

REPORT NUMBER: NCAP-MGA-2012-003

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

**KIA MOTORS MANUFACTURING GEORGIA, INC.
2012 Kia Sorento LX AWD SUV
NHTSA No.: KC0500**

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



Test Date: August 10, 2011

Final Report Date: August 29, 2011

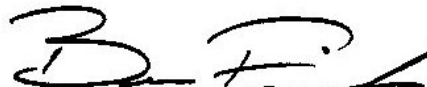
FINAL REPORT

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

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-06-D-00028.

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Approval Date: August 29, 2011

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

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16. Abstract A 56.3 km/h NCAP Frontal Impact Test was conducted on the 2012 Kia Sorento LX AWD SUV in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure for the generation of consumer information on vehicle frontal crash protection. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on August 10, 2011. The impact velocity was 56.3 km/h and the ambient temperature at the barrier face at the time of impact was 21°C. The target vehicle post-test maximum crush was 448 mm located at the vehicle's centerline. The test vehicle's performance was as follows: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">Threshold</th> <th rowspan="2">Driver ATD</th> <th rowspan="2">Passenger ATD</th> </tr> <tr> <th>50th</th> <th>5th</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td> <td>N/A</td> <td>700</td> <td>700</td> <td>271</td> <td>365</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>52</td> <td>20</td> <td>13</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>1</td> <td>0.30</td> <td>0.55</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>2620</td> <td>1337</td> <td>651</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>2520</td> <td>128</td> <td>443</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>2443</td> <td>1960</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>2140</td> <td>1532</td> </tr> </tbody> </table>				Measurement Description	Units	Threshold		Driver ATD	Passenger ATD	50 th	5 th	Head Injury Criteria (HIC ₁₅)	N/A	700	700	271	365	Maximum Chest Compression	mm	63	52	20	13	Nij	N/A	1	1	0.30	0.55	Neck Tension	N	4170	2620	1337	651	Neck Compression	N	4000	2520	128	443	Left Femur Force	N	10008	6805	2443	1960	Right Femur Force	N	10008	6805	2140	1532
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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 DTNH22-06-D-00028. 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 Standard's NCAP Frontal Laboratory Test Procedure dated January 2010.

SUMMARY

A rigid barrier was impacted by a 2012 Kia Sorento LX AWD SUV at a velocity of 56.3 kph. The test was performed at MGA Research Corporation on August 10, 2011. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

Two 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 on the driver's lap and shoulder belts and the passenger's lap belt to measure dummy torso and pelvic section loading. The driver (position 1) ATD (Serial No. 036) and the right-front passenger (position 2) ATD (Serial No. 138) were calibrated previous to this test. Certification details, along with verification data, are found in Appendix C of this report.

The 228 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest displacement, neck, and femur 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 448 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's head and chest contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee bolster. The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the glovebox.

The occupant data is summarized below:

ATD position	HIC ₁₅	T ¹	T ²	Chest Disp. (mm)	Nij	Neck Tension (N)	Neck Comp. (N)	Left Femur (N)	Right Femur (N)
Driver (50 th)	271	63.3	78.3	20	0.30	1337	128	2443	2140
Passenger (5 th)	365	67.0	82.0	13	0.55	651	443	1960	1532

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

TEST NOTES

There was no valid data collected for:

Barrier Channel 8-2

Barrier Channel 8-7

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: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	KC0500	Anti-Lock Brakes	Yes
Model Year	2012	All Wheel Drive	Yes
Make	Kia	Power Steering	Yes
Model	Sorento	Driver Front Airbag	Yes
Body Style	MPV	Driver Curtain Airbag	Yes
VIN	5XYKTD A21CG209642	Driver Head/Torso Airbag	No
Body Color	Titanium Silver	Driver Torso Airbag	No
Delivery Date	7/21/2011	Driver Torso/Pelvis Airbag	Yes
Odometer (mi)	34	Driver Pelvis Airbag	No
Odometer (km)	55	Driver Knee Airbag	No
Dealer	Palmen Kia	Pass. Front Airbag	Yes
Transmission	Automatic	Pass. Curtain Airbag	Yes
Final Drive	AWD	Pass. Head/Torso Airbag	No
Type/No. Cylinders	6	Pass. Torso Airbag	No
Engine Displacement (L)	3.5	Pass. Torso/Pelvis Airbag	Yes
Engine Placement	Lateral	Pass. Pelvis Airbag	No
Roof Rack	Yes	Pass. Knee Airbag	No
Sunroof/T-Top	No	Pretensioners	Yes
Tinted Glass	Yes	Load Limiters	Yes
Traction Control	Yes	Automatic Door Locks	Yes
Power Brakes	Yes	Bucket Seats	Yes
Front Disc	Yes	Tilt Steering	Yes
Rear Disc	Yes	Other	
Does owner's manual provide instructions to turn off automatic door locks?	No		

DATA FROM CERTIFICATION LABEL

Manufactured By	Kia Motors Manufacturing Georgia, Inc.	GVWR (kg)	2410
Date of Manufacture	JUN/17/11	GAWR Front (kg)	1350
		GAWR Rear (kg)	1450

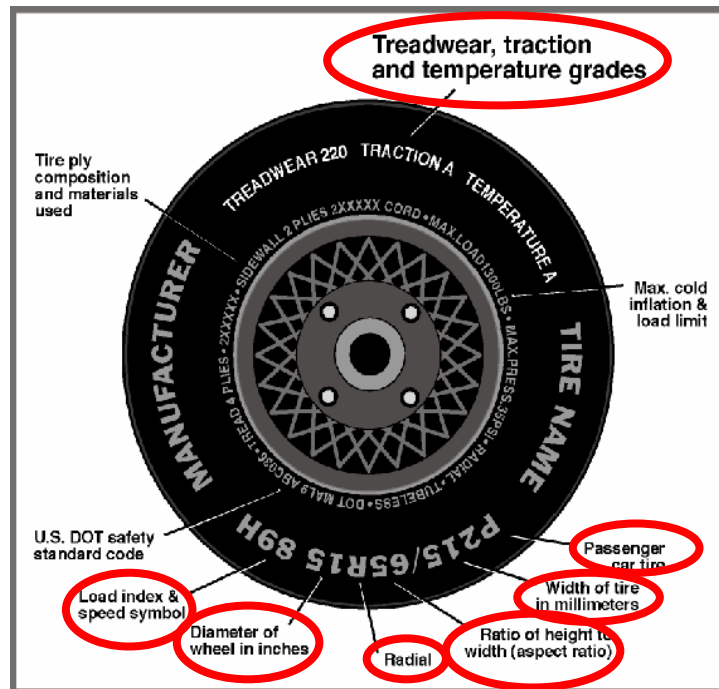
VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench	Split Bench	
Designated Seating Capacity (DSC)	2	3	2	7
Capacity Weight (VCW) (kg)				506
Cargo Weight (RCLW) (kg)				30

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

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011



Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	230	230
Recommended Tire Size	P235/65R17	P235/65R17
Tire Size on Vehicle	P235/65R17	P235/65R17
Tire Manufacturer	Kumho	Kumho
Tire Model	Solus	Solus
Treadwear	500	500
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2	2
Tire Plies Body	5	5
Load Index & Speed Symbol	103T	103T
Tire Material	Rubber	Rubber
DOT Safety Code Right	H2B9 YPL9	H2B9 YPL9
DOT Safety Code Left	H2B9 YPL9	H2B9 YPL9

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

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	517.1	397.3		548.4	455.8	
Right	kg	517.1	394.2		543.0	442.3	
Ratio	%	56.6	43.4		54.9	45.1	
Totals	kg	1034.2	791.5	1825.7	1091.4	898.1	1989.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1825.7
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	30
Calculated Target Vehicle Target Weight (TVTW)	kg	1996.3

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	785	785	793	797	1175
As Tested	mm	776	779	775	779	1223
Post Test	mm	770	773	787	788	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2710
Total Vehicle Length at Left Side	mm	4540
Total Vehicle Length at Centerline	mm	4675
Total Vehicle Length at Right Side	mm	4540
Weight of Ballast in Cargo Area	kg	39.0
Weight of Vehicle Components Removed	kg	37.6
Amount of Stoddard Solvent in Fuel Tank	L	63.2

List of components removed to meet test weight: Third row seat, right tail light, trunk carpet, jack & tools.

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

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4675
2	Total Width	1860
3	Bumper Top Height	576
4	Bumper Bottom Height	459
5	Longitudinal Member Top Height	602
6	Distance between Longitudinal Members	925
7	Longitudinal Member Width	100
8	Engine Top Height	942
9	Engine Bottom Height	222
10	Engine and Gearbox Width	794
11	Front Bumper-Engine Distance	375
12	Front Shock Absorber Fixing Height	1010
13	Bonnet Leading Edge Height	965
14	Front Shock Absorber Fixing Width	1170
15	Front Bumper – Front Axle Distance	928
16	Front Axle – A-Pillar Distance	480
17	A-Pillar – B-Pillar Distance	1080
18	B-Pillar – Rear Axle Distance	1140
19	B-Pillar – C-Pillar Distance	658
20	Roof Sill Bottom Height	1484
21	Roof Sill Top Height	1585
22	Floor Sill bottom Height	275
23	Floor Sill Top Height	423

DATA SHEET NO. 2

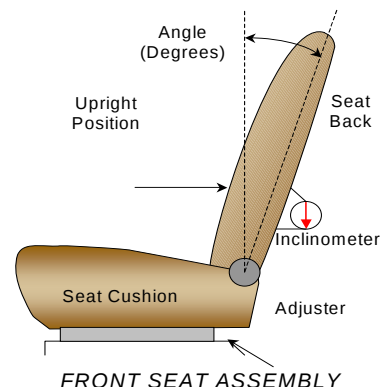
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

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 Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.



SEAT BACK ANGLE	Degrees
Driver Seat Back Angle	0.3° on headrest post
Passenger Seat Back Angle	0.3° on headrest post

SEAT FORE/AFT POSITIONS

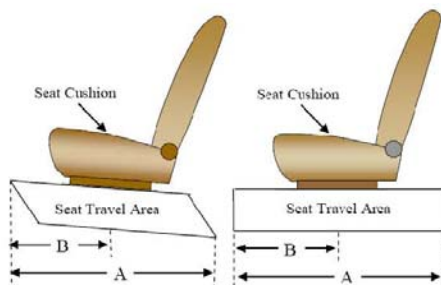
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.

SEAT FORE/AFT POSITIONS	Total Fore/Aft Travel	Placed in Position #
Driver Seat	24 detents	11 th detent (forward-most as 0)
Passenger Seat	22 detents	0 detent (forward-most as 0)

SEAT BELT UPPER ANCHORAGES

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

SEAT BELT UPPER ANCHORAGES	Total # of Positions	Placed in Position #
Driver Seat	3 (1 st as 0)	0 (uppermost as 0)
Passenger Seat	3 (1 st as 0)	2 (uppermost as 0)



DATA SHEET NO. 2 (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

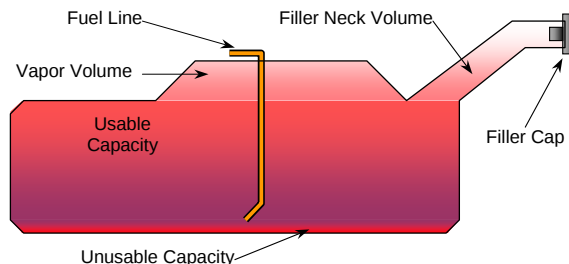
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	68.0
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	62.6 to 63.9
Actual Amount of Solvent used	63.2
1/3 of Usable Capacity	22.7

FUEL PUMP

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

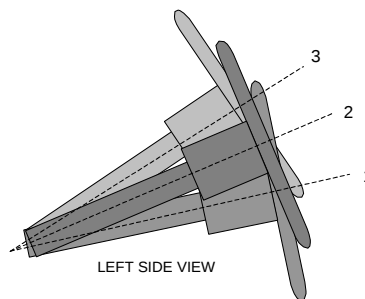
The vehicle is equipped with an electric fuel pump. Key is "ON" position. The fuel pipe is on the left side.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

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



STEERING COLUMN ASSEMBLY

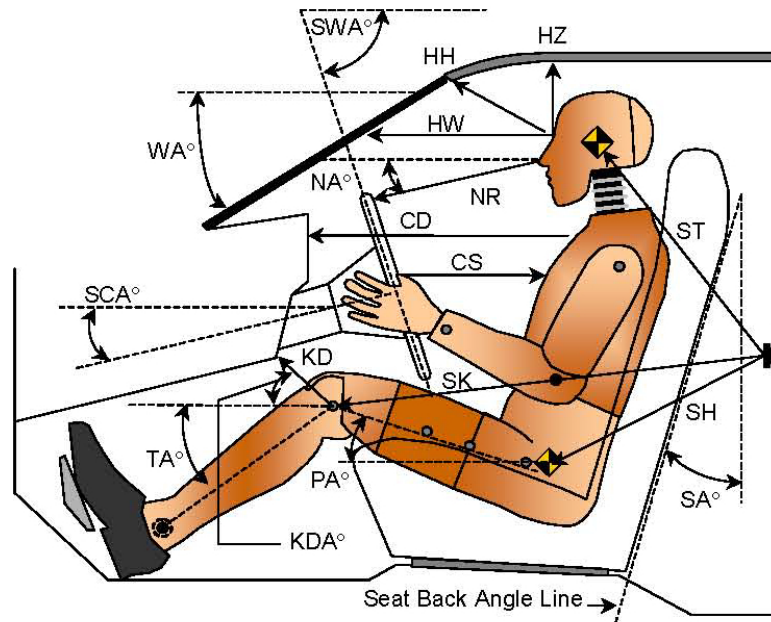
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost – Position 1	65.6	139
Geometric Center – Position 2	63.4	119
Uppermost – Position 3	61.2	99
Telescoping Steering Wheel Travel		40
Test Position	63.4	119

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

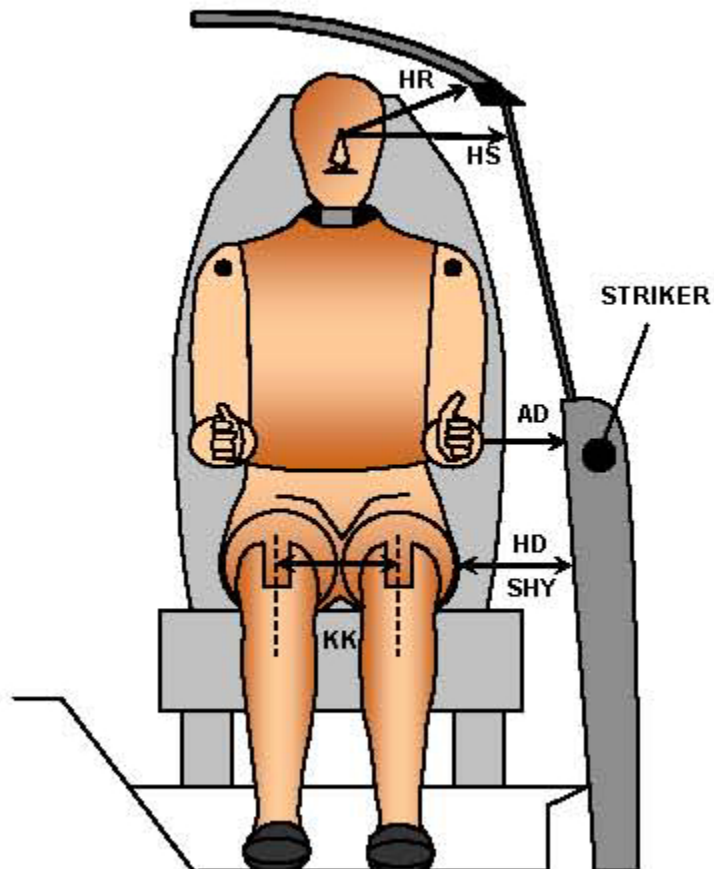


Code	Measurement Description	Driver S/N 036		Passenger S/N 138	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		29.3		
SWA	Steering Wheel Angle		63.4		
SCA	Steering Column Angle		26.6		
SA	Seat Back Angle		0.3		0.3
HZ	Head to Roof (Z)	205	90	263	90
HH	Head to Header	351	24.6	320	43.7
HW	Head to Windshield	617	0	655	0
NR	Nose to Rim	417	10.7		
CD	Chest to Dash	556		415	
CS	Chest to Steering Hub	330	4.5		
RA	Rim to Abdomen	188	0		
KDL	Left Knee to Dash	157	25.6	110	36.5
KDR	Right Knee to Dash	146	32.1	113	38.1
PA	Pelvic Angle		23.5		17.8
TA	Tibia Angle		48.6		56.8
SK	Striker to Knee	603	107.9	687	104.2
ST	Striker to Head	459	11.4	412	26.8
SH	Striker to H-Point	282	133.5	389	134.1

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011



FRONT VIEW OF DUMMY

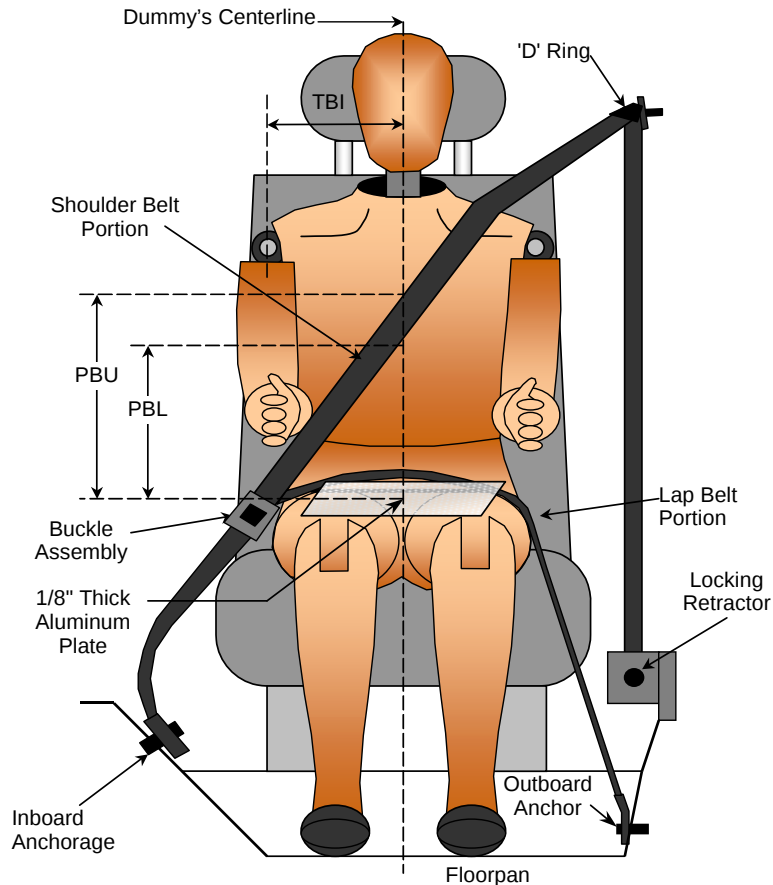
Code	Measurement Description	Driver S/N 036	Passenger S/N 138
		Length (mm)	
AD	Arm to Door	136	116
HD	H-Point to Door	157	196
HR	Head to Side Header	215	274
HS	Head to Side Window	326	358
KK	Knee to Knee	335	210
SHY	Striker to H-Point (Y Direction)	290	296
AA	Ankle to Ankle	363	175

DATA SHEET NO. 5

SEAT BELT POSITIONING DATA

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	360	300
PBL - Top surface of reference to belt lower edge	mm	290	210

BELT LENGTH DATA

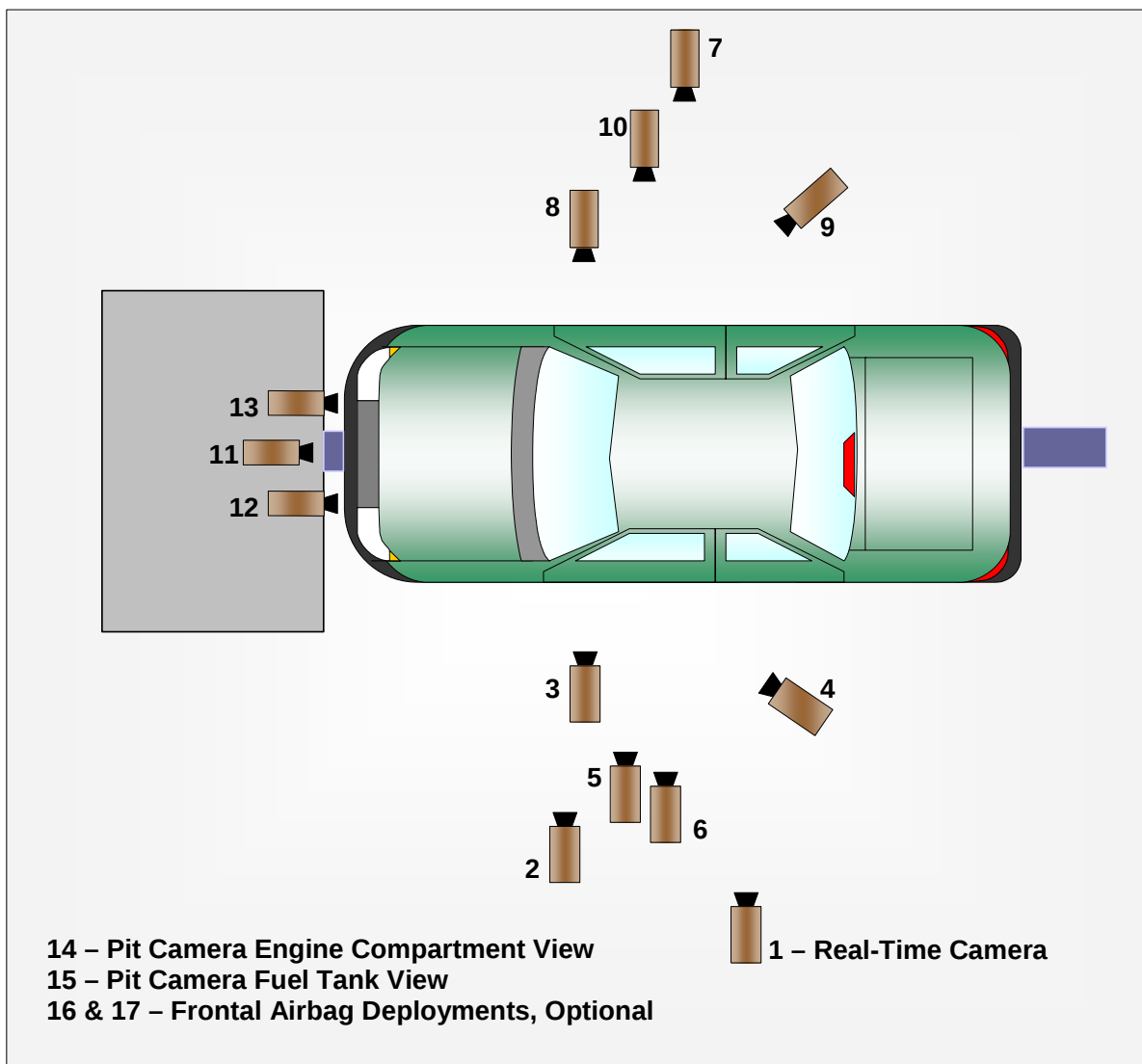
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	845	900
Lap Belt Length as measured on ATD	mm	630	865
Remainder of belt on reel	mm	1610	1335
Total Belt Length for Continuous Webbing Systems	mm	3085	3100

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

Test Vehicle: 2012 Kia Sorento LX AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
Test Date: 8/10/2011

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 (CONTINUED)

CAMERA LOCATIONS AND DATA

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Side View					30
2	Left Front Half	1160	-5170	-1110	24	1000
3	Driver Close-Up	1390	-6230	-1800	35	1000
4	Driver Angle	5390	-4810	-1940	50	1000
5	Steering Column Top	730	-5400	-1230	24	1000
6	Steering Column Bottom	660	-5360	-830	24	1000
7	Right Overall	2430	6710	-1080	20	1000
8	Passenger Close-Up	1650	6850	-1820	35	1000
9	Passenger Angle	5680	4530	-1920	50	1000
10	Right Front Half	1180	5210	-1070	24	1000
11	Windshield	-260	0	-2860	24	1000
12	Top Driver	-30	-360	-2270	12.5	1000
13	Top Passenger	-30	360	-2270	12.5	1000
14	Pit Front	1060	0	3150	24	1000
15	Pit Rear	2980	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

***COORDINATES:**

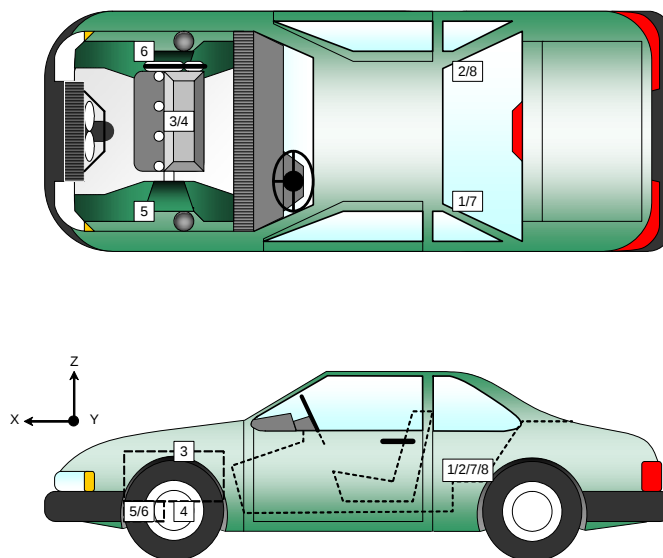
- +X = forward of impact plane
- +Y = right of monorail centerline
- +Z = below ground level

Cameras 16 & 17 were not used for this test.

DATA SHEET NO. 7
VEHICLE ACCELEROMETER DATA

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1884	-395	-420
2	Right Rear X-Member X	1884	395	-420
3	Engine Top X	3642	0	-942
4	Engine Bottom X	3920	0	-320
5	Left Brake Caliper X	3566	-720	-310
6	Right Brake Caliper X	3566	720	-310
7	Left Rear X-Member Z	1884	-395	-420
8	Right Rear X-Member Z	1884	395	-420

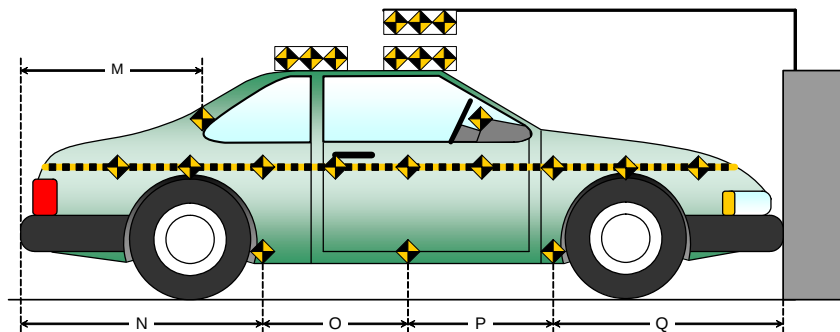
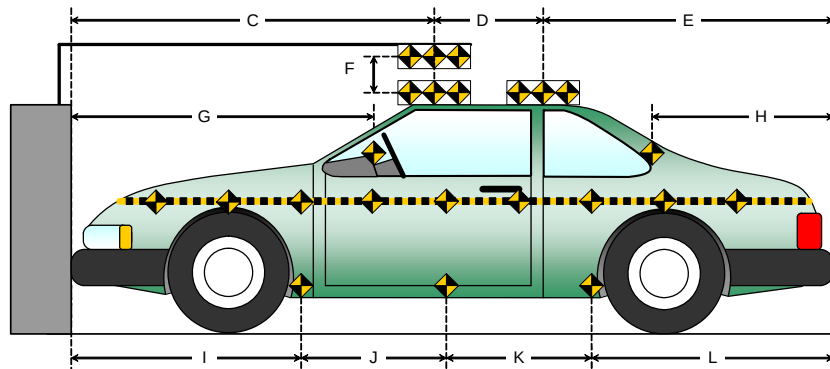
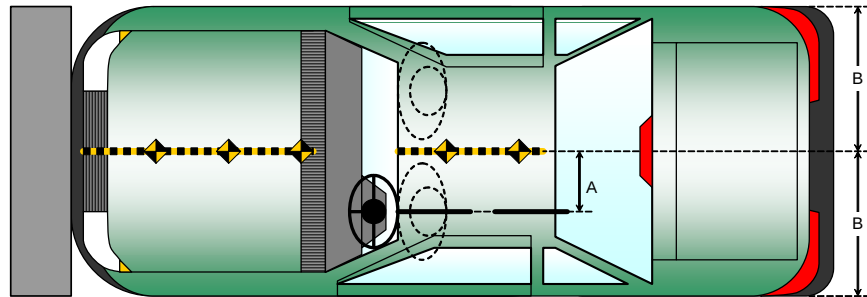
Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

Item	Value (mm)
A	400
B	930
C	2385
D	670
E	1620
F	105
G	
H	888
I	1365
J	875
K	875
L	1560
M	888
N	1560
O	875
P	875
Q	1365



DATA SHEET NO. 9

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

Advanced Research Load Cell Barrier



1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	1-11	1-12	1-13	1-14	1-15	1-16
2-1	2-2	2-3	2-4	2-5	2-6	2-7	2-8	2-9	2-10	2-11	2-12	2-13	2-14	2-15	2-16
3-1	3-2	3-3	3-4	3-5	3-6	3-7	3-8	3-9	3-10	3-11	3-12	3-13	3-14	3-15	3-16
4-1	4-2	4-3	4-4	4-5	4-6	4-7	4-8	4-9	4-10	4-11	4-12	4-13	4-14	4-15	4-16
5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8	5-9	5-10	5-11	5-12	5-13	5-14	5-15	5-16
6-1	6-2	6-3	6-4	6-5	6-6	6-7	6-8	6-9	6-10	6-11	6-12	6-13	6-14	6-15	6-16
7-1	7-2	7-3	7-4	7-5	7-6	7-7	7-8	7-9	7-10	7-11	7-12	7-13	7-14	7-15	7-16
8-1	8-2	8-3	8-4	8-5	8-6	8-7	8-8	8-9	8-10	8-11	8-12	8-13	8-14	8-15	8-16
9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8	9-9	9-10	9-11	9-12	9-13	9-14	9-15	9-16
10-1	10-2	10-3	10-4	10-5	10-6	10-7	10-8	10-9	10-10	10-11	10-12	10-13	10-14	10-15	10-16
11-1	11-2	11-3	11-4	11-5	11-6	11-7	11-8	11-9	11-10	11-11	11-12	11-13	11-14	11-15	11-16

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: 2012 Kia Sorento LX AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
Test Date: 8/10/2011

INSTRUMENTATION

Driver Dummy Data Channels	46
Passenger Dummy Data Channels	46
Vehicle Structure Accelerometers	8
Barrier Channels	128
Total	228

CAMERA COVERAGE

High-Speed Vehicle Onboard	0
High-Speed Offboard	14
Real-Time	2
Total	16

DATA SHEET NO. 11

POST-TEST OBSERVATIONS

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

TEST DUMMY INFORMATION AND CONTACT

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 036	HIII 5% / 138
Head Contact	Airbag, Headrest	Airbag, Headrest
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Bolster	Glovebox
Right Knee Contact	Knee Bolster	Glovebox

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	Cracked
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1115
Center	mm	1140
Right Side	mm	1141
Average	mm	1132

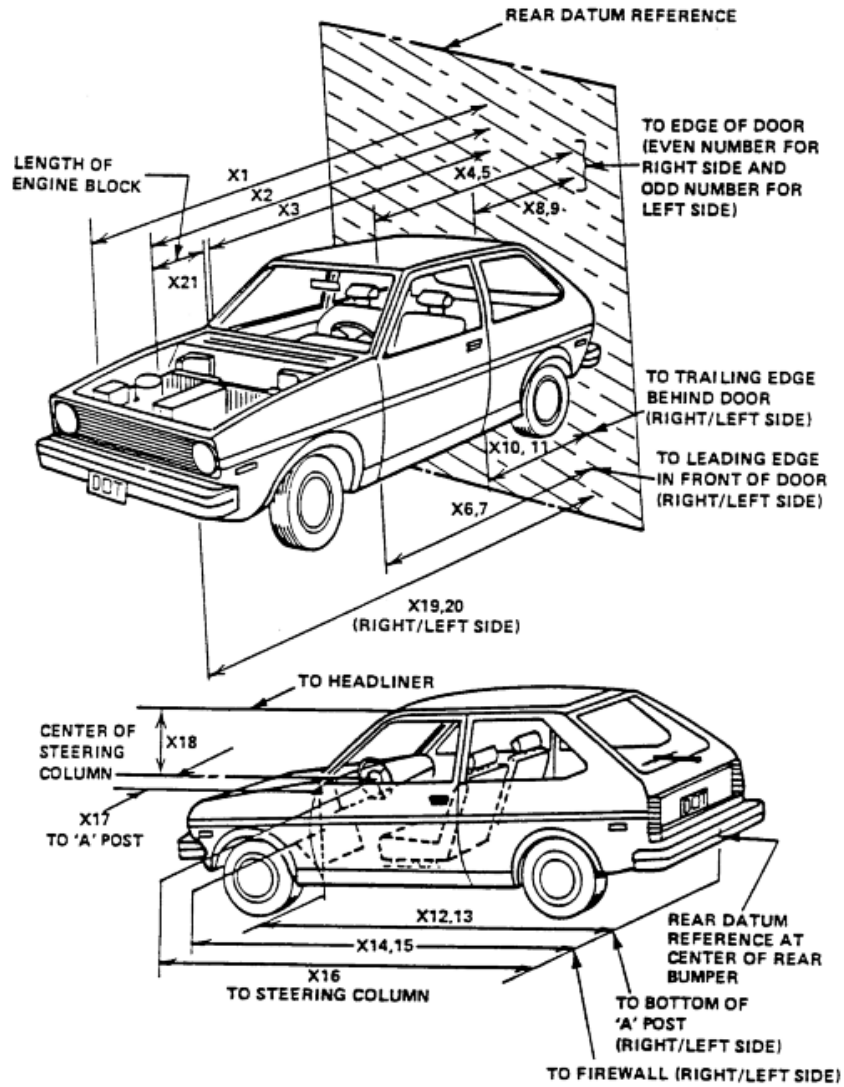
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Right Front (Passenger)	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Knee Airbag	No		No	
Curtain Side Airbag	Yes	No	Yes	No
Torso/Abdomen/Pelvis Side Airbag	Yes	No	Yes	No
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	

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

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4675	4227	448
2	RSOV to Front of Engine	mm	4139	3930	209
3	RSOV to Firewall	mm	3624	3615	9
4	RSOV to Upper Leading Edge of Right Door	mm	3170	3170	0
5	RSOV to Upper Leading Edge of Left Door	mm	3172	3175	-3
6	RSOV to Lower Leading Edge of Right Door	mm	3165	3165	0
7	RSOV to Lower Leading Edge of Left Door	mm	3160	3158	2
8	RSOV to Upper Trailing Edge of Right Door	mm	2122	2125	-3
9	RSOV to Upper Trailing Edge of Left Door	mm	2122	2122	0
10	RSOV to Lower Trailing Edge of Right Door	mm	2148	2150	-2
11	RSOV to Lower Trailing Edge of Left Door	mm	2150	2150	0
12	RSOV to Bottom of "A" Post of Right Side	mm	3155	3155	0
13	RSOV to Bottom of "A" Post of Left Side	mm	3181	3180	1
14	RSOV to Firewall, Right Side	mm	3558	3555	3
15	RSOV to Firewall, Left Side	mm	3568	3560	8
16	RSOV to Steering Column	mm	2732	2730	2
17	Center of Steering Column to "A" Post	mm	390	365	25
18	Center of Steering Column to Headliner	mm	445	460	-15
19	RSOV to Right Side of Front Bumper	mm	4540	4225	315
20	RSOV to Left Side of Front Bumper	mm	4540	4223	317
21	Length of Engine Block	mm	626	626	0
RD	RSOV to Right Side of Dash Panel	mm	2975	2980	-5
CD	RSOV to Center of Dash Panel	mm	2890	2890	0
LD	RSOV to Left Side of Dash Panel	mm	2965	2970	-5

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

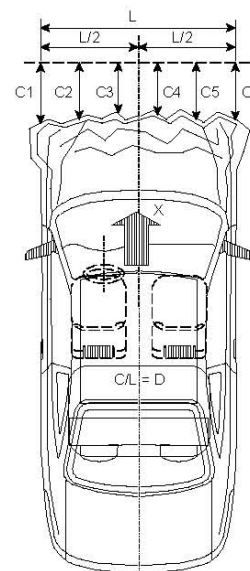
NHTSA No.: KC0500
 Test Date: 8/10/2011

VEHICLE INFORMATION

VIN: 5XYKTD21CG209642 Wheelbase (mm): 2710
 Vehicle Size Category: MPV Test Weight (kg): 1989.5

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): 56.3
 Velocity Change (km/h): 67.2
 Time of Separation (msec): 92.1



CRUSH PROFILE

Collision Deformation Classification: Frontal
 Midpoint of Damage: Centerline
 Damage Region Length (mm): 1200
 Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4540	4223	317
C2	Crush zone 2 at left side	mm	4605	4244	361
C3	Crush zone 3 at left side	mm	4635	4237	398
C4	Crush zone 4 at right side	mm	4635	4232	403
C5	Crush zone 5 at right side	mm	4607	4242	365
C6	Crush zone 6 at right side	mm	4540	4225	315
L	C1 TO C6	mm	1200	1190	10

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

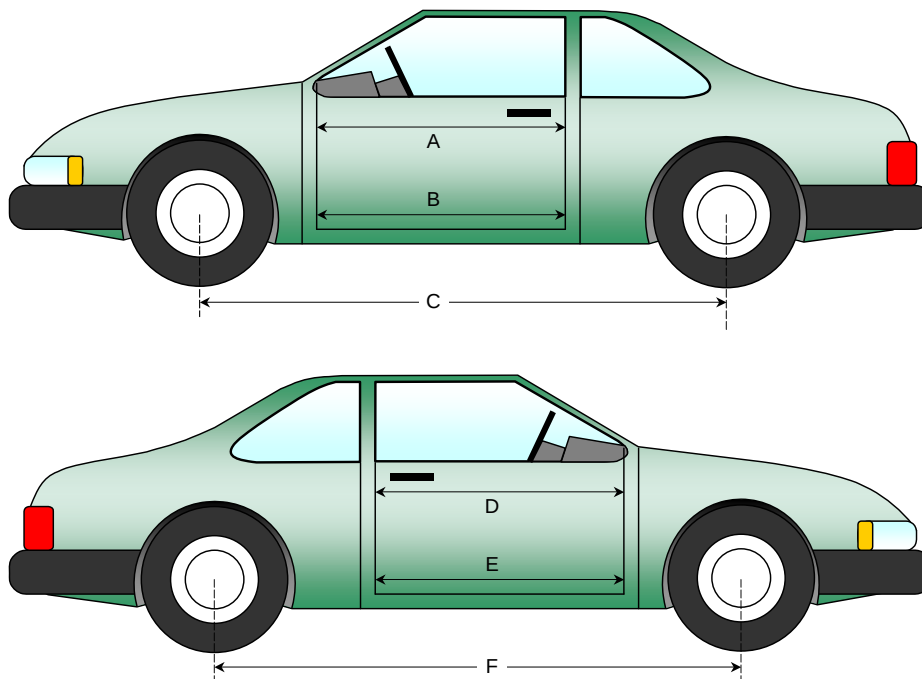
NHTSA No.: KC0500
 Test Date: 8/10/2011

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	945	945	0
B	Left Side Lower	mm	870	872	-2
D	Right Side Upper	mm	945	945	0
E	Right Side Lower	mm	872	872	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2710	2615	95
F	Right Side Wheelbase	mm	2710	2614	96



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

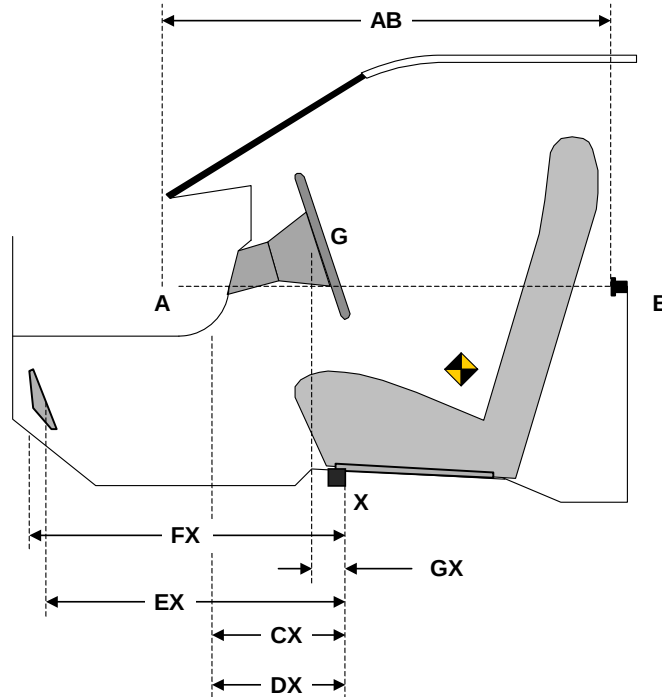
Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	786	786	0
CX	Left Knee Bolster to X	mm	285	300	-15
DX	Right Knee Bolster to X	mm	270	295	-25
EX	Brake Pedal to X	mm	572	588	-16
FX	Foot Rest to X	mm	535	535	0
GX	Center of Steering Column Wheel Hub to X	mm	30	110	-80

X = Front of Seat Track (stationary)

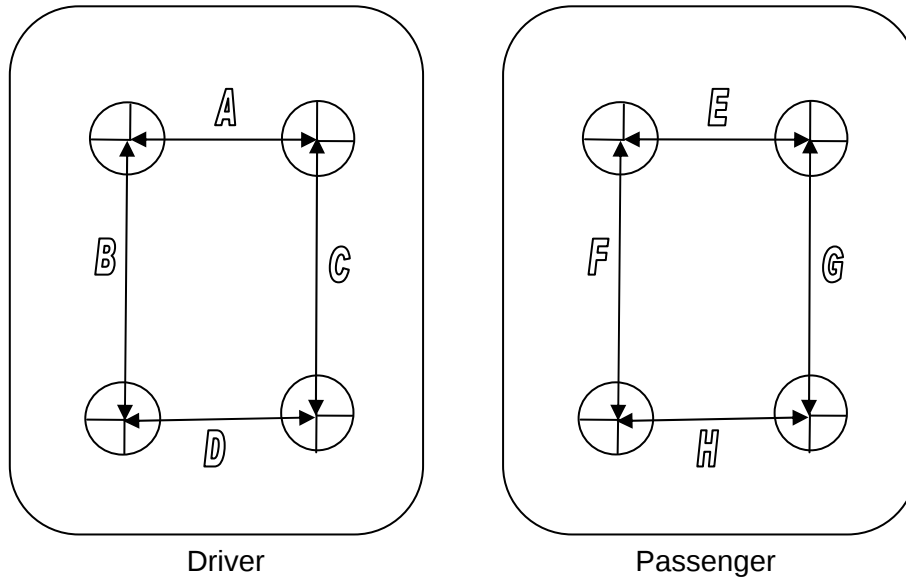


DRIVER COMPARTMENT

DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011



TOP VIEW THROUGH FLOOR PAN

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Units	Pre-Test	Post-Test	Difference
A	mm	300	300	0
B	mm	300	300	0
C	mm	300	300	0
D	mm	300	300	0
E	mm	300	300	0
F	mm	300	300	0
G	mm	300	300	0
H	mm	300	300	0

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

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

Windshield Mounting Details:

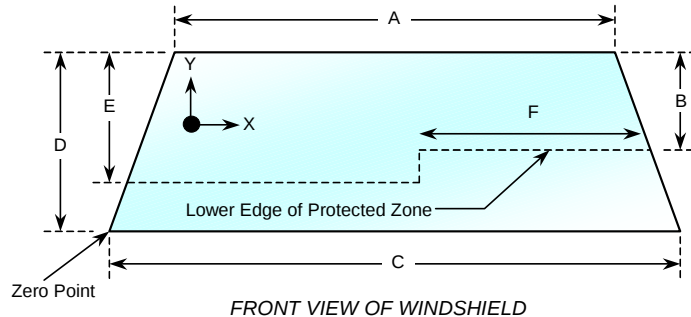
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

The standard requires that the post-test retention measurement be a minimum of 75 percent of the pretest 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°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2126	2126	100
Right Side	2126	2126	100
Total	4252	4252	100



Item	Units	Value
A	mm	1188
B	mm	523
C	mm	1520
D	mm	772
E	mm	538
F	mm	504

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, 219 (PARTIAL), AND 301 DATA

Test Vehicle:	<u>2012 Kia Sorento LX AWD SUV</u>	NHTSA No.:	<u>KC0500</u>
Test Program:	<u>NCAP Frontal Barrier Impact Test</u>	Test Date:	<u>8/10/2011</u>

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Test Time:	<u>1:00 pm</u>	Temperature:	<u>21° C</u>
------------	----------------	--------------	--------------

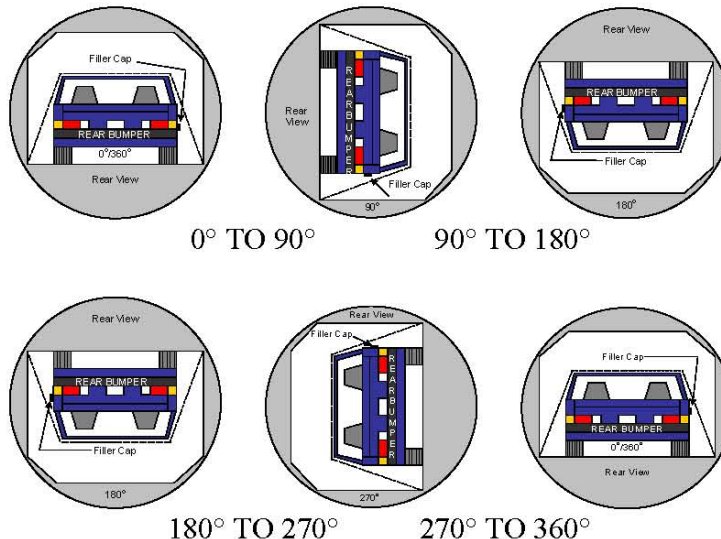
- | | |
|---|--------------|
| A. From impact until vehicle motion ceases:
(Maximum Allowable = 1 ounce) | <u>0</u> oz. |
| B. For the 5 minute period after motion ceases:
(Maximum allowable = 5 ounces) | <u>None</u> |
| C. For the following 25 minutes:
(Maximum allowable = 1 oz./minute) | <u>None</u>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

DATA SHEET NO. 16
FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011

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°	119	300	419
90° to 180°	107	300	407
180° to 270°	105	300	405
270° to 360°	110	300	410

FMVSS 301 ROLLOVER 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

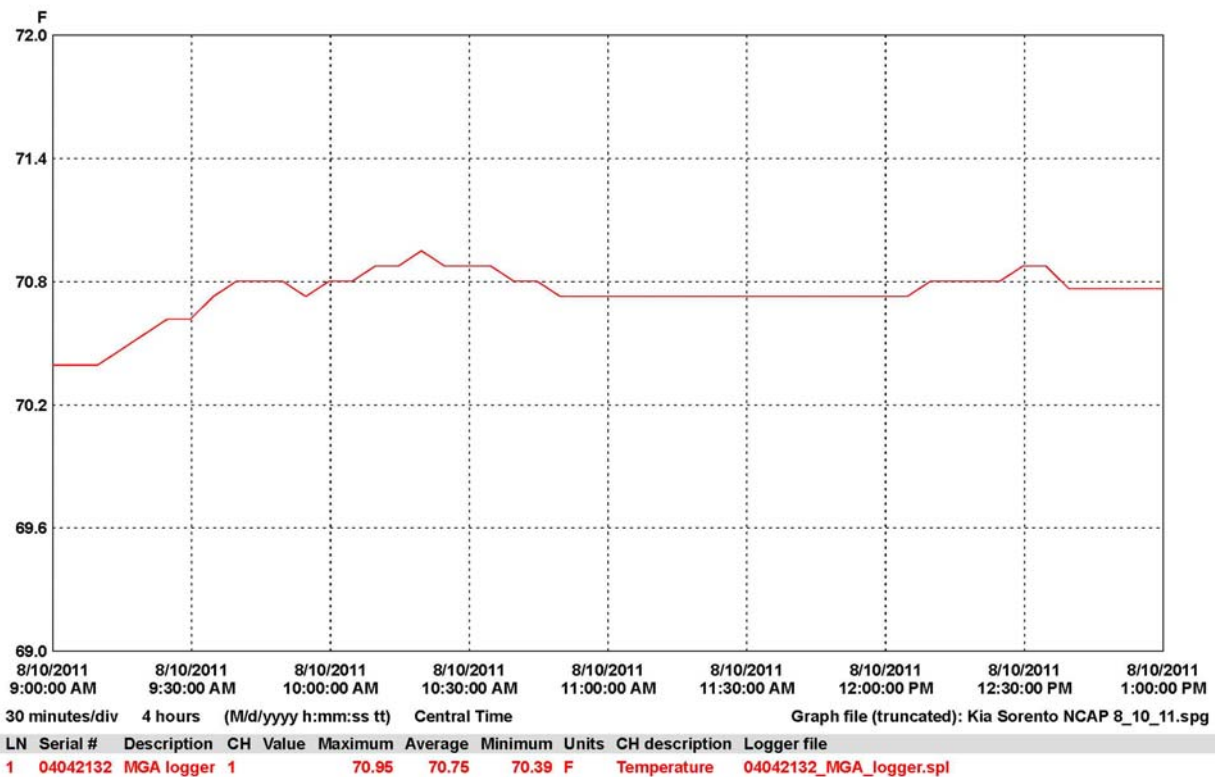
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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: 2012 Kia Sorento LX AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: KC0500
 Test Date: 8/10/2011



APPENDIX A
PHOTOGRAPHS

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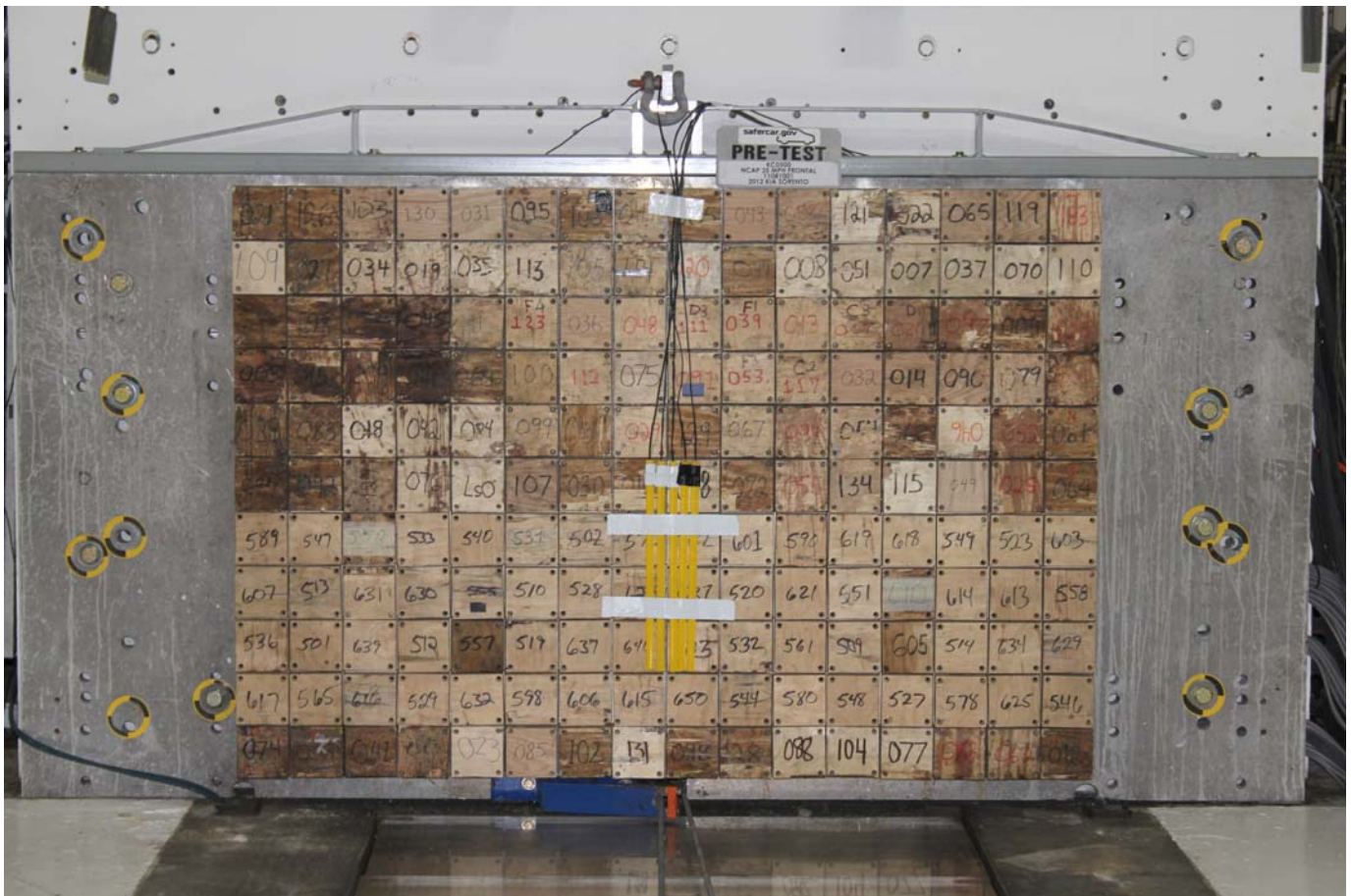
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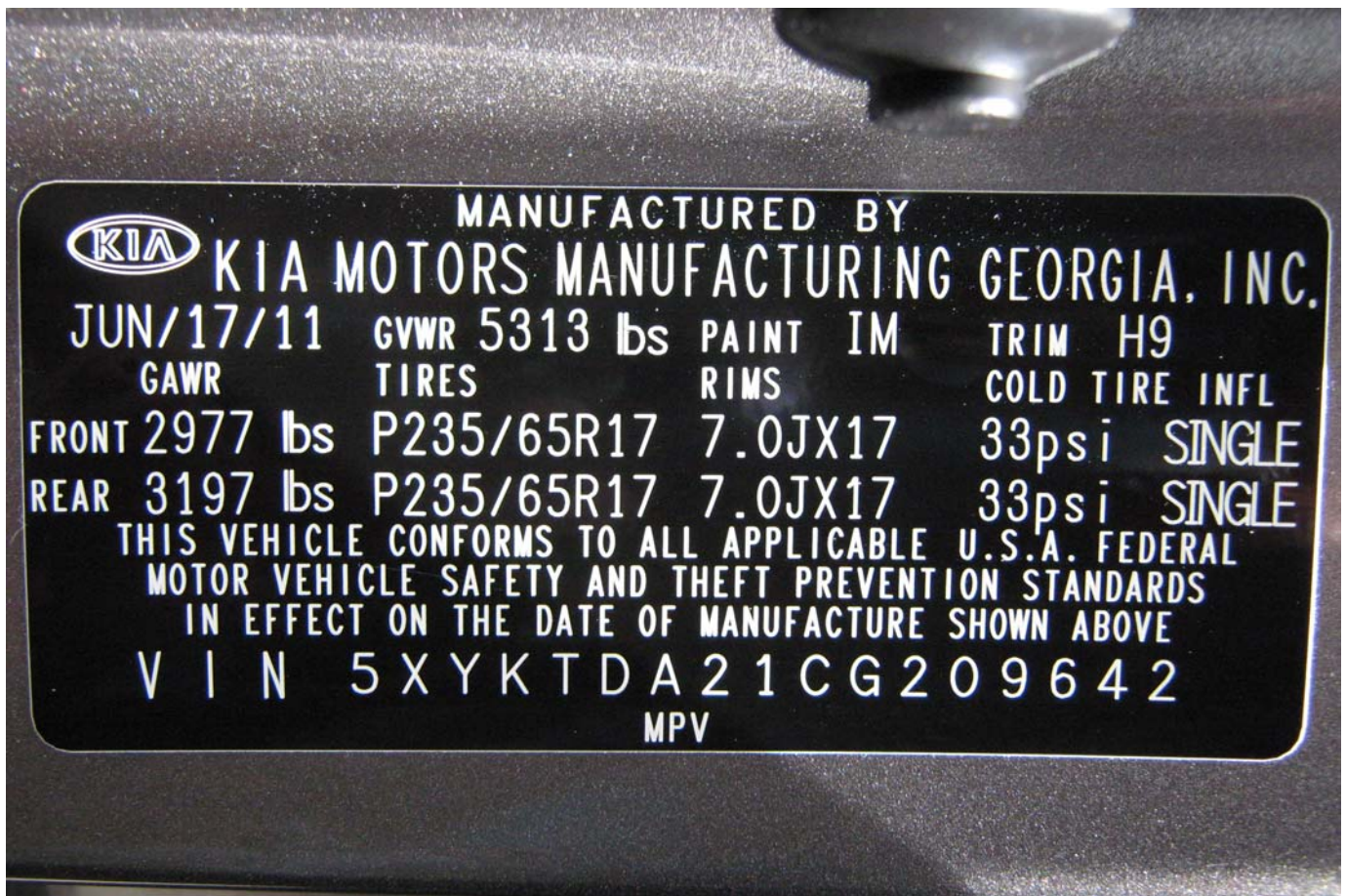
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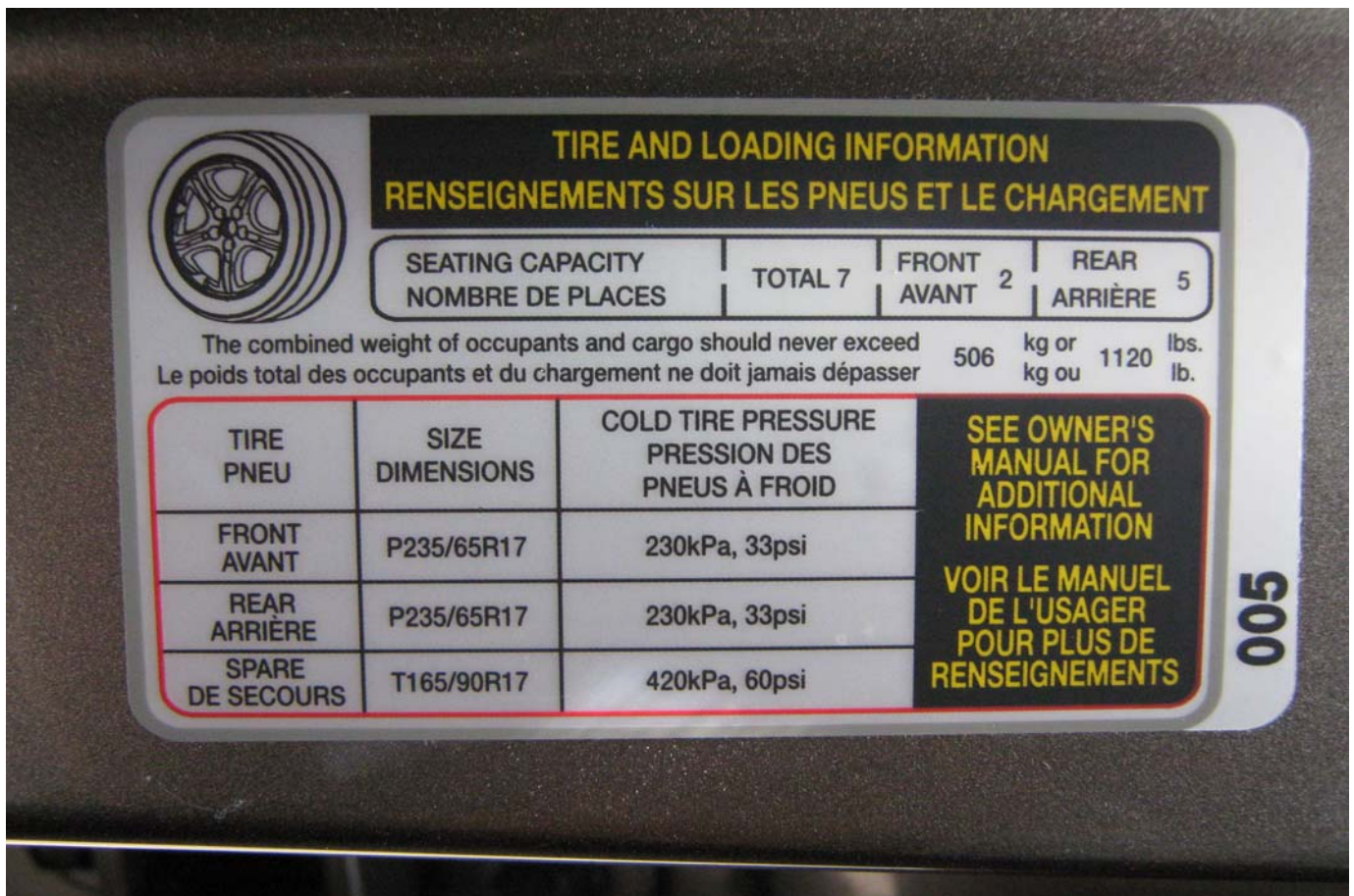
Load Cell Location



Load Cell Wall



Manufacturer's Label



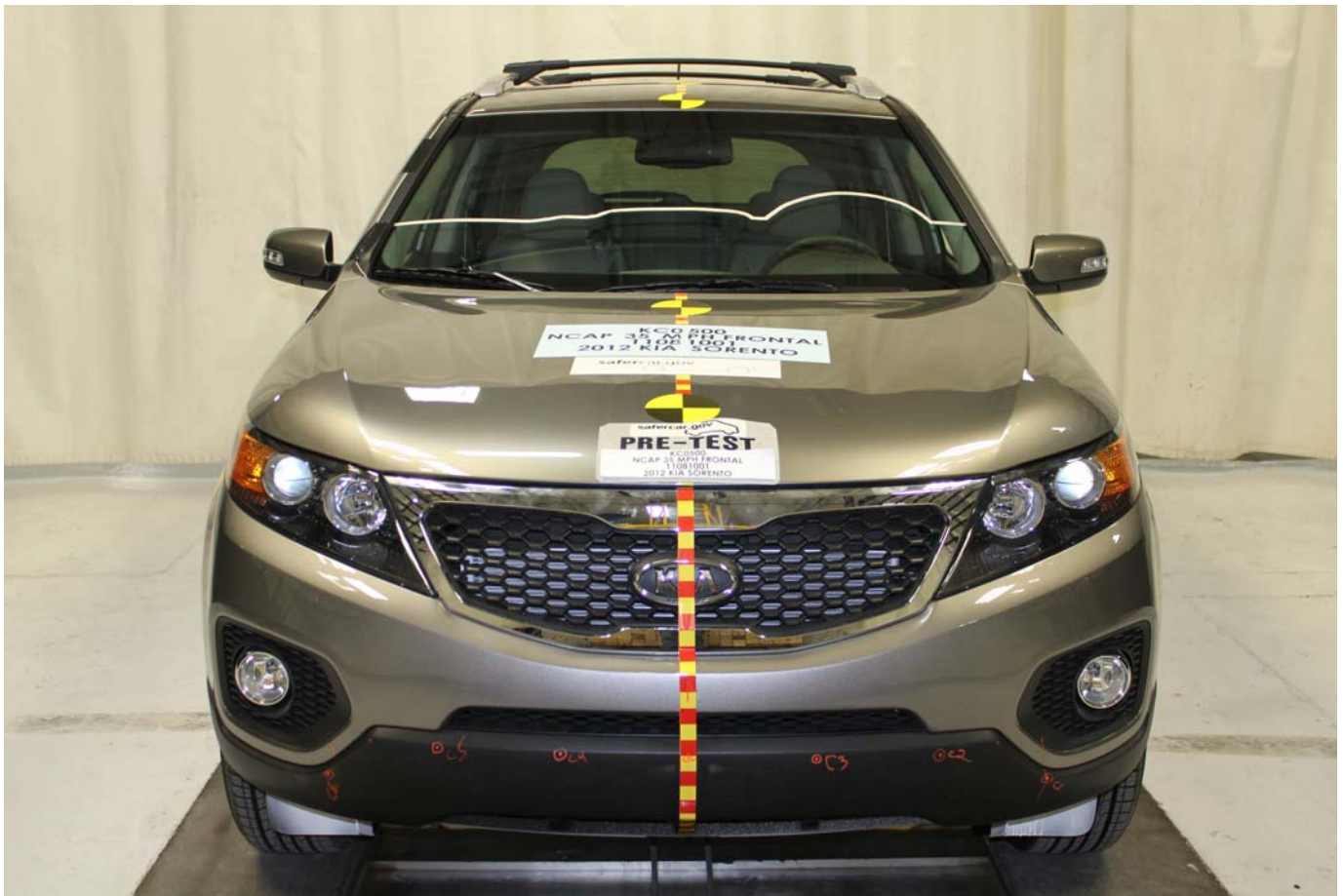
Tire Placard



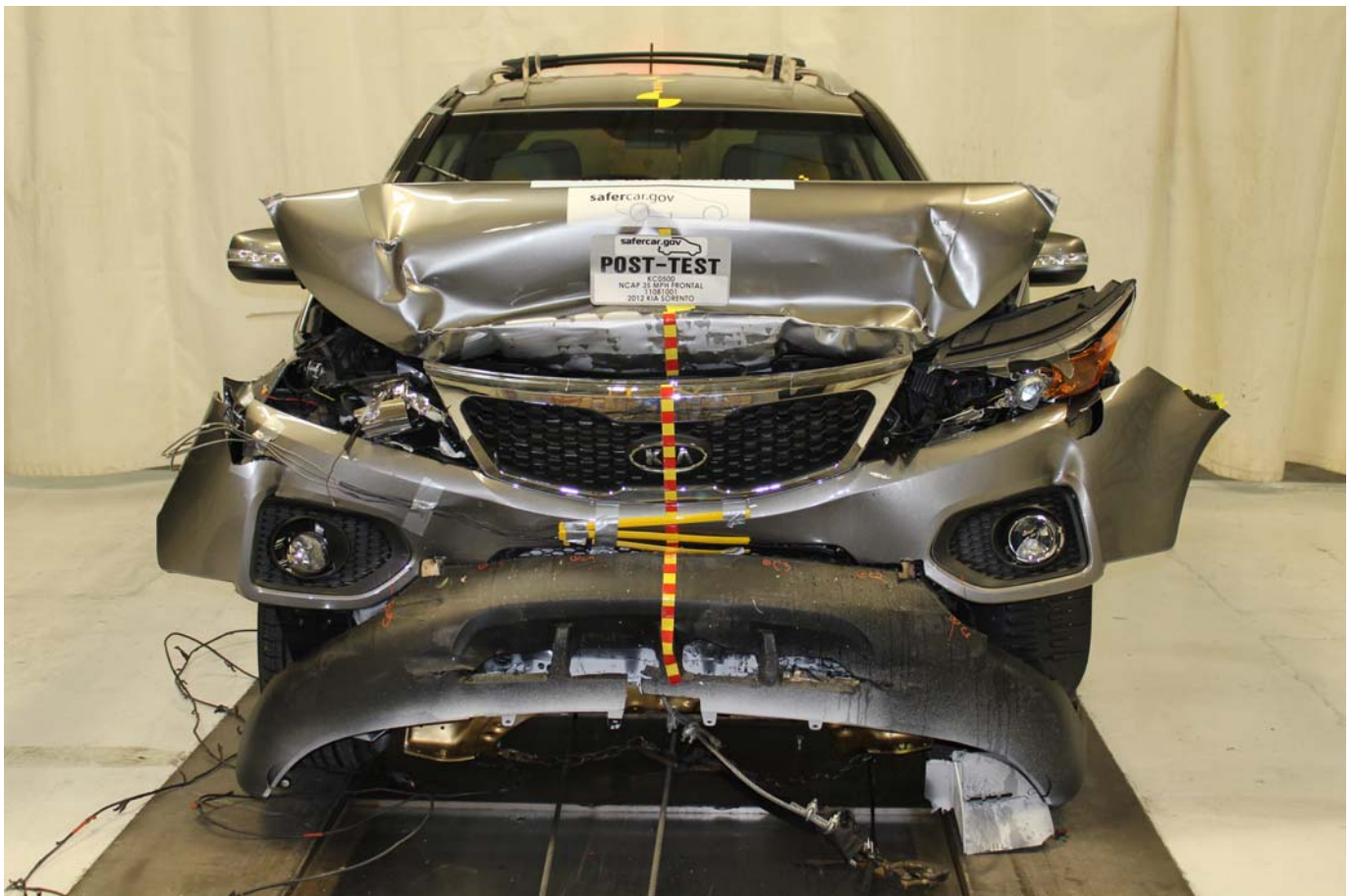
Right Front Three-Quarter View, As Received



Left Rear Three-Quarter View, As Received



Pre-Test Front View



Post-Test Front View



Pre-Test Left Side View (with vehicle at barrier)



Post-Test Left Side View



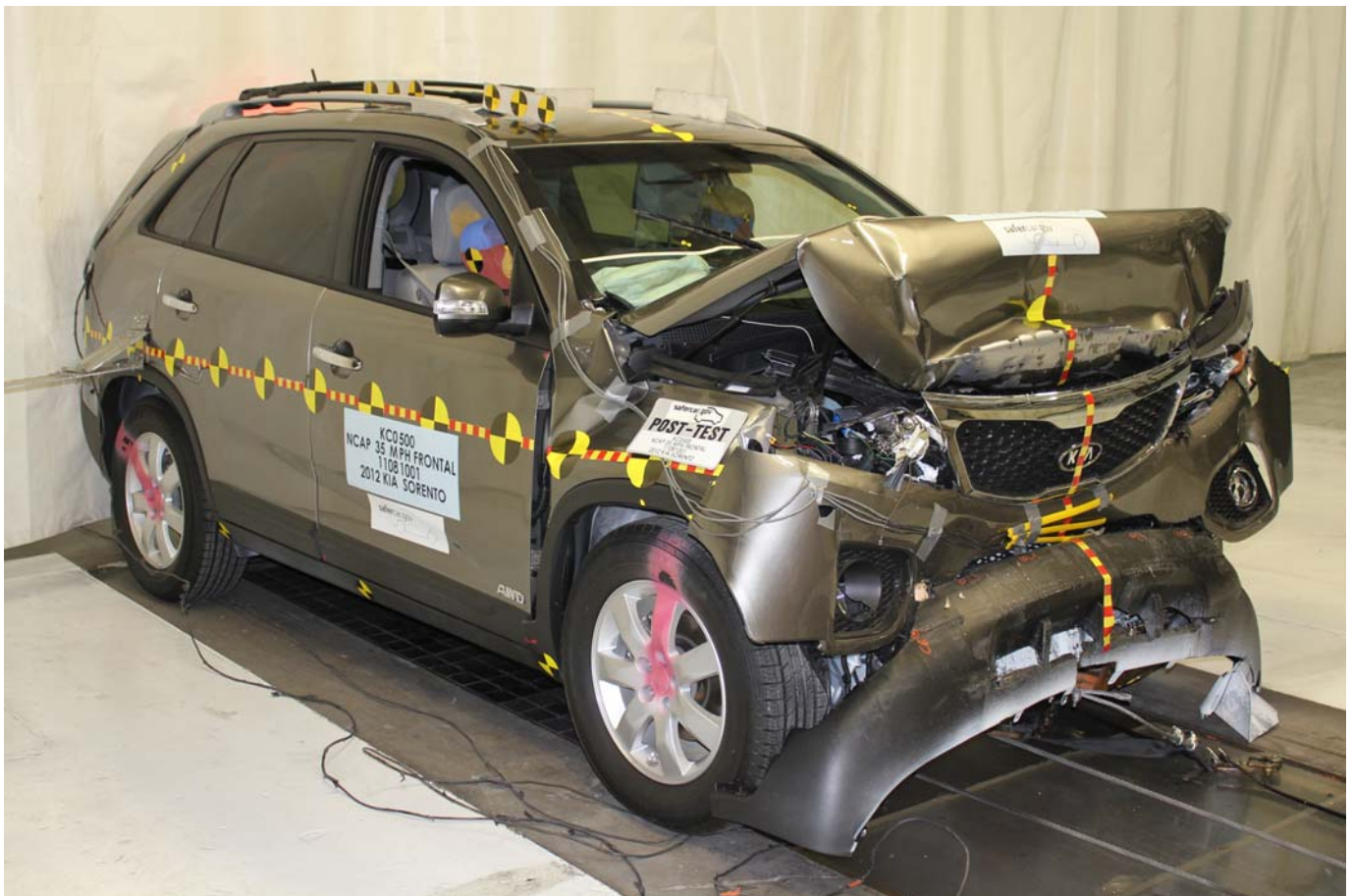
Pre-Test Right Side View (with vehicle at barrier)



Post-Test Right Side View



Pre-Test Right Front Three-Quarter View



Post-Test Right Front Three-Quarter View



Pre-Test Left Rear Three-Quarter View (with vehicle at barrier)



Post-Test Left Rear Three-Quarter View



Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



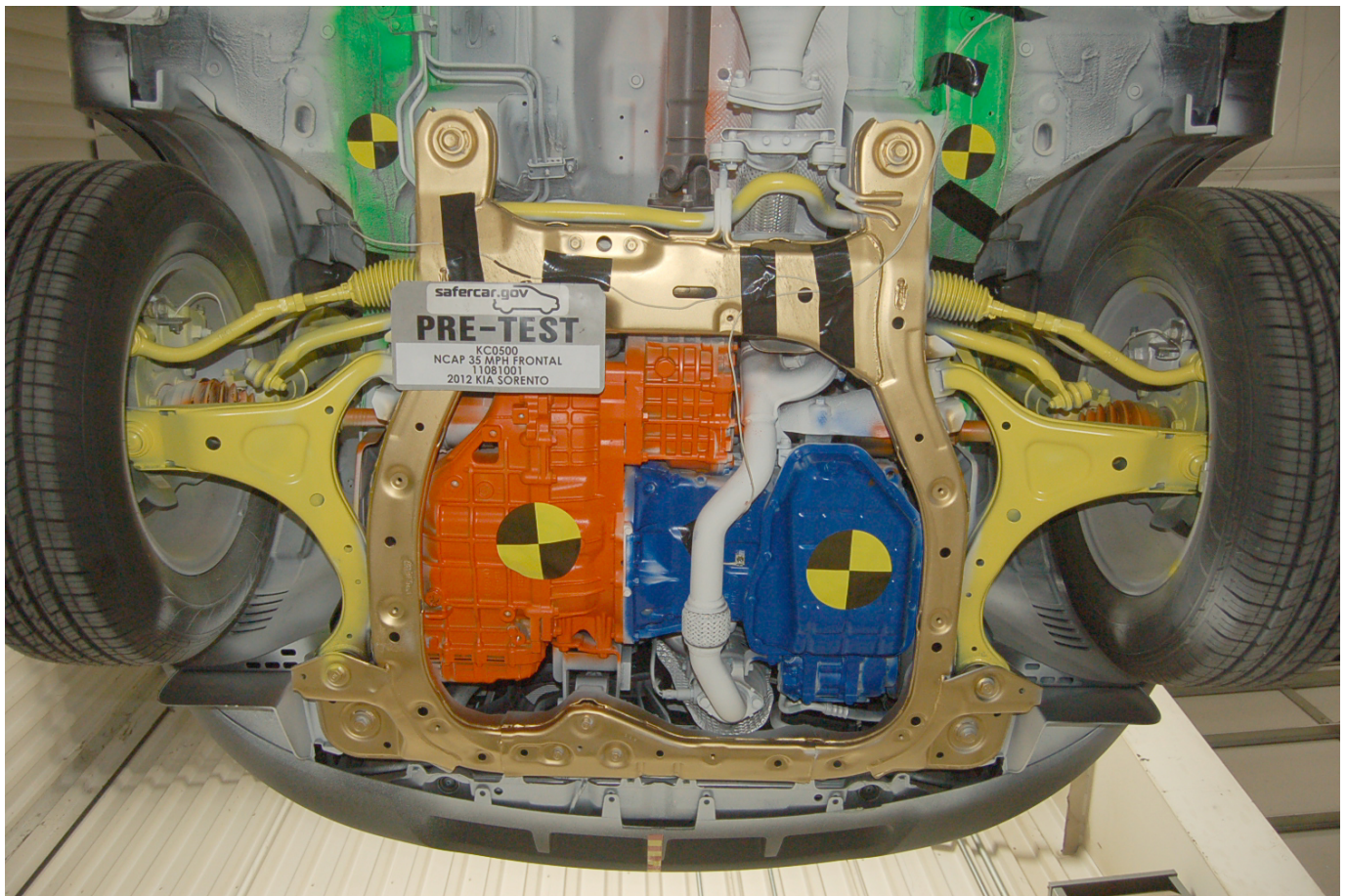
Post-Test Engine Compartment View



Pre-Test Fuel Cap View



Post-Test Fuel Cap View



Pre-Test Front Underbody View



Post-Test Front Underbody View



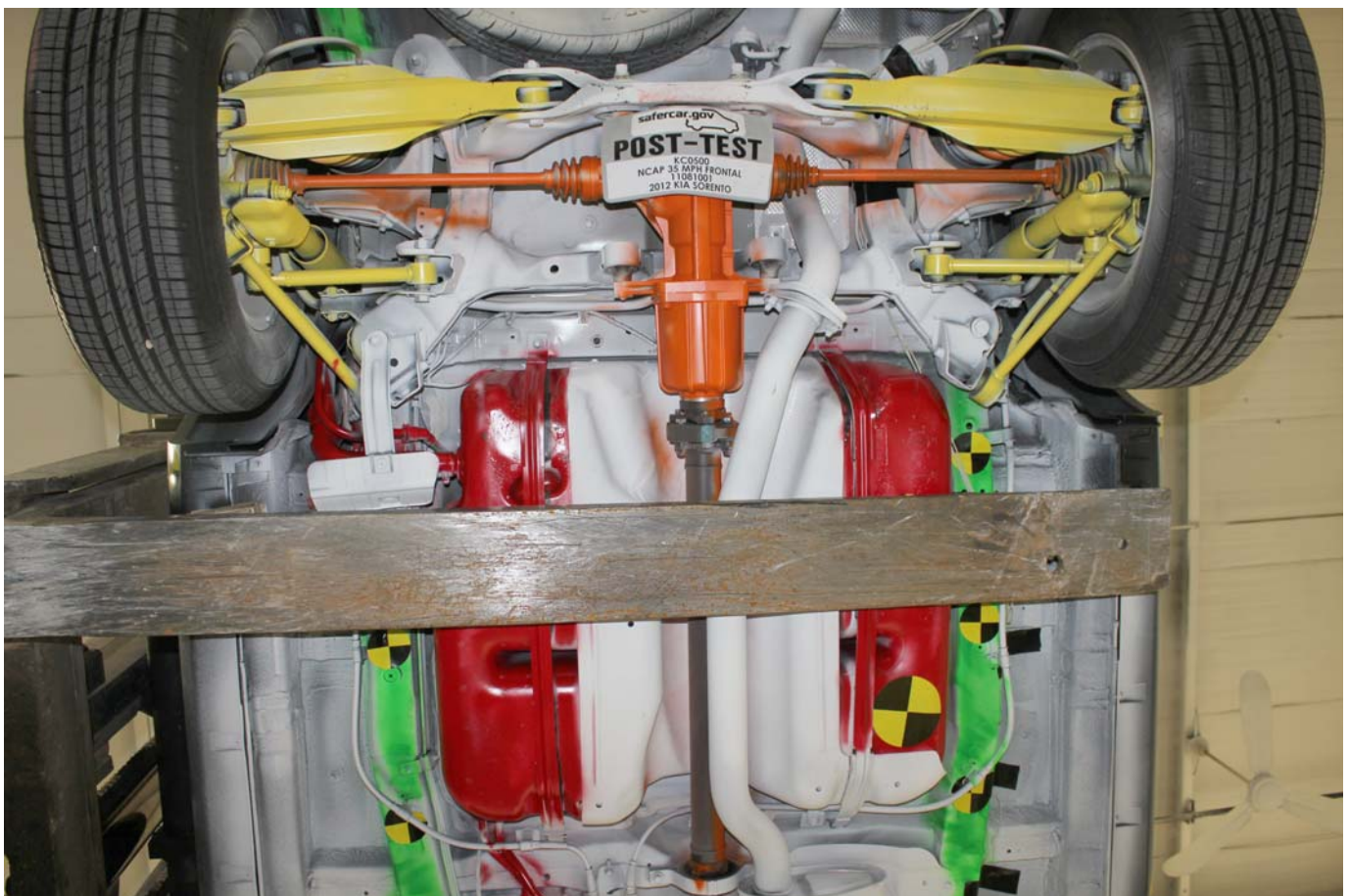
Pre-Test Mid Front Underbody View



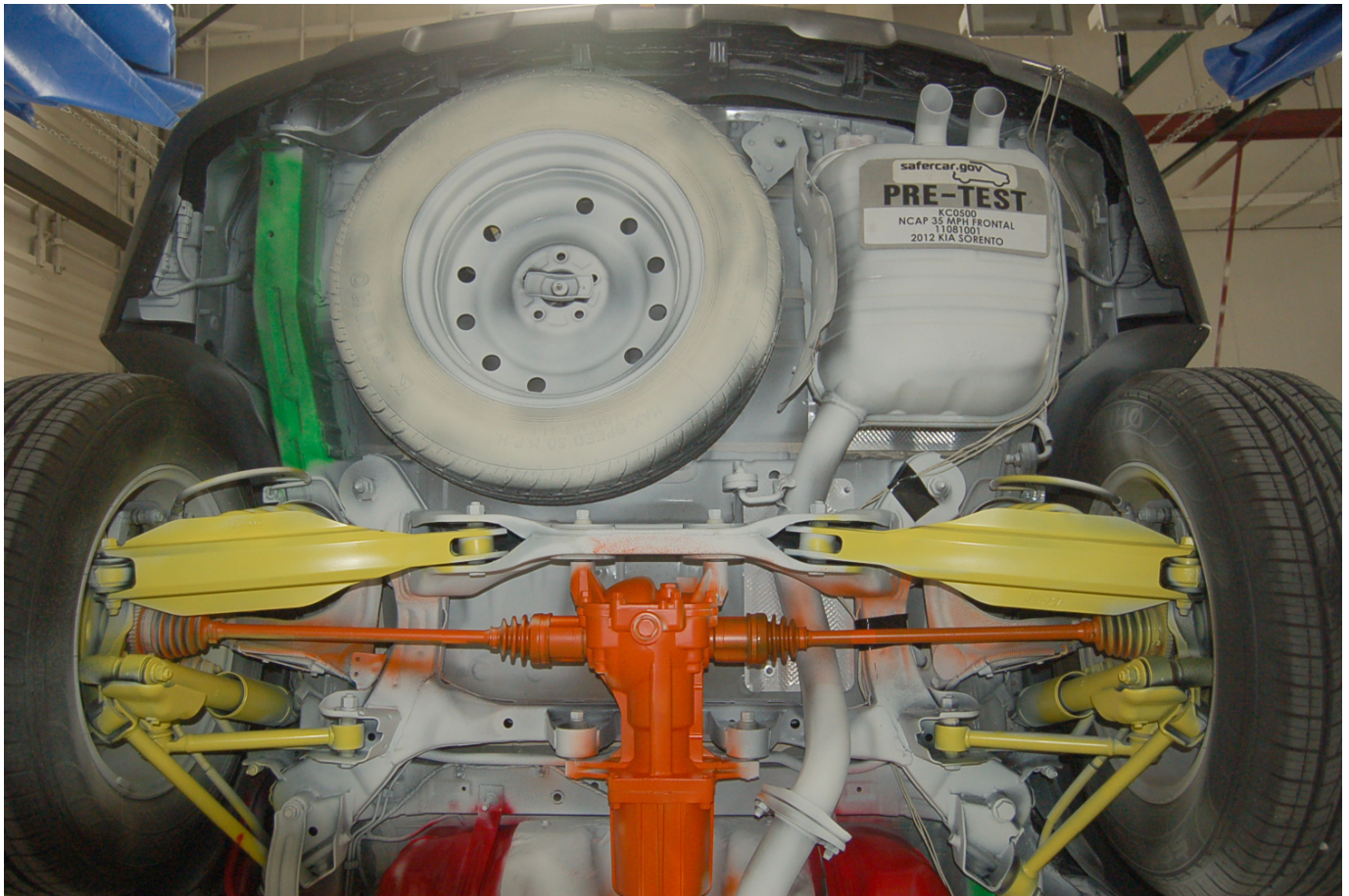
Post-Test Mid Front Underbody View



Pre-Test Mid Rear Underbody View



Post-Test Mid Rear Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View



Pre-Test Dummy Cable Routing



Post-Test Dummy Cable Routing



Pre-Test Driver Dummy Front View



Post-Test Driver Dummy Front View



Pre-Test Driver Dummy Window View



Post-Test Driver Dummy Window View



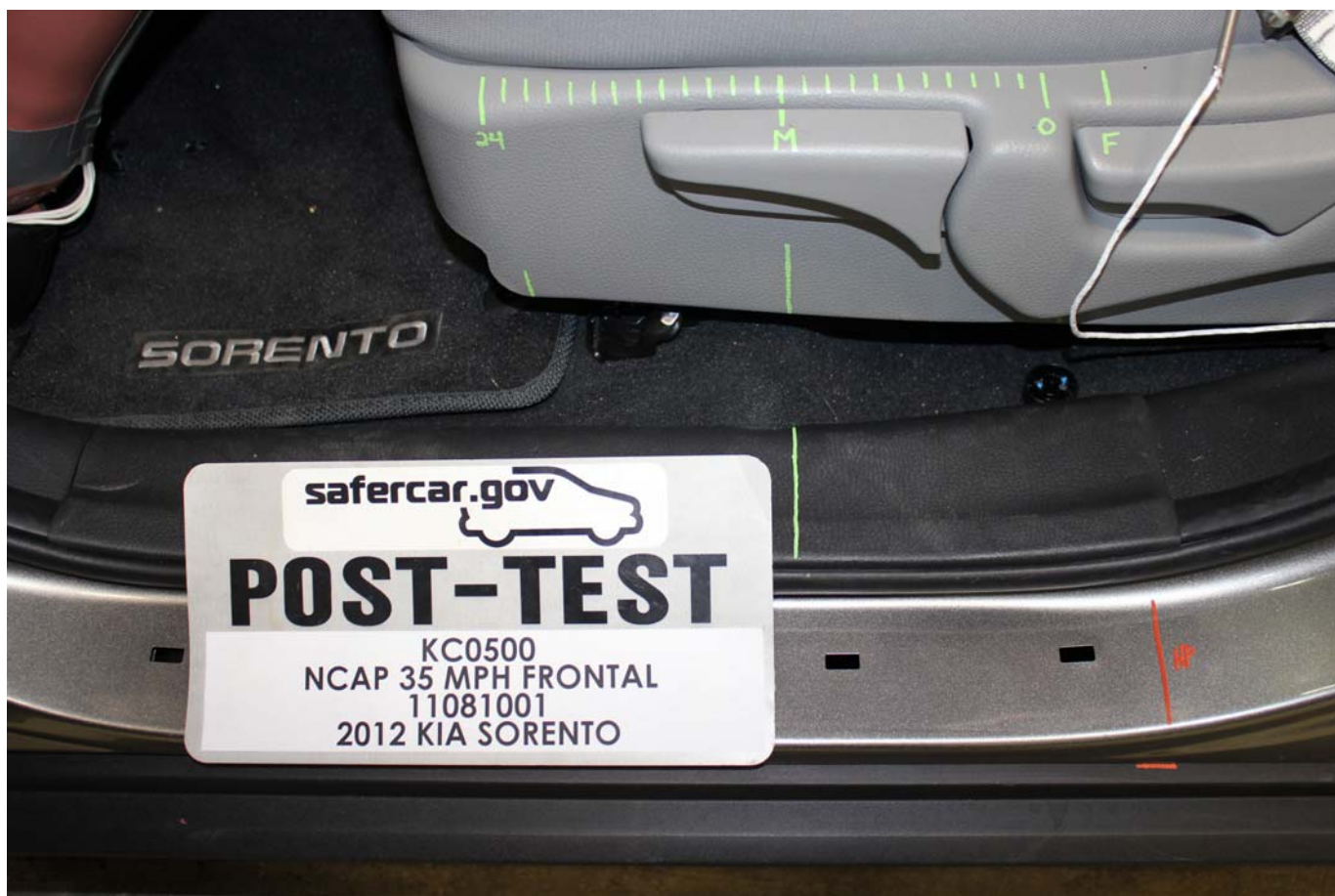
Pre-Test Driver Dummy and Vehicle Interior (Door Open)



Post-Test Driver Dummy and Vehicle Interior (Door Open)



Pre-Test Driver's Seat Fore-Aft Markings



Post-Test Driver's Seat Fore-Aft Markings



Pre-Test Driver Dummy Feet



Post-Test Driver Dummy Feet



Pre-Test Driver's Side Knee Bolster (without dummy)



Post-Test Driver's Side Knee Bolster (without dummy)



Pre-Test Driver's Side Floorpan



Post-Test Driver's Side Floorpan



Post-Test Driver Dummy Contact with Airbag



Post-Test Driver Dummy Contact with Headrest



Post-Test Driver Dummy Contact with Knee Bolster



Pre-Test View of Steering Column Shear Capsule



Post-Test View of Steering Column Shear Capsule



Pre-Test Passenger Dummy Front View



Post-Test Passenger Dummy Front View



Pre-Test Passenger Dummy Window View



Post-Test Passenger Dummy Window View



Pre-Test Passenger Dummy and Vehicle Interior (Door Open)



Post-Test Passenger Dummy and Vehicle Interior (Door Open)



Pre-Test Passenger's Seat Fore-Aft Markings



Post-Test Passenger's Seat Fore-Aft Markings



Pre-Test Passenger Dummy Feet



Post-Test Passenger Dummy Feet



Pre-Test Passenger's Side Knee Bolster (without dummy)



Post-Test Passenger's Side Knee Bolster (without dummy)



Pre-Test Passenger's Side Floorpan



Post-Test Passenger's Side Floorpan



Post-Test Passenger Dummy Contact with Airbag



Post-Test Passenger Dummy Contact with Headrest



Post-Test Passenger Dummy Contact with Glovebox



Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

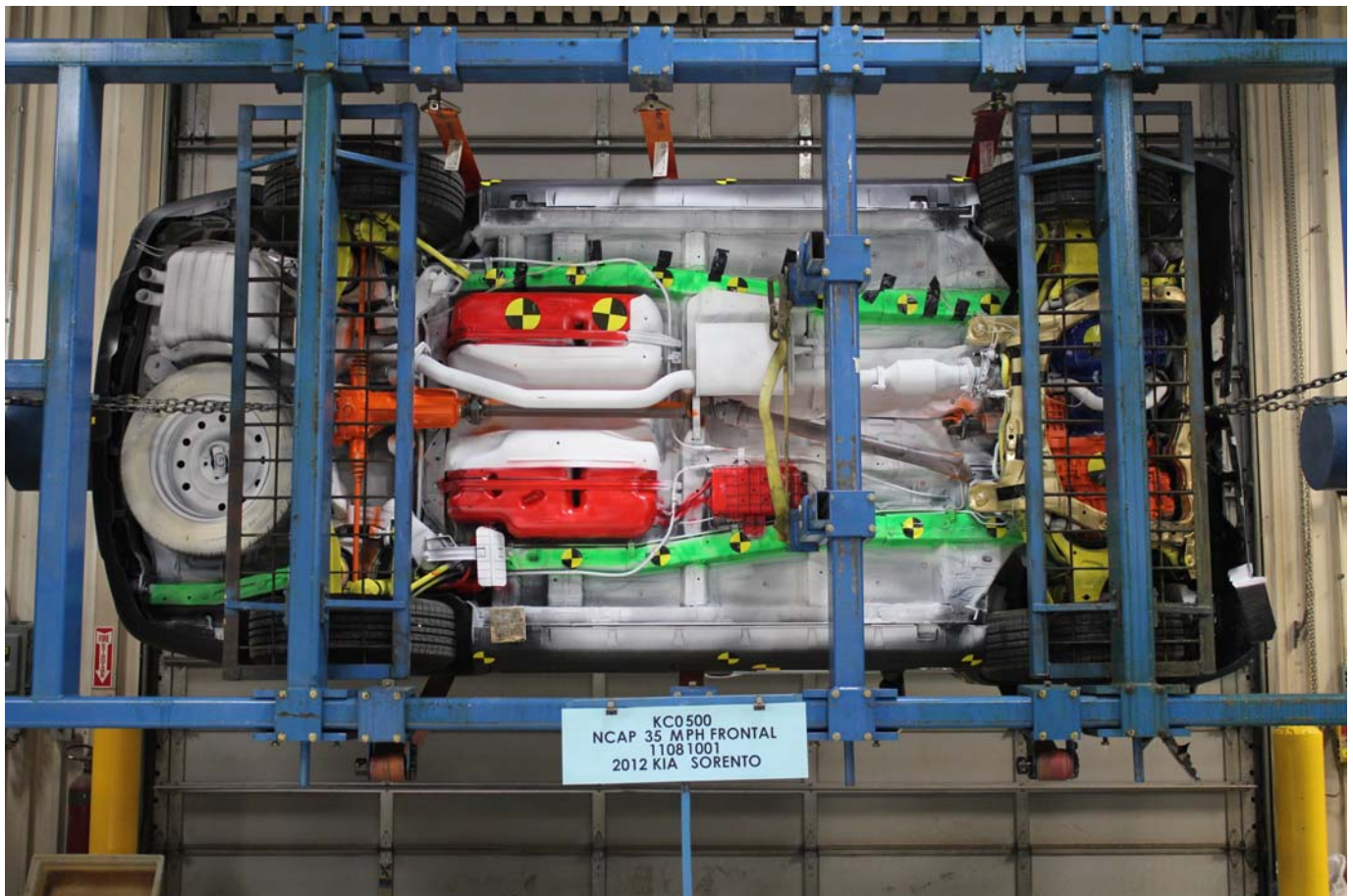
Post-Test Stoddard Solvent Spillage Location View



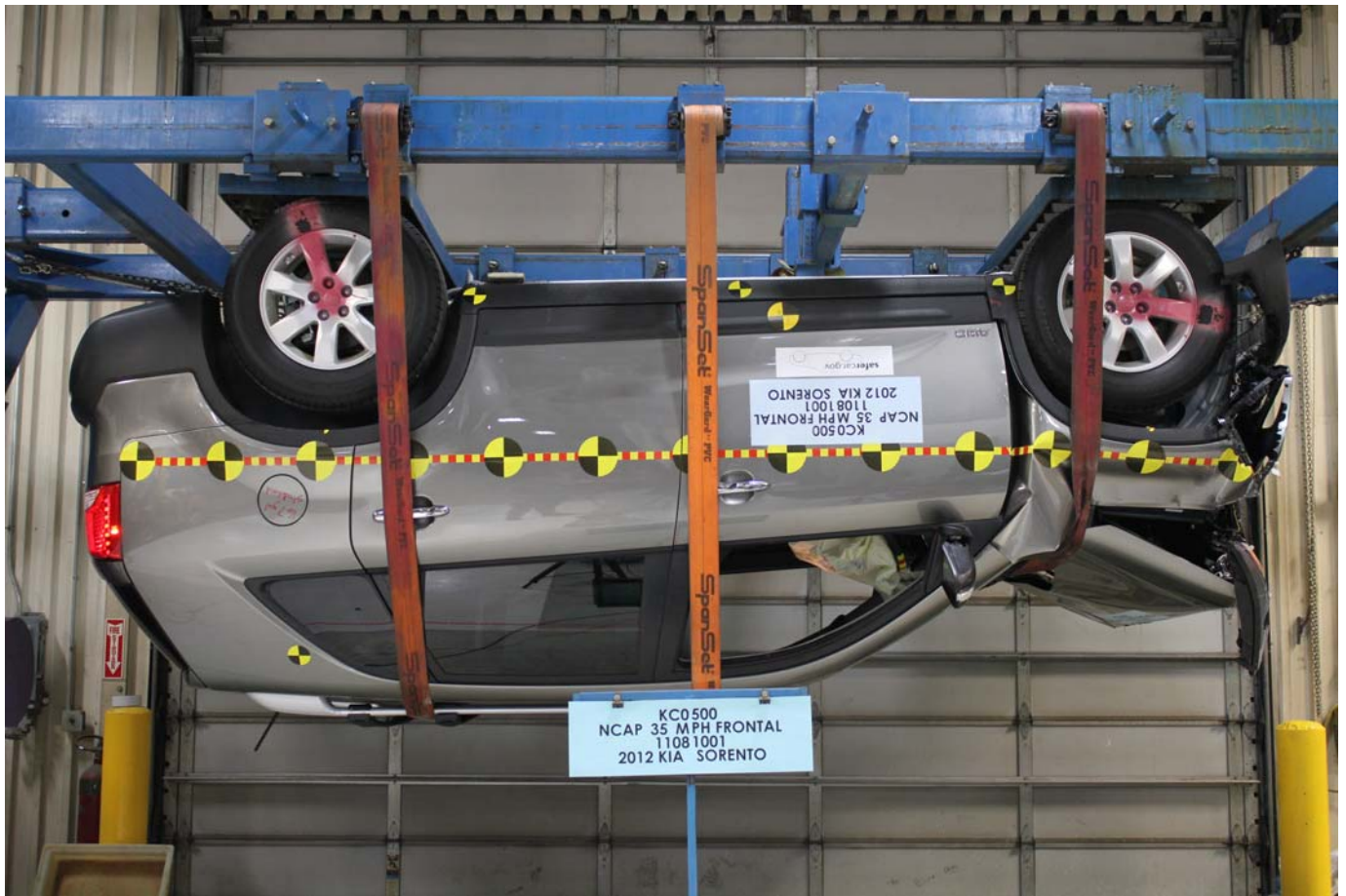
Post-Test Speed Trap Read-Out



Vehicle at 0 Degrees on Static Rollover Device



Vehicle at 90 Degrees on Static Rollover Device



Vehicle at 180 Degrees on Static Rollover Device



Vehicle at 270 Degrees on Static Rollover Device



Vehicle at 360 Degrees on Static Rollover Device



Vehicle Impact

2012 / 7422 KIA SORENTO LX AWD		SOLD TO:		SHIP TO:	
		MODEL YEAR: 2012 MODEL: 7422 MODEL DESCRIPTION: KIA SORENTO LX AWD		W008 PALMEN KIA OF KENOSHA 5301 75TH STREET 5431 75TH STREET KENOSHA WI 53142	
EXTERIOR / INTERIOR COLOR: TITANIUM SILVER/GRAY VEHICLE NUMBER: 5XYKTD21CG209642 ENGINE NUMBER: G6DCBS66 WEST POINT MODE OF TRANSPORTATION: TRUCK		W008 PALMEN KIA OF KENOSHA 5301 75TH STREET 5431 75TH STREET KENOSHA WI 53142			
STANDARD FEATURES MECHANICAL 3.5L 24 Valve DOHC CVT V6 Engine 6-Speed Automatic Transmission w/ Sportmatic Independent Front and Rear Suspension All Wheel Drive w/ Locking Center Differential Alloy Wheels SAFETY Dual Front Advanced Airbags Front Seat-Mounted Side Airbags Side Curtain Airbags (1st & 2nd Row) Front Active Headrests Lower Anchors and Tethers for Children (LATCH) Anti-Lock Brake System (ABS) Traction Control System (TCS) Electronic Stability Control (ESC) Downhill Brake/Hill-start Assist Control (DBC/HAC) Tire Pressure Monitoring System (TPMS) INTERIOR Air Conditioning Power Windows, Door Locks & Outside Mirrors AM/FM/CD/MP3 SIRIUS Satellite Radio w/ free 3-mo. subscription** USB/Auxiliary Input Jacks BLUETOOTH® WIRELESS TECHNOLOGY 60/40 Split Folding and Reclining Rear Seats YES Essentials Seat Fabric Material Rear Center Armrest with Cupholders Remote Keyless Entry Cruise Control Steering Wheel Controls (Bluetooth/Audio/Cruise) Tilt and Telescopic Steering Column Dual Illuminated Visor Vanity Mirrors ECOMINDER™ Indicator EXTERIOR Privacy Glass Heated Outside Mirrors w/ Turn Signal Indicators Roof Rails WARRANTY 10 Year/100,000 Mile Limited Powertrain Warranty 5 Year/60,000 Mile Limited Basic Warranty 5 Year/60,000 Mile Roadside Assistance ** Ask dealer for details		MANUFACTURER'S SUGGESTED RETAIL PRICE ADDITIONAL INSTALLED EQUIPMENT: (In addition to or in place of standard features) Convenience Package * Back-Up Warning System * Auto-dimming Mirror w/Display Camera * Heated Front Seats * Front Fog Lights 50/50 Split Folding 3rd Row Seat Cross Bars (Black) Carpeted Floor Mats Cargo Cover \$26,650.00 \$1,500.00 \$800.00 \$195.00 \$125.00 \$125.00			
MSRP INCLUDING OPTIONS INLAND FREIGHT AND HANDLING \$29,395.00 \$800.00		TOTAL MANUFACTURER'S SUGGESTED RETAIL PRICE \$30,195.00 Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service, license and title fees, state and local taxes and other dealer installed options and accessories are not included in the manufacturer's suggested retail price.			
TOTAL ADDITIONAL WEIGHT: 22.4					

18 CITY MPG
24 HIGHWAY MPG
20 COMBINED MPG
Estimated Annual Fuel Cost \$2250.00
 based on 15,000 miles at \$3.00 per gallon
14 to 22 MPG Expected range for most drivers
19 to 29 MPG Expected range for most drivers
20 This Vehicle
32 ALL SUVS
 Your actual mileage will vary depending on how you drive and maintain your vehicle.

EPA Fuel Economy Estimates
 These estimates reflect new EPA methods beginning with 2008 models.

GOVERNMENT SAFETY RATINGS
 See the FREE Fuel Economy Guide at dealers or www.fueleconomy.gov

PARTS CONTENT INFORMATION
FOR VEHICLES IN THIS CAR LINE U.S./CANADIAN PARTS CONTENT: 56%
MAJOR SOURCES OF FOREIGN PARTS:
 KOREA: 44%
 NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.
FOR THIS VEHICLE FINAL ASSEMBLY POINT: USA
COUNTRY OF ORIGIN ENGINE: KOREA
TRANSMISSION: USA

Environmental Performance
 Protect the environment, choose vehicles with higher scores:
Global Warming Score
 1 2 3 4 5 6 7 8 9 10
 Average new vehicle
 Cleanest
Smog Score
 1 2 3 4 5 6 7 8 9 10
 Average new vehicle
 Cleanest
 Using alternative fuels may improve scores. See www.DriveClean.ca.gov
 Vehicle emissions are a primary contributor to global warming and smog. Scores are determined by the California Air Resources Board based on this vehicle's measured emissions. Please visit www.DriveClean.ca.gov for more information. **AIR RESOURCES BOARD**

Monroney Label

APPENDIX B
DUMMY RESPONSE DATA

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

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

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 Shoulder Belt Force

Driver Lap Belt Force

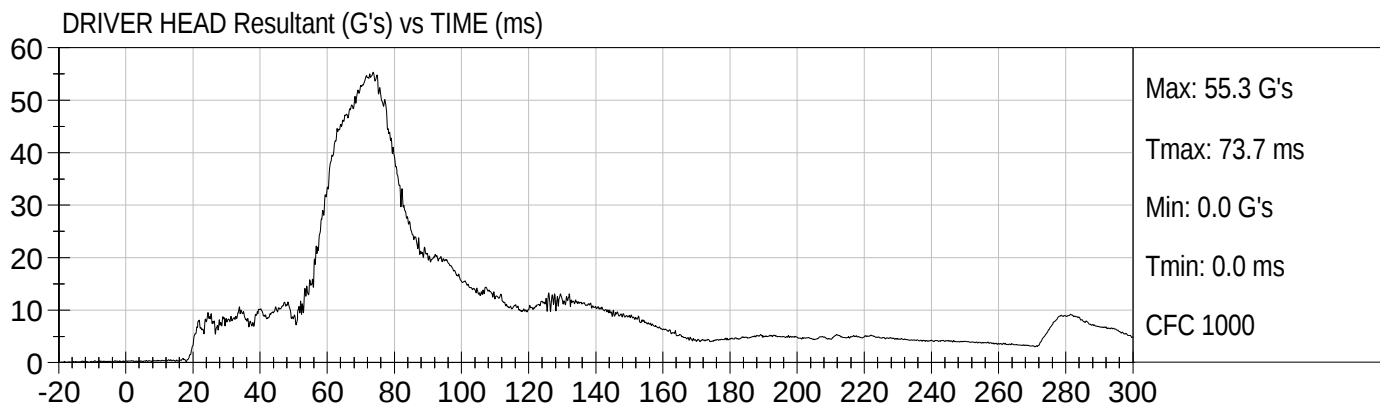
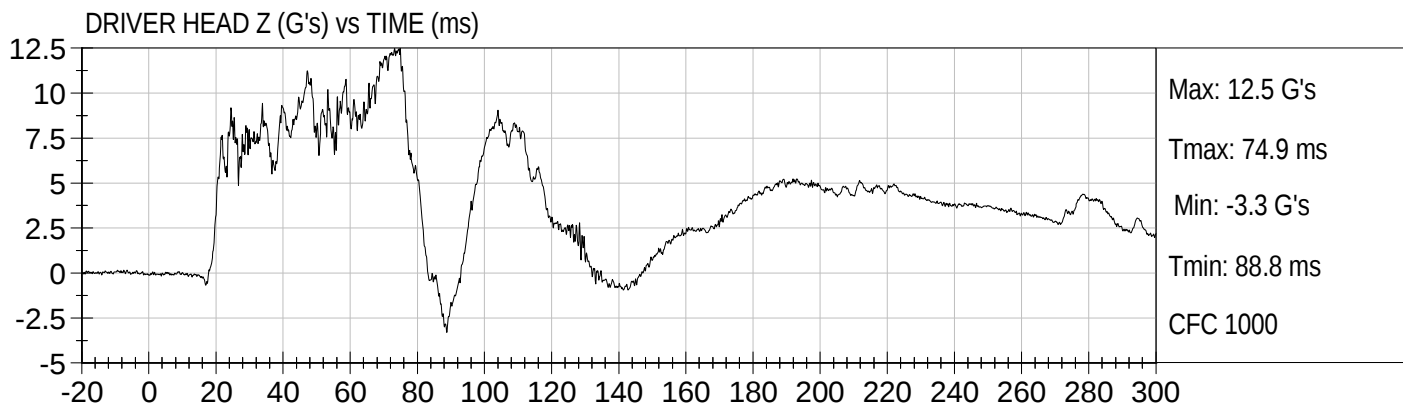
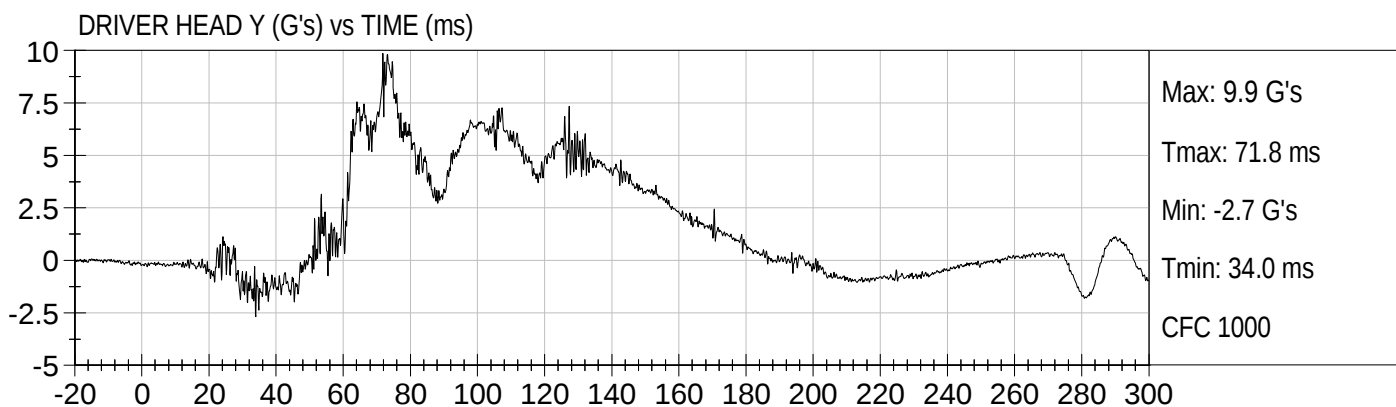
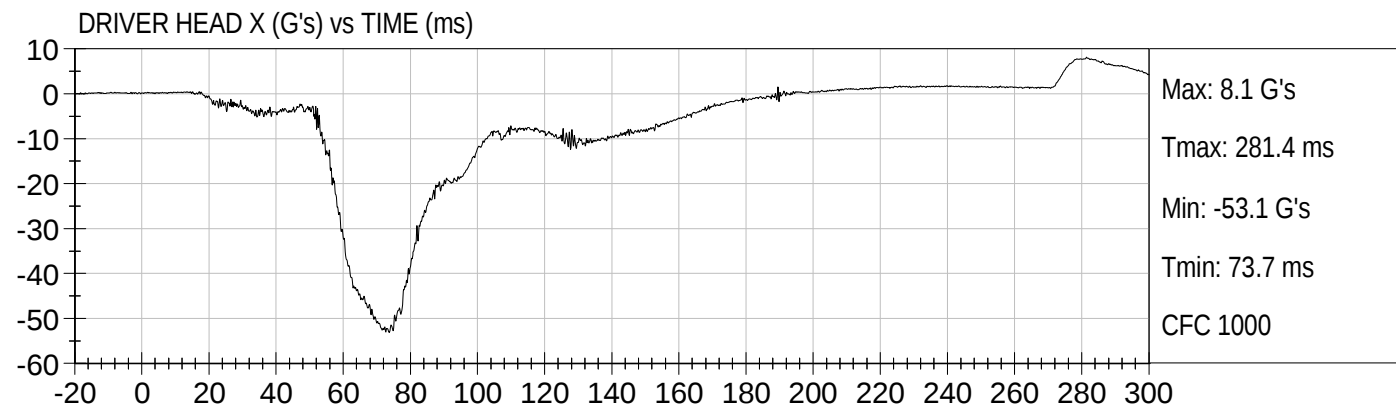
Driver Left Upper Tibia Moment X

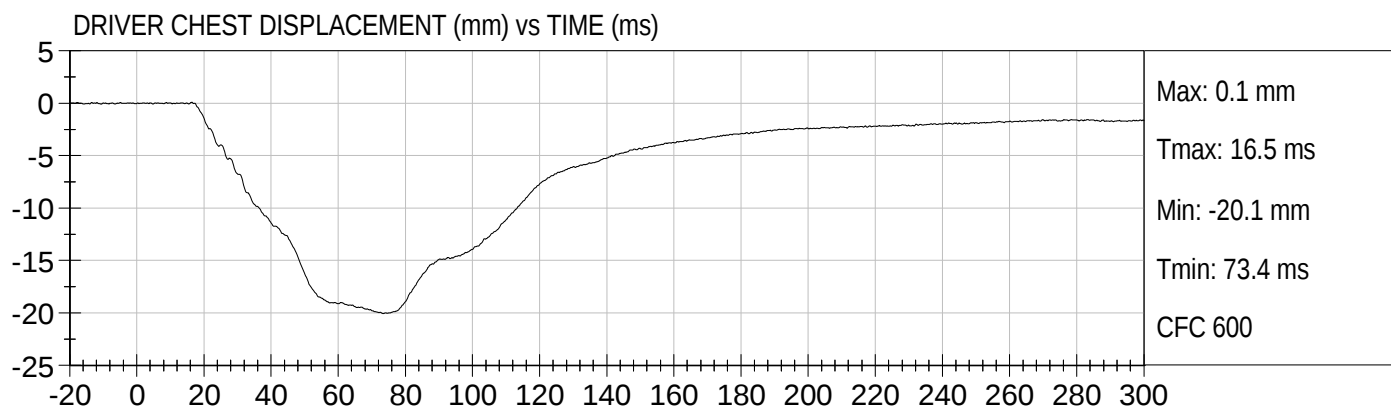
Driver Left Upper Tibia Moment Y

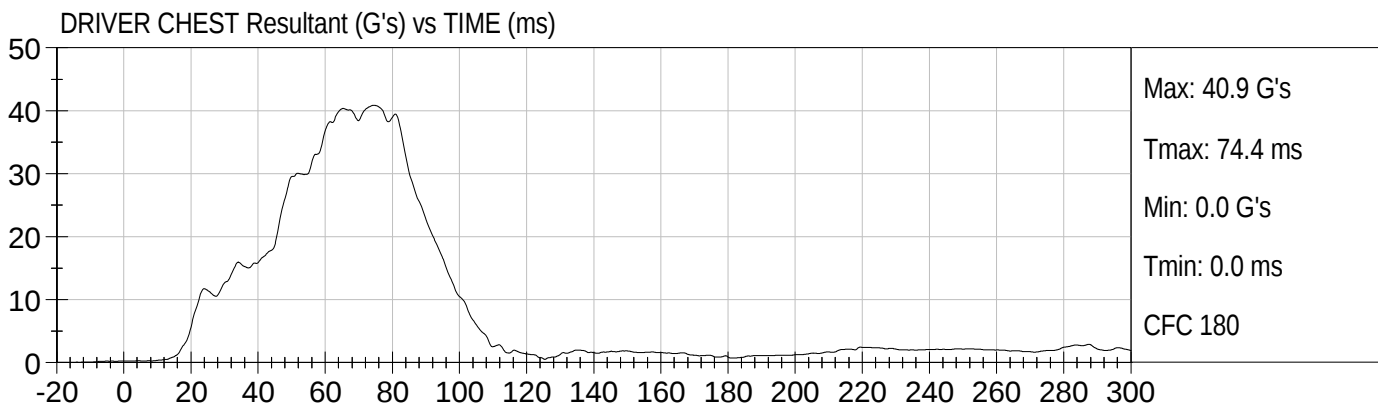
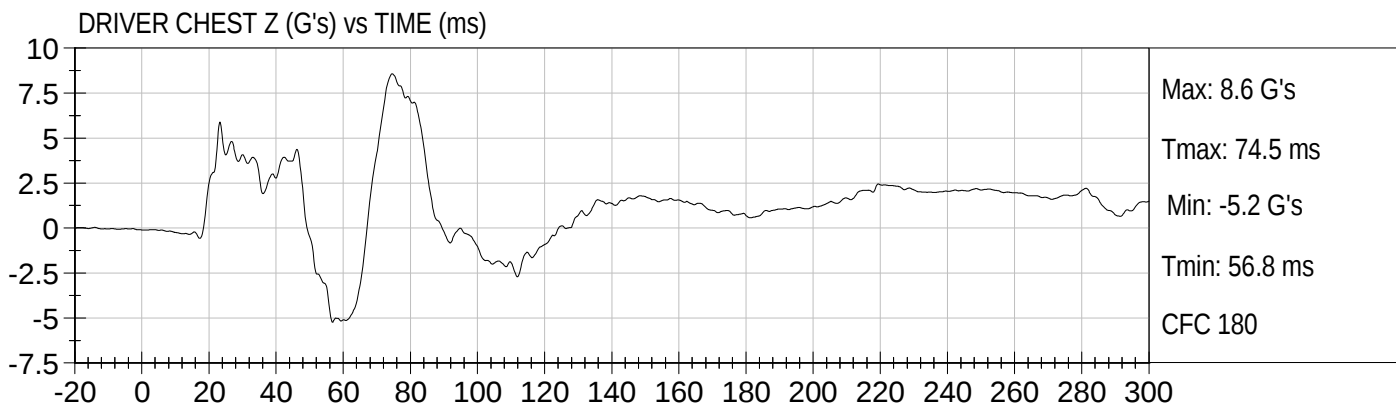
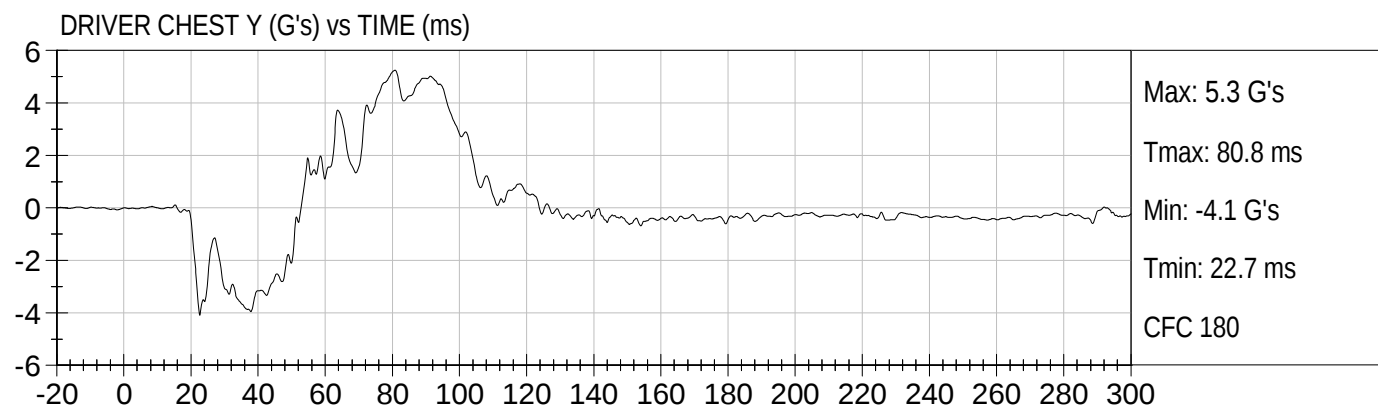
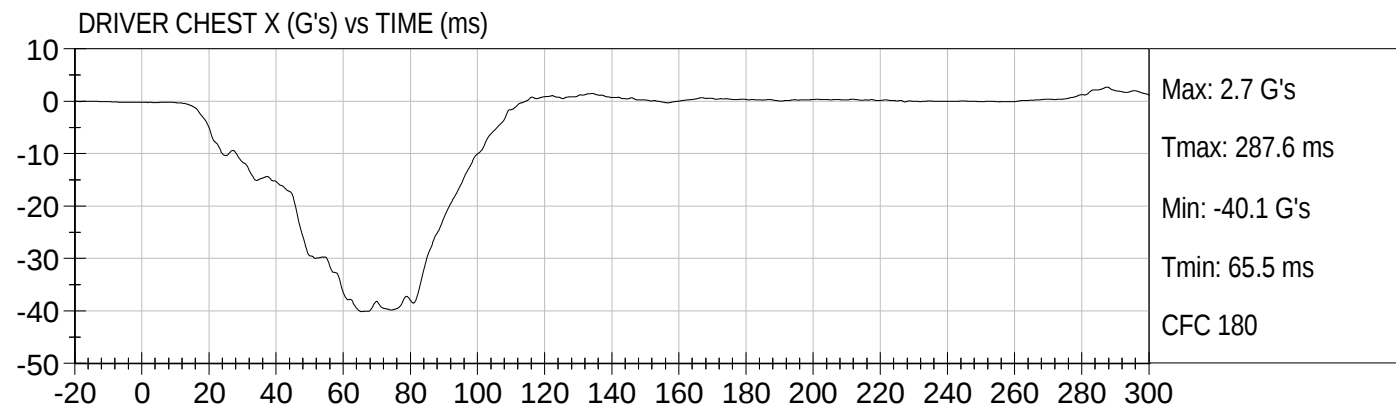
Driver Left Upper Tibia Force Z

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
Passenger Head X Redundant
Passenger Head Y Redundant
Passenger Head Z Redundant
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 Lap Belt Force
Passenger Shoulder Belt Force – not installed

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
Left Rear Seat Crossmember X
Left Rear Seat Crossmember Z
Right Rear Seat Crossmember X
Right Rear Seat Crossmember Z
Vehicle Engine Top X
Vehicle Engine Bottom X
Vehicle Left Brake Caliper X
Vehicle Right Brake Caliper X
Advanced Research Load Cell Barrier – 128 channels

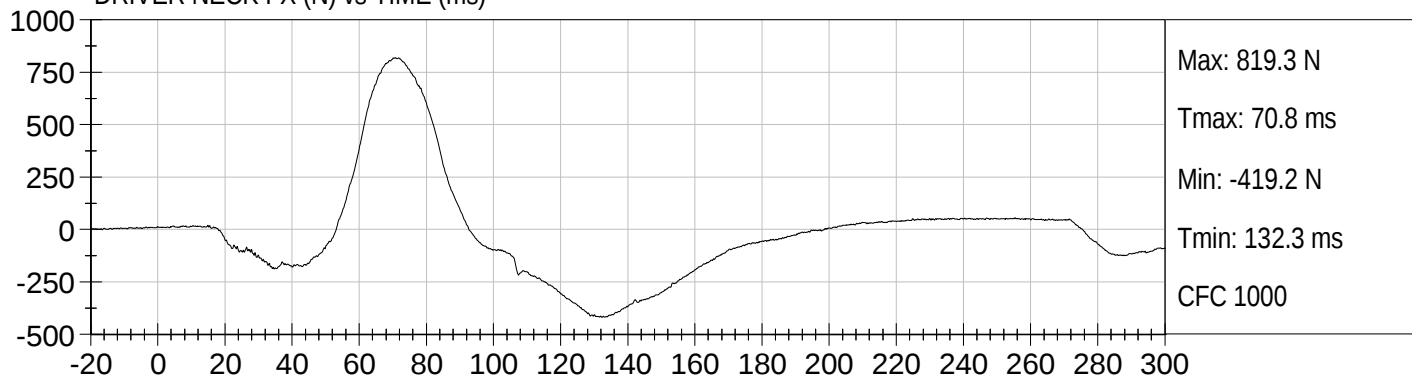




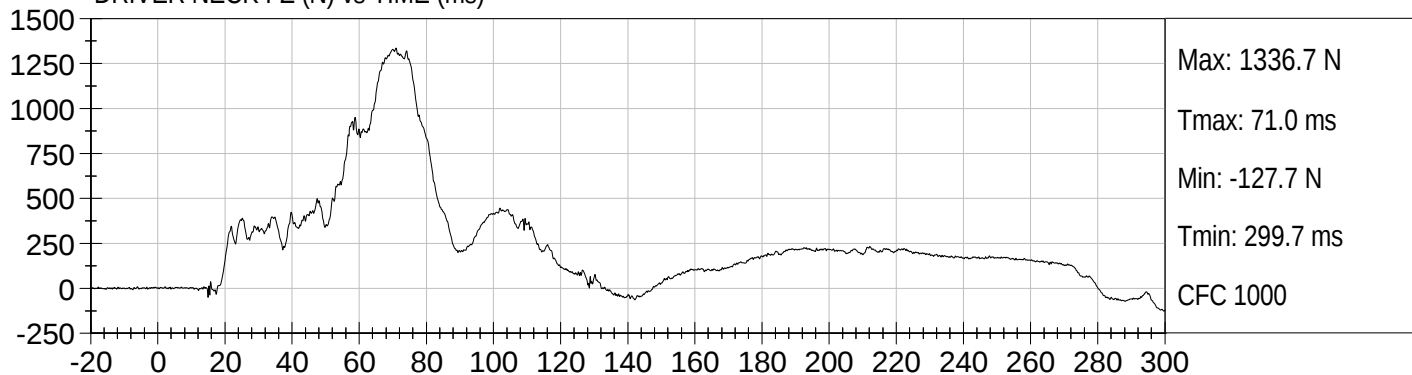




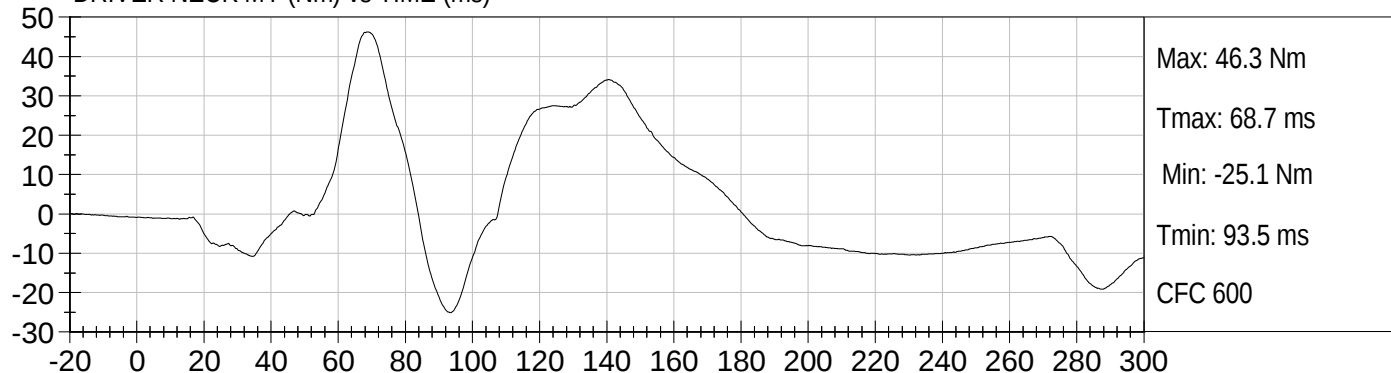
DRIVER NECK FX (N) vs TIME (ms)

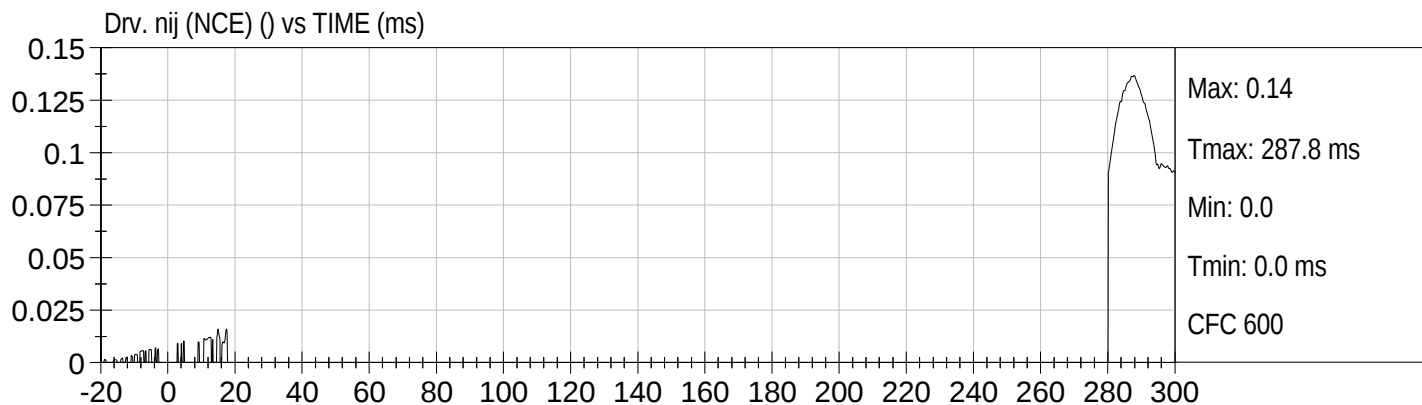
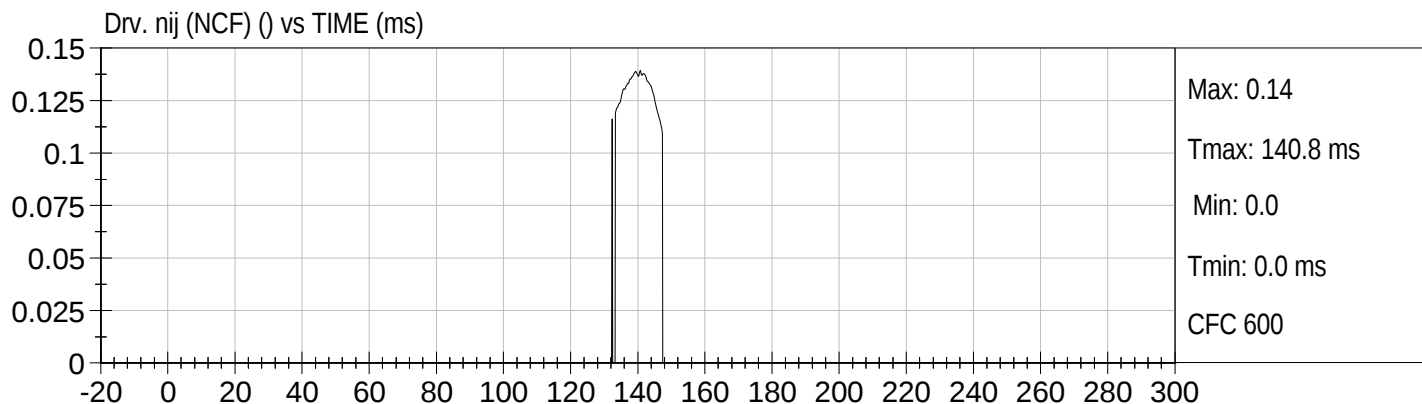
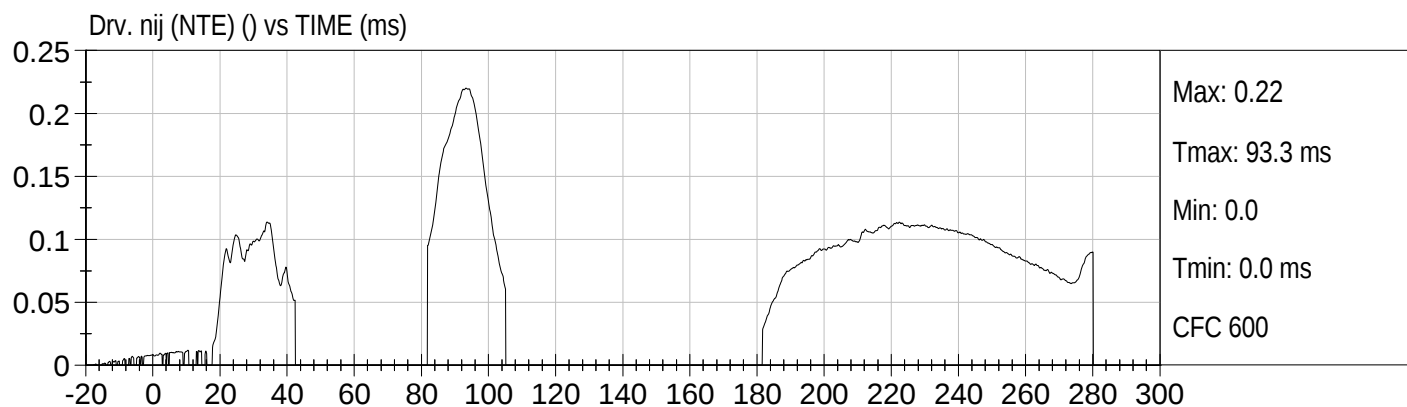
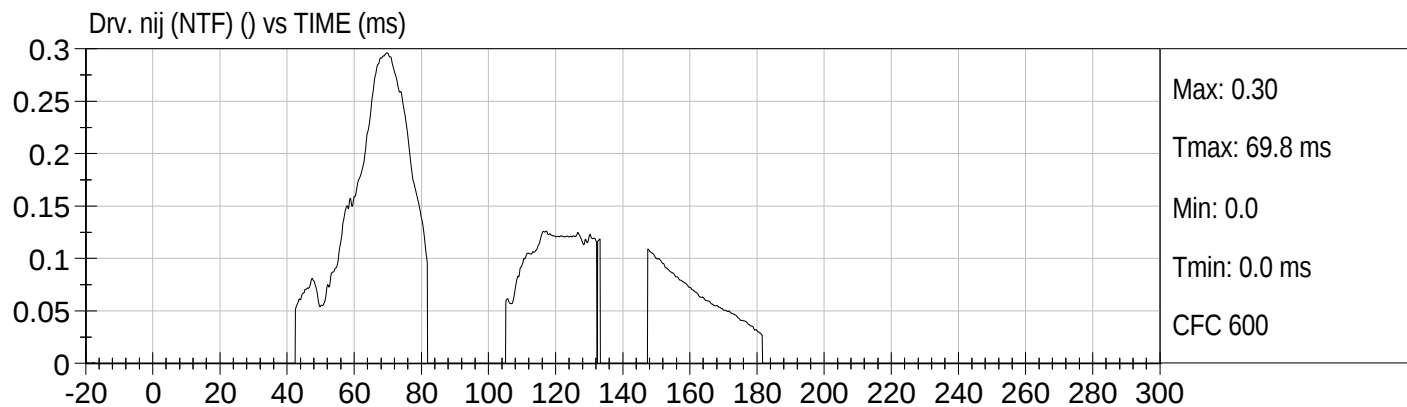


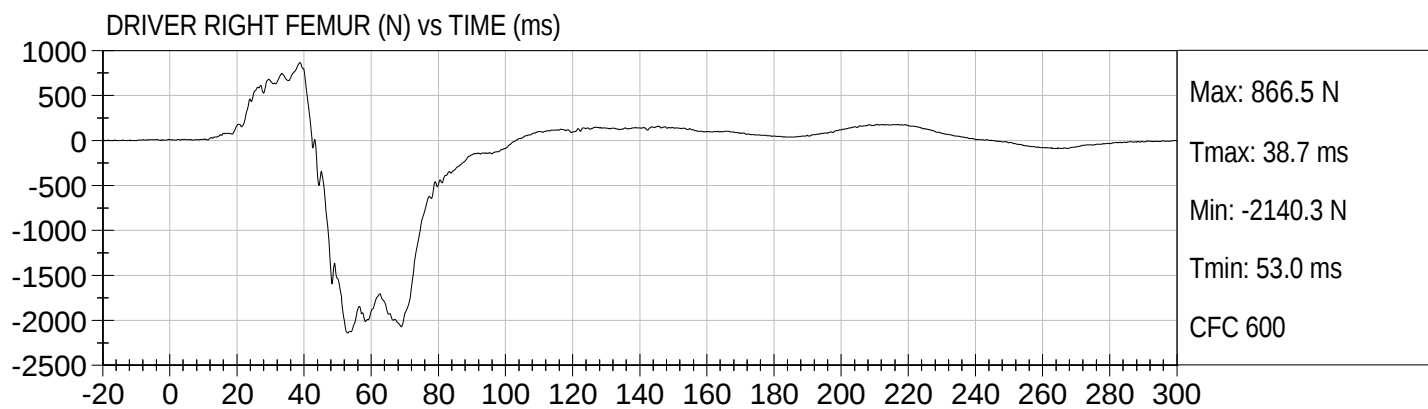
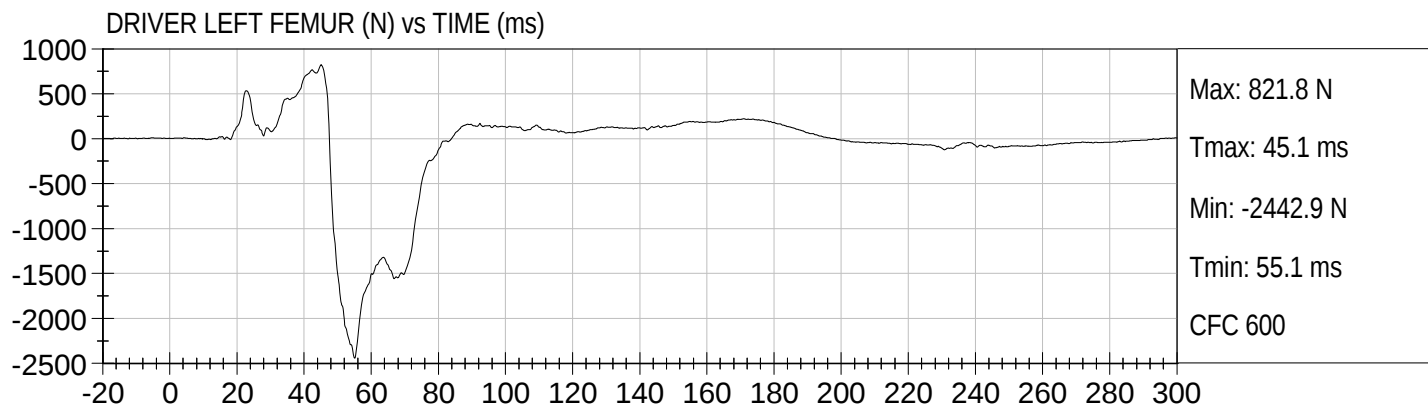
DRIVER NECK FZ (N) vs TIME (ms)

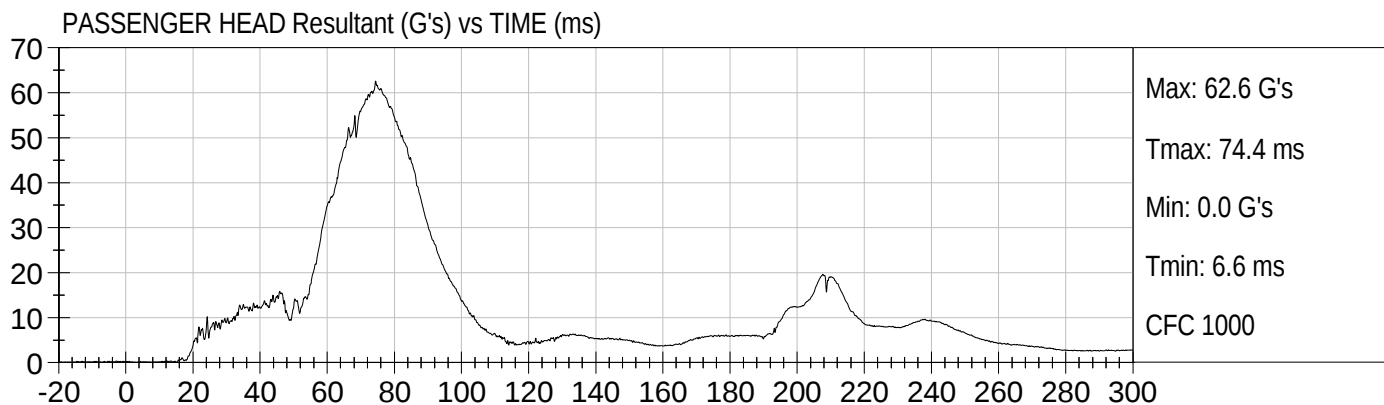
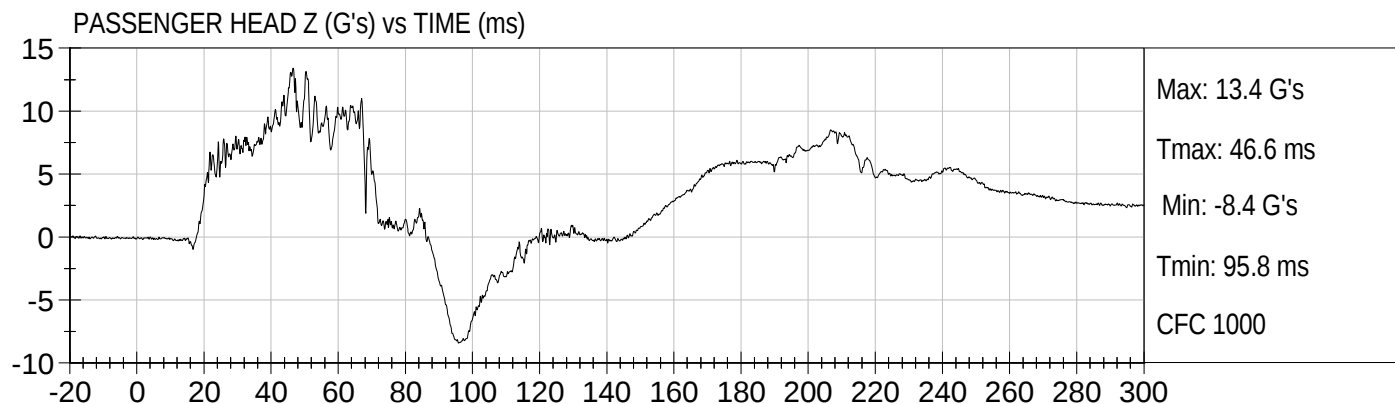
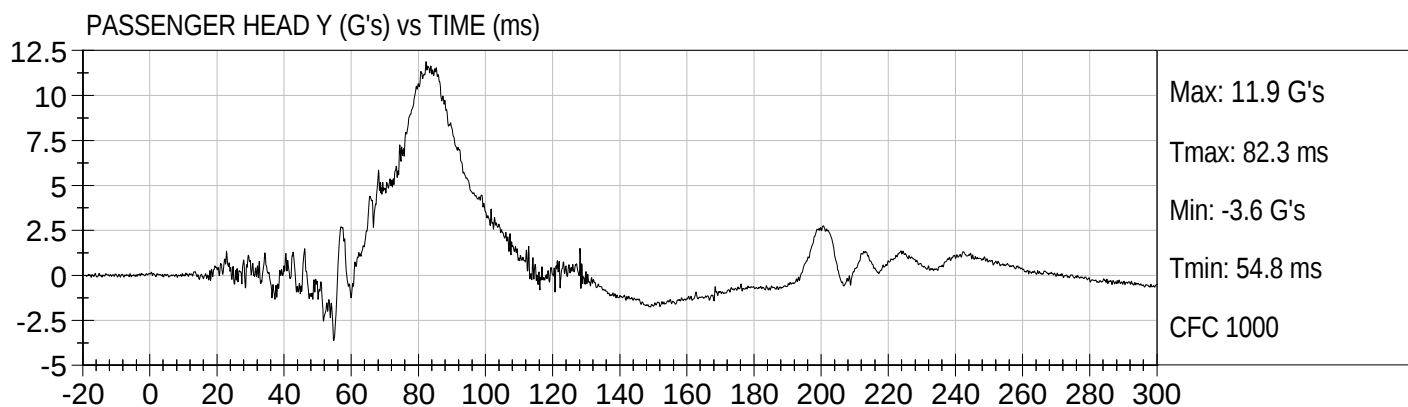
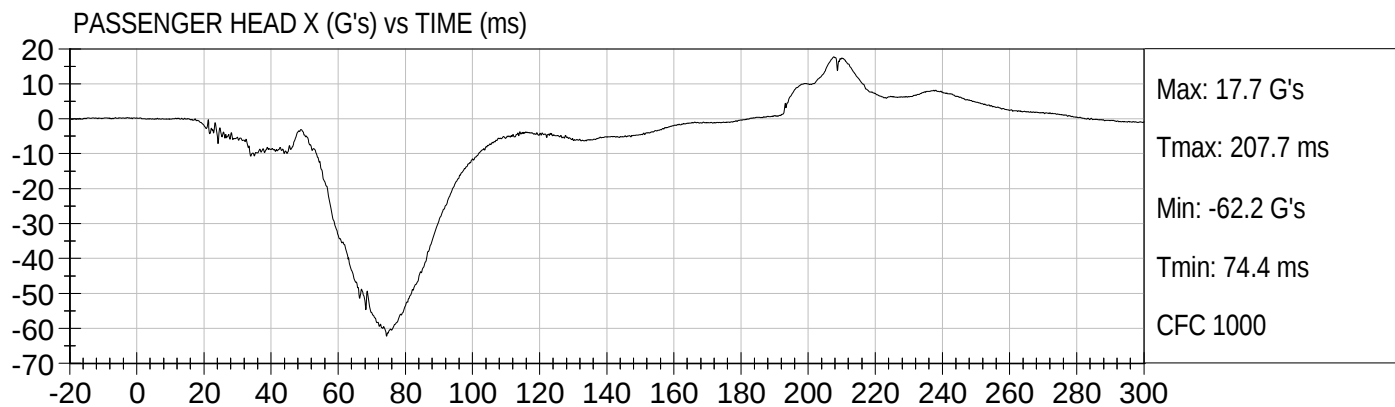


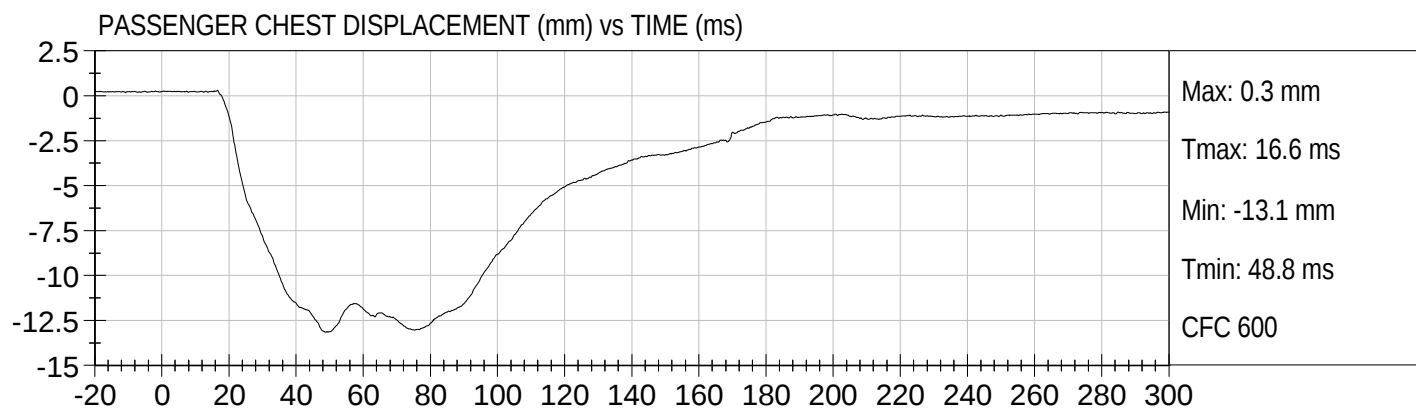
DRIVER NECK MY (Nm) vs TIME (ms)

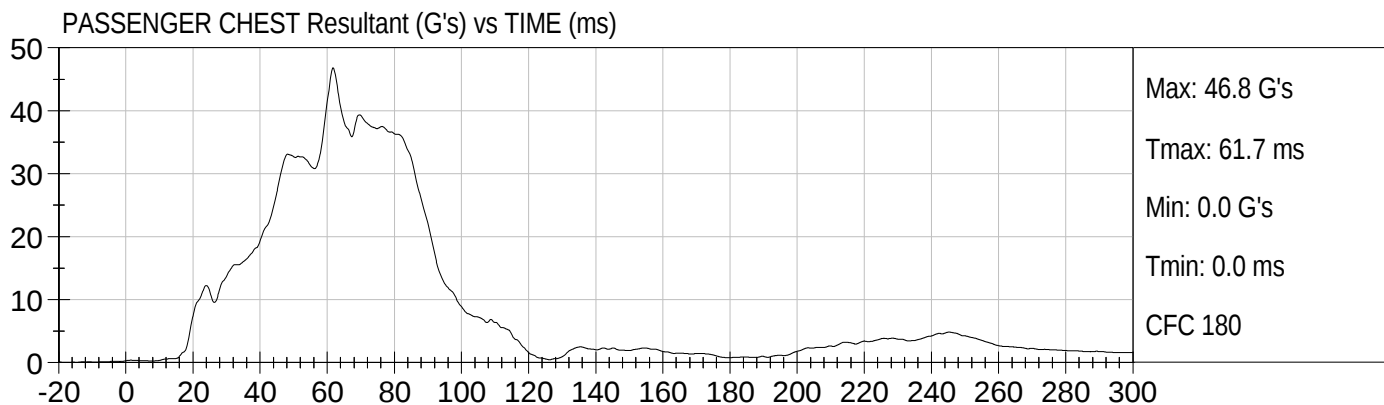
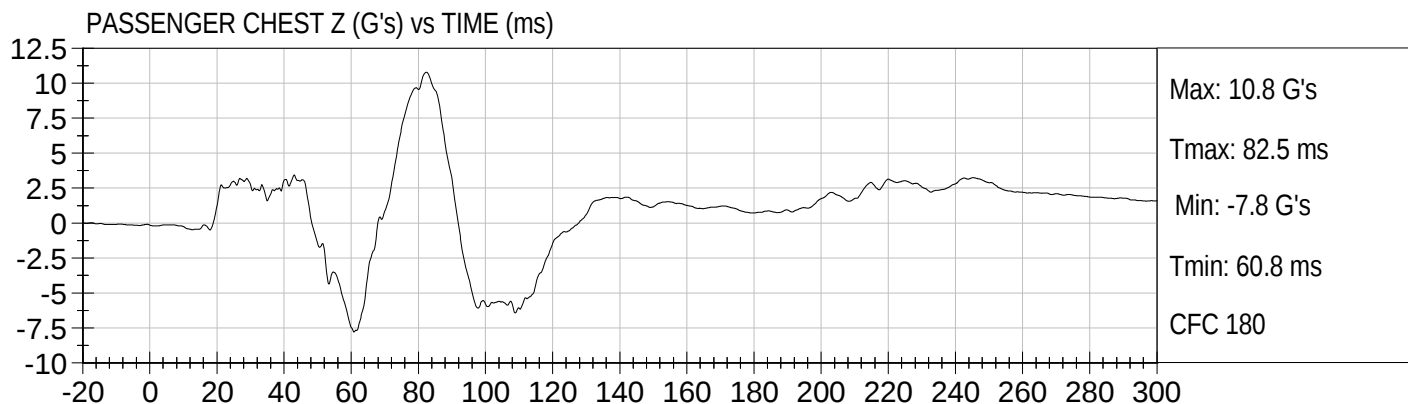
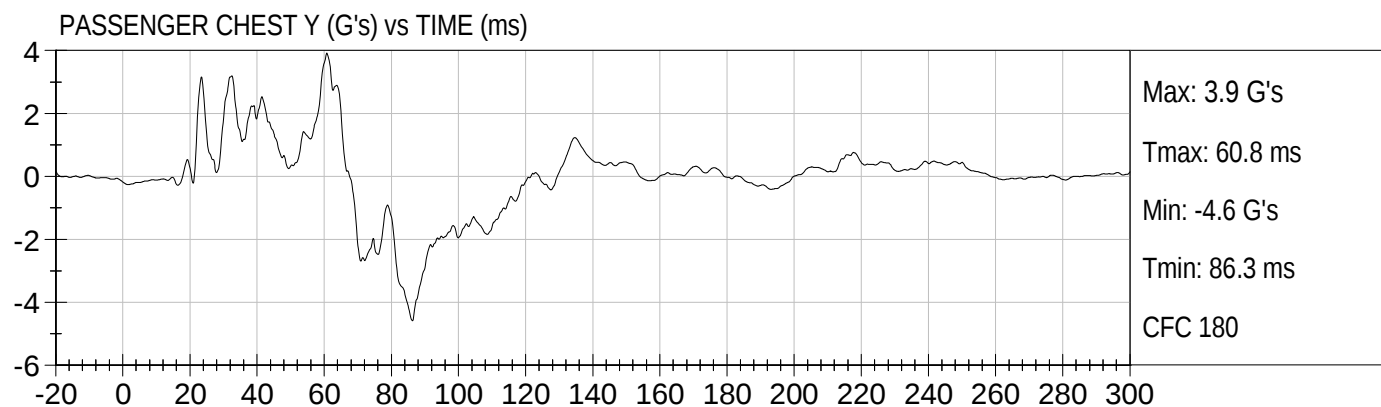
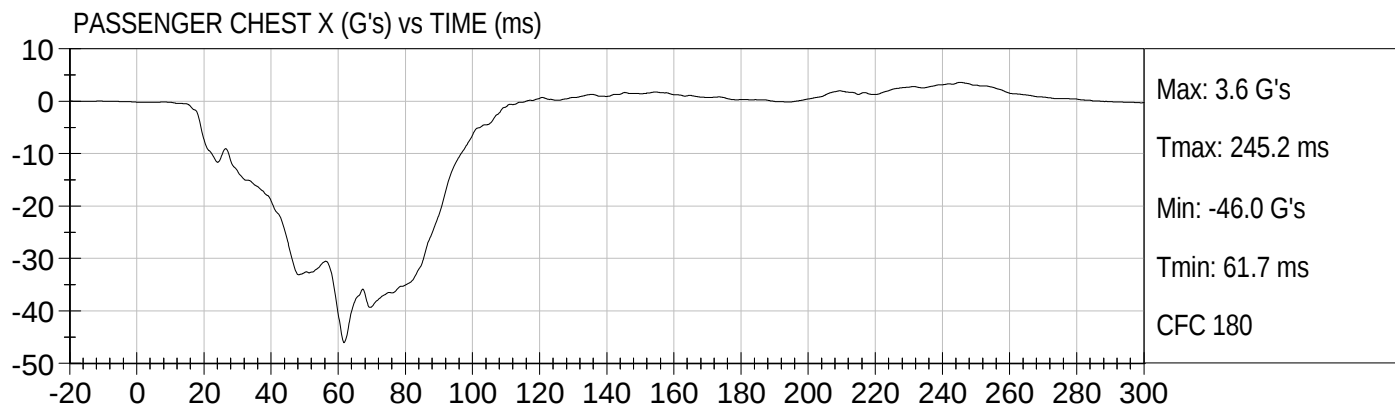


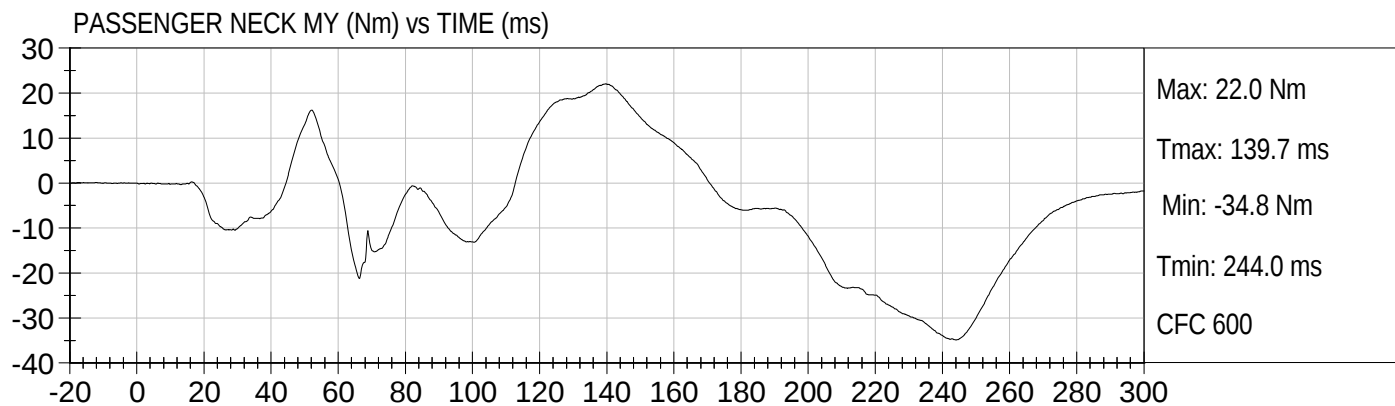
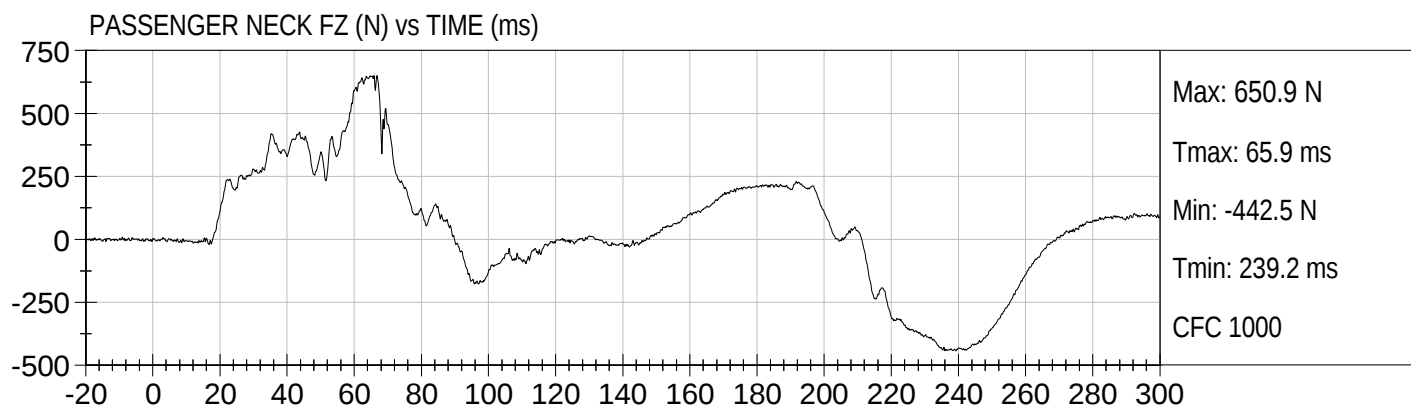
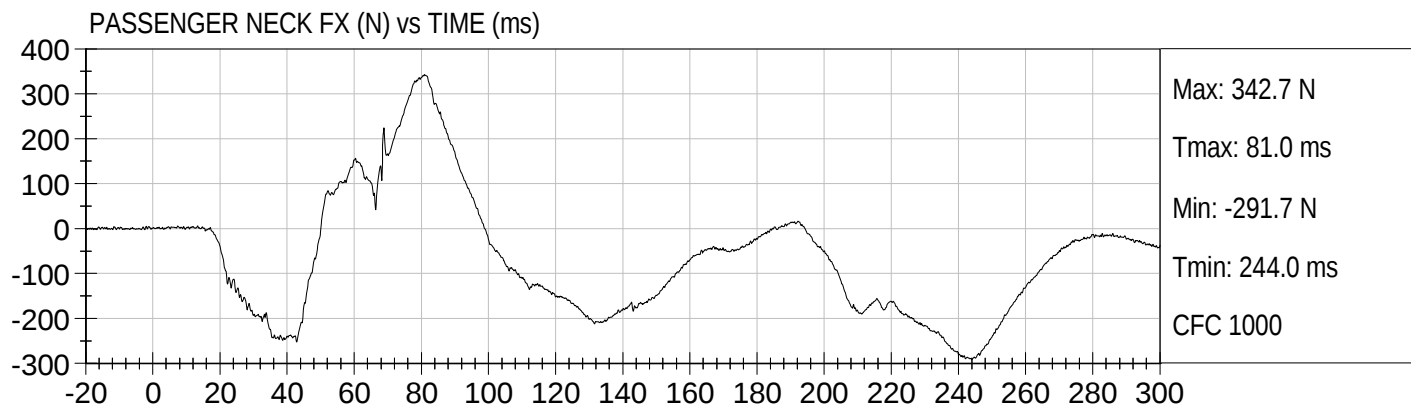


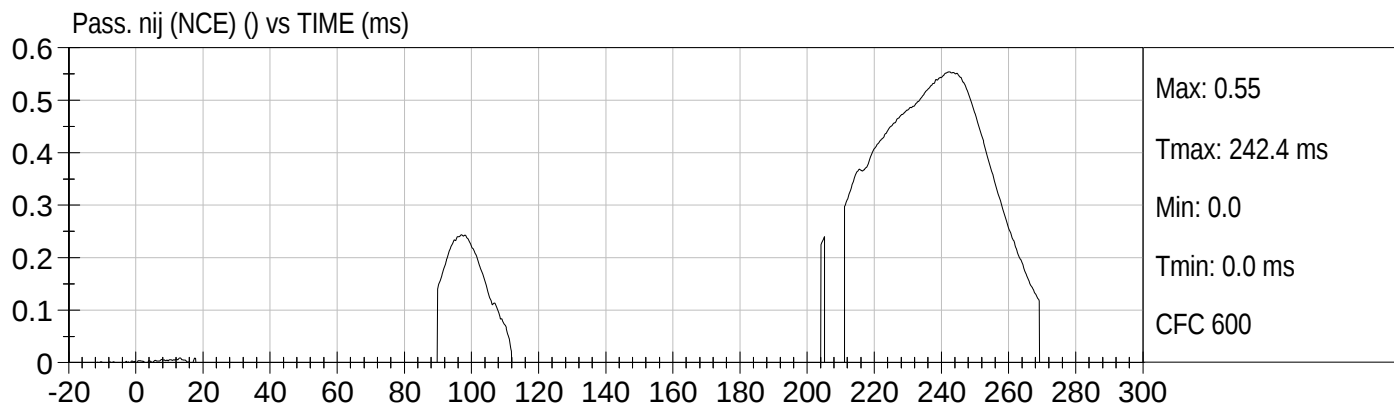
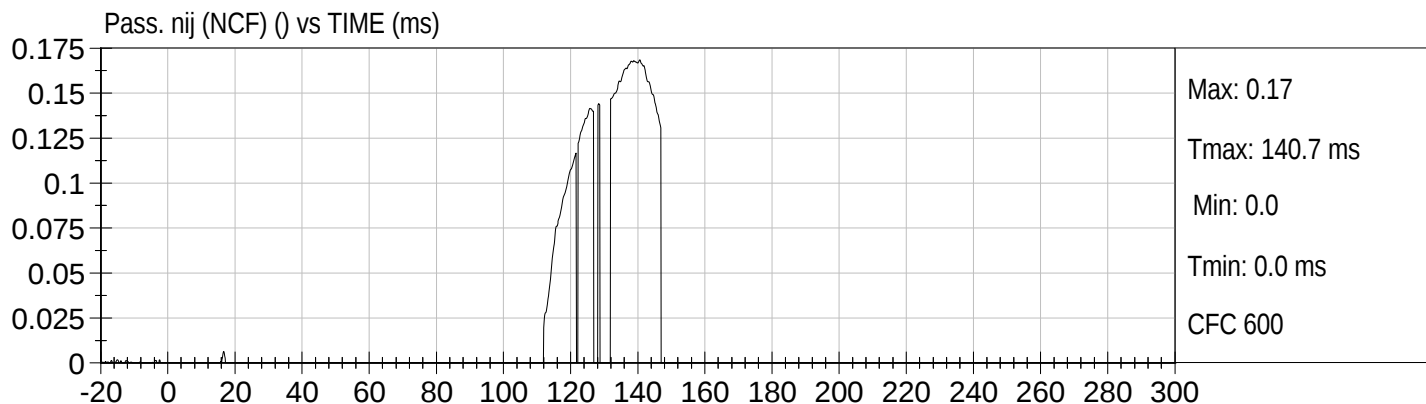
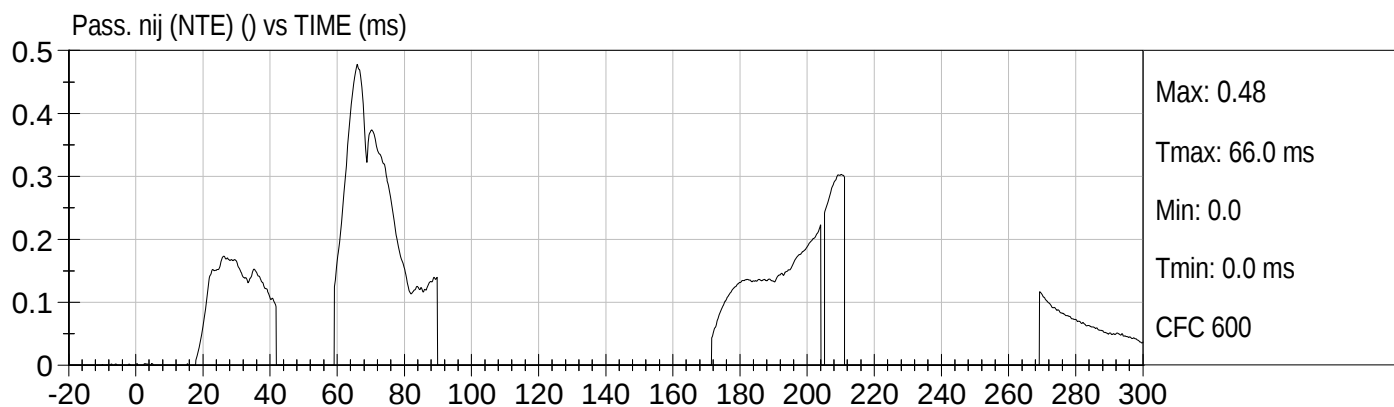
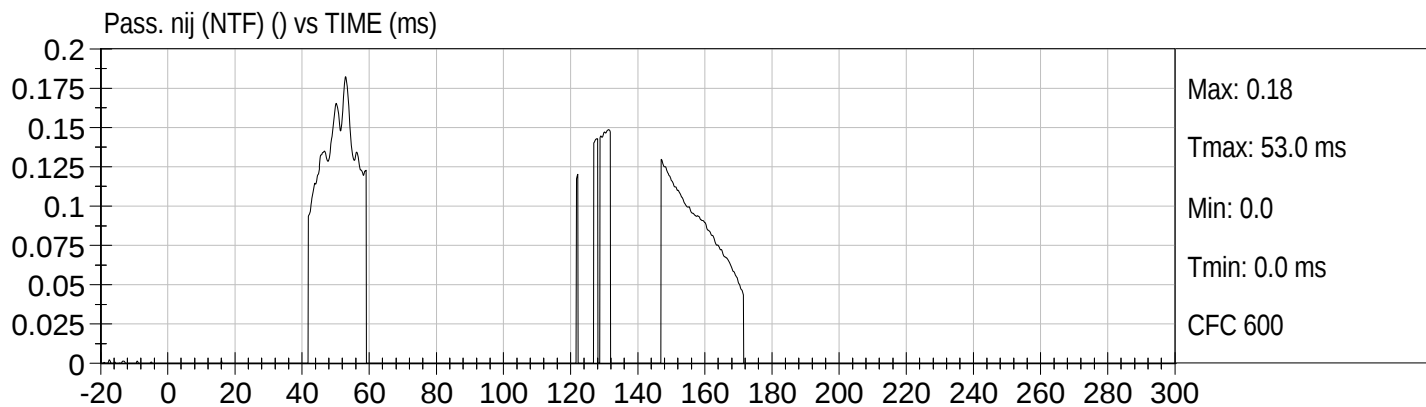


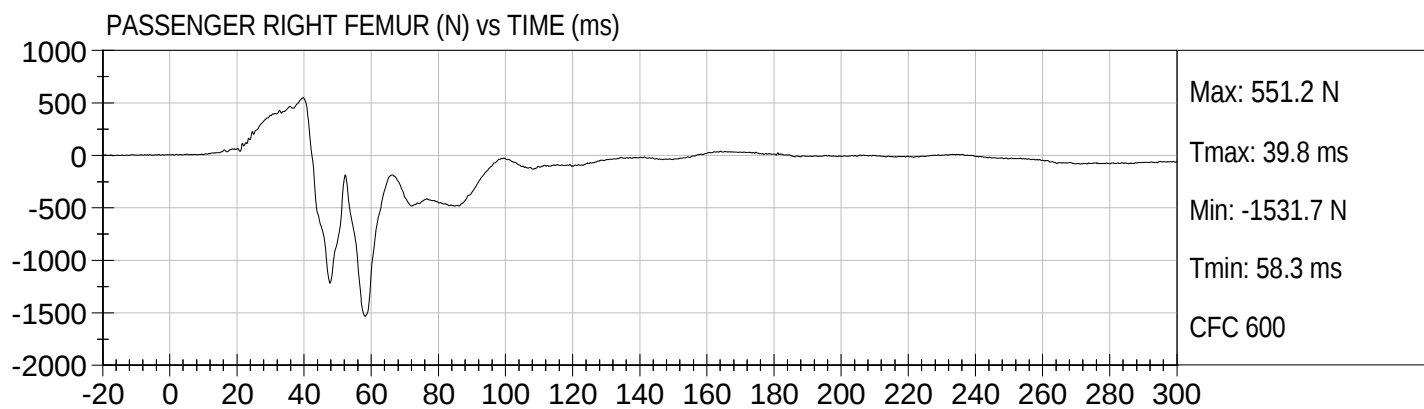
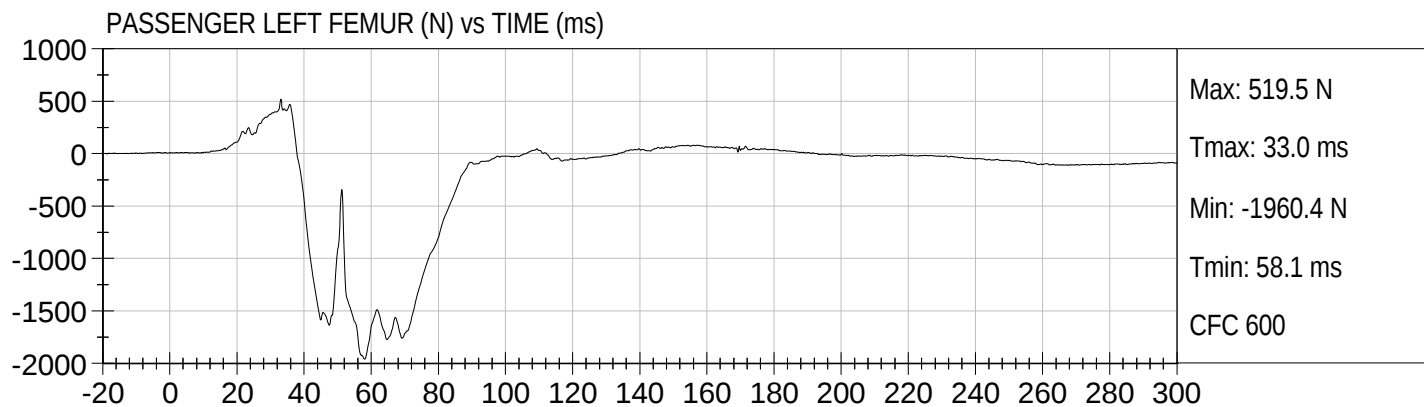












APPENDIX C
DUMMY CALIBRATION DATA

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

ATD Serial No: 036

Test ID: D112151

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	53	Pass
Peak Resultant Acceleration	G's	225 - 275	245	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

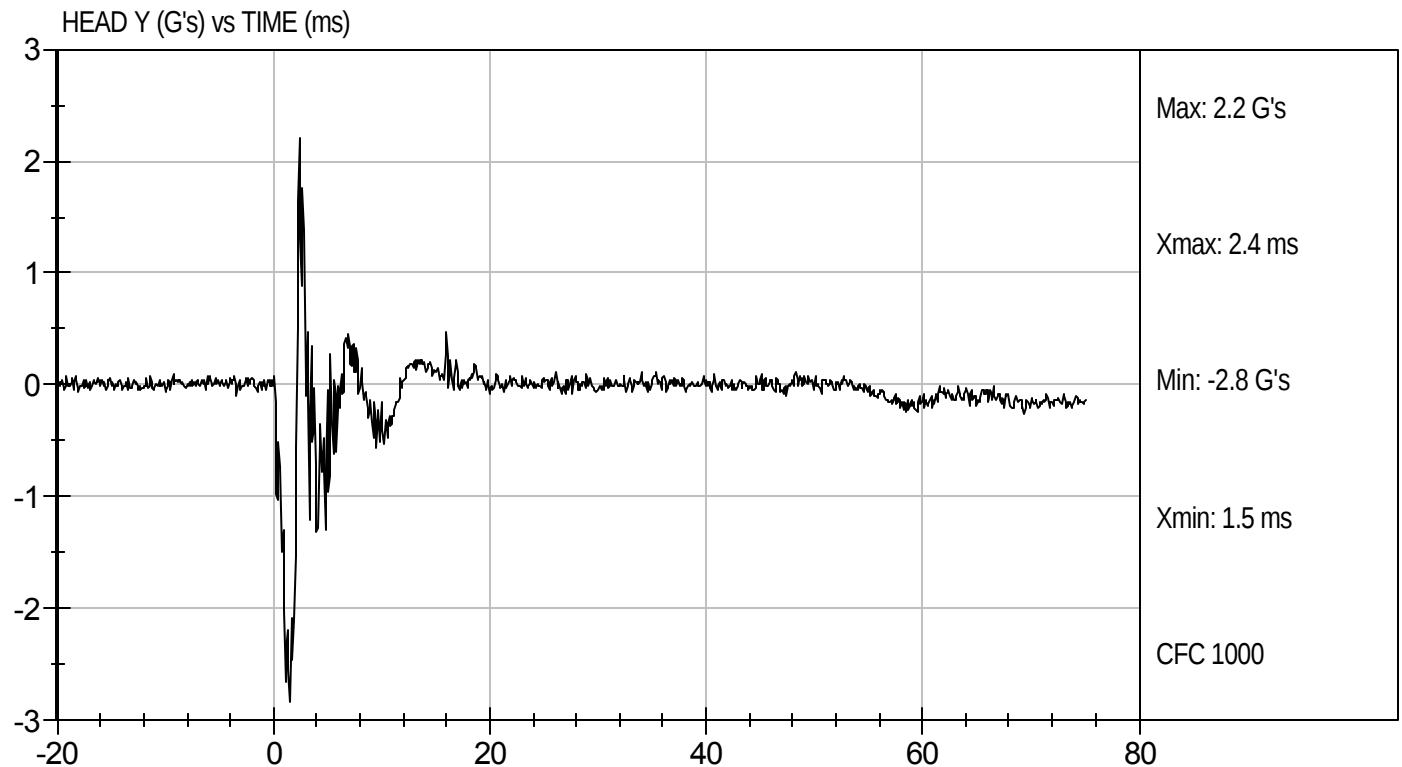
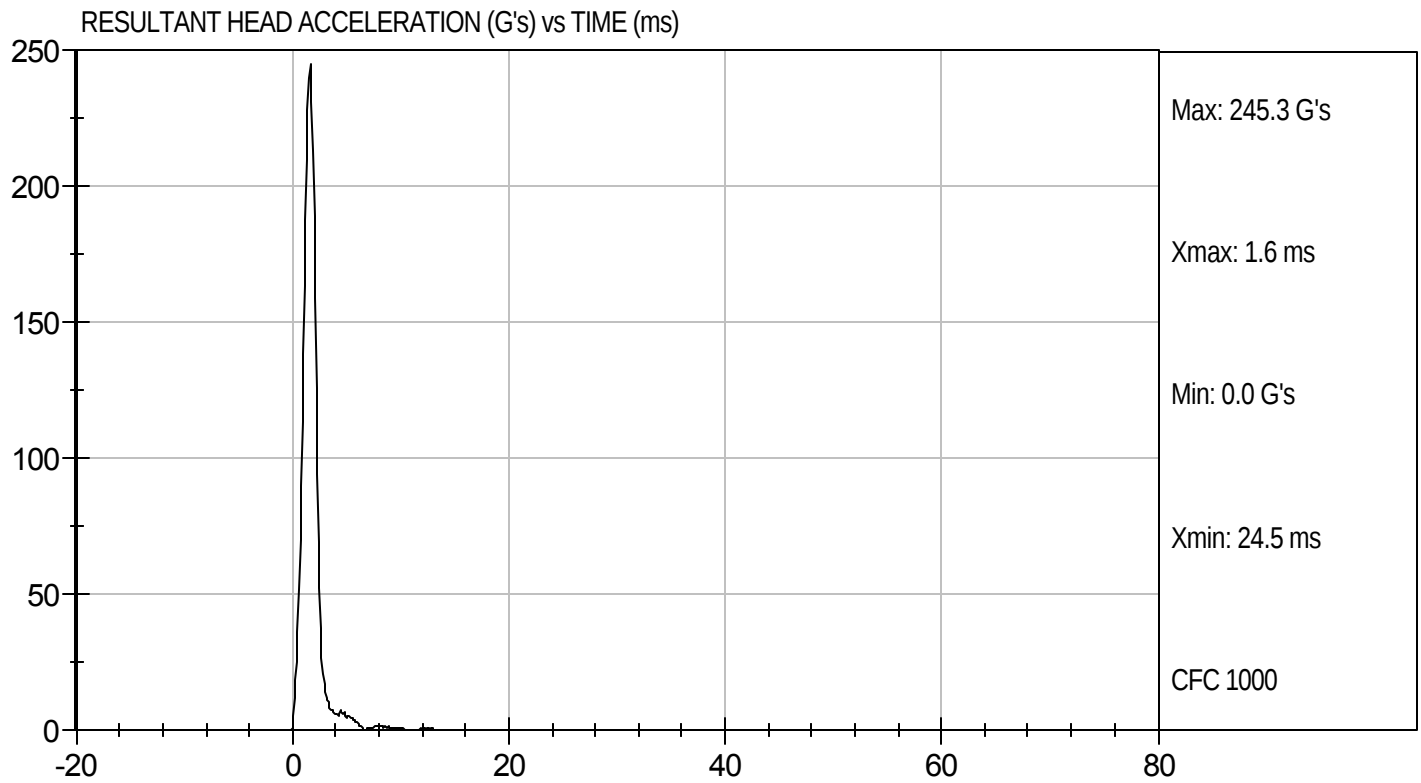
6/21/11
Test Date

David Winkelbauer
Approved By



Test Desc: Head Drop
Component ID: D112151

Test Date: 6/21/11
Velocity: 0 ft/s, 0.00 m/s

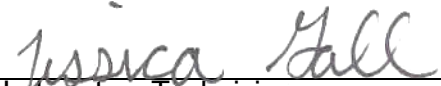


MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D112152

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	53	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.03	Pass
	20 ms	G's	17.60 to 22.60	19.28	Pass
	30 ms	G's	12.50 to 18.50	12.87	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	12.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.8	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	69.7	Pass
	Time	ms	57.0 to 64.0	57.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	116.6	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	97.9	Pass
	Time	ms	47.0 to 58.0	49.0	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	97.6	Pass
Overall Test Results					Pass


 Laboratory Technician

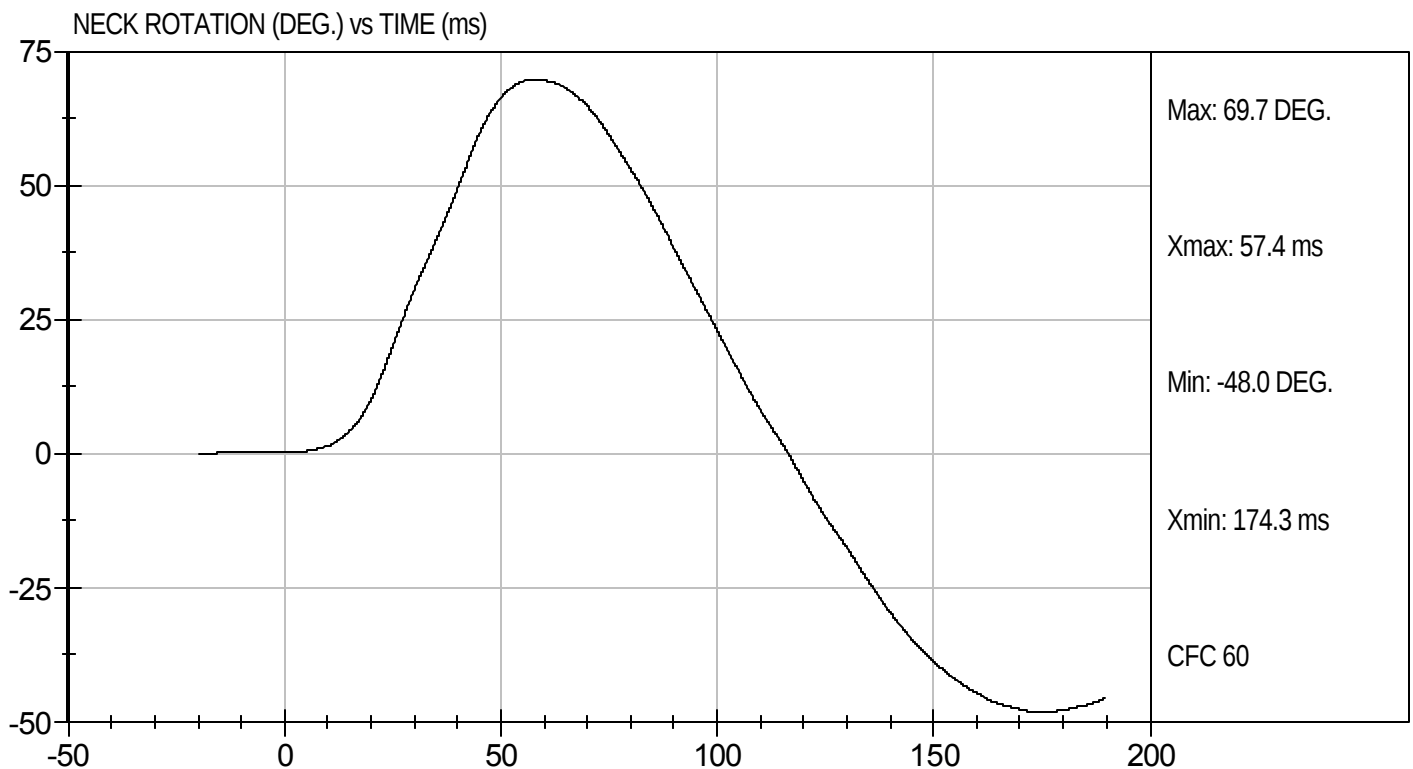
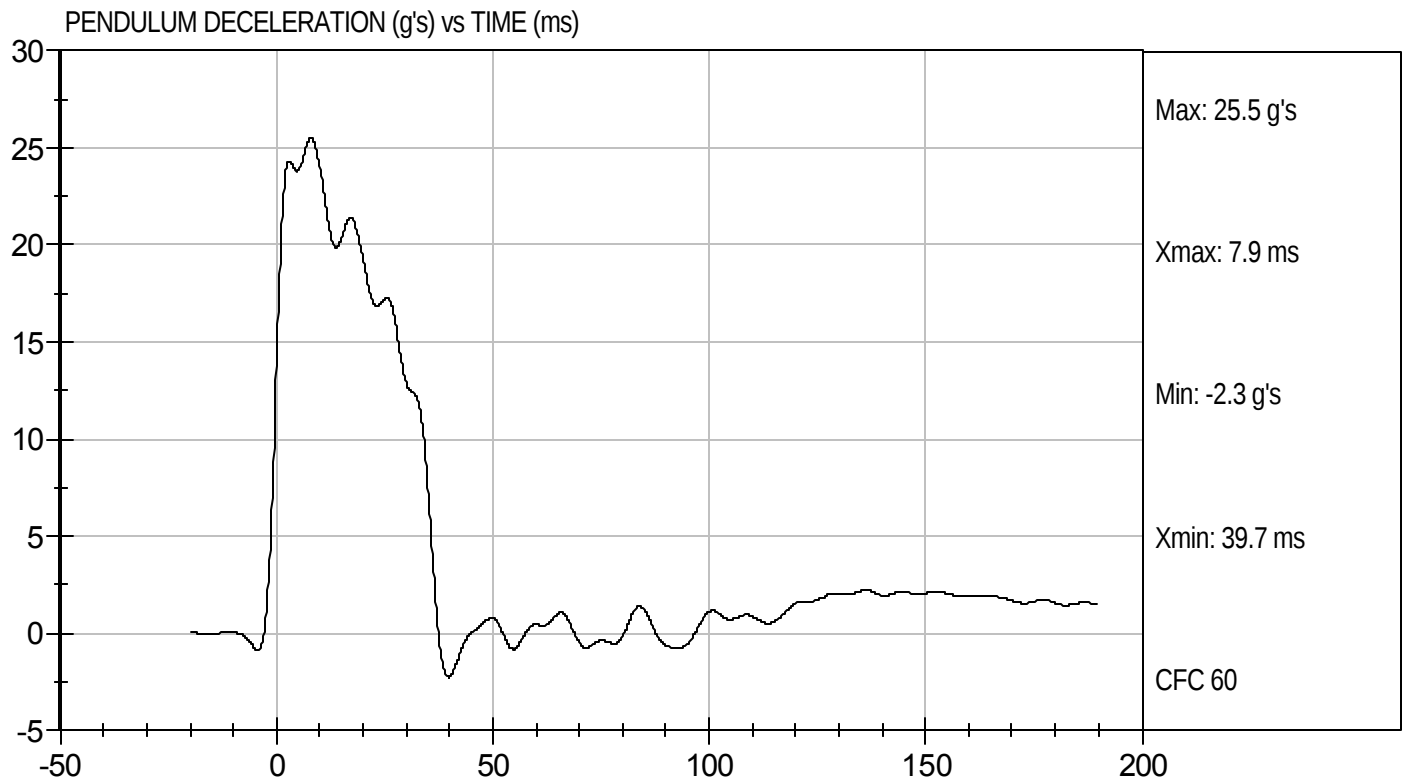
6/21/11
 Test Date


 Approved By



Test Desc: Neck Flexion
Component ID: D112152

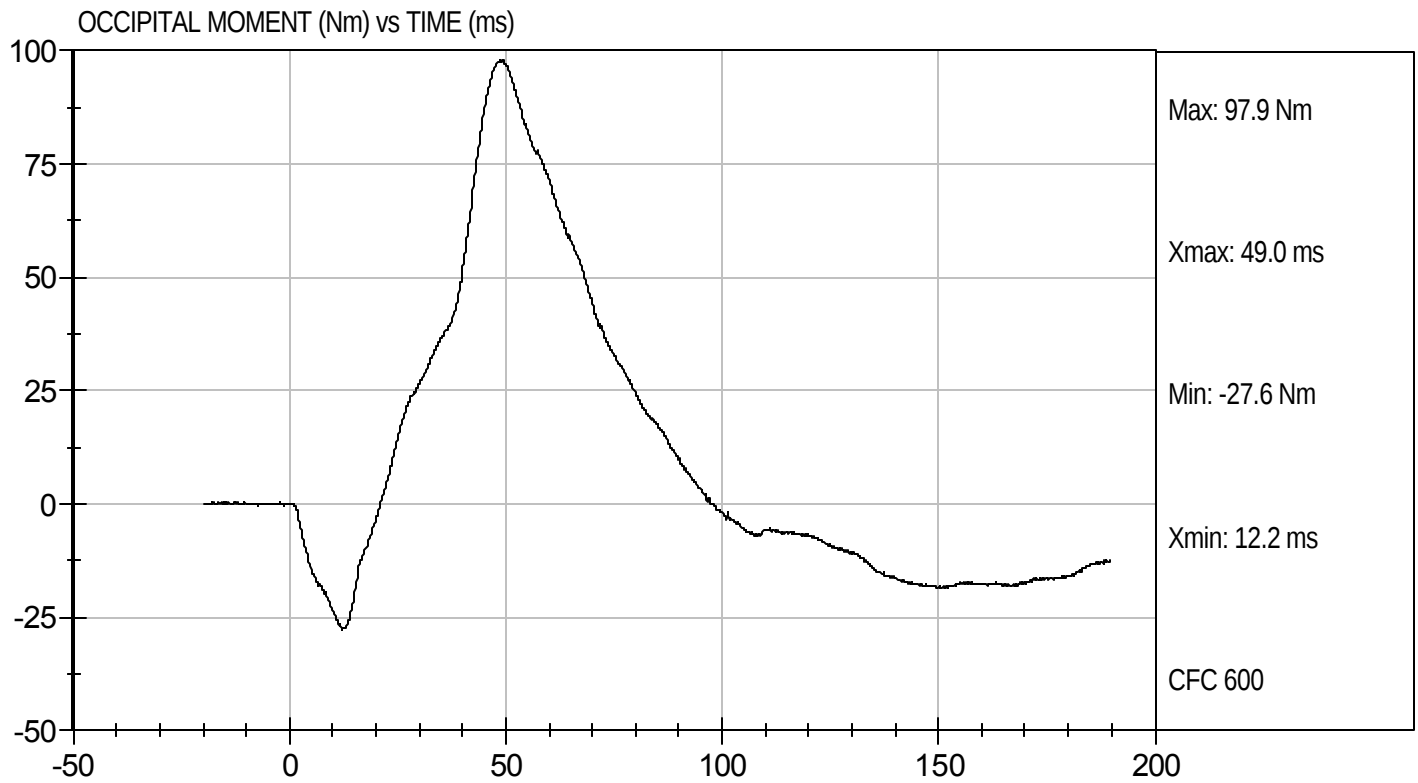
Test Date: 6/21/11
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D112152

Test Date: 6/21/11
Velocity: 23.15 ft/s, 7.06 m/s

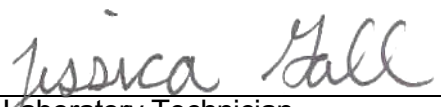


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D.: D112153

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	53	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.43	Pass
	20 ms	G's	14.00 to 19.00	15.89	Pass
	30 ms	G's	11.00 to 16.00	14.86	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	15.4	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.7	Pass
	Time	ms	72.0 to 82.0	74.8	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	155.3	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-68.6	Pass
	Time	ms	65.0 to 79.0	68.5	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	138.3	Pass
Overall Test Results					Pass


 Laboratory Technician

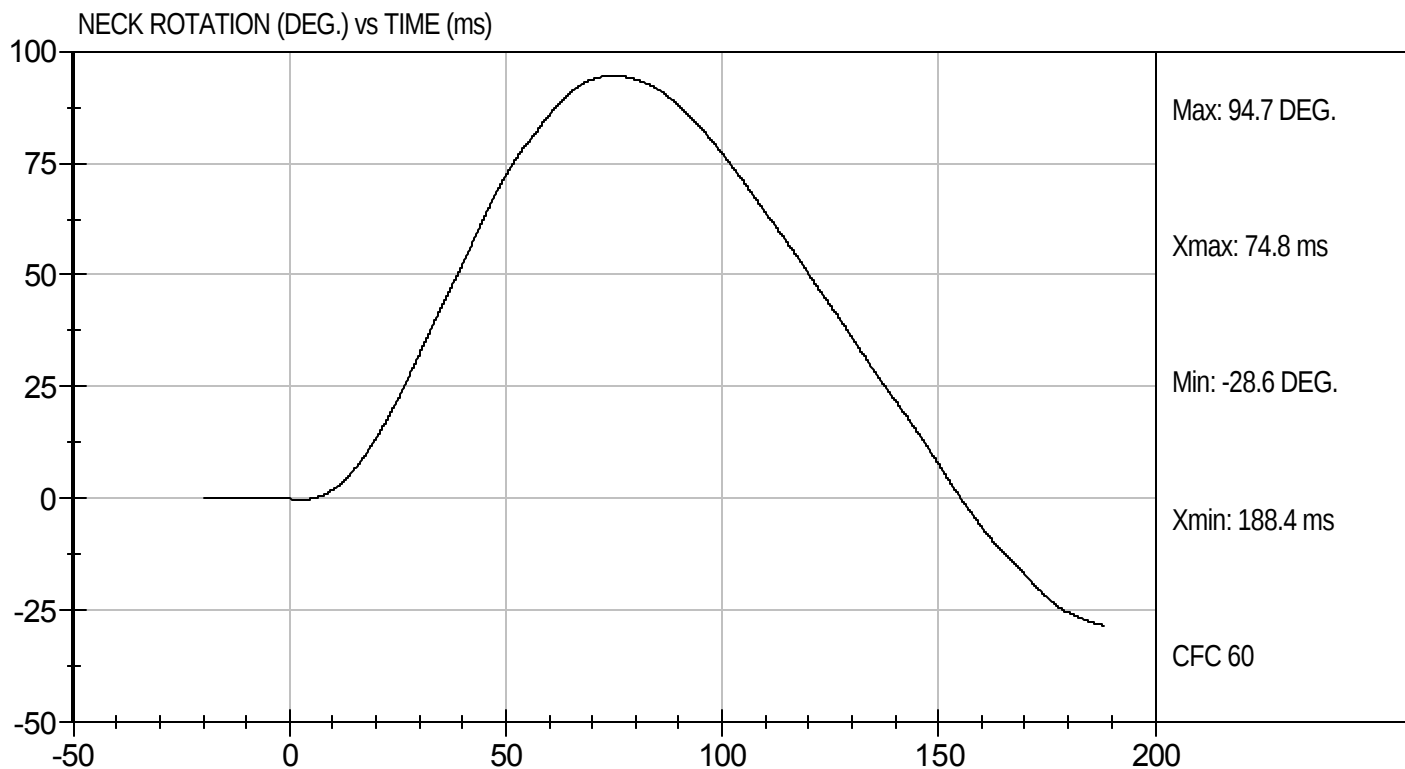
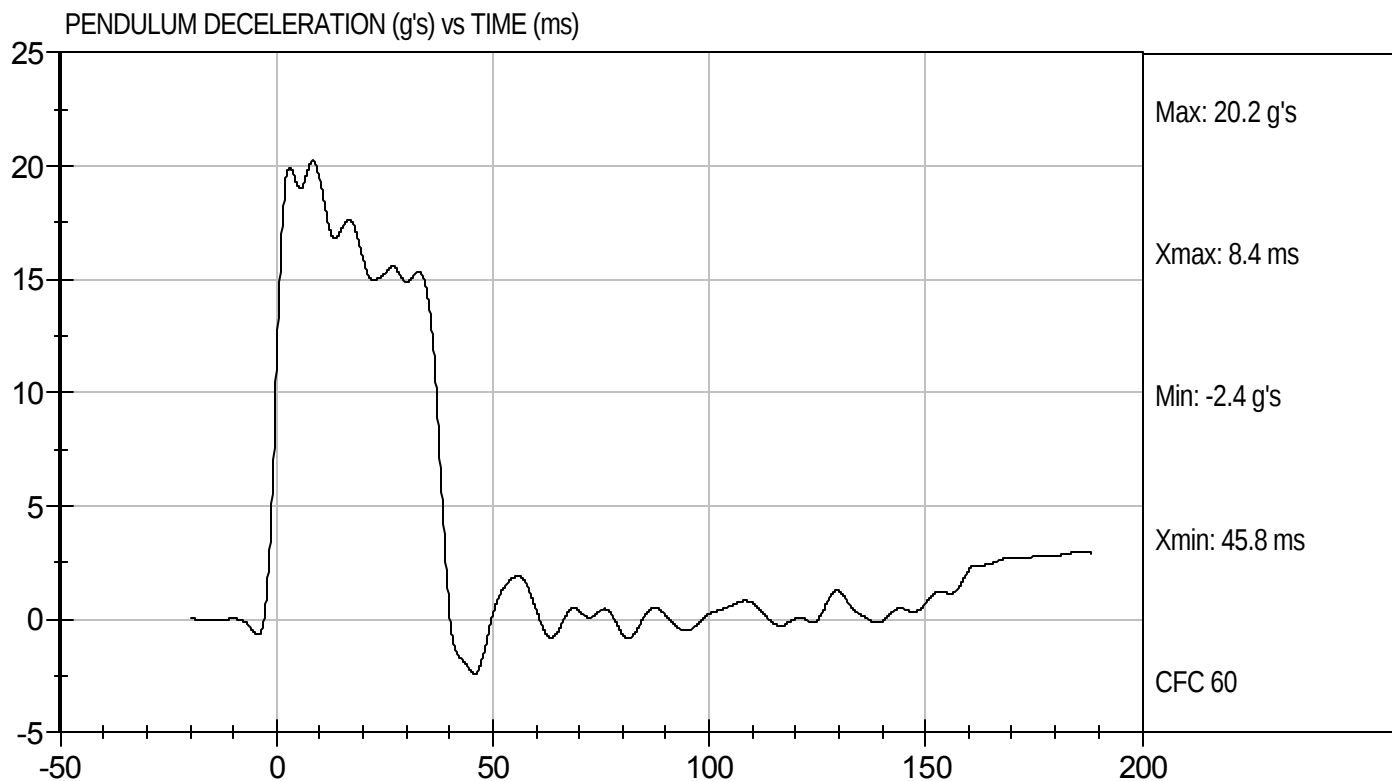
6/21/11
 Test Date


 Approved By



Test Desc: Neck Extension
Component ID: D112153

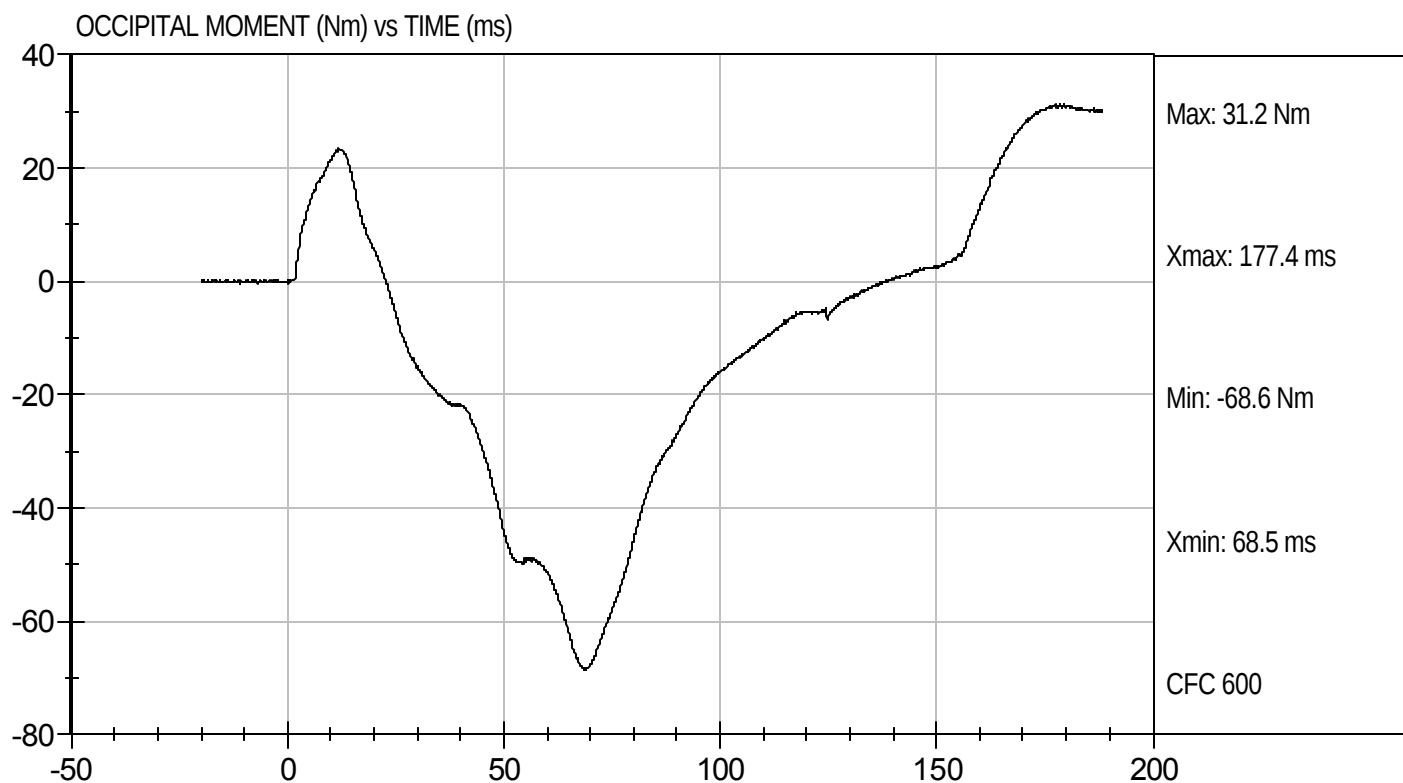
Test Date: 6/21/11
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension
Component ID: D112153

Test Date: 6/21/11
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D112154

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	54	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,407	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.99	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Overall Test Results			Pass	


Laboratory Technician

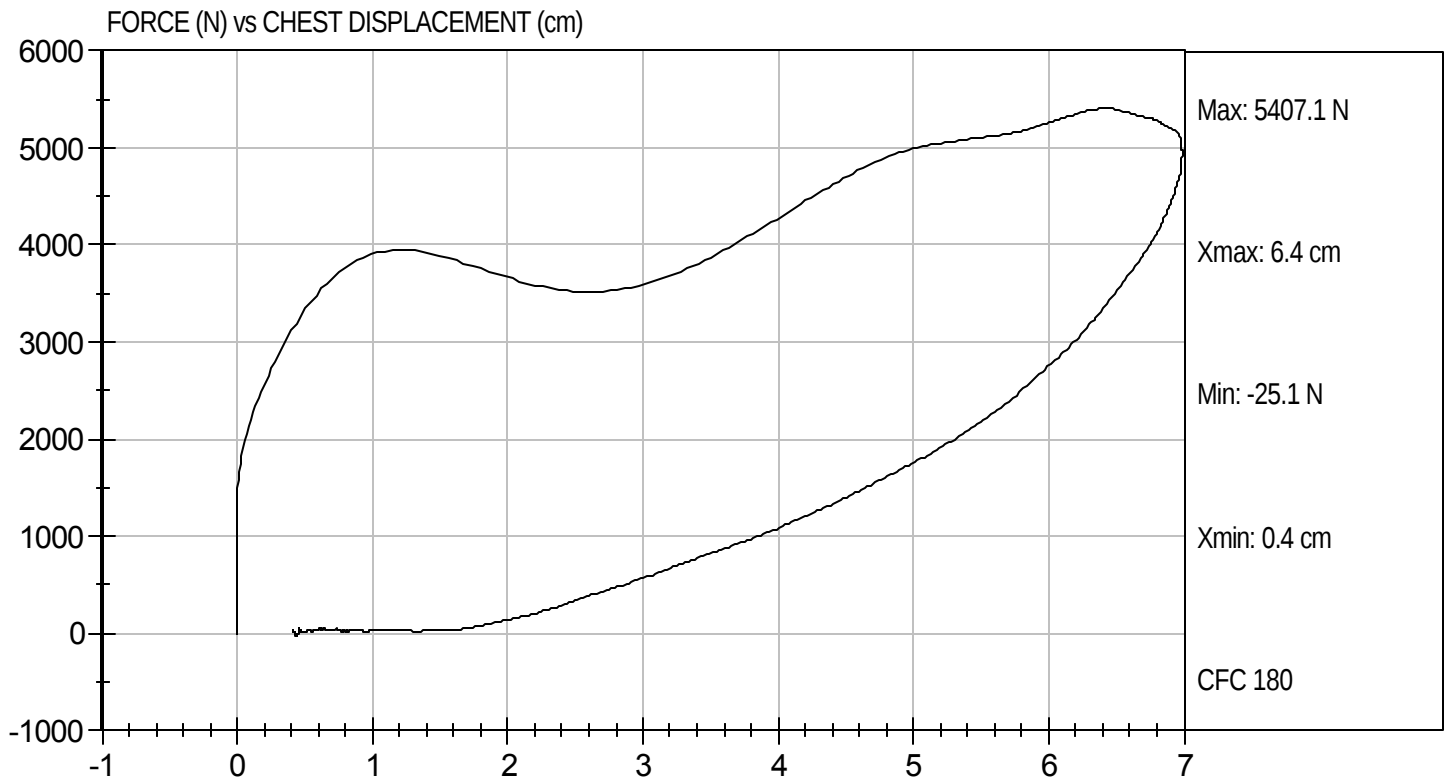
6/22/11
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D112154

Test Date: 6/22/11
Velocity: 21.9 ft/s, 6.68 m/s



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

ATD Serial No: 036

Test I.D: D112155

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	54	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,194	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

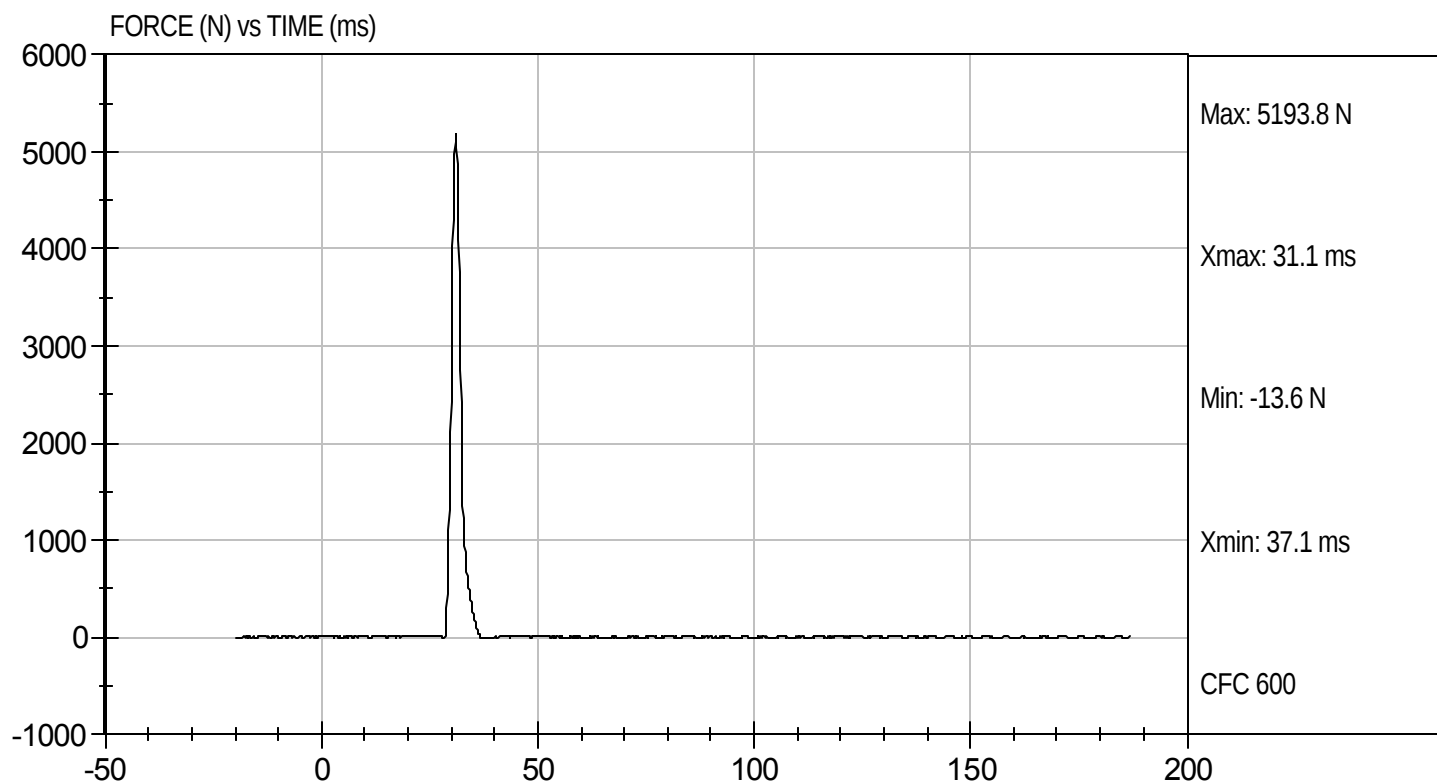
6/21/11
Test Date

David Winkelbauer
Approved By



Test Desc: Right Knee
Component ID: D112155

Test Date: 6/21/11
Velocity: 6.97 ft/s, 2.12 m/s

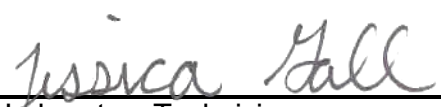


MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D112156

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	54	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,506	Pass
Overall Test Results				Pass


Laboratory Technician

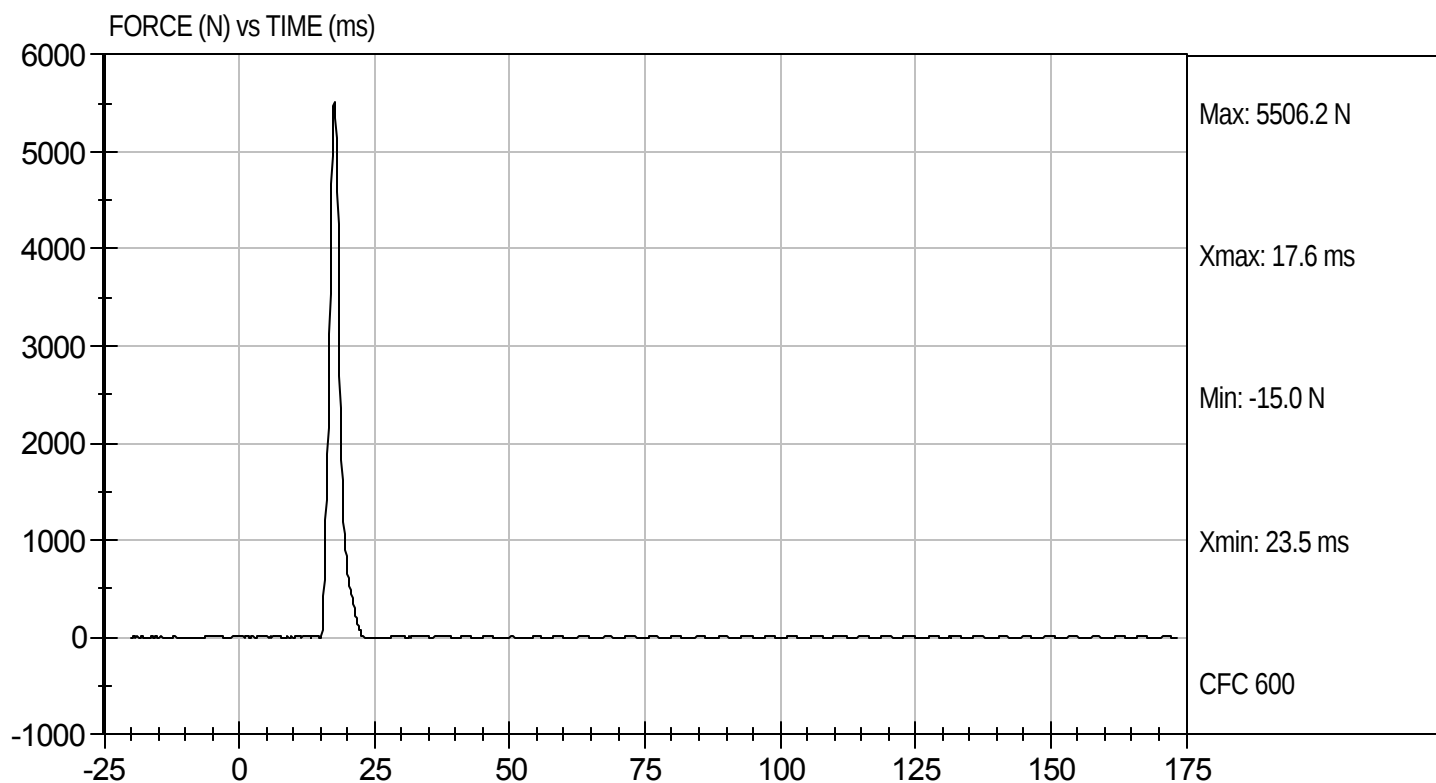
6/21/11
Test Date


Approved By



Test Desc: Left Knee
Component ID: D112156

Test Date: 6/21/11
Velocity: 6.97 ft/s, 2.12 m/s



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

ATD Serial No: 036

Test I.D: D112150

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.1	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	53	53	Pass
Rotation Rate	deg/s	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	56.8	48.5	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	50	49	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

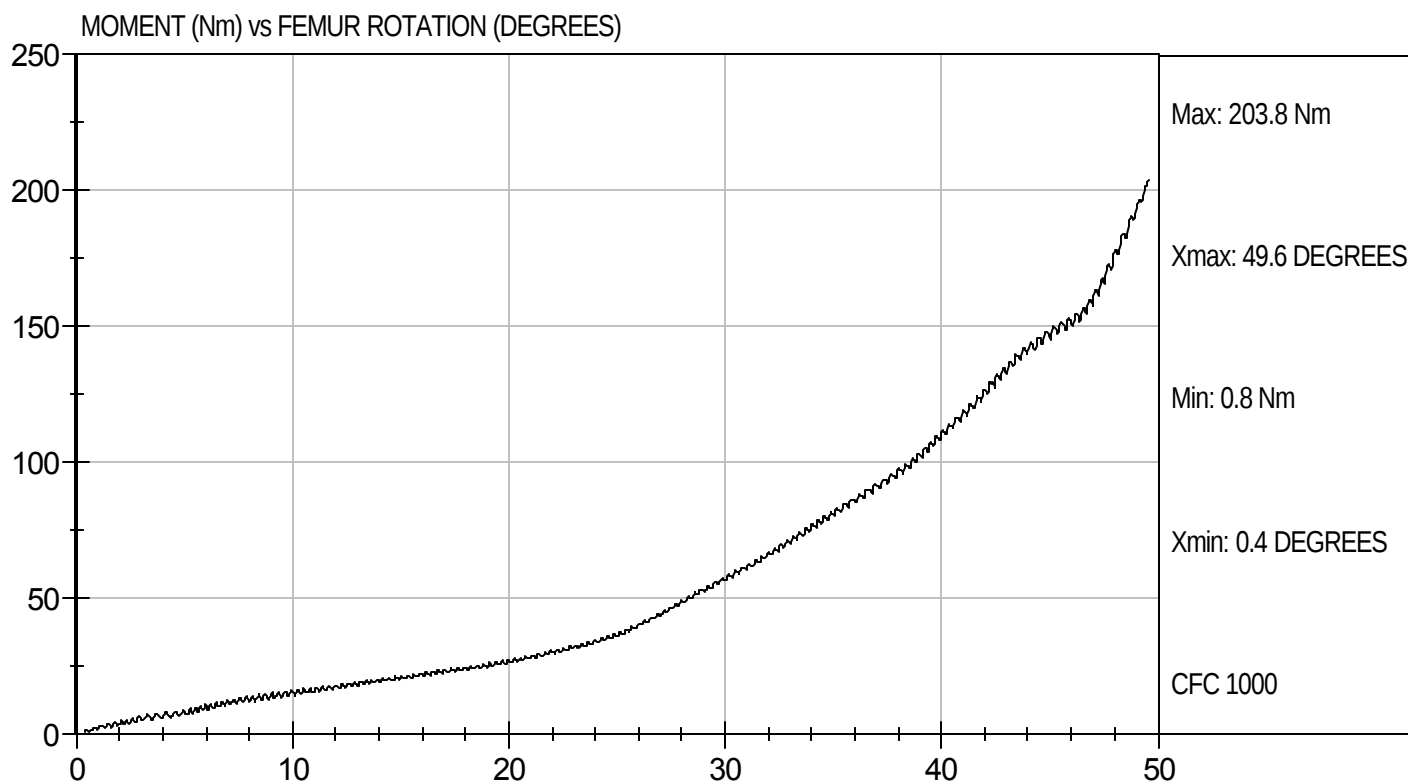
6/21/11
Test Date

David Winkelbauer
Approved By



Test Desc: Hip Femur Flexion
Component ID: D112159

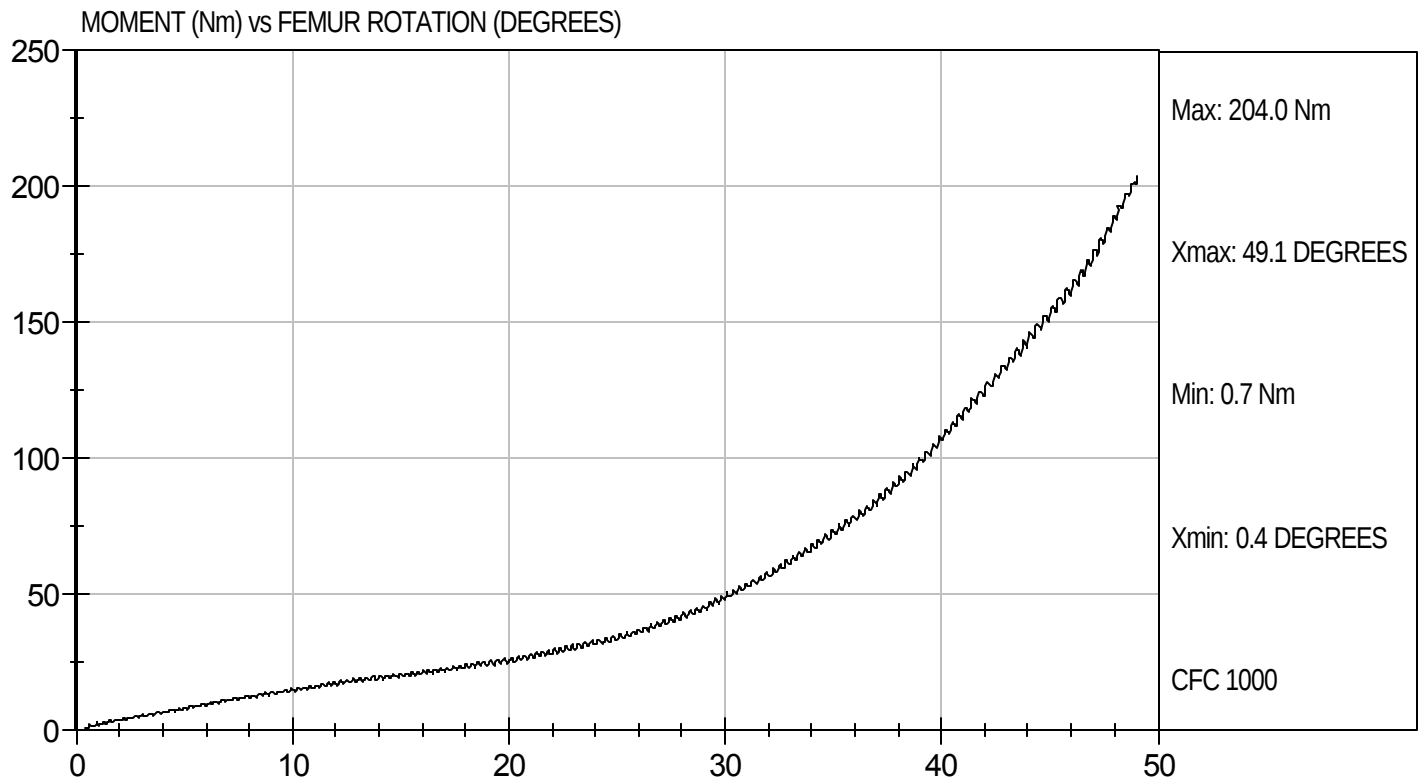
Test Date: 6/21/11
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D112150

Test Date: 6/21/11
Velocity: 0 ft/s, 0.00 m/s



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

ATD Serial No: 036

Test ID: D112721

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Peak Resultant Acceleration	G's	225 - 275	249	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-12.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass



Laboratory Technician

8/10/11
Test Date

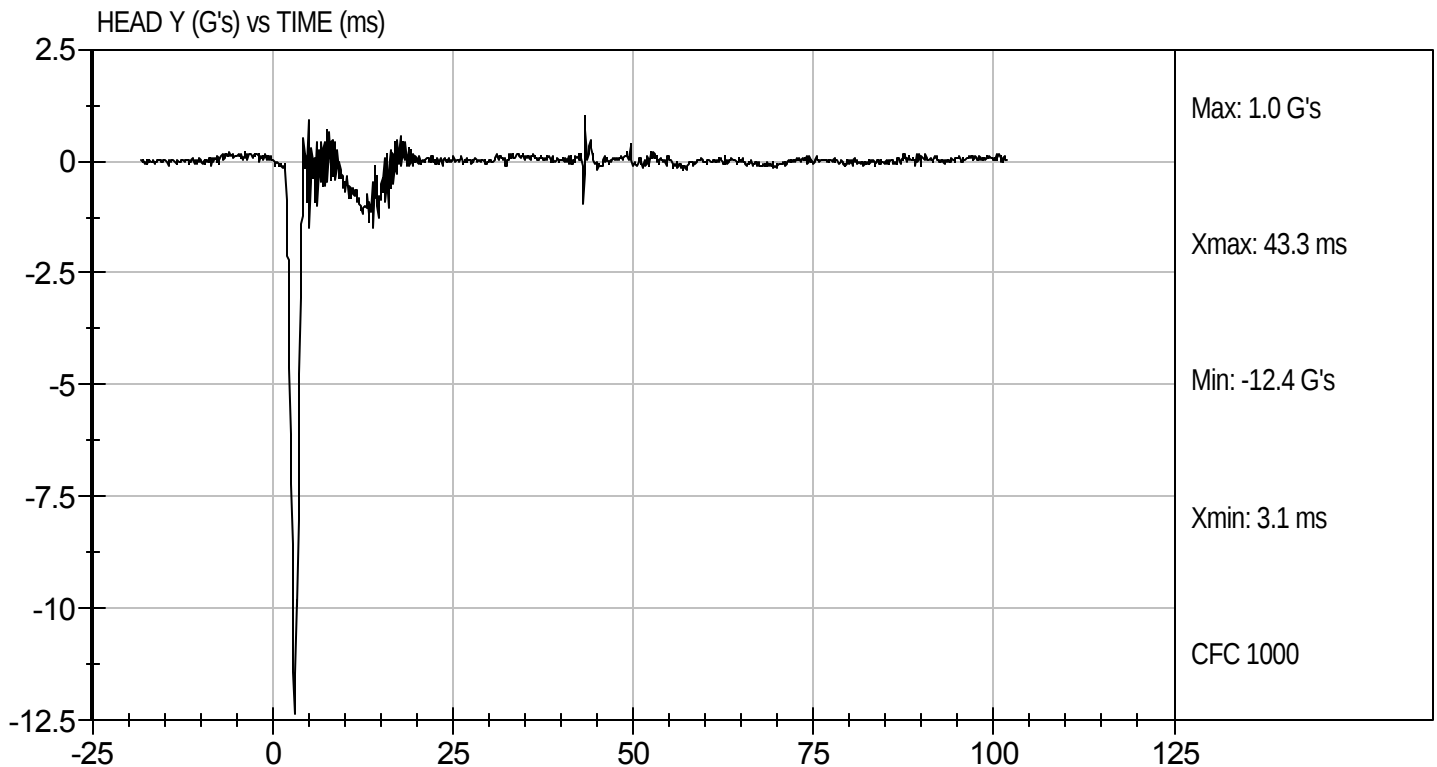
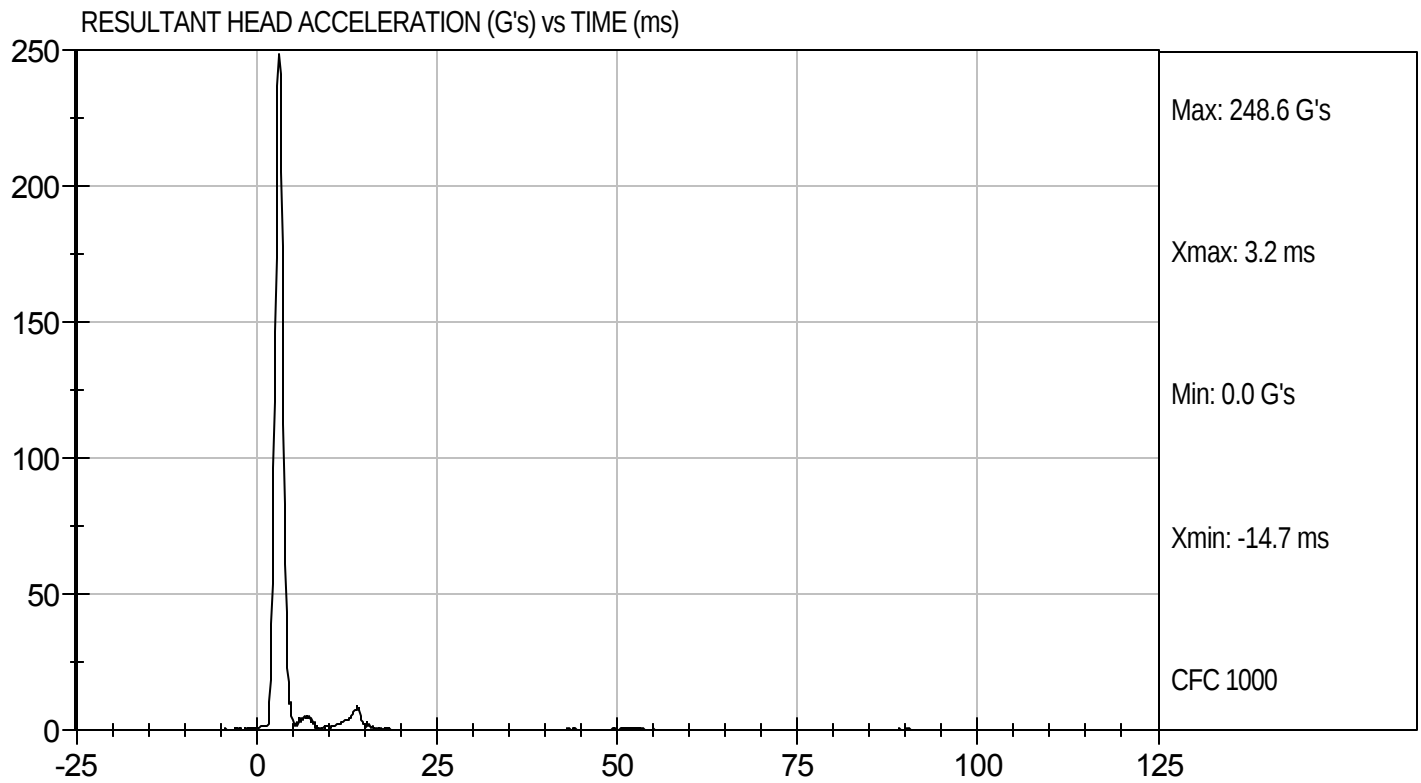


Approved By



Test Desc: Head Drop
Component ID: D112721

Test Date: 8/10/11
Velocity: 0 ft/s, 0.00 m/s

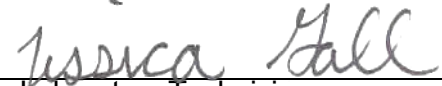


MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D.: D112722

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	47	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.61	Pass
	20 ms	G's	17.60 to 22.60	20.37	Pass
	30 ms	G's	12.50 to 18.50	14.35	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	71.1	Pass
	Time	ms	57.0 to 64.0	57.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	117.3	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	96.9	Pass
	Time	ms	47.0 to 58.0	47.6	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	97.5	Pass
Overall Test Results					Pass


 Laboratory Technician

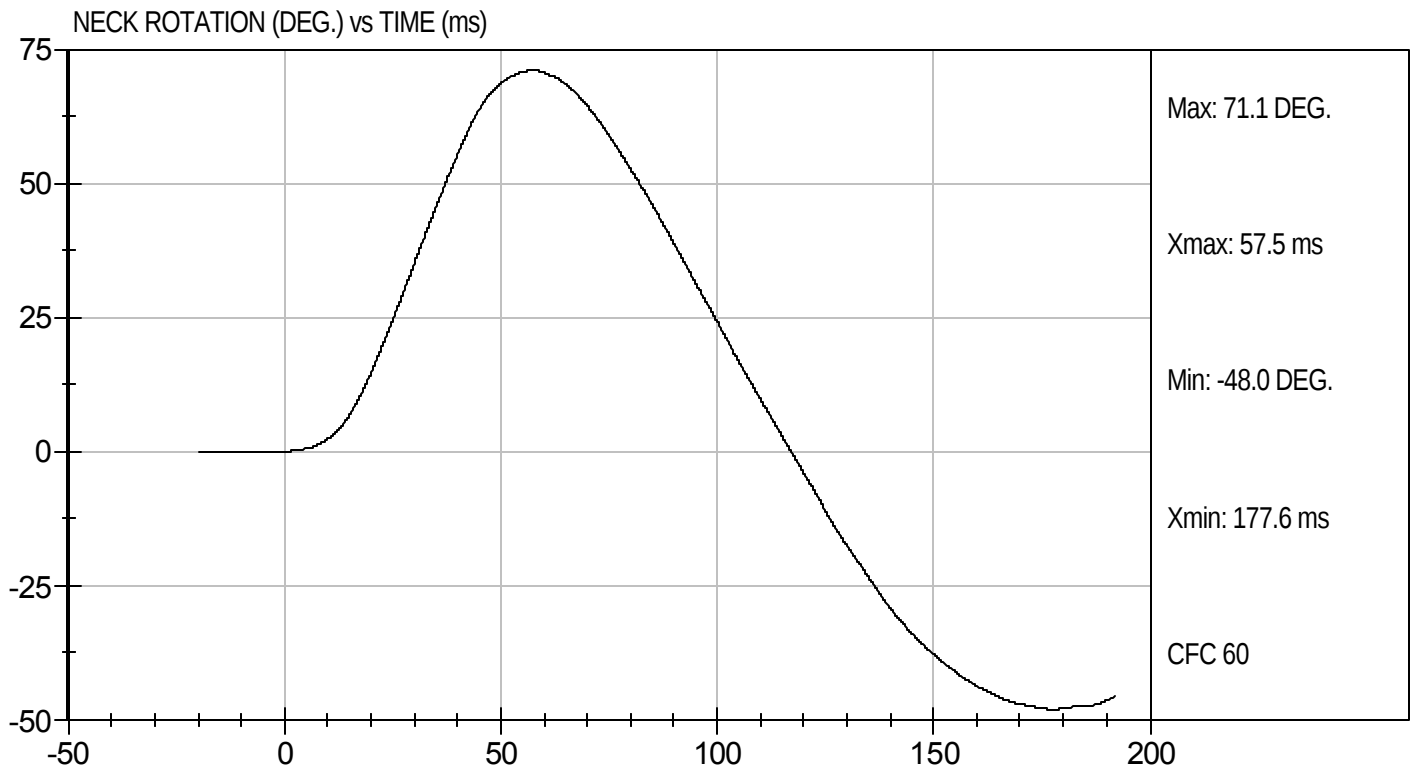
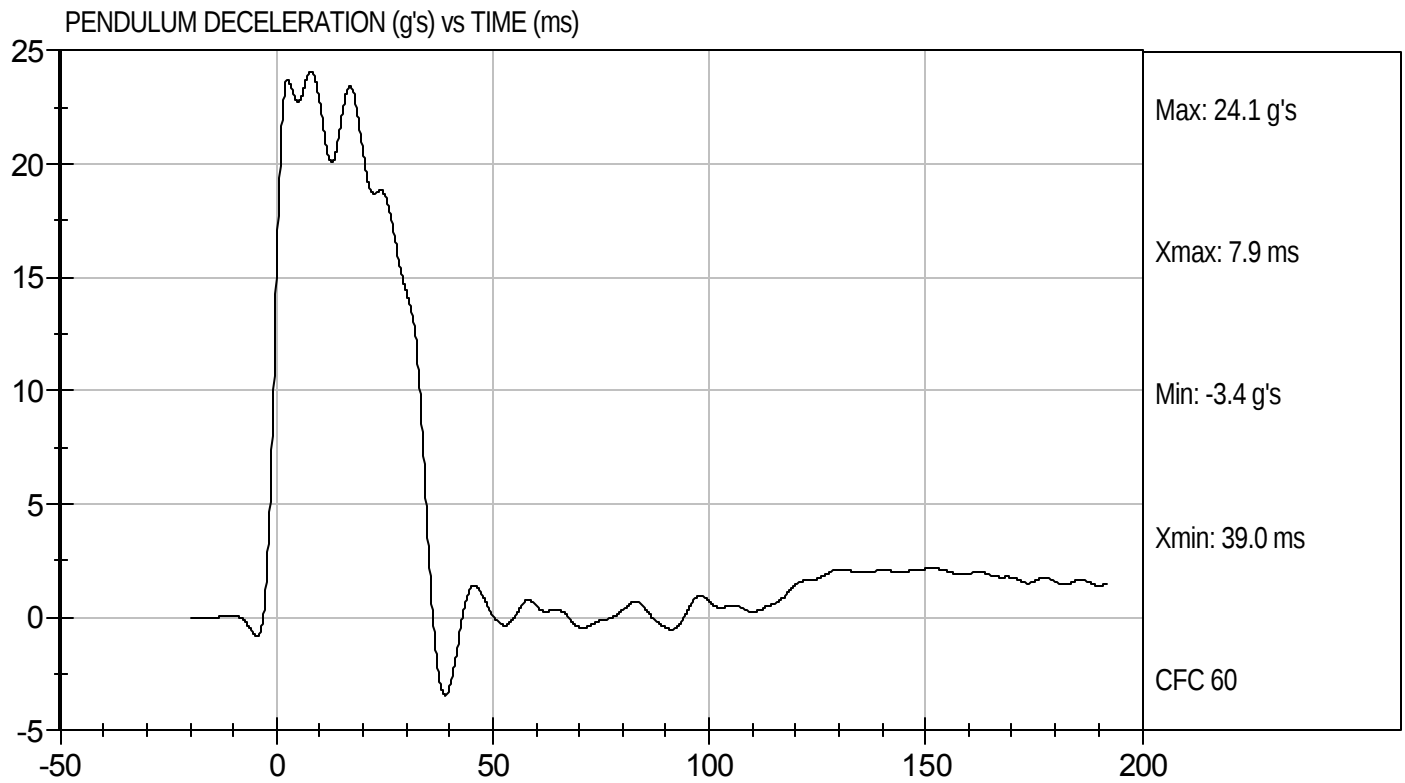
8/10/11
 Test Date


 Approved By



Test Desc: Neck Flexion
Component ID: D112722

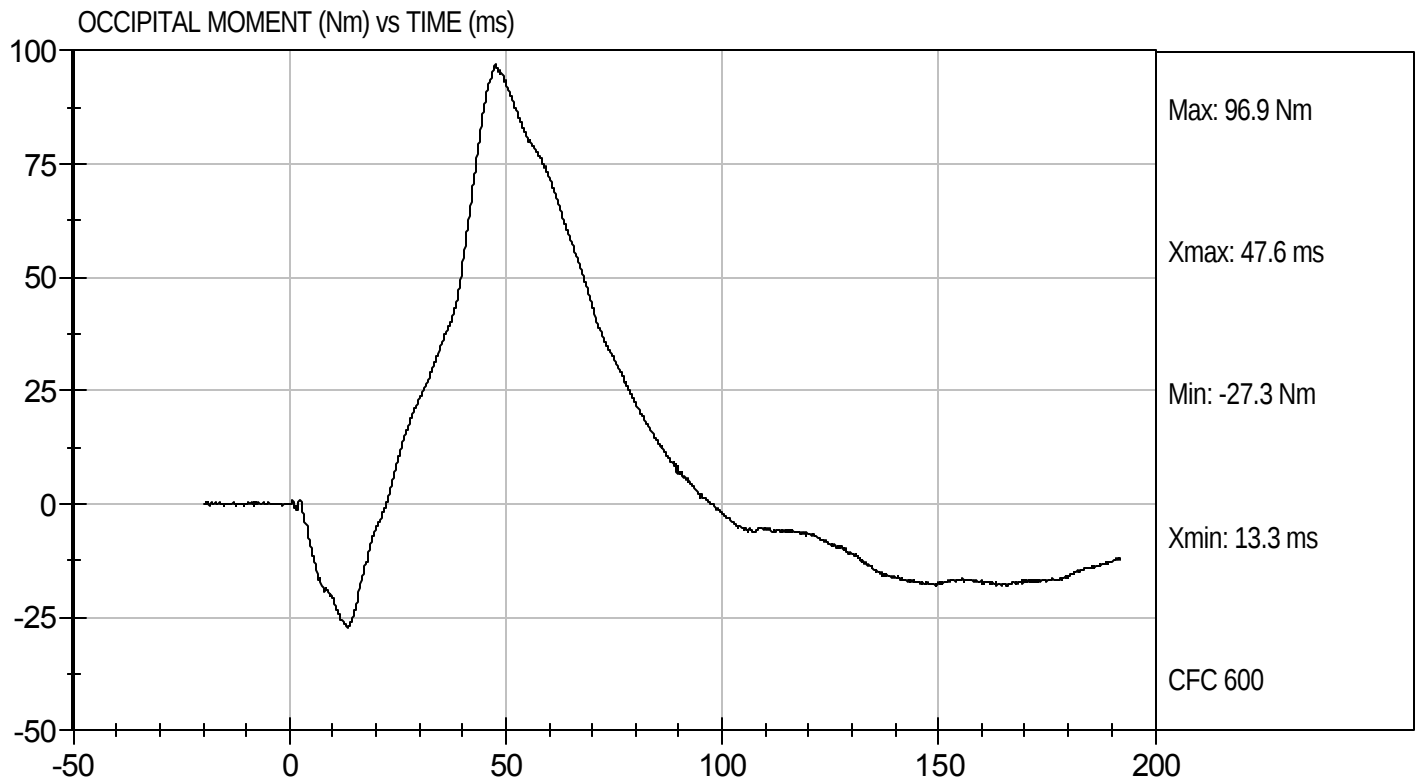
Test Date: 8/10/11
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D112722

Test Date: 8/10/11
Velocity: 23.15 ft/s, 7.06 m/s

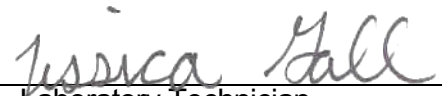


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D.: D112723

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	47	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.13	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.94	Pass
	20 ms	G's	14.00 to 19.00	16.27	Pass
	30 ms	G's	11.00 to 16.00	11.85	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.9	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	98.2	Pass
	Time	ms	72.0 to 82.0	76.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	159.0	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-68.4	Pass
	Time	ms	65.0 to 79.0	68.8	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	140.9	Pass
Overall Test Results					Pass


 Laboratory Technician

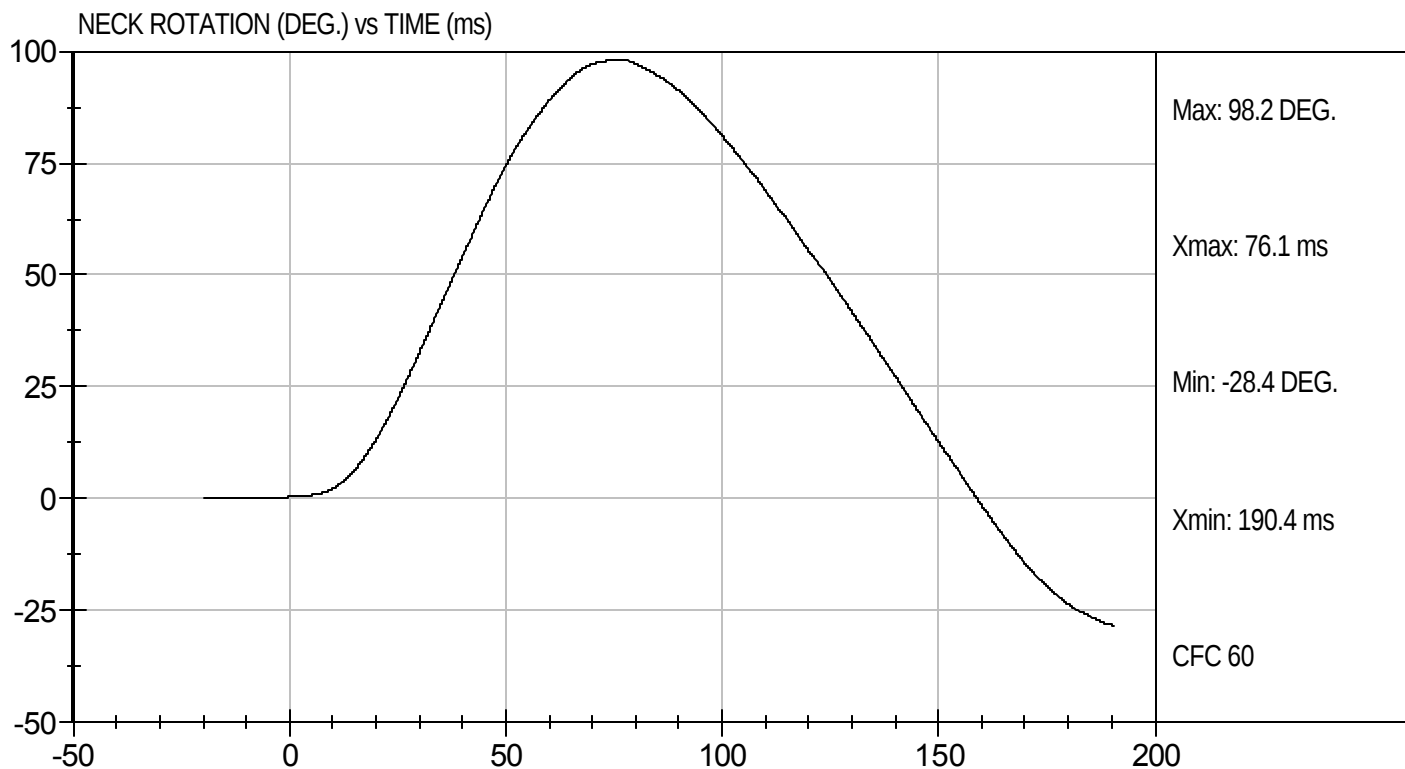
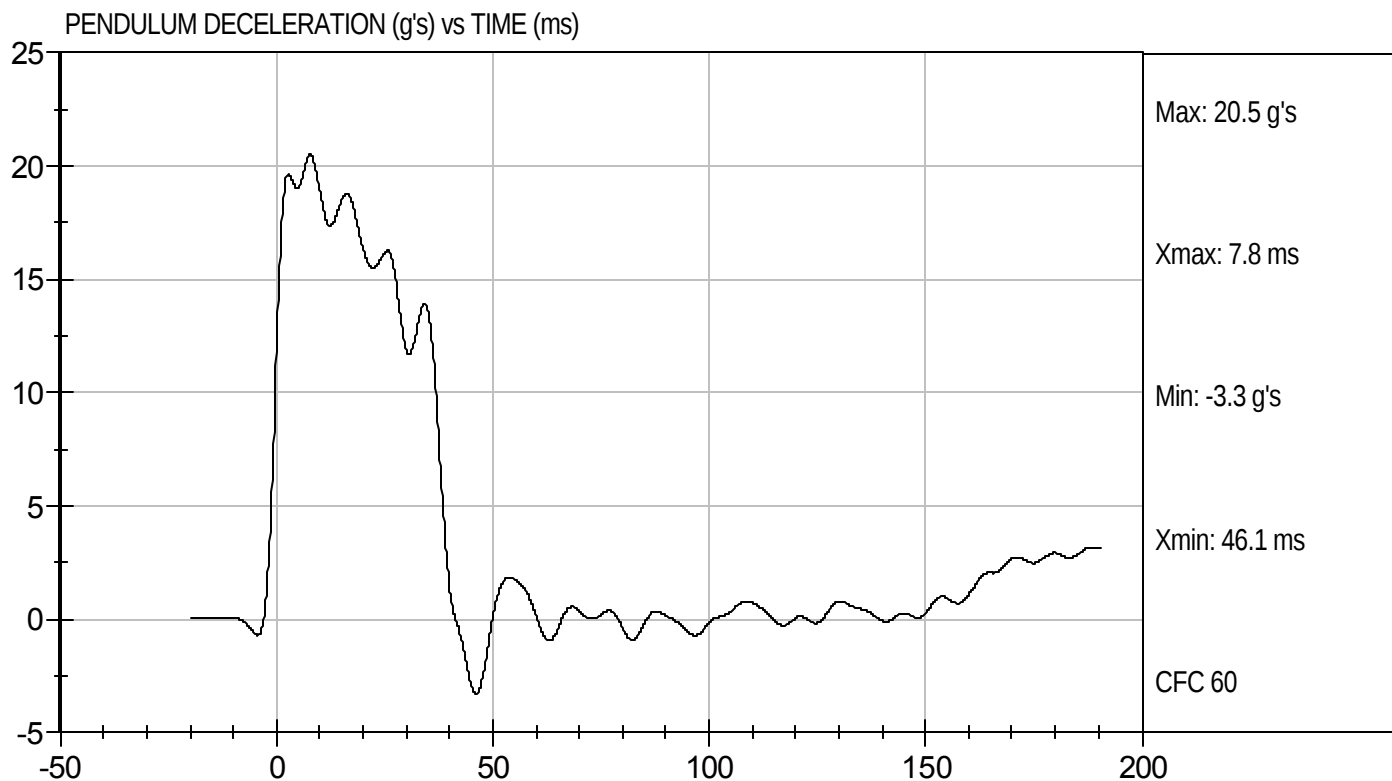
8/10/11
 Test Date


 Approved By



Test Desc: Neck Extension
Component ID: D112723

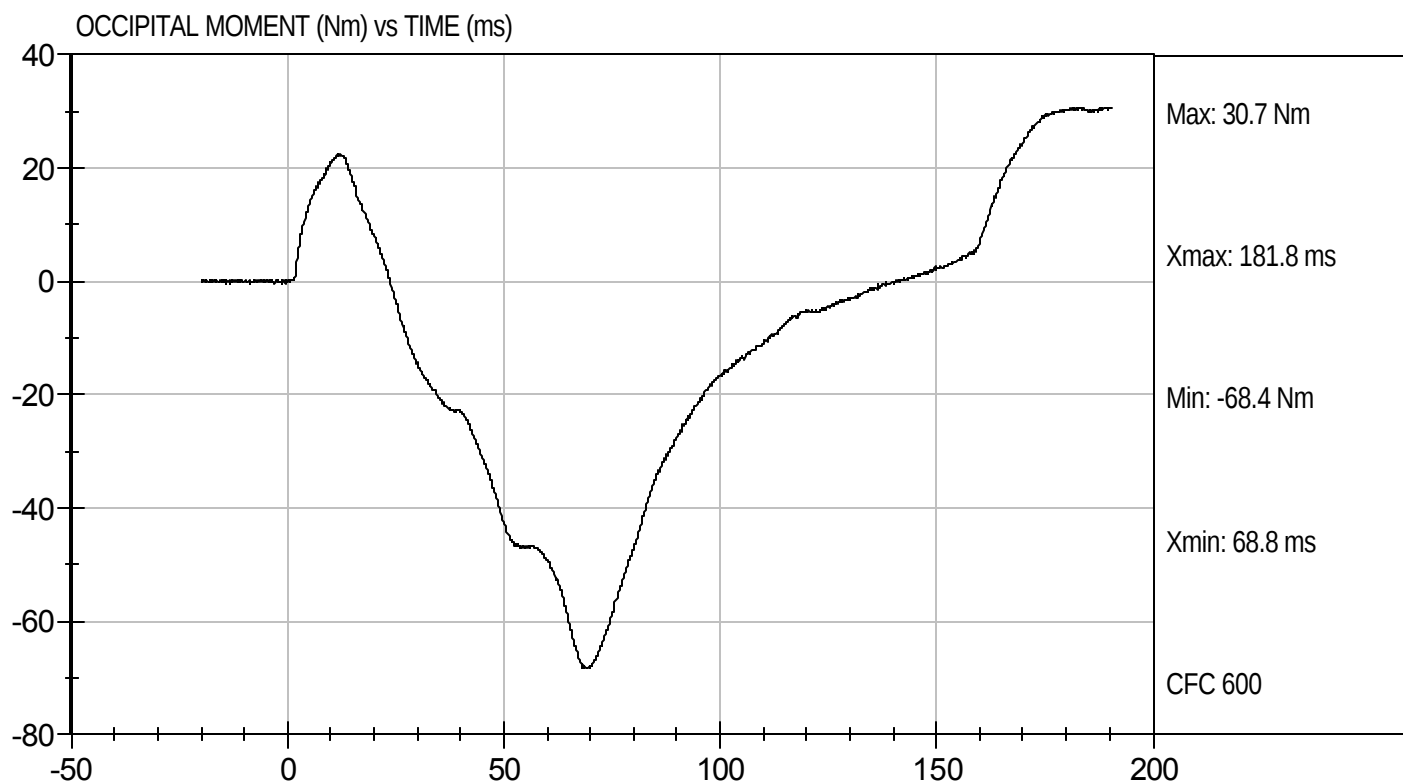
Test Date: 8/10/11
Velocity: 20.10 ft/s, 6.13 m/s





Test Desc: Neck Extension
Component ID: D112723

Test Date: 8/10/11
Velocity: 20.10 ft/s, 6.13 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D112724

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,289	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.95	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Overall Test Results			Pass	


Laboratory Technician

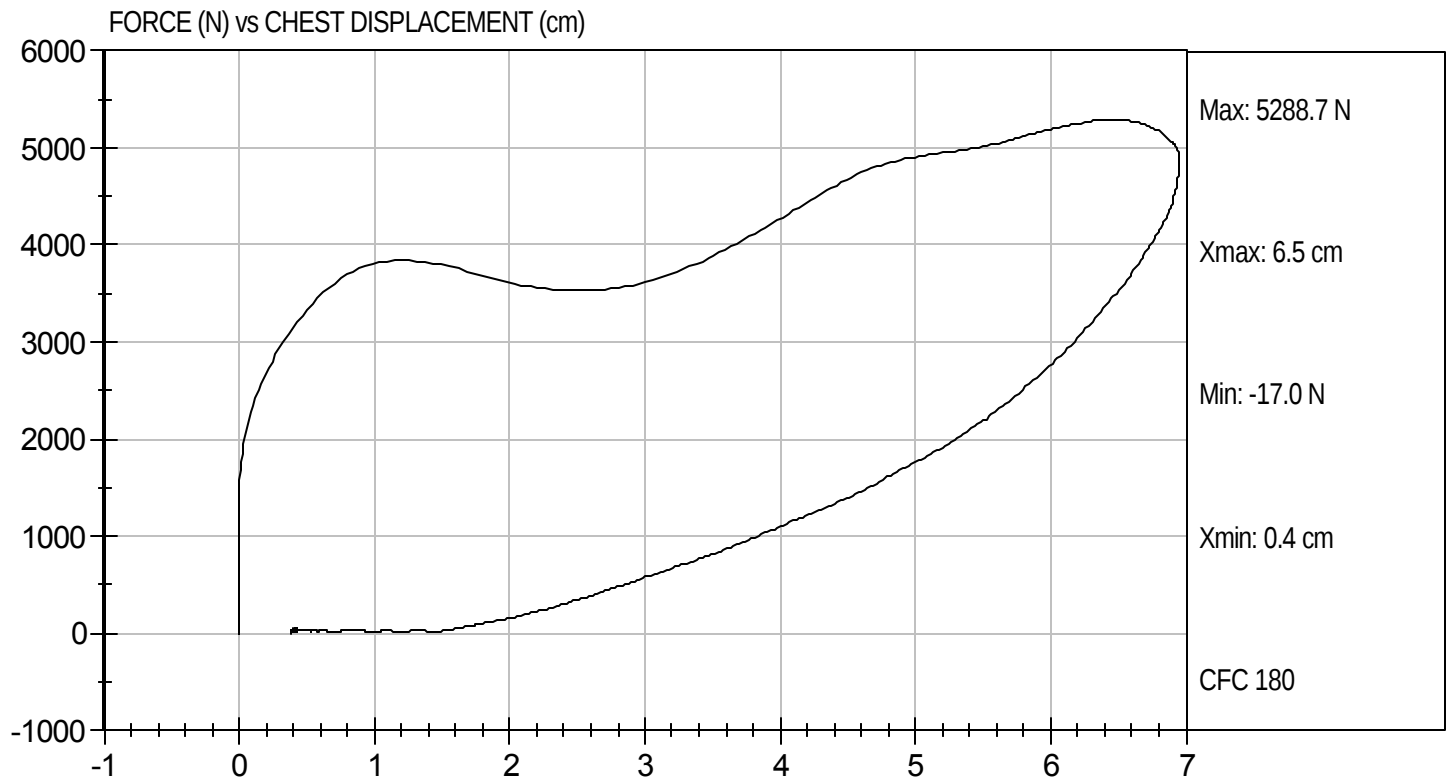
8/11/11
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D112724

Test Date: 8/11/11
Velocity: 22.22 ft/s, 6.77 m/s

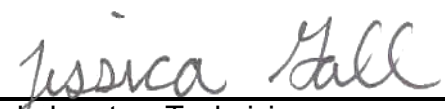


MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D112725

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Probe Velocity	m/s	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	4,754	Pass
Overall Test Results				Pass


Laboratory Technician

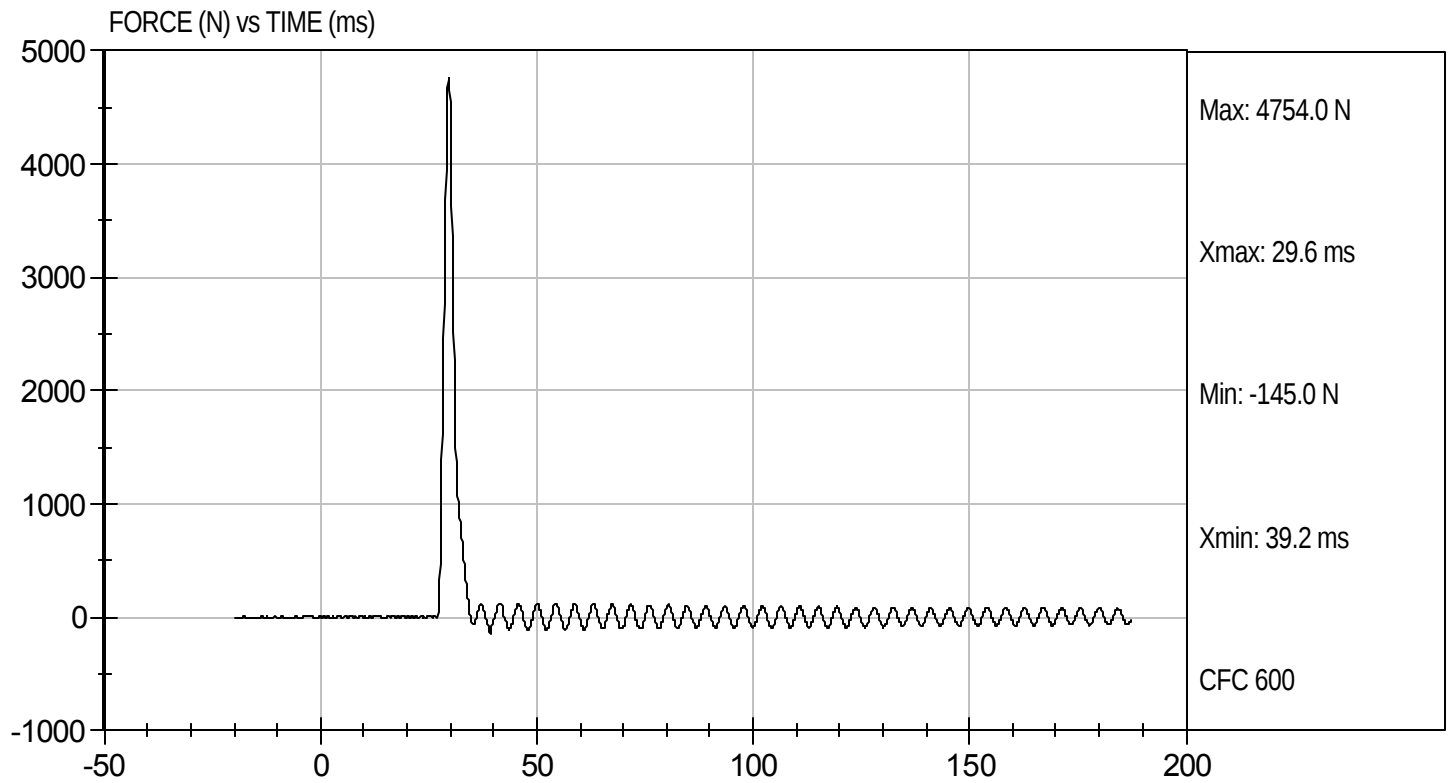
8/10/11
Test Date


Approved By



Test Desc: Right Knee
Component ID: D112725

Test Date: 8/10/11
Velocity: 6.83 ft/s, 2.08 m/s

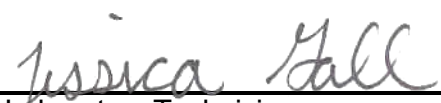


MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036

Test I.D: D112726

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	4,717	Pass
Overall Test Results				Pass



Laboratory Technician

08/10/11
Test Date

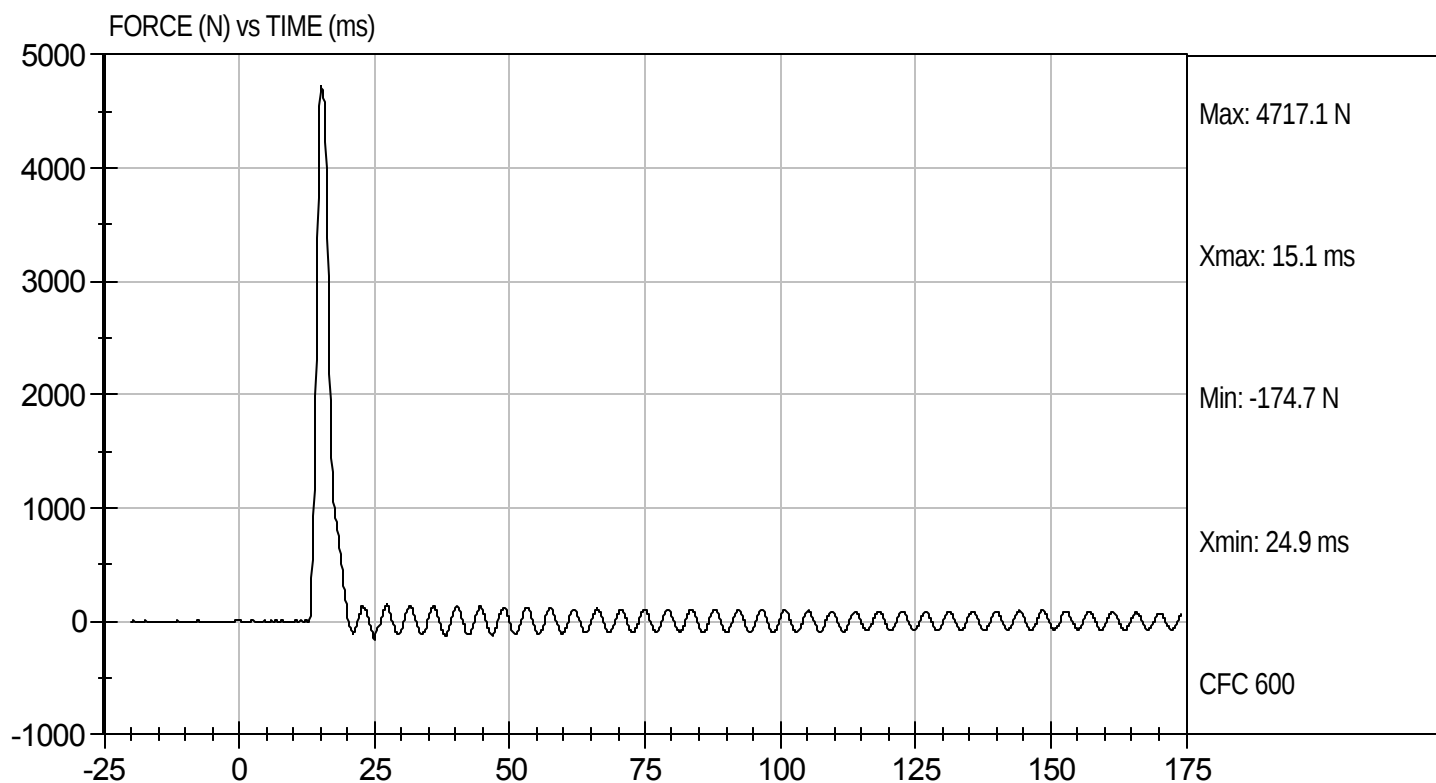


Approved By



Test Desc: Left Knee
Component ID: D112726

Test Date: 08/10/11
Velocity: 6.92 ft/s, 2.11 m/s



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

ATD Serial No: 036

Test I.D: D112720

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	50	50	Pass
Rotation Rate	deg/s	5.0 -10.0	6.0	6.0	Pass
30 Degrees	Nm	94.9 Nm Max	86.6	75.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 - 50.0 Degree Max Rotation	43.0	43.0	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

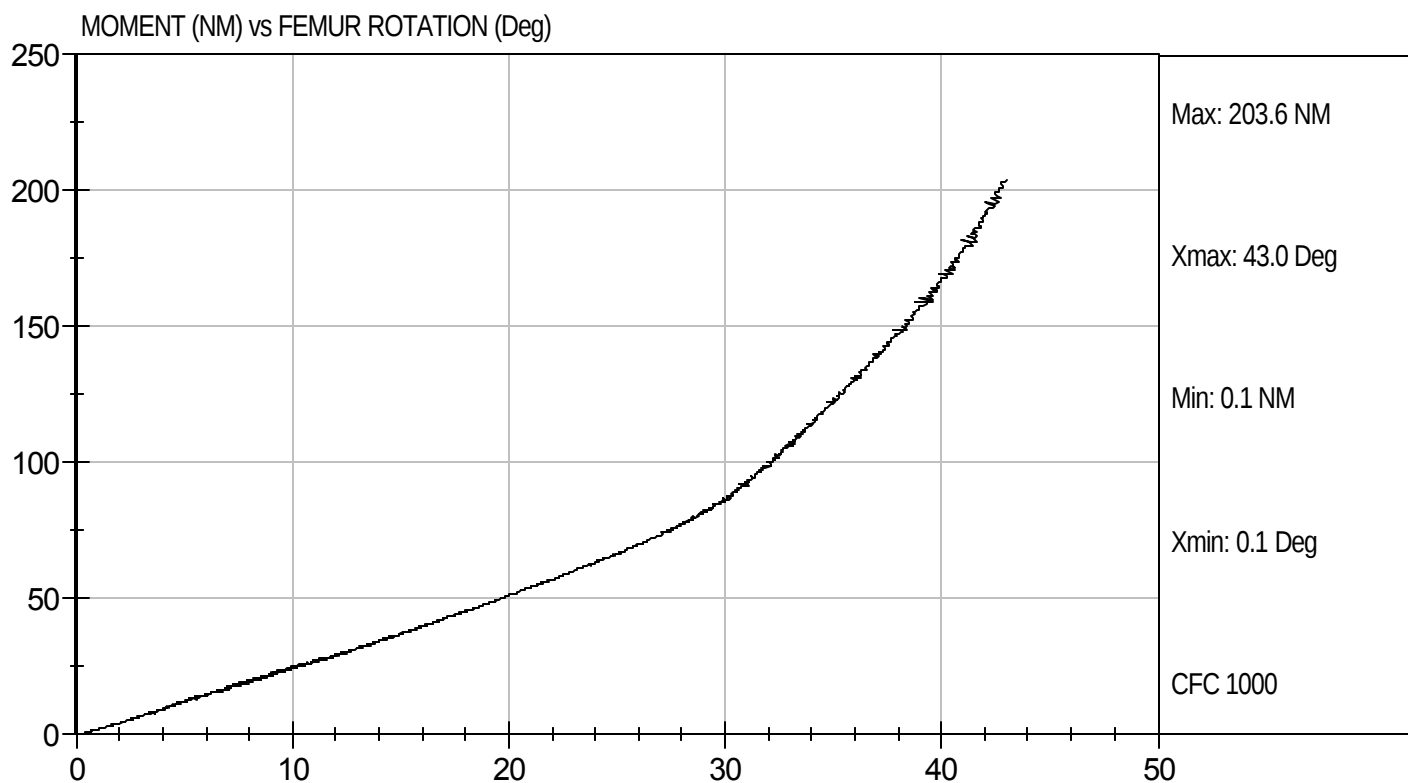
8/11/11
Test Date

David Winkelbauer
Approved By



Test Desc: Hip Femur Flexion
Component ID: D112729

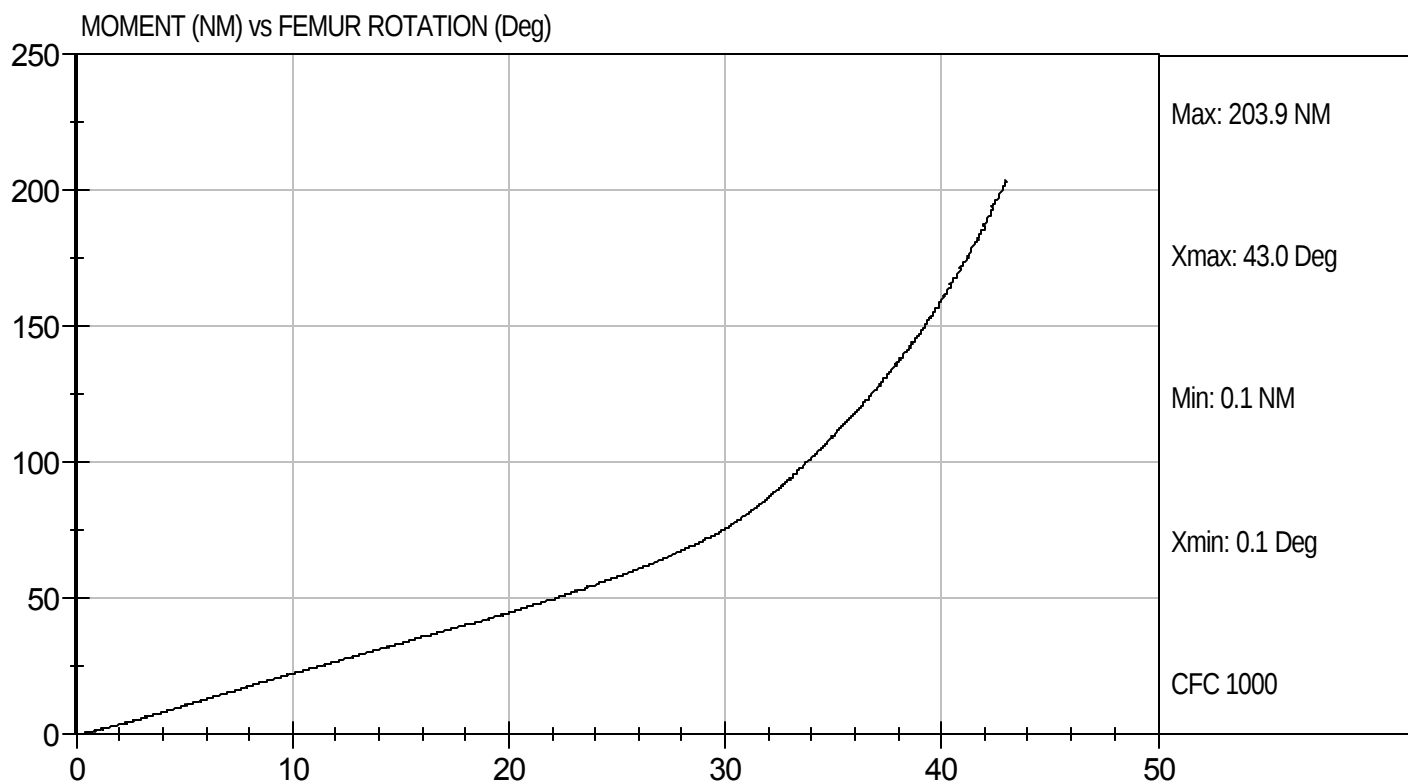
Test Date: 8/11/11
Velocity: 0 ft/s, m/s





Test Desc: Hip Femur Flexion
Component ID: D112720

Test Date: 8/11/11
Velocity: 0 ft/s, 0.00 m/s

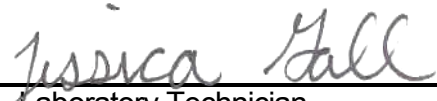


MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test ID: D112551

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Peak Resultant Acceleration	G's	250 to 300	272	Pass
Peak Lateral Acceleration	G's	+/- 15	5.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

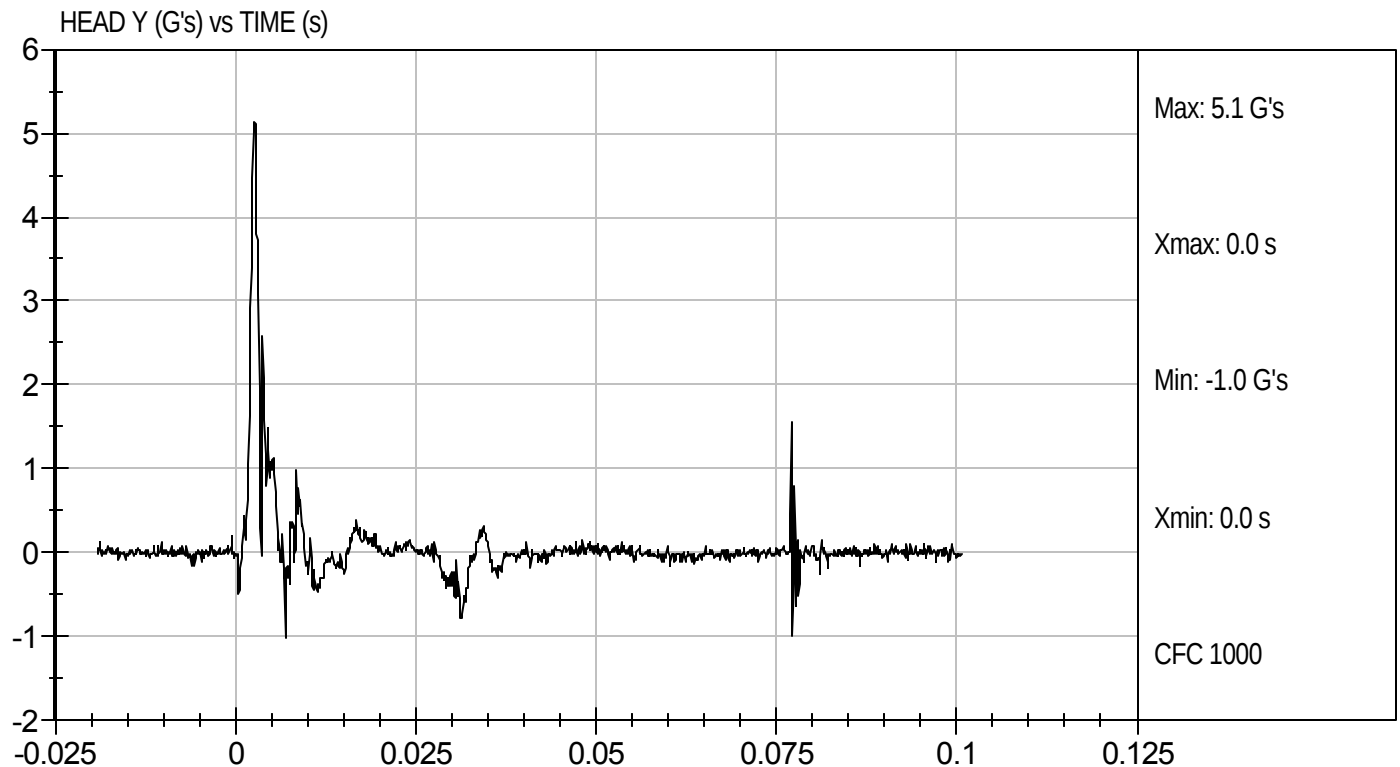
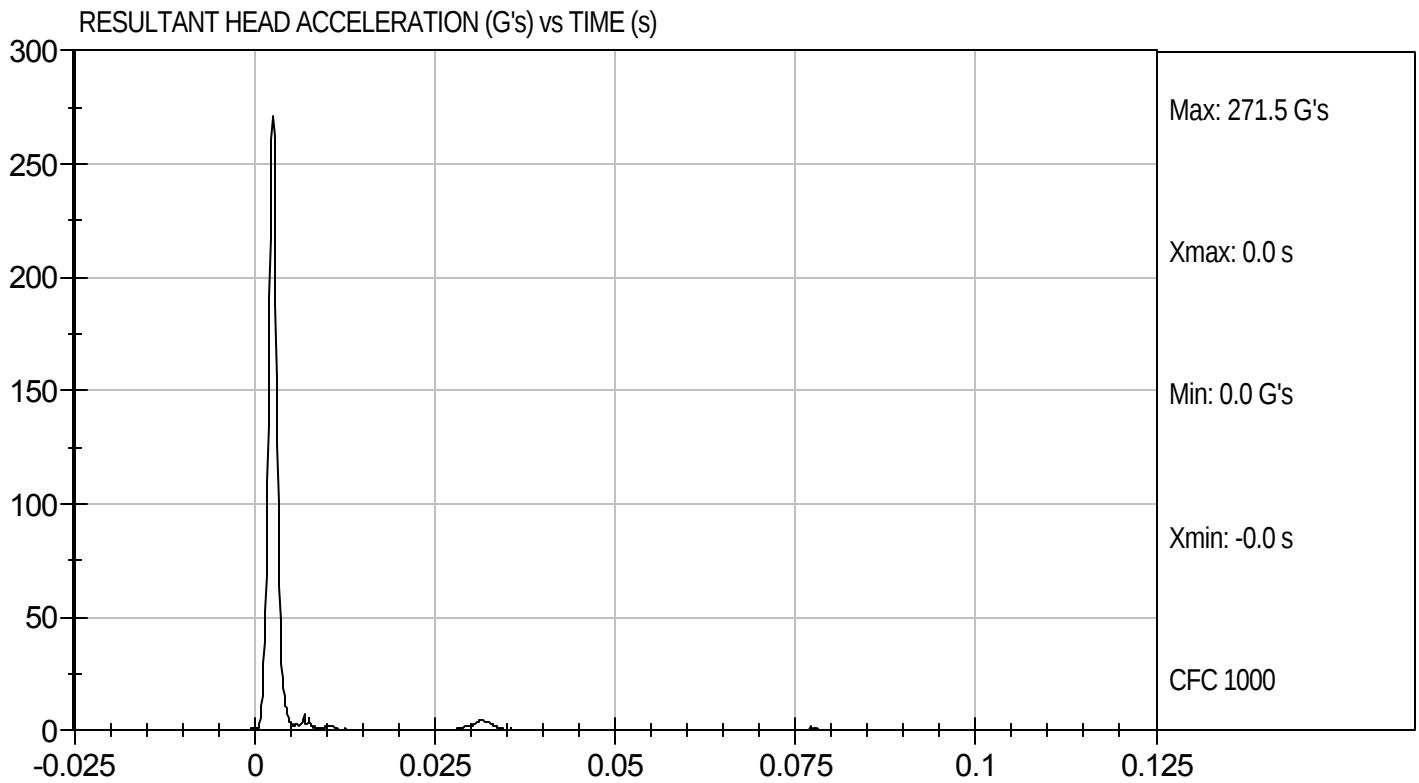
7/26/11
Test Date


Approved By



Test Desc: Head Drop
Component ID: D112551

Test Date: 7/26/11
Velocity: 0 ft/s, 0 m/s



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D112552

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.4	Pass
	30 ms	m/s	5.8 to 7.0	5.9	Pass
D Plane Rotation	Max	deg	77 to 91	79	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	76	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	87	Pass
Overall Results					Pass

Jessica Hall
Laboratory Technician

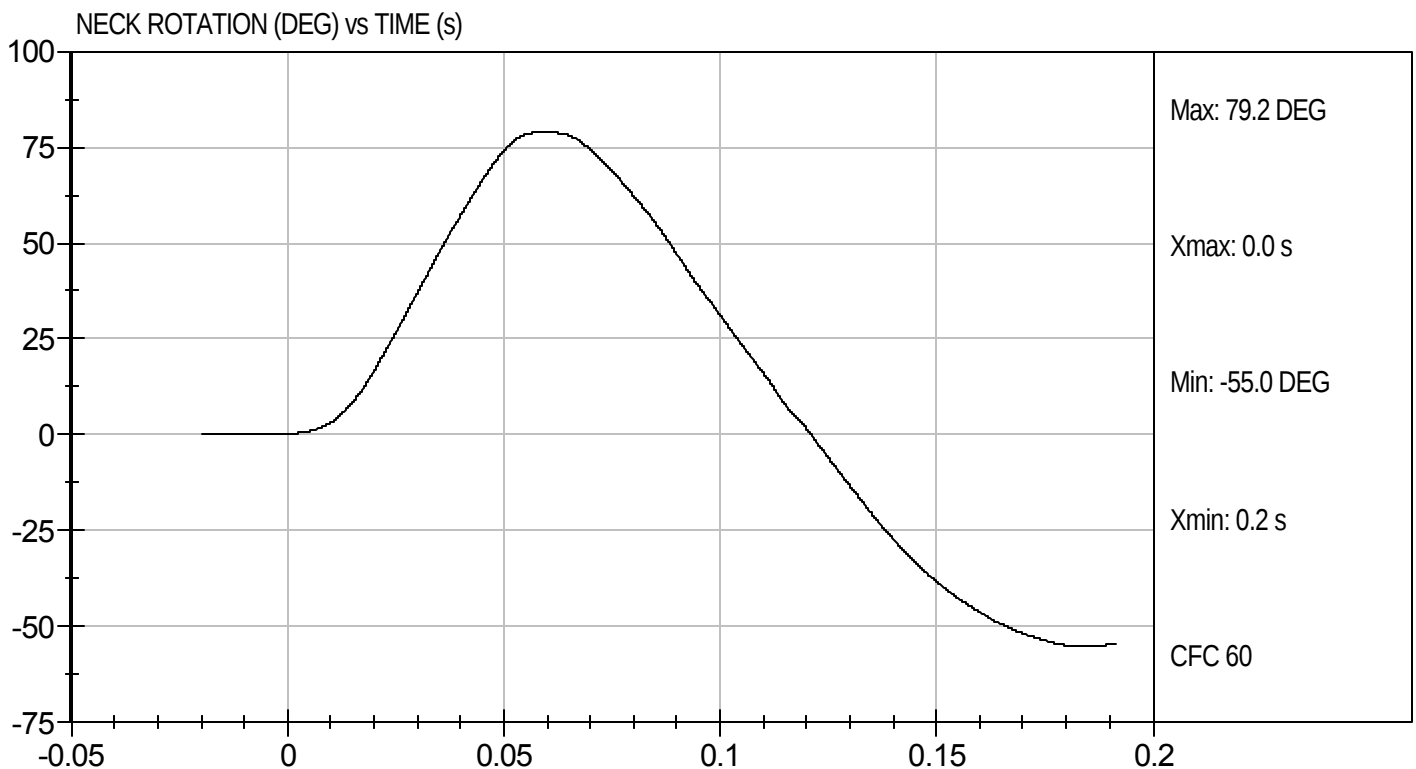
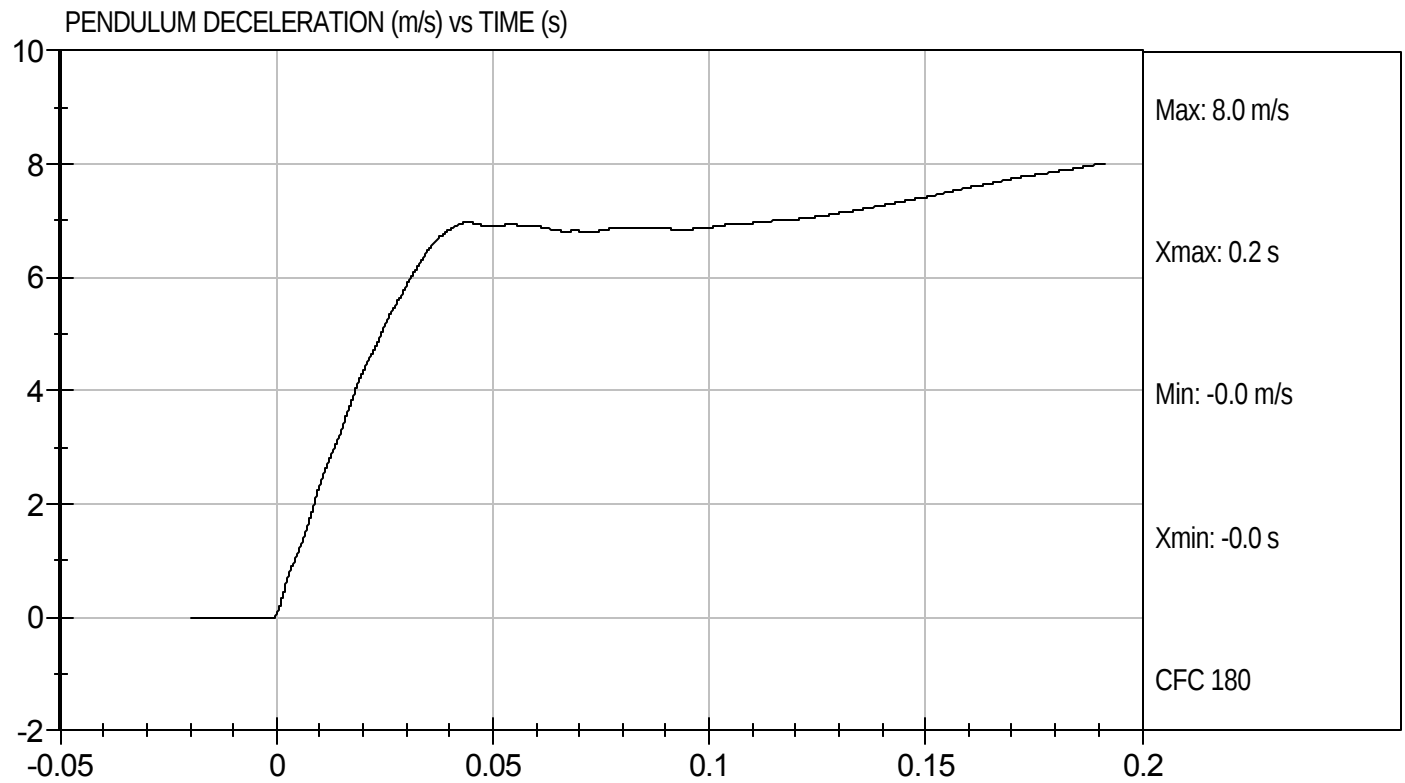
7/26/11
Test Date

David Winkelbauer
Approved By



Test Desc: Neck Flexion
Component ID: D112552

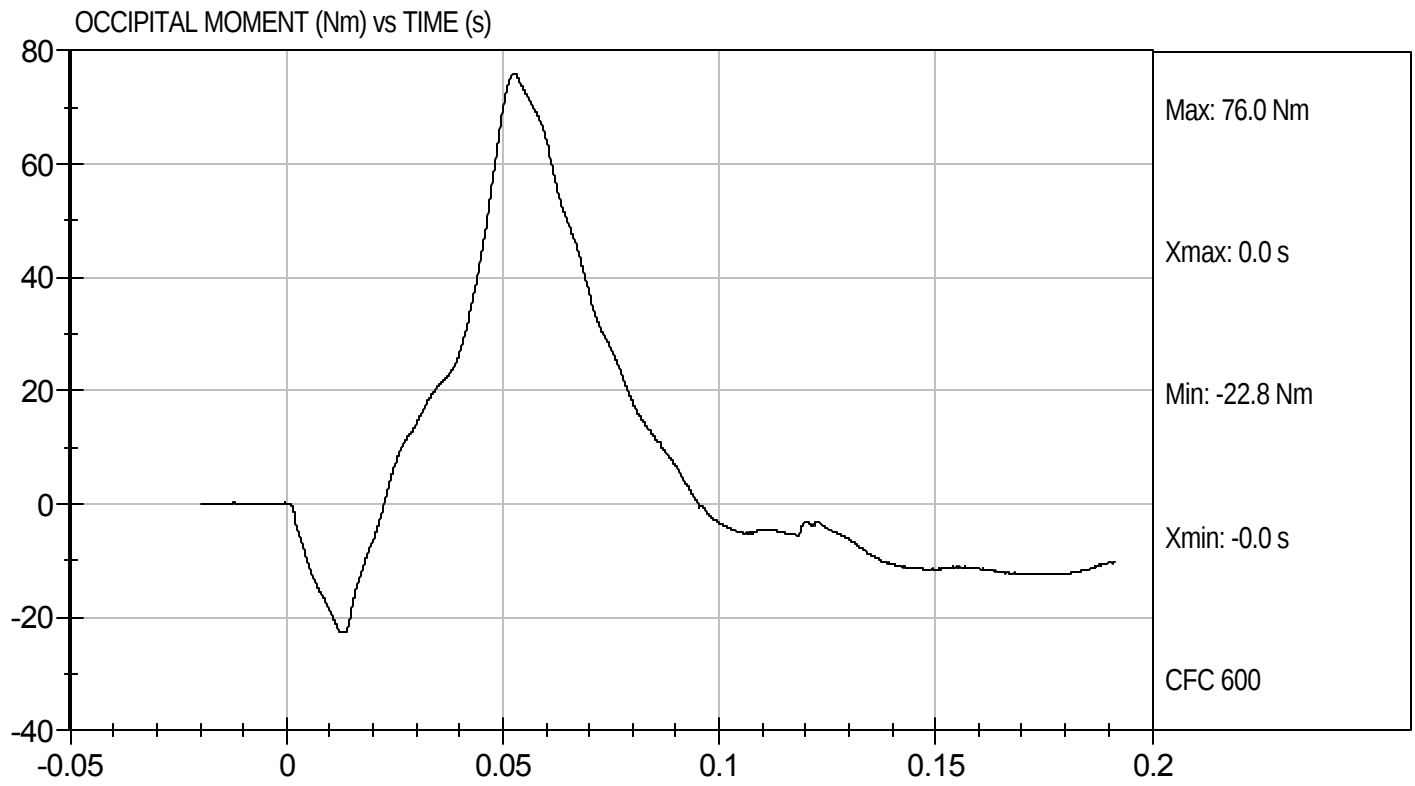
Test Date: 7/26/11
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D112552

Test Date: 7/26/11
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D112553

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.4	Pass
	30 ms	m/s	4.6 to 5.6	5.0	Pass
D Plane Rotation	Max	deg	99 to 114	105	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	103	Pass
Overall Results					Pass

Jessica Hall
Laboratory Technician

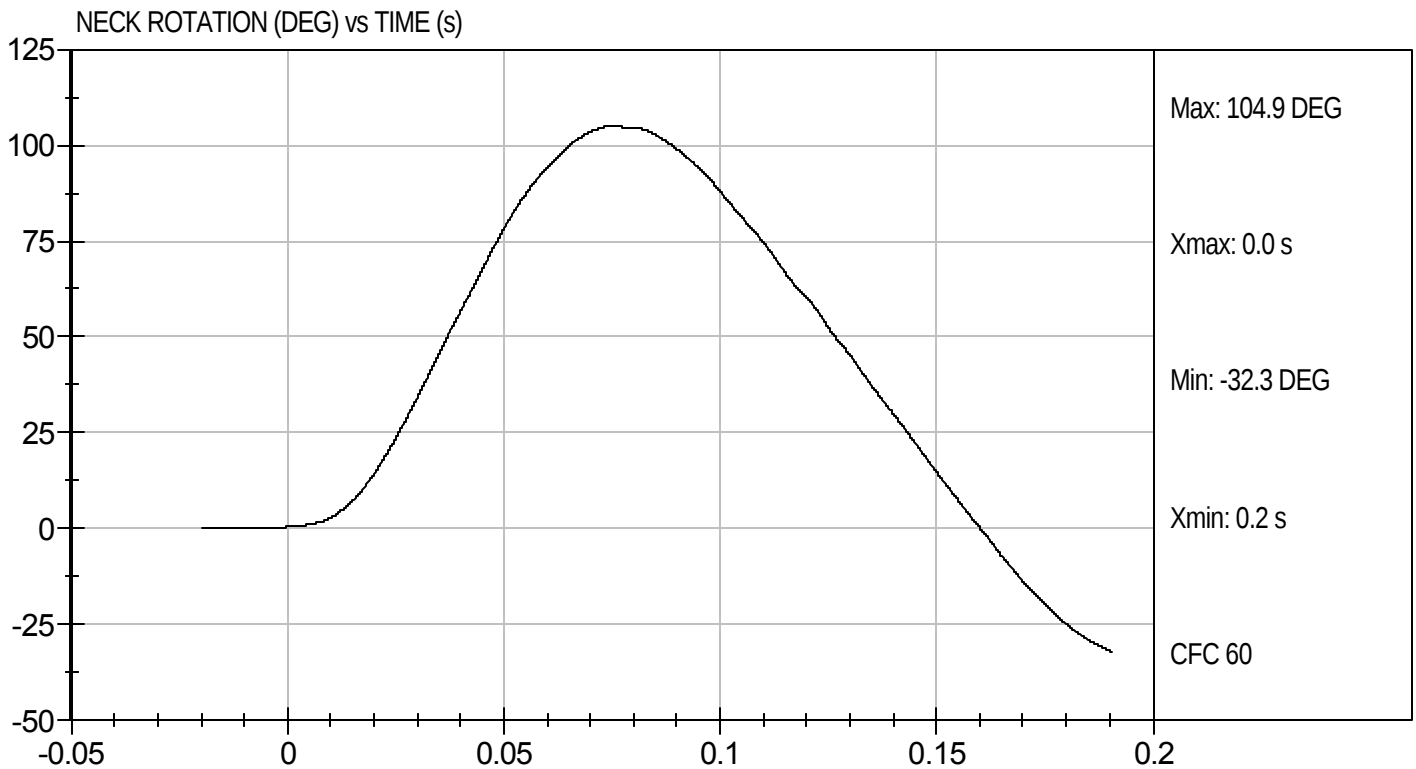
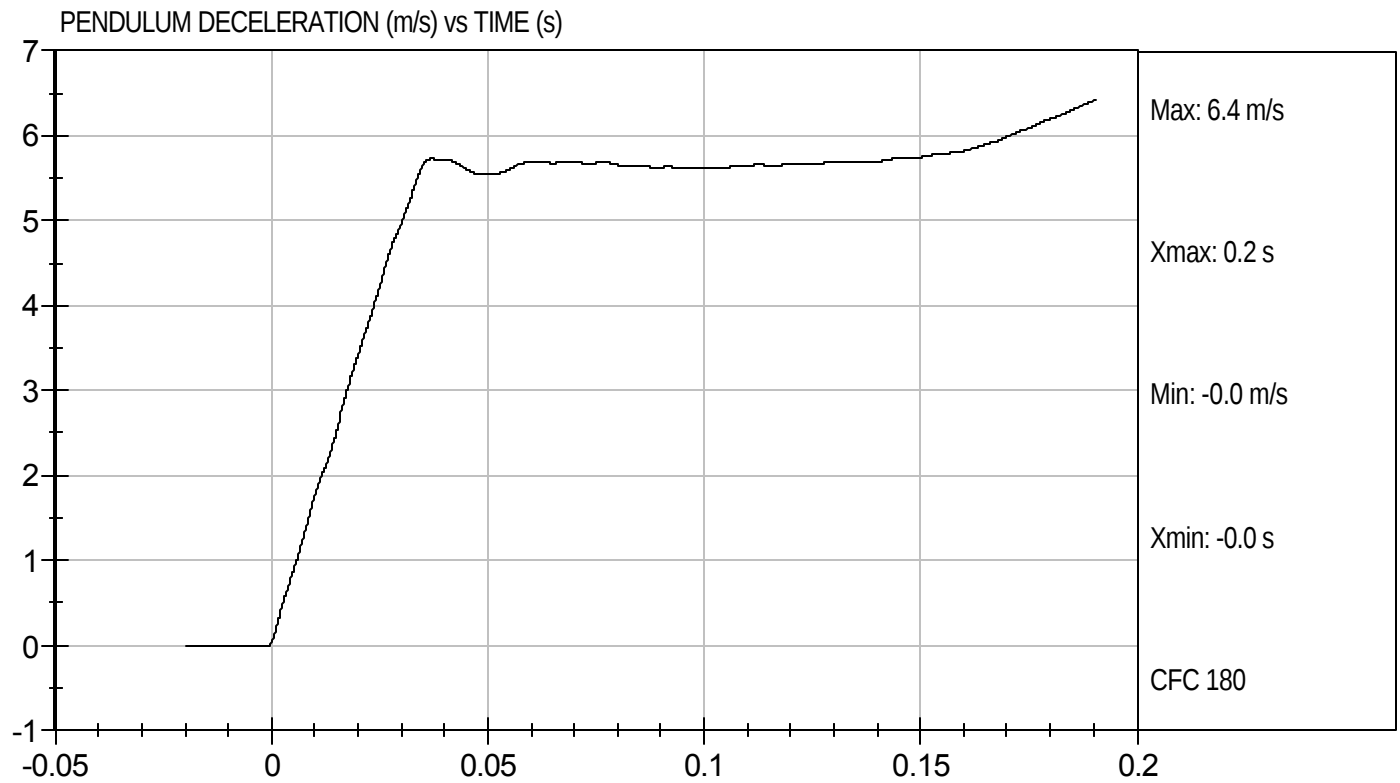
7/26/11
Test Date

David Winkelbauer
Approved By



Test Desc: Neck Extension
Component ID: D112553

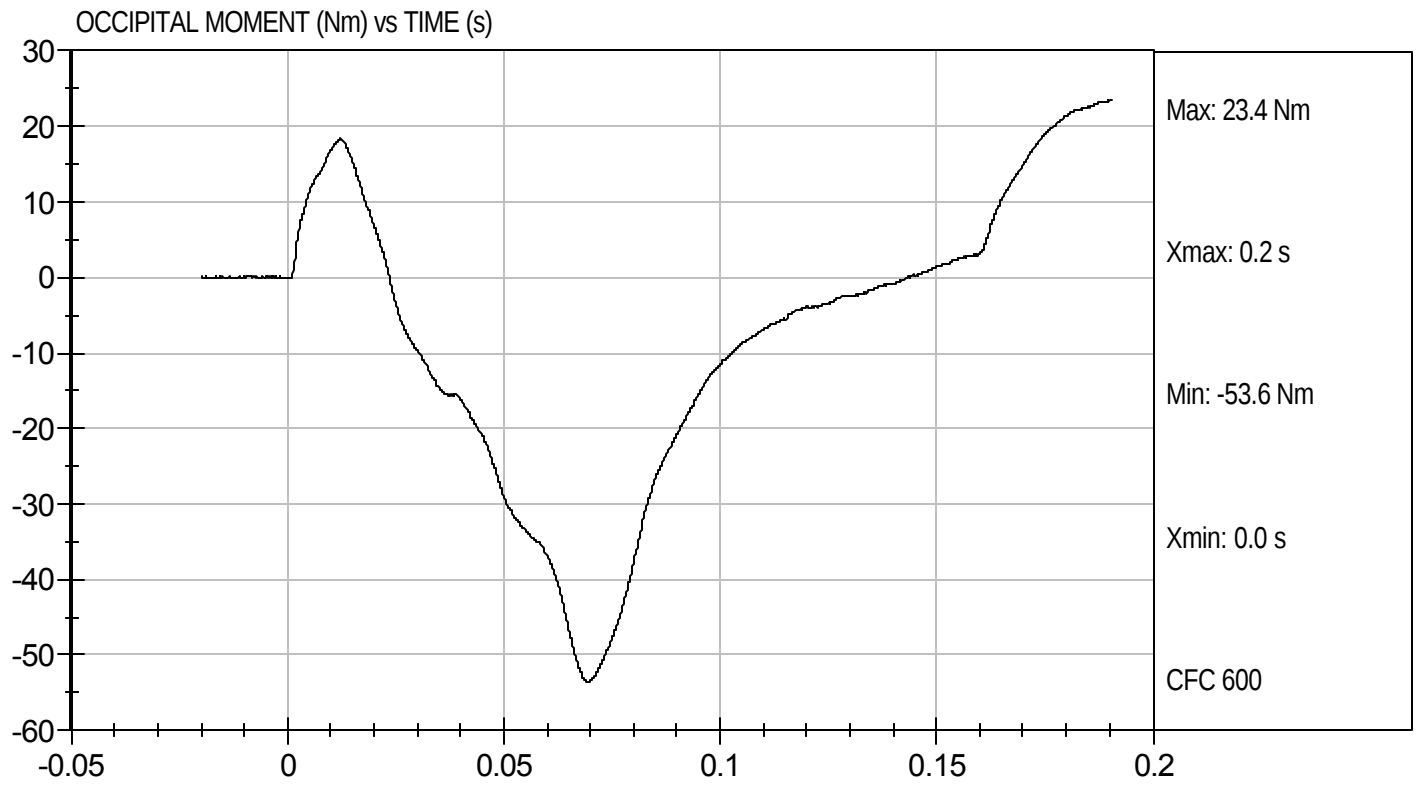
Test Date: 7/26/11
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension
Component ID: D112553

Test Date: 7/26/11
Velocity: 20.08 ft/s, 6.12 m/s

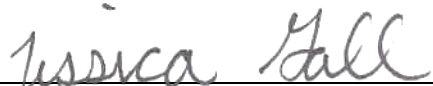


MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D112554

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.0	Pass
Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	56	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.07	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	3899	Pass
			Overall Test Results	Pass


Laboratory Technician

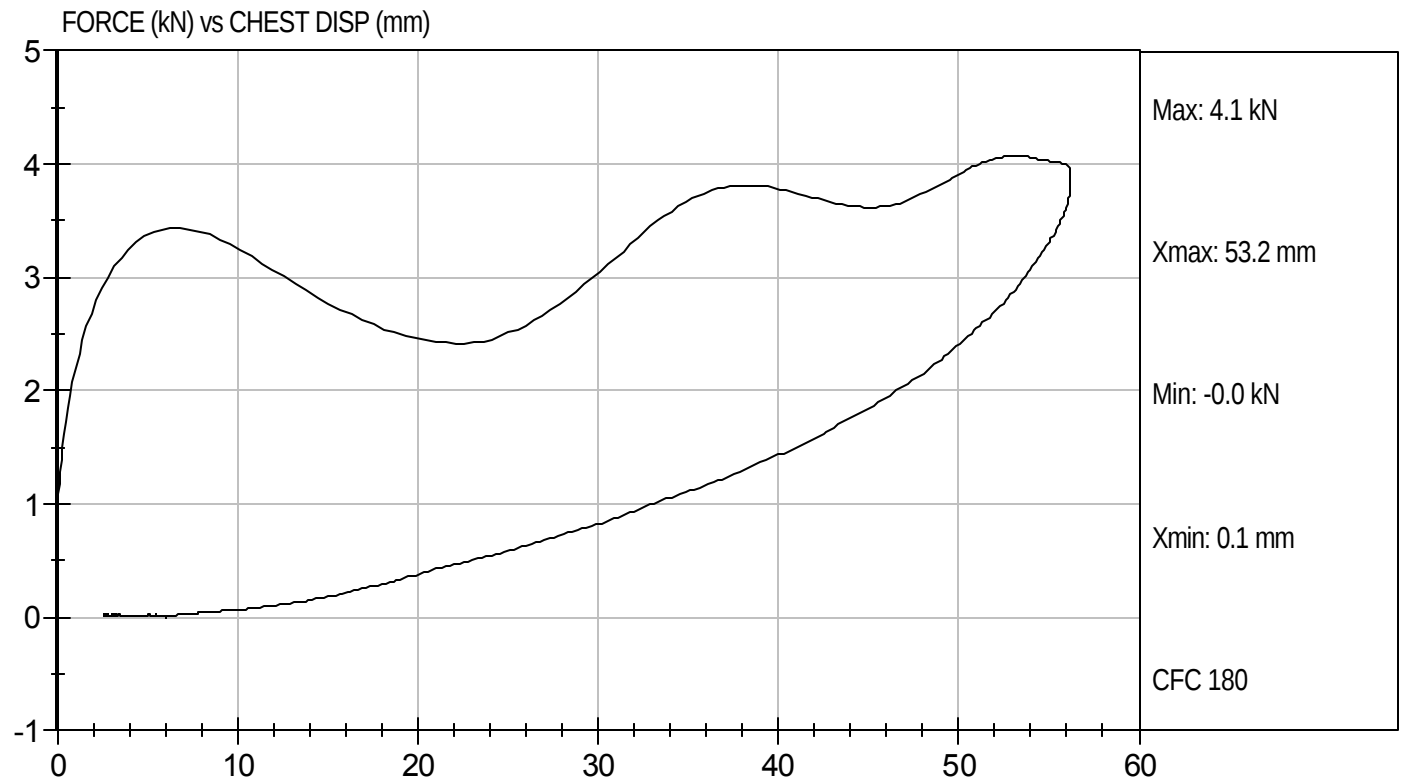
7/26/11
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D112554

Test Date: 7/26/11
Velocity: 22.2 ft/s, 6.77 m/s



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

ATD Serial No: 138

Test I.D: D112555

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.63	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

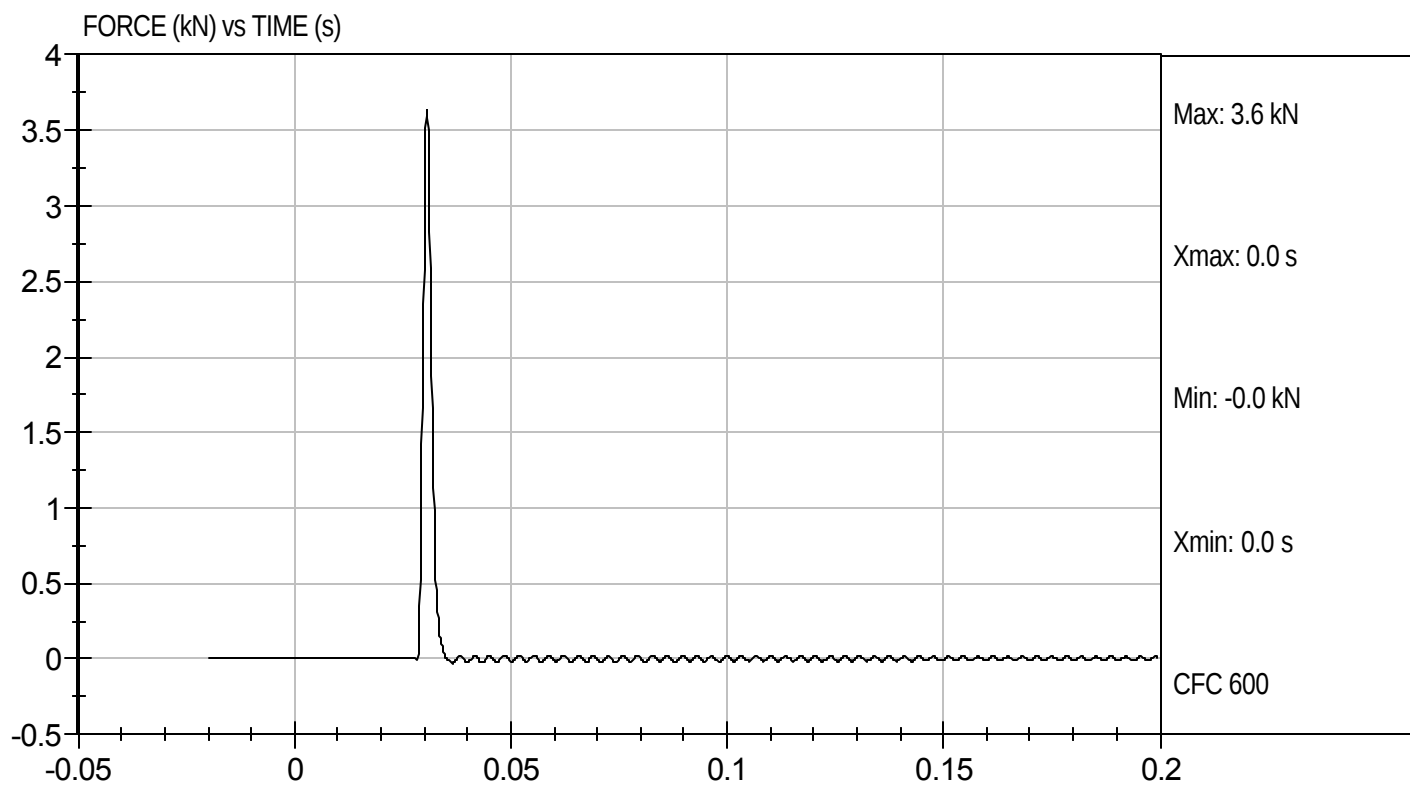
7/26/11
Test Date

David Winkelbauer
Approved By



Test Desc: Right Knee
Component ID: D112555

Test Date: 7/26/11
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D112556

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.84	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

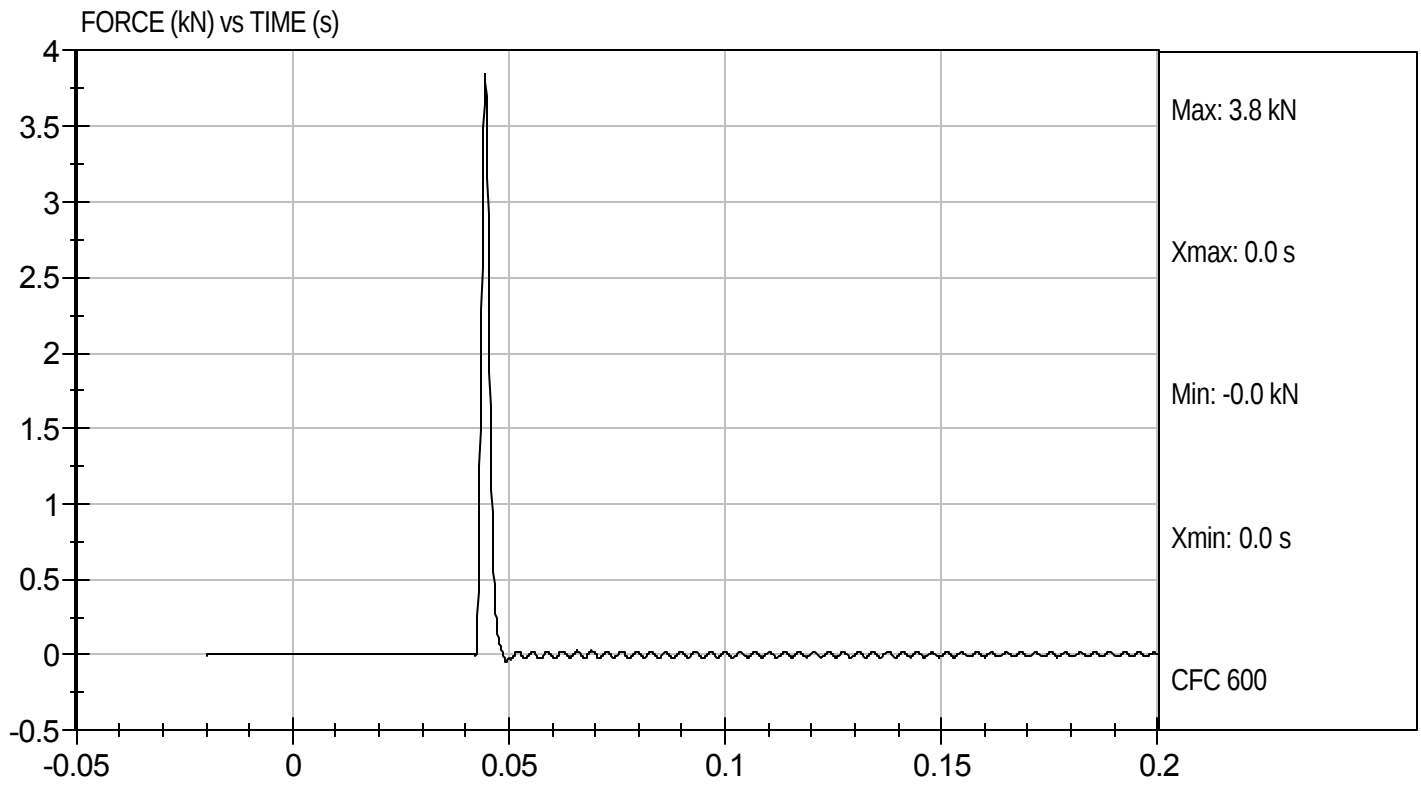
7/26/11
Test Date

David Winkelbauer
Approved By



Test Desc: Left Knee
Component ID: D112556

Test Date: 7/26/11
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D112557

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	49	Pass
Initial Angle	deg	0 to 20	15	Pass
Return Angle	deg	+/- 8	2	Pass
Force at 45 deg	N	320 to 390	361	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
Overall Result			Pass	


Laboratory Technician

7/26/11
Test Date


Approved By

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test ID: D112731

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Peak Resultant Acceleration	G's	250 to 300	283	Pass
Peak Lateral Acceleration	G's	+/- 15	4.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass


Laboratory Technician

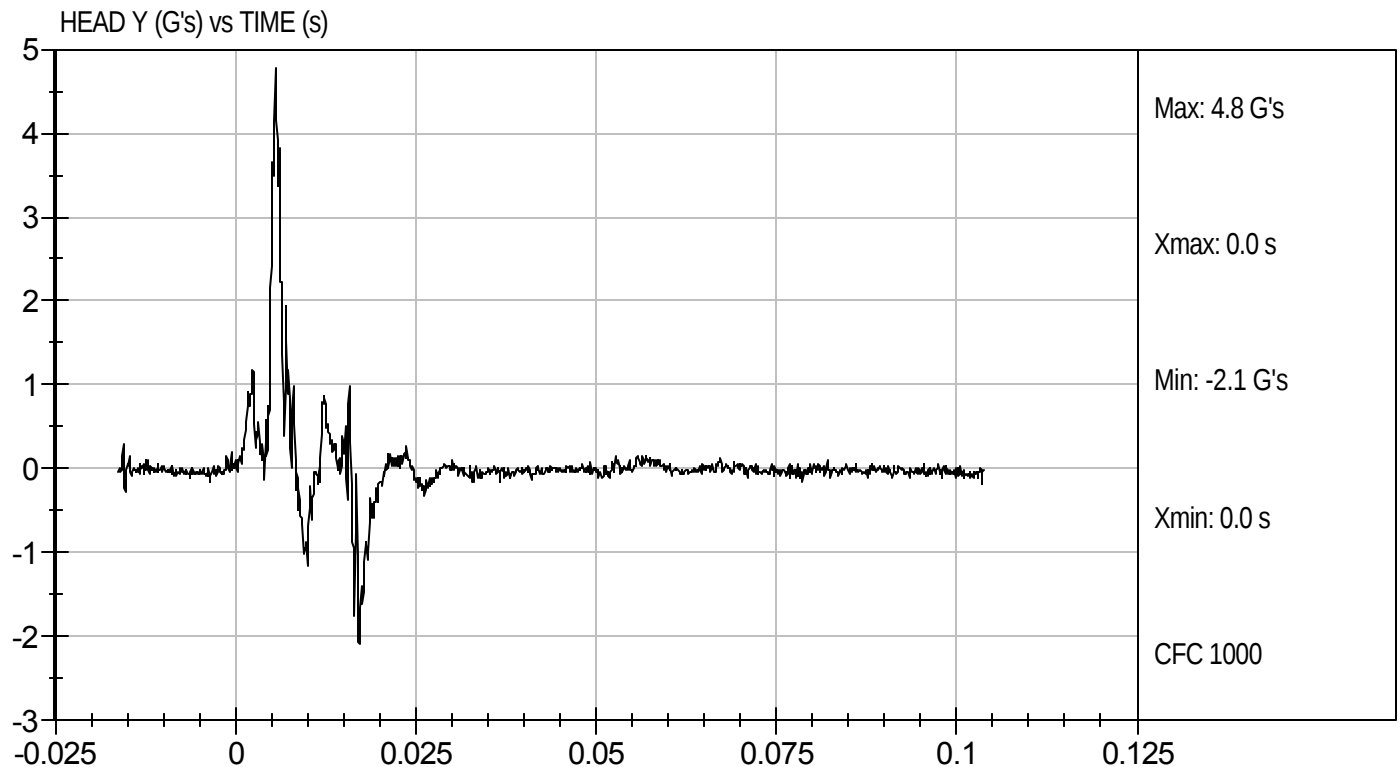
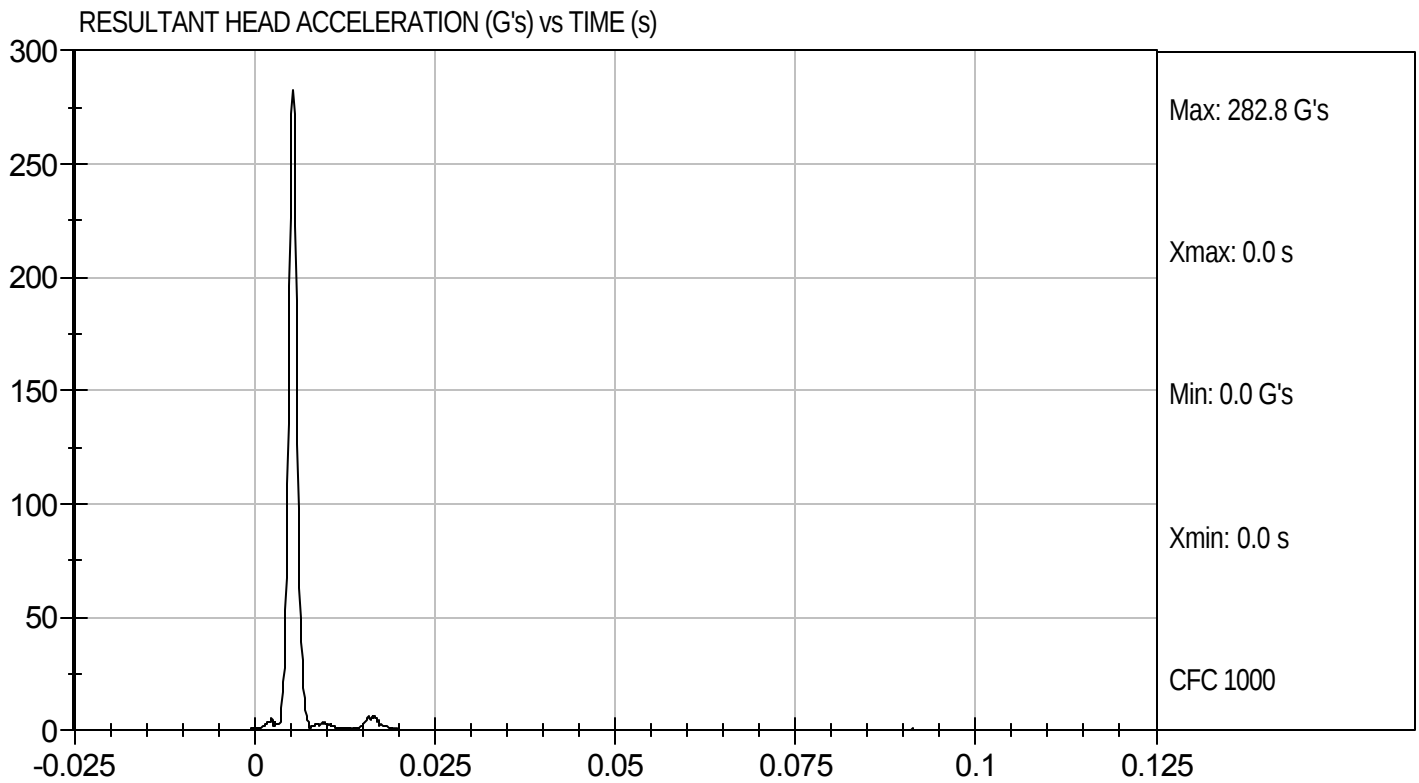
8/10/11
Test Date


Approved By



Test Desc: Head Drop
Component ID: D112731

Test Date: 8/10/11
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D112732

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	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	6.3	Pass
D Plane Rotation	Max	deg	77 to 91	79	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	76	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
Overall Results					Pass

Jessica Hall
Laboratory Technician

8/10/11
Test Date

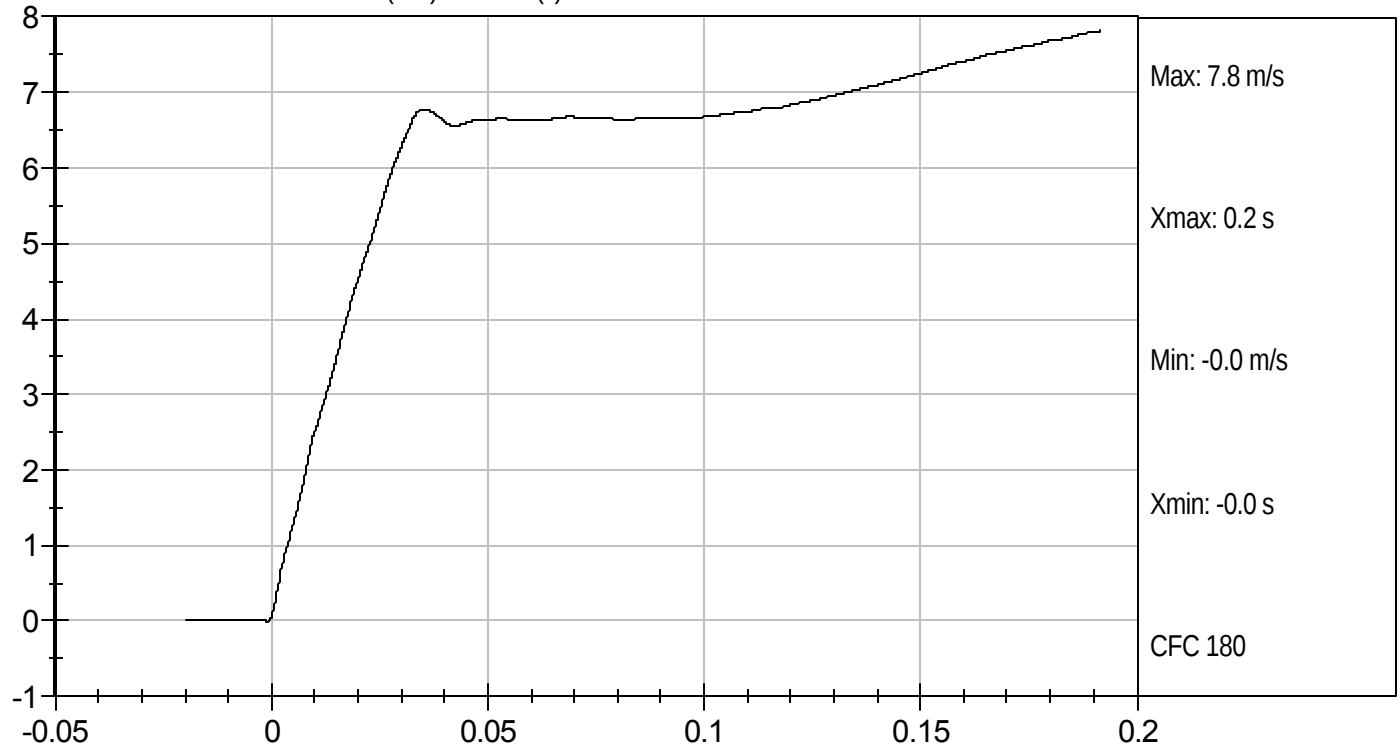
David Winkelbauer
Approved By



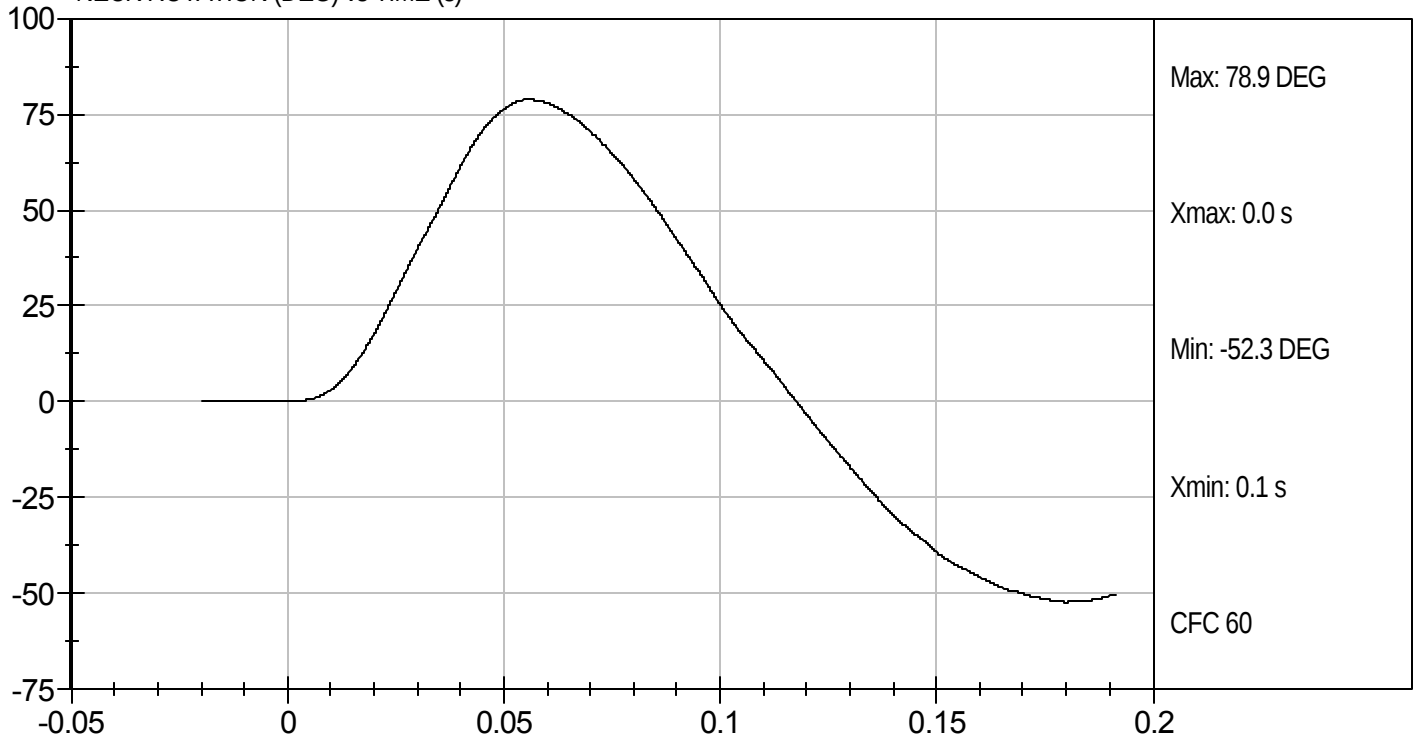
Test Desc: Neck Flexion
Component ID: D112732

Test Date: 8/10/11
Velocity: 23.15 ft/s, 7.06 m/s

PENDULUM DECELERATION (m/s) vs TIME (s)



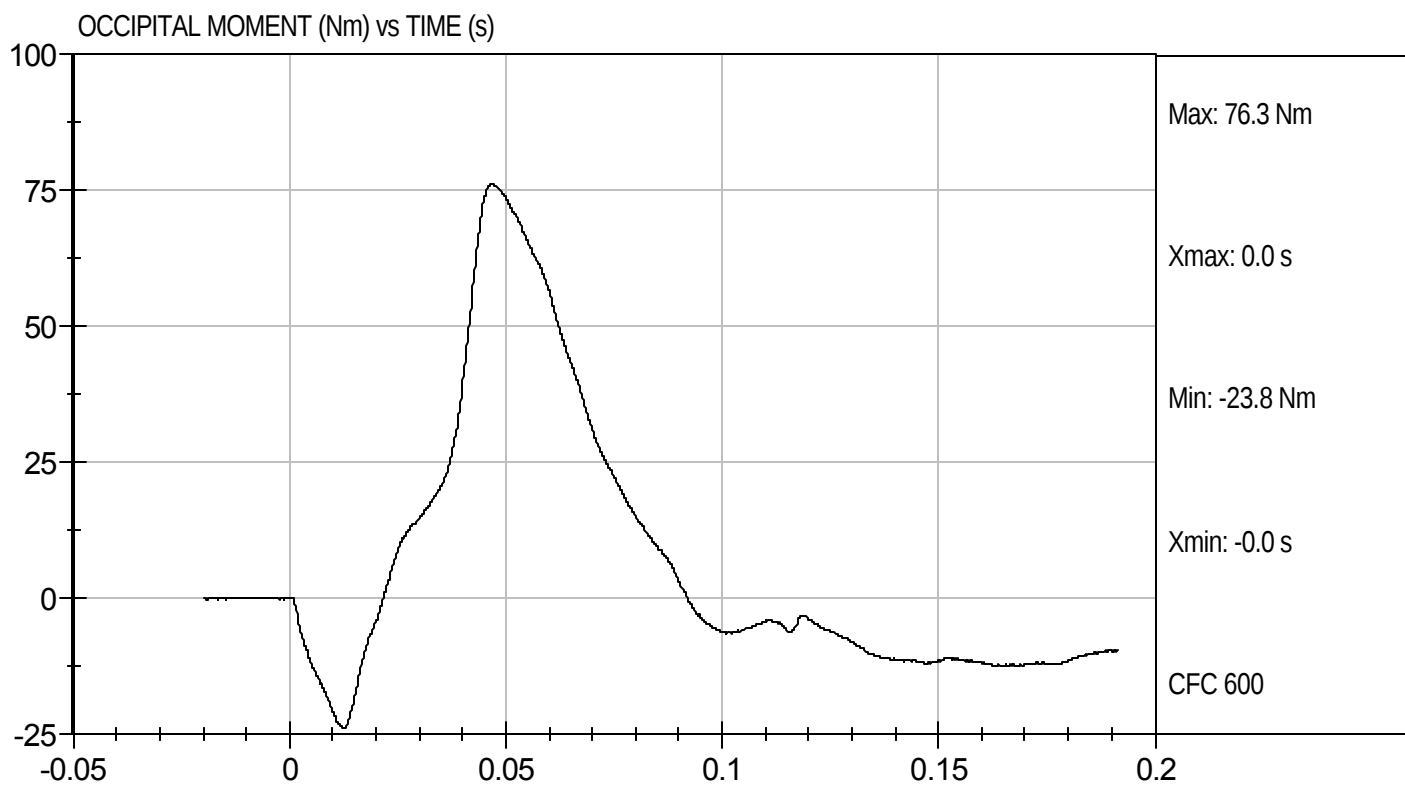
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Component ID: D112732

Test Date: 8/10/11
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138Test I.D: D112733

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.13	Pass
Pendulum Deceleration	10 ms	m/s	1.5 to 1.9	1.9	Pass
	20 ms	m/s	3.1 to 3.9	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	104	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-53	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	102	Pass
Overall Results					Pass

Jessica Hall
Laboratory Technician

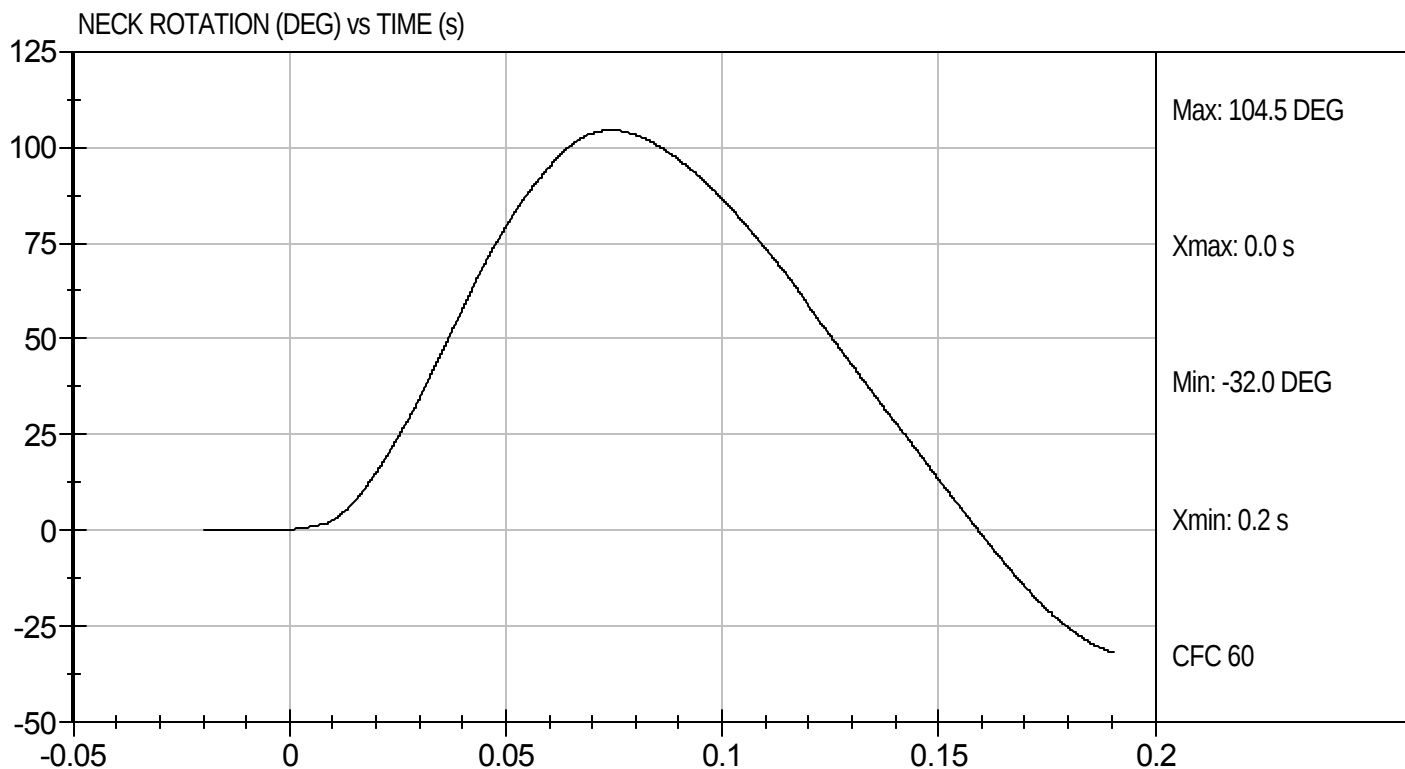
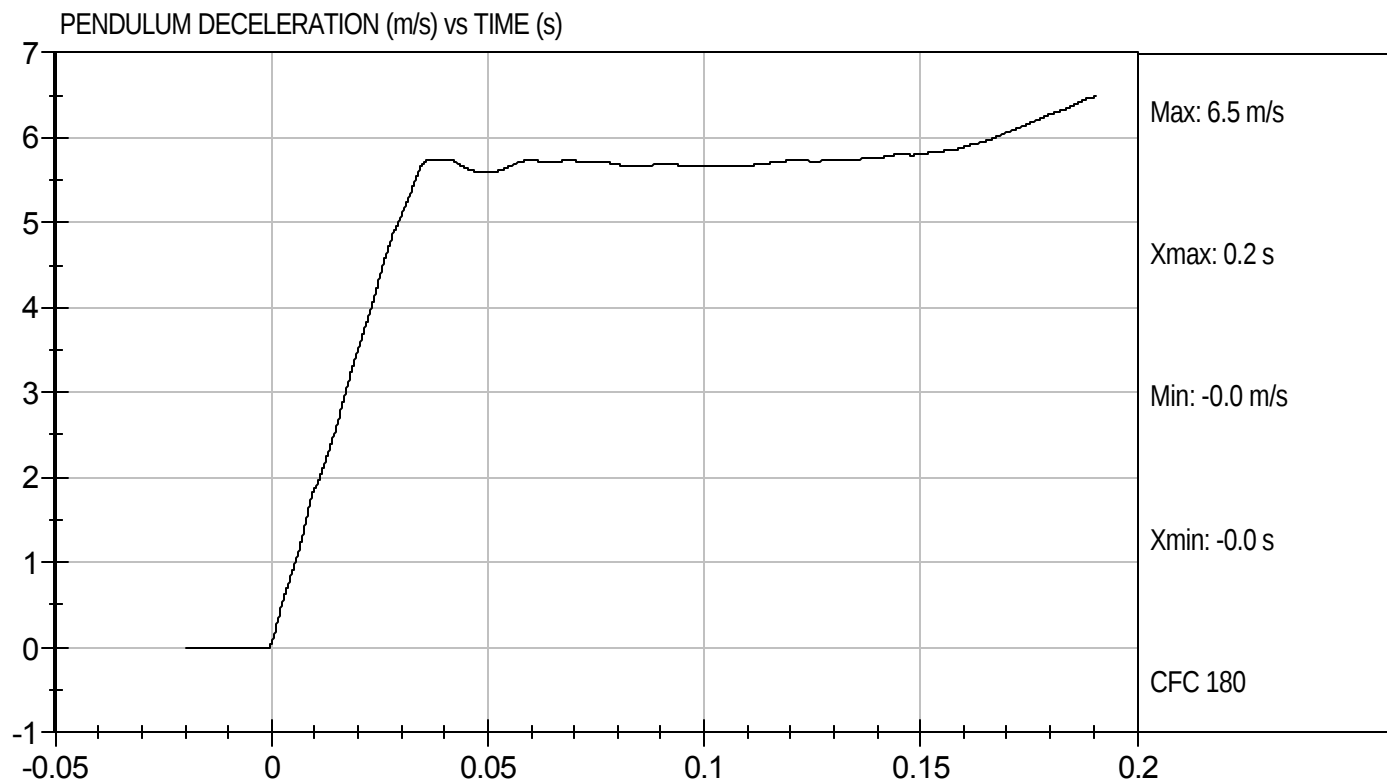
8/10/11
Test Date

David Winkelbauer
Approved By



Test Desc: Neck Extension
Component ID: D112733

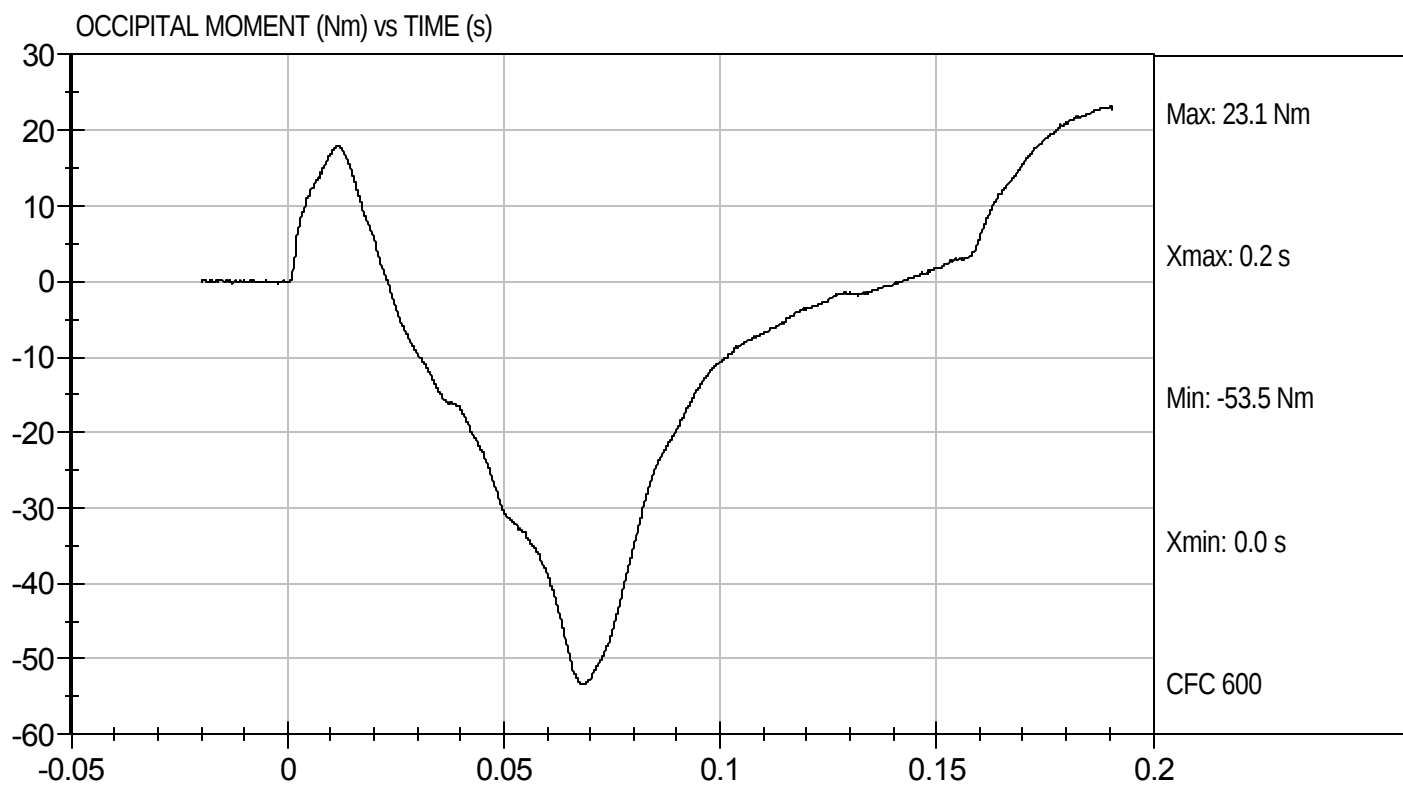
Test Date: 8/10/11
Velocity: 20.10 ft/s, 6.13 m/s





Test Desc: Neck Extension
Component ID: D112733

Test Date: 8/10/11
Velocity: 20.10 ft/s, 6.13 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D112734

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.1	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	56	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.1	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	3958	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

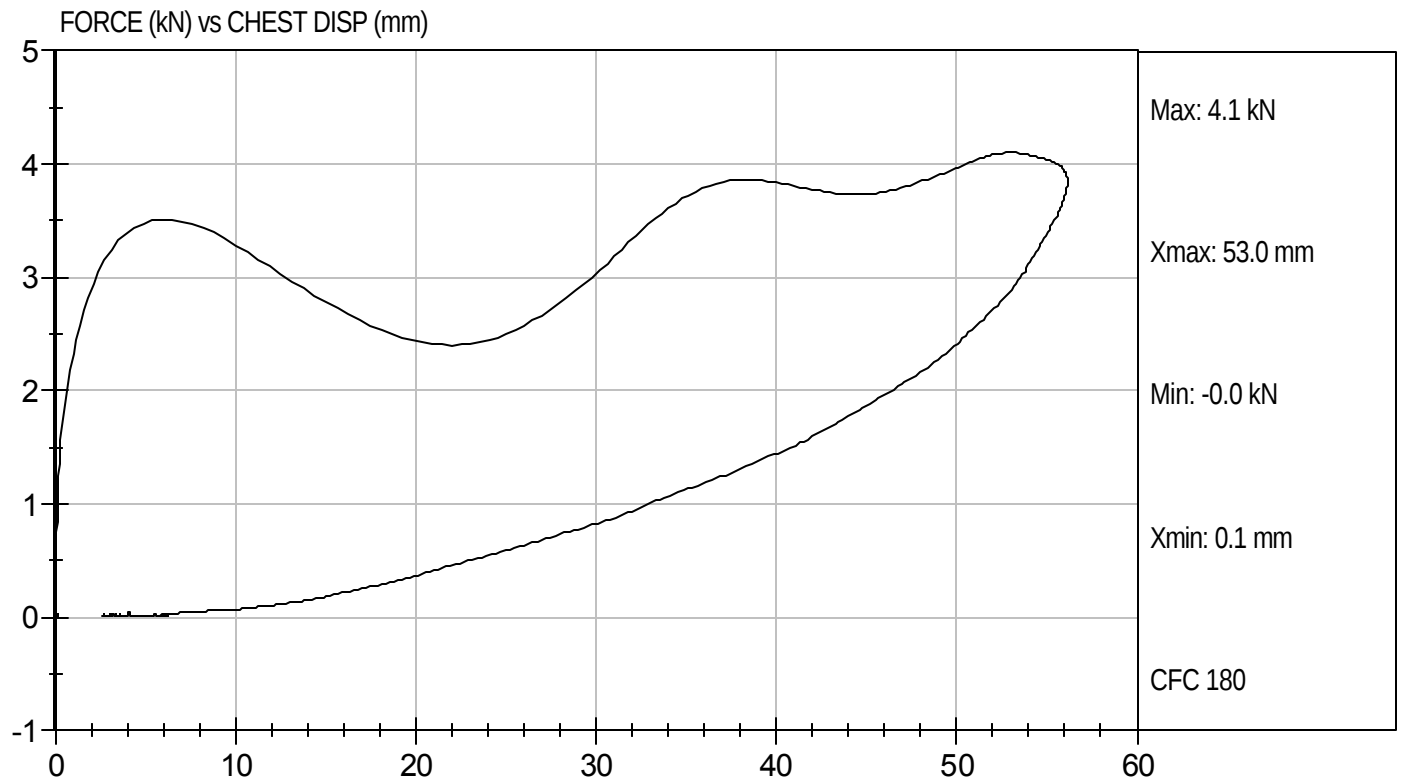
8/11/11
Test Date

David Winkelbauer
Approved By



Test Desc: Thorax Impact
Component ID: D112734

Test Date: 8/11/11
Velocity: 22.22 ft/s, 6.77 m/s



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

ATD Serial No: 138

Test I.D: D112735

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.92	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

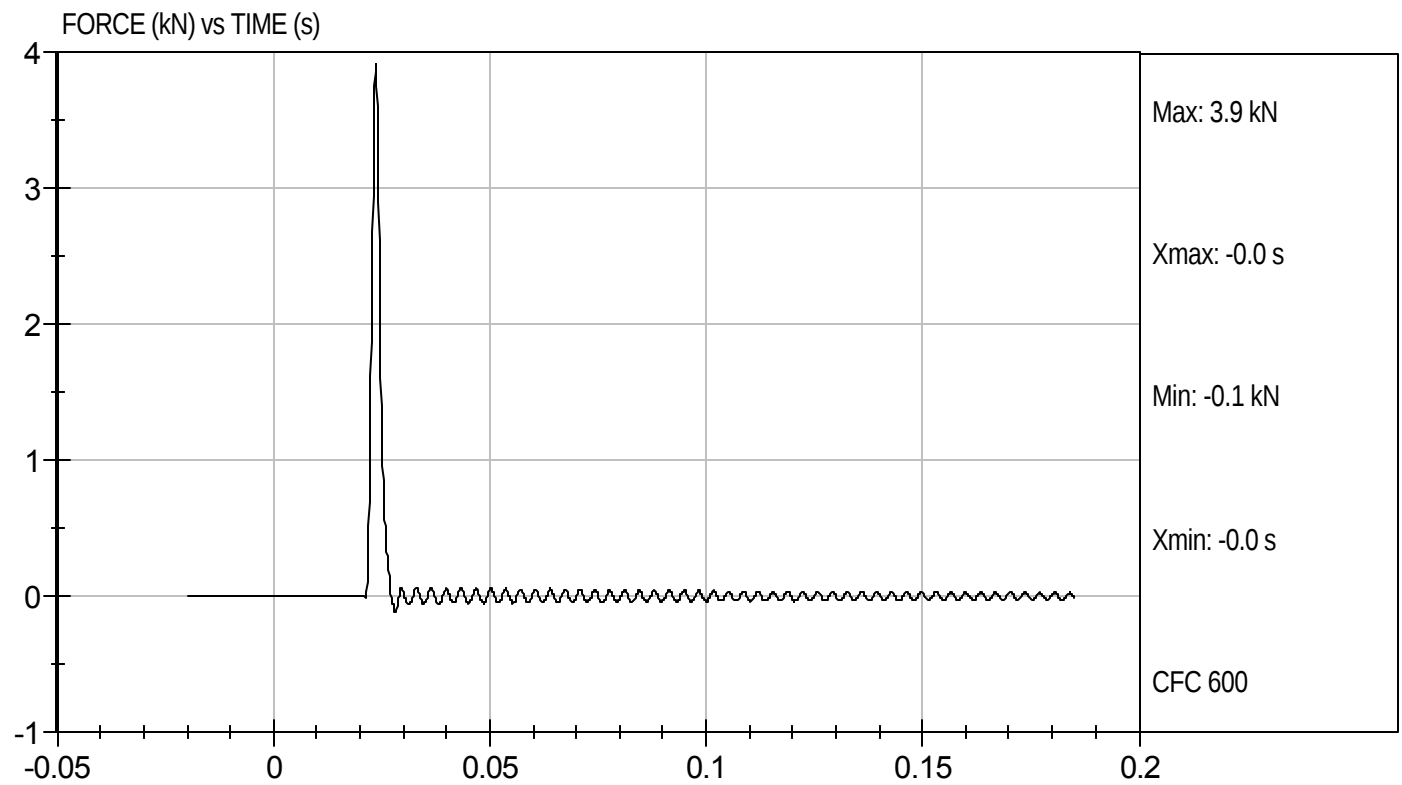
8/10/11
Test Date

David Winkelbauer
Approved By



Test Desc: Right Knee
Component ID: D112735

Test Date: 8/10/11
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D112736

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	kN	3.45 to 4.06	3.67	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

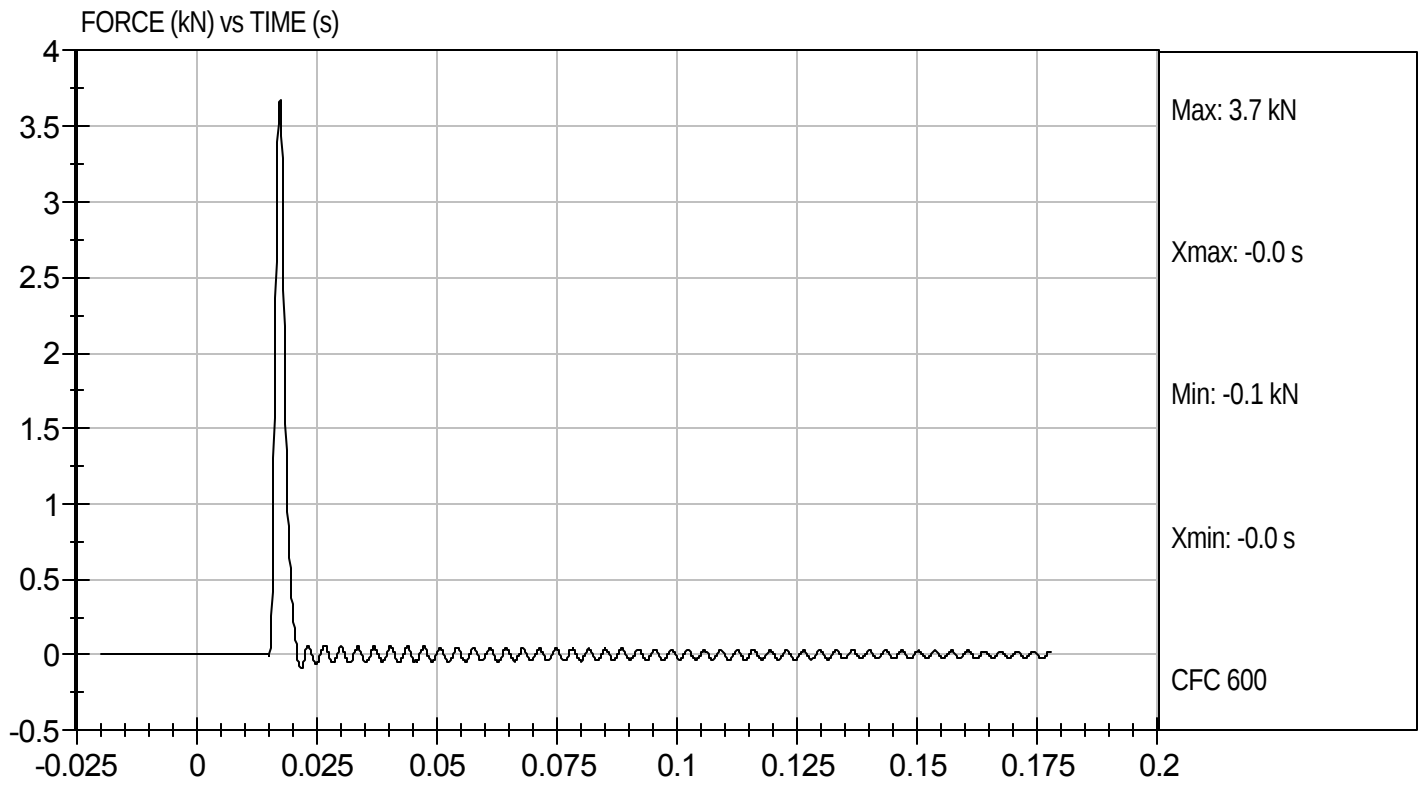
8/10/11
Test Date

David Winkelbauer
Approved By



Test Desc: Left Knee
Component ID: D112736

Test Date: 8/10/11
Velocity: 6.81 ft/s, 2.08 m/s



MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D112737

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	50	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	362	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
Overall Result				Pass


Laboratory Technician

8/11/11
Test Date


Approved By