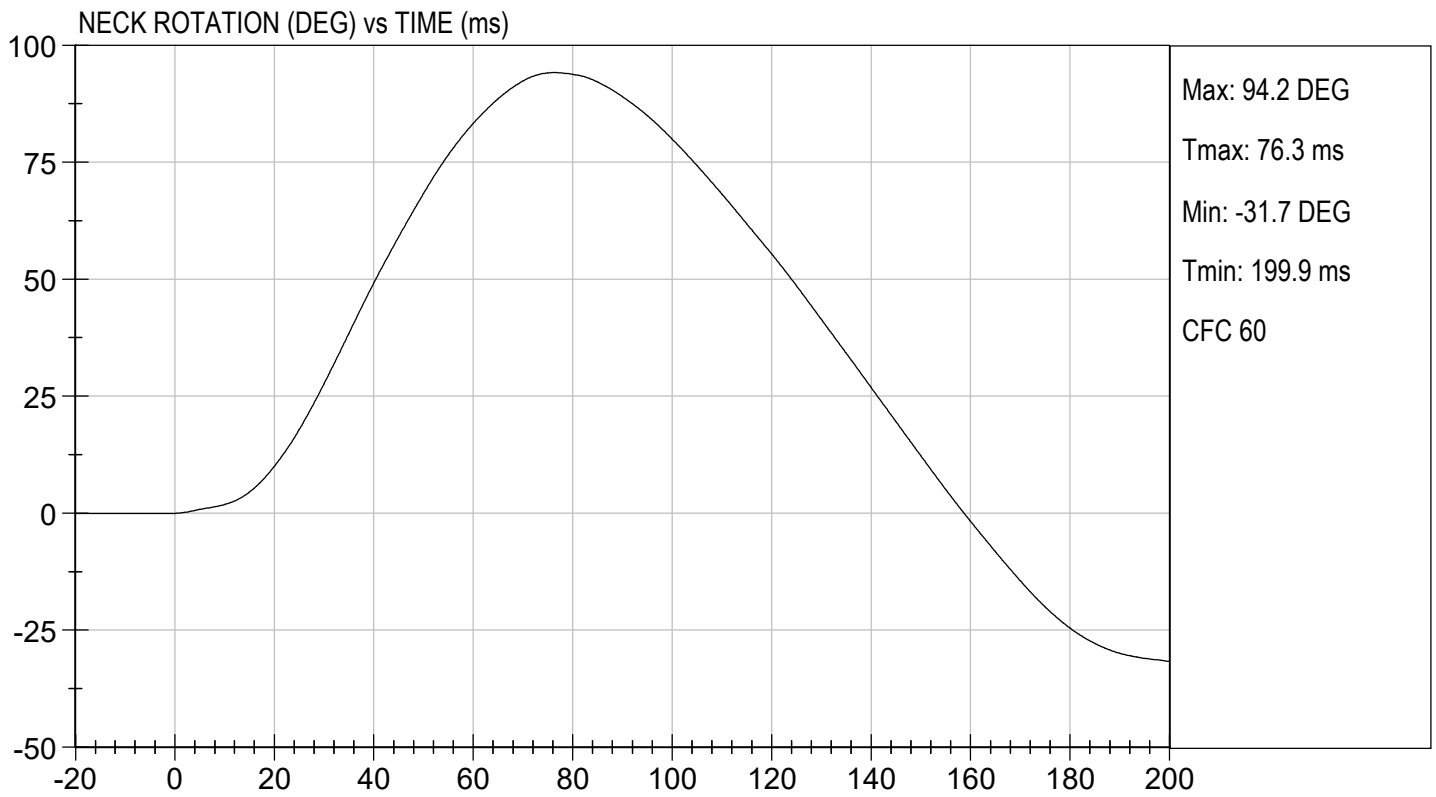
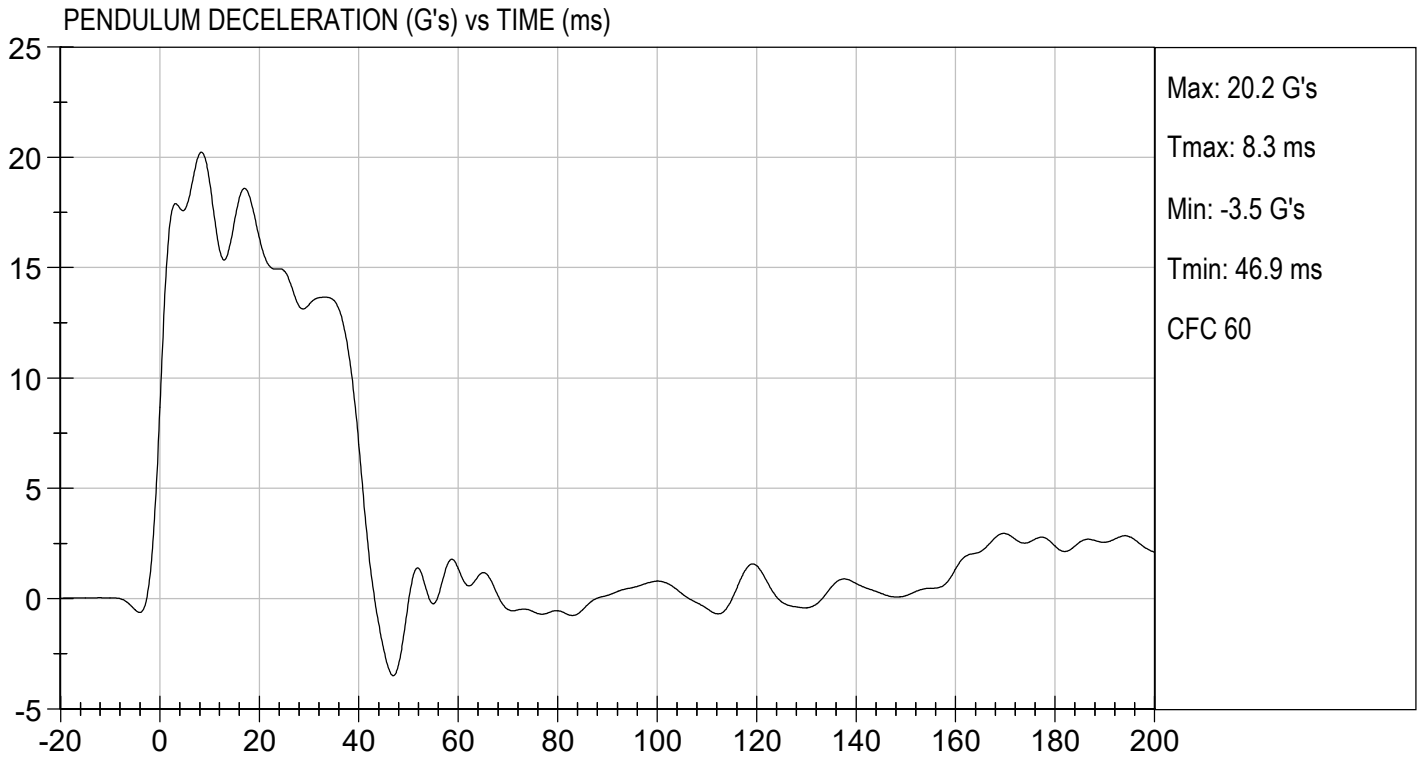
Test I.D.: D213413

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	33	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.89	Pass
	20 ms	G's	14.00 to 19.00	16.34	Pass
	30 ms	G's	11.00 to 16.00	13.33	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.7	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	40.9	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.2	Pass
	Time	ms	72.0 to 82.0	76.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	158.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-60.9	Pass
	Time	ms	65.0 to 79.0	71.9	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.7	Pass
Overall Test Results					Pass

  
 Laboratory Technician

10/28/2021  
 Test Date

  
 Approved By





**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 50TH PERCENTILE MALE**

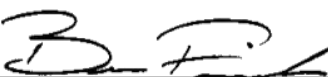
**ATD Serial No:** 351

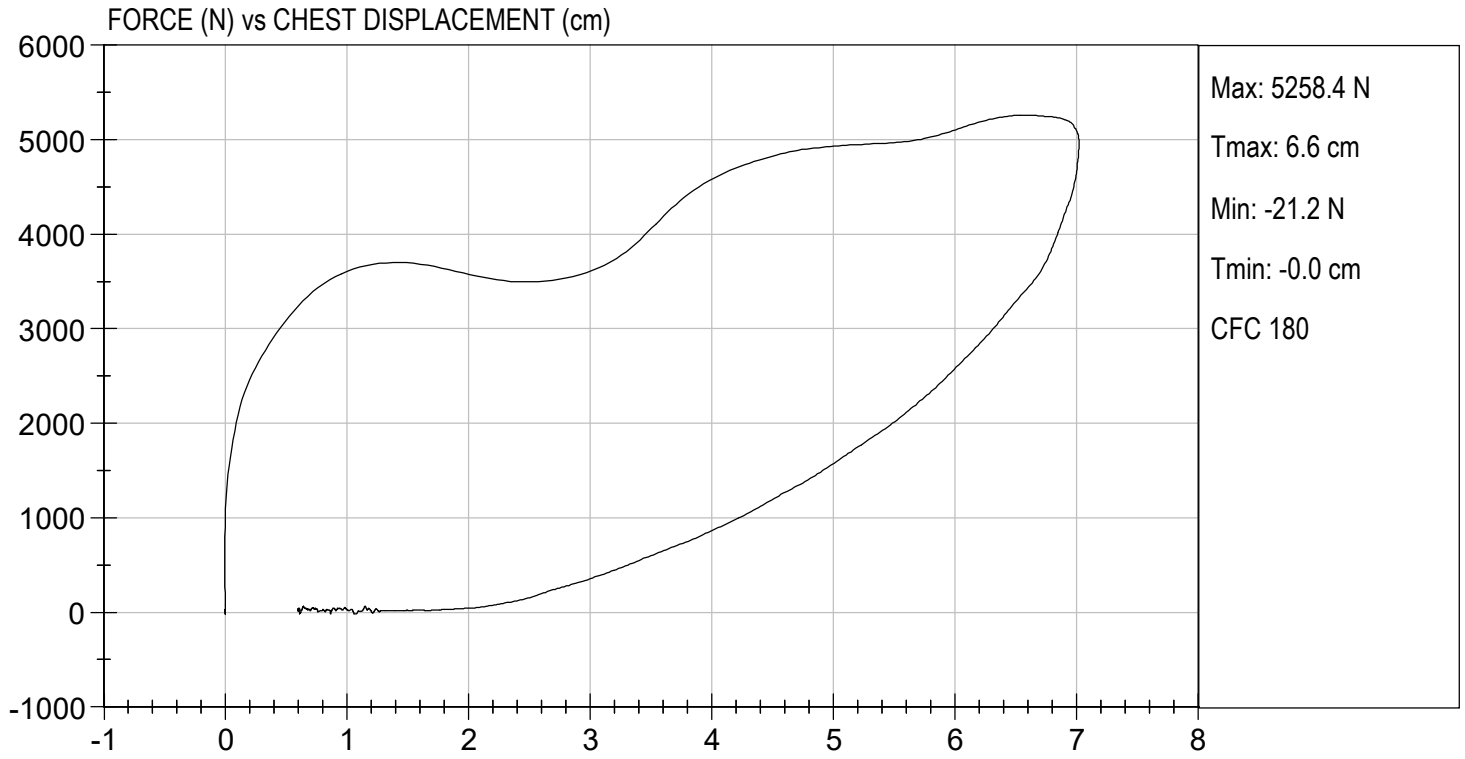
**Test I.D:** D213414

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,258	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	7.02	Pass
Internal Hysteresis	%	69 to 85	74	Pass
<b>Overall Test Results</b>				<b>Pass</b>

  
 Laboratory Technician

11/05/2021  
 Test Date

  
 Approved By



**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 50TH PERCENTILE MALE**

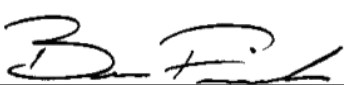
ATD Serial No: 351

Test I.D: D213415

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Probe Velocity	m/s	2.07 to 2.13	2.07	Pass
Peak Probe Force	N	4715 to 5782	5,198	Pass
Overall Test Results				Pass

  
 Laboratory Technician

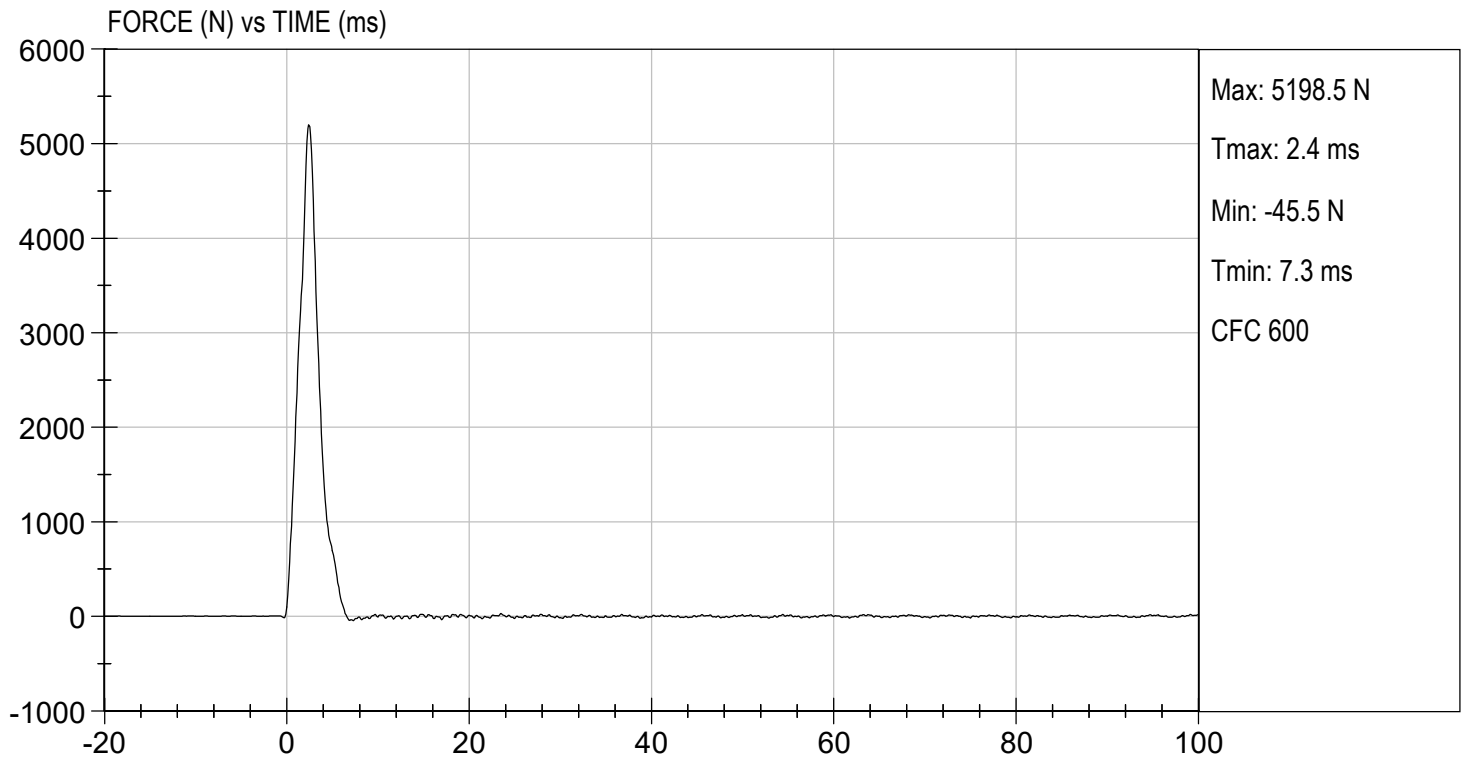
10/27/2021  
 Test Date

  
 Approved By



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

TEST DATE: 10/27/2021  
TEST #: D213415



**MGA RESEARCH CORPORATION**  
**LEFT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

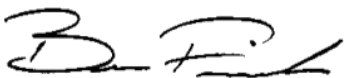
ATD Serial No: 351

Test I.D: D213416

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3576	Pass
Overall Test Results				Pass

  
 \_\_\_\_\_  
 Laboratory Technician

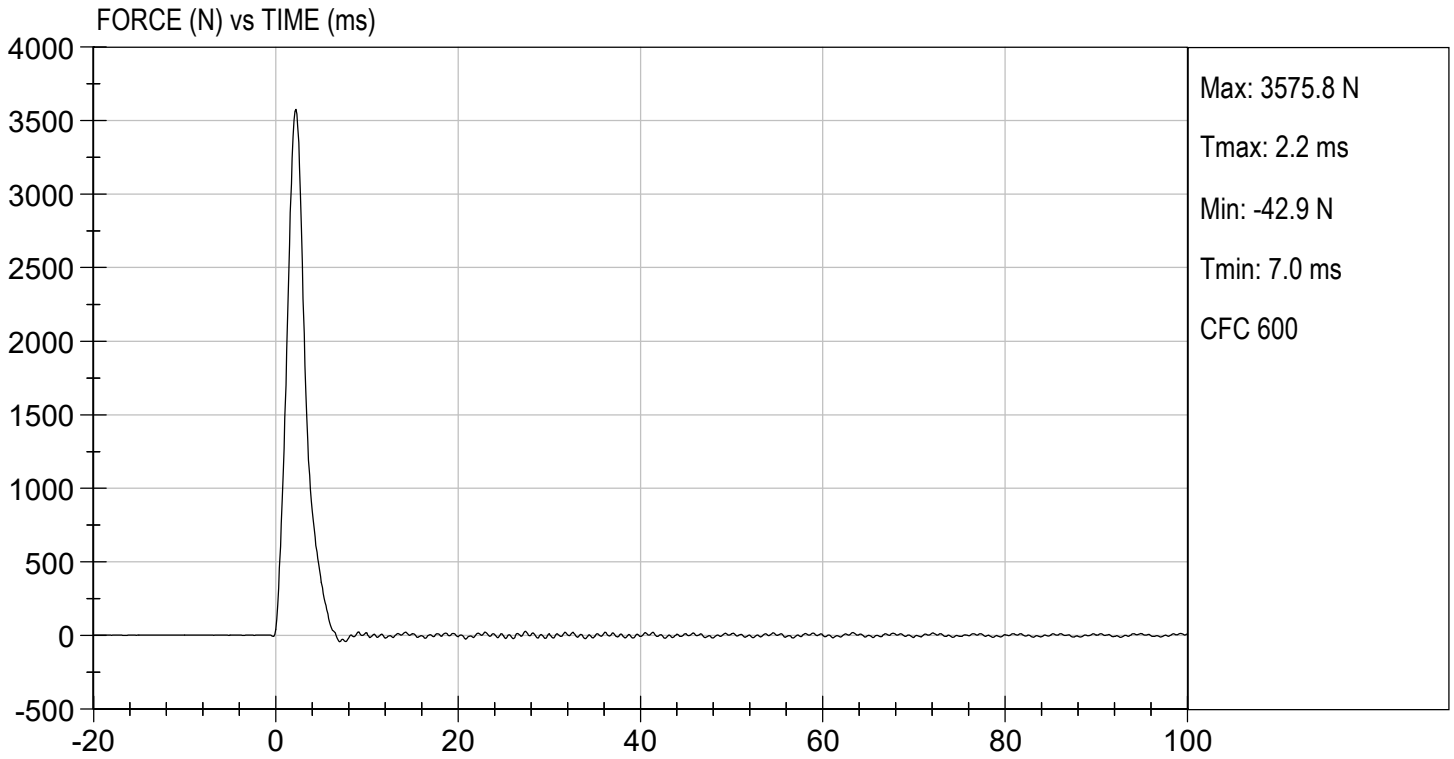
10/27/2021  
 \_\_\_\_\_  
 Test Date

  
 \_\_\_\_\_  
 Approved By



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

TEST DATE: 10/27/2021  
TEST #: D213416



**MGA RESEARCH CORPORATION**  
**HIP-FEMUR FLEXION TEST**  
**HYBRID III 50TH PERCENTILE MALE**

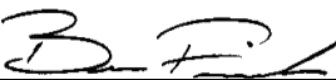
**ATD Serial No:** 351

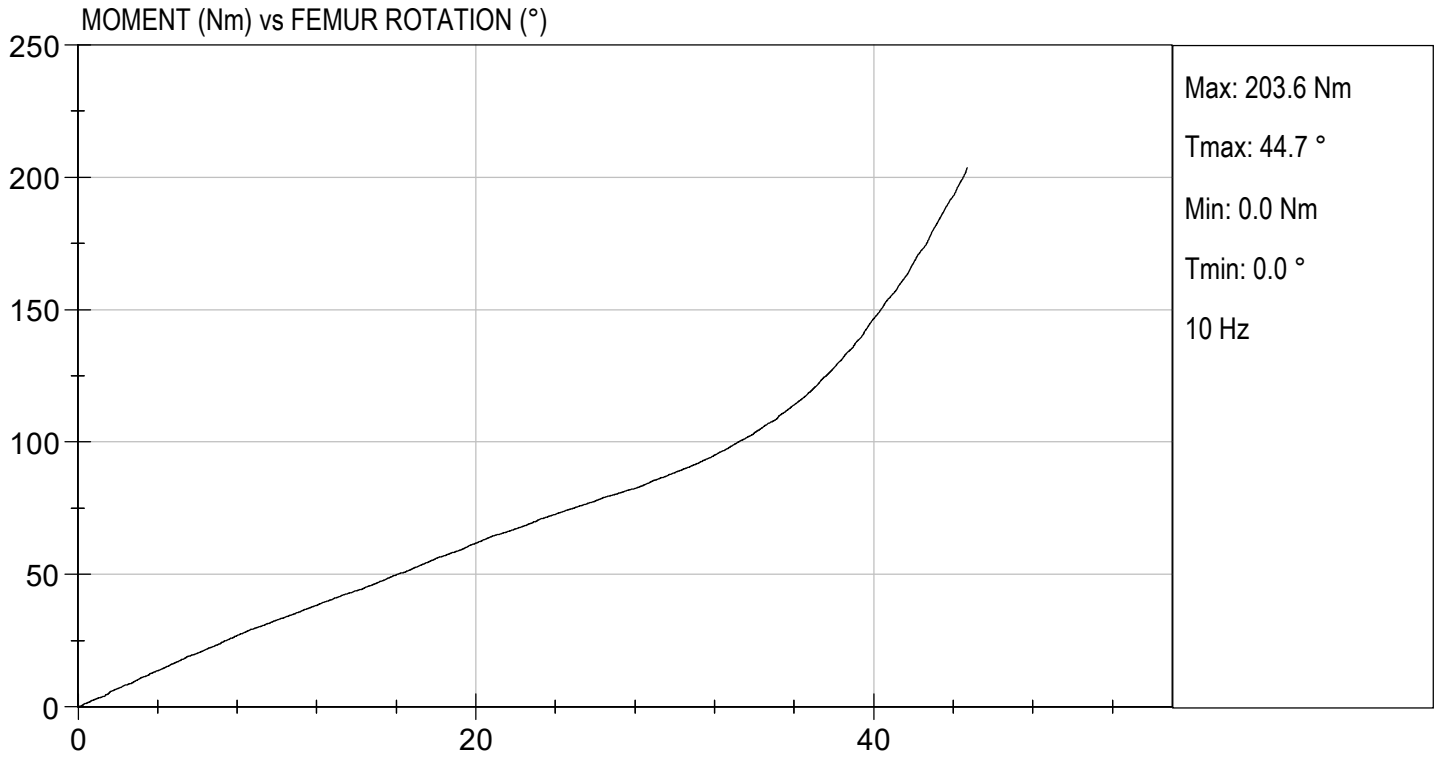
**Test I.D:** D213410

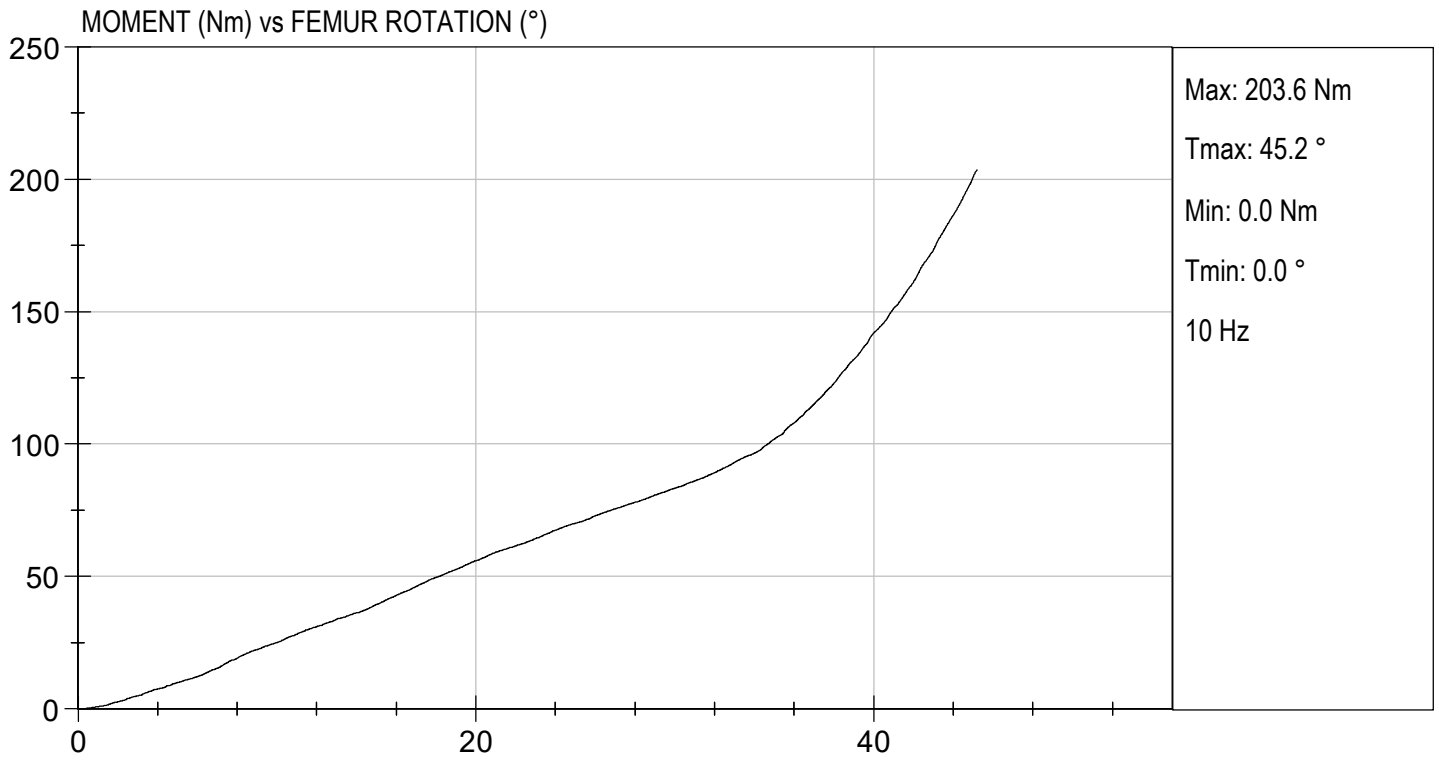
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.4	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	34	34	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.3	6.4	Pass
30 Degrees	Nm	94.9 Nm Max	88.5	83.3	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	44.7	45.2	Pass
Overall Test Results					Pass

  
 Laboratory Technician

11/05/2021  
 Test Date

  
 Approved By





**CALIBRATION TEST RESULTS**

**POST-TEST**

**HYBRID III 50<sup>TH</sup> PERCENTILE MALE - DRIVER ATD**

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 50TH PERCENTILE MALE**

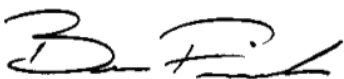
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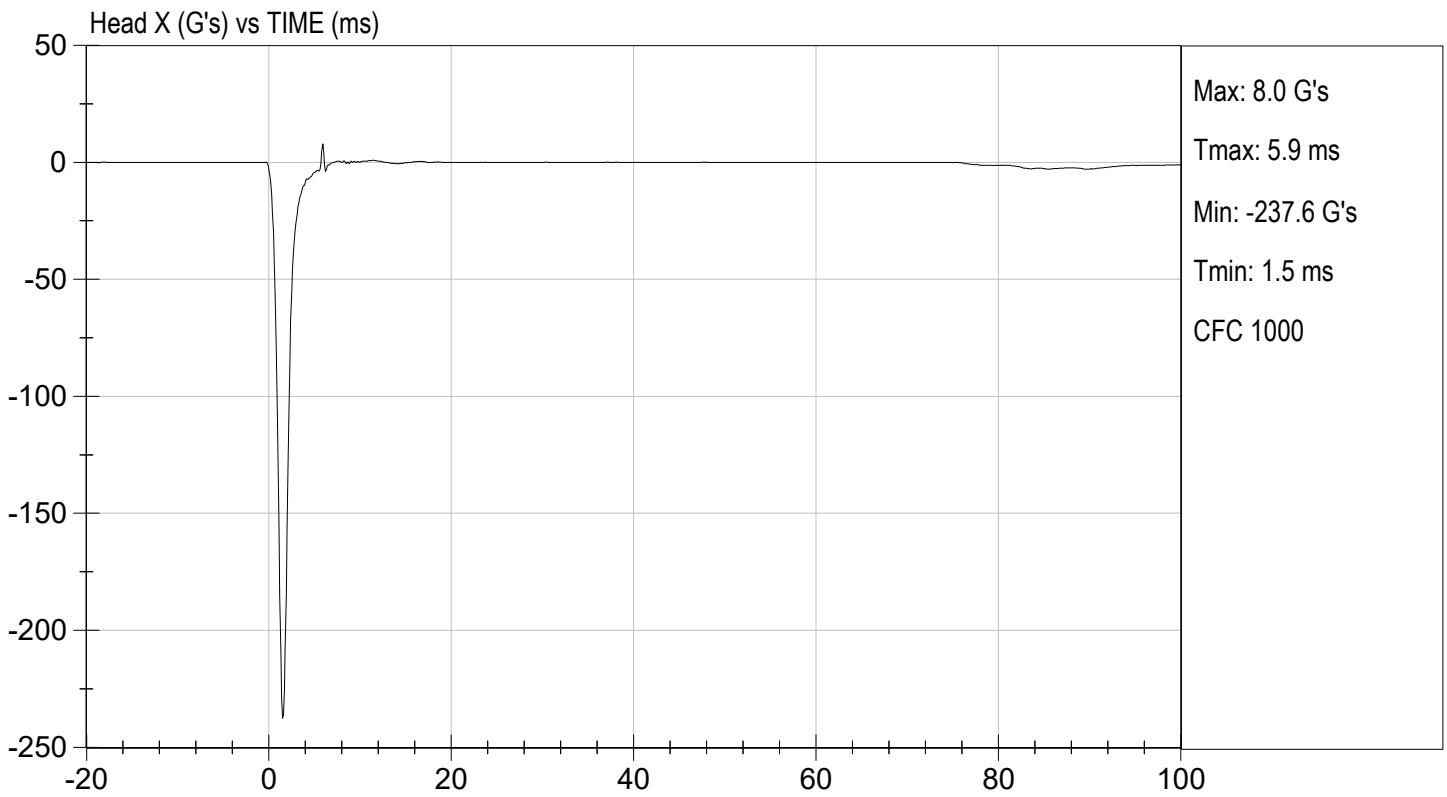
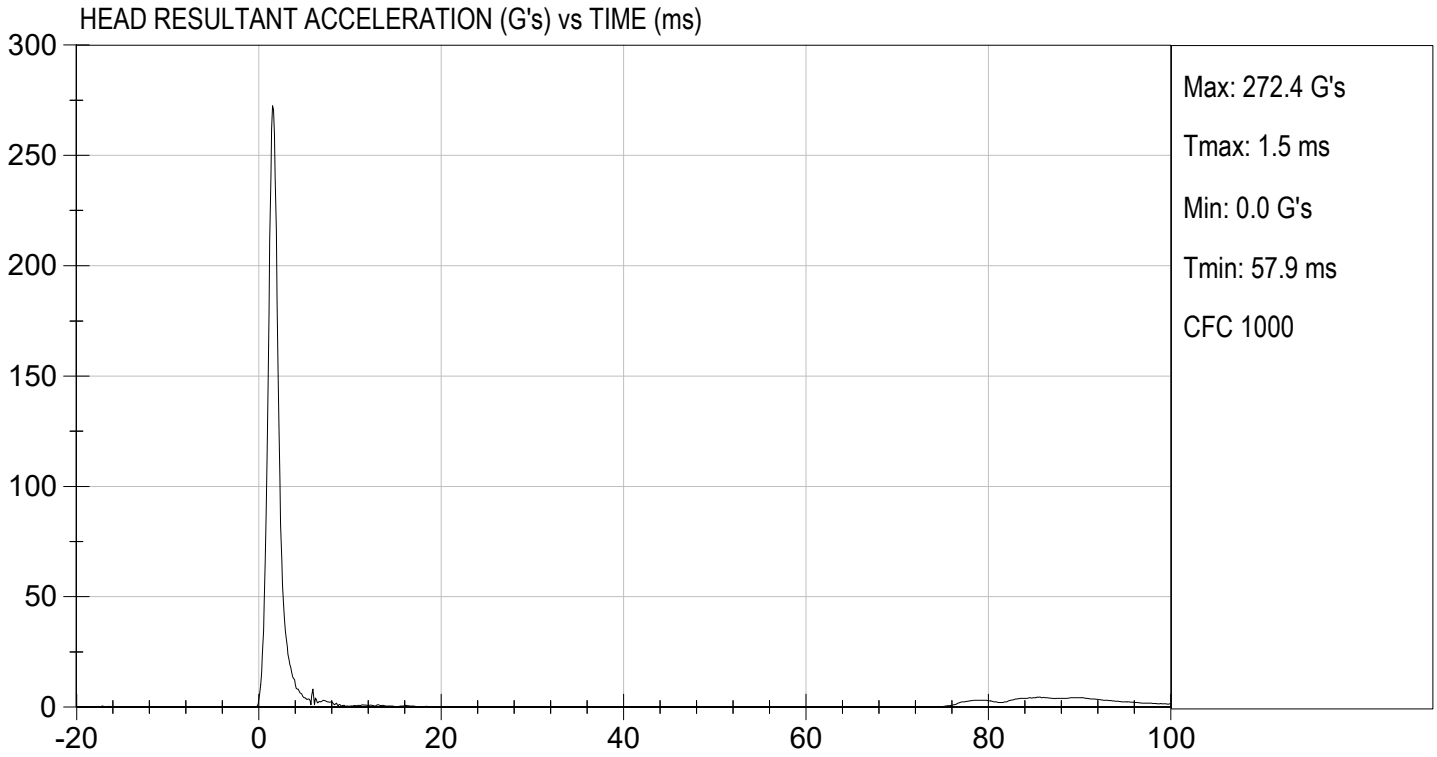
Test ID: D213701

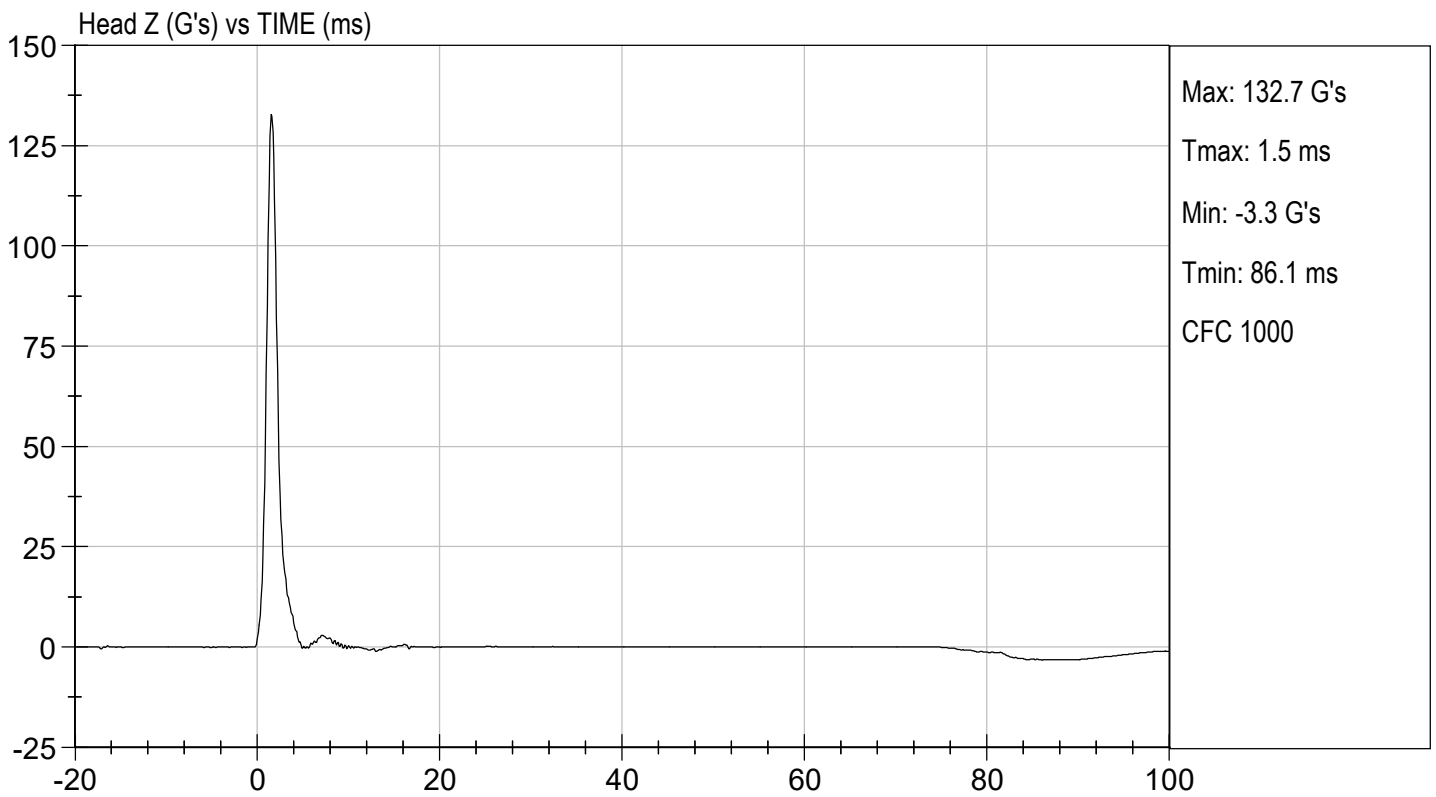
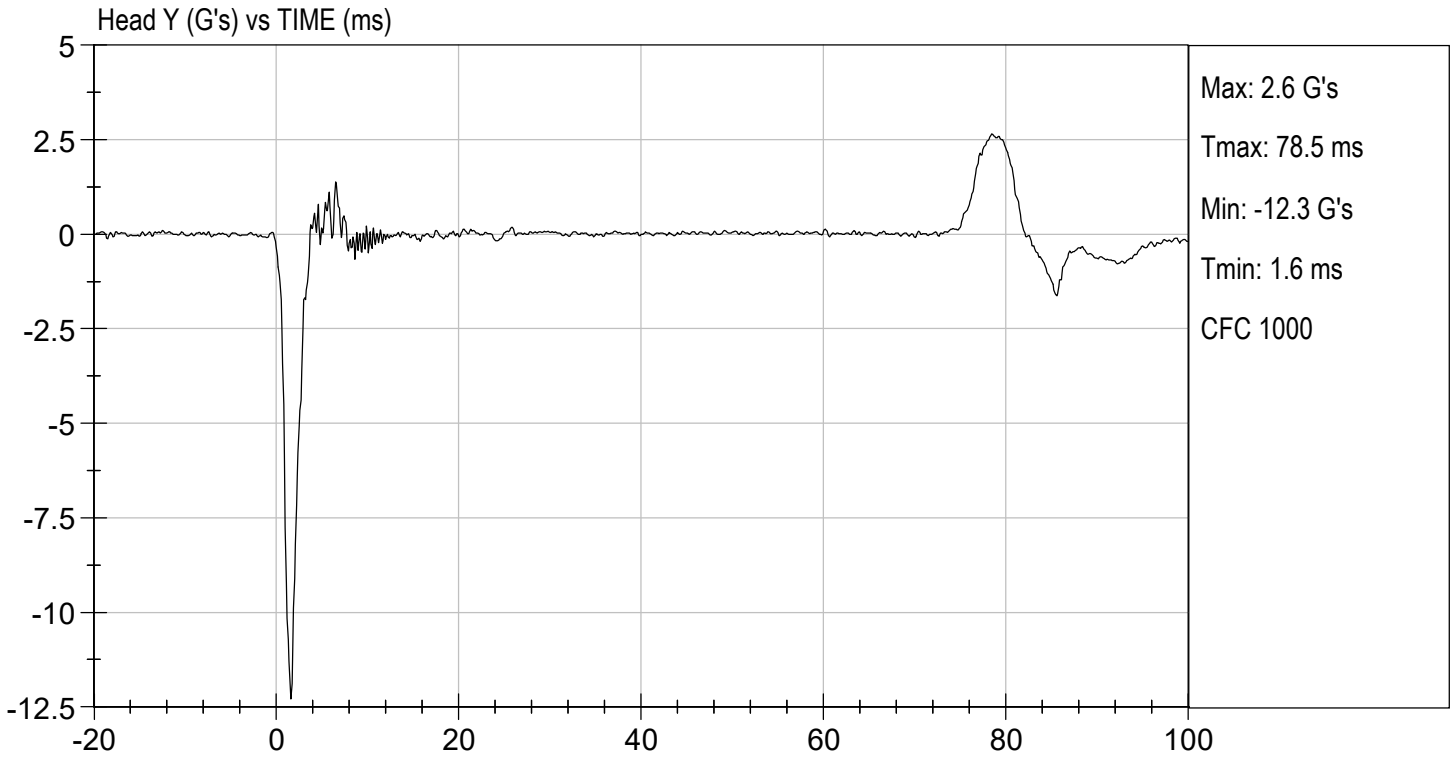
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Peak Resultant Acceleration	G's	225 to 275	272	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-12.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

  
 Laboratory Technician

12/06/2021  
 Test Date

  
 Approved By





**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 50TH PERCENTILE MALE**

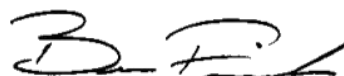
ATD Serial No: 351

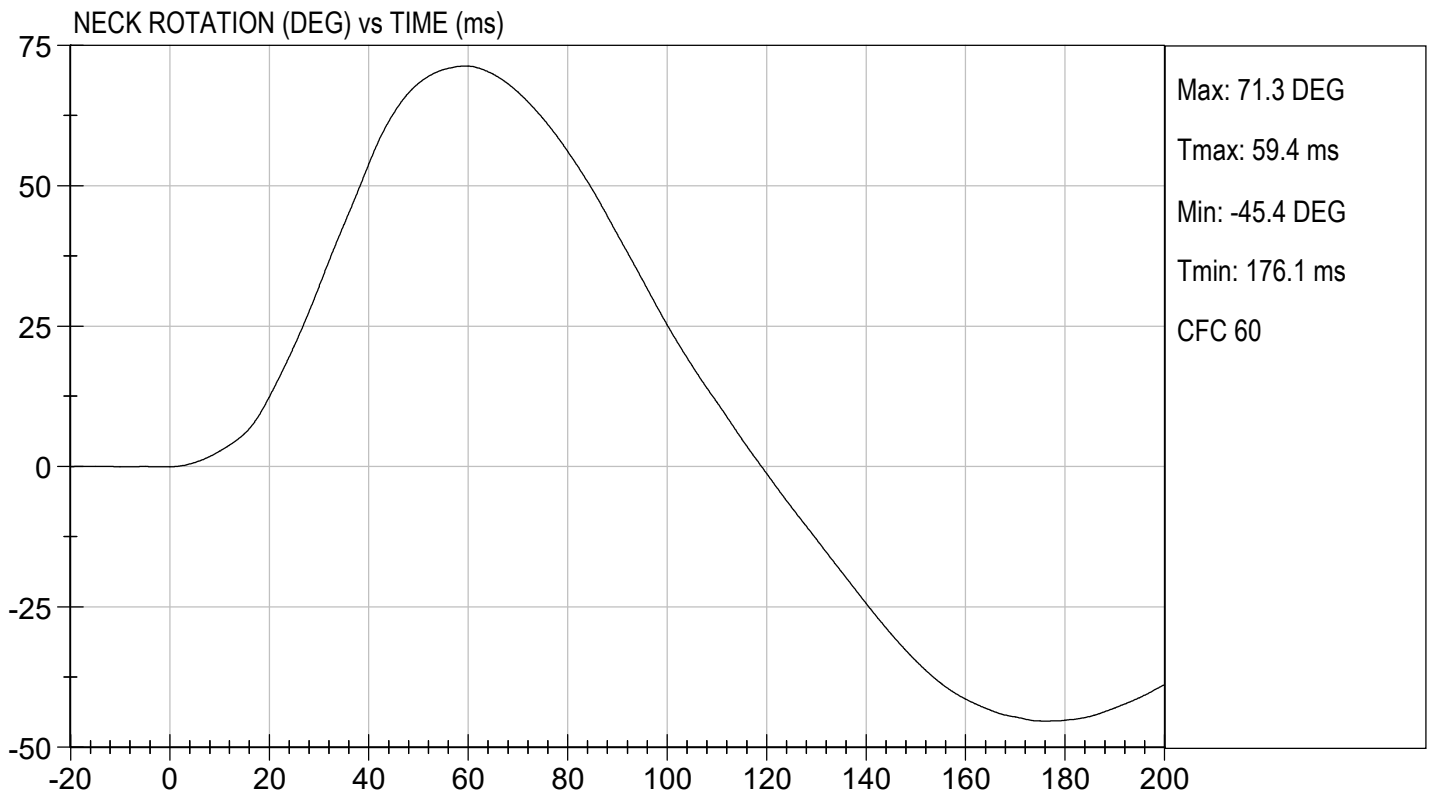
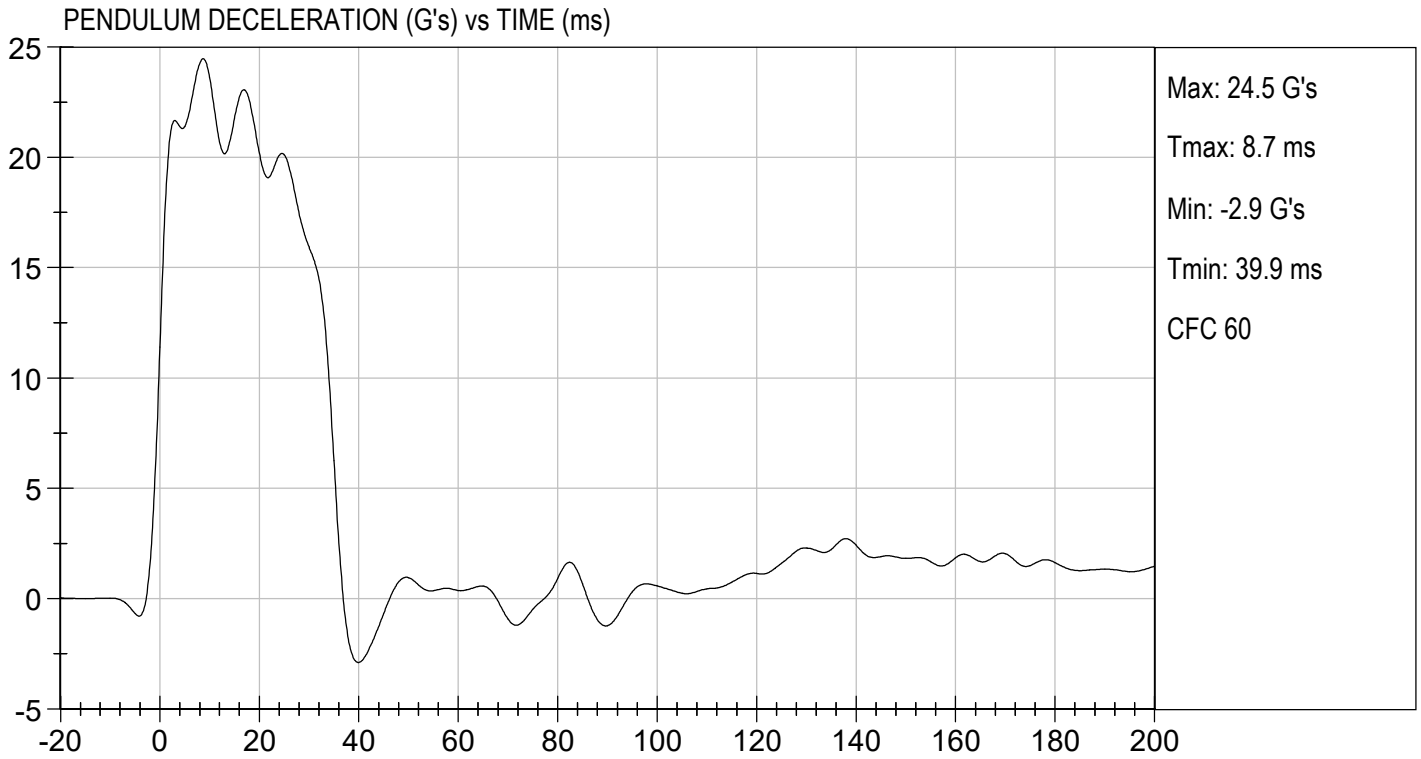
Test I.D: D213702

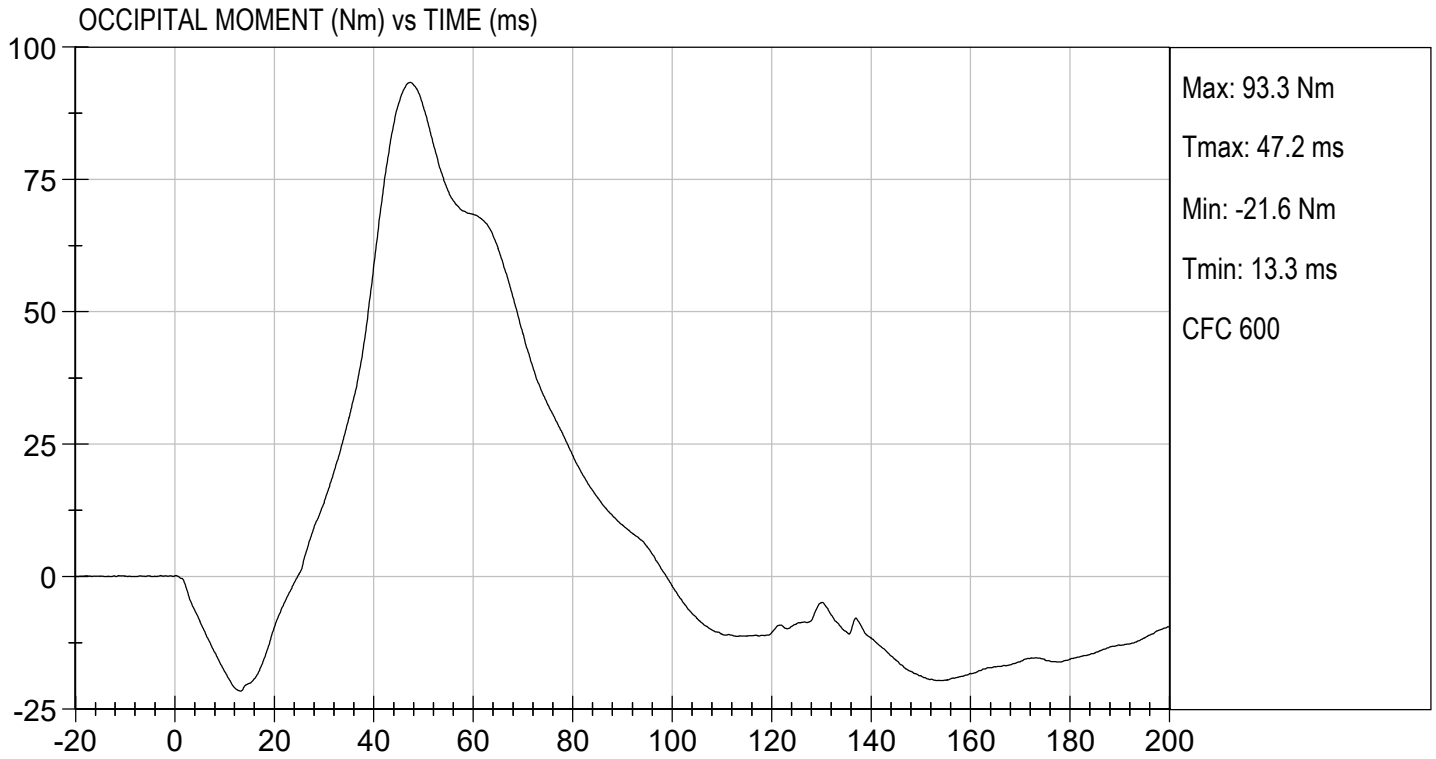
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.62	Pass
	20 ms	G's	17.60 to 22.60	20.19	Pass
	30 ms	G's	12.50 to 18.50	15.93	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	15.9	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.4	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	71.3	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	119.1	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	93.3	Pass
	Time	ms	47.0 to 58.0	47.2	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	99.0	Pass
Overall Test Results					Pass

  
 Laboratory Technician

12/06/2021  
 Test Date

  
 Approved By





**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 50TH PERCENTILE MALE**

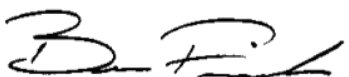
ATD Serial No: 351

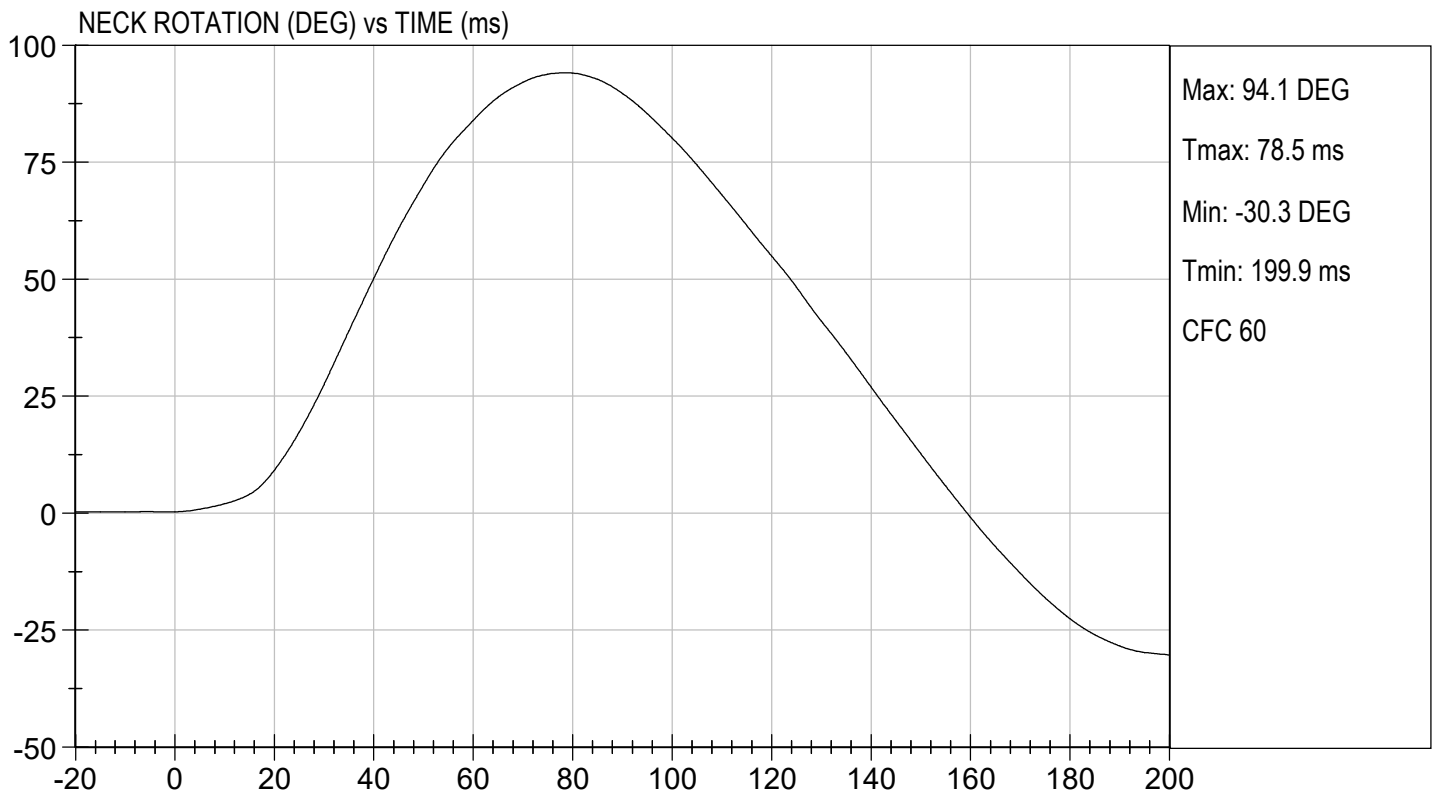
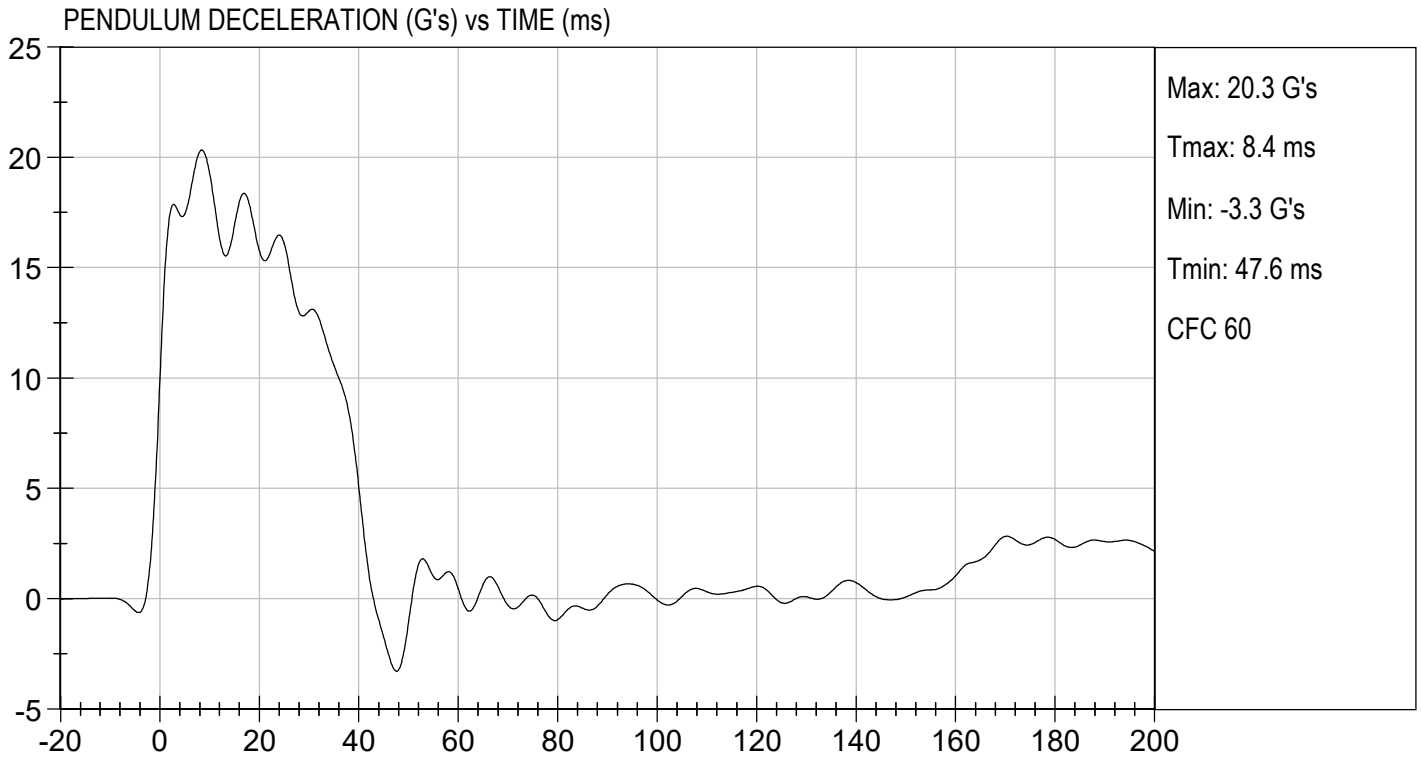
Test I.D.: D213703

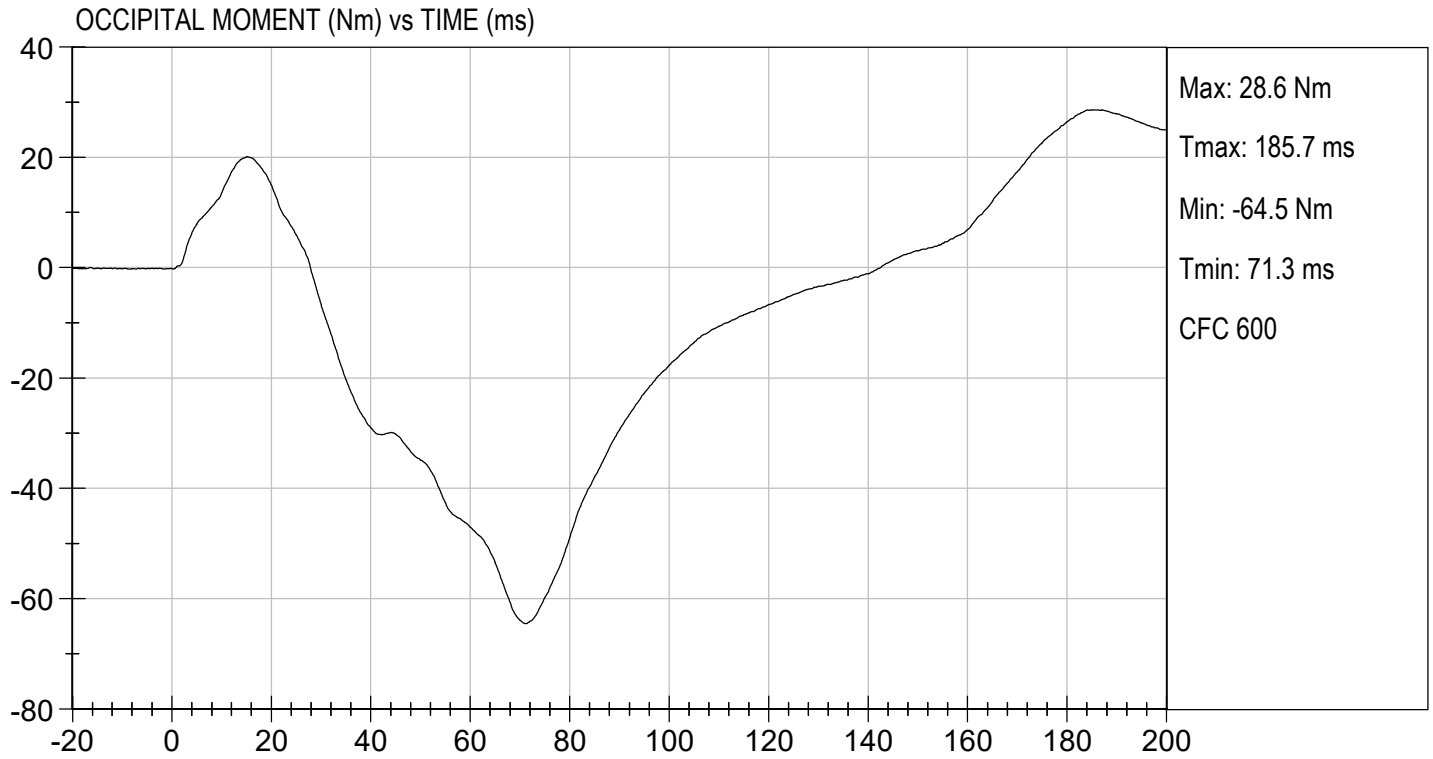
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.28	Pass
	20 ms	G's	14.00 to 19.00	15.76	Pass
	30 ms	G's	11.00 to 16.00	13.04	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.1	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	40.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.1	Pass
	Time	ms	72.0 to 82.0	78.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	159.5	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-64.5	Pass
	Time	ms	65.0 to 79.0	71.3	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	142.7	Pass
Overall Test Results					Pass

  
 Laboratory Technician

12/06/2021  
 Test Date

  
 Approved By





**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 50TH PERCENTILE MALE**

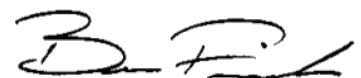
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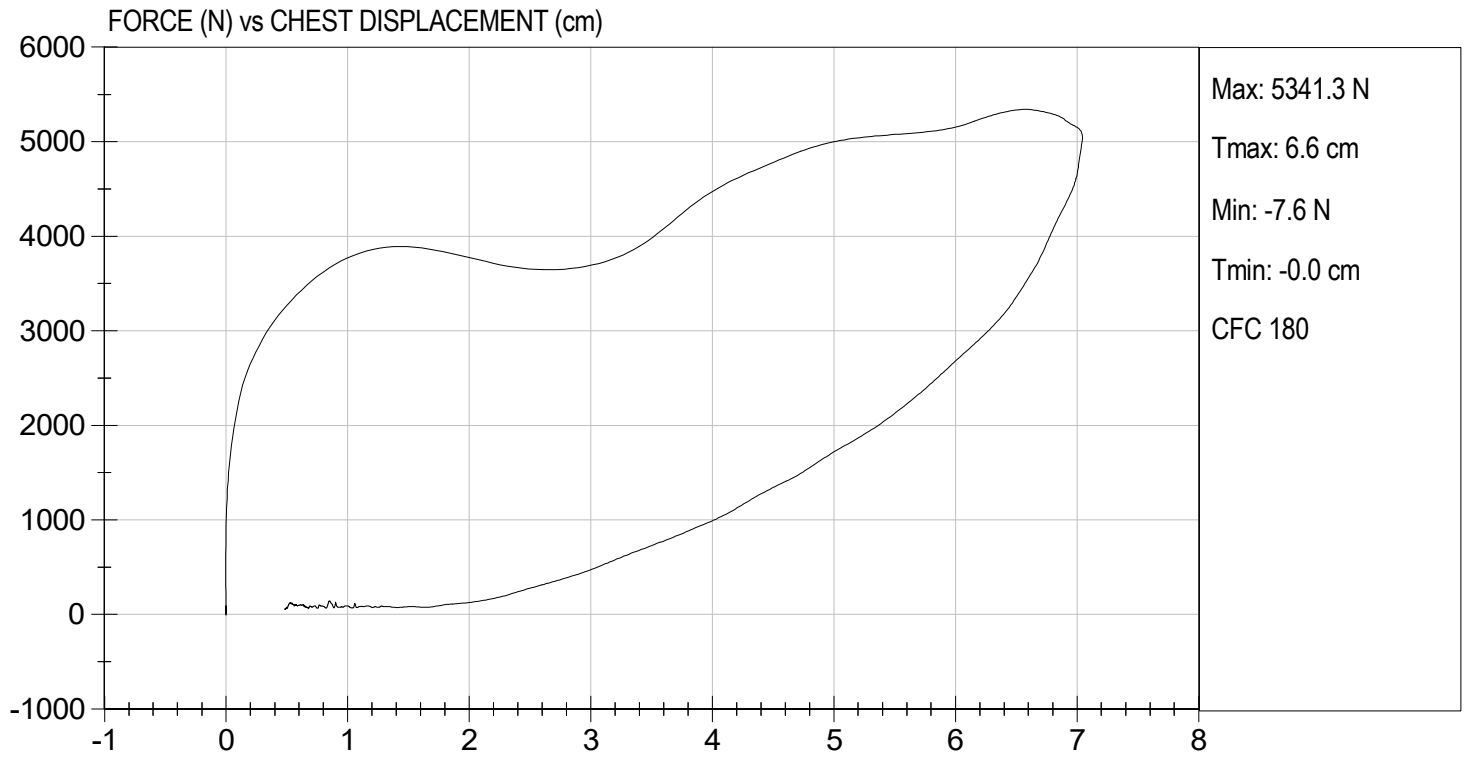
Test I.D: D213704

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,341	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	7.04	Pass
Internal Hysteresis	%	69 to 85	72	Pass
<b>Overall Test Results</b>				<b>Pass</b>

  
 Laboratory Technician

12/07/2021  
 Test Date

  
 Approved By



**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 50TH PERCENTILE MALE**

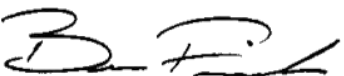
ATD Serial No: 351

Test I.D: D213705

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.4	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Velocity	m/s	2.07 to 2.13	2.08	Pass
Peak Probe Force	N	4715 to 5782	5,431	Pass
Overall Test Results				Pass

  
 Laboratory Technician

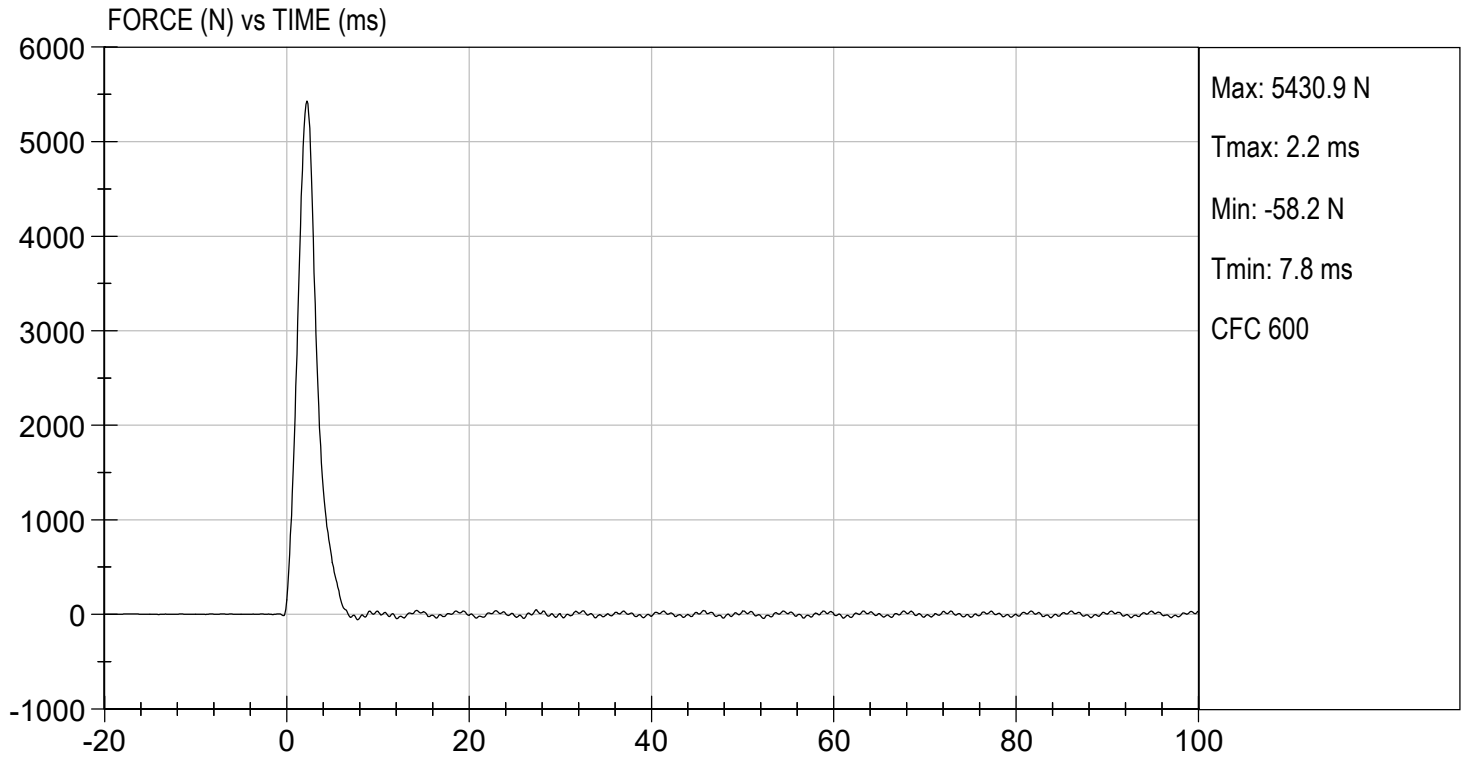
12/03/2021  
 Test Date

  
 Approved By



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

TEST DATE: 12/03/2021  
TEST #: D213705



**MGA RESEARCH CORPORATION**  
**LEFT KNEE IMPACT TEST**  
**HYBRID III 50TH PERCENTILE MALE**

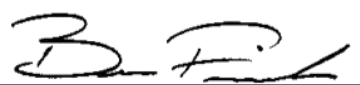
**ATD Serial No:** 351

**Test I.D:** D213706

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.4	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	4,798	Pass
Overall Test Results				Pass

  
 Laboratory Technician

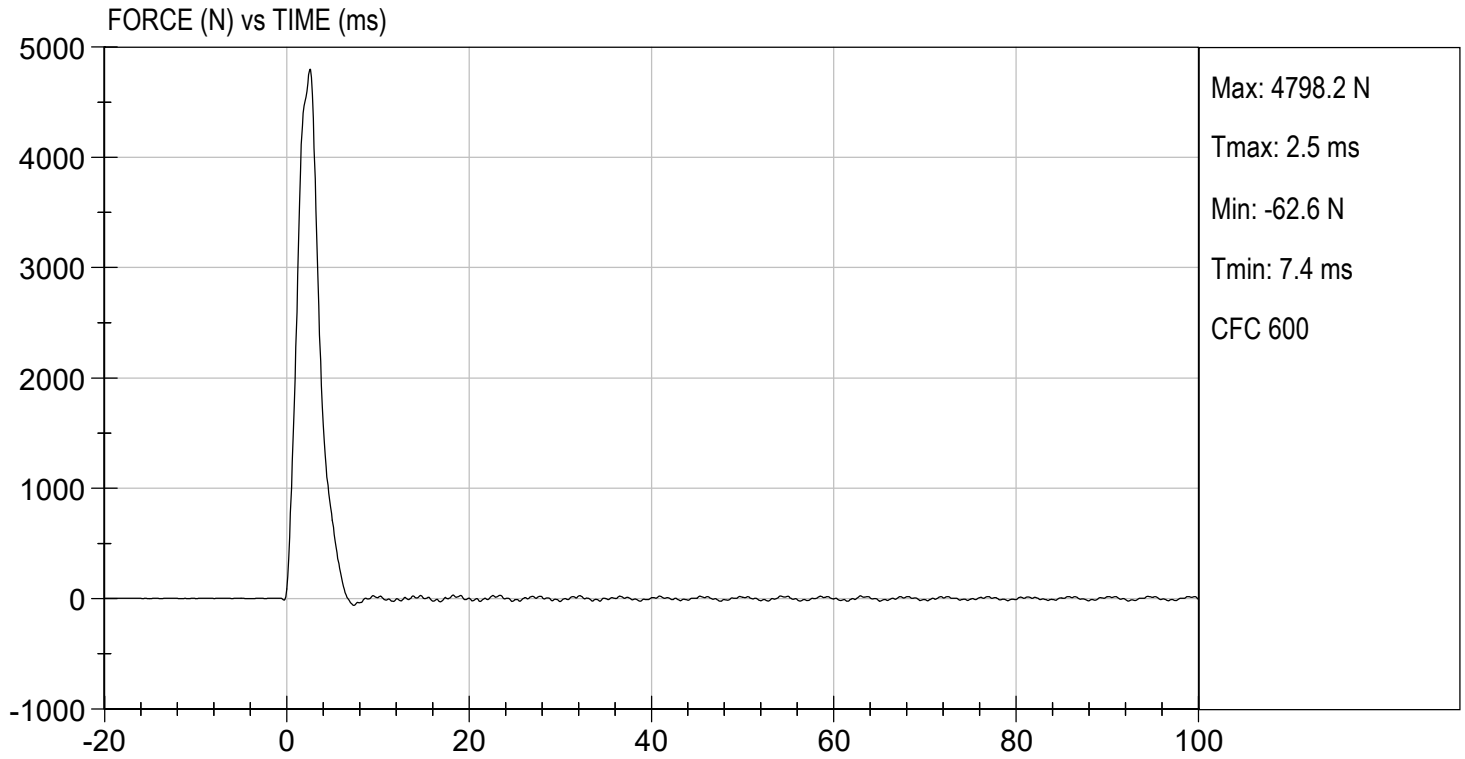
12/03/2021  
 Test Date

  
 Approved By



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

TEST DATE: 12/03/2021  
TEST #: D213706



**MGA RESEARCH CORPORATION**  
**HIP-FEMUR FLEXION TEST**  
**HYBRID III 50TH PERCENTILE MALE**

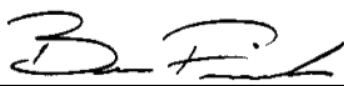
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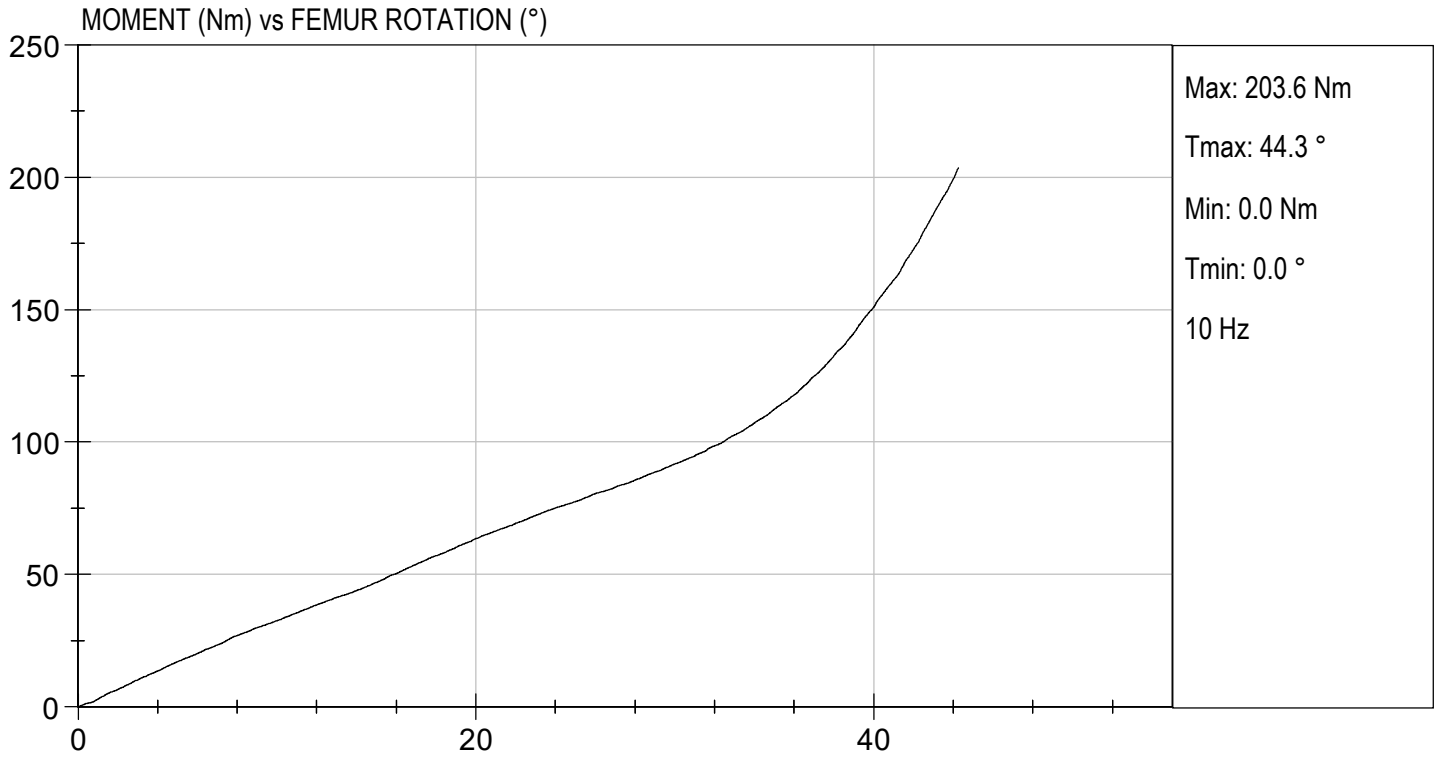
**Test I.D:** D213700

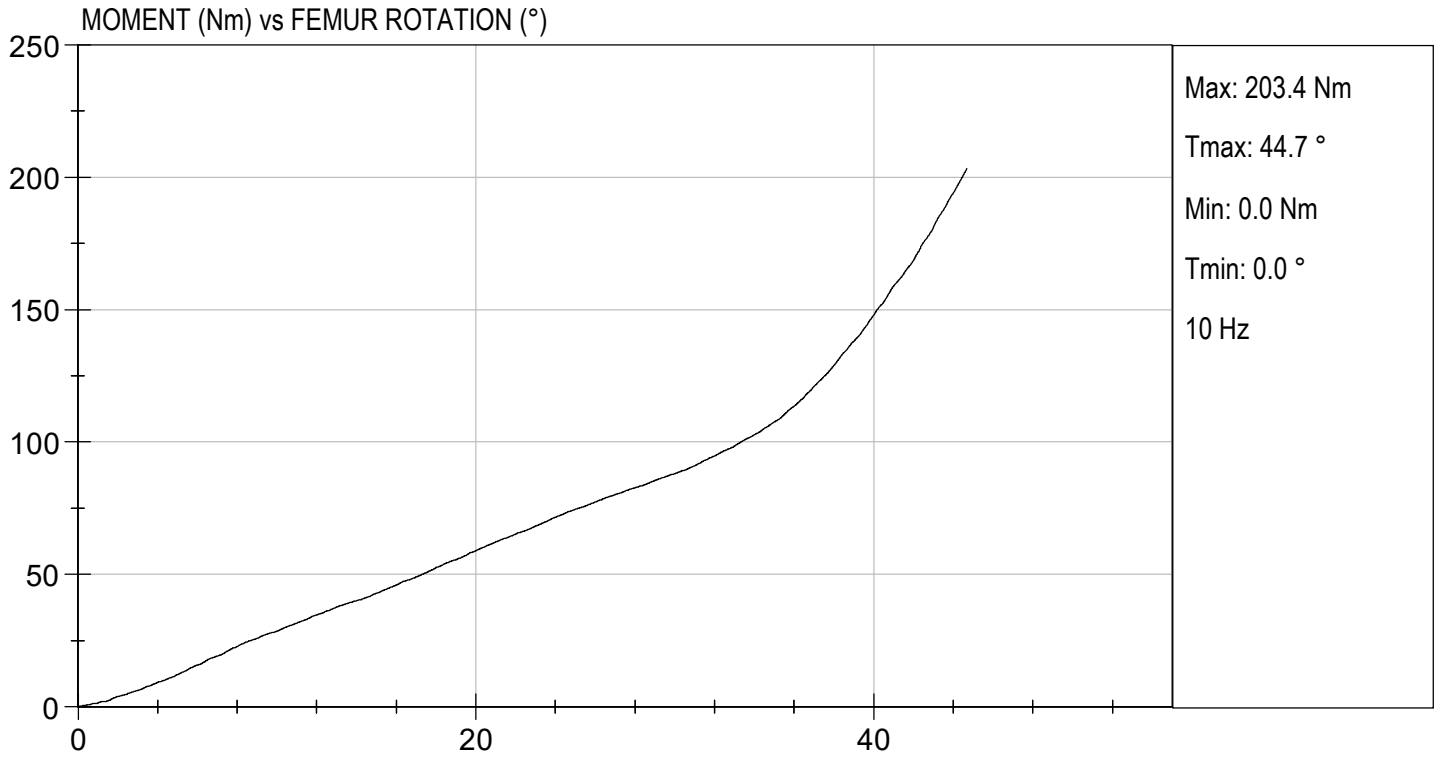
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	24	24	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.3	6.4	Pass
30 Degrees	Nm	94.9 Nm Max	91.7	88.1	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	44.3	44.7	Pass
Overall Test Results					Pass

  
 Laboratory Technician

12/03/2021  
 Test Date

  
 Approved By





**CALIBRATION TEST RESULTS**

**PRE-TEST**

**HYBRID III 5<sup>TH</sup> PERCENTILE FEMALE - PASSENGER ATD**

**EXTERNAL DIMENSIONS**

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

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

**MGA RESEARCH CORPORATION  
HEAD DROP TEST  
HYBRID III 5TH PERCENTILE**

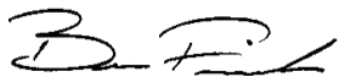
ATD Serial No: 142

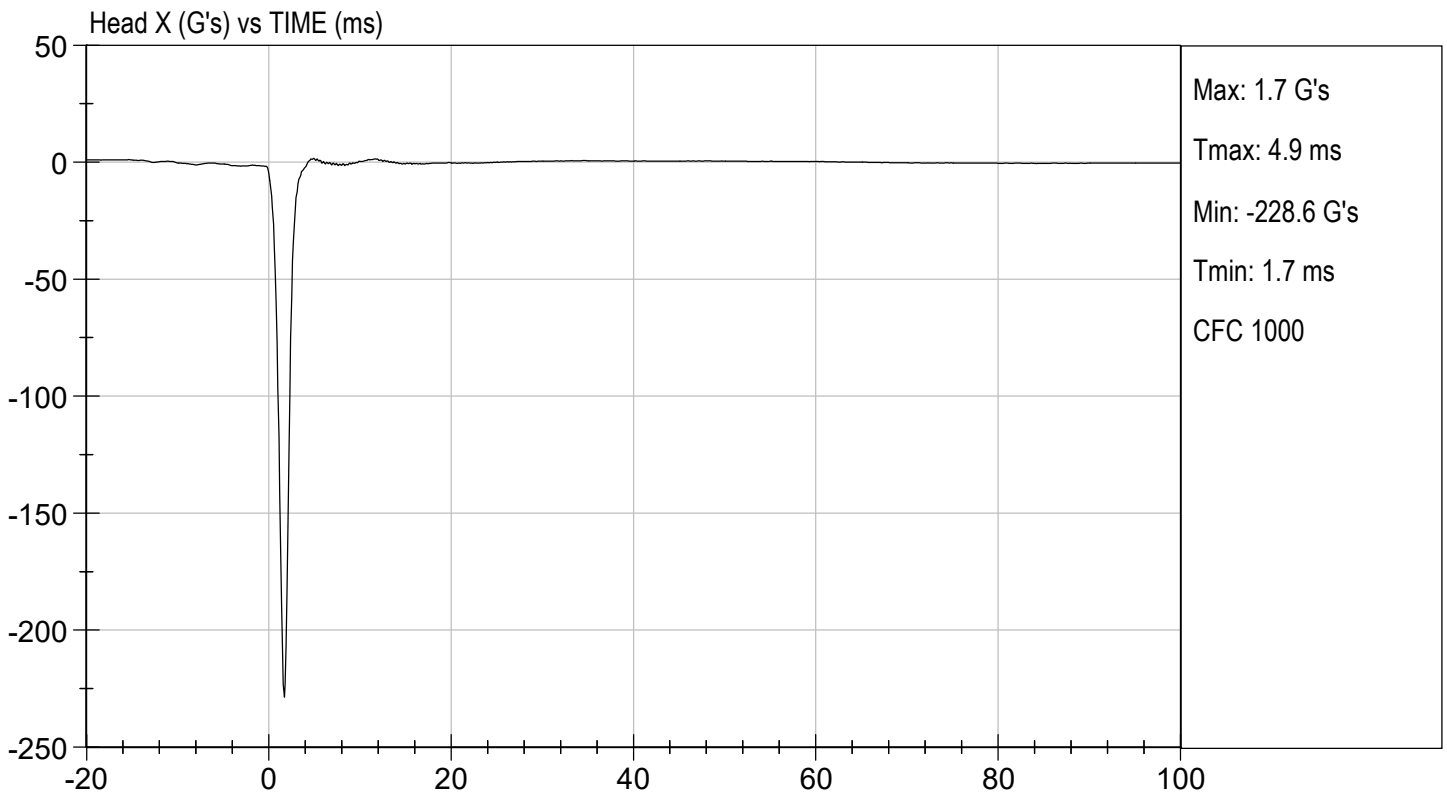
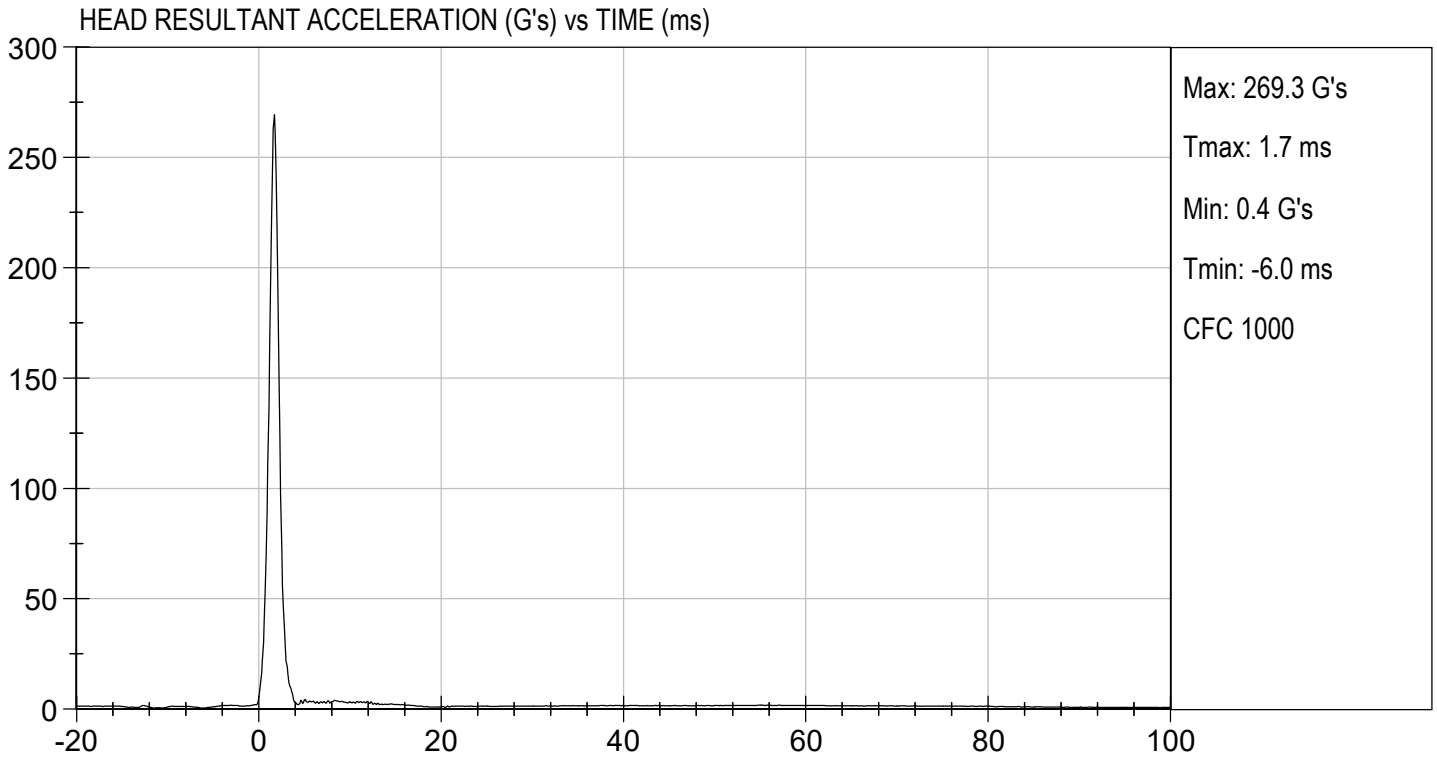
Test ID: D213381

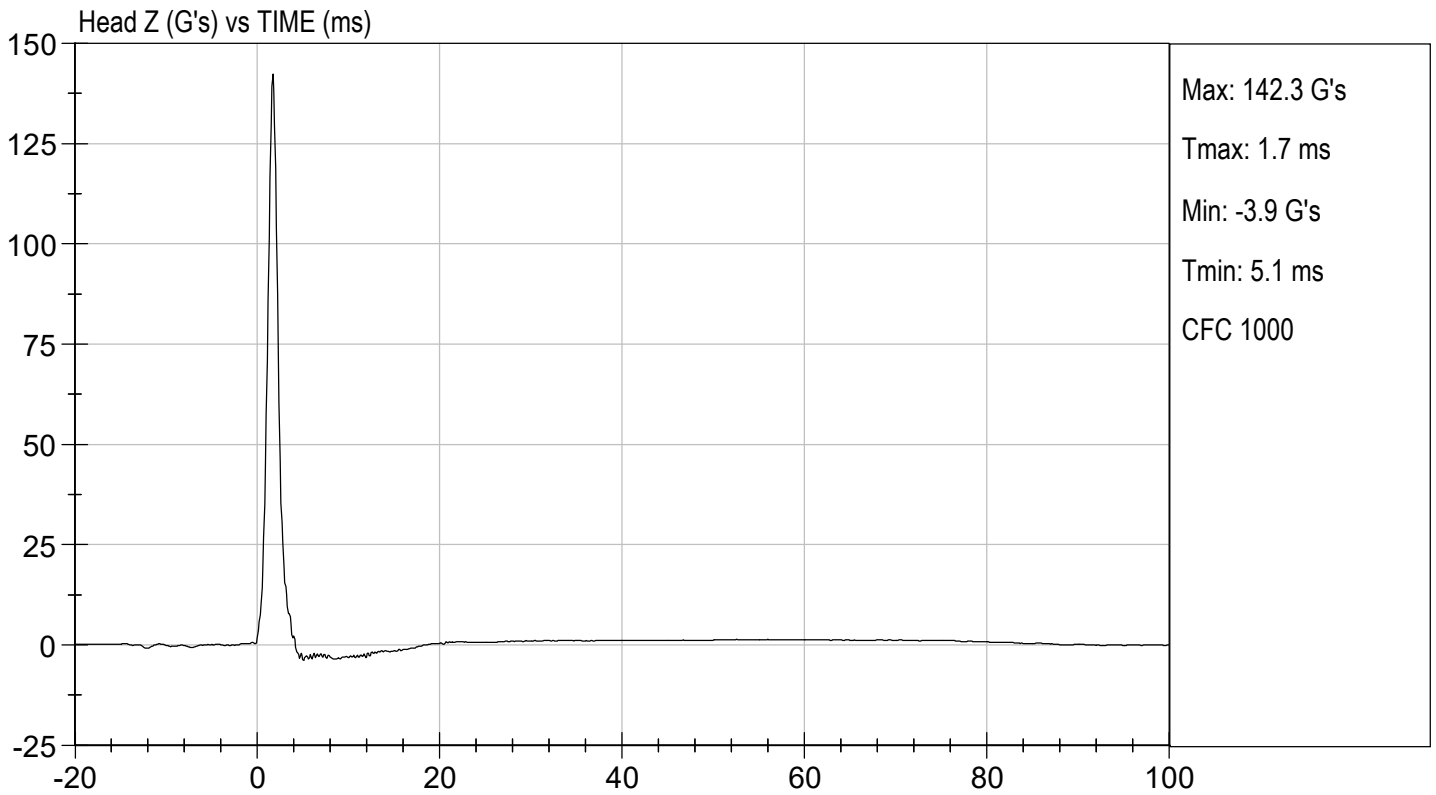
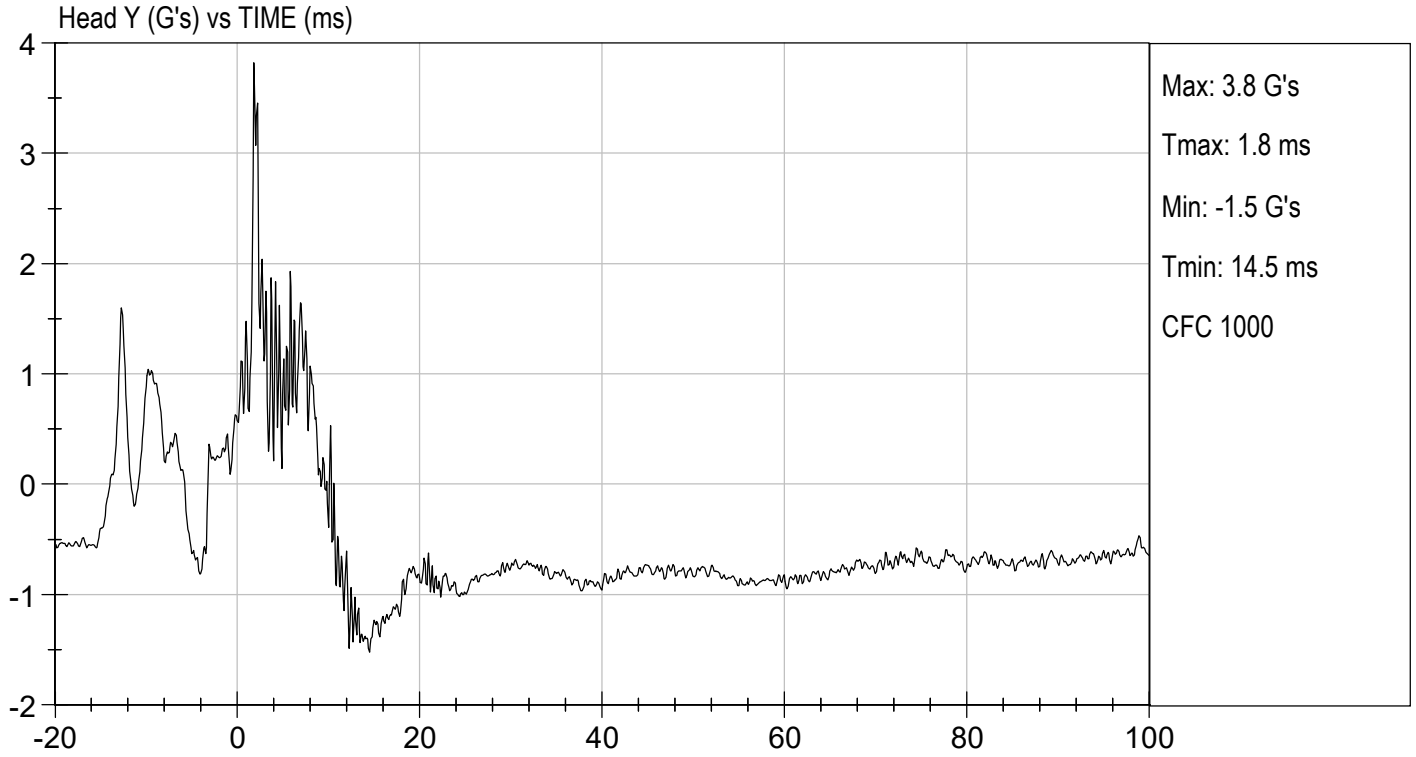
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Peak Resultant Acceleration	G's	250 to 300	269	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	3.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

  
\_\_\_\_\_  
Laboratory Technician

10/26/2021  
\_\_\_\_\_  
Test Date

  
\_\_\_\_\_  
Approved By





**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

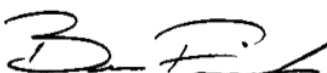
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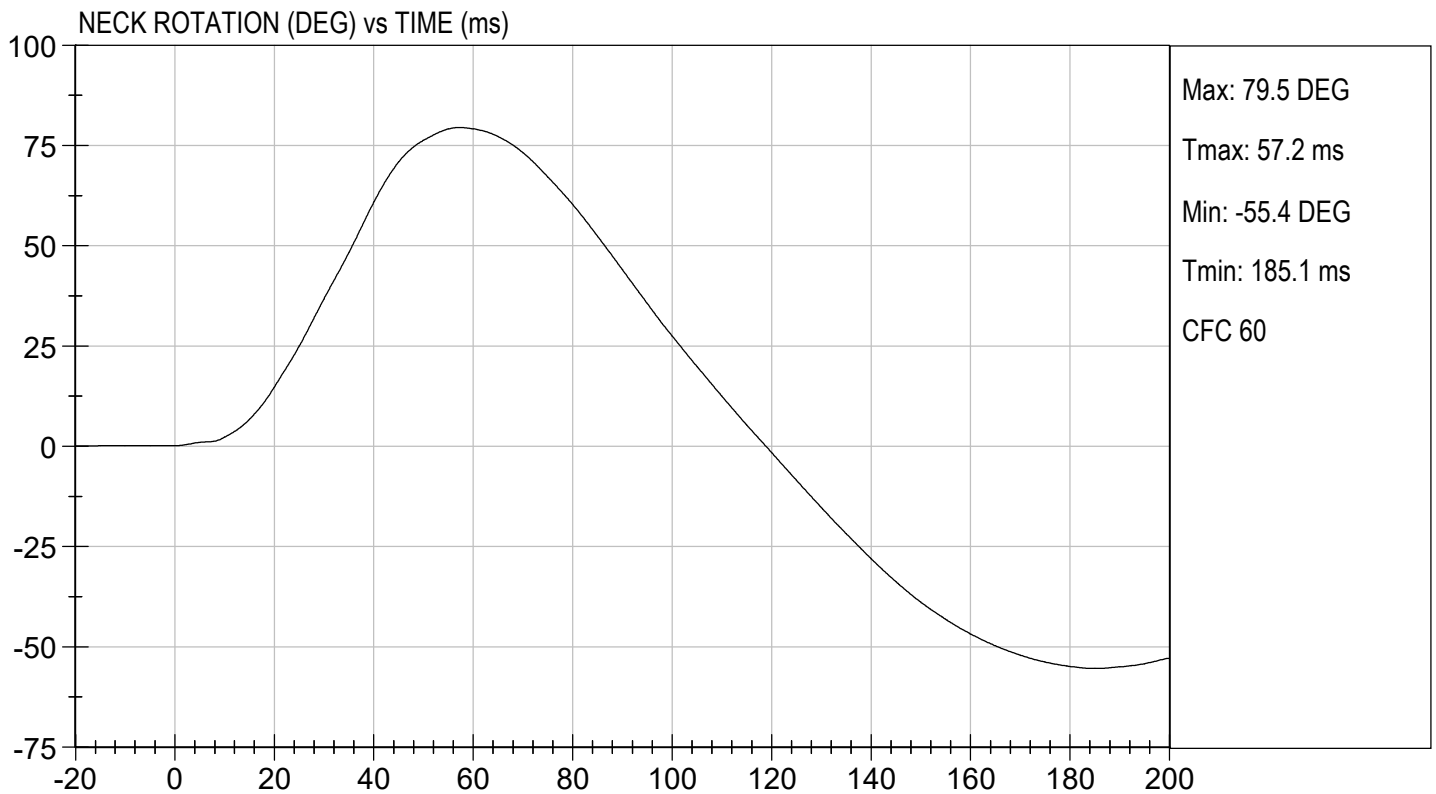
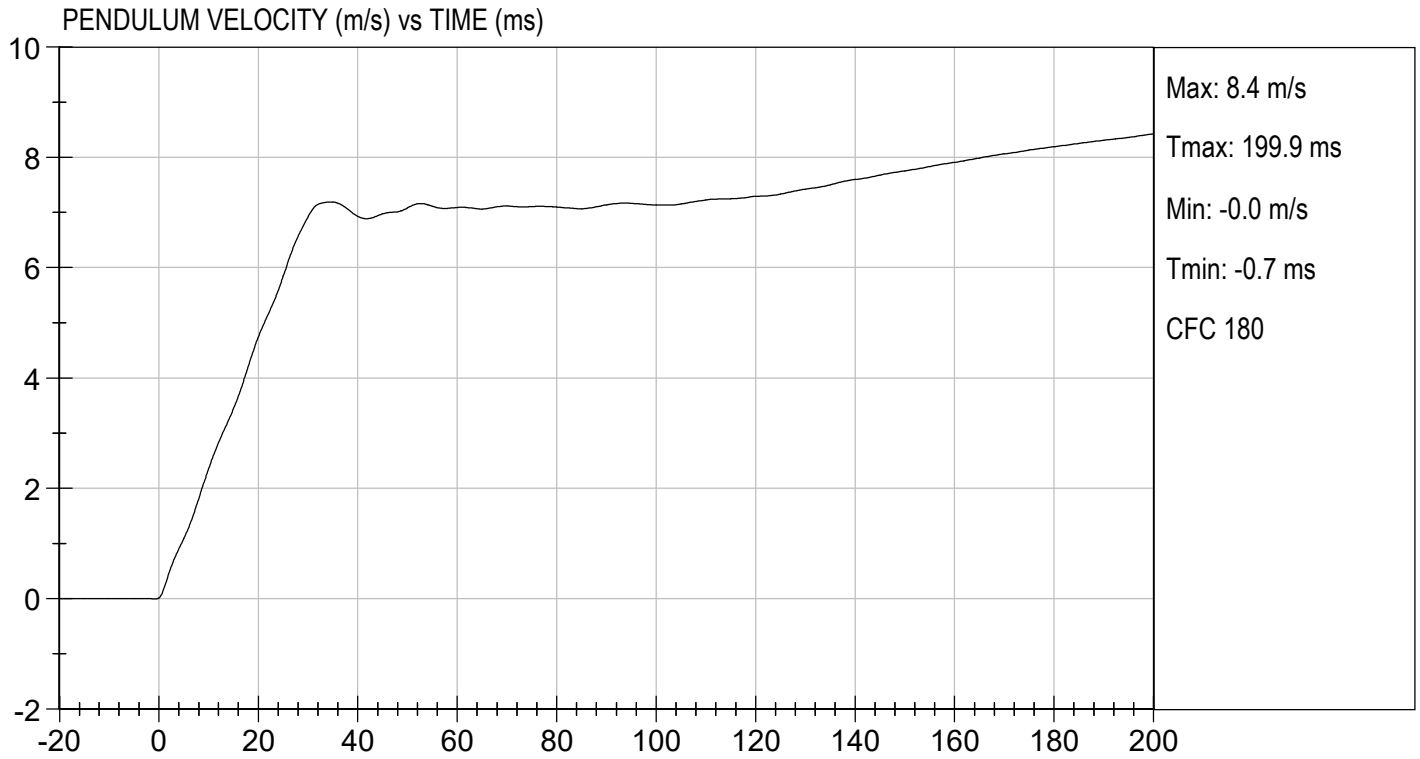
Test I.D.: D213382

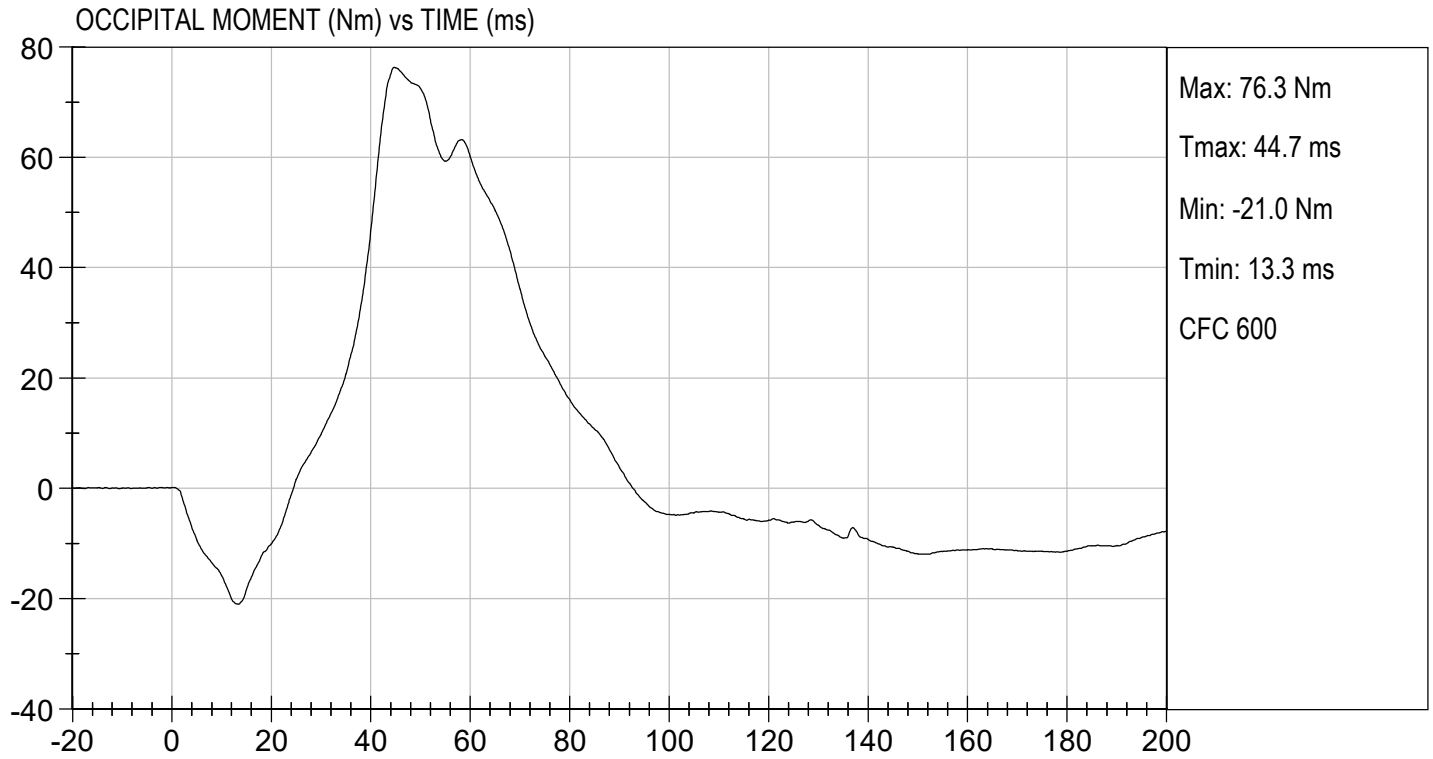
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	33	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.7	Pass
	30 ms	m/s	5.8 to 7.0	6.9	Pass
D Plane Rotation	Max	deg	77 to 91	79	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	83	Pass
Overall Results					Pass

  
 \_\_\_\_\_  
 Laboratory Technician

10/26/2021  
 \_\_\_\_\_  
 Test Date

  
 \_\_\_\_\_  
 Approved By





**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**

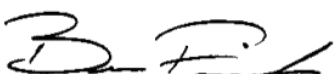
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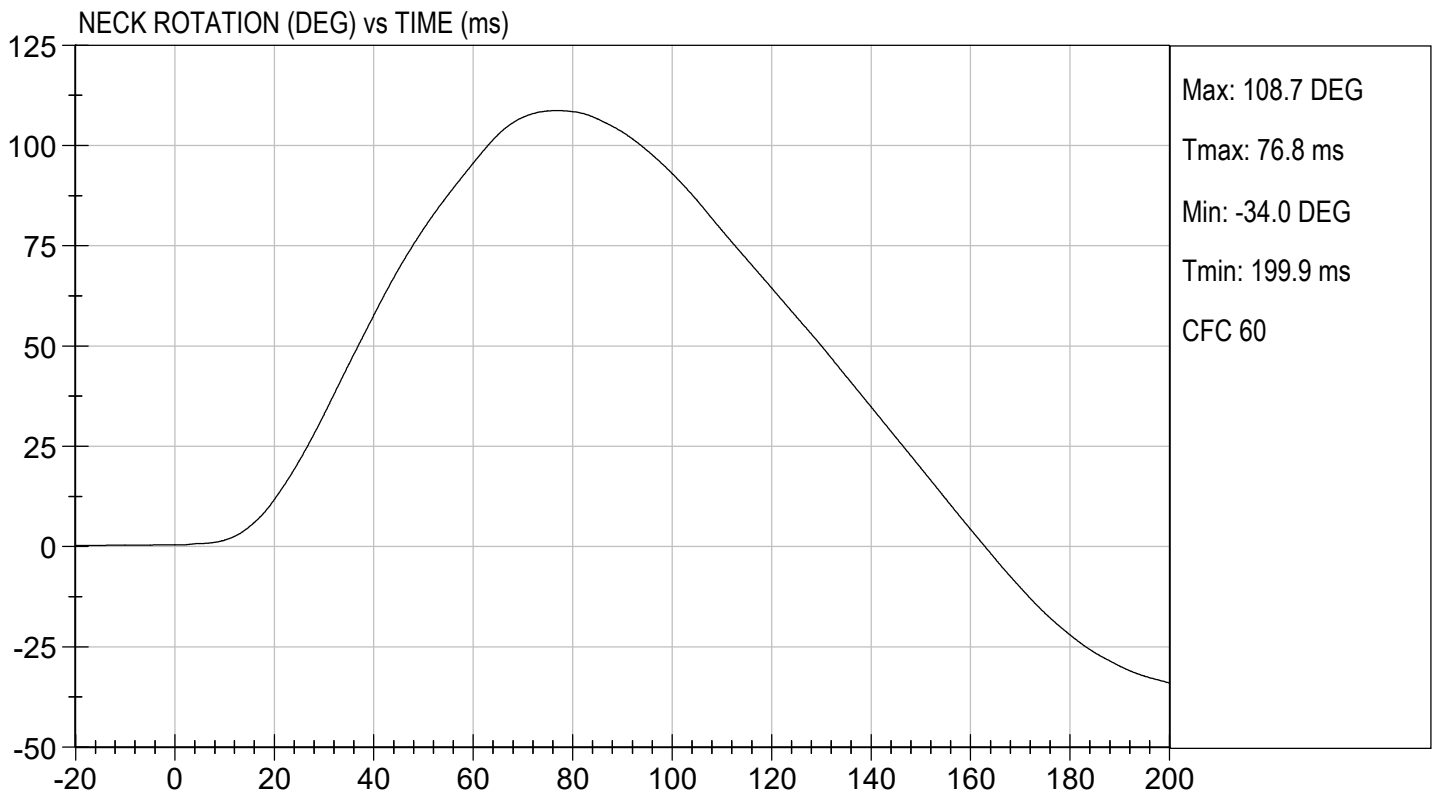
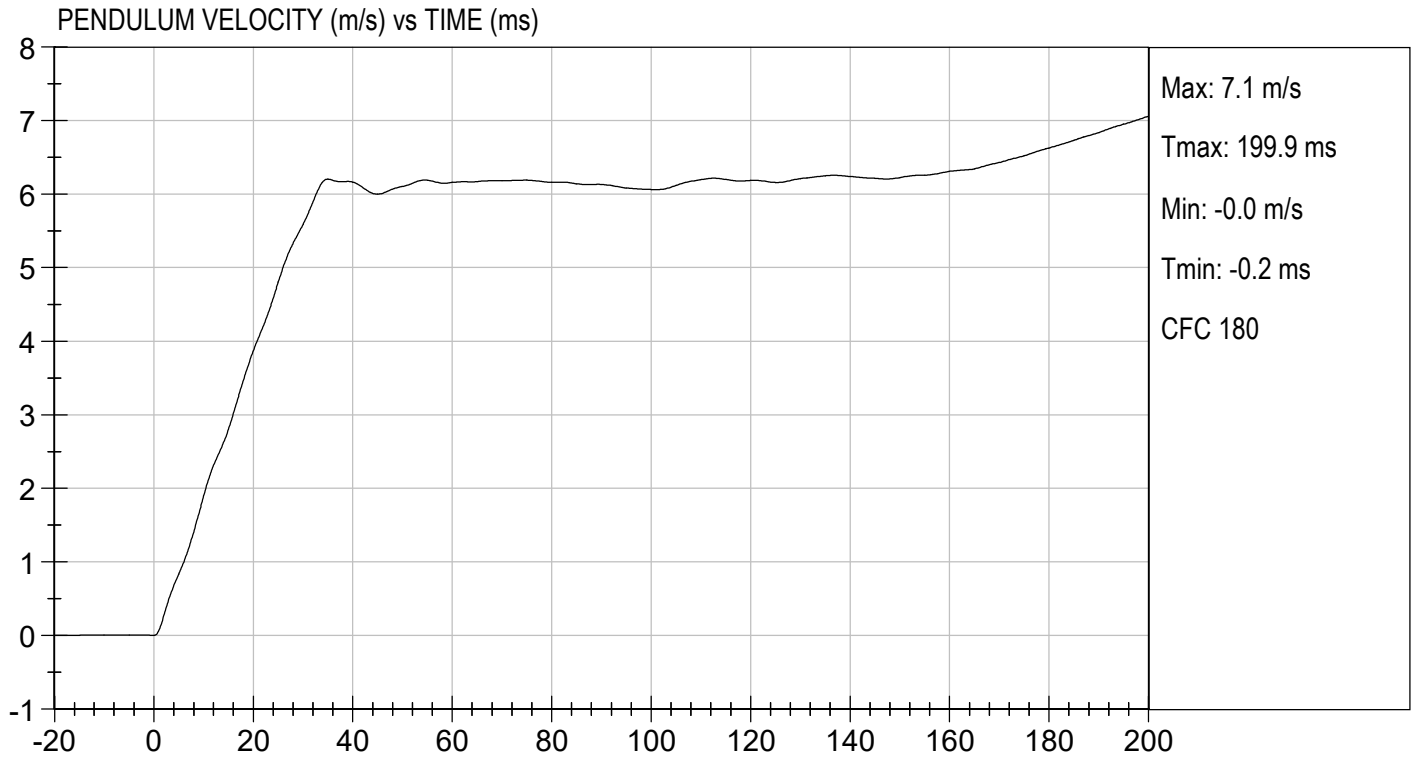
Test I.D: D213383

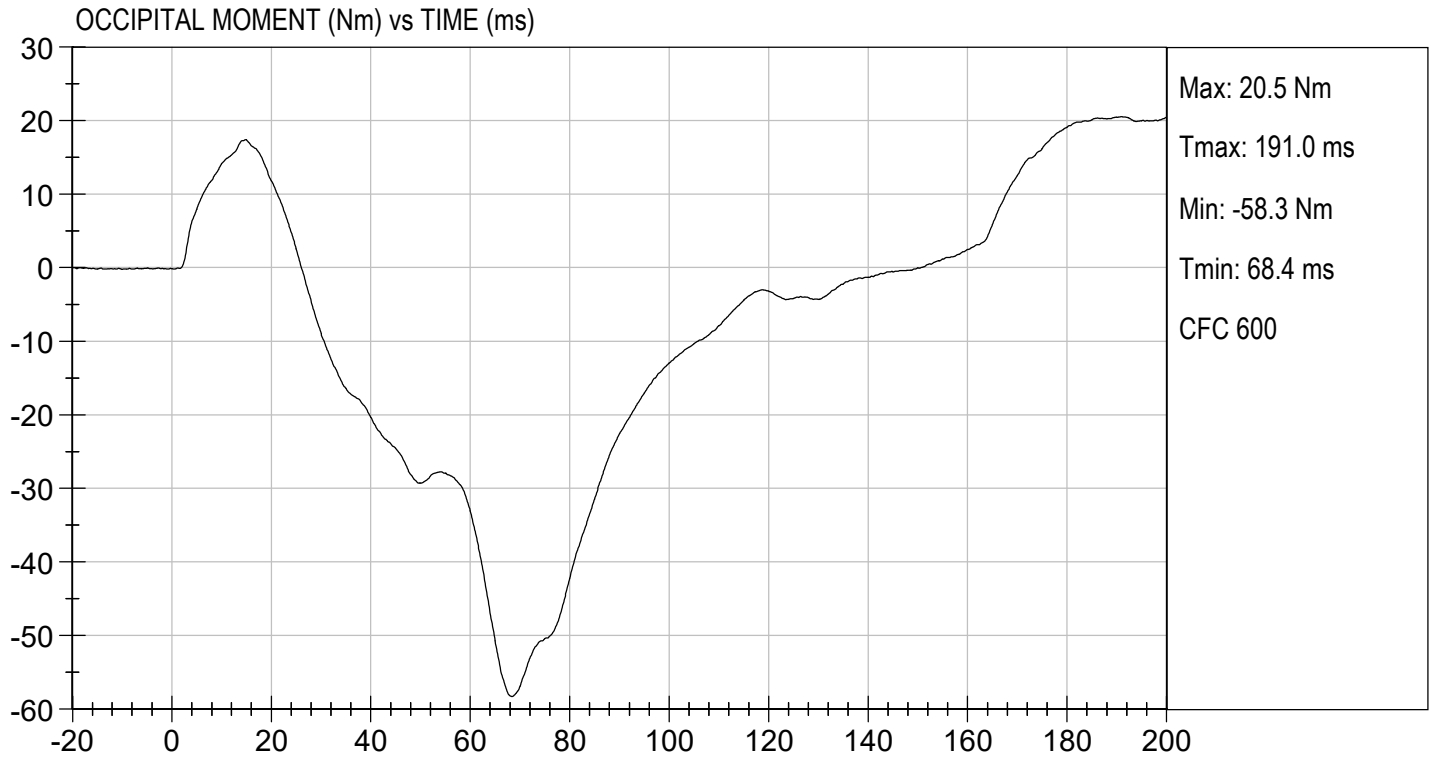
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	33	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.05	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.9	Pass
	20 ms	m/s	3.1 to 3.9	3.9	Pass
	30 ms	m/s	4.6 to 5.6	5.6	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-58	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	105	Pass
Overall Results					Pass

  
 Laboratory Technician

10/26/2021  
 Test Date

  
 Approved By





**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 142

Test I.D: D213384

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	35.3	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	50	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4053	Pass
Internal Hysteresis	%	69 to 85	75	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4375	Pass
Overall Test Results				Pass

*Tammie Liscow*

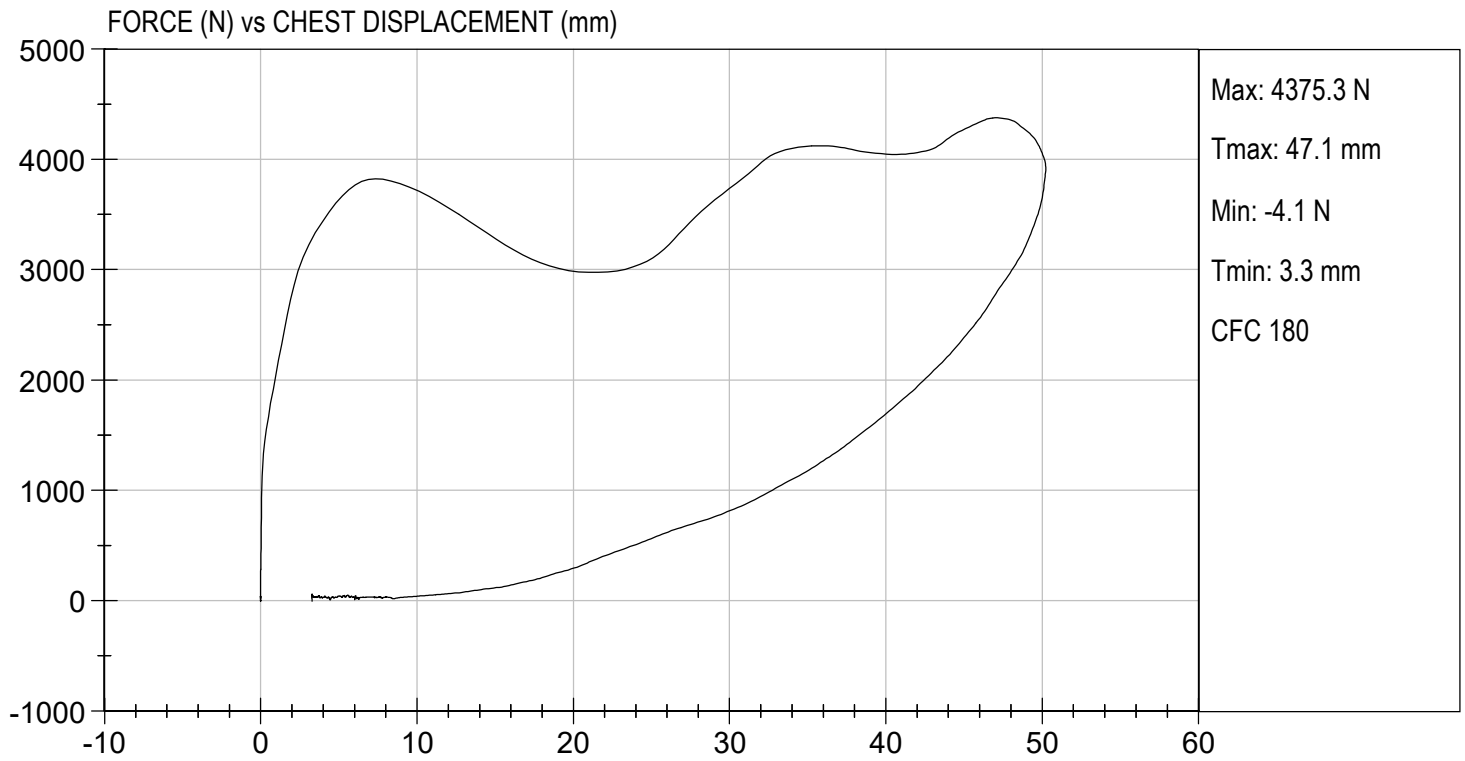
\_\_\_\_\_  
 Laboratory Technician

10/25/2021

\_\_\_\_\_  
 Test Date

*B. Fink*

\_\_\_\_\_  
 Approved By



**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 142

Test I.D: D213385

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	N	3450 to 4060	3695	Pass
Overall Test Results				Pass

*Tanne Liscu*

\_\_\_\_\_  
 Laboratory Technician

10/26/2021

\_\_\_\_\_  
 Test Date

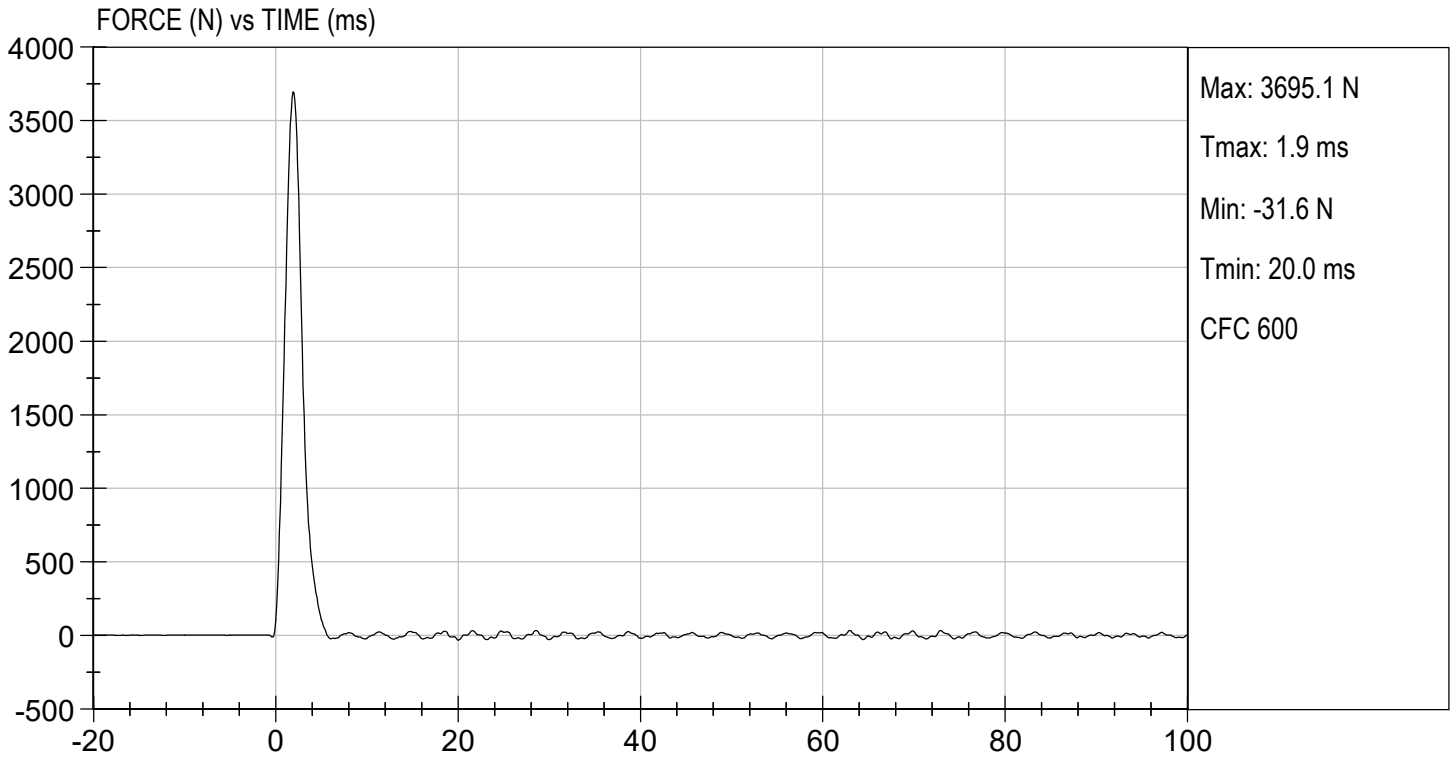
*B. F. K.*

\_\_\_\_\_  
 Approved By



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

TEST DATE: 10/26/2021  
TEST #: D213385



**MGA RESEARCH CORPORATION**  
**LEFT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

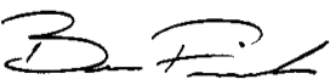
**ATD Serial No:** 142

**Test I.D:** D213386

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3547	Pass
<b>Overall Test Results</b>				<b>Pass</b>

  
 Laboratory Technician

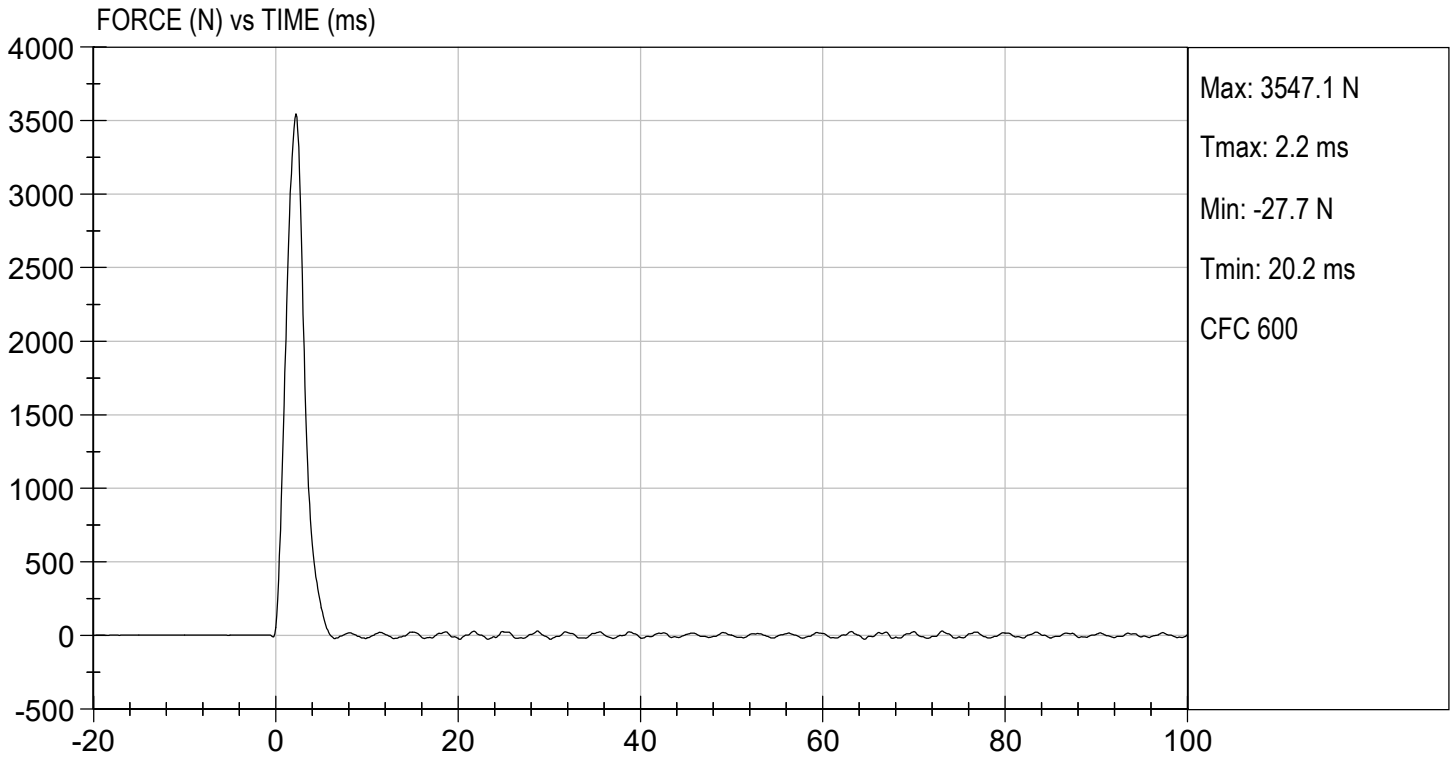
10/26/2021  
 Test Date

  
 Approved By



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

TEST DATE: 10/26/2021  
TEST #: D213386



**MGA RESEARCH CORPORATION**  
**TORSO FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

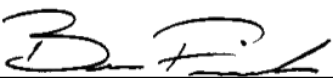
ATD Serial No: 142

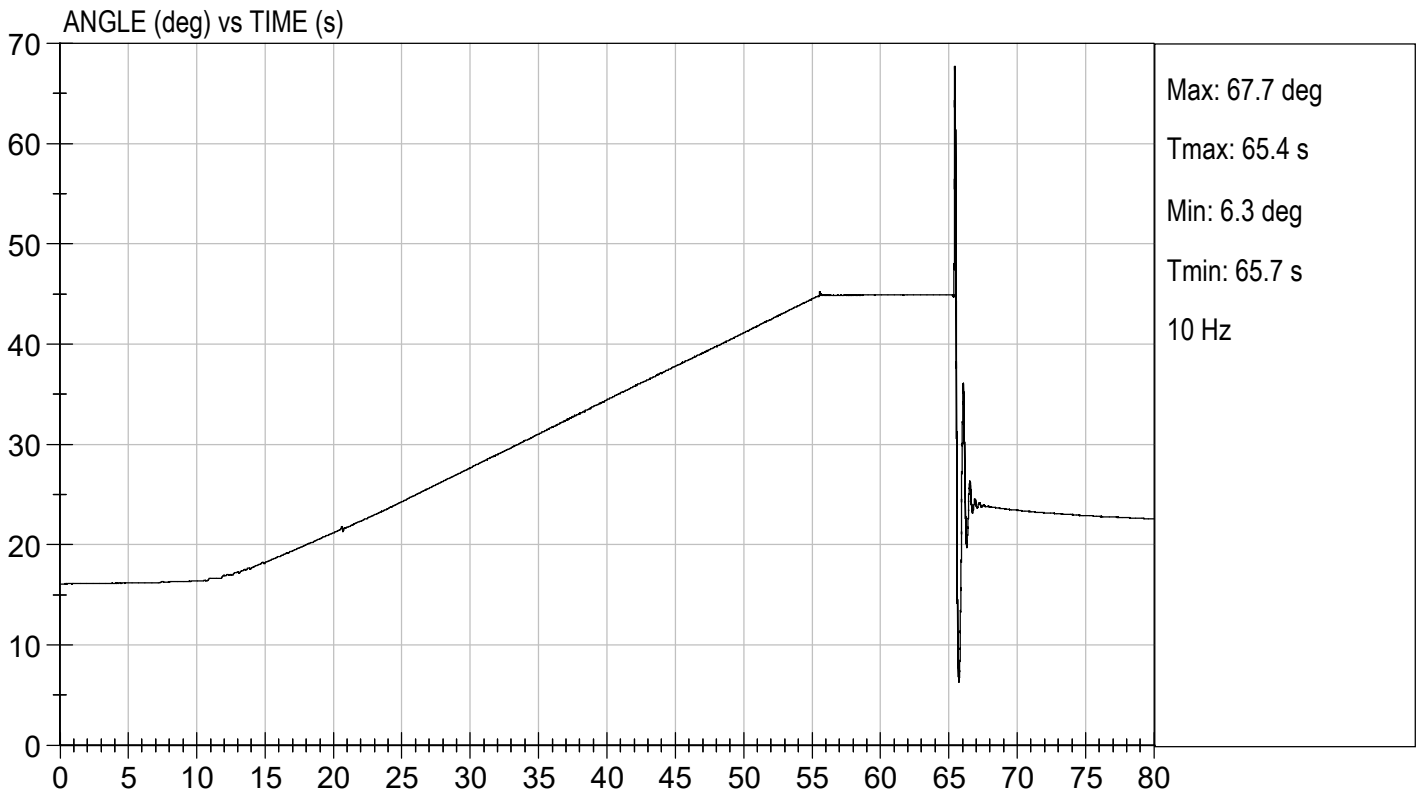
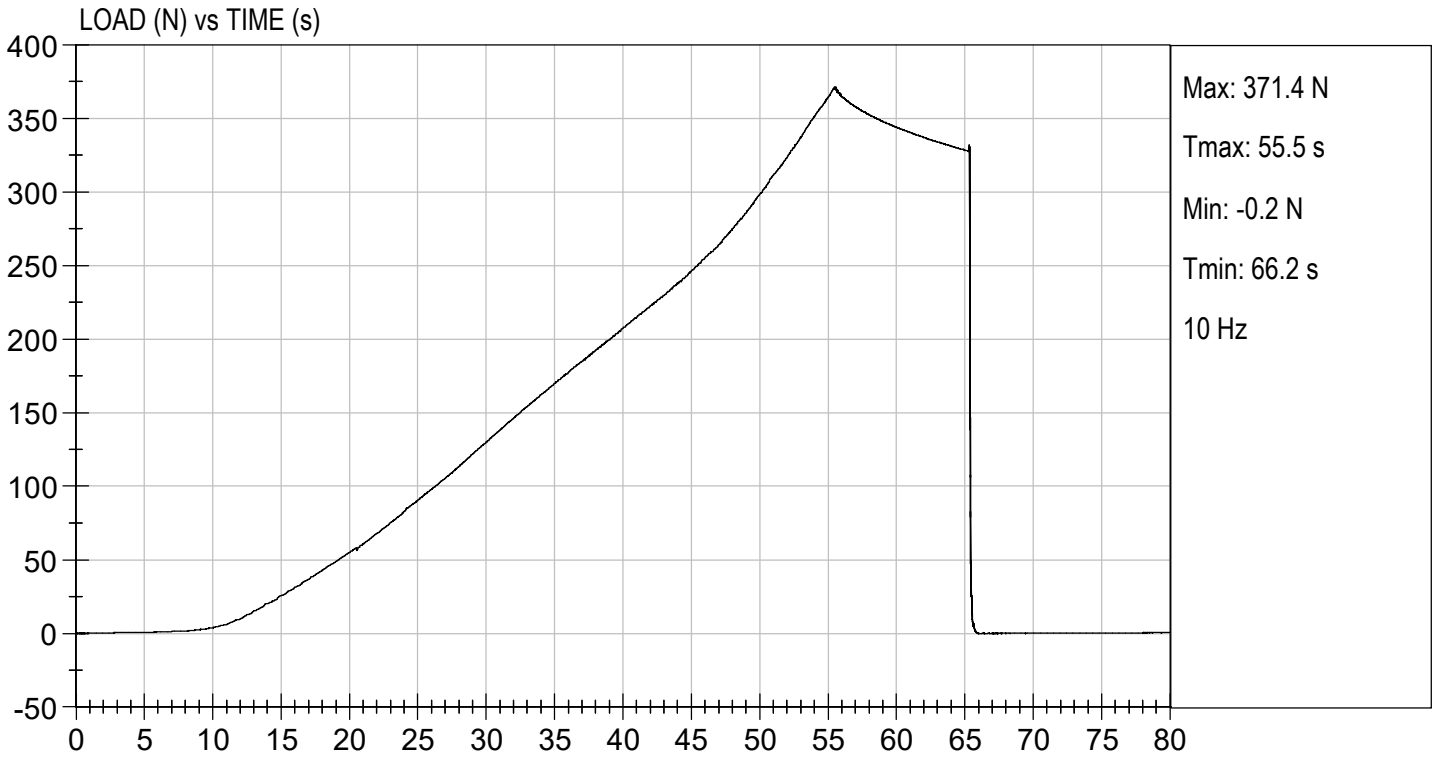
Test I.D: D213387

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	6	Pass
Force at 45 deg	N	320 to 390	371	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.7	Pass
Overall Result				Pass

  
 Laboratory Technician

10/25/2021  
 Test Date

  
 Approved By



**CALIBRATION TEST RESULTS**

**POST-TEST**

**HYBRID III 5<sup>TH</sup> PERCENTILE FEMALE - PASSENGER ATD**

**MGA RESEARCH CORPORATION  
HEAD DROP TEST  
HYBRID III 5TH PERCENTILE**

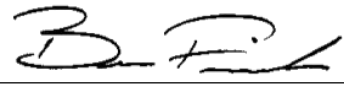
**ATD Serial No:** 142

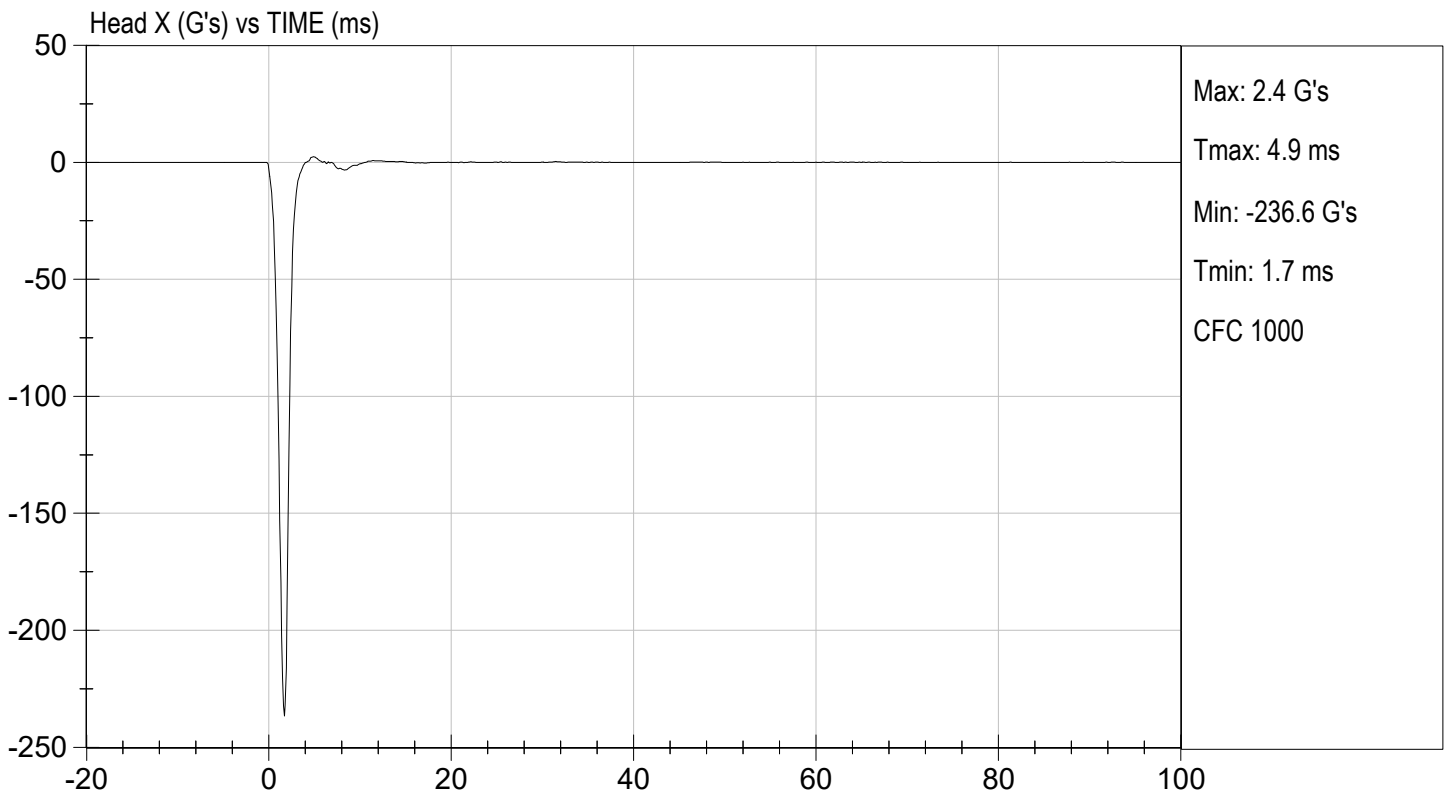
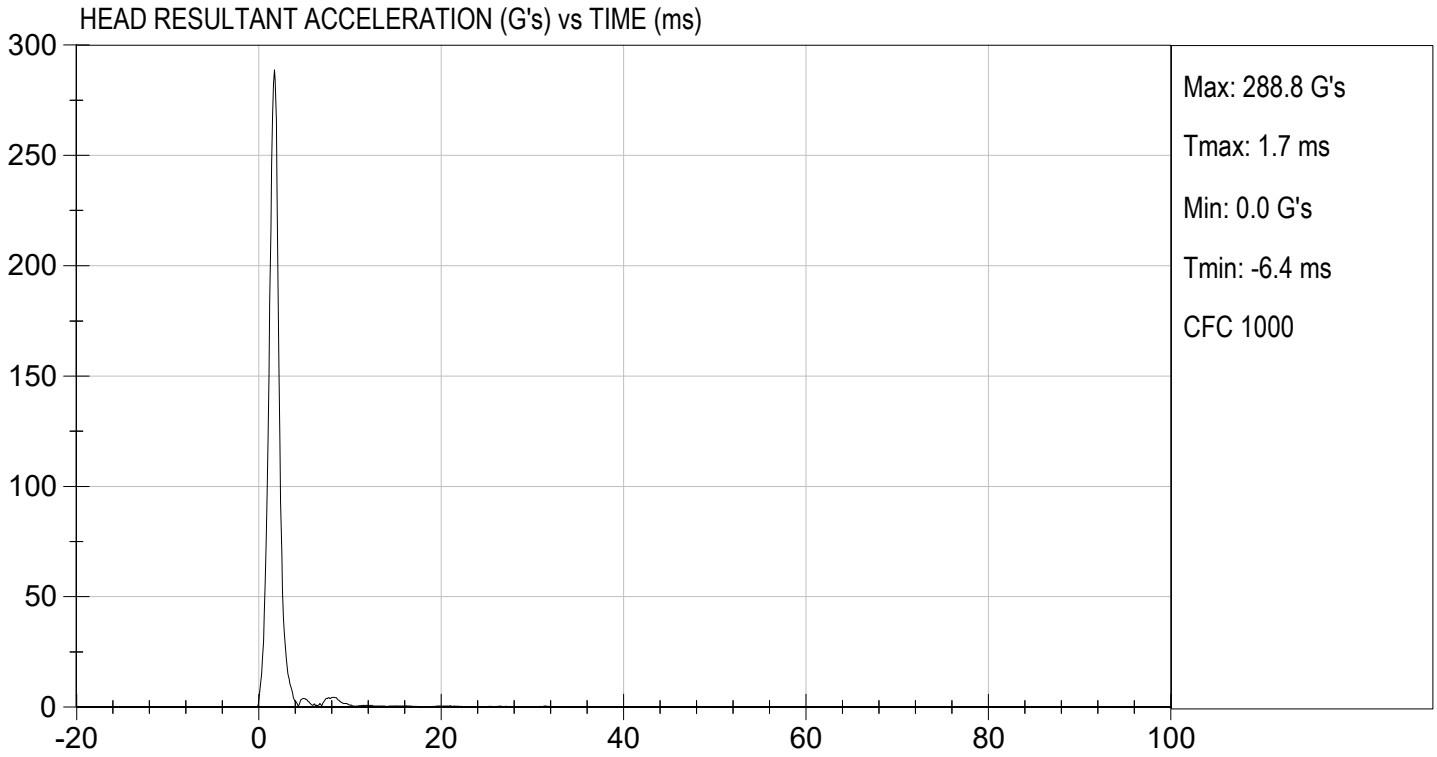
**Test ID:** D213691

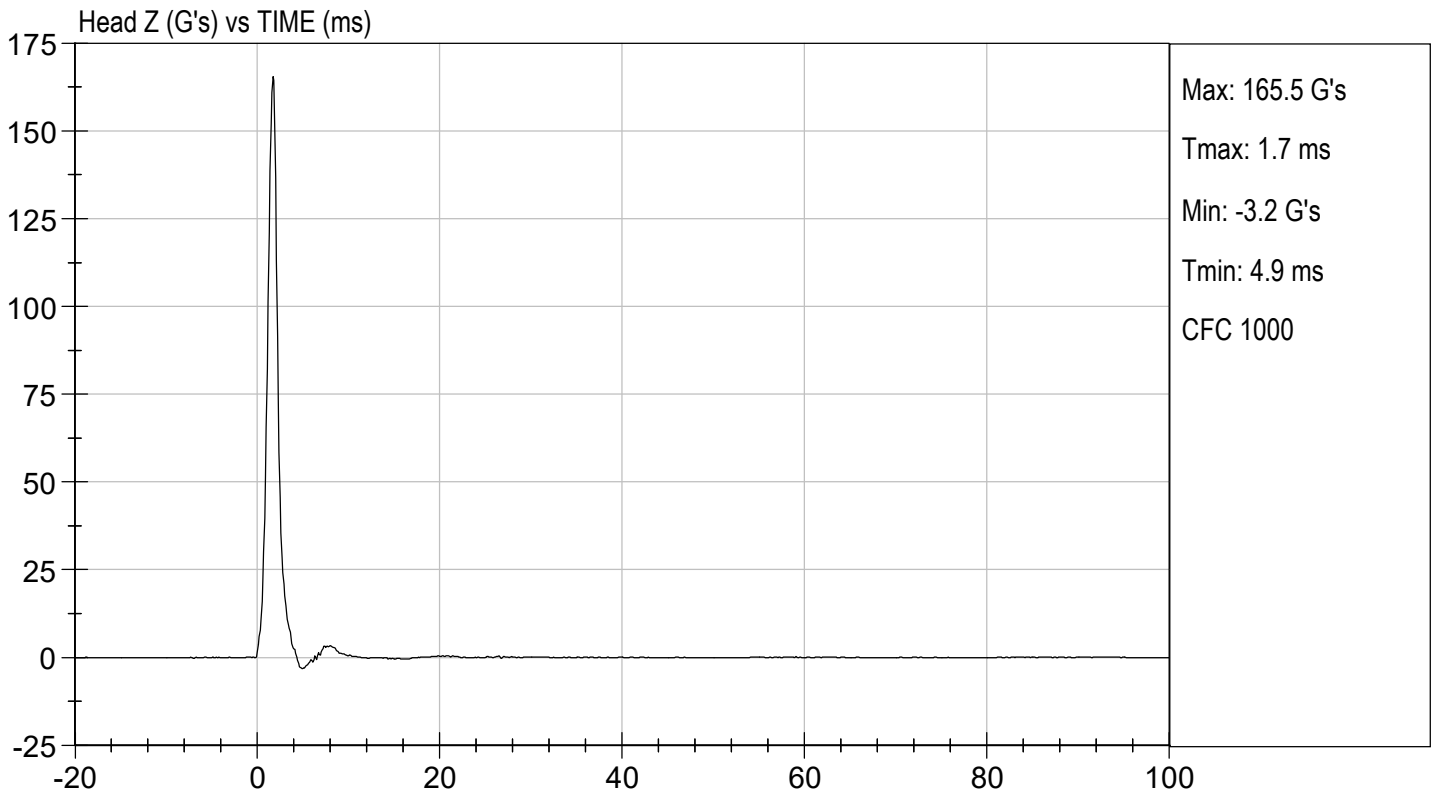
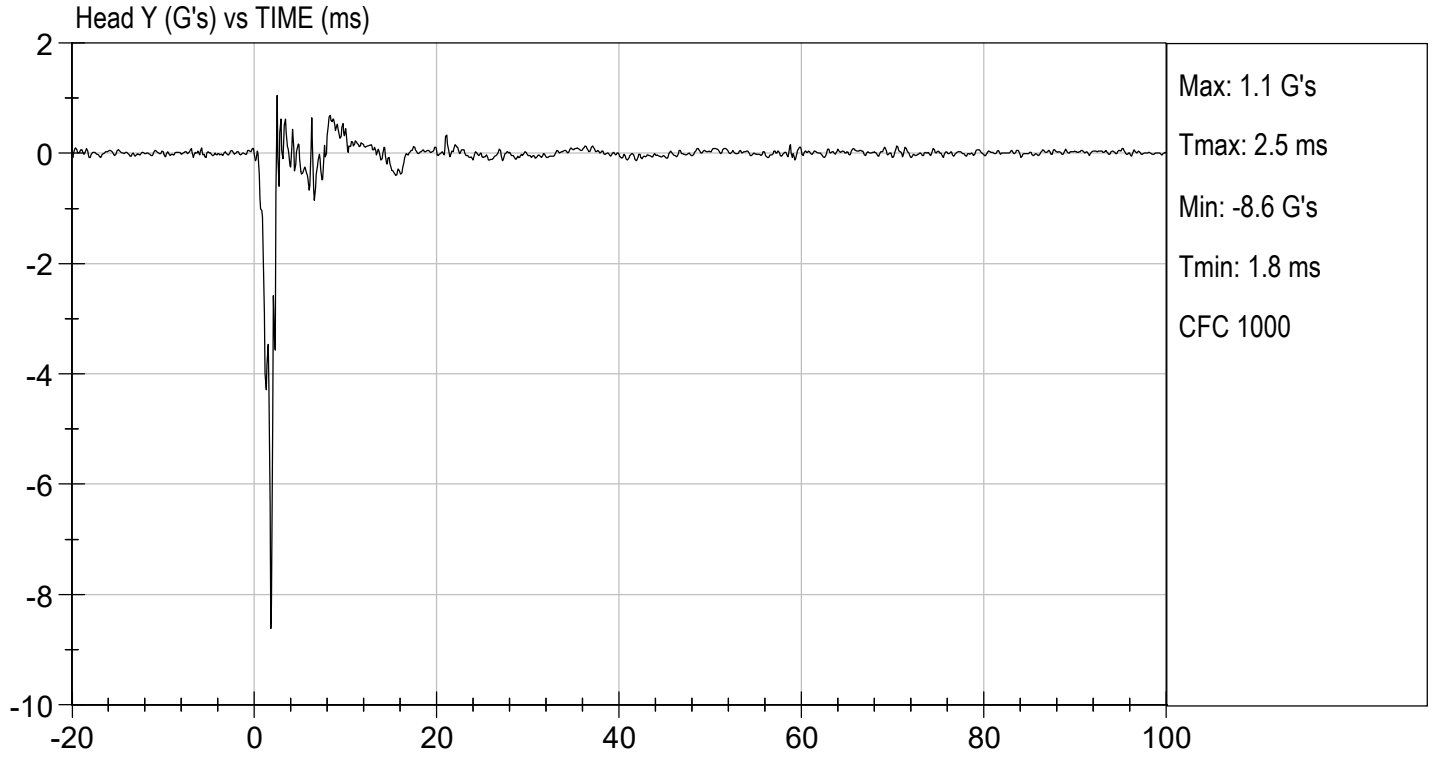
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Peak Resultant Acceleration	G's	250 to 300	289	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-8.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
<b>Overall Test Results</b>				<b>Pass</b>

  
 \_\_\_\_\_  
 Laboratory Technician

12/07/2021  
 \_\_\_\_\_  
 Test Date

  
 \_\_\_\_\_  
 Approved By





**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

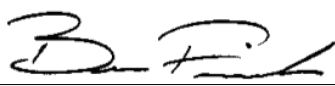
ATD Serial No: 142

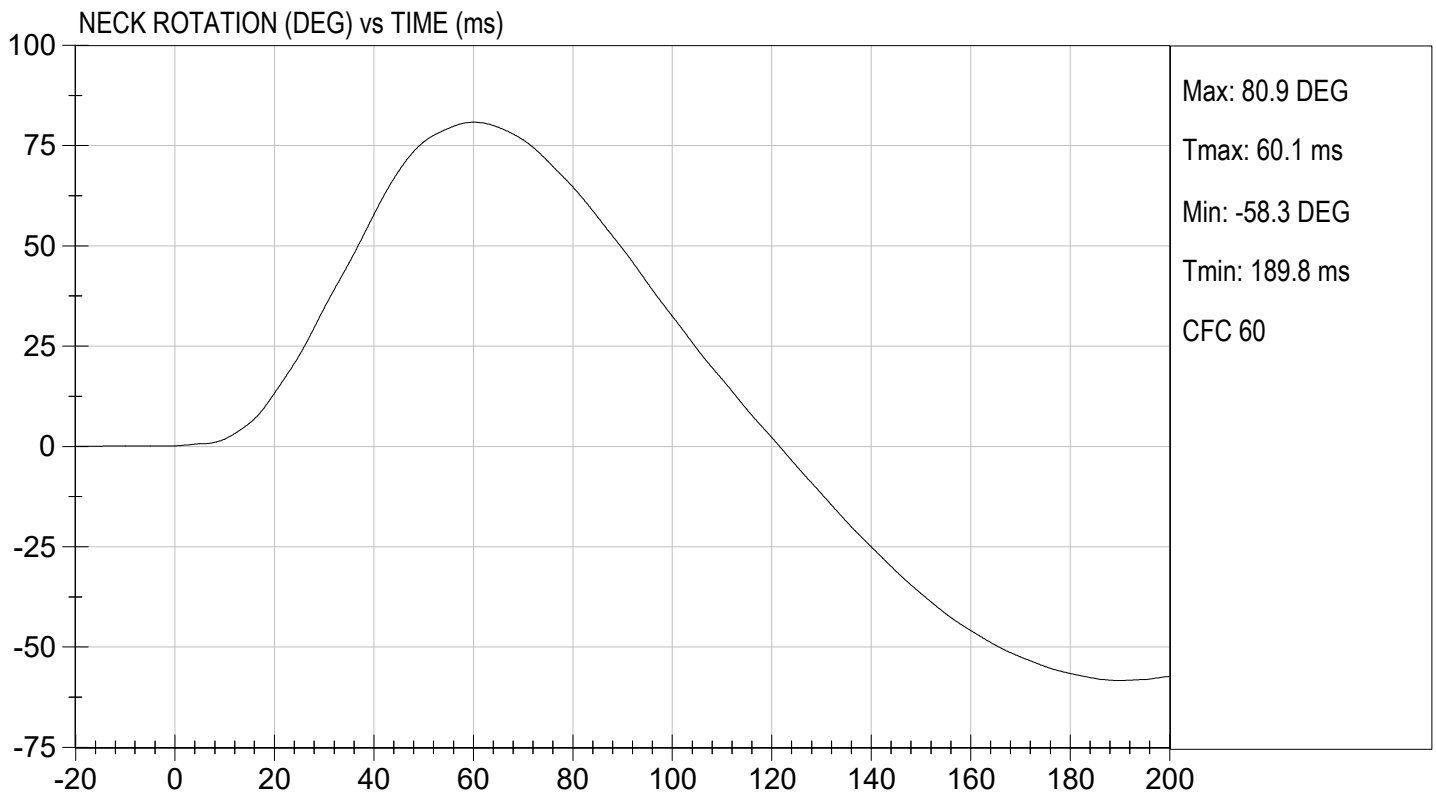
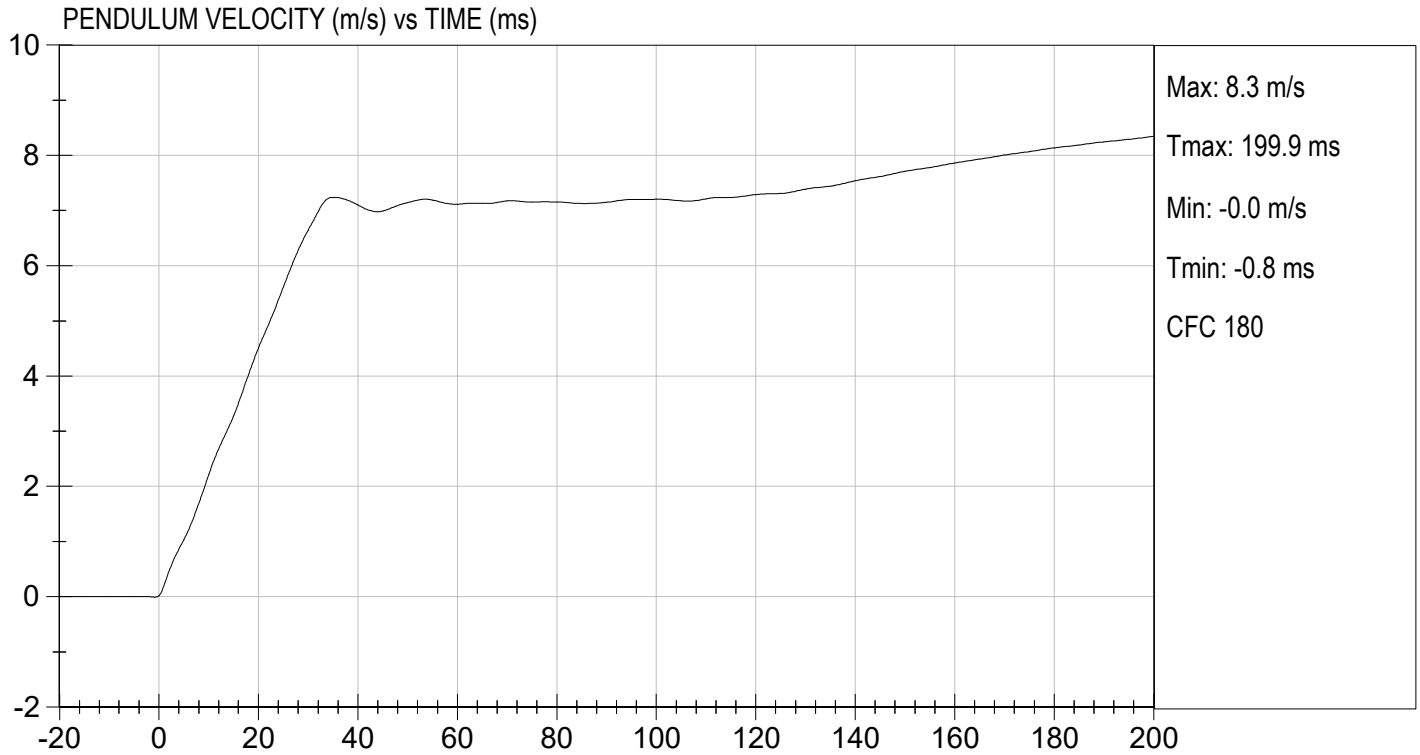
Test I.D: D213692

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	30	Pass
Pendulum Speed		m/s	6.89 to 7.13	6.96	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.2	Pass
	20 ms	m/s	4.0 to 5.0	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.6	Pass
D Plane Rotation	Max	deg	77 to 91	81	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	70	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	84	Pass
Overall Results					Pass

  
 Laboratory Technician

12/07/2021  
 Test Date

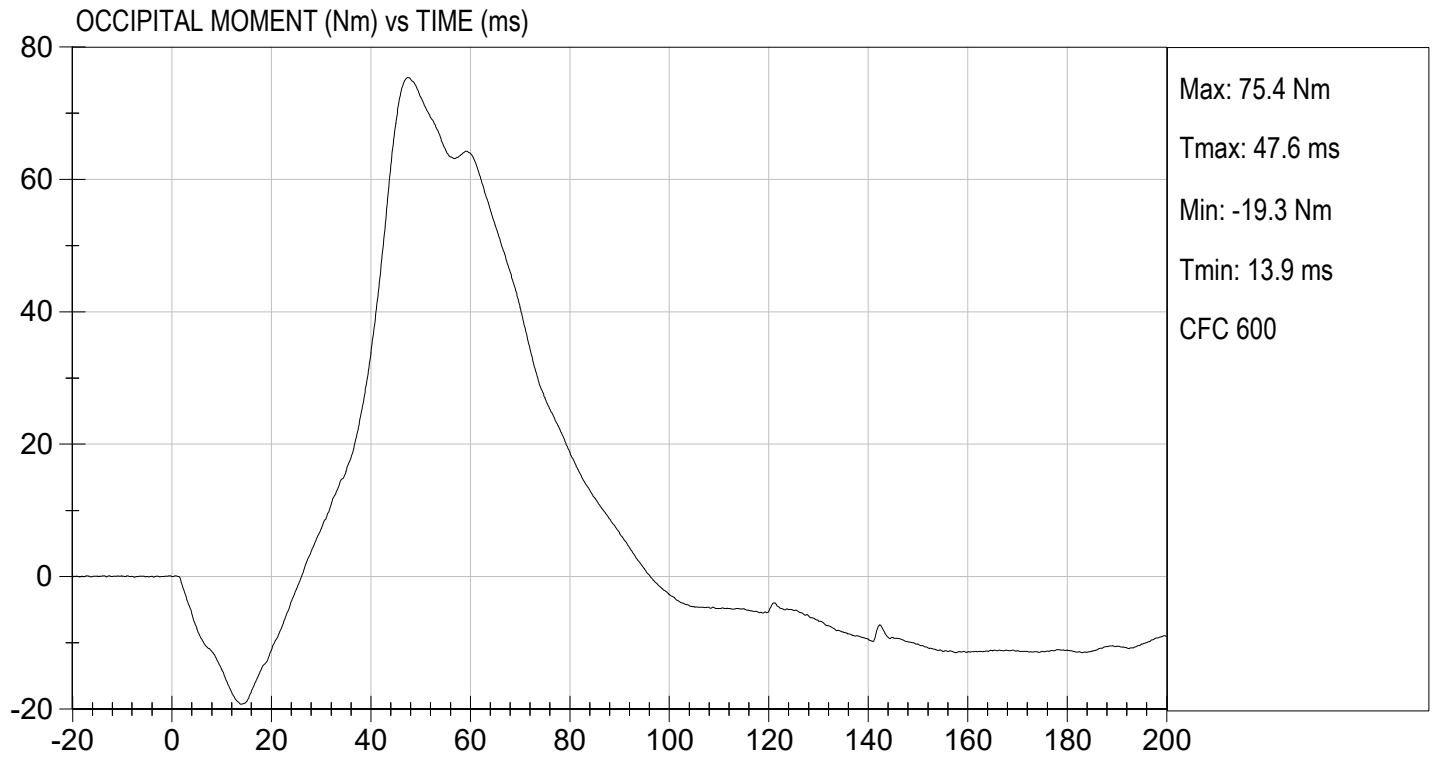
  
 Approved By





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

TEST DATE: 12/07/2021  
TEST #: D213692



**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**

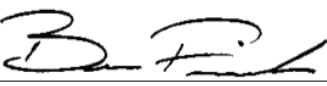
ATD Serial No: 142

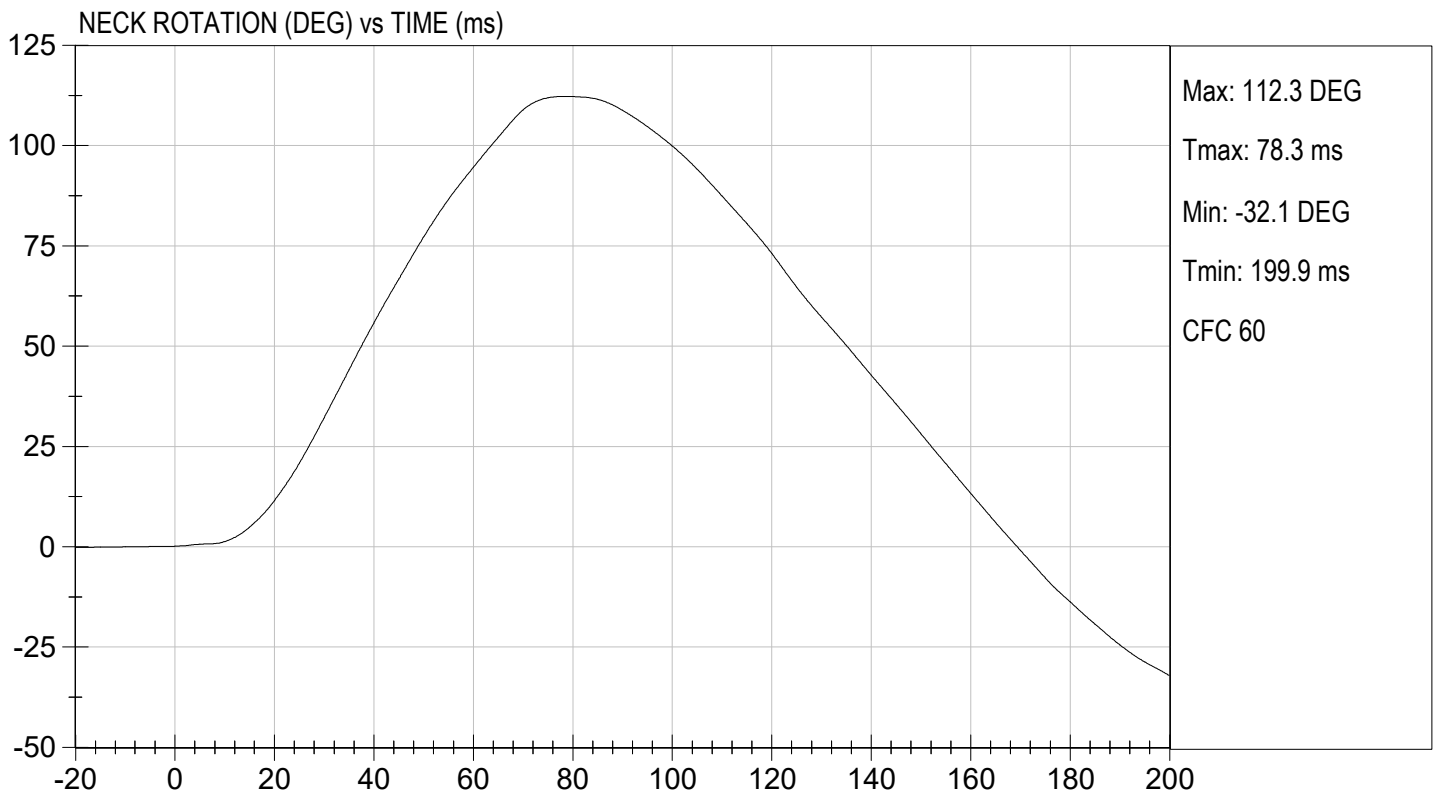
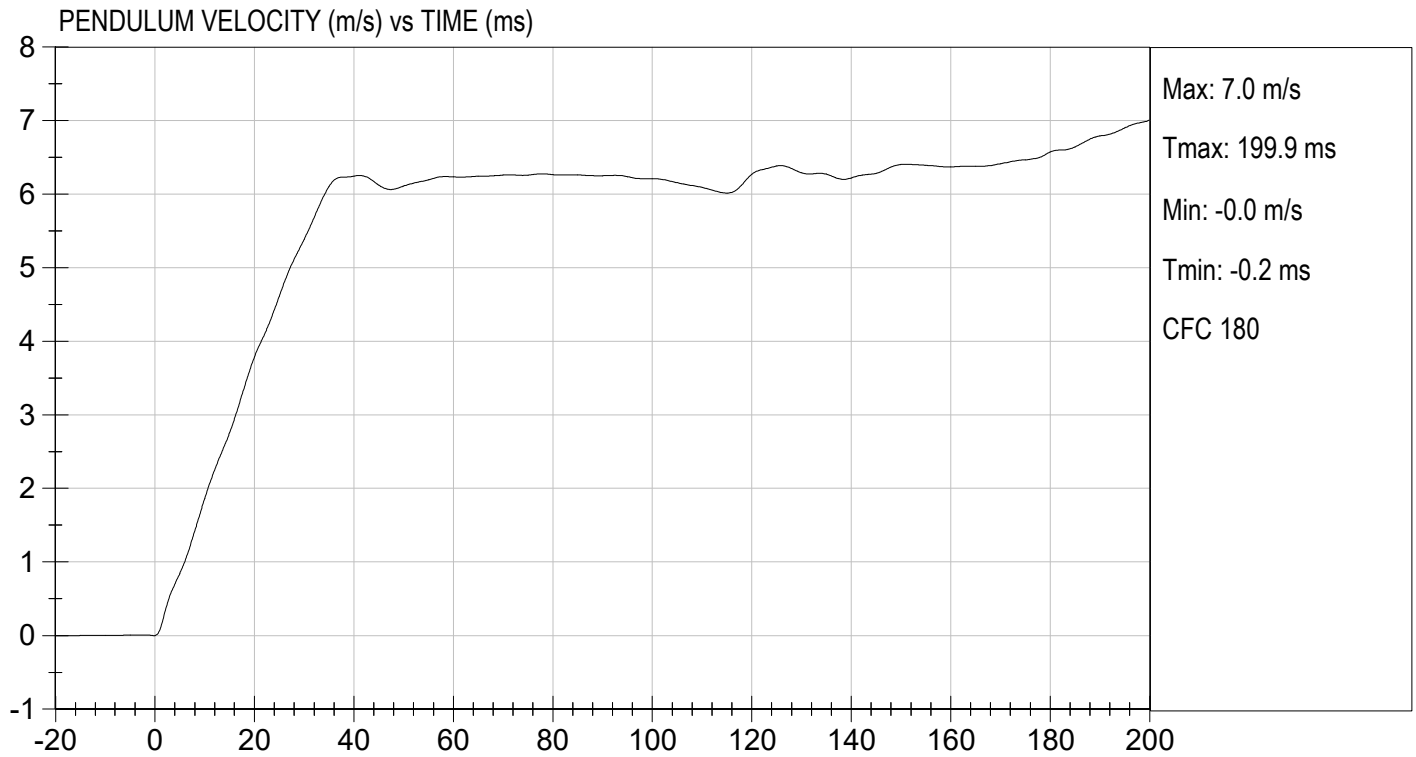
Test I.D.: D213693

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	30	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.05	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.9	Pass
	20 ms	m/s	3.1 to 3.9	3.8	Pass
	30 ms	m/s	4.6 to 5.6	5.4	Pass
D Plane Rotation	Max	deg	99 to 114	112	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-55	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	106	Pass
Overall Results					Pass

  
 Laboratory Technician

12/07/2021  
 Test Date

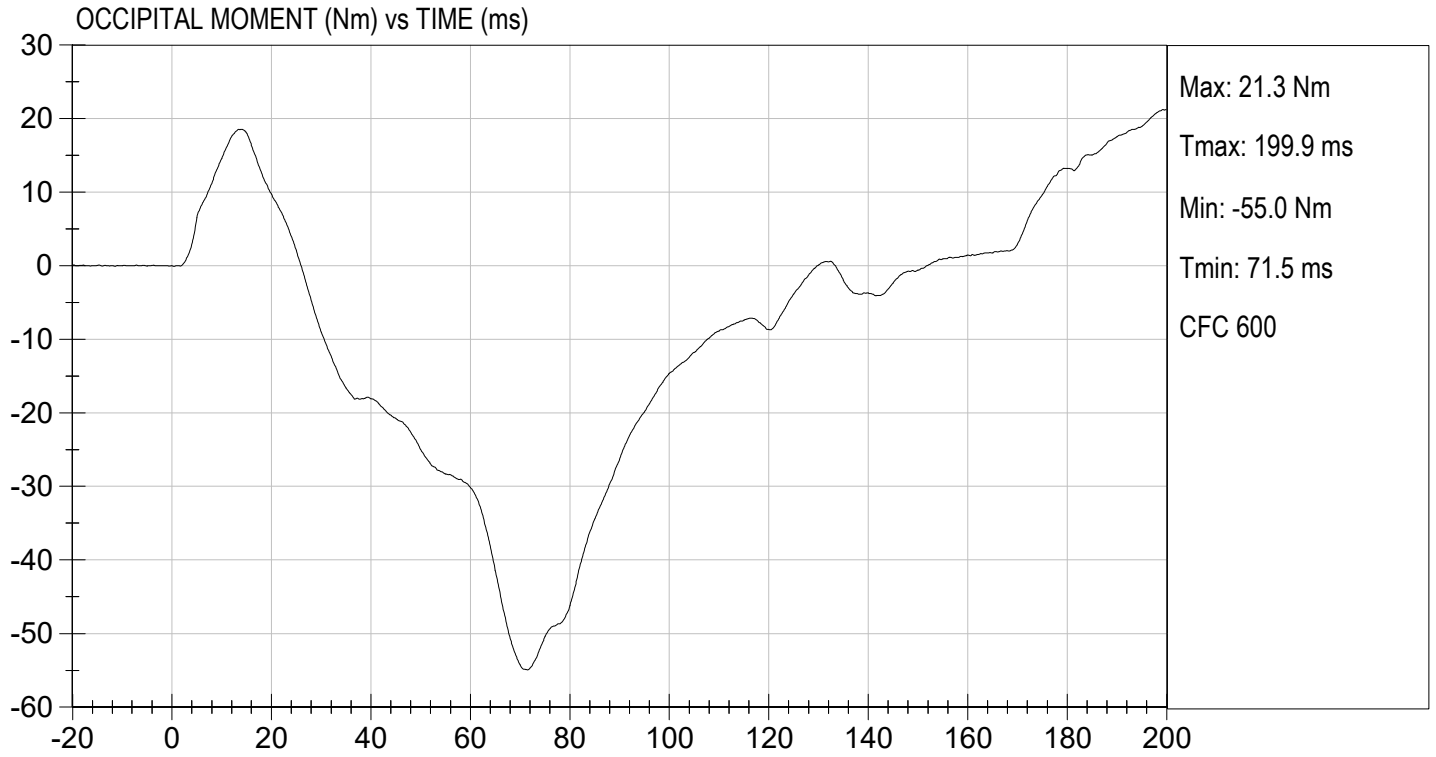
  
 Approved By





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

TEST DATE: 12/07/2021  
TEST #: D213693



**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

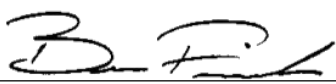
ATD Serial No: 142

Test I.D: D213694

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	30	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4380	Pass
Internal Hysteresis	%	69 to 85	76	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4496	Pass
Overall Test Results				Pass

  
 Laboratory Technician

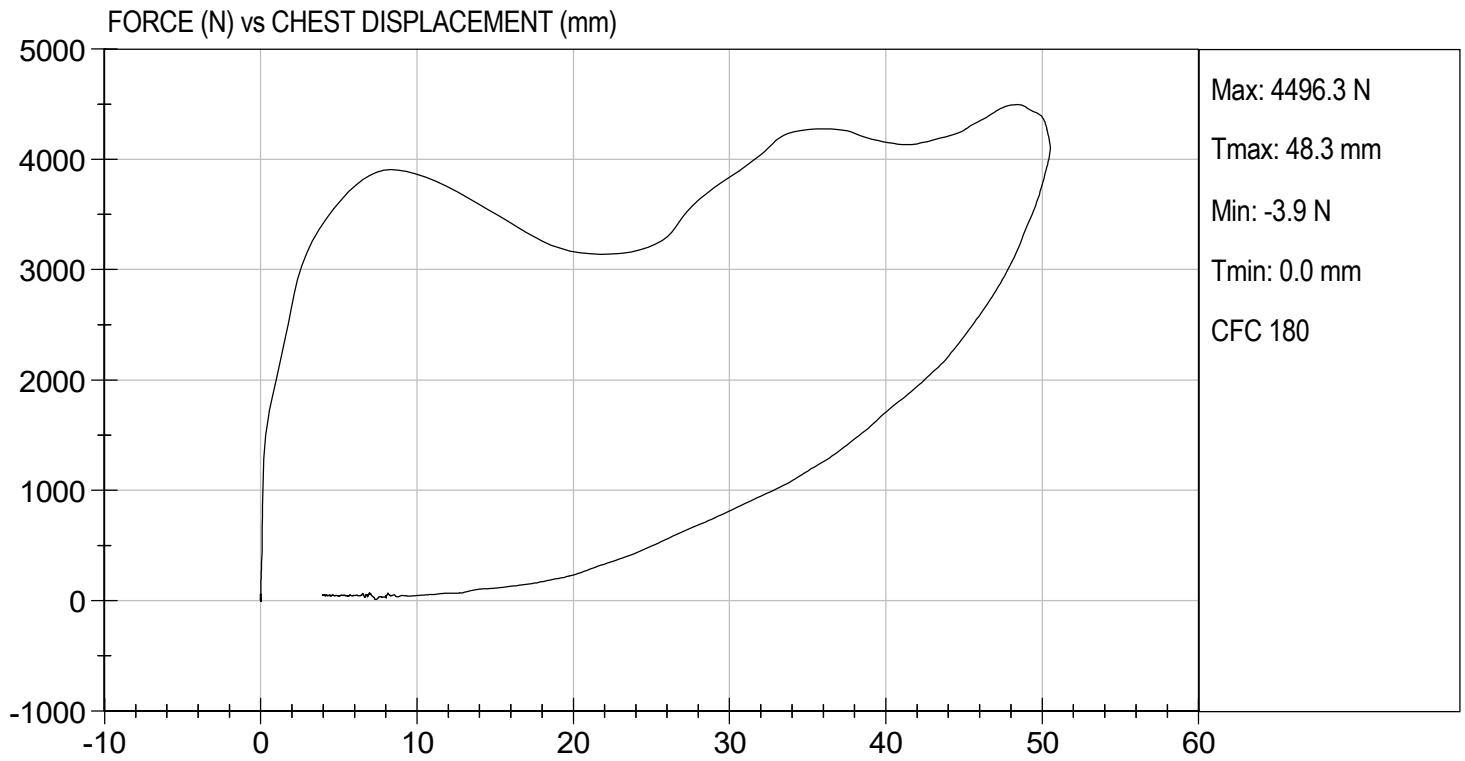
12/03/2021  
 Test Date

  
 Approved By



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

TEST DATE: 12/03/2021  
TEST #: D213694



**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

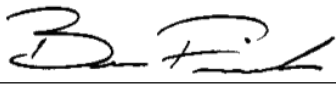
ATD Serial No: 142

Test I.D: D213695

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	N	3450 to 4060	3946	Pass
Overall Test Results				Pass

  
 \_\_\_\_\_  
 Laboratory Technician

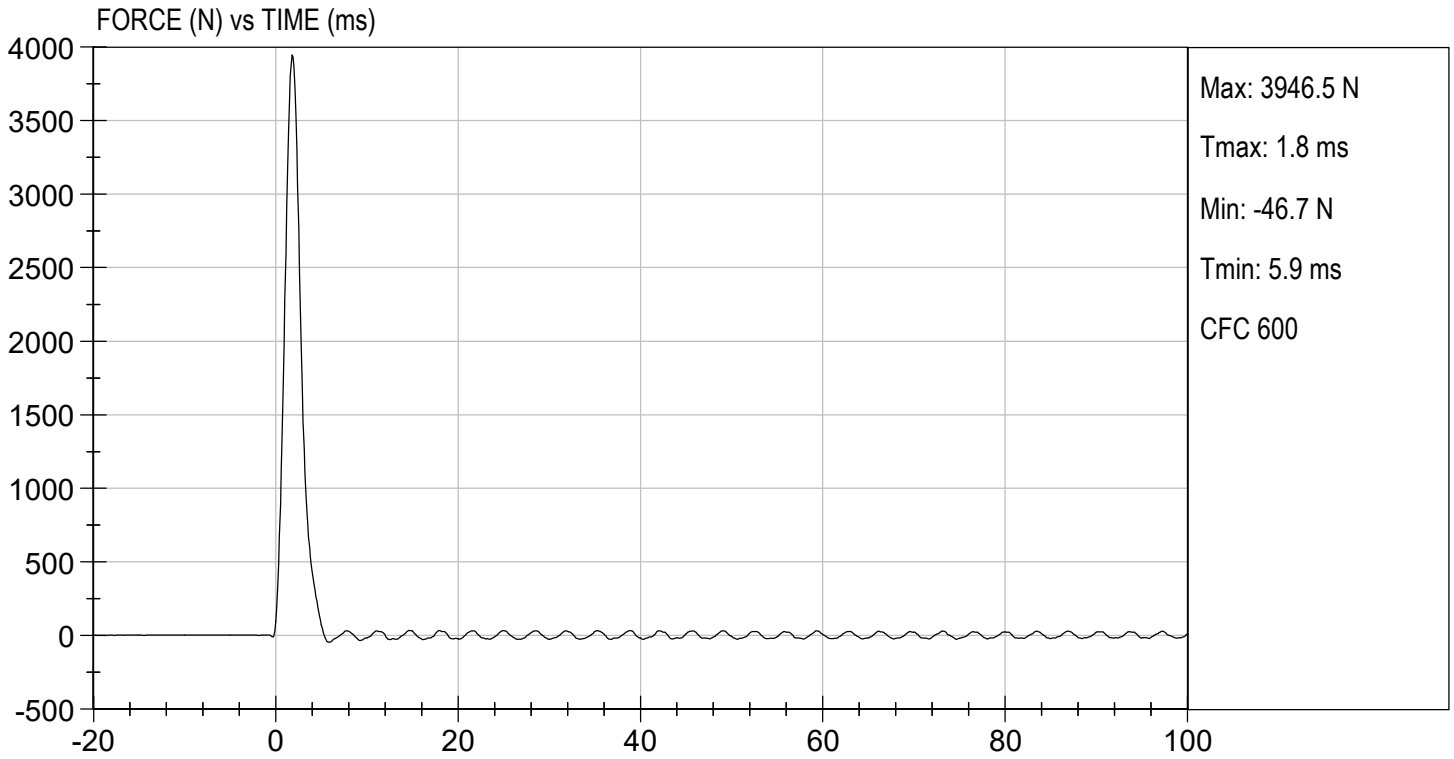
12/07/2021  
 \_\_\_\_\_  
 Test Date

  
 \_\_\_\_\_  
 Approved By



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

TEST DATE: 12/07/2021  
TEST #: D213695



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST  
HYBRID III 5TH PERCENTILE

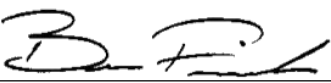
ATD Serial No: 142

Test I.D: D213696

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	N	3450 to 4060	3719	Pass
Overall Test Results				Pass

  
\_\_\_\_\_  
Laboratory Technician

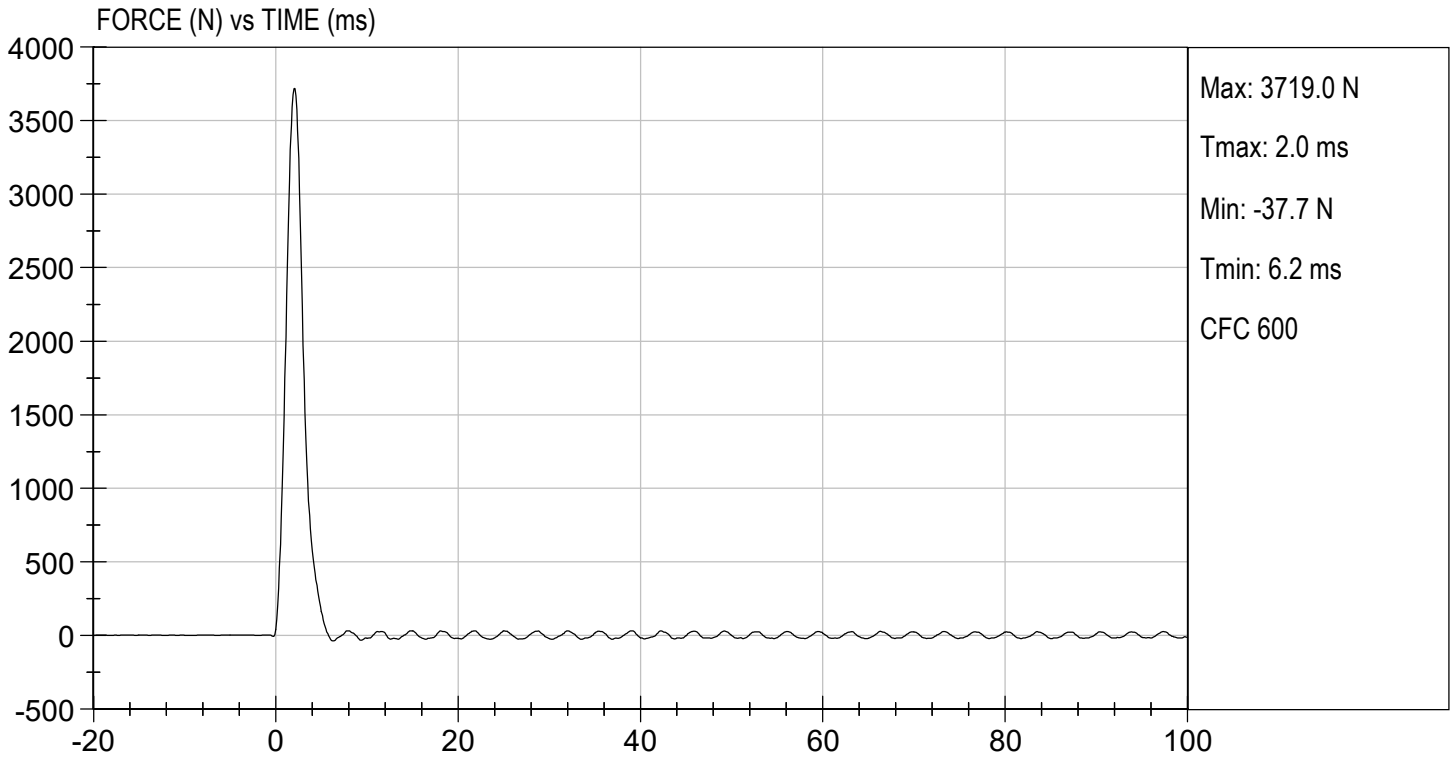
12/07/2021  
\_\_\_\_\_  
Test Date

  
\_\_\_\_\_  
Approved By



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

TEST DATE: 12/07/2021  
TEST #: D213696



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

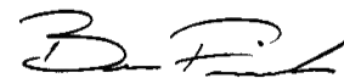
ATD Serial No: 142

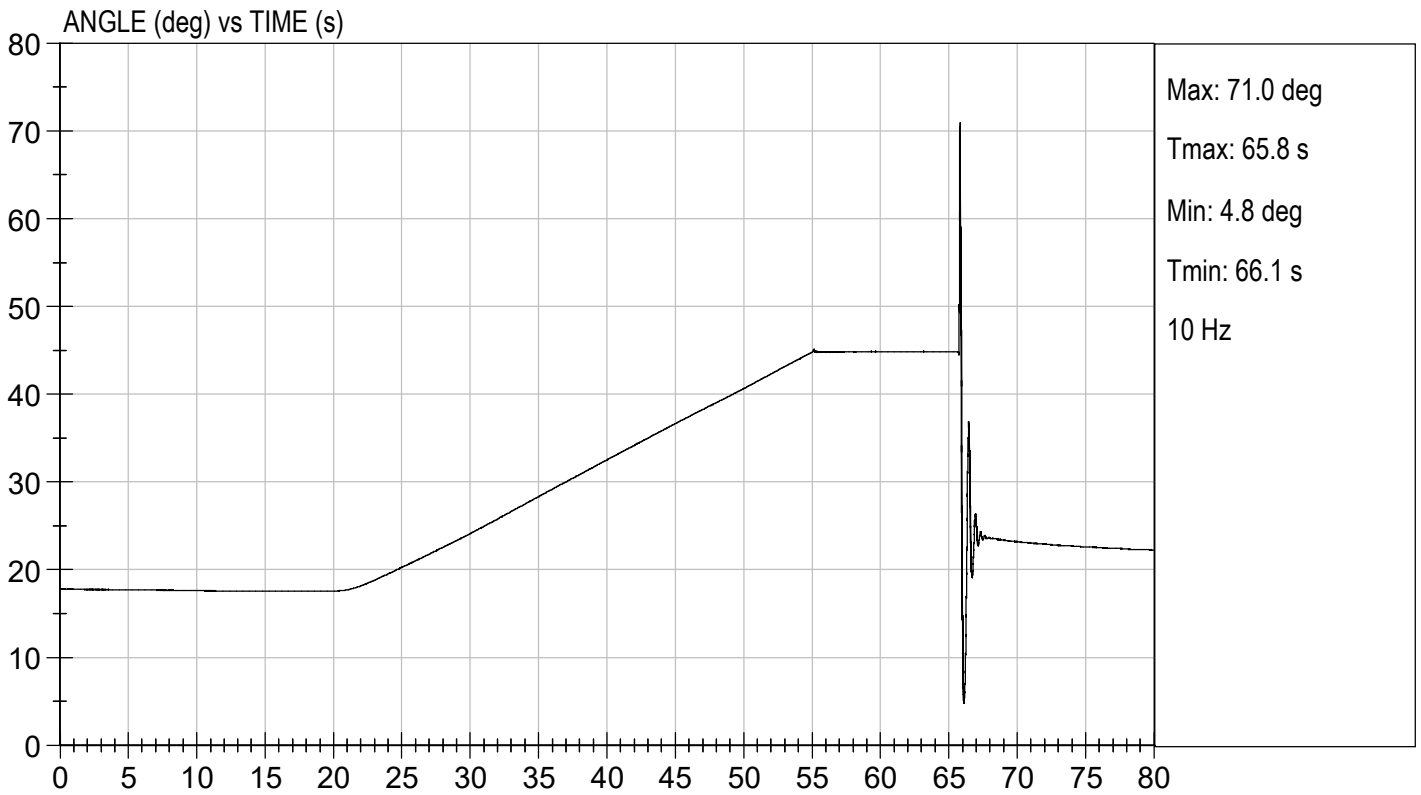
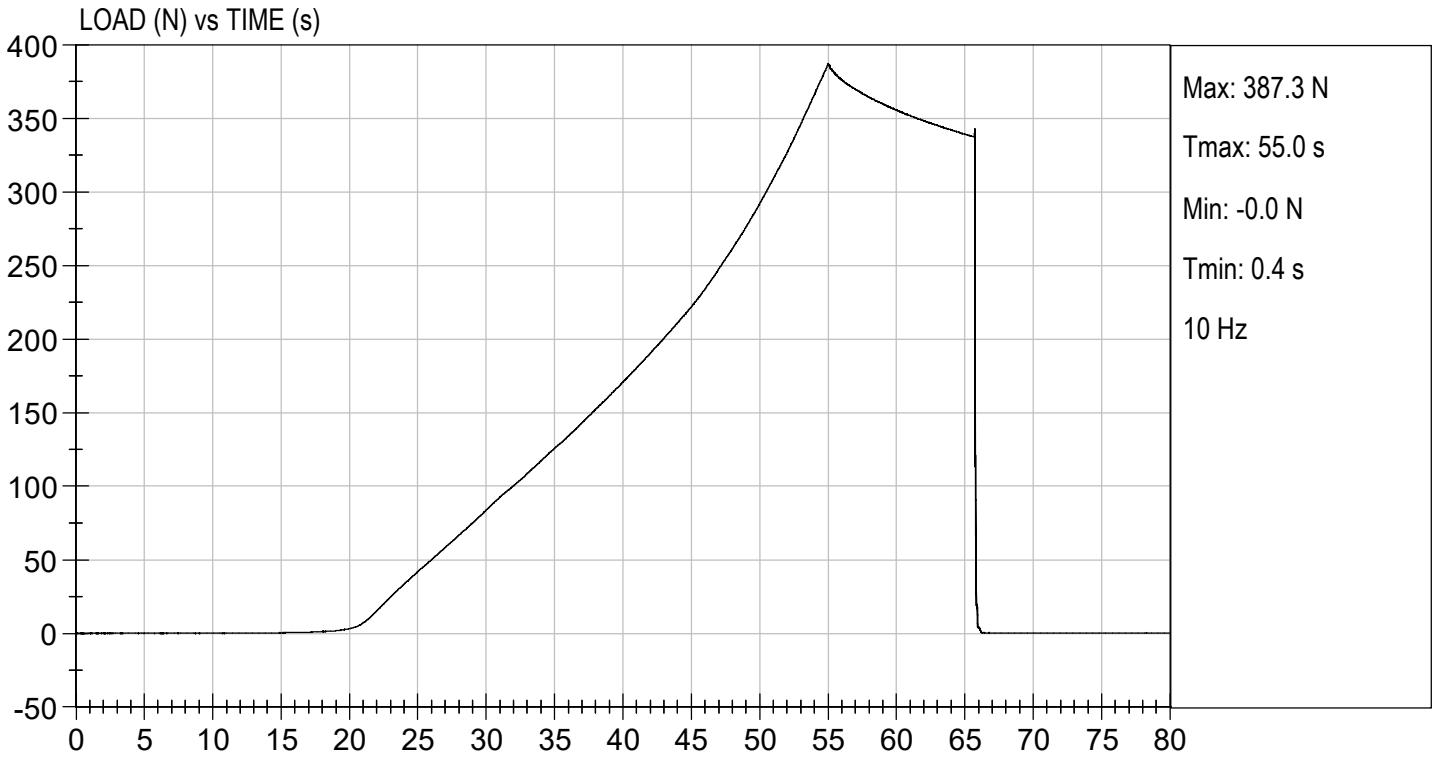
Test I.D: D213697

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	387	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
Overall Result				Pass

  
\_\_\_\_\_  
Laboratory Technician

12/06/2021  
\_\_\_\_\_  
Test Date

  
\_\_\_\_\_  
Approved By



**APPENDIX D**  
**TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA**

**TABLE 1 – DRIVER DUMMY INSTRUMENTATION**

Instrument Location			Axis	Hybrid III 50 <sup>th</sup> S/N 351		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X		P79741	Endevco	08/23/2021
		Y		P79743	Endevco	08/23/2021
		Z		P79744	Endevco	08/23/2021
	Redundant	X		P94834	Endevco	08/23/2021
		Y		P94856	Endevco	08/23/2021
		Z		P97412	Endevco	08/23/2021
Head Angular Rate Sensors			X	ARS15213	DTS	03/02/2021
			Y	ARS15231	DTS	03/02/2021
			Z	ARS15229	DTS	03/02/2021
Upper Neck Load Cell			Fx, Fy, Fz Mx, My, Mz	NG2203	Denton	02/10/2021
Chest Accelerometers	Primary	X		P86792	Endevco	08/23/2021
		Y		P86793	Endevco	08/23/2021
		Z		P88348	Endevco	08/23/2021
	Redundant	X		P88666	Endevco	08/23/2021
		Y		P88667	Endevco	08/23/2021
		Z		P94109	Endevco	08/23/2021
Chest Potentiometer			X	351	Humanetics	08/23/2021
Pelvis Accelerometers			X	P95526	Endevco	08/23/2021
			Y	P96038	Endevco	08/23/2021
			Z	P97742	Endevco	08/23/2021
Femur Load Cells	Right	Primary	Z	FG121P	Denton	08/23/2021
		Redundant	Z	FG121R	Denton	08/23/2021
	Left	Primary	Z	FG122P	Denton	08/23/2021
		Redundant	Z	FG122R	Denton	08/23/2021
Tibia Load Cells	Right	Upper	Mx, My, Fz	TG408	Denton	02/09/2021
		Lower	Mx, My, Fz	AG116	Denton	02/09/2021
	Left	Upper	Mx, My, Fz	TG480	Denton	02/09/2021
		Lower	Mx, My, Fz	AG502	Denton	02/09/2021
Foot Accelerometers	Right	Rear	X	T22486	Endevco	08/23/2021
			Z	P97382	Endevco	08/23/2021
		Front	Z	P82120	Endevco	08/23/2021
	Left	Rear	X	T16468	Endevco	08/23/2021
			Z	T16496	Endevco	08/23/2021
		Front	Z	T16501	Endevco	08/23/2021
Seat Belt Load Cells			Lap	SBG161	FTSS	11/13/2019
			Shoulder	SBG157	FTSS	11/13/2019

**TABLE 2 – FRONT PASSENGER DUMMY INSTRUMENTATION**

Instrument Location			Axis	Hybrid III 5 <sup>th</sup> S/N 142		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary		X	P97377	Endevco	10/04/2021
			Y	P94800	Endevco	10/04/2021
			Z	P94802	Endevco	10/04/2021
	Redundant		X	P94799	Endevco	10/04/2021
			Y	P94801	Endevco	10/04/2021
			Z	P94803	Endevco	10/04/2021
Head Angular Rate Sensors			X	ARS7516	DTS	08/09/2021
			Y	ARS7357	DTS	08/09/2021
			Z	ARS7391	DTS	08/09/2021
Upper Neck Load Cell			Fx, Fy, Fz Mx, My, Mz	NG2256	Denton	04/27/2021
Chest Accelerometers	Primary		X	P94793	Endevco	10/04/2021
			Y	P95322	Endevco	10/04/2021
			Z	P88719	Endevco	10/04/2021
	Redundant		X	P94794	Endevco	10/04/2021
			Y	P95370	Endevco	10/04/2021
			Z	P94785	Endevco	10/04/2021
Chest Potentiometer			X	142	Humanetics	10/18/2021
Pelvis Accelerometers			X	P94798	Endevco	10/04/2021
			Y	P97705	Endevco	10/04/2021
			Z	P82646	Endevco	10/04/2021
Femur Load Cells	Right	Primary	Z	FG126P	Denton	10/04/2021
		Redundant	Z	FG126R	Denton	10/04/2021
	Left	Primary	Z	FG127P	Denton	10/04/2021
		Redundant	Z	FG127R	Denton	10/04/2021
Tibia Load Cells	Right	Upper	Mx, My, Fz	TG467	Denton	04/28/2021
		Lower	Mx, My, Fz	AG491	Denton	04/28/2021
	Left	Upper	Mx, My, Fz	TG478	Denton	04/28/2021
		Lower	Mx, My, Fz	AG500	Denton	04/28/2021
Foot Accelerometers	Right	Rear	X	P94795	Endevco	10/04/2021
			Z	P94796	Endevco	10/04/2021
		Front	Z	P94797	Endevco	10/04/2021
	Left	Rear	X	P83167	Endevco	10/04/2021
			Z	P83168	Endevco	10/04/2021
		Front	Z	P83169	Endevco	10/04/2021
Seat Belt Load Cells			Lap			
			Shoulder		SBG272	FTSS

**TABLE 3 – VEHICLE INSTRUMENTATION**

Instrument Location			Axis	Serial Number	Manufacturer	Calibration Date
Crossmember / Rear Seat Accelerometers	Left	Primary	X	A340210	MSI	10/25/2021
			Z	A383092	MSI	11/05/2021
		Redundant	X	A340617	MSI	10/25/2021
	Right	Primary	X	A391140	MSI	10/22/2021
			Z	A390954	MSI	10/22/2021
		Redundant	X	A390958	MSI	10/22/2021
Engine Accelerometers		Top	X	A382561	MSI	07/02/2021
		Bottom	X	A340746	MSI	07/30/2021