REPORT NUMBER: NCAP-MGA-2012-068

NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test

MITSUBISHI MOTORS CORPORATION, JAPAN
2012 Mitsubishi Outlander Sport SE AWD SUV
NHTSA No.: MC5600

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: February 24, 2012

Final Report Date: April 17, 2012

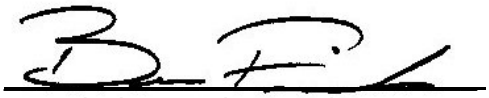
FINAL REPORT

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

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof.

If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared by: 
Donna Janovicz, Project Manager

Approved by: 
Ben Fischer, Project Engineer

Approval Date: April 17, 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-2012-068	*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 Mitsubishi Outlander Sport SE AWD SUV, NHTSA No.: MC5600		*5. Report Date* April 17, 2012 *6. Performing Organization Code* MGA
7. Author(s) Donna Janovicz, Project Manager Ben Fischer, Project Engineer		*8. Performing Organization Report No.* NCAP-MGA-2012-068
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 February 24 to April 17, 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 Mitsubishi Outlander Sport SE 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 February 24, 2012.

The impact velocity was 56.6 km/h and the ambient temperature at the barrier face at the time of impact was 21.3°C. The target vehicle post-test maximum crush was 527 mm at the vehicle's centerline. The test vehicle's performance was as follows:

Measurement Description	Units	Threshold		Driver ATD	Passenger ATD
		50th	5th		
Head Injury Criteria (HIC_{15})	N/A	700	700	208	251
Maximum Chest Compression	mm	63	52	25	16
Nij	N/A	1	1	0.29	0.43
Neck Tension	N	4170	2620	1831	983
Neck Compression	N	4000	2520	399	404
Left Femur Force	N	10008	6805	1487	1751
Right Femur Force	N	10008	6805	2273	2198

17. Key Words 35 mph Frontal Barrier Impact Test New Car Assessment Program (NCAP)		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave, SE, Room E12-100 Washington, DC 20590 Email: tis@nhtsa.dot.gov FAX: 202-493-2833	
19. Security Classification of Report Unclassified	*20. Security Classification of Page* Unclassified	*21. No. of Pages* 163	22. Price

TABLE OF CONTENTS

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 Mitsubishi Outlander Sport SE AWD SUV at a velocity of 56.6 kph. The test was performed at MGA Research Corporation on February 24, 2012. Pre-test 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 installed on the driver's lap and shoulder belts and the passenger's lap and shoulder belts to measure dummy torso and pelvic section loading.

The driver (position 1) ATD (Serial No. 351) and the right-front passenger (position 2) ATD (Serial No. 634) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 228 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest displacement, neck, and femur response data traces.

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

The maximum static crush of the vehicle was 527 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 airbag. The passenger's visible contact points were as follows: The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest and side header. 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})	208	0.29	1831	399	38	25	1487	2273
Passenger (5^{th})	251	0.43	983	404	46	16	1751	2198

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

TEST NOTES

Load Cell 6-10 has No Valid Data.
Load Cell 5-1 has Questionable Data.
Load Cell 5-12 has Questionable Data from 207-217 ms.

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

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MC5600	Traction Control System (TCS)	Yes
Model Year	2012	Auto-Leveling System	No
Make	Mitsubishi	Automatic Door Locks (ADLs)	No
Model	Outlander Sport	Power Window Auto-Reverse	No
Body Style	SUV	Other Optional Feature	N/A
VIN	JA4AR4AU2CZ001826	Driver Front Airbag	Yes
Body Color	Cosmic Blue	Driver Curtain Airbag	Yes
Odometer (km/mi)	156 / 97	Driver Torso Airbag	No
Engine Displacement (L)	2.0	Driver Torso/Pelvis Airbag	Yes
Type/No. Cylinders	4	Driver Pelvis Airbag	No
Engine Placement	Lateral	Driver Knee Airbag	Yes
Transmission Type	Automatic	Pass. Front Airbag	Yes
Transmission Speeds	Continuous	Pass. Curtain Airbag	Yes
Overdrive	No	Pass. Torso Airbag	No
Final Drive	AWD	Pass. Torso/Pelvis Airbag	Yes
Roof Rack	Yes	Pass. Pelvis Airbag	No
Sunroof/T-Top	Yes	Pass. Knee Airbag	No
Running Boards	No	Driver Seat Belt Pretensioner	Yes
Tilt Steering Wheel	Yes	Pass. Seat Belt Pretensioner	Yes
Power Seats	No	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Pass. Load Limiter	Yes
All-Wheel Drive (AWD)	Yes	Other Safety Restraint	N/A
Does owner's manual provide instructions to turn off automatic door locks?			N/A

DATA FROM CERTIFICATION LABEL

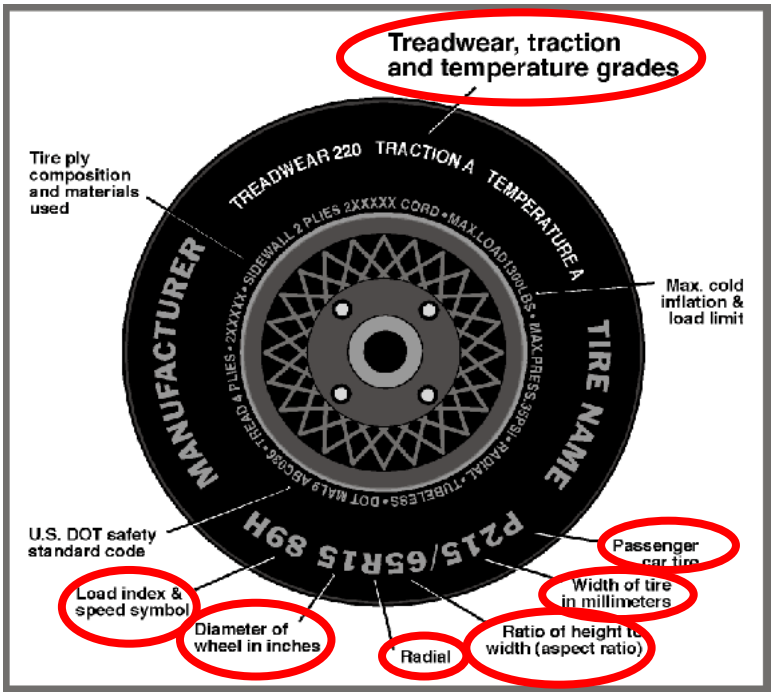
Manufactured By	Mitsubishi Motors Corporation, Japan	GVWR (kg)	1970
Date of Manufacture	OCT 2011	GAWR Front (kg)	1030
Vehicle Type	MPV	GAWR Rear (kg)	1000

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				375
Cargo Weight (RCLW) (kg)				35

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

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012



TIRE PLACARD INFORMATION

Measured Parameter	Front	Rear
Recommended Cold Tire Pressure (kPa)	240	240
Recommended Tire Size	P225/55R18	P255/55R18

TIRE SIDEWALL INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Tire Size on Vehicle	P225/55R18	P225/55R18
Tire Manufacturer	Goodyear	Goodyear
Tire Name	Eagle LS	Eagle LS
Tire Type	Passenger	Passenger
Tire Width	225	225
Aspect Ratio	55	55
Radial	Yes	Yes
Wheel Diameter	18	18
Load Index/Speed Symbol	97H	97H
Treadwear	400	400
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 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	456.3	323.0		494.9	380.6	
Right	kg	439.1	321.1		462.7	370.1	
Ratio	%	58.2	41.8		56.1	43.9	
Totals	kg	895.4	644.1	1539.5	957.6	750.7	1708.3

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1539.5
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	35
Calculated Vehicle Target Weight (TVTW)	kg	1715.1

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	777	780	775	780	1116
As Tested	mm	772	776	758	764	1172
Post Test	mm	718	721	761	760	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2667
Total Vehicle Length at Left Side	mm	4205
Total Vehicle Length at Centerline	mm	4295
Total Vehicle Length at Right Side	mm	4205
Weight of Ballast in Cargo Area	kg	29.0
Weight of Vehicle Components Removed	kg	34.9
Amount of Stoddard Solvent in Fuel Tank	L	55.6

List of components removed: Right taillight, rear carpet, jack/tools, rear subwoofer and spare tire.

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

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

TARGET VEHICLE STRUCTURAL MEASUREMENT

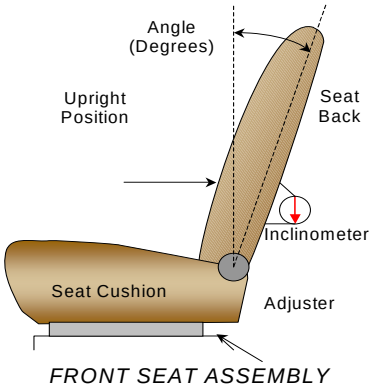
	Elements	Pre-Test (mm)
1	Total Length	4295
2	Total Width	1764
3	Bumper Top Height	710
4	Bumper Bottom Height	580
5	Longitudinal Member Top Height	620
6	Distance between Longitudinal Members	965
7	Longitudinal Member Width	70
8	Engine Top Height	852
9	Engine Bottom Height	234
10	Engine and Gearbox Width	762
11	Front Bumper-Engine Distance	290
12	Front Shock Absorber Fixing Height	950
13	Bonnet Leading Edge Height	932
14	Front Shock Absorber Fixing Width	1122
15	Front Bumper – Front Axle Distance	864
16	Front Axle – A-Pillar Distance	458
17	A-Pillar – B-Pillar Distance	1145
18	B-Pillar – Rear Axle Distance	1065
19	B-Pillar – C-Pillar Distance	618
20	Roof Sill Bottom Height	1478
21	Roof Sill Top Height	1584
22	Floor Sill Bottom Height	261
23	Floor Sill Top Height	425

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

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

NOMINAL DESIGN RIDING POSITION

The driver seat back is positioned as close as possible to the manufacturer's design angle. For the passenger seat back, seat back is adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.



SEAT BACK ANGLE	Degrees
Driver Seat Back Angle	-8.0° on headrest post
Passenger Seat Back Angle	-9.0° on headrest post

SEAT FORE/AFT POSITIONS

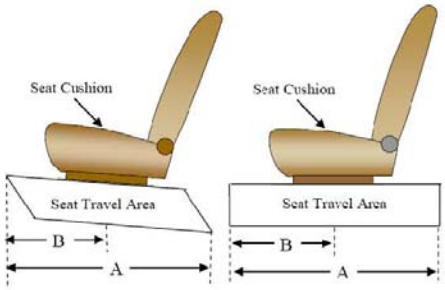
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.

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

SEAT BELT UPPER ANCHORAGES

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

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



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

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

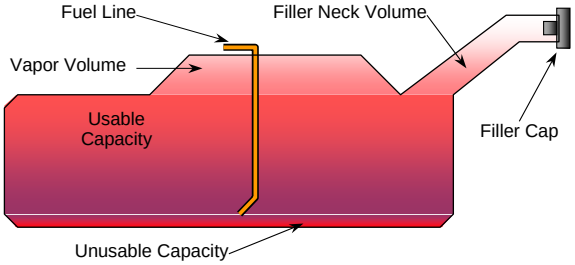
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	59.8
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	55.0 to 56.2
Actual Amount of Solvent used	55.6
1/3 of Usable Capacity	19.9

FUEL PUMP

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

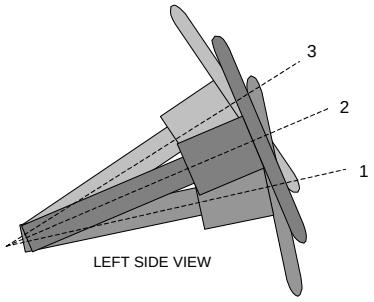
The vehicle is equipped with an electric fuel pump. The electric fuel pump operates during the engine is running. The fuel pipe is on the left side.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

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



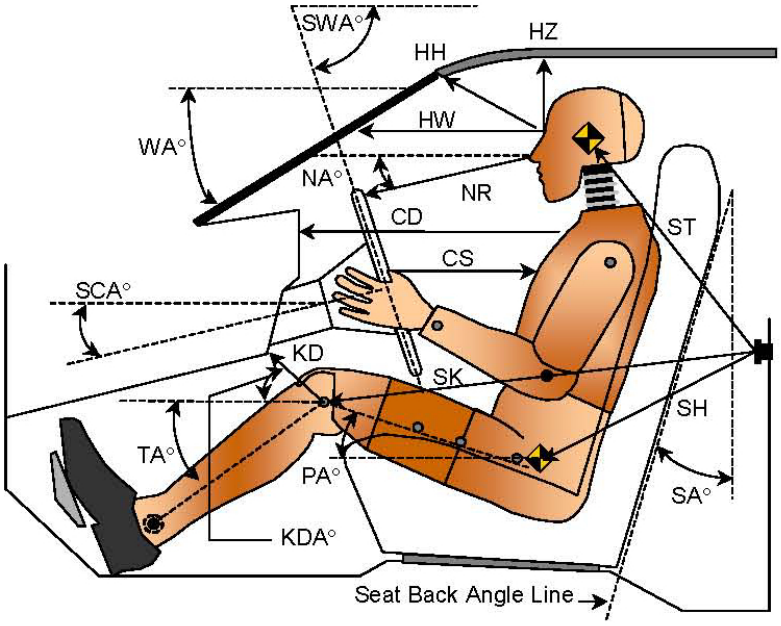
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost – Position 1	65.1	224
Geometric Center – Position 2	62.8	206
Uppermost – Position 3	60.4	187
Telescoping Steering Wheel Travel		37
Test Position	62.8	206

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

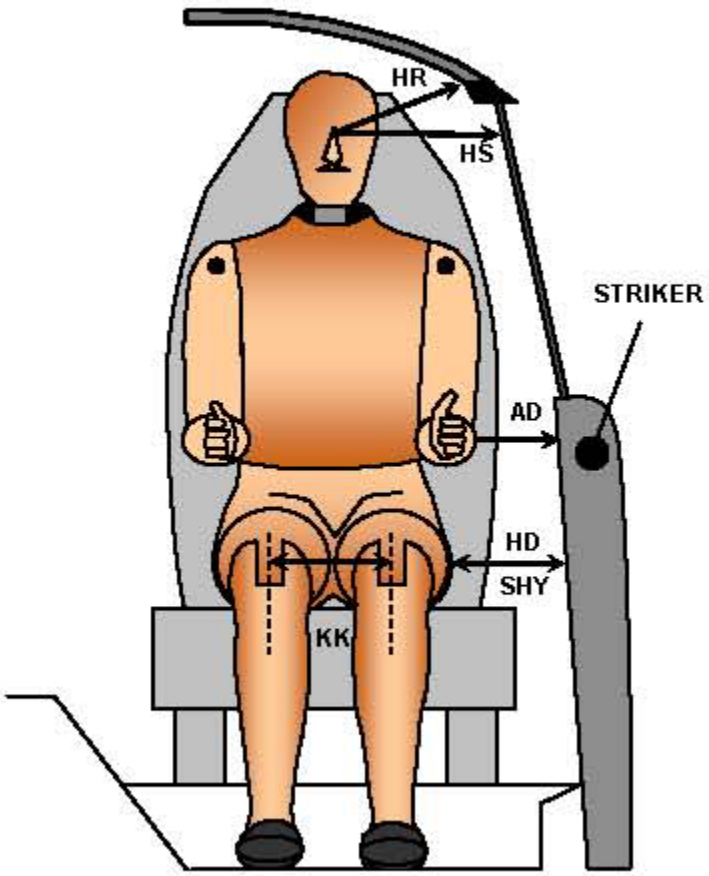


LEFT SIDE VIEW

Code	Measurement Description	Driver S/N 351		Passenger S/N 634	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		25.8		
SWA°	Steering Wheel Angle		62.8		
SCA°	Steering Column Angle		27.2		
SA°	Seat Back Angle (on headrest post)		-8.0		-9.0
HZ	Head to Roof (Z)	190	90	197	90
HH	Head to Header	381	19.3	298	44.0
HW	Head to Windshield	687	0	634	0
NR	Nose to Rim	425	10.6		
CD	Chest to Dash	535		357	
CS	Chest to Steering Hub	332	5.8		
RA	Rim to Abdomen	193	0		
KDL	Left Knee to Dash	164	27.4	64	32.0
KDR	Right Knee to Dash	152	26.8	66	34.2
PA°	Pelvic Angle		22.5		20.0
TA°	Tibia Angle		56.0		65.5
SK	Striker to Knee	606	94.9	703	100.3
ST	Striker to Head	524	10.6	528	37.2
SH	Striker to H-Point	292	124.4	455	108.3

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

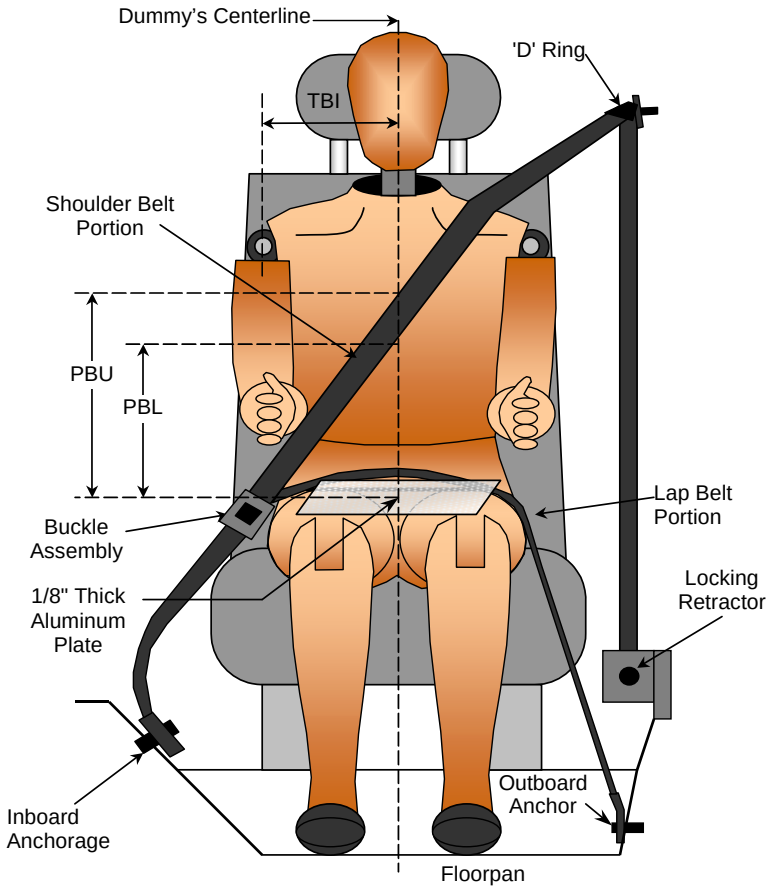


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver S/N 351	Passenger S/N 634
		Length (mm)	
AD	Arm to Door	110	77
HD	H-Point to Door	121	162
HR	Head to Side Header	207	249
HS	Head to Side Window	323	363
KK	Knee to Knee	324	227
SHY	Striker to H-Point (Y Direction)	264	279
AA	Ankle to Ankle	341	177

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	350	320
PBL - Top surface of reference to belt lower edge	mm	270	225

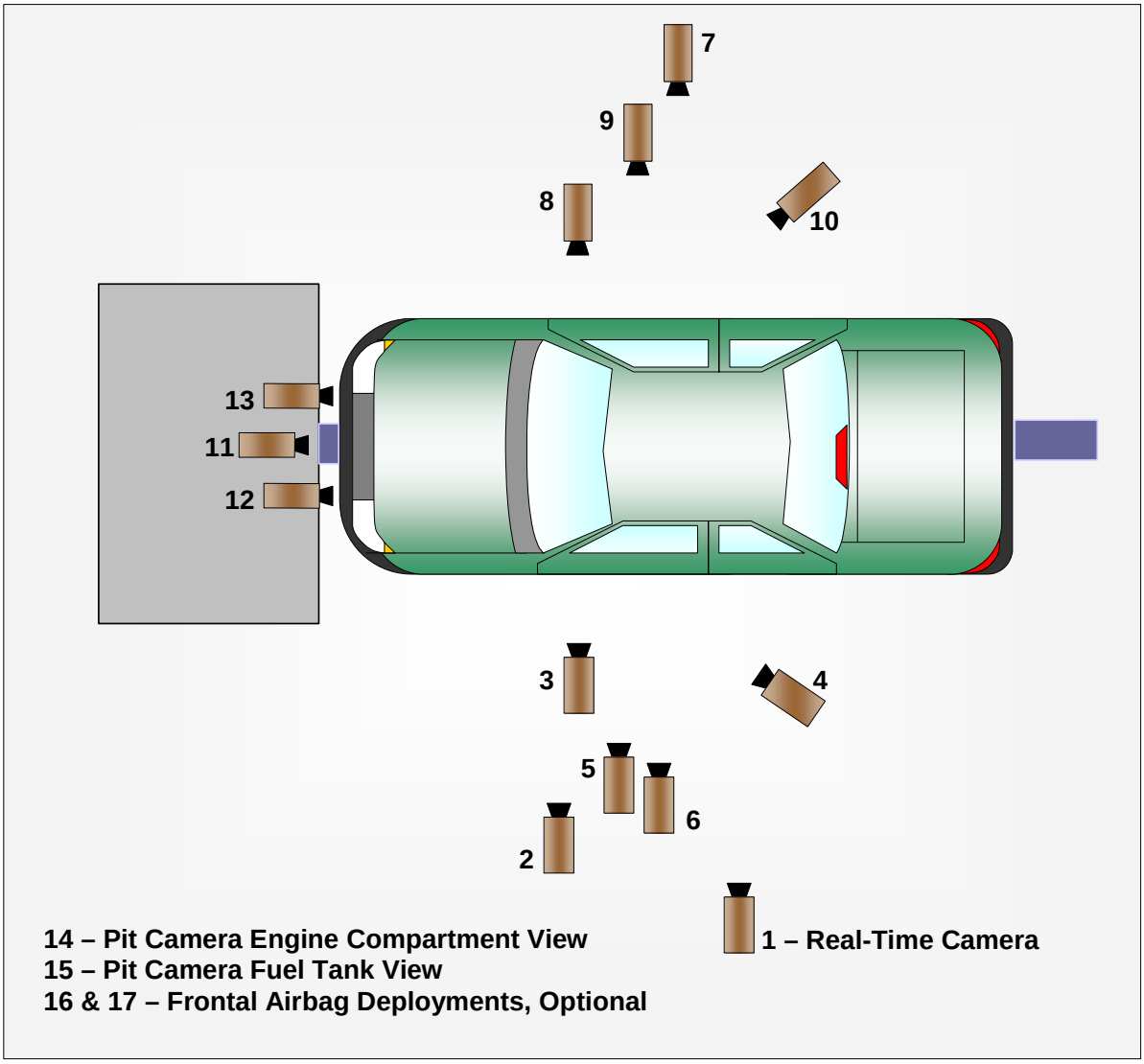
BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	925	910
Lap Belt Length as measured on ATD	mm	915	1010
Remainder of belt on reel	mm	1460	1380
Total Belt Length for Continuous Webbing Systems	mm	3300	3300

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

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

CAMERA POSITIONS FOR FRONTAL IMPACTS



14 – Pit Camera Engine Compartment View
15 – Pit Camera Fuel Tank View
16 & 17 – Frontal Airbag Deployments, Optional

1 – Real-Time Camera

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

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	1430	-6380	-1850	35	1000
3	Left Front Half	1200	-5080	-1070	24	1000
4	Left Angle	5470	-4850	-1900	50	1000
5	Steering Column - Top	560	-5290	-1240	24	1000
6	Steering Column - Bottom	590	-5230	-830	24	1000
7	Right Overall	2030	6420	-1060	20	1000
8	Passenger Close-Up	1490	6480	-1780	35	1000
9	Right Front Half	1250	5100	-1040	24	1000
10	Right Angle	5510	4900	-1930	50	1000
11	Windshield	-130	0	-2810	24	1000
12	Driver Windshield	250	-450	-2030	12.5	1000
13	Passenger Windshield	250	450	-2030	12.5	1000
14	Pit Front	1120	0	3150	24	1000
15	Pit Rear	1830	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

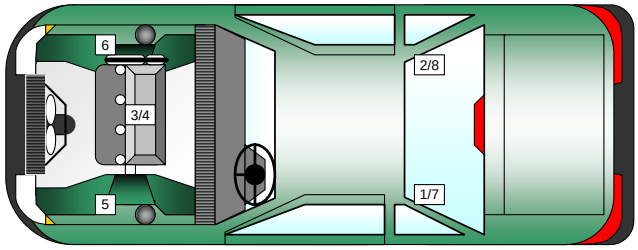
*COORDINATES:

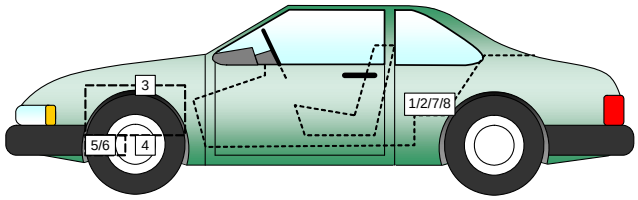
+X = forward of impact plane
+Y = right of monorail centerline
+Z = below ground level

Cameras 16 & 17 were not used for this test.

DATA SHEET NO. 7
VEHICLE ACCELEROMETER DATA

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

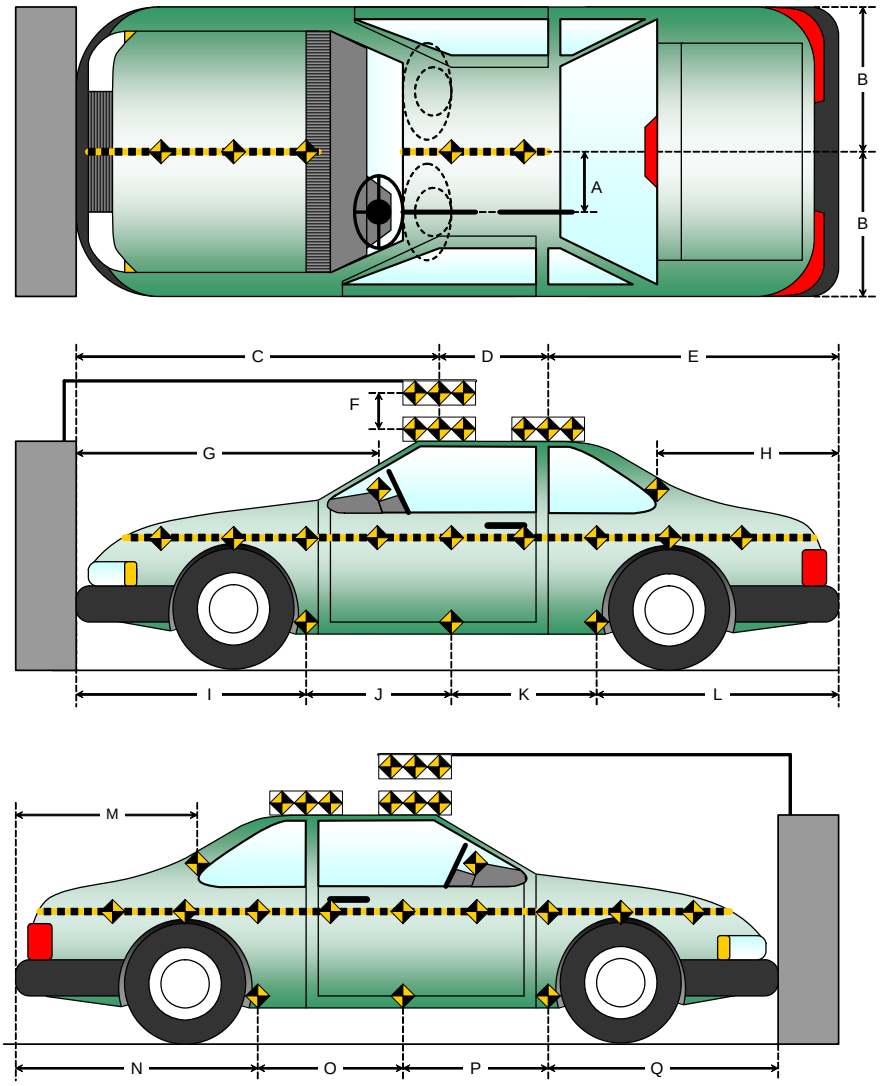
No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Accelerometer – X Direction	1559	-352	-294
2	Right Rear Accelerometer – X Direction	1559	341	-302
3	Engine Top X	3572	30	-862
4	Engine Bottom X	3582	0	-322
5	Left Brake Caliper X	3584	-660	-260
6	Right Brake Caliper X	3584	660	-262
7	Left Rear Accelerometer Redundant – X Direction			
8	Right Rear Accelerometer Redundant – X Direction			

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

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

Item	Value (mm)
A	384
B	882
C	2270
D	665
E	1360
F	203
G	
H	1027
I	1327
J	882
K	882
L	1204
M	1027
N	1204
O	882
P	882
Q	1327



DATA SHEET NO. 9
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

Advanced Research Load Cell Barrier

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

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

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

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 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 351	HIII 5% / 634
Head Contact	Airbag, Headrest	Airbag, Headrest, Side Header
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Airbag	Glovebox
Right Knee Contact	Knee Airbag	Glovebox

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were unlocked	Doors were unlocked
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

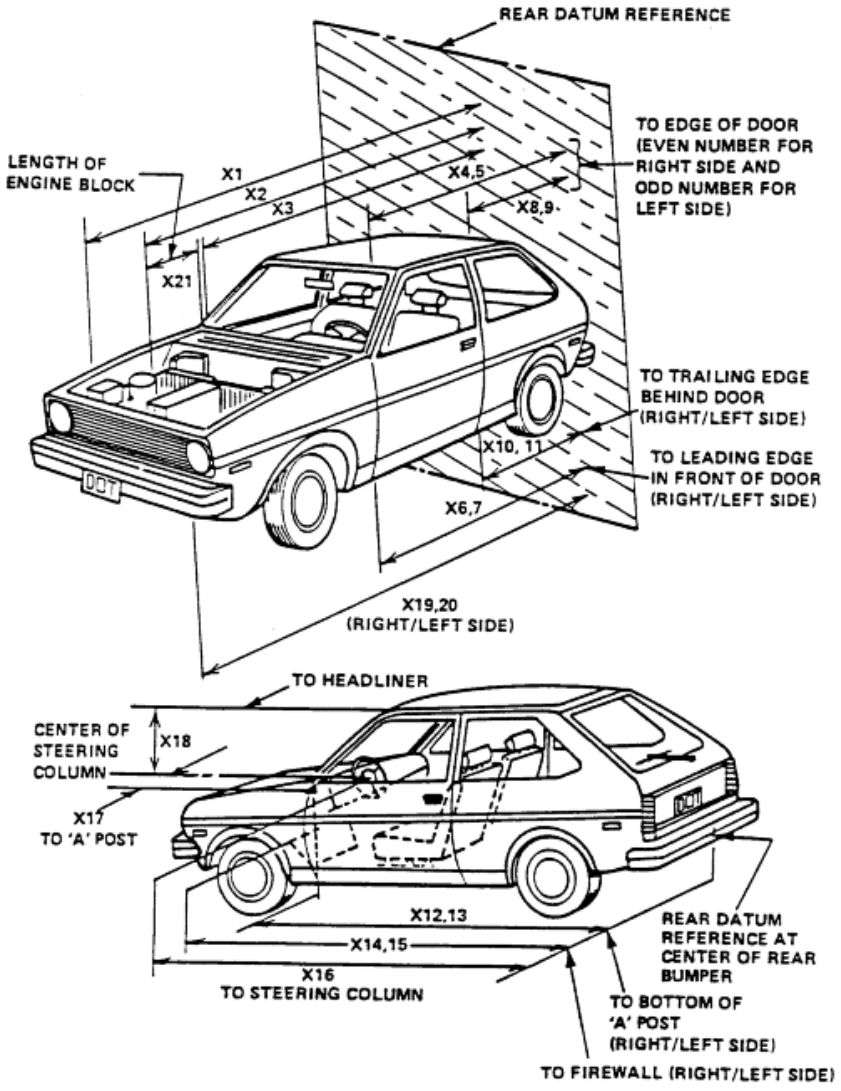
Measured Parameter	Units	Value
Left Side	mm	565
Center	mm	562
Right Side	mm	600
Average	mm	576

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Right Front (Passenger) P2	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Knee Airbag	Yes	Yes	No	
Curtain Side Airbag	Yes	No	Yes	No
Torso/Pelvis Side Airbag	Yes	No	Yes	No
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	

DATA SHEET NO. 12
VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2012 Mitsubishi Outlander Sport SE AWD SUV	NHTSA No.:	MC5600
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	02/24/2012



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4295	3768	527
2	RSOV to Front of Engine	mm	3848	3603	245
3	RSOV to Firewall	mm	3335	3333	2
4	RSOV to Upper Leading Edge of Right Door	mm	2889	2886	3
5	RSOV to Upper Leading Edge of Left Door	mm	2889	2889	0
6	RSOV to Lower Leading Edge of Right Door	mm	2876	2875	1
7	RSOV to Lower Leading Edge of Left Door	mm	2876	2874	2
8	RSOV to Upper Trailing Edge of Right Door	mm	1786	1784	2
9	RSOV to Upper Trailing Edge of Left Door	mm	1786	1786	0
10	RSOV to Lower Trailing Edge of Right Door	mm	1805	1804	1
11	RSOV to Lower Trailing Edge of Left Door	mm	1805	1804	1
12	RSOV to Bottom of “A” Post of Right Side	mm	2869	2869	0
13	RSOV to Bottom of “A” Post of Left Side	mm	2869	2867	2
14	RSOV to Firewall, Right Side	mm	3268	3268	0
15	RSOV to Firewall, Left Side	mm	3292	3285	7
16	RSOV to Steering Column	mm	2460	2480	-20
17	Center of Steering Column to “A” Post	mm	405	418	-13
18	Center of Steering Column to Headliner	mm	444	476	-32
19	RSOV to Right Side of Front Bumper	mm	4205	3734	471
20	RSOV to Left Side of Front Bumper	mm	4205	3762	443
21	Length of Engine Block	mm	453	453	0
RD	RSOV to Right Side of Dash Panel	mm	2629	2629	0
CD	RSOV to Center of Dash Panel	mm	2602	2602	0
LD	RSOV to Left Side of Dash Panel	mm	2663	2660	3

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

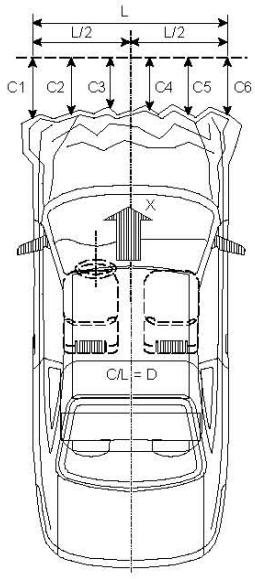
Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

VEHICLE INFORMATION

VIN: JA4AR4AU2CZ001826 Wheelbase (mm): 2667
Vehicle Size Category: MPV Test Weight (kg): 1708.3

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): 56.6
Velocity Change (km/h): 62.0
Time of Separation (msec): 89.4



CRUSH PROFILE

Collision Deformation Classification: Frontal
Midpoint of Damage: Centerline
Damage Region Length (mm): 1071
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4205	3762	443
C2	Crush zone 2 at left side	mm	4250	3751	499
C3	Crush zone 3 at left side	mm	4274	3768	506
C4	Crush zone 4 at right side	mm	4274	3767	507
C5	Crush zone 5 at right side	mm	4250	3749	501
C6	Crush zone 6 at right side	mm	4205	3734	471
L	C1 TO C6	mm	1071	1035	36

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

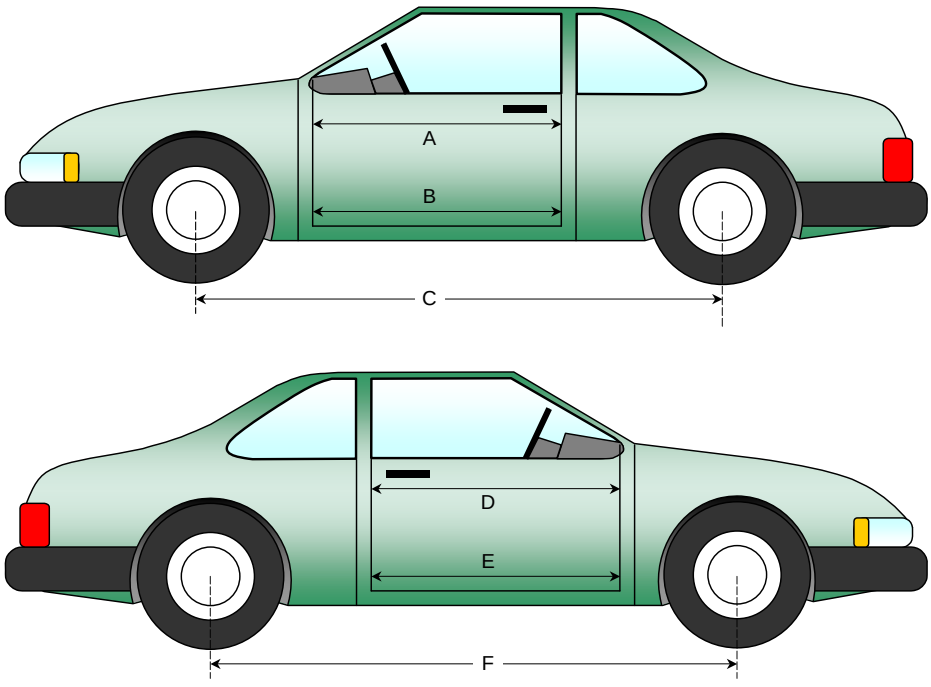
Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1004	1004	0
B	Left Side Lower	mm	966	966	0
D	Right Side Upper	mm	1004	1004	0
E	Right Side Lower	mm	966	966	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2667	2586	81
F	Right Side Wheelbase	mm	2667	2595	72



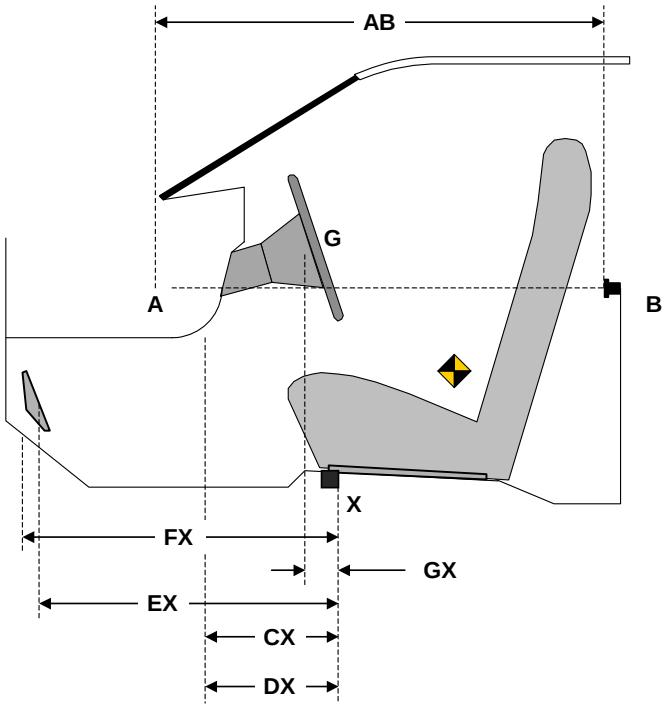
DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	803	803	0
CX	Left Knee Bolster to X	mm	331	357	-26
DX	Right Knee Bolster to X	mm	332	328	4
EX	Brake Pedal to X	mm	525	474	51
FX	Foot Rest to X	mm	530	522	8
GX	Center of Steering Column Wheel Hub to X	mm	74	121	-47

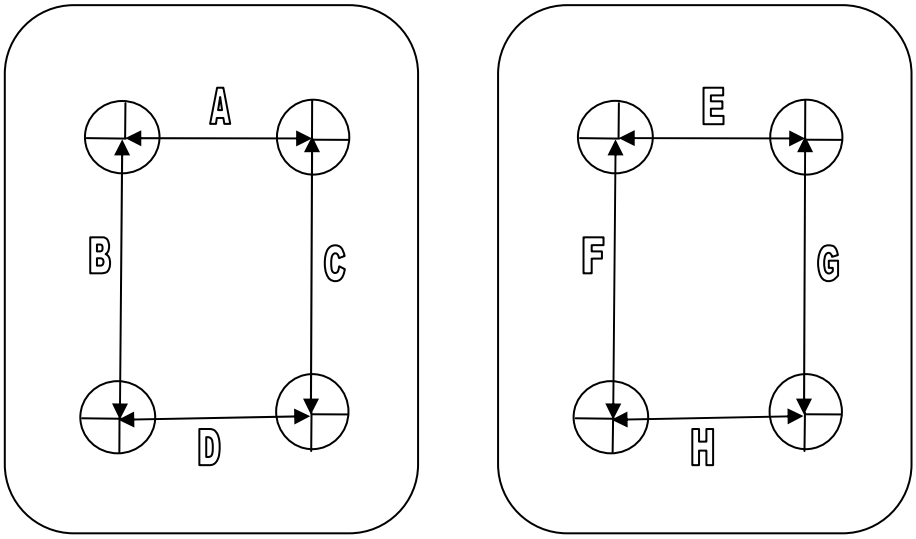
X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012



Driver Passenger

TOP VIEW THROUGH FLOOR PAN

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Units	Pre-Test	Post-Test	Difference
A	mm	300	295	5
B	mm	300	300	0
C	mm	300	290	10
D	mm	300	300	0
E	mm	300	300	0
F	mm	300	277	23
G	mm	300	297	3
H	mm	300	300	0

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

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

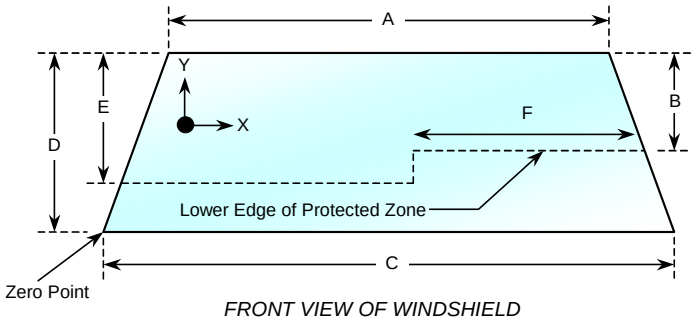
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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

Temperature of windshield molding during test: 21.3°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2191	2191	100
Right Side	2188	2188	100
Total	4379	4379	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1246
B	mm	535
C	mm	1628
D	mm	751
E	mm	543
F	mm	478

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: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

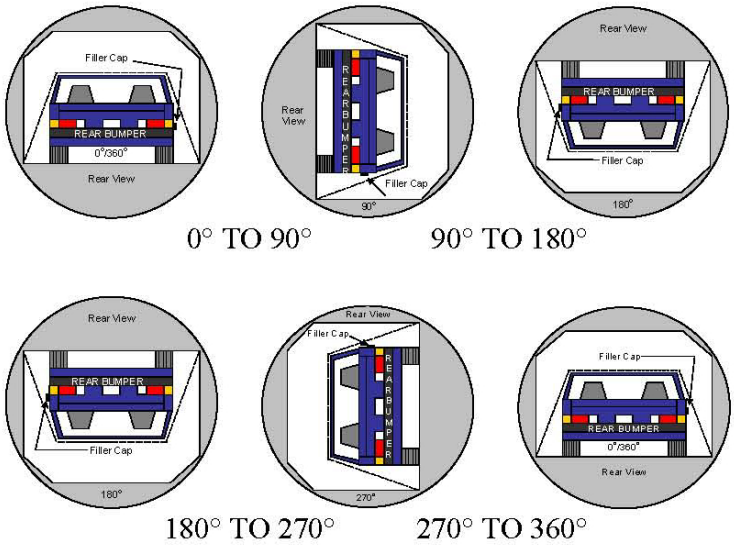
Test Time: 3:28 pm Temperature: 21.3° C

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

DATA SHEET NO. 16
FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2012 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage: **None**



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	113	300	413
90° to 180°	114	300	414
180° to 270°	99	300	399
270° to 360°	118	300	418

FMVSS 301 ROLLOVER SPILLAGE TABLE (units in ounces)

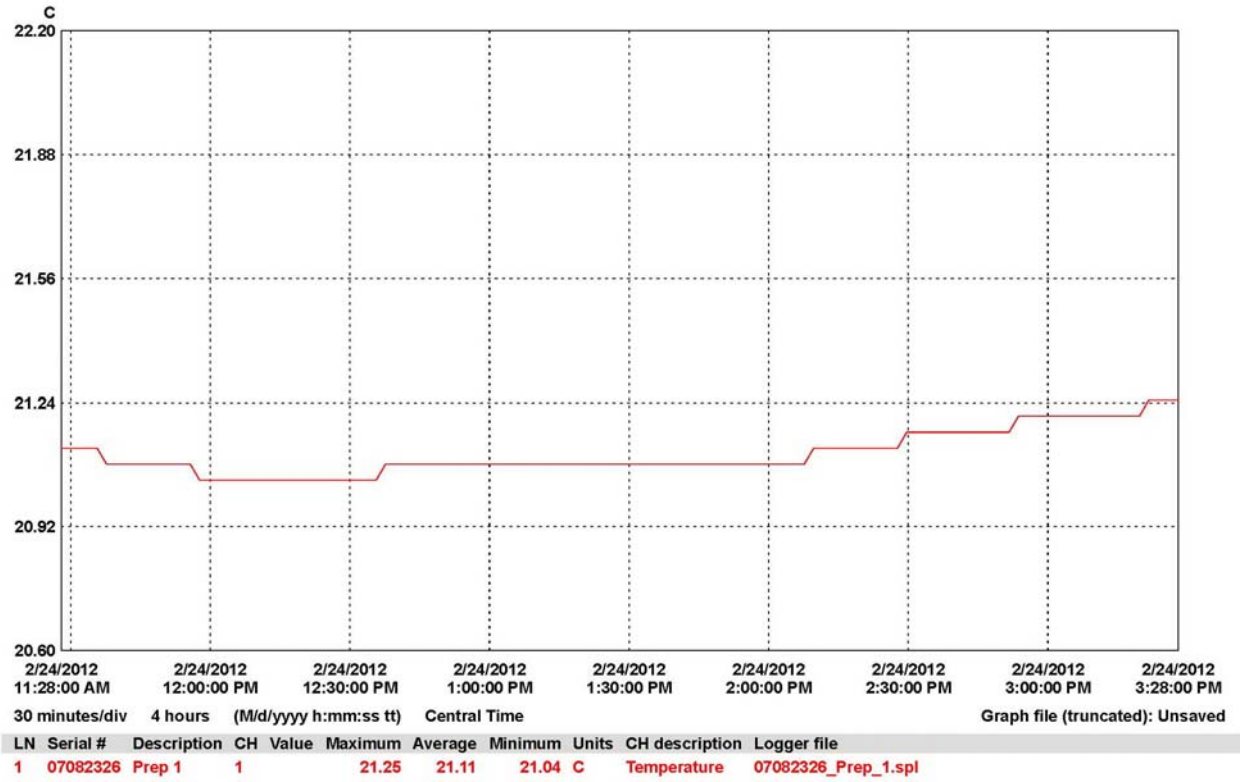
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

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 Mitsubishi Outlander Sport SE AWD SUV NHTSA No.: MC5600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 02/24/2012

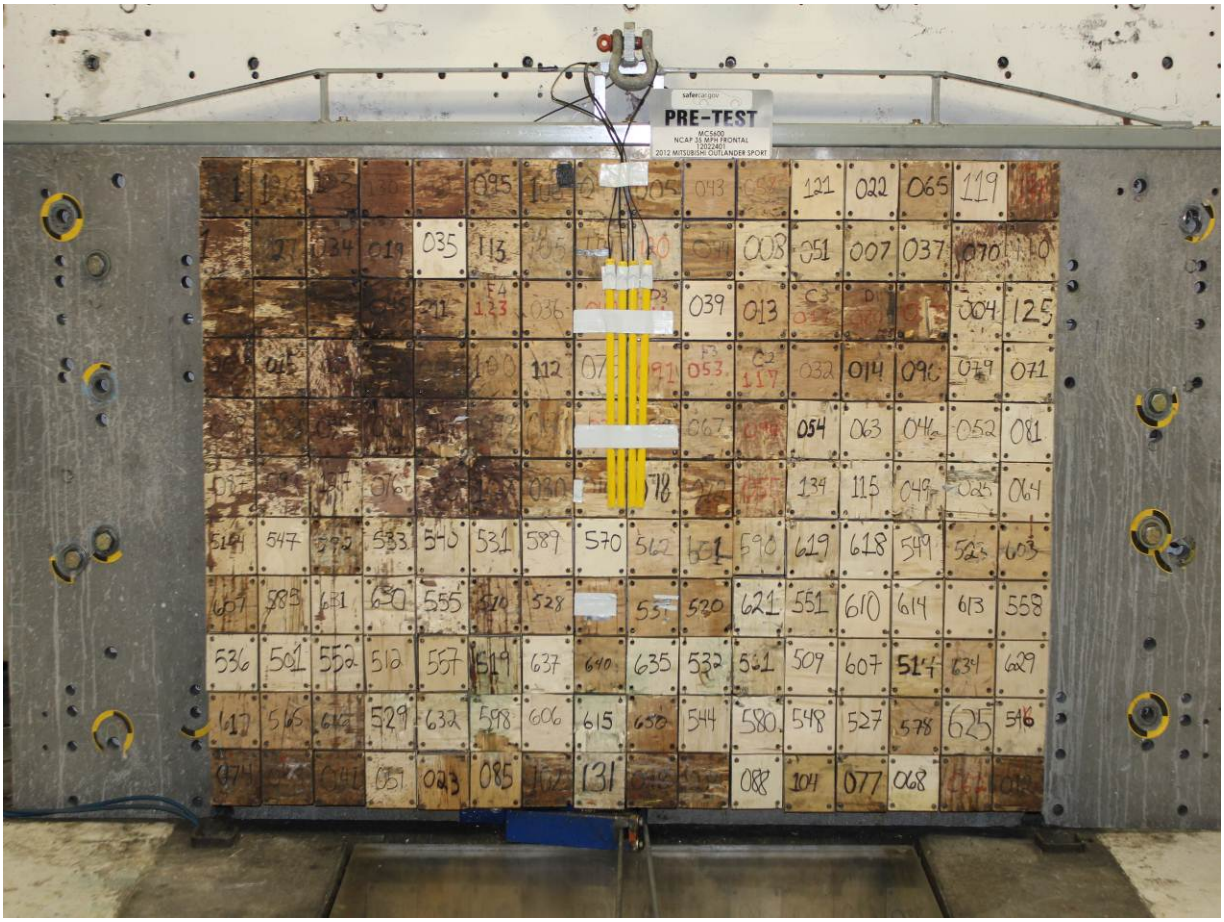


LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	07082326	Prep 1	1		21.25	21.11	21.04	C	Temperature	07082326_Prep_1.spl

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS



Load Cell Location

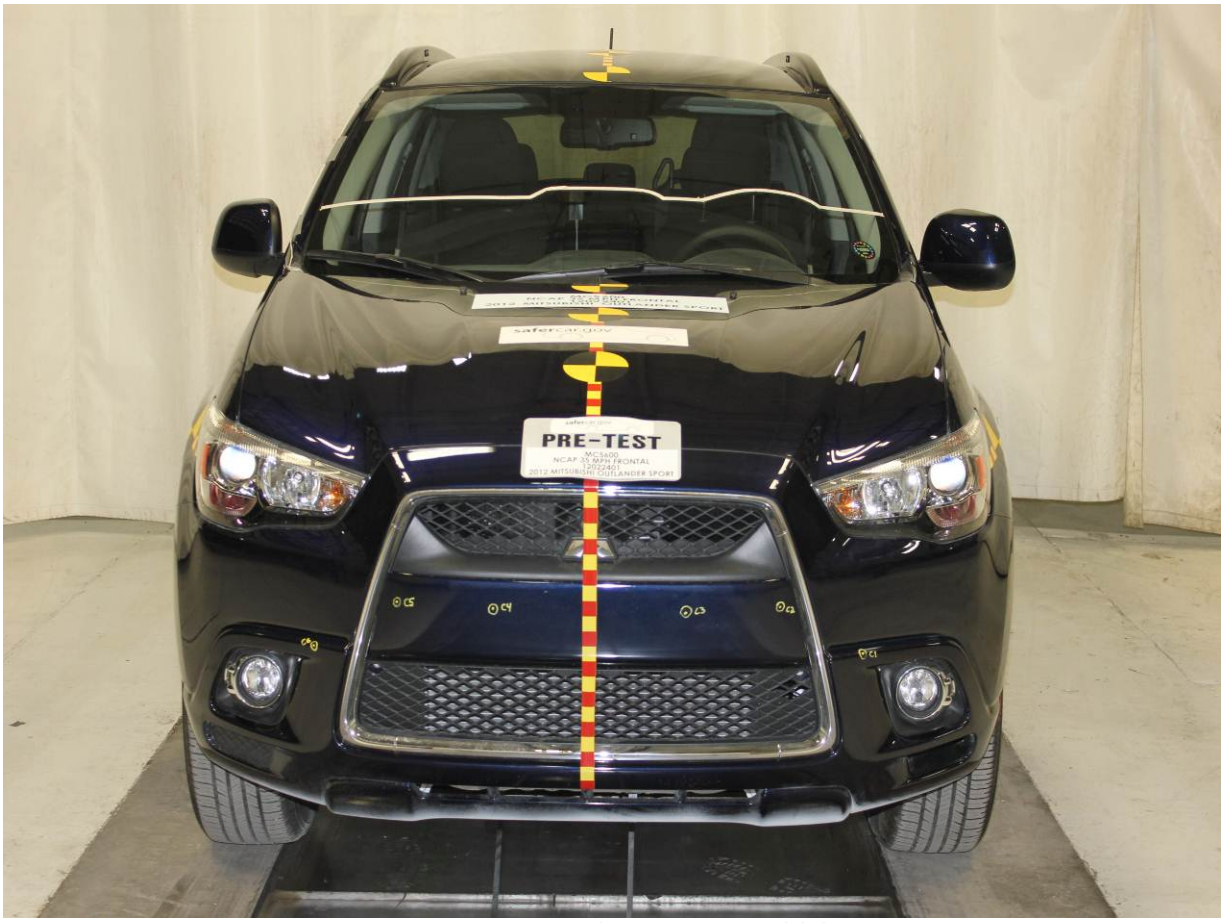
Load Cell Wall

Manufacturer's Label

Tire Placard

2012 Mitsubishi Outlander Sport 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

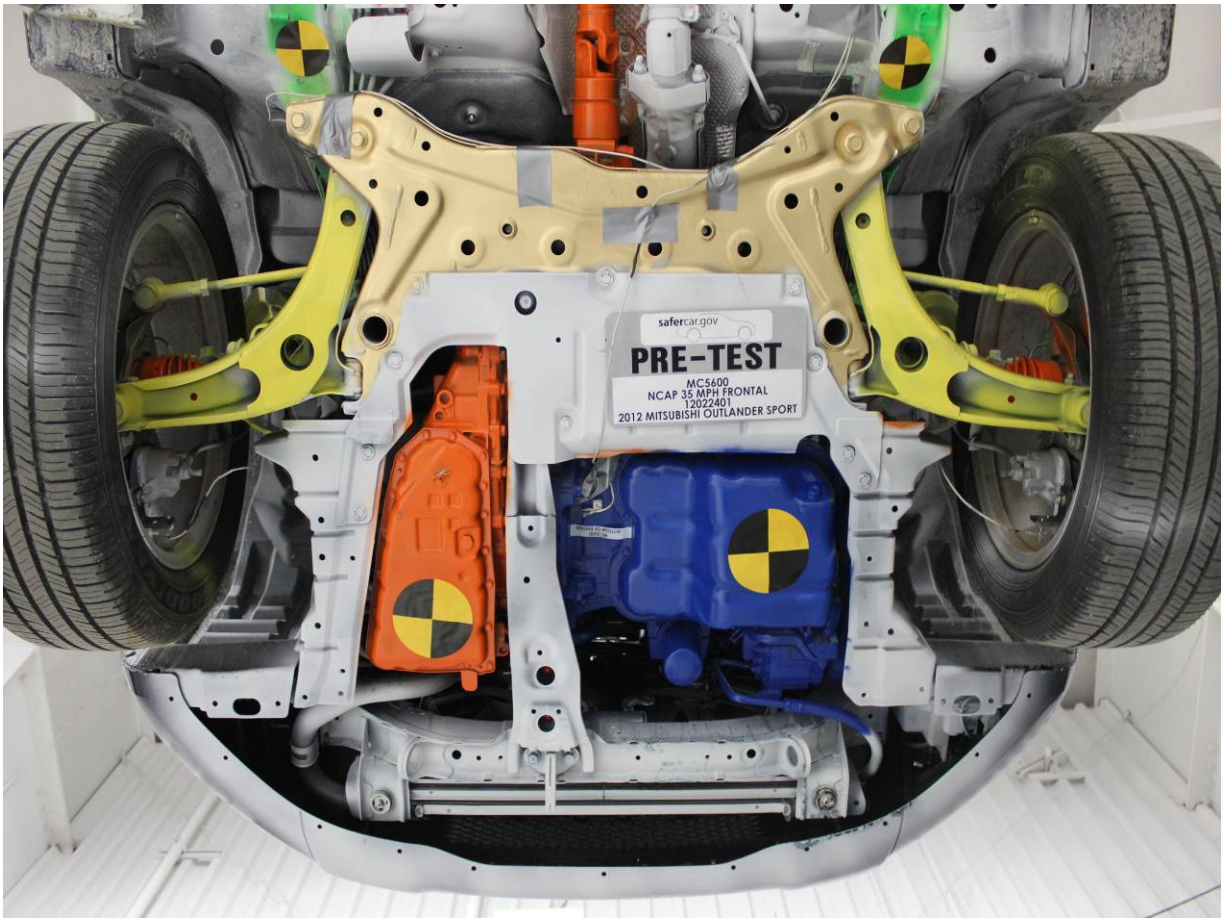
Post-Test Windshield View

Pre-Test Engine Compartment View

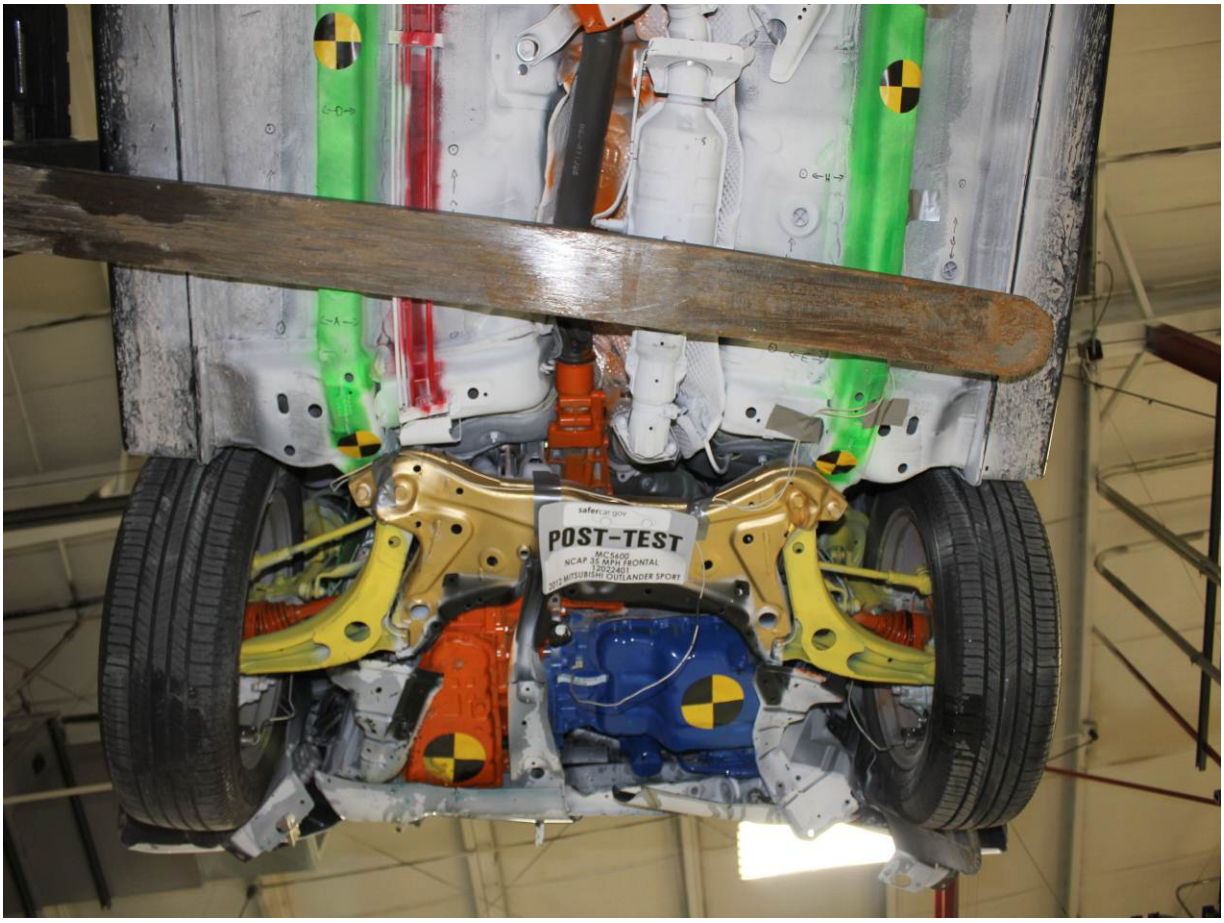
Post-Test Engine Compartment View

Pre-Test Fuel Filler Cap View

Post-Test Fuel Filler Cap View



Pre-Test Front Underbody View



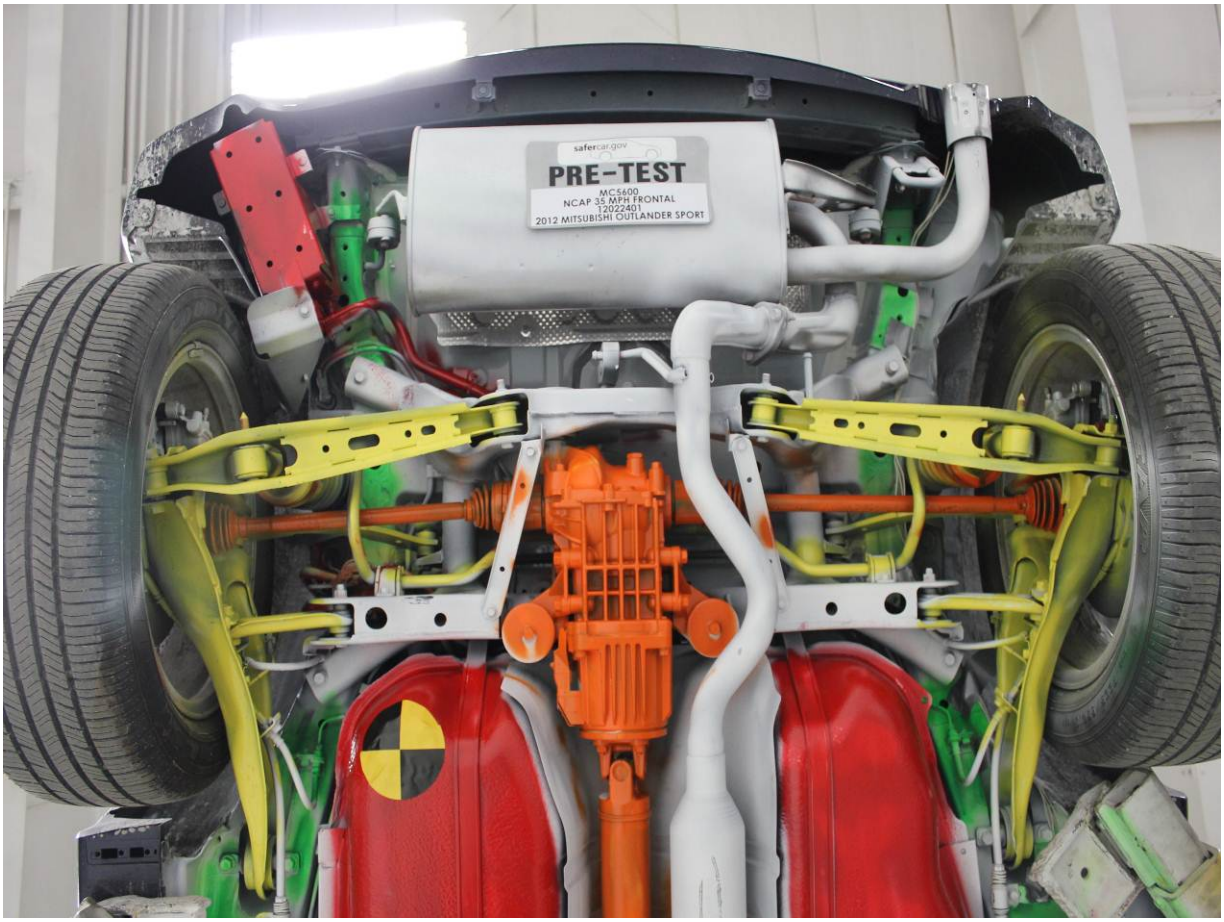
Post-Test Front Underbody View

Pre-Test Mid Front Underbody View

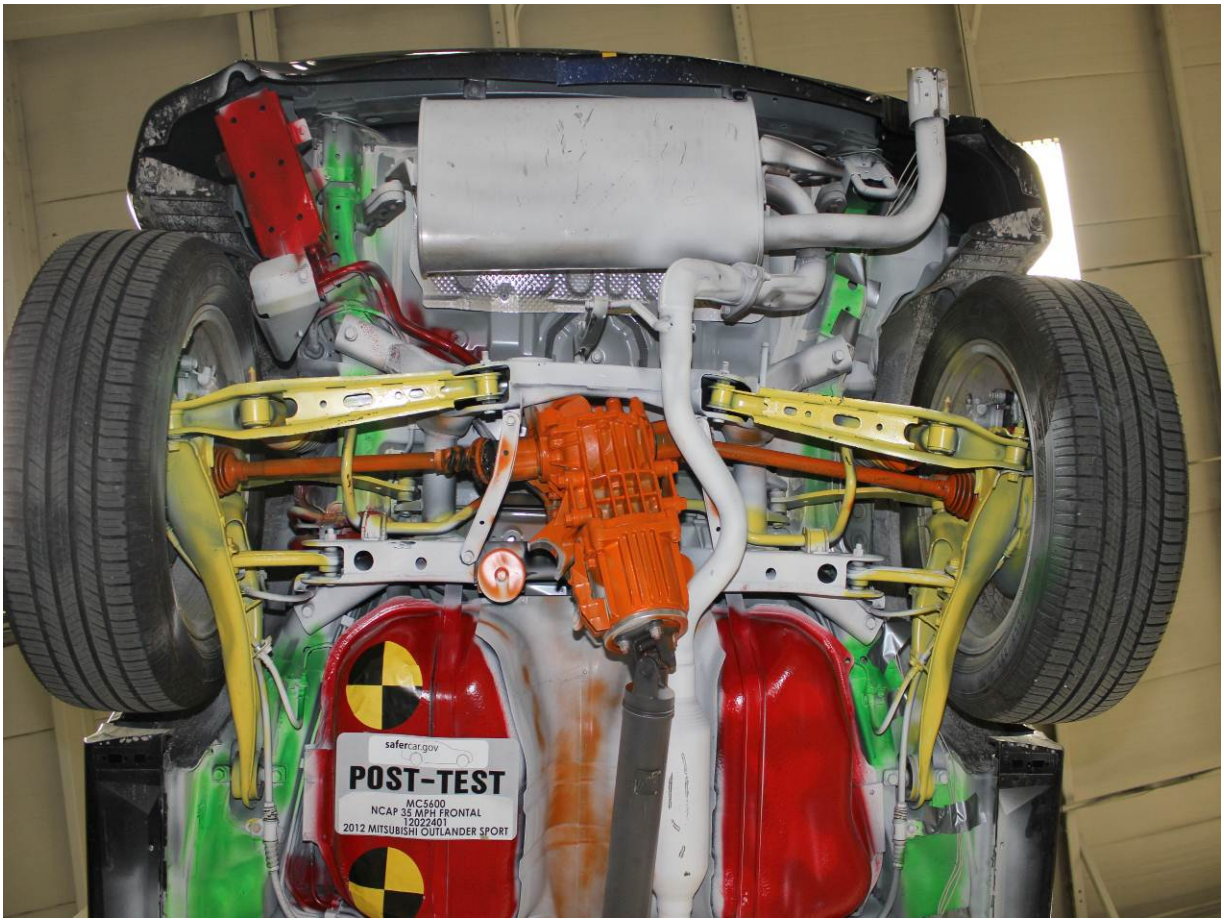
Post-Test Mid Front Underbody View

Pre-Test Mid Rear Underbody View

Post-Test Mid Rear Underbody View



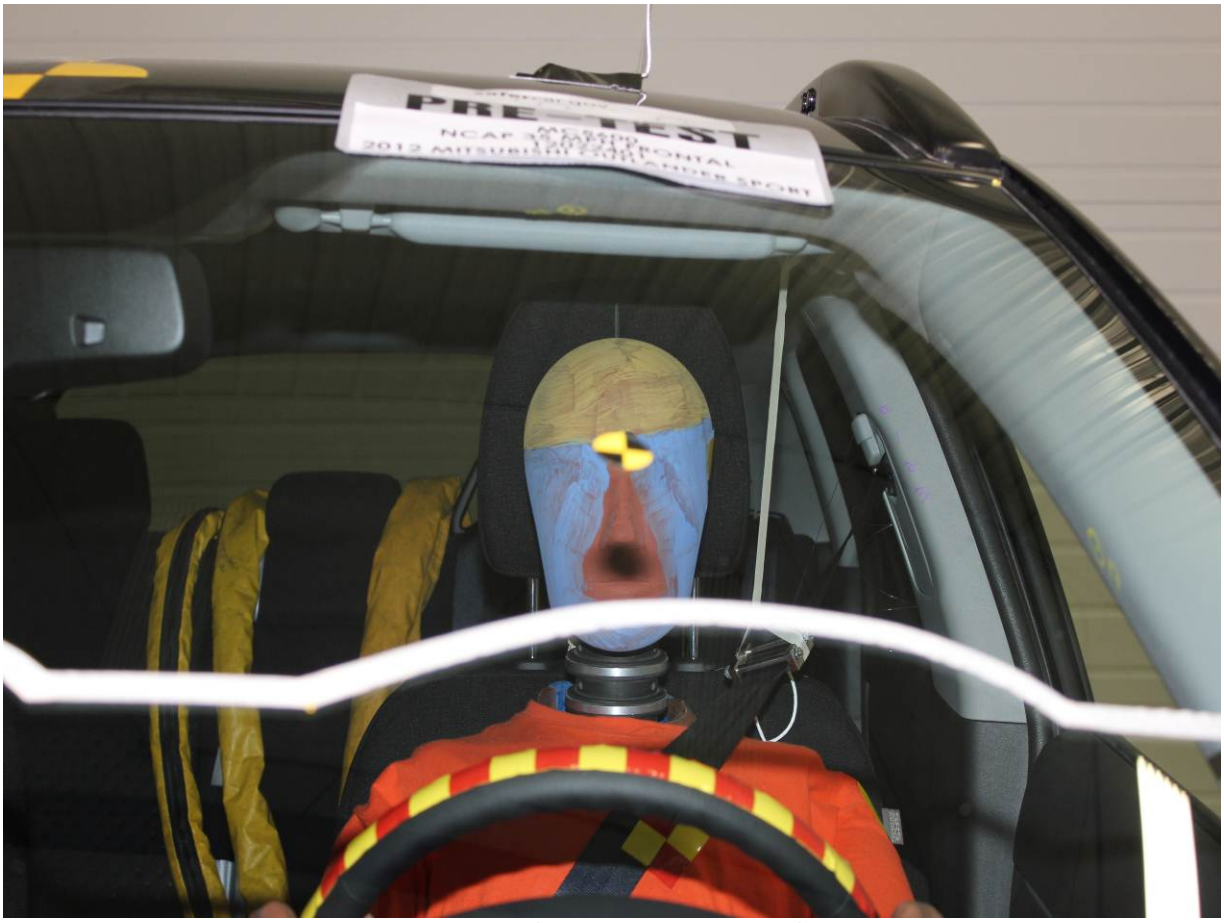
Pre-Test Rear Underbody View



Post-Test Rear Underbody View

Pre-Test Dummy Cable Routing

Post-Test Dummy Cable Routing



Pre-Test Driver Dummy Front View

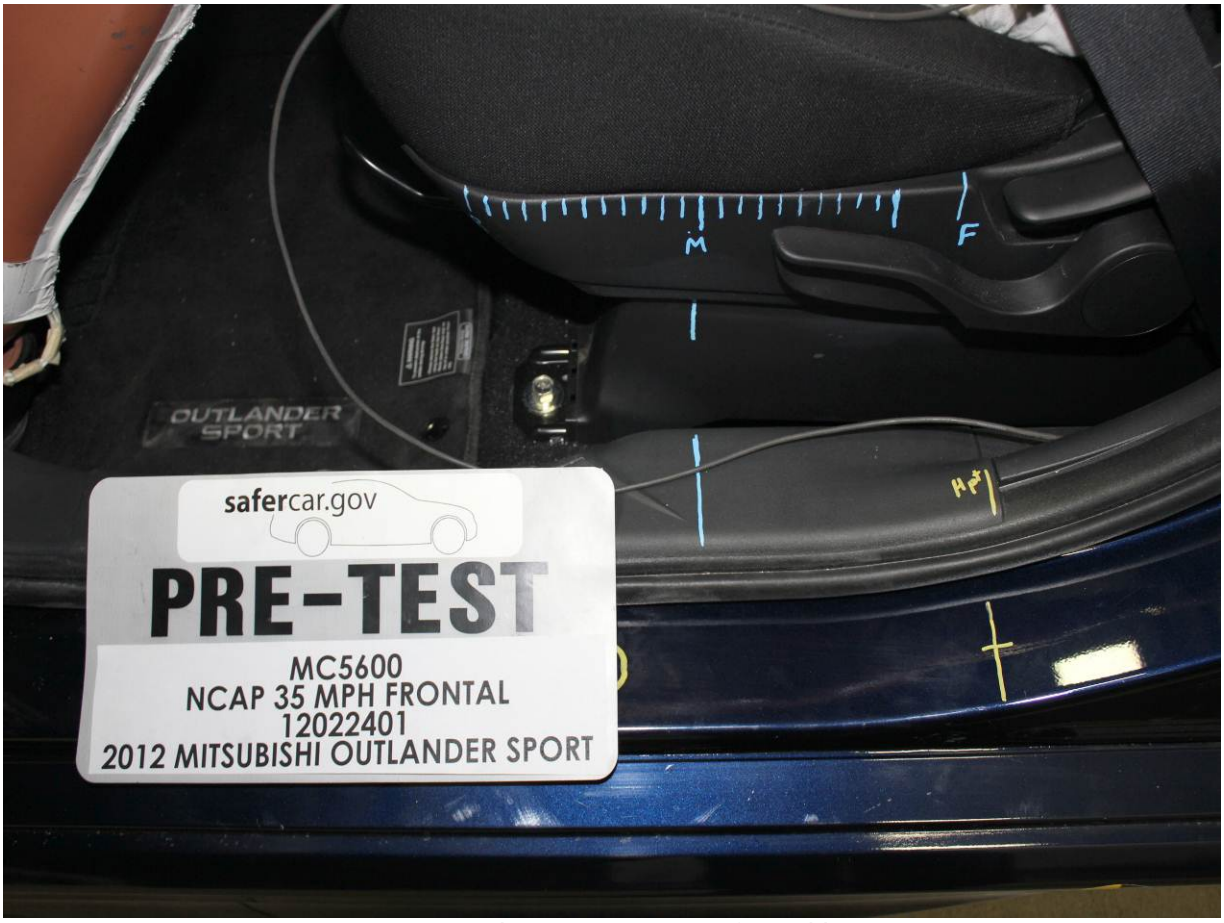
Post-Test Driver Dummy Front View

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

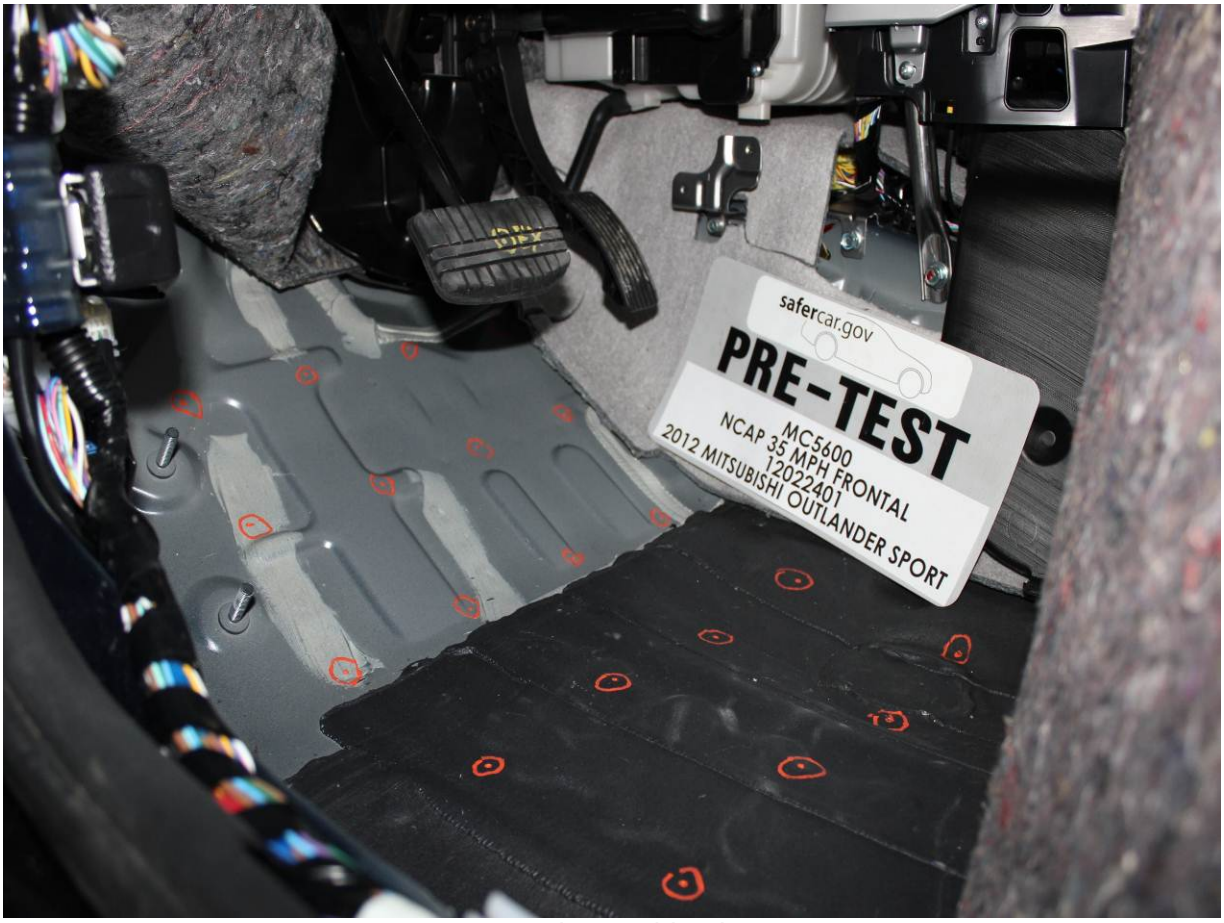
Post-Test Driver's Seat Fore-Aft Markings

Pre-Test Driver Dummy Feet

Post-Test Driver Dummy Feet

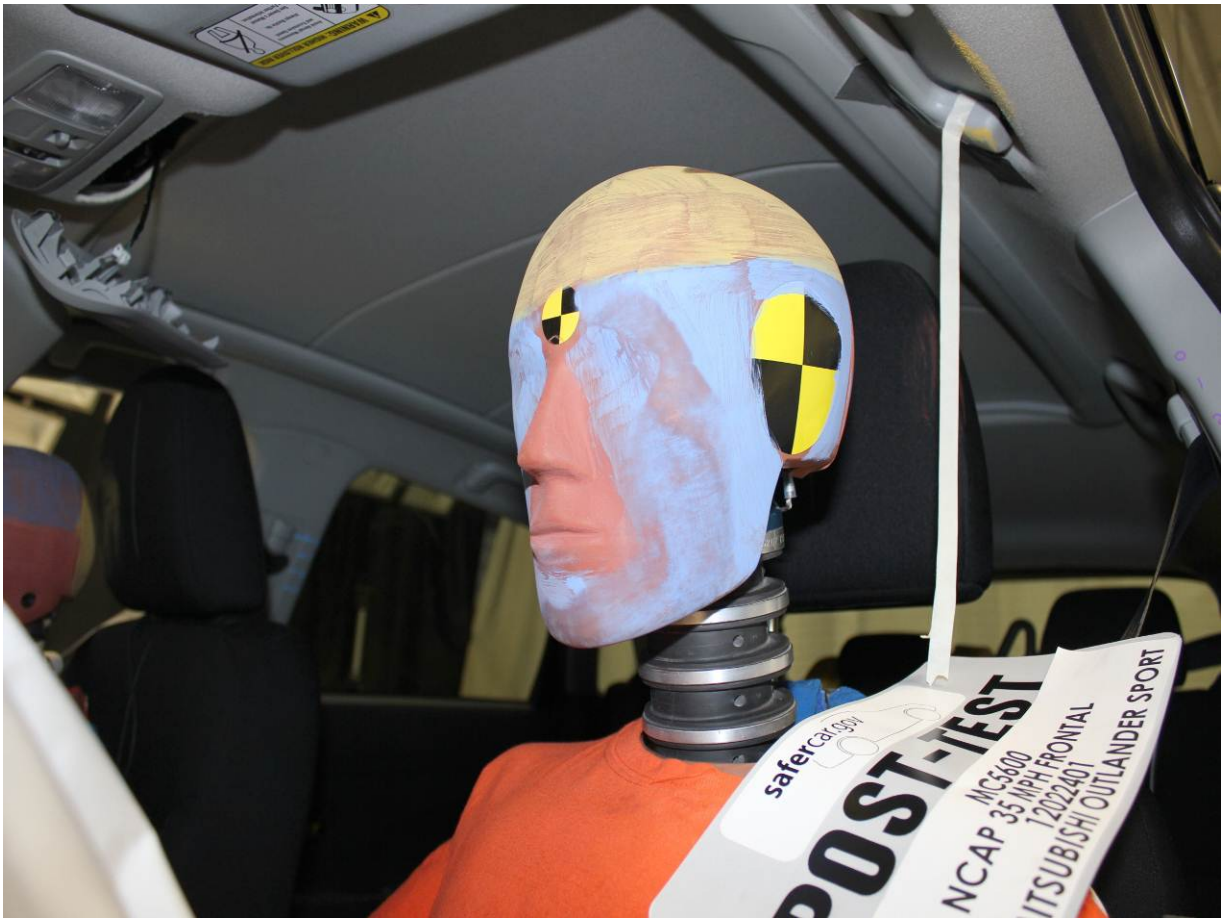
Pre-Test Driver's Side Knee Bolster (without dummy)

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 Airbag

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

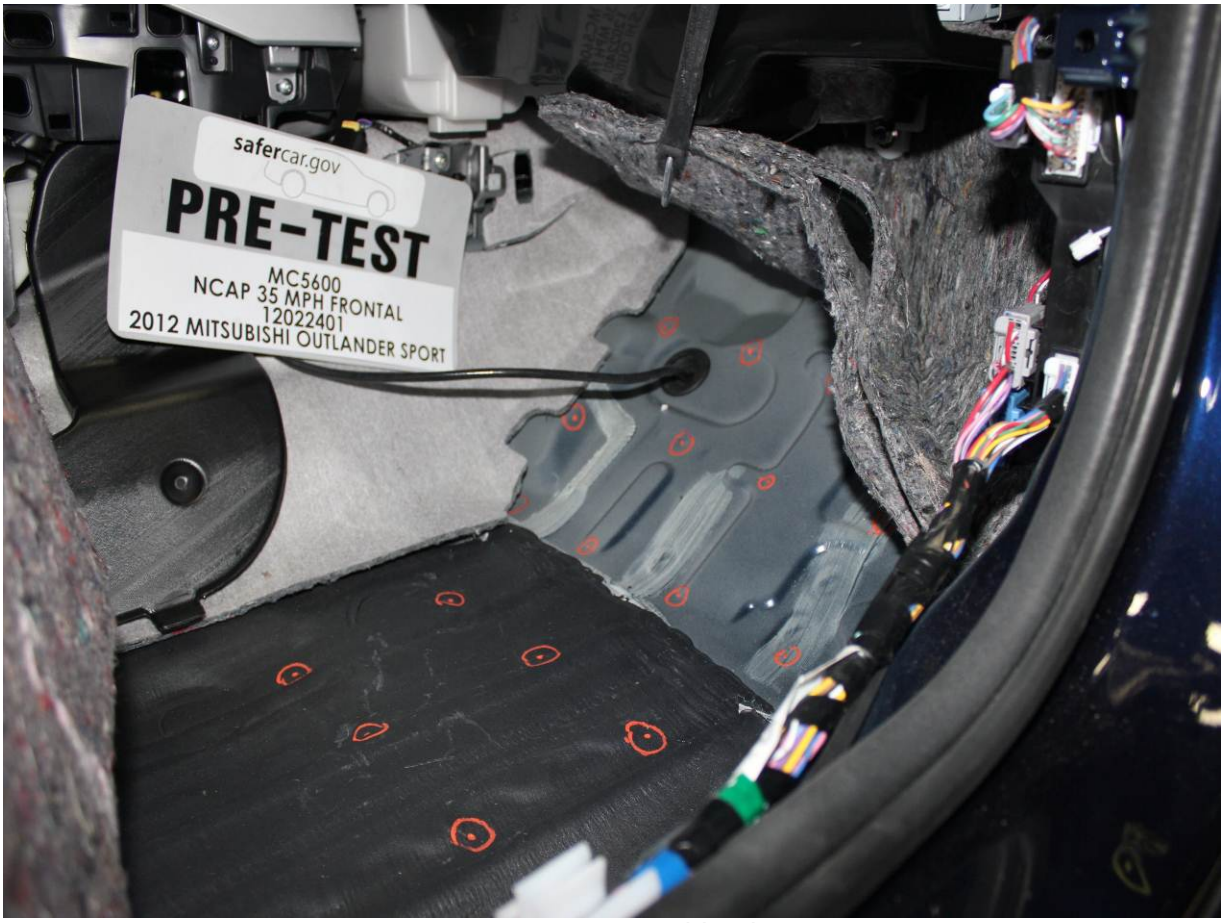
Post-Test Passenger's Seat Fore-Aft Markings

Pre-Test Passenger Dummy Feet

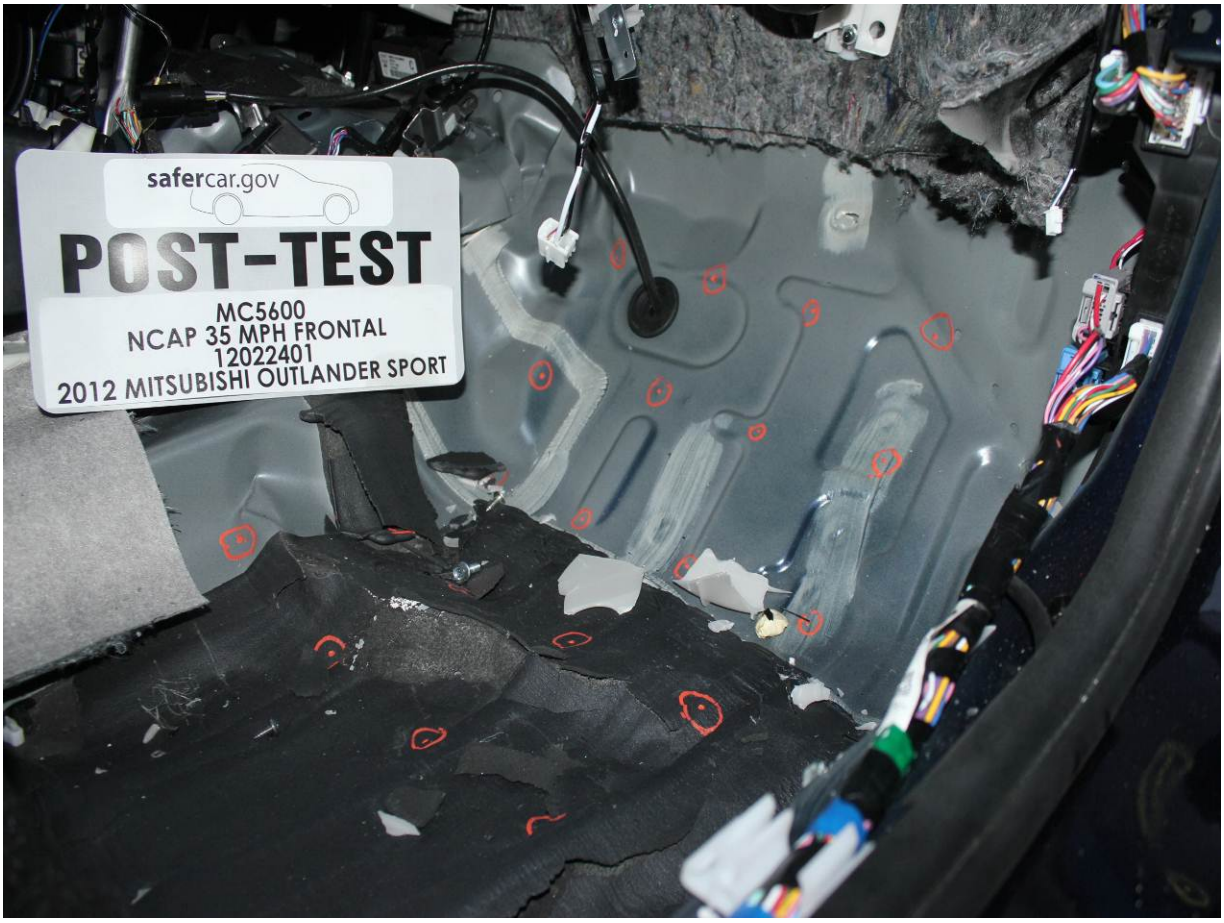
Post-Test Passenger Dummy Feet

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

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



Pre-Test Passenger's Side Floorpan



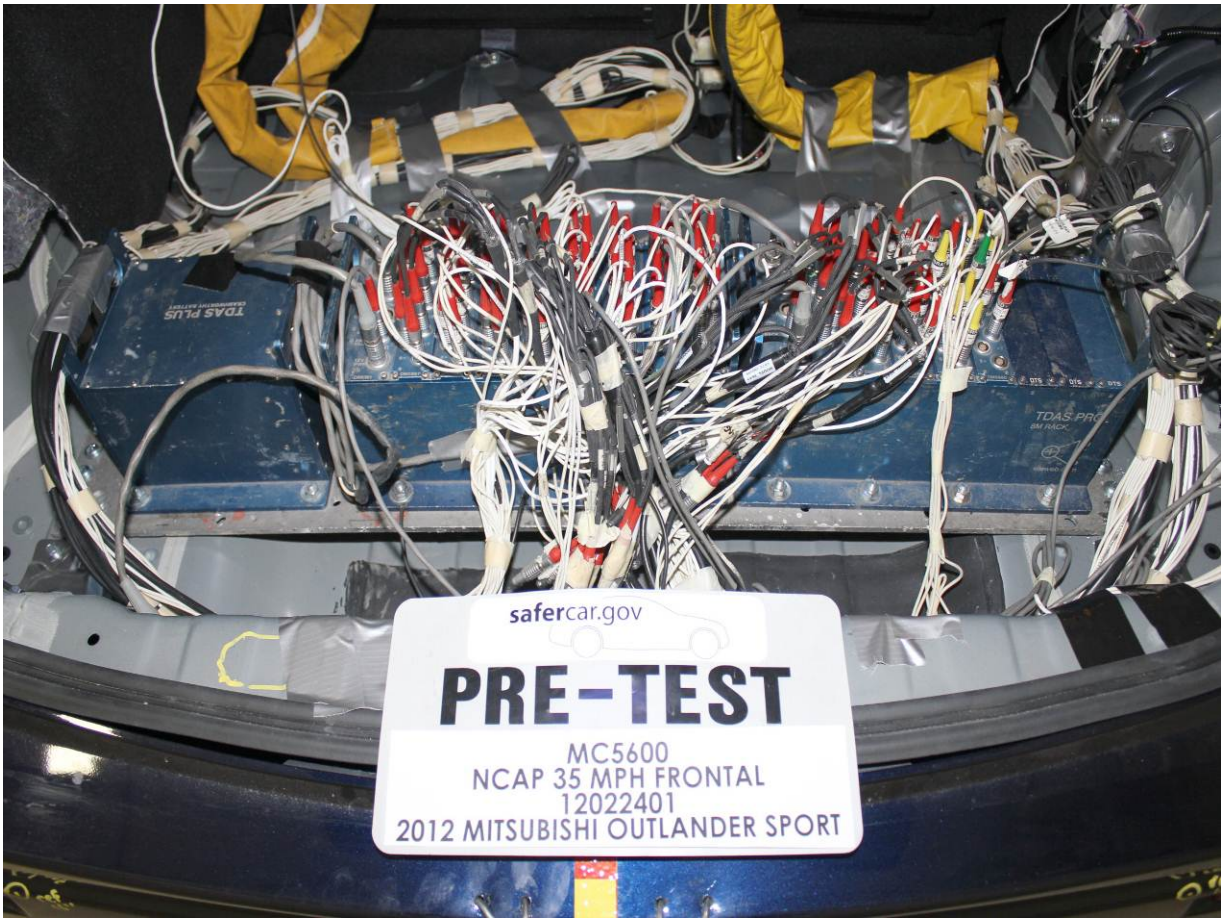
Post-Test Passenger's Side Floorpan

Post-Test Passenger Dummy Contact with Airbag

Post-Test Passenger Dummy Contact with Headrest

Post-Test Passenger Dummy Contact with Side Header

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

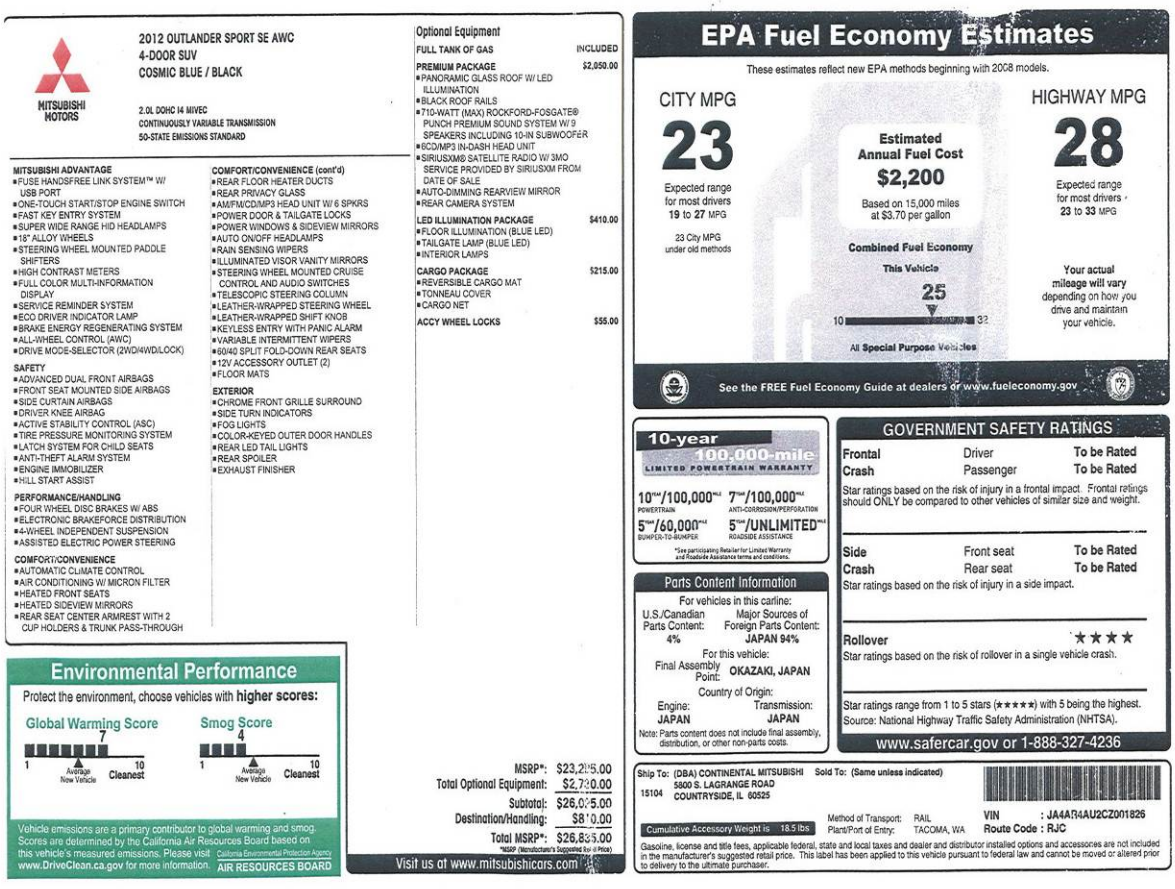
Vehicle at 90 Degrees on Static Rollover Device

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 Mitsubishi Outlander Sport Frontal Impact Event



Monroney Label

APPENDIX B

DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

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

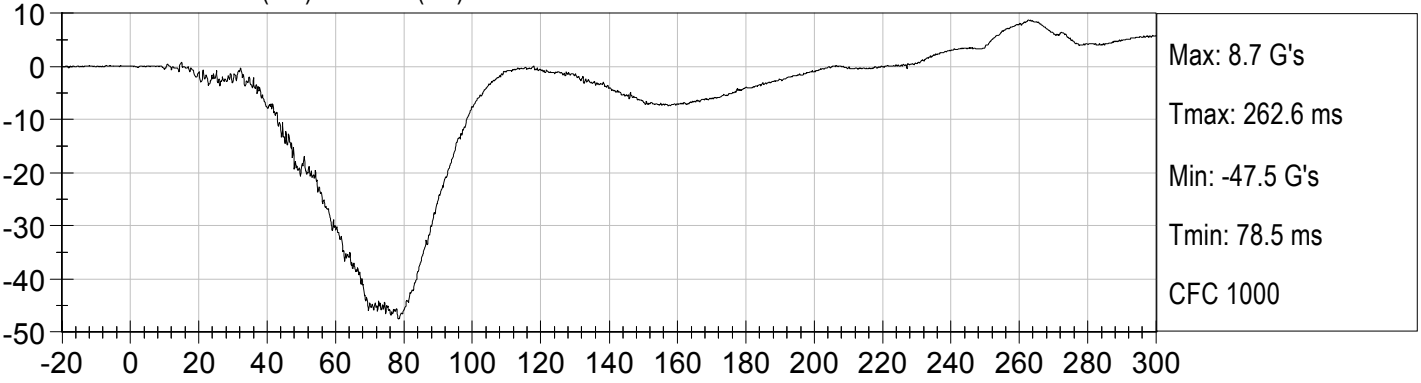
Right Rear Seat Crossmember Xr

Advanced Research Load Cell Barrier – 128 channels

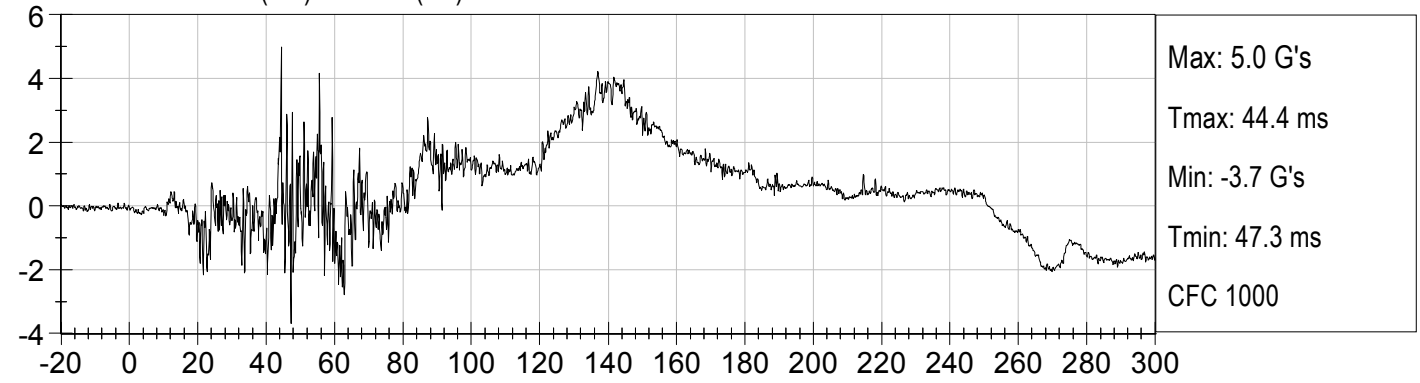
NCAP 35mph Frontal
2012 Mitsubishi Outlander Sport - MC5600

Test Date: 02/24/2012
Speed: 35.2 mph (56.6 km/h)

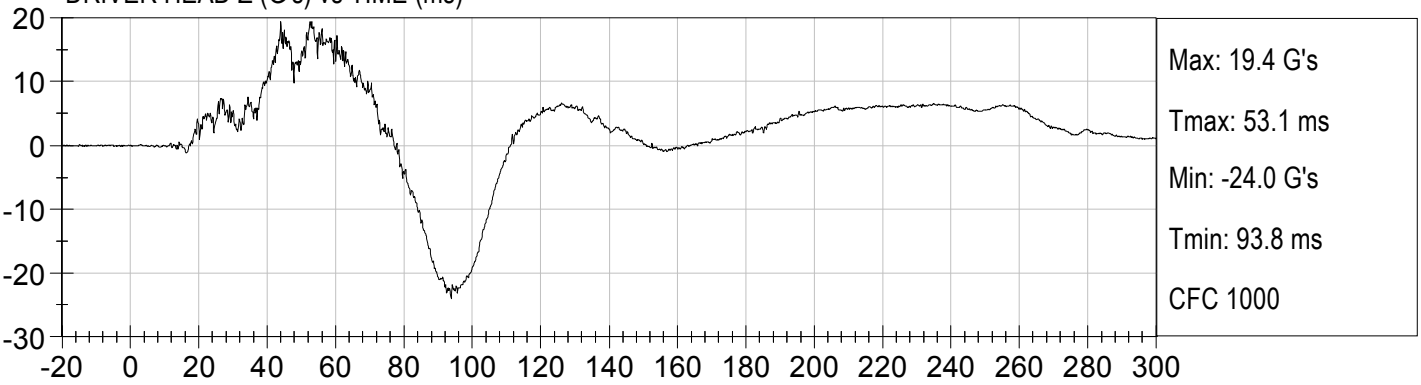
DRIVER HEAD X (G's) vs TIME (ms)



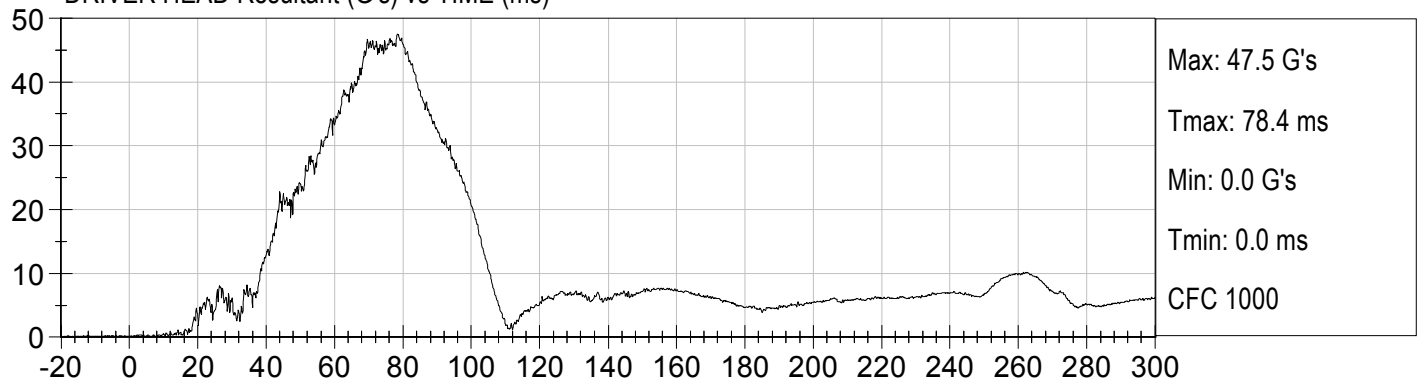
DRIVER HEAD Y (G's) vs TIME (ms)



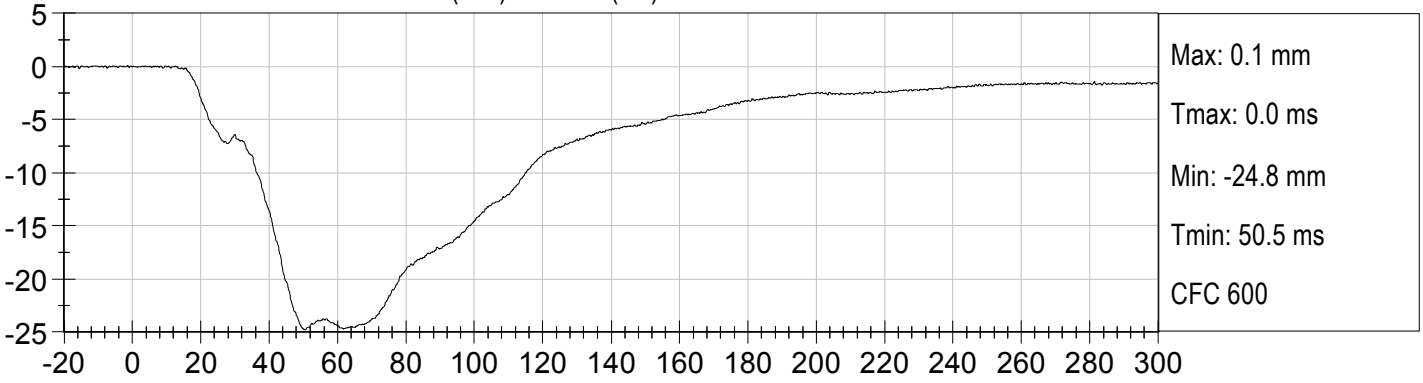
DRIVER HEAD Z (G's) vs TIME (ms)



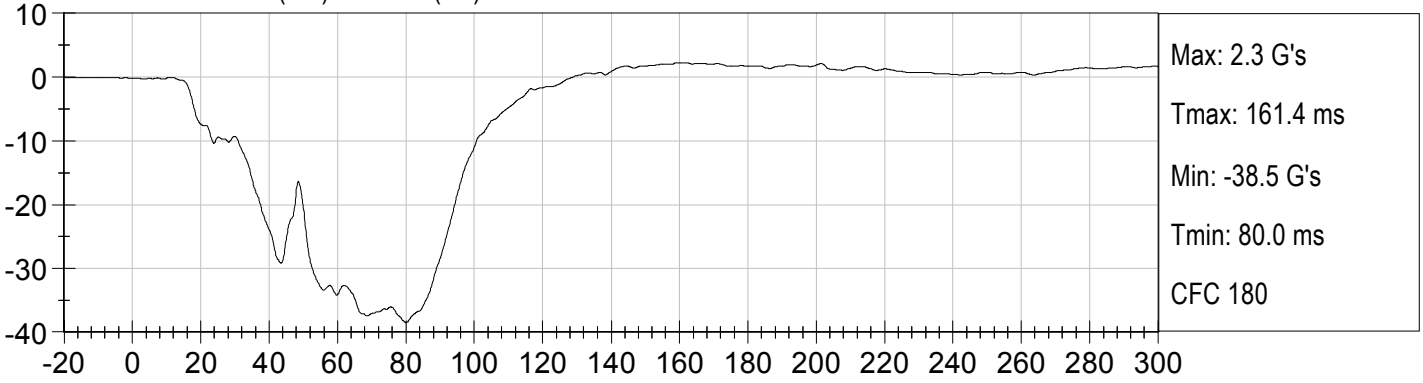
DRIVER HEAD Resultant (G's) vs TIME (ms)



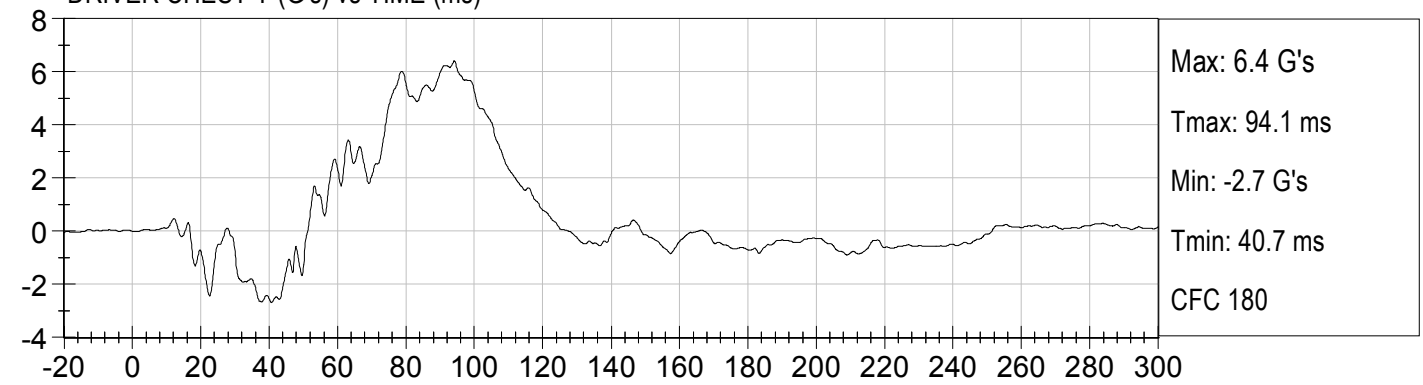
DRIVER CHEST DISPLACEMENT (mm) vs TIME (ms)



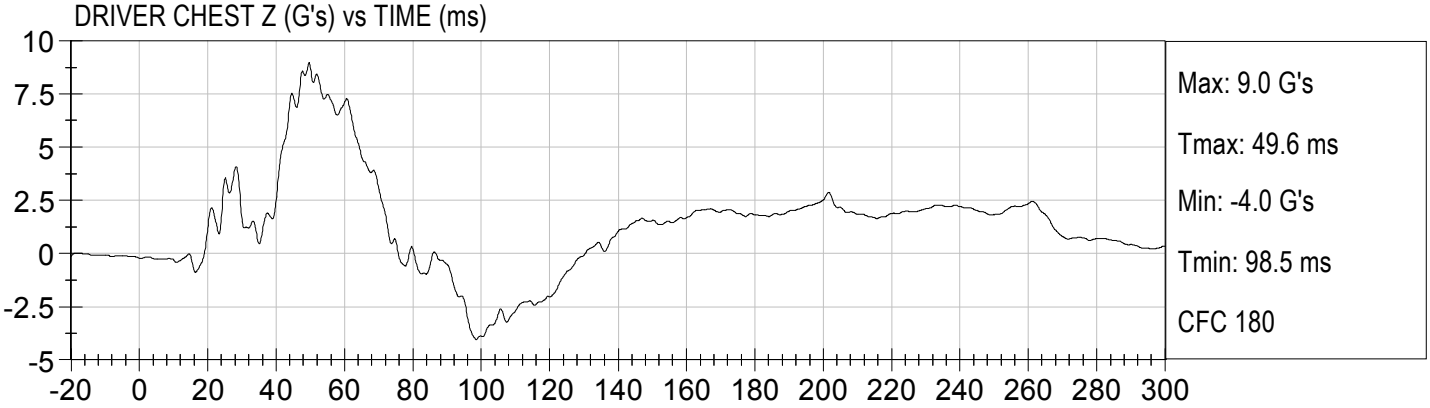
DRIVER CHEST X (G's) vs TIME (ms)



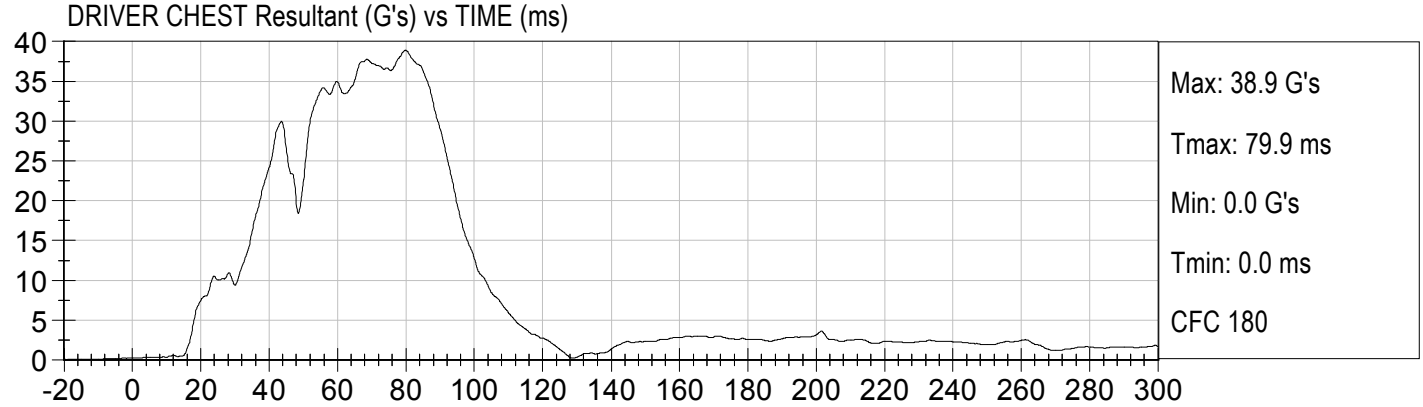
DRIVER CHEST Y (G's) vs TIME (ms)



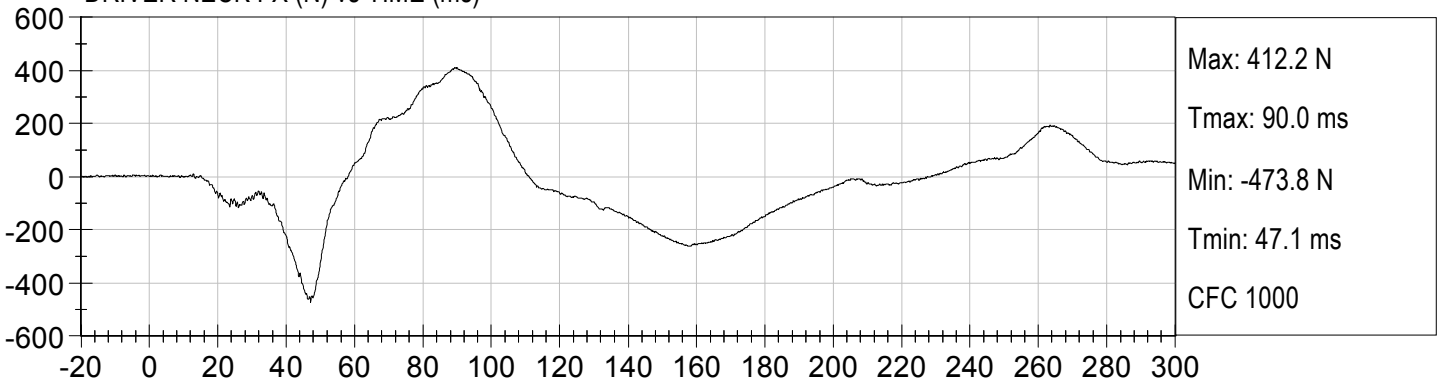
DRIVER CHEST Z (G's) vs TIME (ms)



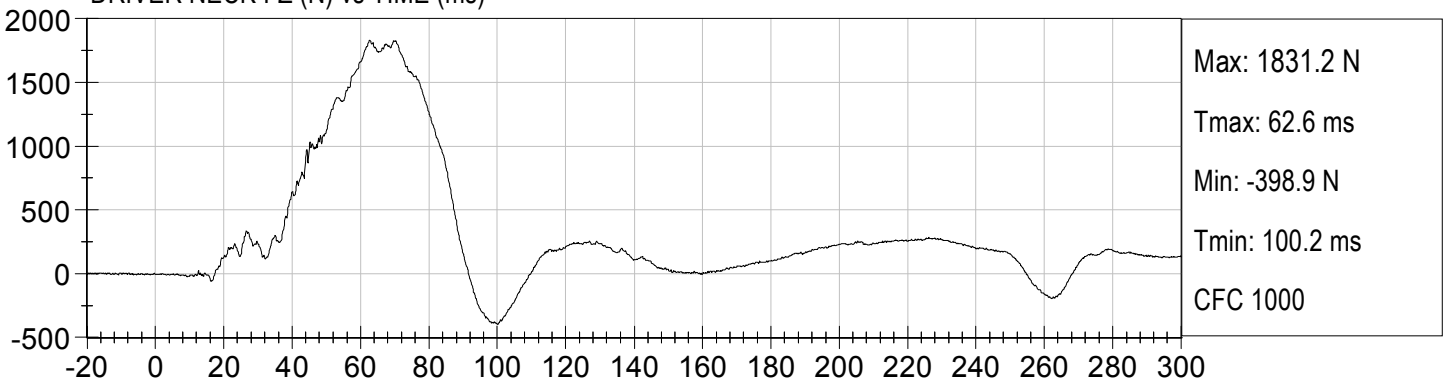
DRIVER CHEST Resultant (G's) vs TIME (ms)



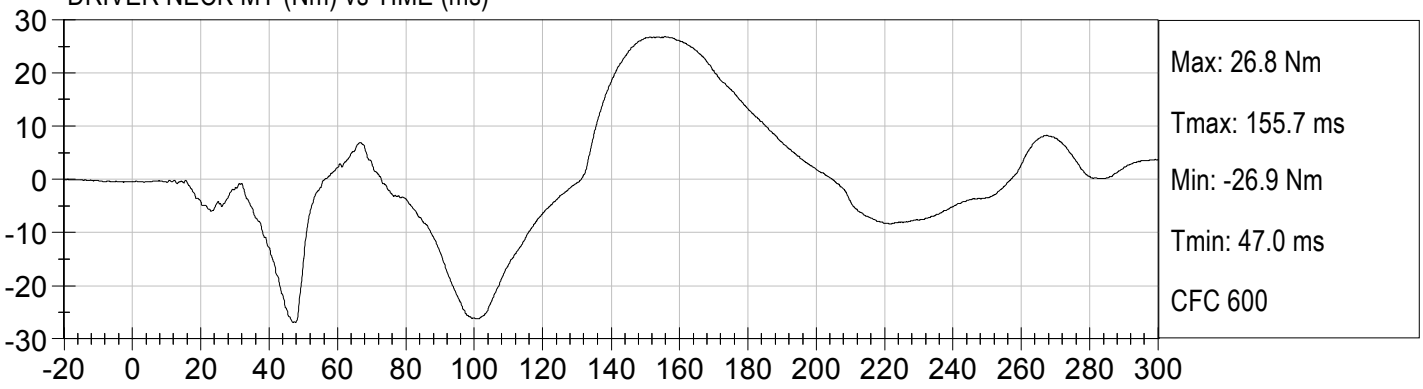
DRIVER NECK FX (N) vs TIME (ms)

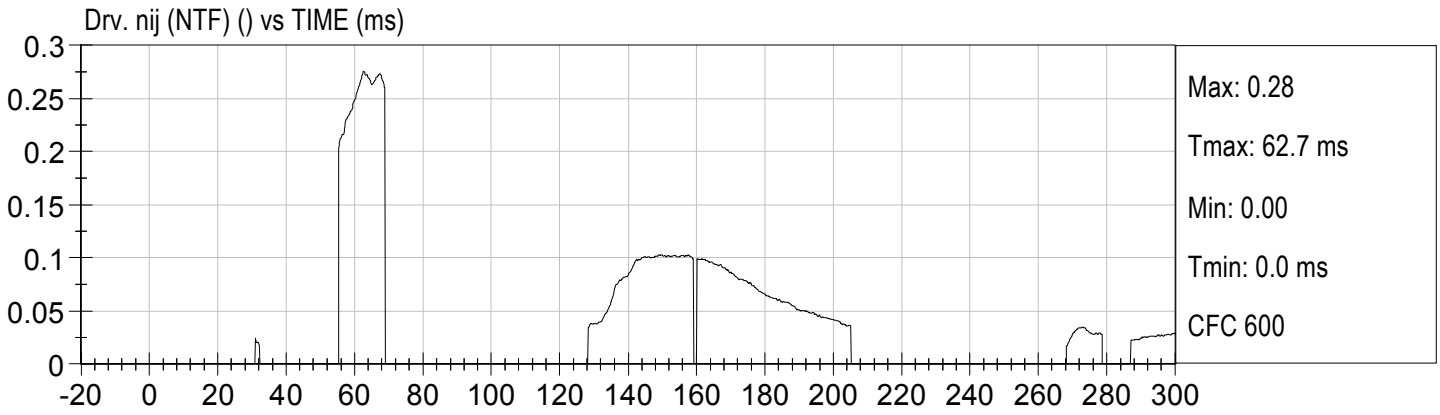


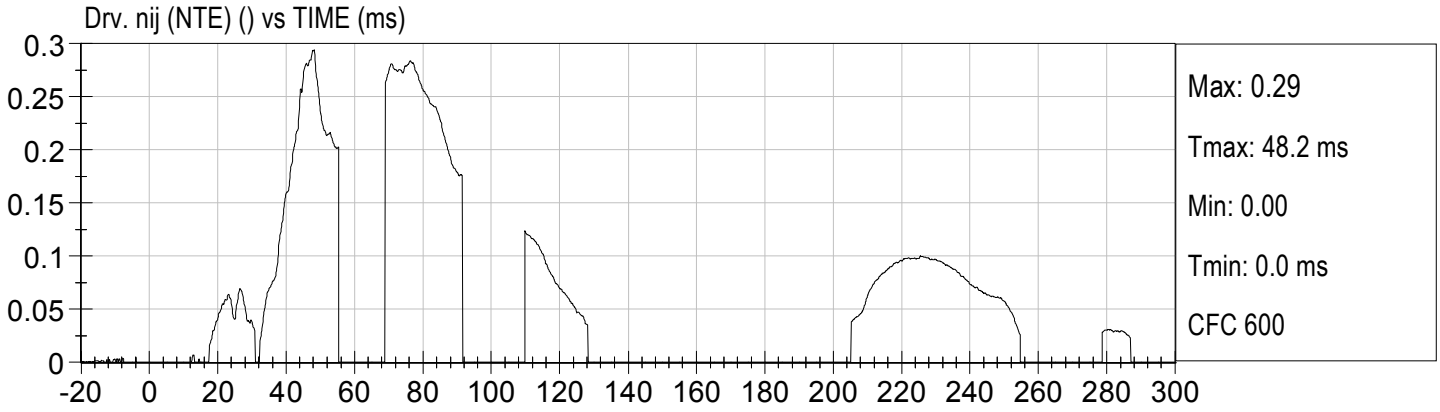
DRIVER NECK FZ (N) vs TIME (ms)

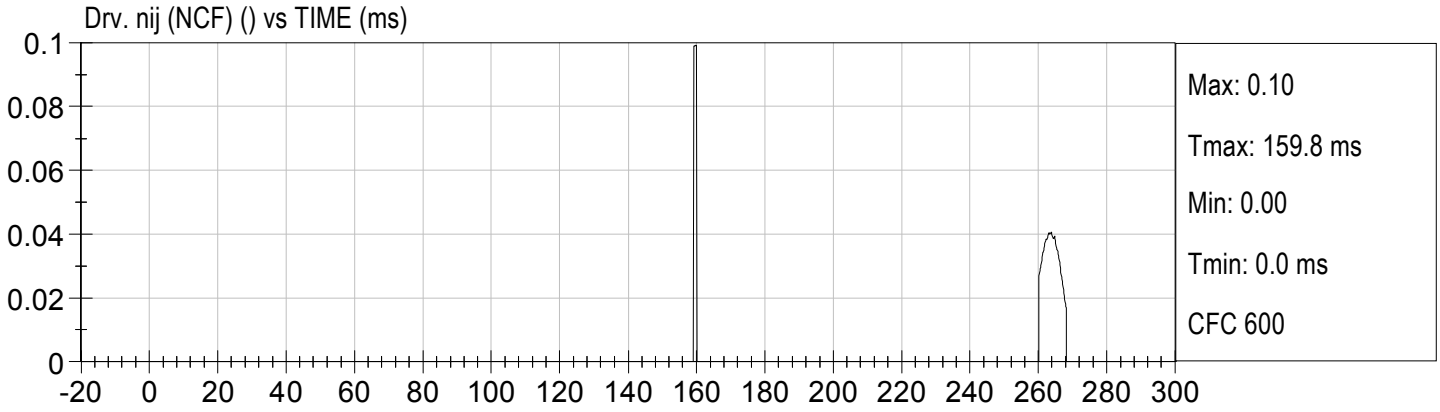


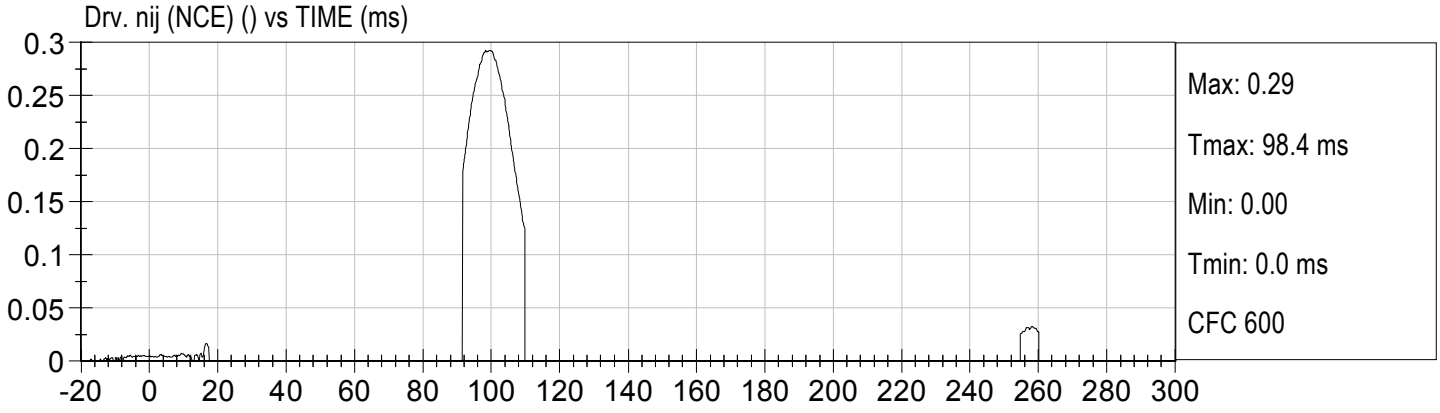
DRIVER NECK MY (Nm) vs TIME (ms)



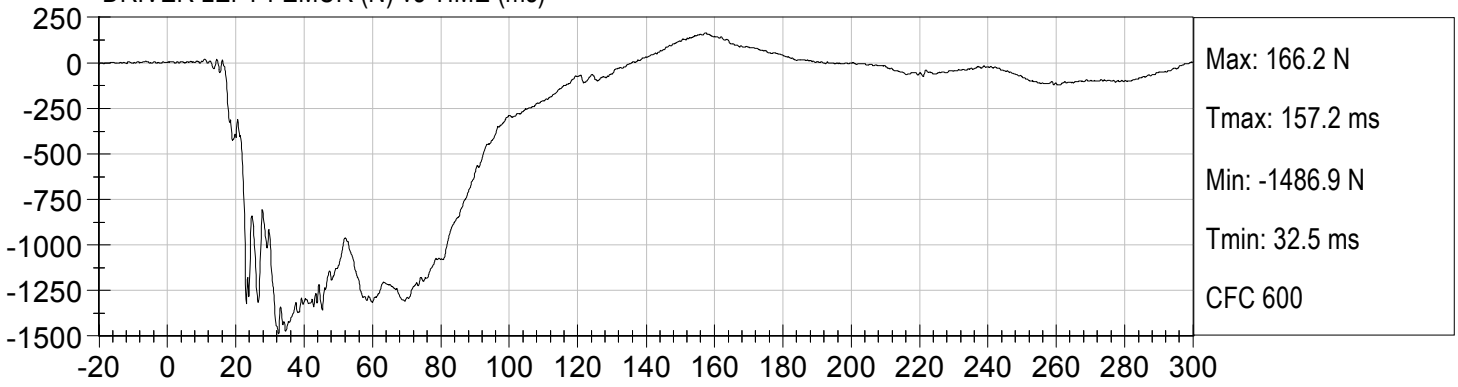

Drv. nij (NTF) () vs TIME (ms)
0.3
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.28
Tmax: 62.7 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


Drv. nij (NTE) () vs TIME (ms)
0.3
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.29
Tmax: 48.2 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

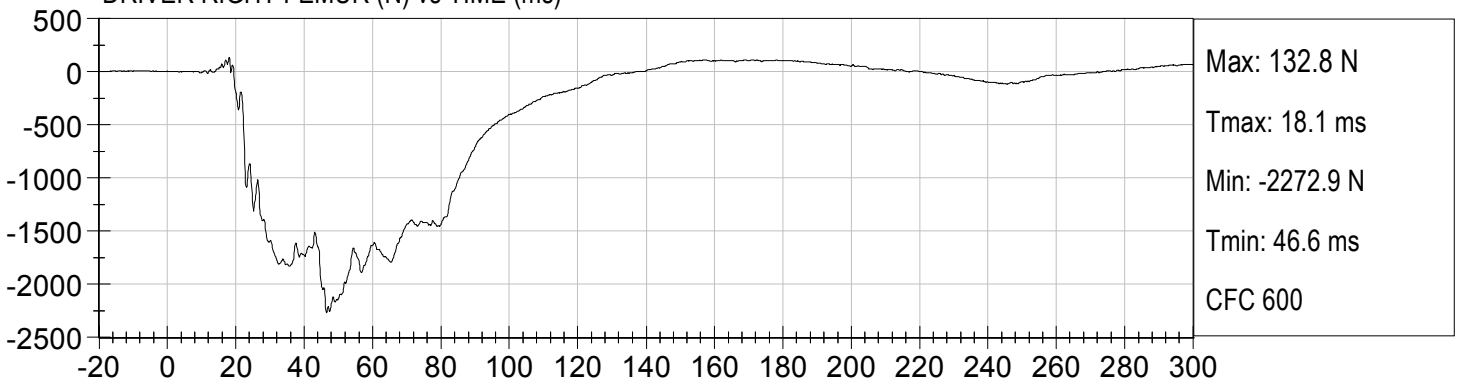

Drv. nij (NCF) () vs TIME (ms)
0.1
0.08
0.06
0.04
0.02
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.10
Tmax: 159.8 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


Drv. nij (NCE) () vs TIME (ms)
0.3
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.29
Tmax: 98.4 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

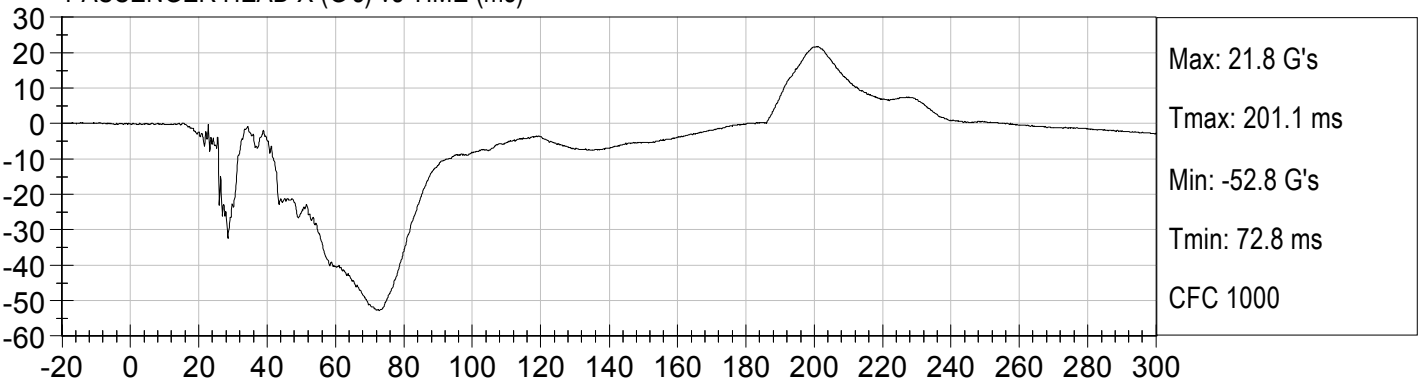
DRIVER LEFT FEMUR (N) vs TIME (ms)



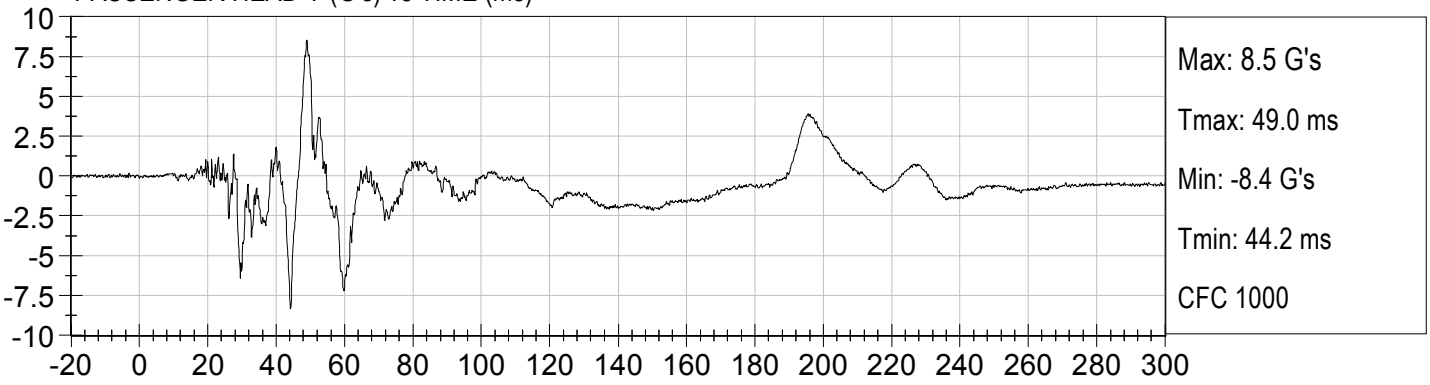
DRIVER RIGHT FEMUR (N) vs TIME (ms)



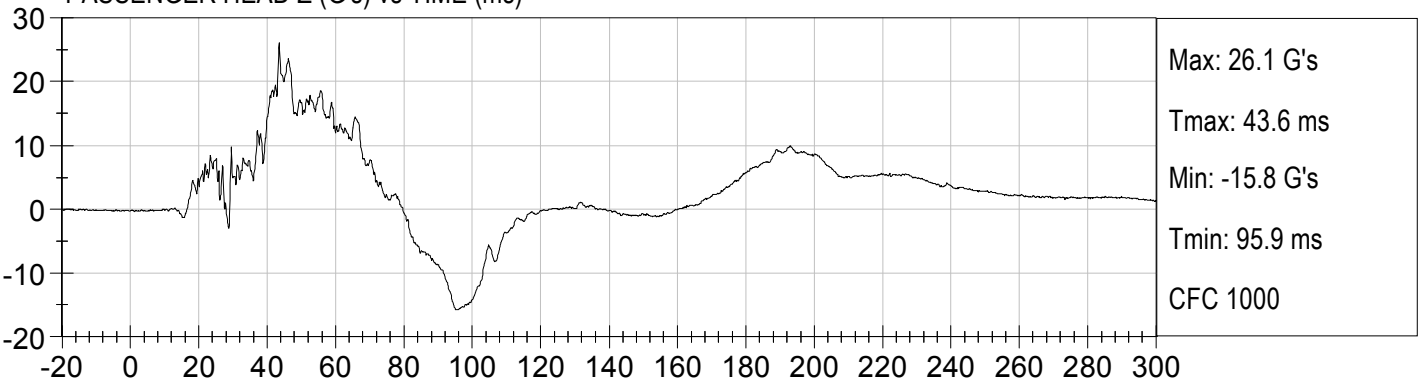
PASSENGER HEAD X (G's) vs TIME (ms)



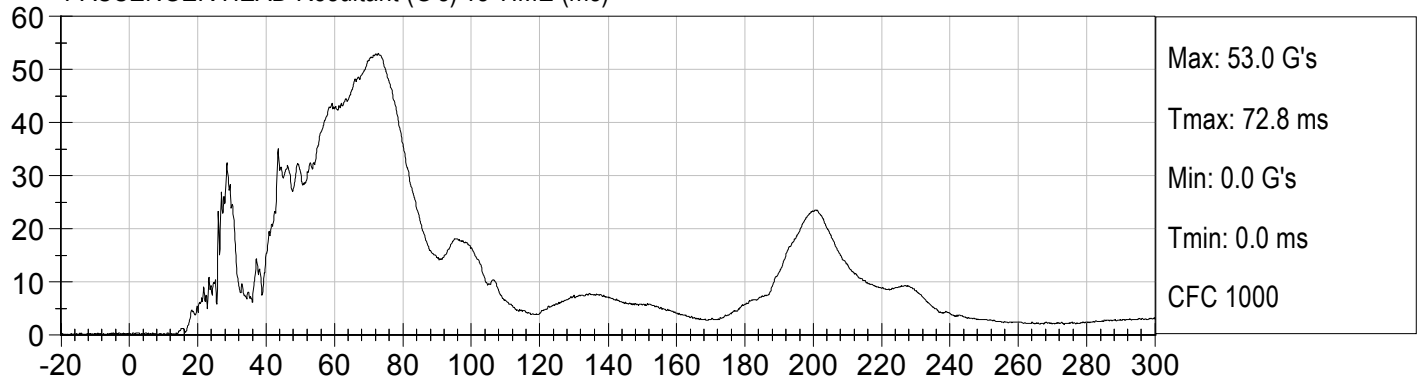
PASSENGER HEAD Y (G's) vs TIME (ms)



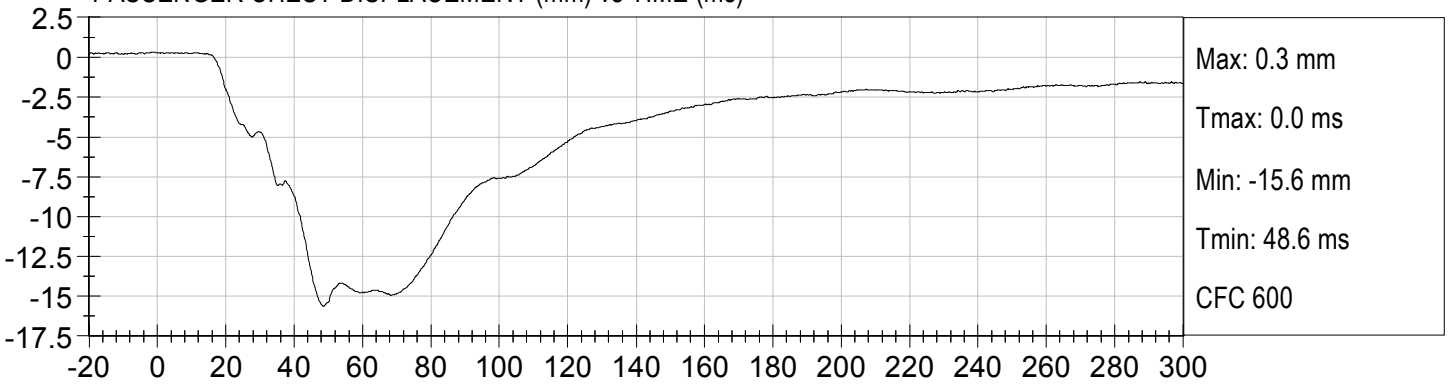
PASSENGER HEAD Z (G's) vs TIME (ms)



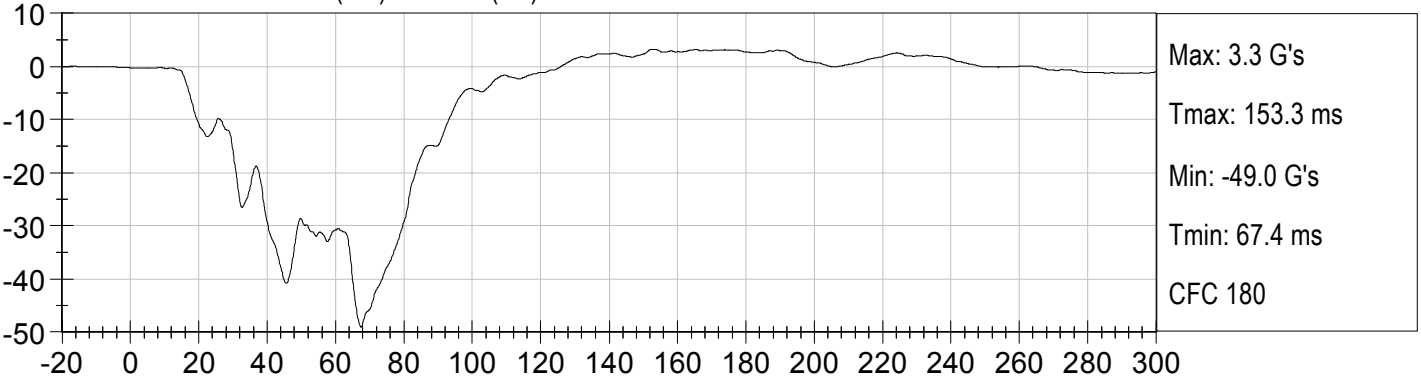
PASSENGER HEAD Resultant (G's) vs TIME (ms)



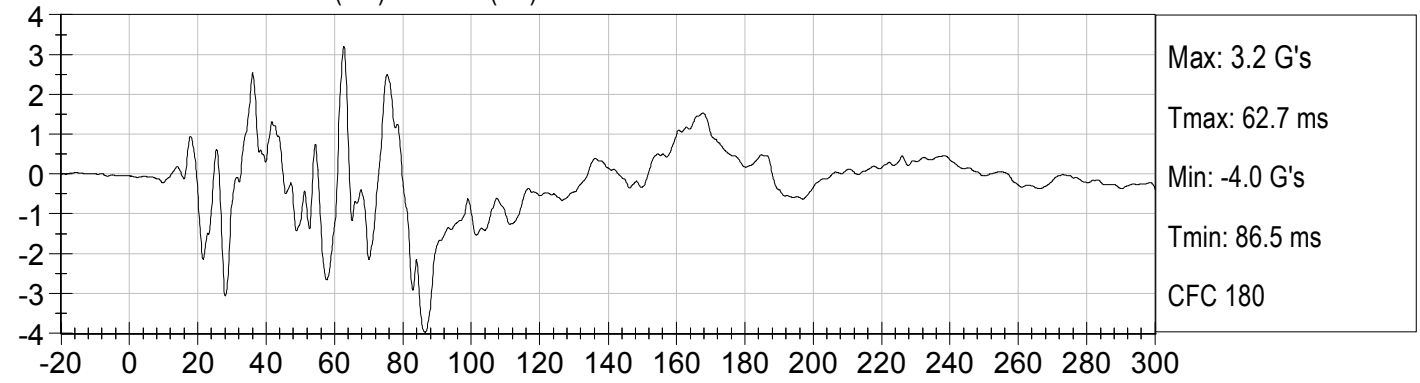
PASSENGER CHEST DISPLACEMENT (mm) vs TIME (ms)



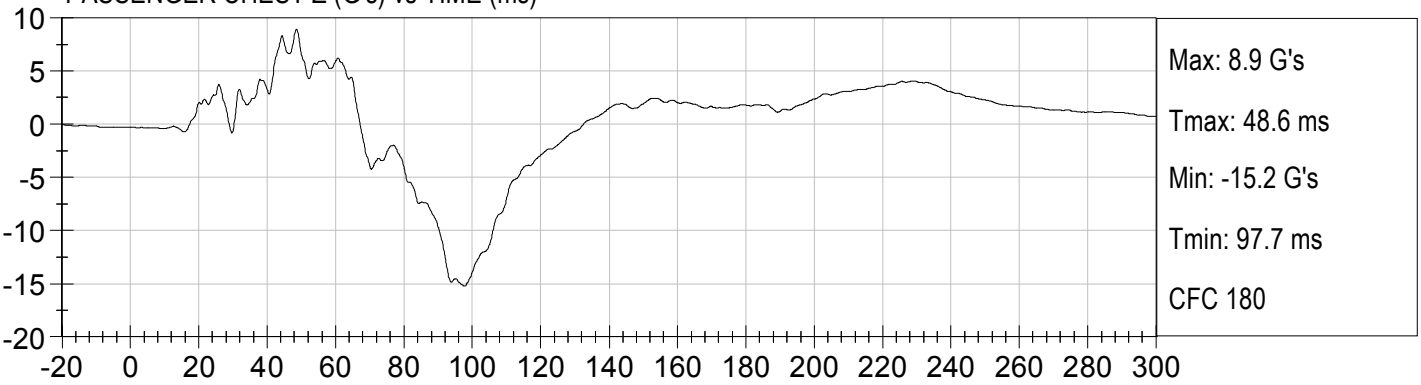
PASSENGER CHEST X (G's) vs TIME (ms)



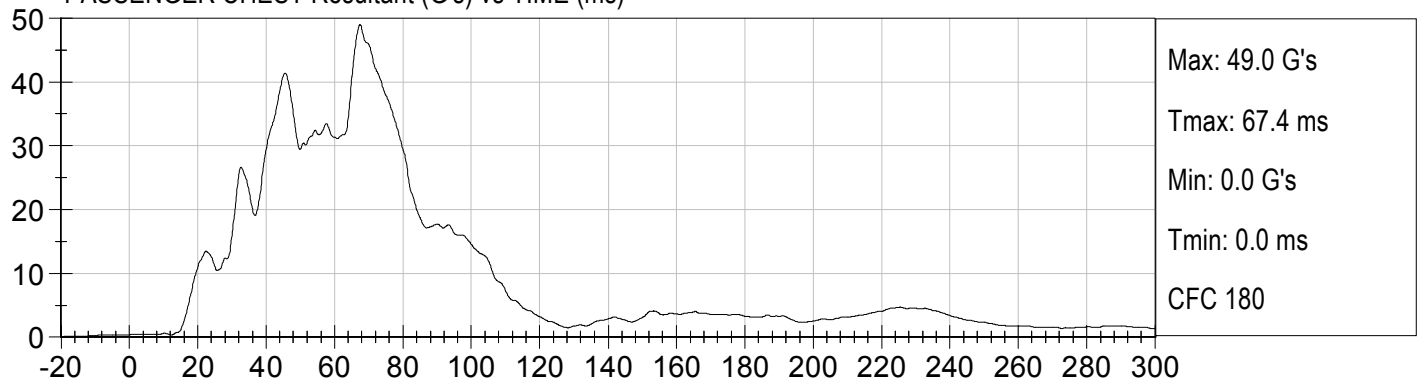
PASSENGER CHEST Y (G's) vs TIME (ms)



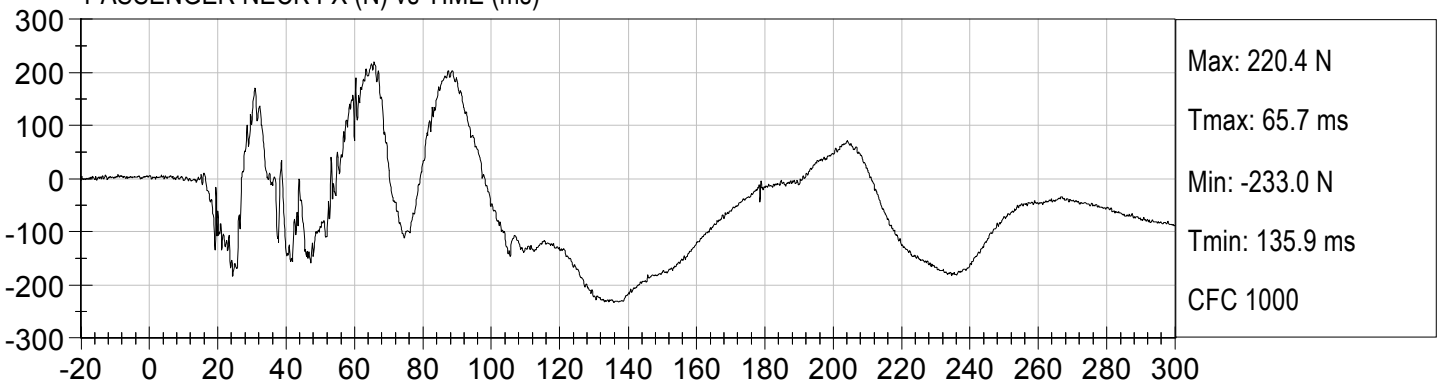
PASSENGER CHEST Z (G's) vs TIME (ms)



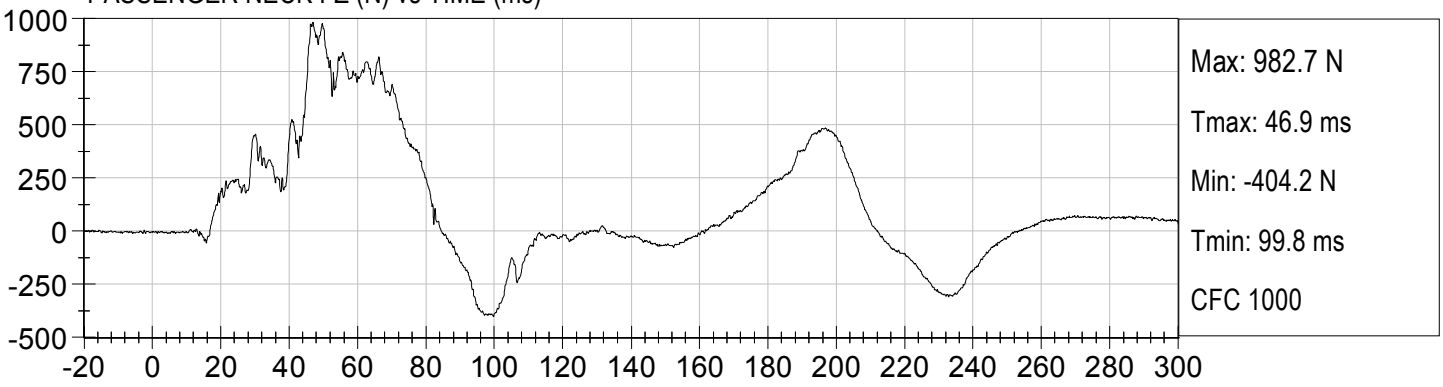
PASSENGER CHEST Resultant (G's) vs TIME (ms)



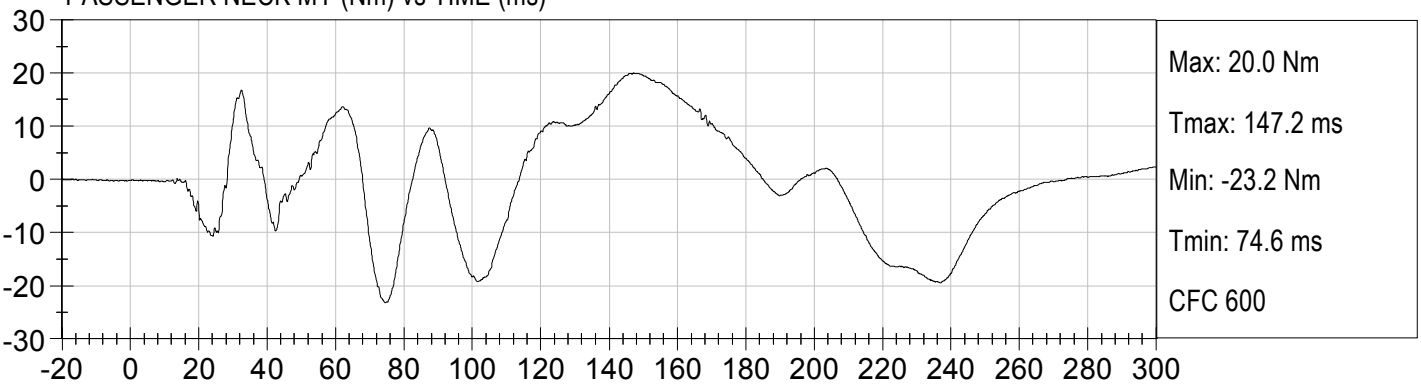
PASSENGER NECK FX (N) vs TIME (ms)

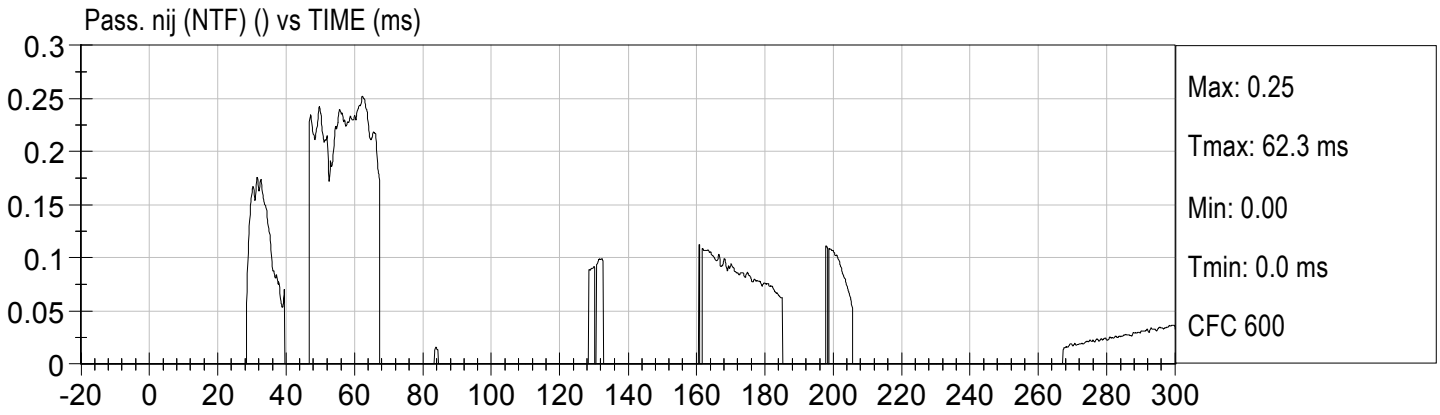


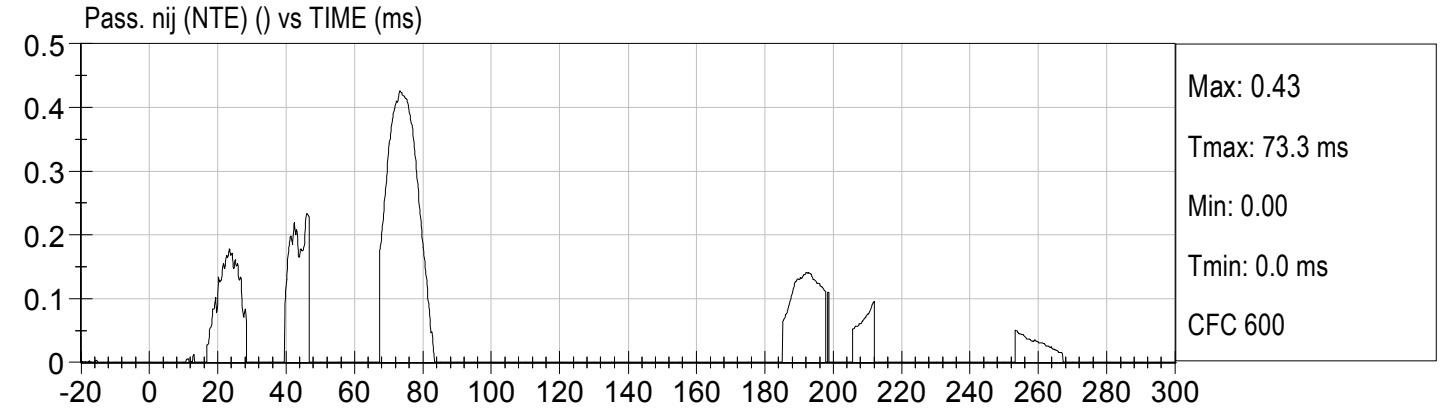
PASSENGER NECK FZ (N) vs TIME (ms)

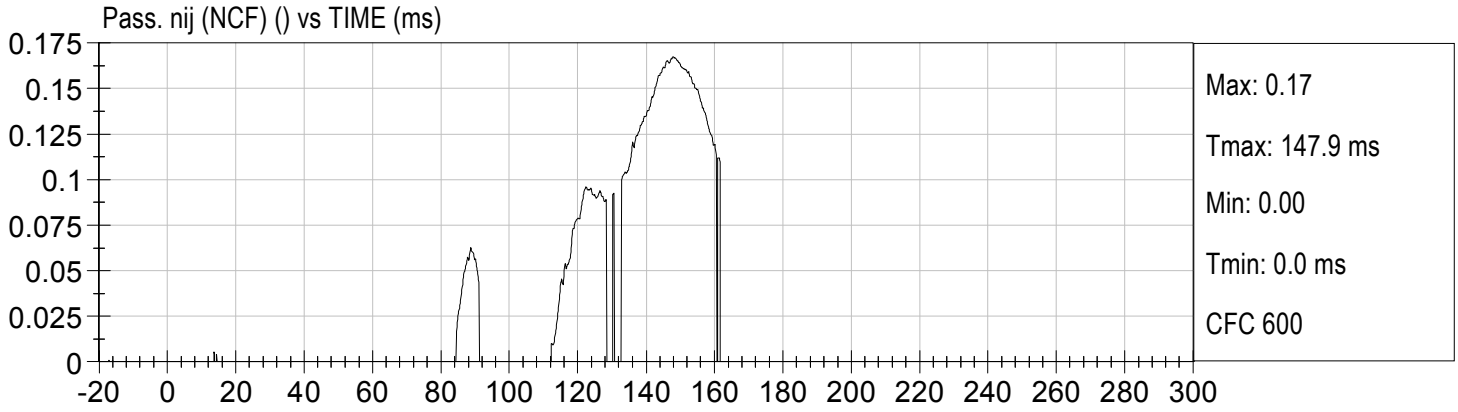


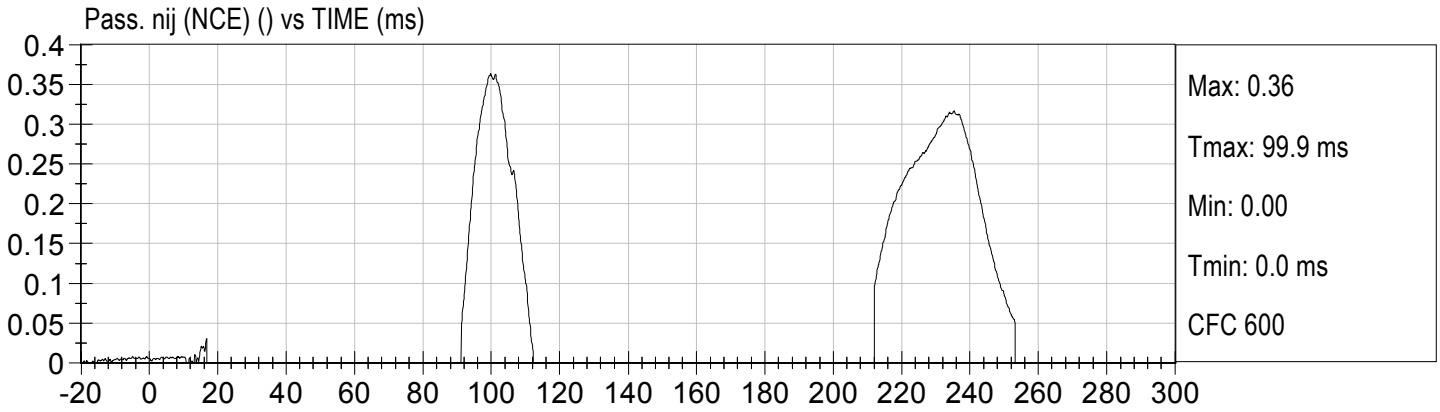
PASSENGER NECK MY (Nm) vs TIME (ms)



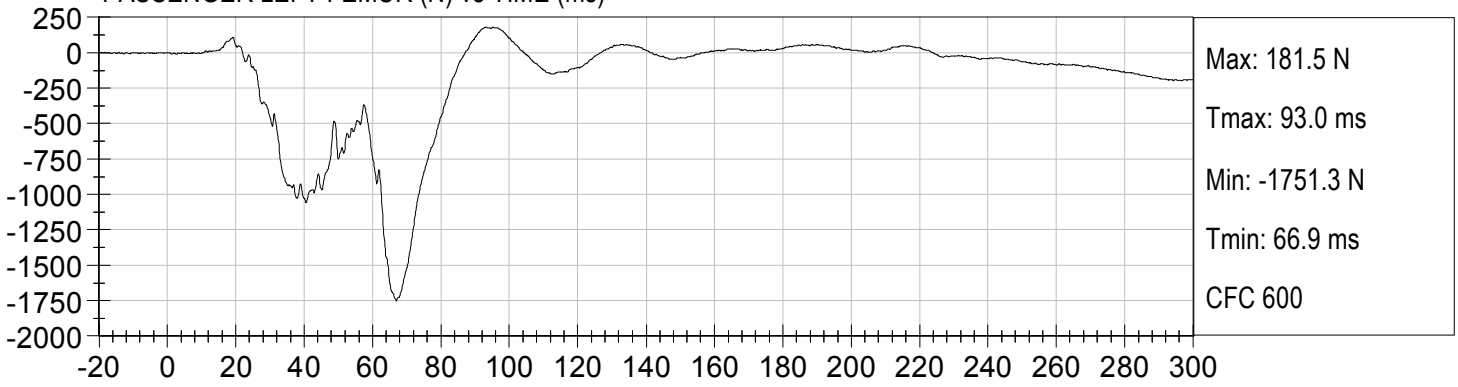

Pass. nij (NTF) () vs TIME (ms)
0.3
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.25
Tmax: 62.3 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


Pass. nij (NTE) () vs TIME (ms)
0.5
0.4
0.3
0.2
0.1
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.43
Tmax: 73.3 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

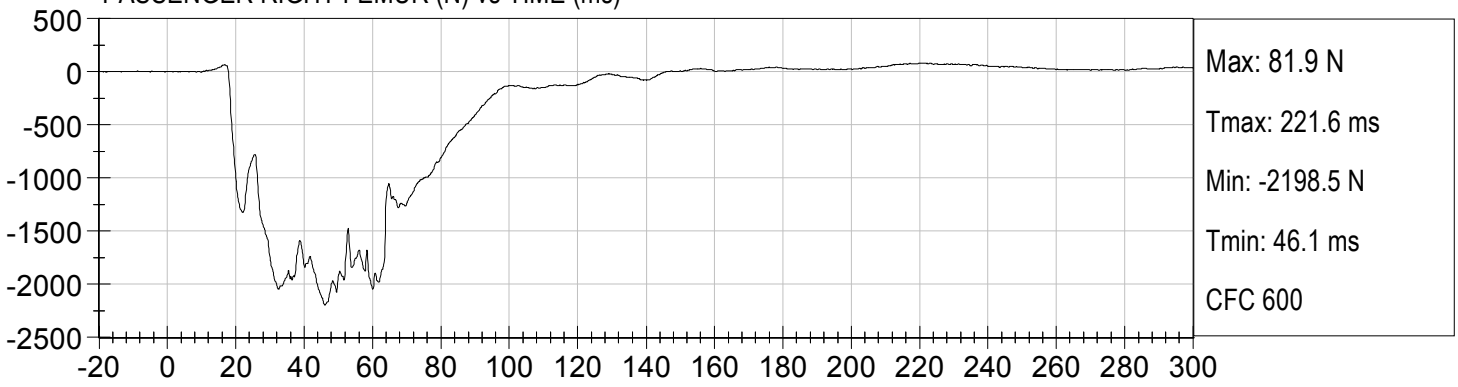

Pass. nij (NCF) () vs TIME (ms)
0.175
0.15
0.125
0.1
0.075
0.05
0.025
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.17
Tmax: 147.9 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


Pass. nij (NCE) () vs TIME (ms)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.36
Tmax: 99.9 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

PASSENGER LEFT FEMUR (N) vs TIME (ms)



PASSENGER RIGHT FEMUR (N) vs TIME (ms)



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 heal	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:** D12621

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Peak Resultant Acceleration	G's	225 - 275	271	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-4.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

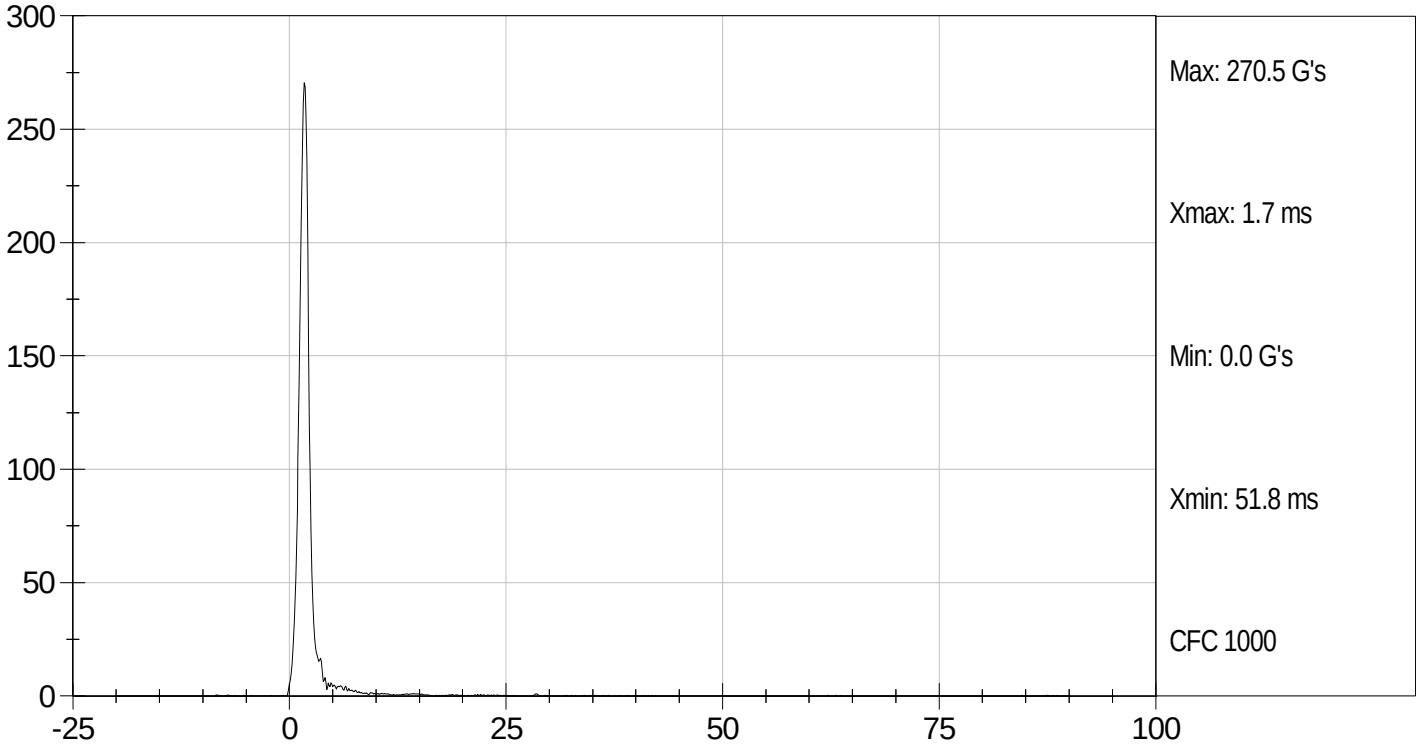
2/23/12
Test Date

David Winkelbauer
Approved By

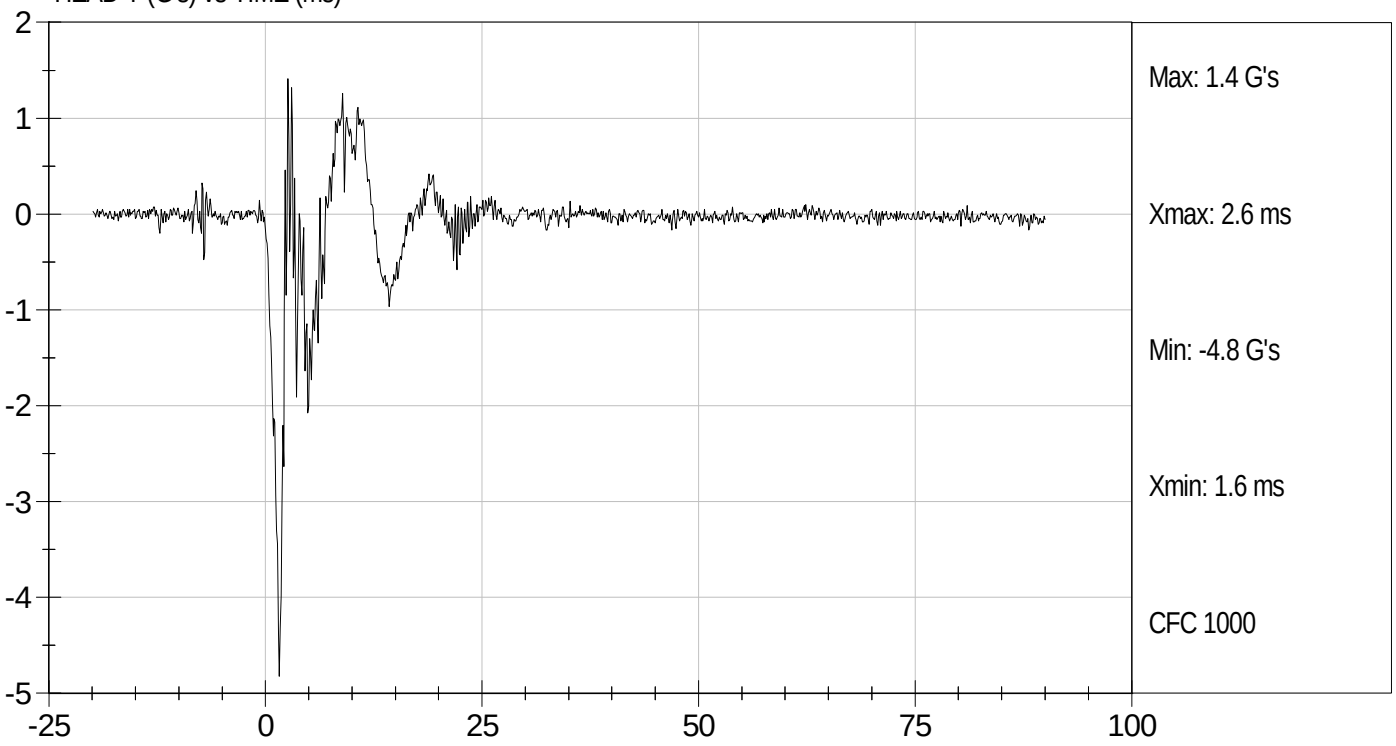
Test Desc: Head Drop
Component ID: D12621

Test Date: 2/23/12
Velocity: 0 ft/s, 0 m/s

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



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D12622

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	25	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.89	Pass
	20 ms	G's	17.60 to 22.60	18.60	Pass
	30 ms	G's	12.50 to 18.50	16.03	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	16.0	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	71.5	Pass
	Time	ms	57.0 to 64.0	57.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.4	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	93.8	Pass
	Time	ms	47.0 to 58.0	47.9	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	100.2	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

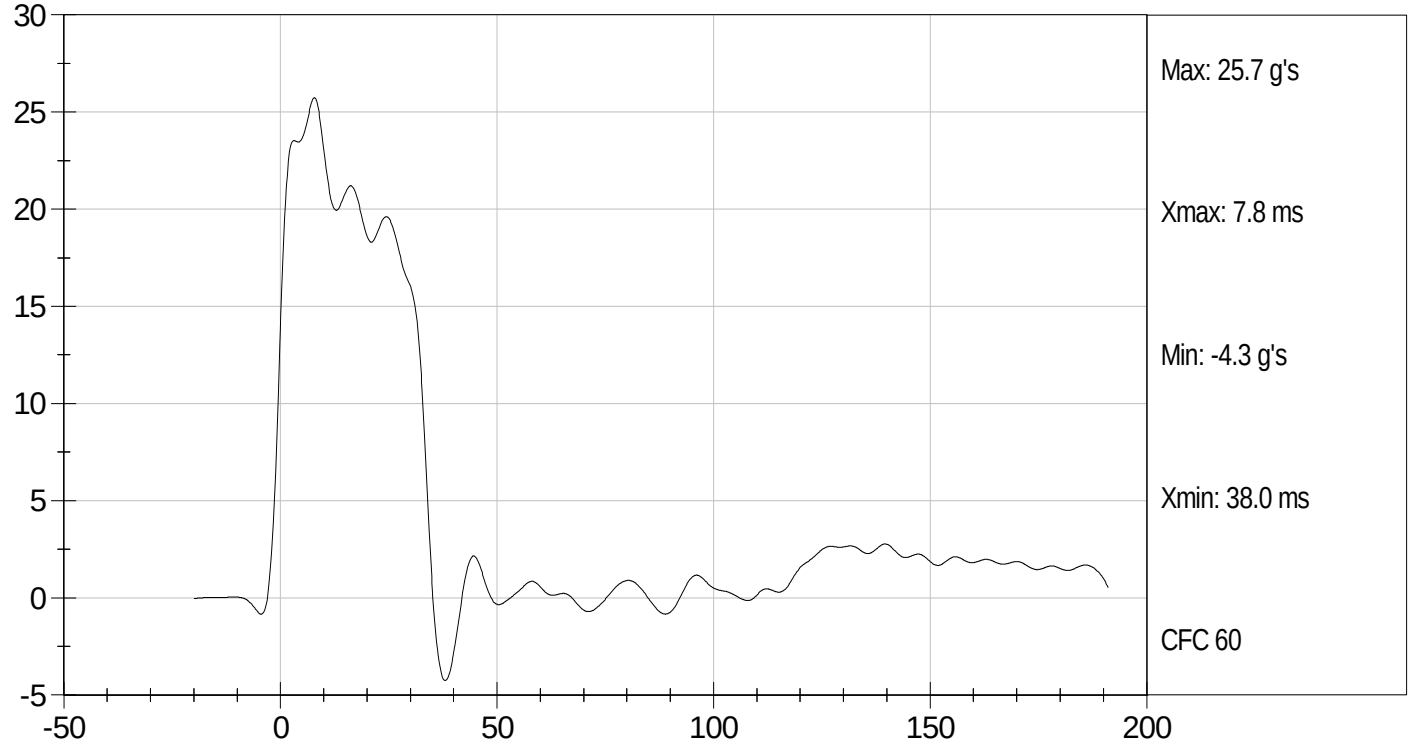
2/23/12
Test Date

David Winkelbauer
Approved By

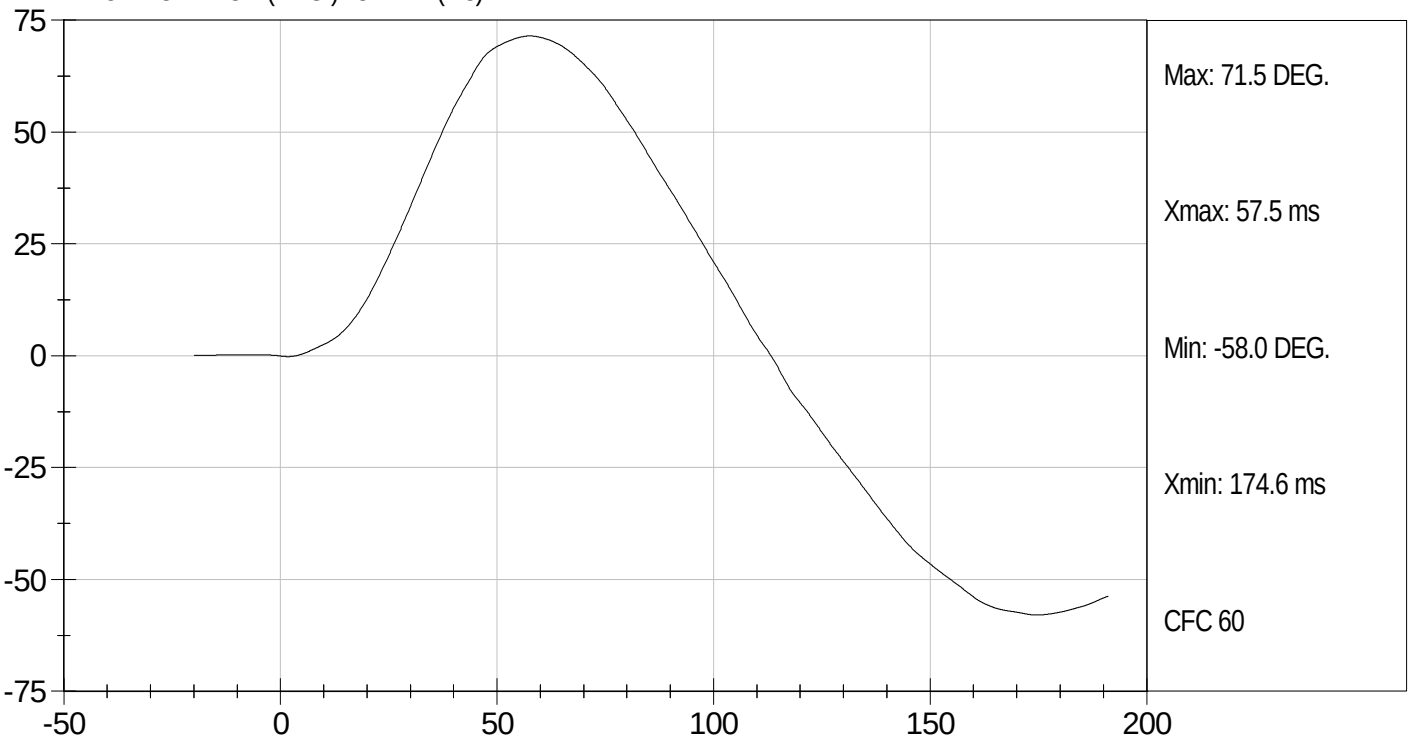
Test Desc: Neck Flexion
Component ID: D12622

Test Date: 2/23/12
Velocity: 22.83 ft/s, 6.96 m/s

PENDULUM DECELERATION (g's) vs TIME (ms)

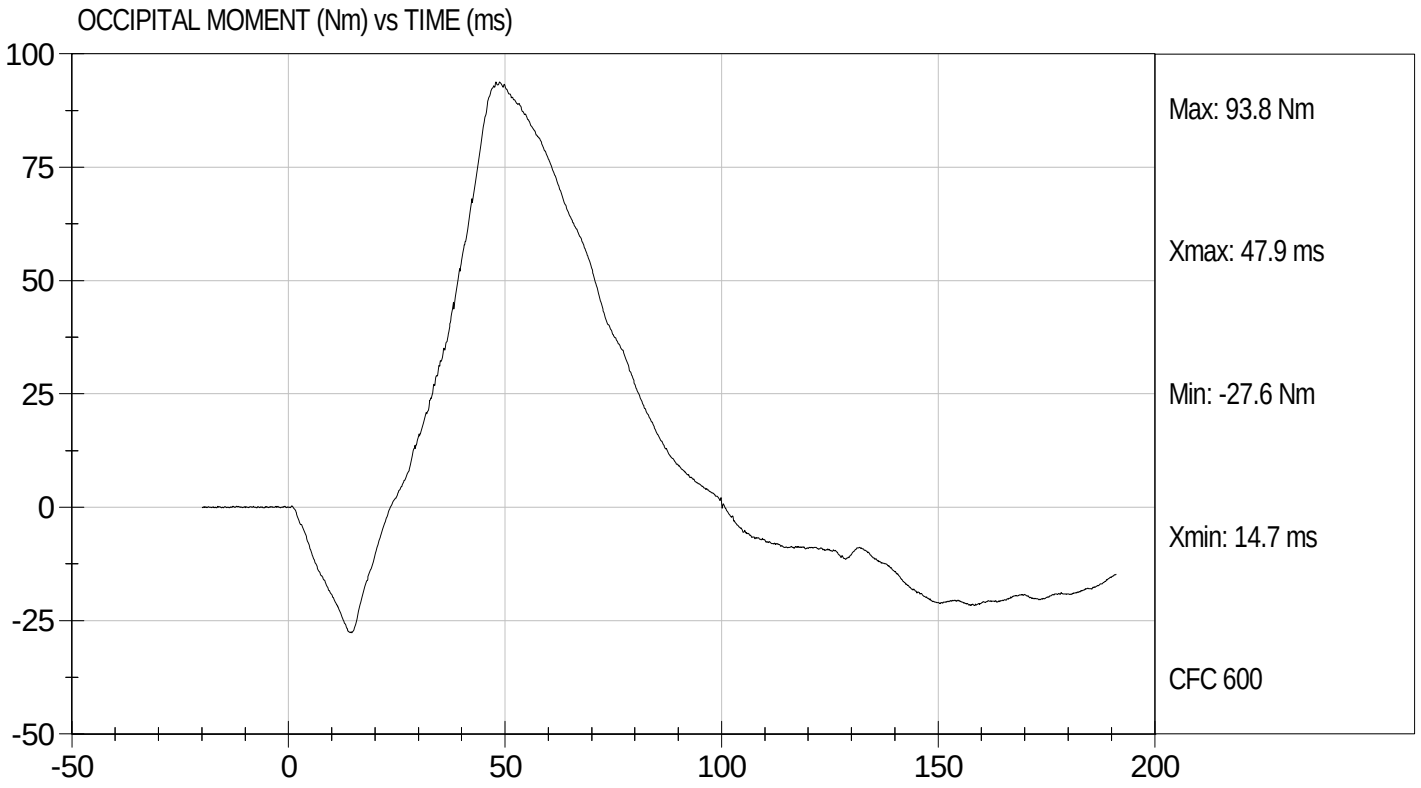


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D12622

Test Date: 2/23/12
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:** D12623

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	25	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.51	Pass
	20 ms	G's	14.00 to 19.00	16.29	Pass
	30 ms	G's	11.00 to 16.00	13.23	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.4	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	95.7	Pass
	Time	ms	72.0 to 82.0	78.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	157.5	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-58.7	Pass
	Time	ms	65.0 to 79.0	72.6	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.8	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

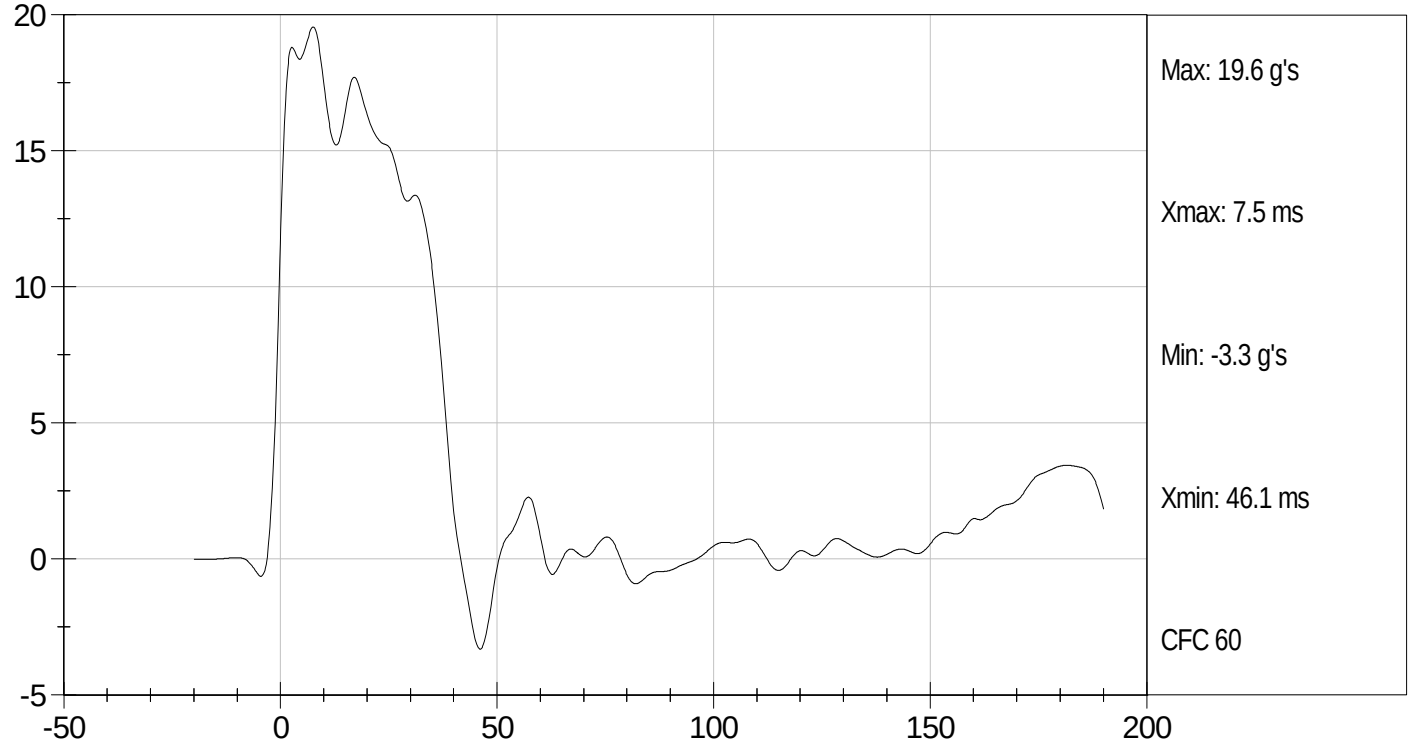
2/23/12
Test Date

David Winkelbauer
Approved By

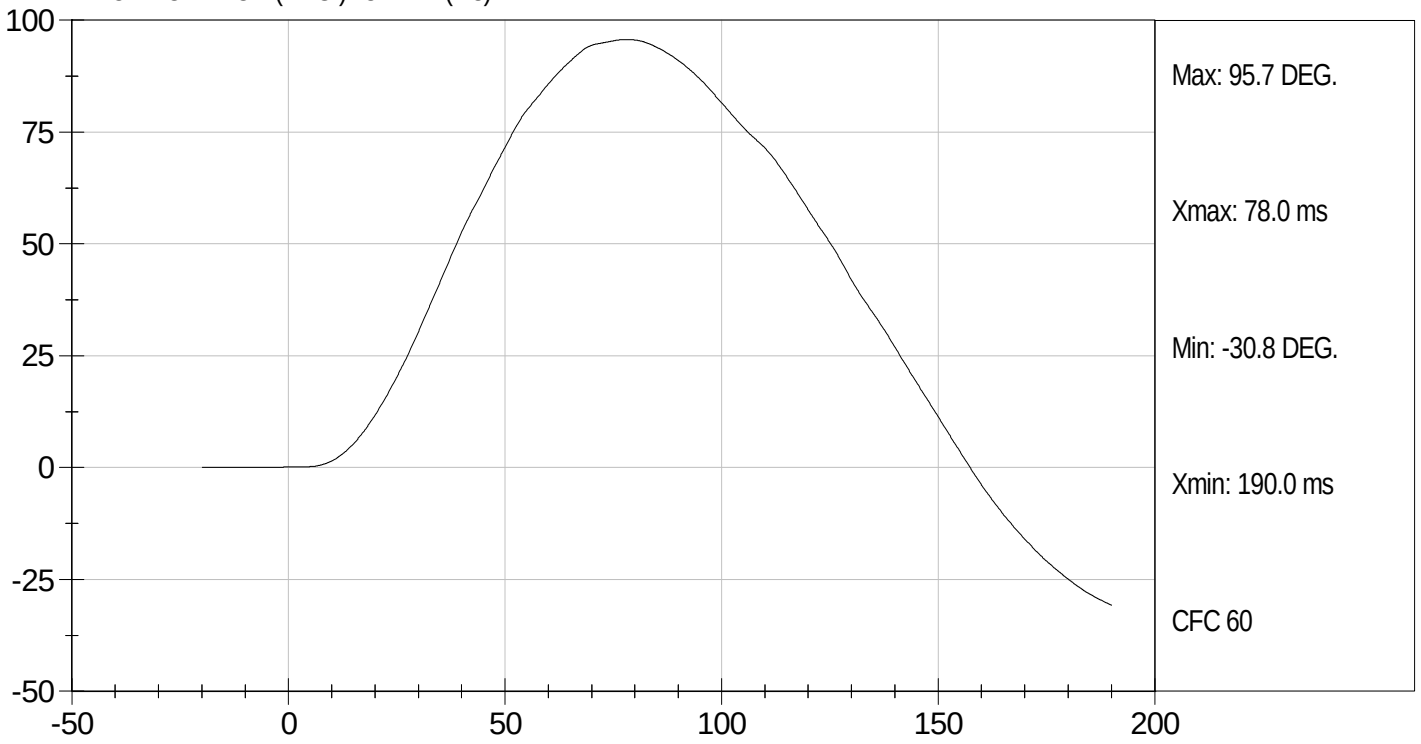
Test Desc: Neck Extension
Component ID: D12623

Test Date: 2/23/12
Velocity: 19.84 ft/s, 6.05 m/s

PENDULUM DECELERATION (g's) vs TIME (ms)

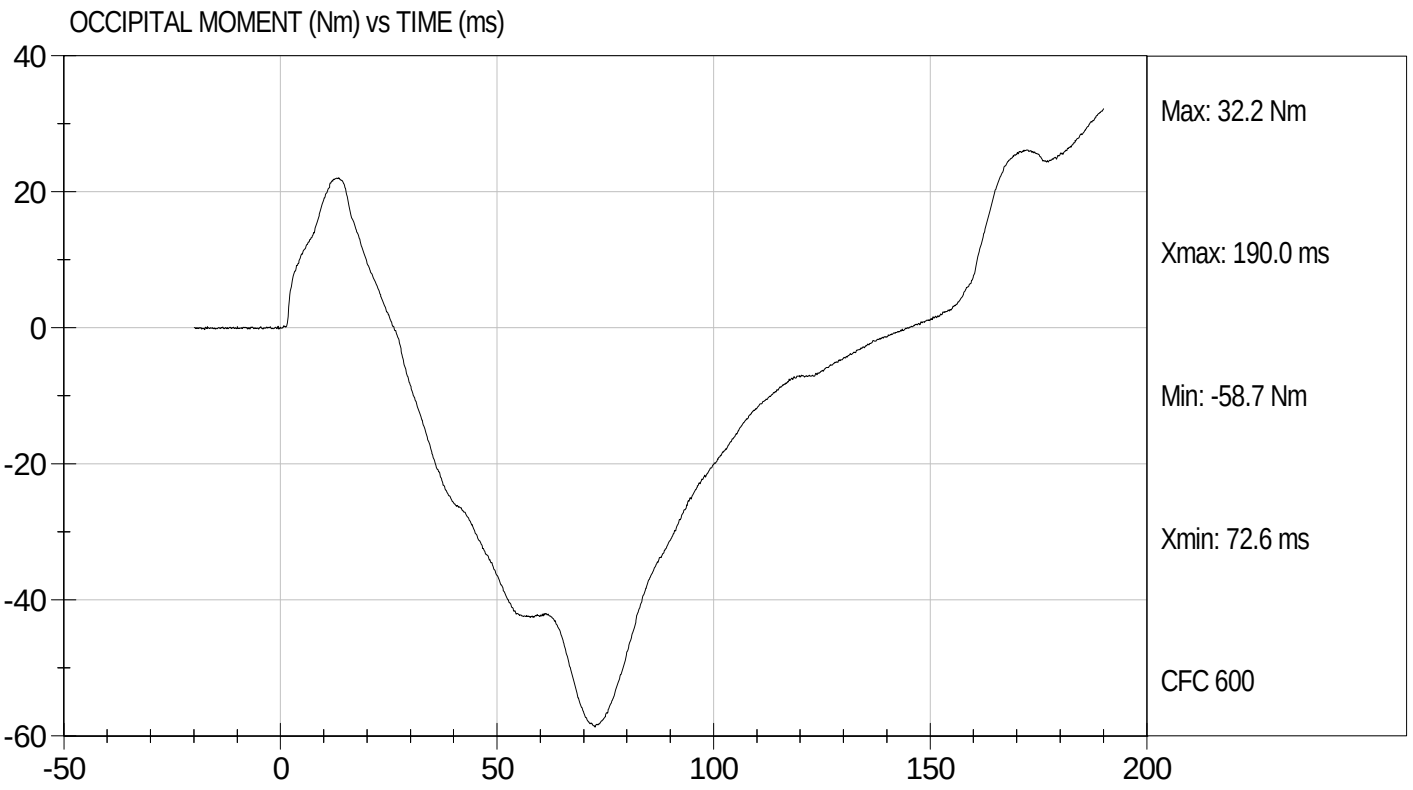


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D12623

Test Date: 2/23/12
Velocity: 19.84 ft/s, 6.05 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D12624

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	27	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,262	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.69	Pass
Internal Hysteresis	%	69 to 85	70	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

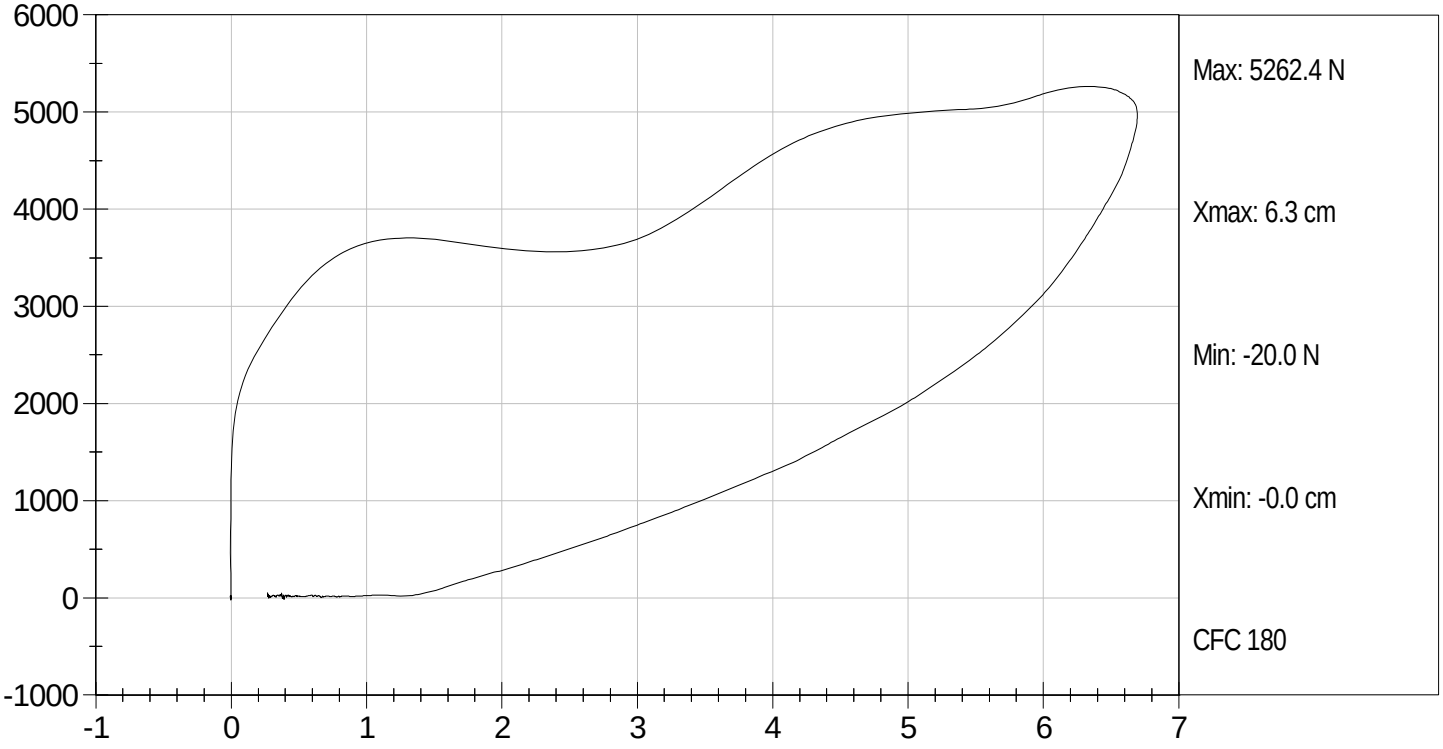
2/23/12
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D12624

Test Date: 2/23/12
Velocity: 22.22 ft/s, 6.77 m/s

FORCE (N) vs CHEST DISPLACEMENT (cm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D12625

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	25	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,458	Pass
		Overall Test Results		Pass

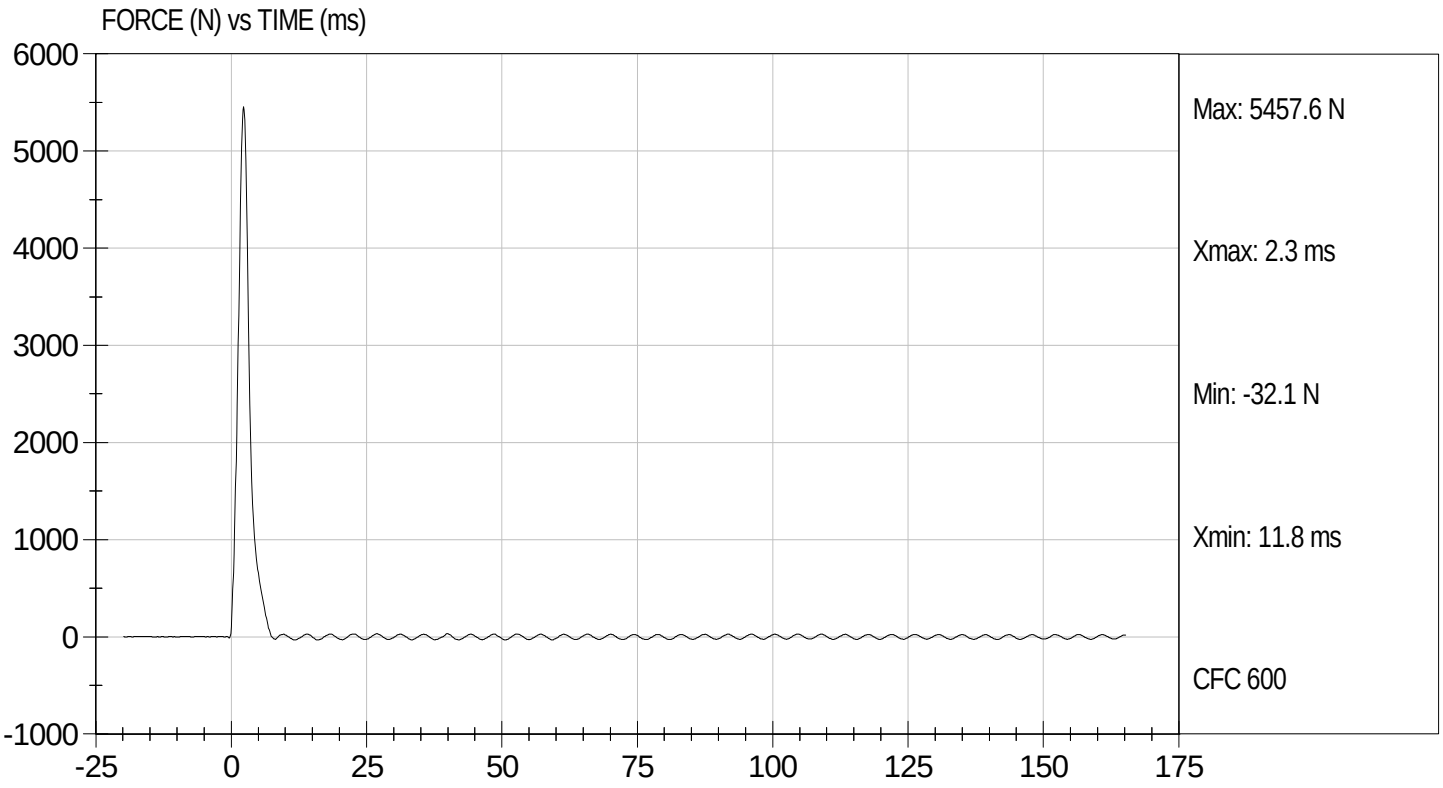
Jessica Hall
Laboratory Technician

2/23/12
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D12625

Test Date: 2/23/12
Velocity: 6.89 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D12626

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	25	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,381	Pass
		Overall Test Results		Pass

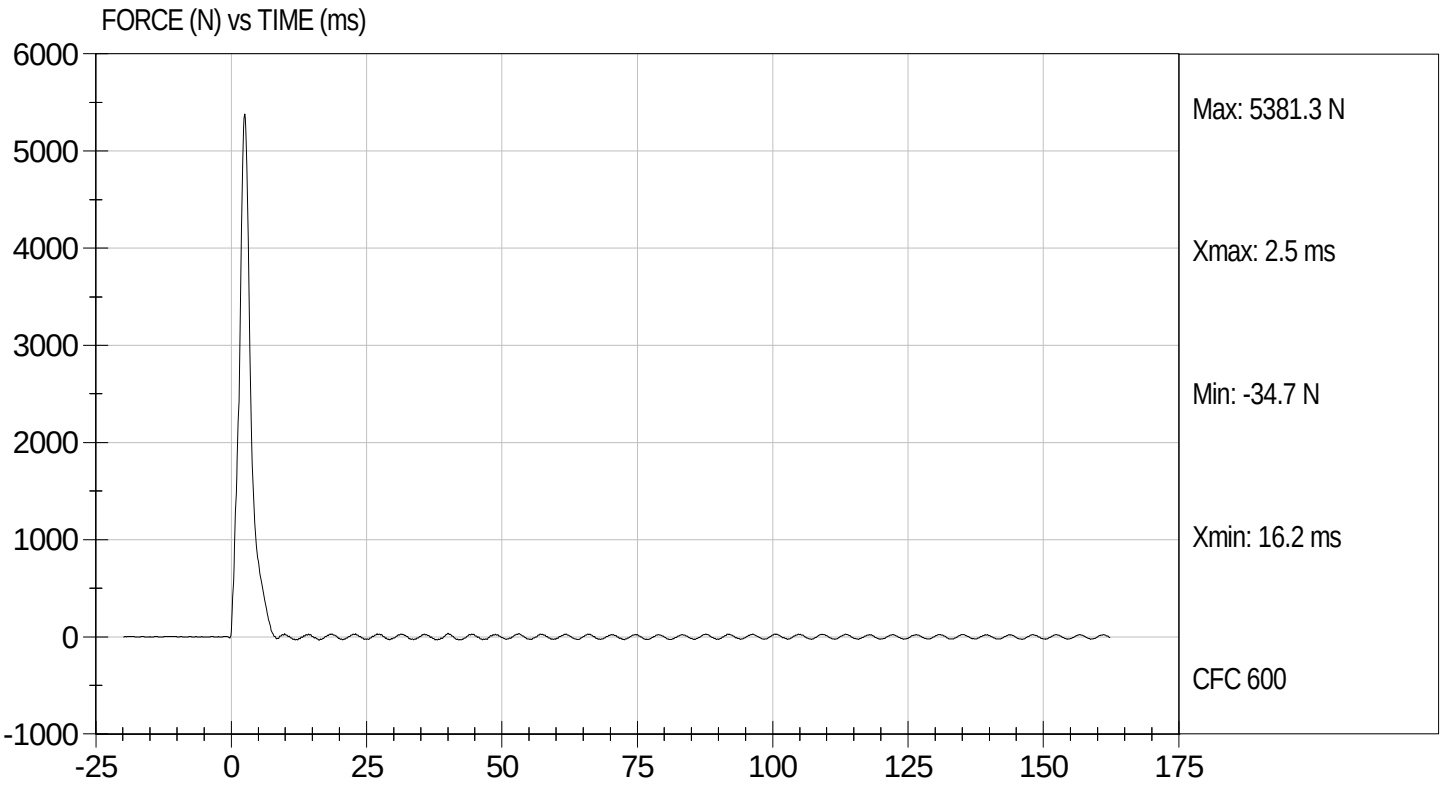
Jessica Hall
Laboratory Technician

2/23/12
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D12626

Test Date: 2/23/12
Velocity: 6.91 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D12620

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	25	25	Pass
Rotation Rate	deg/s	5.0 -10.0	6.3	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	58.1	58.9	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 - 50.0 Degree Max Rotation	49.0	47.5	Pass
		Overall Test Results			Pass

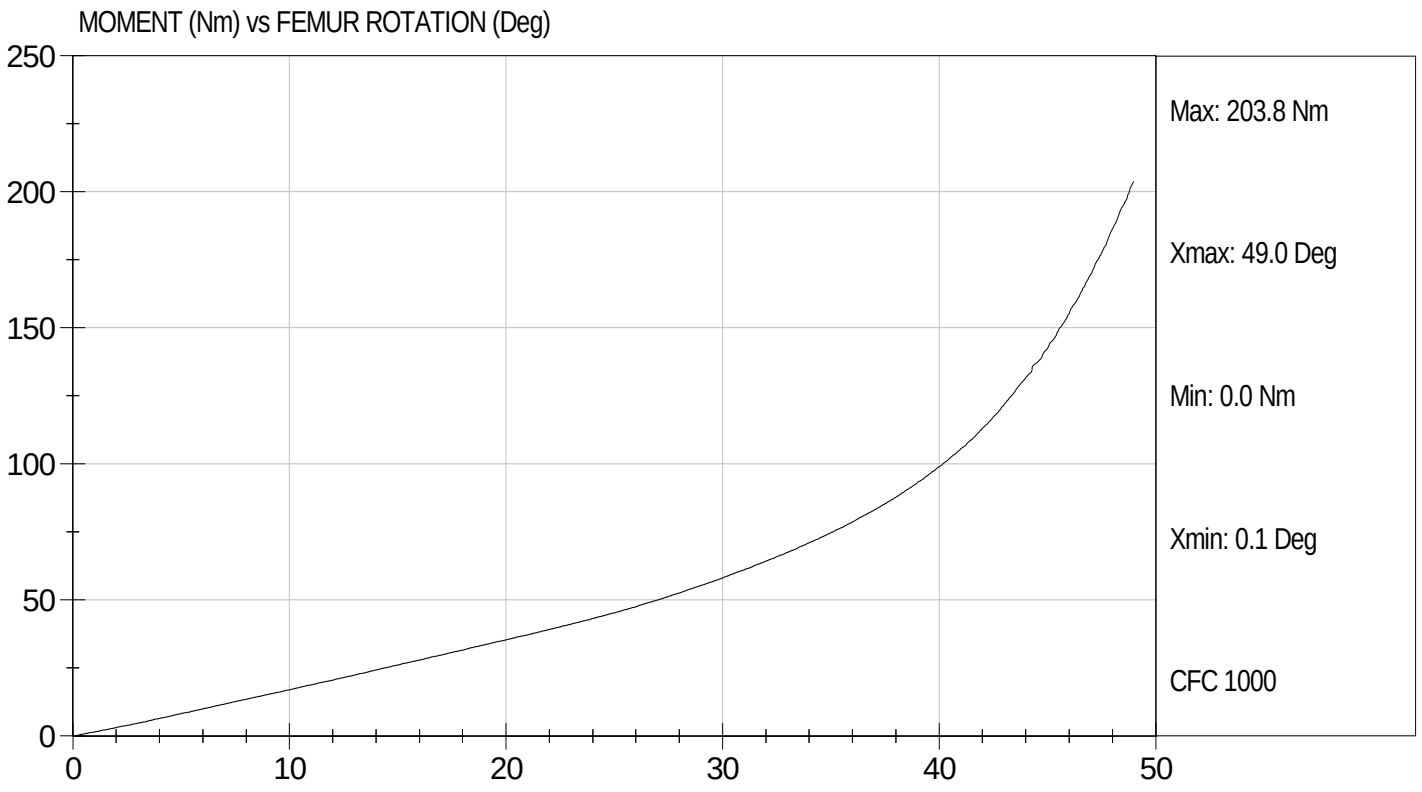
Jessica Gall
Laboratory Technician

2/23/12
Test Date

David Winkelbauer
Approved By

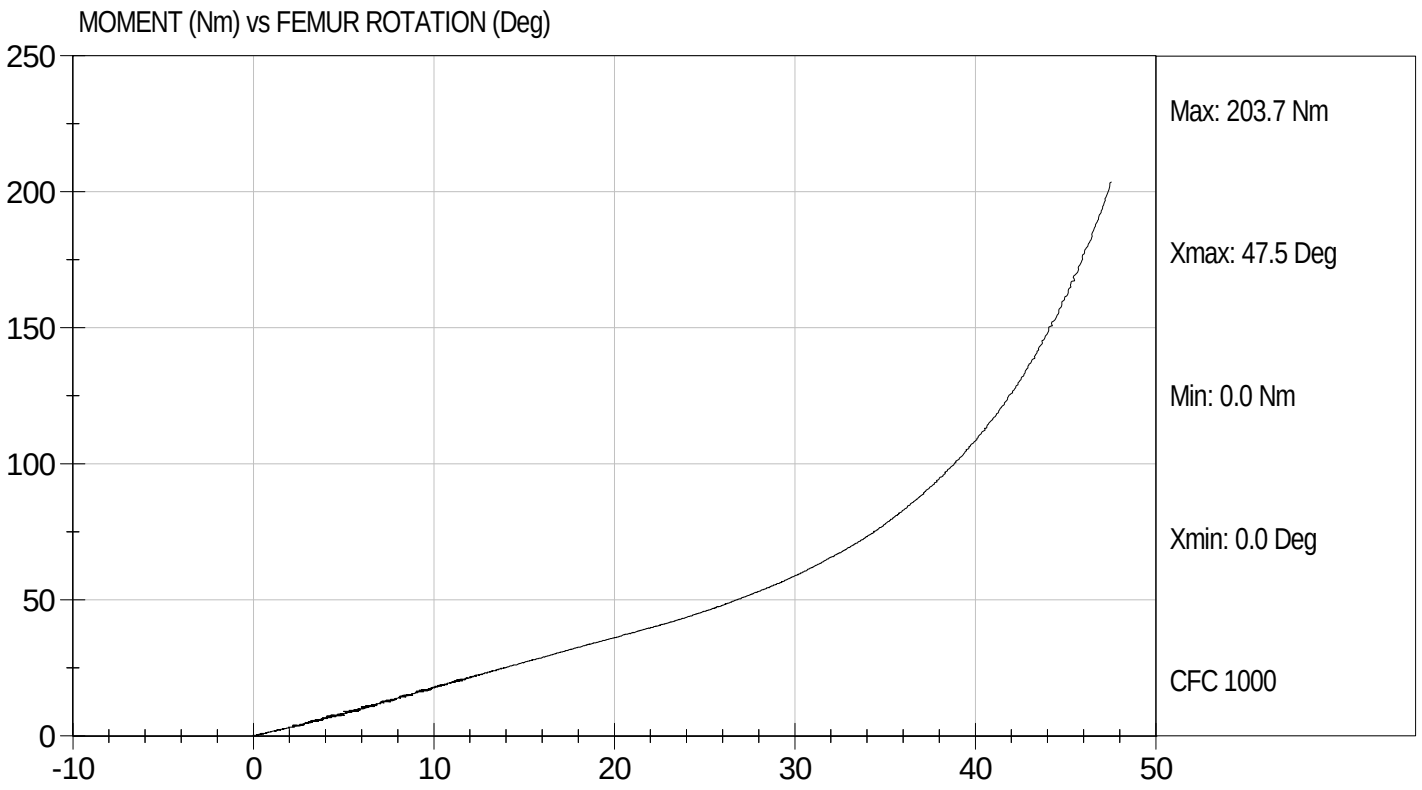
Test Desc: Hip Femur Flexion
Component ID: D12629

Test Date: 2/23/12
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D12620

Test Date: 2/23/12
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test ID:** D12691

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Peak Resultant Acceleration	G's	225 - 275	252	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-5.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

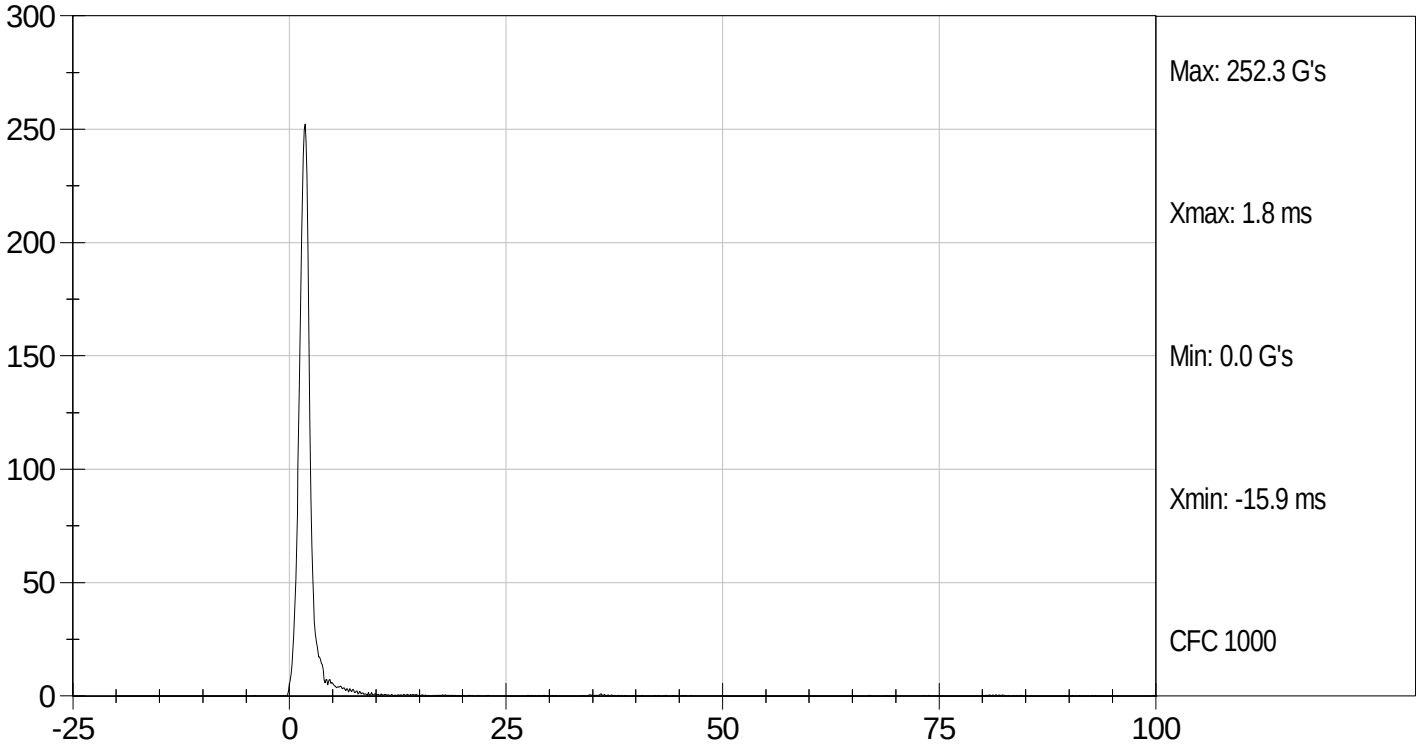
2/27/12
Test Date

David Winkelbauer
Approved By

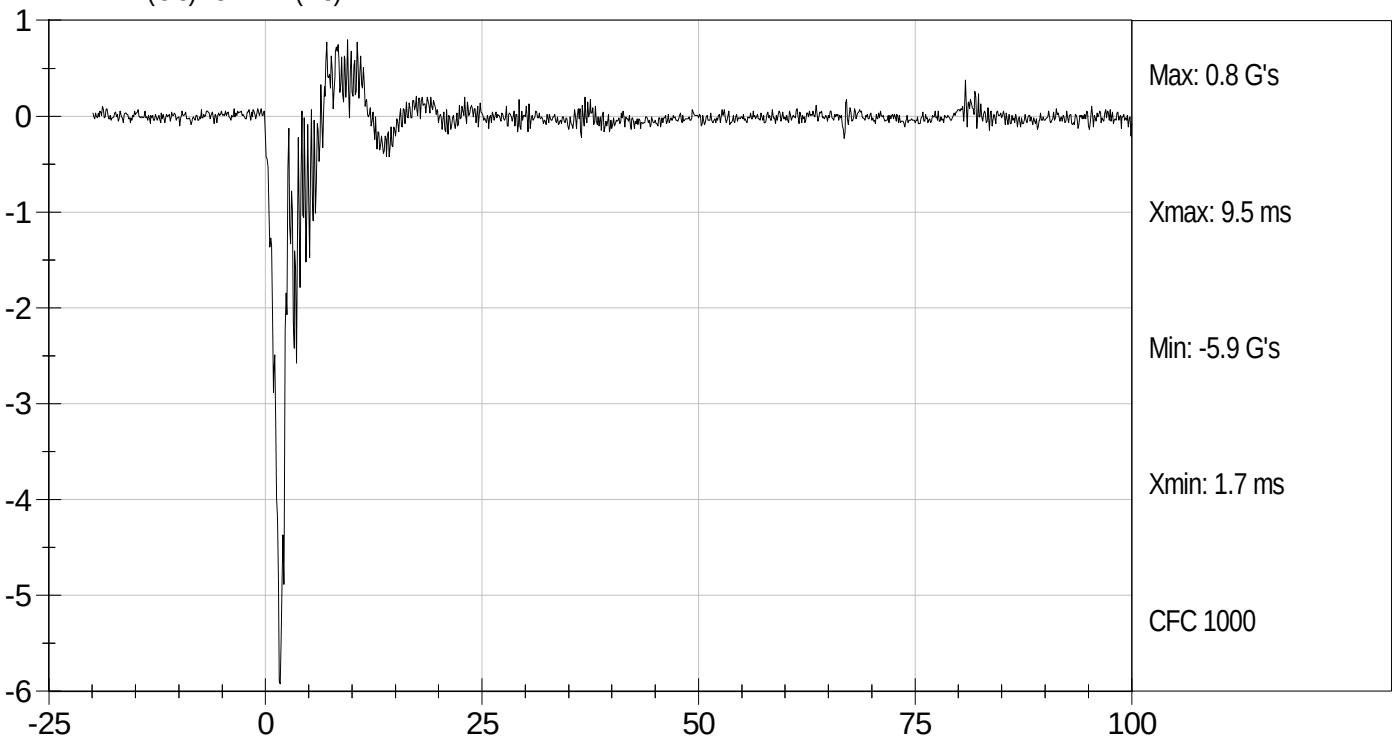
Test Desc: Head Drop
Component ID: D12691

Test Date: 2/27/12
Velocity: 0 ft/s, 0 m/s

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



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D12692

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	19	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.03	Pass
	20 ms	G's	17.60 to 22.60	18.22	Pass
	30 ms	G's	12.50 to 18.50	12.70	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	12.7	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	38.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	71.6	Pass
	Time	ms	57.0 to 64.0	59.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.5	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	95.0	Pass
	Time	ms	47.0 to 58.0	52.3	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	100.9	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

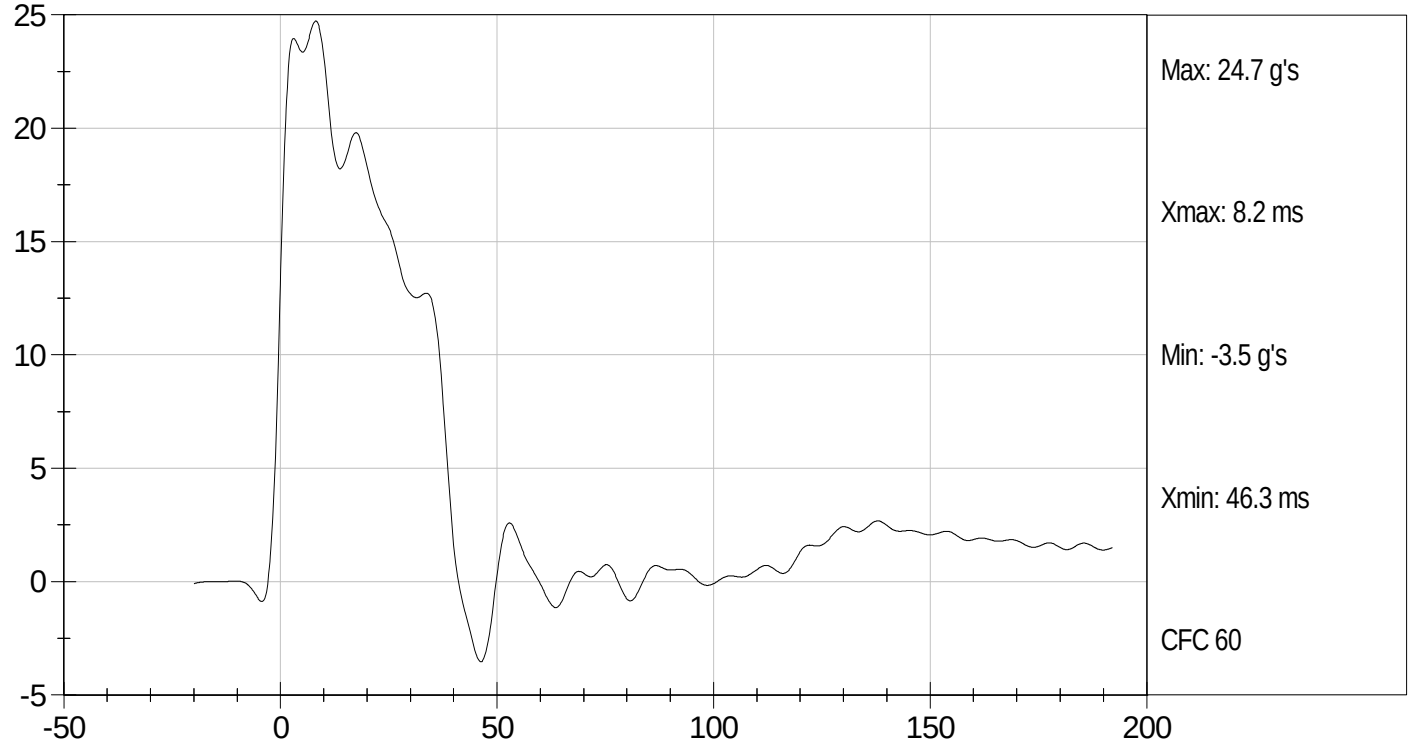
2/27/12
Test Date

David Winkelbauer
Approved By

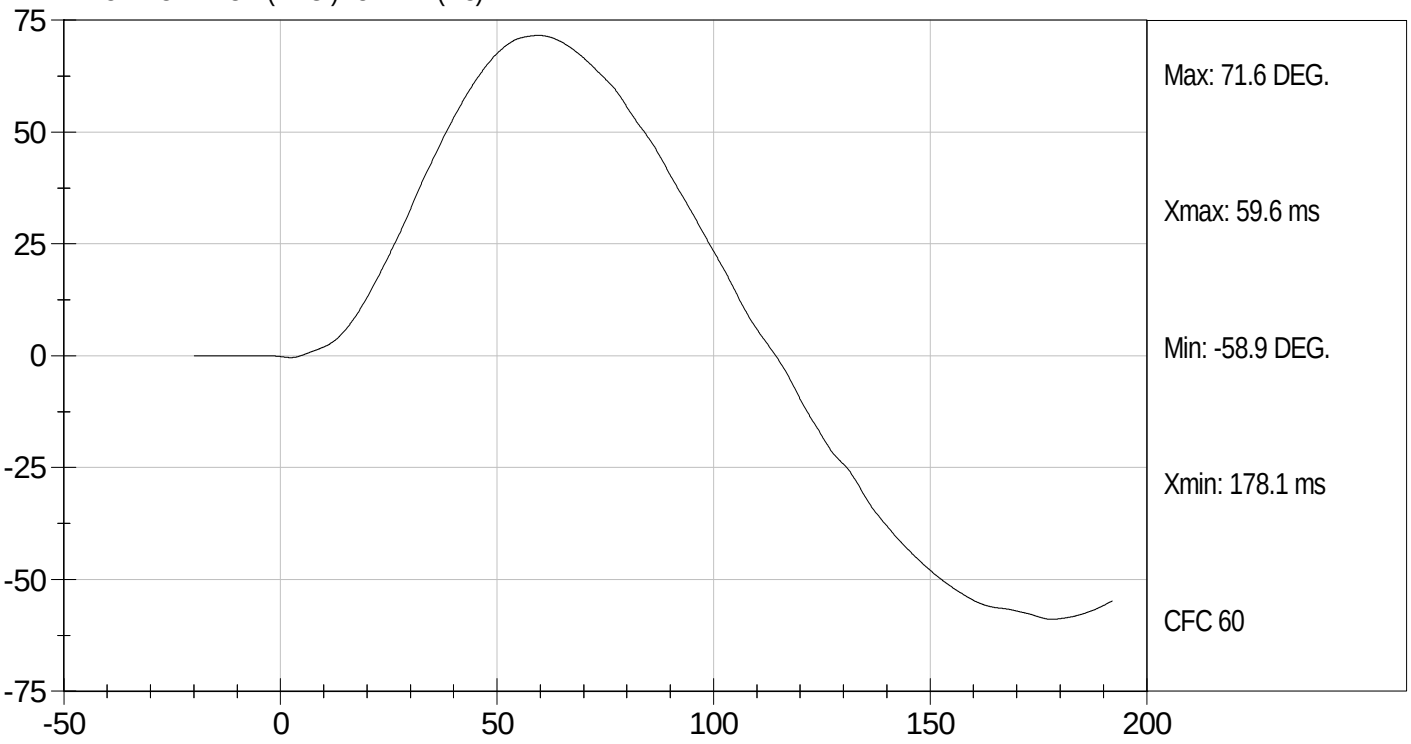
Test Desc: Neck Flexion
Component ID: D12692

Test Date: 2/27/12
Velocity: 23.15 ft/s, 7.06 m/s

PENDULUM DECELERATION (g's) vs TIME (ms)

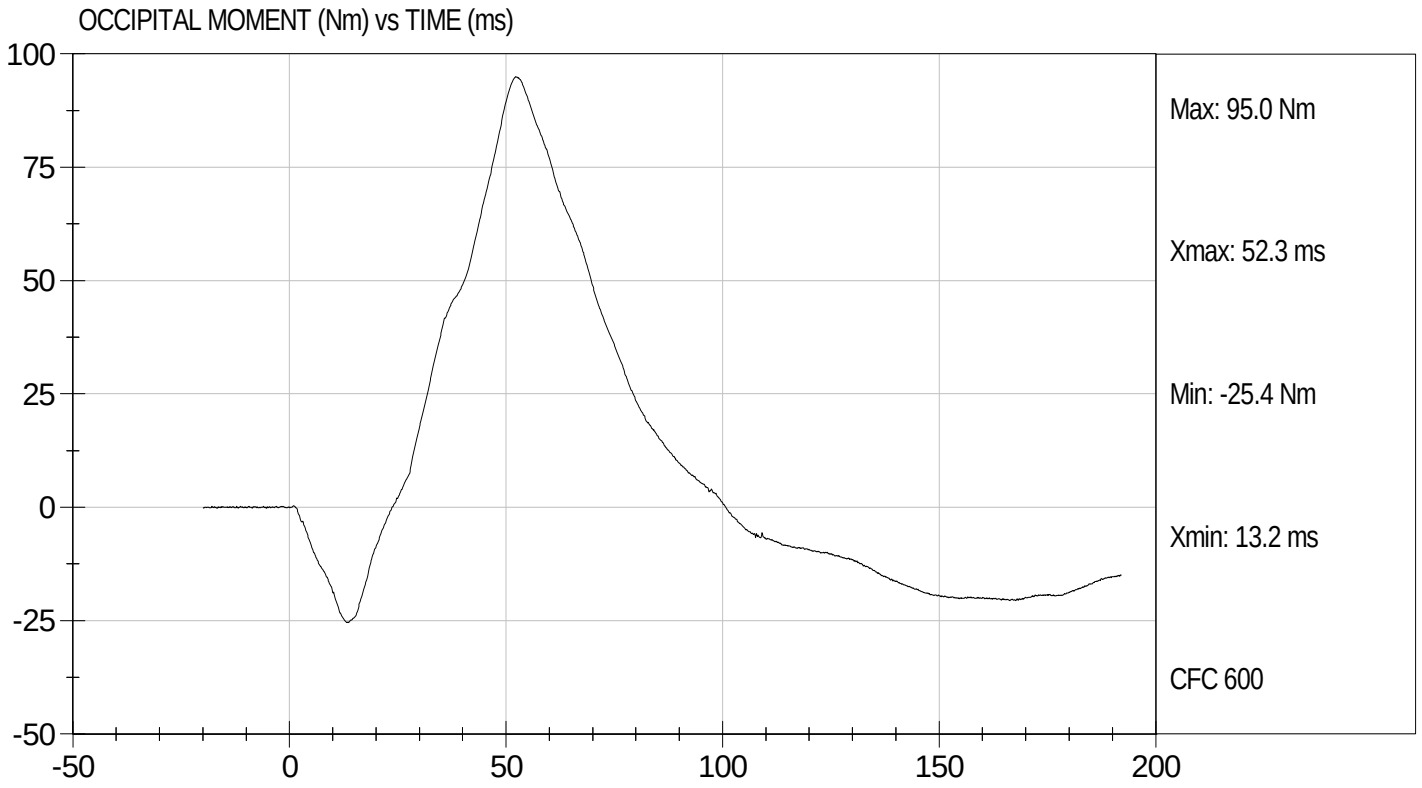


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D12692

Test Date: 2/27/12
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D12693

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	19	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.13	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.01	Pass
	20 ms	G's	14.00 to 19.00	14.63	Pass
	30 ms	G's	11.00 to 16.00	11.86	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	39.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	99.5	Pass
	Time	ms	72.0 to 82.0	78.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	156.9	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-63.6	Pass
	Time	ms	65.0 to 79.0	72.4	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.7	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

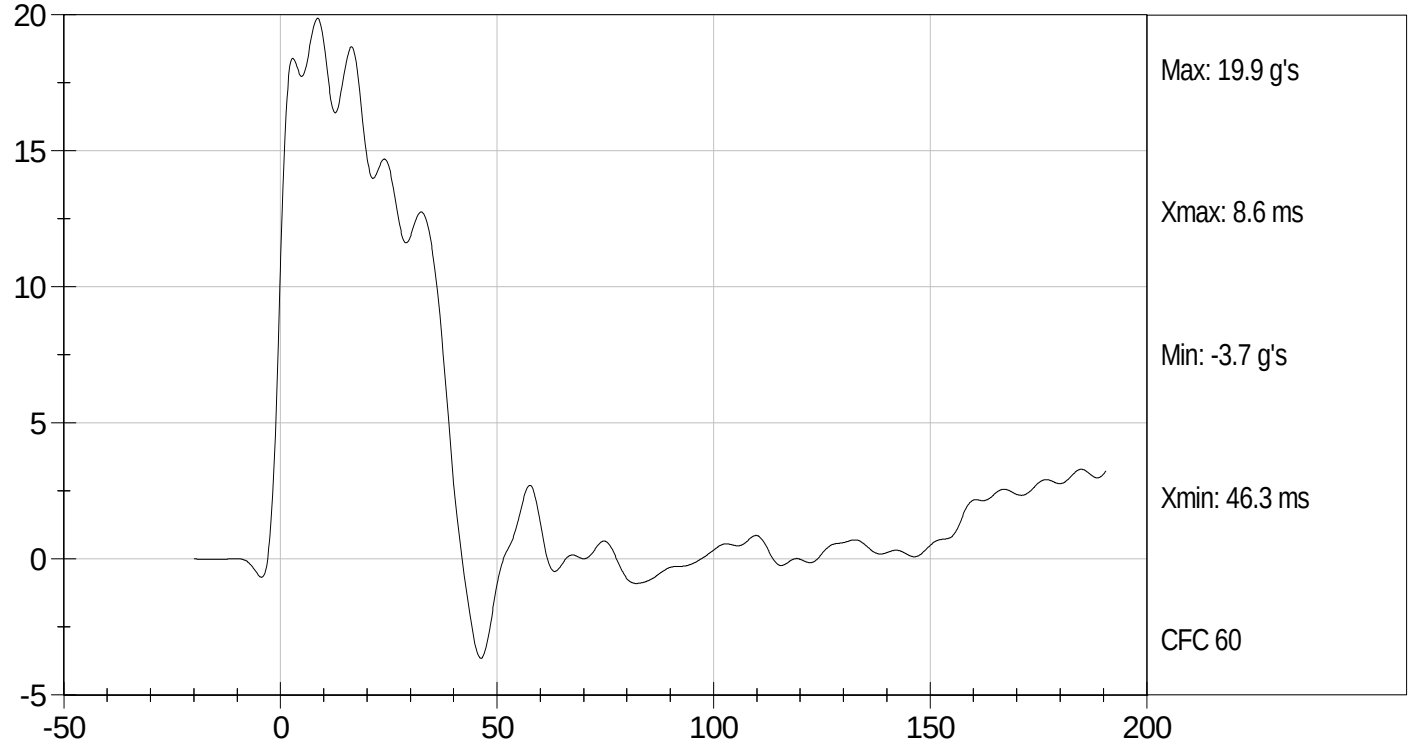
2/27/12
Test Date

David Winkelbauer
Approved By

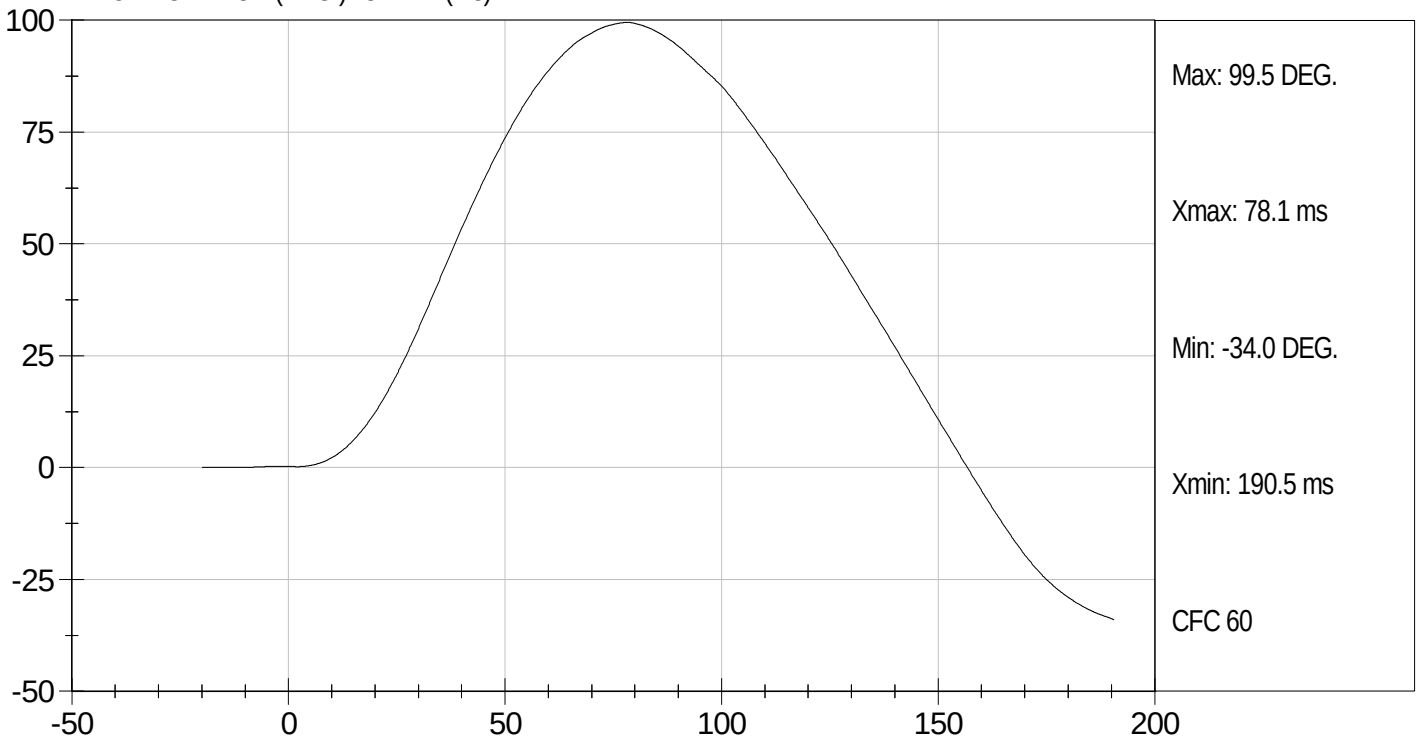
Test Desc: Neck Extension
Component ID: D12693

Test Date: 2/27/12
Velocity: 20.10 ft/s, 6.13 m/s

PENDULUM DECELERATION (g's) vs TIME (ms)

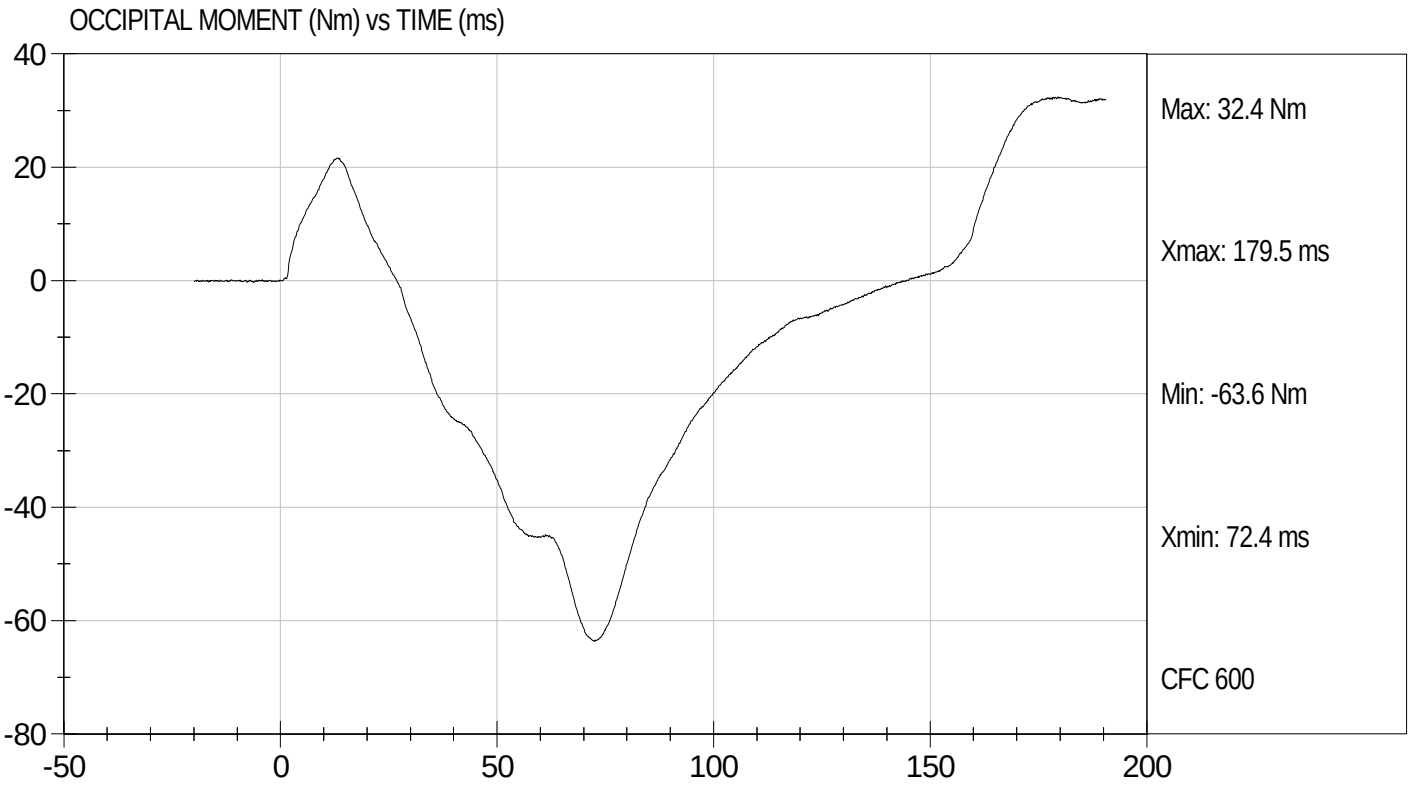


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D12693

Test Date: 2/27/12
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:** D12694

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	18	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,316	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.49	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

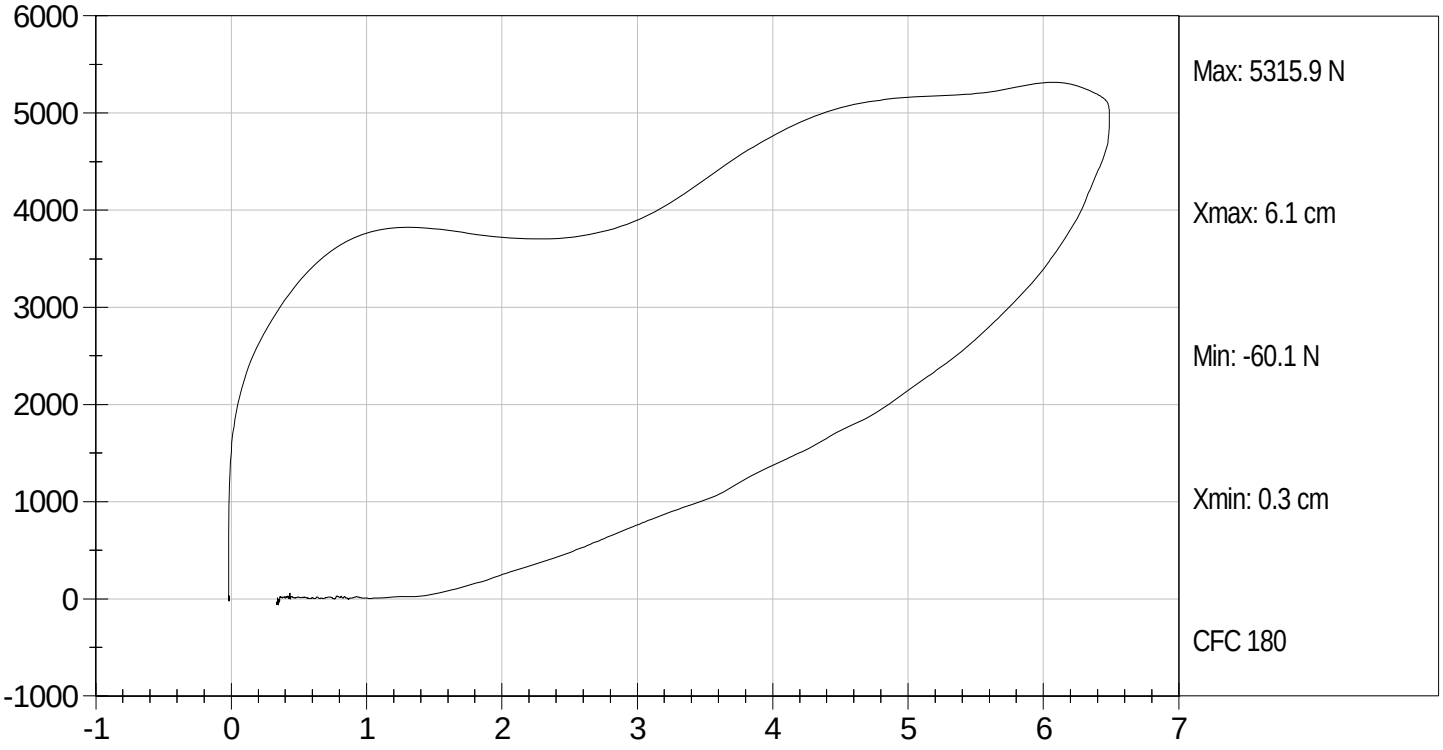
2/27/12
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D12694

Test Date: 2/27/12
Velocity: 21.9 ft/s, 6.68 m/s

FORCE (N) vs CHEST DISPLACEMENT (cm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D12695

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.7	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	5,317	Pass
		Overall Test Results		Pass

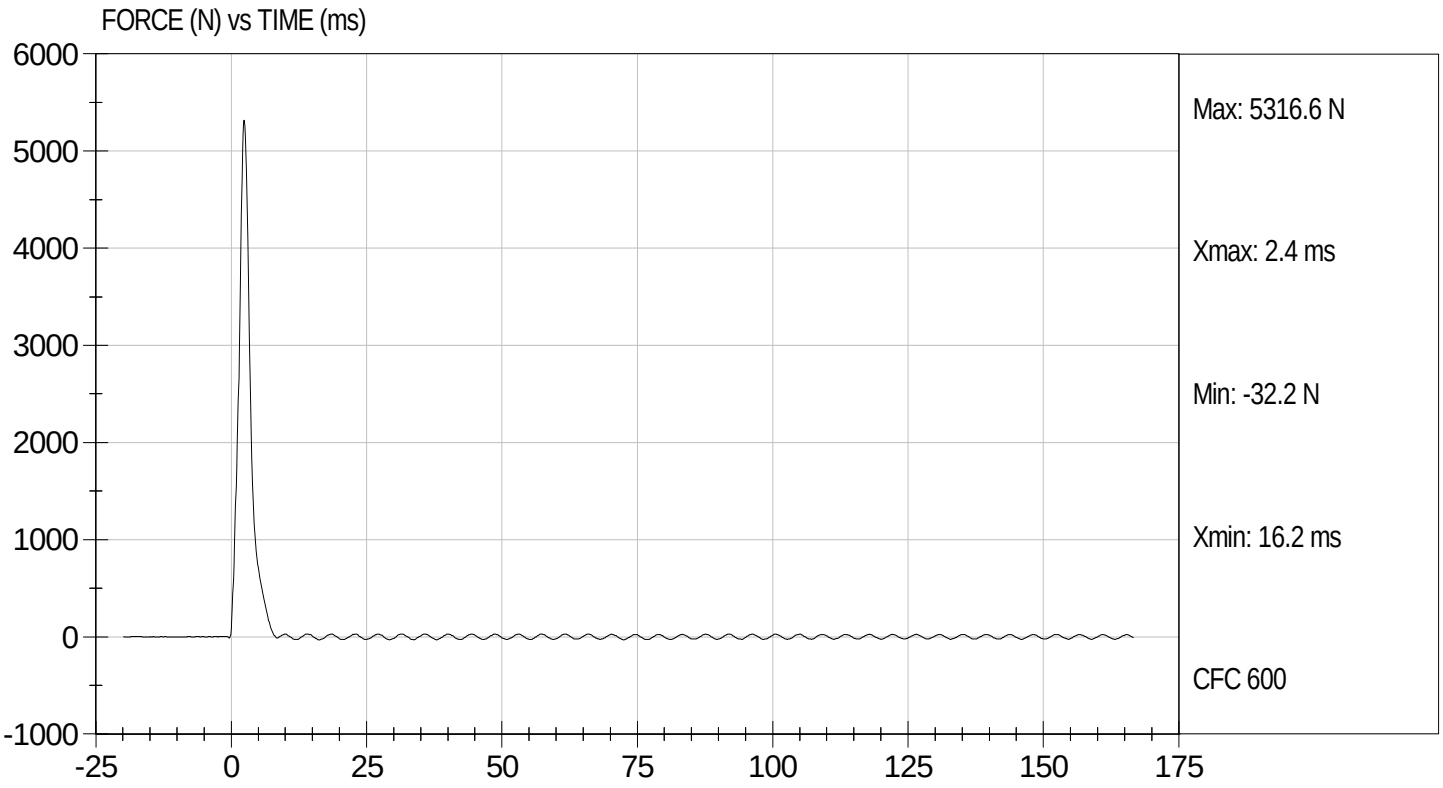
Jessica Hall
Laboratory Technician

2/27/12
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D12695

Test Date: 2/27/12
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:** D12696

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.7	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	5,000	Pass
		Overall Test Results		Pass

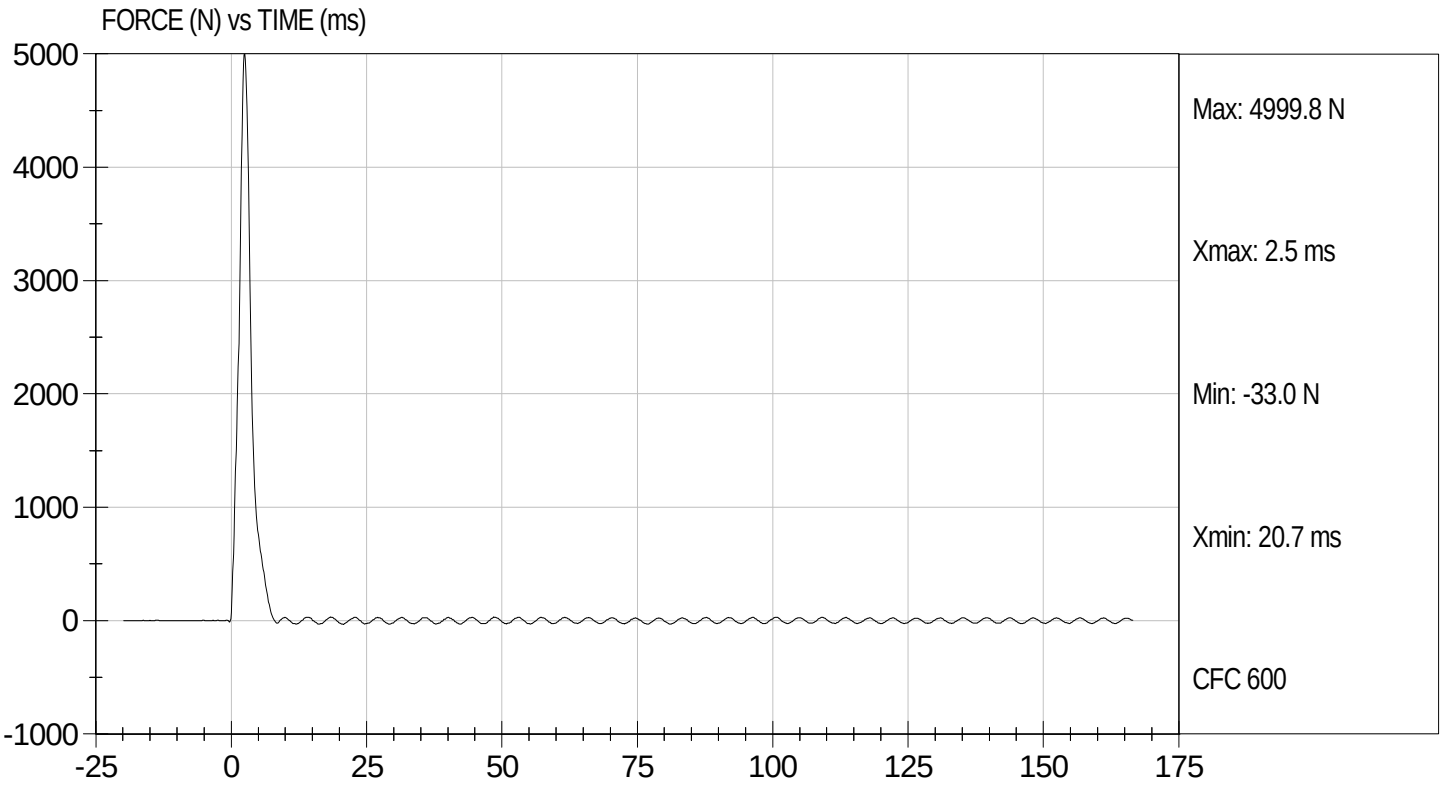
Jessica Hall
Laboratory Technician

2/27/12
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D12696

Test Date: 2/27/12
Velocity: 6.94 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:** D12690

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	22.1	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	20	20	Pass
Rotation Rate	deg/s	5.0 -10.0	6.4	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	58.0	59.2	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 - 50.0 Degree Max Rotation	49.3	47.4	Pass
		Overall Test Results			Pass

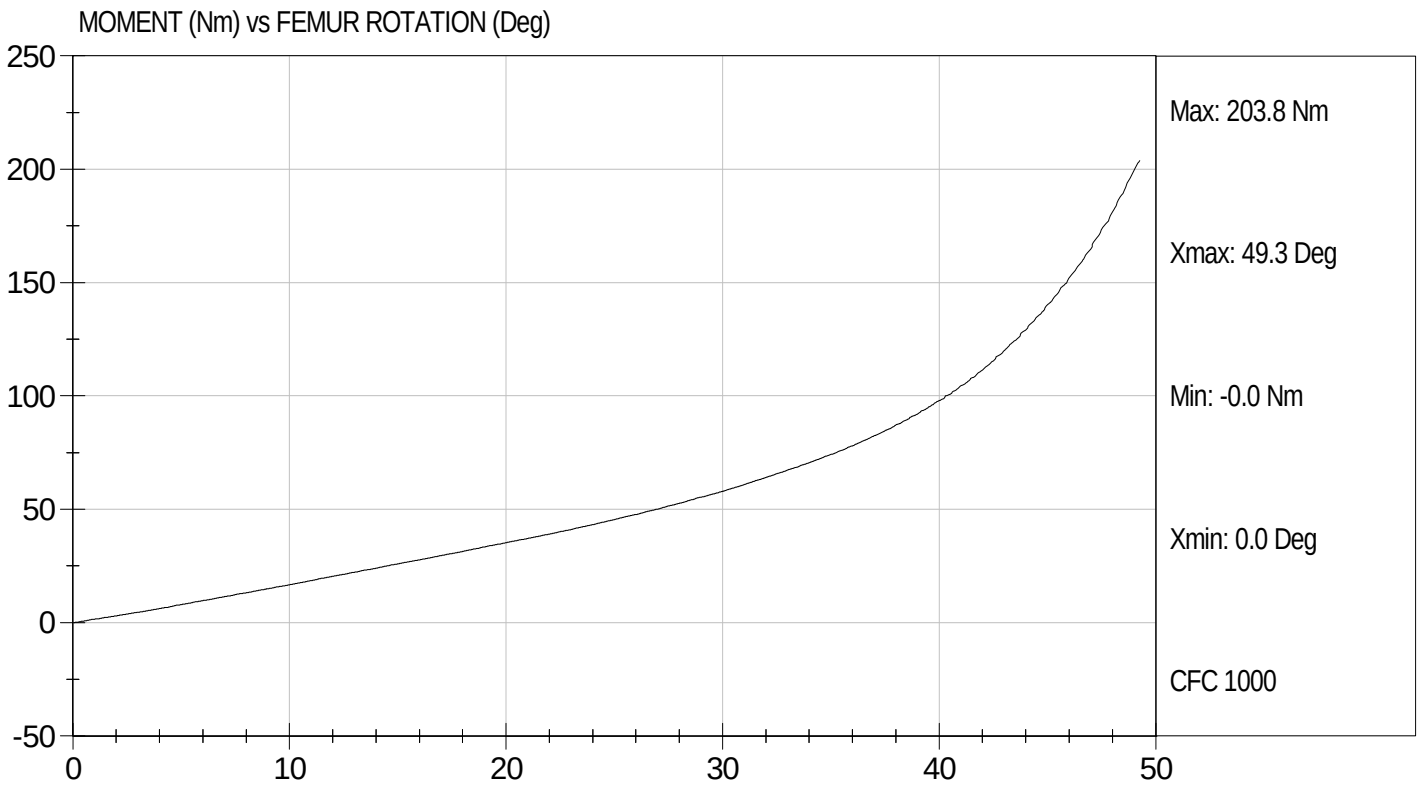
Jessica Hall
Laboratory Technician

2/27/12
Test Date

David Winkelbauer
Approved By

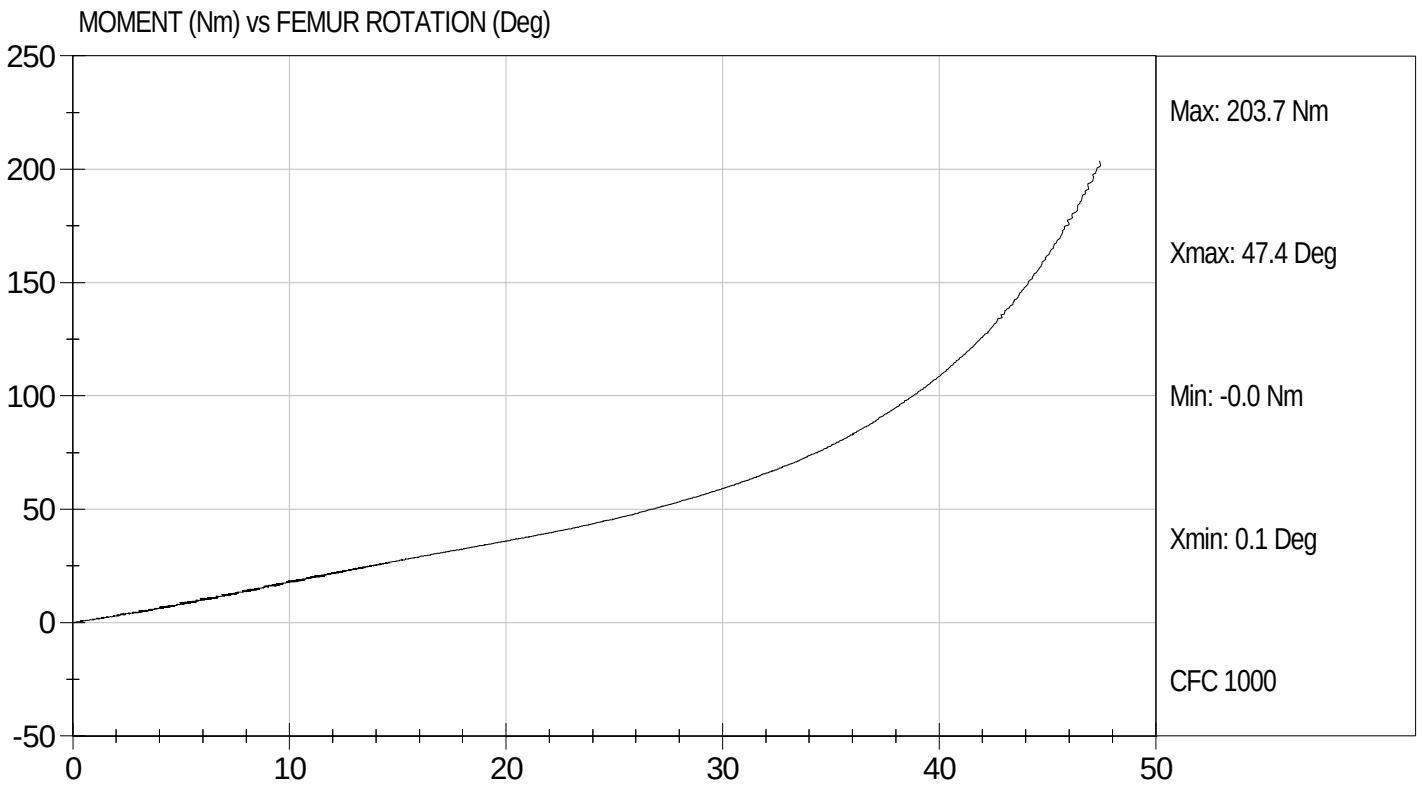
Test Desc: Hip Femur Flexion
Component ID: D12699

Test Date: 2/27/12
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D12690

Test Date: 2/27/12
Velocity: 0 ft/s, 0.00 m/s



Hybrid III, 5th External Measurements
SN: 634

HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	784.6
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	449.0
C	H-POINT HEIGHT	Reference	81.3-86.3	85.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	145.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	79.2
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	125.6
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	253.4
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	277.8
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	197.5
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	541.4
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.1
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	400.4
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. “K”.	414-439.4	428.6

HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	181.6
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	224.7
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	482.0
S	HEAD BREADTH	The widest part of the head	137.1-147.3	139.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	179.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	306.1
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	355.5
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	90.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. “T”	528.3-548.7	540.6
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	868.7
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	786.8
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.4
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.1

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test ID:** D12631

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Peak Resultant Acceleration	G's	250 to 300	268	Pass
Peak Lateral Acceleration	G's	+/- 15	5.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

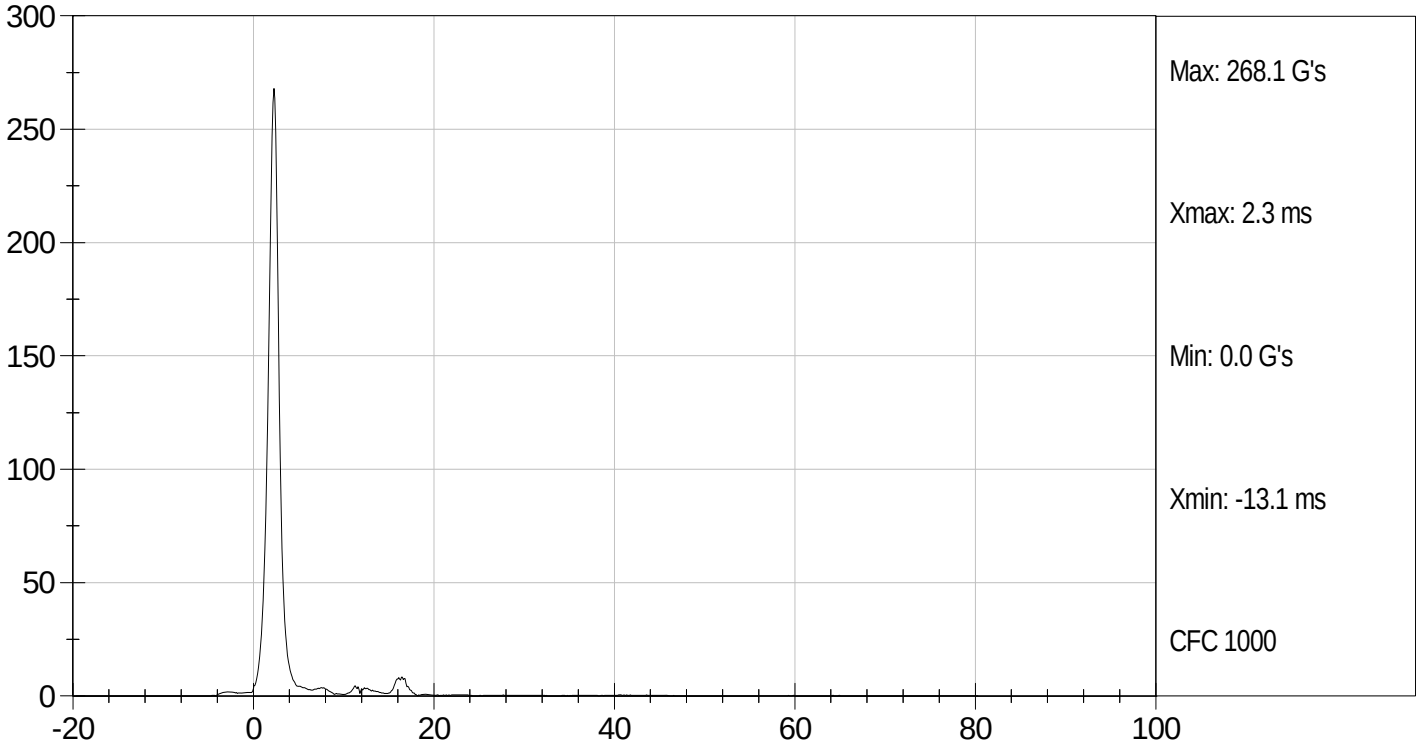
2/23/12
Test Date

David Winkelbauer
Approved By

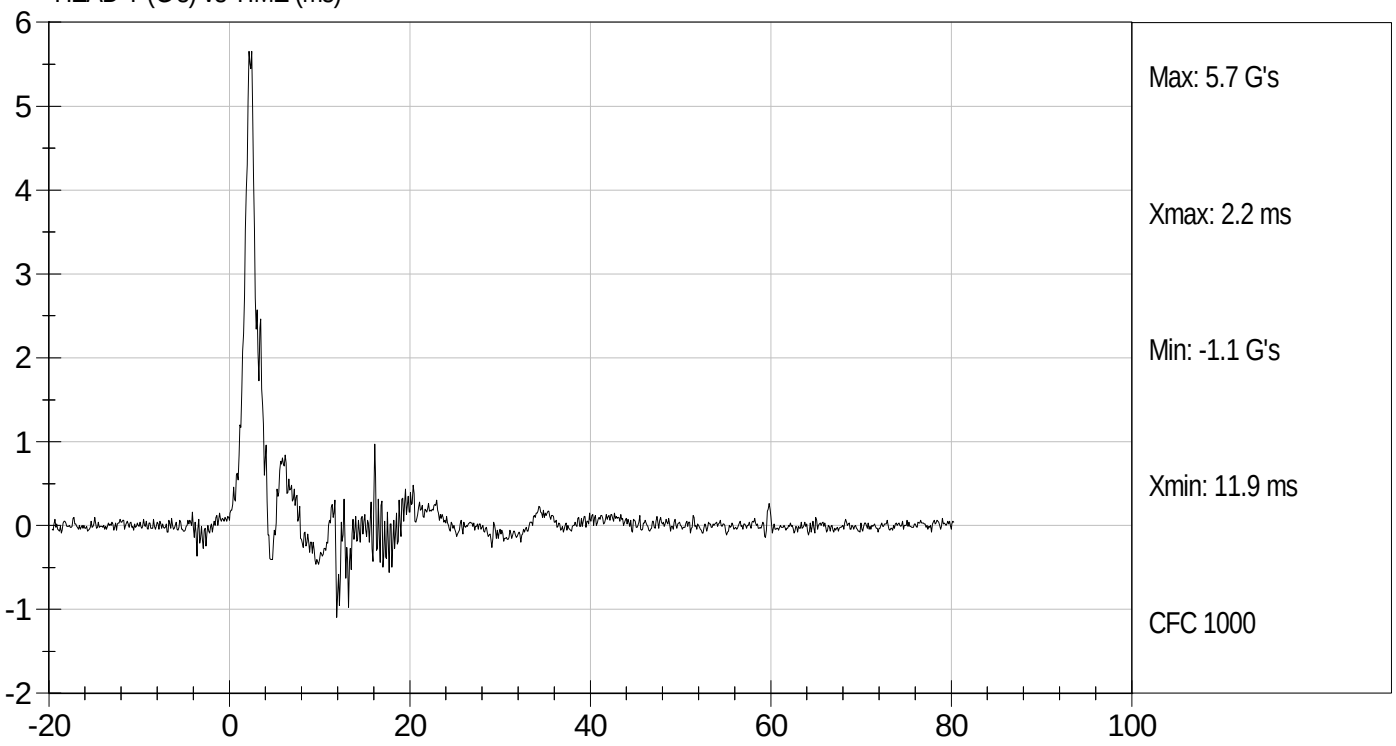
Test Desc: Head Drop
Component ID: D12631

Test Date: 2/23/12
Velocity: 0 ft/s, 0 m/s

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



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12632

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	25	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Pulse	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.9	Pass
	30 ms	m/s	5.8 to 7.0	6.4	Pass
D Plane Rotation	Max	deg	77 to 91	88	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	70	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

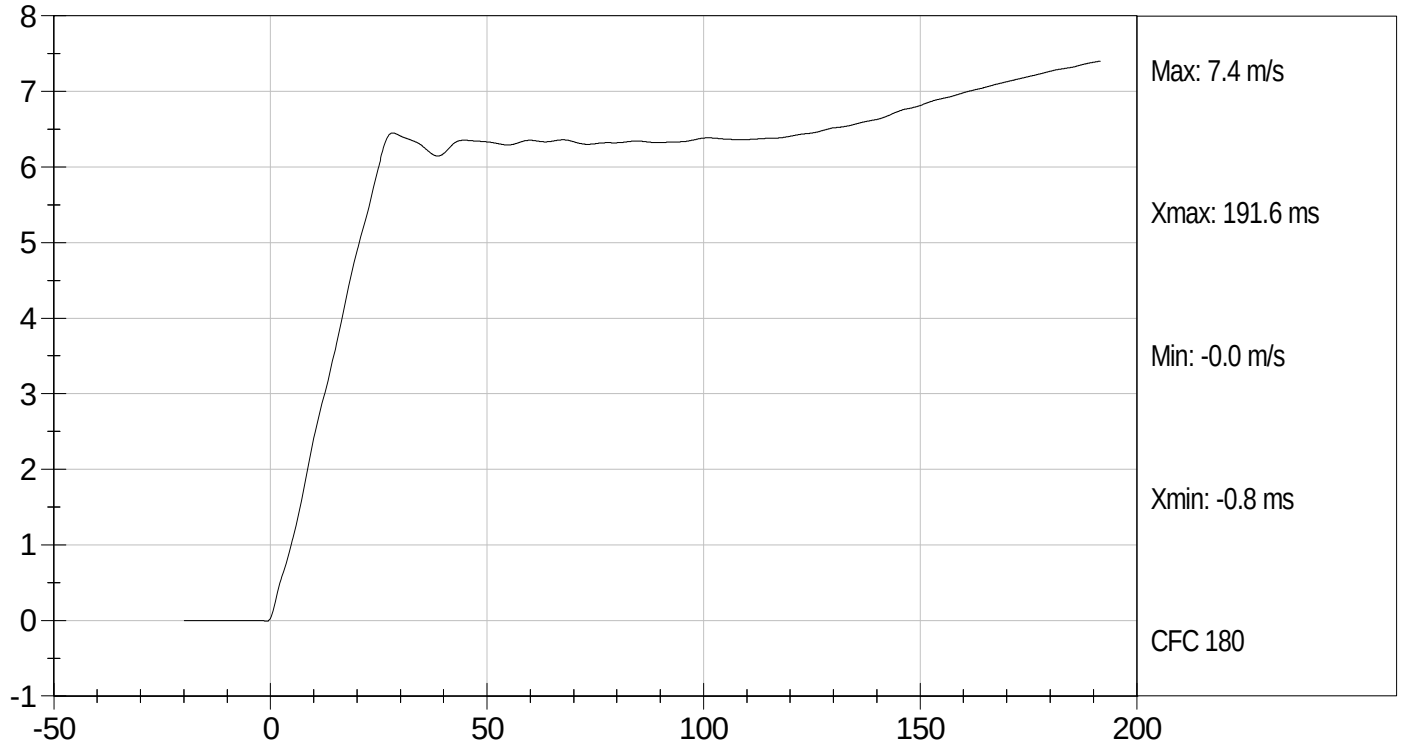
2/23/12
Test Date

David Winkelbauer
Approved By

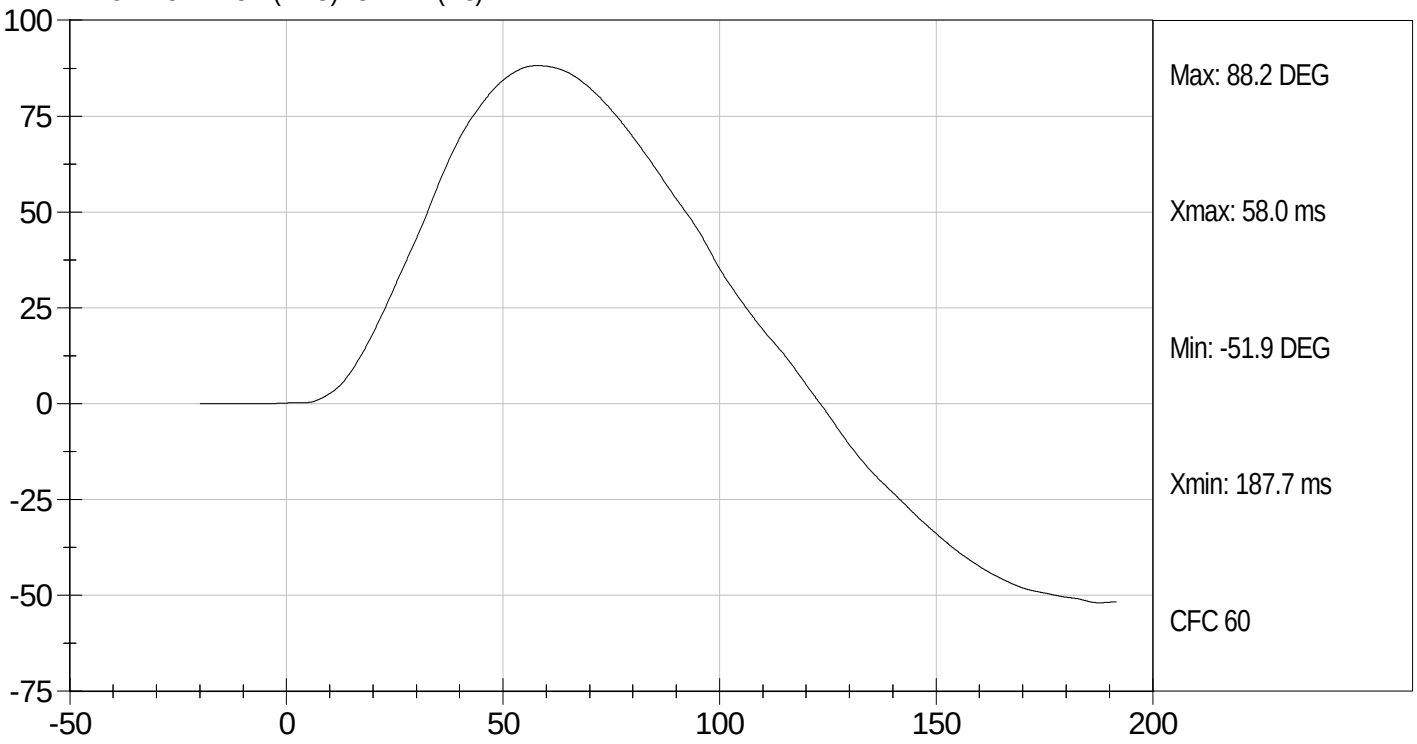
Test Desc: Neck Flexion
Component ID: D12632

Test Date: 2/23/12
Velocity: 23.148 ft/s, 7.06 m/s

PENDULUM VELOCITY (m/s) vs TIME (ms)

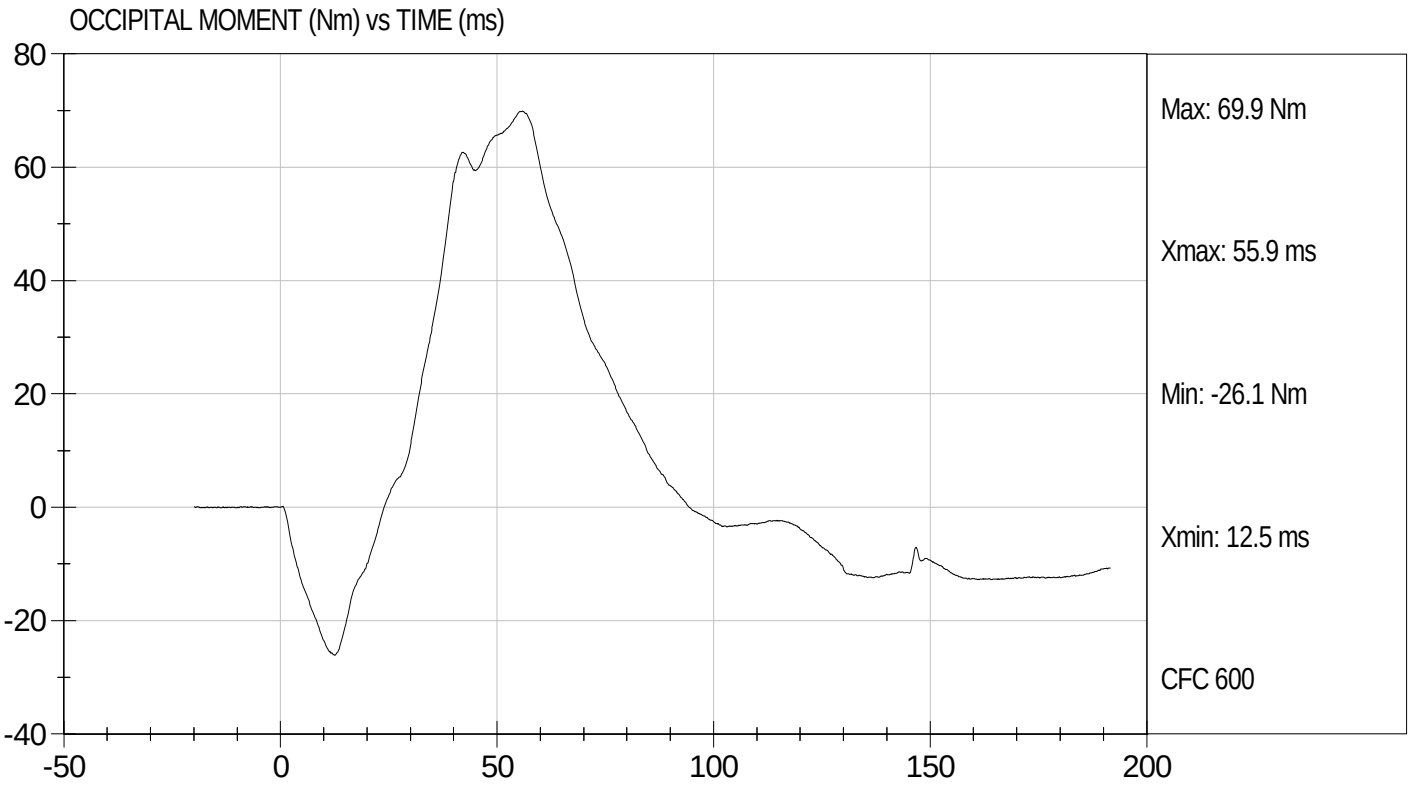


NECK ROTATION (DEG) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D12632

Test Date: 2/23/12
Velocity: 23.148 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12633

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	25	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Pulse	10 ms	m/s	1.5 to 1.9	1.9	Pass
	20 ms	m/s	3.1 to 3.9	3.8	Pass
	30 ms	m/s	4.6 to 5.6	5.5	Pass
D Plane Rotation	Max	deg	99 to 114	108	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-61	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	95	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

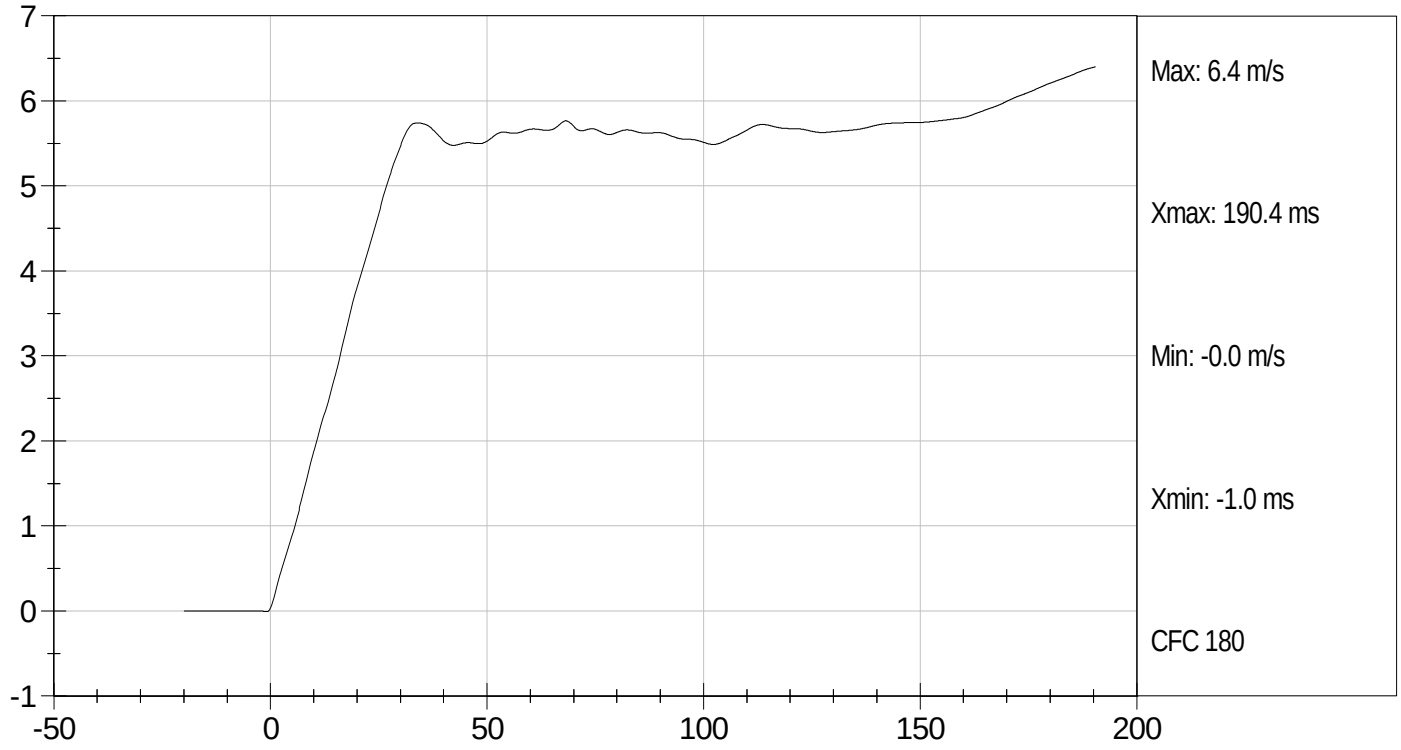
2/23/12
Test Date

David Winkelbauer
Approved By

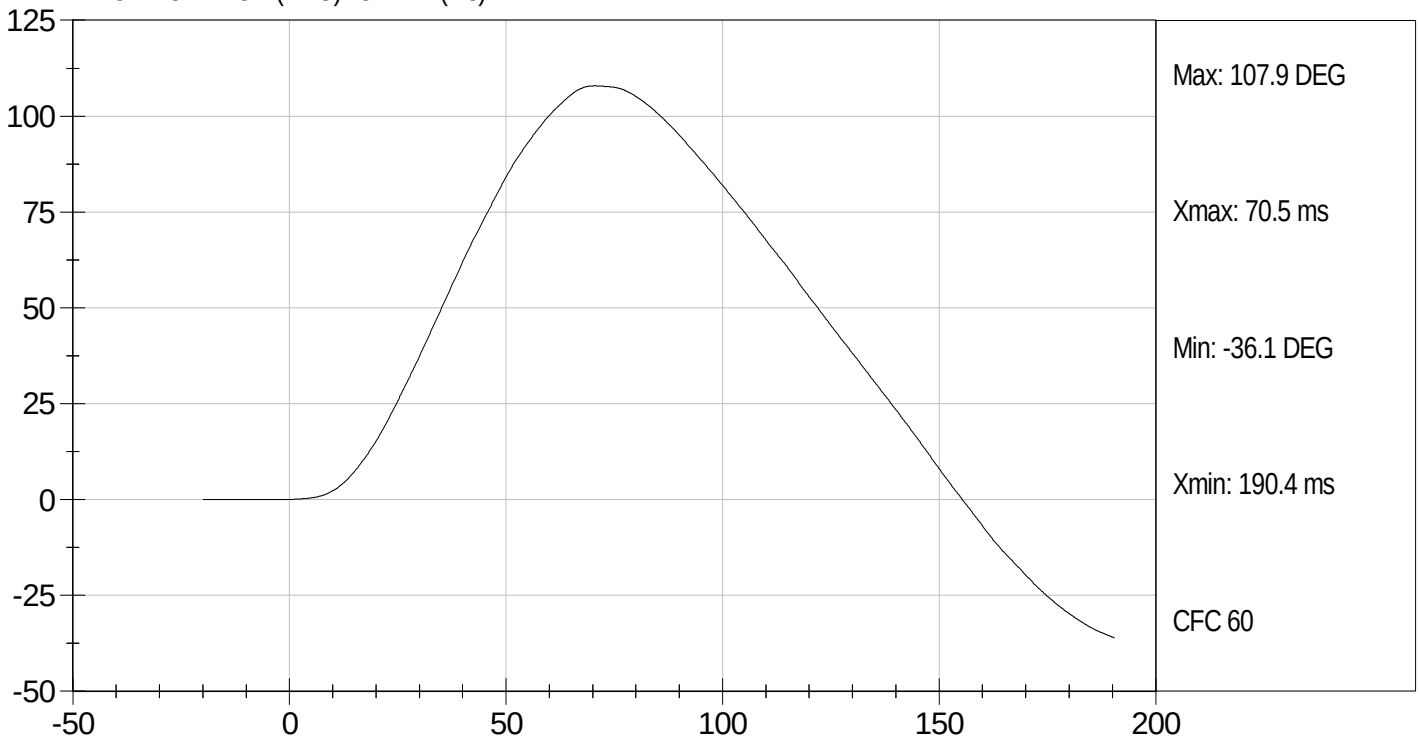
Test Desc: Neck Extension
Component ID: D12633

Test Date: 2/23/12
Velocity: 20.08 ft/s, 6.12 m/s

PENDULUM VELOCITY (m/s) vs TIME (ms)

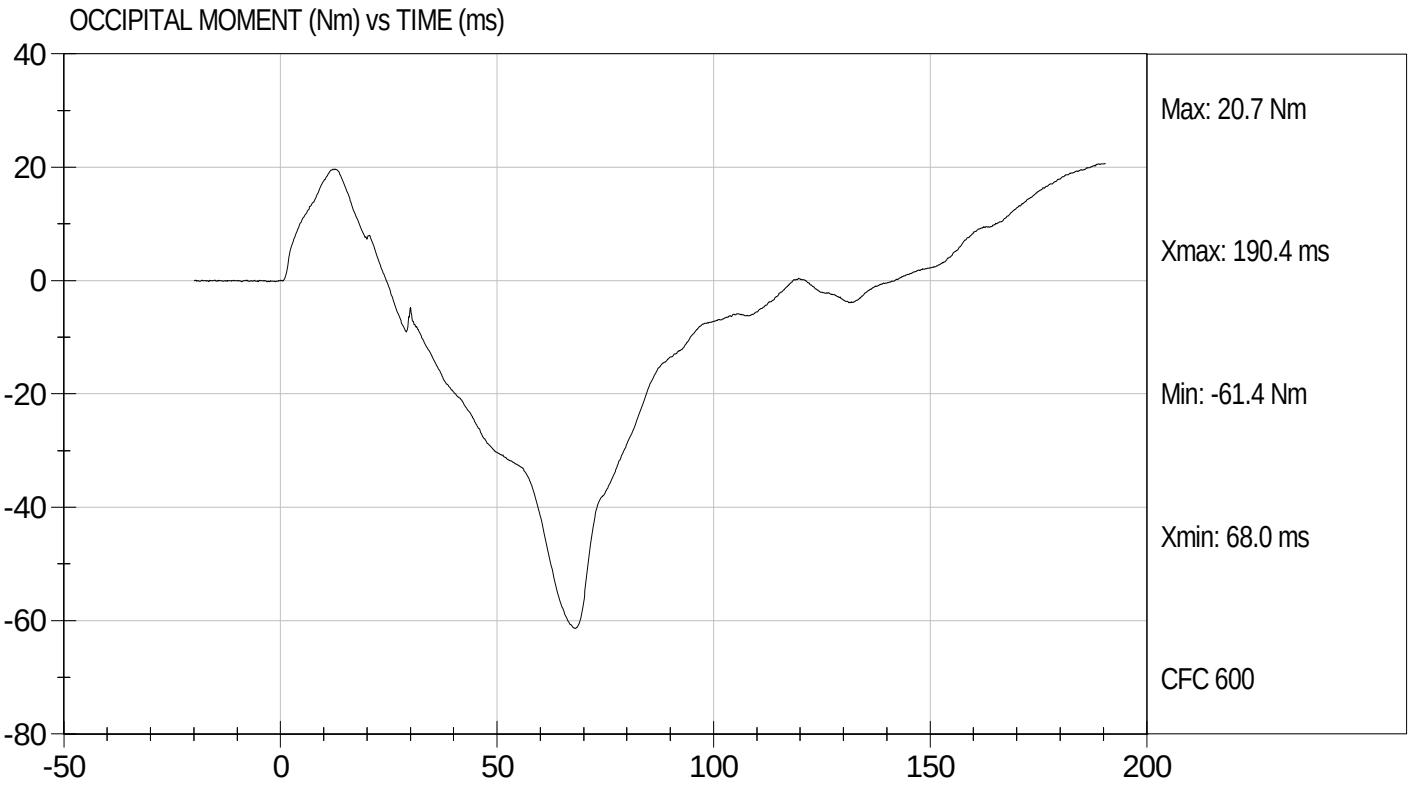


NECK ROTATION (DEG) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D12633

Test Date: 2/23/12
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12634

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Relative Humidity	%	10 to 70	26	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	50	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	3.96	Pass
Internal Hysteresis	%	69 to 85	75	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	4126	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

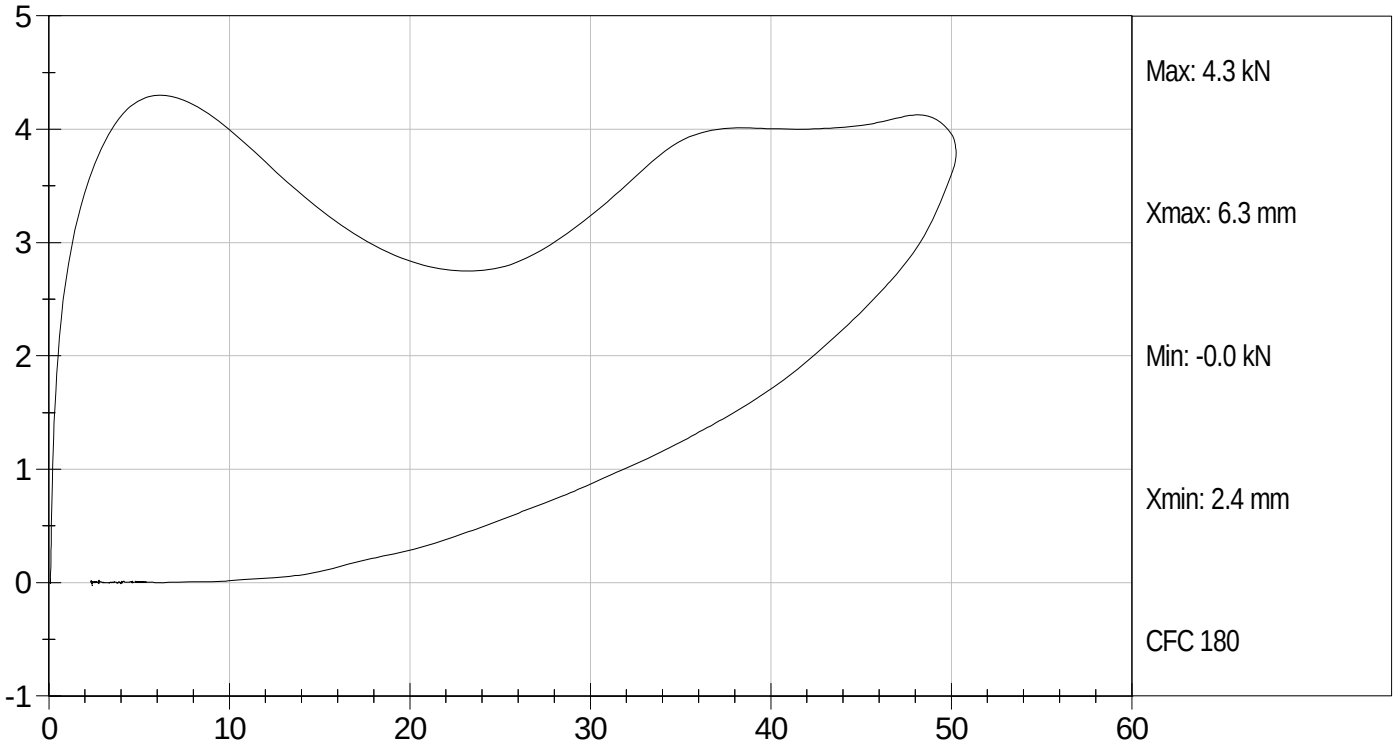
2/23/12
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D12634

Test Date: 2/23/12
Velocity: 22.22 ft/s, 6.77 m/s

FORCE (kN) vs CHEST DISP (mm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12635

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

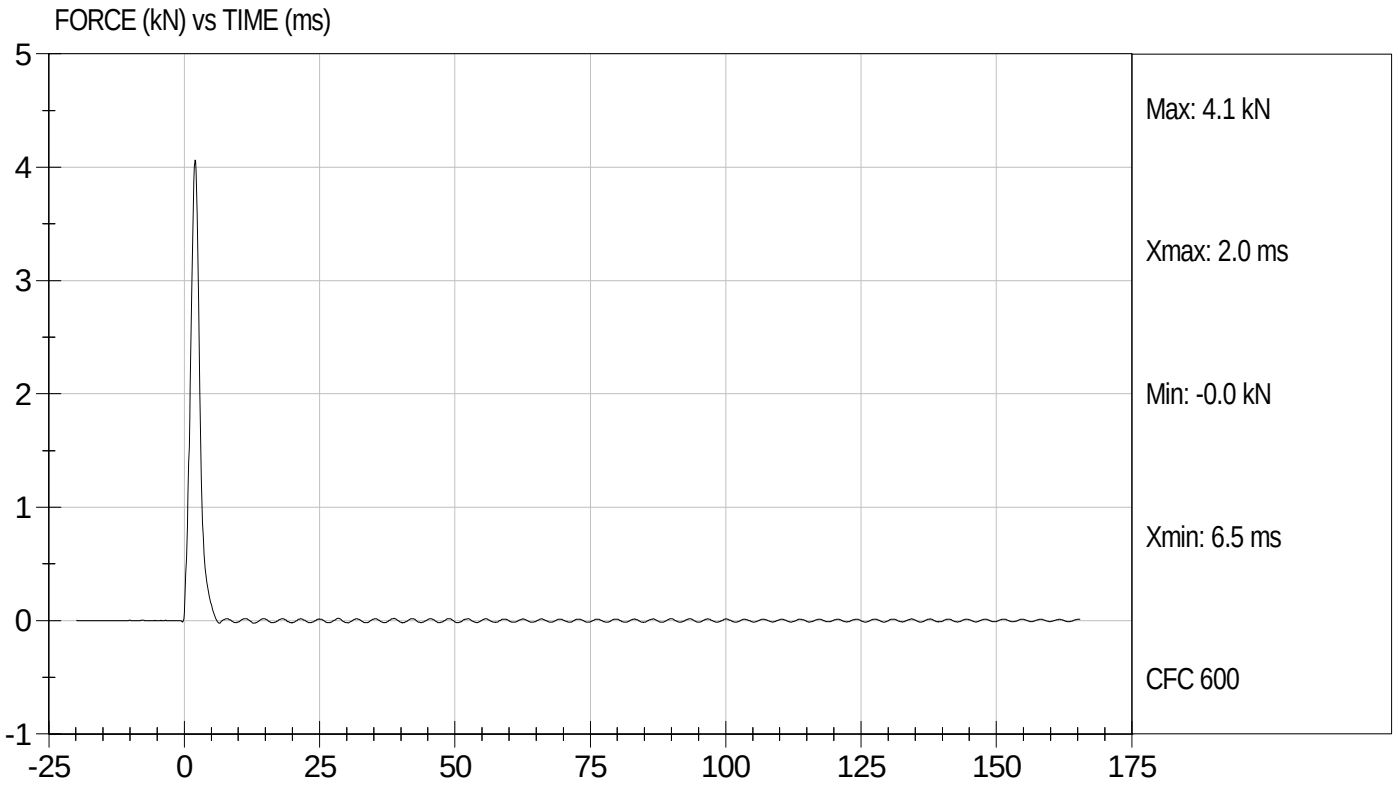
Jessica Hall
Laboratory Technician

2/23/12
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D12635

Test Date: 2/23/12
Velocity: 6.8 ft/s, 2.07 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12636

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	25	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	kN	3.45 to 4.06	3.67	Pass
		Overall Test Results		Pass

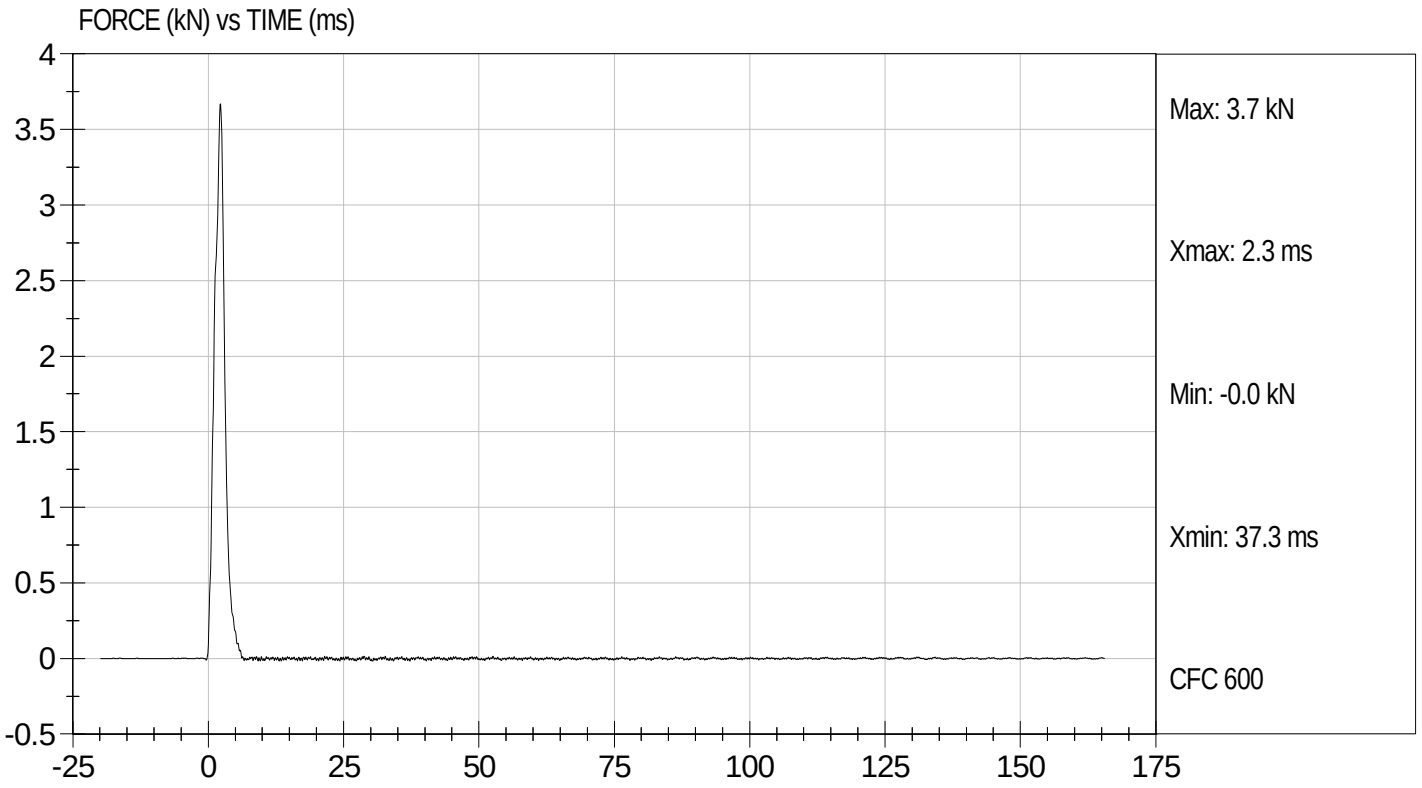
Jessica Hall
Laboratory Technician

2/23/12
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D12636

Test Date: 2/23/12
Velocity: 6.86 ft/s, 2.09 m/s



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12637

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	7	Pass
Force at 45 deg	N	320 to 390	336	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
		Overall Result		Pass

Jessica Hall
Laboratory Technician

2/23/12
Test Date

David Winkelbauer
Approved By

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test ID:** D12701

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Peak Resultant Acceleration	G's	250 to 300	278	Pass
Peak Lateral Acceleration	G's	+/- 15	7.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

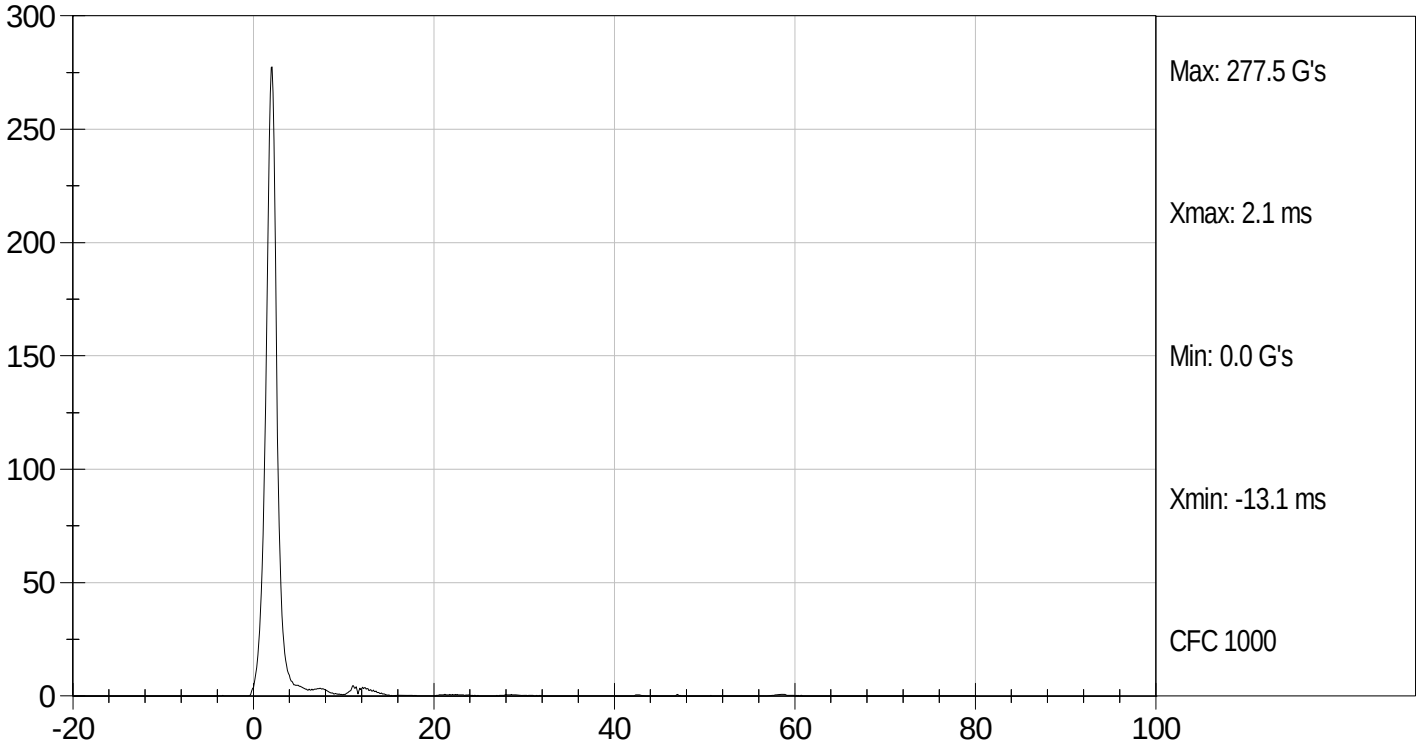
2/27/12
Test Date

David Winkelbauer
Approved By

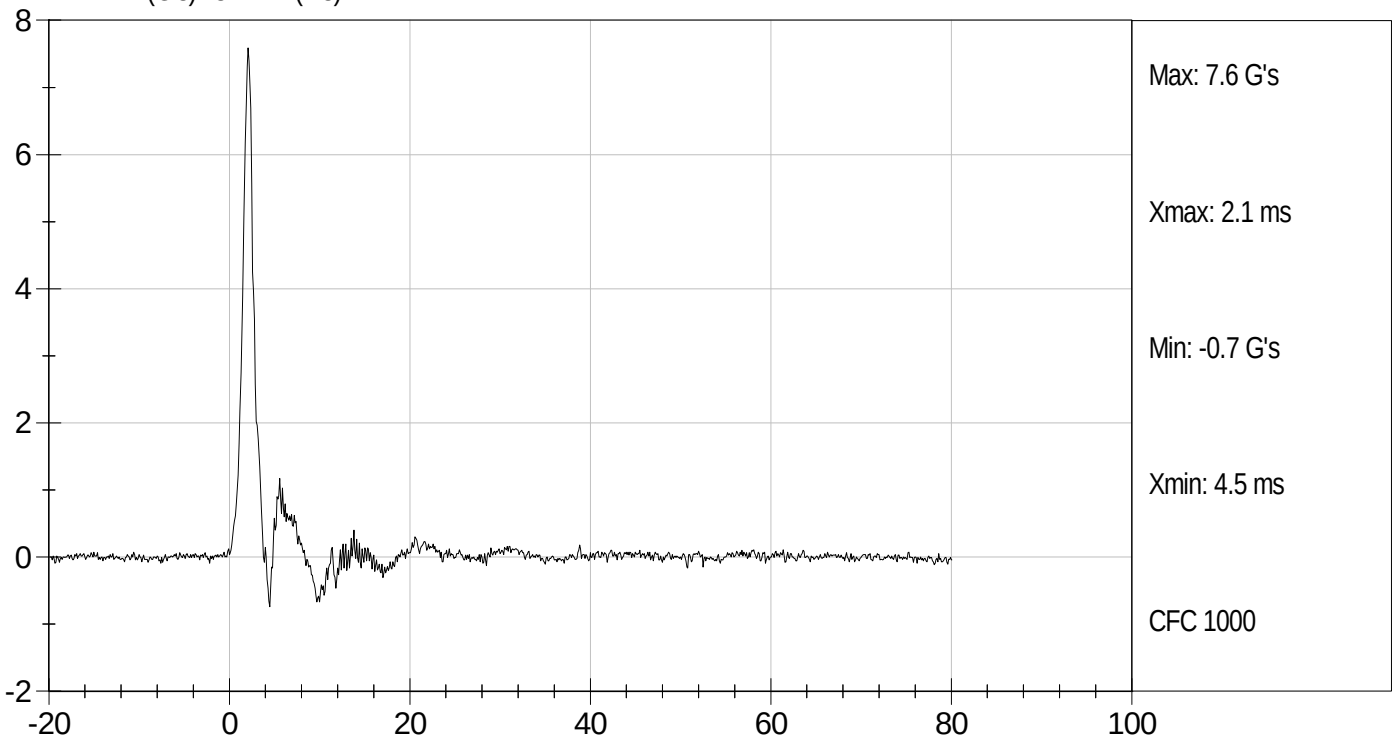
Test Desc: Head Drop
Component ID: D12701

Test Date: 2/27/12
Velocity: 0 ft/s, 0 m/s

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



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12702

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	19	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Pulse	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.8	Pass
	30 ms	m/s	5.8 to 7.0	6.5	Pass
D Plane Rotation	Max	deg	77 to 91	87	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	72	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
			Overall Results		Pass

Jessica Gall
Laboratory Technician

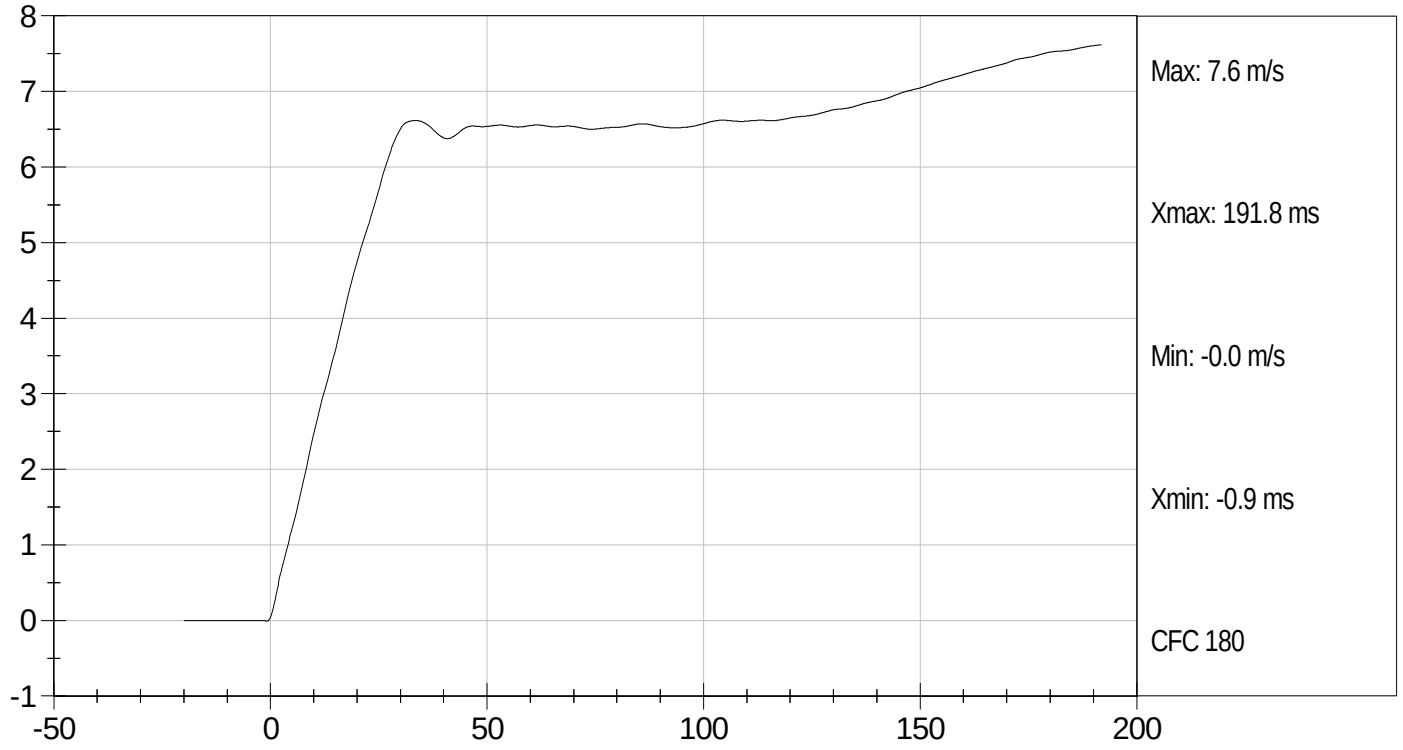
2/27/12
Test Date

David Winkelbauer
Approved By

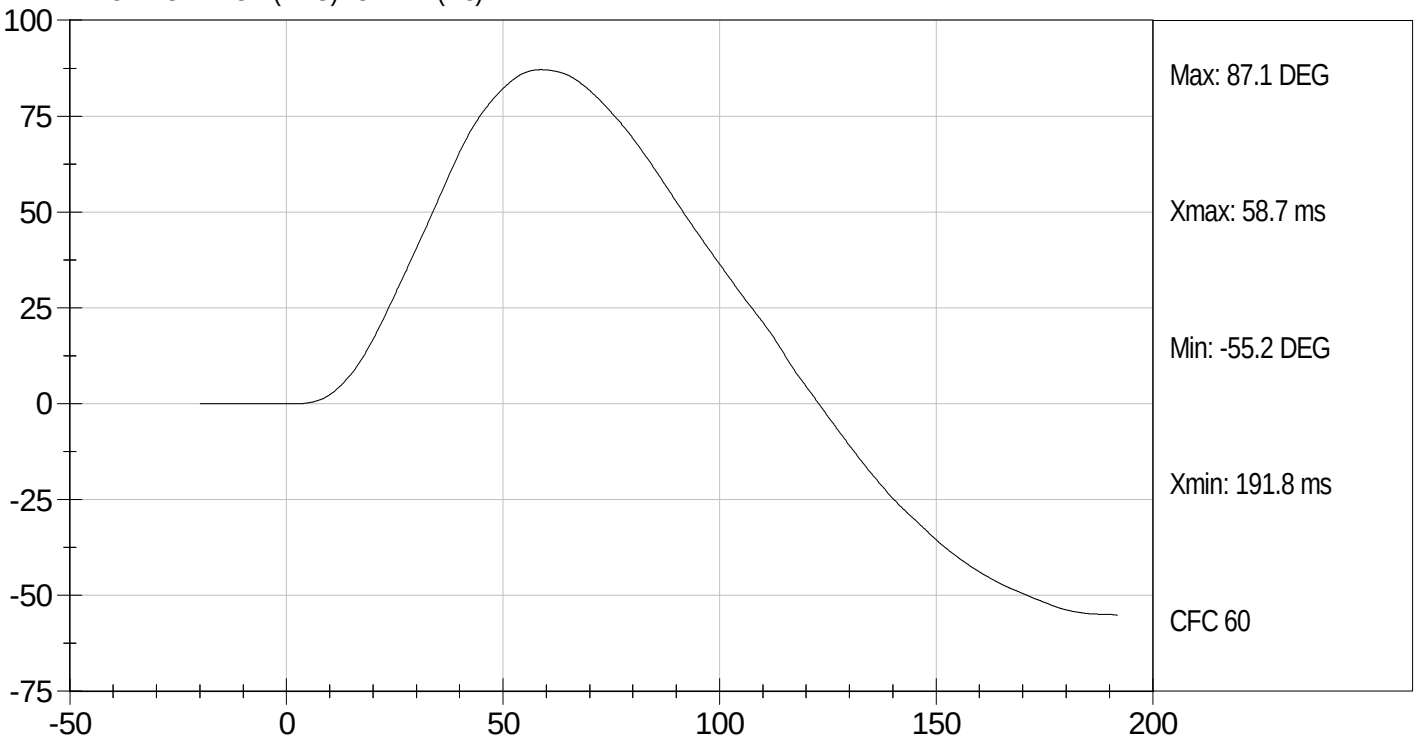
Test Desc: Neck Flexion
Component ID: D12702

Test Date: 2/27/12
Velocity: 23.15 ft/s, 7.06 m/s

PENDULUM VELOCITY (m/s) vs TIME (ms)

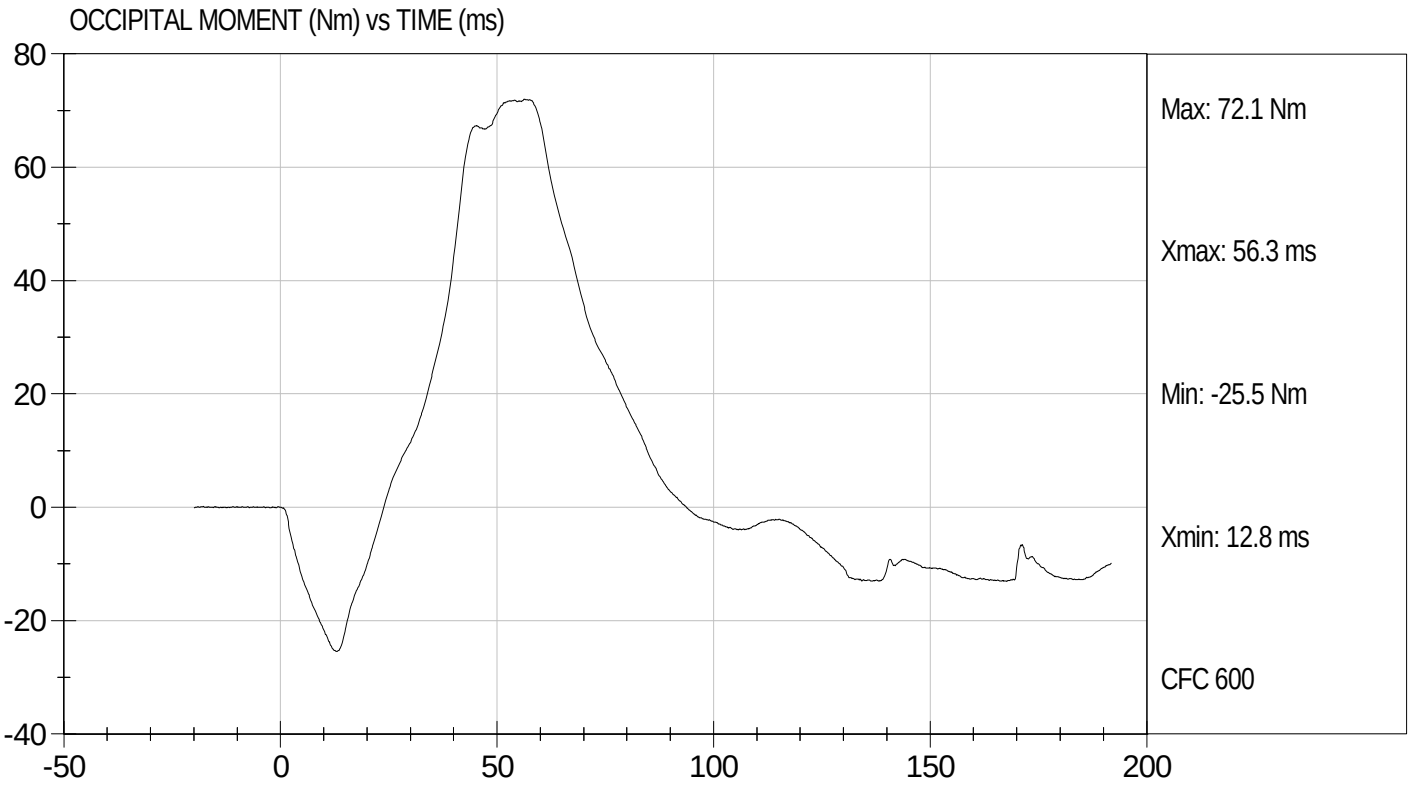


NECK ROTATION (DEG) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D12702

Test Date: 2/27/12
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12703

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	19	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.13	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	99	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-55	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	99	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

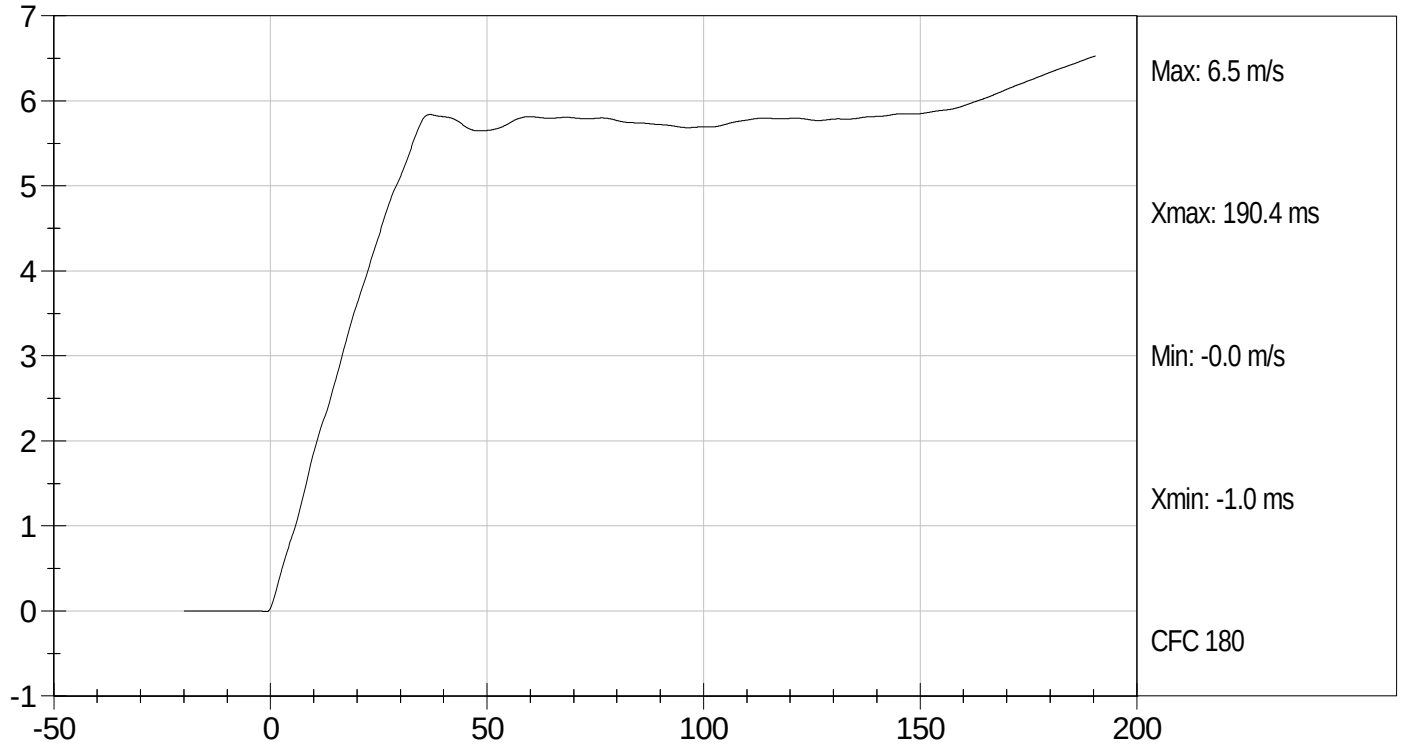
2/27/12
Test Date

David Winkelbauer
Approved By

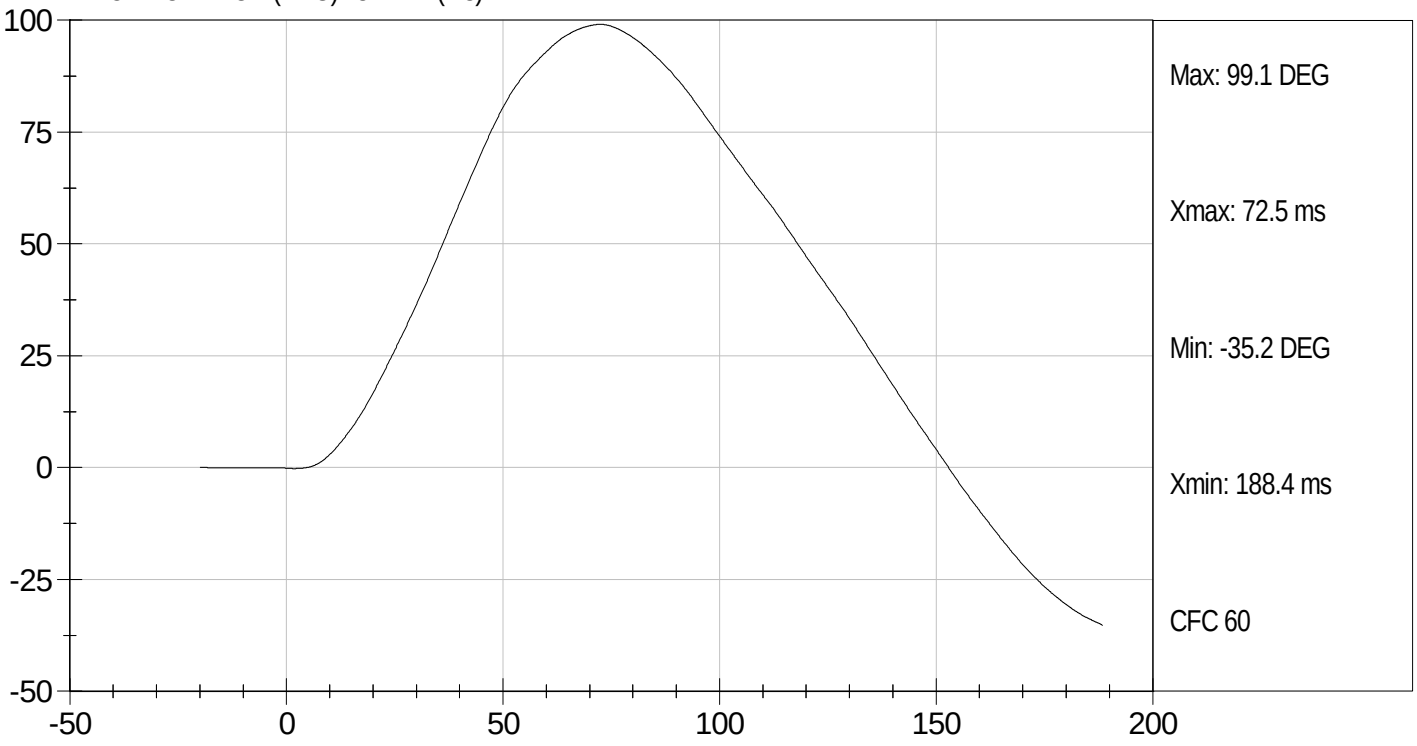
Test Desc: Neck Extension
Component ID: D12703

Test Date: 2/27/12
Velocity: 20.10 ft/s, 6.13 m/s

PENDULUM VELOCITY (m/s) vs TIME (ms)



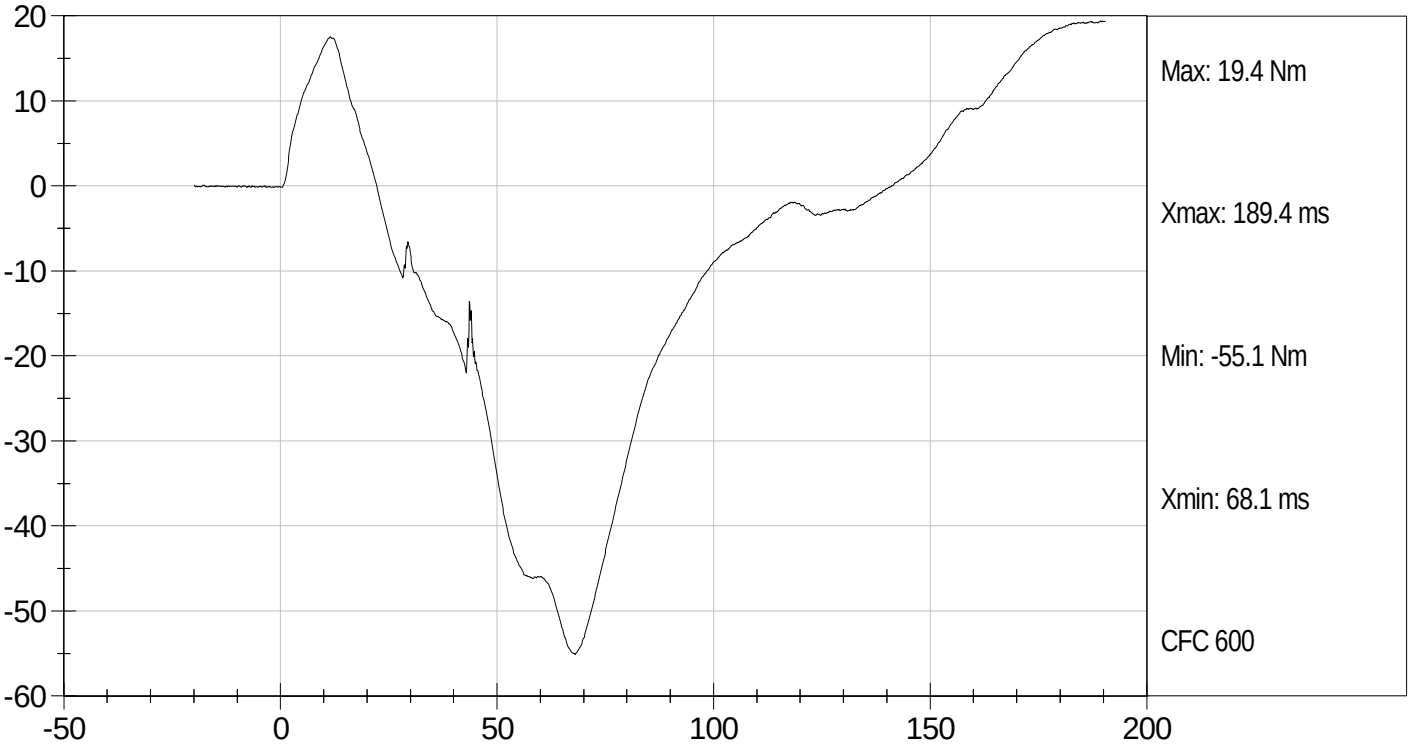
NECK ROTATION (DEG) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D12703

Test Date: 2/27/12
Velocity: 20.10 ft/s, 6.13 m/s

OCCIPITAL MOMENT (Nm) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12704

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Relative Humidity	%	10 to 70	18	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	55	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.11	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	3921	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

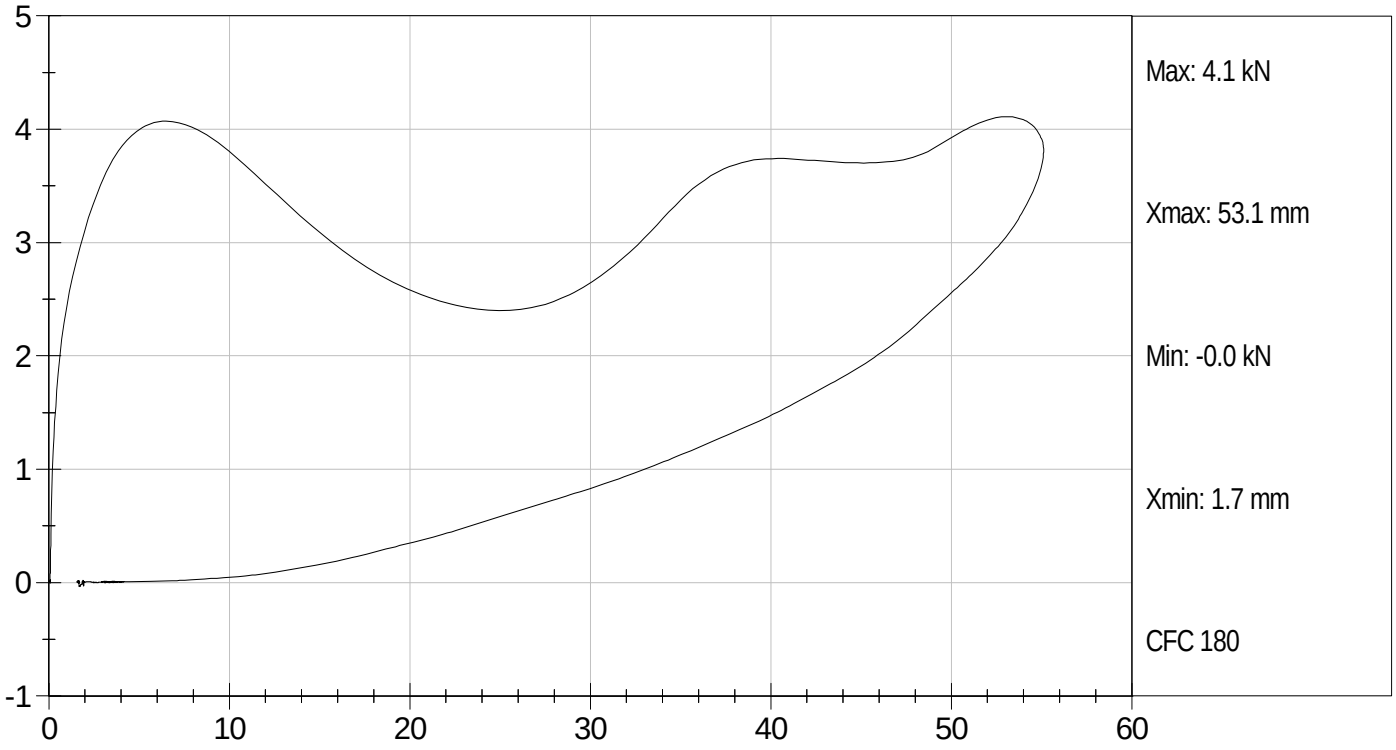
2/27/12
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D12704

Test Date: 2/27/12
Velocity: 22.22 ft/s, 6.77 m/s

FORCE (kN) vs CHEST DISP (mm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12705

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.74	Pass
		Overall Test Results		Pass

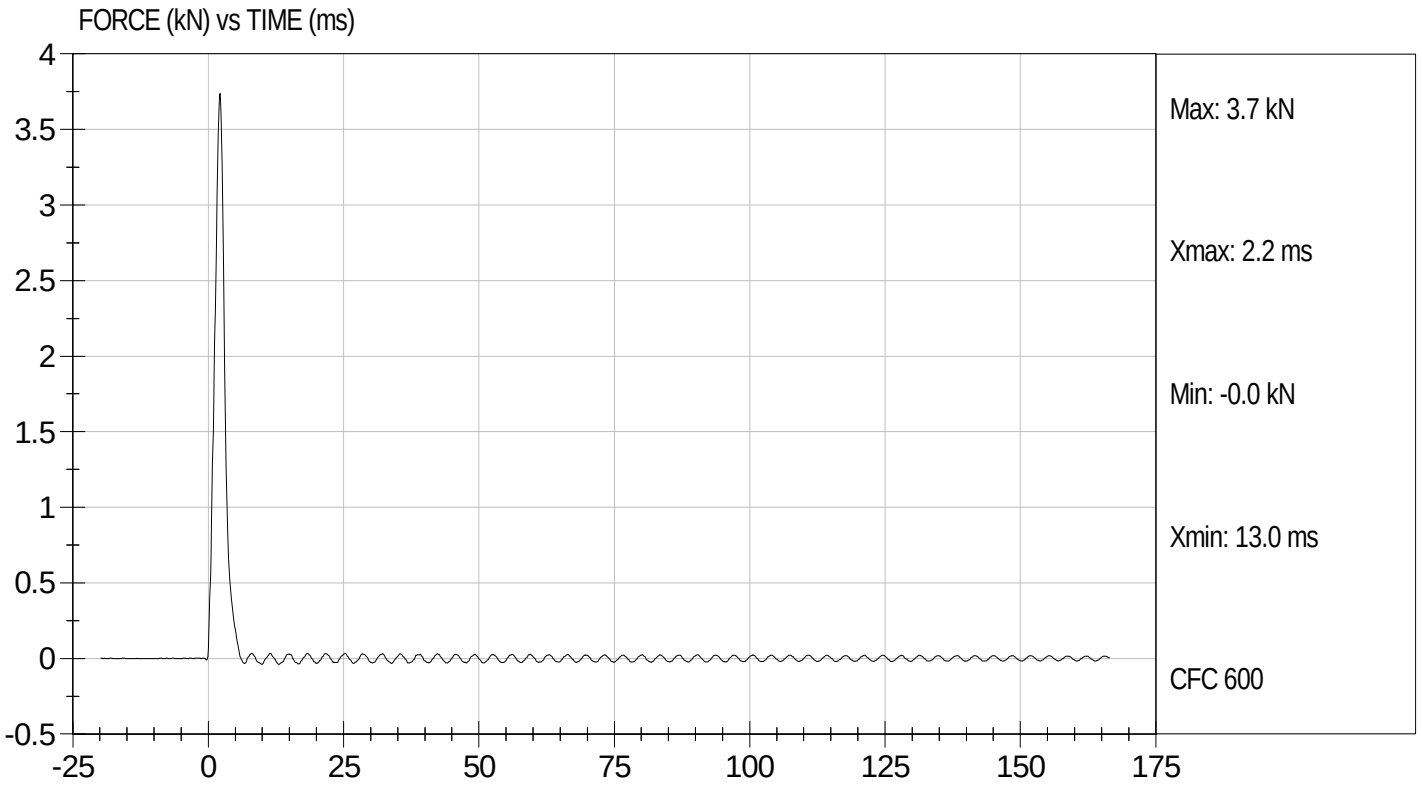
Jessica Hall
Laboratory Technician

2/27/12
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D12705

Test Date: 2/27/12
Velocity: 6.94 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12706

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.77	Pass
		Overall Test Results		Pass

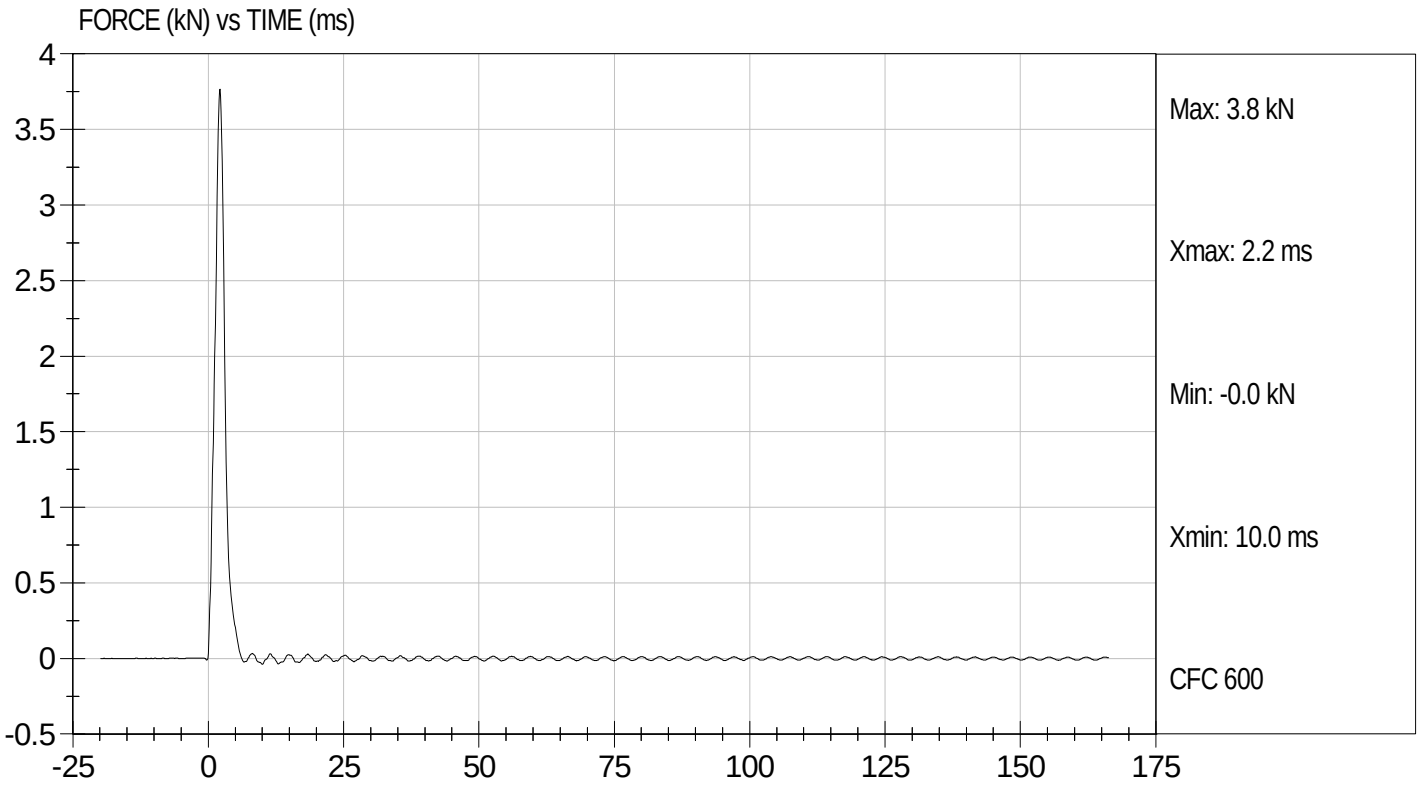
Jessica Hall
Laboratory Technician

2/27/12
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D12706

Test Date: 2/27/12
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D12707

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Initial Angle	deg	0 to 20	15	Pass
Return Angle	deg	+/- 8	7	Pass
Force at 45 deg	N	320 to 390	372	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
		Overall Result		Pass

Jessica Hall
Laboratory Technician

2/27/12
Test Date

David Winkelbauer
Approved By