

REPORT NUMBER: NCAP-MGA-2012-058

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

**HYUNDAI MOTOR COMPANY
2012 Hyundai Elantra GLS 4-Dr Sedan
NHTSA No.: UC0500**

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



Test Date: February 3, 2012

Final Report Date: April 2, 2012

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: 
Donna Janovicz, Project Manager

Approved by: 
Ben Fischer, Project Engineer

Approval Date: April 2, 2012

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

1. <i>Report No.</i> NCAP-MGA-2012-058		2. <i>Government Accession No.</i>		3. <i>Recipient's Catalog No.</i>																																																			
4. <i>Title and Subtitle</i> Final Report of New Car Assessment Program Frontal Impact Testing of 2012 Hyundai Elantra GLS 4-Dr Sedan, NHTSA No.: UC0500				5. <i>Report Date</i> April 2, 2012																																																			
				6. <i>Performing Organization Code</i> MGA																																																			
7. <i>Author(s)</i> Donna Janovicz, Project Manager Ben Fischer, Project Engineer				8. <i>Performing Organization Report No.</i> NCAP-MGA-2012-058																																																			
				10. <i>Work Unit No.</i>																																																			
9. <i>Performing Organization Name and Address</i> MGA Research Corporation 5000 Warren Road Burlington, WI 53105						11. <i>Contract or Grant No.</i> DTNH22-06-D-00028																																																	
				12. <i>Sponsoring Agency Name and Address</i> U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C. 20590				13. <i>Type of Report and Period Covered</i> Final Test Report February 3, 2012 to April 2, 2012																																															
14. <i>Sponsoring Agency Code</i> NVS-111																																																							
15. <i>Supplementary Notes</i>																																																							
16. <i>Abstract</i> A 56.3 km/h NCAP Frontal Impact Test was conducted on the 2012 Hyundai Elantra GLS 4-Dr Sedan 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), 301, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on February 3, 2012. The impact velocity was 56.1 km/h and the ambient temperature at the barrier face at the time of impact was 21.4° C. The target vehicle post-test maximum crush was 469 mm located to the left of the vehicle's centerline. The test vehicle's performance was as follows: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <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>186</td> <td>295</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>52</td> <td>23</td> <td>12</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>1</td> <td>0.30</td> <td>0.42</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>2620</td> <td>1443</td> <td>1064</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>2520</td> <td>98</td> <td>464</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>1081</td> <td>2385</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>2686</td> <td>405</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	186	295	Maximum Chest Compression	mm	63	52	23	12	Nij	N/A	1	1	0.30	0.42	Neck Tension	N	4170	2620	1443	1064	Neck Compression	N	4000	2520	98	464	Left Femur Force	N	10008	6805	1081	2385	Right Femur Force	N	10008	6805	2686	405
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			21. <i>No. of Pages</i> 164																																																				
19. <i>Security Classification of Report</i> Unclassified		20. <i>Security Classification of Page</i> Unclassified				22. <i>Price</i>																																																	

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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 Standards Frontal NCAP Laboratory Test Procedure.

SUMMARY

A load cell barrier was impacted by a 2012 Hyundai Elantra GLS 4-Dr Sedan at a velocity of 56.1 kph. The test was performed at MGA Research Corporation on February 3, 2012. 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 also on the driver and passenger's lap belts to measure dummy torso and pelvic section loading.

The driver (position 1) ATD (Serial No. 351) and the right-front passenger (position 2) ATD (Serial No. 634) were calibrated previous to this test. Certification details, along with instrumentation calibration 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 469 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 and chest contacted the airbag. The driver's head also contacted the headrest and visor. The driver's knees contacted the knee bolster. The passenger's visible contact points were as follows: The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest and seatback. The passenger's knees contacted the knee bolster and front airbag.

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)	186	0.30	1443	98	47	23	1081	2686
Passenger (5 th)	295	0.42	1064	464	46	12	2385	405

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

TEST NOTES

There was no valid data collected for:
Top of Engine after 46 ms.

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 Hyundai Elantra GLS 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
Test Date: 02/03/2012

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	UC0500	Traction Control System (TCS)	Yes
Model Year	2012	Auto-Leveling System	No
Make	Hyundai	Automatic Door Locks (ADLs)	Yes
Model	Elantra	Power Window Auto-Reverse	No
Body Style	Sedan	Other Optional Feature	N/A
VIN	KMHDH4AE5CU363690	Driver Front Airbag	Yes
Body Color	Sky Blue Metallic	Driver Curtain Airbag	Yes
Odometer (km/mi)	108 / 67	Driver Head/Torso Airbag	No
Engine Displacement (L)	1.8	Driver Torso Airbag	No
Type/No. Cylinders	4	Driver Torso/Pelvis Airbag	Yes
Engine Placement	Lateral	Driver Pelvis Airbag	No
Transmission Type	Automatic	Driver Knee Airbag	No
Transmission Speeds	6	Pass. Curtain Airbag	Yes
Overdrive	Yes	Pass. Front Airbag	Yes
Final Drive	Front	Pass. Torso Airbag	No
Roof Rack	No	Pass. Torso/Pelvis Airbag	Yes
Sunroof/T-Top	No	Pass. Pelvis Airbag	No
Running Boards	No	Driver Seat Belt Pretensioner	Yes
Tilt Steering Wheel	Yes	Pass. Seat Belt Pretensioner	Yes
Power Seats	No	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Pass. Load Limiter	Yes
All-Wheel Drive (AWD)	No	Other Safety Restraint	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)	1720
Date of Manufacture	NOV/15/11	GAWR Front (kg)	940
Vehicle Type	Passenger Car	GAWR Rear (kg)	800

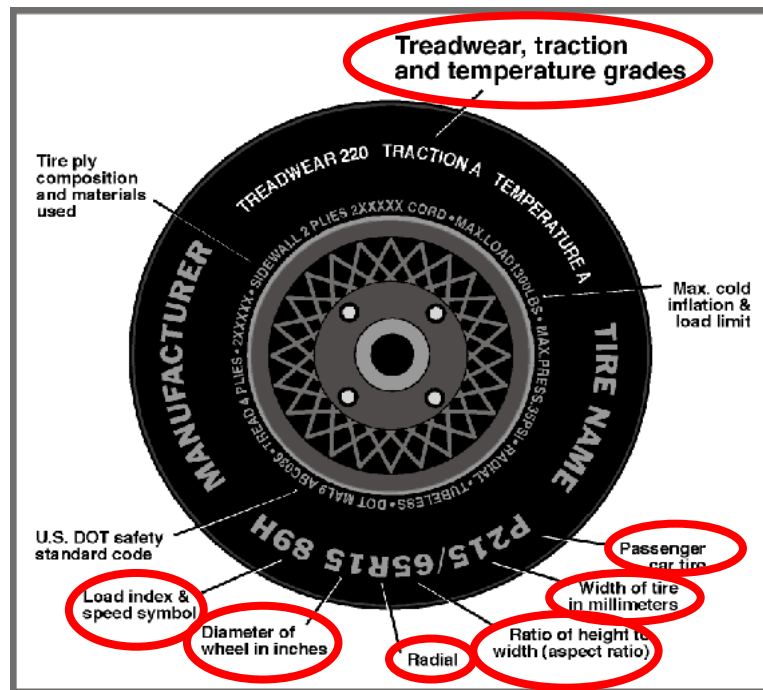
VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				385
Cargo Weight (RCLW) (kg)				45

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

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012



TIRE PLACARD INFORMATION

Measured Parameter	Front	Rear
Recommended Cold Tire Pressure (kPa)	300	300
Recommended Tire Size	P205/55R16	P205/55R16

TIRE SIDEWALL INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Tire Size on Vehicle	P205/55R16	P205/55R16
Tire Manufacturer	Hankook	Hankook
Tire Name	Optimo	Optimo
Tire Type	Passenger	Passenger
Tire Width	205	205
Aspect Ratio	55	55
Radial	Yes	Yes
Wheel Diameter	16	16
Load Index/Speed Symbol	89H	89H
Treadwear	440	440
Traction Grade	A	A
Temperature Grade	A	A
Tire Material	Rubber	Rubber

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

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	395.1	253.1		432.7	320.3	
Right	kg	385.6	238.1		405.5	292.1	
Ratio	%	61.4	38.6		57.8	42.2	
Totals	kg	780.7	491.2	1271.9	838.2	612.4	1450.6

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1271.9
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	45
Calculated Vehicle Target Weight (TVTW)	kg	1457.5

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	678	677	679	680	1043
As Tested	mm	665	672	650	654	1140
Post Test	mm	620	645	643	651	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2700
Total Vehicle Length at Left Side	mm	4235
Total Vehicle Length at Centerline	mm	4527
Total Vehicle Length at Right Side	mm	4235
Weight of Ballast in Cargo Area	kg	16.8
Weight of Vehicle Components Removed	kg	8.2
Amount of Stoddard Solvent in Fuel Tank	L	44.6

List of components removed to meet test weight: Right taillight, trunk carpet, tools, and tire inflator.

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

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4527
2	Total Width	1774
3	Bumper Top Height	531
4	Bumper Bottom Height	401
5	Longitudinal Member Top Height	519
6	Distance between Longitudinal Members	920
7	Longitudinal Member Width	64
8	Engine Top Height	823
9	Engine Bottom Height	172
10	Engine and Gearbox Width	769
11	Front Bumper-Engine Distance	259
12	Front Shock Absorber Fixing Height	835
13	Bonnet Leading Edge Height	670
14	Front Shock Absorber Fixing Width	1200
15	Front Bumper – Front Axle Distance	848
16	Front Axle – A-Pillar Distance	461
17	A-Pillar – B-Pillar Distance	1110
18	B-Pillar – Rear Axle Distance	1124
19	B-Pillar – C-Pillar Distance	713
20	Roof Sill Bottom Height	1308
21	Roof Sill Top Height	1424
22	Floor Sill Bottom Height	204
23	Floor Sill Top Height	375

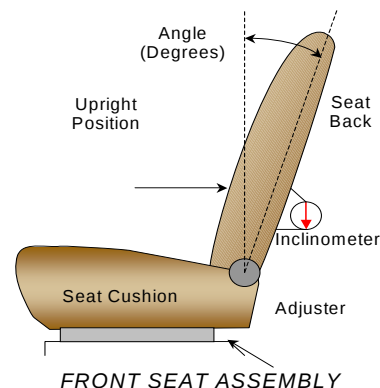
DATA SHEET NO. 2
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

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 January 2010.



SEAT BACK ANGLE	Degrees
Driver Seat Back Angle	4.7° on headrest post
Passenger Seat Back Angle	2.9° on headrest post

SEAT FORE/AFT POSITIONS

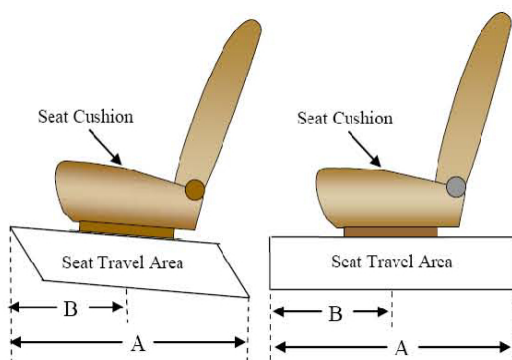
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	22 detents (1 st as 0)	10 th detent (forward-most as 0)
Passenger Seat	22 detents (1 st as 0)	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.

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



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

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

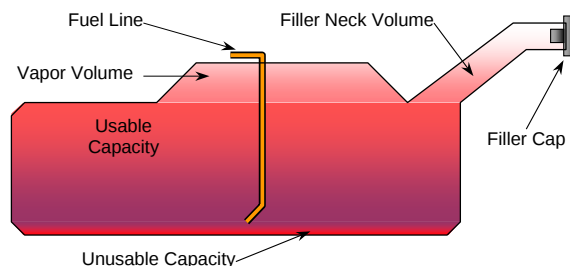
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	48.0
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	44.2 to 45.0
Actual Amount of Solvent used	44.6
1/3 of Usable Capacity	16.0

FUEL PUMP

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

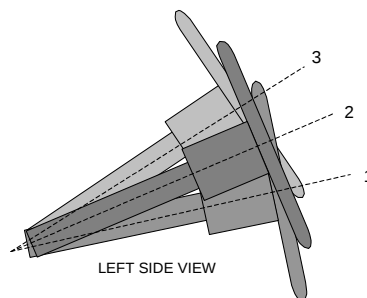
The vehicle is equipped with an electric fuel pump. Fuel pump will pump fuel: Key is "ON" position. The fuel pipe is on the left side.



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

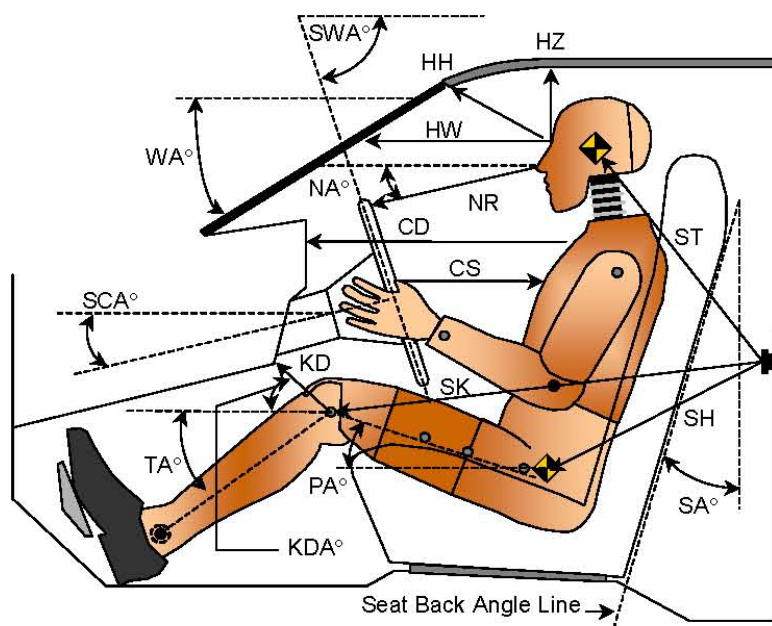
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost – Position 1	68.9	190
Geometric Center – Position 2	66.7	170
Uppermost – Position 3	64.4	150
Telescoping Steering Wheel Travel		40
Test Position	66.7	150

DATA SHEET NO. 3 DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
Test Date: 02/03/2012



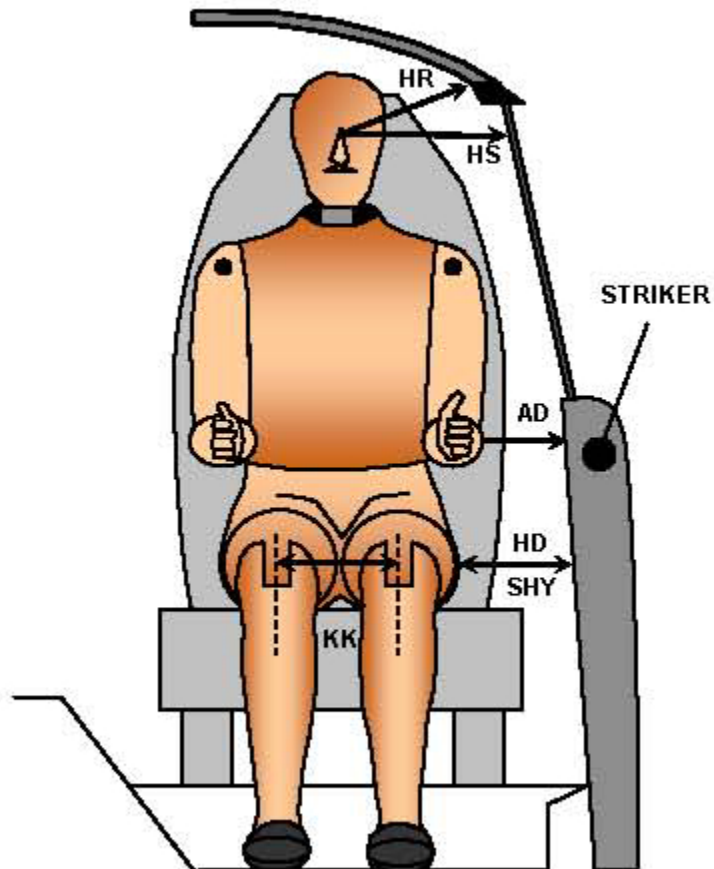
LEFT SIDE VIEW

Code	Measurement Description	Driver S/N 351		Passenger S/N 634	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		22.0		
SWA°	Steering Wheel Angle		66.7		
SCA°	Steering Column Angle		23.3		
SA°	Seat Back Angle (on headrest post)		4.7		2.9
HZ	Head to Roof (Z)	181	90	215	90
HH	Head to Header	332	20.8	314	41.1
HW	Head to Windshield	687	0	768	0
NR	Nose to Rim	416	7.6		
CD	Chest to Dash	532		466	
CS	Chest to Steering Hub	336	3.1		
RA	Rim to Abdomen	220	0		
KDL	Left Knee to Dash	186	23.4	149	35.9
KDR	Right Knee to Dash	163	33.2	154	37.0
PA°	Pelvic Angle		24.6		21.2
TA°	Tibia Angle		46.1		44.6
SK	Striker to Knee	601	100.8	702	105.8
ST	Striker to Head	410	12.9	394	31.0
SH	Striker to H-Point	329	135.9	410	127.6

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012



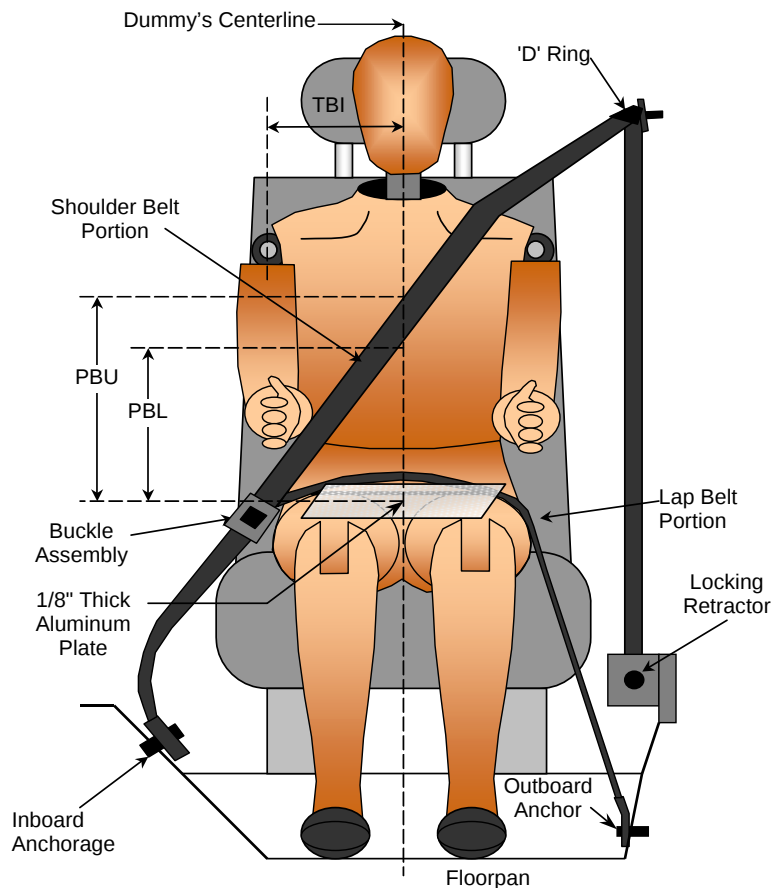
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver S/N 351	Passenger S/N 634
		Length (mm)	
AD	Arm to Door	118	101
HD	H-Point to Door	141	179
HR	Head to Side Header	209	268
HS	Head to Side Window	318	365
KK	Knee to Knee	360	215
SHY	Striker to H-Point (Y Direction)	265	315
AA	Ankle to Ankle	360	164

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
Test Date: 02/03/2012



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	375	340
PBL - Top surface of reference to belt lower edge	mm	305	265

BELT LENGTH DATA

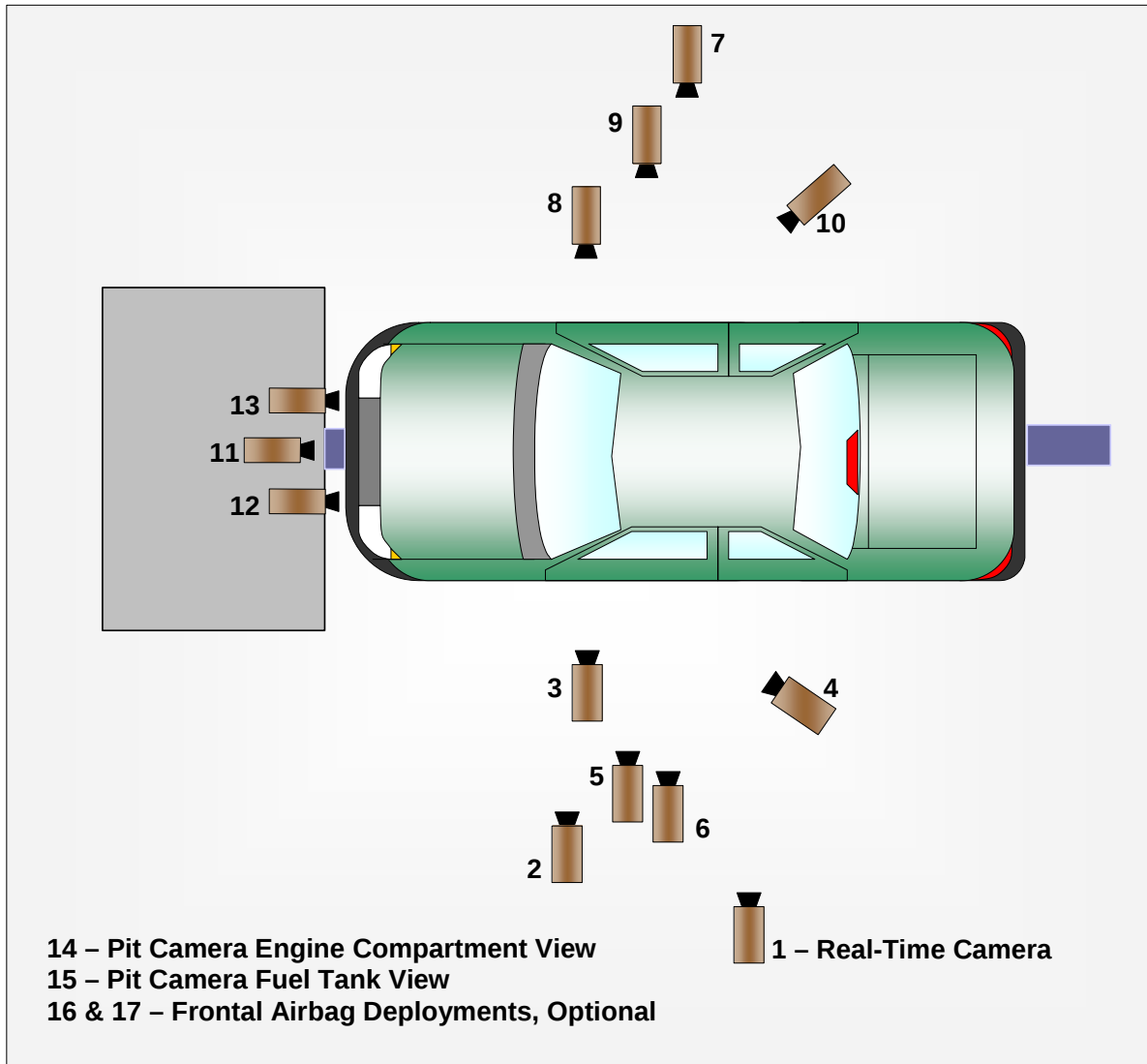
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	870	905
Lap Belt Length as measured on ATD	mm	655	650
Remainder of belt on reel	mm	1475	1395
Total Belt Length for Continuous Webbing Systems	mm	3000	2950

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

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
Test Date: 02/03/2012

CAMERA POSITIONS FOR FRONTAL IMPACTS



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

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	1300	-6420	-1770	35	1000
3	Left Front Half	1090	-4720	-1070	24	1000
4	Left Angle	5510	-4900	-1910	50	1000
5	Steering Column - Top	500	-4890	-1230	24	1000
6	Steering Column - Bottom	480	-4960	-830	24	1000
7	Right Overall	2060	6410	-1100	20	1000
8	Passenger Close-Up	1590	6300	-1790	35	1000
9	Right Front Half	1130	4760	-1070	24	1000
10	Right Angle	5620	4720	-1930	50	1000
11	Windshield	-130	0	-2810	24	1000
12	Driver Windshield	250	-450	-2030	12.5	1000
13	Passenger Windshield	250	450	-2030	12.5	1000
14	Pit Front	1070	0	3150	24	1000
15	Pit Rear	2860	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

***COORDINATES:**

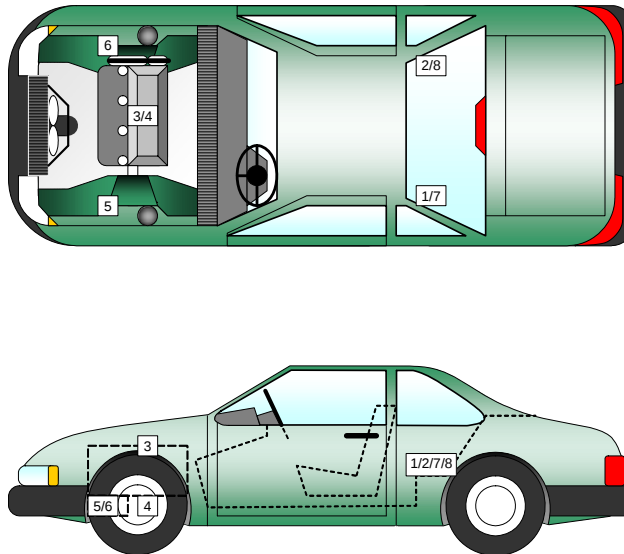
- +X = forward of impact plane
- +Y = right of monorail centerline
- +Z = below ground level

Cameras 16 & 17 were not used for this test.

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

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Accelerometer – X Direction	3770	-408	-330
2	Right Rear Accelerometer – X Direction	3770	408	-330
3	Engine Top X	3764	15	-823
4	Engine Bottom X	3868	20	-275
5	Left Brake Caliper X	3438	-715	-262
6	Right Brake Caliper X	3469	715	-287
7	Left Rear Accelerometer Redundant – X Direction			
8	Right Rear Accelerometer Redundant – X Direction			

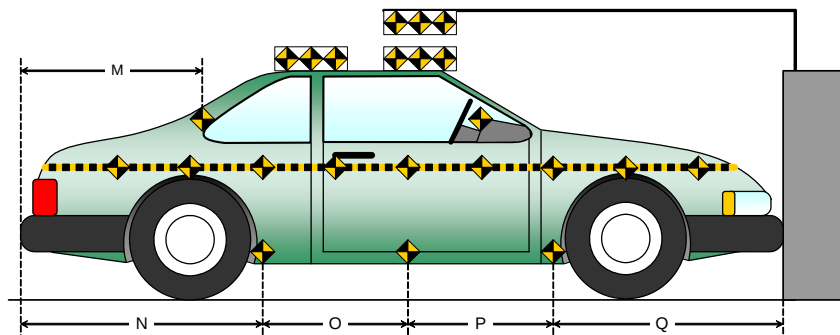
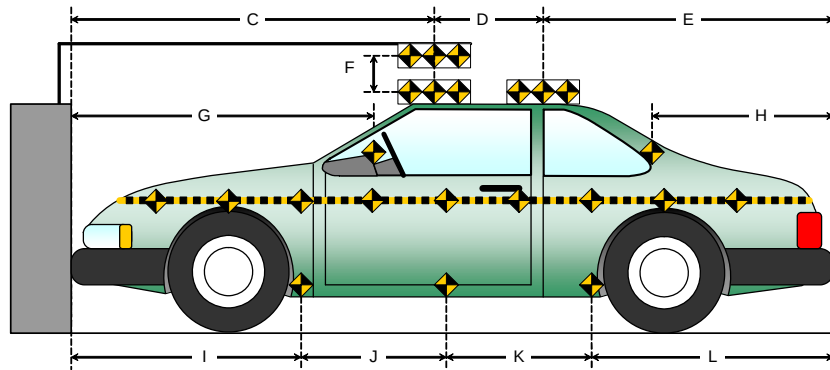
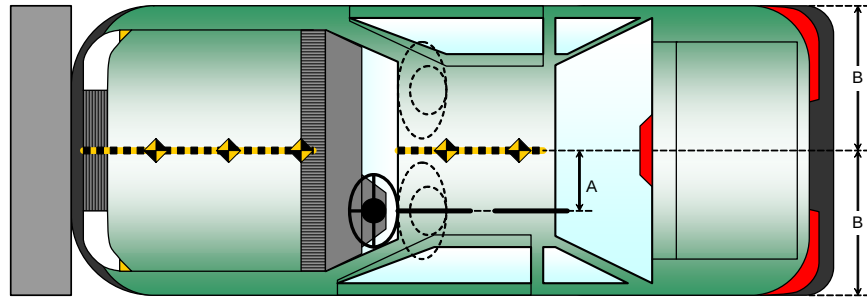
Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

Item	Value (mm)
A	380
B	887
C	2220
D	660
E	1647
F	180
G	
H	978
I	1325
J	911
K	911
L	1380
M	978
N	1380
O	911
P	911
Q	1325

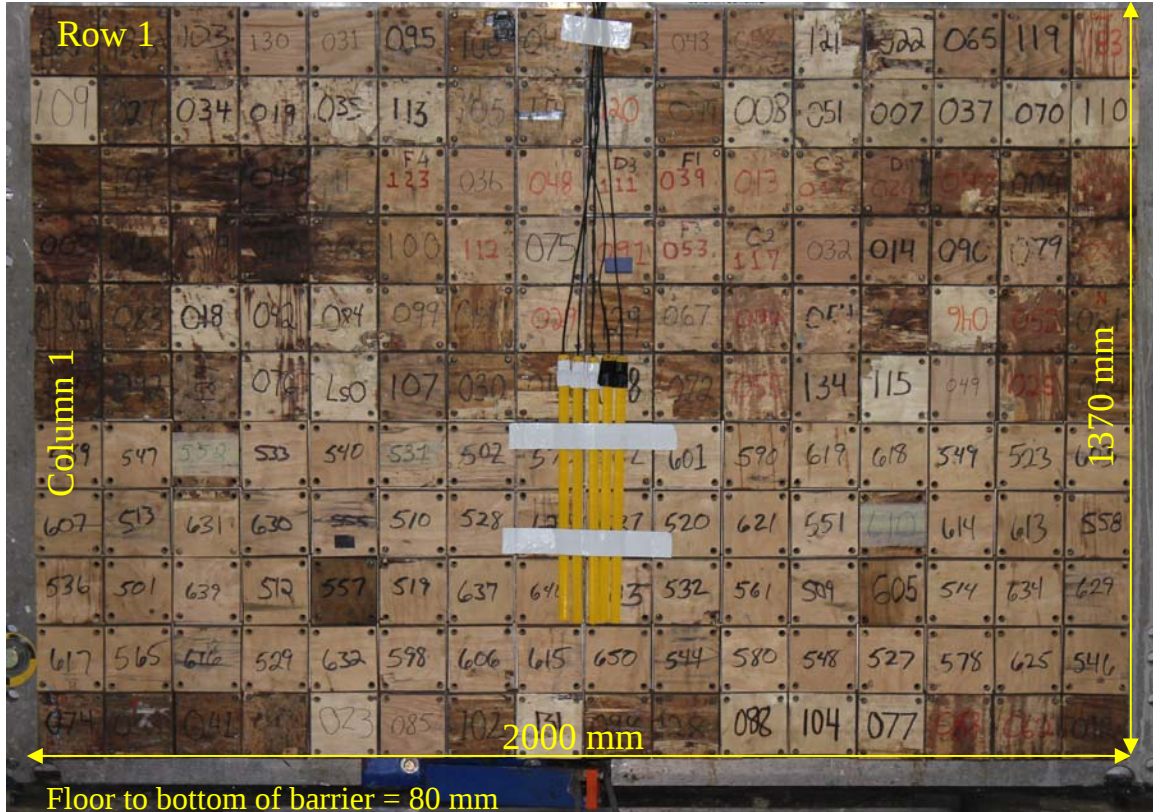


DATA SHEET NO. 9 **LOAD CELL LOCATIONS ON FIXED BARRIER**

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

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 Hyundai Elantra GLS 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
Test Date: 02/03/2012

INSTRUMENTATION

Driver Dummy Data Channels	46
Passenger Dummy Data Channels	46
Vehicle Structure Accelerometers	8
Barrier Channels	0
Total	100

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 Hyundai Elantra GLS 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
Test Date: 02/03/2012

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 351	HIII 5% / 634
Head Contact	Airbag, Headrest, Visor	Airbag, Headrest, Seat Back
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Bolster	Knee Bolster, Airbag
Right Knee Contact	Knee Bolster	Knee Bolster, Airbag

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	1773
Center	mm	1722
Right Side	mm	1760
Average	mm	1752

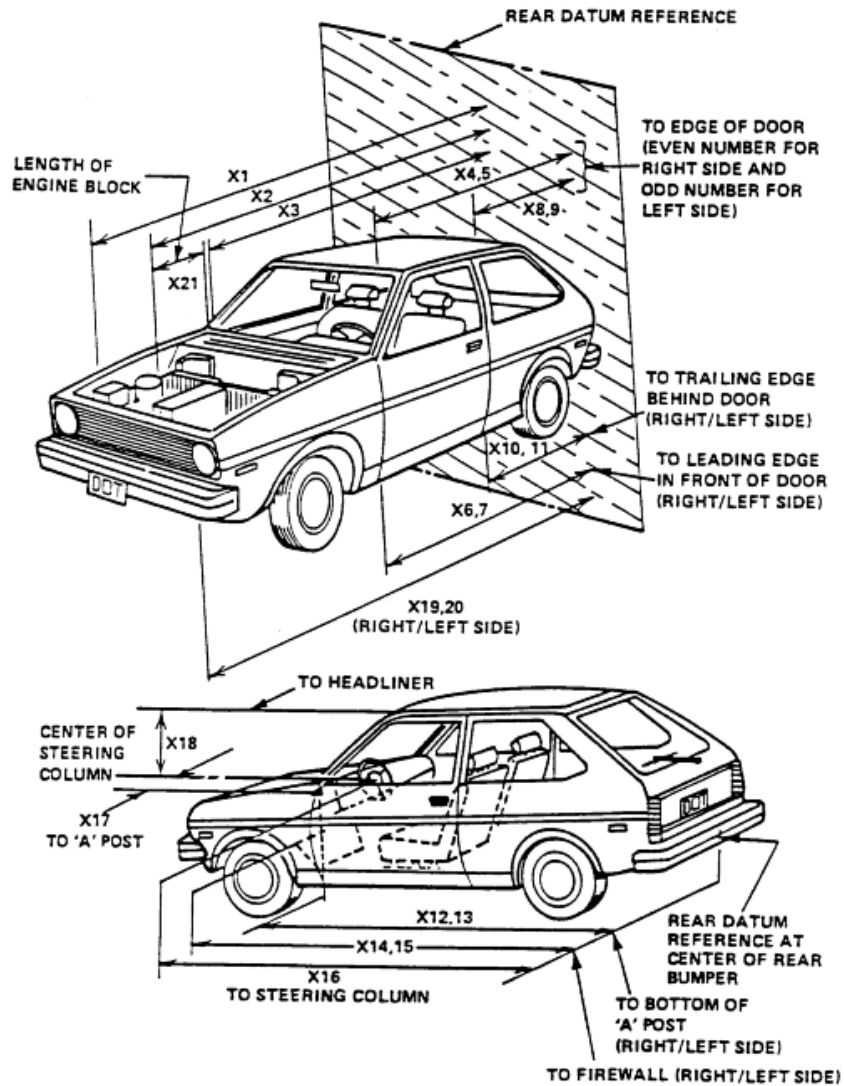
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Right Front (Passenger) P2	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Knee Airbag	No		No	
Curtain Side Airbag	Yes	No	Yes	No
Side Torso/Pelvis 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 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4527	4068	459
2	RSOV to Front of Engine	mm	4025	3868	157
3	RSOV to Firewall	mm	3564	3517	47
4	RSOV to Upper Leading Edge of Right Door	mm	3167	3184	-17
5	RSOV to Upper Leading Edge of Left Door	mm	3165	3178	-13
6	RSOV to Lower Leading Edge of Right Door	mm	3163	3153	10
7	RSOV to Lower Leading Edge of Left Door	mm	3163	3157	6
8	RSOV to Upper Trailing Edge of Right Door	mm	2032	2051	-19
9	RSOV to Upper Trailing Edge of Left Door	mm	2035	2050	-15
10	RSOV to Lower Trailing Edge of Right Door	mm	2052	2051	1
11	RSOV to Lower Trailing Edge of Left Door	mm	2055	2054	1
12	RSOV to Bottom of "A" Post of Right Side	mm	3189	3169	20
13	RSOV to Bottom of "A" Post of Left Side	mm	3183	3172	11
14	RSOV to Firewall, Right Side	mm	3574	3508	66
15	RSOV to Firewall, Left Side	mm	3556	3510	46
16	RSOV to Steering Column	mm	2667	2730	-63
17	Center of Steering Column to "A" Post	mm	370	407	-37
18	Center of Steering Column to Headliner	mm	415	458	-43
19	RSOV to Right Side of Front Bumper	mm	4235	3842	393
20	RSOV to Left Side of Front Bumper	mm	4235	3843	392
21	Length of Engine Block	mm	530	530	0
RD	RSOV to Right Side of Dash Panel	mm	2843	2864	-21
CD	RSOV to Center of Dash Panel	mm	2886	2926	-40
LD	RSOV to Left Side of Dash Panel	mm	2829	2858	-29

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
Test Date: 02/03/2012

VEHICLE INFORMATION

VIN: KMH4H4AE5CU363690 Wheelbase (mm): 2700
Vehicle Size Category: Sedan Test Weight (kg): 1450.6

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15

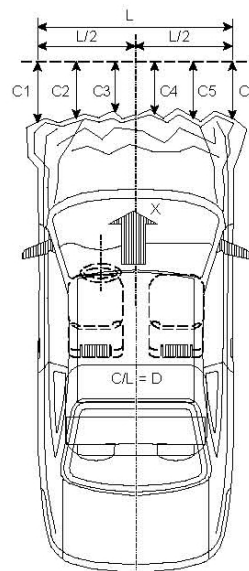
Cal. Procedure/Interval: MGA procedure / 6 month

Integration Algorithm: Trapezoidal Linearity: > 99%

Impact Velocity (km/h): 56.1

Velocity Change (km/h): 61.7

Time of Separation (msec): 84.5



CRUSH PROFILE

Collision Deformation Classification: Frontal

Midpoint of Damage: Centerline

Damage Region Length (mm): 1574

Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4235	3843	392
C2	Crush zone 2 at left side	mm	4380	3968	412
C3	Crush zone 3 at left side	mm	4474	4005	469
C4	Crush zone 4 at right side	mm	4474	4012	462
C5	Crush zone 5 at right side	mm	4380	3961	419
C6	Crush zone 6 at right side	mm	4235	3842	393
L	C1 TO C6	mm	1574	1470	104

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

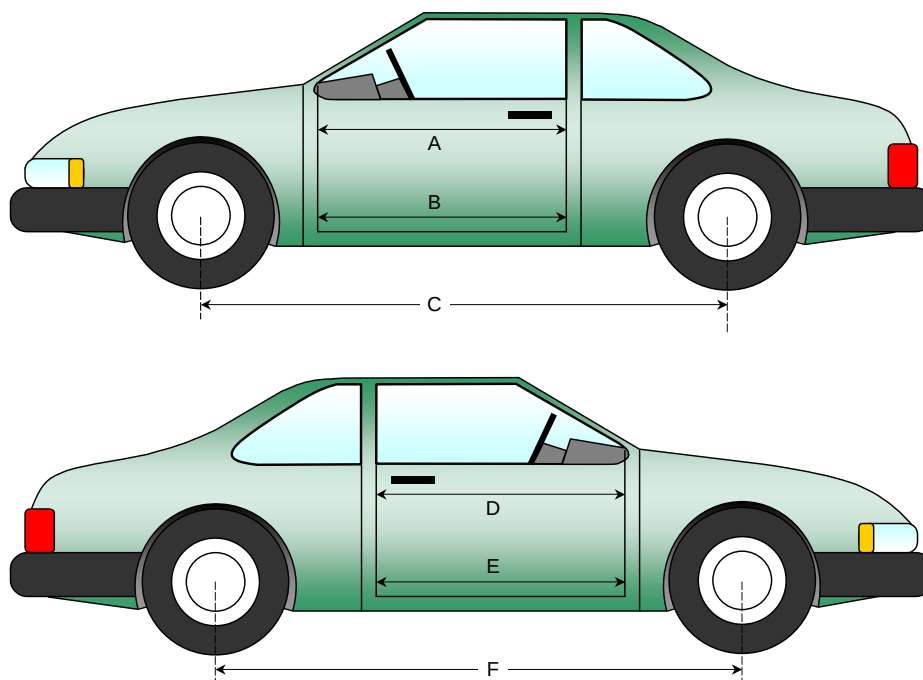
NHTSA No.: UC0500
 Test Date: 02/03/2012

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1055	1055	0
B	Left Side Lower	mm	865	754	0
D	Right Side Upper	mm	1054	1054	0
E	Right Side Lower	mm	875	875	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2700	2663	37
F	Right Side Wheelbase	mm	2700	2670	30



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

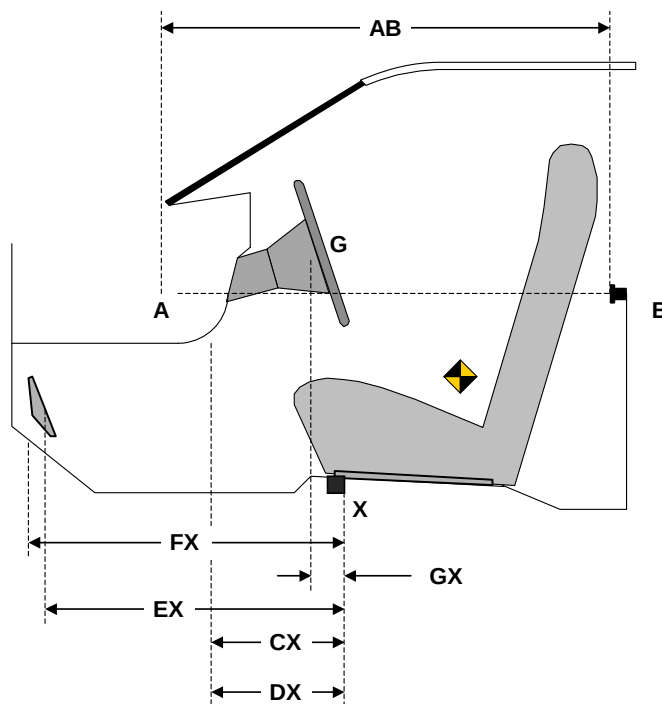
Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	878	878	0
CX	Left Knee Bolster to X	mm	261	271	-10
DX	Right Knee Bolster to X	mm	261	262	-1
EX	Brake Pedal to X	mm	561	503	58
FX	Foot Rest to X	mm	594	575	19
GX	Center of Steering Column Wheel Hub to X	mm	71	136	-65

X = Front of Seat Track (stationary)

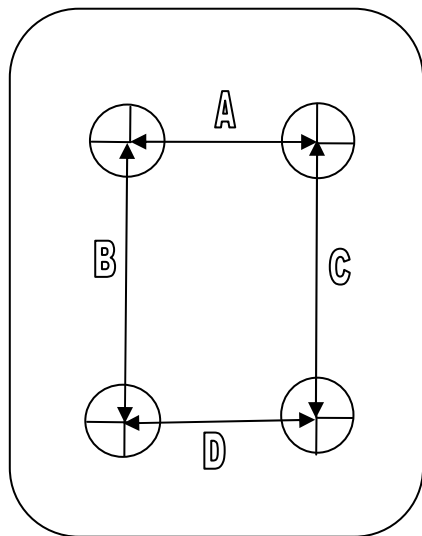


DRIVER COMPARTMENT

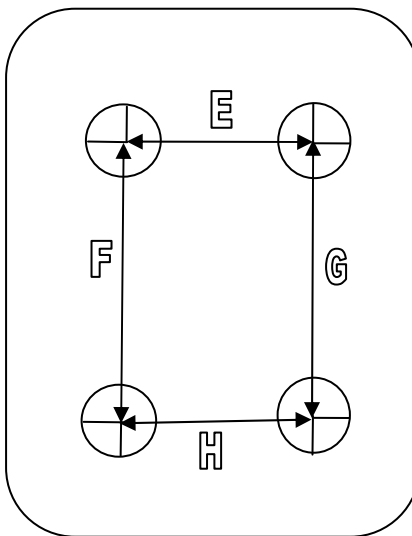
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VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012



Driver



Passenger

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	302	-2
D	mm	300	300	0
E	mm	300	302	-2
F	mm	300	303	-3
G	mm	300	300	0
H	mm	300	303	-3

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

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

Windshield Mounting Details:

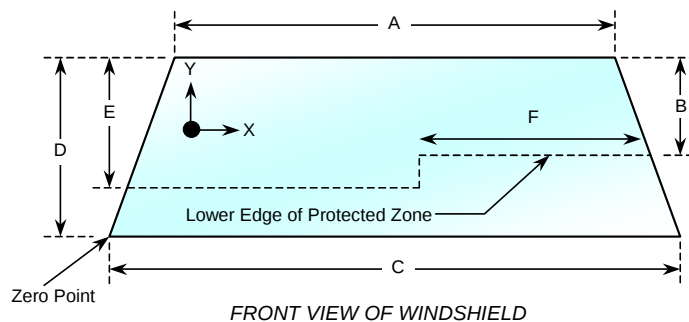
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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: 21.4°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2222	2222	100
Right Side	2222	2222	100
Total	4444	4444	100



Item	Units	Value
A	mm	1204
B	mm	556
C	mm	1420
D	mm	910
E	mm	573
F	mm	444

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 Hyundai Elantra GLS 4-Dr Sedan</u>	NHTSA No.:	<u>UC0500</u>
Test Program:	<u>NCAP Frontal Barrier Impact Test</u>	Test Date:	<u>02/03/2012</u>

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Test Time: 10:29 am

Temperature: 21.4° C

- | | |
|---|--------------|
| 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> |

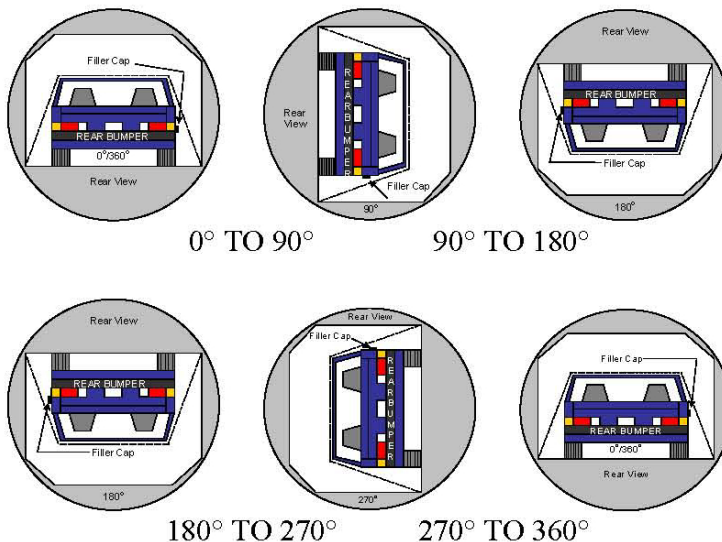
DATA SHEET NO. 16

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2012 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012

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°	111	300	411
180° to 270°	109	300	409
270° to 360°	113	300	413

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

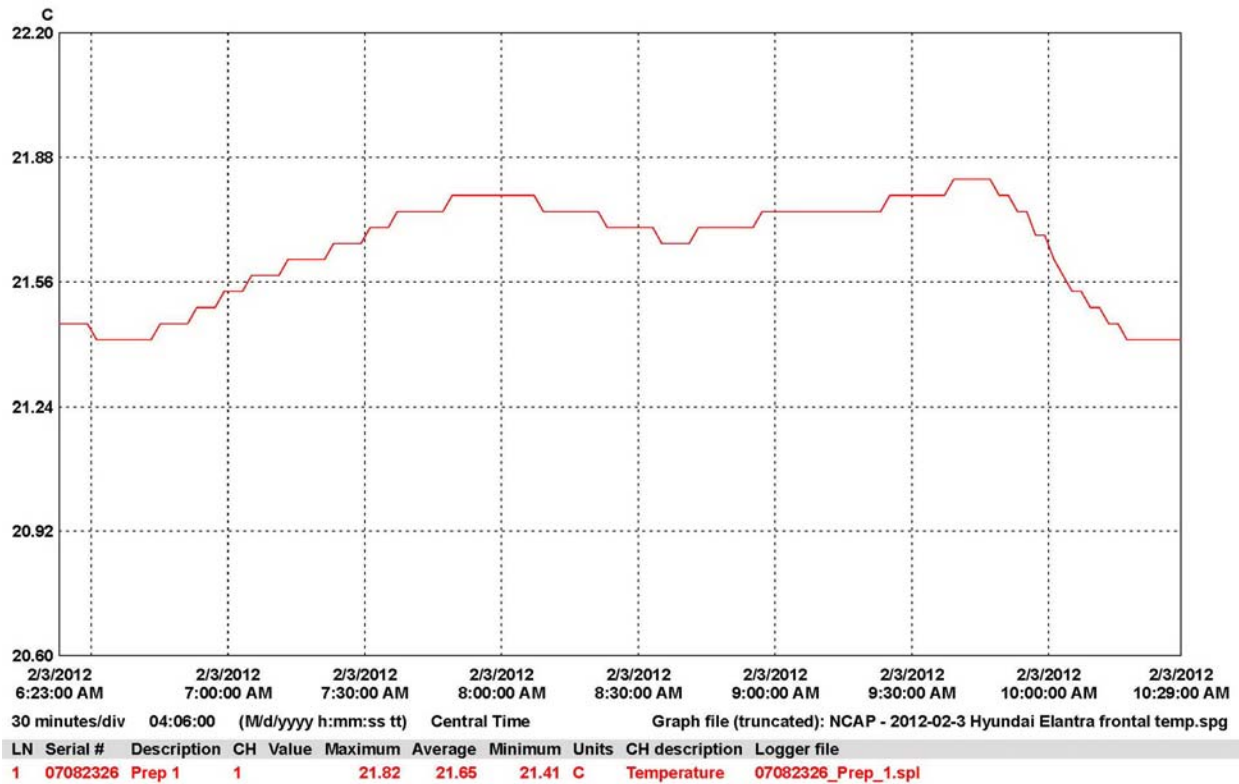
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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 Hyundai Elantra GLS 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: UC0500
 Test Date: 02/03/2012



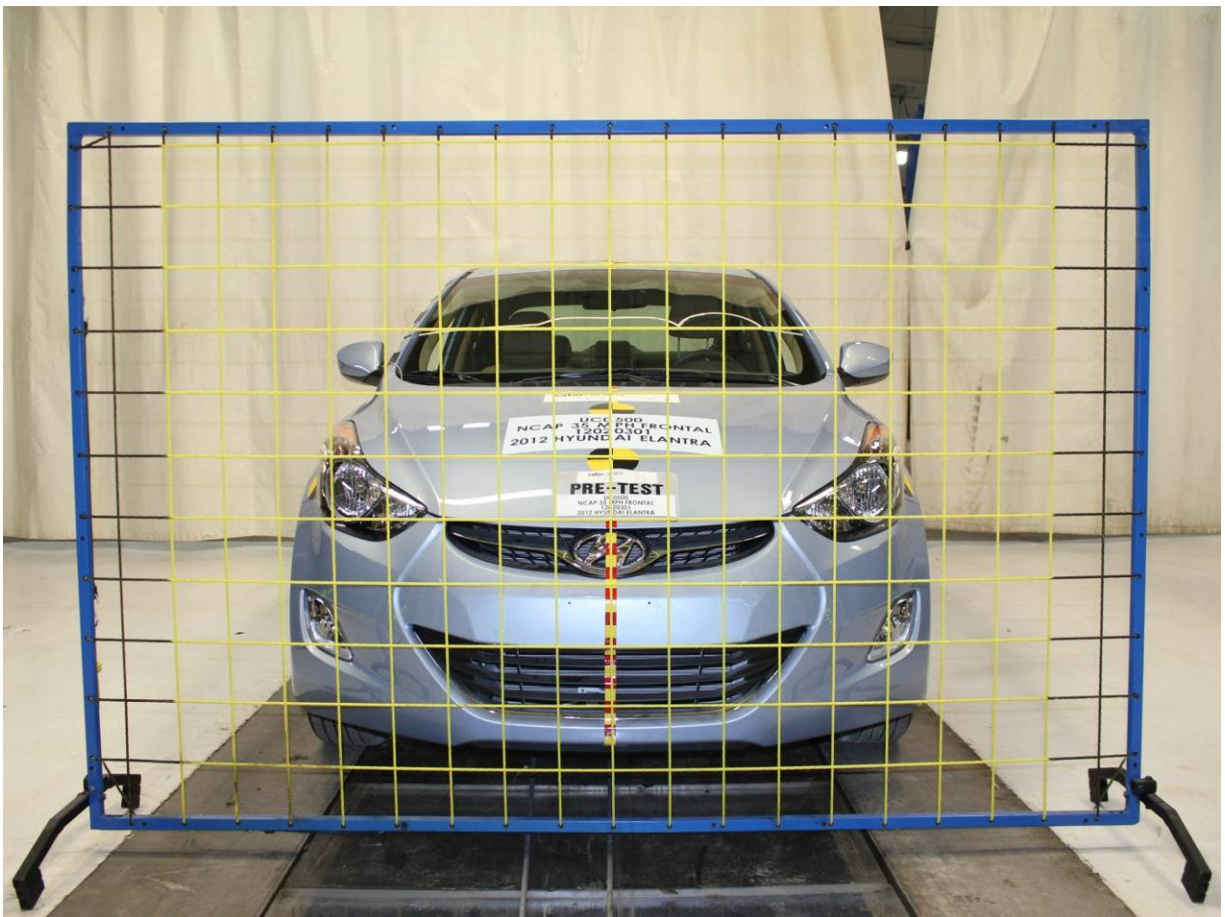
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Load Cell Location



Load Cell Wall



Manufacturer's Label



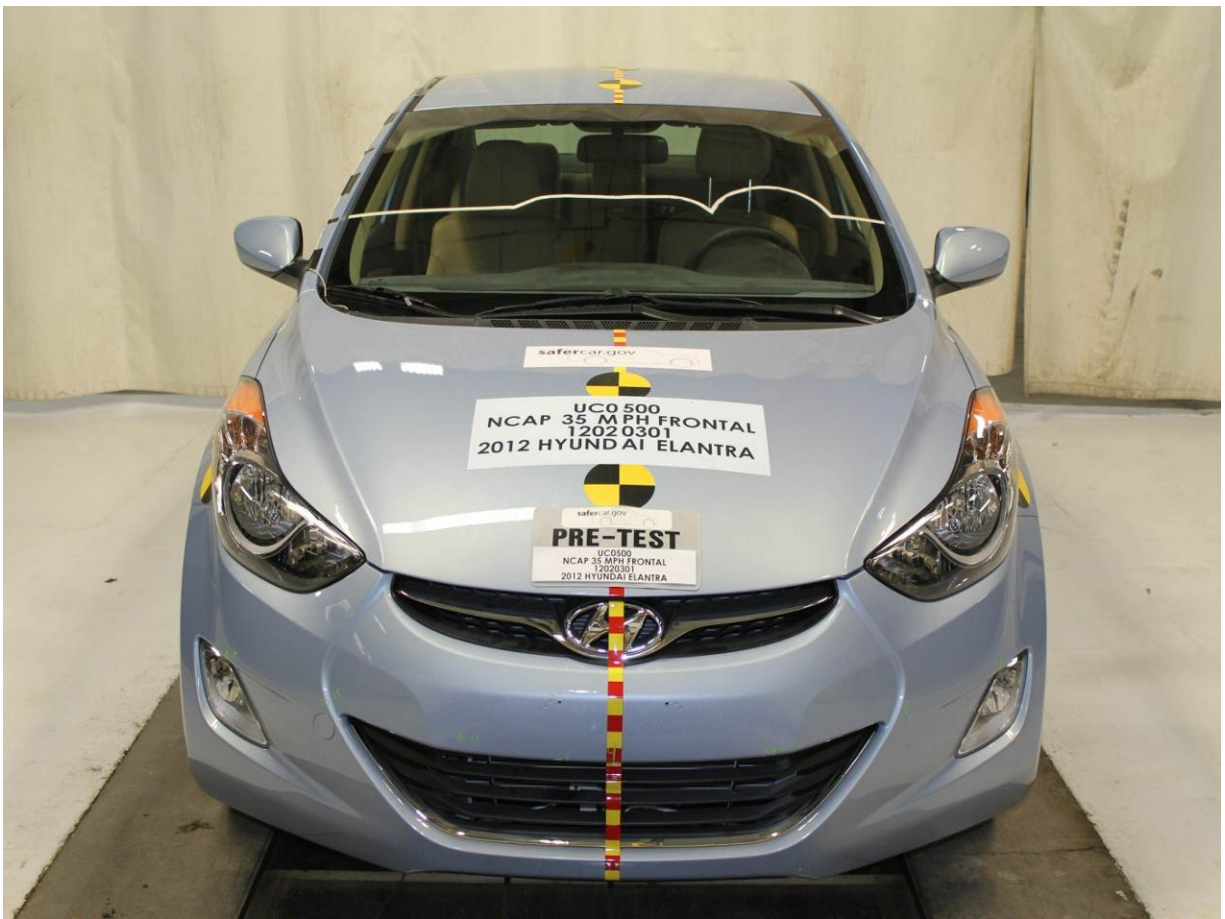
Tire Placard



2012 Hyundai Elantra Frontal As Delivered



Left Rear Three-Quarter View, As Received



Pre-Test Front View of Test Vehicle



Post-Test Front View of Test Vehicle



Pre-Test Left View of Test Vehicle



Post-Test Left View of Test Vehicle



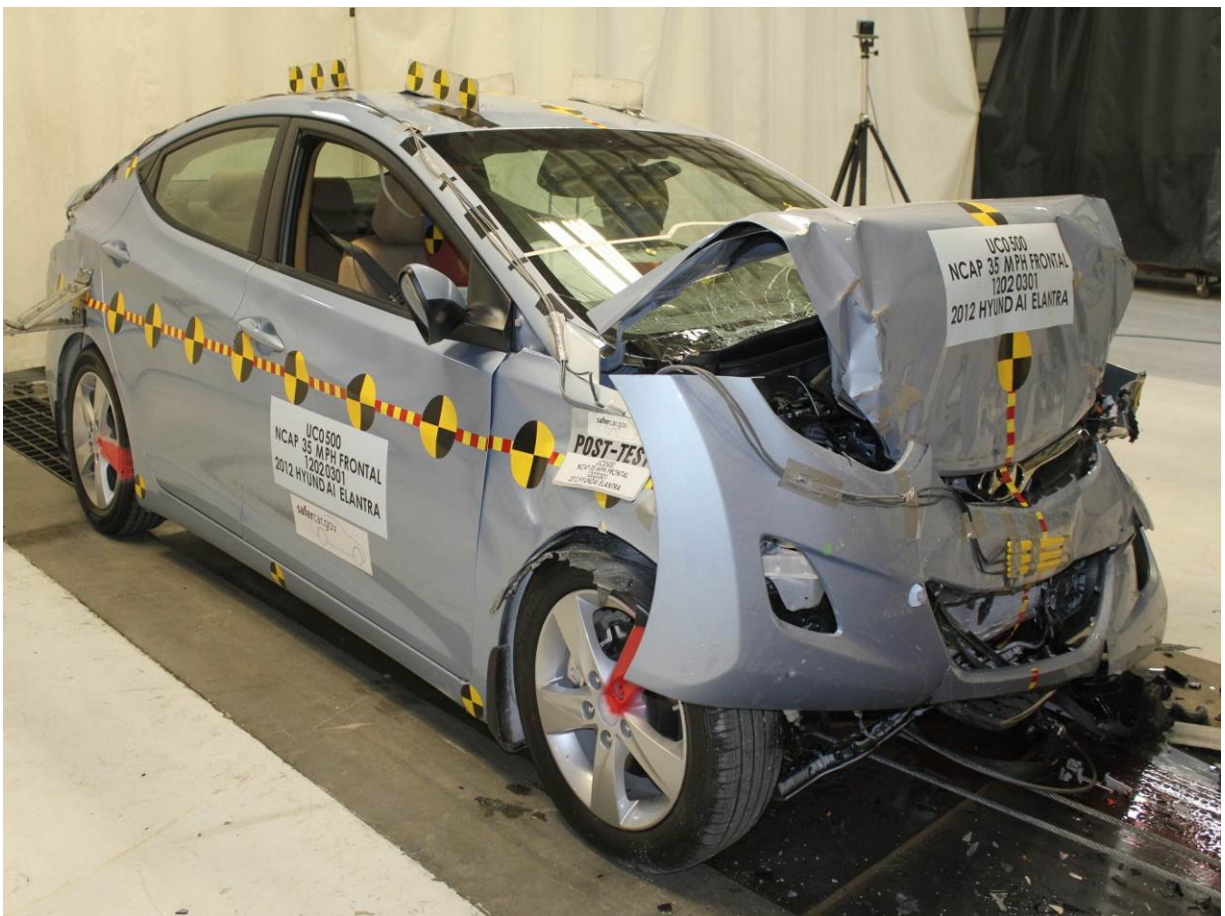
Pre-Test Right View of Test Vehicle



Post-Test Right View of Test Vehicle



Pre-Test Right Front Three-Quarter View



Post-Test Right Front Three-Quarter View



Pre-Test Left Rear Three-Quarter View



Post-Test Left Rear Three-Quarter View



Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



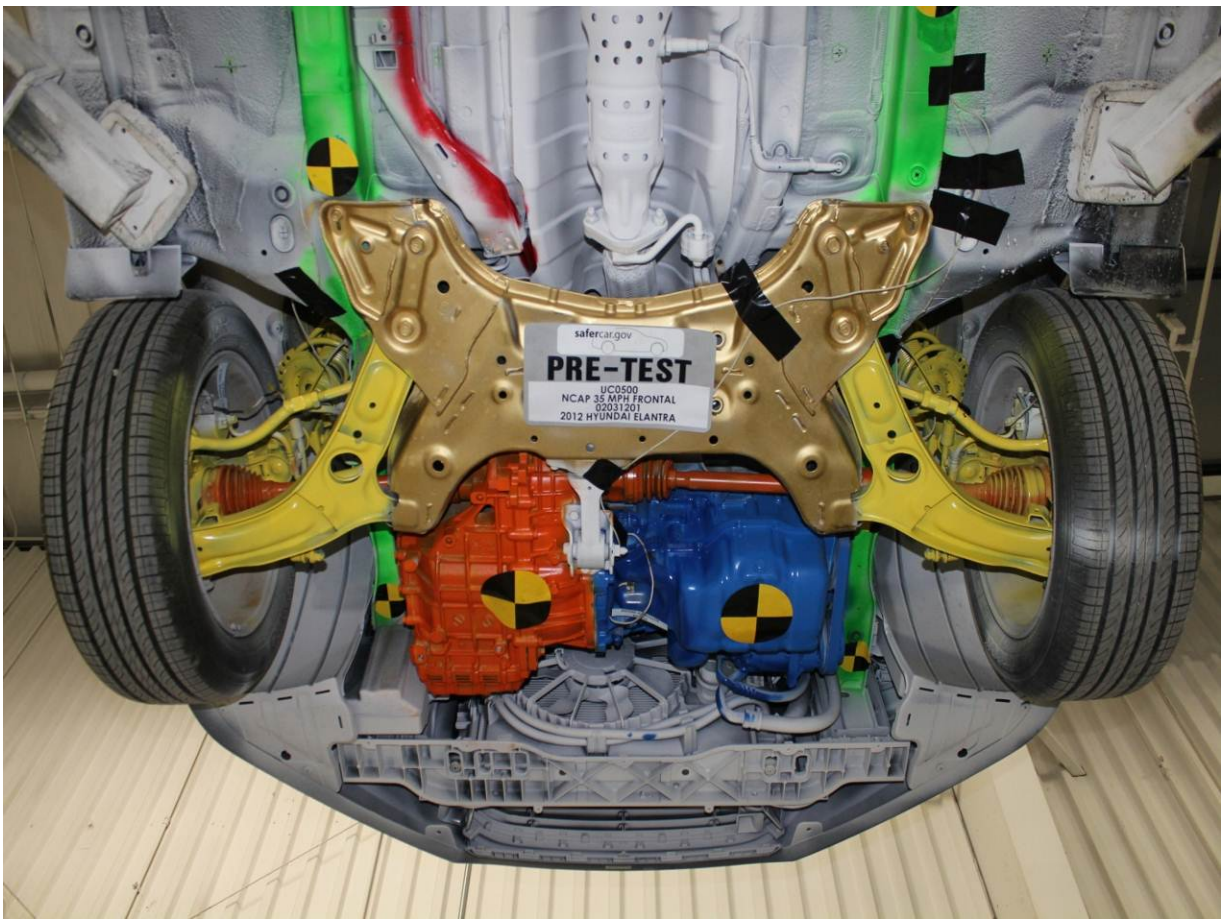
Post-Test Engine Compartment View



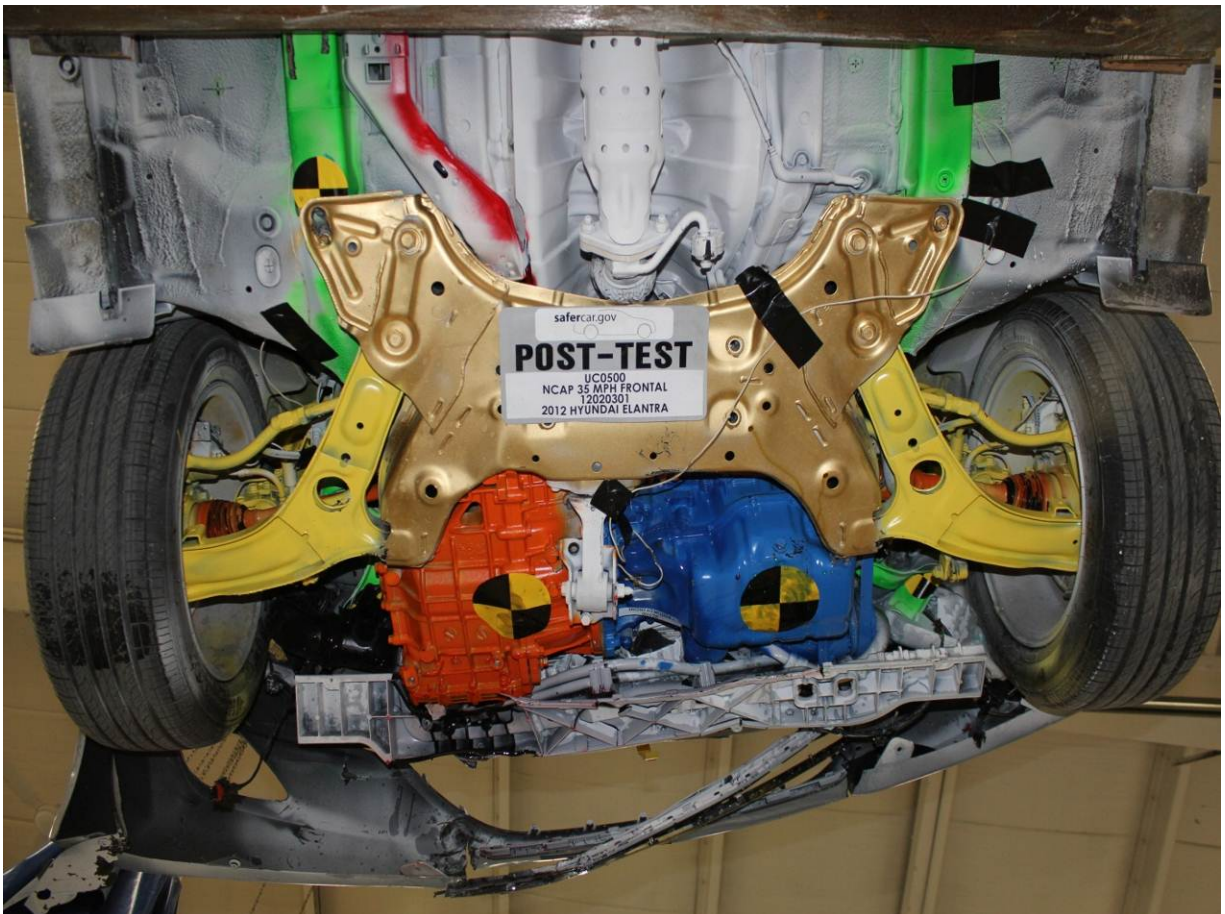
Pre-Test Fuel Filler Cap View



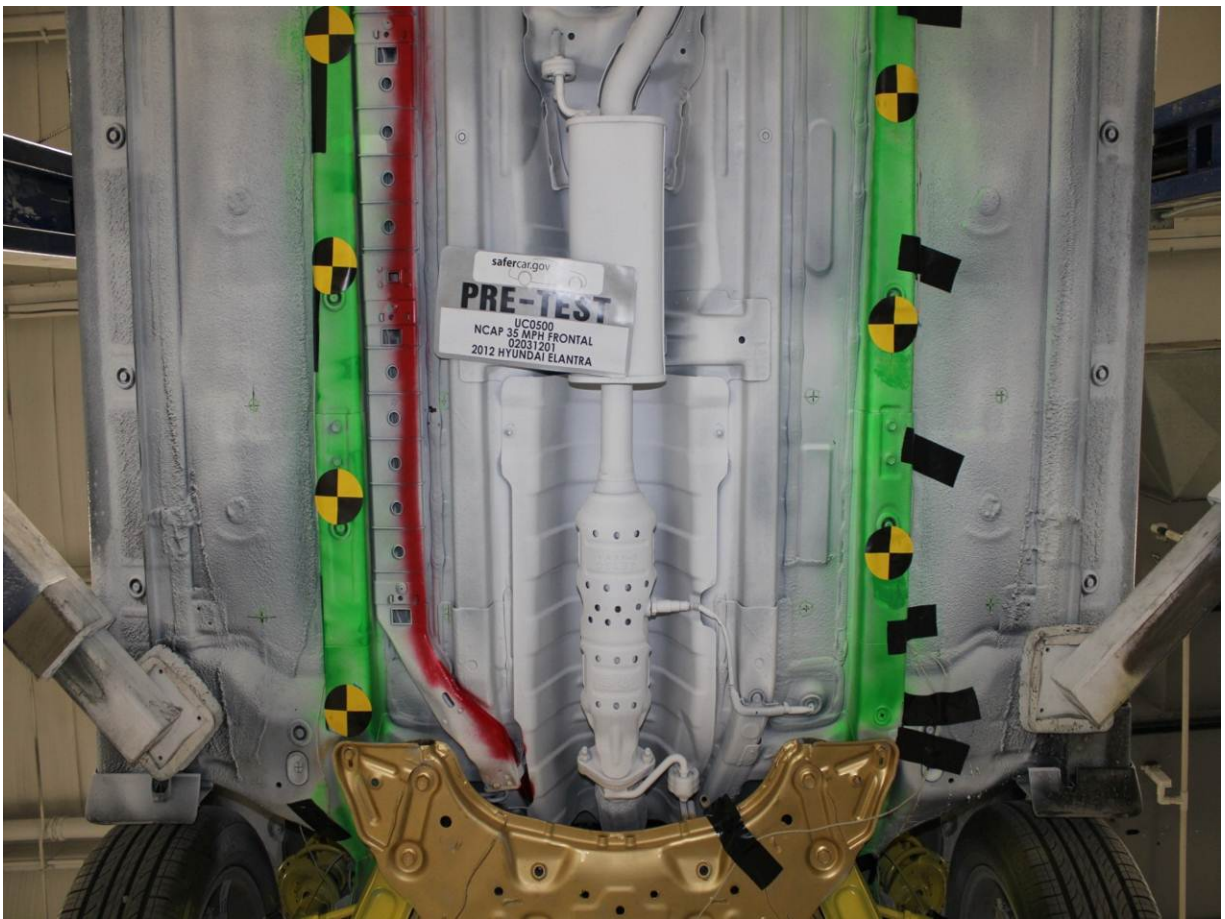
Post-Test Fuel Filler Cap View



Pre-Test Front Underbody View



Post-Test Front Underbody View



Pre-Test Mid Front Underbody View



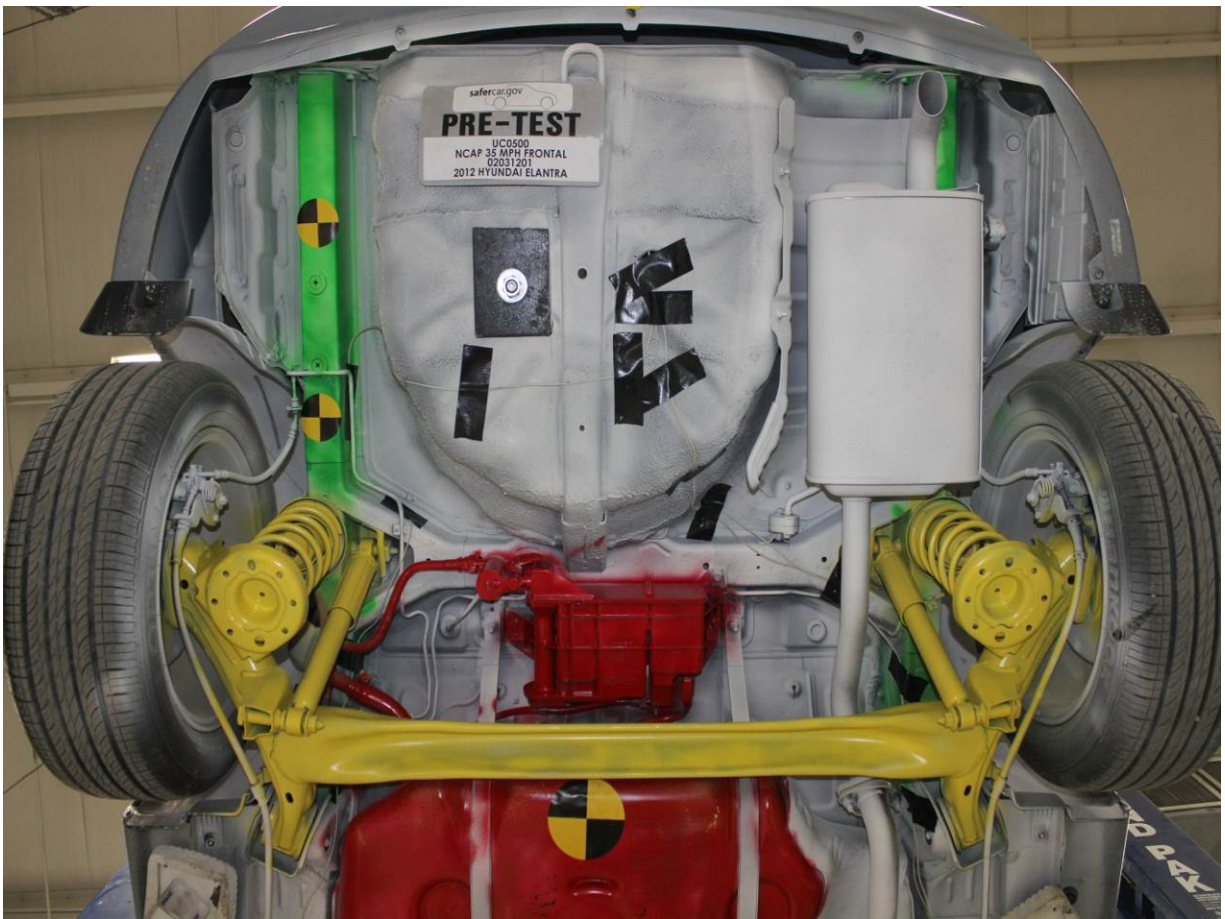
Post-Test Mid Front Underbody View



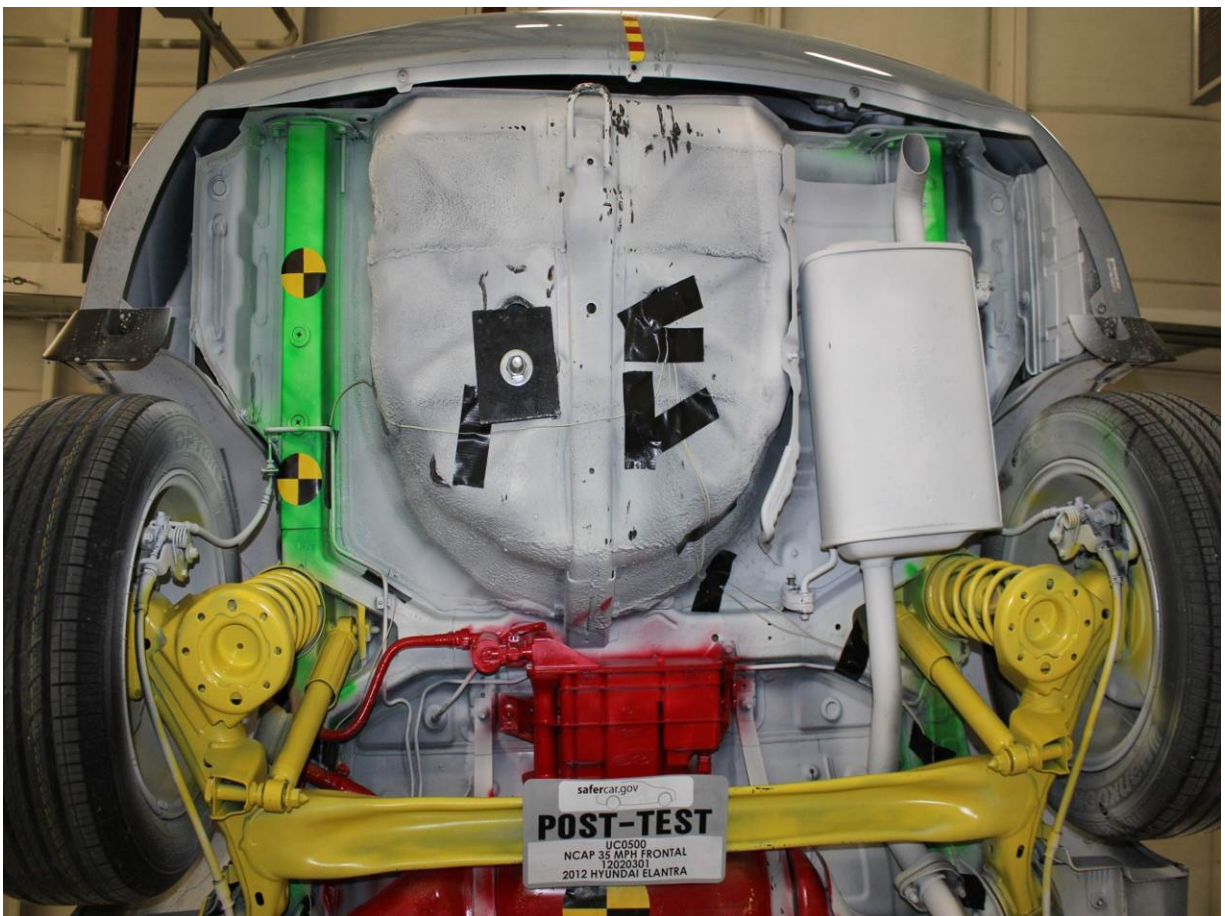
Pre-Test Mid Rear Underbody View



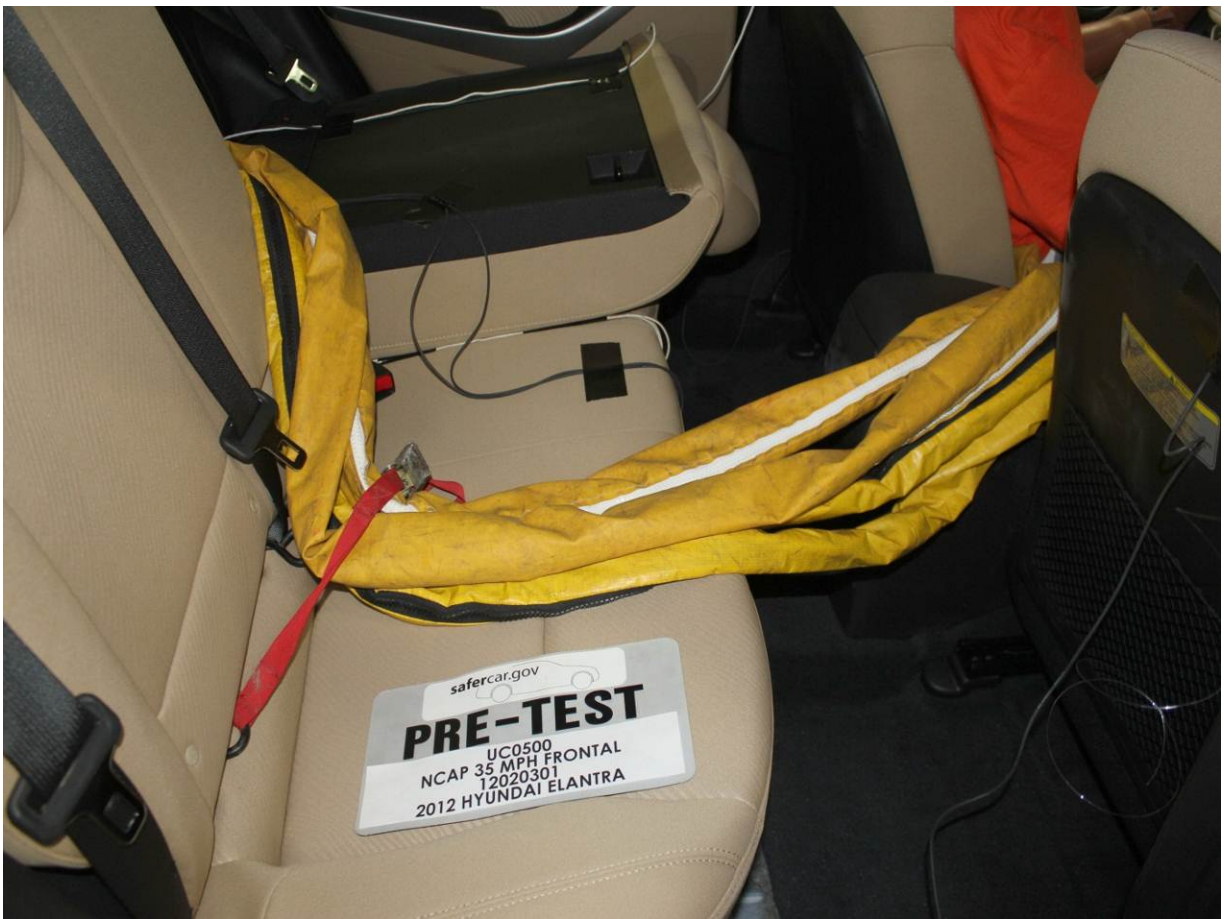
Post-Test Mid Rear Underbody View



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



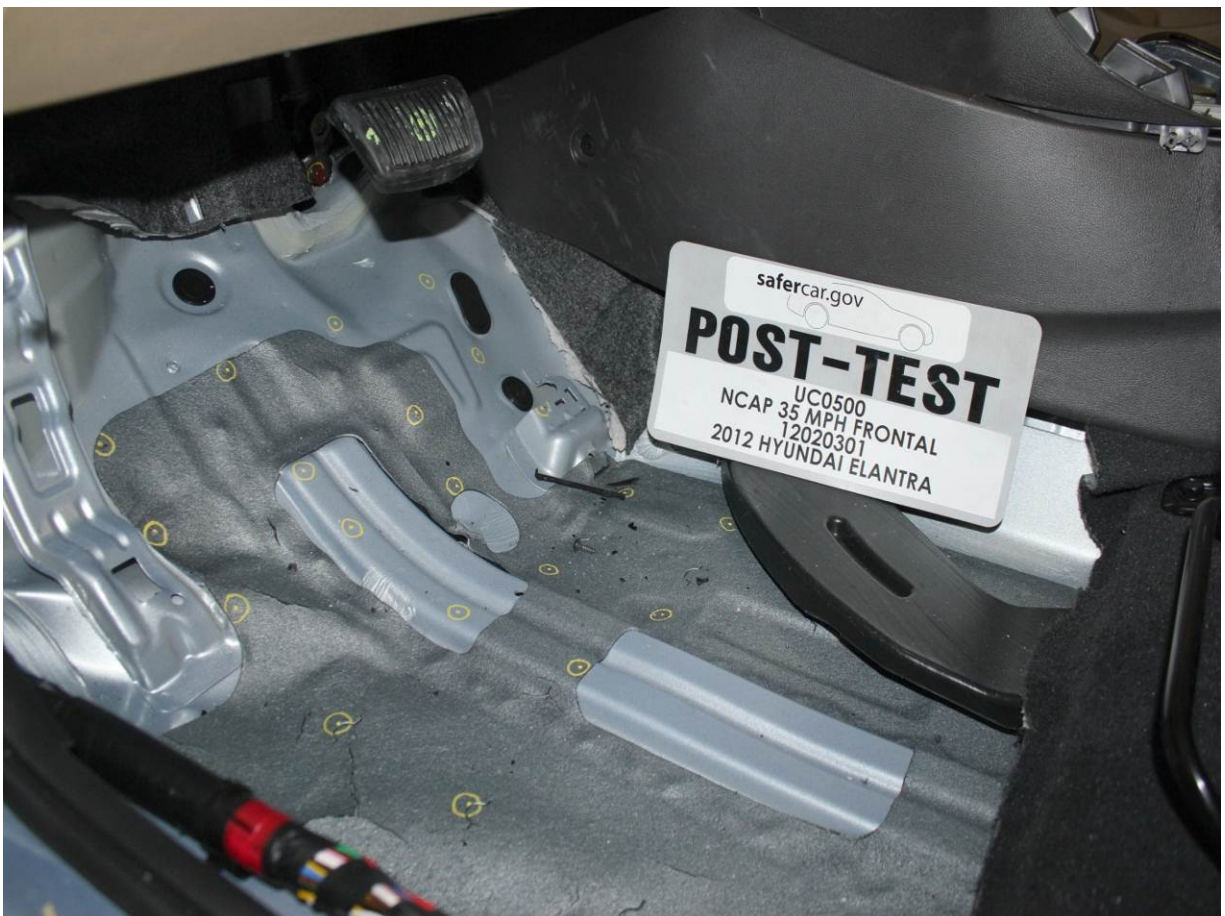
Pre-Test Driver's Side Knee Bolster (without dummy)



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 Face



Post-Test Driver Dummy Contact with Airbag



Post-Test Driver Dummy Contact with Headrest



Post-Test Driver Dummy Contact with Visor



Post-Test Driver Dummy Contact with Knee Bolster



Pre-Test View of the Steering Wheel



Post-Test View of the Steering Wheel



Pre-Test Passenger Dummy Front View



Post-Test Passenger Dummy Front View



Pre-Test Passenger Dummy Window View



Post-Test Passenger Dummy Window View



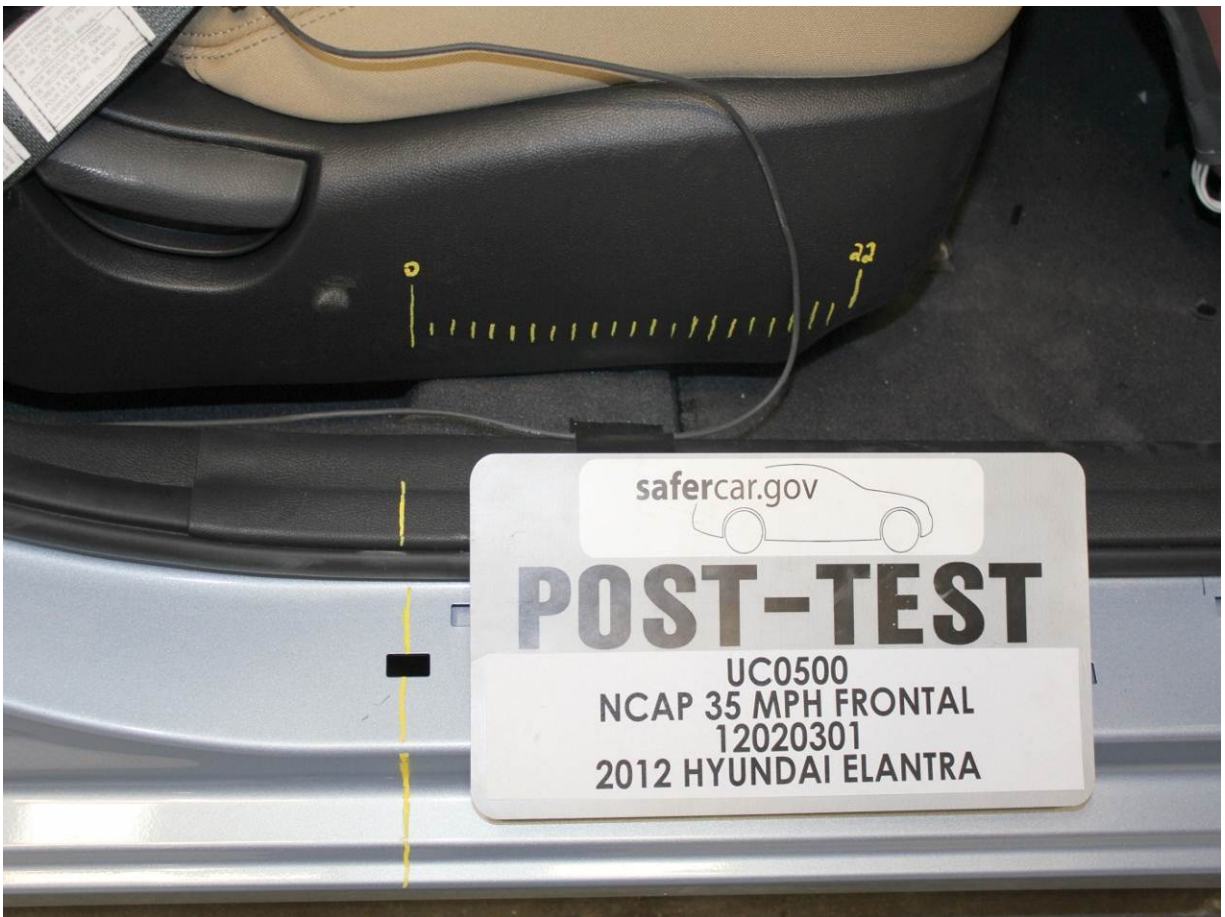
Pre-Test Passenger Dummy and Vehicle Interior (Door Open)



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



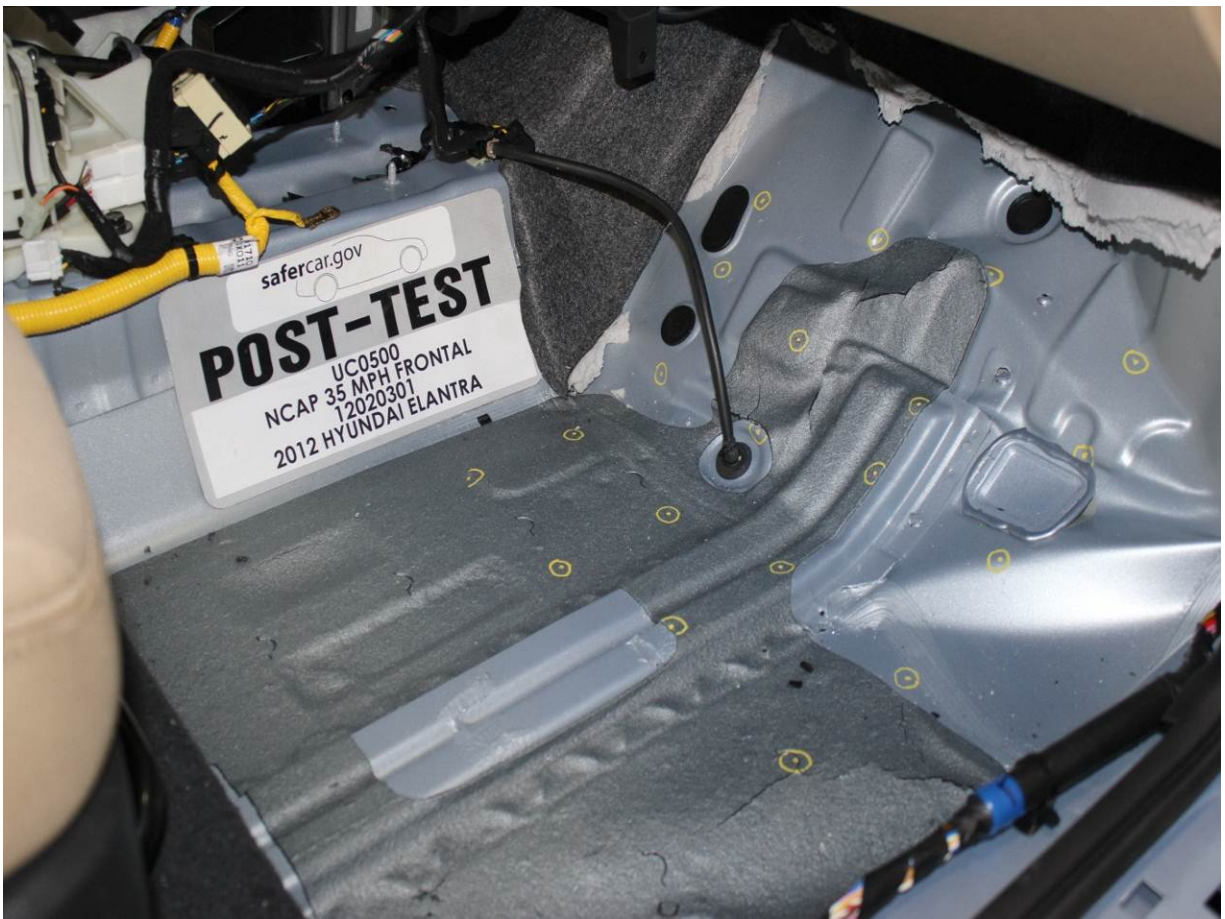
Pre-Test Passenger's Side Knee Bolster (without dummy)



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



Pre-Test Passenger's Side Floorpan



Post-Test Passenger's Side Floorpan



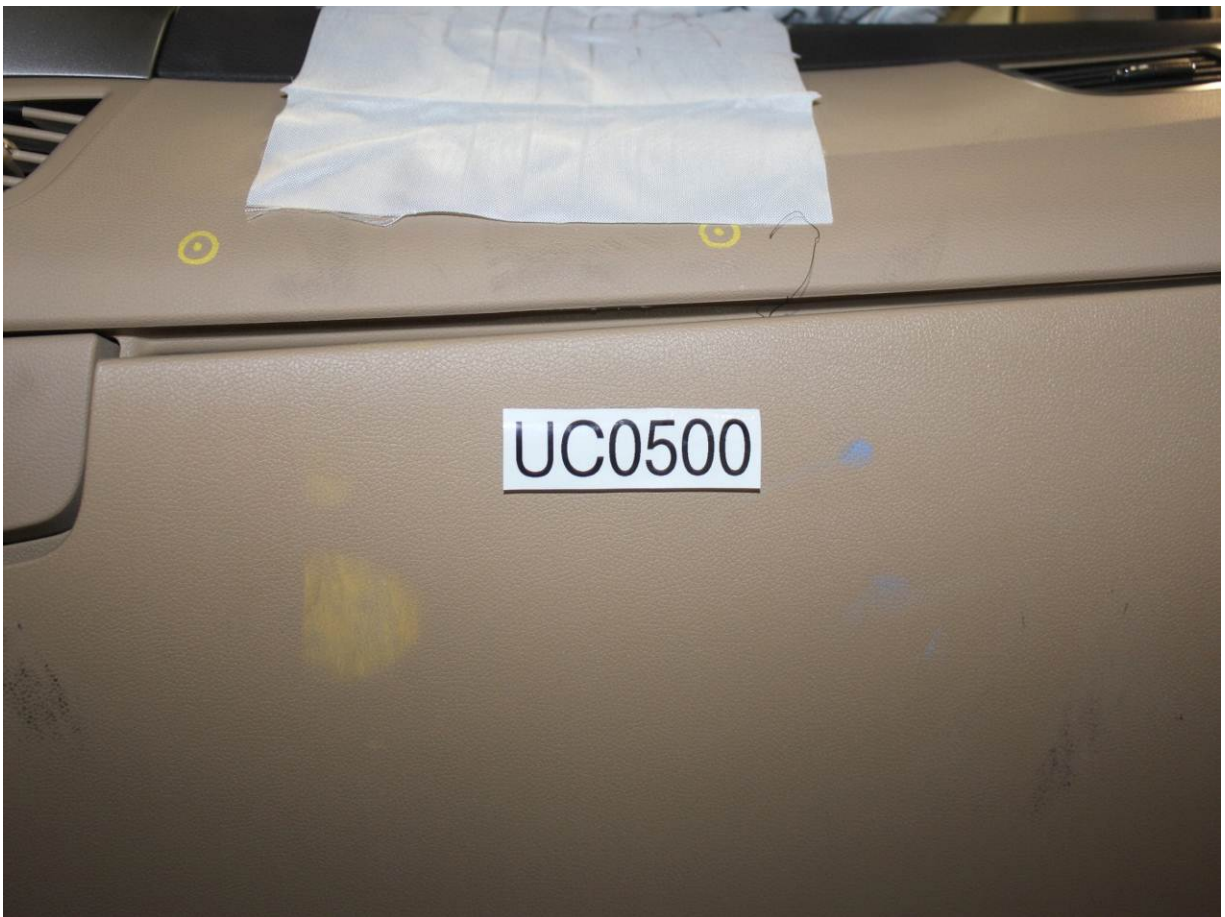
Post-Test Passenger Dummy Contact with Airbag



Post-Test Passenger Dummy Contact with Airbag



Post-Test Passenger Dummy Contact with Headrest



Post-Test Passenger Dummy Contact with Knee Bolster



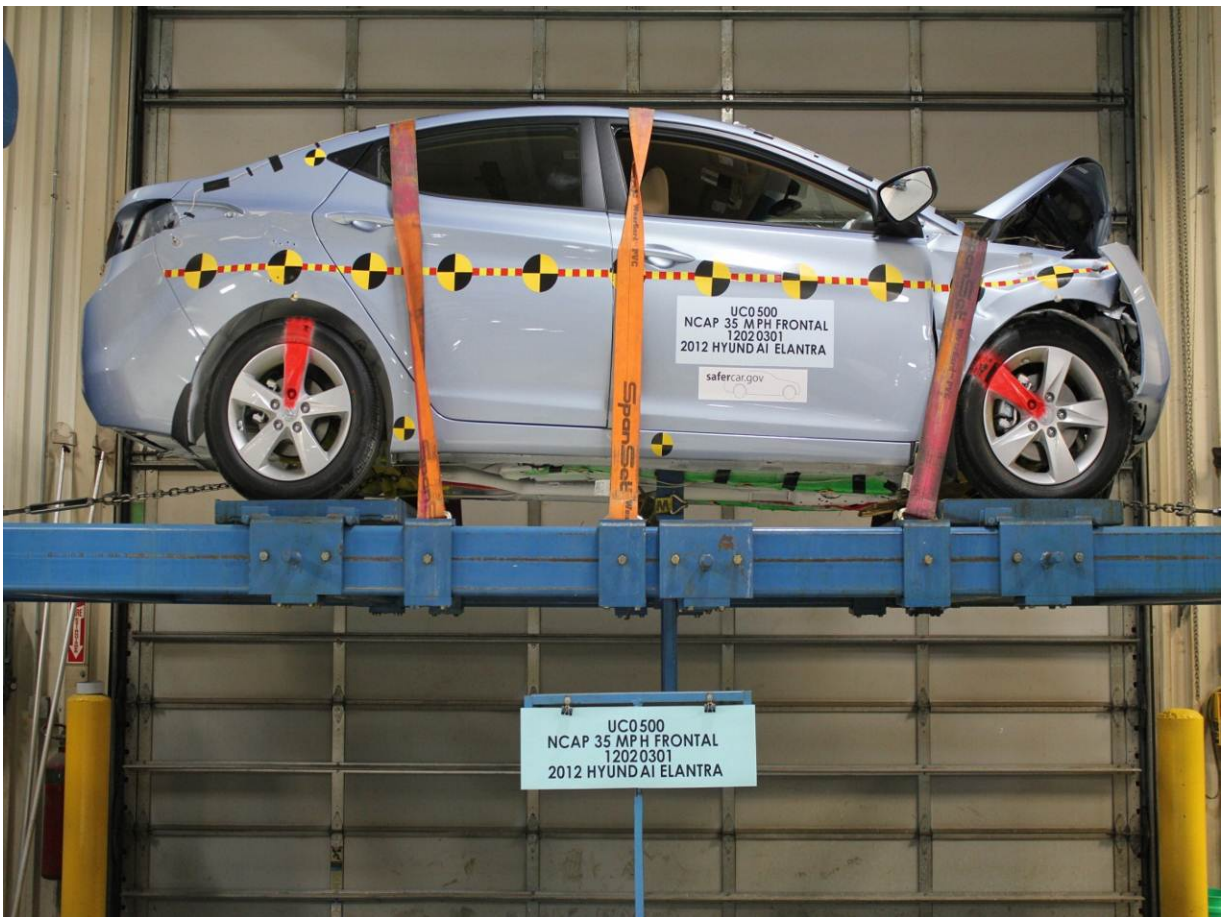
Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

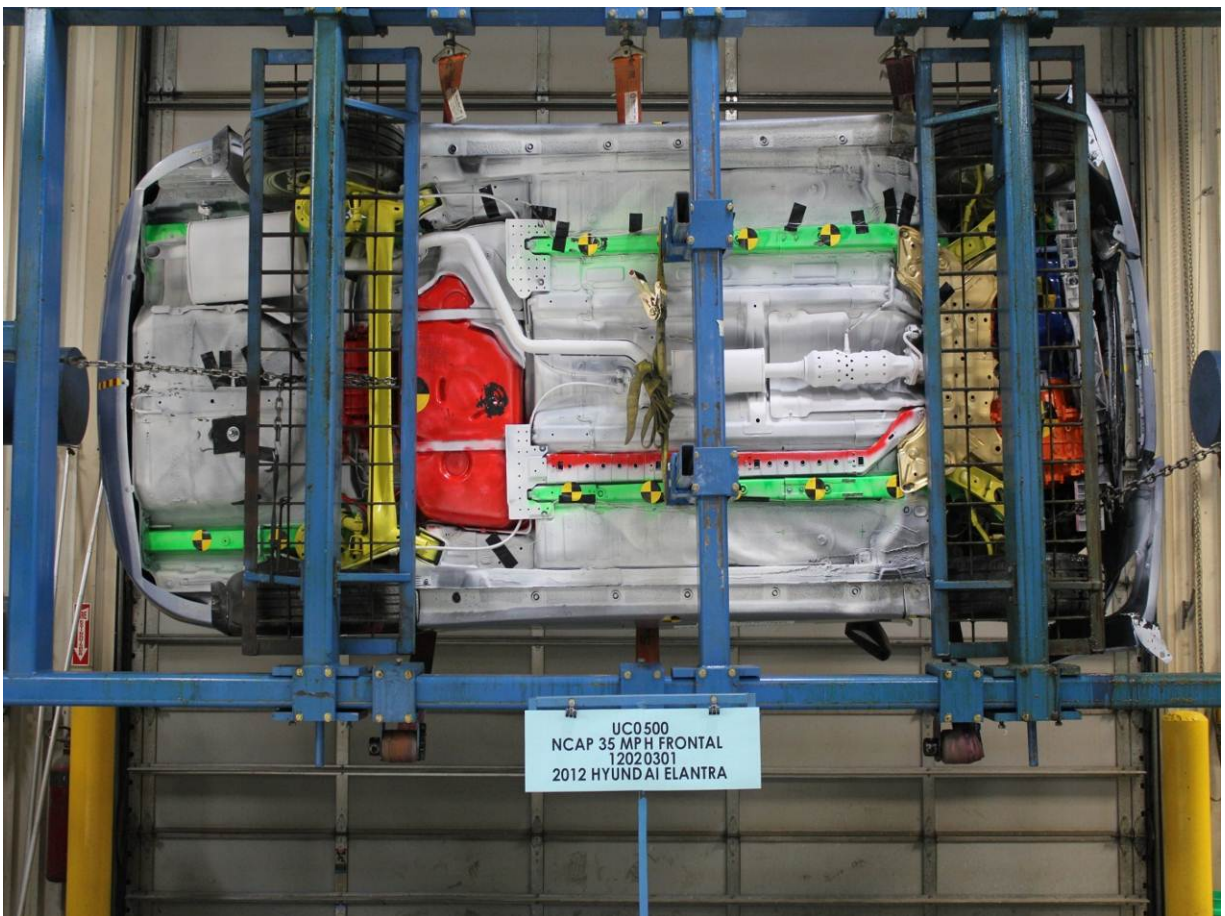
Post-Test Stoddard Solvent Spillage Location View



Post-Test Speed Trap Read-Out



Vehicle at 0 Degrees on Static Rollover Device



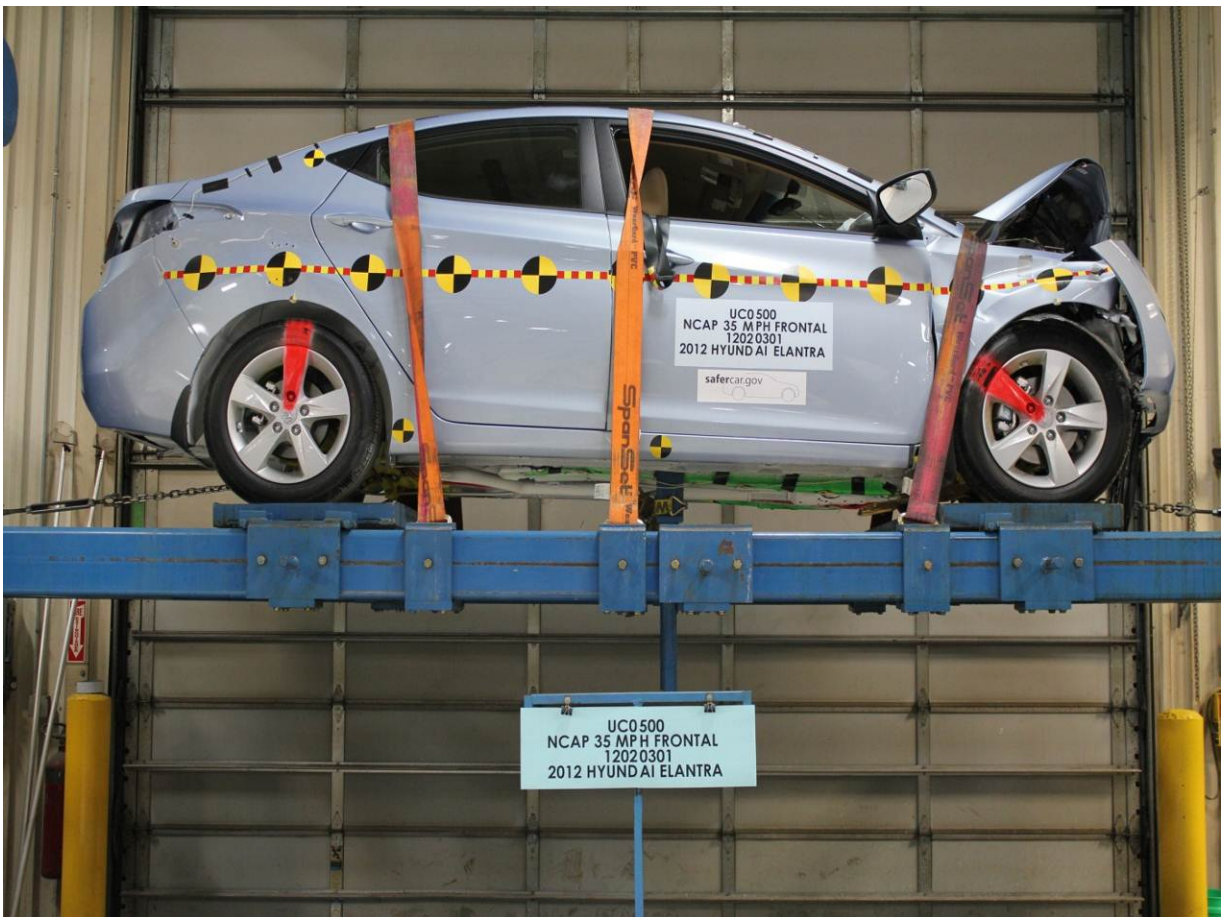
Vehicle at 90 Degrees on Static Rollover Device



Vehicle at 180 Degrees on Static Rollover Device



Vehicle at 270 Degrees on Static Rollover Device



Vehicle at 360 Degrees on Static Rollover Device



2012 Hyundai Elantra Frontal Impact Event



SOLD TO: WI014
BOUCHER HYUNDAI
1553 EAST MORELAND BOULEVARD
WAUKESHA WI 53186

VIN: KMHDH4AE5CU363690
MODEL: 45412F45
ENGINE: G4NBSU384609
PORT OF ENTRY: PT
EXTERIOR COLOR: BLUE SKY METALLIC
INTERIOR COLOR: BEIGE

SHIPPED TO: WI014

MODE OF TRANSPORT: TRUCK
ACCESSORY WEIGHT: 16 lbs.

EMISSIONS: This vehicle is certified to meet emission requirements in all 50 states.

Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. Gasoline license and title fees, state and local taxes and dealer installed options and accessories are not included in the manufacturer's suggested retail price.

This label has been affixed to this vehicle by Hyundai Motor America, pursuant to the requirements of 15 U.S.C. 1231 et seq. which prohibits its removal or alteration prior to delivery to the ultimate purchaser.

PART CONTENT INFORMATION

FOR VEHICLES IN THIS COUNTRY: U.S./CANADIAN PARTS CONTENT: 2 %
MAJOR SOURCES OF FOREIGN PARTS CONTENT: Korea 89 %

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

FOR THIS VEHICLE: FINAL ASSEMBLY POINT: Ulsan, Korea

COUNTRY OF ORIGIN: ENGINE: Korea TRANSMISSION: Korea

EPA Fuel Economy Estimates

CITY MPG

29

Expected range for most drivers
24 to 34 MPG

Estimated Annual Fuel Cost
\$ 1682.00
based on 15,000 miles at \$3.70 per gallon

Combined Fuel Economy

This Vehicle **33**

10 33 39
All Midsize Cars

HIGHWAY MPG

40

Expected range for most drivers
33 to 47 MPG

Your actual mileage will vary depending on how you drive and maintain your vehicle

STANDARD FEATURES:

AMERICA'S BEST WARRANTY

5-year/60,000-mile New Vehicle Warranty
10-year/100,000-mile Powertrain Warranty
7-year/unlimited-mile Anti-rust/perforation Warranty
*5-year/unlimited-mile Roadside Assistance

*Limited warranties, see dealer for details

ADVANCED SAFETY TECHNOLOGY

*Electronic Stability Control (ESC) w/ Traction Control
*ABS w/ Electronic Brake Force Distribution & Brake Assist
*4-wheel Disc Brakes
*Front, Front Side Impact & Side Curtain Airbags
*Front Seatbelt Pre-Tensioners
*Tire Pressure Monitoring System
*Daytime Running Lights

POWERTRAIN TECHNOLOGY

*1.8L, 148 HP, 131 lbs-ft Torque, DOHC 4-Cylinder
*Dual Continuous Variable Valve Timing
*6-Speed Automatic Transmission w/ SHIFTRONIC8

COMFORT & CONVENIENCE

*16-Inch Wheels w/ Full Covers and P205/55R16 Tires
*Solar Glass w/ Windshield Shade Band
*Bodycolor Door Handles & Mirrors
*Map Lights w/ Sunglass Holder
*Air Conditioning w/ Cabin Air Filter
*AM/FM/XMR/CD/MP3 Audio System w/ 6 Speakers
*XM® Satellite Radio w/90 Day Trial; Not Available in AK & HI
*iPod®/USB & Auxiliary Input Jacks
*Remote Keyless Entry w/ Alarm
*Power Heated Outside Mirrors
*Power Windows and Door Locks
*Trip Computer
*External Temperature Display
*Steering Wheel Mounted Cruise Control
*Tilt-and-Telescopic Steering Column
*Driver Seat Height Adjustment
*Front Armrest Storage Box
*Front Passenger Seatback Pocket
*60/40 Split-Folding Rear Seat
*Rear Center Armrest w/ Cupholders
*Front and Rear Door Map Pockets
*Fuel Tank of Gas

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Manufacturer's Suggested Retail Price:

\$17,445.00

ADDED FEATURES:

*Preferred Package:
16" Alloy Wheels
Steering Wheel Audio Controls
Bluetooth® Hands-Free Phone System with Voice Recognition
Cloth Insert Door Trim
Sliding Center Armrest
Illuminated Vanity Mirrors with Extensions
Illuminated Ignition
Front Foglights
*Carpeted Floor Mats
*Cargo Net
*Cargo Tray
*Mud Guards
*Rear Bumper Protector

\$600.00

\$95.00

\$50.00

\$70.00

\$85.00

\$50.00

Inland Freight & Handling:

\$760.00

Total Price:

\$19,155.00

GOVERNMENT SAFETY RATINGS

Frontal Crash Driver Passenger Not Rated
Not Rated

Star ratings based on the risk of injury in a frontal impact.
Frontal ratings should ONLY be compared to other vehicles of similar size and weight.

Side Crash Front seat Rear seat Not Rated
Not Rated

Star ratings based on the risk of injury in a side impact.

Rollover Not Rated

Star ratings based on the risk of rollover in a single vehicle crash.

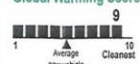
Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.

Source: National Highway Traffic Safety Administration (NHTSA).

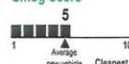
Environmental Performance

Protect the Environment, choose vehicles with higher scores:

Global Warming Score



Smog Score



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

343 A 3412GTOPAZ 211



See the Free Fuel Economy Guide at dealers or www.fueleconomy.gov



www.safercar.gov or 1-888-327-4236

Monroney Label

APPENDIX B
DUMMY RESPONSE DATA TRACES

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Figure No. 27.	Passenger Chest Resultant Z Acceleration vs. Time	B-9

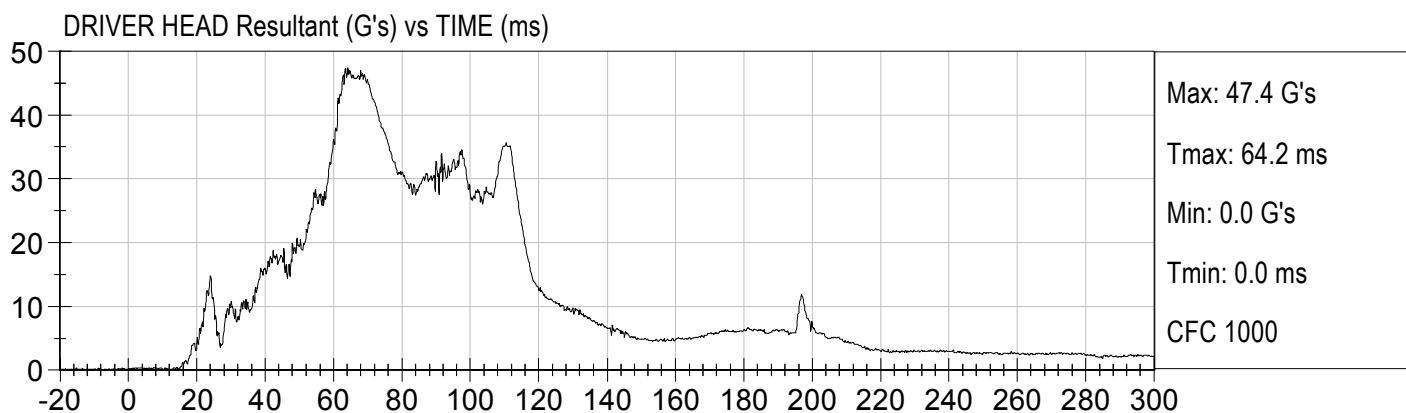
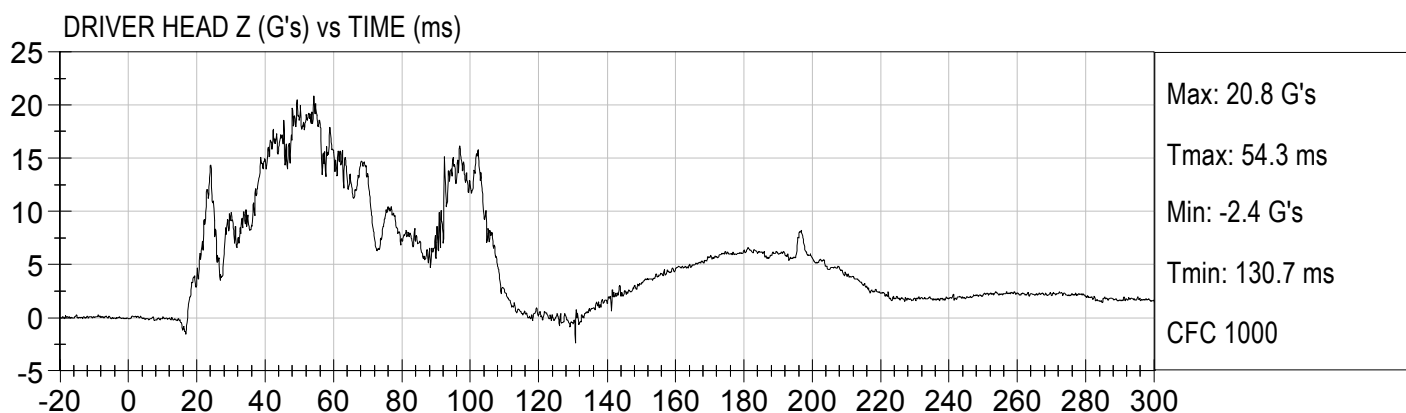
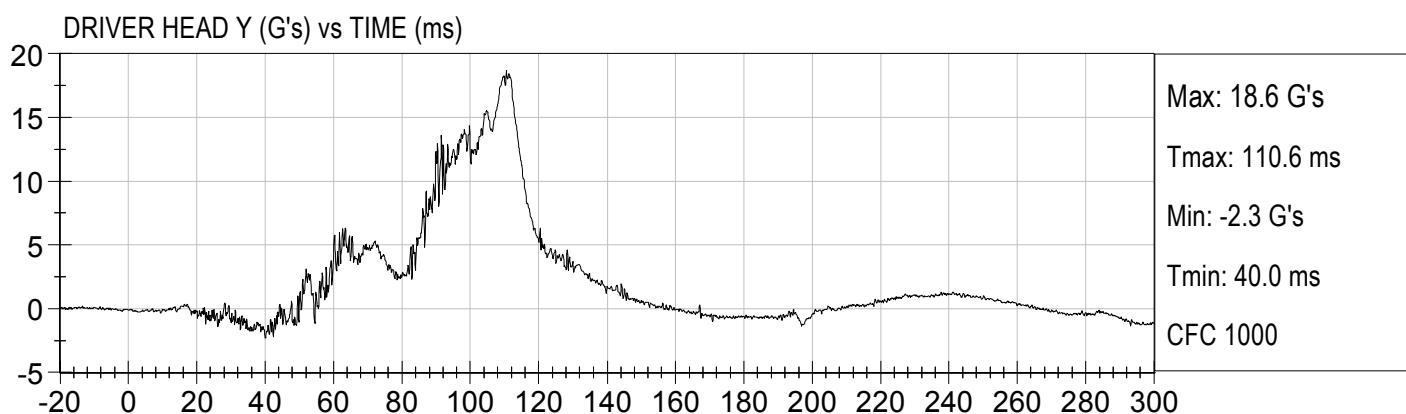
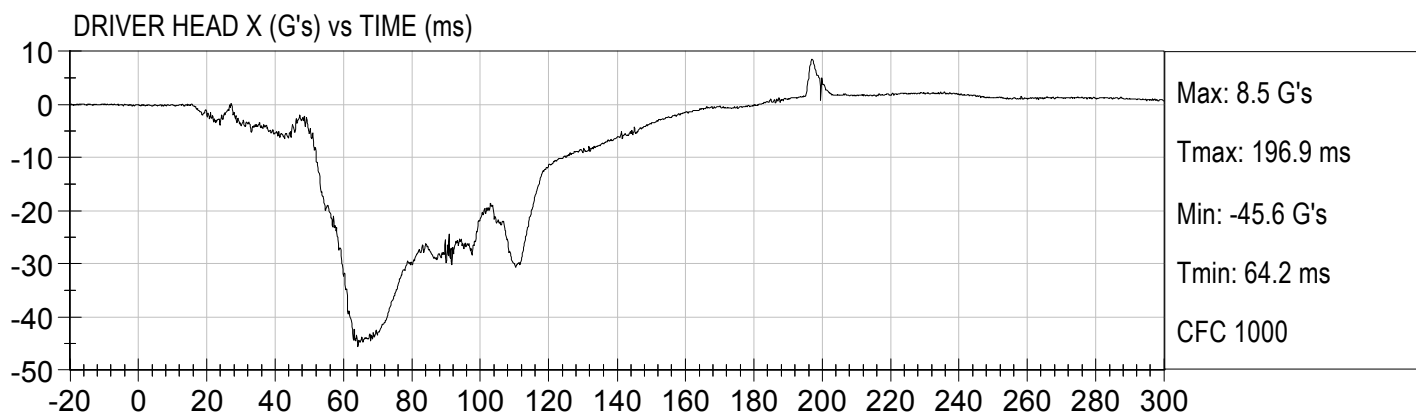
	<u>Page No.</u>
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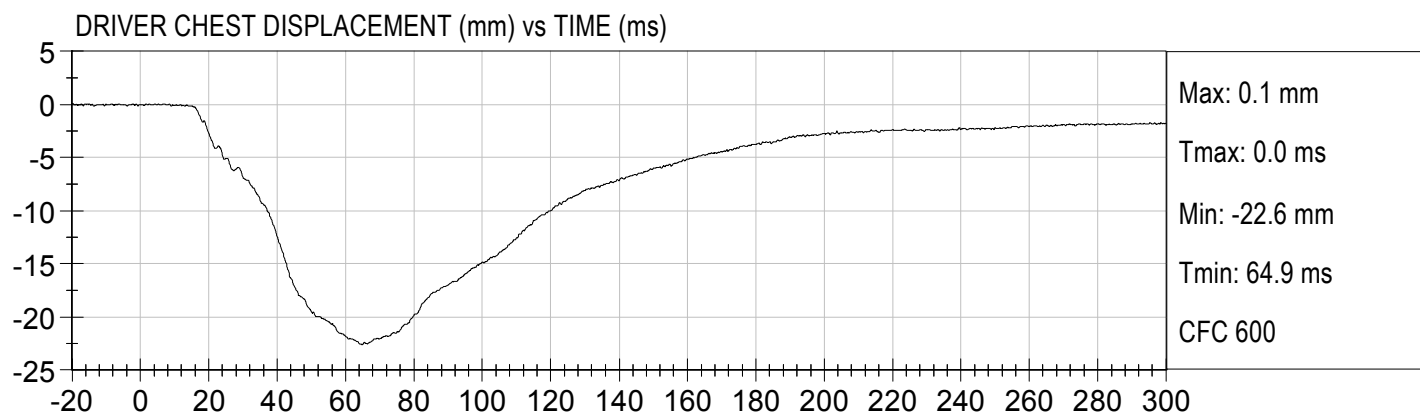
The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

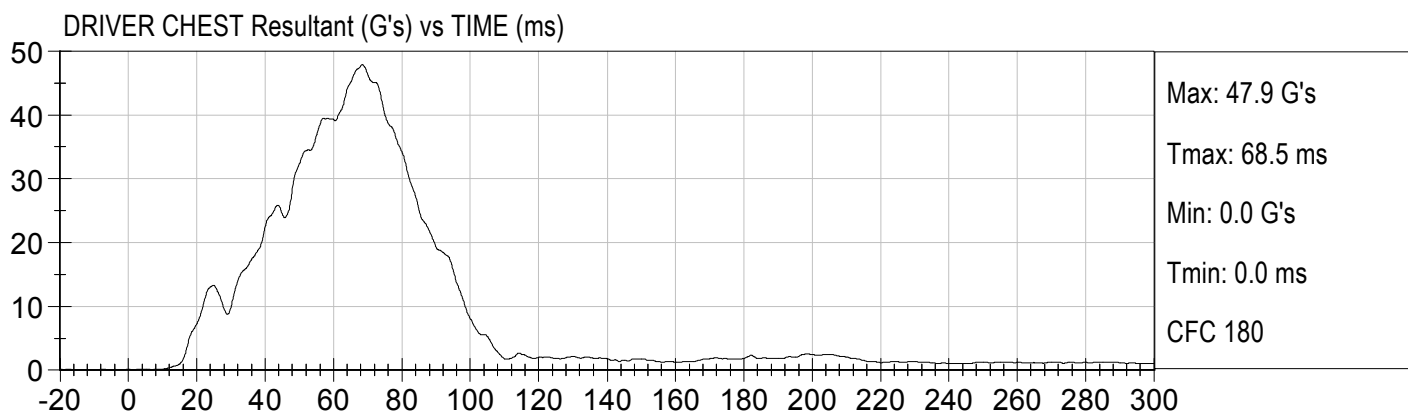
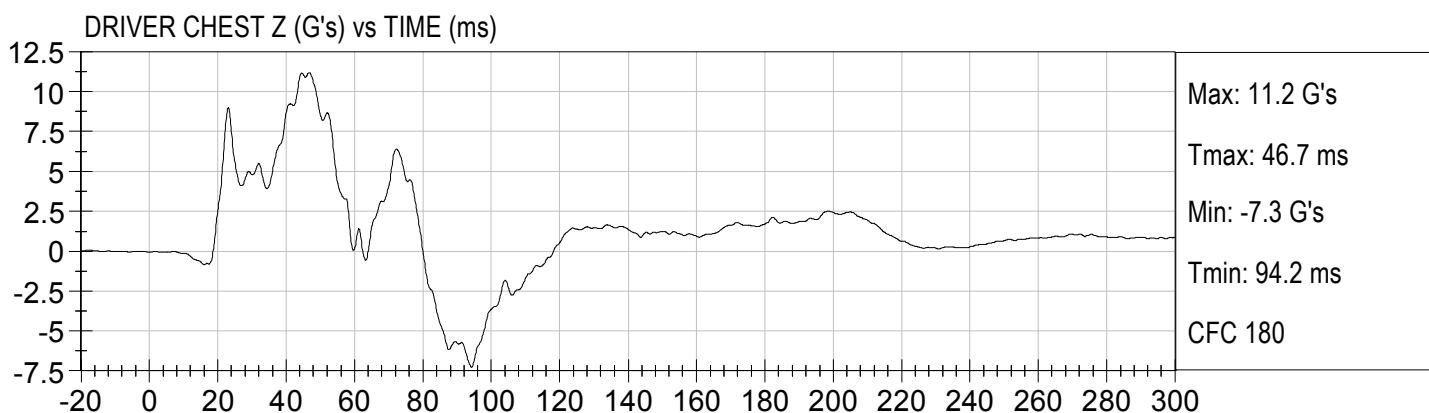
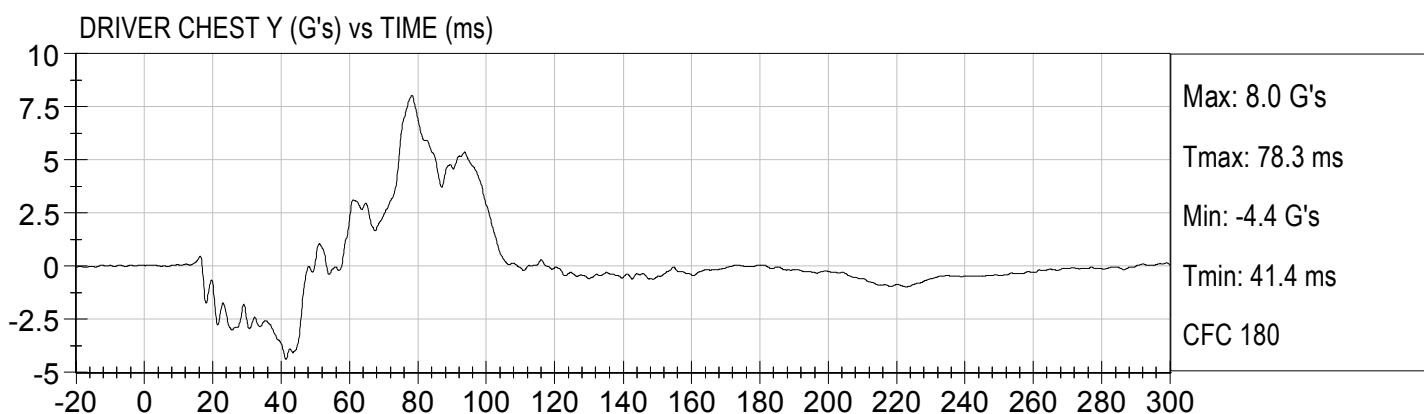
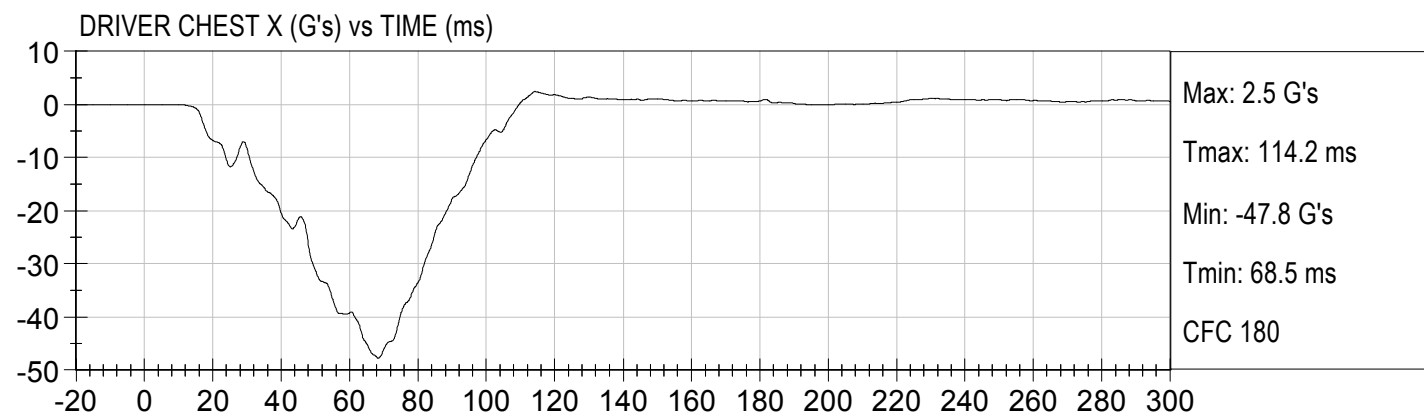
Driver Head X Redundant
 Driver Head Y Redundant
 Driver Head Z Redundant
 Driver Upper Neck Force Y
 Driver Upper Neck Moment X
 Driver Upper Neck Moment Z
 Driver Chest X Redundant
 Driver Chest Y Redundant
 Driver Chest Z Redundant
 Driver Pelvis X
 Driver Pelvis Y
 Driver Pelvis Z
 Driver Left Femur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

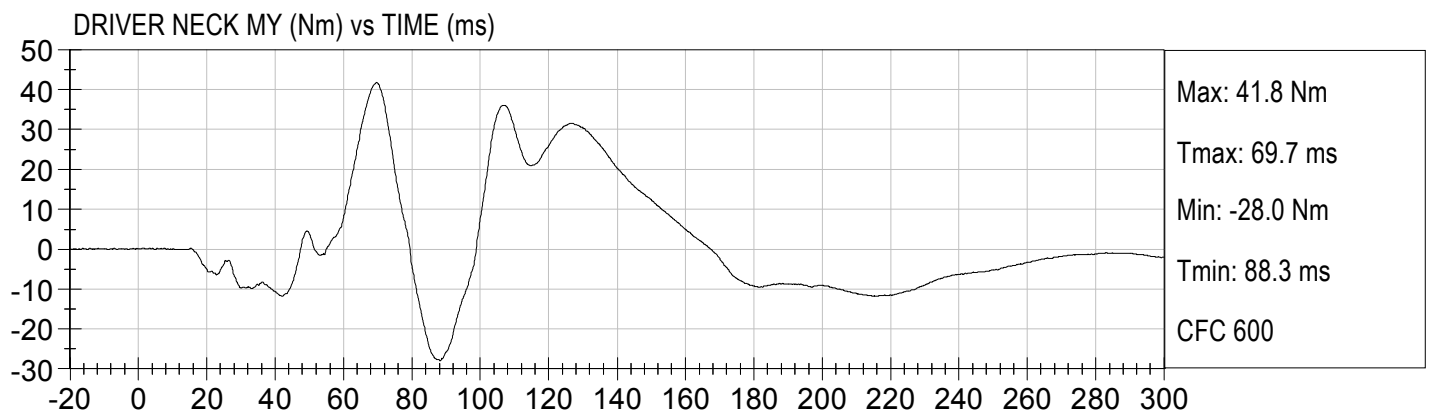
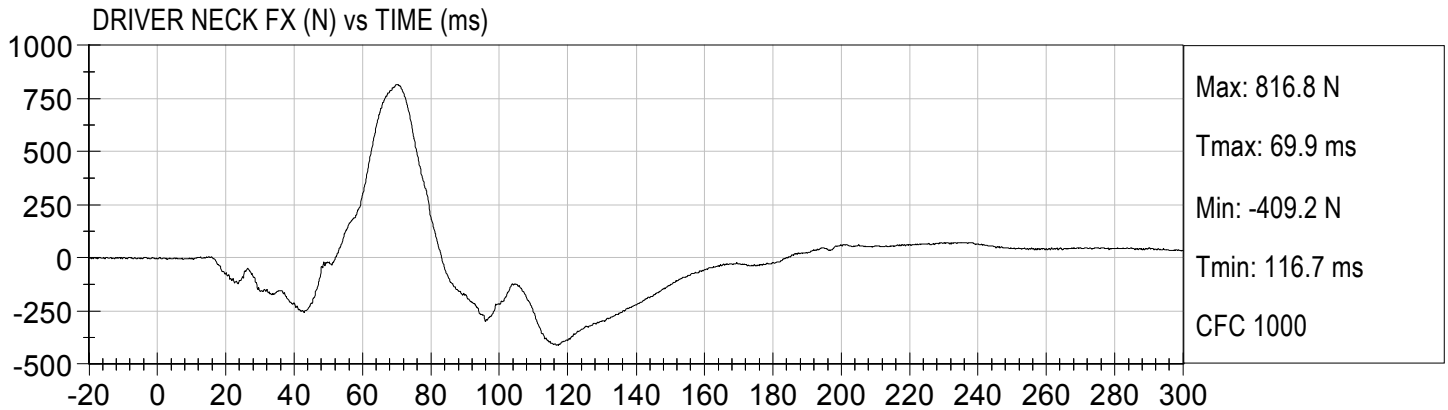
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left 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 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

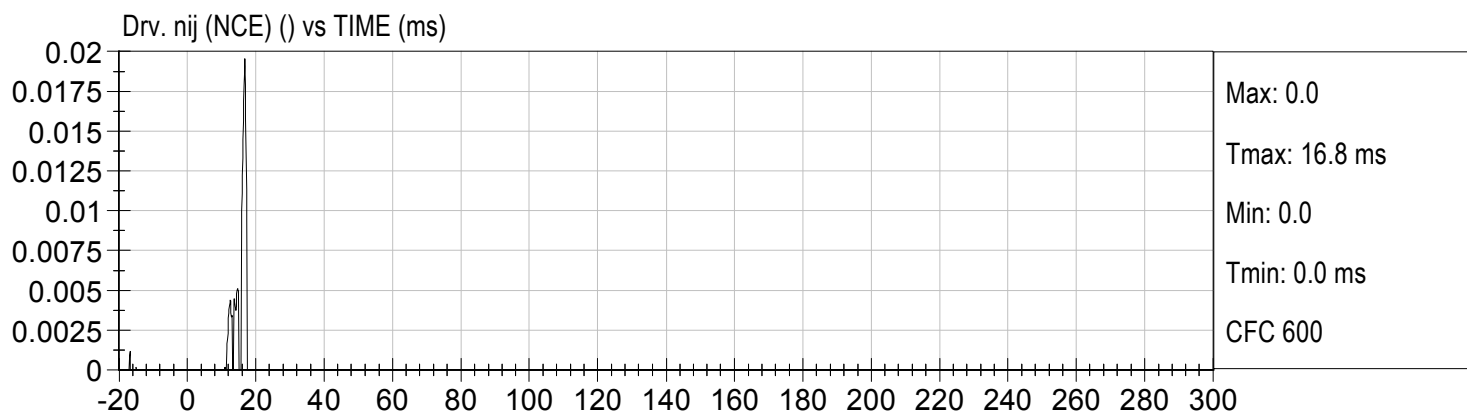
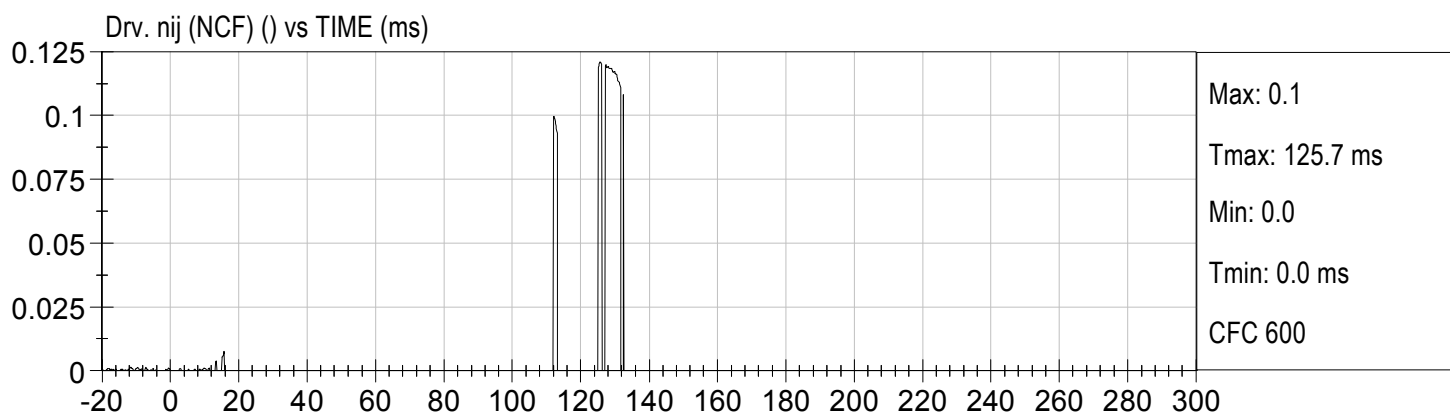
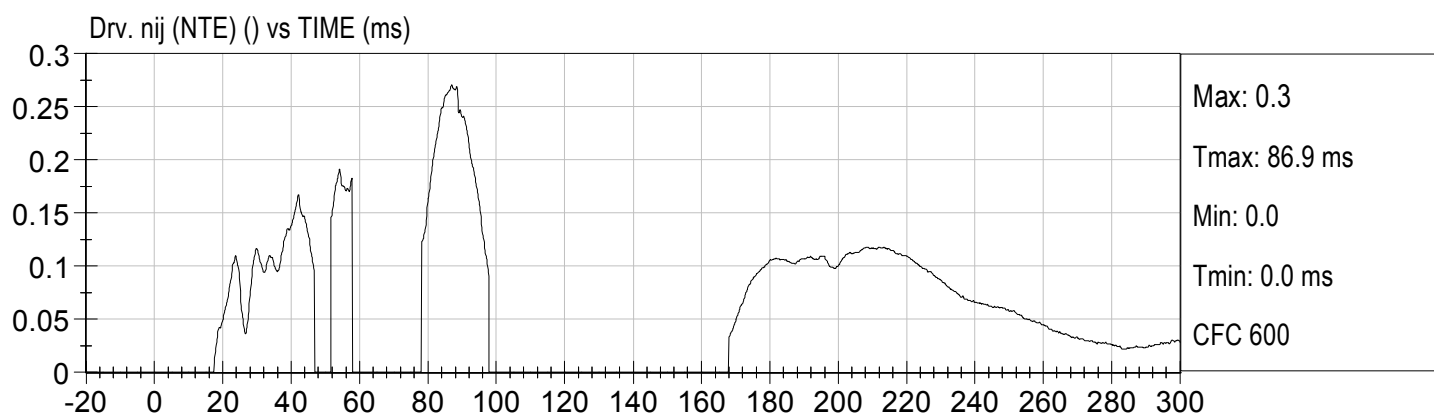
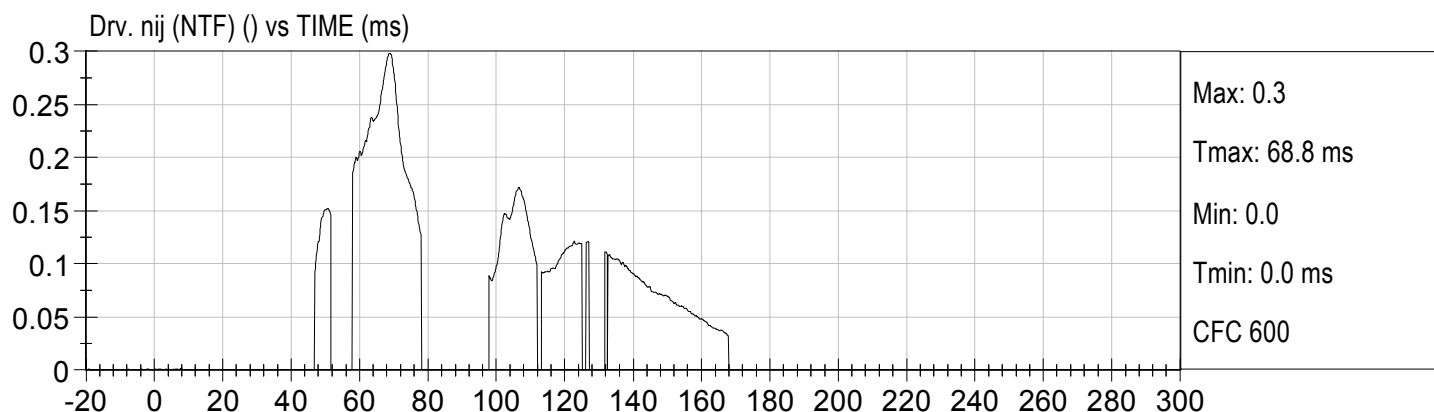
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right 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
Vehicle Left Brake Caliper X
Vehicle Right Brake Caliper X
Left Rear Seat Crossmember Xr
Right Rear Seat Crossmember Xr

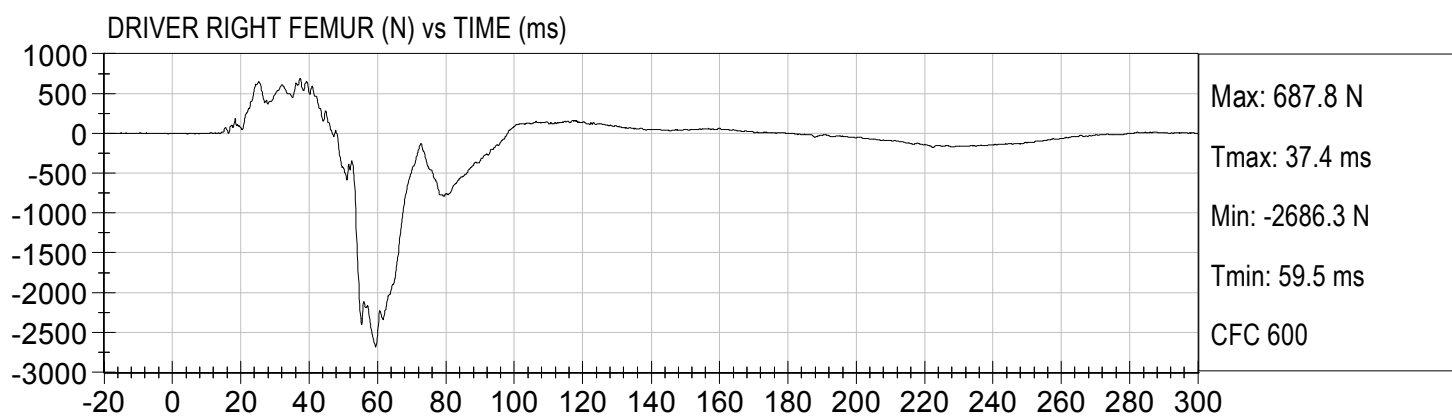
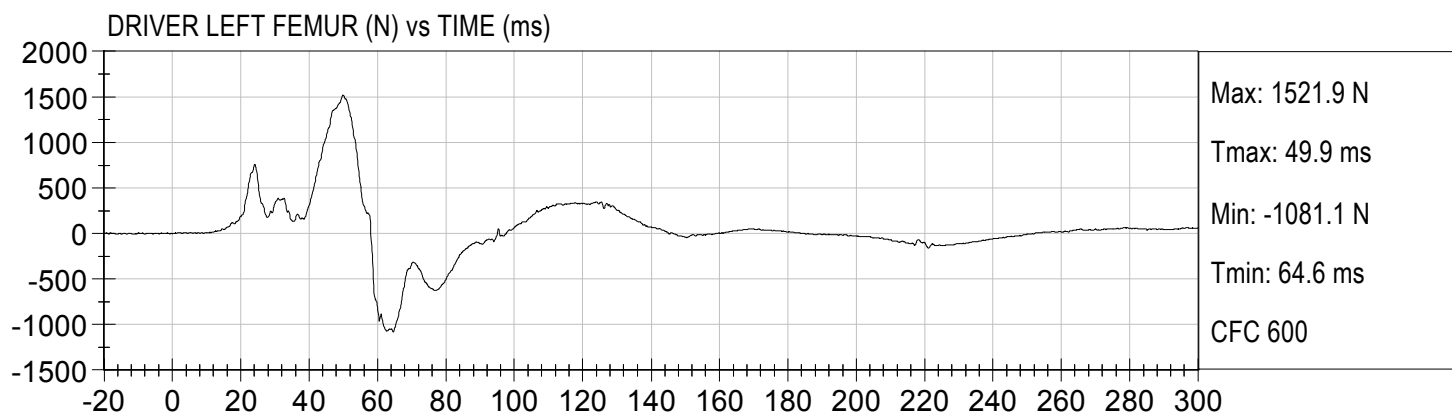


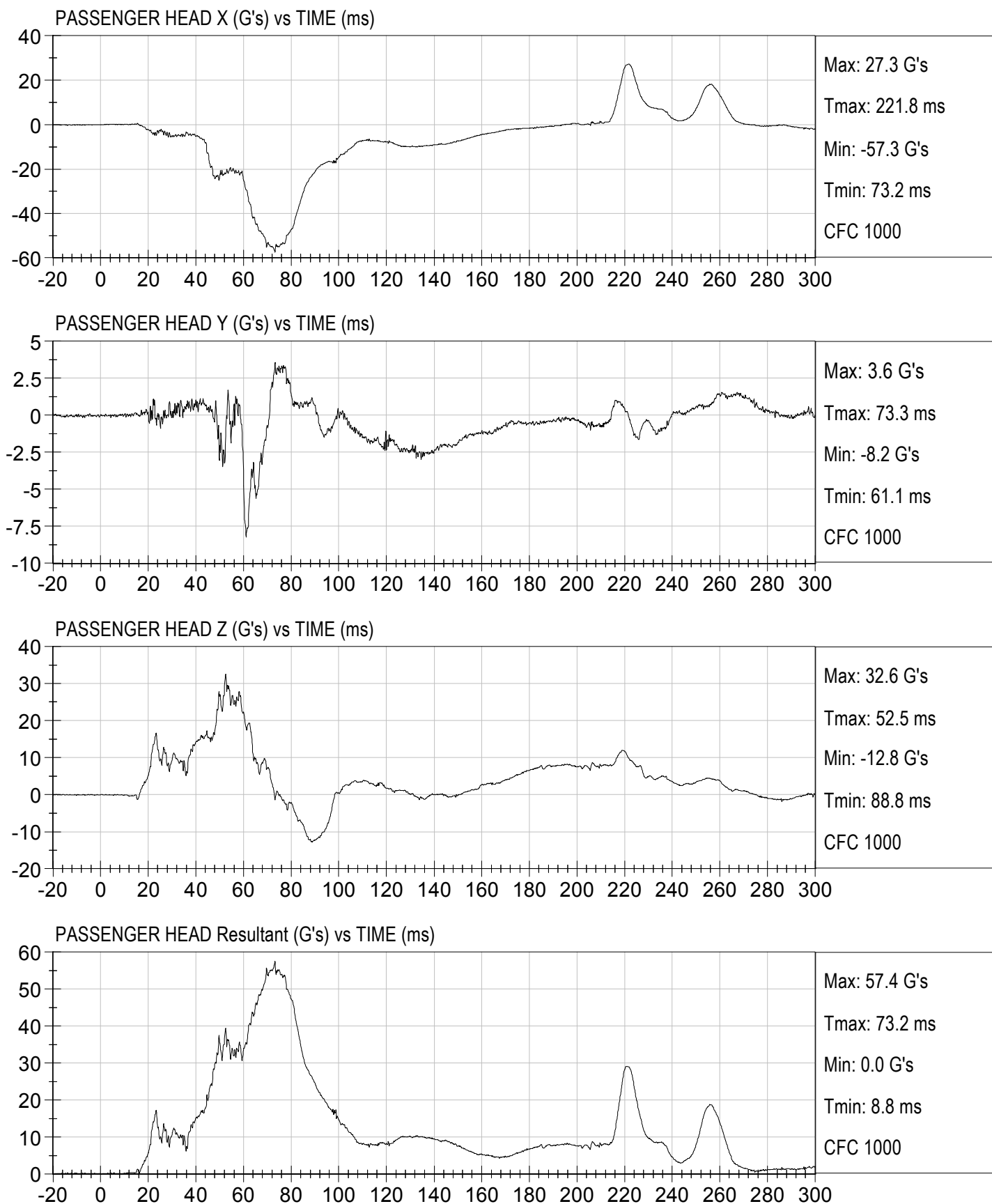


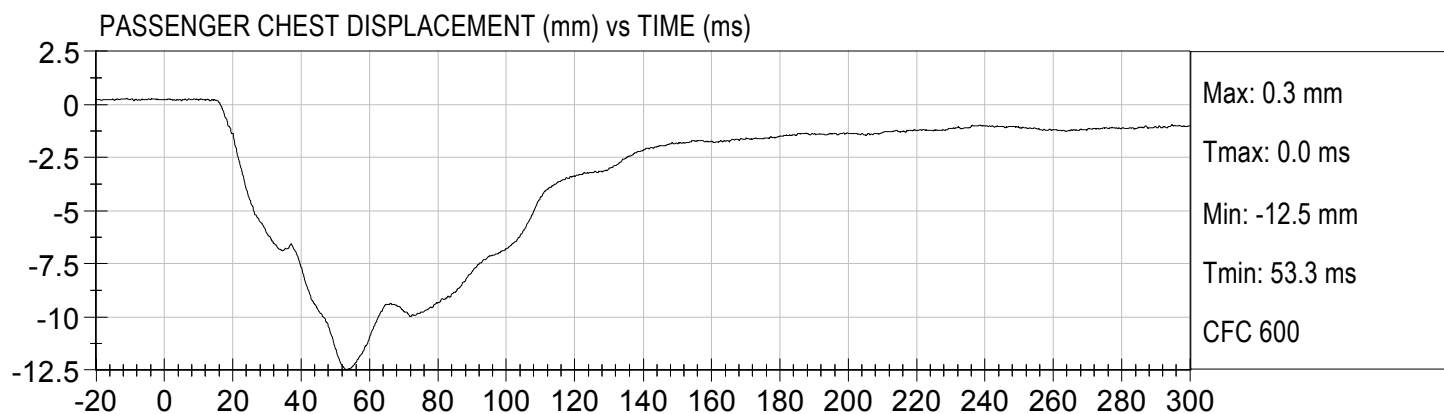


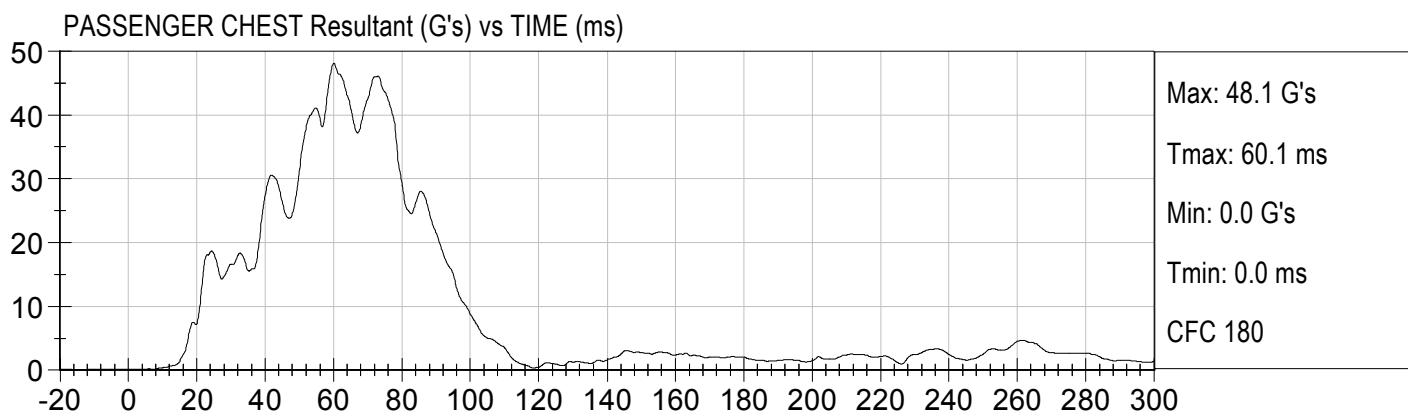
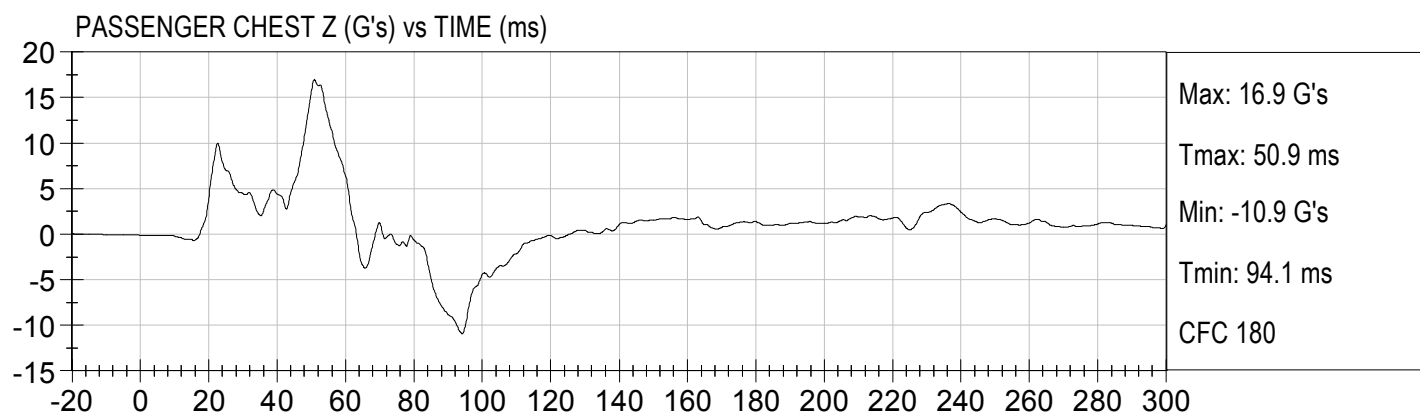
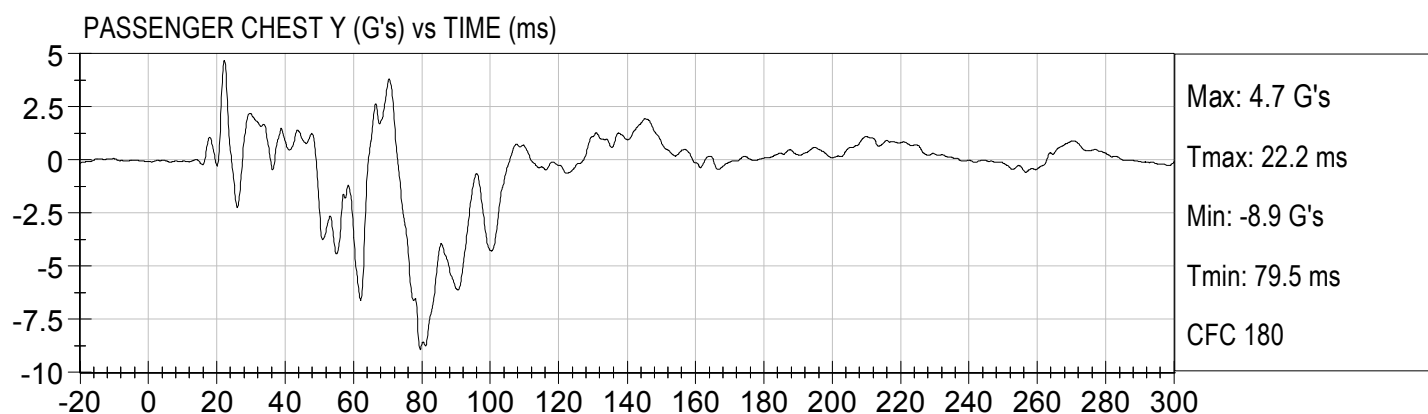
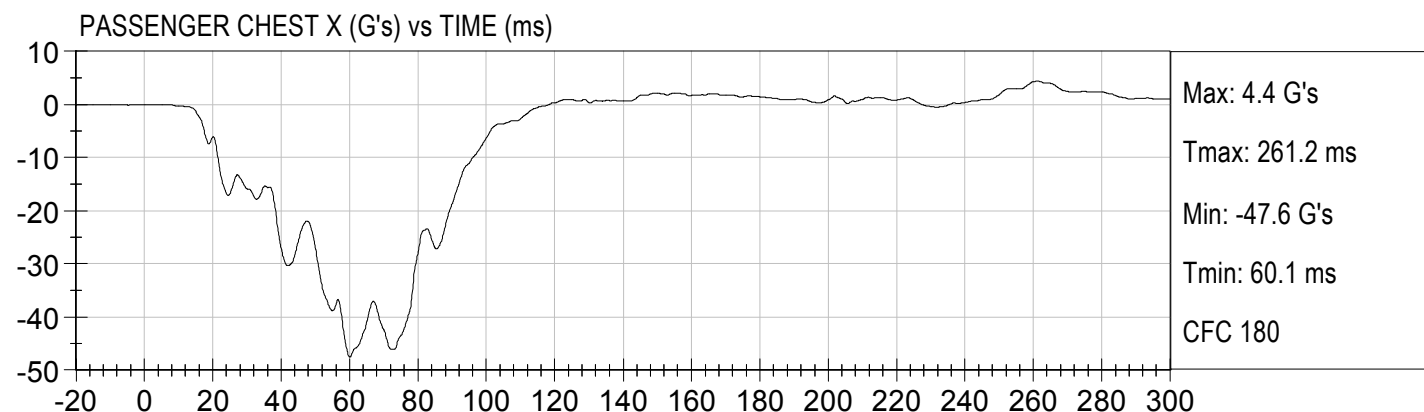


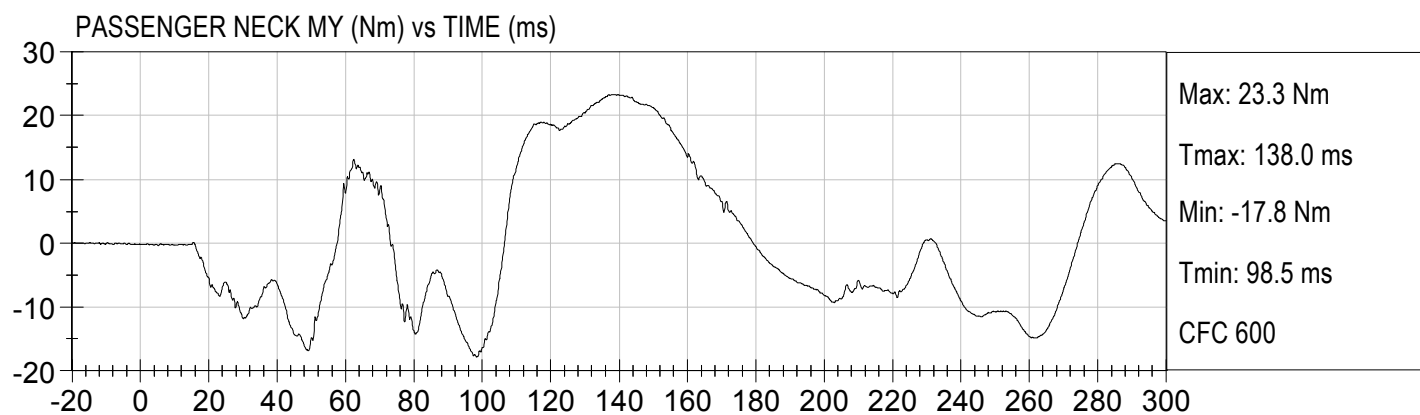
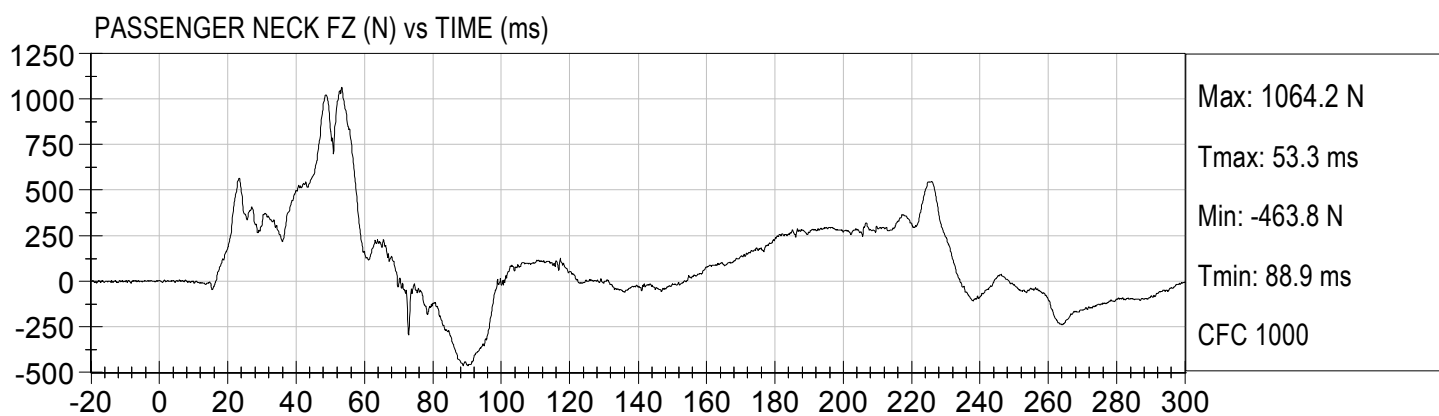
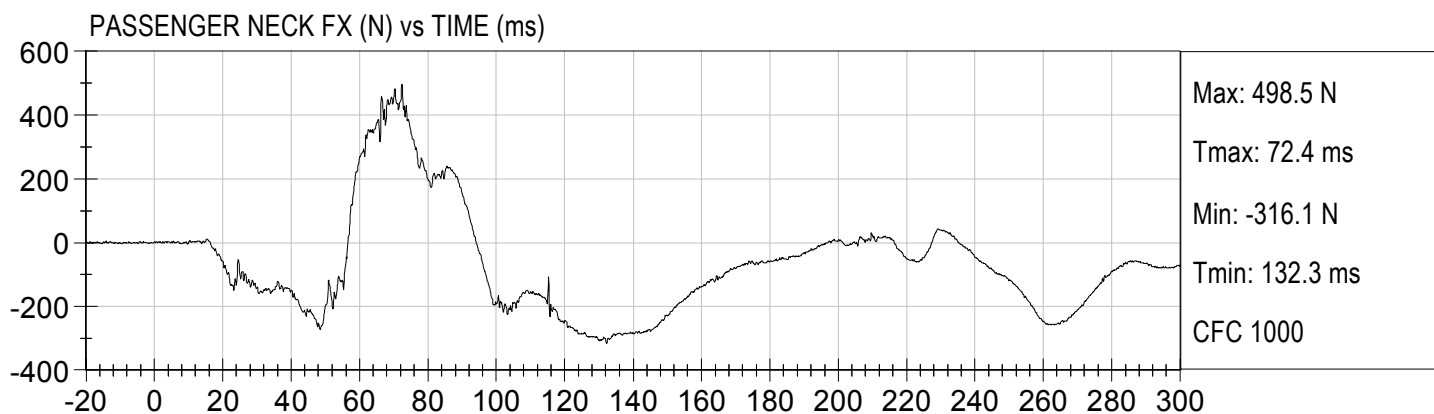


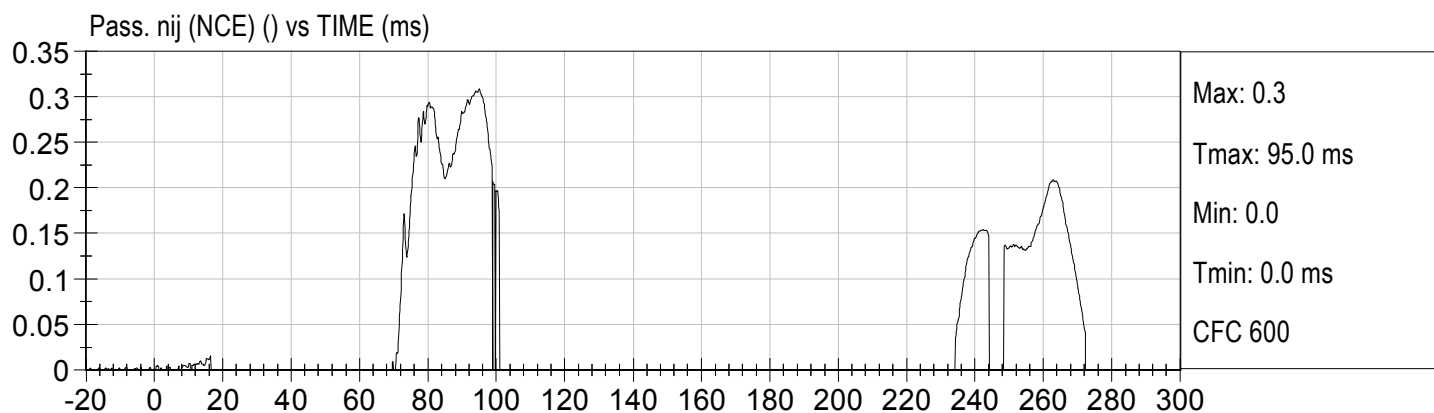
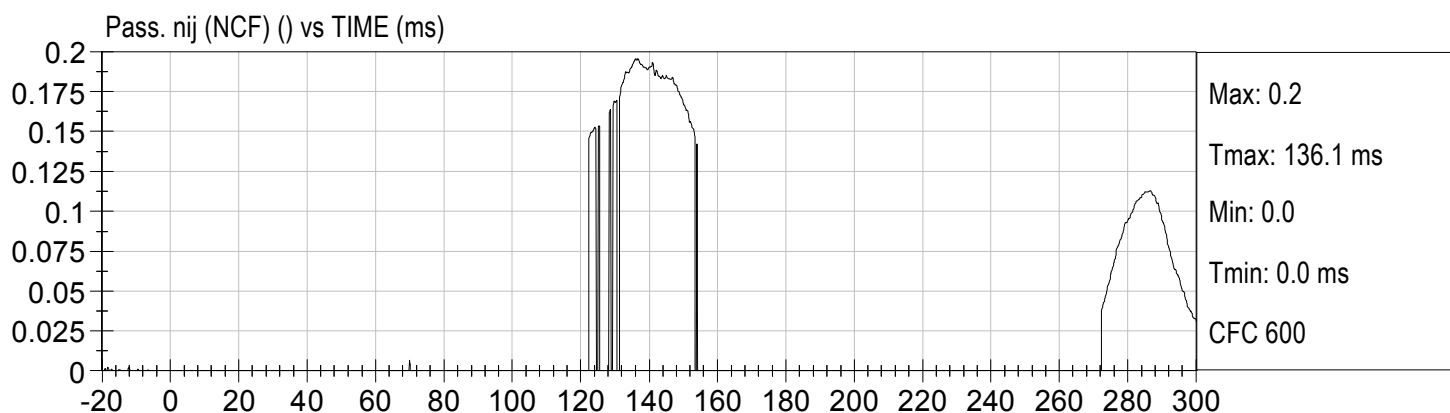
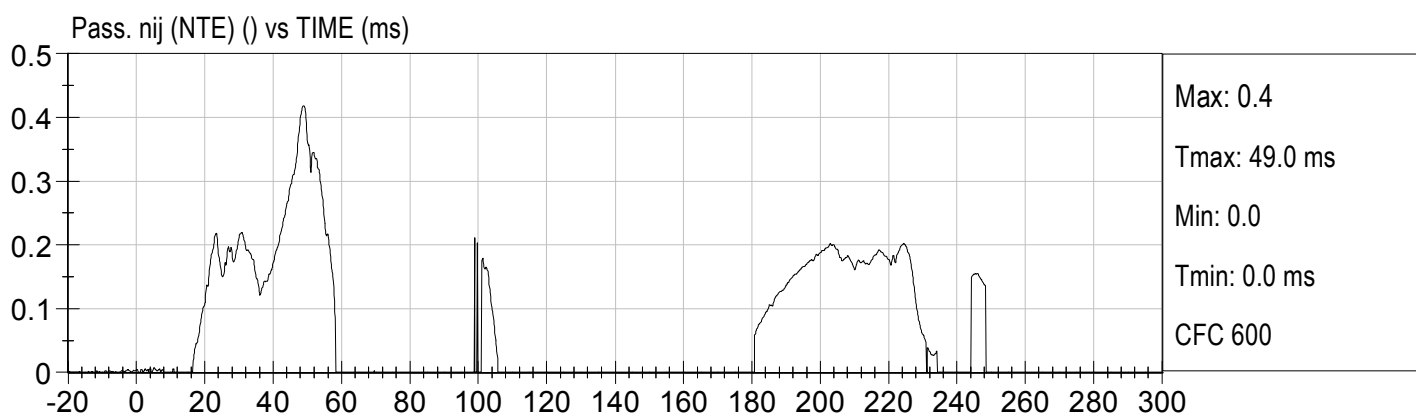
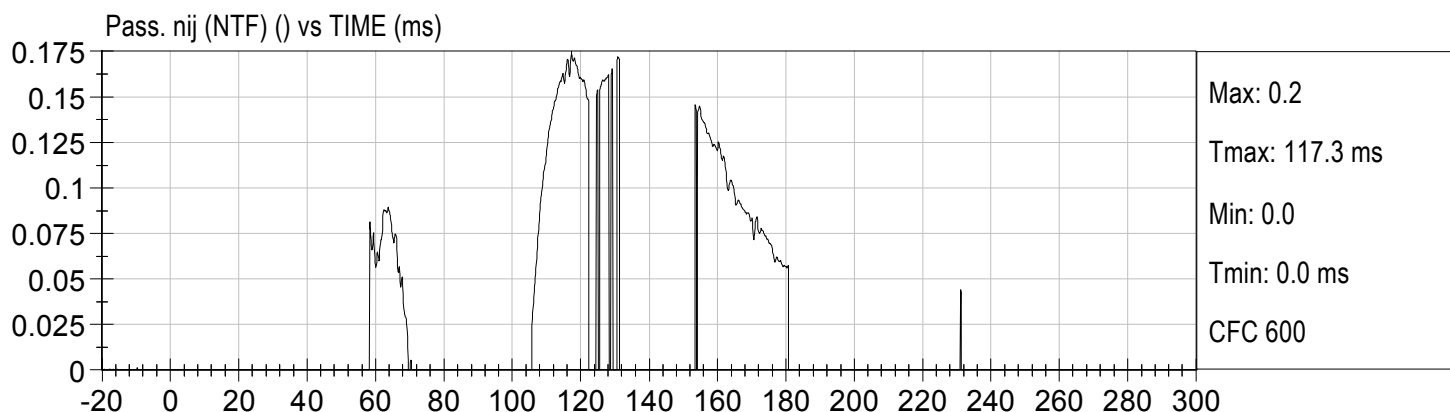


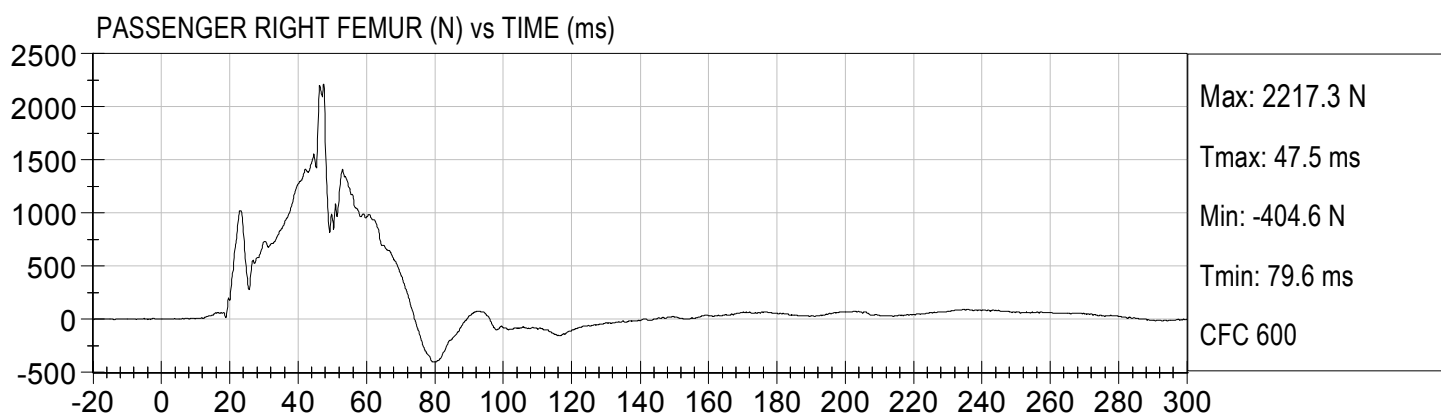
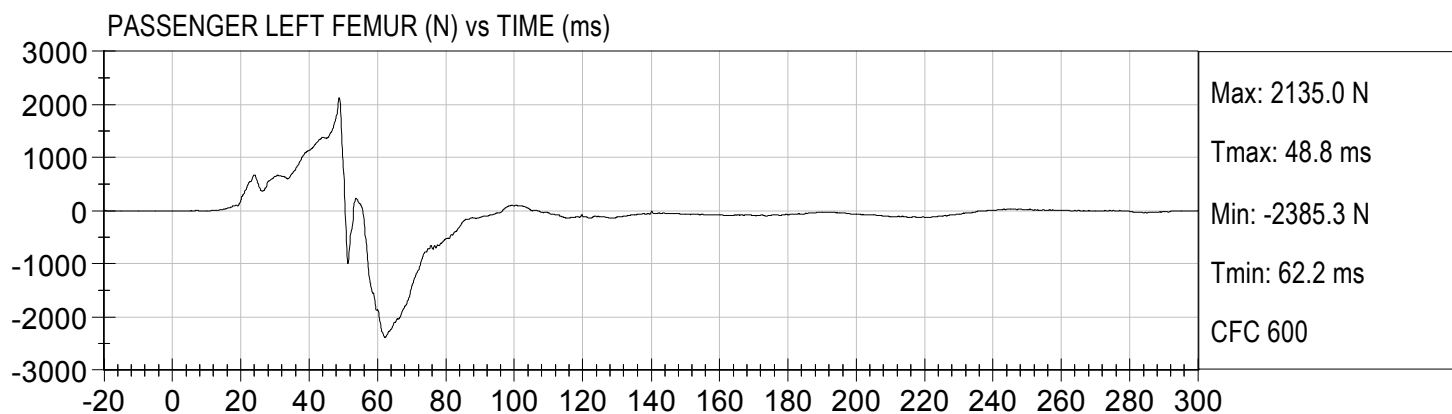












APPENDIX C

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

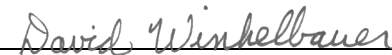
ATD Serial No: 351

Test ID: D12211

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	15	Pass
Peak Resultant Acceleration	G's	225 - 275	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


Laboratory Technician

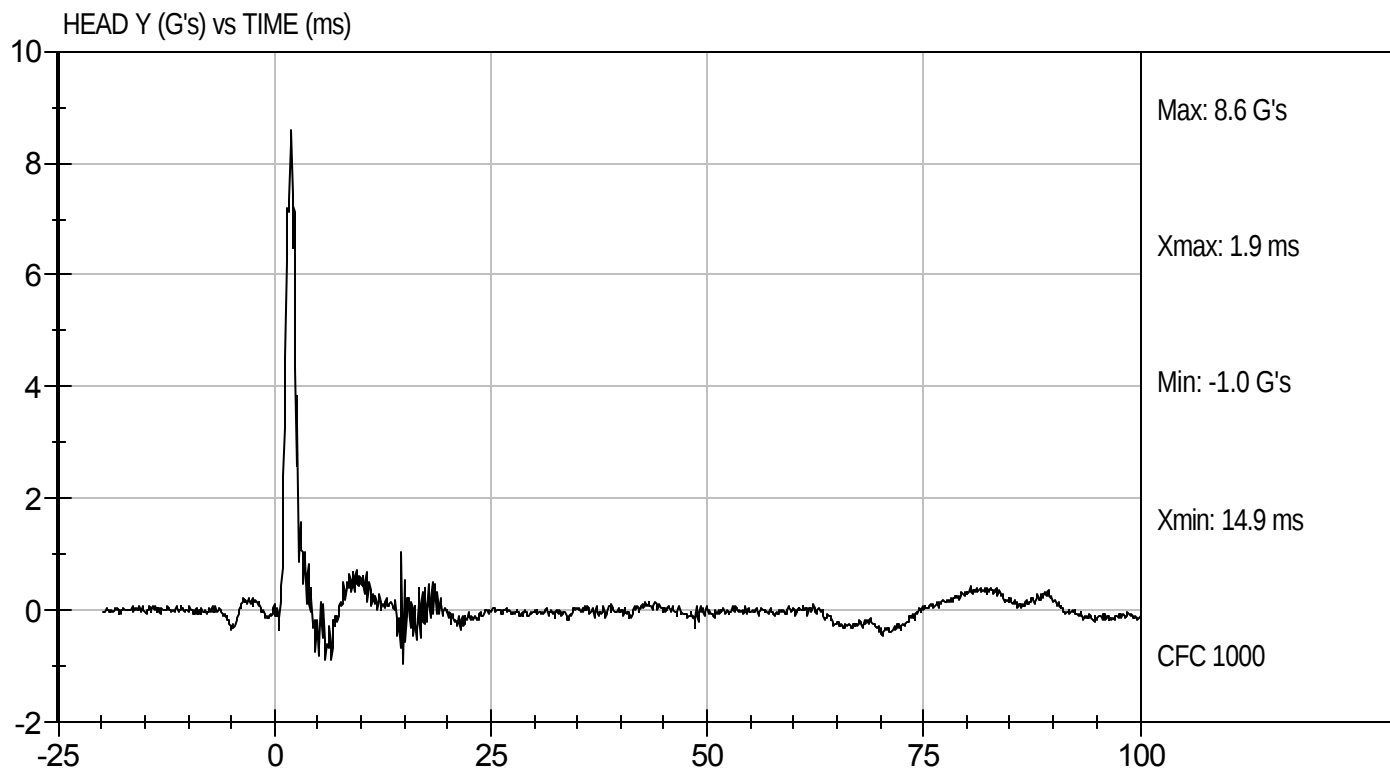
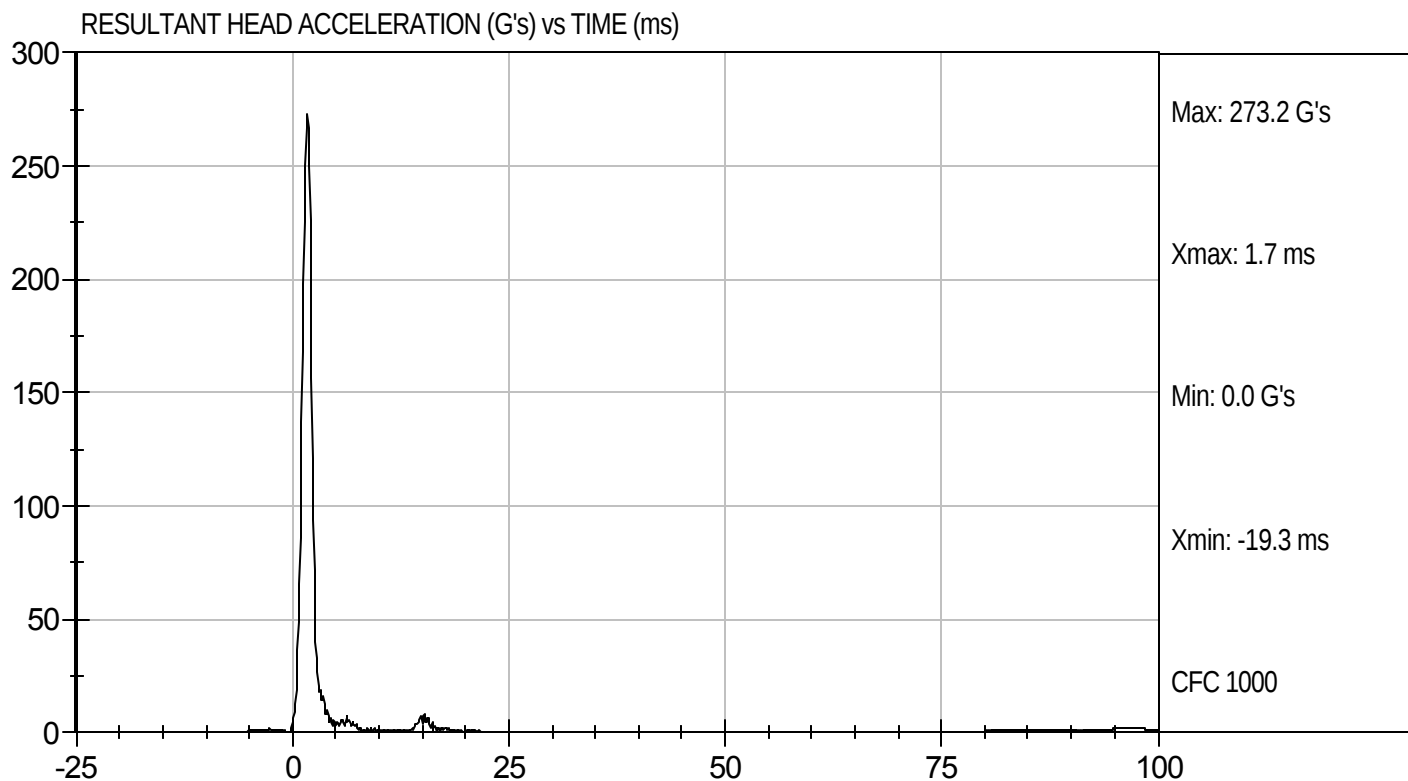
1/18/12
Test Date


Approved By



Test Desc: Head Drop
Component ID: D12211

Test Date: 1/18/12
Velocity: 0 ft/s, 0 m/s



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

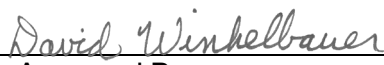
ATD Serial No: 351

Test I.D.: D12212

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	19	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.27	Pass
	20 ms	G's	17.60 to 22.60	18.20	Pass
	30 ms	G's	12.50 to 18.50	14.16	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.1	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	68.1	Pass
	Time	ms	57.0 to 64.0	58.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	116.8	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	91.4	Pass
	Time	ms	47.0 to 58.0	47.1	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	97.5	Pass
Overall Test Results					Pass


Laboratory Technician

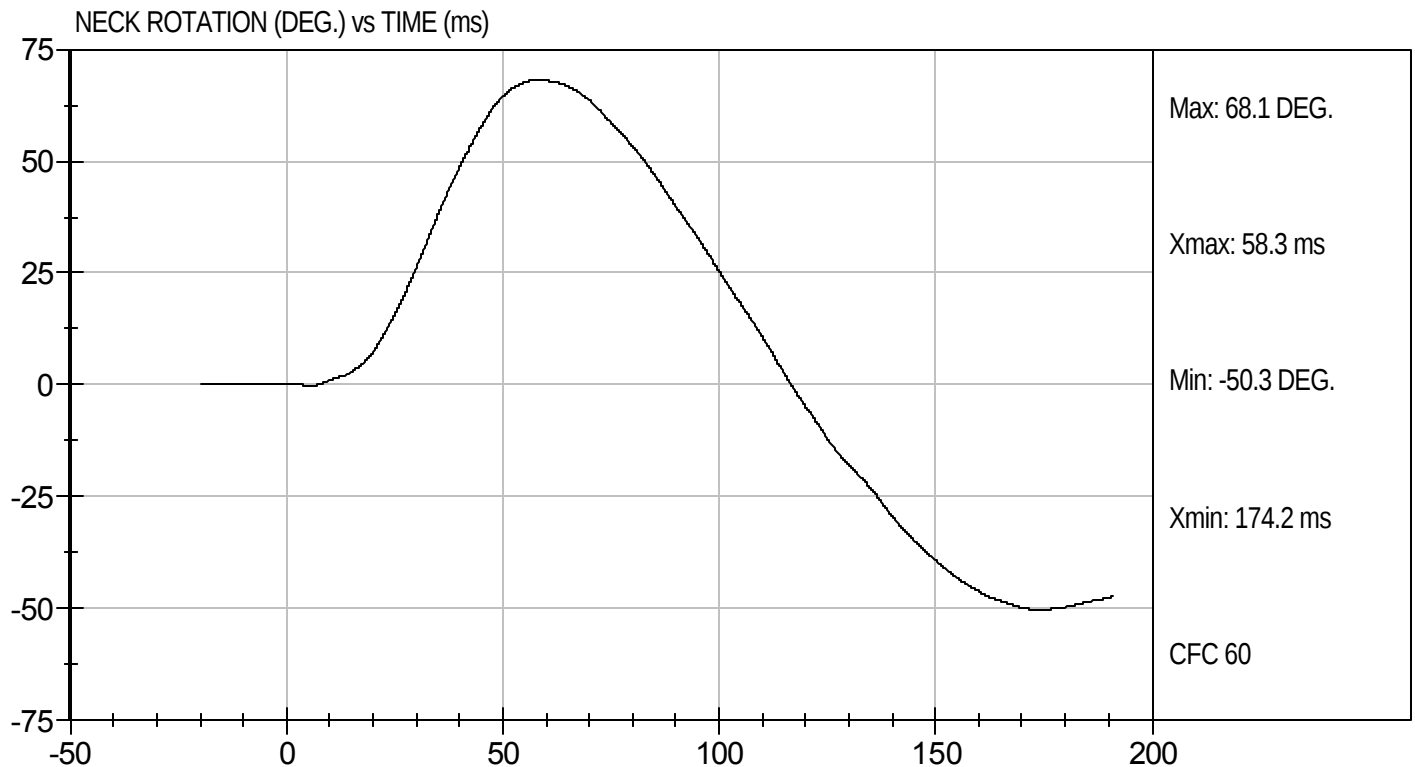
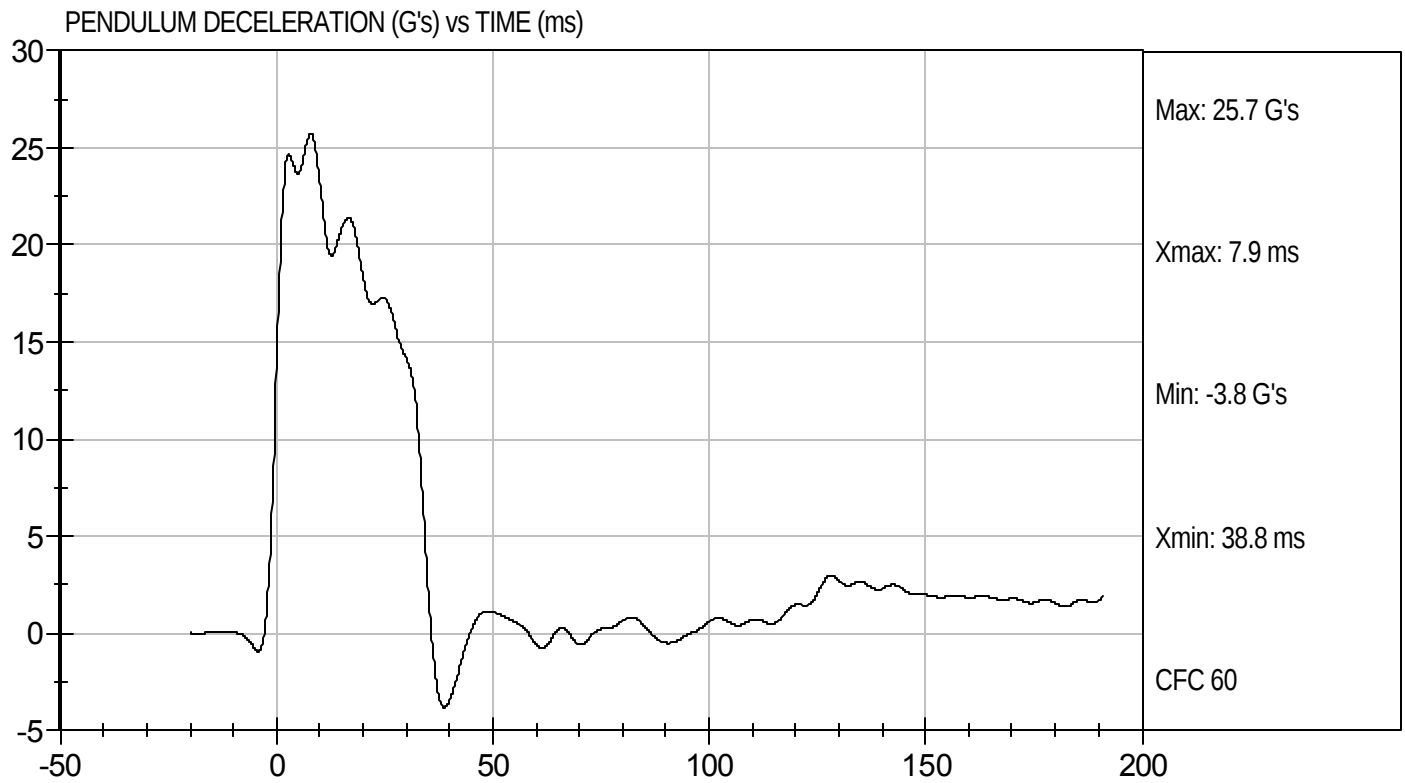
1/18/12
Test Date


Approved By



Test Desc: Neck Flexion
Component ID: D12212

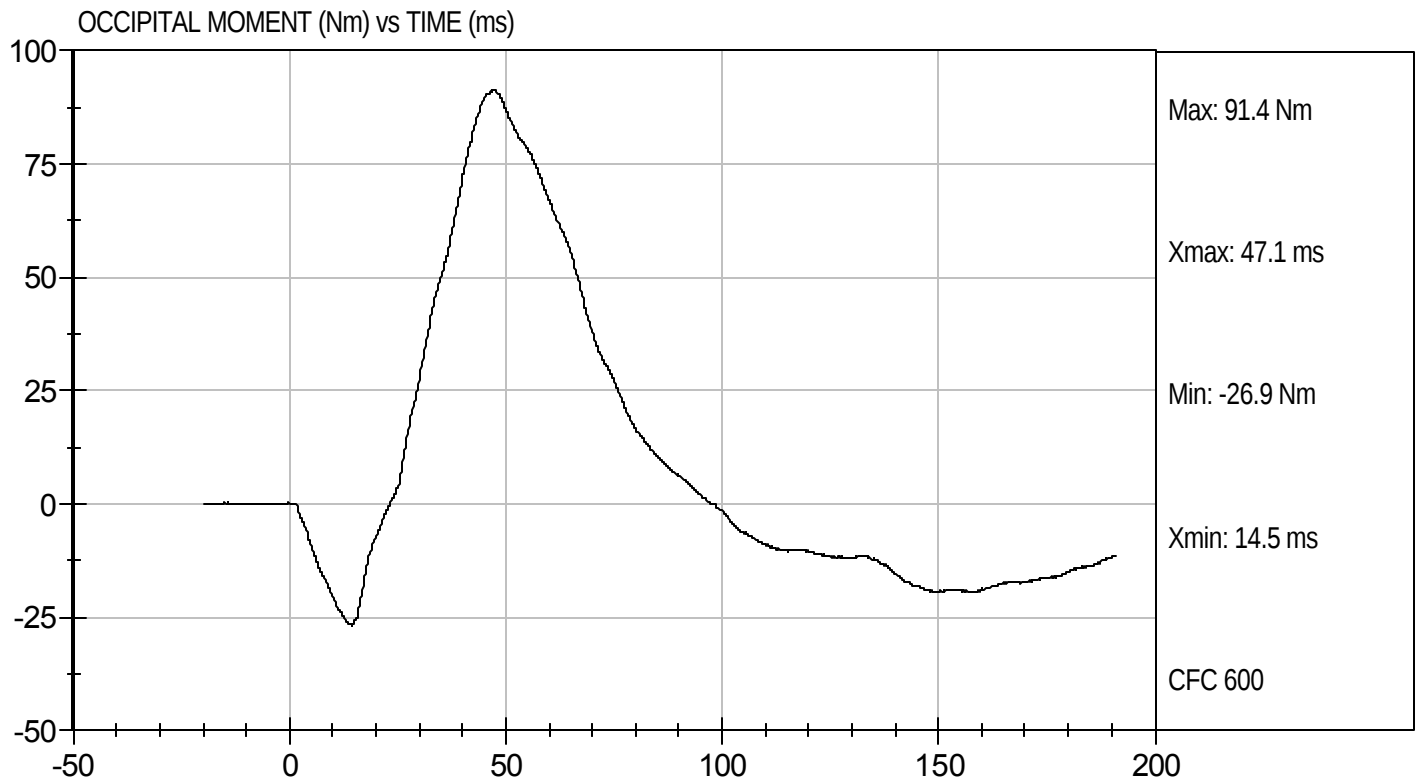
Test Date: 1/18/12
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D12212

Test Date: 1/18/12
Velocity: 23.15 ft/s, 7.06 m/s



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

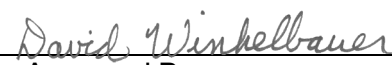
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Test I.D.: D12213

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	19	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.53	Pass
	20 ms	G's	14.00 to 19.00	17.25	Pass
	30 ms	G's	11.00 to 16.00	14.58	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.6	Pass
	Time	ms	72.0 to 82.0	75.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	155.1	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-61.0	Pass
	Time	ms	65.0 to 79.0	69.3	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	140.6	Pass
Overall Test Results					Pass


 Laboratory Technician

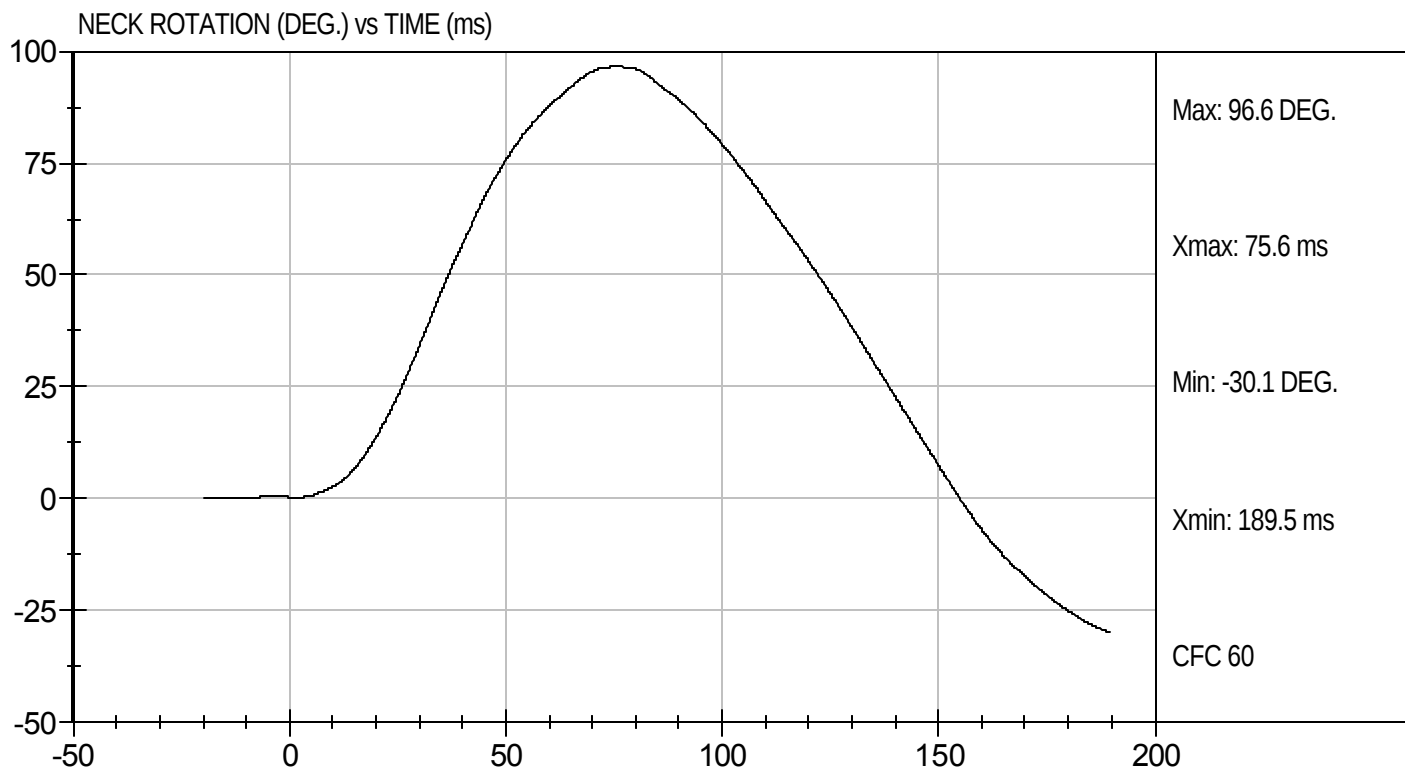
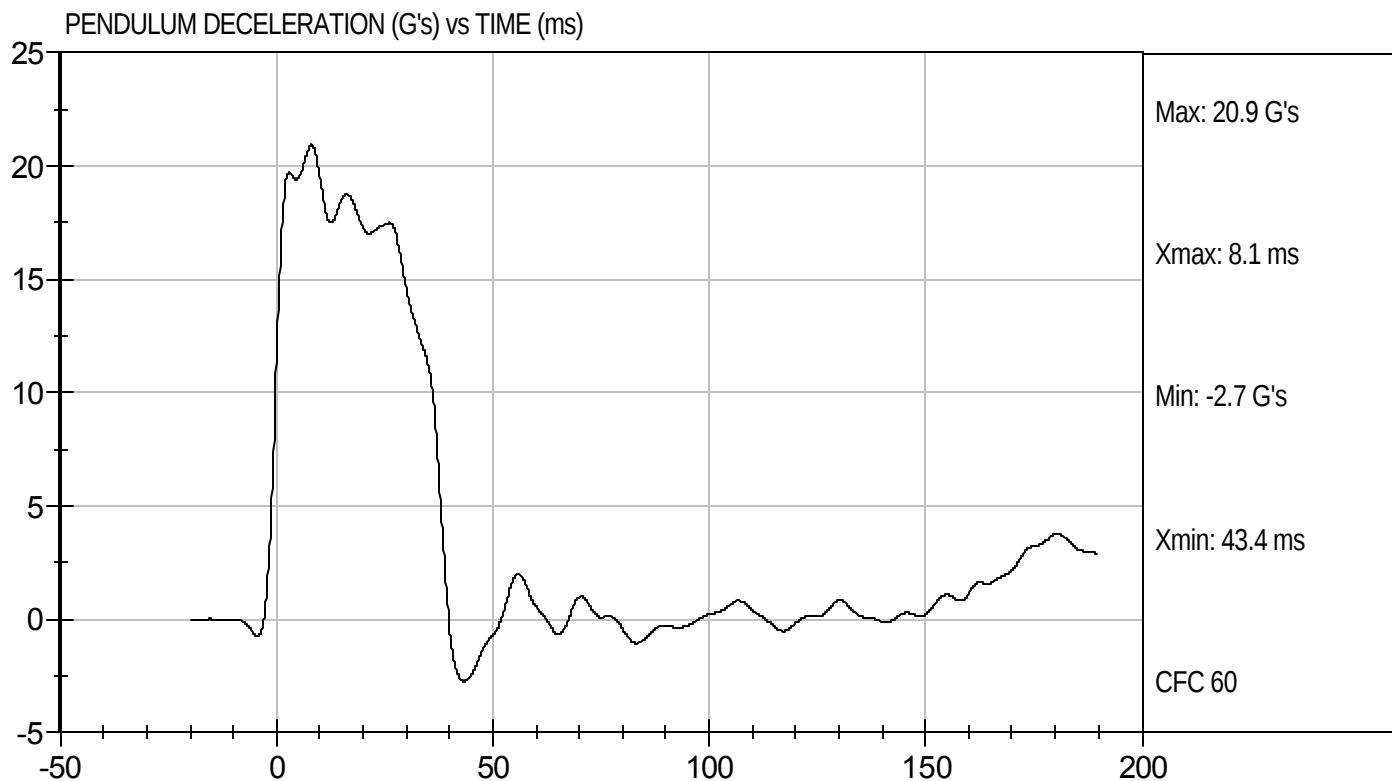
1/18/12
 Test Date


 Approved By



Test Desc: Neck Extension
Component ID: D12213

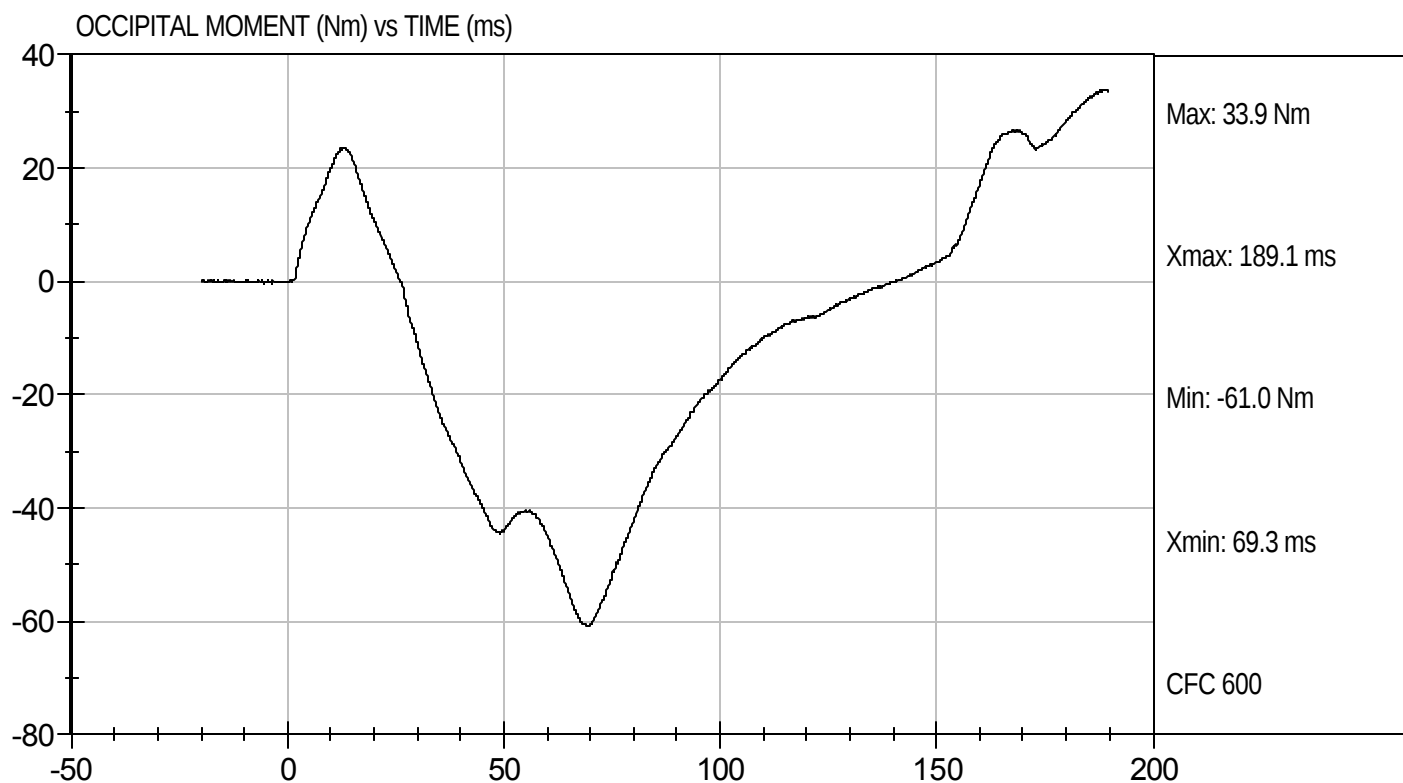
Test Date: 1/18/12
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension
Component ID: D12213

Test Date: 1/18/12
Velocity: 20.08 ft/s, 6.12 m/s

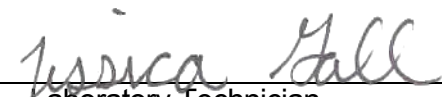


MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D12214

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,309	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.47	Pass
Internal Hysteresis	%	69 to 85	71	Pass
			Overall Test Results	Pass


Laboratory Technician

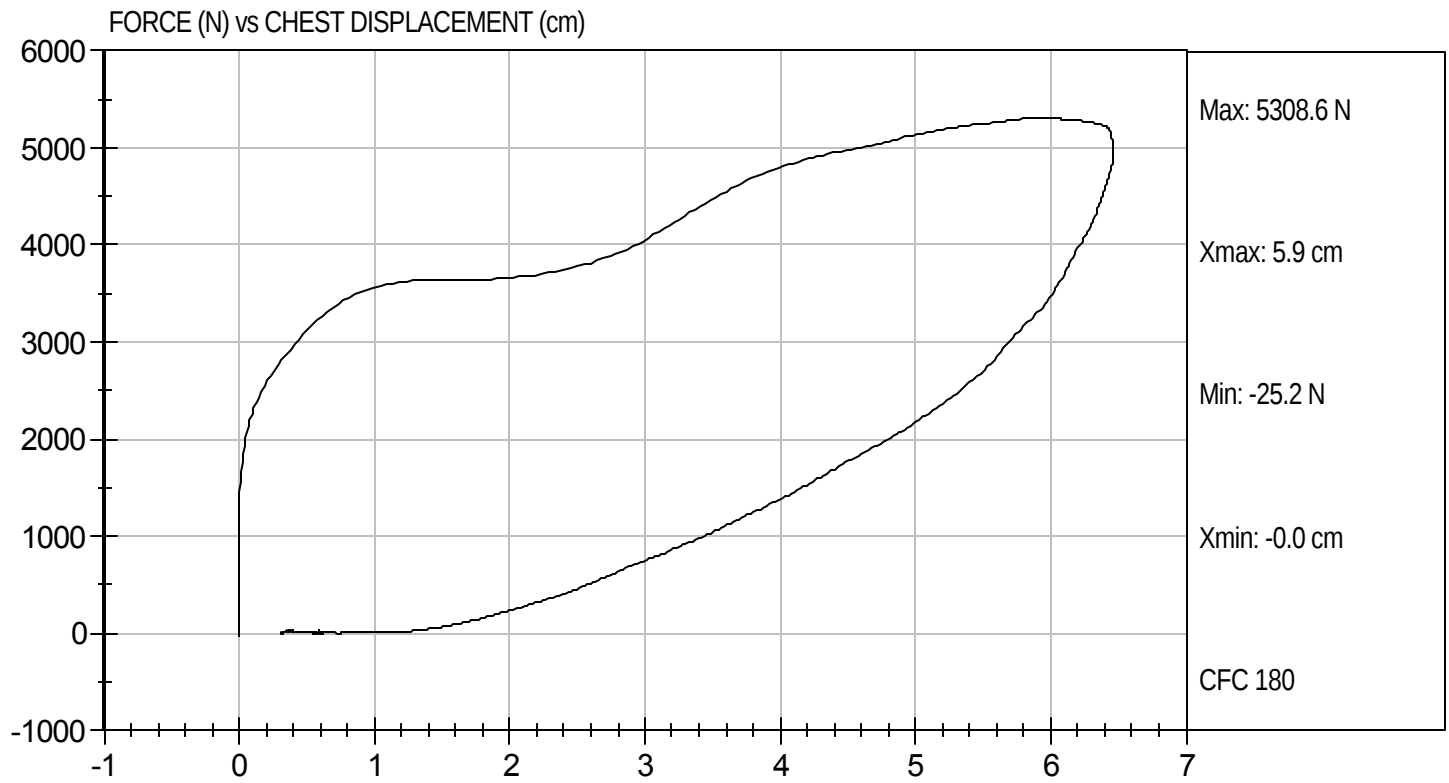
1/18/12
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D12214

Test Date: 1/18/12
Velocity: 22.22 ft/s, 6.77 m/s



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

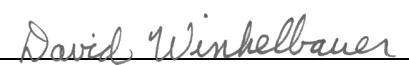
ATD Serial No: 351

Test I.D: D12215

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,436	Pass
Overall Test Results				Pass


Laboratory Technician

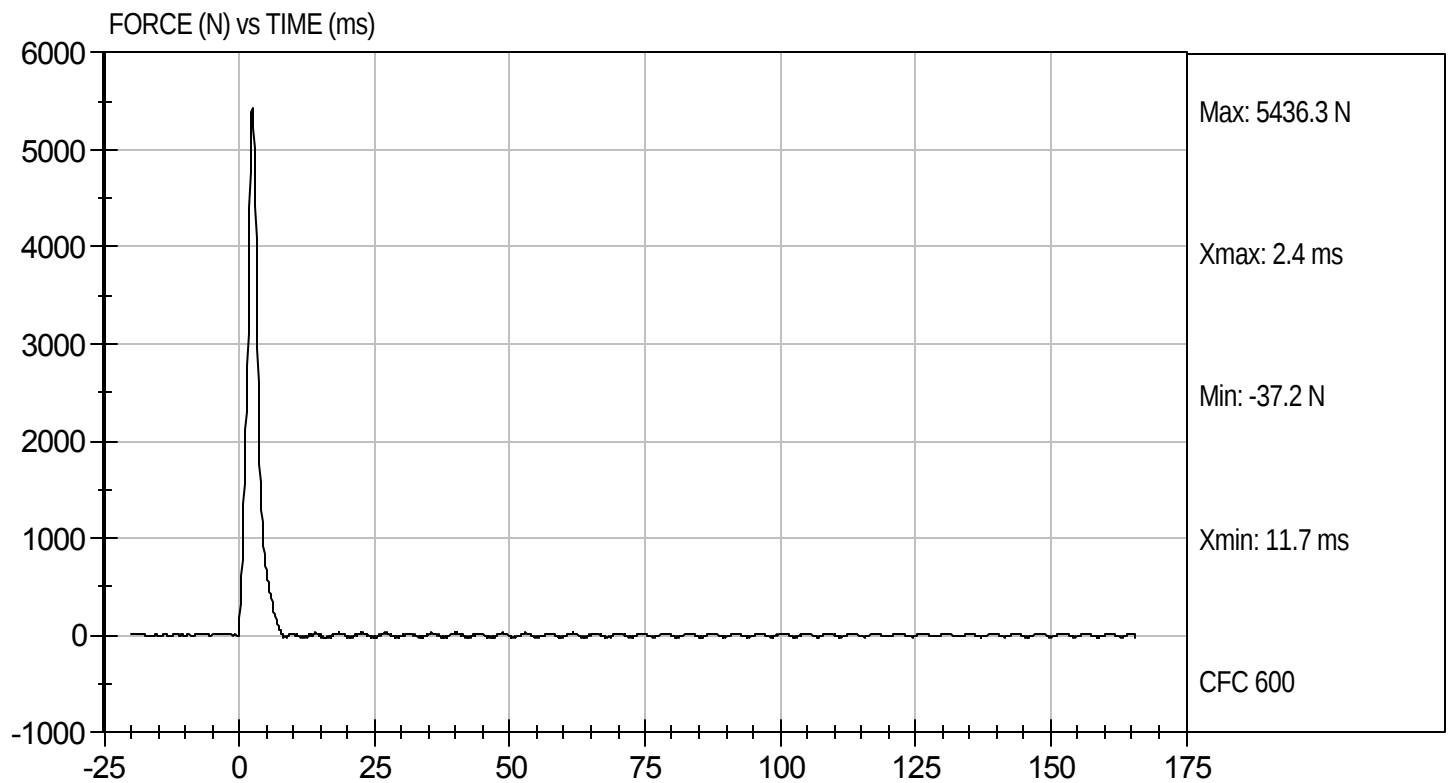
1/18/12
Test Date


Approved By



Test Desc: Right Knee
Component ID: D12215

Test Date: 1/18/12
Velocity: 6.88 ft/s, 2.10 m/s



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

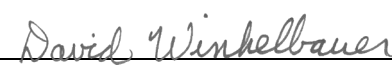
ATD Serial No: 351

Test I.D: D12216

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,210	Pass
Overall Test Results				Pass


Laboratory Technician

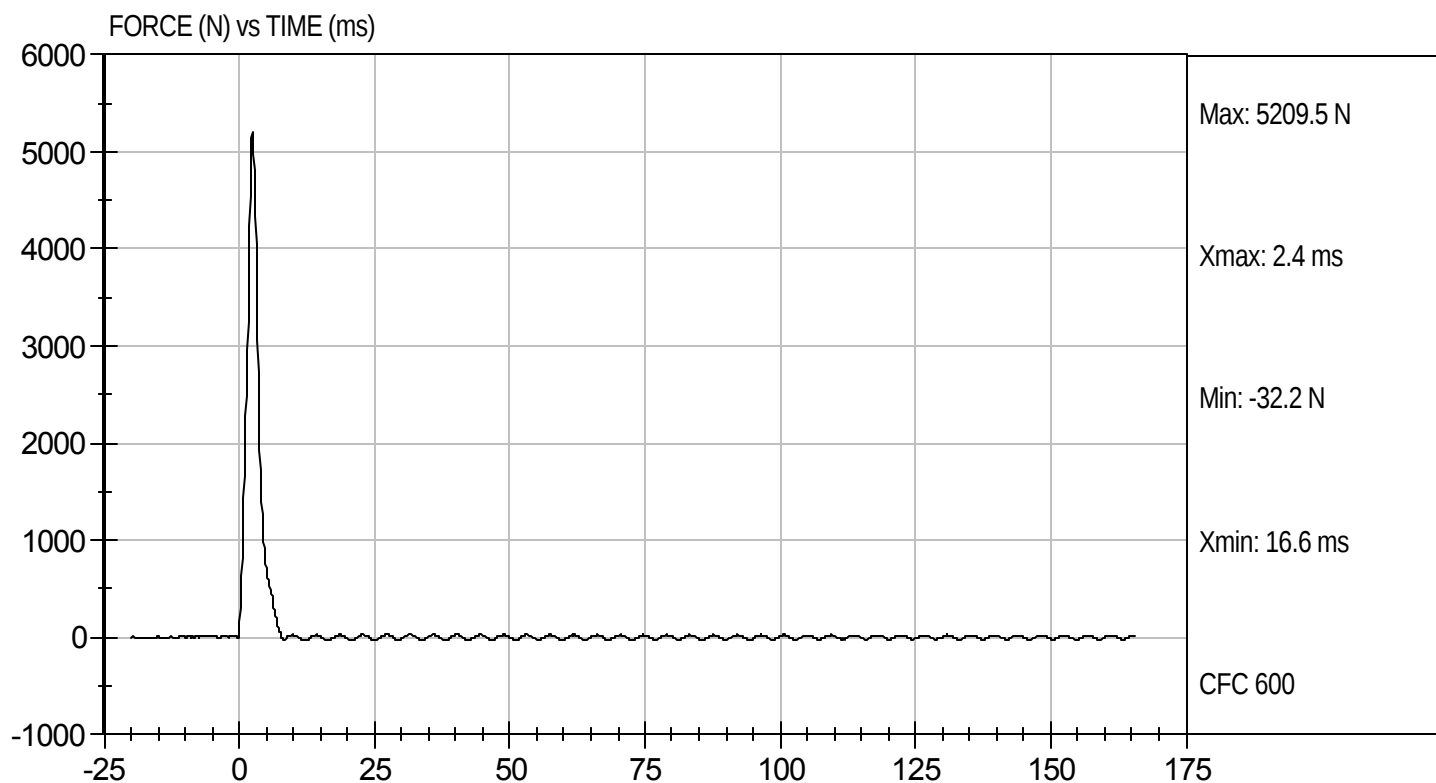
1/18/12
Test Date


Approved By



Test Desc: Left Knee
Component ID: D12216

Test Date: 1/18/12
Velocity: 6.88 ft/s, 2.10 m/s



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

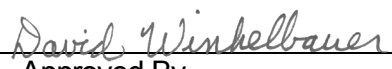
ATD Serial No: 351

Test I.D: D12210

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.8	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	17	17	Pass
Rotation Rate	deg/s	5.0 -10.0	5.7	5.7	Pass
30 Degrees	Nm	94.9 Nm Max	60.7	60.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 - 50.0 Degree Max Rotation	43.5	42.7	Pass
Overall Test Results					Pass


 Laboratory Technician

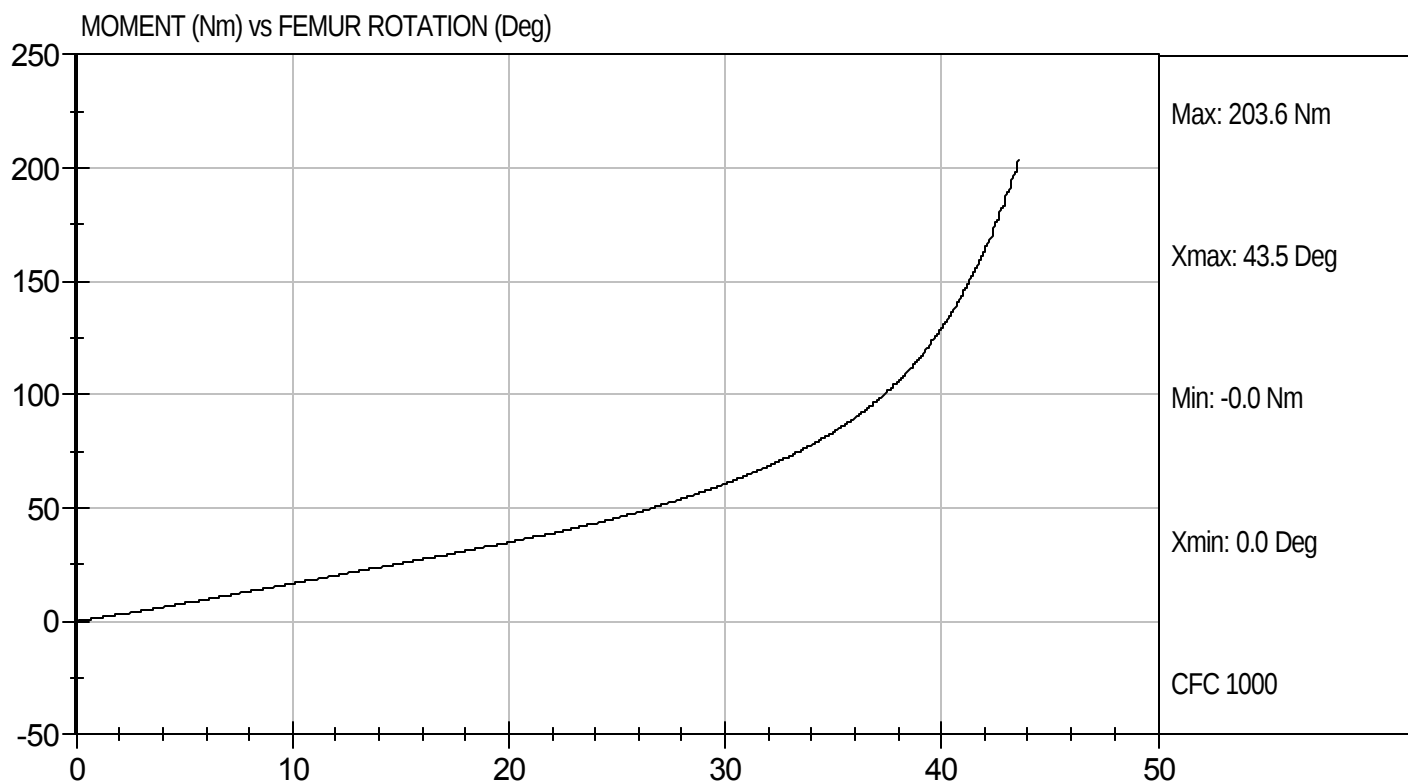
1/18/12
 Test Date


 Approved By



Test Desc: Hip Femur Flexion
Component ID: D12219

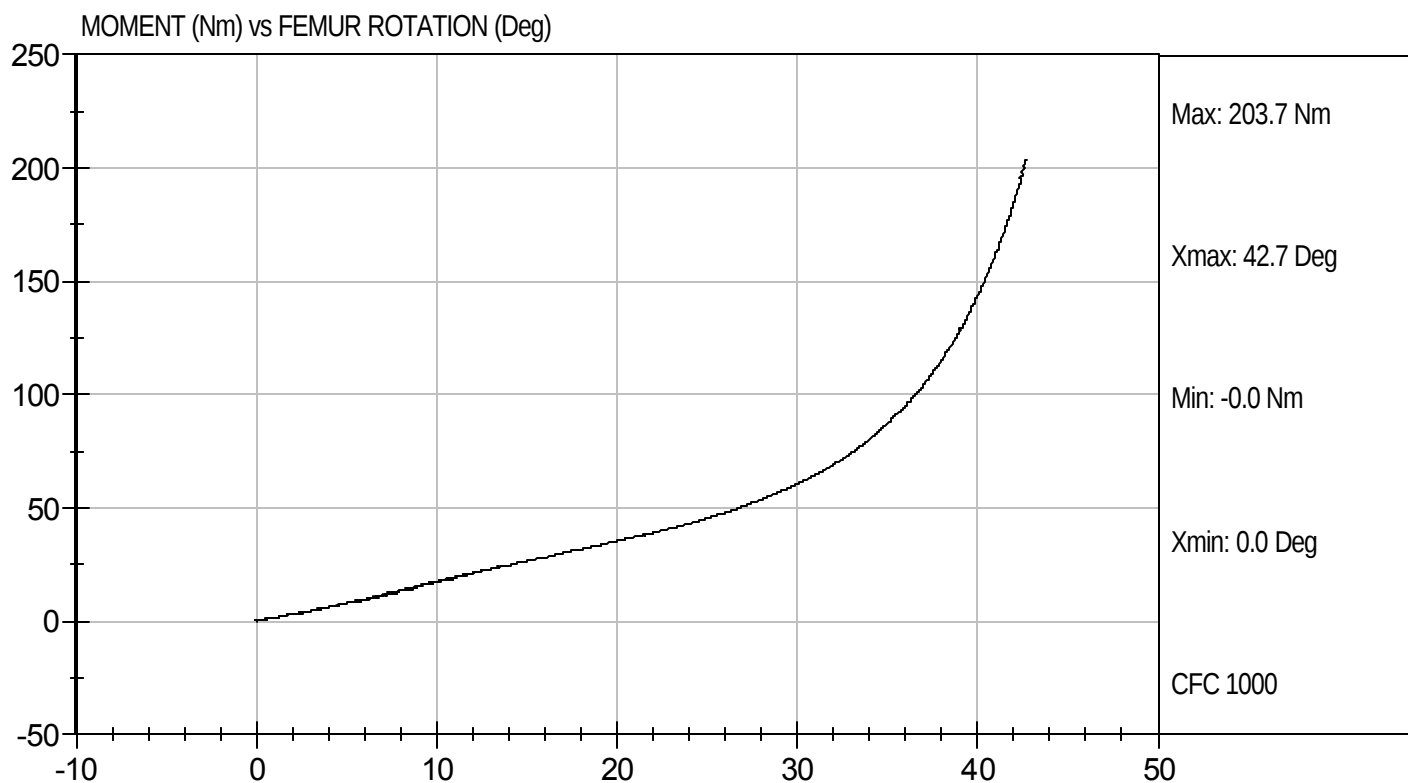
Test Date: 1/18/12
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D12210

Test Date: 1/18/12
Velocity: 0 ft/s, 0.00 m/s



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

ATD Serial No: 351

Test ID: D12381

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Peak Resultant Acceleration	G's	225 - 275	255	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

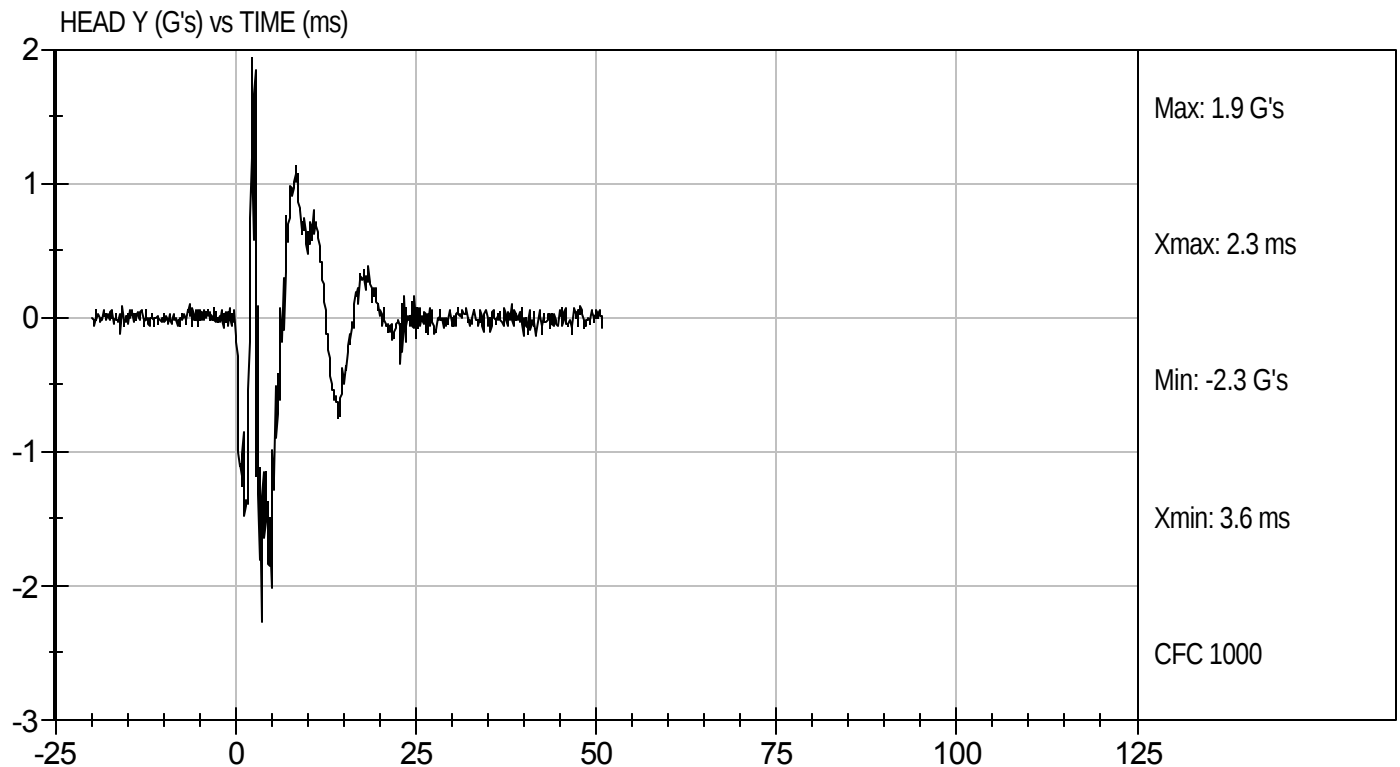
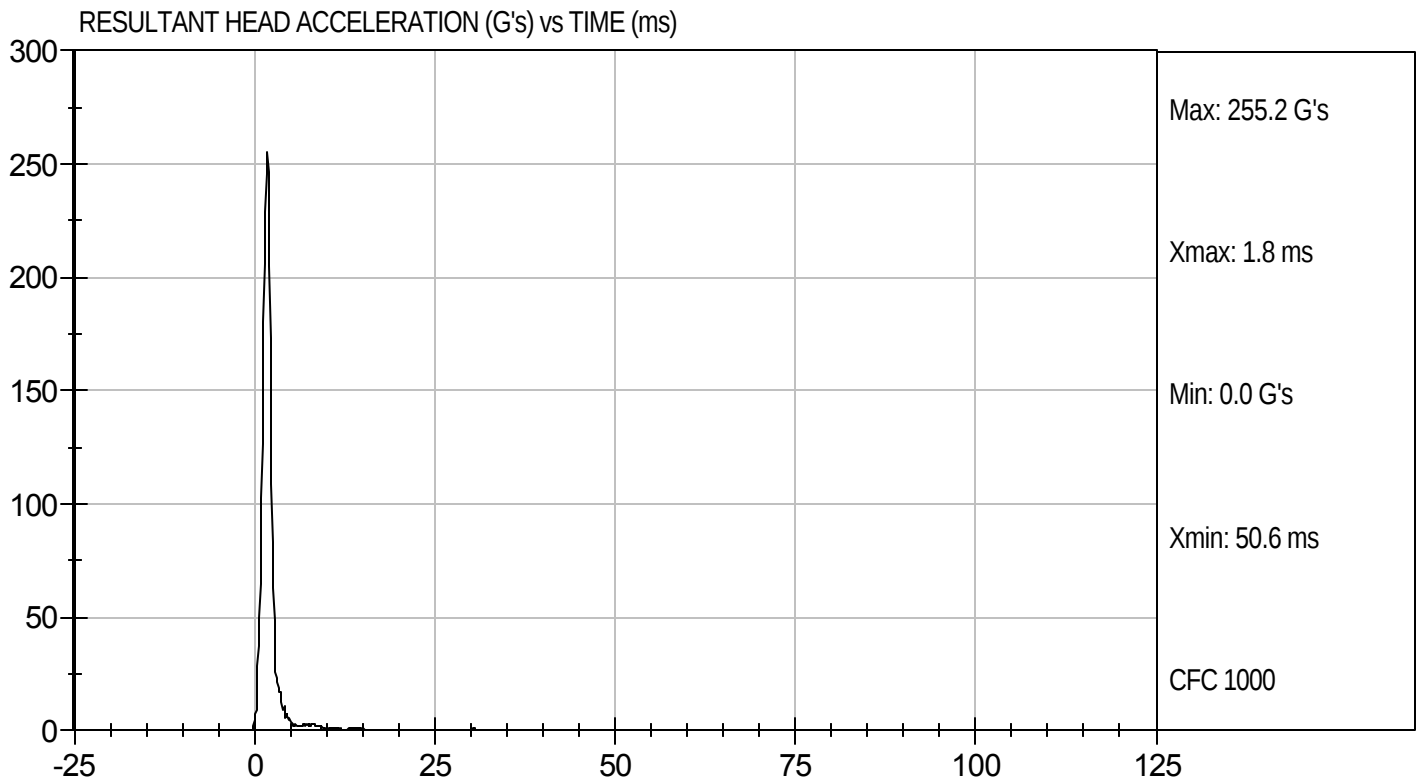
2/6/12
Test Date

David Winkelbauer
Approved By



Test Desc: Head Drop
Component ID: D12381

Test Date: 2/6/12
Velocity: 0 ft/s, 0 m/s



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

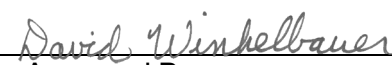
ATD Serial No: 351

Test I.D.: D12382

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	25	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.30	Pass
	20 ms	G's	17.60 to 22.60	18.37	Pass
	30 ms	G's	12.50 to 18.50	15.98	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	15.9	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	68.0	Pass
	Time	ms	57.0 to 64.0	57.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.9	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	91.8	Pass
	Time	ms	47.0 to 58.0	47.3	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.8	Pass
Overall Test Results					Pass


 Laboratory Technician

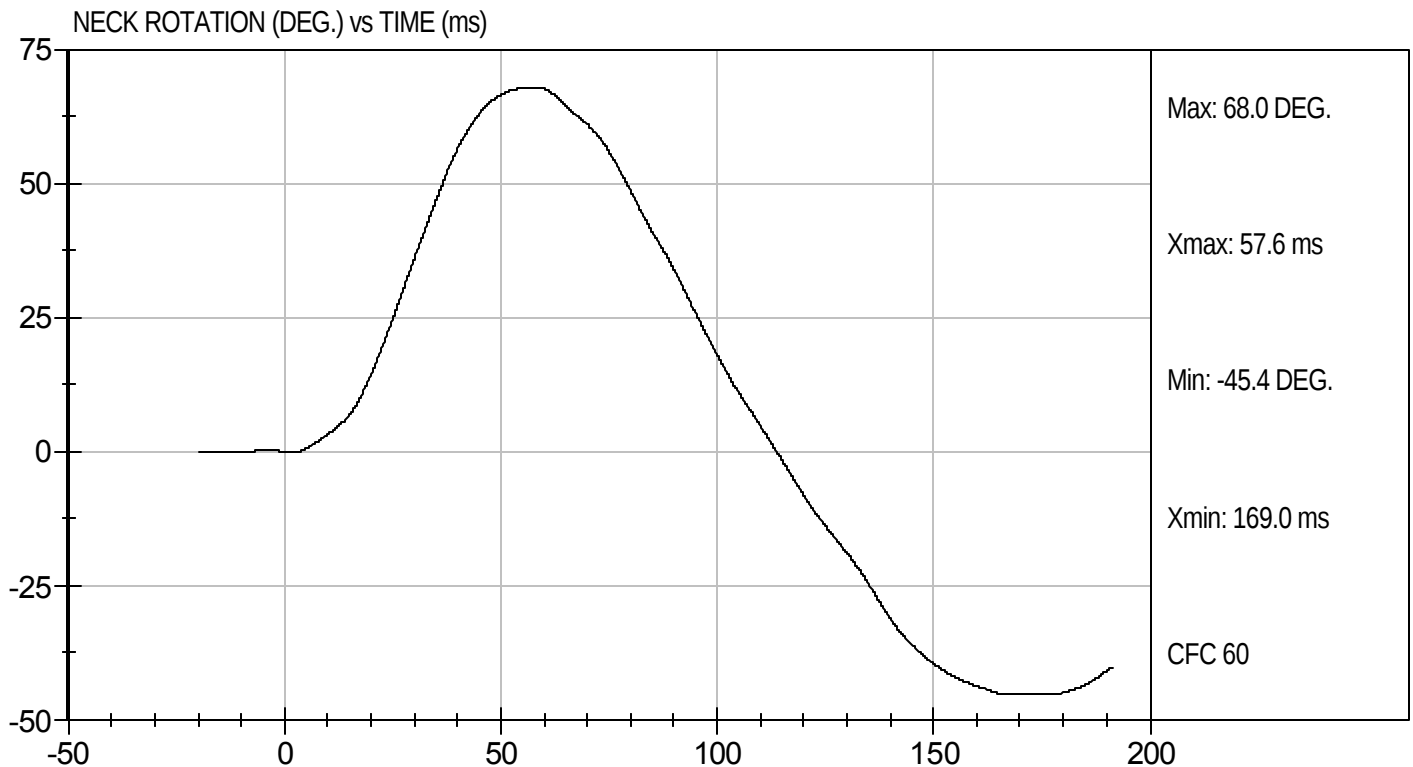
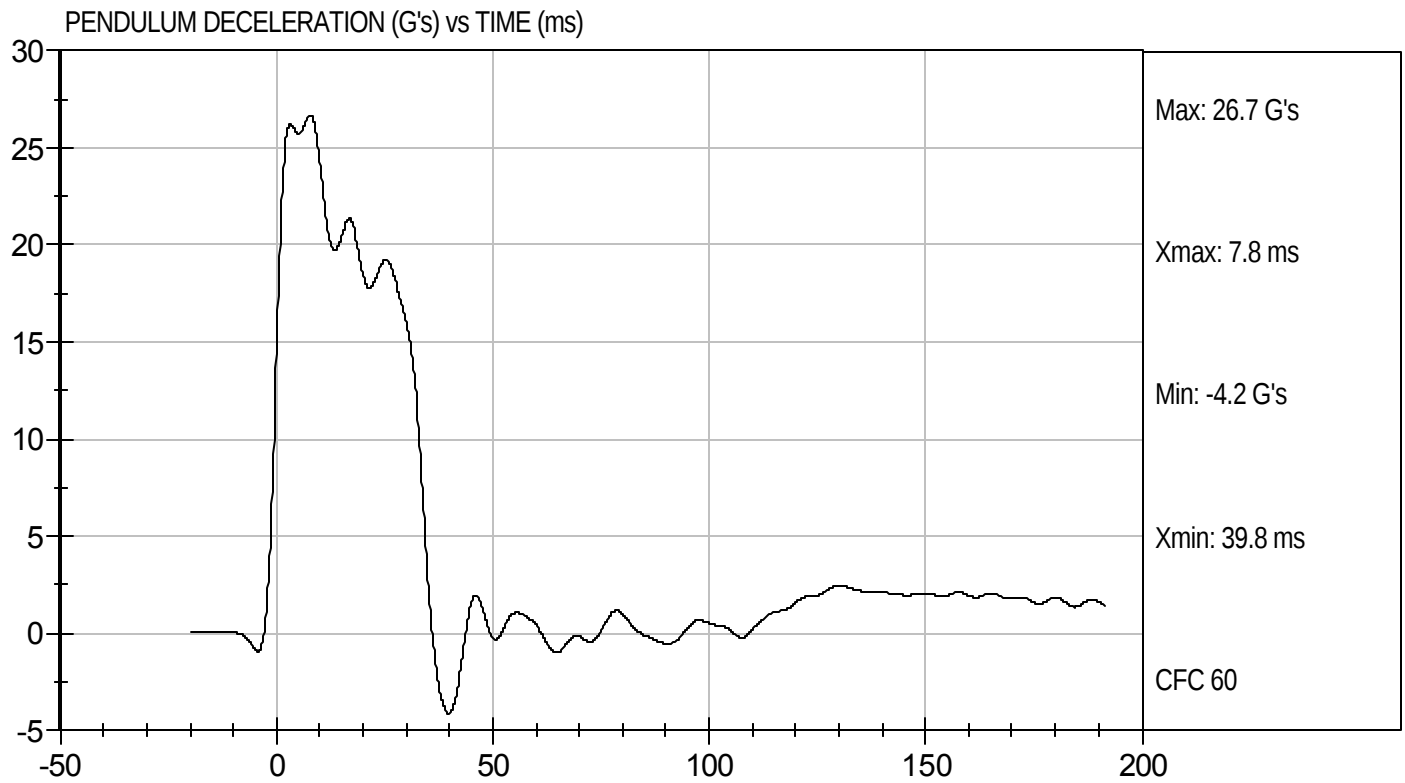
2/3/12
 Test Date


 Approved By



Test Desc: Neck Flexion
Component ID: D12382

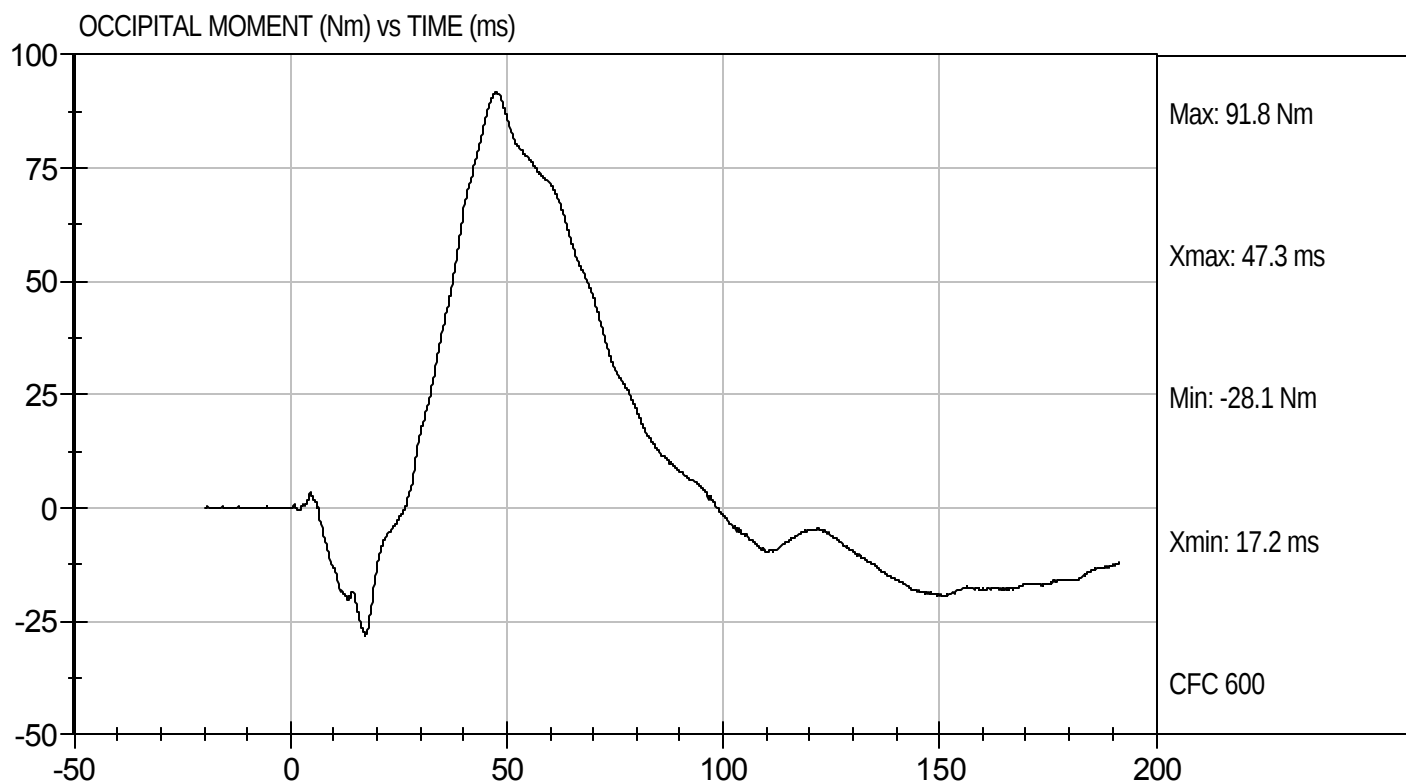
Test Date: 2/3/12
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D12382

Test Date: 2/3/12
Velocity: 23.15 ft/s, 7.06 m/s



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

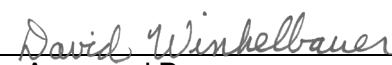
ATD Serial No: 351

Test I.D.: D12383

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	24	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.65	Pass
	20 ms	G's	14.00 to 19.00	17.99	Pass
	30 ms	G's	11.00 to 16.00	14.15	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.1	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	94.0	Pass
	Time	ms	72.0 to 82.0	79.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	154.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-59.8	Pass
	Time	ms	65.0 to 79.0	69.2	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	140.9	Pass
Overall Test Results					Pass


 Laboratory Technician

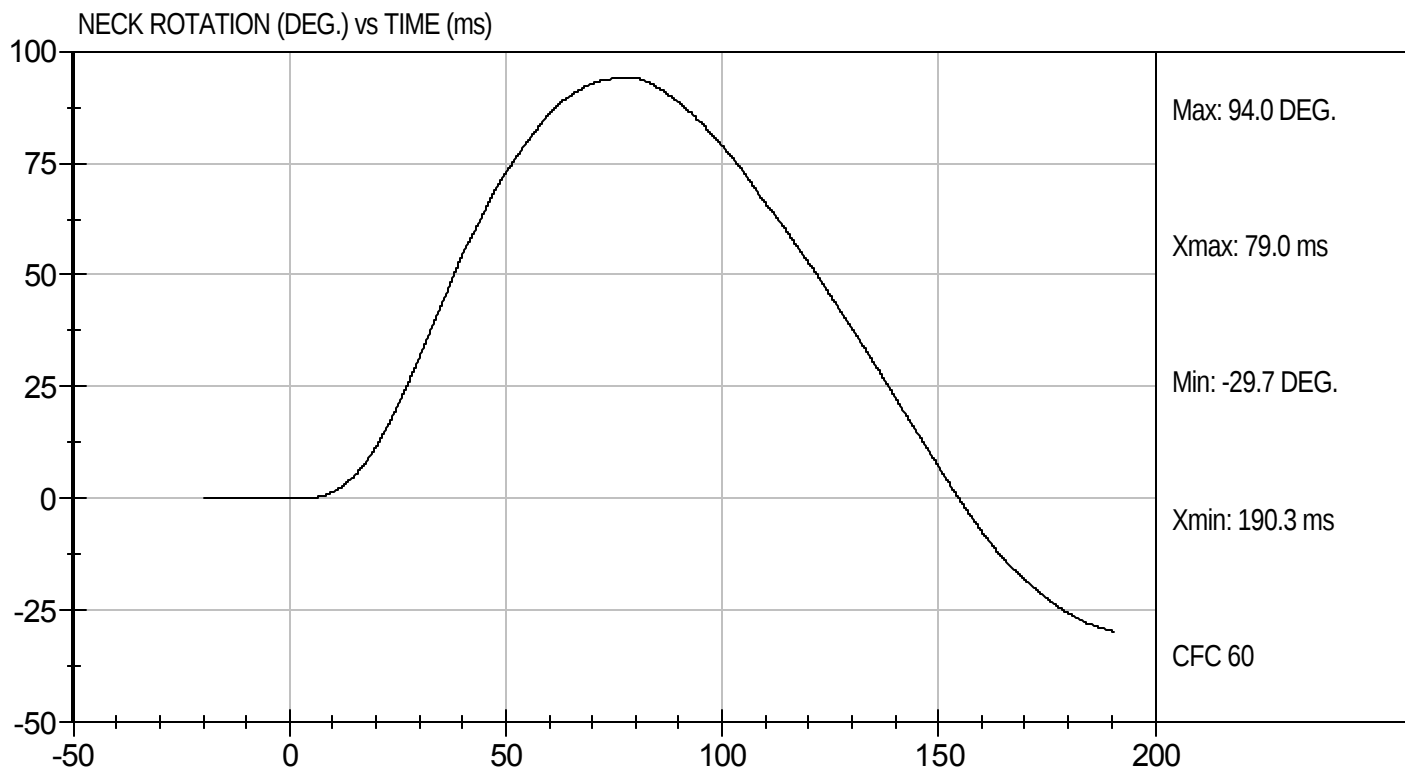
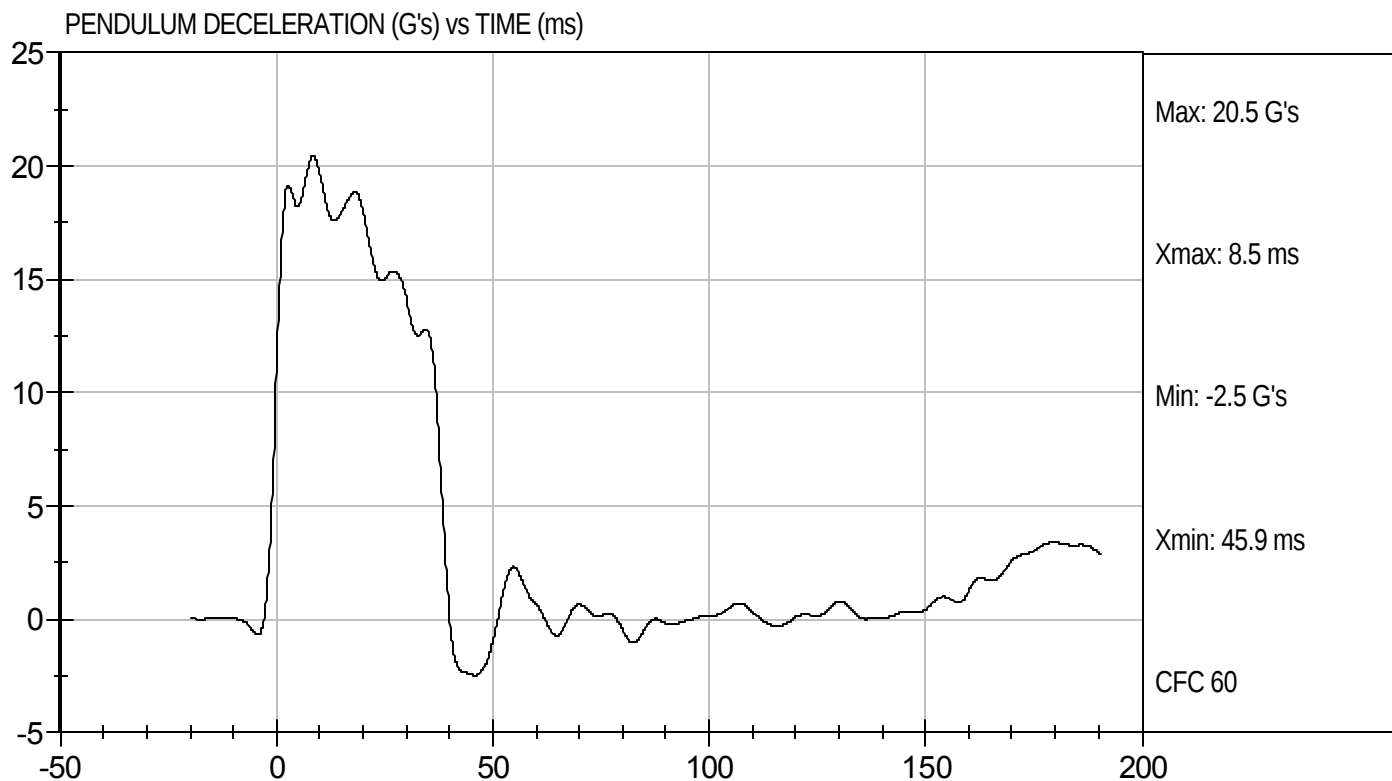
2/3/12
 Test Date


 Approved By



Test Desc: Neck Extension
Component ID: D12383

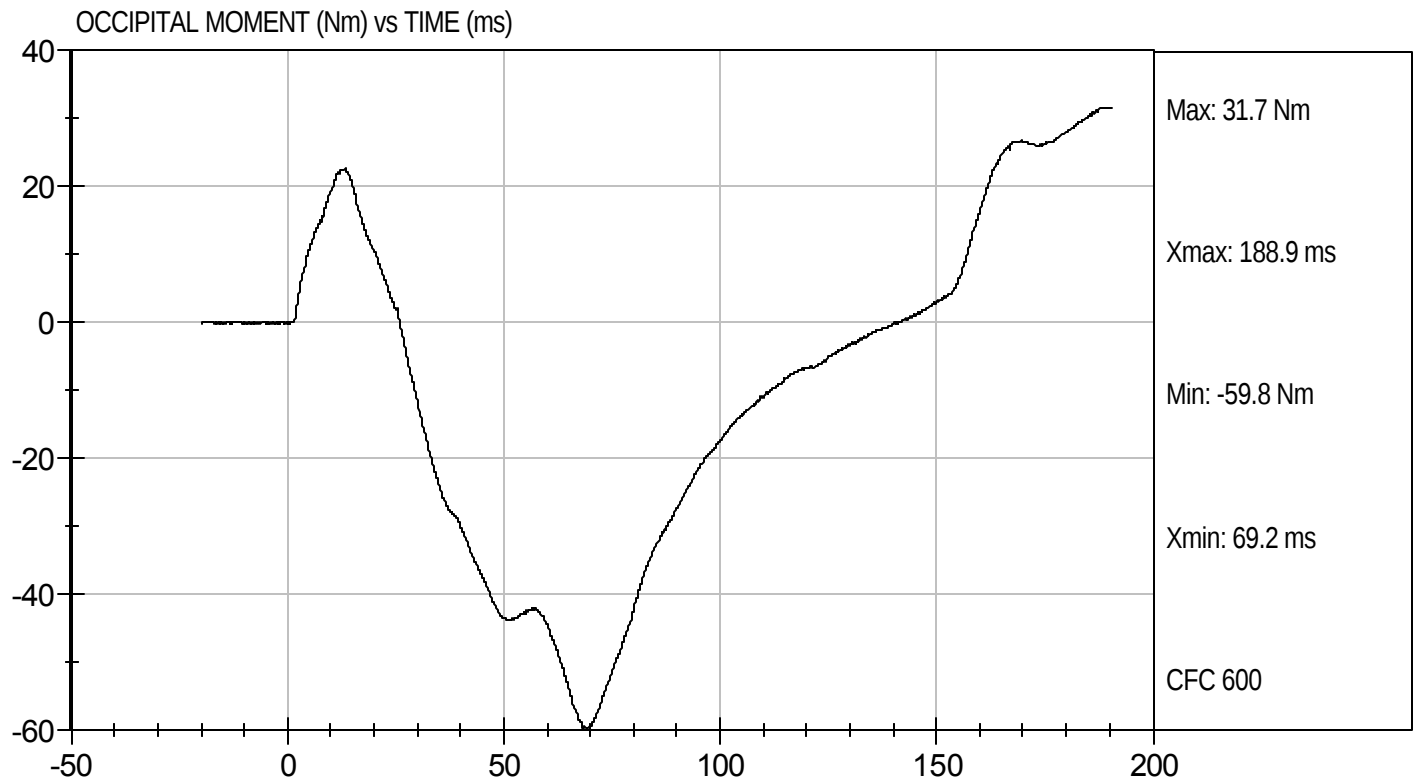
Test Date: 2/3/12
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension
Component ID: D12383

Test Date: 2/3/12
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

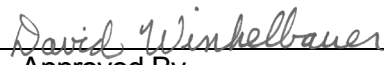
ATD Serial No: 351

Test I.D: D12384

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,437	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.40	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Overall Test Results			Pass	


Laboratory Technician

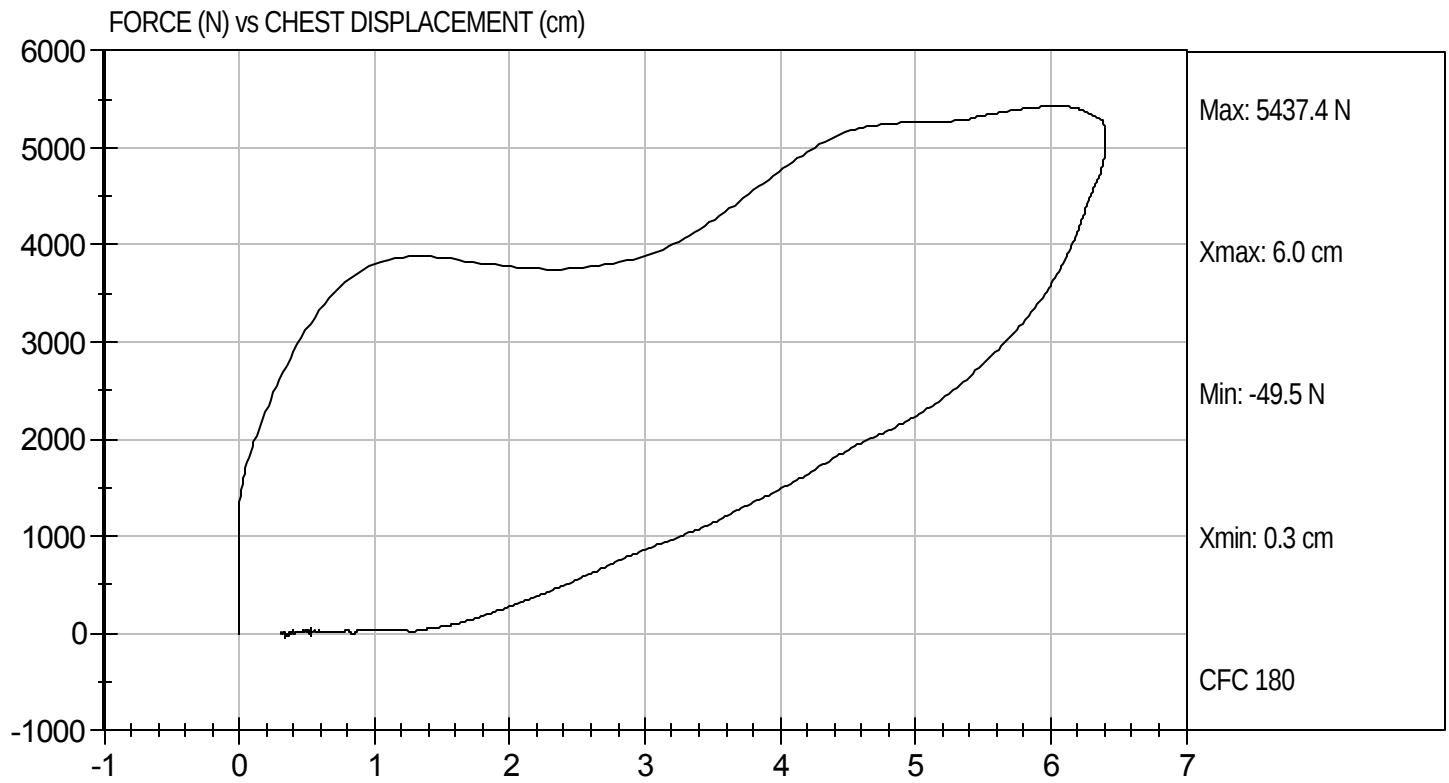
2/6/12
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D12384

Test Date: 2/6/12
Velocity: 21.9 ft/s, 6.68 m/s



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

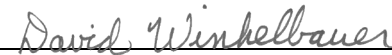
ATD Serial No: 351

Test I.D: D12385

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	4,852	Pass
Overall Test Results				Pass


Laboratory Technician

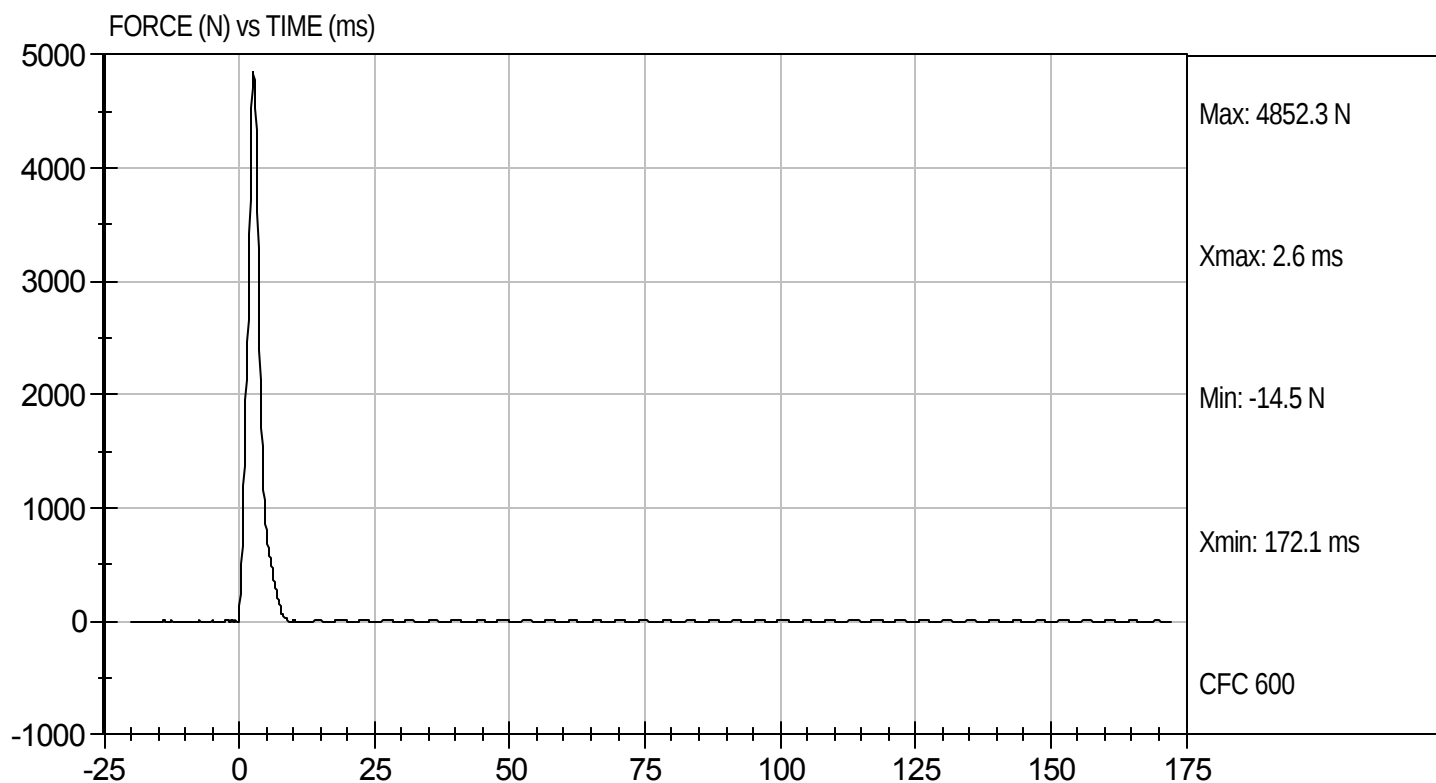
2/3/12
Test Date


Approved By



Test Desc: Right Knee
Component ID: D12385

Test Date: 2/3/12
Velocity: 6.89 ft/s, 2.10 m/s

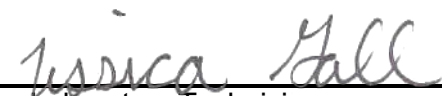


MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

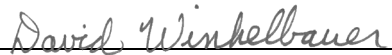
ATD Serial No: 351

Test I.D: D12386

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,050	Pass
Overall Test Results				Pass


Laboratory Technician

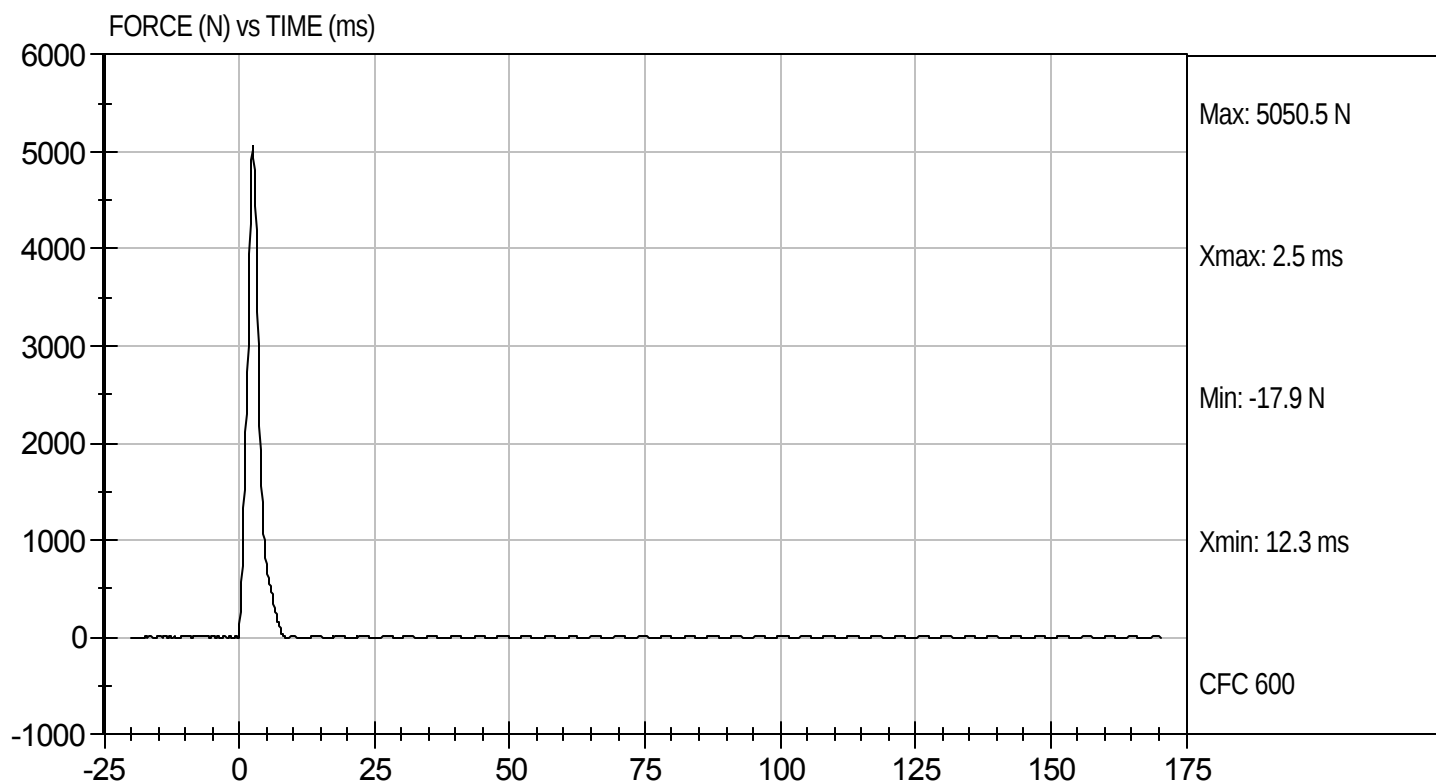
2/3/12
Test Date


Approved By



Test Desc: Left Knee
Component ID: D12386

Test Date: 2/3/12
Velocity: 6.97 ft/s, 2.12 m/s



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

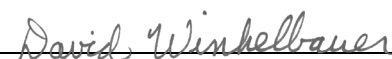
ATD Serial No: 351

Test I.D: D12380

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	25	25	Pass
Rotation Rate	deg/s	5.0 -10.0	6.3	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	58.3	57.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 - 50.0 Degree Max Rotation	48.9	47.4	Pass
Overall Test Results					Pass


 Laboratory Technician

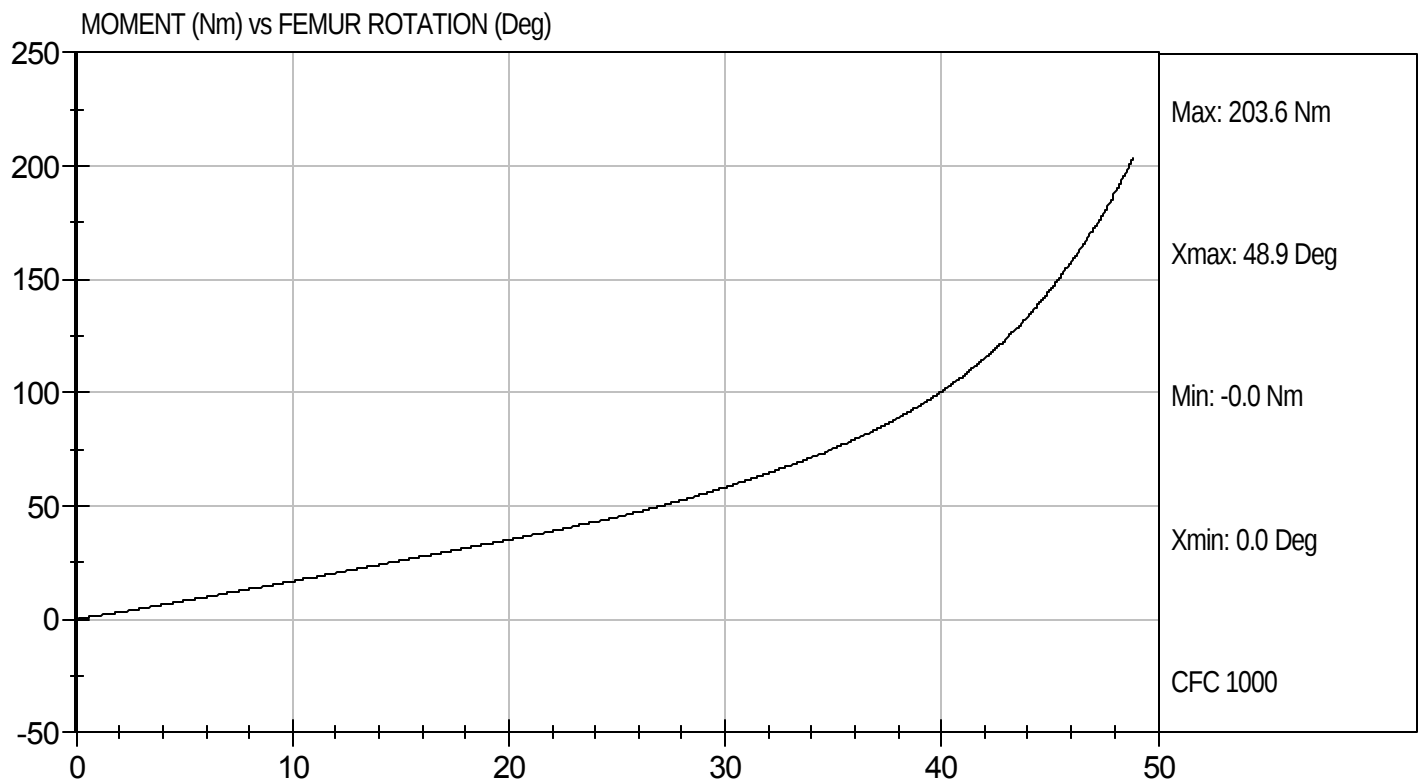
2/3/12
 Test Date


 Approved By



Test Desc: Hip Femur Flexion
Component ID: D12389

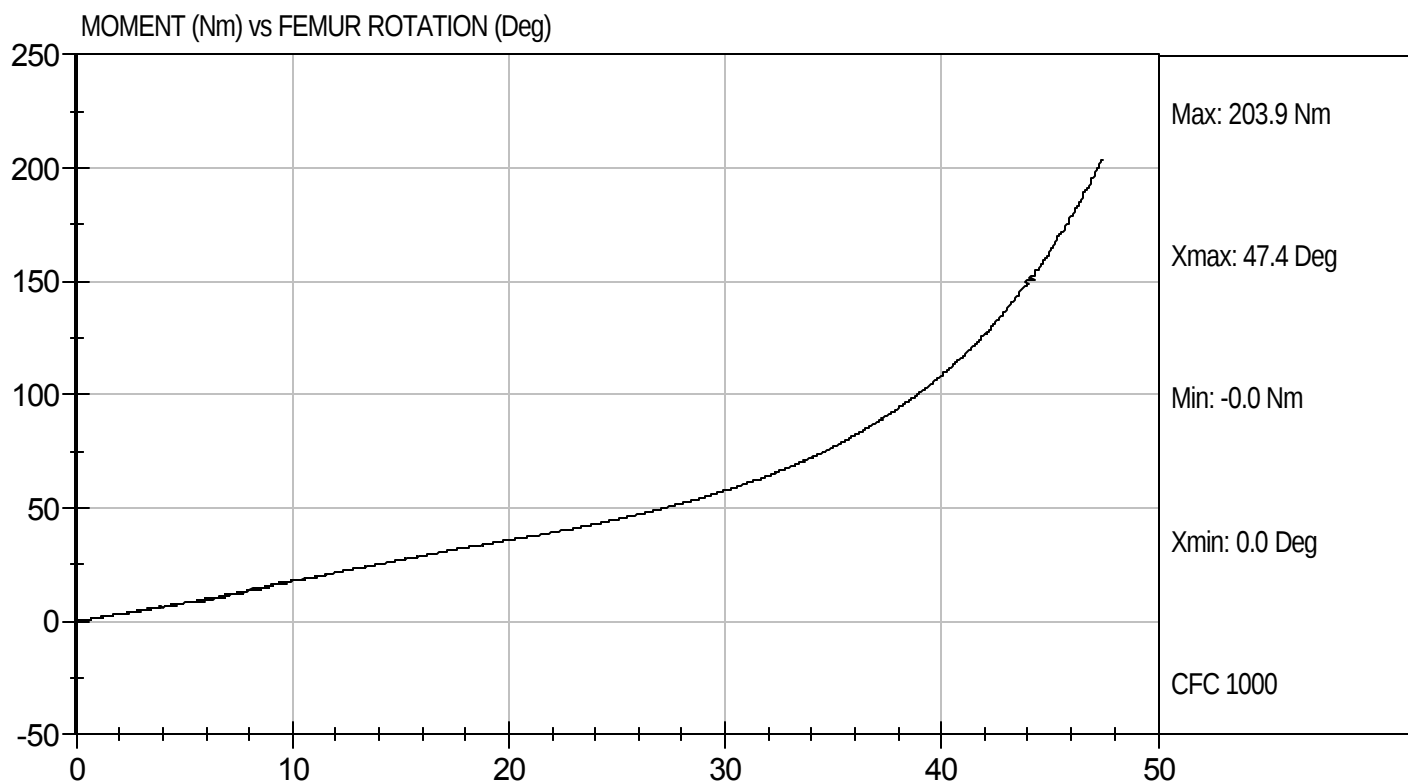
Test Date: 2/3/12
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D12380

Test Date: 2/3/12
Velocity: 0 ft/s, 0.00 m/s



Hybrid III, 5th External Measurements
SN: 634

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	784.6
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	449.0
C	H-POINT HEIGHT	Reference	81.3-86.3	85.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	145.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	79.2
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	125.6
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	253.4
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	277.8
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	197.5
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	541.4
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.1
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	400.4
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	428.6

HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	181.6
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	224.7
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	482.0
S	HEAD BREADTH	The widest part of the head	137.1-147.3	139.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	179.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	306.1
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	355.5
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	90.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	540.6
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	868.7
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	786.8
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

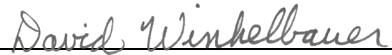
ATD Serial No: 634

Test ID: D12221

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	18	Pass
Peak Resultant Acceleration	G's	250 to 300	266	Pass
Peak Lateral Acceleration	G's	+/- 15	1.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

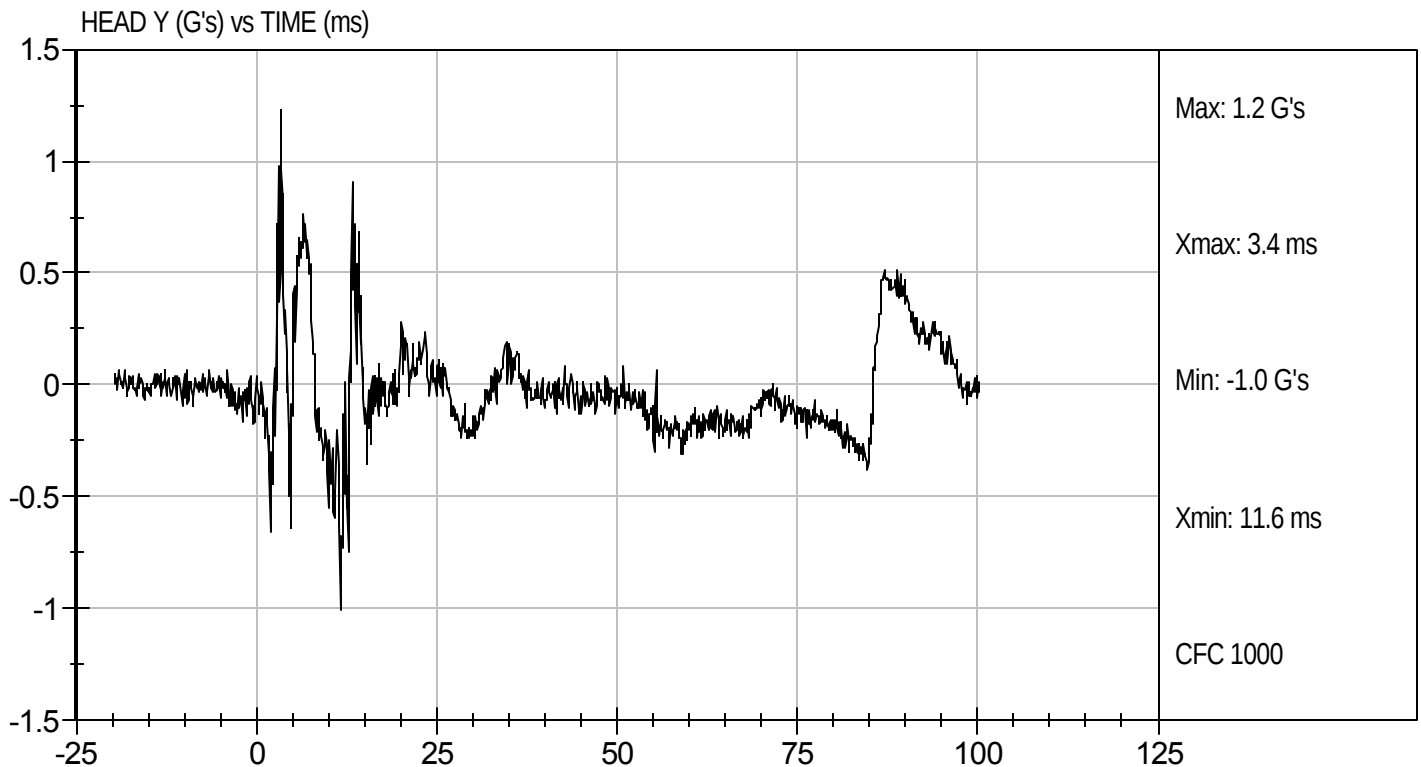
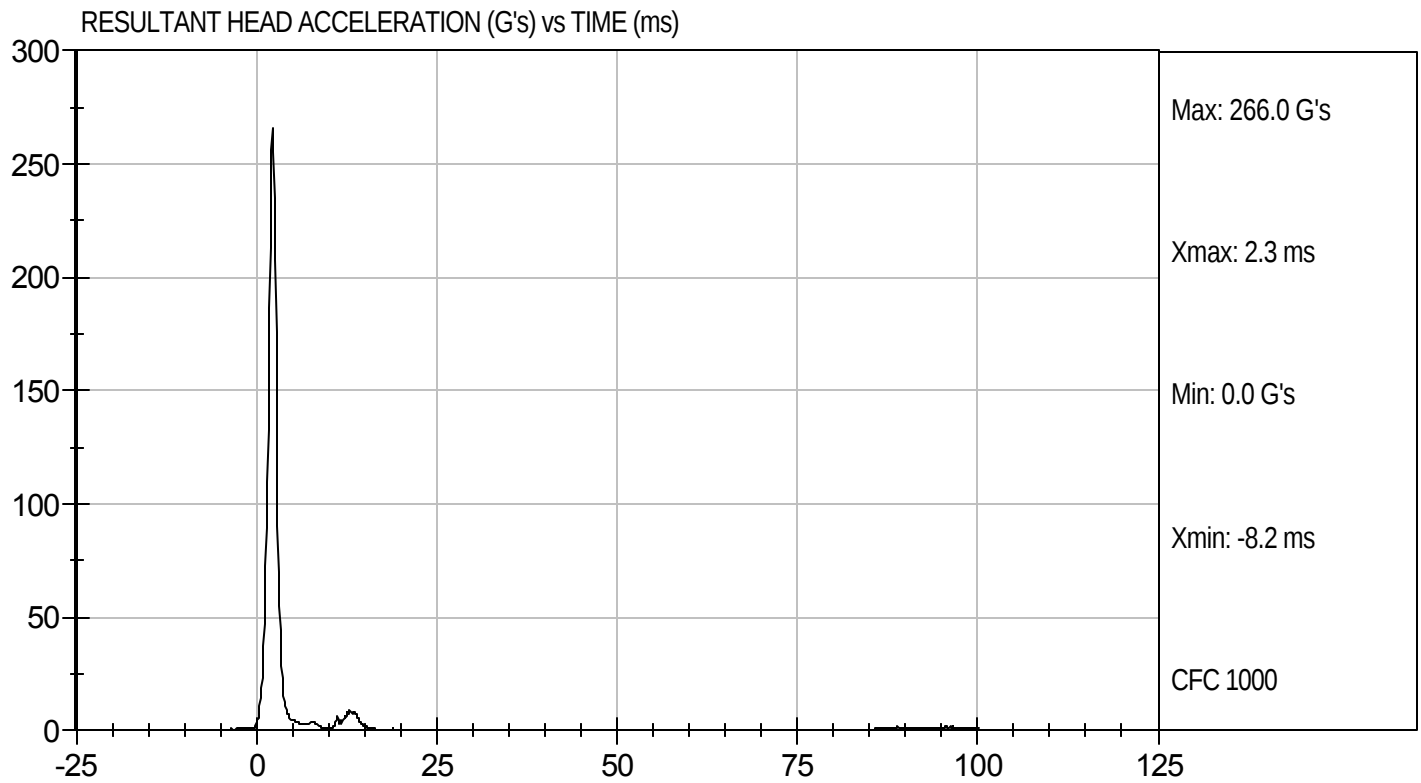
1/18/12
Test Date


Approved By



Test Desc: Head Drop
Component ID: D12221

Test Date: 1/18/12
Velocity: 0 ft/s, 0 m/s

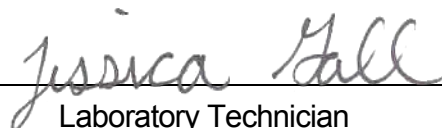


MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

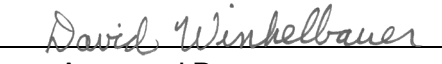
ATD Serial No: 634

Test I.D: D12222

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	18	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Pulse	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.2	Pass
D Plane Rotation	Max	deg	77 to 91	78	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	72	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	83	Pass
Overall Results				Pass	


Laboratory Technician

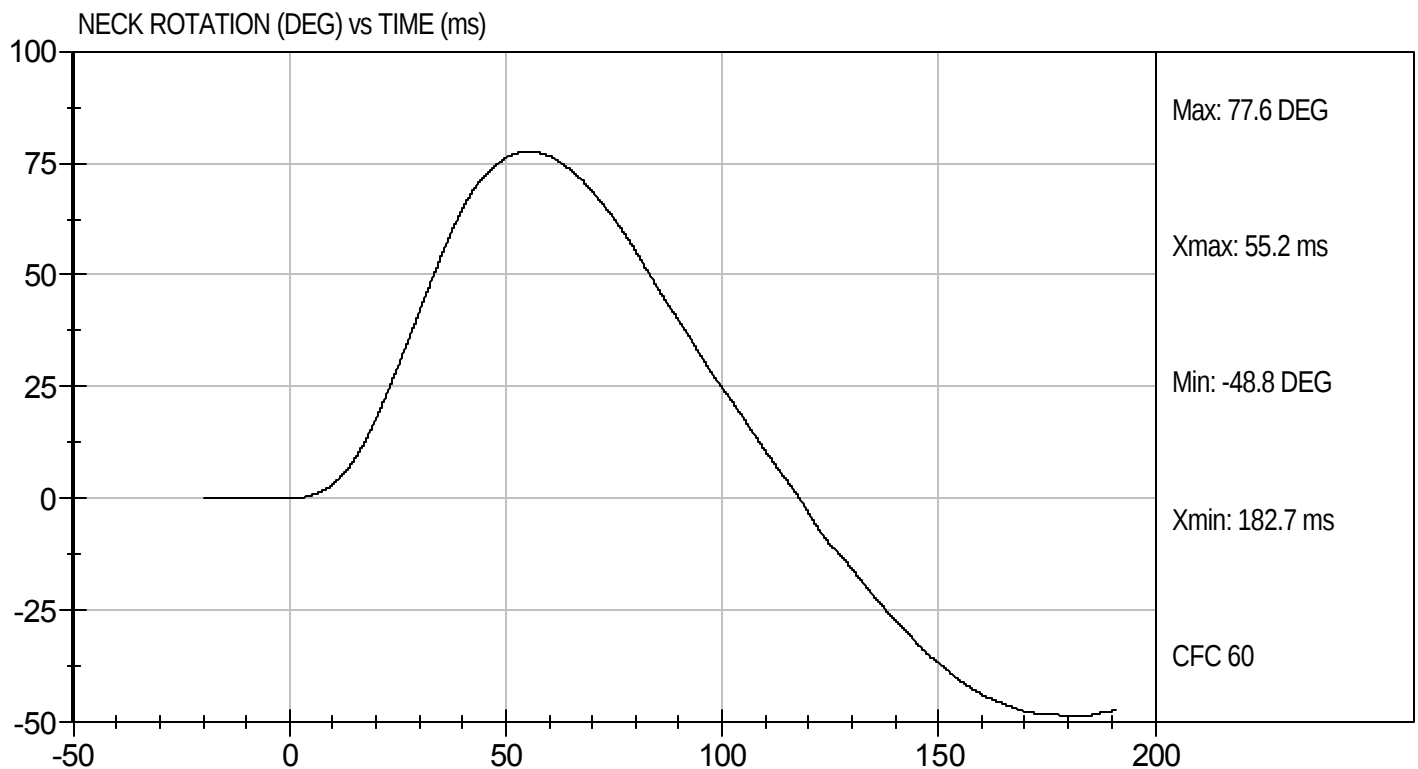
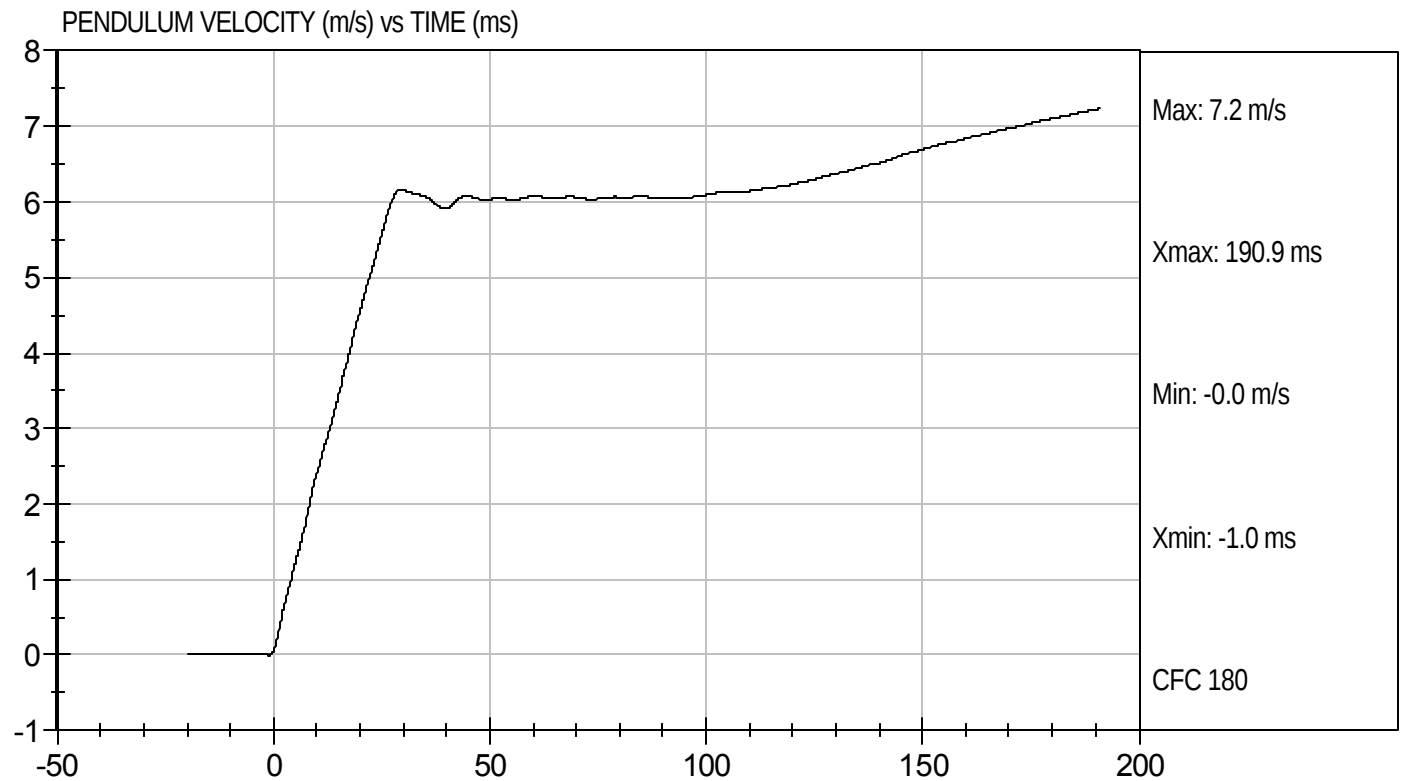
1/18/12
Test Date


Approved By



Test Desc: Neck Flexion
Component ID: D12222

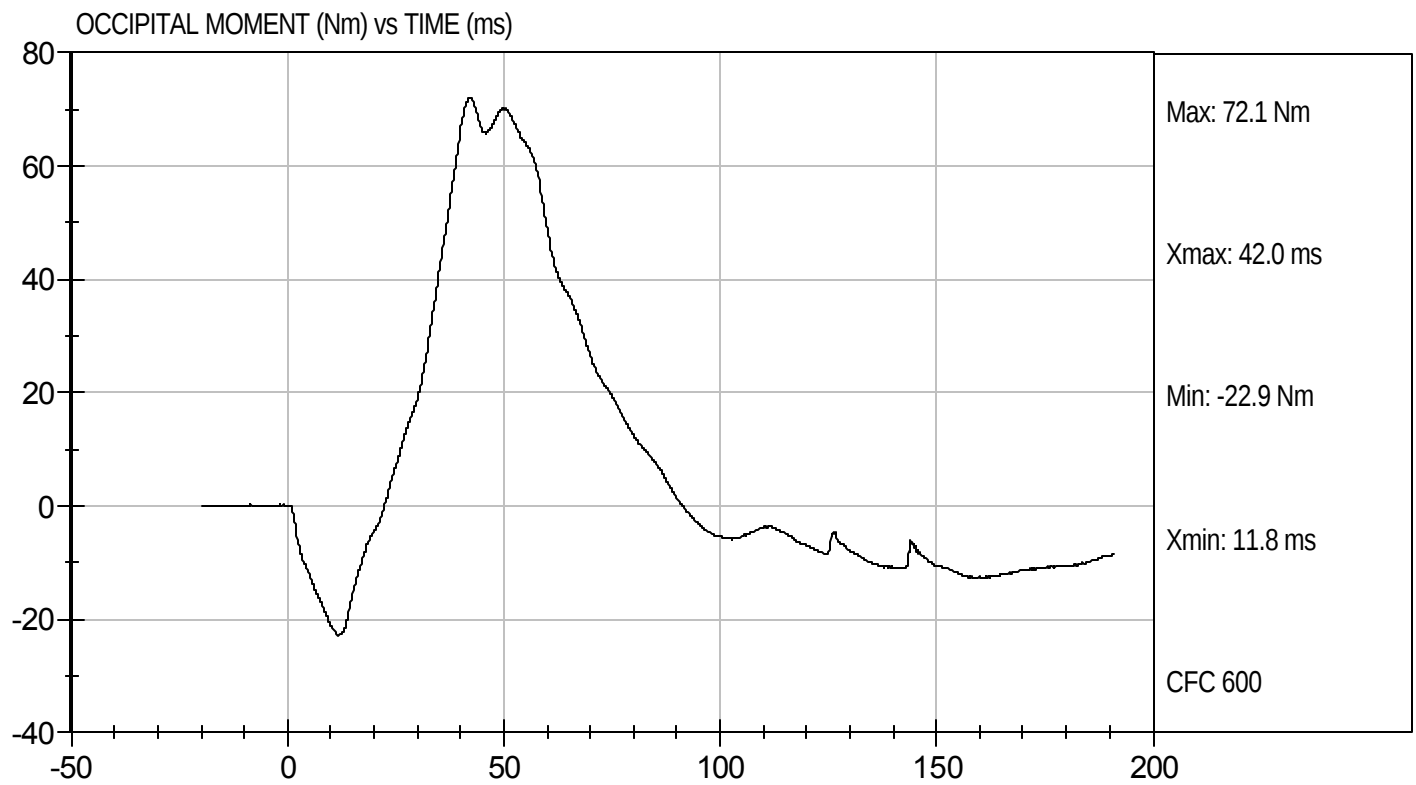
Test Date: 1/18/12
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D12222

Test Date: 1/18/12
Velocity: 23.15 ft/s, 7.06 m/s



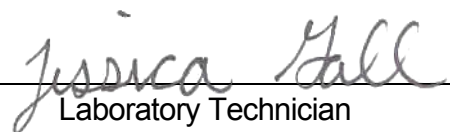
MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

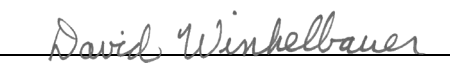
ATD Serial No: 634Test I.D: D12223

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	18	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Pulse	10 ms	m/s	1.5 to 1.9	1.6	Pass
	20 ms	m/s	3.1 to 3.9	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	102	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	104	Pass
Overall Results					Pass


Laboratory Technician

1/18/12

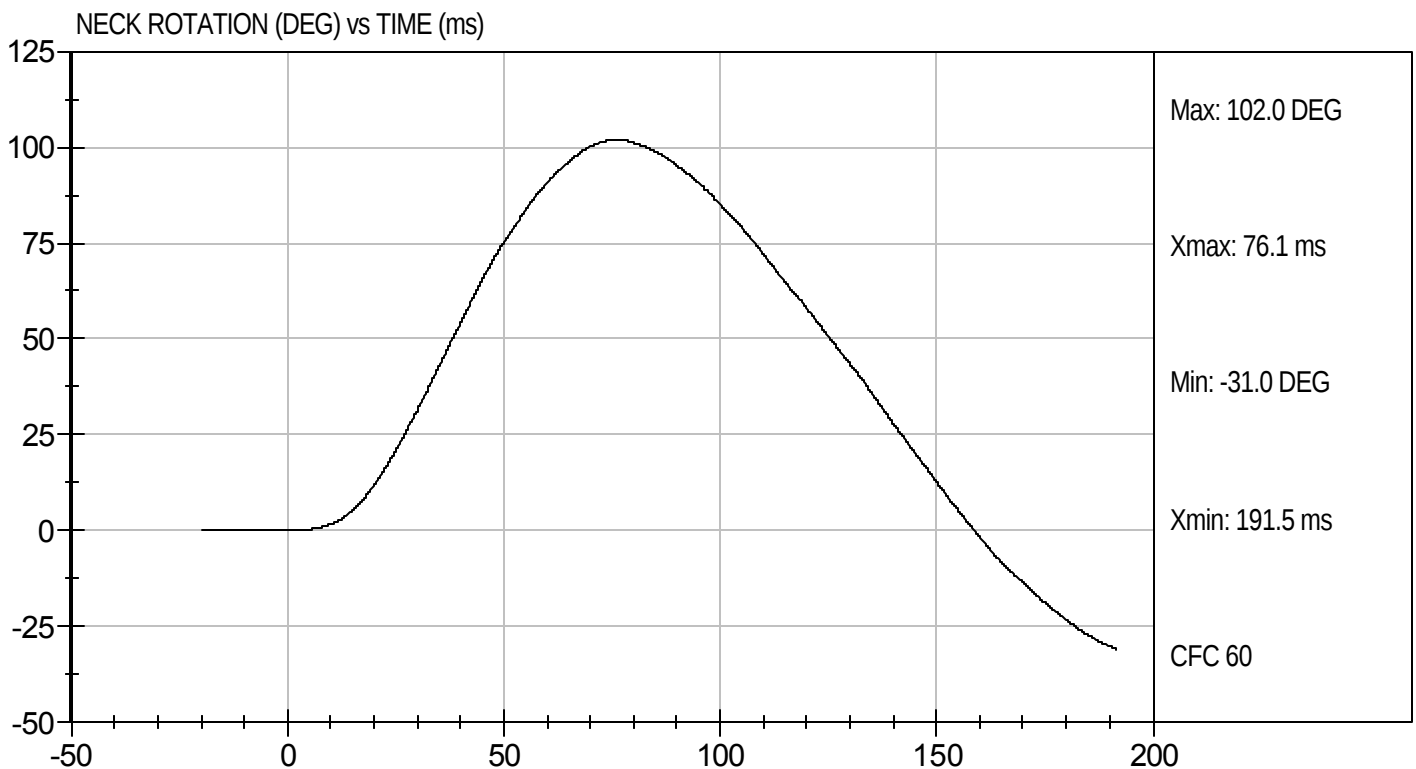
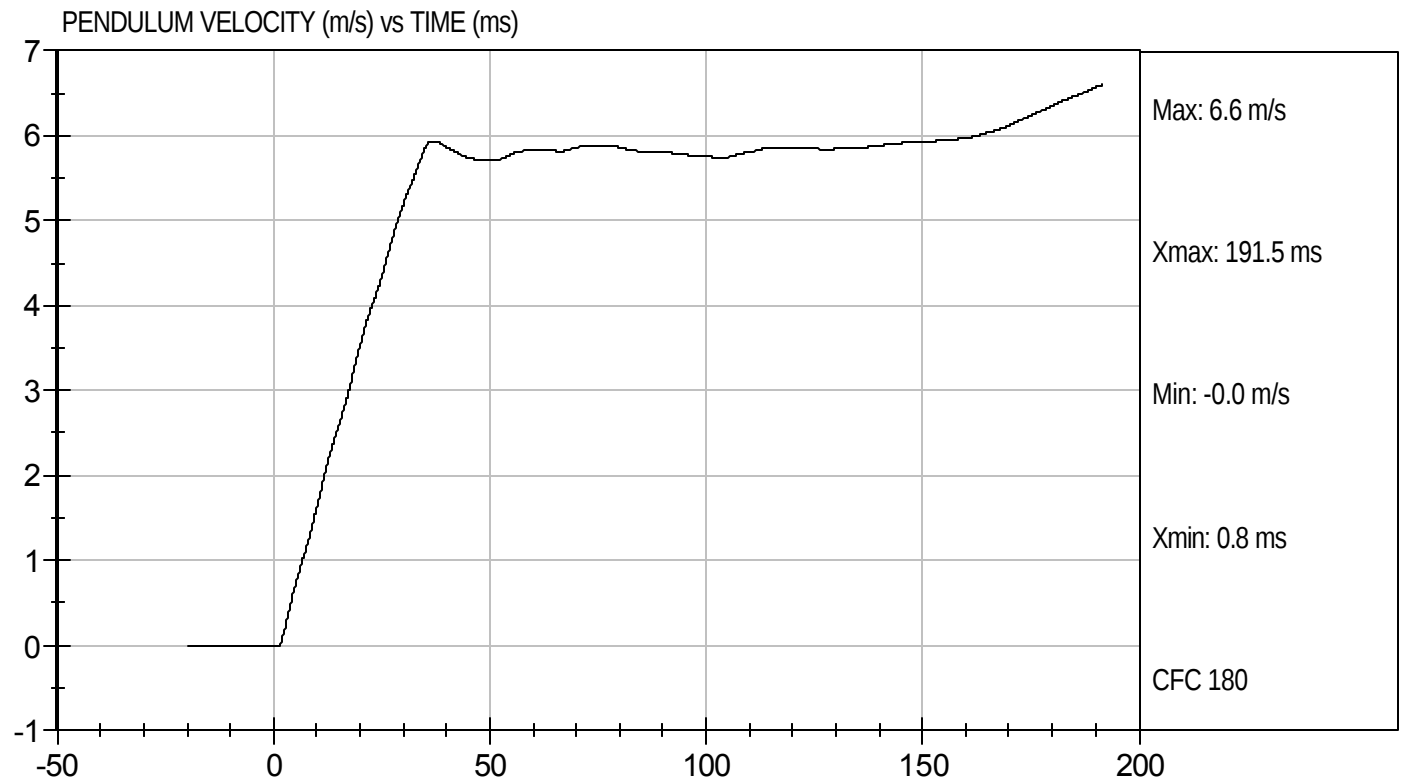
Test Date


Approved By



Test Desc: Neck Extension
Component ID: D12223

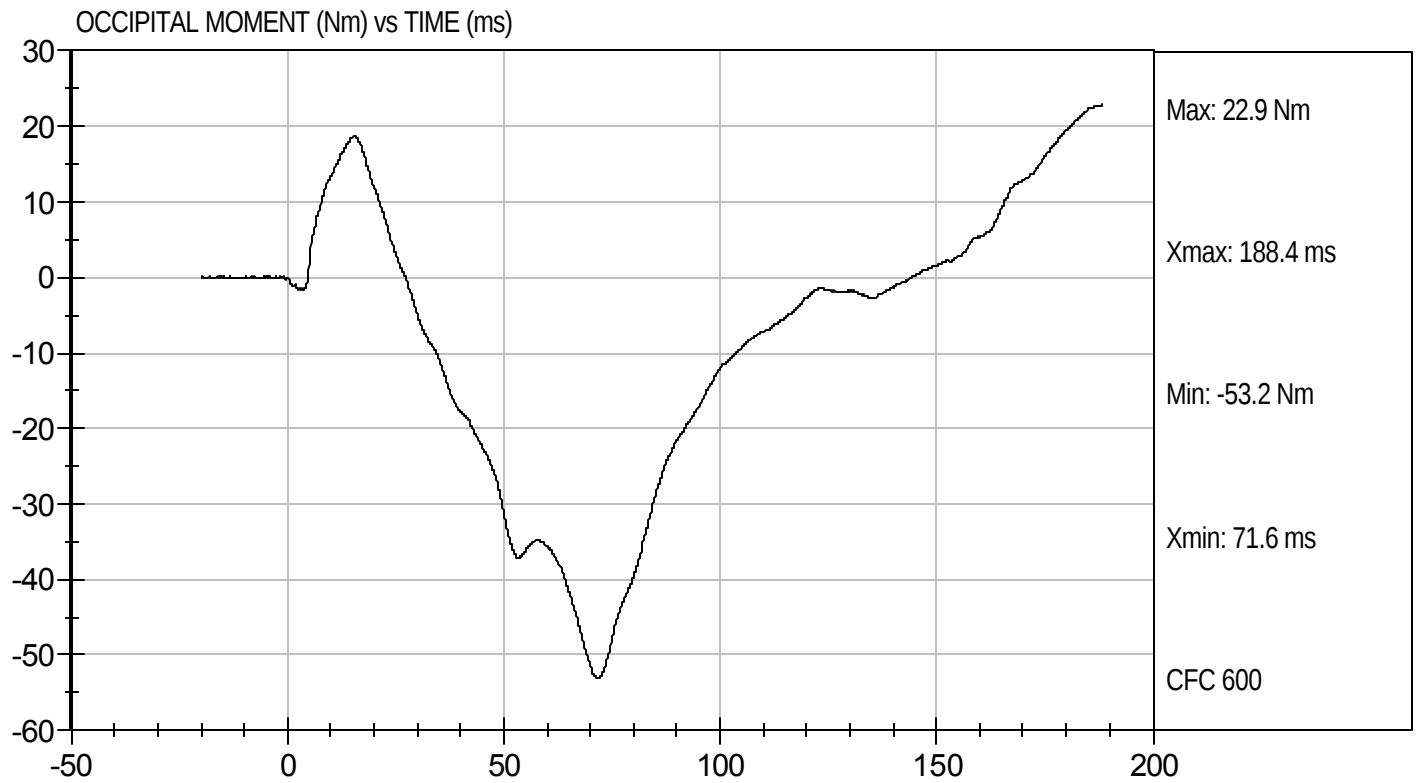
Test Date: 1/18/12
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension
Component ID: D12223

Test Date: 1/18/12
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

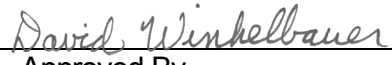
ATD Serial No: 634

Test I.D: D12224

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Relative Humidity	%	10 to 70	19	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	4.0	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	3932	Pass
Overall Test Results				Pass


Laboratory Technician

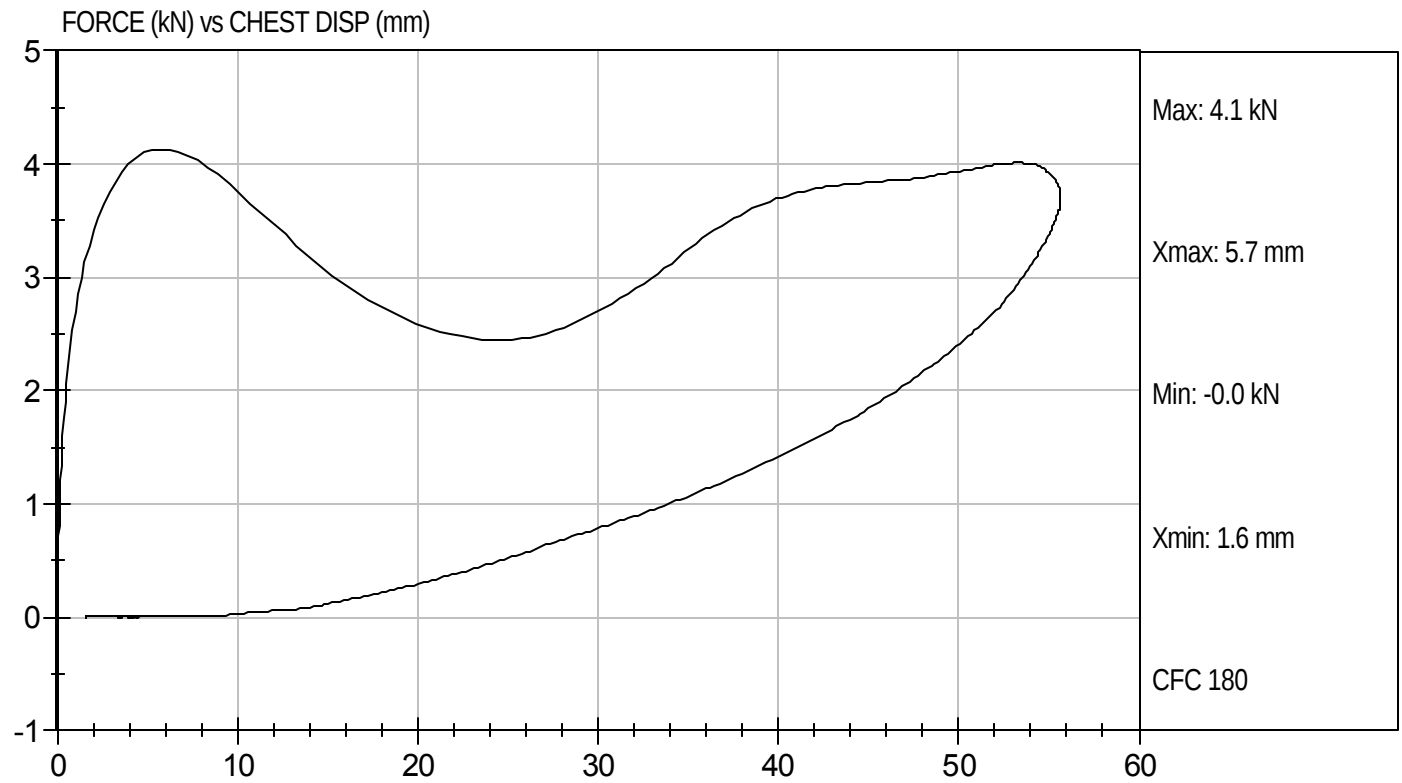
1/18/12
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D12224

Test Date: 1/18/12
Velocity: 22.22 ft/s, 6.77 m/s



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

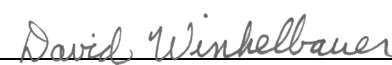
ATD Serial No: 634

Test I.D: D12225

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.99	Pass
Overall Test Results				Pass


Laboratory Technician

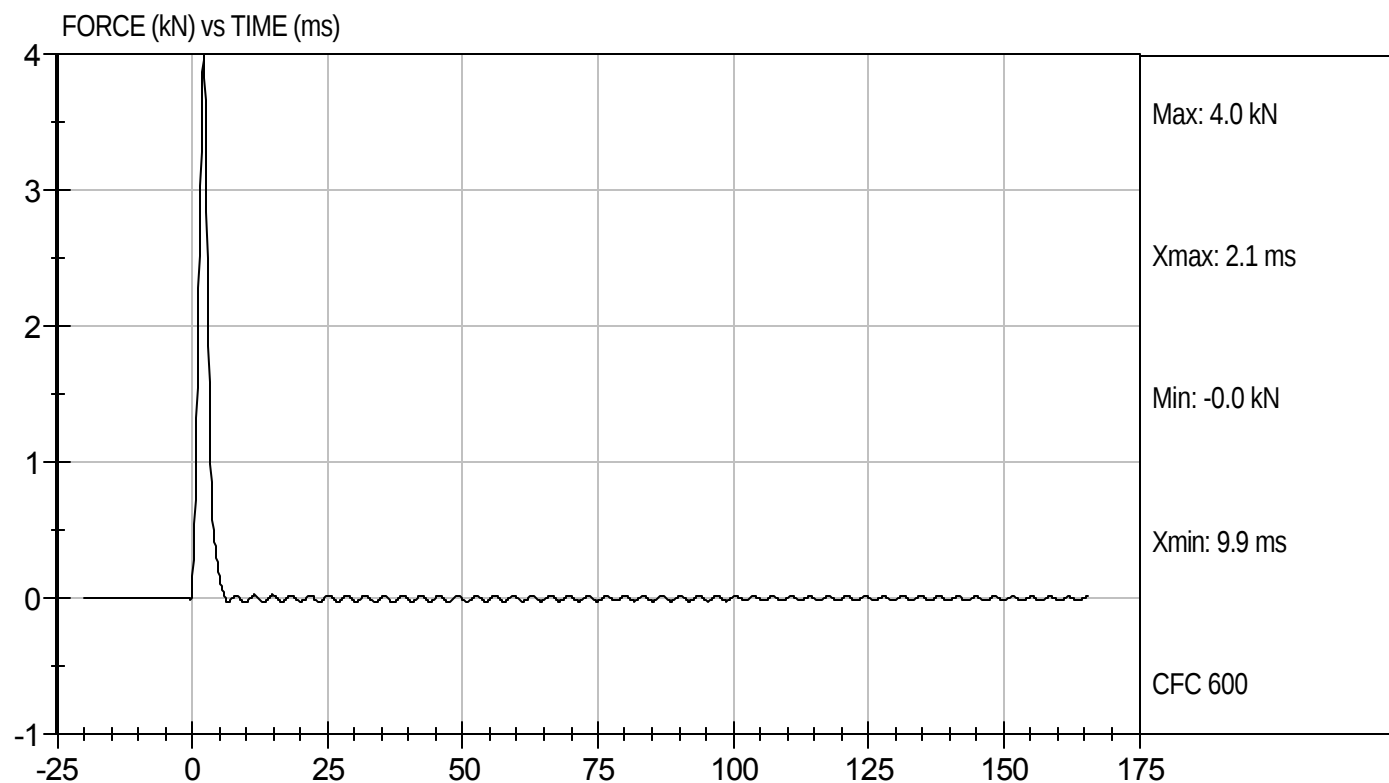
1/18/12
Test Date


Approved By



Test Desc: Right Knee
Component ID: D12225

Test Date: 1/18/12
Velocity: 6.94 ft/s, 2.12 m/s



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

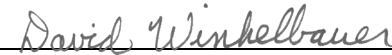
ATD Serial No: 634

Test I.D: D12226

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	4.02	Pass
Overall Test Results				Pass


Laboratory Technician

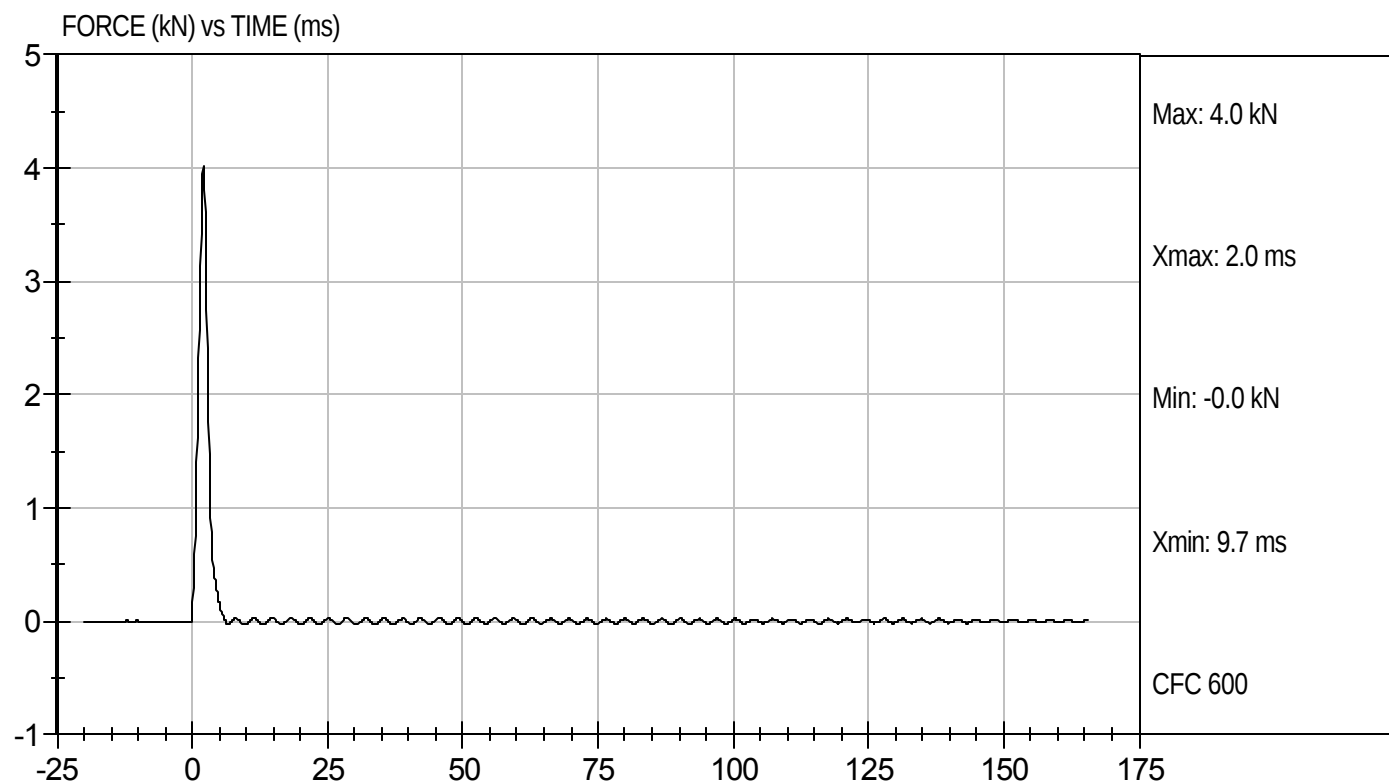
1/18/12
Test Date


Approved By



Test Desc: Right Knee
Component ID: D12226

Test Date: 1/18/12
Velocity: 6.94 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

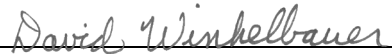
ATD Serial No: 634

Test I.D: D12227

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	18	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	5	Pass
Force at 45 deg	N	320 to 390	376	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
Overall Result				Pass


Laboratory Technician

1/18/12
Test Date


Approved By

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test ID: D12391

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Peak Resultant Acceleration	G's	250 to 300	272	Pass
Peak Lateral Acceleration	G's	+/- 15	-1.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

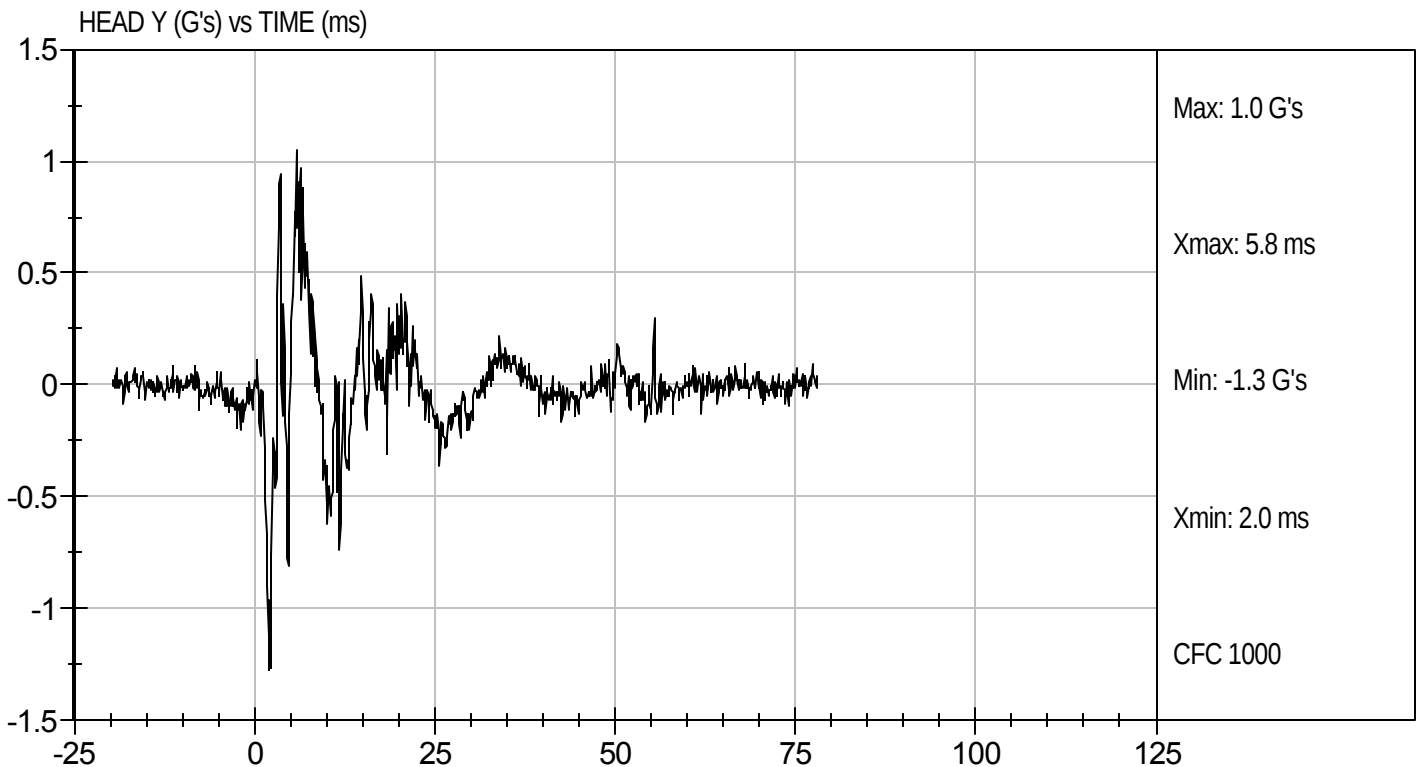
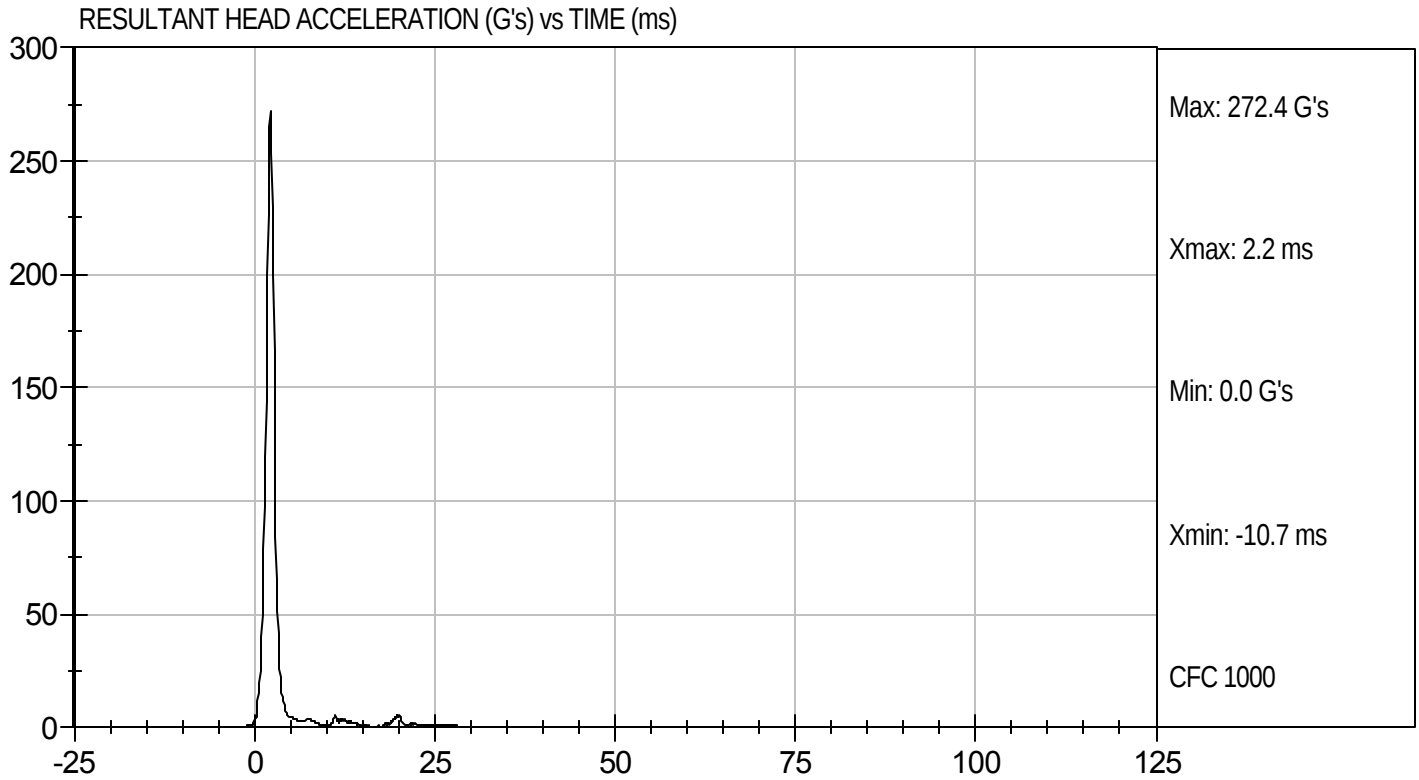
2/3/12
Test Date

David Winkelbauer
Approved By



Test Desc: Head Drop
Component ID: D12391

Test Date: 2/3/12
Velocity: 0 ft/s, 0 m/s

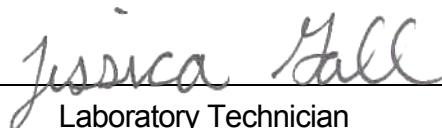


MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

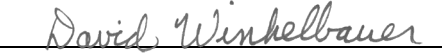
ATD Serial No: 634

Test I.D: D12392

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	24	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Pulse	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.2	Pass
D Plane Rotation	Max	deg	77 to 91	78	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	71	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	83	Pass
Overall Results				Pass	


Laboratory Technician

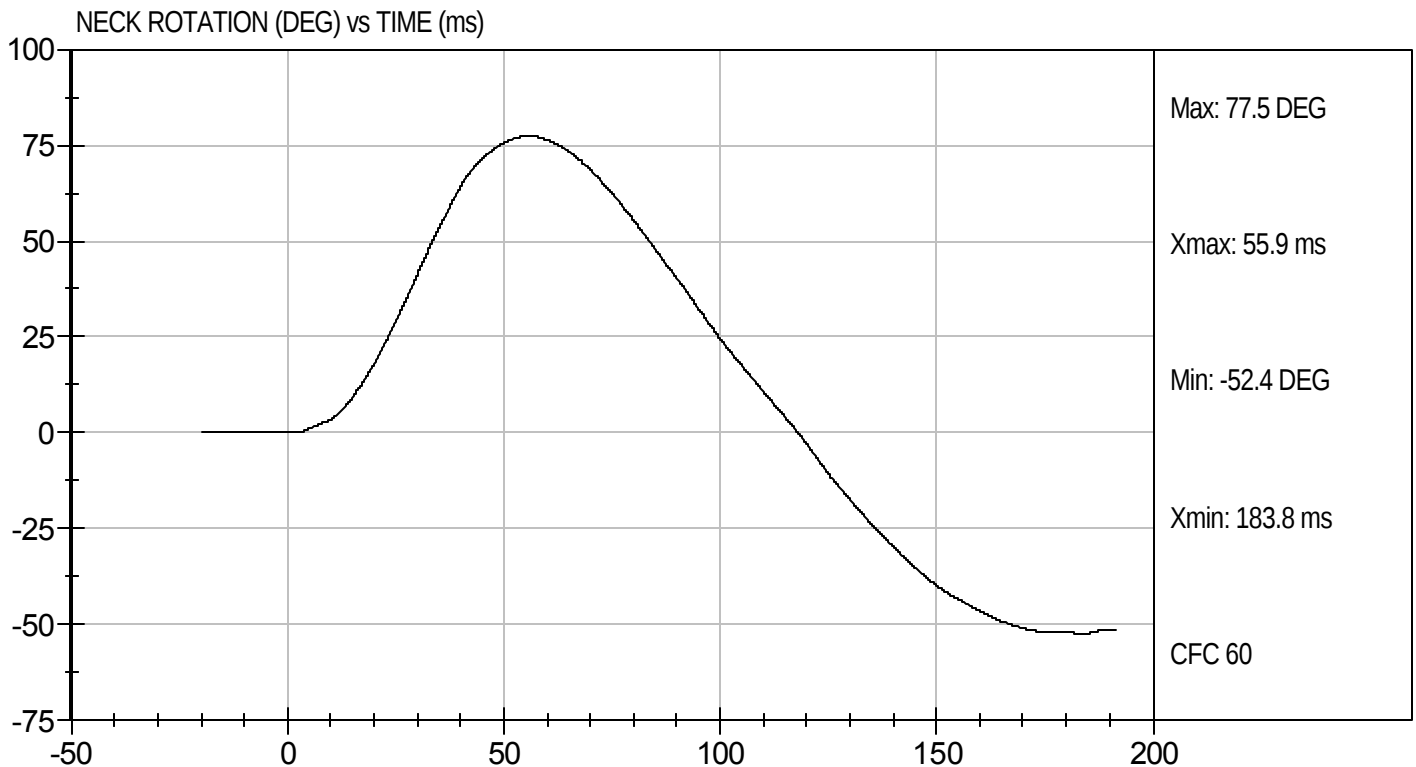
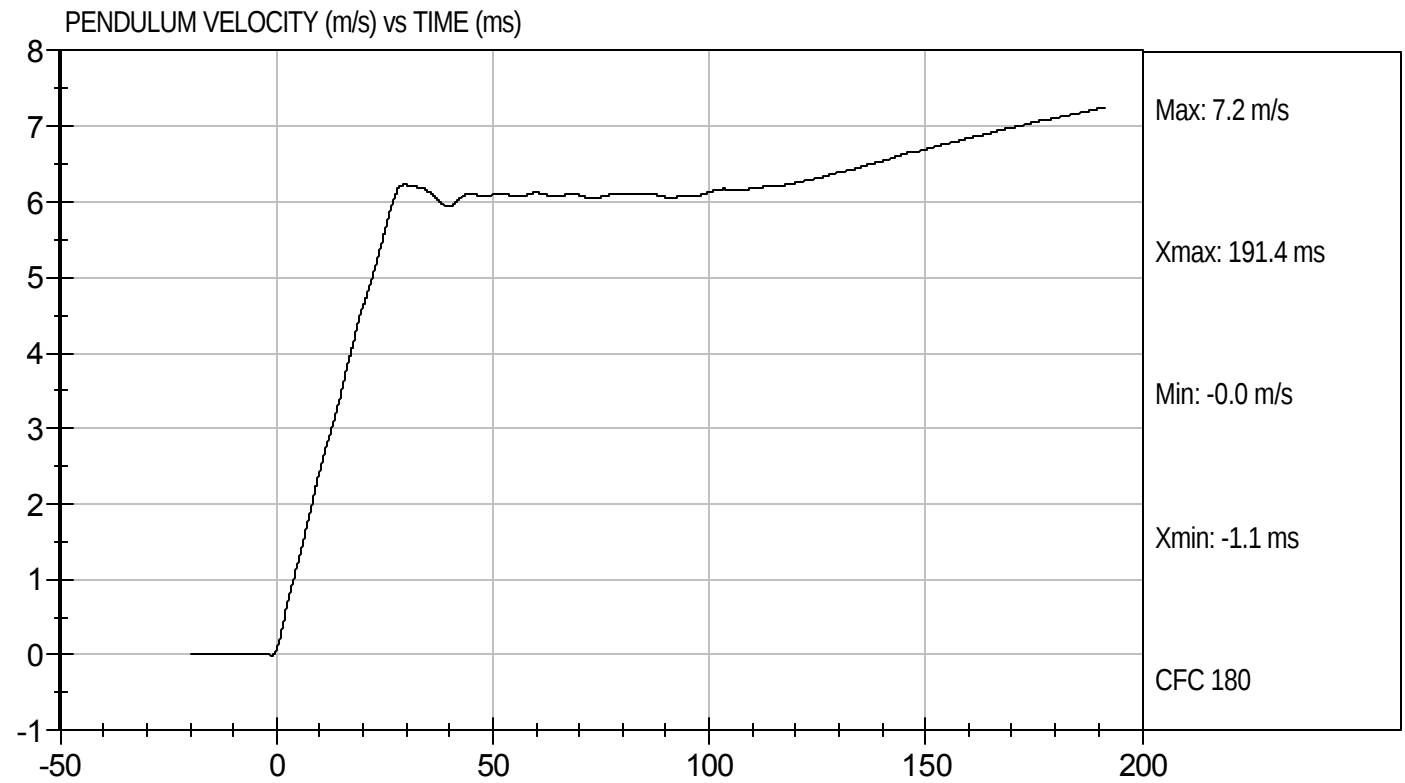
2/3/12
Test Date


Approved By



Test Desc: Neck Flexion
Component ID: D12392

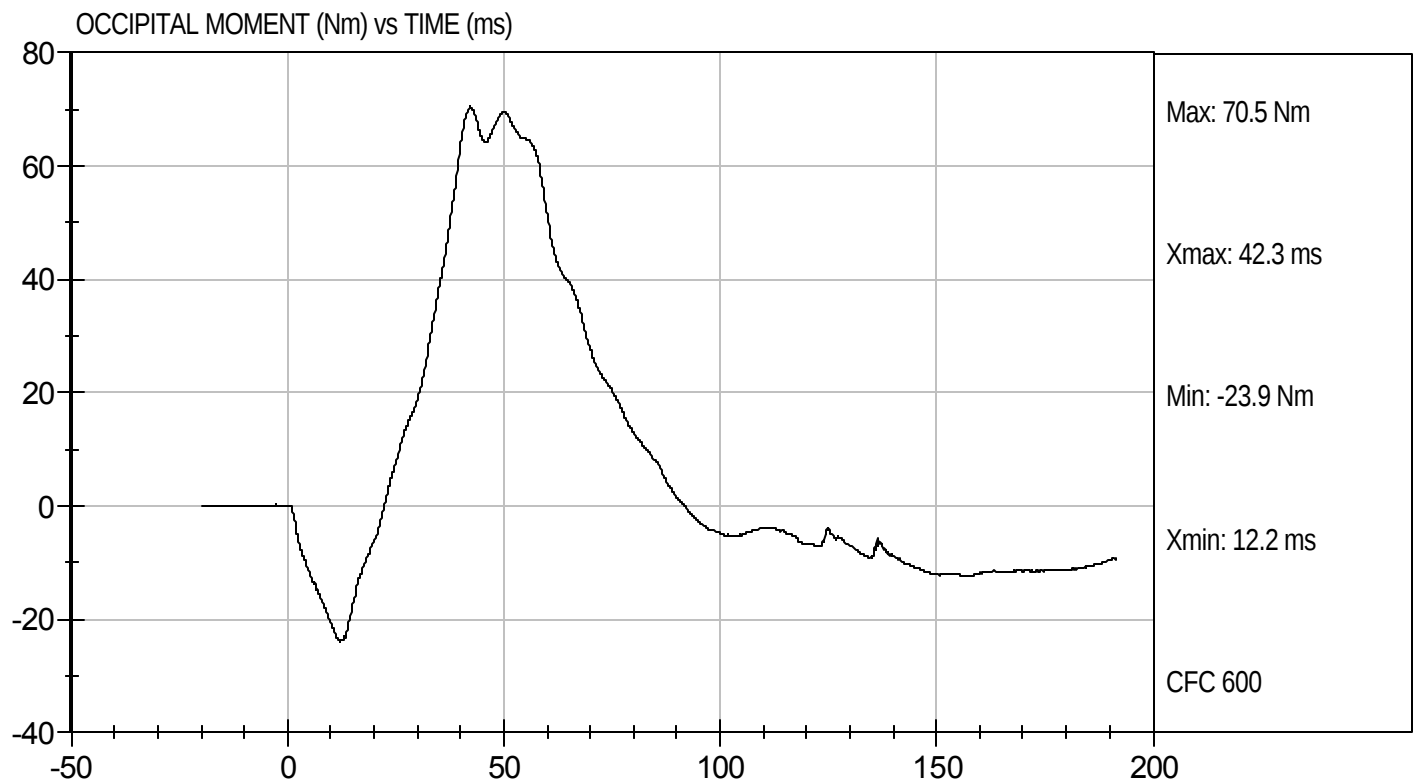
Test Date: 2/3/12
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D12392

Test Date: 2/3/12
Velocity: 23.15 ft/s, 7.06 m/s

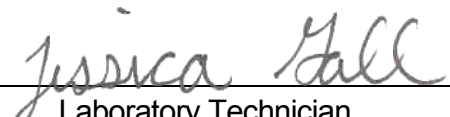


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

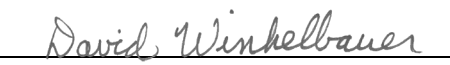
ATD Serial No: 634

Test I.D: D12393

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	26	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Pulse	10 ms	m/s	1.5 to 1.9	1.9	Pass
	20 ms	m/s	3.1 to 3.9	3.8	Pass
	30 ms	m/s	4.6 to 5.6	5.3	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	103	Pass
Overall Results					Pass


 Laboratory Technician

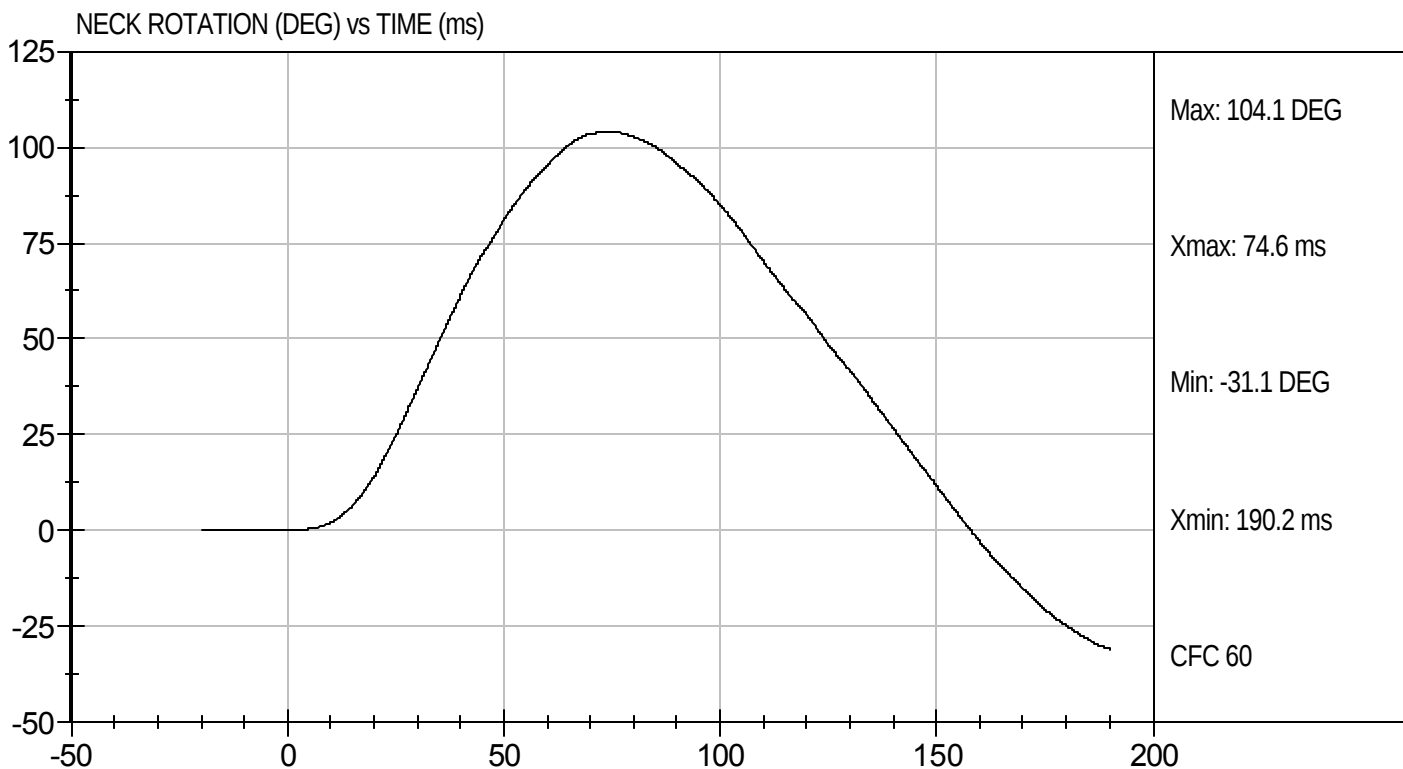
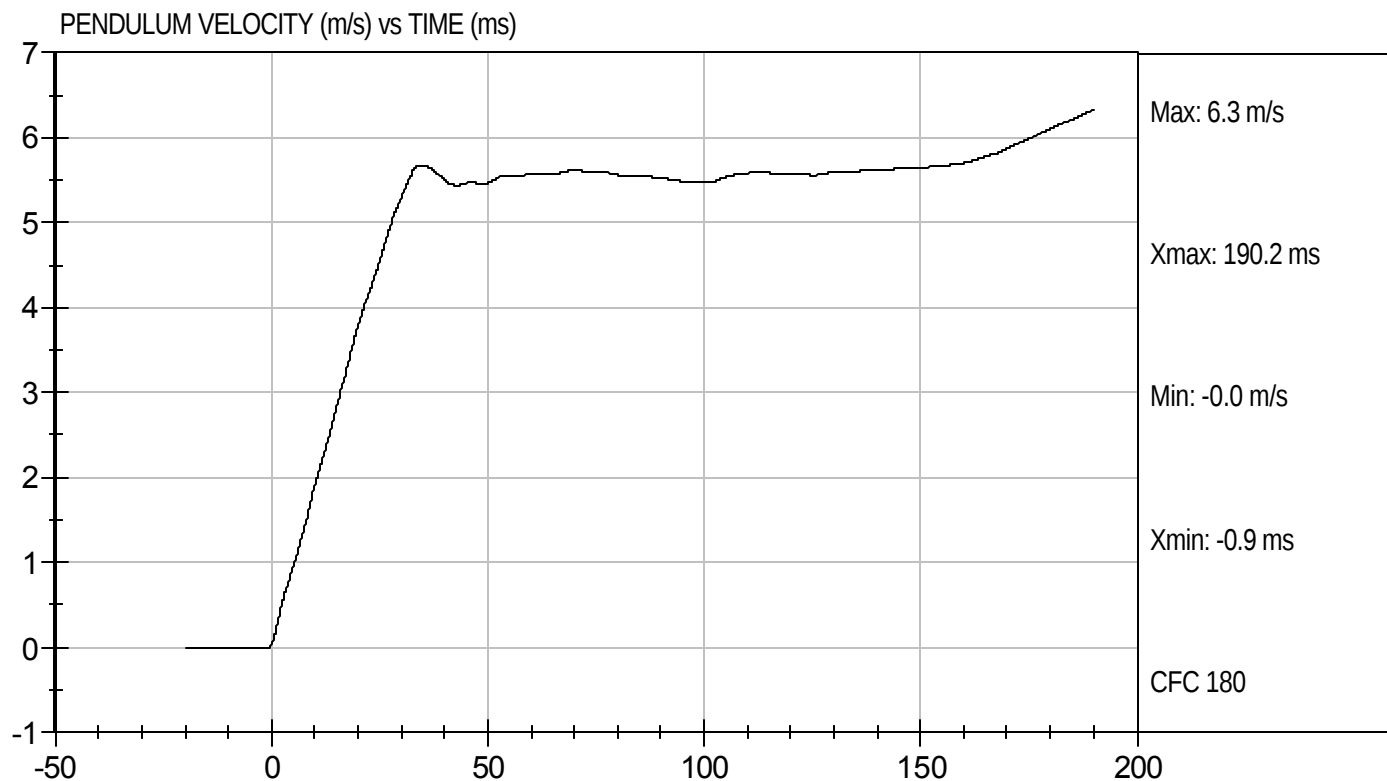
2/3/12
 Test Date


 Approved By



Test Desc: Neck Extension
Component ID: D12393

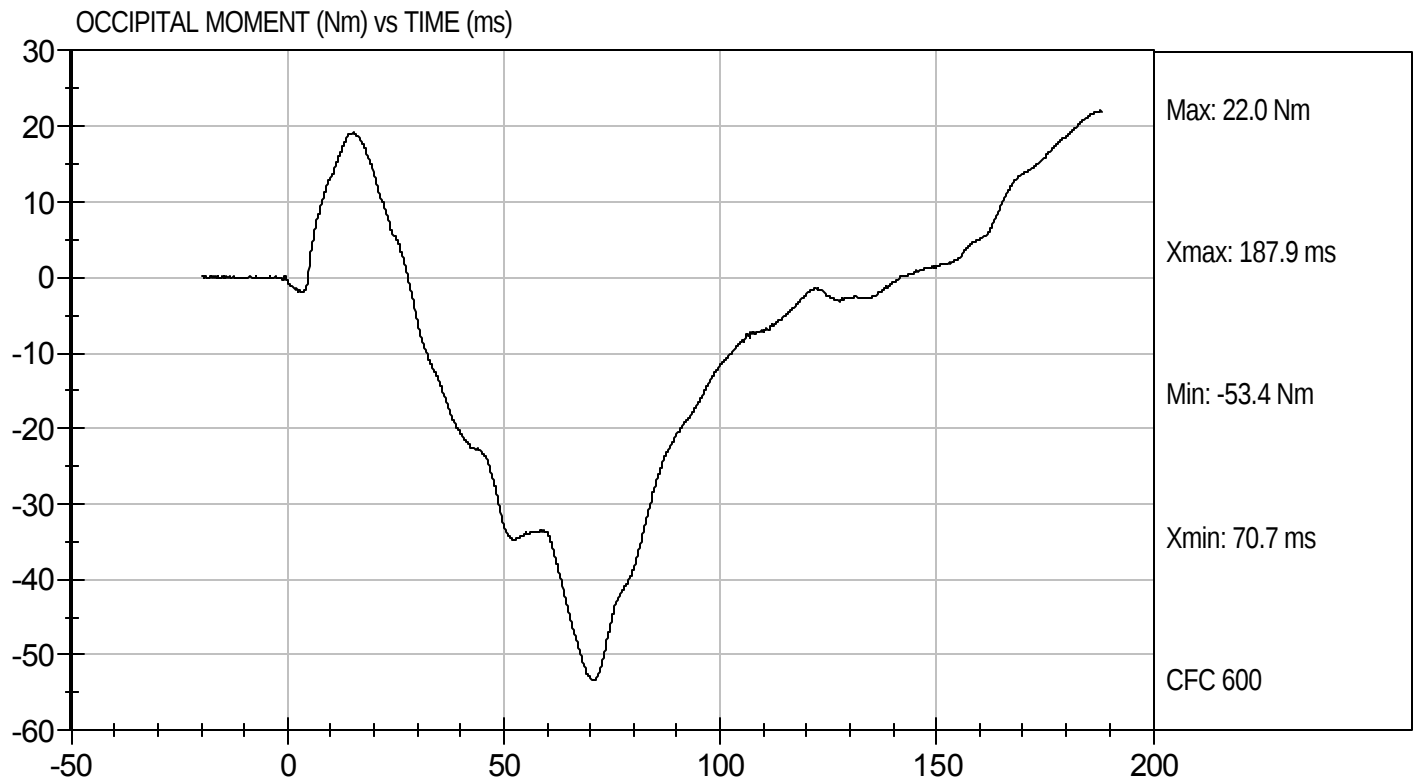
Test Date: 2/3/12
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension
Component ID: D12393

Test Date: 2/3/12
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

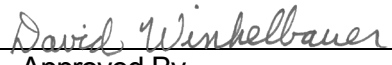
ATD Serial No: 634

Test I.D: D12394

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Relative Humidity	%	10 to 70	22	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.16	Pass
Internal Hysteresis	%	69 to 85	74	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	4183	Pass
			Overall Test Results	Pass


Laboratory Technician

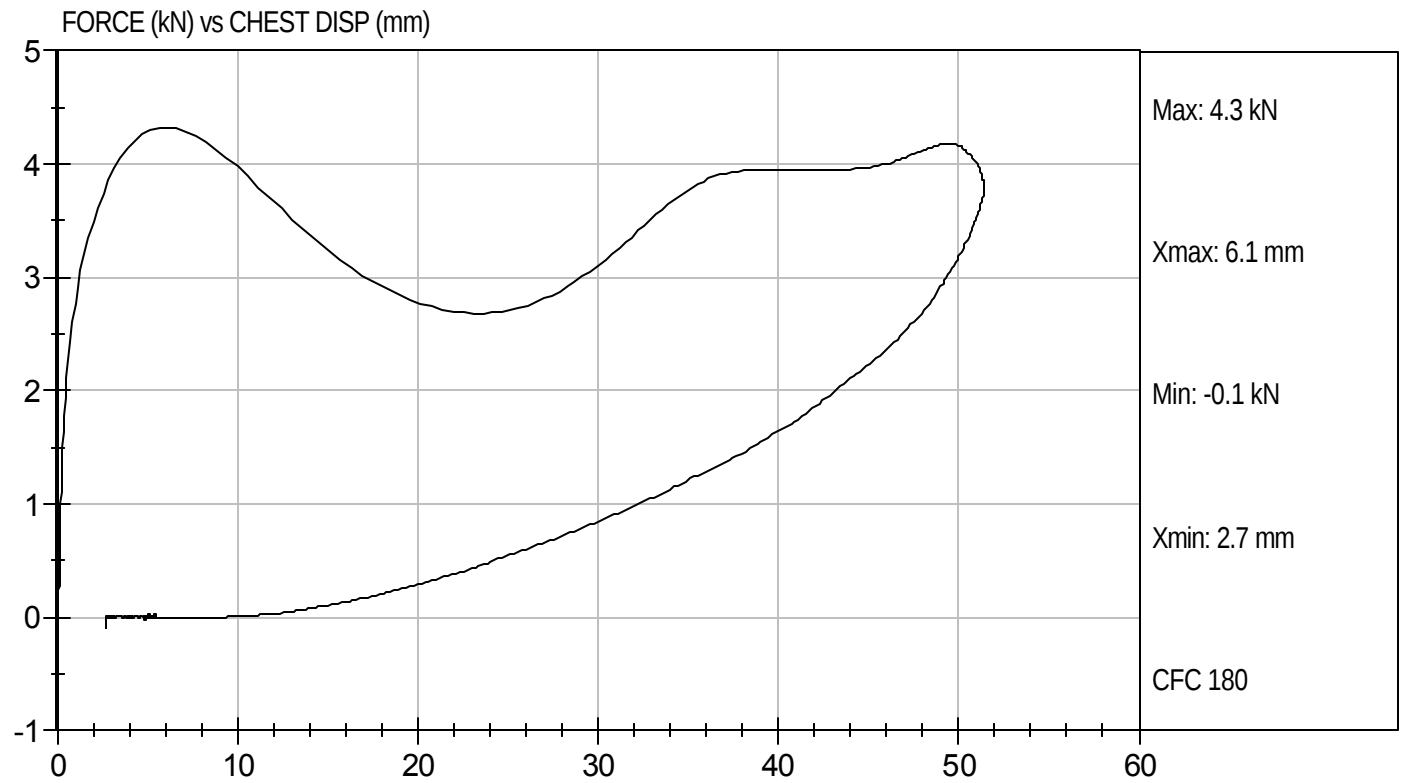
2/6/12
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D12394

Test Date: 2/6/12
Velocity: 22.22 ft/s, 6.77 m/s

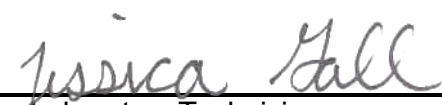


MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

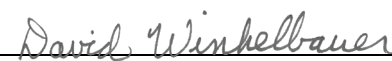
ATD Serial No: 634

Test I.D: D12395

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	21	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.95	Pass
Overall Test Results				Pass


Laboratory Technician

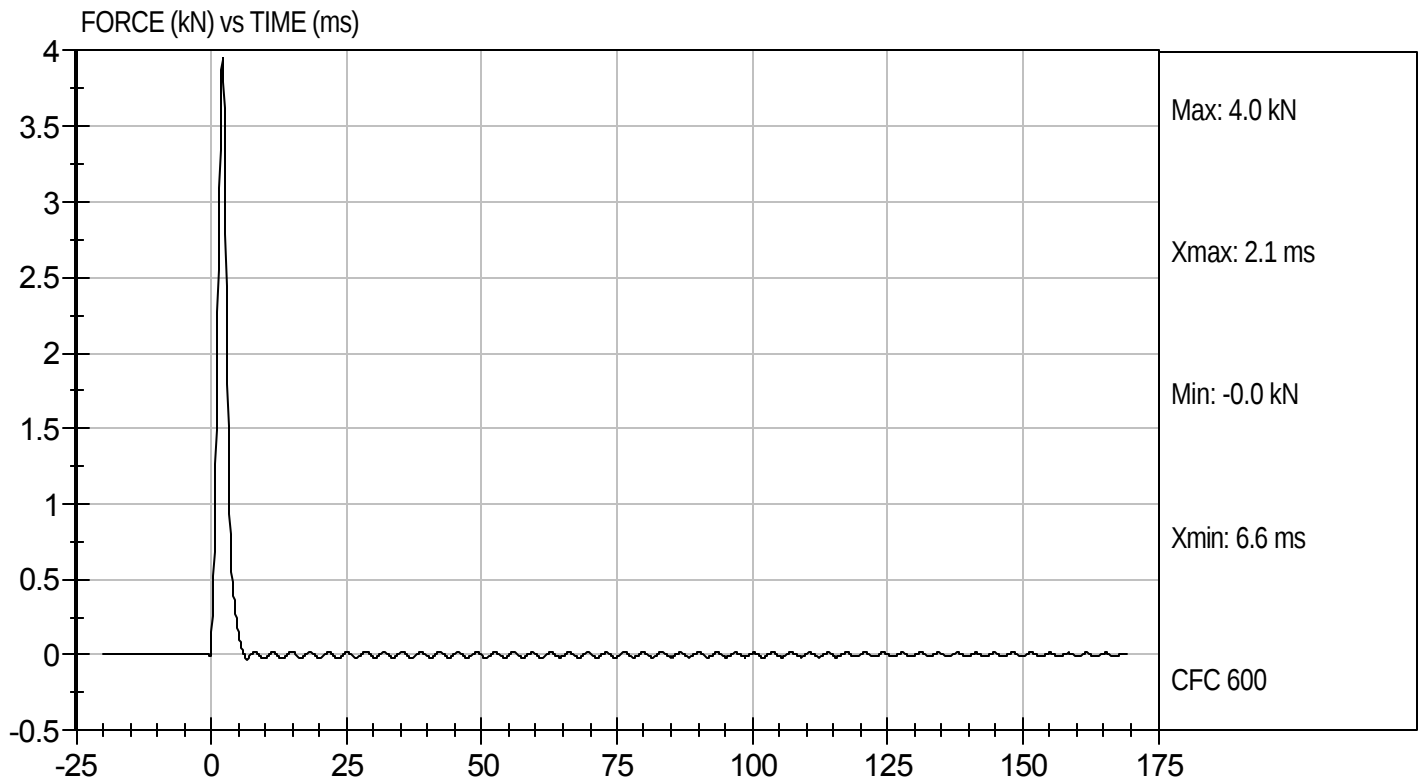
2/6/12
Test Date


Approved By



Test Desc: Right Knee
Component ID: D12395

Test Date: 2/6/12
Velocity: 6.88 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D12396

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	21	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.86	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

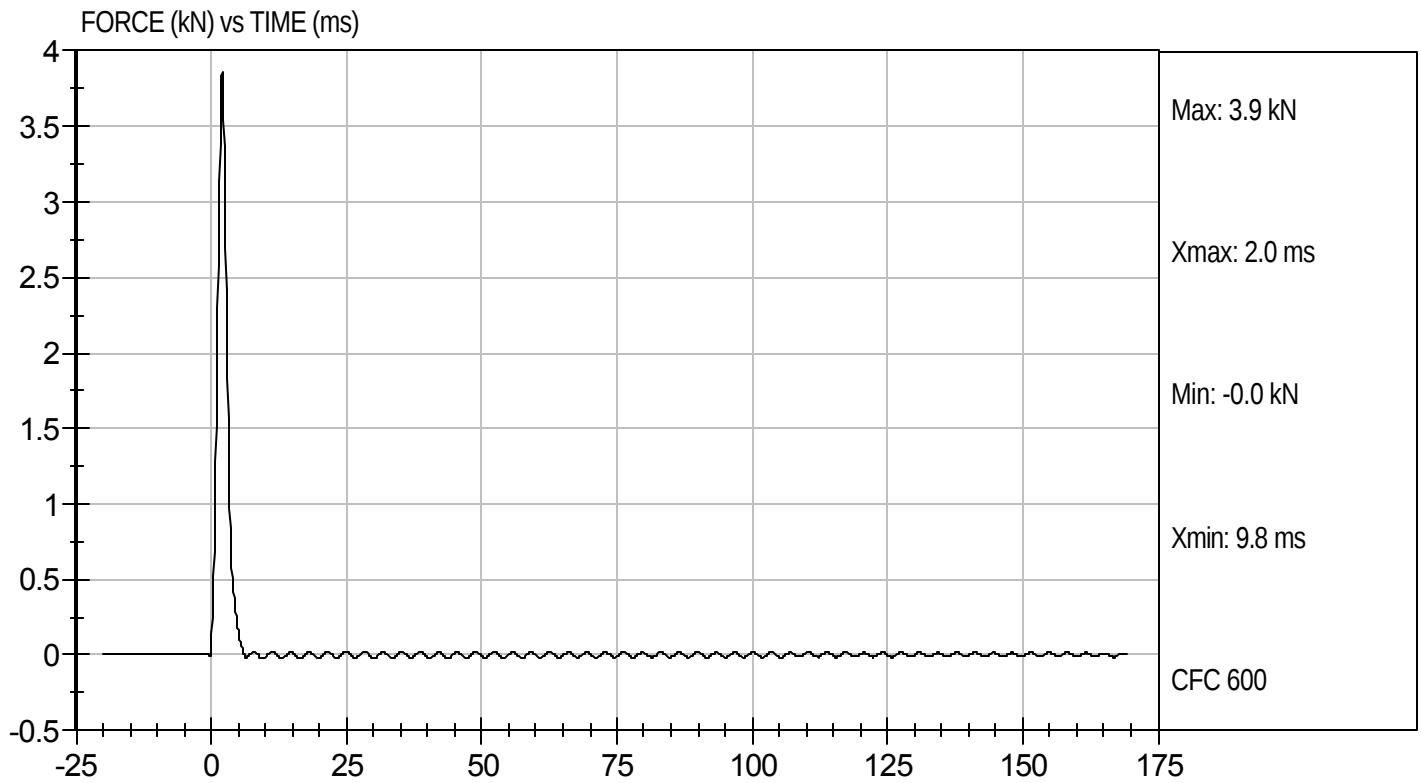
2/6/12
Test Date

David Winkelbauer
Approved By



Test Desc: Left Knee
Component ID: D12396

Test Date: 2/6/12
Velocity: 6.88 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

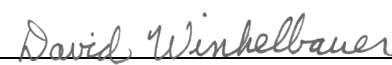
ATD Serial No: 634

Test I.D: D12397

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	22	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	6	Pass
Force at 45 deg	N	320 to 390	339	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
Overall Result				Pass


Laboratory Technician

2/6/12
Test Date


Approved By