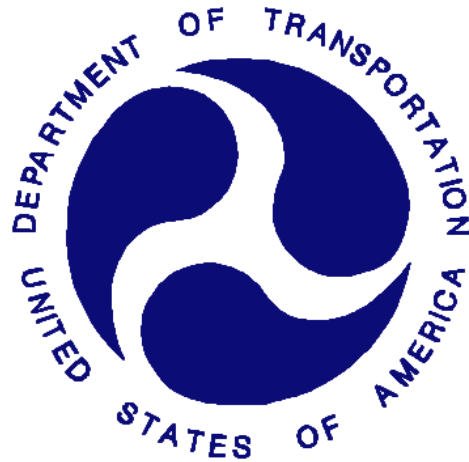


REPORT NUMBER: NCAP-MGA-2016-020

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

**Hyundai Motor Company
2016 Hyundai Tucson SE AWD 5-Dr. SUV
NHTSA No.: M20164203**

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



Test Date: October 5, 2015

Final Report Date: October 30, 2015

FINAL REPORT

**U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NVS-111
1200 New Jersey Ave, SE
Room W43-410
Washington, DC 20590**

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Prepared by: 
Ben Fischer, Project Engineer

Approved by: 
Dave Winkelbauer, Project Engineer

Approval Date: October 30, 2015

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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15. Supplementary Notes																																																									
16. Abstract A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2016 Hyundai Tucson SE AWD 5-Dr. SUV in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), and 301 performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on October 5, 2015. The impact velocity of the vehicle was 56.23 km/h and the ambient temperature at the barrier face at the time of impact was 22.1°C. The target vehicle post-test maximum crush was 450mm located to the right of the vehicle's centerline. The test vehicle's performance was as follows:																																																									
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <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 (HIC₁₅)</td> <td>N/A</td> <td>700</td> <td>172</td> <td>700</td> <td>226</td> </tr> <tr> <td>Maximum Chest</td> <td>mm</td> <td>63</td> <td>27</td> <td>52</td> <td>16</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>0.21</td> <td>1</td> <td>0.37</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>972</td> <td>2620</td> <td>722</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>430</td> <td>2520</td> <td>224</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>285</td> <td>6805</td> <td>201</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>241</td> <td>6805</td> <td>191</td> </tr> </tbody> </table>						Measurement Description	Units	Driver ATD		Passenger ATD		Threshold	Result	Threshold	Result	Head Injury Criteria (HIC ₁₅)	N/A	700	172	700	226	Maximum Chest	mm	63	27	52	16	Nij	N/A	1	0.21	1	0.37	Neck Tension	N	4170	972	2620	722	Neck Compression	N	4000	430	2520	224	Left Femur Force	N	10008	285	6805	201	Right Femur Force	N	10008	241	6805	191
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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 DTNH22-12-D-00258. 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 Frontal NCAP Laboratory Test Procedure.

SUMMARY

A load cell barrier consisting of 176 load cells was impacted by a 2016 Hyundai Tucson SE AWD 5-Dr. SUV at a velocity of 56.23 km/h. The test was performed at MGA Research Corporation on October 5, 2015. Pre-test and post-test photographs of the vehicle and dummies can be found in Appendix A.

Two (2) real-time cameras and fourteen (14) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

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

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 also installed on the driver's shoulder belt, driver's lap belt, passenger's shoulder belt, and passenger's lap belt to measure dummy torso section loading.

The driver (position 1) ATD (Serial No. 351) and the right-front passenger (position 2) ATD (Serial No. 138) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 634 channels of data were recorded on a data acquisition system. Appendix B contains the dummy response data traces.

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

The maximum static crush of the vehicle was 450 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

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

The occupant data is summarized below:

ATD position	HIC ₁₅	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (Gs)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50 th)	172	0.21	972	430	44	27	285	241
Passenger (5 th)	226	0.37	722	224	40	16	201	191

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

TEST NOTES

BARRIER C-04 FX has no valid data.
 BARRIER C-04 MY has no valid data.
 BARRIER C-04 MZ has no valid 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: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
Test Date: 10/5/2015

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20164203	Traction Control System (TCS)	Yes
Model Year	2016	Power Steering	Yes
Make	Hyundai	Power Window Auto-Reverse	Yes
Model	Tucson	Driver Frontal Airbag	Yes
Body Style	5-Door SUV	Driver Curtain Airbag	Yes
VIN	KM8J3CA45GU055511	Driver Head/Torso Airbag	No
Body Color	Mojave Sand	Driver Torso Airbag	No
Odometer (km/mi)	95km / 59mi	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	2.0	Driver Pelvis Airbag	No
Type/No. Cylinders	4	Driver Knee Airbag	No
Engine Placement	Lateral	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	6	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	AWD	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	Driver	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 Company	GVWR (kg)	2150
Date of Manufacture	07/'15	GAWR Front (kg)	1280
		GAWR Rear (kg)	1150

VEHICLE SEATING AND WEIGHT CAPACITY DATA

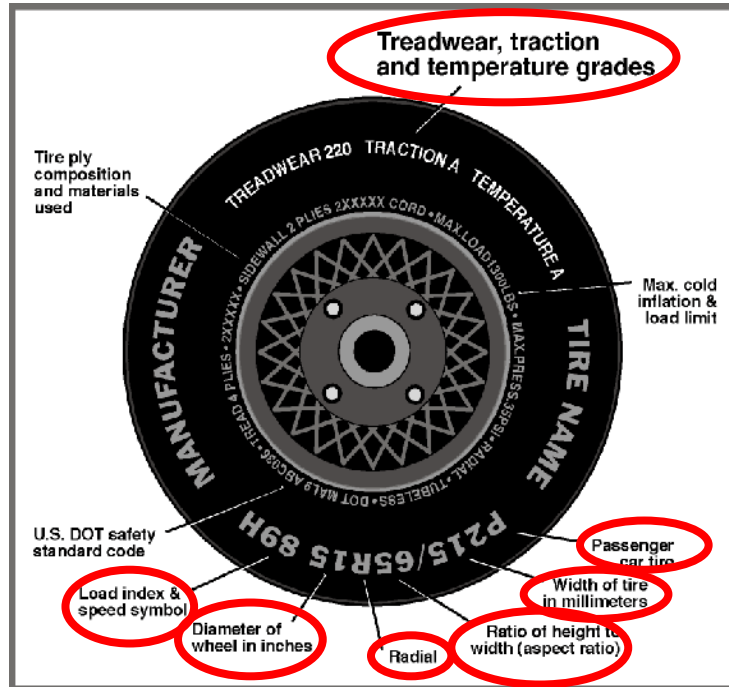
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Contoured		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				440
Cargo Weight (RCLW) (kg)				100

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

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	225/60R17	225/60R17
Tire Size on Vehicle	225/60R17	225/60R17
Tire Manufacturer	Hankook	Hankook
Tire Model	Kinergy GT	Kinergy GT
Treadwear	540	540
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	99H	99H
Tire Material	Rubber	Rubber
DOT Safety Code Left	5MJF 1BH 2715	5MJF 1BH 2715
DOT Safety Code Right	5MJF 1BH 2715	5MJF 1BH 2715

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

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	451.0	350.5		491.5	439.5	
Right	kg	465.0	310.5		482.5	397.0	
Ratio	%	58.1	41.9		53.8	46.2	
Totals	kg	916.0	661.0	1577.0	974.0	836.5	1810.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1577.0
Weight of 1 P572E ATD & 1 P572O ATD	kg	141
Rated Cargo/Luggage Weight (RCLW)	kg	100
Calculated Test Vehicle Target Weight (TVTW)	kg	1818.0

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	771	762	769	783	1121
As Tested	mm	754	760	735	748	1235
Post Test	mm	749	789	718	775	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2674
Total Vehicle Length at Left Side	mm	4285
Total Vehicle Length at Centerline	mm	4477
Total Vehicle Length at Right Side	mm	4285
Weight of Ballast in Cargo Area	kg	37
Weight of Vehicle Components Removed	kg	28
Amount of Stoddard Solvent in Fuel Tank	L	57.9

List of components removed to meet test weight: None.

List of components removed for instrumentation, data box, and equipment installation: Cargo area carpet, LR & RR floor mats, jack and tool kit, spare tire and cover, tire repair kit.

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

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4477
2	Total Width	1810
3	Bumper Top Height	554
4	Bumper Bottom Height	451
5	Longitudinal Member Top Height	557
6	Distance between Longitudinal Members	928
7	Longitudinal Member Width	58
8	Engine Top Height	897
9	Engine Bottom Height	152
10	Engine and Gearbox Width	900
11	Front Bumper-Engine Distance	357
12	Front Shock Absorber Fixing Height	961
13	Bonnet Leading Edge Height	856
14	Front Shock Absorber Fixing Width	1189
15	Front Bumper – Front Axle Distance	911
16	Front Axle – A-Pillar Distance	473
17	A-Pillar – B-Pillar Distance	1083
18	B-Pillar – Rear Axle Distance	1129
19	B-Pillar – C-Pillar Distance	652
20	Roof Sill Bottom Height	1466
21	Roof Sill Top Height	1604
22	Floor Sill Bottom Height	256
23	Floor Sill Top Height	473

DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

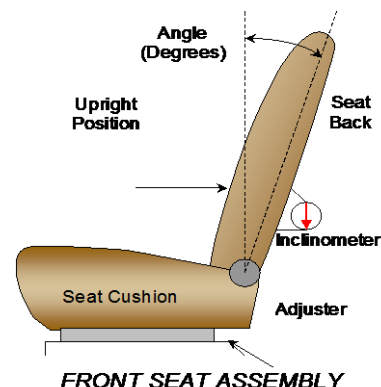
Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

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 August 2013.

	Degrees
Driver Seat Back Angle	1.8° on headrest post
Passenger Seat Back Angle	2.3° on headrest post



SEAT FORE/AFT POSITIONS

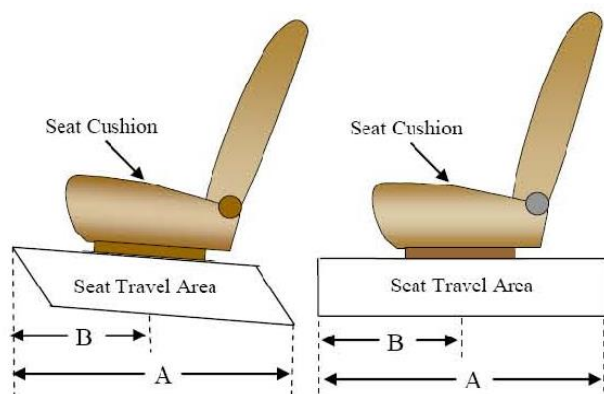
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated August 2013.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	300 mm	150 mm
Passenger Seat	240mm / 38 detents (1 st as 1)	0 mm / 0 th detent (1 st as 0)

SEAT BELT UPPER ANCHORAGES

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

	Total # of Positions	Placed in Position #
Driver Seat	4 (1 st as 1)	0 (1 st as 0)
Passenger Seat	4 (1 st as 1)	0 (1 st as 0)



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

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

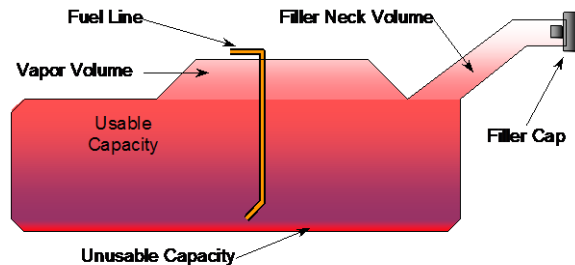
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	62.0
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	57.0 to 58.3
Actual Amount of Solvent used	57.9
1/3 of Usable Capacity	20.7

FUEL PUMP

Describe the fuel pump type, its behavior, and the location of the fuel filler pipe.

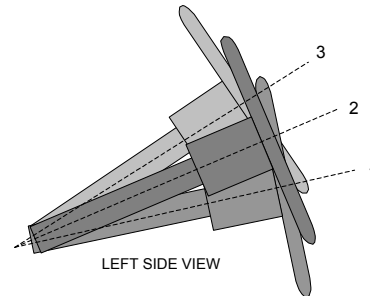
The electric fuel pump turns on when the key is in the "ON" position.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

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



STEERING COLUMN ASSEMBLY

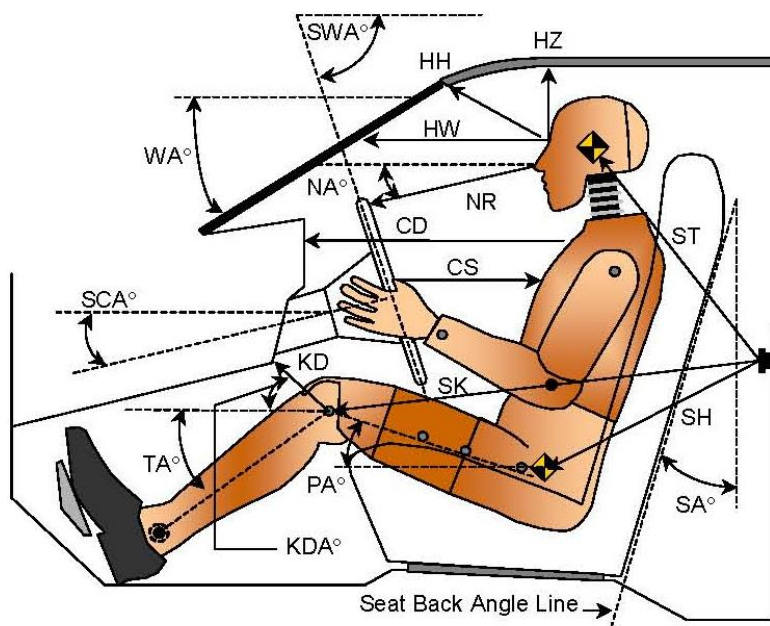
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	66.6	224
Geometric Center Position 2	63.8	253
Uppermost Position 3	61.0	281
Telescoping Steering Wheel Travel		57
Test Position	63.8	253

DATA SHEET NO. 3 DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
Test Date: 10/5/2015



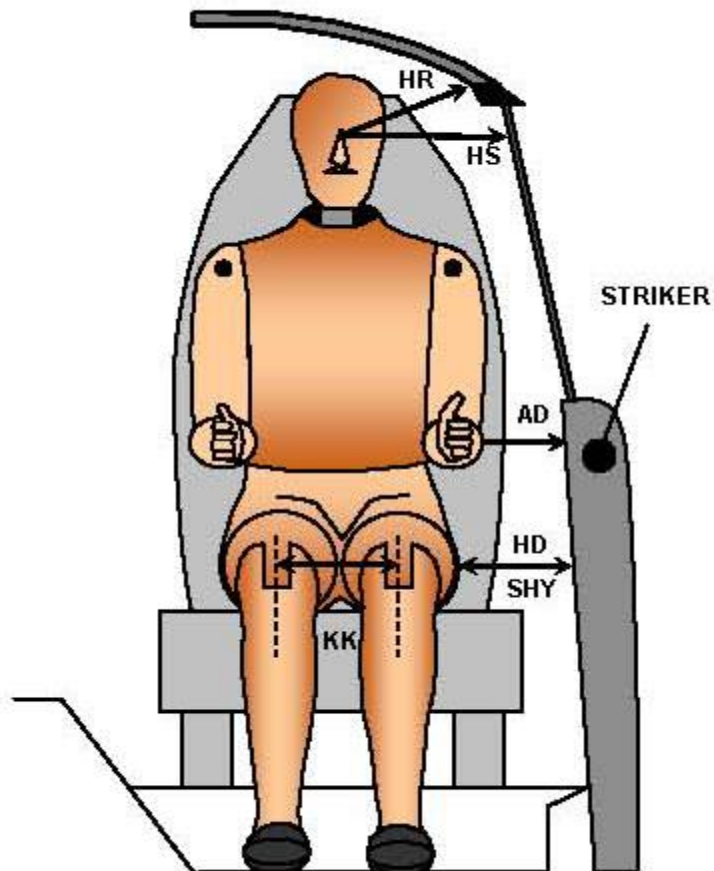
LEFT SIDE VIEW

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		23.0		
SWA°	Steering Wheel Angle		63.8		
SCA°	Steering Column Angle		26.2		
SA°	Seat Back Angle (on headrest post)		1.8		2.3
HZ	Head to Roof (Z)	210	90	273	90
HH	Head to Header	324	25.2	357	42.9
HW	Head to Windshield	647	0	745	0
NR	Nose to Rim	379	13.3		
CD	Chest to Dash	523		436	
CS	Chest to Steering Hub	303	7.0		
RA	Rim to Abdomen	183	0		
KDL	Left Knee to Dash	172	19.8	135	31.1
KDR	Right Knee to Dash	141	21.1	147	32.4
PA°	Pelvic Angle		24.5		19.0
TA°	Tibia Angle		48.0		47.3
SK	Striker to Knee	588	101.6	656	103.8
ST	Striker to Head	443	17.5	415	28.4
SH	Striker to H-Point	299	137.6	390	122.0

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015



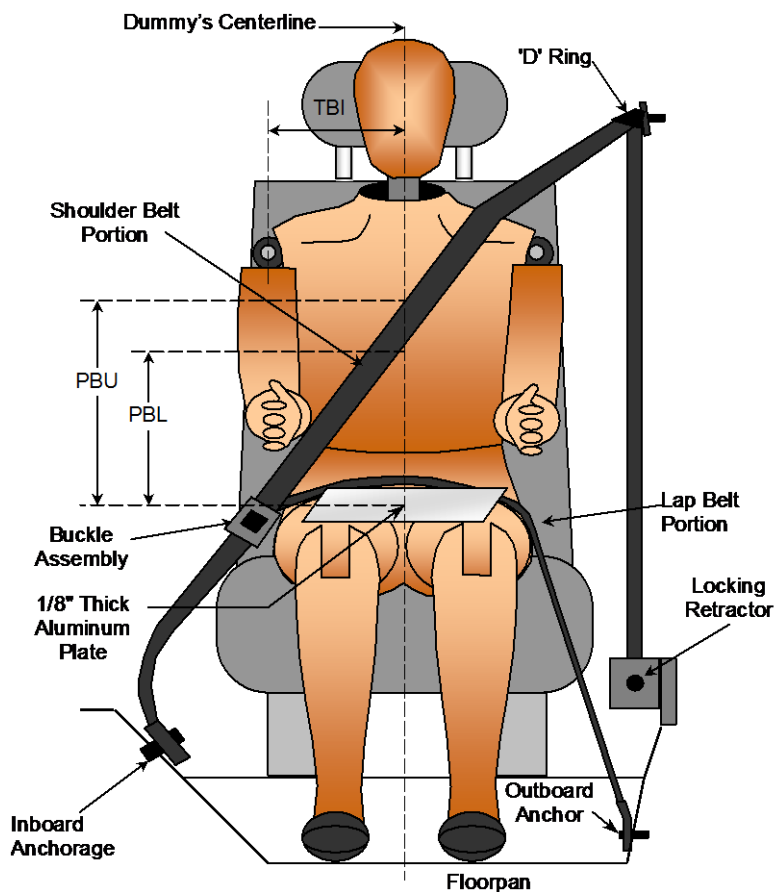
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
AD	Arm to Door	130	94
HD	H-Point to Door	154	183
HR	Head to Side Header	221	285
HS	Head to Side Window	327	374
KK	Knee to Knee	353	227
SHY	Striker to H-Point (Y Direction)	288	320
AA	Ankle to Ankle	349	166

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
Test Date: 10/5/2015



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	380	340
PBL - Top surface of reference to belt lower edge	mm	310	250

BELT LENGTH DATA

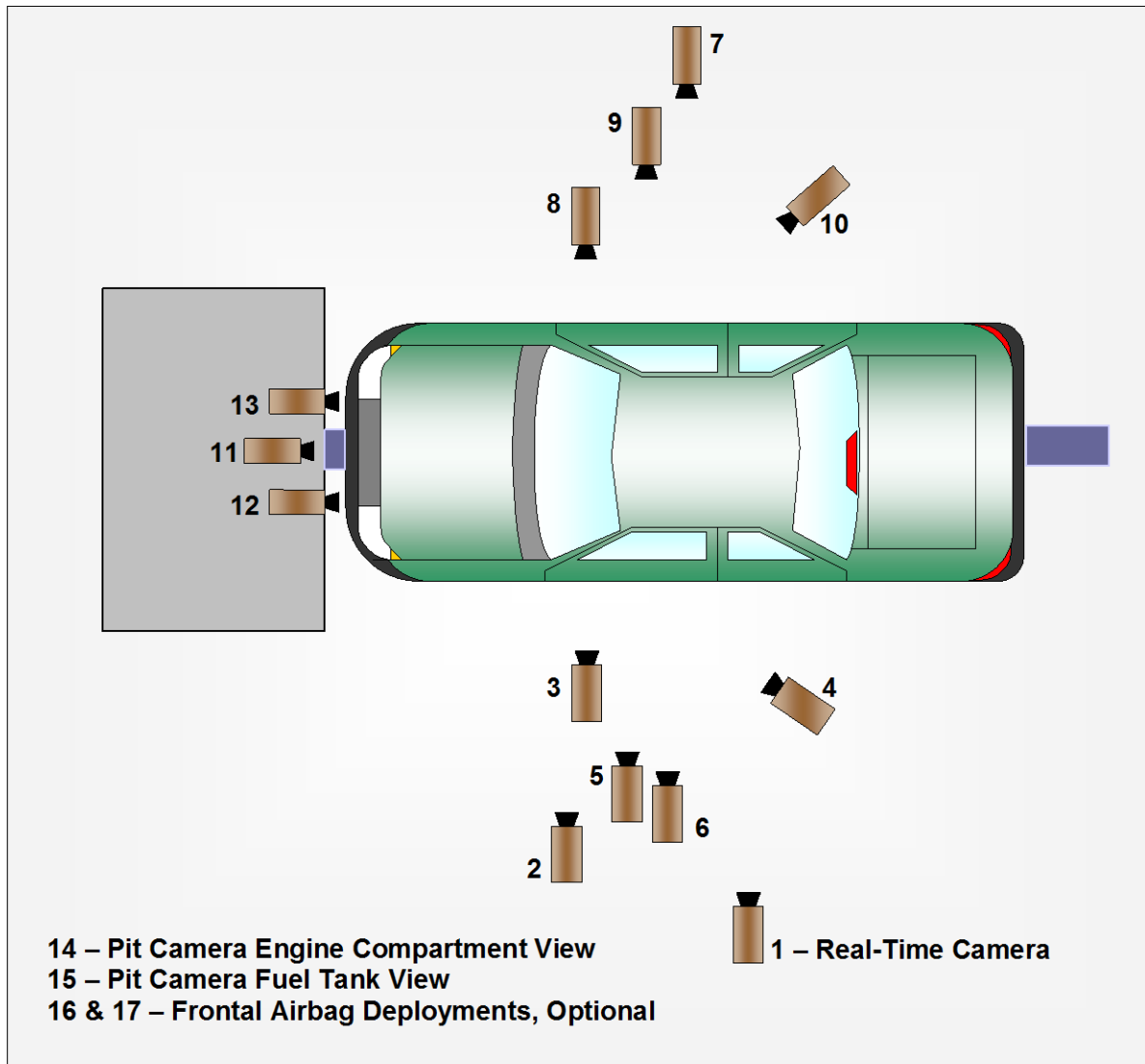
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	845	840
Lap Belt Length as measured on ATD	mm	660	655
Remainder of belt on reel	mm	775	785
Total Belt Length for Continuous Webbing Systems	mm	3030	3030

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

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
Test Date: 10/5/2015

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 (CONTINUED)
CAMERA LOCATIONS AND DATA

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	-1440	-6200	-1920	35	1000
3	Left Front Half	-1110	-5310	-1220	24	1000
4	Left Angle	-6050	-4900	-1990	50	1000
5	Steering Column - Top					
6	Steering Column - Bottom					
7	Right Overall	-1810	6330	-1210	16	1000
8	Passenger Close-Up	-1460	6500	-1910	35	1000
9	Right Front Half	-1120	5280	-1250	24	1000
10	Right Angle	-6020	4860	-1960	50	1000
11	Windshield	490	0	-2810	20	1000
12	Driver Windshield	-30	-450	-2030	8.5	1000
13	Passenger Windshield	-30	450	-2030	8.5	1000
14	Pit Front	-1170	0	3150	24	1000
15	Pit Rear	-3240	0	3150	24	1000
16	Onboard Driver Side				12	1000
17	Onboard Passenger Side				12	1000
18	Real-Time Pan View					30

***COORDINATES:**

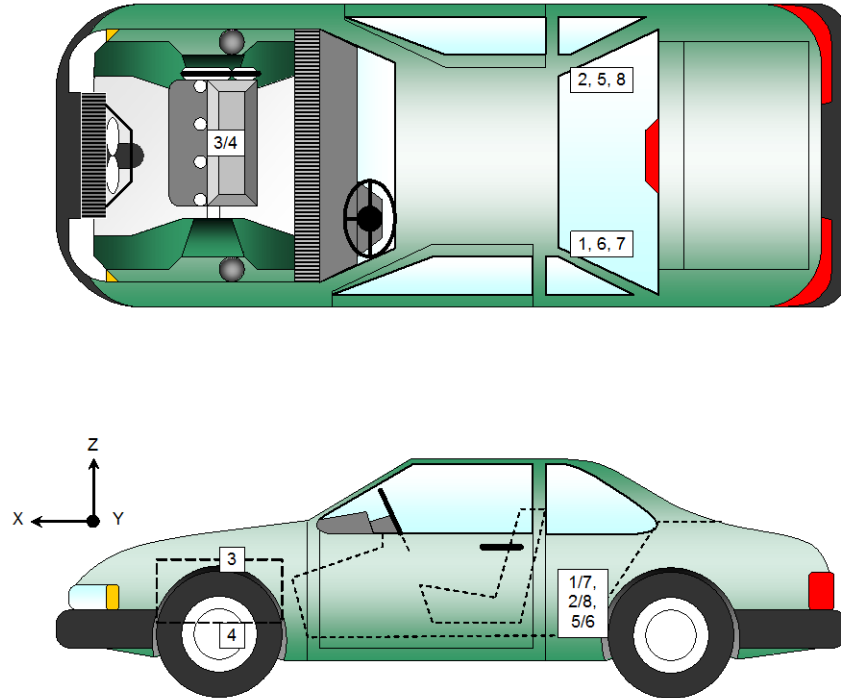
+X = forward of impact plane
 +Y = right of monorail centerline
 +Z = below ground level

Cameras 5 & 6 were not used for this test.

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

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	1768	-418	-335
2	Right Rear Crossmember Accelerometer – X Direction	1770	432	-335
3	Engine Top X	3699	0	-887
4	Engine Bottom X	3790	15	-331
5	Left Rear Crossmember Accelerometer – Z Direction	1768	-418	-335
6	Right Rear Crossmember Accelerometer – Z Direction	1770	432	-335
7	Left Rear Crossmember Accelerometer Redundant – X Direction	1802	-418	-335
8	Right Rear Crossmember Accelerometer Redundant – X Direction	1804	432	-335

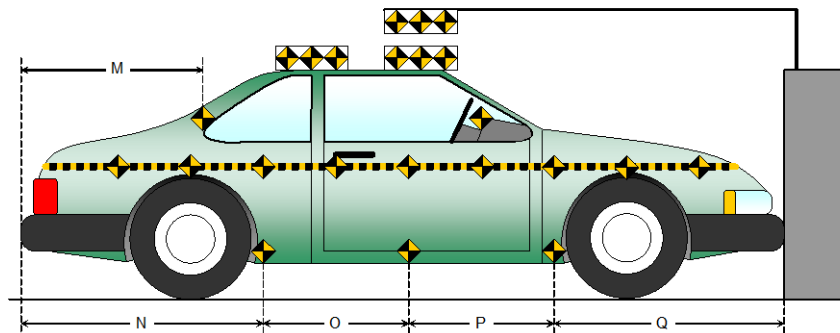
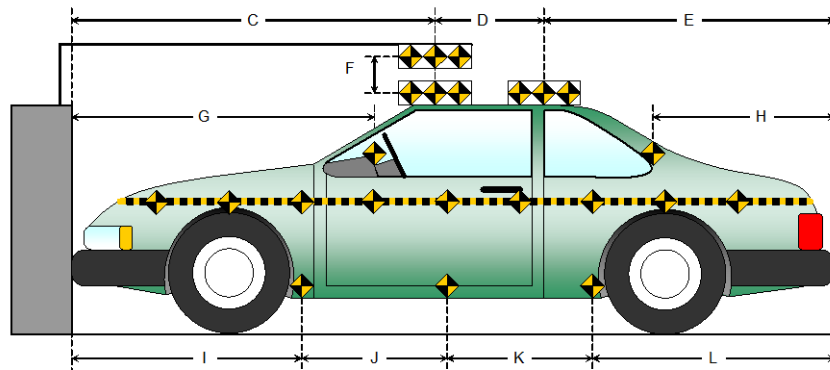
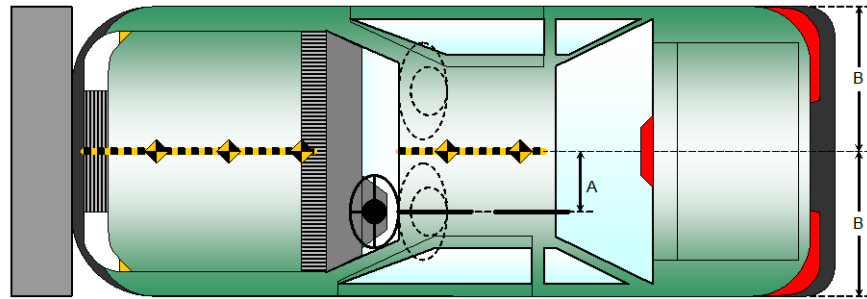
Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

Item	Value (mm)
A	367
B	905
C	2220
D	617
E	1640
F	112
G	
H	1229
I	1403
J	866
K	866
L	1342
M	1229
N	1342
O	866
P	866
Q	1403



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

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

Advanced Research Load Cell Barrier

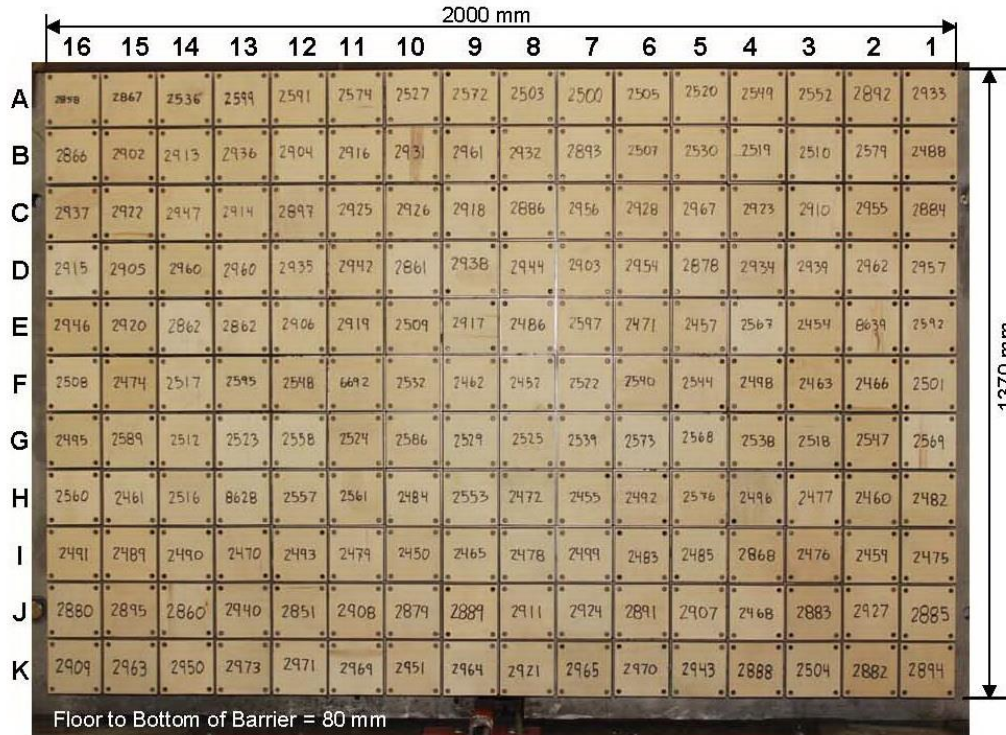


Photo for Reference Only

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: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
Test Date: 10/5/2015

INSTRUMENTATION

Driver Dummy Data Channels	49
Passenger Dummy Data Channels	49
Vehicle Structure Accelerometers	8
Barrier Channels	528
Total	634

CAMERA COVERAGE

High-Speed Vehicle Onboard	2
High-Speed Offboard	12
Real-Time	2
Total	16

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

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
Test Date: 10/5/2015

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 351	HIII 5% / 138
Head Contact	Airbag, Headrest	Airbag, Headrest
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Bolster	None
Right Knee Contact	Knee Bolster	None

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were locked	Doors were locked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None

POST TEST STRUCTURAL OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	4845
Center	mm	4700
Right Side	mm	4720
Average	mm	4755

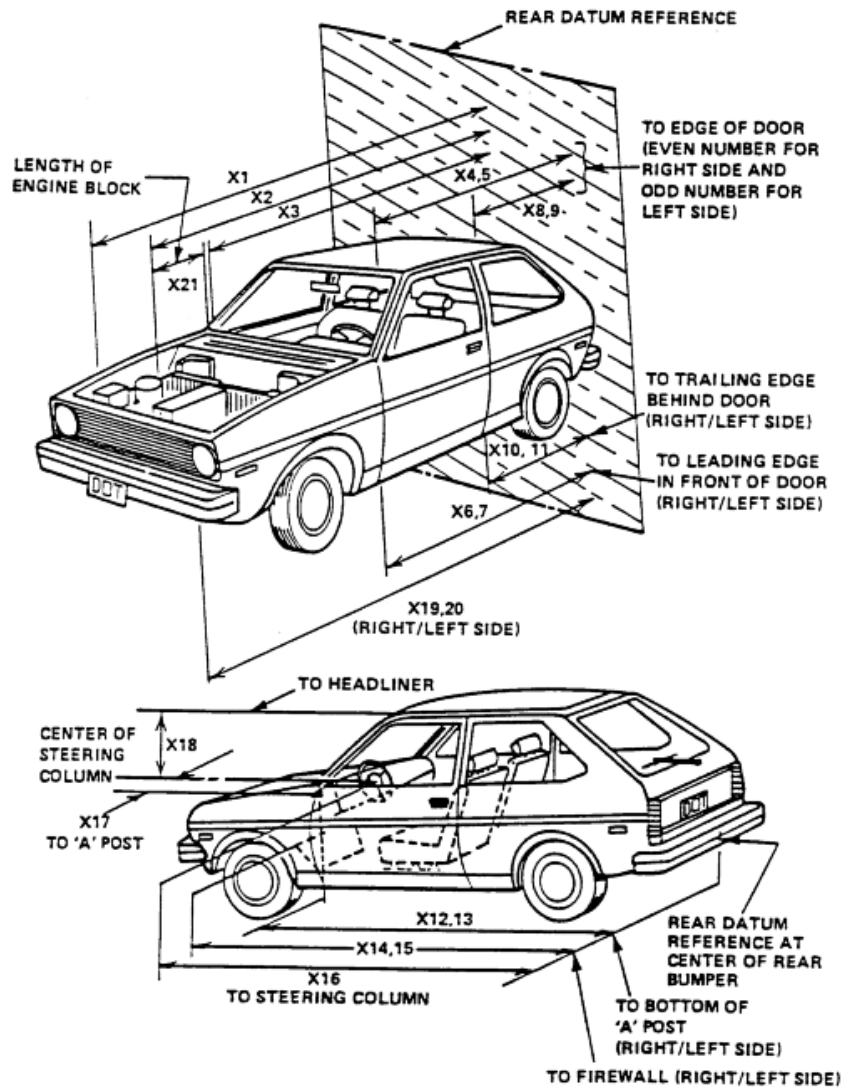
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver (Occupant 1)		Passenger (Occupant 2)	
	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	

DATA SHEET NO. 12 VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4477	4028	449
2	RSOV to Front of Engine	mm	3990	3774	216
3	RSOV to Firewall	mm	3484	3454	30
4	RSOV to Upper Leading Edge of Right Door	mm	2995	3003	-8
5	RSOV to Upper Leading Edge of Left Door	mm	2995	3001	-6
6	RSOV to Lower Leading Edge of Right Door	mm	3014	3005	9
7	RSOV to Lower Leading Edge of Left Door	mm	3014	3007	7
8	RSOV to Upper Trailing Edge of Right Door	mm	1976	1982	-6
9	RSOV to Upper Trailing Edge of Left Door	mm	1976	1980	-4
10	RSOV to Lower Trailing Edge of Right Door	mm	2003	1994	9
11	RSOV to Lower Trailing Edge of Left Door	mm	2003	1998	5
12	RSOV to Bottom of "A" Post of Right Side	mm	3015	3004	11
13	RSOV to Bottom of "A" Post of Left Side	mm	3015	3008	7
14	RSOV to Firewall, Right Side	mm	3600	3589	11
15	RSOV to Firewall, Left Side	mm	3600	3588	12
16	RSOV to Steering Column	mm	2573	2639	-66
17	Center of Steering Column to "A" Post	mm	413	423	-10
18	Center of Steering Column to Headliner	mm	434	466	-32
19	RSOV to Right Side of Front Bumper	mm	4285	3972	313
20	RSOV to Left Side of Front Bumper	mm	4285	3982	303
21	Length of Engine Block	mm	502	502	0
RD	RSOV to Right Side of Dash Panel	mm	2905	2904	1
CD	RSOV to Center of Dash Panel	mm	2826	2824	2
LD	RSOV to Left Side of Dash Panel	mm	2929	2926	3

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
Test Date: 10/5/2015

VEHICLE INFORMATION

VIN: KM8J3CA45GU055511 Wheelbase (mm): 2674
Vehicle Size Category: MPV Test Weight (kg): 1810.5

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15

Cal. Procedure/Interval: MGA procedure / 6 month

Integration Algorithm: Trapezoidal

Linearity: > 99%

Impact Velocity (km/h): 56.23

Velocity Change (km/h): 65.4

Time of Separation (msec): 99

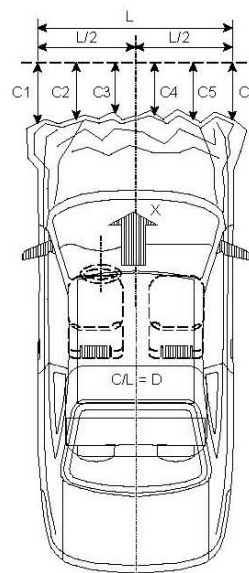
CRUSH PROFILE

Collision Deformation Classification: Frontal

Midpoint of Damage: Centerline

Damage Region Length (mm): 1482

Impact Mode: Frontal



No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4285	3982	303
C2	Crush zone 2 at left side	mm	4404	4008	396
C3	Crush zone 3 at left side	mm	4431	4016	415
C4	Crush zone 4 at right side	mm	4431	3981	450
C5	Crush zone 5 at right side	mm	4404	3970	434
C6	Crush zone 6 at right side	mm	4285	3972	313
L	C1 TO C6	mm	1482	1469	13

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
Test Program: NCAP Frontal Barrier Impact Test

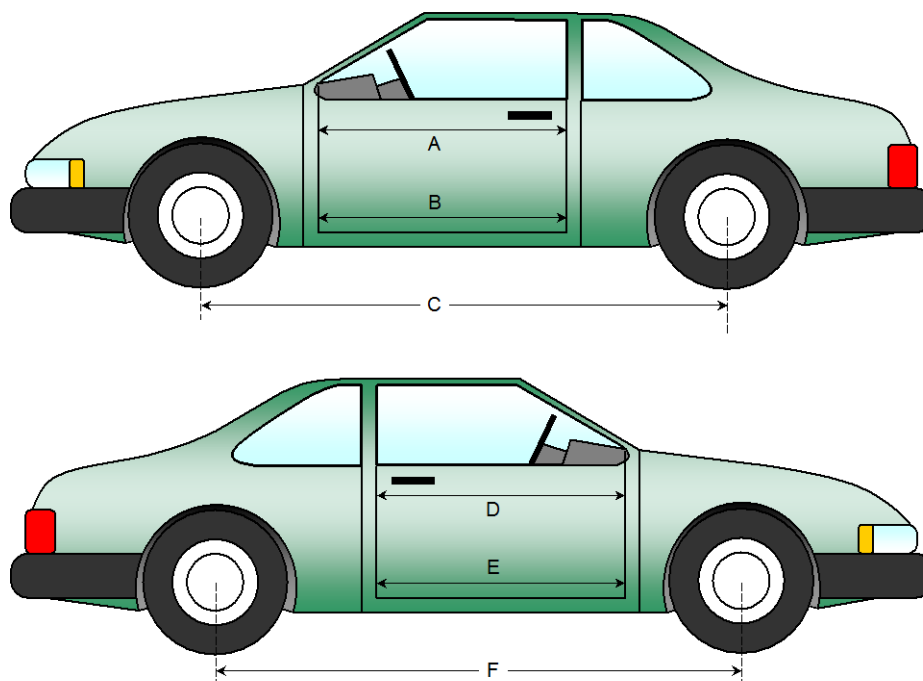
NHTSA No.: M20164203
Test Date: 10/5/2015

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	960	960	0
B	Left Side Lower	mm	918	918	0
D	Right Side Upper	mm	960	960	0
E	Right Side Lower	mm	918	918	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2674	2614	60
F	Right Side Wheelbase	mm	2674	2646	28



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

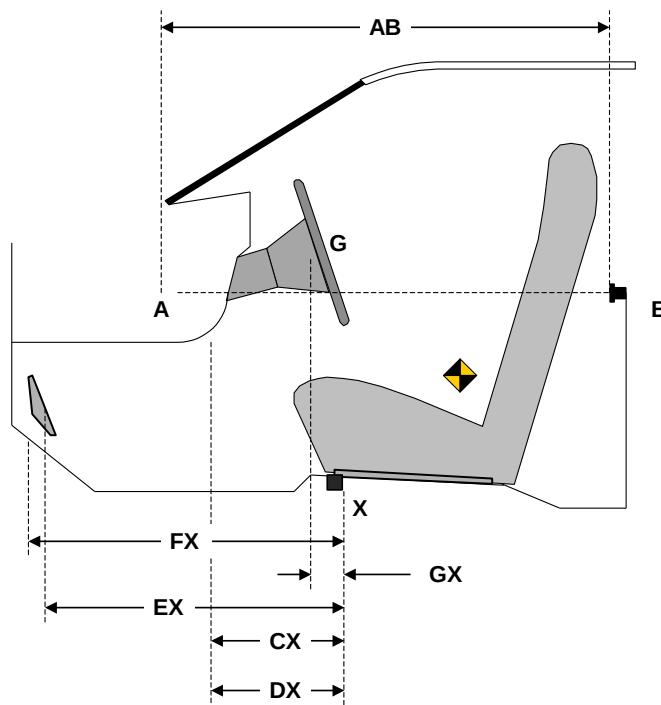
Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	766	766	0
CX	Left Knee Bolster to X	mm	257	256	1
DX	Right Knee Bolster to X	mm	223	223	0
EX	Brake Pedal to X	mm	522	531	-9
FX	Foot Rest to X	mm	532	532	0
GX	Center of Steering Column Wheel Hub to X	mm	36	103	-67

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 15
SUMMARY OF FMVSS 212, FMVSS 219 (PARTIAL) DATA, AND 301 DATA

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

Windshield Mounting Details:

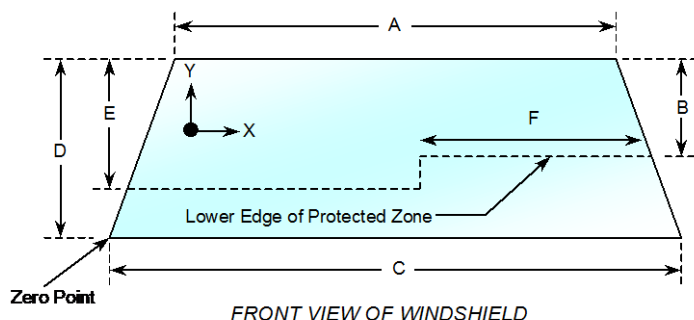
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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: 21.9° C.

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2211	2211	100
Right Side	2211	2211	100
Total	4422	4422	100



Item	Units	Value
A	mm	1196
B	mm	482
C	mm	1598
D	mm	814
E	mm	538
F	mm	560

AREA OF PROTECTED ZONE FAILURES - NONE

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. 15 (CONTINUED)
SUMMARY OF FMVSS 212, FMVSS 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
Test Date: 10/5/2015

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 22.1°C Test Time: 10:35 a.m.

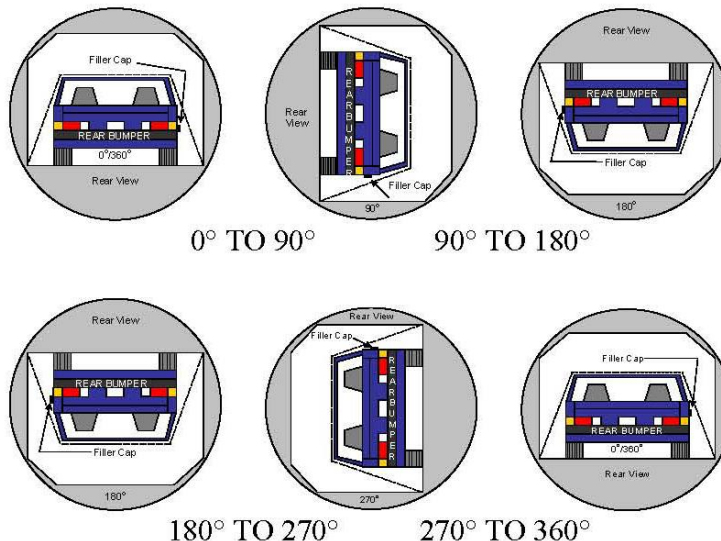
- A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)
- B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)
- C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)
- D. Spillage: None

DATA SHEET NO. 16 **FMVSS 301 STATIC ROLLOVER RESULTS**

Test Vehicle: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015

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°	116	300	416
90° to 180°	111	300	411
180° to 270°	108	300	408
270° to 360°	109	300	409

FMVSS 301 SPILLAGE TABLE (units in ounces)

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

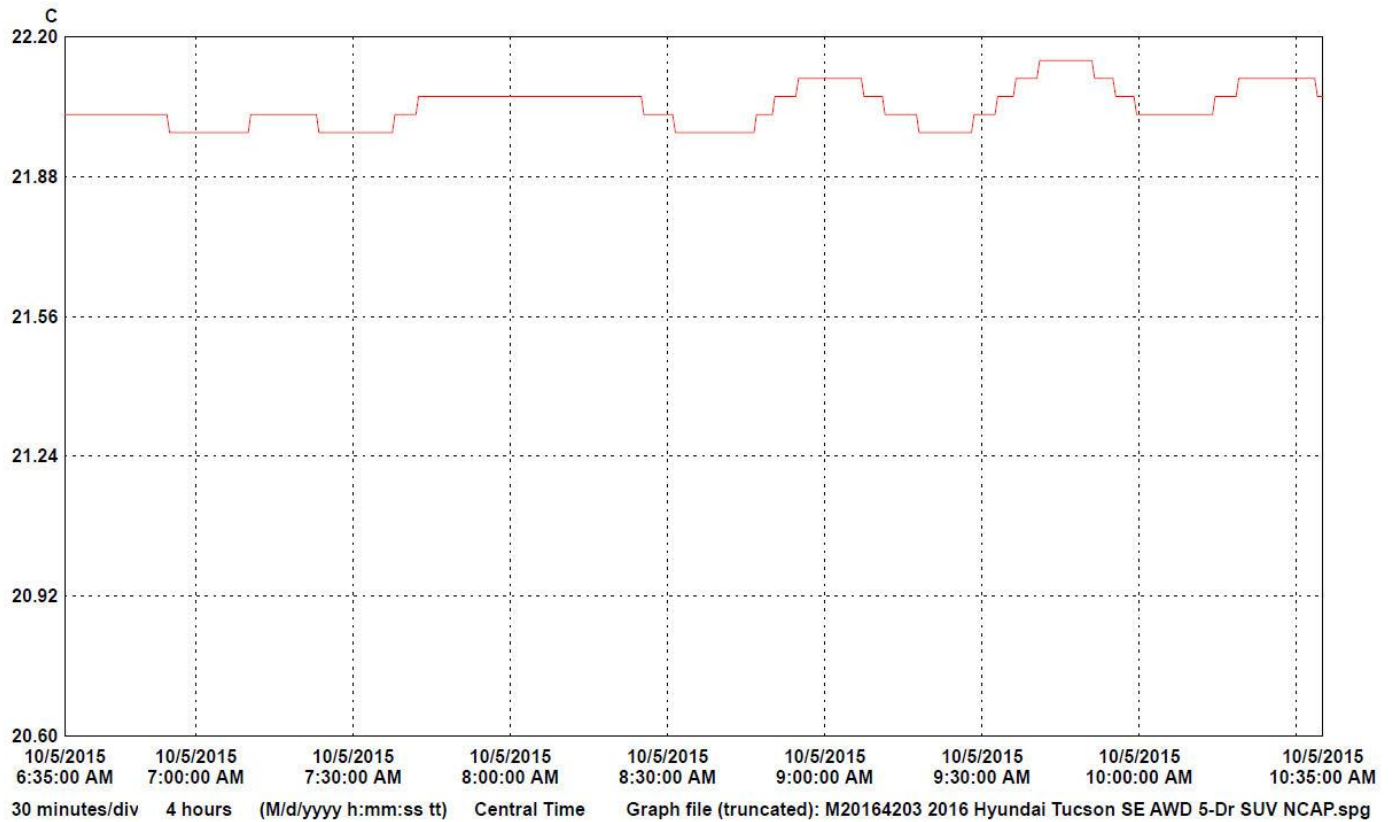
SOLVENT SPILLAGE LOCATION TABLE

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: 2016 Hyundai Tucson SE AWD 5-Dr. SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20164203
 Test Date: 10/5/2015



**APPENDIX A
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Photo No. 001 - Load Cell Location



Photo No. 002 - Load Cell Wall



Photo No. 003 - Manufacturer's Label



Photo No. 004 - Tire Placard



Photo No. 005 - 2016 Hyundai Tucson Frontal As Delivered



Photo No. 006 - Left Rear 3-4 View, As Received



Photo No. 007 - Pre-Test Front View of Test Vehicle



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



Photo No. 009 - Pre-Test Left View of Test Vehicle



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



Photo No. 011 - Pre-Test Right View of Test Vehicle



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



Photo No. 013 - Pre-Test Right Front 3-4 View



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



Photo No. 015 - Pre-Test Left Rear 3-4 View



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

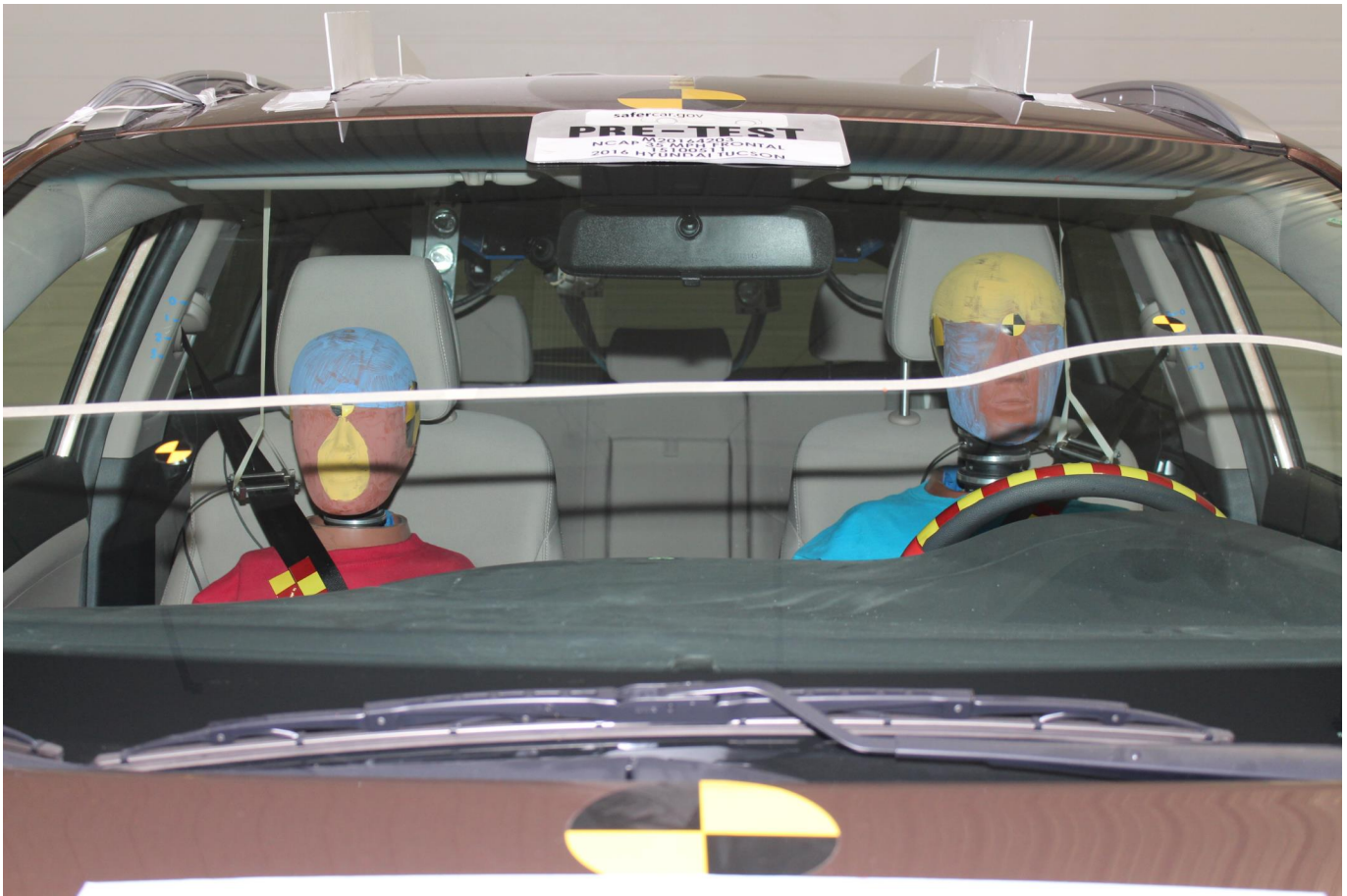


Photo No. 017 - Pre-Test Windshield View



Photo No. 018 - Post-Test Windshield View



Photo No. 019 - Pre-Test Engine Compartment View



Photo No. 020 - Post-Test Engine Compartment View



Photo No. 021 - Pre-Test Fuel Filler Cap View



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

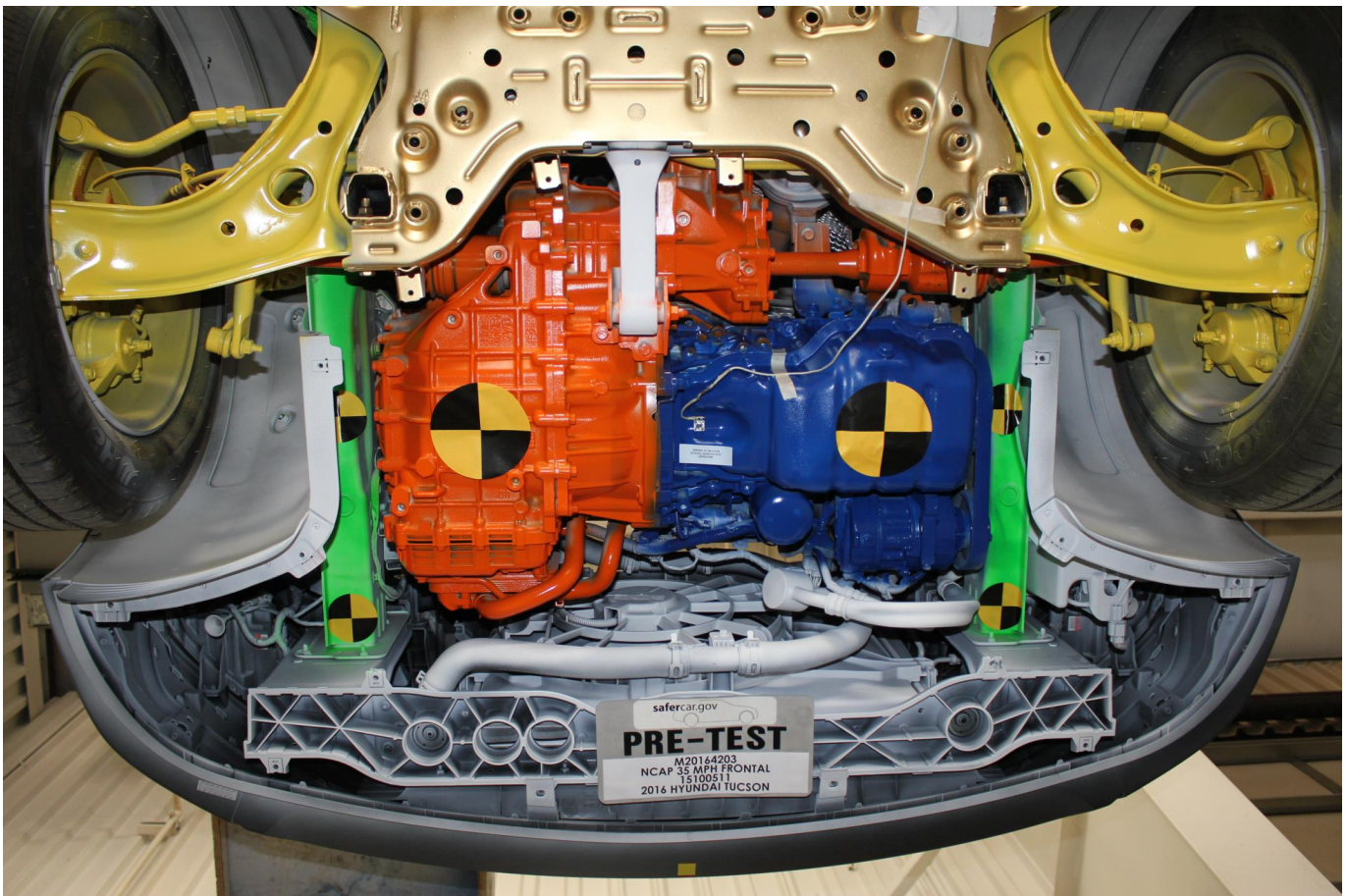


Photo No. 023 - Pre-Test Front Underbody View

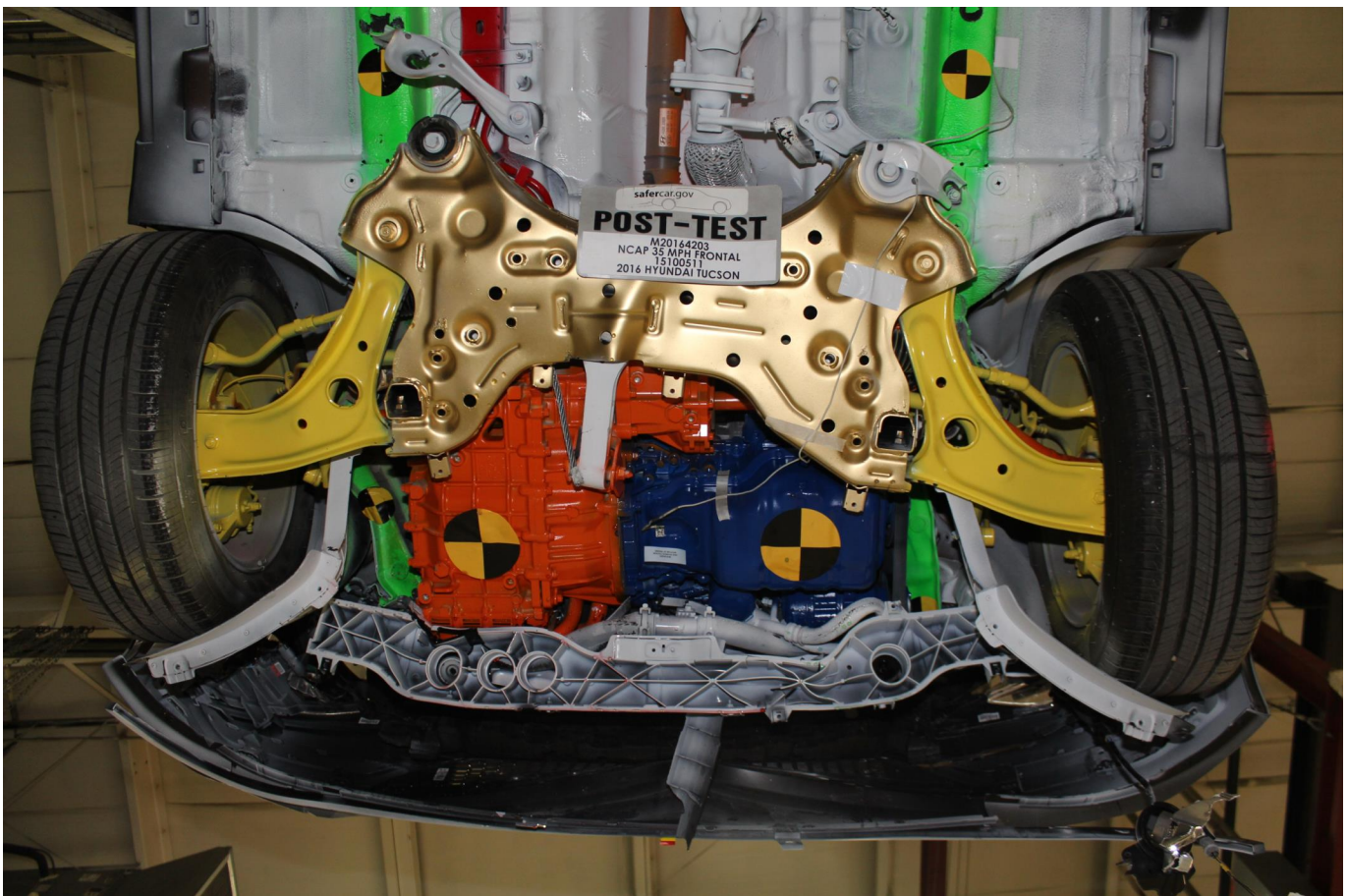


Photo No. 024 - Post-Test Front Underbody View

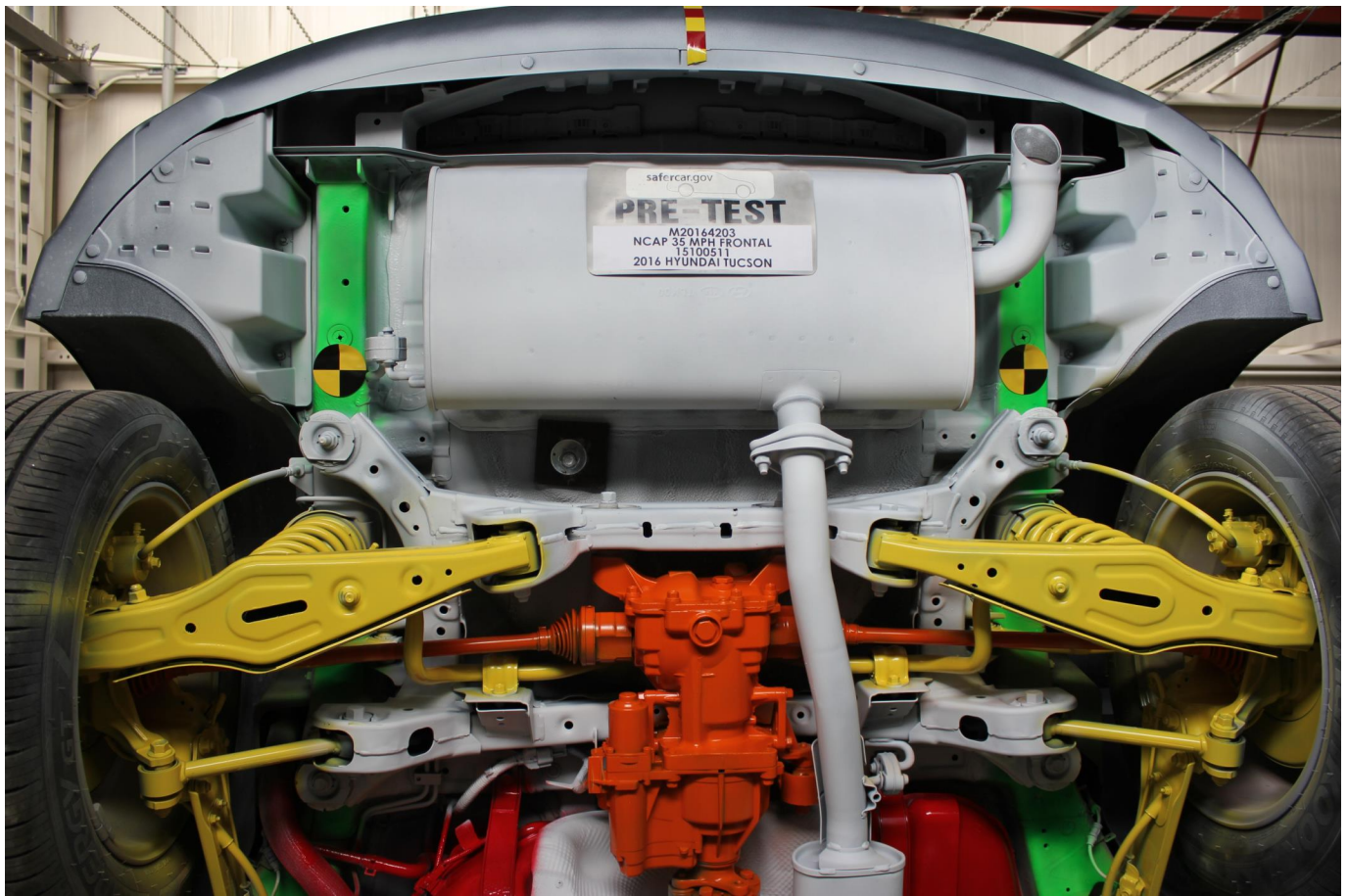


Photo No. 025 - Pre-Test Rear Underbody View



Photo No. 026 - Post-Test Rear Underbody View



Photo No. 027 - Pre-Test Dummy Cable Routing



Photo No. 028 - Post-Test Dummy Cable Routing



Photo No. 029 - Pre-Test Driver Dummy Front View



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



Photo No. 031 - Pre-Test Driver Dummy Window View



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



Photo No. 033 - Pre-Test Driver Dummy and Vehicle Interior (Door Open)



Photo No. 034 - Post-Test Driver Dummy and Vehicle Interior (Door Open)



Photo No. 035 - Pre-Test Driver's Seat Fore-Aft Markings



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



Photo No. 037 - Pre-Test View of Belt Anchorage for Driver Dummy



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



Photo No. 039 - Pre-Test Driver Dummy Feet



Photo No. 040 - Post-Test Driver Dummy Feet



Photo No. 041 - Pre-Test Driver's Side Knee Bolster (without dummy)



Photo No. 042 - Post-Test Driver's Side Knee Bolster (without dummy)



Photo No. 043 - Pre-Test Driver's Side Floorpan



Photo No. 044 - Post-Test Driver's Side Floorpan



Photo No. 045 - Post-Test Driver Dummy Face



Photo No. 046 - Post-Test Driver Dummy Contact with Airbag



Photo No. 047 - Post-Test Driver Dummy Contact with Headrest



Photo No. 048 - Pre-Test View of the Steering Wheel



Photo No. 049 - Post-Test View of the Steering Wheel



Photo No. 050 - Pre-Test Passenger Dummy Front View



Photo No. 051 - Post-Test Passenger Dummy Front View



Photo No. 052 - Pre-Test Passenger Dummy Window View



Photo No. 053 - Post-Test Passenger Dummy Window View



Photo No. 054 - Pre-Test Passenger Dummy and Vehicle Interior (Door Open)



Photo No. 055 - Post-Test Passenger Dummy and Vehicle Interior (Door Open)



Photo No. 056 - Pre-Test Passenger's Seat Fore-Aft Markings



Photo No. 057 - Post-Test Passenger's Seat Fore-Aft Markings



Photo No. 058 - Pre-Test View of Belt Anchorage for Passenger Dummy



Photo No. 059 - Post-Test View of Belt Anchorage for Passenger Dummy



Photo No. 060 - Pre-Test Passenger Dummy Feet



Photo No. 061 - Post-Test Passenger Dummy Feet



Photo No. 062 - Pre-Test Passenger's Side Knee Bolster (without dummy)



Photo No. 063 - Post-Test Passenger Side Knee Bolster (without dummy)



Photo No. 064 - Pre-Test Passenger Side Floorpan



Photo No. 065 - Post-Test Passenger Side Floorpan



Photo No. 066 - Post-Test Passenger Dummy Face



Photo No. 067 - Post-Test Passenger Dummy Contact with Airbag



Photo No. 068 - Post-Test Passenger Dummy Contact with Headrest



Photo No. 069 - Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

Photo No. 070 - Post-Test Stoddard Solvent Spillage Location View



Photo No. 071 - Post-Test Speed Trap Read-Out



Photo No. 072 - Vehicle at 0 Degree on Static Rollover Device

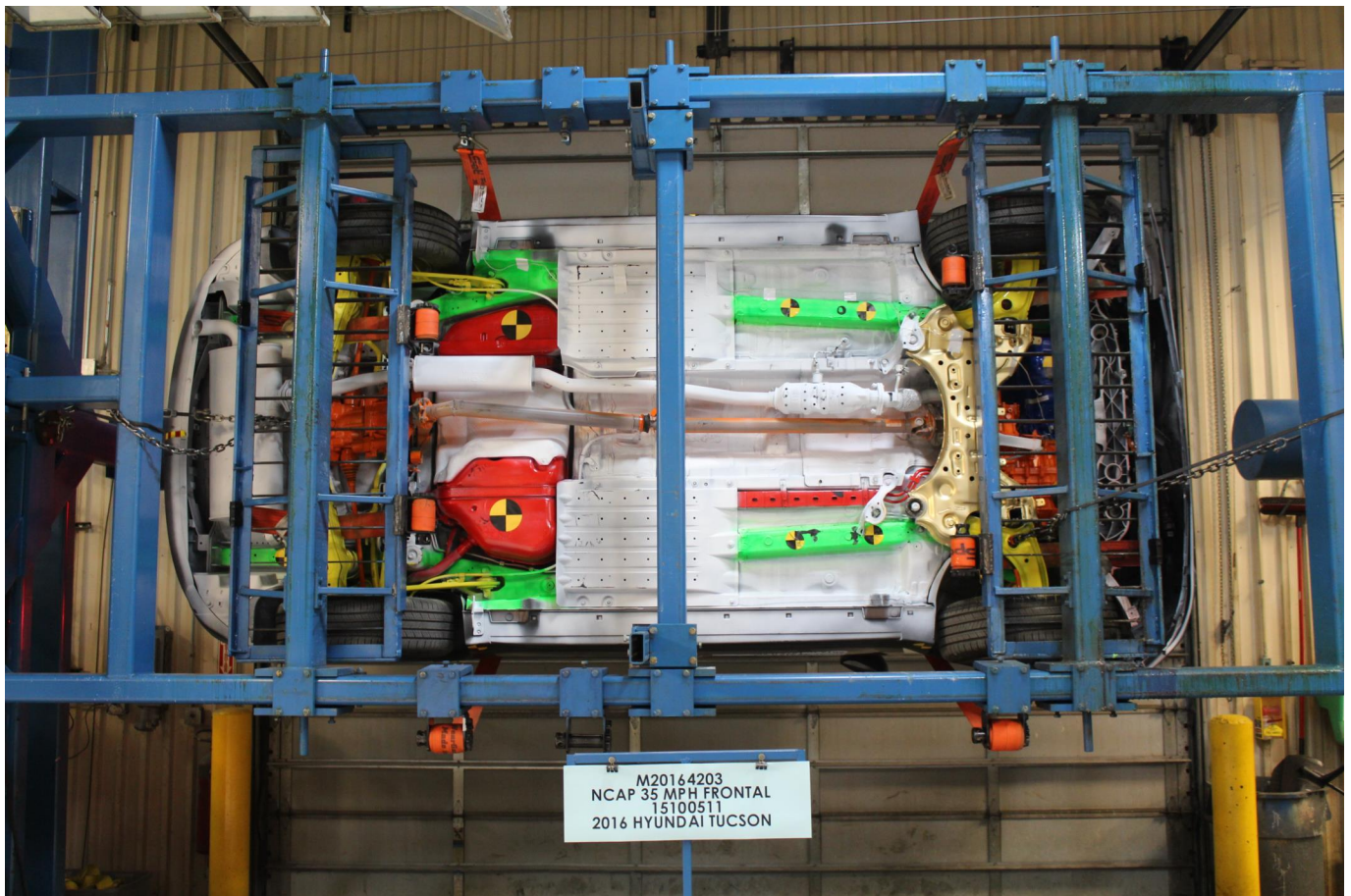


Photo No. 073 - Vehicle at 90 Degrees on Static Rollover Device



Photo No. 074 - Vehicle at 180 Degrees on Static Rollover Device



Photo No. 075 - Vehicle at 270 Degrees on Static Rollover Device



Photo No. 076 - Vehicle at 360 Degrees on Static Rollover Device

APPENDIX B
DUMMY RESPONSE DATA TRACES

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Figure No. 2.	Driver Head Y Acceleration vs. Time	B-1
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Figure No. 26.	Passenger Chest Z Acceleration vs. Time	B-9
Figure No. 27.	Passenger Chest Resultant Z Acceleration vs. Time	B-9

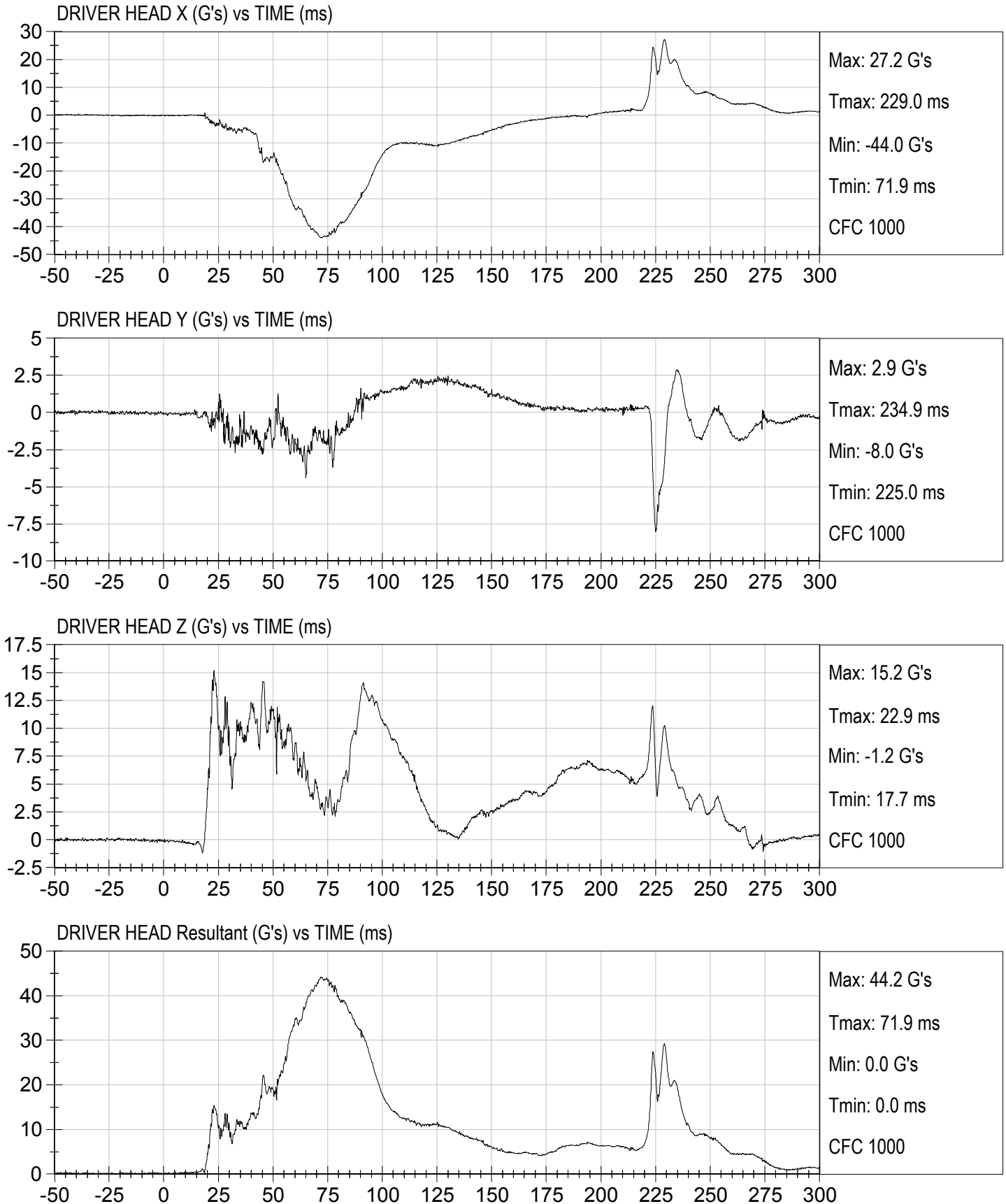
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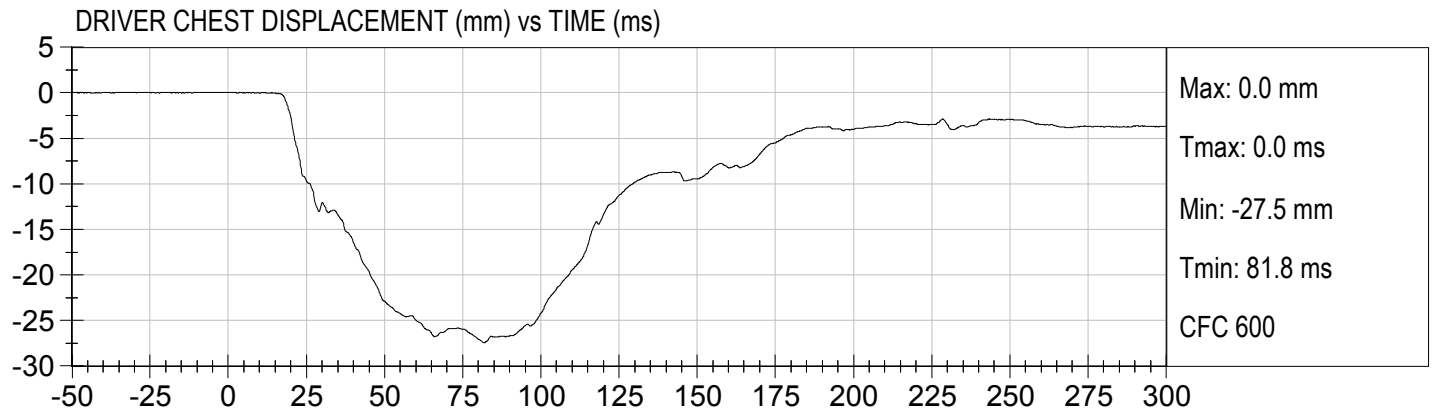
The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

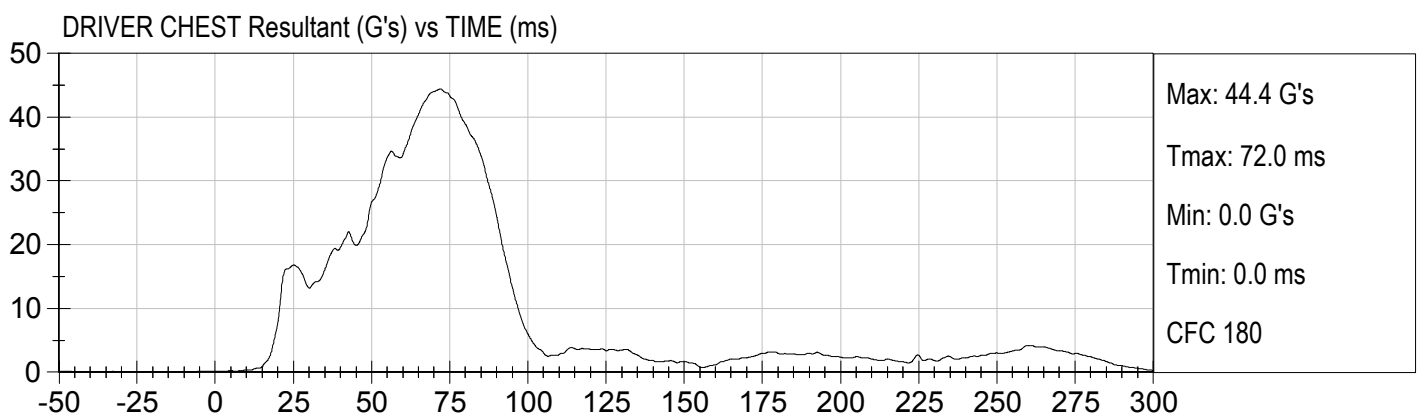
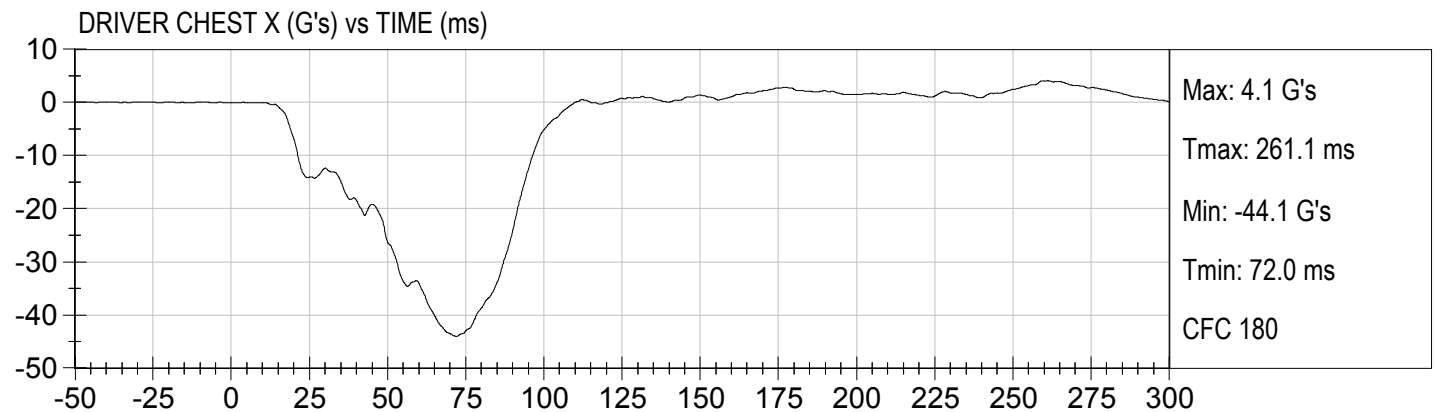
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 Driver Head Y Redundant
 Driver Head Z Redundant
 Driver Head Angular Velocity X
 Driver Head Angular Velocity Y
 Driver Head Angular Velocity Z
 Driver Upper Neck Force Y
 Driver Upper Neck Moment X
 Driver Upper Neck Moment Z
 Driver Chest X Redundant
 Driver Chest Y Redundant
 Driver Chest Z Redundant
 Driver Pelvis X
 Driver Pelvis Y
 Driver Pelvis Z
 Driver Left Femur Redundant
 Driver Right Femur Redundant
 Driver Left Upper Tibia Moment X
 Driver Left Upper Tibia Moment Y

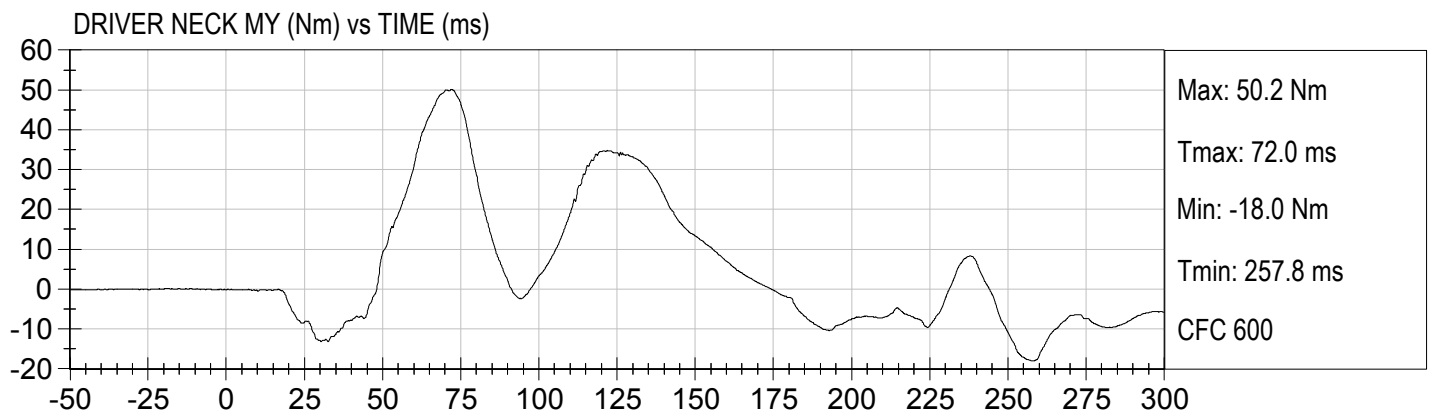
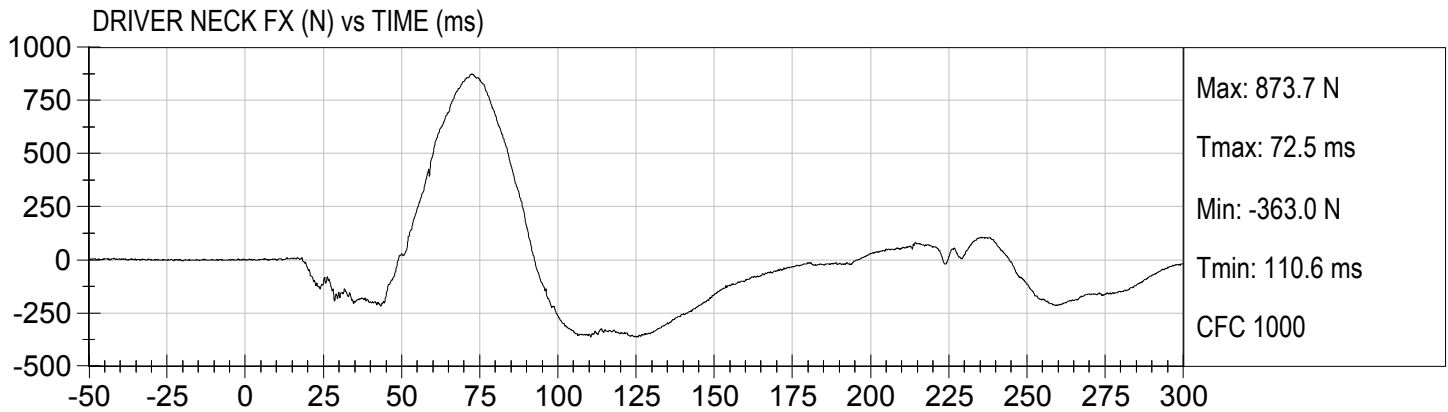
Driver Left Upper Tibia Force Z
Driver Left Lower Tibia Moment X
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Right Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z
Driver Lap Belt Force
Driver Shoulder Belt Force
Passenger Head X Redundant
Passenger Head Y Redundant
Passenger Head Z Redundant
Passenger Head Angular Velocity X
Passenger Head Angular Velocity Y
Passenger Head Angular Velocity Z
Passenger Upper Neck Force Y
Passenger Upper Neck Moment X
Passenger Upper Neck Moment Z
Passenger Chest X Redundant
Passenger Chest Y Redundant
Passenger Chest Z Redundant
Passenger Pelvis X
Passenger Pelvis Y

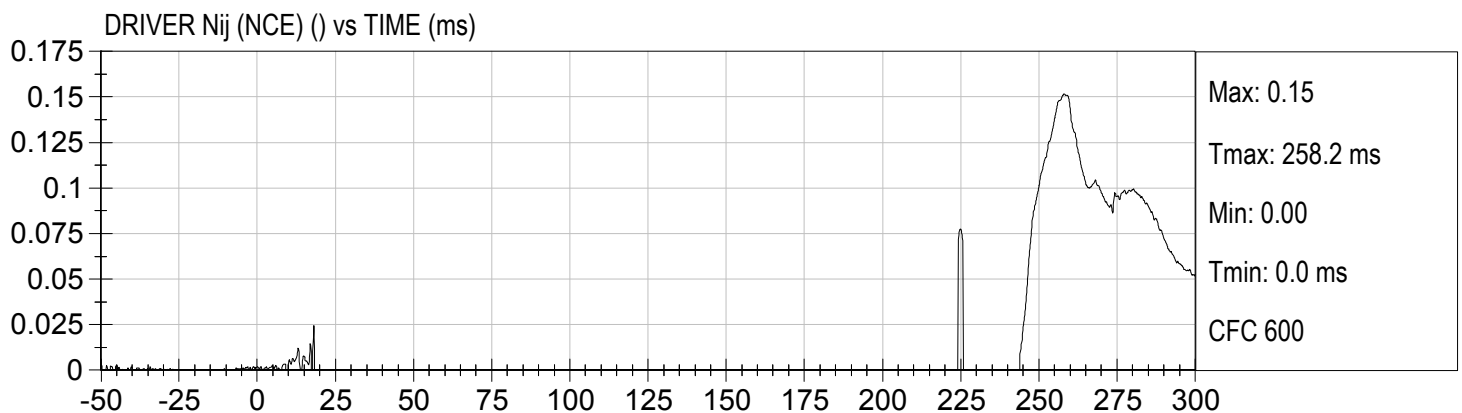
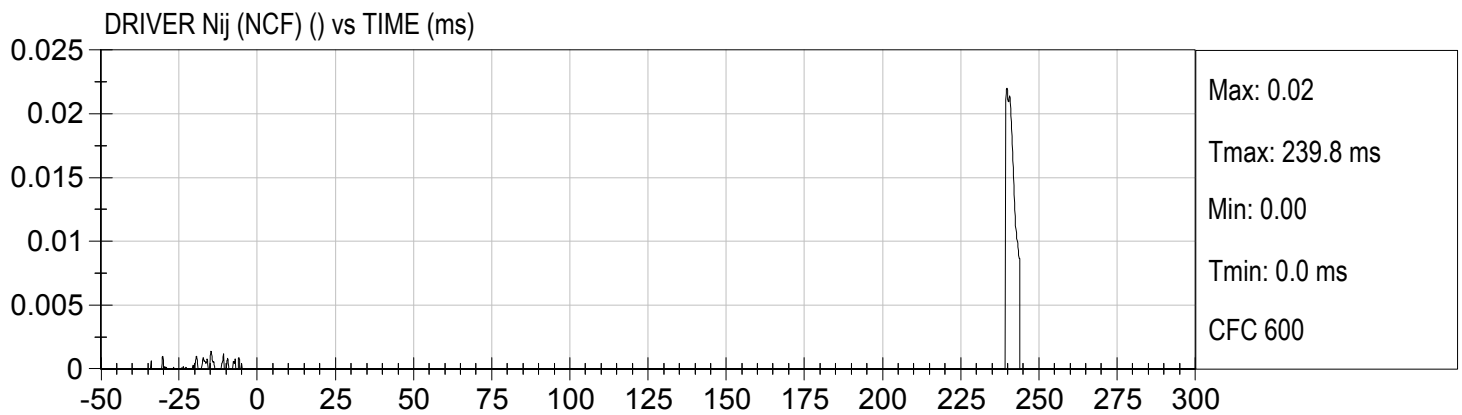
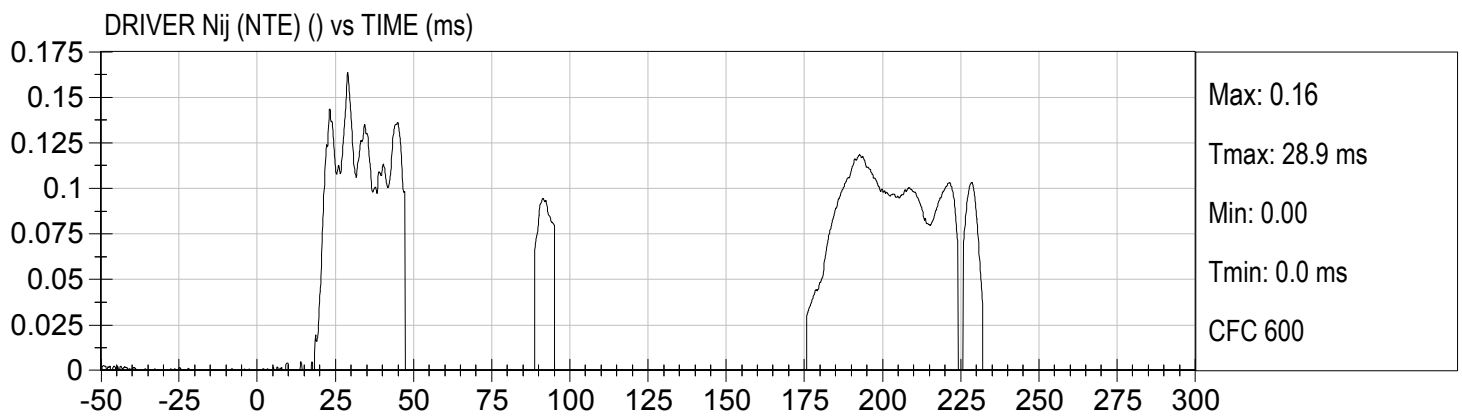
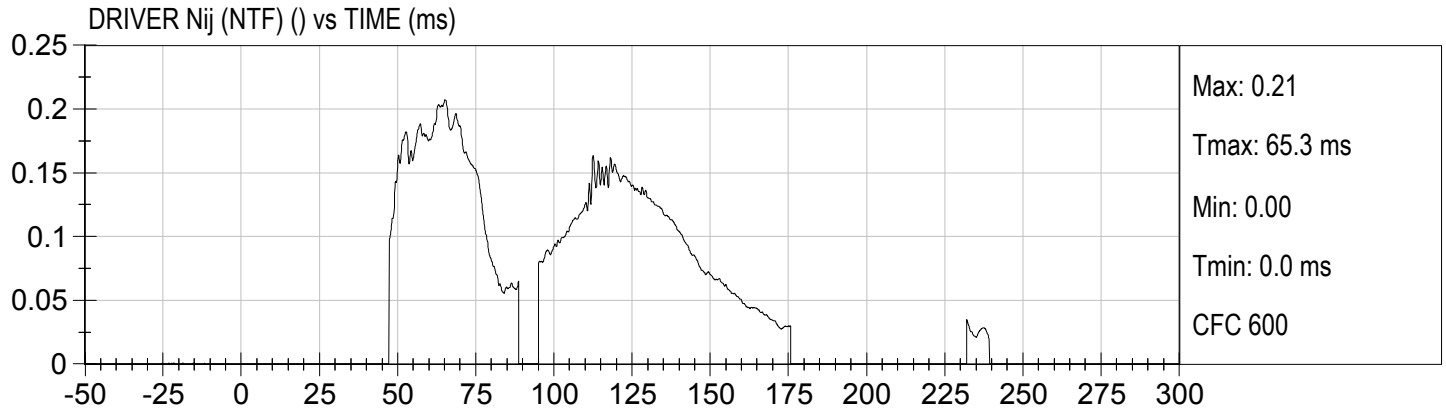
Passenger Pelvis Z
Passenger Left Femur Redundant
Passenger Right Femur Redundant
Passenger Left Upper Tibia Moment X
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right Lower Tibia Moment X
Passenger Right Lower Tibia Moment Y
Passenger Right Lower Tibia Force Z
Passenger Left Foot Fore Z
Passenger Left Foot Aft X
Passenger Left Foot Aft Z
Passenger Right Foot Fore Z
Passenger Right Foot Aft X
Passenger Right Foot Aft Z
Passenger Lap Belt Force
Passenger Shoulder Belt Force
Left Rear Seat Crossmember X
Right Rear Seat Crossmember X
Vehicle Engine Top X
Vehicle Engine Bottom X
Left Rear Seat Crossmember Z
Right Rear Seat Crossmember Z
Left Rear Seat Crossmember Xr
Right Rear Seat Crossmember Xr
Advanced Research Load Cell Barrier – 528 channels

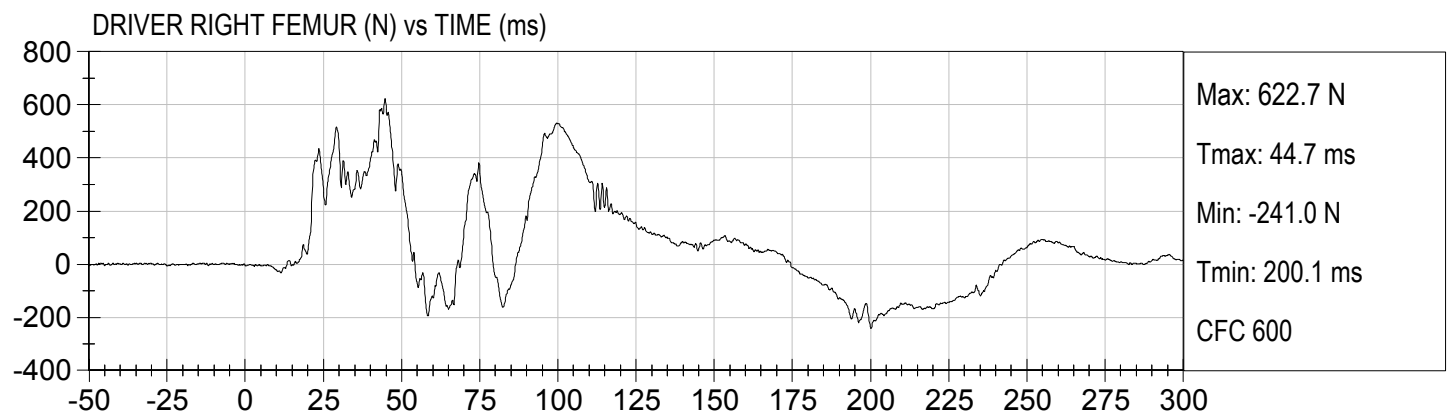


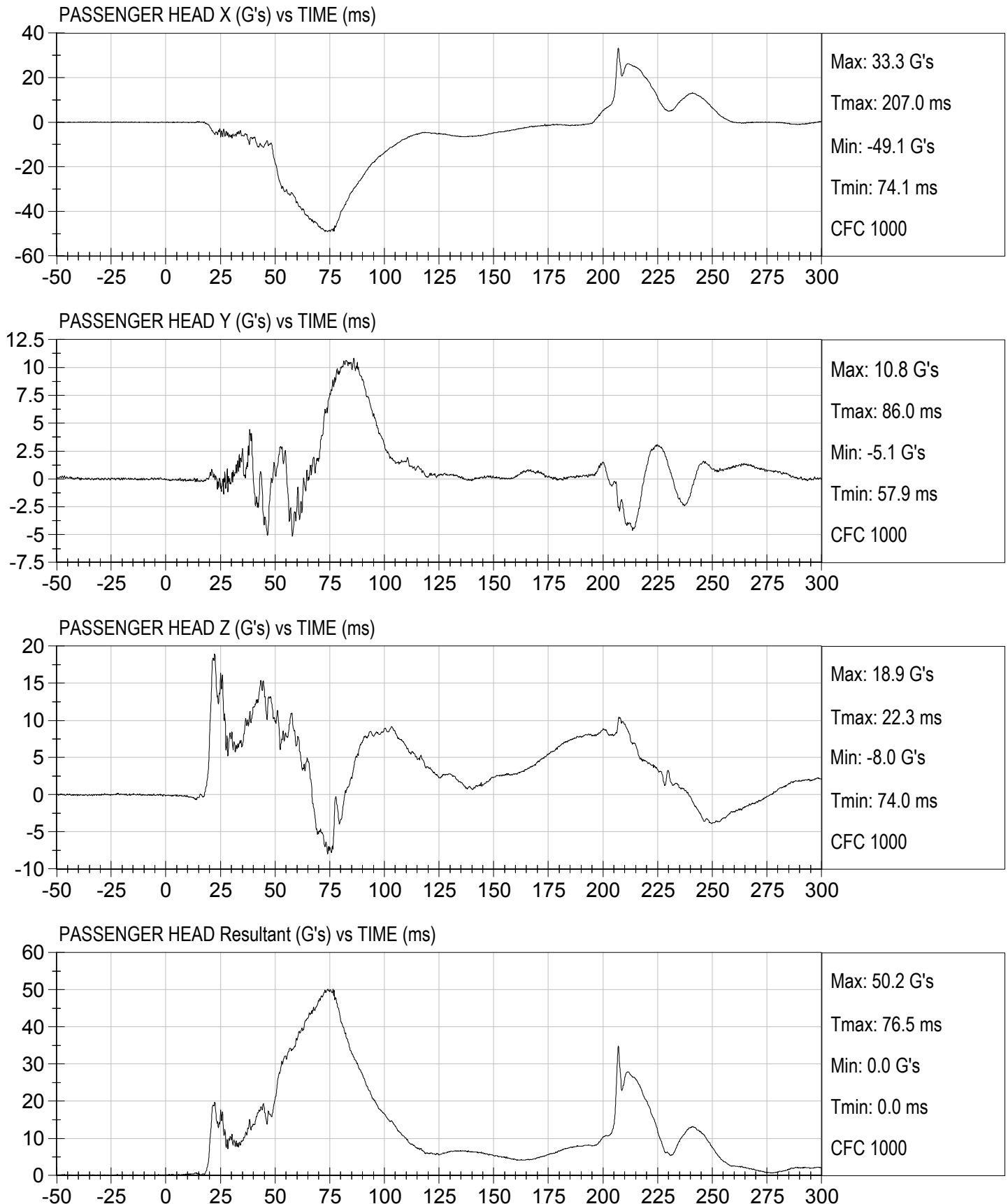


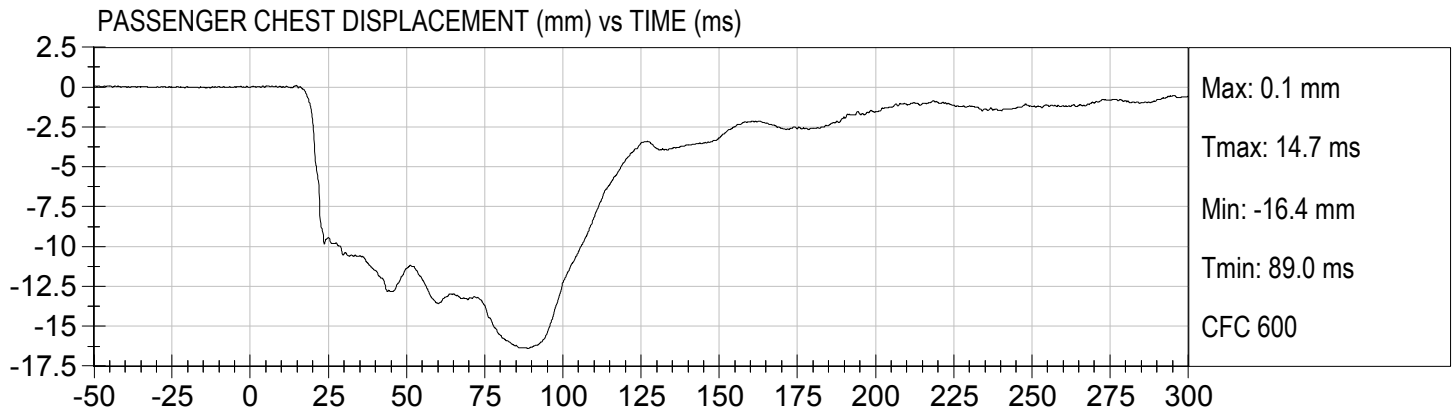


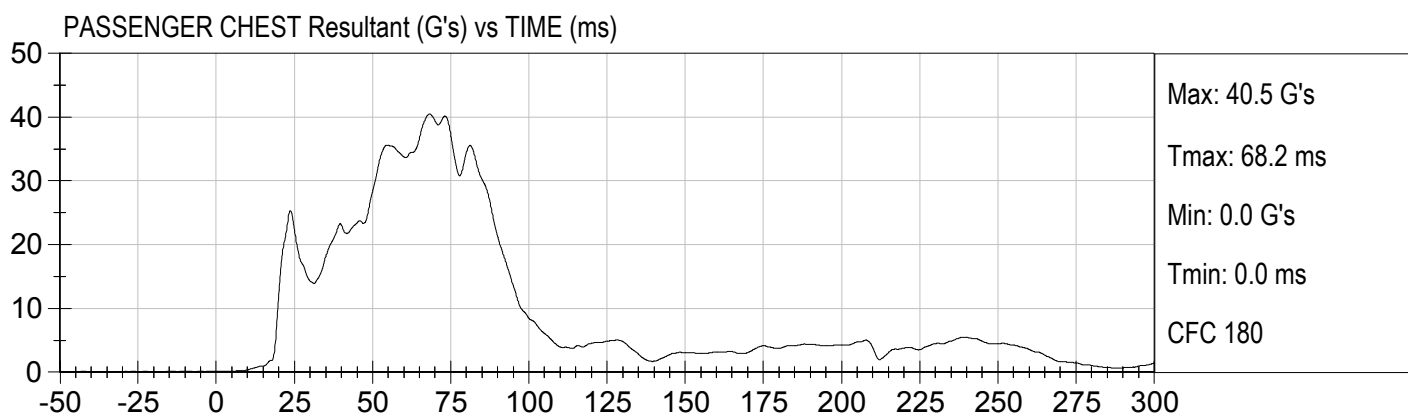
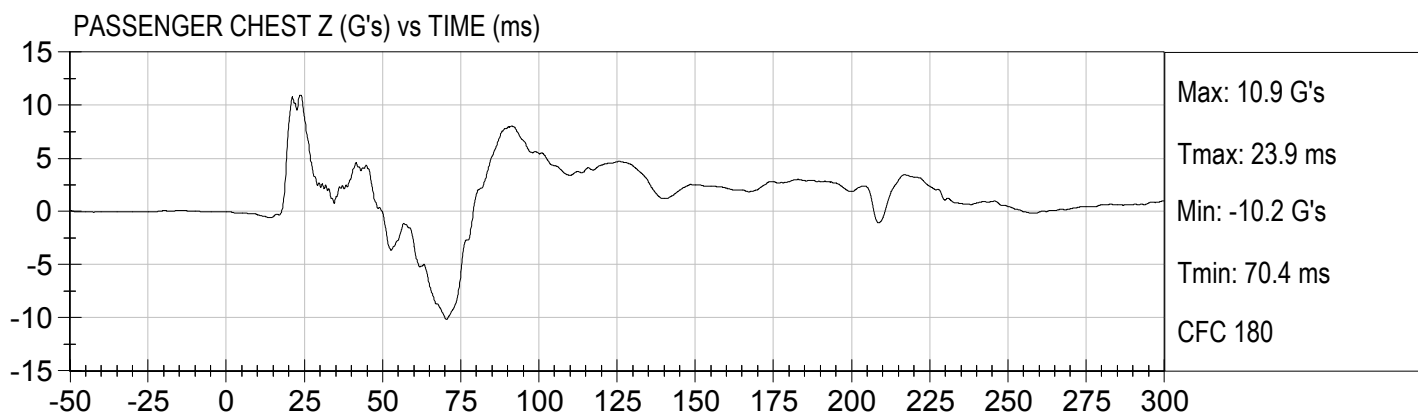
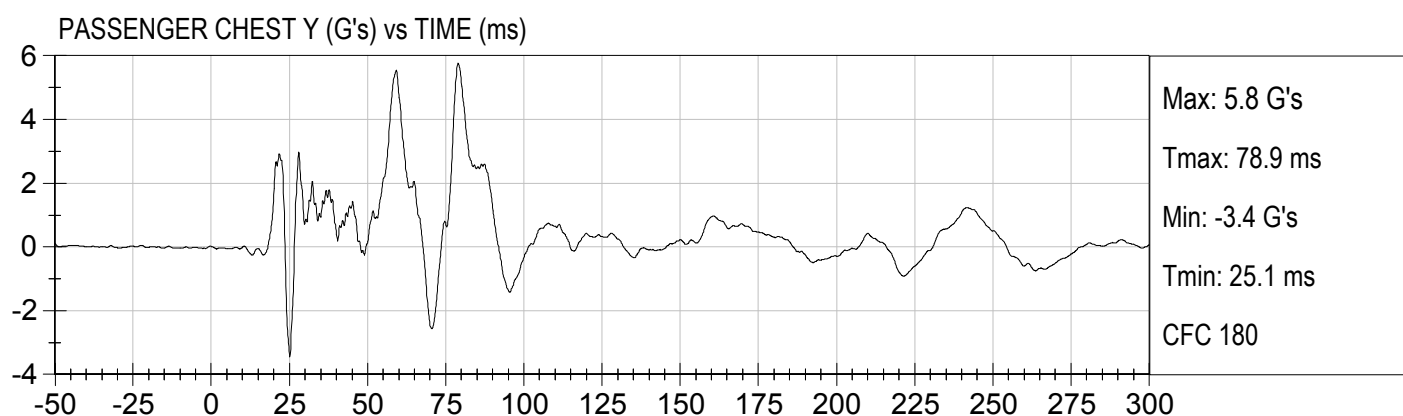
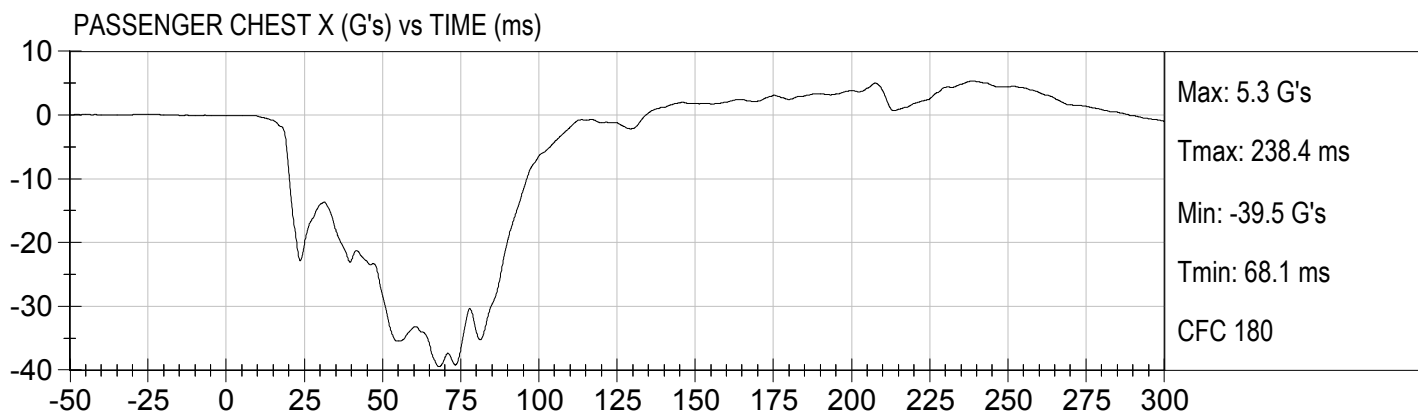


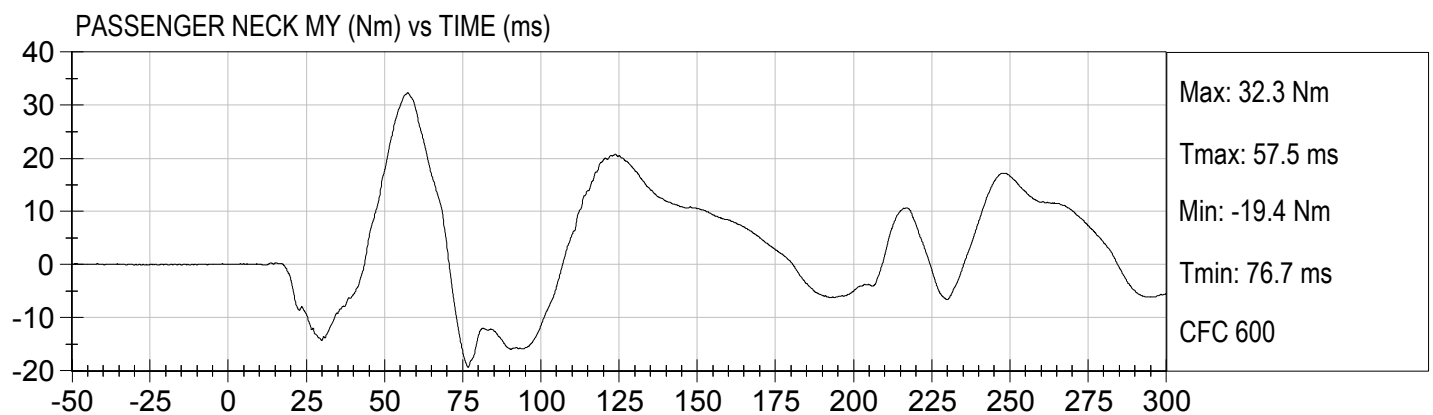
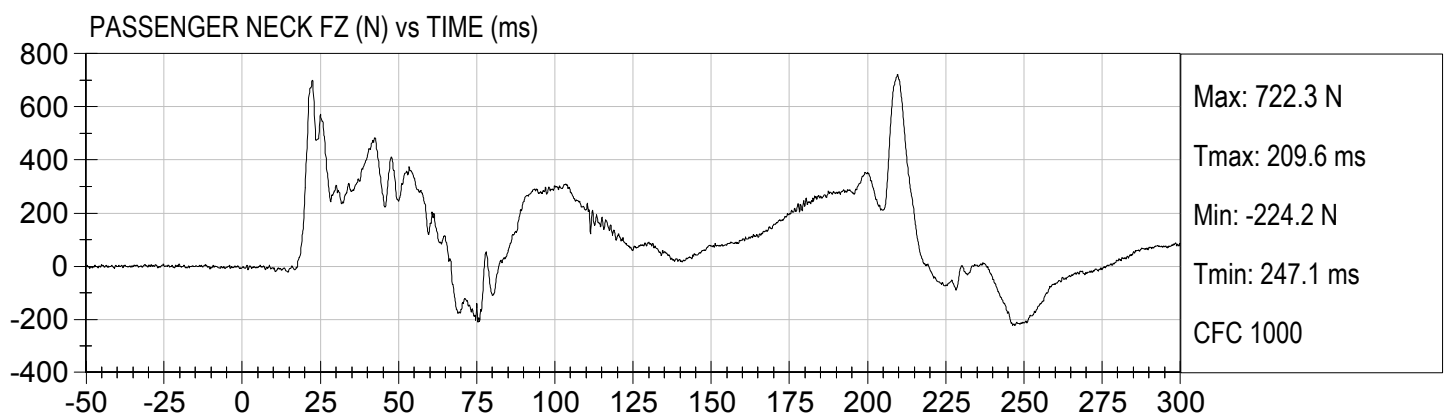
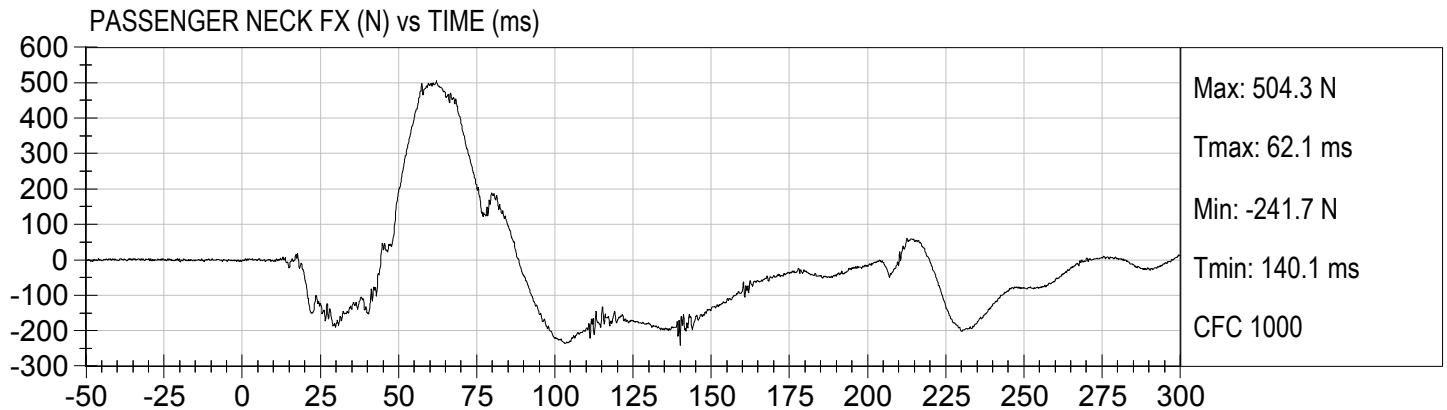


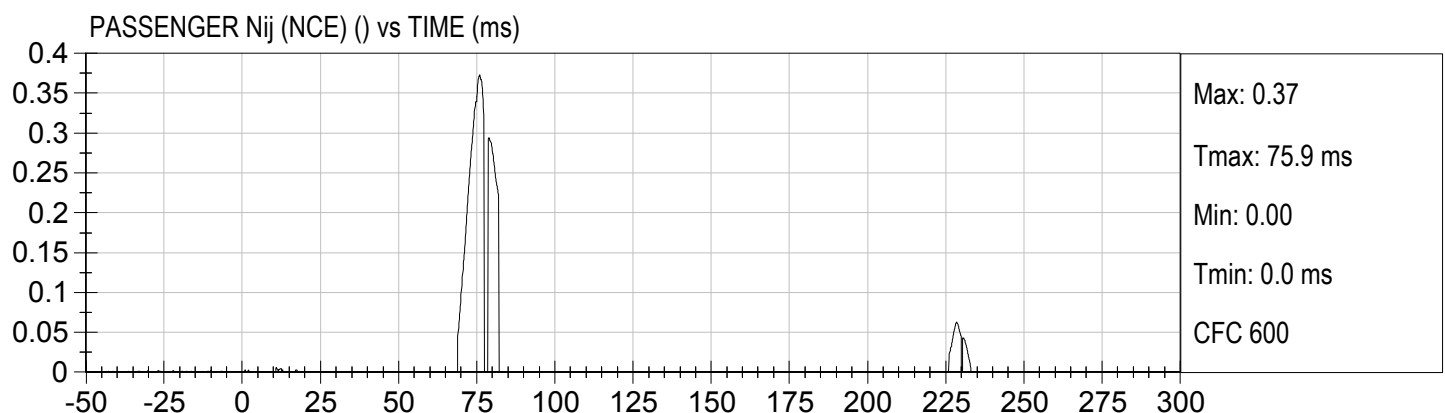
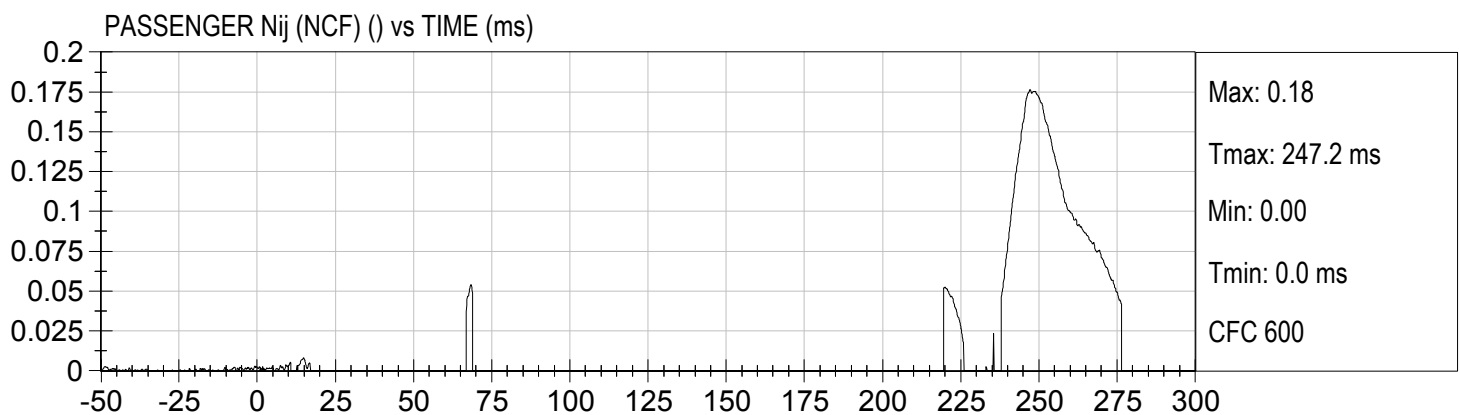
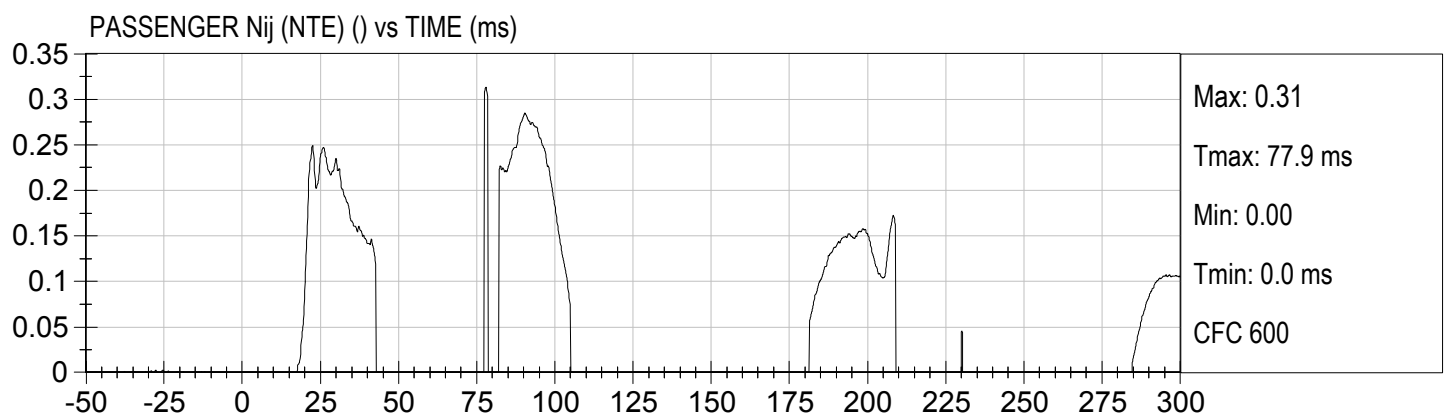
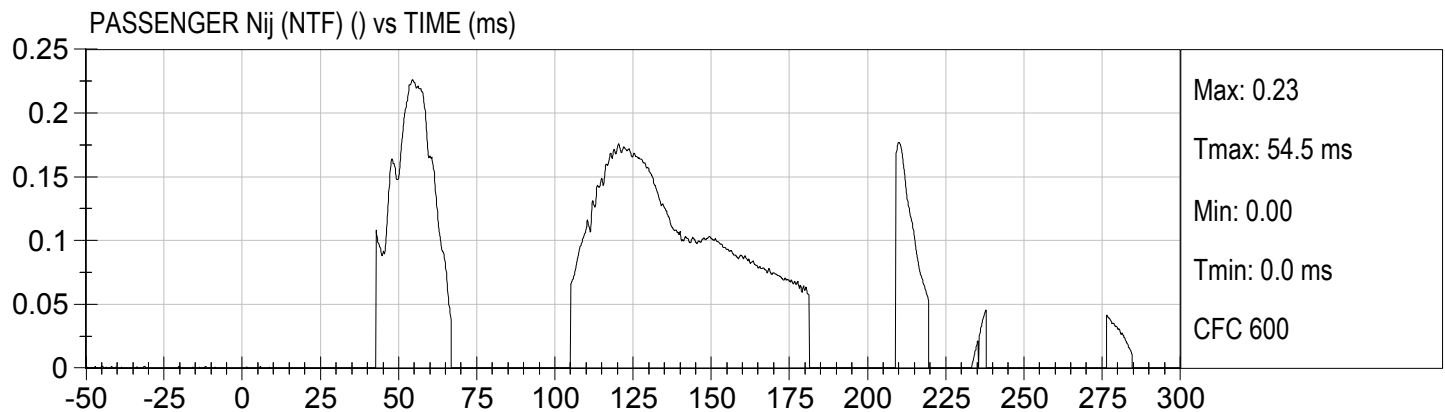


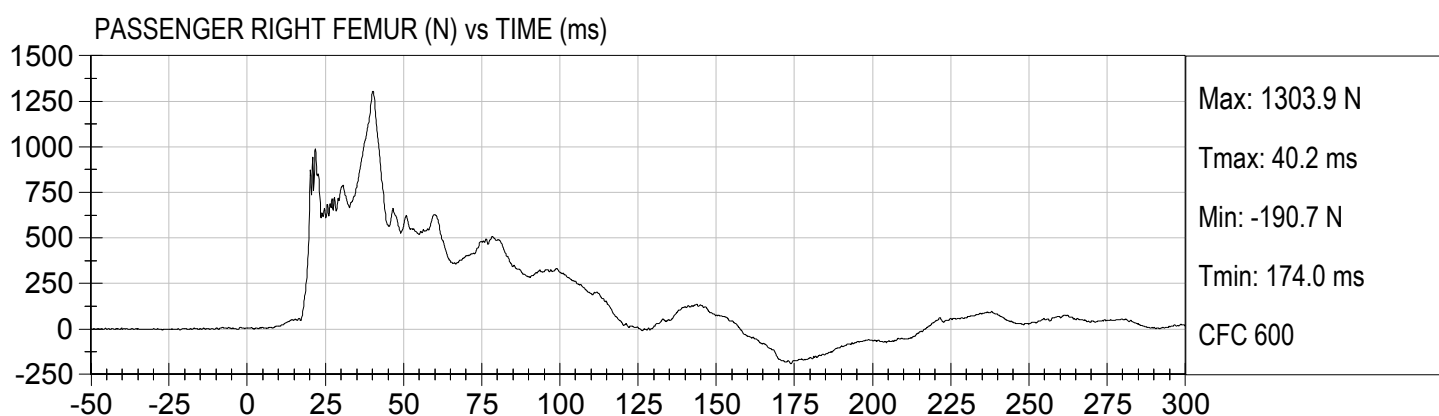
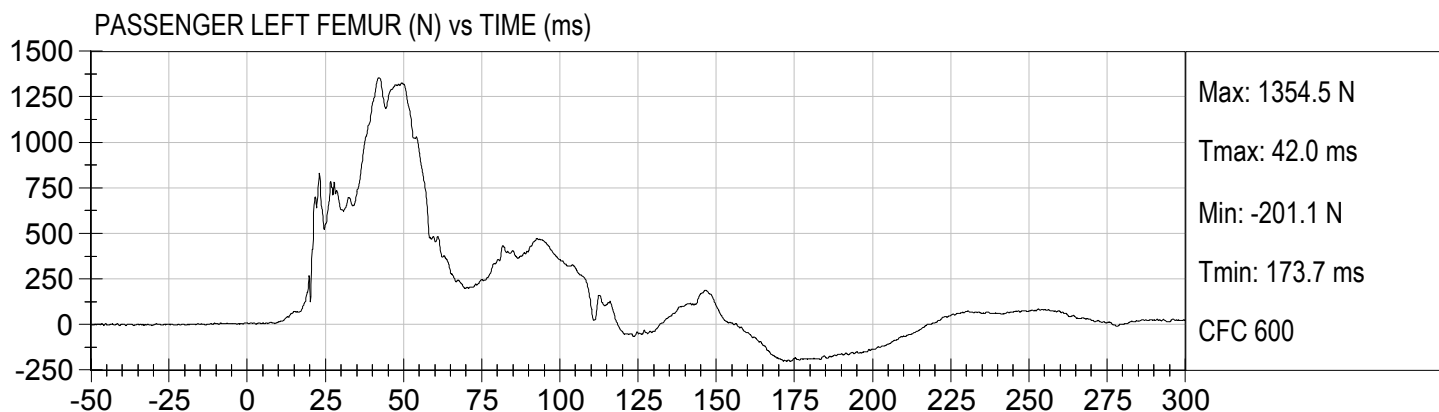












APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

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

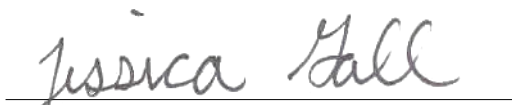
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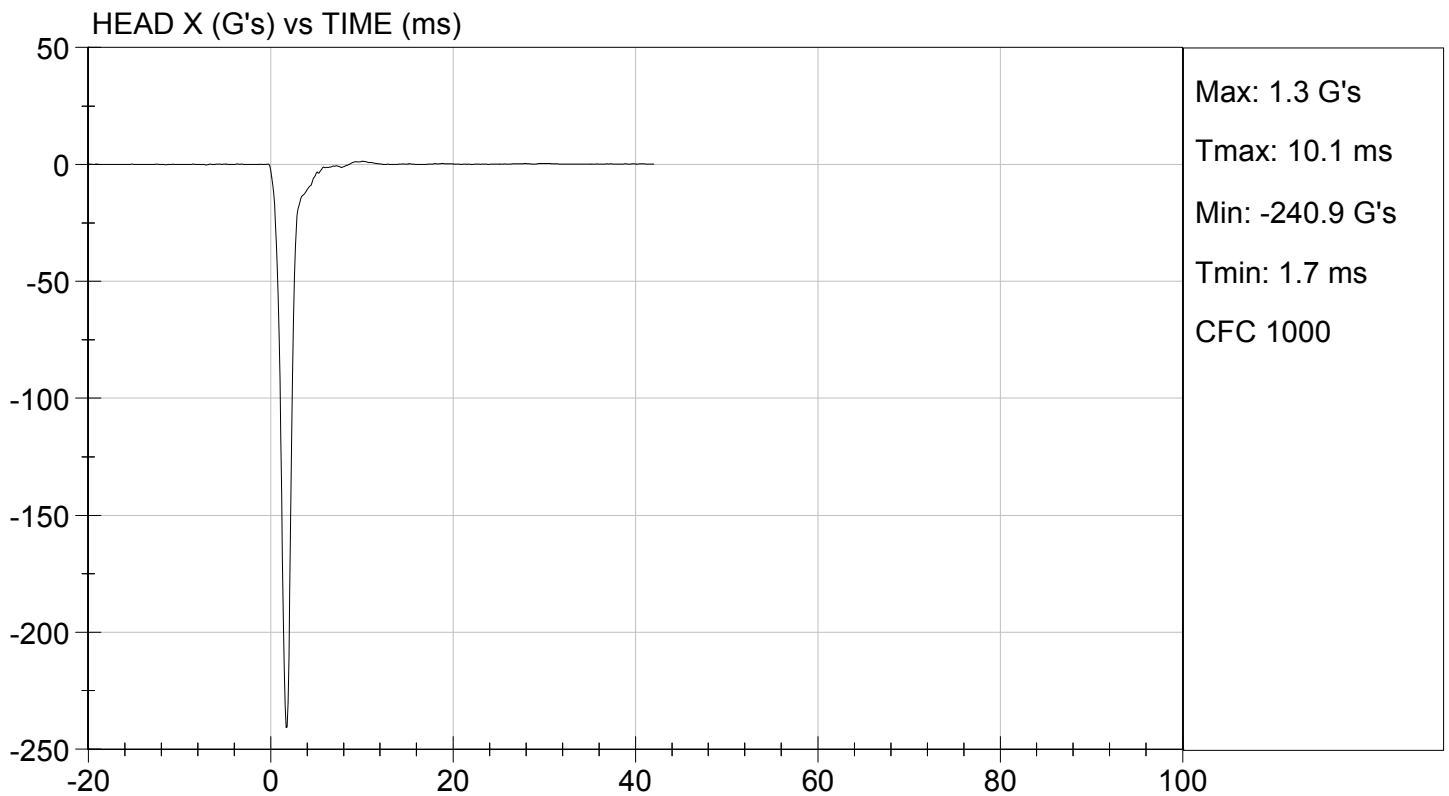
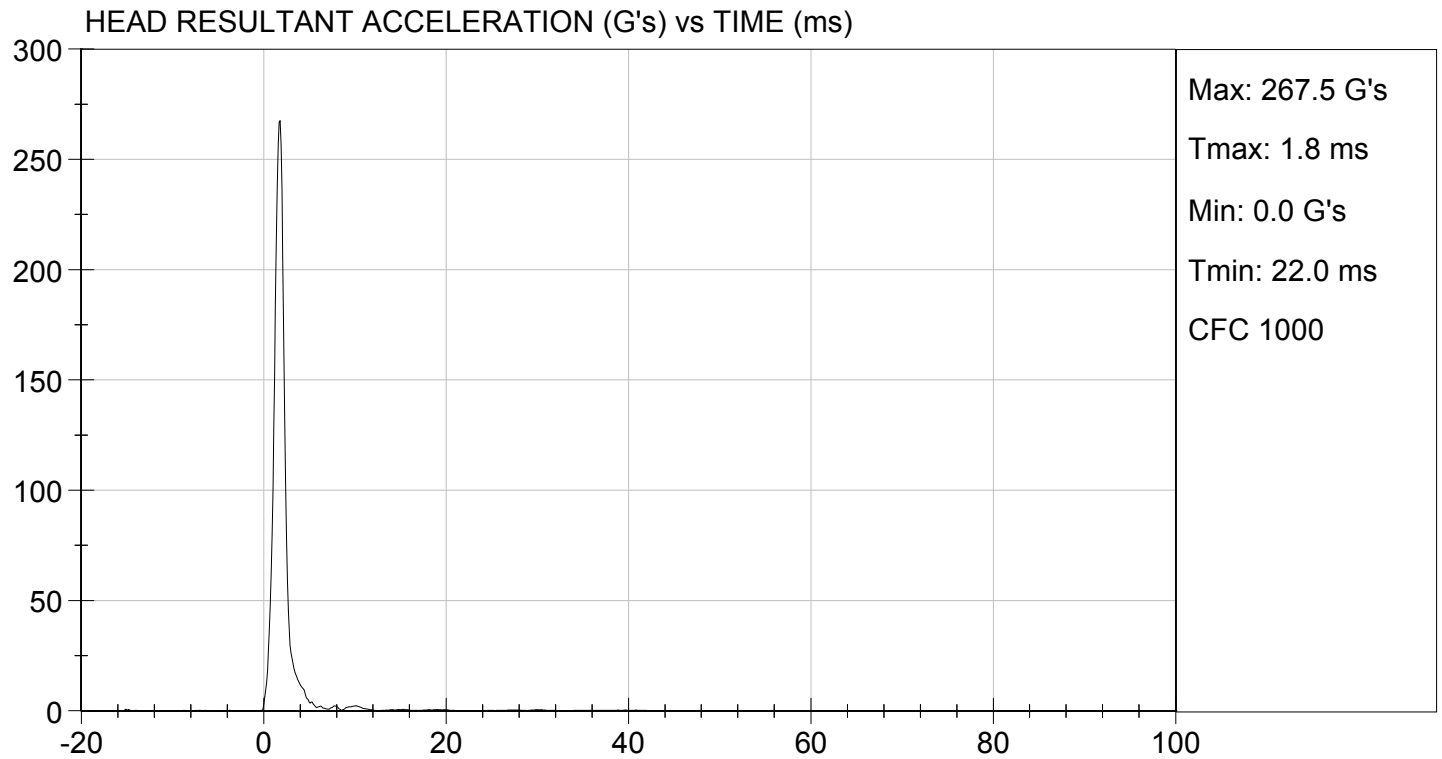
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Peak Resultant Acceleration	G's	225 to 275	268	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	6.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

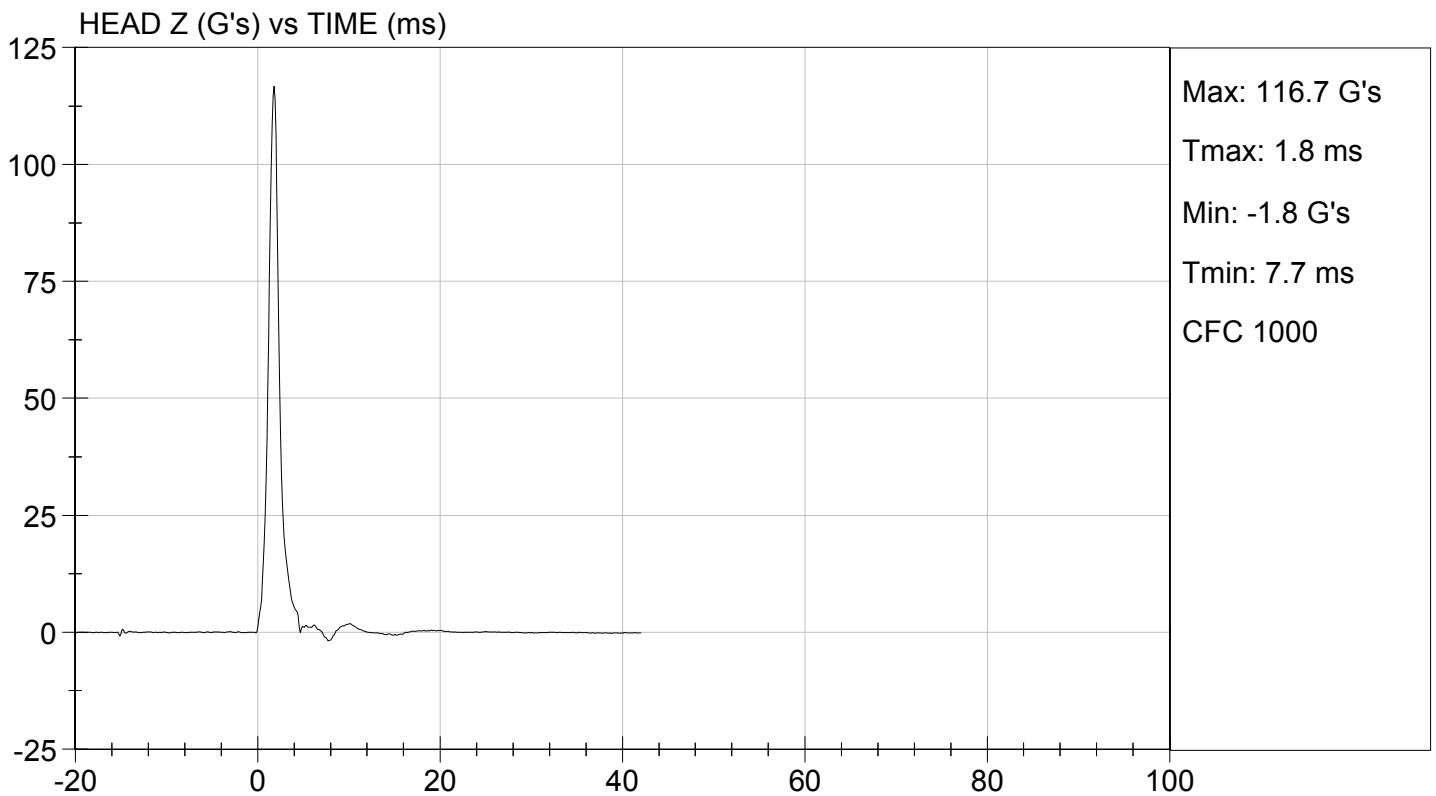
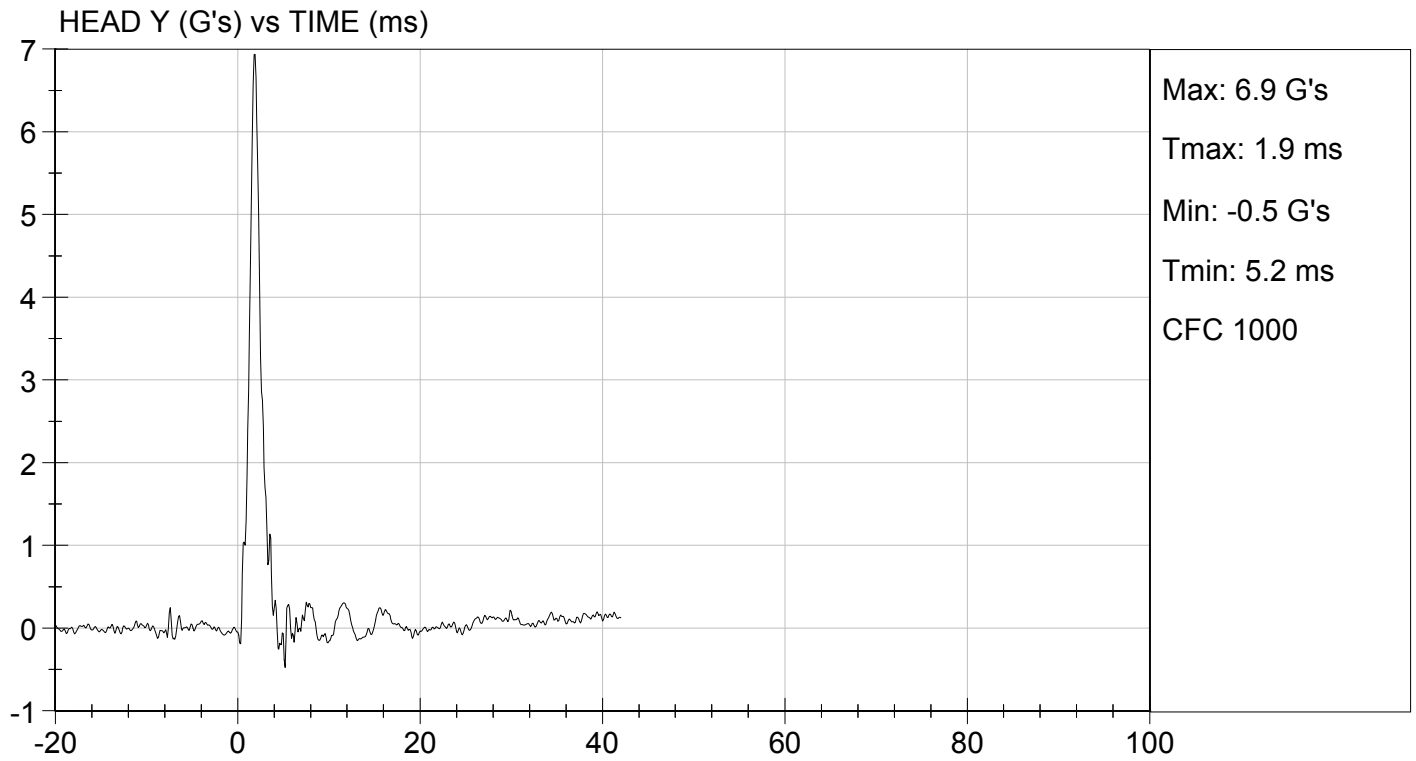

Laboratory Technician

08/10/2015

Test Date


Approved By





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

ATD Serial No: 351

Test I.D: D152412

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.74	Pass
	20 ms	G's	17.60 to 22.60	19.99	Pass
	30 ms	G's	12.50 to 18.50	14.50	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	37.7	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	74.7	Pass
	Time	ms	57.0 to 64.0	59.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	118.7	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	89.6	Pass
	Time	ms	47.0 to 58.0	50.9	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	105.1	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

08/10/2015

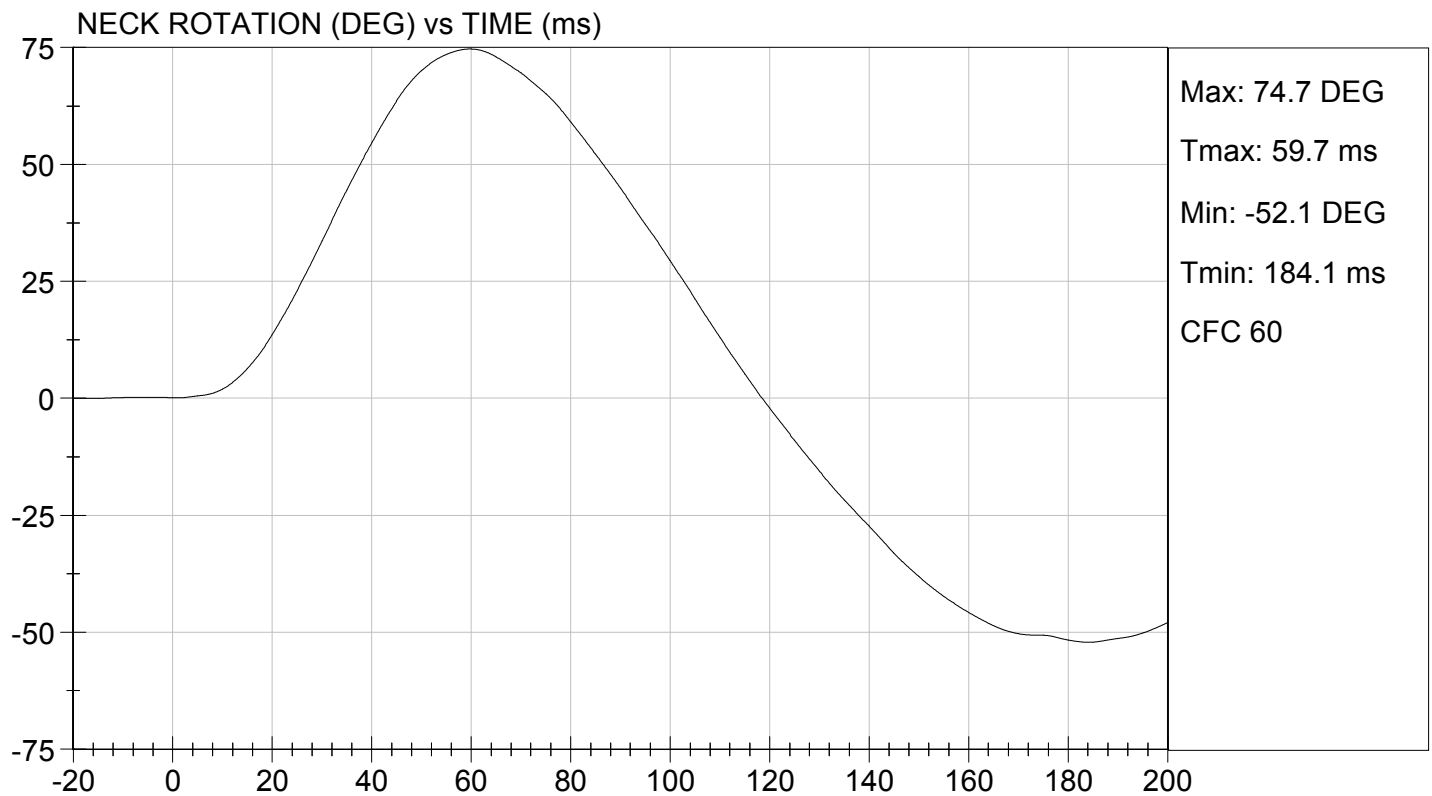
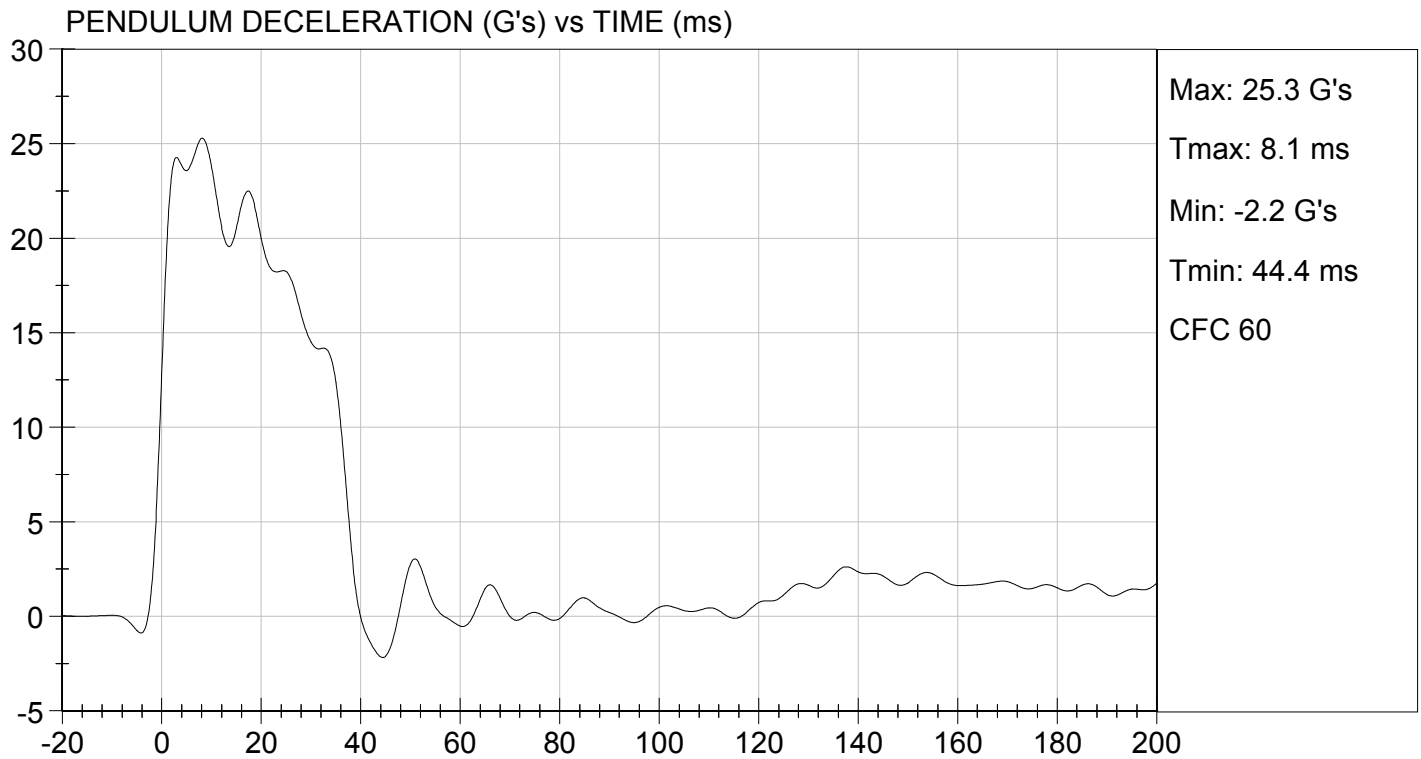
Test Date

Jessica Hall
Approved By



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

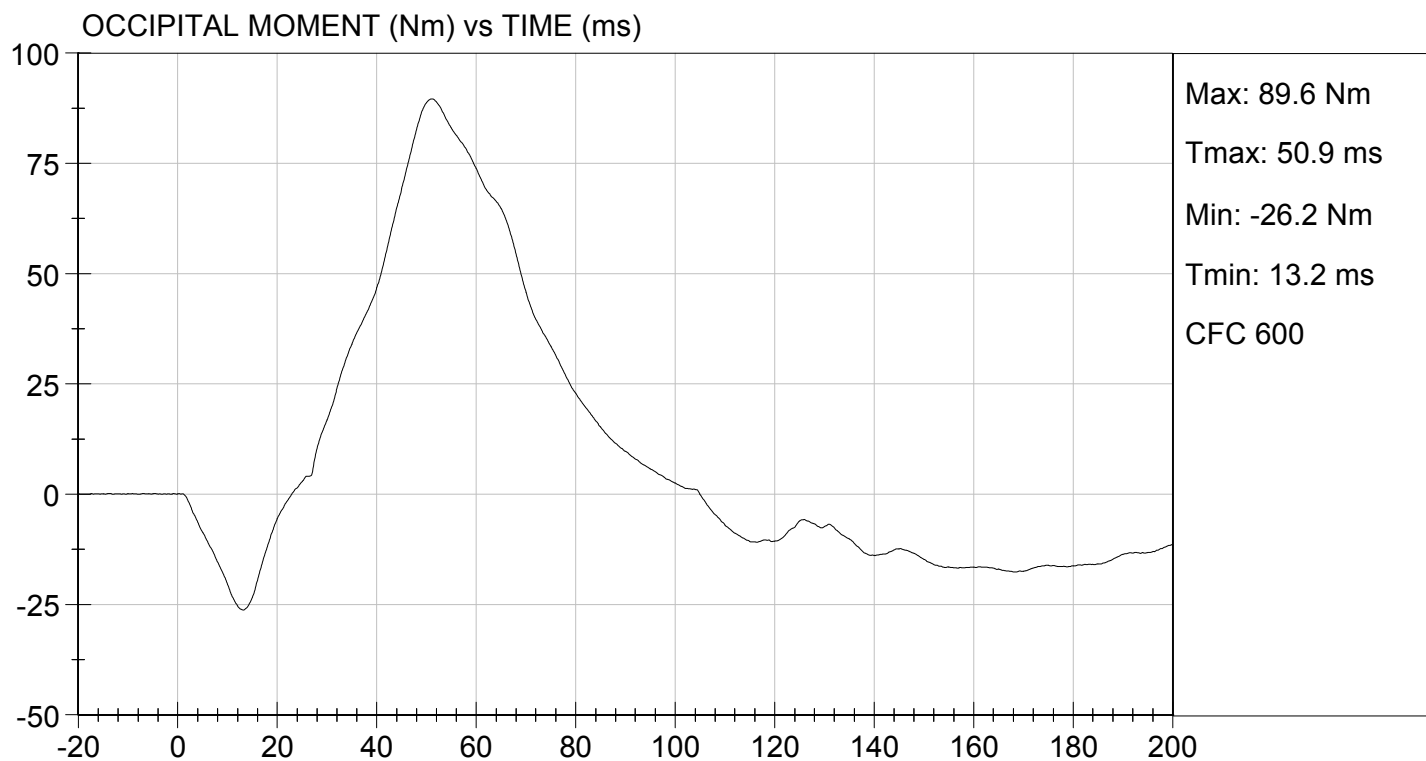
TEST DATE: 08/10/2015
TEST #: D152412





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

TEST DATE: 08/10/2015
TEST #: D152412



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

ATD Serial No: 351

Test I.D: D152413

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	20.68	Pass
	20 ms	G's	14.00 to 19.00	17.28	Pass
	30 ms	G's	11.00 to 16.00	14.83	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.6	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	101.8	Pass
	Time	ms	72.0 to 82.0	79.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	165.6	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-60.2	Pass
	Time	ms	65.0 to 79.0	73.3	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	146.7	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

08/10/2015

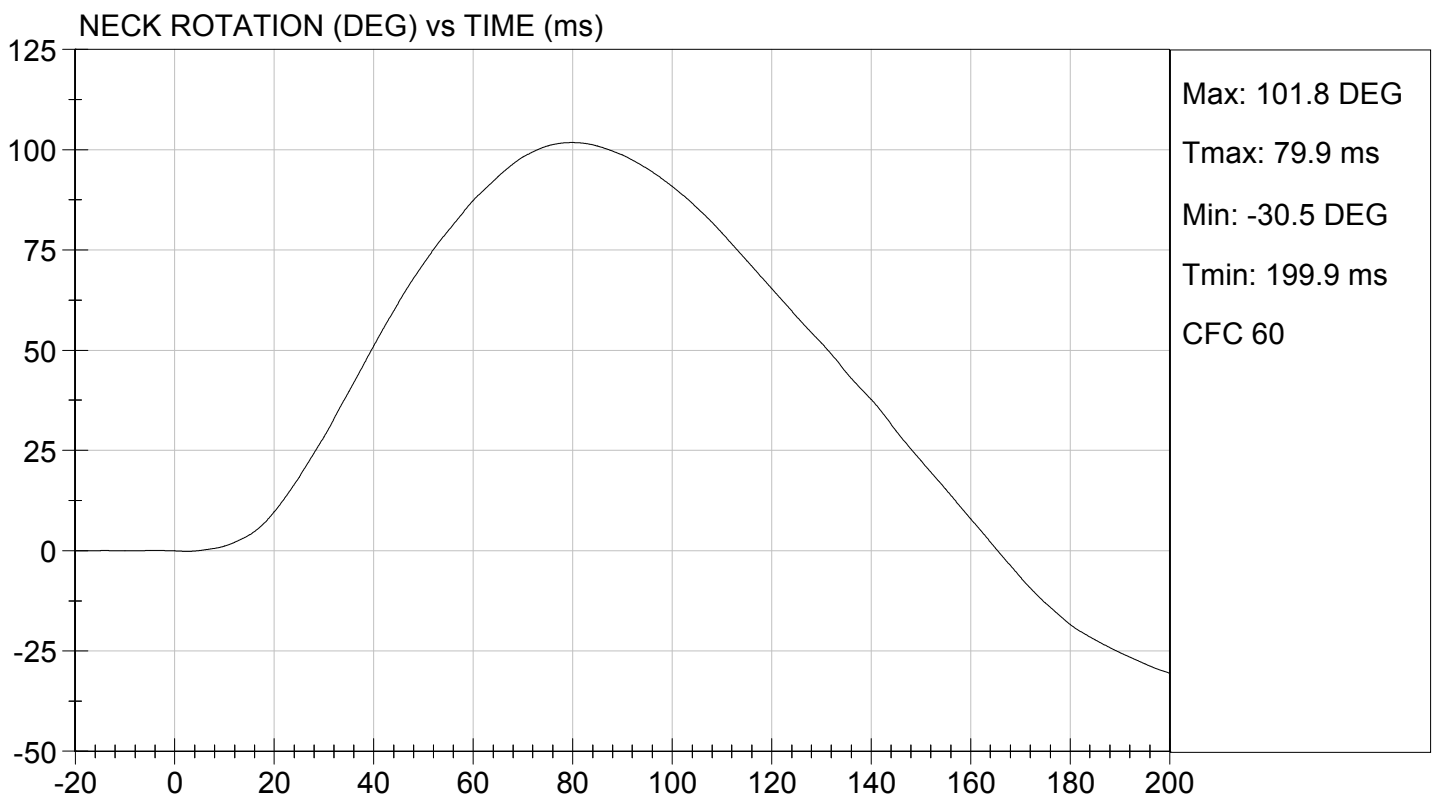
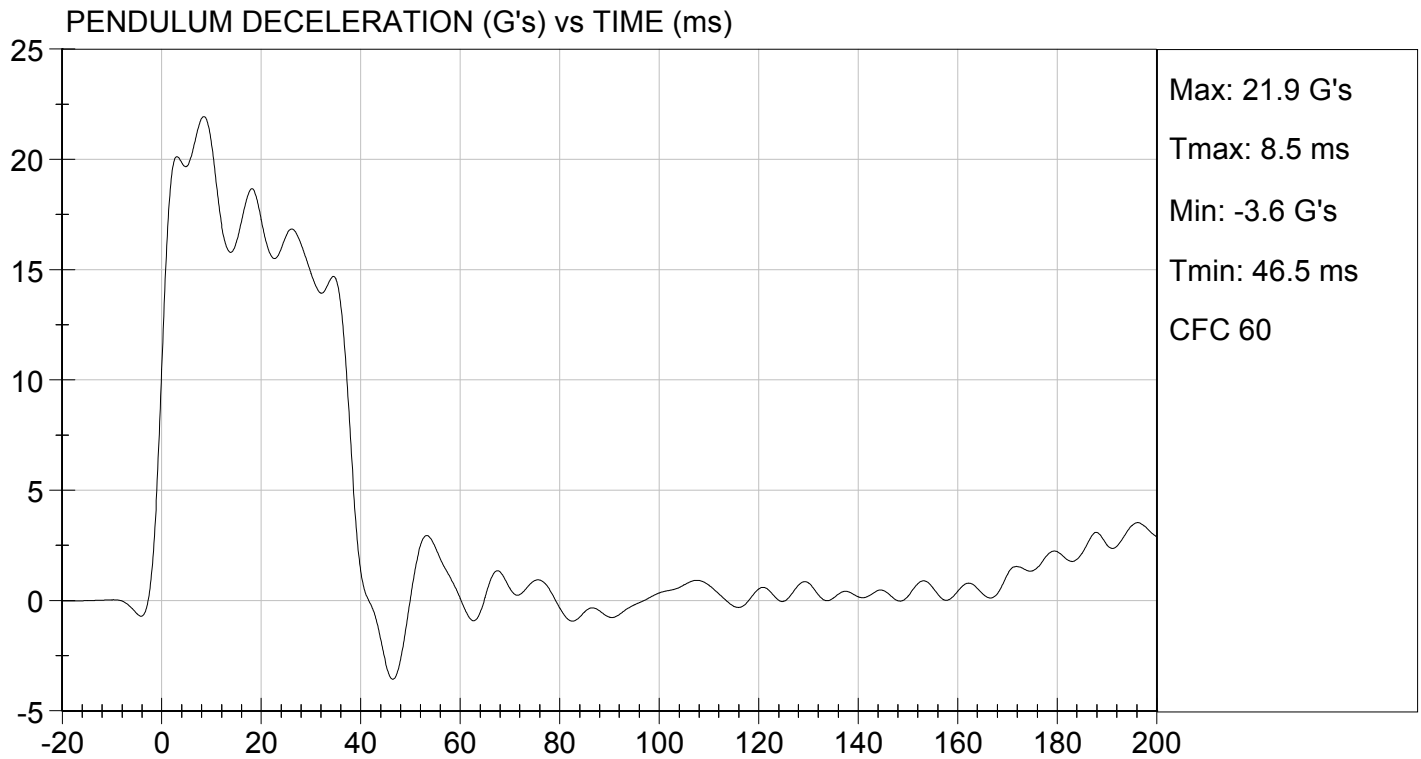
Test Date

Jessica Hall
Approved By



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

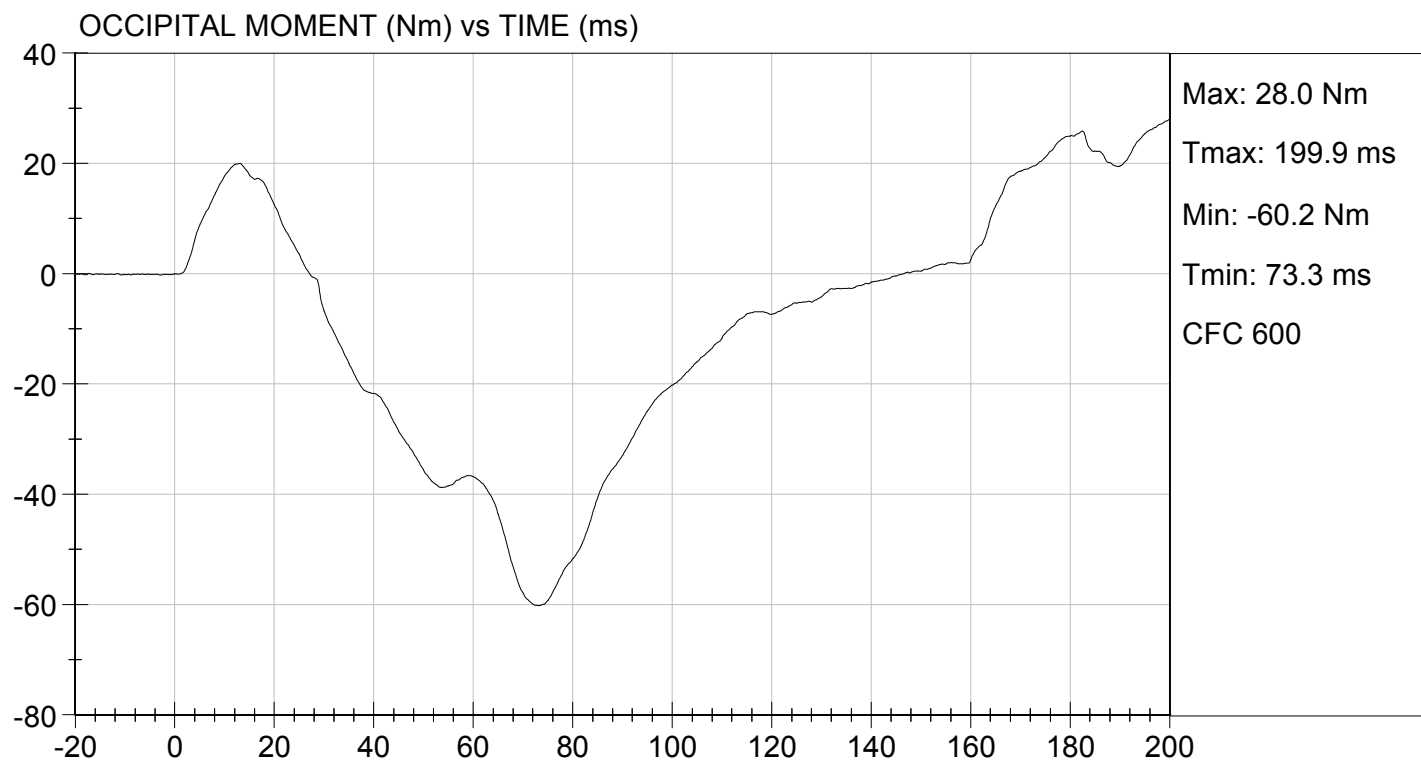
TEST DATE: 08/10/2015
TEST #: D152413





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

TEST DATE: 08/10/2015
TEST #: D152413



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D152414

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,452	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	7.09	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Overall Test Results			Pass	

David Schoedel
Laboratory Technician

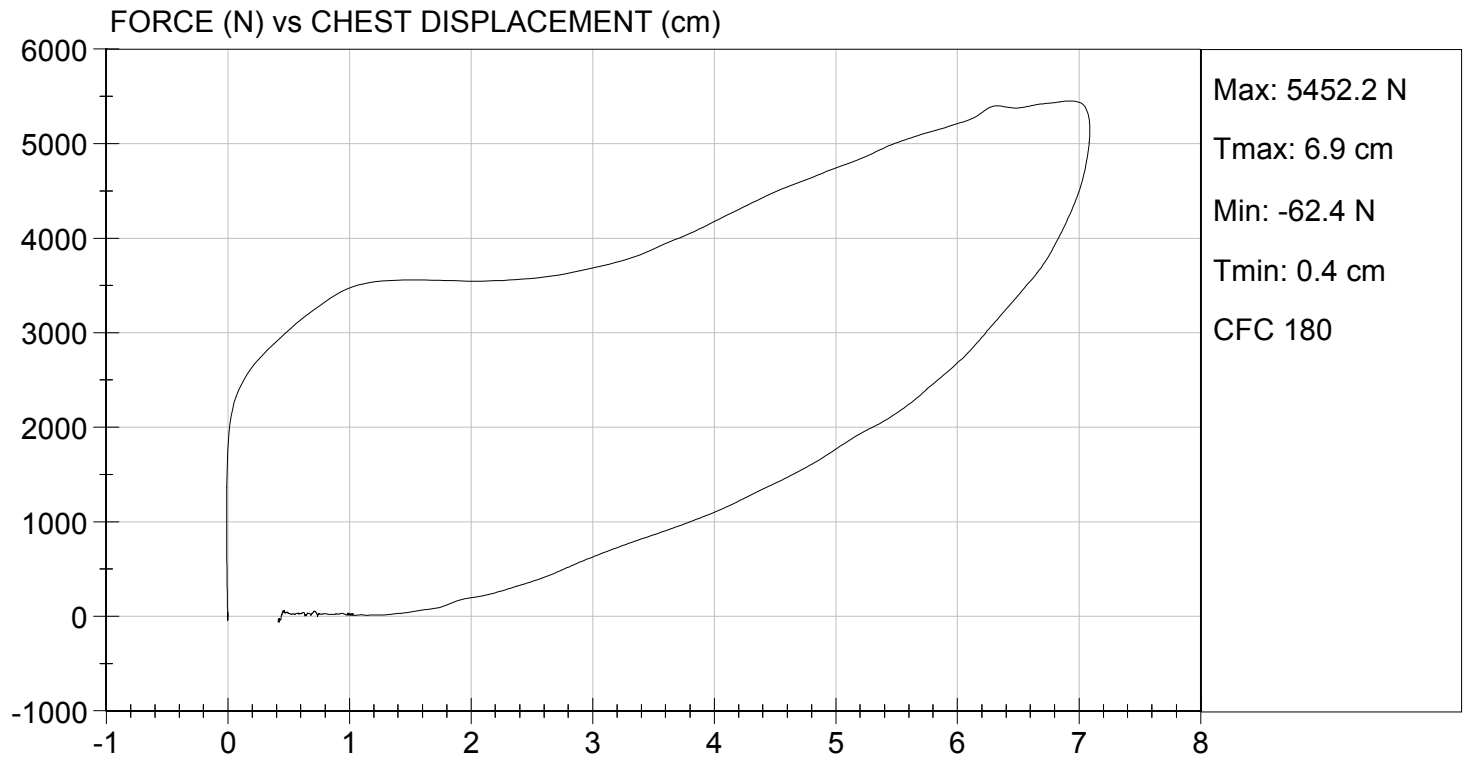
08/11/2015
Test Date

Jessica Hall
Approved By



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

TEST DATE: 08/11/2015
TEST #: D152414



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

ATD Serial No: 351

Test I.D: D152415

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,574	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

8/10/2015

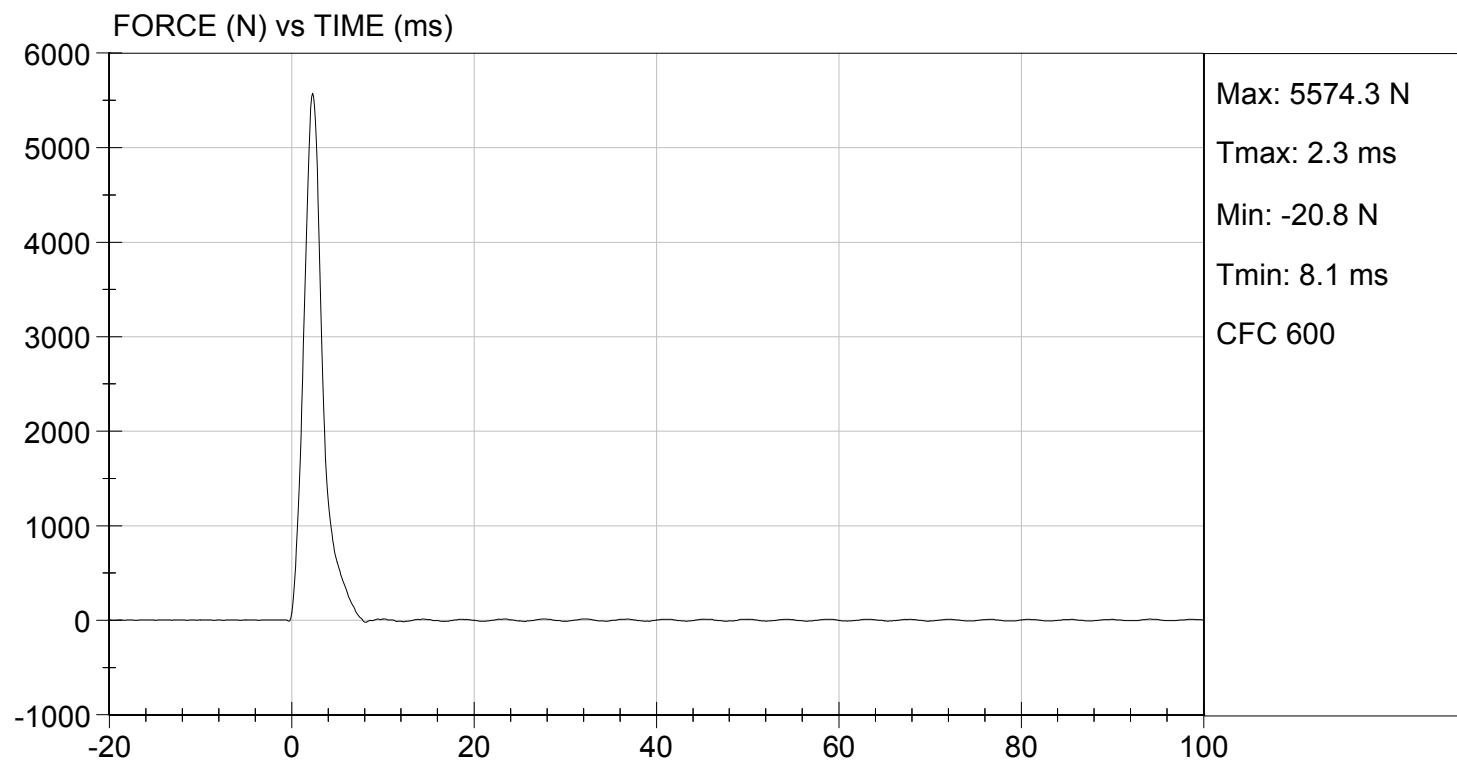
Test Date

Jessica Hall
Approved By



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

TEST DATE: 8/10/2015
TEST #: D152415



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

ATD Serial No: 351

Test I.D: D152416

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,453	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

08/10/2015

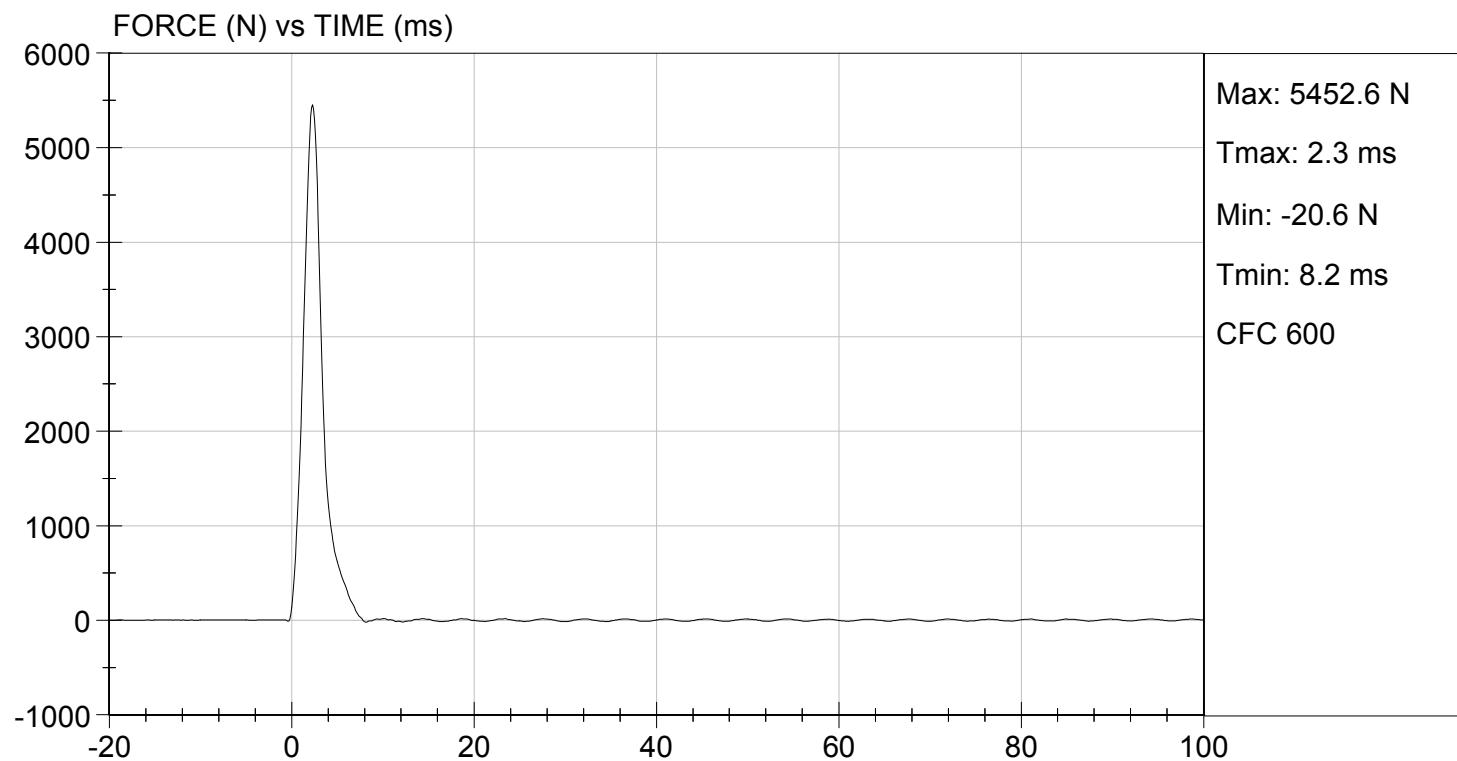
Test Date

Jessica Hall
Approved By



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

TEST DATE: 08/10/2015
TEST #: D152416



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

ATD Serial No: 351

Test I.D: D152410

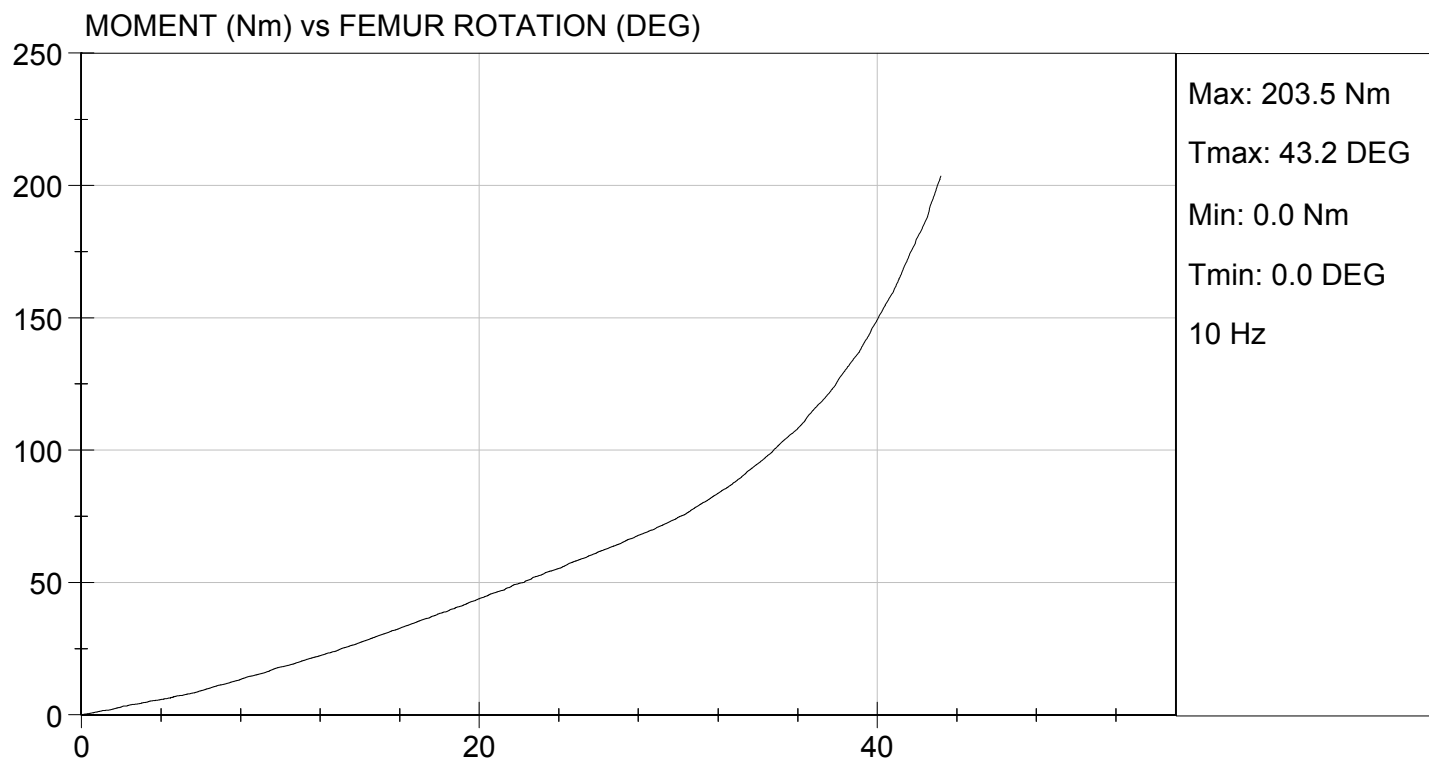
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.0	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	48	48	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.2	Pass
30 Degrees	Nm	94.9 Nm Max	74.6	79.4	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	43.2	42.3	Pass
Overall Test Results					Pass

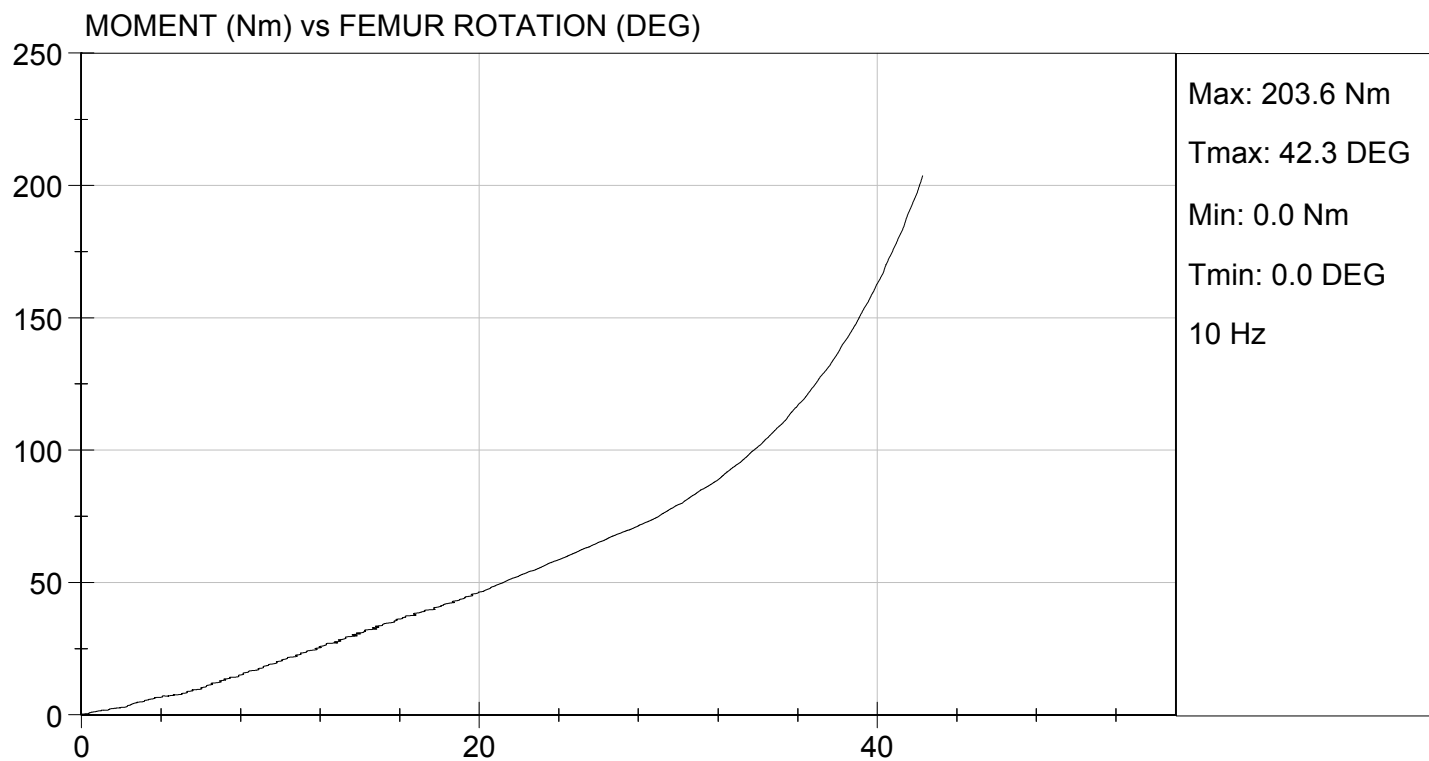

Laboratory Technician

08/10/2015

Test Date


Approved By





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

ATD Serial No: 351

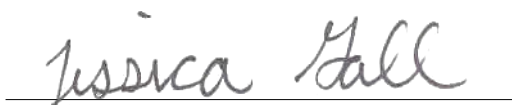
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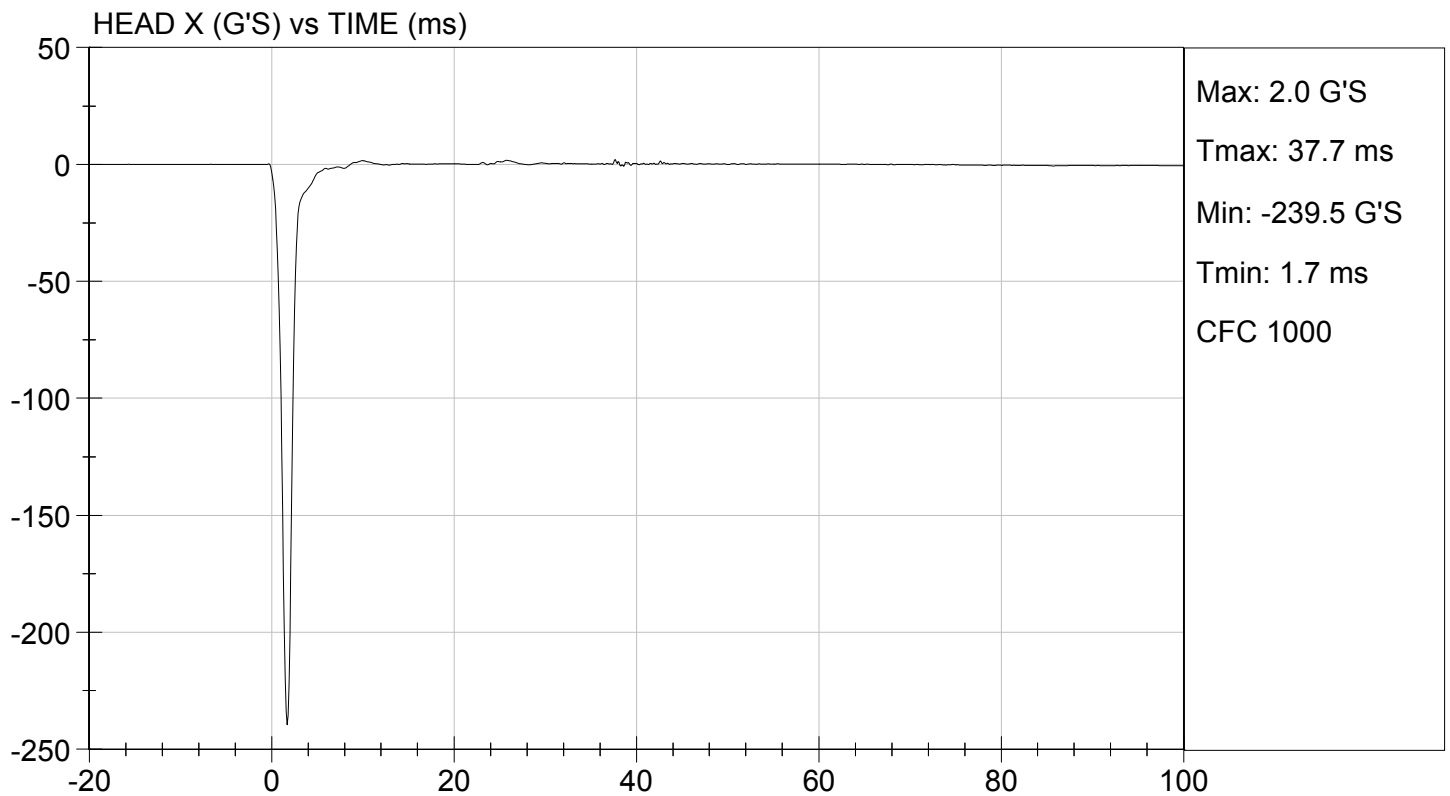
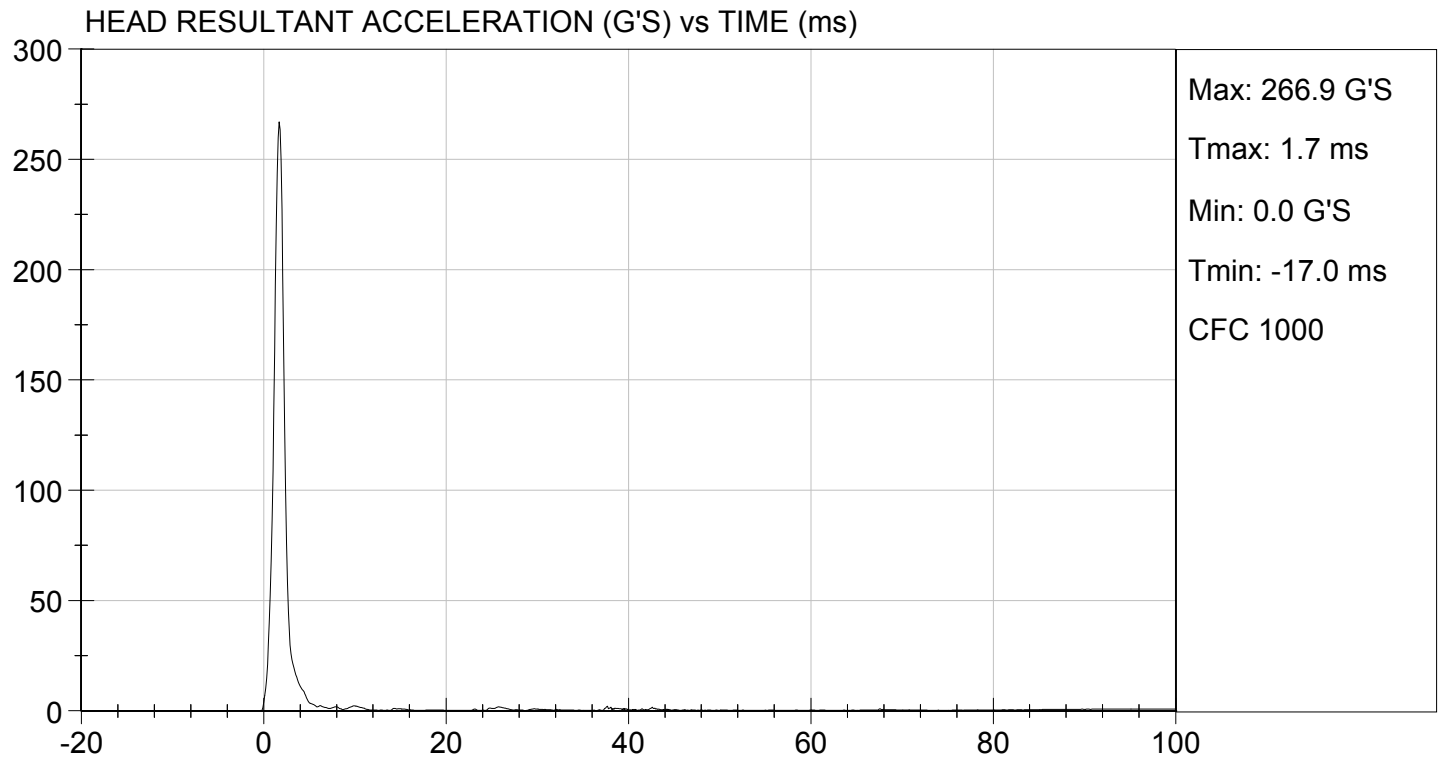
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Peak Resultant Acceleration	G's	225 to 275	267	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-1.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

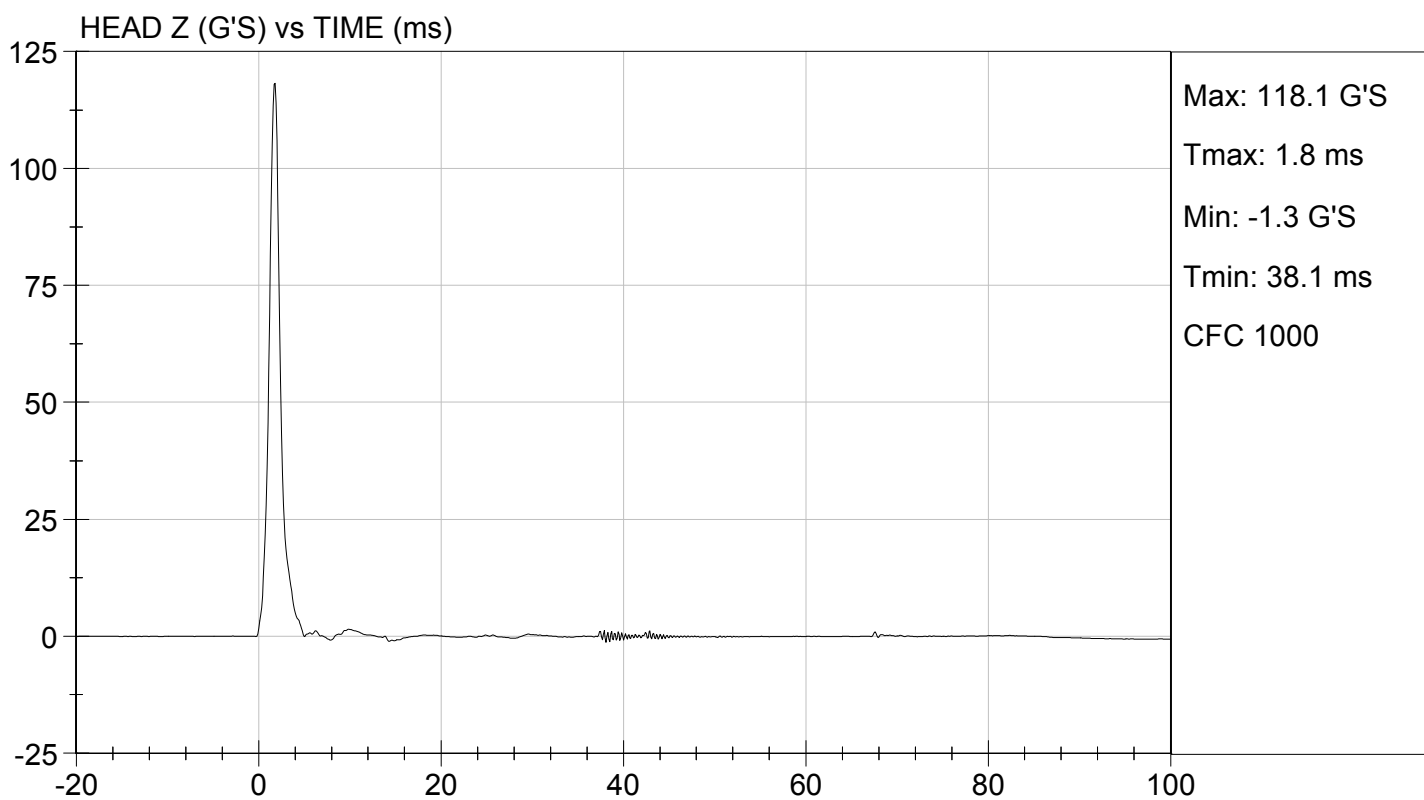
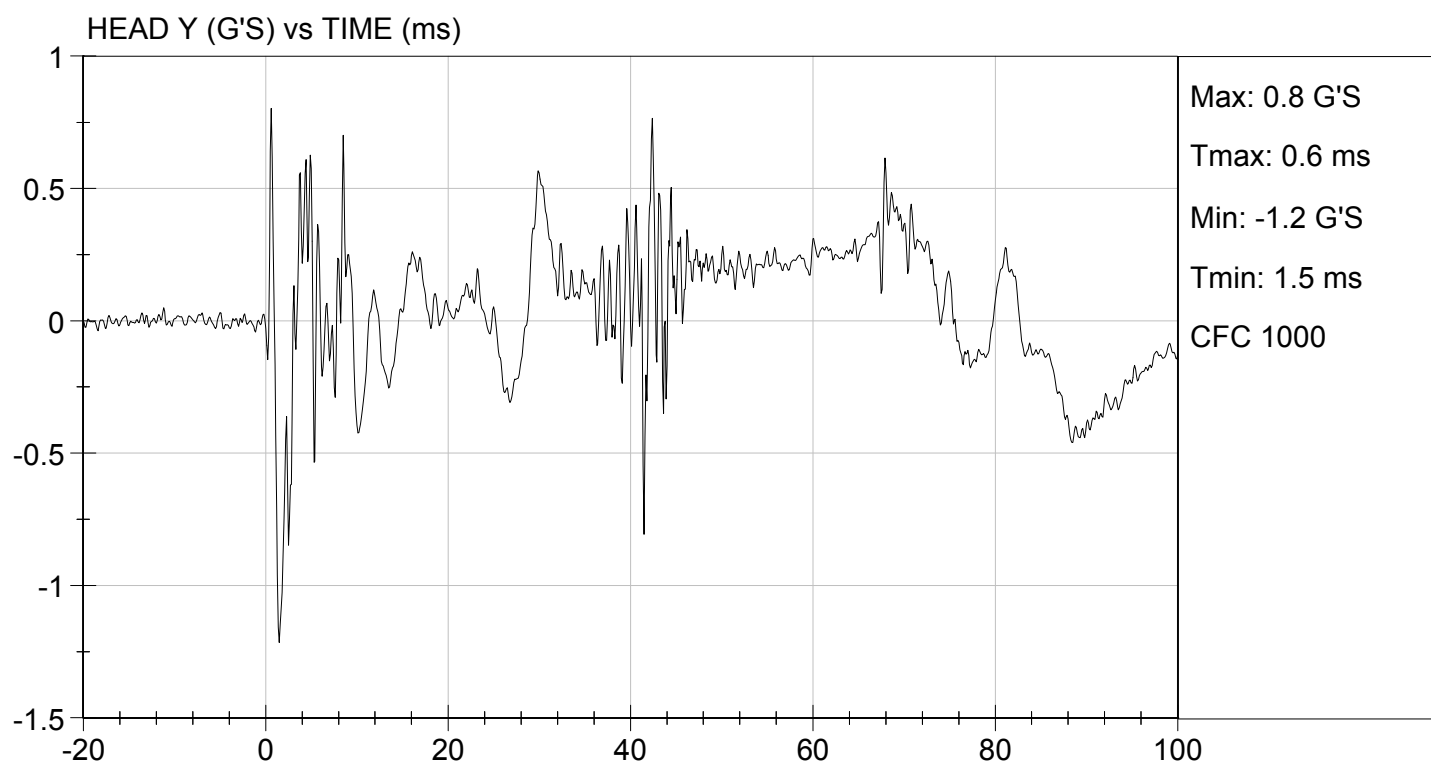

Laboratory Technician

10/05/2015

Test Date


Approved By





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

ATD Serial No: 351

Test I.D: D153102

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.97	Pass
	20 ms	G's	17.60 to 22.60	19.80	Pass
	30 ms	G's	12.50 to 18.50	13.57	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	13.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	37.8	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	70.4	Pass
	Time	ms	57.0 to 64.0	61.8	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	118.5	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	88.8	Pass
	Time	ms	47.0 to 58.0	51.0	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	103.8	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

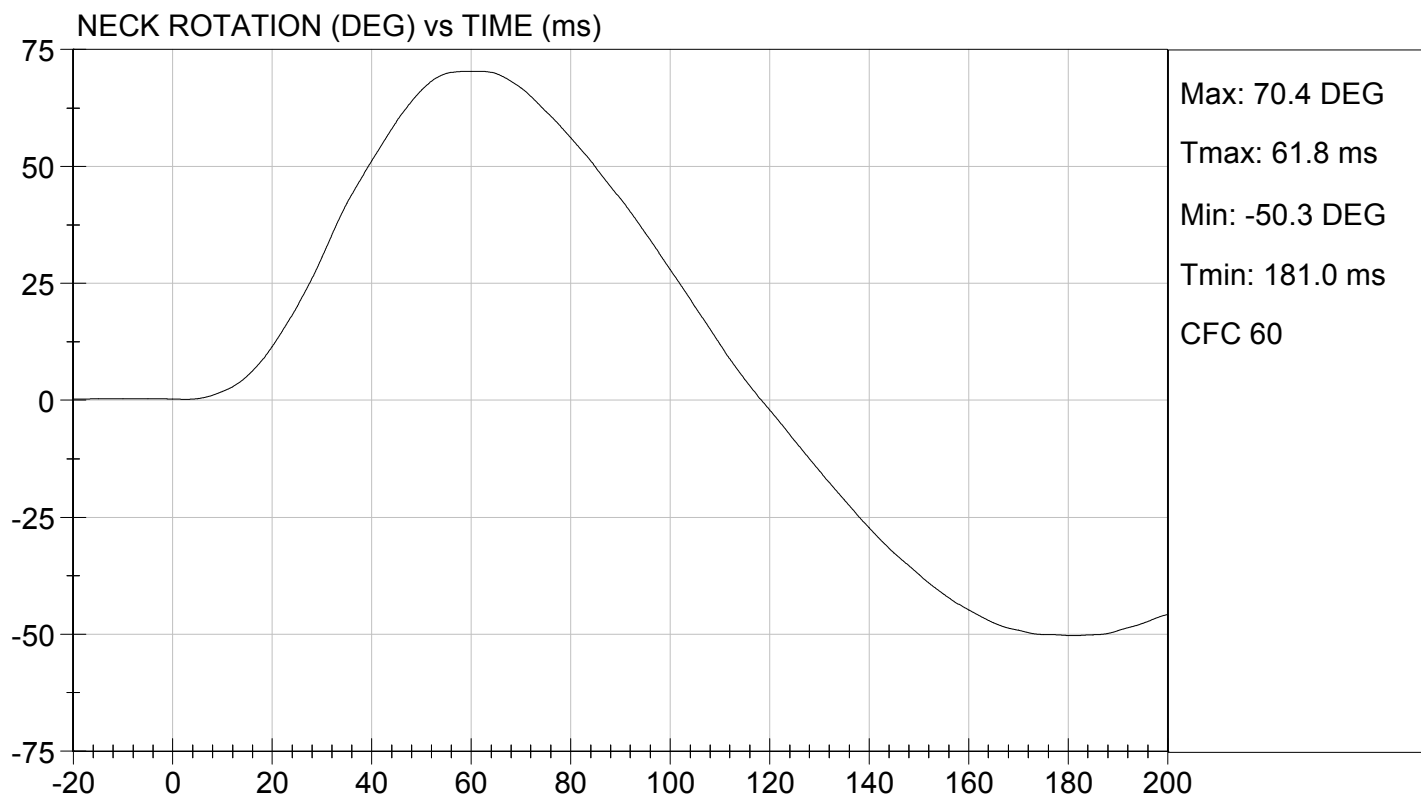
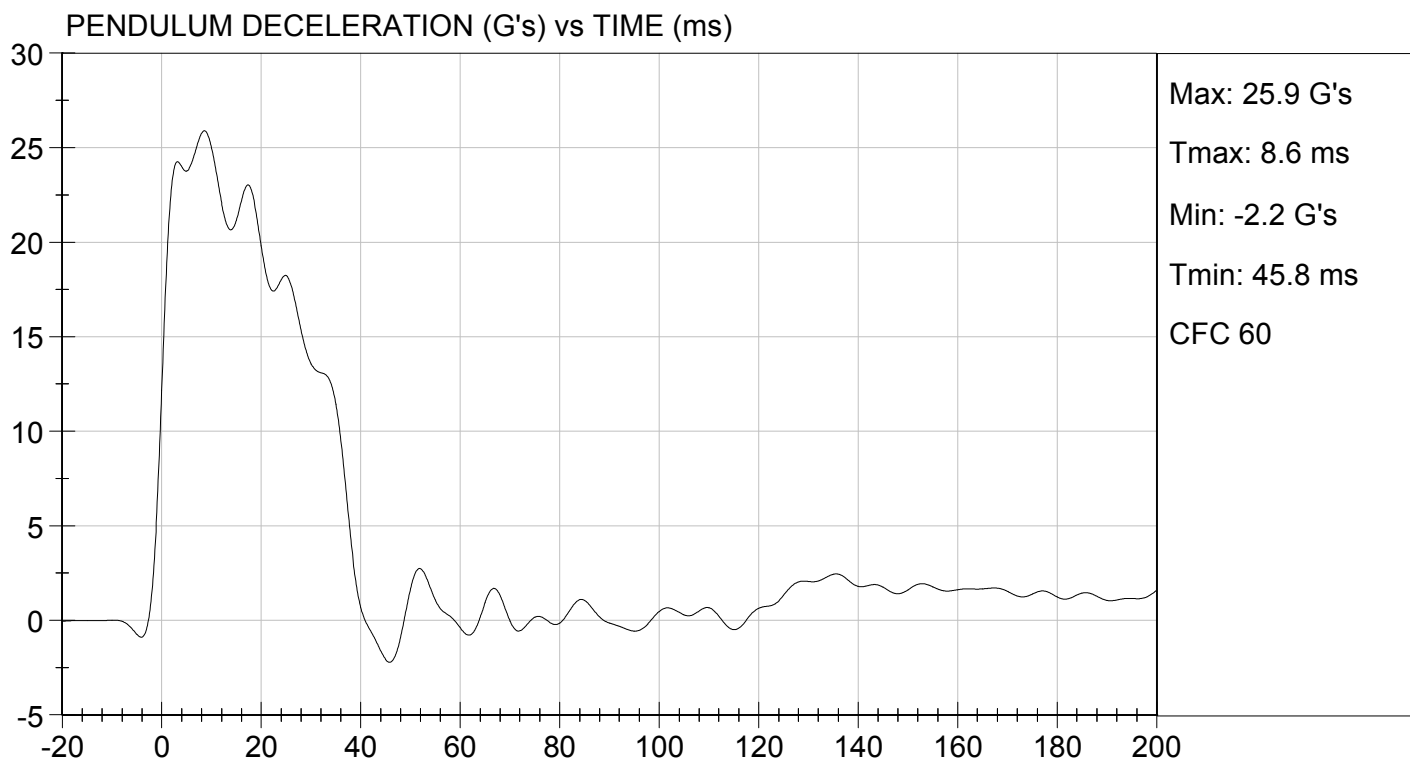
10/05/2015
Test Date

Jessica Hall
Approved By



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

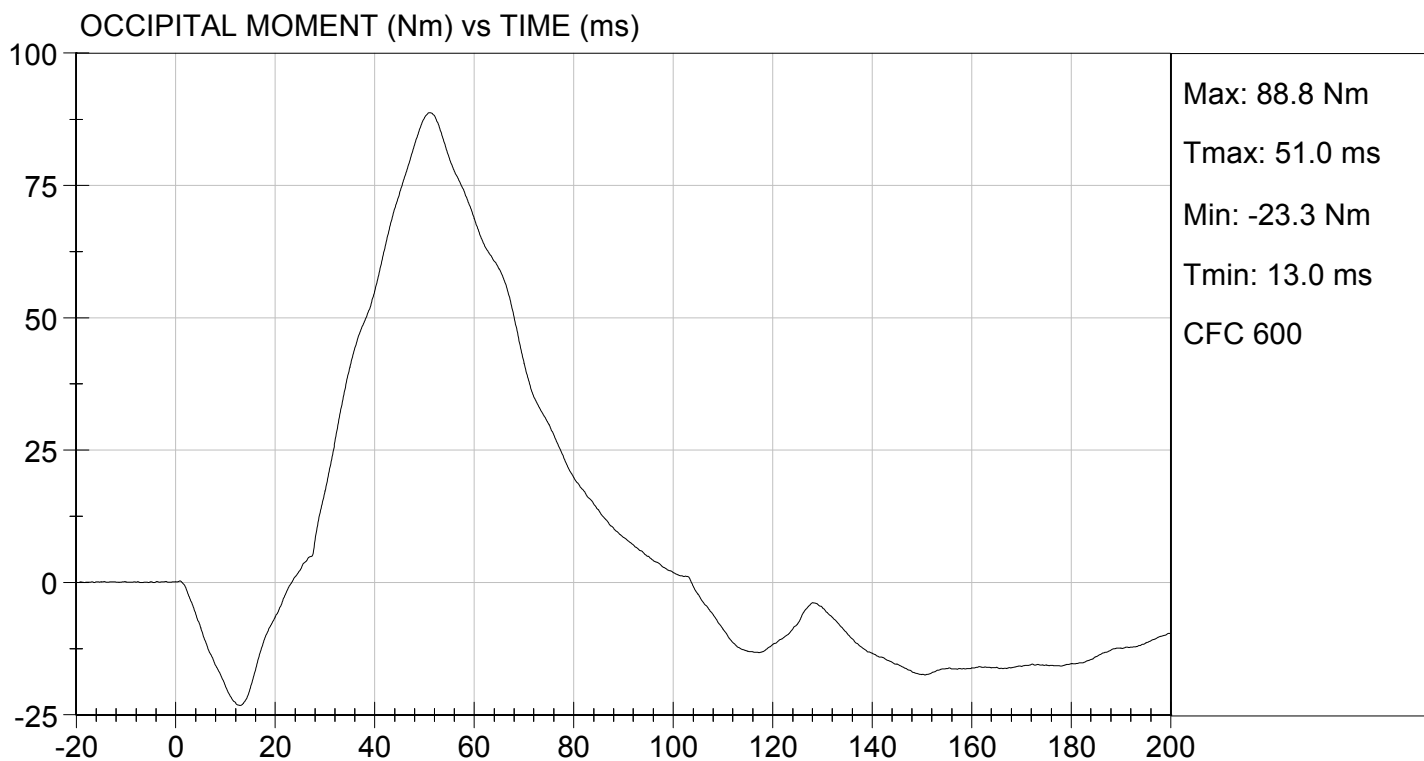
TEST DATE: 10/05/2015
TEST #: D153102





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

TEST DATE: 10/05/2015
TEST #: D153102



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

ATD Serial No: 351

Test I.D: D153103

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	20.70	Pass
	20 ms	G's	14.00 to 19.00	18.05	Pass
	30 ms	G's	11.00 to 16.00	14.90	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	42.9	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	101.2	Pass
	Time	ms	72.0 to 82.0	76.8	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	160.4	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-64.0	Pass
	Time	ms	65.0 to 79.0	67.9	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	143.6	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

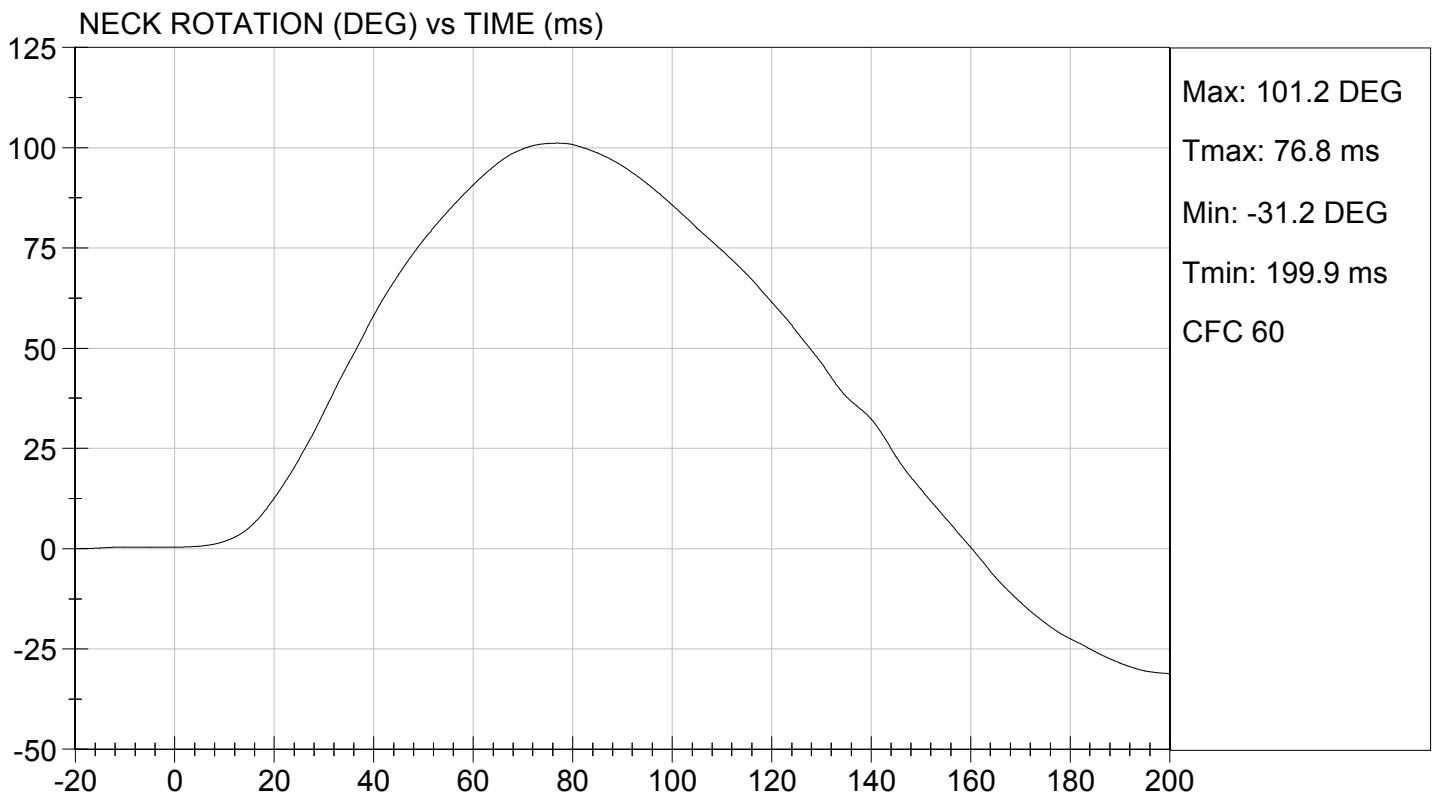
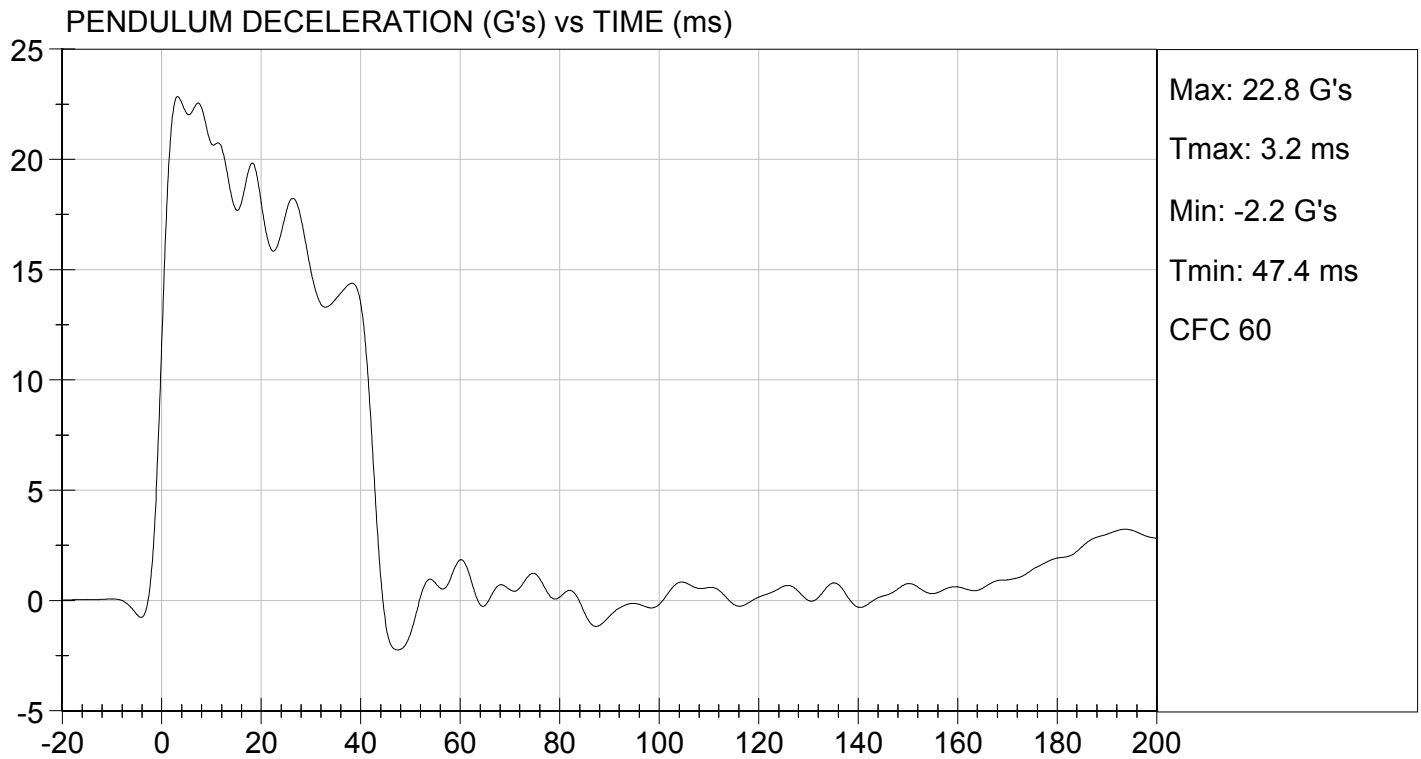
10/05/2015
Test Date

Jessica Hall
Approved By



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

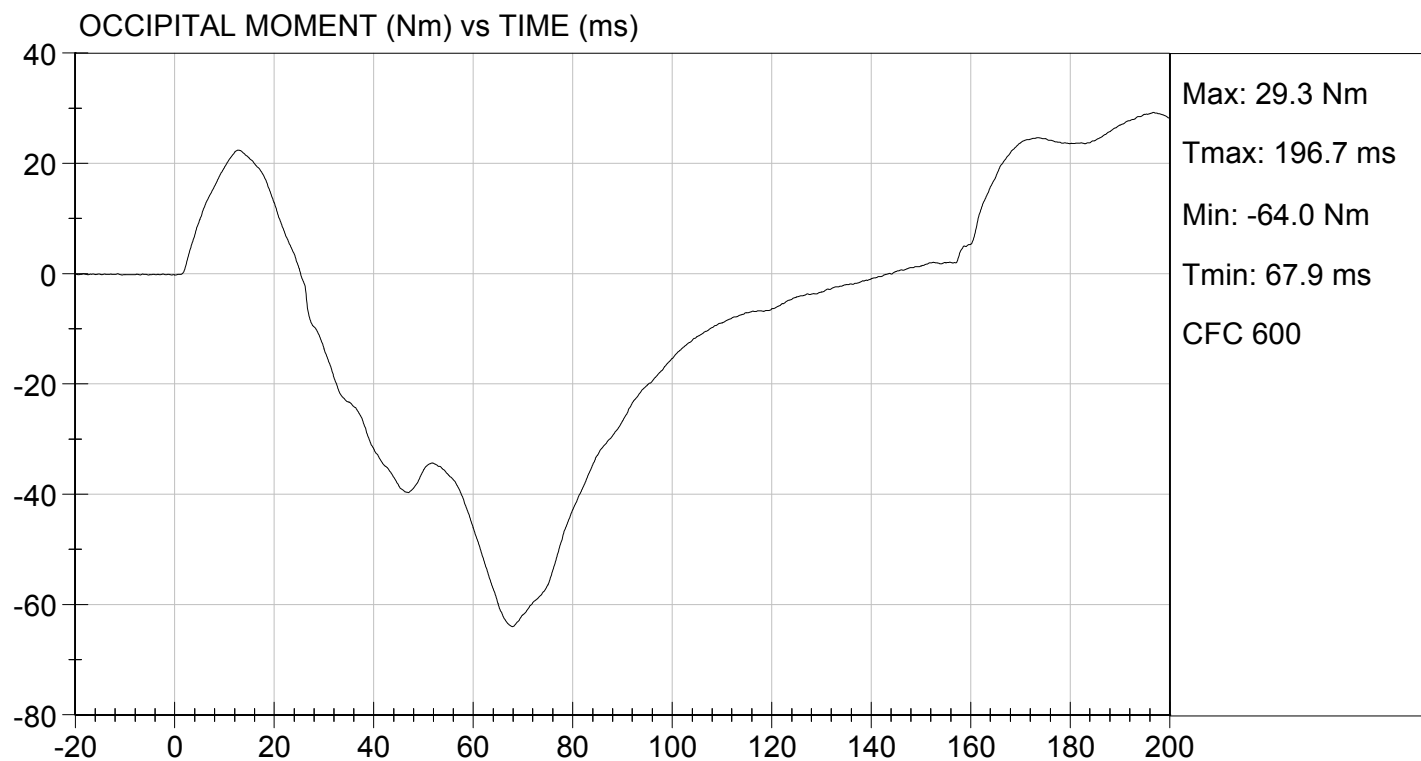
TEST DATE: 10/05/2015
TEST #: D153103





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

TEST DATE: 10/05/2015
TEST #: D153103

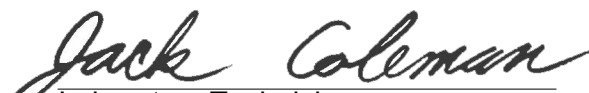


MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D153104

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,562	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	7.16	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Overall Test Results			Pass	


Laboratory Technician

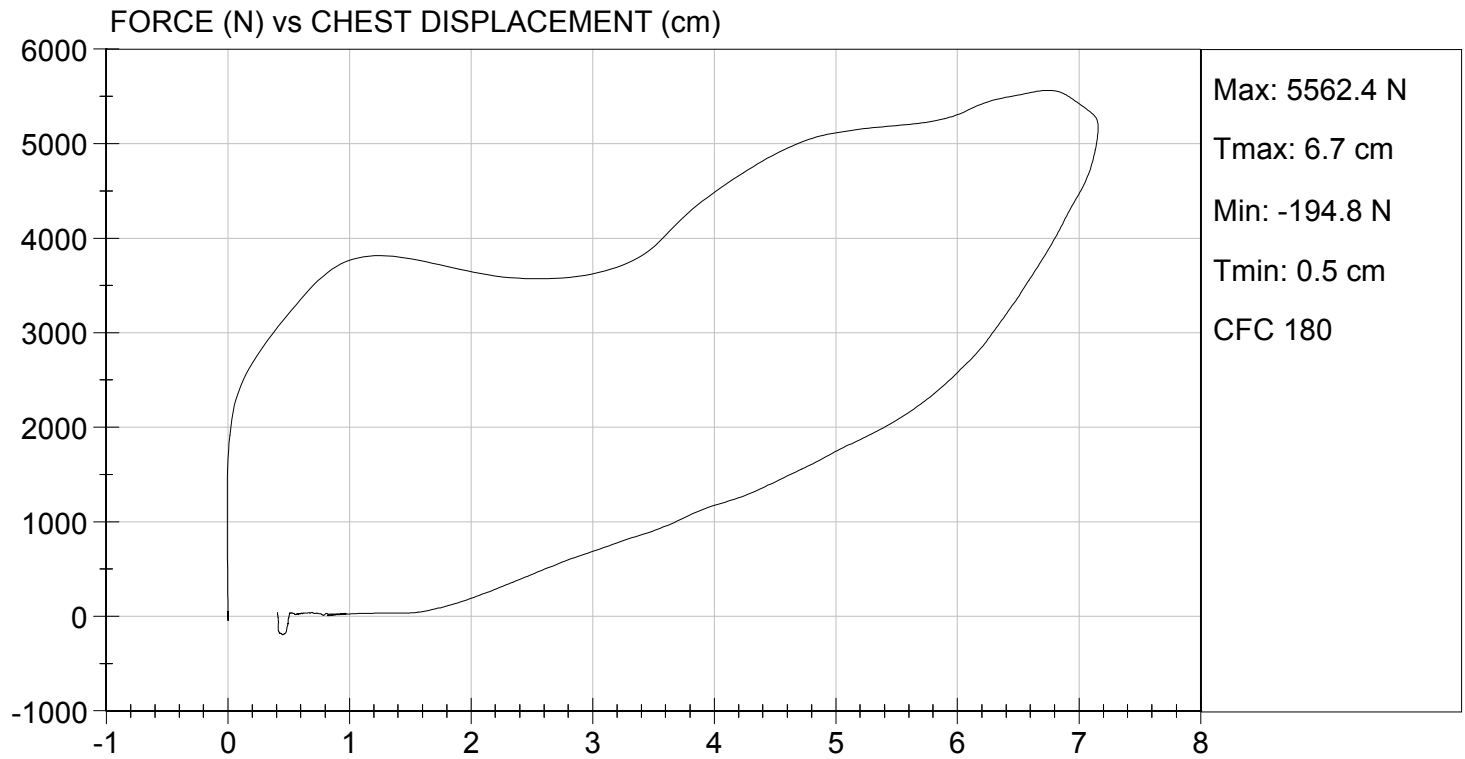
10/05/2015
Test Date


Approved By



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

TEST DATE: 10/05/2015
TEST #: D153104



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

ATD Serial No: 351

Test I.D: D153105

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	5,211	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

10/05/2015

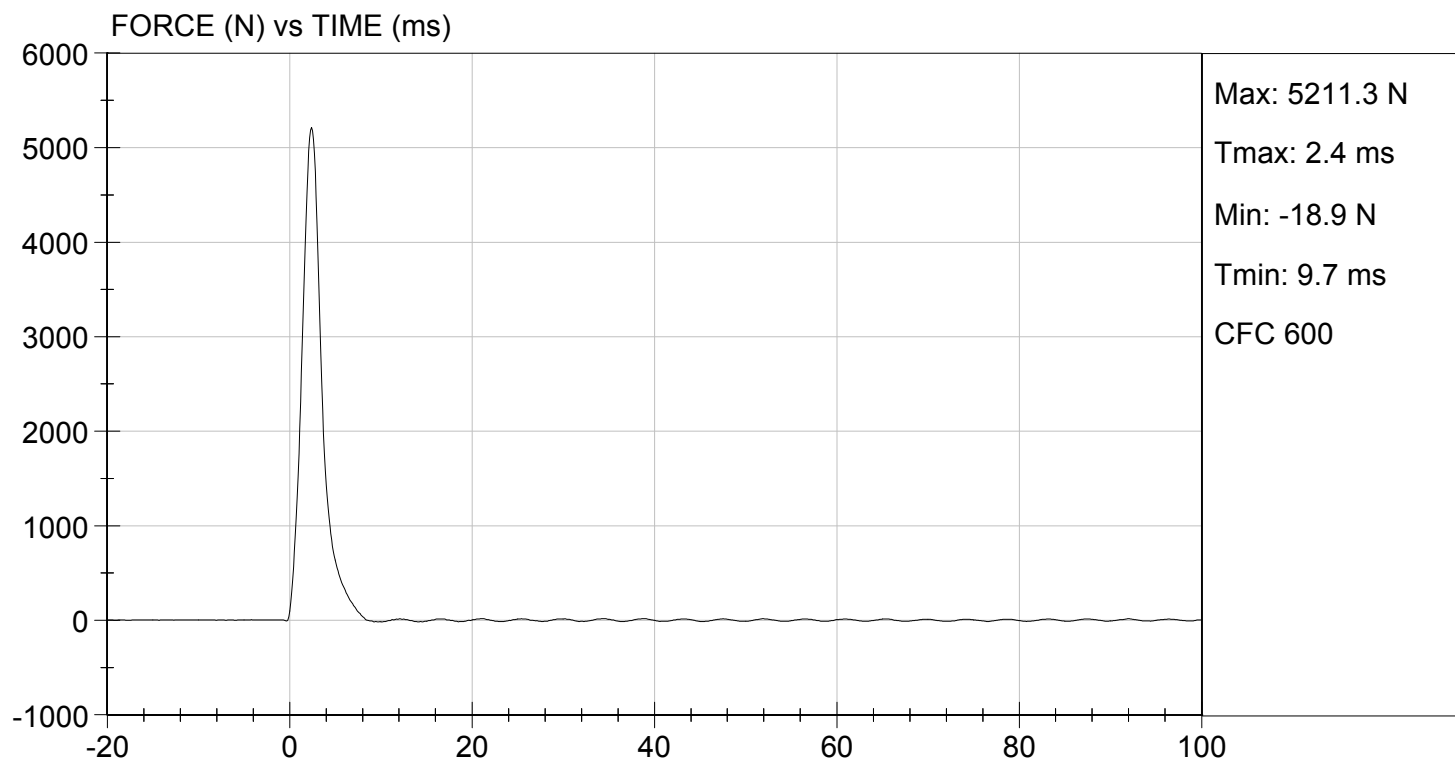
Test Date

Jessica Hall
Approved By



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

TEST DATE: 10/05/2015
TEST #: D153105



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

ATD Serial No: 351

Test I.D: D153106

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,309	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

10/05/2015

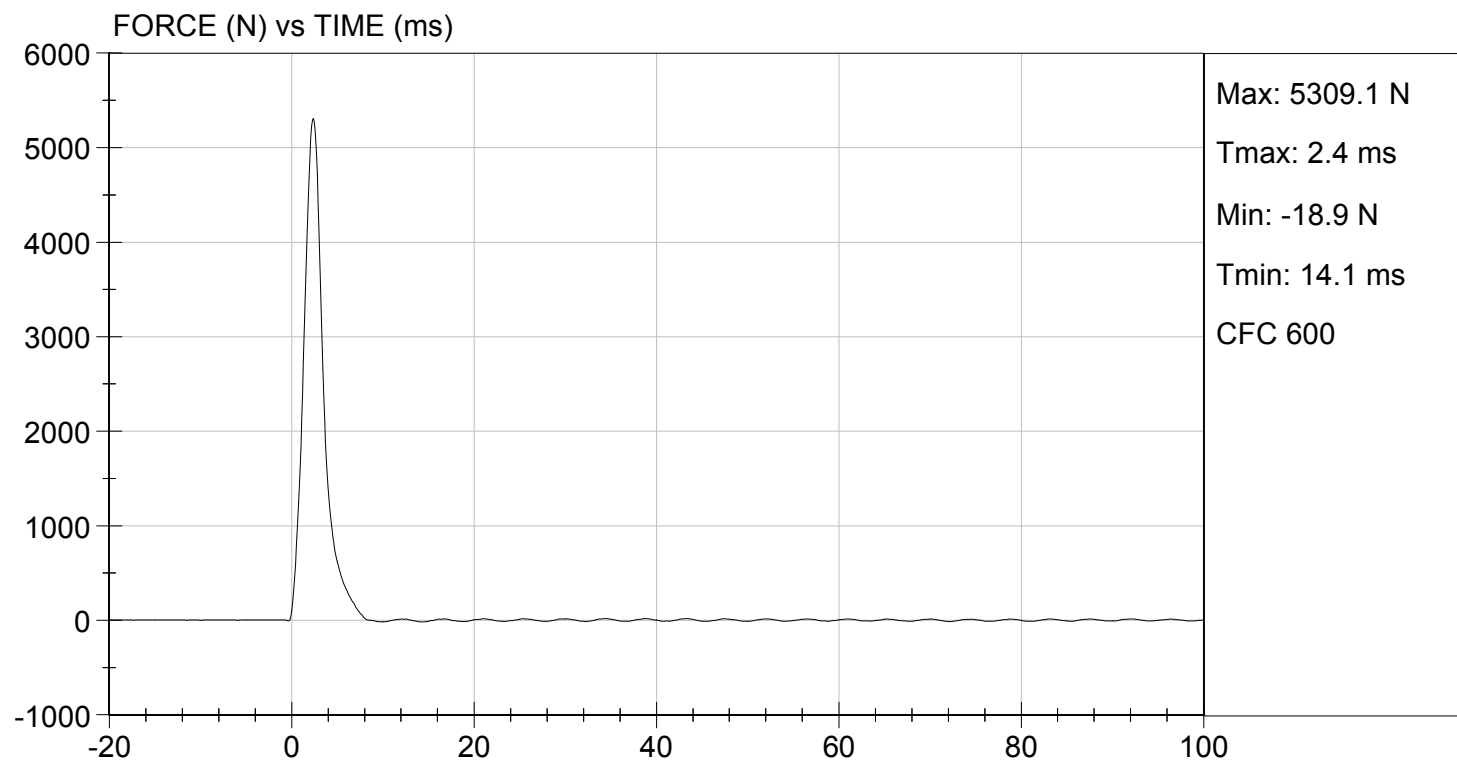
Test Date

Jessica Hall
Approved By



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

TEST DATE: 10/05/2015
TEST #: D153106



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

ATD Serial No: 351

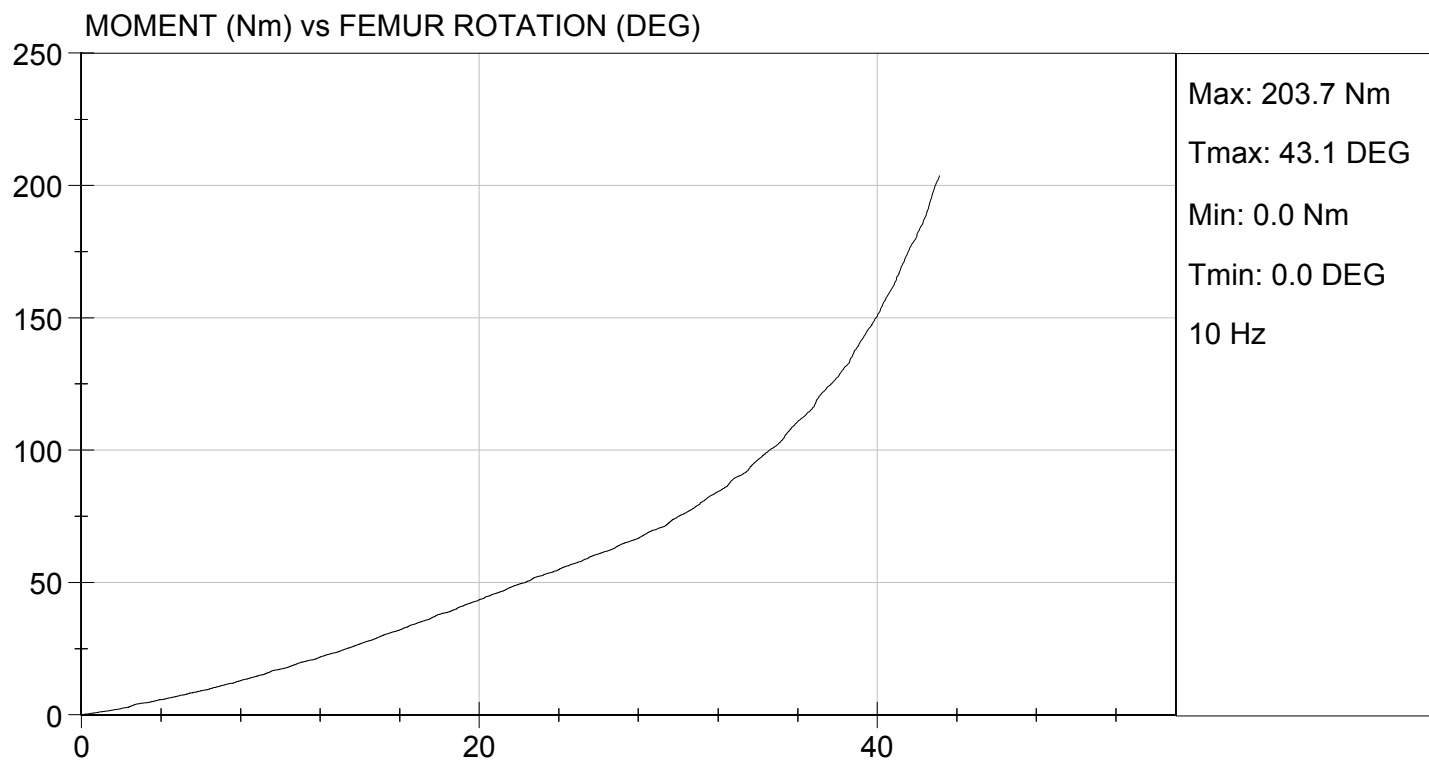
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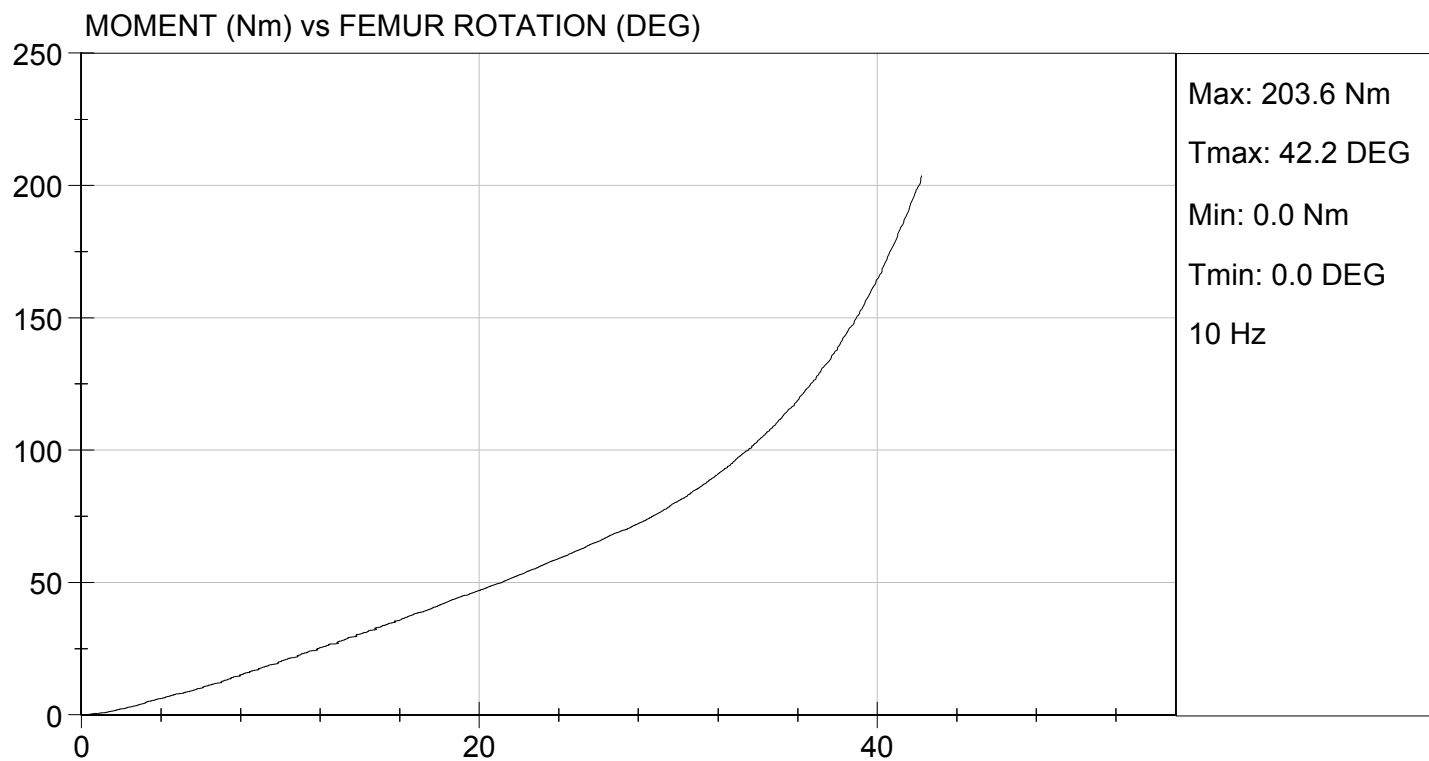
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.7	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	48	48	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.2	Pass
30 Degrees	Nm	94.9 Nm Max	75.0	80.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	43.1	42.2	Pass
Overall Test Results					Pass


Laboratory Technician

10/05/2015
Test Date


Approved By





Hybrid III, 5th External Measurements
SN: 138

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	785.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	456.8
C	H-POINT HEIGHT	Reference	81.3-86.3	84.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	146.2
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	78.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	127.5
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	249.6
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.0
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	280.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	201.9
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	526.7
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.3
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	398.0

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	430.5
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	184.6
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	221.0
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	472.6
S	HEAD BREADTH	The widest part of the head	137.1-147.3	141.9
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	184.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	307.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	360.5
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	85.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	546.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	875.1
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	785.4
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.4
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.1

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

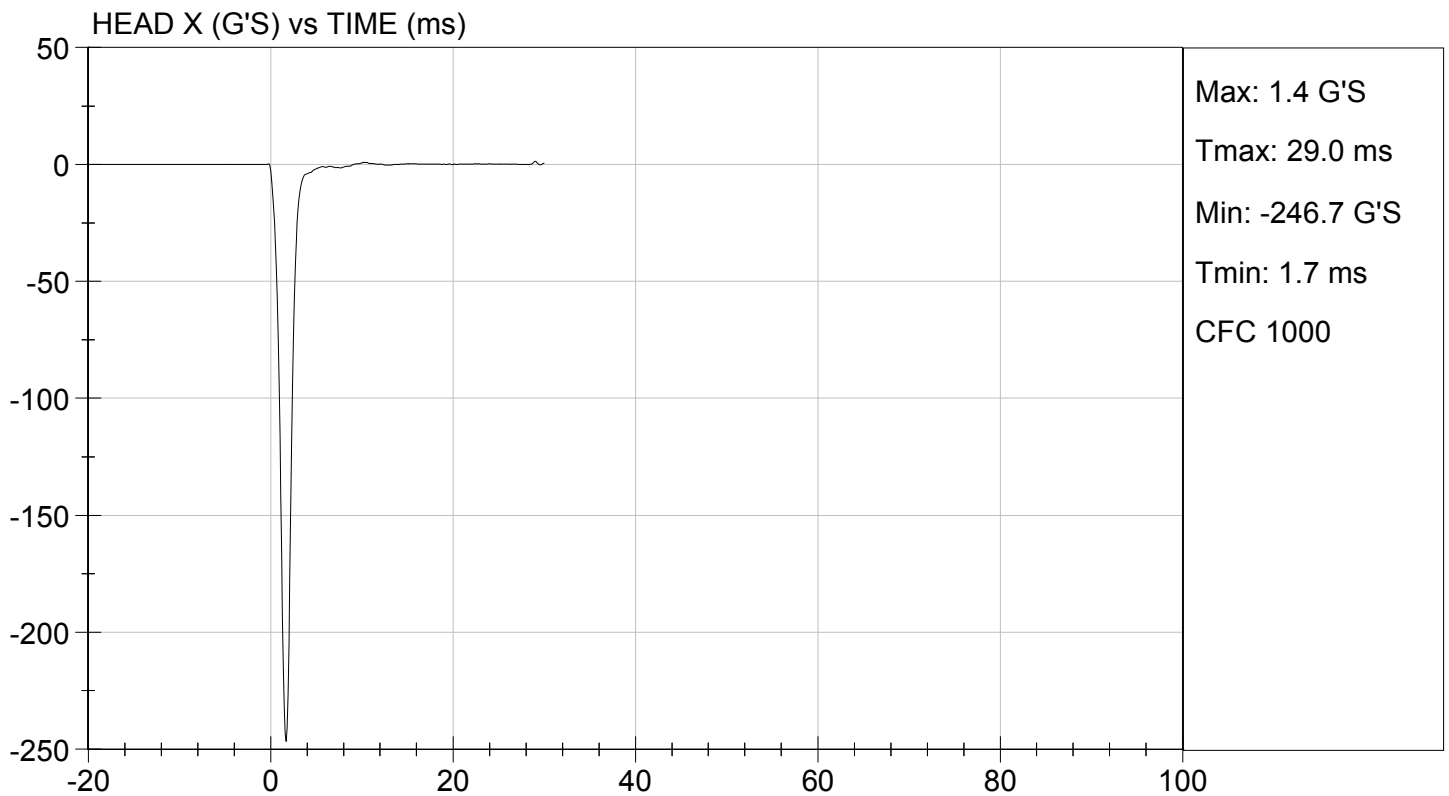
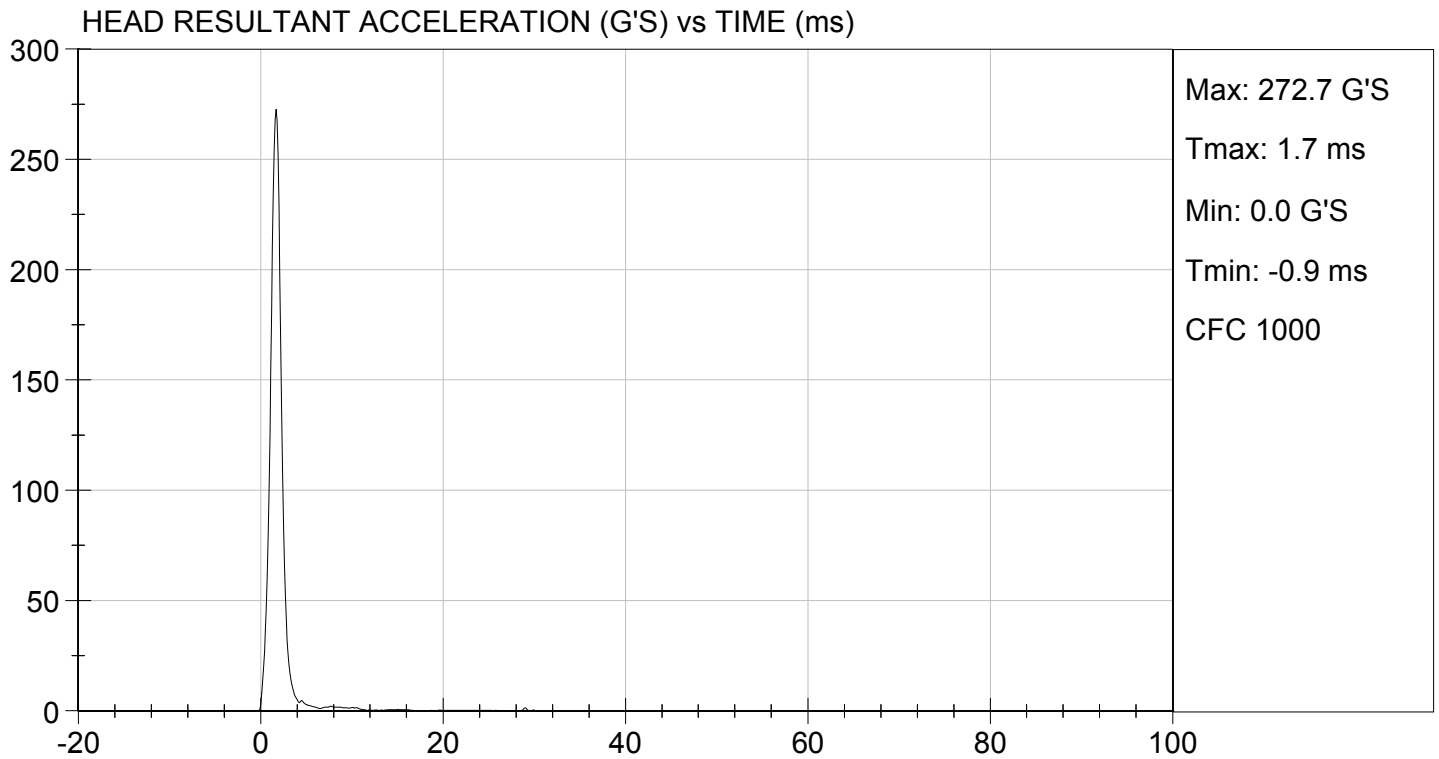
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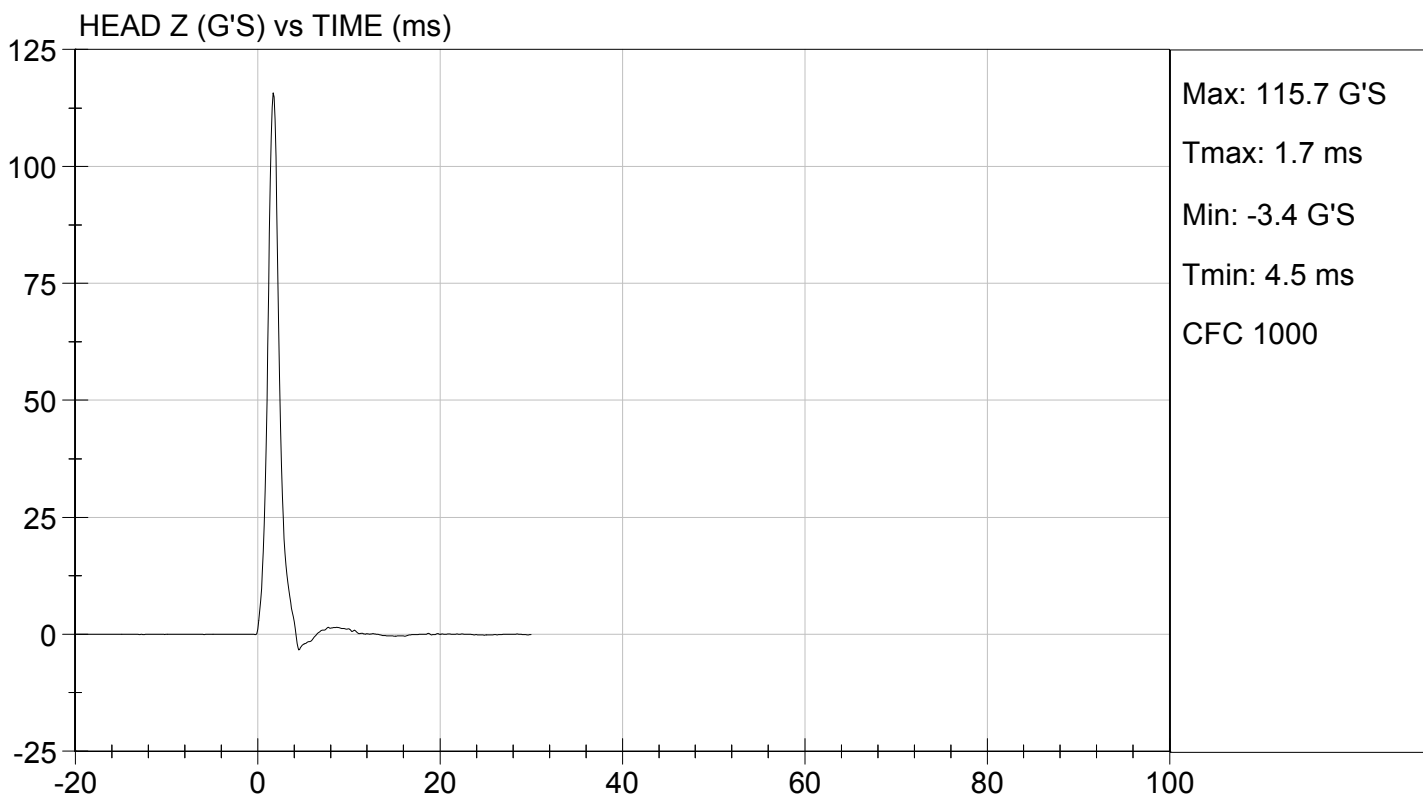
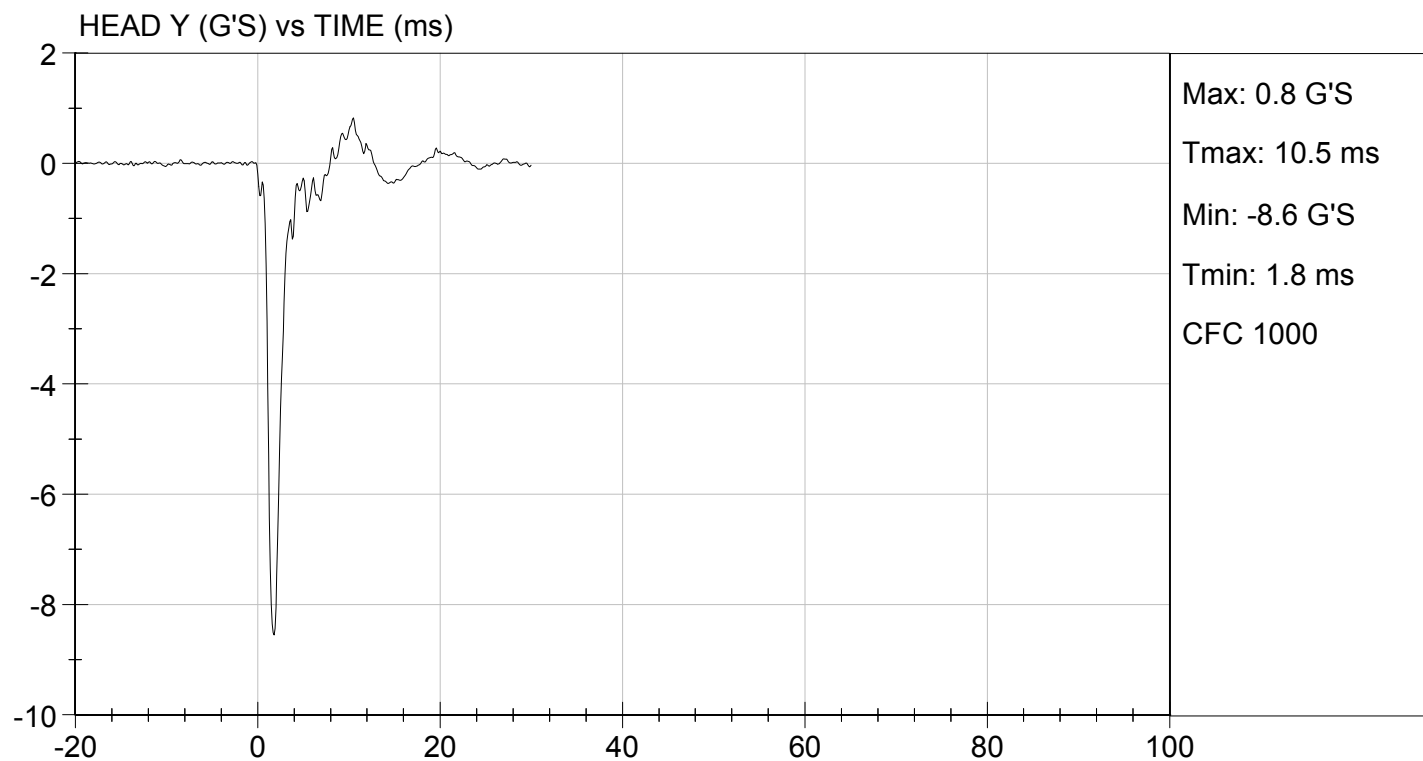
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Peak Resultant Acceleration	G's	250 to 300	273	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-8.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

09/28/2015
Test Date

Jessica Hall
Approved By





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D153012

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity		%	10 to 70	53	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.5	Pass
	20 ms	m/s	4.0 to 5.0	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.2	Pass
D Plane Rotation	Max	deg	77 to 91	82	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	77	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
Overall Results					Pass



Laboratory Technician

09/28/2015

Test Date

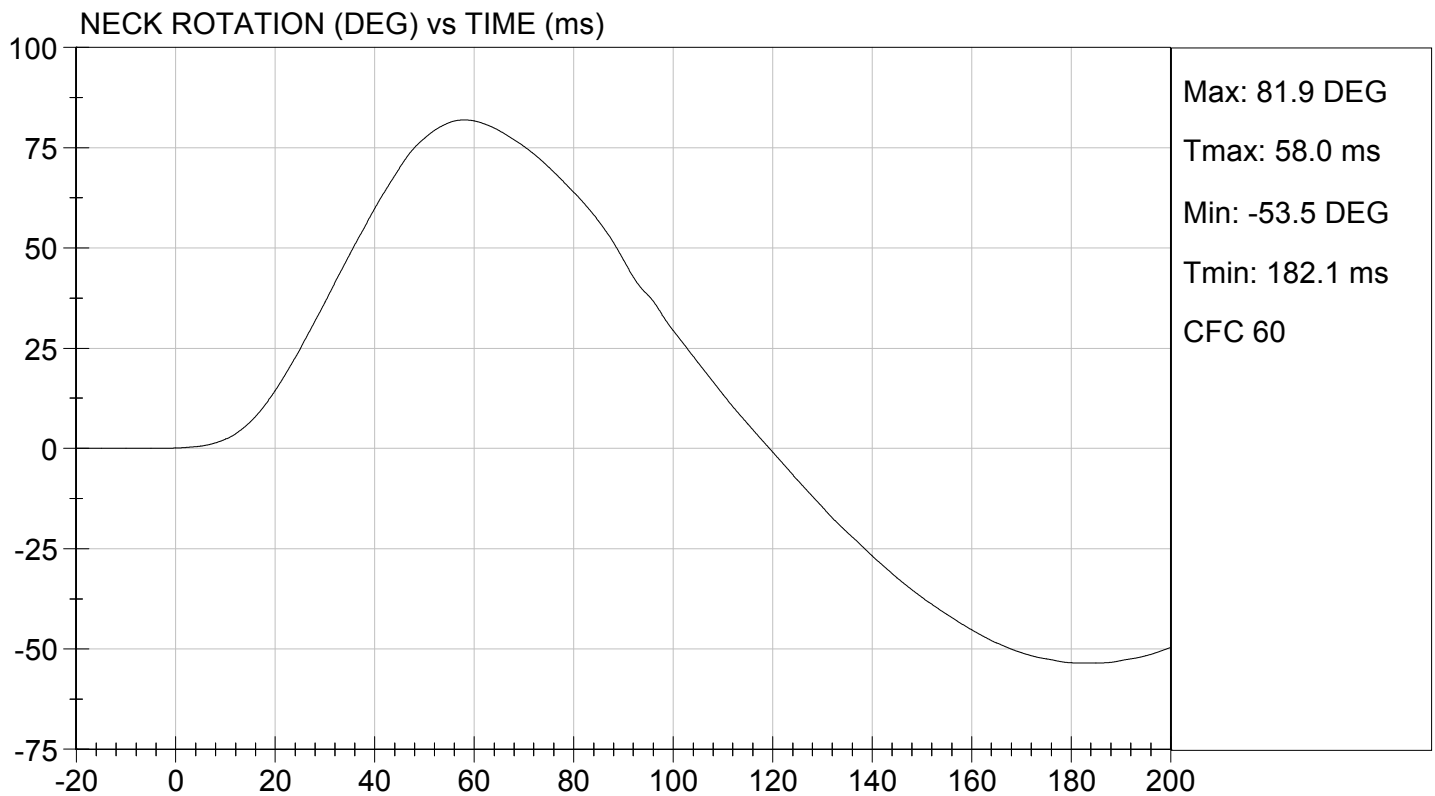
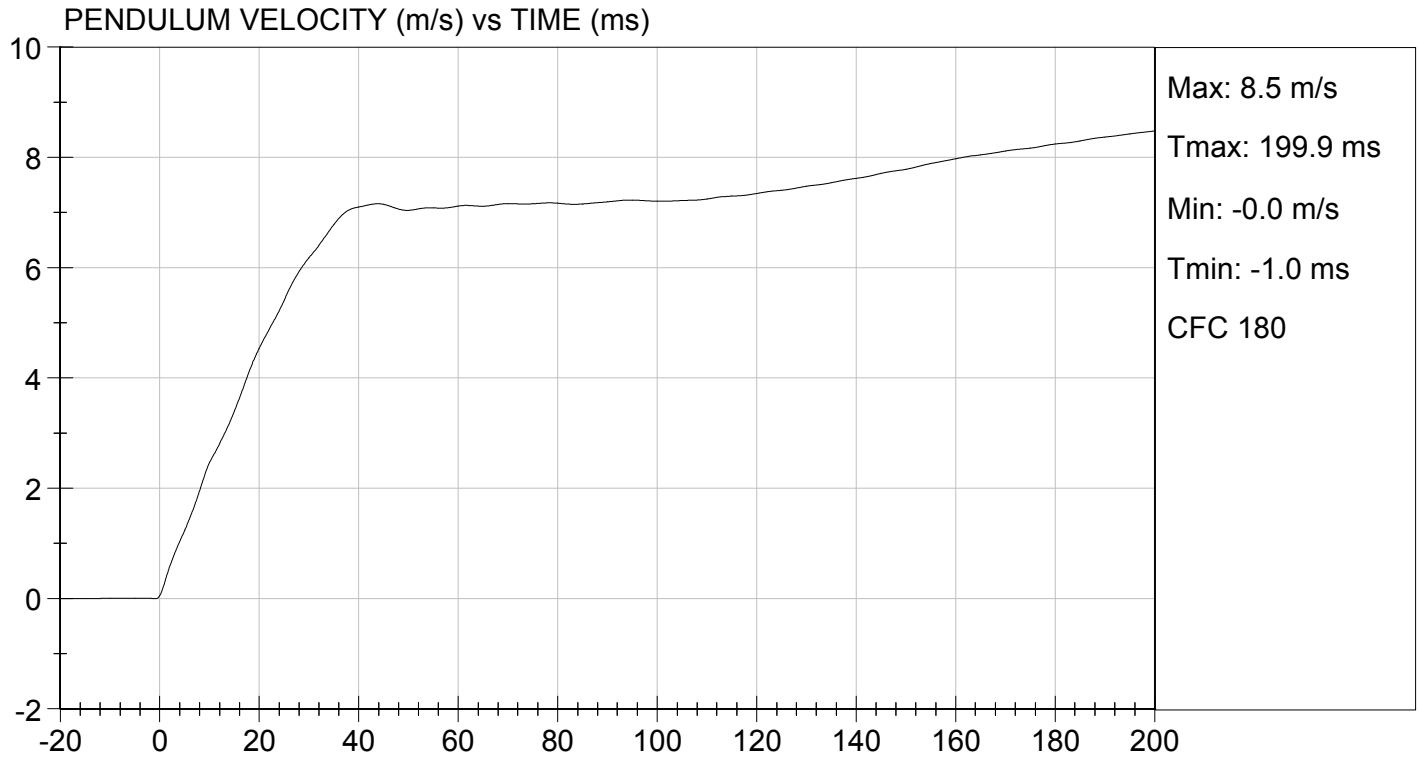


Approved By



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

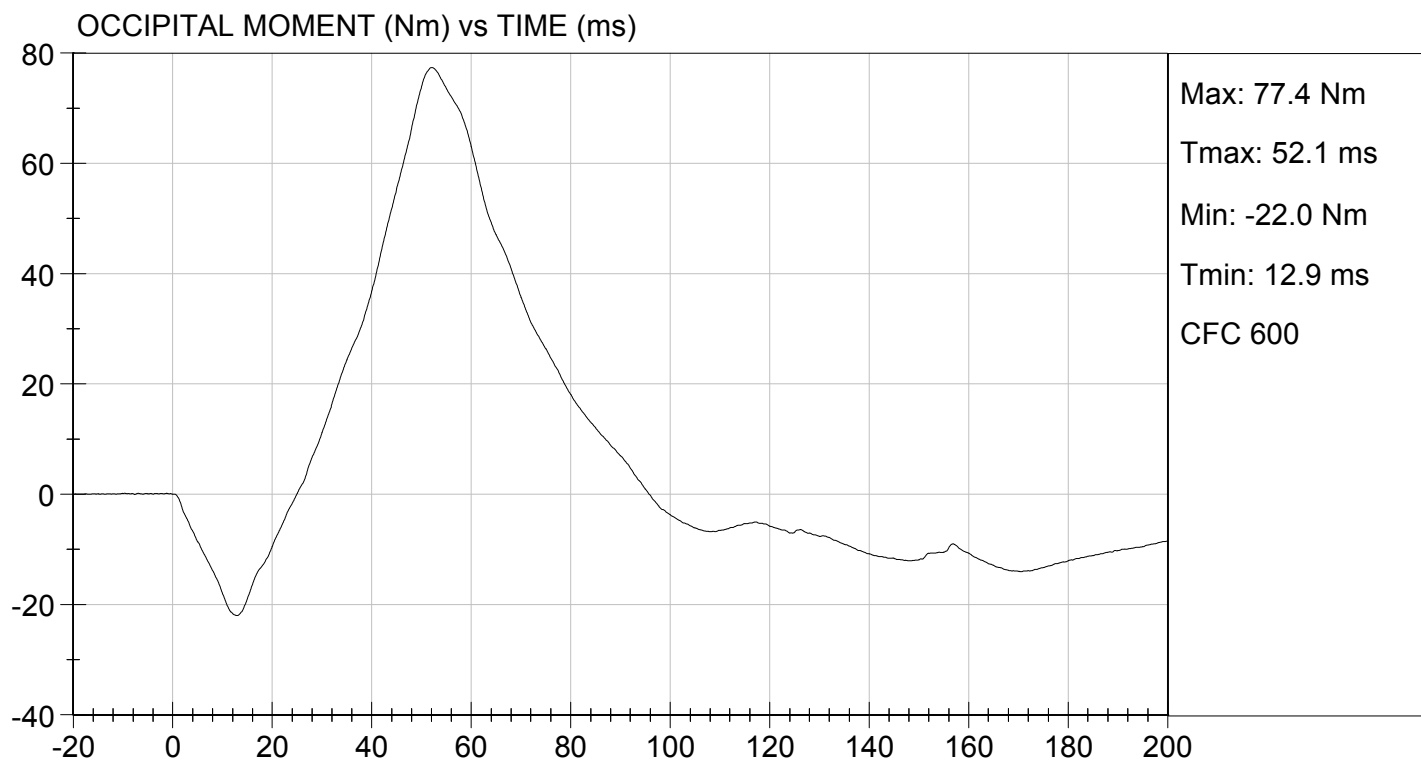
TEST DATE: 09/28/2015
TEST #: D153012





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

TEST DATE: 09/28/2015
TEST #: D153012



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D153013

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity		%	10 to 70	53	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.7	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	106	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-61	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	102	Pass
Overall Results					Pass

David Schoedel
Laboratory Technician

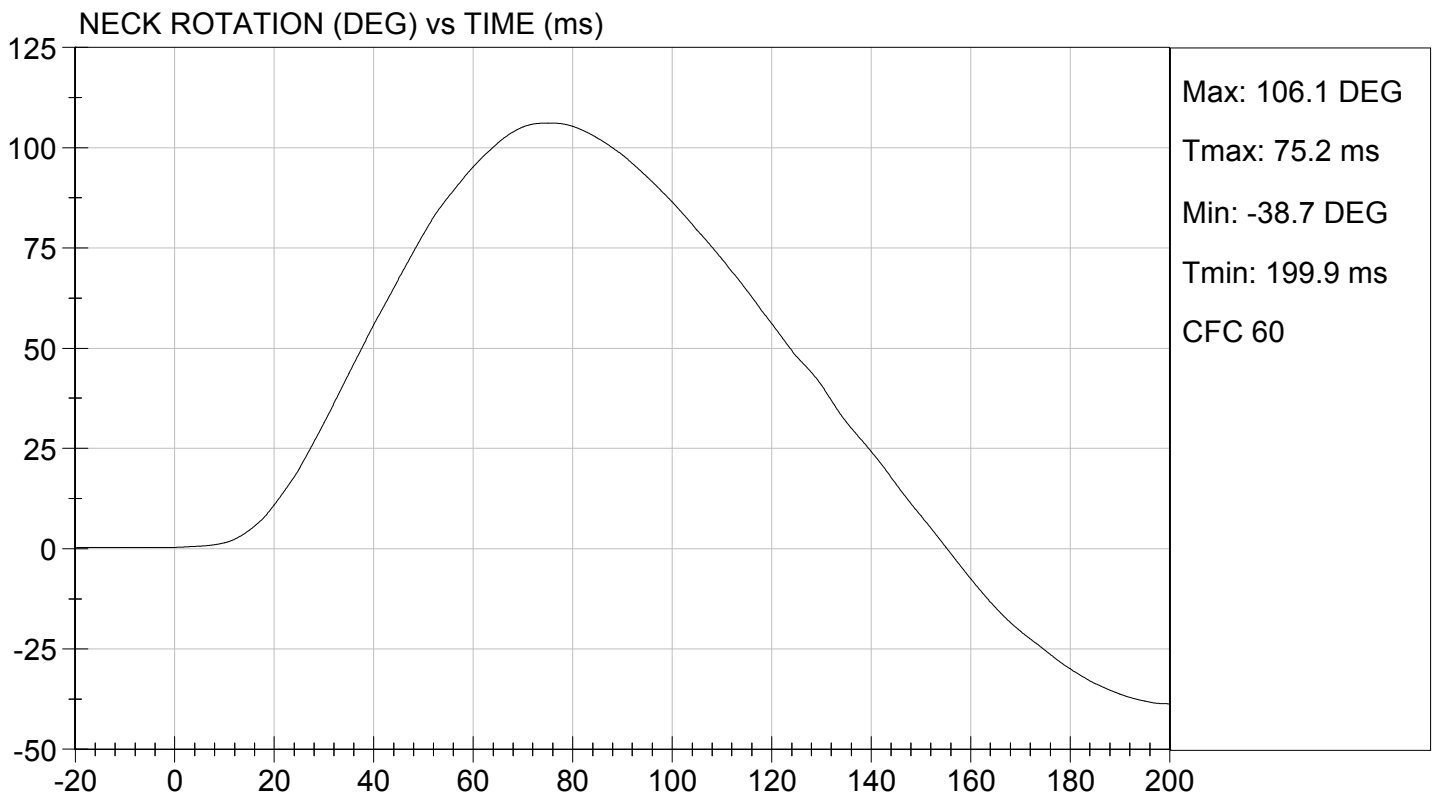
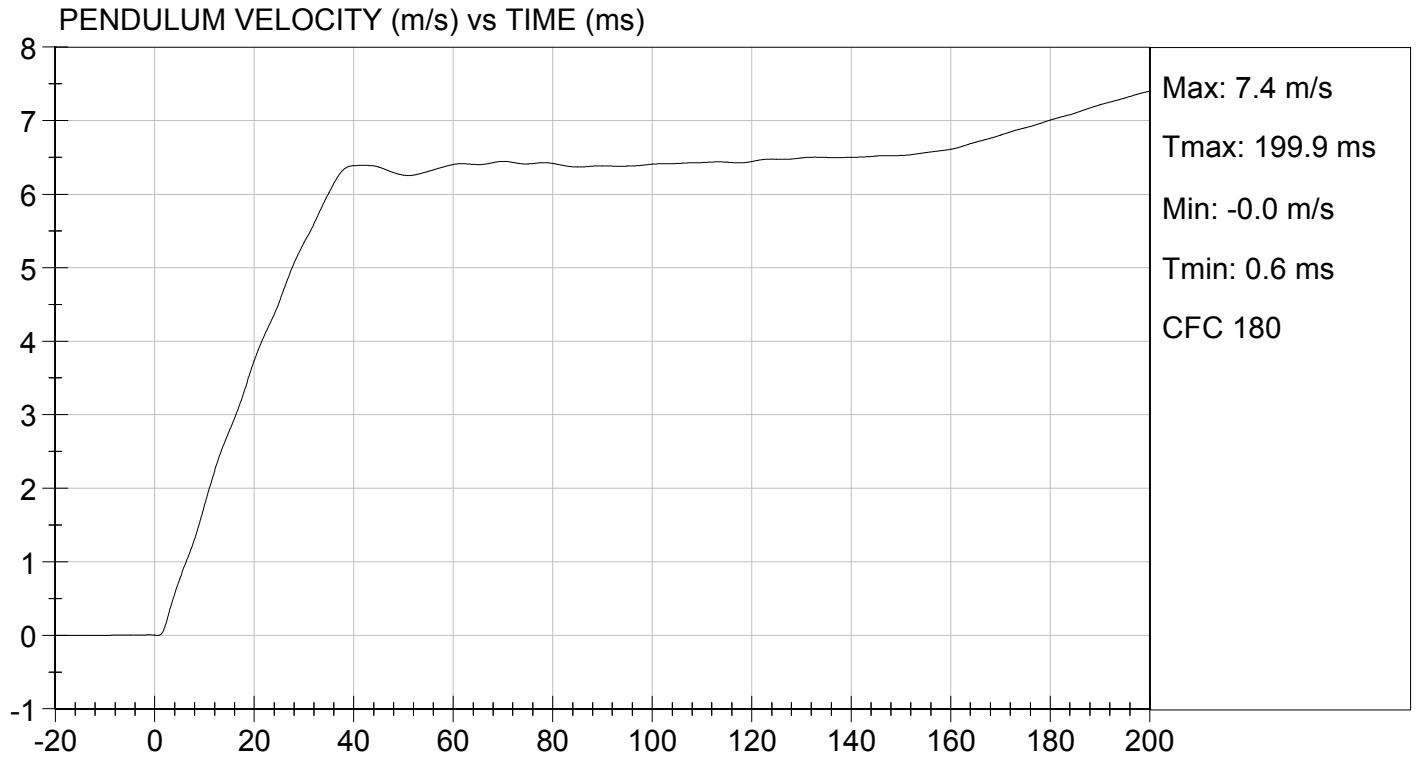
09/28/2015
Test Date

Jessica Hall
Approved By



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

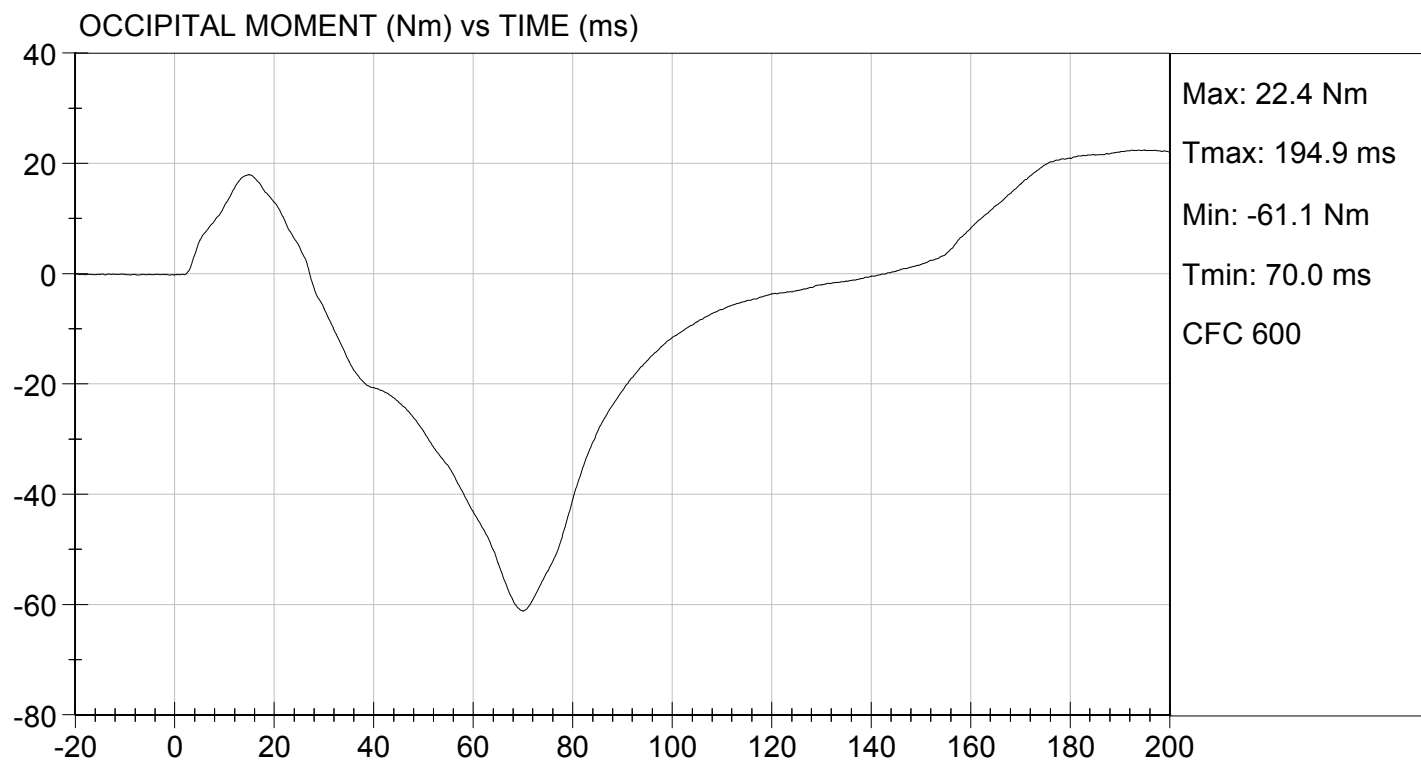
TEST DATE: 09/28/2015
TEST #: D153013





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

TEST DATE: 09/28/2015
TEST #: D153013



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D153014

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	50	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	54	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4219	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4211	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

09/28/2015

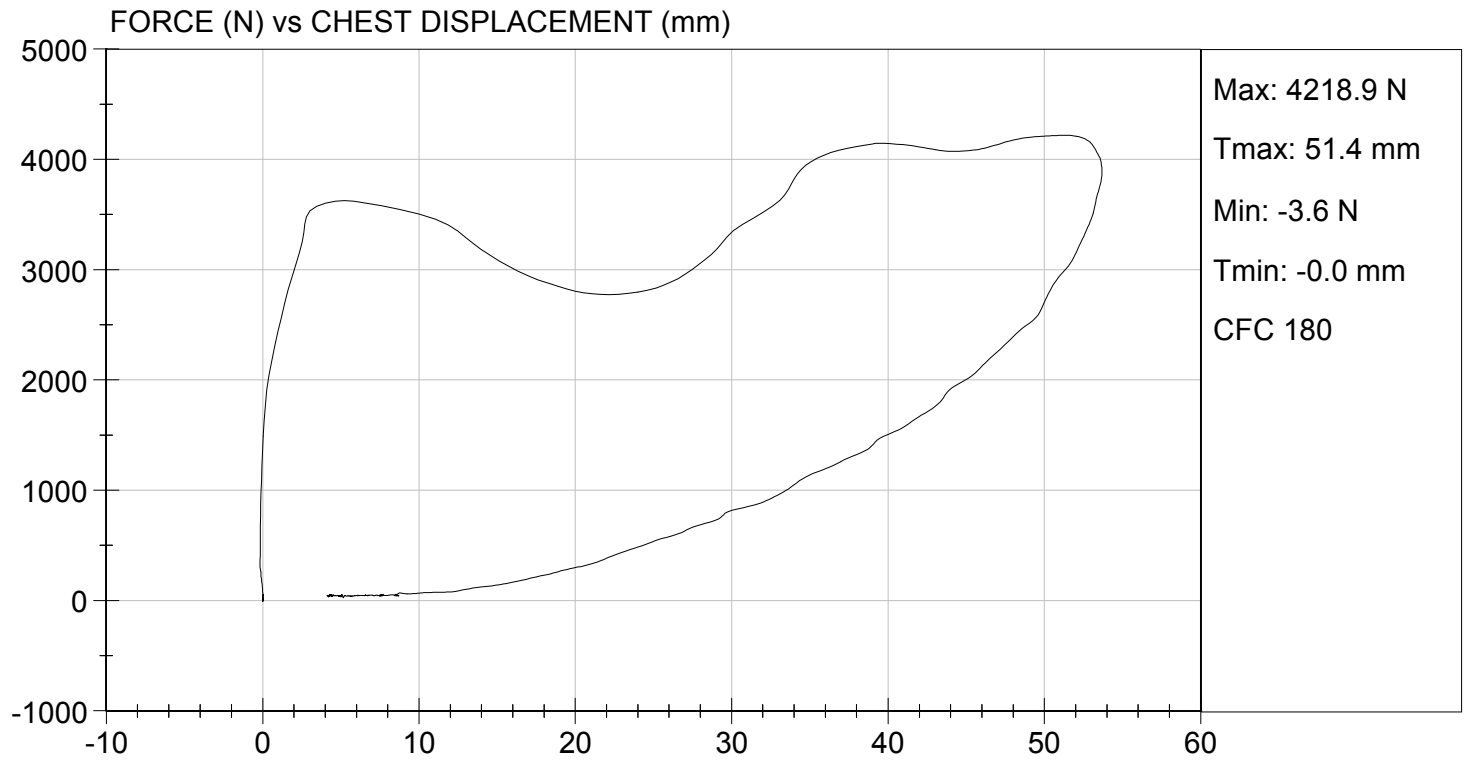
Test Date

Jessica Hall
Approved By



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

TEST DATE: 09/28/2015
TEST #: D153014



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D153015

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	53	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3678	Pass
Overall Test Results				Pass


Laboratory Technician

09/28/2015

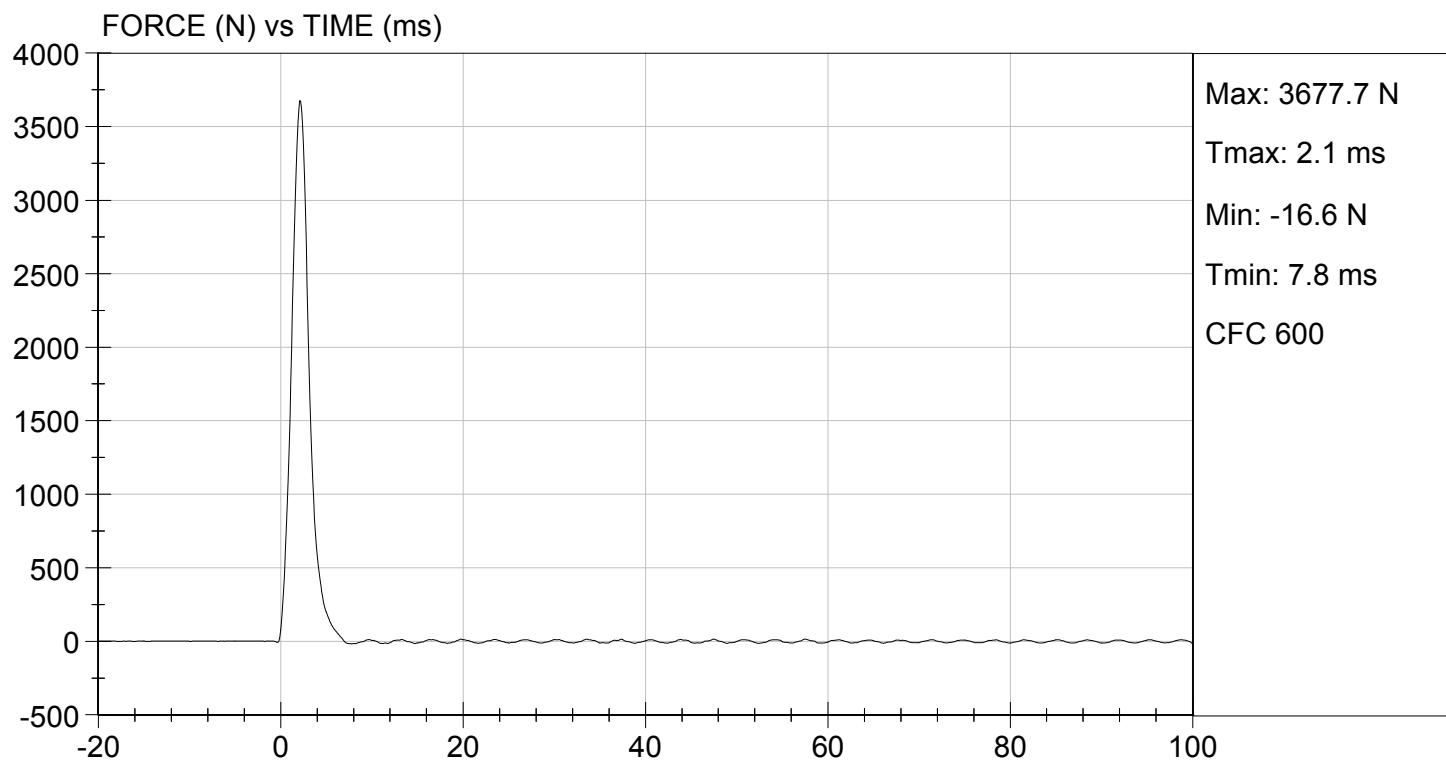
Test Date


Approved By



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

TEST DATE: 09/28/2015
TEST #: D153015



MGA RESEARCH CORPORATION

**LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE**

ATD Serial No: 138

Test I.D: D153016

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	53	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	3450 to 4060	3513	Pass
Overall Test Results				Pass


Laboratory Technician

09/28/2015

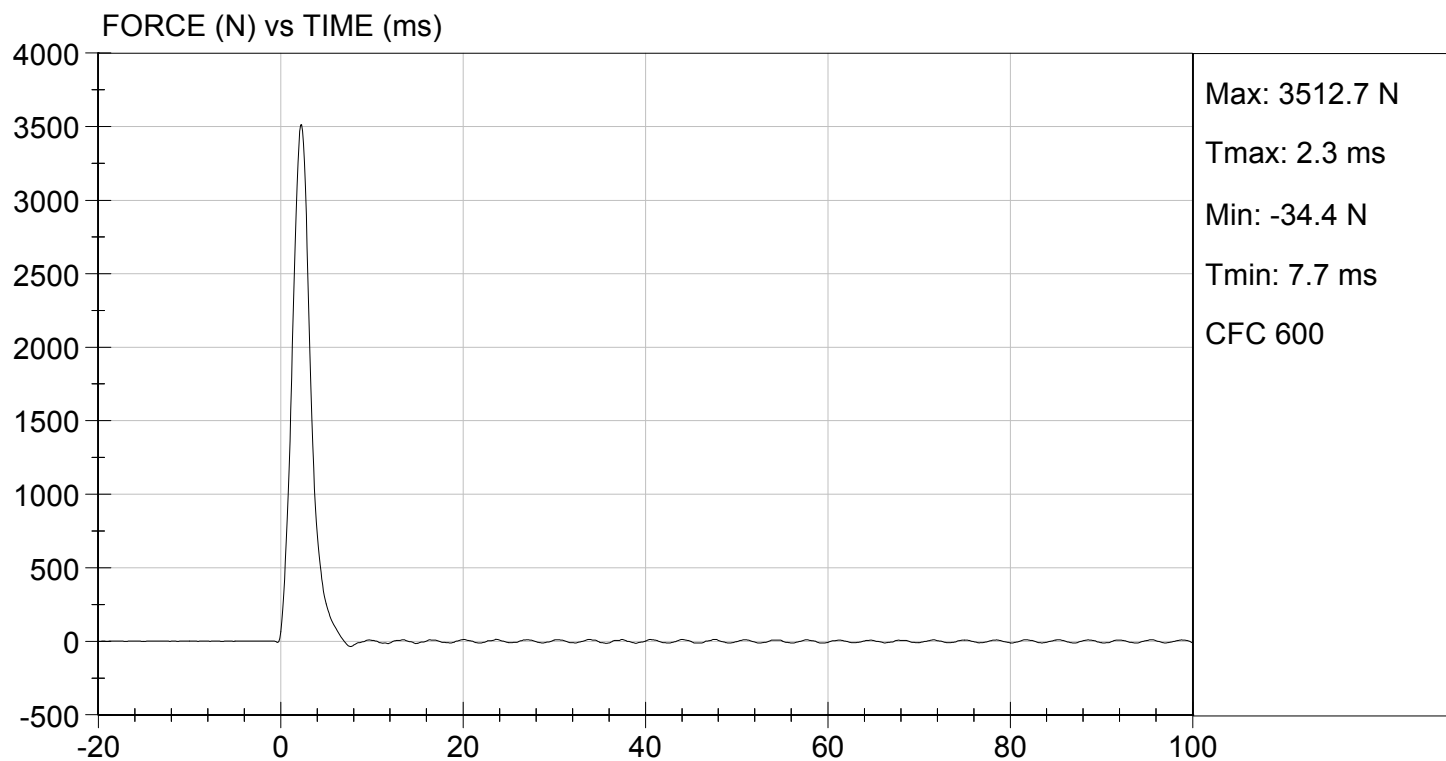
Test Date


Approved By



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

TEST DATE: 09/28/2015
TEST #: D153016



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D153017

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	3	Pass
Force at 45 deg	N	320 to 390	383	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
Overall Result				Pass

David Schoedel
Laboratory Technician

09/28/2015

Test Date

Jessica Hall
Approved By

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

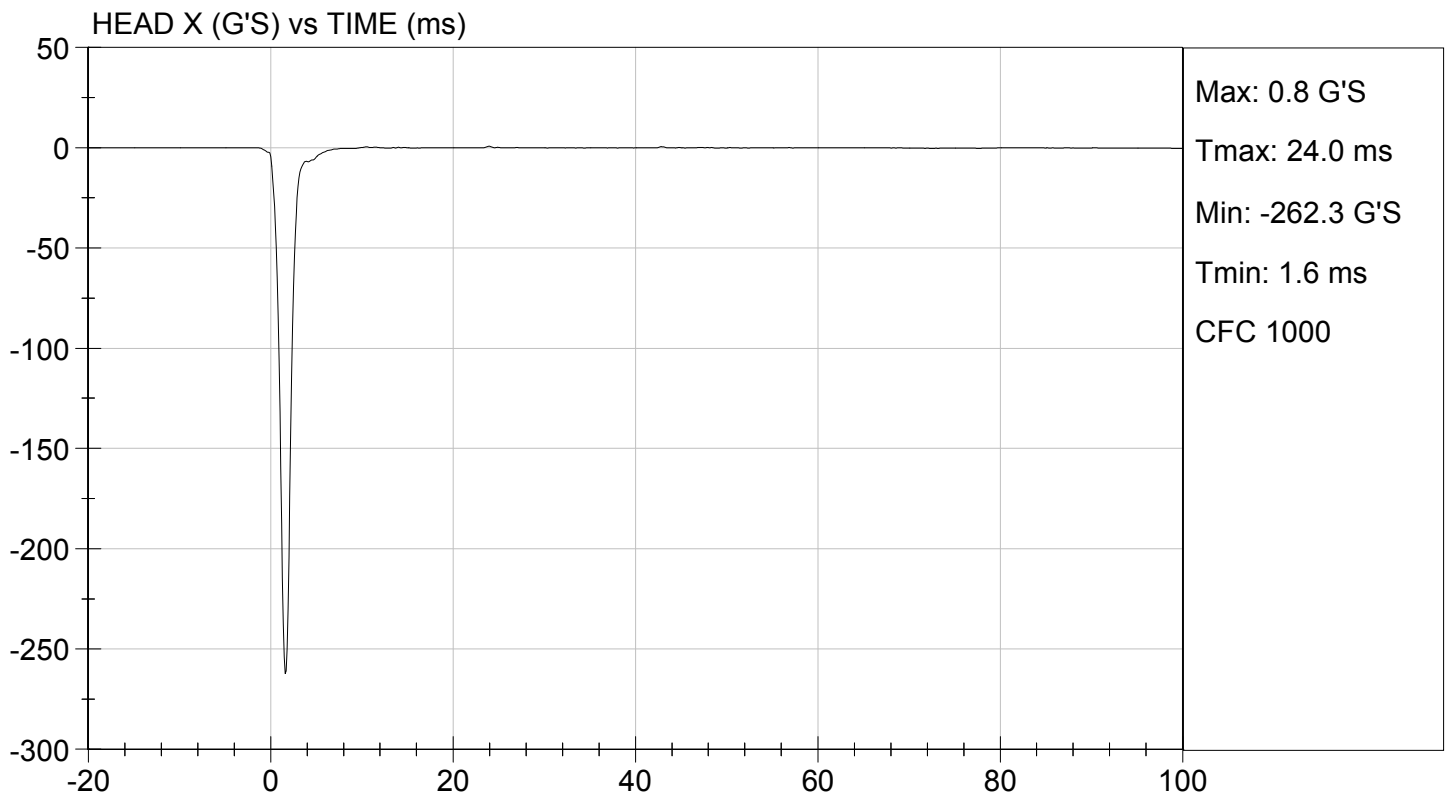
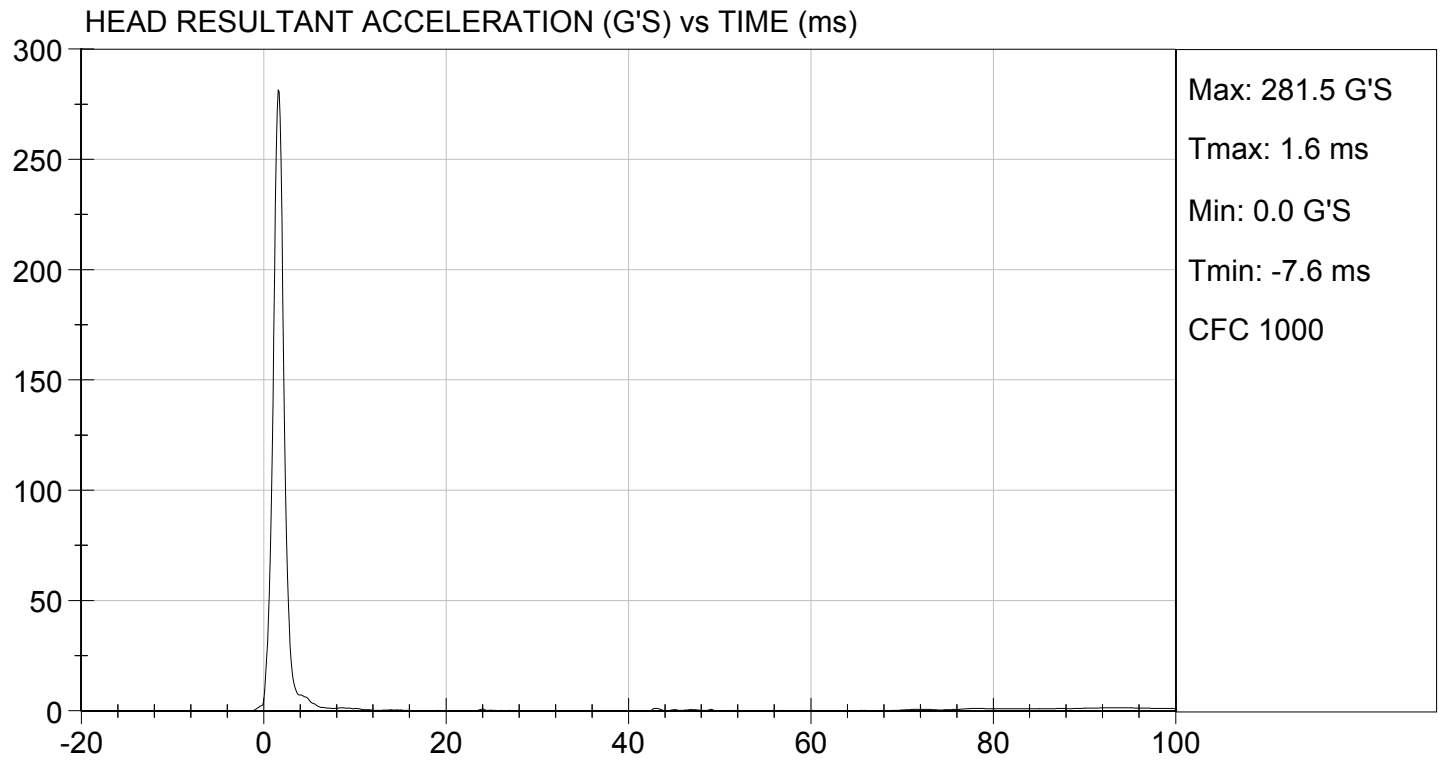
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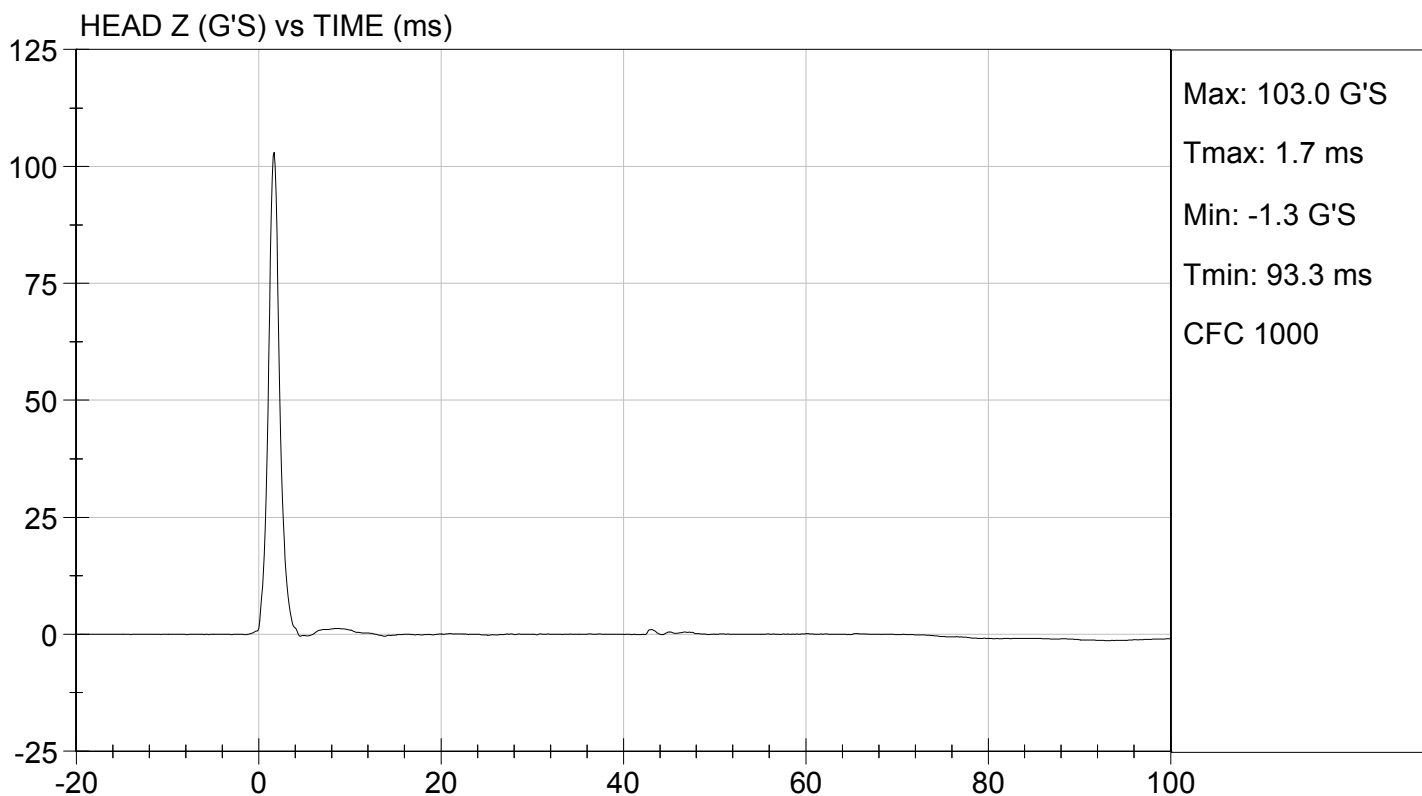
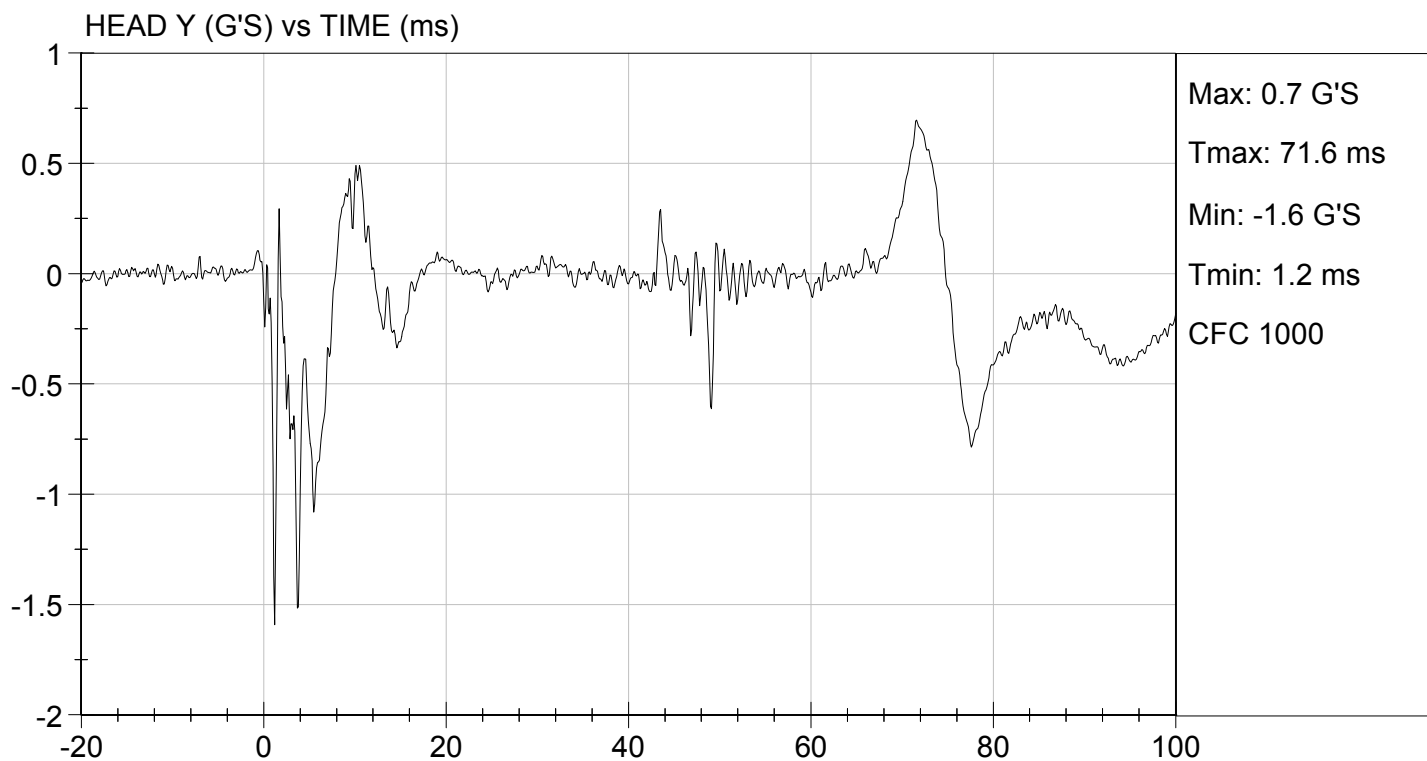
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Peak Resultant Acceleration	G's	250 to 300	282	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-1.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

10/05/2015
Test Date

Approved By _____





MGA RESEARCH CORPORATION

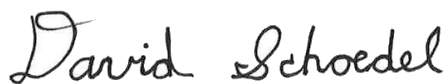
NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D153112

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.5	Pass
	20 ms	m/s	4.0 to 5.0	4.7	Pass
	30 ms	m/s	5.8 to 7.0	6.4	Pass
D Plane Rotation	Max	deg	77 to 91	83	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	75	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	84	Pass
Overall Results				Pass	



Laboratory Technician

10/05/2015

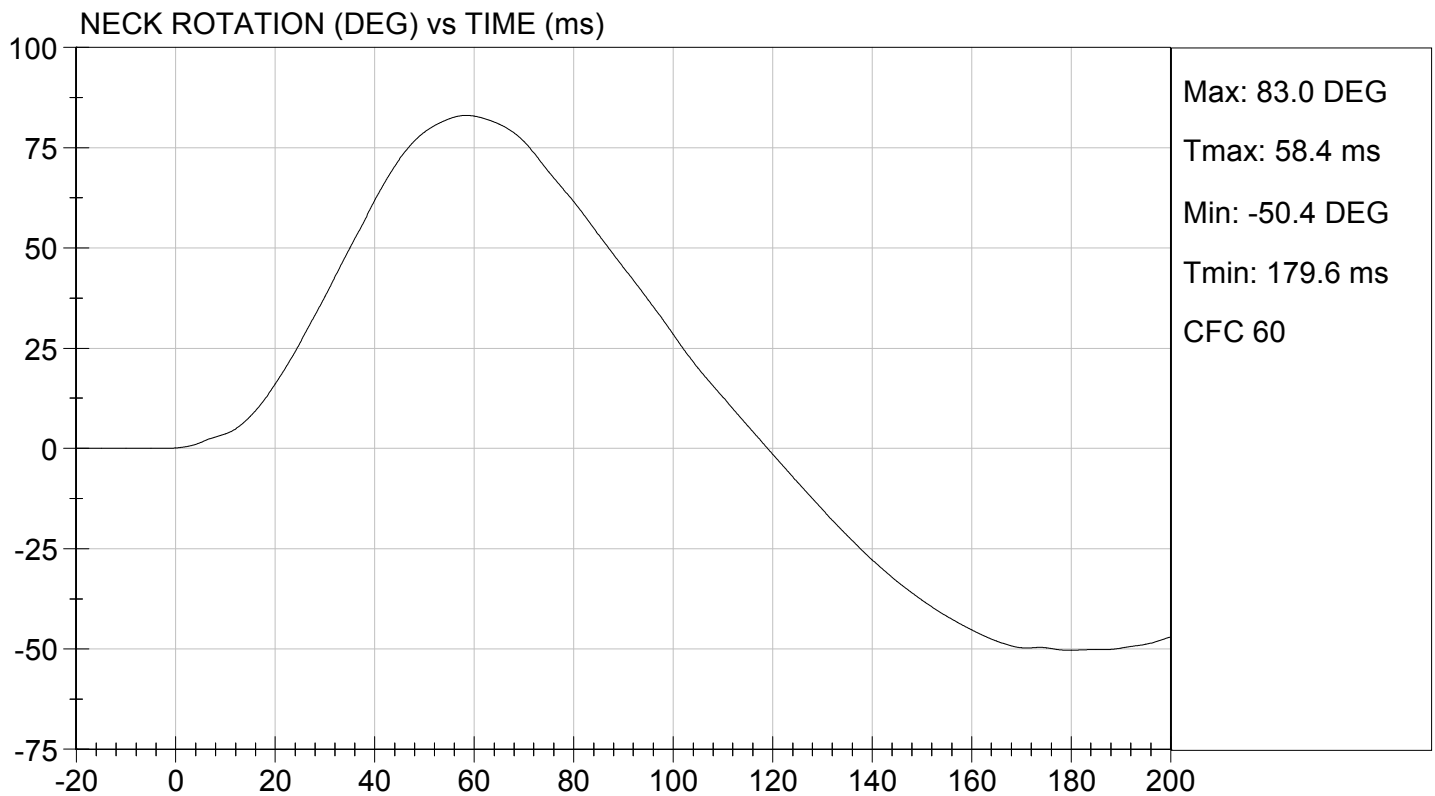
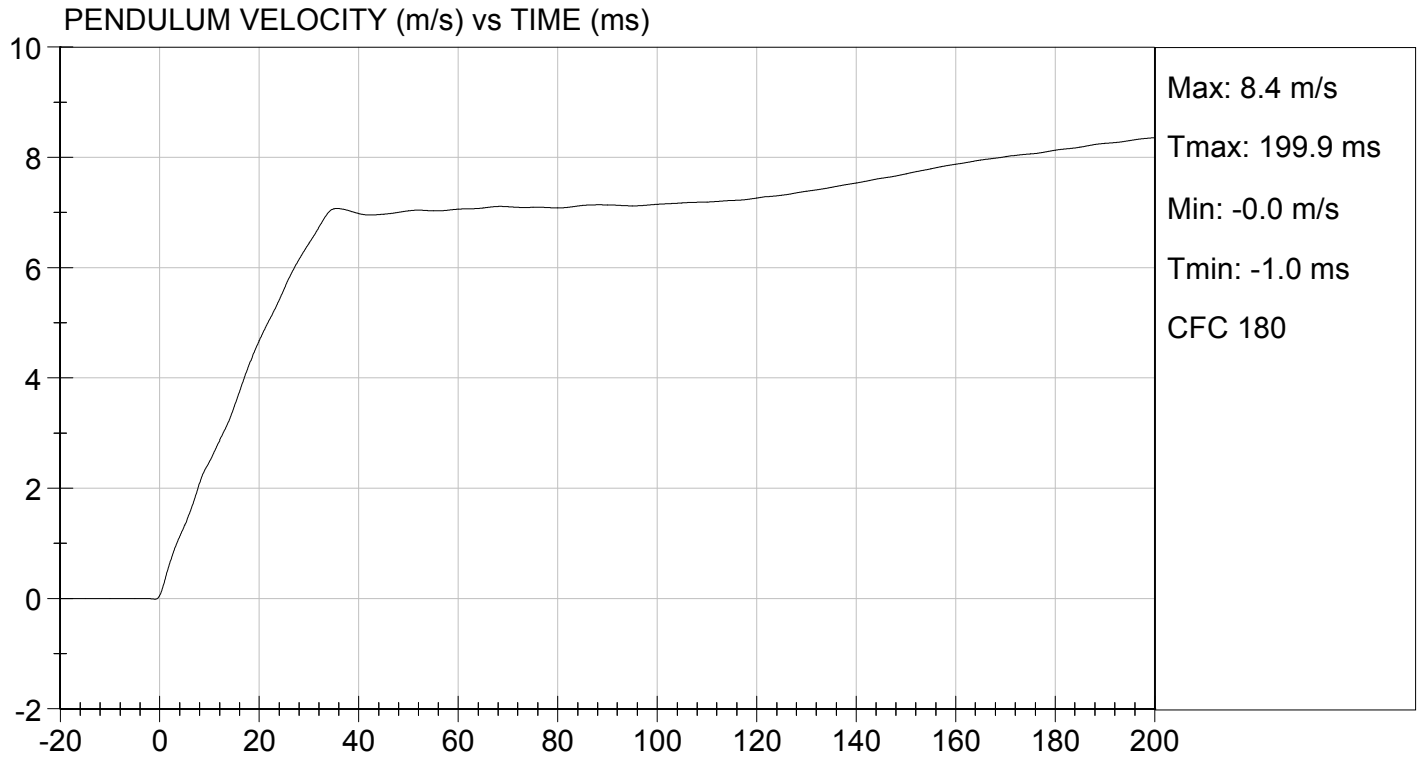
Test Date


Approved By



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

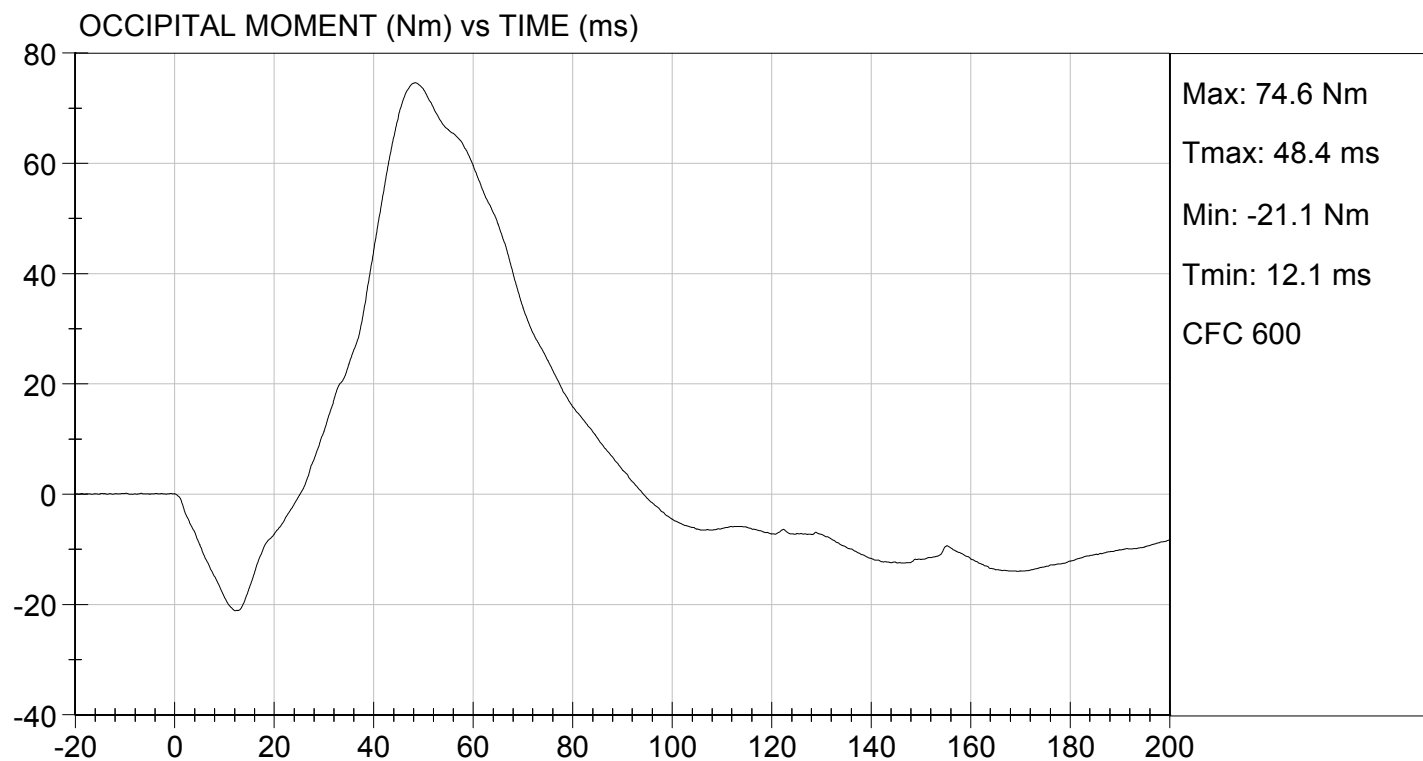
TEST DATE: 10/05/2015
TEST #: D153112





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

TEST DATE: 10/05/2015
TEST #: D153112



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D153113

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.7	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	106	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-59	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	103	Pass
Overall Results					Pass

David Schoedel
Laboratory Technician

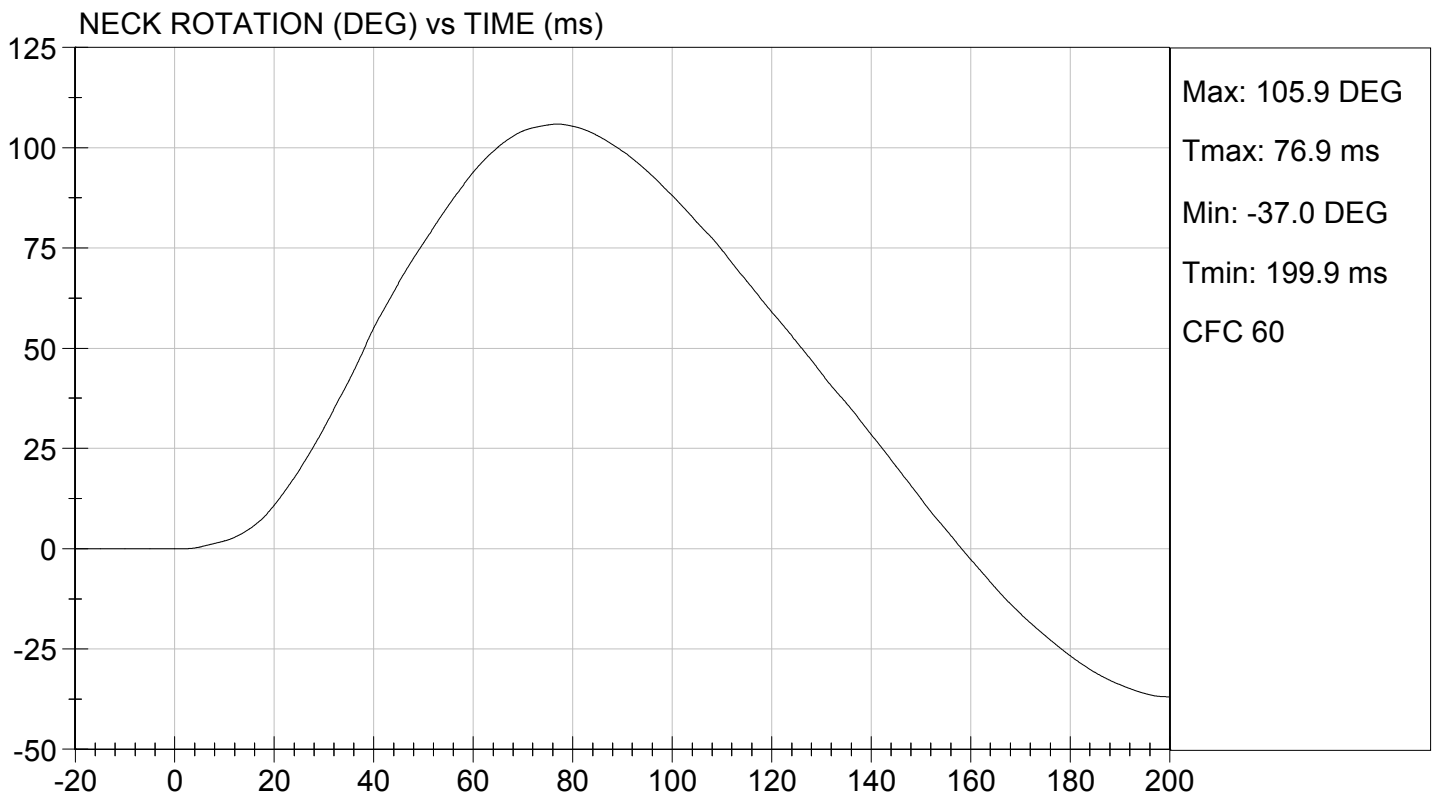
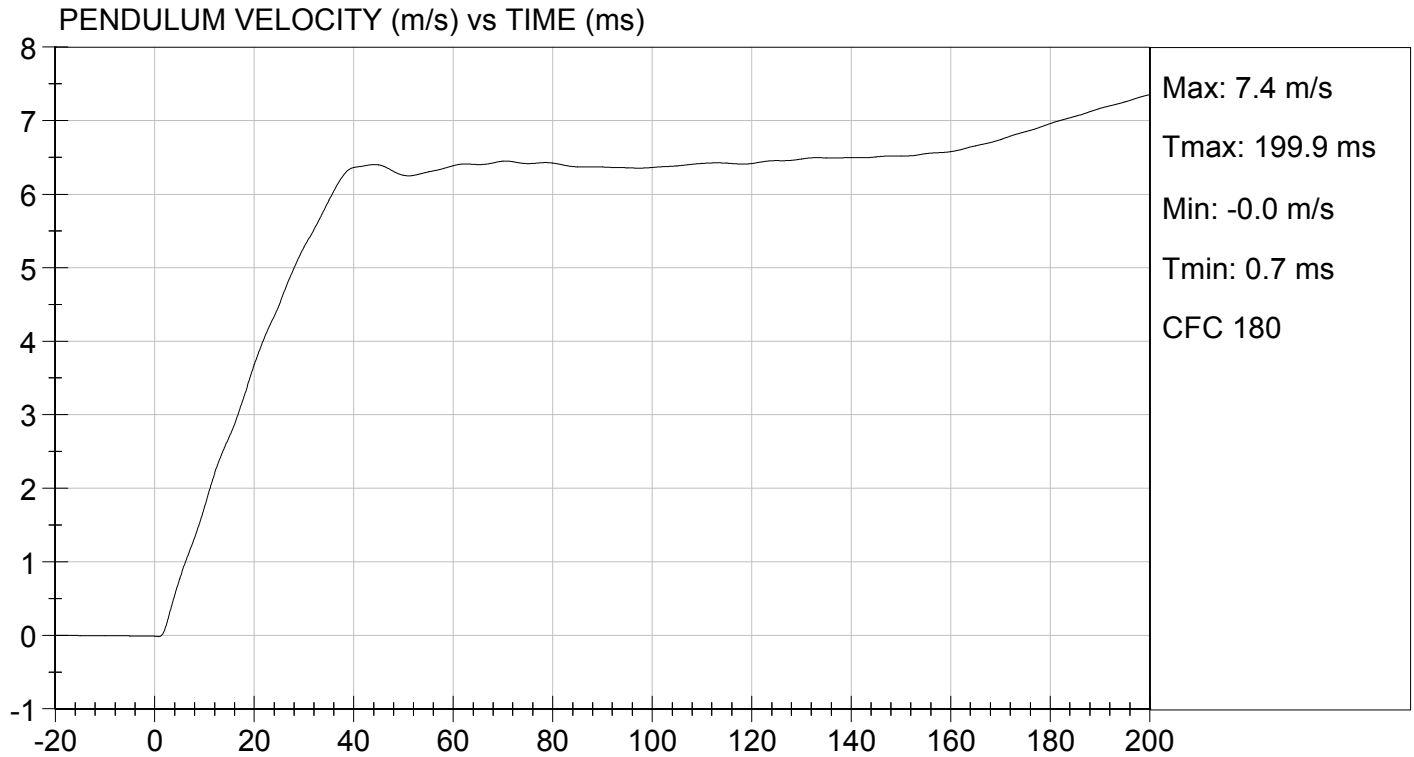
10/05/2015
Test Date

Jessica Hall
Approved By



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

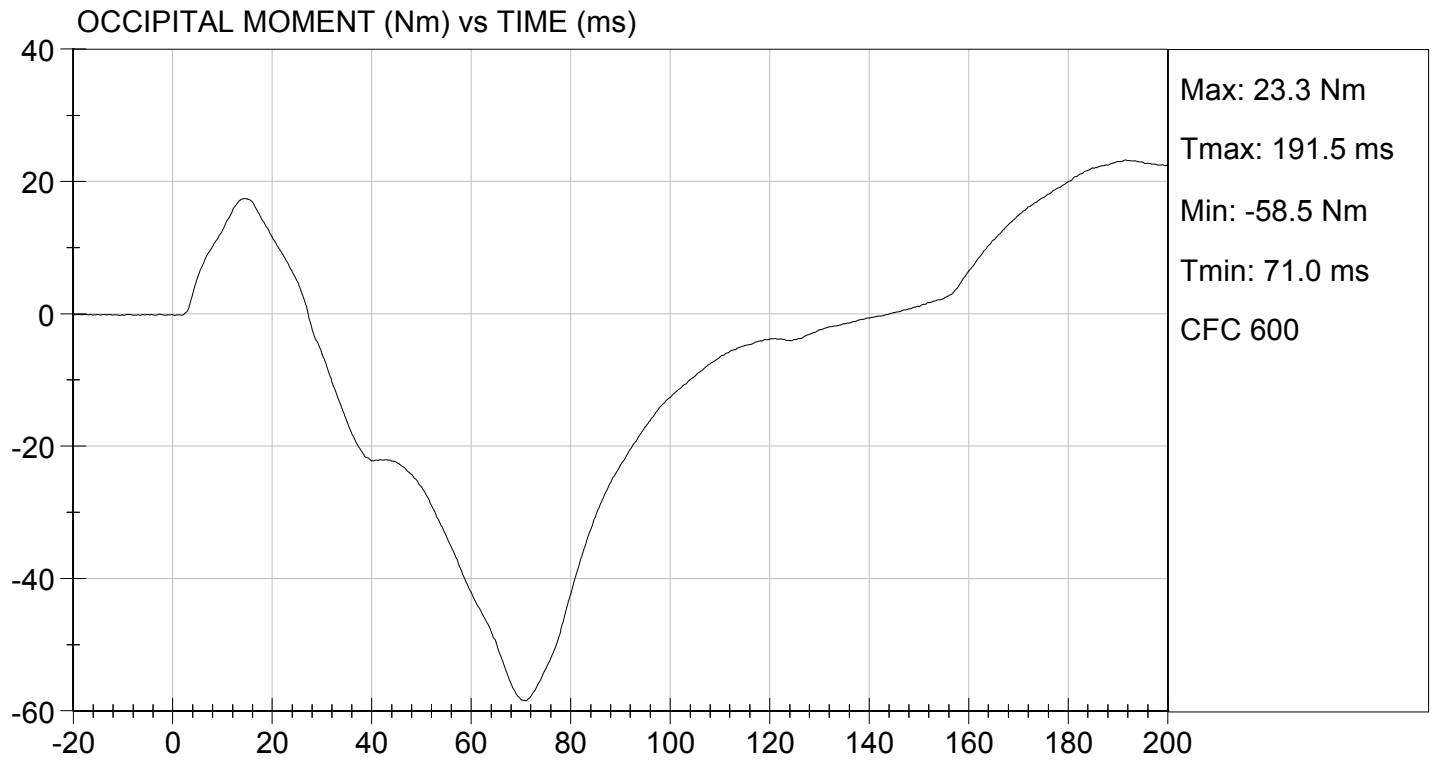
TEST DATE: 10/05/2015
TEST #: D153113





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

TEST DATE: 10/05/2015
TEST #: D153113



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D153114

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Relative Humidity	%	10 to 70	47	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4239	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4234	Pass
Overall Test Results				Pass

David Schoedel

Laboratory Technician

10/05/2015

Test Date

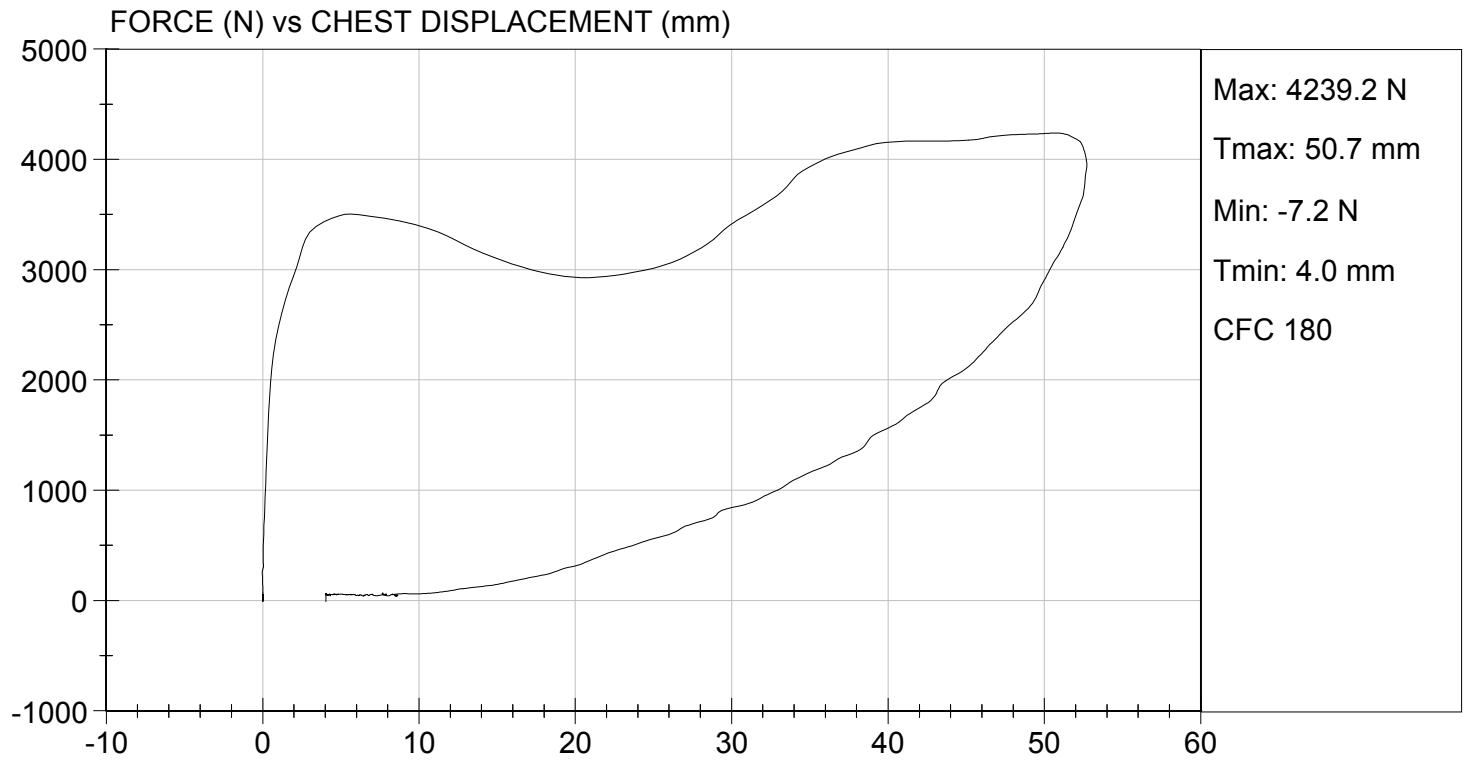
Jessica Hall

Approved By



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

TEST DATE: 10/05/2015
TEST #: D153114



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D153115

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3724	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

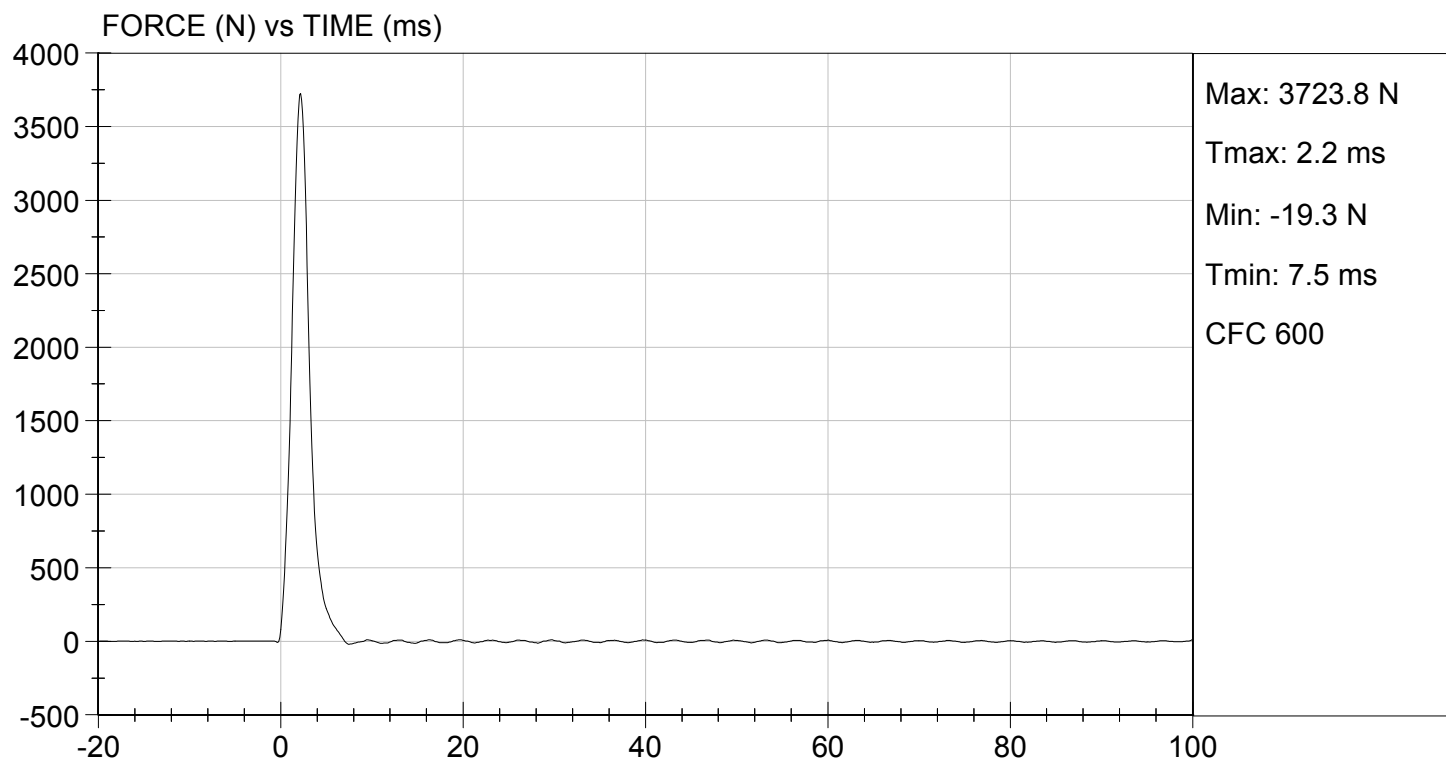
10/05/2015
Test Date

Jessica Hall
Approved By



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

TEST DATE: 10/05/2015
TEST #: D153115



MGA RESEARCH CORPORATION

**LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE**

ATD Serial No: 138

Test I.D: D153116

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	N	3450 to 4060	3544	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

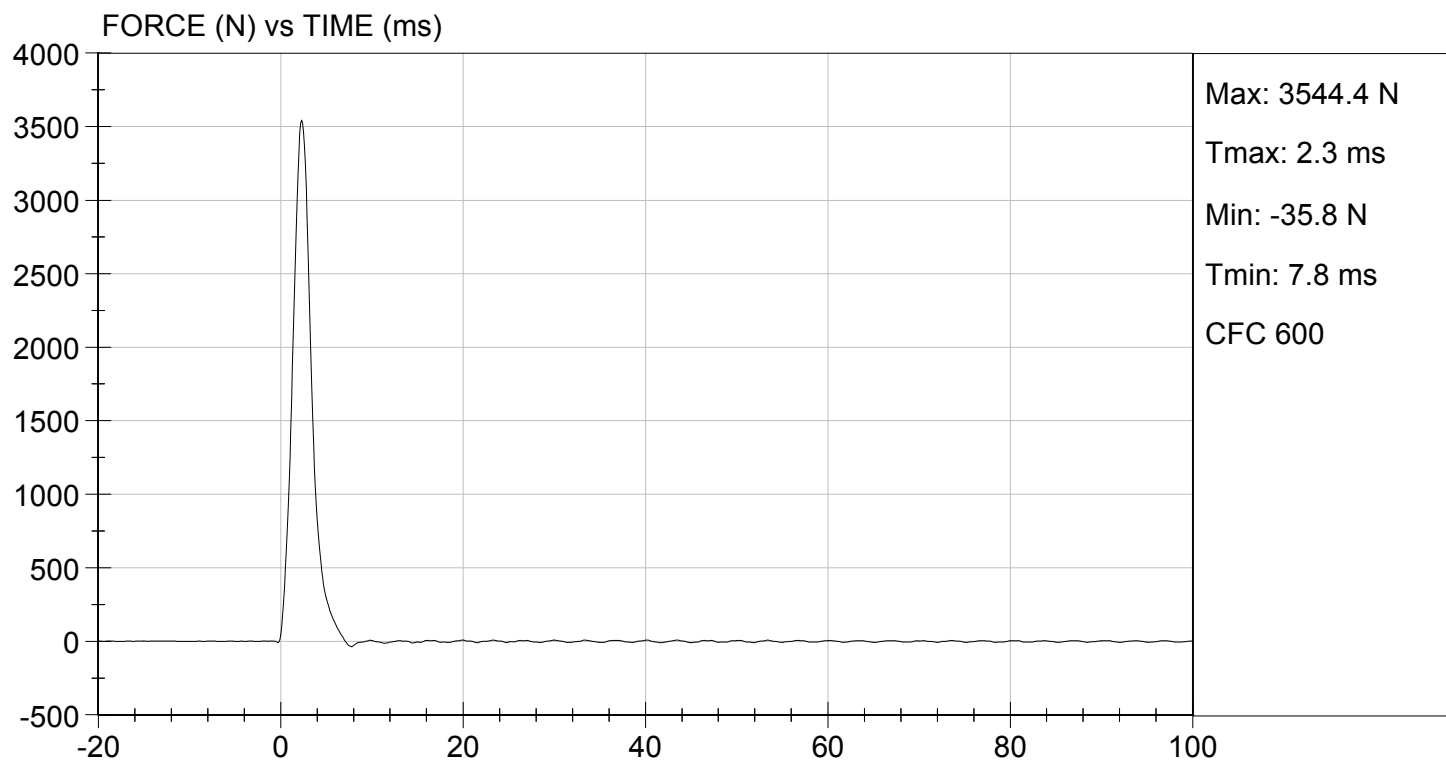
10/05/2015
Test Date

Jessica Hall
Approved By



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

TEST DATE: 10/05/2015
TEST #: D153116



MGA RESEARCH CORPORATION

**TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE**

ATD Serial No: 138

Test I.D: D153117

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Initial Angle	deg	0 to 20	19	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	0.7	Pass
Overall Result				Pass


Laboratory Technician

10/05/2015

Test Date


Approved By