REPORT NUMBER: SINCAP-MGA-2012-038

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

KIA MOTORS MANUFACTURING GEORGIA, INC. FOR HYUNDAI MOTOR COMPANY
2012 Hyundai Santa Fe GLS FWD SUV
NHTSA No.: MC0513

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: December 13, 2011

Final Report Date: February 10, 2012

FINAL REPORT

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

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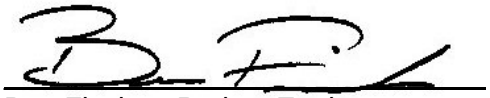
Prepared by: 
Donna Janovicz, Project Manager

Approved by: 
Ben Fischer, Project Engineer

Approval Date: February 10, 2012

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

Technical Report Documentation Page

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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 2012 Hyundai Santa Fe GLS FWD SUV 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 December 13, 2011.

The impact velocity of the Moving Deformable Barrier (MDB) was 62.4 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 20.8°C. The target vehicle post-test maximum crush was 280 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	75
Maximum Thorax Rib Deflection	mm	44	24
Total Abdominal Force	N	2500	830
Pubic Symphysis Force	N	6000	1721

	Passenger ATD (SID-IIs)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	171
Resultant Lower Spine Acceleration	Gs	82	61
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	6357
Maximum Thoracic Rib Deflection	mm	38*	28
Maximum Abdomen Rib Deflection	mm	45*	19

*Proposed IARV

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 Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave, SE, Room E12-100 Washington, DC 20590 Email: tis@nhtsa.dot.gov FAX: 202-493-2833

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SECTION 1
TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2012 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 2012 Hyundai Santa Fe GLS FWD SUV. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Laboratory Test Procedure dated August 2011.

SECTION 2
SUMMARY OF TEST RESULTS

A 2012 Hyundai Santa Fe GLS FWD SUV 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 62.4 km/h (38.8 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 December 13, 2011. Pretest 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 August 2011. 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)
Primary and Redundant Head CG Triaxial Accelerometers
Chest Upper Rib, Middle Rib, and Lower Rib Y-Axis Displacement Potentiometers
Abdomen Forward, Middle, and Rear Y-Axis Load Cells
Lower Spine (T12) Triaxial Accelerometers
Pubic Symphysis Y-Axis Load Cell

PASSENGER ATD (SID-IIs)
Primary and Redundant Head CG Triaxial Accelerometers
Chest Upper Rib, Middle Rib, and Lower Rib Y-Axis Displacement Potentiometers
Abdomen Upper Rib and Lower Rib Y-Axis Displacement Potentiometers
Lower Spine (T12) Triaxial Accelerometers
Acetabulum and Iliac Wing Y-Axis Load Cells

Appendix B contains the dummy response data. Dummy configuration and performance verification data can be found in Appendix C of this report. Appendix D contains the test equipment and instrumentation calibration data.

Dummy Injury readings were recorded as follows:

DUMMY INJURY VALUES

	Driver ATD (ES-2re)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	75
Maximum Thorax Rib Deflection	mm	44	24
Total Abdominal Force	N	2500	830
Pubic Symphysis Force	N	6000	1721

	Passenger ATD (SID-IIs)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	171
Resultant Lower Spine Acceleration	Gs	82	61
Total Pelvic Force	N	5525	6357
Maximum Thoracic Rib Deflection	mm	38*	28
Maximum Abdomen Rib Deflection	mm	45*	19

*Proposed IARV

Supplemental restraint information is given below:

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	No			
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Abdomen/Pelvis Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	No	
Seat Belt Load Limiter	Yes		No	
Other				

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

Passenger Mid Thorax Rib DY is questionable from 47-51 msec.
Left Front Sill Y is questionable from 0-11 msec.
Left Mid A-Post Y is questionable from 0-11 msec.
Driver Seat Track Y is questionable from 11-23 msec.
Left Rear Seat Y is questionable from 24-30 msec. and 45-56 msec.

SECTION 3
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle:	2012 Hyundai Santa Fe GLS FWD SUV	NHTSA No.	MC0513
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/13/2011

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MC0513	Traction Control System (TCS)	Yes
Model Year	2012	Auto-Leveling System	No
Make	Hyundai	Automatic Door Locks (ADL)	Yes
Model	Santa Fe	Power Window Auto-Reverse	Yes
Body Style	MPV	Other Optional Feature	N/A
VIN	5XYZG3AB7CG092467	Driver Front Airbag	Yes
Body Color	Black Forest Green	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	161 / 100	Driver Head/Torso Airbag	No
Engine Displacement (L)	2.4	Driver Torso Airbag	No
Type/No. Cylinders	4	Driver Torso/Pelvis Airbag	Yes
Engine Placement	Lateral	Driver Pelvis Airbag	No
Transmission Type	Automatic	Driver Knee Airbag	No
Transmission Speeds	6	Rear Pass. Curtain Airbag	Yes
Overdrive	Yes	Rear Pass. Head/Torso Airbag	No
Final Drive	Front	Rear Pass. Torso Airbag	No
Roof Rack	Yes	Rear Pass. Torso/Pelvis Airbag	No
Sunroof/T-Top	No	Rear Pass. Pelvis Airbag	No
Running Boards	No	Driver Seat Belt Pretensioner	Yes
Tilt Steering Wheel	Yes	Rear Pass. Seat Belt Pretensioner	No
Power Seats	No	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Rear Pass. Load Limiter	No
All Wheel Drive (AWD)	No	Other Safety Restraint	N/A
Does owner's manual provide instruction to turn off automatic door locks?			No

DATA FROM CERTIFICATION LABEL

Manufactured By	Kia Motors Manufacturing Georgia, Inc. for Hyundai Motor Company
Date of Manufacture	JUL/27/11
Vehicle Type	MPV

GVWR (kg)	2230
GAWR Front (kg)	1350
GAWR Rear (kg)	1450

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3		5	
Capacity Weight (VCW) (kg)				420	(A)
DSC x 68.04 kg				340	(B)
Rated Cargo and Luggage Weight (RCLW)				80	(A-B)

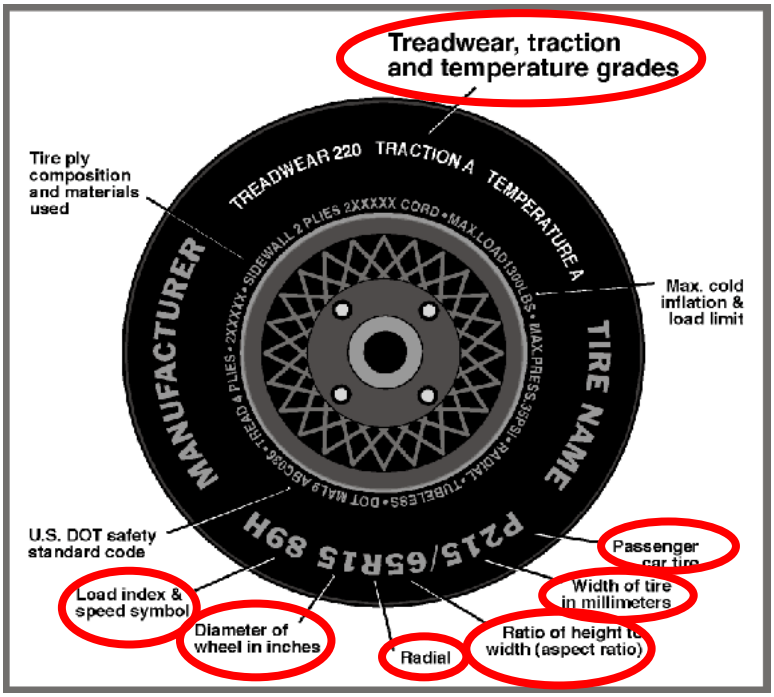
VEHICLE SEAT TYPE

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

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

Test Vehicle:	2012 Hyundai Santa Fe GLS FWD SUV	NHTSA No.	MC0513
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/13/2011

VEHICLE TIRE INFORMATION



TIRE PLACARD INFORMATION

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

TIRE SIDEWALL INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Tire Size on Vehicle	P235/65R17	P235/65R17
Tire Manufacturer	KUMHO	KUMHO
Tire Name	SOLUS	SOLUS
Tire Type	Passenger	Passenger
Tire Width	235	235
Aspect Ratio	65	65
Radial	Yes	Yes
Wheel Diameter	17	17
Load Index/Speed Symbol	103T	103T
Treadwear	500	500
Traction Grade	A	A
Temperature Grade	A	A
Tire Material	Rubber	Rubber

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

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011

TEST PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kpa	230	230	230	230
Tire Placard	kpa	230	230	230	230
Owner's Manual	kpa				
As Tested	kpa	230	230	230	230

MDB TIRE SPECIFICATIONS

	Requirement	Units	LF	RF	LR	RR
Tire Size	P205/75R15	N/A	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire	200 ± 21	kpa	220	220	220	220

TEST VEHICLE AXLE WEIGHTS

		As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
	Units	Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	482.2	369.2		516.2	463.1		522.5	467.7	
Right	kg	486.7	353.4		495.8	419.6		486.3	424.1	
Ratio	%	57.3	42.7		53.4	46.6		53.1	46.9	
Totals	kg	968.9	722.6	1691.5	1012.0	882.7	1894.7	1008.8	891.8	1900.6

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1691.5	(A)
Sum of Actual Weight of 2 P572 ATDs Used	kg	129.3	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	80	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1900.8	(A+B+C)

Does the measured As Tested Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight – 4.5 kg to 9 kg)? **YES**

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Weight of Ballast, if any	44.5
Right taillight, cargo holder, jack & tools, right rear view mirror.	24.5

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

Test Vehicle:	2012 Hyundai Santa Fe GLS FWD SUV	NHTSA No.	MC0513
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/13/2011

TEST VEHICLE ATTITUDES AND CG

	Units	Fully Loaded	As Tested	Meets Requirement***
Left Front	mm	807	809	Yes
Right Front	mm	816	818	Yes
Right Rear	mm	790	797	Yes
Left Rear	mm	777	787	Yes
Vehicle CG (Aft of Front Axle)	mm	1267	1258	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	34	27	

*** The “As Tested” vehicle attitude measurements must be equal to or within ± 10 mm of the “Fully Loaded” vehicle attitude measurements at each wheel well.

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

Test Vehicle:	2012 Hyundai Santa Fe GLS FWD SUV	NHTSA No.	MC0513
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/13/2011

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and right front passenger's seat should be set to the mid-track, lowest, mid-angle position. The struck-side rear passenger's seat, rear center seat, and non-struck side rear passenger's seats should be set to the rear-most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	16.4	11.8	14.1
Front Passenger Seat	Fixed	Fixed	Fixed
Front Center Seat			
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rear-most	Mid-Fore/Aft	Forward-Most
Driver Seat	14.1	Fixed	Max	Fixed	Fixed	Fixed
	14.1	Fixed	Mid	Fixed	Fixed	Fixed
	14.1	Fixed	Min	Fixed	Fixed	Fixed
Front Passenger Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
	Fixed	Fixed	Mid	Fixed	Fixed	Fixed
	Fixed	Fixed	Min	Fixed	Fixed	Fixed
Front Center Seat			Max			
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
	Fixed	Fixed	Mid	Fixed	Fixed	Fixed
	Fixed	Fixed	Min	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
	Fixed	Fixed	Mid	Fixed	Fixed	Fixed
	Fixed	Fixed	Min	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
	Fixed	Fixed	Mid	Fixed	Fixed	Fixed
	Fixed	Fixed	Min	Fixed	Fixed	Fixed

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

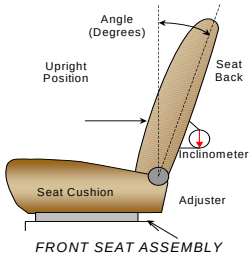
Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011

SEAT FORE/AFT POSITIONS

Seat	Total Fore/Aft Travel		Test Position from Forward-most Position	
	mm	Detents	mm	Detent
Driver Seat	240	24 (1st as 0)	120	12th (1st as 0)
Front Passenger Seat	240	24 (1st as 0)	120	12th (1st as 0)
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side	Fixed	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed	Fixed

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned to the manufacturer's designated design angle. The front passenger's seat back is positioned in a similar manner as the driver's seat back. The struck side rear seat back is fixed. The rear center and non-struck side rear outboard seat backs are also fixed.



Seat	Total Seat Back Angle Range		Test Position from Vertical	
	Degrees	Detents	Degrees	Detent
Driver Seat w/Seated Dummy	73.2		6.1	11th (1st as 0)
Front Passenger Seat	69.7		5.6	10th (1st as 0)
Front Center Seat				
Struck Side Rear Seat	35.9		-7.1	2nd (1st as 0)
Non-Struck Side Rear Seat	35.9		-7.0	2nd (1st as 0)
Rear Center Seat	35.9		-7.1	2nd (1st as 0)

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

Test Vehicle:	2012 Hyundai Santa Fe GLS FWD SUV	NHTSA No.	MC0513
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/13/2011

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1.

	Total # of Positions	Placed in Position #
Driver Seat	3 (1st as 0)	0 (uppermost as 0)
Rear Seat	Fixed	Not Applicable

HEAD RESTRAINT ADJUSTMENT

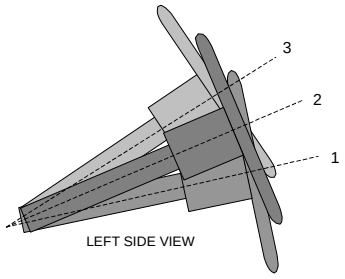
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	5	Highest
Rear Seat	3	Lowest

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel geometric locus is described when it moves through its full range of motion.

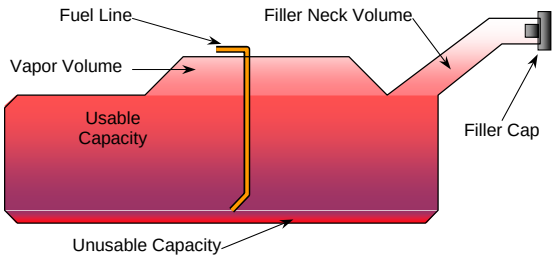
	Degrees	Fore/Aft Position (mm)
Lowermost, Position 1	69.1	250
Geometric Center, Position 2	62.1	240
Uppermost, Position 3	55.1	230
Telescoping Steering Wheel Travel		20
Test Position	62.1	240



STEERING COLUMN ASSEMBLY

FUEL PUMP

Describe the fuel pump type, details about how it operates and the location of the fuel filler pipe.
The vehicle is equipped with an electric fuel pump. The fuel pump will pump fuel when the key is in the "ON" position. The fuel pipe is on the left side.



VEHICLE FUEL TANK ASSEMBLY

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

Test Vehicle:	2012 Hyundai Santa Fe GLS FWD SUV	NHTSA No.	MC0513
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/13/2011

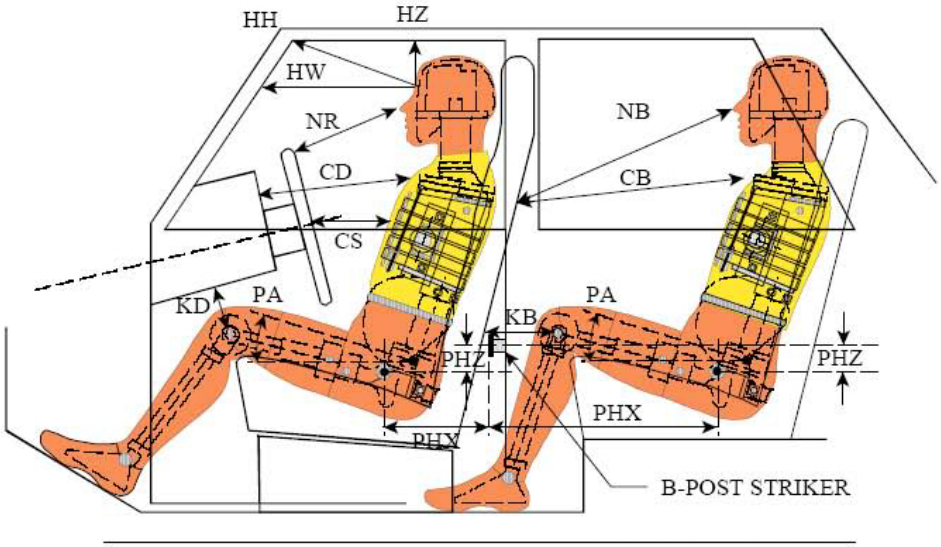
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard" Tank (see Form No. 1)	70.0
Usable Capacity of "Optional" Tank (see Form No. 1)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	68.0
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	65.1
Actual Amount of Solvent Used	65.1
1/3 of Usable Capacity	23.3

Is the actual amount of solvent used in the test equal to 93% ± 1%
of the Usable Capacity stated in Form No. 1? **YES**

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011



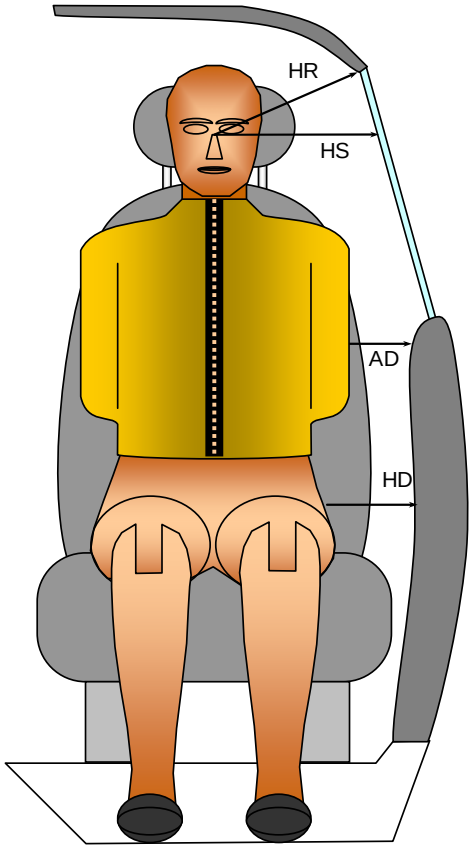
LEFT SIDE VIEW

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Measurement Description	Driver S/N 032		Passenger S/N 306	
			Length (mm)	Angle(°)	Length (mm)	Angle(°)
HH		Head to Header	295	13.3		
HW		Head to Windshield	451			
HZ	HZ	Head to Roof Liner	110		285	
NR	NB	Nose to Rim/Seat Back	436	23.3	485	11.8
CD	CB	Chest to Dashboard/Seat Back	504	3.2	502	10.1
CS		Chest to Steering Wheel	307	20.9		
KDL	KBL	Left Knee to Dash/Seat Back	122	19.6	305	15.6
KDR	KBR	Right Knee to Dash/Seat Back	118	22.0	307	15.1
PAX	PAX	Pelvic Tilt Angle X		20.3		18.1
	PAY	Pelvic Tilt Angle Y		0.3		0.0
PHX	PHX	Hip Point to Striker (X-Axis)	246		301	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	130		165	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011



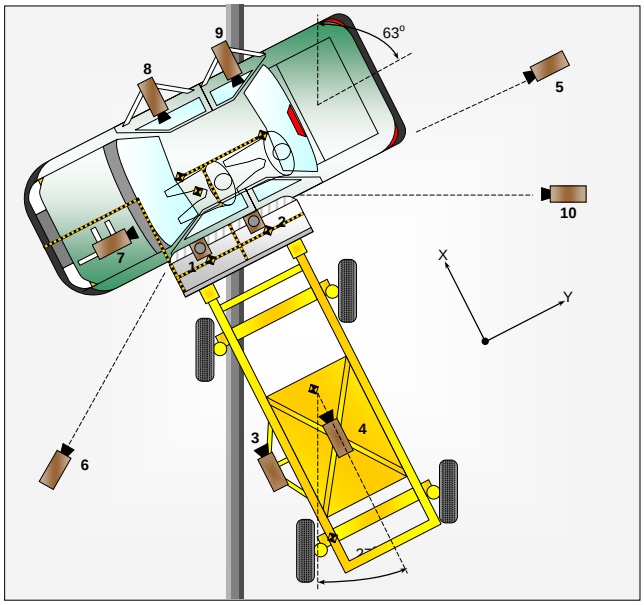
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver S/N 032	Passenger S/N 306
HR	Head to Side Header	mm	183	278
HS	Head to Side Window	mm	325	379
AD	Arm to Door	mm	198	185
HD	Hip Point to Door	mm	222	180

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X*	Y*	Z*		
1	Overhead Overall	110	170	-5050	14	1000
2	Overhead Close-Up	70	110	-5050	20	1000
3	Left Impact Point (MDB)				50	1000
4	Side Overall (MDB)				16	1000
5	Rear	70	4790	-1100	24	1000
6	Left Front	4180	-4350	-1170	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

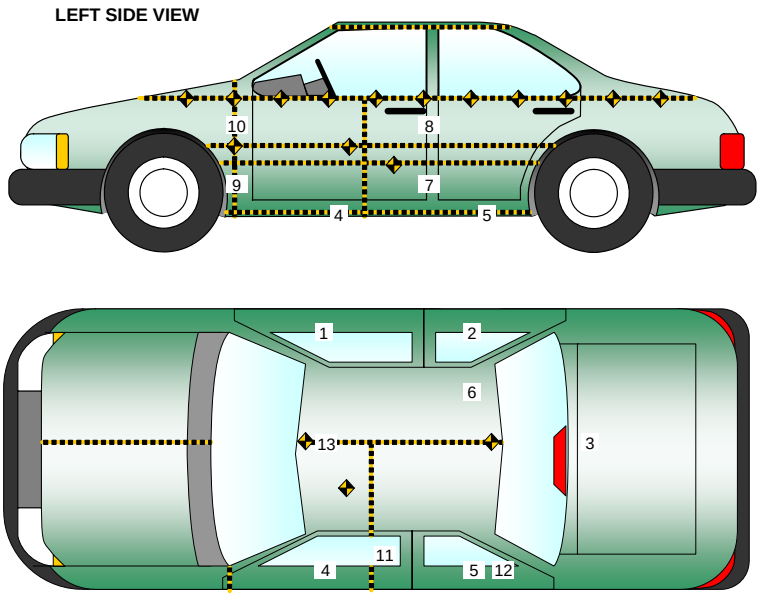
Explain why camera(s) did not operate as intended: Not Applicable

INSTRUMENTATION

Driver Dummy Channels	16
Passenger Dummy Channels	16
Vehicle Structure Accelerometers	23
MDB Accelerometers	5
MDB Contacts	2
Total	62

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011



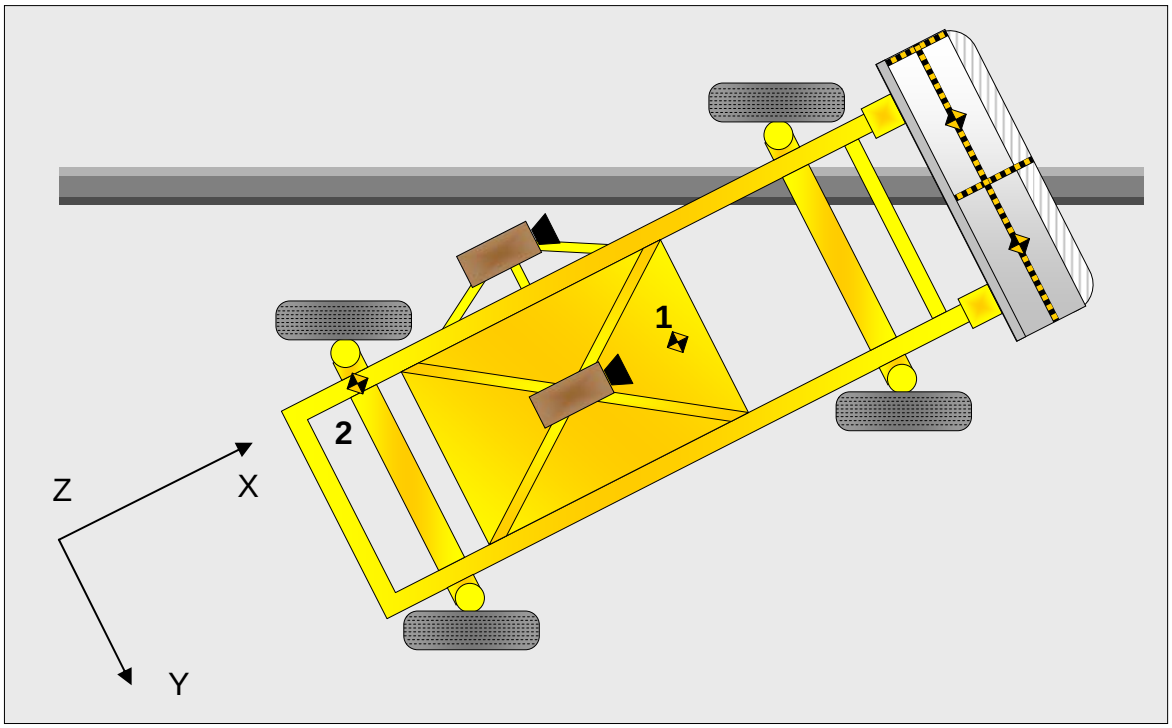
TEST VEHICLE ACCELEROMETER LOCATIONS

Accelerometer Location				
No.	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2675	0	-470
2	Right Sill at Front Seat	2502	763	-304
3	Right Sill at Rear Seat	1735	763	-306
4	Left Sill at Front Door	2725	-755	-302
5	Left Sill at Rear Door	1744	-755	-305
6	Left Lower A-Post	3062	-711	-670
7	Left Middle A-Post	3160	-820	-922
8	Left Lower B-Post	2105	-741	-724
9	Left Middle B-Post	2141	-741	-895
10	Front Seat Track	2471	-601	-540
11	Rear Seat Structure	1735	-466	-542
12	Rt. Rear Occ. Compartment	1850	490	-556
13	Engine Block	3921	0	-883
14	Rear Above Axle	943	0	-450

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

DATA SHEET NO. 7
MDB ACCELEROMETER LOCATIONS

Test Vehicle:	2012 Hyundai Santa Fe GLS FWD SUV	NHTSA No.	MC0513
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/13/2011



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
POST-TEST OBSERVATIONS

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Airbag	Curtain Airbag
Top of Head	Curtain Airbag, Headliner	Curtain Airbag
Left Side of Head	Curtain Airbag, Headliner	Curtain Airbag
Back of Head	Curtain Airbag, Headrest, Headliner	Curtain Airbag, Headrest
Left Shoulder	Curtain Airbag, Side Airbag	Door Panel
Upper Torso	Side Airbag, Seatback	None
Lower Torso	Side Airbag, Seatback	Door Panel
Left Hip	Side Airbag	Door Panel
Left Knee	Door Panel	Door Panel

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Rear Hatch/ Other Door
	Front	Rear	Front	Rear	
Remained Closed and Operational	No	No	Yes	Yes	Yes
Total Separation from Vehicle at Hinges or Latches	No	No	No	No	No
Latch or Hinge Systems Pulled Out of Their Anchorages	No	No	No	No	No
Disengaged from Latched Position	No	No	No	No	No
Latch Separated from Striker	No	No	No	No	No
Jammed Shut	Yes	Yes	No	No	No
If Door Opened at Striker, Record Width of Opening at Striker (mm)	N/A	N/A	N/A	N/A	N/A

POST-TEST SEAT PERFORMANCE

	Struck Side		Non-Struck Side	
Description	Front	Rear	Front	Rear
Seat Movement Along Seat Track	No	No	No	No
Seat Disengagement from Floor Pan	No	No	No	No
Seat Back Movement from Initial Position	No	No	No	No
Seat Back Collapse	No	No	No	No

POST-TEST STRUCTURAL OBSERVATIONS

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

DATA SHEET NO. 8 (CONTINUED)
POST-TEST OBSERVATIONS

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	No			
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Abdomen/Pelvis Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	No	
Seat Belt Load Limiter	Yes		No	
Other				

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2700
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		410
Actual Impact Point (Aft of Front Axle)	mm		425
Horizontal Offset (+forward / -rearward)	mm	+/- 50 of intended impact point	-15
Vertical Offset (+down / -up)	mm	+/- 20 of intended impact point	+1

DATA SHEET NO. 9

MDB SUMMARY OF RESULTS

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011

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 ANGLE AT IMPACT DATA

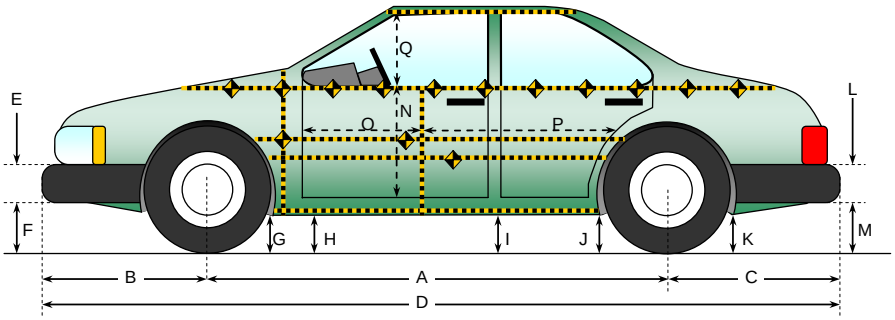
Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	62.4
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	62.4
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.1
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.2
MDB Crabbed Angle to MDB Forward Line of Motion	degrees	26 to 28	26.8

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush
Row	Description	Height	Distance	Direction	
A	Center of Bumper	432	800	Left	178
B	Top of Bumper	533	800	Left	115
C	Mid-Level	686	800	Right	98
D	Top of Stack	813	800	Left	140

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011



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

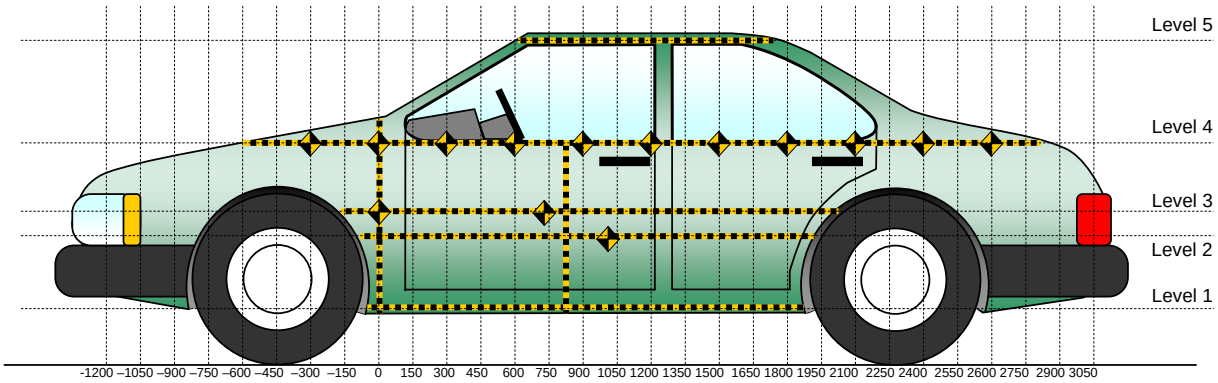
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2700	2675	25
B	Front Axle to FSOV	959	955	4
C	Rear Axle to RSOV	997	995	2
D	Total Length at Centerline	4656	4625	31
E	Front Bumper Thickness	95	95	0
F	Front Bumper Bottom to Ground	282	300	-18
G	Sill Height at Front Wheel Well	281	283	-2
H	Sill Height at Front Door Leading Edge	281	281	0
I	Sill Height at B Pillar	275	302	-27
J1	Sill Height at Rear Wheel Well	271	308	-37
J2	Pinch Weld Height at Rear Wheel Well	273	311	-38
K	Sill Height Aft of Rear Wheel Well	311	310	1
L	Rear Bumper Thickness	120	120	0
M	Rear Bumper Bottom to Ground	331	343	-12
N	Sill Height to Window Bottom Sill	755	700	55
O	Front Door Leading Edge to Impact CL	756	749	7
P	Rear Door Trailing Edge to Impact CL	1214	1160	54
Q	Front Window Opening	480	478	2
R	Right Side Length	3480	3490	-10
S	Left Side Length	3480	3435	45
T	Vehicle Width at B Post	1846	1699	147

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle:	2012 Hyundai Santa Fe GLS FWD SUV	NHTSA No.	MC0513
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/13/2011



All Measurements Shown in mm

LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEAUREMENTS

Level	Measurement Description	Height Above Ground (mm)	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	373	183	1800
2	Occupant Hip Point	738	279	1650
3	Mid Door	765	280	1650
4	Window Sill	1110	124	1200
5	Window Top	1630	15	750

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

DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

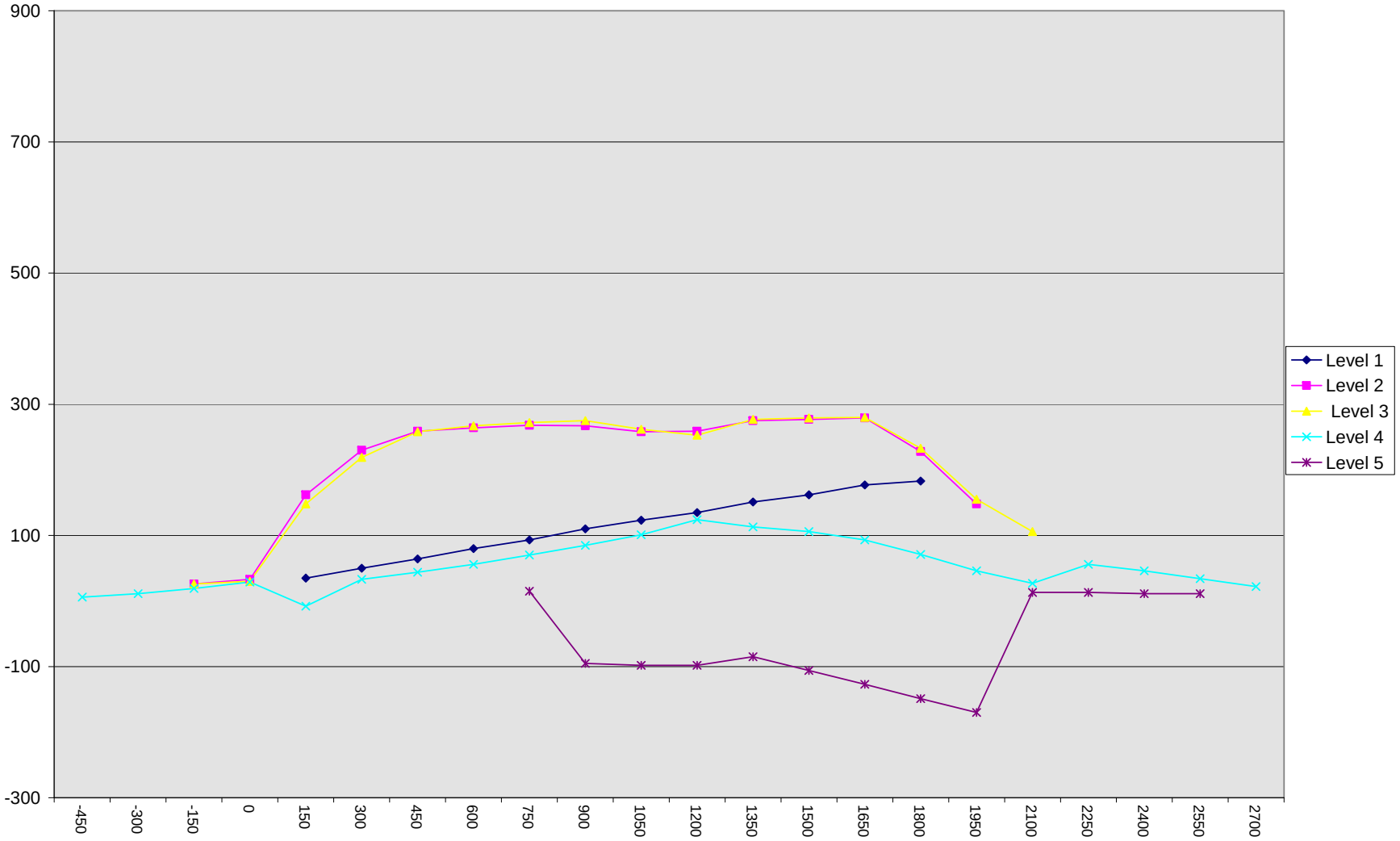
Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-450				282					288					6	
-300				275					286					11	
-150		159	157	268			185	183	287			26	26	19	
0		164	165	260			197	195	289			33	30	29	
150	210	170	170	258		245	332	318	250		35	162	148	-8	
300	208	172	171	252		258	402	390	285		50	230	219	33	
450	208	174	172	248		272	433	430	292		64	259	258	44	
600	208	176	173	242		288	440	440	298		80	264	267	56	
750	207	177	174	235	450	300	445	446	305	465	93	268	272	70	15
900	207	179	175	231	435	317	446	450	316	340	110	267	275	85	-95
1050	206	180	176	226	434	329	438	438	327	336	123	258	262	101	-98
1200	205	181	179	224	432	340	440	432	348	334	135	259	253	124	-98
1350	204	182	180	222	433	355	457	457	335	348	151	275	277	113	-85
1500	204	183	181	219	434	366	460	460	325	328	162	277	279	106	-106
1650	206	181	179	219	435	383	460	459	312	308	177	279	280	93	-127
1800	210	175	175	216	437	393	403	408	287	288	183	228	233	71	-149
1950		159	162	210	440		307	317	256	270		148	155	46	-170
2100			158	203	440			264	230	453			106	27	13
2250				200	443				256	456				56	13
2400				200	450				246	461				46	11
2550				204	461				238	472				34	11
2700				212					234					22	

NOTE: Pre-test measurements are taken when the vehicle is in the “As Tested” weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush profile grid is established prior to the test based on an estimated impact point.

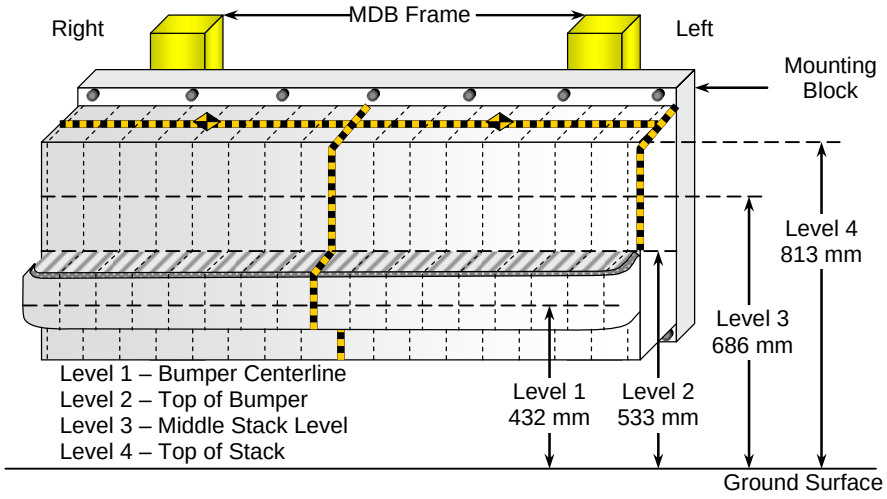
DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011



DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011



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	101	37	20	10	14	19	29	29	10	23	27	31	39	47	61	91	140
3	98	18	7	5	5	7	11	28	17	14	26	35	22	25	34	47	86
2	70	70	69	69	68	67	57	66	66	69	75	84	90	96	103	106	115
1	120	123	124	127	132	133	139	140	147	152	152	157	159	164	171	176	178

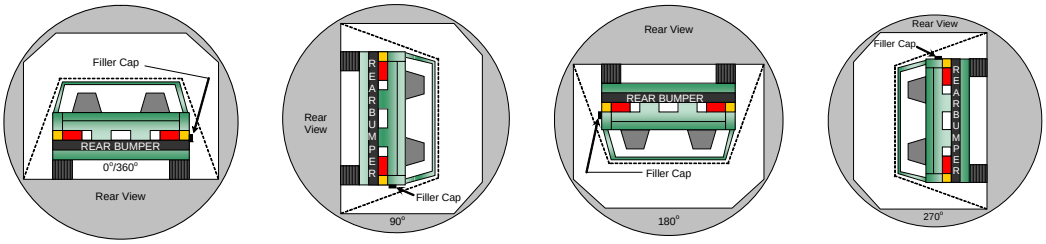
DATA SHEET NO. 13
FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA

Test Vehicle: 2012 Hyundai Santa Fe GLS FWD SUV NHTSA No. MC0513
Test Program: NCAP Side MDB Impact Test Test Date: 12/13/2011

Test Time: 11:36 am Temperature: 20.8° 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°	116	300	416
90° to 180°	114	300	414
180° to 270°	109	300	409
270° to 360°	116	300	416

FMVSS 301 ROLLOVER SPILLAGE TABLE (units in ounces)

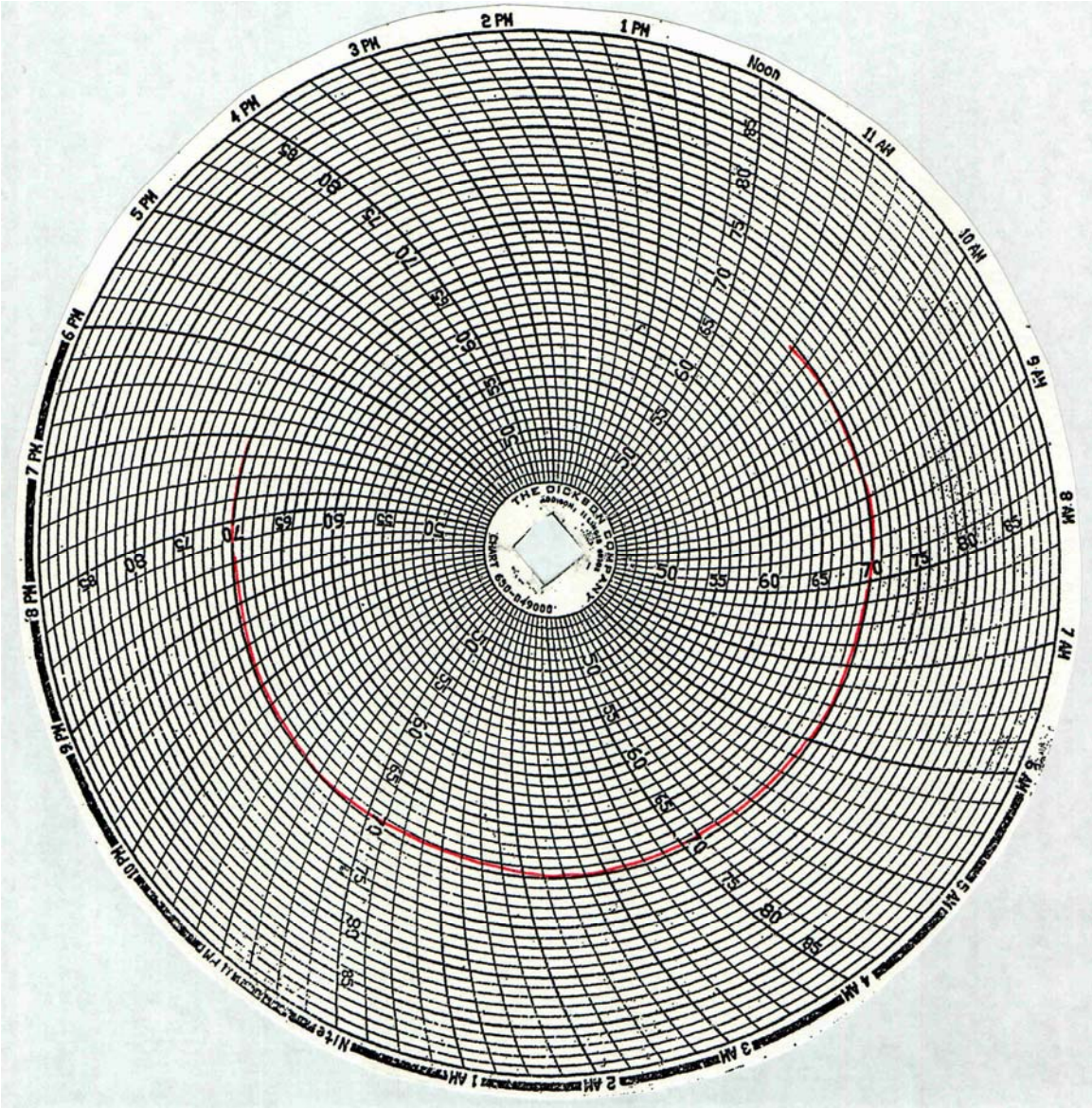
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 14
DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle:	2012 Hyundai Santa Fe GLS FWD SUV	NHTSA No.	MC0513
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/13/2011



APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

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 Front Three-Quarter View of Test Vehicle

Post-Test Left Front Three-Quarter 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

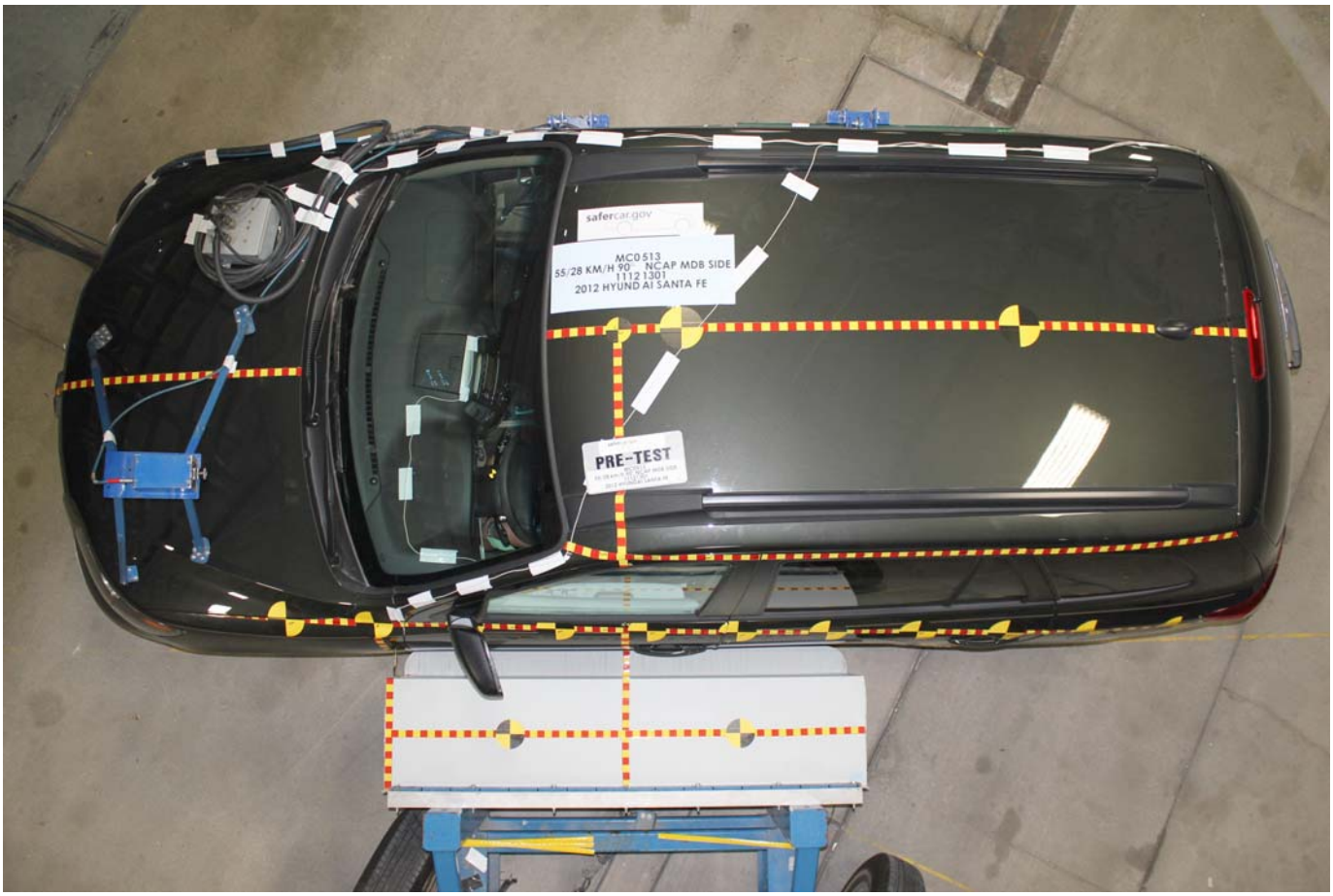
Post-Test Left Three-Quarter Rear View of Test Vehicle

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 Area

Post-Test Overhead View of Test Area

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

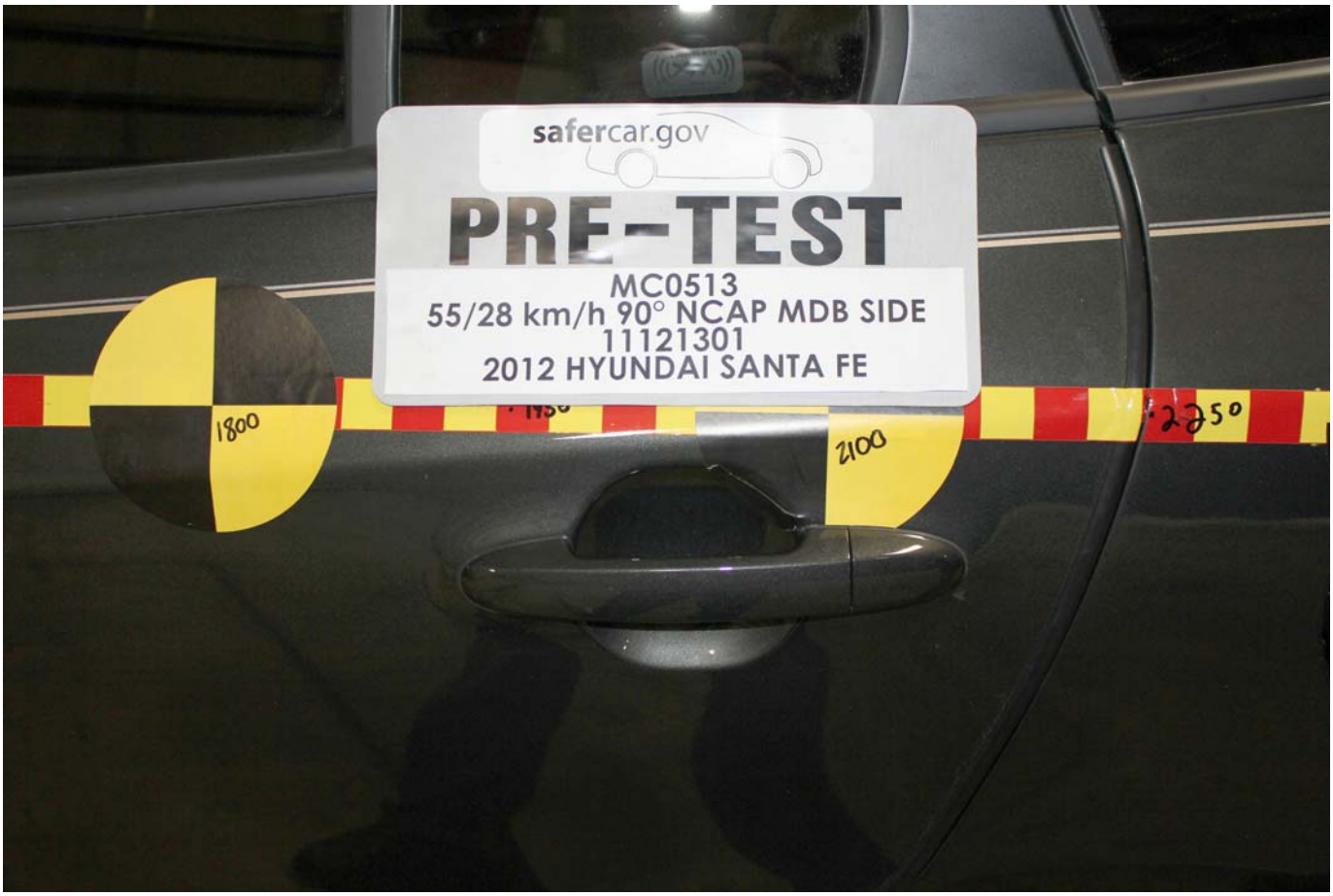
Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle

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

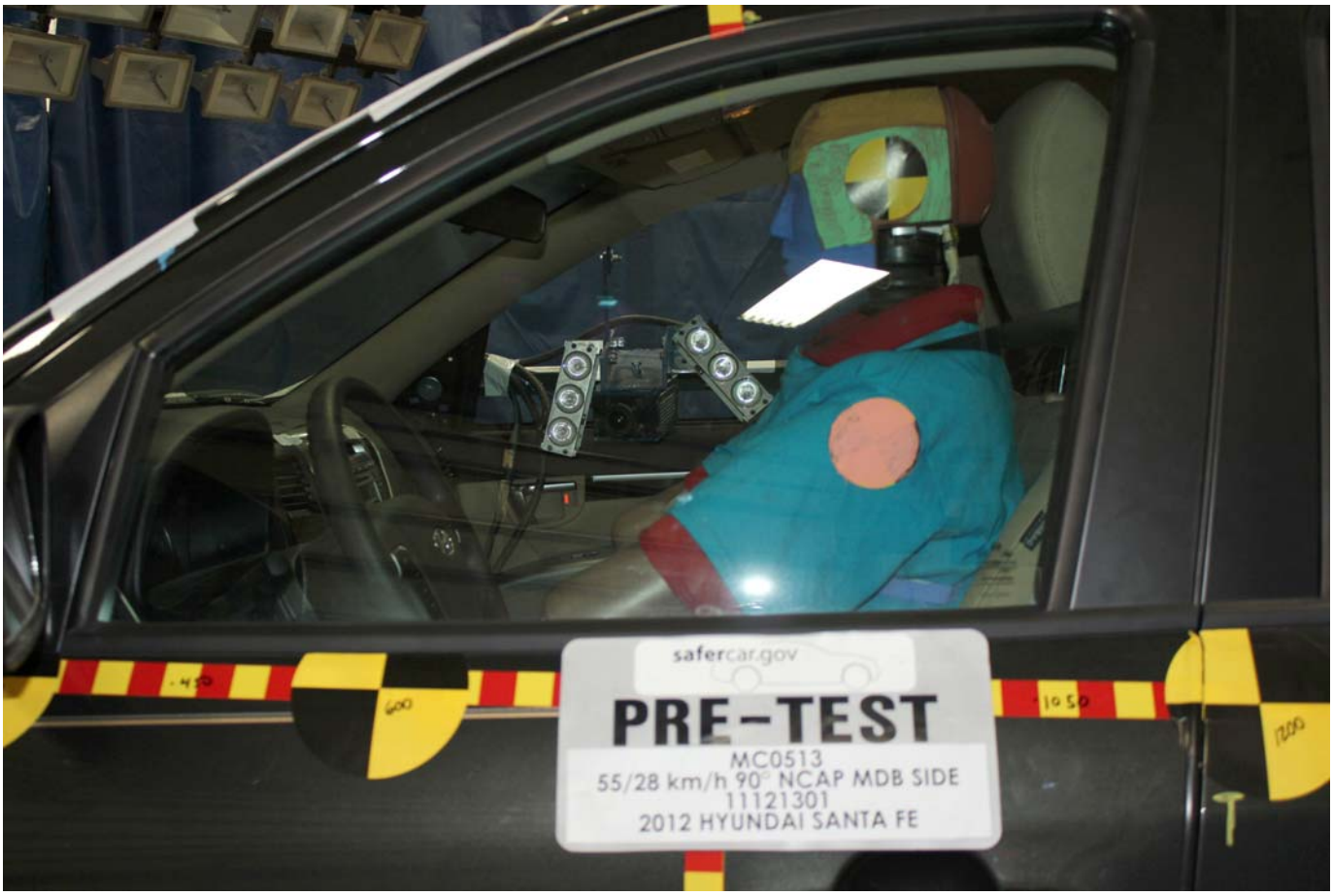
Post-Test Left Rear Door Latch Close-Up

Pre-Test Front Close-Up View of Driver Dummy

Post-Test Front Close-Up View of Driver Dummy

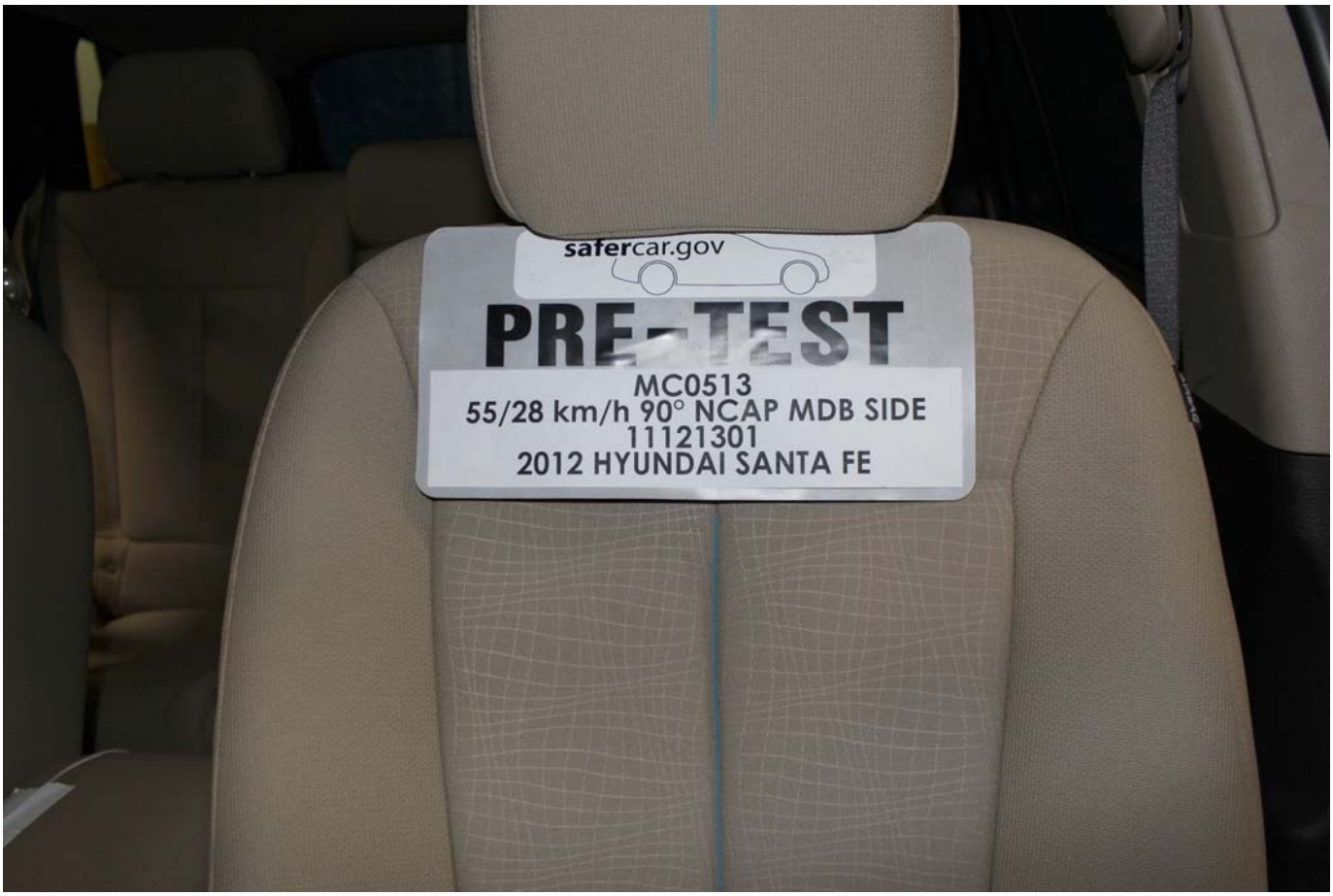
PHOTOGRAPH NOT AVAILABLE

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



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 Disengaged Parking Brake

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

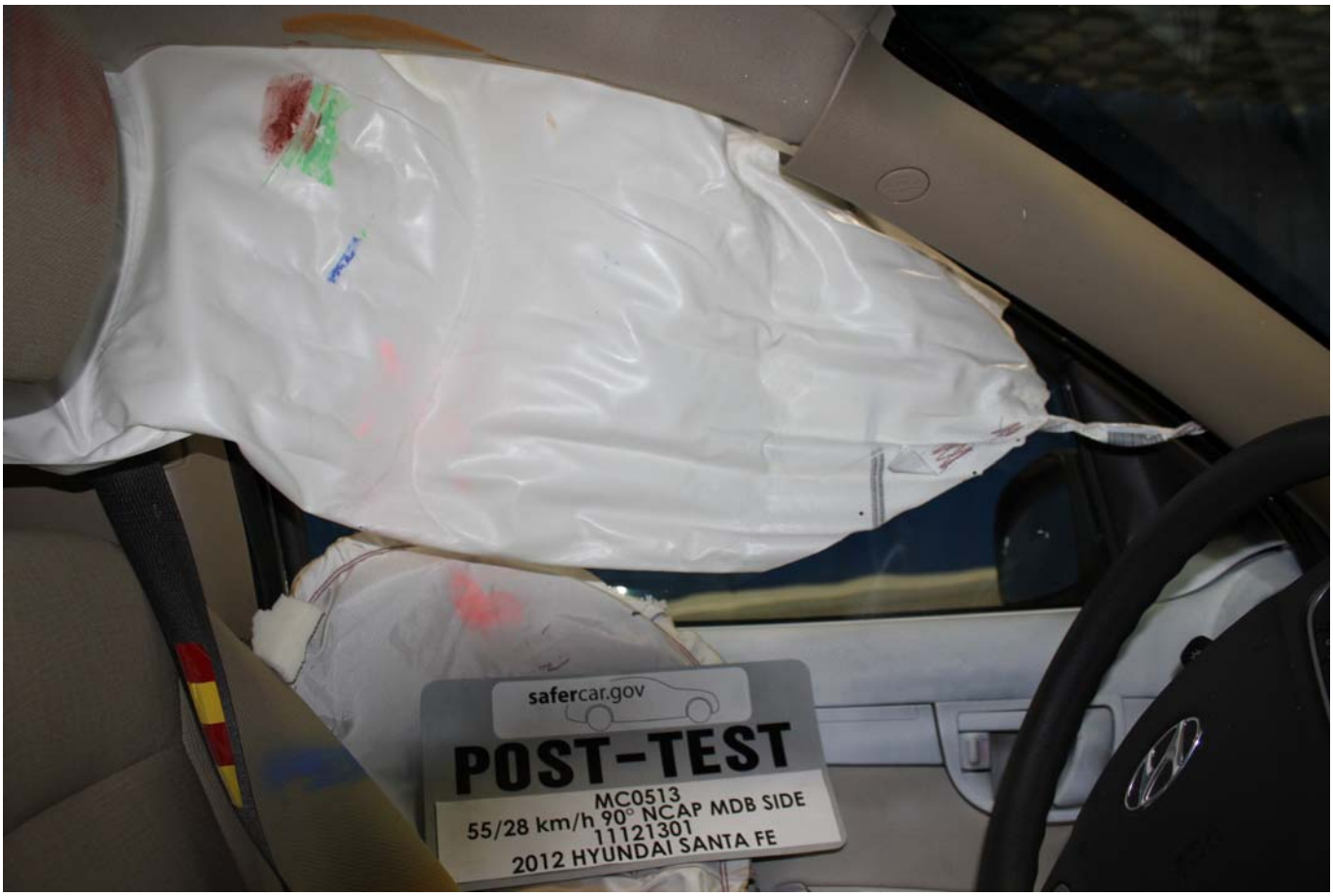
Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment

Post-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment

Pre-Test Driver Inner Door Panel View

Post-Test Driver Inner Door Panel View

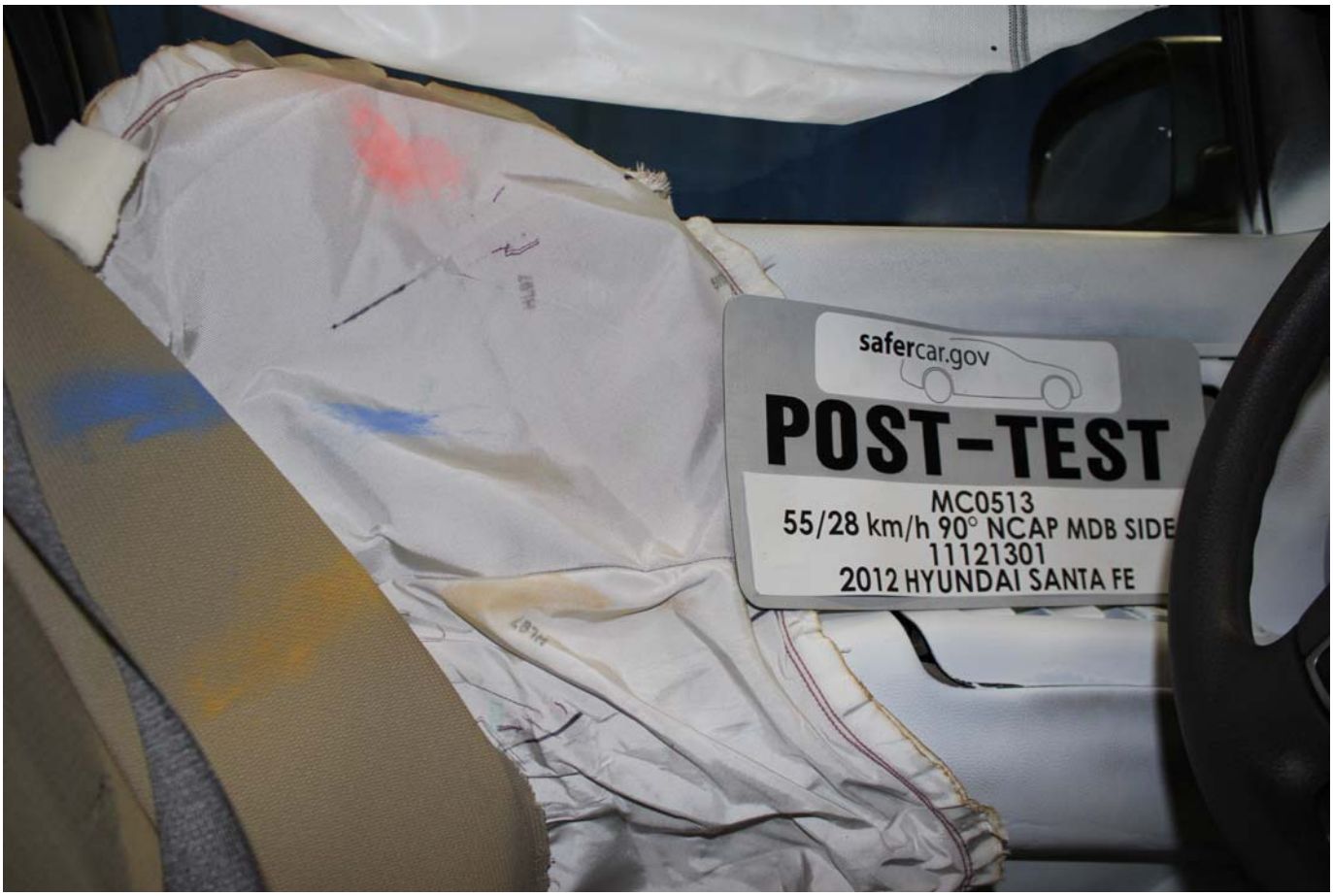
Post-Test Driver Dummy Close-up Head Contact with Vehicle Interior View



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

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

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



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

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

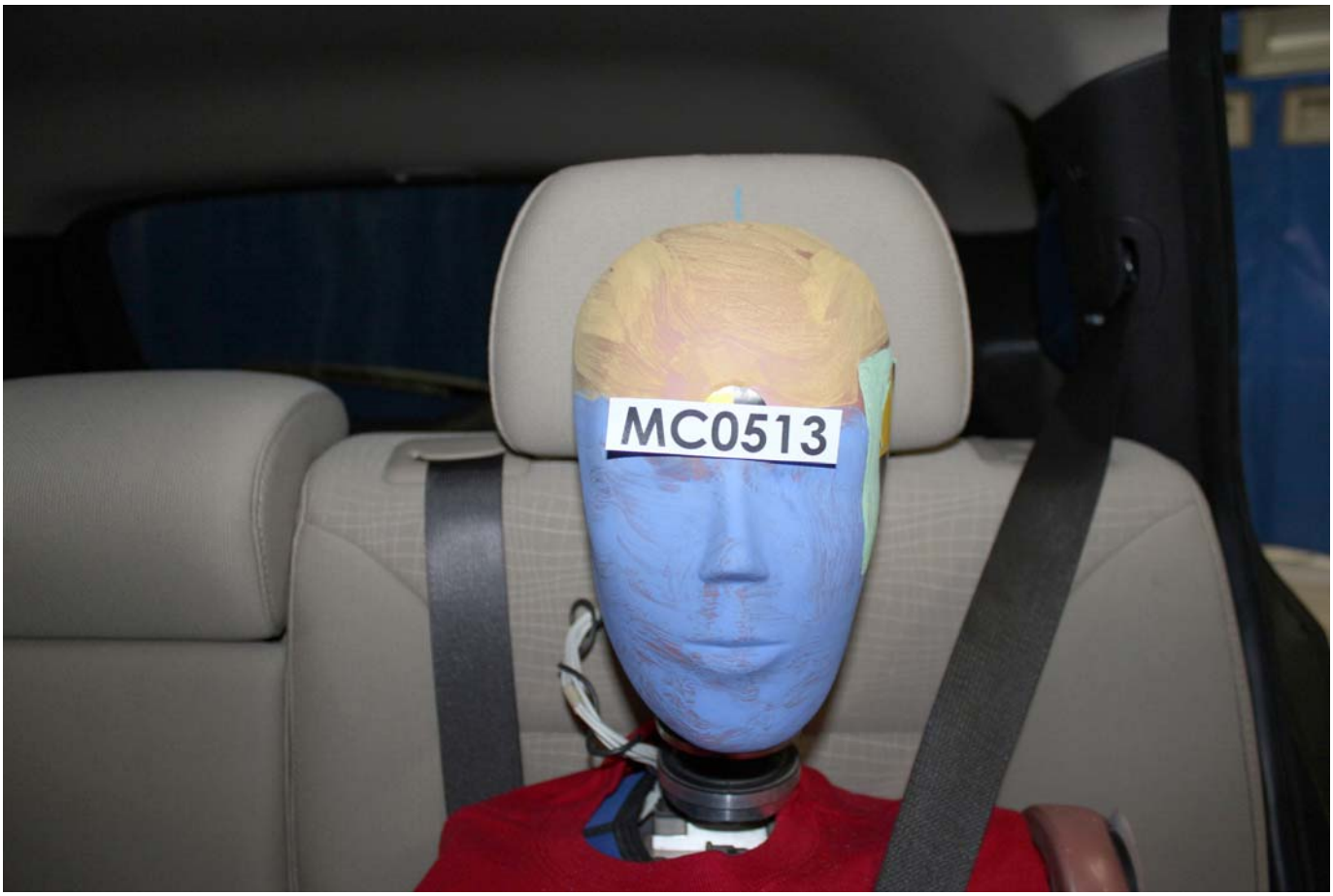
Post-Test Driver Dummy Close-up Pelvis Contact with Side Airbag View

Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking

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

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



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

Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning

Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan

Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket

Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level

Pre-Test Placement of Rear Passenger Dummy's Feet

Pre-Test View of Belt Anchorage for Rear Passenger Dummy

Pre-Test Close-Up Left Side View of Rear Passenger Seat Track

Pre-Test Close-Up Left Side View of Rear Passenger Seat Back

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

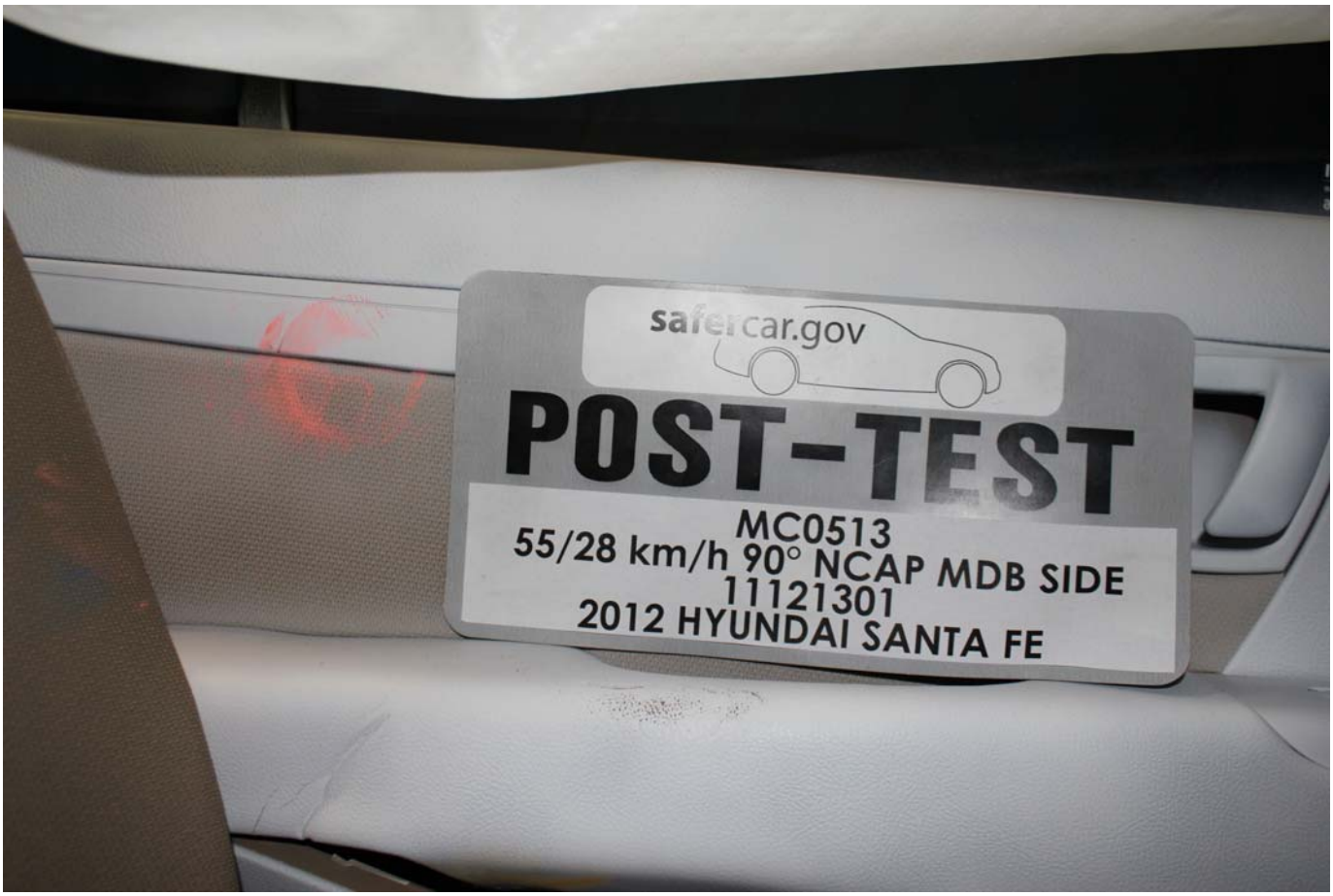
Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment

Pre-Test Rear Passenger Inner Door Panel View

Post-Test Rear Passenger Inner Door Panel View

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

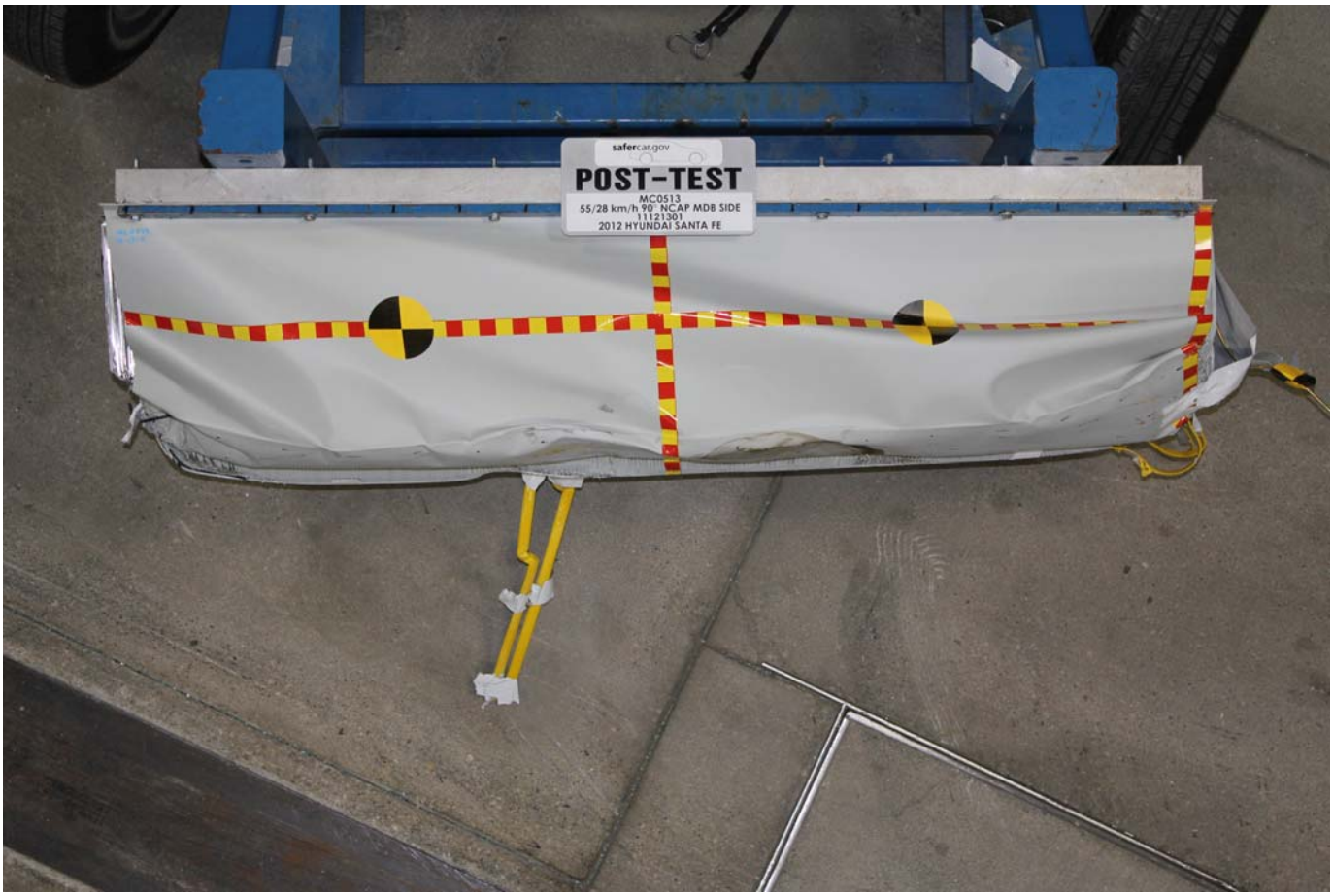
Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

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

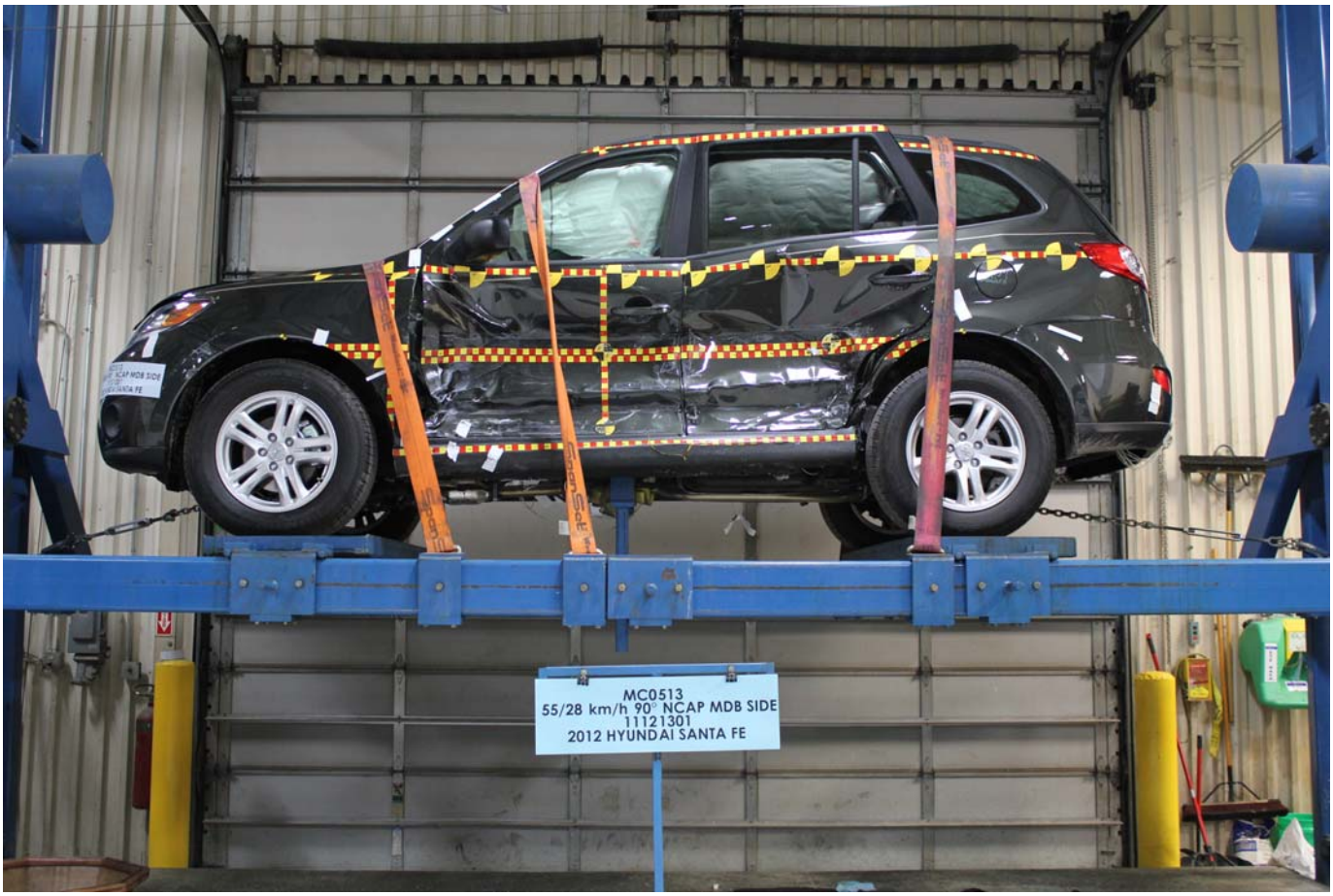
Post-Test Right Side View of MDB Impactor Face

Close-Up View of Vehicle's Certification Label

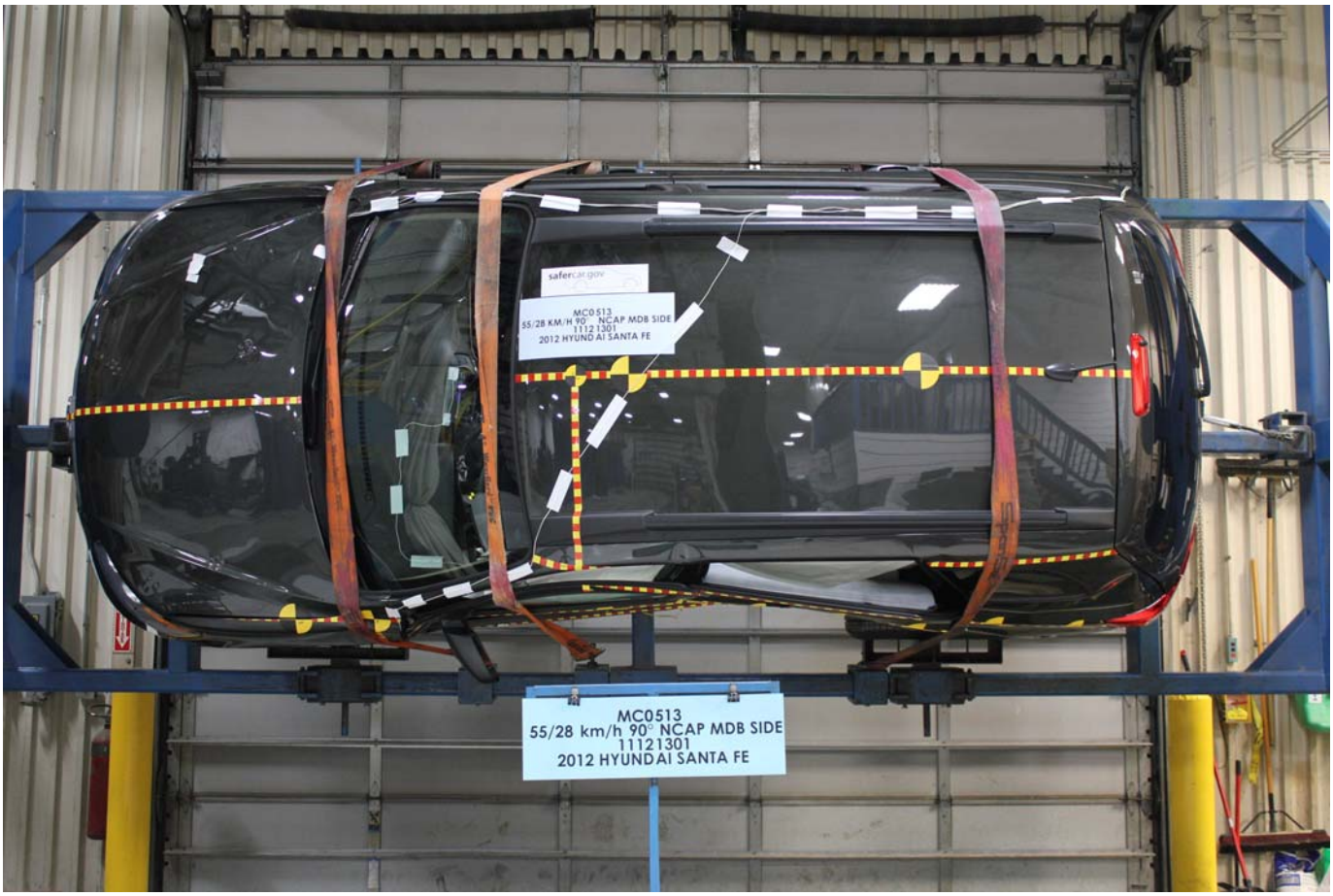
Close-Up View of Vehicle's Tire Information Placard or Label

Pre-Test Ballast View

Post-Test Primary and Redundant Speed Trap Read-Out

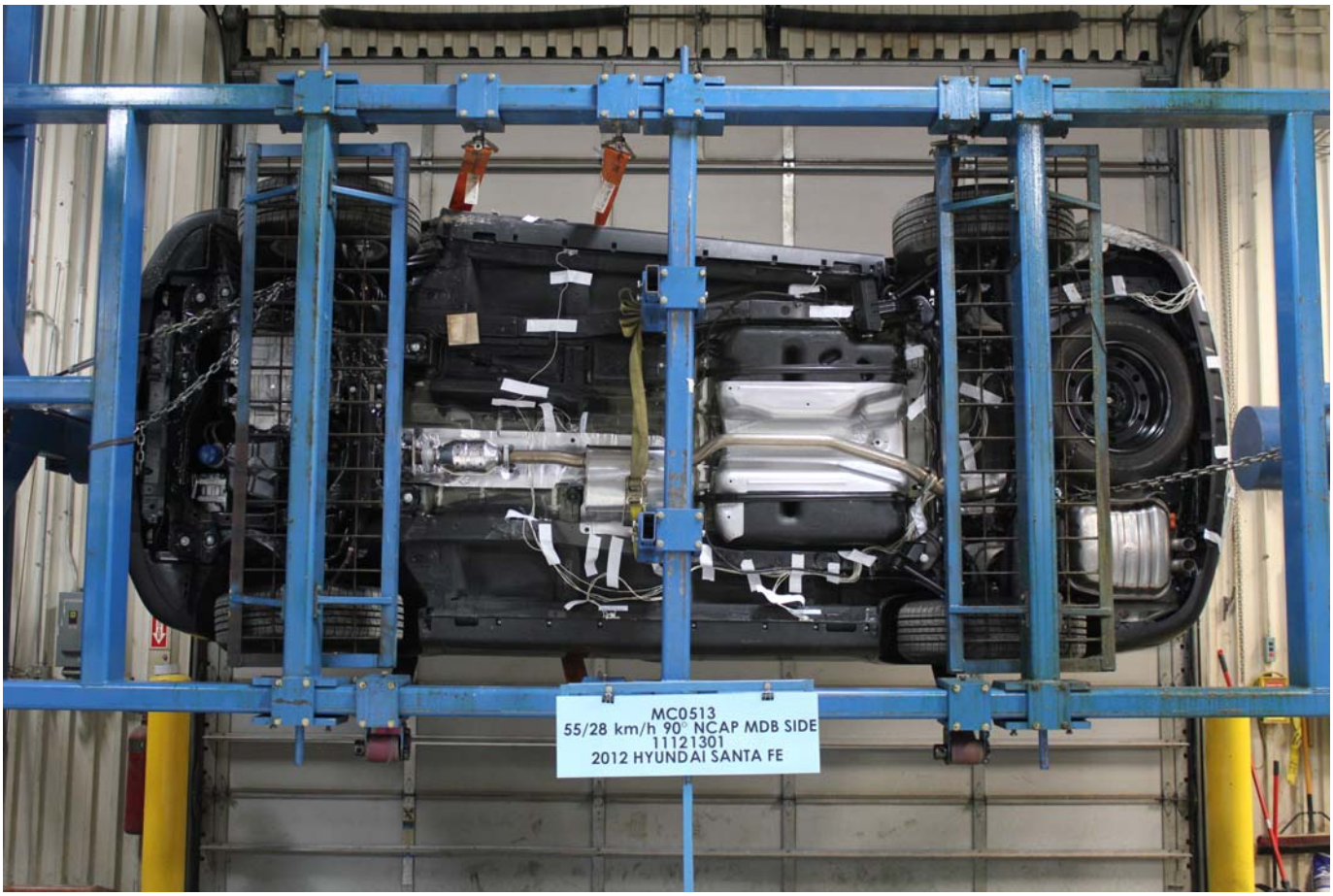


FMVSS No. 301 Static Rollover 0 Degrees



FMVSS No. 301 Static Rollover 90 Degrees

FMVSS No. 301 Static Rollover 180 Degrees



FMVSS No. 301 Static Rollover 270 Degrees

FMVSS No. 301 Static Rollover 360 Degrees

Impact Event

HYUNDAI **2012 SANTA FE GLS FWD**

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

Q13167

SOLD TO: IL002
O'HARE HYUNDAI
1509 S. RIVER ROAD
DES PLAINES IL 60018

SHIPPED TO: IL002

VIN: 5XYZG3AB7CG092467
MODEL: 62422F45
ENGINE: G4KEBK330164
PORT OF ENTRY: WP
EXTERIOR COLOR: BLACK FOREST GREEN
INTERIOR COLOR: BEIGE
MODE OF TRANSPORT: TRUCK
ACCESSORY WEIGHT: 16 lbs.
EMISSIONS: This vehicle is certified to meet emission requirements in all 50 states.

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

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

PART CONTENT INFORMATION

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

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

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

EPA Fuel Economy Estimates

CITY MPG **20**
Expected range for most drivers **16** to **24** MPG

Estimated Annual Fuel Cost **$ 1957.00** based on 15,000 miles at $3.00 per gallon

Combined Fuel Economy
This Vehicle **23**
10 — 32
All SUVs

HIGHWAY MPG **28**
Expected range for most drivers **23** to **33** MPG

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

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

STANDARD FEATURES:

AMERICA'S BEST WARRANTY	
5-year/60,000-mile New Vehicle Warranty	INCLUDED
10-year/100,000-mile Powertrain Warranty	INCLUDED
7-year/Unlimited-mile Anti-perforation Warranty	INCLUDED
*5-year/Unlimited-mile Roadside Assistance	INCLUDED
*Limited warranties, see dealer for details	
ADVANCED SAFETY TECHNOLOGY	
*Electronic Stability Control w/ Traction Control System	INCLUDED
*ABS w/ Electronic Brake-Force Distribution & Brake Assist	INCLUDED
*Advanced Front Seat Airbag System	INCLUDED
*Front Side-Impact Airbags	INCLUDED
*Side Curtain Airbags with Rollover Sensors	INCLUDED
*Tire Pressure Monitor System	INCLUDED
*Active Front Head Restraints	INCLUDED
POWERTRAIN TECHNOLOGY	
*2.4L DOHC 16-Valve 4-cylinder Engine	INCLUDED
*6-Spd Automatic Transmission w/ SHIFTRONIC® Shift Function	INCLUDED
*Front Wheel Drive	INCLUDED
*Downhill Brake Control	INCLUDED
*17" Alloy Wheels w/ Low Rolling Resistance Tires	INCLUDED
COMFORT & CONVENIENCE	
*Air Conditioning with Cabin Air Filter	INCLUDED
*AM/FM/CD/MP3 Audio System w/ iPod®/USB/Aux Input Jacks	INCLUDED
*XM® Satellite Radio w/90 Day Trial; Not Available in AK & HI	INCLUDED
*Integrated Bluetooth® Hands-Free Phone System	INCLUDED
*Steering-Wheel-Mounted Audio & Cruise Controls	INCLUDED
*Tilt-and-Telescopic Steering Wheel	INCLUDED
*Premium Seat Cloth	INCLUDED
*Driver Seat Adjustable Lumbar Support	INCLUDED
*60/40 Split Folding Rear Seat with Auto-Fold Head Restraints	INCLUDED
*Keyless Entry System with Alarm	INCLUDED
*Black Manual-Folding Heated Power Mirrors	INCLUDED
*Power Door & Liftgate Locks	INCLUDED
*Multi-Function Trip Computer	INCLUDED
*Power Windows with Driver's Auto Up / Down	INCLUDED
*Front Solar Glass and Rear Privacy Glass	INCLUDED
*Roof Rack Side Rails	INCLUDED
*Rear Wiper with Washer	INCLUDED
*Full Tank of Gas	INCLUDED

Manufacturer's Suggested Retail Price: $23,225.00

ADDED FEATURES:

*Carpeted Floor Mats	$125.00
*Cargo Net	$50.00
*Composite Cargo Tray	$115.00
*First Aid Kit	$25.00
*iPod® Cable	$35.00
*Remote Start System	$350.00

Inland Freight & Handling : $810.00
Total Price : $24,735.00

Environmental Performance

Protect the Environment, choose vehicles with higher scores:

Global Warming Score 6 (1 — Average new vehicle — 10 Cleanest)
Smog Score 5 (1 — Average new vehicle — 10 Cleanest)

Vehicle emissions are a primary contributor to global warming and smog. Scores are determined by the California Air Resources Board based on this vehicle's measured emissions. Please visit California Environmental Protection Agency www.DriveClean.ca.gov for more information. AIR RESOURCES BOARD

227 A 4

GOVERNMENT SAFETY RATINGS

Frontal Crash — Driver: Not Rated; Passenger: Not Rated
Star ratings based on the risk of injury in a frontal impact. Frontal ratings should ONLY be compared to other vehicles of similar size and weight.

Side Crash — Front seat: Not Rated; Rear seat: Not Rated
Star ratings based on the risk of injury in a side impact.

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

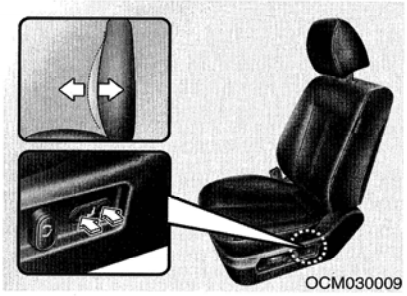
Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.

Source: National Highway Traffic Safety Administration (NHTSA).

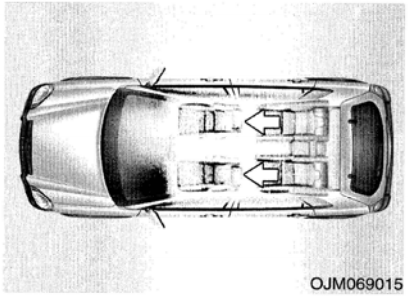
www.safercar.gov or 1-888-327-4236

Monroney Label

Safety systems of your vehicle



Lumbar support
(for driver's seat, if equipped)
The lumbar support can be adjusted by pressing the button.



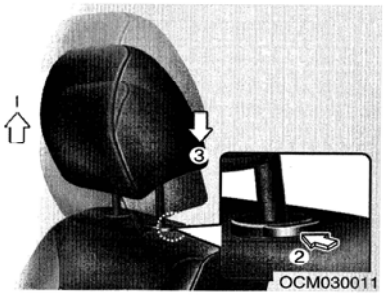
C010104CFD

Headrest
The driver's and front passenger's seats are equipped with a headrest for the occupant's safety and comfort.
The headrest not only provides comfort for the driver and front passenger, but also helps to protect the head and neck in the event of a collision.

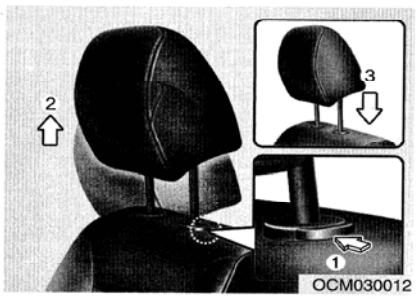
⚠ WARNING

- **For maximum effectiveness in case of an accident, the headrest should be adjusted so the middle of the headrest is at the same height as the center of gravity of an occupant's head. Generally, the center of gravity of most people's head is similar with the height of the top of their eyes. Also, adjust the headrest as close to your head as possible. For this reason, the use of a cushion that holds the body away from the seatback is not recommended.**
- **Do not operate the vehicle with the headrests removed as severe injury to the occupants may occur in the event of an accident. Headrests may provide protection against neck injuries when properly adjusted.**
- **Do not adjust the headrest position of the driver's seat while the vehicle is in motion.**

Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual



Adjusting the height up and down
To raise the headrest, pull it up to the desired position (1). To lower the headrest, push and hold the release button (2) on the headrest support and lower the headrest to the desired position (3).



Removal and installation
To remove the headrest, raise it as far as it can go then press the release button (1) while pulling upward (2).
To reinstall the headrest, put the headrest poles (3) into the holes while pressing the release button (1). Then adjust it to the appropriate height.

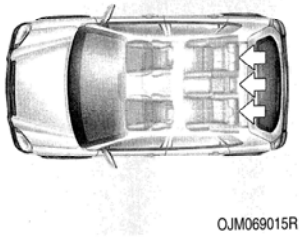
⚠ WARNING
Make sure the headrest locks in position after adjusting it to properly protect the occupants.

Active headrest (if equipped)
The active headrest is designed to move forward and upward during a rear impact. This helps prevent the driver's and front passenger's heads from moving backward and thus helps minimize neck injuries.

⚠ WARNING
A gap between the seat and the headrest release button may appear when sitting on the seat or when you push or pull the seat. Be careful not to get your finger caught in the gap.

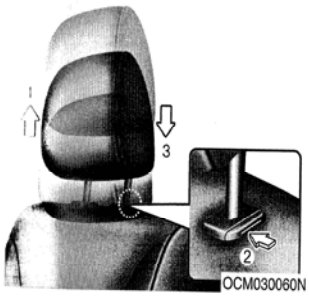
3 9

Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual



Headrest
The rear seat(s) is equipped with headrests in all the seating positions for the occupant's safety and comfort.
The headrest not only provides comfort for passengers, but also helps protect the head and neck in the event of a collision.

⚠ WARNING
- **For maximum effectiveness in case of an accident, the headrest should be adjusted so the middle of the headrest is at the same height of the center of gravity of an occupant's head. Generally, the center as gravity of most people's head is similar with the height of the top of their eyes. Also adjust the headrest as close to your head as possible. For this reason, the use of a cushion that holds the body away from the seatback is not recommended.**
- **Do not operate the vehicle with the headrests removed. Severe injury to an occupant may occur in the event of an accident. Headrests may provide protection against severe neck injuries when properly adjusted.**



Adjusting the height up and down
To raise the headrest, pull it up to the desired position (1). To lower the headrest, push and hold the release button (2) on the headrest support and lower the headrest to the desired position (3).

Removal
The headrest cannot be removed. If there is any problem with the headrest, take your vehicle to an authorized HYUNDAI dealer and have the system checked.

Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

Post-Test Driver Dummy Knee Contact with Vehicle Interior View

Post-Test Rear Passenger Dummy Knee Contact with Vehicle Interior View

APPENDIX B

DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS
Driver Dummy Instrumentation Plots

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

Additional 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)

Passenger Head Acceleration Redundant (X)

Passenger Head Acceleration Redundant (Y)

Passenger Head Acceleration Redundant (Z)

Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)

Vehicle Center of Gravity Acceleration (Y)

Vehicle Center of Gravity Acceleration (Z)

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)

Left Side Sill at Front Seat Acceleration (Y)

Left Side Sill at Rear Seat 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)

Right Rear Occupant Compartment Acceleration (Y)

Engine Block (X)

Engine Block (Y)

Rear Floorpan Above Axle Acceleration (X)

Rear Floorpan Above Axle Acceleration (Y)

Rear Floorpan Above Axle 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)

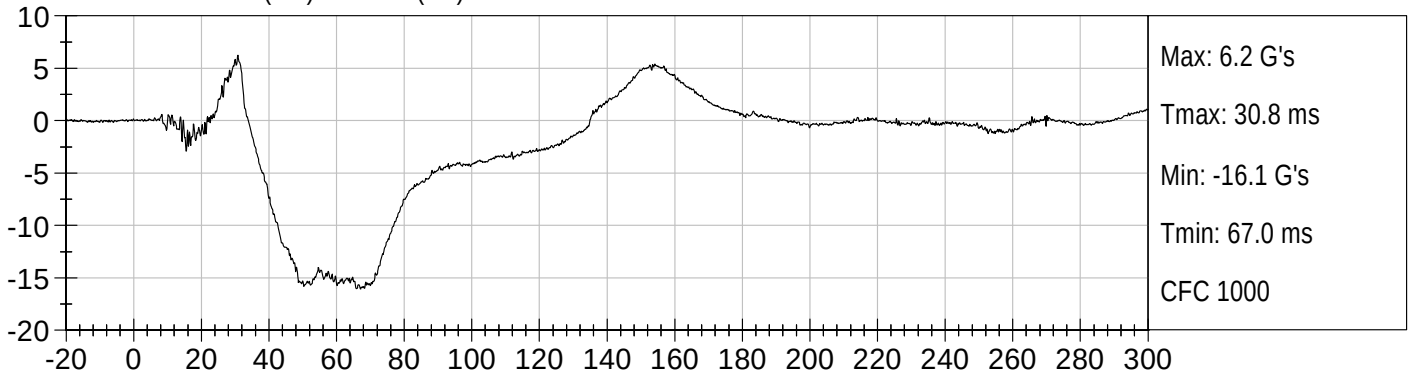
Left MDB Contact Switch

Right MDB Contact Switch

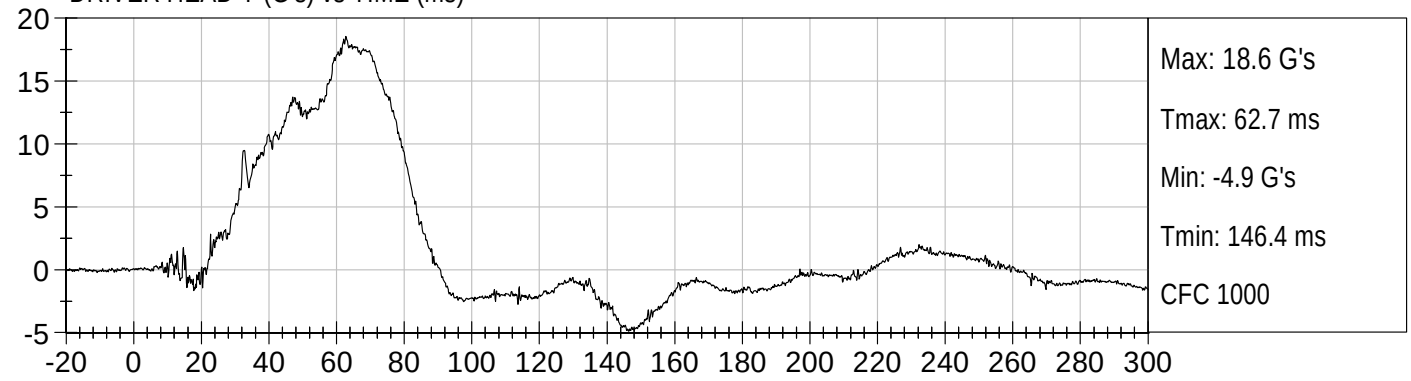
55/28 km/h 90° MDB Side Impact
2012 Hyundai Santa Fe - MC0513

Test Date: 12/13/2011
Speed: 38.8 mph (62.4 km/h)

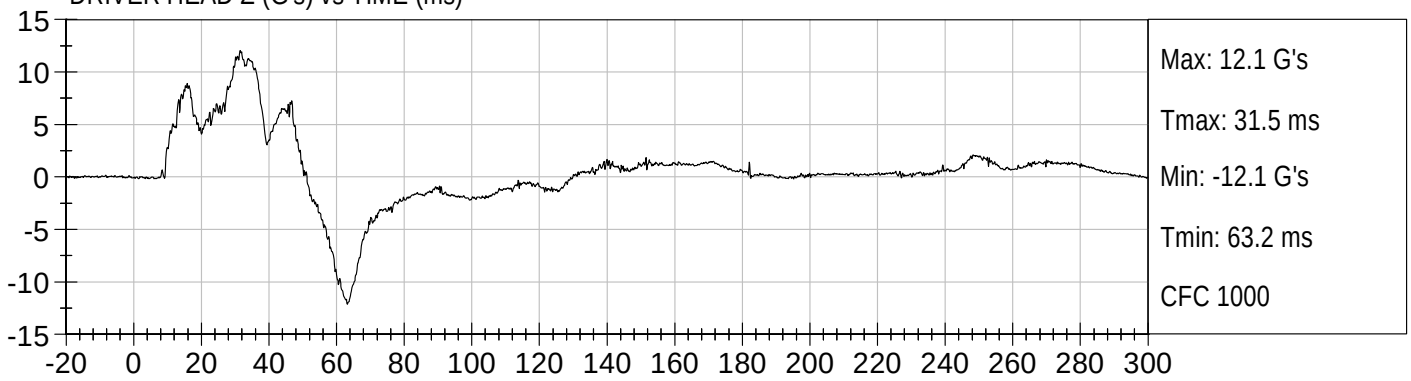
DRIVER HEAD X (G's) vs TIME (ms)



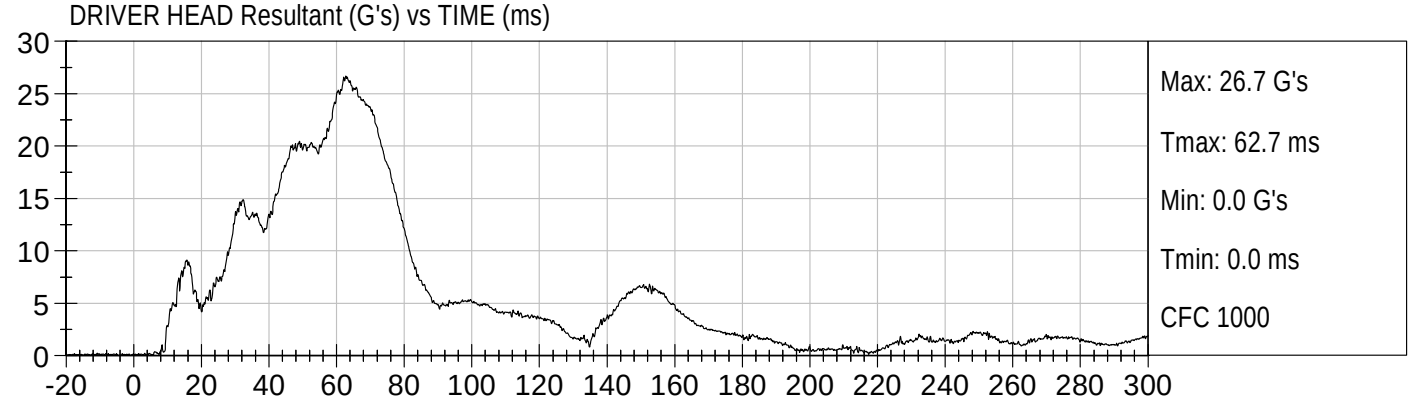
DRIVER HEAD Y (G's) vs TIME (ms)



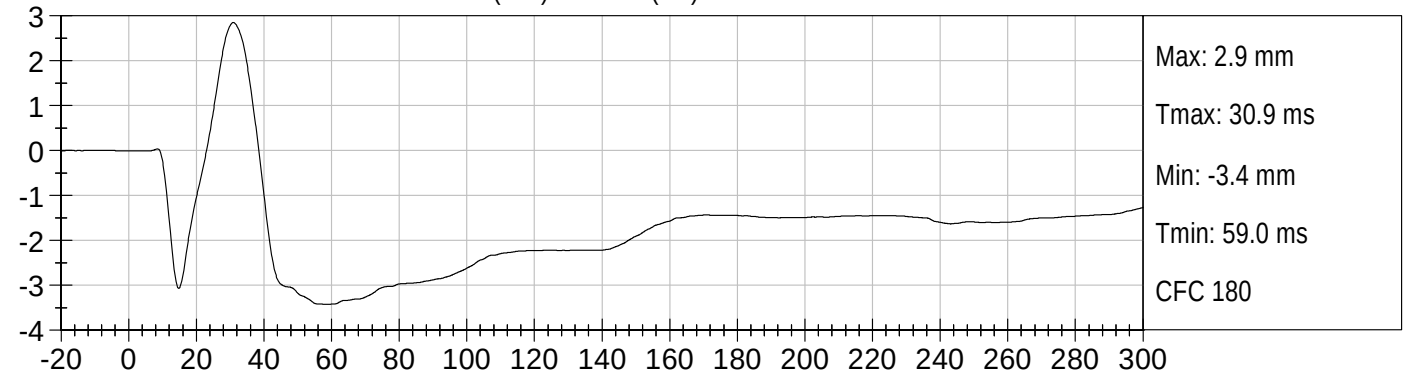
DRIVER HEAD Z (G's) vs TIME (ms)



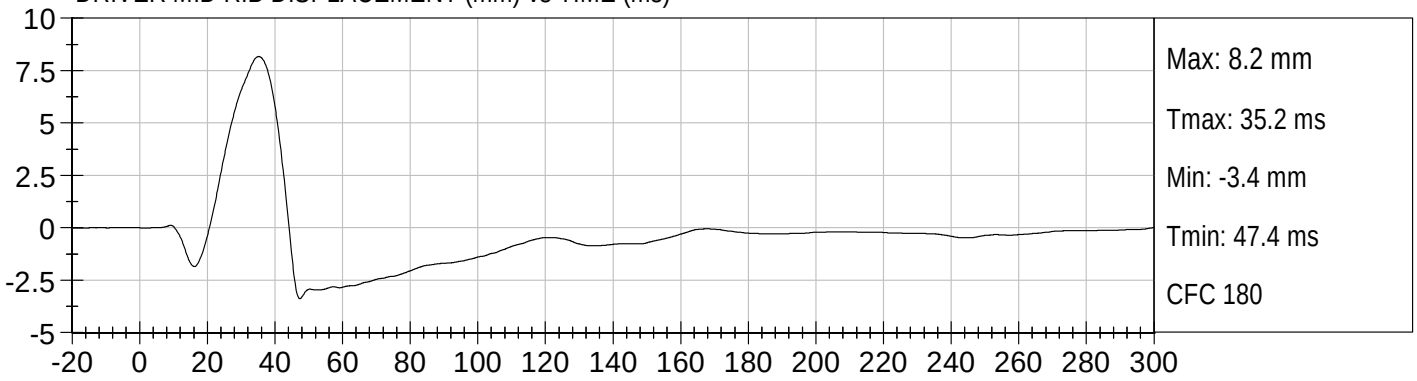
DRIVER HEAD Resultant (G's) vs TIME (ms)



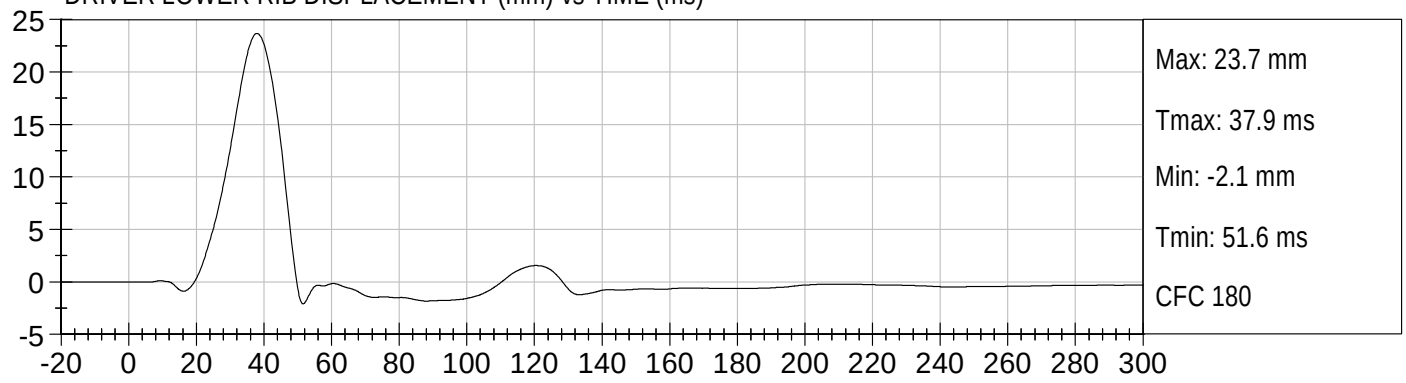
DRIVER UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



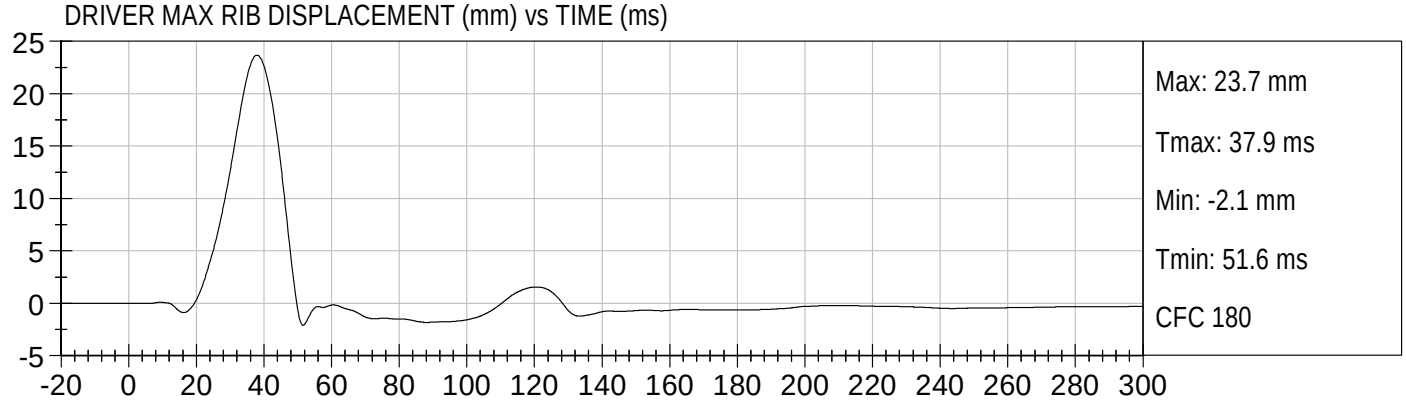
DRIVER MID RIB DISPLACEMENT (mm) vs TIME (ms)



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



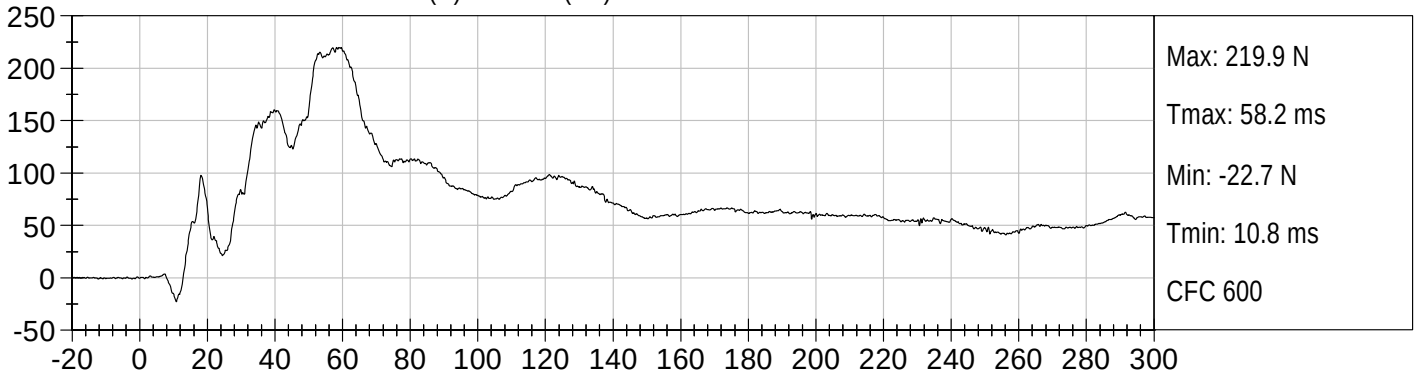
DRIVER MAX RIB DISPLACEMENT (mm) vs TIME (ms)



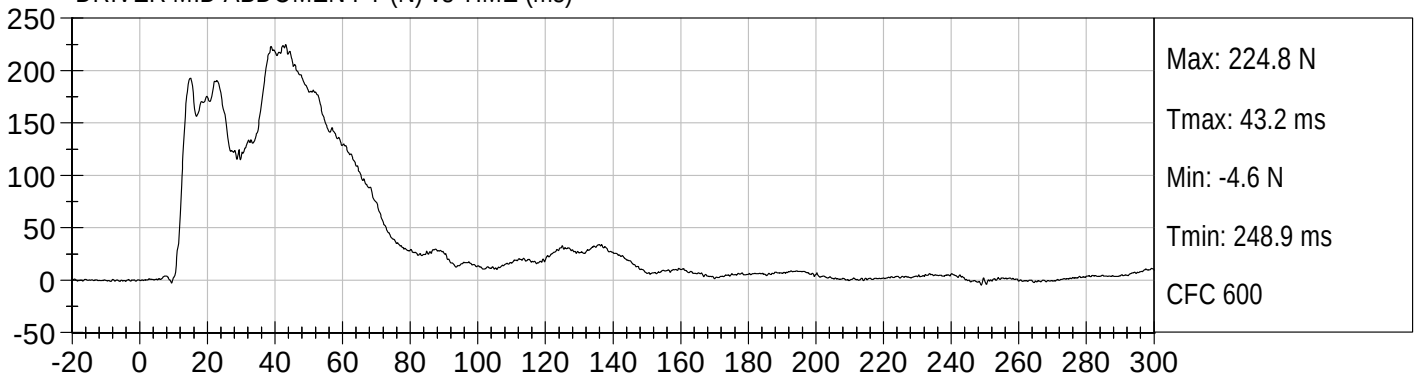
55/28 km/h 90° MDB Side Impact
2012 Hyundai Santa Fe - MC0513

Test Date: 12/13/2011
Speed: 38.8 mph (62.4 km/h)

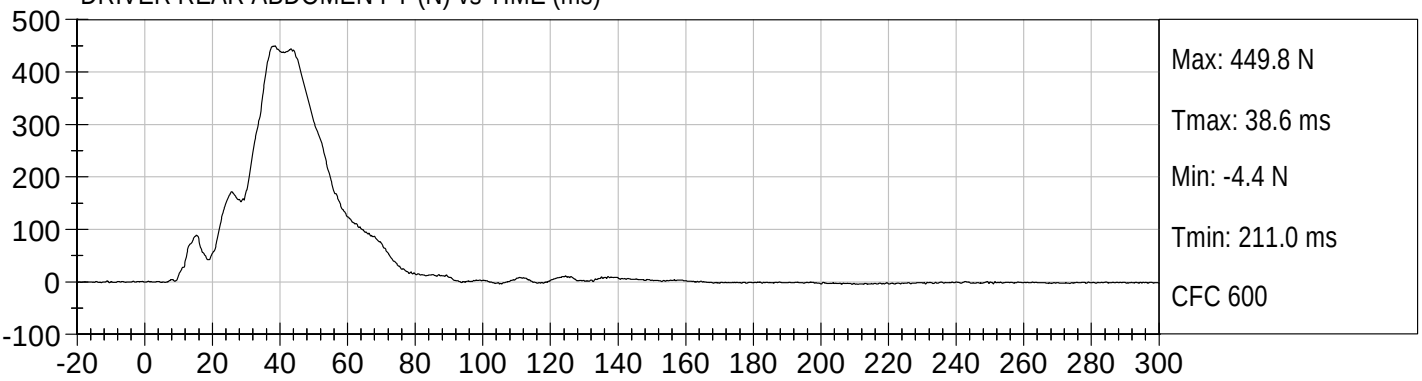
DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)



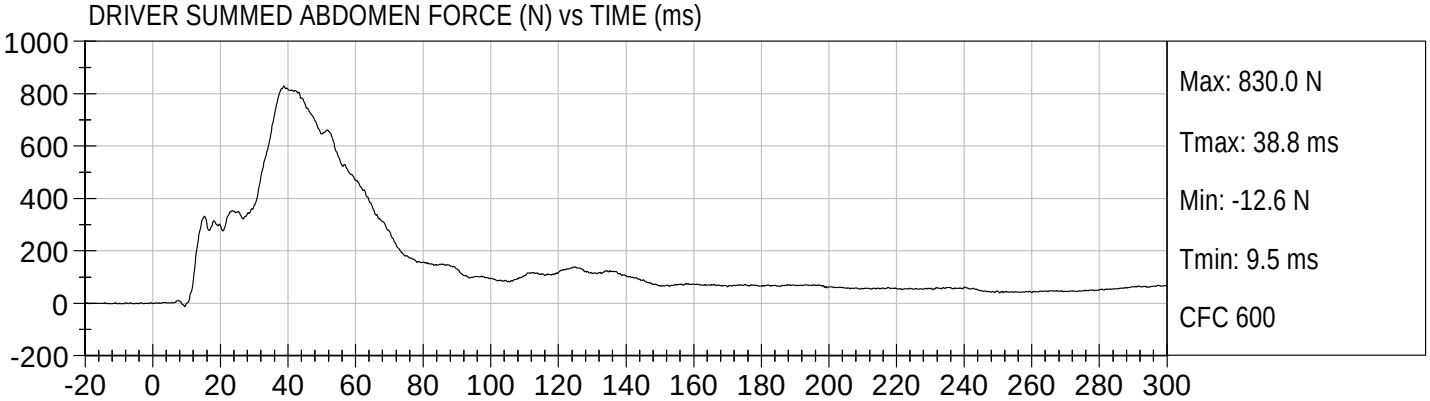
DRIVER MID ABDOMEN FY (N) vs TIME (ms)



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

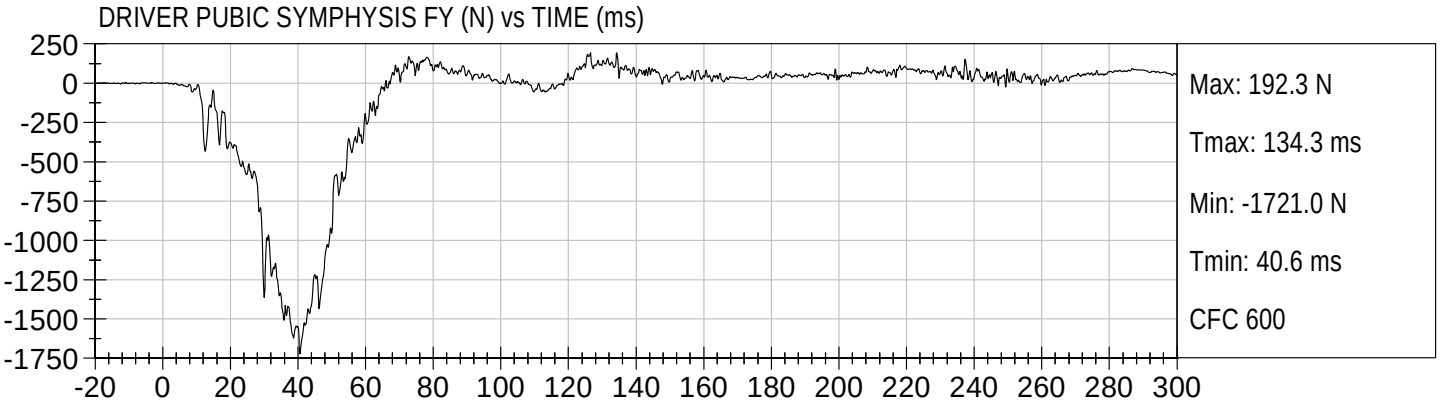


DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)



55/28 km/h 90° MDB Side Impact
2012 Hyundai Santa Fe - MC0513

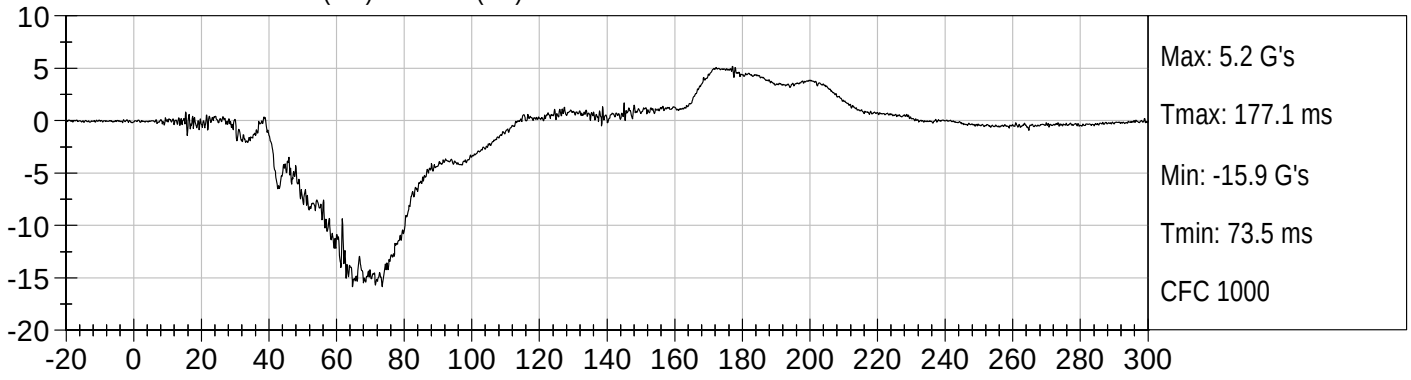
Test Date: 12/13/2011
Speed: 38.8 mph (62.4 km/h)



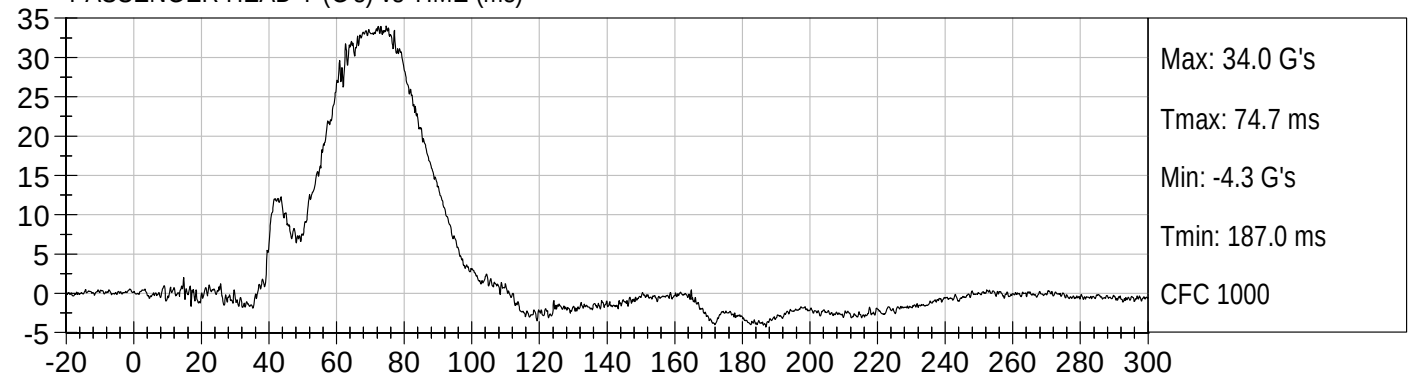
55/28 km/h 90° MDB Side Impact
2012 Hyundai Santa Fe - MC0513

Test Date: 12/13/2011
Speed: 38.8 mph (62.4 km/h)

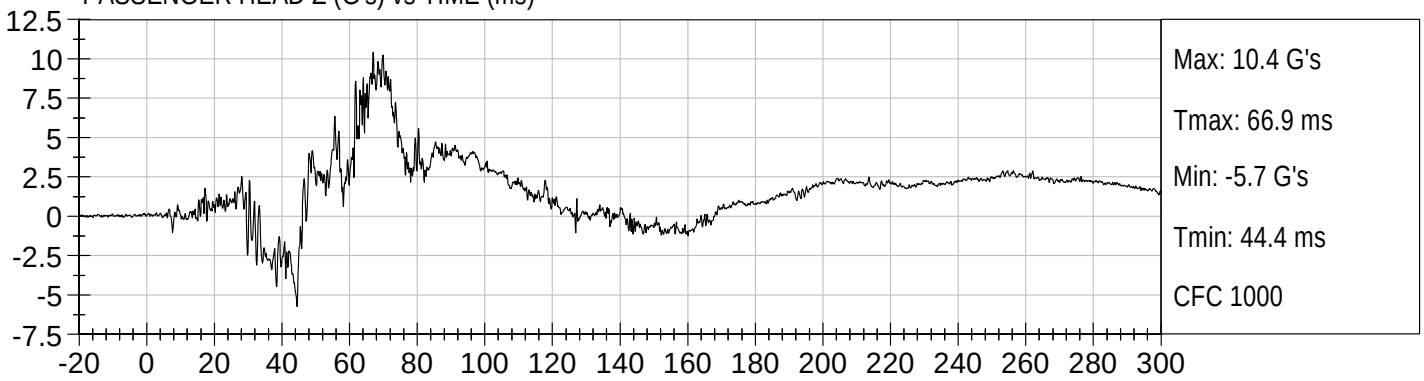
PASSENGER HEAD X (G's) vs TIME (ms)



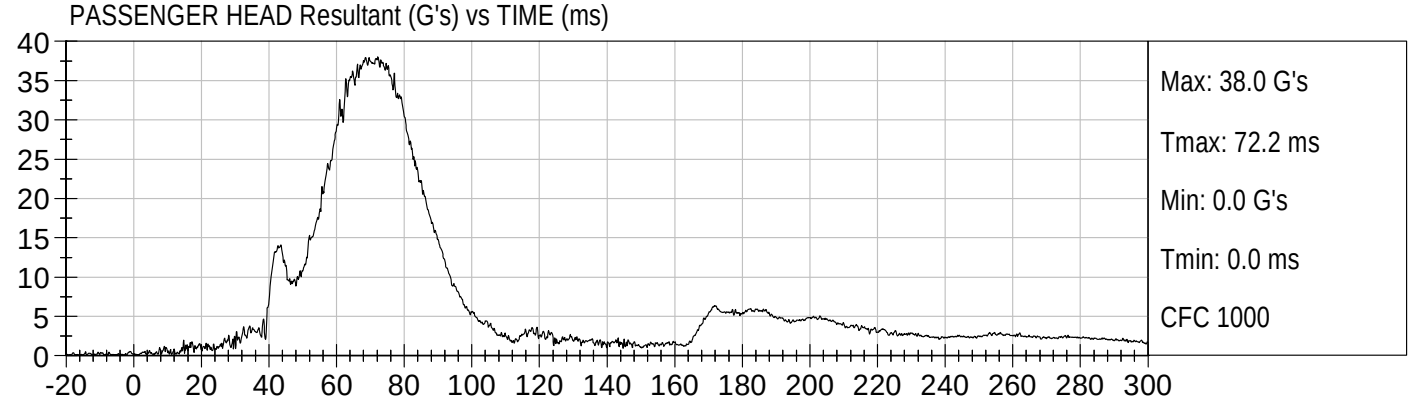
PASSENGER HEAD Y (G's) vs TIME (ms)



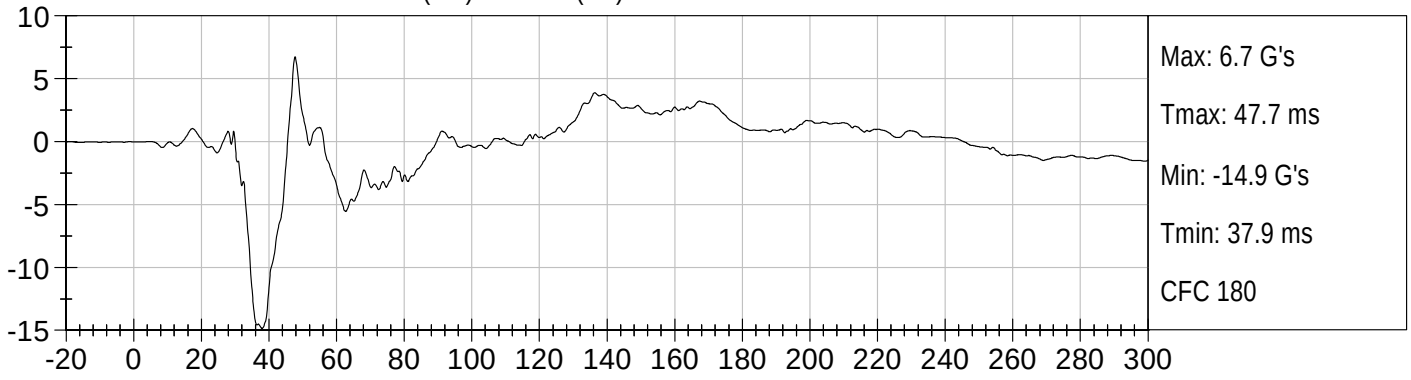
PASSENGER HEAD Z (G's) vs TIME (ms)



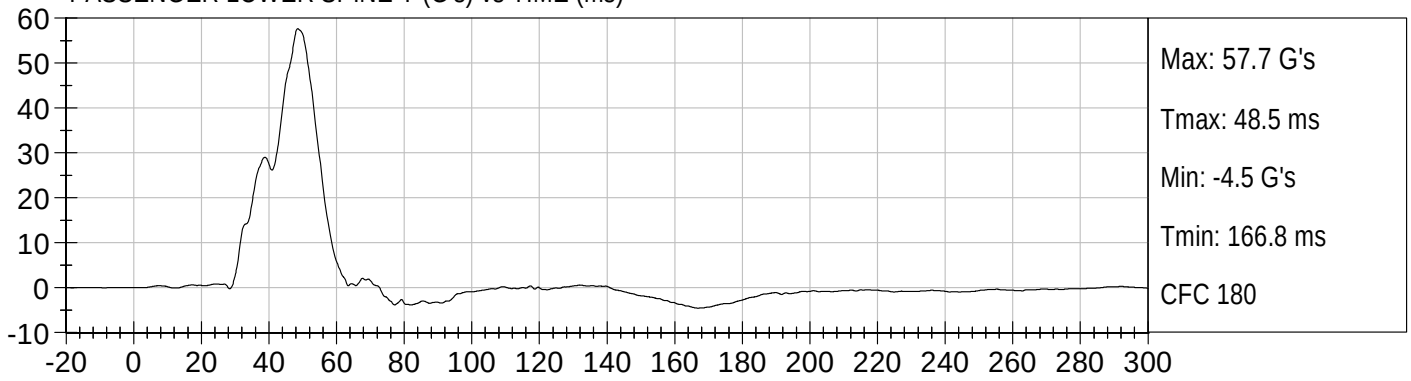
PASSENGER HEAD Resultant (G's) vs TIME (ms)



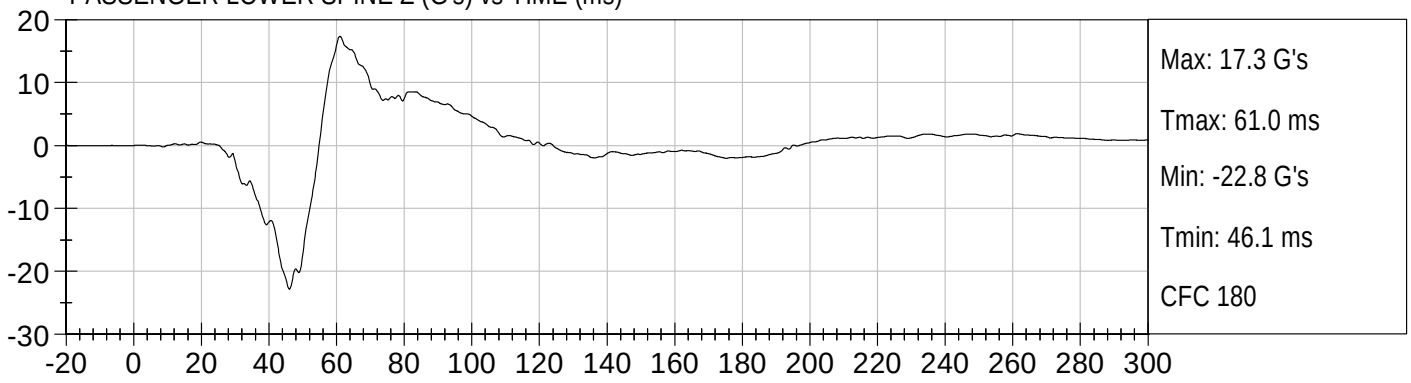
PASSENGER LOWER SPINE X (G's) vs TIME (ms)



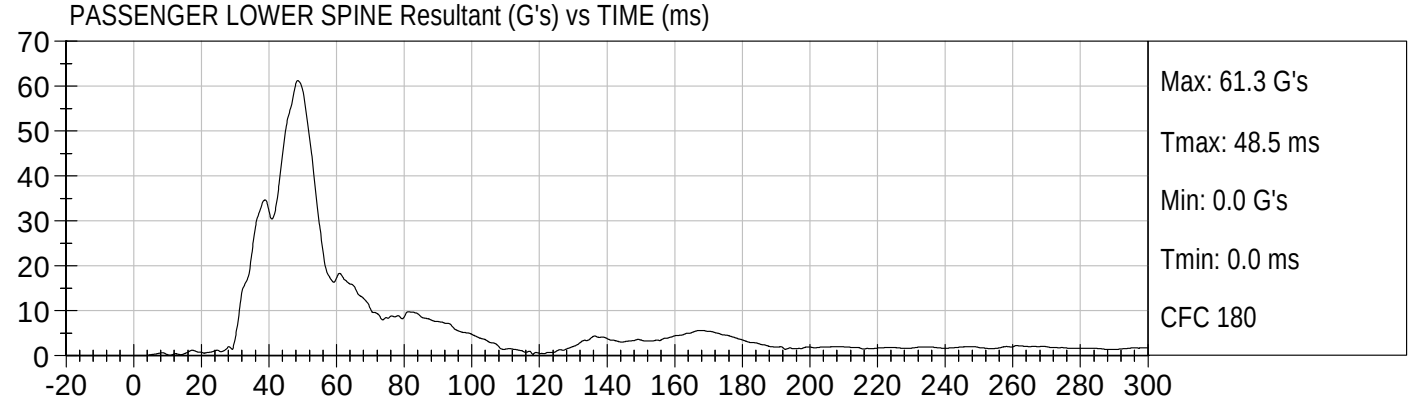
PASSENGER LOWER SPINE Y (G's) vs TIME (ms)



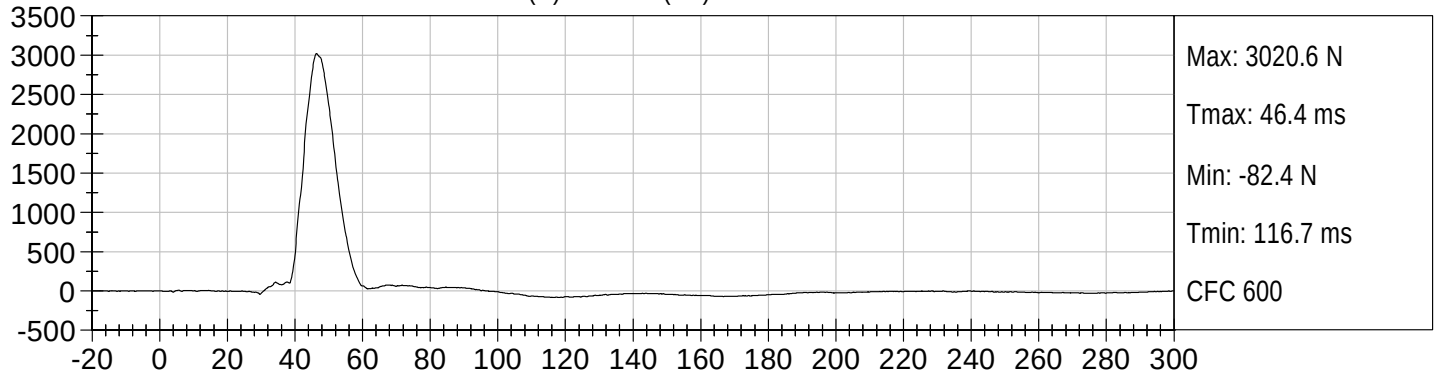
PASSENGER LOWER SPINE Z (G's) vs TIME (ms)



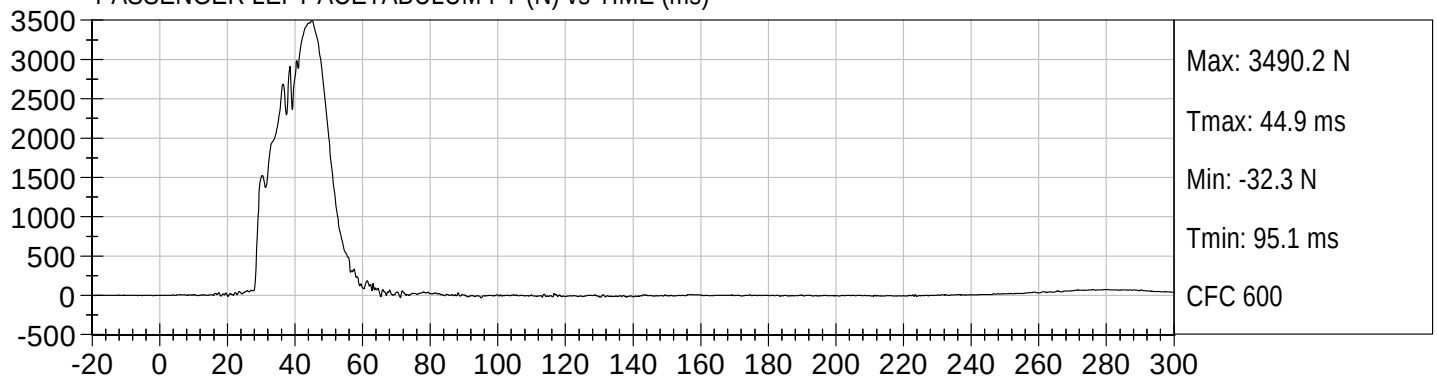
PASSENGER LOWER SPINE Resultant (G's) vs TIME (ms)



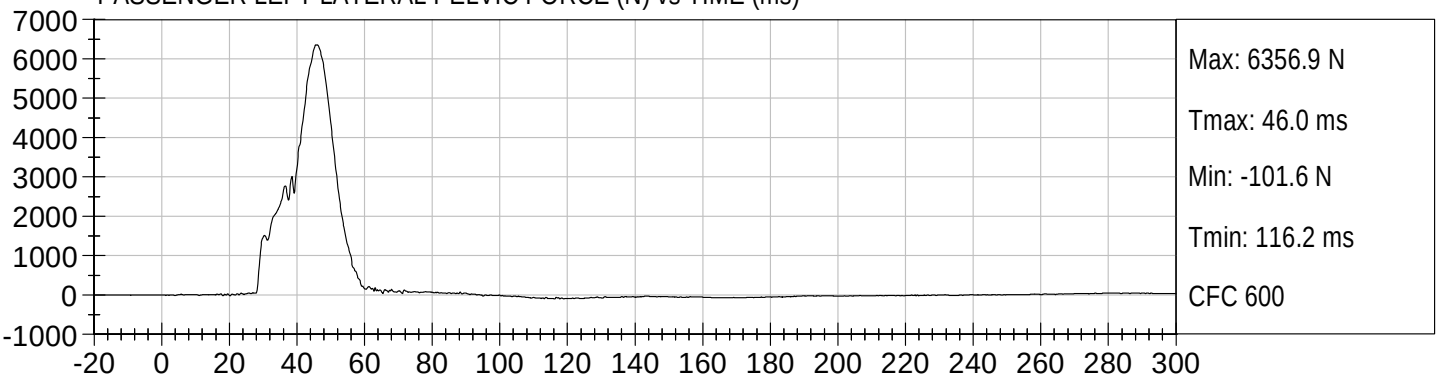
PASSENGER LEFT ILLIUM CREST FY (N) vs TIME (ms)



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



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



APPENDIX C

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

ES-2re External Measurements
SN: 032

No.	Name	Spec. (mm)	Result	Pass/Fail
1	Sitting Height	900 - 918	915	Pass
2	Seat to Shoulder Joint	558 - 572	568	Pass
3	Seat to Lower Face of Thoracic Spine Box	346 - 356	355	Pass
4	Seat to Hip Joint (center of bolt)	97 - 103	98	Pass
5	Sole to Seat, Sitting	333 - 451	440	Pass
6	Head Width	152 - 158	157	Pass
7	Shoulder/Arm Width	461 - 479	464	Pass
8	Thorax Width	322 - 332	323	Pass
9	Abdomen Width	273 - 287	281	Pass
10	Pelvis Lap Width	359 - 373	370	Pass
11	Head Depth	196 - 206	203	Pass
12	Thorax Depth	262 - 272	264	Pass
13	Abdomen Depth	194 - 204	196	Pass
14	Pelvis Depth	235 - 245	236	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150 - 160	151	Pass
16	Back of Buttocks to Front Knee	597 - 615	607	Pass

MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 032 **Test ID:** D114101

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	19	Pass
Peak Resultant Acceleration	G's	125 to 155	145	Pass
Peak Lateral Acceleration	G's	+/- 15	-7.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

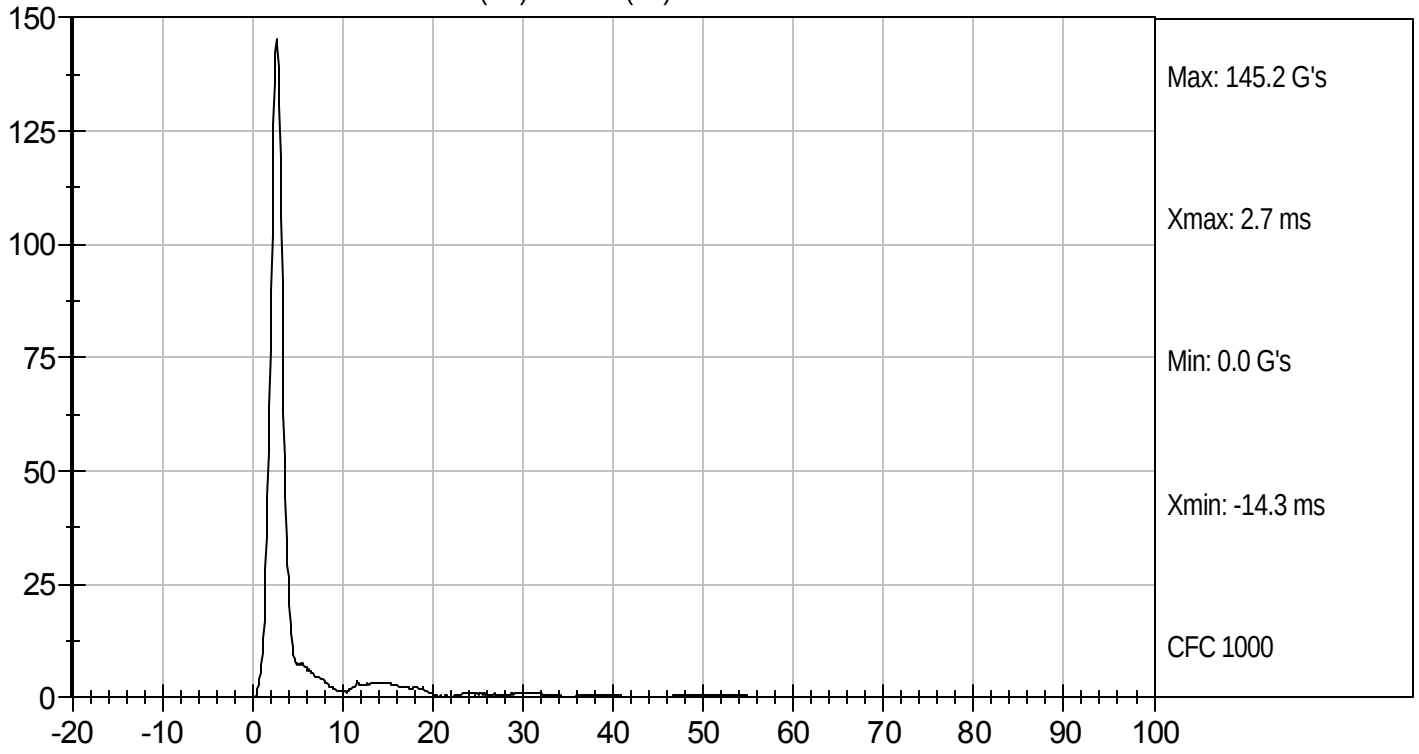
12/7/11
Test Date

David Winkelbauer
Approved By

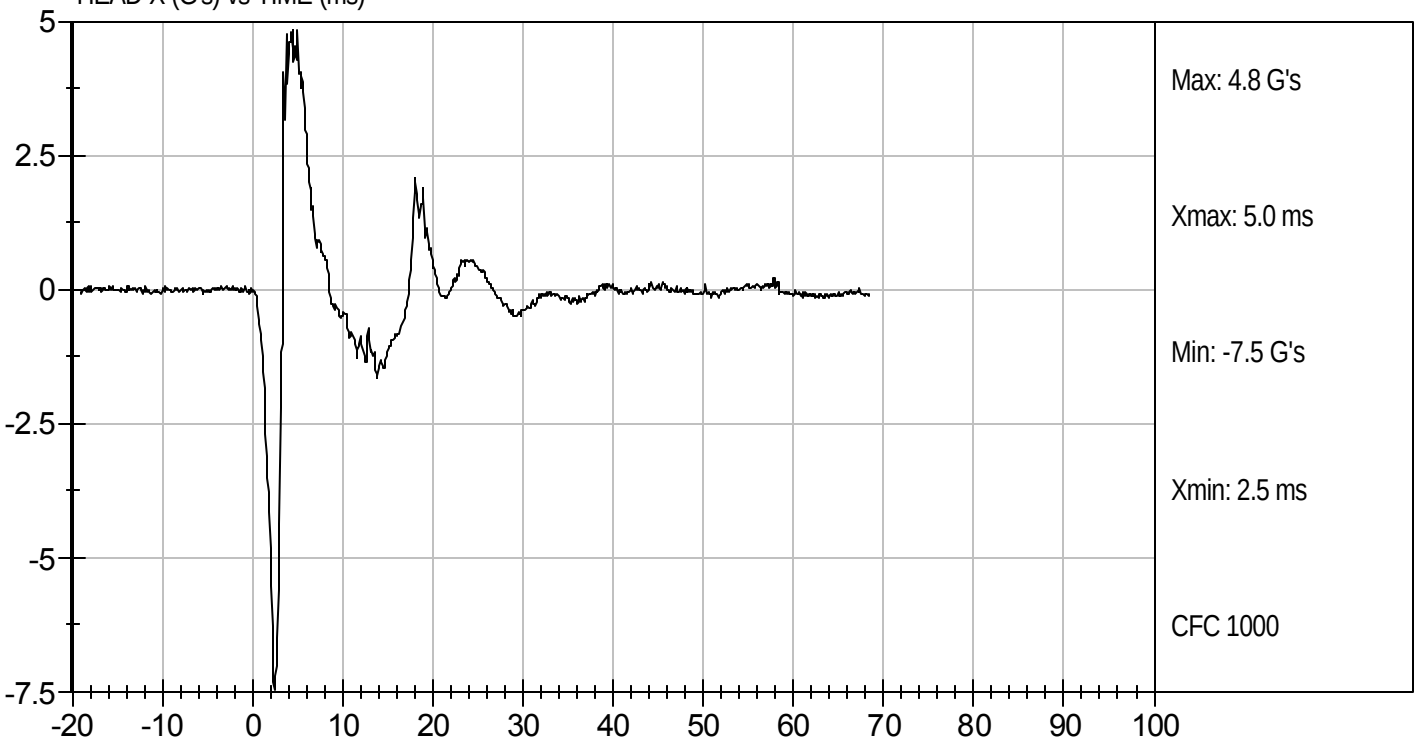
Test Desc: Head Drop
Component ID: D114101

Test Date: 12/7/11
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:** D114102

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.8	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	-0.03	Pass
	3 ms	m/s	-0.25 to -0.375	-0.33	Pass
	14 ms	m/s	-3.20 to -3.70	-3.27	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	50.0	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	57.8	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	55.4	Pass
			Overall Test Results		Pass

Jessica Gall
Laboratory Technician

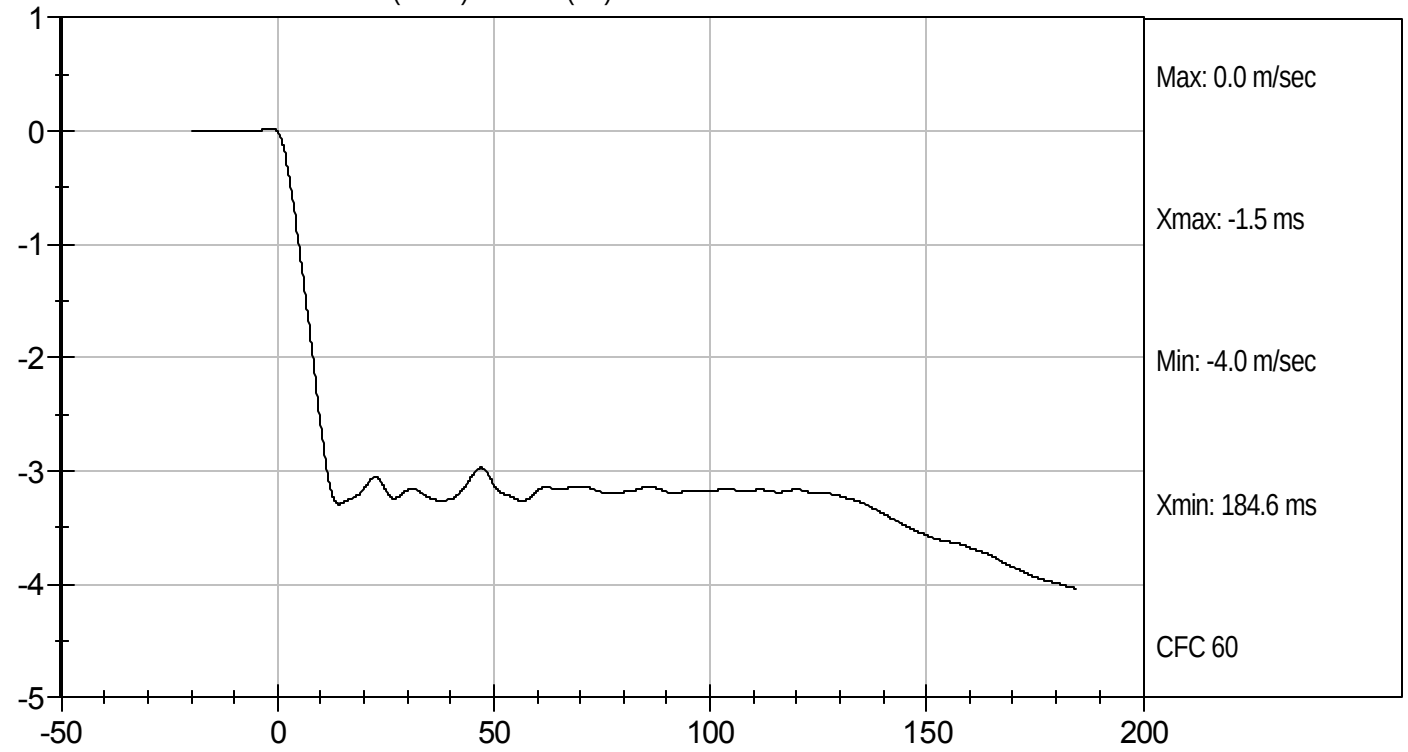
12/7/11
Test Date

David Winkelbauer
Approved By

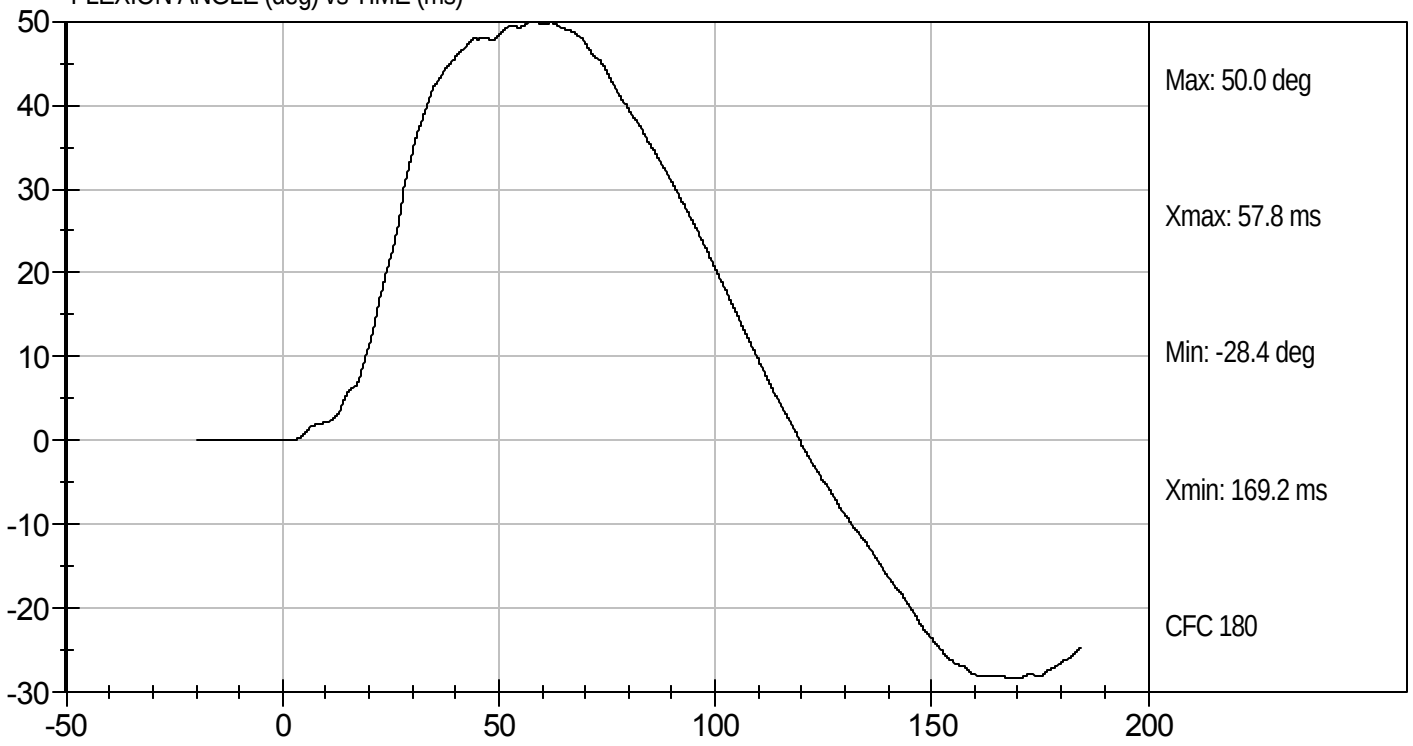
Test Desc: Neck Bending
Component ID: D114102

Test Date: 12/7/11
Velocity: 11.2 ft/s, 3.41 m/s

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

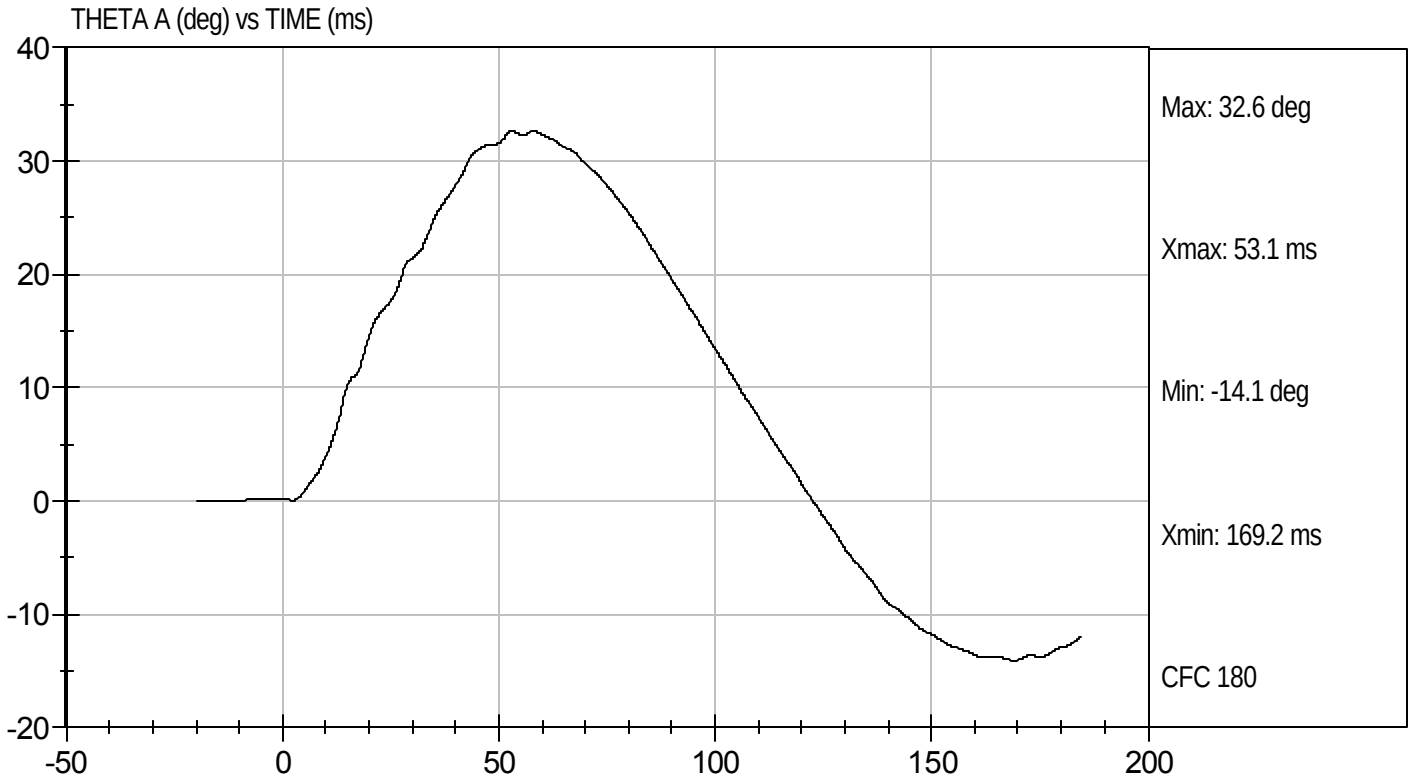


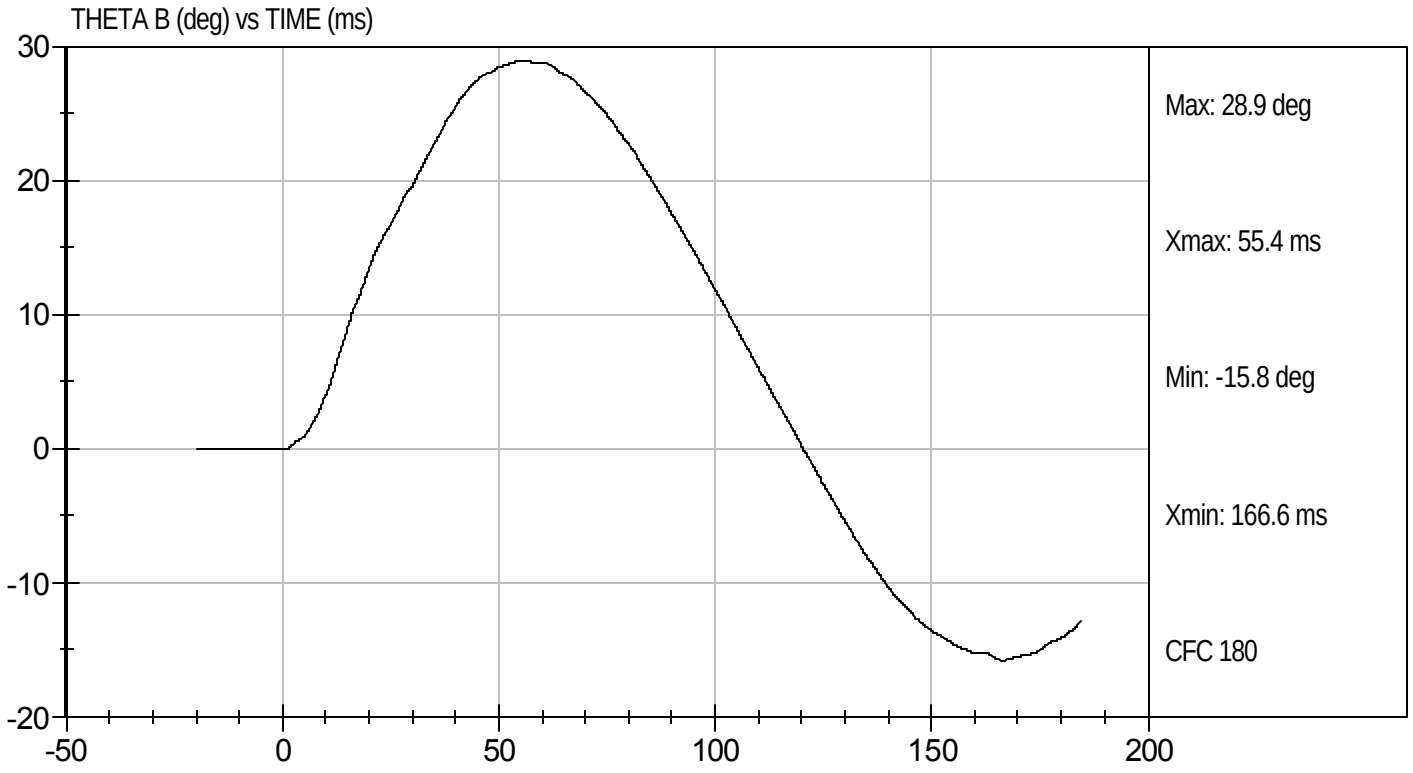
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D114102

Test Date: 12/7/11
Velocity: 11.2 ft/s, 3.41 m/s





MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D114103

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	20	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.3	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

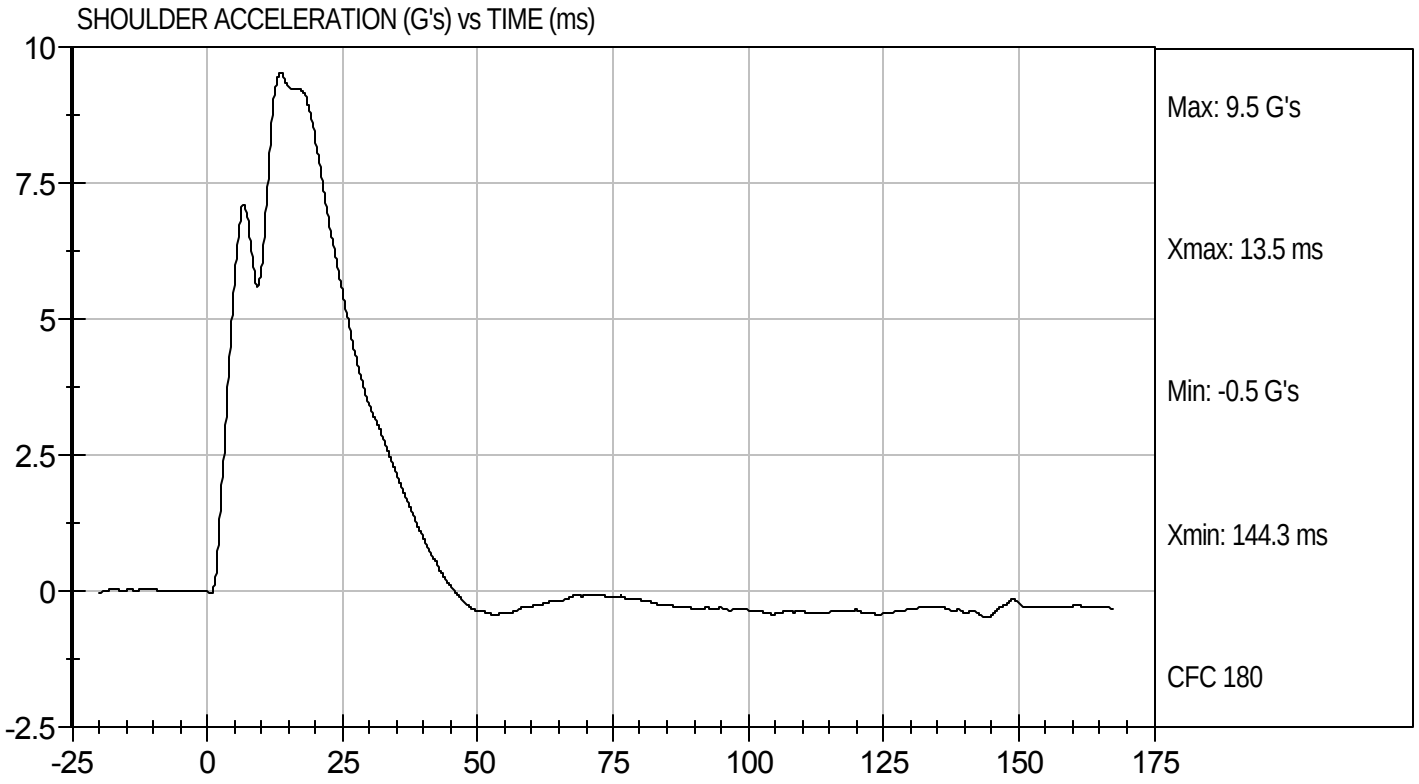
Jessica Hall
Laboratory Technician

12/7/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D114103

Test Date: 12/7/11
Velocity: 14.25 ft/s, 4.3 m/s



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D114104

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	19	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	47.9	Pass
		Overall Test Results		Pass

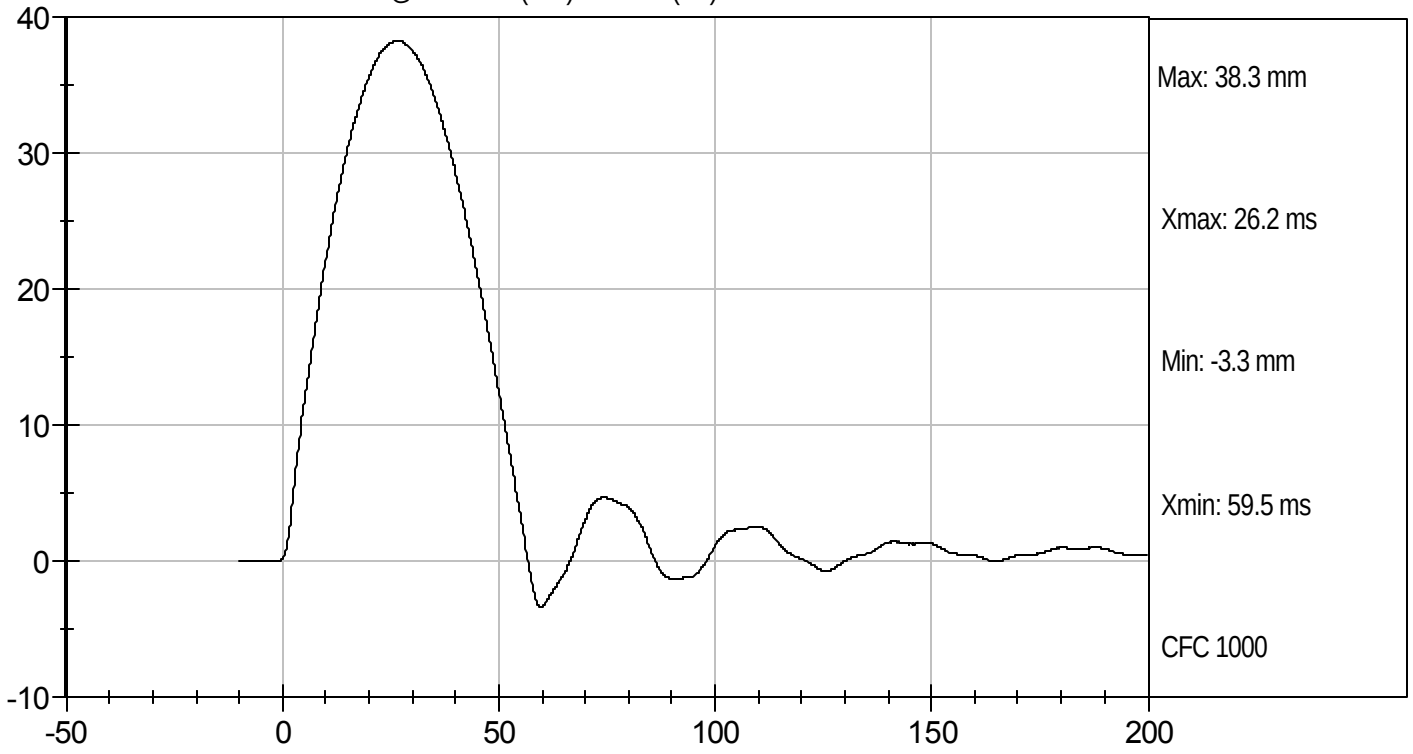
Jessica Gall
Laboratory Technician

12/7/11
Test Date

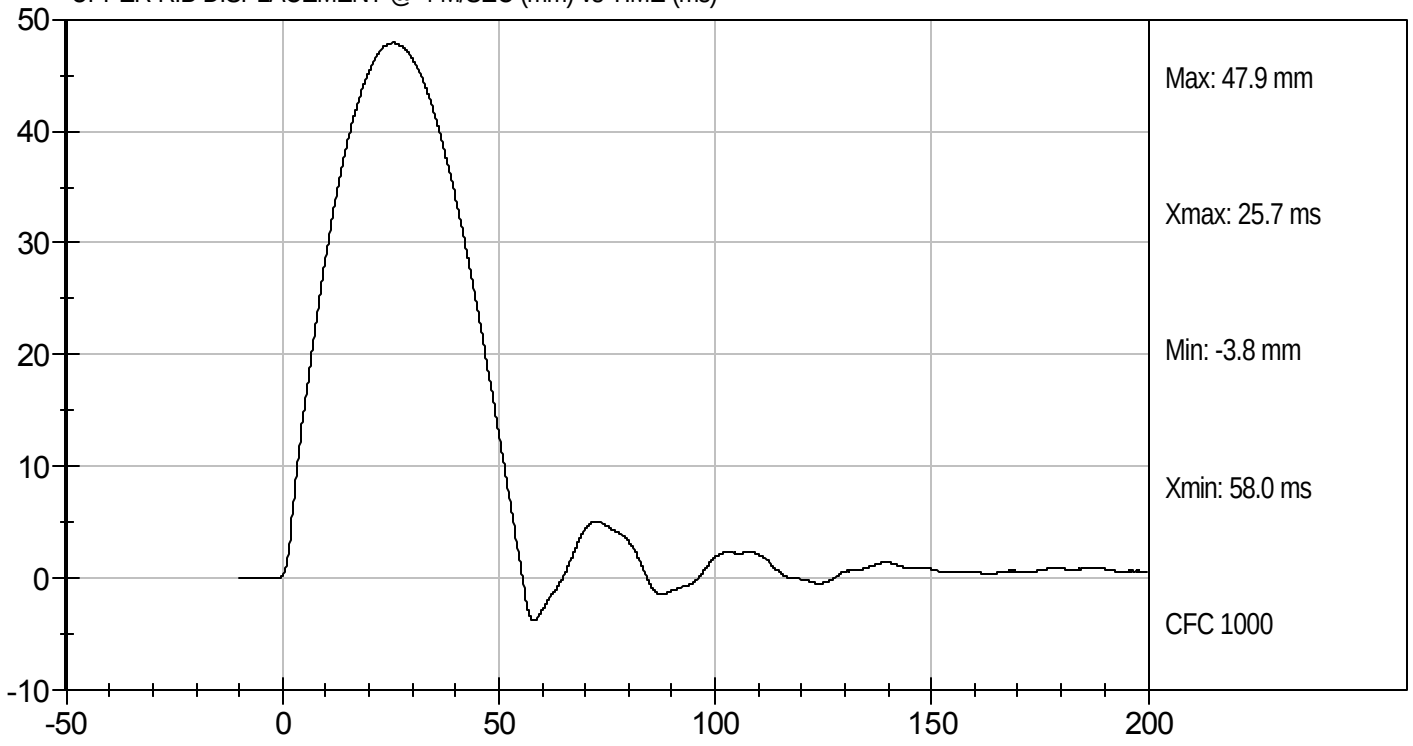
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D114104
Test Date: 12/7/11

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:** D114105

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	19	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	37.2	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	46.9	Pass
		Overall Test Results		Pass

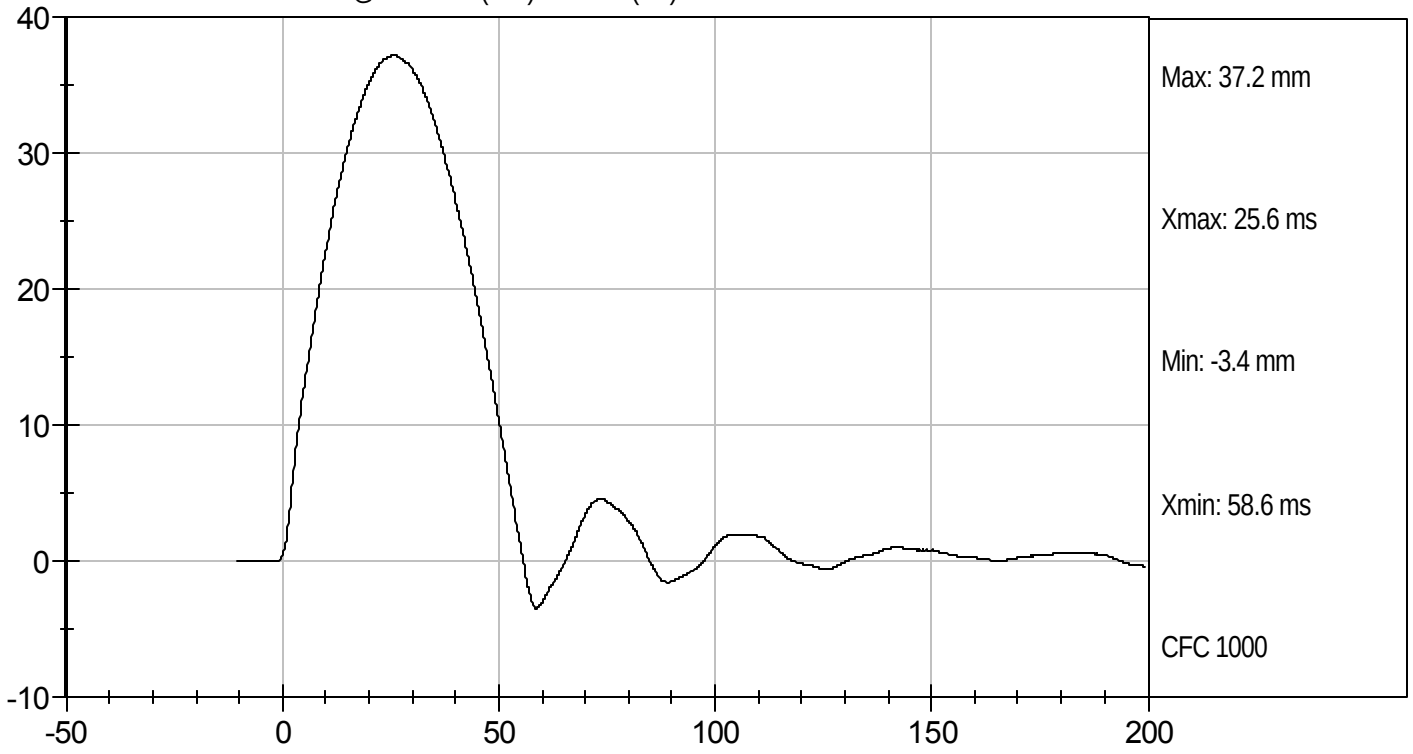
Jessica Gall
Laboratory Technician

12/7/11
Test Date

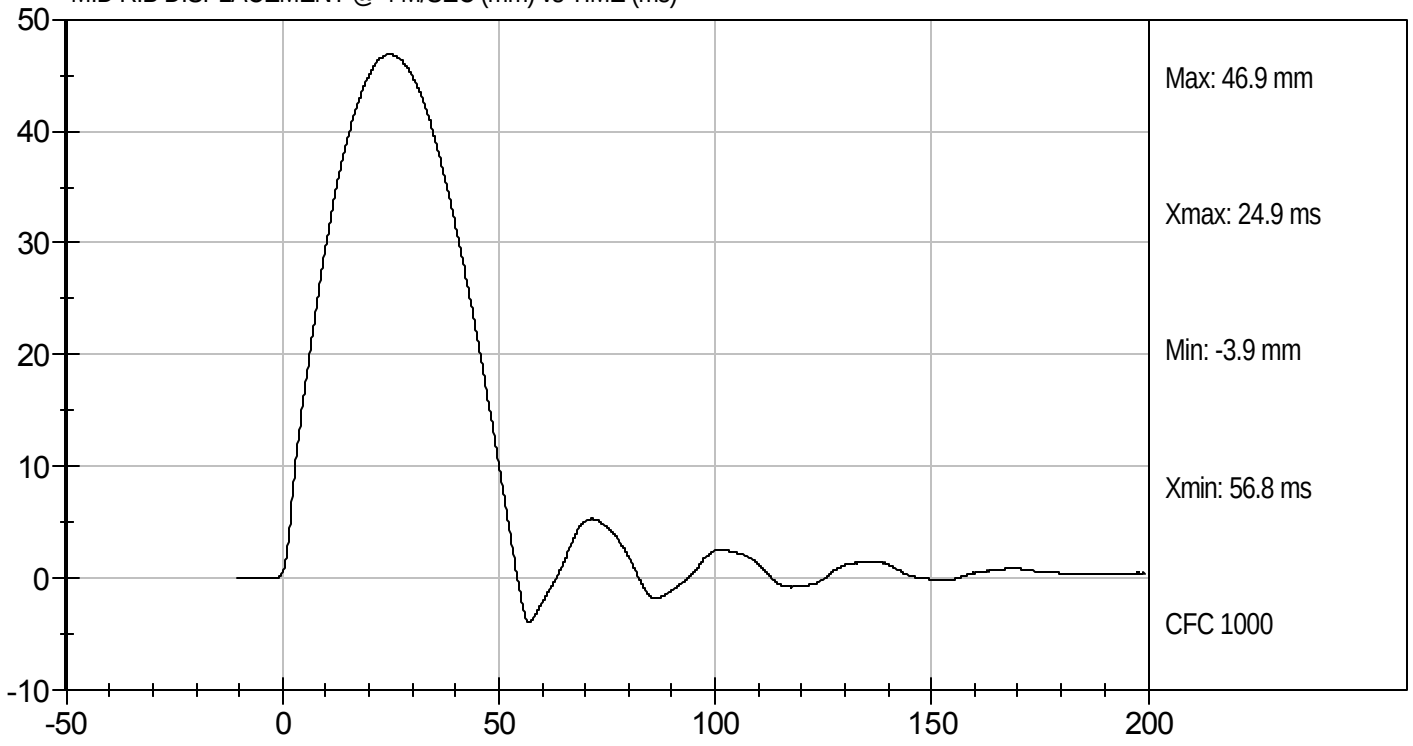
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D114105
Test Date: 12/7/11

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:** D114106

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	19	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	37.8	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.0	Pass
		Overall Test Results		Pass

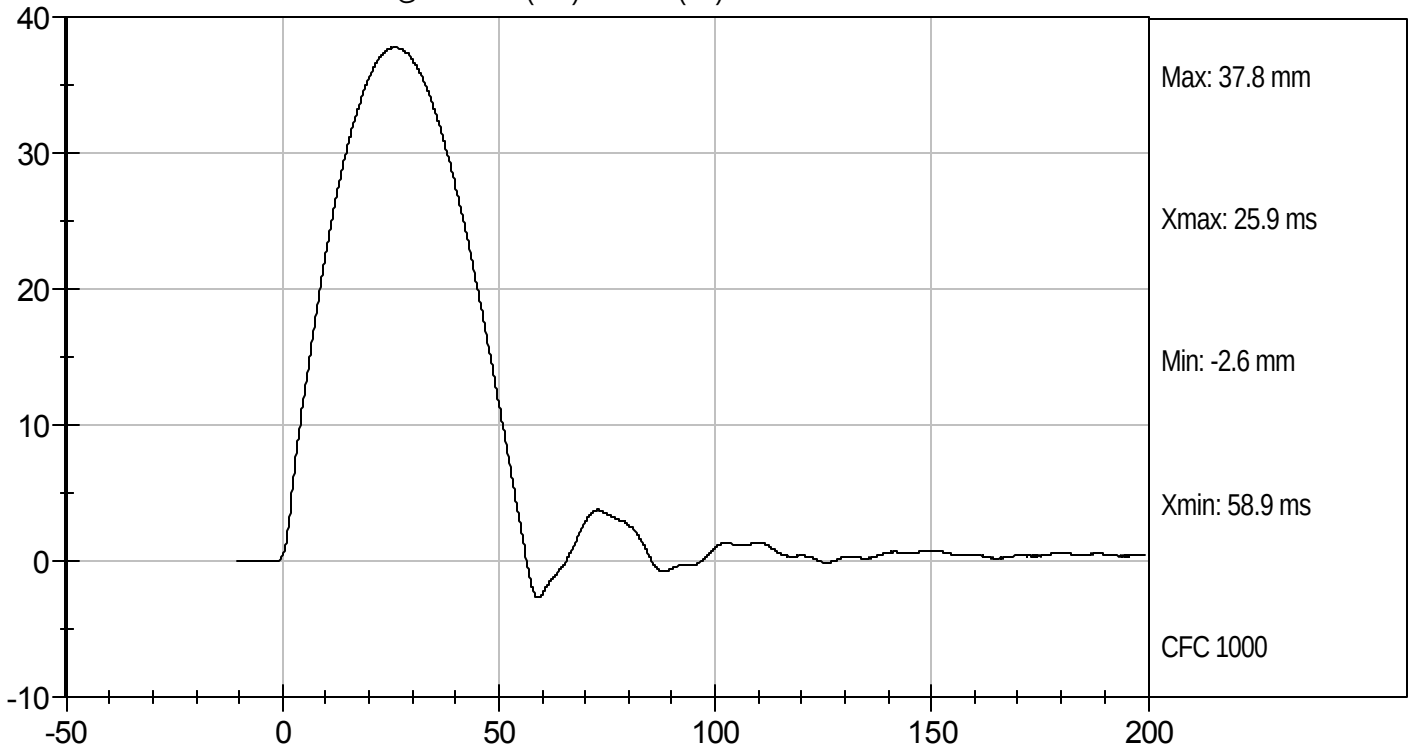
Jessica Hall
Laboratory Technician

12/7/11
Test Date

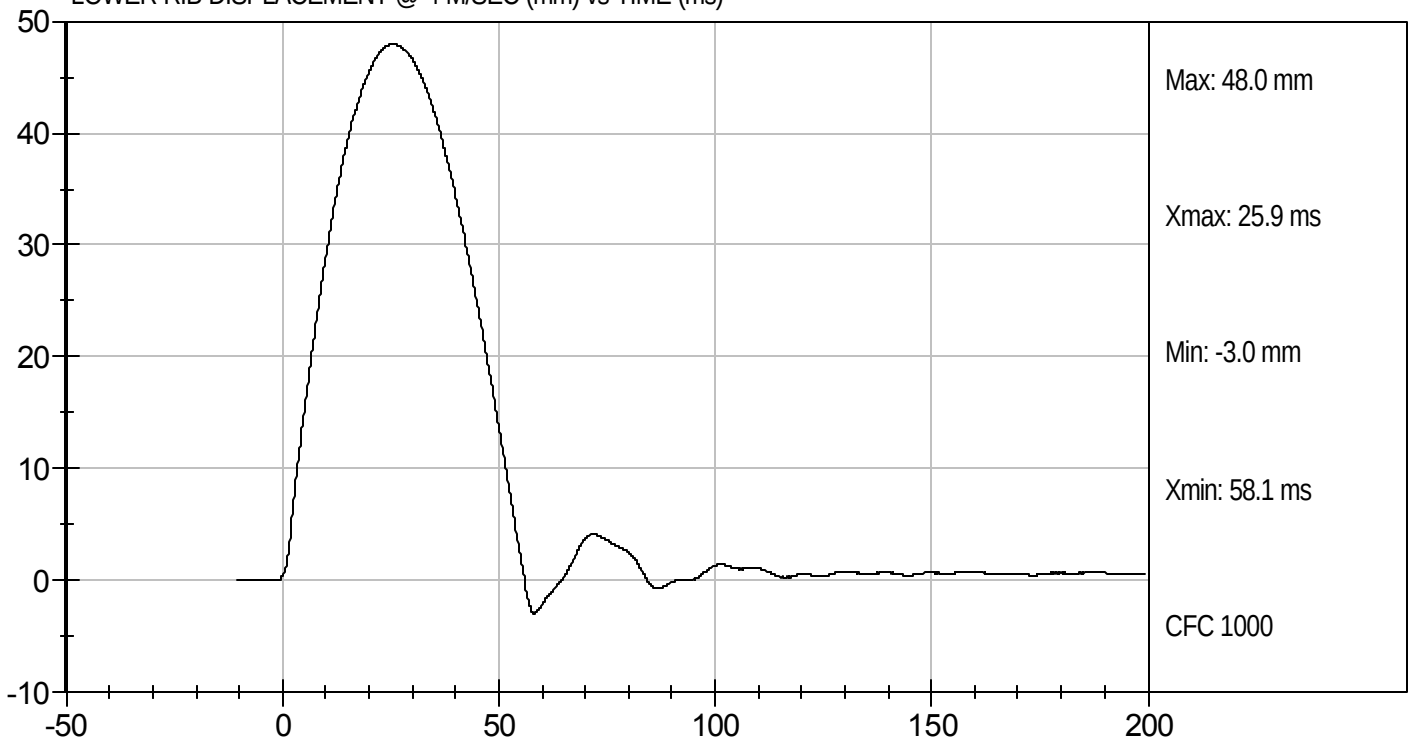
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D114106
Test Date: 12/7/11

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



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



MGA RESEARCH CORPORATION

FULL BODY THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D114100

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.1	Pass
Humidity	%	10 to 70	19	Pass
Probe Speed	m/s	5.40 to 5.60	5.49	Pass
Maximum Impactor Force (after 6 ms)	kN	5.10 to 6.20	5.14	Pass
Upper Rib Displacement	mm	34.0 to 41.0	36.5	Pass
Middle Rib Displacement	mm	37.0 to 45.0	39.4	Pass
Lower Rib Displacement	mm	37.0 to 44.0	39.0	Pass
		Overall Test Results		Pass

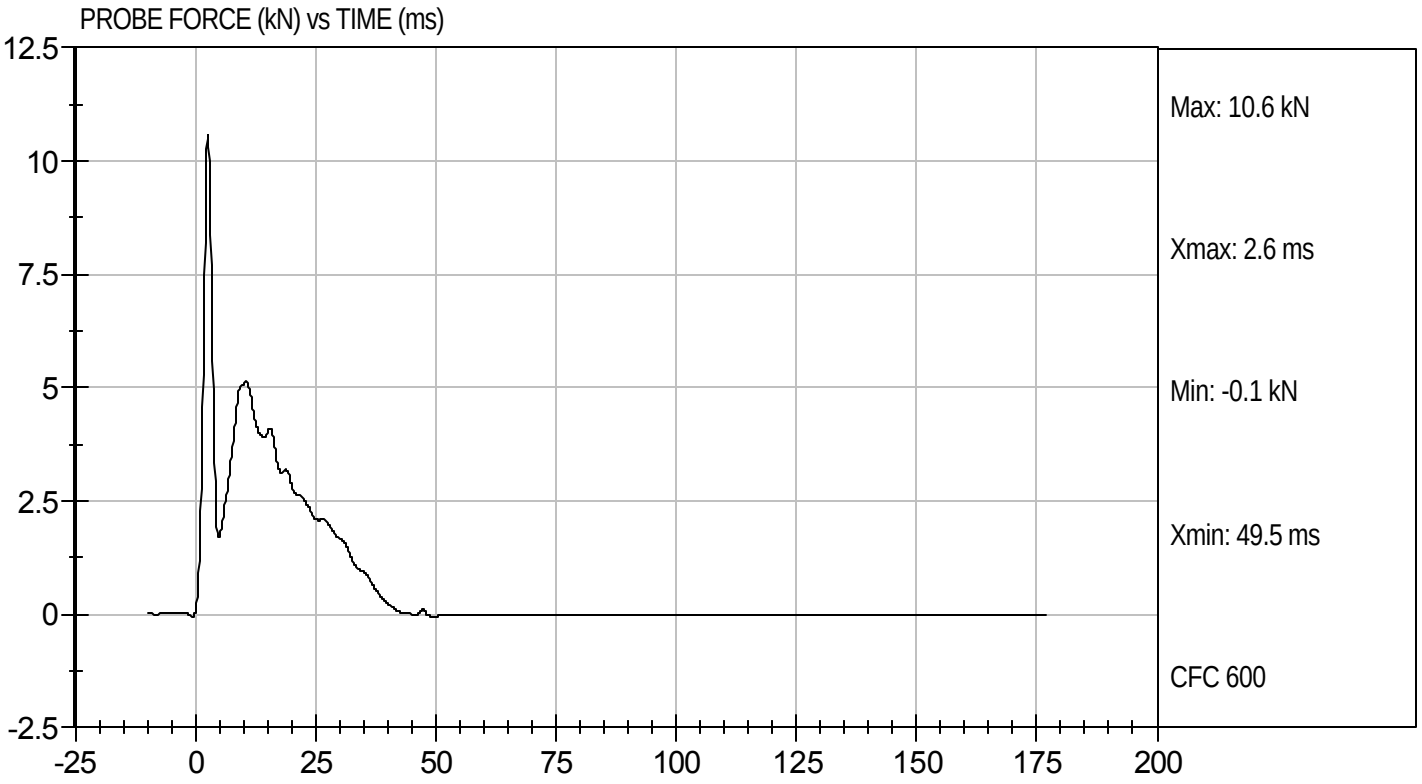
Jessica Gall
Laboratory Technician

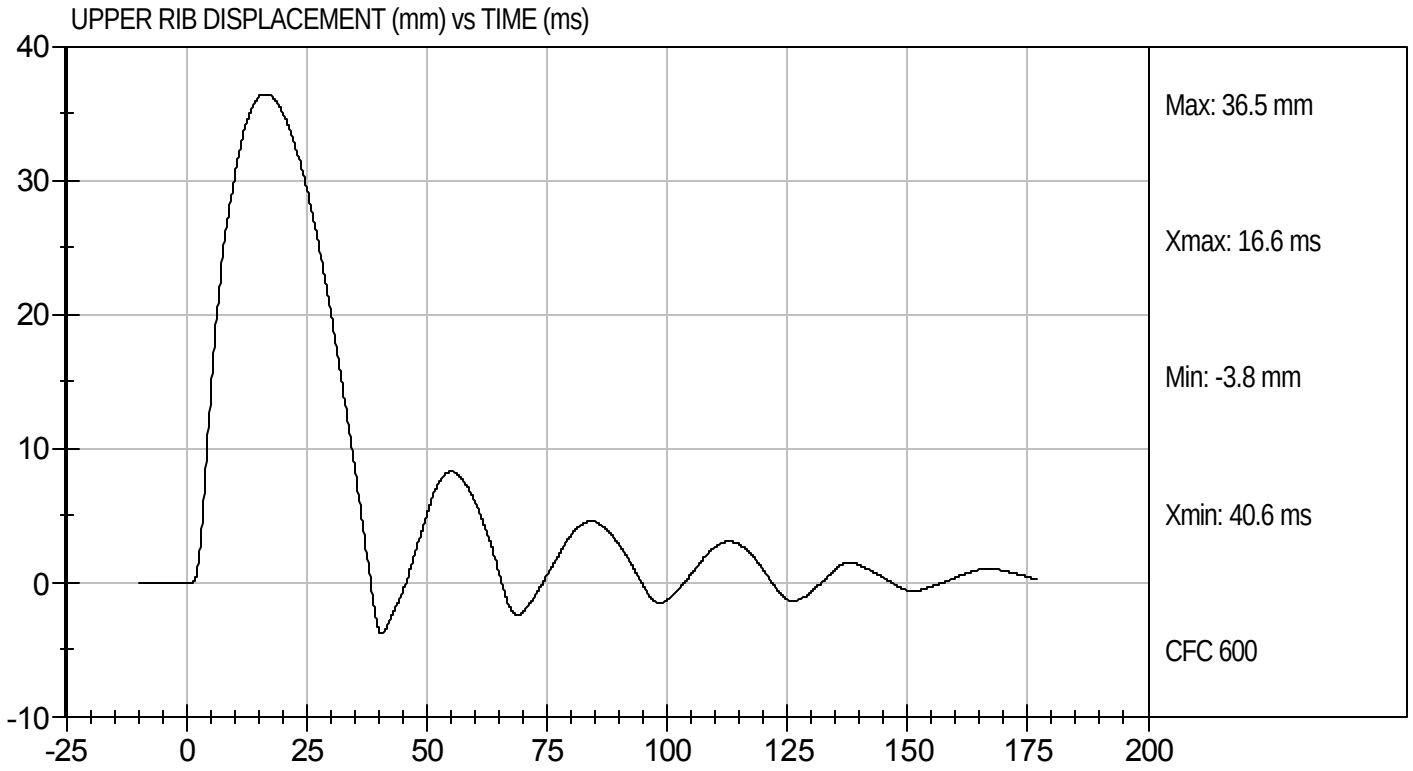
12/8/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D114100

Test Date: 12/8/11
Velocity: 18.00 ft/s, 5.49 m/s

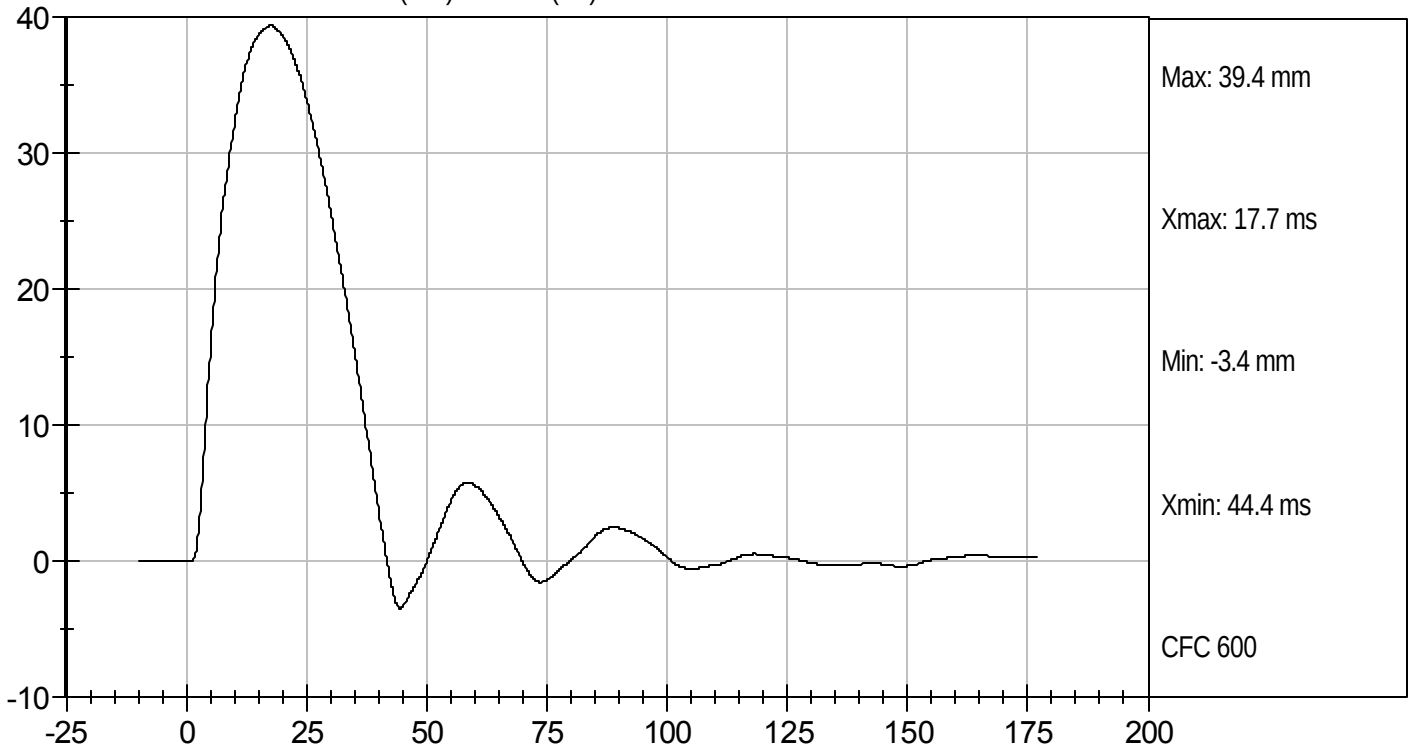




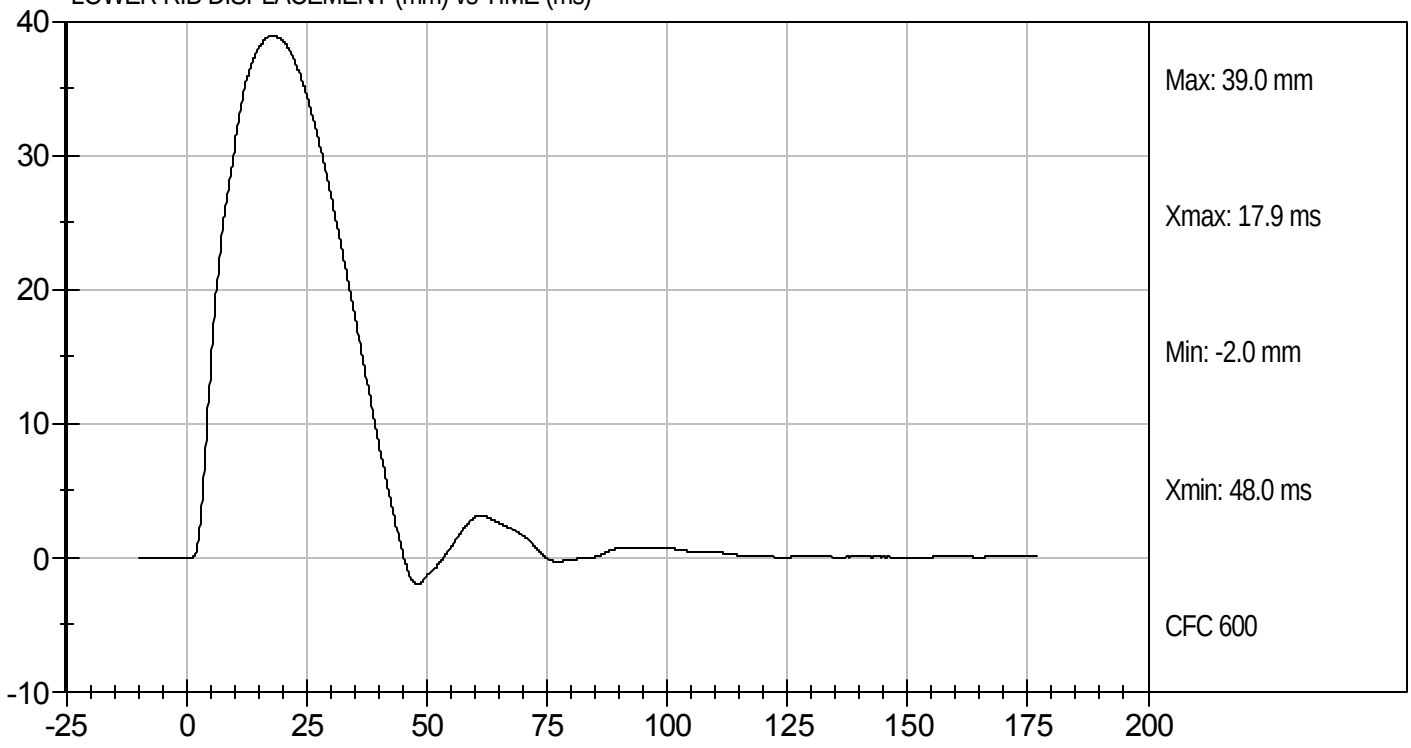
Test Desc: Thorax Impact
Component ID: D114100

Test Date: 12/8/11
Velocity: 18.00 ft/s, 5.49 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D114107

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	19	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.18	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	10.70	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.45	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.20	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

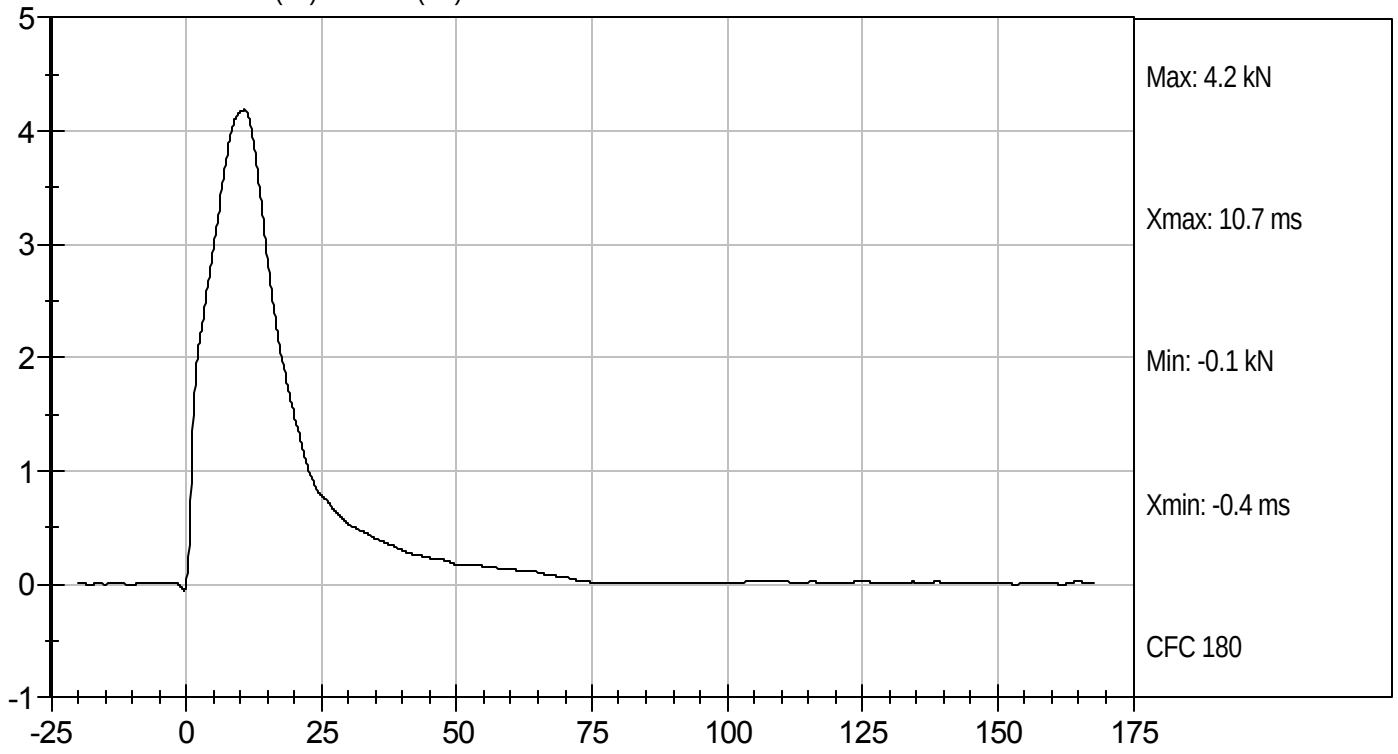
12/7/11
Test Date

David Winkelbauer
Approved By

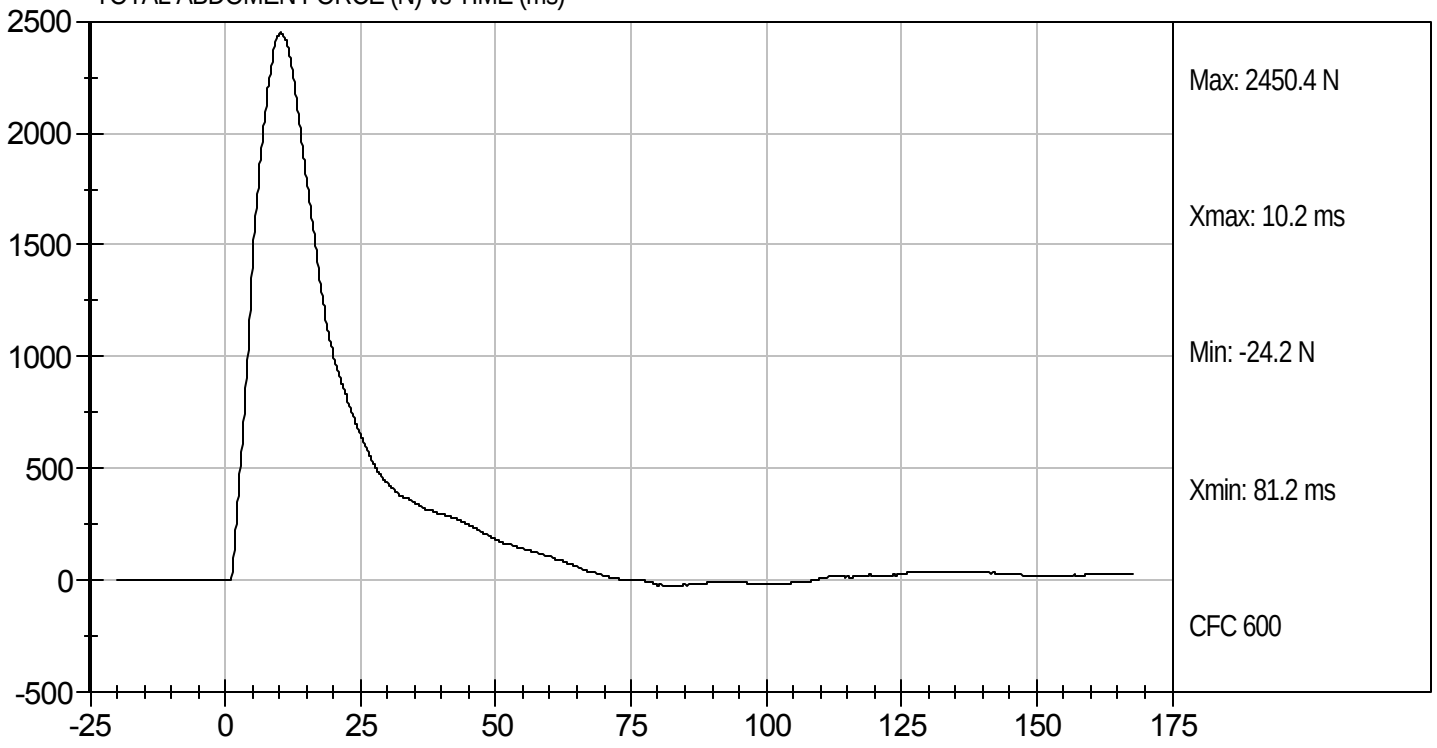
Test Desc: Abdomen Impact
Component ID: D114107

Test Date: 12/7/11
Velocity: 13.33 ft/s, 4.06 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:** D114108

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	19	Pass
Pendulum Speed		m/s	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	-5.85	Pass
	30 ms	m/s	>= -6.5	-5.82	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.1	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	43.7	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	44	Pass
			Overall Results		Pass

Jessica Gall
Laboratory Technician

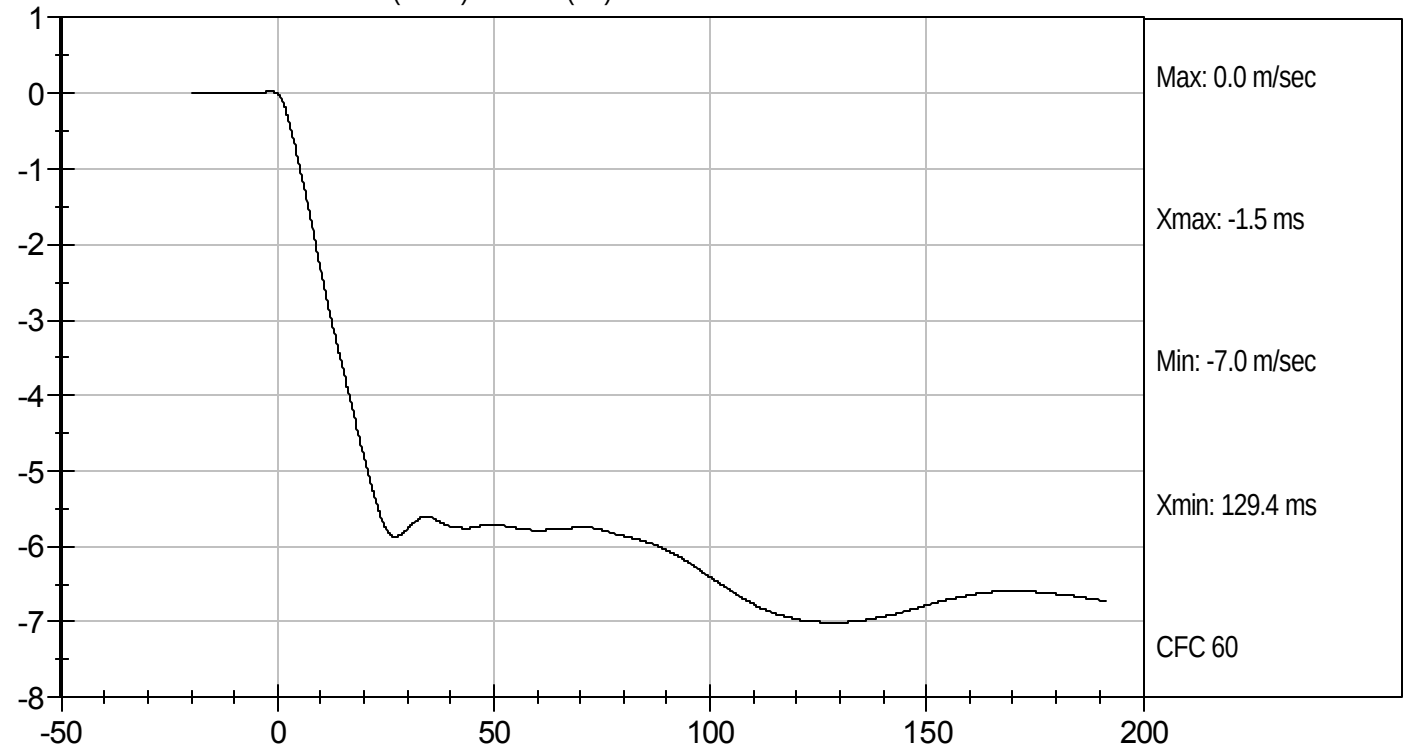
12/7/11
Test Date

David Winkelbauer
Approved By

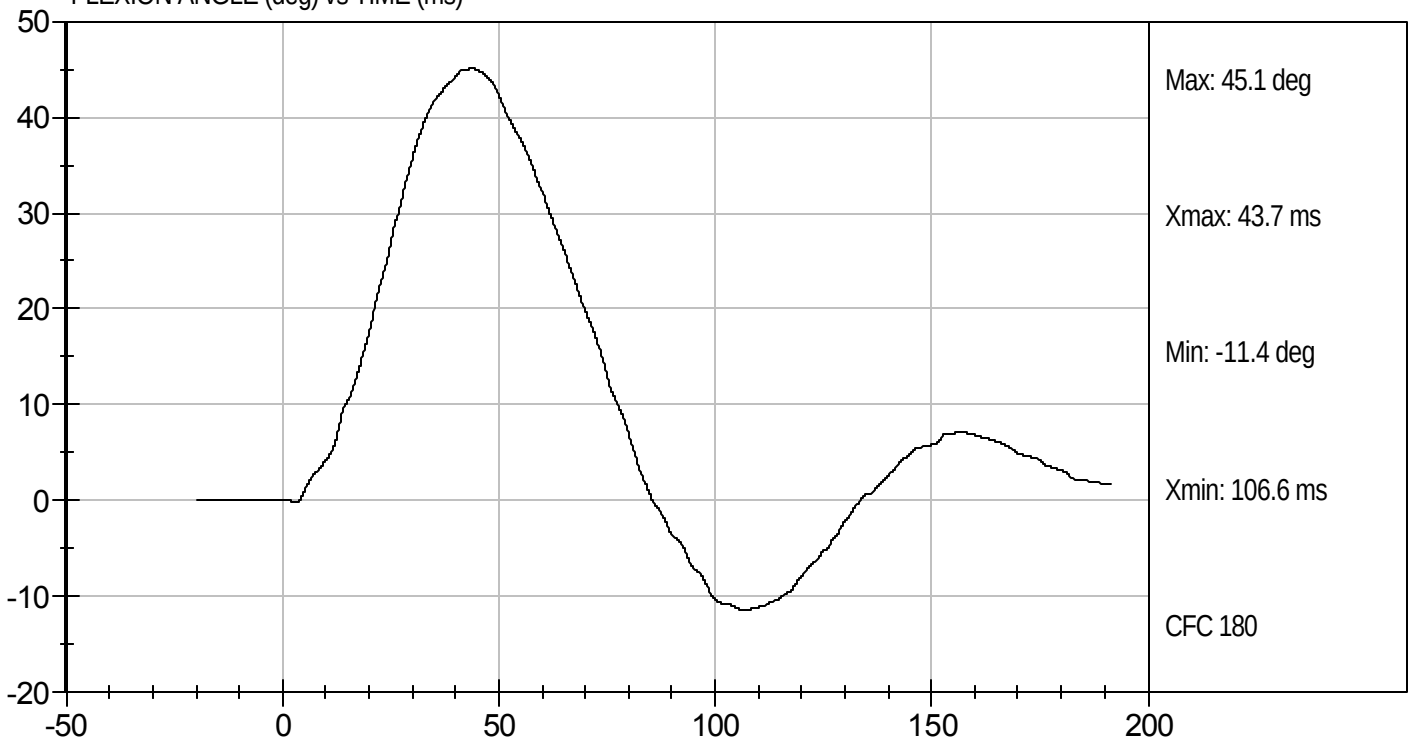
Test Desc: Lumbar Bending
Component ID: D114108

Test Date: 12/7/11
Velocity: 20.08 ft/s, 6.12 m/s

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

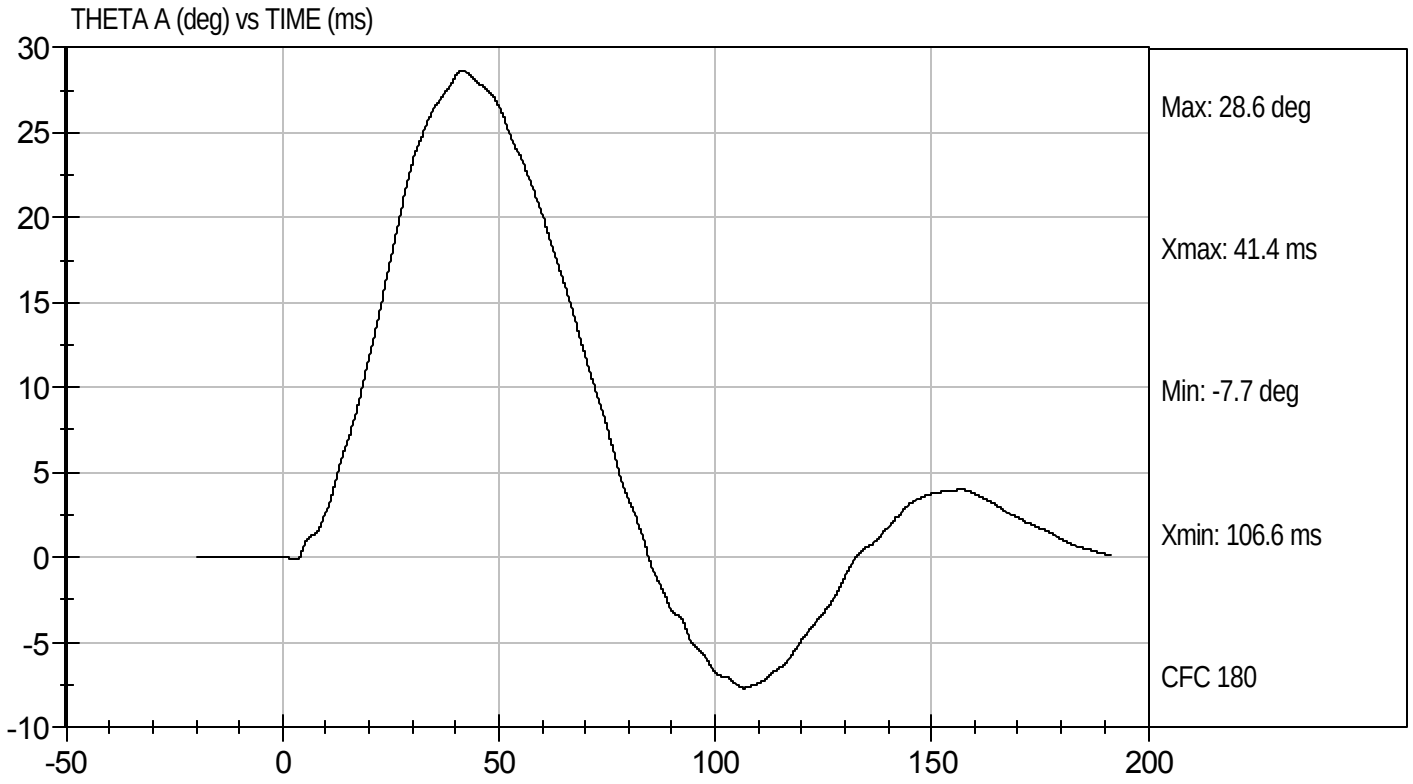


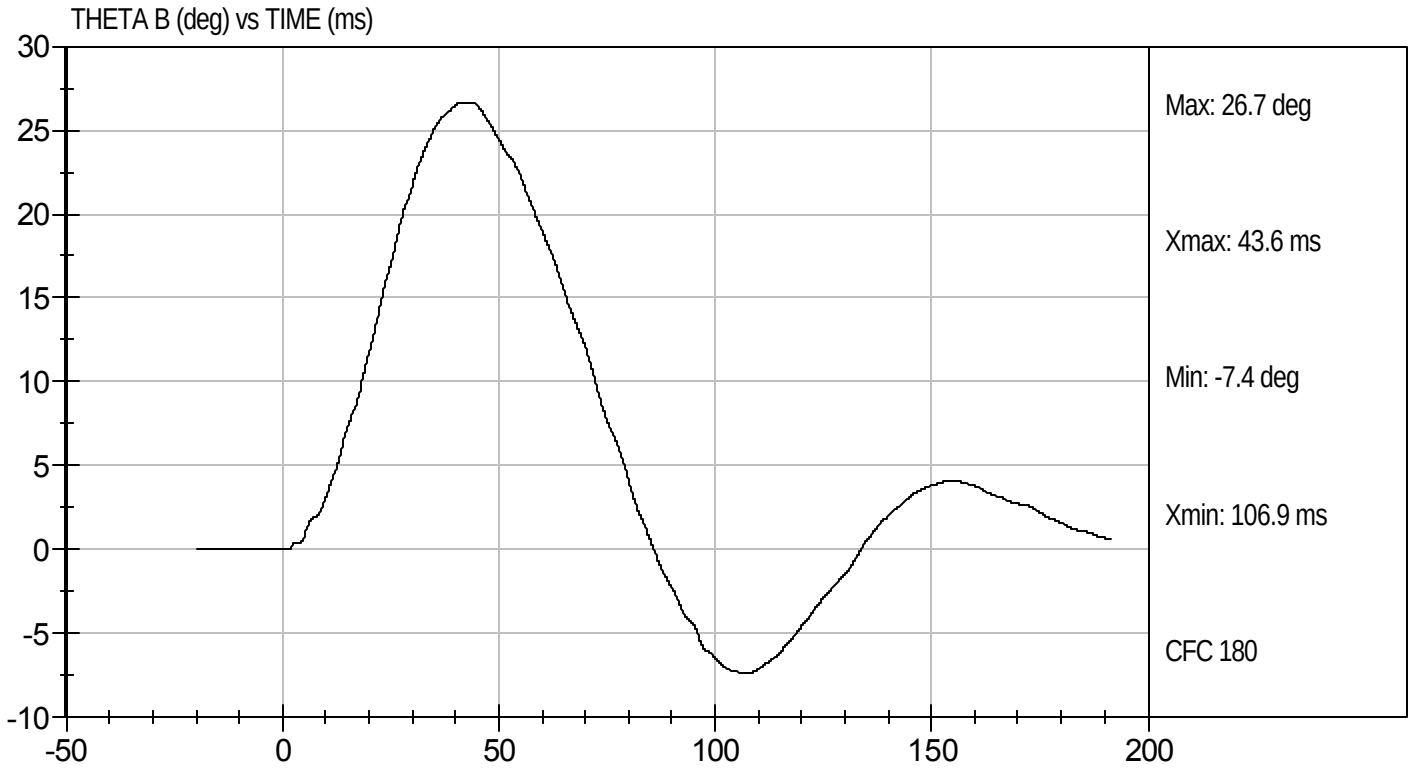
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D114108

Test Date: 12/7/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D114109

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	19	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.85	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.40	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.43	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	14.50	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

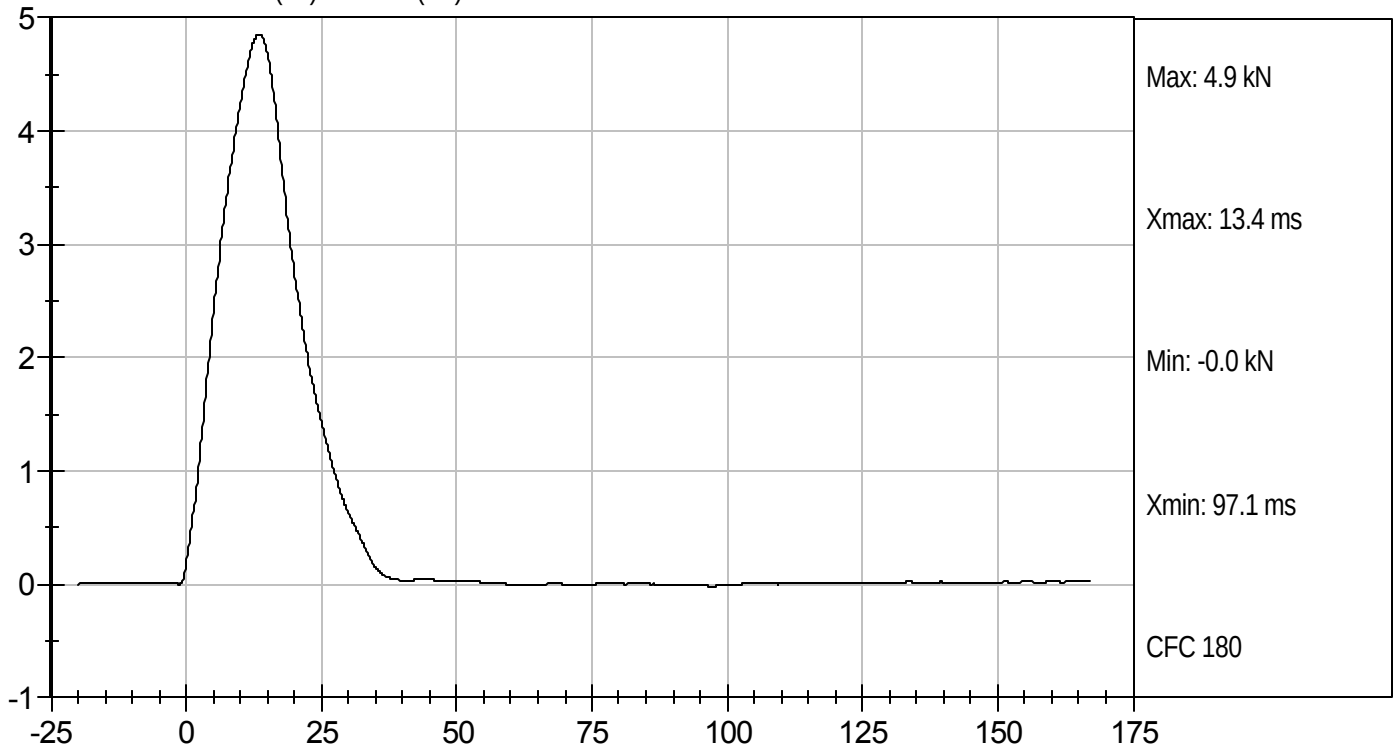
12/7/11
Test Date

David Winkelbauer
Approved By

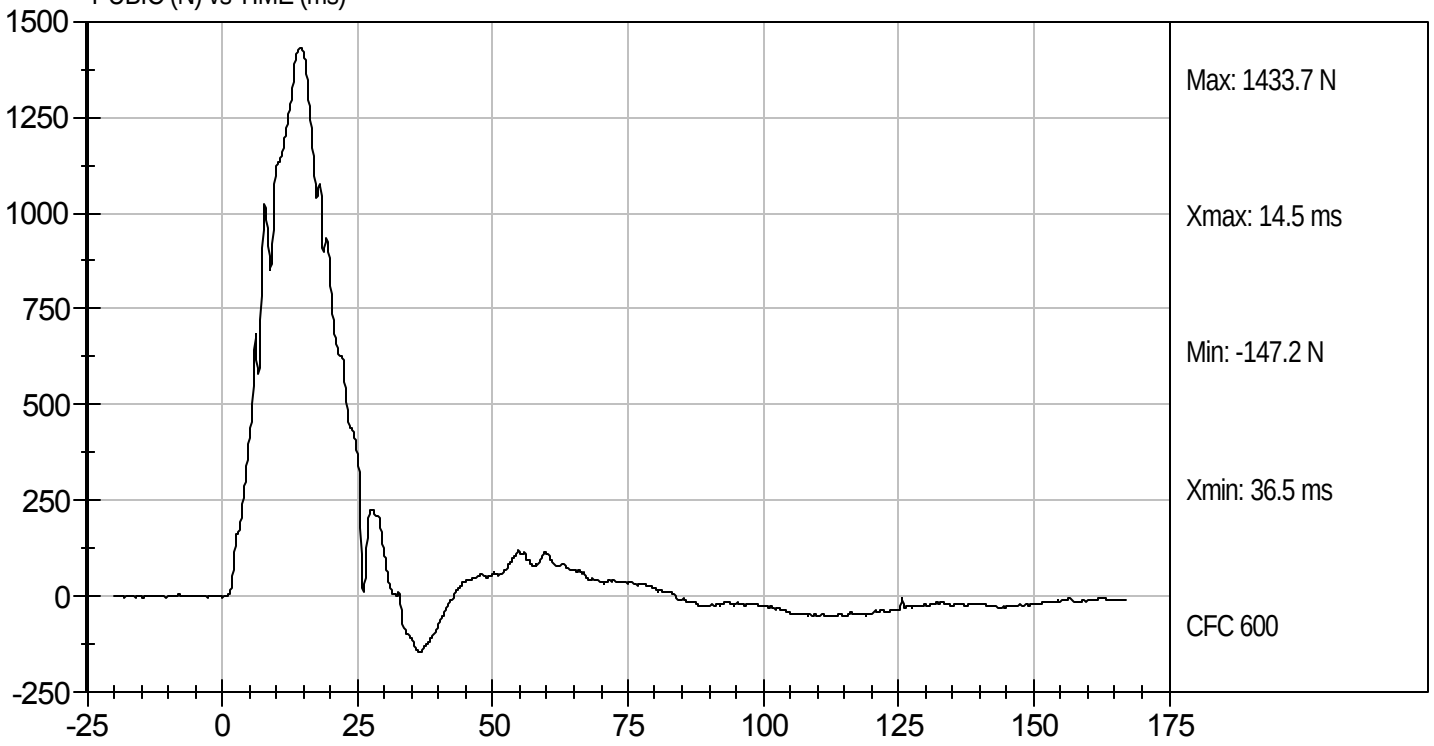
Test Desc: Pelvis Impact
Component ID: D114109

Test Date: 12/7/11
Velocity: 14.25 ft/s, 4.34 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



PUBIC (N) vs TIME (ms)



MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 032 **Test ID:** D114171

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Peak Resultant Acceleration	G's	125 to 155	146	Pass
Peak Lateral Acceleration	G's	+/- 15	-13.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

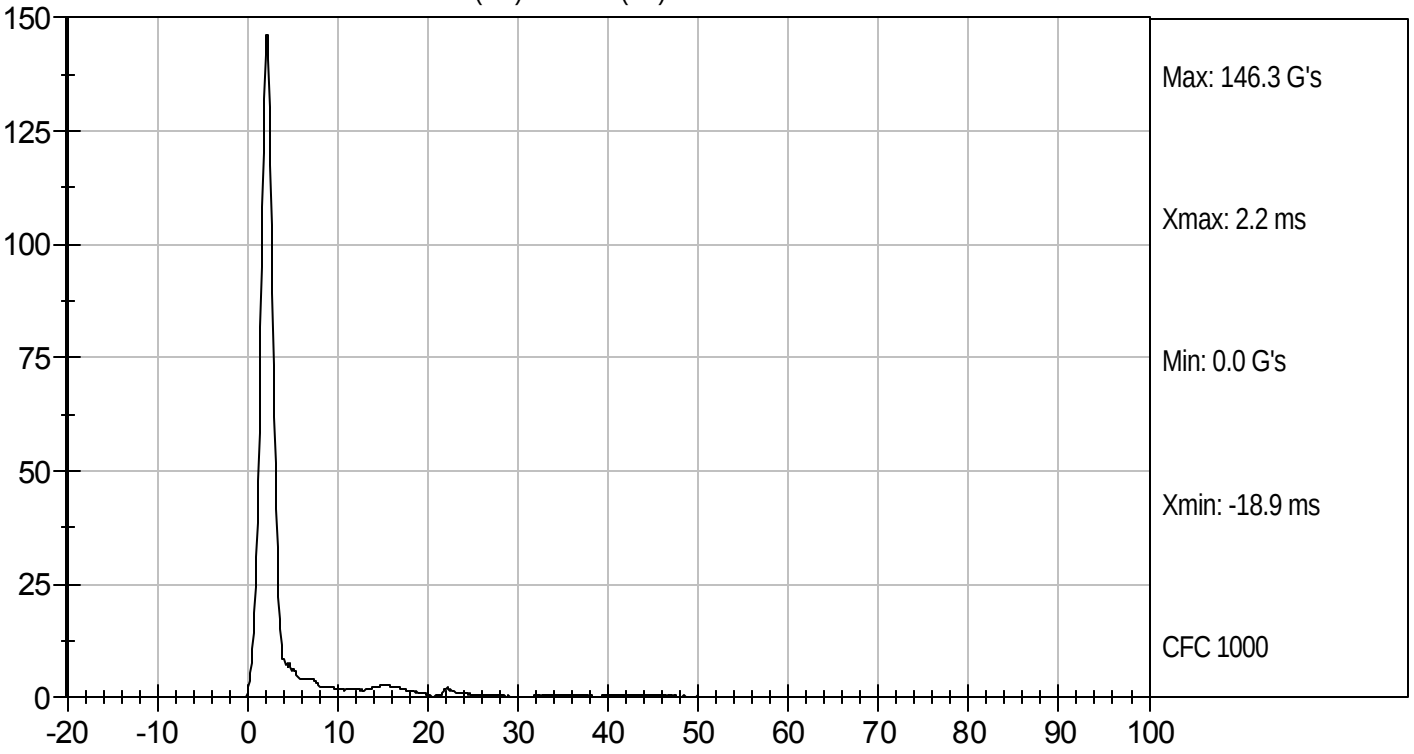
12/13/11
Test Date

David Winkelbauer
Approved By

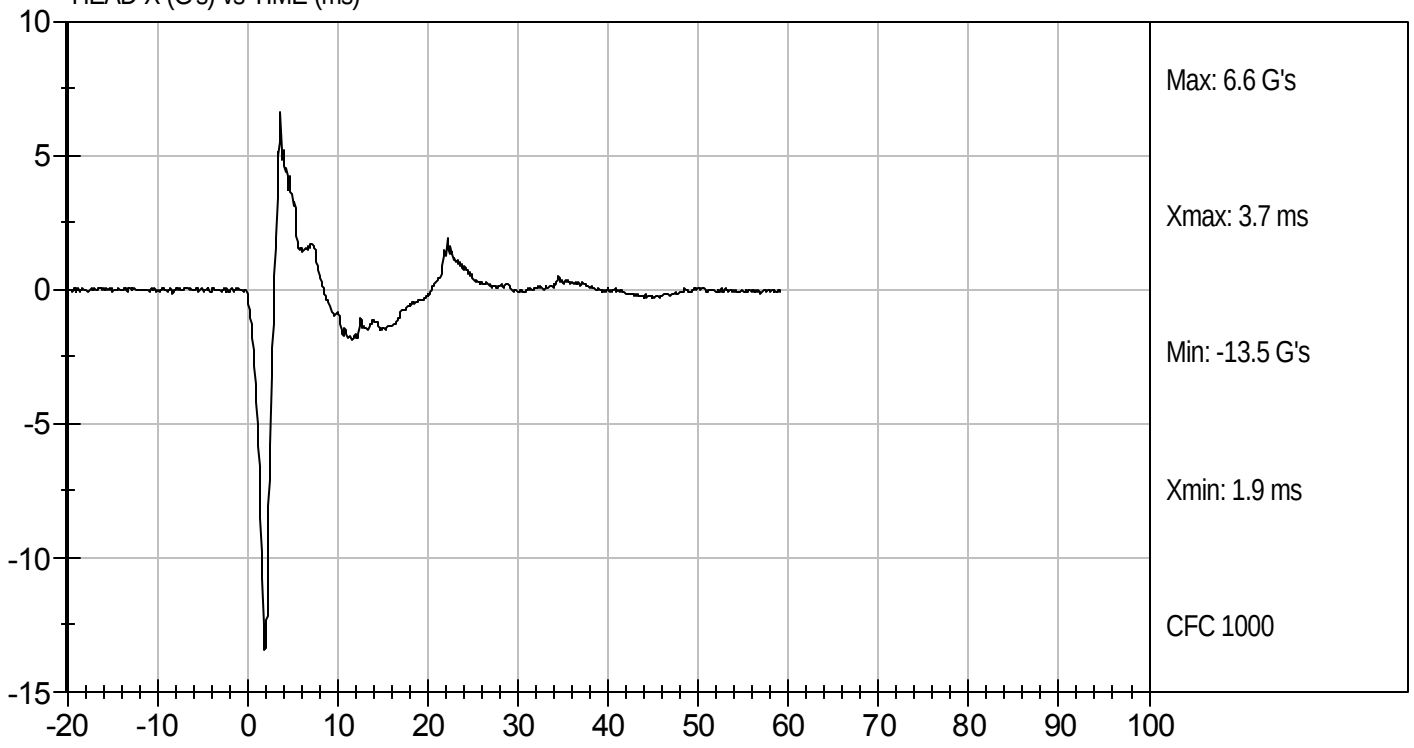
Test Desc: Head Drop
Component ID: D114171

Test Date: 12/13/11
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:** D114172

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	23	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.4	Pass
Pendulum Deceleration	1 ms	m/s	0.00 to -0.05	-0.03	Pass
	3 ms	m/s	-0.25 to -0.375	-0.33	Pass
	14 ms	m/s	-3.20 to -3.70	-3.30	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	53.6	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	61.3	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	60.1	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

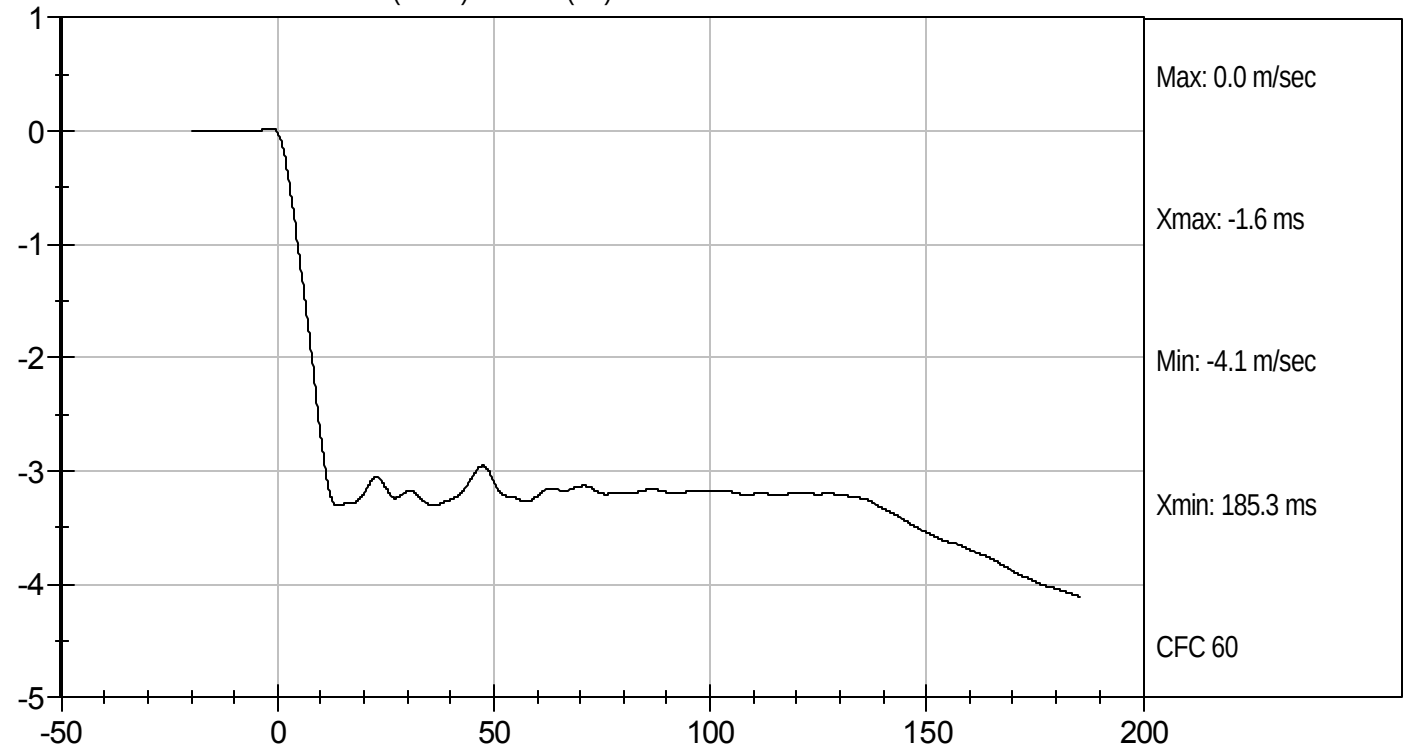
12/13/11
Test Date

David Winkelbauer
Approved By

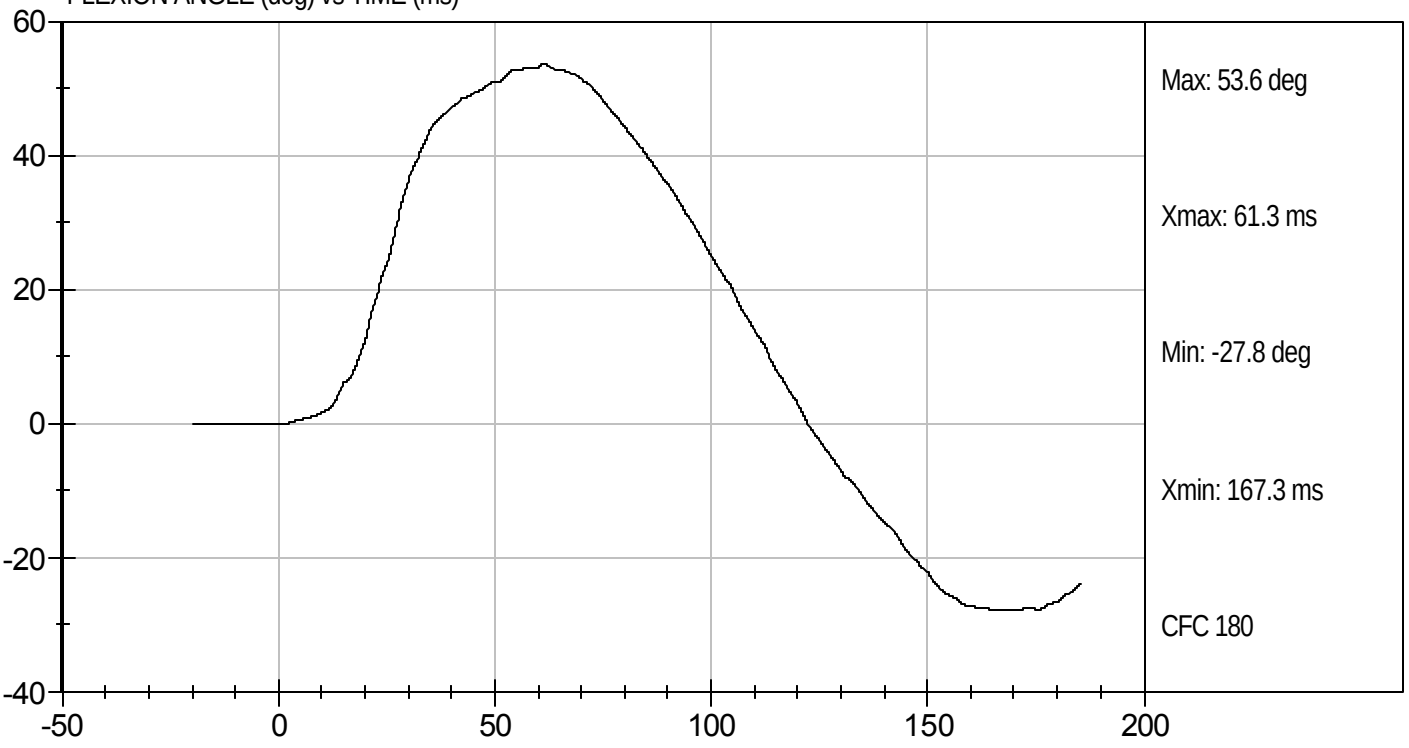
Test Desc: Neck Bending
Component ID: D114172

Test Date: 12/13/11
Velocity: 11.16 ft/s, 3.4 m/s

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

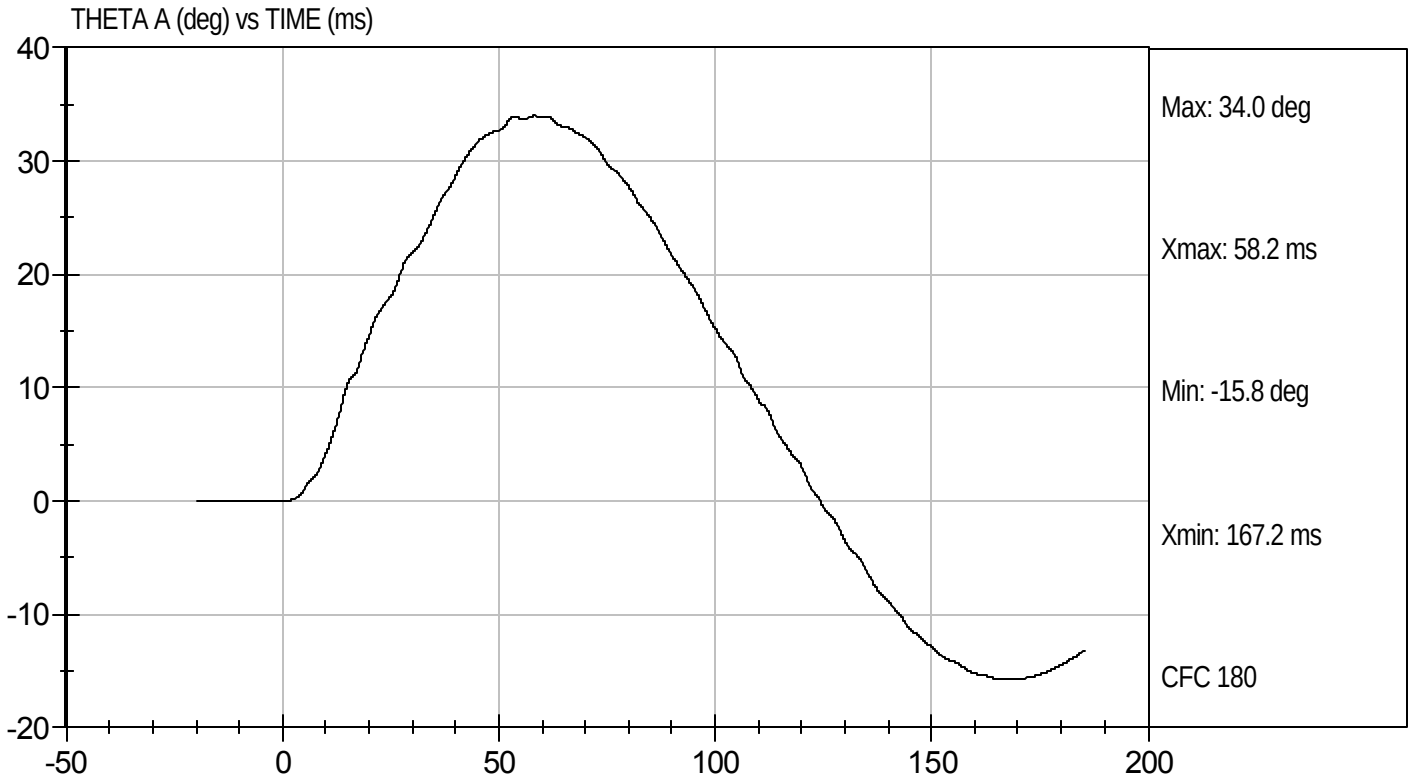


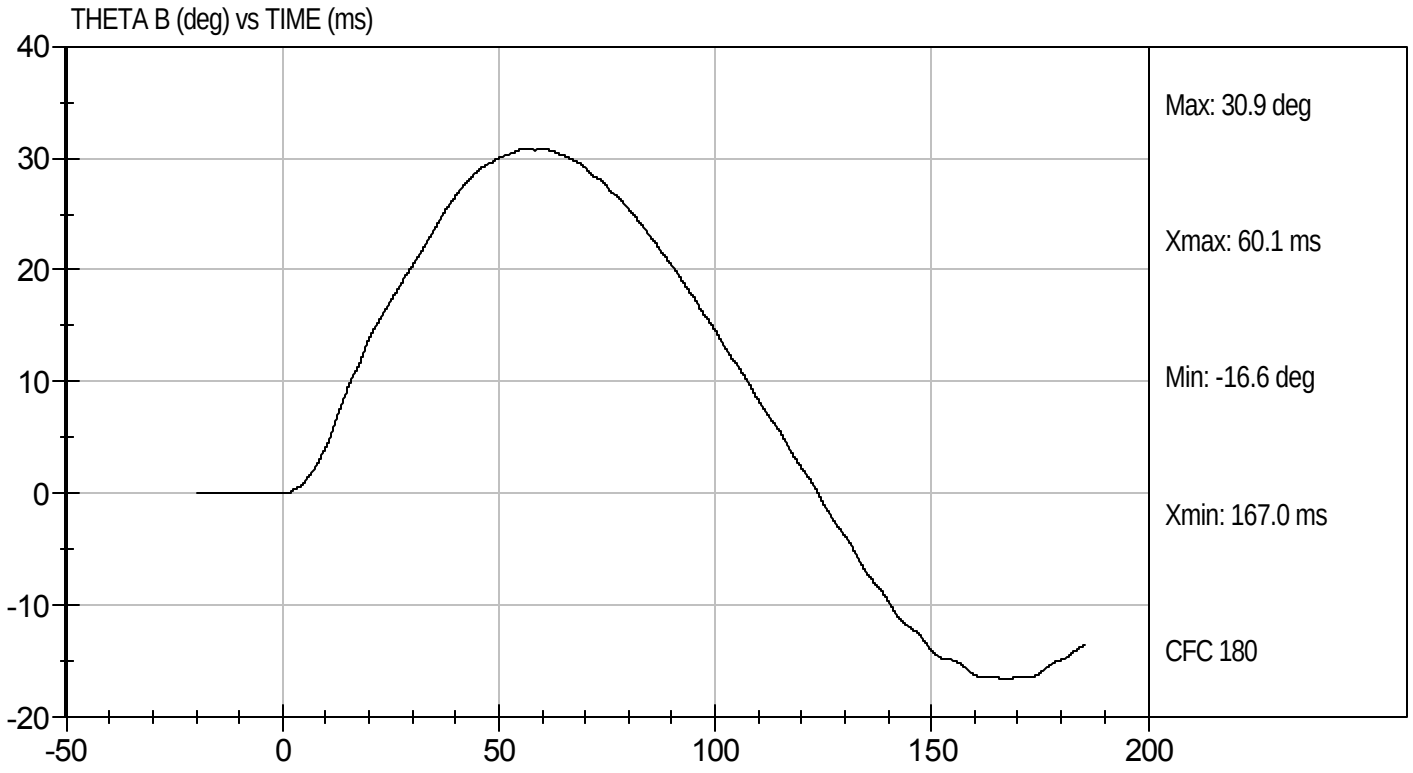
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D114172

Test Date: 12/13/11
Velocity: 11.16 ft/s, 3.4 m/s





MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D114173

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	33	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.3	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	9.6	Pass
Time of Peak Shoulder Acceleration	ms	NA	13.0	Pass
		Overall Test Results		Pass

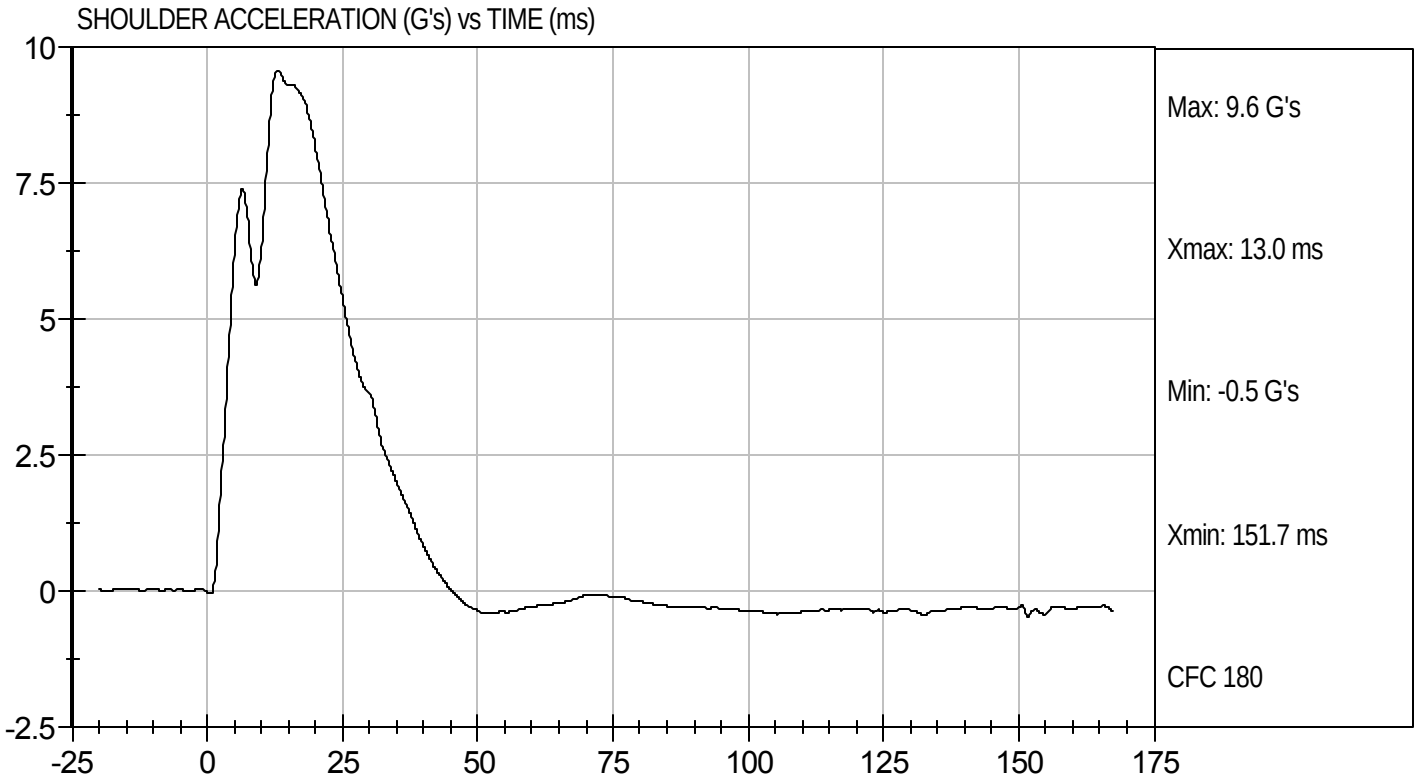
Jessica Hall
Laboratory Technician

12/14/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D114173

Test Date: 12/14/11
Velocity: 14.25 ft/s, 4.3 m/s



MGA RESEARCH CORPORATION

UPPER RIB TEST

EUROSID 2 DUMMY

ATD Serial No: 032 **Test I.D:** D114174

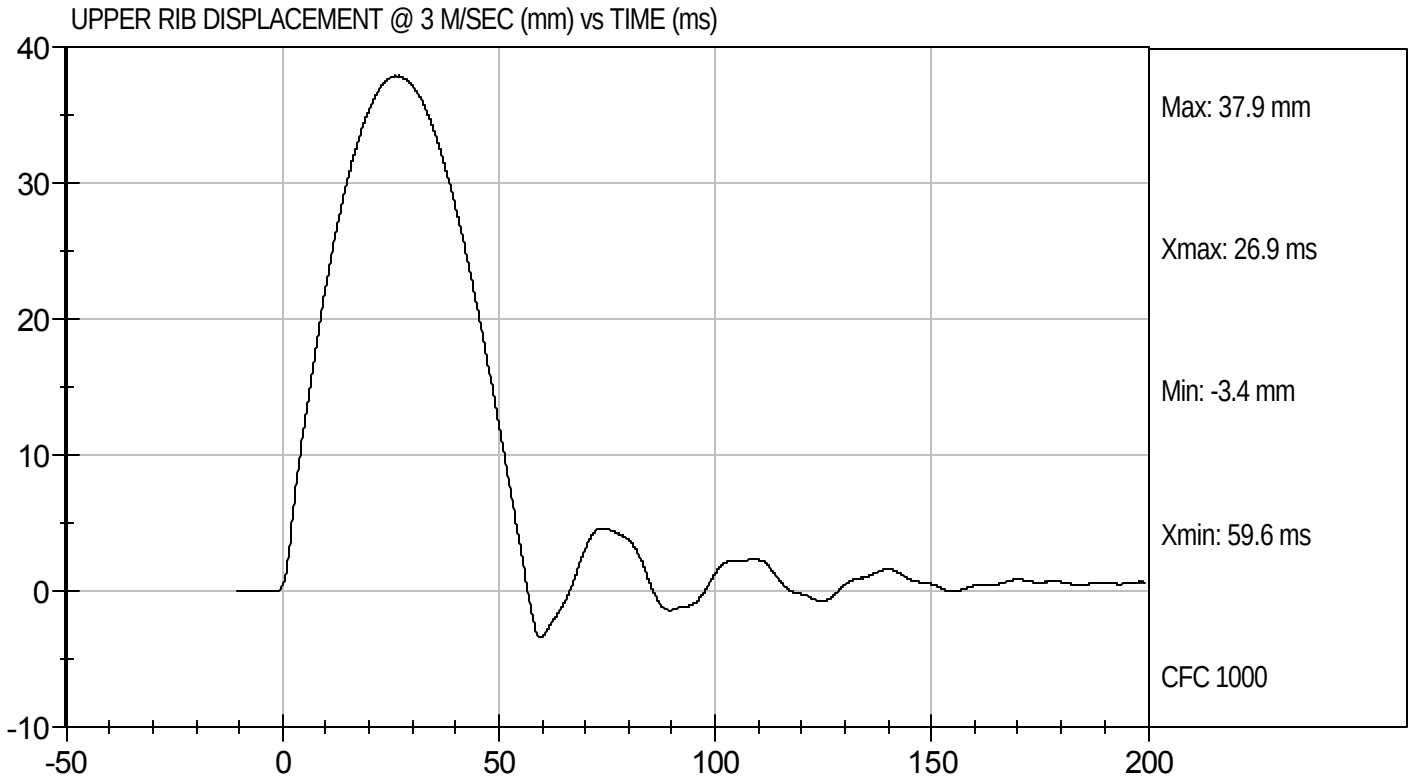
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	37.9	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	47.4	Pass
		Overall Test Results		Pass

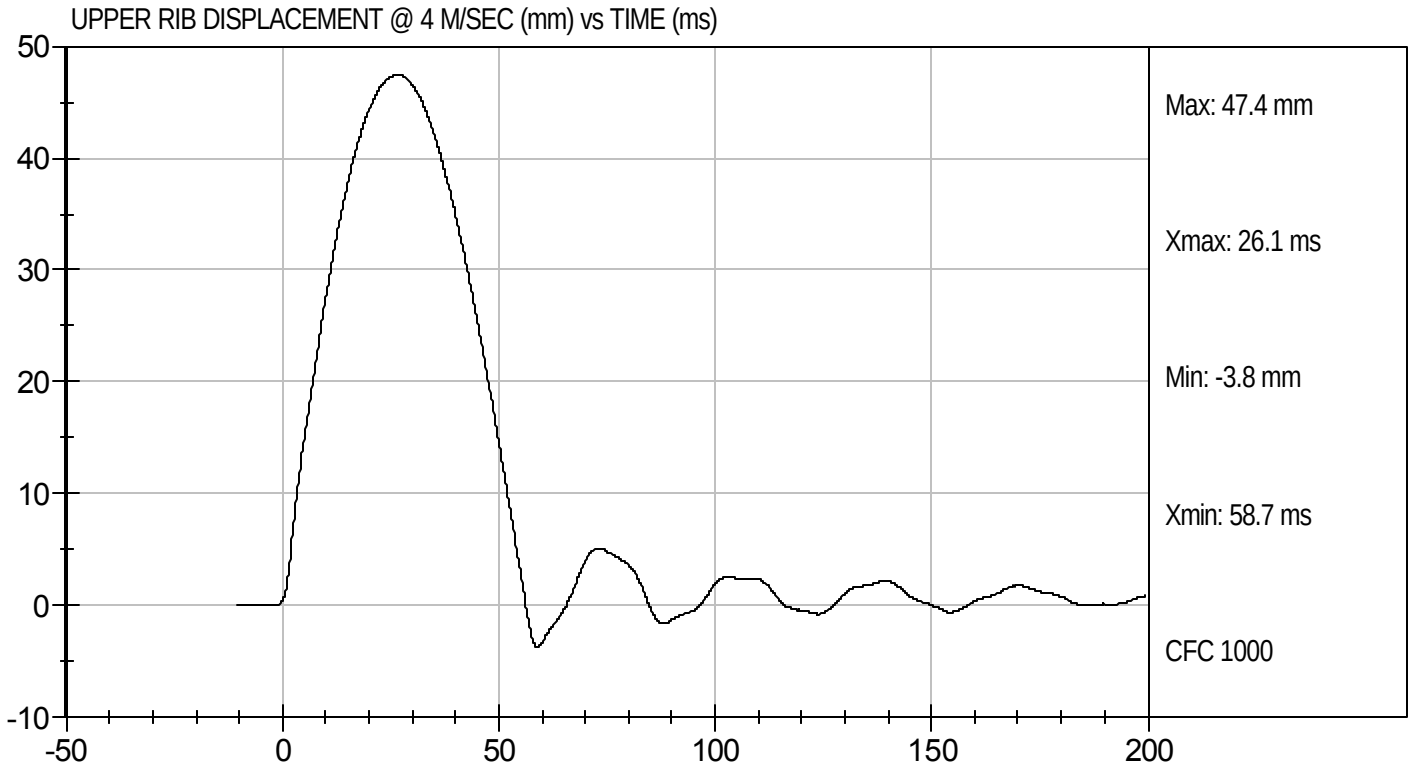
Jessica Gall
Laboratory Technician

12/13/11
Test Date

David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D114174
Test Date: 12/13/11





MGA RESEARCH CORPORATION

MID RIB TEST

EUROSID 2 DUMMY

ATD Serial No: 032 **Test I.D:** D114175

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	21	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	37.6	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	47.8	Pass
		Overall Test Results		Pass

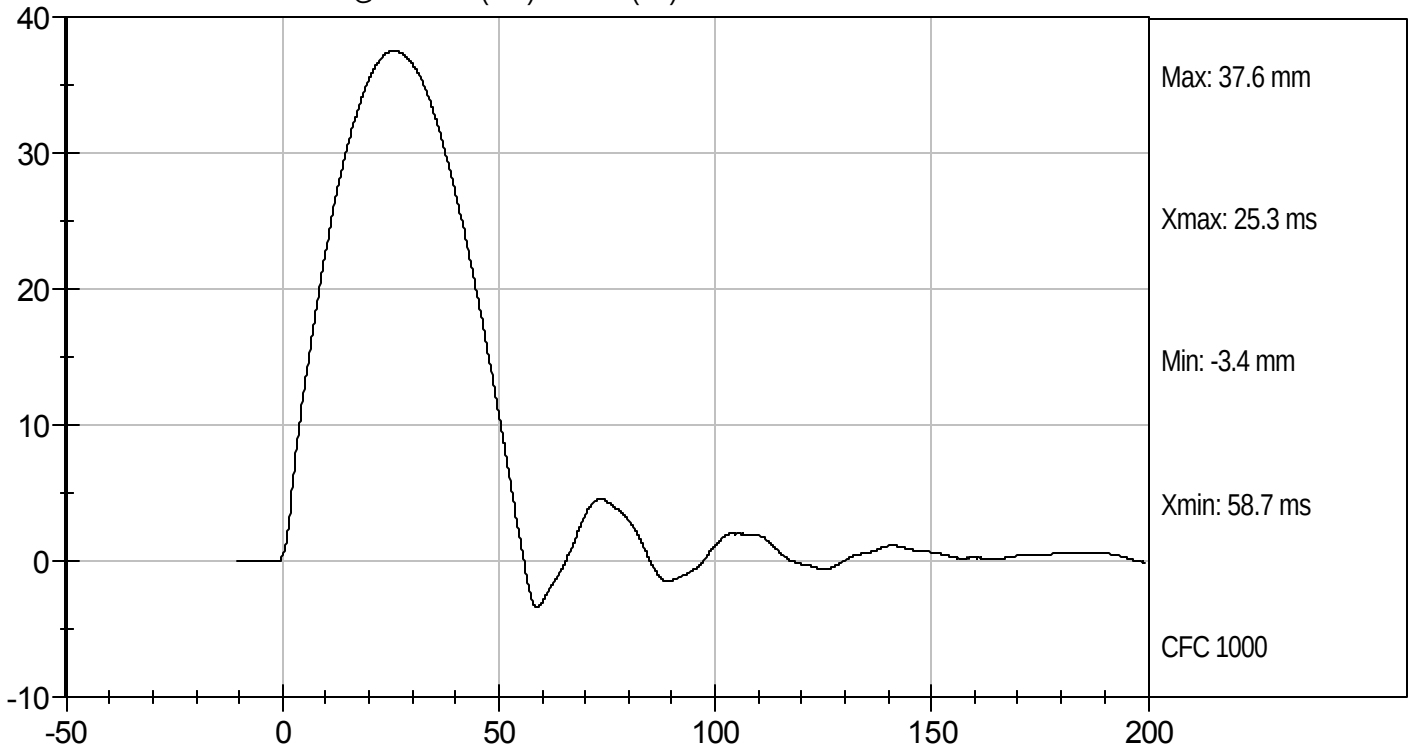
Jessica Hall
Laboratory Technician

12/14/11
Test Date

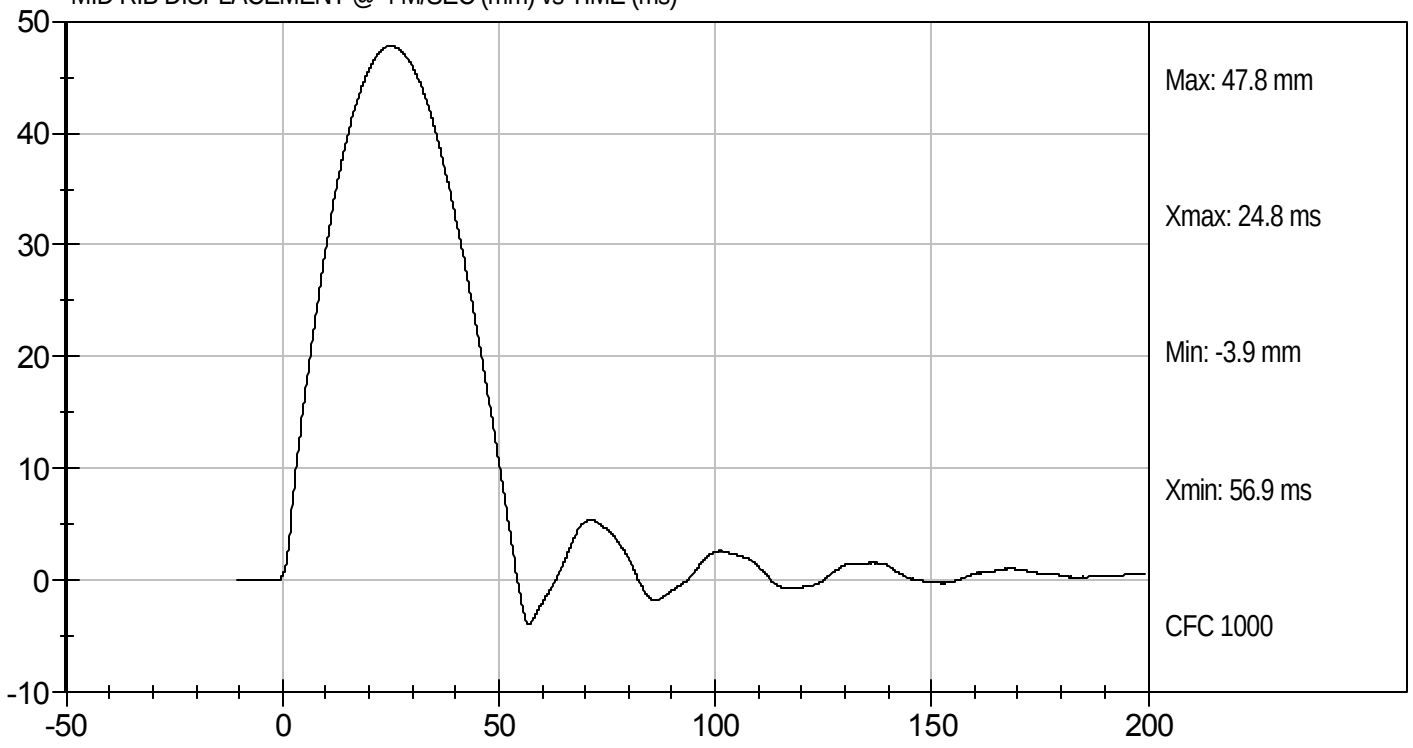
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D114175
Test Date: 12/14/11

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

EUROSID 2 DUMMY

ATD Serial No: 032 **Test I.D:** D114176

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	21	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	37.9	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.2	Pass
		Overall Test Results		Pass

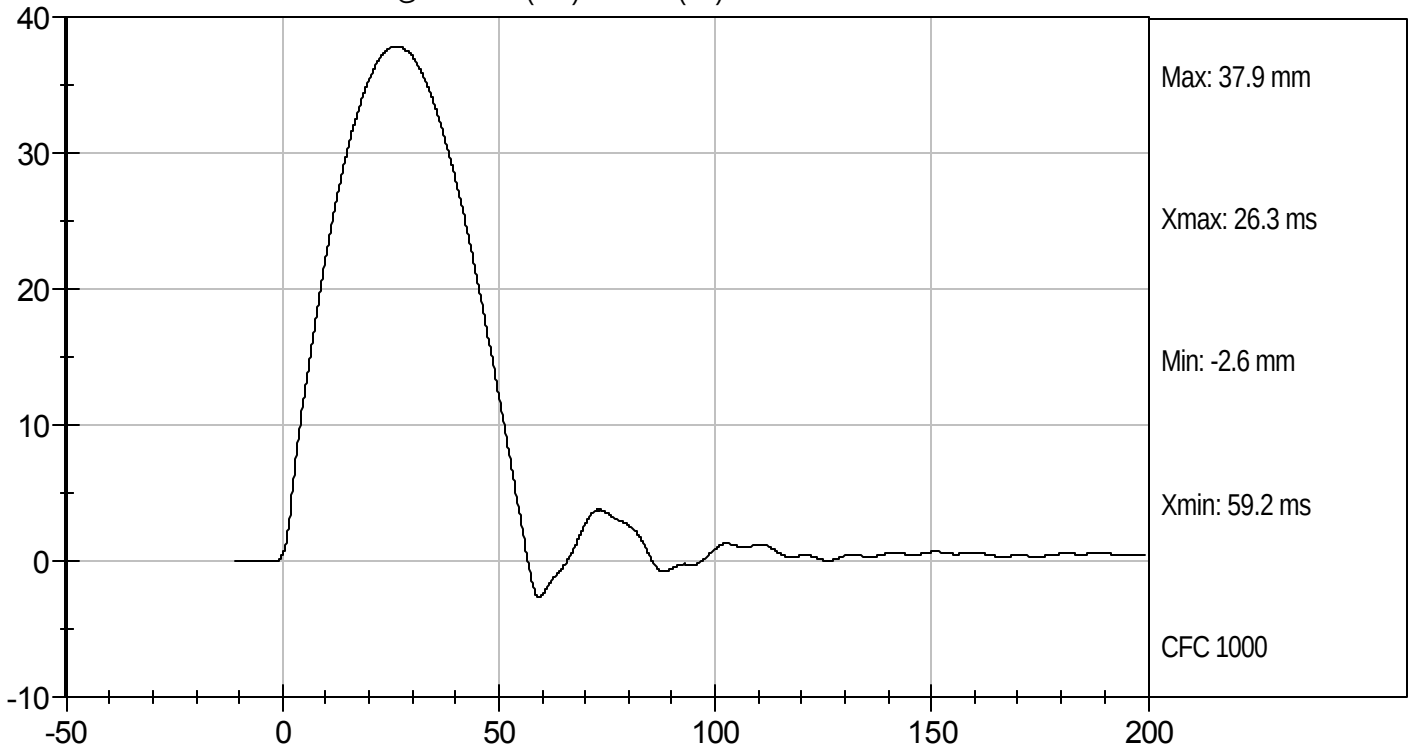
Jessica Gall
Laboratory Technician

12/14/11
Test Date

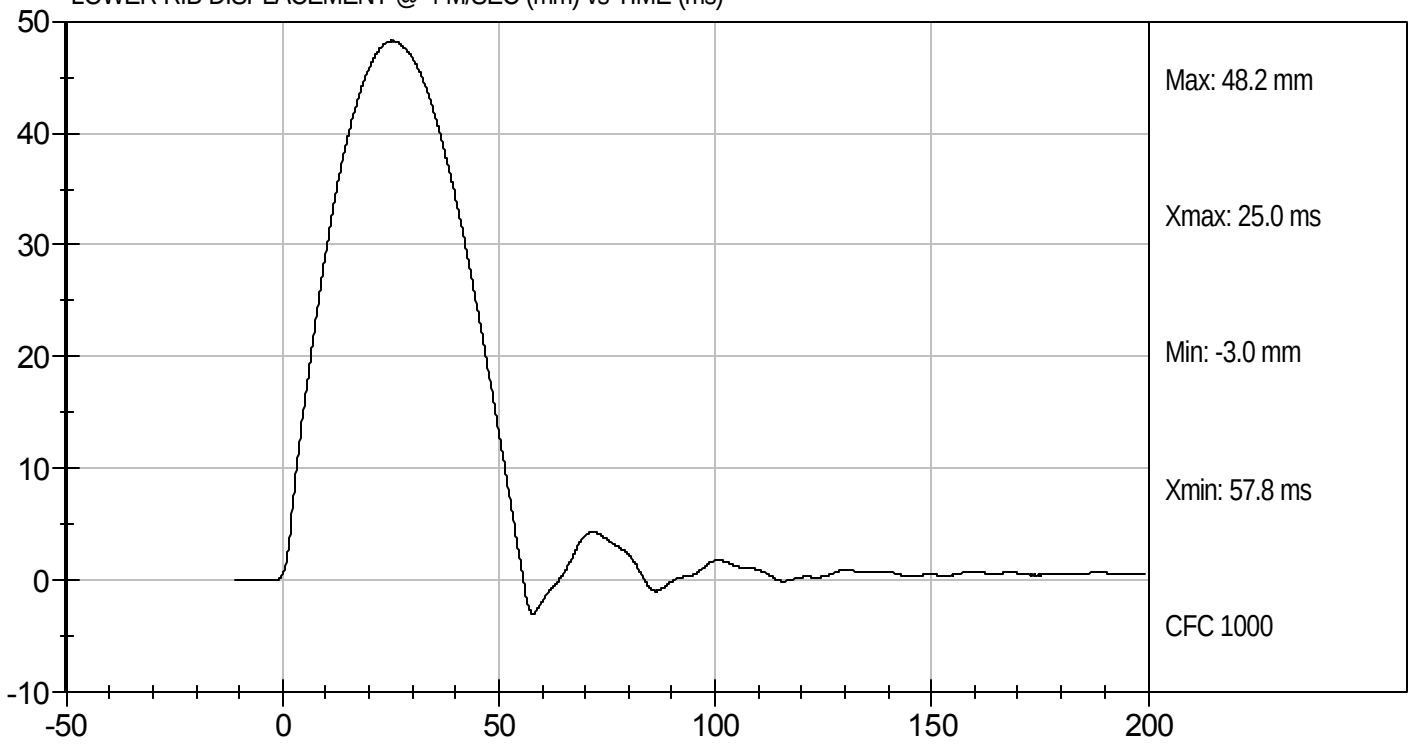
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D114176
Test Date: 12/14/11

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



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



MGA RESEARCH CORPORATION

FULL BODY THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D114170

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	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	5.20	Pass
Upper Rib Displacement	mm	34.0 to 41.0	36.8	Pass
Middle Rib Displacement	mm	37.0 to 45.0	39.6	Pass
Lower Rib Displacement	mm	37.0 to 44.0	38.8	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

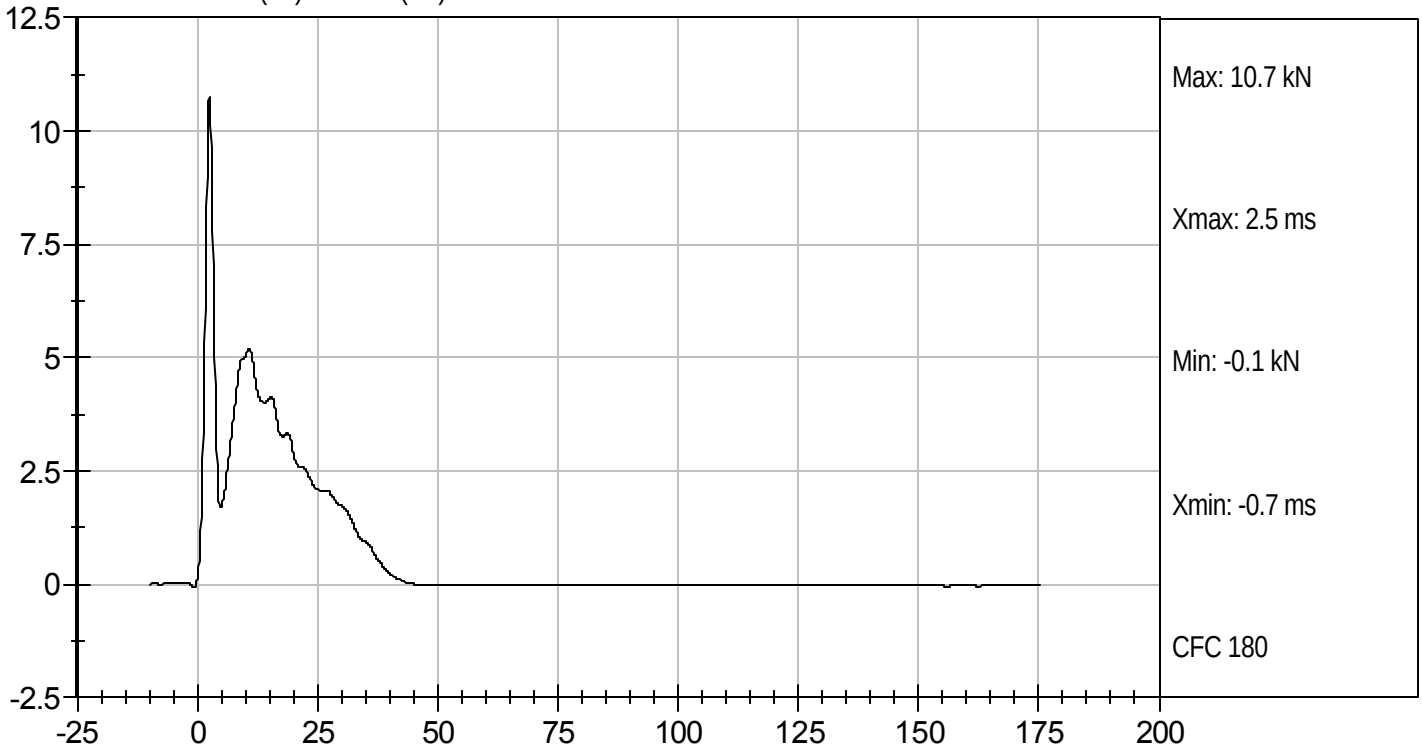
12/14/11
Test Date

David Winkelbauer
Approved By

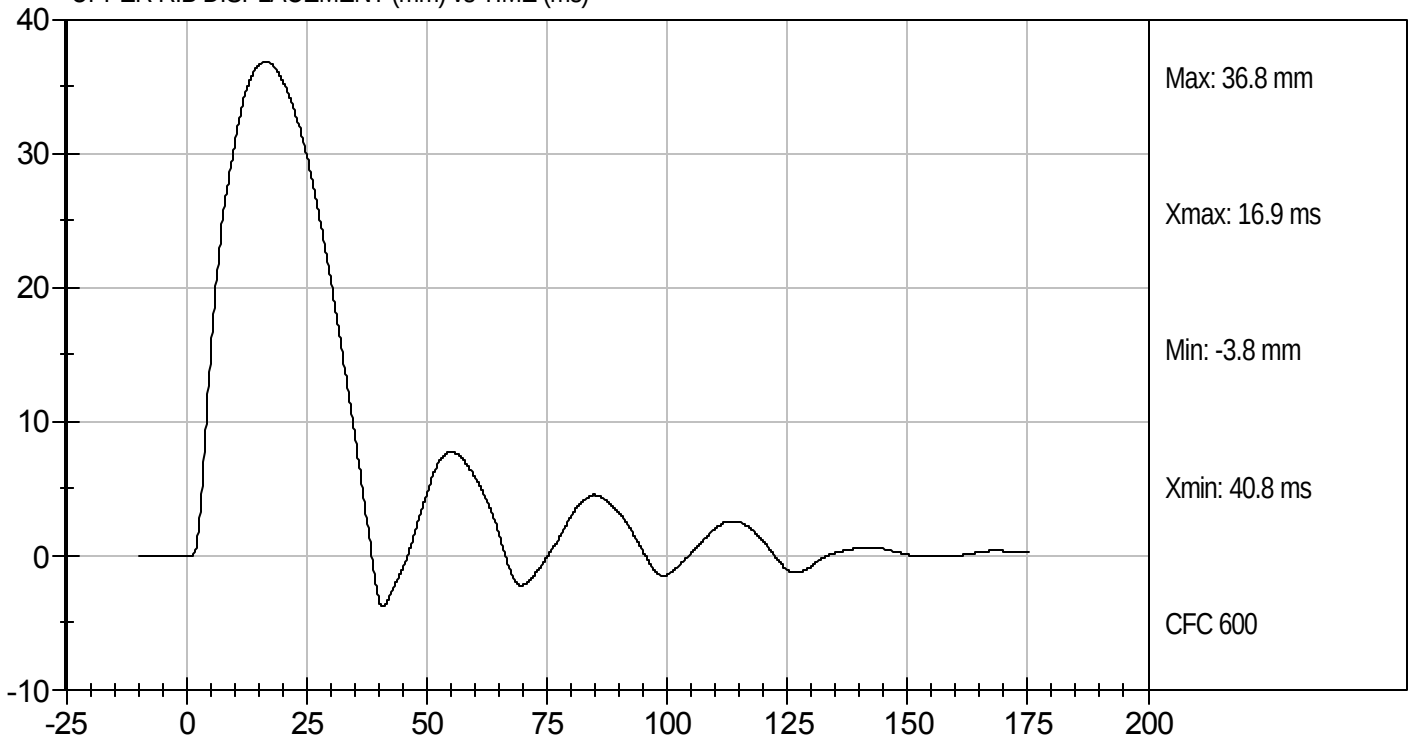
Test Desc: Thorax Impact
Component ID: D114170

Test Date: 12/14/11
Velocity: 18.32 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



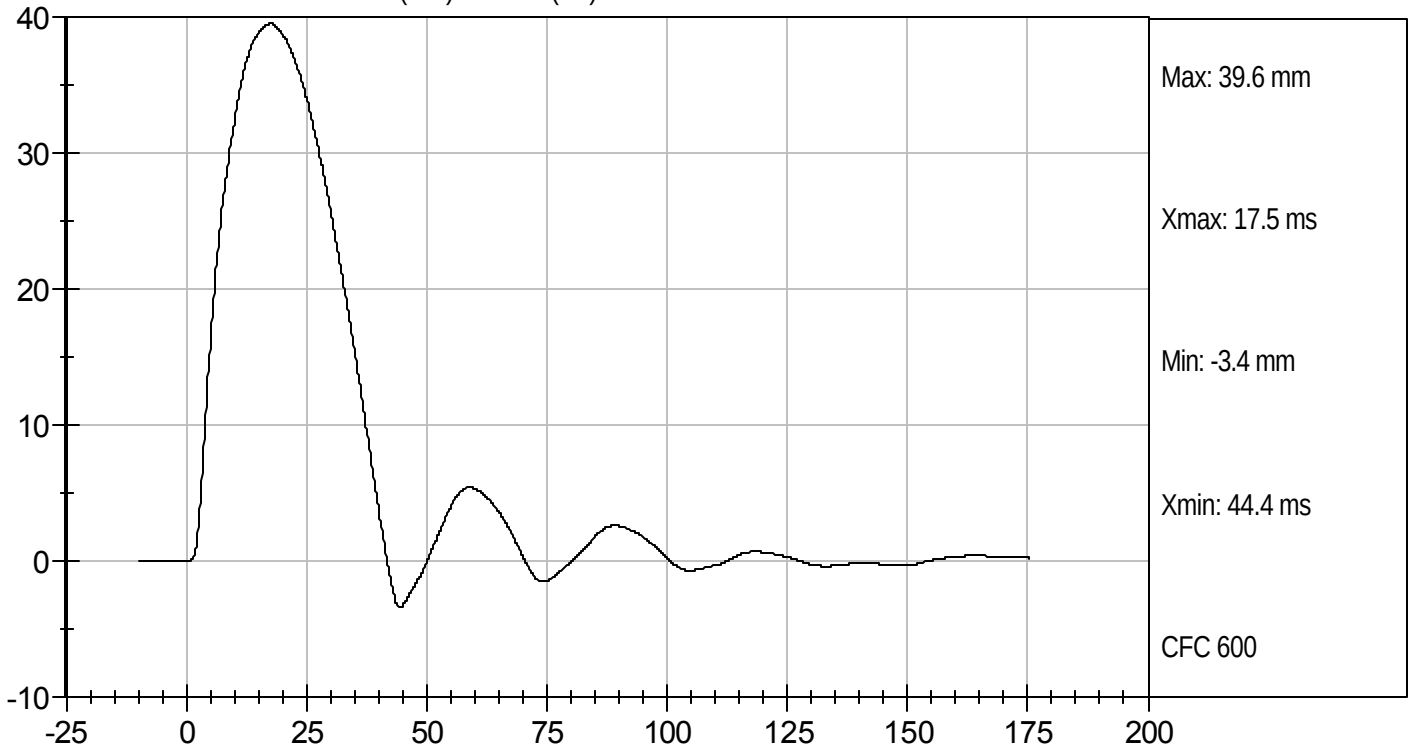
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



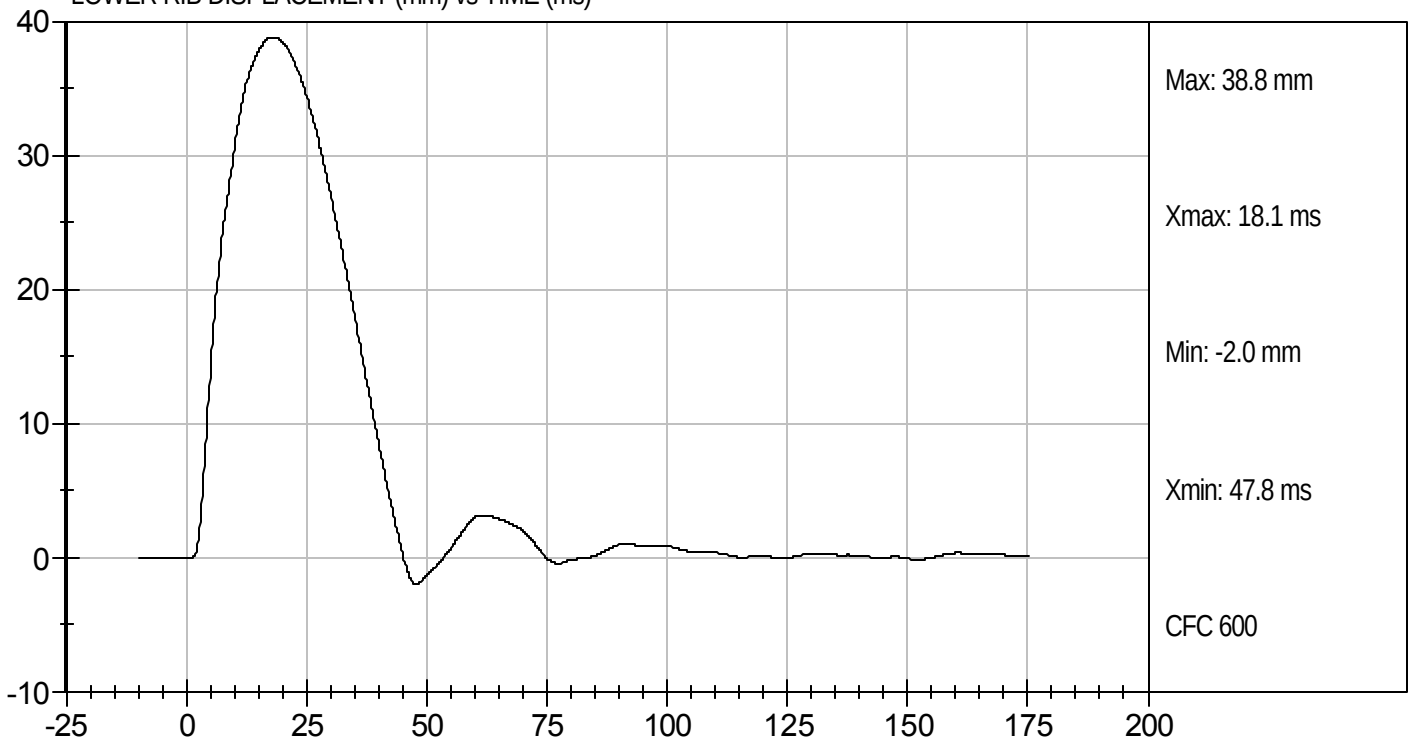
Test Desc: Thorax Impact
Component ID: D114170

Test Date: 12/14/11
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

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D114177

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	33	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.22	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	10.80	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.52	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.20	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

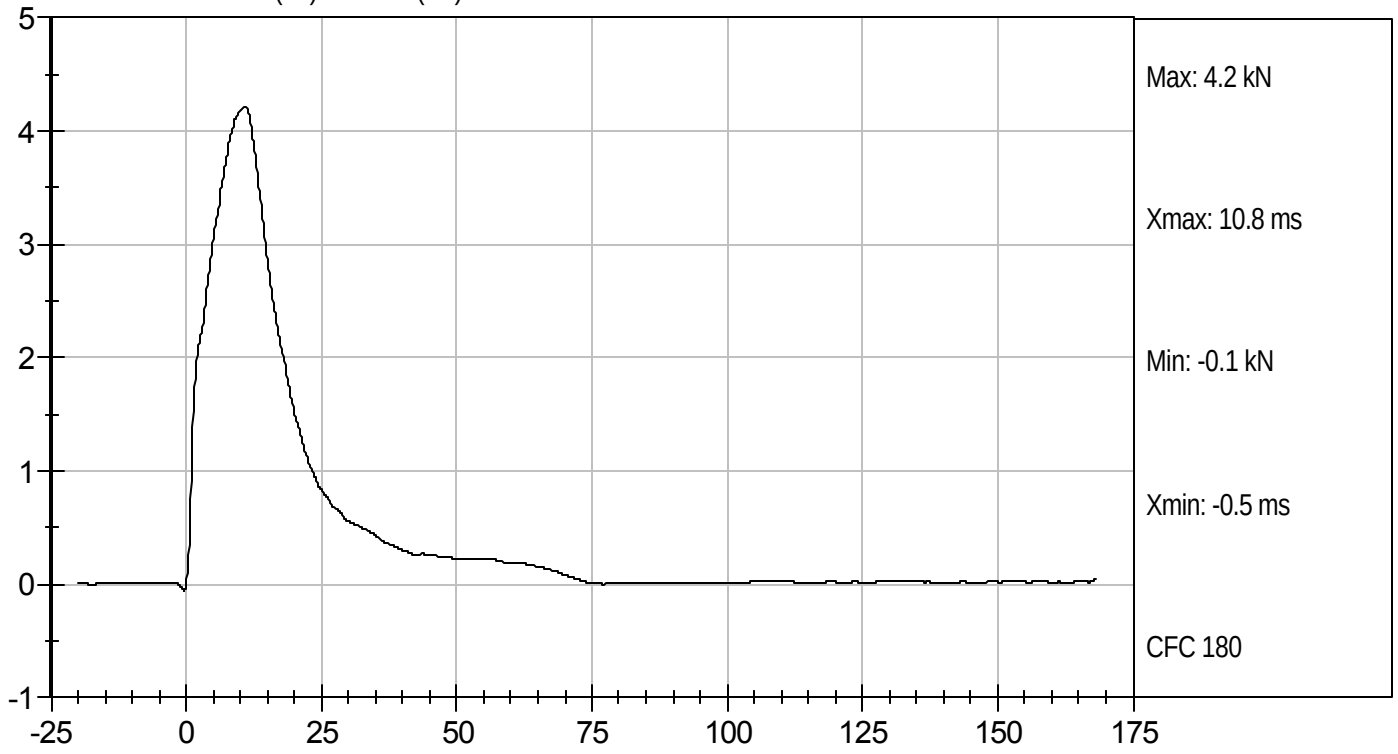
12/14/11
Test Date

David Winkelbauer
Approved By

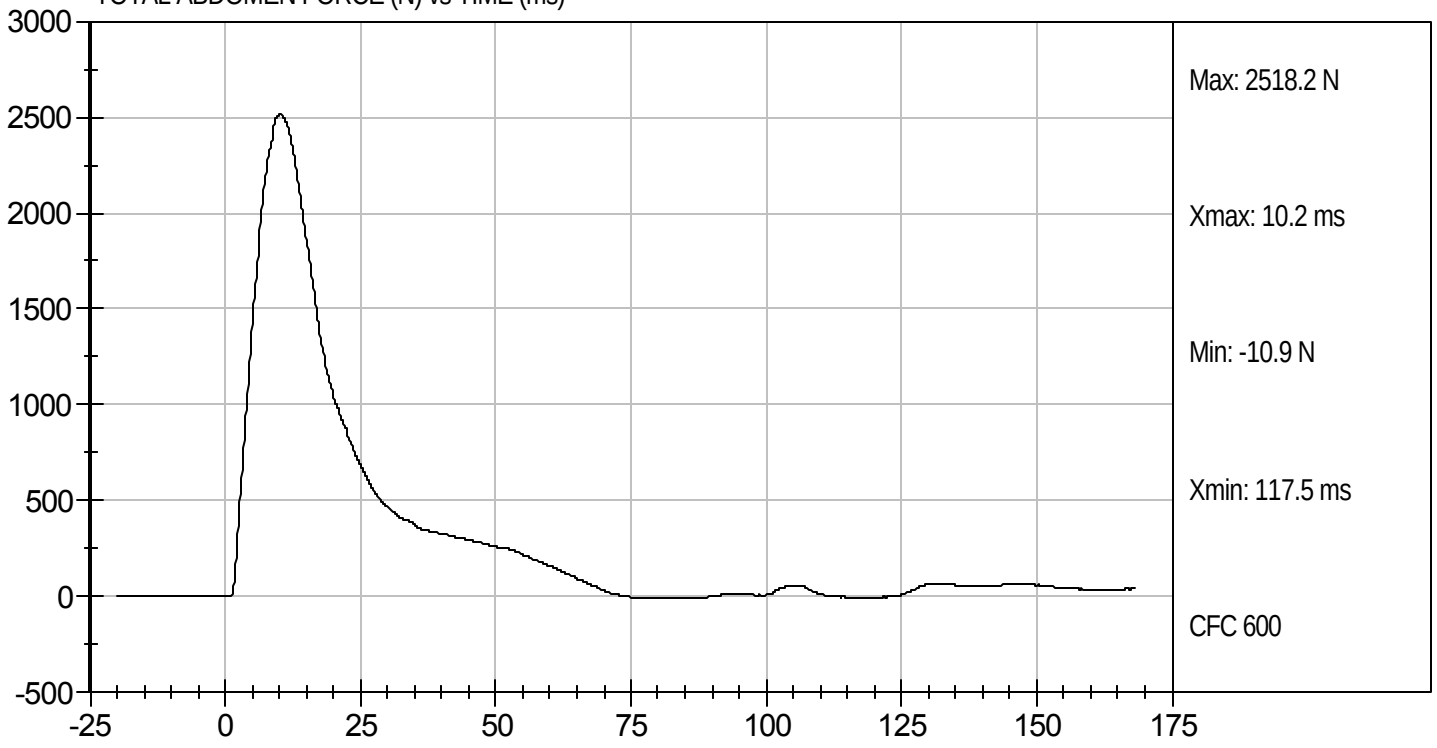
Test Desc: Abdomen Impact
Component ID: D114177

Test Date: 12/14/11
Velocity: 13.33 ft/s, 4.06 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:** D114178

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	23	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.13	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	-5.91	Pass
	30 ms	m/s	>= -6.5	-5.85	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	46.9	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	43.6	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	44	Pass
			Overall Results		Pass

Jessica Gall
Laboratory Technician

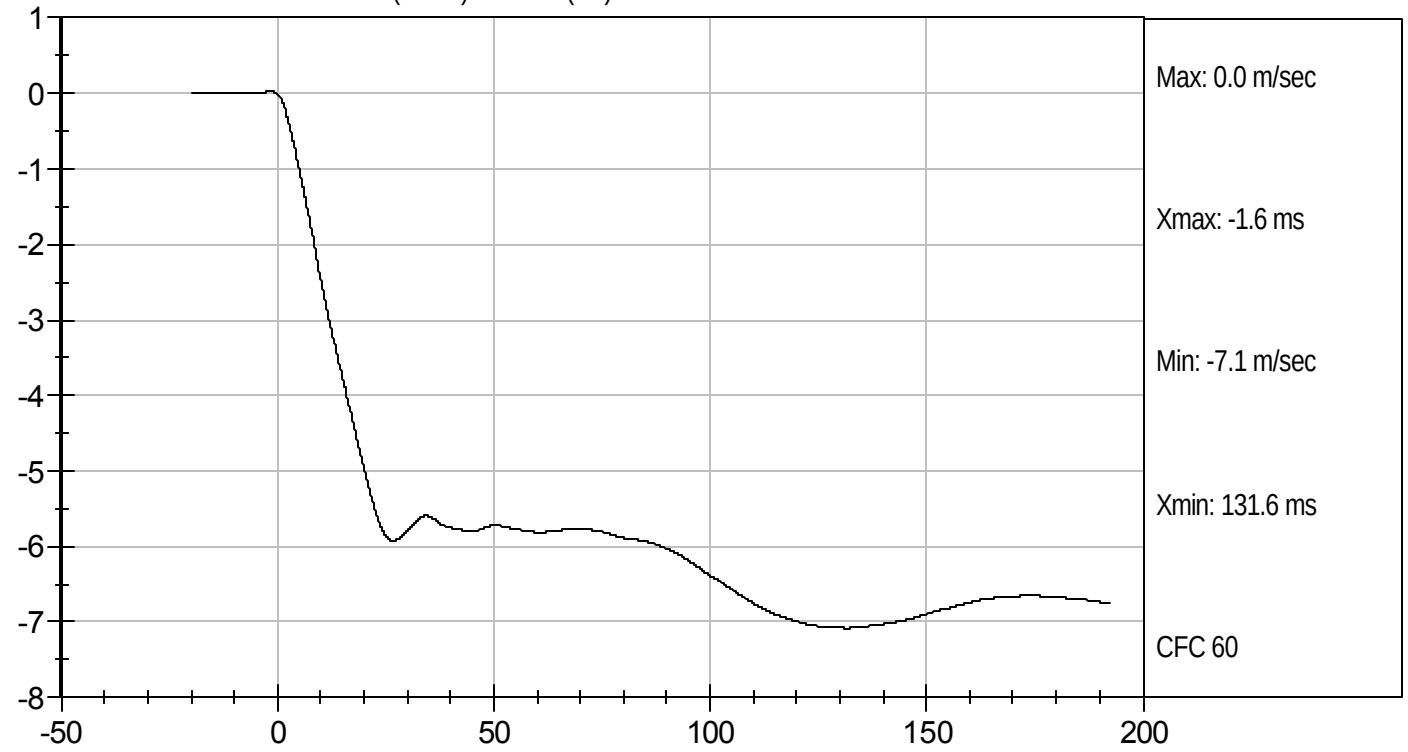
12/13/11
Test Date

David Winkelbauer
Approved By

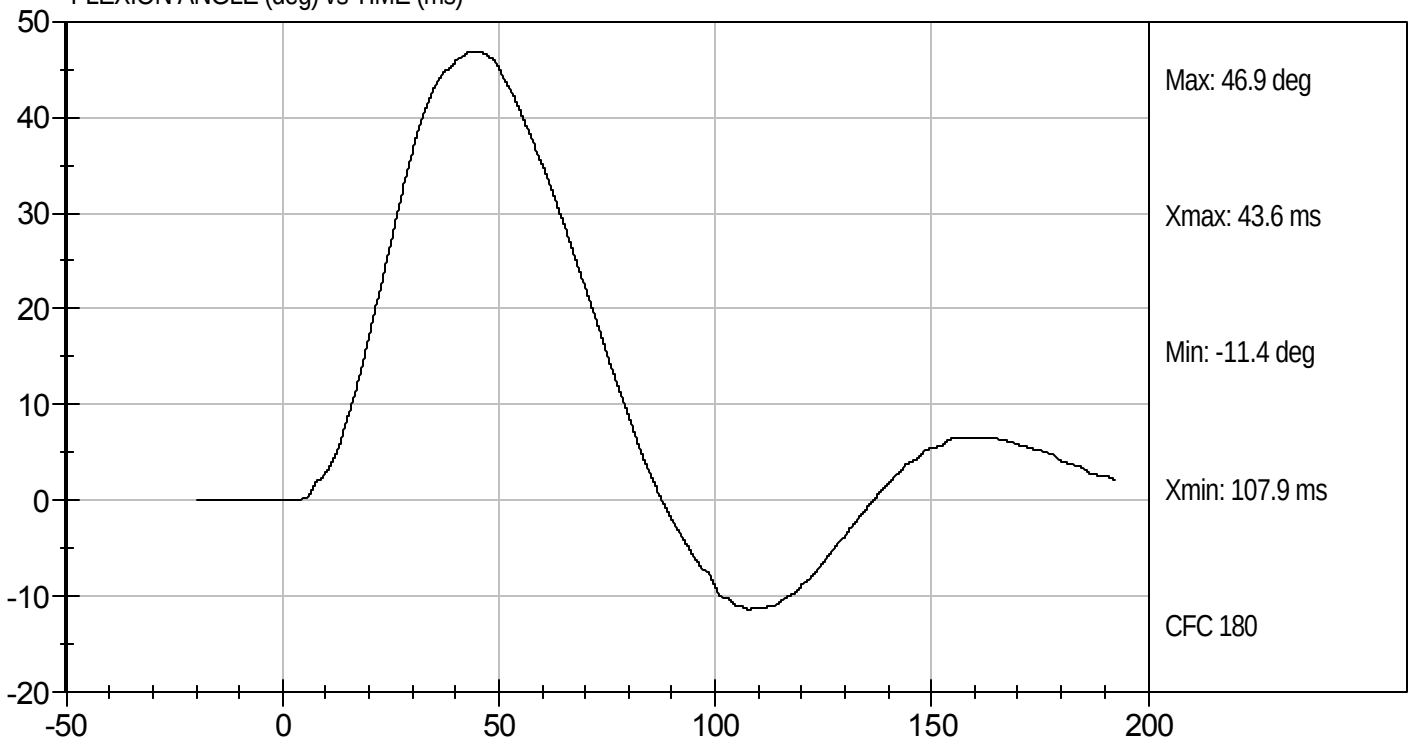
Test Desc: Lumbar Bending
Component ID: D114178

Test Date: 12/13/11
Velocity: 20.10 ft/s, 6.13 m/s

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

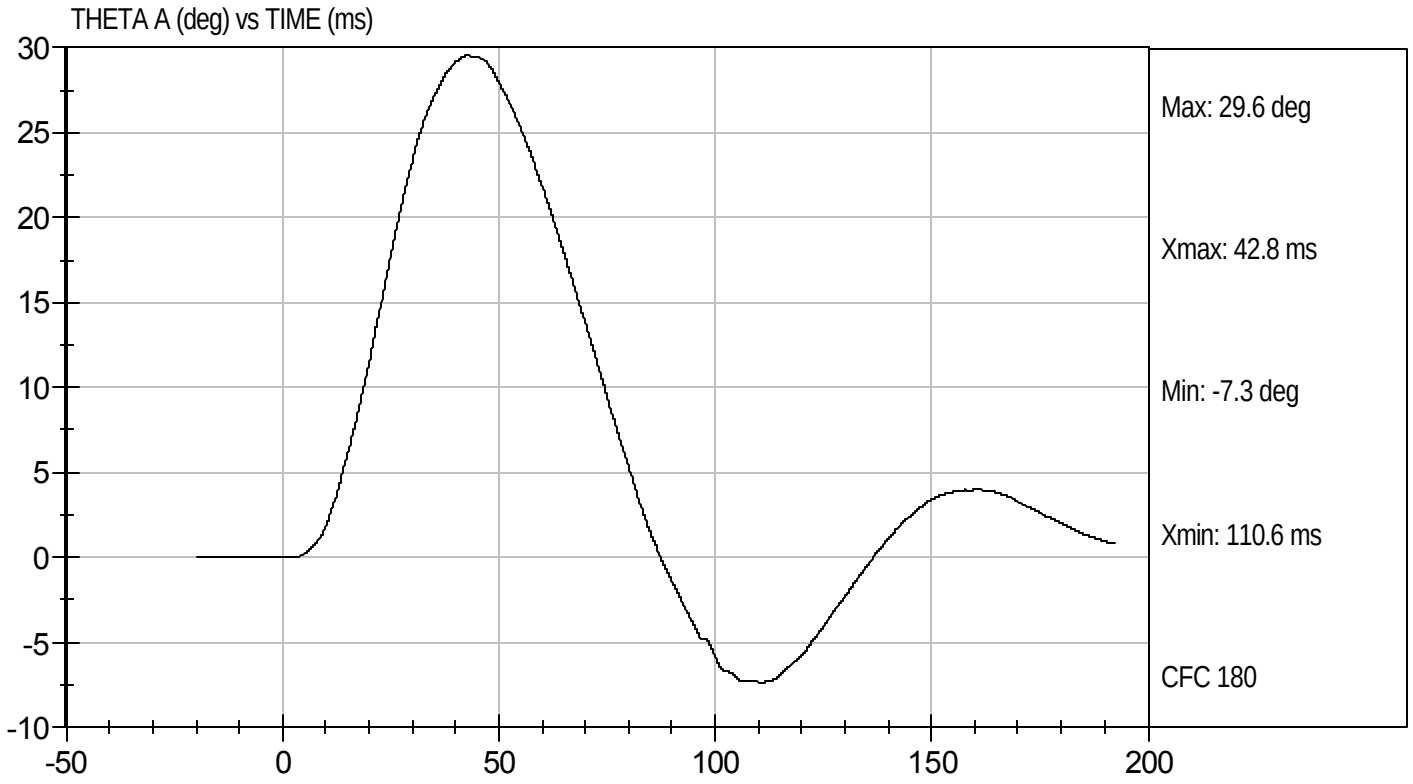


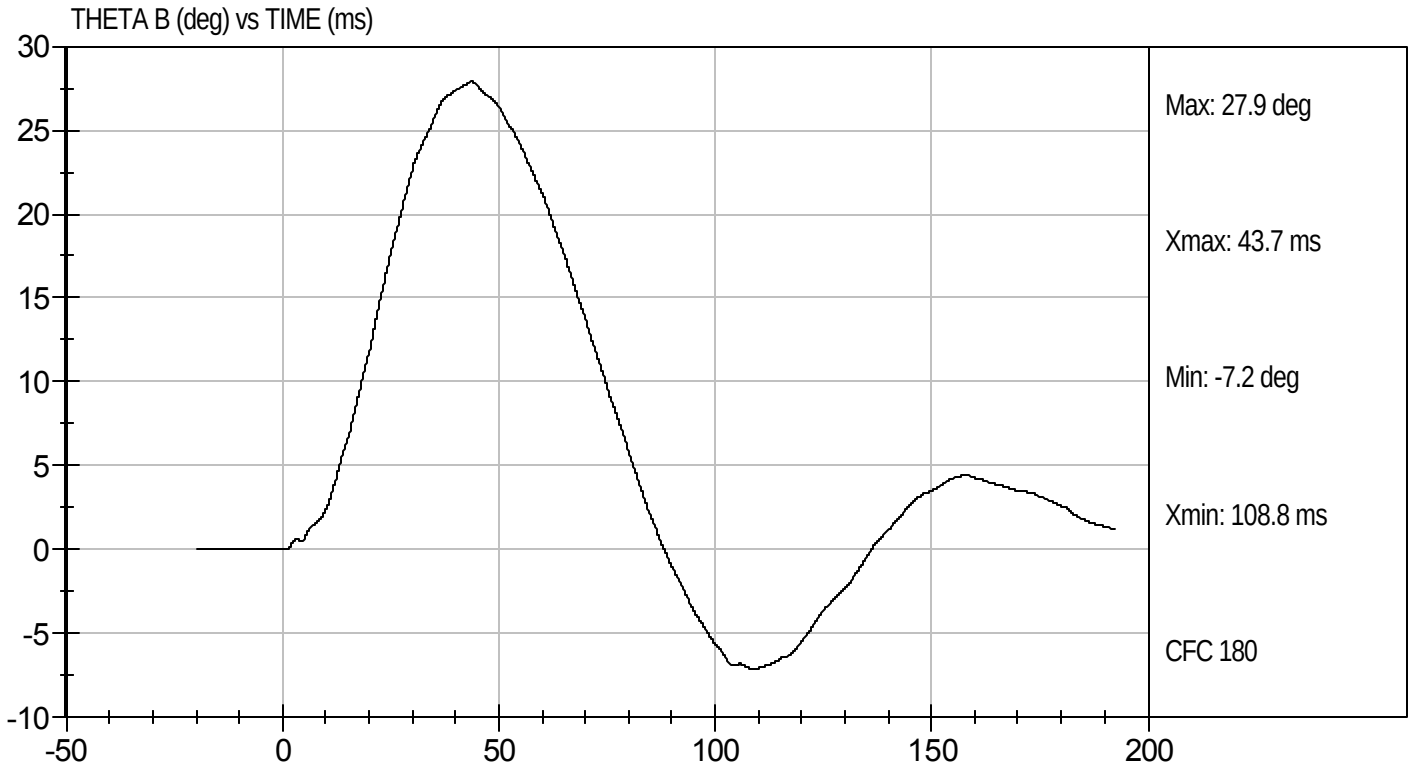
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D114178

Test Date: 12/13/11
Velocity: 20.10 ft/s, 6.13 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D114179

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	33	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	5.06	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.10	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.43	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	13.70	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

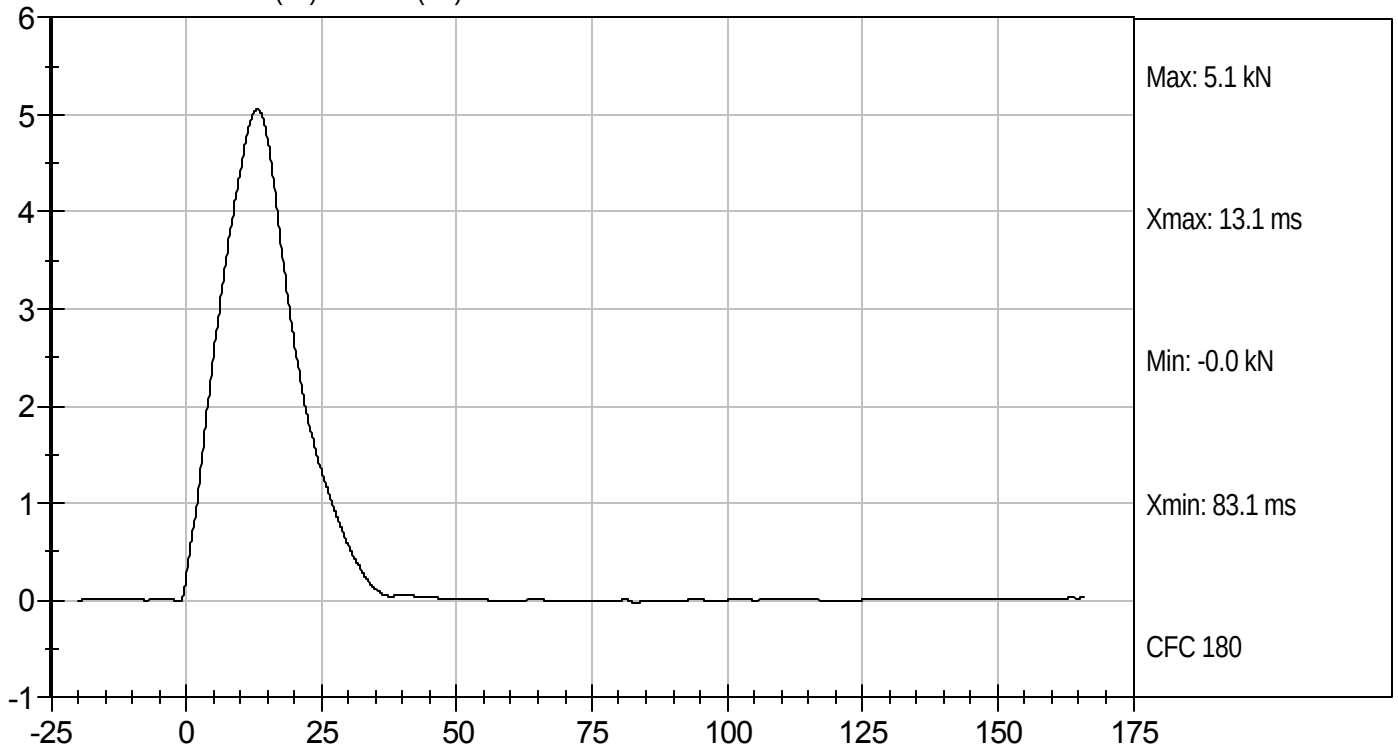
12/14/11
Test Date

David Winkelbauer
Approved By

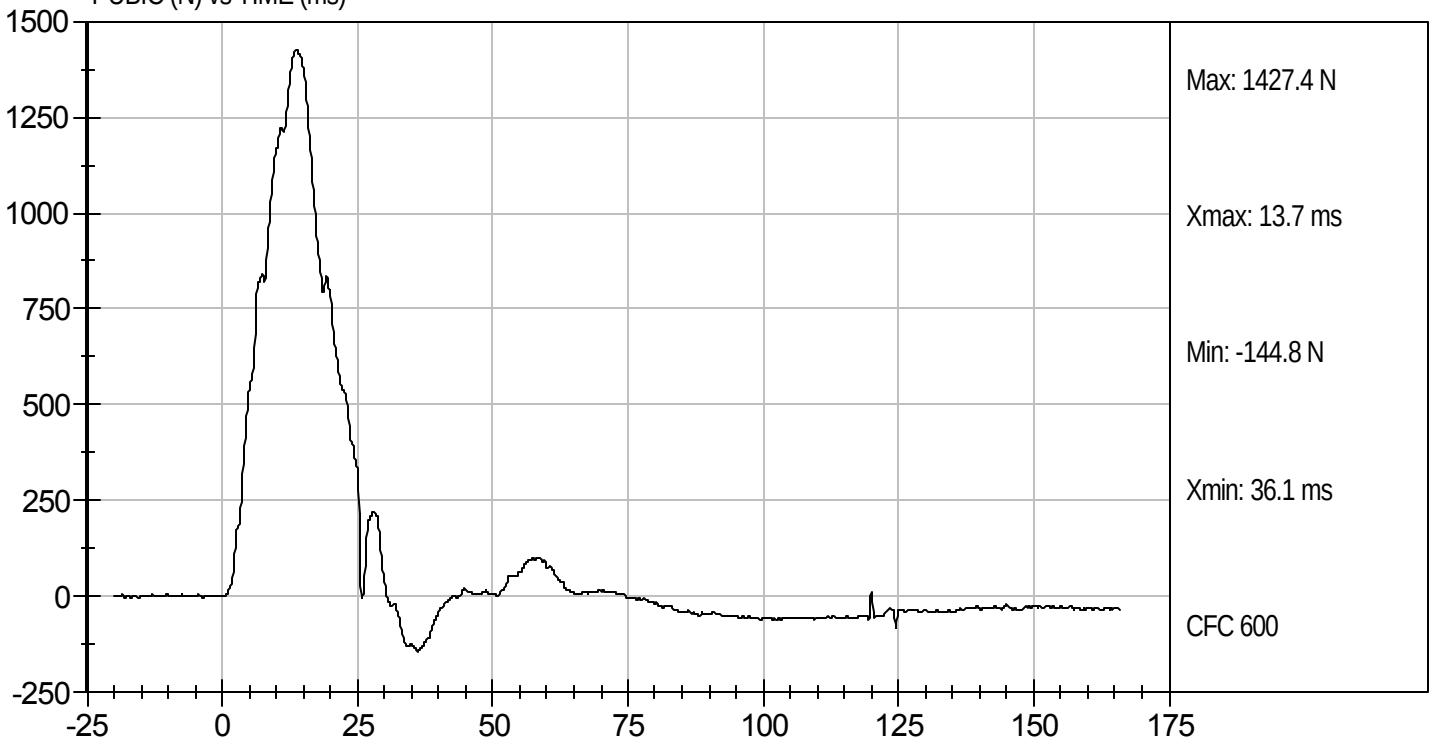
Test Desc: Pelvis Impact
Component ID: D114179

Test Date: 12/14/11
Velocity: 14.25 ft/s, 4.34 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



PUBIC (N) vs TIME (ms)



SID-IIsD External Measurements
SN: 306

No.	Name	Spec. (mm)	Result	Pass/Fail
A	Sitting Height	772 - 788	785	Pass
B	Shoulder Pivot Height	437 - 453	449	Pass
C	H-point Height	79 - 89	86	Pass
D	H-point from Seatback	141 - 151	147	Pass
E	Shoulder Pivot from Backline	97 - 107	99	Pass
F	Thigh Clearance	119 -135	120	Pass
G	Head Breadth	140 - 148	141	Pass
H	Head Back from Backline	40 - 46	45	Pass
I	Head Depth	178 - 188	182	Pass
J	Head Circumference	541 - 551	550	Pass
K	Buttock to Knee Length	514 - 540	538	Pass
L	Popliteal Height	343 - 369	349	Pass
M	Knee Pivot to Floor Height	392 - 409	394	Pass
N	Buttock Popliteal Length	416 - 442	435	Pass
O	Chest Depth w/o Jacket	195 - 211	198	Pass
P	Foot Length	216 - 232	222	Pass
Q	Hip Breadth (w/ pelvic plugs)	313 - 323	317	Pass
R	Arm Length	249 - 259	250	Pass
S	Knee Joint to Seatback	477 - 493	483	Pass
V	Shoulder Width	341 - 357	351	Pass
W	Foot Width	78 - 94	82	Pass
Y	Chest Circumference w/ jacket	851 - 881	863	Pass
Z	Waist Circumference	761 - 791	782	Pass

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D114091

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	115 to 137	117	Pass
Peak Lateral Acceleration	G's	+/- 15	-5.4	Pass
Unimodal	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

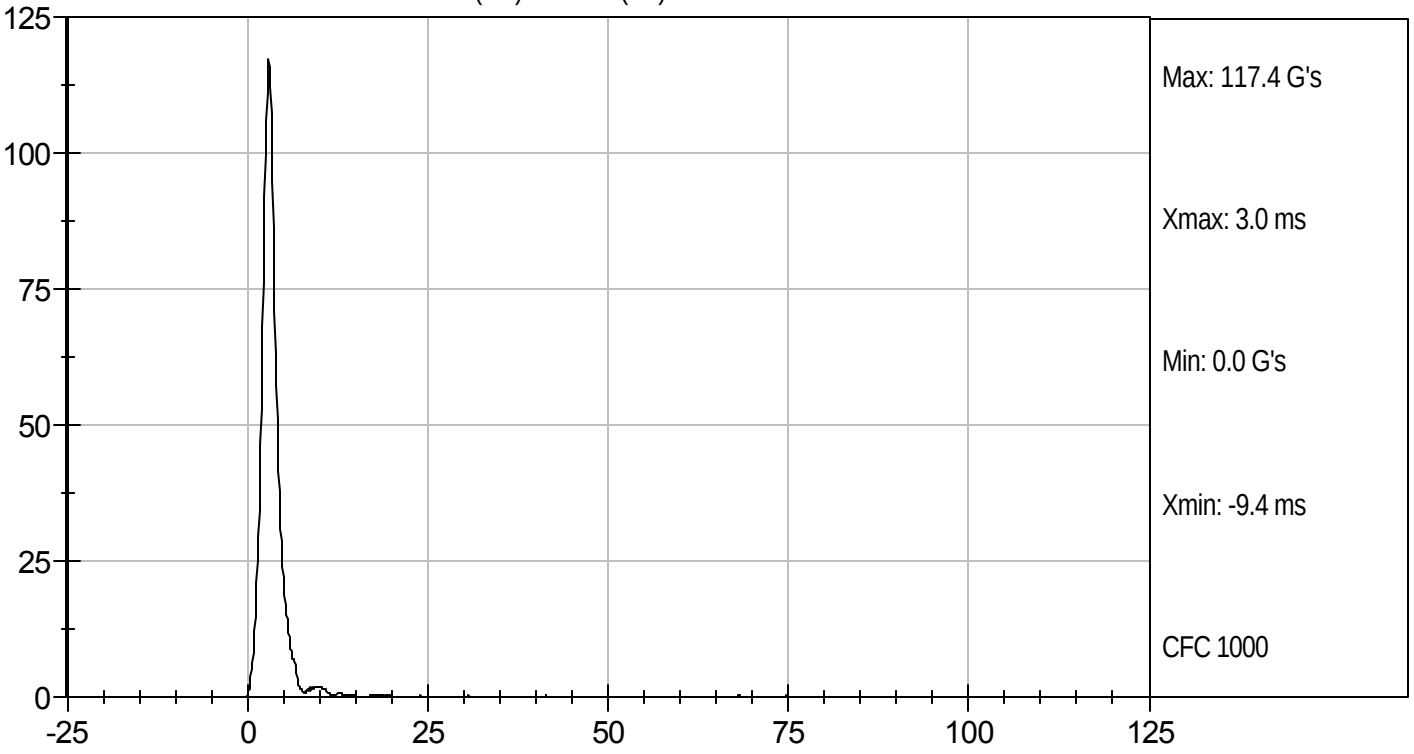
12/6/11
Test Date

David Winkelbauer
Approved By

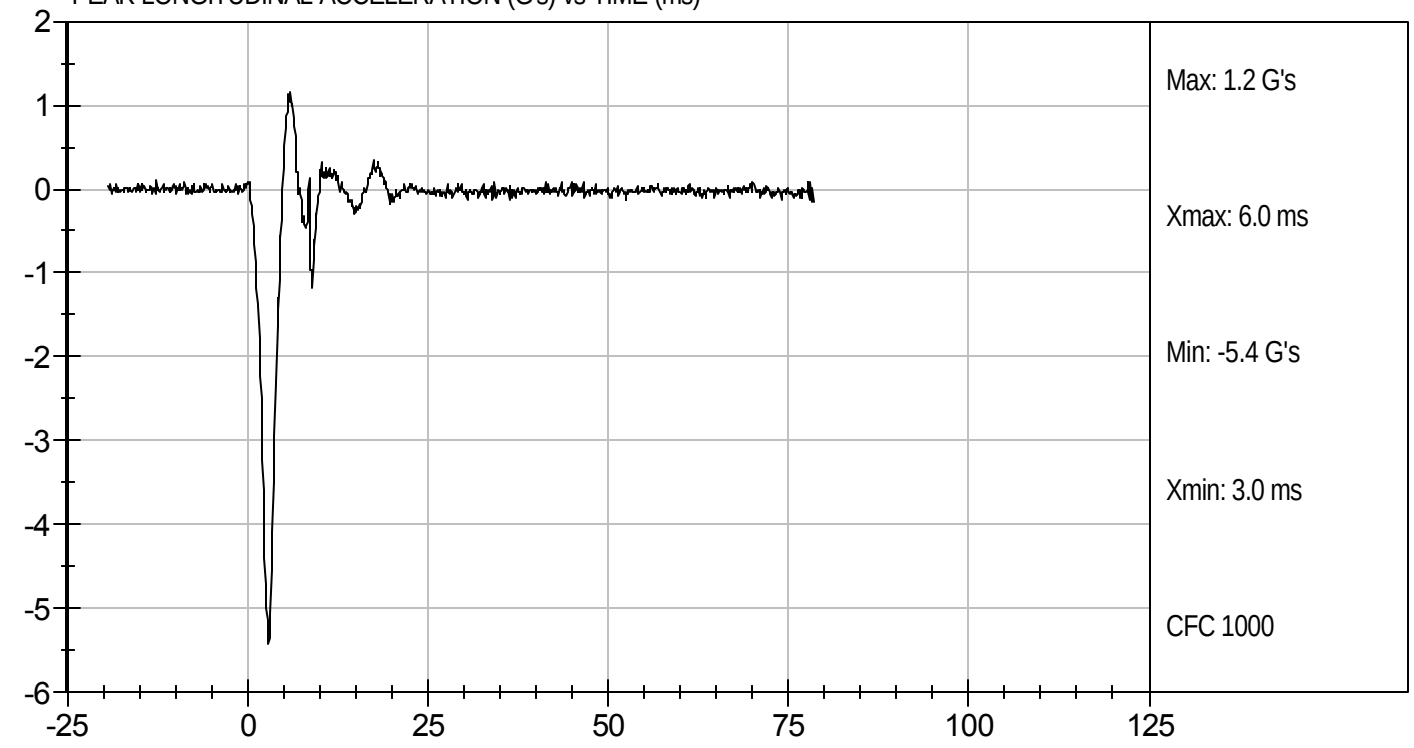
Test Desc: Head Drop
Component ID: D114091

Test Date: 12/6/11
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: 306 **Test I.D:** D114092

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.4	Pass
Humidity		%	10 to 70	20	Pass
Impact Velocity		m/s	5.51 to 5.63	5.52	Pass
Delta Velocity	10 ms	m/s	2.20 to 2.80	2.41	Pass
	15 ms	m/s	3.30 to 4.10	3.43	Pass
	20 ms	m/s	4.40 to 5.40	4.57	Pass
	25 ms	m/s	5.40 to 6.10	5.44	Pass
	25-100 ms	m/s	5.50 to 6.20	5.58	Pass
Maximum D-Plane Rotation		deg	71 to 81	71	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	60	Pass
Maximum Occipital Condyle Moment during Rotation Interval		Nm	-44 to -36	-41	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	116	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

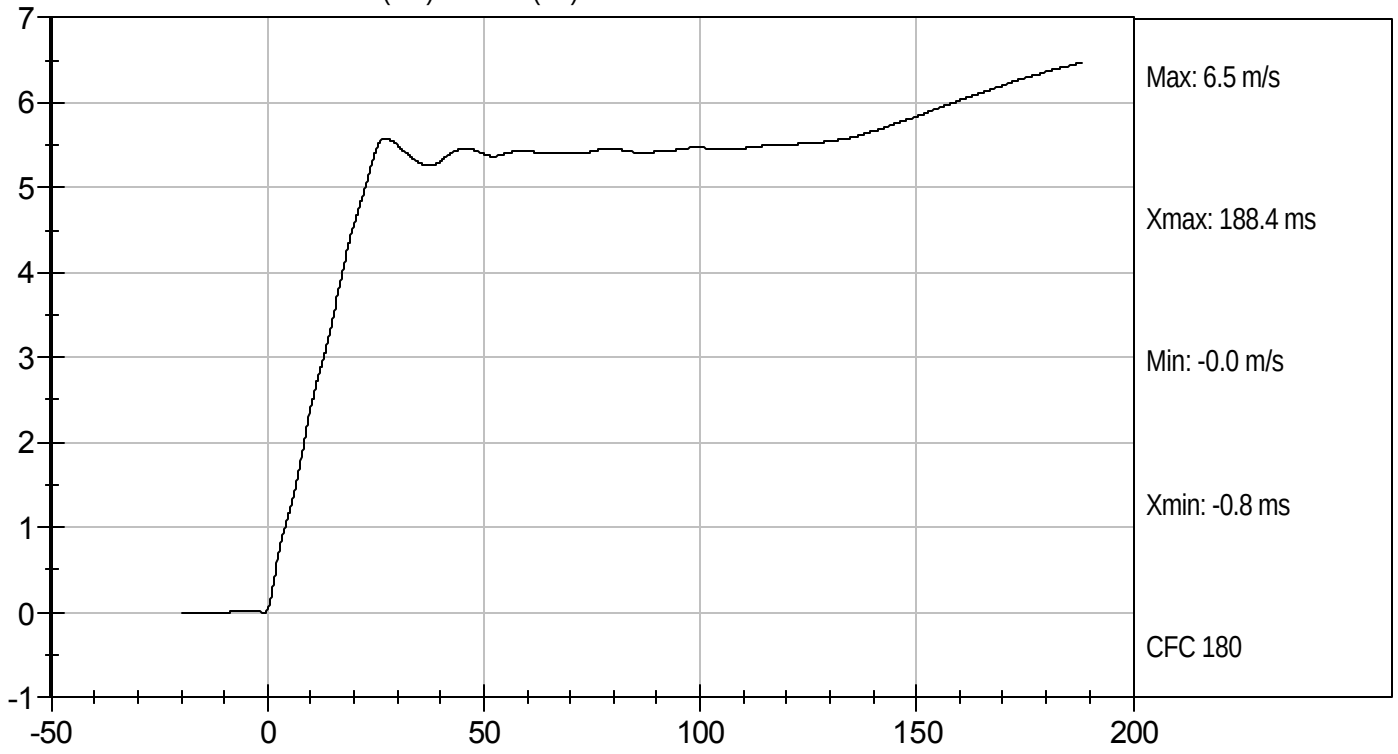
12/7/11
Test Date

David Winkelbauer
Approved By

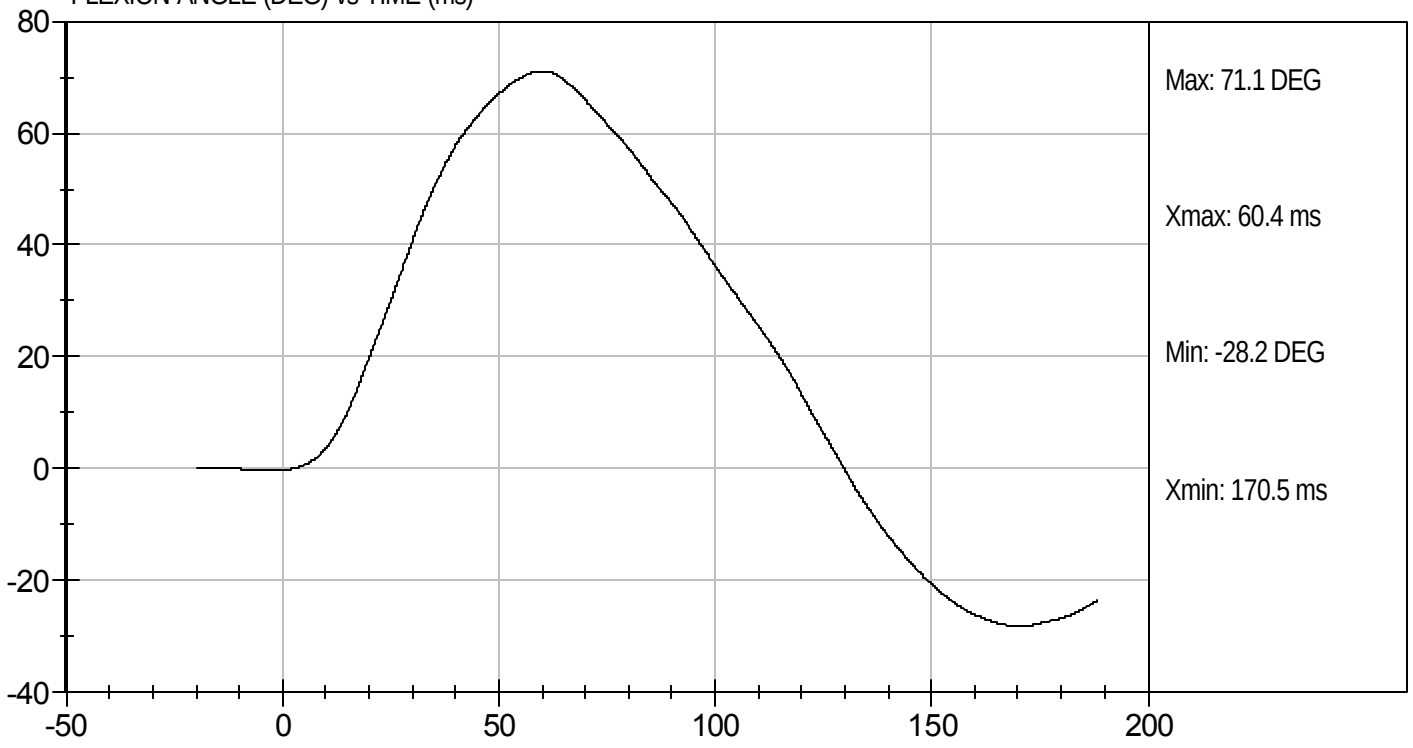
Test Desc: Neck Bending
Component ID: D114092

Test Date: 12/7/11
Velocity: 18.12 ft/s, 5.52 m/s

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

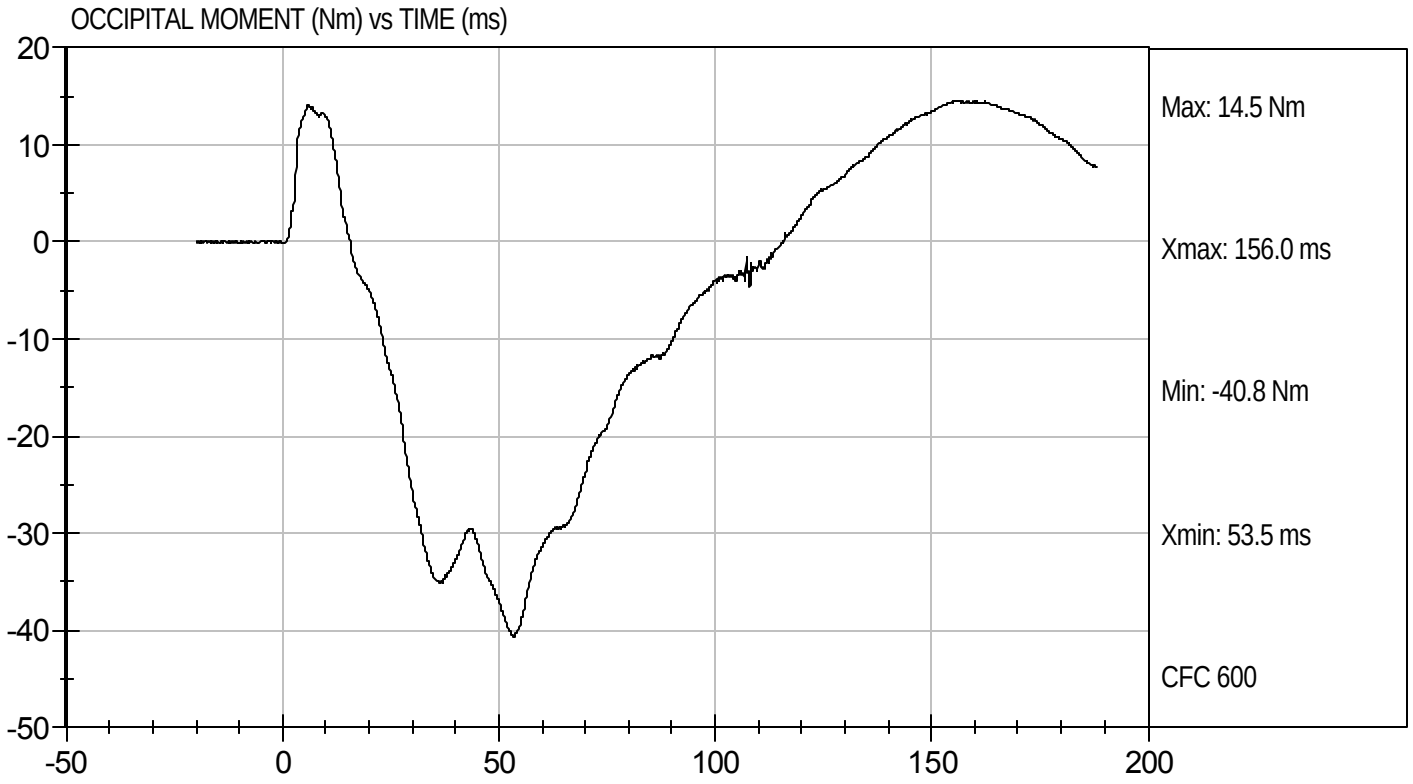


FLEXION ANGLE (DEG) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D114092

Test Date: 12/7/11
Velocity: 18.12 ft/s, 5.52 m/s



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D114093

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	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	19	Pass
		Overall Test Results		Pass

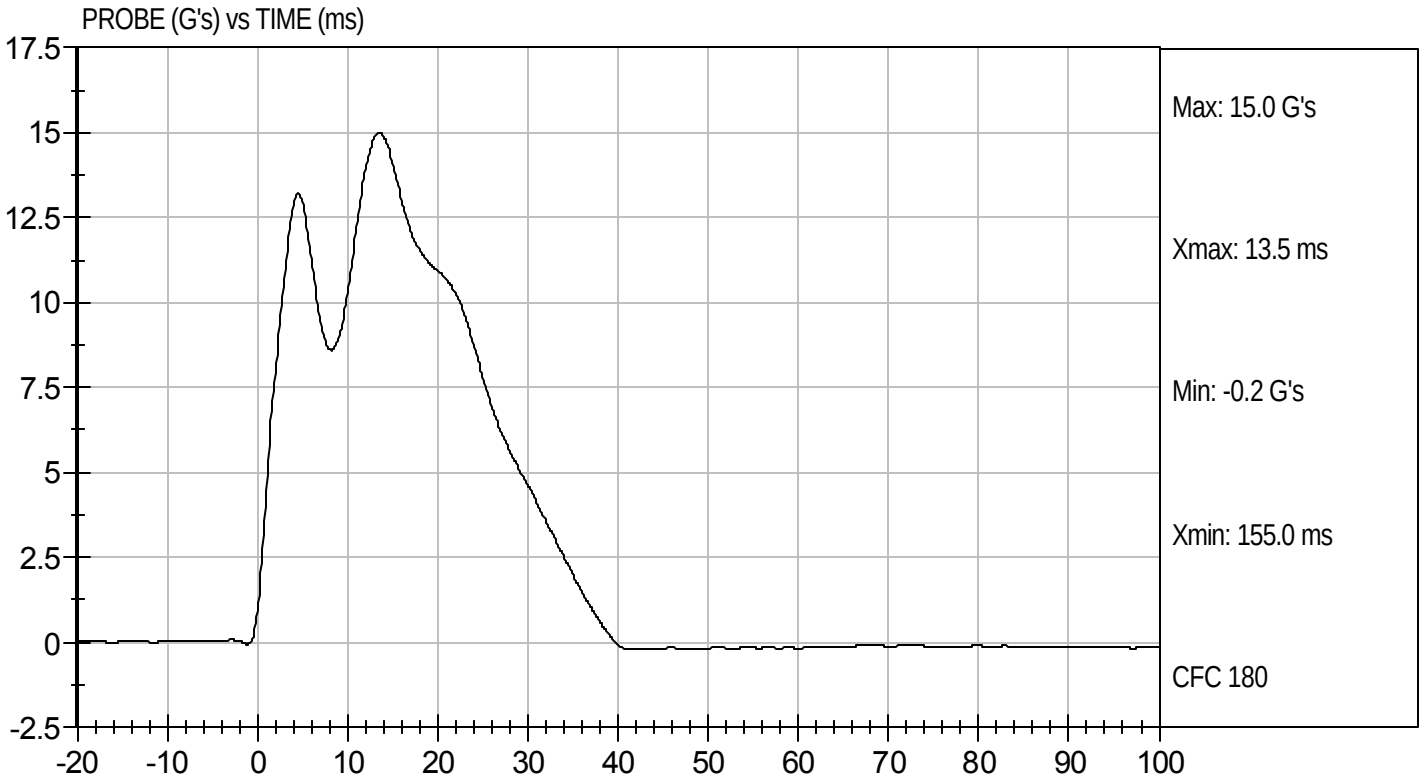
Jessica Gall
Laboratory Technician

12/7/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D114093

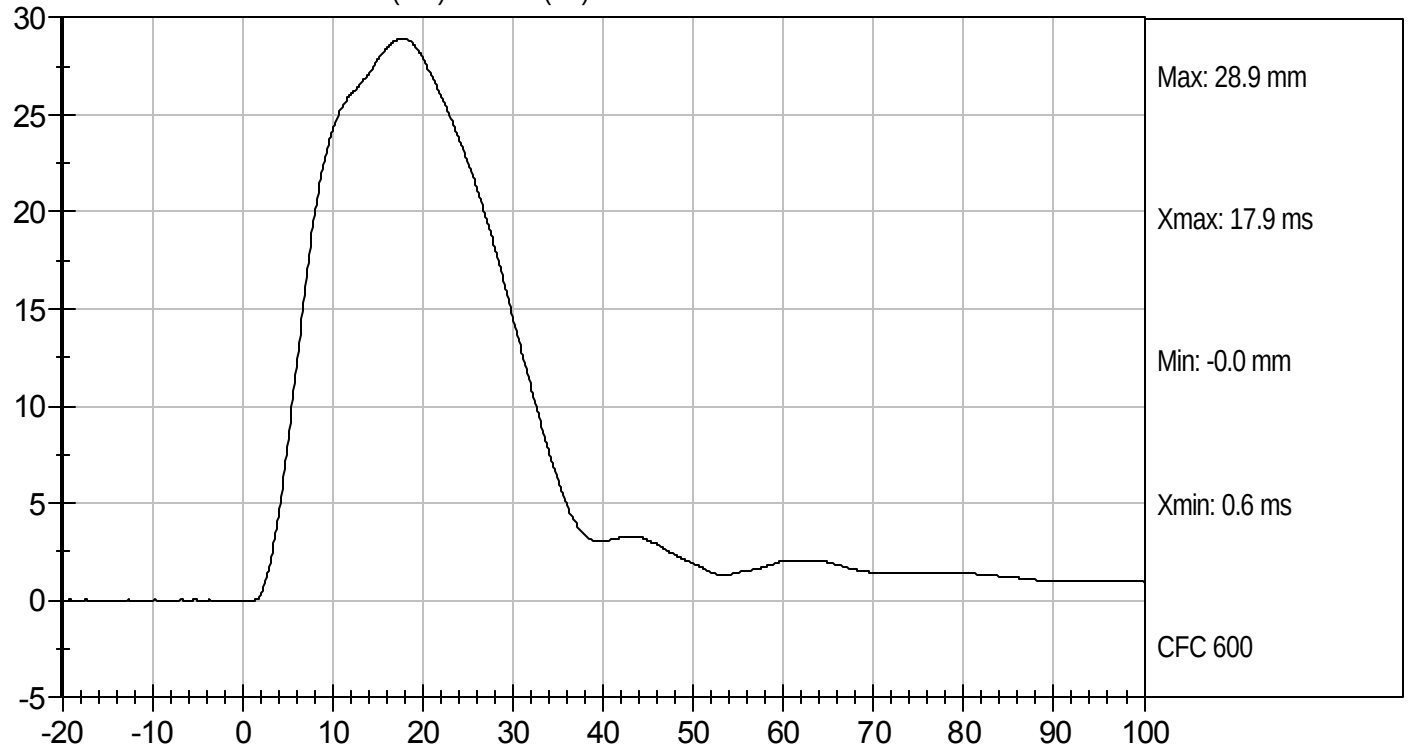
Test Date: 12/7/11
Velocity: 14.24 ft/s, 4.34 m/s



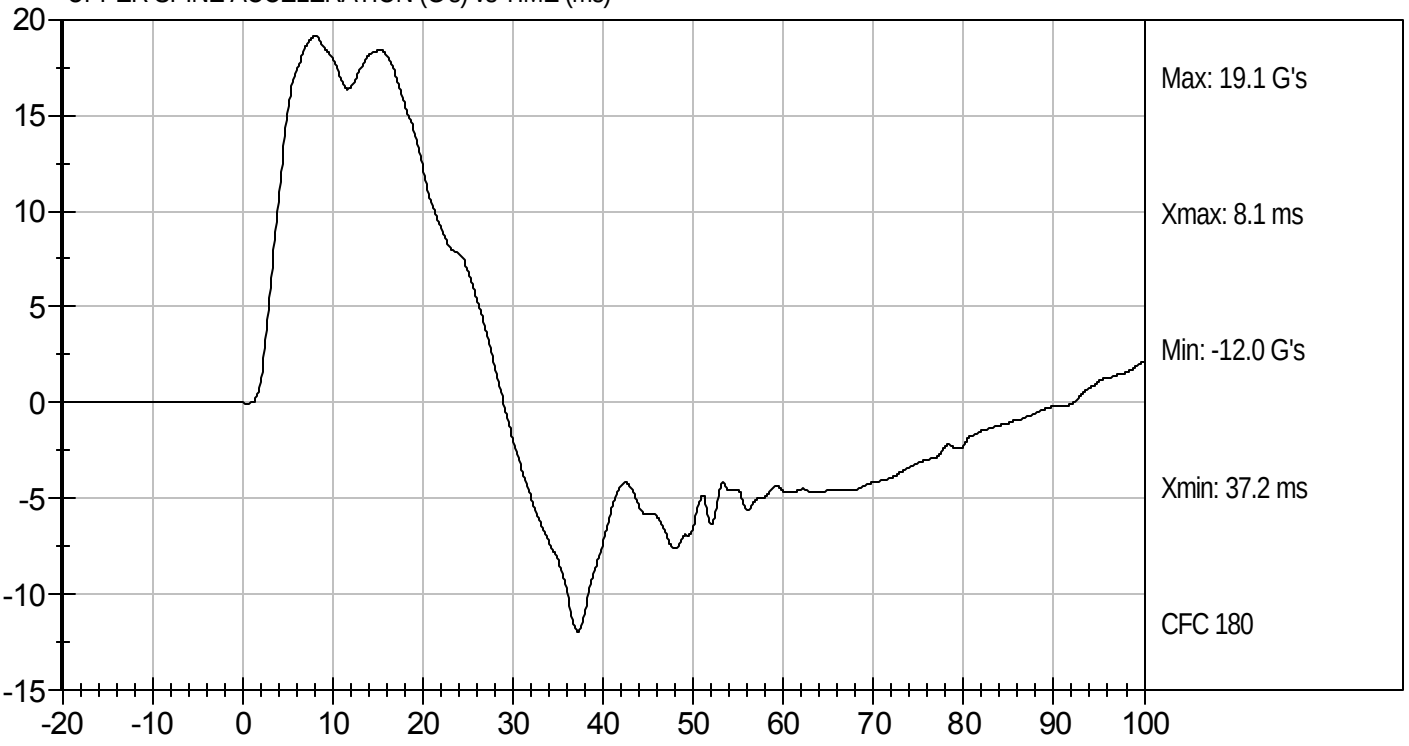
Test Desc: Shoulder Impact
Component ID: D114093

Test Date: 12/7/11
Velocity: 14.24 ft/s, 4.34 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: 306 **Test I.D:** D114094

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	20	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	33	Pass
Upper Rib Displacement	mm	25 to 32	26	Pass
Middle Rib Displacement	mm	30 to 36	31	Pass
Lower Rib Displacement	mm	32 to 38	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	39	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	33	Pass
		Overall Test Results		Pass

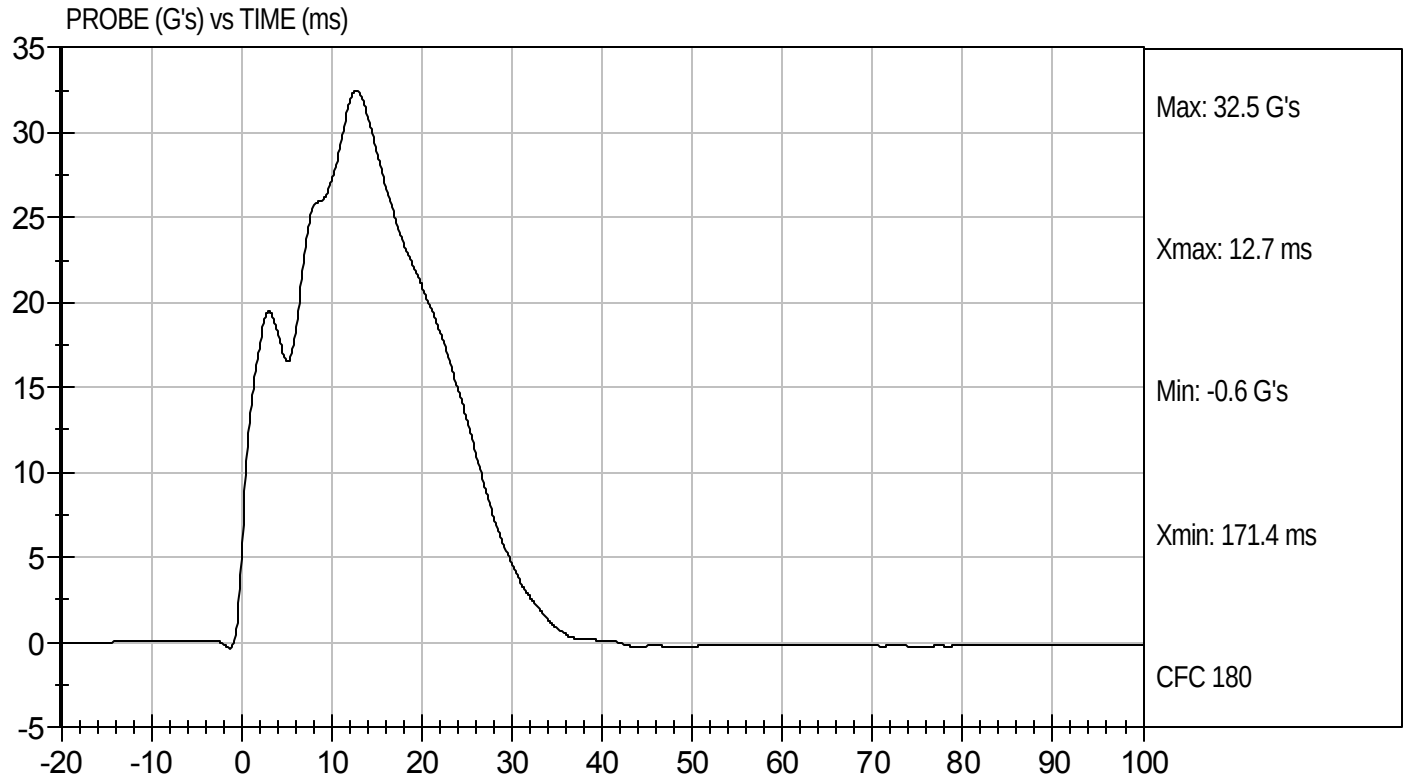
Jessica Hall
Laboratory Technician

12/7/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax With Arm
Component ID: D114094

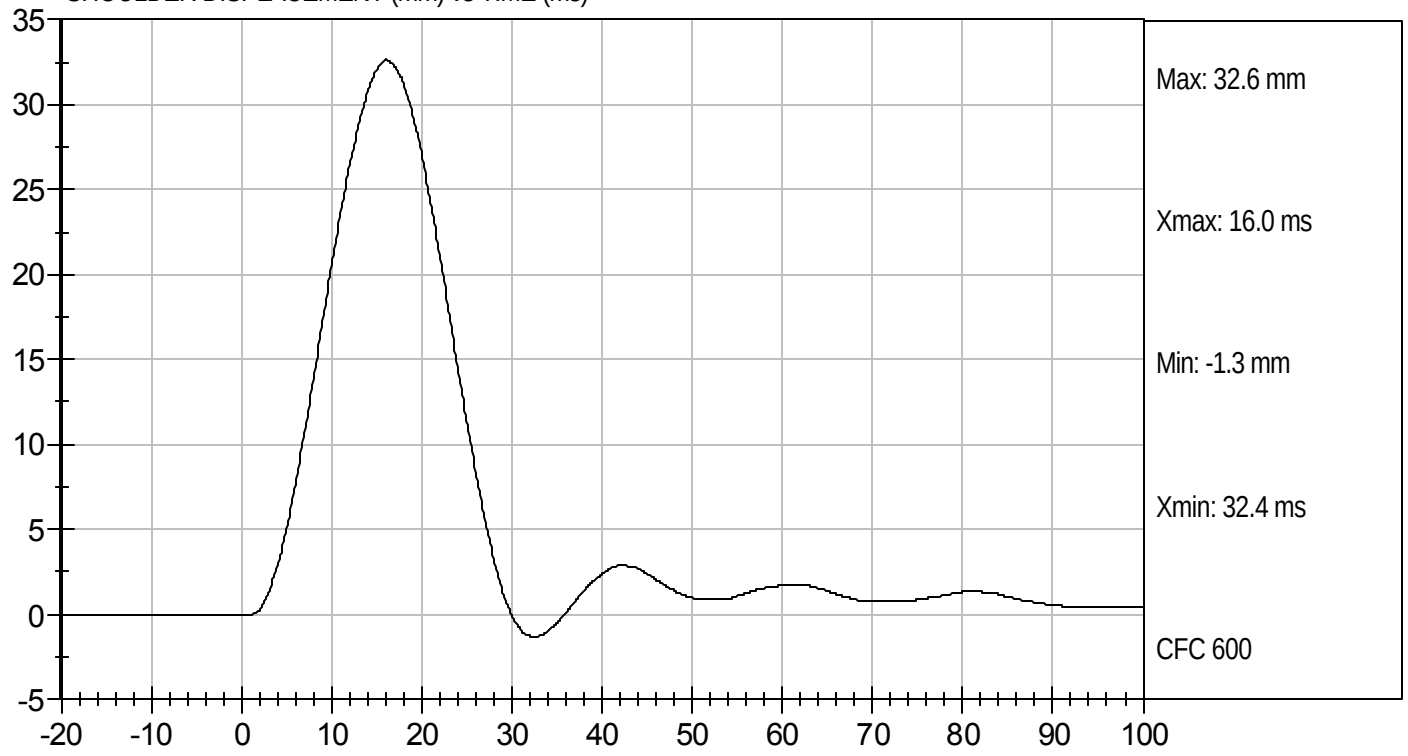
Test Date: 12/7/11
Velocity: 22.2 ft/s, 6.77 m/s



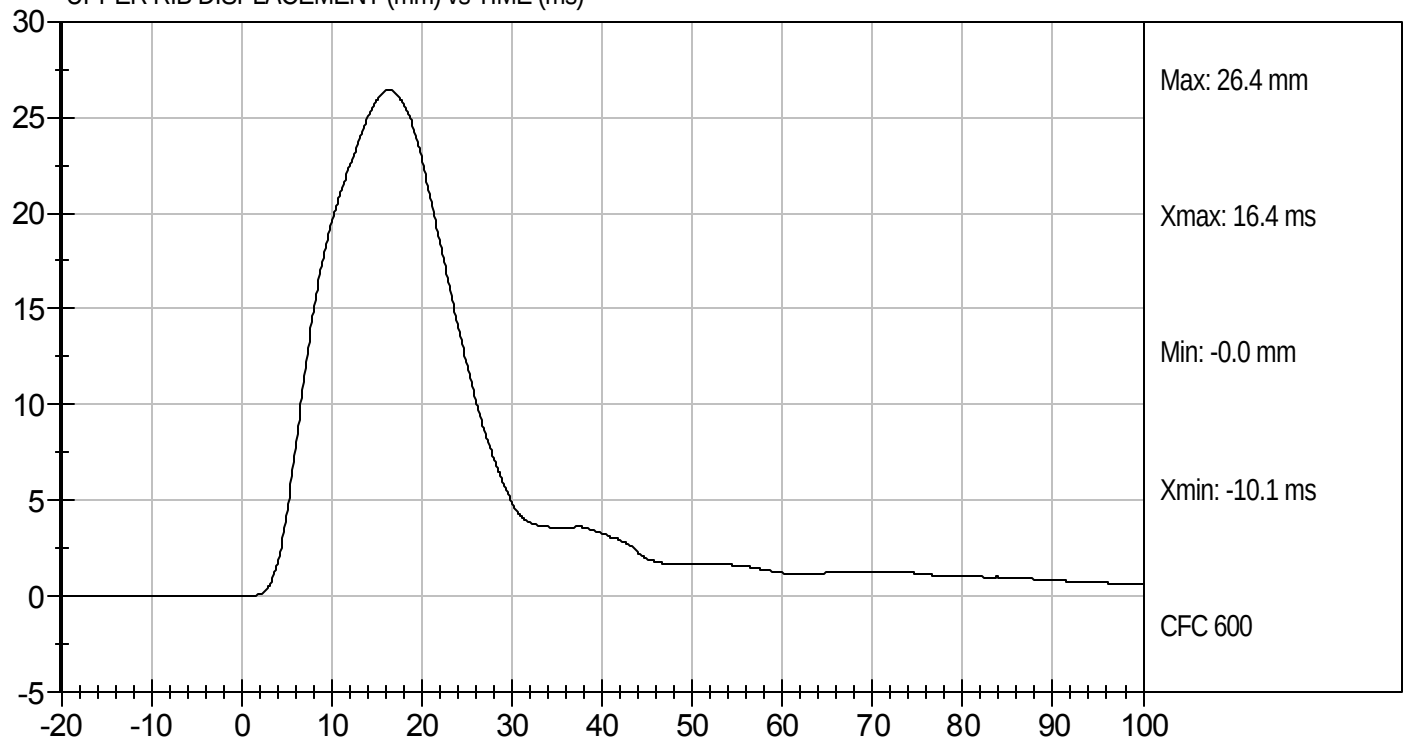
Test Desc: Thorax With Arm
Component ID: D114094

Test Date: 12/7/11
Velocity: 22.2 ft/s, 6.77 m/s

SHOULDER DISPLACEMENT (mm) vs TIME (ms)



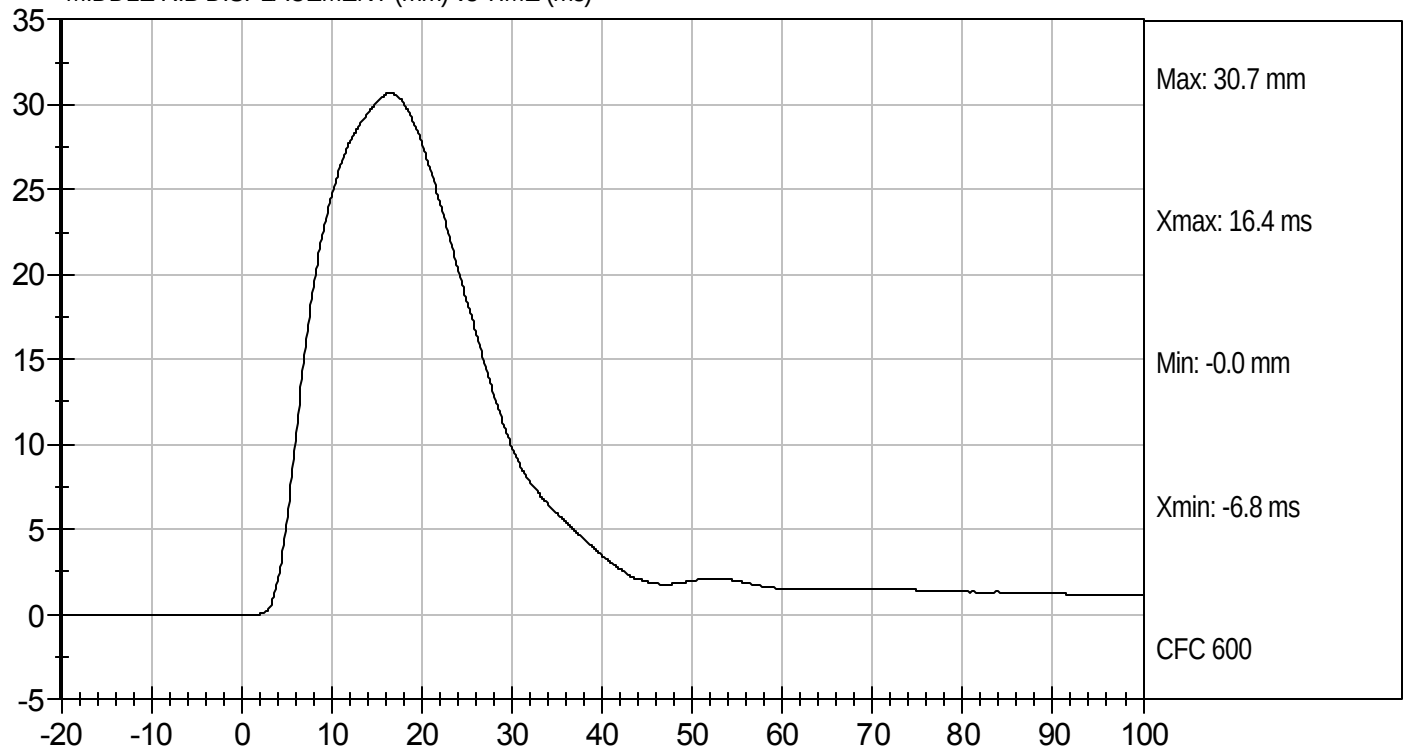
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



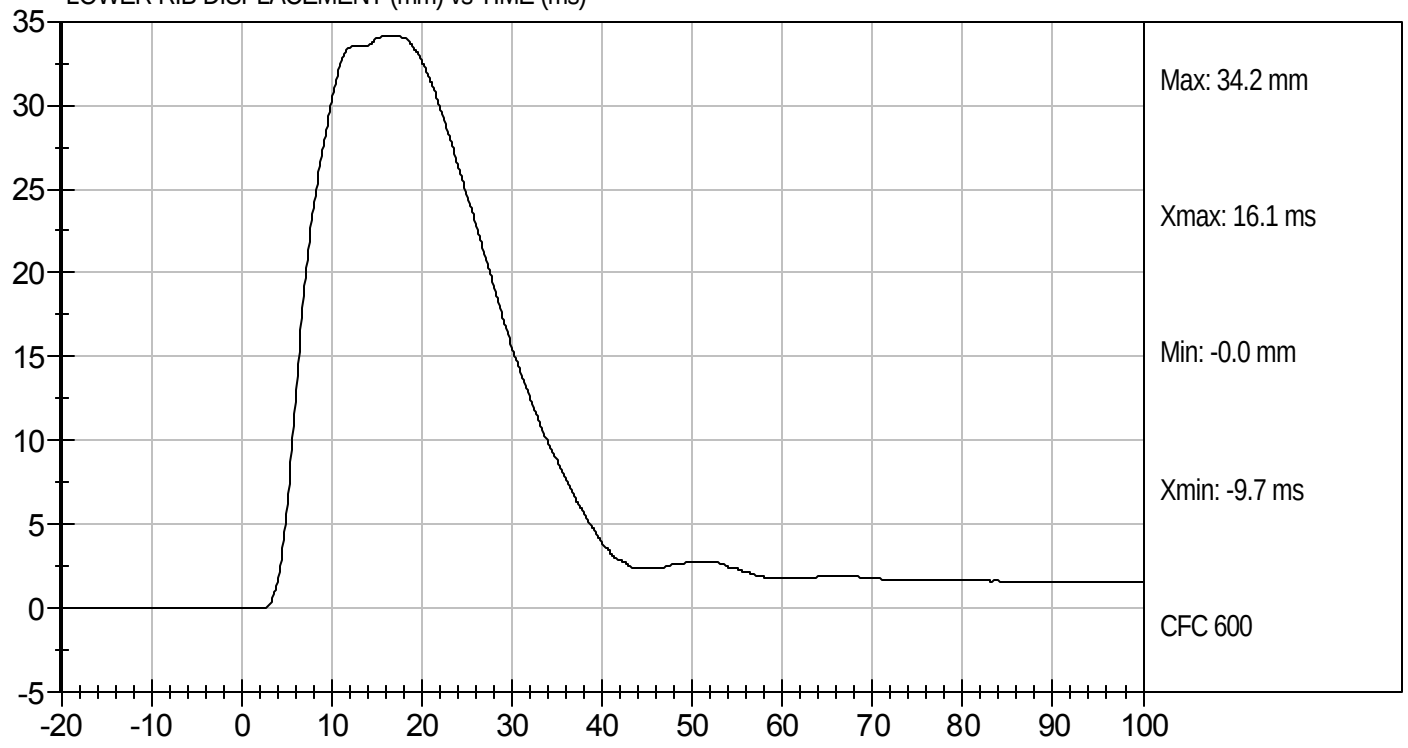
Test Desc: Thorax With Arm
Component ID: D114094

Test Date: 12/7/11
Velocity: 22.2 ft/s, 6.77 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



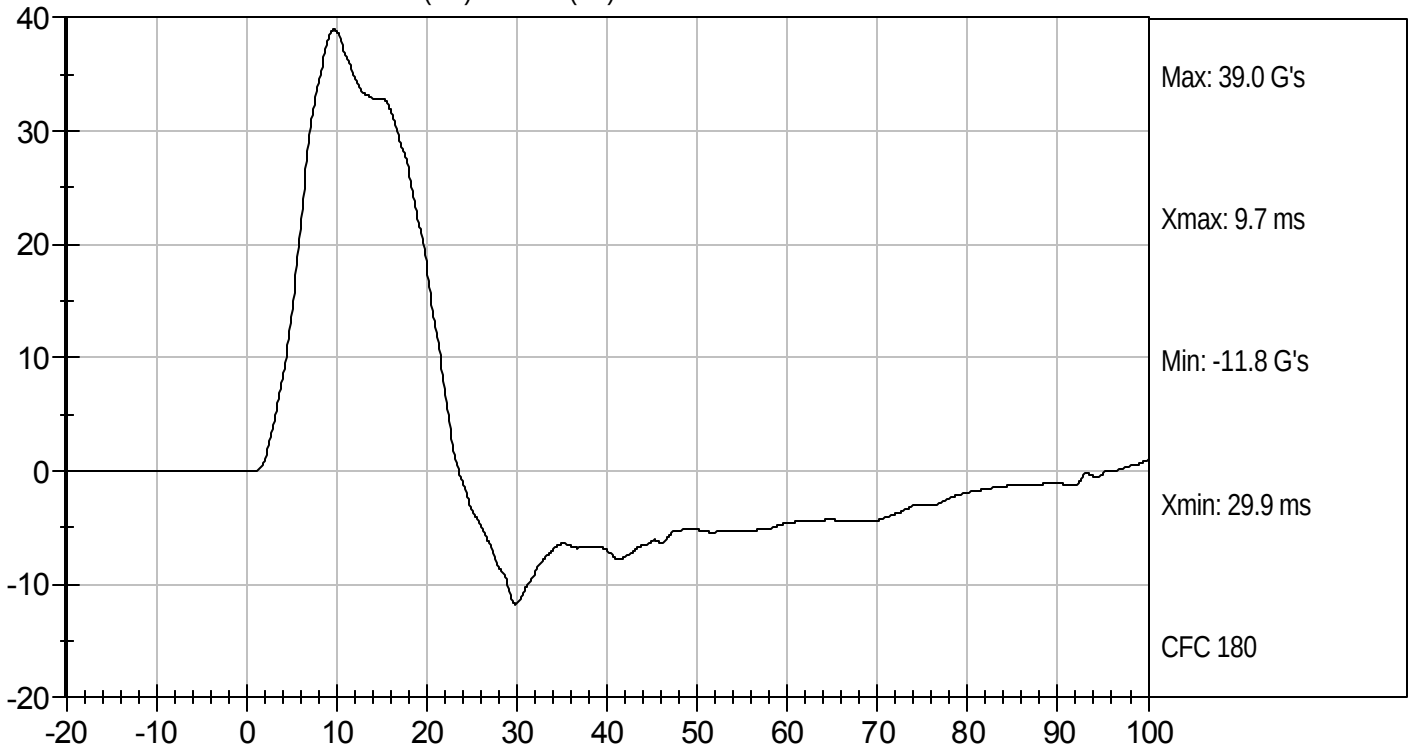
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



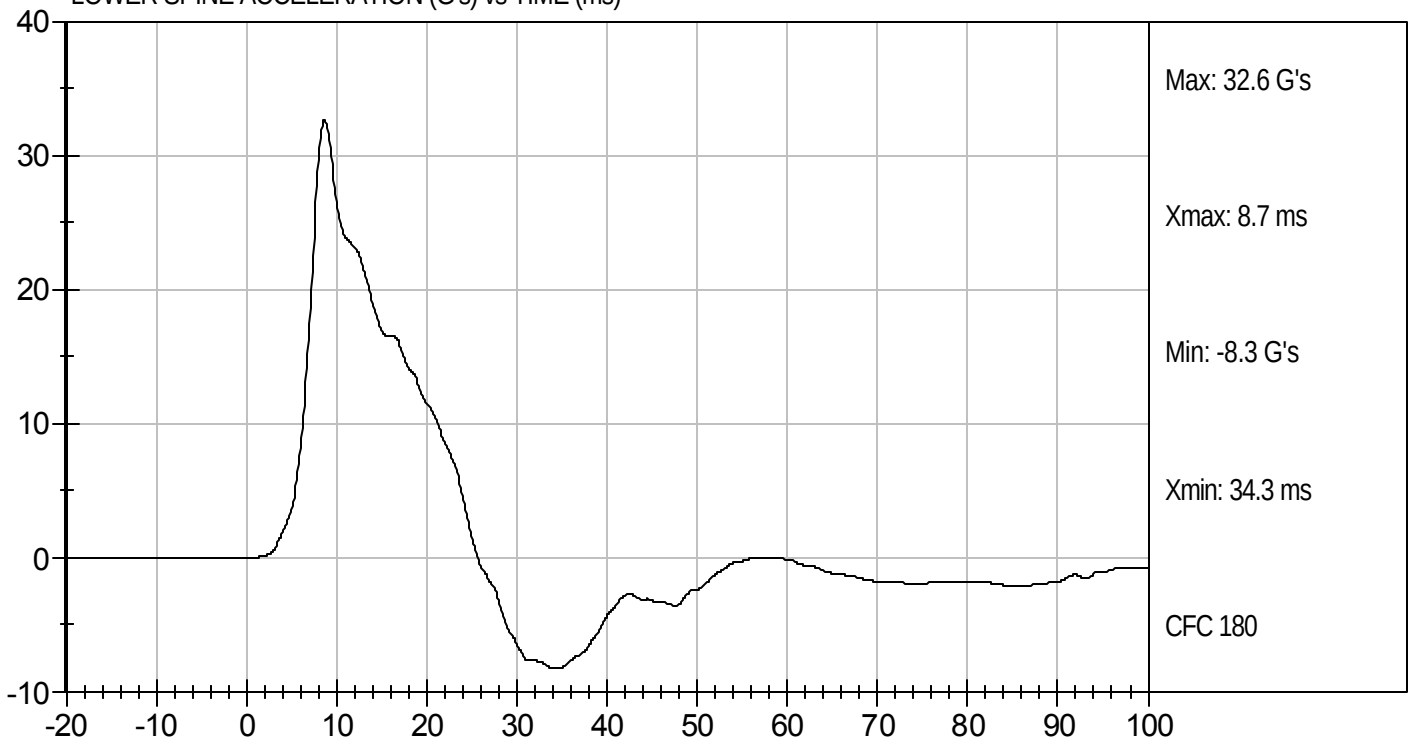
Test Desc: Thorax With Arm
Component ID: D114094

Test Date: 12/7/11
Velocity: 22.2 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: 306 **Test I.D:** D114095

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor Force	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	35	Pass
Middle Rib Displacement	mm	39 to 45	41	Pass
Lower Rib Displacement	mm	35 to 43	41	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	15	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	10	Pass
		Overall Test Results		Pass

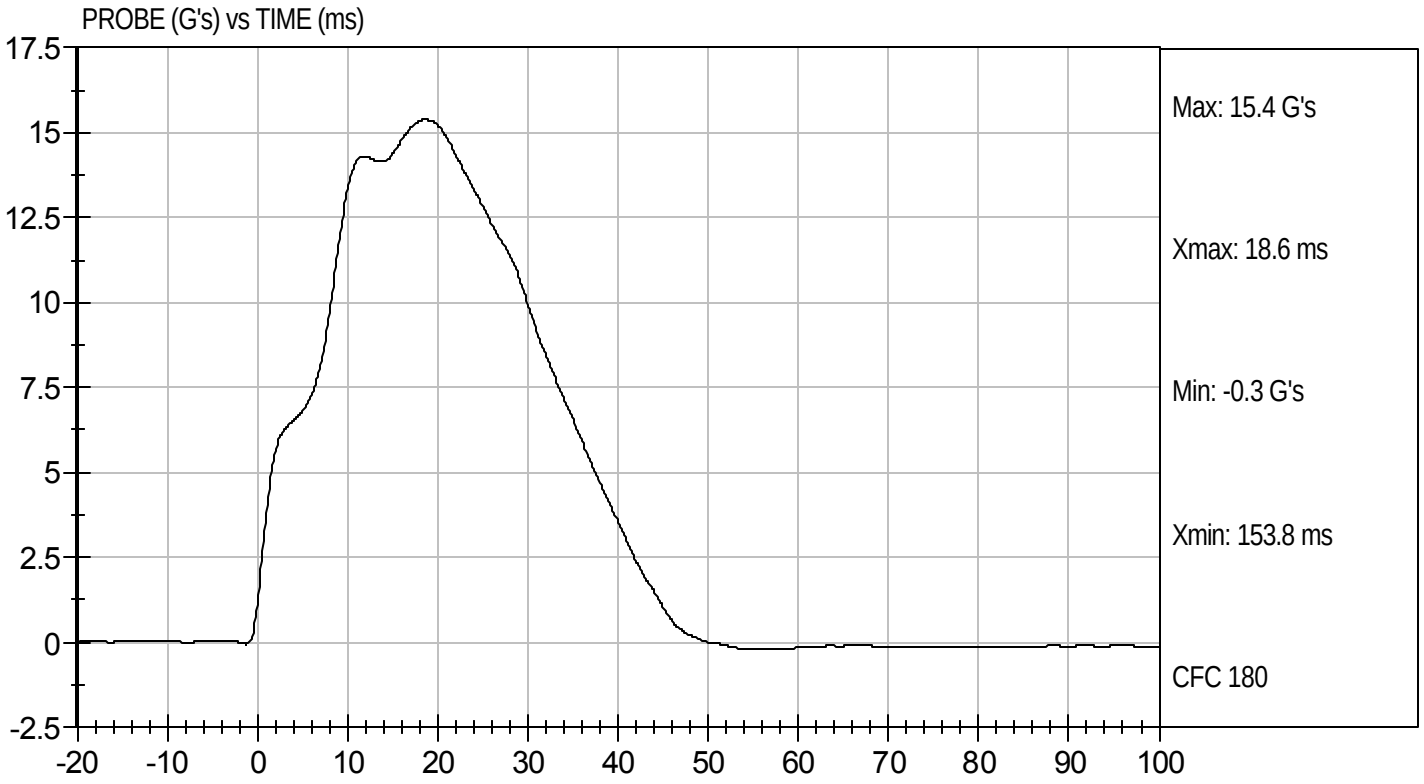
Jessica Hall
Laboratory Technician

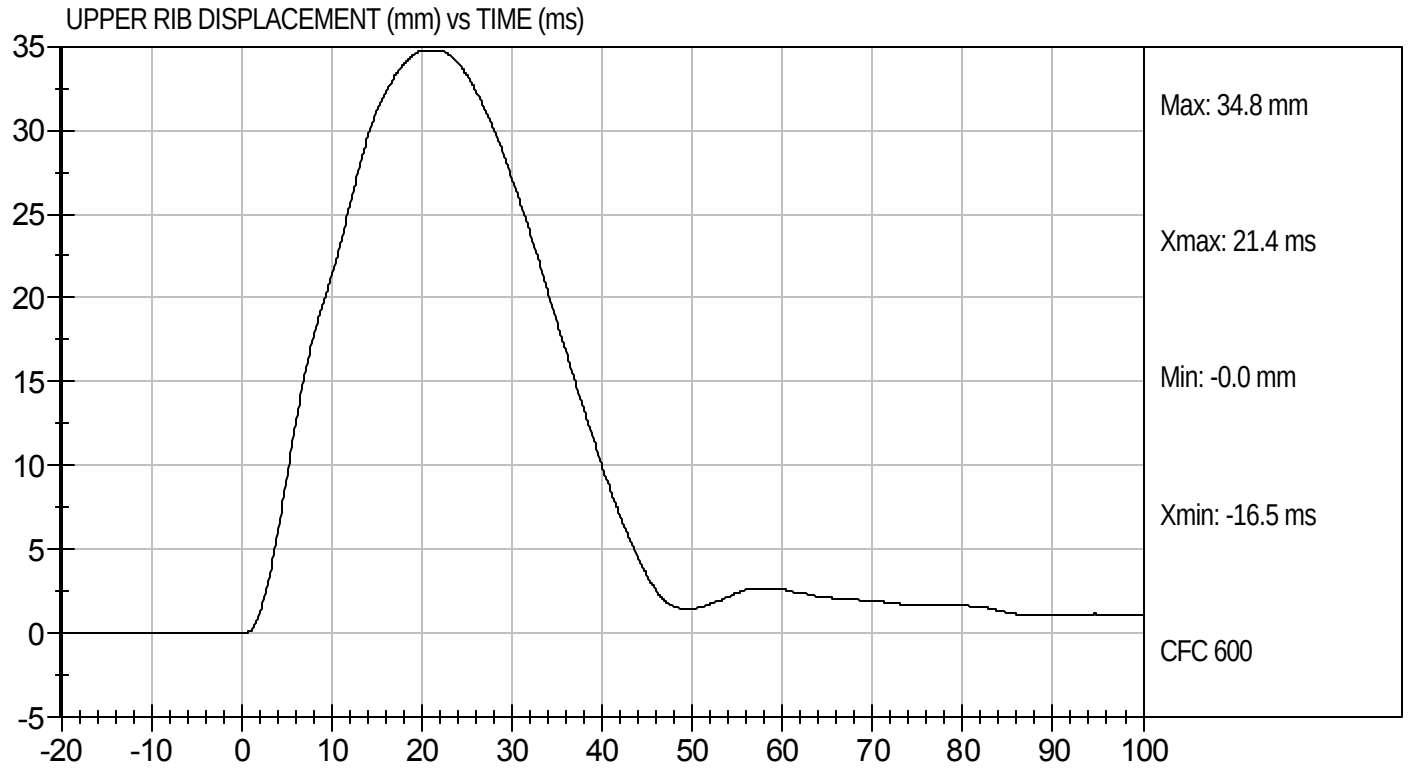
12/7/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Without Arm
Component ID: D114095

Test Date: 12/7/11
Velocity: 14.36 ft/s, 4.38 m/s

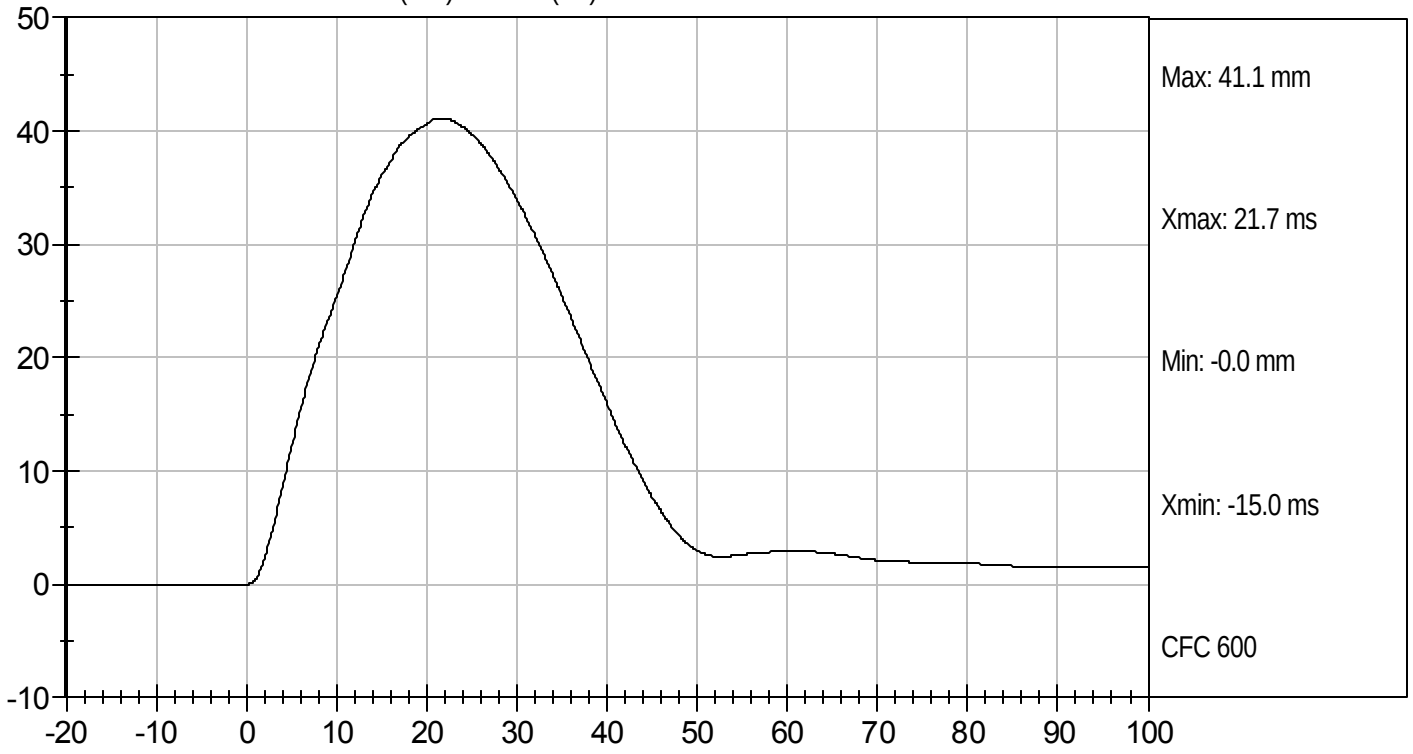




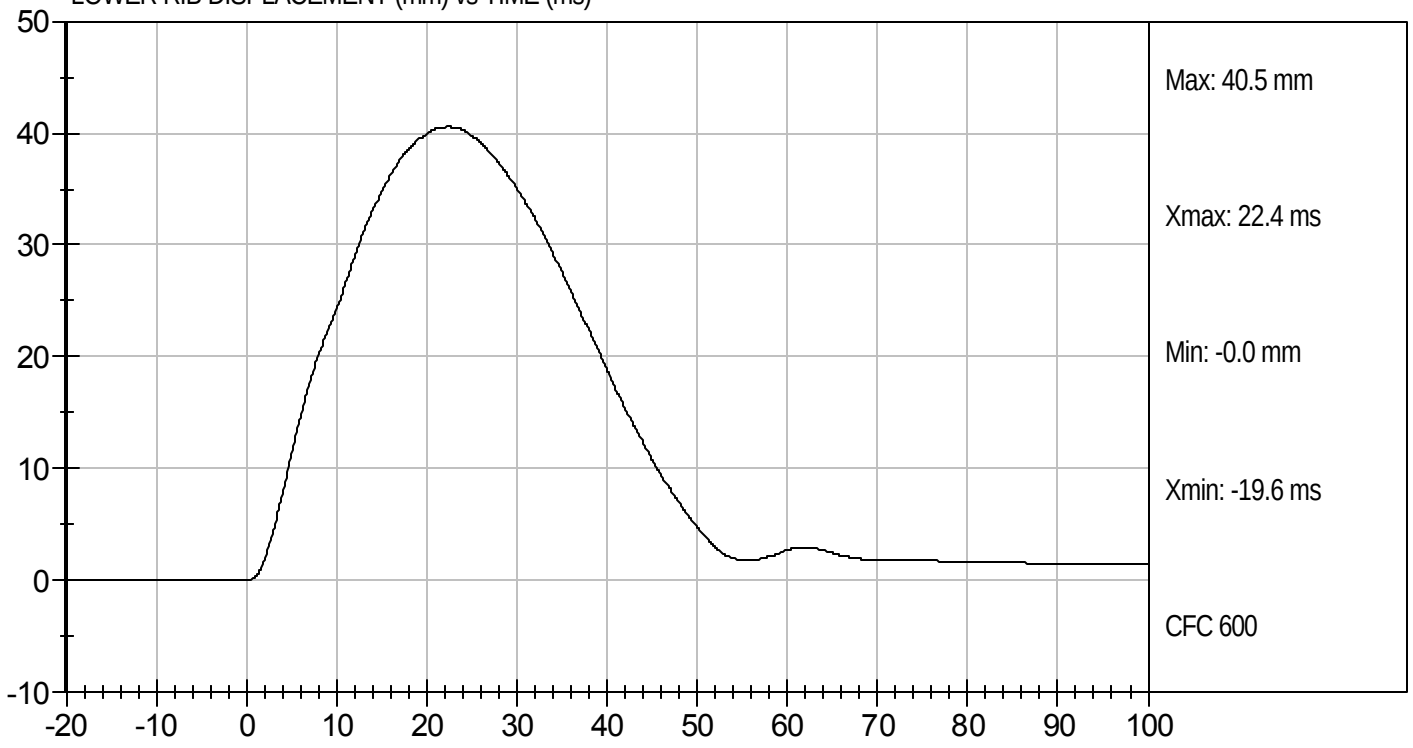
Test Desc: Thorax Without Arm
Component ID: D114095

Test Date: 12/7/11
Velocity: 14.36 ft/s, 4.38 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

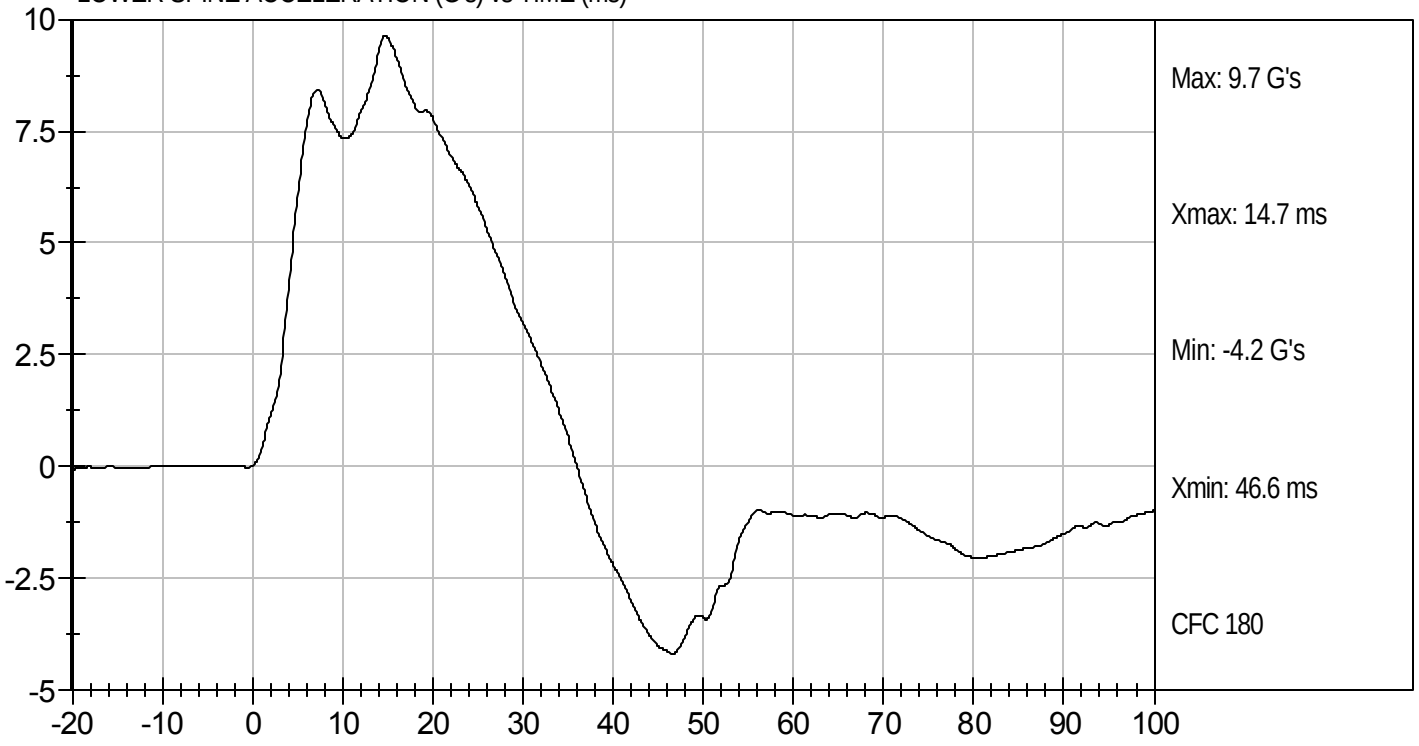


Test Desc: Thorax Without Arm
Component ID: D114095

Test Date: 12/7/11
Velocity: 14.36 ft/s, 4.38 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: 306 **Test I.D:** D114096

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Peak Impactor Acceleration	G's	12 to 16	14	Pass
Upper Rib Displacement	mm	36 to 47	38	Pass
Lower Rib Displacement	mm	33 to 44	34	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

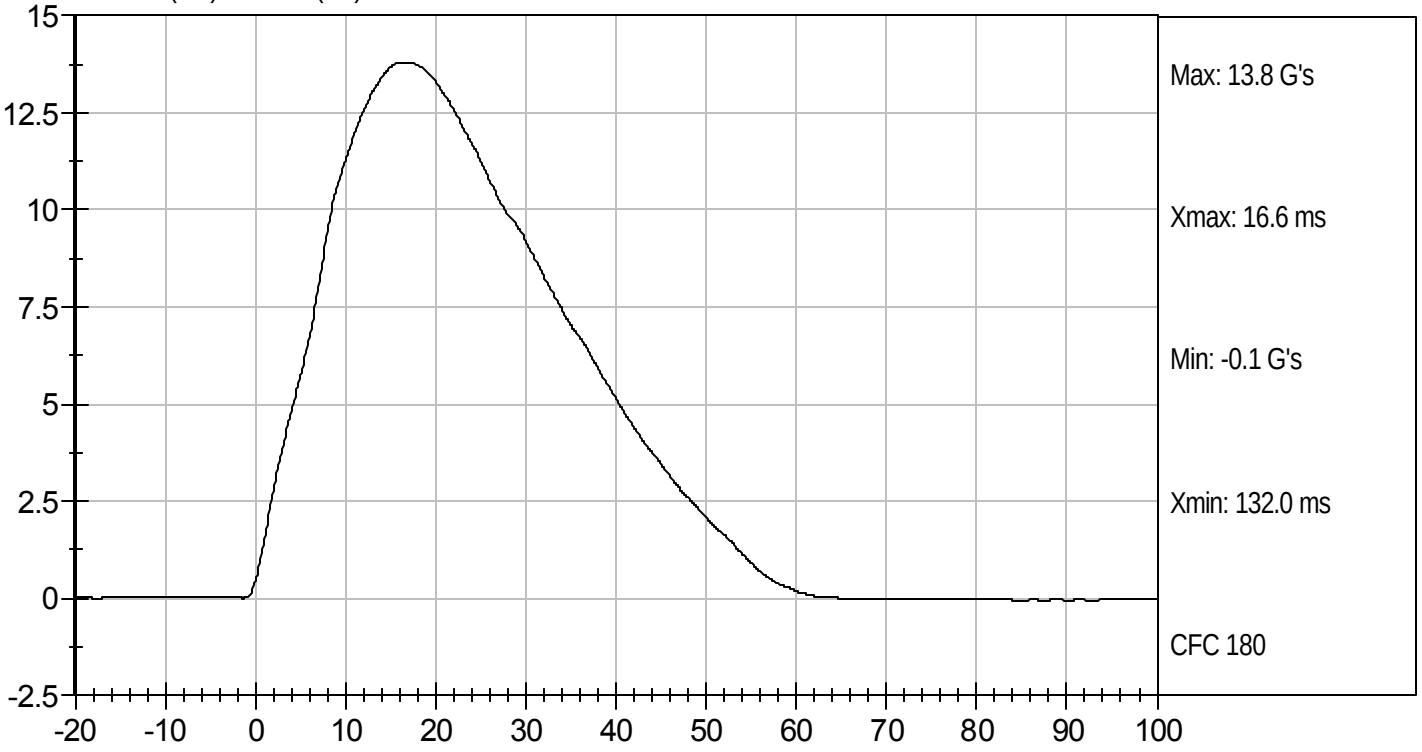
12/7/11
Test Date

David Winkelbauer
Approved By

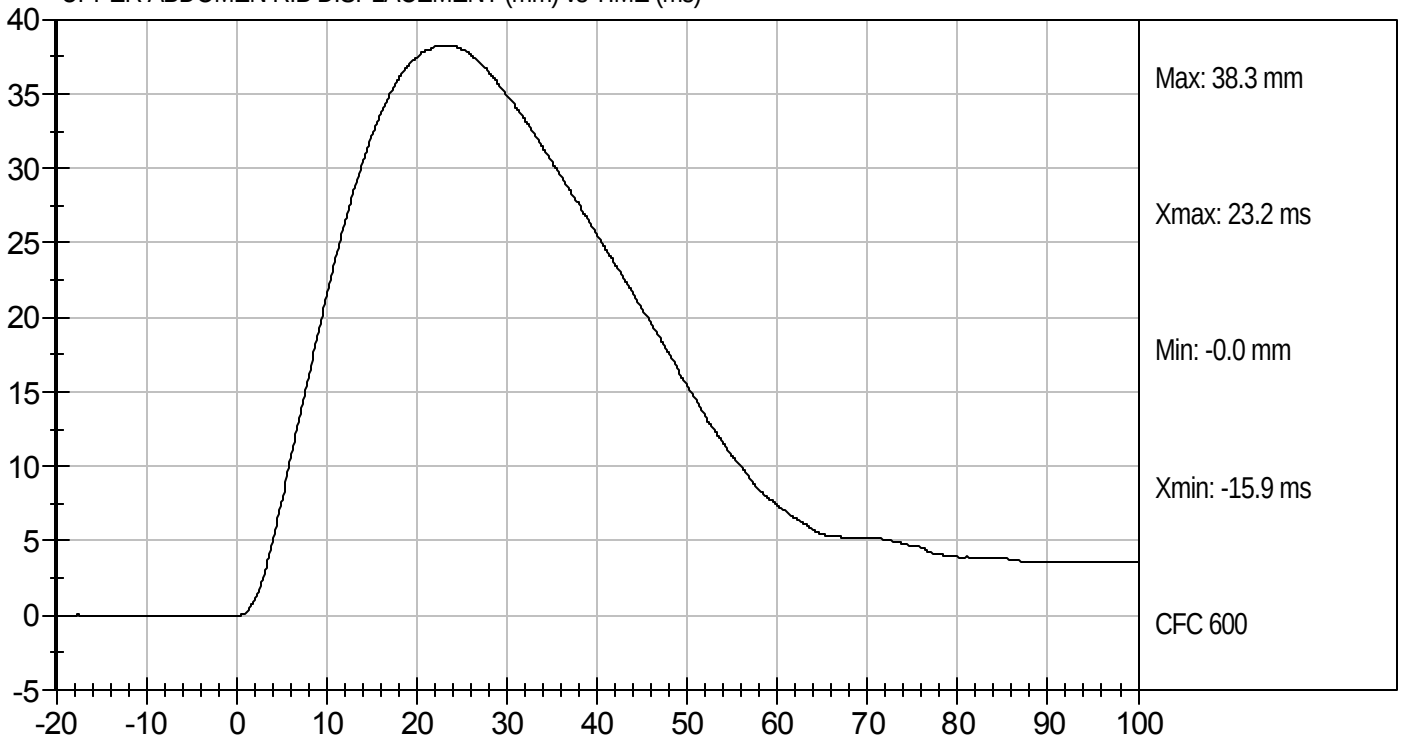
Test Desc: Abdomen Impact
Component ID: D114096

Test Date: 12/7/11
Velocity: 14.12 ft/s, 4.30 m/s

PROBE (G's) vs TIME (ms)



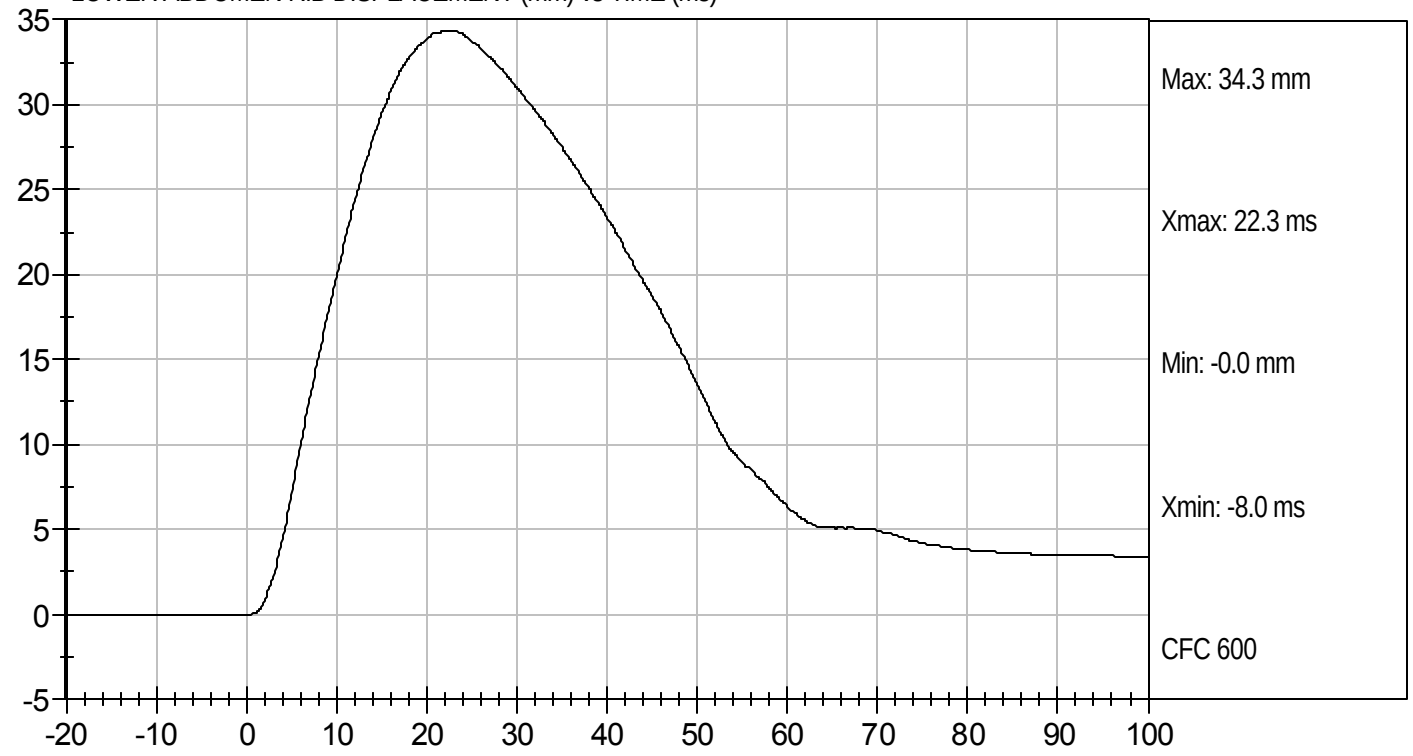
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



Test Desc: Abdomen Impact
Component ID: D114096

Test Date: 12/7/11
Velocity: 14.12 ft/s, 4.30 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: 306 **Test I.D:** D114097

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Peak Impactor Acceleration	G's	38 to 47	41	Pass
Pelvis Y Acceleration after 6 ms	G's	34 to 42	41	Pass
Peak Acetabulum Force	N	3600 to 4300	3724	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

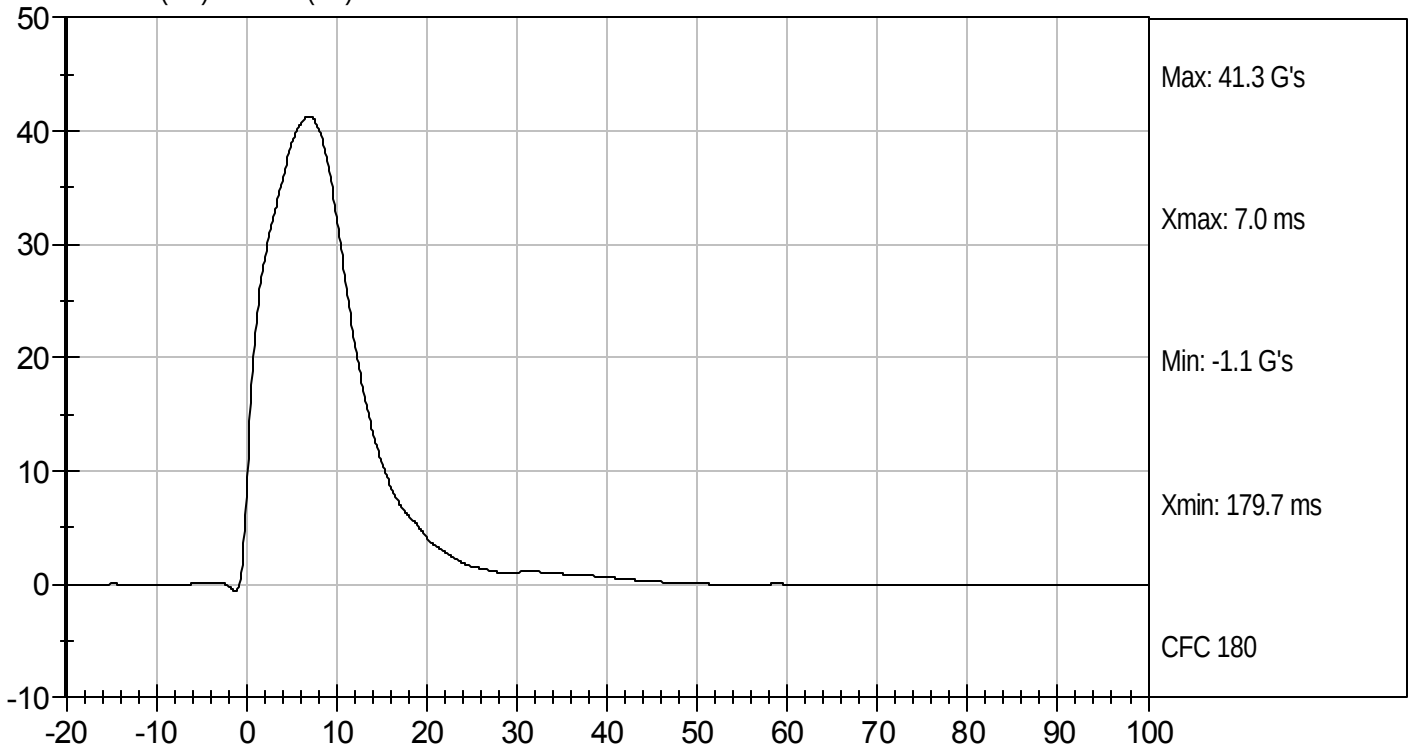
12/7/11
Test Date

David Winkelbauer
Approved By

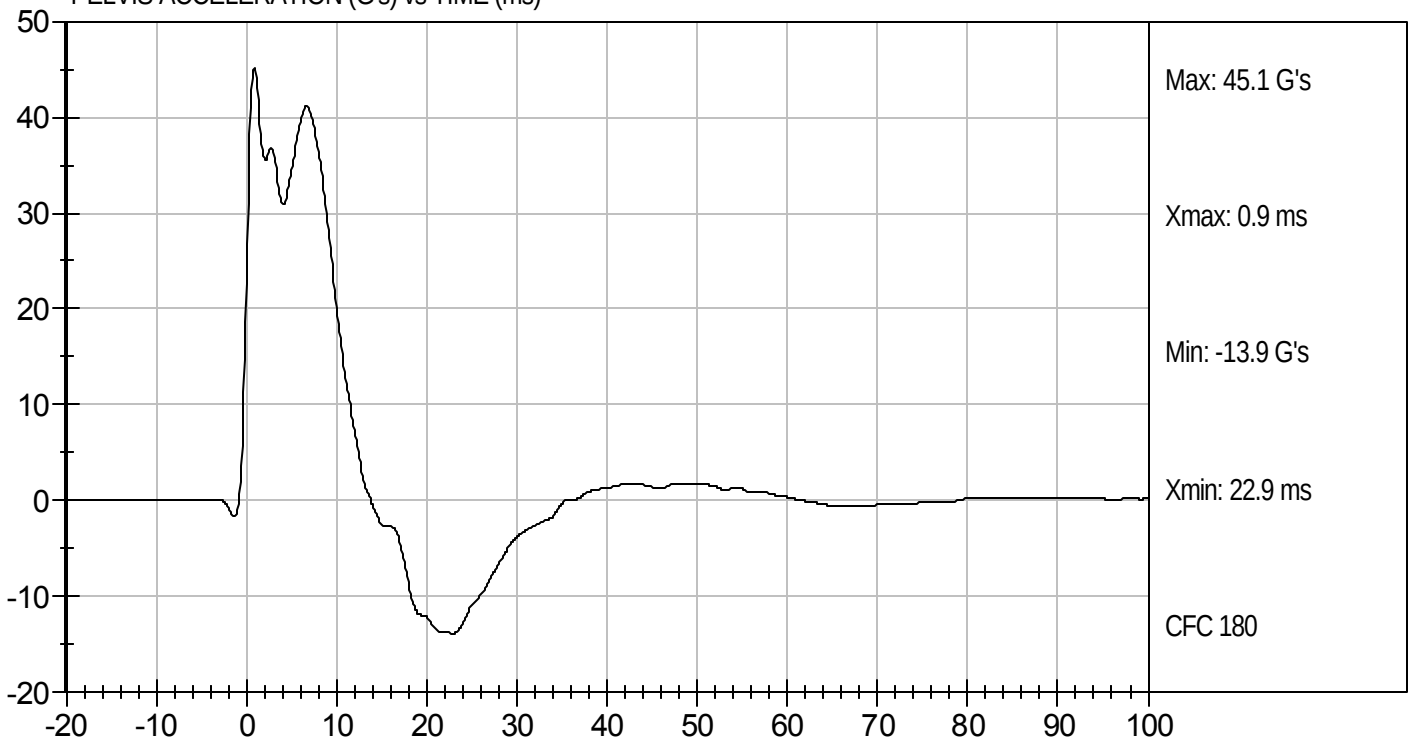
Test Desc: Pelvis Impact
Component ID: D114097

Test Date: 12/7/11
Velocity: 21.9 ft/s, 6.68 m/s

PROBE (G's) vs TIME (ms)

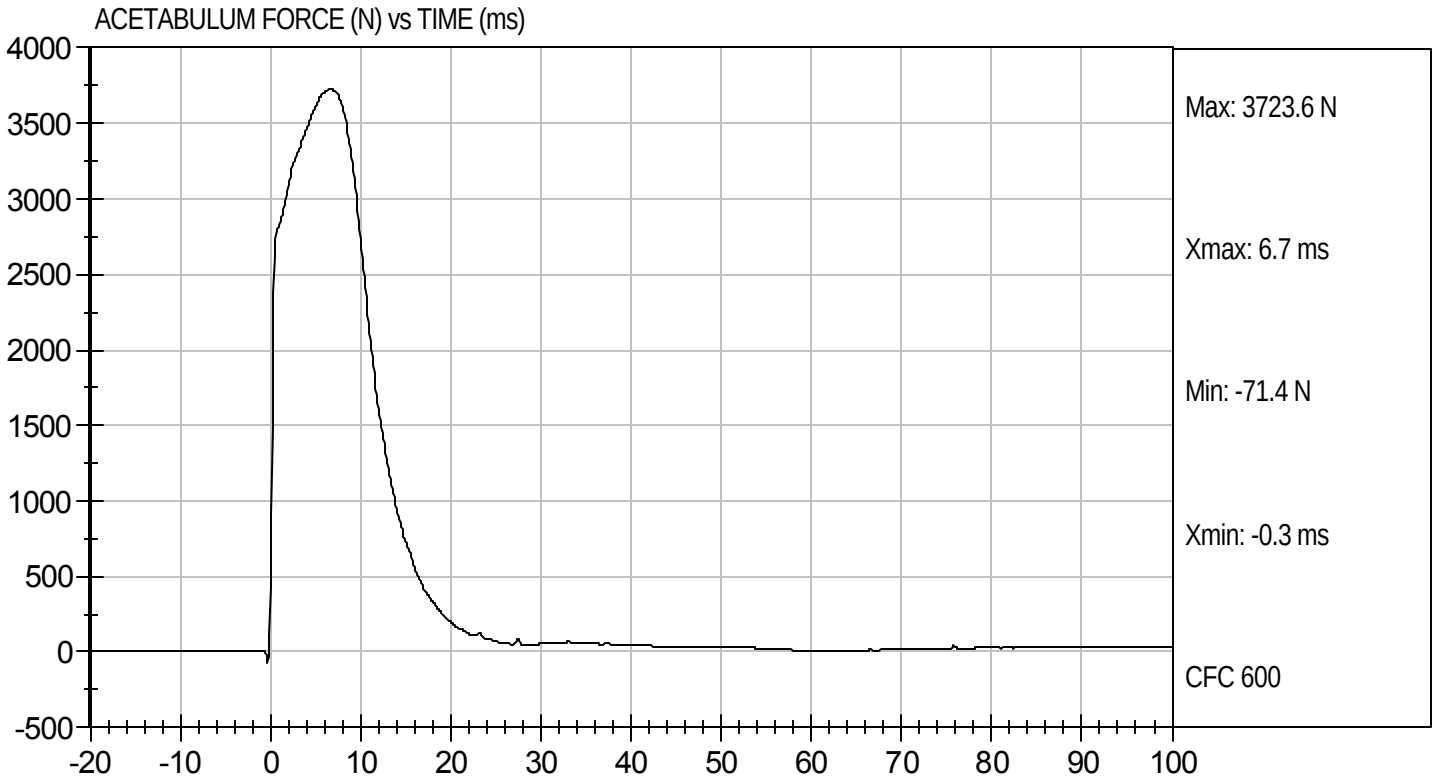


PELVIS ACCELERATION (G's) vs TIME (ms)



Test Desc: Pelvis Impact
Component ID: D114097

Test Date: 12/7/11
Velocity: 21.9 ft/s, 6.68 m/s



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D114098

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor Acceleration	G's	36 to 45	39	Pass
Pelvis Y Acceleration	G's	28 to 39	33	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4728	Pass
		Overall Test Results		Pass

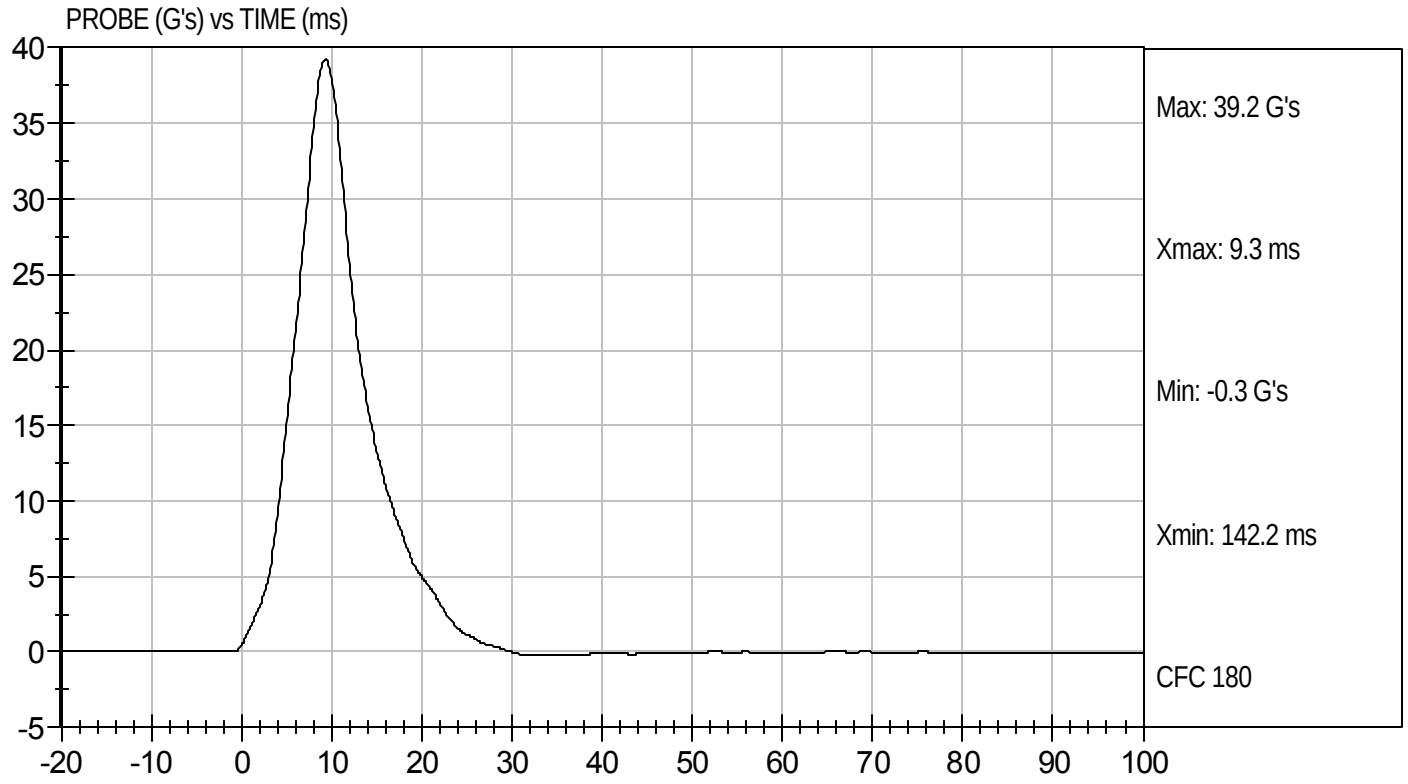
Jessica Gall
Laboratory Technician

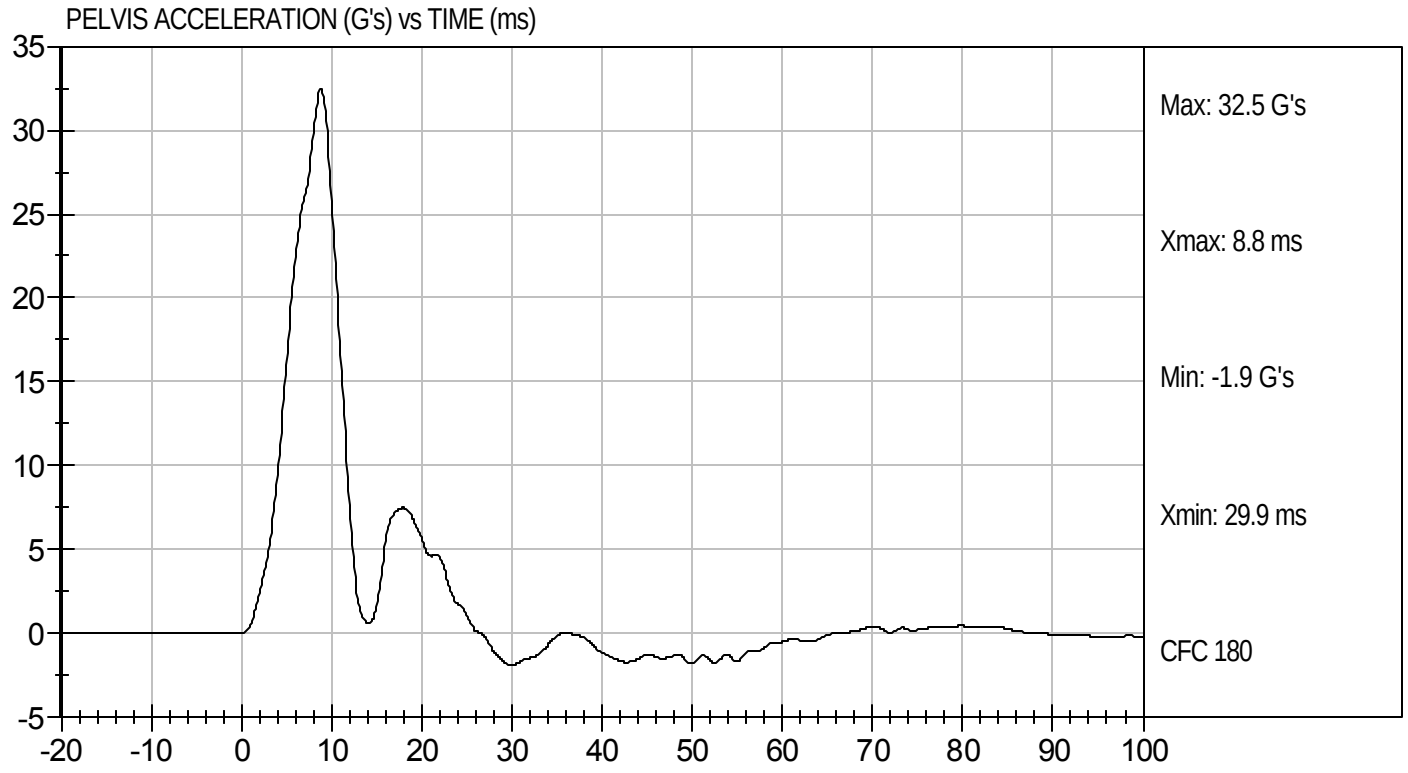
12/7/11
Test Date

David Winkelbauer
Approved By

Test Desc: Iliac Impact
Component ID: D114098

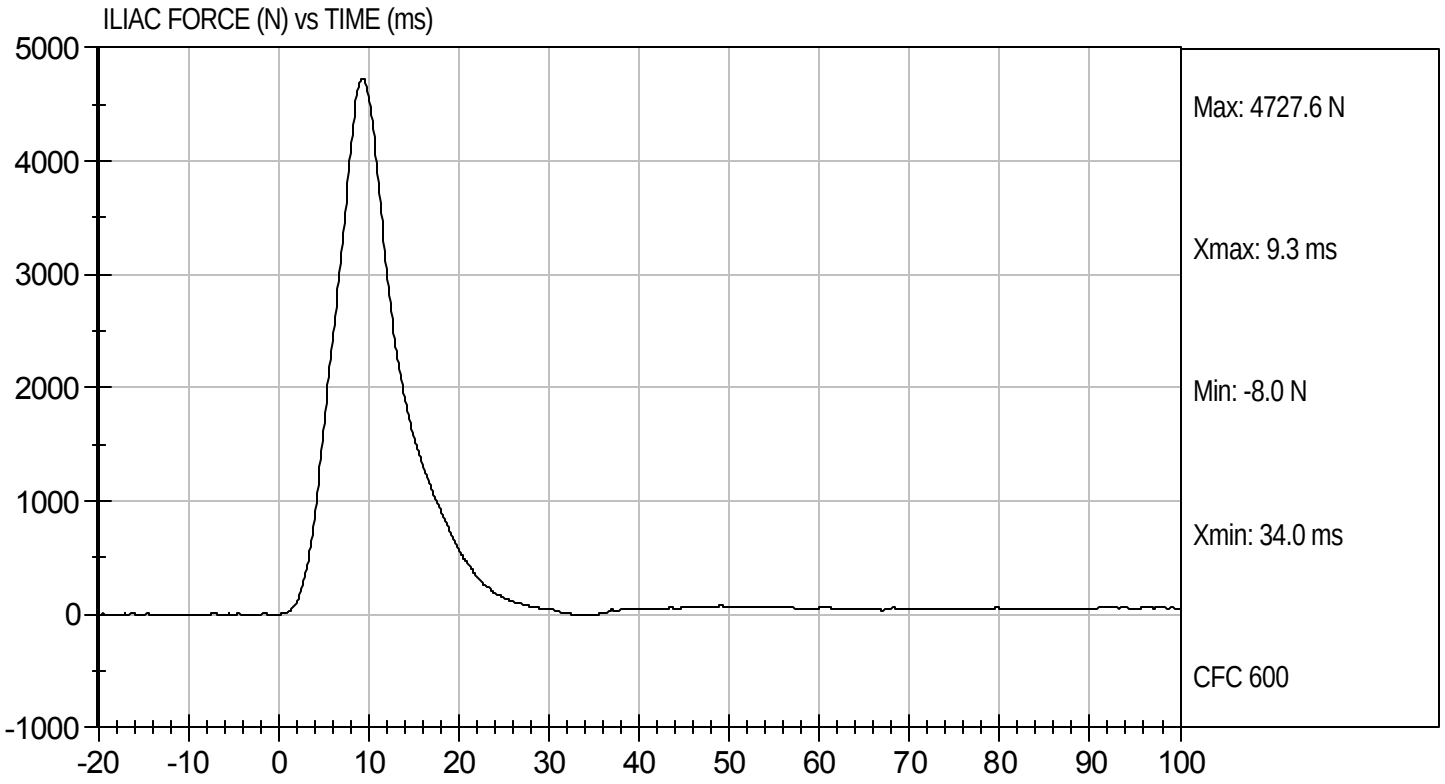
Test Date: 12/7/11
Velocity: 14.36 ft/s, 4.38 m/s





Test Desc: Iliac Impact
Component ID: D114098

Test Date: 12/7/11
Velocity: 14.36 ft/s, 4.38 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D114181

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	31	Pass
Peak Resultant Acceleration	G's	115 to 137	119	Pass
Peak Lateral Acceleration	G's	+/- 15	-3.9	Pass
Unimodal	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

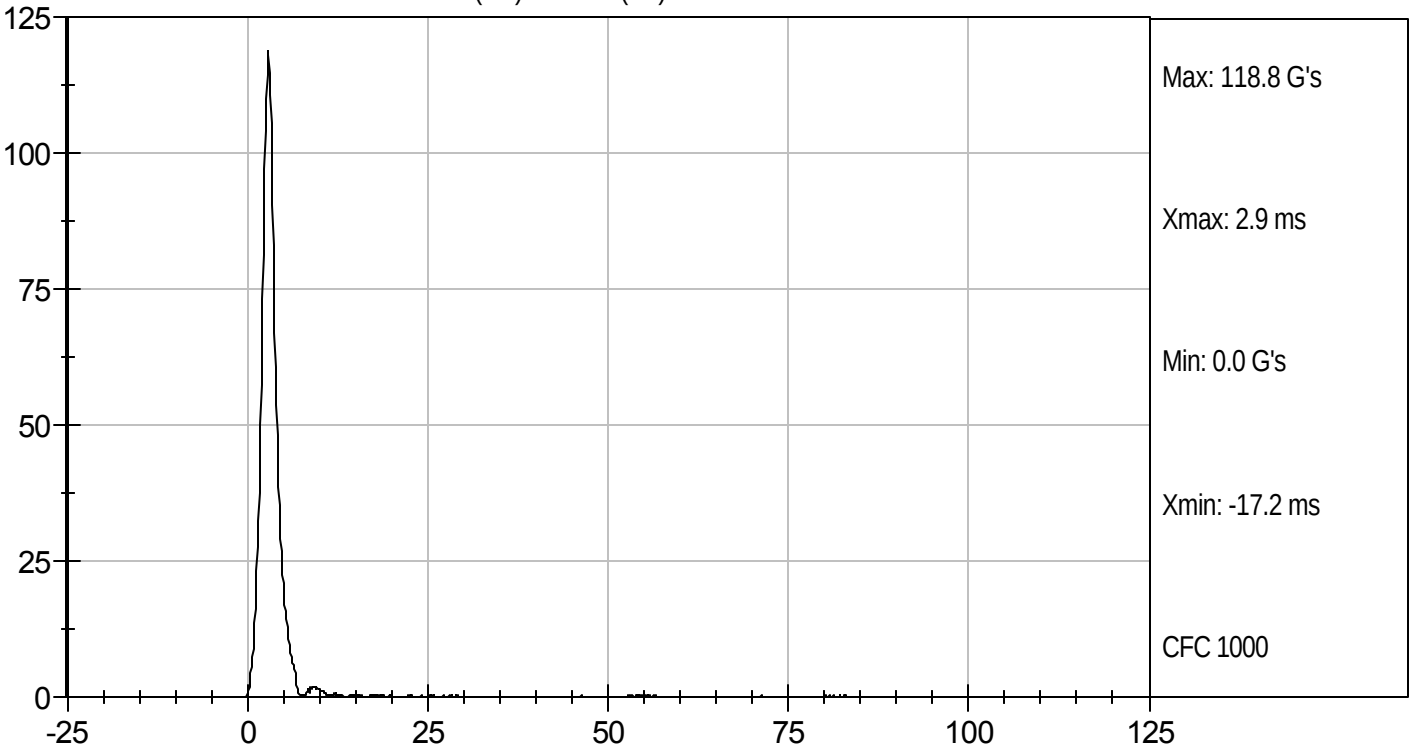
12/14/11
Test Date

David Winkelbauer
Approved By

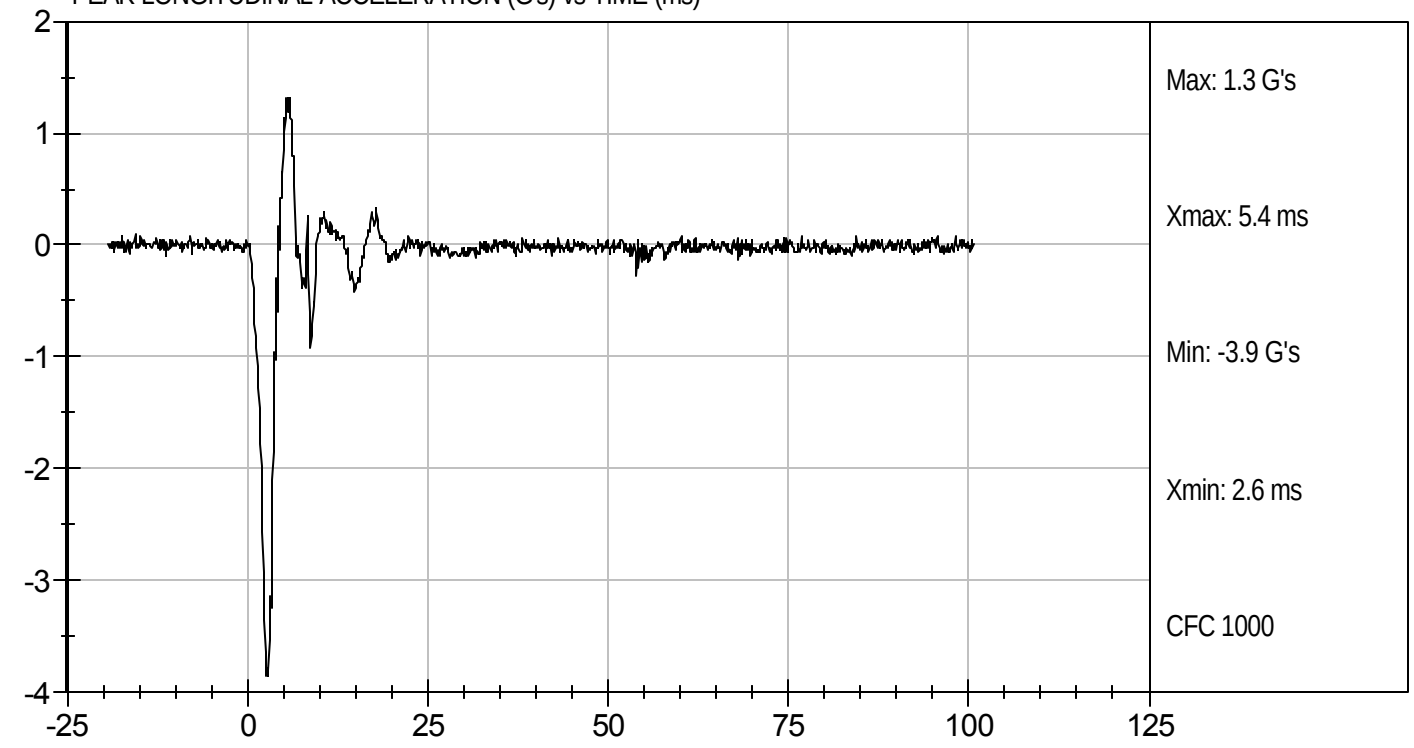
Test Desc: Head Drop
Component ID: D114181

Test Date: 12/14/11
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: 306 **Test I.D:** D114182

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.4	Pass
Humidity		%	10 to 70	32	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Delta Velocity	10 ms	m/s	2.20 to 2.80	2.57	Pass
	15 ms	m/s	3.30 to 4.10	3.64	Pass
	20 ms	m/s	4.40 to 5.40	4.81	Pass
	25 ms	m/s	5.40 to 6.10	5.44	Pass
	25-100 ms	m/s	5.50 to 6.20	5.57	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	58	Pass
Maximum Occipital Condyle Moment during Rotation Interval		Nm	-44 to -36	-42	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	116	Pass
			Overall Test Results		Pass

Jessica Gall
Laboratory Technician

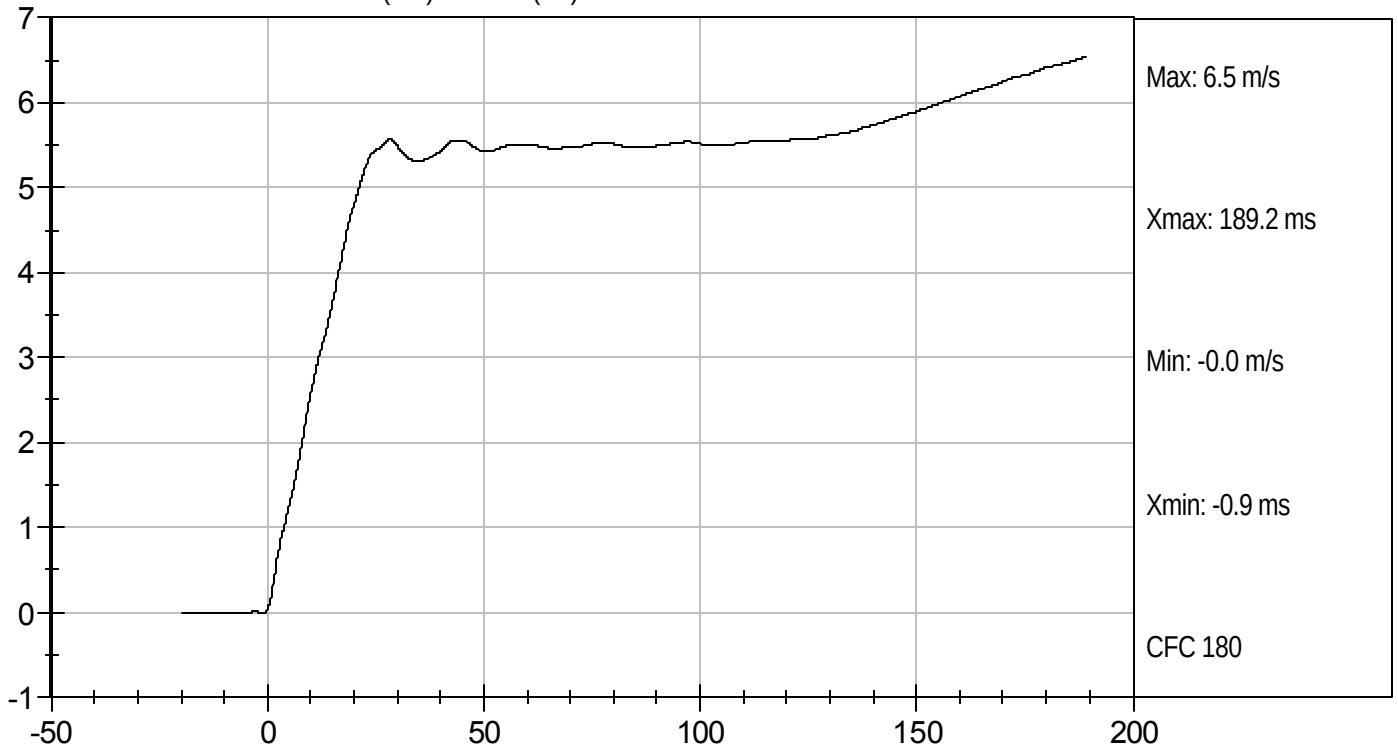
12/14/11
Test Date

David Winkelbauer
Approved By

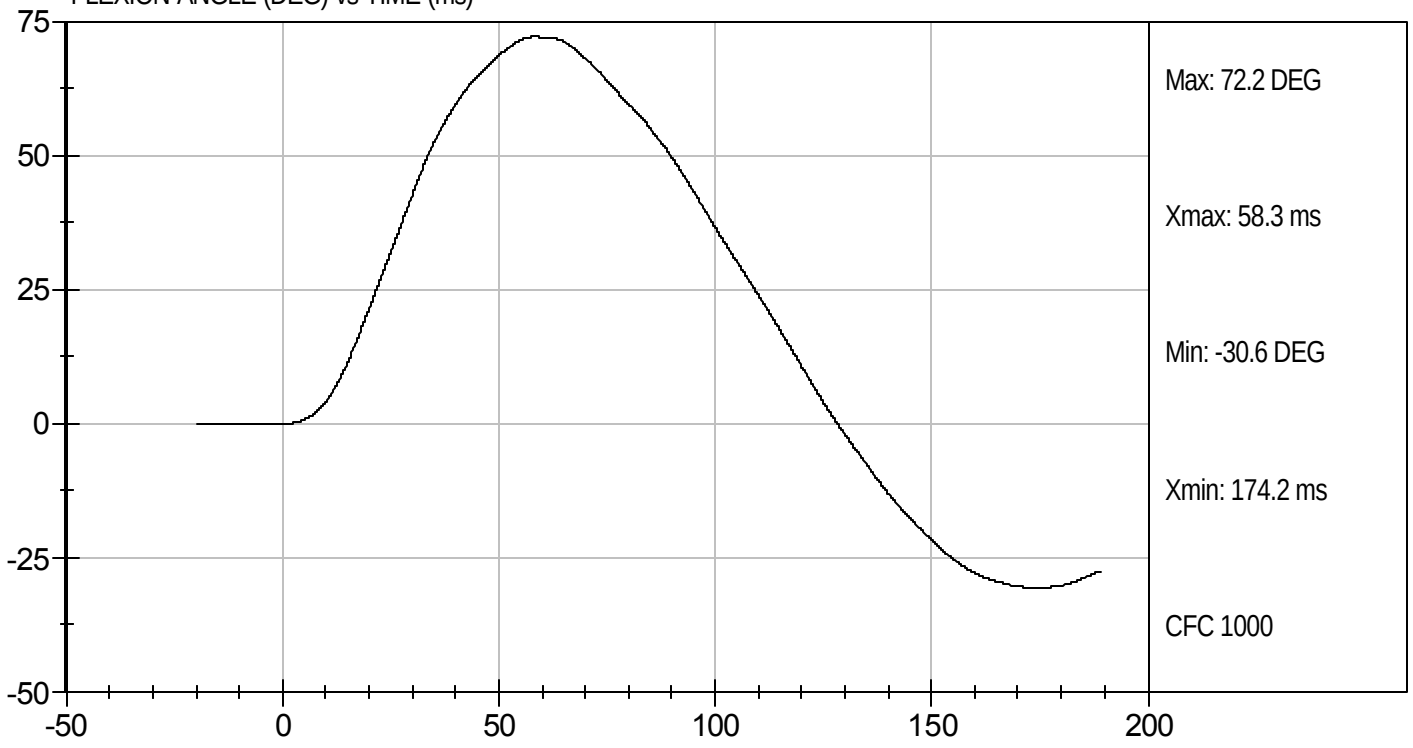
Test Desc: Neck Bending
Component ID: D114182

Test Date: 12/14/11
Velocity: 18.31 ft/s, 5.58 m/s

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

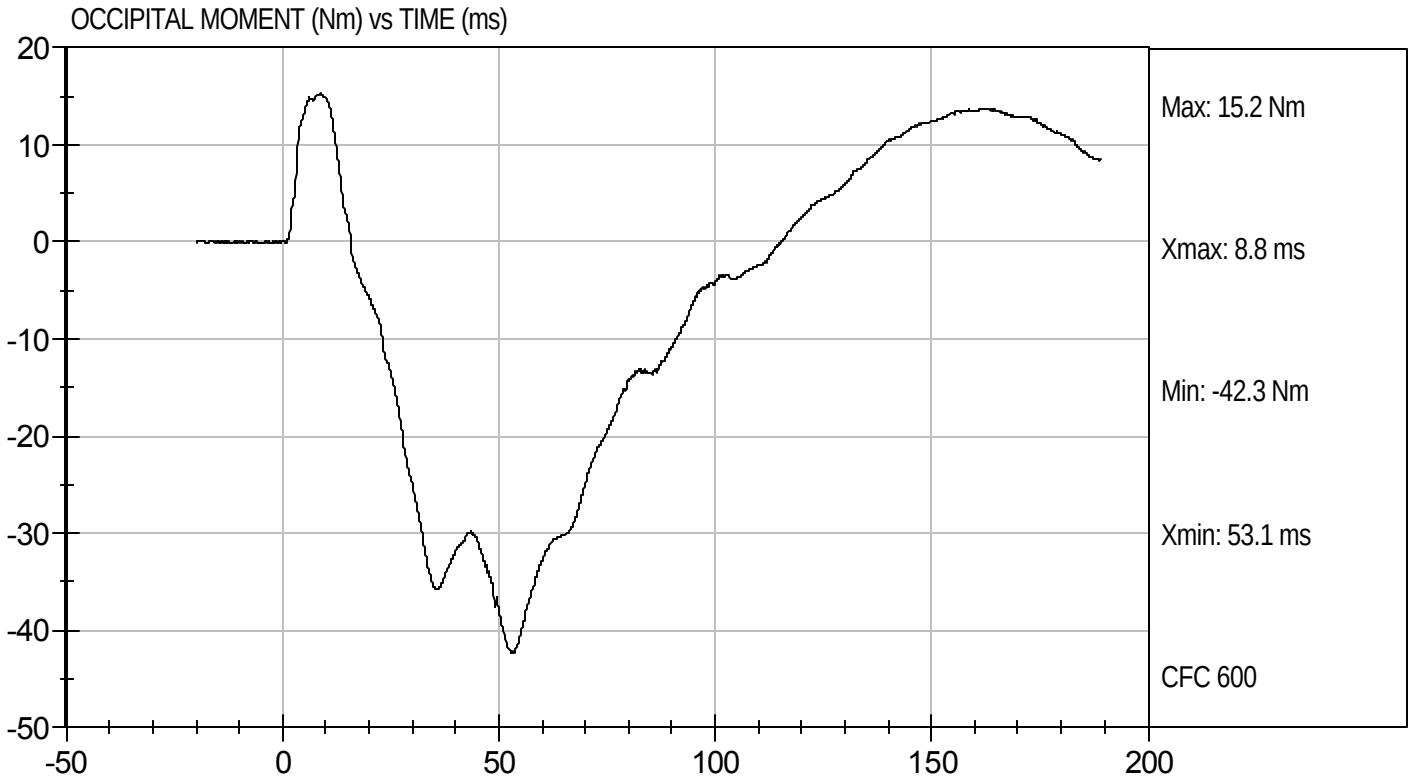


FLEXION ANGLE (DEG) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D114182

Test Date: 12/14/11
Velocity: 18.31 ft/s, 5.58 m/s



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D114183

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	13 to 18	16	Pass
Shoulder Displacement	mm	28 to 37	28	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	19	Pass
		Overall Test Results		Pass

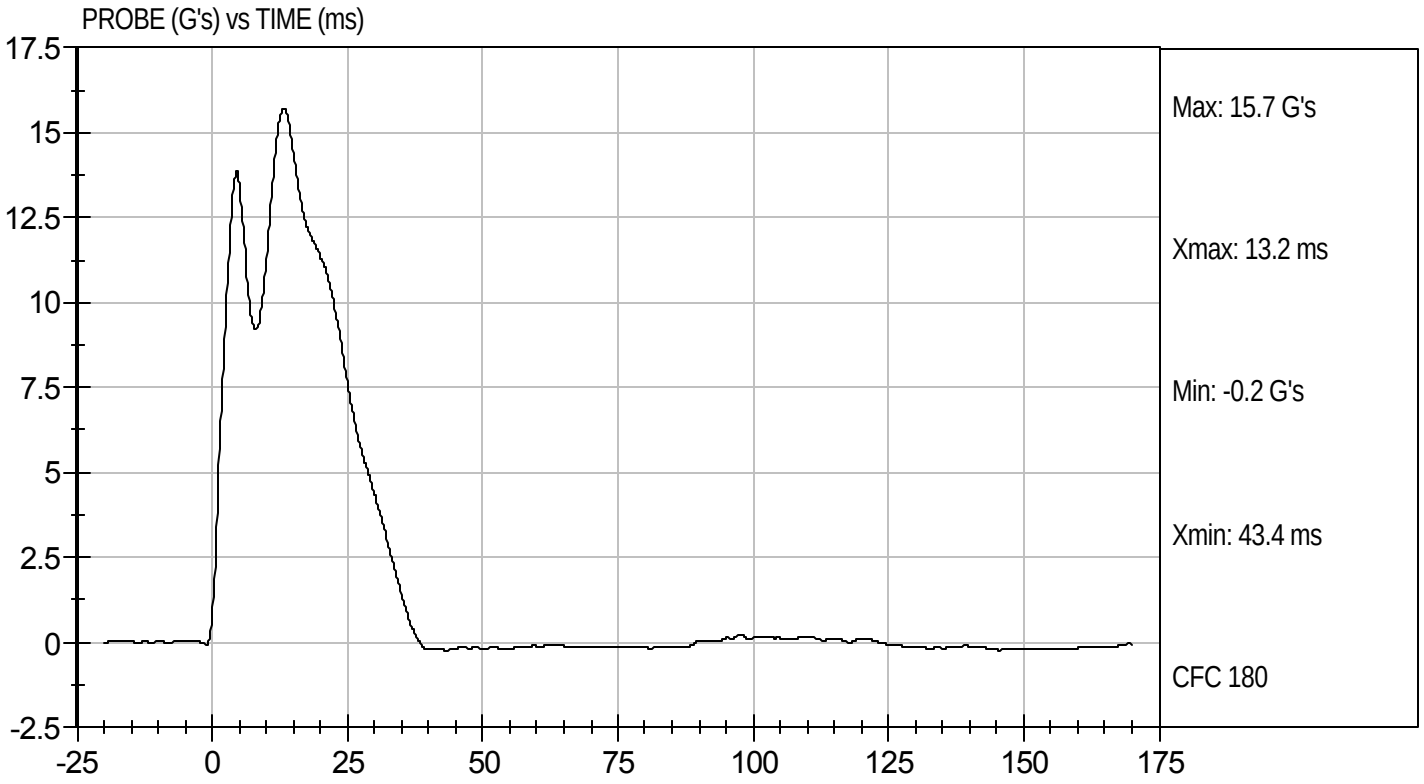
Jessica Hall
Laboratory Technician

12/13/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D114183

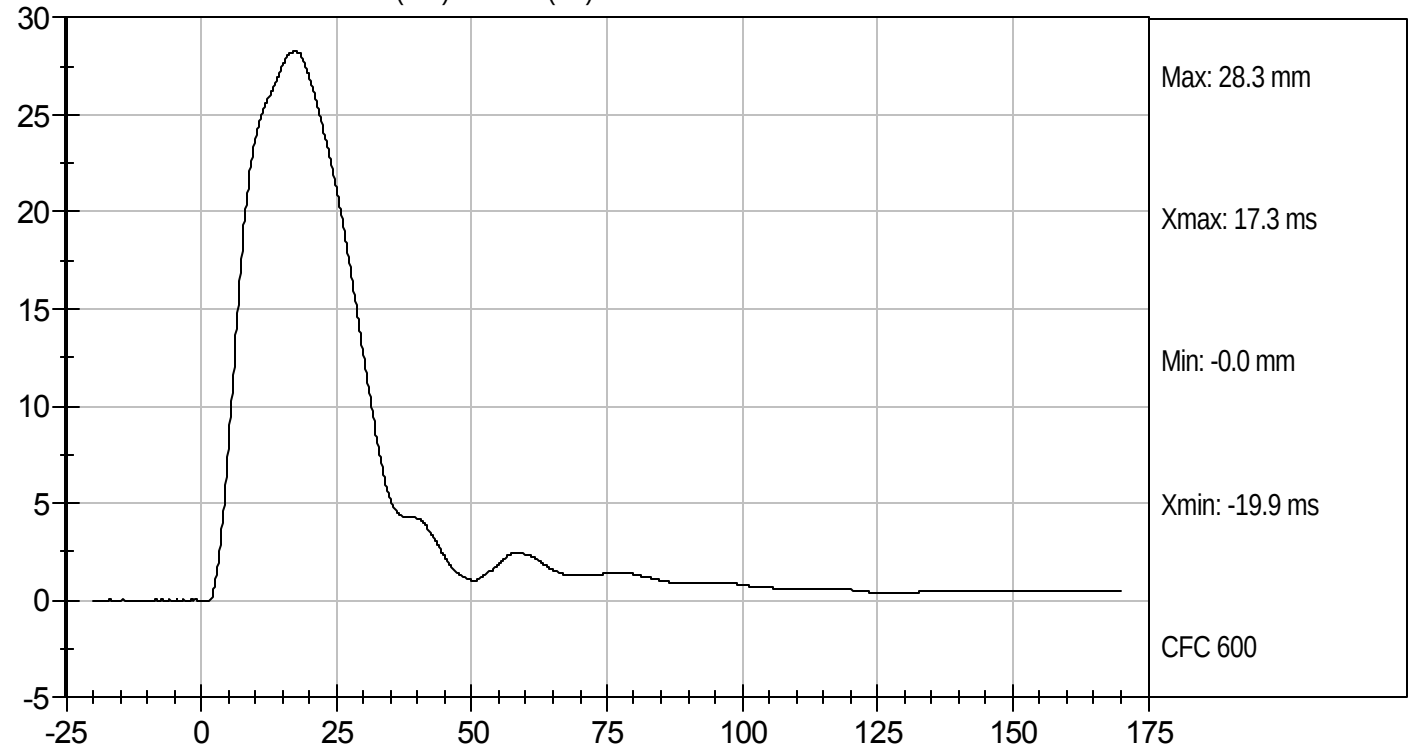
Test Date: 12/13/11
Velocity: 14.36 ft/s, 4.38 m/s



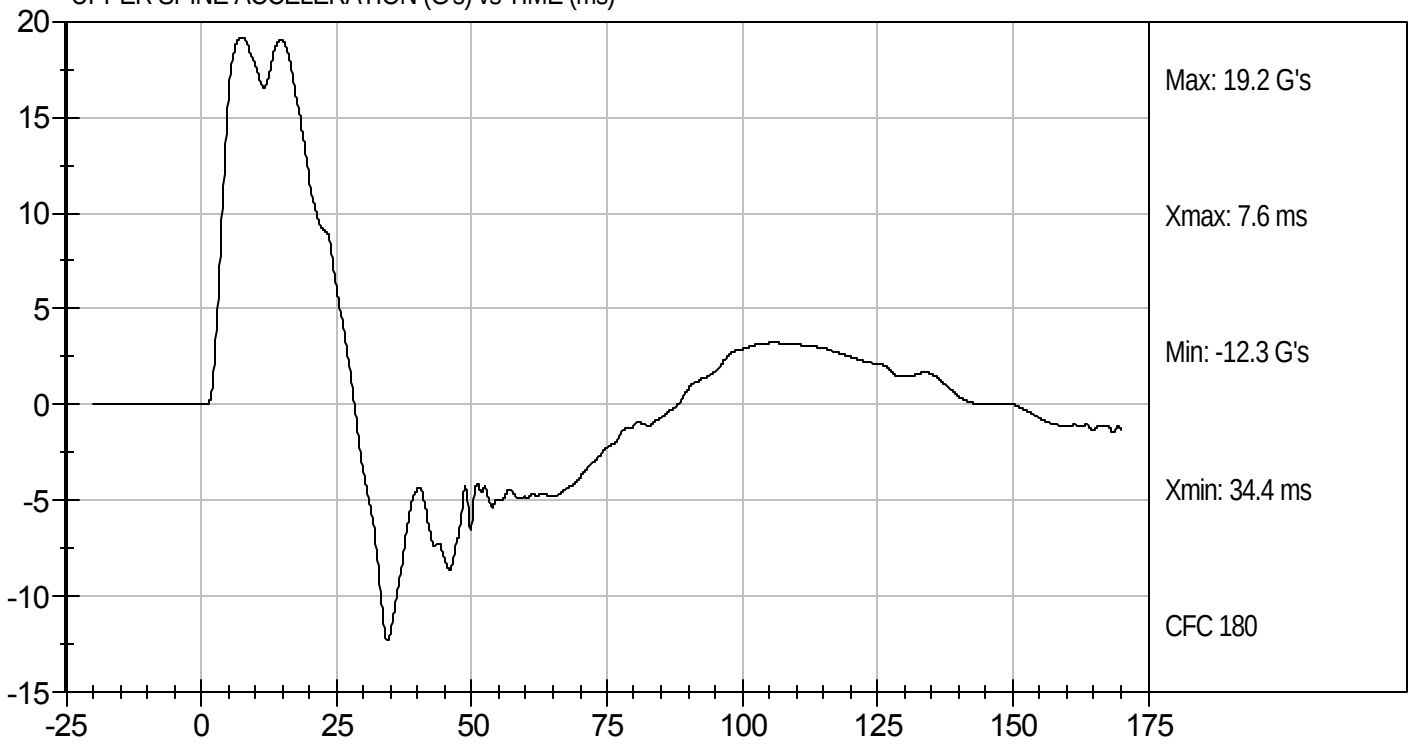
Test Desc: Shoulder Impact
Component ID: D114183

Test Date: 12/13/11
Velocity: 14.36 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: 306 **Test I.D:** D114184

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Peak Impactor Acceleration	G's	30 to 36	34	Pass
Shoulder Displacement	mm	31 to 40	33	Pass
Upper Rib Displacement	mm	25 to 32	26	Pass
Middle Rib Displacement	mm	30 to 36	31	Pass
Lower Rib Displacement	mm	32 to 38	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	41	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	34	Pass
		Overall Test Results		Pass

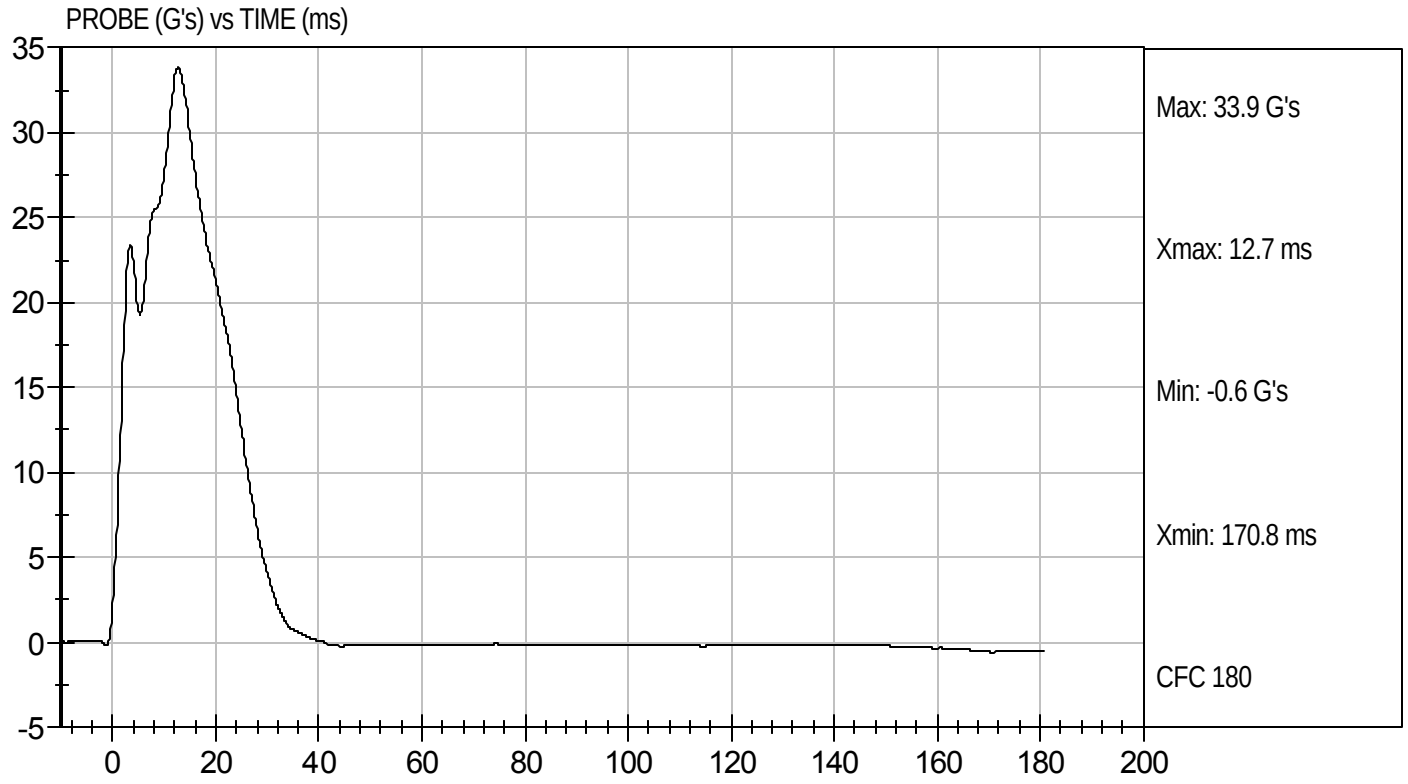
Jessica Hall
Laboratory Technician

12/13/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax With Arm
Component ID: D114184

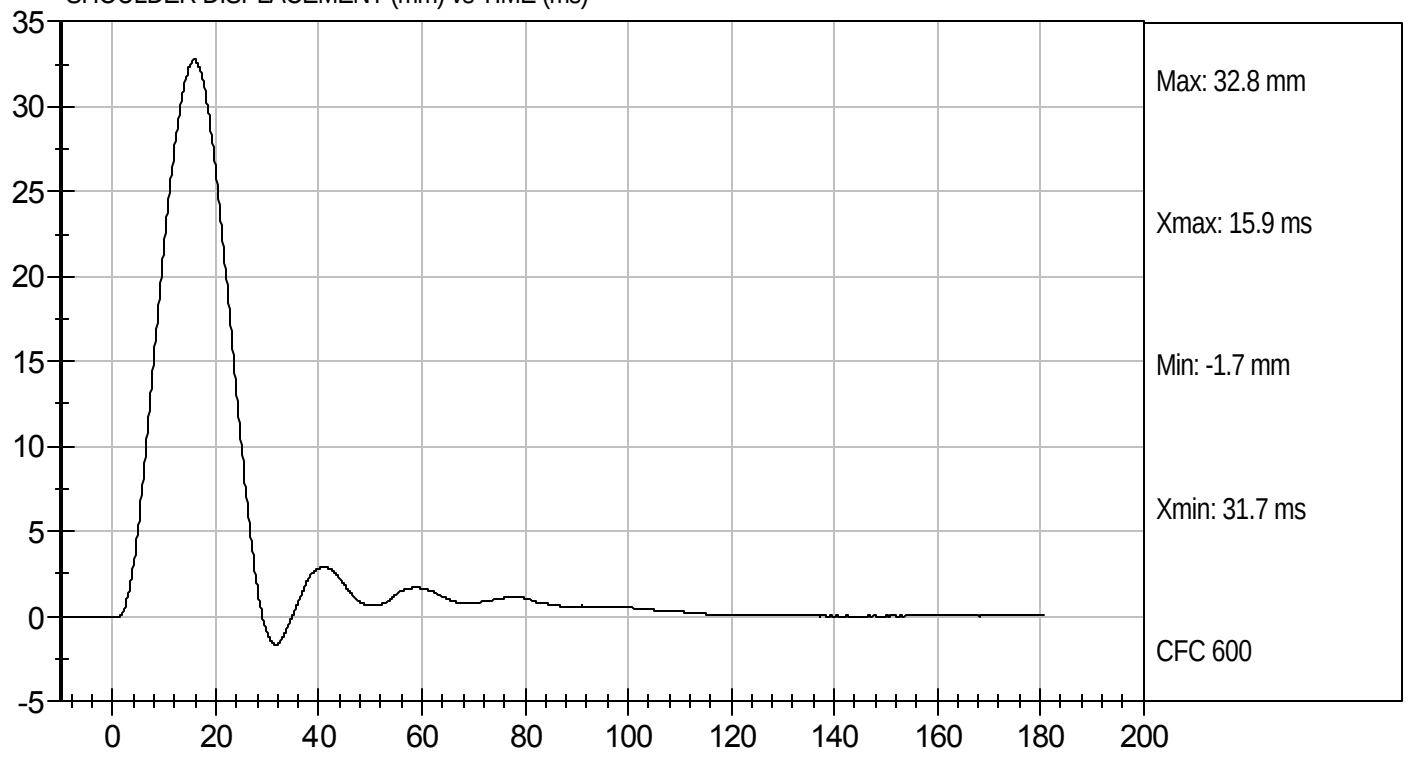
Test Date: 12/13/11
Velocity: 21.9 ft/s, 6.68 m/s



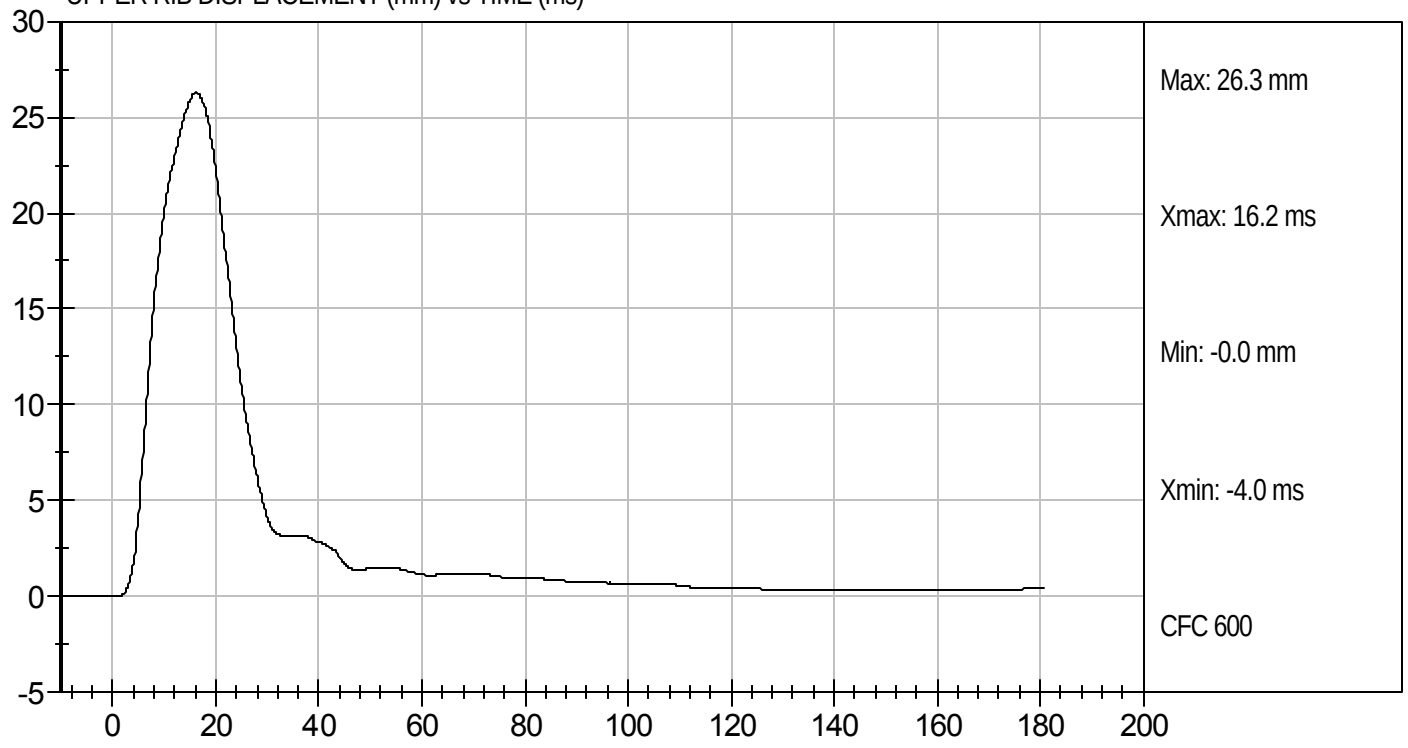
Test Desc: Thorax With Arm
Component ID: D114184

Test Date: 12/13/11
Velocity: 21.9 ft/s, 6.68 m/s

SHOULDER DISPLACEMENT (mm) vs TIME (ms)



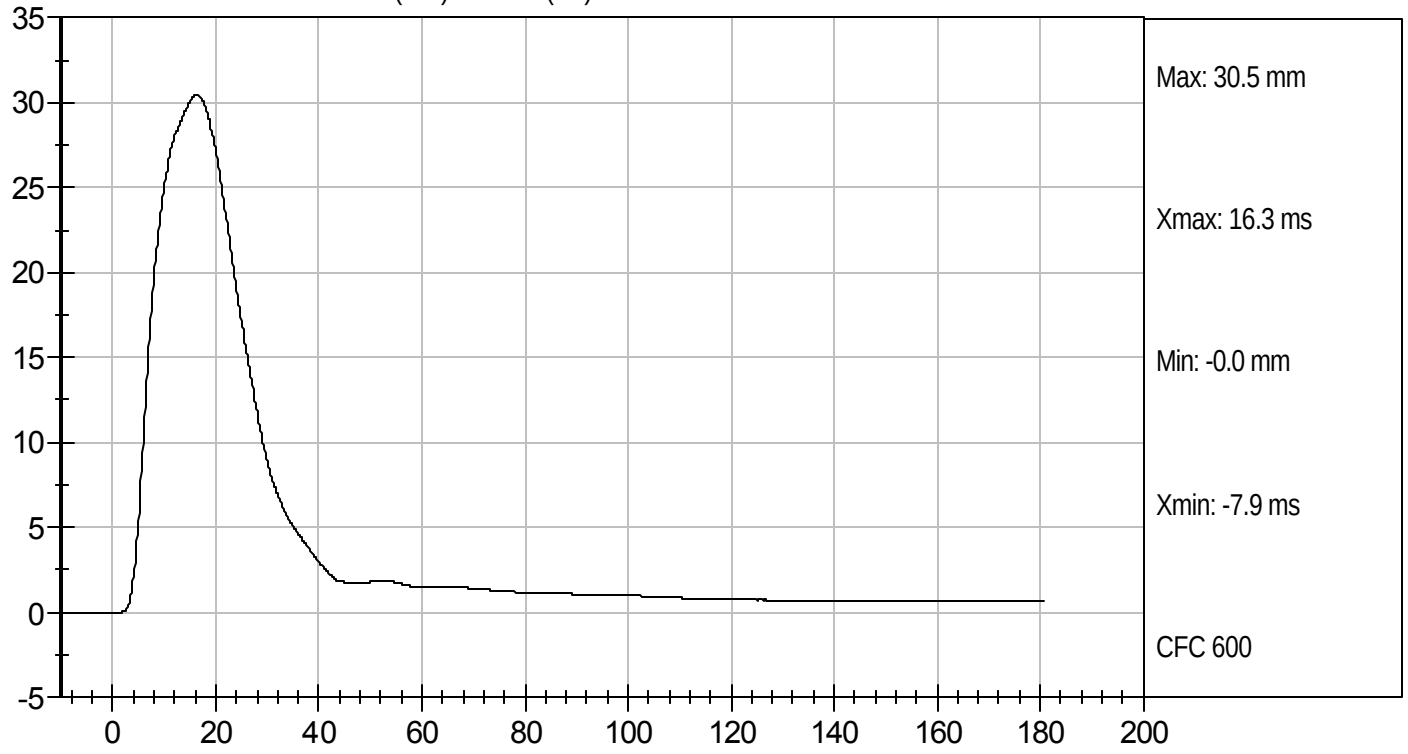
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



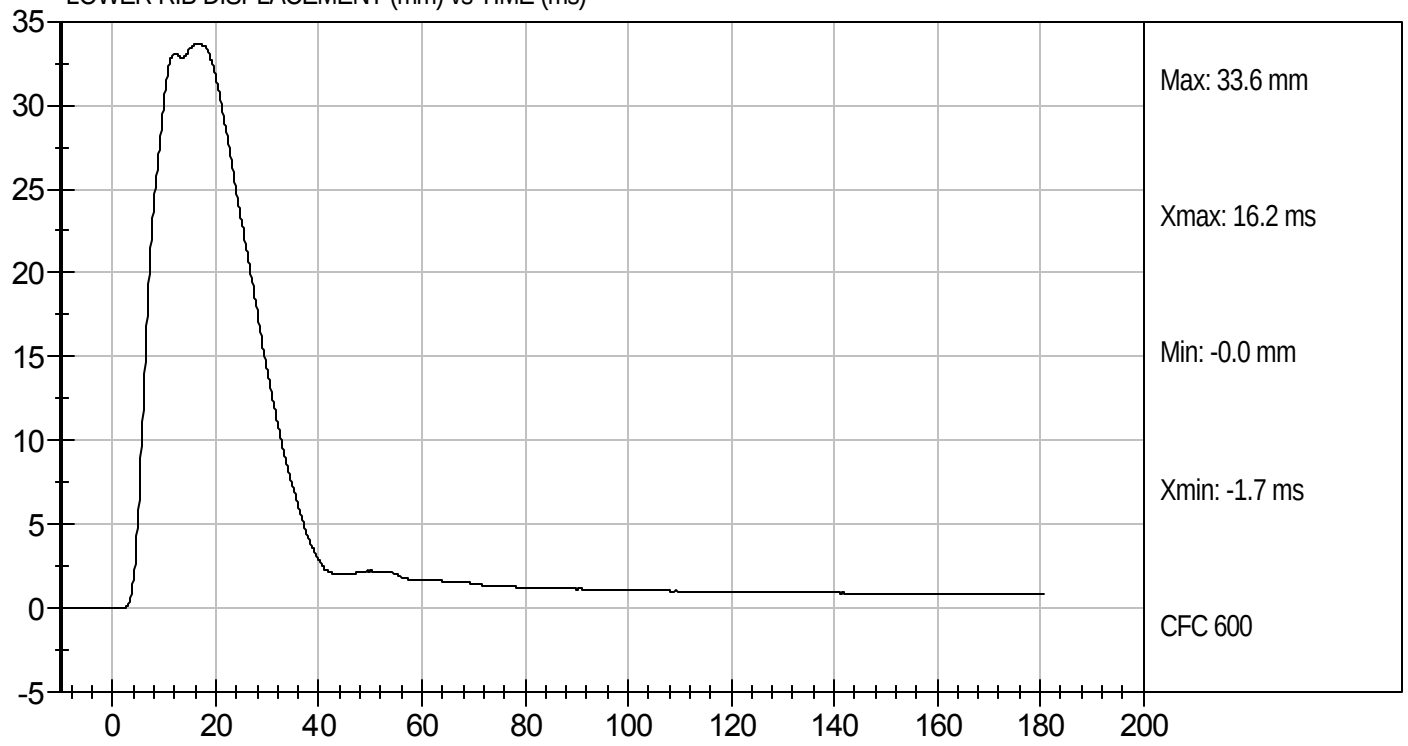
Test Desc: Thorax With Arm
Component ID: D114184

Test Date: 12/13/11
Velocity: 21.9 ft/s, 6.68 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



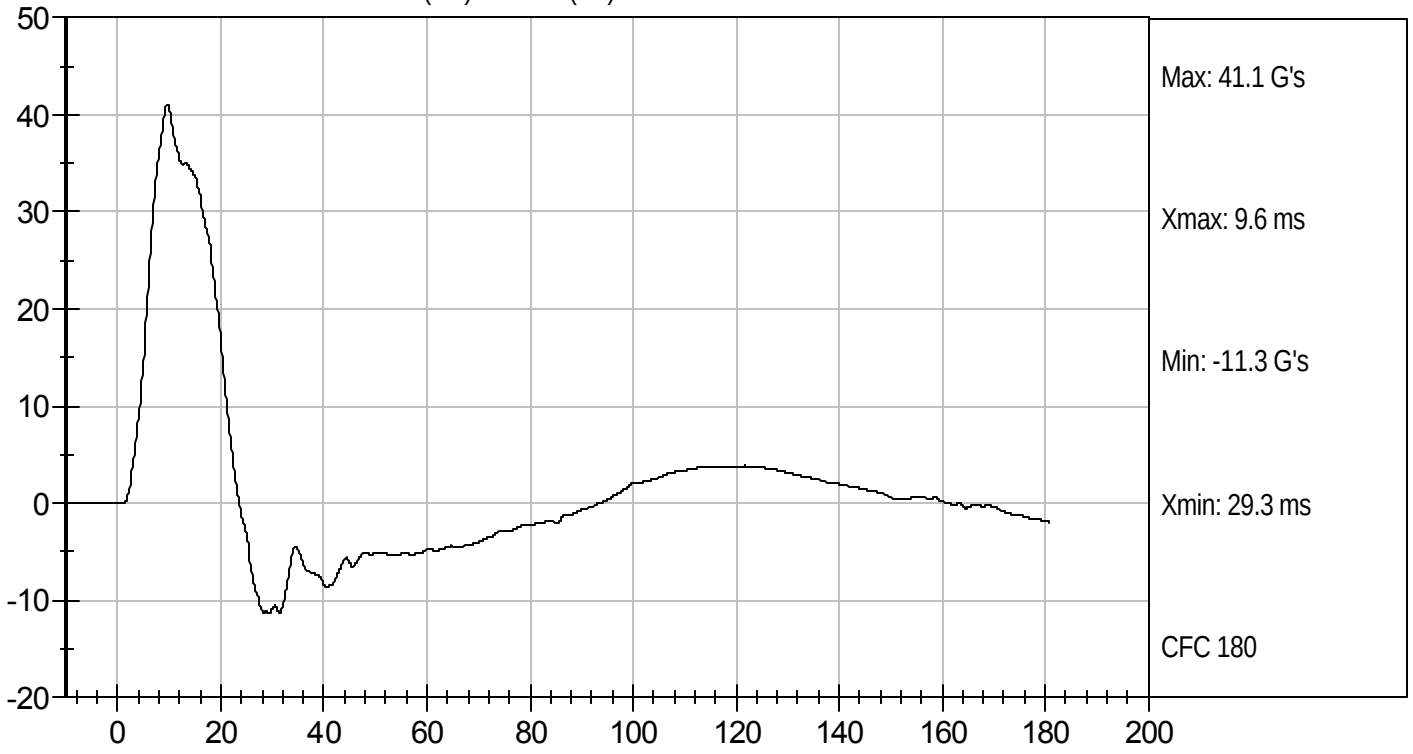
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



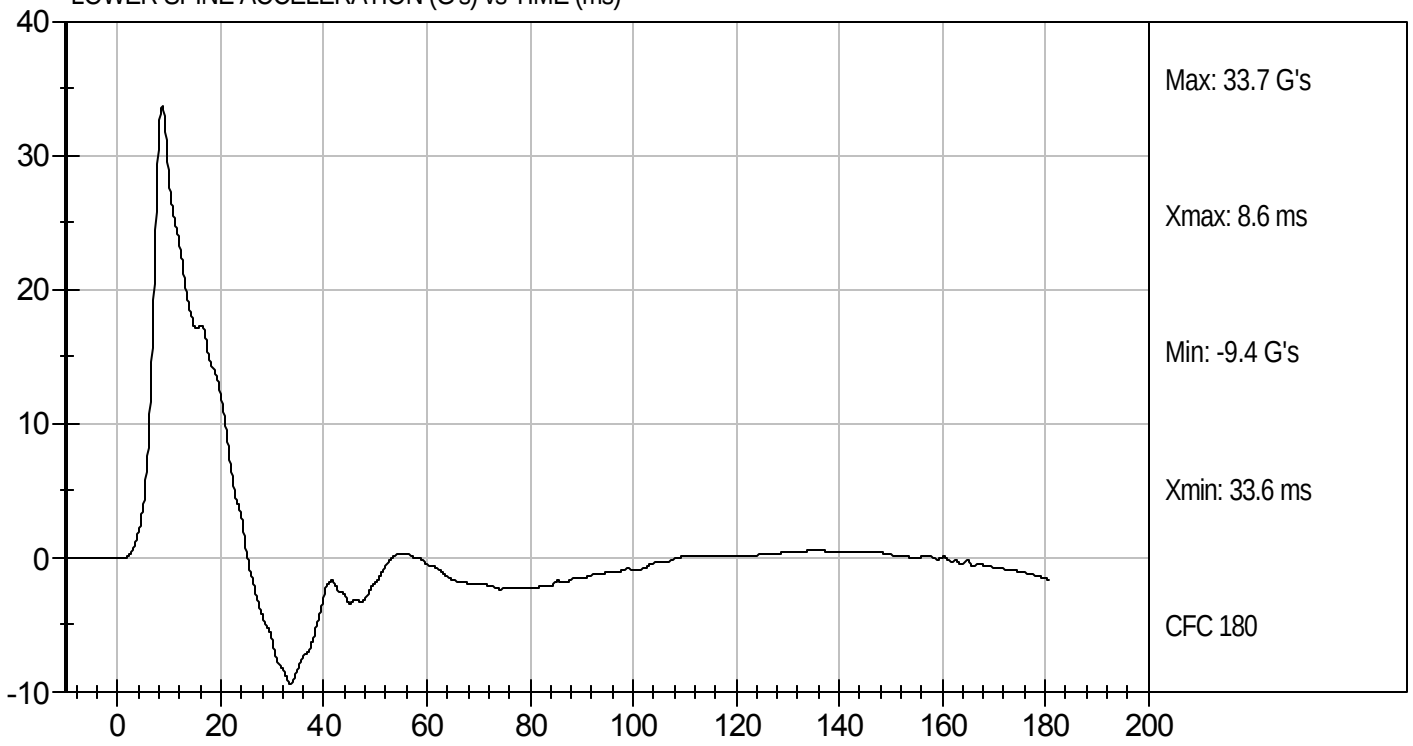
Test Desc: Thorax With Arm
Component ID: D114184

Test Date: 12/13/11
Velocity: 21.9 ft/s, 6.68 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: 306 **Test I.D:** D114185

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Peak Impactor Force	G's	14 to 18	16	Pass
Upper Rib Displacement	mm	32 to 40	36	Pass
Middle Rib Displacement	mm	39 to 45	41	Pass
Lower Rib Displacement	mm	35 to 43	39	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	15	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	10	Pass
		Overall Test Results		Pass

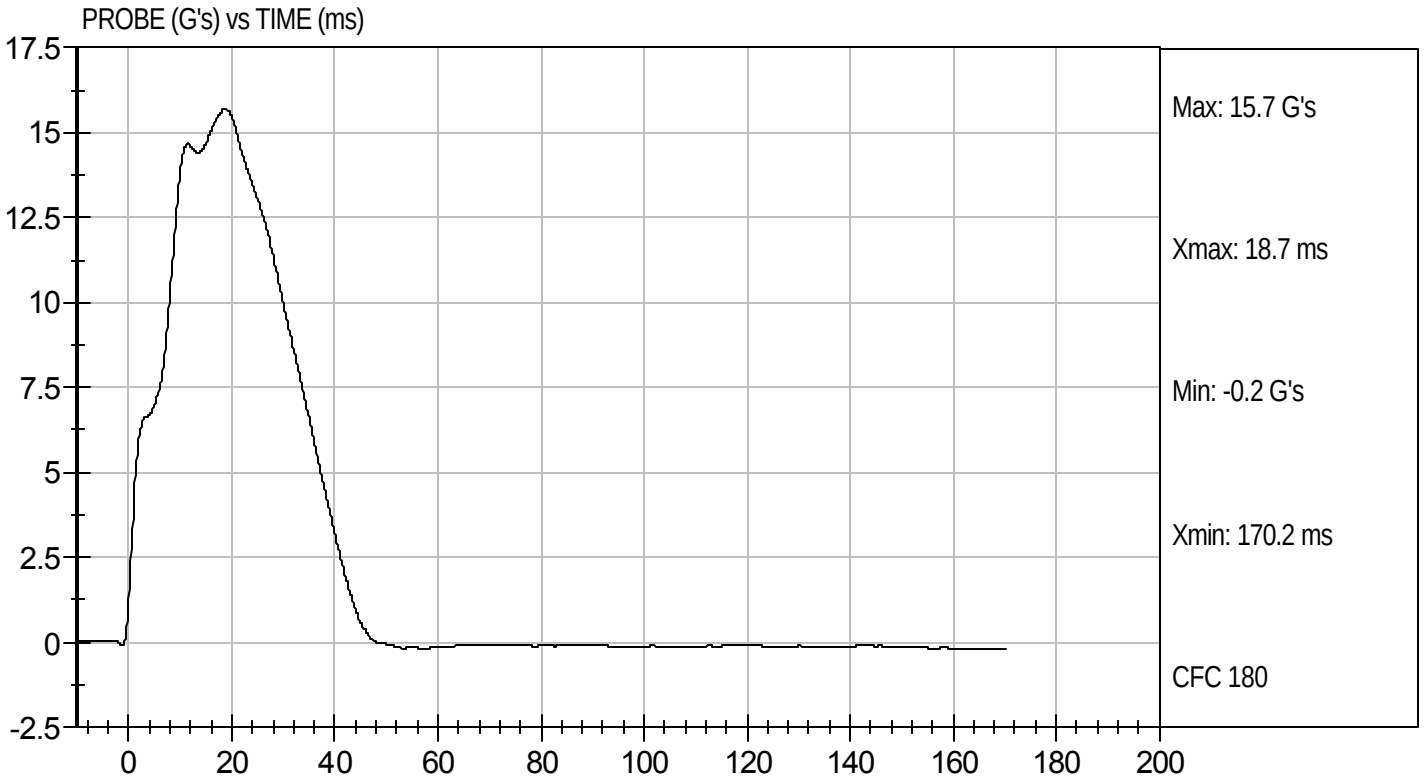
Jessica Gall
Laboratory Technician

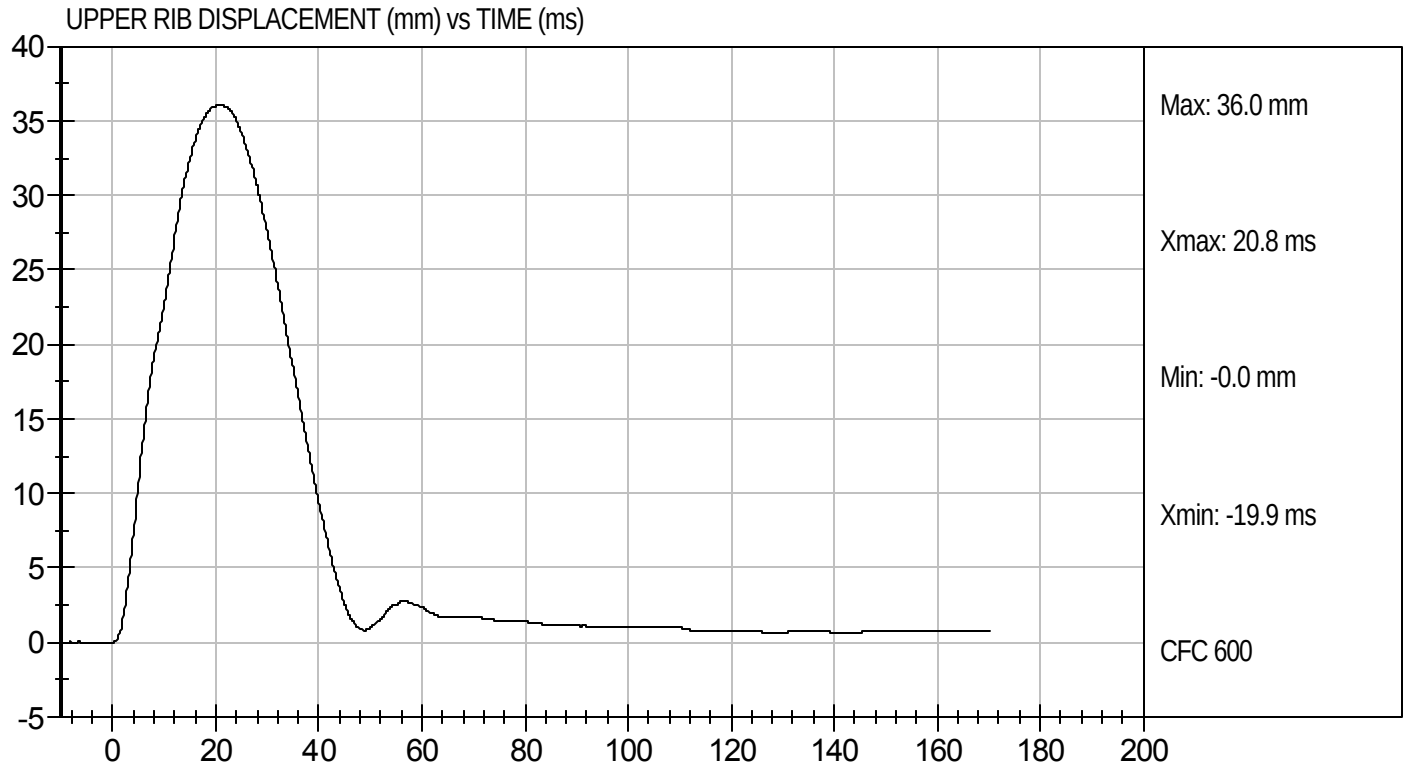
12/13/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Without Arm
Component ID: D114185

Test Date: 12/13/11
Velocity: 14.24 ft/s, 4.34 m/s

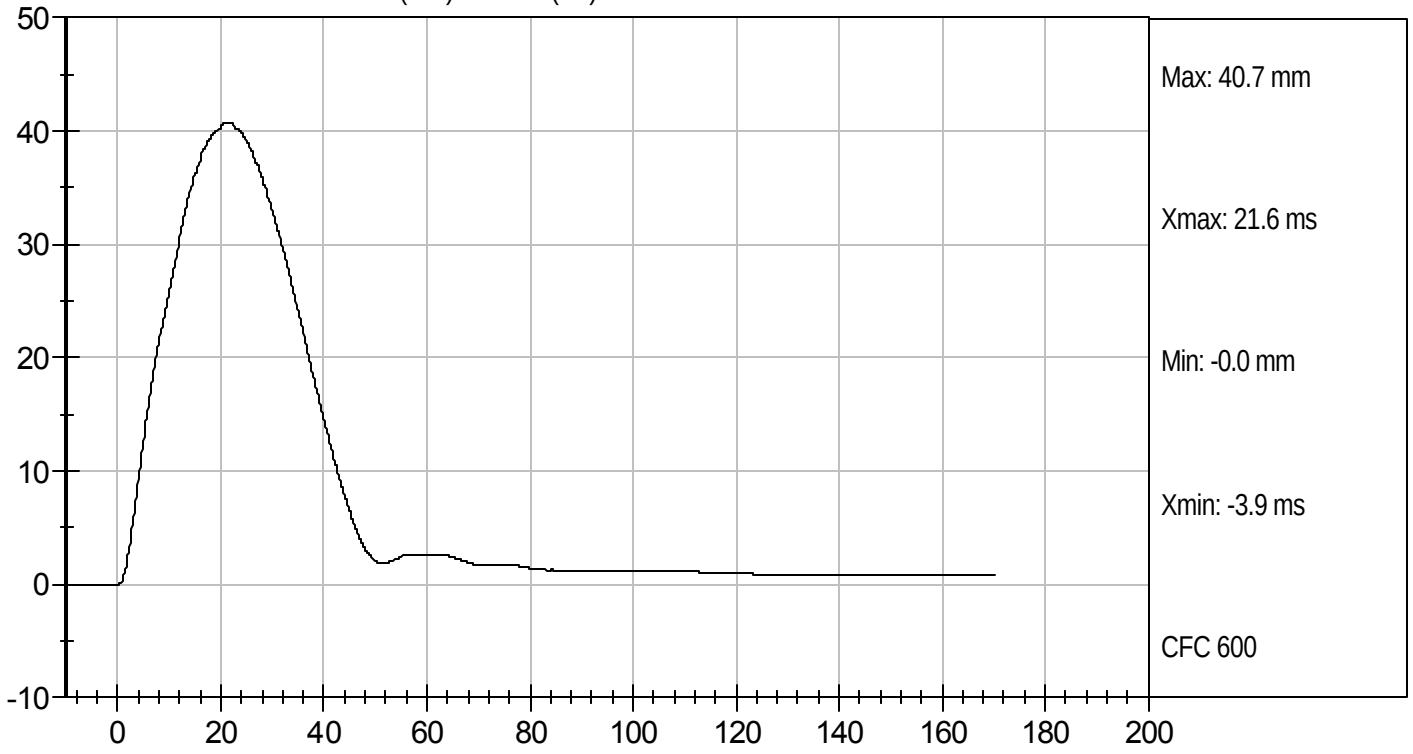




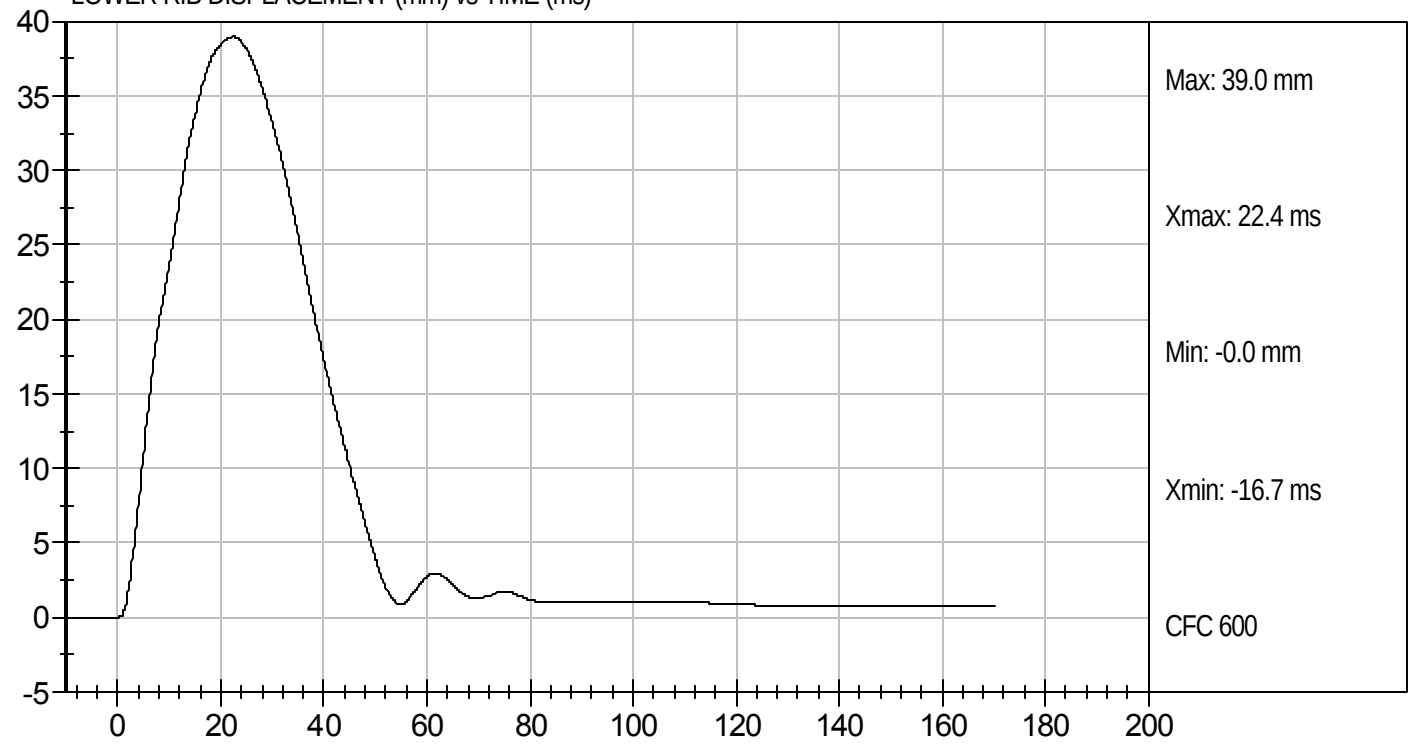
Test Desc: Thorax Without Arm
Component ID: D114185

Test Date: 12/13/11
Velocity: 14.24 ft/s, 4.34 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



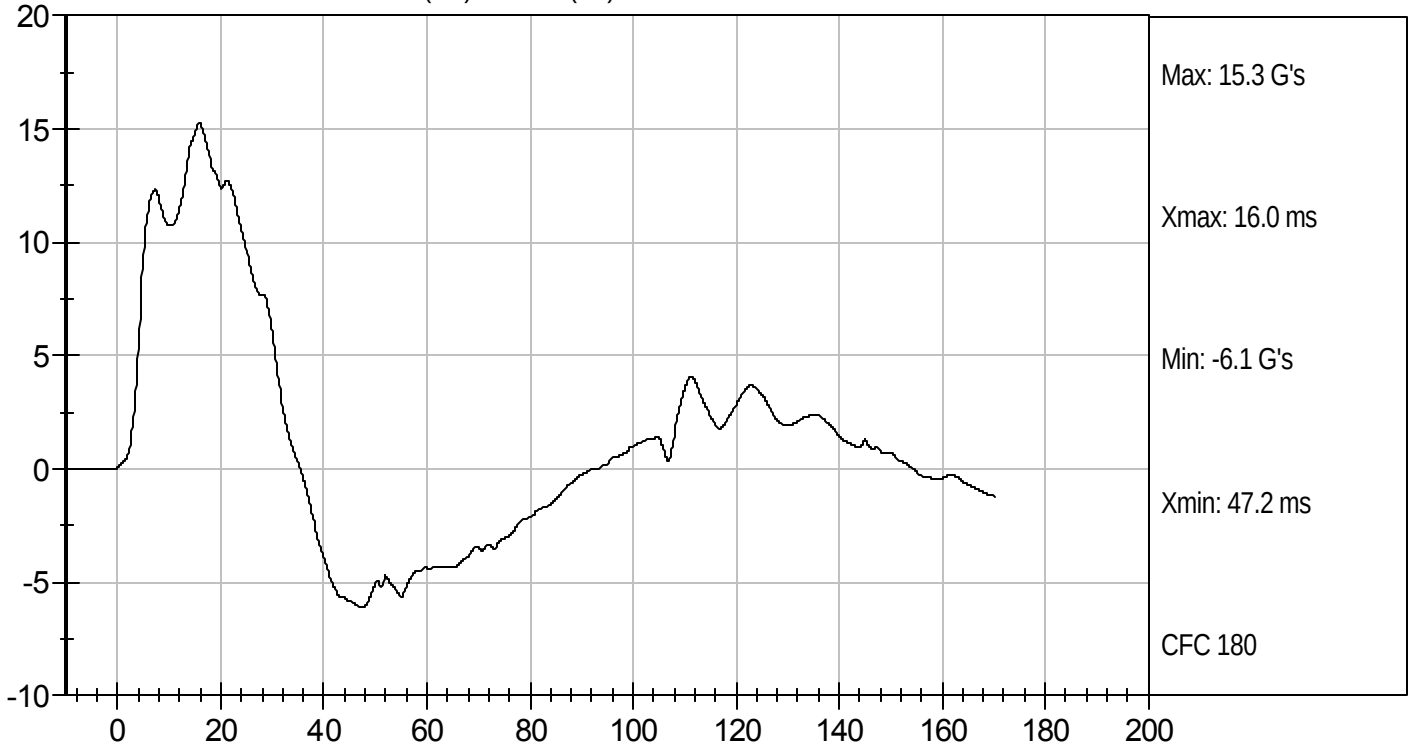
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



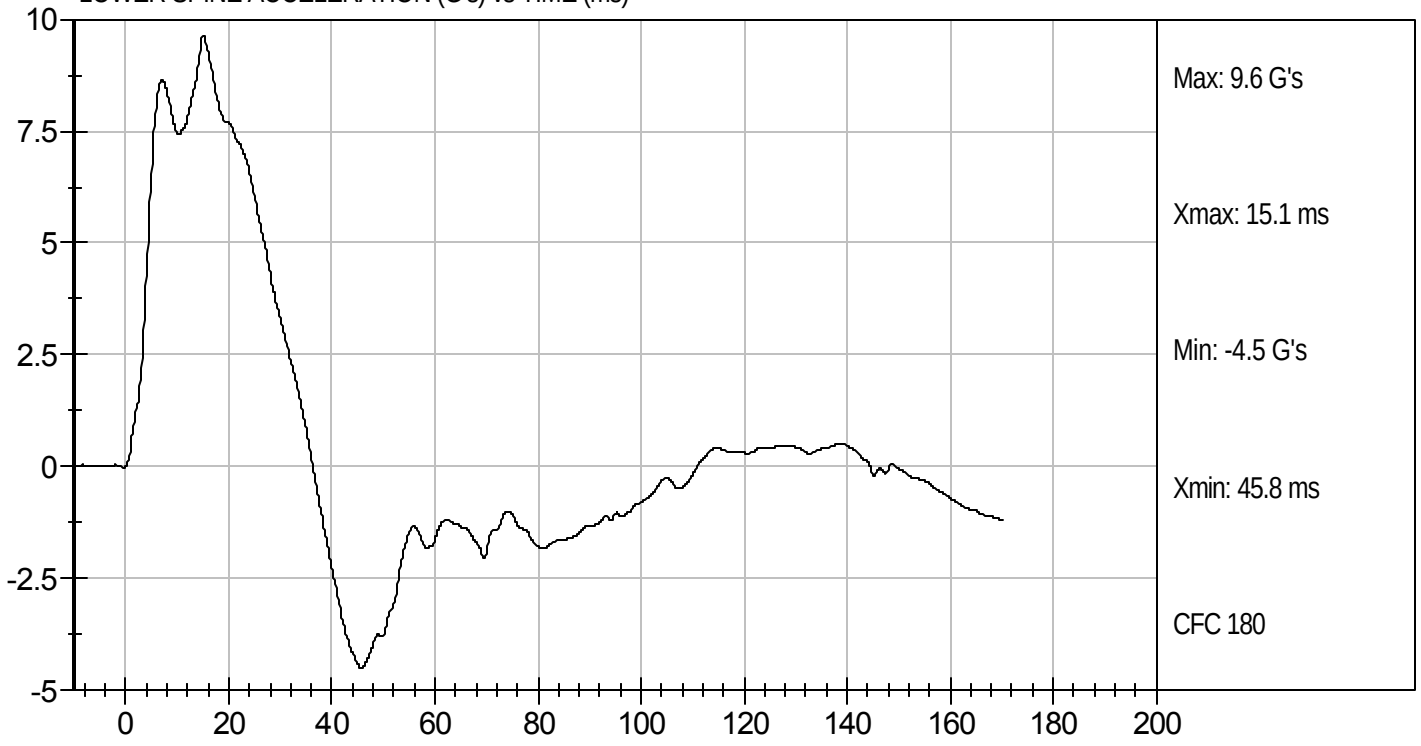
Test Desc: Thorax Without Arm
Component ID: D114185

Test Date: 12/13/11
Velocity: 14.24 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: 306 **Test I.D:** D114186

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	Pass
Humidity	%	10 to 70	23	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	39	Pass
Lower Rib Displacement	mm	33 to 44	35	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

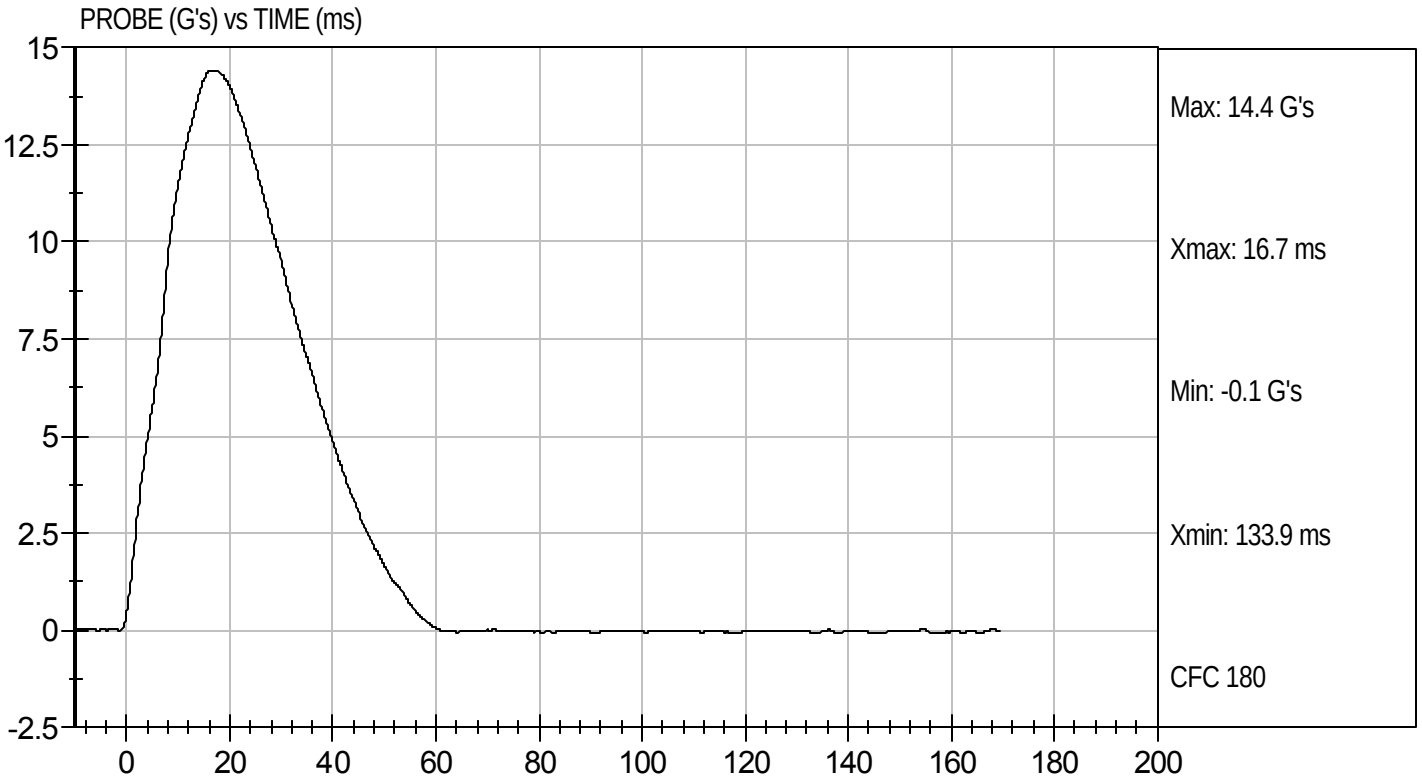
Jessica Gall
Laboratory Technician

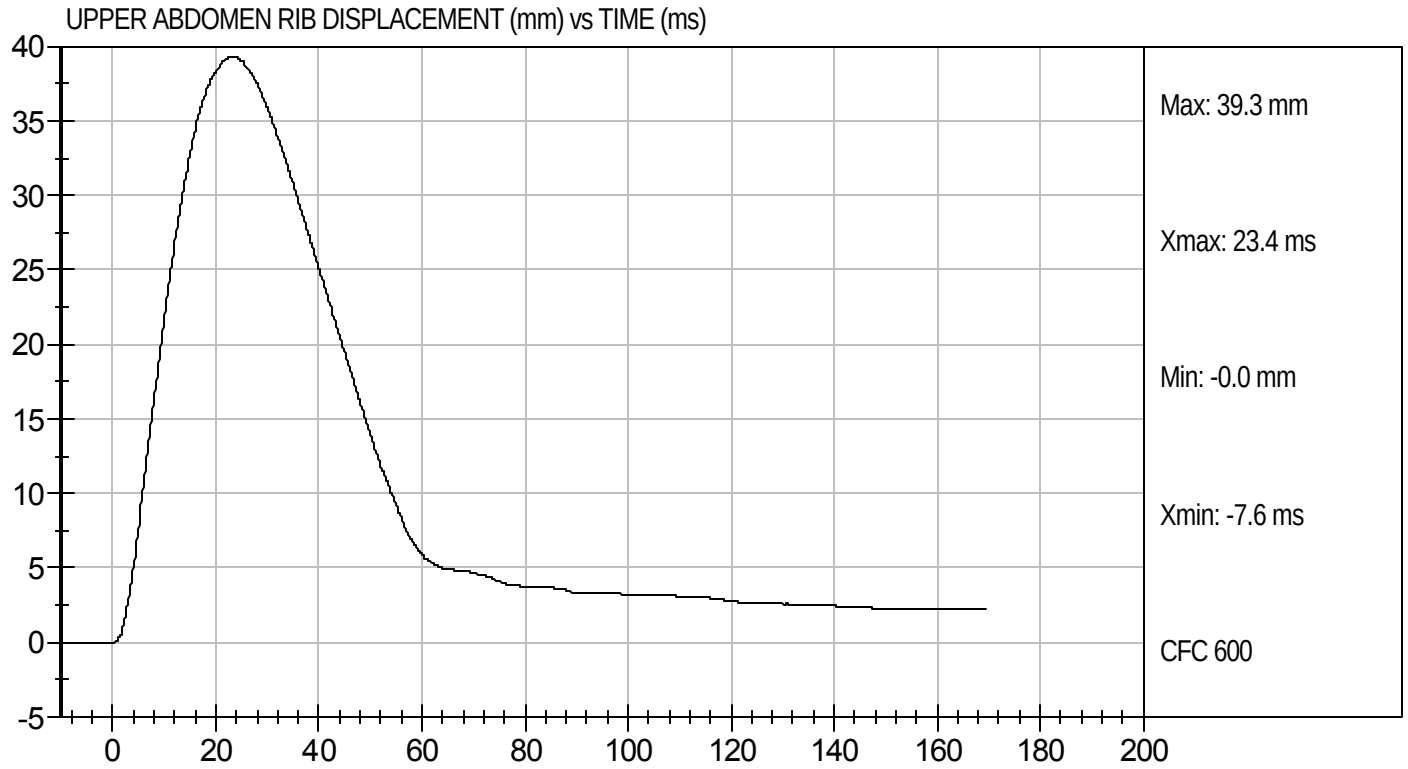
12/13/11
Test Date

David Winkelbauer
Approved By

Test Desc: Abdomen Impact
Component ID: D114186

Test Date: 12/13/11
Velocity: 14.24 ft/s, 4.34 m/s

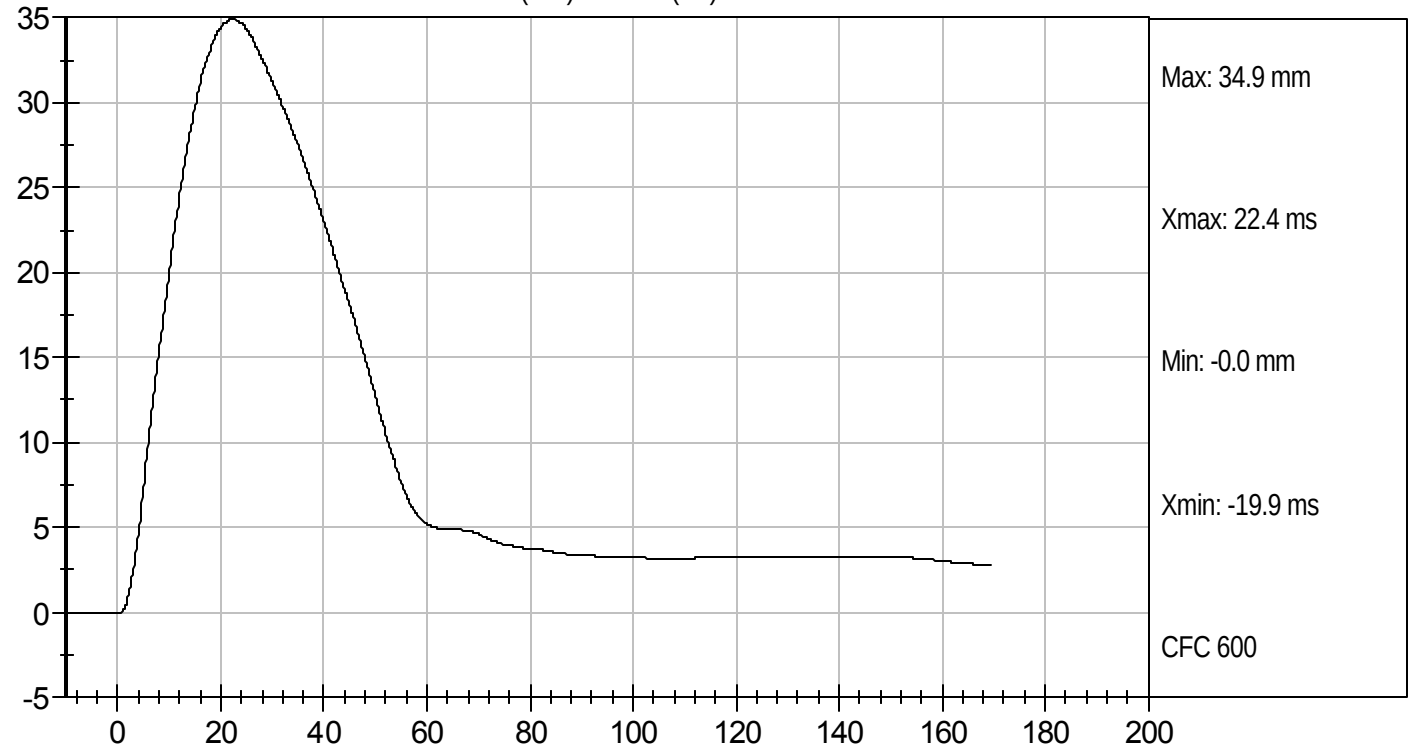




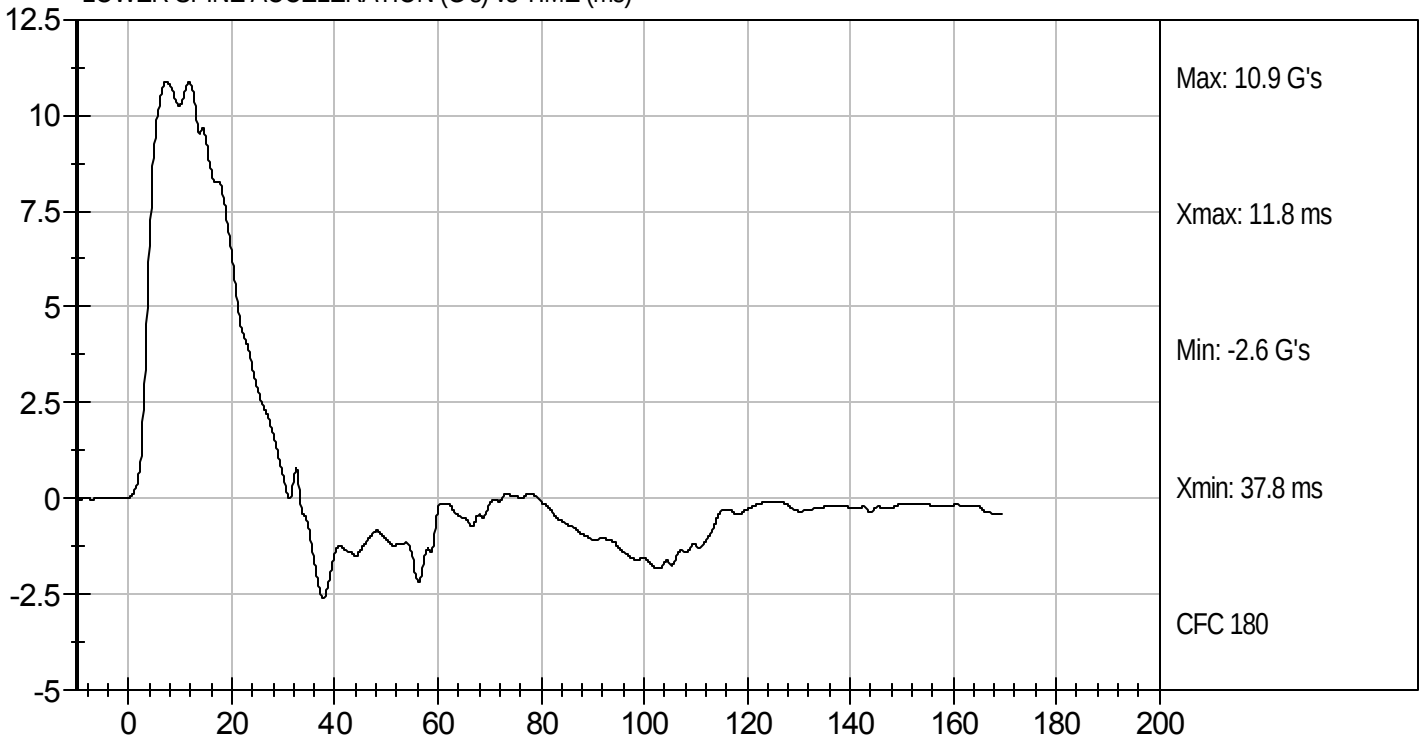
Test Desc: Abdomen Impact
Component ID: D114186

Test Date: 12/13/11
Velocity: 14.24 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: 306 **Test I.D:** D114187

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Peak Impactor Acceleration	G's	38 to 47	43	Pass
Pelvis Y Acceleration after 6 ms	G's	34 to 42	41	Pass
Peak Acetabulum Force	N	3600 to 4300	3903	Pass
		Overall Test Results		Pass

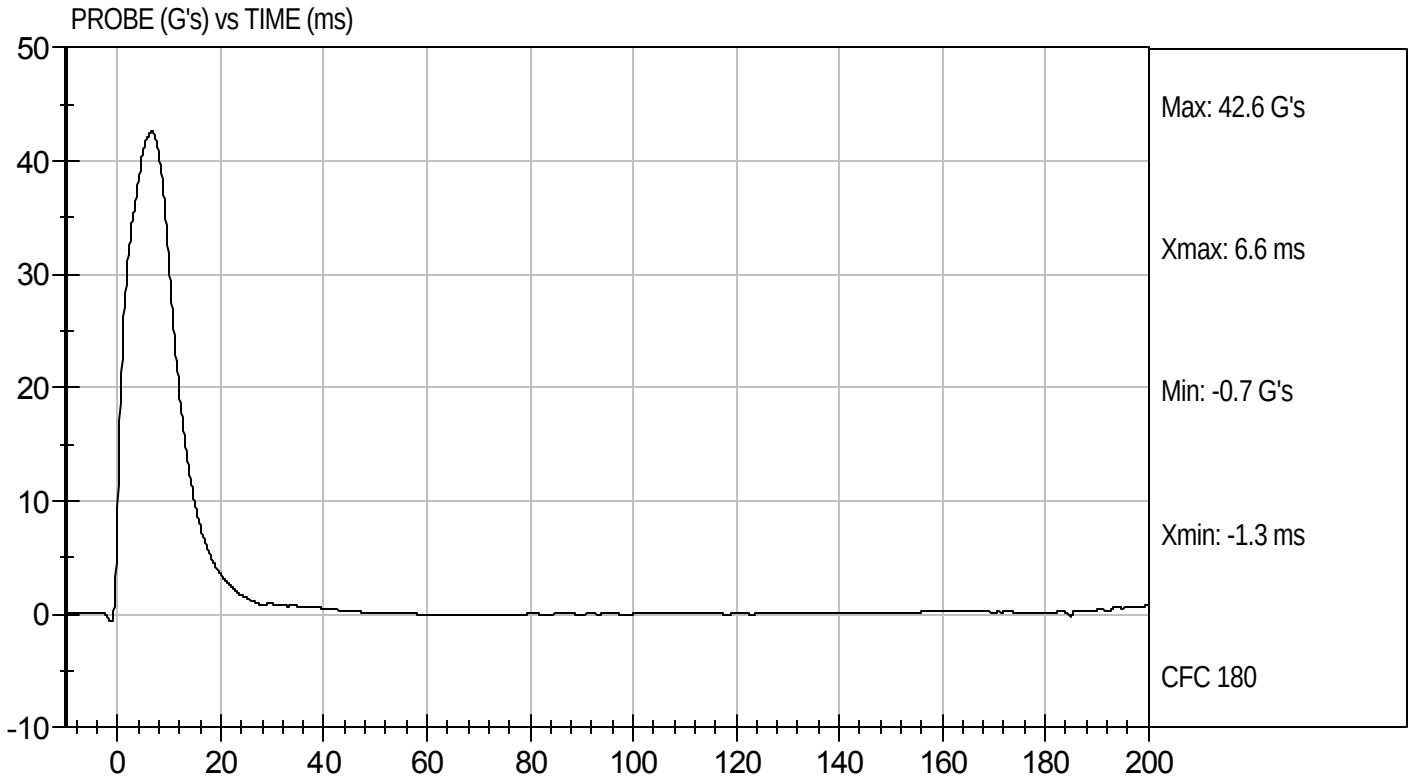
Jessica Hall
Laboratory Technician

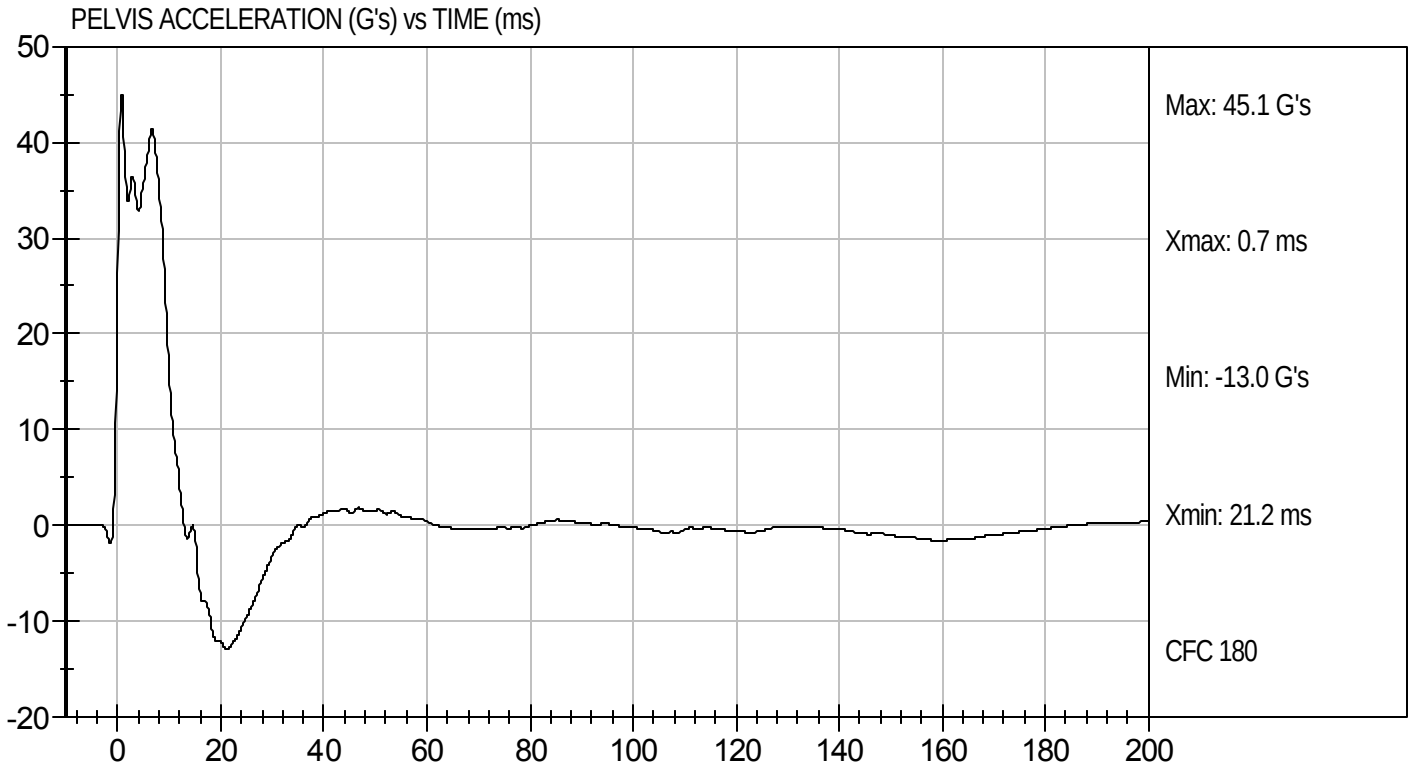
12/13/11
Test Date

David Winkelbauer
Approved By

Test Desc: Pelvis Impact
Component ID: D114187

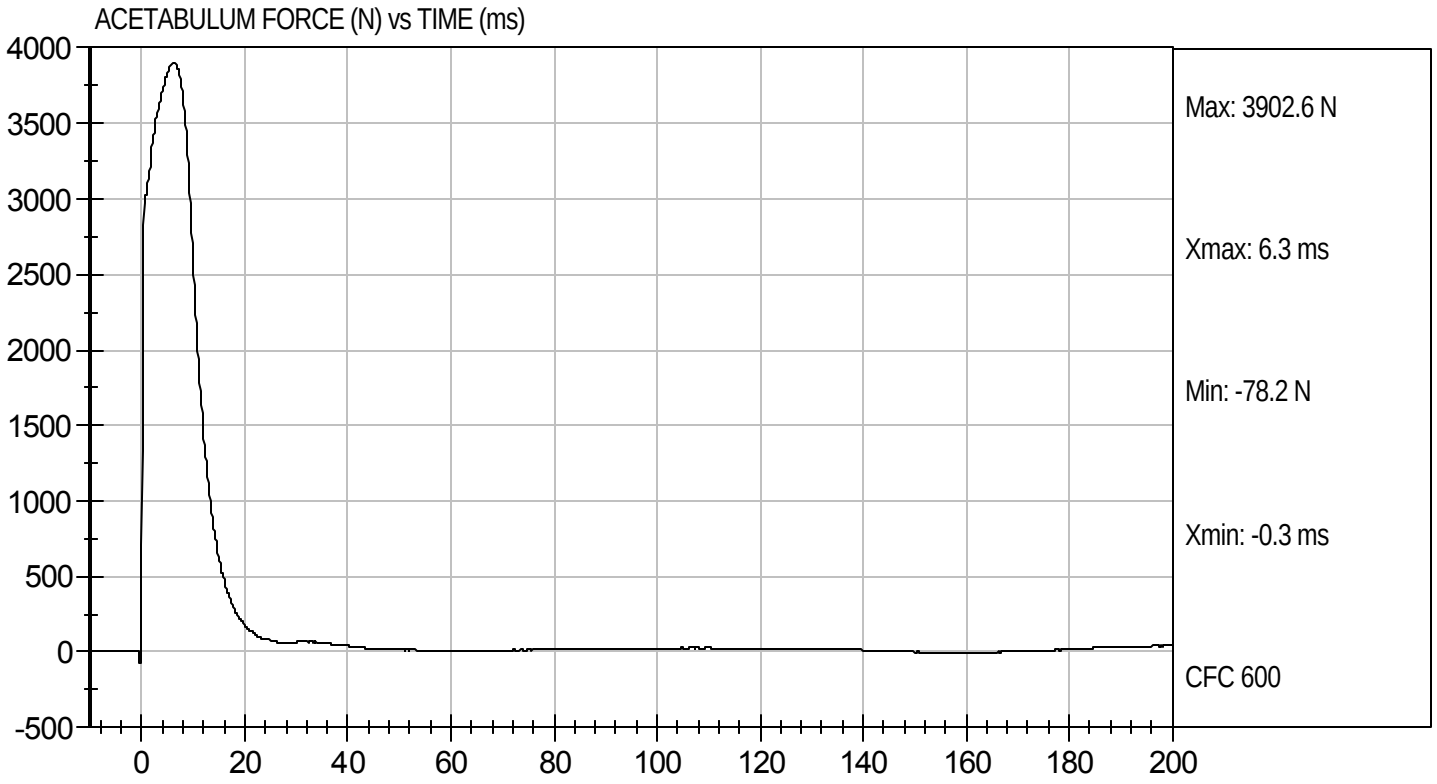
Test Date: 12/13/11
Velocity: 21.9 ft/s, 6.68 m/s





Test Desc: Pelvis Impact
Component ID: D114187

Test Date: 12/13/11
Velocity: 21.9 ft/s, 6.68 m/s



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D114188

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Peak Impactor Acceleration	G's	36 to 45	40	Pass
Pelvis Y Acceleration	G's	28 to 39	33	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4808	Pass
		Overall Test Results		Pass

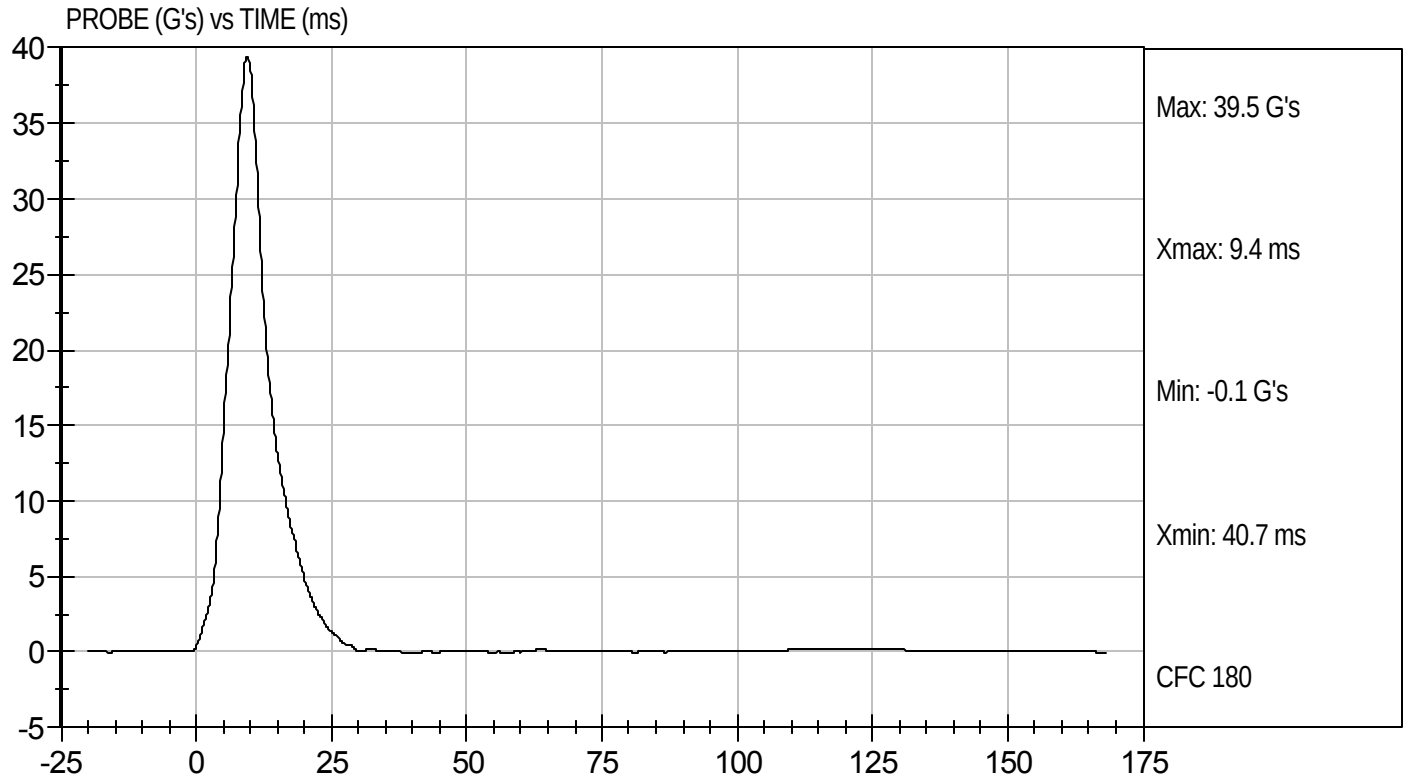
Jessica Hall
Laboratory Technician

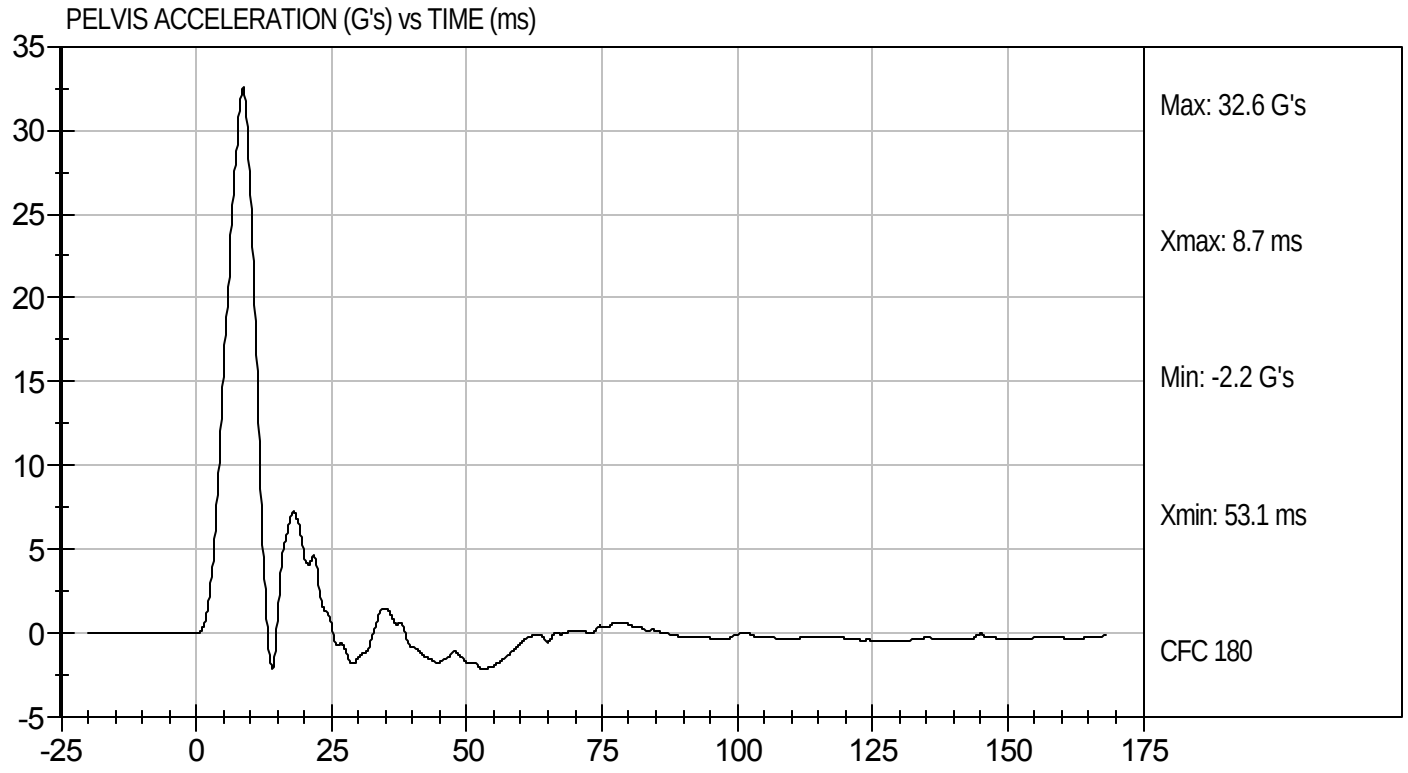
12/13/11
Test Date

David Winkelbauer
Approved By

Test Desc: Iliac Impact
Component ID: D114188

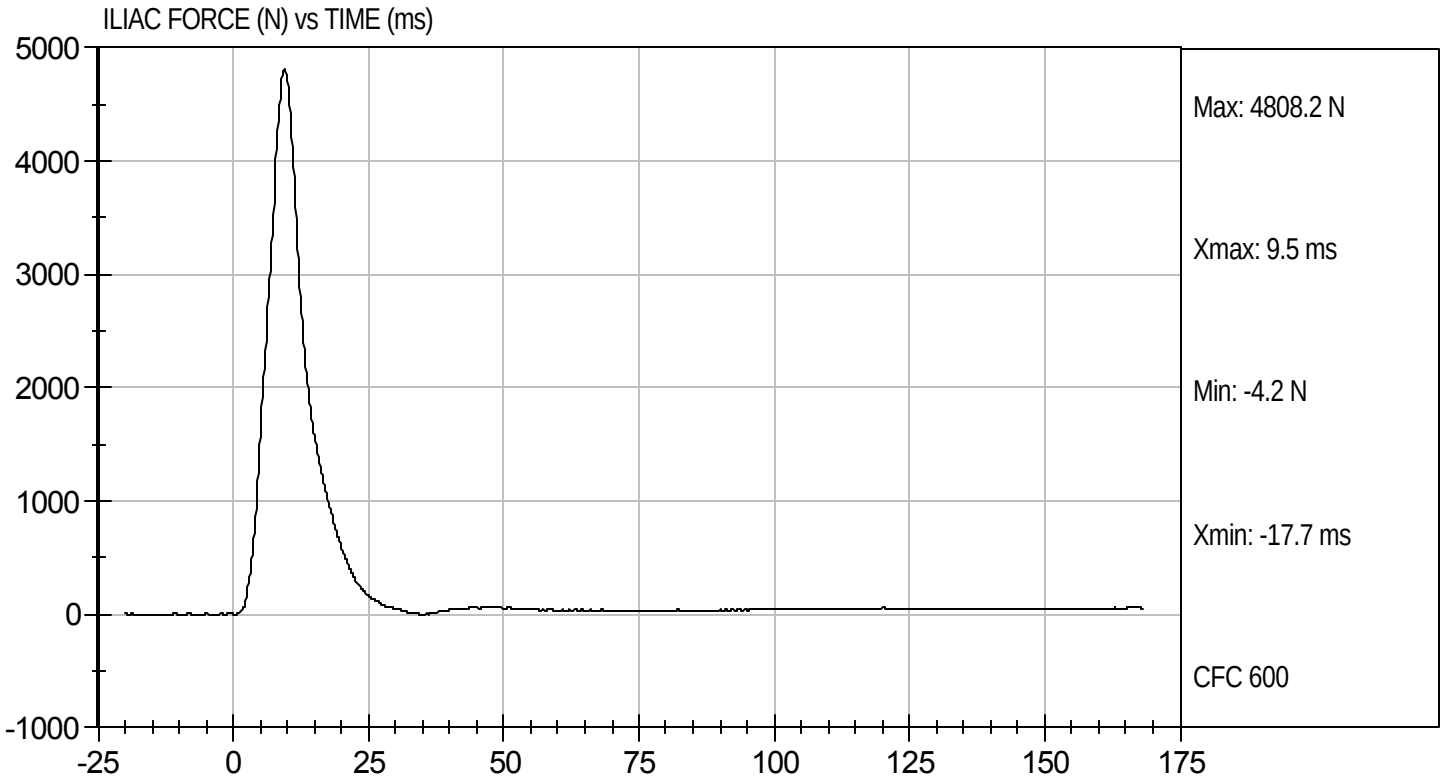
Test Date: 12/13/11
Velocity: 14.12 ft/s, 4.30 m/s





Test Desc: Iliac Impact
Component ID: D114188

Test Date: 12/13/11
Velocity: 14.12 ft/s, 4.30 m/s



APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N 032		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers		X	P73737	Endevco	10/04/11
		Y	P73738	Endevco	10/04/11
		Z	P73740	Endevco	10/04/11
Head Accelerometers		Xr	P66627	Endevco	10/10/11
		Yr	P73753	Endevco	10/04/11
		Zr	P73754	Endevco	10/04/11
Thorax Rib Displacement Potentiometers	Upper	Y	G176	Honeywell	10/12/11
	Middle	Y	G169	Honeywell	10/12/11
	Lower	Y	G164	Honeywell	10/12/11
Abdomen Load Cells	Forward	Y	ABG1532	Denton	01/06/11
	Middle	Y	ABG1534	Denton	01/06/11
	Rear	Y	ABG1535	Denton	01/06/11
Lower Spine Accelerometers (T12)		X	P73742	Endevco	10/04/11
		Y	P73743	Endevco	10/04/11
		Z	P73749	Endevco	10/04/11
Pubic Symphysis Load Cell		Y	PG461	Denton	01/06/11

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N 306		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers			X	P67884	Endevco	12/06/11
			Y	P67886	Endevco	12/06/11
			Z	P67887	Endevco	12/06/11
Head Accelerometers			X	P67888	Endevco	12/06/11
			Y	P67889	Endevco	12/06/11
			Z	P67890	Endevco	12/06/11
Displacement Potentiometers	Thoracic Rib	Upper	Y	G1187	FTSS	12/06/11
		Middle	Y	G1261	FTSS	12/06/11
		Lower	Y	G1270	FTSS	12/06/11
	Abdominal Rib	Upper	Y	G1287	FTSS	12/06/11
		Lower	Y	G1304	FTSS	12/06/11
Lower Spine Accelerometers (T12)			X	P67893	Endevco	12/06/11
			Y	P67894	Endevco	12/06/11
			Z	P67895	Endevco	12/06/11
Acetabulum Load Cell			Y	ACG111	FTSS	05/20/11
Iliac Wing Load Cell			Y	IWG226	FTSS	05/20/11
Pelvis Plug (struck side)				47279	FTSS	10/17/11
Pelvis Plug (non-struck side)				36131	FTSS	08/31/10

Table 3 – Vehicle Instrumentation

		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	P59264	Endevco	08/22/11
Vehicle Center of Gravity	Y	P59265	Endevco	08/22/11
Vehicle Center of Gravity	Z	P59266	Endevco	08/22/11
Right Sill at Front Seat	X	P63503	Endevco	10/25/11
Right Sill at Front Seat	Y	P63505	Endevco	10/25/11
Right Sill at Front Seat	Z	P63504	Endevco	10/25/11
Right Sill at Rear Seat	X	P63536	Endevco	08/01/11
Right Sill at Rear Seat	Y	P63535	Endevco	08/01/11
Right Sill at Rear Seat	Z	P63534	Endevco	08/01/11
Left Sill at Front Door	Y	P59365	Endevco	07/01/11
Left Sill at Rear Door	Y	P47881	Endevco	11/04/11
Left A-Post Lower	Y	P52278	Endevco	11/04/11
Left A-Post Middle	Y	P59634	Endevco	11/04/11
Left B-Post Lower	Y	P59309	Endevco	06/15/11
Left B-Post Middle	Y	P59310	Endevco	06/15/11
Front Seat Track	Y	P59376	Endevco	10/20/11
Rear Seat Track or Structure	Y	P59301	Endevco	11/04/11
Right Rear Occ. Compartment	Y	P45392	Endevco	09/12/11
Engine Block	X	P63283	Endevco	08/22/11
Engine Block	Y	P63284	Endevco	08/22/11
Rear Floorpan Above Axle	X	P59623	Endevco	09/13/11
Rear Floorpan Above Axle	Y	P59624	Endevco	09/13/11
Rear Floorpan Above Axle	Z	P59625	Endevco	09/13/11

Table 4 – MDB Instrumentation

		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	P63411	Endevco	07/08/11
MDB Center of Gravity	Y	P63412	Endevco	07/08/11
MDB Center of Gravity	Z	P63413	Endevco	07/08/11
Left Frame at Rear Axle Centerline	X	P59322	Endevco	07/07/11
Left Frame at Rear Axle Centerline	Y	P59323	Endevco	07/07/11