REPORT NUMBER: SINCAP-MGA-2011-079

NEW CAR ASSESSMENT PROGRAM (NCAP)
Moving Deformable Barrier Side Impact Test

GENERAL MOTORS LLC
2011 Chevrolet Volt 5-Dr Hatchback
NHTSA No.: MB0126

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: May 6, 2011

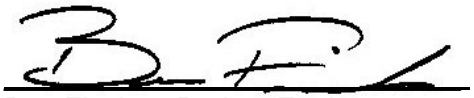
Final Report Date: June 7, 2011

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 DTNH22-09-D-00124.

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 Side Impact Testing of a 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No.: MB0126		*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.* SINCAP-MGA-2011-079
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-09-D-00124
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15. Supplementary Notes		

16. Abstract

A 55/28 km/h 90° Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2011 Chevrolet Volt 5-Dr Hatchback in accordance with the specifications of the Office of Crashworthiness Standards NCAP Side Laboratory Test Procedure for the generation of consumer information on vehicle side crash protection. The test was conducted at MGA Research Corporation, in Burlington, Wisconsin, on May 6, 2011.

The impact velocity of the Moving Deformable Barrier (MDB) was 62.1 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21°C. The target vehicle post-test maximum crush was 243 mm at level 3. The test vehicle's performance was as follows:

	Driver ATD (ES-2re)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	92
Maximum Thorax Rib Deflection	mm	44	27
Combined Abdominal Force	N	2500	1023
Pubic Symphysis Force	N	6000	2219

	Passenger ATD (SID-IIs)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	388
Lower Spine (T12) Resultant Acceleration	G	82	70
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3753

The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.

17. Key Words New Car Assessment Program (NCAP) Side Impact MDB ES-2re SID-IIs		*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 moving deformable barrier side impact test is part of the MY 2011 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-09-D-00124. The purpose of this test is to generate comparative side impact performance in a 2011 Chevrolet Volt 5-Dr Hatchback. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Laboratory Test Procedure dated January 2010.

SUMMARY

A 2011 Chevrolet Volt 5-Dr Hatchback was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 62.1 km/h (38.6 mph). The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by MGA Research Corporation in Burlington, Wisconsin, on May 6, 2011. Pre test and post test photographs of the test vehicle, the MDB, and the dummies (ES-2re and SID-IIs) are included in this report.

Dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OCWS NCAP Side Laboratory Test Procedure dated January 2010. The side impact event was documented by eleven (11) cameras. Camera locations are included in this report.

The dummies were instrumented in the following manner:

DRIVER ATD (ES-2re)
Head CG Triaxial Accelerometers
Thorax Rib 1 to Rib 3 Displacement Potentiometers
Abdomen Forward, Middle, and Rear Load Cells
Lower Spine Triaxial Accelerometers
Pubic Load Cell

PASSENGER ATD (SID-IIs)
Head CG Triaxial Accelerometers
Thorax Upper, Middle, and Lower Rib Displacement Potentiometers
Abdomen Upper and Lower Rib Displacement Potentiometers
Lower Spine Triaxial Accelerometers
Iliac Load Cell
Acetabulum Load Cell

DUMMY INJURY VALUES

	Driver ATD (ES-2re)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	92
Maximum Thorax Rib Deflection	mm	44	27
Combined Abdominal Force	N	2500	1023
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	Passenger ATD (SID-IIs)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	388
Lower Spine (T12) Resultant Acceleration	G	82	70
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3753

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Left Rear (Passenger) P4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No	No	
Knee Airbag	Yes	No	No	
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	No	
Seat Belt Load Limiter	Yes		No	

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

GENERAL COMMENTS

There was no valid data collected for:

Left Lower B-Post Y
Left Mid B-Post Y
Left Lower A-Post Y
Left Mid A-Post Y

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 NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MB0126	Anti-Lock Brakes	Yes
Model Year	2011	All Wheel Drive	No
Make	Chevrolet	Power Steering	Yes
Model	Volt	Driver Front Airbag	Yes
Body Style	5-Dr Hatchback	Driver Curtain Airbag	Yes
VIN	1G1RD6E44BU102111	Driver Head/Torso Airbag	No
Body Color	White Diamond Tricoat	Driver Torso Airbag	No
Delivery Date	5/05/2011	Driver Torso/Pelvis Airbag	Yes
Odometer (mi)	101	Driver Pelvis Airbag	No
Odometer (km)	163	Driver Knee Airbag	Yes
Dealer	Ken Dixon Automotive	Rear Pass. Front Airbag	No
Transmission	Automatic	Rear Pass. Curtain Airbag	Yes
Final Drive	Front	Rear Pass. Head/Torso Airbag	No
Type/No. Cylinders	4	Rear Pass. Torso Airbag	No
Engine Displacement (L)	1.4	Rear Pass. Torso/Pelvis Airbag	No
Engine Placement	Lateral	Rear Pass. Pelvis Airbag	No
Roof Rack	No	Rear Pass. Knee Airbag	No
Sunroof/T-Top	No	Pretensioners	Yes
Tinted Glass	No	Load Limiters	Yes
Traction Control	Yes	Automatic Door Locks	Yes
Power Brakes	Yes	Bucket Seats	Yes
Front Disc	Yes	Tilt Steering	Yes
Rear Disc	Yes	Power Seats	No
Does owner's manual provide instruction to turn off automatic door locks?			No

DATA FROM CERTIFICATION LABEL

Manufactured By	General Motors LLC	GVWR (kg)	2065
Date of Manufacture	03/11	GAWR Front (kg)	1142
		GAWR Rear (kg)	923

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	2		4	
Capacity Weight (VCW) (kg)				340	(A)
DSC x 68.04 (kg)				272	(B)
Cargo Weight (RCLW) (kg)				68	(A-B)

VEHICLE SEAT TYPE

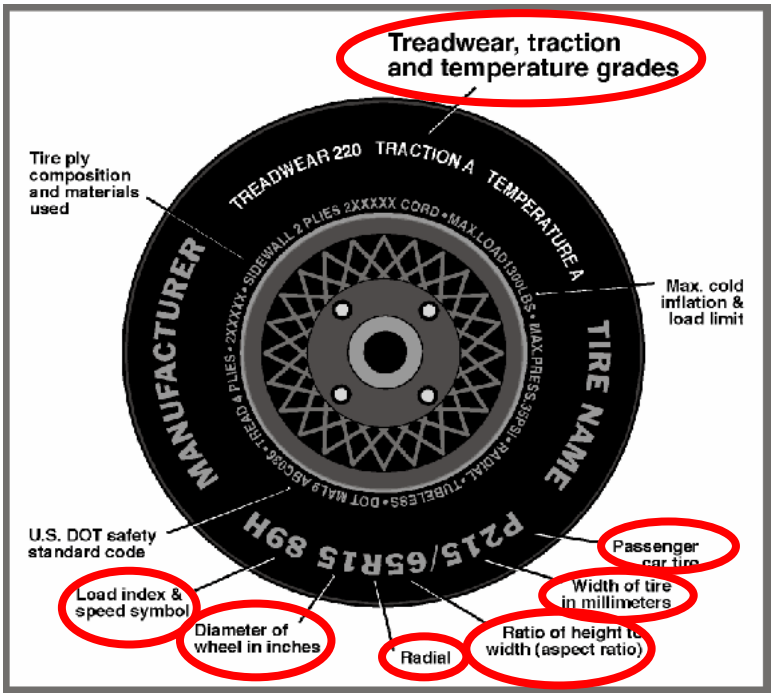
	Type of Seat Pan				Type of Seat Back		
Seating Location	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						Manual	Power
Front Seat	X					w/Lever	
Rear or Second Row			X		X		
Third Row Seat							

DATA SHEET NO. 1 (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

VEHICLE TIRE INFORMATION



DATA FROM TIRE PLACARD

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 0611	4BPJ KAIR 0611
DOT Safety Code Left	4BPJ KAIR 0611	4BPJ KAIR 0611

DATA SHEET NO. 1 (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	522.5	349.7		566.1	422.3		571.5	433.6	
Right	kg	520.3	321.2		536.2	380.1		528.0	377.9	
Ratio	%	60.8	39.2		57.9	42.1		57.5	42.5	
Totals	kg	1042.8	670.9	1713.7	1102.3	802.4	1904.7	1099.5	811.5	1911.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1713.7	(A)
Sum of Actual Weight of 2 P572 ATDs Used	kg	129.3	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	68	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	1911.0	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
Fully Loaded	mm	690	697	678	691	
As Tested (Fully Loaded ± 10mm at each wheel well)	mm	692	699	684	691	1131

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2685
Total Vehicle Length at Left Side	mm	3070
Total Vehicle Length at Centerline	mm	4500
Total Vehicle Length at Right Side	mm	3070
Weight of Ballast in Cargo Area	kg	23.6
Weight of Vehicle Components Removed	kg	0.0
Amount of Stoddard Solvent in Fuel Tank	L	32.6

Vehicle components removed to meet target vehicle test weight: Right tail light, trunk trim, air compressor.

TEST VEHICLE VERTICAL IMPACT POINT DATA

Measurement Description	Units	Value
Target Impact Point Aft of Front Axle	mm	403
Actual Impact Point Aft of Front Axle	mm	396

DATA SHEET 1A

ELECTRIC VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

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

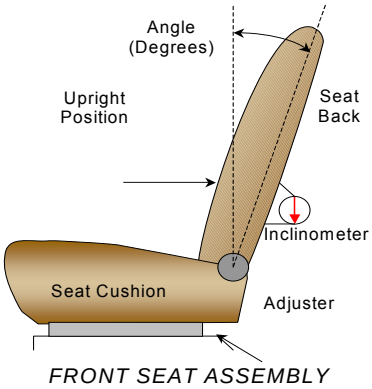
DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle:	2011 Chevrolet Volt 5-Dr Hatchback	NHTSA No.	MB0126
Test Program:	NCAP Side MDB Impact Test	Test Date:	5/06/2011

NOMINAL DESIGN RIDING POSITION

The driver seatback is positioned to the manufacturer's designated angle. The procedure is as follows: Set seat back angle to 5.0° on the headrest post. Seat back angle is referenced to "zero" on top of rocker (sill). The right front passenger seatback is set to match the driver seatback. The left rear passenger seat back is fixed.



FRONT SEAT ASSEMBLY

SEAT BACK ANGLES

	Degrees
Driver with Seated Dummy	5.9° on headrest post
Passenger with Seated Dummy	28.9° on seatback

SEAT FORE/AFT POSITIONS

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	54 detents (1st as 0)	27th detent (forward-most as 0)
Rear Seat	Fixed	Fixed

Describe method: For the driver seat track, using only the controls that primarily move the seat in the fore-aft direction, the seat was moved to the full rear position and marked. The seat was then moved to the foremost position and marked. The seat was then placed in the mid point of travel and marked. The left rear passenger seat track was fixed.

SEAT BELT UPPER ANCHORAGES

	Total # of Positions	Placed in Position #
Driver Seat	Fixed	Fixed
Rear Seat	Fixed	Fixed

Describe method: The driver and left rear passenger seat anchorages were fixed.

DATA SHEET NO. 2 (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

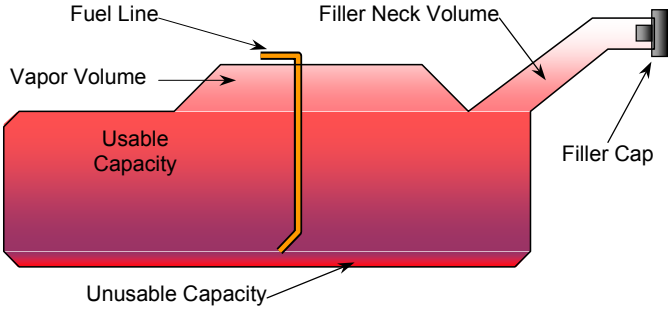
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	35.2
Usable Capacity of "Optional" Tank	
Usable Capacity Used for FMVSS 301	32.4 to 33.1
Actual Amount of Solvent used	32.6

FUEL PUMP

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

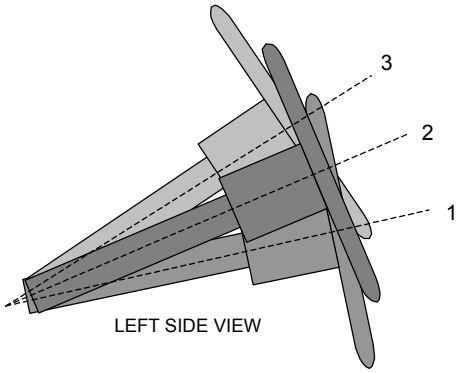
The test vehicle is equipped with an electric fuel pump. Fuel pump will run when the gasoline generator is commanded to start. The fuel pipe is on the right side.



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

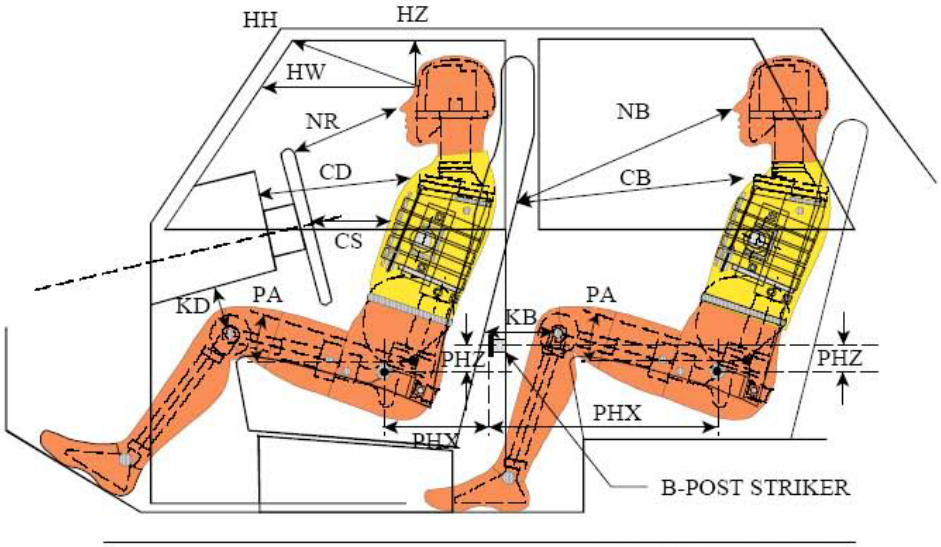
STEERING COLUMN POSITION

	Detent	Fore/Aft Position (mm)
Lowermost - Position 1	71.2	189
Geometric Center – Position 2	69.2	162
Uppermost – Position 3	67.2	134
Telescoping Steering Wheel Travel		55
Test Position	69.2	162

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



NOTE: 2-DOOR VEHICLE SHOWN. REAR DUMMY PHX & PHZ MEASUREMENTS FOR A 4-DOOR VEHICLE WOULD USE THE C-POST STRIKER AS A REFERENCE POINT

LEFT SIDE VIEW

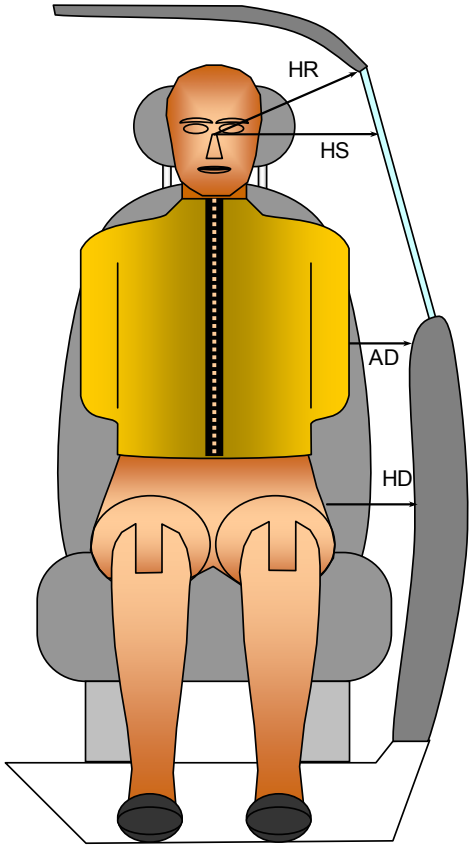
DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Measurement Description	Driver S/N 032		Passenger S/N 296	
			Length (mm)	Angle(°)	Length (mm)	Angle(°)
HH		Head to Header	465	7.8		
HW		Head to Windshield	706	0		
HZ	HZ	Head to Roof	145	90	220	90
NR	NB	Nose to Rim/Seat Back	463	23.2	490	9.8
CD	CB	Chest to Dash/Seat Back	581	7.5	493	16.7
CS		Chest to Steering Wheel	372	8.7		
KDL	KBL	Left Knee to Dash/Seat Back	209	30.0	223	7.9
KDR	KBR	Right Knee to Dash/Seat Back	200	23.2	219	10.6
PA	PA	Pelvic Angle		23.1		26.2
PHX	PHX	H-Point to Striker (X-Axis)	145	0	202	0
PHZ	PHZ	H-Point to Striker (Z-Axis)	141	90	245	90
SA	SA	Seat Back Angle		5.9		Fixed

DATA SHEET NO. 4

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



FRONT VIEW OF DUMMY

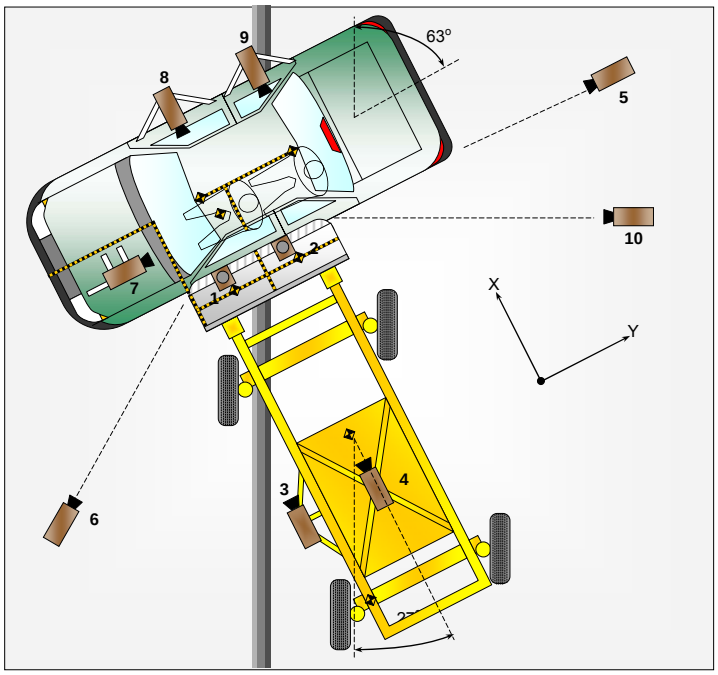
DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver S/N 032	Passenger S/N 296
HR	Head to Side Header	mm	167	199
HS	Head to Side Window	mm	295	361
AD	Arm to Door	mm	104	150
HD	H-Point to Door	mm	153	167

DATA SHEET NO. 5

CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Angle	Lens (mm)	Film Speed (fps)
		X*	Y*	Z*			
1	Overhead Overall	-190	0	-5050	87.8	14	1000
2	Overhead Close-up	290	-1140	-5050	82.5	50	1000
3	Left Impact Point (MDB)					50	1000
4	Side Overall (MDB)					16	1000
5	Rear	50	4920	-1060	6.2	24	1000
6	Left Front	3290	-4030	-1150	5.9	24	1000
7	Driver Front (OB)					16	1000
8	Driver Side (OB)					8	1000
9	Passenger Side (OB)					8	1000
10	Real Time Left Rear						30
11	Real Time Inrun						30

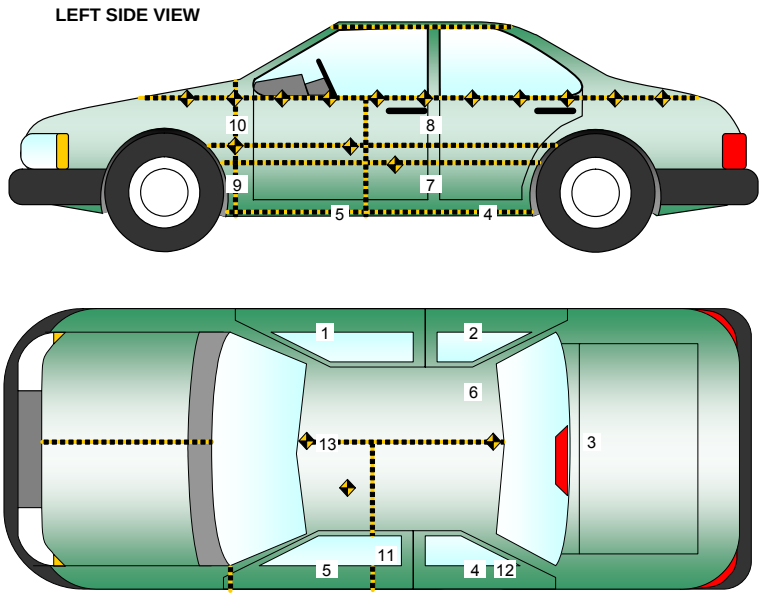
Reference: Impact Point projected to Ground
+X = To Front of MDB, + Y = To Right of MDB, +Z = Down

* All measurements accurate to ± 6 mm

DATA SHEET NO. 6

VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

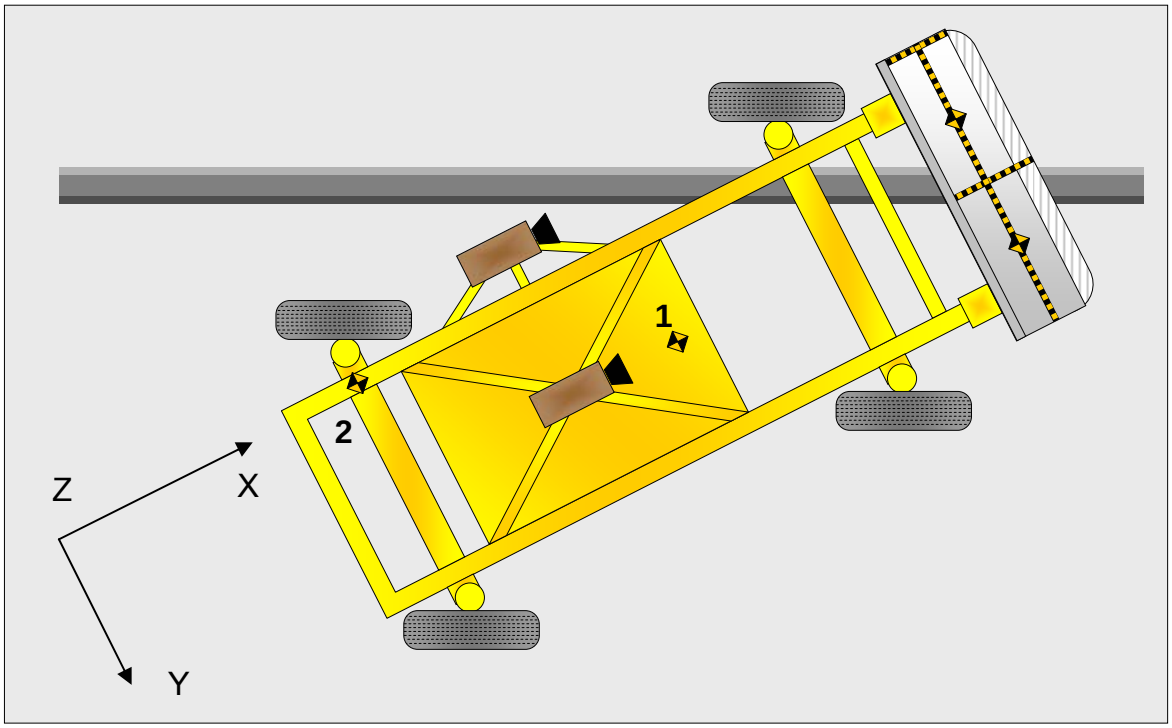
Accelerometer Location				
No.	ID	Coordinates (mm)		
		X	Y	Z
1	Right Sill at Front Seat	2330	727	-185
2	Right Sill at Rear Seat	1396	725	-195
3	Rear Floorpan Above Axle	480	20	-381
4	Left Sill at Rear Door	1444	-725	-190
5	Left Sill at Front Door	2446	-727	-180
6	Rt. Rear Occ. Compartment	1760	380	-237
7	Left Lower B-Post	1965	-705	-420
8	Left Middle B-Post	1895	-710	-712
9	Left Lower A-Post	2992	-690	-503
10	Left Middle A-Post	2983	-770	-774
11	Front Seat Track	2065	-570	-302
12	Rear Seat Track or Structure			
13	Vehicle CG	2344	240	-148

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

DATA SHEET NO. 7

MOVING DEFORMABLE BARRIER (MDB) ACCELEROMETER LOCATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



MDB ACCELEROMETER LOCATIONS

Loc. No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	MDB CG	-1105	0	-330
2	MDB Rear	-2580	-650	-625

Reference: X - MDB Face (+ forward)
Y - MDB Centerline (+ to right)
Z - Ground Plane (+ down)

DATA SHEET NO. 8

TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

MAXIMUM EXTERIOR STATIC CRUSH

Level	Measurement Description	Units	Maximum Crush	Above Ground
1	Sill Top Height	mm	36	220
2	Occupant H-Point	mm	219	513
3	Mid Door	mm	243	613
4	Window Sill	mm	204	856
5	Window Top	mm	39	1343
	Maximum Penetration	mm	243	

INSTRUMENTATION

Driver Dummy Channels	16
Passenger Dummy Channels	16
Vehicle Structure Accelerometers	21
MDB Accelerometers	5
Total No. of Contact Switches	8
Monitoring Channels	4
Total	70

CAMERA COVERAGE

High-Speed Vehicle Onboard	3
High-Speed Offboard	4
High-Speed MDB Onboard	2
Real-Time Stationary	1
Real-Time Panning	1
Total	11

DATA SHEET NO. 9

MOVING DEFORMABLE BARRIER (MDB) SUMMARY OF RESULTS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1252
Overall Length Including Honeycomb Face	4115
Wheelbase of Framework Carriage	2592
CG Location aft of Front Axle	1129

MDB WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg	411.8	281.6	
Right	kg	356.8	311.3	
Ratio	%	56.5	43.5	
Totals	kg	768.6	592.9	1361.5

SPEED AND IMPACT DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	62.1
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	62.2
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	89.8

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush
Row	Description	Height	Distance	Direction	
A	Center of Bumper	432	800	Right	206
B	Top of Bumper	533	800	Left	107
C	Mid-Level	686	800	Left	136
D	Top of Stack	813	800	Left	165

MDB INSTRUMENTATION AND CAMERAS

Accelerometers	5
Contact Switches	2
High-Speed Cameras	2

DATA SHEET NO. 10

POST-TEST OBSERVATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

TEST DUMMY INFORMATION AND CONTACT

Description	Driver (ES-2re)	Passenger (SID-IIs)
Dummy Type / Serial No.	ES-2re / 032	SID-IIs / 296
Head Contact	Curtain Airbag, Headrest, Side Header	Curtain Airbag, Side Header
Upper Torso Contact	Side Airbag	Door Panel
Lower Torso Contact	Side Airbag	Door Panel
Left Knee Contact	Door Panel	Door Panel
Right Knee Contact	Left Knee	Left Knee

POST TEST DOOR OPENING AND SEAT TRACK INFORMATION

Description	Front	Rear
Left Side Doors	Remained closed and jammed shut	Remained closed and jammed shut
Right Side Doors	Remained closed and operational	Remained closed and operational
Hatch and Other Doors		Remained closed and operational
Seat Movement	0	0
Seat Back Failure	None	None

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No Separation
Sill Separation	None
Windshield Damage	None
Window Damage	Left Front Broke
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Left Rear (Passenger) P4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No	No	
Knee Airbag	Yes	No	No	
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	No	
Seat Belt Load Limiter	Yes		No	

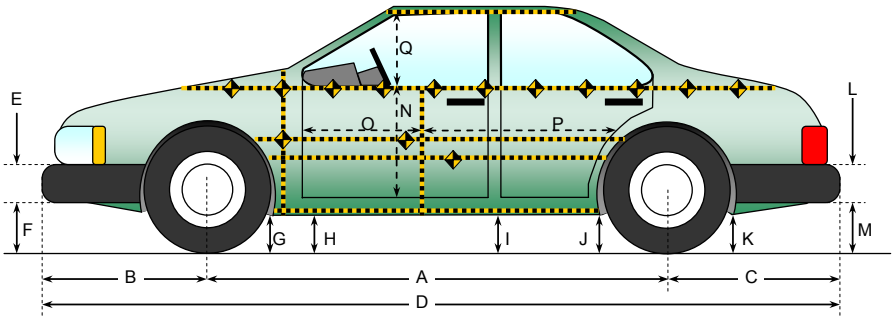
MDB LEFT EDGE IMPACT POINT DATA

Measured Parameter	Units	Requirement	Value
Horizontal Offset	mm	+/- 50	7 forward
Vertical Offset	mm	+/-20	3 down

DATA SHEET NO. 11

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



All measurements in (mm) with tolerance of ± 3 mm

LEFT SIDE VIEW

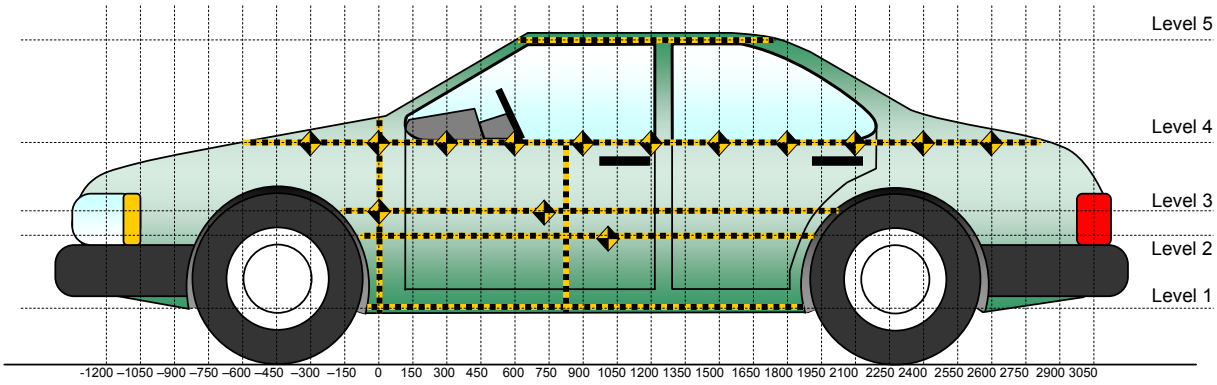
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2685	2685	0
B	Front Axle to FSOV	1010	1010	0
C	Rear Axle to RSOV	805	805	0
D	Total Length at Centerline	4500	4500	0
E	Front Bumper Thickness	140	140	0
F	Front Bumper Bottom to Ground	215	214	1
G	Sill Height at Front Wheel Well	162	175	-13
H	Sill Height at Front Door Leading Edge	164	176	-12
I	Sill Height at B Pillar	160	158	2
J1	Sill Height at Rear Wheel Well	151	147	4
J2	Pinch Weld Height at Rear Wheel Well	155	154	1
K	Sill Height Aft of Rear Wheel Well	215	210	5
L	Rear Bumper Thickness	95	95	0
M	Rear Bumper Bottom to Ground	218	233	-15
N	Sill Height to Window Bottom Sill	760	712	48
O	Front Door Leading Edge to Impact CL	787	760	75
P	Rear Door Trailing Edge to Impact CL	1108	1113	-5
Q	Front Window Opening	356	332	24
R	Right Side Length	3070	3070	0
S	Left Side Length	3070	3050	20
T	Vehicle Width at B Post	1785	1620	165

DATA SHEET NO. 12

VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



All Measurements Shown in mm

LEFT SIDE VIEW

Note: The measurements are taken along the vertical impact reference line.
Vehicle measurements forward of the vertical impact reference line are negative.

Level	Measurement Description	Height Above Ground (mm)
1	Sill Top	220
2	Mid Door	513
3	Occupant H-Point	613
4	Window Sill	856
5	Window Top	1343

DATA SHEET NO. 12 (CONTINUED)

VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-600				266					292					26	
-450				250					270					20	
-300				246					272					26	
-150			213	249				234	274				21	25	
0	237	216	220	245		253	255	260	275		16	39	40	30	
150	237	227	226	241		275	375	368	334		38	148	142	93	
300	236	227	223	240		262	409	394	376		26	182	171	136	
450	235	225	221	236	499	262	413	405	413	522	27	188	184	177	23
600	235	221	218	236	497	264	392	407	436	523	29	171	189	200	26
750	234	219	216	236	496	268	400	407	440	529	34	181	191	204	33
900	234	217	214	237	503	270	412	408	414	535	36	195	194	177	32
1050	233	215	213	238	508	268	408	403	369	546	35	193	190	131	38
1200	232	214	213	240	513	264	405	397	372	549	32	191	184	132	36
1350	231	212	212	244	515	260	423	430	390	554	29	211	218	146	39
1500	231	211	213	247	517	254	418	436	394	550	23	207	223	147	33
1650	230	211	213	250	523	248	430	450	398	552	18	219	237	148	29
1800	230	210	212	255	530	245	407	455	396	557	15	197	243	141	27
1950		212	207	260			218	250	381			6	43	121	
2100				267					288					21	
2250				273					304					31	
2400				282					302					20	
2550				293					312					19	
2700				308					323					15	

Note: The measurements are taken along the vertical impact reference line.
Vehicle measurements forward of the vertical impact reference line are negative.

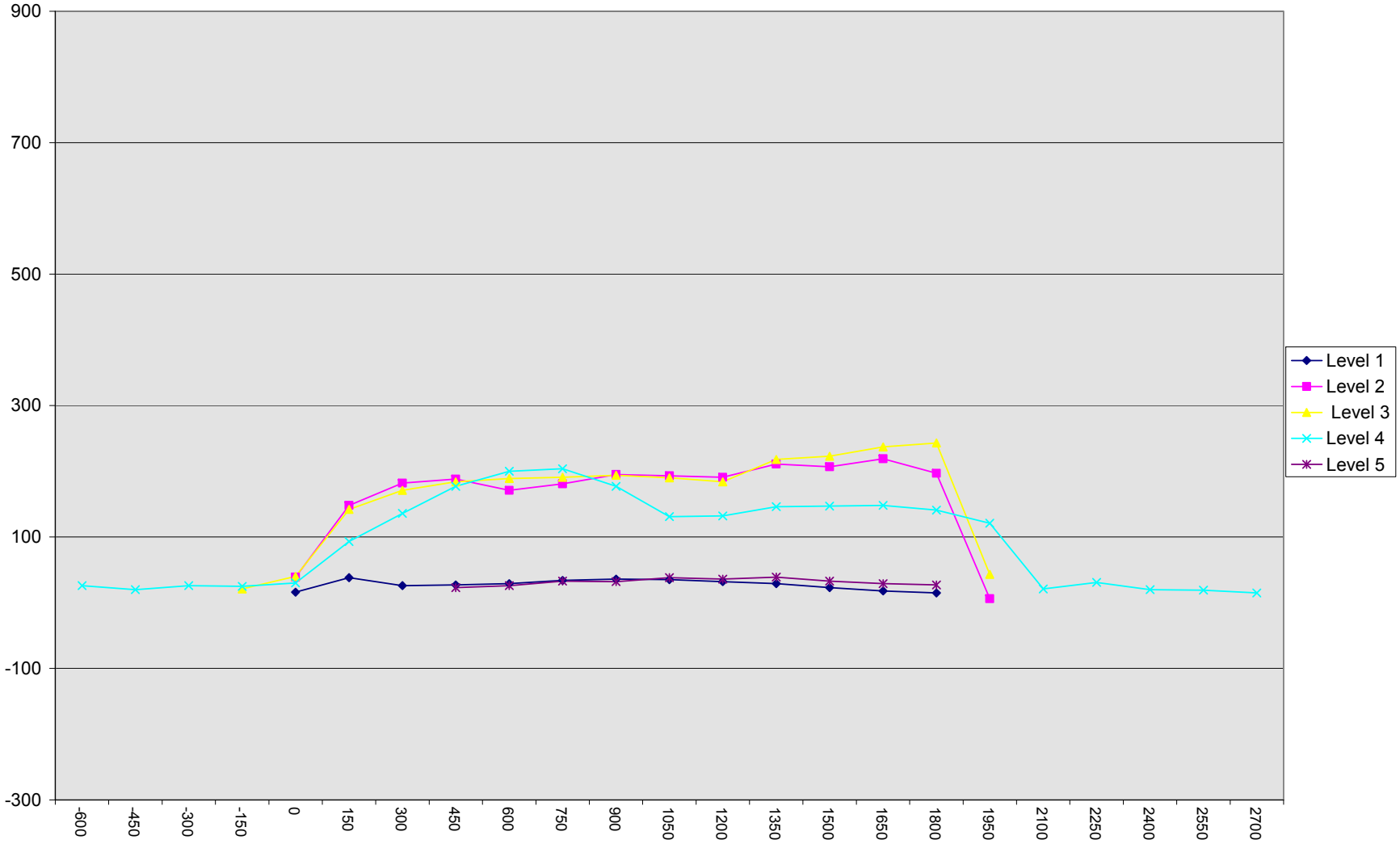
MAXIMUM CRUSH DATA

	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	36	219	243	204	39
Distance From Impact (mm)	900	1650	1800	750	1350

DATA SHEET NO. 12 (continued)

VEHICLE EXTERIOR CRUSH MEASUREMENTS

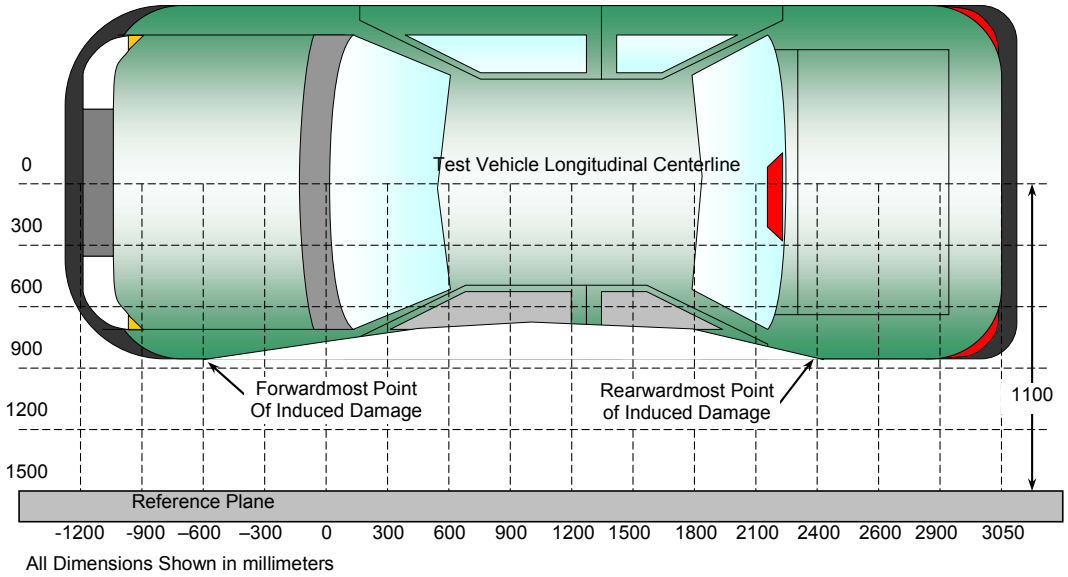
Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



DATA SHEET NO. 13

VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



TOP VIEW

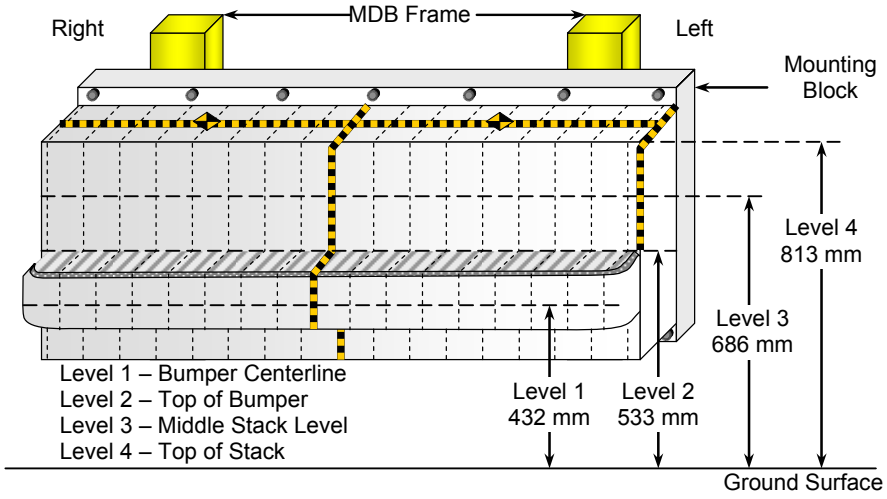
DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Pre-Test (mm)	Post-Test (mm)	Max. Static Crush (mm)
1	2700	4	308	323	15
2	2080	4	235	280	45
3	1370	4	230	450	220
4	695	4	236	445	209
5	75	1	237	282	45
6	-600	4	266	292	26

DATA SHEET NO. 14

EXTERIOR STATIC CRUSH FOR IMPACTOR FACE

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



FRONT VIEW

DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center (mm)								C_L	Distance Left of Center (mm)							
	800	700	600	500	400	300	200	100	0	100	200	300	400	500	600	700	800
4	24	24	26	26	44	70	112	100	78	50	25	28	23	44	76	121	165
3	31	23	25	27	32	47	59	75	51	23	18	30	43	43	41	87	136
2	102	93	90	77	77	73	77	82	75	73	73	76	80	87	87	92	107
1	206	201	199	195	186	195	192	191	187	183	175	173	169	172	174	184	191

DATA SHEET NO. 15A

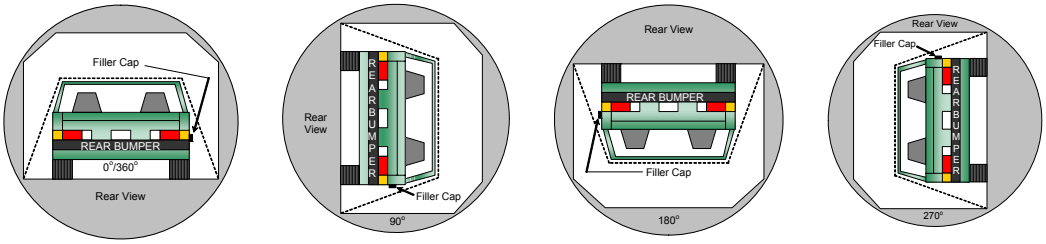
FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

Test Time: 12:40 pm 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

FMVSS 301 STATIC ROLLOVER DATA



0°/360° 90° 180° 270°

ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	121	300	421
90° to 180°	113	300	413
180° to 270°	108	300	408
270° to 360°	116	300	416

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

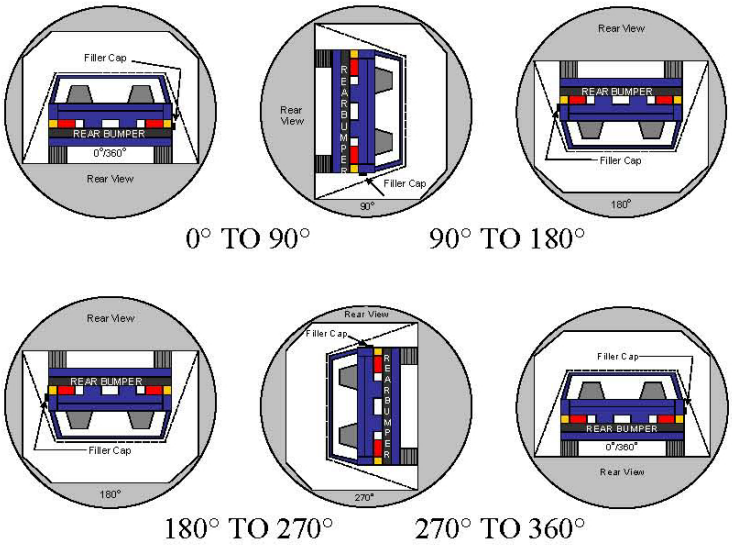
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET 15B

FMVSS 305 STATIC ROLLOVER RESULTS FOR ELECTRIC-POWERED VEHICLES

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011



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 electrolyte spillage: **None**

ELECTROLYTE COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	121	300	421
90° to 180°	113	300	413
180° to 270°	108	300	408
270° to 360°	116	300	416

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 15B (CONTINUED)

FMVSS 305 STATIC ROLLOVER RESULTS FOR ELECTRIC-POWERED VEHICLES

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

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 =	0.8	V	90°	Time:	2	Minutes	10	s
V1 =	0.8	V	180°	Time:	2	Minutes	06	s
V1 =	0.8	V	270°	Time:	1	Minutes	51	s
V1 =	0.8	V	360°	Time:	2	Minutes	03	s
V2 =	1.1	V	90°	Time:	2	Minutes	23	s
V2 =	1.1	V	180°	Time:	2	Minutes	13	s
V2 =	1.0	V	270°	Time:	2	Minutes	01	s
V2 =	1.0	V	360°	Time:	2	Minutes	13	s
V1' =	0.1	V	90°	Time:	2	Minutes	18	s
V1' =	0.1	V	180°	Time:	2	Minutes	10	s
V1' =	0.1	V	270°	Time:	1	Minutes	56	s
V1' =	0.1	V	360°	Time:	1	Minutes	10	s
V2' =	1.8	V	90°	Time:	2	Minutes	26	s
V2' =	1.8	V	180°	Time:	2	Minutes	17	s
V2' =	1.8	V	270°	Time:	2	Minutes	07	s
V2' =	1.8	V	360°	Time:	2	Minutes	16	s

DATA SHEET 15B (CONTINUED)

FMVSS 305 STATIC ROLLOVER RESULTS FOR ELECTRIC-POWERED VEHICLES

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

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.

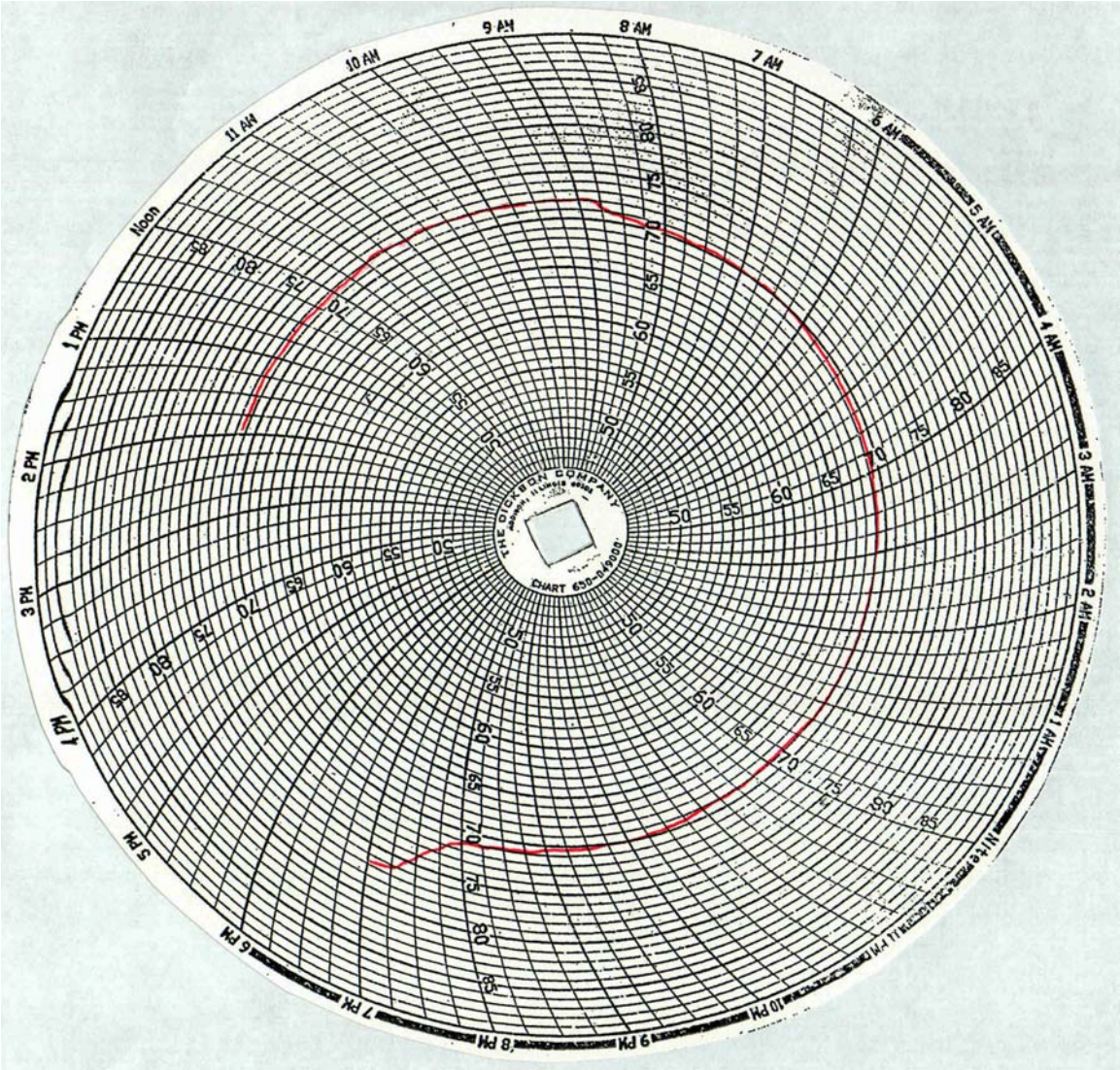
Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']								
Ri1 =	3325033	Ω	90°	Time:	2	Minutes	23	s
Ri1 =	3325033	Ω	180°	Time:	2	Minutes	13	s
Ri1 =	3150032	Ω	270°	Time:	2	Minutes	01	s
Ri1 =	3150032	Ω	360°	Time:	2	Minutes	13	s
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']								
Ri2 =	3454580	Ω	90°	Time:	2	Minutes	26	s
Ri2 =	3454580	Ω	180°	Time:	2	Minutes	17	s
Ri2 =	3240032	Ω	270°	Time:	2	Minutes	07	s
Ri2 =	3240032	Ω	360°	Time:	2	Minutes	16	s
Ri = The lesser of Ri1 and Ri2								
Ri =	3325033	Ω	90°	Time:	2	Minutes	23	s
Ri =	3325033	Ω	180°	Time:	2	Minutes	13	s
Ri =	3150032	Ω	270°	Time:	2	Minutes	01	s
Ri =	3150032	Ω	360°	Time:	2	Minutes	13	s
Ri/Vb = Electrical Isolation Value/Nominal Battery Voltage Minumum Electrical Isolation Value is 500 Ω /V								
Ri/Vb =	8559	Ω/V	90°	Time:	2	Minutes	23	s
Ri/Vb =	8559	Ω/V	180°	Time:	2	Minutes	13	s
Ri/Vb =	8108	Ω/V	270°	Time:	2	Minutes	01	s
Ri/Vb =	8108	Ω/V	360°	Time:	2	Minutes	13	s

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

DATA SHEET NO. 16

DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle:	2011 Chevrolet Volt 5-Dr Hatchback	NHTSA No.	MB0126
Test Program:	NCAP Side MDB Impact Test	Test Date:	5/06/2011



DATA SHEET 17

PRE-IMPACT ELECTRIC ISOLATION MEASUREMENTS AND CALCULATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

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):	388.5

PROPULSION BATTERY TO VEHICLE CHASSIS

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

V1 (V):	242.1
V2 (V):	250.1

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 17 (CONTINUED)

PRE-IMPACT ELECTRIC ISOLATION MEASUREMENTS AND CALCULATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

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):	57.3 V
Ri1 = Ro (1 + V2/V1) [(V1-V1’)/V1’]	
Ri1 (Ω):	1311 K Ω
V2’ (V):	36.3 V
Ri2 = R0 (1 + V1/V2) [(V2-V2’)/V2’]	
Ri2 (Ω):	2318 K Ω
Ri = The lesser of Ti1 and Ri2	
Ri Pre-Test ((Ω):	1311 K Ω
Ri/Vb (Ω/V):	3375 Ω/V (Electrical Isolation Value)
Minimum Electrical Isolation Value is 500 Ω/V	

Note: Measured 5 minutes 45 seconds before impact.

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

DATA SHEET 18

POST-IMPACT ELECTRIC ISOLATION MEASUREMENTS AND CALCULATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

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 =	2.7	V	Impact Time:	0	Minutes	43	S
V1 =	1.2	V	Impact Time:	0	Minutes	49	S
V2 =	1.1	V	Impact Time:	1	Minutes	00	S
V1' =	0.1	V	Impact Time:	0	Minutes	56	S
V2' =	0.2	V	Impact Time:	1	Minutes	06	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 =	4217 K	Ω	Impact Time:	1	Minutes	0	s
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']							
Ri2 =	1882 K	Ω	Impact Time:	1	Minutes	06	s
Ri = The lesser of Ri1 and Ri2							
Ri =	1882 K	Ω	Impact Time:	1	Minutes	06	s
Ri/Vb = electrical Isolation Value/Nominal Battery Voltage							
Minimum Electrical Value is 500 Ω/V							
Ri/Vb =	4843	Ω/V	Impact Time:	1	Minutes	06	s

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

DATA SHEET 18 (CONTINUED)

POST-IMPACT ELECTRIC ISOLATION MEASUREMENTS AND CALCULATIONS

Test Vehicle: 2011 Chevrolet Volt 5-Dr Hatchback NHTSA No. MB0126
Test Program: NCAP Side MDB Impact Test Test Date: 5/06/2011

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

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As Delivered Right Front Three-Quarter View of Test Vehicle

As Delivered Left Rear Three-Quarter View of Test Vehicle

Pre-Test Frontal View of Test Vehicle

Post-Test Frontal View of Test Vehicle

Pre-Test Left Three-Quarter Front View of Test Vehicle

Post-Test Left Three-Quarter Front View of Test Vehicle

Pre-Test Left Side View of Test Vehicle

Post-Test Left Side View of Test Vehicle

Pre-Test Left Three-Quarter Rear View of Test Vehicle

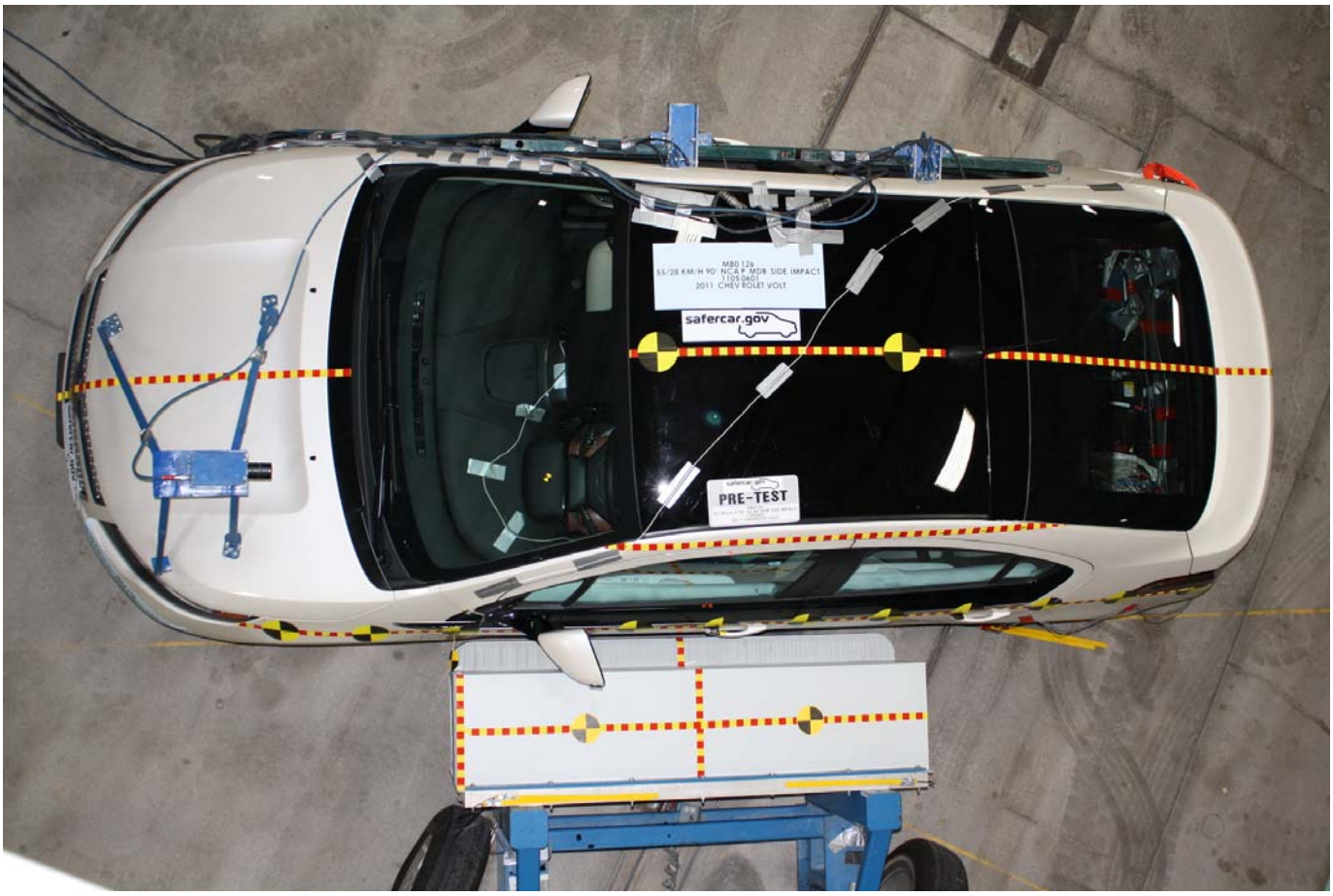
Post-Test Left Three-Quarter Rear View of Test Vehicle

Pre-Test Rear View of Test Vehicle

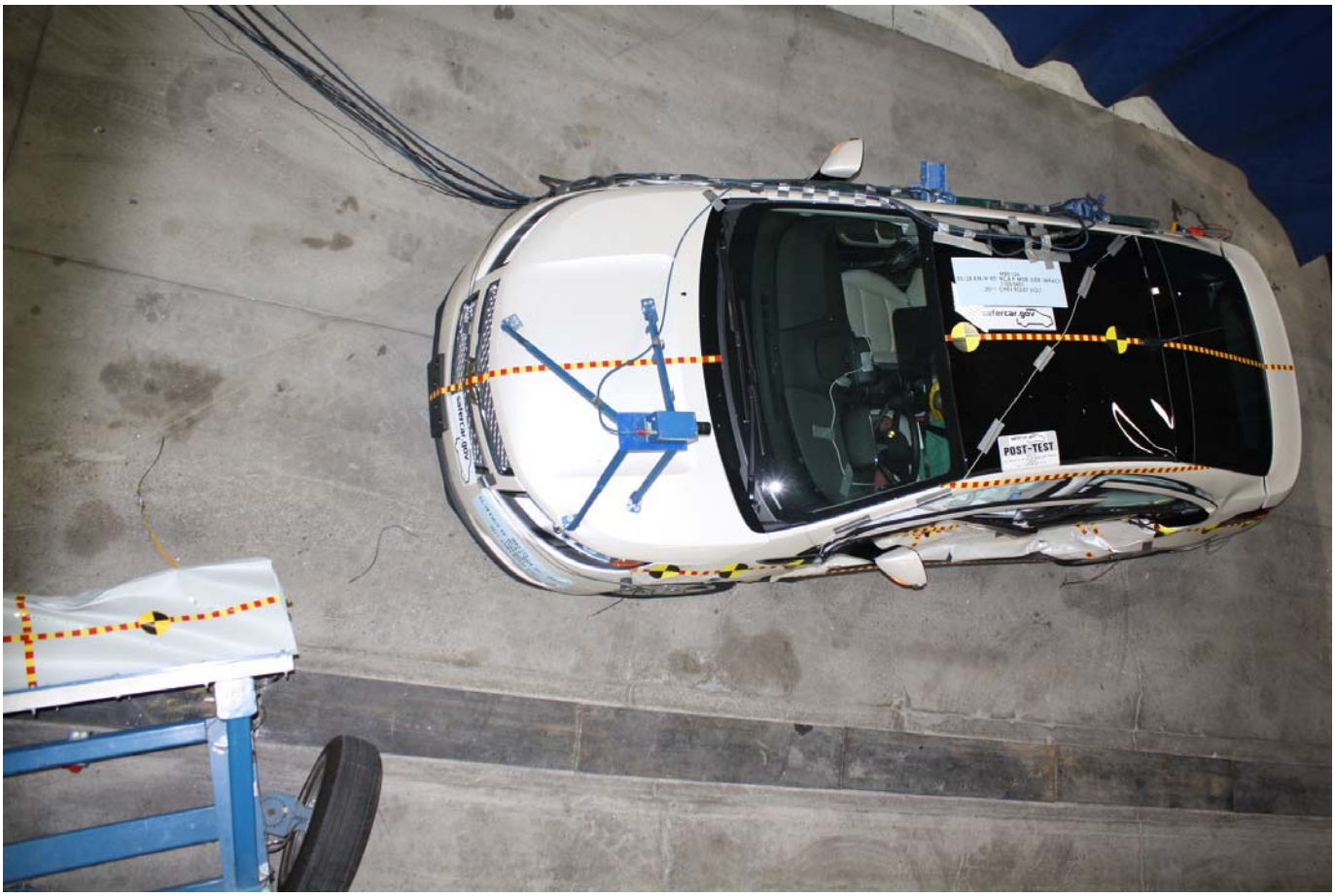
Post-Test Rear View of Test Vehicle

Pre-Test Right Side View of Test Vehicle

Post-Test Right Side View of Test Vehicle



Pre-Test Overhead View of Test Vehicle with MDB Positioned Against Side of Test Vehicle



Post-Test Overhead View of Test Vehicle and MDB

Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle

Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle

Pre-Test Close-Up View of Impact Point Target

Post-Test Close-Up View of Impact Point Target

Pre-Test Left Front Door Latch Close-Up

Post-Test Left Front Door Latch Close-Up

Pre-Test Left Rear Door Latch Close-Up

Post-Test Left Rear Door Latch Close-Up

Pre-Test Front Close-Up View of Driver Dummy

Post-Test Front Close-Up View of Driver Dummy

Pre-Test Left Side View of Driver Dummy Showing Belt, Chalking, and Contact Switches

Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View

Post-Test Left Side View of Driver Dummy Shoulder and Door Top View

Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning


Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint

Pre-Test Frontal View of Driver Seat Pan Prior to Dummy Positioning

Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan

Pre-Test Placement of Driver Dummy's Feet

Pre-Test View of Belt Anchorage for Driver Dummy

Pre-Test Left Side View of Steering Wheel

Pre-Test View of Parking Brake

Pre-Test Close-Up Left Side View of Driver Seat Track

Pre-Test Close-Up Left Side View of Driver Seat Back

Pre-Test Close-Up View of Driver Seat Back or Head Restraint

Pre-Test Driver Dummy and Door Clearance View

Post-Test Driver Dummy and Door Clearance View

Pre-Test Right Side View of Front Seat of Occupant Compartment

Post-Test Right Side View of Front Seat of Occupant Compartment

Pre-Test Driver Inner Door Panel View

Post-Test Driver Inner Door Panel View Showing Driver Dummy Contact Locations

Post-Test Driver Dummy Close-up Head Contact with Vehicle Interior View

Post-Test Driver Dummy Close-up Head Contact with Side Airbag View

PHOTOGRAPH NOT APPLICABLE

Post-Test Driver Dummy Close-up Torso Contact with Vehicle Interior View

Post-Test Driver Dummy Close-up Torso Contact with Side Airbag View

PHOTOGRAPH NOT APPLICABLE

Post-Test Driver Dummy Close-up Pelvis Contact with Vehicle Interior View

Post-Test Driver Dummy Close-up Pelvis Contact with Side Airbag View

Pre-Test Left Side View of Passenger Dummy Showing Belt, Chalking, and Contact Switches

Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View

Post-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View

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Pre-Test Close-up View of Rear Passenger Seat Back or Head Restraint

Pre-Test Rear Passenger Dummy and Door Clearance View

Post-Test Rear Passenger Dummy and Door Clearance View

Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment

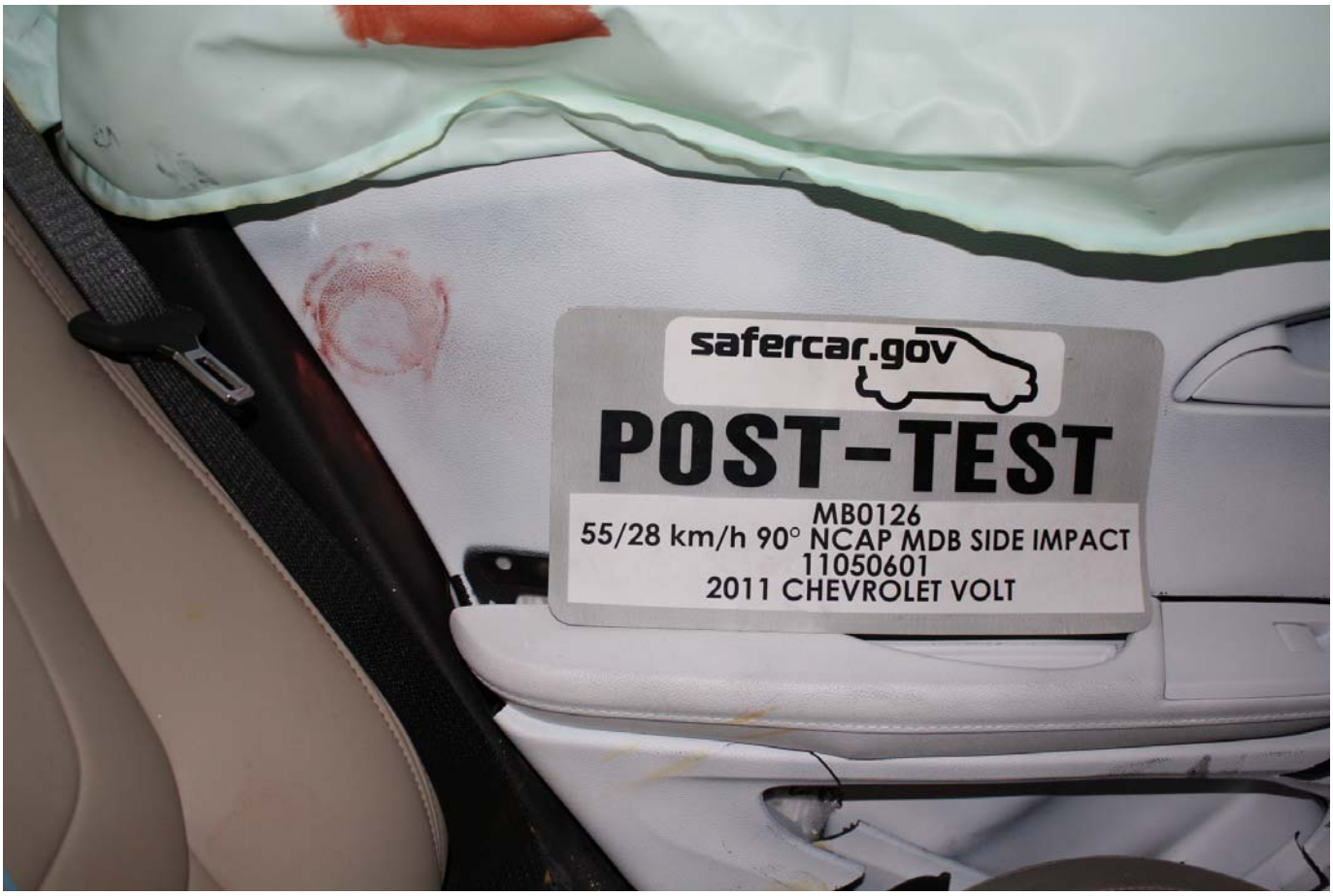
Post-Test Right Side View of Rear Passenger Dummy Seat and Rear Seat Occupant Compartment

Pre-Test Passenger Inner Door Panel View

Post-Test Rear Passenger Inner Door Panel View Showing Dummy Contact Locations

Post-Test Rear Passenger Dummy Close-up Head Contact with Vehicle Interior View

Post-Test Rear Passenger Dummy Close-up Head Contact with Side Airbag View



Post-Test Rear Passenger Dummy Close-up Torso Contact with Vehicle Interior View

PHOTOGRAPH NOT APPLICABLE

Post-Test Rear Passenger Dummy Close-up Torso Contact with Side Airbag View

Post-Test Rear Passenger Dummy Close-up Pelvis Contact with Vehicle Interior View

PHOTOGRAPH NOT APPLICABLE

Post-Test Rear Passenger Dummy Close-up Pelvis Contact with Side Airbag View

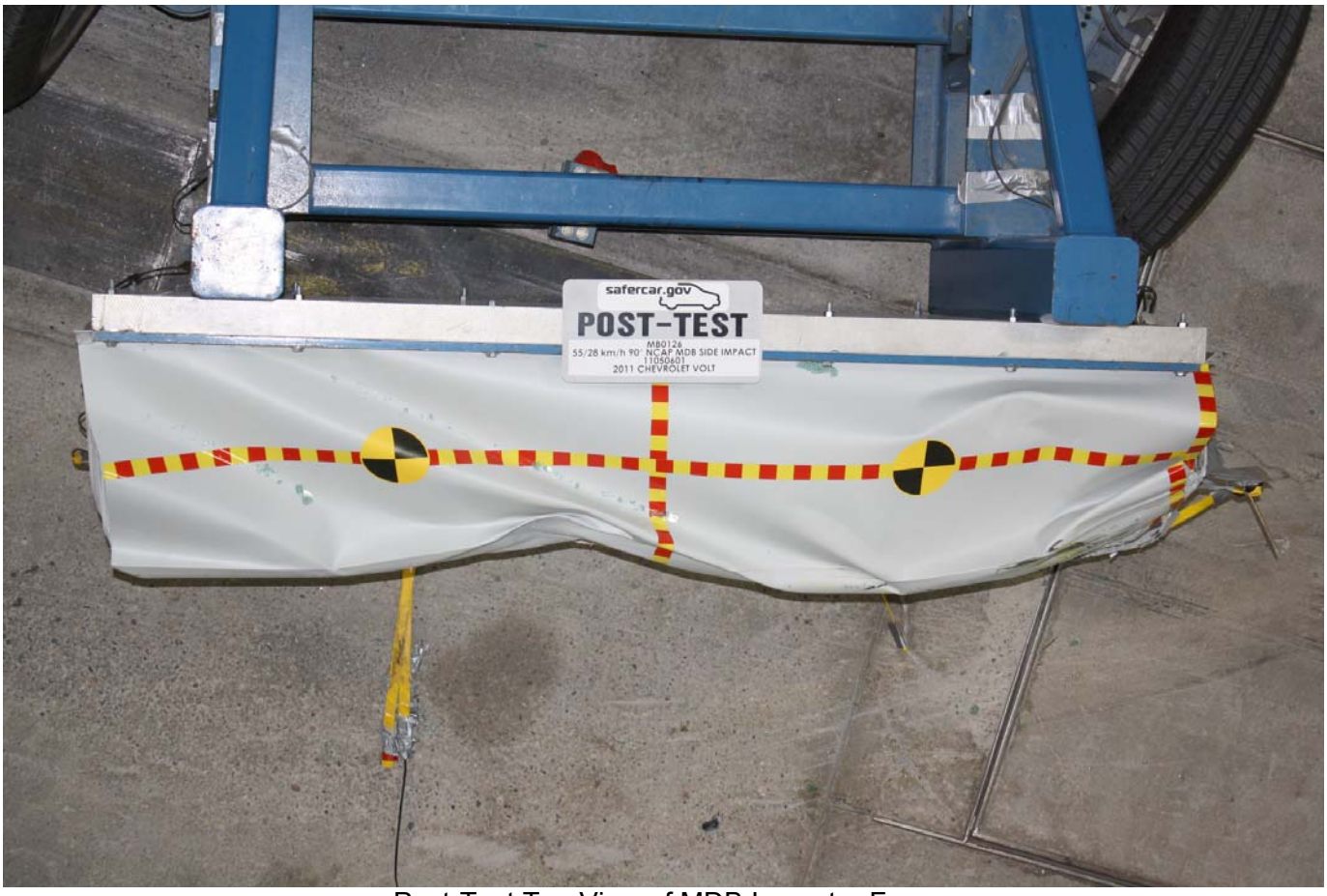
Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

Post-Test View of Fuel Filler Cap or Fuel Filler Neck

Pre-Test Front View of MDB Impactor Face

Post-Test Front View of MDB Impactor Face

Pre-Test Top View of MDB Impactor Face



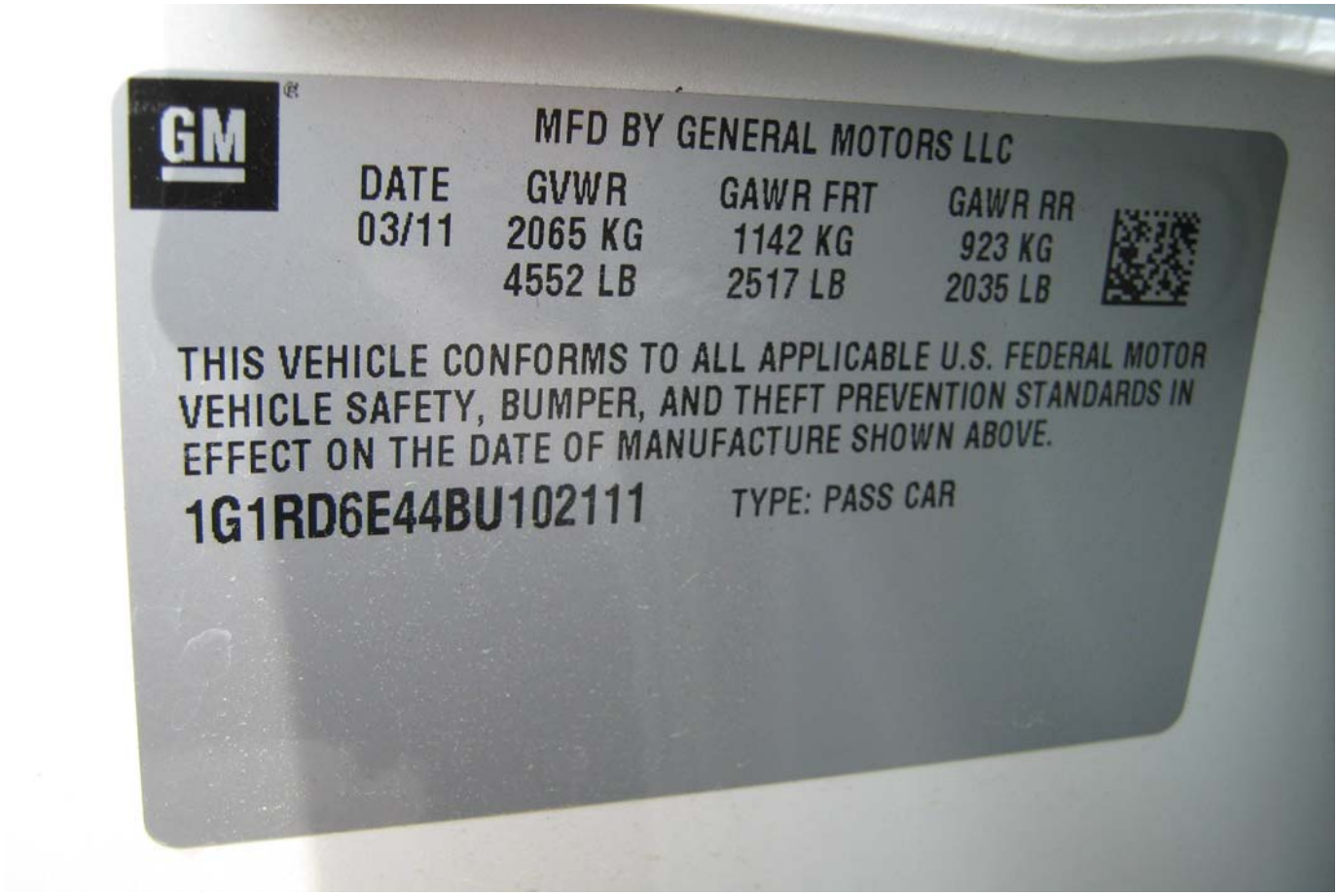
Post-Test Top View of MDB Impactor Face

Pre-Test Left Side View of MDB Impactor Face

Post-Test Left Side View of MDB Impactor Face

Pre-Test Right Side View of MDB Impactor Face

Post-Test Right Side View of MDB Impactor Face



Close-Up View of Vehicle's Certification Label

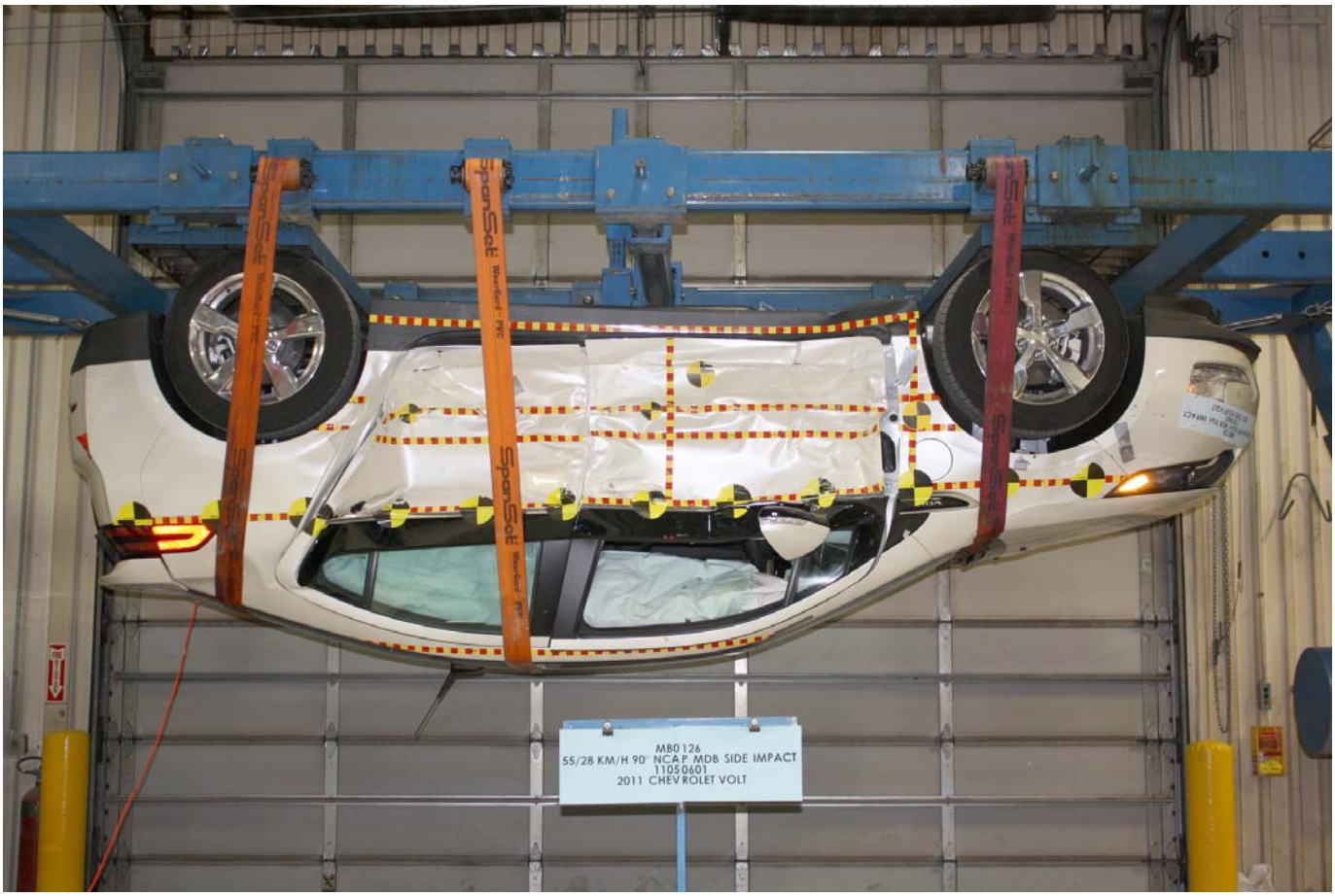
Close-Up View of Vehicle's Tire Information Placard or Label

Pre-Test Ballast View

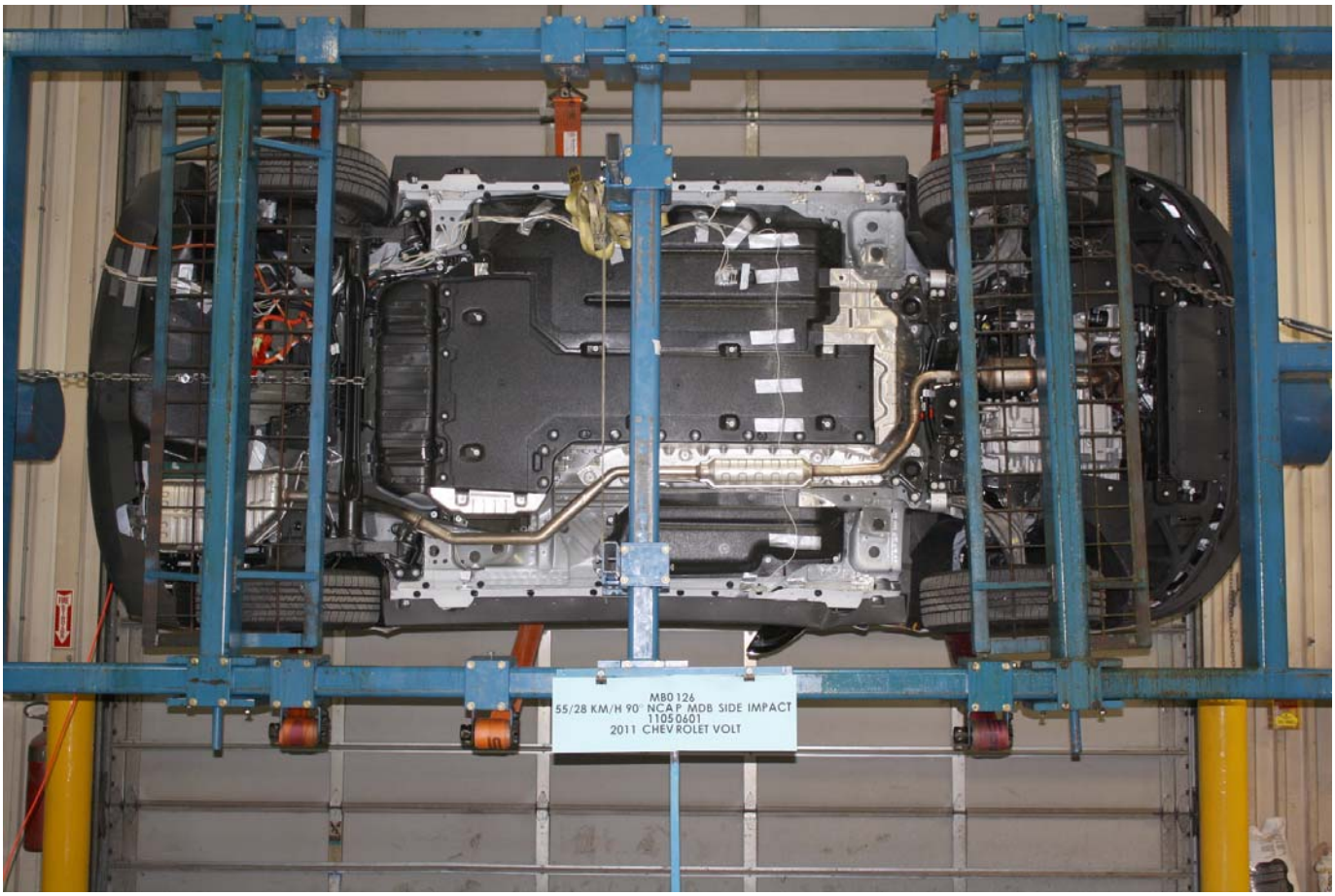
Post-Test Primary and Redundant Speed Trap Read-Out

FMVSS No. 301/305 Rollover 0 Degrees

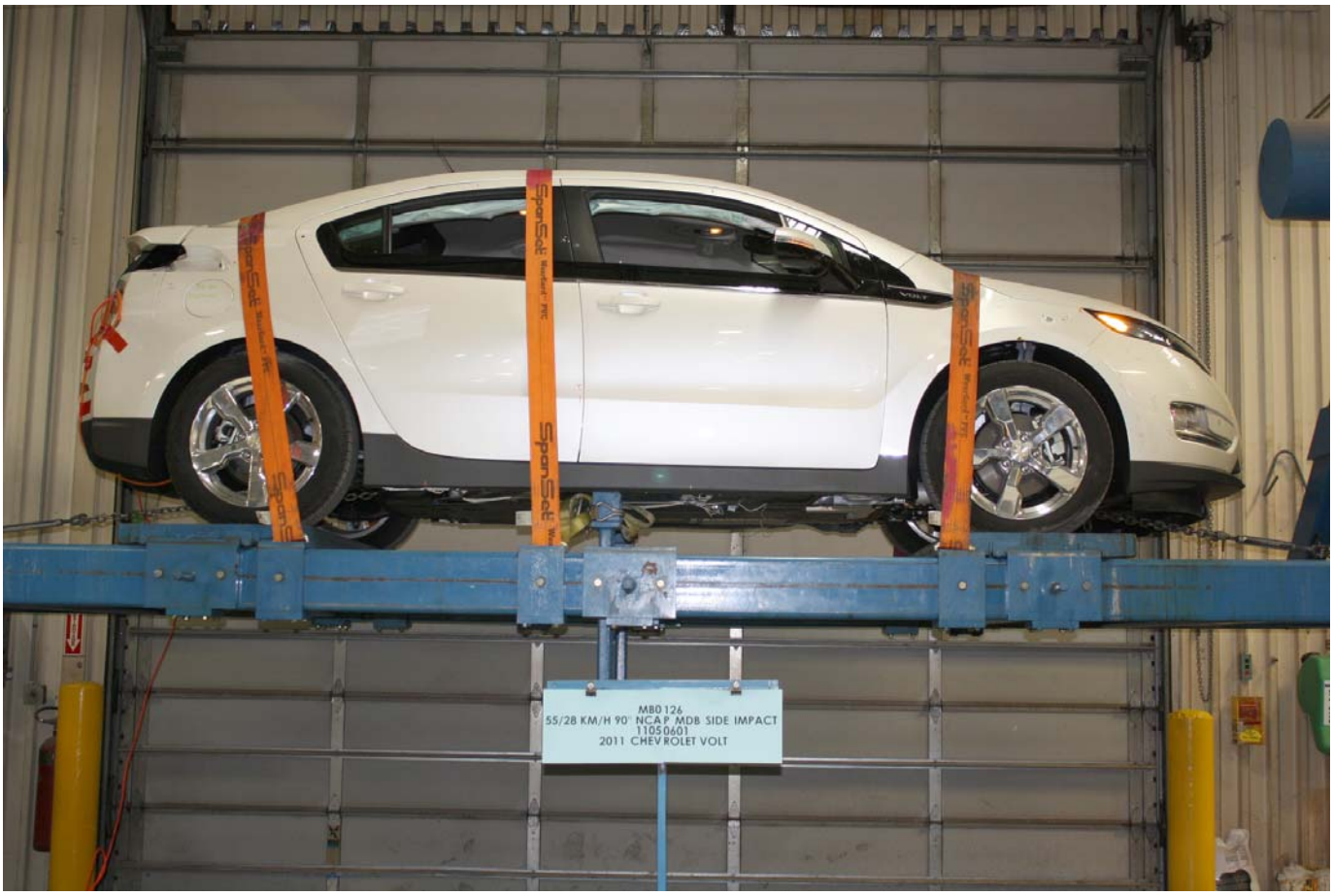
FMVSS No. 301/305 Rollover 90 Degrees



FMVSS No. 301/305 Rollover 180 Degrees



FMVSS No. 301/305 Rollover 270 Degrees



FMVSS No. 301/305 Rollover 360 Degrees

Impact Event

CHEVROLET

2011 CHEVROLET VOLT

EXTERIOR: WHITE DIAMOND TRICOAT
INTERIOR: LIGHT NEUTRAL/DARK ACCENTS

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

Visit us at www.chevy.com

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

OPTIONS & PRICING

	MANUFACTURER'S SUGGESTED RETAIL PRICE
STANDARD VEHICLE PRICE	**$40,280.00**

OPTIONS INSTALLED BY THE MANUFACTURER (MAY REPLACE STANDARD EQUIPMENT SHOWN)

PREMIUM TRIM PKG INCLUDES:	1,395.00
• LEATHER APPOINTED SEATING, • PREMIUM DOOR TRIM • HEATED FRONT SEATS, DRIVER & PASSENGER • LEATHER WRAP STEERING WHEEL	
WHITE DIAMOND TRICOAT	995.00
REAR CAMERA & PARK ASSIST PACKAGE INCLUDES: • ULTRASONIC FRONT & REAR PARK ASSIST • REAR VISION CAMERA SYSTEM	695.00
WHEELS, 17" FORGED POLISHED ALLOY	595.00
FRONT LICENSE PLATE BRACKET	15.00
TOTAL OPTIONS	$3,695.00
TOTAL VEHICLE & OPTIONS	$43,975.00
DESTINATION CHARGE	720.00
TOTAL VEHICLE PRICE*	**$44,695.00**

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 – 379
0 10 20 30 40 50 60 350 360 370

How This Vehicle Compares (combined composite)
Among all vehicles and within compact cars
Worst 13 — 60 Best
Compact Cars
987 — 84 — 0
Other Air Pollutants
Worst 1 — 6 — 10 Best

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

Your actual mileage and costs will vary ...
Visit www.fueleconomy.gov to download the Fuel Economy Guide (also available at dealers).

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.

ORDER NO PJSBPK SALES CODE E
SALES MODEL CODE 1RC68
DEALER NO 14142
FINAL ASSEMBLY:
DETROIT, MI U.S.A.

VIN 1G1RD6E44BU102111

DEALER TO WHOM DELIVERED
KEN DIXON CHEVROLET-CADILLAC
2298 CRAIN HWY
WALDORF, MD 20601-3145

NZ
1000966585

Monroney Label

Head Restraints

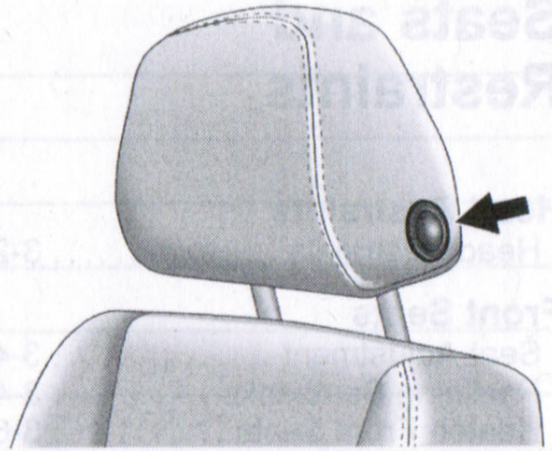
⚠ WARNING

With head restraints that are not installed and adjusted properly, there is a greater chance that occupants will suffer a neck/spinal injury in a crash. Do not drive until the head restraints for all occupants are installed and adjusted properly.

Front Seats

The vehicle's front seats have adjustable head restraints in the outboard seating positions.

Adjust the head restraint so that the top of the restraint is at the same height as the top of the occupant's head. This position reduces the chance of a neck injury in a crash.



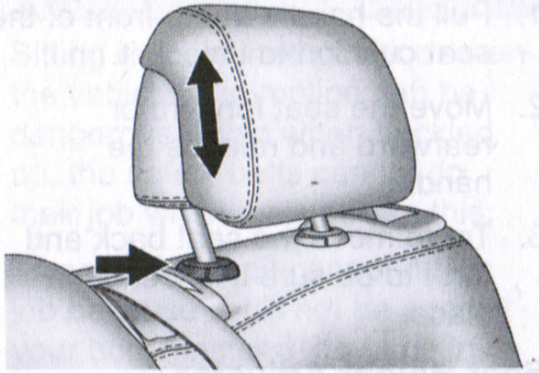
To raise or lower the head restraint, press the button located on the side of the head restraint and pull up or push the head restraint down and release the button.

Pull and push on the head restraint after the button is released to make sure that it is locked in place.

The front seat outboard head restraints are not designed to be removed.

Rear Seats

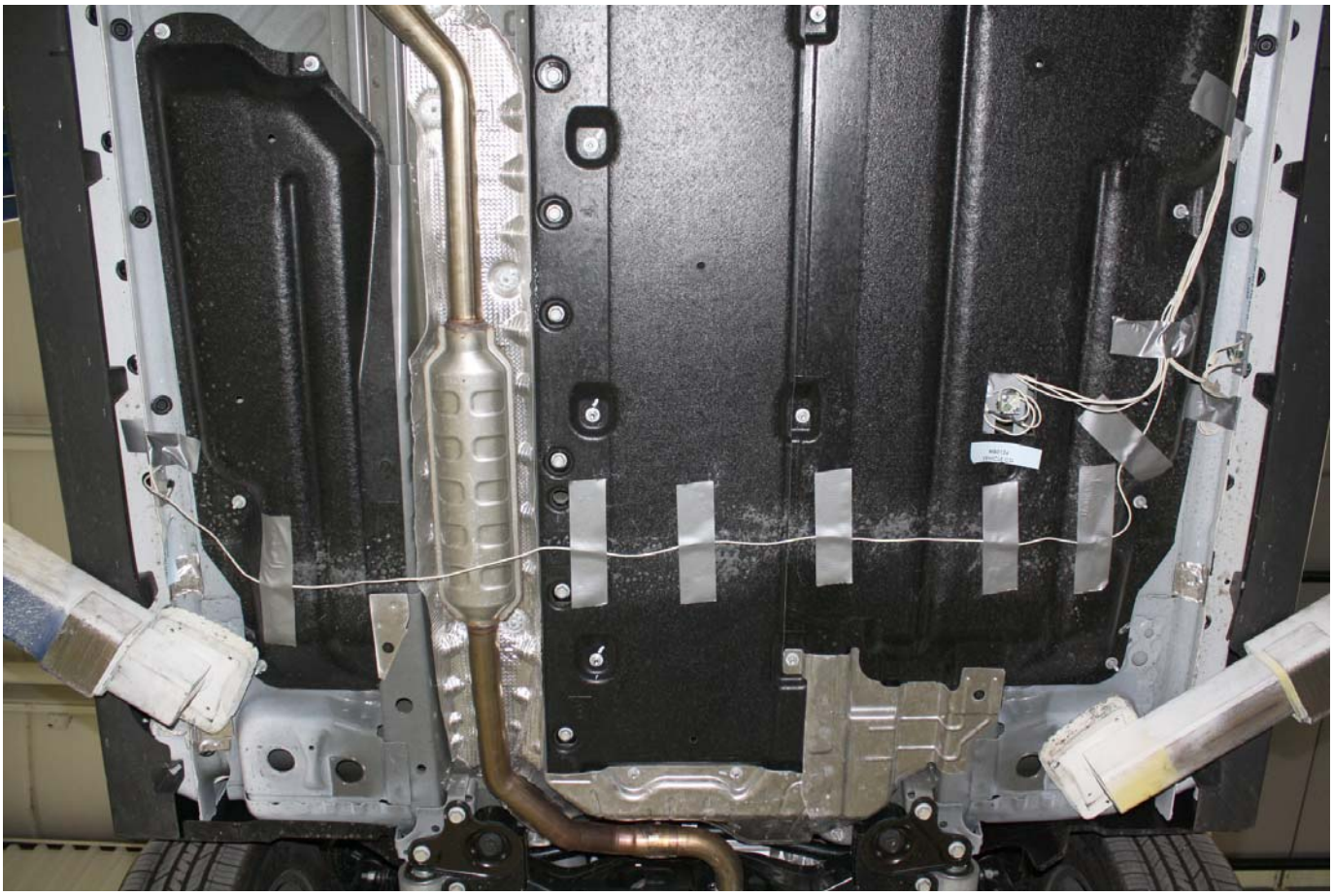
The vehicle's rear seats have adjustable head restraints in the outboard seating positions.



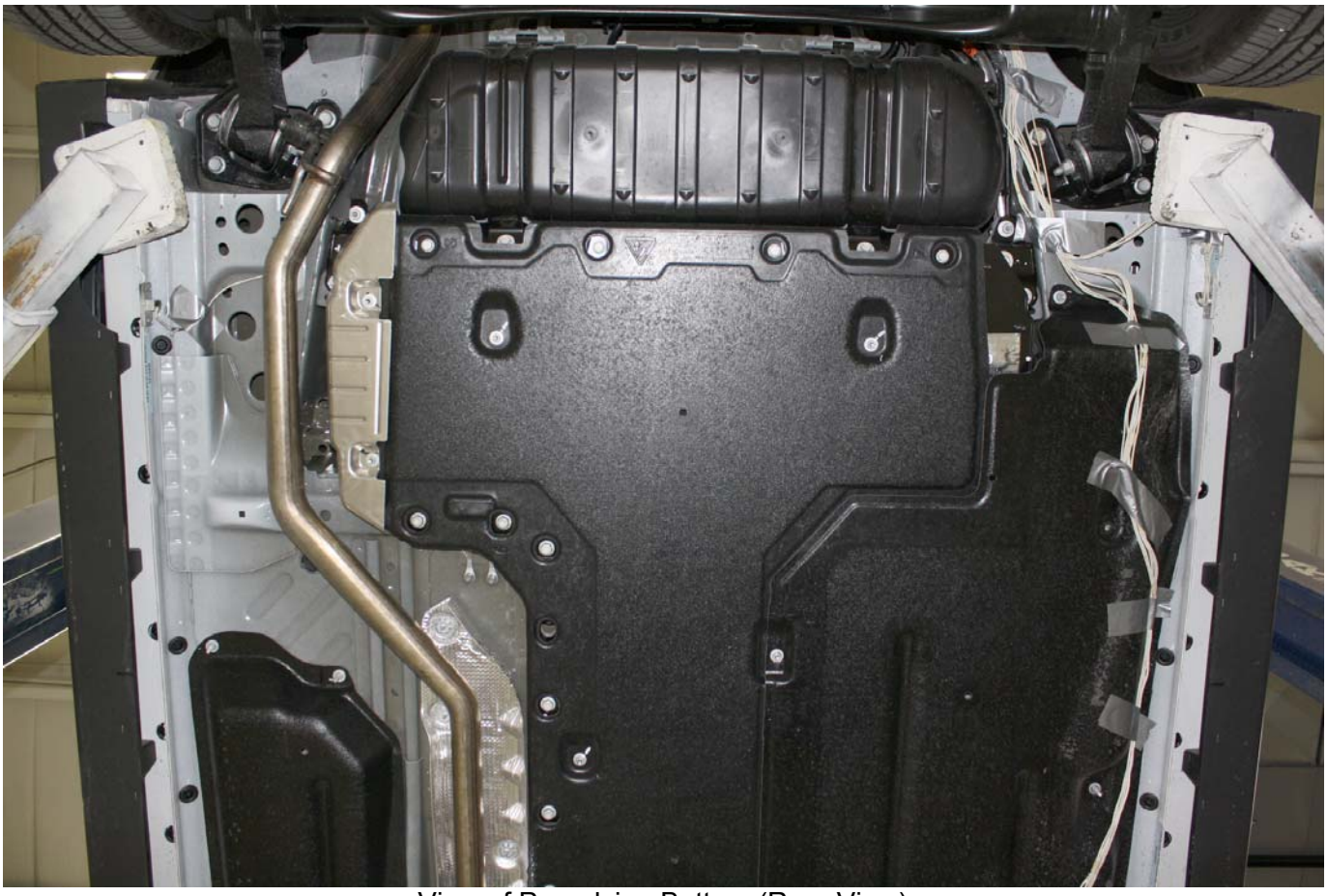
The height of the head restraint can be adjusted. Pull the head restraint up to raise it. Try to move the head restraint to make sure that it is locked in place.

To lower the head restraint, press the button, located on the top of the seatback, and push the head restraint down. Try to move the head restraint after the button is released to make sure that it is locked in place.

If you are installing a child restraint in the rear seat, see “Securing a Child Restraint Designed for the LATCH System” under *Lower Anchors and Tethers for Children (LATCH System) on page 3-49.*



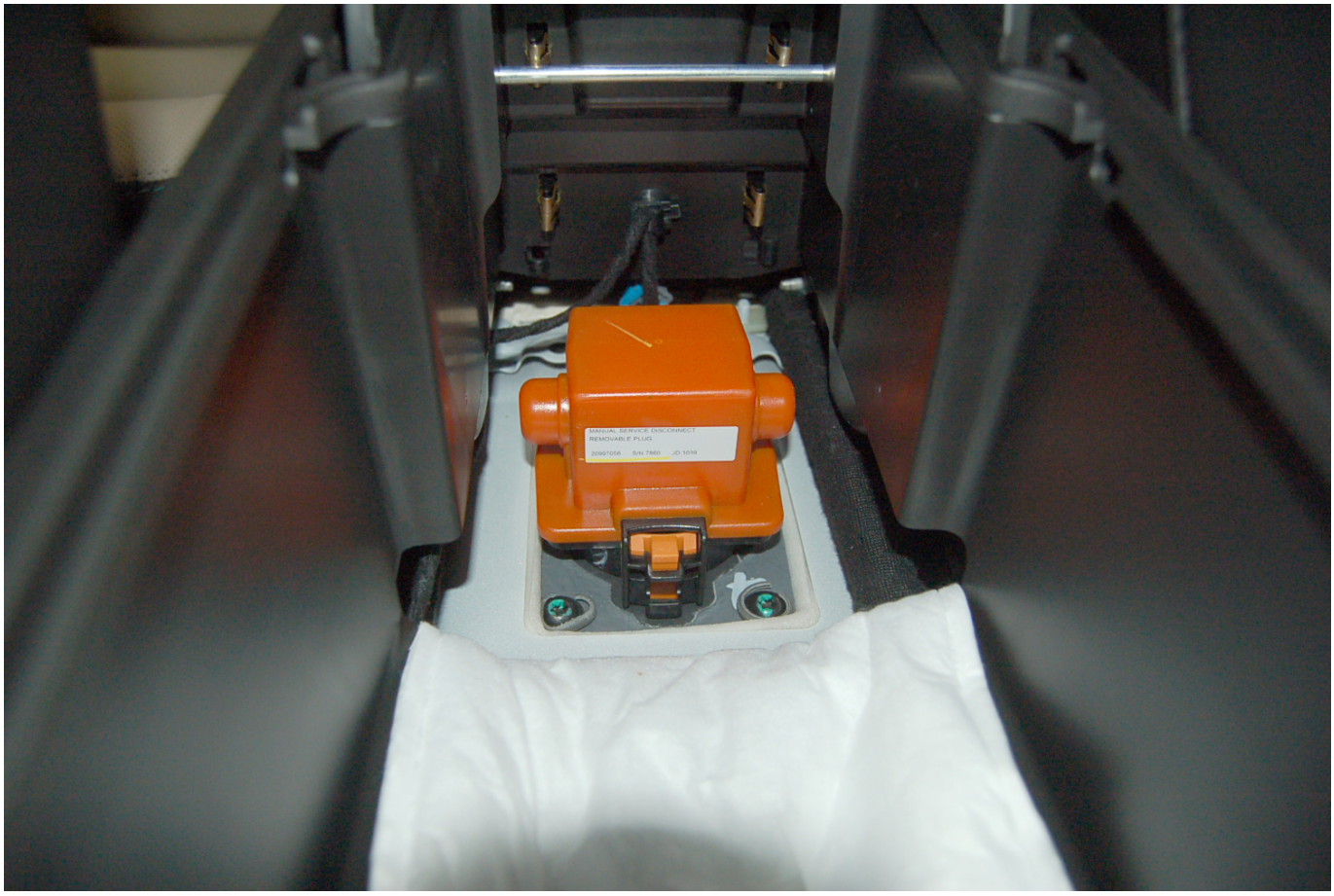
View of Propulsion Battery (Front View)



View of Propulsion Battery (Rear View)

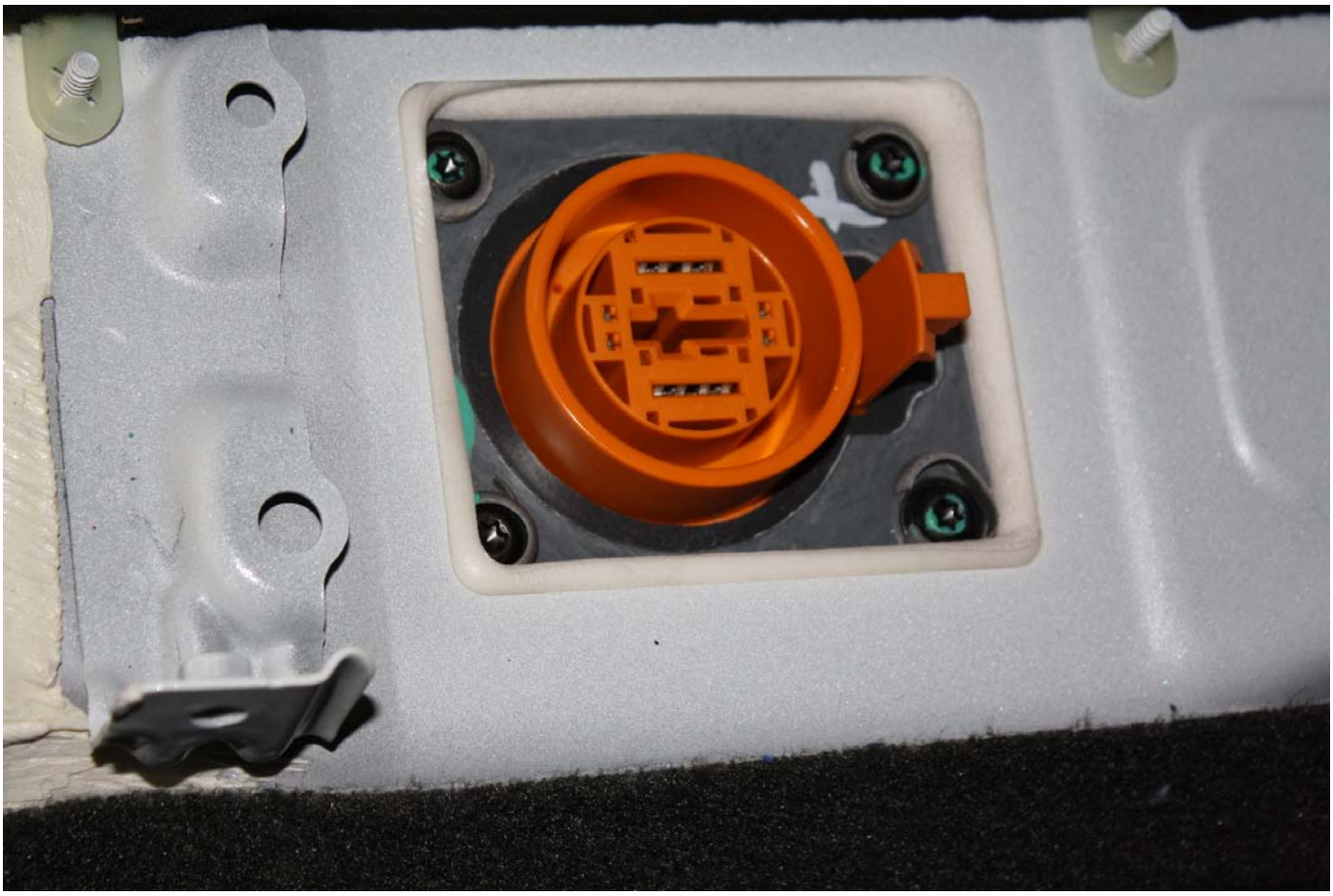
View of Electric Propulsion Drive


View of Vehicle's Passenger Compartment Adjacent to Propulsion Battery



Manual High Voltage Service Disconnect

Manual High Voltage Service Disconnect



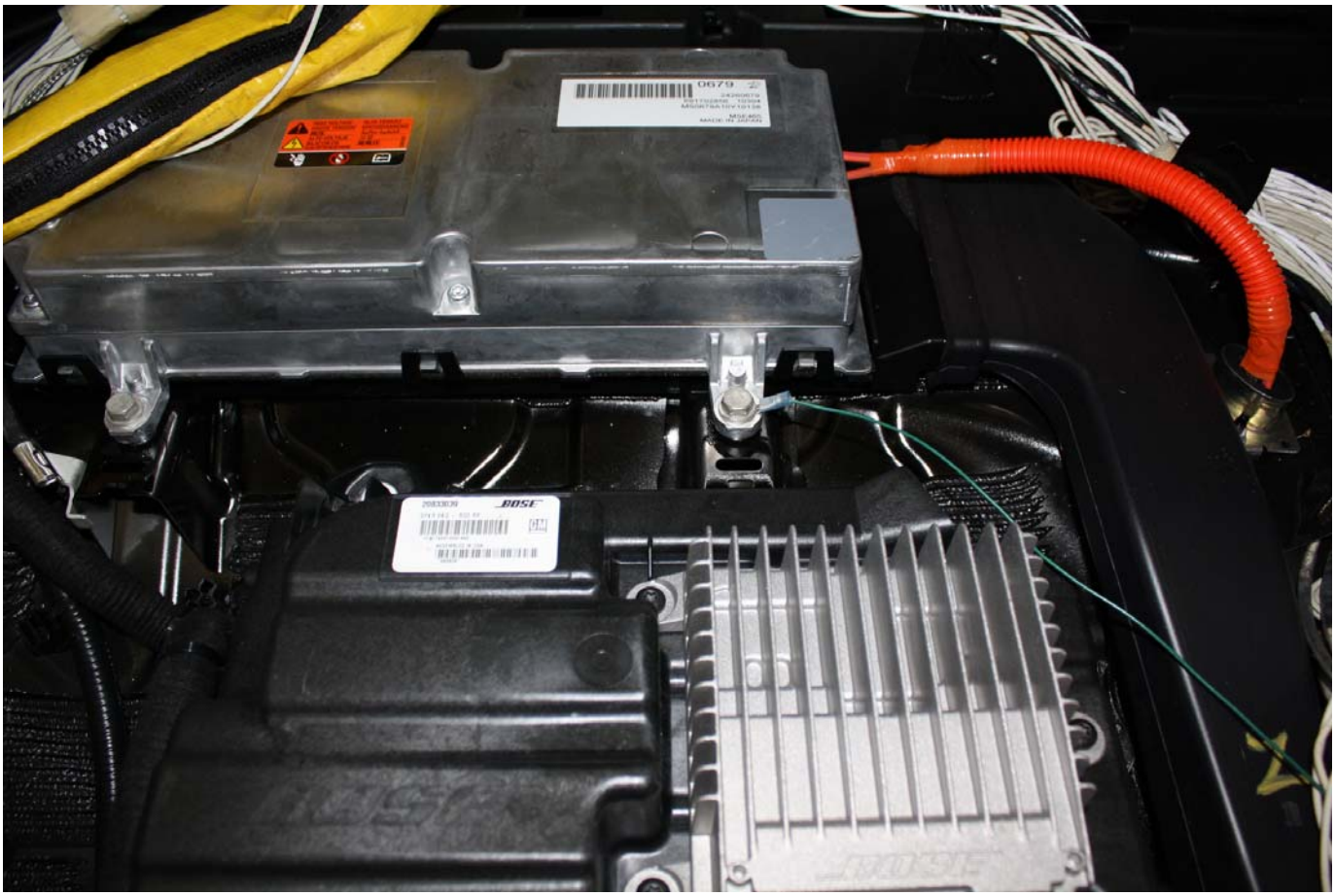
Manual High Voltage Service Disconnect

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
Driver & Passenger Dummy Instrumentation Plots
FILTERED DATA

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Figure No. 2.	Driver Head Acceleration (Y) Primary vs. Time	B-1
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Figure No. 19.	Passenger Lower Spine T12 Acceleration (Y) vs. Time	B-6
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Figure No. 21.	Passenger Lower Spine T12 Resultant Acceleration vs. Time	B-6
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The following additional data for this test can be obtained from the Research and Development section of the NHTSA website. The website can be found at www.nhtsa.dot.gov

Driver & Passenger Dummy Instrumentation Data

Driver Lower Spine T12 Acceleration (X)

Driver Lower Spine T12 Acceleration (Y)

Driver Lower Spine T12 Acceleration (Z)

Passenger Upper Thorax Rib Deflection (Y)

Passenger Middle Thorax Rib Deflection (Y)

Passenger Lower Thorax Rib Deflection (Y)

Passenger Upper Abdomen Rib Deflection (Y)

Passenger Lower Abdomen Rib Deflection (Y)

Driver Head Acceleration Redundant (X)

Driver Head Acceleration Redundant (Y)

Driver Head Acceleration Redundant (Z)

Driver Shoulder Contact Switch (not installed)

Driver Torso Contact Switch (not installed)

Driver Pelvis Contact Switch (not installed)

Passenger Head Acceleration Redundant (X)

Passenger Head Acceleration Redundant (Y)

Passenger Head Acceleration Redundant (Z)

Passenger Shoulder Contact Switch (not installed)

Passenger Torso Contact Switch (not installed)

Passenger Pelvis Contact Switch (not installed)

Vehicle Instrumentation Data

Driver Side Airbag Timing (not installed)

Driver Side Curtain Airbag Timing (not installed)

Passenger Side Airbag Timing (not installed)

Passenger Side Curtain Airbag Timing (not installed)

Right Side Sill at Front Seat Acceleration (X)

Right Side Sill at Front Seat Acceleration (Y)

Right Side Sill at Front Seat Acceleration (Z)

Right Side Sill at Rear Seat Acceleration (X)

Right Side Sill at Rear Seat Acceleration (Y)

Right Side Sill at Rear Seat Acceleration (Z)

Rear Floorpan Above Axle Acceleration (X)

Rear Floorpan Above Axle Acceleration (Y)

Rear Floorpan Above Axle Acceleration (Z)

Left Side Sill at Front Seat Acceleration (Y)

Left Side Sill at Rear Seat Acceleration (Y)

Right Rear Occupant Compartment Acceleration (Y)

Lower A-Post Acceleration (Y)

Middle A-Post Acceleration (Y)

Lower B-Post Acceleration (Y)

Middle B-Post Acceleration (Y)

Front Seat Track Acceleration (Y)

Rear Seat Track Acceleration (Y) (not installed)

Vehicle Center of Gravity Acceleration (X)

Vehicle Center of Gravity Acceleration (Y)

Vehicle Center of Gravity Acceleration (Z)

MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)

MDB Center of Gravity Acceleration (Y)

MDB Center of Gravity Acceleration (Z)

MDB Rear Acceleration (X)

MDB Rear Acceleration (Y)

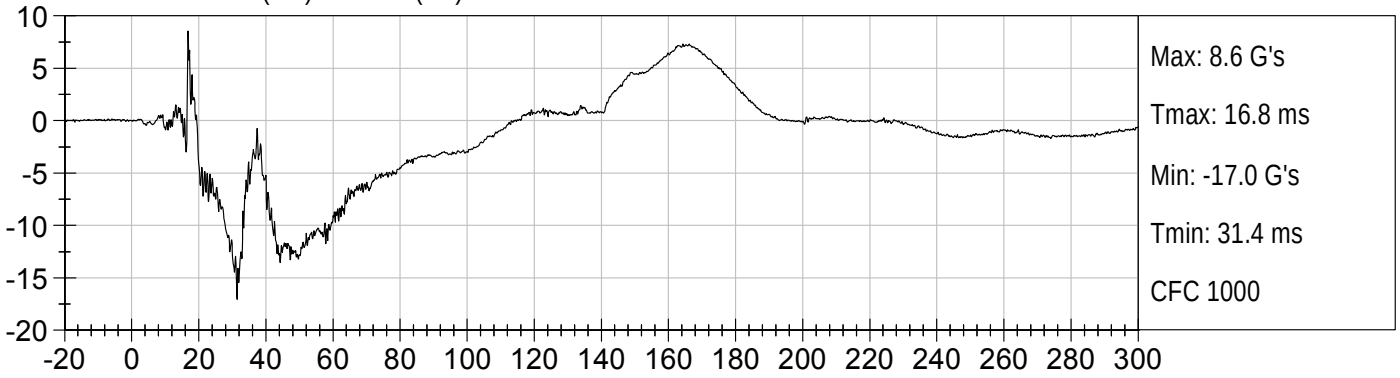
Left MDB Contact Switch

Right MDB Contact Switch

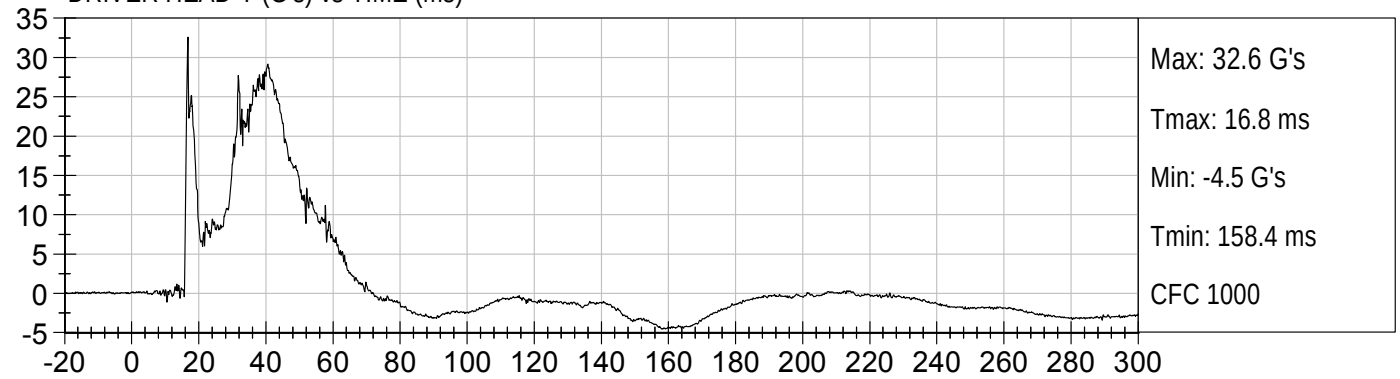
55/28 km/h 90° NCAP MDB Side Impact
2011 Chevrolet Volt - MB0126

Test Date: 05/06/2011
Speed: 38.6 mph (62.1 km/h)

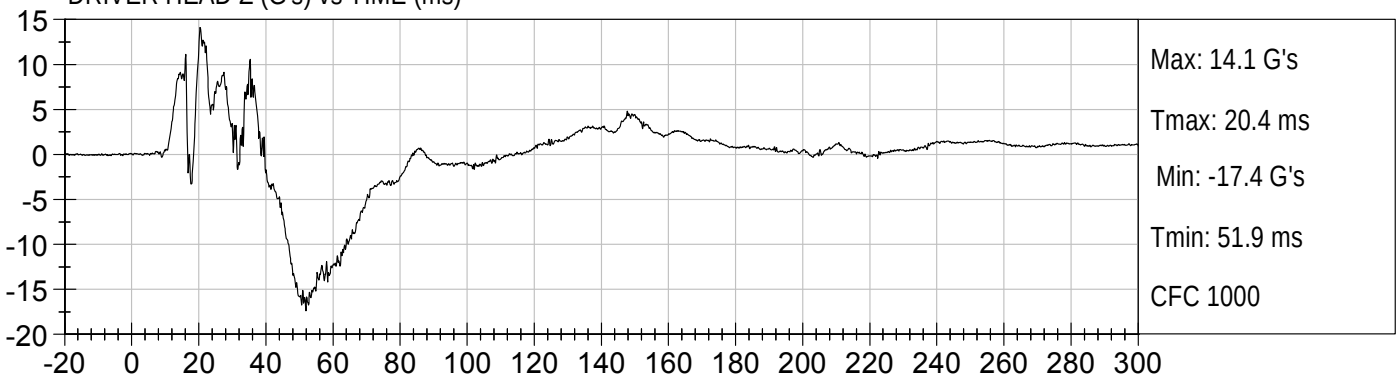
DRIVER HEAD X (G's) vs TIME (ms)



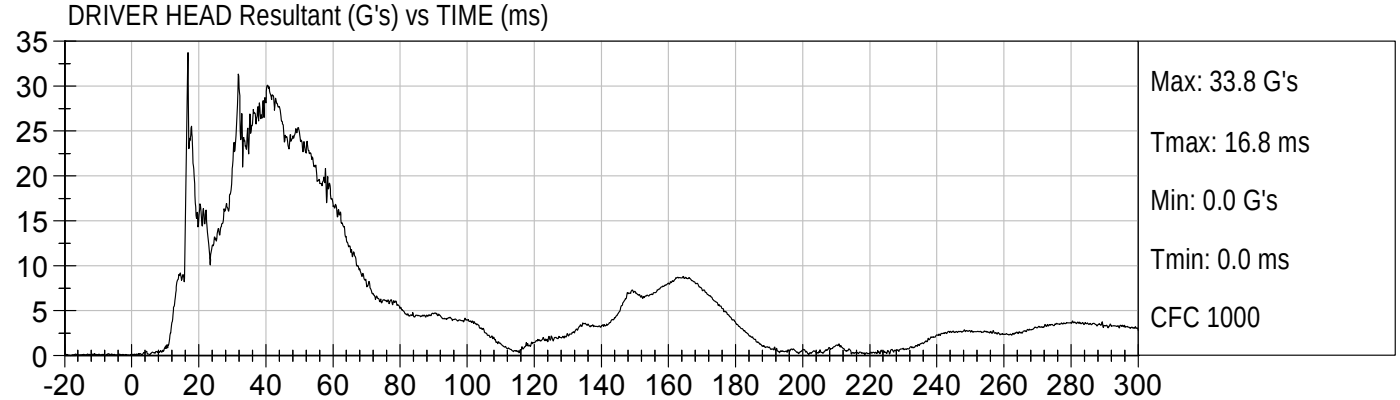
DRIVER HEAD Y (G's) vs TIME (ms)



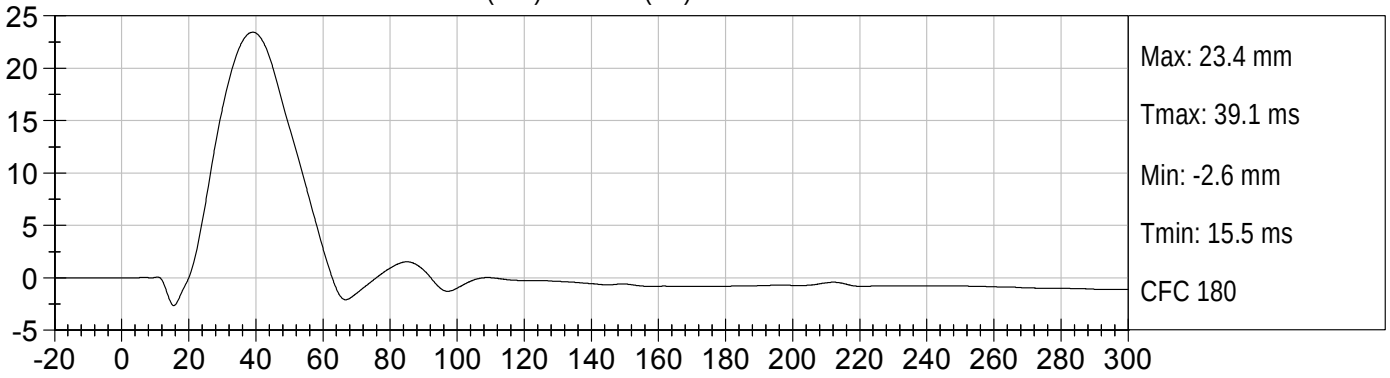
DRIVER HEAD Z (G's) vs TIME (ms)



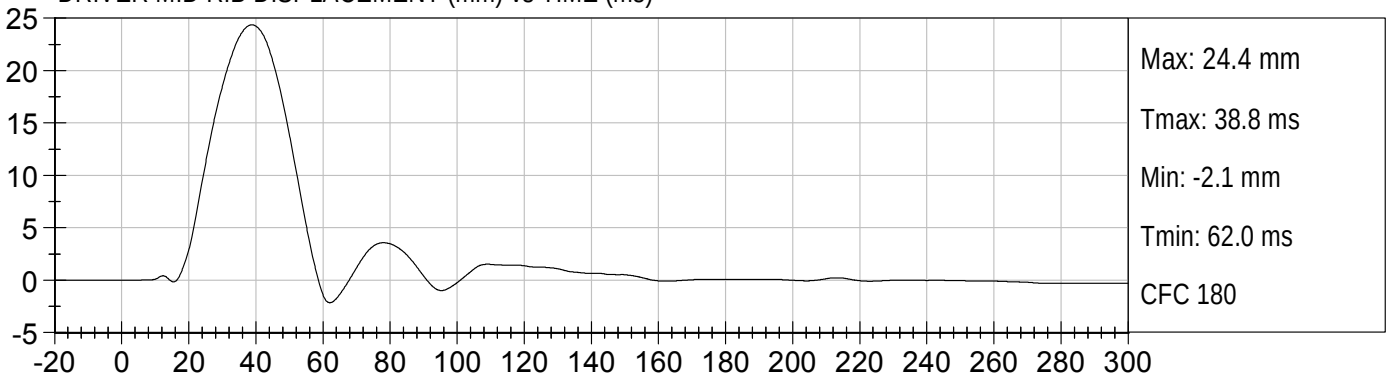
DRIVER HEAD Resultant (G's) vs TIME (ms)



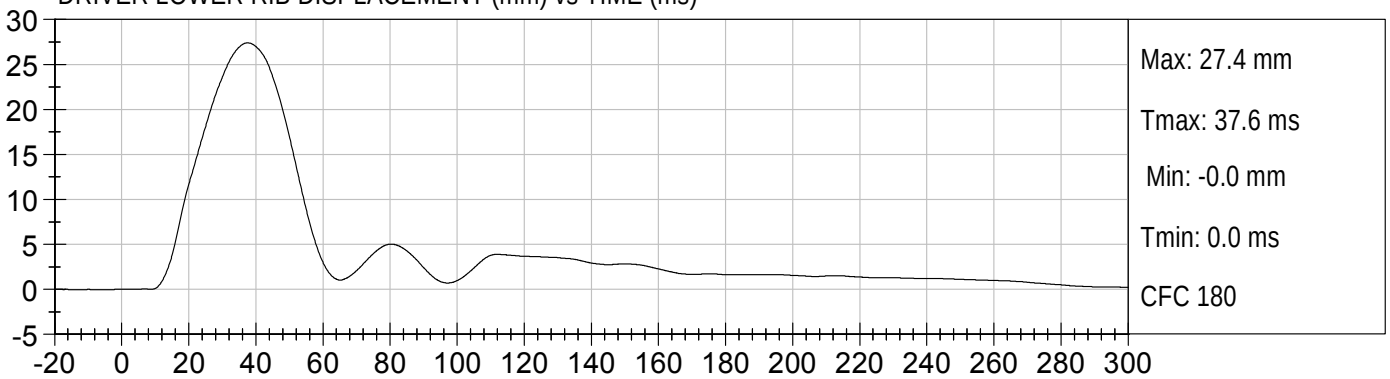
DRIVER UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



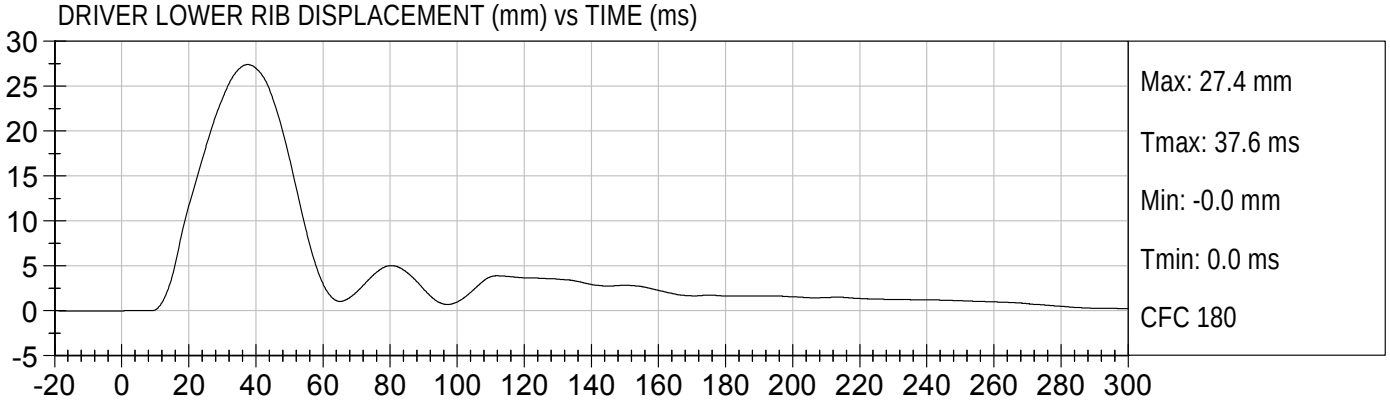
DRIVER MID RIB DISPLACEMENT (mm) vs TIME (ms)



DRIVER LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



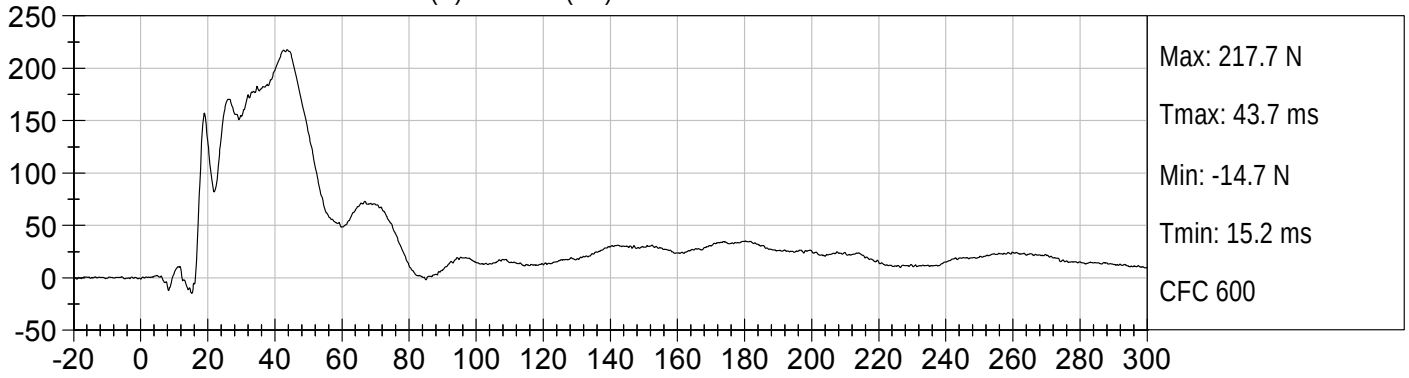
DRIVER LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



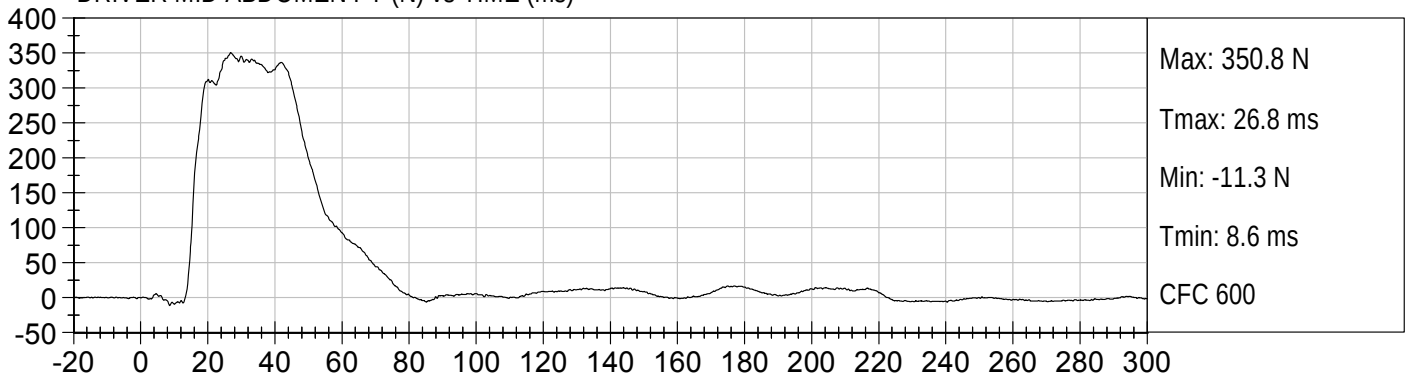
55/28 km/h 90° NCAP MDB Side Impact
2011 Chevrolet Volt - MB0126

Test Date: 05/06/2011
Speed: 38.6 mph (62.1 km/h)

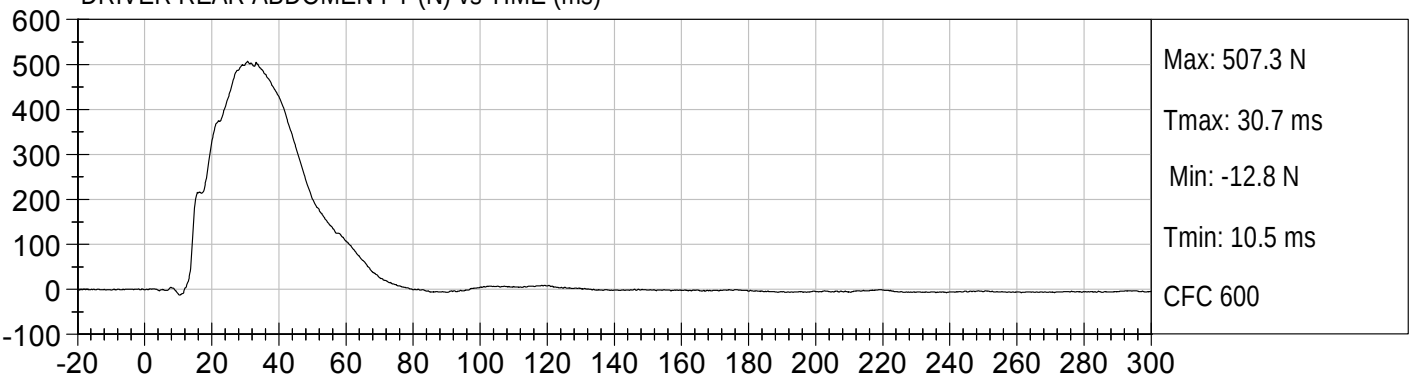
DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)



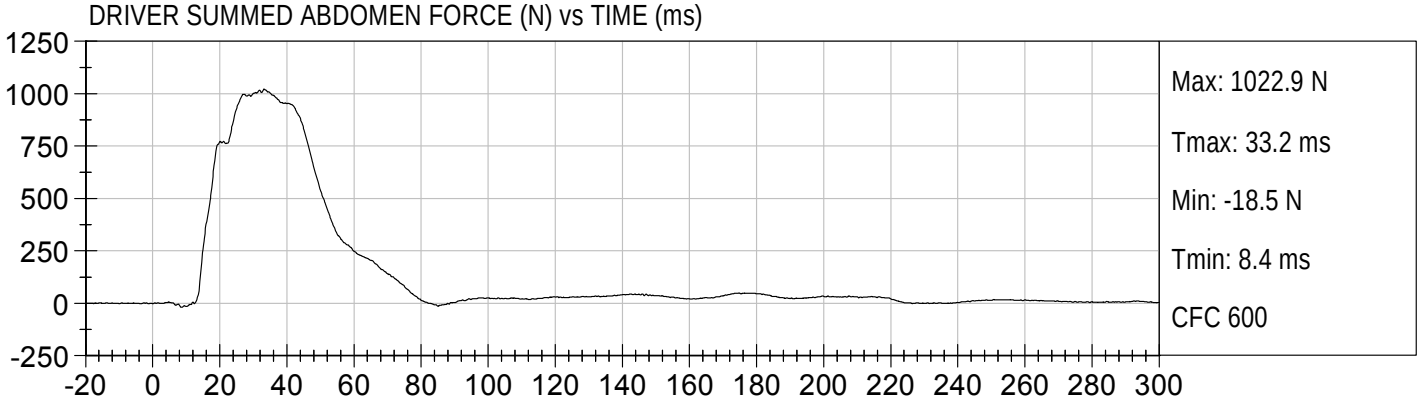
DRIVER MID ABDOMEN FY (N) vs TIME (ms)



DRIVER REAR ABDOMEN FY (N) vs TIME (ms)



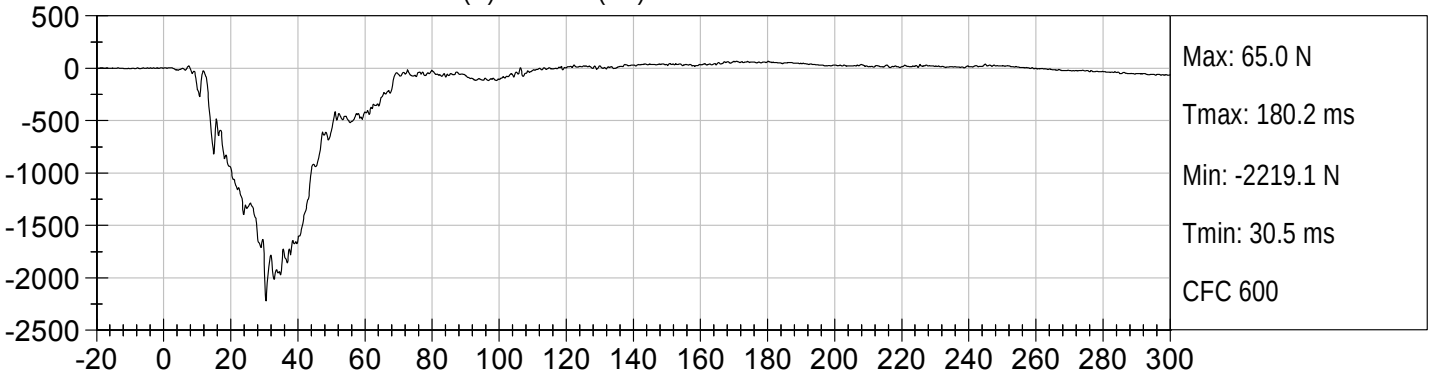
DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)



55/28 km/h 90° NCAP MDB Side Impact
2011 Chevrolet Volt - MB0126

Test Date: 05/06/2011
Speed: 38.6 mph (62.1 km/h)

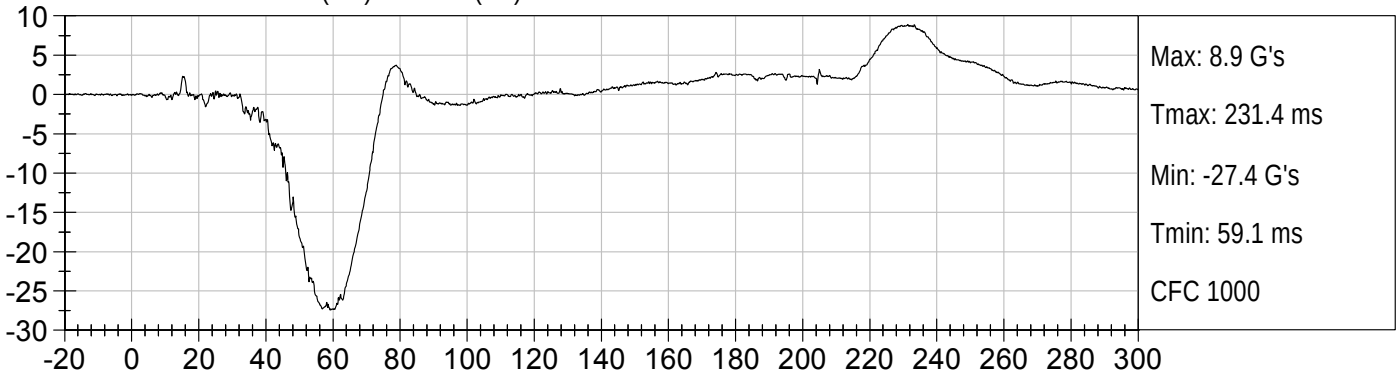
DRIVER PUBIC SYMPHYSIS FY (N) vs TIME (ms)



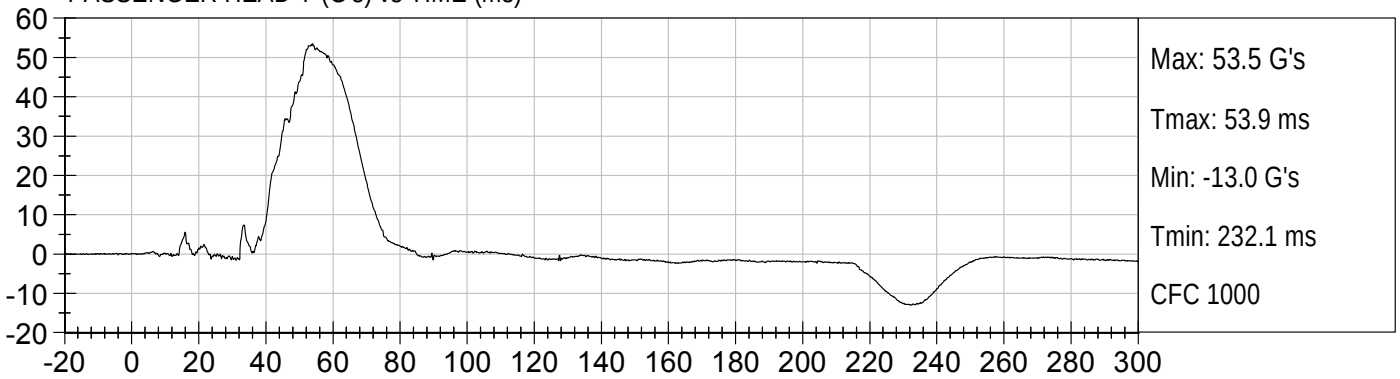
55/28 km/h 90° NCAP MDB Side Impact
2011 Chevrolet Volt - MB0126

Test Date: 05/06/2011
Speed: 38.6 mph (62.1 km/h)

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

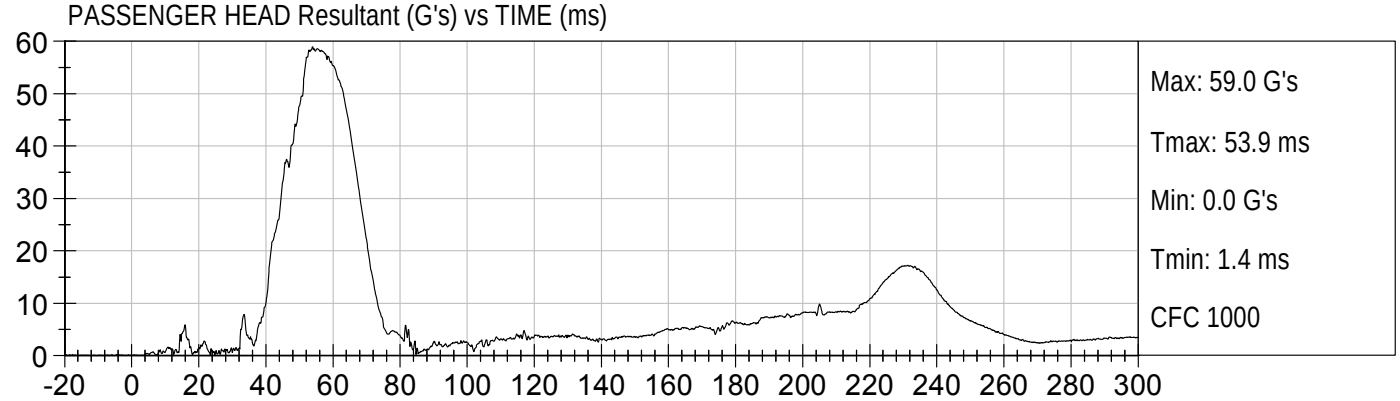


PASSENGER HEAD Y (G's) vs TIME (ms)



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

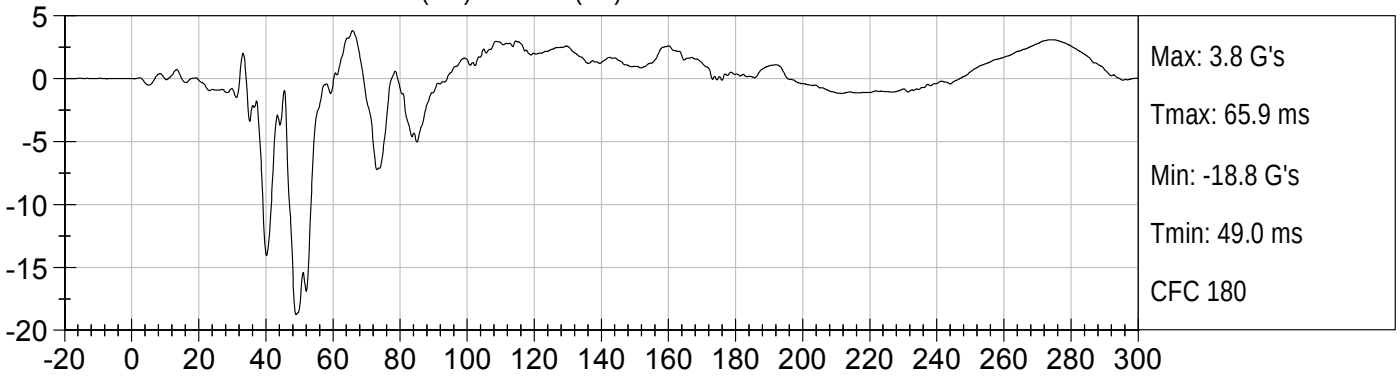
PASSENGER HEAD Resultant (G's) vs TIME (ms)



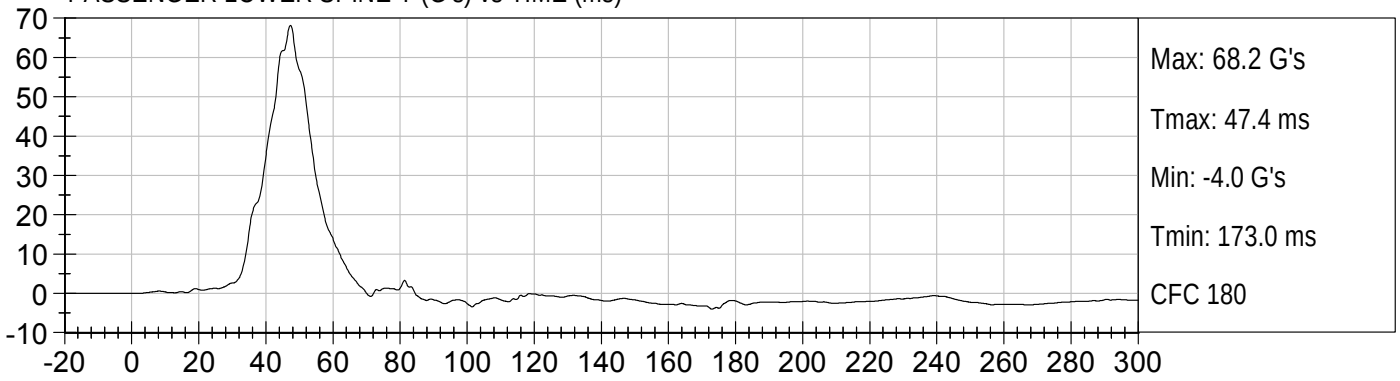
55/28 km/h 90° NCAP MDB Side Impact
2011 Chevrolet Volt - MB0126

Test Date: 05/06/2011
Speed: 38.6 mph (62.1 km/h)

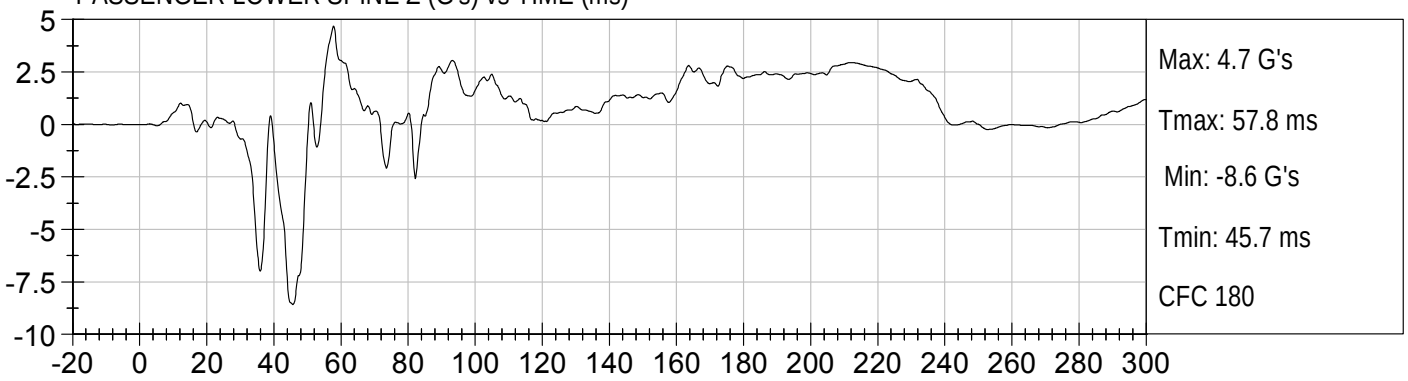
PASSENGER LOWER SPINE X (G's) vs TIME (ms)



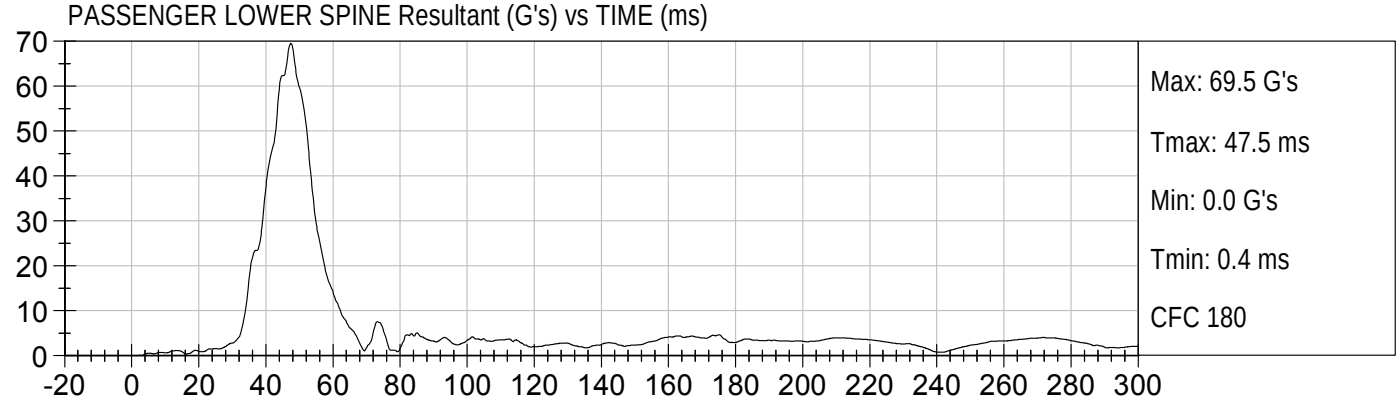
PASSENGER LOWER SPINE Y (G's) vs TIME (ms)



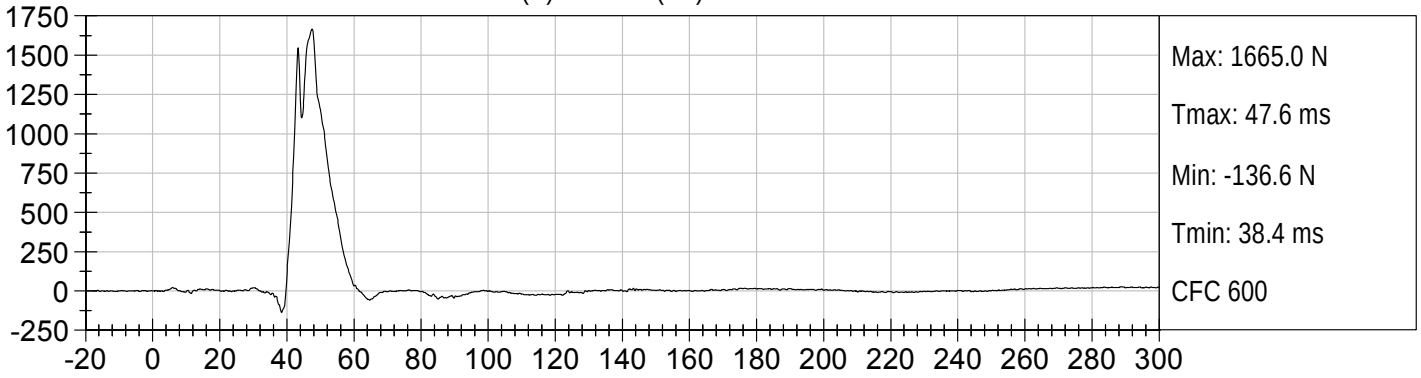
PASSENGER LOWER SPINE Z (G's) vs TIME (ms)



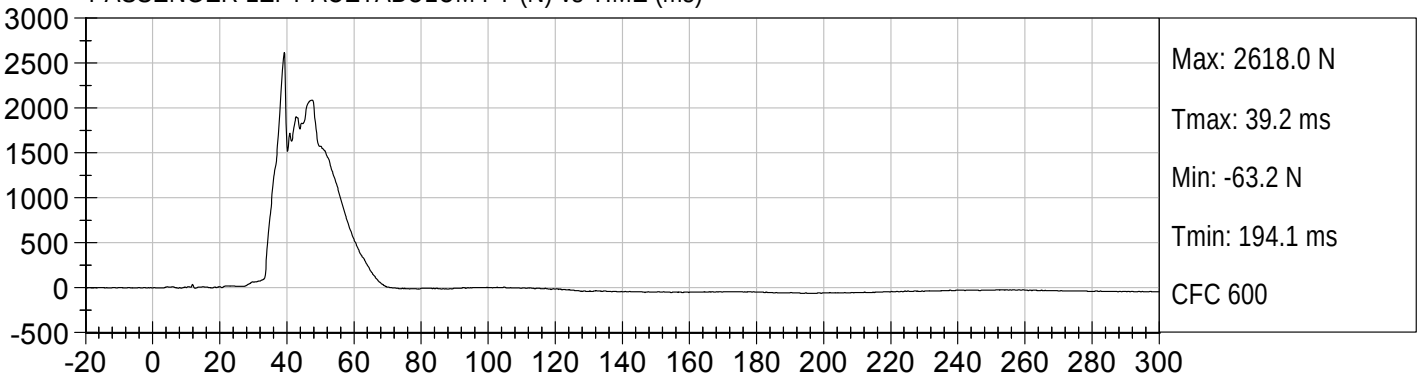
PASSENGER LOWER SPINE Resultant (G's) vs TIME (ms)



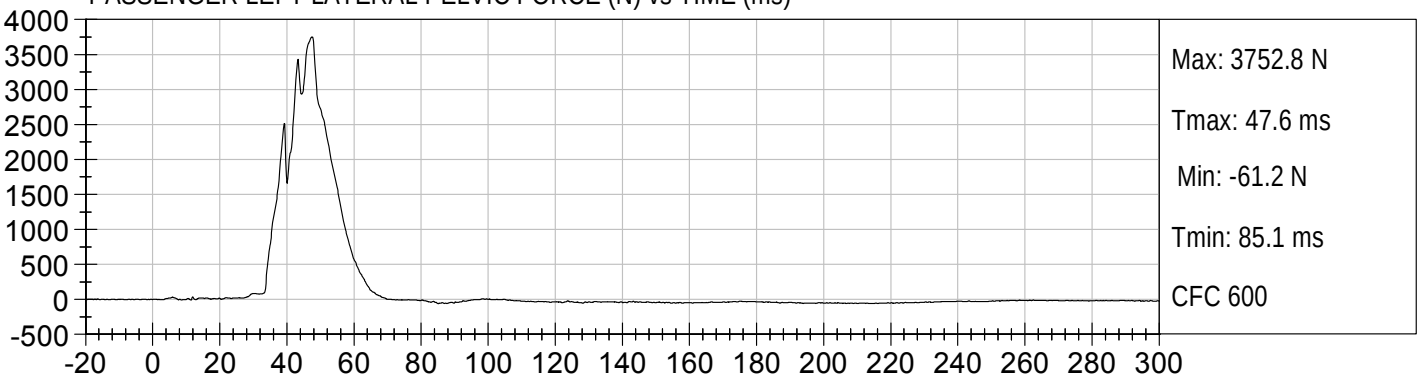
PASSENGER LEFT ILLIUM CREST FY (N) vs TIME (ms)



PASSENGER LEFT ACETABULUM FY (N) vs TIME (ms)



PASSENGER LEFT LATERAL PELVIC FORCE (N) vs TIME (ms)



APPENDIX C

DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 032 **Test ID:** D11781

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Peak Resultant Acceleration	G's	125 to 155	139	Pass
Peak Lateral Acceleration	G's	+/- 15	-8.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

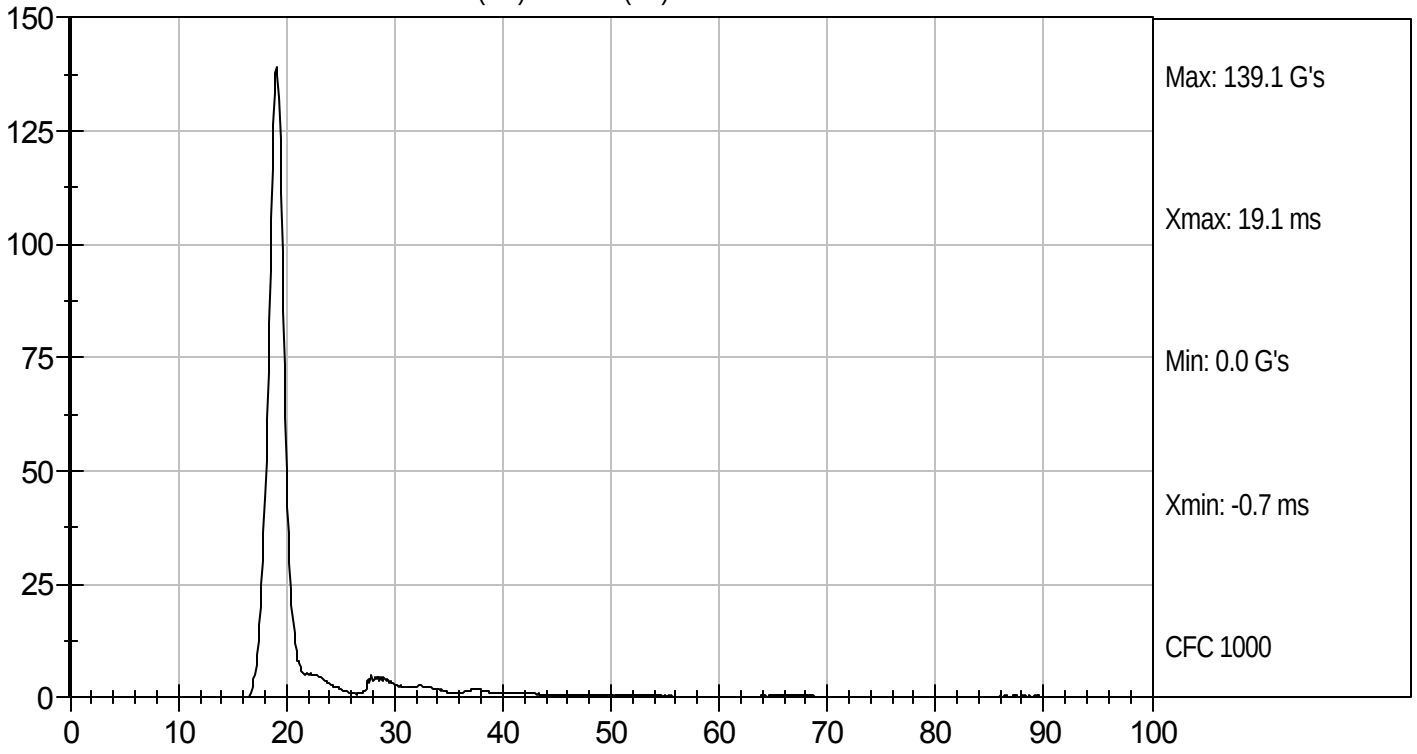
3/2/11
Test Date

David Winkelbauer
Approved By

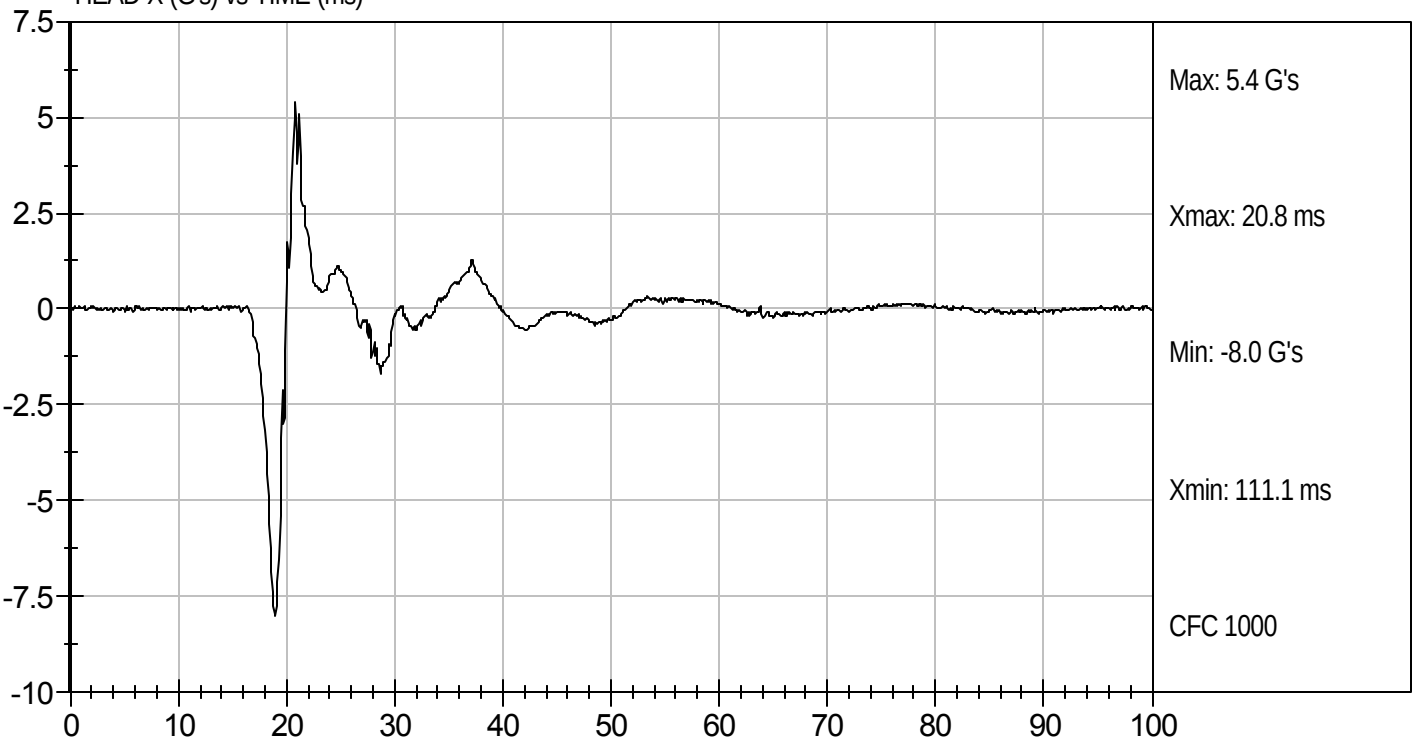
Test Desc: Head Drop
Component ID: D11781

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

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



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



MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D11782

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	19	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.4	Pass
Pendulum Deceleration	1 ms	m/s	0.00 to -0.05	-0.02	Pass
	3 ms	m/s	-0.25 to -0.375	-0.33	Pass
	14 ms	m/s	-3.20 to -3.70	-3.36	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	52.1	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	58.8	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	59.4	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

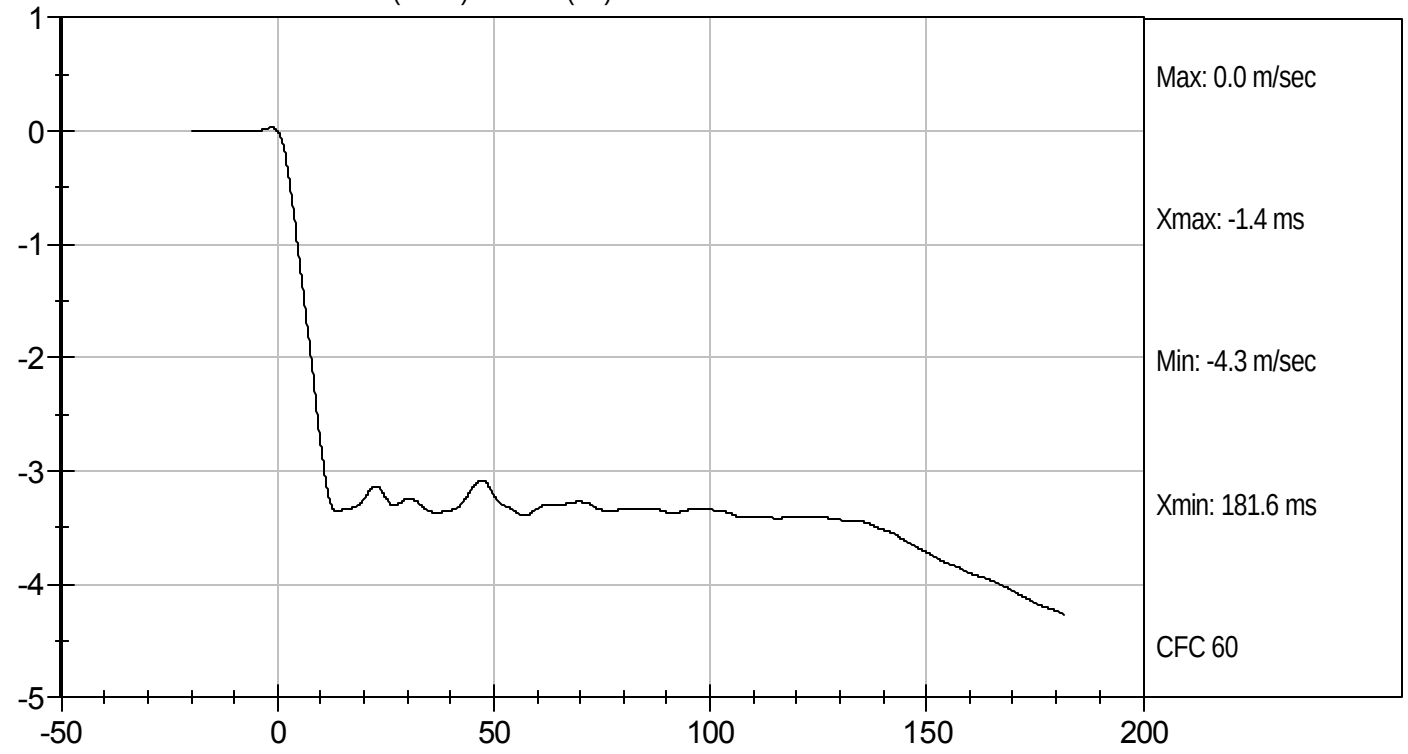
3/2/11
Test Date

David Winkelbauer
Approved By

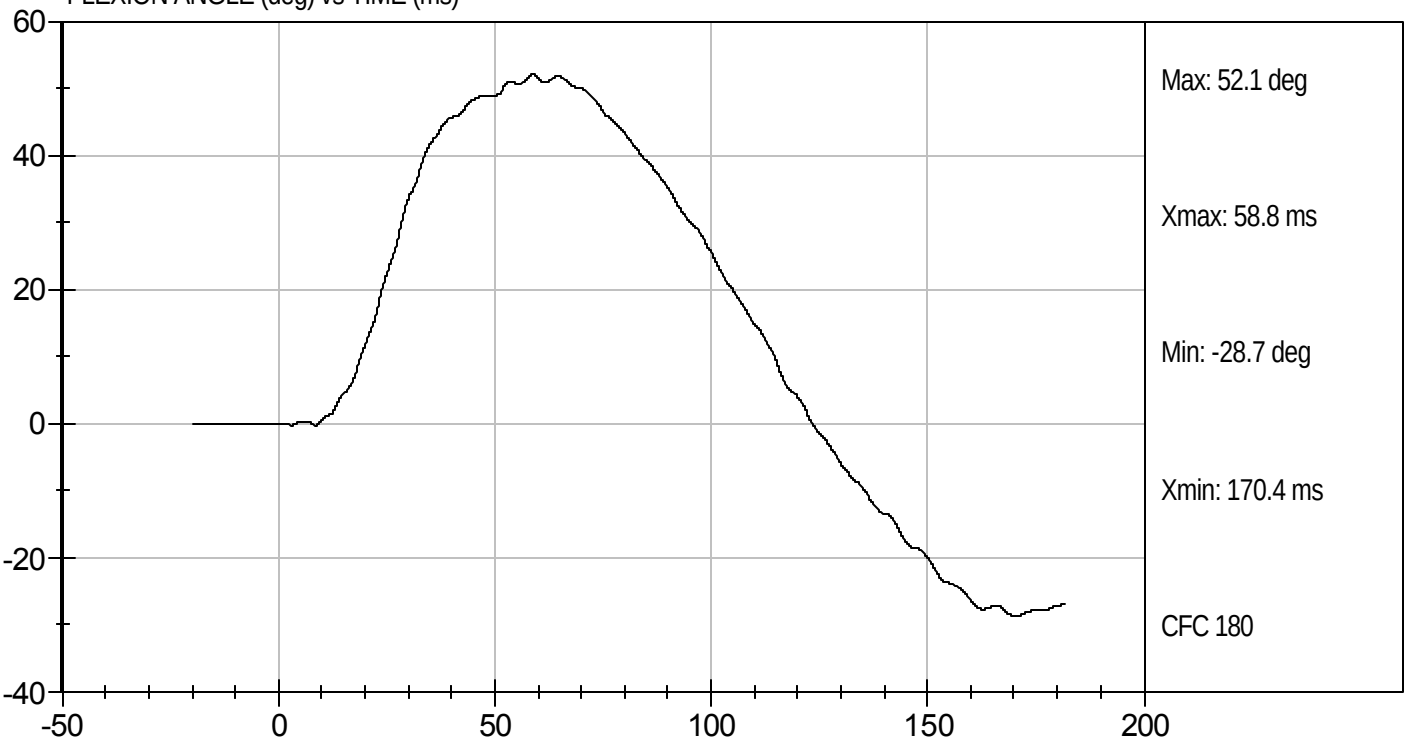
Test Desc: Neck Bending
Component ID: D11782

Test Date: 3/2/11
Velocity: 11.11 ft/s, 3.4 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

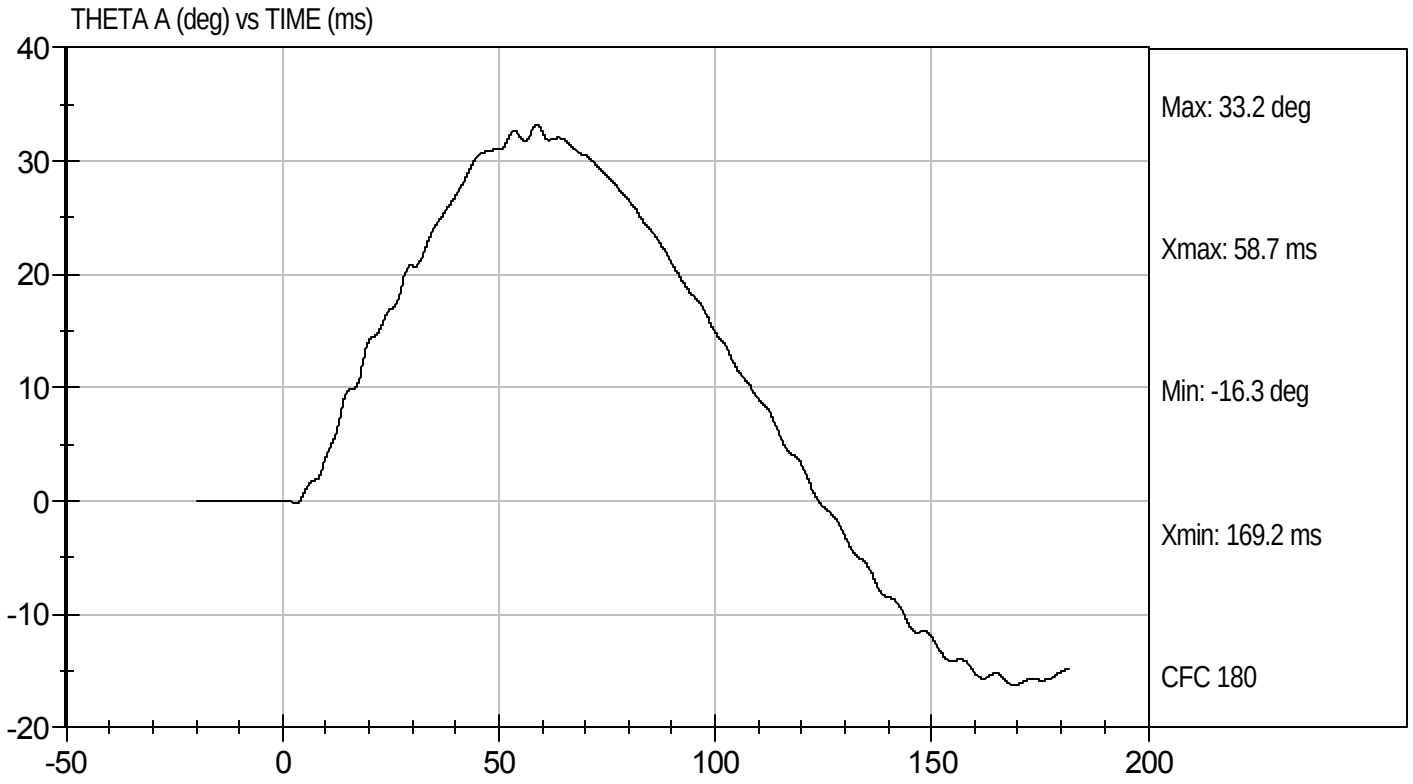


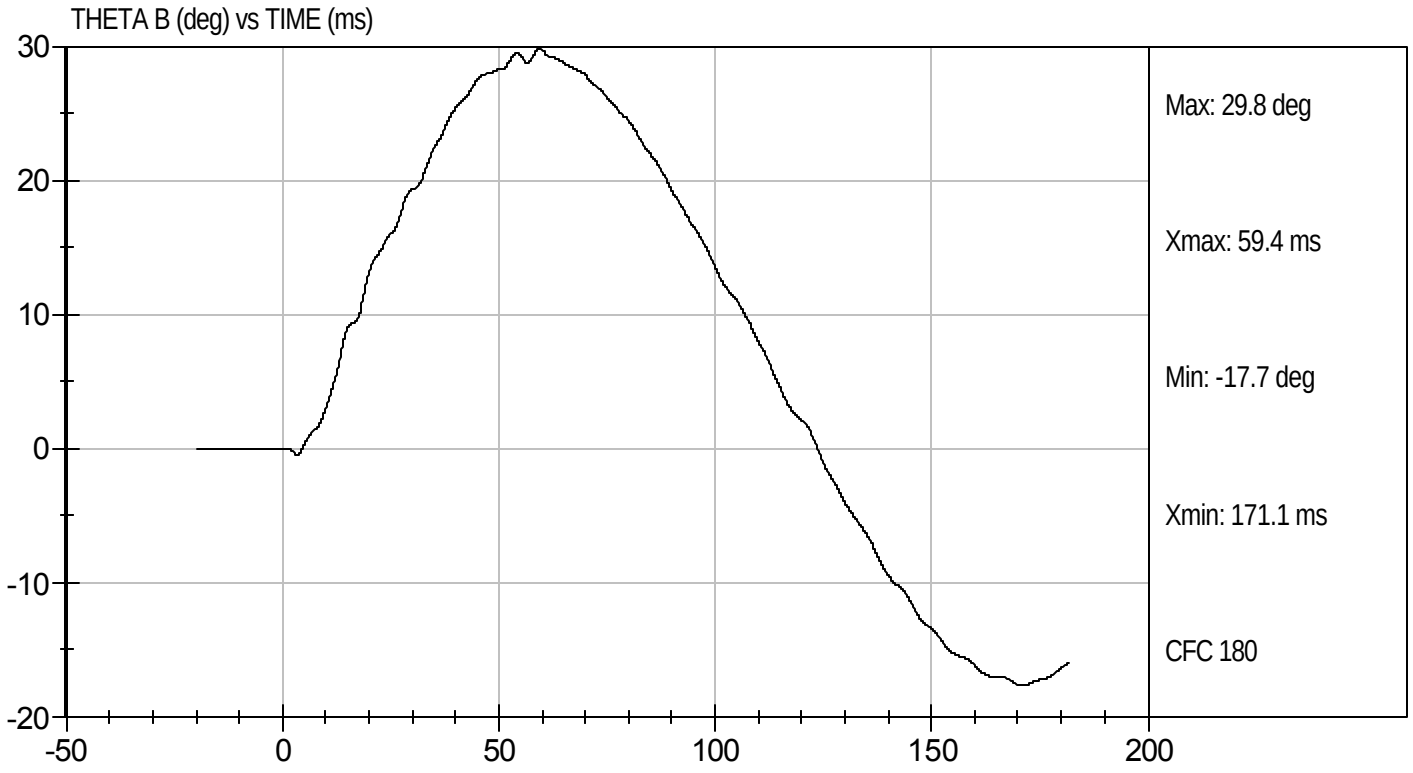
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D11782

Test Date: 3/2/11
Velocity: 11.11 ft/s, 3.4 m/s





MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D11783

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	21	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.3	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	9.4	Pass
Time of Peak Shoulder Acceleration	ms	NA	12.8	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

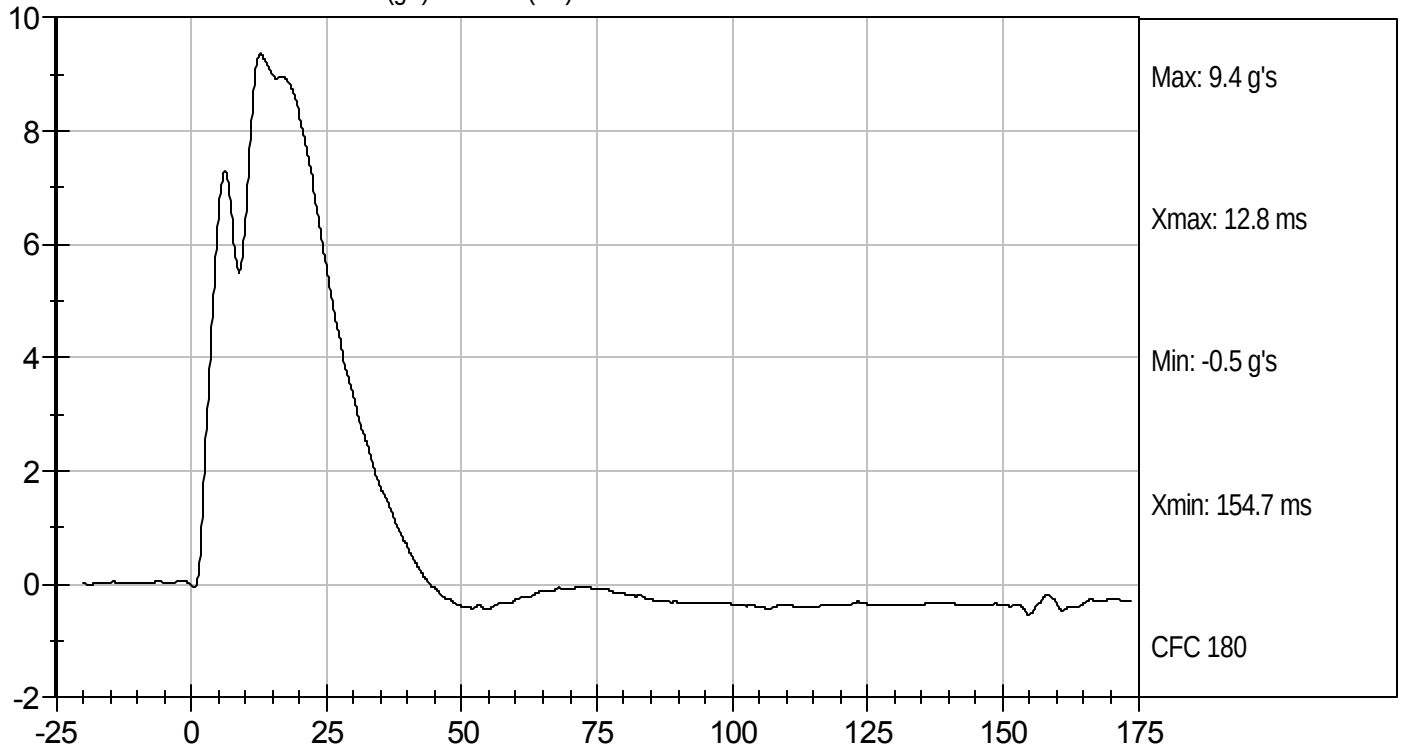
3/1/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D11783

Test Date: 3/1/11
Velocity: 14.12 ft/s, 4.3 m/s

SHOULDER ACCELERATION (g's) vs TIME (ms)



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D11784

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.1	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.2	Pass
		Overall Test Results		Pass

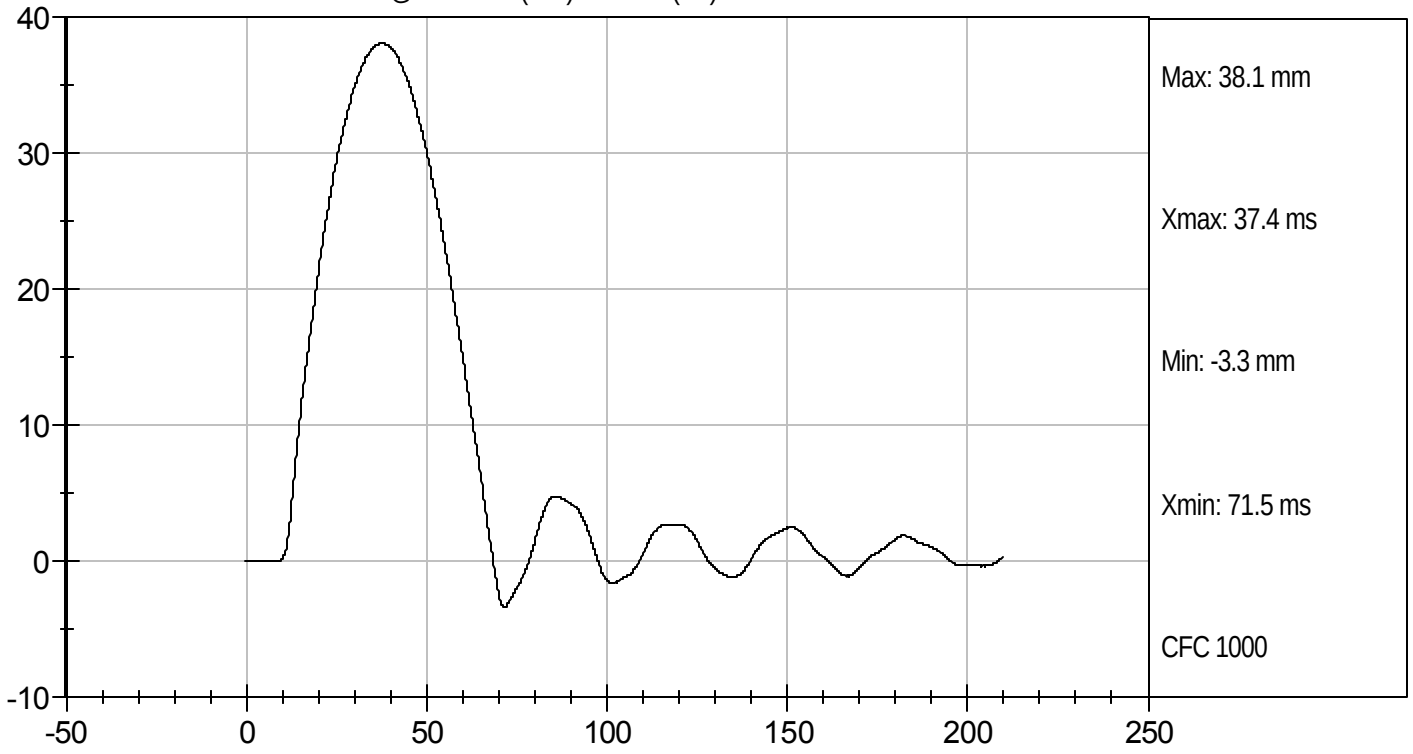
Jessica Gall
Laboratory Technician

3/2/11
Test Date

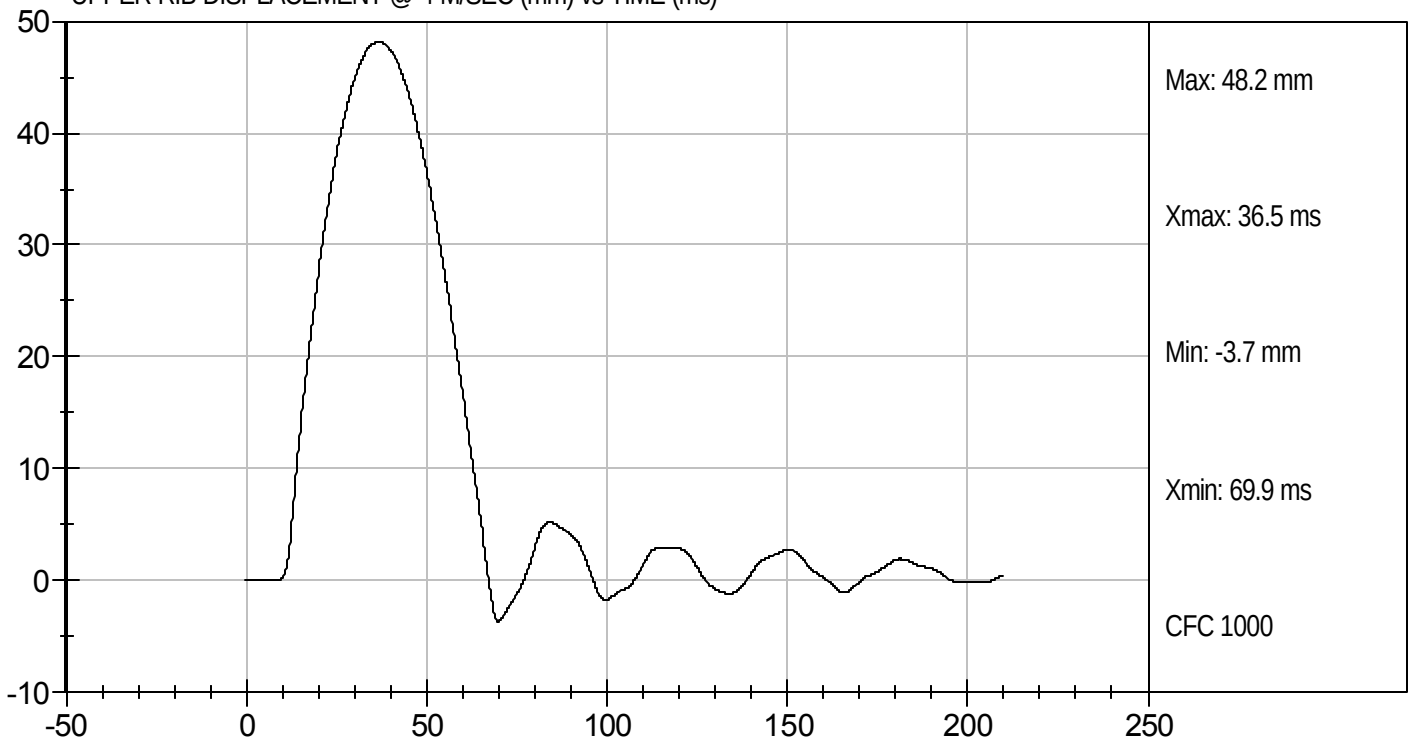
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D11784
Test Date: 3/2/11

UPPER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D11785

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.1	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.1	Pass
		Overall Test Results		Pass

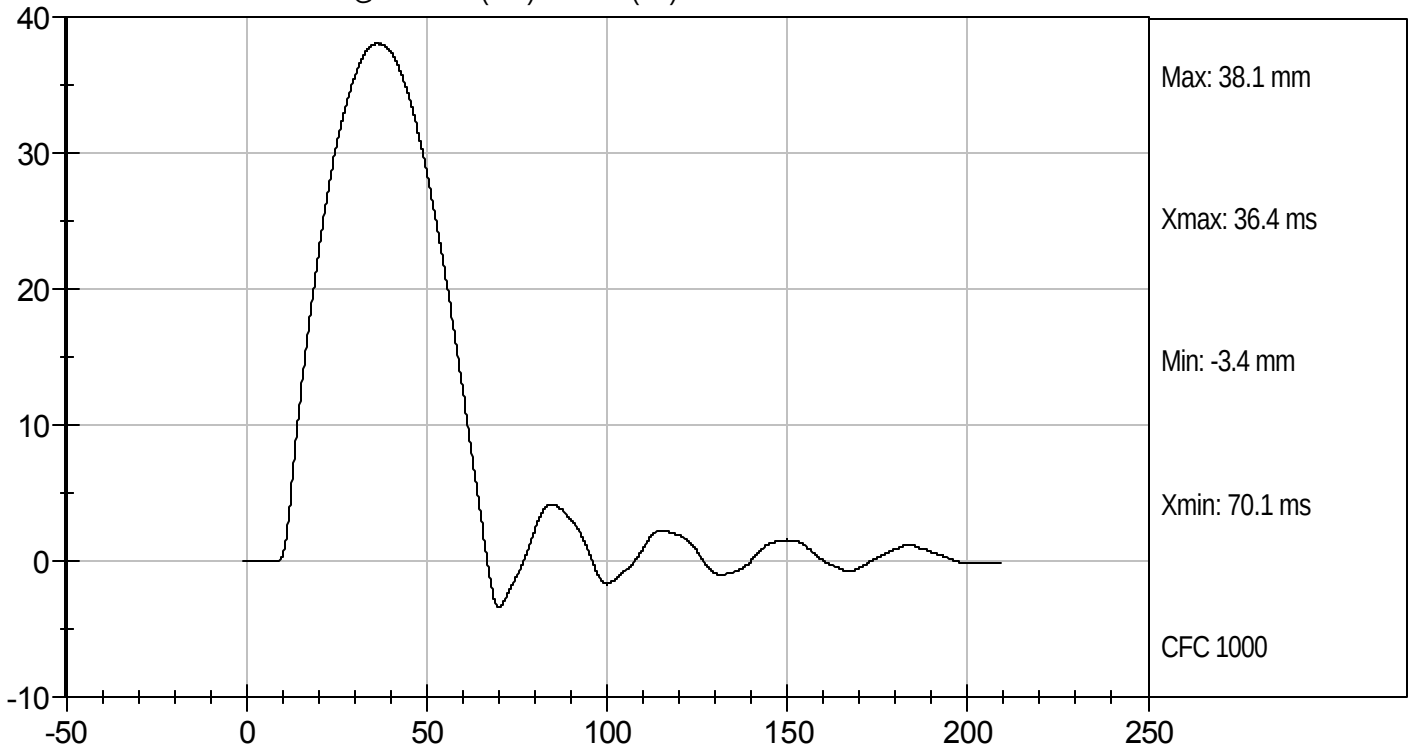
Jessica Hall
Laboratory Technician

3/2/11
Test Date

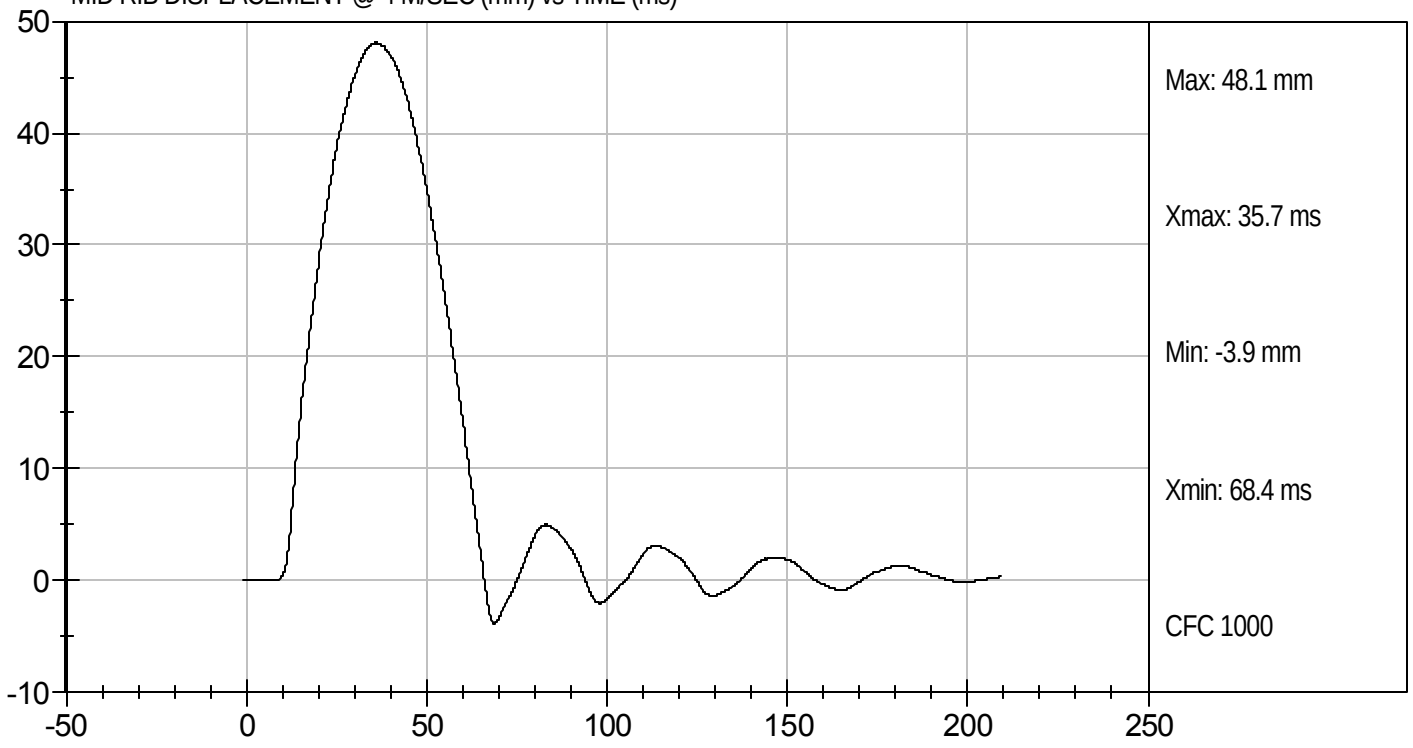
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D11785
Test Date: 3/2/11

MID RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



MID RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D11786

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.3	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.8	Pass
		Overall Test Results		Pass

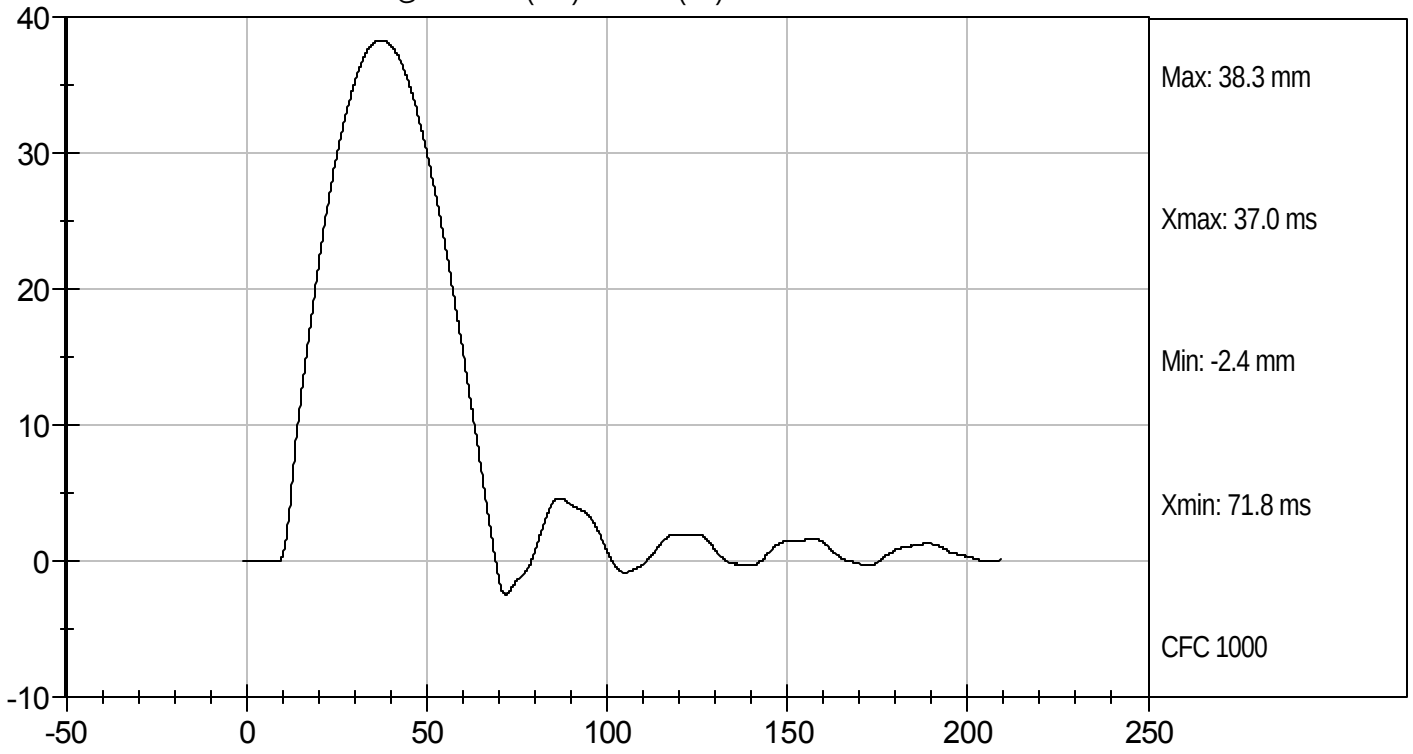
Jessica Gall
Laboratory Technician

3/2/11
Test Date

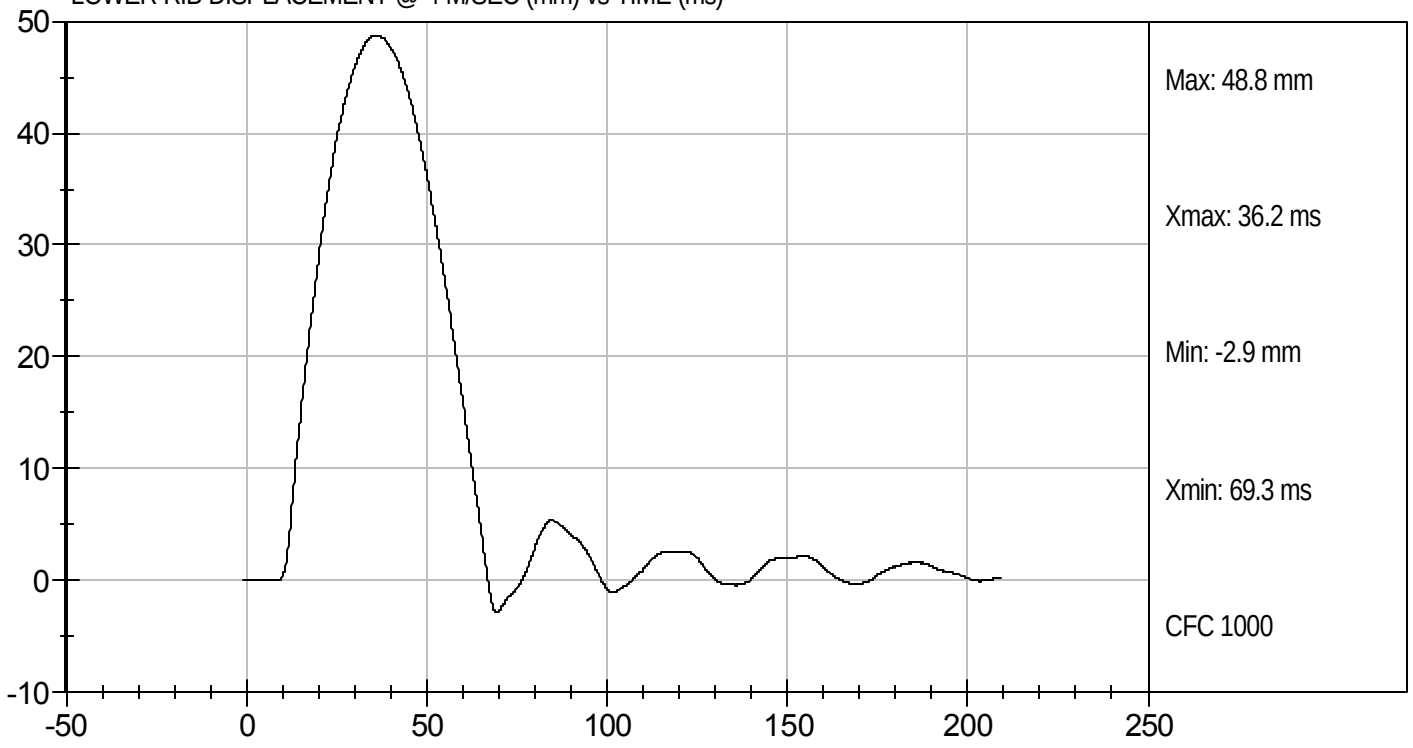
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D11786
Test Date: 3/2/11

LOWER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D11787

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	3.90 to 4.10	4.10	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.36	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	10.60	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.41	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.00	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

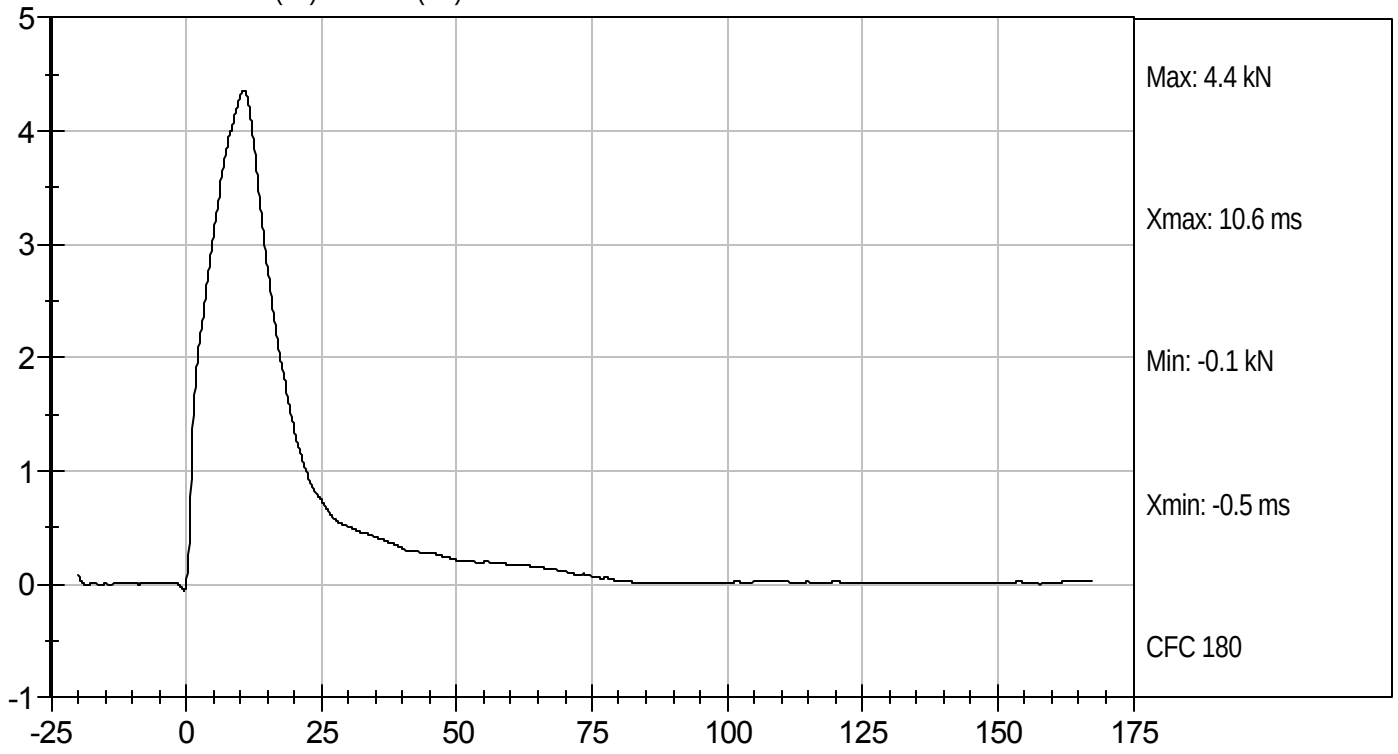
3/1/11
Test Date

David Winkelbauer
Approved By

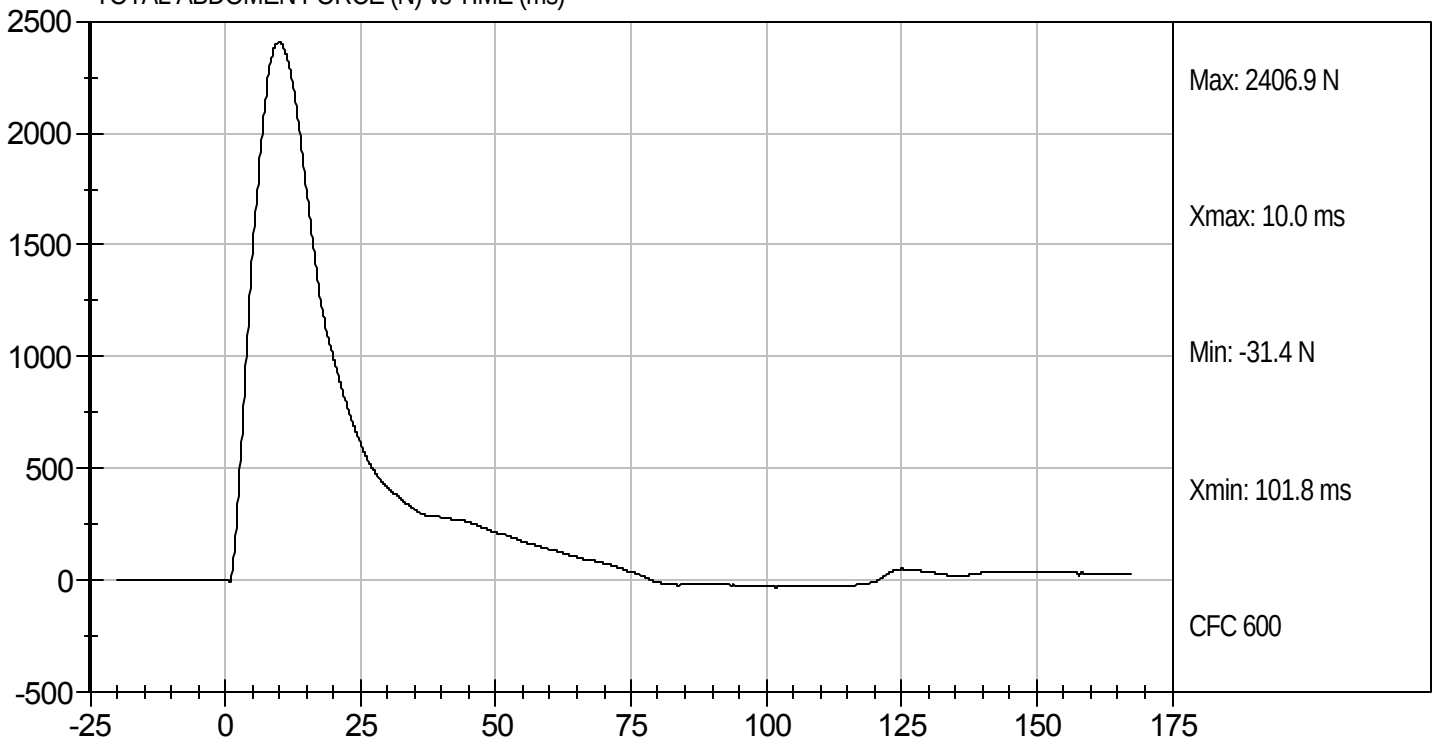
Test Desc: Abdomen Impact
Component ID: D11787

Test Date: 3/1/11
Velocity: 13.44 ft/s, 4.1 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



TOTAL ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D11788

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	22	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Deceleration	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.41	Pass
	27 ms	m/s	-6.50 to -5.80	-5.81	Pass
	30 ms	m/s	>= -6.5	-6.01	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.1	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	45.3	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	45	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

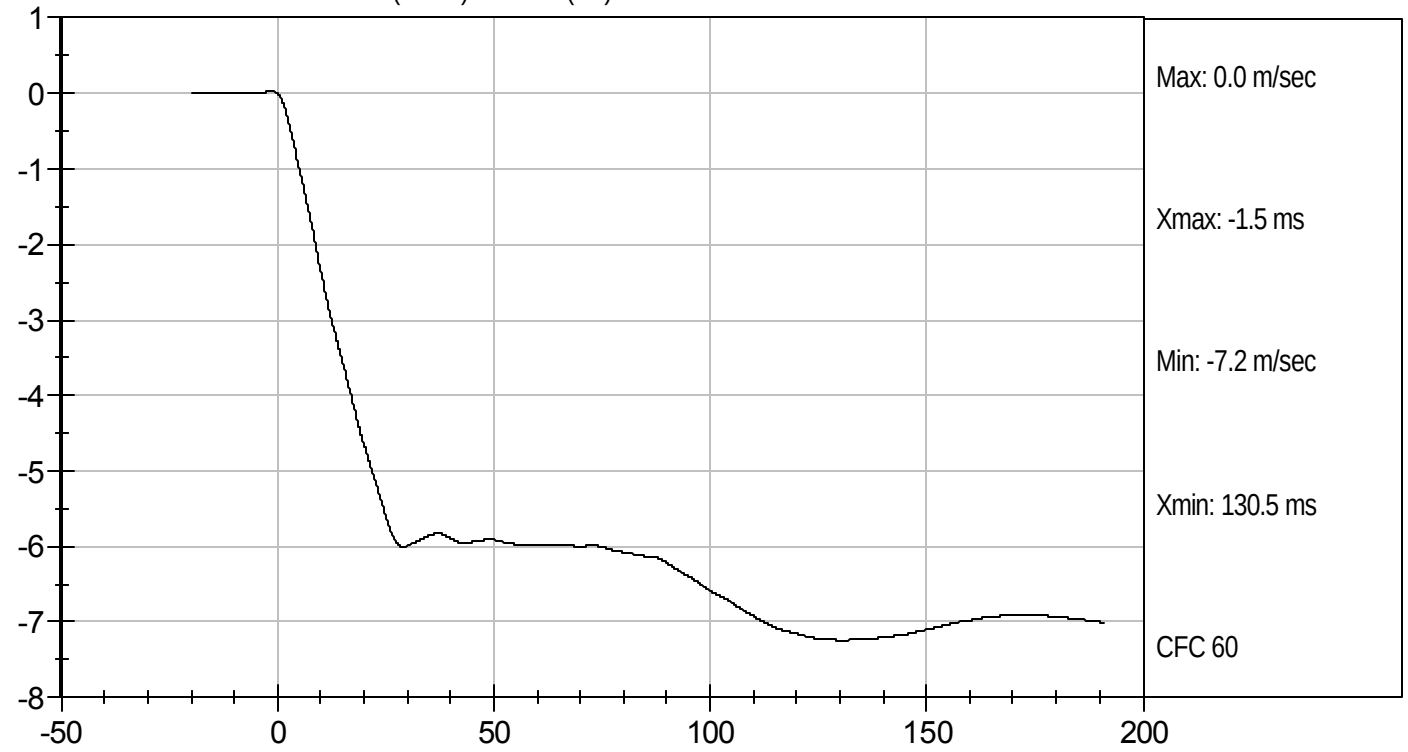
3/1/11
Test Date

David Winkelbauer
Approved By

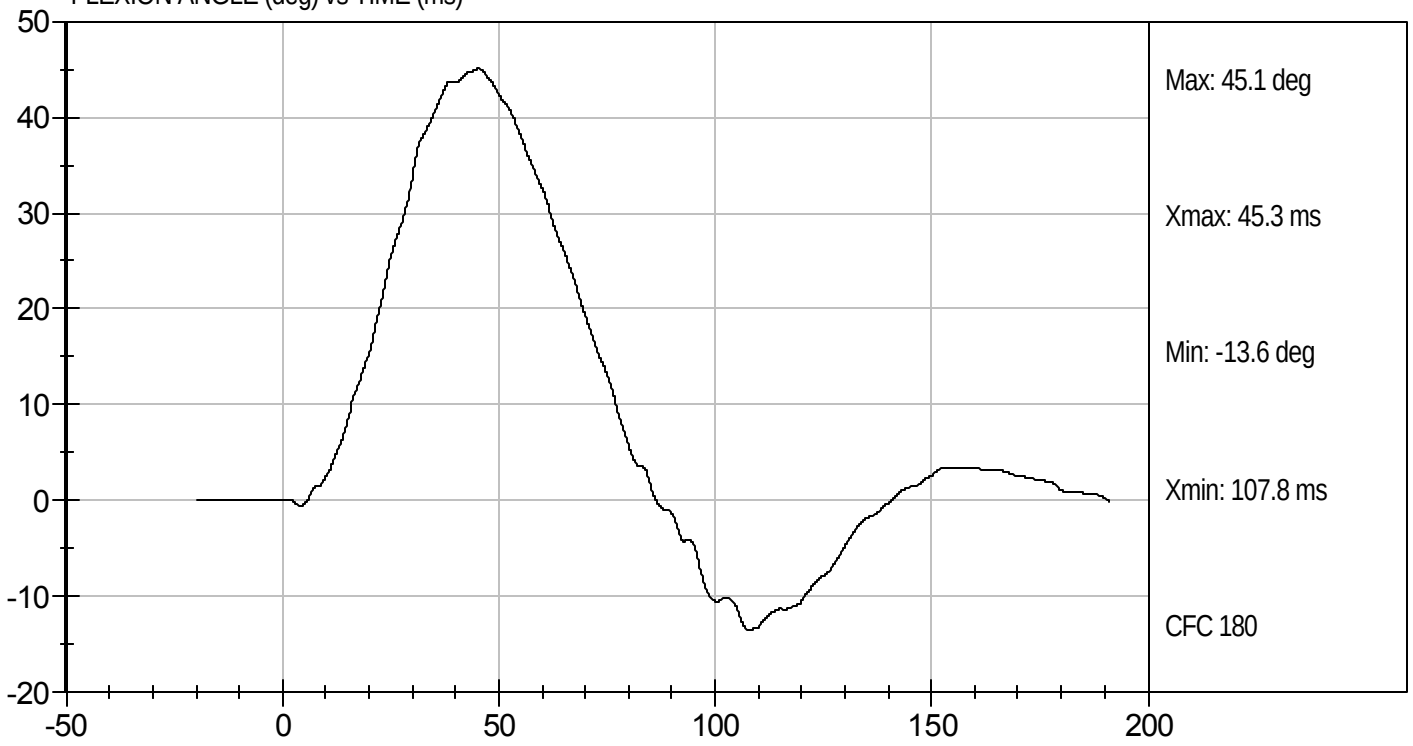
Test Desc: Lumbar Bending
Component ID: D11788

Test Date: 3/1/11
Velocity: 20.08 ft/s, 6.12 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

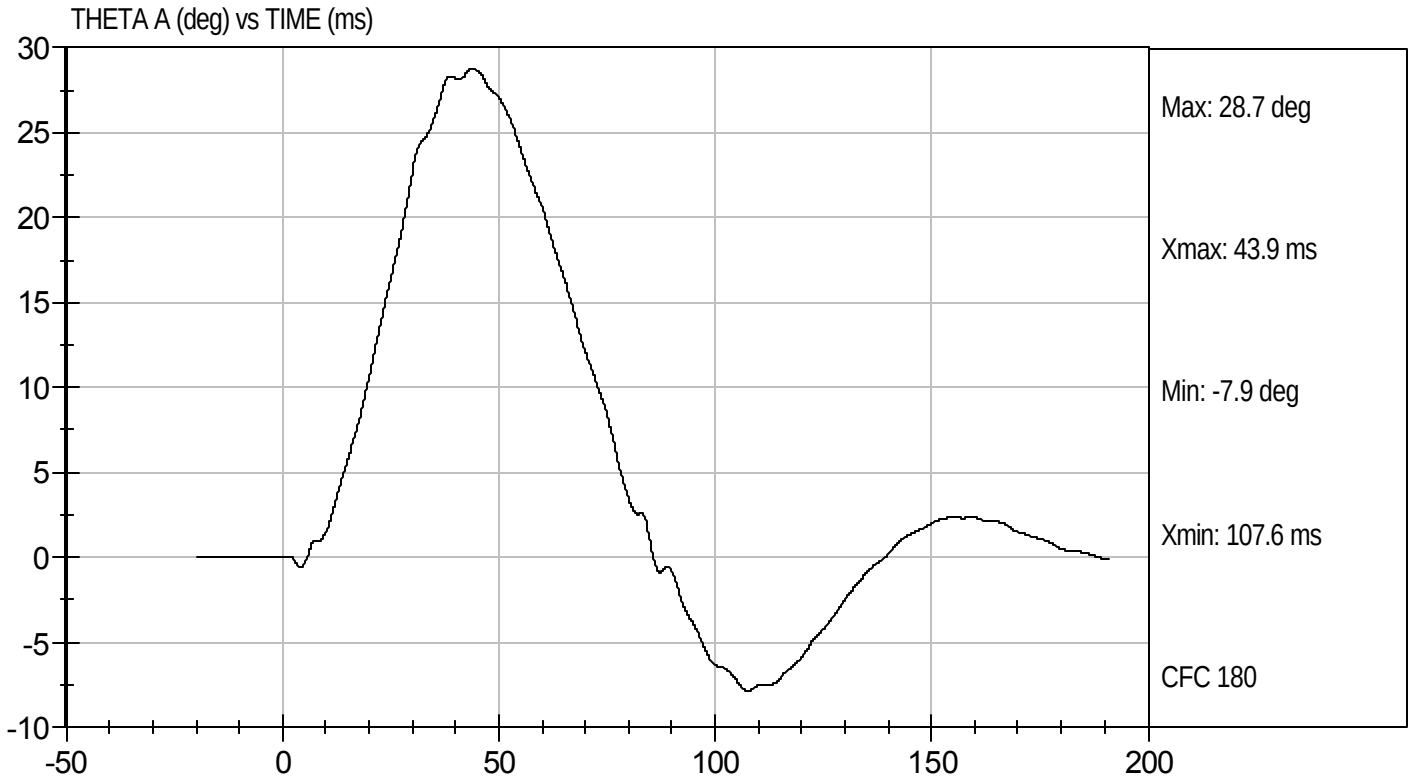


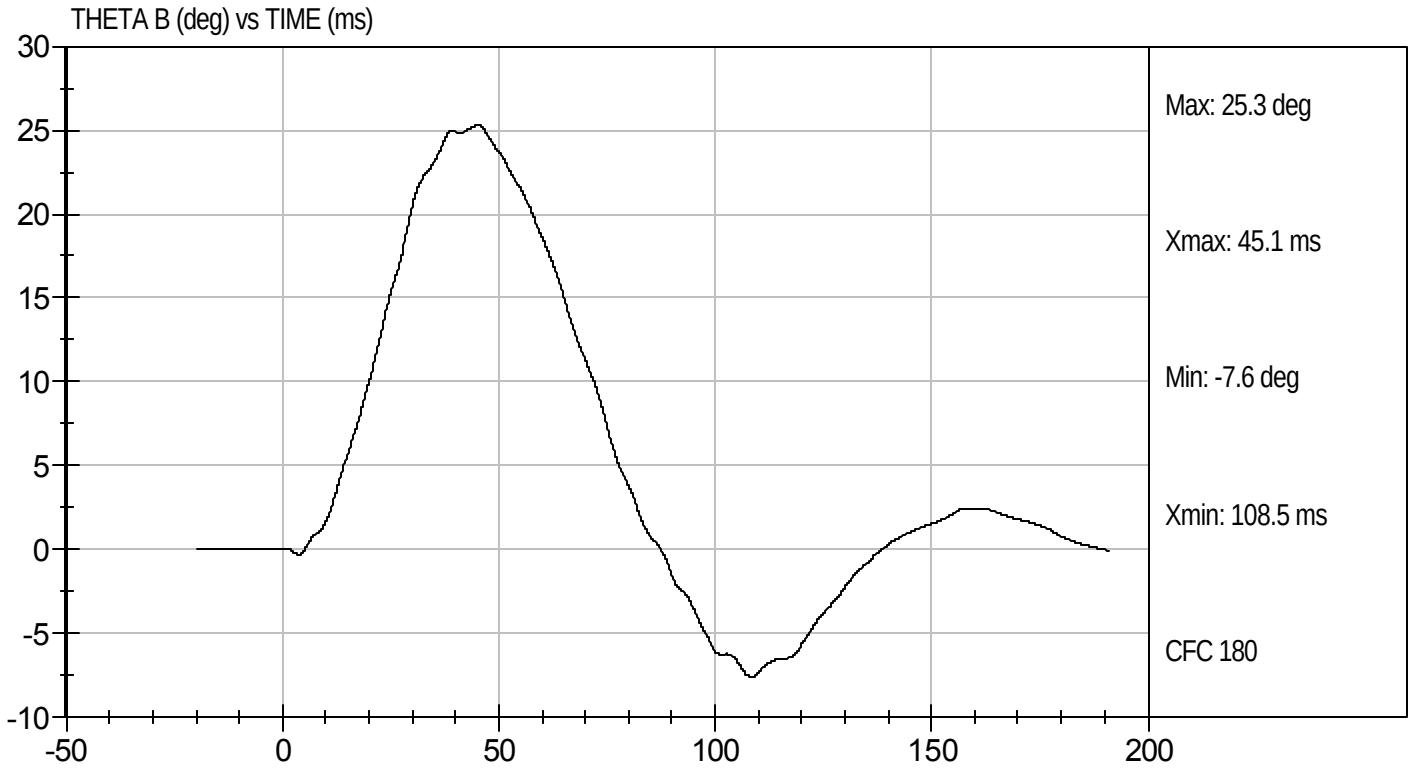
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D11788

Test Date: 3/1/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D11789

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 Speed	m/s	4.20 to 4.40	4.30	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.71	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	12.70	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.36	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	13.30	Pass
		Overall Test Results		Pass

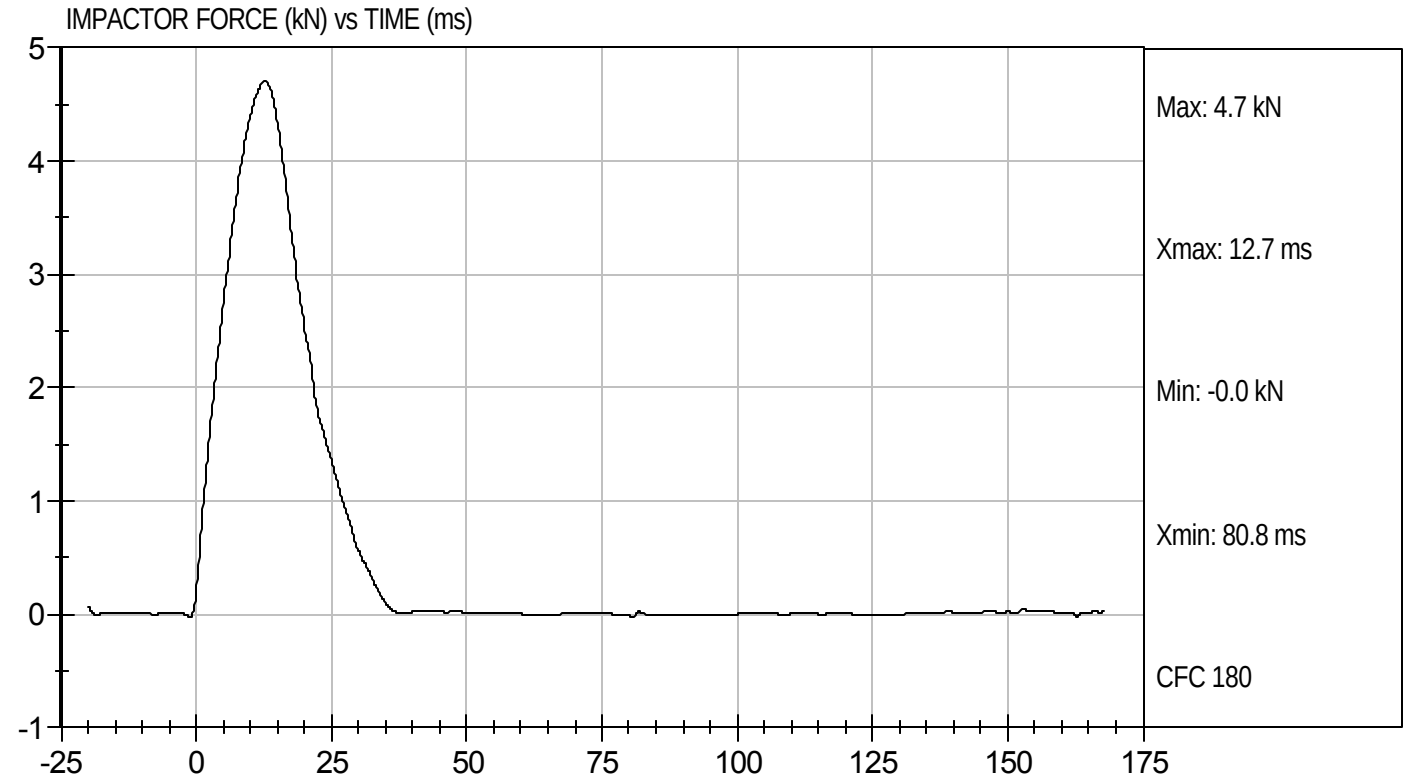
Jessica Hall
Laboratory Technician

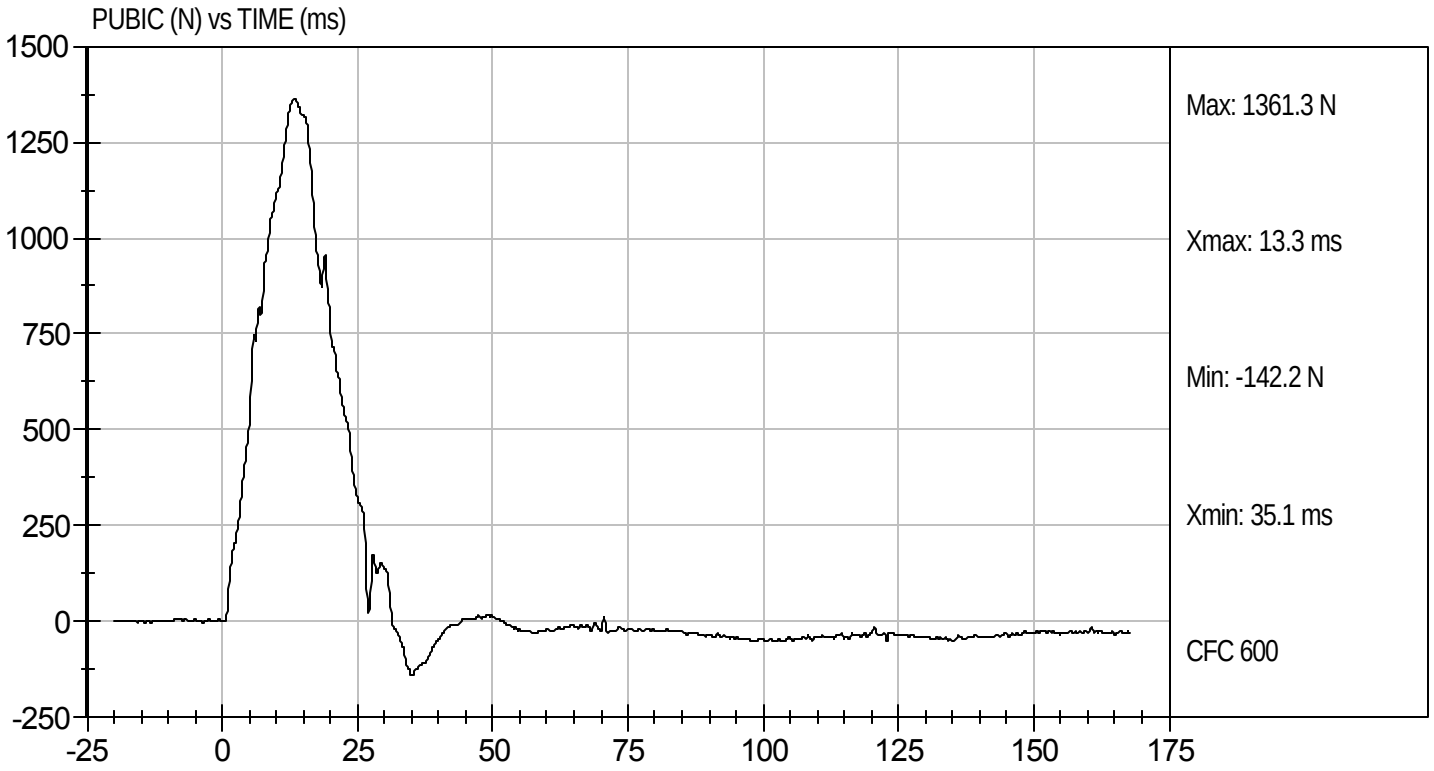
3/1/11
Test Date

David Winkelbauer
Approved By

Test Desc: Pelvis Impact
Component ID: D11789

Test Date: 3/1/11
Velocity: 14.12 ft/s, 4.30 m/s





MGA RESEARCH CORPORATION

FULL BODY THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D11780

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	kN	5.10 to 6.20	5.26	Pass
Upper Rib Displacement	mm	34.0 to 41.0	38.8	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.0	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.1	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

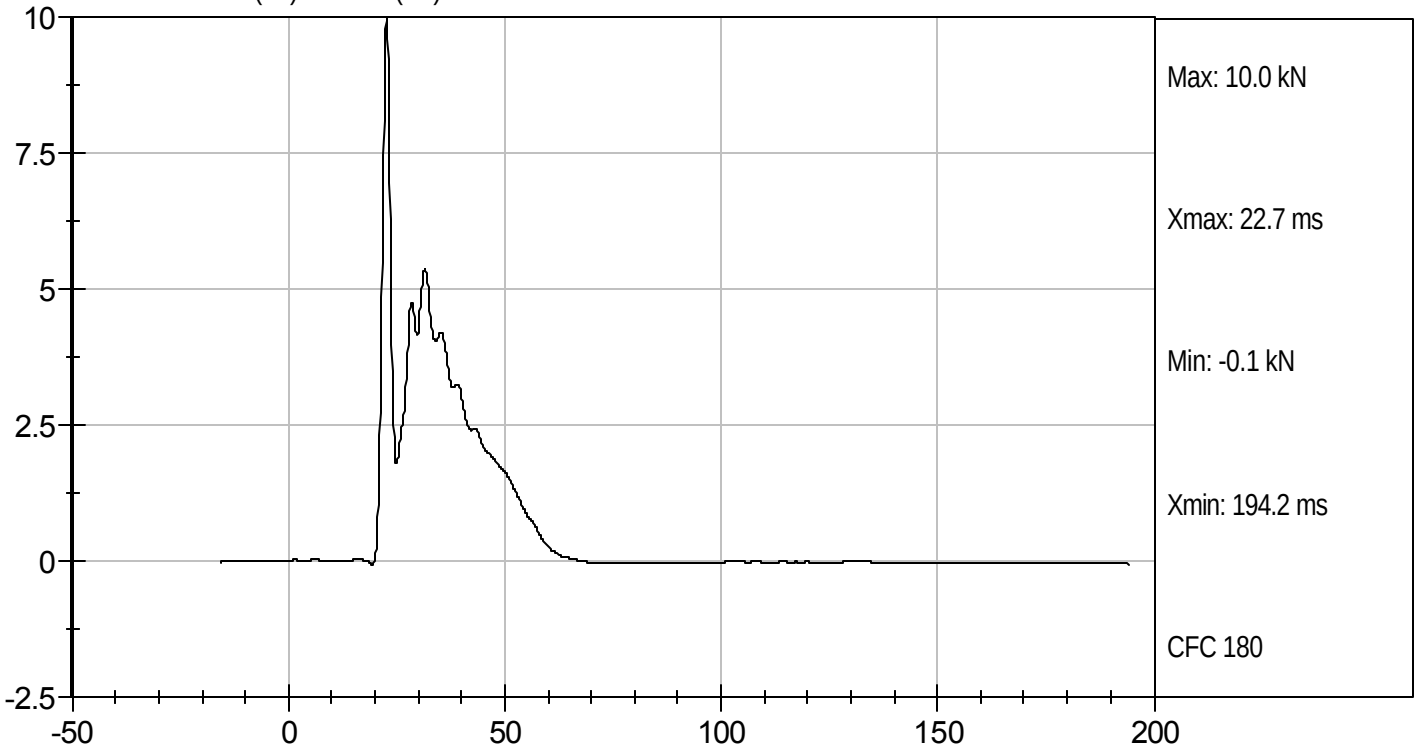
3/1/11
Test Date

David Winkelbauer
Approved By

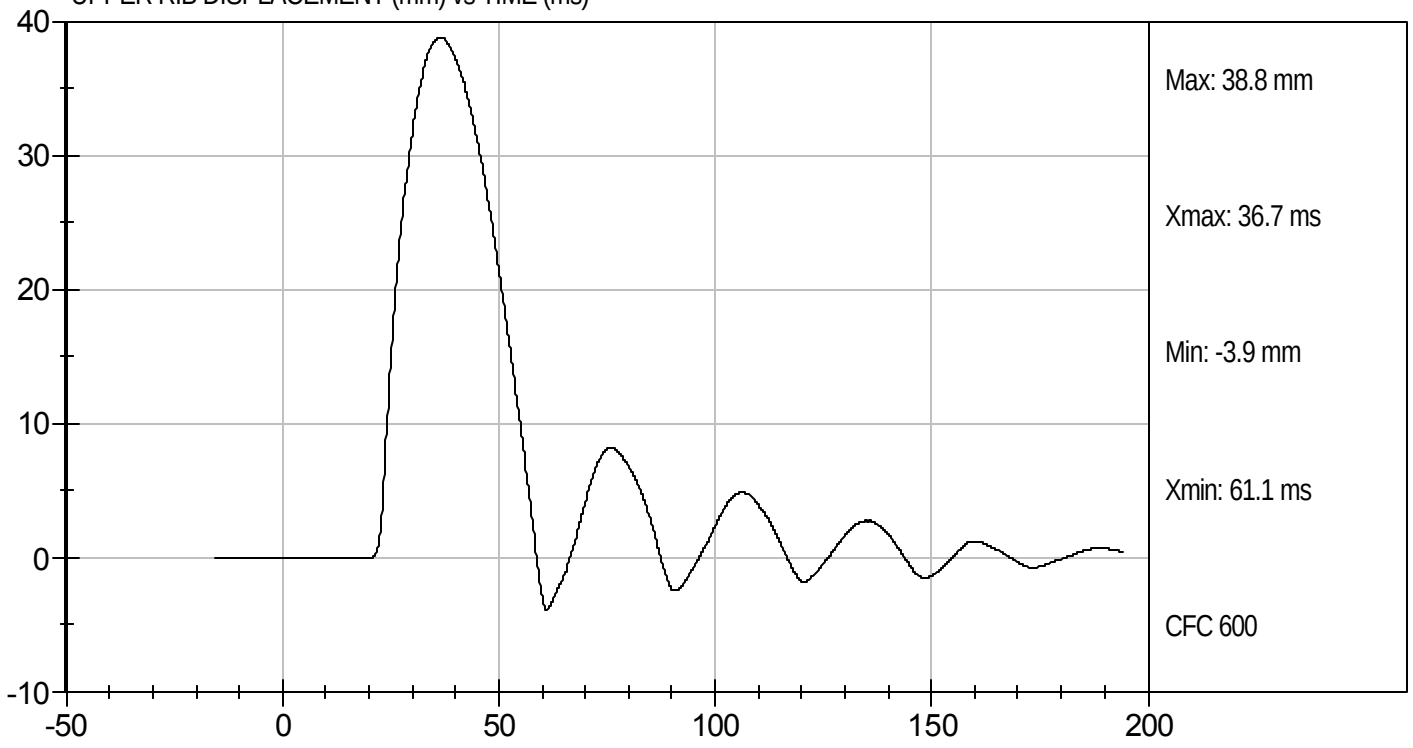
Test Desc: Thorax Impact
Component ID: D11780

Test Date: 3/1/11
Velocity: 18.32 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



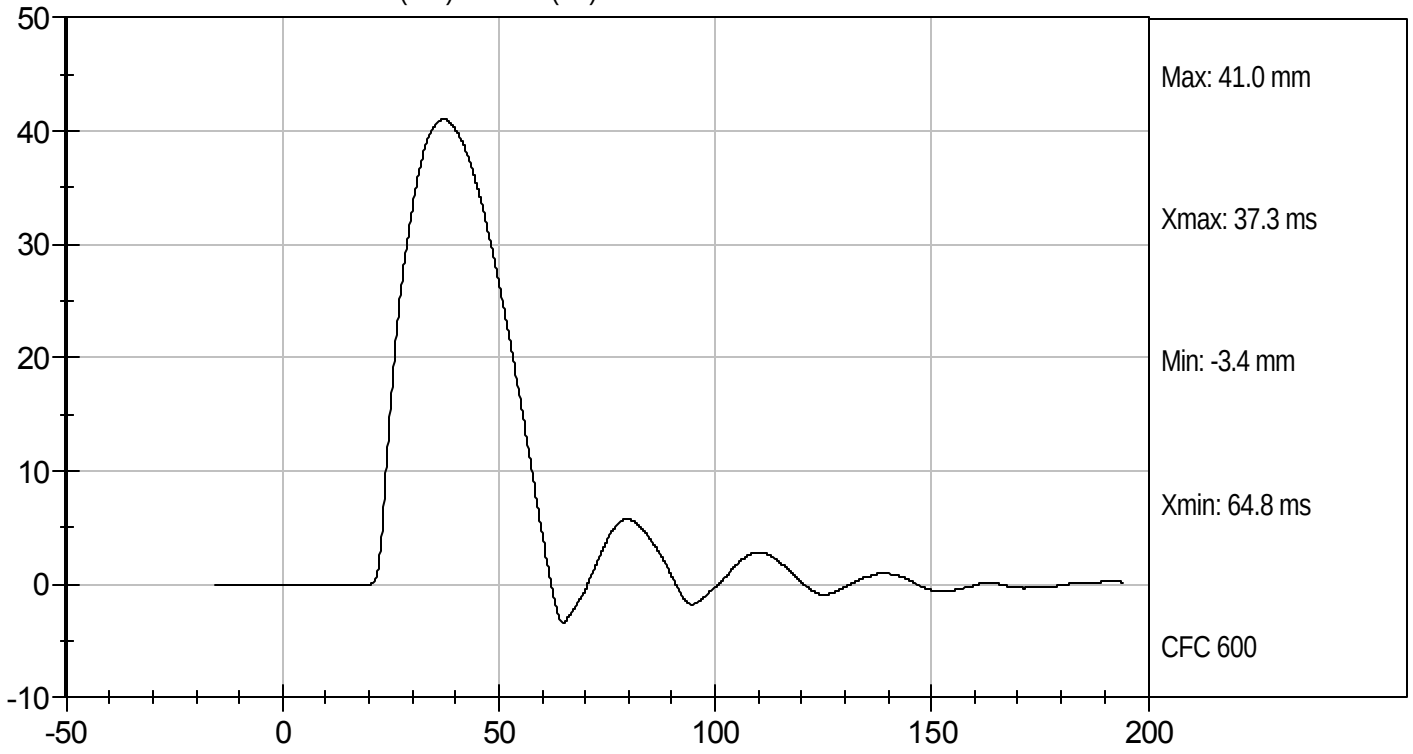
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



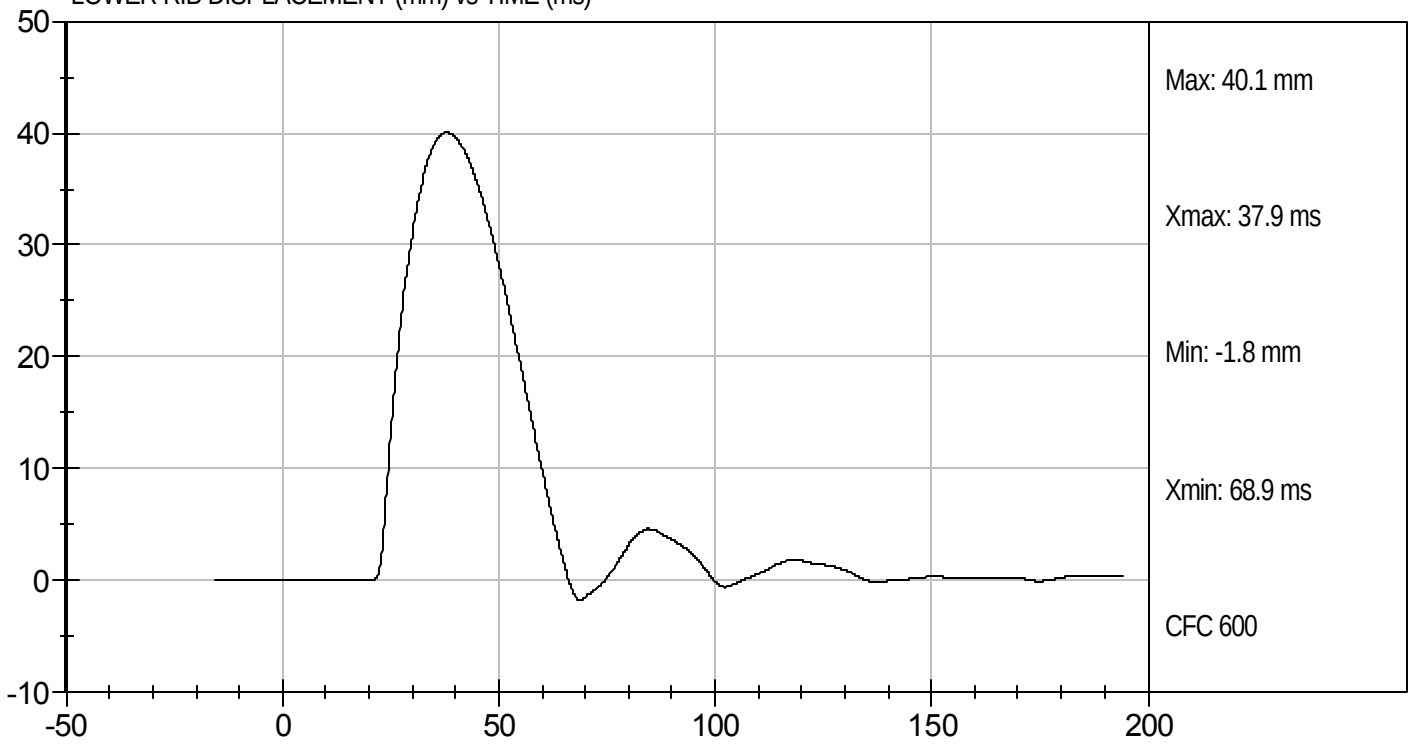
Test Desc: Thorax Impact
Component ID: D11780

Test Date: 3/1/11
Velocity: 18.32 ft/s, 5.58 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 032 **Test ID:** D111691

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Peak Resultant Acceleration	G's	125 to 155	142	Pass
Peak Lateral Acceleration	G's	+/- 15	5.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

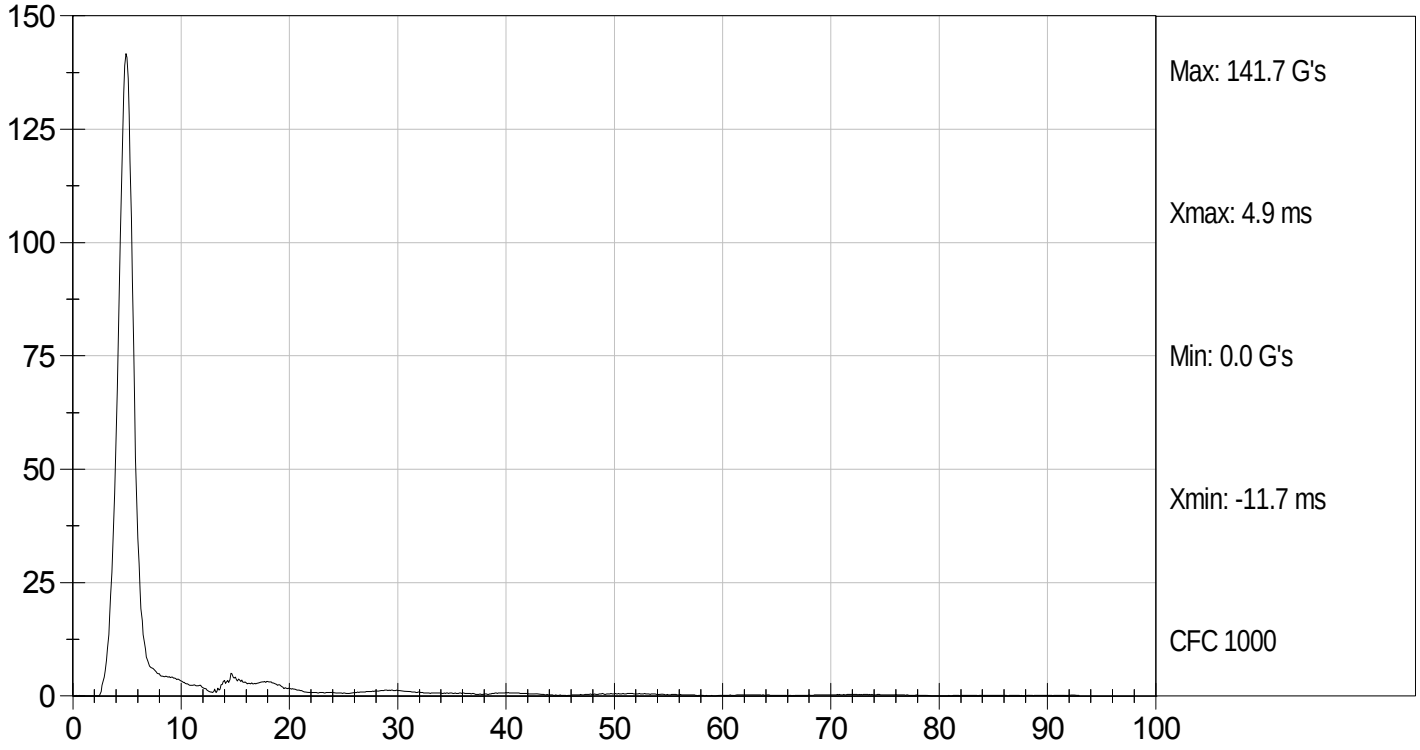
5/9/11
Test Date

David Winkelbauer
Approved By

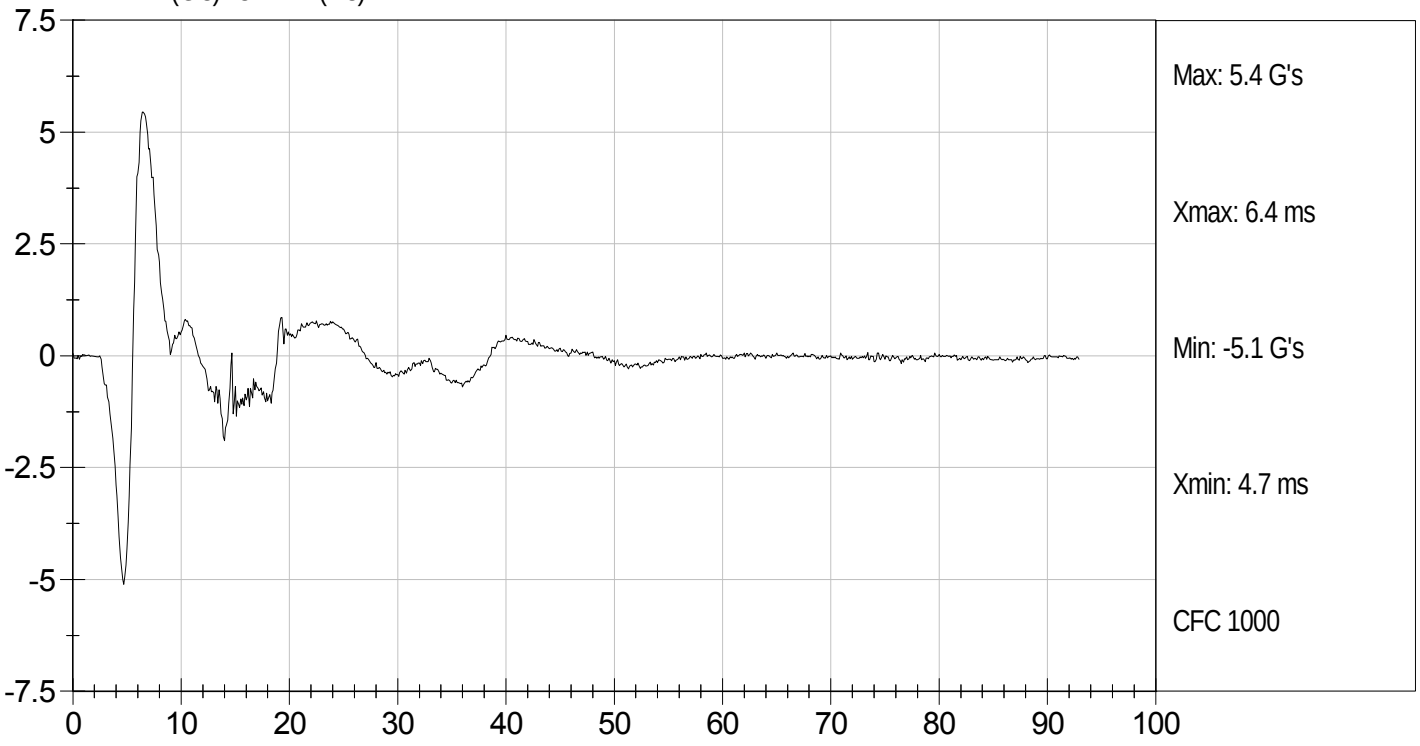
Test Desc: Head Drop
Component ID: D111691

Test Date: 5/9/11
Velocity: 0 ft/s, 0 m/s

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



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



MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D111692

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	36	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.5	Pass
Pendulum Deceleration	1 ms	m/s	0.00 to -0.05	-0.01	Pass
	3 ms	m/s	-0.25 to -0.375	-0.32	Pass
	14 ms	m/s	-3.20 to -3.70	-3.34	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	53.7	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	58.8	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	58.7	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

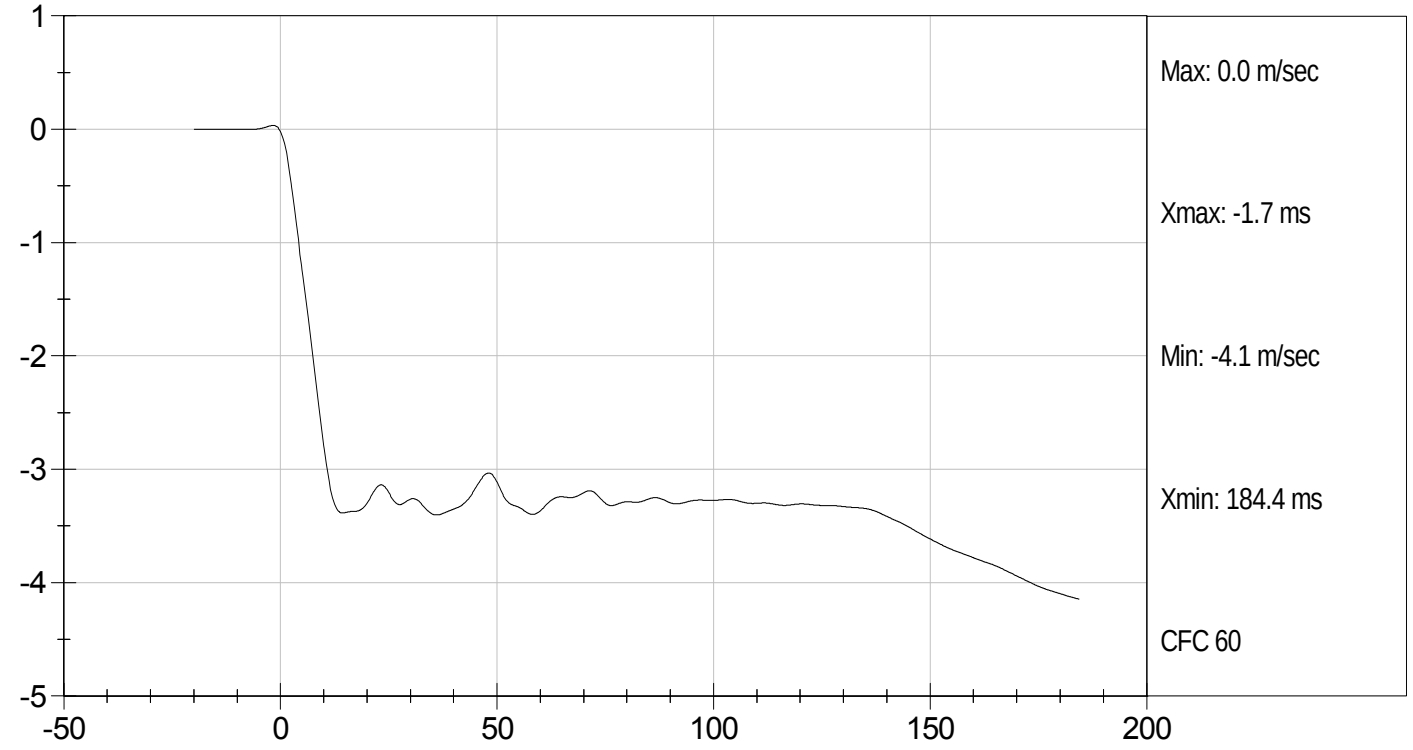
5/9/11
Test Date

David Winkelbauer
Approved By

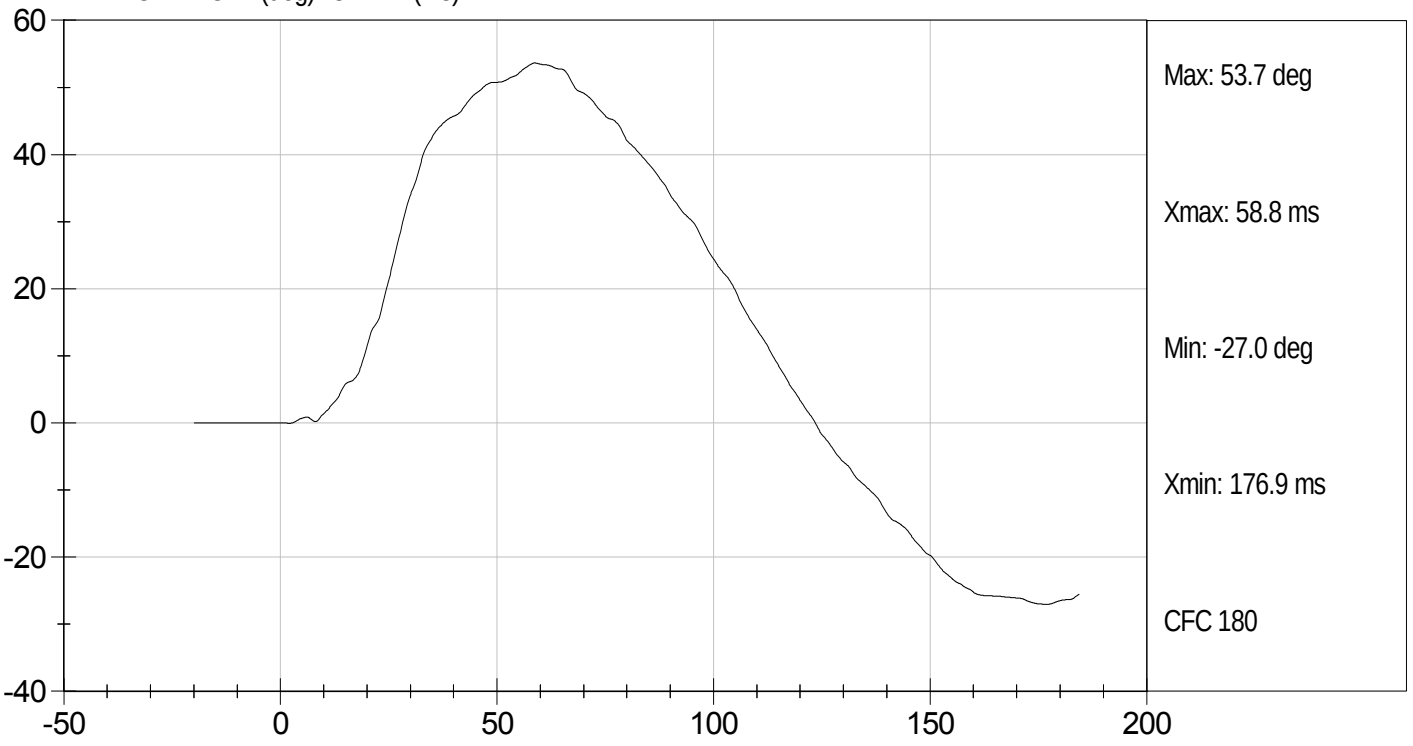
Test Desc: Neck Bending
Component ID: D111692

Test Date: 5/9/11
Velocity: 11.42 ft/s, 3.48 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)



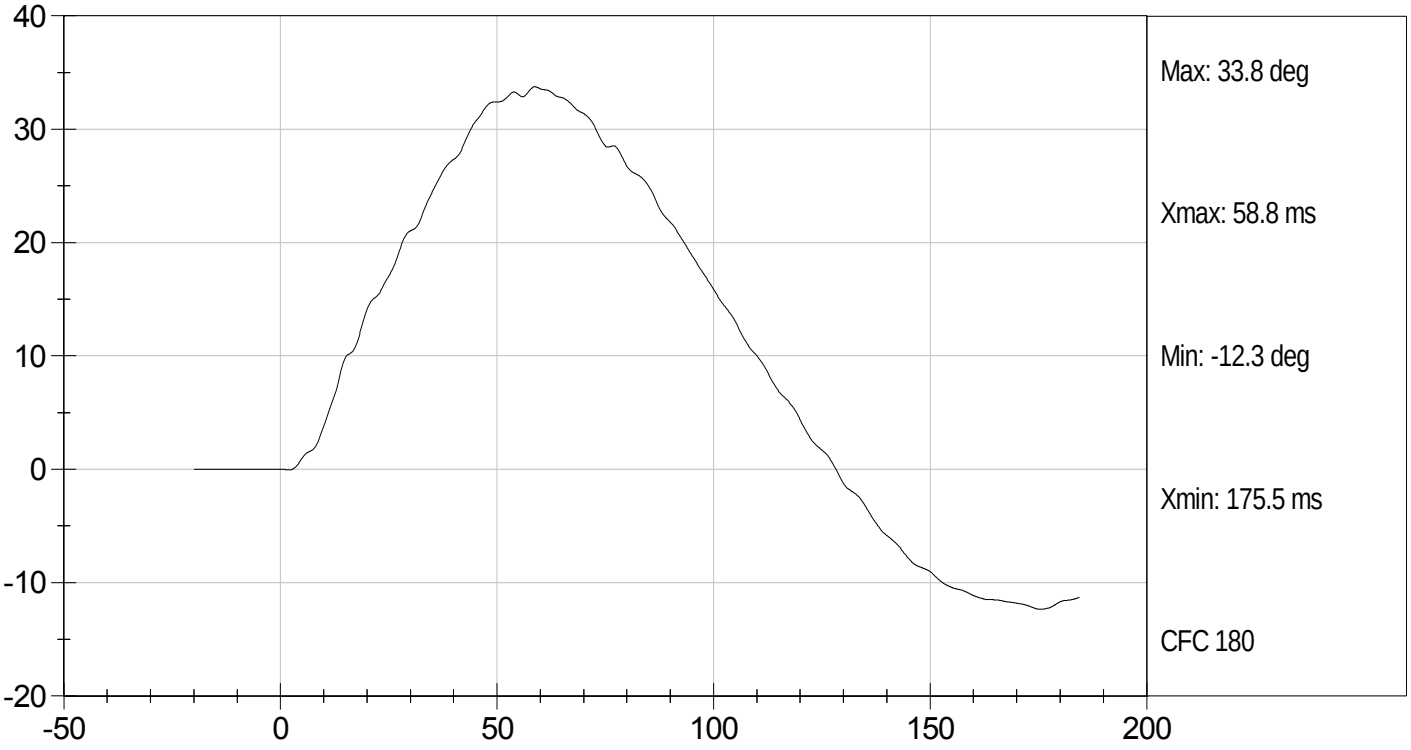
FLEXION ANGLE (deg) vs TIME (ms)



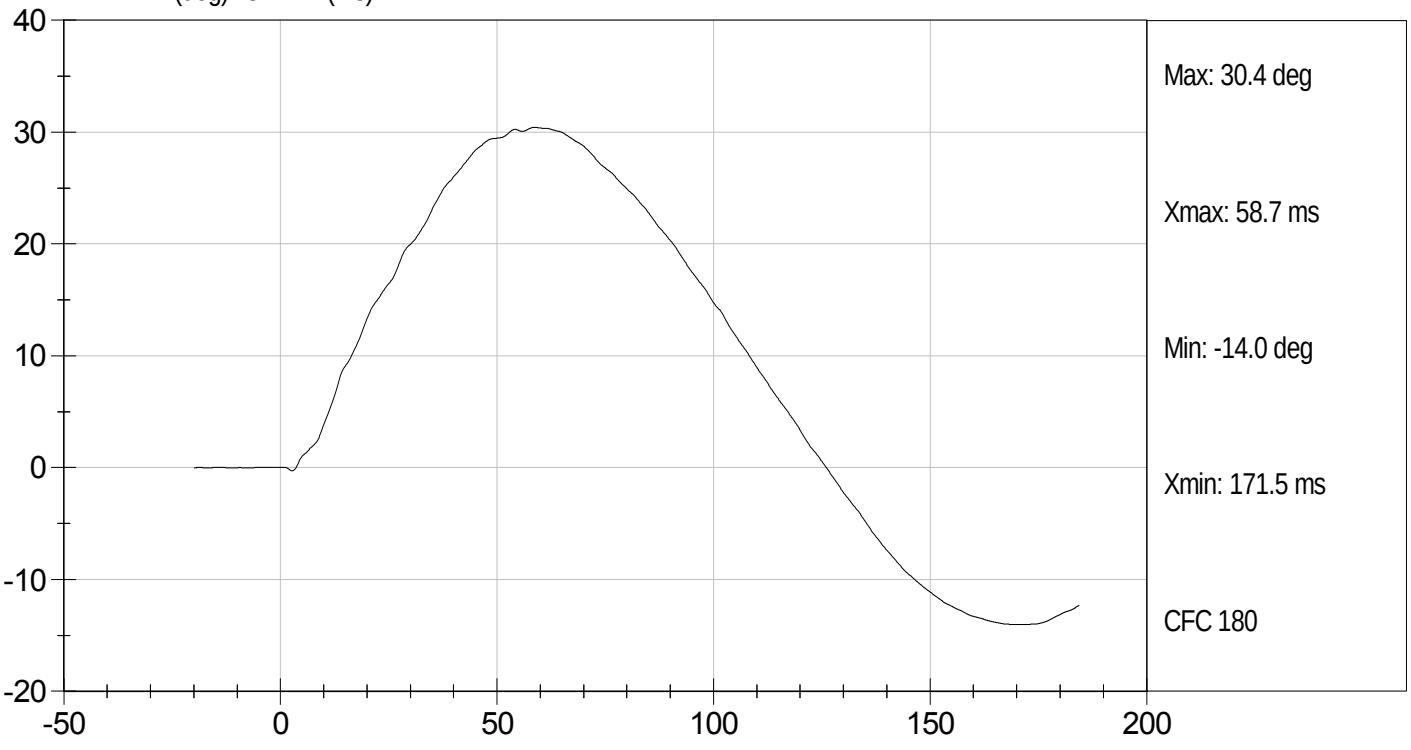
Test Desc: Neck Bending
Component ID: D111692

Test Date: 5/9/11
Velocity: 11.42 ft/s, 3.48 m/s

THETA A (deg) vs TIME (ms)



THETA B (deg) vs TIME (ms)



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D111693

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.4	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	9.5	Pass
Time of Peak Shoulder Acceleration	ms	NA	13.5	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

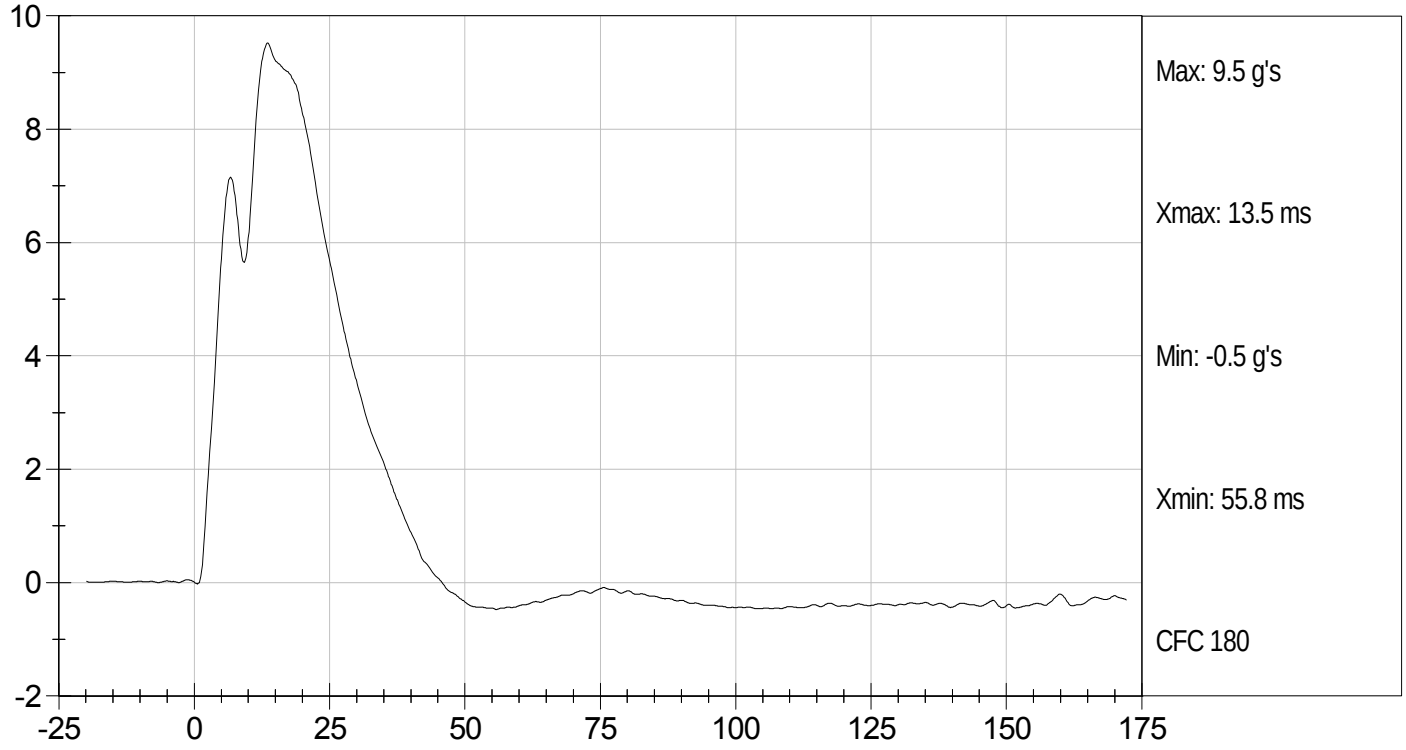
5/9/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D111693

Test Date: 5/9/11
Velocity: 14.36 ft/s, 4.4 m/s

SHOULDER ACCELERATION (g's) vs TIME (ms)



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D111694

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	31	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	39.7	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	46.5	Pass
		Overall Test Results		Pass

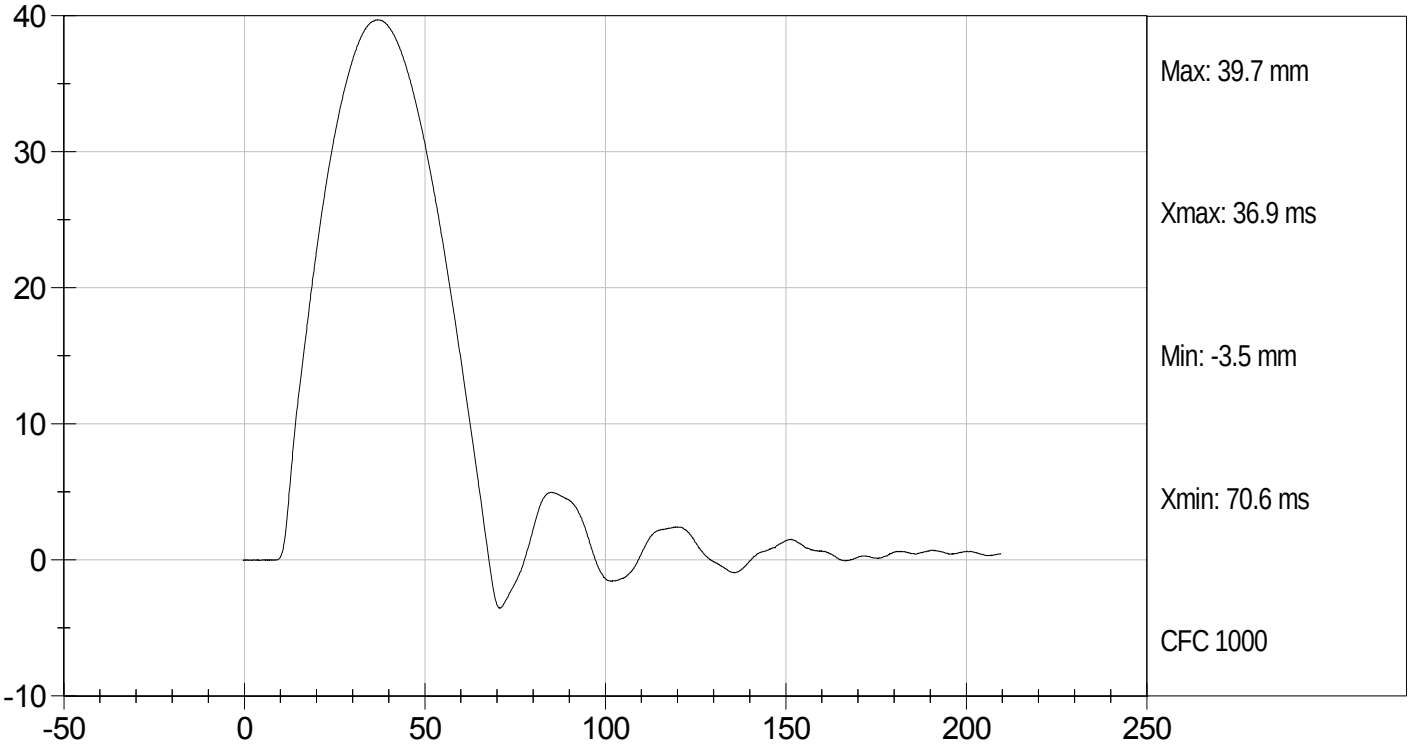
Jessica Hall
Laboratory Technician

5/6/11
Test Date

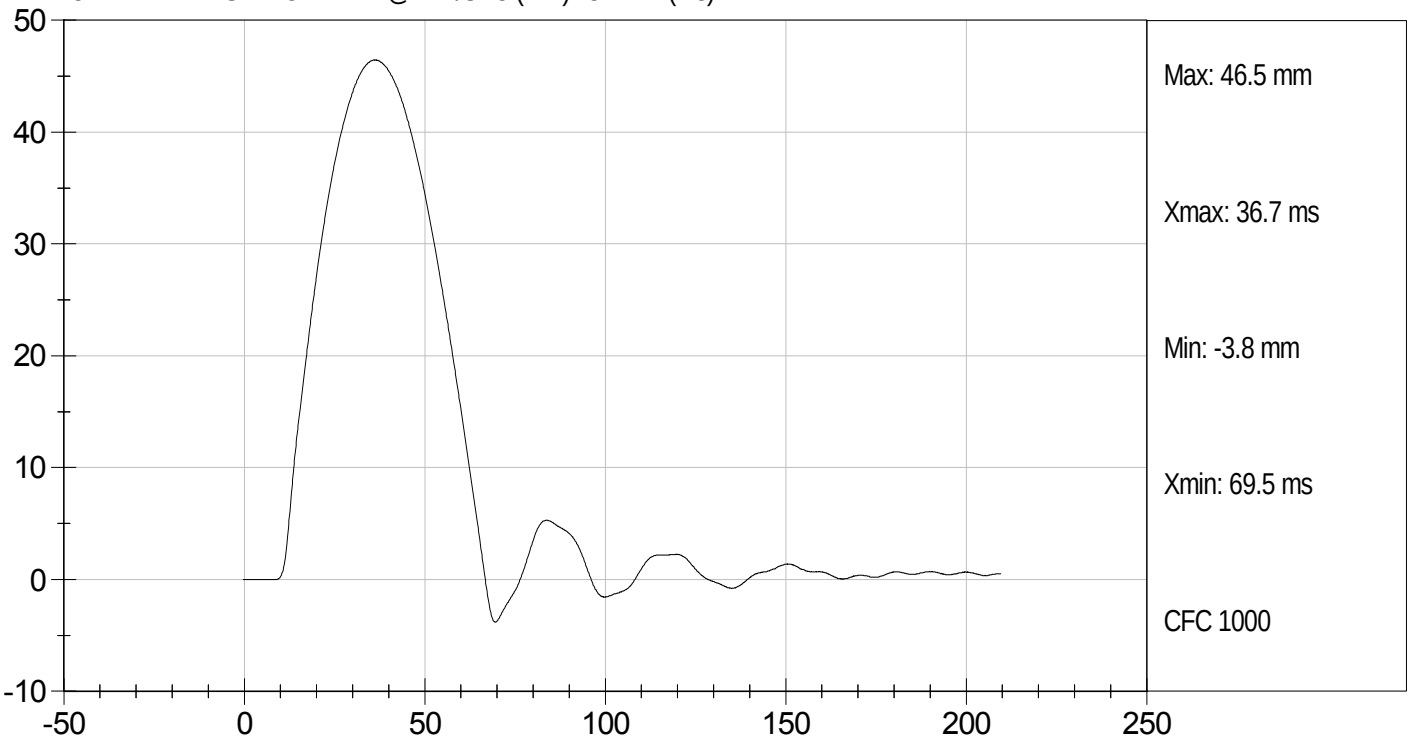
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D111694
Test Date: 5/6/11

UPPER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D111695

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	31	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.0	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.4	Pass
		Overall Test Results		Pass

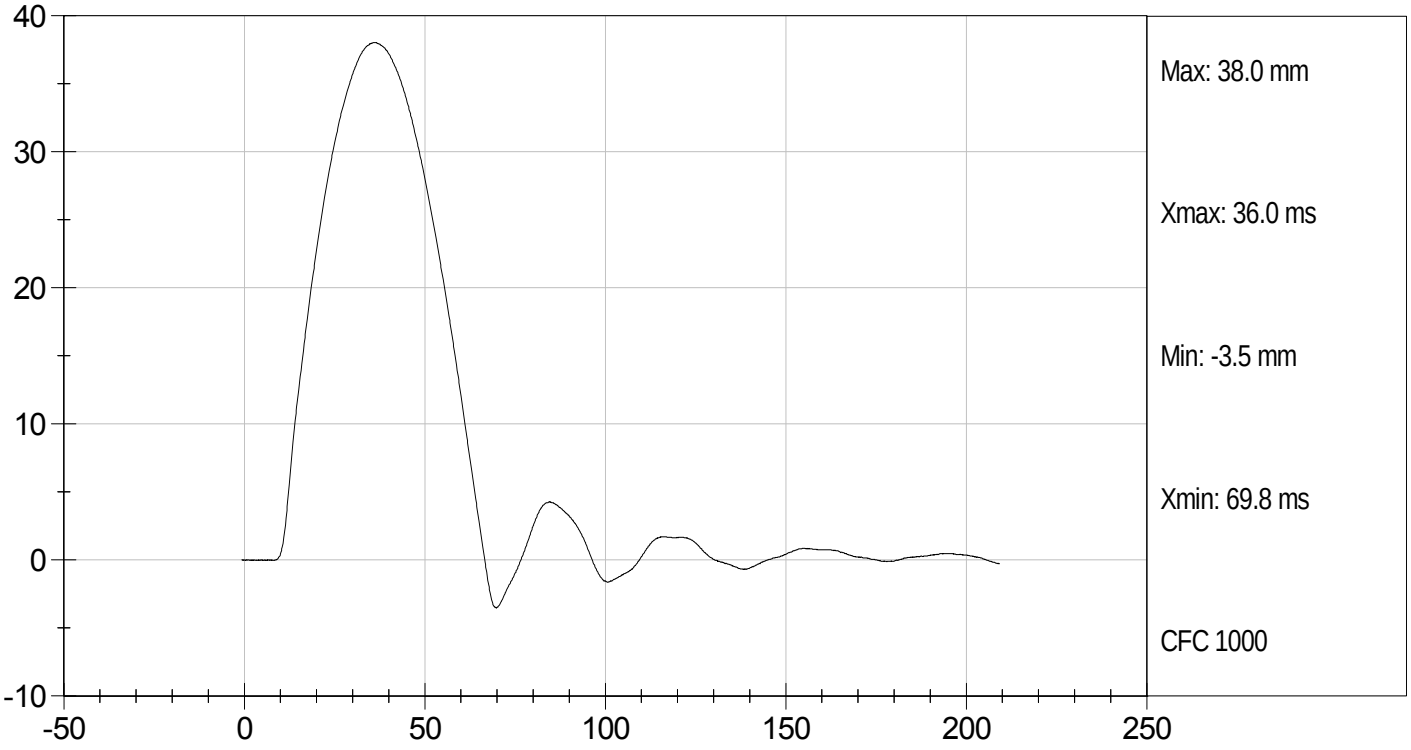
Jessica Gall
Laboratory Technician

5/6/11
Test Date

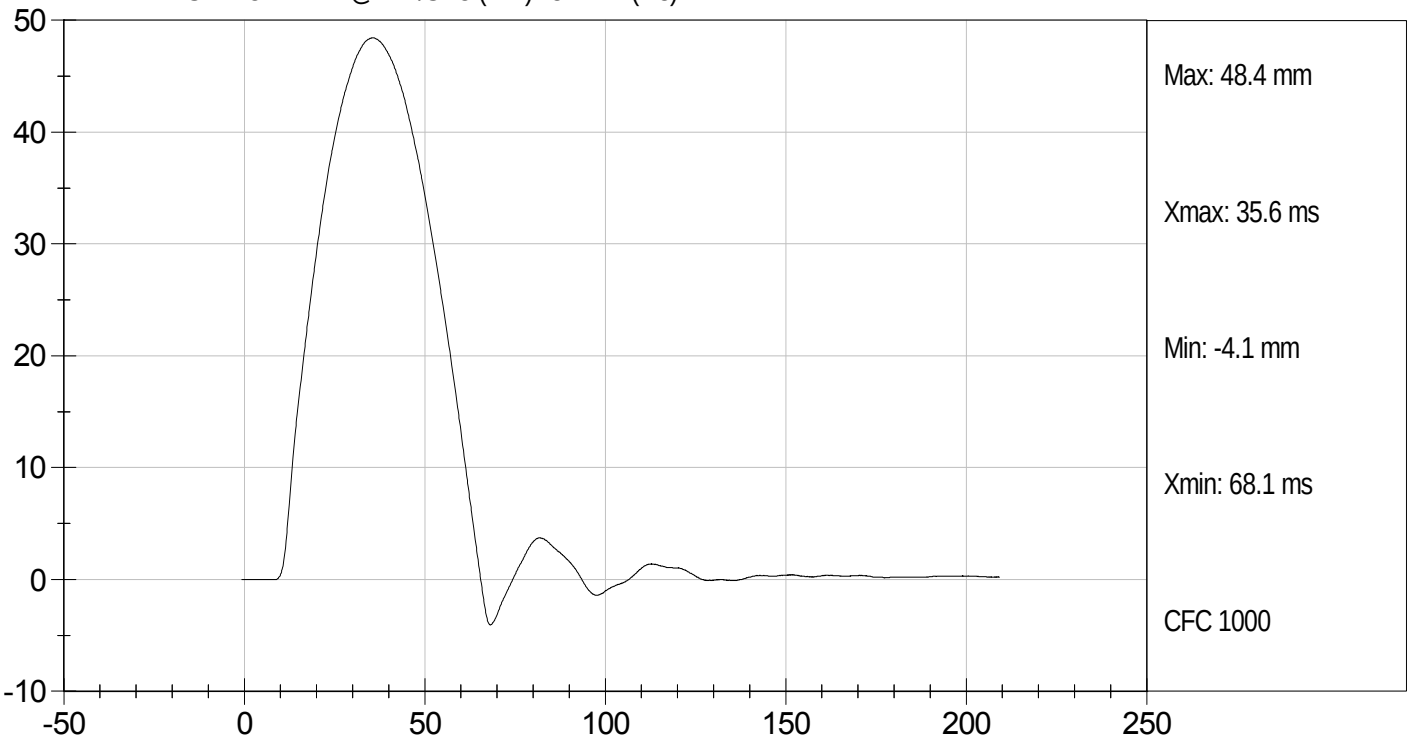
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D111695
Test Date: 5/6/11

MID RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



MID RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D111696

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	31	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	39.1	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.8	Pass
		Overall Test Results		Pass

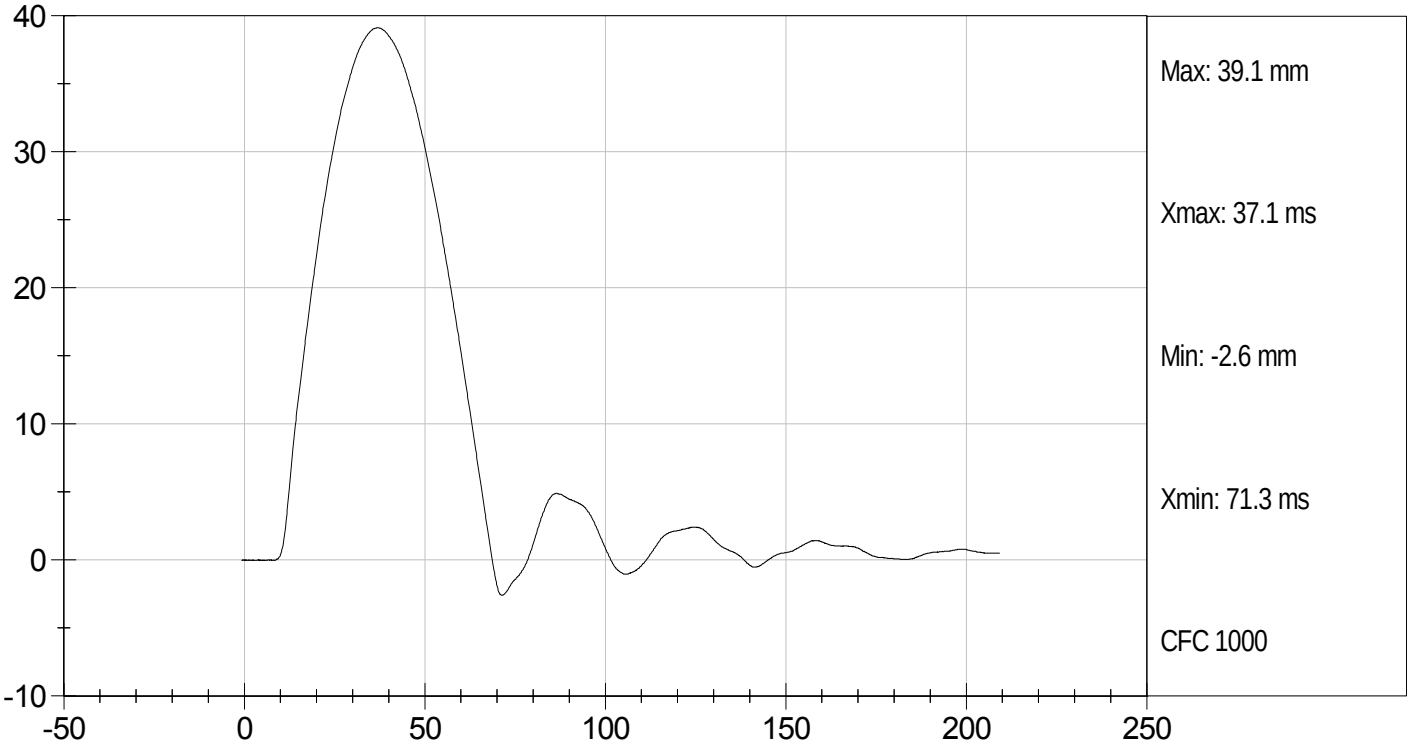
Jessica Gall
Laboratory Technician

5/6/11
Test Date

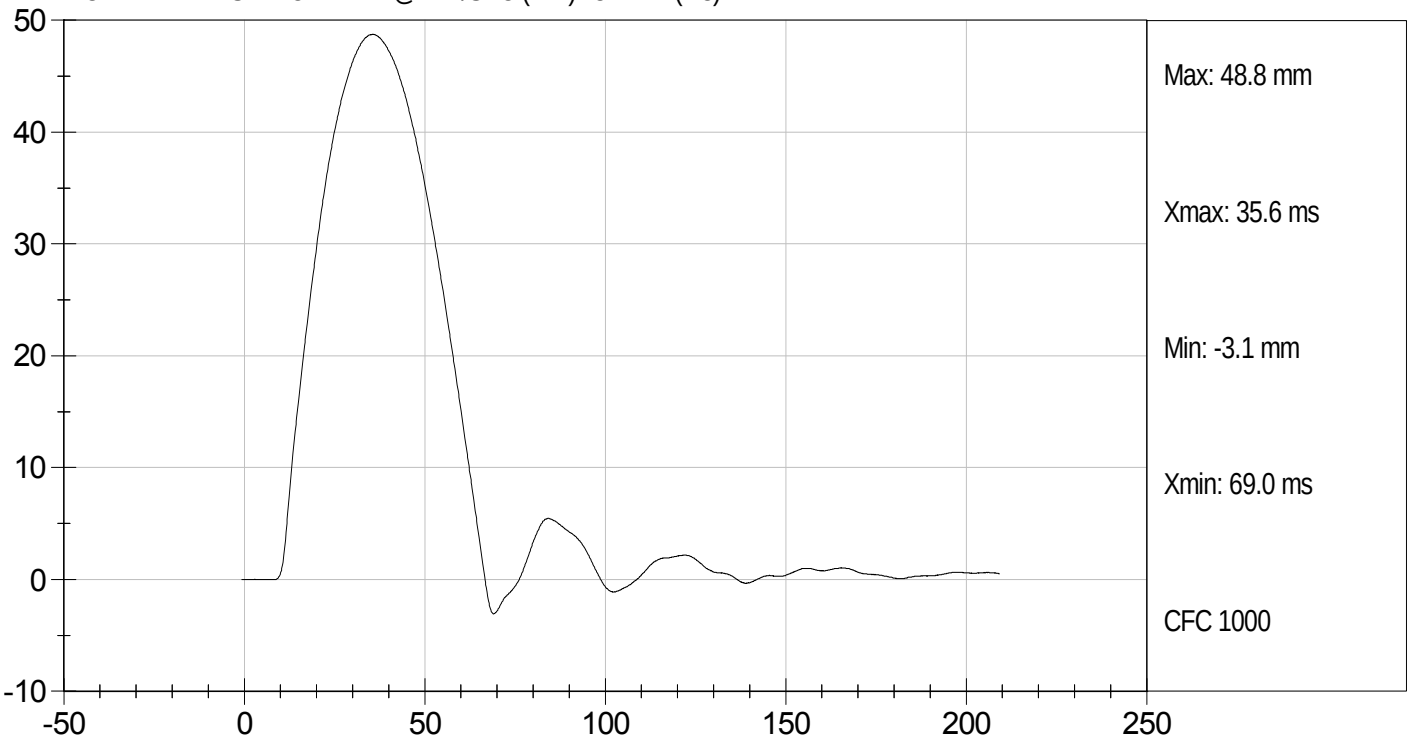
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D111696
Test Date: 5/6/11

LOWER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D111697

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Probe Speed	m/s	3.90 to 4.10	4.10	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.13	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	10.90	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.41	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.80	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

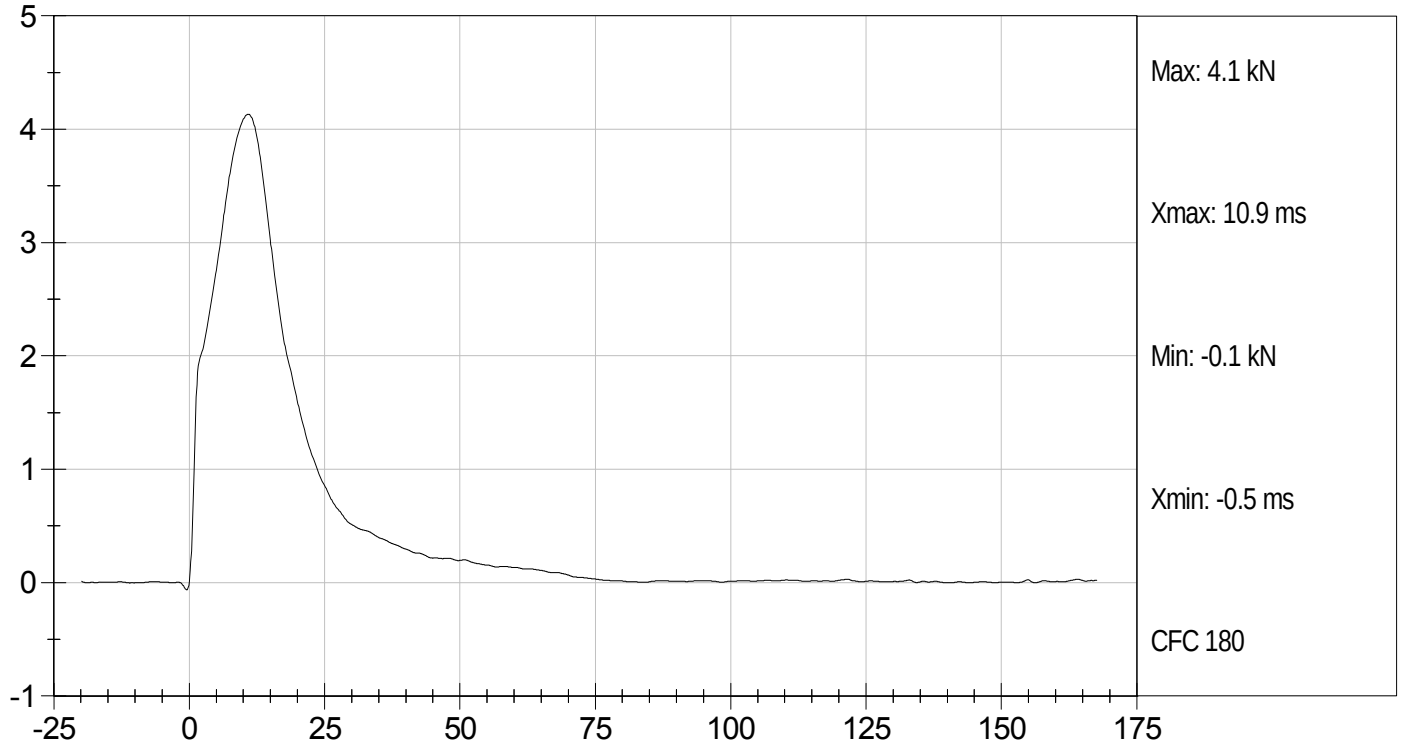
5/9/11
Test Date

David Winkelbauer
Approved By

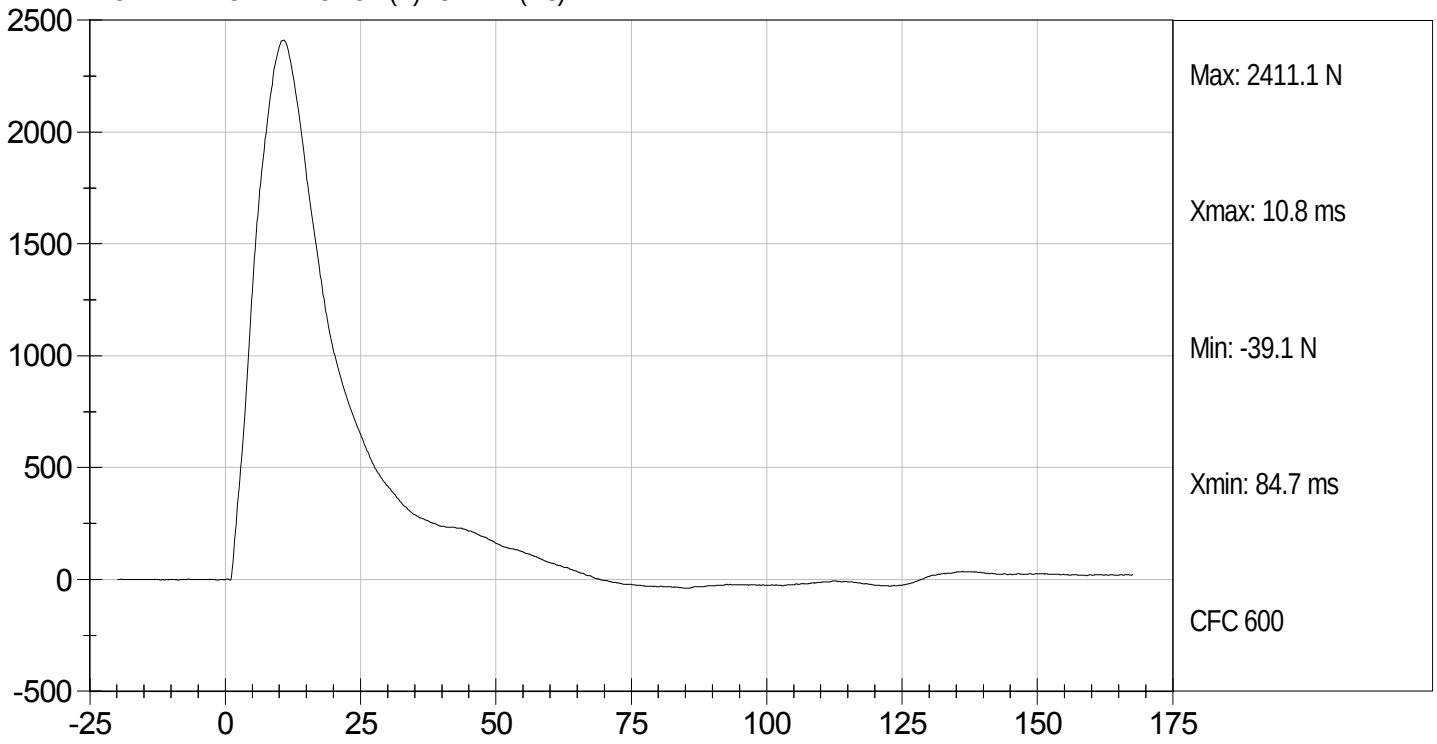
Test Desc: Abdomen Impact
Component ID: D111697

Test Date: 5/9/11
Velocity: 13.44 ft/s, 4.1 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



TOTAL ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D111698

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	36	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Deceleration	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.42	Pass
	27 ms	m/s	-6.50 to -5.80	-6.09	Pass
	30 ms	m/s	>= -6.5	-5.98	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	51.7	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	44.7	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	47	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

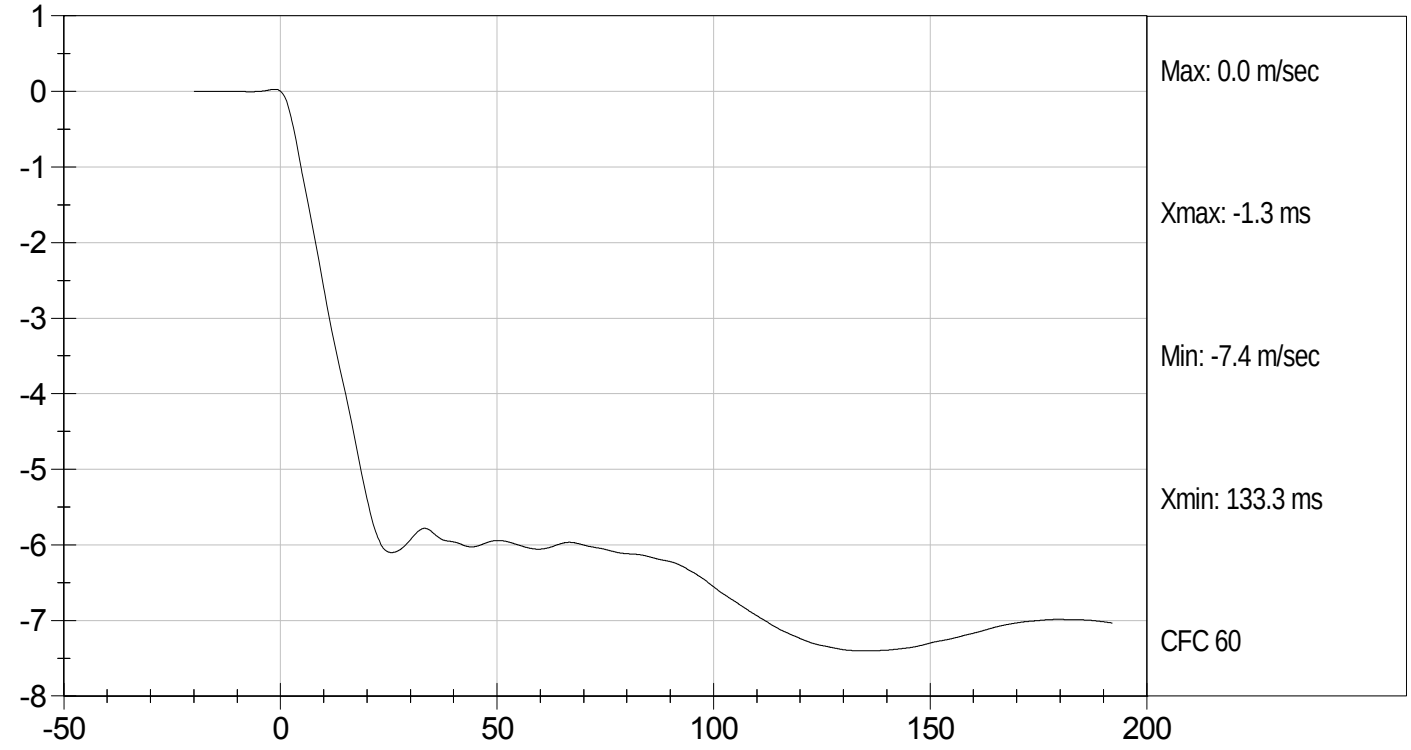
5/9/11
Test Date

David Winkelbauer
Approved By

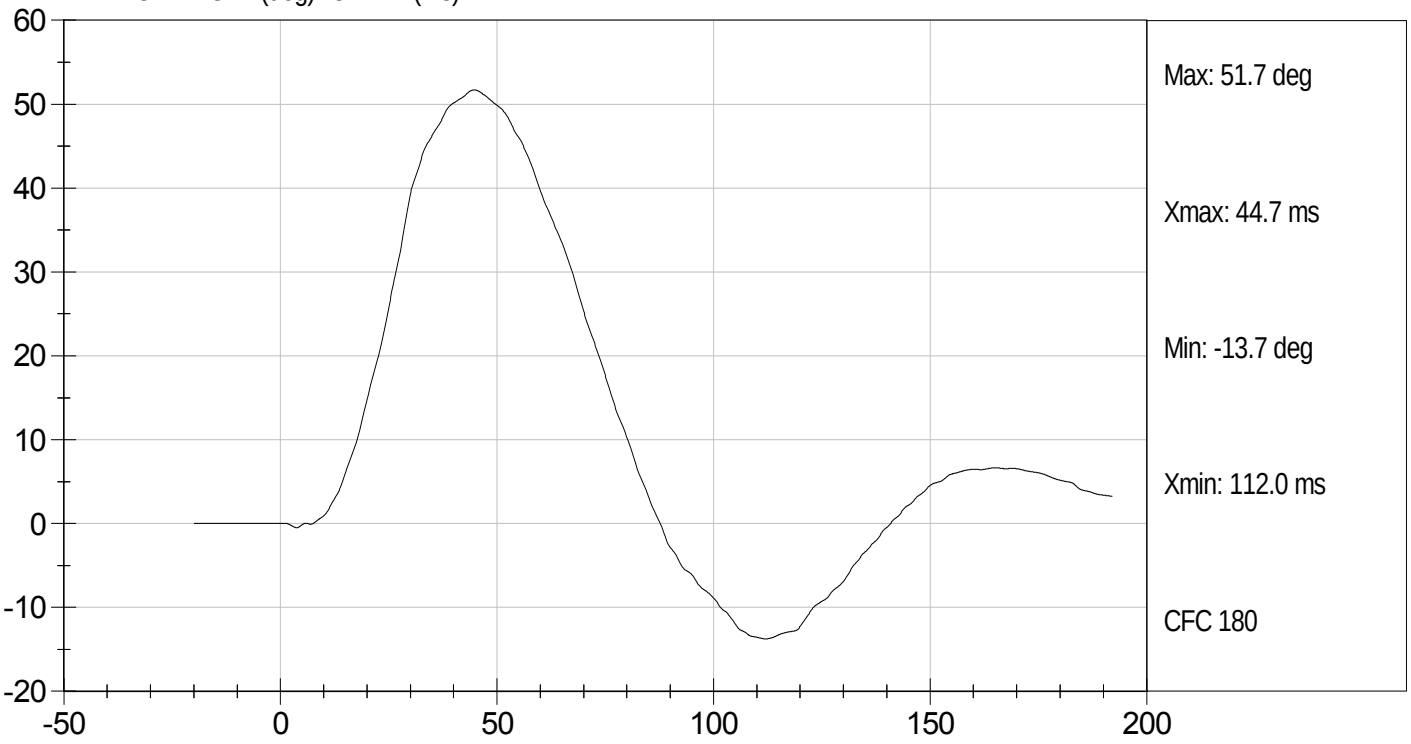
Test Desc: Lumbar Flexion
Component ID: D111698

Test Date: 5/9/11
Velocity: 20.08 ft/s, 6.12 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

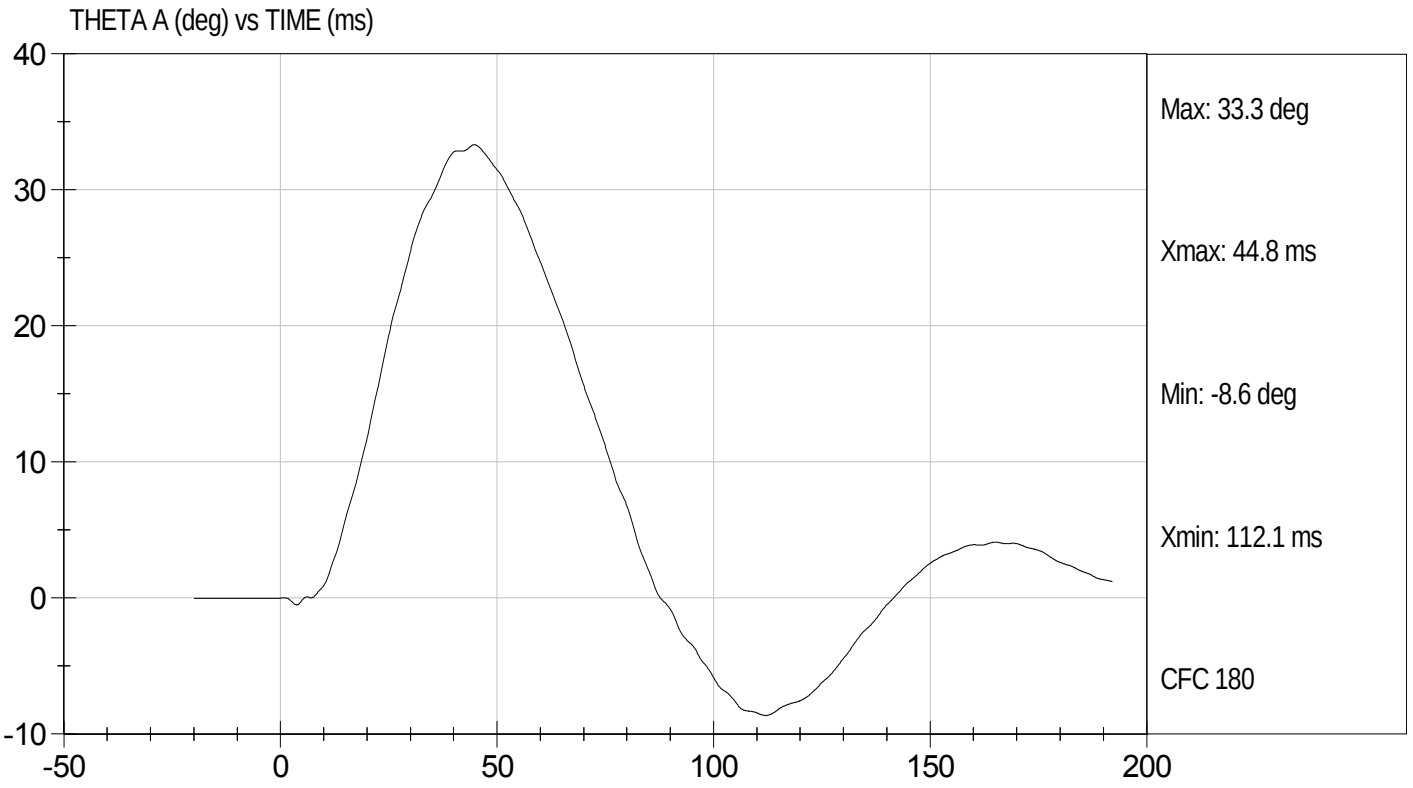


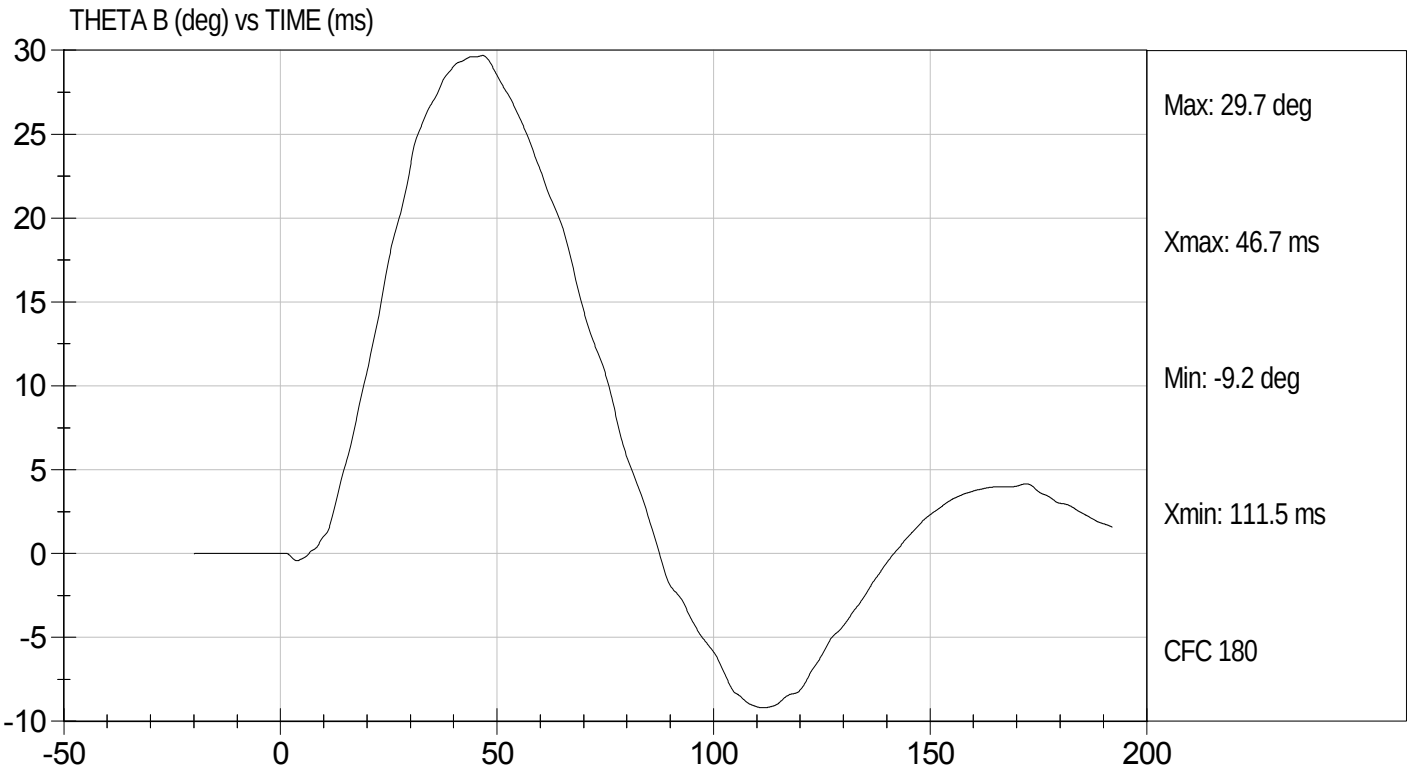
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Flexion
Component ID: D111698

Test Date: 5/9/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D111699

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.72	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.10	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.36	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	14.50	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

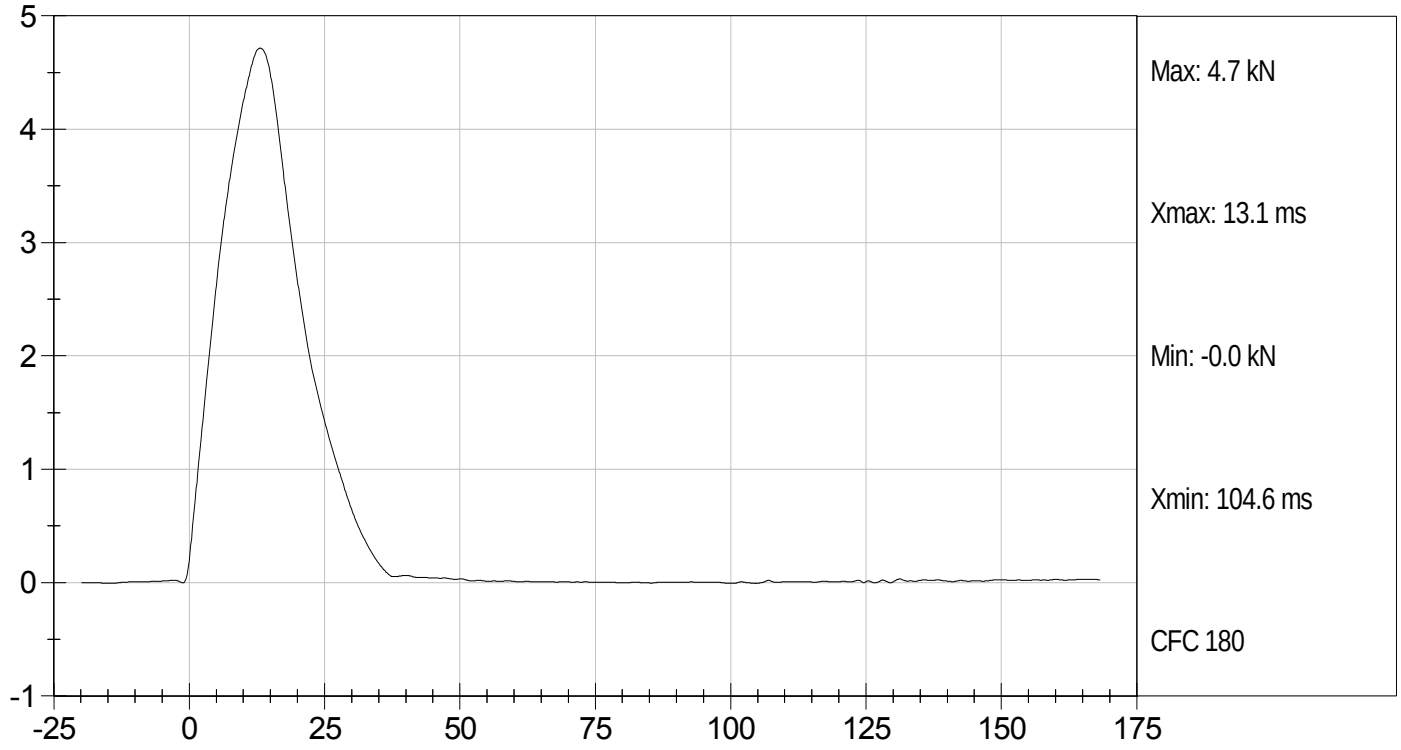
5/9/11
Test Date

David Winkelbauer
Approved By

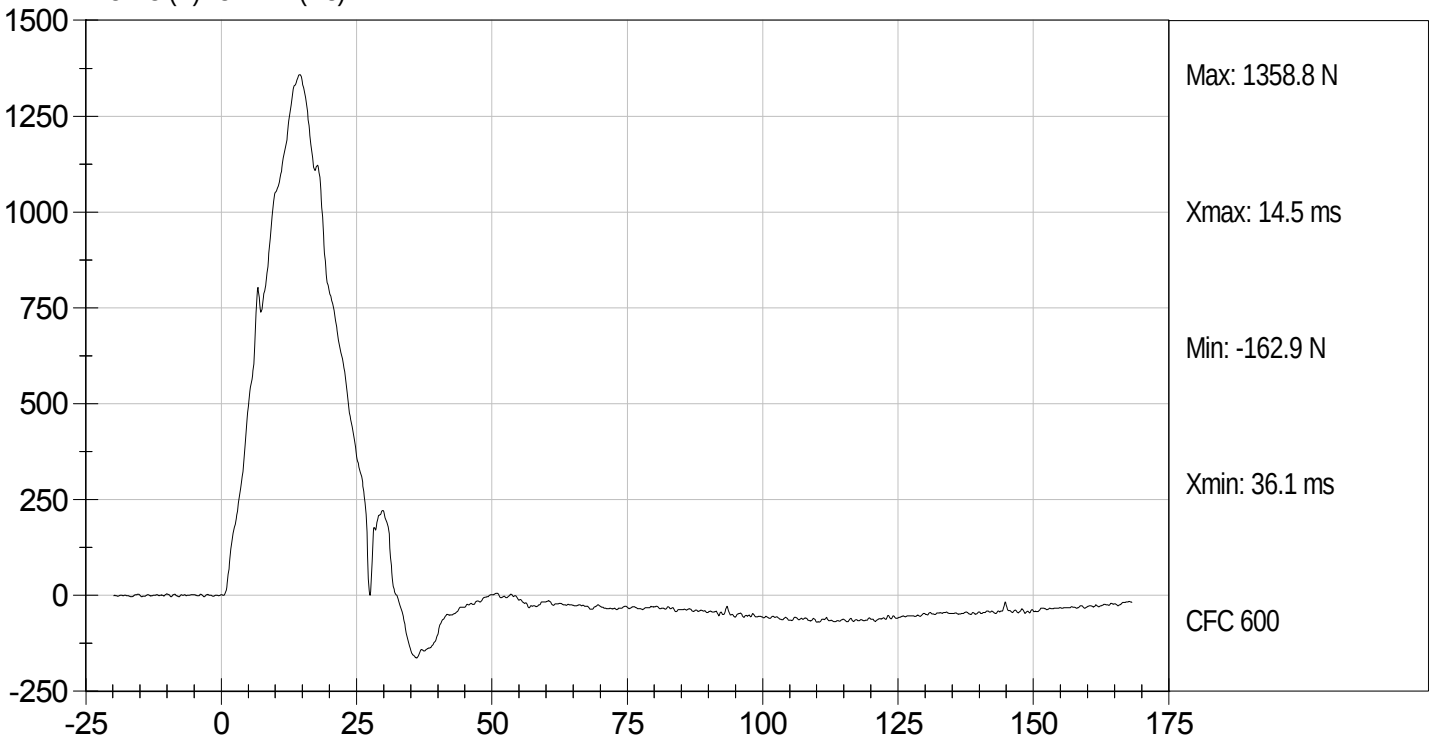
Test Desc: Pelvis Impact
Component ID: D111699

Test Date: 5/9/11
Velocity: 14.24 ft/s, 4.34 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



PUBIC (N) vs TIME (ms)



MGA RESEARCH CORPORATION

FULL BODY THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D111690

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	32	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	kN	5.10 to 6.20	5.25	Pass
Upper Rib Displacement	mm	34.0 to 41.0	38.0	Pass
Middle Rib Displacement	mm	37.0 to 45.0	40.4	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.3	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

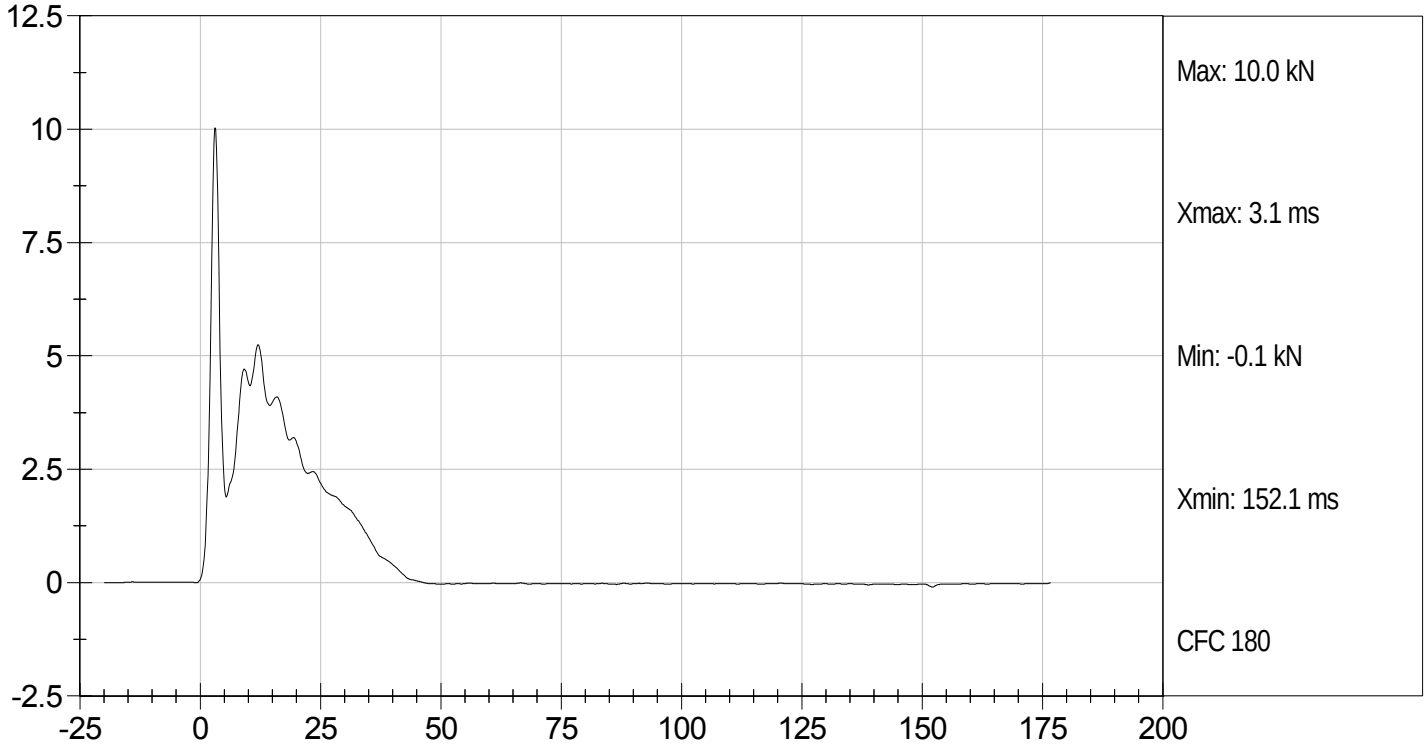
5/9/11
Test Date

David Winkelbauer
Approved By

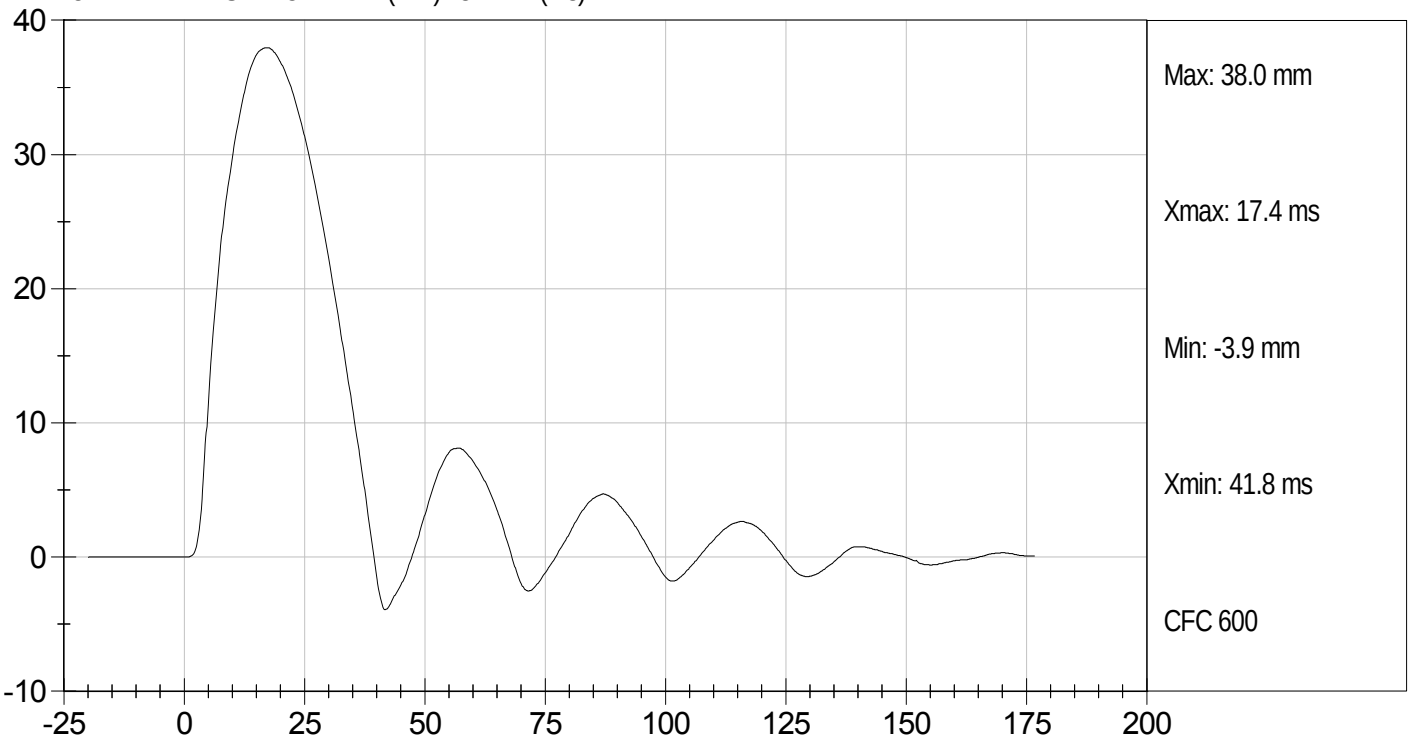
Test Desc: Thorax Impact
Component ID: D111690

Test Date: 5/9/11
Velocity: 18.31 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



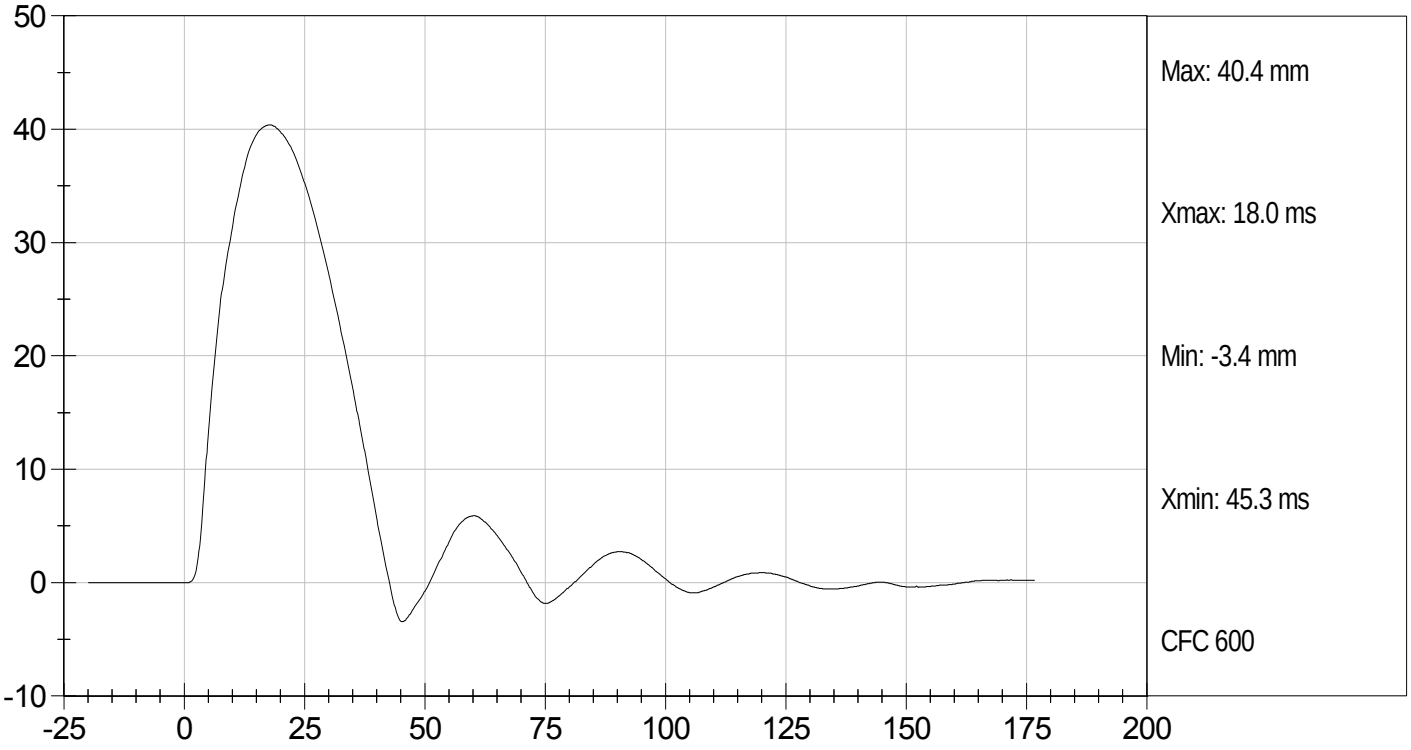
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



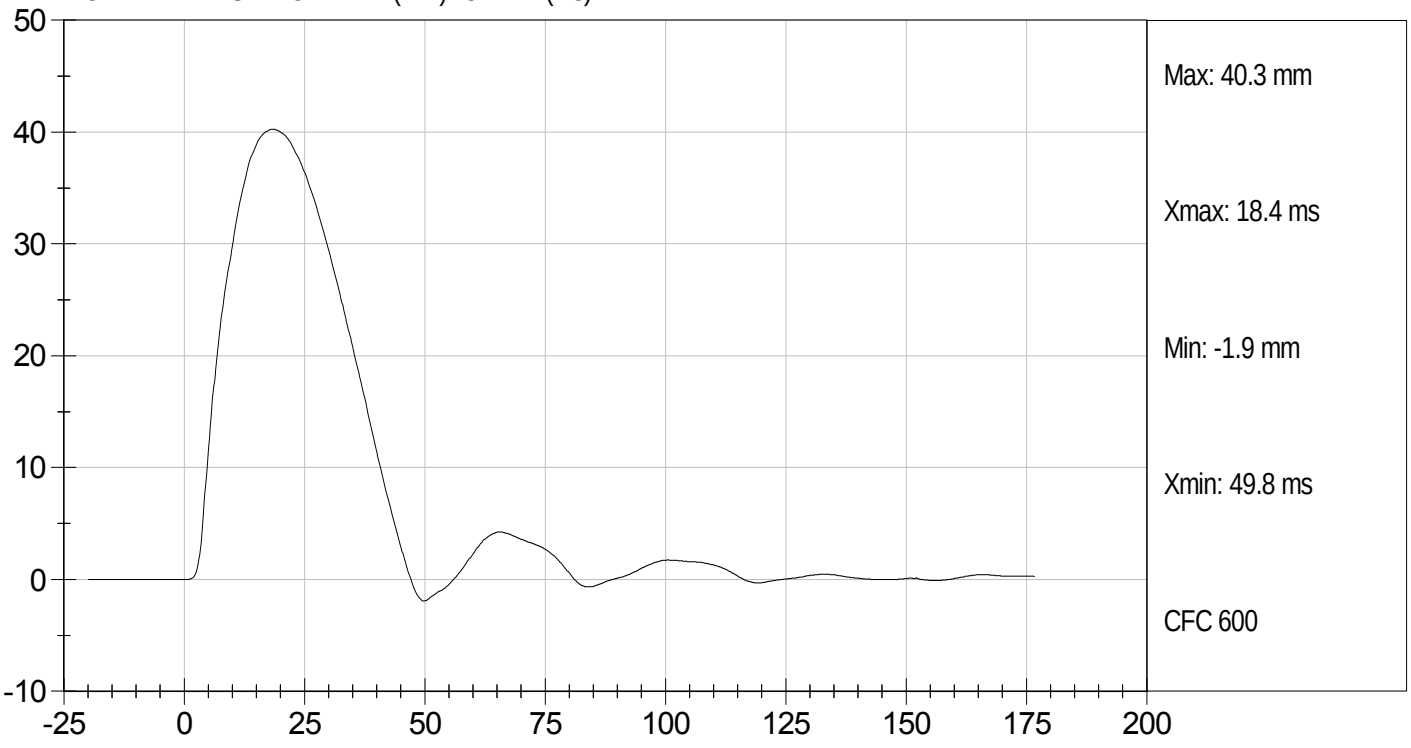
Test Desc: Thorax Impact
Component ID: D111690

Test Date: 5/9/11
Velocity: 18.31 ft/s, 5.58 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D11751

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	115 to 137	128	Pass
Peak Lateral Acceleration	G's	+/- 15	-2.7	Pass
Unimodal	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

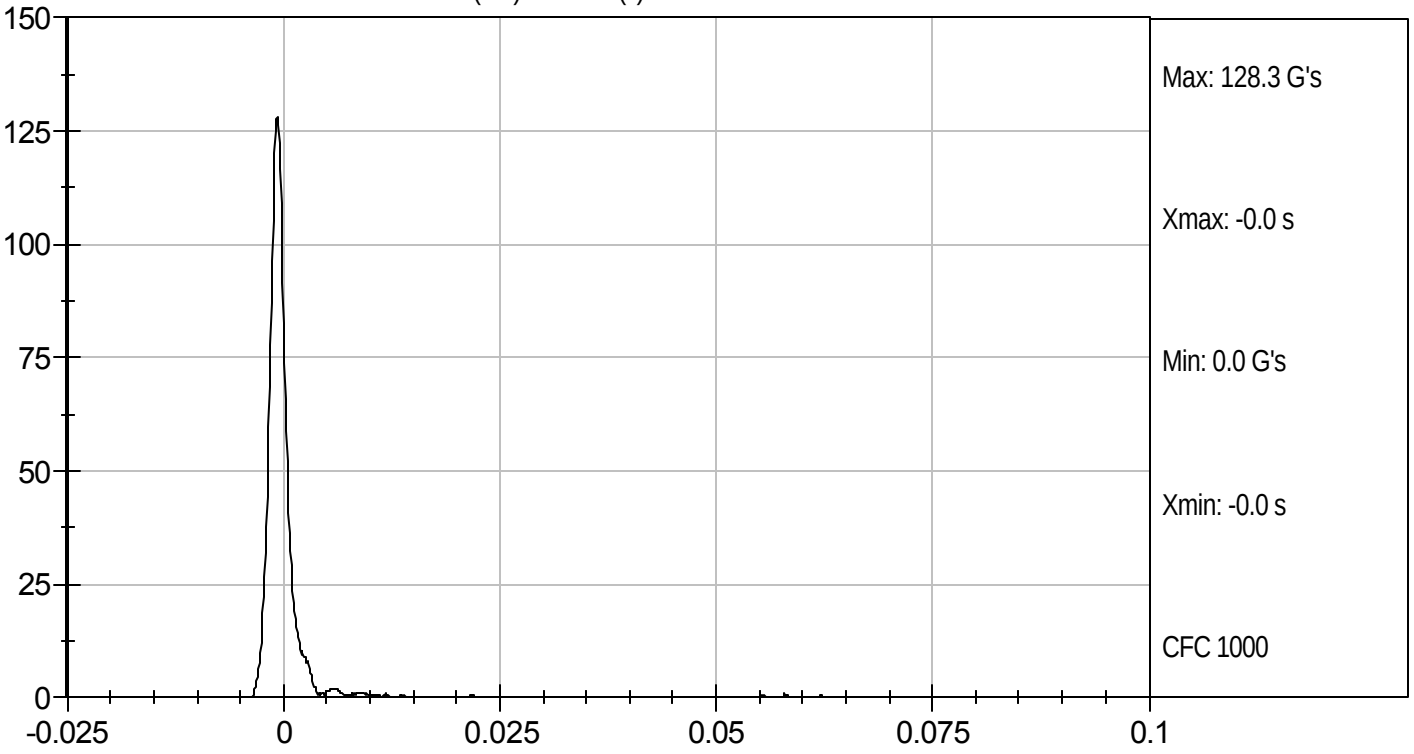
2/28/11
Test Date

David Winkelbauer
Approved By

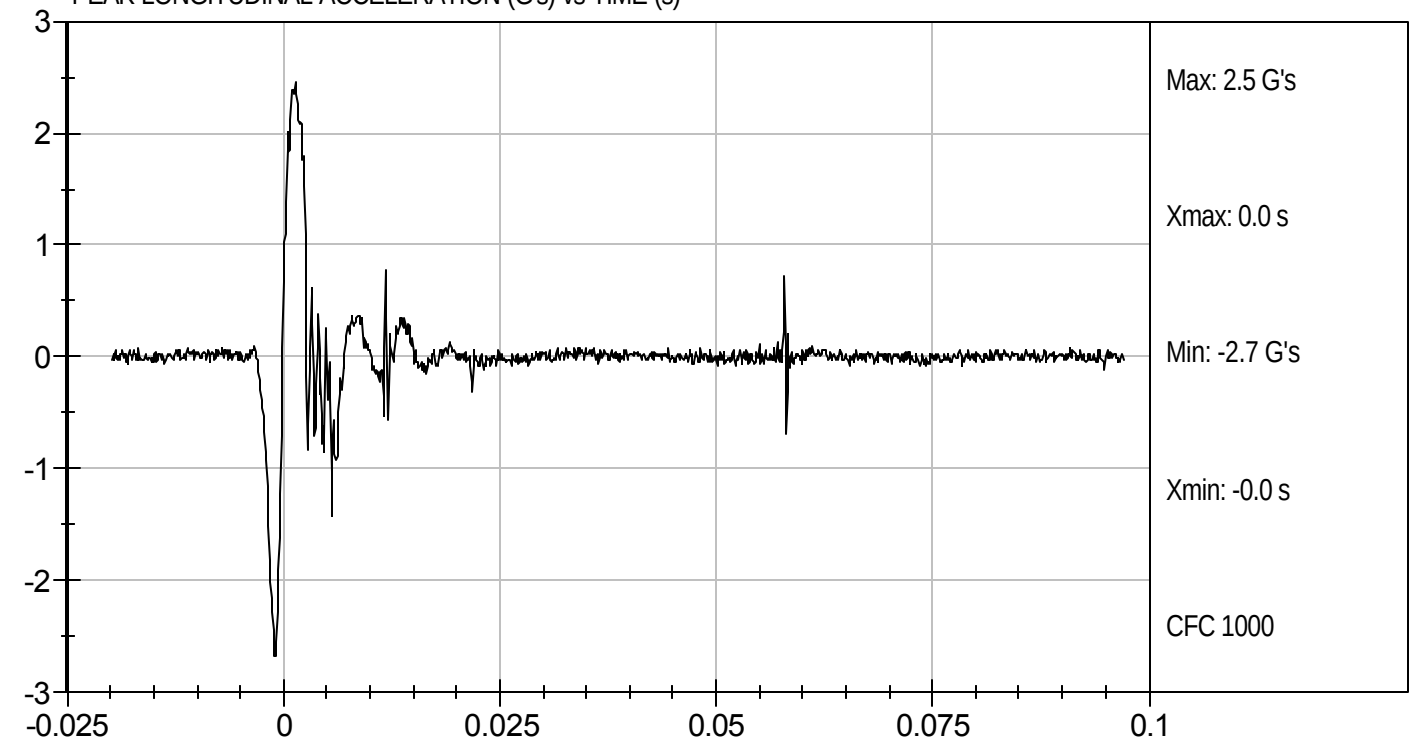
Test Desc: Head Drop
Component ID: D11751

Test Date: 2/28/11
Velocity: 0 ft/s, 0 m/s

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



PEAK LONGITUDINAL ACCELERATION (G's) vs TIME (s)



MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D11752

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.7	Pass
Humidity		%	10 to 70	21	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Delta Velocity	10 ms	m/s	2.20 to 2.80	2.50	Pass
	15 ms	m/s	3.30 to 4.10	3.59	Pass
	20 ms	m/s	4.40 to 5.40	4.74	Pass
	25 ms	m/s	5.40 to 6.10	5.52	Pass
	25-100 ms	m/s	5.50 to 6.20	5.54	Pass
Maximum D-Plane Rotation		deg	71 to 81	77	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	61	Pass
Maximum Occipital Condyle Moment during Rotation Interval		Nm	-44 to -36	-43	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	117	Pass
			Overall Test Results		Pass

Jessica Gall
Laboratory Technician

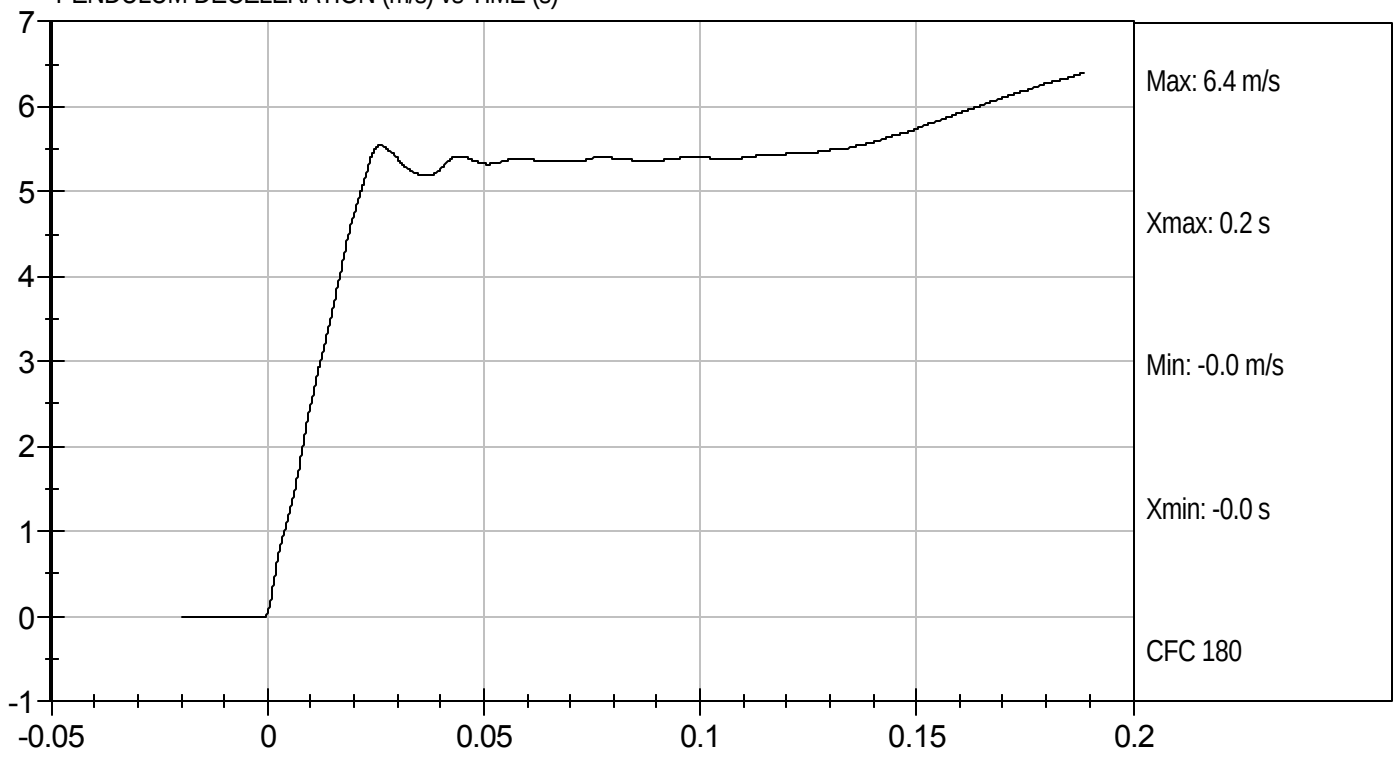
2/28/11
Test Date

David Winkelbauer
Approved By

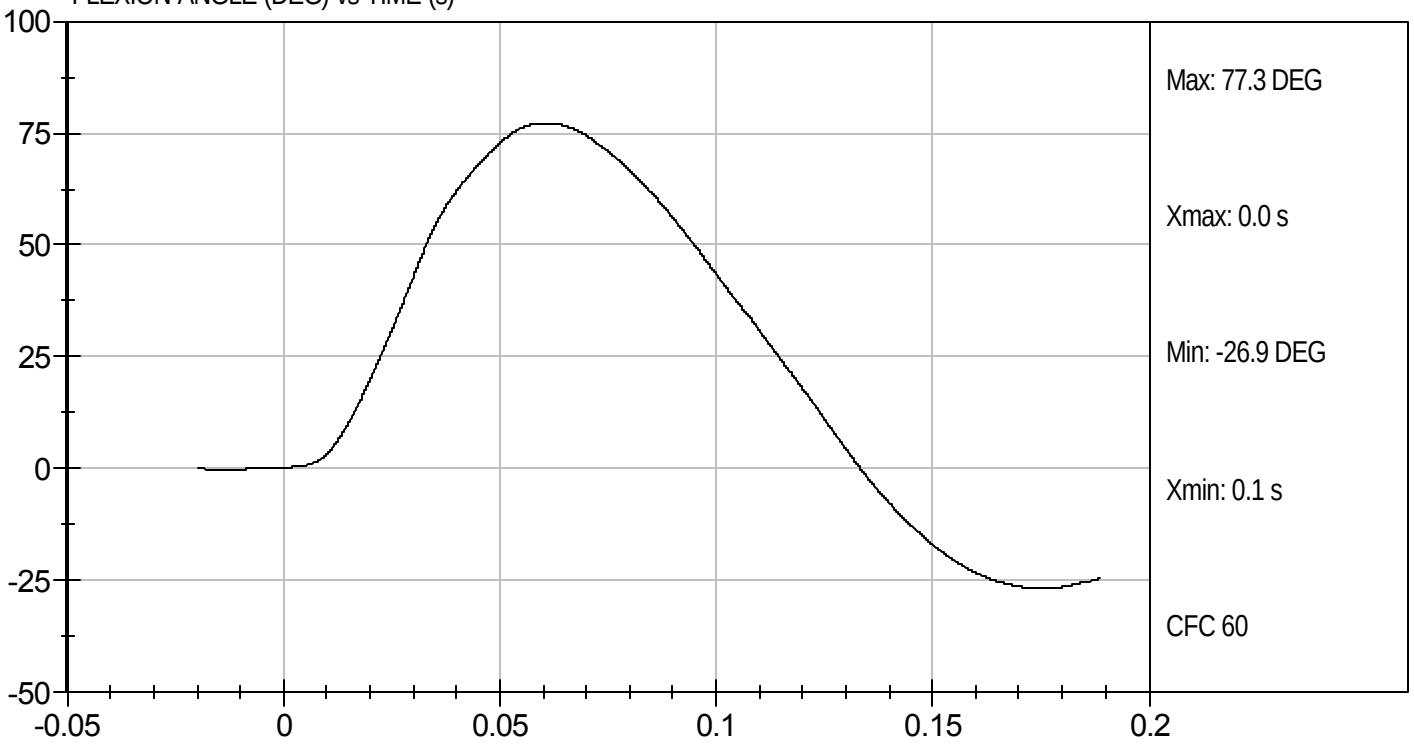
Test Desc: Neck Bending
Component ID: D11752

Test Date: 2/28/11
Velocity: 18.32 ft/s, 5.58 m/s

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

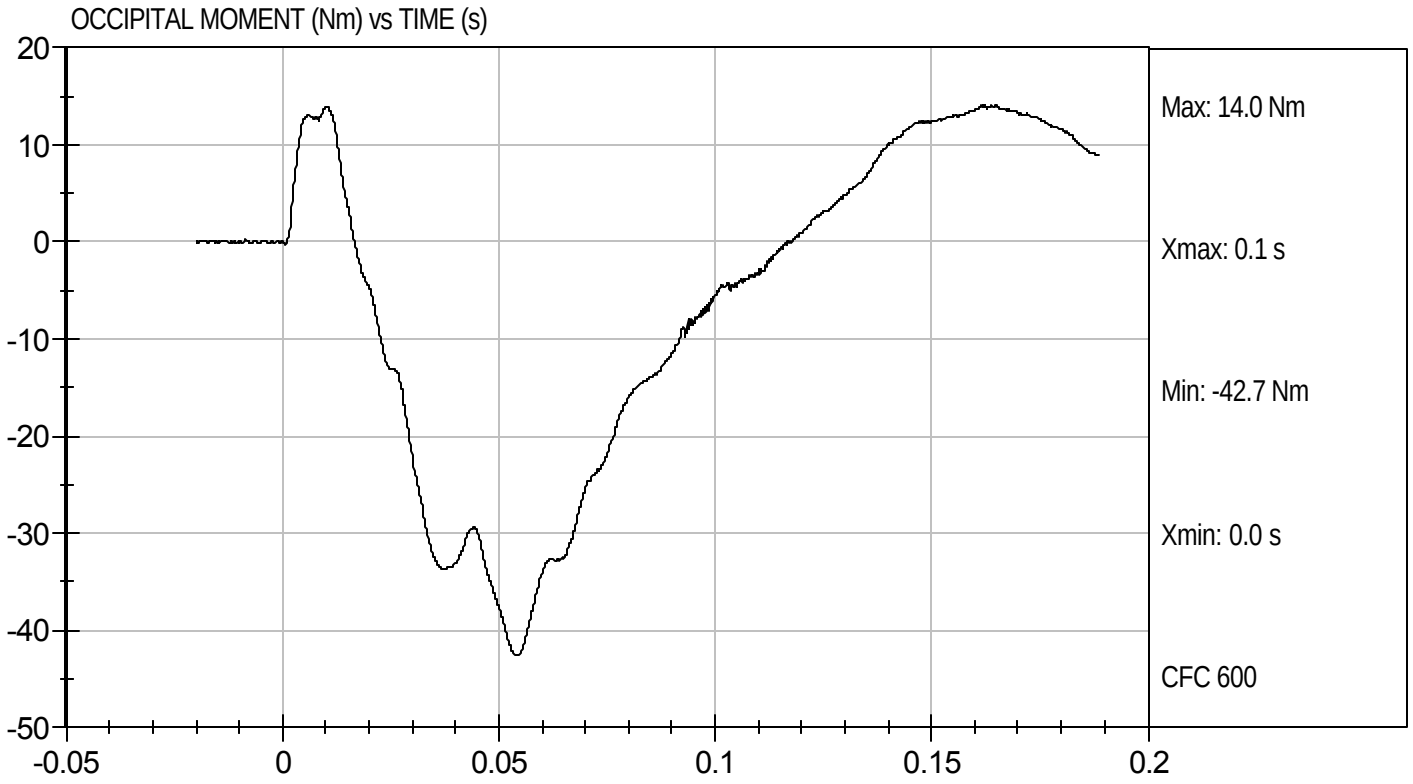


FLEXION ANGLE (DEG) vs TIME (s)



Test Desc: Neck Bending
Component ID: D11752

Test Date: 2/28/11
Velocity: 18.32 ft/s, 5.58 m/s



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D11753

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	19	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	29	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
		Overall Test Results		Pass

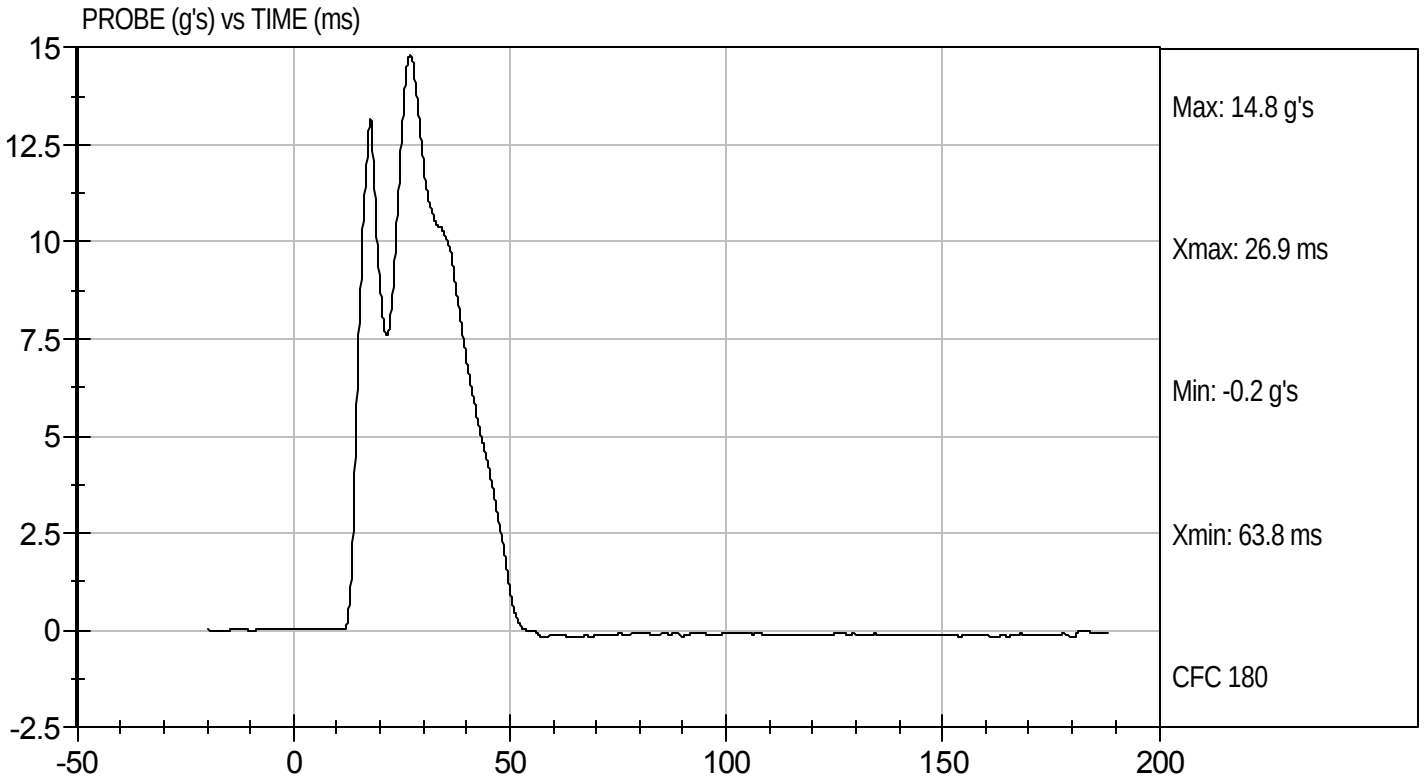
Jessica Hall
Laboratory Technician

2/28/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D11753

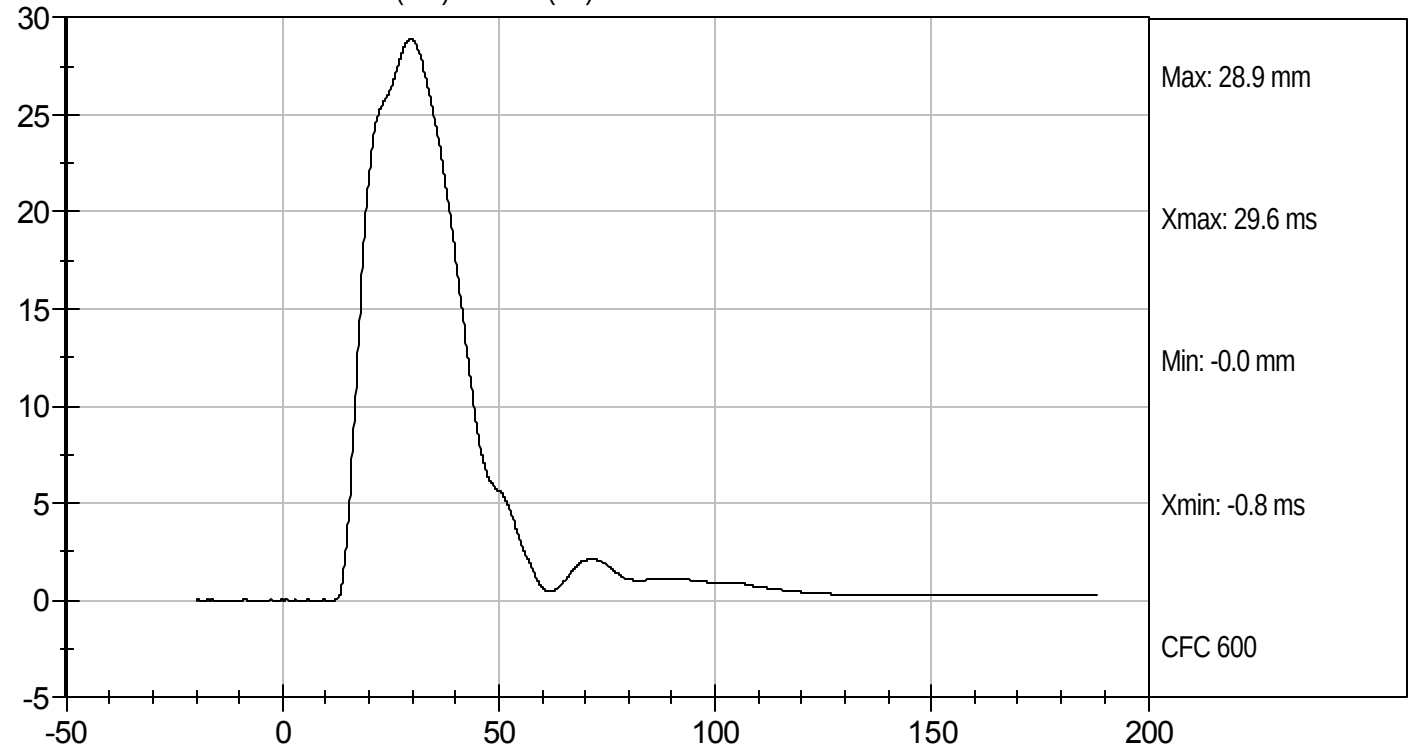
Test Date: 2/28/11
Velocity: 14.37 ft/s, 4.38 m/s



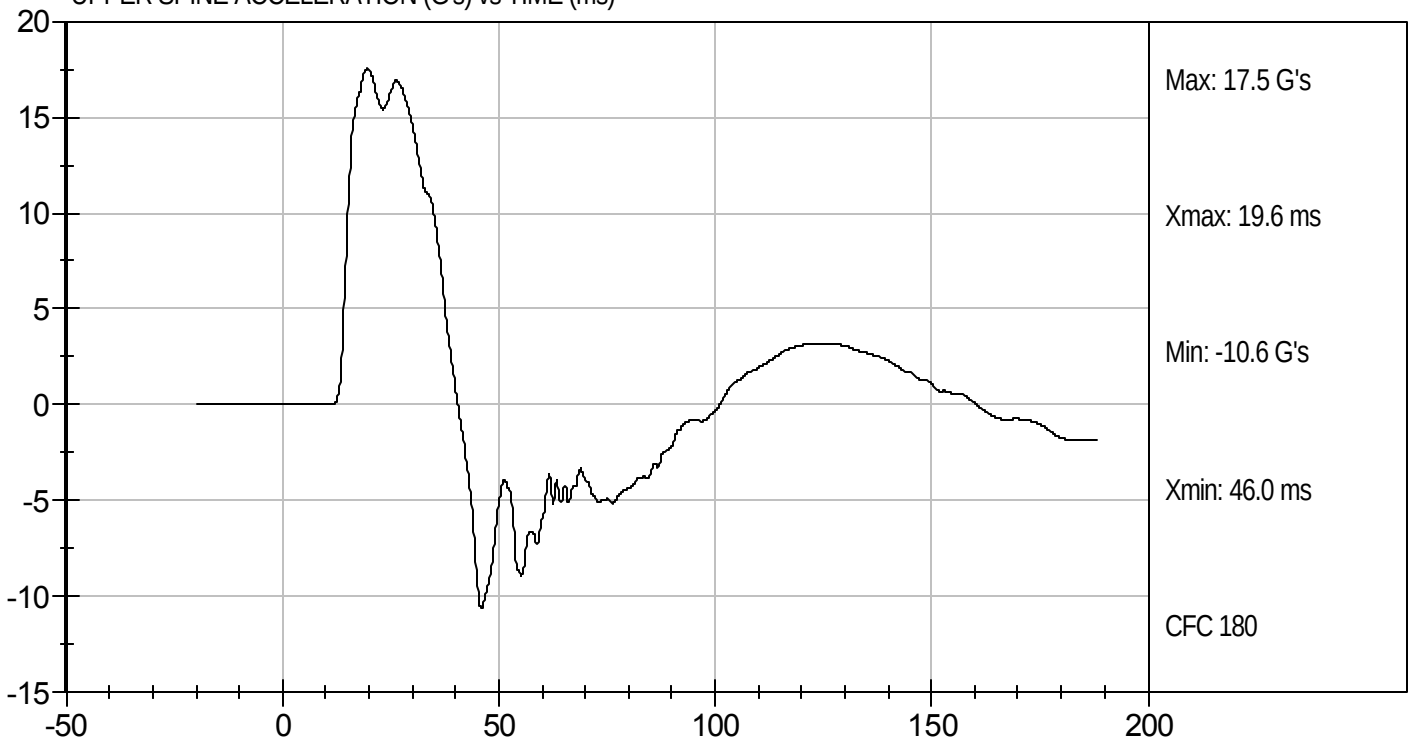
Test Desc: Shoulder Impact
Component ID: D11753

Test Date: 2/28/11
Velocity: 14.37 ft/s, 4.38 m/s

SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D11754

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Humidity	%	10 to 70	17	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Peak Impactor Acceleration	G's	30 to 36	33	Pass
Shoulder Displacement	mm	31 to 40	35	Pass
Upper Rib Displacement	mm	25 to 32	30	Pass
Middle Rib Displacement	mm	30 to 36	31	Pass
Lower Rib Displacement	mm	32 to 38	33	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	37	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	35	Pass
		Overall Test Results		Pass

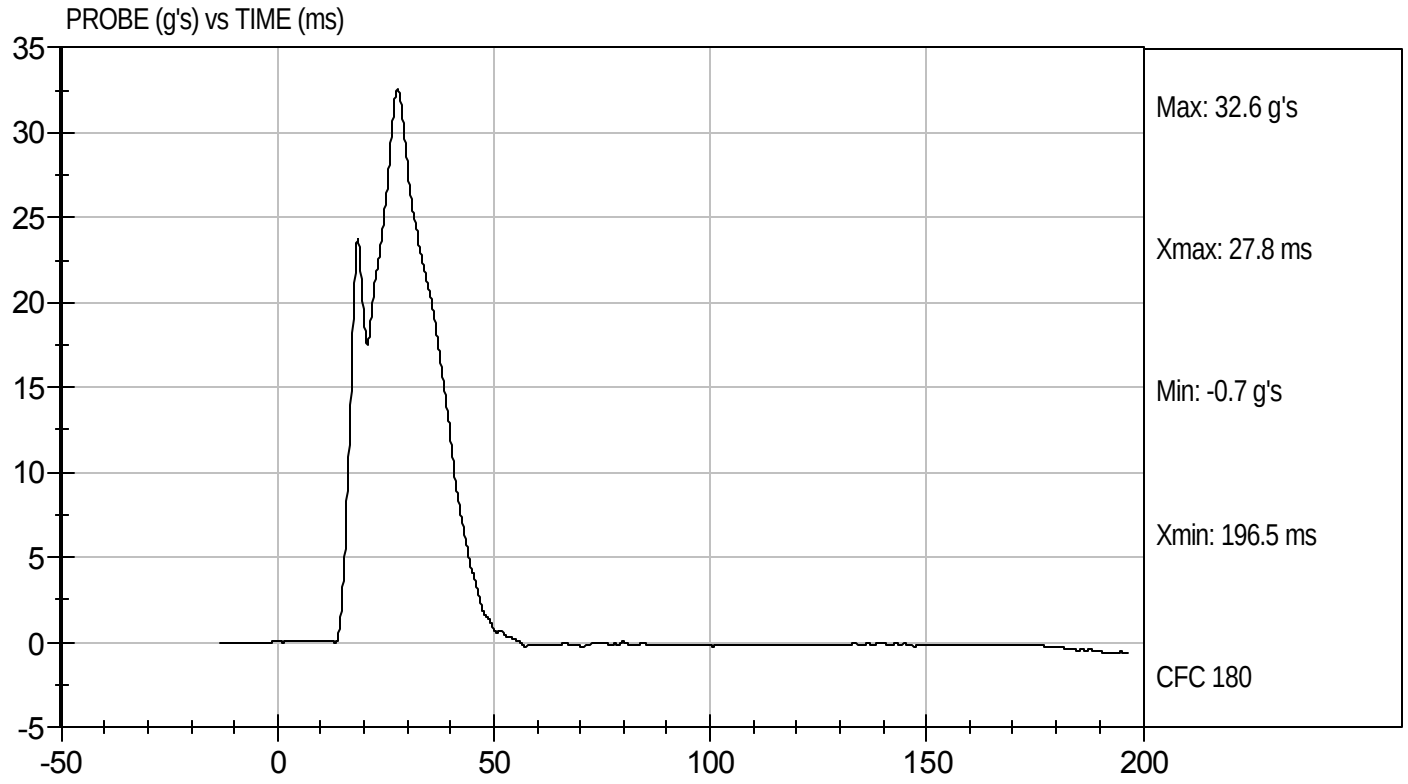
Jessica Gall
Laboratory Technician

3/1/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax With Arm
Component ID: D11754

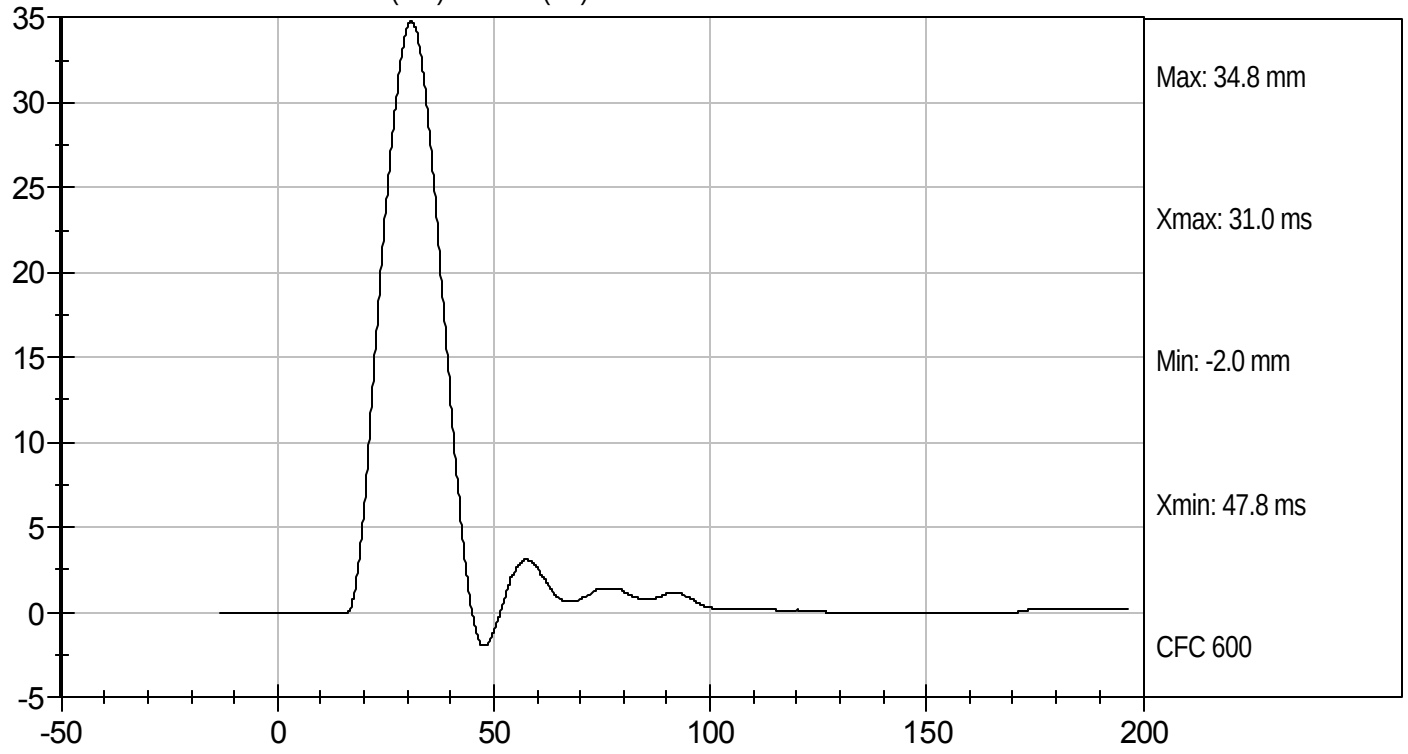
Test Date: 3/1/11
Velocity: 22.22 ft/s, 6.77 m/s



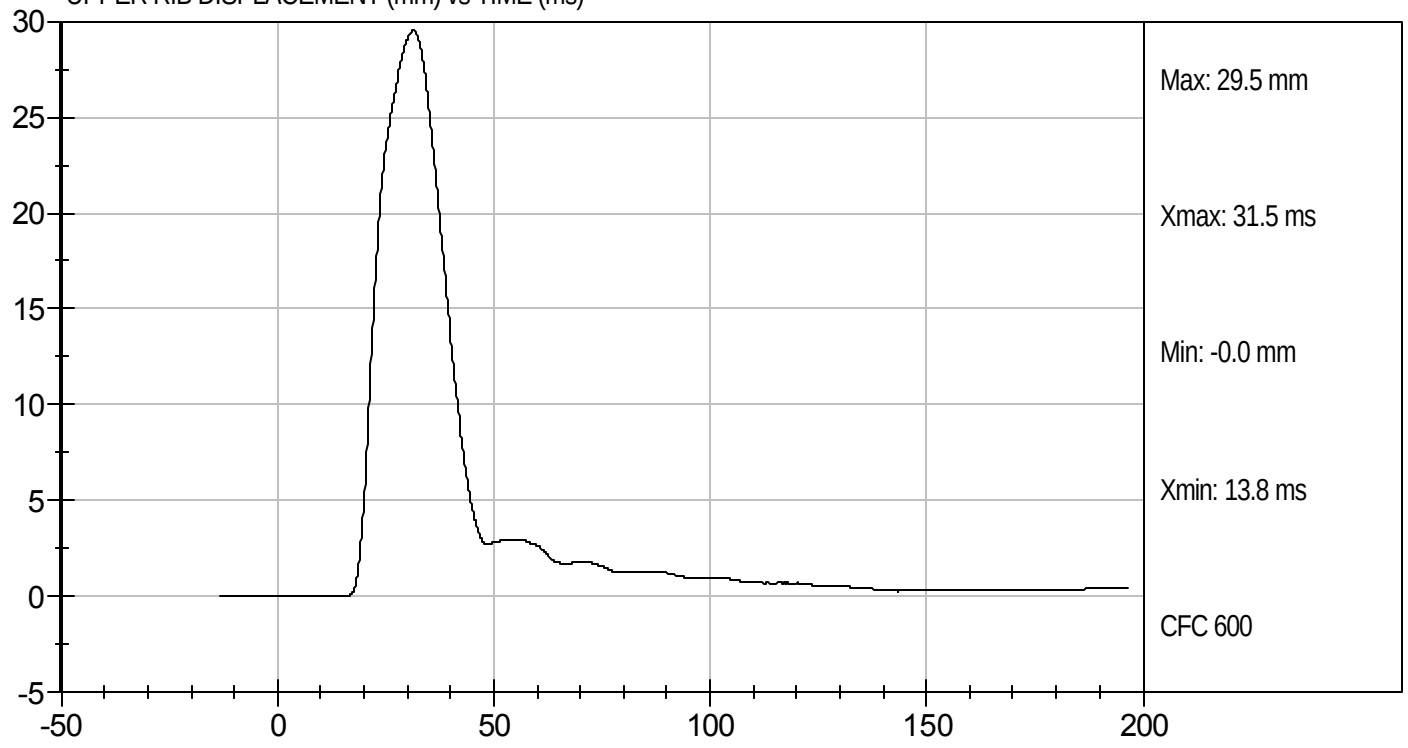
Test Desc: Thorax With Arm
Component ID: D11754

Test Date: 3/1/11
Velocity: 22.22 ft/s, 6.77 m/s

SHOULDER DISPLACEMENT (mm) vs TIME (ms)



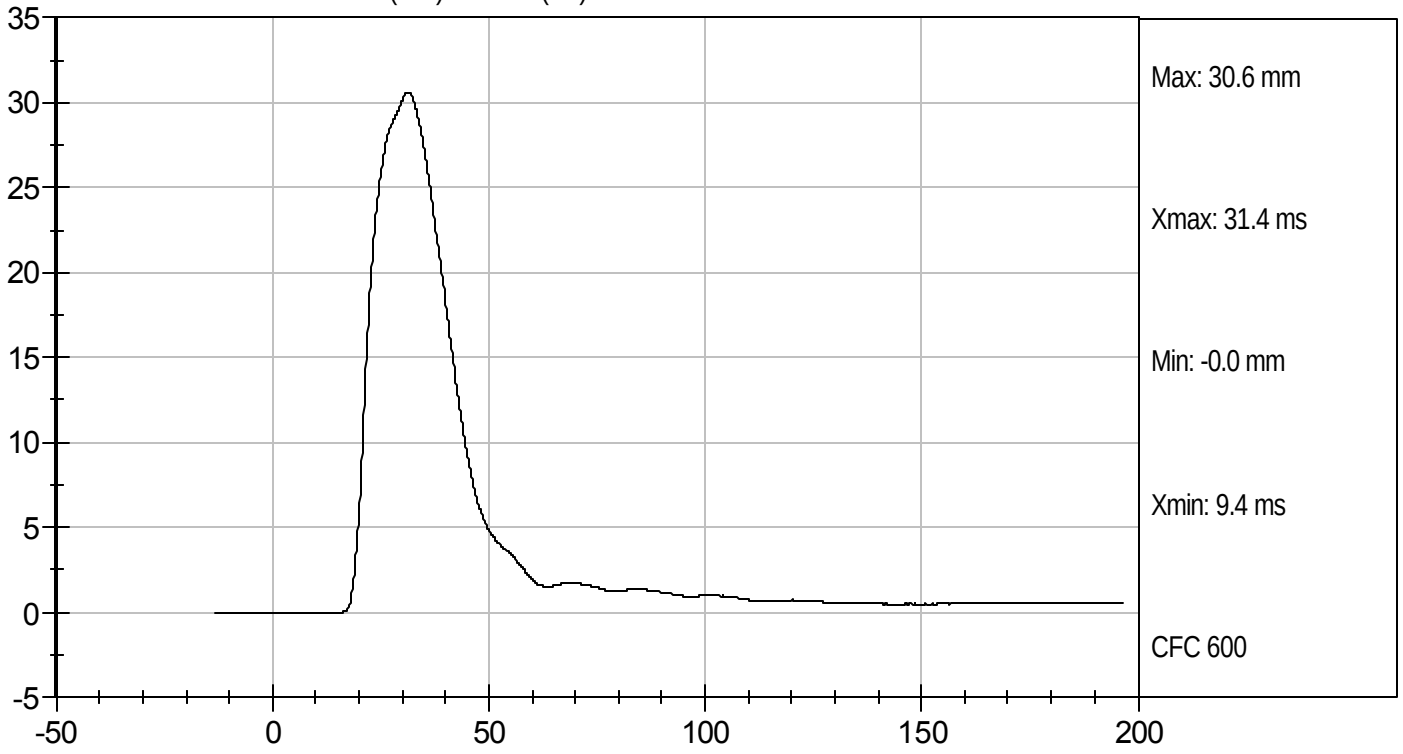
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



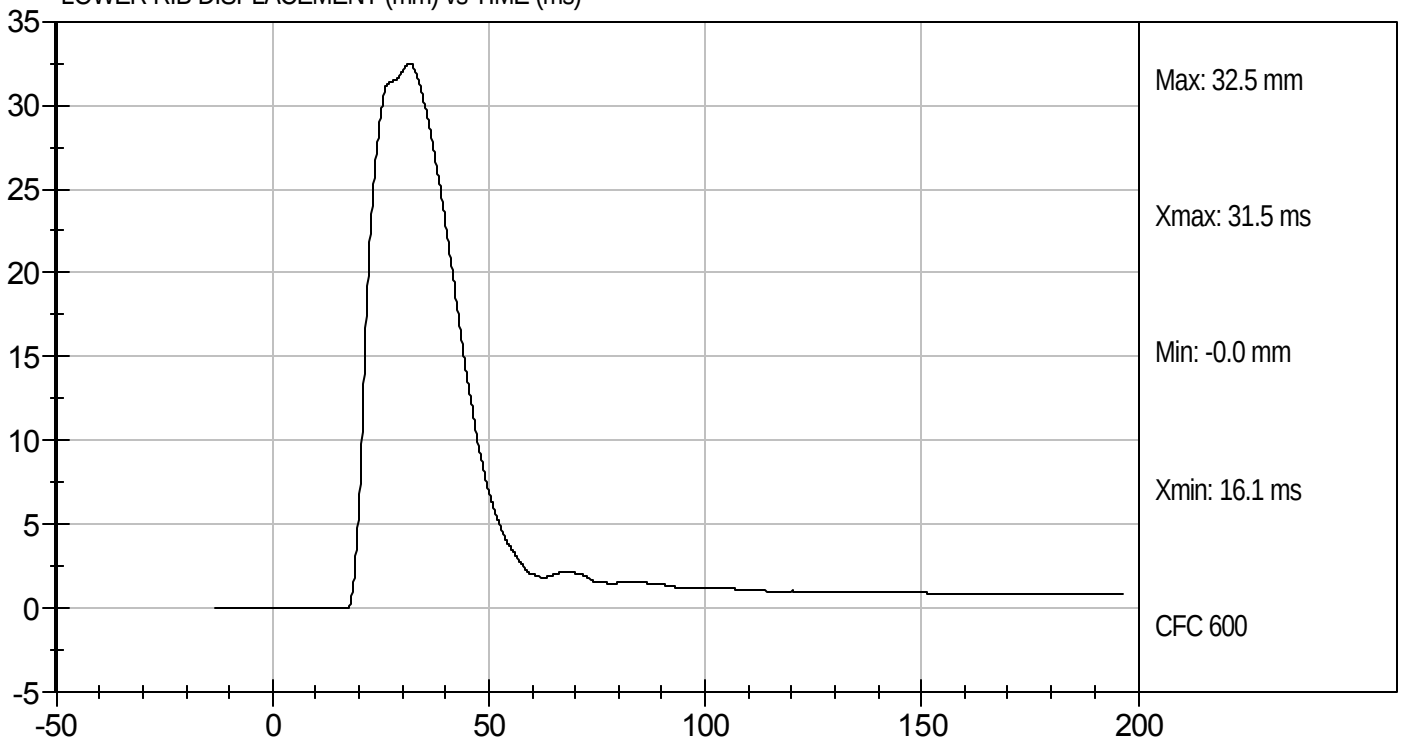
Test Desc: Thorax With Arm
Component ID: D11754

Test Date: 3/1/11
Velocity: 22.22 ft/s, 6.77 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



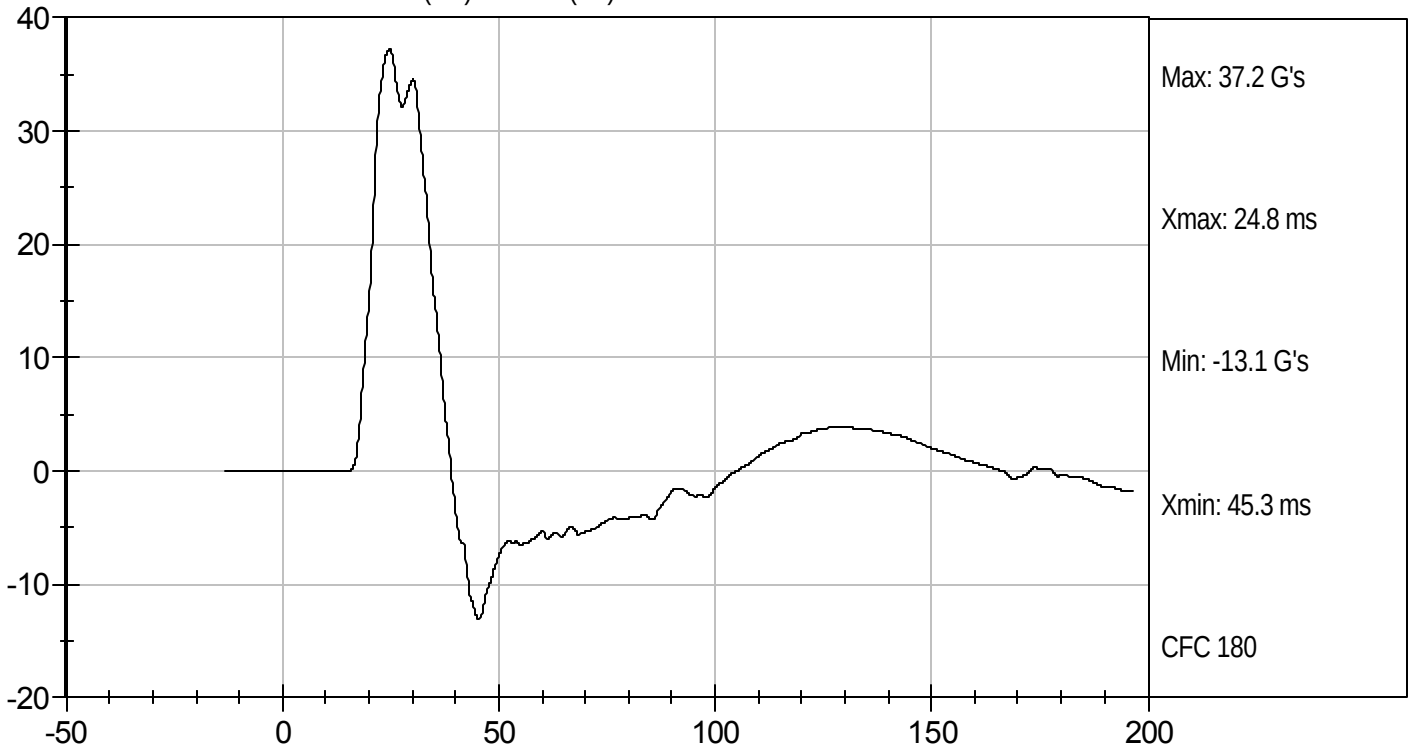
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



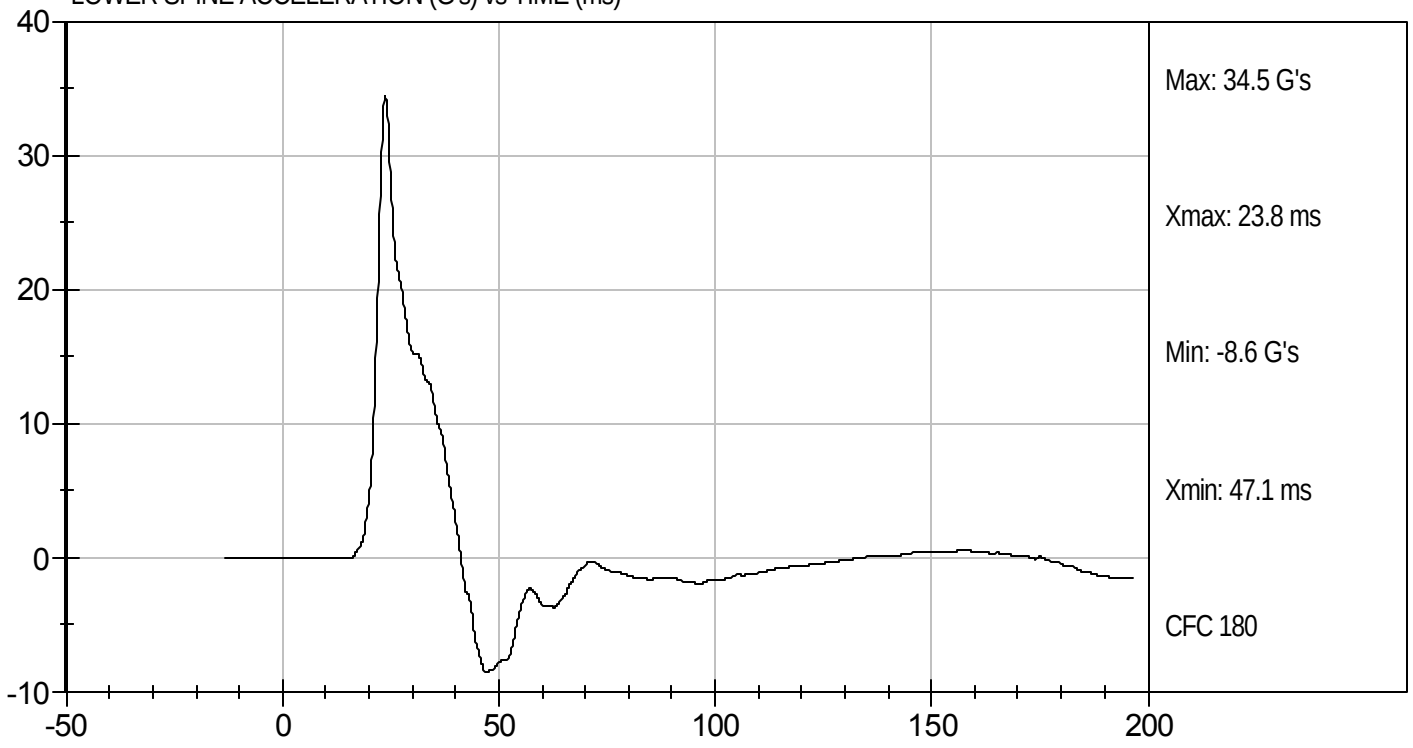
Test Desc: Thorax With Arm
Component ID: D11754

Test Date: 3/1/11
Velocity: 22.22 ft/s, 6.77 m/s

UPPER SPINE ACCELERATION (G's) vs TIME (ms)



LOWER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D11755

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	17	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Peak Impactor Force	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	36	Pass
Middle Rib Displacement	mm	39 to 45	40	Pass
Lower Rib Displacement	mm	35 to 43	38	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	10	Pass
		Overall Test Results		Pass

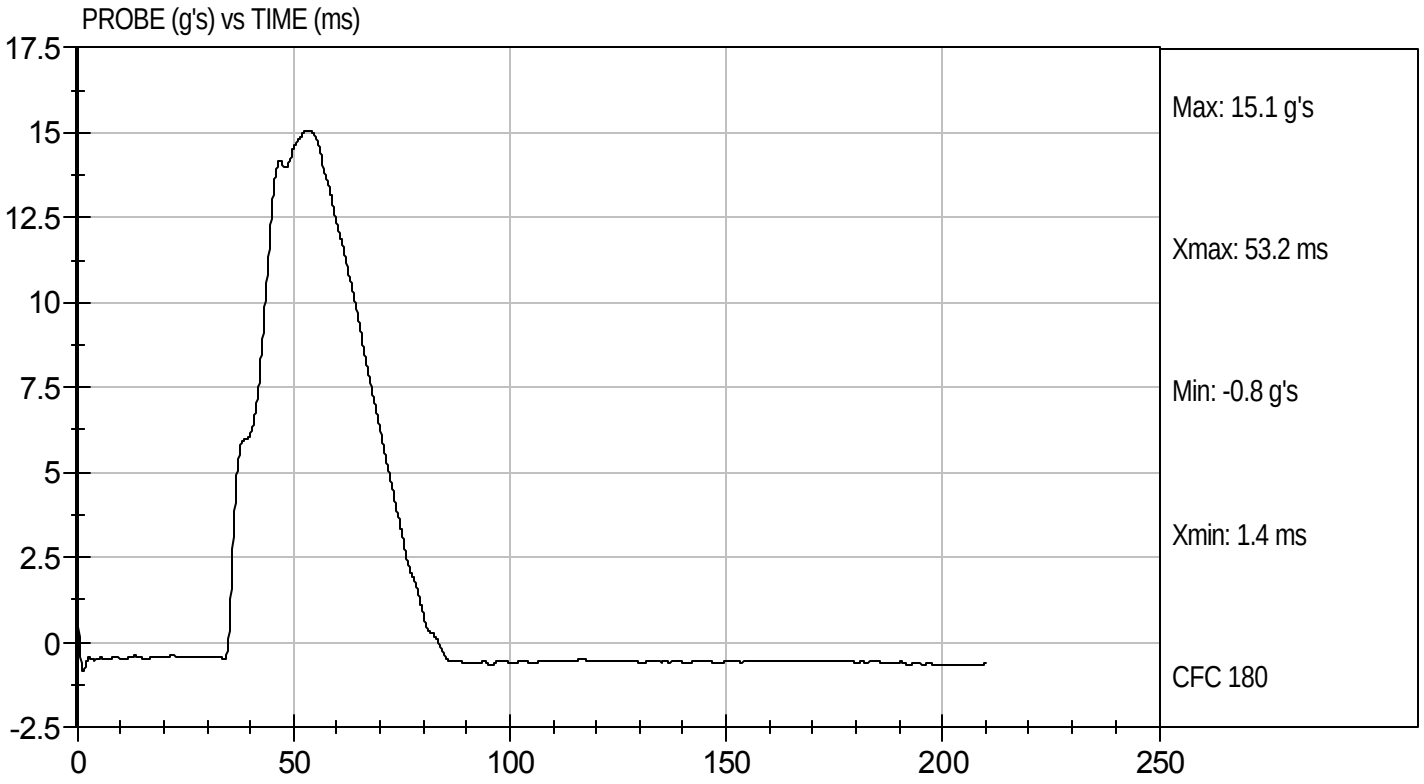
Jessica Gall
Laboratory Technician

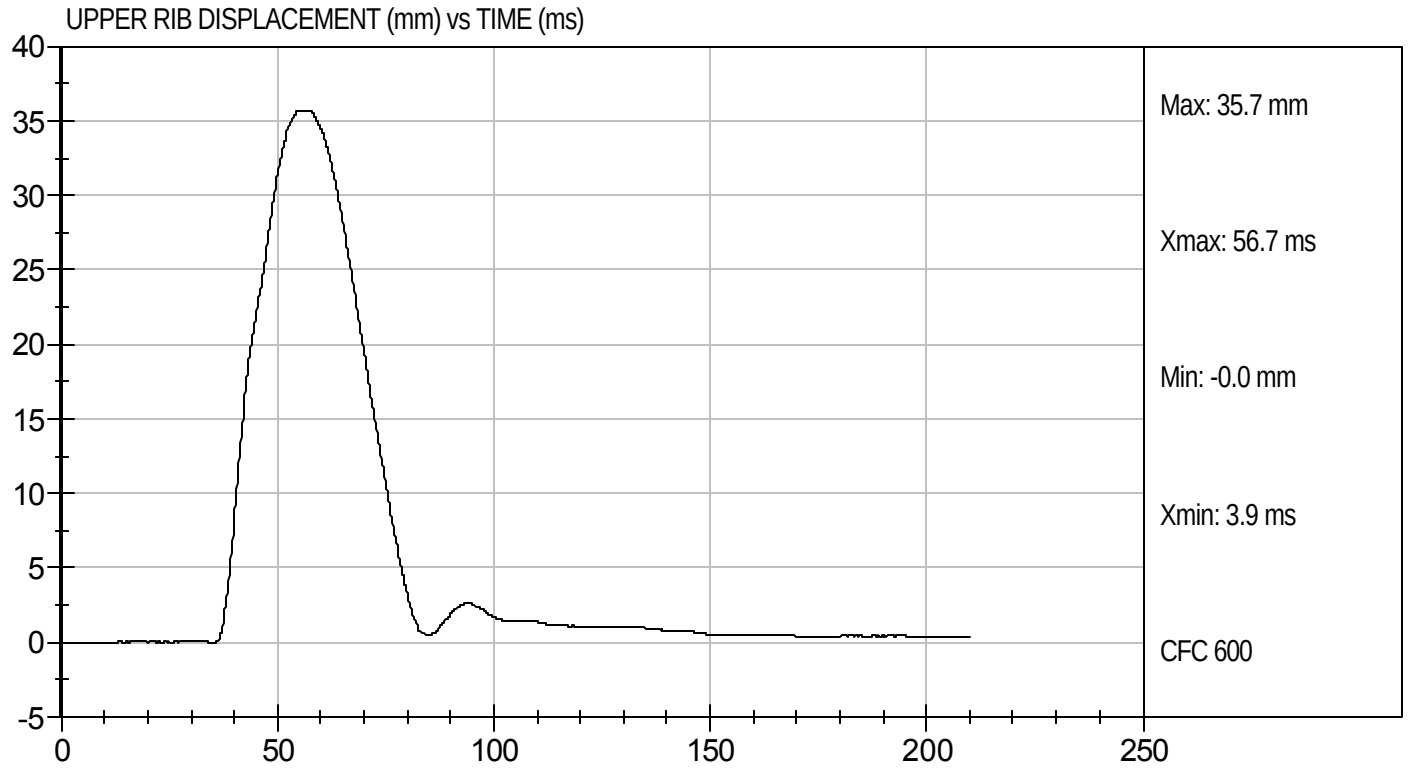
3/1/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Without Arm
Component ID: D11755

Test Date: 3/1/11
Velocity: 14.25 ft/s, 4.34 m/s

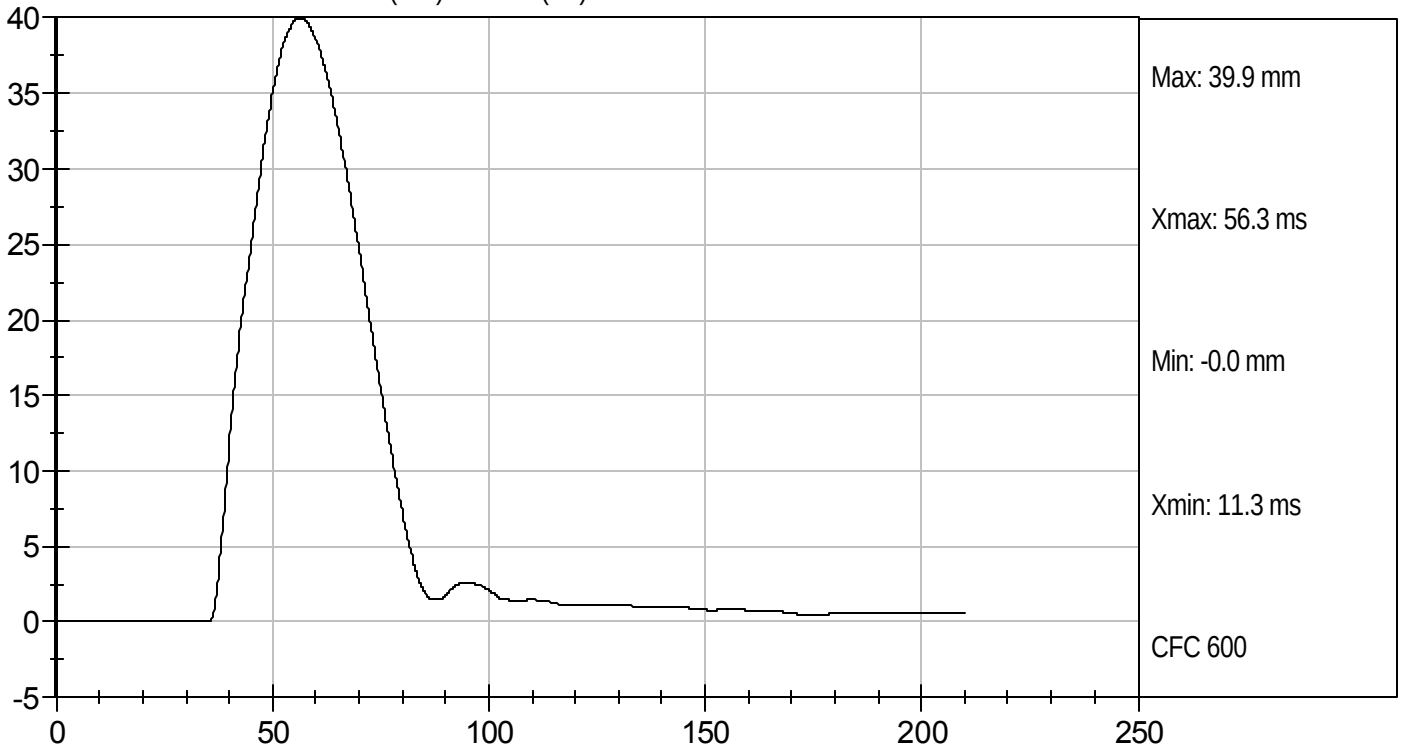




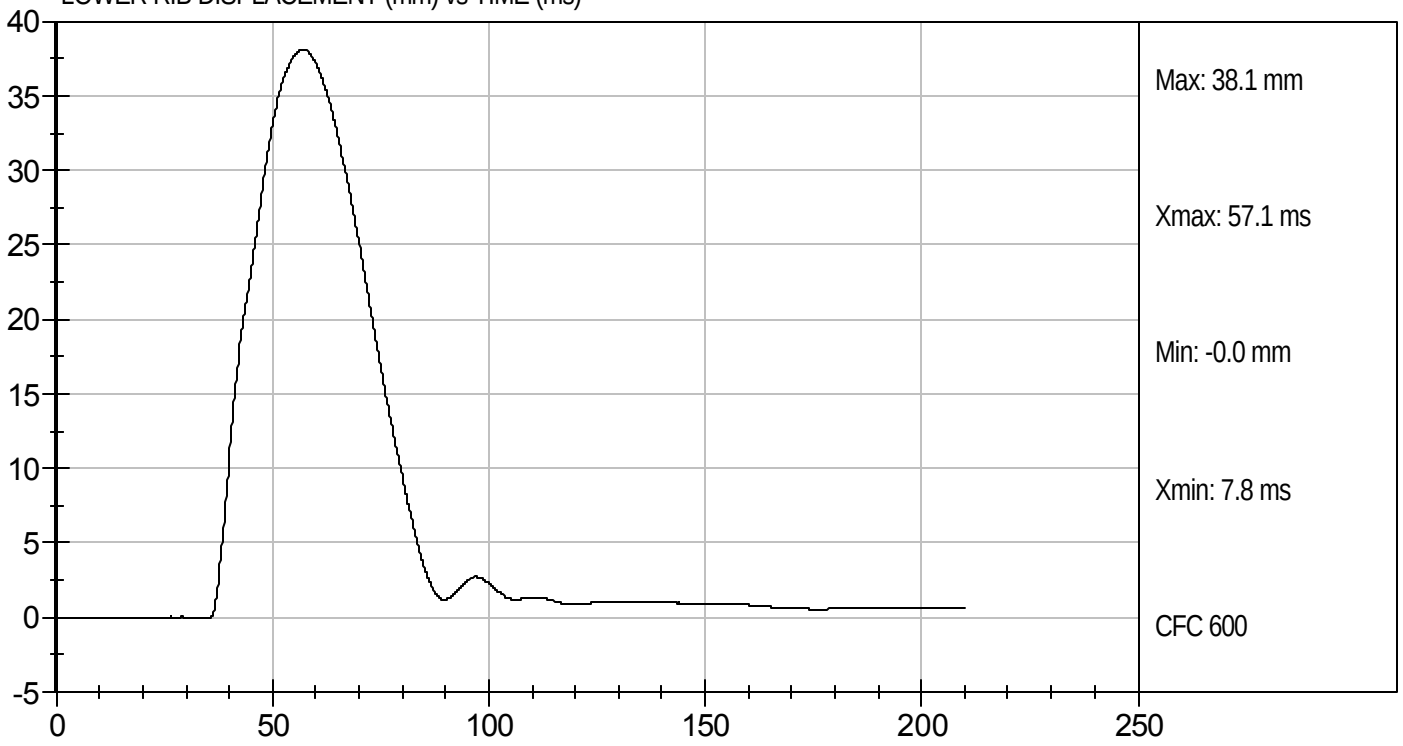
Test Desc: Thorax Without Arm
Component ID: D11755

Test Date: 3/1/11
Velocity: 14.25 ft/s, 4.34 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



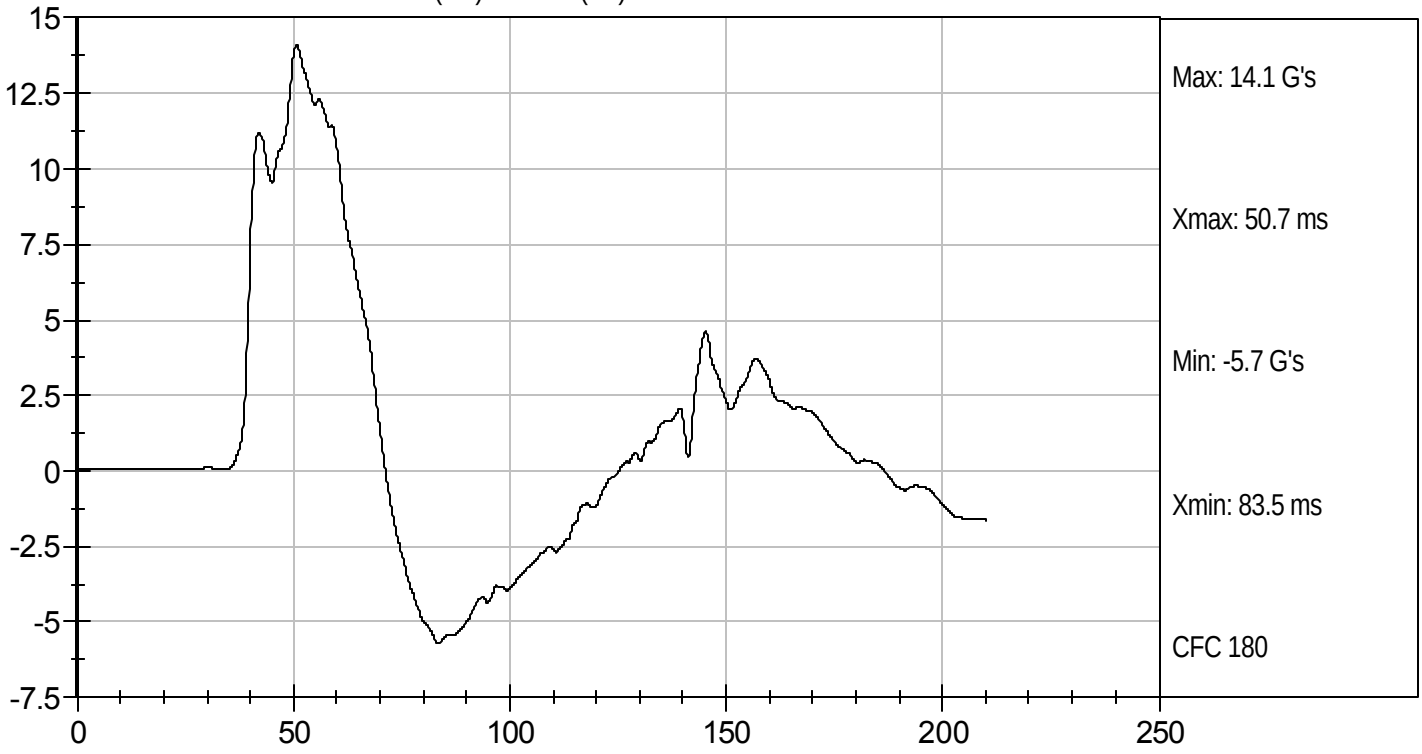
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



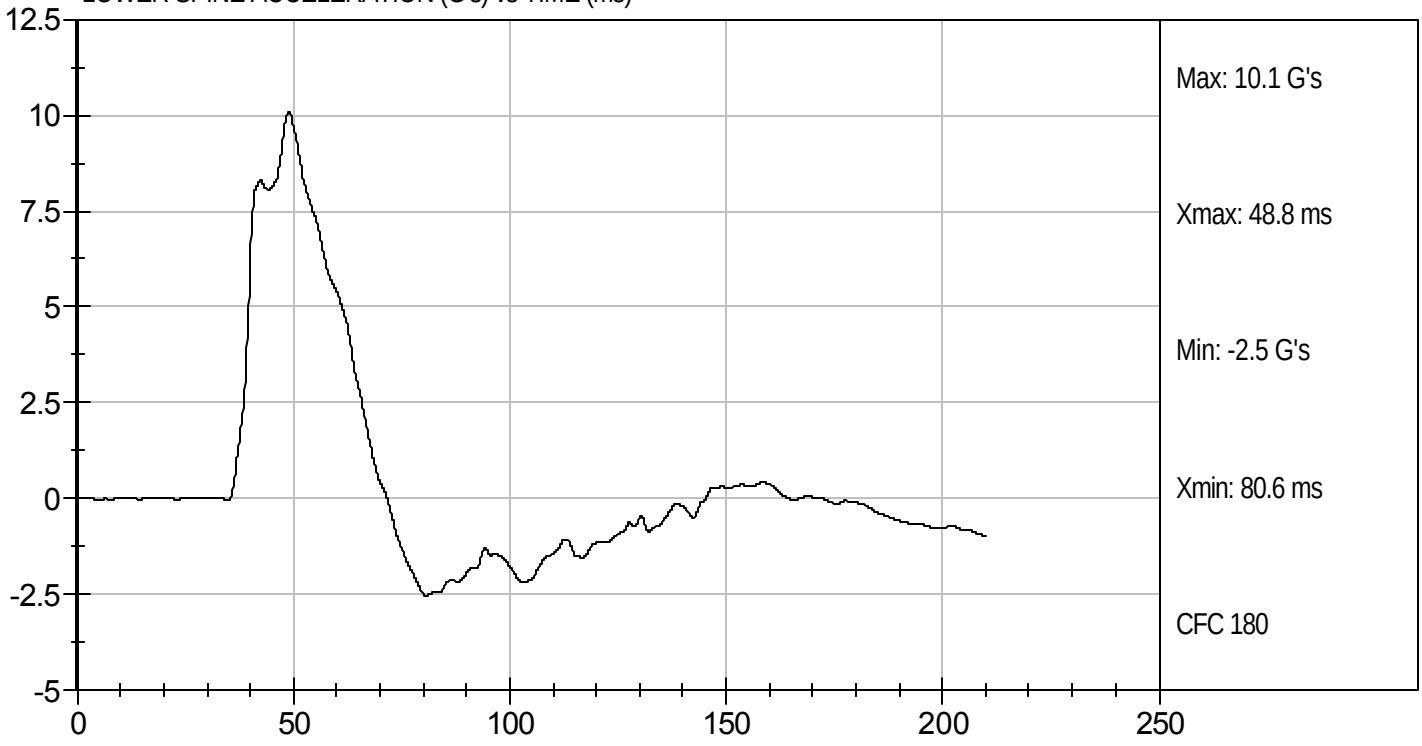
Test Desc: Thorax Without Arm
Component ID: D11755

Test Date: 3/1/11
Velocity: 14.25 ft/s, 4.34 m/s

UPPER SPINE ACCELERATION (G's) vs TIME (ms)



LOWER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D11756

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Humidity	%	10 to 70	18	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor Acceleration	G's	12 to 16	14	Pass
Upper Rib Displacement	mm	36 to 47	40	Pass
Lower Rib Displacement	mm	33 to 44	37	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

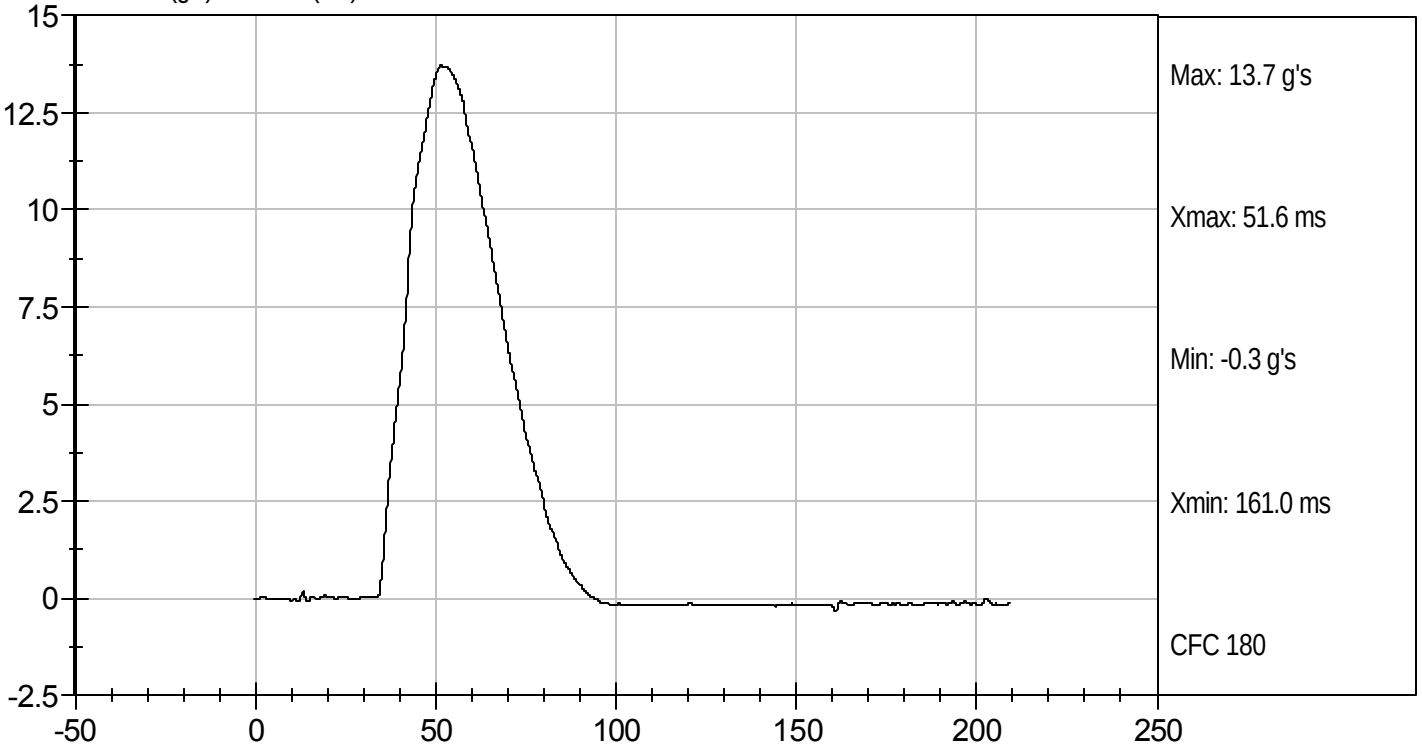
3/1/11
Test Date

David Winkelbauer
Approved By

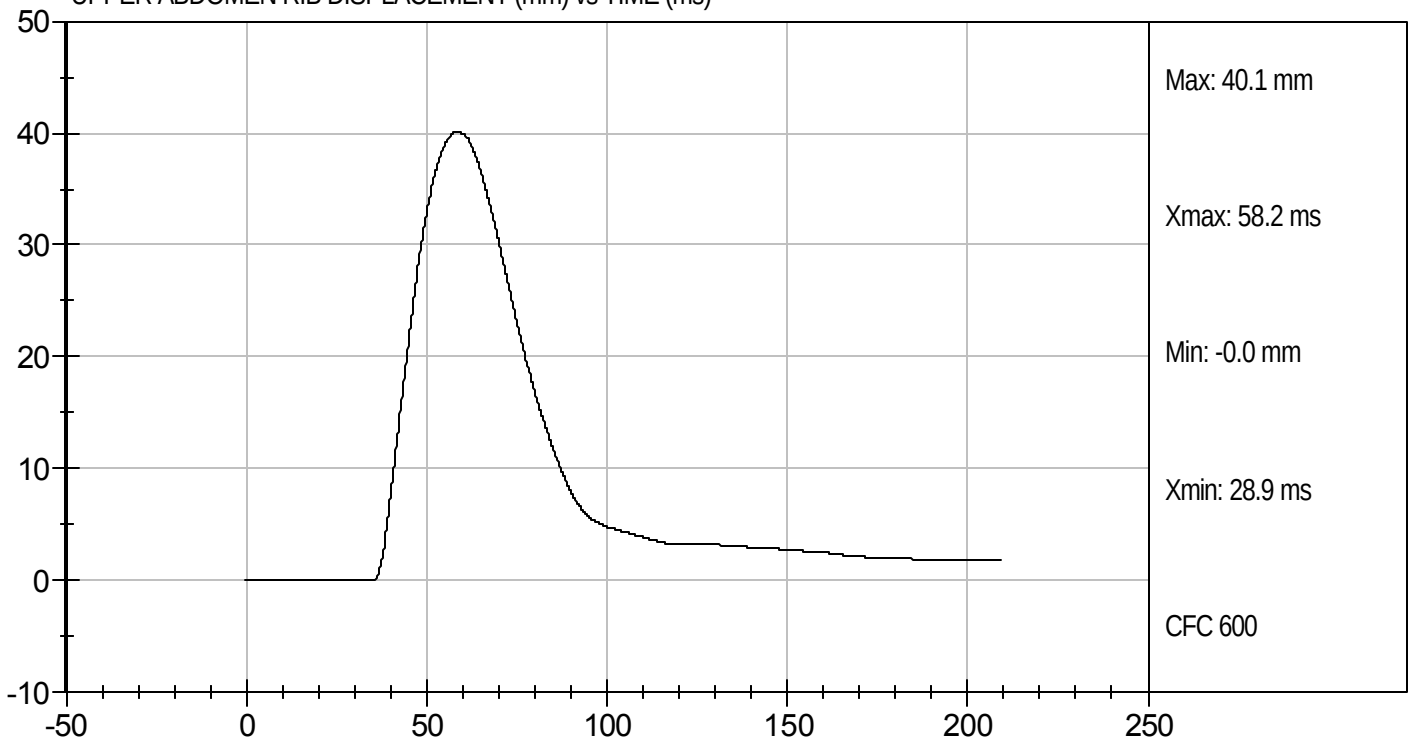
Test Desc: Abdomen Impact
Component ID: D11756

Test Date: 3/1/11
Velocity: 14.37 ft/s, 4.38 m/s

PROBE (g's) vs TIME (ms)



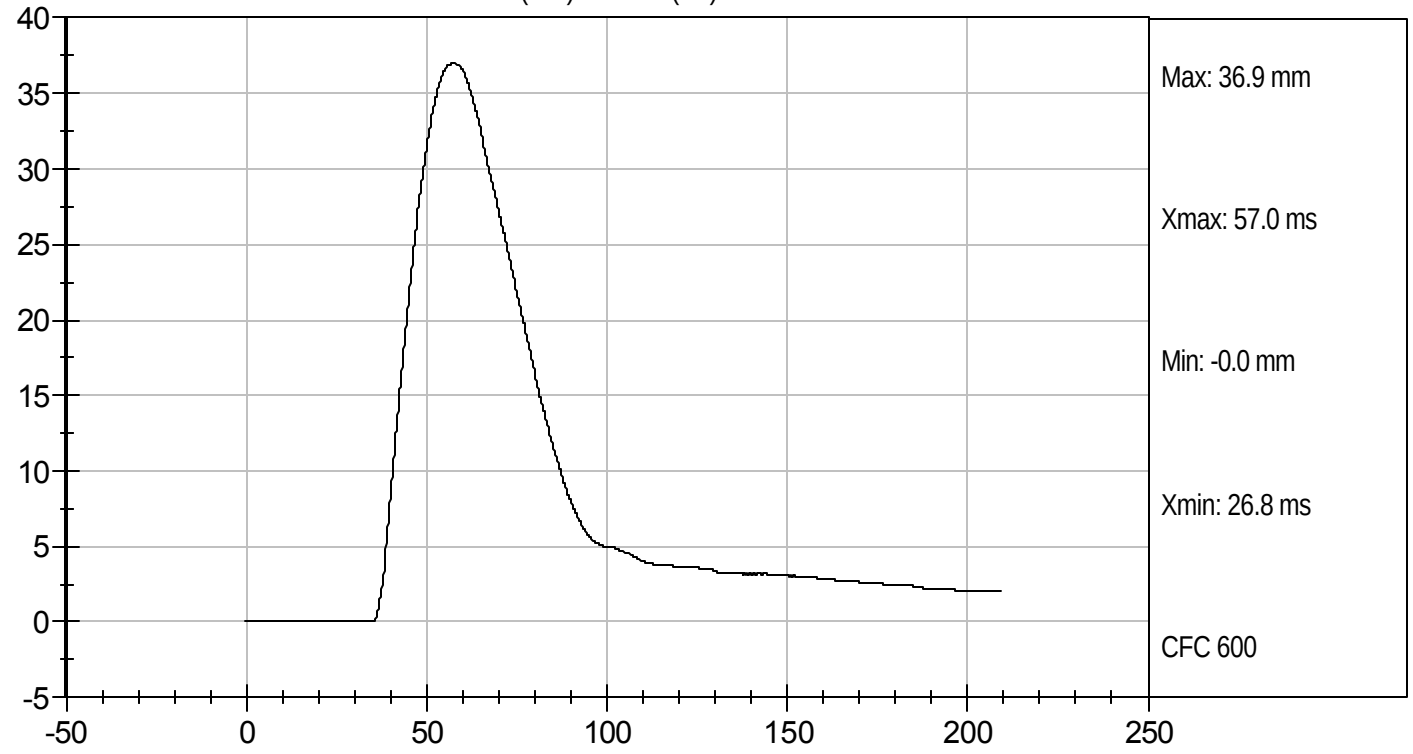
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



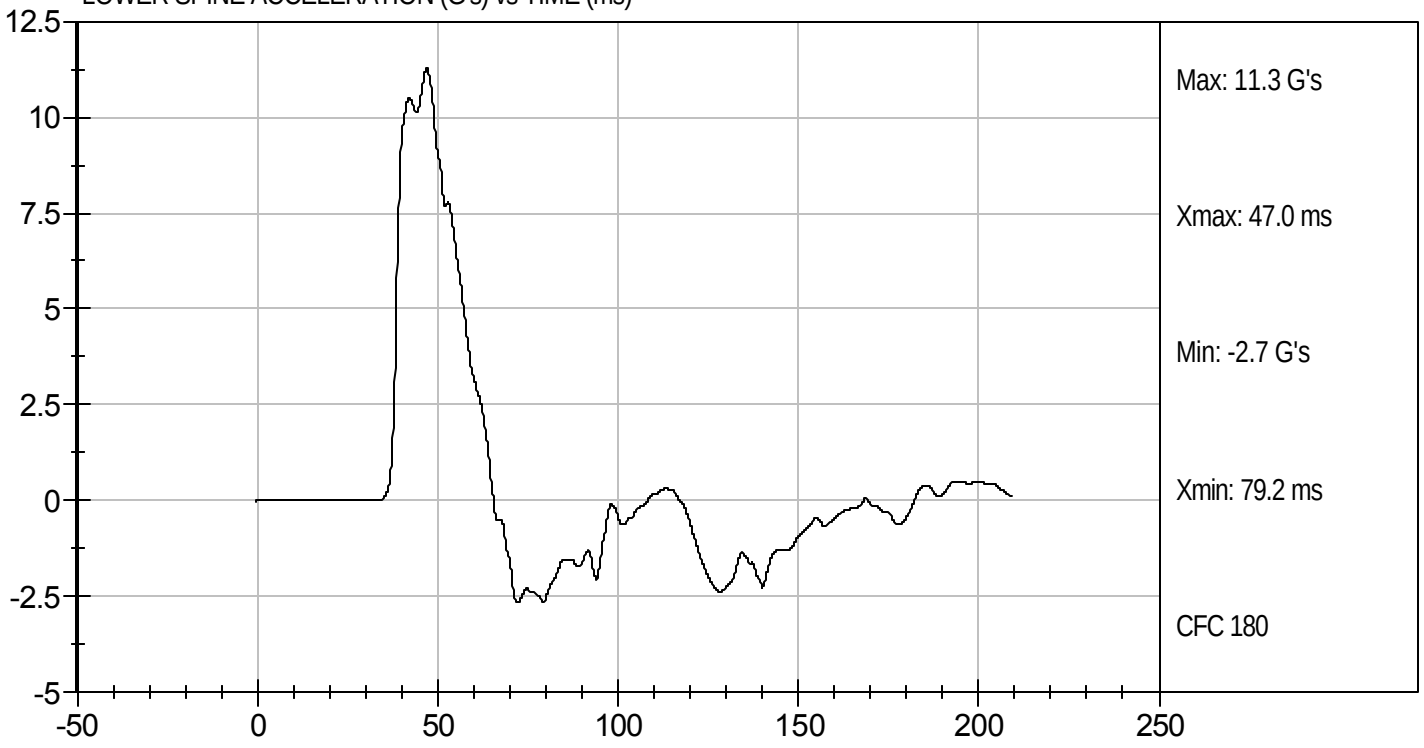
Test Desc: Abdomen Impact
Component ID: D11756

Test Date: 3/1/11
Velocity: 14.37 ft/s, 4.38 m/s

LOWER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D11757

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	18	Pass
Impact Velocity	m/s	6.60 to 6.80	6.70	Pass
Peak Impactor Acceleration	G's	38 to 47	41	Pass
Pelvis Y Acceleration after 6 ms	G's	34 to 42	40	Pass
Peak Acetabulum Force	N	3600 to 4300	4299	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

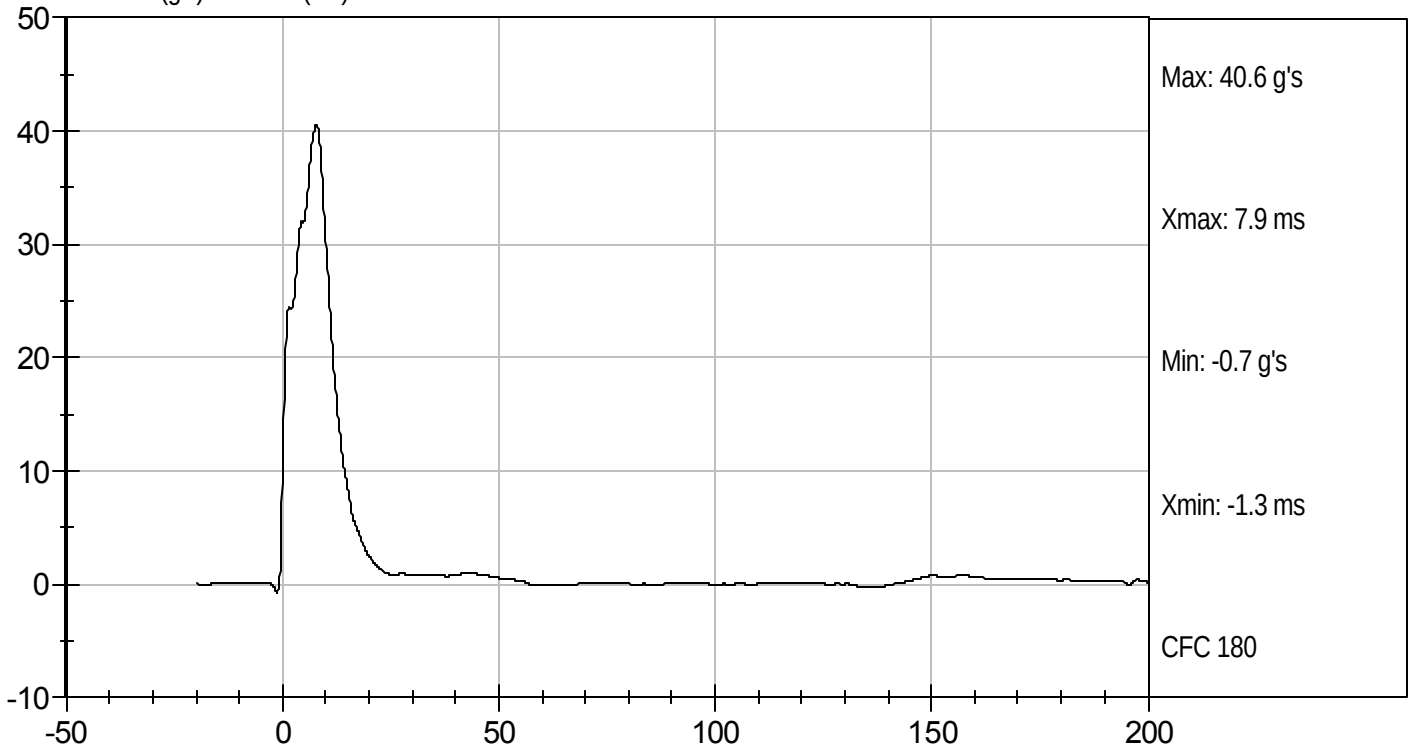
3/1/11
Test Date

David Winkelbauer
Approved By

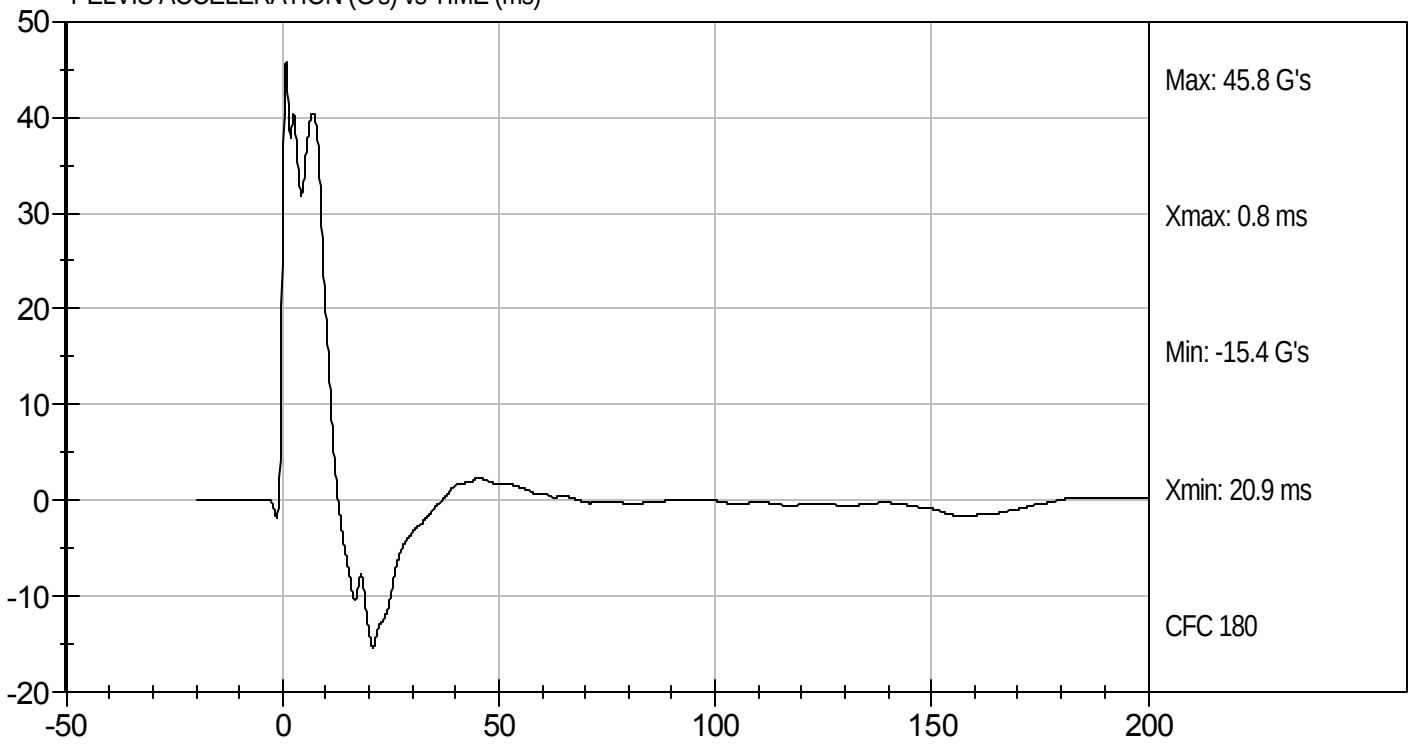
Test Desc: Pelvis Impact
Component ID: D11757

Test Date: 3/1/11
Velocity: 21.99 ft/s, 6.70 m/s

PROBE (g's) vs TIME (ms)

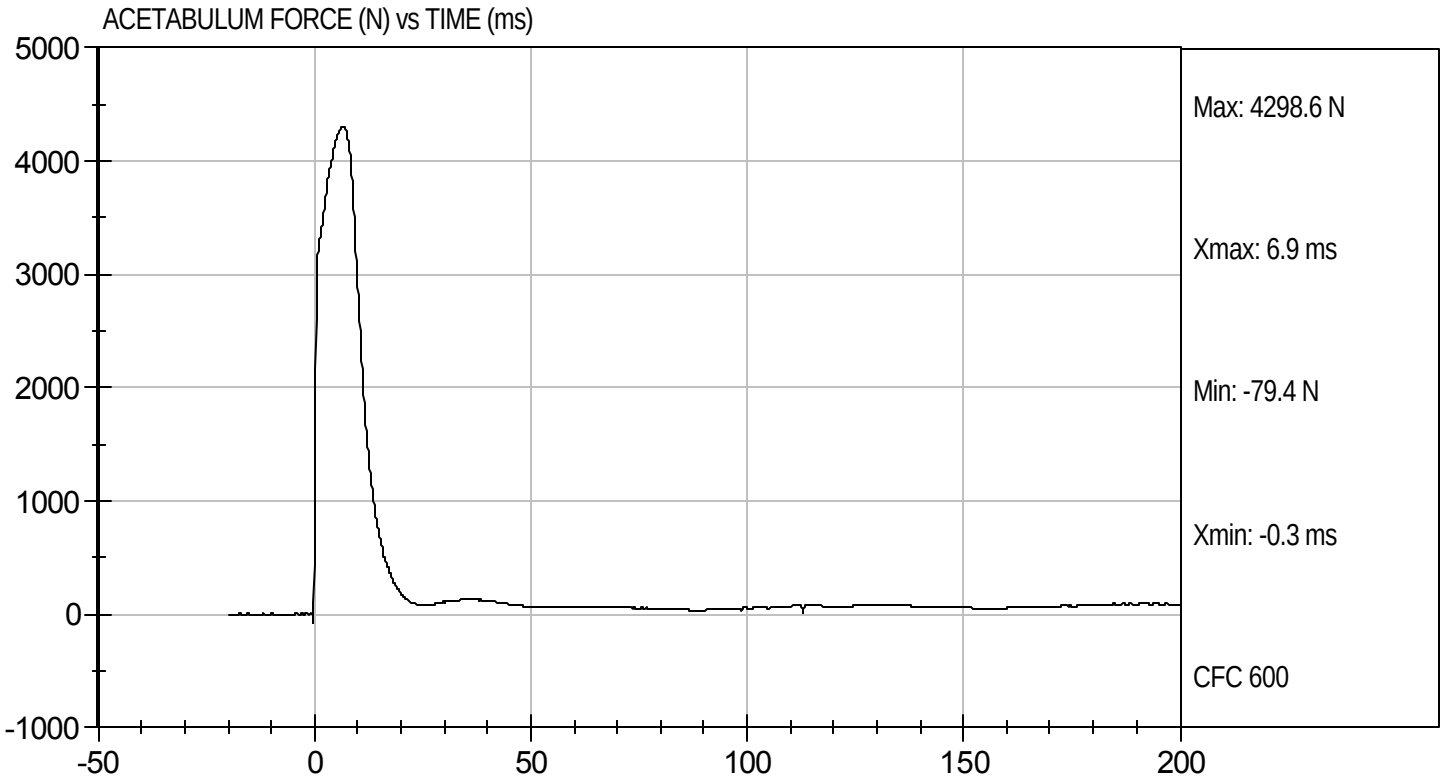


PELVIS ACCELERATION (G's) vs TIME (ms)



Test Desc: Pelvis Impact
Component ID: D11757

Test Date: 3/1/11
Velocity: 21.99 ft/s, 6.70 m/s



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D11758

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Humidity	%	10 to 70	18	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor Acceleration	G's	36 to 45	36	Pass
Pelvis Y Acceleration	G's	28 to 39	29	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4448	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

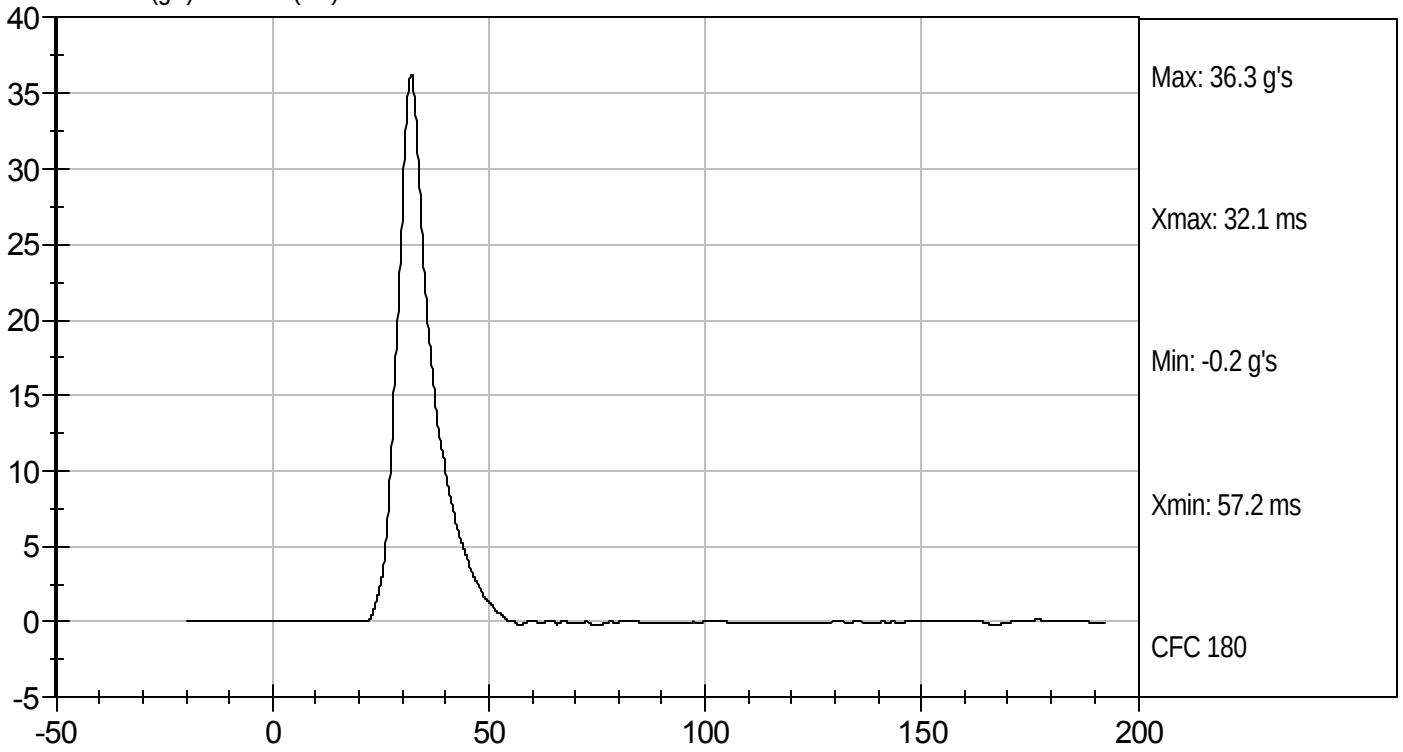
3/1/11
Test Date

David Winkelbauer
Approved By

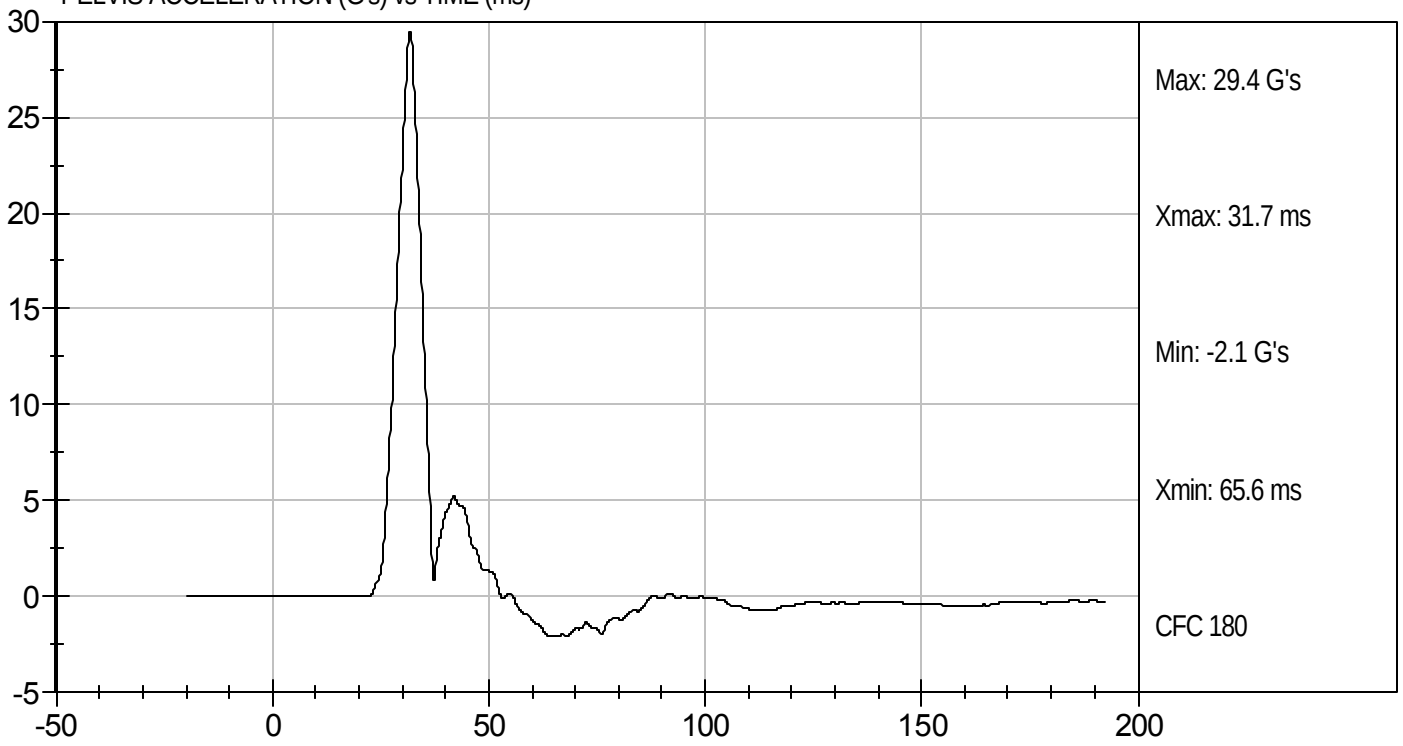
Test Desc: Iliac Impact
Component ID: D11758

Test Date: 3/1/11
Velocity: 14.37 ft/s, 4.38 m/s

PROBE (g's) vs TIME (ms)

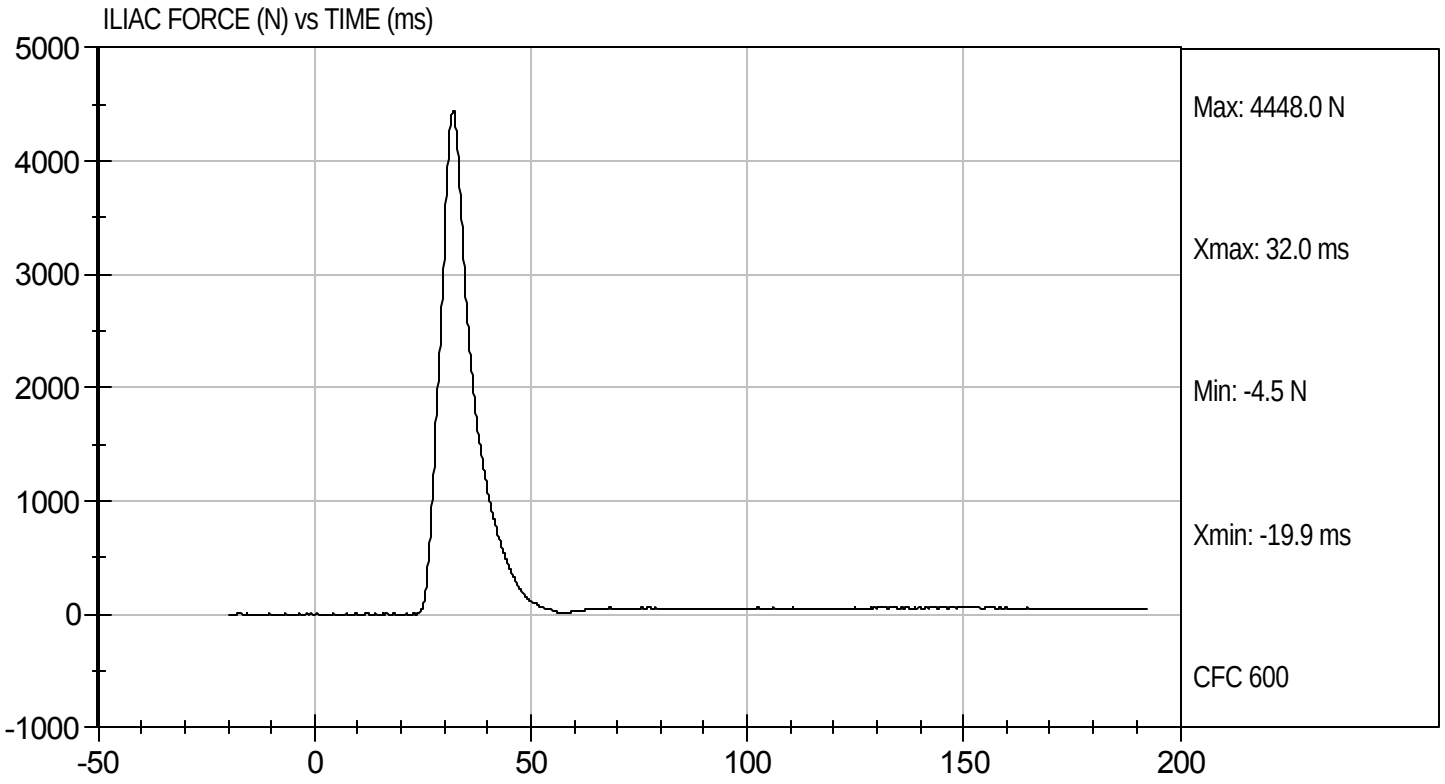


PELVIS ACCELERATION (G's) vs TIME (ms)



Test Desc: Iliac Impact
Component ID: D11758

Test Date: 3/1/11
Velocity: 14.37 ft/s, 4.38 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D111701

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Peak Resultant Acceleration	G's	115 to 137	128	Pass
Peak Lateral Acceleration	G's	+/- 15	-2.8	Pass
Unimodal	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

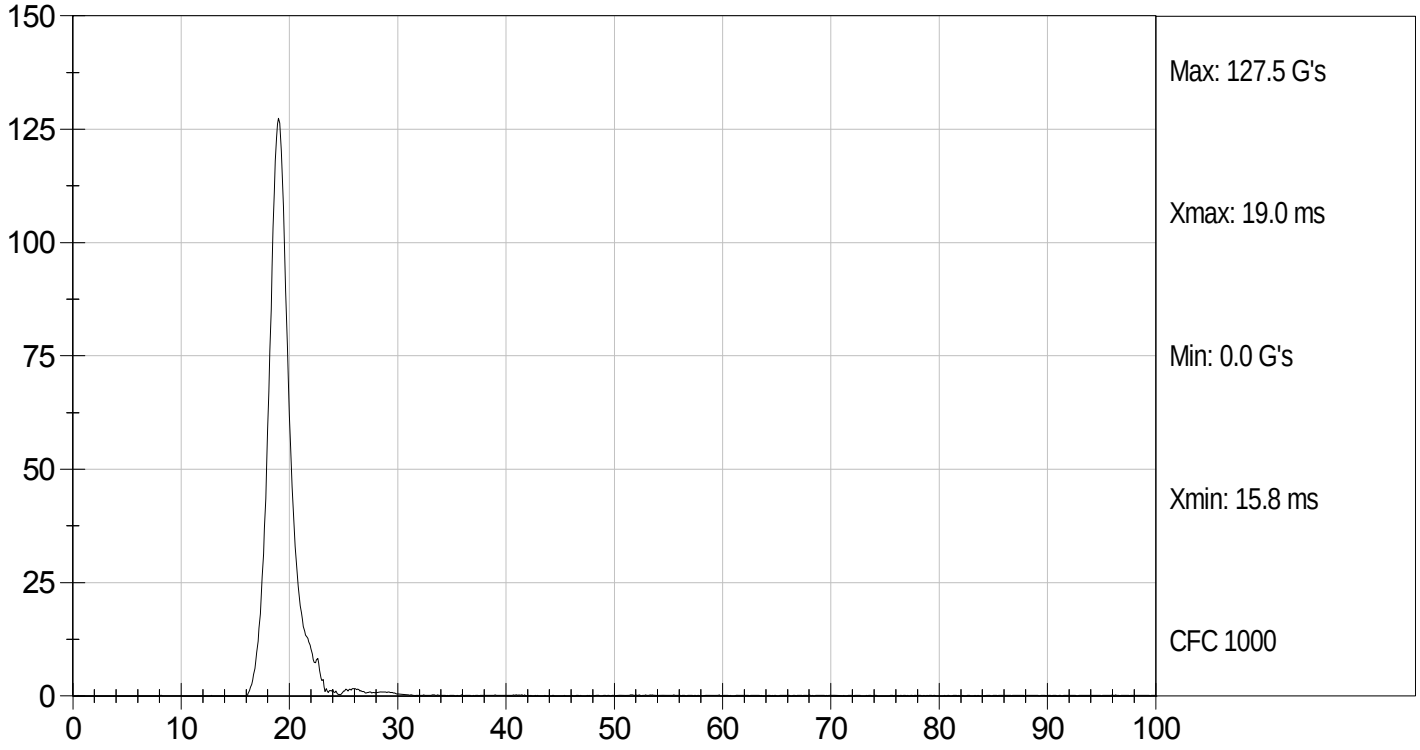
5/9/11
Test Date

David Winkelbauer
Approved By

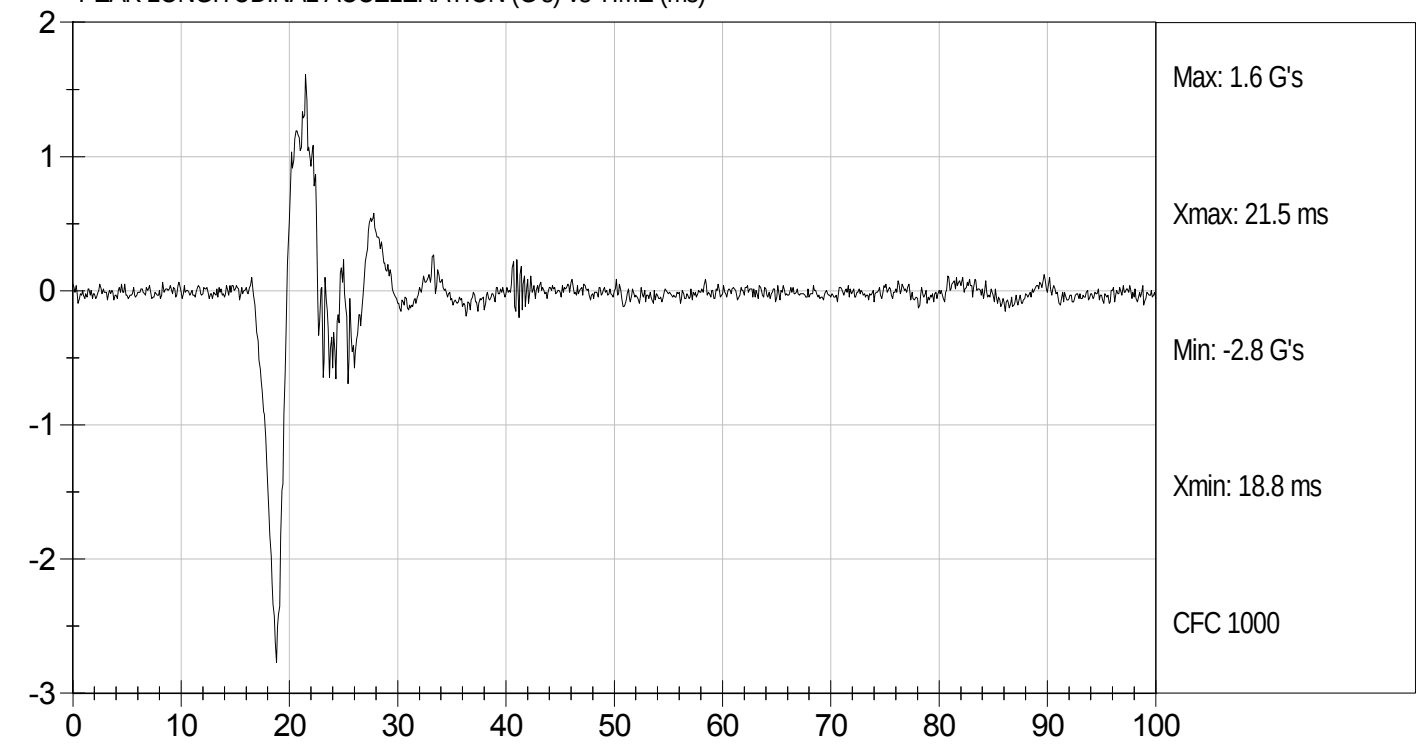
Test Desc: Head Drop
Component ID: D111701

Test Date: 5/9/11
Velocity: 0 ft/s, 0 m/s

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



PEAK LONGITUDINAL ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D111702

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.9	Pass
Humidity		%	10 to 70	31	Pass
Impact Velocity		m/s	5.51 to 5.63	5.52	Pass
Delta Velocity	10 ms	m/s	2.20 to 2.80	2.47	Pass
	15 ms	m/s	3.30 to 4.10	3.47	Pass
	20 ms	m/s	4.40 to 5.40	4.59	Pass
	25 ms	m/s	5.40 to 6.10	5.48	Pass
	25-100 ms	m/s	5.50 to 6.20	5.87	Pass
Maximum D-Plane Rotation		deg	71 to 81	75	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	60	Pass
Maximum Occipital Condyle Moment during Rotation Interval		Nm	-44 to -36	-40	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	121	Pass
			Overall Test Results		Pass

Jessica Gall
Laboratory Technician

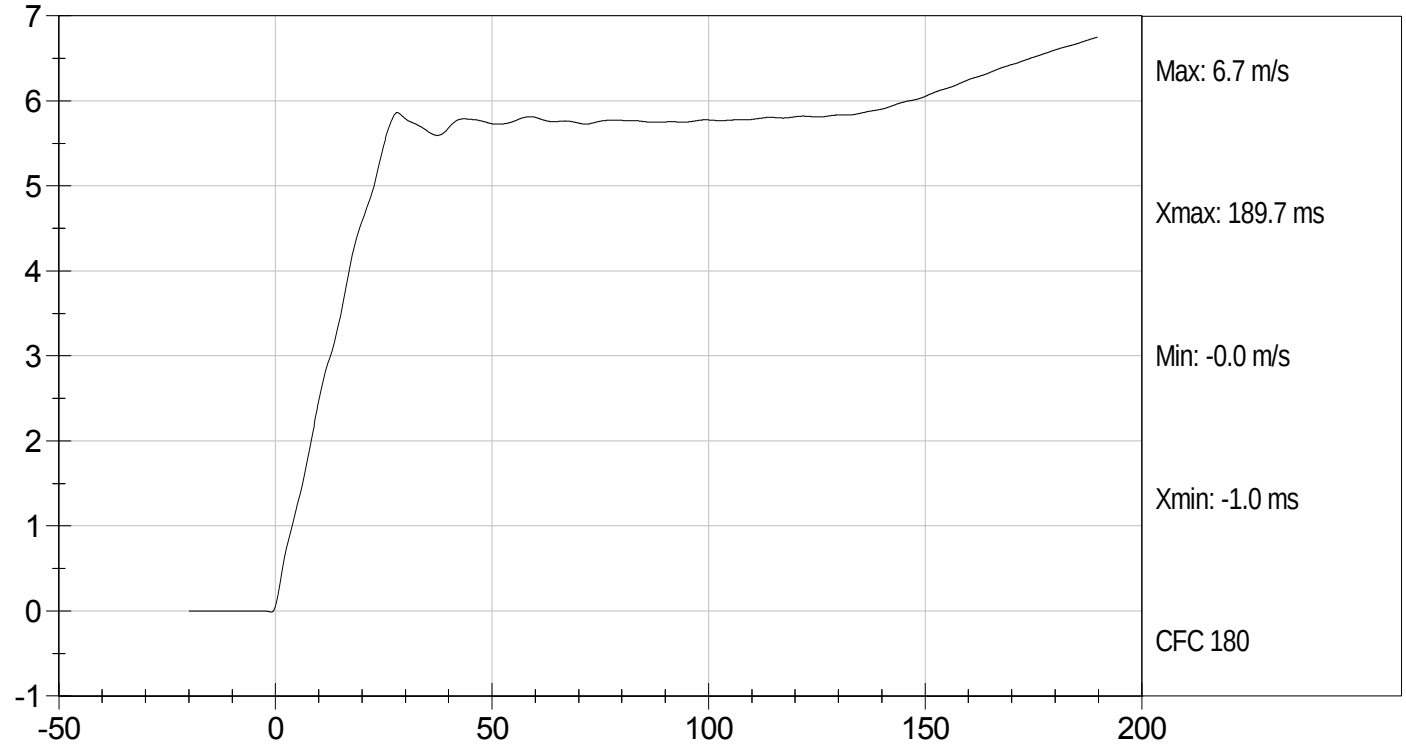
5/9/11
Test Date

David Winkelbauer
Approved By

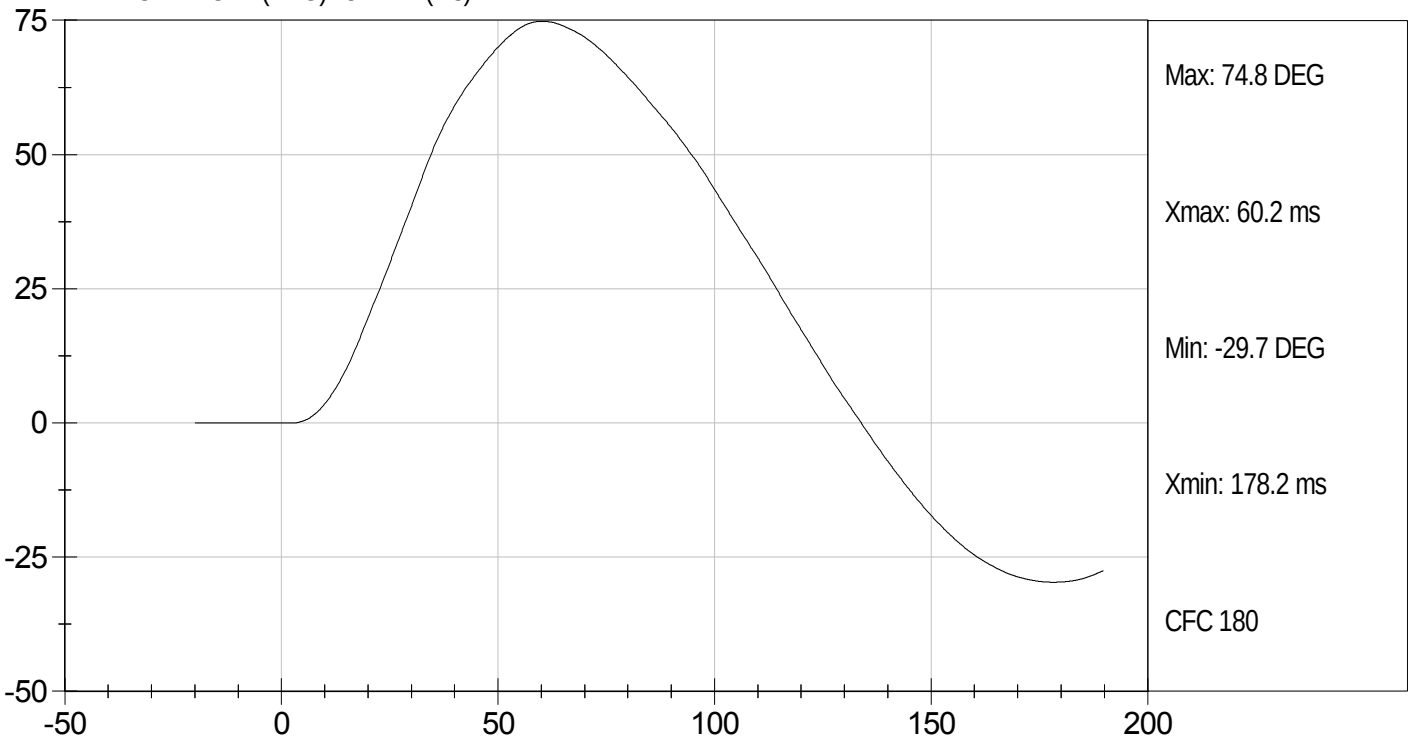
Test Desc: Neck Bending
Component ID: D111702

Test Date: 5/9/11
Velocity: 18.12 ft/s, 5.52 m/s

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

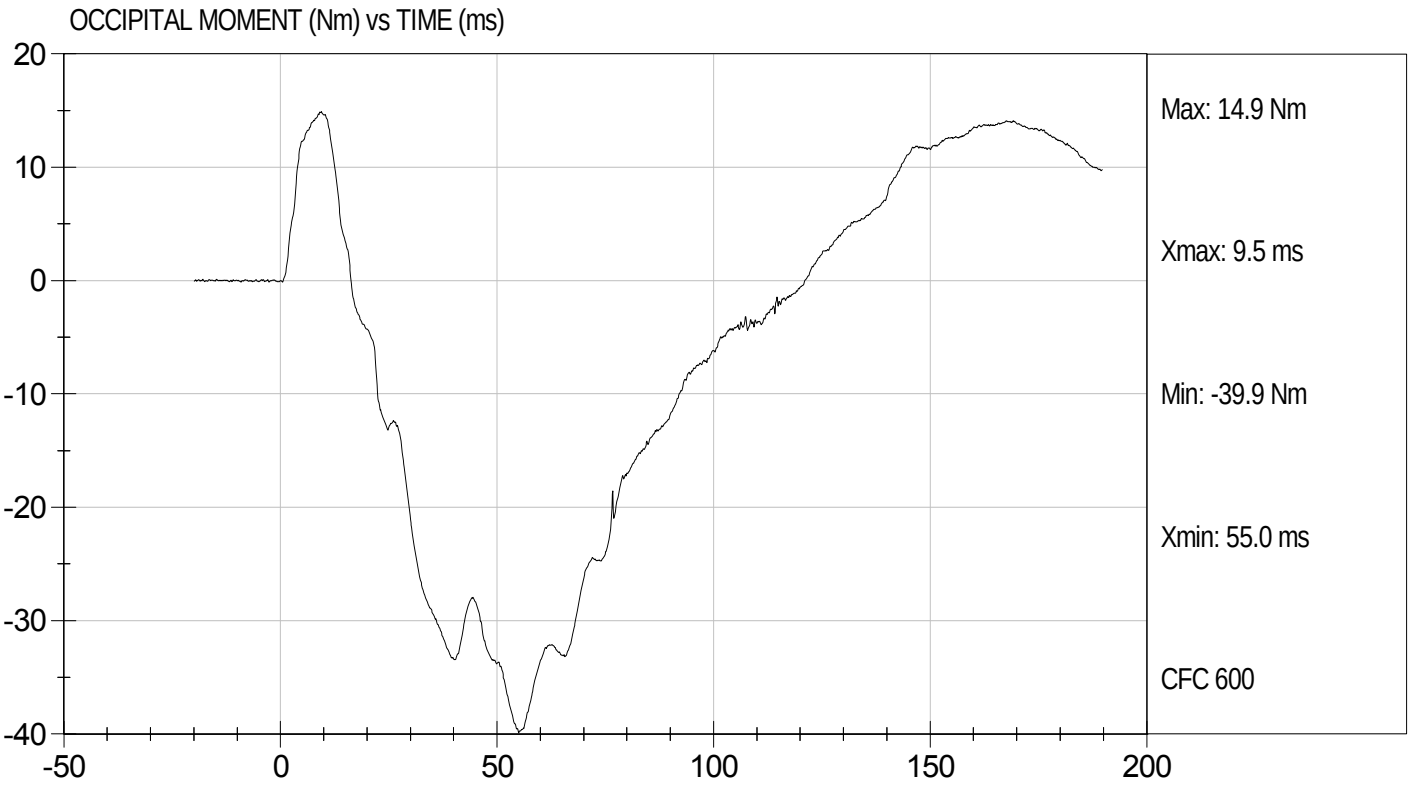


FLEXION ANGLE (DEG) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D111702

Test Date: 5/9/11
Velocity: 18.12 ft/s, 5.52 m/s



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D111703

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	35	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	32	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
		Overall Test Results		Pass

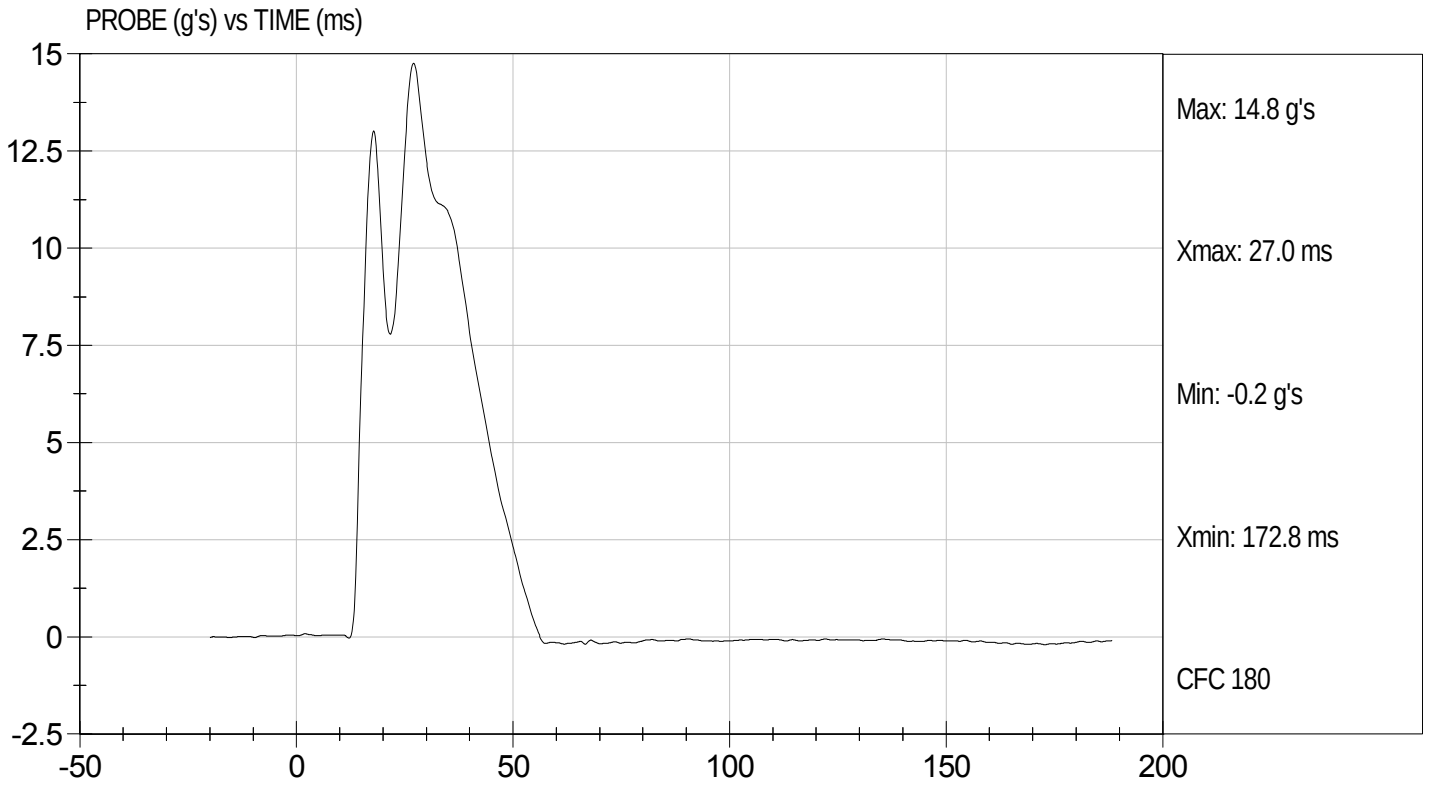
Jessica Hall
Laboratory Technician

5/9/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D111703

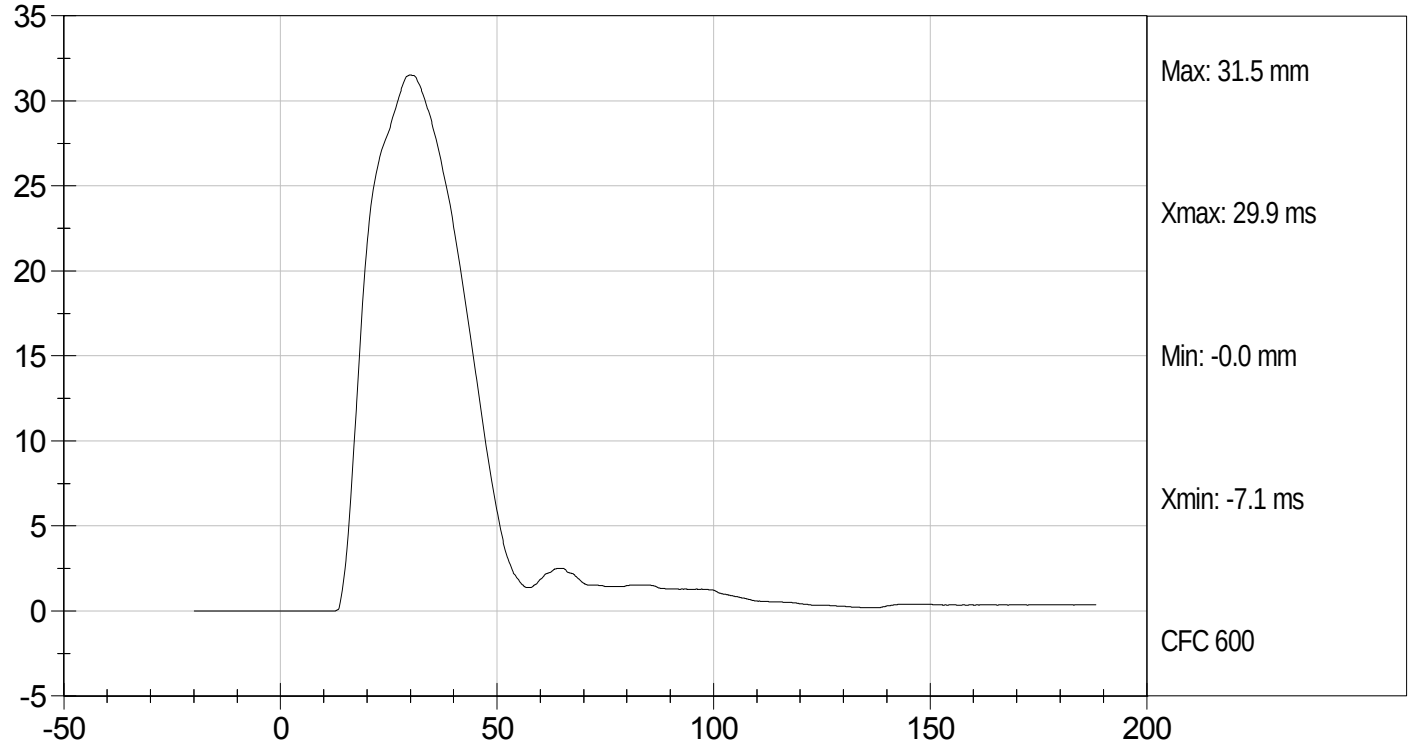
Test Date: 5/9/11
Velocity: 14.37 ft/s, 4.38 m/s



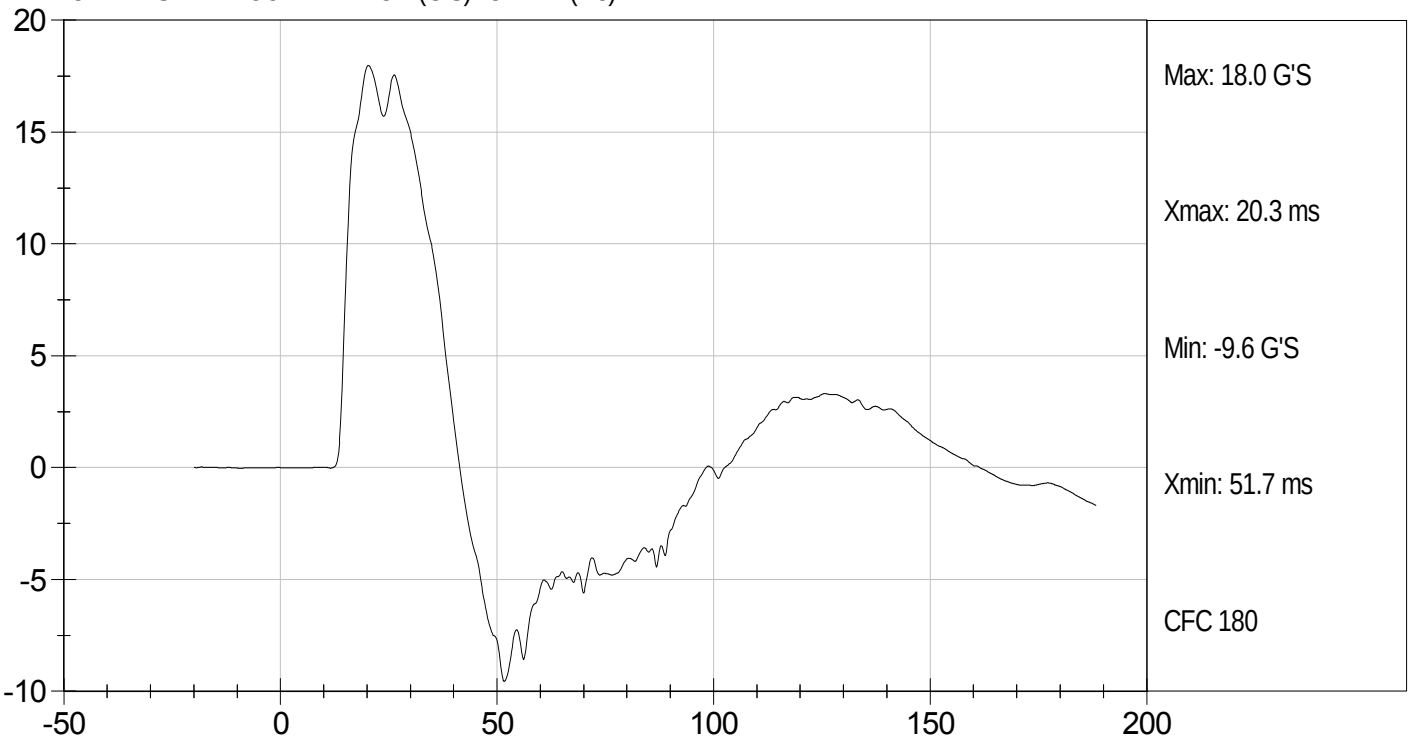
Test Desc: Shoulder Impact
Component ID: D111703

Test Date: 5/9/11
Velocity: 14.37 ft/s, 4.4 m/s

SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER SPINE ACCELERATION (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D111704

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	34	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Peak Impactor Acceleration	G's	30 to 36	32	Pass
Shoulder Displacement	mm	31 to 40	37	Pass
Upper Rib Displacement	mm	25 to 32	31	Pass
Middle Rib Displacement	mm	30 to 36	32	Pass
Lower Rib Displacement	mm	32 to 38	33	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	36	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	34	Pass
		Overall Test Results		Pass

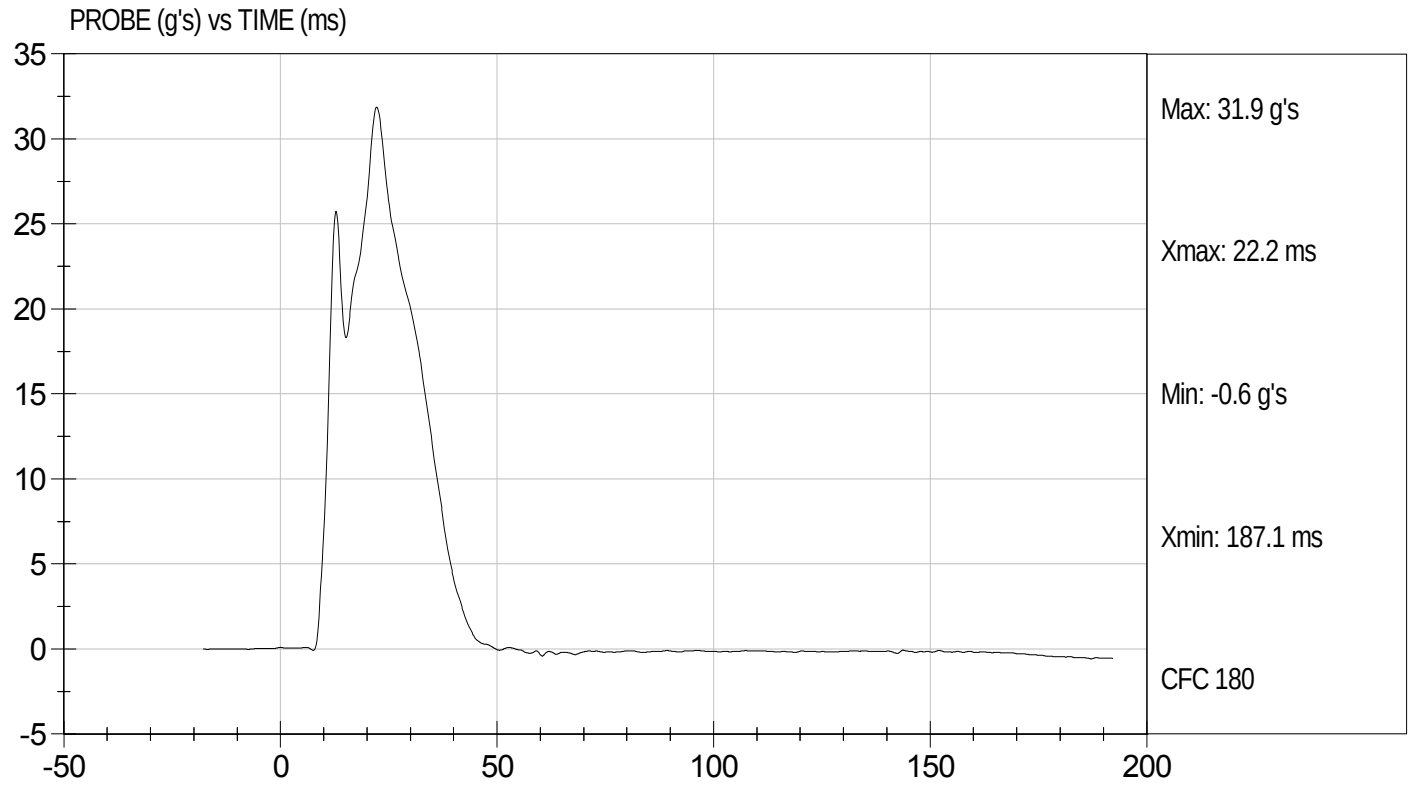
Jessica Gall
Laboratory Technician

5/9/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax With Arm
Component ID: D111704

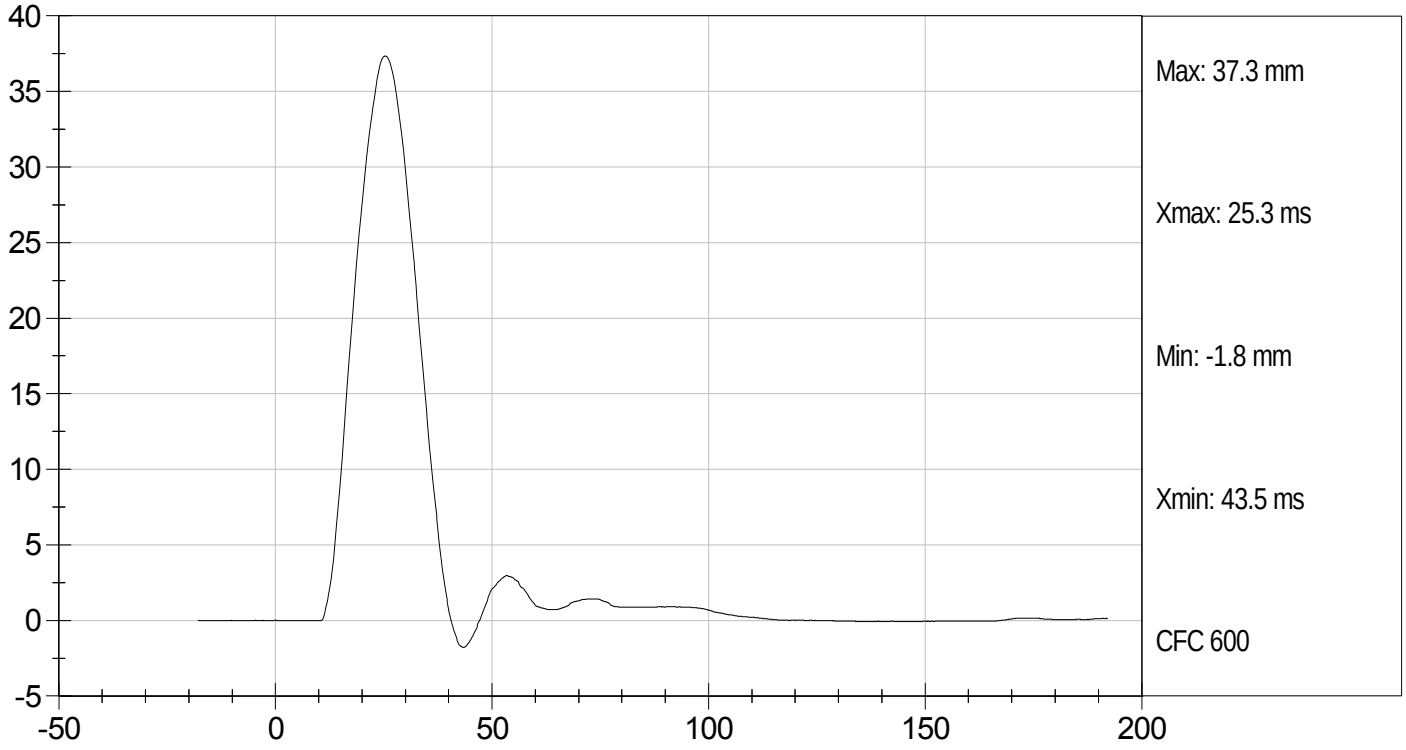
Test Date: 5/9/11
Velocity: 22.22 ft/s, 6.77 m/s



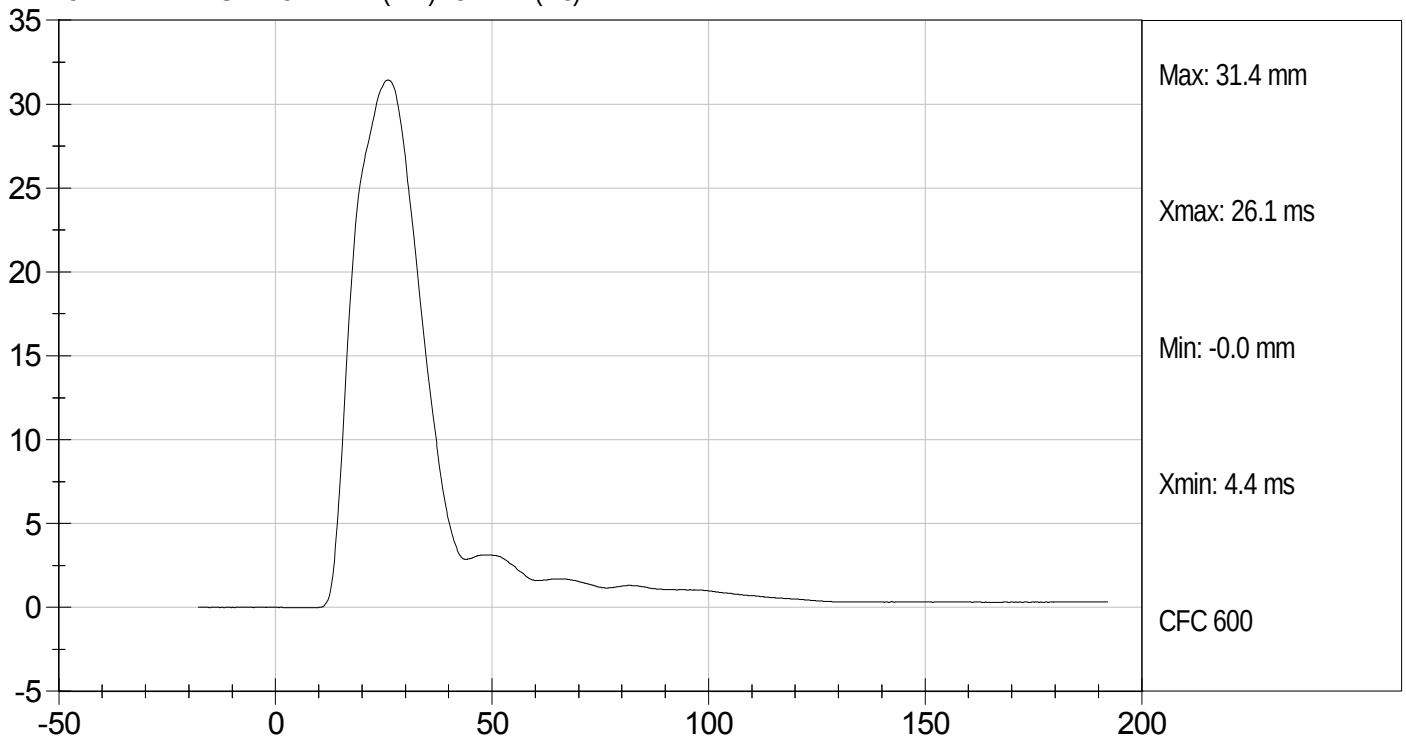
Test Desc: Thorax With Arm
Component ID: D111704

Test Date: 5/9/11
Velocity: 22.22 ft/s, 6.77 m/s

SHOULDER DISPLACEMENT (mm) vs TIME (ms)



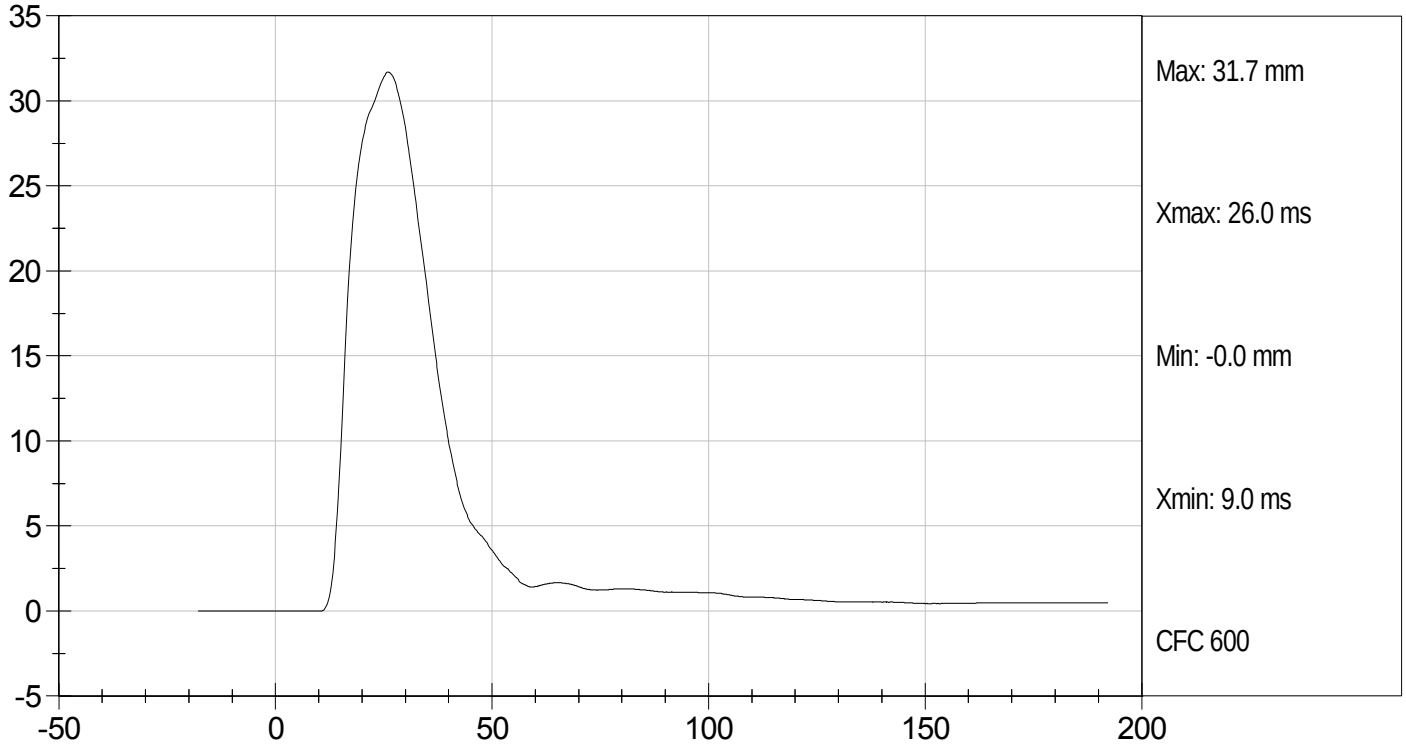
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



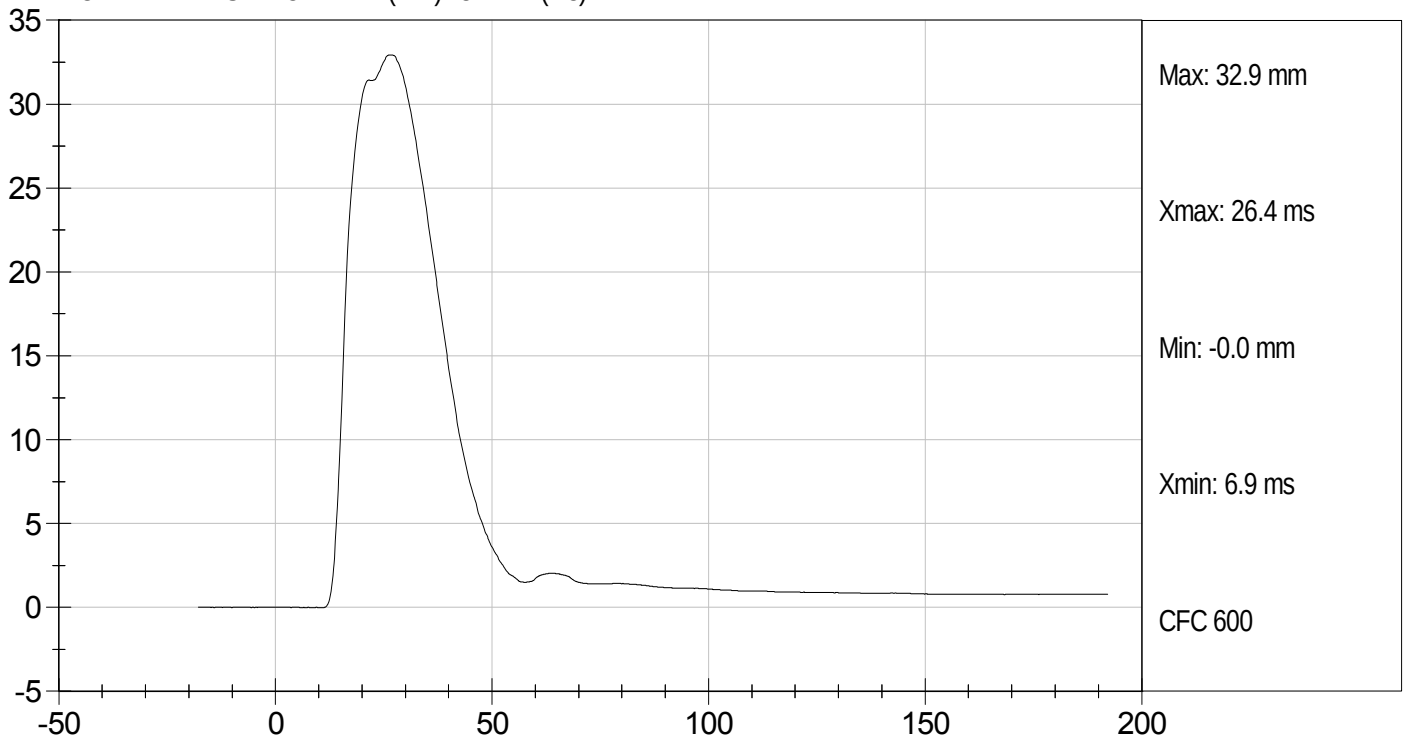
Test Desc: Thorax With Arm
Component ID: D111704

Test Date: 5/9/11
Velocity: 22.22 ft/s, 6.77 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



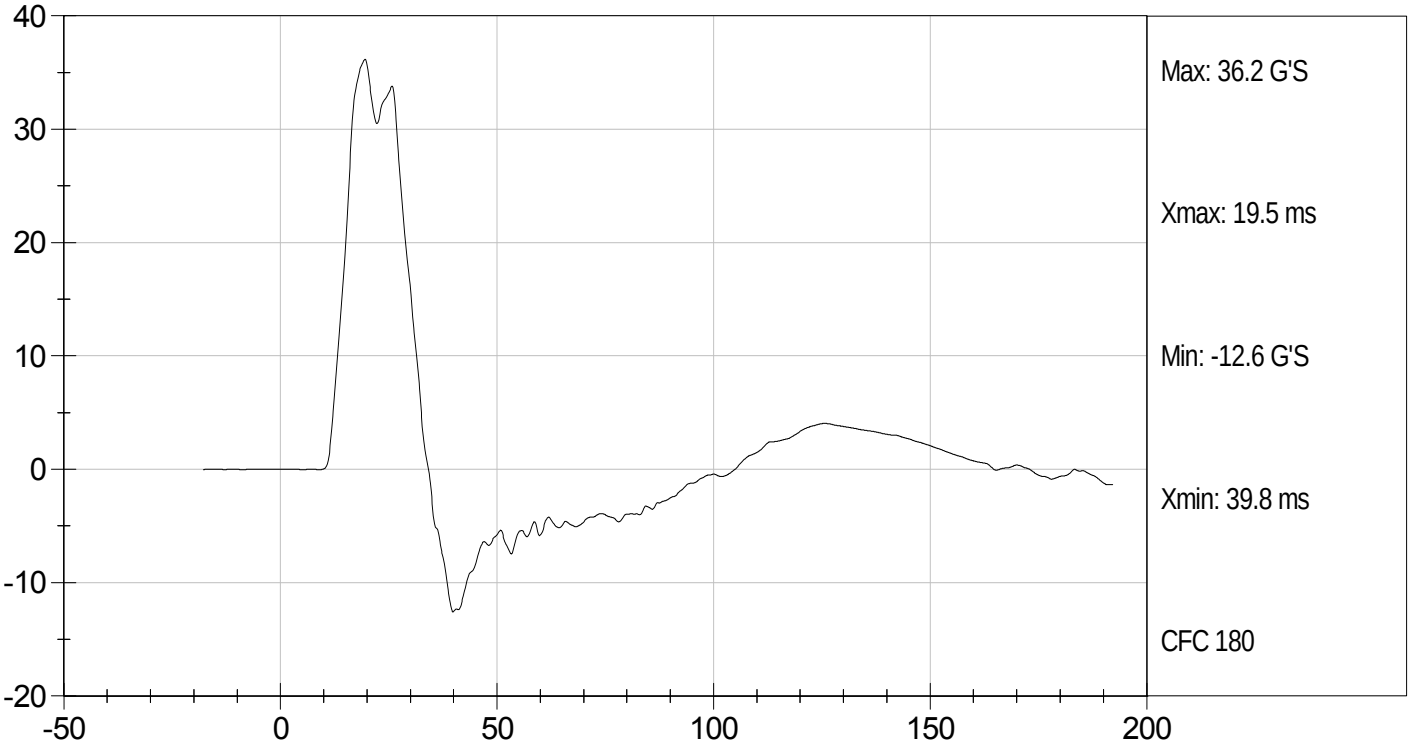
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



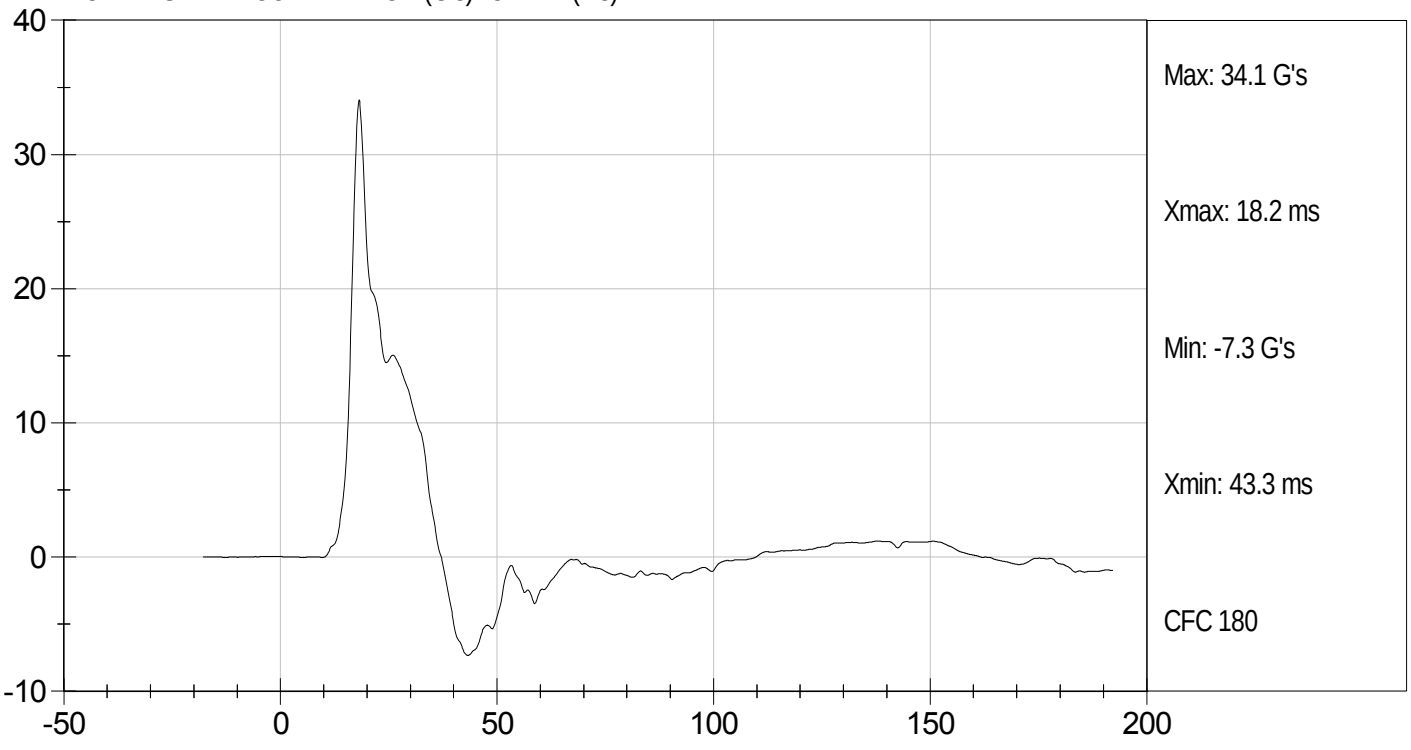
Test Desc: Thorax With Arm
Component ID: D111704

Test Date: 5/9/11
Velocity: 22.22 ft/s, 6.77 m/s

UPPER SPINE ACCELERATION (G'S) vs TIME (ms)



LOWER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D111705

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.0	Pass
Humidity	%	10 to 70	34	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Peak Impactor Force	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	38	Pass
Middle Rib Displacement	mm	39 to 45	42	Pass
Lower Rib Displacement	mm	35 to 43	40	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	13	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

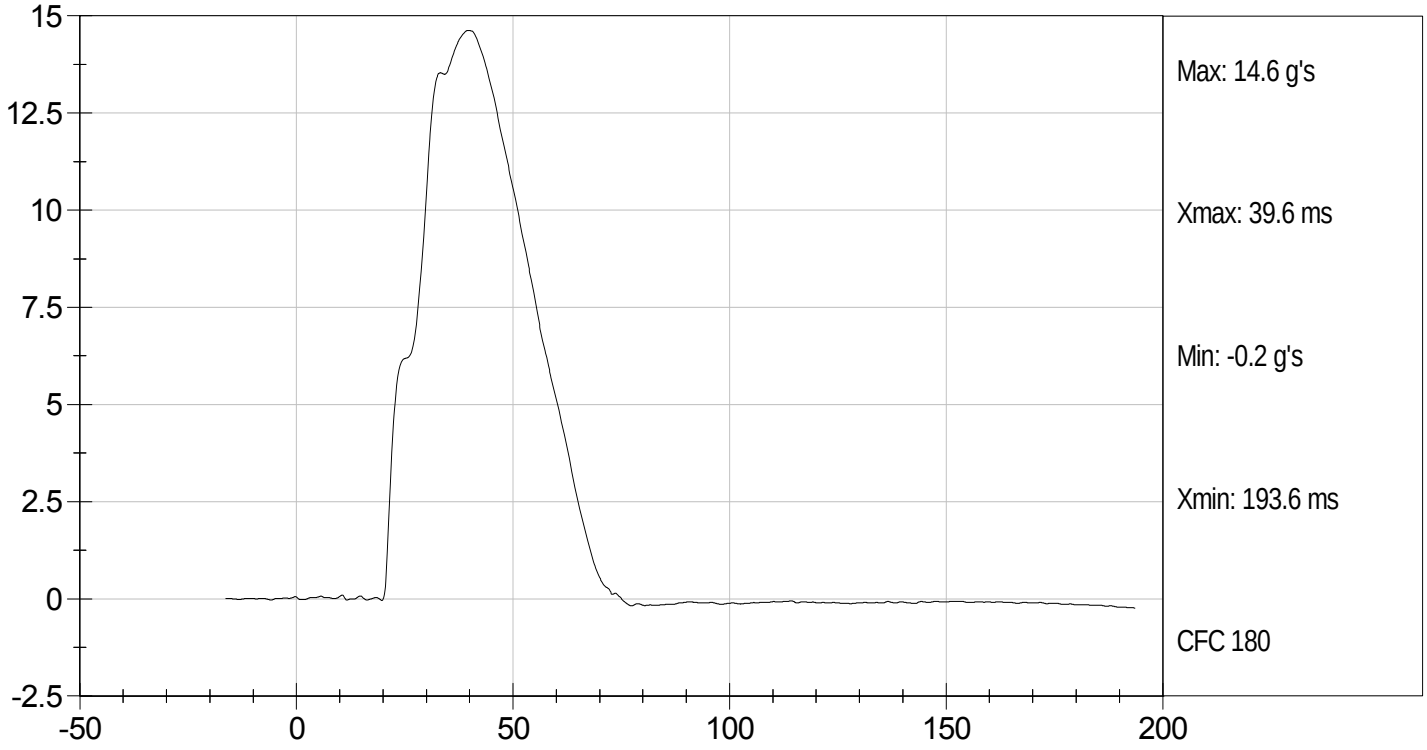
5/9/11
Test Date

David Winkelbauer
Approved By

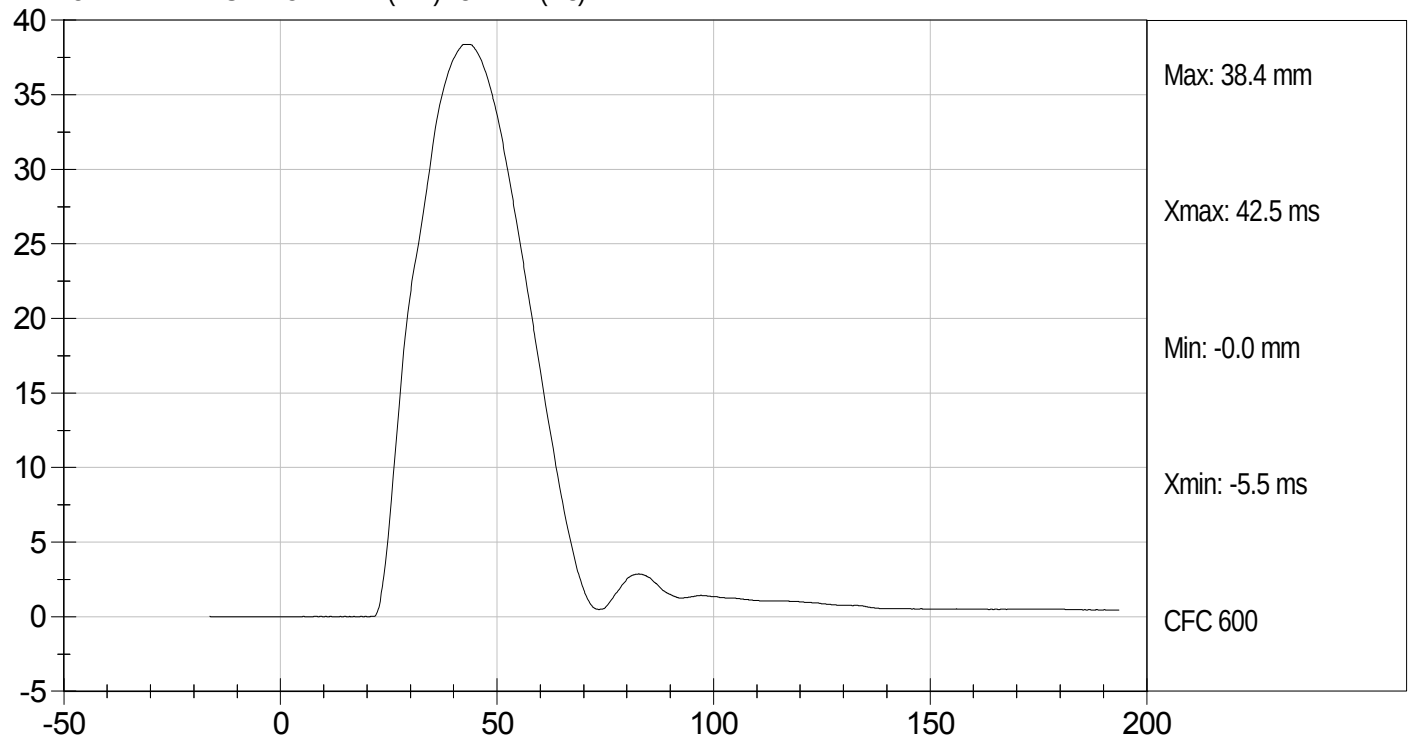
Test Desc: Thorax Without Arm
Component ID: D111705

Test Date: 5/9/11
Velocity: 14.12 ft/s, 4.30 m/s

PROBE (g's) vs TIME (ms)



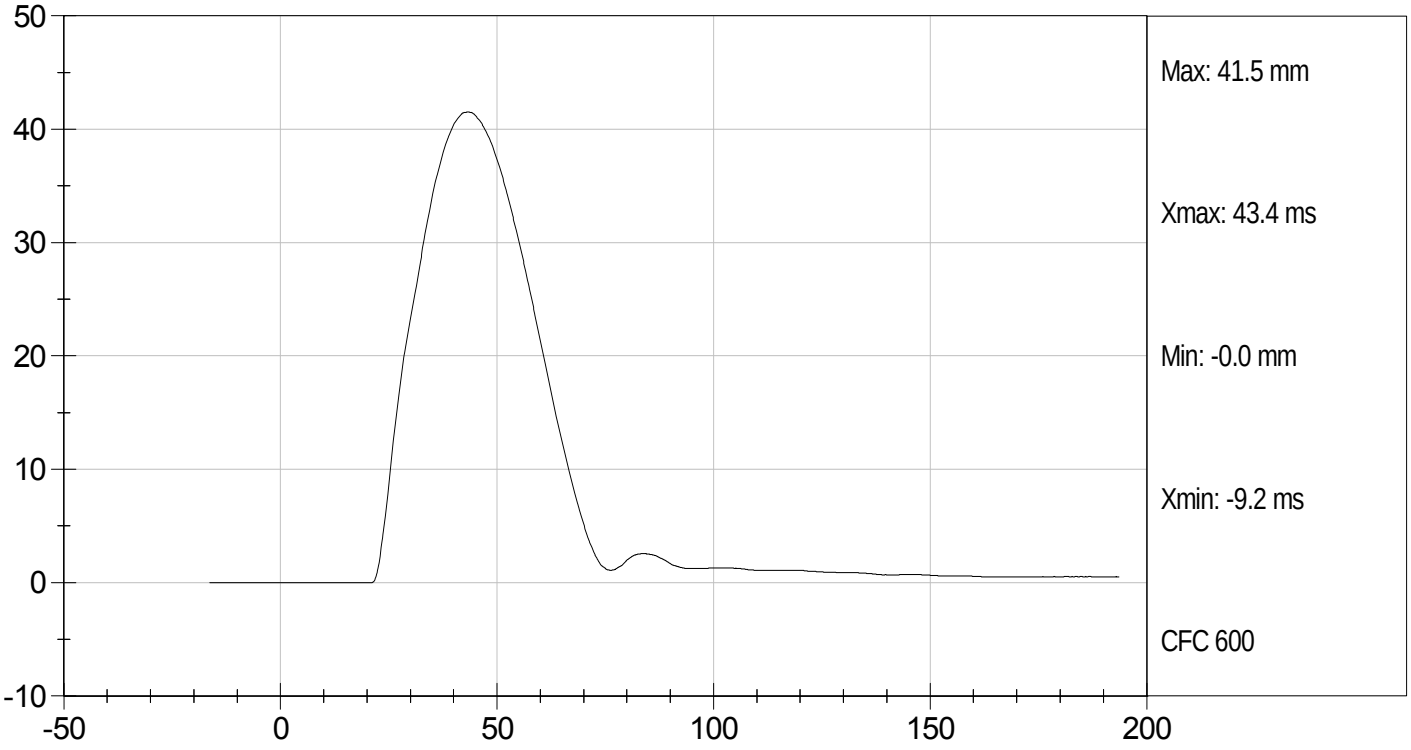
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



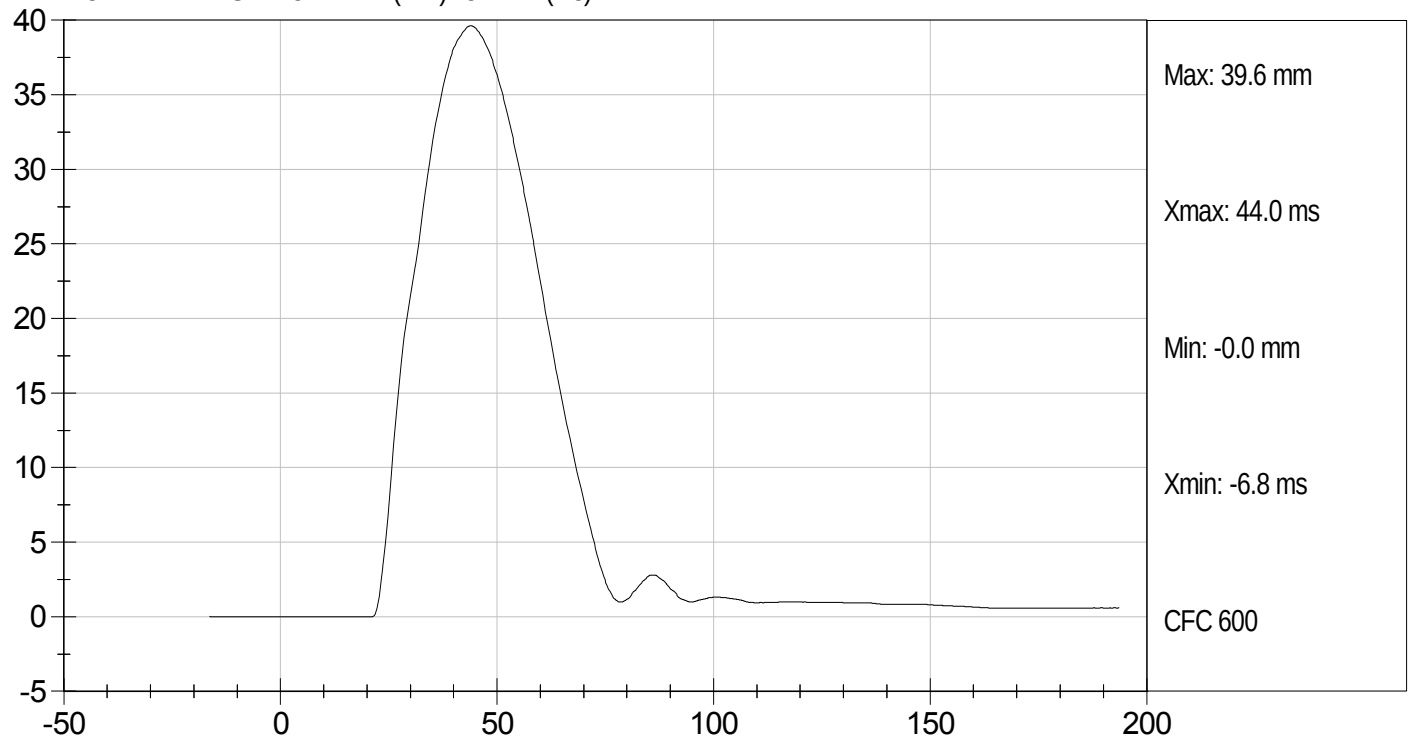
Test Desc: Thorax Without Arm
Component ID: D111705

Test Date: 5/9/11
Velocity: 14.12 ft/s, 4.30 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



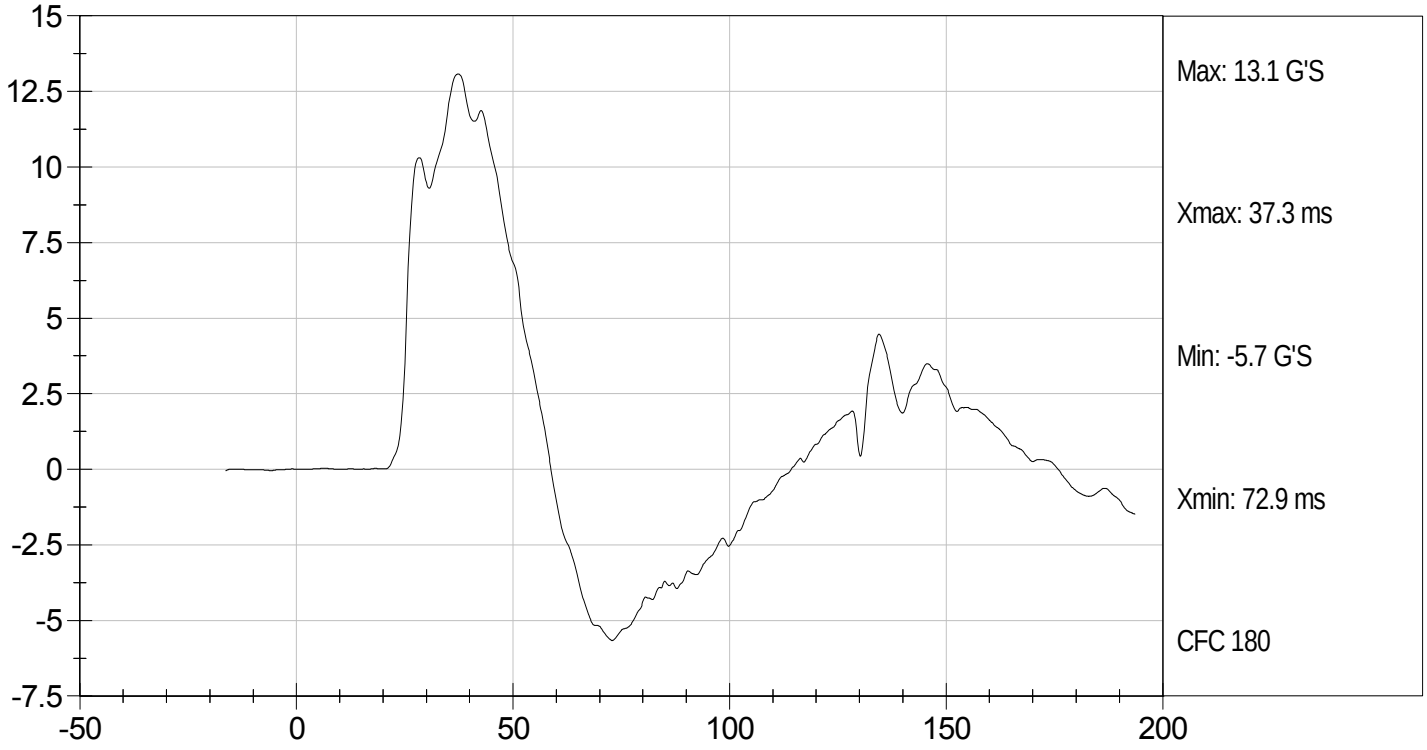
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



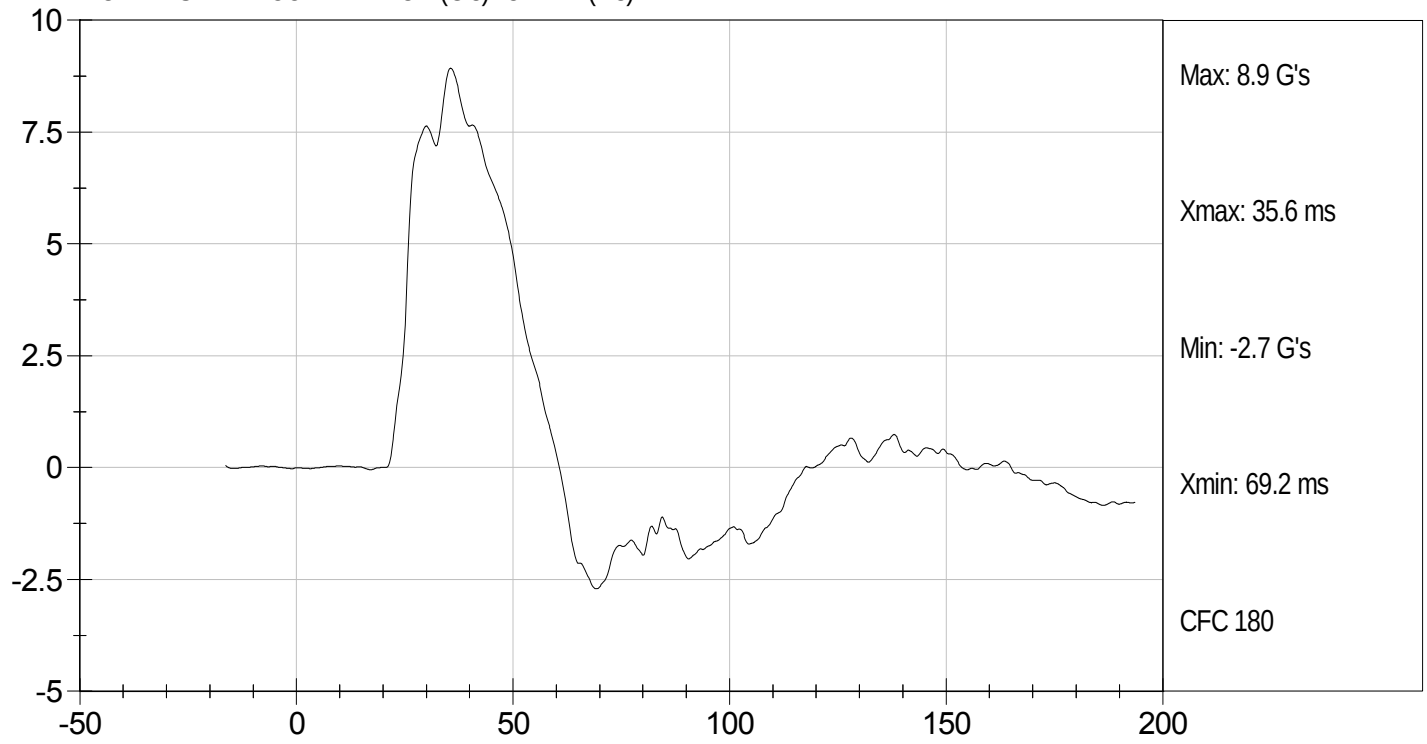
Test Desc: Thorax Without Arm
Component ID: D111705

Test Date: 5/9/11
Velocity: 14.12 ft/s, 4.30 m/s

UPPER SPINE ACCELERATION (G'S) vs TIME (ms)



LOWER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D111706

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	35	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Peak Impactor Acceleration	G's	12 to 16	14	Pass
Upper Rib Displacement	mm	36 to 47	43	Pass
Lower Rib Displacement	mm	33 to 44	35	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	10	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

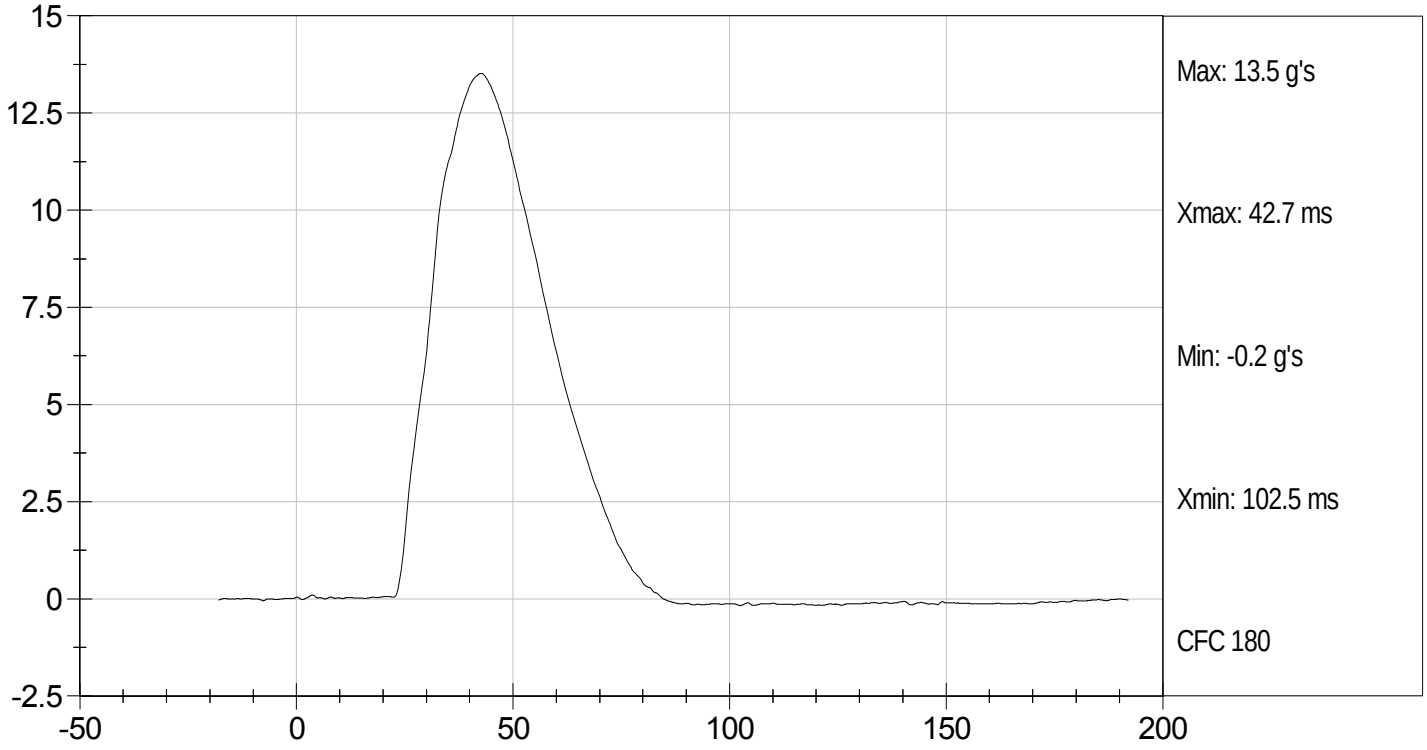
5/9/11
Test Date

David Winkelbauer
Approved By

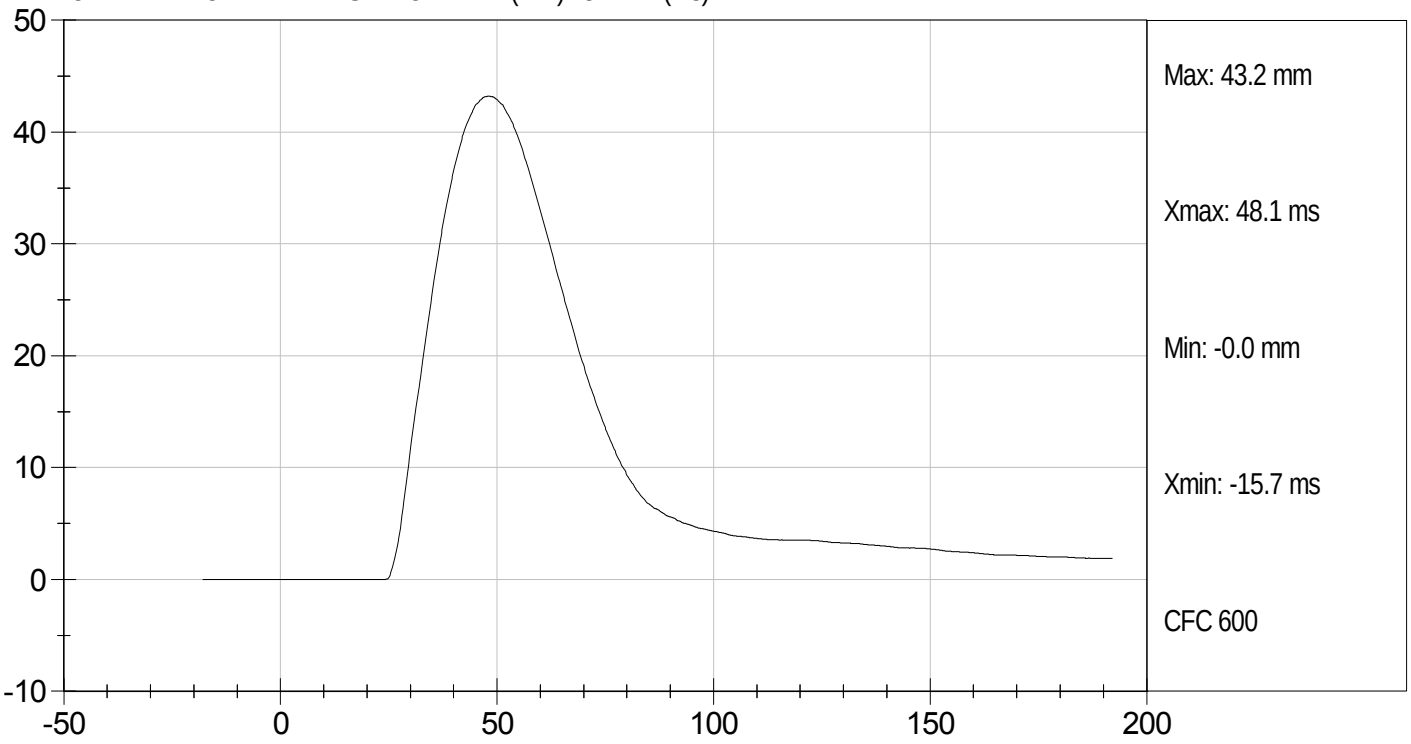
Test Desc: Abdomen Impact
Component ID: D111706

Test Date: 5/9/11
Velocity: 14.25 ft/s, 4.34 m/s

PROBE (g's) vs TIME (ms)



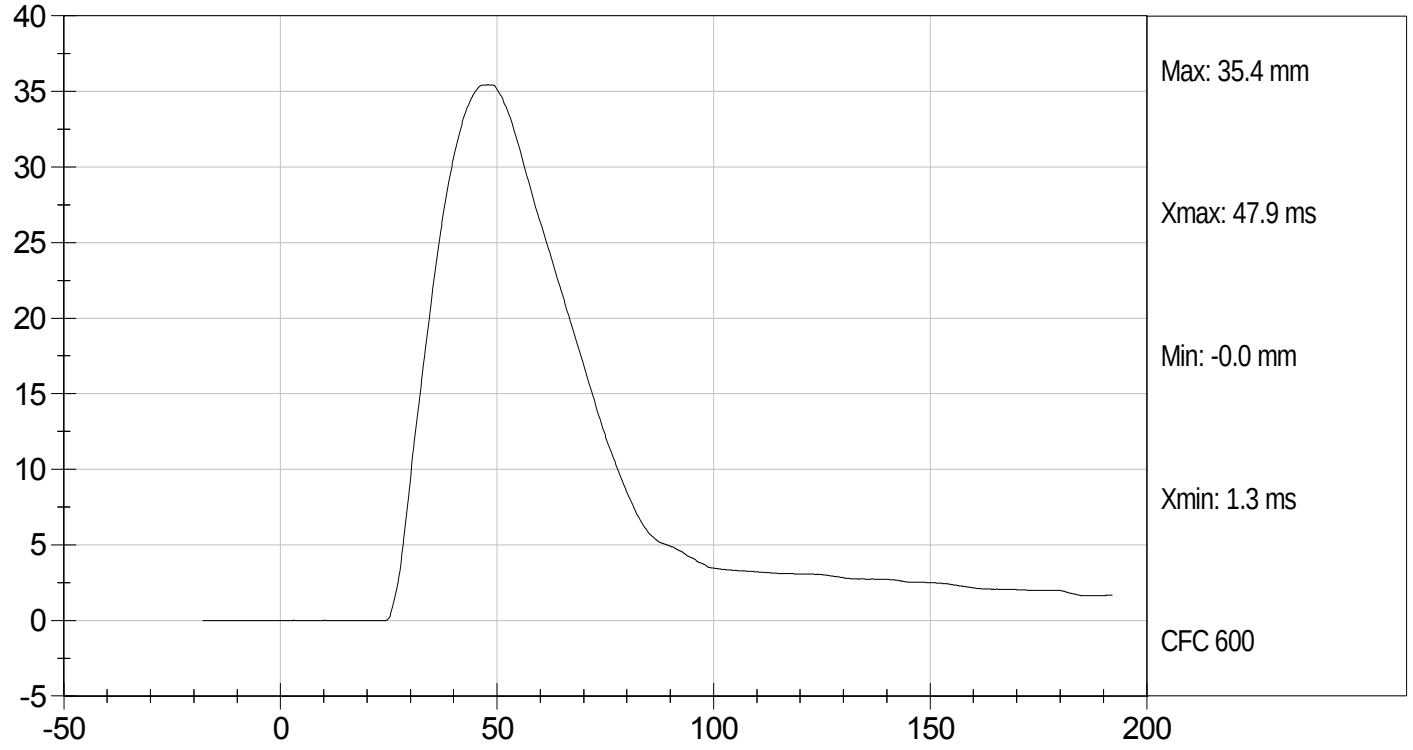
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



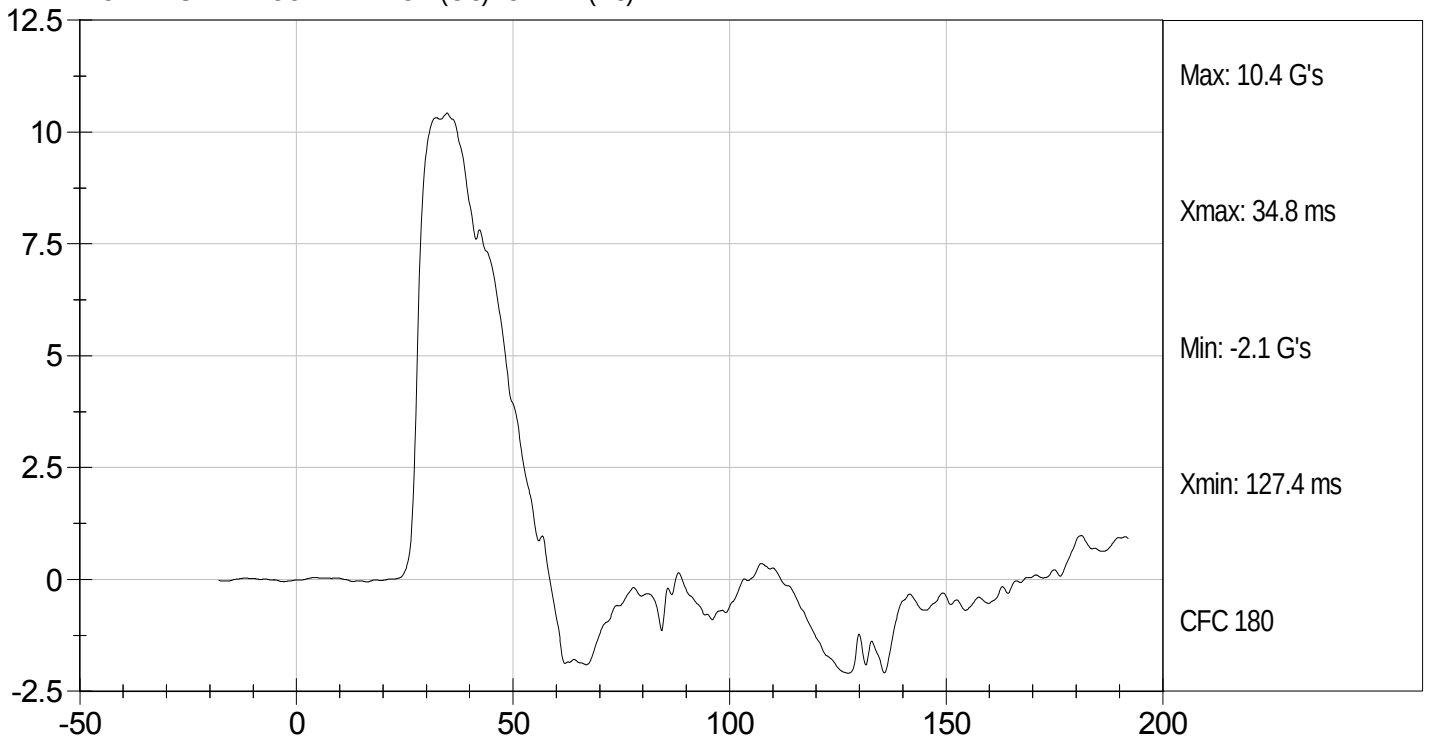
Test Desc: Abdomen Impact
Component ID: D111706

Test Date: 5/9/11
Velocity: 14.25 ft/s, 4.34 m/s

LOWER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D111707

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	35	Pass
Impact Velocity	m/s	6.60 to 6.80	6.71	Pass
Peak Impactor Acceleration	G's	38 to 47	43	Pass
Pelvis Y Acceleration after 6 ms	G's	34 to 42	42	Pass
Peak Acetabulum Force	N	3600 to 4300	3826	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

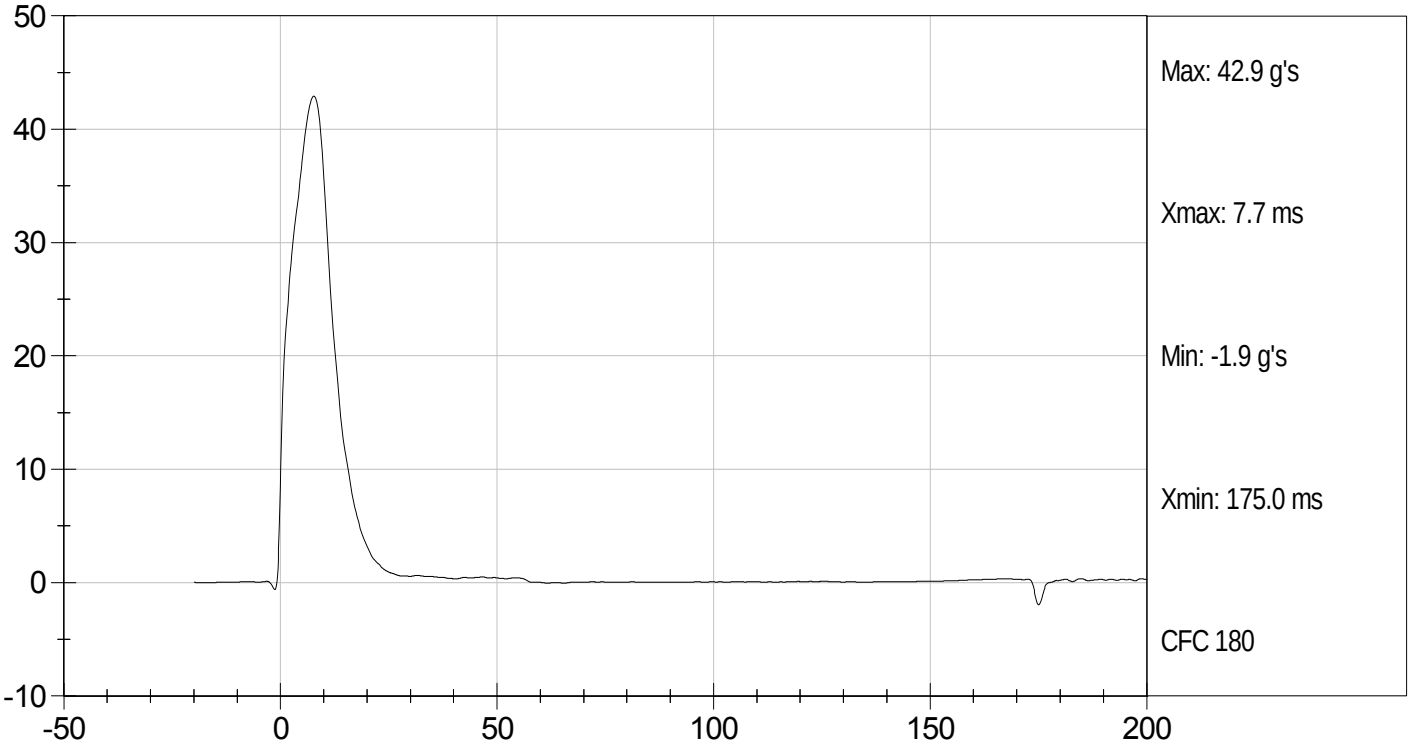
5/9/11
Test Date

David Winkelbauer
Approved By

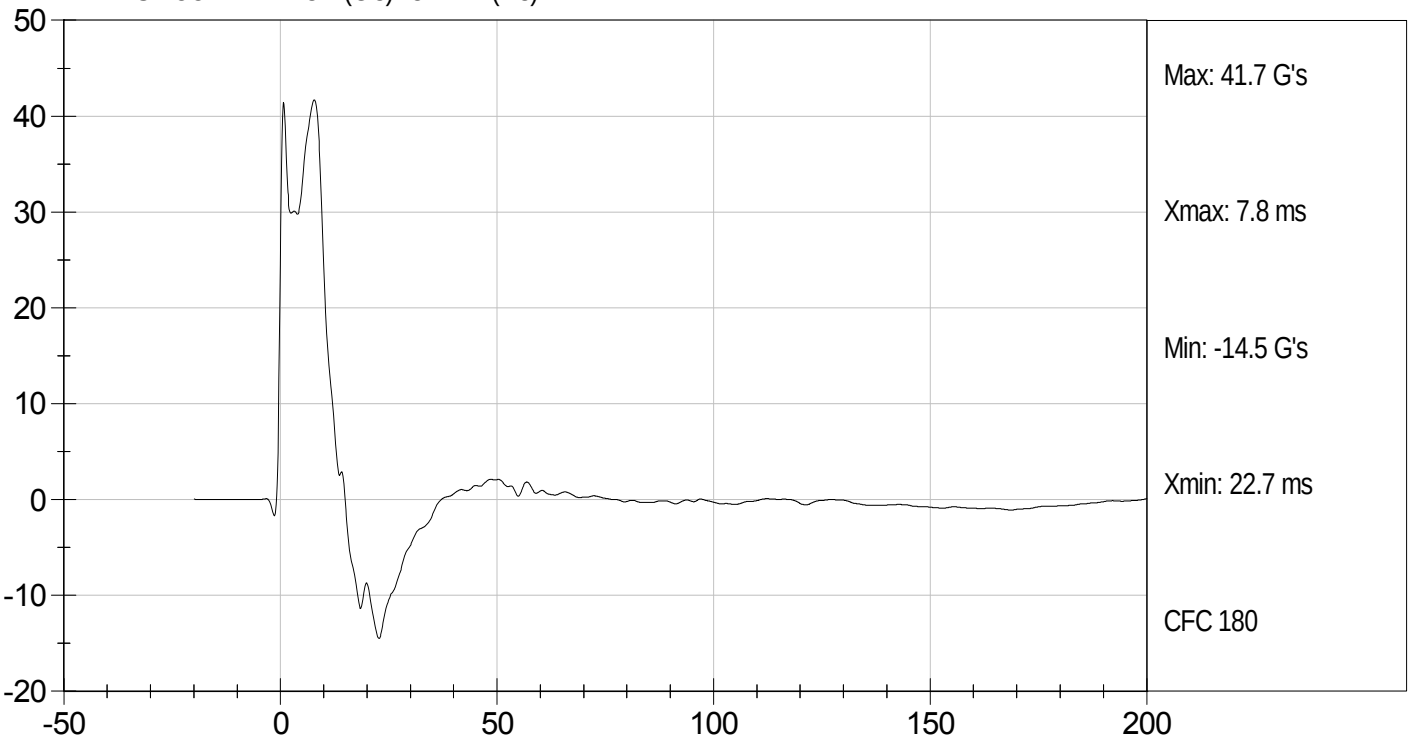
Test Desc: Pelvis Impact
Component ID: D111707

Test Date: 5/9/11
Velocity: 22.00 ft/s, 6.71 m/s

PROBE (g's) vs TIME (ms)



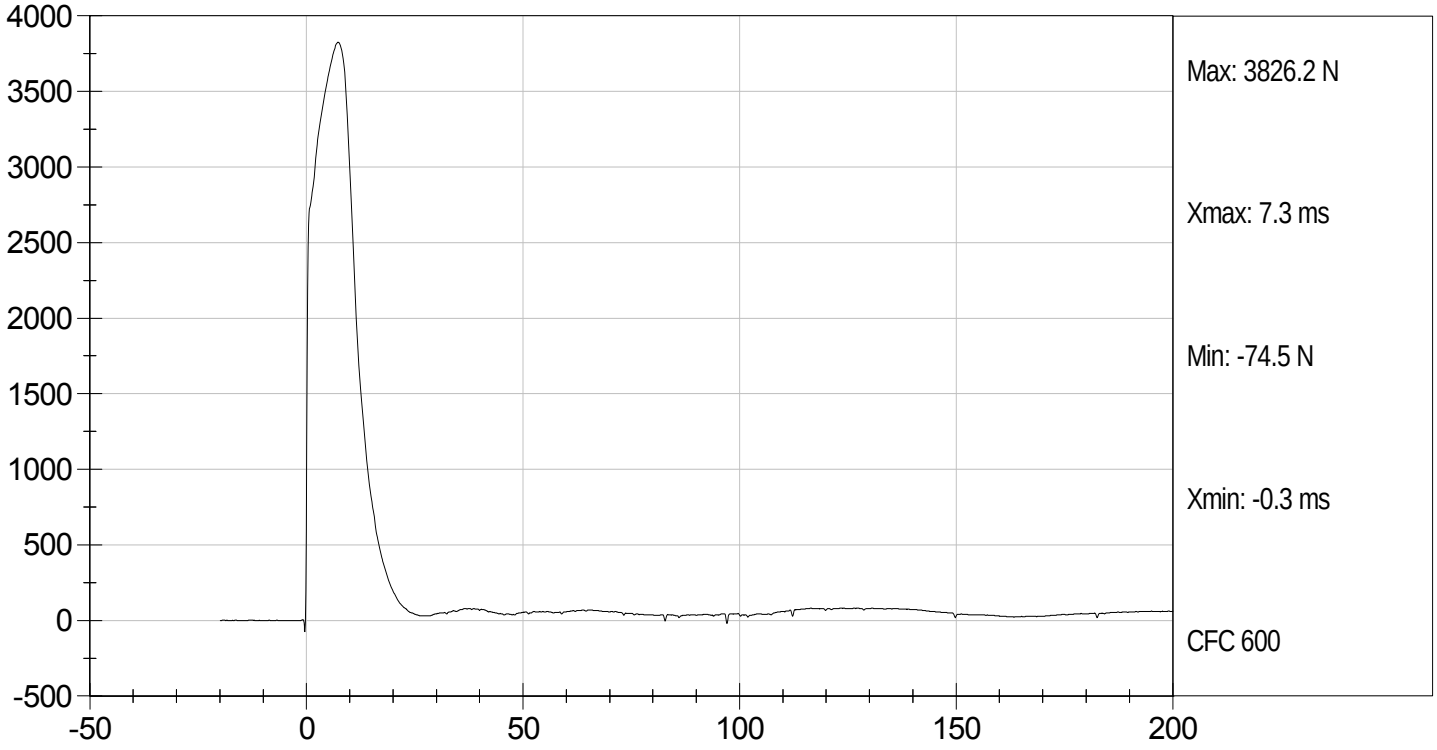
PELVIS ACCELERATION (G's) vs TIME (ms)



Test Desc: Pelvis Impact
Component ID: D111707

Test Date: 5/9/11
Velocity: 22.00 ft/s, 6.71 m/s

ACETABULUM FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D111708

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	35	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor Acceleration	G's	36 to 45	37	Pass
Pelvis Y Acceleration	G's	28 to 39	29	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4489	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

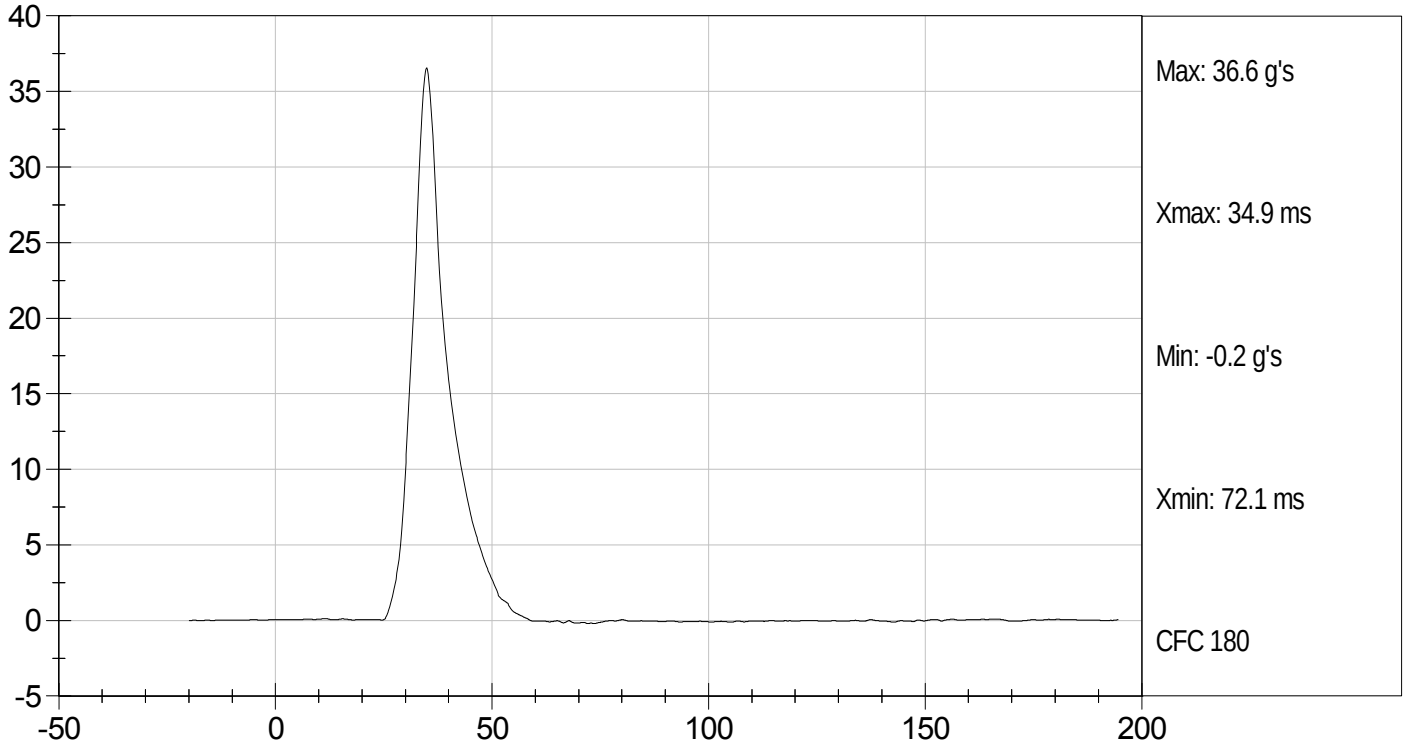
5/9/11
Test Date

David Winkelbauer
Approved By

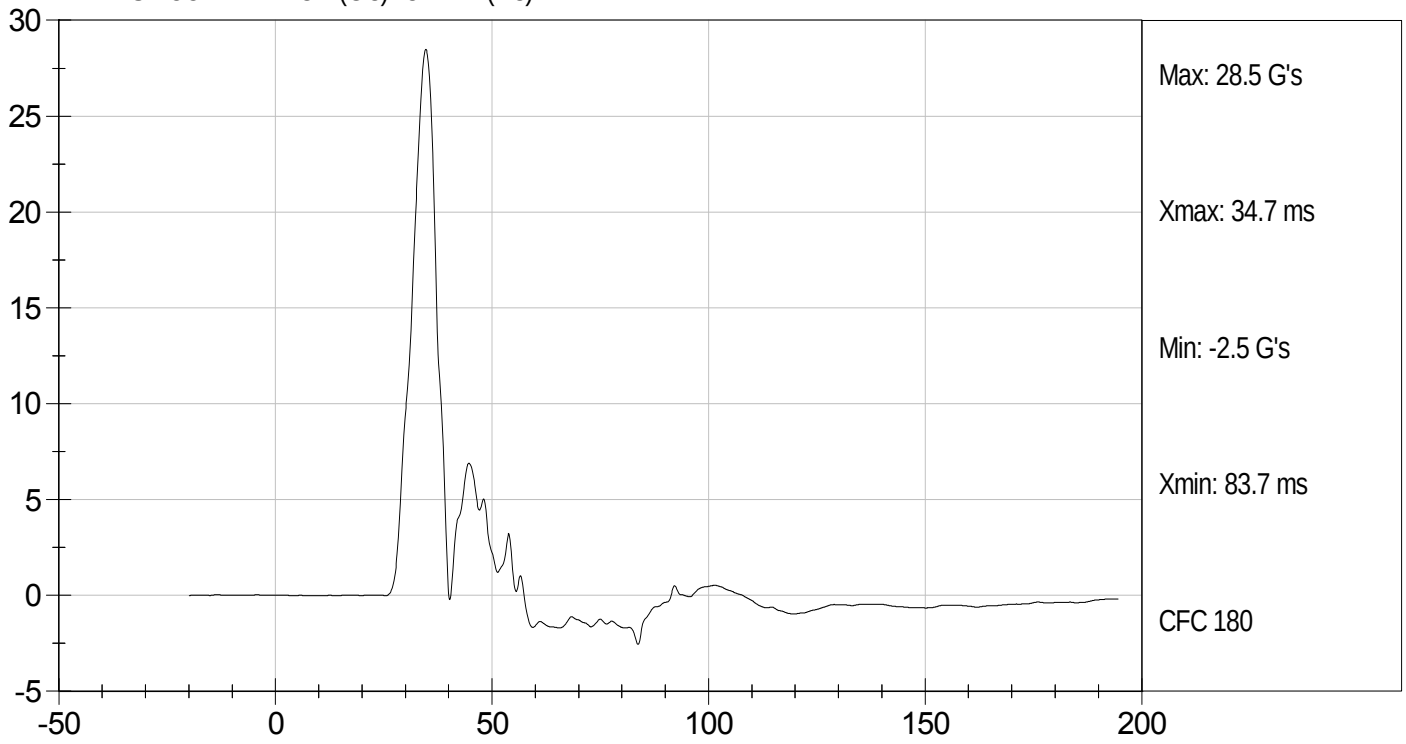
Test Desc: Iliac Impact
Component ID: D111708

Test Date: 5/9/11
Velocity: 14.37 ft/s, 4.38 m/s

PROBE (g's) vs TIME (ms)



PELVIS ACCELERATION (G's) vs TIME (ms)



Test Desc: Iliac Impact
Component ID: D111708

Test Date: 5/9/11
Velocity: 14.37 ft/s, 4.38 m/s