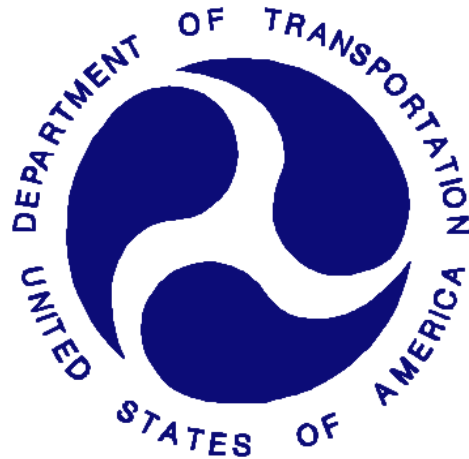


REPORT NUMBER: NCAP-MGA-2012-039

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

**KIA MOTORS MANUFACTURING GEORGIA, INC. FOR HYUNDAI MOTOR COMPANY
2012 Hyundai Santa Fe GLS AWD SUV
NHTSA No.: MC0512**

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



Test Date: December 14, 2011

Final Report Date: February 10, 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: February 10, 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. Report No. NCAP-MGA-2012-039		2. Government Accession No.		3. Recipient's Catalog No.																																																			
4. Title and Subtitle Final Report of New Car Assessment Program Frontal Impact Testing of 2012 Hyundai Santa Fe GLS AWD SUV, NHTSA No.: MC0512		5. Report Date February 10, 2012																																																					
		6. Performing Organization Code MGA																																																					
7. Author(s) Donna Janovicz, Project Manager Ben Fischer, Project Engineer		8. Performing Organization Report No. NCAP-MGA-2012-039																																																					
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		10. Work Unit No.																																																					
		11. Contract or Grant No. DTNH22-06-D-00028																																																					
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NVS-111) 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C. 20590		13. Type of Report and Period Covered Final Test Report December 14 to February 10, 2012																																																					
		14. Sponsoring Agency Code NVS-111																																																					
15. Supplementary Notes																																																							
16. Abstract A 56.3 km/h NCAP Frontal Impact Test was conducted on the 2012 Hyundai Santa Fe GLS AWD SUV in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on December 14, 2011. The impact velocity was 56.5 km/h and the ambient temperature at the barrier face at the time of impact was 21.5°C. The target vehicle post-test maximum crush was 594 mm located at the vehicle's centerline. The test vehicle's performance was as follows: <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">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>326</td> <td>287</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>52</td> <td>22</td> <td>16</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>1</td> <td>0.26</td> <td>0.60</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>2620</td> <td>1316</td> <td>1045</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>2520</td> <td>164</td> <td>200</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>4885</td> <td>1815</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>3916</td> <td>2099</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	326	287	Maximum Chest Compression	mm	63	52	22	16	Nij	N/A	1	1	0.26	0.60	Neck Tension	N	4170	2620	1316	1045	Neck Compression	N	4000	2520	164	200	Left Femur Force	N	10008	6805	4885	1815	Right Femur Force	N	10008	6805	3916	2099
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19. Security Classification of Report Unclassified	20. Security Classification of Page Unclassified	21. No. of Pages 163		22. Price																																																			

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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 Santa Fe GLS AWD SUV at a velocity of 56.5 kph. The test was performed at MGA Research Corporation on December 14, 2011. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

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

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

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

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

The 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 594 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. 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. The passenger's knees contacted the glovebox.

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)	326	0.26	1316	164	40	22	4885	3916
Passenger (5 th)	287	0.60	1045	200	48	16	1815	2099

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

TEST NOTES

The left rear seat crossmember X is questionable from 58-64 msec.
The right rear seat crossmember Xr is questionable from 84-88 msec.
Load cell 9-13 is questionable data.
Load cell 8-2 is questionable data.

Camera No. 11 – Windshield did not run.
Camera No. 13 – Passenger Windshield did not run.

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 Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MC0512	Traction Control System (TCS)	Yes
Model Year	2012	Auto-Leveling System	No
Make	Hyundai	Automatic Door Locks (ADLs)	Yes
Model	Santa Fe	Power Window Auto-Reverse	Yes
Body Style	MPV	Other Optional Feature	N/A
VIN	5XYZGDAB0CG100639	Driver Front Airbag	Yes
Body Color	Moonstone Silver	Driver Curtain Airbag	Yes
Odometer (km/mi)	241 / 150	Driver Head/Torso Airbag	No
Engine Displacement (L)	2.4	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	AWD	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	Rear Pass. Load Limiter	Yes
All-Wheel Drive (AWD)	Yes	Other Safety Restraints	N/A
Does owner's manual provide instructions to turn off automatic door locks?			No

DATA FROM CERTIFICATION LABEL

Manufactured By	KIA Motors Manufacturing Georgia, Inc. For Hyundai Motor Company	GVWR (kg)	2300
Date of Manufacture	AUG/22/11	GAWR Front (kg)	1350
Vehicle Type	MPV	GAWR Rear (kg)	1450

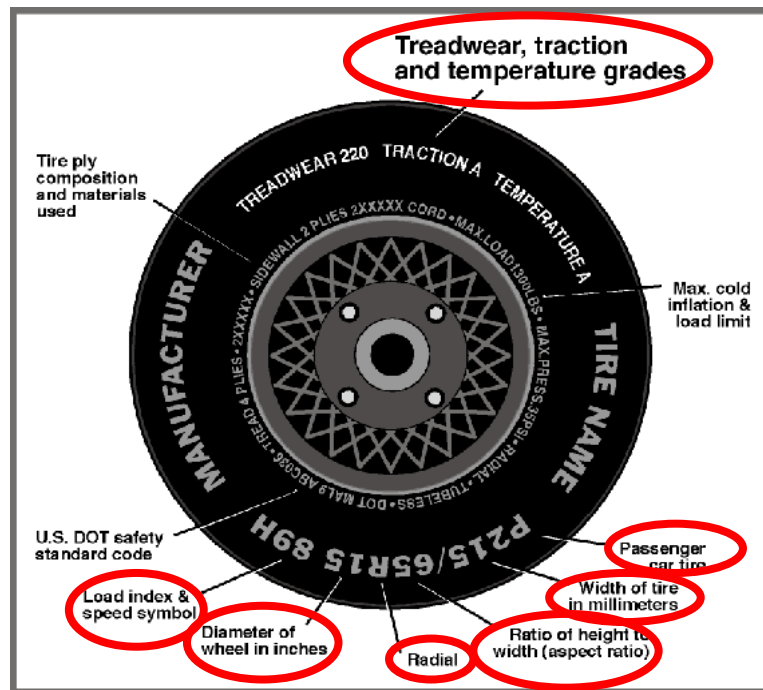
VEHICLE SEATING AND WEIGHT CAPACITY DATA

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

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

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11



TIRE PLACARD INFORMATION

Measured Parameter	Front	Rear
Recommended Cold Tire Pressure (kPa)	230	230
Recommended Tire Size	P235/65R17	P235/65R17

TIRE SIDEWALL INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Tire Size on Vehicle	P235/65R17	P235/65R17
Tire Manufacturer	KUMHO	KUMHO
Tire Name	SOLUS	SOLUS
Tire Type	Passenger	Passenger
Tire Width	235	235
Aspect Ratio	65	65
Radial	Yes	Yes
Wheel Diameter	17	17
Load Index/Speed Symbol	103T	103T
Treadwear	500	500
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 Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	506.7	393.7		531.2	481.7	
Right	kg	480.8	376.5		504.0	456.3	
Ratio	%	56.2	43.8		52.5	47.5	
Totals	kg	987.5	770.2	1757.7	1035.2	938.0	1973.2

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1757.7
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	80
Calculated Vehicle Target Weight (TVTW)	kg	1978.3

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	823	822	813	820	1183
As Tested	mm	812	817	776	784	1283
Post Test	mm	826	848	777	797	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2700
Total Vehicle Length at Left Side	mm	4498
Total Vehicle Length at Centerline	mm	4656
Total Vehicle Length at Right Side	mm	4498
Weight of Ballast in Cargo Area	kg	97.5
Weight of Vehicle Components Removed	kg	26.3
Amount of Stoddard Solvent in Fuel Tank	L	65.1

List of components removed: Jack/tools, trunk carpet, trunk compartments, and rear floor mats.

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

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4656
2	Total Width	1846
3	Bumper Top Height	568
4	Bumper Bottom Height	453
5	Longitudinal Member Top Height	676
6	Distance between Longitudinal Members	900
7	Longitudinal Member Width	95
8	Engine Top Height	887
9	Engine Bottom Height	267
10	Engine and Gearbox Width	866
11	Front Bumper-Engine Distance	360
12	Front Shock Absorber Fixing Height	1019
13	Bonnet Leading Edge Height	953
14	Front Shock Absorber Fixing Width	1165
15	Front Bumper – Front Axle Distance	919
16	Front Axle – A-Pillar Distance	483
17	A-Pillar – B-Pillar Distance	1094
18	B-Pillar – Rear Axle Distance	1130
19	B-Pillar – C-Pillar Distance	650
20	Roof Sill Bottom Height	1565
21	Roof Sill Top Height	1672
22	Floor Sill Bottom Height	290
23	Floor Sill Top Height	459

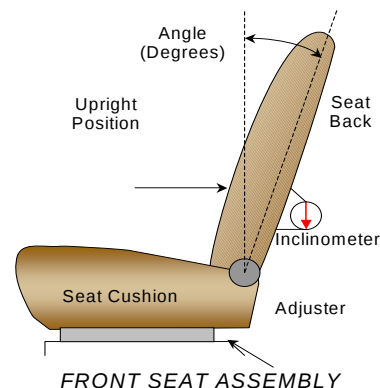
DATA SHEET NO. 2
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

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	5.7° on headrest post
Passenger Seat Back Angle	2.3° on headrest post

SEAT FORE/AFT POSITIONS

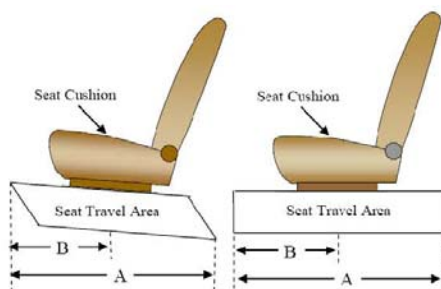
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	24 detents	11 th detent (foremost as 0)
Passenger Seat	24 detents	0 (foremost 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	3 (1 st as 0)	0 (uppermost as 0)
Passenger Seat	3 (1 st as 0)	0 (uppermost as 0)



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

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

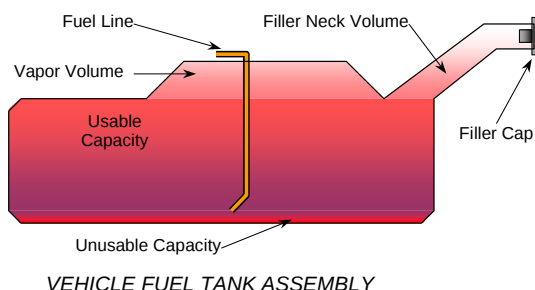
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	70.0
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	64.4 to 65.8
Actual Amount of Solvent used	65.1
1/3 of Usable Capacity	23.3

FUEL PUMP

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

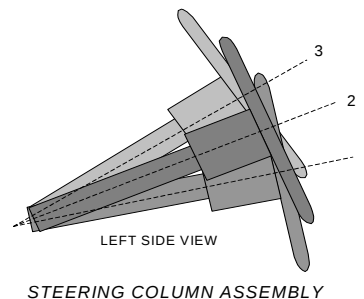
The vehicle is equipped with an electric fuel pump. The fuel pump will pump fuel when key is in "ON" position. The fuel pipe is on the left side.



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 POSITION

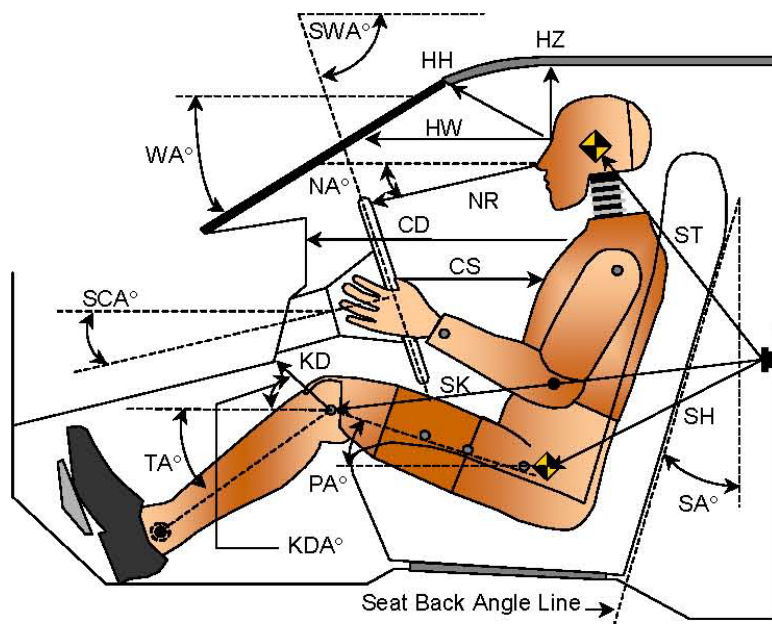


	Degrees	Fore/Aft Position (mm)
Lowermost – Position 1	55.0	260
Geometric Center – Position 2	62.0	245
Uppermost – Position 3	69.0	230
Telescoping Steering Wheel Travel		30
Test Position	69.0	245

DATA SHEET NO. 3 DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
Test Date: 12/14/11

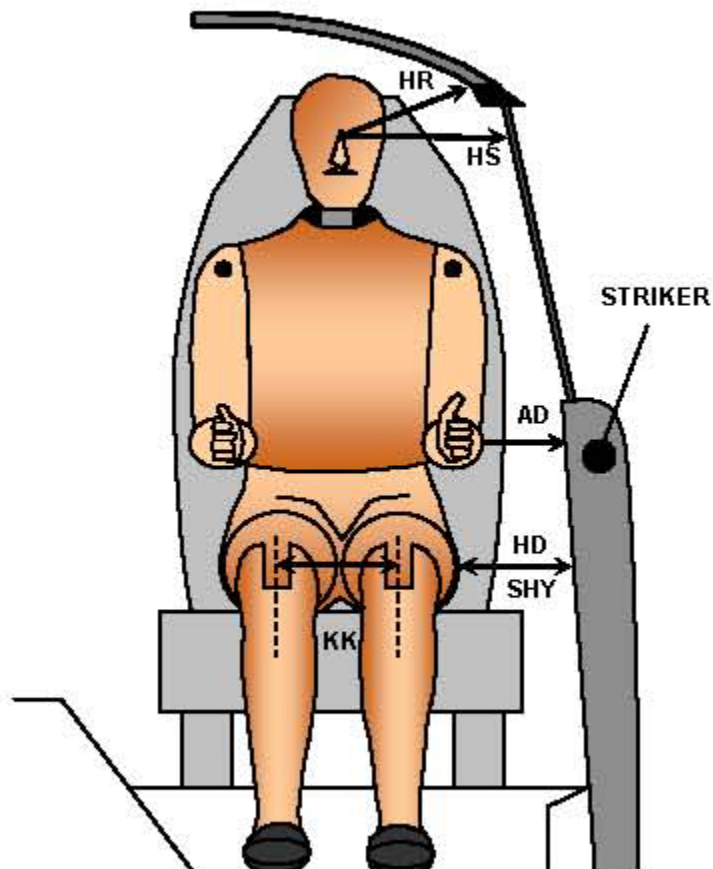


Code	Measurement Description	Driver S/N 351		Passenger S/N 138	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		27.7		
SWA°	Steering Wheel Angle		62.0		
SCA°	Steering Column Angle		28.0		
SA°	Seat Back Angle (on headrest post)		5.7		2.3
HZ	Head to Roof (Z)	160	90	193	90
HH	Head to Header	271	27.0	235	56.7
HW	Head to Windshield	529	0	538	0
NR	Nose to Rim	398	12.8		
CD	Chest to Dash	515		379	
CS	Chest to Steering Hub	298	6.1		
RA	Rim to Abdomen	164	0		
KDL	Left Knee to Dash	145	20.8	80	34.6
KDR	Right Knee to Dash	134	29.4	84	33.2
PA°	Pelvic Angle		23.7		21.5
TA°	Tibia Angle		45.3		47.7
SK	Striker to Knee	605	91.5	712	100.9
ST	Striker to Head	515	12.9	463	36.8
SH	Striker to H-Point	298	121.4	420	113.3

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11



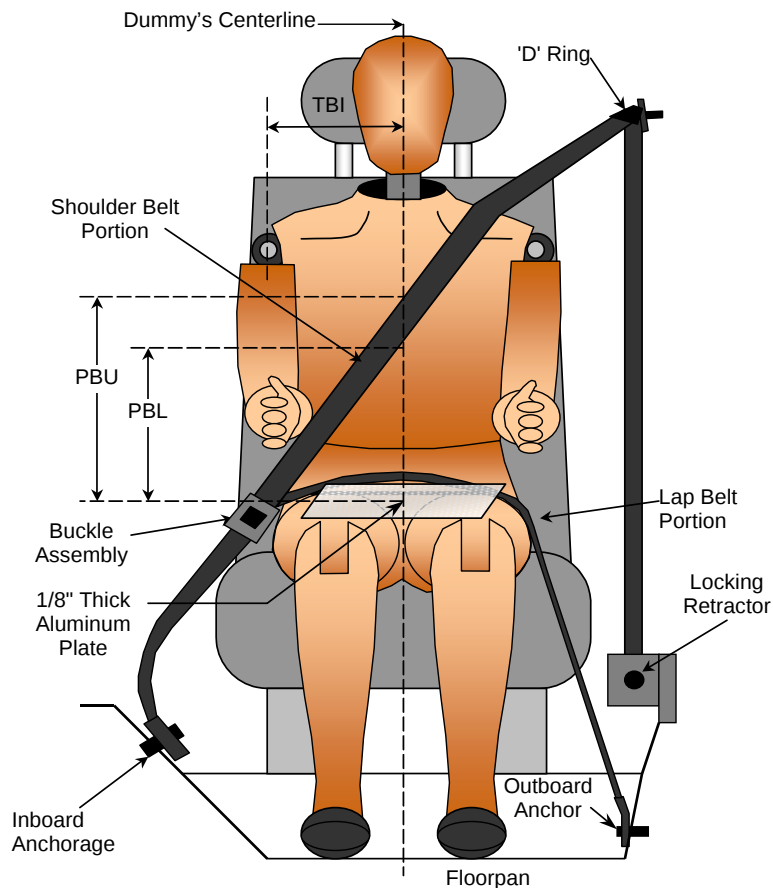
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver S/N 351	Passenger S/N 138
		Length (mm)	
AD	Arm to Door	111	90
HD	H-Point to Door	227	259
HR	Head to Side Header	216	257
HS	Head to Side Window	318	353
KK	Knee to Knee	359	233
SHY	Striker to H-Point (Y Direction)	276	302
AA	Ankle to Ankle	355	183

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
Test Date: 12/14/11



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	380	340
PBL - Top surface of reference to belt lower edge	mm	300	260

BELT LENGTH DATA

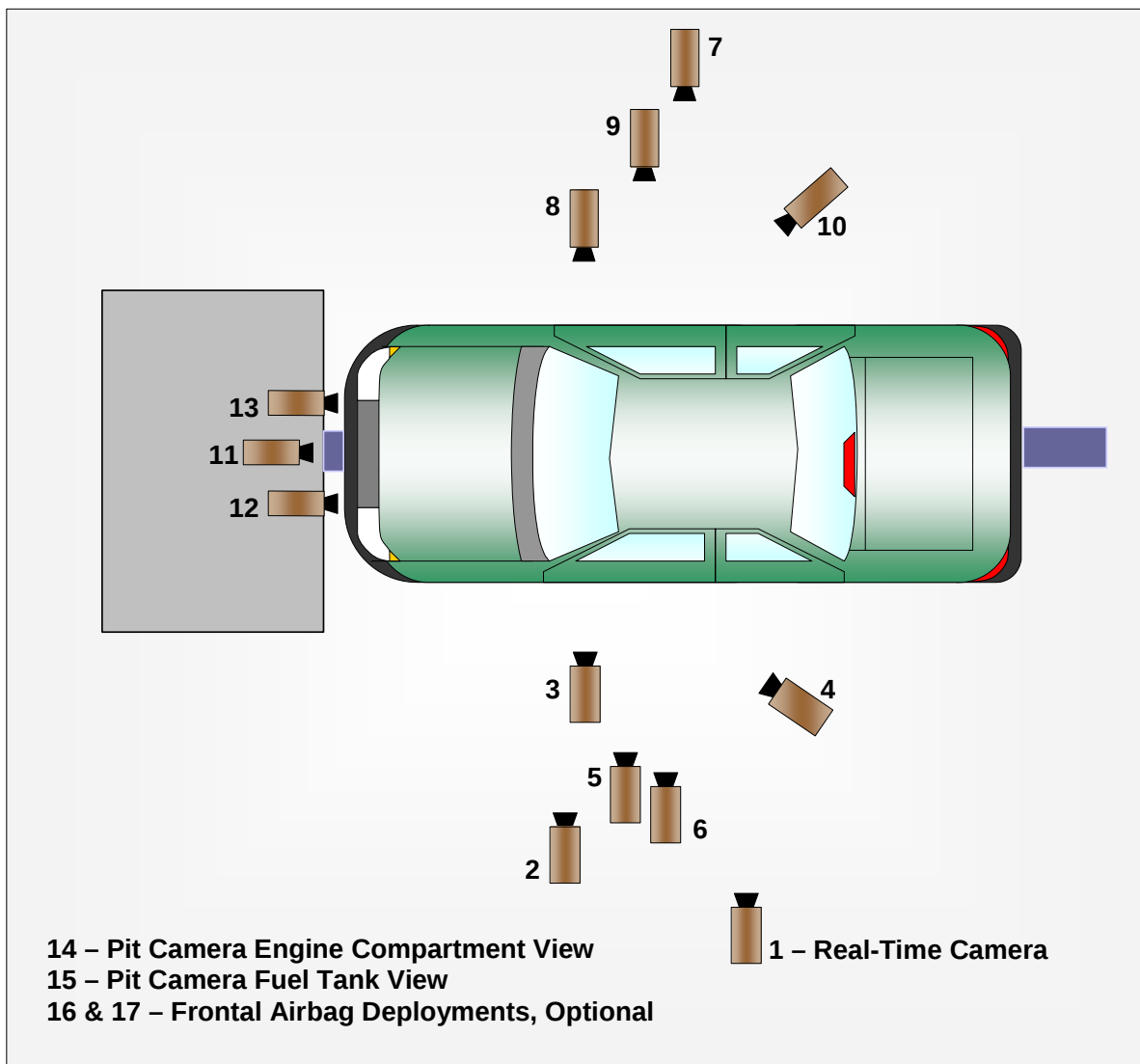
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	889	908
Lap Belt Length as measured on ATD	mm	873	775
Remainder of belt on reel	mm	1368	1427
Total Belt Length for Continuous Webbing Systems	mm	3130	3110

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

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
Test Date: 12/14/11

CAMERA POSITIONS FOR FRONTAL IMPACTS



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

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	1420	-6720	-1820	35	1000
3	Left Front Half	1120	-4980	-1110	24	1000
4	Left Angle	5690	-5010	-1940	50	1000
5	Steering Column - Top	680	-5350	-1230	24	1000
6	Steering Column - Bottom	610	-5380	-830	24	1000
7	Right Overall	2170	6610	-1080	20	1000
8	Passenger Close-Up	1410	6810	-1830	35	1000
9	Right Front Half	1160	4950	-1080	24	1000
10	Right Angle	5870	4970	-1930	50	1000
11	Windshield	-130	0	-2810	24	-
12	Driver Windshield	-250	-450	-2030	12.5	1000
13	Passenger Windshield	-250	450	-2030	12.5	-
14	Pit Front	1270	0	3150	24	1000
15	Pit Rear	2760	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

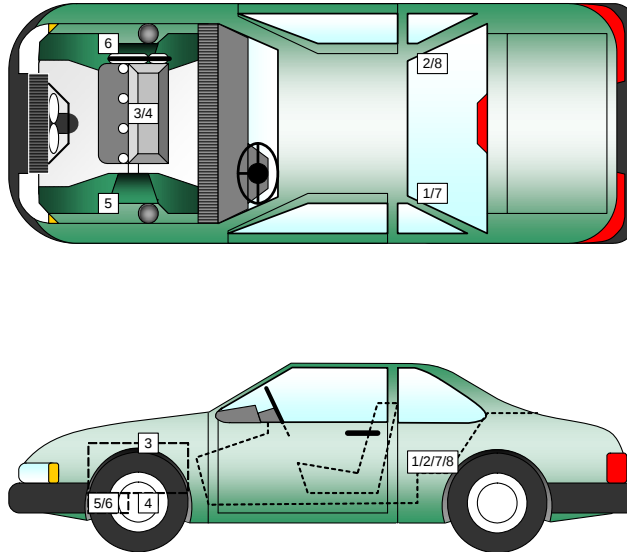
Cameras 16 and 17 were not used for this test.

Cameras 11 and 13 did not run during the test.

DATA SHEET NO. 7
VEHICLE ACCELEROMETER DATA

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
Test Date: 12/14/11



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Accelerometer – X Direction	1854	-565	-458
2	Right Rear Accelerometer – X Direction	1854	540	-458
3	Engine Top X	3930	0	-897
4	Engine Bottom X	3913	0	-363
5	Left Brake Caliper X	2538	-722	-310
6	Right Brake Caliper X	2538	722	-310
7	Left Rear Accelerometer Redundant – X Direction	1854	-565	-458
8	Right Rear Accelerometer Redundant – X Direction	1854	540	-458

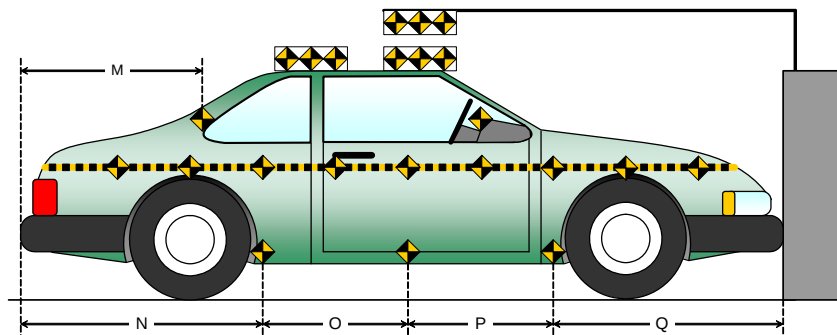
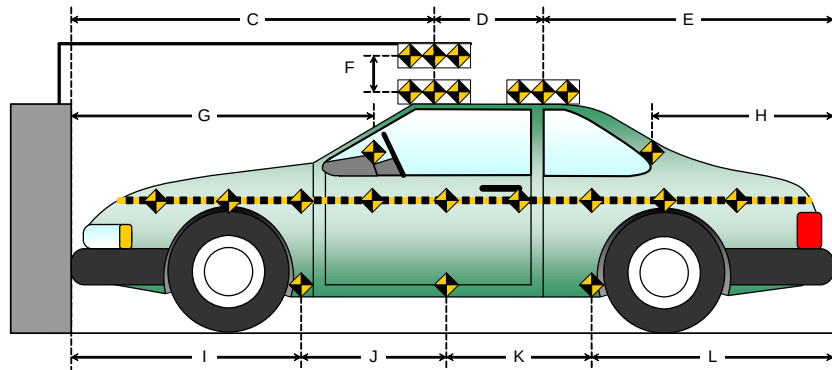
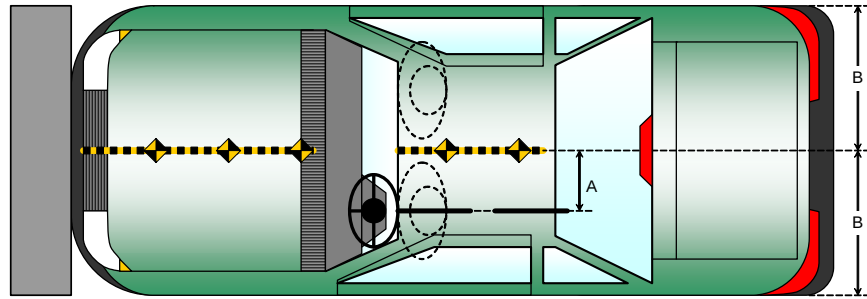
Reference Points: X - Rear Surface of Vehicle (+ forward)
Y - Vehicle Centerline (+ to right)
Z - Ground Plane (+ down)

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

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

Item	Value (mm)
A	395
B	923
C	2274
D	670
E	1712
F	100
G	
H	1216
I	1407
J	870
K	870
L	1509
M	1216
N	1509
O	870
P	870
Q	1407

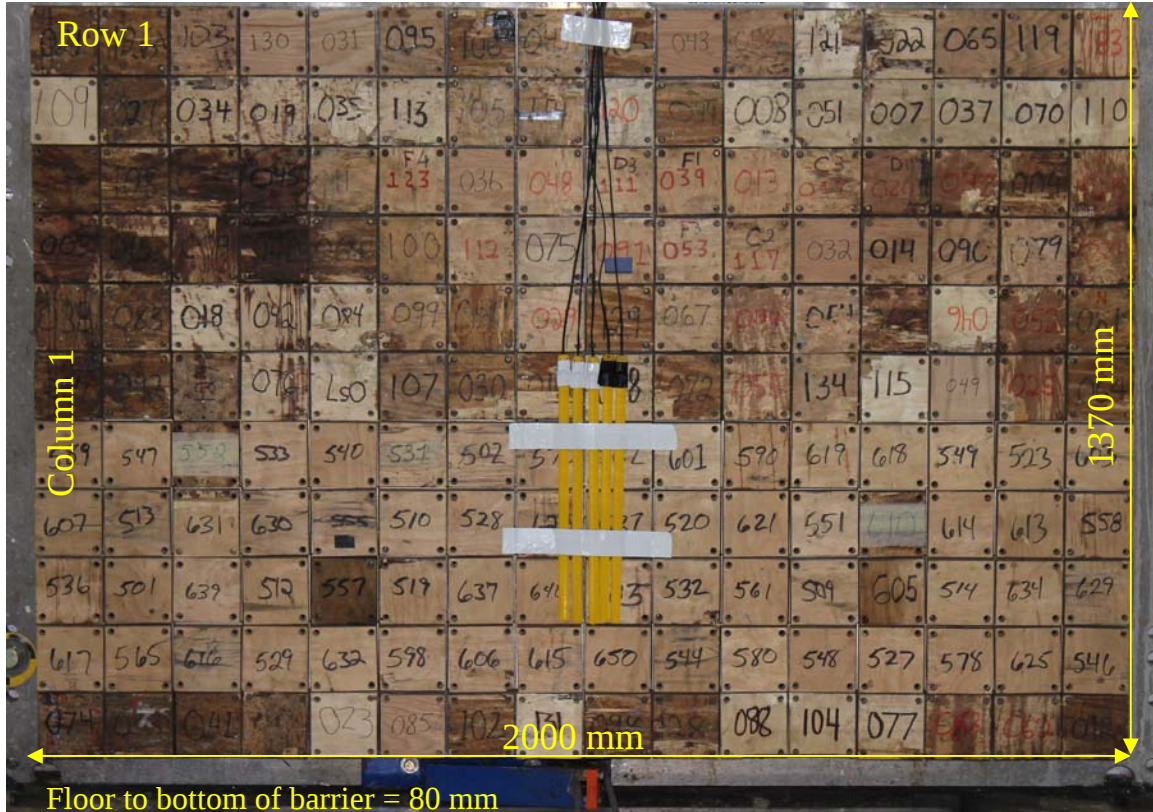


DATA SHEET NO. 9 **LOAD CELL LOCATIONS ON FIXED BARRIER**

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

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 Santa Fe GLS AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
Test Date: 12/14/11

INSTRUMENTATION

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

CAMERA COVERAGE

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

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

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
Test Date: 12/14/11

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

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

DOOR OPENING AND SEAT TRACK INFORMATION

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

POST TEST STRUCTURAL OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1322
Center	mm	1304
Right Side	mm	1253
Average	mm	1293

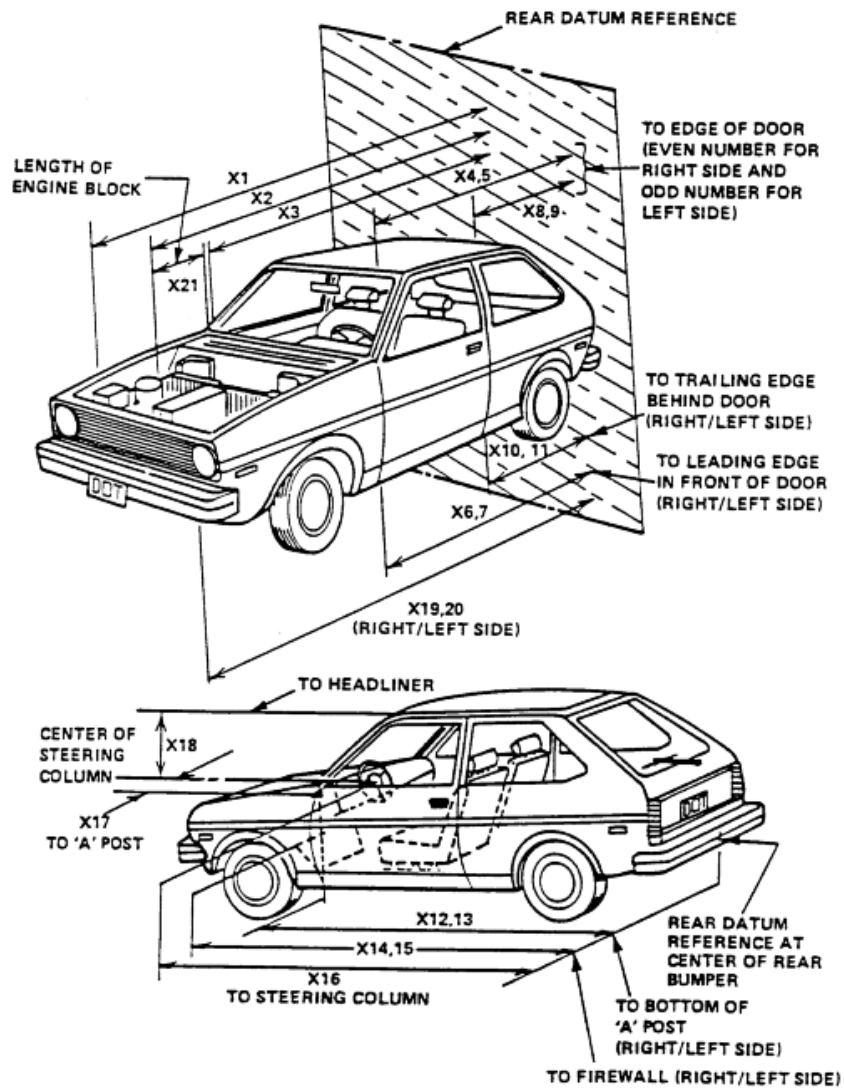
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Right Front (Passenger)	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Knee Airbag	No		No	
Curtain Side Airbag	Yes	No	Yes	No
Torso/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 Santa Fe GLS AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
Test Date: 12/14/11



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4656	4062	594
2	RSOV to Front of Engine	mm	4146	3948	198
3	RSOV to Firewall	mm	3554	3550	4
4	RSOV to Upper Leading Edge of Right Door	mm	3180	3180	0
5	RSOV to Upper Leading Edge of Left Door	mm	3180	3180	0
6	RSOV to Lower Leading Edge of Right Door	mm	3166	3165	1
7	RSOV to Lower Leading Edge of Left Door	mm	3166	3164	2
8	RSOV to Upper Trailing Edge of Right Door	mm	2122	2122	0
9	RSOV to Upper Trailing Edge of Left Door	mm	2122	2120	2
10	RSOV to Lower Trailing Edge of Right Door	mm	2135	2135	0
11	RSOV to Lower Trailing Edge of Left Door	mm	2135	2130	5
12	RSOV to Bottom of "A" Post of Right Side	mm	3192	3190	2
13	RSOV to Bottom of "A" Post of Left Side	mm	3185	3185	0
14	RSOV to Firewall, Right Side	mm	3504	3500	4
15	RSOV to Firewall, Left Side	mm	3504	3502	2
16	RSOV to Steering Column	mm	2697	2730	-33
17	Center of Steering Column to "A" Post	mm	373	357	16
18	Center of Steering Column to Headliner	mm	448	420	28
19	RSOV to Right Side of Front Bumper	mm	4498	4038	460
20	RSOV to Left Side of Front Bumper	mm	4498	4036	462
21	Length of Engine Block	mm	468	468	0
RD	RSOV to Right Side of Dash Panel	mm	2914	2910	4
CD	RSOV to Center of Dash Panel	mm	2934	2934	0
LD	RSOV to Left Side of Dash Panel	mm	2914	2914	0

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

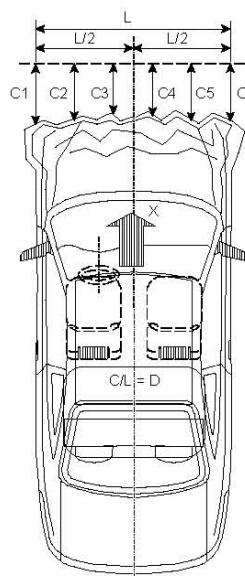
Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV NHTSA No.: MC0512
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/14/11

VEHICLE INFORMATION

VIN: 5XYZGDAB0CG100639 Wheelbase (mm): 2700
Vehicle Size Category: MPV Test Weight (kg): 1973.2

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): 56.5
Velocity Change (km/h): 64.6
Time of Separation (msec): 90.6



CRUSH PROFILE

Collision Deformation Classification: Frontal
Midpoint of Damage: Centerline
Damage Region Length (mm): 1237
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4498	4036	462
C2	Crush zone 2 at left side	mm	4570	4058	512
C3	Crush zone 3 at left side	mm	4604	4070	534
C4	Crush zone 4 at right side	mm	4604	4063	541
C5	Crush zone 5 at right side	mm	4570	4060	510
C6	Crush zone 6 at right side	mm	4498	4038	460
L	C1 TO C6	mm	1237	1225	12

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

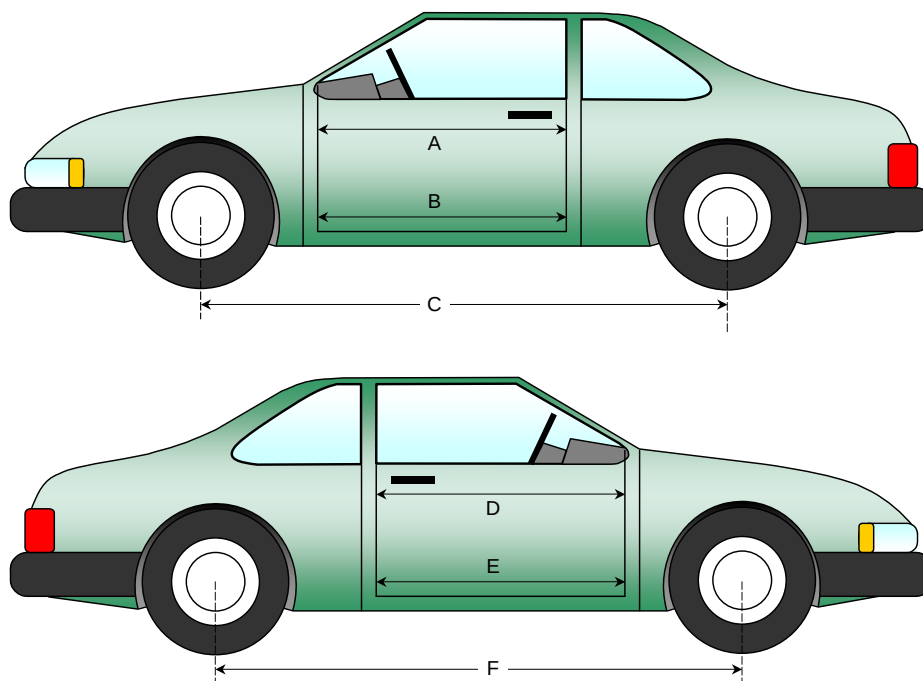
NHTSA No.: MC0512
 Test Date: 12/14/11

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	945	945	0
B	Left Side Lower	mm	838	838	0
D	Right Side Upper	mm	945	945	0
E	Right Side Lower	mm	838	838	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2700	2625	75
F	Right Side Wheelbase	mm	2700	2622	78



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

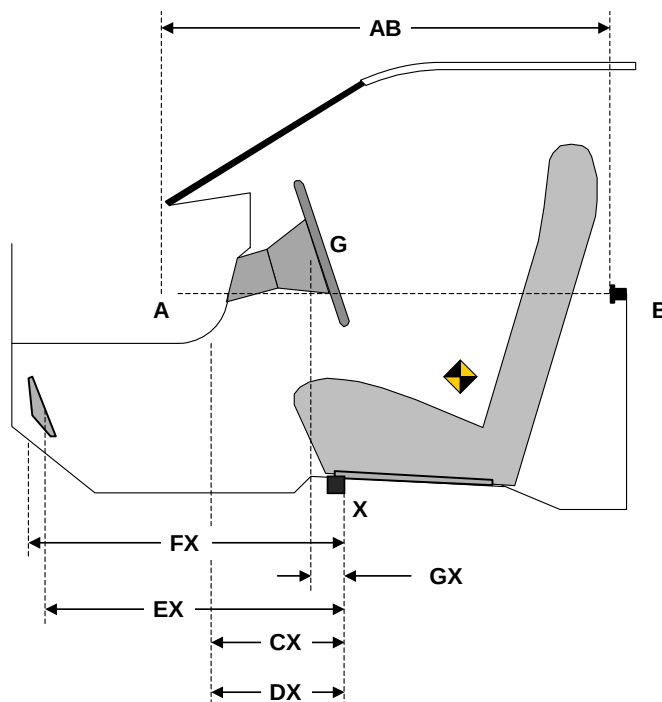
Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	689	686	3
CX	Left Knee Bolster to X	mm	258	271	-13
DX	Right Knee Bolster to X	mm	257	270	-13
EX	Brake Pedal to X	mm	534	520	14
FX	Foot Rest to X	mm	620	610	10
GX	Center of Steering Column Wheel Hub to X	mm	41	60	-19

X = Front of Seat Track (stationary)

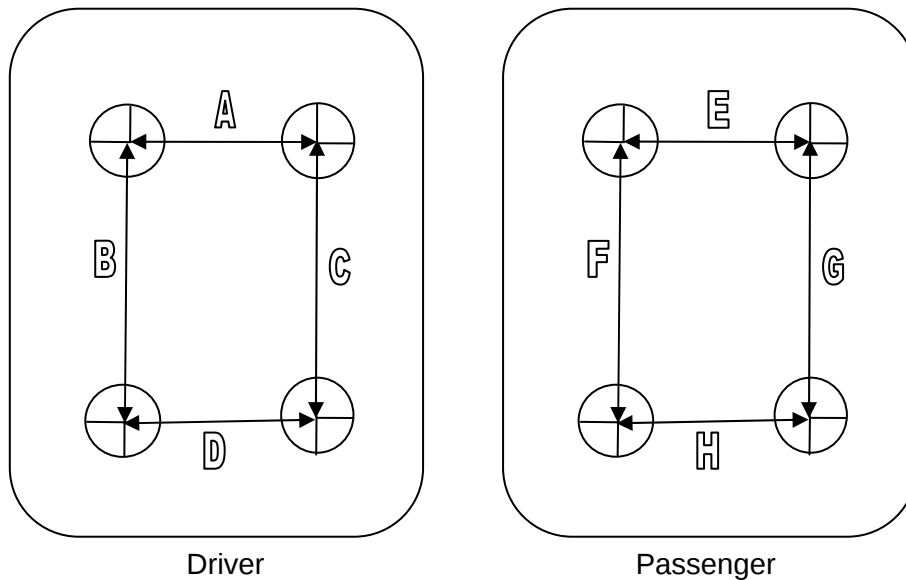


DRIVER COMPARTMENT

DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11



TOP VIEW THROUGH FLOOR PAN

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Units	Pre-Test	Post-Test	Difference
A	mm	280	280	0
B	mm	280	280	0
C	mm	280	277	3
D	mm	280	280	0
E	mm	280	280	0
F	mm	280	280	0
G	mm	280	280	0
H	mm	280	280	0

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

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

Windshield Mounting Details:

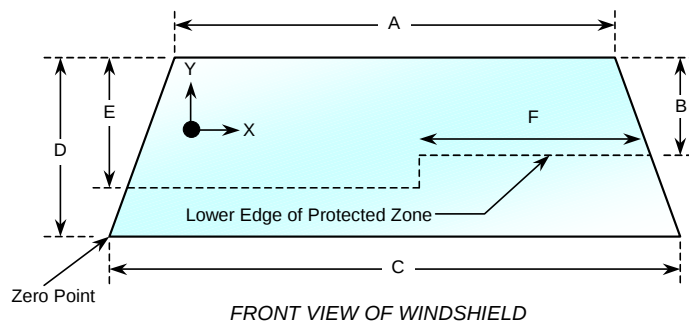
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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: 21.5°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2153	2153	100
Right Side	2153	2153	100
Total	4306	4306	100



Item	Units	Value
A	mm	1216
B	mm	405
C	mm	1407
D	mm	810
E	mm	510
F	mm	566

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 Santa Fe GLS AWD SUV</u>	NHTSA No.:	<u>MC0512</u>
Test Program:	<u>NCAP Frontal Barrier Impact Test</u>	Test Date:	<u>12/14/11</u>

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Test Time: 12:52 pm

Temperature: 21.5° 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> |

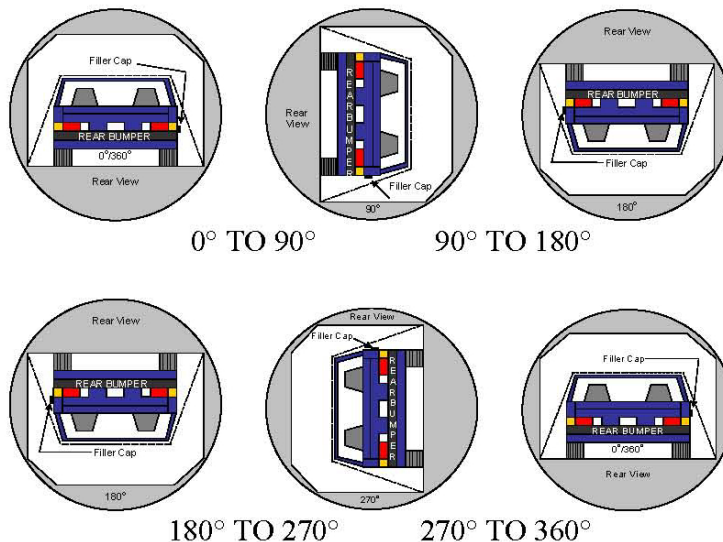
DATA SHEET NO. 16

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2012 Hyundai Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11

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°	120	300	420
90° to 180°	115	300	415
180° to 270°	109	300	409
270° to 360°	118	300	418

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

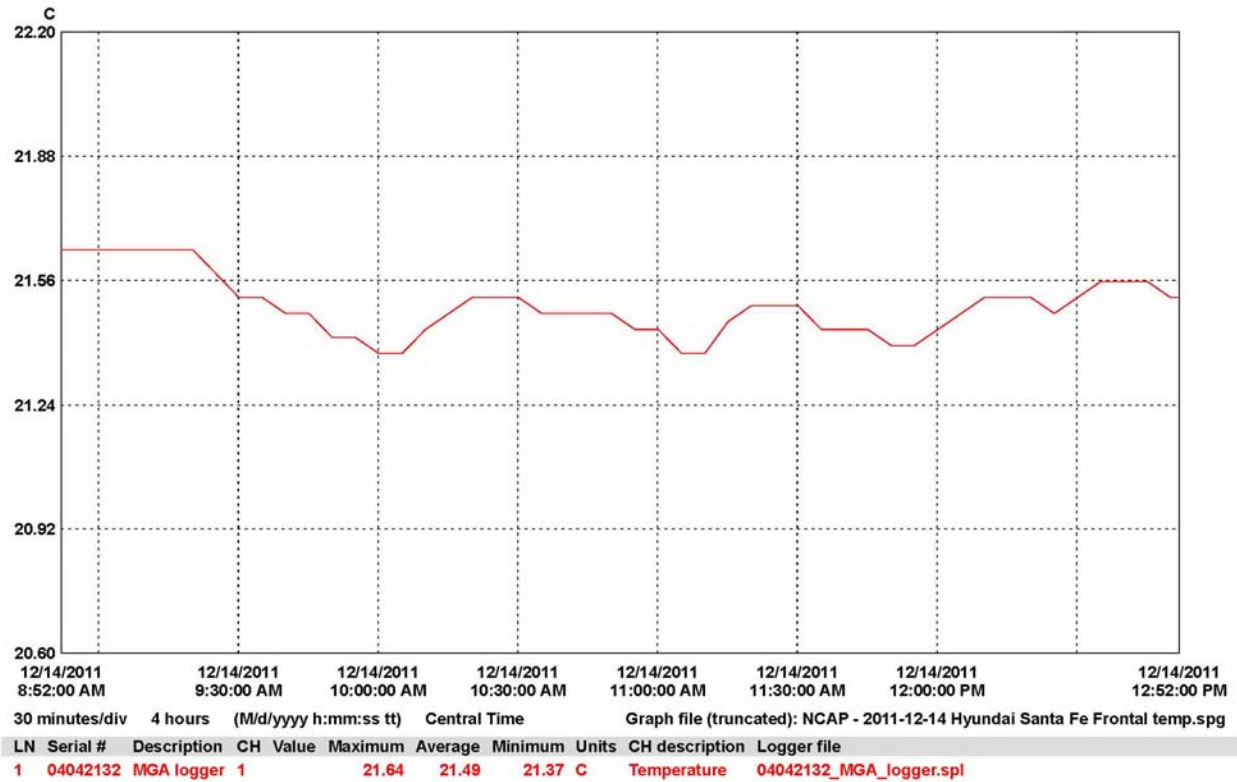
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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 Santa Fe GLS AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0512
 Test Date: 12/14/11



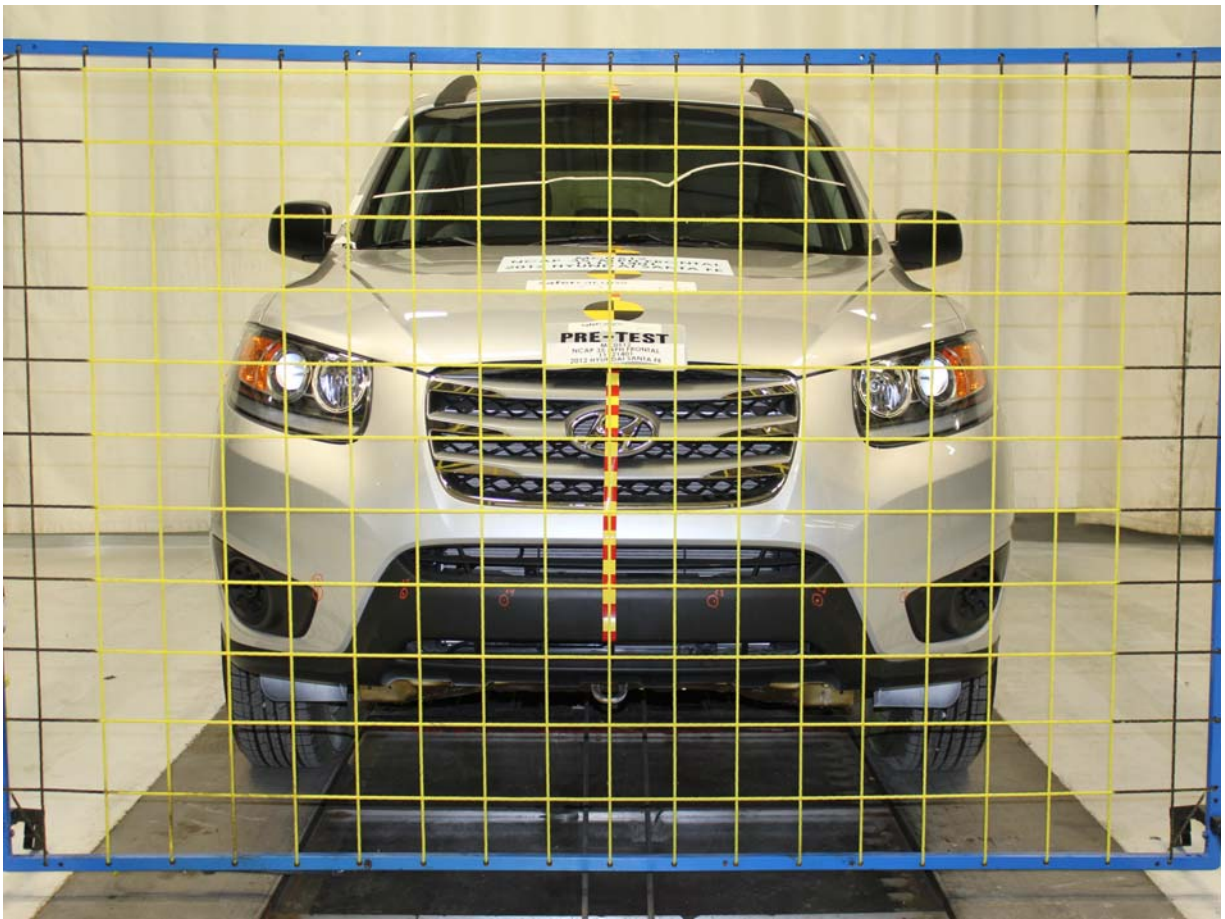
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Load Cell Location



Load Cell Wall



Manufacturer's Label



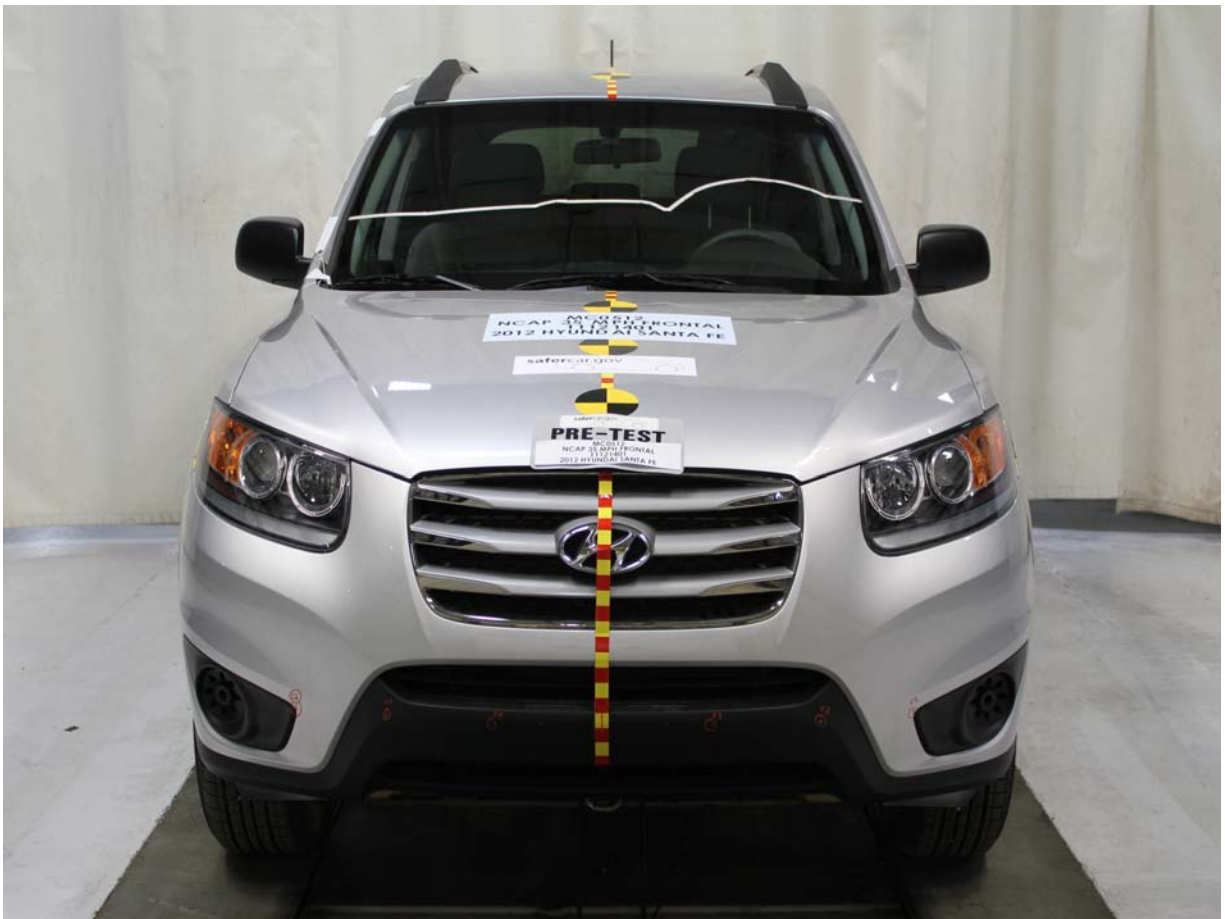
Tire Placard



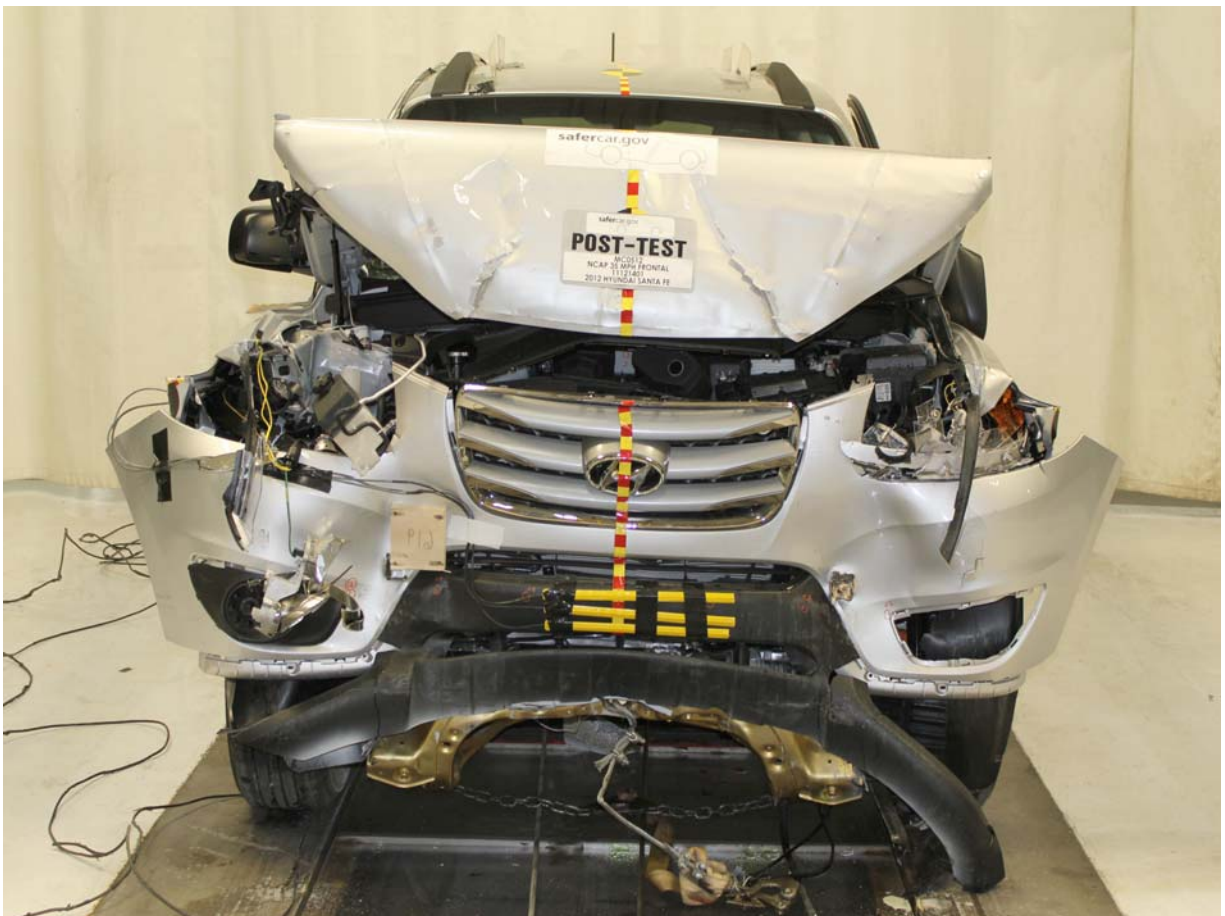
2012 Hyundai Santa Fe Frontal As Delivered



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



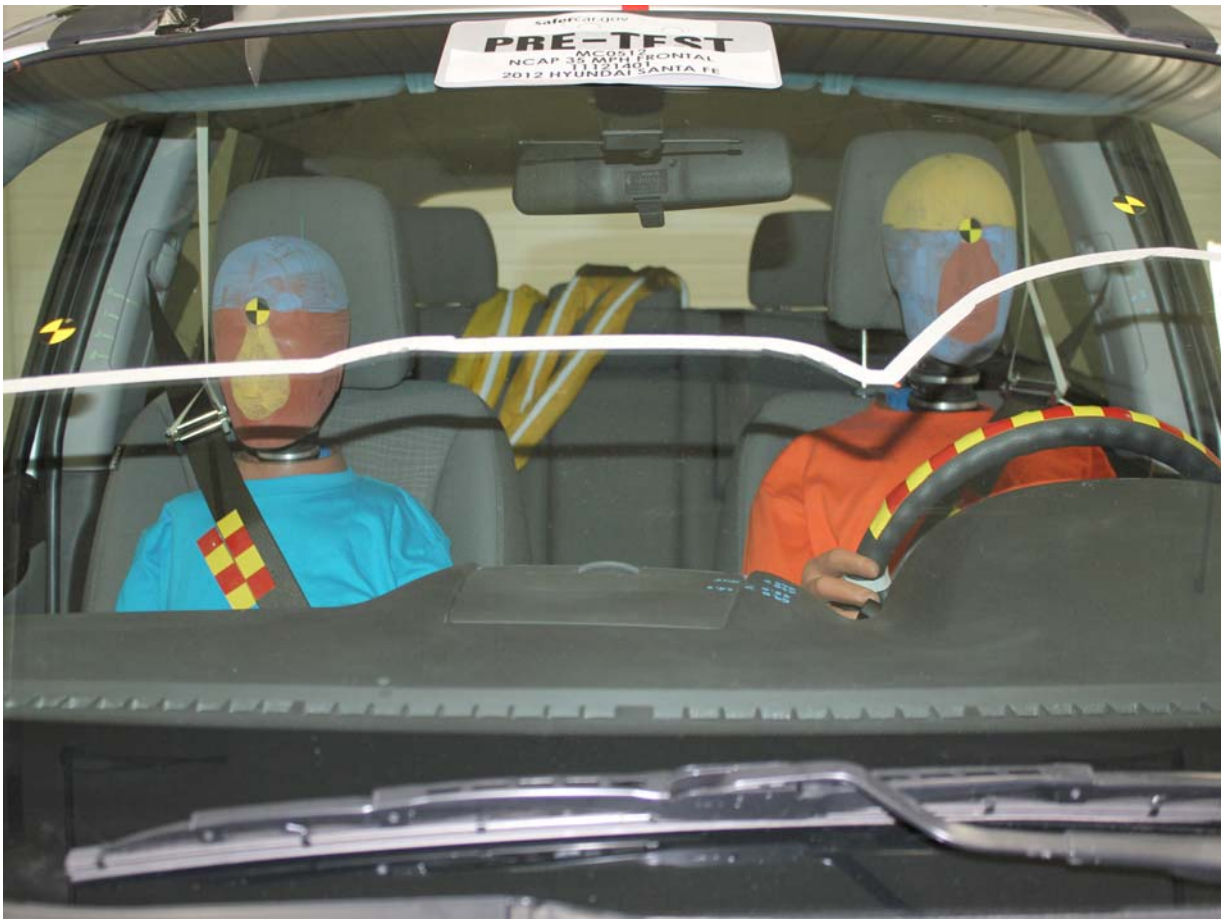
Post-Test Right Front Three-Quarter View



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



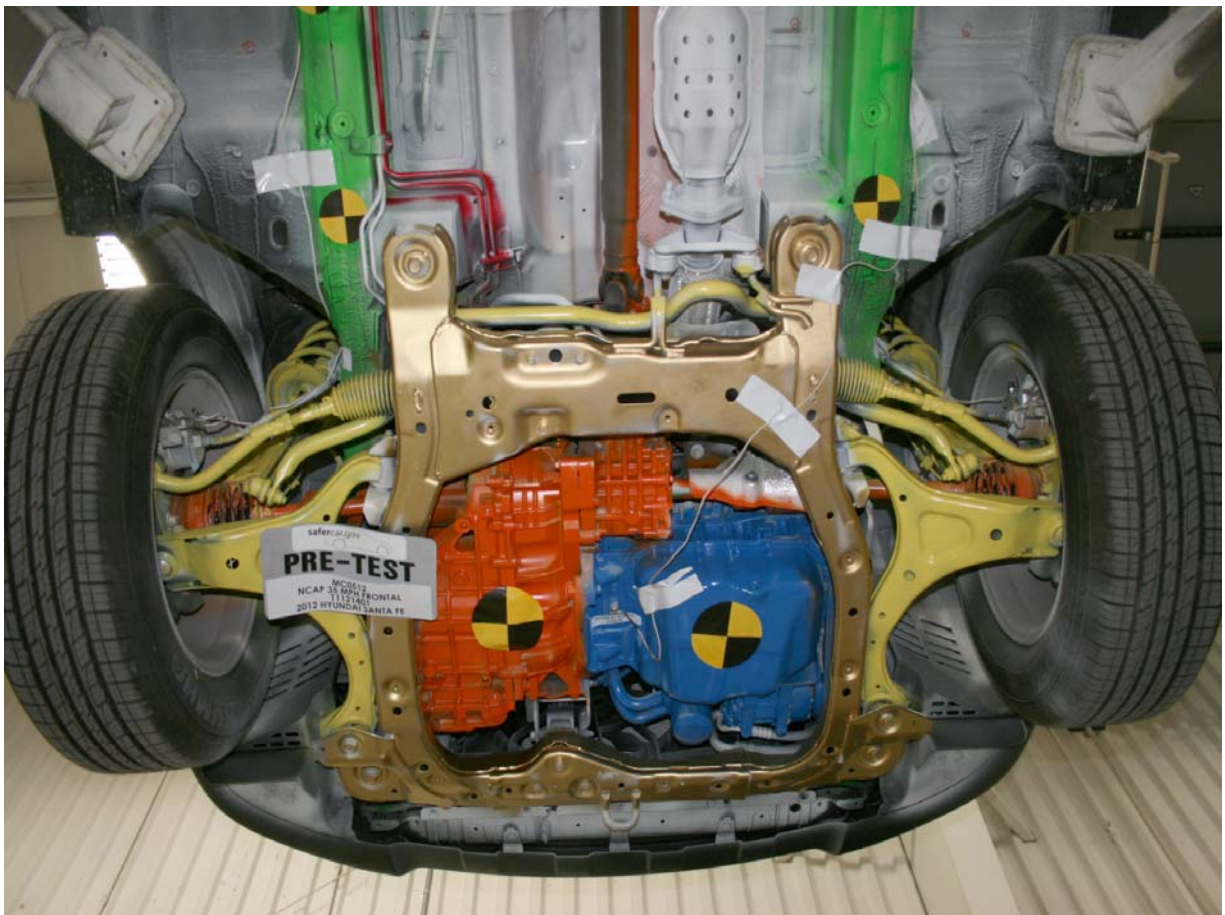
Post-Test Engine Compartment View



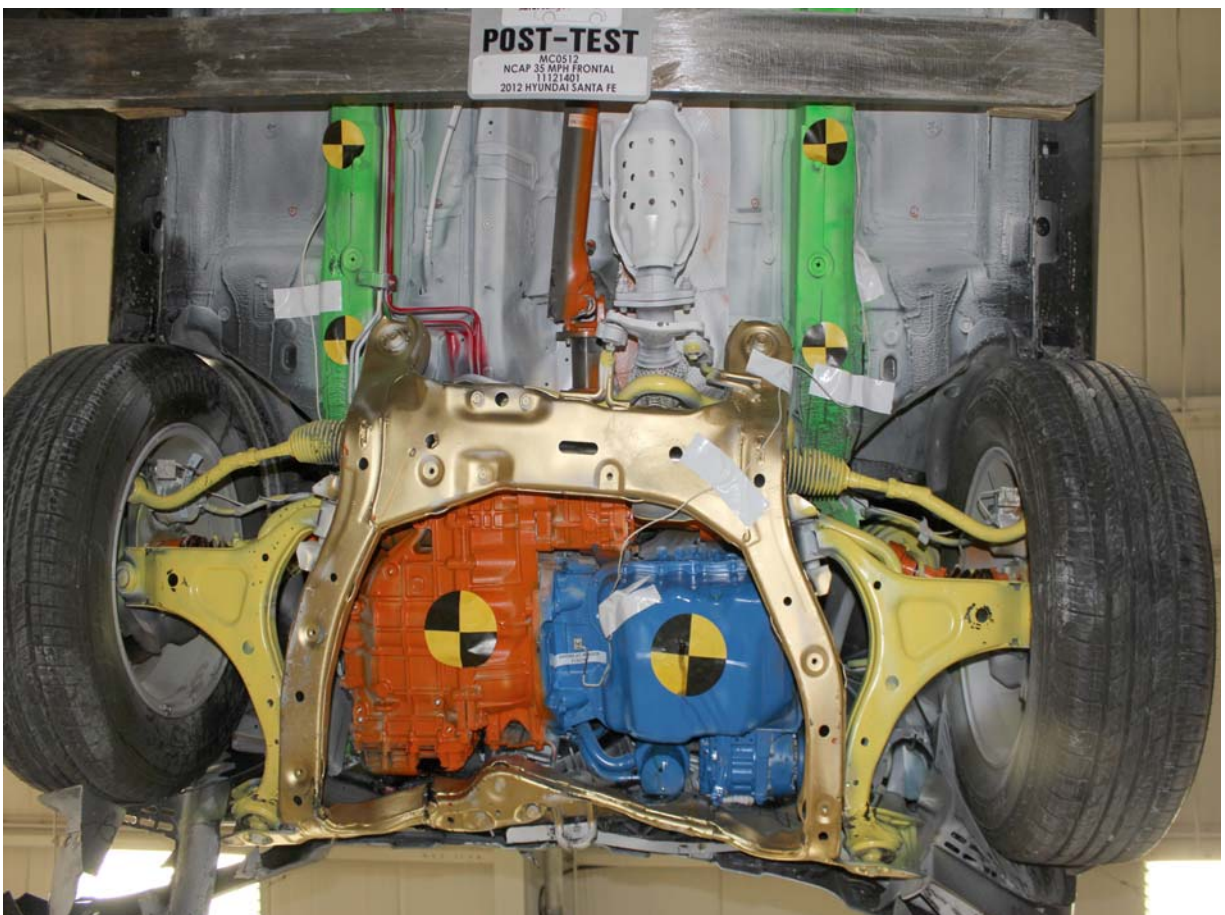
Pre-Test Fuel Filler Cap View



Post-Test Fuel Filler Cap View



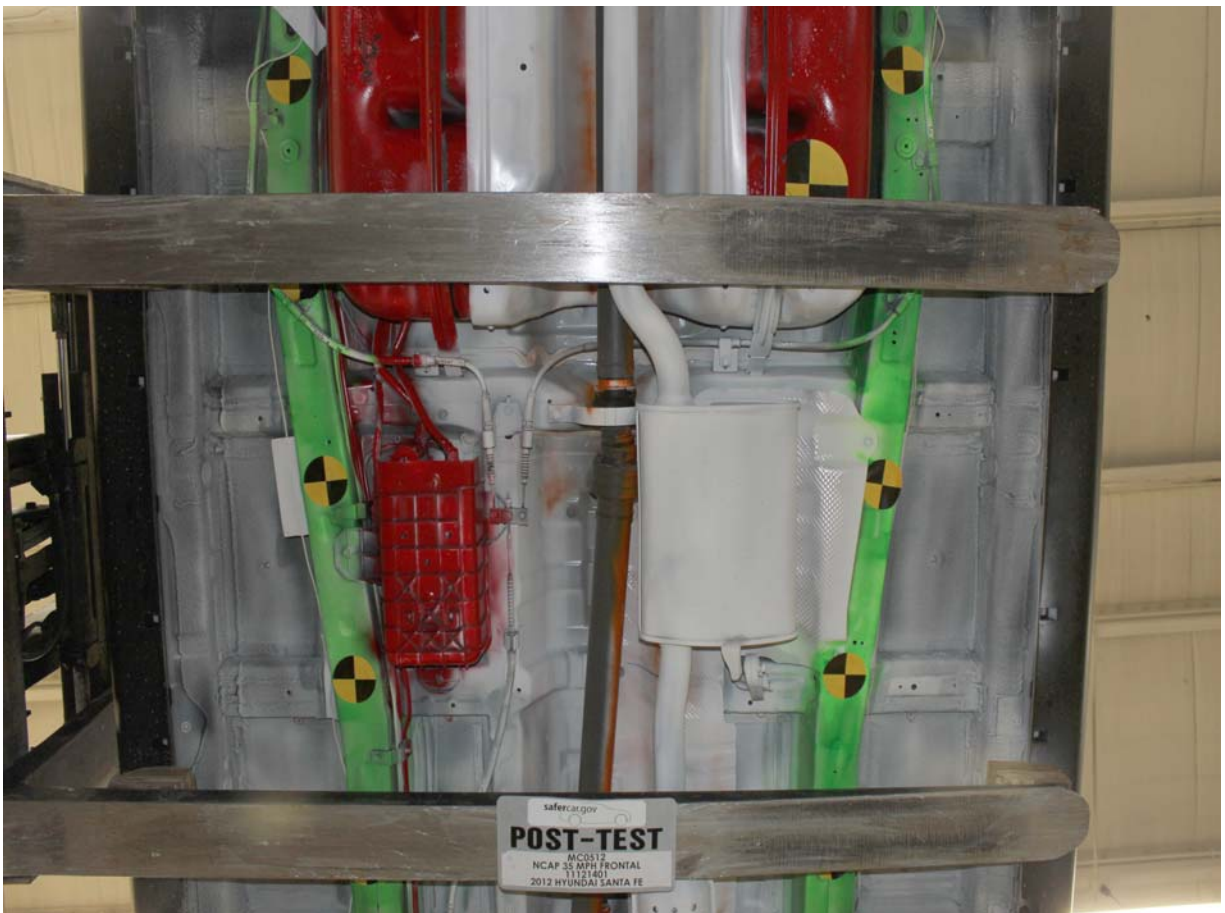
Pre-Test Front Underbody View



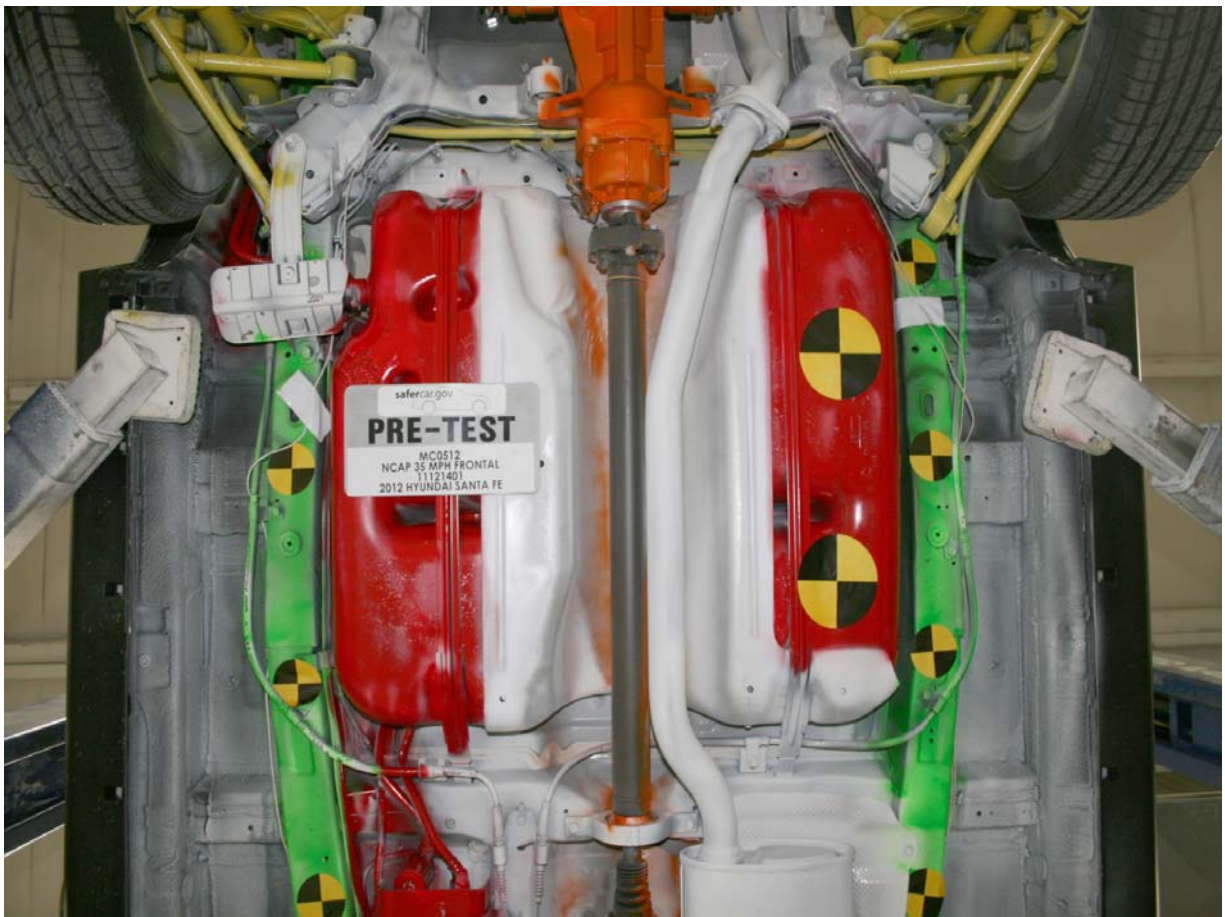
Post-Test Front Underbody View



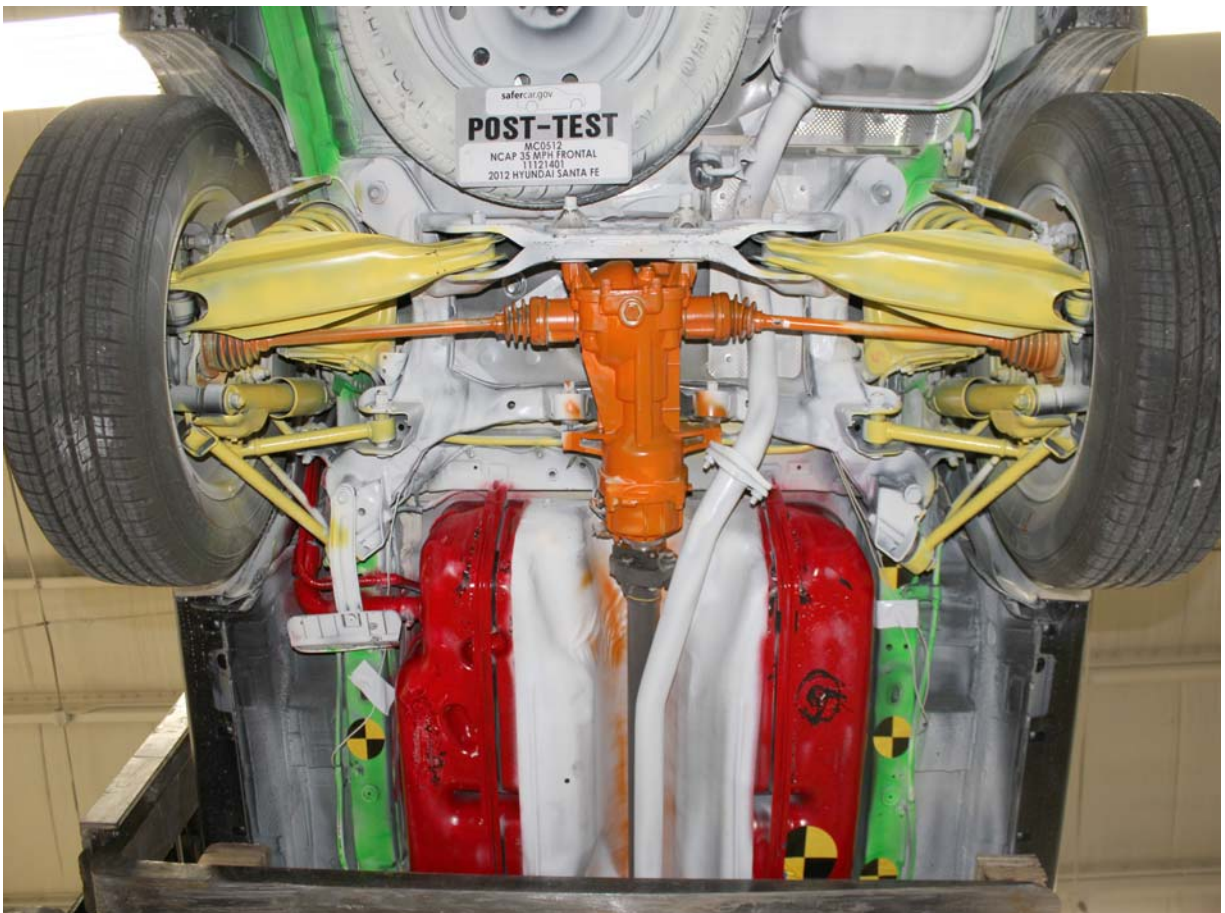
Pre-Test Mid Front Underbody View



Post-Test Mid Front Underbody View



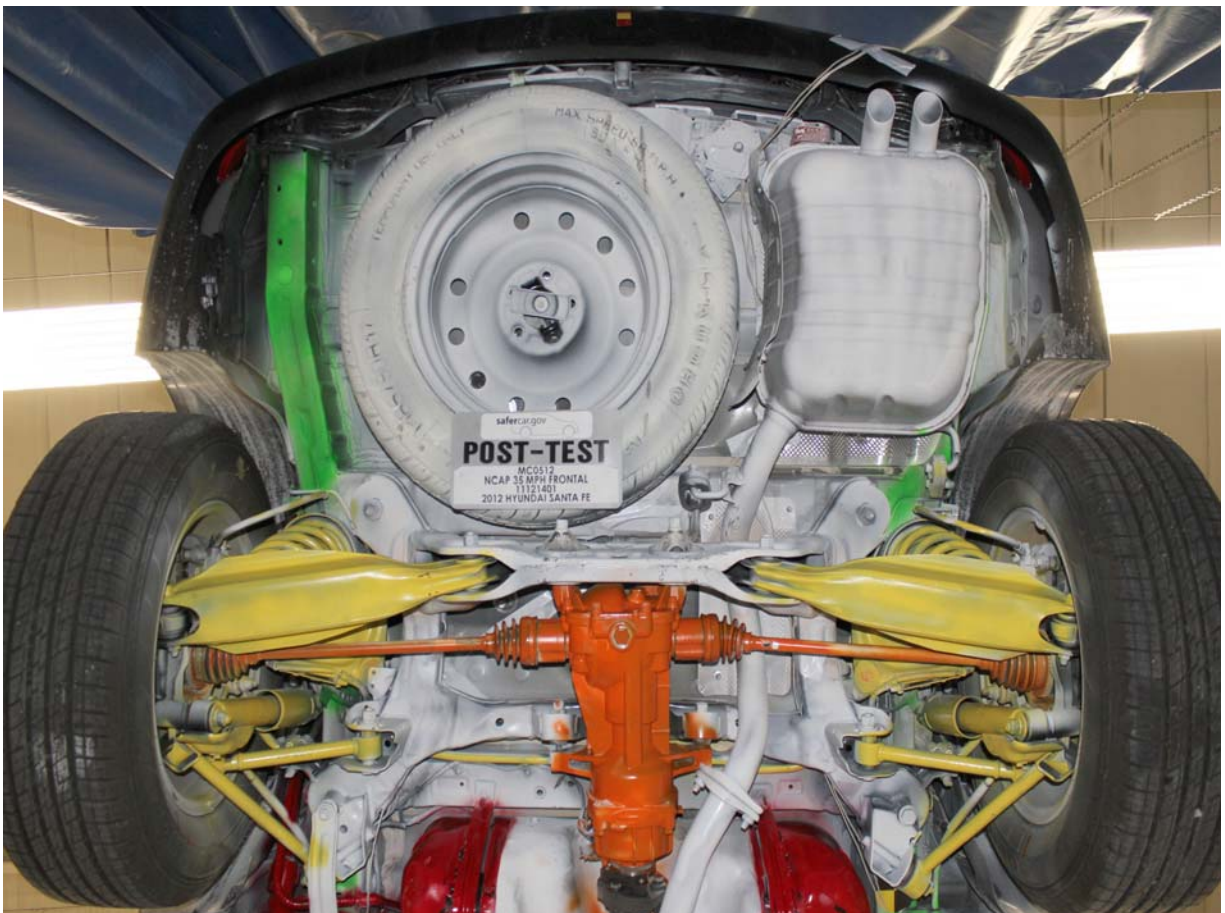
Pre-Test Mid Rear Underbody View



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)



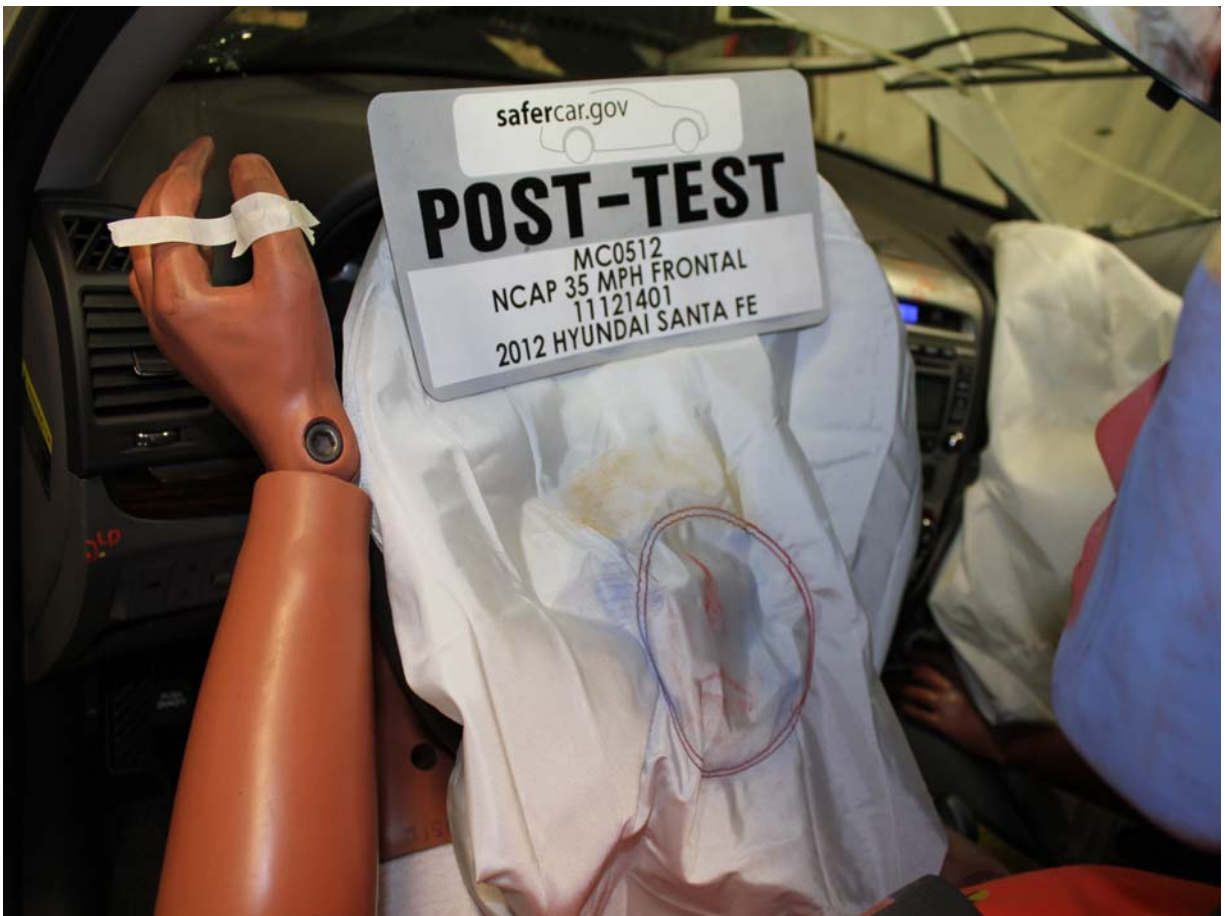
Pre-Test Driver's Side Floorpan



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 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



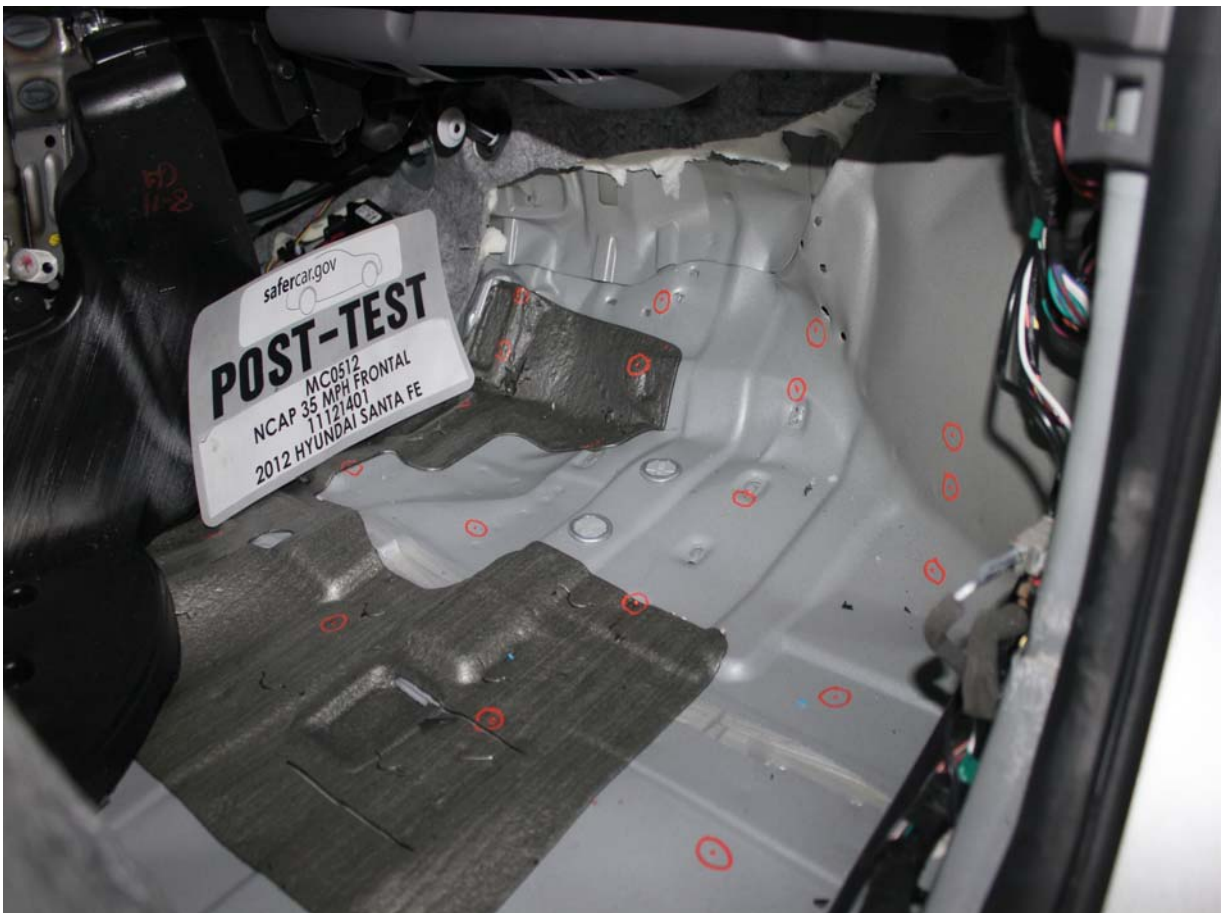
Pre-Test Passenger's Side Knee Bolster (without dummy)



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



Pre-Test Passenger's Side Floorpan



Post-Test Passenger's Side Floorpan



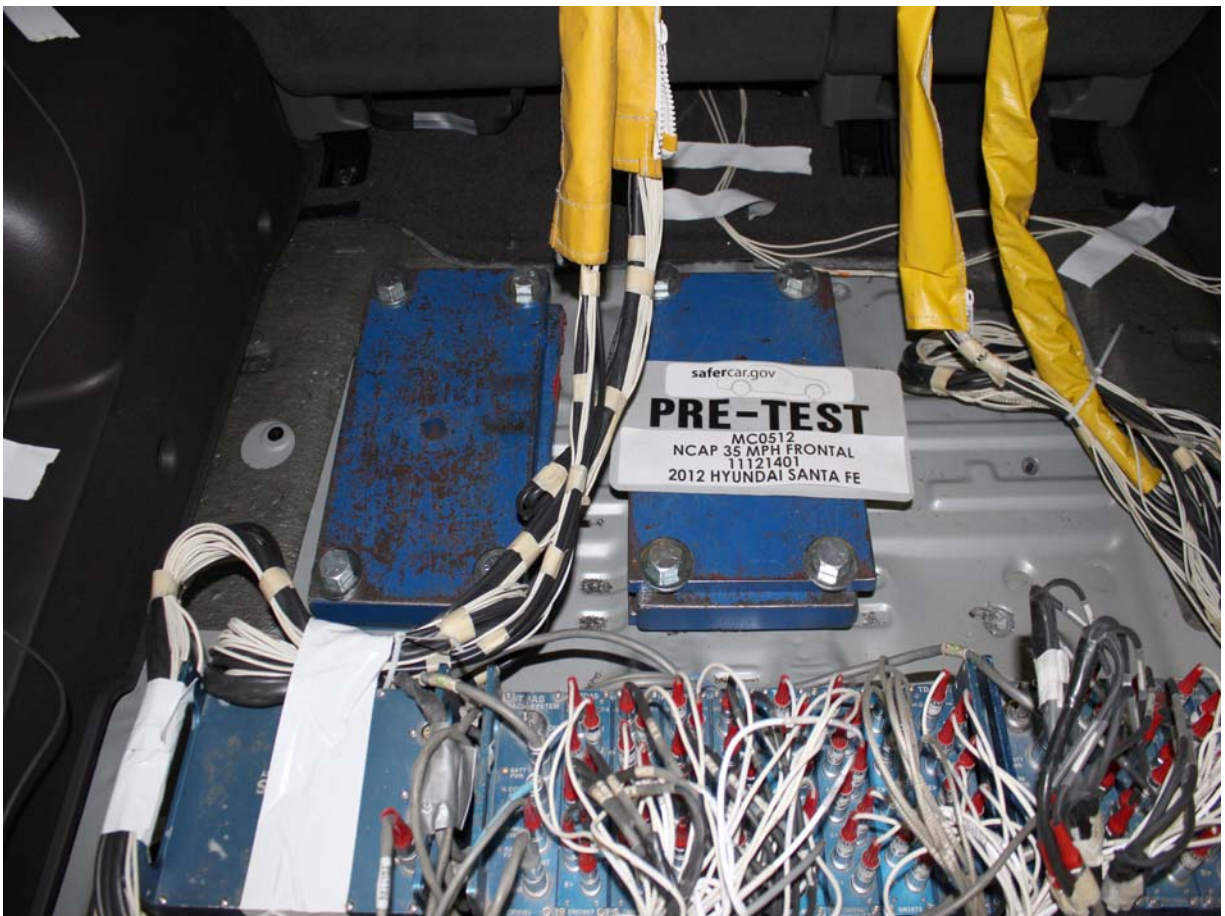
Post-Test Passenger Dummy Contact with Airbag



Post-Test Passenger Dummy Contact with Headrest



Post-Test Passenger Dummy Contact with Knee Bolster



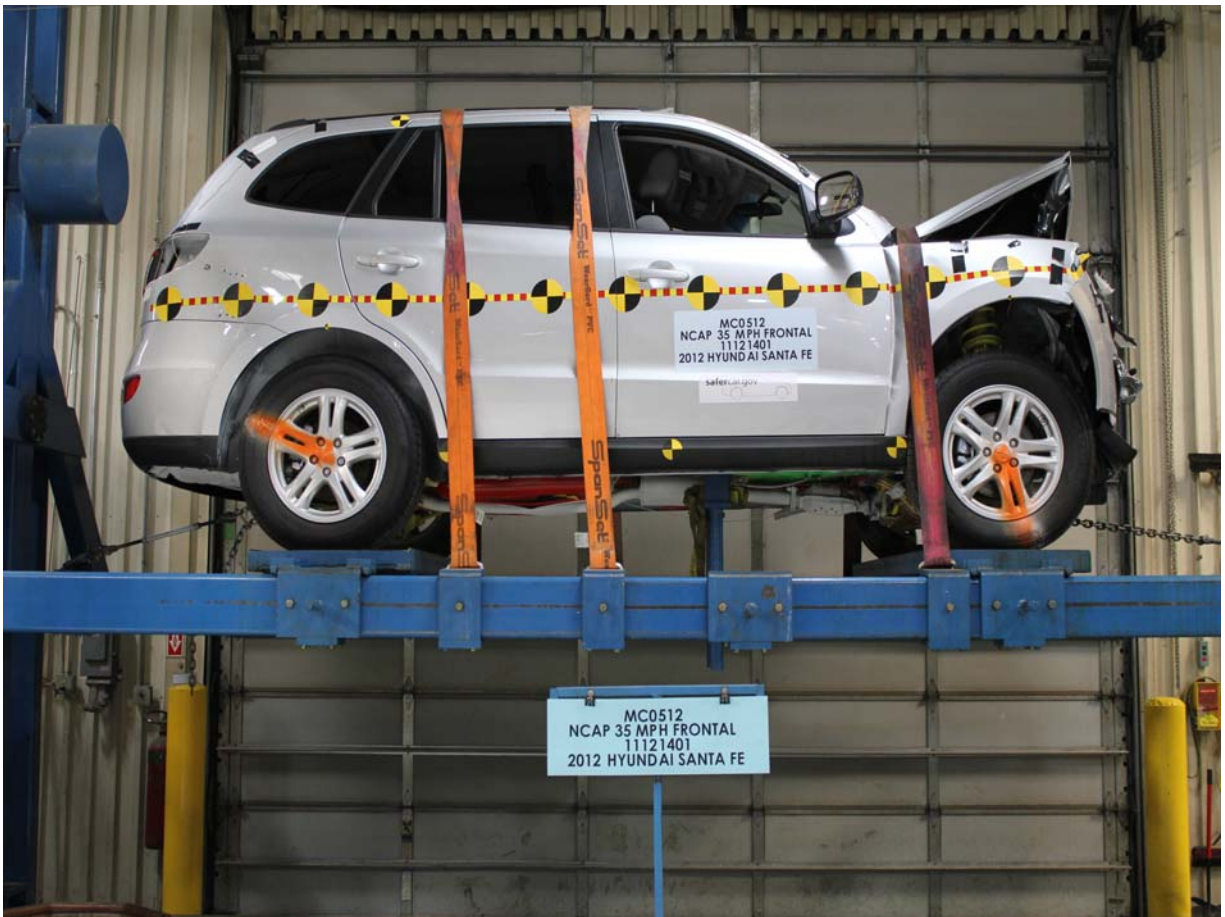
Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

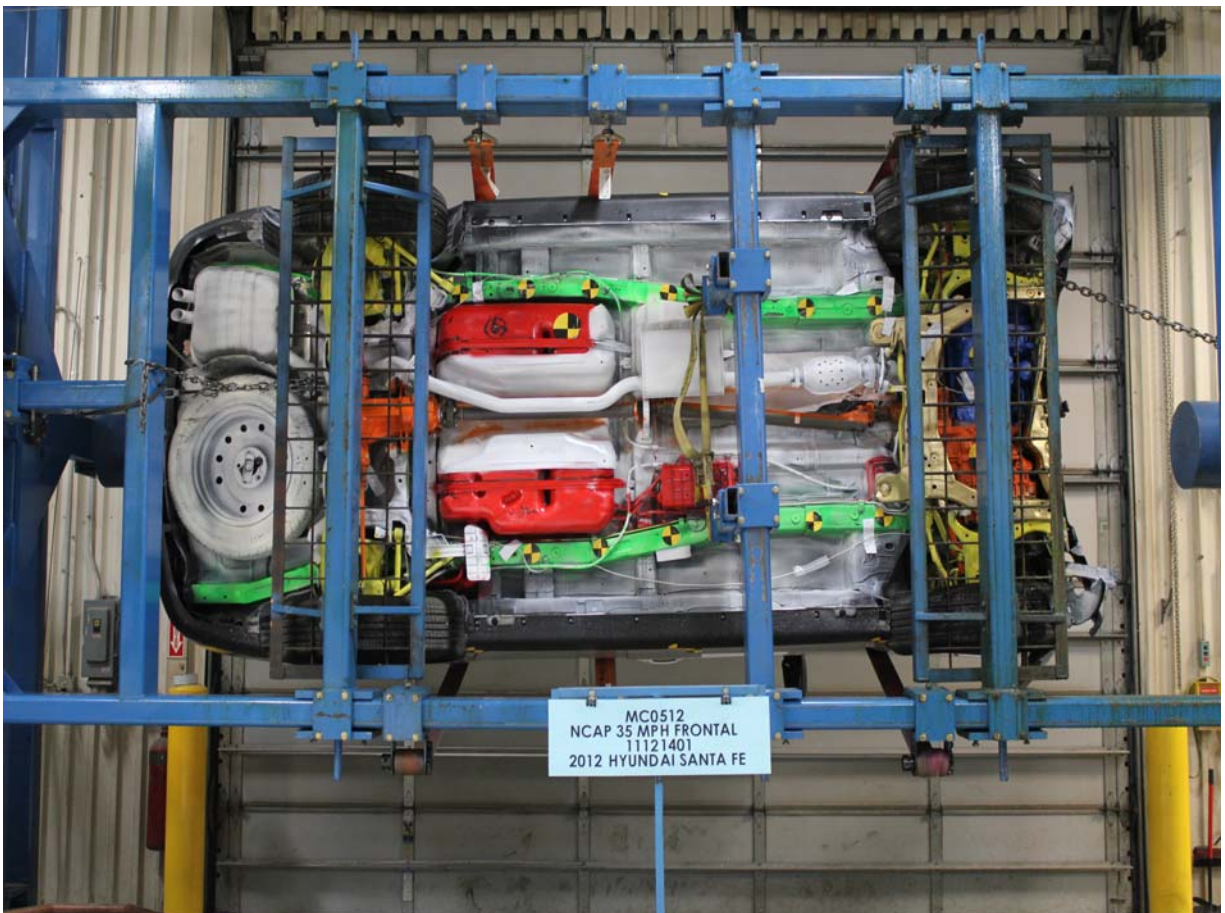
Post-Test Stoddard Solvent Spillage Location View



Post-Test Speed Trap Read-Out



Vehicle at 0 Degrees on Static Rollover Device



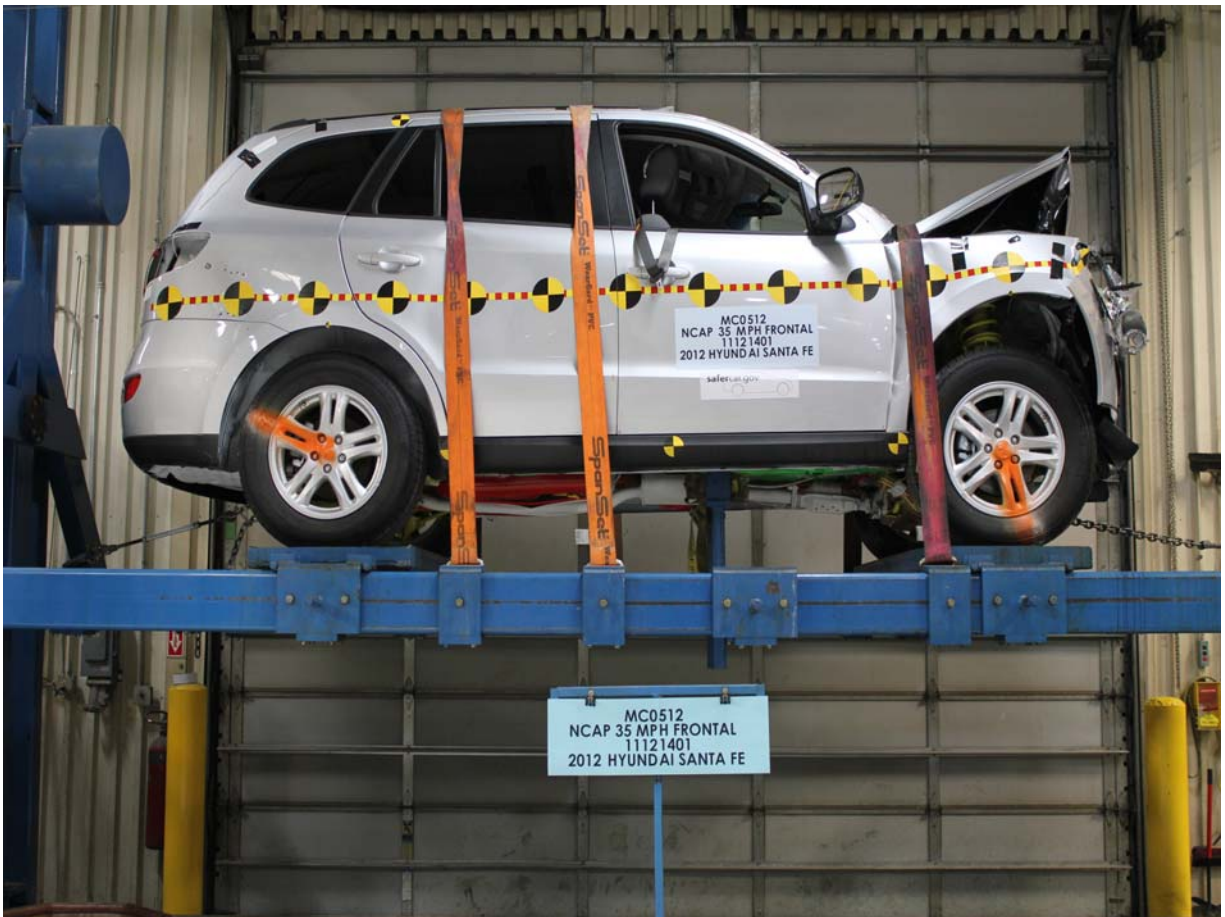
Vehicle at 90 Degrees on Static Rollover Device



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 Santa Fe Frontal Impact Event

HYUNDAI

2012 SANTA FE GLS AWD

Santa Fe is a highly rated crossover with award winning safety, style, & refinement

Q/3/10

SOLD TO: IL072
WORLD HYUNDAI MATTESON
 5337 MILLER CIRCLE DRIVE
 MATTESON IL 60443
SHIPPED TO: IL072

VIN: SKYJGDA00CG100639
MODEL: G2422A45
ENGINE: G4KEBK351378
PORT OF ENTRY: WP
EXTERIOR COLOR: MOONSTONE SILVER
INTERIOR COLOR: GRAY
MODE OF TRANSPORT: TRUCK
ACCESSORY WEIGHT: 12 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. 1201 et seq. which prohibits its removal or alteration prior to delivery to the ultimate purchaser.

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/performance Warranty
 *5-year/Unlimited-mile Roadside Assistance
 *Limited warranties, see dealer for details

ADVANCED SAFETY TECHNOLOGY
 *Electronic Stability Control w/ Traction Control System
 *ABS w/ Electronic Brake-Force Distribution & Brake Assist
 *Advanced Front Airbag System
 *Front Side-Impact Airbags
 *Side Curtain Airbags with Rollover Sensors
 *Tire Pressure Monitor System
 *Active Front Head Restraints

POWERTRAIN TECHNOLOGY
 *2.4L DOHC 16-Valve 4-cylinder Engine
 *6-Spd Automatic Transmission w/ SHIFTRONIC® Shift Function
 *Electronic All Wheel Drive
 *Downhill Brake Control
 *17" Alloy Wheels w/ Low Rolling Resistance Tires

COMFORT & CONVENIENCE
 *Air Conditioning with Cabin Air Filter
 *AM/FM/CD/MP3 Audio System w/ iPod®/USB/Aux Input Jacks
 *XM® Satellite Radio w/50 Day Trial; Not Available in AK & HI
 *Integrated Bluetooth® Hands-Free Phone System
 *Steering-Wheel-Mounted Audio & Cruise Controls
 *18-and-Telescopic Steering Wheel
 *Premium Seat Cloth
 *Driver Seat Adjustable Lumbar Support
 *60/40 Split Folding Rear Seat with Auto-Fold Head Restraints
 *Keyless Entry/Brake-in with Alarm
 *Black Manual-Folding Heated Power Mirrors
 *Power Door & Luggage Locks
 *Multi-Function Trip Computer
 *Power Windows with Driver's Auto Up / Down
 *Front Solar Glass and Rear Privacy Glass
 *Rear Wiper with Washer
 *Full Tank of Gas

Manufacturer's Suggested Retail Price

ADDED FEATURES

*Carpeted Floor Mats	\$125.00
*Cargo Net	\$50.00
*Tire Aid Kit	\$25.00
*Pod® Cable	\$35.00
*Remote Start System	\$350.00
*Wheel Locks	\$50.00

Inland Freight & Handling : \$810.00
Total Price : \$26,370.00

PART CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE: U.S./CANADIAN PARTS CONTENT: 55 %
 MAJOR SOURCES OF FOREIGN PARTS CONTENT: Korea 45 %

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

FOR THIS VEHICLE: FINAL ASSEMBLY POINT: West Point, Georgia U.S.
 COUNTRY OF ORIGIN: ENGINE: Korea TRANSMISSION: U.S.A.

Environmental Performance
 Protect the Environment. Choose vehicles with higher scores:

Global Warming Score

Average new vehicle

Smog Score

Average new vehicle

Vehicles 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

EPA Fuel Economy Estimates

CITY MPG

20

Expected range for most drivers 16 to 24 MPG

Estimated Annual Fuel Cost
\$ 2047.00
based on 15,000 miles at \$3.00 per gallon

Combined Fuel Economy

22

This Vehicle

10 32 All SUVs

HIGHWAY MPG

25

Expected range for most drivers 20 to 30 MPG

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

GOVERNMENT SAFETY RATINGS

Frontal Crash	Driver Passenger	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	★★★★	
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).		

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

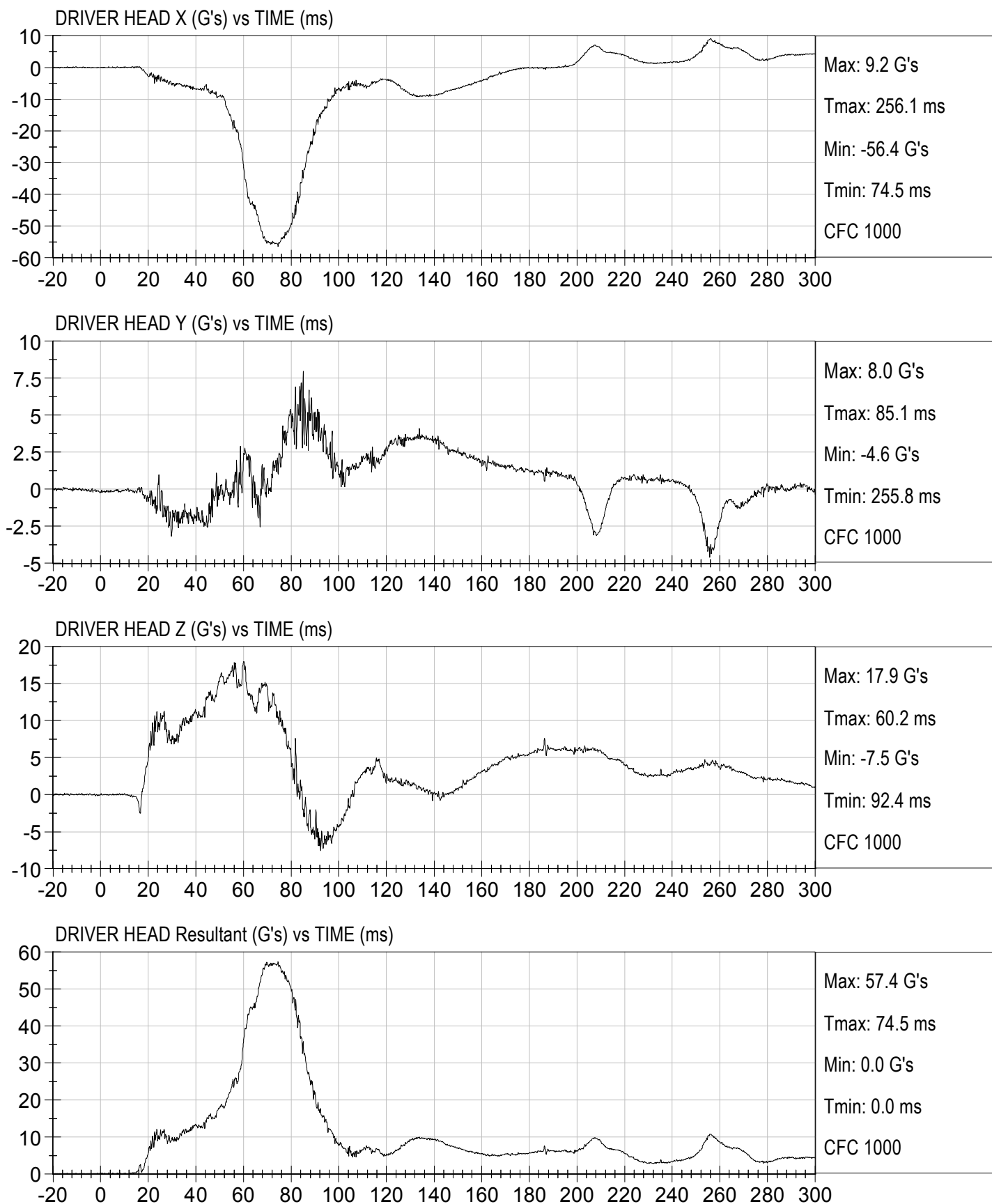
	<u>Page No.</u>
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Figure No. 29. Passenger Neck Force Z vs. Time	B-10
Figure No. 30. Passenger Neck Moment Y vs. Time	B-10
Figure No. 31. Passenger Nij (NTF) vs. Time	B-11
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Figure No. 34. Passenger Nij (NCE) vs. Time	B-11
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Figure No. 36. Passenger Right Femur Force vs. Time	B-12

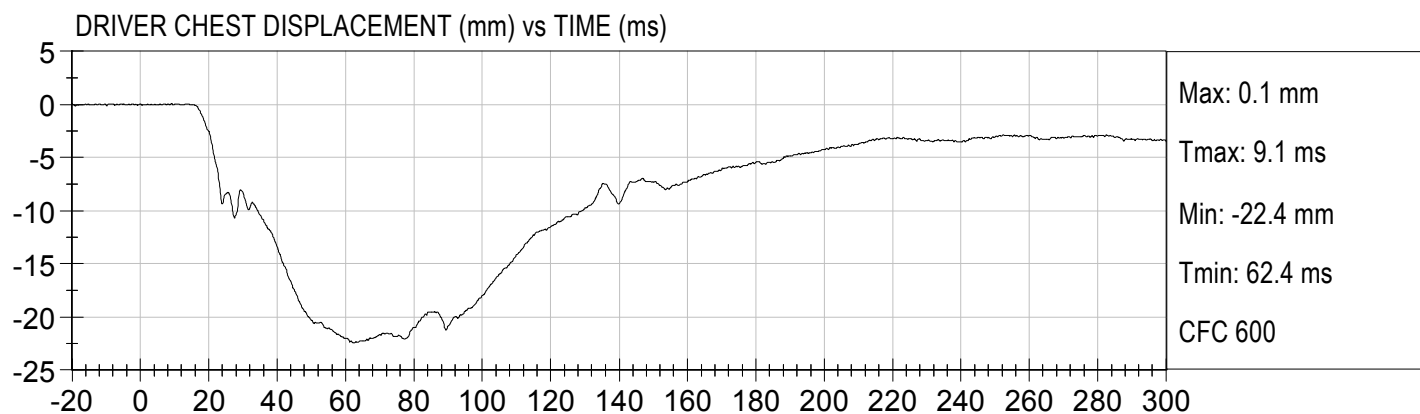
The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

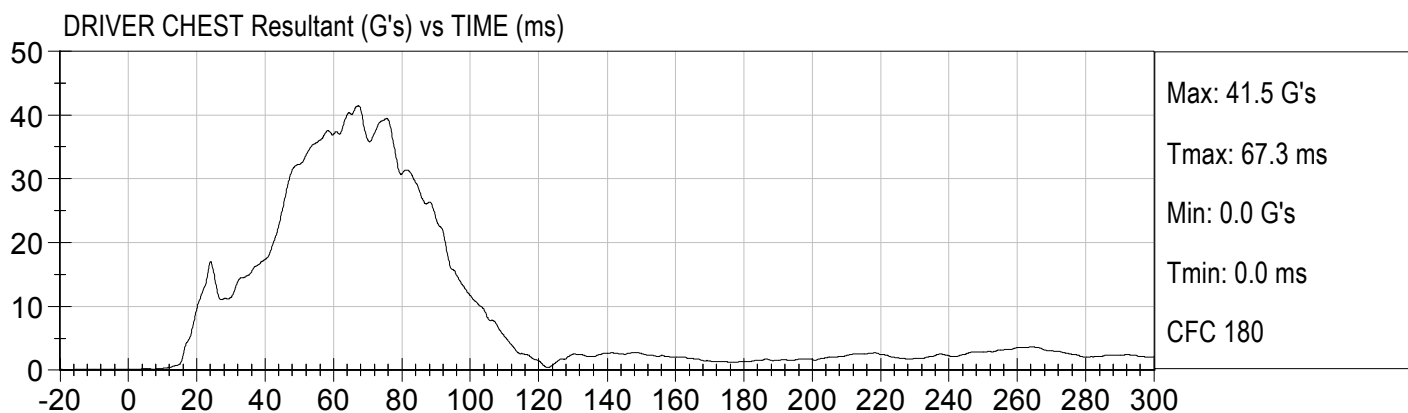
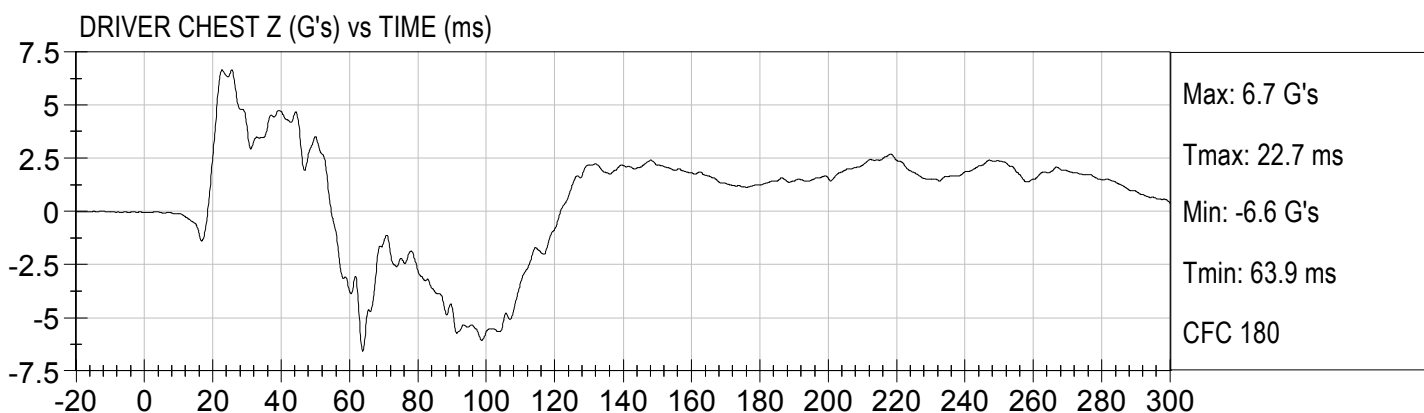
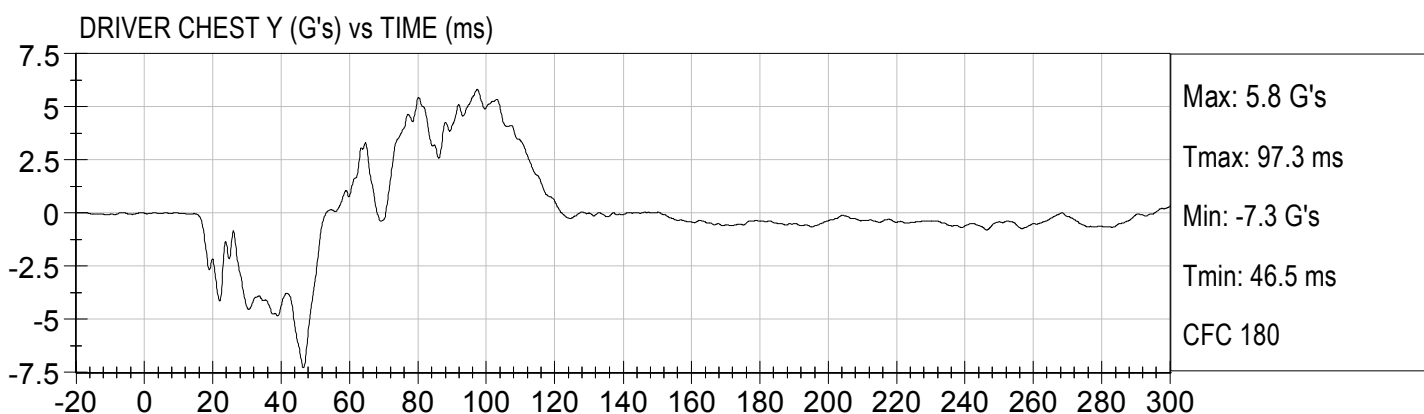
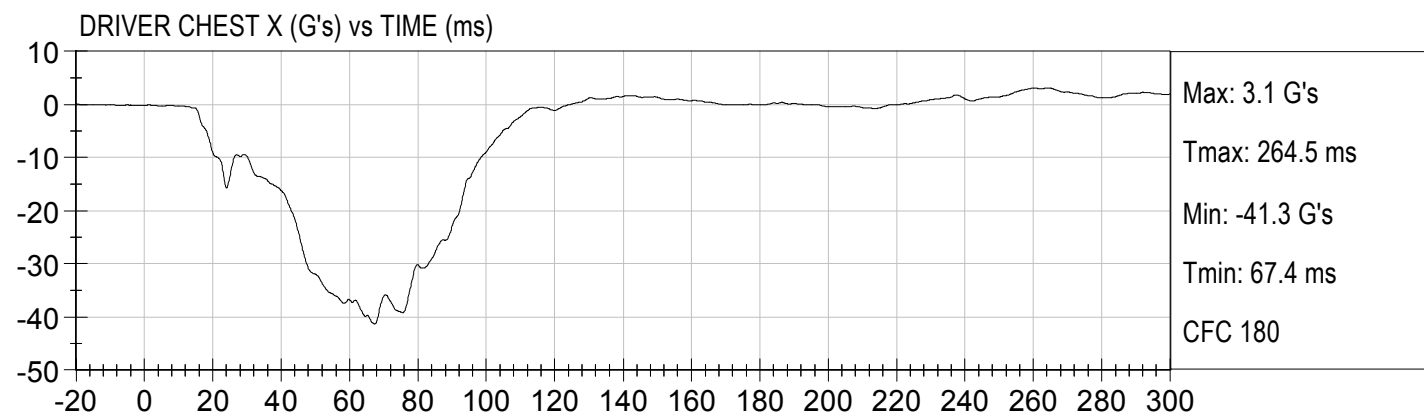
Driver Head X Redundant
 Driver Head Y Redundant
 Driver Head Z Redundant
 Driver Upper Neck Force Y
 Driver Upper Neck Moment X
 Driver Upper Neck Moment Z
 Driver Chest X Redundant
 Driver Chest Y Redundant
 Driver Chest Z Redundant
 Driver Pelvis X
 Driver Pelvis Y
 Driver Pelvis Z
 Driver Left Femur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

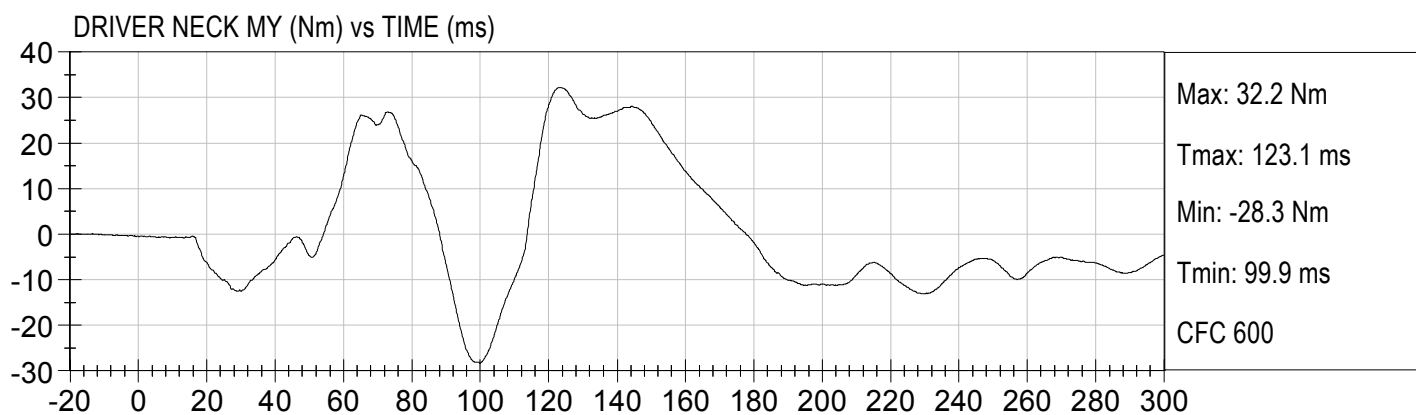
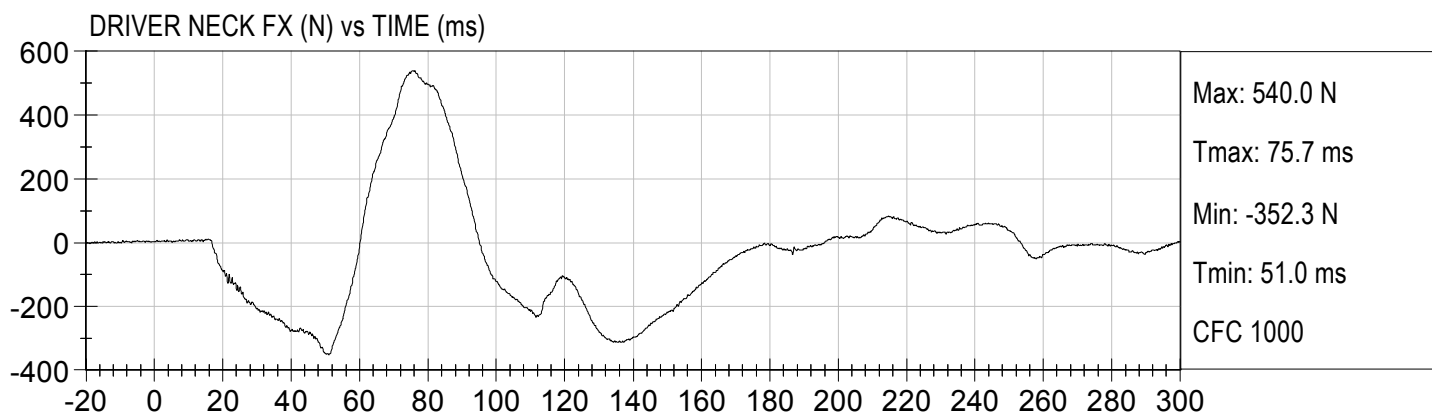
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left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

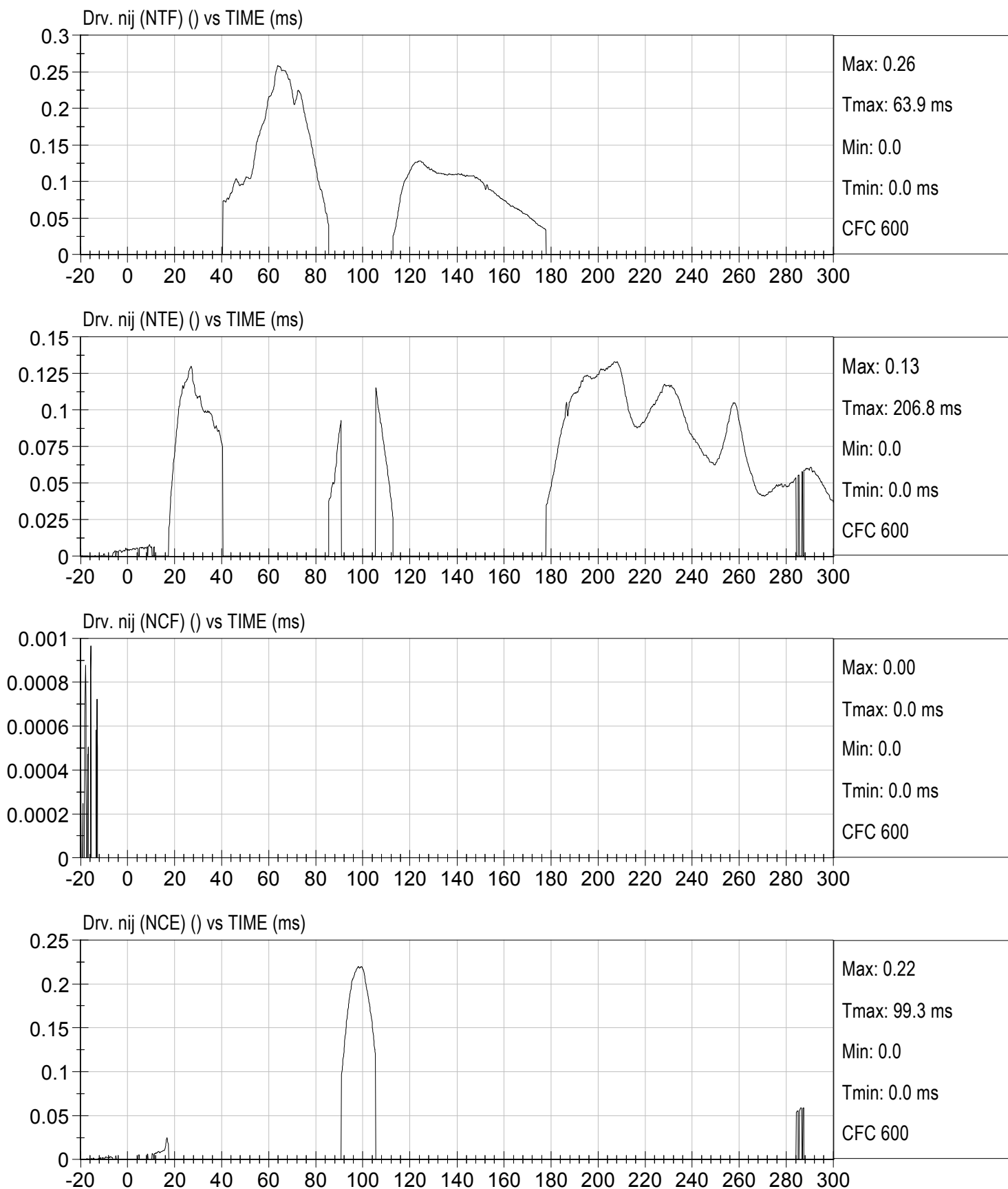
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right 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
Advanced Research Load Cell Barrier – 128 channels

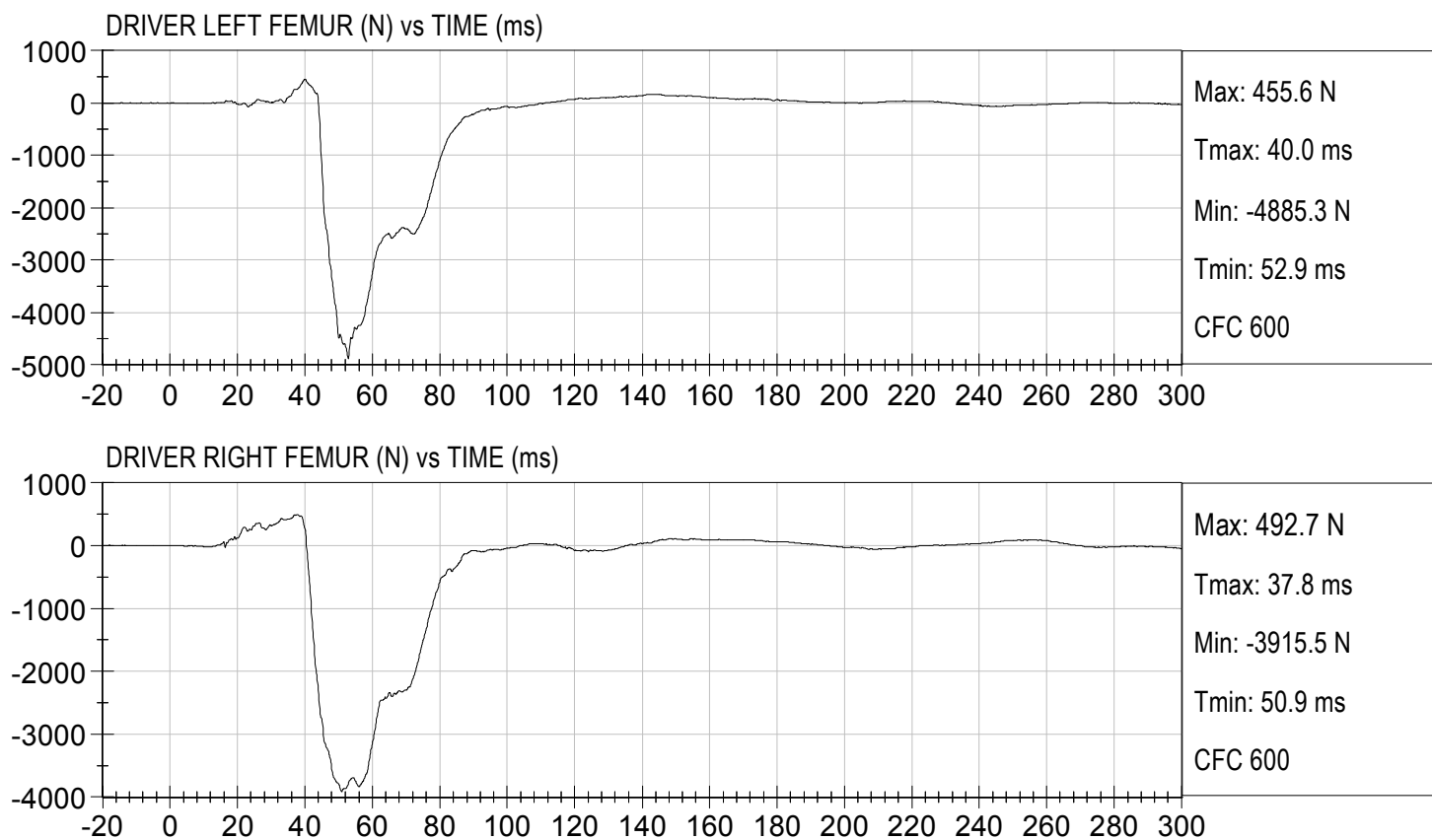


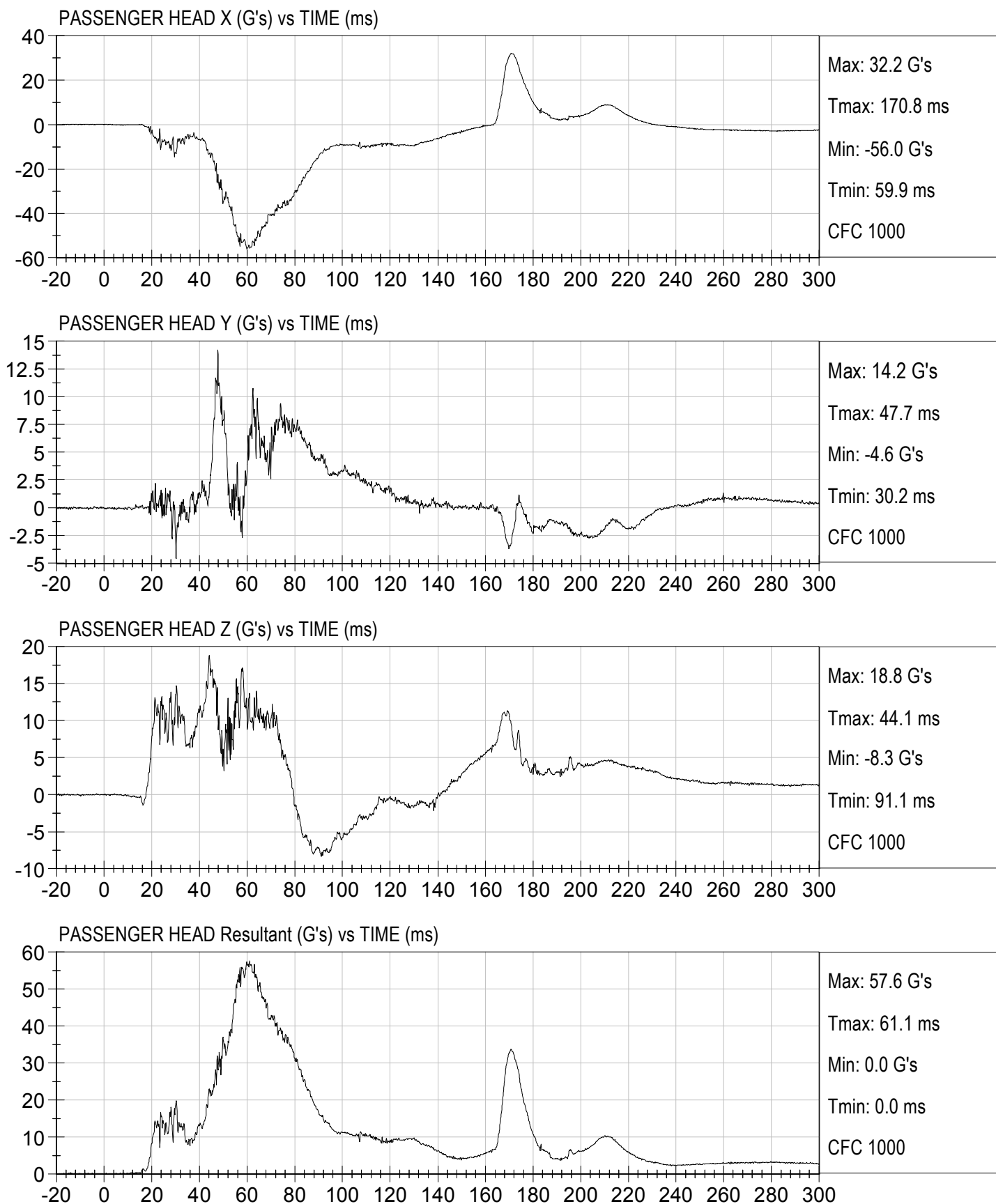


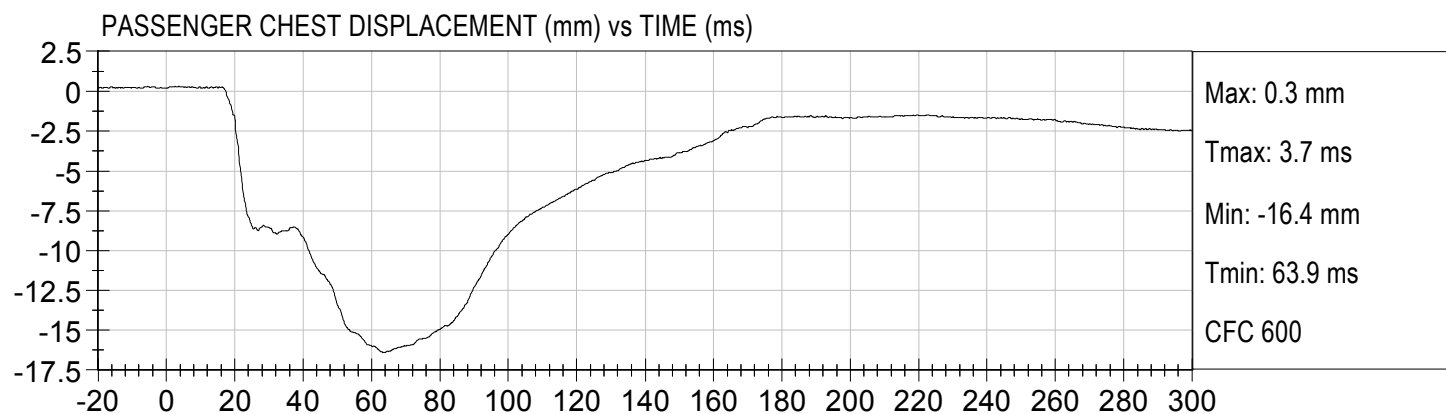


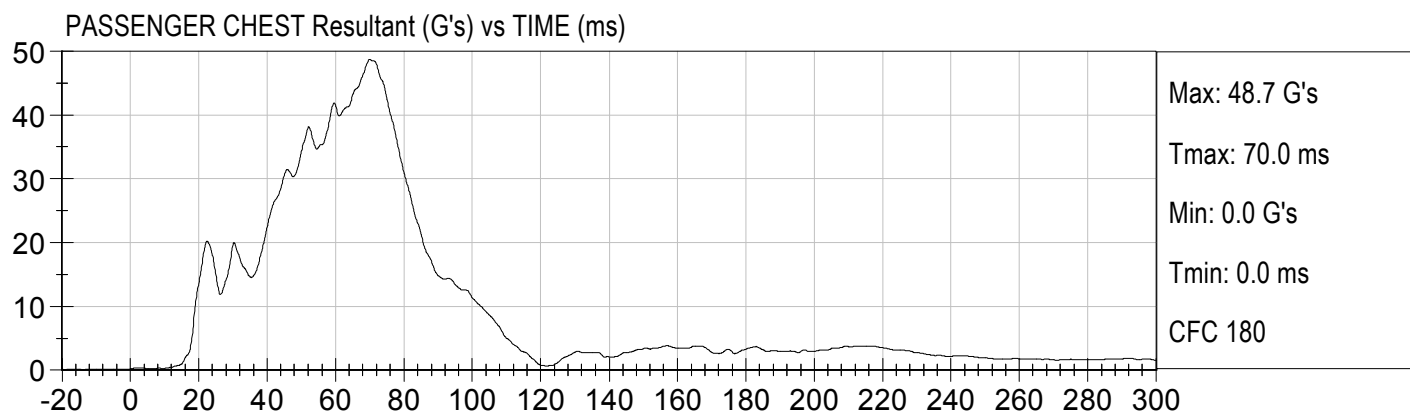
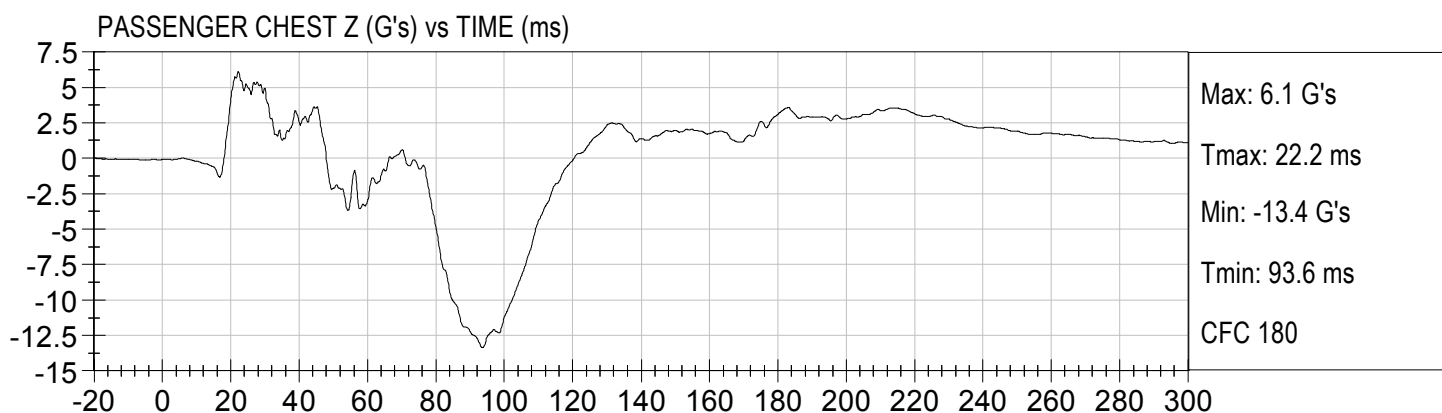
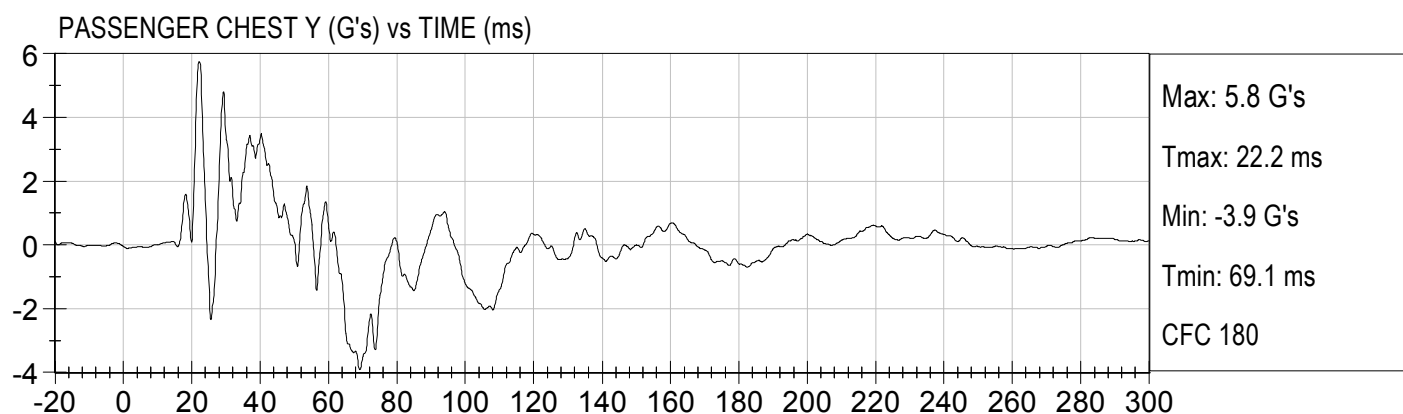
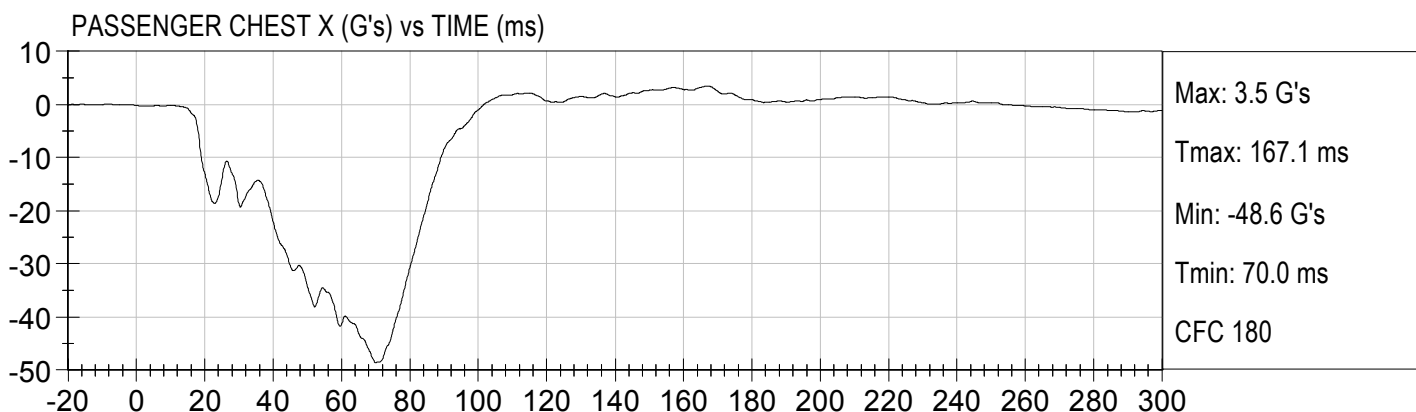


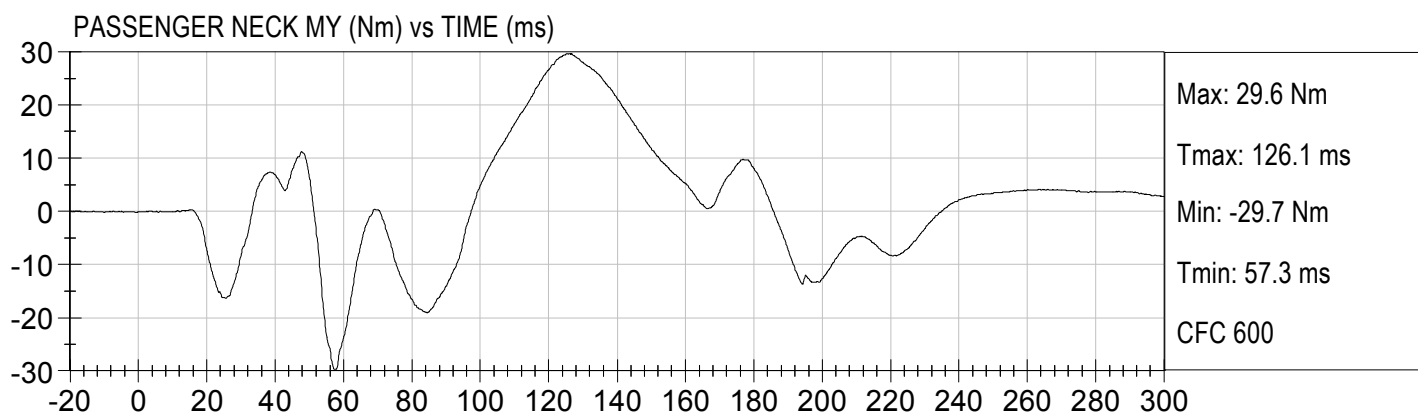
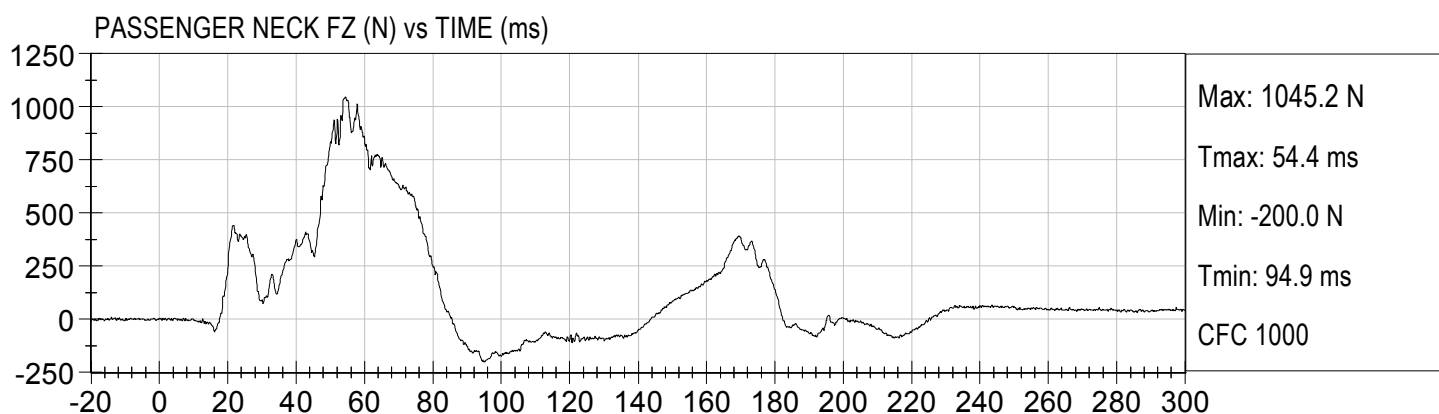
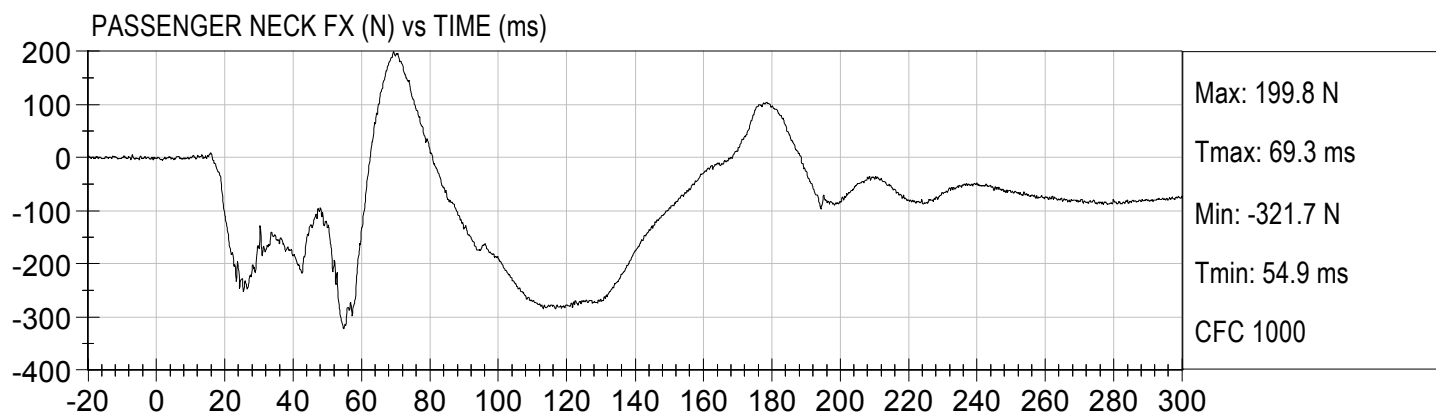


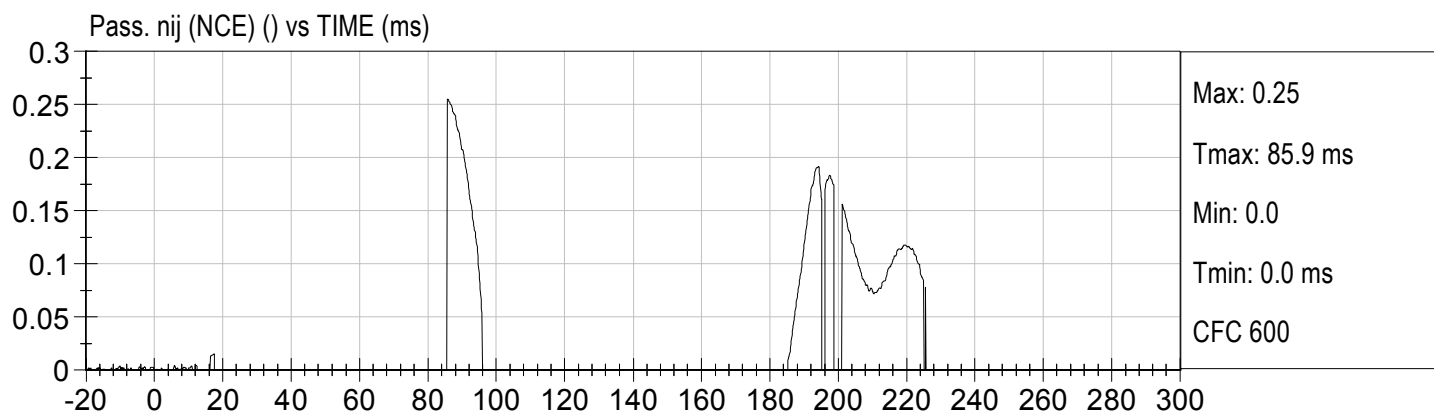
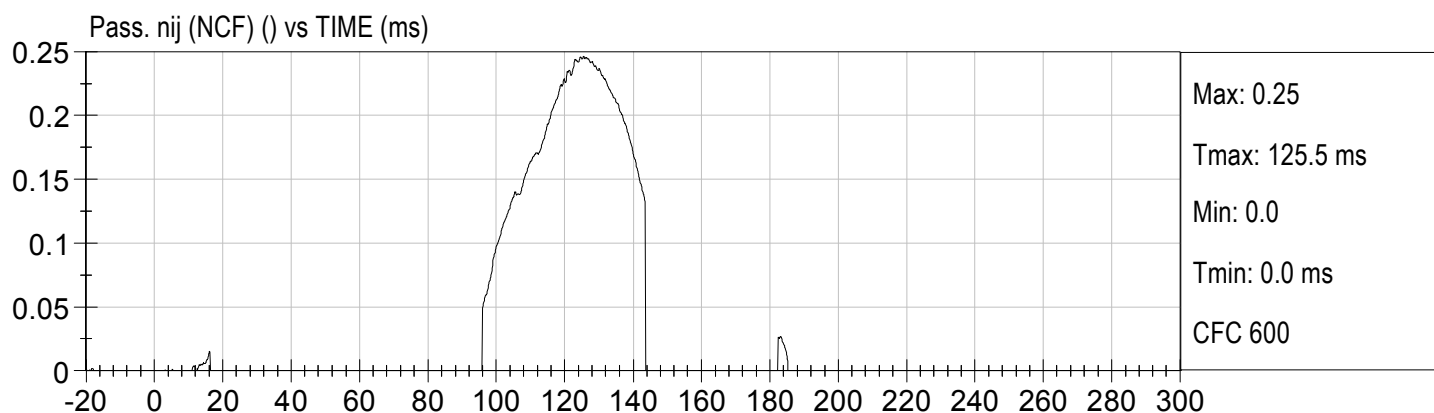
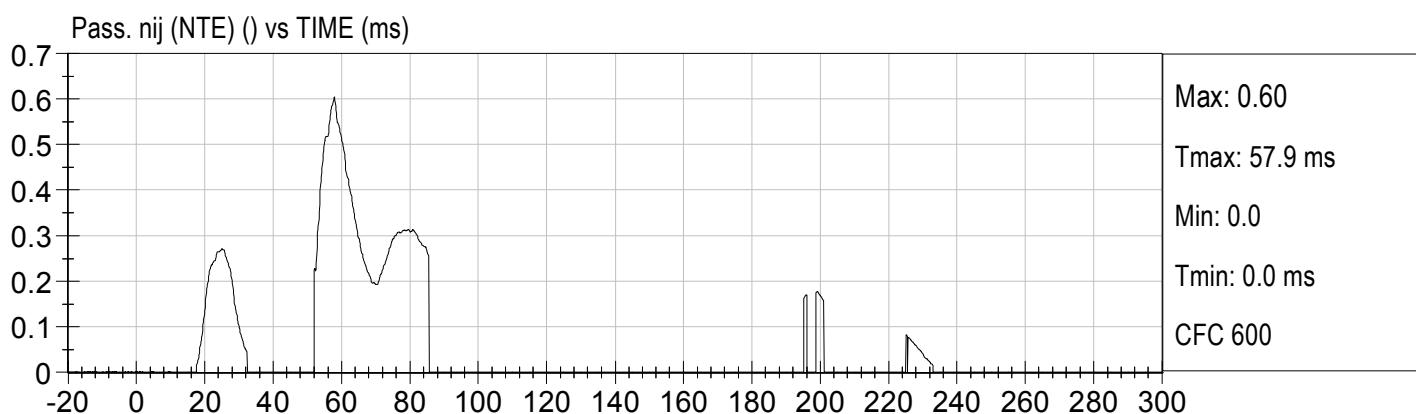
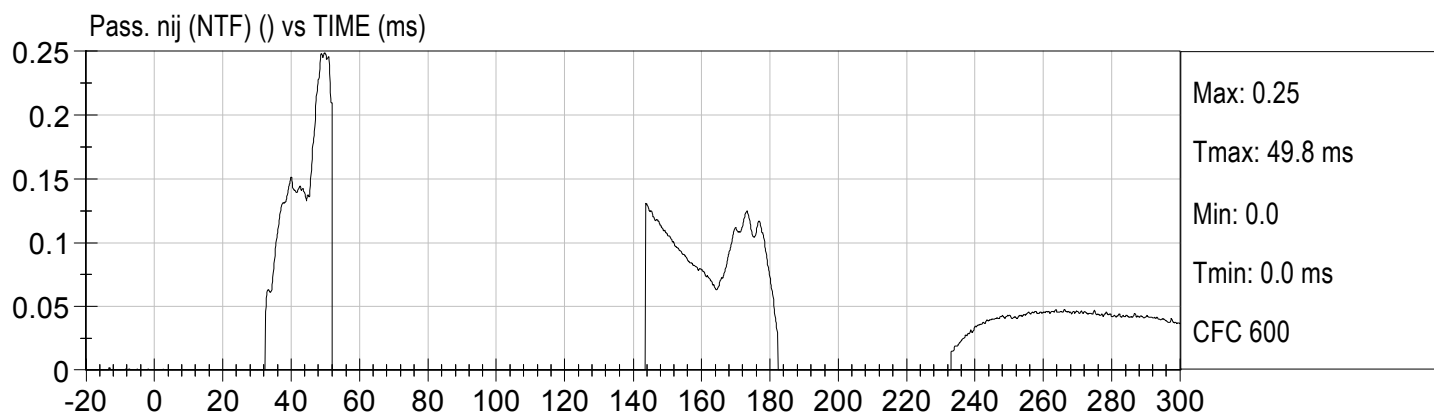


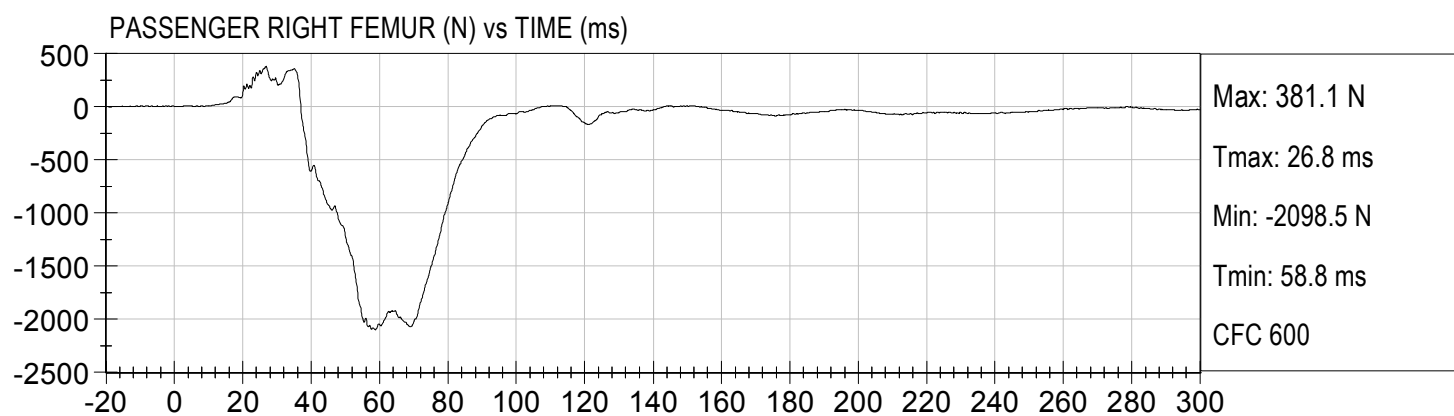
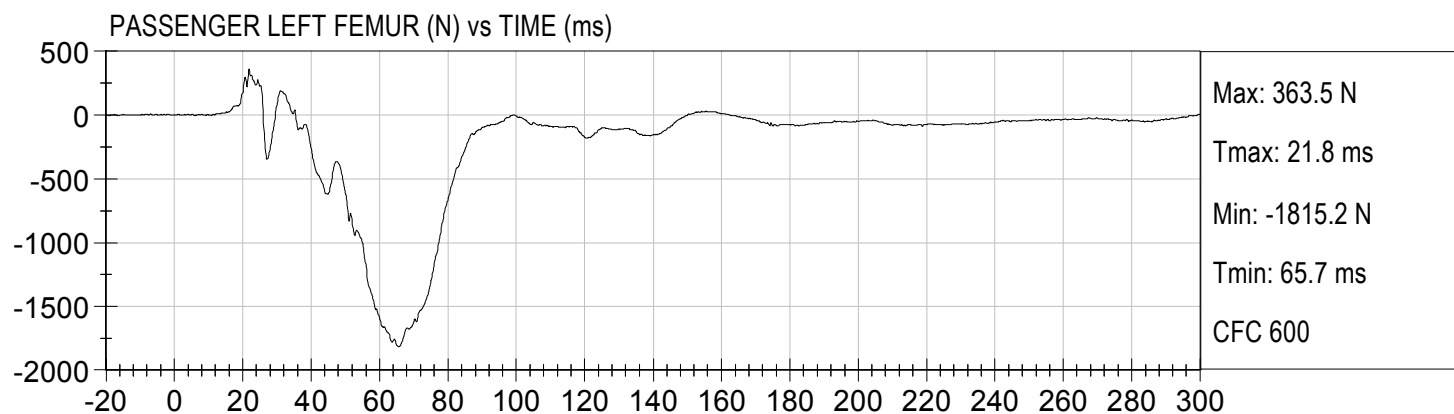












APPENDIX C

DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

Hybrid III, 50th External Measurements
SN: 351

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

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

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

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

ATD Serial No: 351

Test ID: D114111

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	225 - 275	254	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-8.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

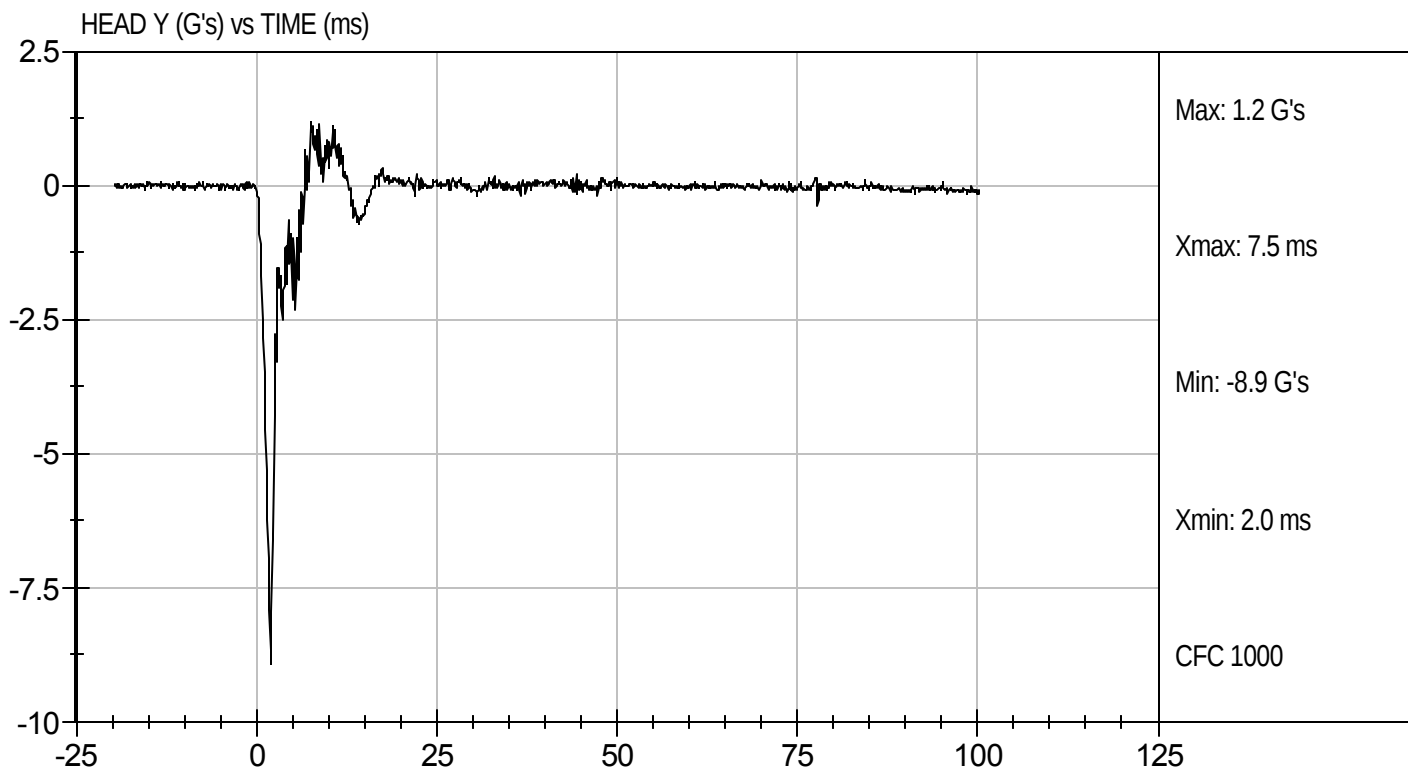
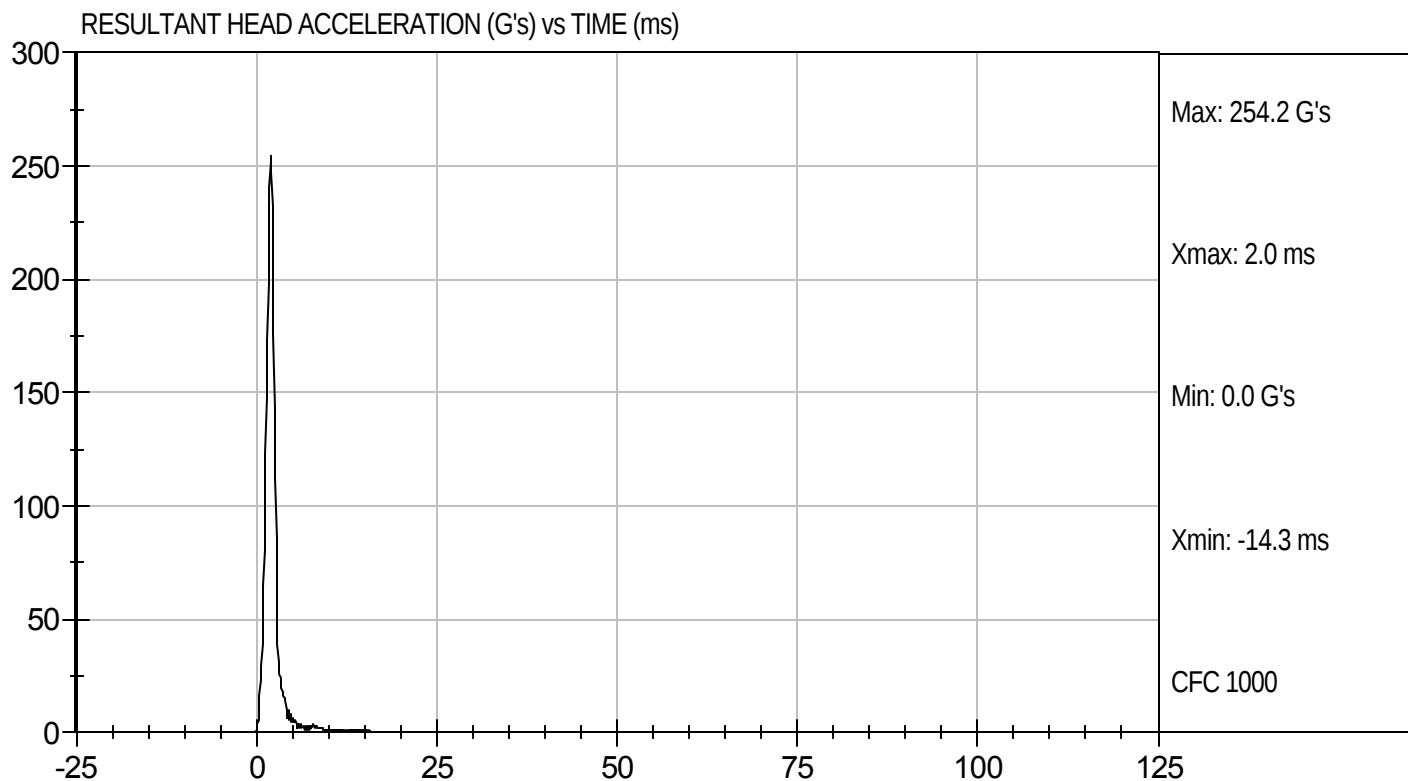
12/8/11
Test Date

David Winkelbauer
Approved By



Test Desc: Head Drop
Component ID: D114111

Test Date: 12/8/11
Velocity: 0 ft/s, 0.00 m/s



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

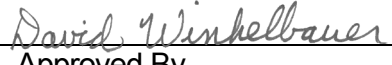
ATD Serial No: 351

Test I.D.: D114112

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.09	Pass
	20 ms	G's	17.60 to 22.60	17.97	Pass
	30 ms	G's	12.50 to 18.50	14.60	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.9	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	69.1	Pass
	Time	ms	57.0 to 64.0	58.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.2	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	91.9	Pass
	Time	ms	47.0 to 58.0	49.3	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.5	Pass
Overall Test Results					Pass


 Laboratory Technician

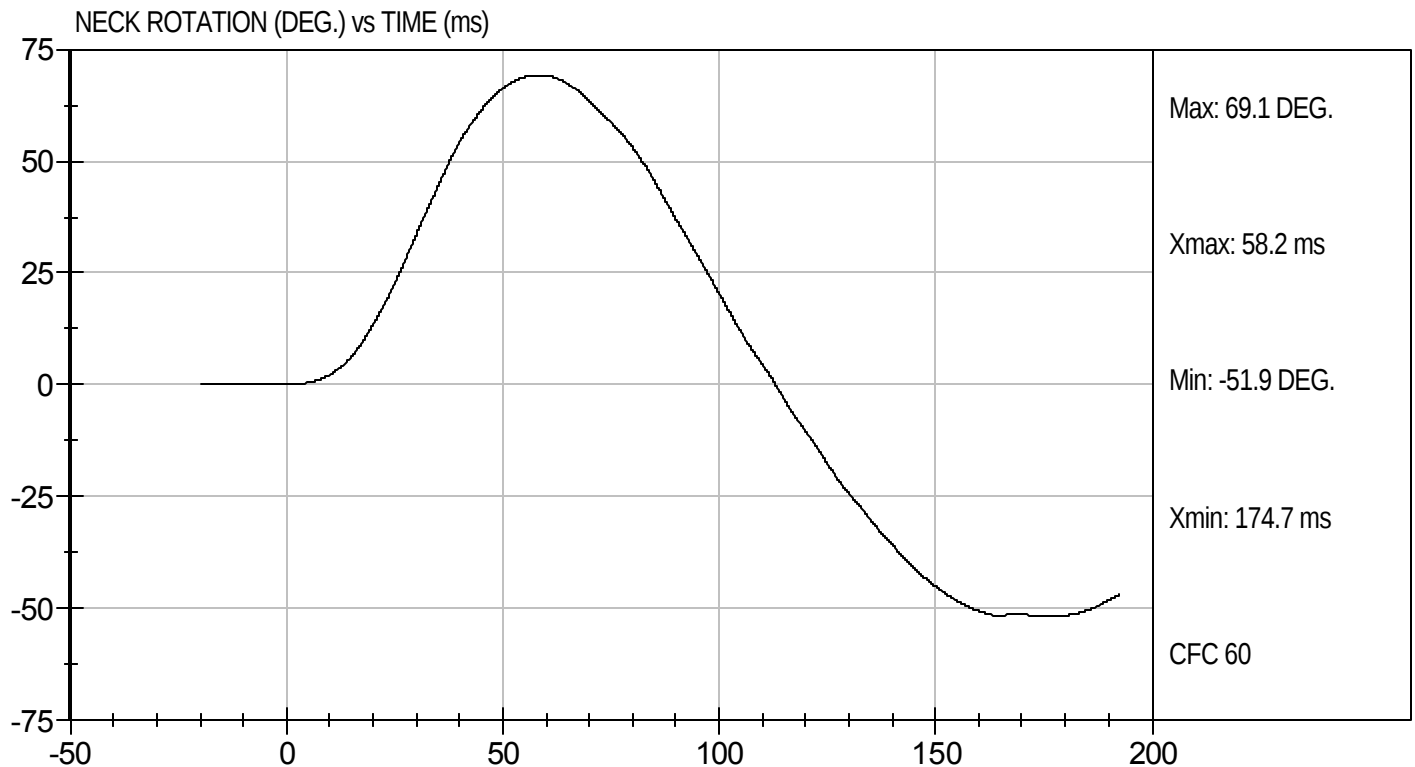
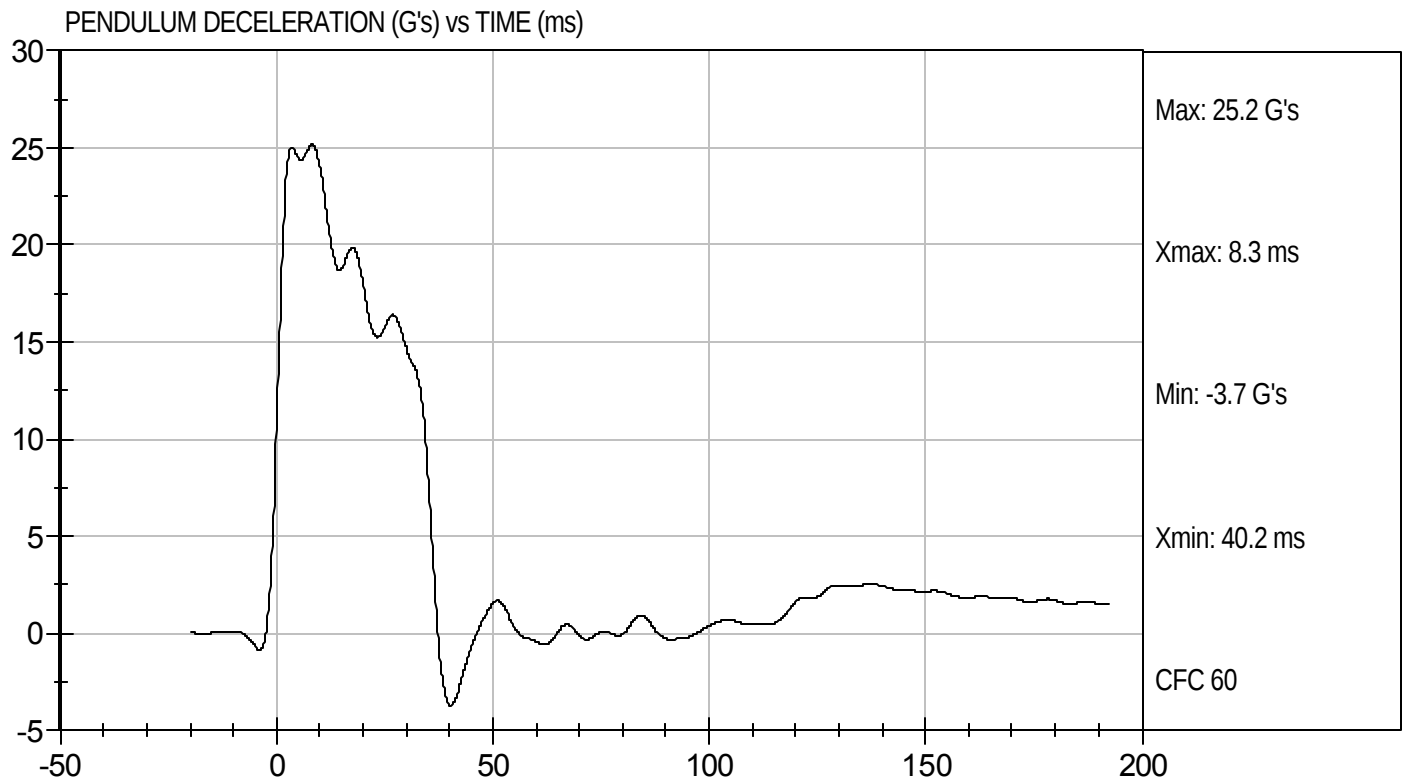
12/8/11
 Test Date


 Approved By



Test Desc: Neck Flexion
Component ID: D114112

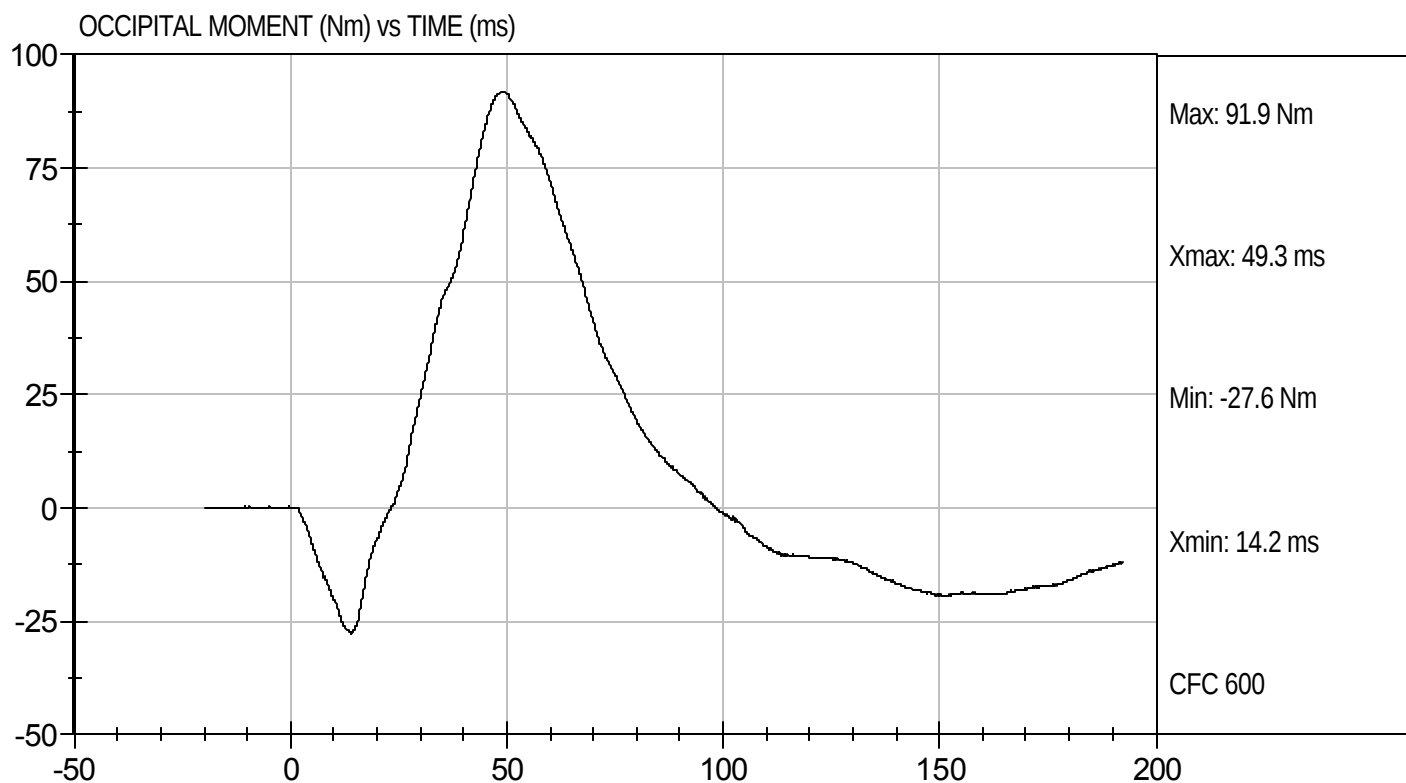
Test Date: 12/8/11
Velocity: 2.83 ft/s, 6.96 m/s





Test Desc: Neck Flexion
Component ID: D114112

Test Date: 12/8/11
Velocity: 22.83 ft/s, 6.96 m/s



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

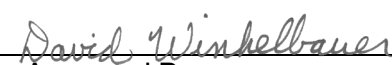
ATD Serial No: 351

Test I.D.: D114113

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.13	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.22	Pass
	20 ms	G's	14.00 to 19.00	16.01	Pass
	30 ms	G's	11.00 to 16.00	12.67	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.9	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.4	Pass
	Time	ms	72.0 to 82.0	75.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	156.6	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-59.9	Pass
	Time	ms	65.0 to 79.0	70.0	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	143.5	Pass
Overall Test Results					Pass


Laboratory Technician

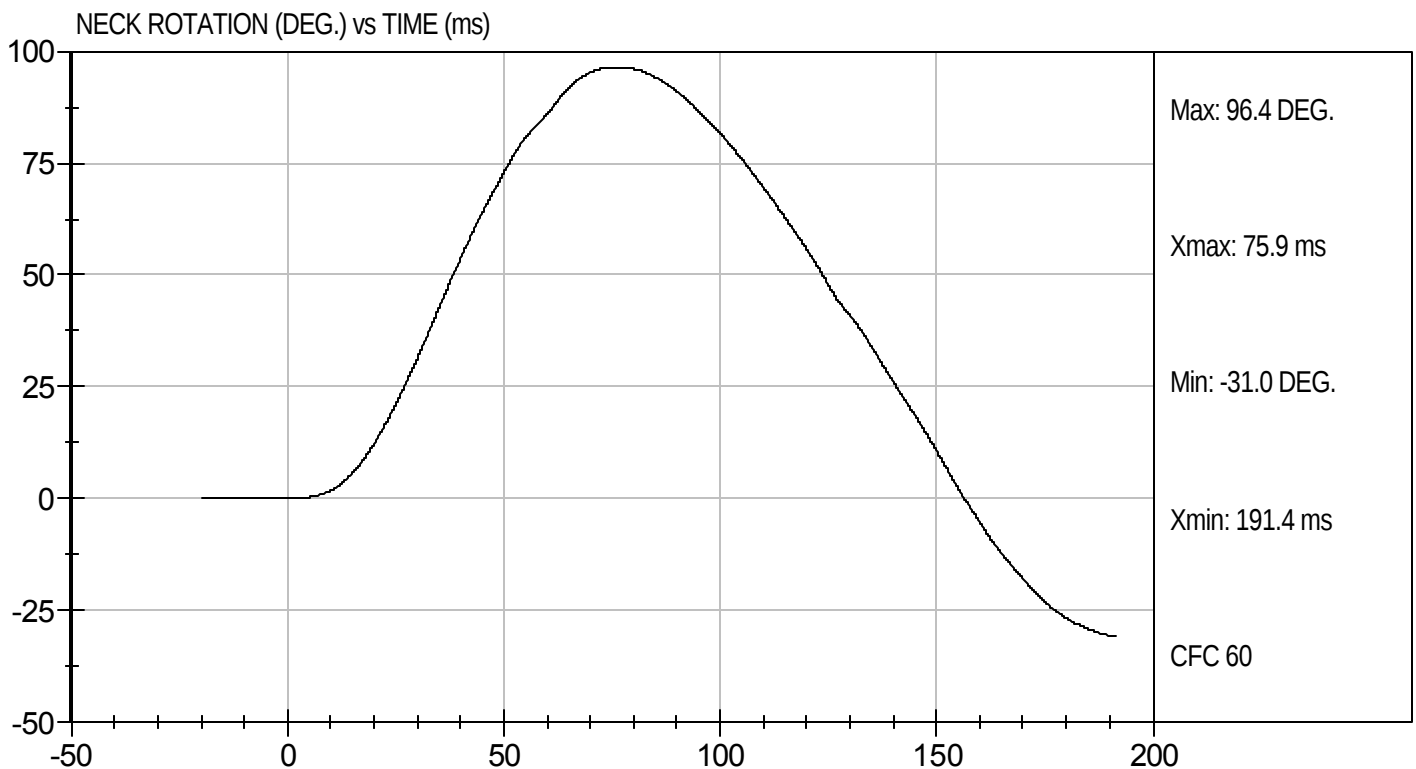
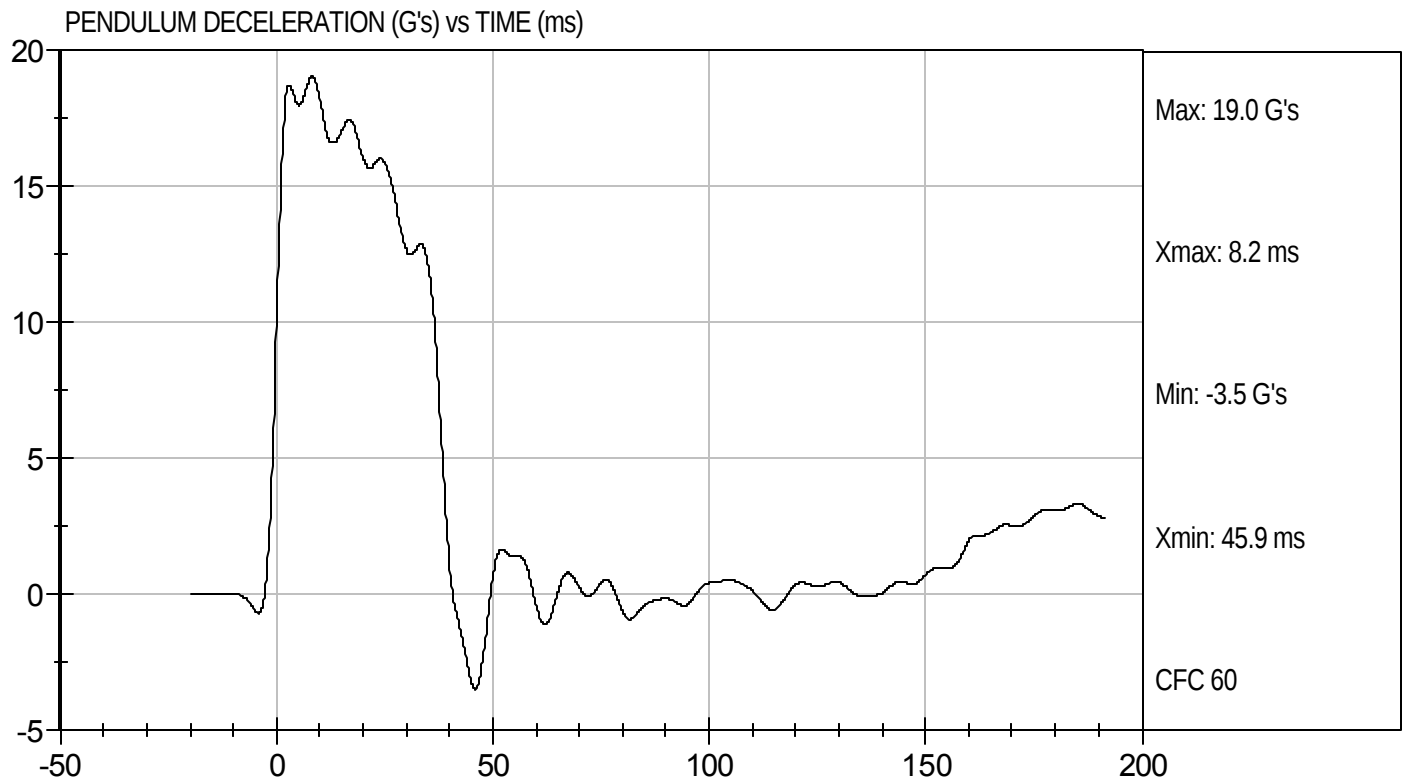
12/8/11
Test Date


Approved By



Test Desc: Neck Extension
Component ID: D114113

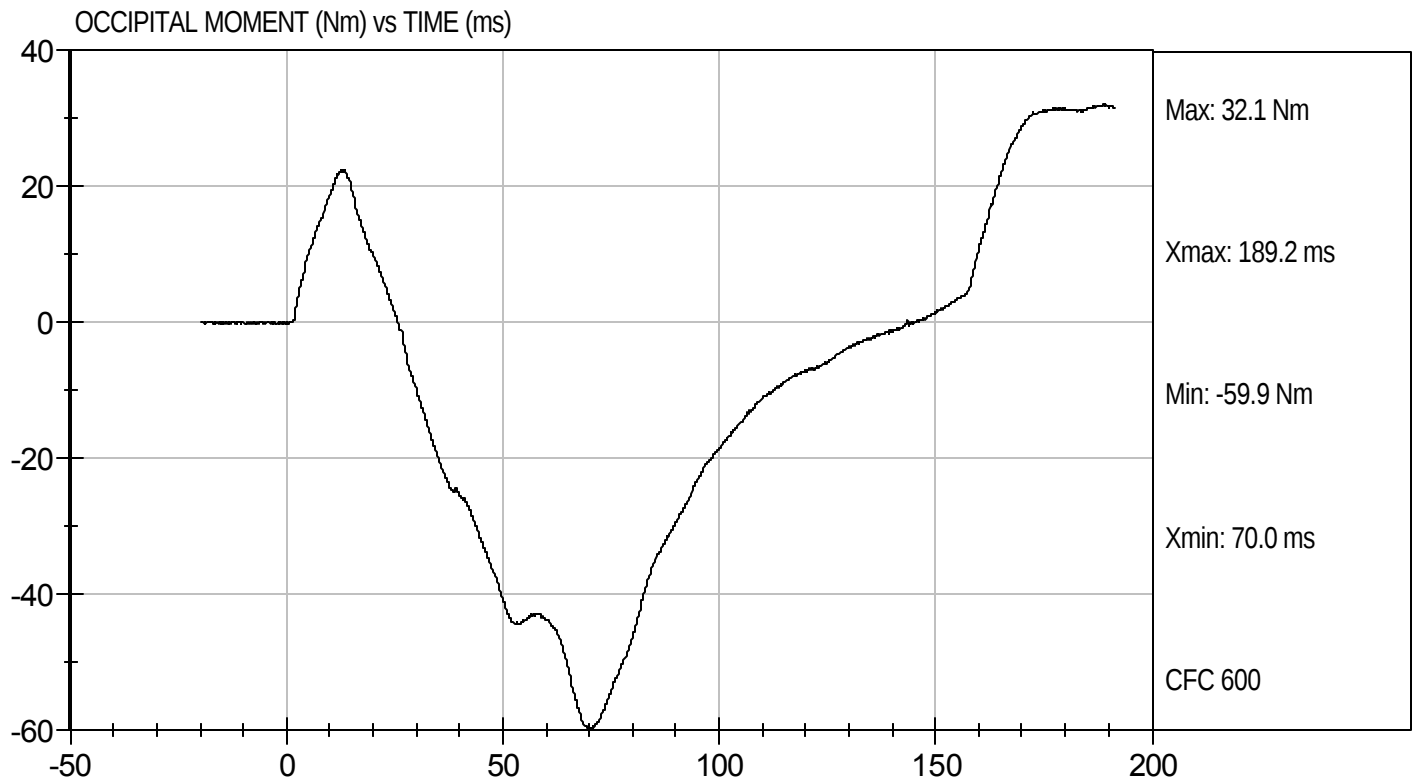
Test Date: 12/8/11
Velocity: 20.10 ft/s, 6.13 m/s





Test Desc: Neck Extension
Component ID: D114113

Test Date: 12/8/11
Velocity: 20.10 ft/s, 6.13 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

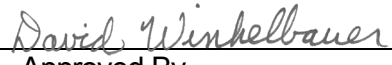
ATD Serial No: 351

Test I.D: D114114

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,192	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.53	Pass
Internal Hysteresis	%	69 to 85	72	Pass
			Overall Test Results	Pass


Laboratory Technician

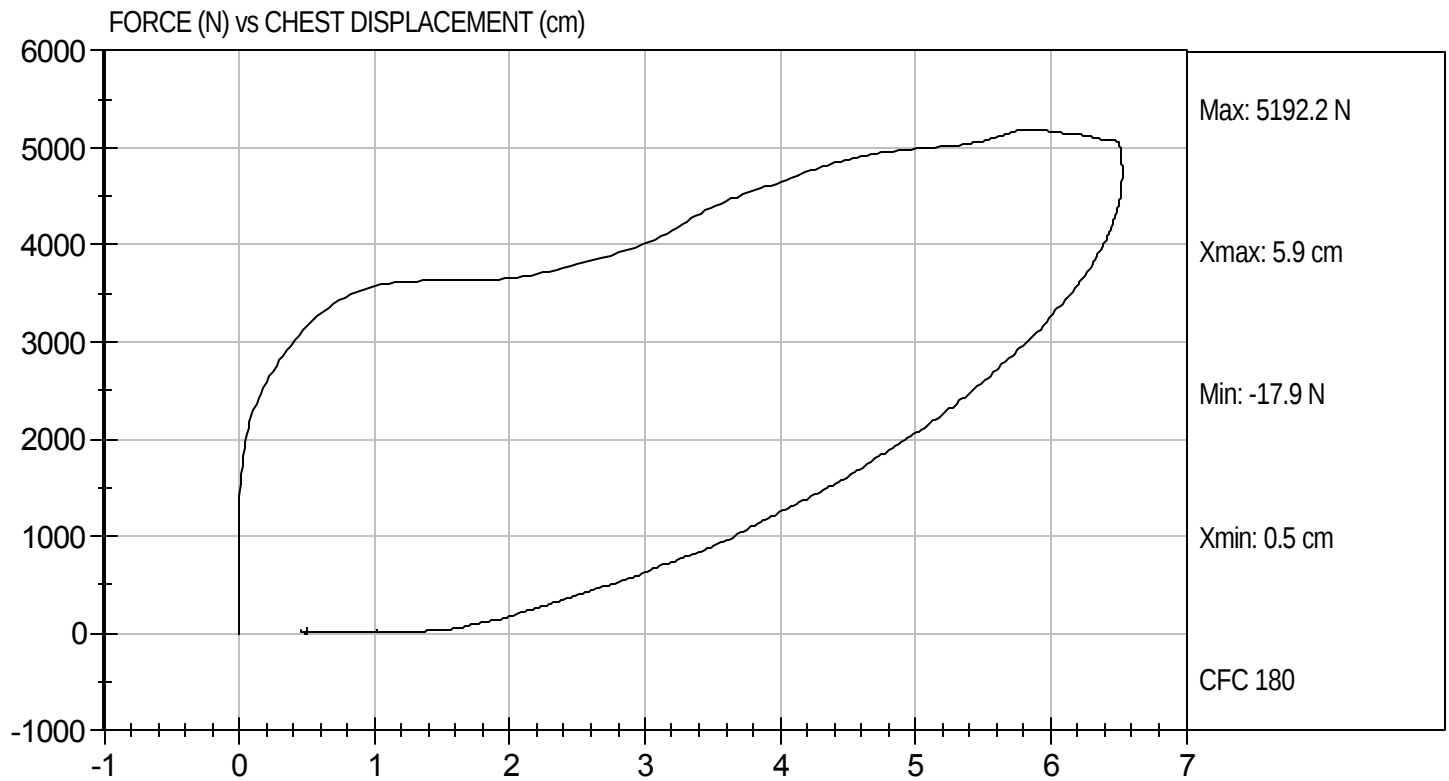
12/7/11
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D114114

Test Date: 12/7/11
Velocity: 22.22 ft/s, 6.77 m/s



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

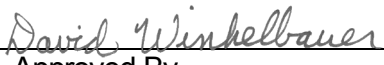
ATD Serial No: 351

Test I.D: D114115

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,214	Pass
Overall Test Results				Pass


Laboratory Technician

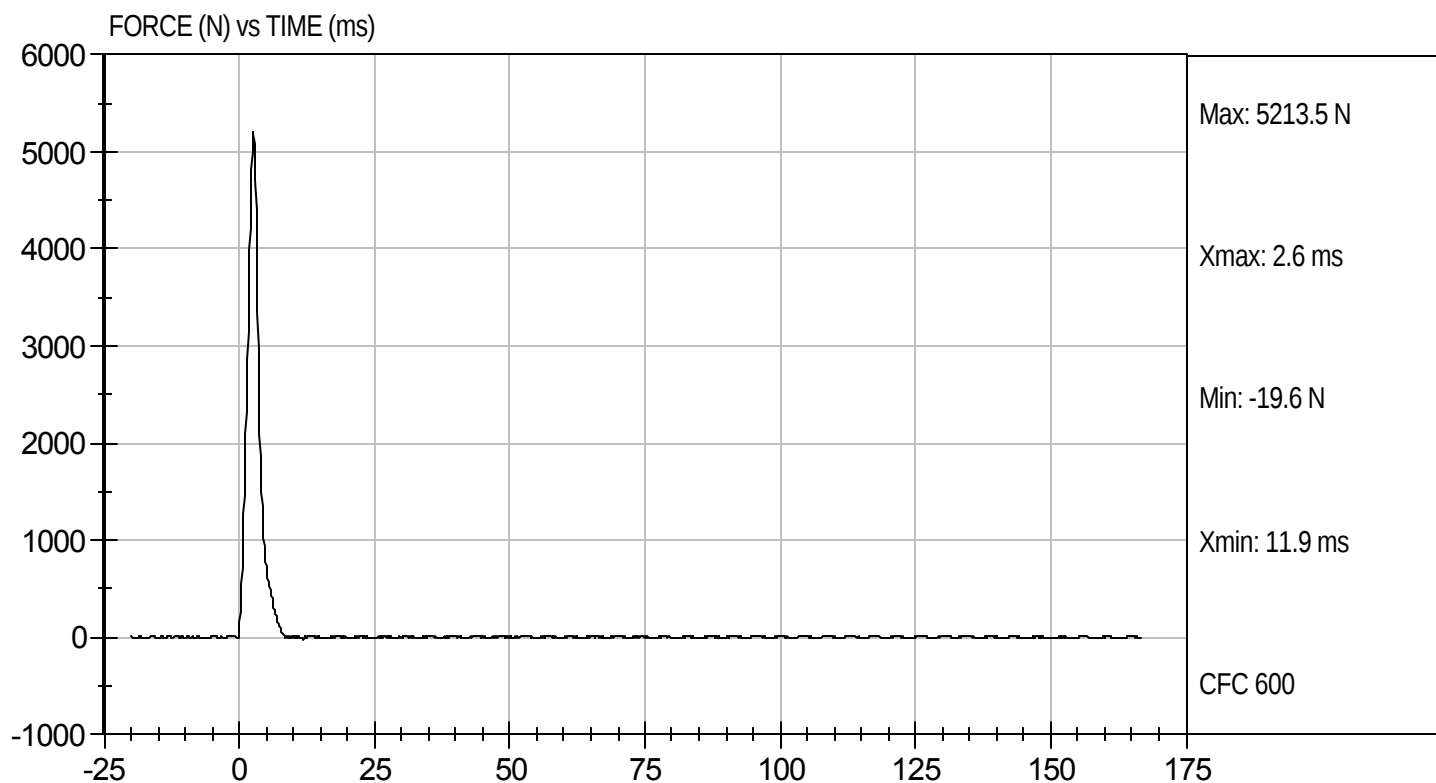
12/8/11
Test Date


Approved By



Test Desc: Right Knee
Component ID: D114115

Test Date: 12/8/11
Velocity: 6.97 ft/s, 2.12 m/s



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

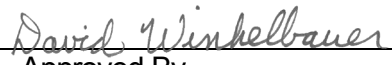
ATD Serial No: 351

Test I.D: D114116

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	4,744	Pass
Overall Test Results				Pass


Laboratory Technician

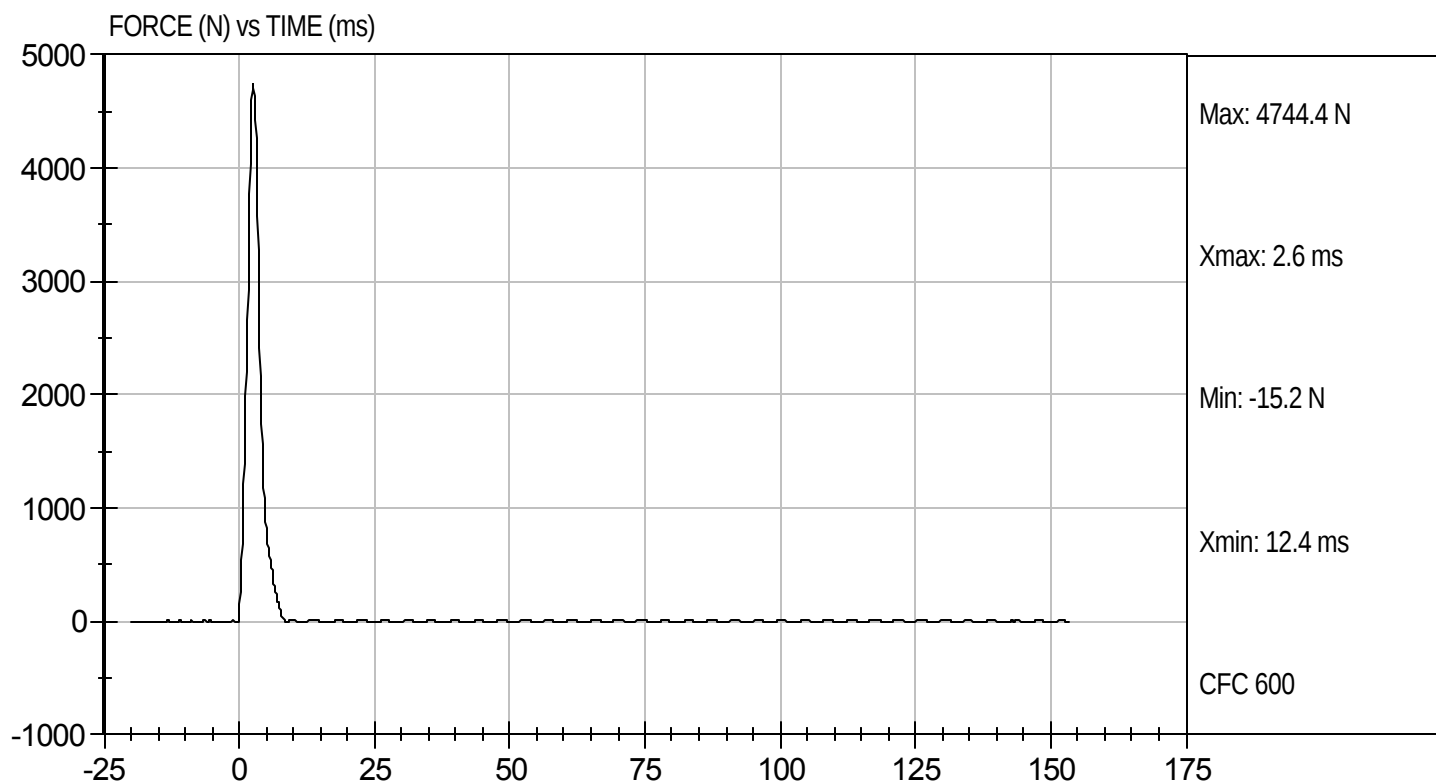
12/8/11
Test Date


Approved By



Test Desc: Left Knee
Component ID: D114116

Test Date: 12/8/11
Velocity: 6.97 ft/s, 2.12 m/s



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

ATD Serial No: 351

Test I.D: D114110

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.0	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	20	20	Pass
Rotation Rate	deg/s	5.0 -10.0	5.7	5.7	Pass
30 Degrees	Nm	94.9 Nm Max	61.5	61.9	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 - 50.0 Degree Max Rotation	42.7	42.0	Pass
Overall Test Results					Pass


 Laboratory Technician

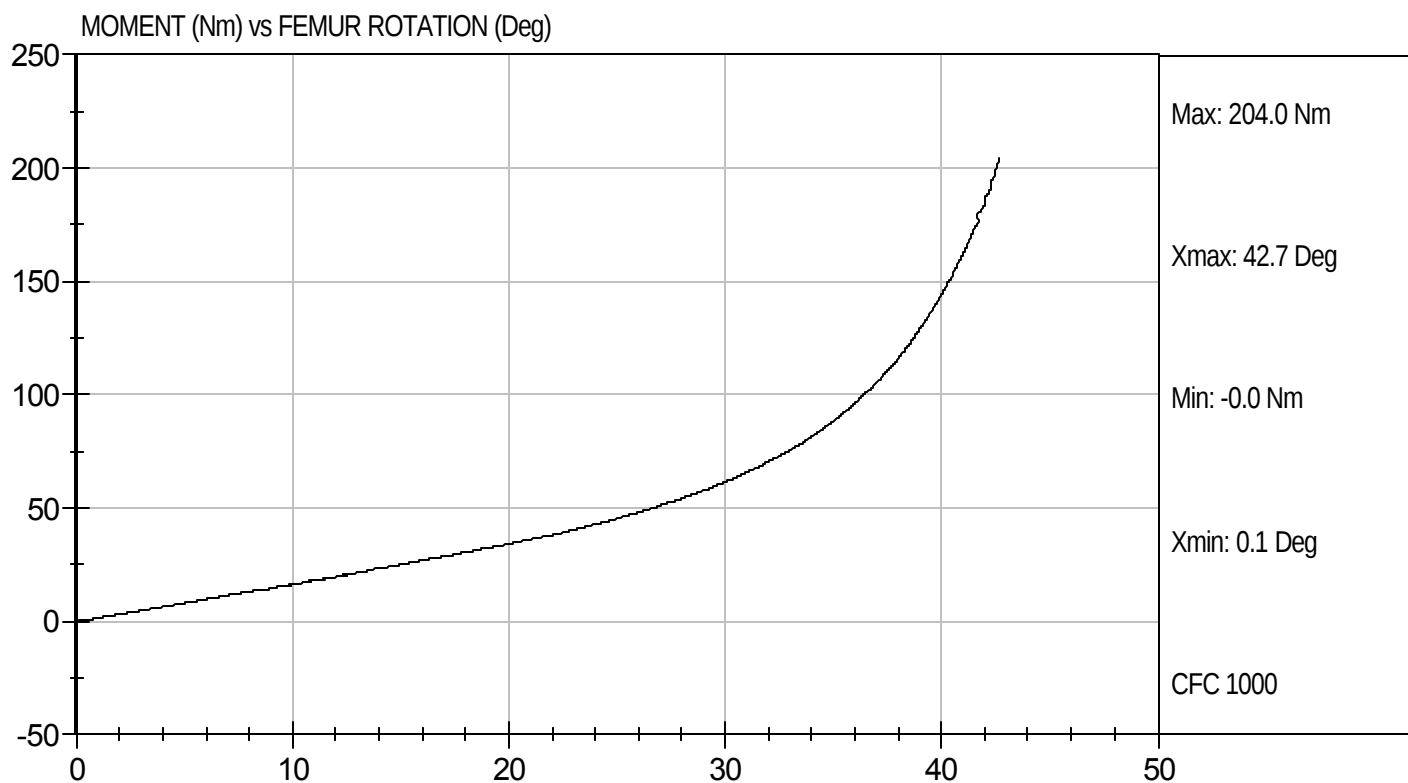
12/8/11
 Test Date


 Approved By



Test Desc: Hip Femur Flexion
Component ID: D114119

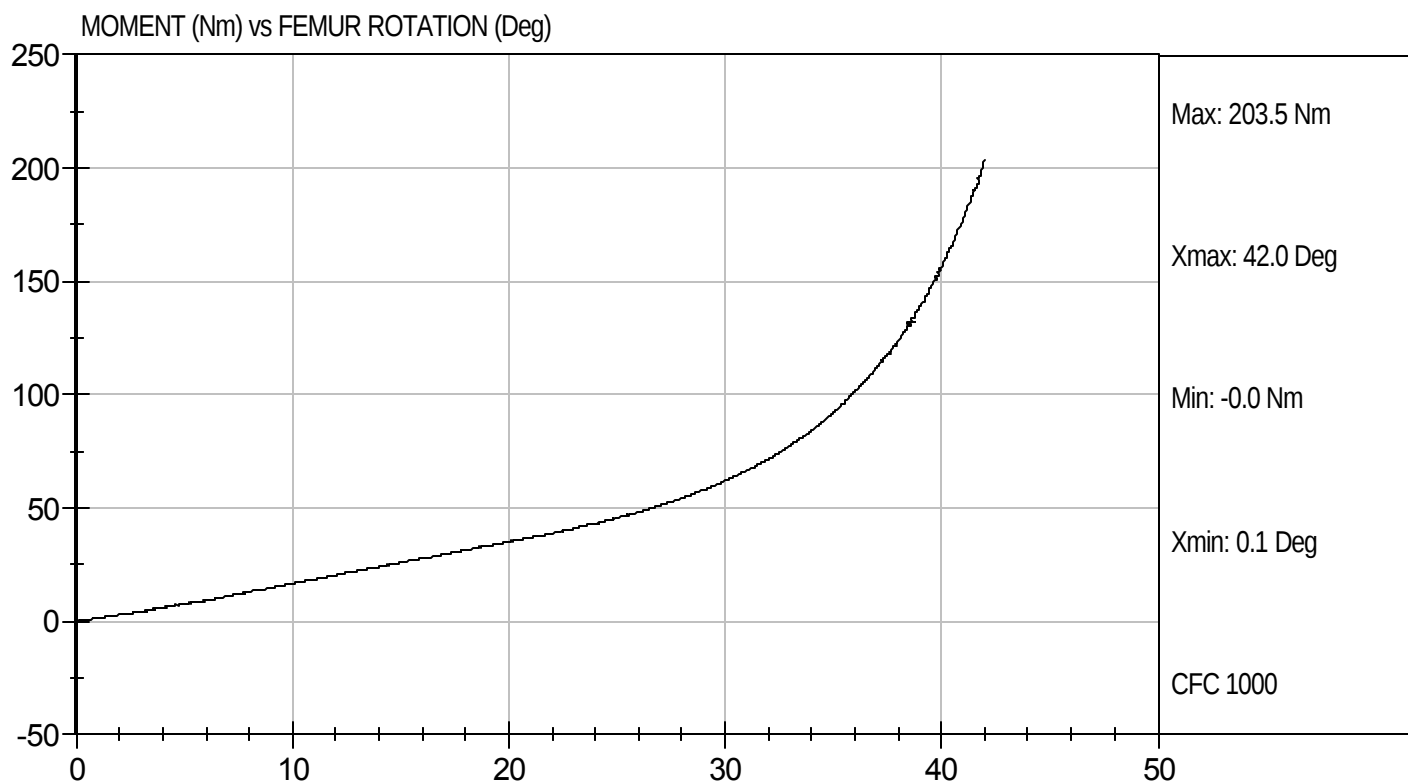
Test Date: 12/8/11
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D114110

Test Date: 12/8/11
Velocity: 0 ft/s, 0.00 m/s



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

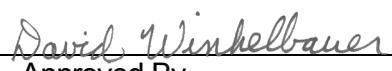
ATD Serial No: 351

Test ID: D114201

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Peak Resultant Acceleration	G's	225 - 275	272	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	3.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

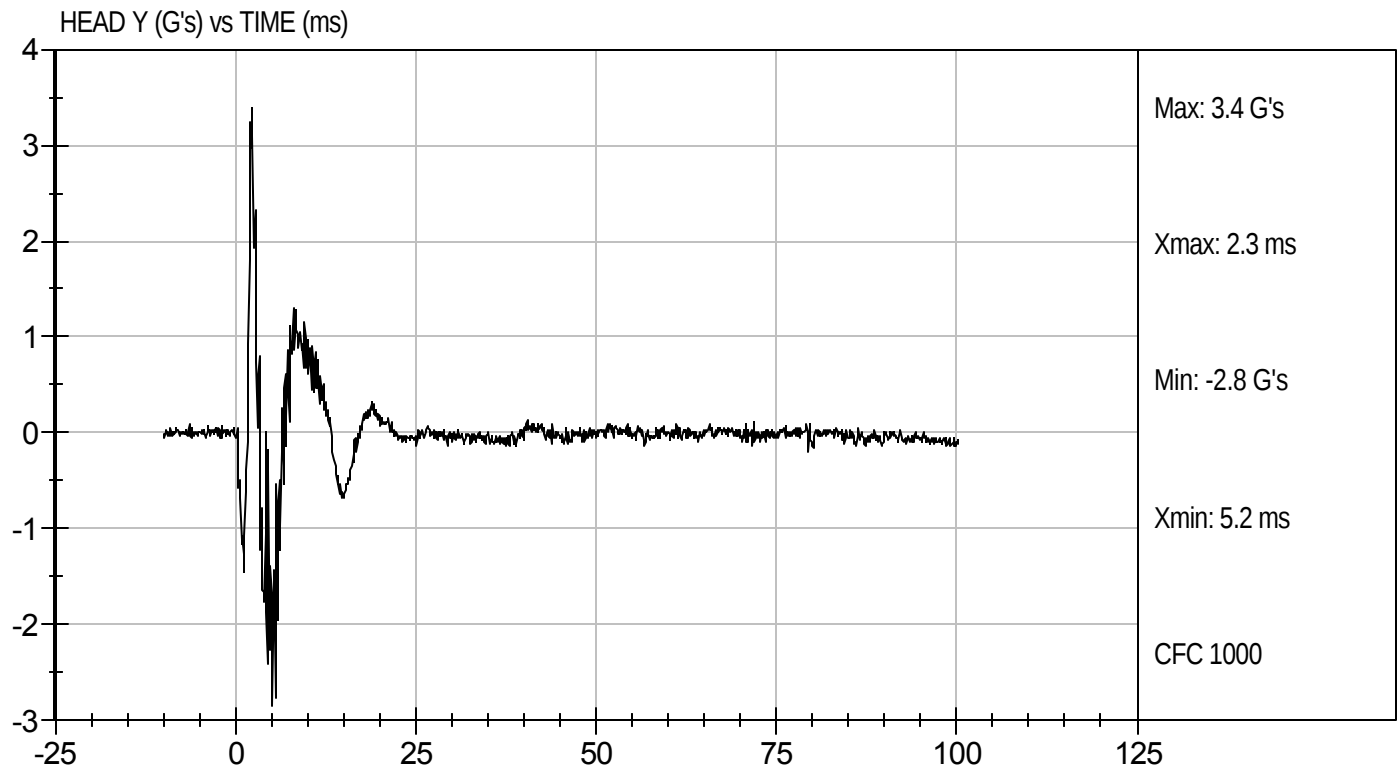
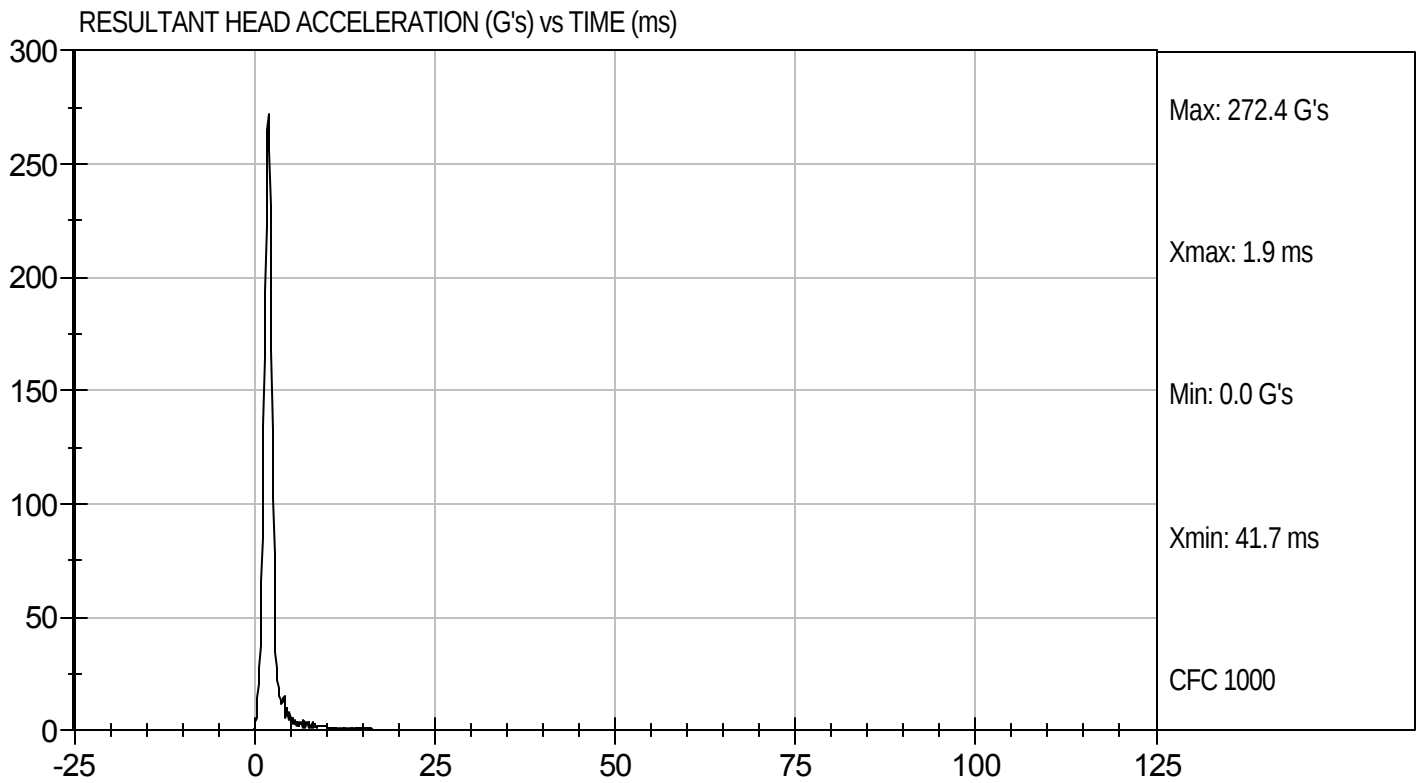
12/14/11
Test Date


Approved By



Test Desc: Head Drop
Component ID: D114201

Test Date: 12/14/11
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.: D114202

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	39	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	25.68	Pass
	20 ms	G's	17.60 to 22.60	18.97	Pass
	30 ms	G's	12.50 to 18.50	17.86	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	17.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.6	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	70.7	Pass
	Time	ms	57.0 to 64.0	58.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.4	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	98.7	Pass
	Time	ms	47.0 to 58.0	48.1	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	100.3	Pass
Overall Test Results					Pass


Laboratory Technician

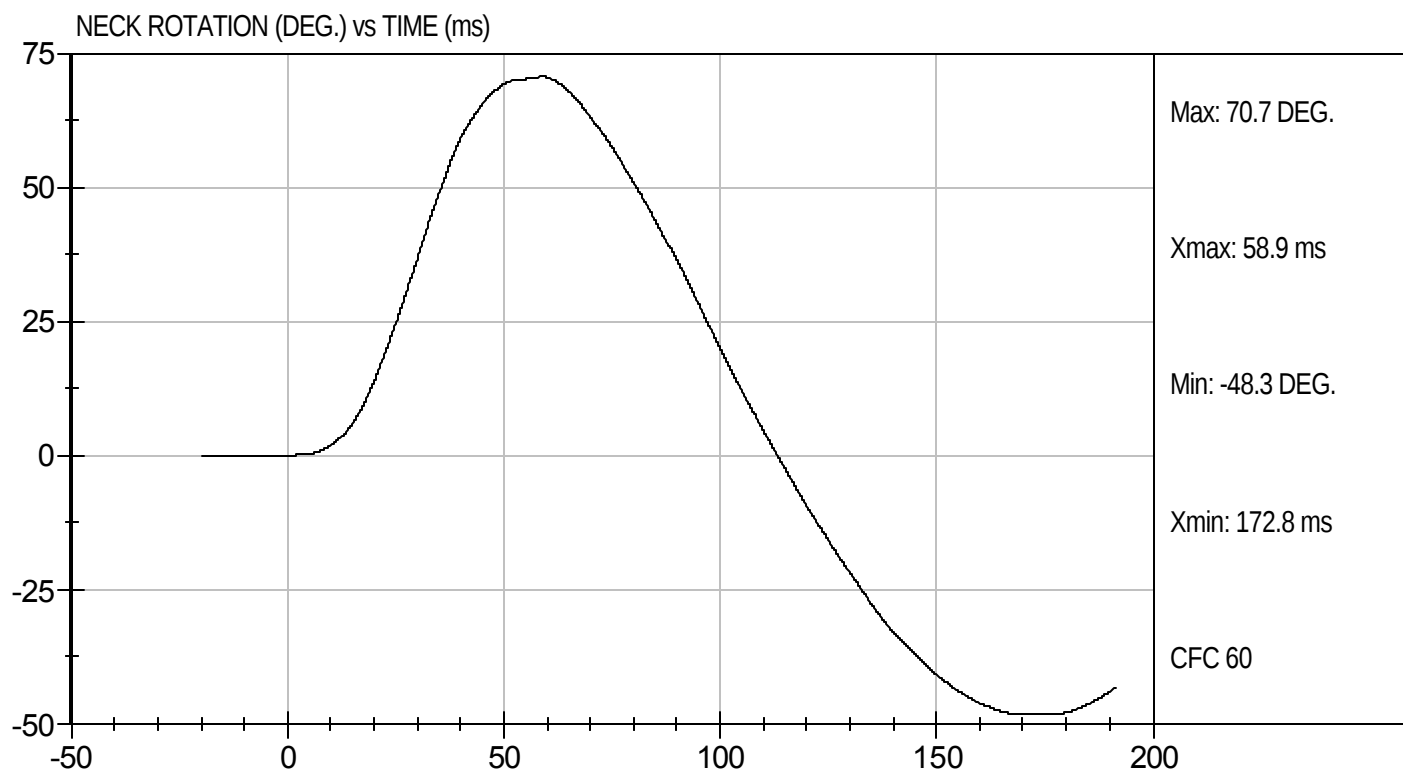
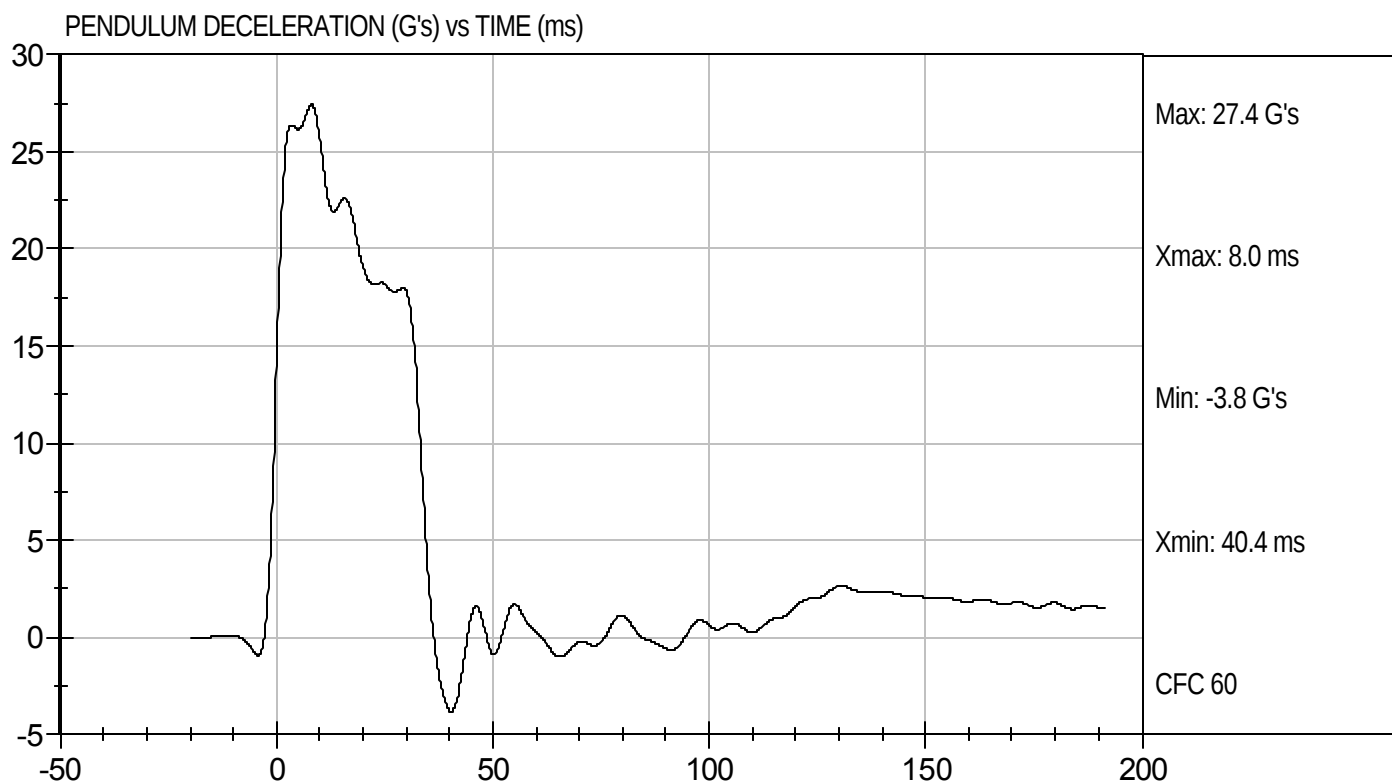
12/14/11
Test Date


Approved By



Test Desc: Neck Flexion
Component ID: D114202

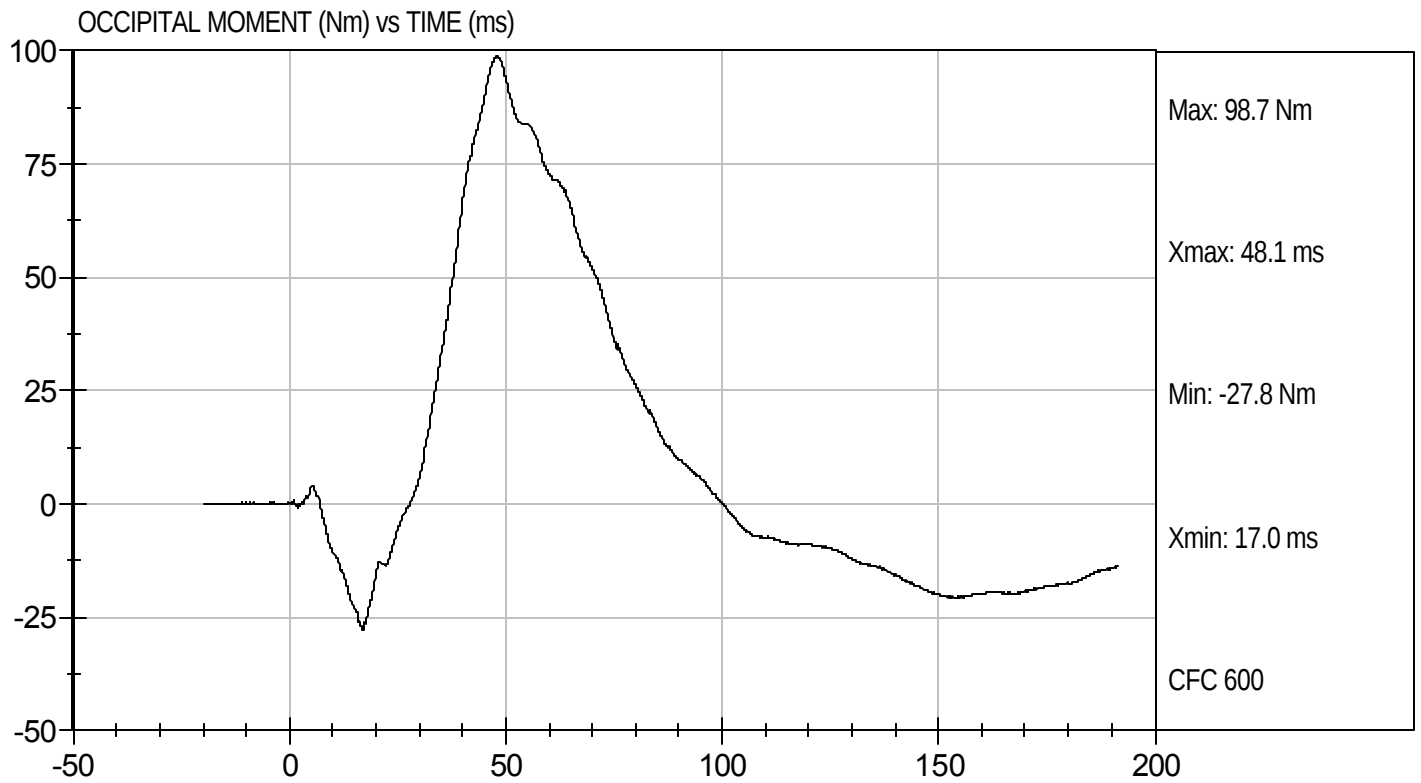
Test Date: 12/14/11
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D114202

Test Date: 12/14/11
Velocity: 23.15 ft/s, 7.06 m/s



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

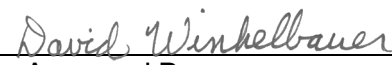
ATD Serial No: 351

Test I.D.: D114203

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	39	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	20.58	Pass
	20 ms	G's	14.00 to 19.00	16.87	Pass
	30 ms	G's	11.00 to 16.00	15.55	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	15.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.6	Pass
	Time	ms	72.0 to 82.0	78.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	155.0	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-64.3	Pass
	Time	ms	65.0 to 79.0	69.6	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	143.2	Pass
Overall Test Results					Pass


 Laboratory Technician

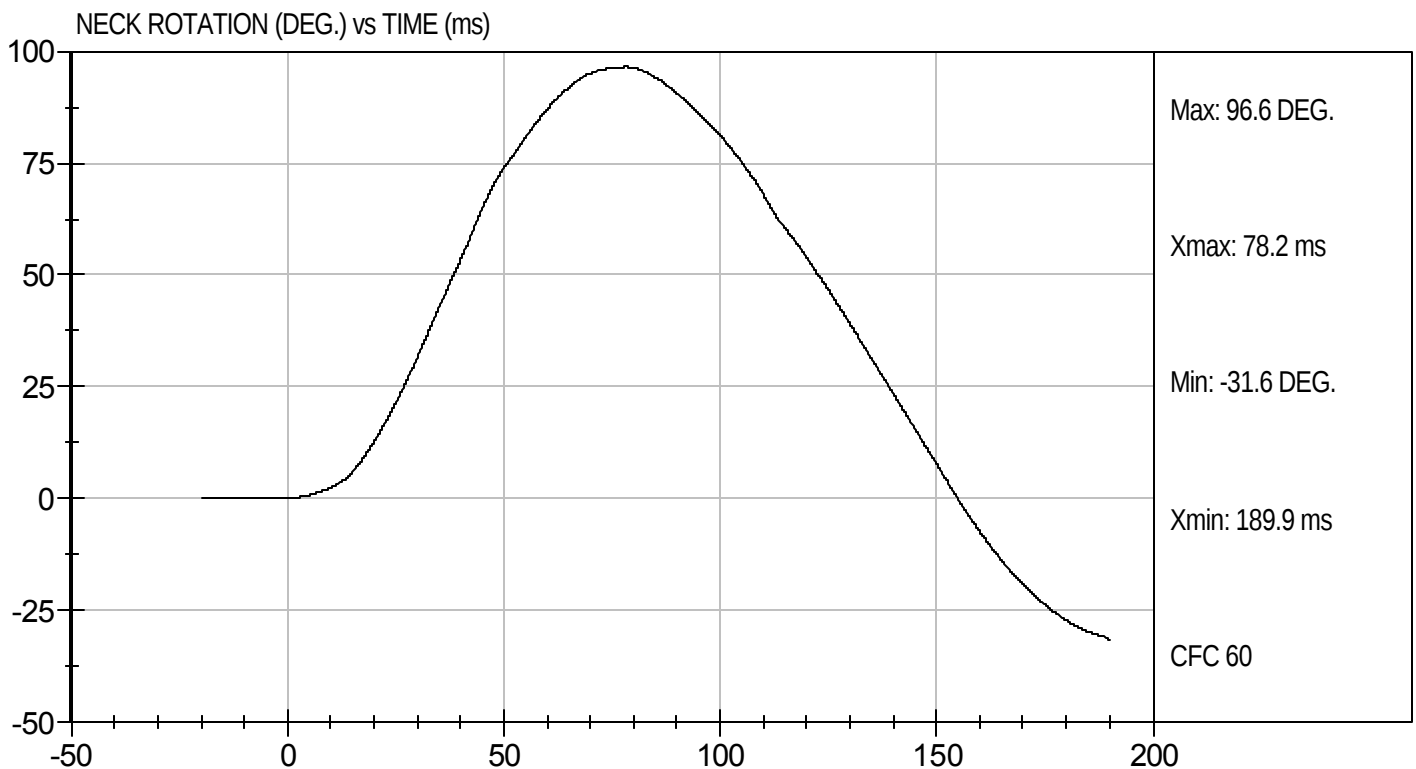
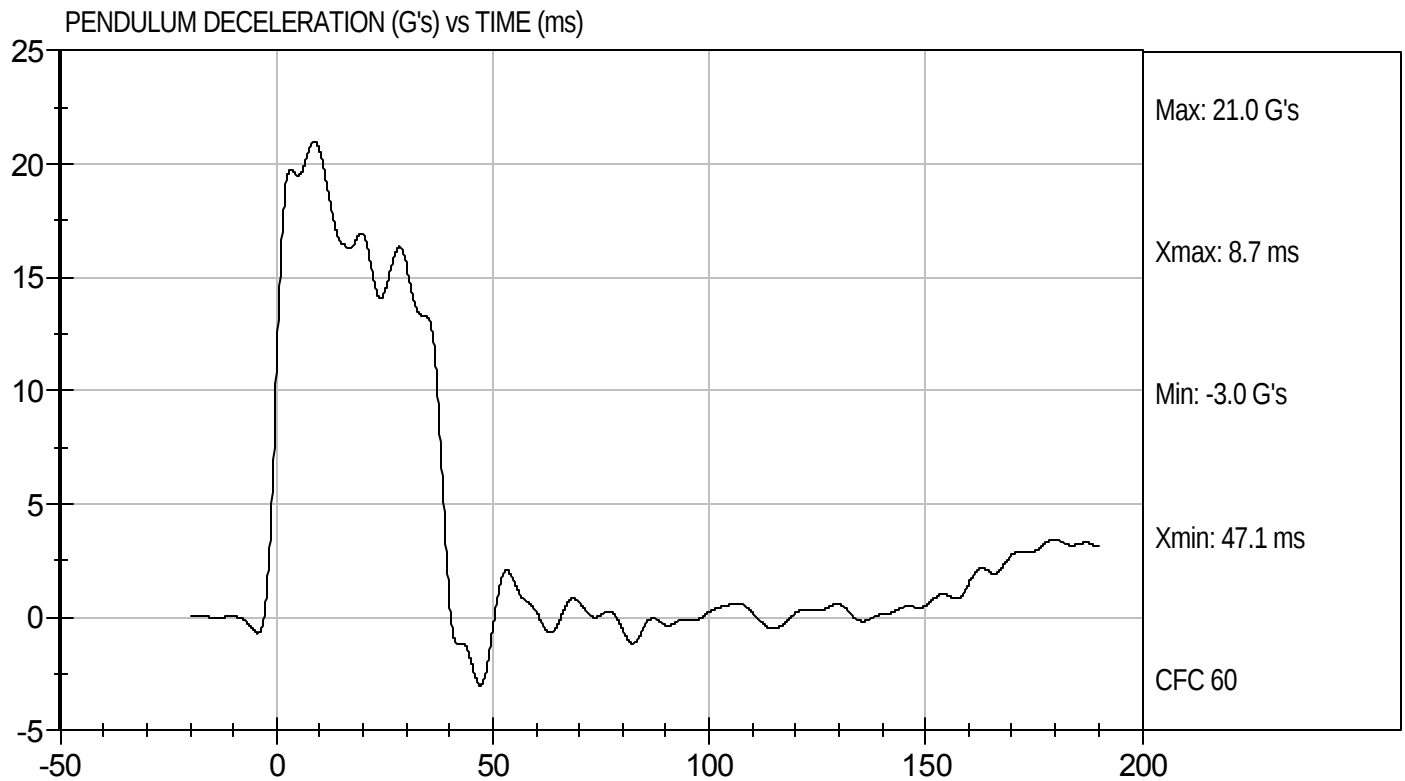
12/14/11
 Test Date


 Approved By



Test Desc: Neck Extension
Component ID: D114203

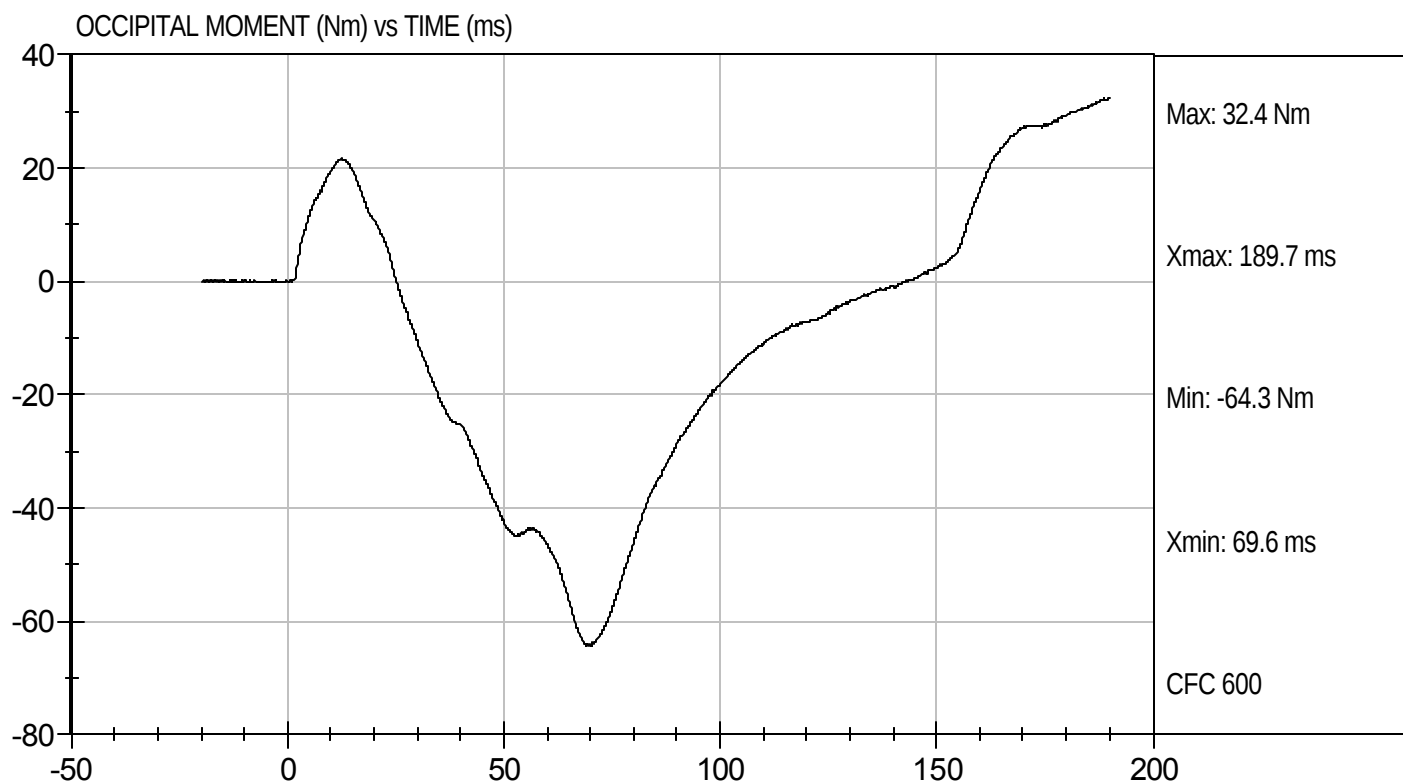
Test Date: 12/14/11
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension
Component ID: D114203

Test Date: 12/14/11
Velocity: 20.08 ft/s, 6.12 m/s

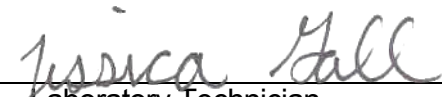


MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D114204

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,284	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.80	Pass
Internal Hysteresis	%	69 to 85	69	Pass
			Overall Test Results	Pass


Laboratory Technician

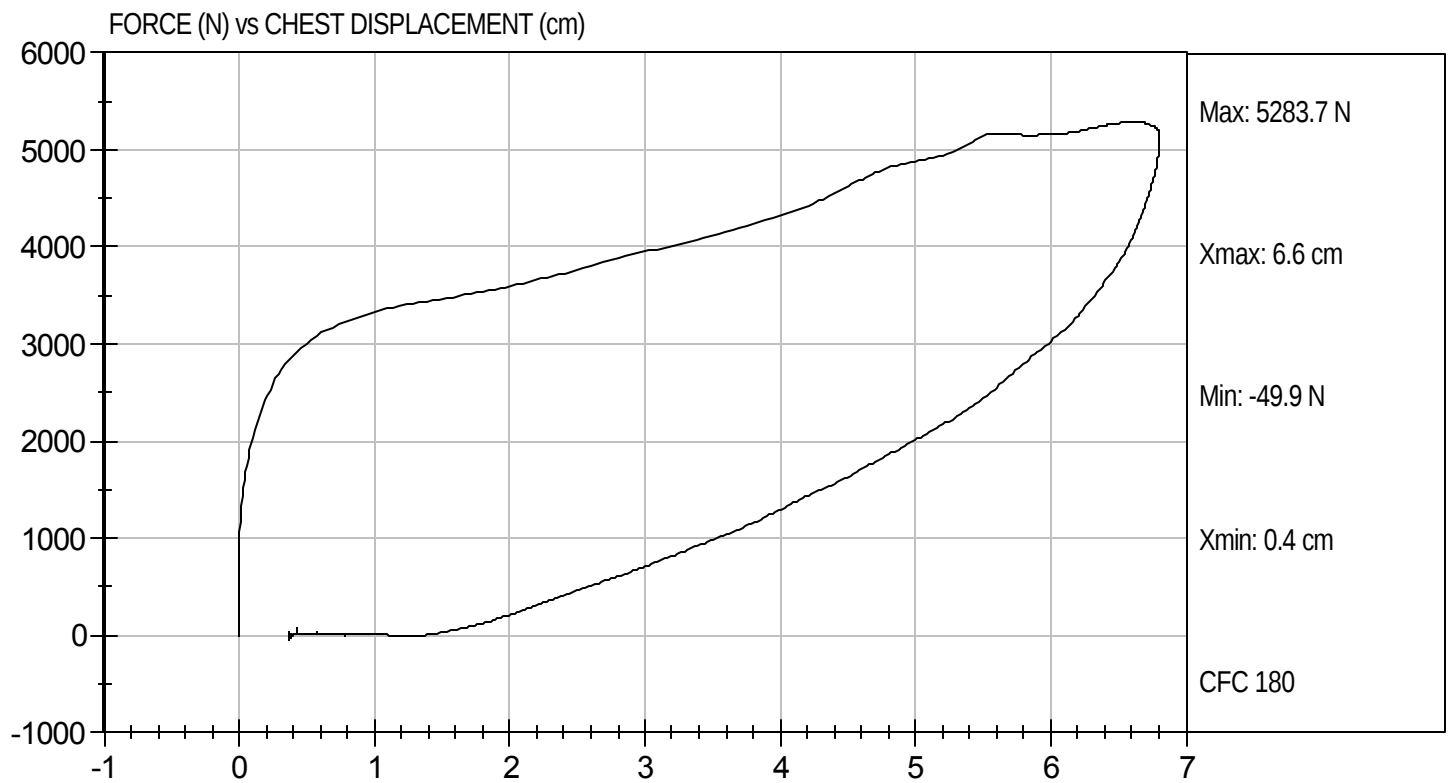
12/14/11
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D114204

Test Date: 12/14/11
Velocity: 22.22 ft/s, 6.77 m/s



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

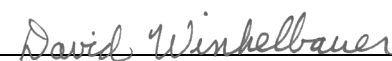
ATD Serial No: 351

Test I.D: D114205

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	40	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,184	Pass
Overall Test Results				Pass


Laboratory Technician

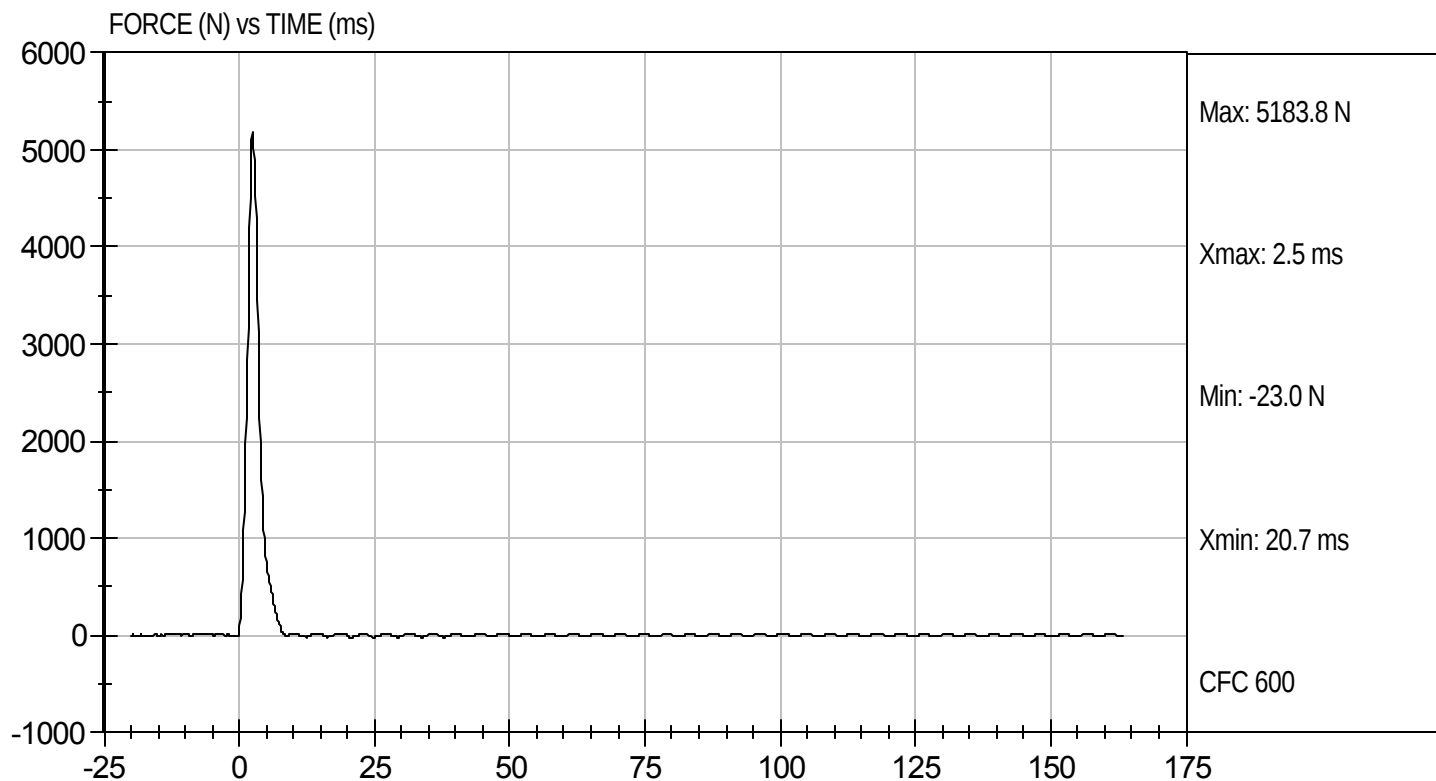
12/14/11
Test Date


Approved By



Test Desc: Right Knee
Component ID: D114205

Test Date: 12/14/11
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

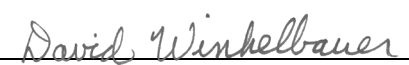
Test I.D: D114206

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	40	Pass
Probe Velocity	m/s	2.07 to 2.13	2.09	Pass
Peak Probe Force	Newtons	4715 to 5782	4,993	Pass
Overall Test Results				Pass



Laboratory Technician

12/14/11
Test Date

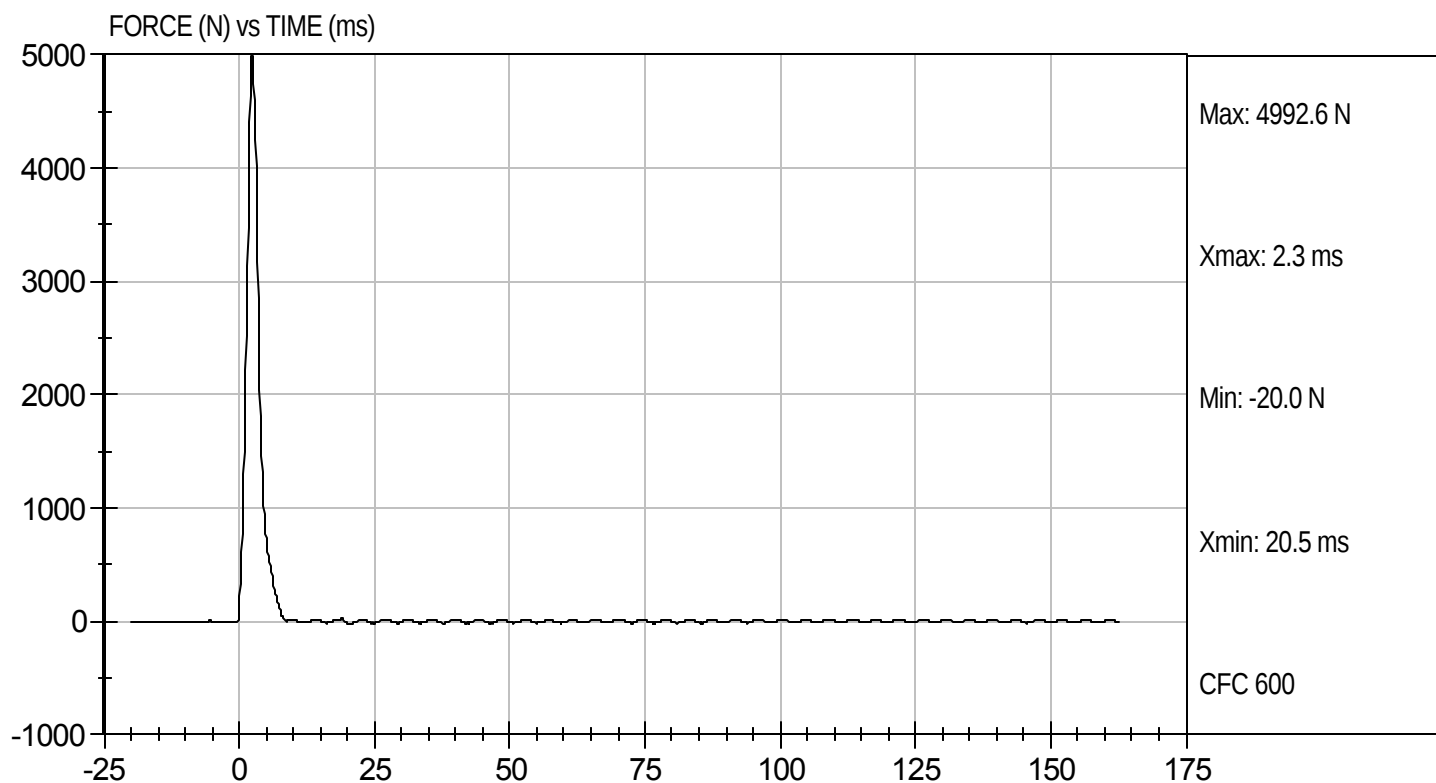


Approved By



Test Desc: Left Knee
Component ID: D114206

Test Date: 12/14/11
Velocity: 6.86 ft/s, 2.09 m/s



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

ATD Serial No: 351

Test I.D: D114200

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	43	43	Pass
Rotation Rate	deg/s	5.0 -10.0	5.7	5.7	Pass
30 Degrees	Nm	94.9 Nm Max	62.9	61.0	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 - 50.0 Degree Max Rotation	42.7	42.1	Pass
Overall Test Results					Pass


 Laboratory Technician

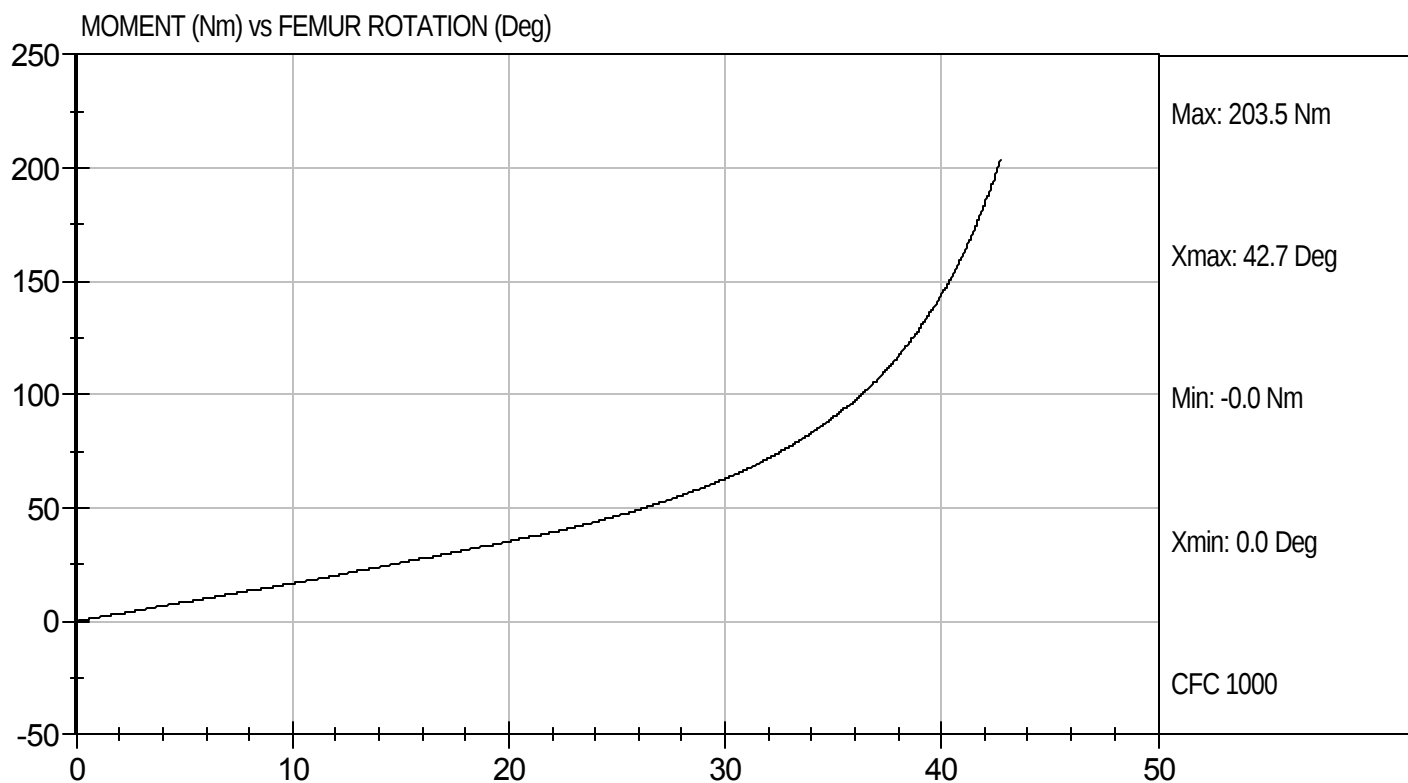
12/14/11
 Test Date


 Approved By



Test Desc: Hip Femur Flexion
Component ID: D114209

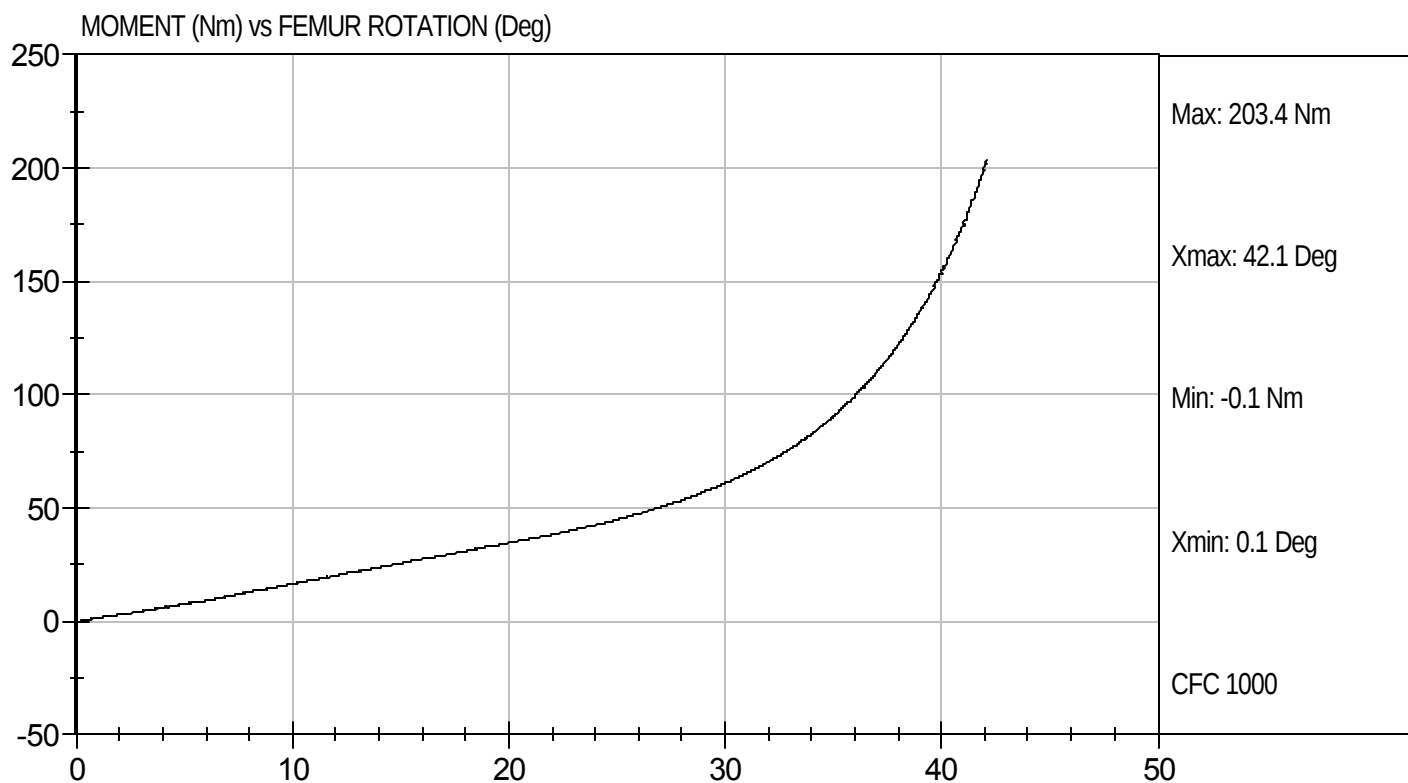
Test Date: 12/14/11
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D114200

Test Date: 12/14/11
Velocity: 0 ft/s, 0.00 m/s



Hybrid III, 5th External Measurements
SN: 138

HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	785.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	456.8
C	H-POINT HEIGHT	Reference	81.3-86.3	84.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	146.2
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	78.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	127.5
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	249.6
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	280.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	201.9
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	526.7
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.3
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	398.0
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	430.5

HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	184.6
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	221.0
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	472.6
S	HEAD BREADTH	The widest part of the head	137.1-147.3	141.9
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	184.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	307.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	360.5
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	85.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	546.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	875.1
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	785.4
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.4
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.1

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

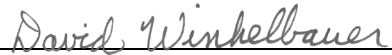
ATD Serial No: 138

Test ID: D114021

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	273	Pass
Peak Lateral Acceleration	G's	+/- 15	-12	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

11/30/11
Test Date

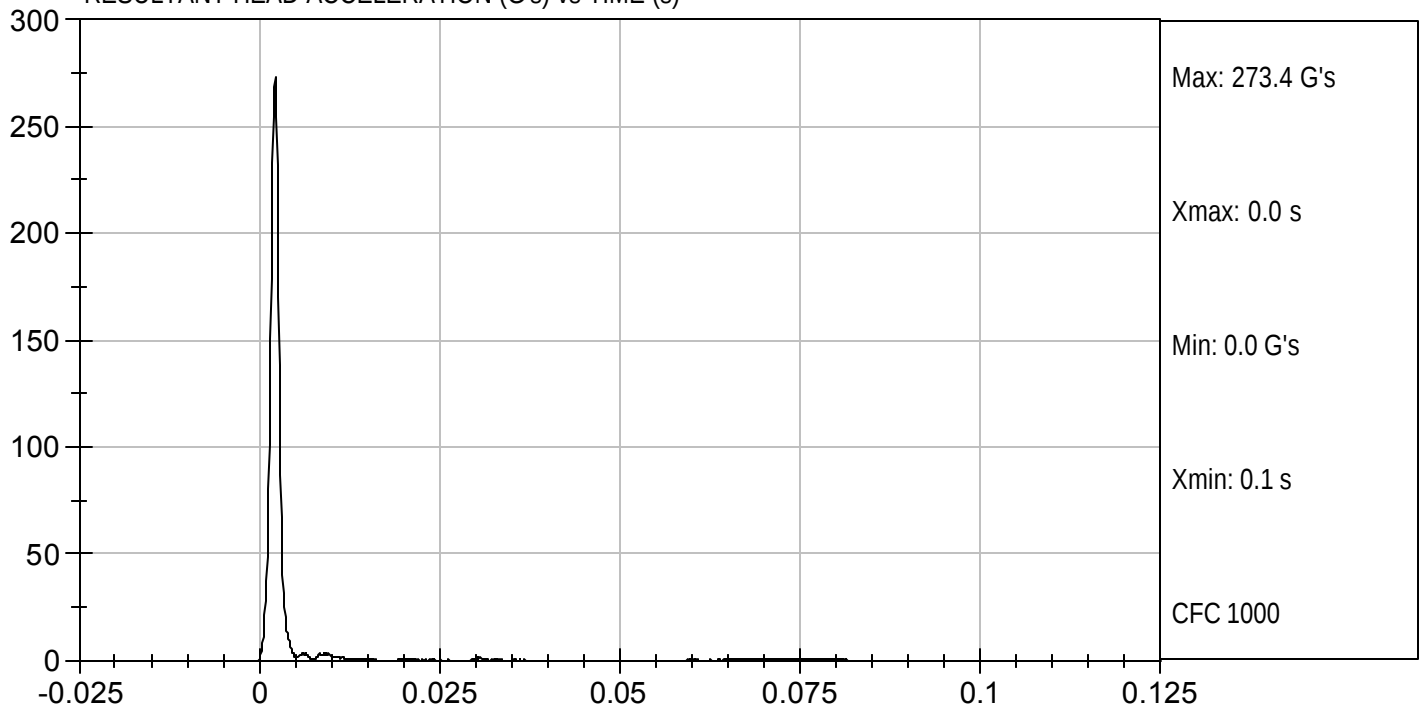

Approved By



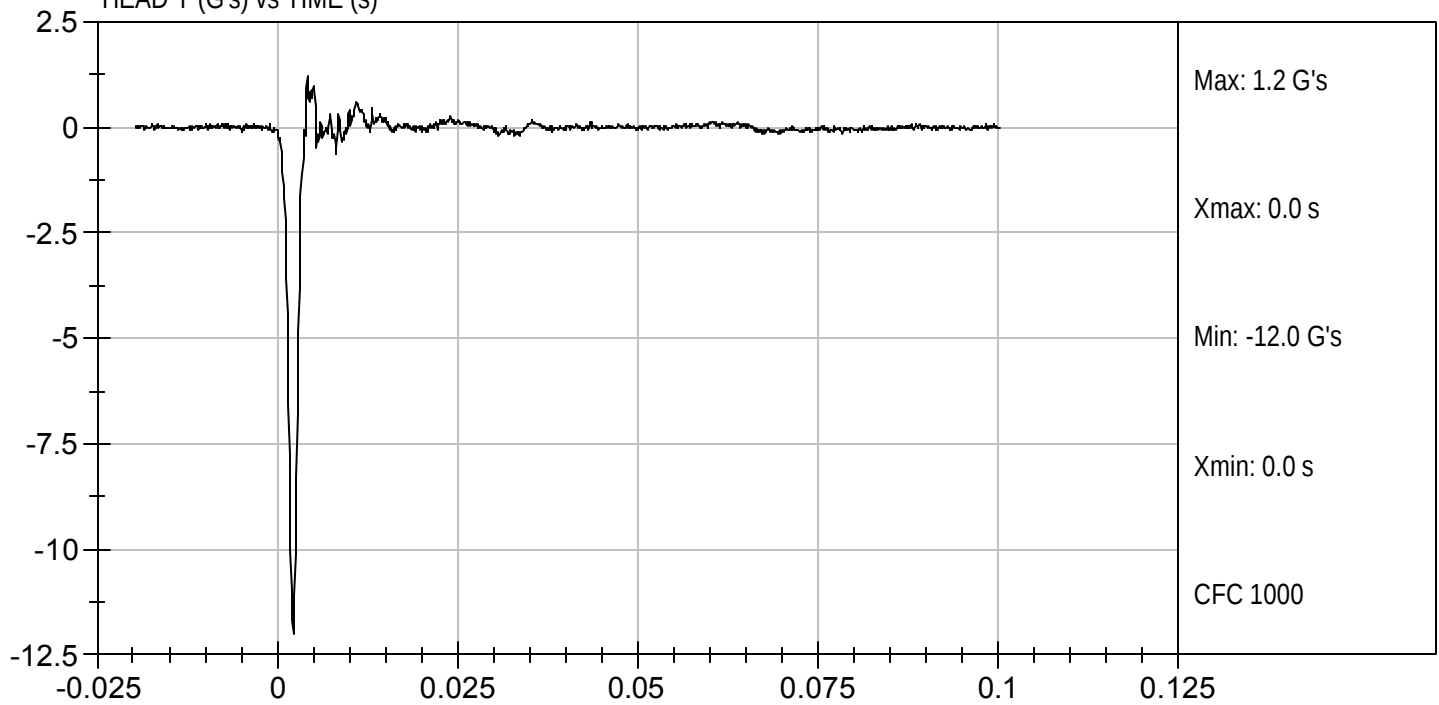
Test Desc: Head Drop
Component ID: D114021

Test Date: 11/30/11
Velocity: 0 ft/s, 0 m/s

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



HEAD Y (G's) vs TIME (s)

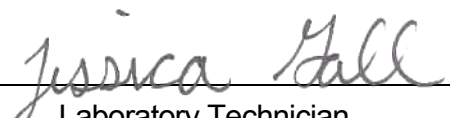


MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

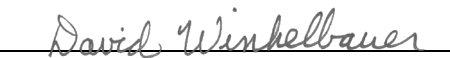
ATD Serial No: 138

Test I.D: D114022

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	16	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Pulse	10 ms	m/s	2.1 to 2.5	2.5	Pass
	20 ms	m/s	4.0 to 5.0	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.3	Pass
D Plane Rotation	Max	deg	77 to 91	77	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	77	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
Overall Results					Pass


 Laboratory Technician

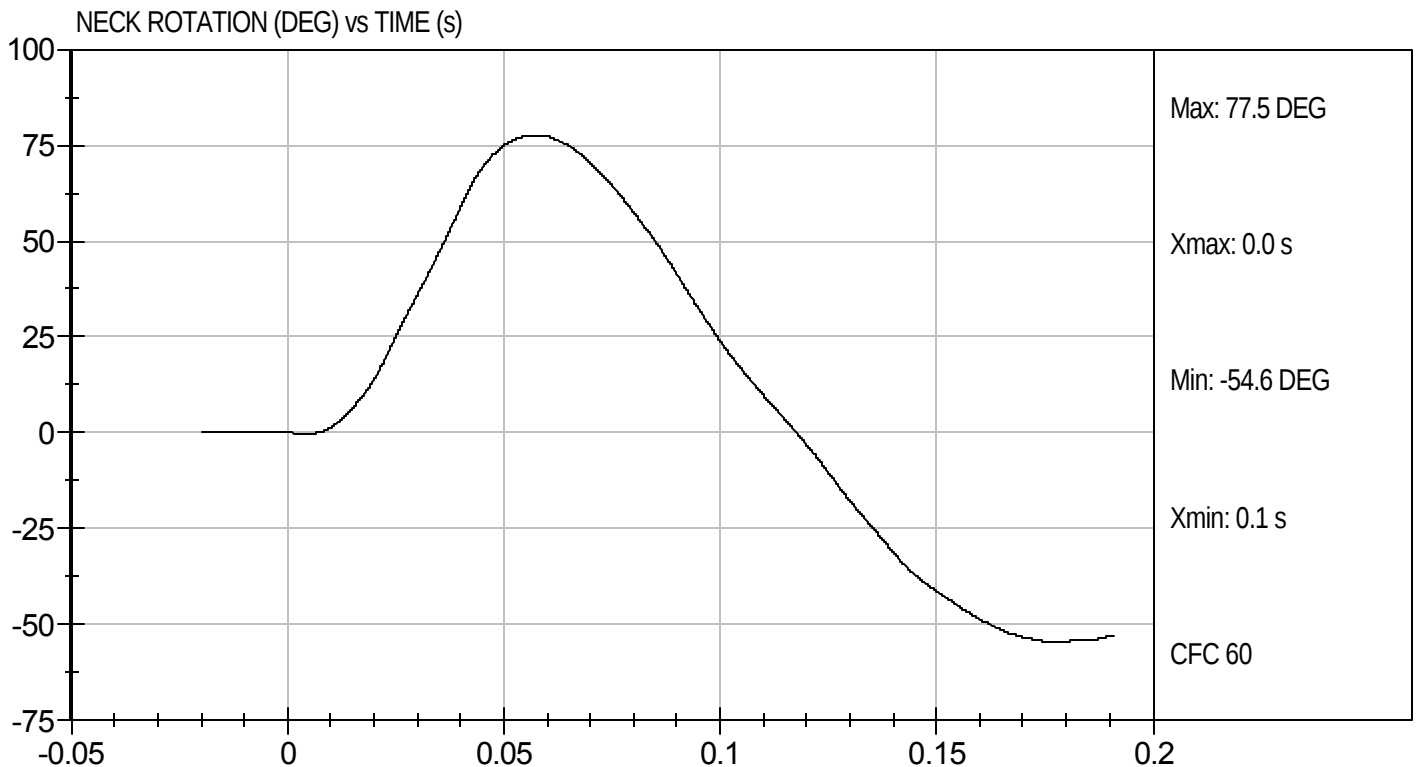
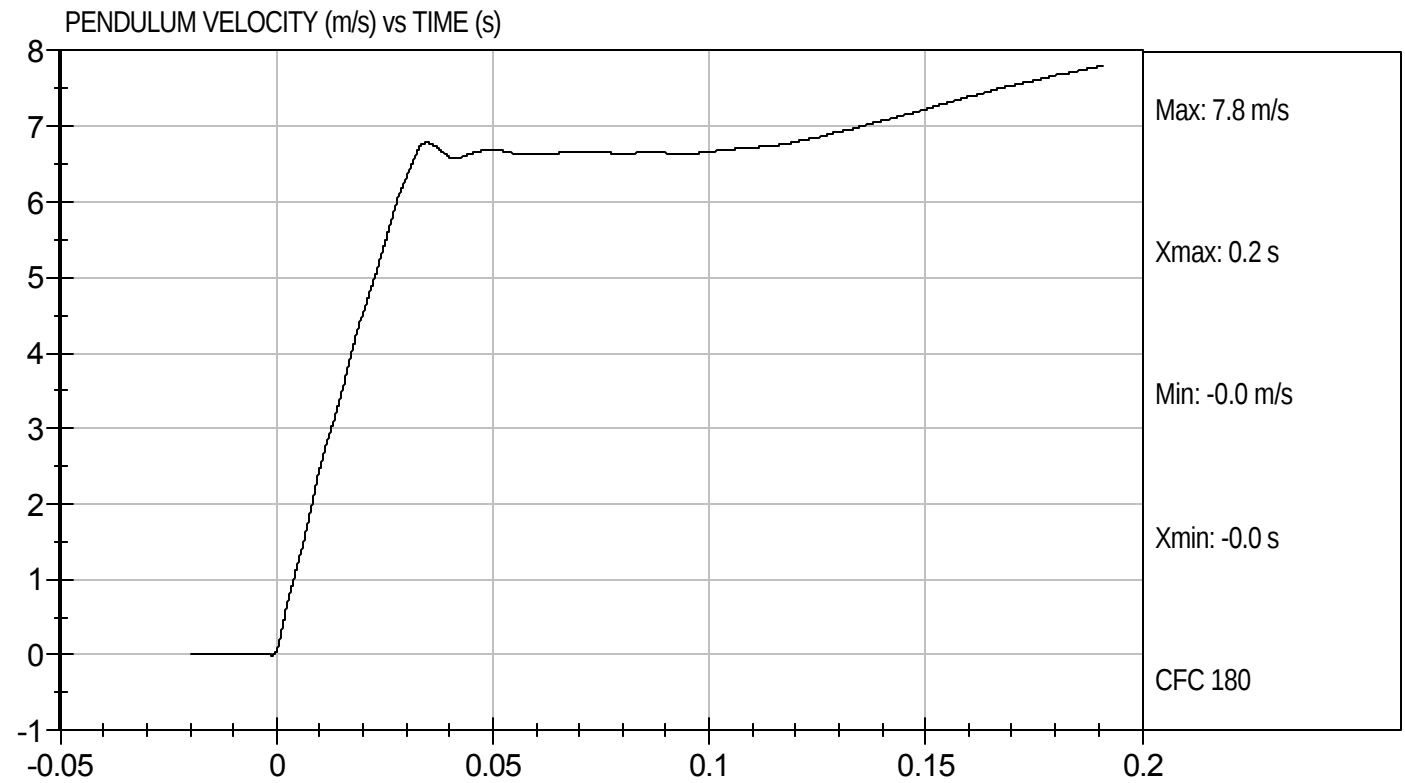
11/30/11
 Test Date


 Approved By



Test Desc: Neck Flexion
Component ID: D114022

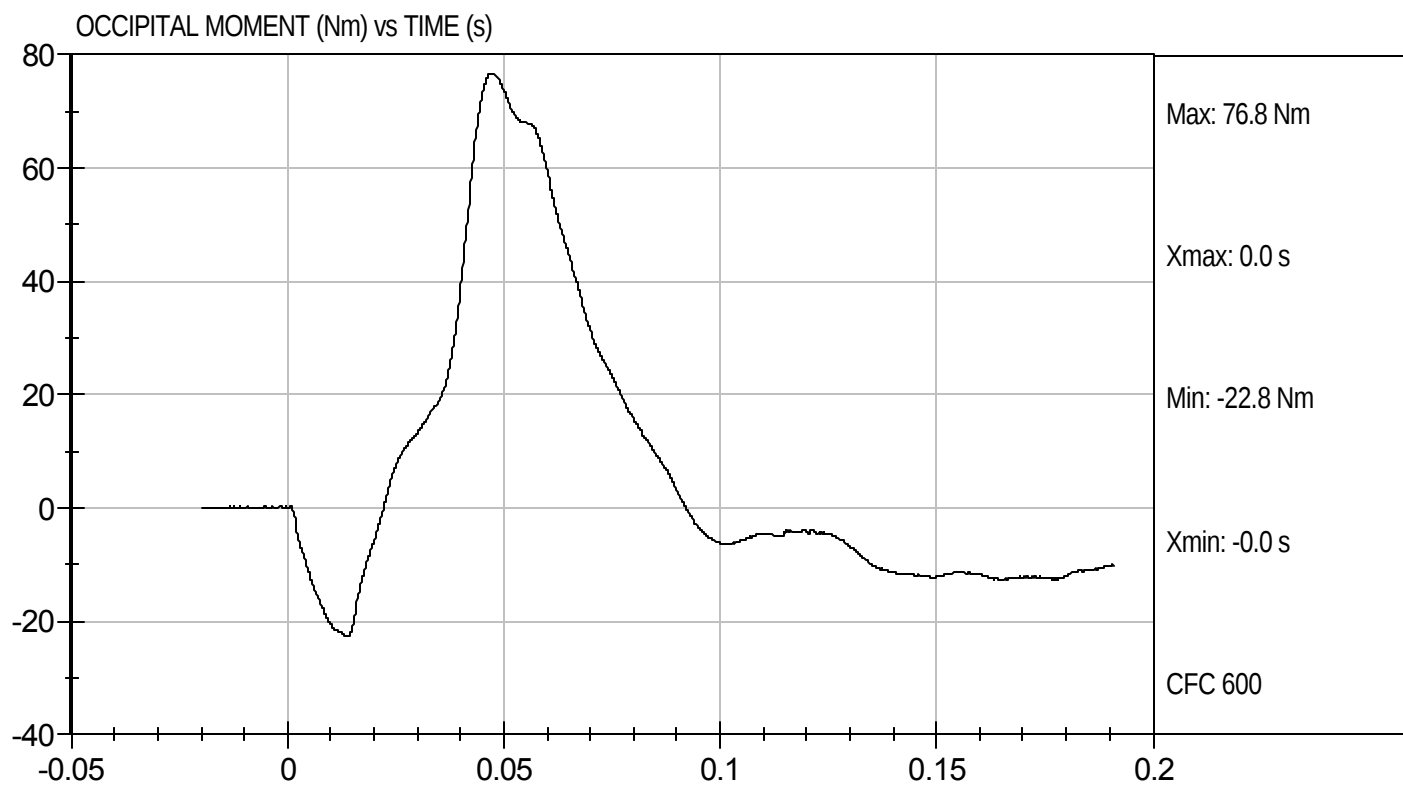
Test Date: 11/30/11
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D114022

Test Date: 11/30/11
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

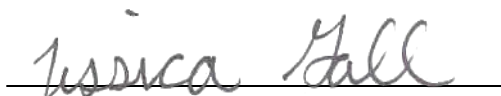
NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

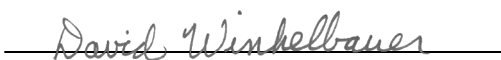
ATD Serial No: 138

Test I.D: D114023

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	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	1.9	Pass
	20 ms	m/s	3.1 to 3.9	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	102	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	101	Pass
Overall Results					Pass


Laboratory Technician

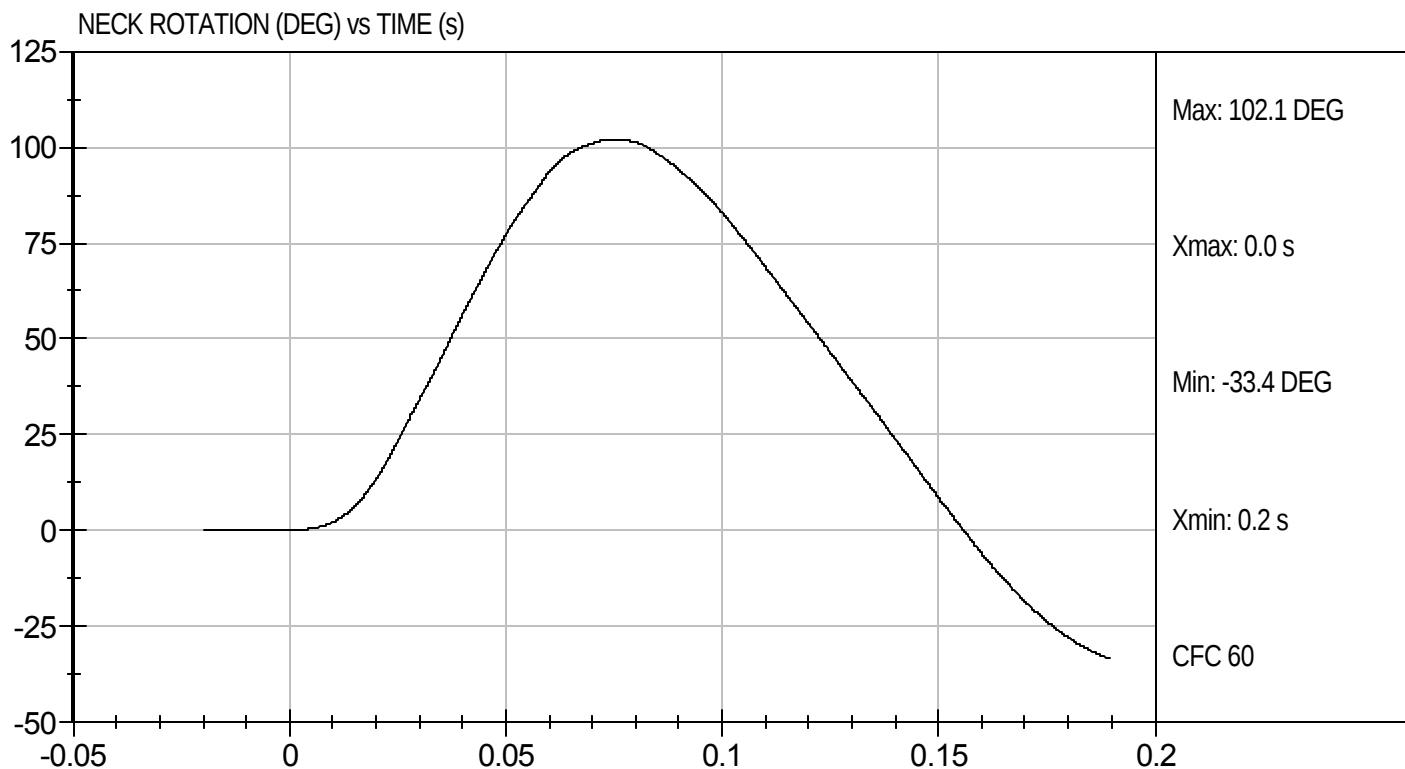
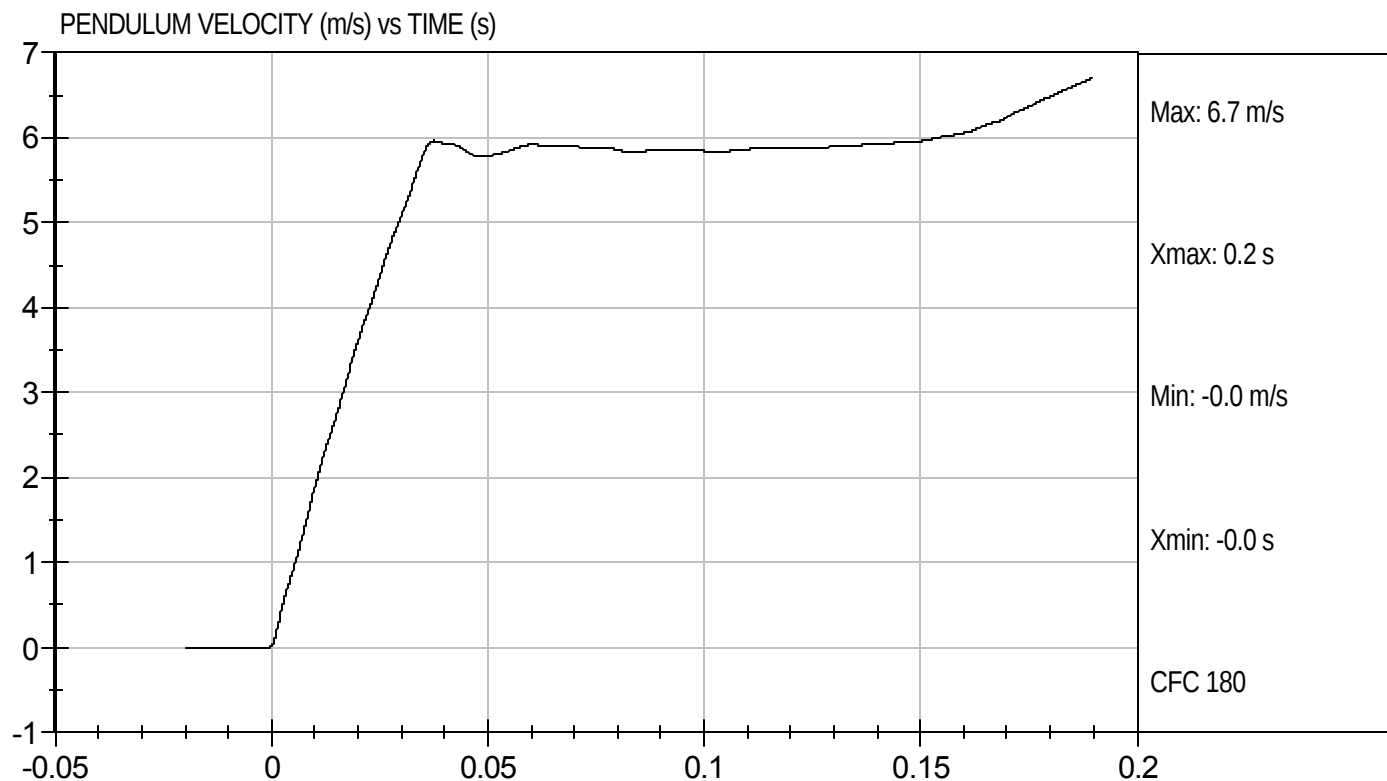
11/30/11
Test Date


Approved By



Test Desc: Neck Extension
Component ID: D114023

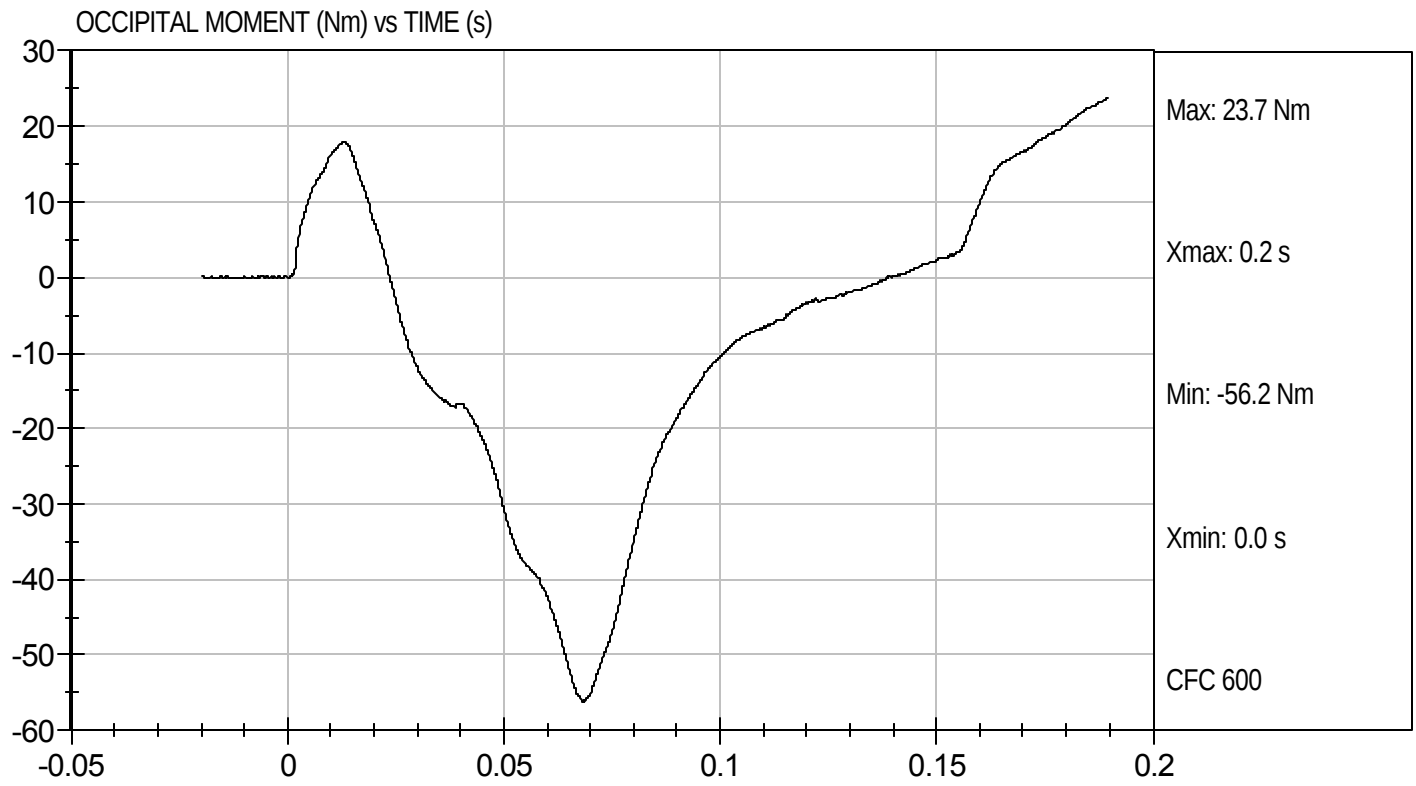
Test Date: 11/30/11
Velocity: 0 ft/s, 0 m/s





Test Desc: Neck Extension
Component ID: D114023

Test Date: 11/30/11
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

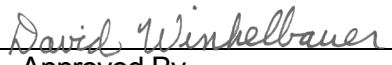
ATD Serial No: 138

Test I.D: D114024

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	20	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	69	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	3906	Pass
			Overall Test Results	Pass


Laboratory Technician

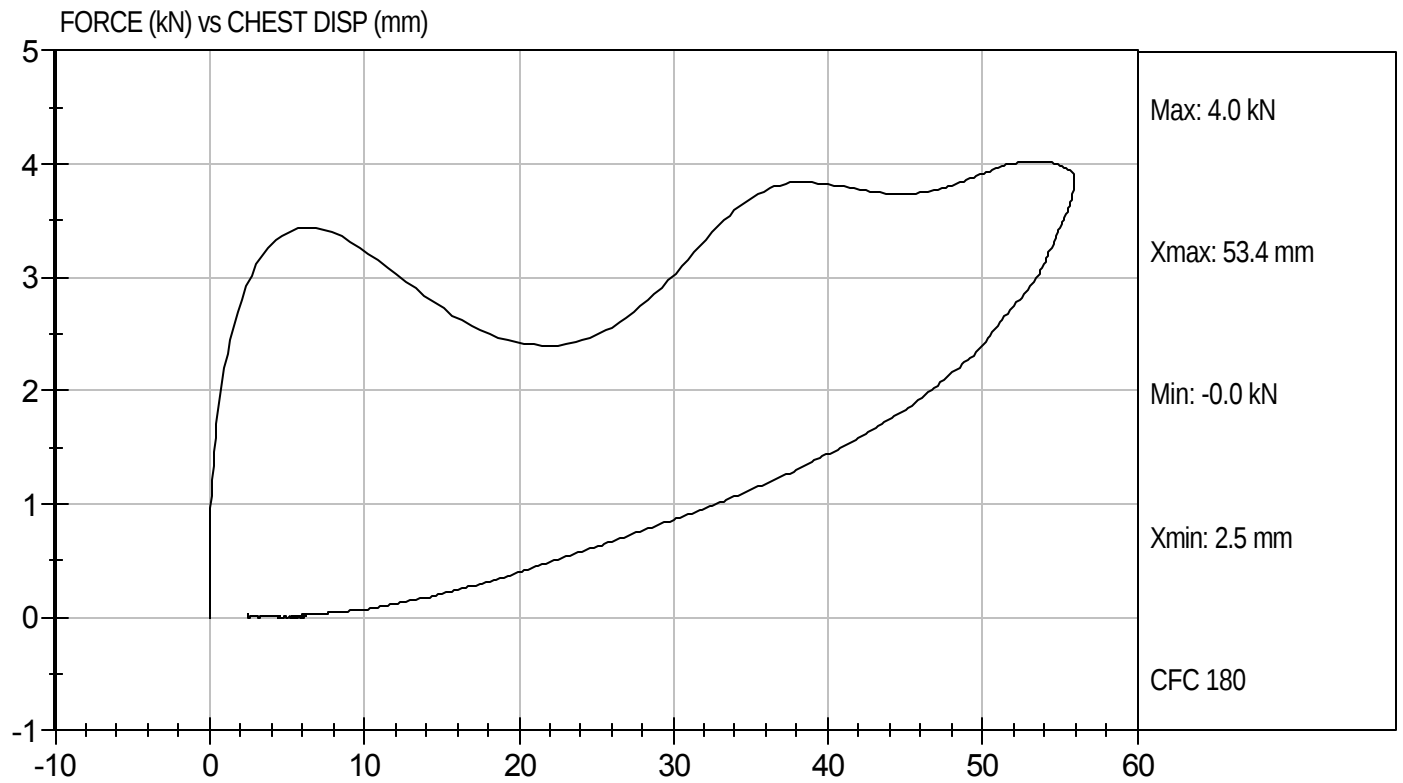
12/1/11
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D114024

Test Date: 12/1/11
Velocity: 22.22 ft/s, 6.77 m/s



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

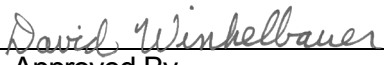
ATD Serial No: 138

Test I.D: D114025

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	18	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.59	Pass
Overall Test Results				Pass


Laboratory Technician

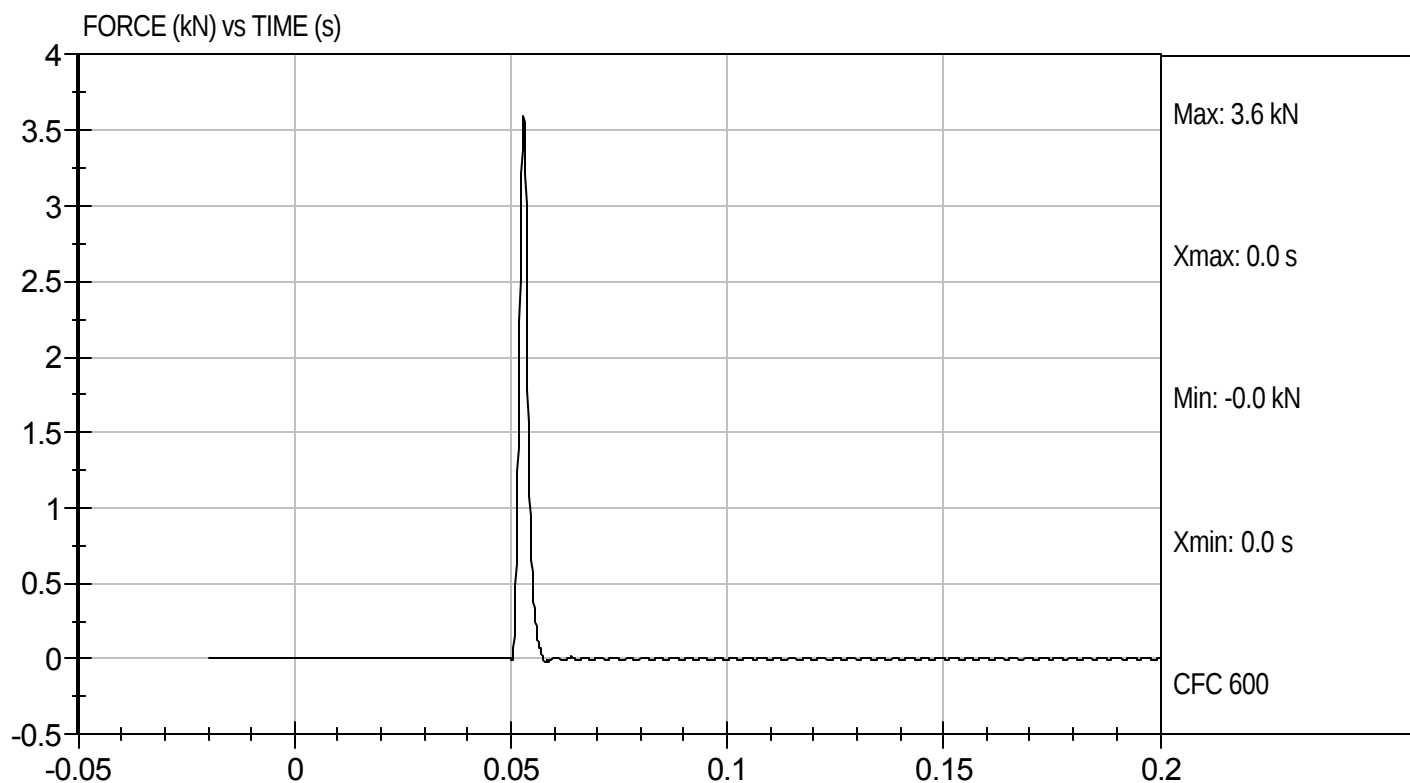
11/30/11
Test Date


Approved By



Test Desc: Right Knee
Component ID: D114025

Test Date: 11/30/11
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D114026

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.6	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	3.57	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

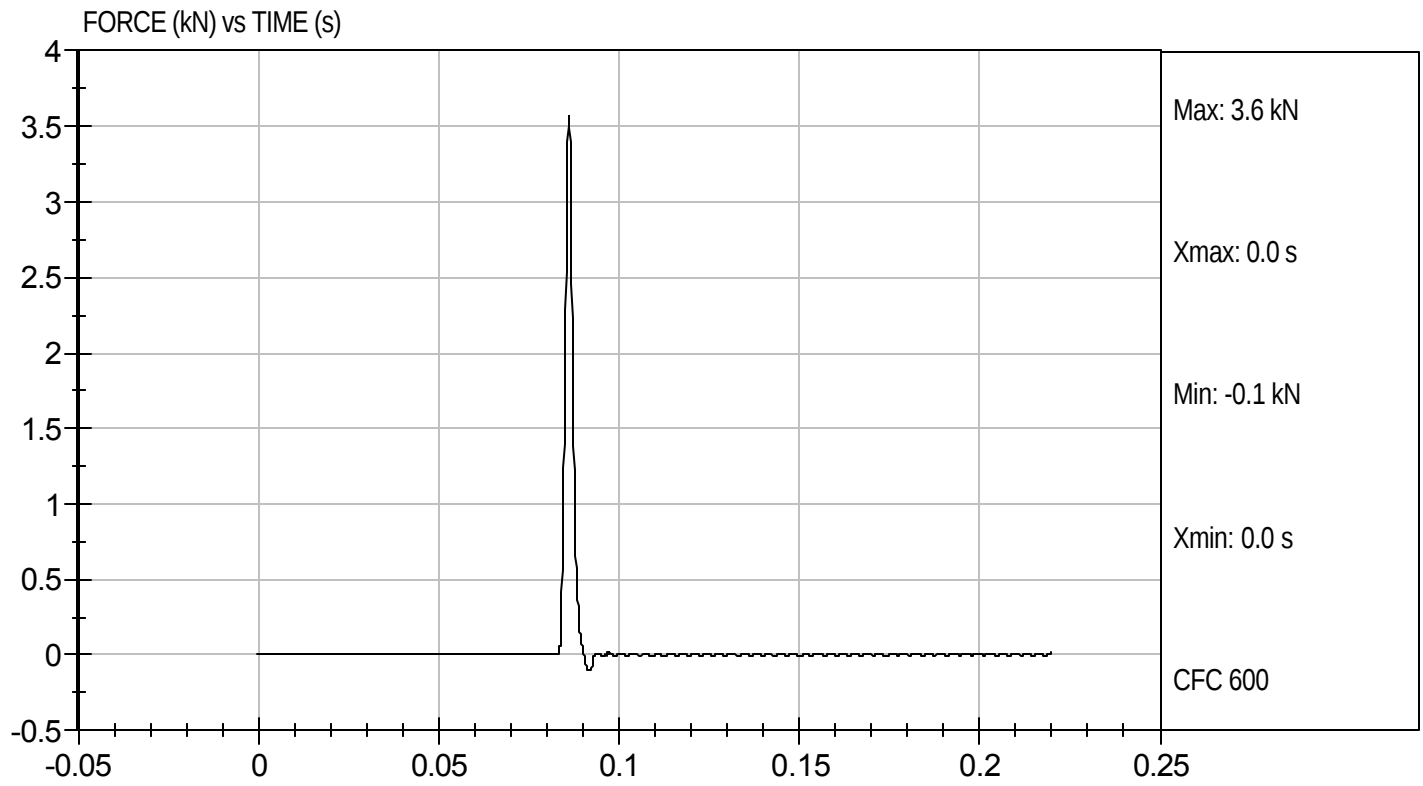
11/30/11
Test Date

David Winkelbauer
Approved By



Test Desc: Left Knee
Component ID: D114026

Test Date: 11/30/11
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

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

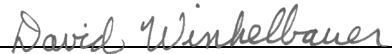
ATD Serial No: 138

Test I.D: D114027

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Initial Angle	deg	0 to 20	14	Pass
Return Angle	deg	+/- 8	7	Pass
Force at 45 deg	N	320 to 390	378	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
Overall Result				Pass


Laboratory Technician

11/30/11
Test Date


Approved By

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test ID: D114211

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	42	Pass
Peak Resultant Acceleration	G's	250 to 300	266	Pass
Peak Lateral Acceleration	G's	+/- 15	8.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

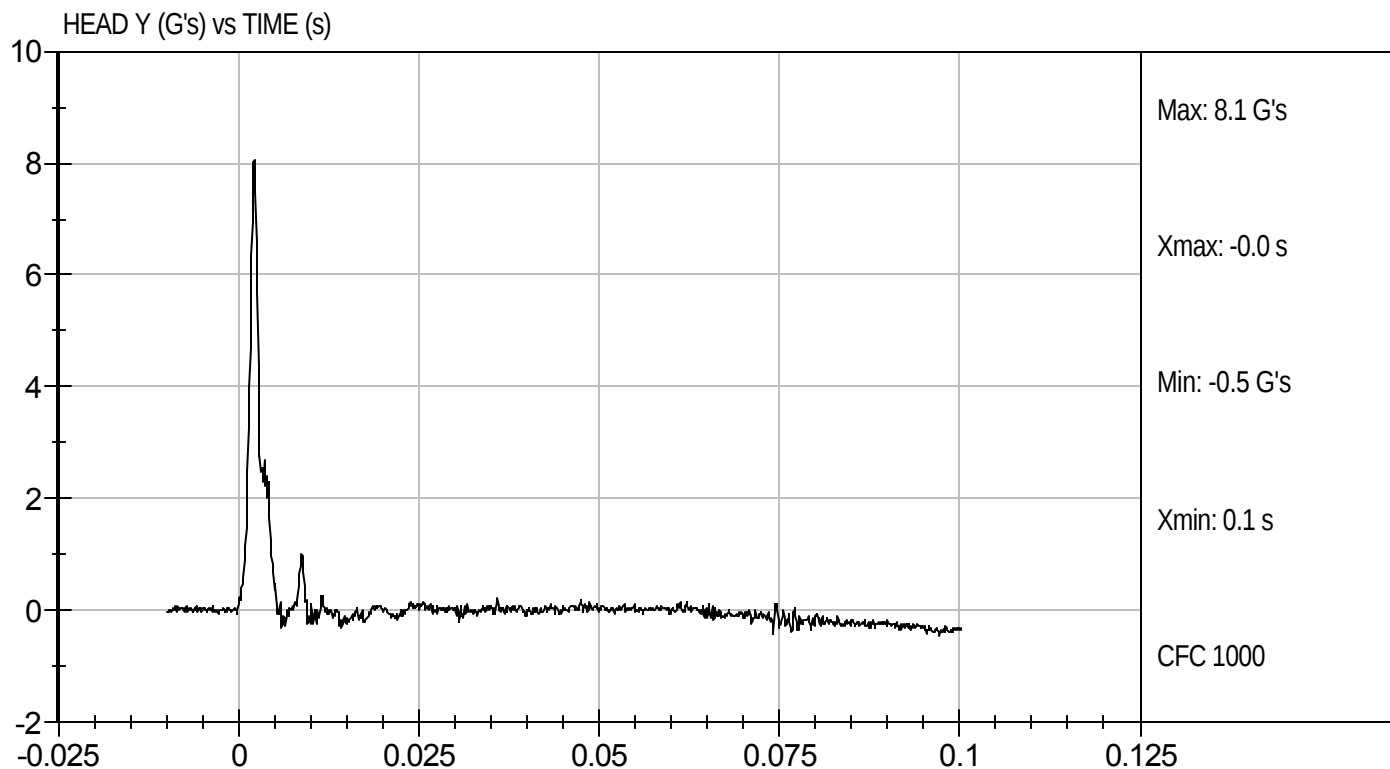
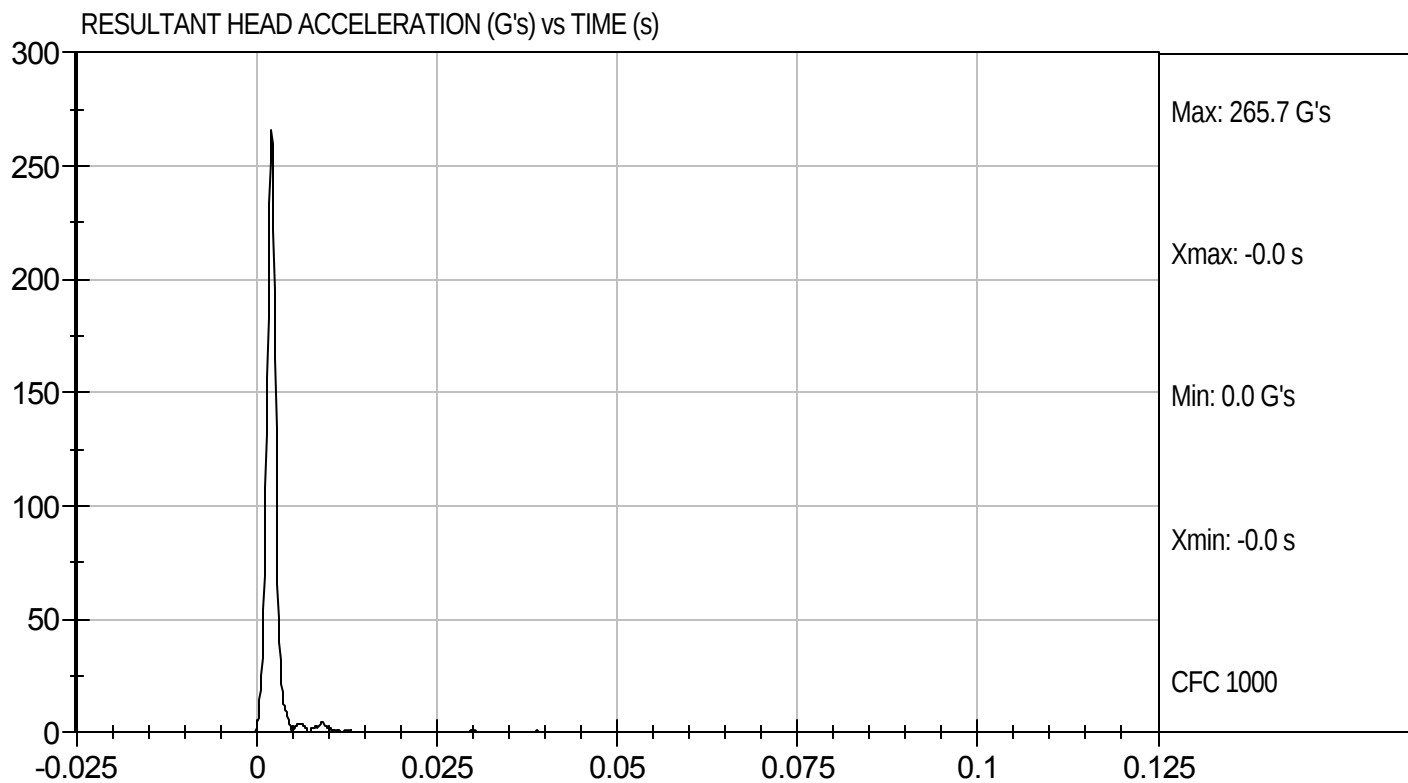
12/14/11
Test Date


Approved By



Test Desc: Head Drop
Component ID: D114211

Test Date: 12/14/11
Velocity: 0 ft/s, 0 m/s



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

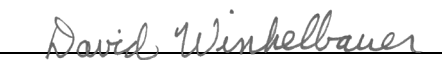
ATD Serial No: 138

Test I.D: D114212

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	38	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.05	Pass
Pendulum Pulse	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.2	Pass
	30 ms	m/s	5.8 to 7.0	5.9	Pass
D Plane Rotation	Max	deg	77 to 91	78	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	76	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	87	Pass
Overall Results					Pass


 Laboratory Technician

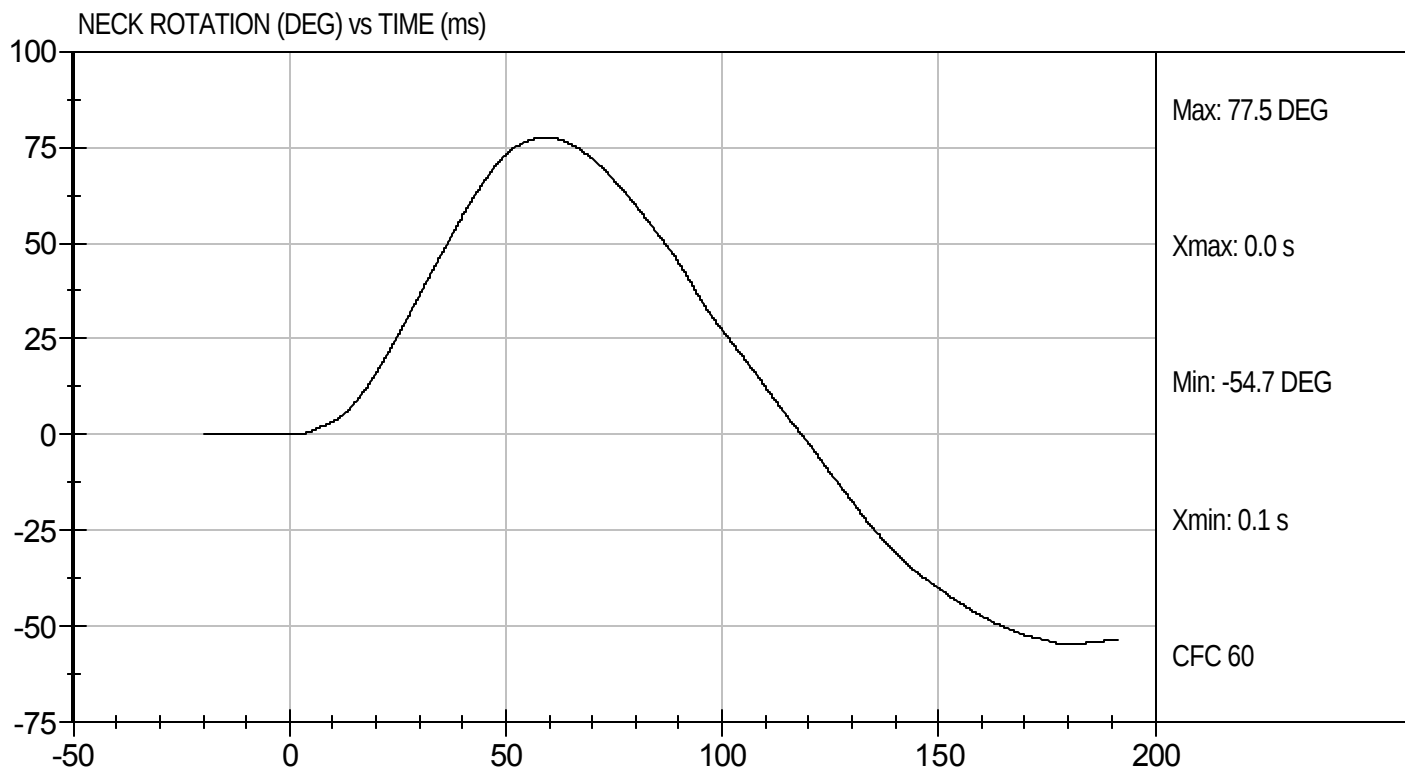
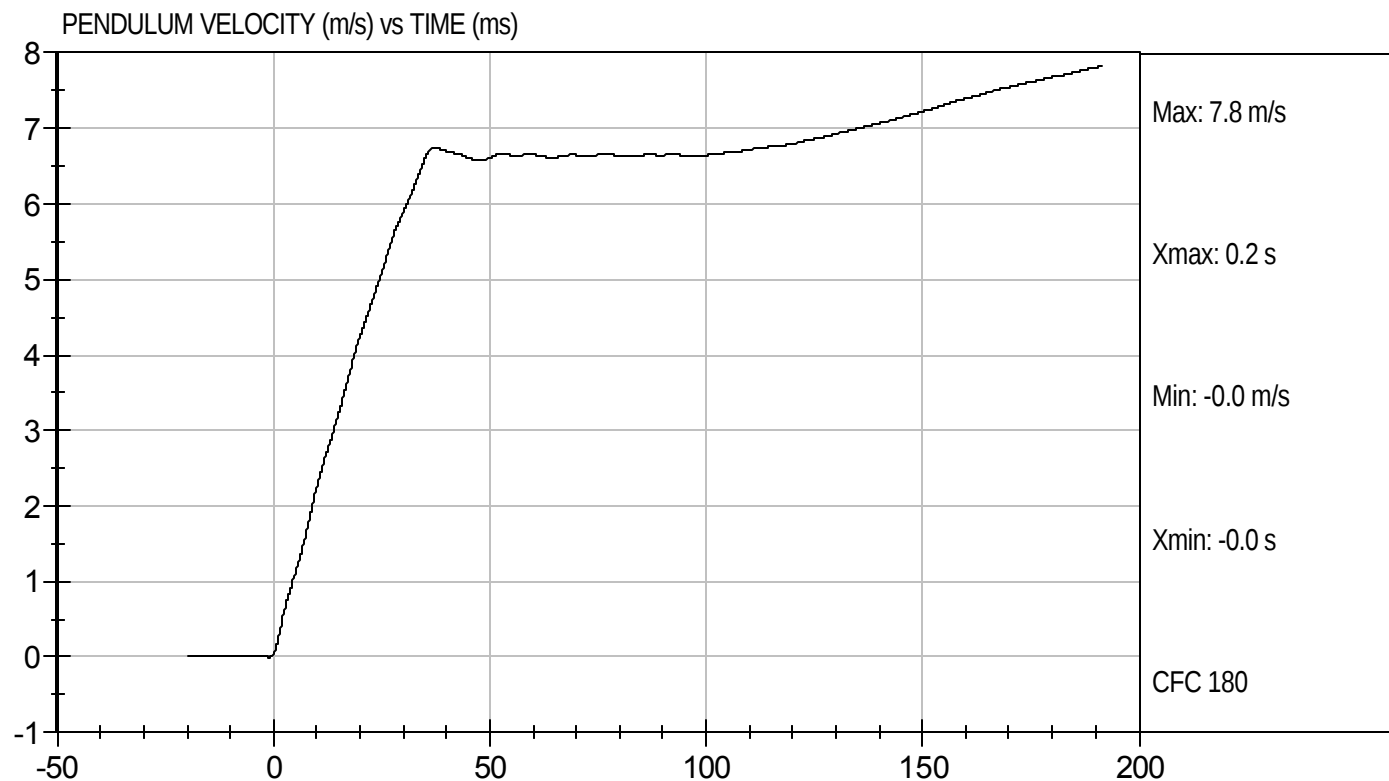
12/15/11
 Test Date


 Approved By



Test Desc: Neck Flexion
Component ID: D114212

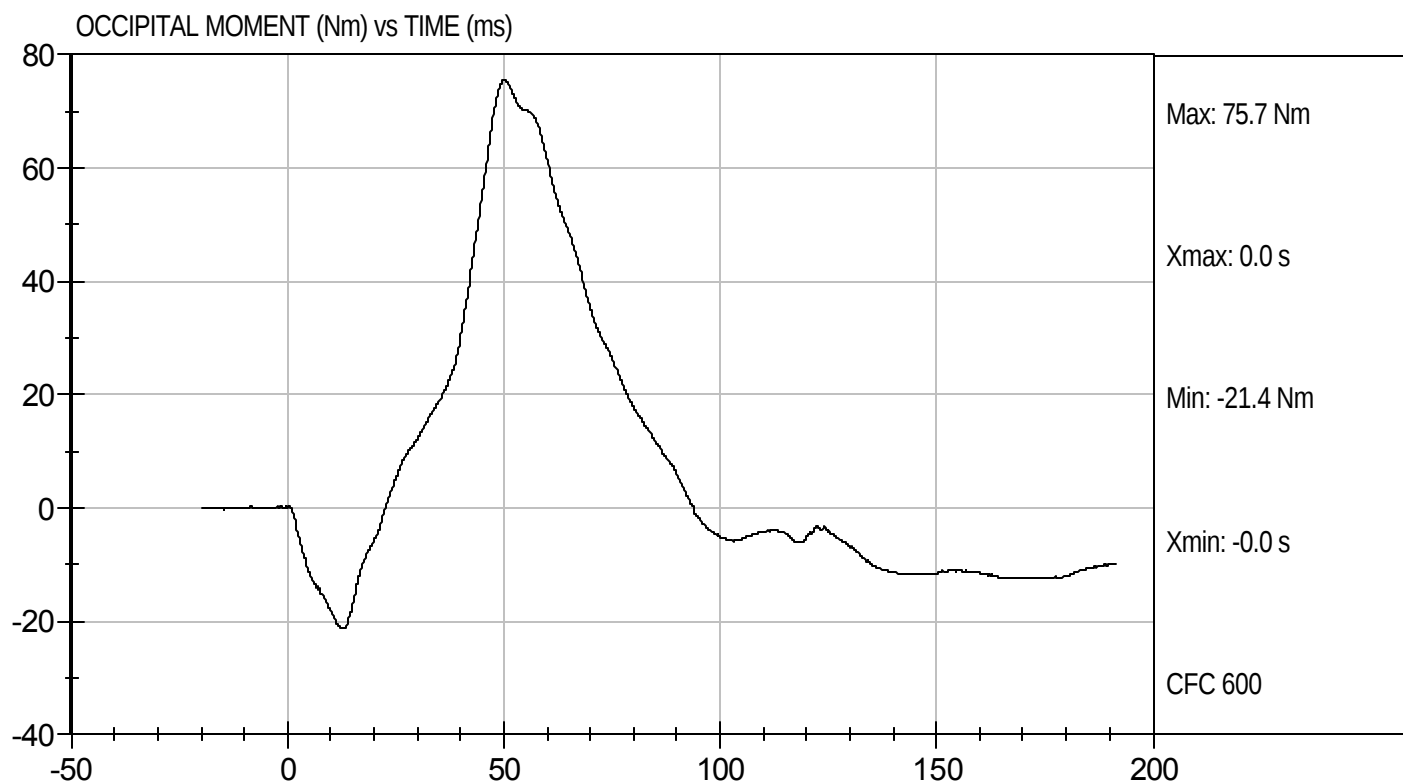
Test Date: 12/15/11
Velocity: 23.14 ft/s, 7.05 m/s





Test Desc: Neck Flexion
Component ID: D114212

Test Date: 12/15/11
Velocity: 23.14 ft/s, 7.05 m/s



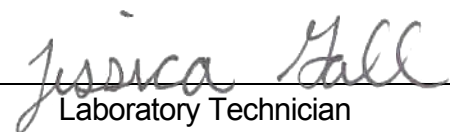
MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138Test I.D: D114213

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	38	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	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	104	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-57	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	102	Pass
Overall Results					Pass


 Laboratory Technician

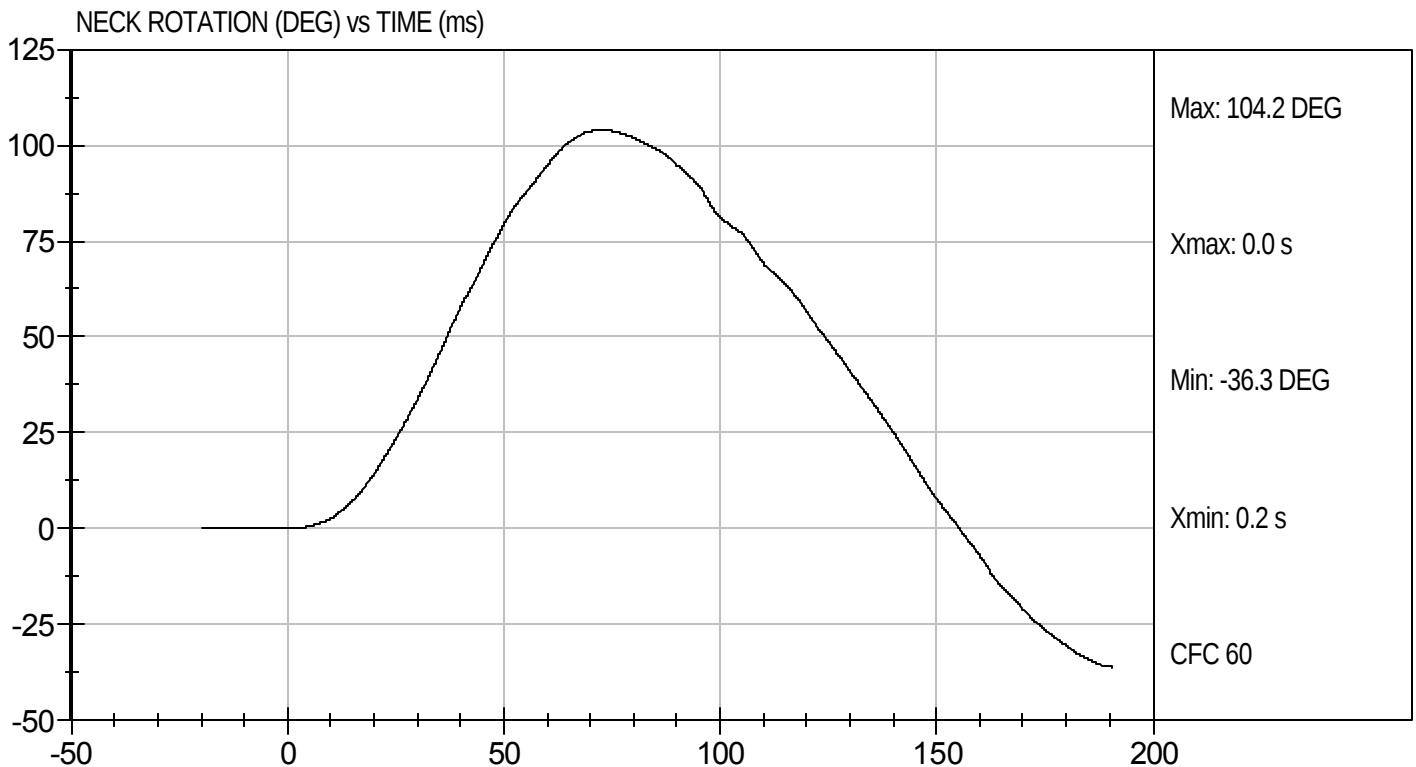
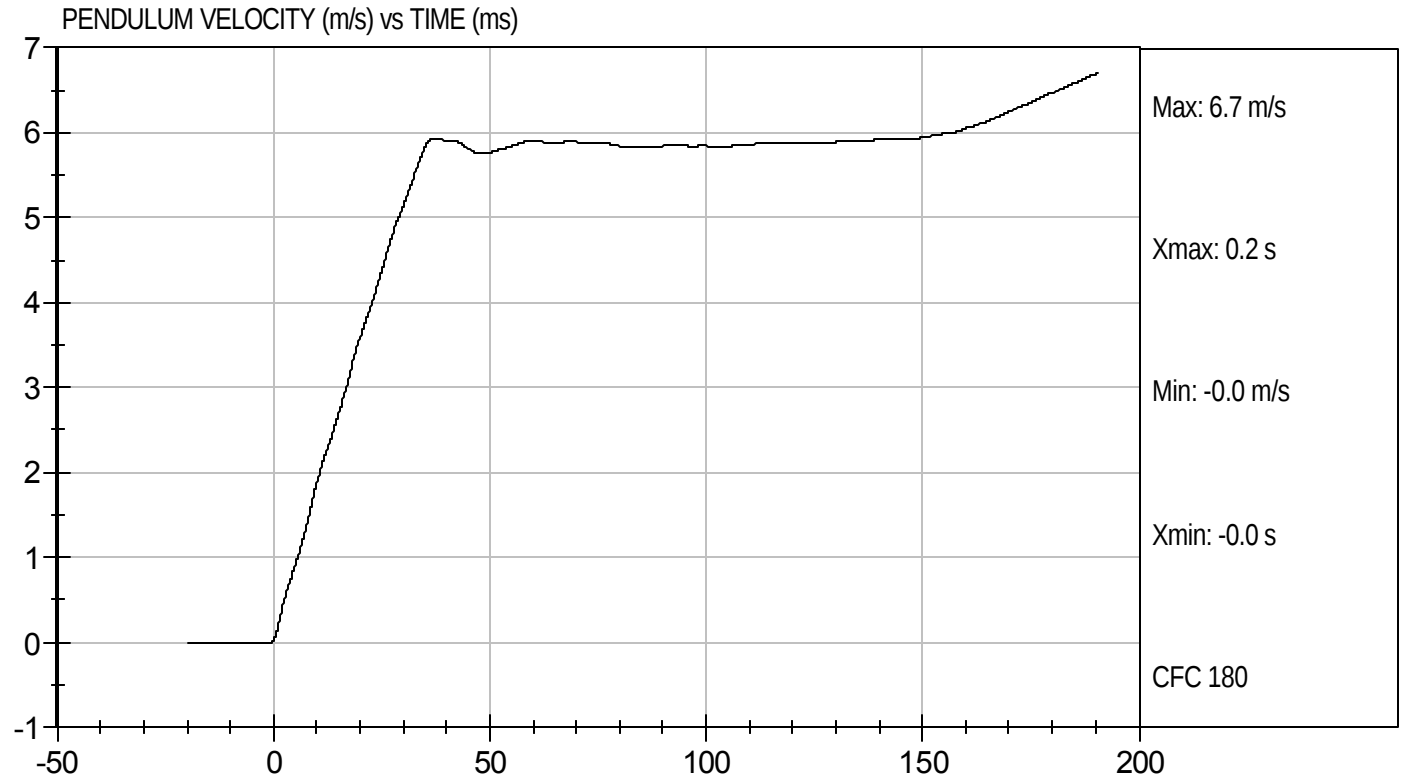
12/15/11
 Test Date


 Approved By



Test Desc: Neck Extension
Component ID: D114213

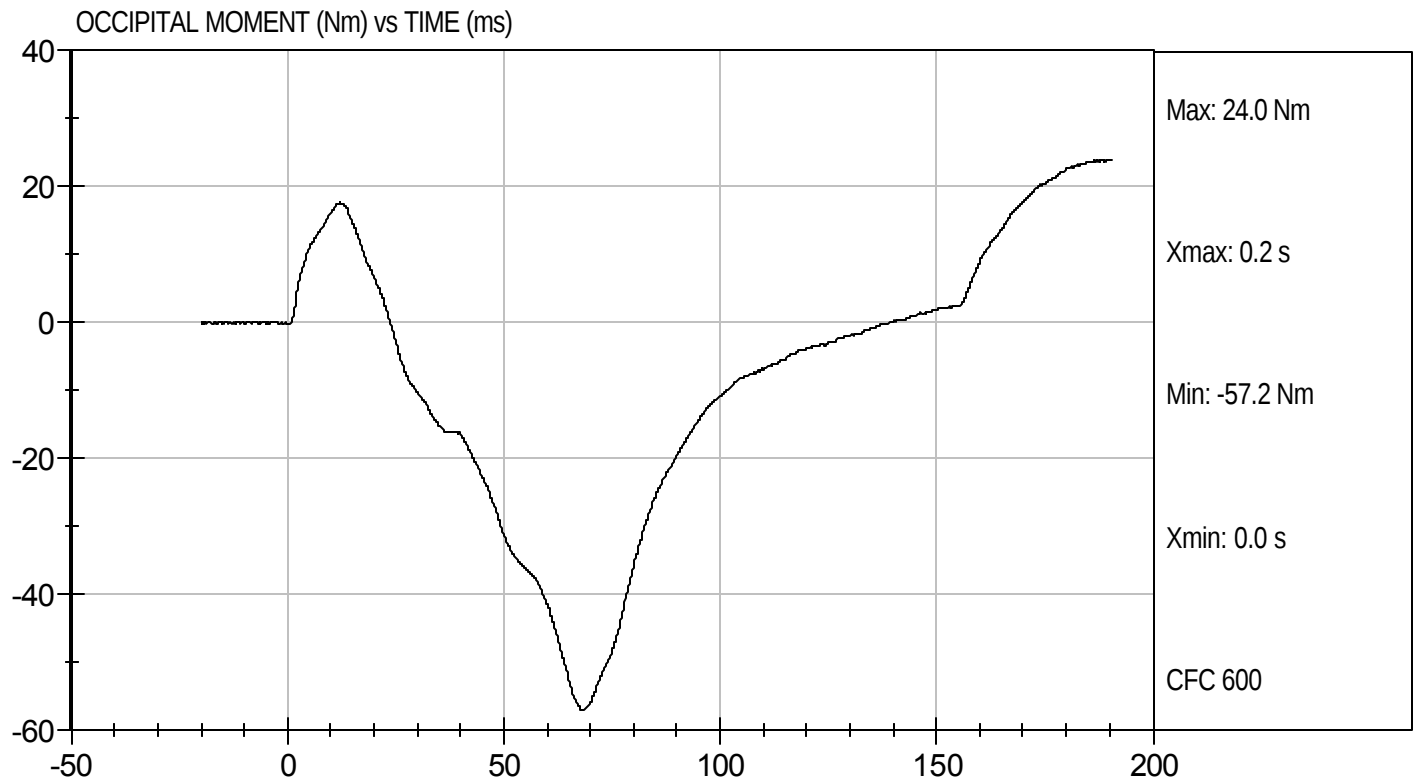
Test Date: 12/15/11
Velocity: 0 ft/s, 0 m/s





Test Desc: Neck Extension
Component ID: D114213

Test Date: 12/15/11
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D114214

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.0	Pass
Relative Humidity	%	10 to 70	35	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.1	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	4084	Pass
			Overall Test Results	Pass


Laboratory Technician

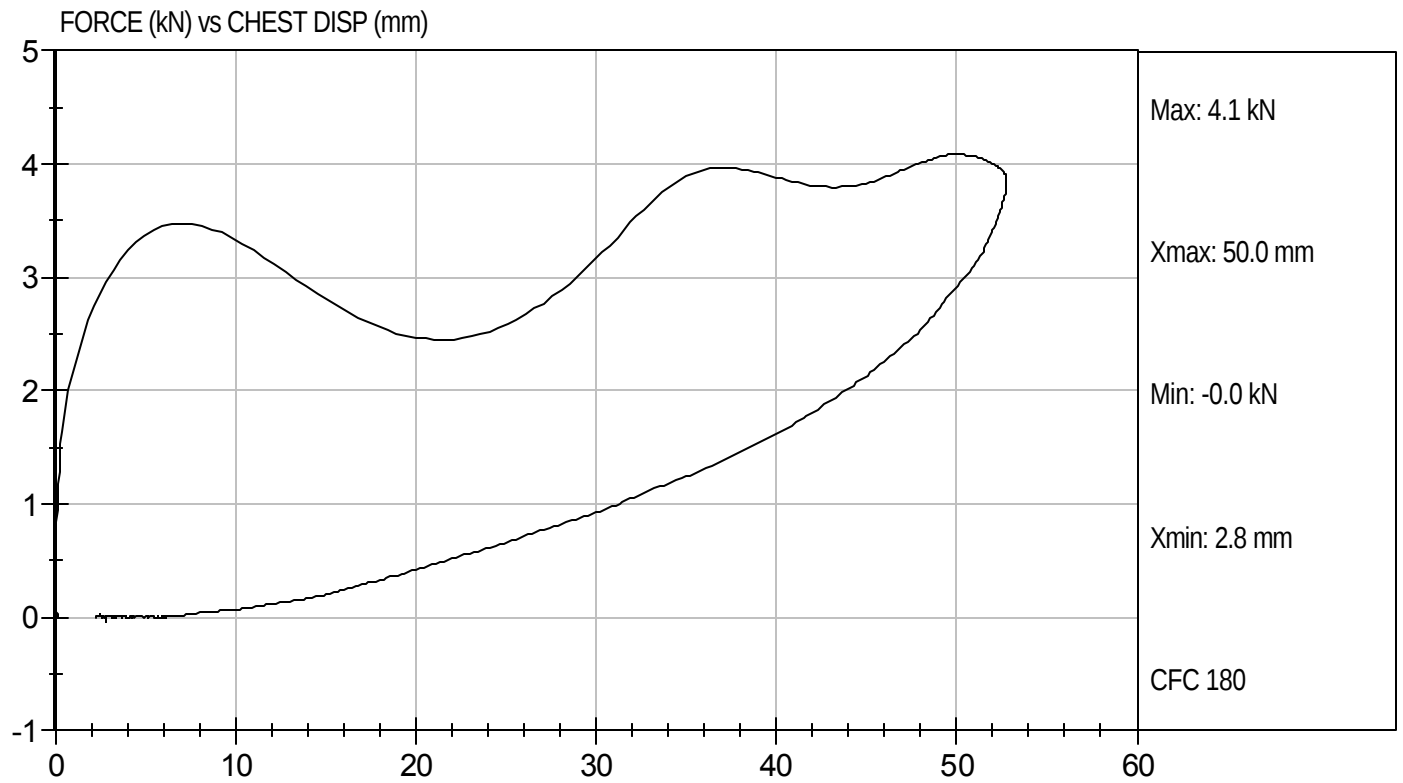
12/15/11
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D114214

Test Date: 12/15/11
Velocity: 22.22 ft/s, 6.77 m/s



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

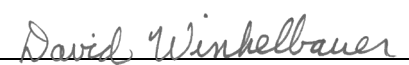
ATD Serial No: 138

Test I.D: D114215

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.53	Pass
Overall Test Results				Pass


Laboratory Technician

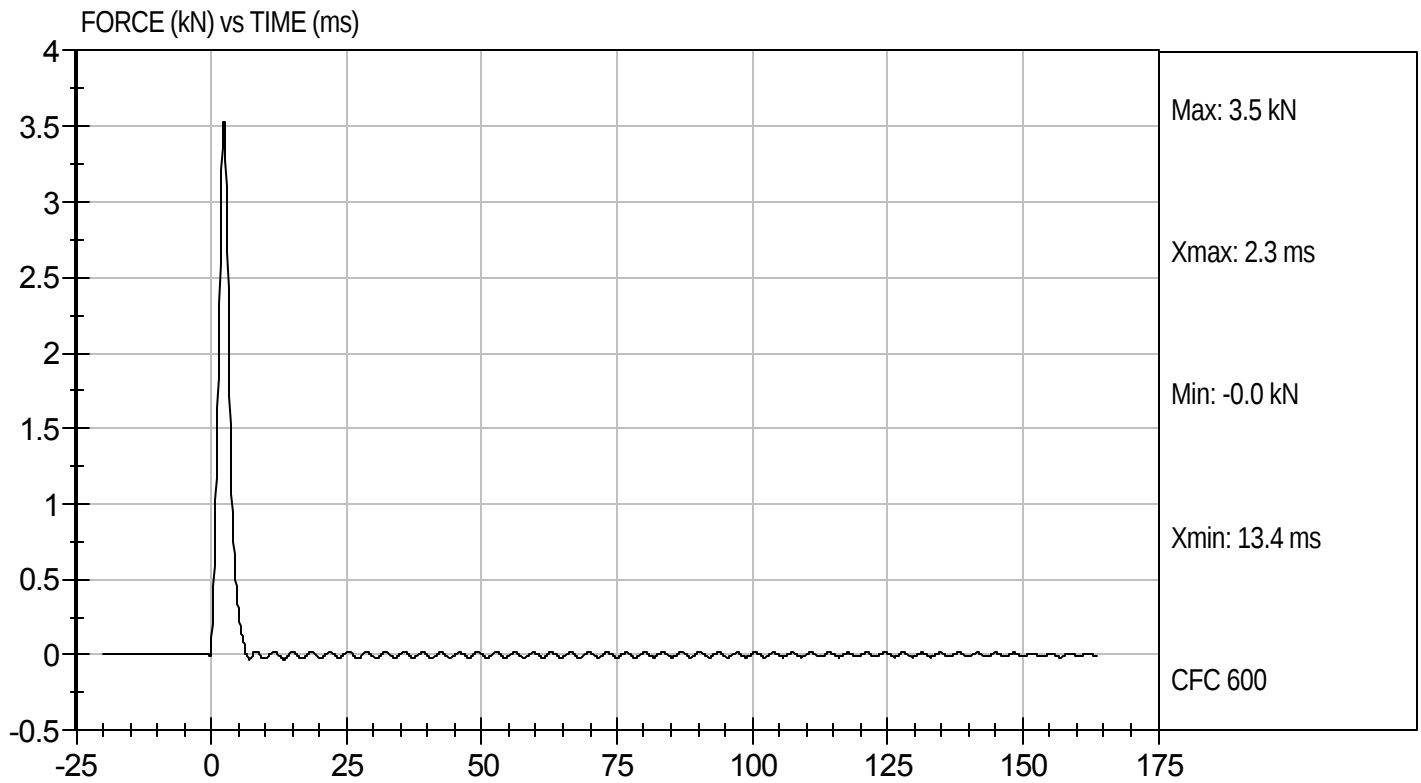
12/14/11
Test Date


Approved By



Test Desc: Right Knee
Component ID: D114215

Test Date: 12/14/11
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D114216

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	38	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.49	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

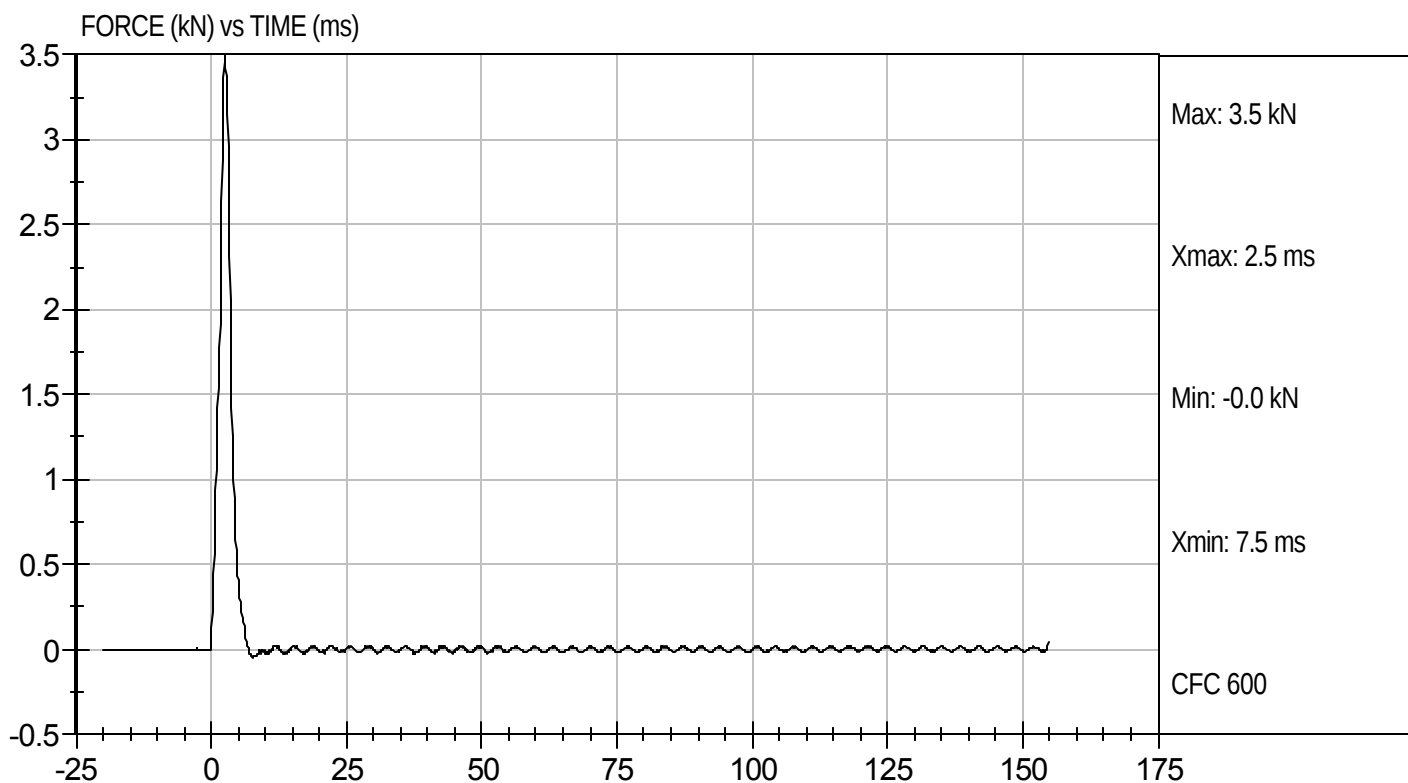
12/14/11
Test Date

David Winkelbauer
Approved By



Test Desc: Left Knee
Component ID: D114216

Test Date: 12/14/11
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

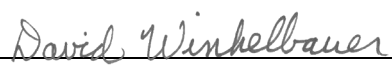
HYBRID III 5TH PERCENTILE

ATD Serial No: 138Test I.D: D114217

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	43	Pass
Initial Angle	deg	0 to 20	14	Pass
Return Angle	deg	+/- 8	7	Pass
Force at 45 deg	N	320 to 390	382	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
Overall Result				Pass


Laboratory Technician

12/14/11
Test Date


Approved By