REPORT NUMBER: NCAP-MGA-2011-080

NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test

GENERAL MOTORS LLC
2011 Chevrolet Volt 5-Dr Hatchback
NHTSA No.: MB0127

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: May 11, 2011

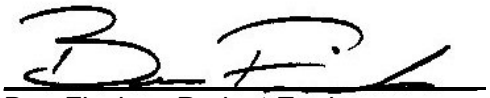
Final Report Date: June 7, 2011

FINAL REPORT

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

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

Prepared by: 
Donna Janovicz, Project Manager

Approved by: 
Ben Fischer, Project Engineer

Approval Date: June 7, 2011

FINAL REPORT ACCEPTANCE BY OCWS:

_____
Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

_____
COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

Technical Report Documentation Page

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4. Title and Subtitle Final Report of New Car Assessment Program Frontal Impact Testing of 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127		*5. Report Date* June 7, 2011 *6. Performing Organization Code* MGA
7. Author(s) Donna Janovicz, Project Manager Ben Fischer, Project Engineer		*8. Performing Organization Report No.* NCAP-MGA-2011-080
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 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C. 20590		*13. Type of Report and Period Covered* Final Test Report May 11, 2011 to June 7, 2011 *14. Sponsoring Agency Code* NVS-111
15. Supplementary Notes		

16. Abstract

A 56.3 km/h NCAP Frontal Impact Test was conducted on the 2011Chevrolet Volt 5-Dr Hatchback in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure for the generation of consumer information on vehicle frontal crash protection. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, 305, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on May 11, 2011.

The impact velocity was 56.2 km/h and the ambient temperature at the barrier face at the time of impact was 21°C. The target vehicle post-test maximum crush was 510 mm located 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	272	381
Maximum Chest Compression	mm	63	52	19	9
Nij	N/A	1	1	0.27	0.51
Neck Tension	N	4170	2620	785	887
Neck Compression	N	4000	2520	68	135
Left Femur Force	N	10008	6805	1780	1350
Right Femur Force	N	10008	6805	1150	1759

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 Adm. Technical Reference Division 1200 New Jersey Ave, SE Washington, D.C. 20590	
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-06-D-00028. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact was conducted in accordance with the Office of Crashworthiness Standard's NCAP Frontal Laboratory Test Procedure dated January 2010.

SUMMARY

A rigid barrier was impacted by a 2011 Chevrolet Volt 5-Dr Hatchback at a velocity of 56.2 kph. The test was performed at MGA Research Corporation on May 11, 2011. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

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

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

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, right/left femur load cells, and lower leg instrumentation. A seat belt load cell was on the driver's shoulder belt to measure dummy torso and pelvic section loading. The driver (position 1) ATD (Serial No. 036) and the right-front passenger (position 2) ATD (Serial No. 634) were calibrated previous to this test. Certification details, along with verification data, are found in Appendix C of this report.

The 100 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 510 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

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

The occupant data is summarized below:

ATD position	HIC_{15}	T^1	T^2	Chest Disp. (mm)	Nij	Neck Tension (N)	Neck Comp. (N)	Left Femur (N)	Right Femur (N)
Driver (50^{th})	272	67.6	82.6	19	0.27	785	68	1780	1150
Passenger (5^{th})	381	71.3	86.3	9	0.51	887	135	1350	1759

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

TEST NOTES

There was no valid data collected for:

Left Rear Seat Crossmember X after 68 msec.
Left Brake Caliper X after 49 msec.
Right Brake Caliper X after 50 msec.
Left Rear Seat Crossmember Z after 56 msec.

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: 2011 Chevrolet Volt 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: MB0127
Test Date: 5/11/2011

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MB0127
Model Year	2011
Make	Chevrolet
Model	Volt
Body Style	5-Dr Hatchback
VIN	1G1RC6E43BU100899
Body Color	Black
Delivery Date	5/09/2011
Odometer (mi)	47
Odometer (km)	76
Dealer	Oasis Chevrolet
Transmission	Automatic
Final Drive	Front
Type/No. Cylinders	4
Engine Displacement (L)	1.4
Engine Placement	Lateral
Roof Rack	No
Sunroof/T-Top	No
Tinted Glass	No
Traction Control	Yes
Power Brakes	Yes
Front Disc	Yes
Rear Disc	Yes
Does owner's manual provide instructions to turn off automatic door locks?	No

Anti-Lock Brakes	Yes
All Wheel Drive	No
Power Steering	Yes
Driver Front Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	Yes
Pass. Front Airbag	Yes
Pass. Curtain Airbag	Yes
Pass. Head/Torso Airbag	No
Pass. Torso Airbag	No
Pass. Torso/Pelvis Airbag	Yes
Pass. Pelvis Airbag	No
Pass. Knee Airbag	Yes
Pretensioners	Yes
Load Limiters	Yes
Automatic Door Locks	Yes
Bucket Seats	Yes
Tilt Steering	Yes
Other	

DATA FROM CERTIFICATION LABEL

Manufactured By	General Motors LLC
Date of Manufacture	01/11

GVWR (kg)	2062
GAWR Front (kg)	1139
GAWR Rear (kg)	923

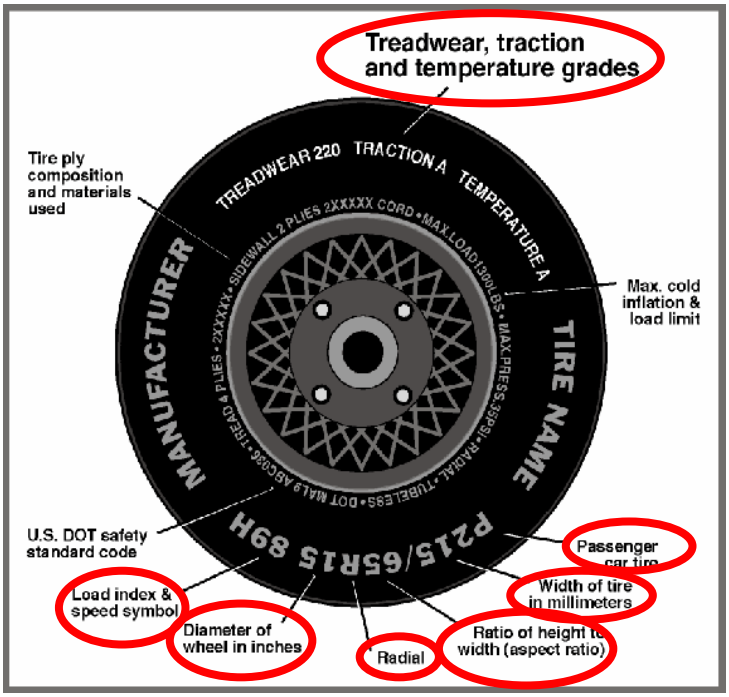
VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Designated Seating Capacity (DSC)	2	2		4
Capacity Weight (VCW) (kg)				340
Cargo Weight (RCLW) (kg)				68

DATA SHEET NO. 1 (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011



Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	P215/55R17	P215/55R17
Tire Size on Vehicle	P215/55R17	P215/55R17
Tire Manufacturer	Goodyear	Goodyear
Tire Model	Assurance	Assurance
Treadwear	580	580
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2	2
Tire Plies Body	4	4
Load Index & Speed Symbol	93H	93H
Tire Material	Rubber	Rubber
DOT Safety Code Right	4BPJ KAIR 4010	4BPJ KAIR 4010
DOT Safety Code Left	4BPJ KAIR 4010	4BPJ KAIR 4010

DATA SHEET NO. 1 (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	527.1	337.5		565.2	408.2	
Right	kg	512.1	328.8		541.1	392.9	
Ratio	%	60.9	39.1		58.0	42.0	
Totals	kg	1039.2	666.3	1705.5	1106.3	801.1	1907.4

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1705.5
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	68
Calculated Target Vehicle Target Weight (TVTW)	kg	1914.1

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	706	704	715	712	1049
As Tested	mm	694	695	684	686	1128
Post Test	mm	701	704	678	676	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2685
Total Vehicle Length at Left Side	mm	4320
Total Vehicle Length at Centerline	mm	4500
Total Vehicle Length at Right Side	mm	4320
Weight of Ballast in Cargo Area	kg	29.5
Weight of Vehicle Components Removed	kg	11.3
Amount of Stoddard Solvent in Fuel Tank	L	32.6

List of components removed to meet test weight: Right tail light, charging cable, trunk trim, tire compressor.

DATA SHEET NO. 1 (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4500
2	Total Width	1785
3	Bumper Top Height	490
4	Bumper Bottom Height	375
5	Longitudinal Member Top Height	540
6	Distance between Longitudinal Members	942
7	Longitudinal Member Width	90
8	Engine Top Height	781
9	Engine Bottom Height	195
10	Engine and Gearbox Width	795
11	Front Bumper-Engine Distance	480
12	Front Shock Absorber Fixing Height	925
13	Bonnet Leading Edge Height	730
14	Front Shock Absorber Fixing Width	1180
15	Front Bumper – Front Axle Distance	995
16	Front Axle – A-Pillar Distance	440
17	A-Pillar – B-Pillar Distance	1115
18	B-Pillar – Rear Axle Distance	1146
19	B-Pillar – C-Pillar Distance	715
20	Roof Sill Bottom Height	1217
21	Roof Sill Top Height	1391
22	Floor Sill bottom Height	166
23	Floor Sill Top Height	330

DATA SHEET 1A

ELECTRIC VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

Type of Electric Vehicle (Electric/Hybrid):	Electric
Propulsion Battery Type:	Lithium-Ion
Nominal Voltage (V):	370 V
Physical Location of Automatic Propulsion Battery Disconnect:	Accessed by removing lower Console bin in storage area
Auxiliary Battery Type:	12 V AGM (Absorbent Glass Mat)

PROPULSION BATTERY SYSTEM DATA (COTR SUPPLIED DATA)

Electrolyte Fluid Type:	1 molar concentration of a lithium salt, lithium hexafluorophosphate (LiPF6) dissolved in a mixture of various organic carbonates that includes ethylene carbonate as the base solvent.	
Electrolyte Fluid Specific Gravity:	1.15 g/ml estimated	
Electrolyte Kinematic Viscosity (centistokes):	Liquid, no specific physical data available	
Electrolyte Fluid Color:	Clear, pale yellow	
Propulsion Battery Coolant Type, Color, Specific Gravity (if applicable):	DEX-COOL	
Location of Battery Modules:		Inside Passenger Compartment
	X	Outside Passenger Compartment

MEASURE AND RECORD BATTERY STATE OF CHARGE

X	Maximum State of Charge recommended by manufacturer:	**390 V**
	Test Voltage (>95% of Maximum State of Charge):	
	Test Voltage (Within Normal Operating Voltage Range):	

VEHICLE CHASSIS GROUND POINT(S) LOCATION(S)

Details of Vehicle Chassis Ground Point(s) & Locations(s)	Use either the 12V negative battery cable attachment to the body or the propulsion battery tray ground strap to body attachment on the underside of the vehicle

PROPULSION BATTERY SYSTEM

Details of Propulsion Battery Components	Service Disconnect

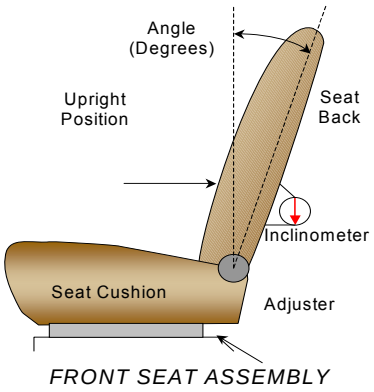
DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

NOMINAL DESIGN RIDING POSITION

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



SEAT BACK ANGLE	Degrees
Driver Seat Back Angle	-5.2° on headrest post
Passenger Seat Back Angle	-10.4° on headrest post

SEAT FORE/AFT POSITIONS

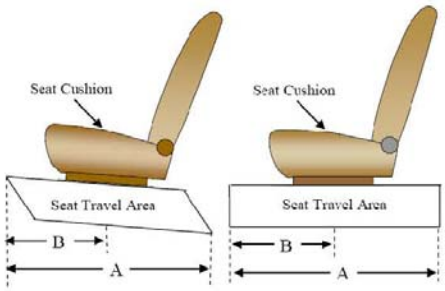
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.

SEAT FORE/AFT POSITIONS	Total Fore/Aft Travel	Placed in Position #
Driver Seat	54 detents (1st as 0)	20th detent (forward-most as 0)
Passenger Seat	54 detents (1st as 0)	0 detent (forward-most as 0)

SEAT BELT UPPER ANCHORAGES

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

SEAT BELT UPPER ANCHORAGES	Total # of Positions	Placed in Position #
Driver Seat	Fixed	Fixed
Passenger Seat	Fixed	Fixed



DATA SHEET NO. 2 (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

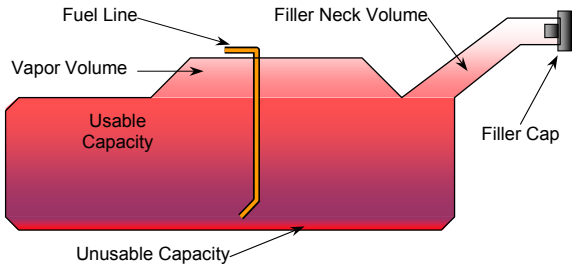
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	35.2
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	32.4 to 33.1
Actual Amount of Solvent used	32.6
1/3 of Usable Capacity	11.7

FUEL PUMP

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

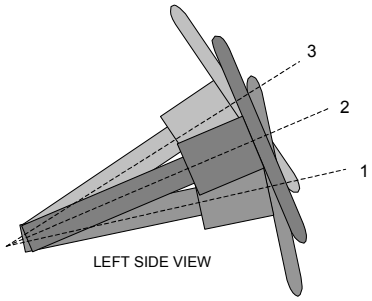
The vehicle is equipped with an electric fuel pump. Fuel pump will run when the gasoline generator is commanded to start. The fuel pipe is on the right side.



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

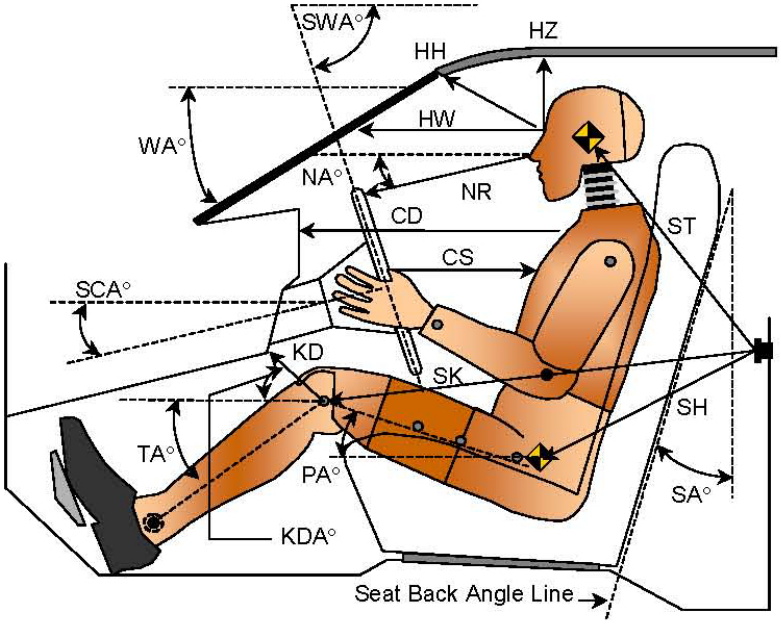
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost – Position 1	70.6	200
Geometric Center – Position 2	68.5	172
Uppermost – Position 3	66.4	144
Telescoping Steering Wheel Travel		56
Test Position	68.5	172

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

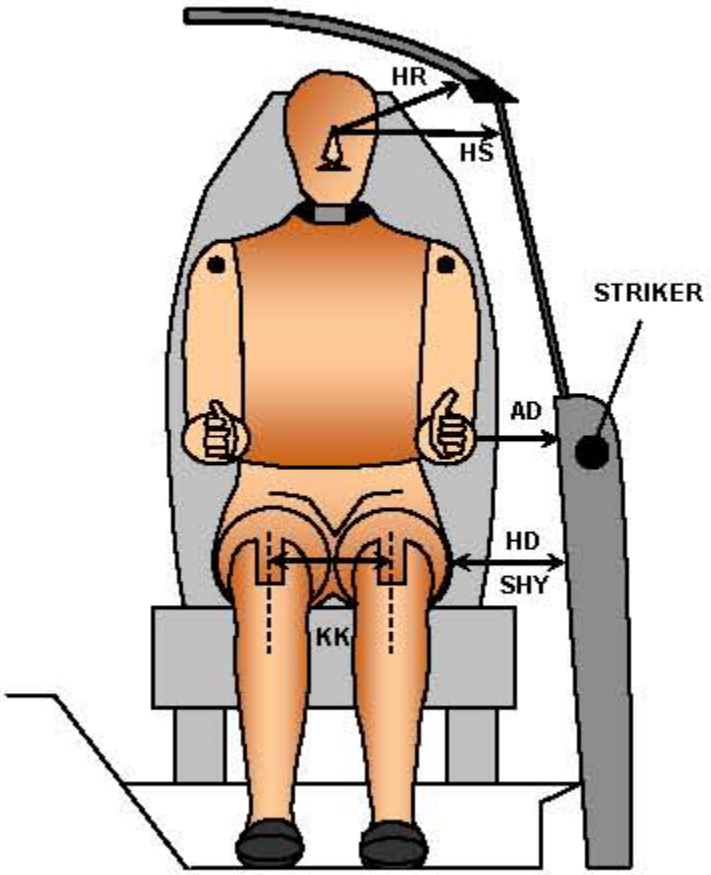


Code	Measurement Description	Driver S/N 036		Passenger S/N 634	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		21.7		
SWA	Steering Wheel Angle		68.5		
SCA	Steering Column Angle		21.5		
SA	Seat Back Angle		-5.2		-10.4
HZ	Head to Roof (Z)	200	90	239	90
HH	Head to Header	456	11.1	353	31.5
HW	Head to Windshield	803	0	797	0
NR	Nose to Rim	426	7.2		
CD	Chest to Dash	589		430	
CS	Chest to Steering Hub	347	3.7		
RA	Rim to Abdomen	239	0		
KDL	Left Knee to Dash	208	27.7	172	34.2
KDR	Right Knee to Dash	200	33.2	167	30.6
PA	Pelvic Angle		24.7		22.1
TA	Tibia Angle		44.3		38.1
SK	Striker to Knee	528	93.2	587	97.9
ST	Striker to Head	470	0.1	440	19.4
SH	Striker to H-Point	230	136.4	310	118.9

DATA SHEET NO. 4

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011



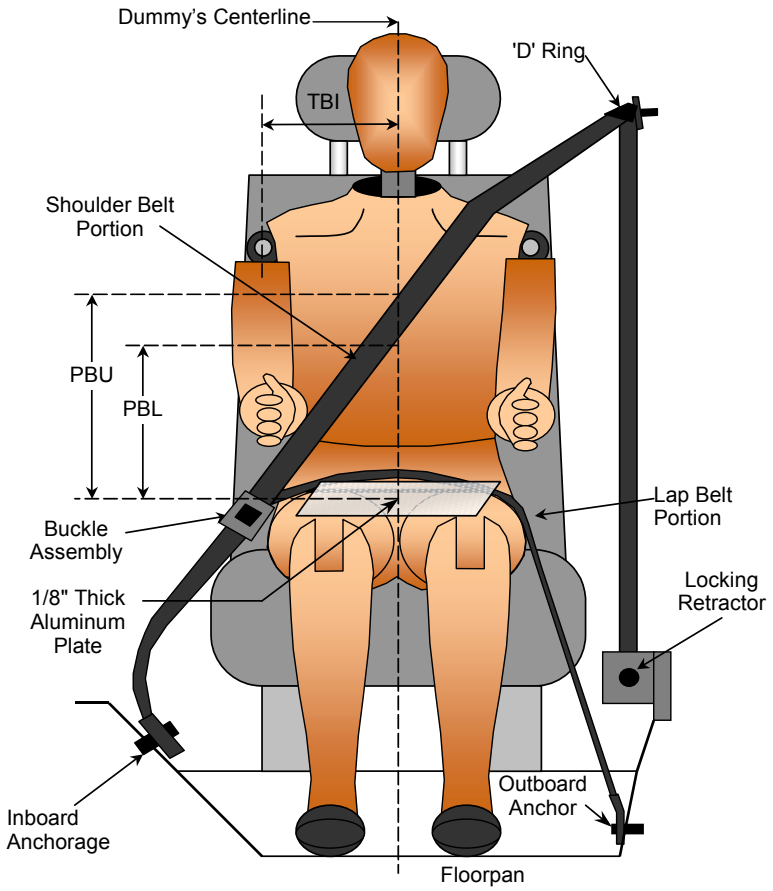
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver S/N 036	Passenger S/N 634
		Length (mm)	
AD	Arm to Door	112	102
HD	H-Point to Door	134	170
HR	Head to Side Header	211	238
HS	Head to Side Window	334	341
KK	Knee to Knee	310	213
SHY	Striker to H-Point (Y Direction)	273	287
AA	Ankle to Ankle	283	175

DATA SHEET NO. 5

SEAT BELT POSITIONING DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: MB0127
Test Date: 5/11/2011



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	335	290
PBL - Top surface of reference to belt lower edge	mm	250	200

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	780	815
Lap Belt Length as measured on ATD	mm	430	445
Remainder of belt on reel	mm	2117	2067
Total Belt Length for Continuous Webbing Systems	mm	3327	3327

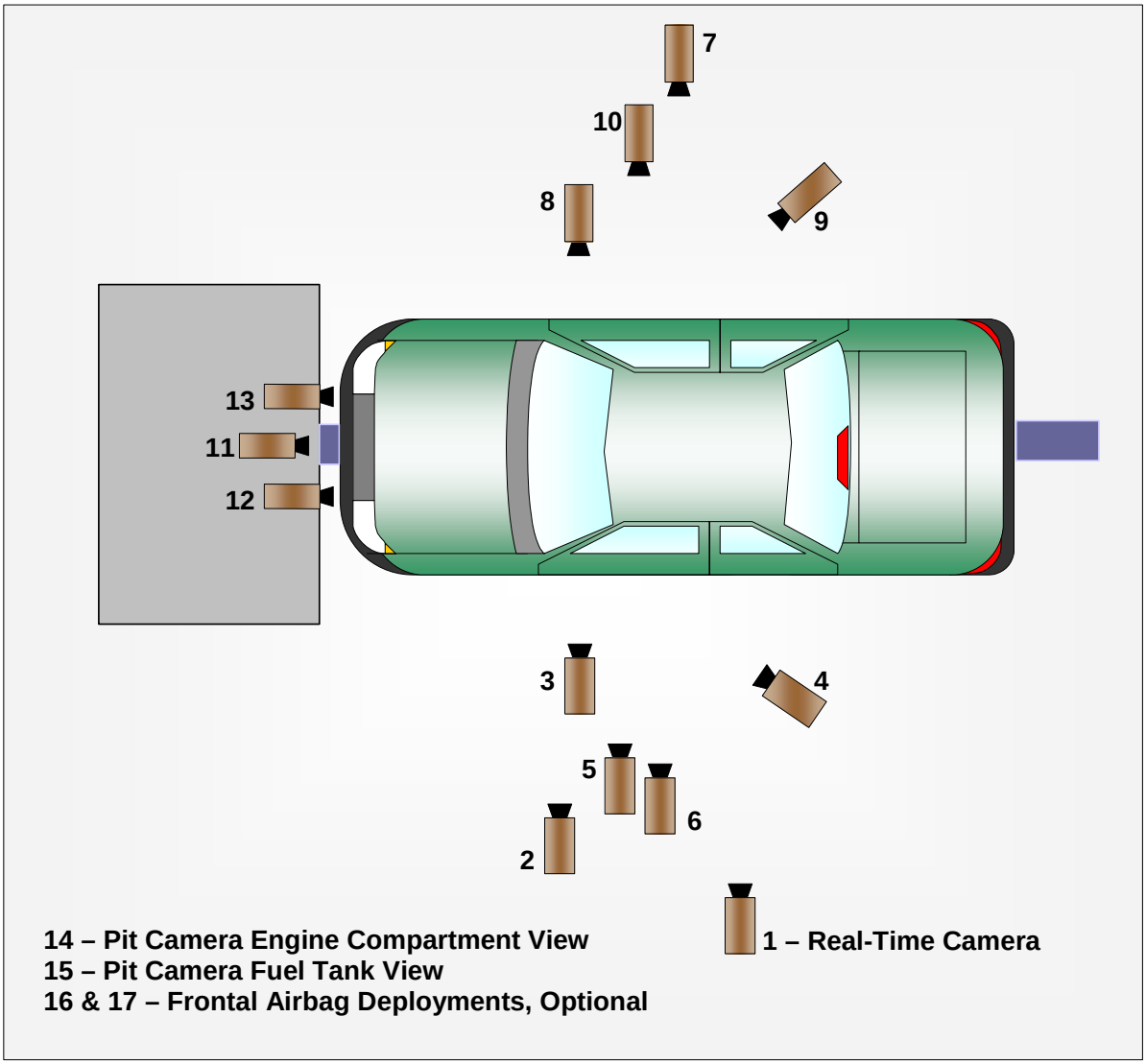
DATA SHEET NO. 6

HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0127
Test Date: 5/11/2011

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: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Side View					30
2	Left Front Half	1090	-4890	-1110	24	1000
3	Driver Close-Up	1370	-6330	-1790	35	1000
4	Driver Angle	5370	-4830	-1830	50	1000
5	Steering Column Top	690	-4950	-1230	24	1000
6	Steering Column Bottom	670	-4920	-830	24	1000
7	Right Overall	1970	6260	-1080	20	1000
8	Passenger Close-Up	1420	6450	-1750	35	1000
9	Passenger Angle	5430	4850	-1820	50	1000
10	Right Front Half	1120	4850	-1080	24	1000
11	Windshield	-260	0	-2860	24	1000
12	Top Driver	-20	-460	-2040	12.5	1000
13	Top Passenger	-20	460	-2040	12.5	1000
14	Pit Front	1040	0	3150	24	1000
15	Pit Rear	3060	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

*COORDINATES:

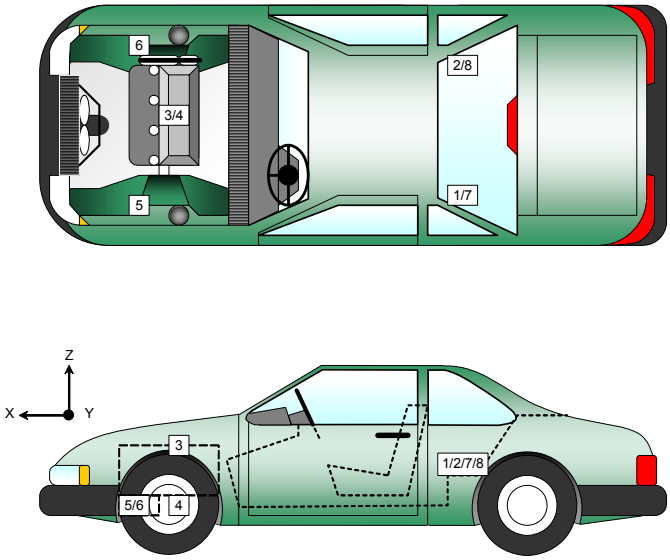
+X = forward of impact plane
+Y = right of monorail centerline
+Z = below ground level

Cameras 16 & 17 were not used for this test.

DATA SHEET NO. 7

VEHICLE ACCELEROMETER DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: MB0127
Test Date: 5/11/2011



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1750	-385	-235
2	Right Rear X-Member X	1750	385	-235
3	Engine Top X	3680	60	-792
4	Engine Bottom X	3690	0	-270
5	Left Brake Caliper X	3624	-670	-268
6	Right Brake Caliper X	3624	670	-268
7	Left Rear X-Member Z	1750	-385	-235
8	Right Rear X-Member Z	1750	385	-235

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

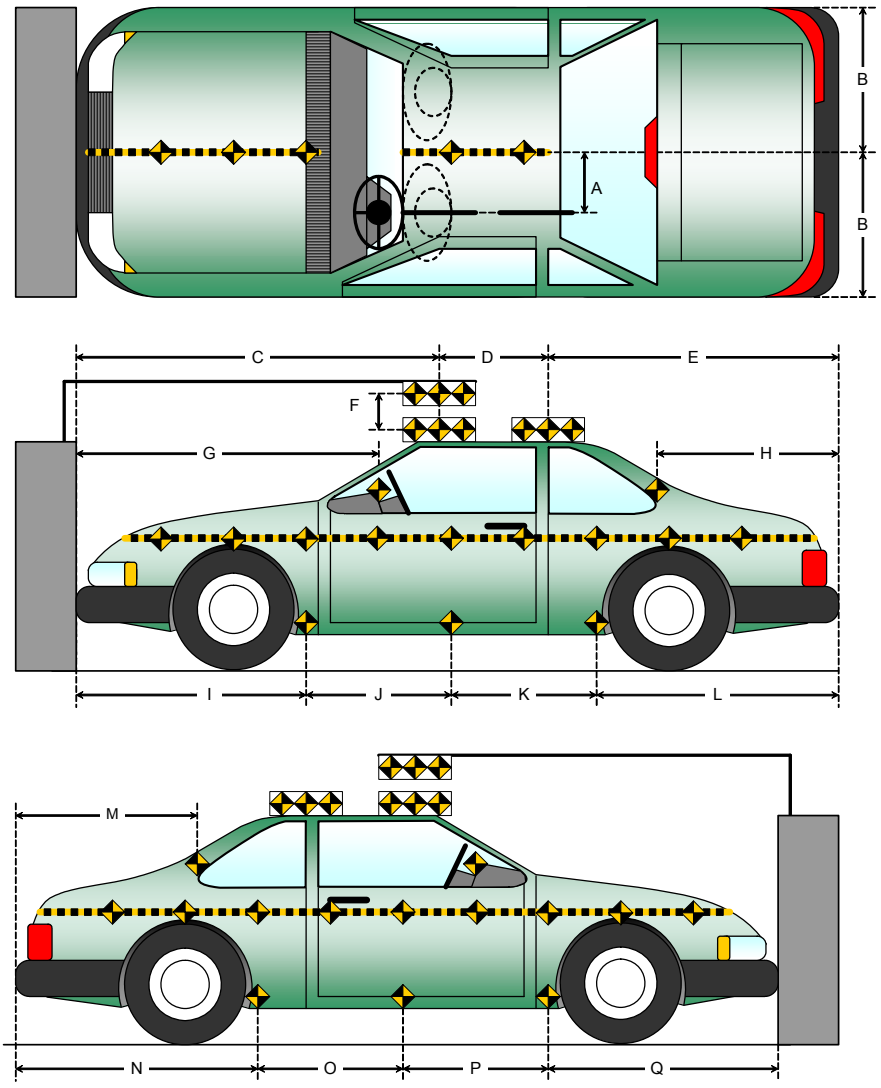
DATA SHEET NO. 8

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0127
Test Date: 5/11/2011

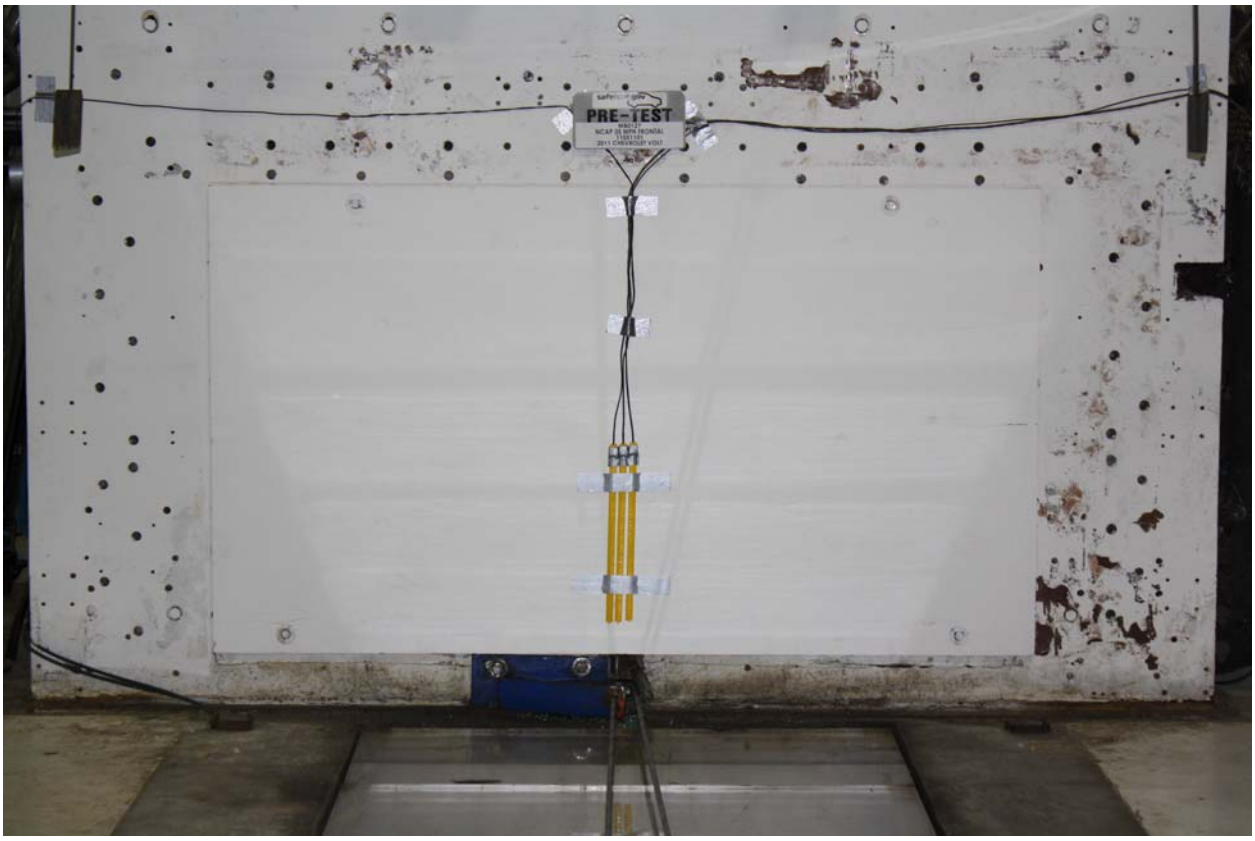
Item	Value (mm)
A	370
B	891
C	2468
D	450
E	1582
F	140
G	
H	860
I	1442
J	912
K	912
L	1234
M	860
N	1234
O	912
P	912
Q	1442



DATA SHEET NO. 9

FIXED BARRIER

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011



DATA SHEET NO. 10

TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

INSTRUMENTATION

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

CAMERA COVERAGE

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

DATA SHEET NO. 11

POST-TEST OBSERVATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

TEST DUMMY INFORMATION AND CONTACT

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 036	HIII 5% / 634
Head Contact	Airbag, Headrest	Airbag, Headrest
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	Airbag	Airbag
Left Knee Contact	Knee Airbag	Knee Airbag
Right Knee Contact	Knee Airbag	Knee Airbag

DOOR OPENING AND SEAT TRACK INFORMATION

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

POST TEST STRUCTURAL OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	860
Center	mm	812
Right Side	mm	772
Average	mm	815

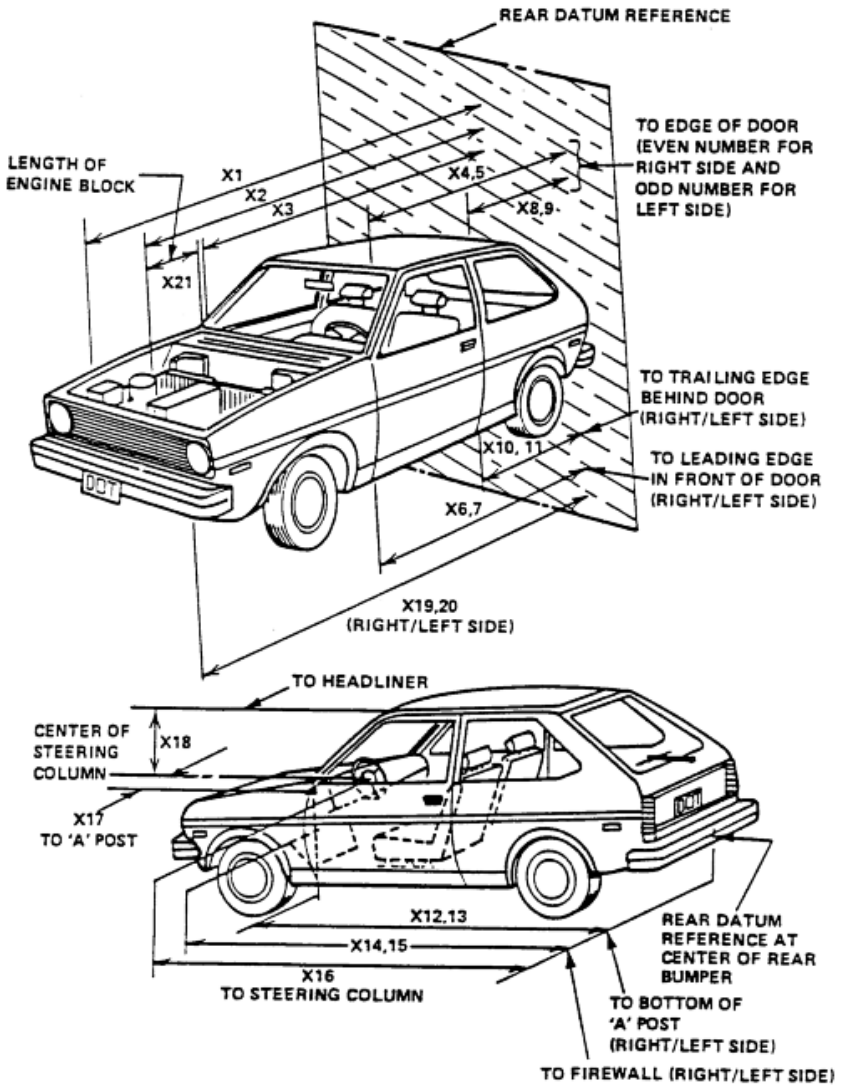
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Right Front (Passenger)	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Knee Airbag	Yes	Yes	Yes	Yes
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: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011



DATA SHEET NO. 12 (CONTINUED)

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4500	3990	510
2	RSOV to Front of Engine	mm	3840	3600	240
3	RSOV to Firewall	mm	3458	3450	8
4	RSOV to Upper Leading Edge of Right Door	mm	2995	2997	-2
5	RSOV to Upper Leading Edge of Left Door	mm	2995	2995	0
6	RSOV to Lower Leading Edge of Right Door	mm	2960	2965	-5
7	RSOV to Lower Leading Edge of Left Door	mm	2960	2965	-5
8	RSOV to Upper Trailing Edge of Right Door	mm	1906	1905	1
9	RSOV to Upper Trailing Edge of Left Door	mm	1906	1906	0
10	RSOV to Lower Trailing Edge of Right Door	mm	1930	1930	0
11	RSOV to Lower Trailing Edge of Left Door	mm	1932	1935	-3
12	RSOV to Bottom of “A” Post of Right Side	mm	2980	2980	0
13	RSOV to Bottom of “A” Post of Left Side	mm	2920	2920	0
14	RSOV to Firewall, Right Side	mm	3460	3455	5
15	RSOV to Firewall, Left Side	mm	3470	3460	10
16	RSOV to Steering Column	mm	2484	2488	-4
17	Center of Steering Column to “A” Post	mm	365	370	-5
18	Center of Steering Column to Headliner	mm	400	395	5
19	RSOV to Right Side of Front Bumper	mm	4320	4015	305
20	RSOV to Left Side of Front Bumper	mm	4320	3966	354
21	Length of Engine Block	mm	380	380	0
RD	RSOV to Right Side of Dash Panel	mm	2710	2705	5
CD	RSOV to Center of Dash Panel	mm	2700	2700	0
LD	RSOV to Left Side of Dash Panel	mm	2705	2705	0

DATA SHEET NO. 13

ACCIDENT INVESTIGATION DIVISION DATA

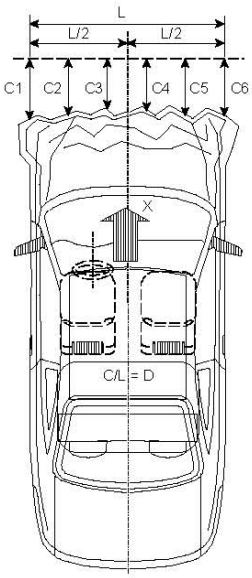
Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

VEHICLE INFORMATION

VIN: 1G1RC6E43BU100899 Wheelbase (mm): 2685
Vehicle Size Category: Pass Car Test Weight (kg): 1907.4

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 16
Cal. Procedure/Interval: MGA procedure / 6 month
Integration Algorithm: Trapezoidal Linearity: > 99%
Impact Velocity (km/h): 56.2
Velocity Change (km/h): 60.6
Time of Separation (msec): 97.9



CRUSH PROFILE

Collision Deformation Classification: Frontal
Midpoint of Damage: Centerline
Damage Region Length (mm): 1202
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4320	3966	354
C2	Crush zone 2 at left side	mm	4424	3960	464
C3	Crush zone 3 at left side	mm	4452	3990	462
C4	Crush zone 4 at right side	mm	4452	4000	452
C5	Crush zone 5 at right side	mm	4424	4010	414
C6	Crush zone 6 at right side	mm	4320	4015	305
L	C1 TO C6	mm	1202	1188	14

DATA SHEET NO. 14

VEHICLE INTRUSION MEASUREMENTS

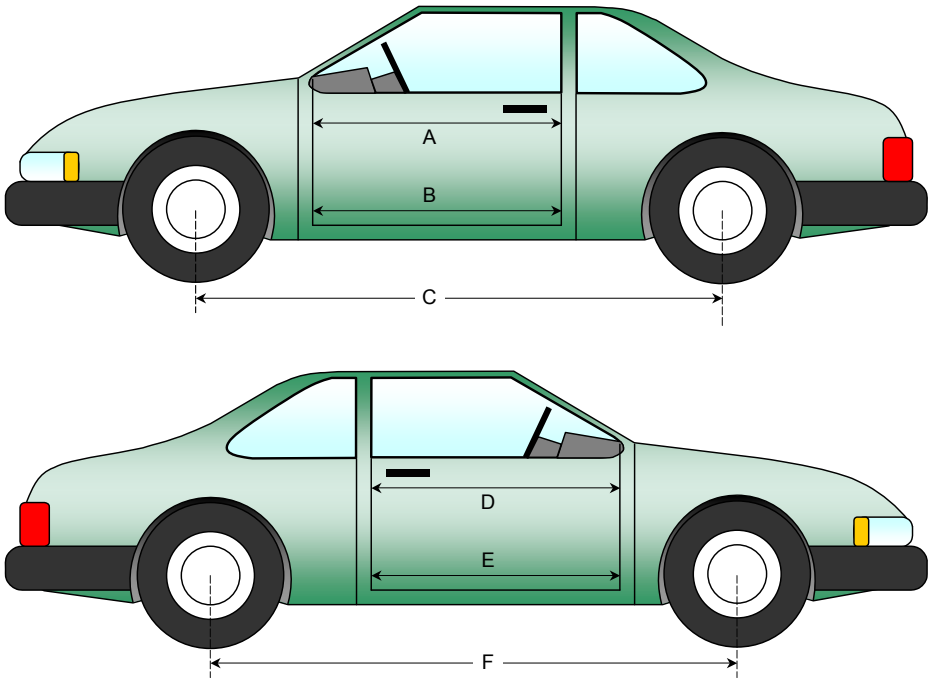
Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: MB0127
Test Date: 5/11/2011

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	966	965	1
B	Left Side Lower	mm	870	872	-2
D	Right Side Upper	mm	966	965	1
E	Right Side Lower	mm	870	870	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2685	2625	60
F	Right Side Wheelbase	mm	2685	2625	60



DATA SHEET NO. 14 (CONTINUED)

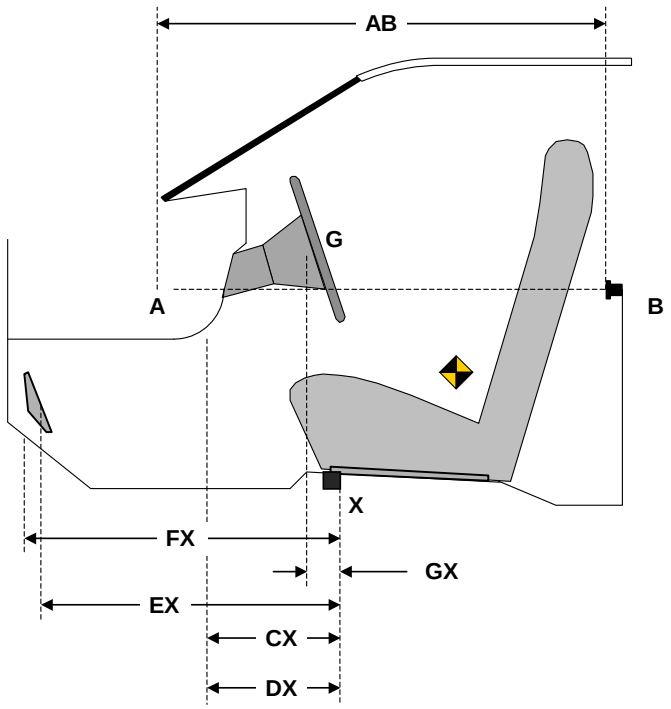
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	710	710	0
CX	Left Knee Bolster to X	mm	255	250	5
DX	Right Knee Bolster to X	mm	255	248	7
EX	Brake Pedal to X	mm	570	550	20
FX	Foot Rest to X	mm	614	605	9
GX	Center of Steering Column Wheel Hub to X	mm	75	95	-20

X = Front of Seat Track (stationary)

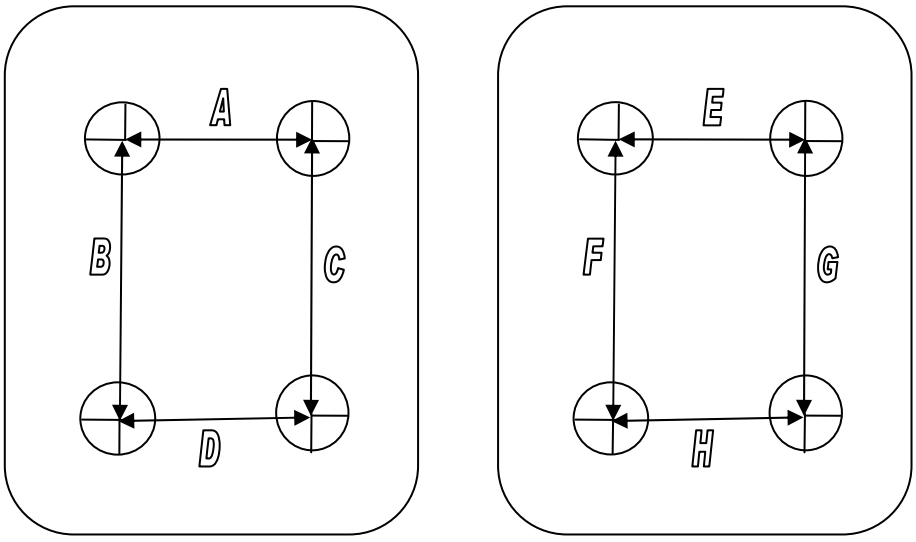


DRIVER COMPARTMENT

DATA SHEET NO. 14 (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011



Driver Passenger

TOP VIEW THROUGH FLOOR PAN

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Units	Pre-Test	Post-Test	Difference
A	mm	200	200	0
B	mm	200	200	0
C	mm	200	200	0
D	mm	200	200	0
E	mm	200	200	0
F	mm	200	200	0
G	mm	200	200	0
H	mm	200	200	0

DATA SHEET NO. 15

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

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

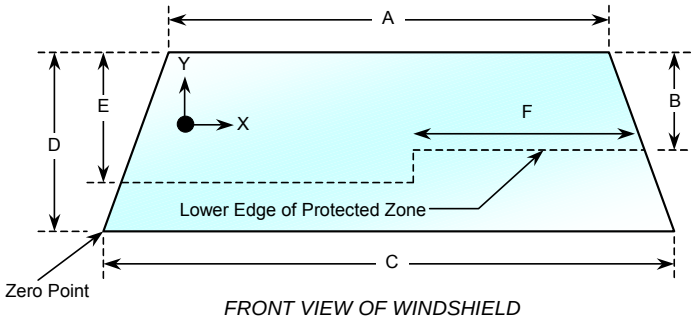
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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

Temperature of windshield molding during test: 21°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2078	2078	100
Right Side	2078	2078	100
Total	4156	4156	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1156
B	mm	475
C	mm	1390
D	mm	805
E	mm	468
F	mm	525

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:	2011 Chevrolet Volt 5-Dr Hatchback	NHTSA No.:	MB0127
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	5/11/2011

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Test Time: 11:31 am Temperature: 21° 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)

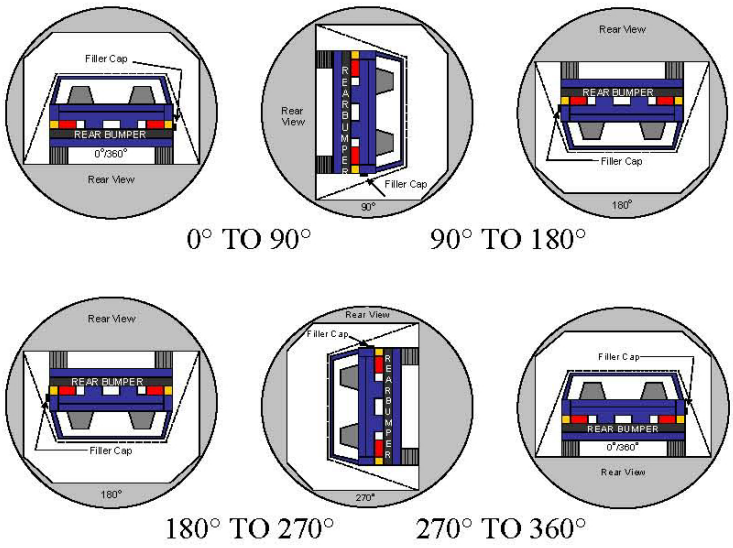
D. Spillage Details: None

DATA SHEET NO. 16

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

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



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	113	300	413
90° to 180°	113	300	413
180° to 270°	105	300	405
270° to 360°	112	300	412

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

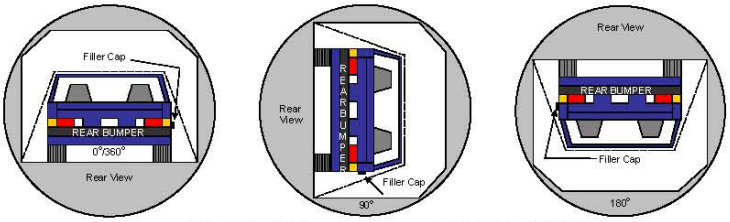
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	
90° to 180°	
180° to 270°	
270° to 360°	

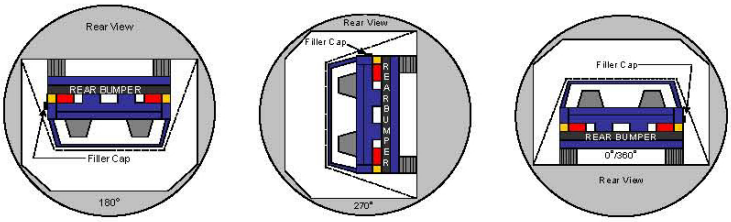
DATA SHEET 16A

FMVSS 305 STATIC ROLLOVER RESULTS FOR ELECTRIC-POWERED VEHICLES

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011



0° TO 90° 90° TO 180°



180° TO 270° 270° TO 360°

4. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
5. The position hold time at each position is 300 seconds (minimum).
6. Details of electrolyte spillage: **None**

ELECTROLYTE COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	113	300	413
90° to 180°	113	300	413
180° to 270°	105	300	405
270° to 360°	112	300	412

FMVSS 305 ELECTROLYTE SPILLAGE LOCATION TABLE (units in liters)

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

Total Spillage: __0__ L

	Yes	No
Is the total spillage of propulsion battery electrolyte greater than 5.0 Liters?		X
Is propulsion battery electrolyte spillage visible in the passenger compartment?		X

DATA SHEET 16A (CONTINUED)

FMVSS 305 STATIC ROLLOVER RESULTS FOR ELECTRIC-POWERED VEHICLES

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

VOLTMETER INFORMATION

Make:	Fluke
Model:	11
Serial Number:	68541895
Internal Impedance Value (MΩ):	>10 MΩ < 100 pF
Nominal Propulsion Battery Voltage (Vb) (V):	370

ELECTRICAL ISOLATION MEASUREMENT

V1 =	0	V	90°	Time:	2	Minutes	08	s
V1 =	0.2	V	180°	Time:	1	Minutes	54	s
V1 =	0.2	V	270°	Time:	1	Minutes	57	s
V1 =	0.1	V	360°	Time:	2	Minutes	01	s
V2 =	0	V	90°	Time:	2	Minutes	09	s
V2 =	0.1	V	180°	Time:	1	Minutes	57	s
V2 =	0.2	V	270°	Time:	2	Minutes	01	s
V2 =	0.1	V	360°	Time:	2	Minutes	05	s
V1' =	0	V	90°	Time:	2	Minutes	10	s
V1' =	0.1	V	180°	Time:	1	Minutes	56	s
V1' =	0	V	270°	Time:	1	Minutes	59	s
V1' =	0	V	360°	Time:	2	Minutes	02	s
V2' =	0	V	90°	Time:	2	Minutes	11	s
V2' =	0	V	180°	Time:	2	Minutes	09	s
V2' =	0.1	V	270°	Time:	2	Minutes	08	s
V2' =	0	V	360°	Time:	2	Minutes	06	s

DATA SHEET 16A (CONTINUED)

FMVSS 305 STATIC ROLLOVER RESULTS FOR ELECTRIC-POWERED VEHICLES

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

ELECTRICAL ISOLATION CALCULATION

Note: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

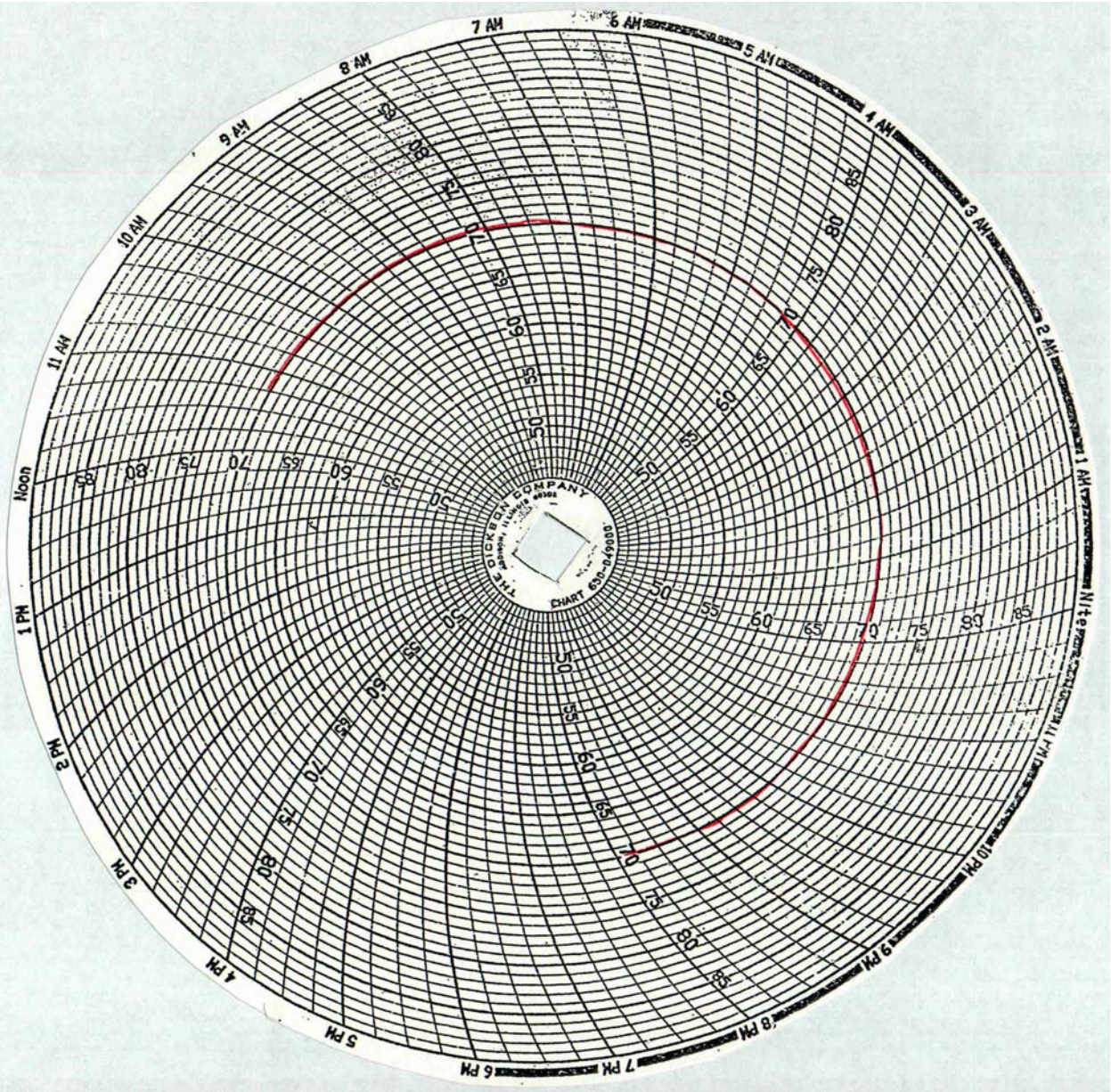
Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']								
Ri1 =	Zero Volts	Ω	90°	Time:	2	Minutes	09	s
Ri1 =	Zero Volts	Ω	180°	Time:	1	Minutes	57	s
Ri1 =	Zero Volts	Ω	270°	Time:	2	Minutes	01	s
Ri1 =	Zero Volts	Ω	360°	Time:	2	Minutes	05	s
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']								
Ri2 =	Zero Volts	Ω	90°	Time:	2	Minutes	11	s
Ri2 =	Zero Volts	Ω	180°	Time:	2	Minutes	09	s
Ri2 =	Zero Volts	Ω	270°	Time:	2	Minutes	08	s
Ri2 =	Zero Volts	Ω	360°	Time:	2	Minutes	06	s
Ri = The lesser of Ri1 and Ri2								
Ri =	Zero Volts	Ω	90°	Time:	2	Minutes	11	s
Ri =	Zero Volts	Ω	180°	Time:	2	Minutes	09	s
Ri =	Zero Volts	Ω	270°	Time:	2	Minutes	08	s
Ri =	Zero Volts	Ω	360°	Time:	2	Minutes	06	s
Ri/Vb = Electrical Isolation Value/Nominal Battery Voltage Minumum Electrical Isolation Value is 500 Ω /V								
Ri/Vb =	Zero Volts	Ω/V	90°	Time:	2	Minutes	11	s
Ri/Vb =	Zero Volts	Ω/V	180°	Time:	2	Minutes	09	s
Ri/Vb =	Zero Volts	Ω/V	270°	Time:	2	Minutes	08	s
Ri/Vb =	Zero Volts	Ω/V	360°	Time:	2	Minutes	06	s

	Yes	No, Fail
Is the measured Electrical Isolation Value ≥ 500 Ω/V?	X	

DATA SHEET NO. 17

DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011



DATA SHEET 18

PRE-IMPACT ELECTRIC ISOLATION MEASUREMENTS AND CALCULATIONS

Test Vehicle:	2011 Chevrolet Volt 5-Dr Hatchback	NHTSA No.:	MB0127
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	5/11/2011

VOLTMETER INFORMATION

Make:	Fluke
Model:	11
Serial Number:	68541895
Internal Impedance Value (MΩ):	>10 MΩ < 100 pF
Resolution (V):	0.001
Last Calibration Date:	1/24/2011

PROPULSION BATTERY VOLTAGE

Measurement shall be made with propulsion battery connected to the vehicle propulsion system, and the vehicle in the “ready-to-drive” (Propulsion motor(s) activated) position.

If voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.

Vb (V):	387.4

PROPULSION BATTERY TO VEHICLE CHASSIS

Vehicle chassis point(s) determined and supplied to contractor by COTR.

V1 (V):	184.1
V2 (V):	270.8

PROPULSION BATTERY TO VEHICLE CHASSIS ACROSS RESISTOR

The known resistance Ro (in ohms) should be approximately 500 times the normal operating voltage of the vehicle (in volts) per SAE J1766.

Ro (Ω):	200 K Ω

DATA SHEET 18 (CONTINUED)

PRE-IMPACT ELECTRIC ISOLATION MEASUREMENTS AND CALCULATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

ELECTRICAL ISOLATION MEASUREMENT

Note: If measured voltage is zero and results in a division by zero, record “Zero Volts”. This “zero voltage” condition is considered as being compliant.

V1’ (V):	77.2
Ri1 = Ro (1 + V2/V1) [(V1-V1’)/V1’]	
Ri1 (Ω):	684 K
V2’ (V):	63.2
Ri2 = R0 (1 + V1/V2) [(V2-V2’)/V2’]	
Ri2 (Ω):	1104 K
Ri = The lesser of Ri1 and Ri2	
Ri Pre-Test ((Ω):	684 K
Ri/Vb (Ω/V):	1768 (Electrical Isolation Value)
Minimum Electrical Isolation Value is 500 Ω/V	

	Yes	No, Fail
Is the measured Electrical Isolation Value ≥ 500 Ω/V?	X	

DATA SHEET 19

POST-IMPACT ELECTRIC ISOLATION MEASUREMENTS AND CALCULATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

VOLTMETER INFORMATION

Make:	Fluke
Model:	11
Serial Number:	68541895
Internal Impedance Value (MΩ):	>10 MΩ < 100 pF
Nominal Propulsion Battery Voltage (Vb) (V):	370

PROPULSION BATTERY VOLTAGE

NOTE: Record V1, V2, V1', V2' voltage measurements immediately after the impacted vehicle **comes to rest.**

VB =	2.4	V	Impact Time:	0	Minutes	46	s
V1 =	1.0	V	Impact Time:	0	Minutes	55	s
V2 =	0.3	V	Impact Time:	1	Minutes	07	s
V1' =	0.1	V	Impact Time:	1	Minutes	15	s
V2' =	0.1	V	Impact Time:	1	Minutes	22	s

ELECTRICAL ISOLATION MEASUREMENT

Note: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']							
Ri1 =	2340 K	Ω	Impact Time:	1	Minutes	15	s
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']							
Ri2 =	1733 K	Ω	Impact Time:	1	Minutes	22	s
Ri = The lesser of Ri1 and Ri2							
Ri =	1733 K	Ω	Impact Time:	1	Minutes	22	s
Ri/Vb = electrical Isolation Value/Nominal Battery Voltage							
Minimum Electrical Value is 500 Ω/V							
Ri/Vb =	4478	Ω/V	Impact Time:	1	Minutes	22	s

	Yes	No, Fail
Is the measured Electrical Isolation Value ≥ 500 Ω/V?	X	

DATA SHEET 19 (CONTINUED)

POST-IMPACT ELECTRIC ISOLATION MEASUREMENTS AND CALCULATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0127
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/11/2011

PROPULSION BATTERY SYSTEM COMPONENTS

Describe Propulsion Battery Module movement within the passenger compartment [Supply photographs as appropriate]:
Not Applicable

	Yes	No
Has the Propulsion Battery Module moved within the passenger compartment?		X

Describe intrusion of an outside Propulsion Battery Component into the passenger compartment [Supply photographs as appropriate]:
No Intrusion

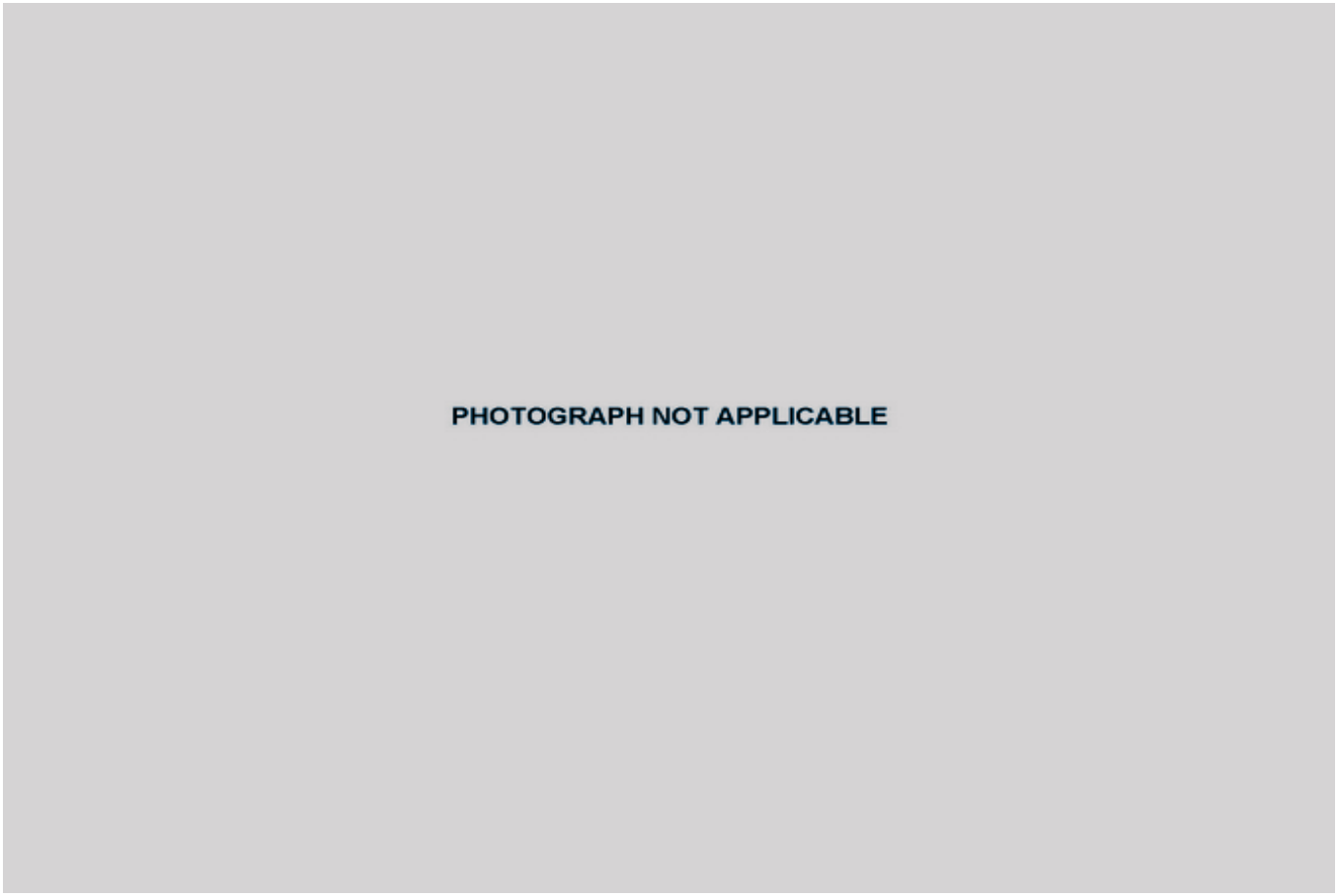
	Yes	No
Has an outside Propulsion Battery Component intruded into the passenger compartment?		X

	Yes	No
Is propulsion battery electrolyte spillage visible in the passenger compartment?		X

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS



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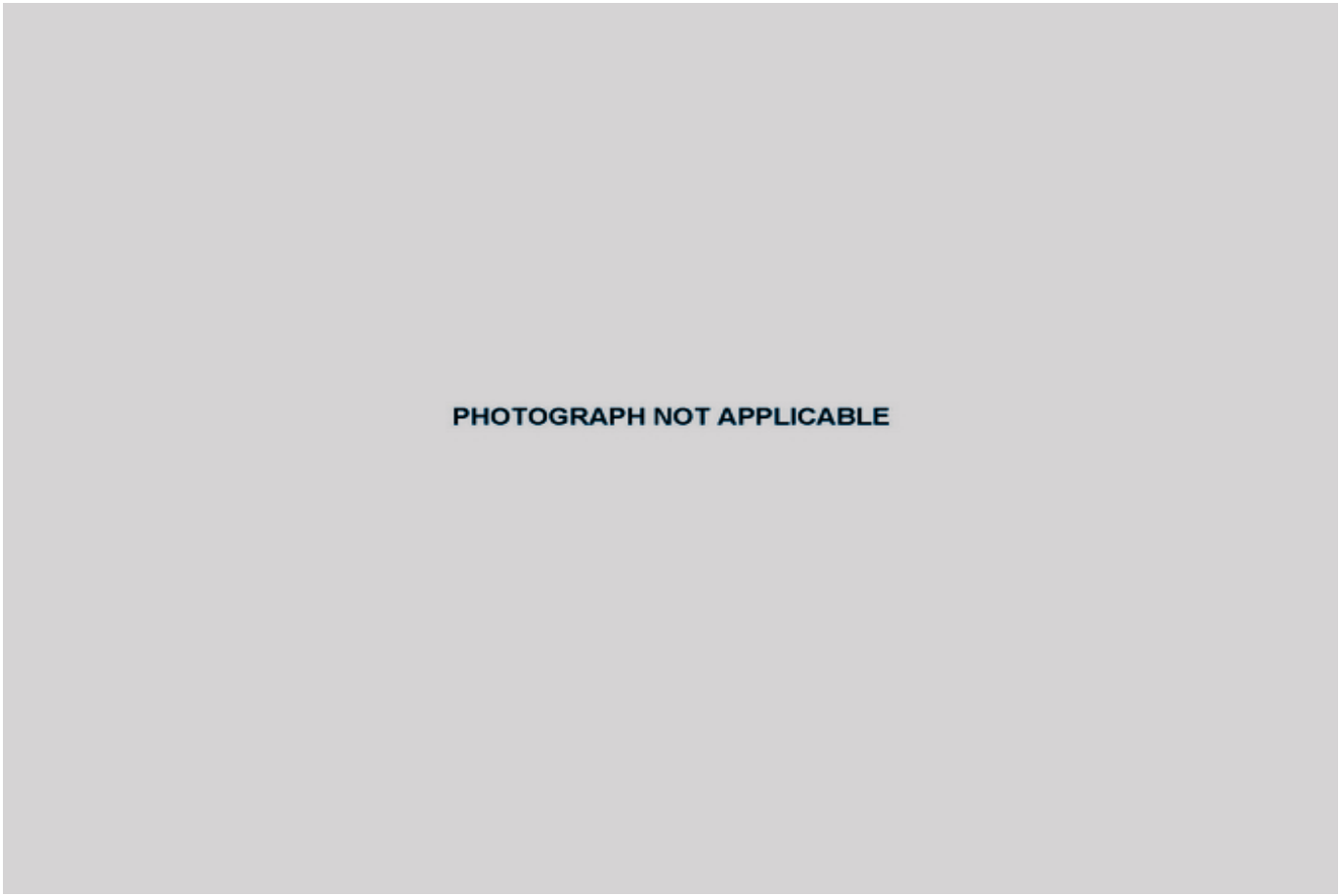


Load Cell Wall

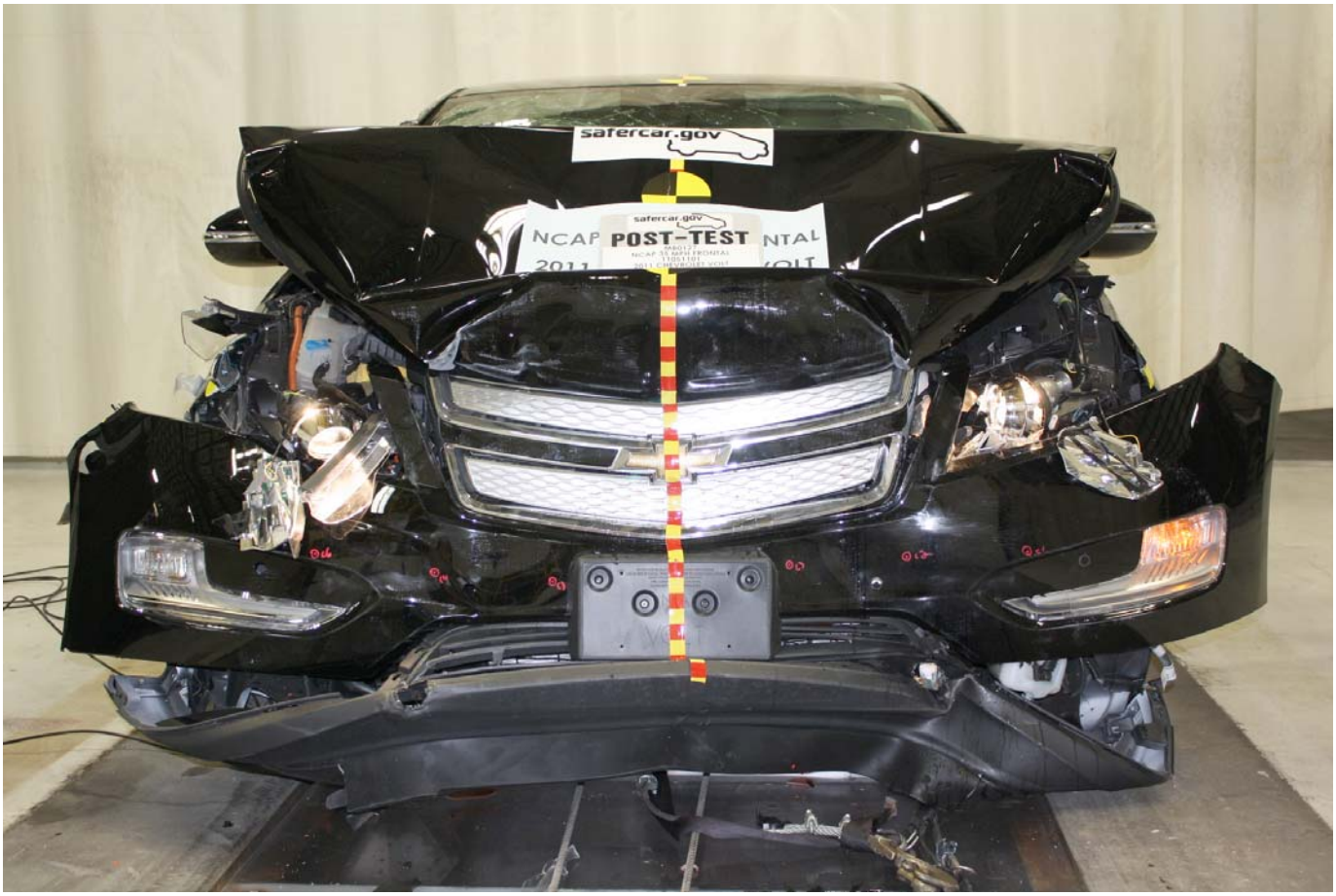
Manufacturer's Label

Tire Placard

Right Front Three-Quarter View, As Received

Left Rear Three-Quarter View, As Received

Pre-Test Front View



Post-Test Front View

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

Post-Test Left Side View

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

Post-Test Right Side View

Pre-Test Right Front Three-Quarter View

Post-Test Right Front Three-Quarter View

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

Post-Test Left Rear Three-Quarter View

Pre-Test Windshield View

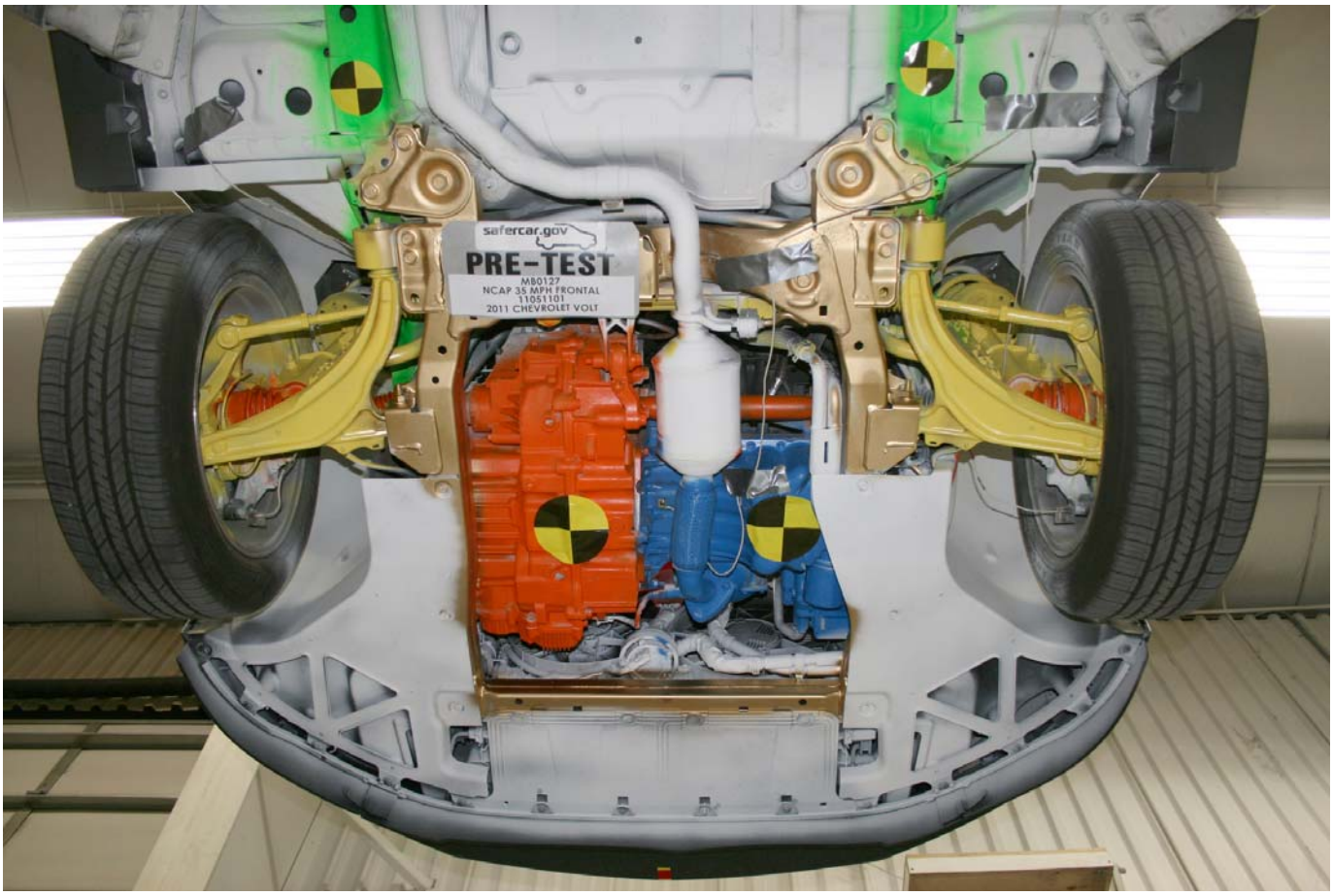
Post-Test Windshield View

Pre-Test Engine Compartment View

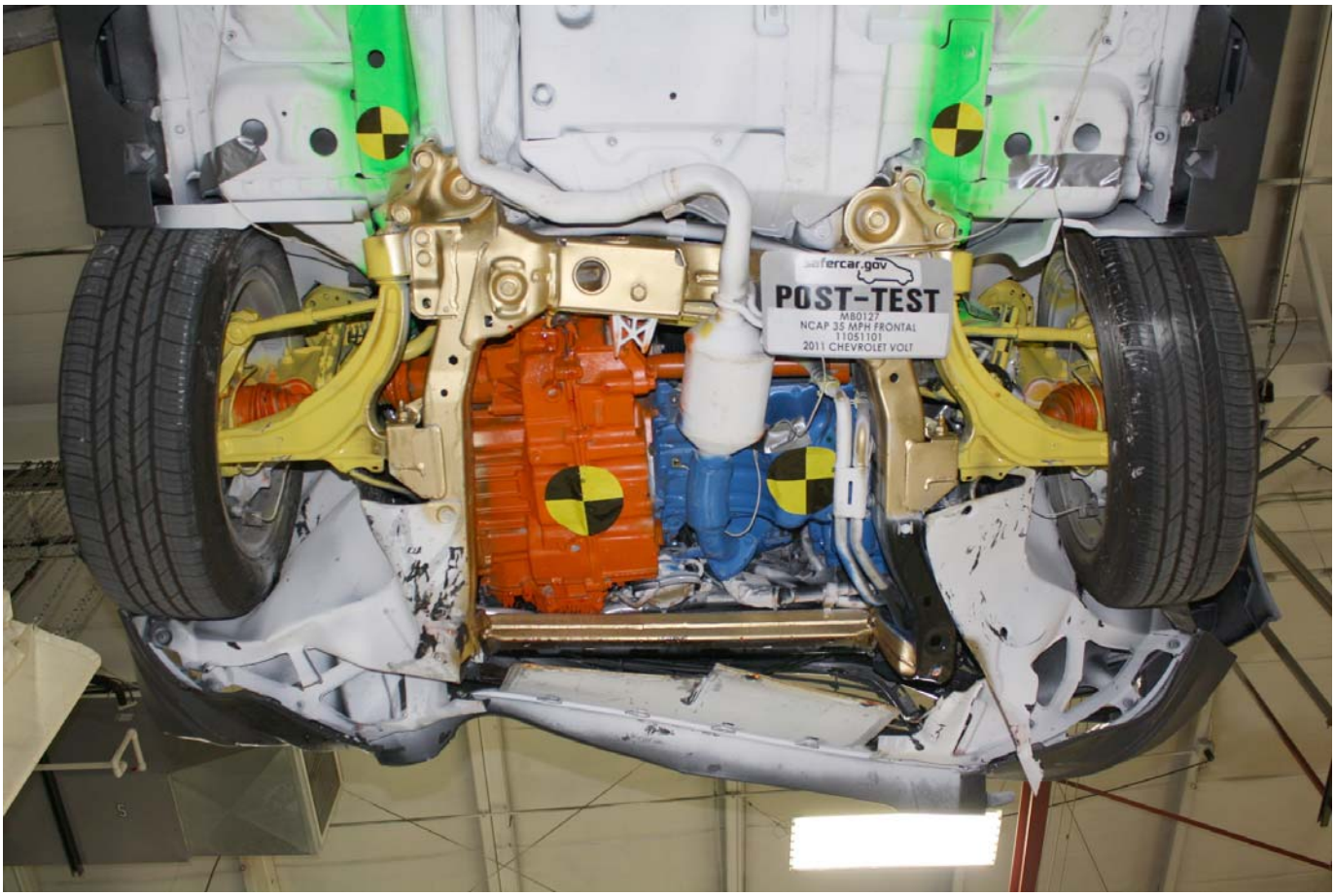
Post-Test Engine Compartment View

Pre-Test Fuel Cap View

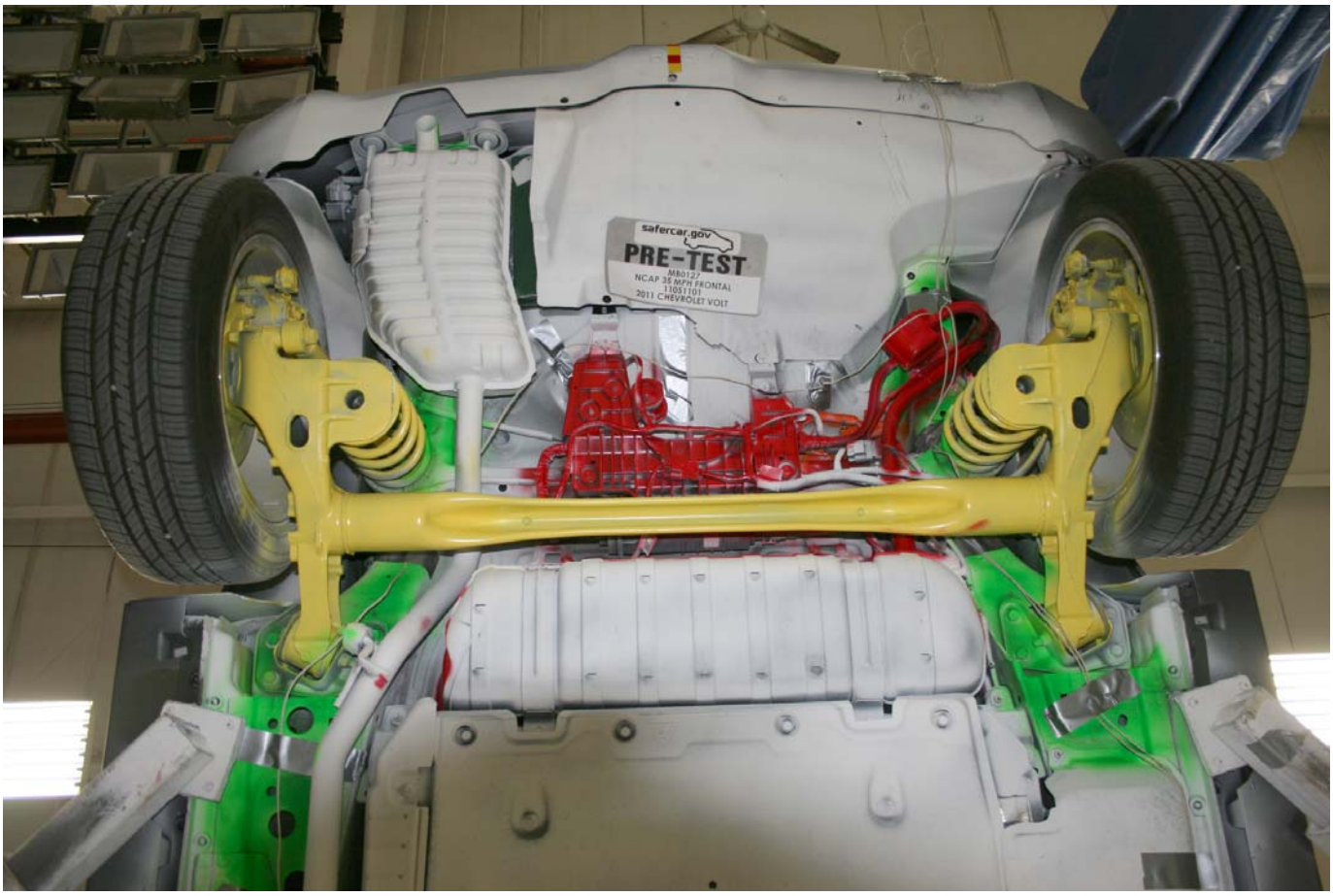
Post-Test Fuel Cap View



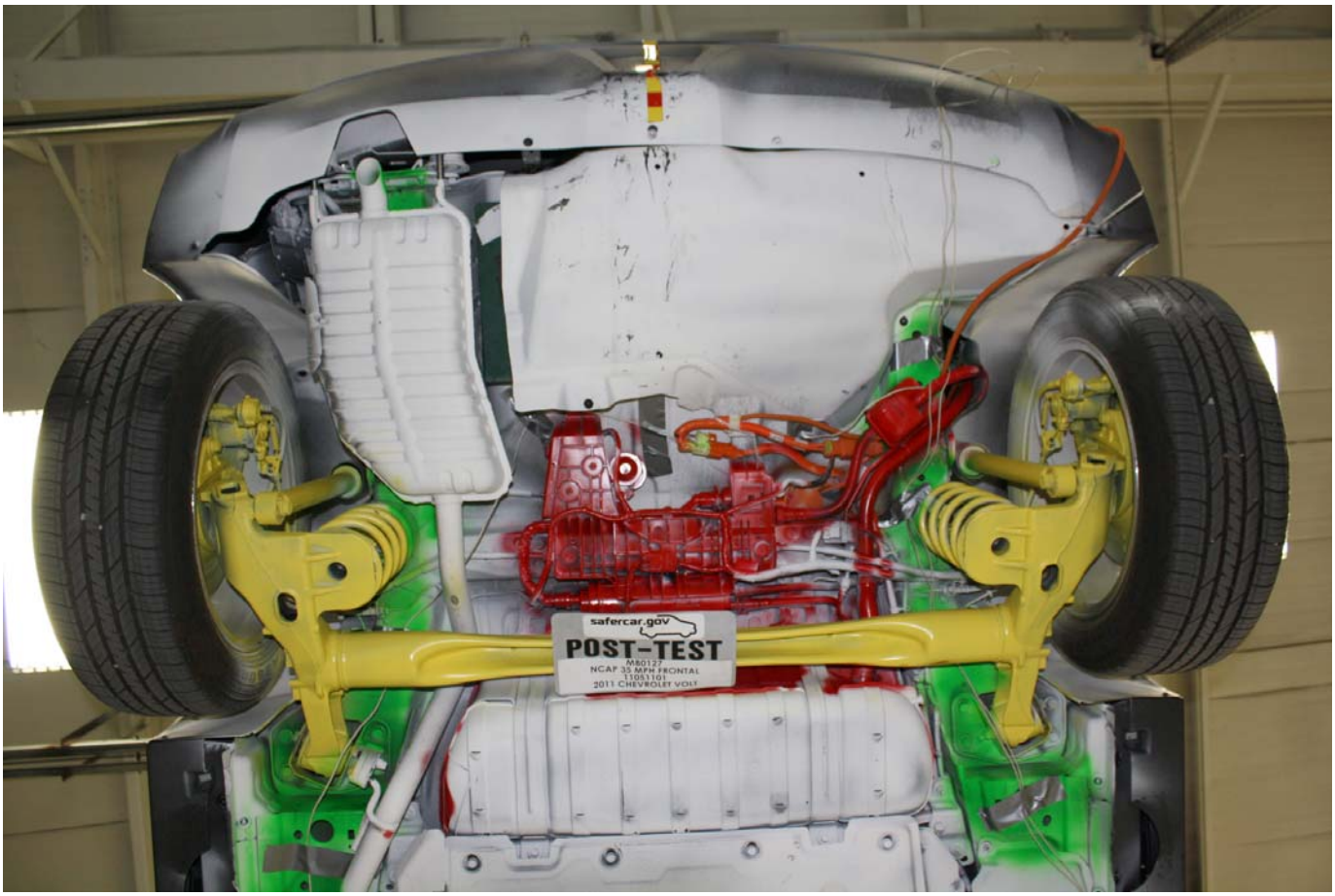
Pre-Test Front Underbody View



Post-Test Front Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View

Pre-Test Dummy Cable Routing

Post-Test Dummy Cable Routing

Pre-Test Driver Dummy Front View

Post-Test Driver Dummy Front View

Pre-Test Driver Dummy Window View

Post-Test Driver Dummy Window View

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

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

Pre-Test Driver's Seat Fore-Aft Markings

Post-Test Driver's Seat Fore-Aft Markings

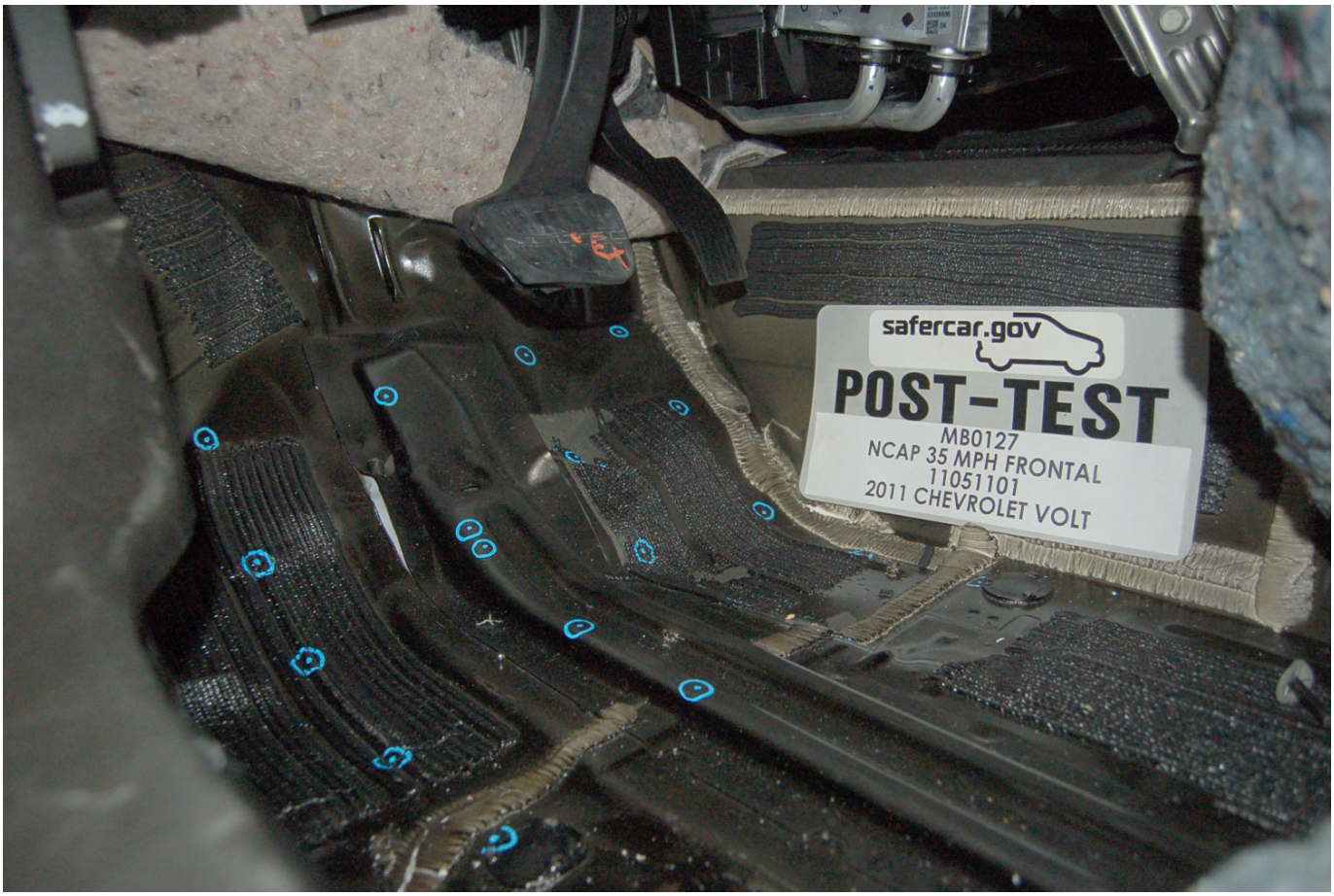
Pre-Test Driver Dummy Feet

Post-Test Driver Dummy Feet

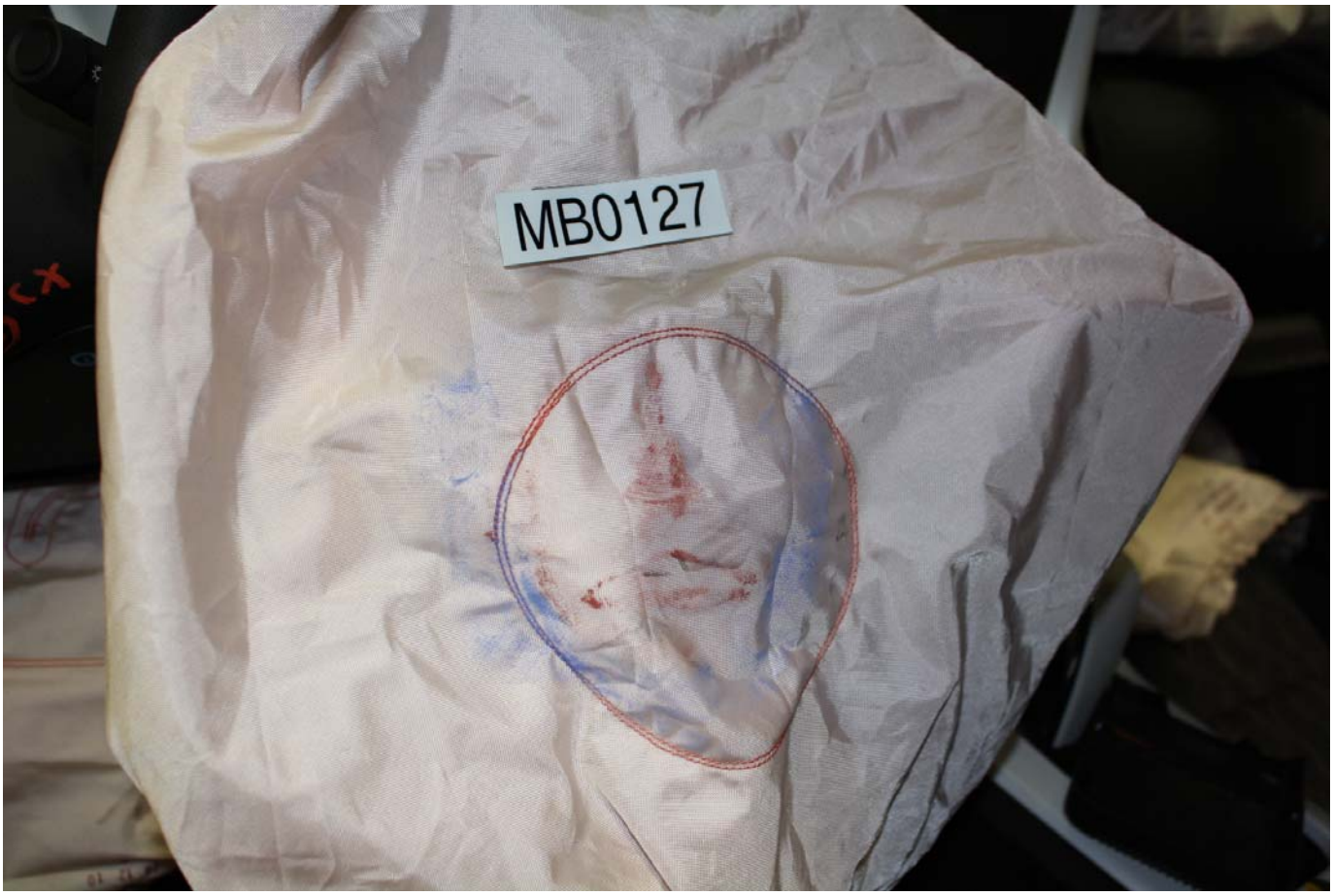
Pre-Test Driver's Side Knee Bolster (without dummy)

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

Pre-Test Driver's Side Floorpan



Post-Test Driver's Side Floorpan



Post-Test Driver Dummy Contact with Airbag

Post-Test Driver Dummy Contact with Headrest

Post-Test Driver Dummy Contact with Knee Airbag

Pre-Test View of Steering Column Shear Capsule

Post-Test View of Steering Column Shear Capsule

Pre-Test Passenger Dummy Front View

Post-Test Passenger Dummy Front View

Pre-Test Passenger Dummy Window View

Post-Test Passenger Dummy Window View

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

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

Pre-Test Passenger's Seat Fore-Aft Markings

Post-Test Passenger's Seat Fore-Aft Markings

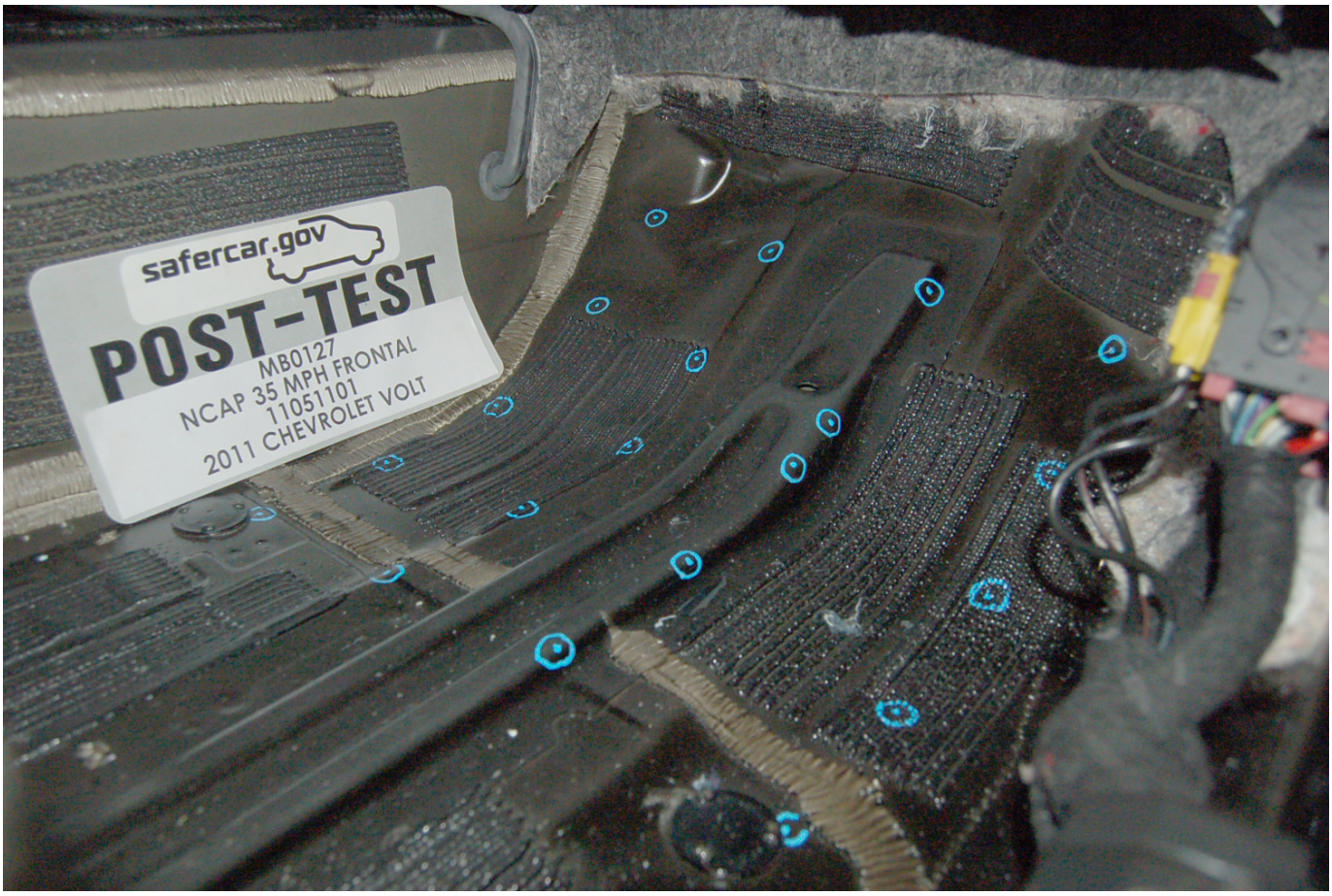
Pre-Test Passenger Dummy Feet

Post-Test Passenger Dummy Feet

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

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

Pre-Test Passenger's Side Floorpan

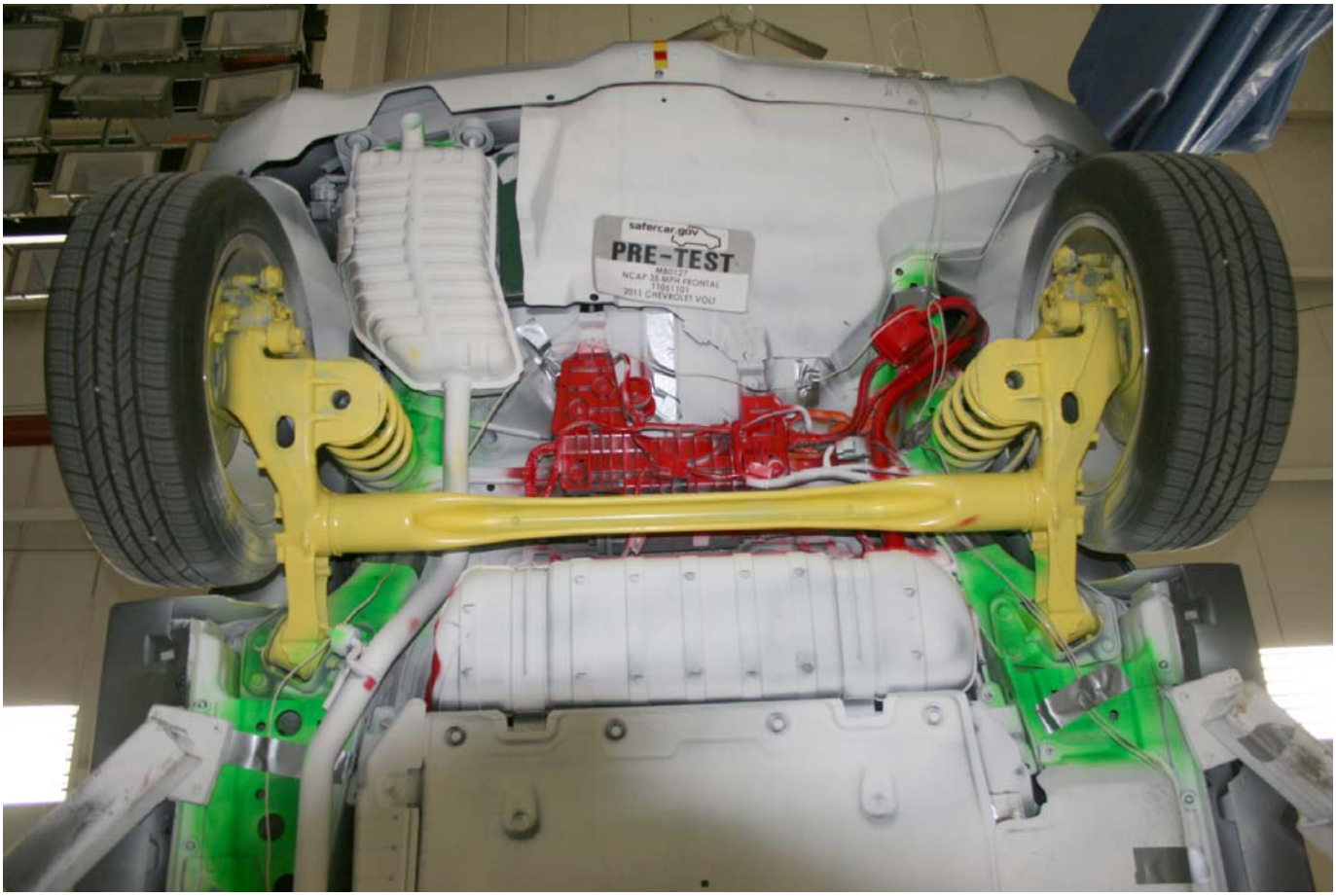


Post-Test Passenger's Side Floorpan

Post-Test Passenger Dummy Contact with Airbag

Post-Test Passenger Dummy Contact with Headrest

Post-Test Passenger Dummy Contact with Knee Airbag



Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

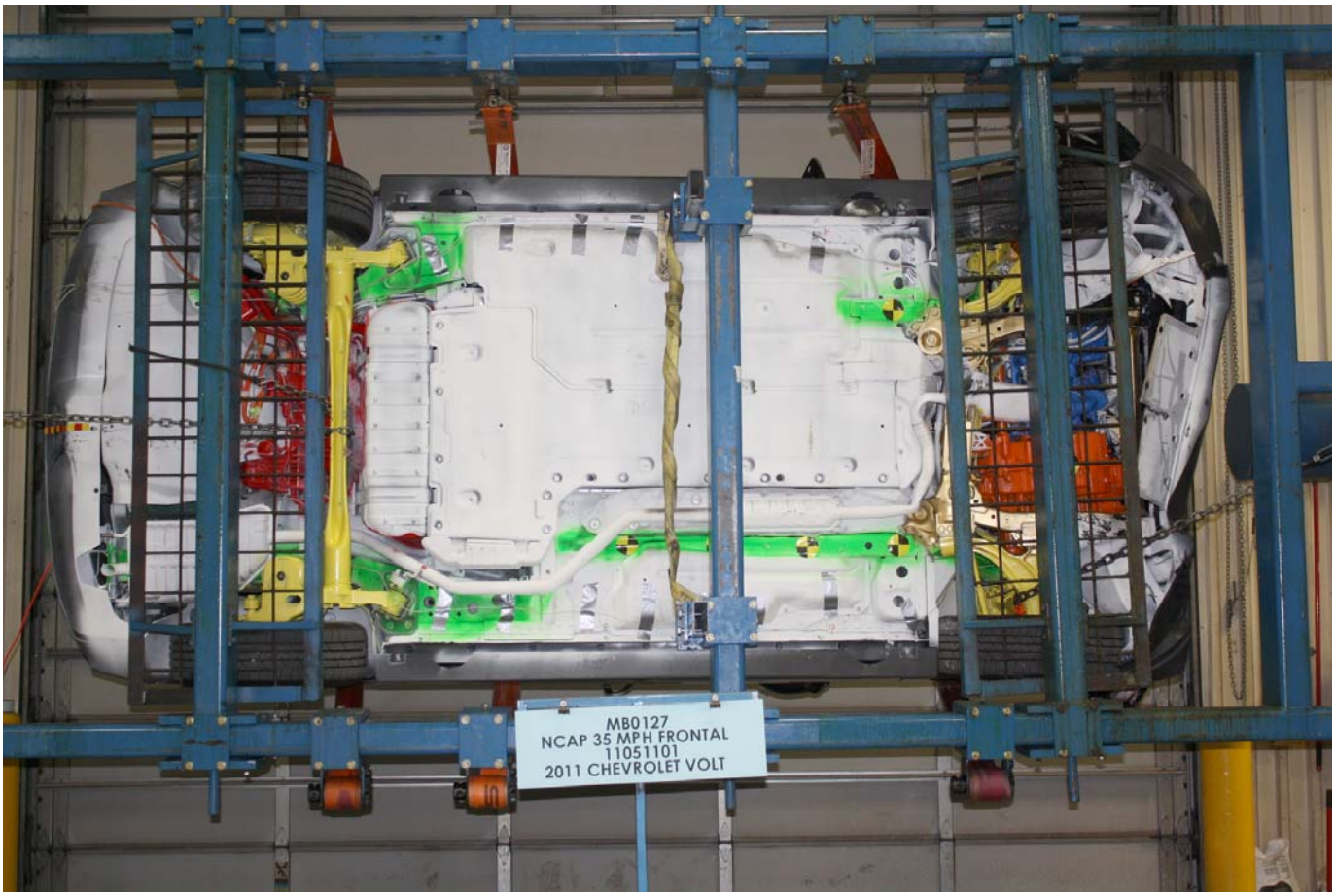
Post-Test Stoddard Solvent Spillage Location View

Post-Test Speed Trap Read-Out

Vehicle at 0 Degrees on Static Rollover Device

Vehicle at 90 Degrees on Static Rollover Device

Vehicle at 180 Degrees on Static Rollover Device



Vehicle at 270 Degrees on Static Rollover Device

Vehicle at 360 Degrees on Static Rollover Device

Vehicle Impact

CHEVROLET

2011 CHEVROLET VOLT

EXTERIOR: BLACK
INTERIOR: JET BLACK/CERAMIC WHITE

ENGINE, RANGE EXTENDER, 1.4L
ELECTRIC DRIVE UNIT, VOLTEC

STANDARD EQUIPMENT

ITEMS FEATURED BELOW ARE INCLUDED AT NO EXTRA CHARGE IN THE STANDARD VEHICLE PRICE SHOWN

- 8 YEAR / 100,000 MILE BATTERY AND VOLTEC COMPONENT LIMITED WARRANTY SEE DEALER FOR DETAILS
- 5 YEAR / 100,000 MILE POWERTRAIN LIMITED WARRANTY SEE DEALER FOR DETAILS

MECHANICAL

- BATTERY, PROPULSION, LITHIUM ION
- ELECTRIC DRIVE UNIT, VOLTEC
- ENGINE, RANGE EXTENDER, 1.4L INTERNAL COMBUSTION ENGINE
- TIRE SEALANT & INFLATOR KIT IN PLACE OF SPARE TIRE

SAFETY AND SECURITY

- AIRBAGS, DUAL-STAGE FRONTAL, SIDE-IMPACT, & KNEE FOR DRIVER AND FRONT PASSENGER
- AIRBAGS, ROOF RAIL SIDE-IMPACT FOR FRONT AND REAR OUTBOARD SEATING POSITIONS
- ANTILOCK BRAKE SYSTEM, 4 WHEEL DISC
- REAR CHILD SEAT LATCH ANCHORS
- THEFT DETERRENT SYSTEM, CONTENT THEFT ALARM
- DAYTIME RUNNING LAMPS
- STABILITRAK-STABILITY CONTROL
- REMOTE KEYLESS ENTRY WITH REMOTE START
- PEDESTRIAN FRIENDLY ALERT
- POWER DOOR LOCKS WITH LOCKOUT PROTECTION
- HEADLAMPS, AUTO ON/OFF
- TIRE PRESSURE MONITOR
- 5 YEARS ONSTAR DIRECTIONS AND CONNECTIONS WITH AUTOMATIC CRASH RESPONSE

EXTERIOR

- MIRRORS, OUTSIDE HEATED, POWER ADJUSTABLE, BODY COLOR
- REAR WINDOW DEFROSTER
- WINDSHIELD WIPERS VARIABLE & INTERMITTENT
- WINDSHIELD, SOLAR ABSORBING
- CHILD LOCKS, REAR DOORS & WINDOWS
- WHEELS, 17" FORGED PAINTED ALUMINUM

INTERIOR

- 30 GB AUDIO HARD DRIVE
- AUDIO SYSTEM W/ NAVIGATION, DVD ROM
- AIR CONDITIONING, AUTOMATIC
- AUXILIARY AUDIO INPUT JACK
- FLOOR MATS, CARPET FRONT/REAR
- INSIDE REARVIEW MIRROR, AUTO DIMMING
- STEERING COLUMN, TILT & TELESCOPING
- VISORS, ILLUMINATED VANITY MIRRORS
- EFFICIENCY DISPLAY SCREENS W/ PROGRAMMABLE CHARGE TIMES
- STEERING WHEEL RADIO CONTROLS
- CRUISE CONTROL
- FRONT BUCKET SEATS, MANUAL DRIVER & PASS ADJUST
- REAR SEAT, 40/40 SPLIT FOLDING SEATBACK
- POWER WINDOWS EXPRESS DOWN, DRIVER EXPRESS UP
- USB PORT
- XM RADIO INCL XM NAVTRAFFIC/LOCAL FORECAST - SERVICE SUBSCRIPTION SOLD SEPARATELY BY SIRIUS/XM AFTER 3 MTHS
- UNIVERSAL HOME REMOTE
- BLUETOOTH FOR PHONE
- BOSE PREMIUM AUDIO

OTHER

- CHARGE CORD, 120 V PORTABLE

Visit us at www.chevy.com

OPTIONS & PRICING

	MANUFACTURER'S SUGGESTED RETAIL PRICE
STANDARD VEHICLE PRICE	**$40,280.00**
OPTIONS INSTALLED BY THE MANUFACTURER (MAY REPLACE STANDARD EQUIPMENT SHOWN)	
REAR CAMERA & PARK ASSIST PACKAGE INCLUDES: • ULTRASONIC FRONT & REAR PARK ASSIST • REAR VISION CAMERA SYSTEM	695.00
FRONT LICENSE PLATE BRACKET	15.00
TOTAL OPTIONS	$710.00
TOTAL VEHICLE & OPTIONS	$40,990.00
DESTINATION CHARGE	720.00
TOTAL VEHICLE PRICE*	**$41,710.00**

2011 MOTOR TREND CAR OF THE YEAR®

EPA Fuel Economy and Environmental Comparisons

Charge Time 4 hours @ 240V

All Electric — When battery is fully charged, first 35 miles only.
93 MPG equivalent — 36 kW-hrs per 100 miles — combined city/hwy
$601

Gas Only — When electricity is used up, runs on gas for another 344 miles.
37 MPG — 2.7 gallons per 100 miles — combined city/hwy
$1,302

Range (Miles): All Electric Range (battery) 35; total 379
0 10 20 30 40 50 60 350 360 370

How This Vehicle Compares (combined composite) Among all vehicles and within compact cars: 60

Other Air Pollutants: 6

Examples: Charging Routines

Miles driven between full charge	Fuel Economy MPG	Electricity Consumed	Electricity + Fuel Energy Cost
30	N/A	10.9 kWh	4¢/mi
60	89	12.9 kWh	6¢/mi
Never Charge	37 35 city / 40 hwy	N/A	9¢/mi

GOVERNMENT SAFETY RATINGS

This vehicle has not been rated by the government for frontal crash, side crash or rollover risk.

Source: National Highway Traffic Safety Administration (NHTSA).

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

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE:
U.S./CANADIAN PARTS CONTENT: 40%
MAJOR SOURCES OF FOREIGN PARTS CONTENT: KOREA 20%

NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.

FOR THIS VEHICLE:
FINAL ASSEMBLY POINT: DETROIT, MI U.S.A.
COUNTRY OF ORIGIN:
ENGINE: AUSTRIA
TRANSMISSION (ELECTRIC DRIVE UNIT): JAPAN

This label has been applied pursuant to Federal law - Do not remove prior to delivery to the ultimate purchaser. *Includes Manufacturer's Recommended Pre-Delivery Service. Does not include dealer installed options and accessories not listed above, local taxes or license fees.

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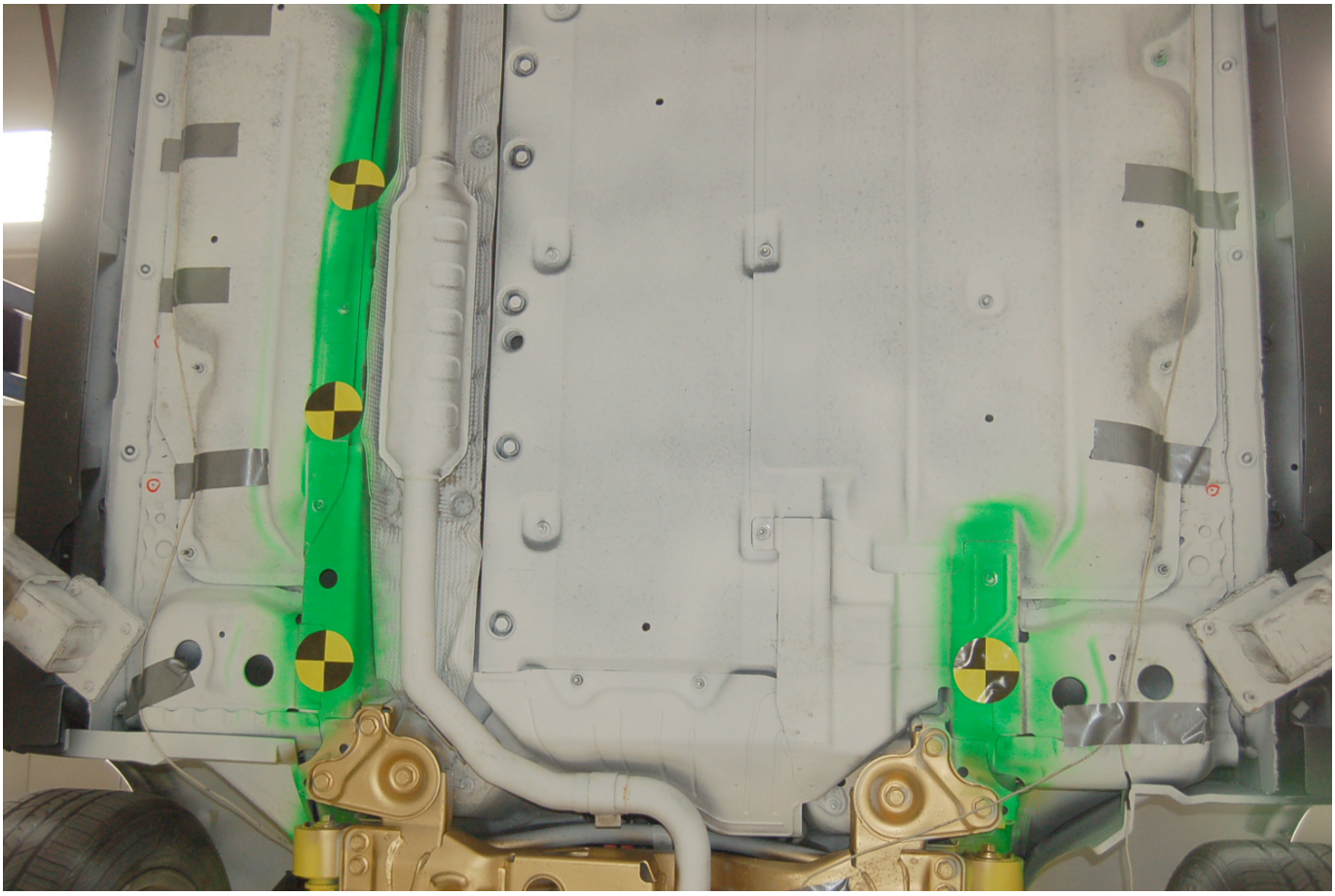
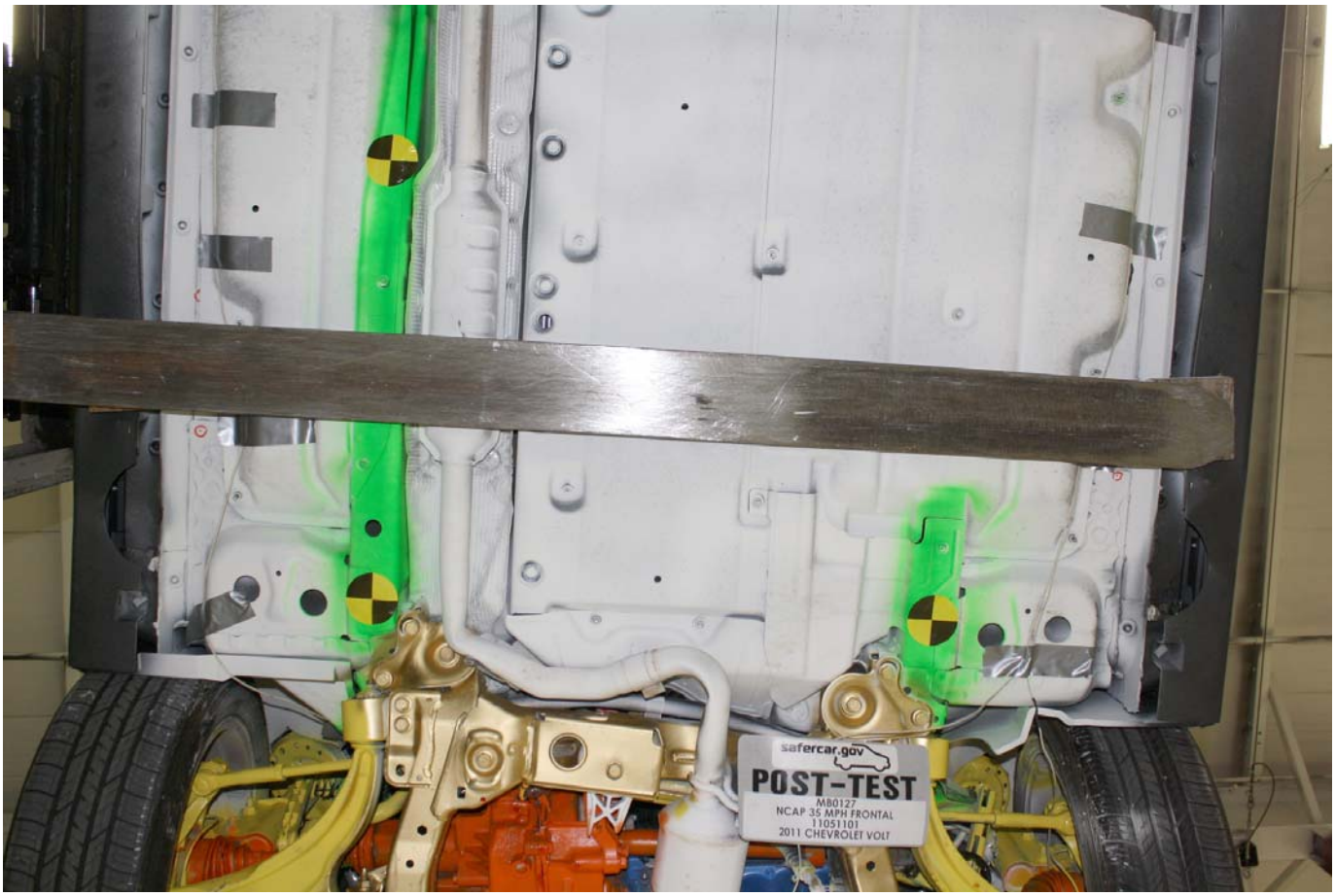
ORDER NO PHJFTT SALES CODE E
SALES MODEL CODE 1RC68
DEALER NO 02098
FINAL ASSEMBLY: DETROIT, MI U.S.A.
VIN 1G1RC6E43BU100899
DEALER TO WHOM DELIVERED
OASIS CHEVROLET, L.L.C.
PO BOX 448
OLD BRIDGE, NJ 08857-0448

NZ
1OO957474

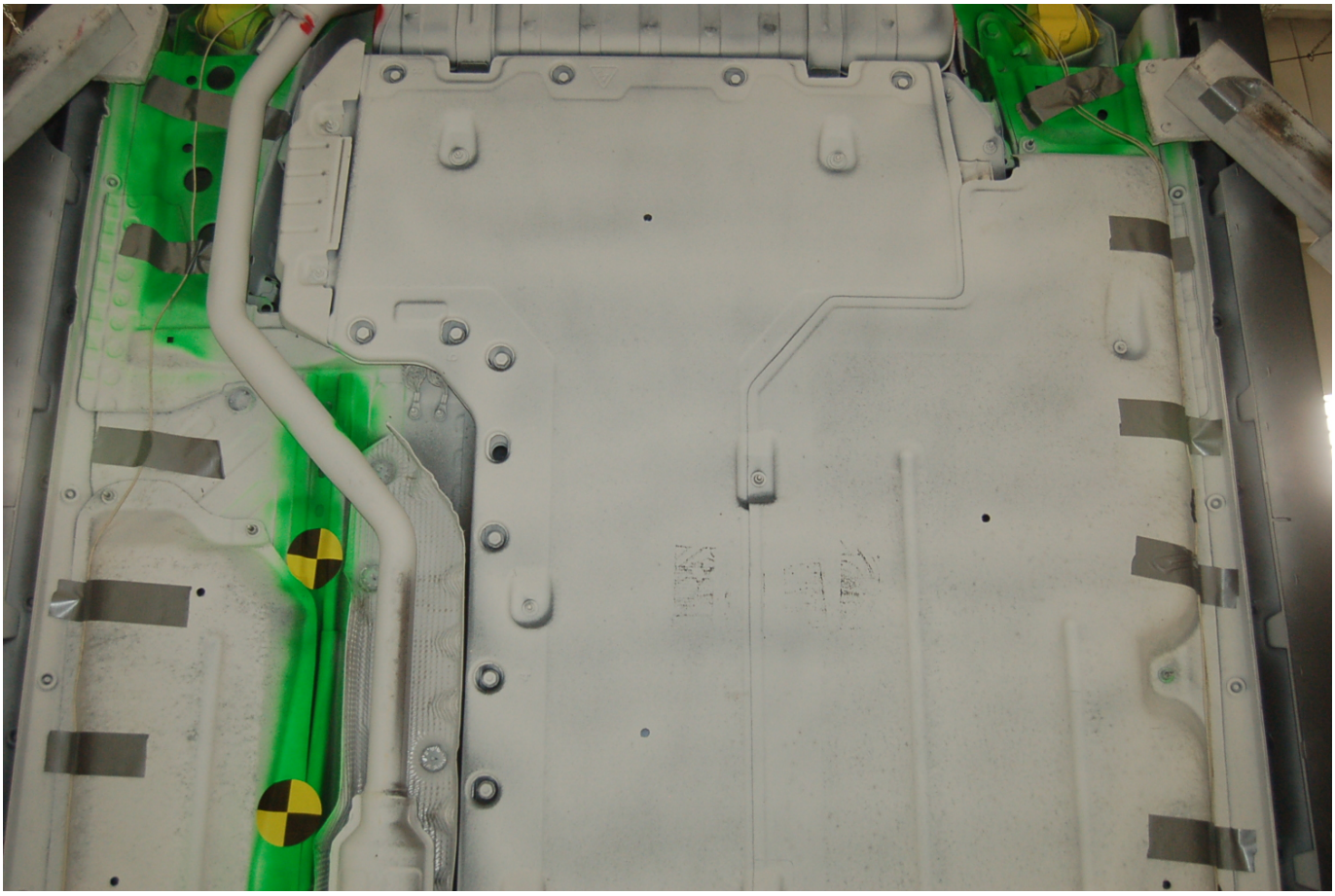
Monroney Label



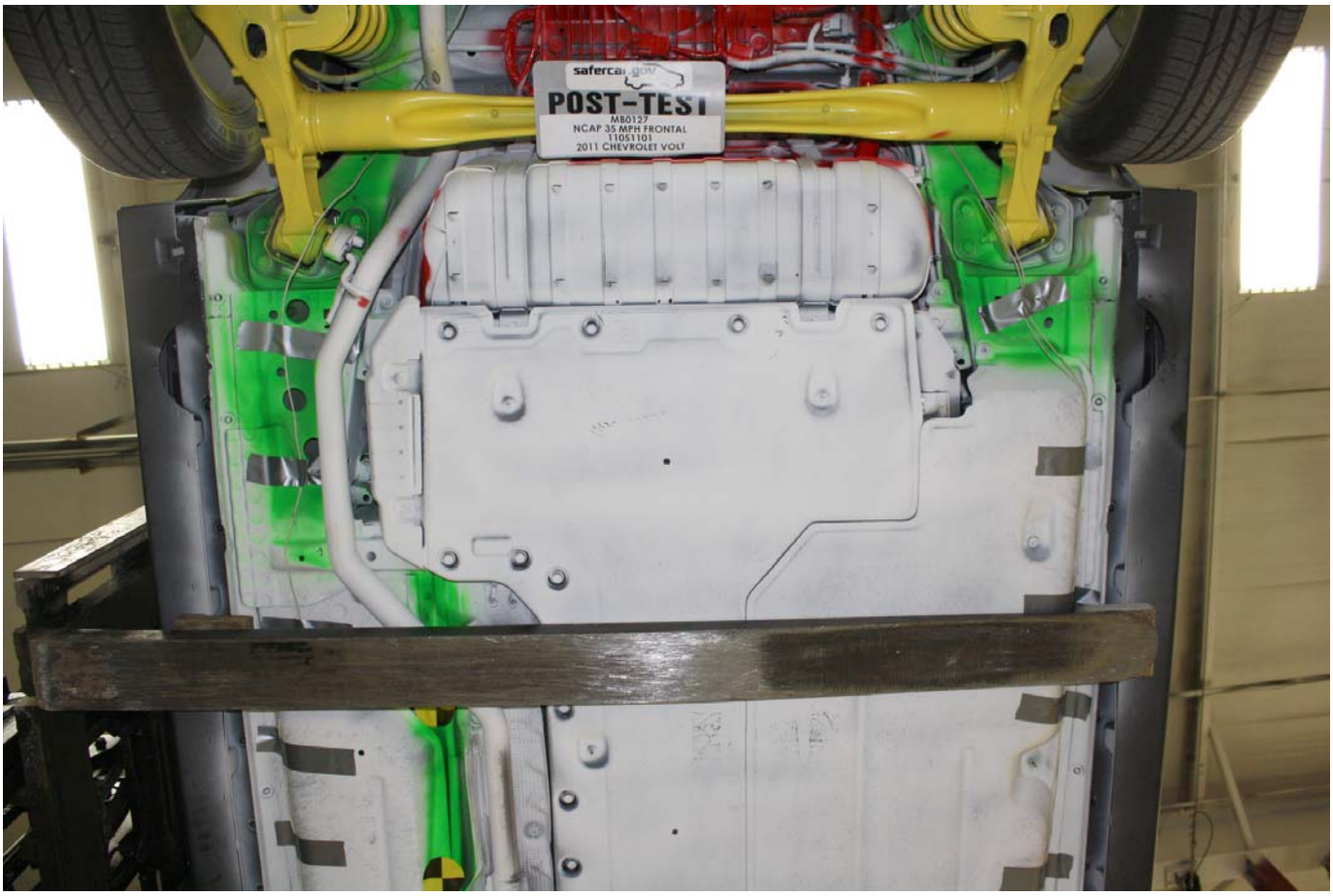
Pre-Test View of Propulsion Battery (Front View)



Post-Test View of Propulsion Battery (Front View)

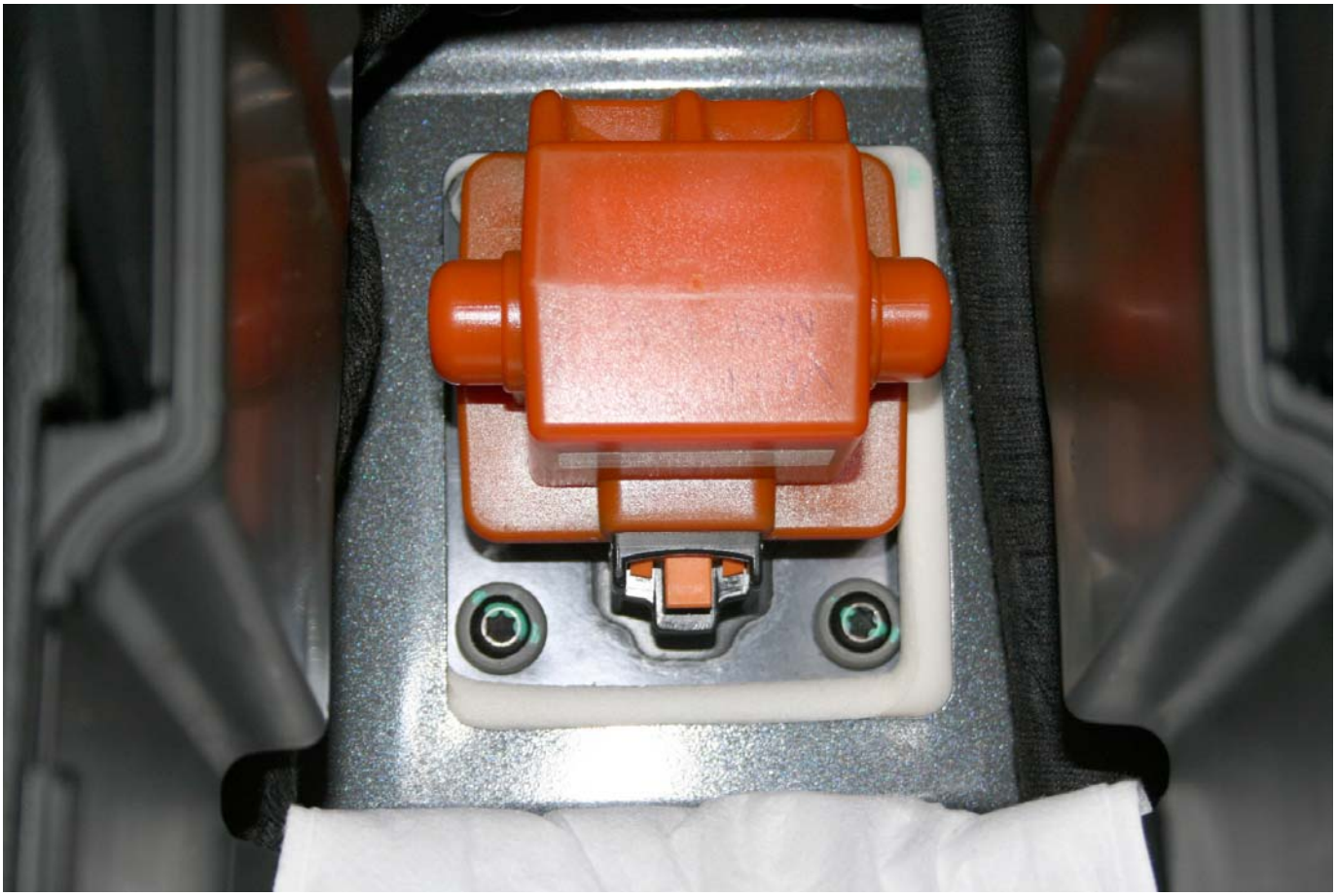


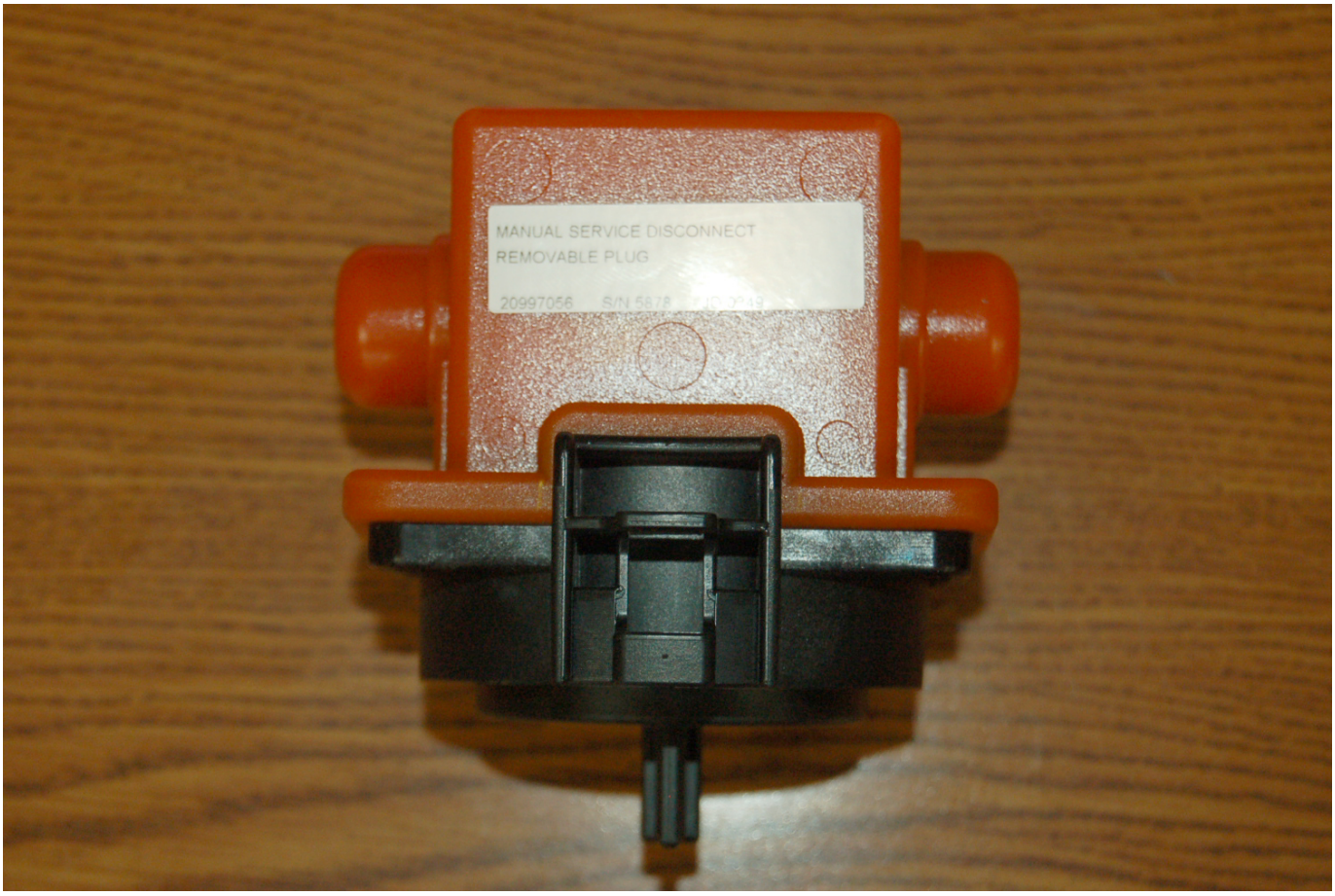
Pre-Test View of Propulsion Battery (Rear View)



Post-Test View of Propulsion Battery (Rear View)

View of Electric Propulsion Drive


Manual High Voltage Service Disconnect



Manual High Voltage Service Disconnect

First Responder Warning Label

First Responder Warning Location

Auxiliary Power Module Warning Label

Power Inverter Warning Label

Close-Up of Ground Lead Attached

Close-Up of High Voltage Leads Attached

APPENDIX B

DUMMY RESPONSE DATA

TABLE OF DATA PLOTS

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

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Upper Neck Force Y

Driver Upper Neck Moment X

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

Driver Left Femur Redundant

Driver Right Femur Redundant

Driver Shoulder Belt Force

Driver Lap Belt Force – not installed

Driver Left Upper Tibia Moment X

Driver Left Upper Tibia Moment Y

Driver Left Upper Tibia Force Z

Driver Left Lower Tibia Moment X

Driver Left Lower Tibia Moment Y

Driver Left Lower Tibia Force Z

Driver Right Upper Tibia Moment X

Driver Right Upper Tibia Moment Y

Driver Right Upper Tibia Force Z

Driver Right Lower Tibia Moment X

Driver Right Lower Tibia Moment Y

Driver Right Lower Tibia Force Z

Driver Left Foot Fore Z

Driver Left Foot Aft X

Driver Left Foot Aft Z

Driver Right Foot Fore Z

Driver Right Foot Aft X

Driver Right Foot Aft Z

Passenger Head X Redundant

Passenger Head Y Redundant

Passenger Head Z Redundant

Passenger Upper Neck Force Y

Passenger Upper Neck Moment X

Passenger Upper Neck Moment Z

Passenger Chest X Redundant

Passenger Chest Y Redundant

Passenger Chest Z Redundant

Passenger Pelvis X

Passenger Pelvis Y

Passenger Pelvis Z

Passenger Left Femur Redundant

Passenger Right Femur Redundant

Passenger Lap Belt Force – not installed

Passenger Shoulder Belt Force – not installed

Passenger Left Upper Tibia Moment X

Passenger Left Upper Tibia Moment Y

Passenger Left Upper Tibia Force Z

Passenger Left Lower Tibia Moment X

Passenger Left Lower Tibia Moment Y

Passenger Left Lower Tibia Force Z

Passenger Right Upper Tibia Moment X

Passenger Right Upper Tibia Moment Y

Passenger Right Upper Tibia Force Z

Passenger Right Lower Tibia Moment X

Passenger Right Lower Tibia Moment Y

Passenger Right Lower Tibia Force Z

Passenger Left Foot Fore Z

Passenger Left Foot Aft X

Passenger Left Foot Aft Z

Passenger Right Foot Fore Z

Passenger Right Foot Aft X

Passenger Right Foot Aft Z

Left Rear Seat Crossmember X

Left Rear Seat Crossmember Z

Right Rear Seat Crossmember X

Right Rear Seat Crossmember Z

Vehicle Engine Top X

Vehicle Engine Bottom X

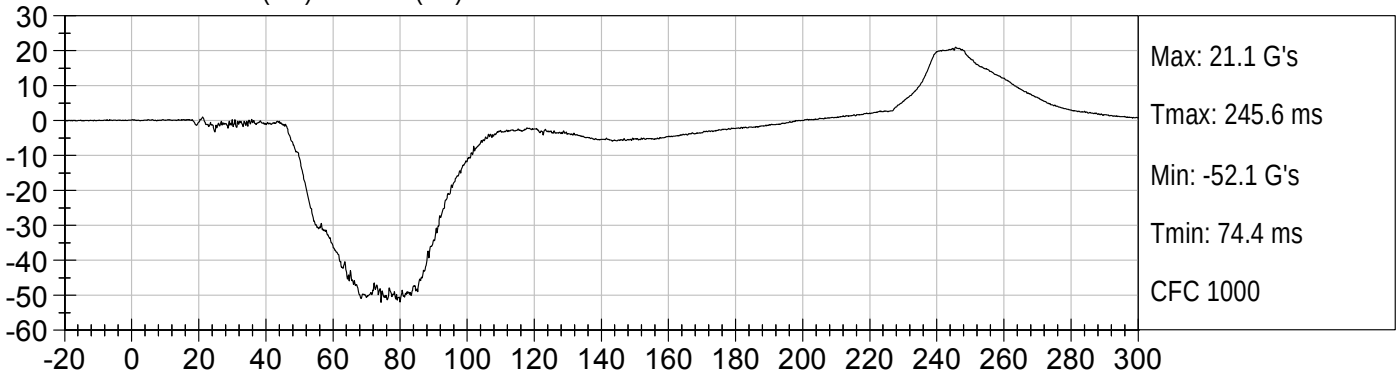
Vehicle Left Brake Caliper X

Vehicle Right Brake Caliper X

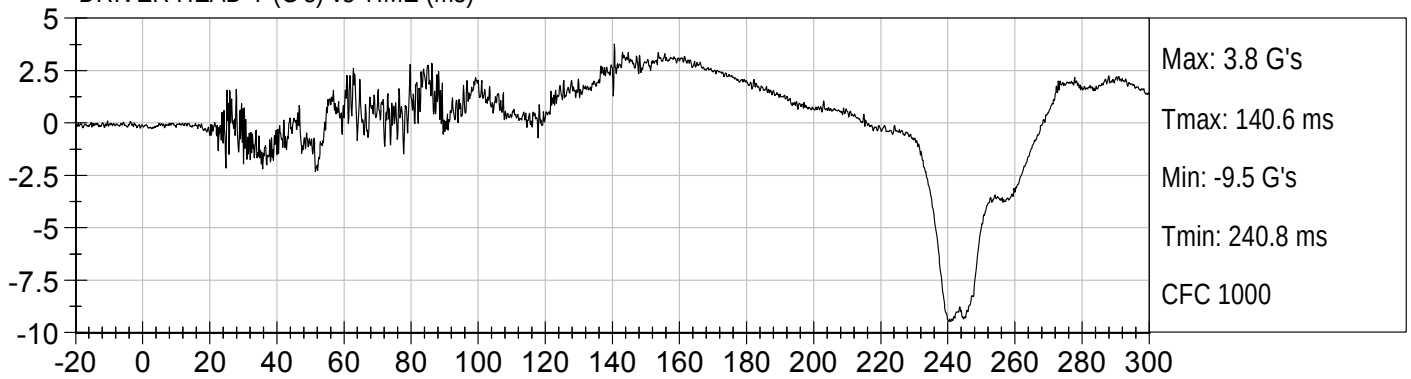
NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

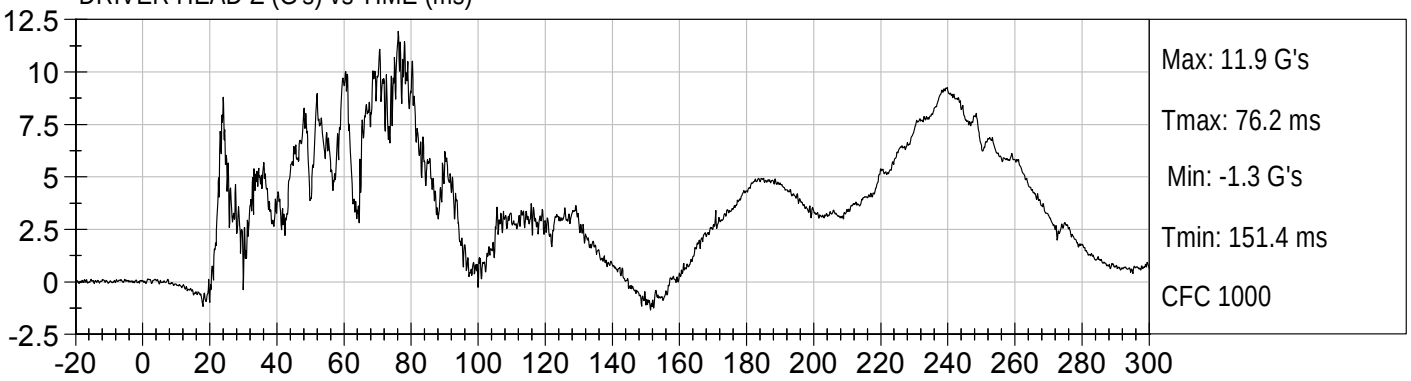
DRIVER HEAD X (G's) vs TIME (ms)



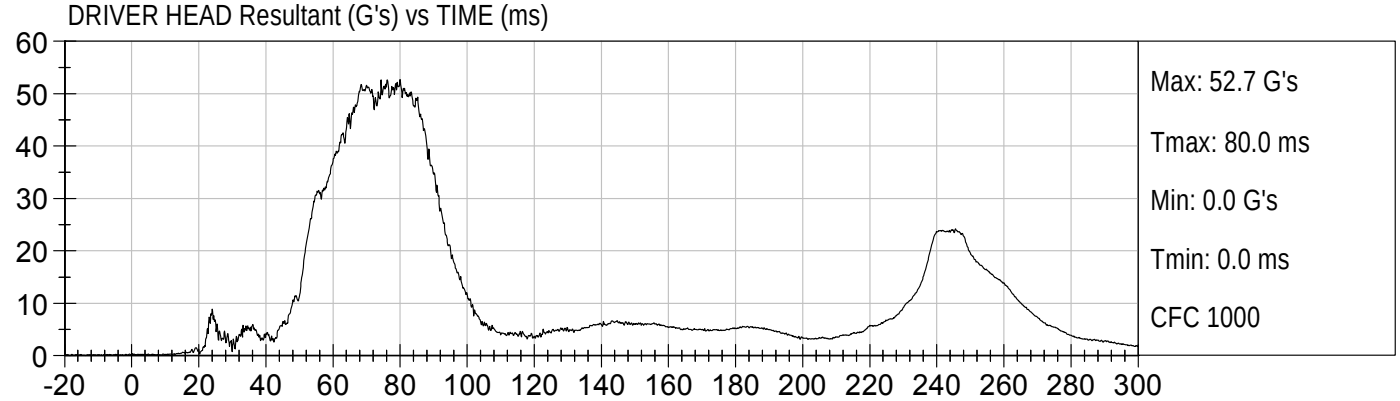
DRIVER HEAD Y (G's) vs TIME (ms)



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



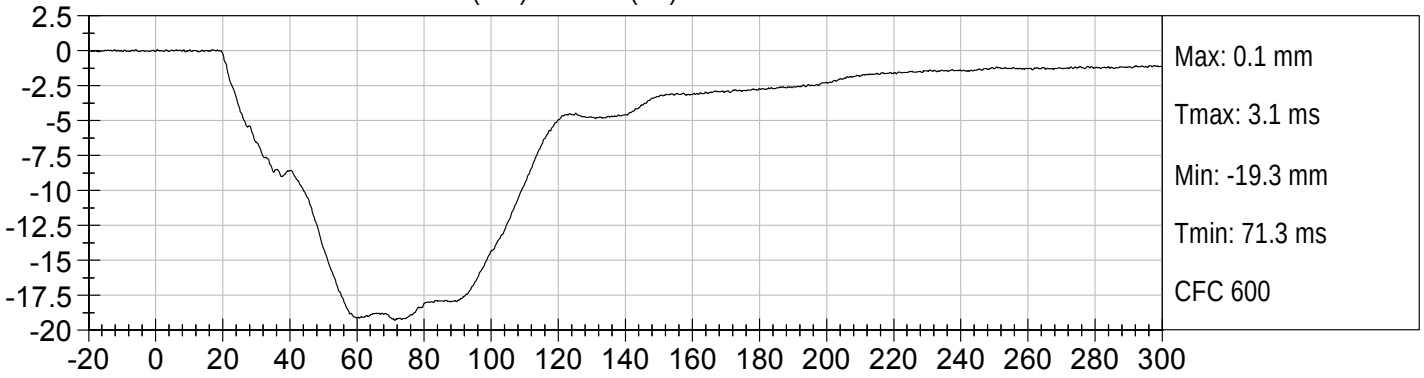
DRIVER HEAD Resultant (G's) vs TIME (ms)



NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

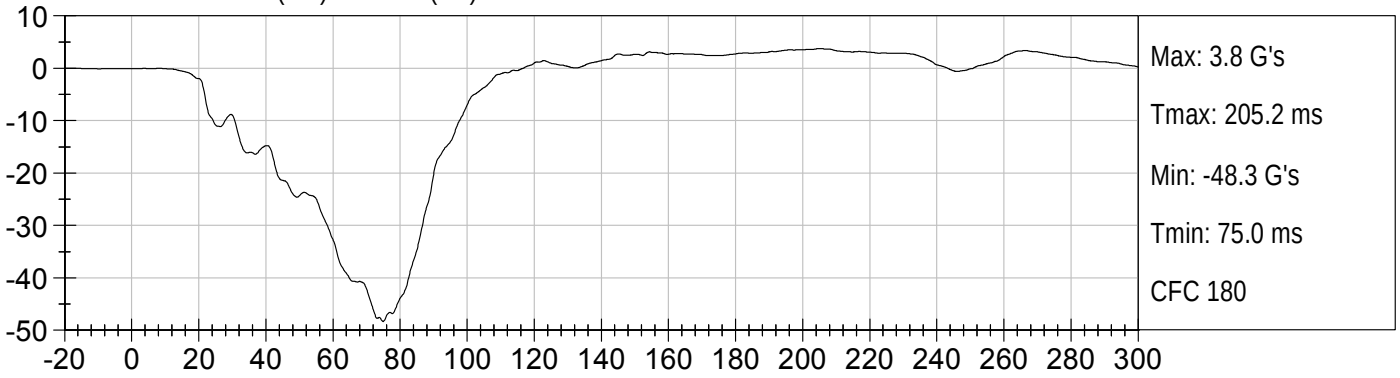
DRIVER CHEST DISPLACEMENT (mm) vs TIME (ms)



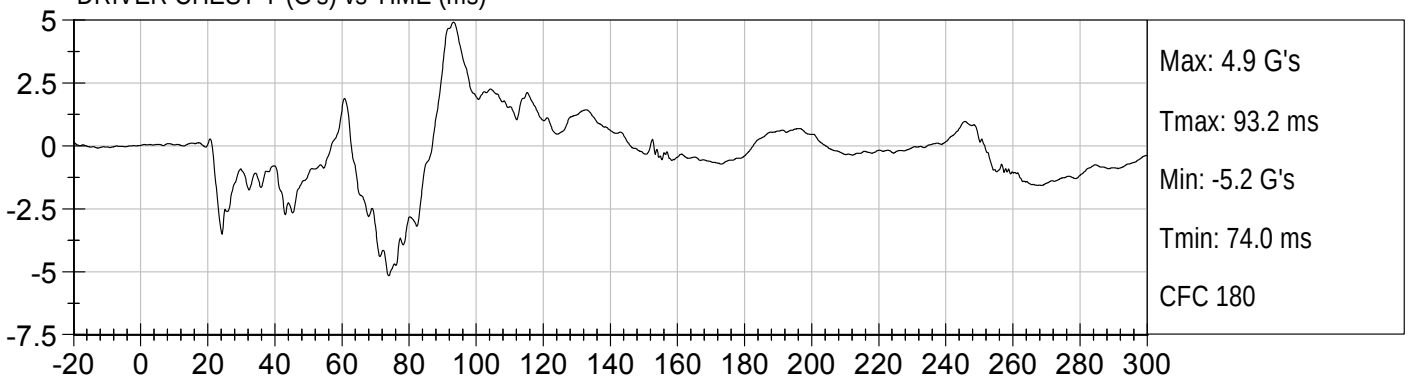
NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

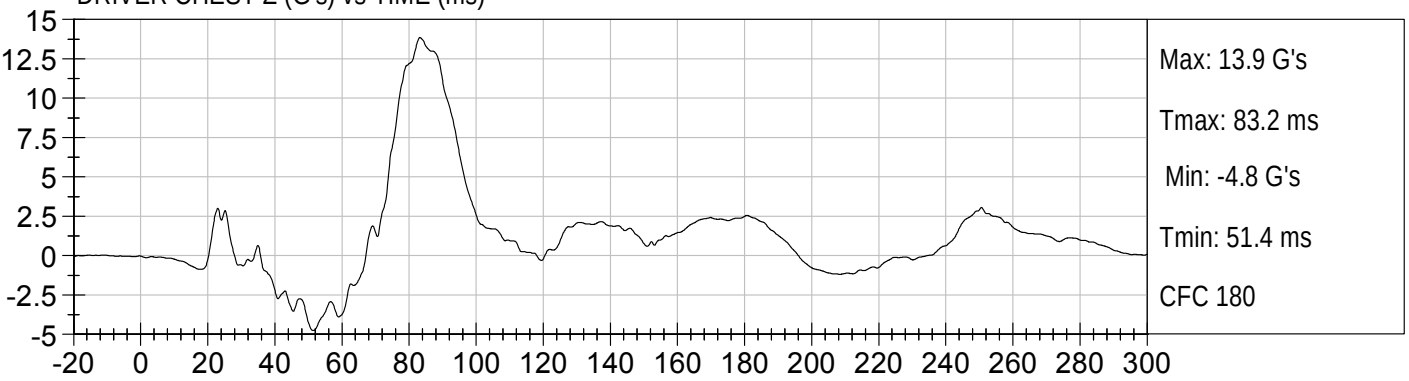
DRIVER CHEST X (G's) vs TIME (ms)



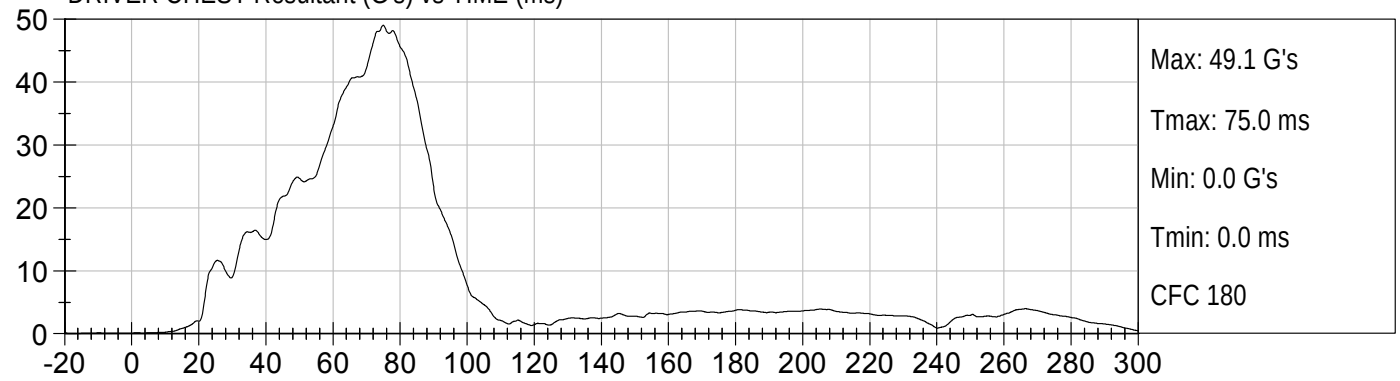
DRIVER CHEST Y (G's) vs TIME (ms)



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



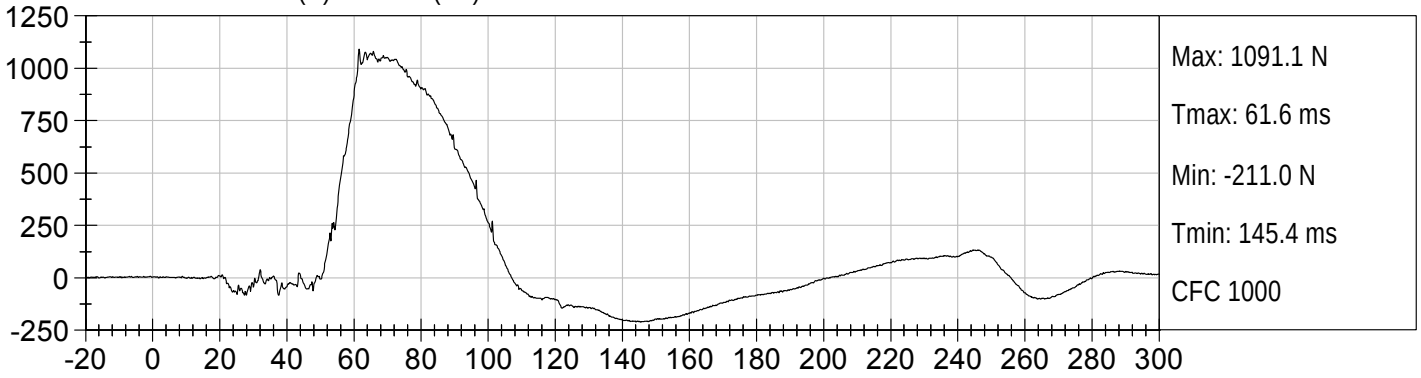
DRIVER CHEST Resultant (G's) vs TIME (ms)



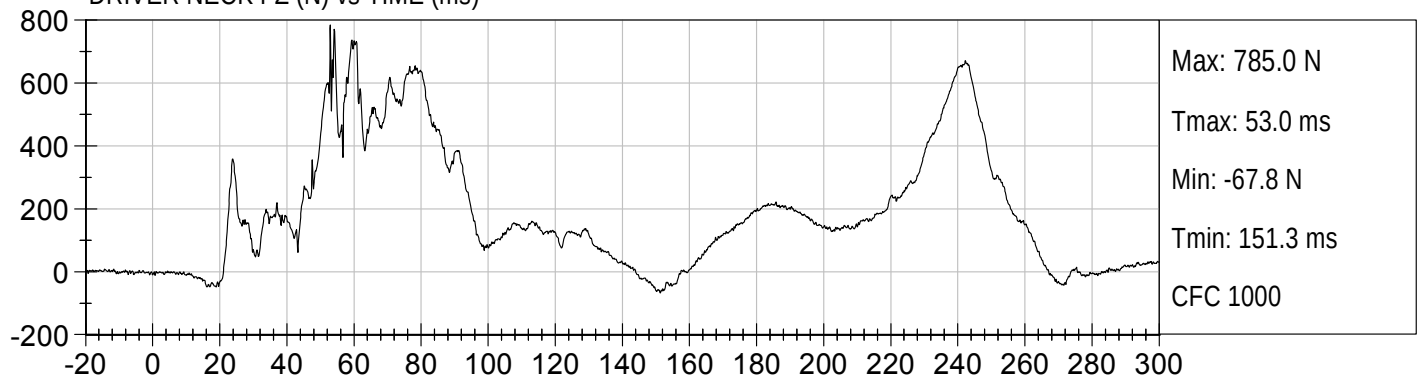
NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

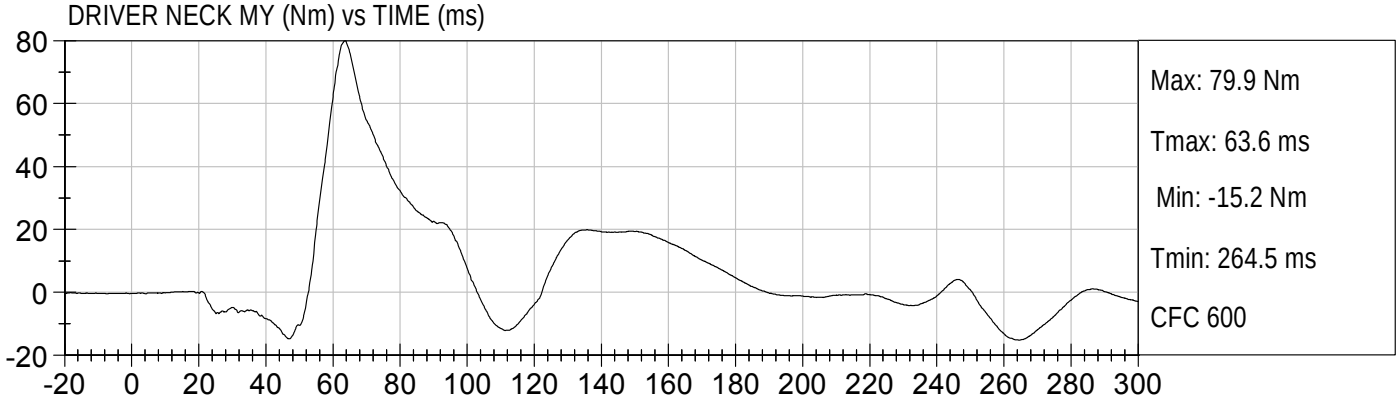
DRIVER NECK FX (N) vs TIME (ms)



DRIVER NECK FZ (N) vs TIME (ms)



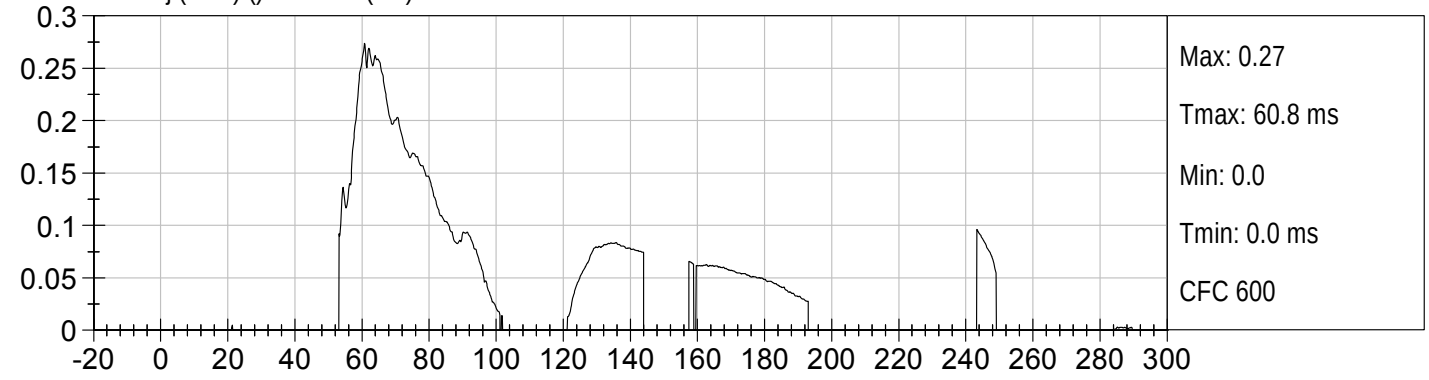
DRIVER NECK MY (Nm) vs TIME (ms)



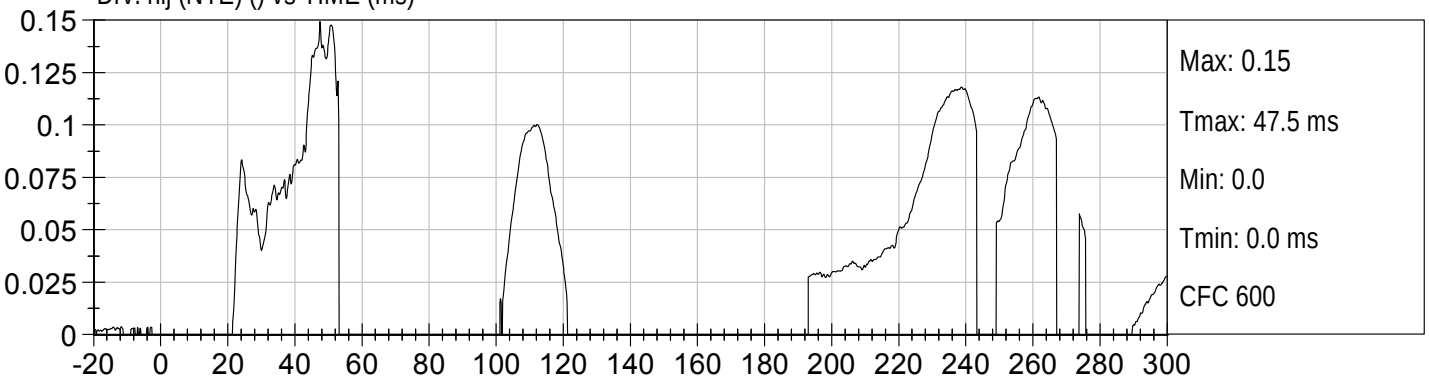
NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

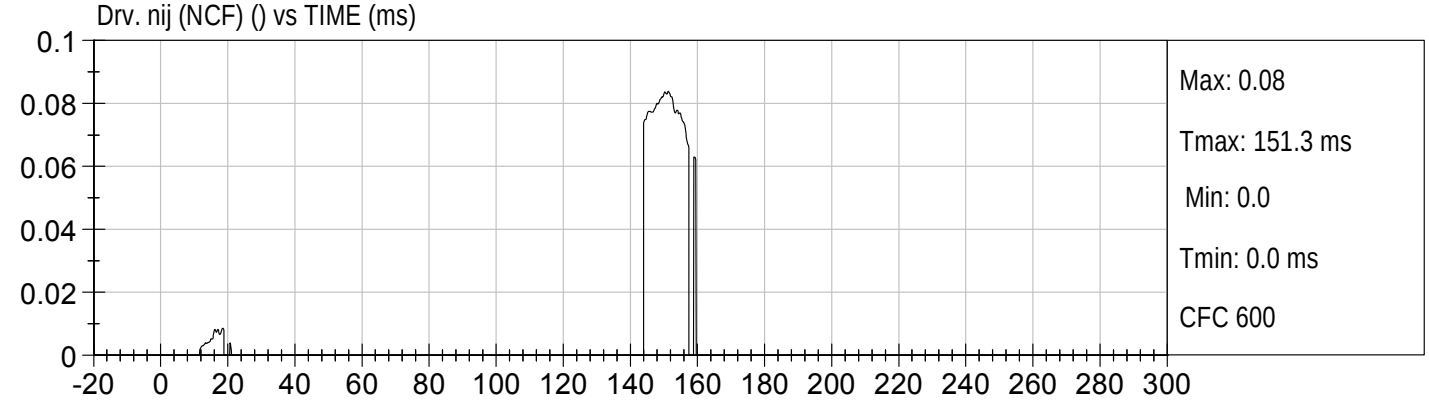
Drv. nij (NTF) () vs TIME (ms)



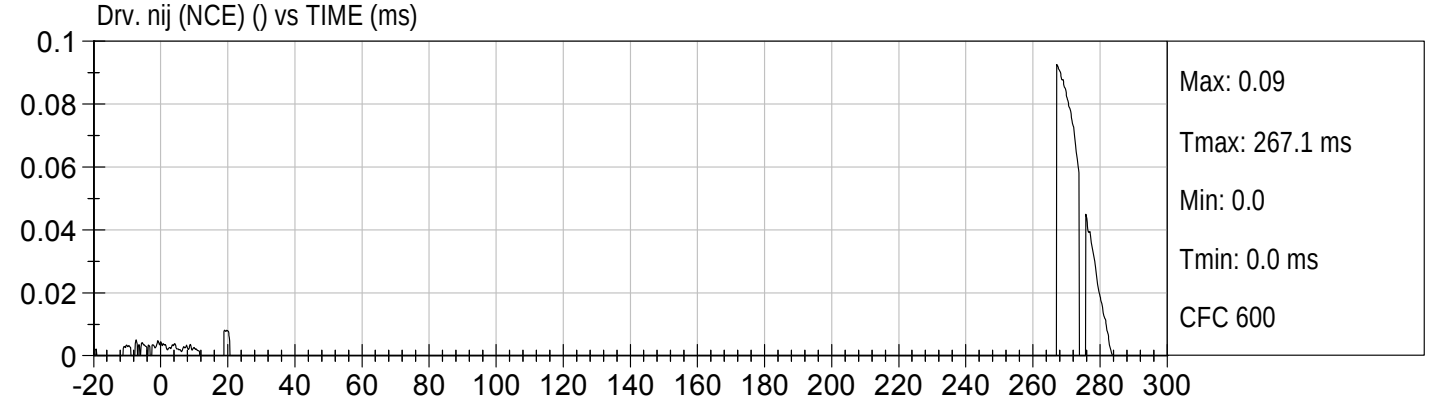
Drv. nij (NTE) () vs TIME (ms)



Drv. nij (NCF) () vs TIME (ms)



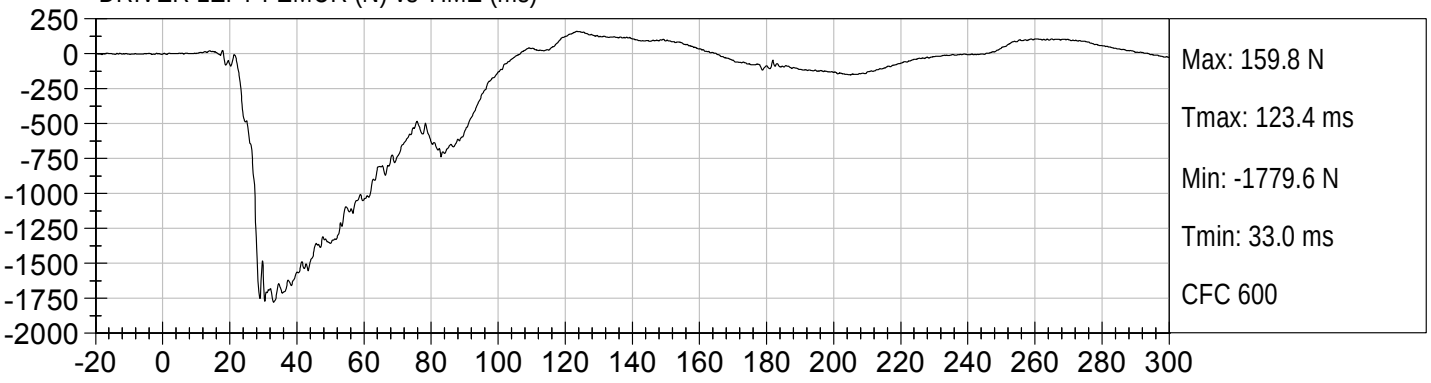
Drv. nij (NCE) () vs TIME (ms)



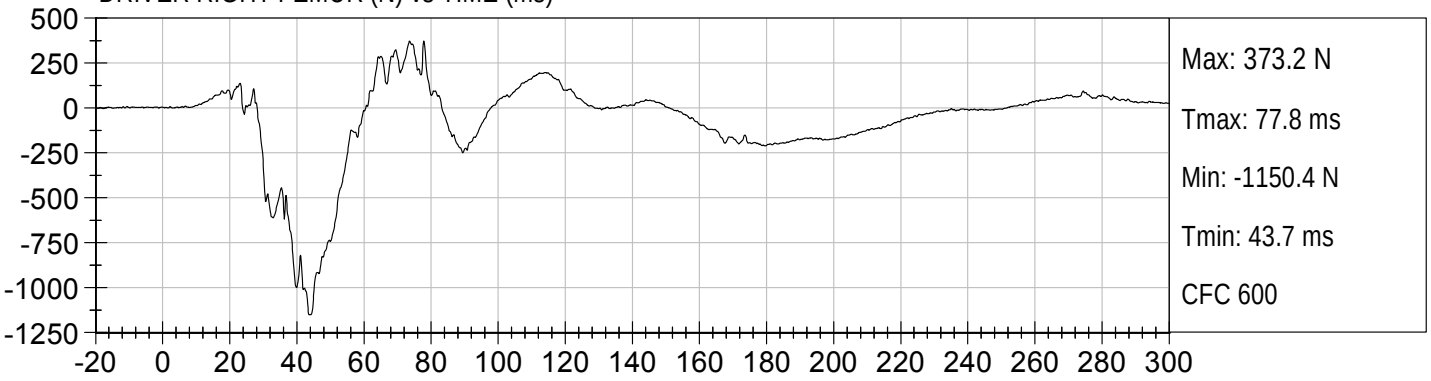
NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

DRIVER LEFT FEMUR (N) vs TIME (ms)



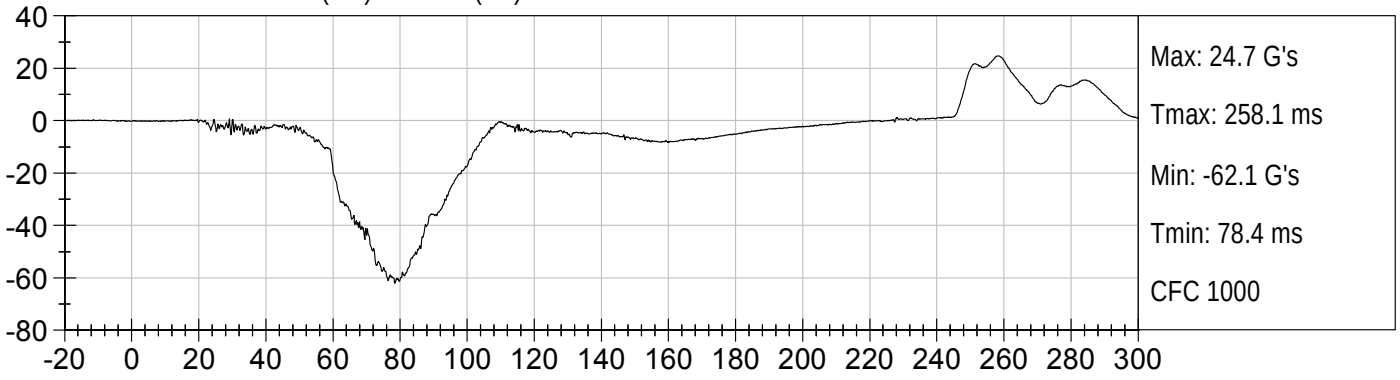
DRIVER RIGHT FEMUR (N) vs TIME (ms)



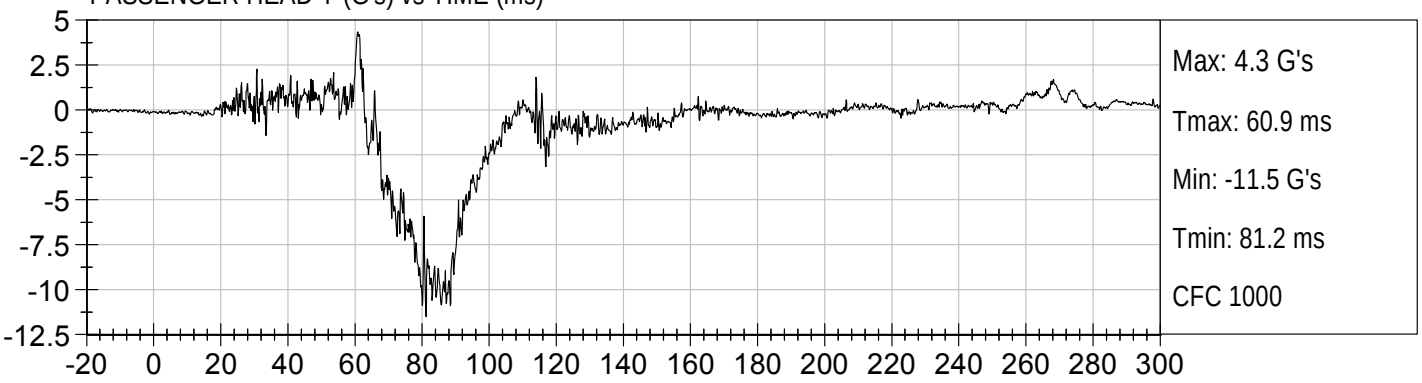
NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

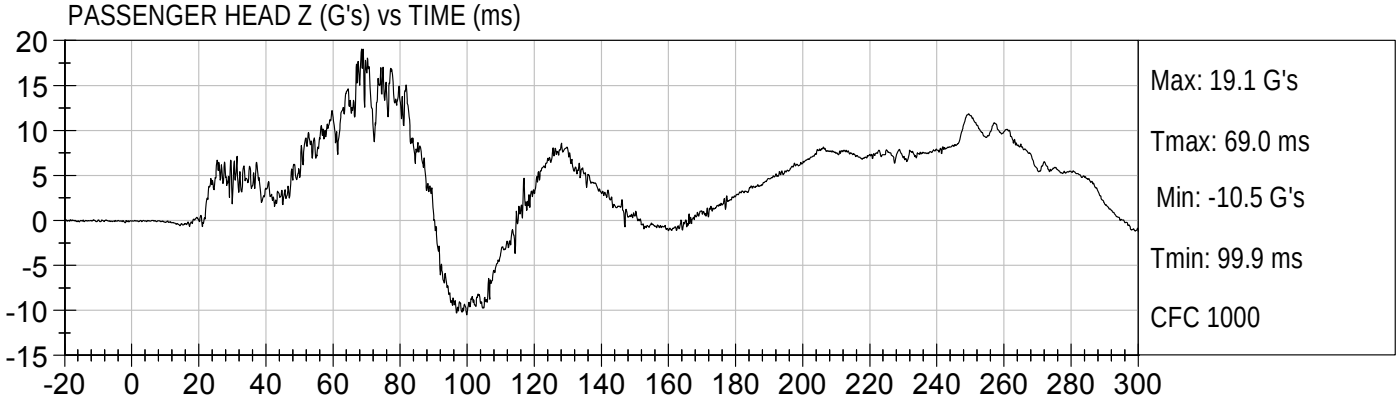
PASSENGER HEAD X (G's) vs TIME (ms)



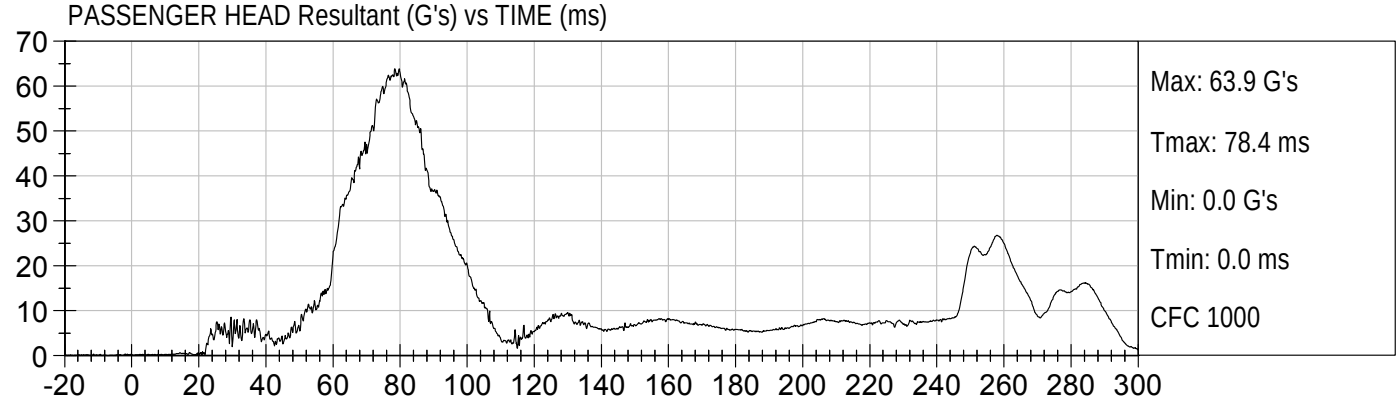
PASSENGER HEAD Y (G's) vs TIME (ms)



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



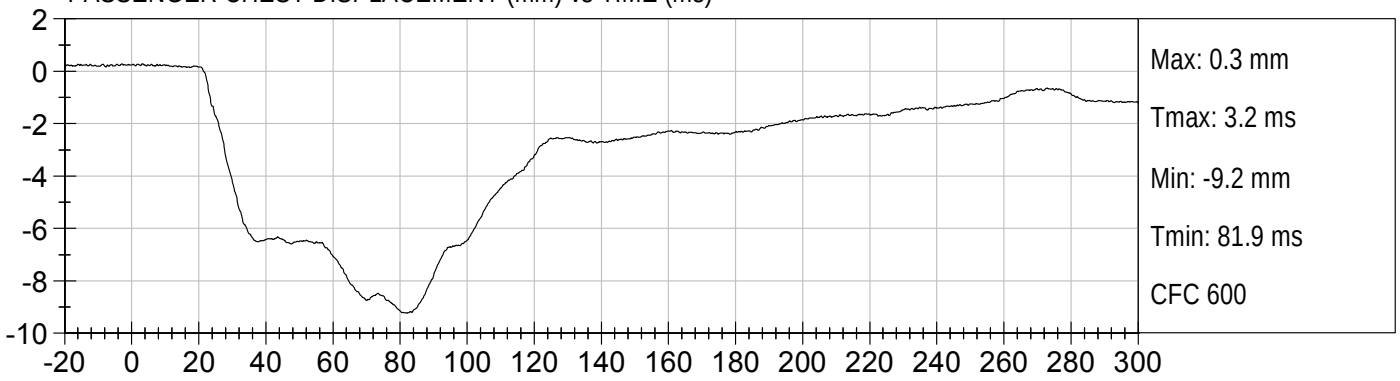
PASSENGER HEAD Resultant (G's) vs TIME (ms)



NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

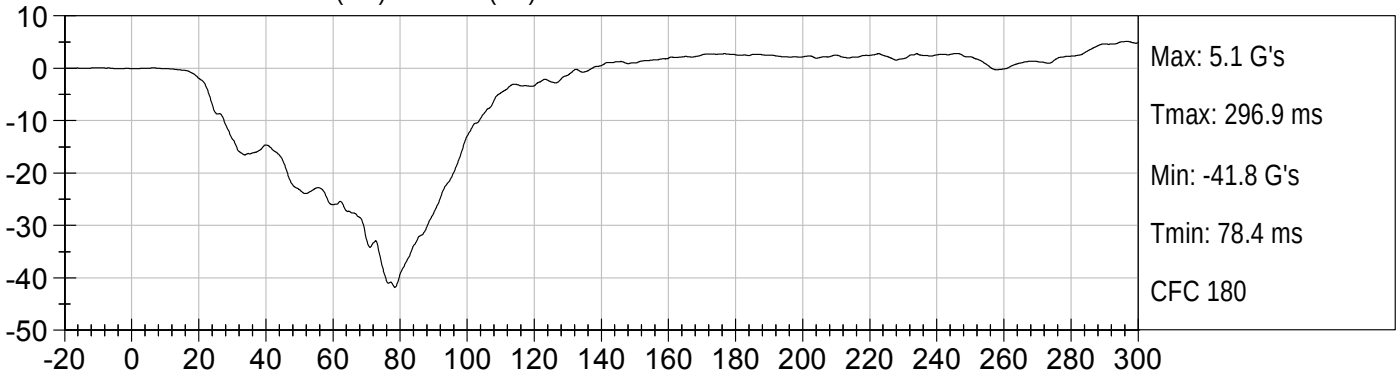
PASSENGER CHEST DISPLACEMENT (mm) vs TIME (ms)



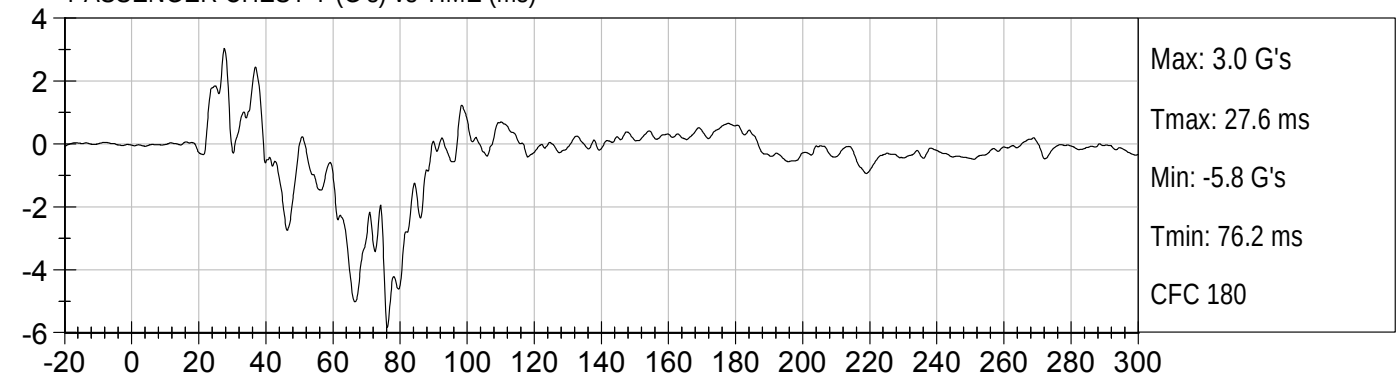
NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

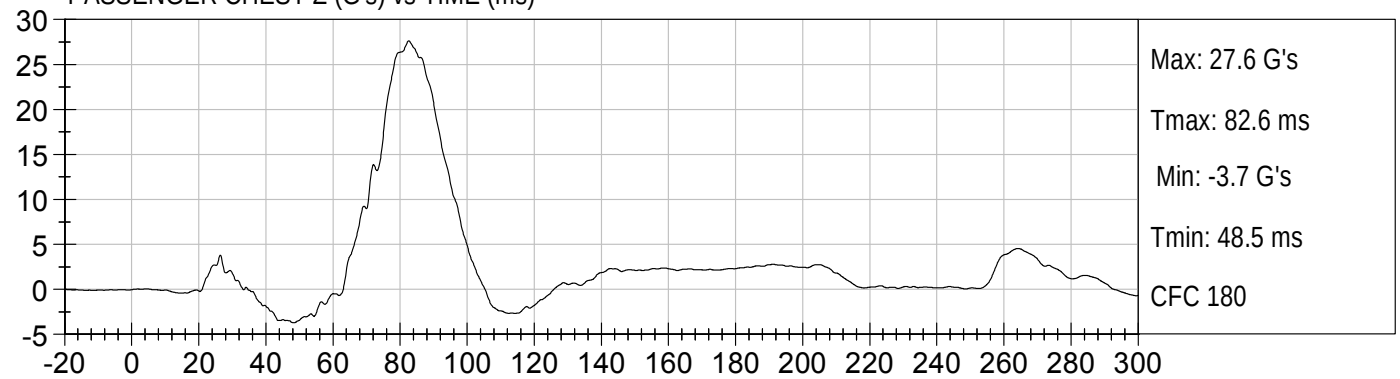
PASSENGER CHEST X (G's) vs TIME (ms)



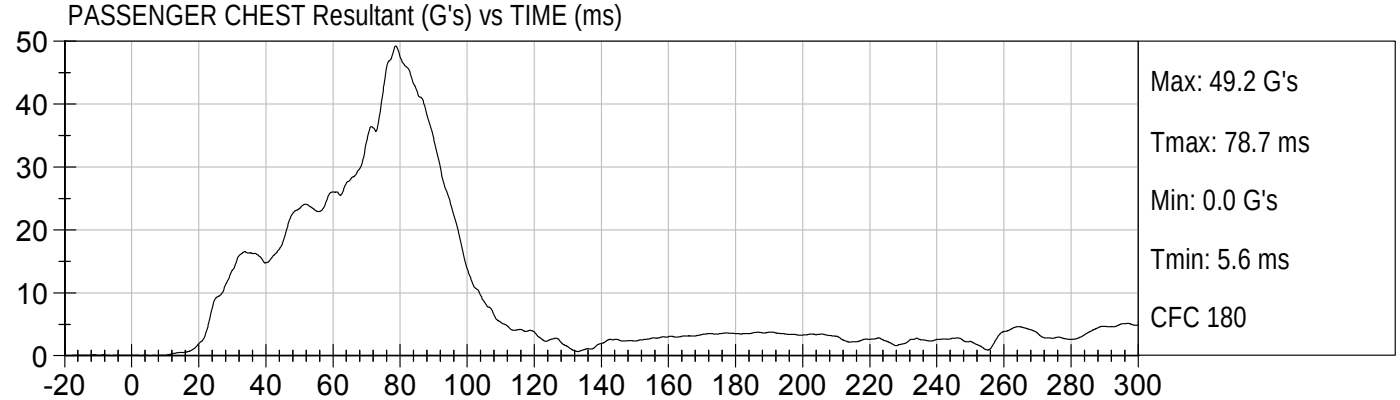
PASSENGER CHEST Y (G's) vs TIME (ms)



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



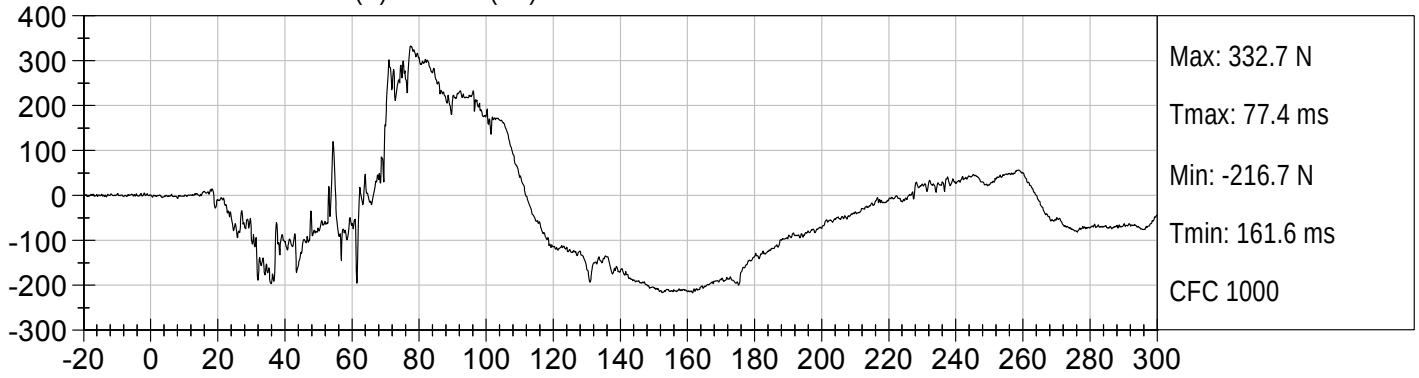
PASSENGER CHEST Resultant (G's) vs TIME (ms)



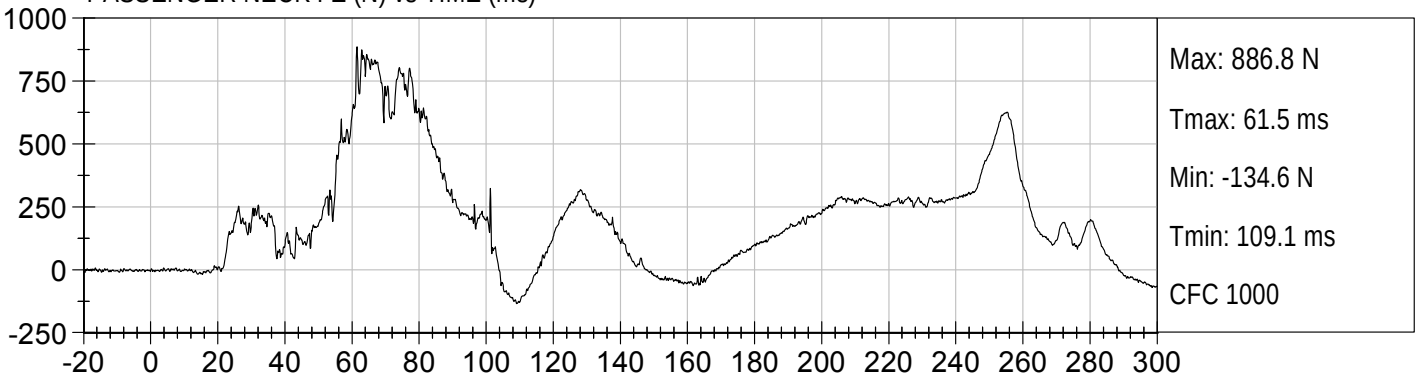
NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

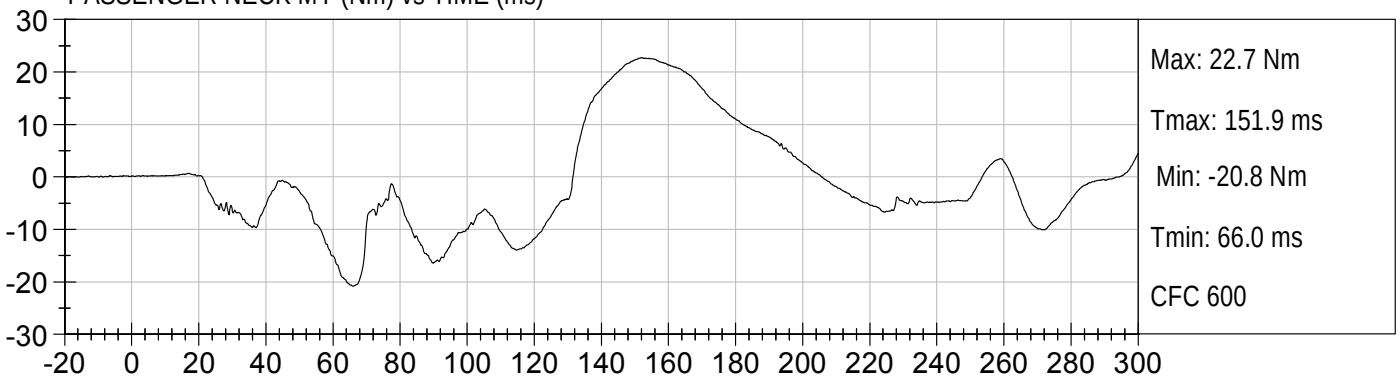
PASSENGER NECK FX (N) vs TIME (ms)



PASSENGER NECK FZ (N) vs TIME (ms)



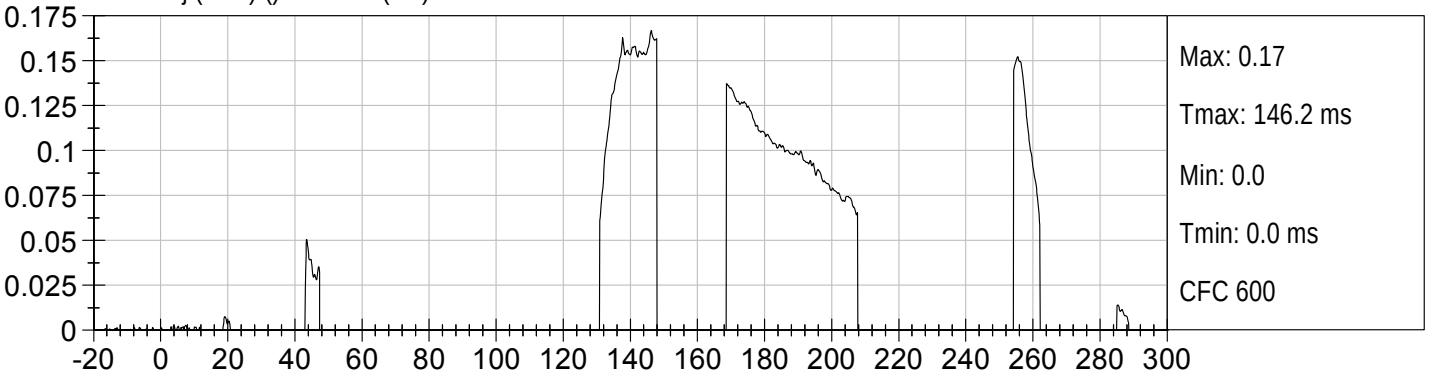
PASSENGER NECK MY (Nm) vs TIME (ms)



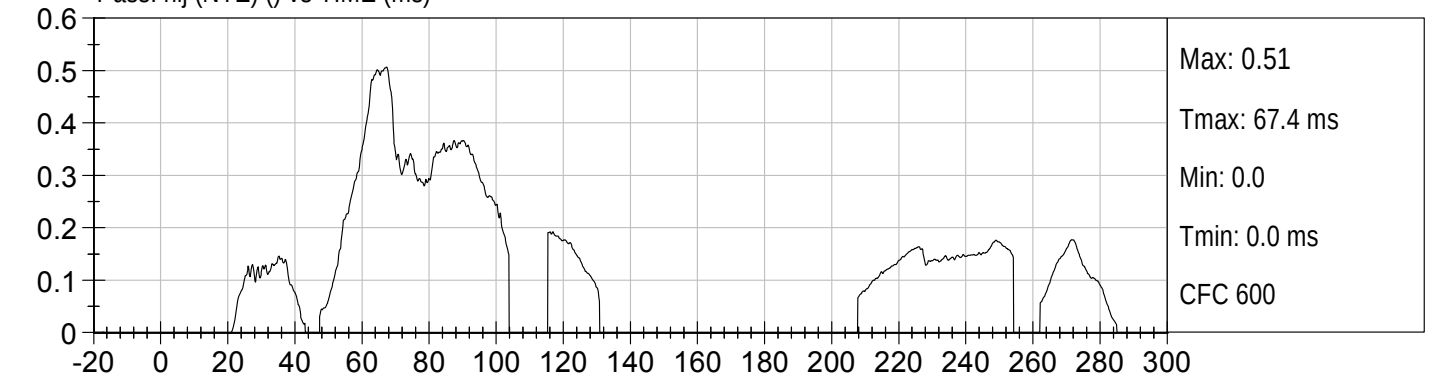
NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

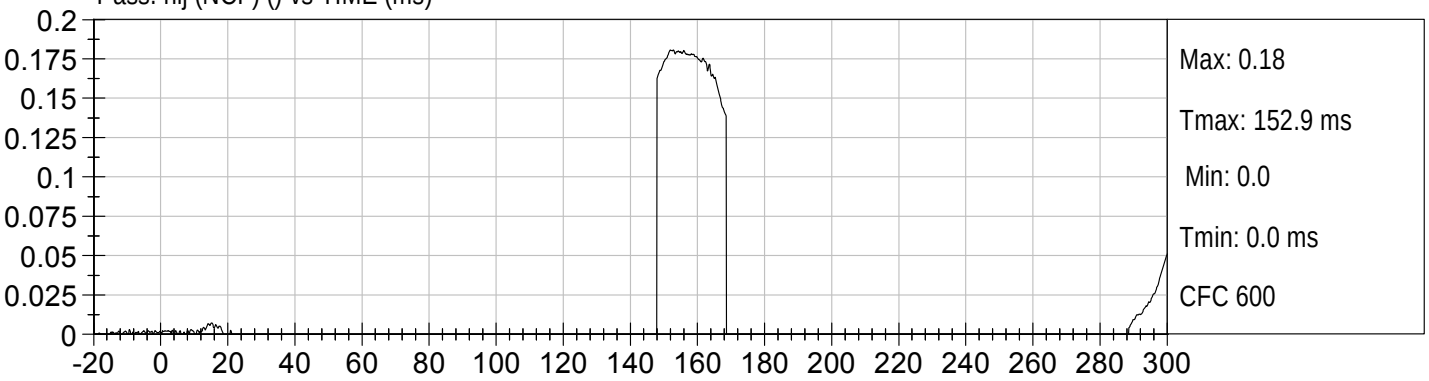
Pass. nij (NTF) () vs TIME (ms)



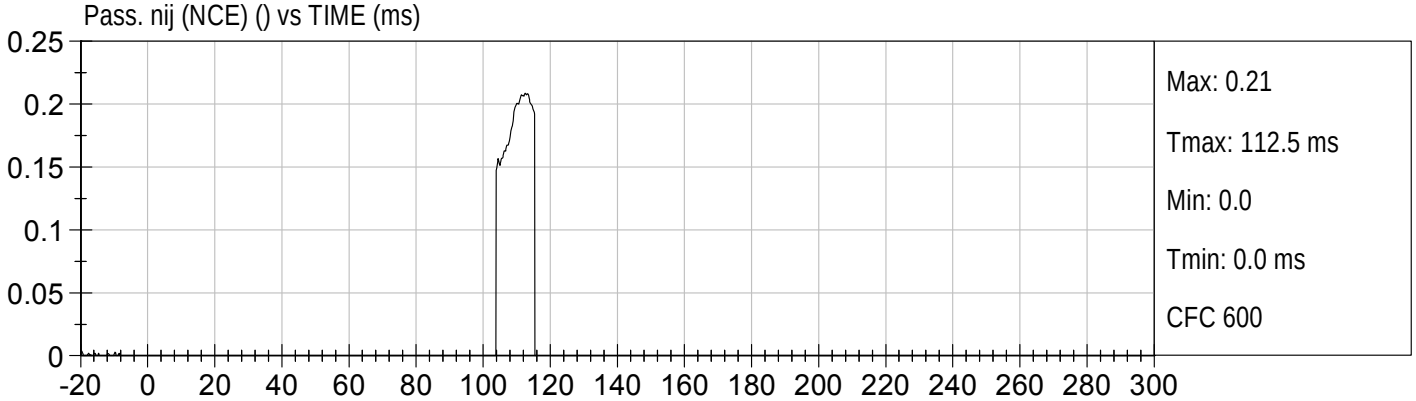
Pass. nij (NTE) () vs TIME (ms)



Pass. nij (NCF) () vs TIME (ms)



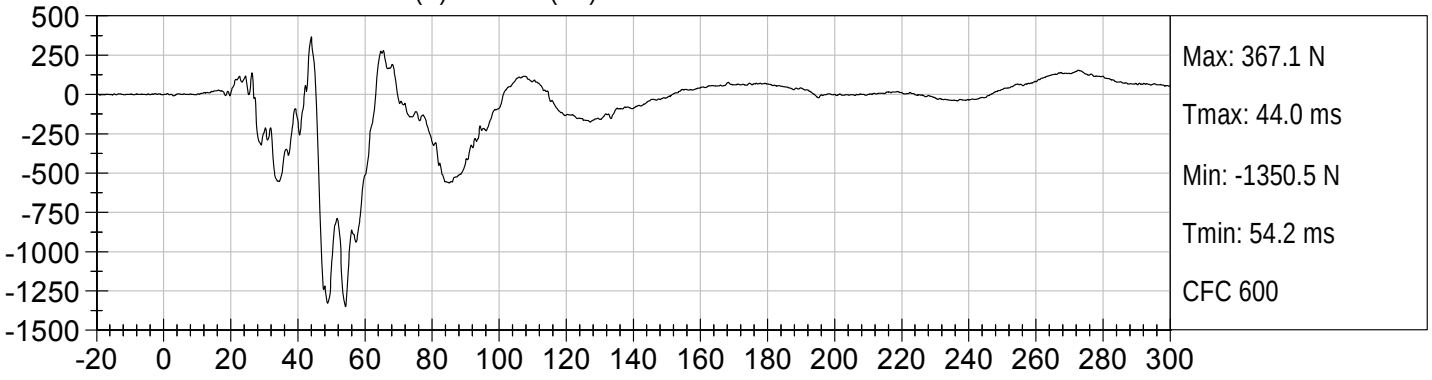
Pass. nij (NCE) () vs TIME (ms)



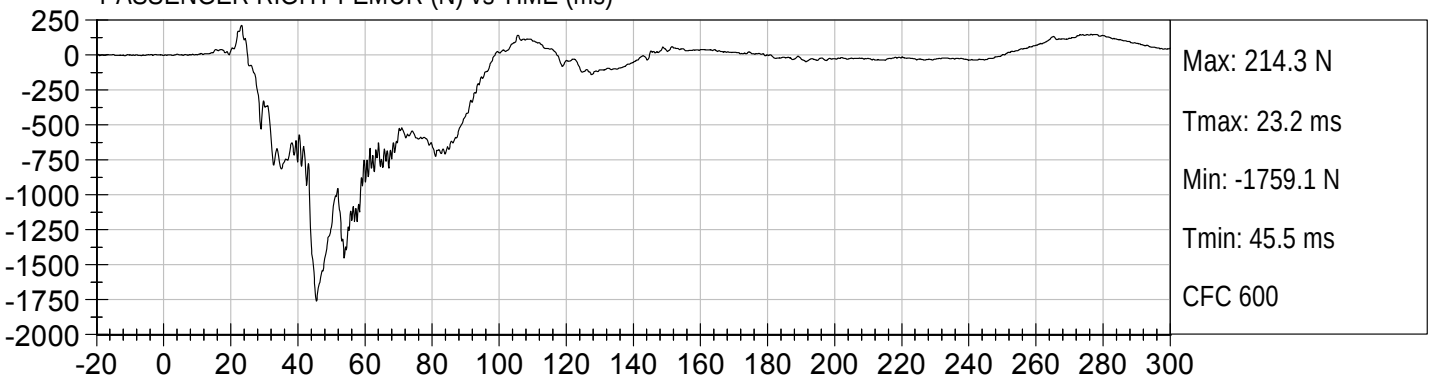
NCAP 35mph Frontal
2011 Chevrolet Volt - MB0127

Test Date: 05/11/2011
Speed: 34.9 mph (56.2 km/h)

PASSENGER LEFT FEMUR (N) vs TIME (ms)



PASSENGER RIGHT FEMUR (N) vs TIME (ms)



APPENDIX C

DUMMY CALIBRATION DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test ID:** D111131

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Peak Resultant Acceleration	G's	225 - 275	226	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-9.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

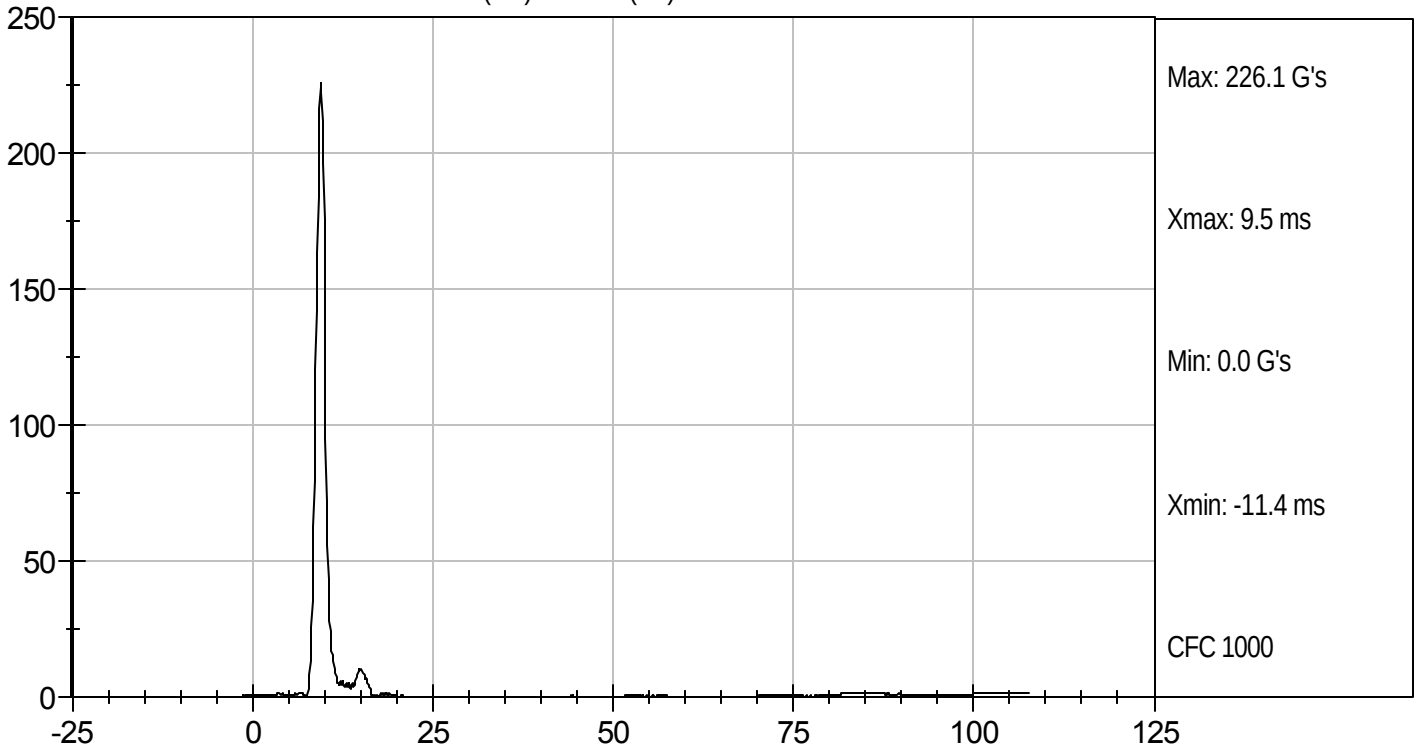
3/24/11
Test Date

David Winkelbauer
Approved By

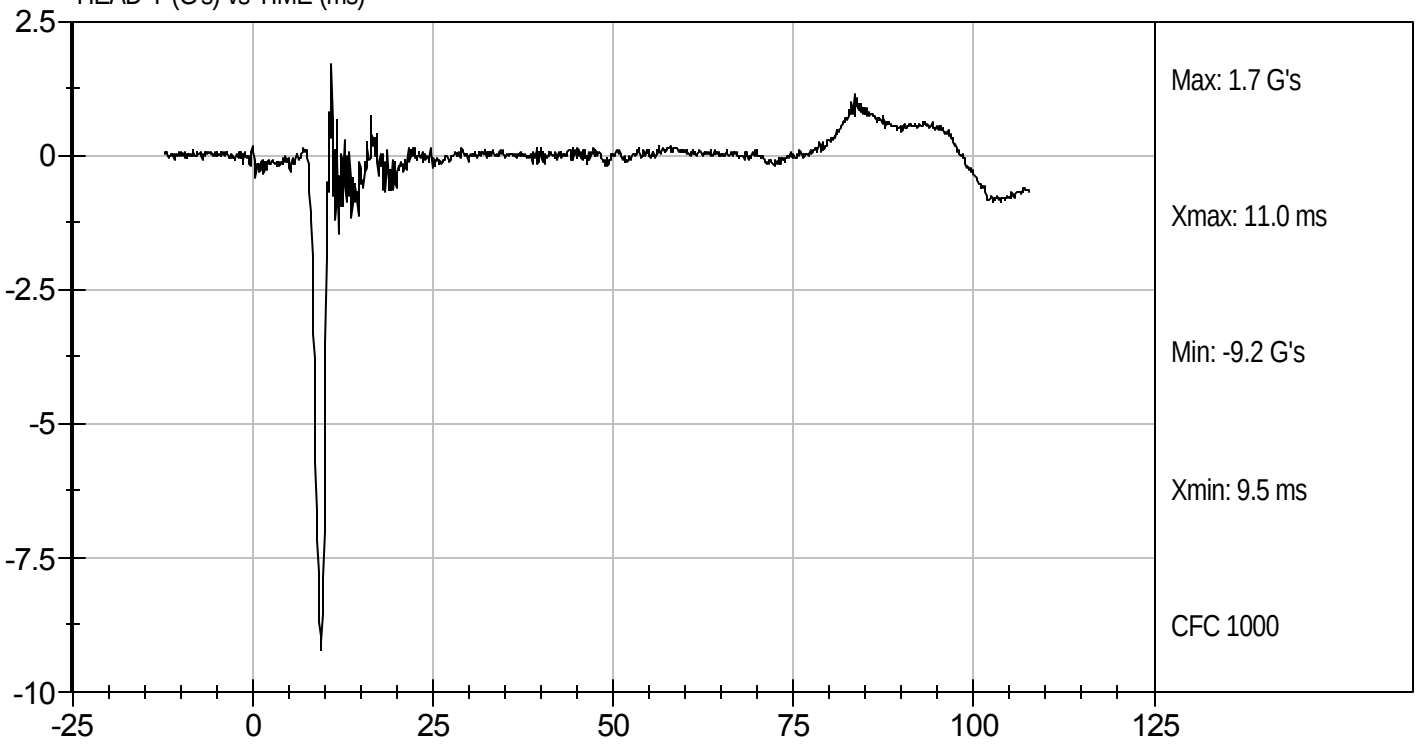
Test Desc: Head Drop
Component ID: D111131

Test Date: 3/24/11
Velocity: 0 ft/s, 0.00 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: 036 **Test I.D:** D111132

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	29	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	25.03	Pass
	20 ms	G's	17.60 to 22.60	20.02	Pass
	30 ms	G's	12.50 to 18.50	17.60	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	17.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	74.1	Pass
	Time	ms	57.0 to 64.0	57.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	116.4	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	93.4	Pass
	Time	ms	47.0 to 58.0	47.3	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.2	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

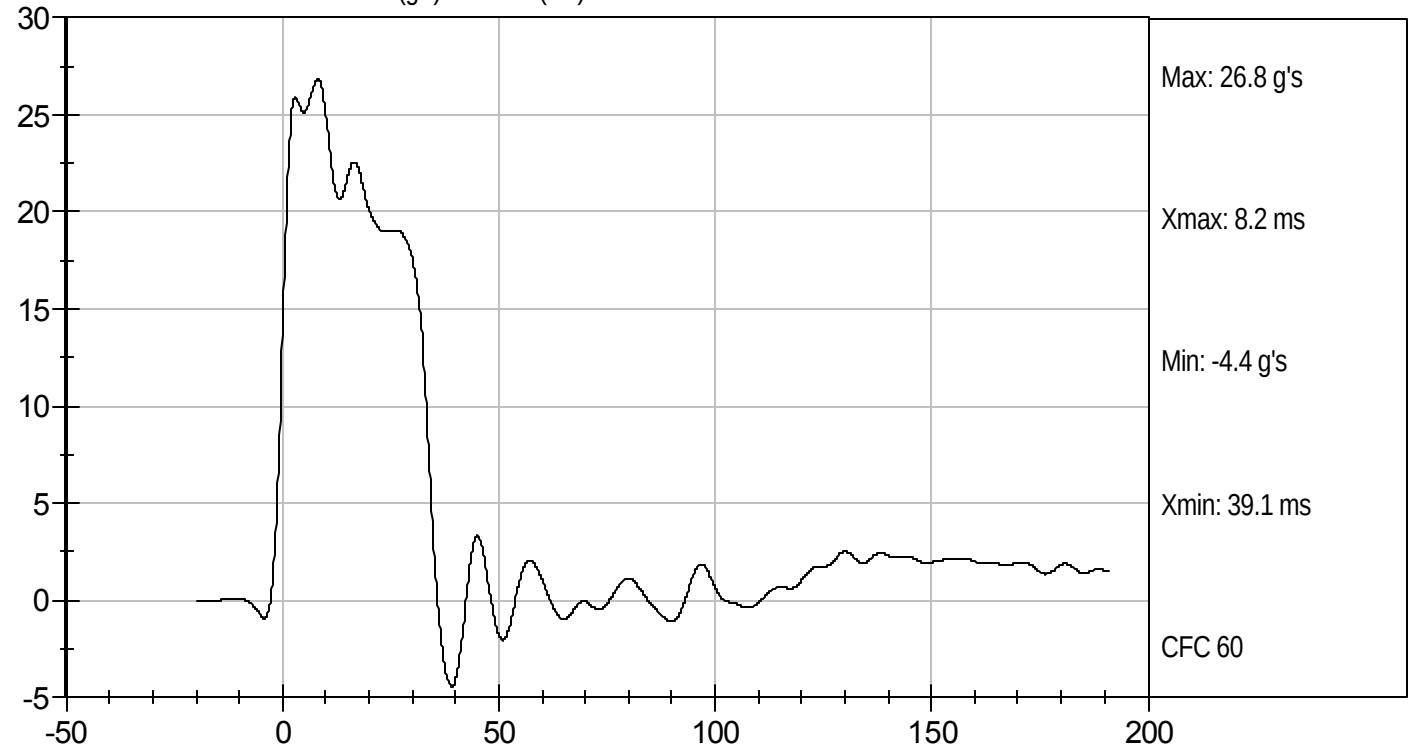
3/25/11
Test Date

David Winkelbauer
Approved By

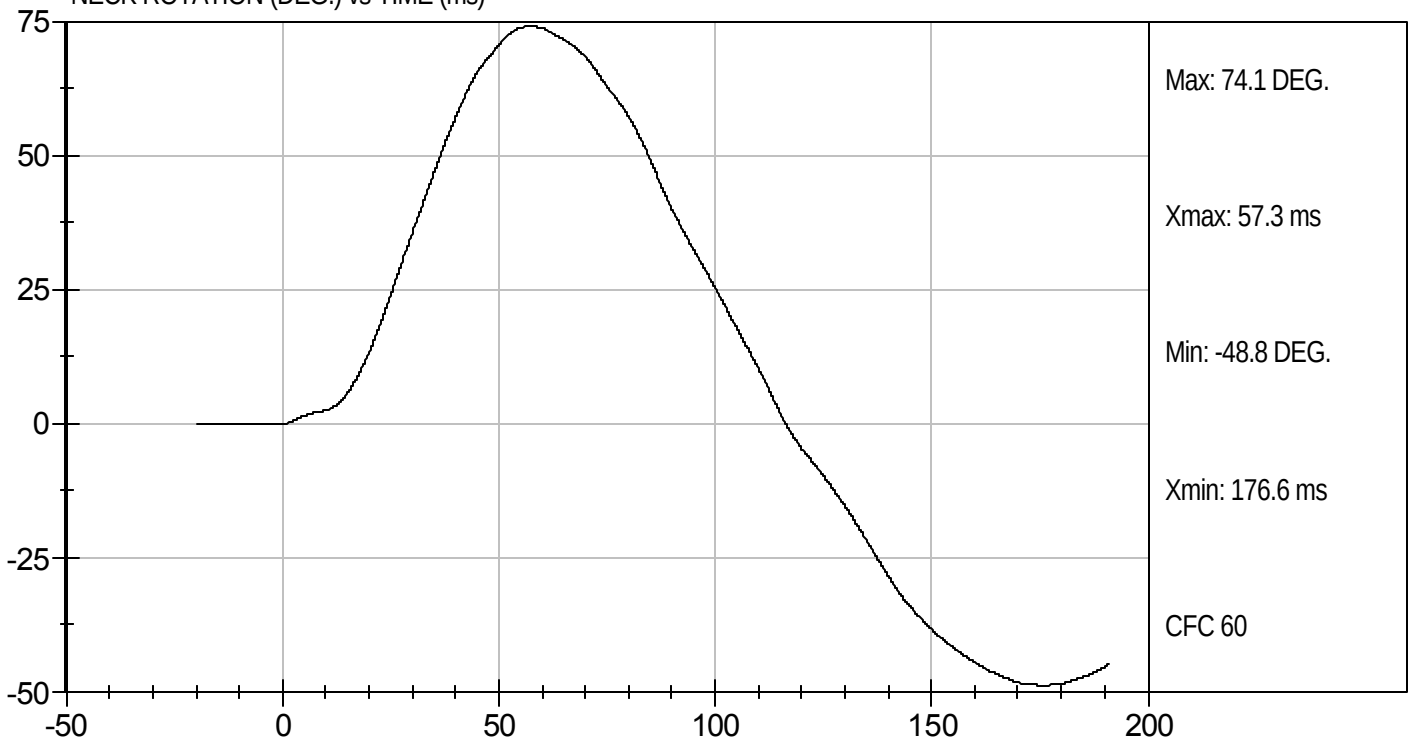
Test Desc: Neck Flexion
Component ID: D111132

Test Date: 3/25/11
Velocity: 23.15 ft/s, 7.06 m/s

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

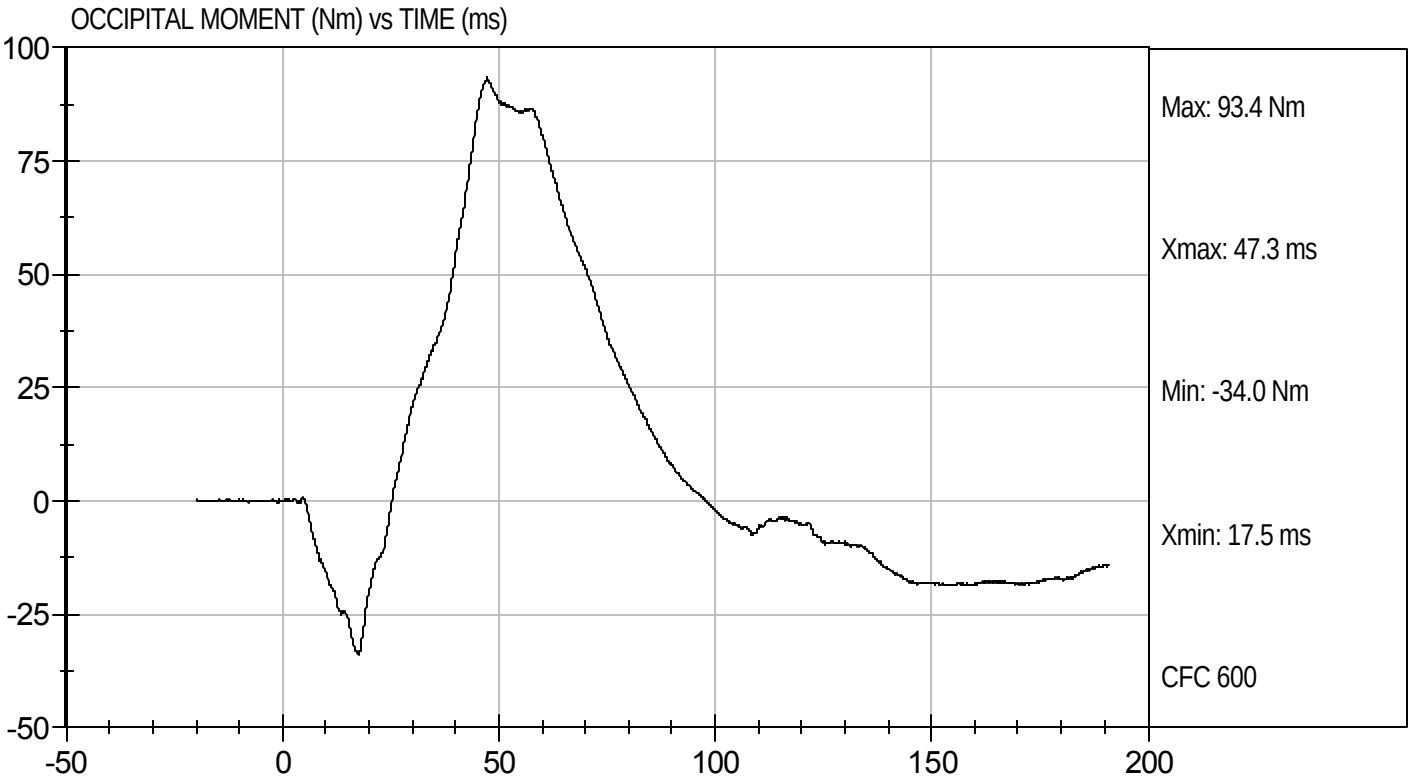


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D111132

Test Date: 3/25/11
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D111133

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	29	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.03	Pass
	20 ms	G's	14.00 to 19.00	14.91	Pass
	30 ms	G's	11.00 to 16.00	11.95	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	39.8	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	95.4	Pass
	Time	ms	72.0 to 82.0	76.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	157.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-65.6	Pass
	Time	ms	65.0 to 79.0	70.6	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	143.7	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

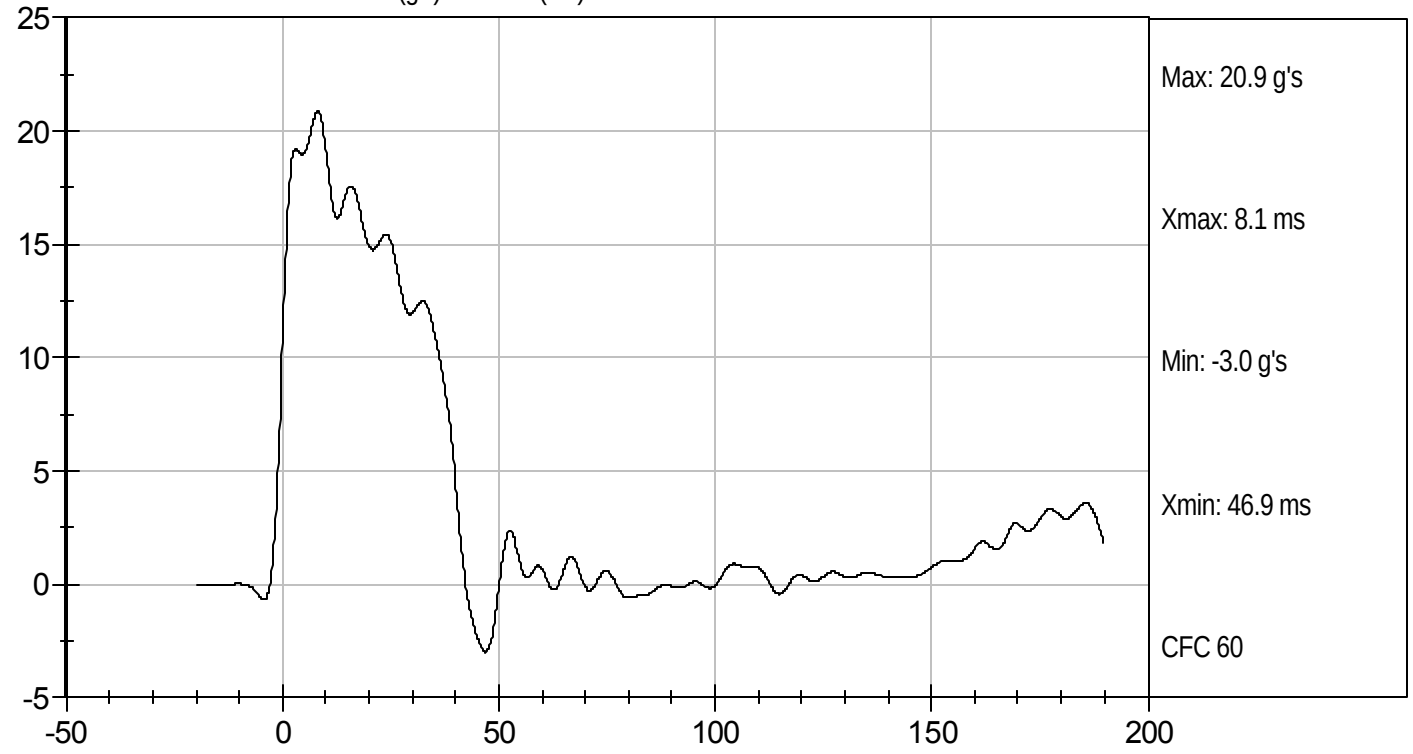
3/25/11
Test Date

David Winkelbauer
Approved By

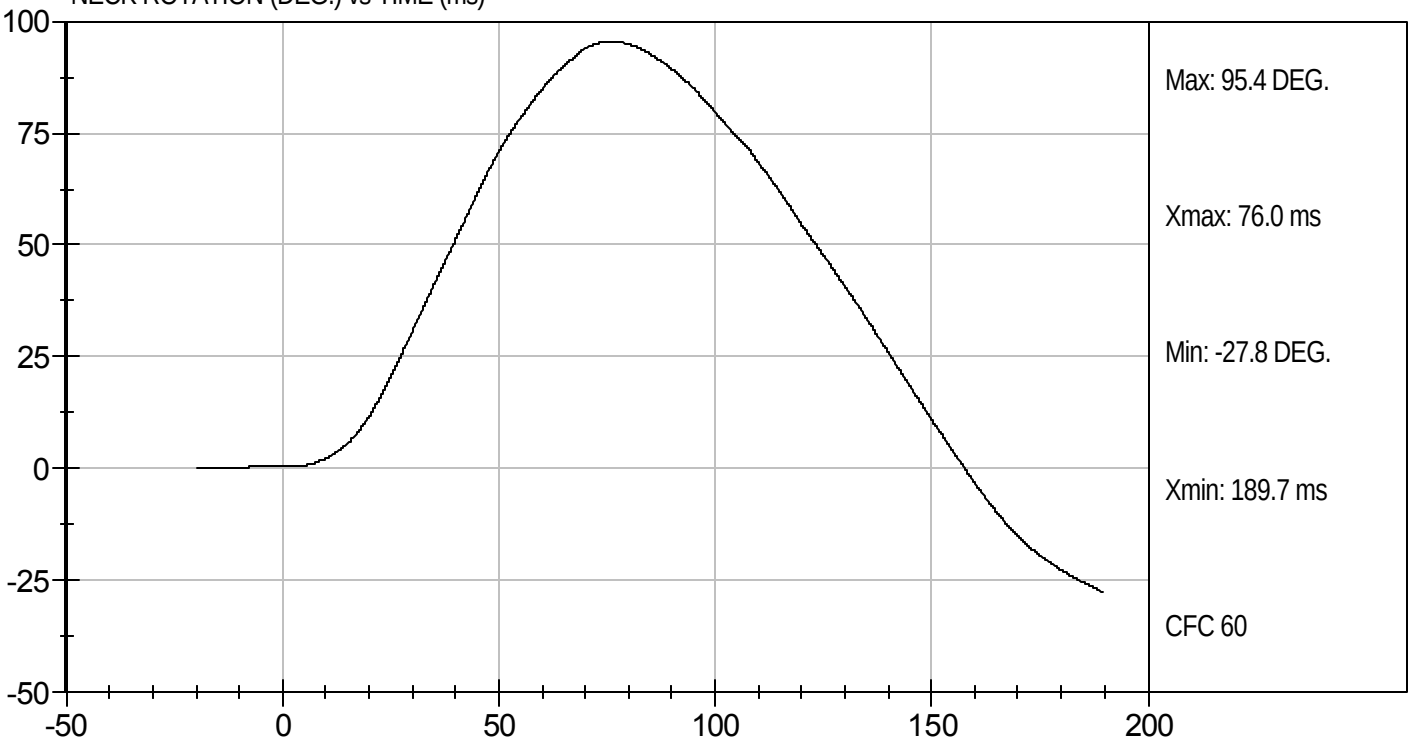
Test Desc: Neck Extension
Component ID: D111133

Test Date: 3/25/11
Velocity: 20.08 ft/s, 6.12 m/s

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

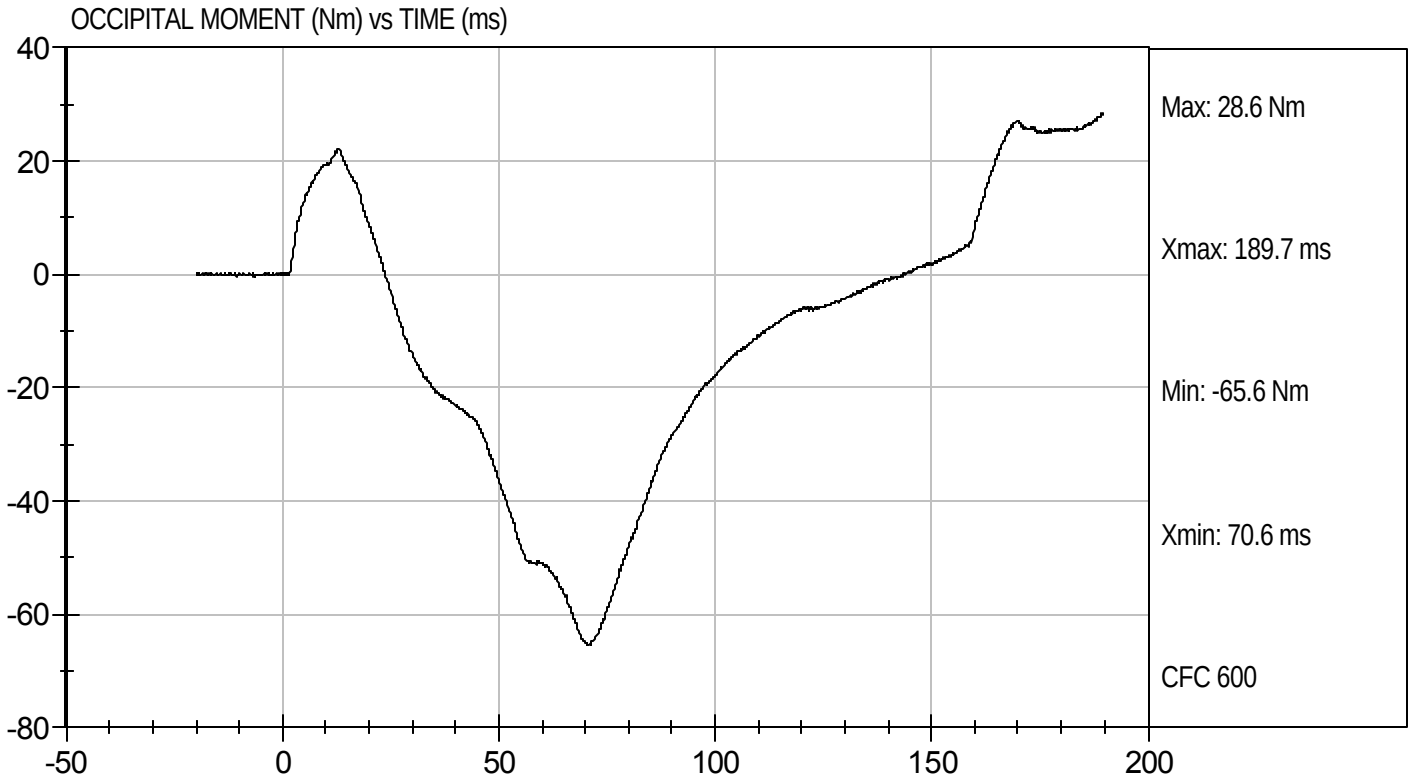


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D111133

Test Date: 3/25/11
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D111134

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	23	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,327	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.87	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

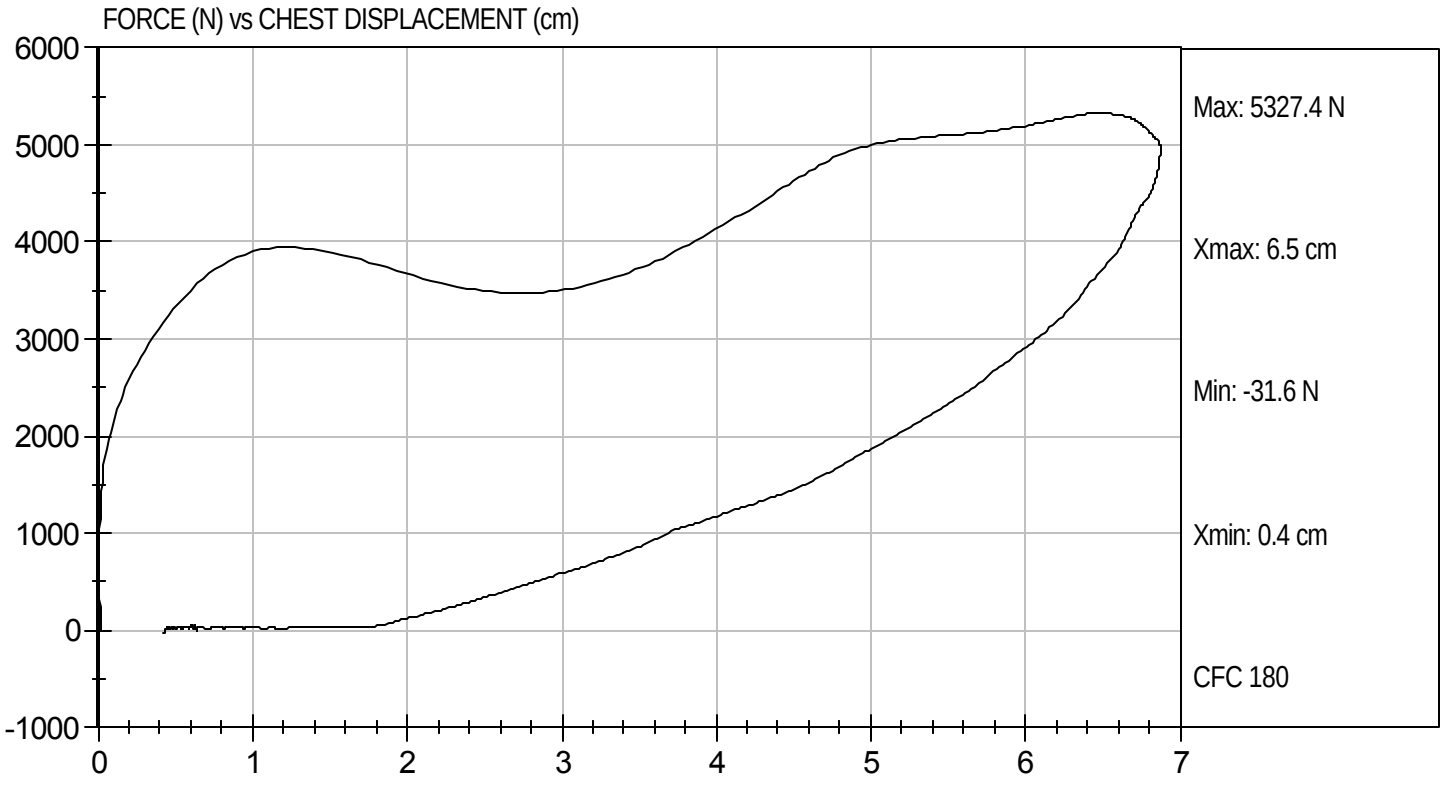
Jessica Gall
Laboratory Technician

3/25/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D111134

Test Date: 3/25/11
Velocity: 22.2 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D111135

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,226	Pass
		Overall Test Results		Pass

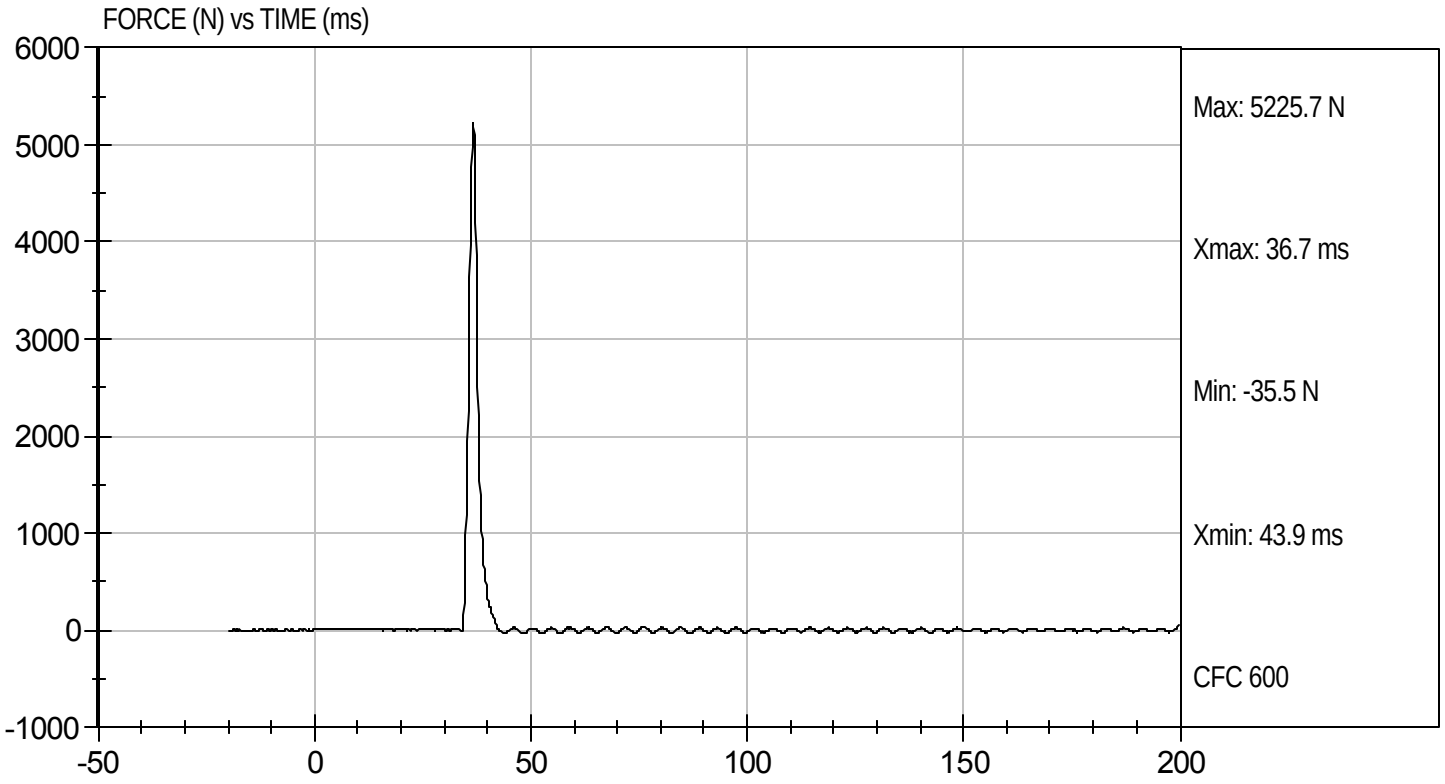
Jessica Hall
Laboratory Technician

3/25/11
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D111135

Test Date: 3/25/11
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D111136

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,358	Pass
		Overall Test Results		Pass

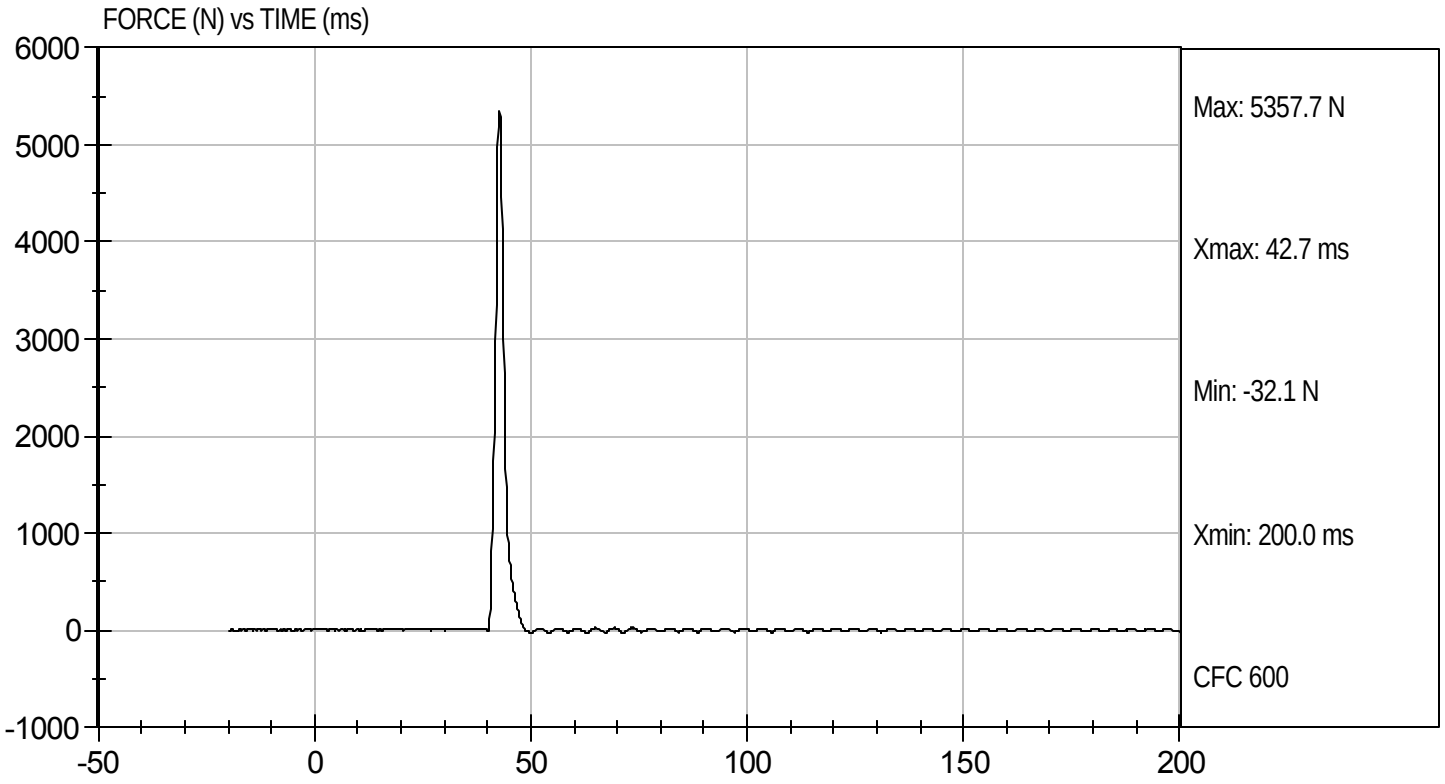
Jessica Hall
Laboratory Technician

3/25/11
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D111136

Test Date: 3/25/11
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D111130

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.3	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	20	20	Pass
Rotation Rate	deg/s	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	58.6	51.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	49	48	Pass
		Overall Test Results			Pass

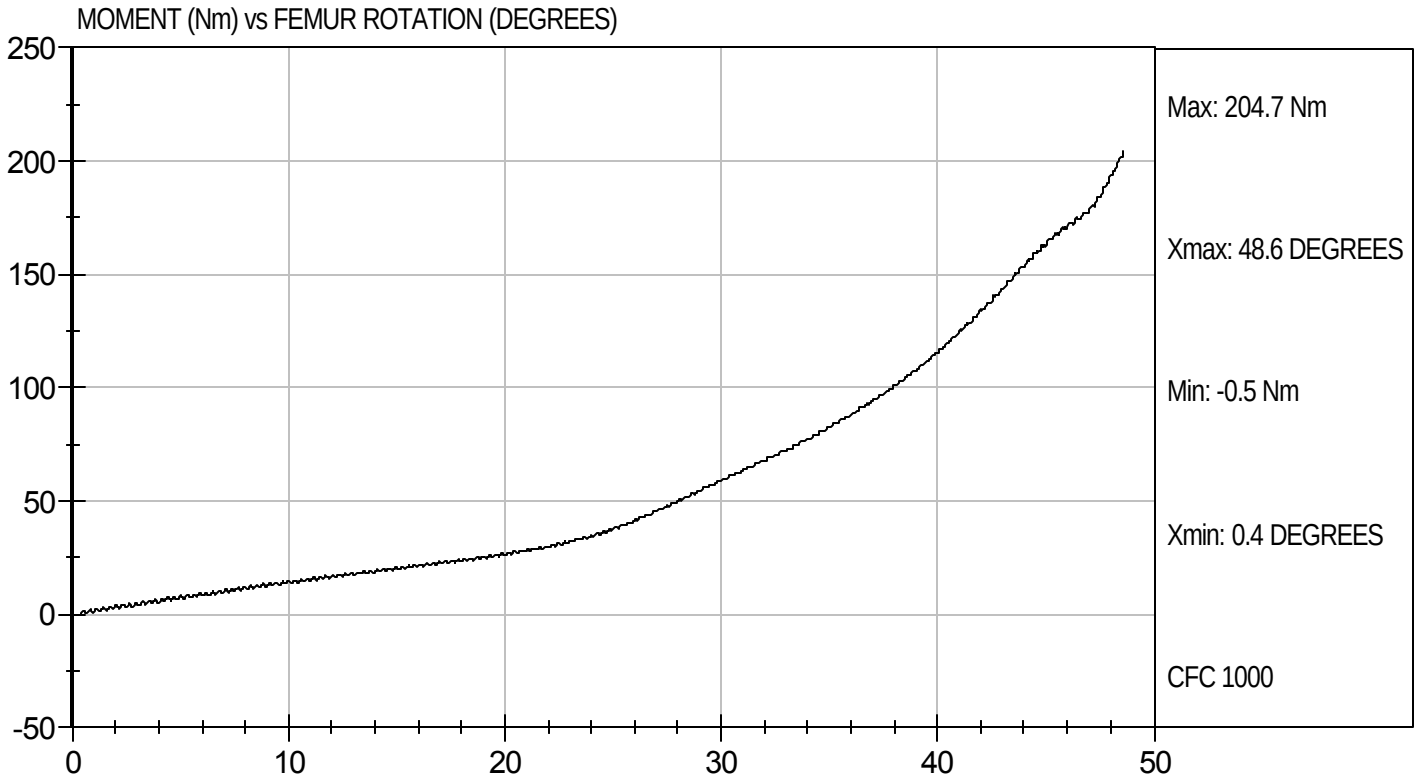
Jessica Hall
Laboratory Technician

3/25/11
Test Date

David Winkelbauer
Approved By

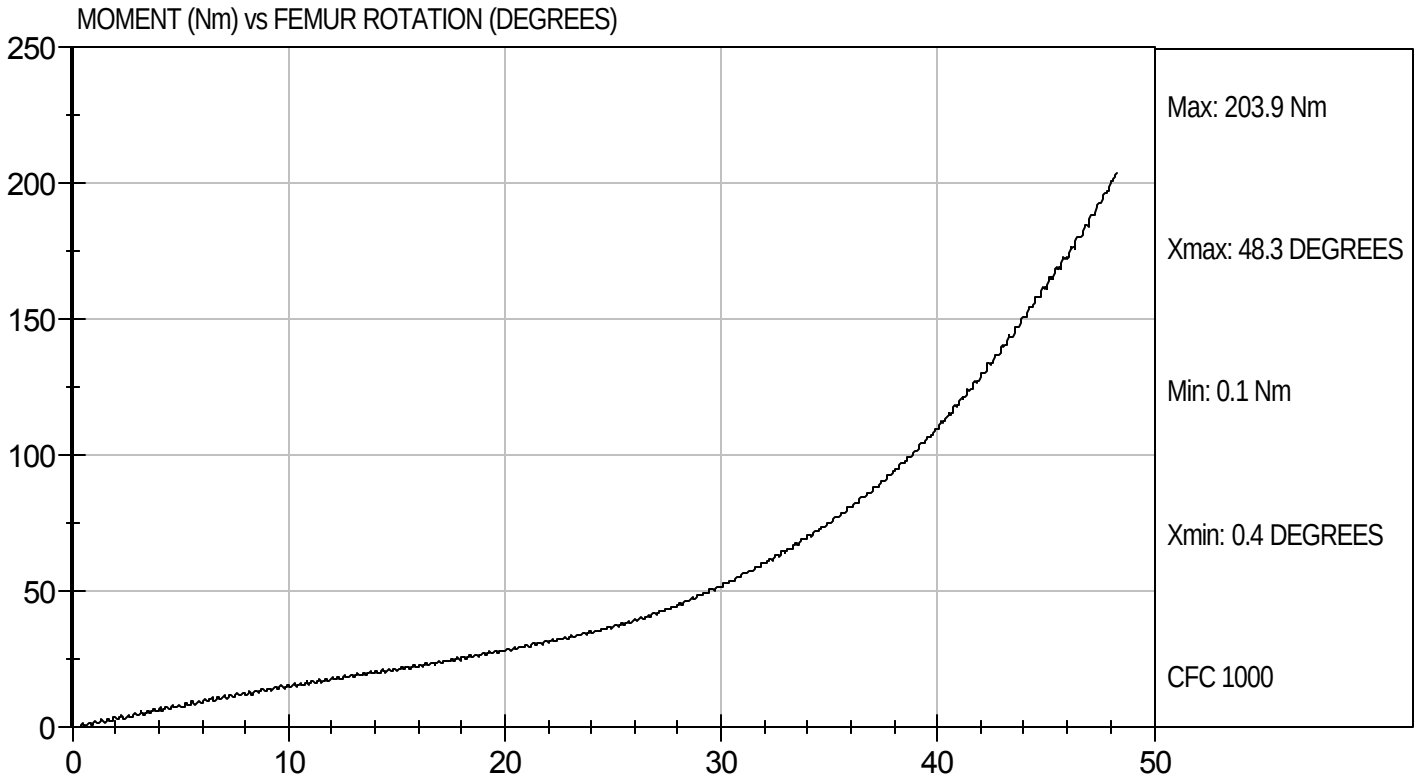
Test Desc: Hip Femur Flexion
Component ID: D111139

Test Date: 3/25/11
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D111130

Test Date: 3/25/11
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test ID:** D111741

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Peak Resultant Acceleration	G's	225 - 275	238	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	7.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

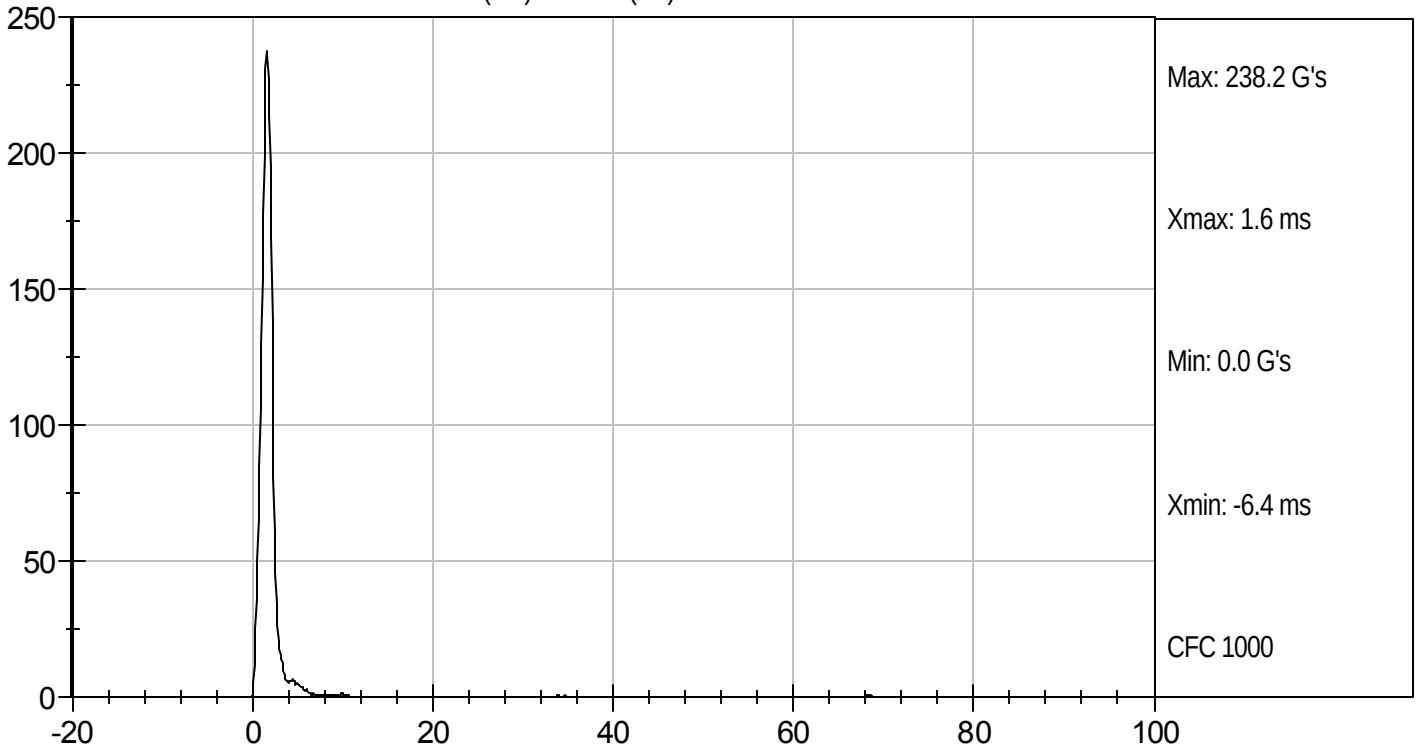
5/11/11
Test Date

David Winkelbauer
Approved By

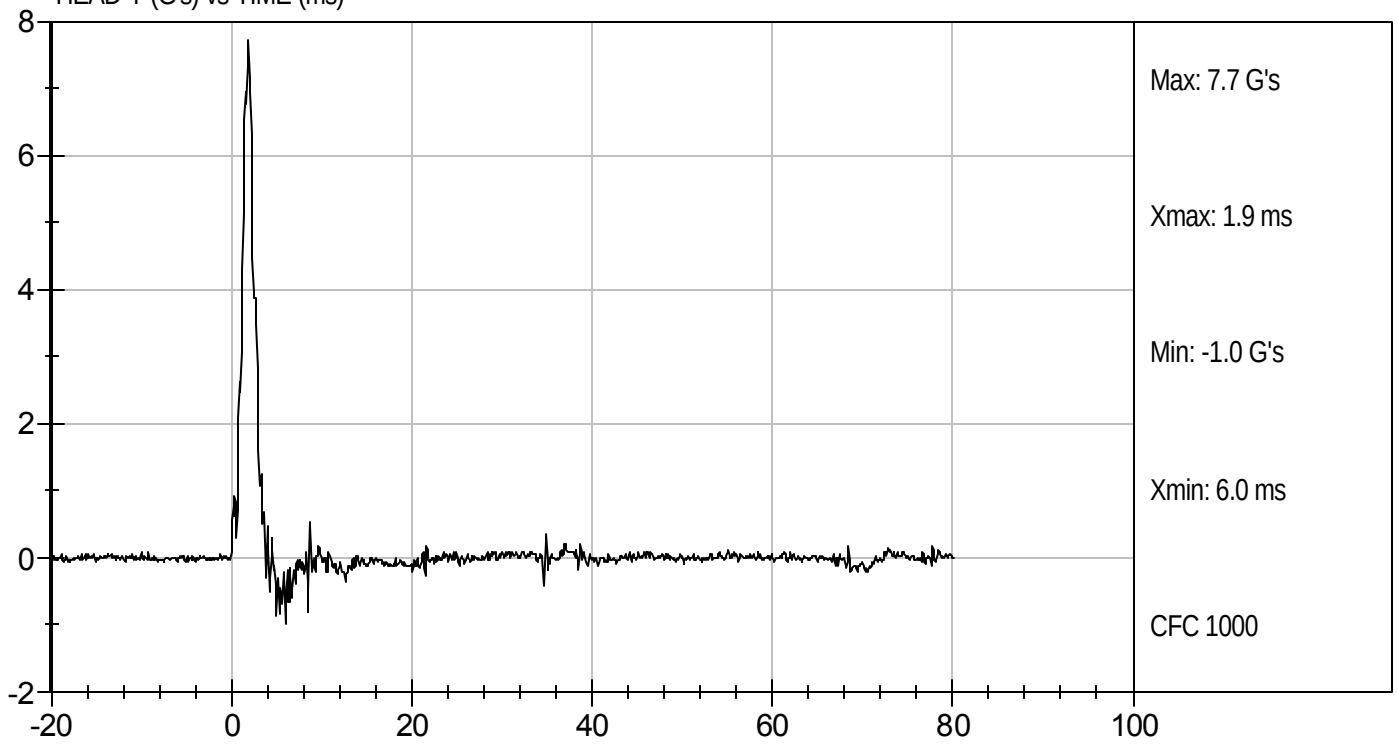
Test Desc: Head Drop
Component ID: D111741

Test Date: 5/11/11
Velocity: 0 ft/s, 0.00 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: 036 **Test I.D:** D111742

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.23	Pass
	20 ms	G's	17.60 to 22.60	19.05	Pass
	30 ms	G's	12.50 to 18.50	12.84	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	12.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	72.8	Pass
	Time	ms	57.0 to 64.0	58.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	116.5	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	94.6	Pass
	Time	ms	47.0 to 58.0	48.6	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	97.2	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

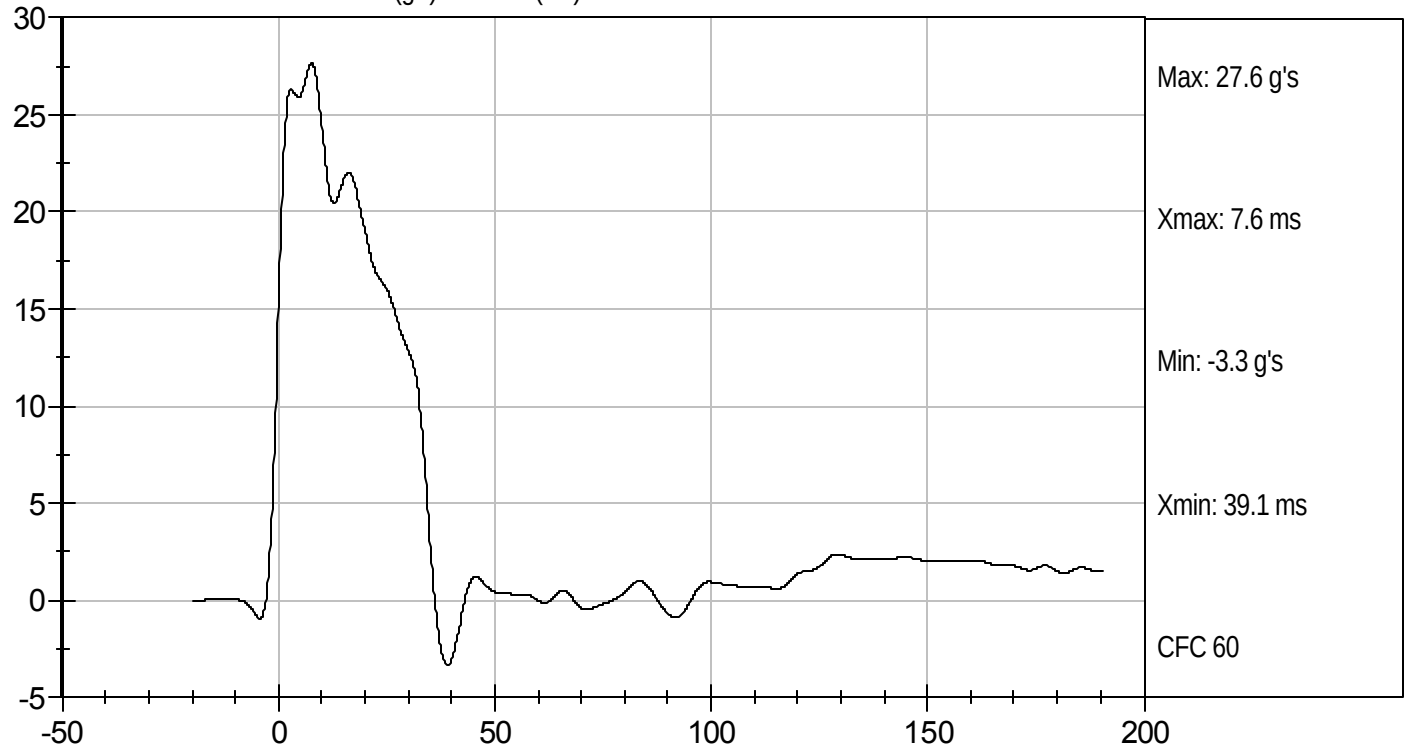
5/12/11
Test Date

David Winkelbauer
Approved By

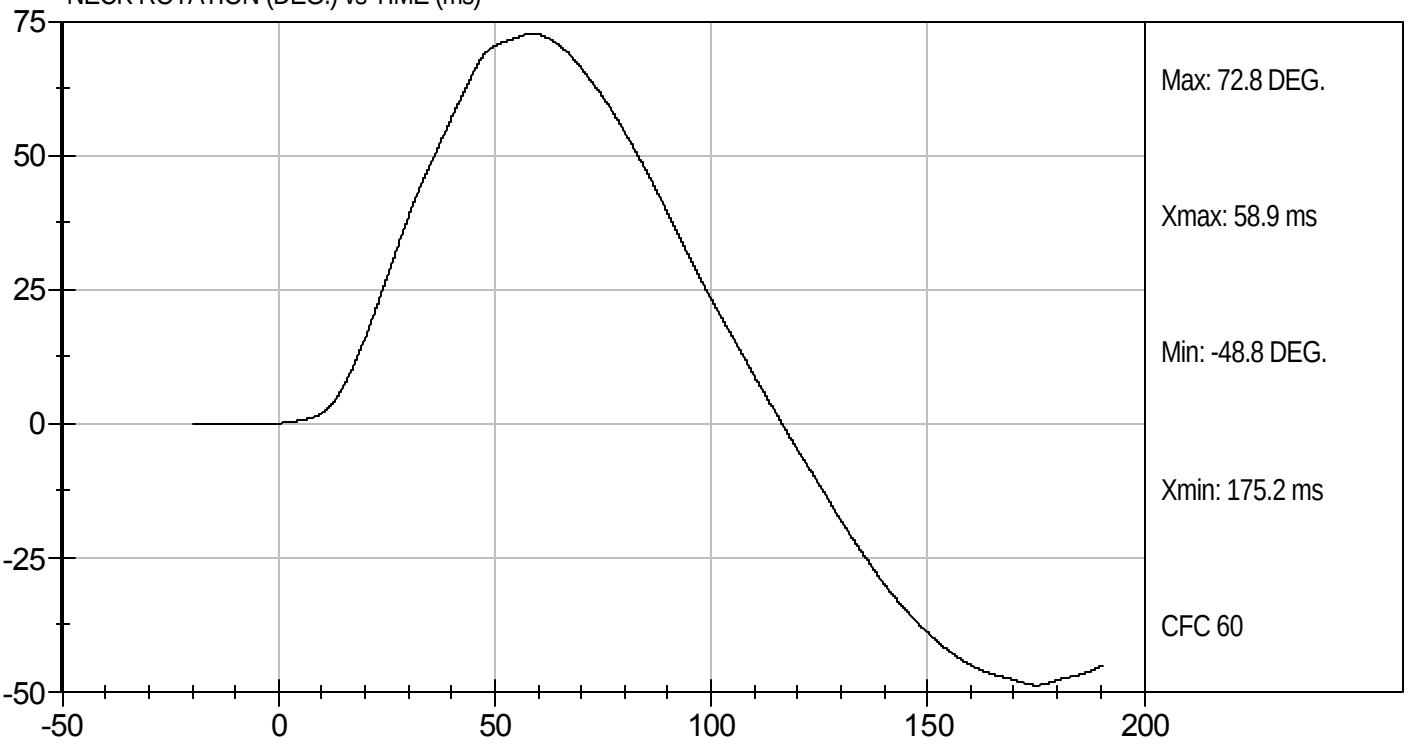
Test Desc: Neck Flexion
Component ID: D111742

Test Date: 5/12/11
Velocity: 22.83 ft/s, 6.96 m/s

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

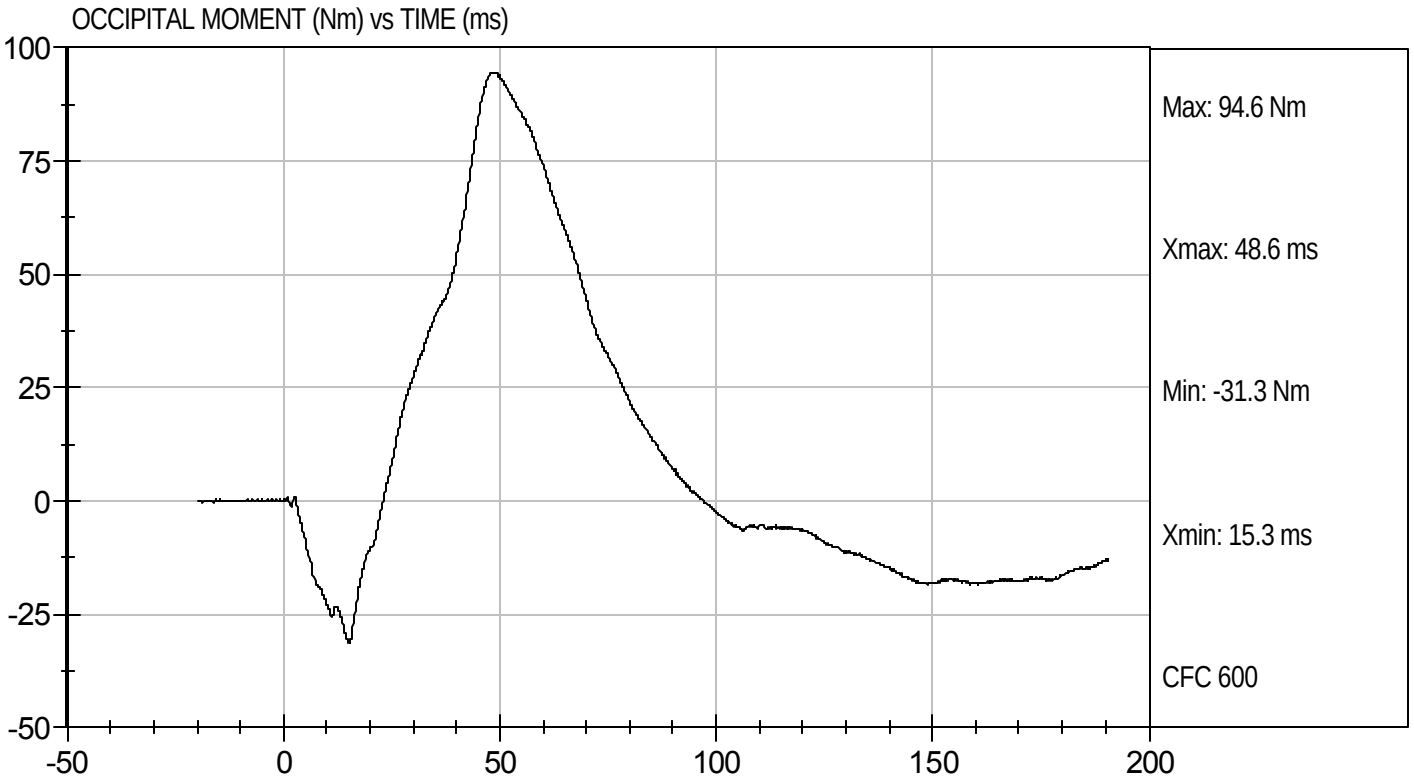


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D111742

Test Date: 5/12/11
Velocity: 22.83 ft/s, 6.96 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D111743

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	49	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.67	Pass
	20 ms	G's	14.00 to 19.00	17.25	Pass
	30 ms	G's	11.00 to 16.00	12.01	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.0	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	98.5	Pass
	Time	ms	72.0 to 82.0	74.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	158.0	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-70.6	Pass
	Time	ms	65.0 to 79.0	69.0	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	140.0	Pass
			Overall Test Results		Pass

Jessica Gall
Laboratory Technician

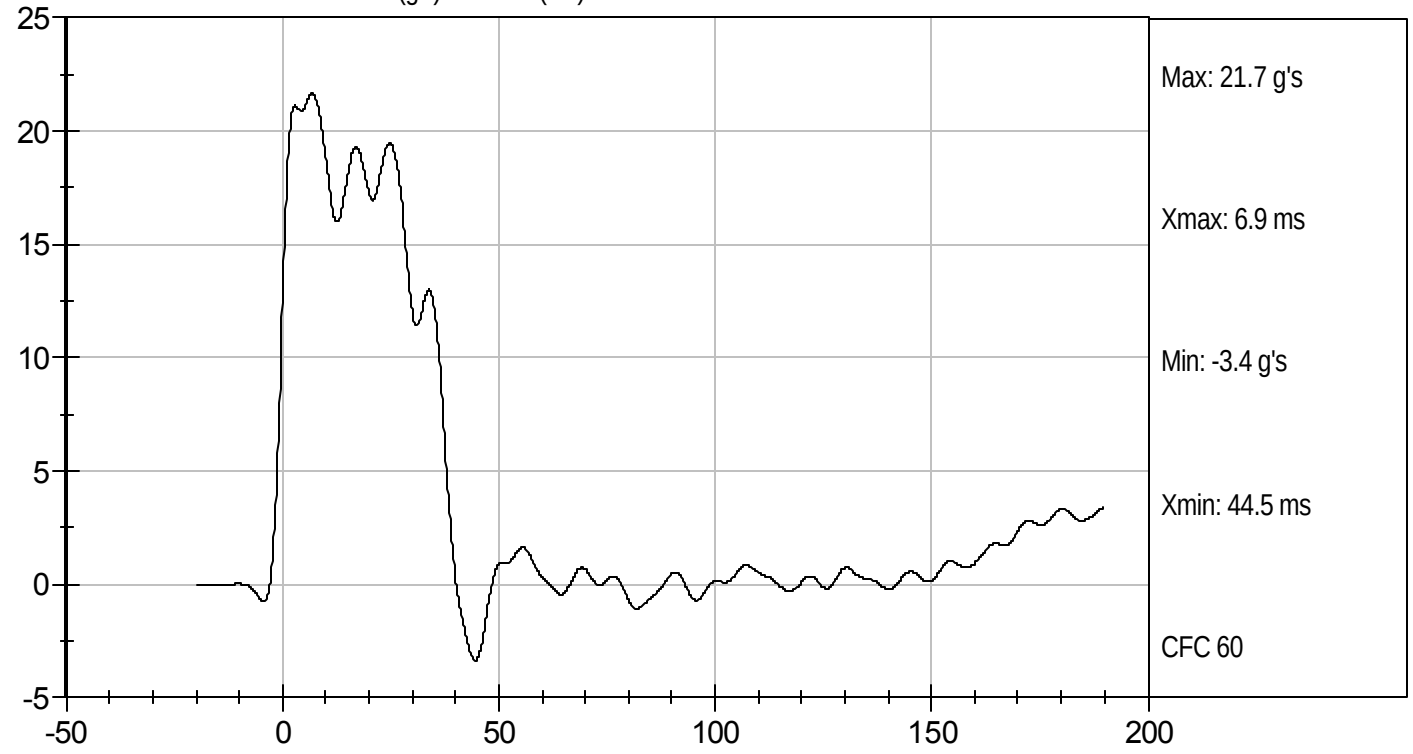
5/12/11
Test Date

David Winkelbauer
Approved By

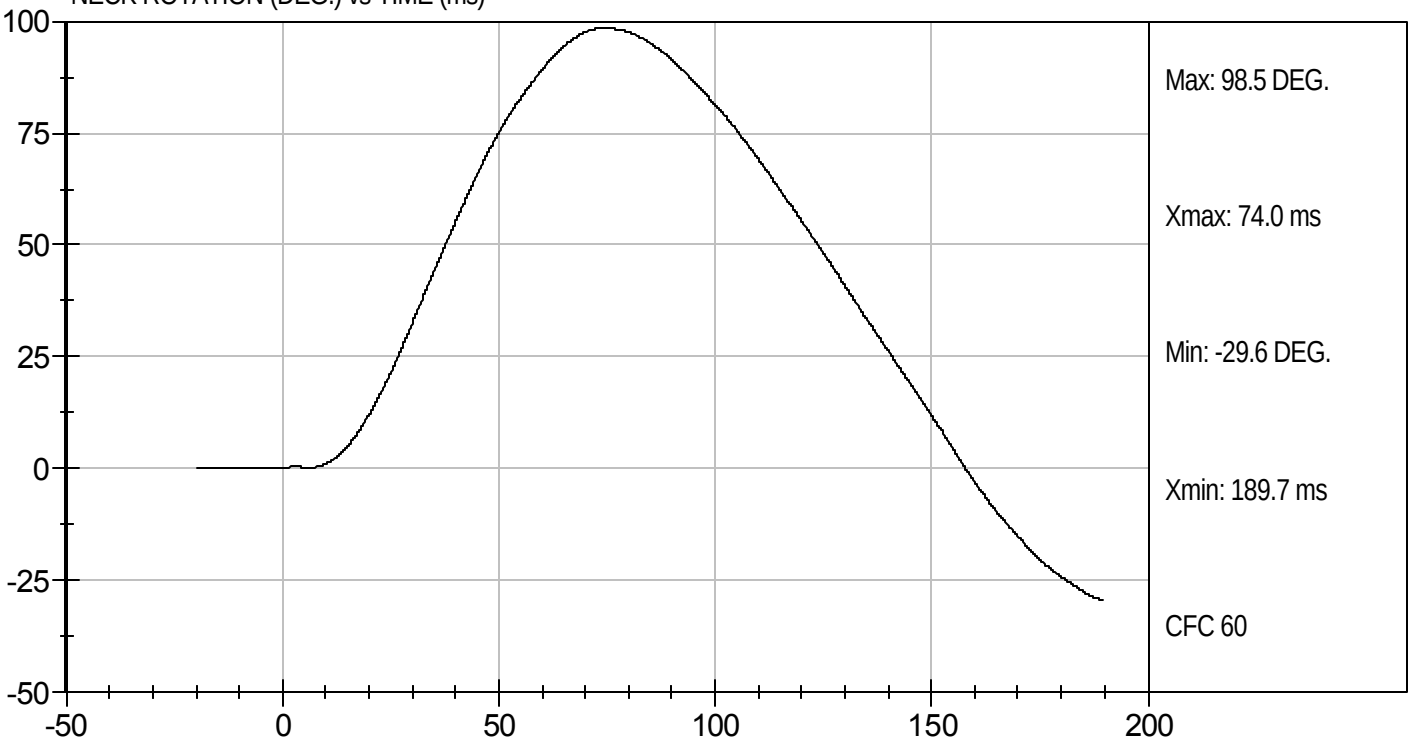
Test Desc: Neck Extension
Component ID: D111743

Test Date: 5/12/11
Velocity: 20.08 ft/s, 6.12 m/s

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

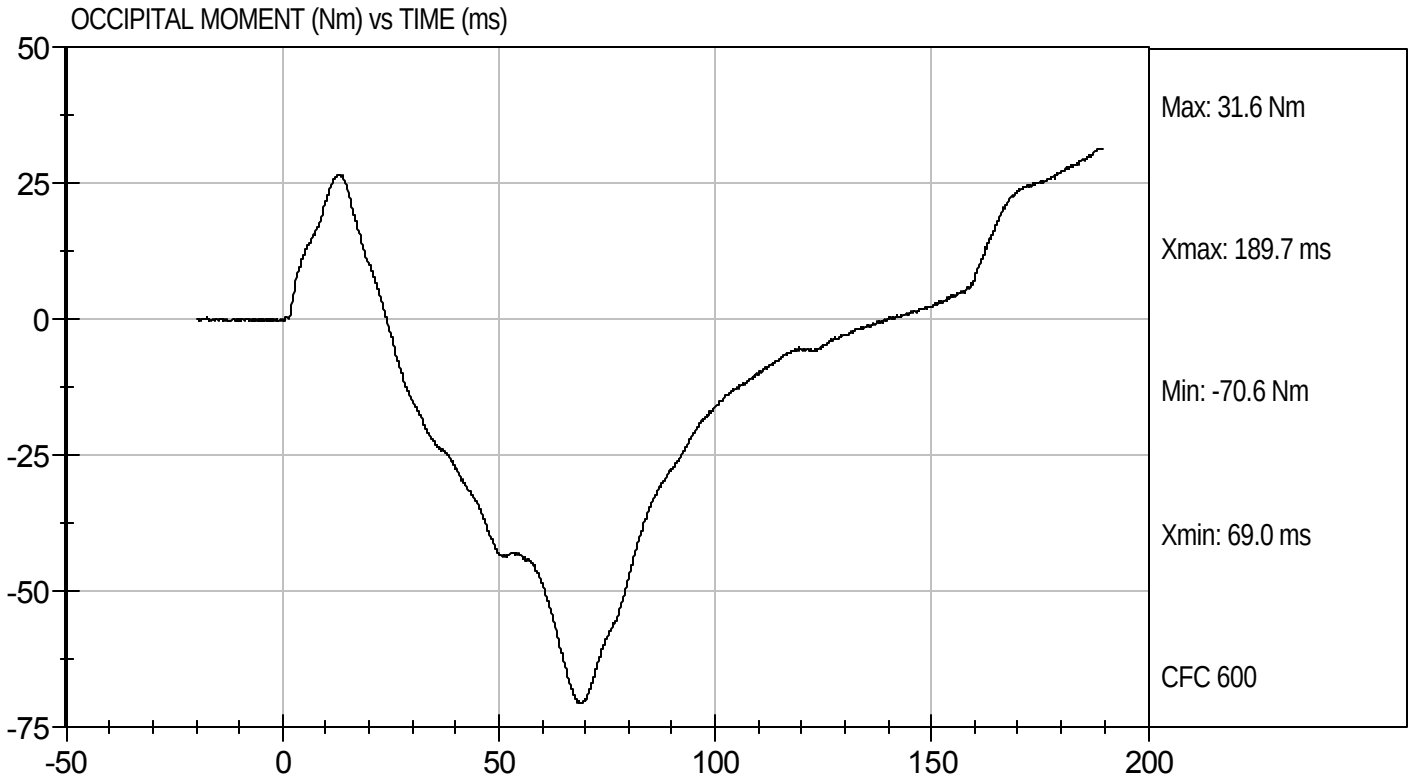


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D111743

Test Date: 5/12/11
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D111744

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,309	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.92	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

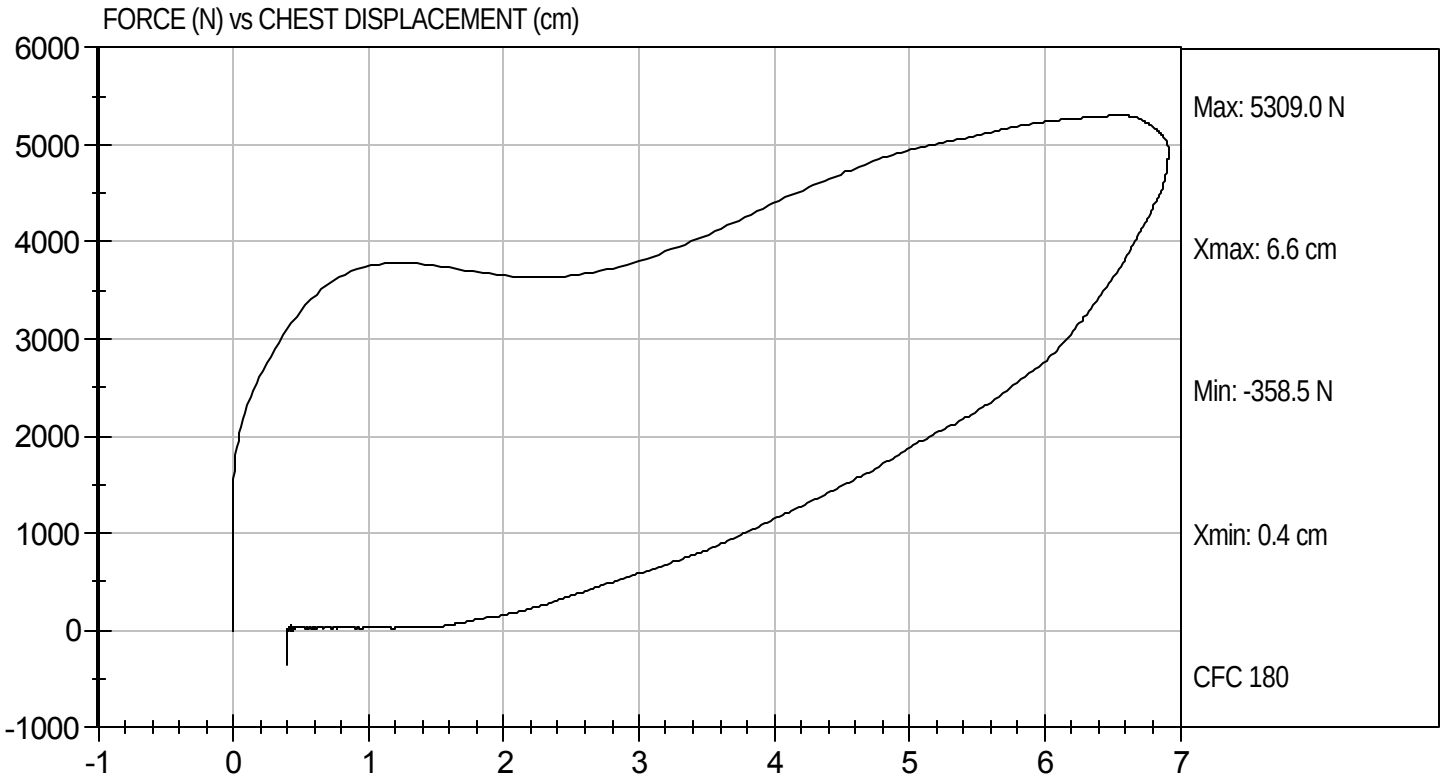
Jessica Hall
Laboratory Technician

5/12/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D111744

Test Date: 5/12/11
Velocity: 22.22 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D111745

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,012	Pass
		Overall Test Results		Pass

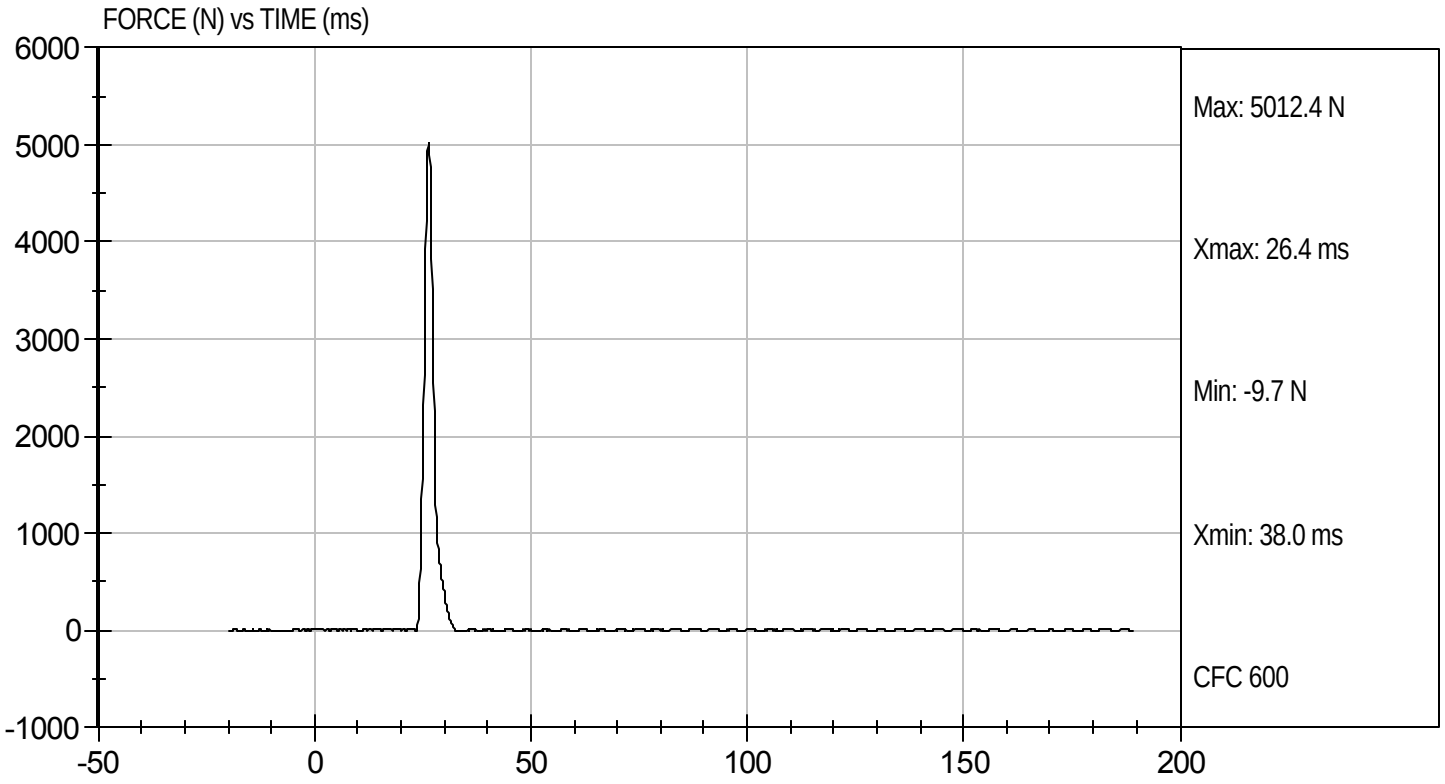
Jessica Hall
Laboratory Technician

5/12/11
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D111745

Test Date: 5/12/11
Velocity: 6.9 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D111746

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Velocity	m/s	2.07 to 2.13	2.07	Pass
Peak Probe Force	Newtons	4715 to 5782	5,640	Pass
		Overall Test Results		Pass

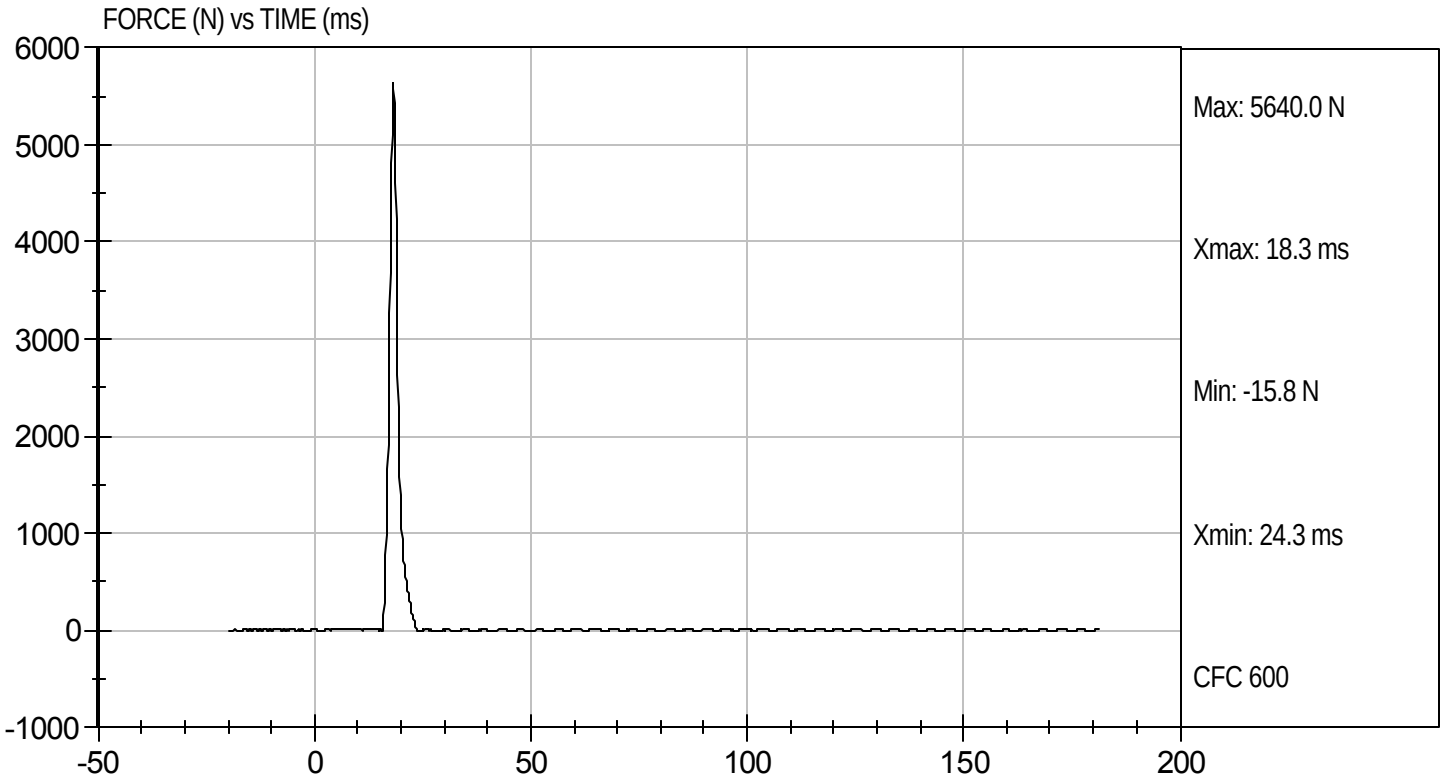
Jessica Gall
Laboratory Technician

5/12/11
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D111746

Test Date: 5/12/11
Velocity: 6.80 ft/s, 2.07 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D111740

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.9	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	47	47	Pass
Rotation Rate	deg/s	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	58.3	54.6	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	49	48	Pass
		Overall Test Results			Pass

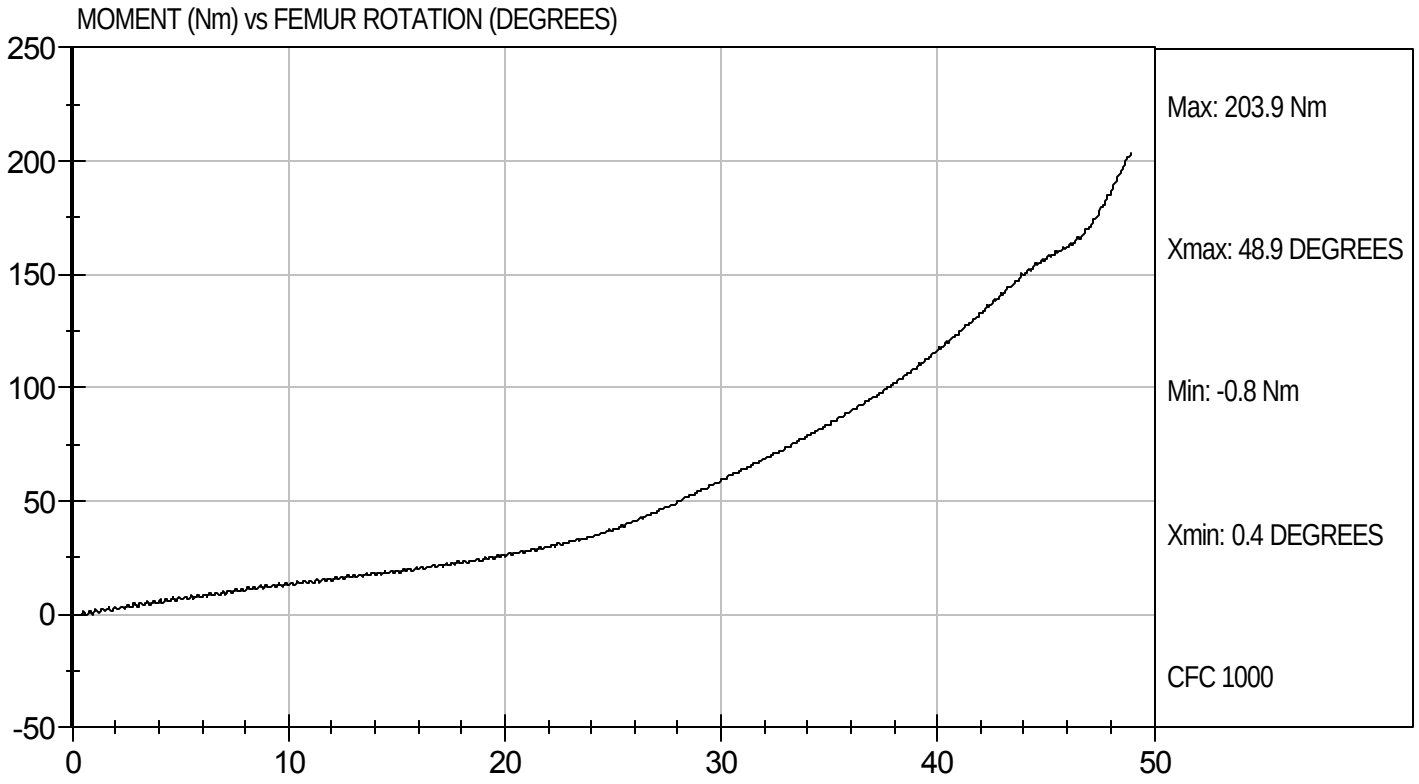
Jessica Hall
Laboratory Technician

5/11/11
Test Date

David Winkelbauer
Approved By

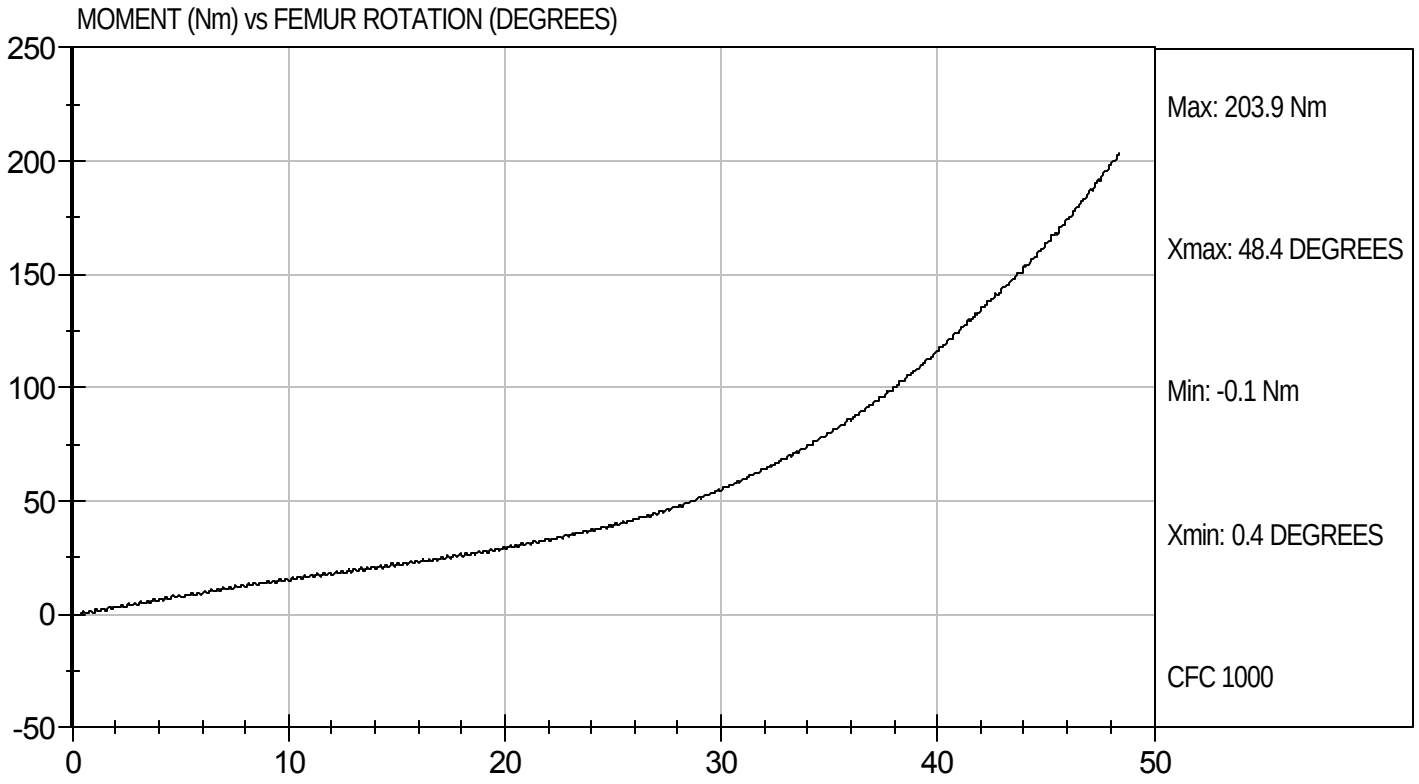
Test Desc: Hip Femur Flexion
Component ID: D111749

Test Date: 5/11/11
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D111740

Test Date: 5/11/11
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test ID:** D11811

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Peak Resultant Acceleration	G's	250 to 300	260	Pass
Peak Lateral Acceleration	G's	+/- 15	8.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

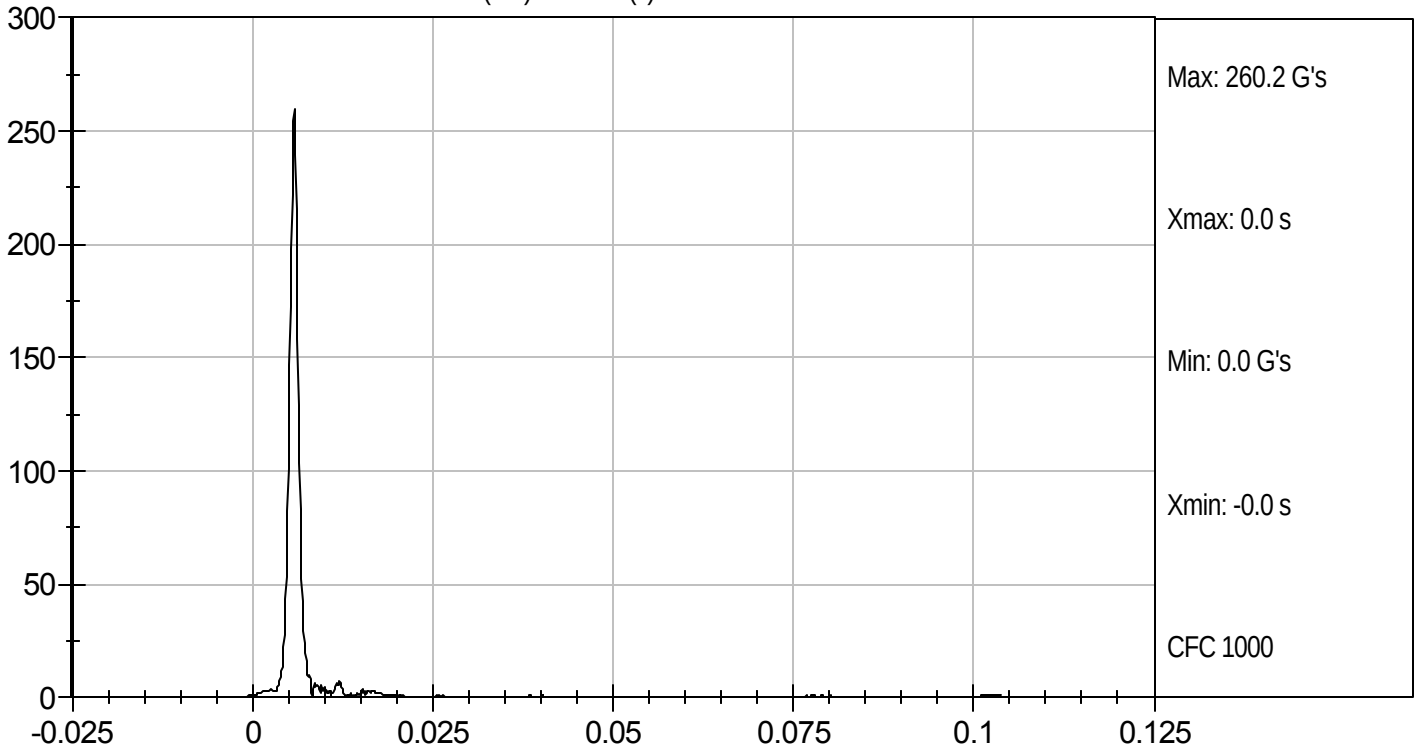
3/2/11
Test Date

David Winkelbauer
Approved By

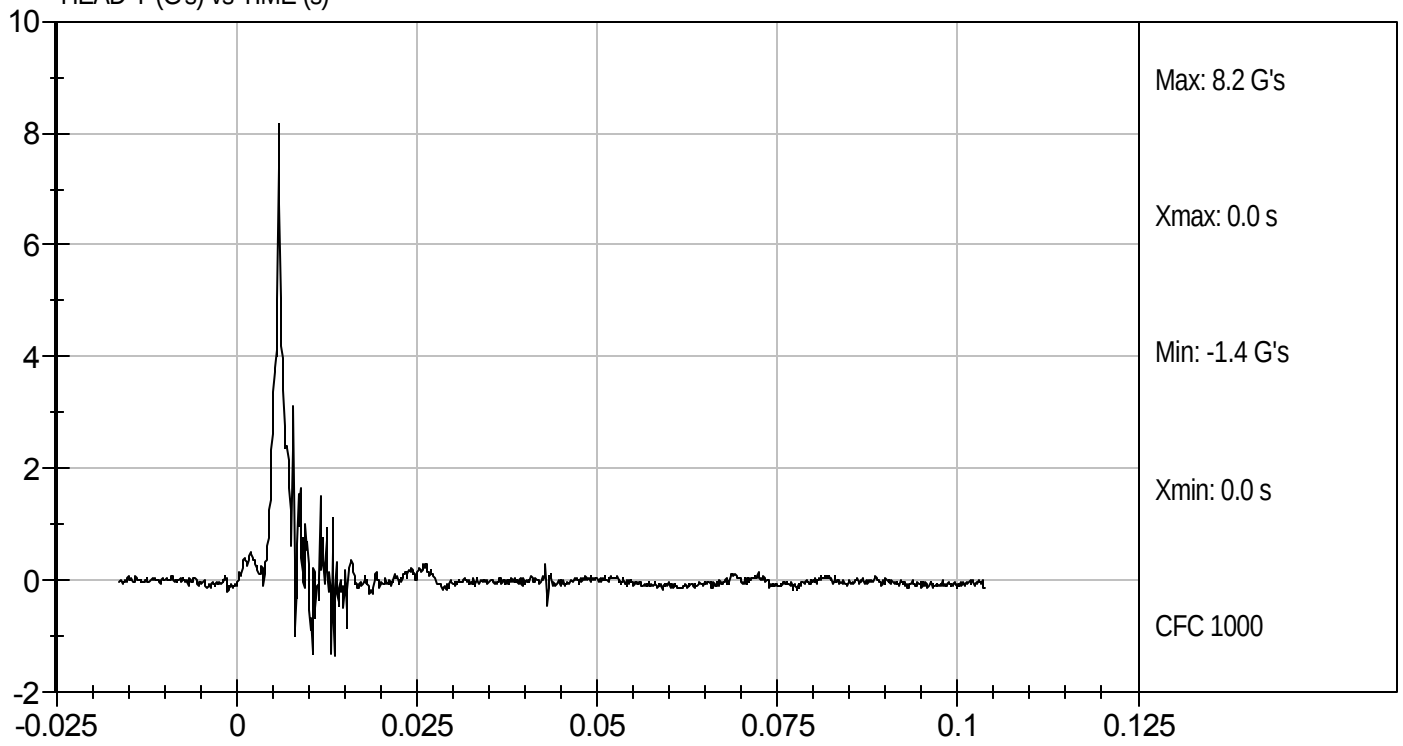
Test Desc: Head Drop
Component ID: D11811

Test Date: 3/2/11
Velocity: 0 ft/s, 0.00 m/s

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



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11812

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	15	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	2.1 to 2.5	2.5	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.3	Pass
D Plane Rotation	Max	deg	77 to 91	80	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	86	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

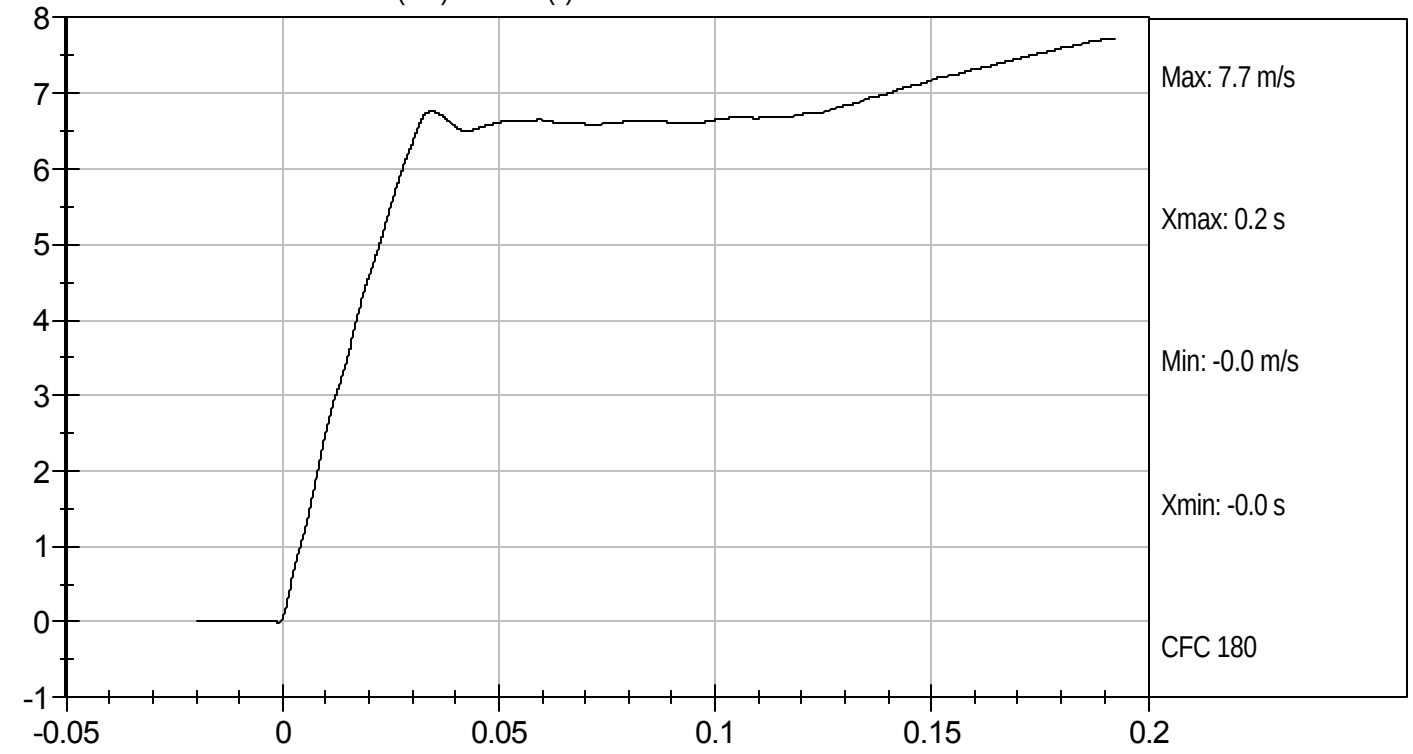
3/2/11
Test Date

David Winkelbauer
Approved By

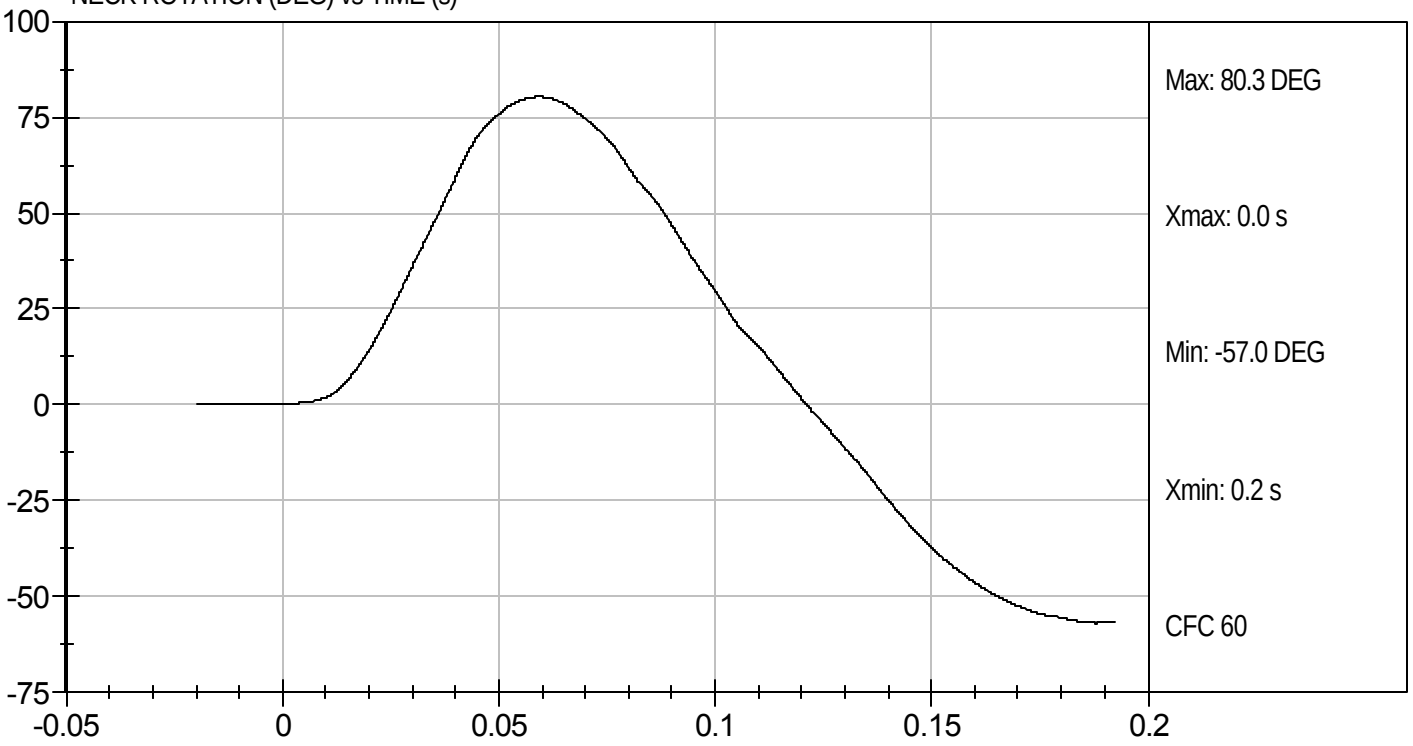
Test Desc: Neck Flexion
Component ID: D11812

Test Date: 3/2/11
Velocity: 23.15 ft/s, 7.06 m/s

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

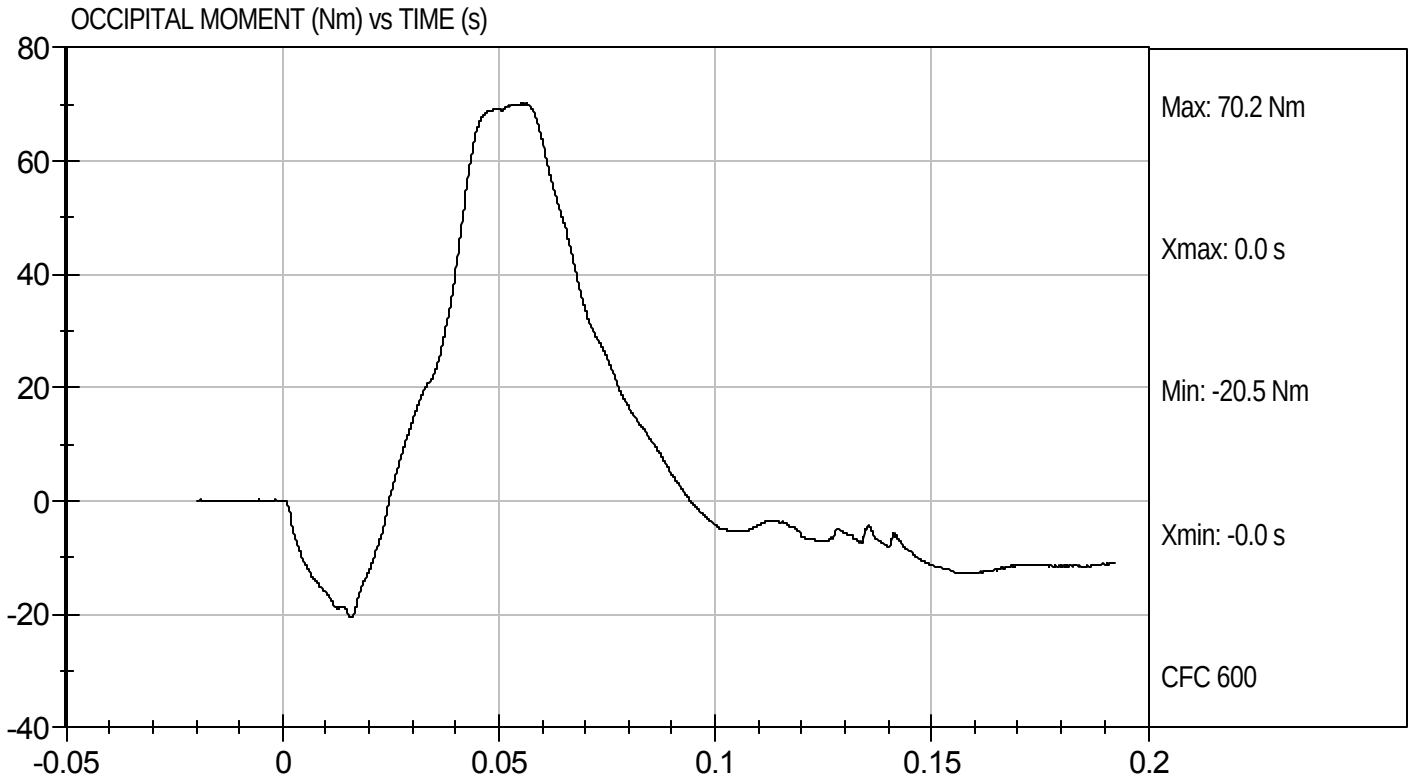


NECK ROTATION (DEG) vs TIME (s)



Test Desc: Neck Flexion
Component ID: D11812

Test Date: 3/2/11
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:** D11813

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	16	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.13	Pass
Pendulum Deceleration	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.3	Pass
	30 ms	m/s	4.6 to 5.6	4.9	Pass
D Plane Rotation	Max	deg	99 to 114	102	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	102	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

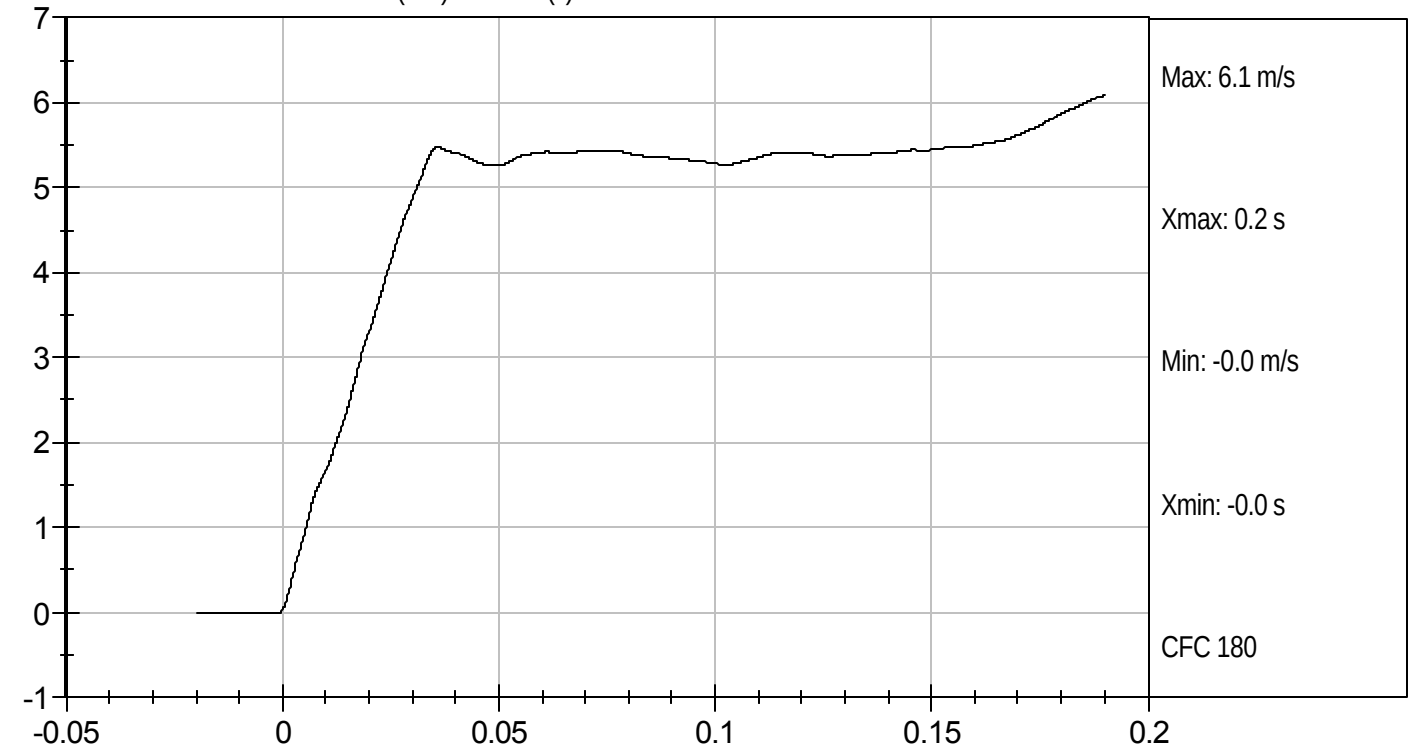
3/2/11
Test Date

David Winkelbauer
Approved By

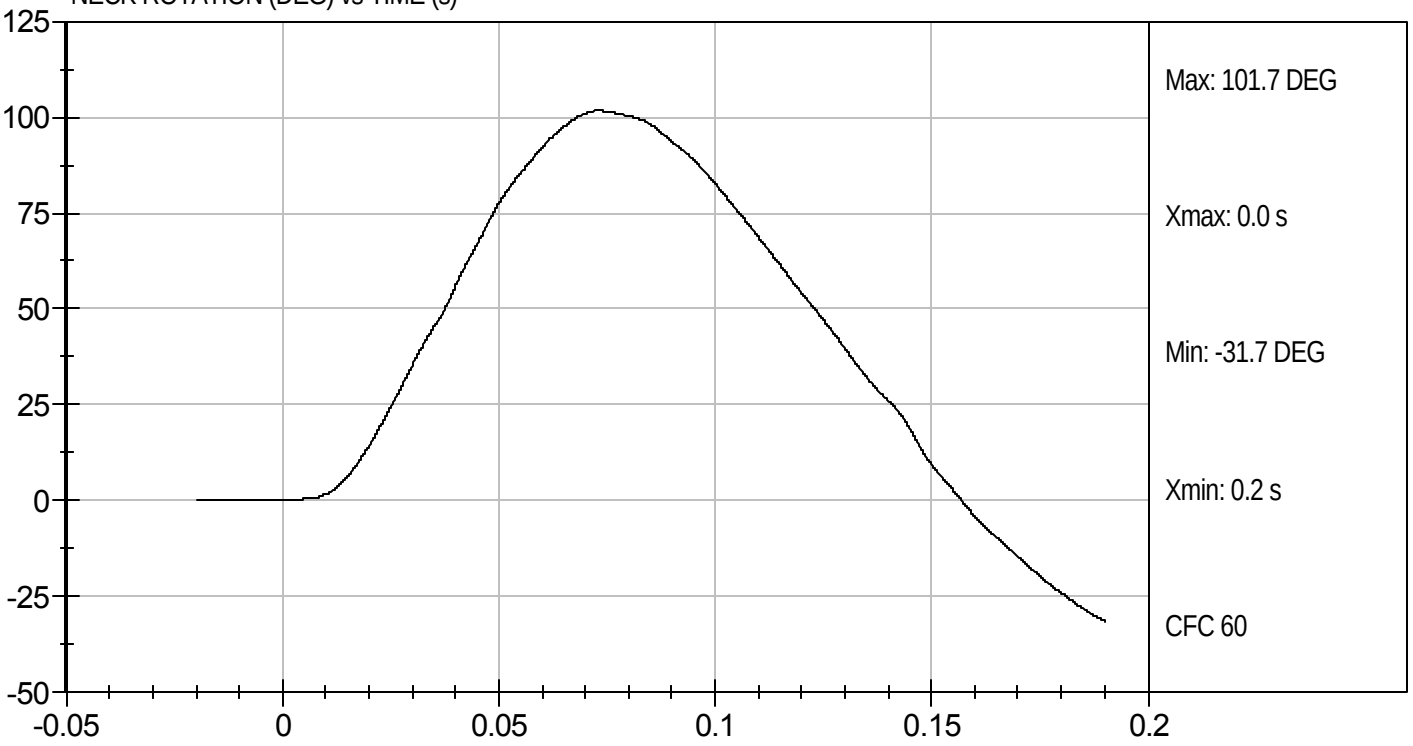
Test Desc: Neck Extension
Component ID: D11813

Test Date: 3/2/11
Velocity: 20.10 ft/s, 6.13 m/s

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

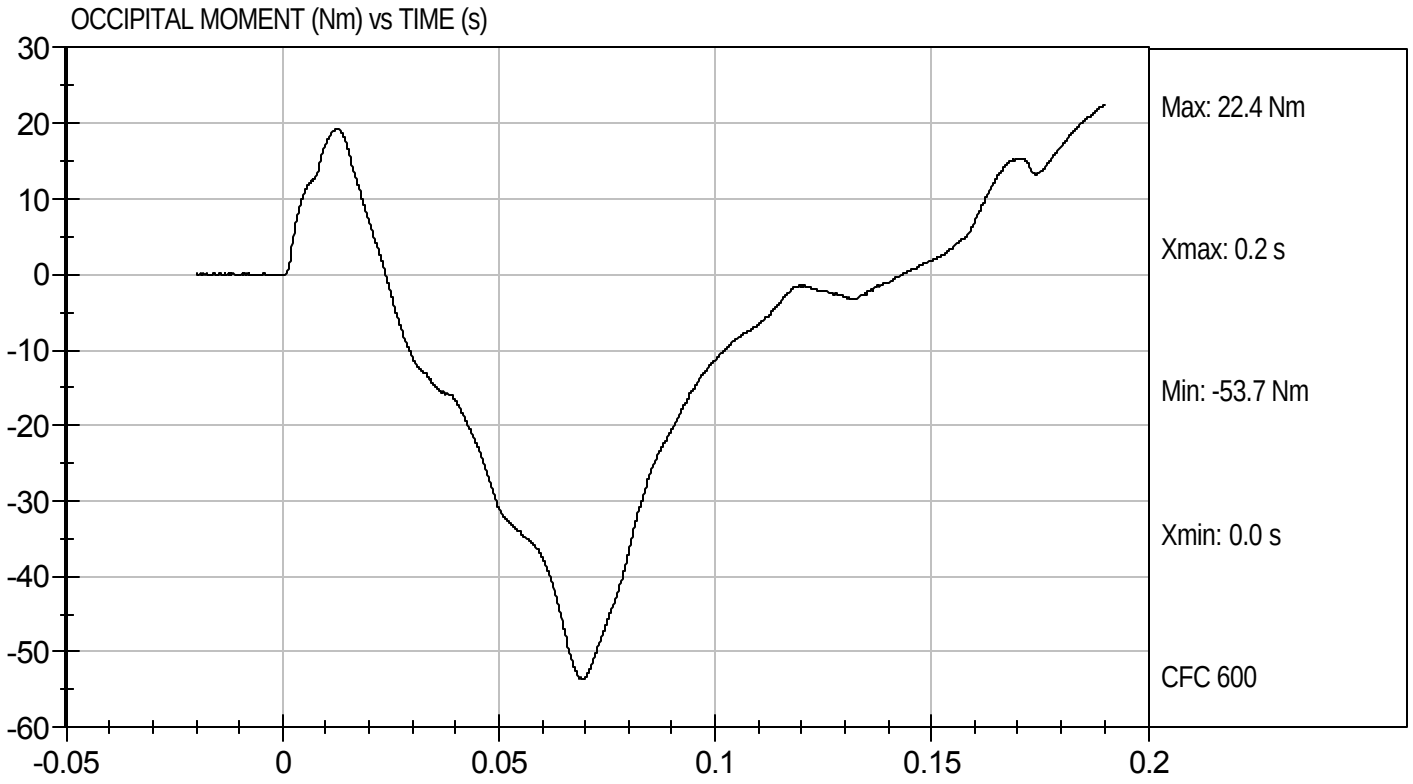


NECK ROTATION (DEG) vs TIME (s)



Test Desc: Neck Extension
Component ID: D11813

Test Date: 3/2/11
Velocity: 20.10 ft/s, 6.13 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11814

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Relative Humidity	%	10 to 70	17	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	56	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.0	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	3868	Pass
		Overall Test Results		Pass

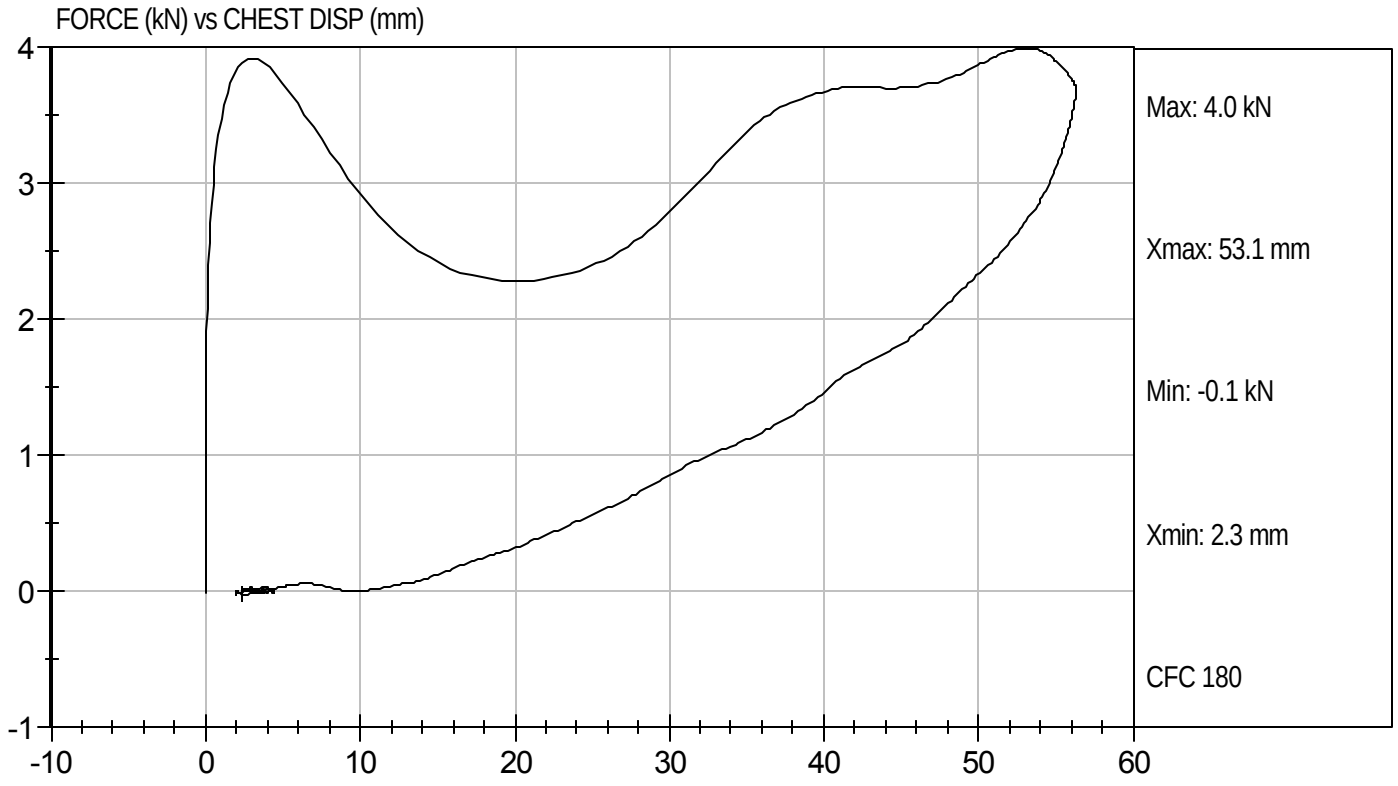
Jessica Hall
Laboratory Technician

3/3/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D11814

Test Date: 3/3/11
Velocity: 22.2 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11815

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.77	Pass
		Overall Test Results		Pass

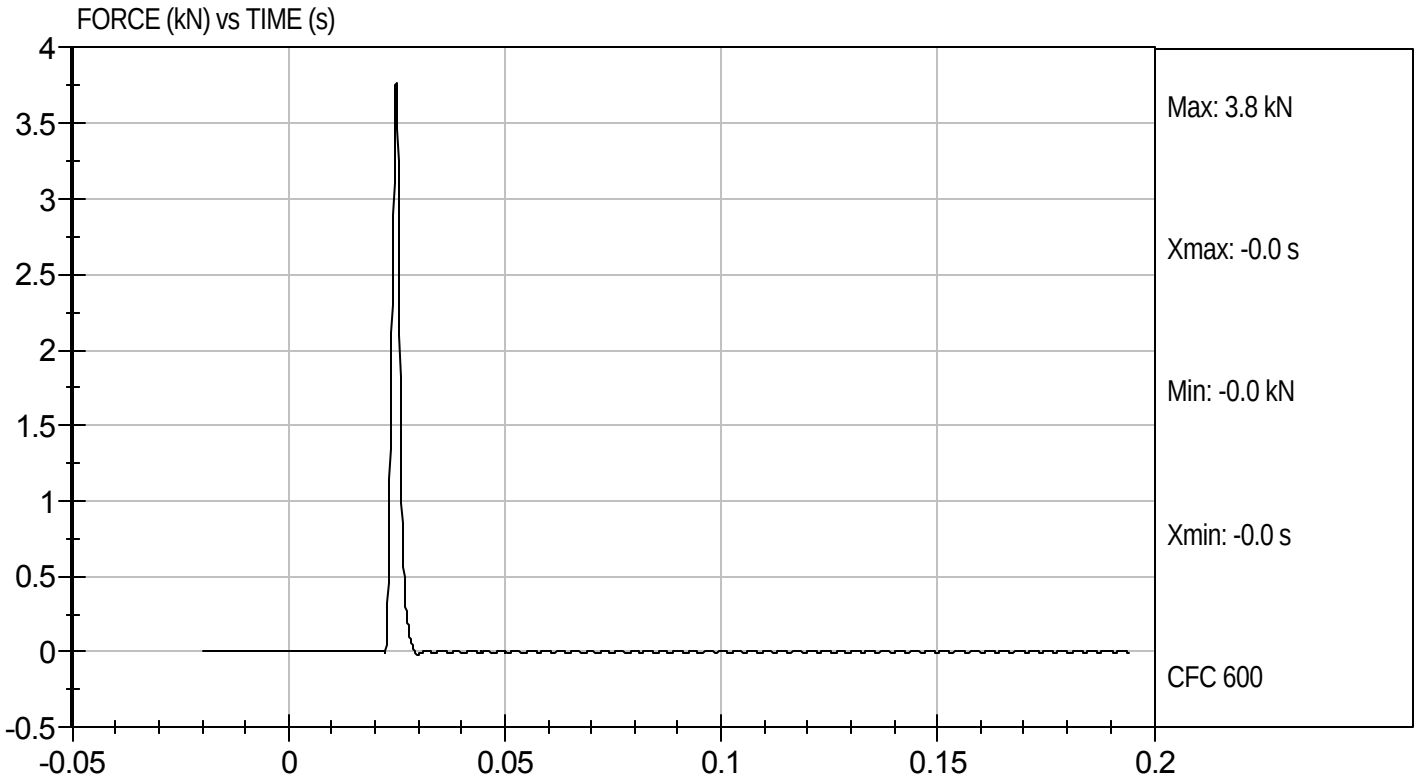
Jessica Gall
Laboratory Technician

3/2/11
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D11815

Test Date: 3/2/11
Velocity: 6.89 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11816

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.78	Pass
		Overall Test Results		Pass

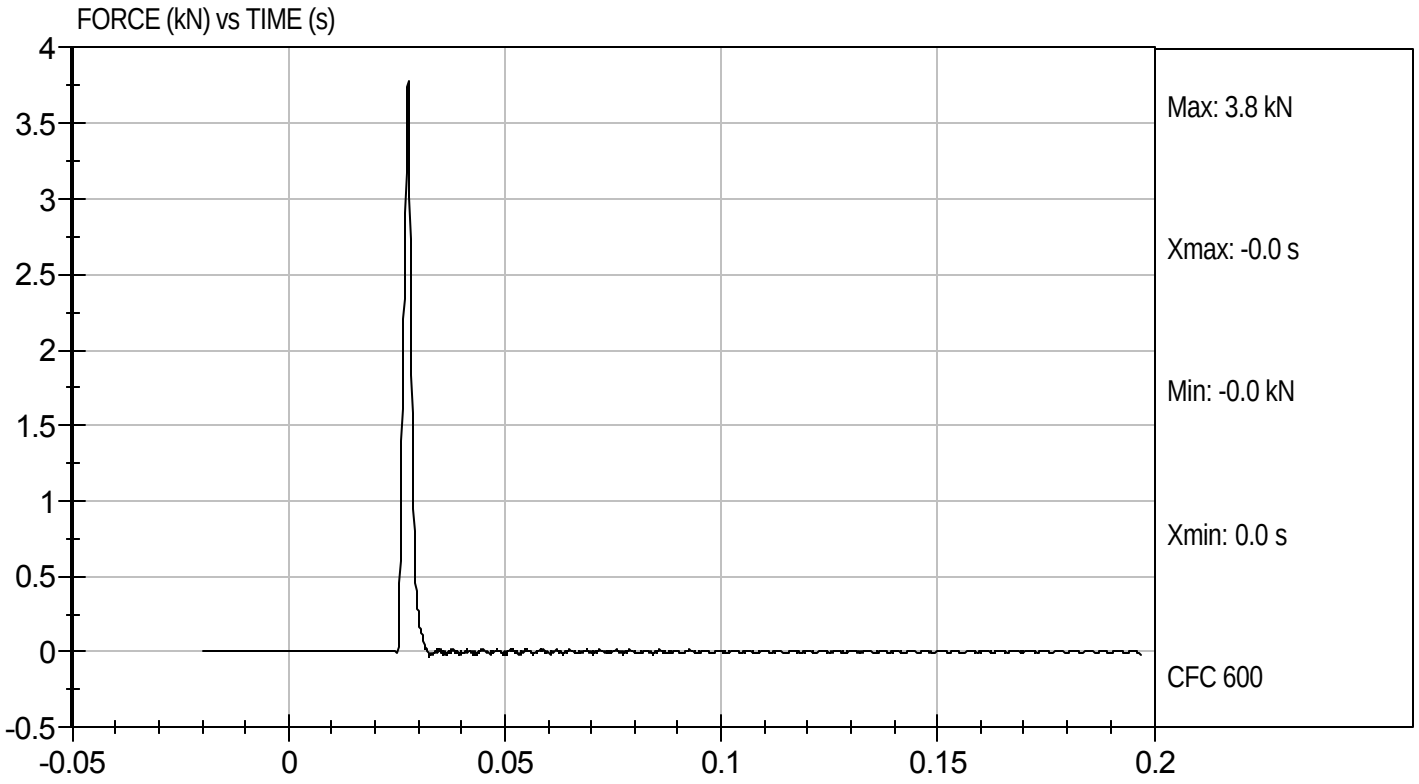
Jessica Hall
Laboratory Technician

3/2/11
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D11816

Test Date: 3/2/11
Velocity: 6.92 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11817

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	15	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	5	Pass
Force at 45 deg	N	320 to 390	346	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
		Overall Result		Pass

Jessica Hall
Laboratory Technician

3/2/11
Test Date

David Winkelbauer
Approved By

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test ID:** D111751

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Peak Resultant Acceleration	G's	250 to 300	274	Pass
Peak Lateral Acceleration	G's	+/- 15	-1.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

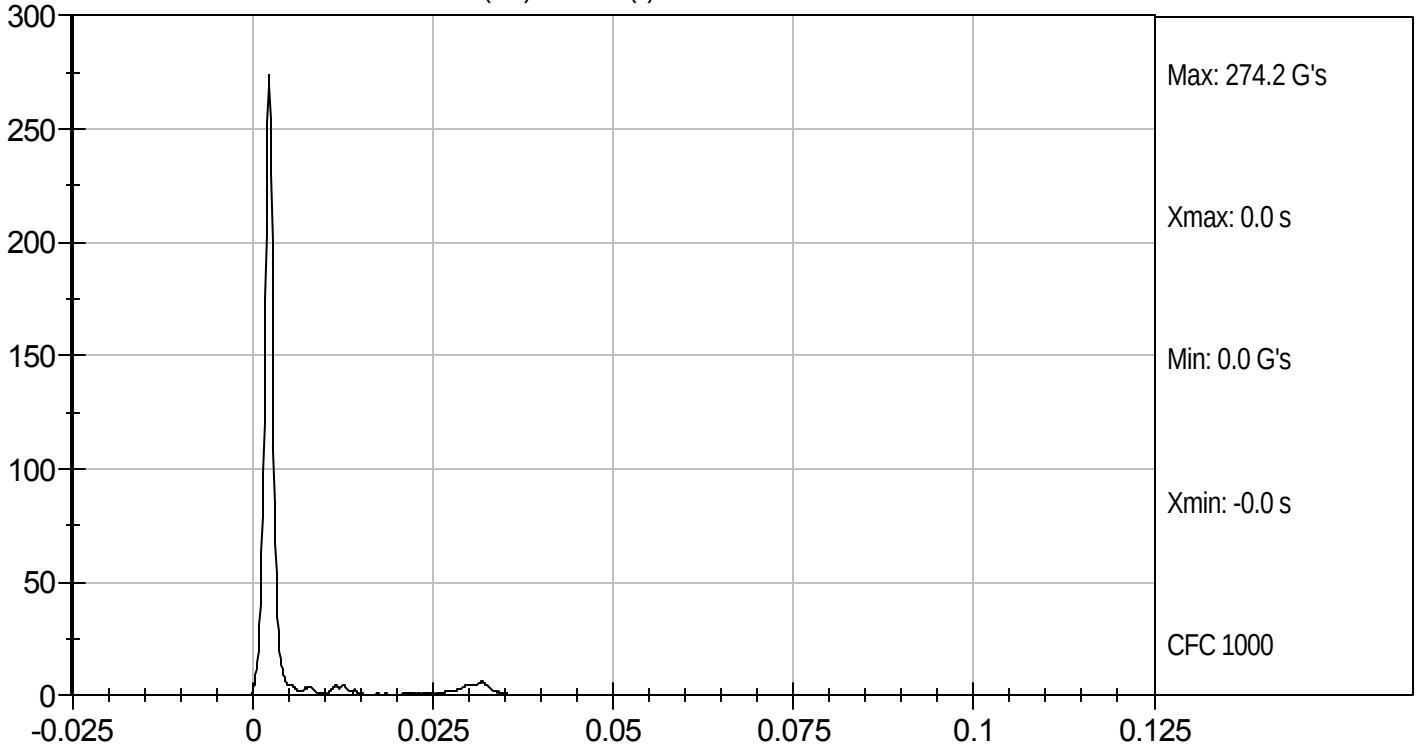
5/11/11
Test Date

David Winkelbauer
Approved By

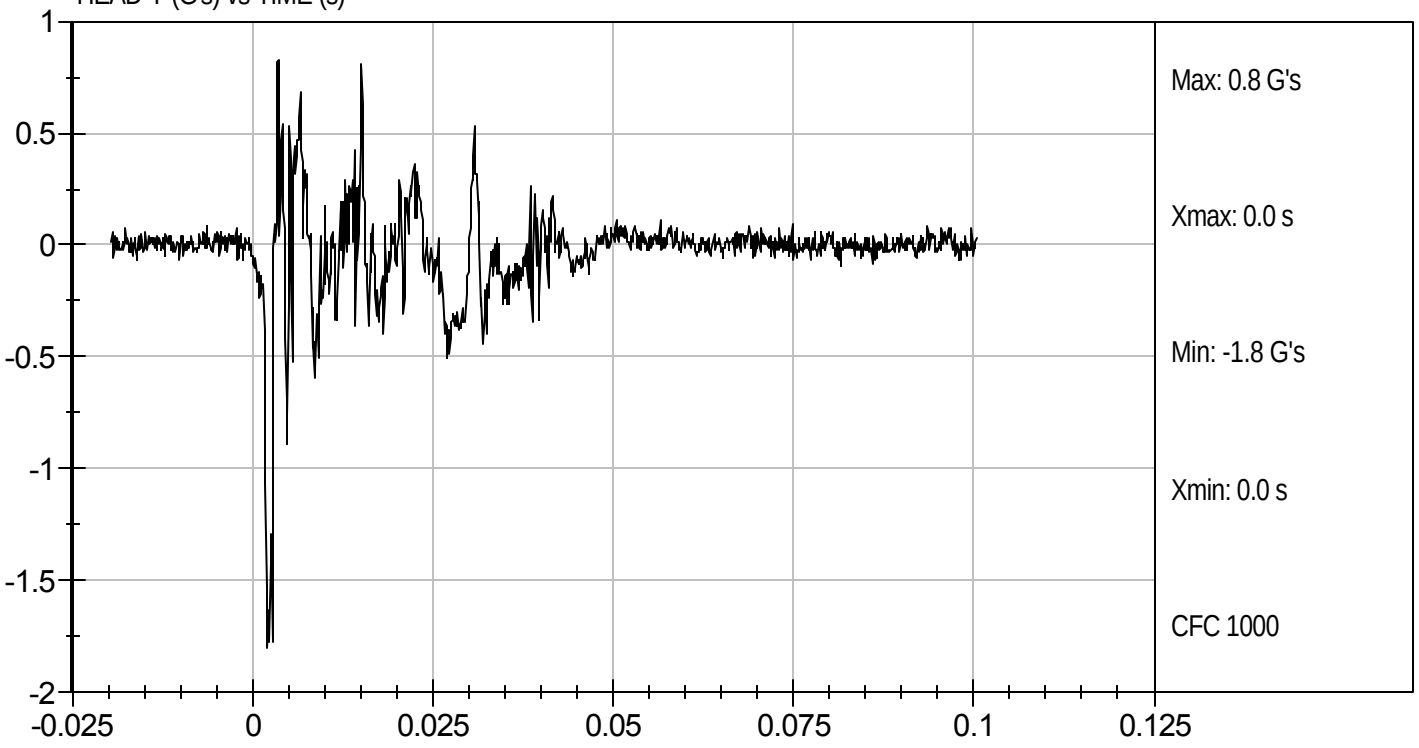
Test Desc: Head Drop
Component ID: D111751

Test Date: 5/11/11
Velocity: 0 ft/s, 0.00 m/s

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



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D111752

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	49	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.3	Pass
	30 ms	m/s	5.8 to 7.0	5.9	Pass
D Plane Rotation	Max	deg	77 to 91	77	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	89	Pass
			Overall Results		Pass

Jessica Hall

Laboratory Technician

5/11/11

Test Date

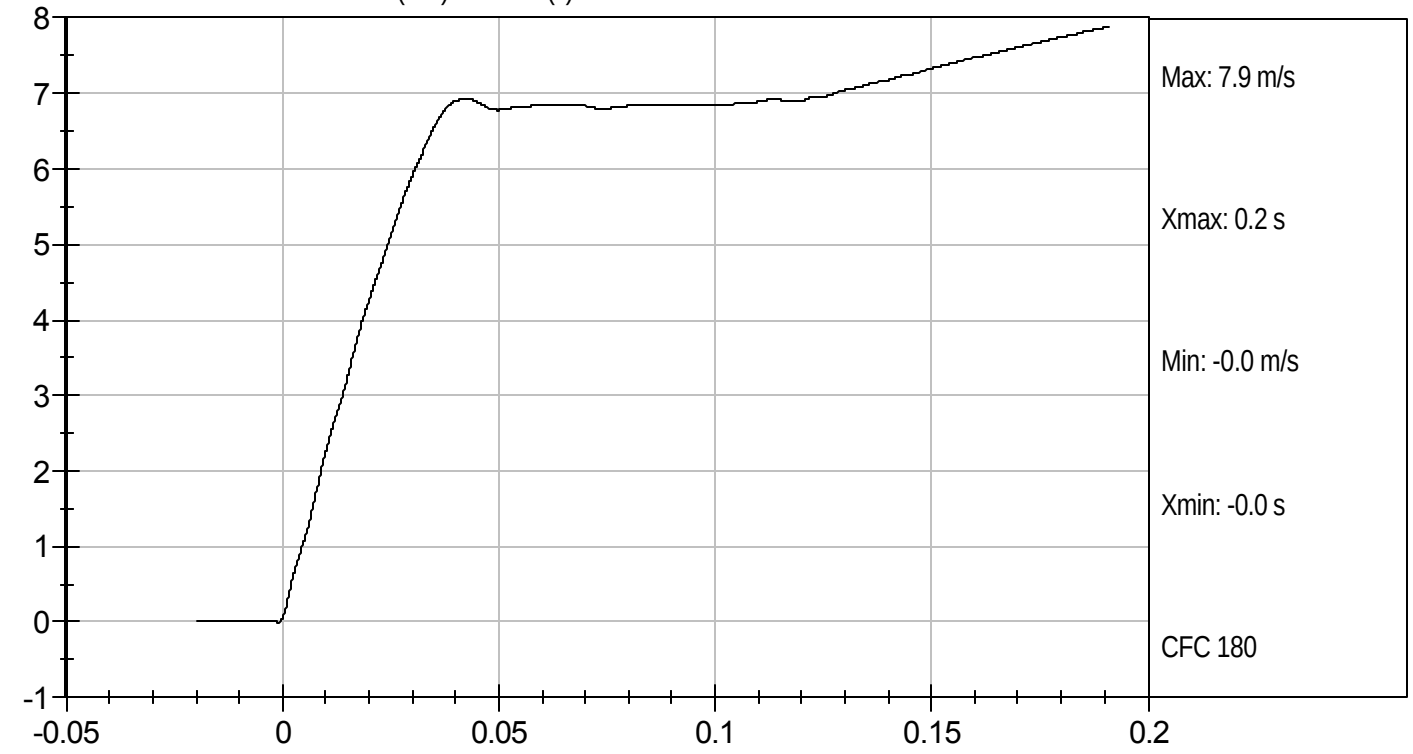
David Winkelbauer

Approved By

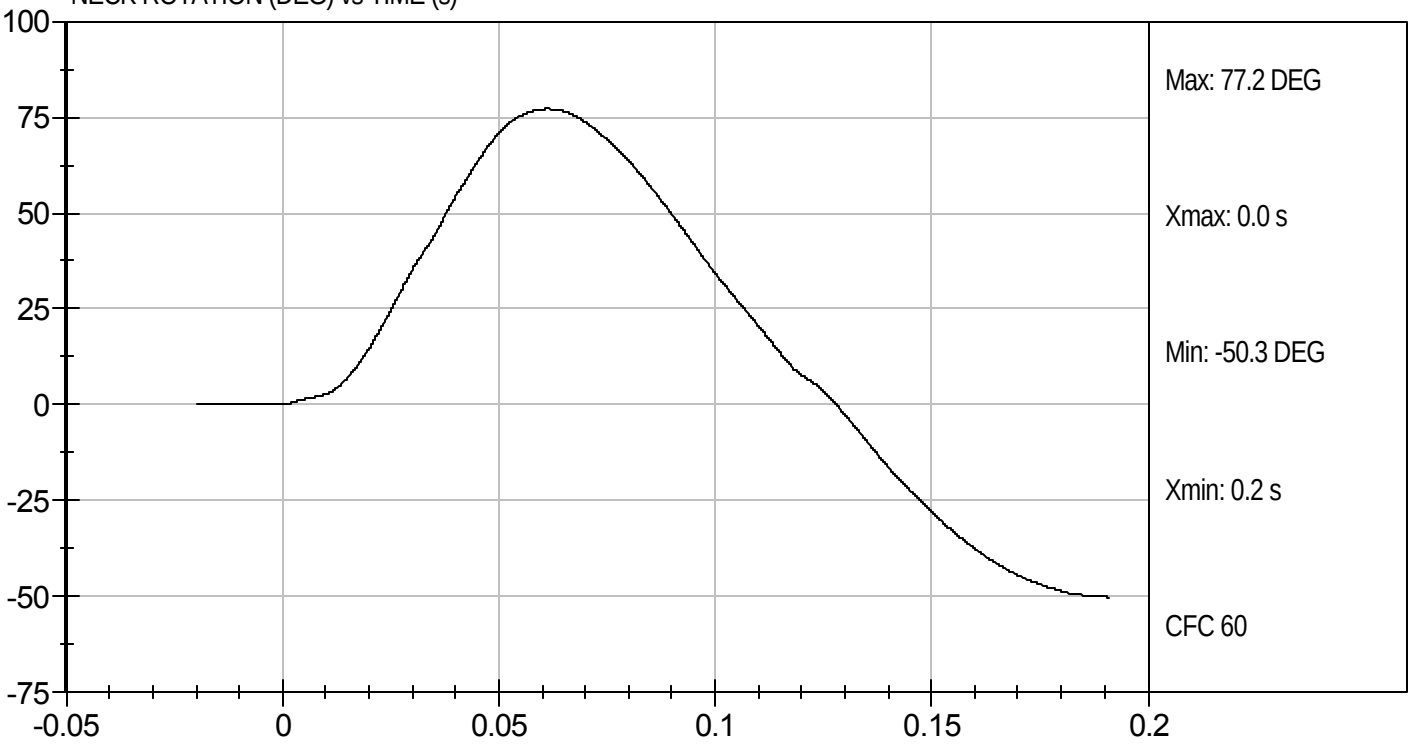
Test Desc: Neck Flexion
Component ID: D111752

Test Date: 5/11/11
Velocity: 23.15 ft/s, 7.06 m/s

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

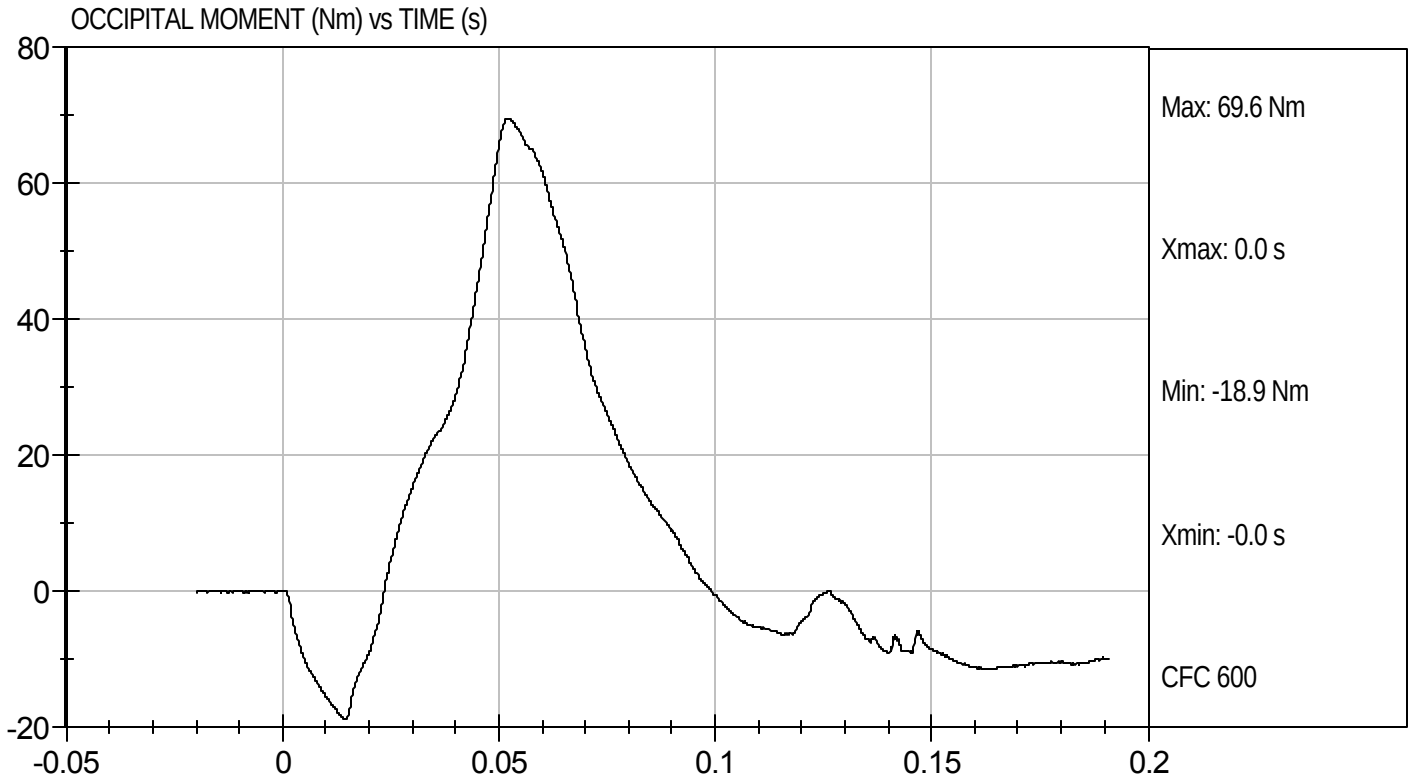


NECK ROTATION (DEG) vs TIME (s)



Test Desc: Neck Flexion
Component ID: D111752

Test Date: 5/11/11
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:** D111753

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	49	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	m/s	1.5 to 1.9	1.9	Pass
	20 ms	m/s	3.1 to 3.9	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	107	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	104	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

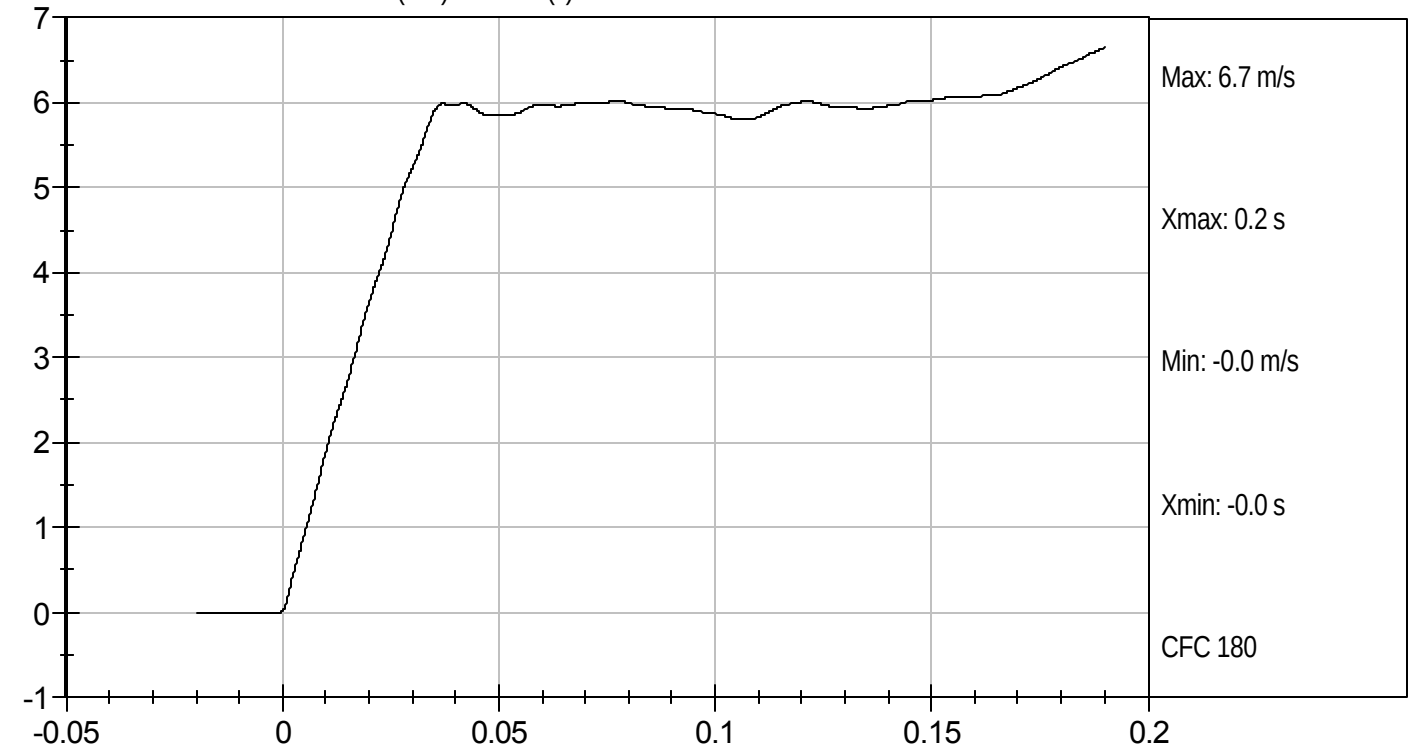
5/12/11
Test Date

David Winkelbauer
Approved By

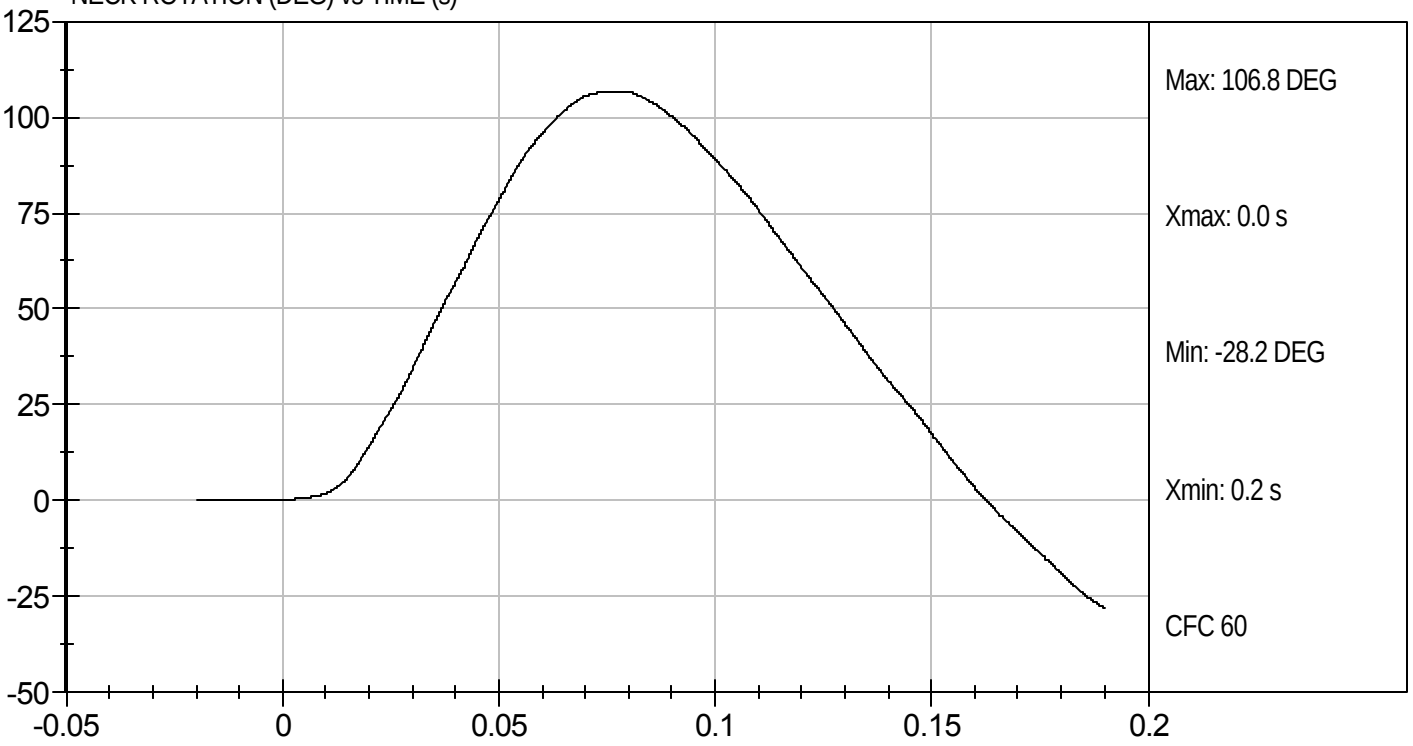
Test Desc: Neck Extension
Component ID: D111753

Test Date: 5/12/11
Velocity: 20.08 ft/s, 6.12 m/s

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

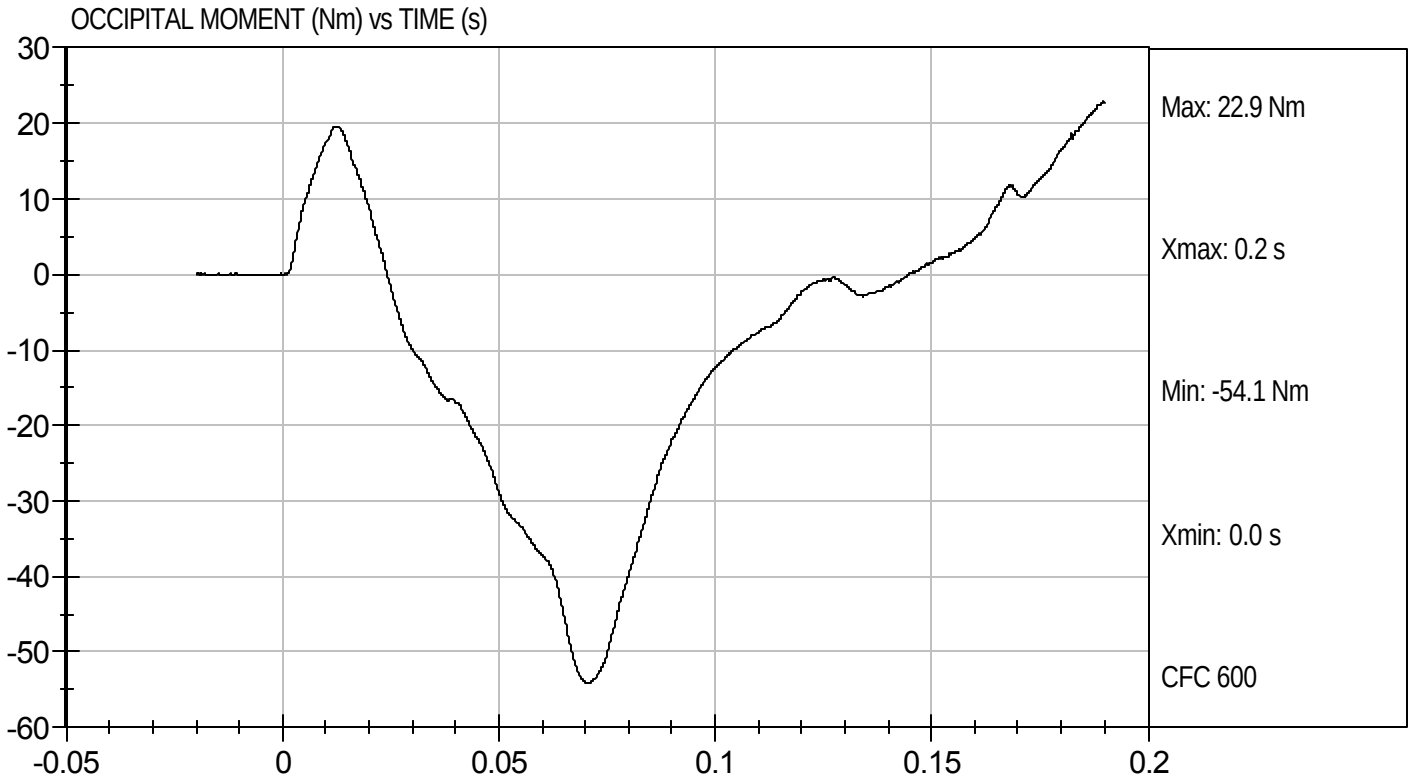


NECK ROTATION (DEG) vs TIME (s)



Test Desc: Neck Extension
Component ID: D111753

Test Date: 5/12/11
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:** D111754

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	56	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.02	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	3929	Pass
		Overall Test Results		Pass

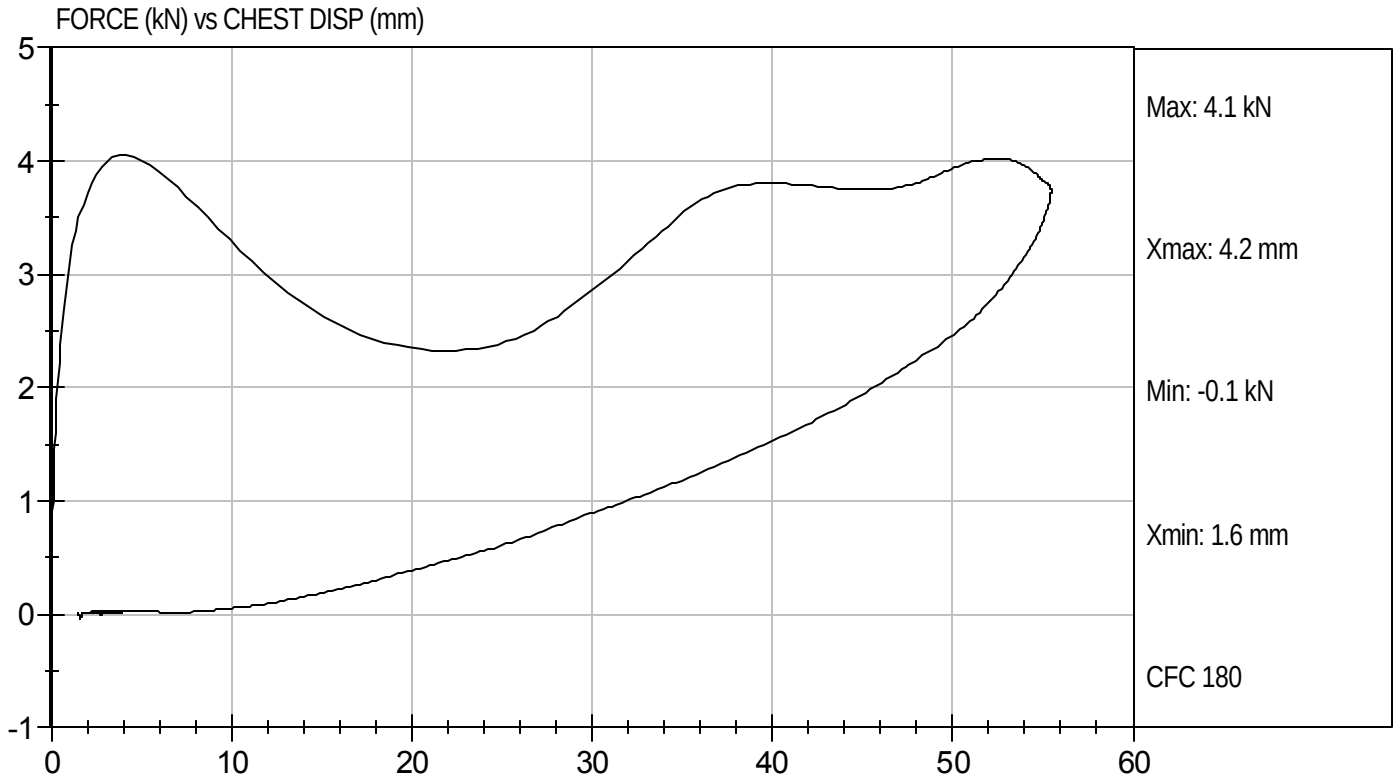
Jessica Hall
Laboratory Technician

5/12/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D111754

Test Date: 5/12/11
Velocity: 22.2 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D111755

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.99	Pass
		Overall Test Results		Pass

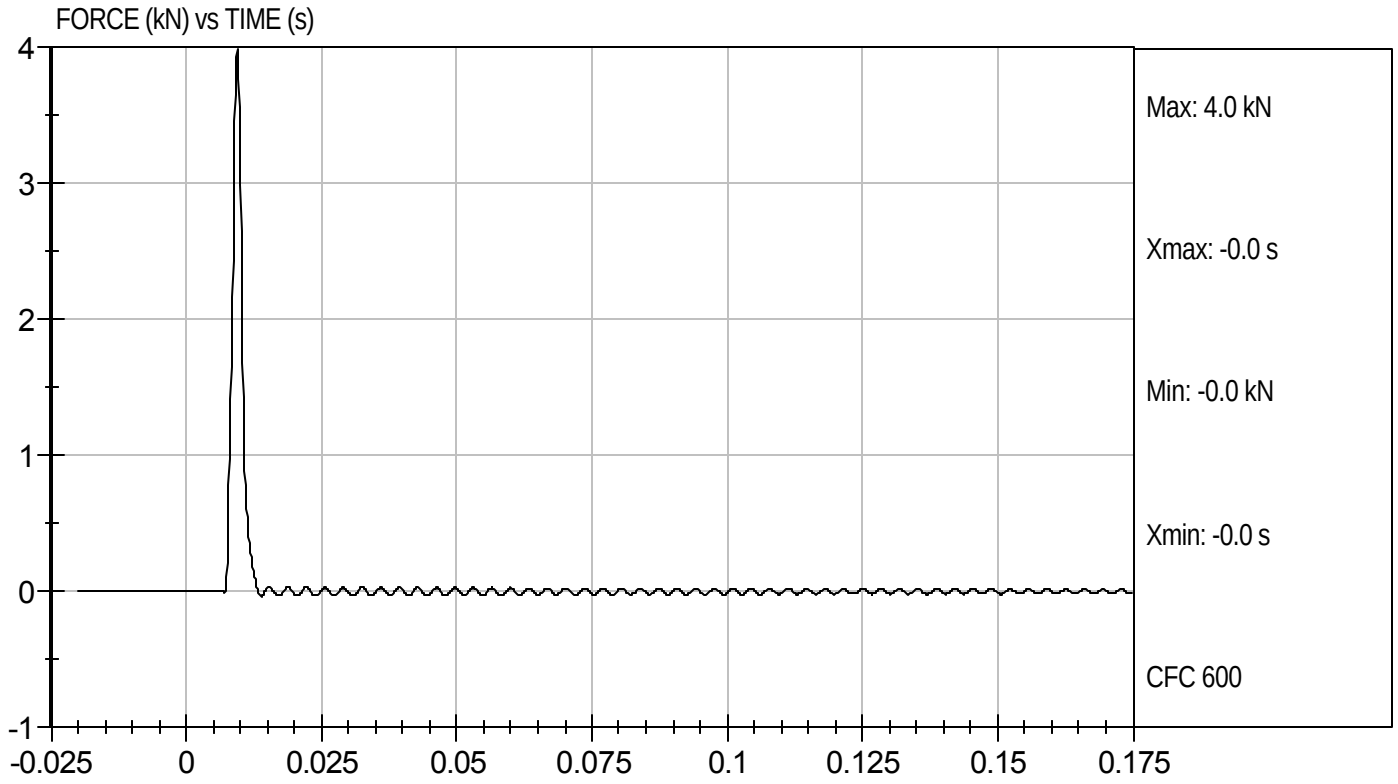
Jessica Gall
Laboratory Technician

5/12/11
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D111755

Test Date: 5/12/11
Velocity: 6.9 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D111756

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.88	Pass
		Overall Test Results		Pass

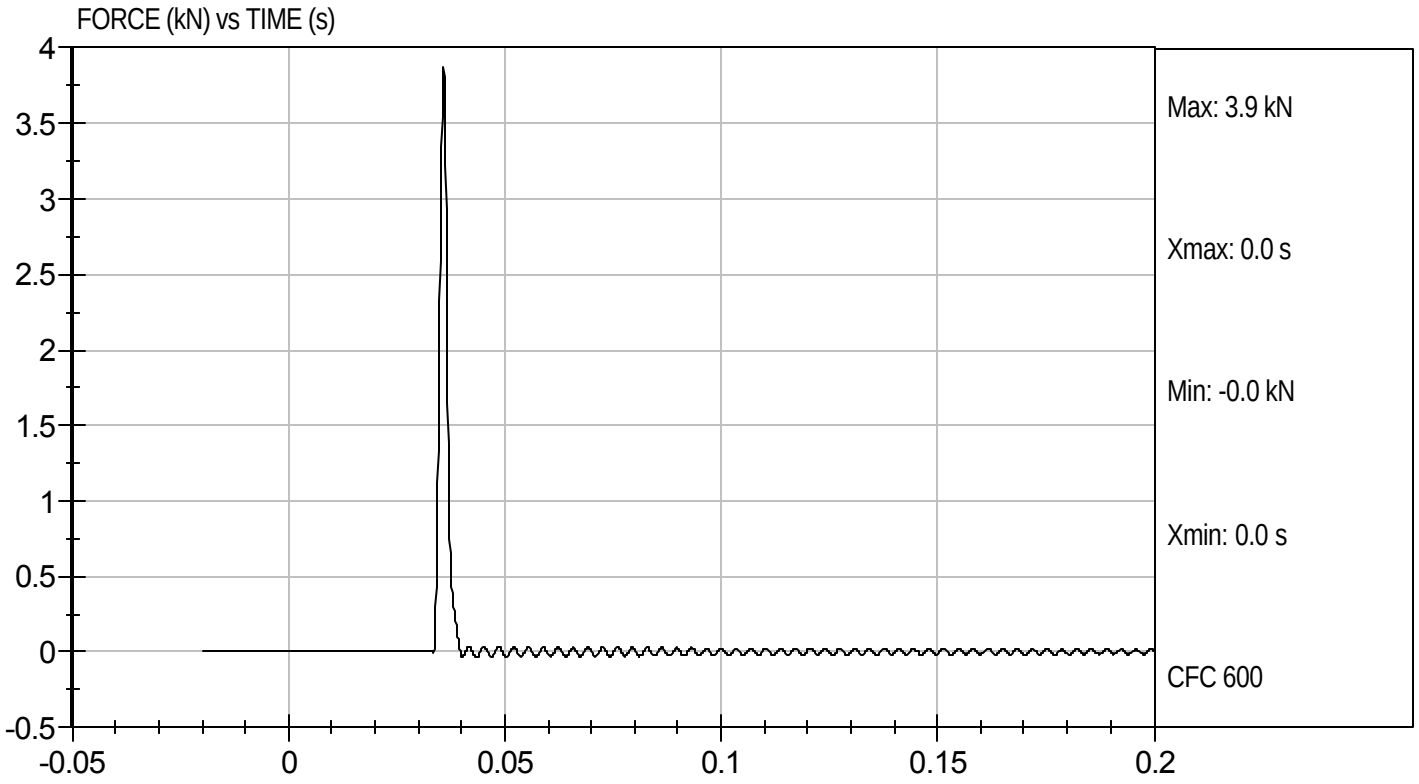
Jessica Gall
Laboratory Technician

5/12/11
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D111756

Test Date: 5/12/11
Velocity: 6.89 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D111757

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	7	Pass
Force at 45 deg	N	320 to 390	333	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
		Overall Result		Pass

Jessica Gall
Laboratory Technician

5/12/11
Test Date

David Winkelbauer
Approved By