

**REPORT NUMBER: SINCAP-MGA-2013-020**

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

**KIA MOTORS MANUFACTURING GEORGIA, INC.  
FOR HYUNDAI MOTOR COMPANY  
2013 Hyundai Santa Fe Sport SUV  
NHTSA No.: MD0505**

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



**Test Date: October 9, 2012**

**Final Report Date: November 2, 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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Approval Date: November 2, 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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		6. Performing Organization Code MGA																												
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		14. Sponsoring Agency Code NVS-111																												
15. Supplementary Notes																														
16. Abstract A 55/28 km/h 90° Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2013 Hyundai Santa Fe Sport 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 October 9, 2012.  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 21.7° C. The target vehicle post-test maximum crush was 194 mm at level 2. The test vehicle's performance was as follows:																														
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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 Washington, DC 20590 e-mail: <a href="mailto:tis@nhtsa.dot.gov">tis@nhtsa.dot.gov</a> 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 2013 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 2013 Hyundai Santa Fe Sport SUV. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Laboratory Test Procedure dated September 2012.

## SECTION 2 SUMMARY OF TEST RESULTS

A 2013 Hyundai Santa Fe Sport 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. 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 October 9, 2012. 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 May 2012. 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
- Head 9-Axis 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

Measurement Description	Driver ATD (ES-2re)		
	Units	Threshold	Result
Head Injury Criteria (HIC <sub>36</sub> )	N/A	1000	115
Maximum Thorax Rib Deflection	mm	44	18
Total Abdominal Force	N	2500	667
Pubic Symphysis Force	N	6000	1641

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC <sub>36</sub> )	N/A	1000	143
Resultant Lower Spine Acceleration	Gs	82	54
Total Pelvic Force	N	5525	3053
Maximum Thoracic Rib Deflection	mm	38*	35
Maximum Abdomen Rib Deflection	mm	45*	33

\*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	Yes	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](http://www.nhtsa.dot.gov)

**GENERAL COMMENTS**

There was no valid data collected for:  
 Left Lower A-Post Y after 30ms  
 Left Mid A-Post Y after 30ms  
 Left Lower B-Post Y after 3ms  
 Left Mid B-Post Y after 5ms

Left Front Sill Y is questionable from 3-10ms  
 Left Rear Seat Y is questionable from 20-35ms

The spare tire became dislodged from the vehicle during the test.

Driver seat back lever was activated during the test causing the driver seat back to recline.

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

**SECTION 3  
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS**

**DATA SHEET NO. 1  
GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
Test Date: 10/09/2012

**TEST VEHICLE INFORMATION AND OPTIONS**

NHTSA No.	MD0505	Traction Control System (TCS)	Yes
Model Year	2013	Auto-Leveling System	No
Make	Hyundai	Automatic Door Locks (ADL)	Yes
Model	Santa Fe Sport	Power Window Auto-Reverse	Yes
Body Style	SUV	Other Optional Feature	N/A
VIN	5XYZU3LB5DG003227	Driver Front Airbag	Yes
Body Color	Marlin Blue	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	76 / 47	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	Yes
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	Yes, Driver Only	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Rear Pass. Load Limiter	No
		Other Safety Restraint	N/A

Does owner's manual provide instructions to turn off automatic door locks? **Yes**

**DATA FROM CERTIFICATION LABEL**

Manufactured By	Kia Motors Manufacturing Georgia, Inc. for Hyundai Motor Company	GVWR (kg)	2200
Date of Manufacture	JUL/27/12	GAWR Front (kg)	1350
Vehicle Type	MPV	GAWR Rear (kg)	1395

**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						X
Rear or Second Row			X			w/lever	
Third Row Seat							

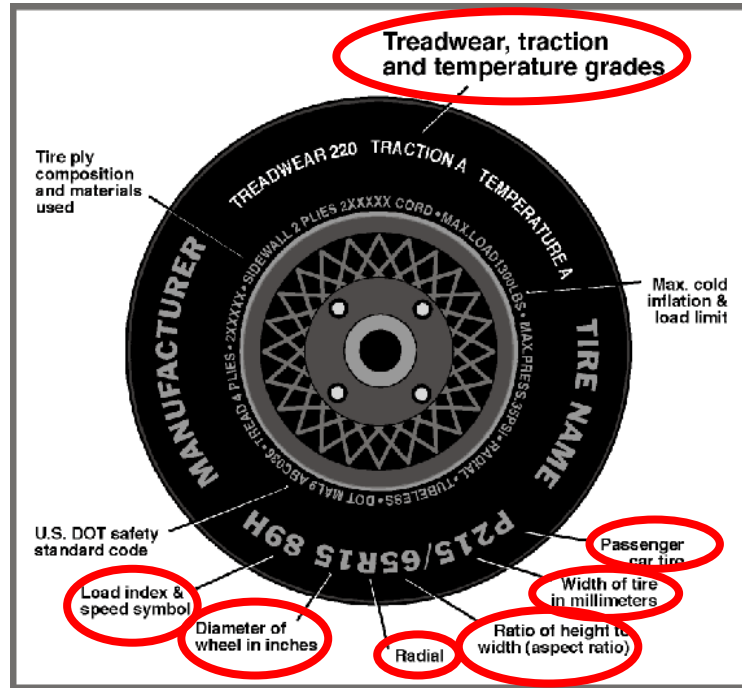
## DATA SHEET NO. 1 (CONTINUED)

### GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012

#### VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	230	230
Recommended Tire Size	P235/65R17	P235/65R17
Tire Size on Vehicle	P235/65R17	P235/65R17
Tire Manufacturer	Continental	Continental
Tire Model	Cross Contact	Cross Contact
Treadwear	680	680
Traction	A	A
Temperature Grade	B	B
Tire Plies Sidewall	2	2
Tire Plies Body	5	5
Load Index/Speed Symbol	103T	103T
Tire Material	Rubber	Rubber
DOT Safety Code Left	P587 WBLH 2712	P587 WBLH 2712
DOT Safety Code Right	P587 WBLH 2712	P587 WBLH 2712

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

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012

**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**

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	472.2	361.5		510.3	450.9		509.8	458.1	
Right	kg	466.3	329.8		483.1	388.2		466.3	404.2	
Ratio	%	57.6	42.4		54.2	45.8		53.1	46.9	
Totals	kg	938.5	691.3	1629.8	993.4	839.1	1832.5	976.1	862.3	1838.4

**TARGET TEST WEIGHT CALCULATION**

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1629.8	(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 (TVT <sub>W</sub> )	kg	1839.1	(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**

**TEST VEHICLE ATTITUDES AND CG**

	Units	Fully Loaded	As Tested	Meets Requirement***
Left Front	mm	768	770	Yes
Right Front	mm	789	781	Yes
Right Rear	mm	769	779	Yes
Left Rear	mm	765	772	Yes
Vehicle CG (Aft of Front Axle)	mm	1266	1236	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	43	40	

\*\*\* 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. 1 (CONTINUED)**  
**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
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NHTSA No. MD0505  
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**WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW**

Component Description	Weight (kg)
Weight of Ballast, if any	36.7
Right taillight, right side mirror, jack & tools, cargo box/carpet/ sill cover/foam, right rear floor mat.	20.0

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

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012

**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	20.9	13.5	17.2
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	17.2	0	Max	50	50	50
	17.2	0	Mid	25	25	25
	17.2	0	Min	0	0	0
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: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

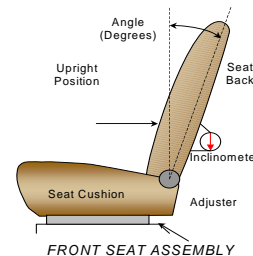
NHTSA No. MD0505  
 Test Date: 10/09/2012

**SEAT FORE/AFT POSITIONS**

Seat	Total Fore/Aft Travel		Test Position from Forward-most Position	
	mm	Detents	mm	Detent
Driver Seat	242		121	
Front Passenger Seat	240	24 (1 <sup>st</sup> as 0)	121	12 (1 <sup>st</sup> 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	55.5		-12.0	
Front Passenger Seat	56.1		-12.6	5 (1 <sup>st</sup> as 0)
Front Center Seat				
Struck Side Rear Seat	37.0		-6.0	2 (1 <sup>st</sup> as 0)
Non-Struck Side Rear Seat	37.0		-6.0	2 (1 <sup>st</sup> as 0)
Rear Center Seat	37.0		-6.0	2 (1 <sup>st</sup> as 0)

## DATA SHEET NO. 2 (CONTINUED)

### SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
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#### 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	4 detents (1 <sup>st</sup> as 1)	0 (uppermost as 0)
Rear Seat	Fixed	Not Applicable

#### HEAD RESTRAINT ADJUSTMENT

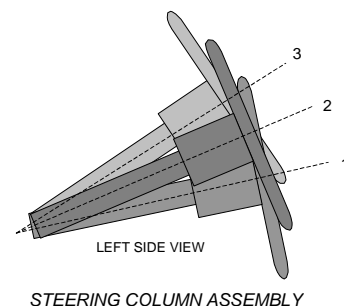
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	5	Highest/Full Forward
Rear Seat	4	Lowest

#### STEERING COLUMN ADJUSTMENT

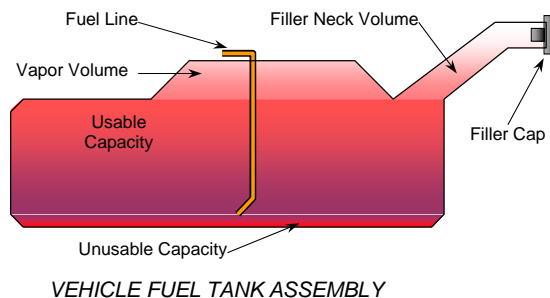
Steering wheel and column adjustments are made so that the steering wheel Ogeometric locus is described when it moves through its full range of motion.

	Degrees	Fore/Aft Position (mm)
Lowermost, Position 1	66.4	205
Geometric Center, Position 2	64.3	185
Uppermost, Position 3	62.2	165
Telescoping Steering Wheel Travel		40
Test Position	64.3	185



#### 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.



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

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
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**FUEL TANK CAPACITY DATA**

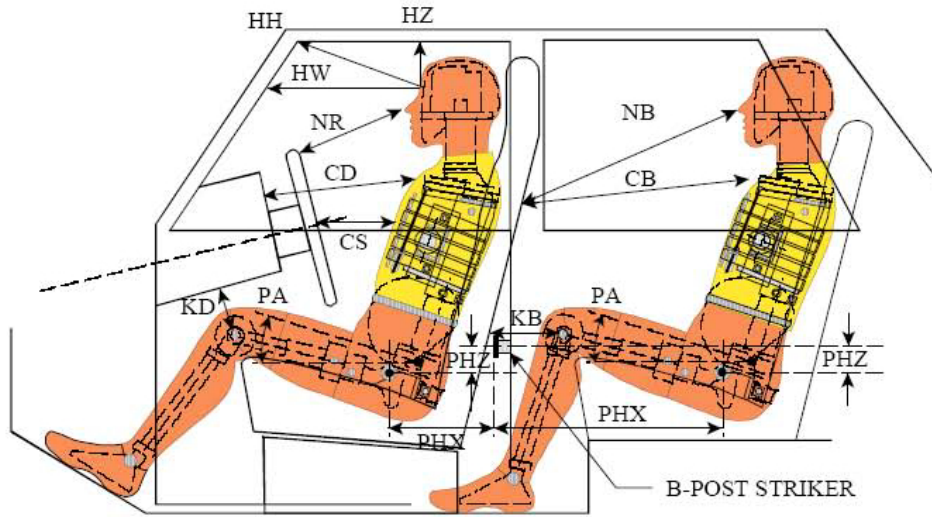
	Liters
Usable Capacity of "Standard" Tank (see Form No. 1)	66.0
Usable Capacity of "Optional" Tank (see Form No. 1)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	66.0
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	61.4
Actual Amount of Solvent Used	61.4
1/3 of Usable Capacity	22.0

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

**DATA SHEET NO. 3  
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
Test Date: 10/09/2012



**LEFT SIDE VIEW**

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

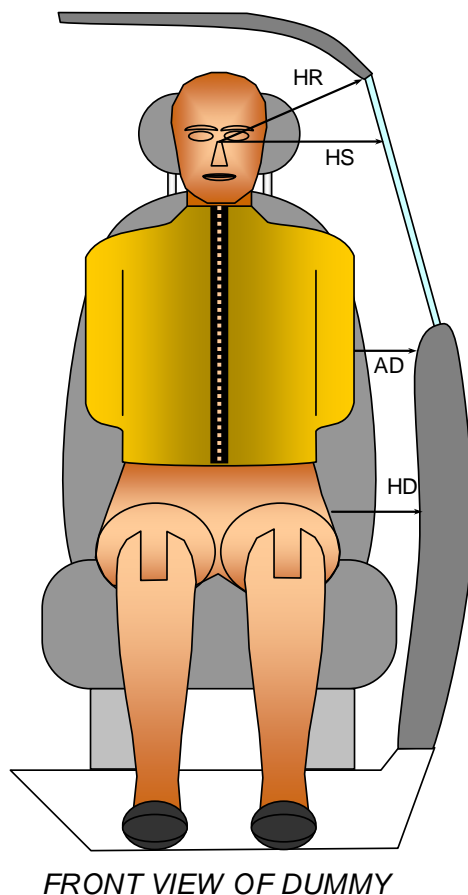
**DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION**

Driver Code	Pass. Code	Measurement Description	Driver S/N 032		Passenger S/N 296	
			Length (mm)	Angle(°)	Length (mm)	Angle(°)
HH		Head to Header	338	17.1		
HW		Head to Windshield	621			
HZ	HZ	Head to Roof Liner	169		292	
NR	NB	Nose to Rim/Seat Back	465	20.6	450	11.1
CD	CB	Chest to Dashboard/Seat Back	573	10.0	461	4.3
CS		Chest to Steering Wheel	386	10.4		
KDL	KBL	Left Knee to Dash/Seat Back	162	26.7	266	20.7
KDR	KBR	Right Knee to Dash/Seat Back	141	29.0	268	30.2
PAX	PAX	Pelvic Tilt Angle X		22.5		21.7
	PAY	Pelvic Tilt Angle Y		-0.1		0.0
PHX	PHX	Hip Point to Striker (X-Axis)	190		361	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	231		227	

**DATA SHEET NO. 4  
DUMMY LATERAL CLEARANCE DIMENSIONS**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012



*FRONT VIEW OF DUMMY*

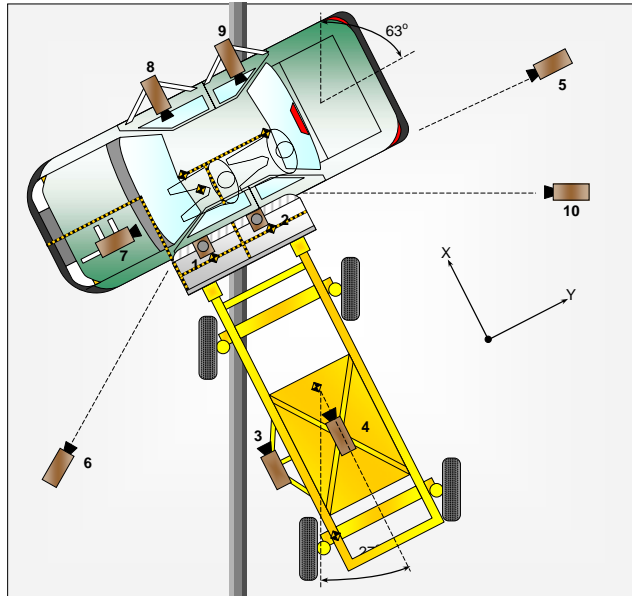
**DUMMY LATERAL CLEARANCE DIMENSION INFORMATION**

Code	Measurement Description	Units	Driver S/N 032	Passenger S/N 296
HR	Head to Side Header	mm	199	259
HS	Head to Side Window	mm	334	380
AD	Arm to Door	mm	117	177
HD	Hip Point to Door	mm	172	211

**DATA SHEET NO. 5  
CAMERA AND INSTRUMENTATION DATA**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
Test Date: 10/09/2012



**CAMERA LOCATIONS AND DATA**

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X*	Y*	Z*		
1	Overhead Overall	110	450	-5020	14	1000
2	Overhead Close-Up	100	440	-5000	50	1000
3	Left Impact Point (MDB)				50	1000
4	Side Overall (MDB)				16	1000
5	Rear	90	4990	-1220	24	1000
6	Left Front	3270	-4190	-1180	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  $\pm 6$  mm

Explain why camera(s) did not operate as intended: None

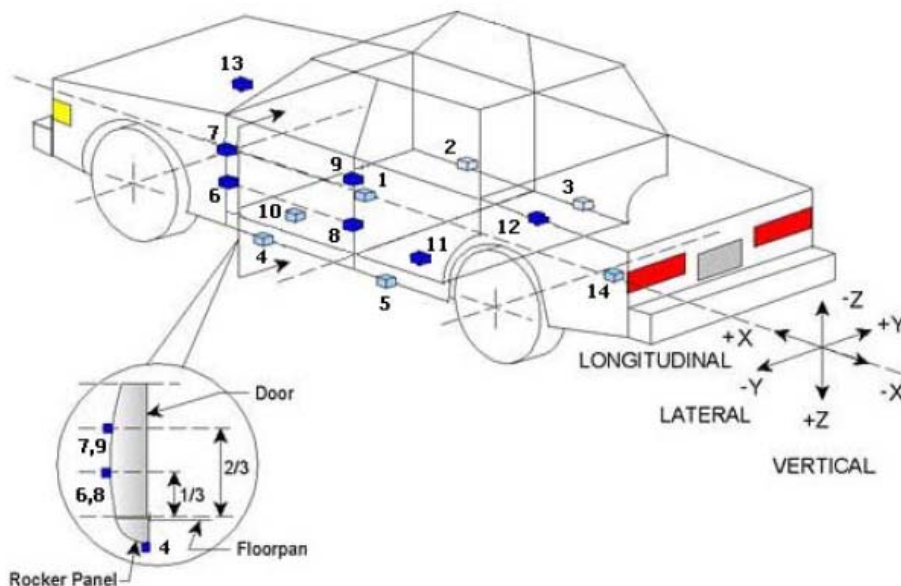
**INSTRUMENTATION**

Driver Dummy Channels	22
Passenger Dummy Channels	16
Vehicle Structure Accelerometers	23
MDB Accelerometers	5
MDB Contacts	2
Total	68

**DATA SHEET NO. 6  
TEST VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012



**TEST VEHICLE ACCELEROMETER LOCATIONS**

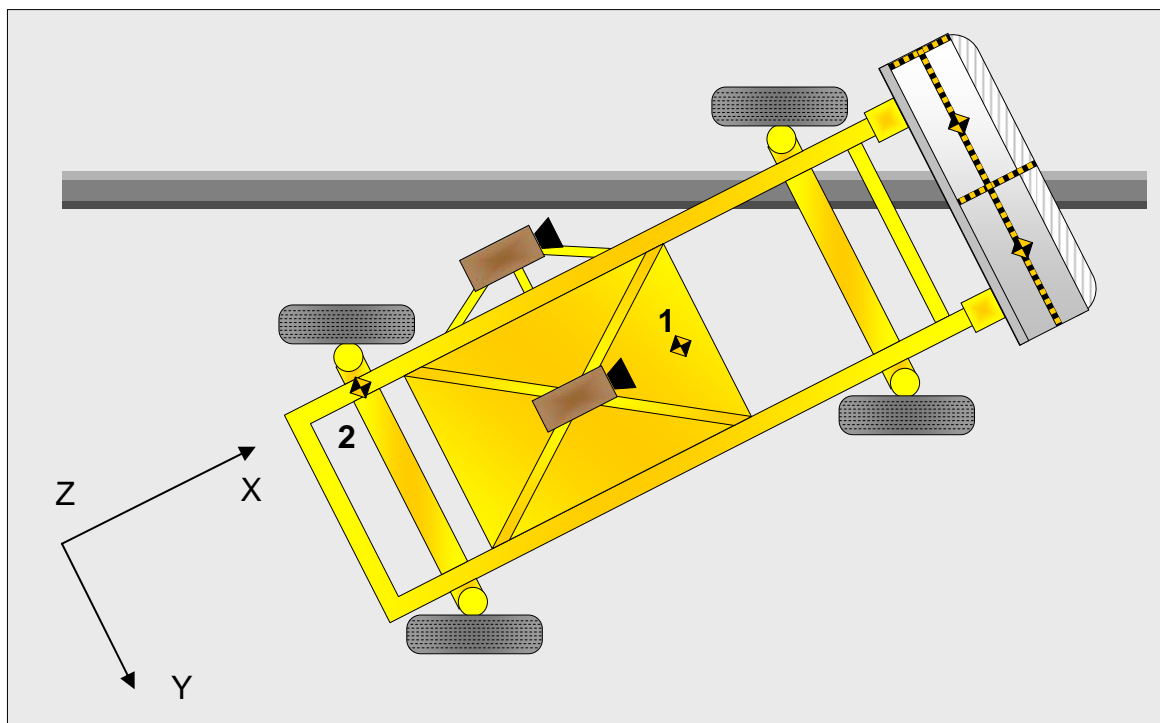
Accelerometer Location				
No.	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2577	415	-235
2	Right Sill at Front Seat	2341	755	-255
3	Right Sill at Rear Seat	1541	755	-260
4	Left Sill at Front Door	2678	-755	-245
5	Left Sill at Rear Door	1540	-755	-265
6	Left Lower A-Post	3198	-846	-625
7	Left Middle A-Post	3198	-837	-862
8	Left Lower B-Post	2072	-758	-625
9	Left Middle B-Post	2072	-766	-845
10	Front Seat Track	2449	-576	-525
11	Rear Seat Structure	1687	-525	-535
12	Rt. Rear Occ. Compartment	1872	410	-350
13	Engine Block	3960	0	-857
14	Rear Above Axle	1009	0	-532

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: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012



**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: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012

**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	Curtain Airbag
Back of Head	Curtain Airbag, Headrest	Curtain Airbag, Headrest, Center Seatback
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, Seatpan
Left Knee	Door Panel	None

**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**

Description	Struck Side		Non-Struck Side	
	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: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012

**SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION**

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	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		419
Horizontal Offset (+forward / -rearward)	mm	+/- 50 of intended impact point	-9
Vertical Offset (+down / -up)	mm	+/- 20 of intended impact point	+7

**DATA SHEET NO. 9**  
**MDB SUMMARY OF RESULTS**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
Test Date: 10/09/2012

**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	90.0
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.4
MDB Crabbed Angle to MDB Forward Line of Motion	degrees	26 to 28	26.6

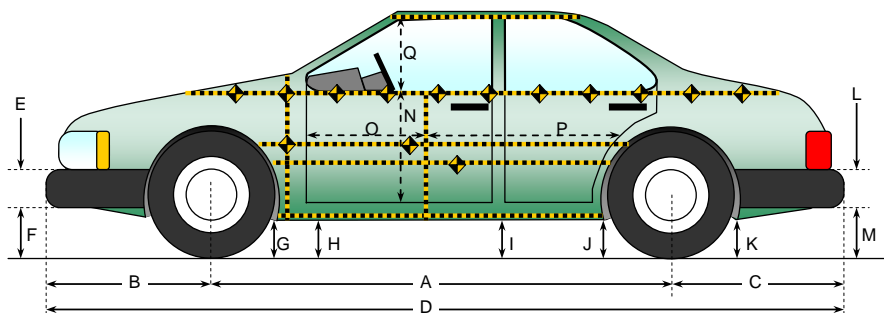
**MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE**

Row	Vertical Location		From Centerline		Maximum Crush
	Description	Height	Distance	Direction	
A	Center of Bumper	432	700	Left	221
B	Top of Bumper	533	800	Left	150
C	Mid-Level	686	800	Left	150
D	Top of Stack	813	800	Left	199

**DATA SHEET NO. 10  
TEST VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
Test Date: 10/09/2012



All measurements in (mm) with tolerance of  $\pm 3$  mm

**LEFT SIDE VIEW**

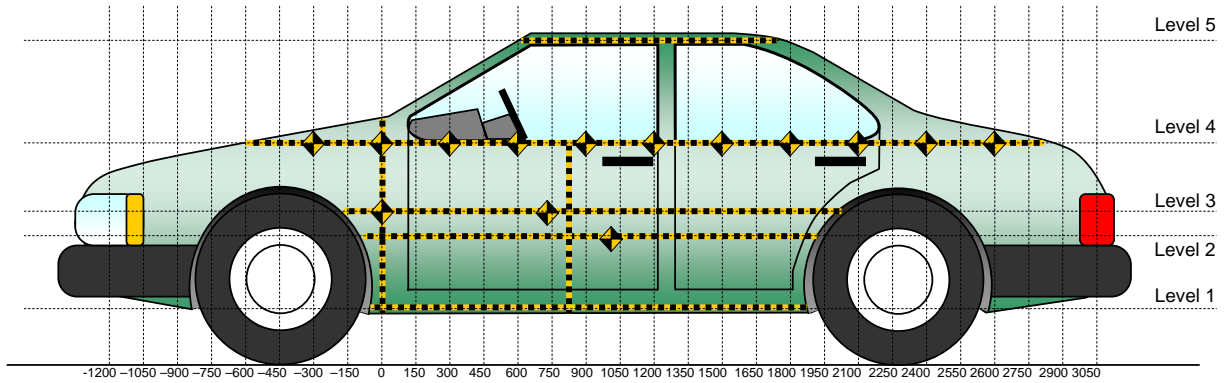
**VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION**

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2700	2705	-5
B	Front Axle to FSOV	1056	1097	-41
C	Rear Axle to RSOV	936	890	46
D	Total Length at Centerline	4692	4692	0
E	Front Bumper Thickness	135	135	0
F	Front Bumper Bottom to Ground	284	283	1
G	Sill Height at Front Wheel Well	231	239	-8
H	Sill Height at Front Door Leading Edge	233	235	-2
I	Sill Height at B Pillar	236	245	-9
J1	Sill Height at Rear Wheel Well	230	248	-18
J2	Pinch Weld Height at Rear Wheel Well	230	248	-18
K	Sill Height Aft of Rear Wheel Well	265	275	-10
L	Rear Bumper Thickness	110	110	0
M	Rear Bumper Bottom to Ground	322	326	-4
N	Sill Height to Window Bottom Sill	926	836	90
O	Front Door Leading Edge to Impact CL	743	746	-3
P	Rear Door Trailing Edge to Impact CL	1215	1240	-25
Q	Front Window Opening	451	440	11
R	Right Side Length	3245	3245	0
S	Left Side Length	3245	3238	7
T	Vehicle Width at B Post	1880	1729	151

**DATA SHEET NO. 11**  
**TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012



All Measurements Shown in mm

**LEFT SIDE VIEW**

**MAXIMUM EXTERIOR CRUSH MEASUREMENTS**

Level	Measurement Description	Height Above Ground (mm)	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	270	68	1800
2	Mid Door	671	194	1500
3	Occupant Hip Point	695	188	1500
4	Window Sill	1104	61	1200
5	Window Top	1597	11	2250

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: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012

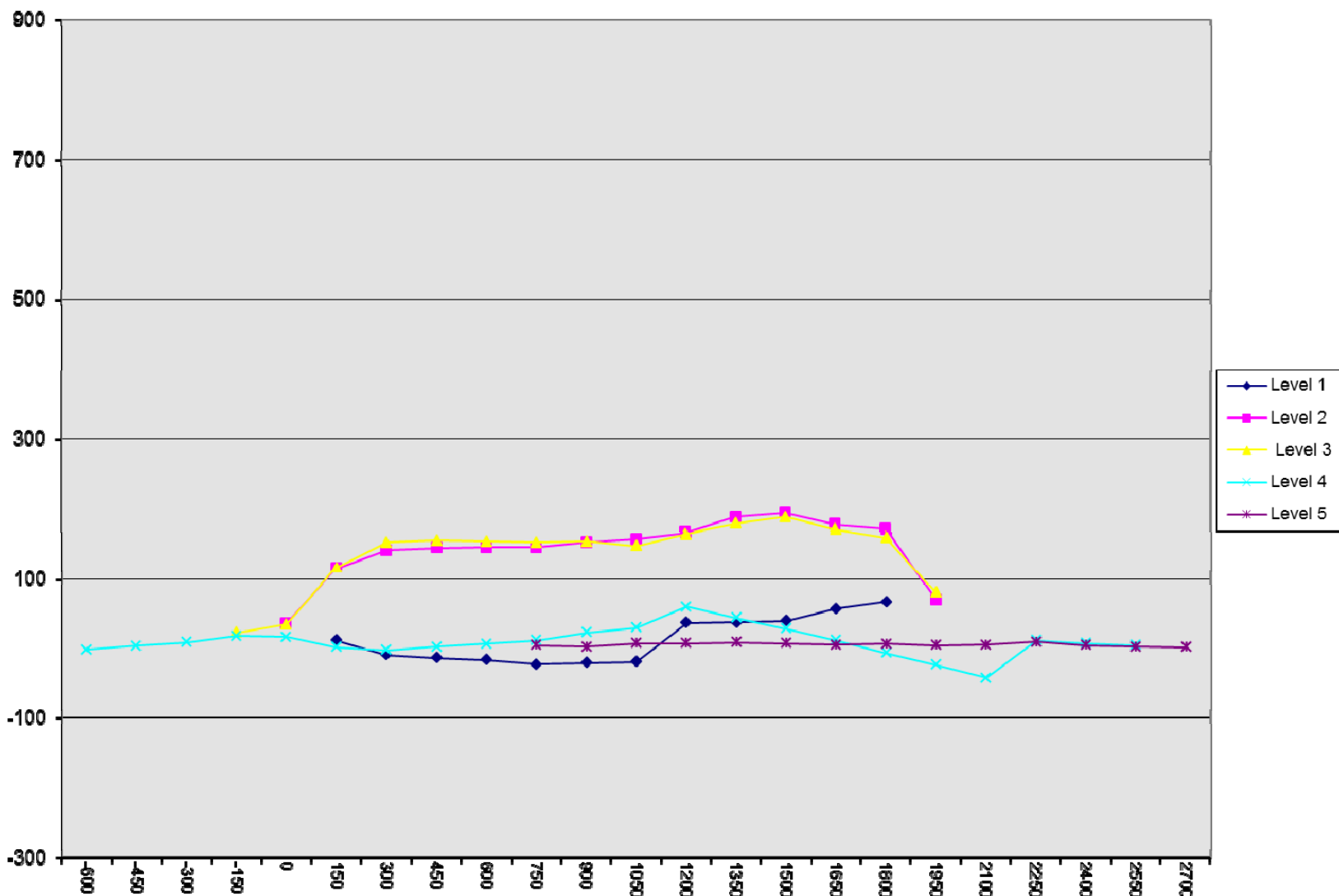
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-600				306					306					0	
-450				288					293					5	
-300				275					285					10	
-150			153	267				177	286				24	19	
0		153	154	262			190	190	280			37	36	18	
150	203	170	169	260		216	286	286	263		13	116	117	3	
300	220	172	170	257		212	314	323	256		-8	142	153	-1	
450	226	172	170	247		214	317	326	251		-12	145	156	4	
600	228	173	171	238		213	319	325	246		-15	146	154	8	
750	233	175	172	232	470	212	321	325	245	476	-21	146	153	13	6
900	233	176	173	227	460	214	329	327	251	464	-19	153	154	24	4
1050	234	177	175	226	456	216	334	323	257	465	-18	157	148	31	9
1200	233	181	178	225	457	271	347	342	286	466	38	166	164	61	9
1350	232	183	181	225	458	271	371	360	270	468	39	188	179	45	10
1500	230	185	182	226	459	271	379	370	256	468	41	194	188	30	9
1650	215	185	183	228	461	273	362	353	241	468	58	177	170	13	7
1800	203	170	172	229	463	271	341	331	224	471	68	171	159	-5	8
1950		160	160	227	467		231	241	205	473		71	81	-22	6
2100				225	473				184	480				-41	7
2250				227	480				240	491				13	11
2400				231	490				240	496				9	6
2550				239	501				245	505				6	4
2700					512					515					3

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: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

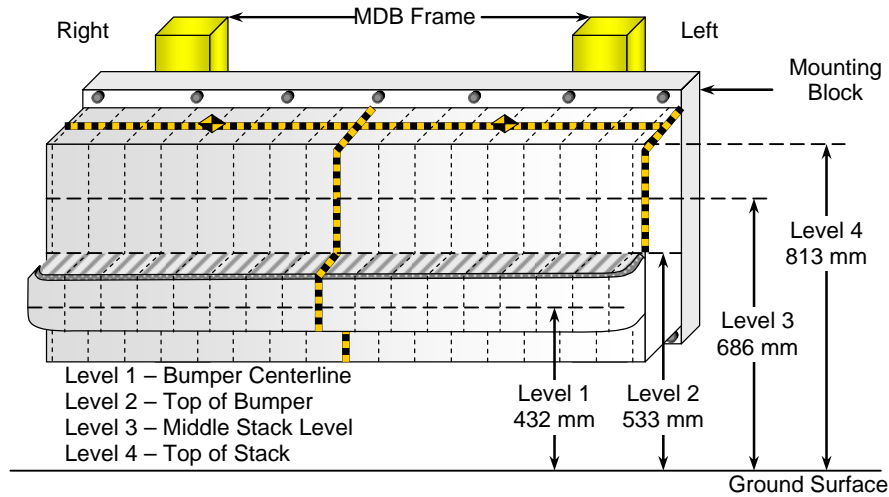
NHTSA No. MD0505  
 Test Date: 10/09/2012



**DATA SHEET NO. 12**  
**MDB EXTERIOR STATIC CRUSH MEASUREMENTS**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012



**FRONT VIEW**

**DEFORMABLE BARRIER STATIC CRUSH**

Stack Level	Distance Right of Center (mm)								C <sub>L</sub>	Distance Left of Center (mm)							
	800	700	600	500	400	300	200	100		0	100	200	300	400	500	600	700
4	79	57	43	43	60	85	96	68	59	64	73	74	83	93	112	140	199
3	69	65	31	30	35	50	70	60	59	60	60	62	64	73	89	105	150
2	103	102	108	108	104	103	105	98	100	109	115	119	122	122	125	131	150
1	197	202	202	208	211	212	212	210	205	206	211	212	211	211	216	221	218

**DATA SHEET NO. 13**  
**FMVSS NO. 301 STATIC ROLLOVER RESULTS**

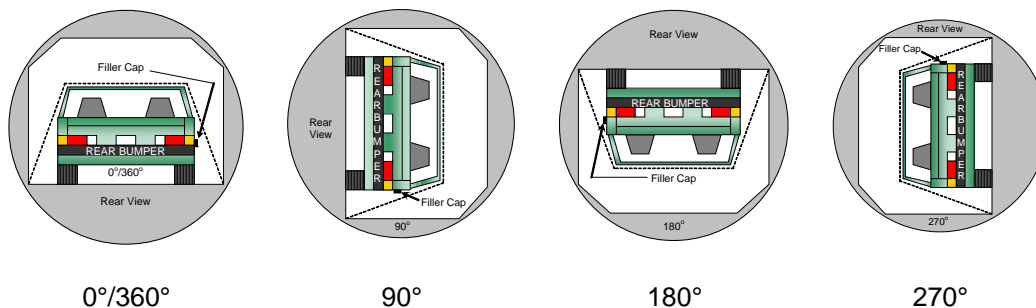
Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012

Test Time: 4:07 pm      Temperature: 21.7° 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**



**ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS**

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	112	300	412
90° to 180°	111	300	411
180° to 270°	108	300	408
270° to 360°	110	300	410

**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

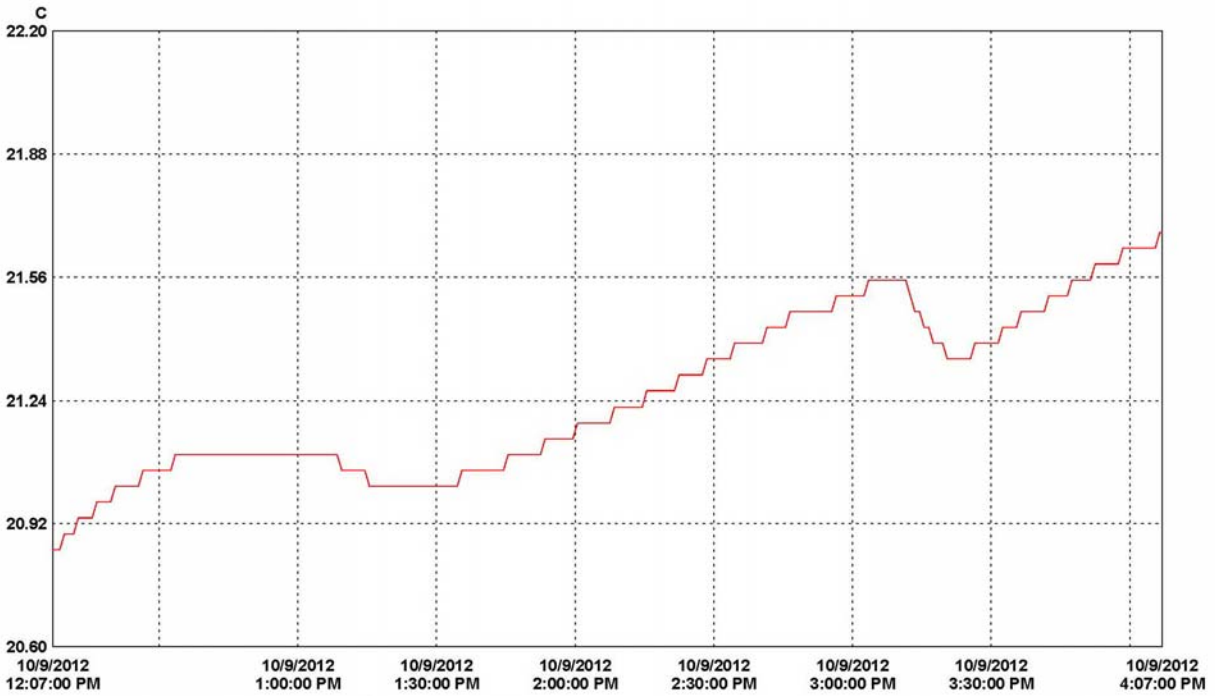
**ROLLOVER SOLVENT SPILLAGE LOCATION TABLE**

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

**DATA SHEET NO. 14**  
**DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA**

Test Vehicle: 2013 Hyundai Santa Fe Sport SUV  
 Test Program: NCAP Side MDB Impact Test

NHTSA No. MD0505  
 Test Date: 10/09/2012



30 minutes/div 4 hours (M/d/yyyy h:mm:ss tt) Central Time Graph file (truncated): Santa Fe Sport MDB 10-9-12.spg

LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	12032257	LoggerID	1		21.68	21.25	20.85	C	Temperature	12032257_LoggerID.spl

**APPENDIX A**  
**PHOTOGRAPHS**

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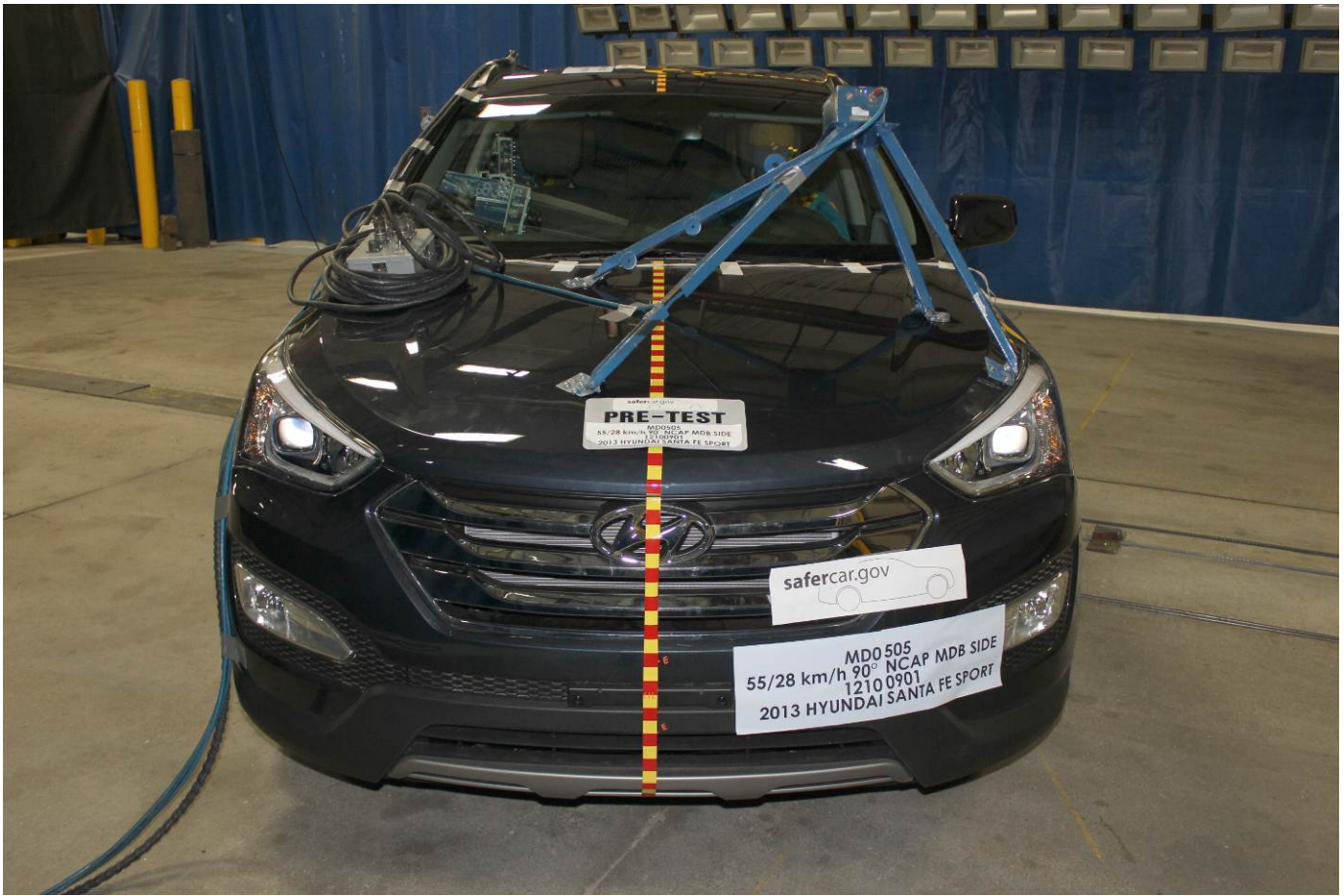
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As Delivered Right Front Three-Quarter View of Test Vehicle



As Delivered Left Rear Three-Quarter View of Test Vehicle



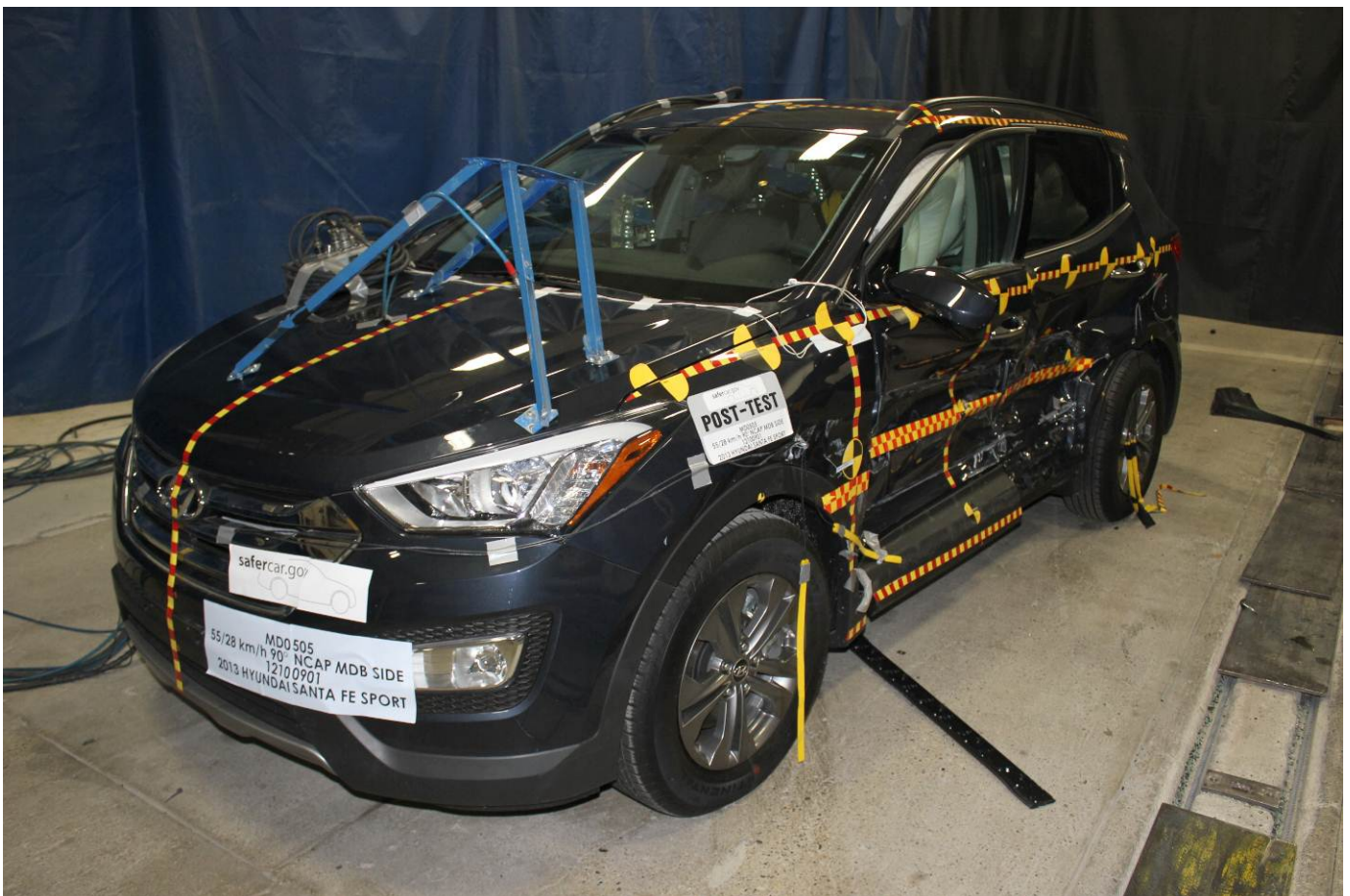
Pre-Test Frontal View of Test Vehicle



Post-Test Frontal View of Test Vehicle



Pre-Test Left 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



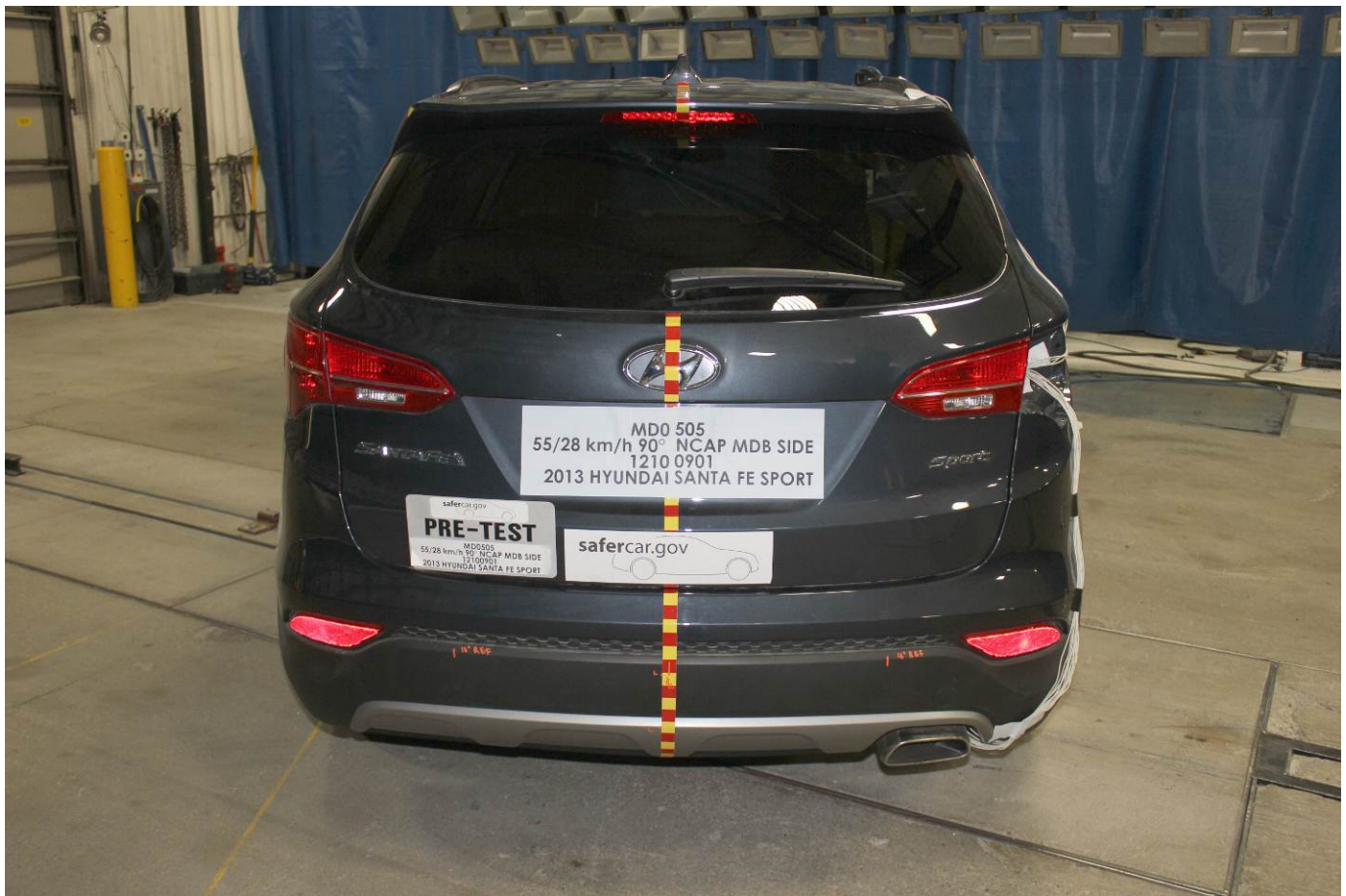
Post-Test Left Side View of Test Vehicle



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



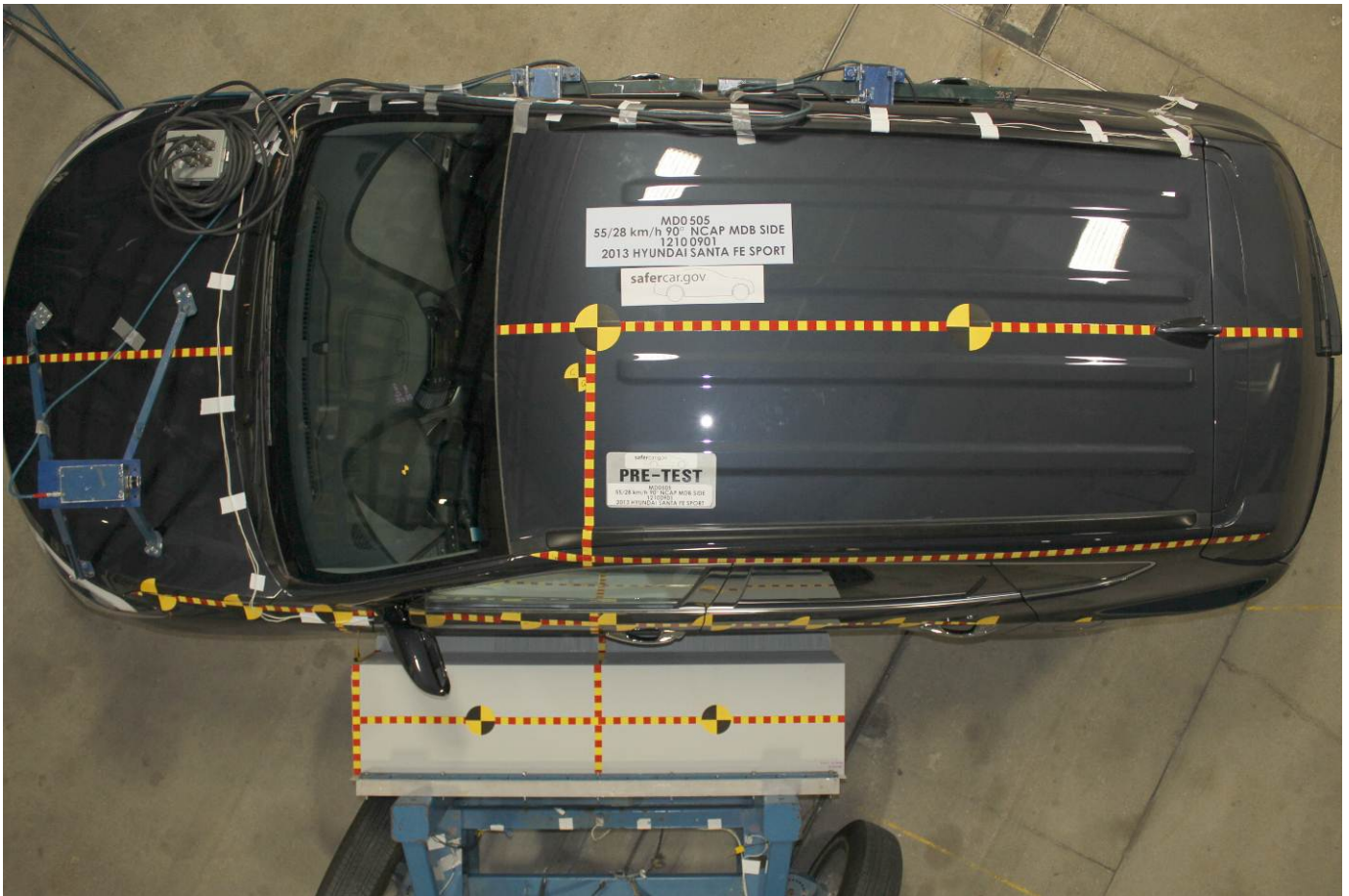
Post-Test Rear View of Test Vehicle



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



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



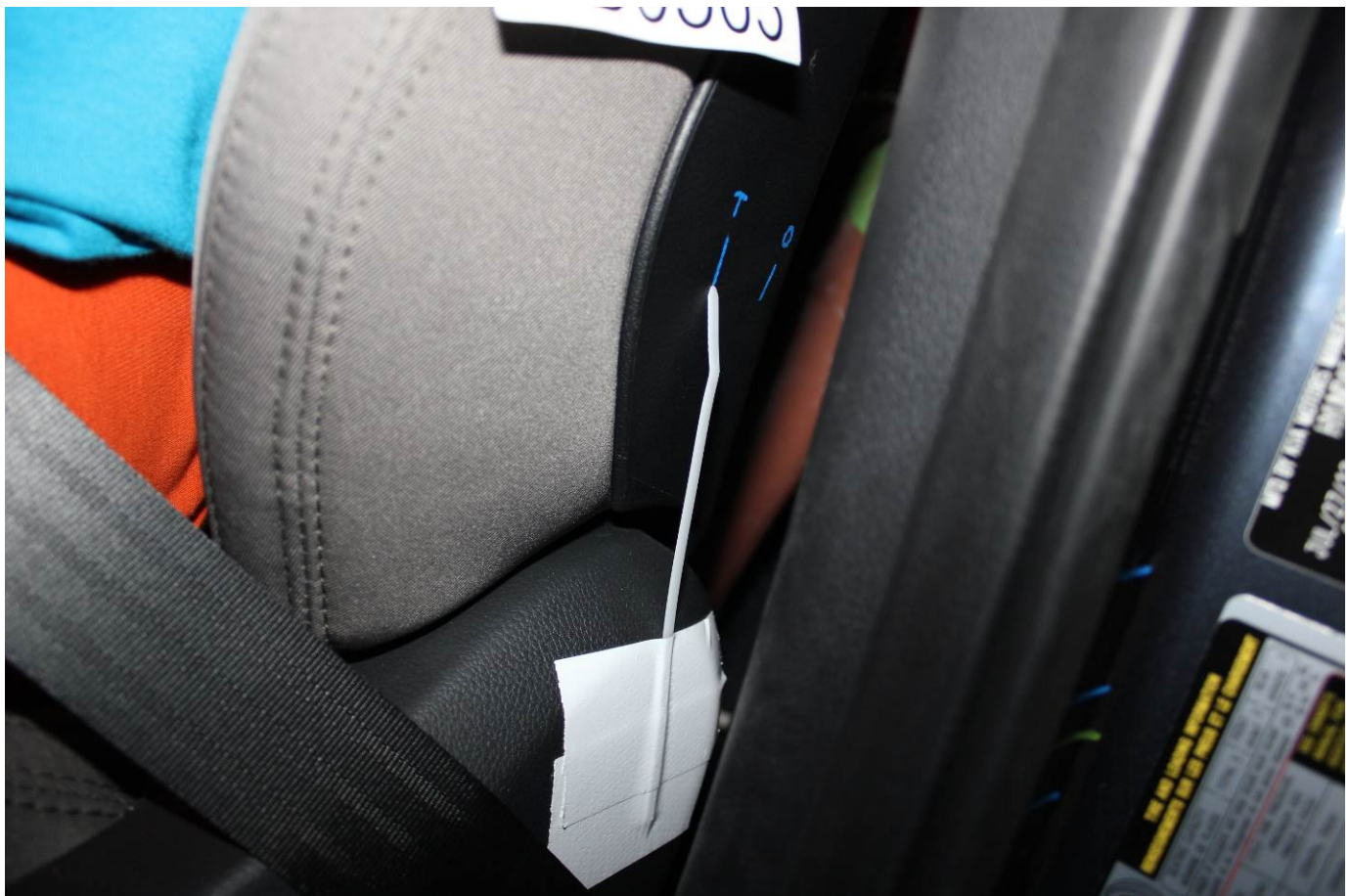
Pre-Test View of Disengaged Parking Brake



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 Vehicle Interior 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

**PHOTOGRAPH NOT APPLICABLE**

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



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



Post-Test Driver Dummy Close-up Knee Contact 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



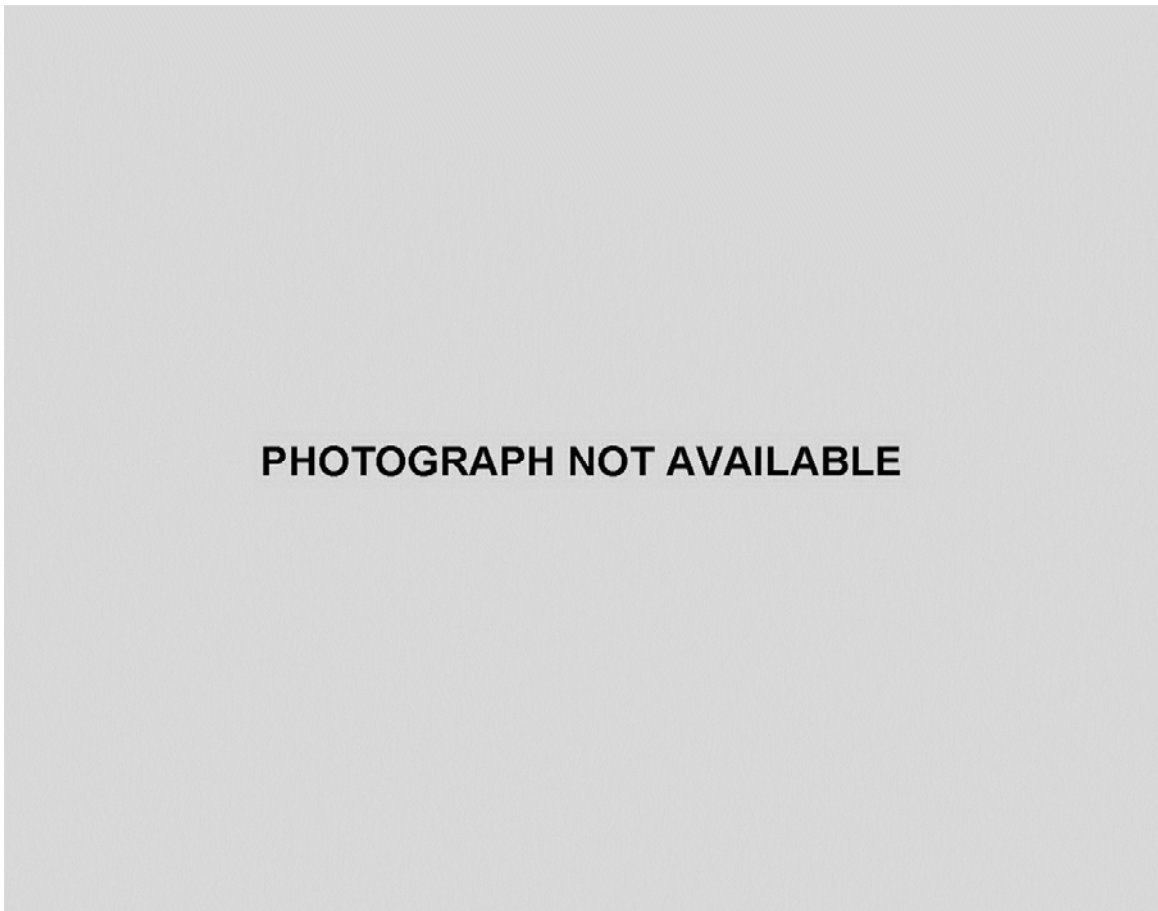
Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning



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



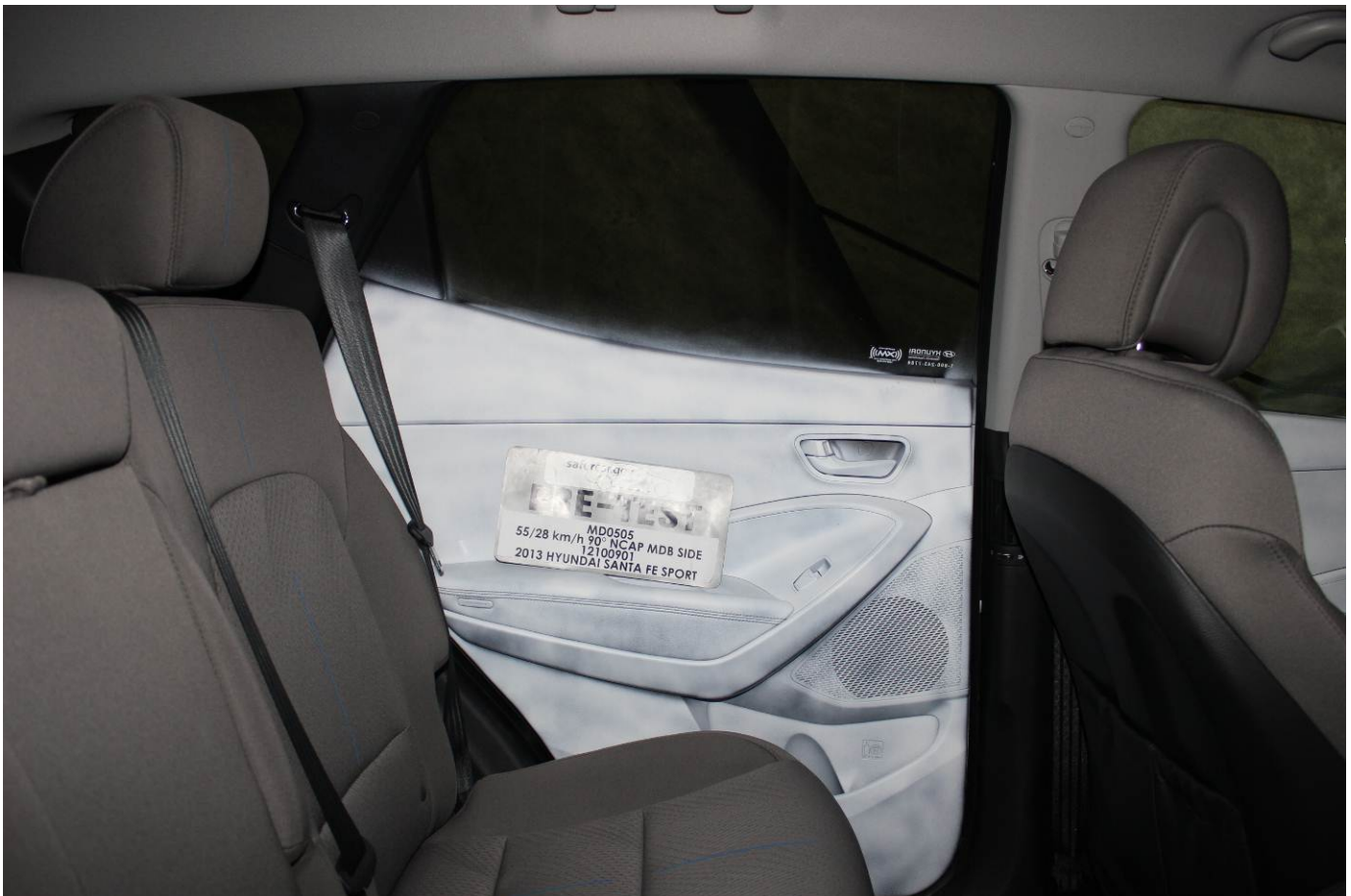
Post-Test Rear Passenger Dummy and Door Clearance View



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



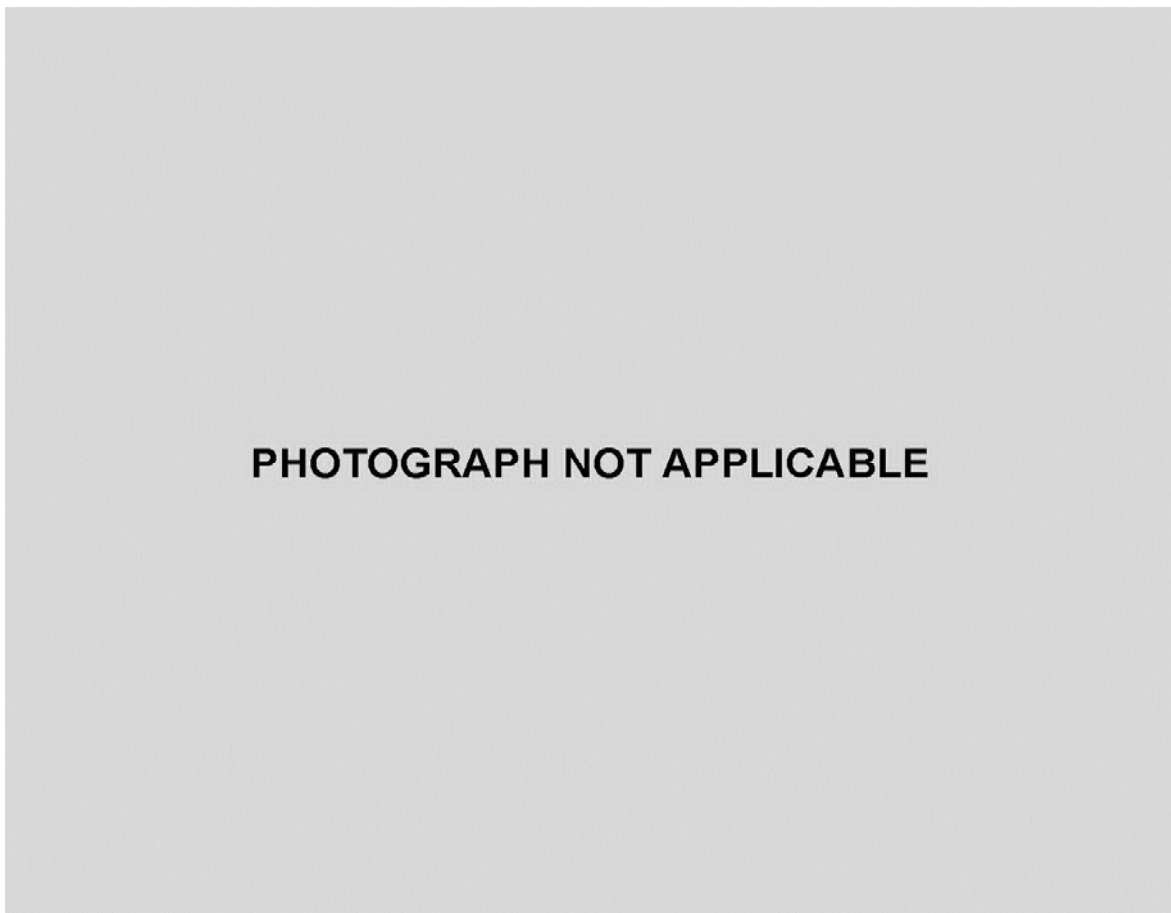
Post-Test Rear Passenger Dummy Close-up Head Contact with Vehicle Interior View



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



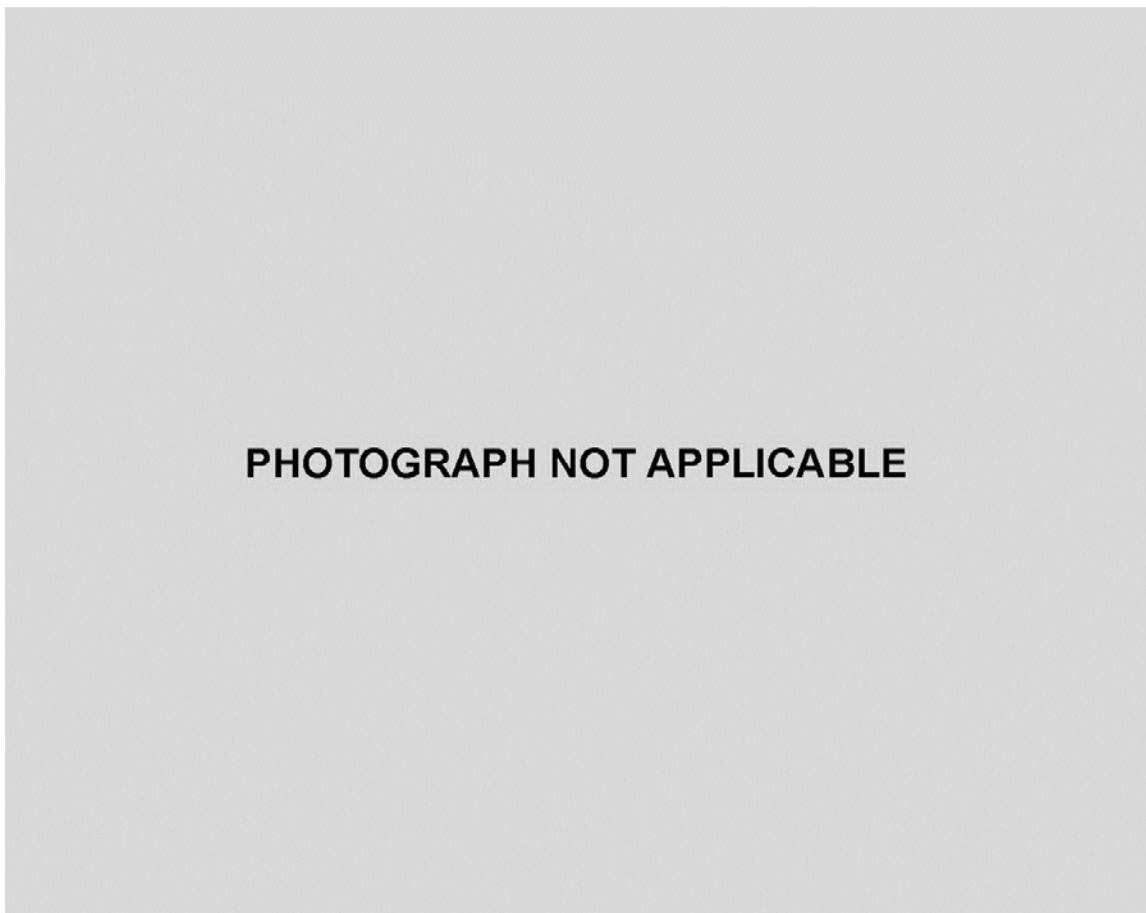
Post-Test Rear Passenger Dummy Close-up Torso Contact with Vehicle Interior View



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



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

PHOTOGRAPH NOT APPLICABLE

Post-Test Rear Passenger Dummy Close-up Knee Contact View



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



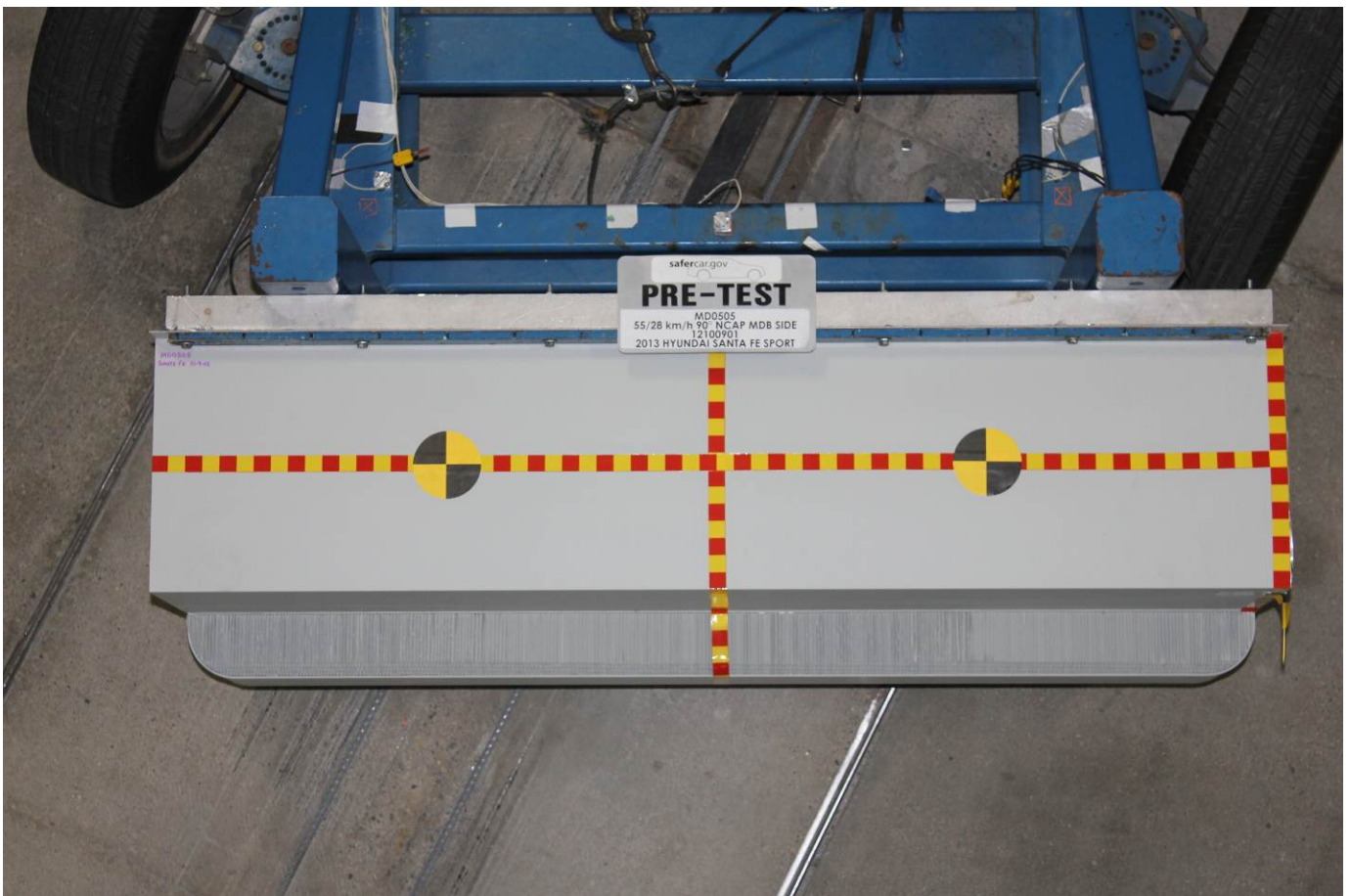
Post-Test View of Fuel Filler Cap or Fuel Filler Neck



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



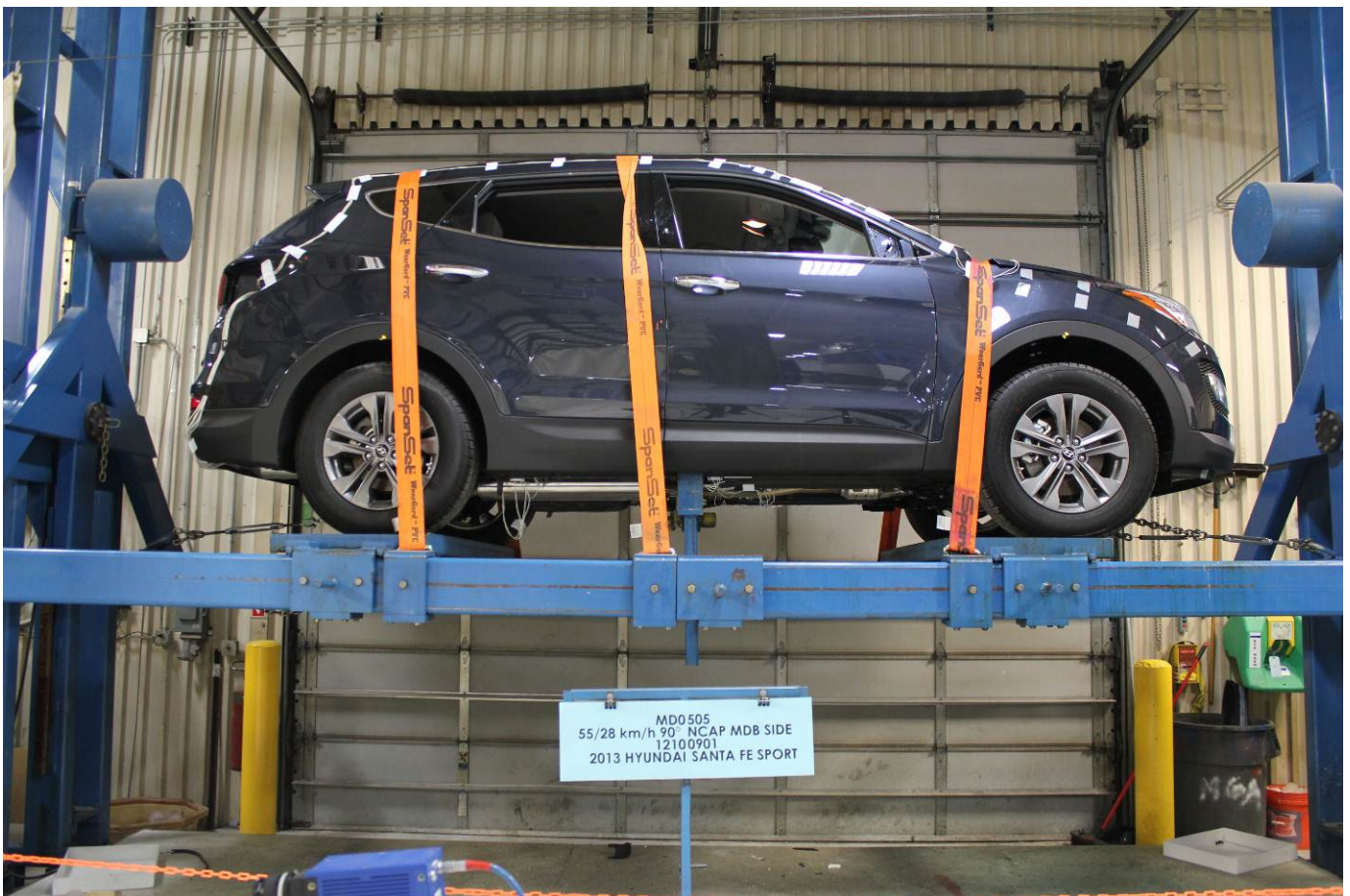
FMVSS No. 301 Static Rollover 90 Degrees



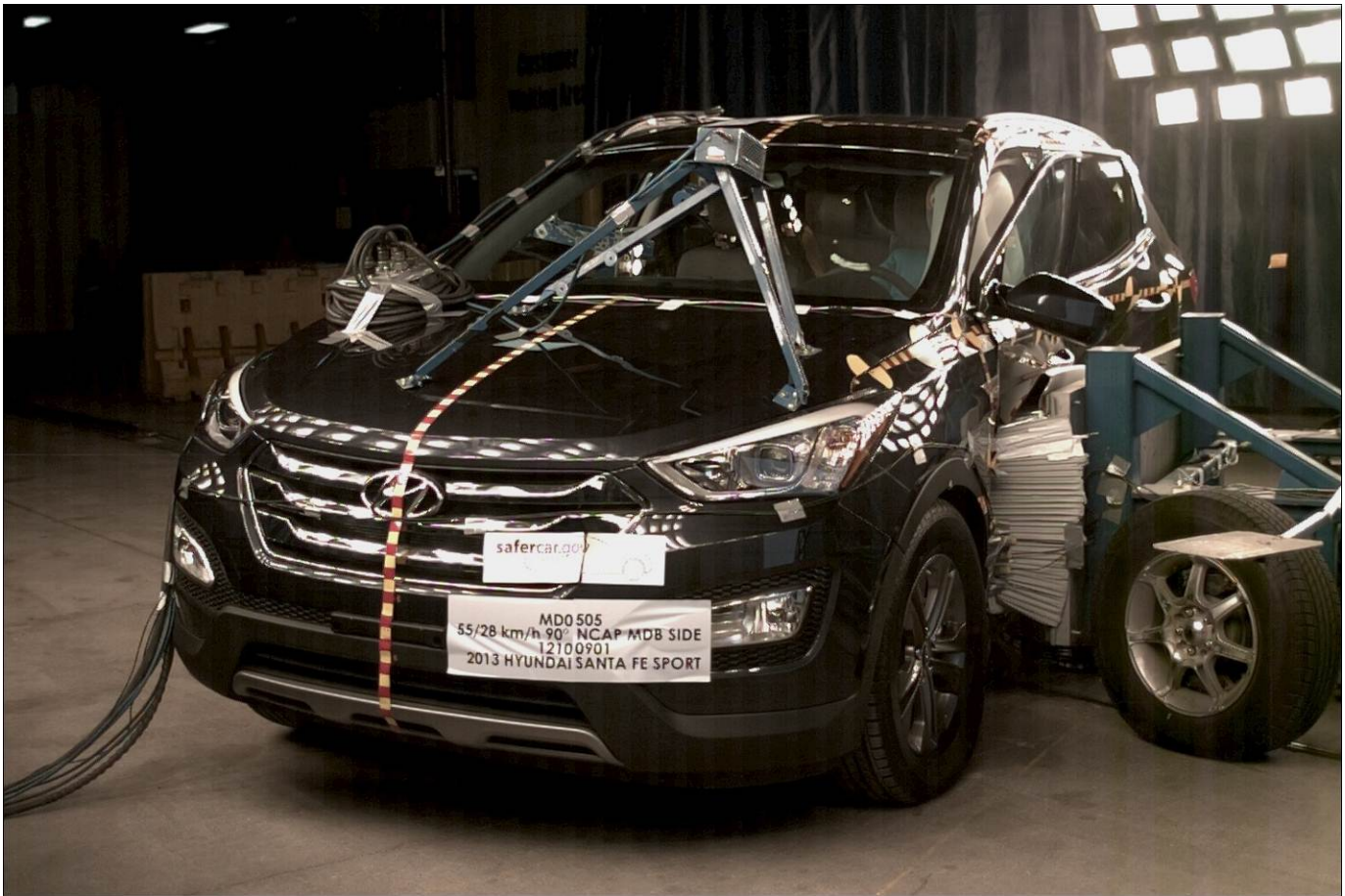
FMVSS No. 301 Static Rollover 180 Degrees



FMVSS No. 301 Static Rollover 270 Degrees



FMVSS No. 301 Static Rollover 360 Degrees



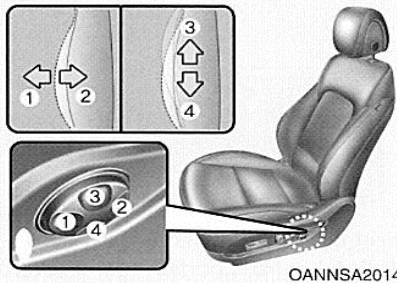
Impact Event

45 miles

<b>HYUNDAI 2013 SANTA FE SPORT FWD 2.4</b>		Highly capable CUV offering flexible space, premium interior amenities and advanced safety.		
<b>SOLD TO: WI014</b> BOUCHER HYUNDAI 1563 EAST MORELAND BOULEVARD WAUKESHA WI 53186  <b>SHIPPED TO: WI014</b>	<b>VIN:</b> 5XYZU3LB5DG003227 <b>MODEL:</b> 63402F45 <b>ENGINE:</b> G4KJCK640351 <b>PORT OF ENTRY:</b> WP <b>EXTERIOR COLOR:</b> MARLIN BLUE <b>INTERIOR/SEAT COLOR:</b> GRAY(VFG)/GRAY(VFG) <b>MODE OF TRANSPORT:</b> TRUCK <b>ACCESSORY WEIGHT:</b> 10 lbs. <b>EMISSIONS:</b> This vehicle is certified to meet emission requirements in all 50 states.	<b>STANDARD FEATURES:</b> <b>AMERICA'S BEST WARRANTY</b> *5-year/60,000-mile New Vehicle Warranty* *10-year/100,000-mile Powertrain Warranty* *7-year/Unlimited-mile Anti-perforation Warranty* *5-year/Unlimited-mile Roadside Assistance* *Limited warranties, see dealer for details* <b>ADVANCED SAFETY TECHNOLOGY</b> *Vehicle Stability Management (VSM) *Electronic Stability Control (ESC) w/ Traction Control *ABS w/ Electronic Brake-Force Distribution & Brake Assist *Downhill Brake Control & Hillstart Assist Control *Front Driver's Knee, Front Side Impact & Curtain Airbags *Tire Pressure Monitoring System (TPMS) *Front Seatbelt Pre-Tensioners <b>POWERTRAIN TECHNOLOGY</b> *2.4L Gasoline Direct Injection (GDI) 4-Cylinder Engine *190 Horsepower@6,300 rpm / 181 lb-ft Torque@4,250 rpm *6-Speed Automatic Transmission w/ SHIFTRONIC® *Active ECO System <b>COMFORT &amp; CONVENIENCE</b> *17-inch Alloy Wheels & P235/65R17 Tires *LED Headlight Accents *Bodycolor Rear Spoiler w/ LED Brake Lights *Rear Window Wiper *Remote Keyless Entry System w/ Alarm *YES Essentials® Stain-resistant Cloth Seats *40/20/40 Split-Folding Rear Seats *Air Conditioning w/ Cabin Air Filter & 2nd Row Vents *Power Windows w/ Driver's Auto Down/Up *Sun visors w/ Illuminated Vanity Mirrors & Extensions *Tilt-and-Telescopic Steering Wheel *Driver Selectable Steering Modes (DSSM) *Steering Wheel-Mounted Cruise, Audio & Phone Controls *AM/FM/SiriusXM®/CD/MP3 w/ iPod®/USB/Aux Input Jacks *SiriusXM® w/ 90 Day Trial; Not Available in AK & HI *Bluetooth® Hands-Free Phone System *Multi-Function Trip Computer *Hyundai Blue Link® Telematics System (90-Day Free Trial) Full Tank of Gas	<b>Manufacturer's Suggested Retail Price:</b> \$24,450.00 <b>ADDED FEATURES:</b> *Popular Equipment Package: \$950.00 Roof Side Rails Front Fog Lights Automatic Headlight Control Heated Exterior Mirrors Power Driver Seat w/ Lumbar Support Heated Front Seats Leather-Wrapped Steering Wheel & Shift Knob Carpeted Floor Mats \$100.00	
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.		
<b>PART CONTENT INFORMATION</b> FOR VEHICLES IN THIS CARLINE: U.S./CANADIAN PARTS CONTENT: 47 % MAJOR SOURCES OF FOREIGN PARTS CONTENT: Korea 53 %  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: U.S.A. TRANSMISSION: U.S.A.				
<b>EPA DOT Fuel Economy and Environment</b> Gasoline Vehicle <b>Fuel Economy</b> 		<b>GOVERNMENT 5-STAR SAFETY RATINGS</b> This vehicle has not been rated by the government for overall vehicle score, frontal crash, side crash or rollover risk.  Source: National Highway Traffic Safety Administration (NHTSA). <a href="http://www.safercar.gov">www.safercar.gov</a> or 1-888-327-4236		
<b>Annual fuel cost \$2,050</b> <b>Fuel Economy &amp; Greenhouse Gas Rating</b> (tailpipe only) Smog Rating (tailpipe only) 		<b>Environmental Performance</b> Protect the Environment, choose vehicles with higher scores: <b>Global Warming Score 7</b> <b>Smog Score 5</b> 		
Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 21 MPG and costs \$11,600 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.55 per gallon. MPG is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog. <a href="http://fuelconomy.gov">fuelconomy.gov</a> Calculate personalized estimates and compare vehicles.				

Monroney Label

**Lumbar support**  
(for driver's seat, if equipped)



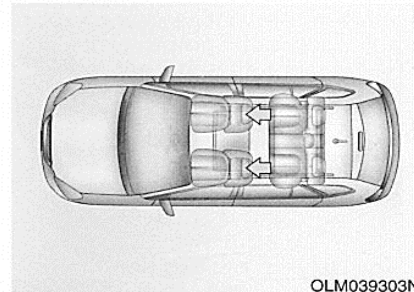
OANNSA2014

The lumbar support can be adjusted by pressing the switch.

1. Press the front portion (1) of the switch to increase support, or the rear portion (2) of the switch, to decrease support.
2. Release the switch once it reaches the desired position.

3. Press the upper portion (3) of the switch to move the support position up, or press the lower portion (4) of the switch, to move the support position down.
4. Release the switch once it reaches the desired position.

**Headrest**



OLM039303N

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 - Headrest adjustment**

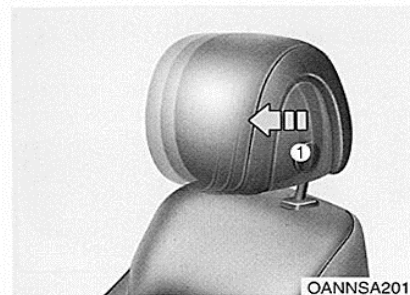
- For maximum effectiveness in case of an accident, the headrest should be adjusted so the middle of the headrest is at the same height as the center of gravity of an occupant's head. Generally, the center of gravity of most people's head is similar with the height of the top of their eyes.

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.

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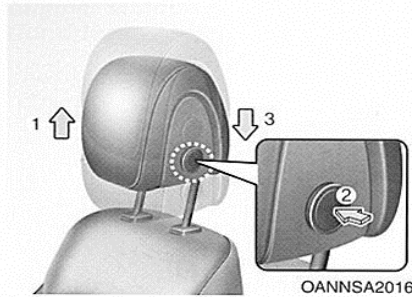
- Do not operate the vehicle with the headrests removed. Severe injury to an occupant may occur in the event of an accident. Headrests may provide protection against severe neck injuries when properly adjusted.
- Do not adjust the headrest position of the driver's seat while the vehicle is in motion.



OANNSA2015

**Forward and backward adjustment**

The headrest may be adjusted forward to 4 different positions by pulling the headrest forward to the desired detent. To adjust the headrest to backwards position, press and hold the release button (1), and adjust position of the headrest. Adjust the headrest so that it properly supports the head and neck.



**Adjusting the height up and down**

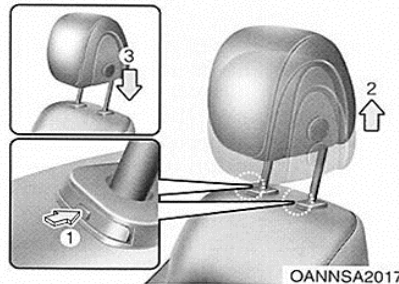
To raise the headrest :

1. Pull it up to the desired position (1).

To lower the headrest :

1. Push and hold the release button (2) on the headrest support
2. Lower the headrest to the desired position (3).

OANNSA2016



**Removal and installation**

To remove the headrest :

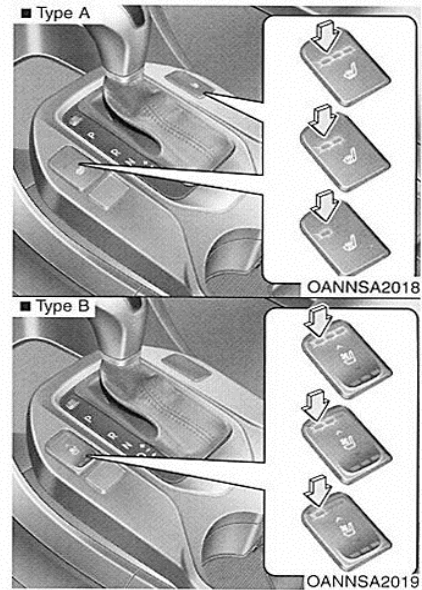
1. Raise it as far as it can go then press the release button with the slim tool (1) while pulling the headrest up (2).

To reinstall the headrest :

1. Put the headrest poles (3) into the holes.
2. Adjust it to the appropriate height.

OANNSA2017

**Seat warmer (if equipped)**



The seat warmer is provided to warm the front seats during cold weather.

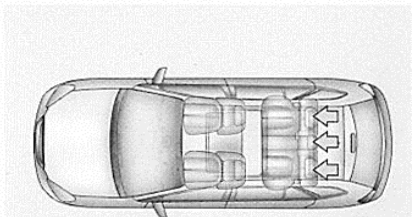
OANNSA2018

OANNSA2019

3:10

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

**Headrest (for rear seat)**



OLM039304N

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 to protect the head and neck in the event of a collision.

**⚠ WARNING - Headrest adjustment**



- 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.

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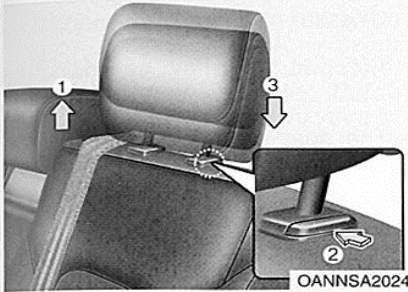
- Do not operate the vehicle with the headrests removed. Severe injury to an occupant may occur in the event of an accident. Headrests may provide protection against severe neck injuries when properly adjusted.
- Do not adjust the headrest height while the vehicle is in motion.

3:14

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

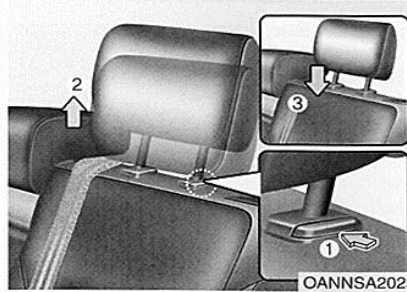
*Adjusting the height up and down*

*Removal and installation*



To raise the headrest :  
1. Pull it up to the desired position (1).

To lower the headrest :  
1. Push and hold the release button (2) on the headrest support  
2. Lower the headrest to the desired position (3).



To remove the headrest :  
1. Raise it as far as it can go then press the release button (1) while pulling the headrest up (2).

To reinstall the headrest :  
1. Put the headrest poles (3) into the holes while pressing the release button (1).  
2. Adjust it to the appropriate height.

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

**APPENDIX B**  
**DUMMY RESPONSE DATA PLOTS**

**TABLE OF DATA PLOTS**  
**Driver Dummy Instrumentation Plots**

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Figure No. 2.	Driver 9 Axis Head CG Acceleration (Y) vs. Time	B-1
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Figure No. 9.	Driver Anterior Abdomen Force (Y) vs. Time	B-3
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Figure No. 18.	Passenger Lower Spine T12 Acceleration (X) vs. Time	B-6
Figure No. 19.	Passenger Lower Spine T12 Acceleration (Y) vs. Time	B-6
Figure No. 20.	Passenger Lower Spine T12 Acceleration (Z) vs. Time	B-6
Figure No. 21.	Passenger Lower Spine T12 Resultant Acceleration vs. Time	B-6
Figure No. 22.	Passenger Iliac Force on Impact Side (Y) vs. Time	B-7
Figure No. 23.	Passenger Acetabulum Force on Impact Side (Y) vs. Time	B-7
Figure No. 24.	Passenger Total Pelvic Force on Impact Side (Y) vs. Time	B-7

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](http://www.NHTSA.dot.gov)

**Additional Driver & Passenger Dummy Instrumentation Data**

Driver 9 Axis Head CG Redundant Acceleration (X) vs. Time

Driver 9 Axis Head CG Redundant Acceleration (Y) vs. Time

Driver 9 Axis Head CG Redundant Acceleration (Z) vs. Time

Driver 9 Axis Head X Arm Y

Driver 9 Axis Head X Arm Z

Driver 9 Axis Head Y Arm X

Driver 9 Axis Head Y Arm Z

Driver 9 Axis Head Z Arm X

Driver 9 Axis Head Z Arm Y

Driver Lower Spine T12 Acceleration (X)

Driver Lower Spine T12 Acceleration (Y)

Driver Lower Spine T12 Acceleration (Z)

Passenger Head Acceleration Redundant (X)

Passenger Head Acceleration Redundant (Y)

Passenger Head Acceleration Redundant (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)

### **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)

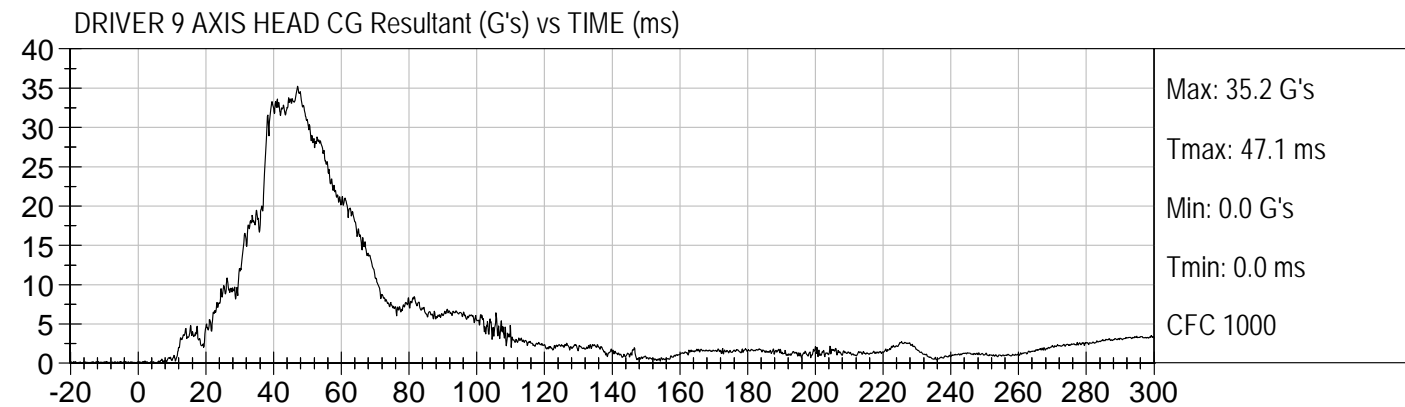
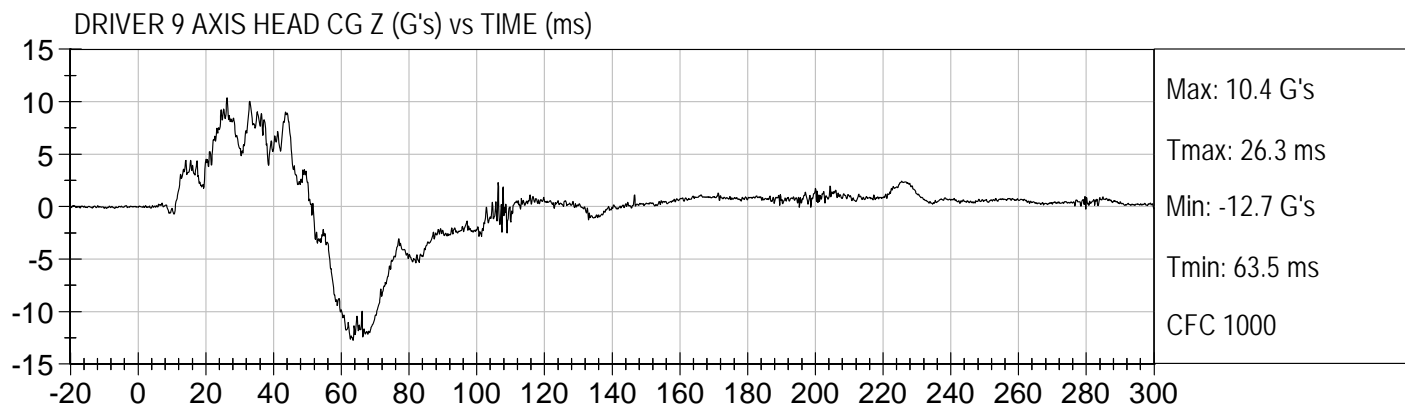
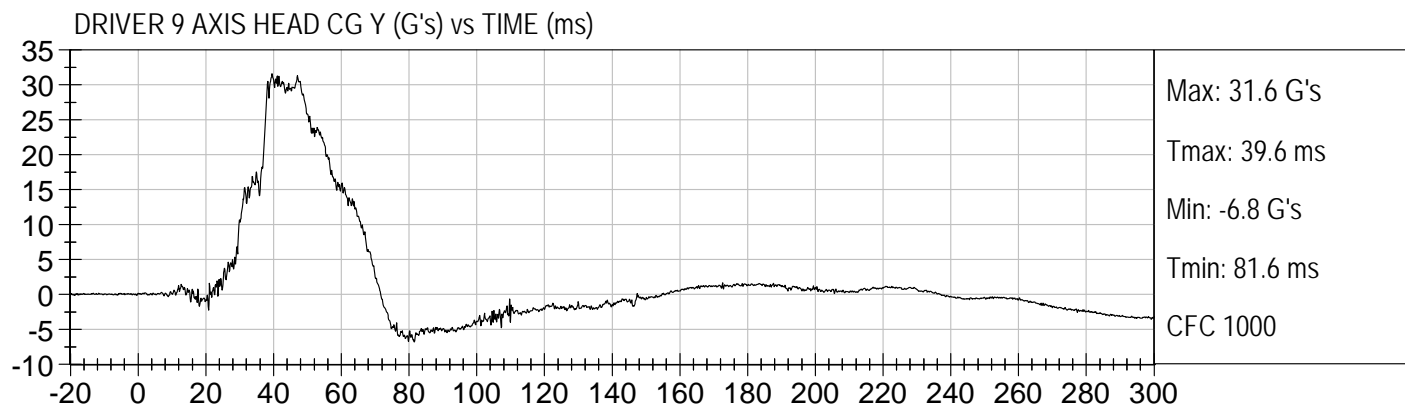
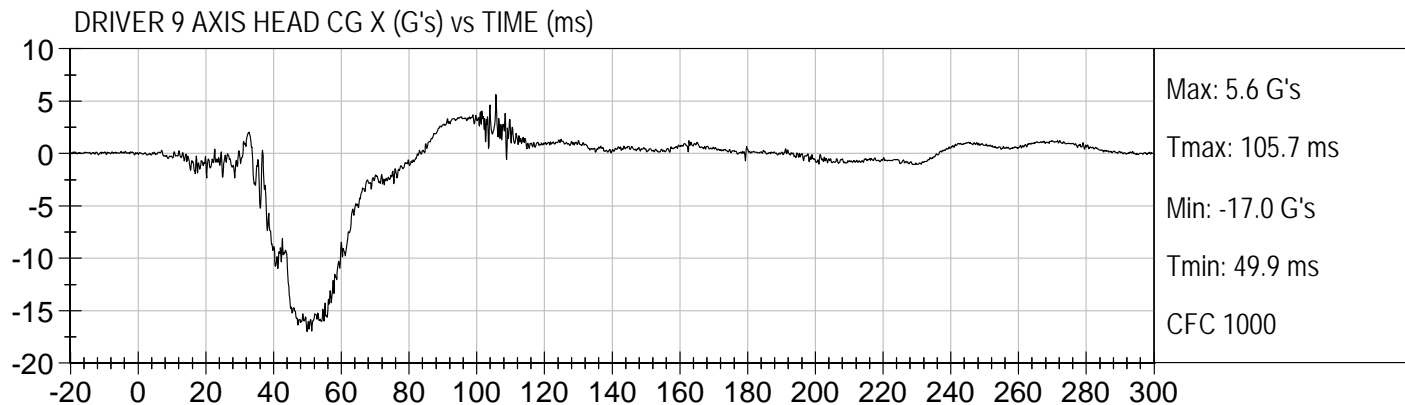
MDB Center of Gravity Acceleration (Z)

MDB Rear Acceleration (X)

MDB Rear Acceleration (Y)

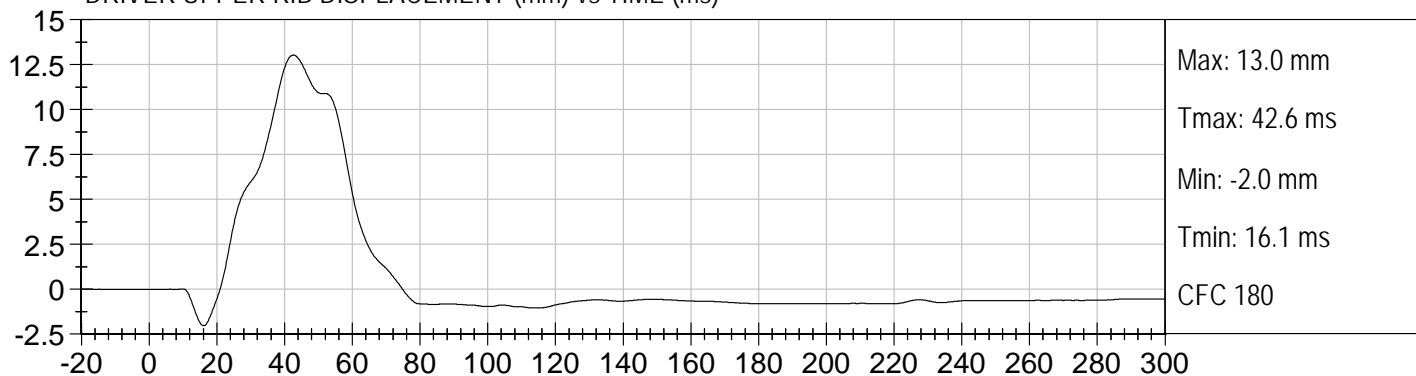
Left MDB Contact Switch

Right MDB Contact Switch

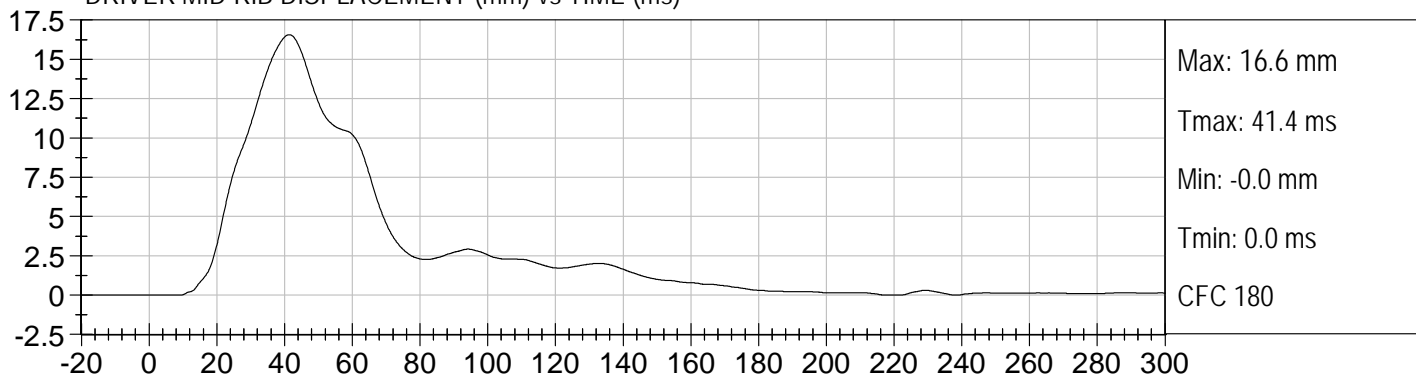




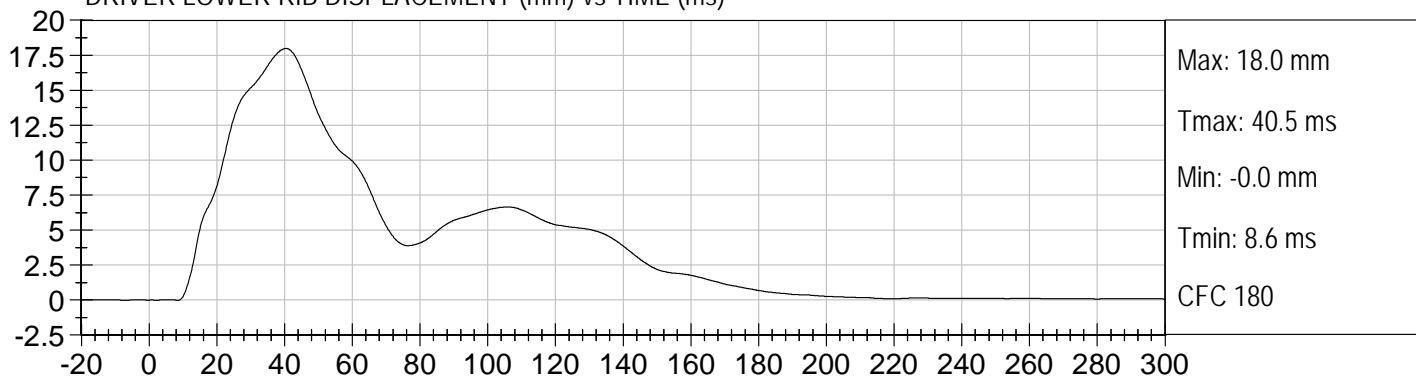
DRIVER UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



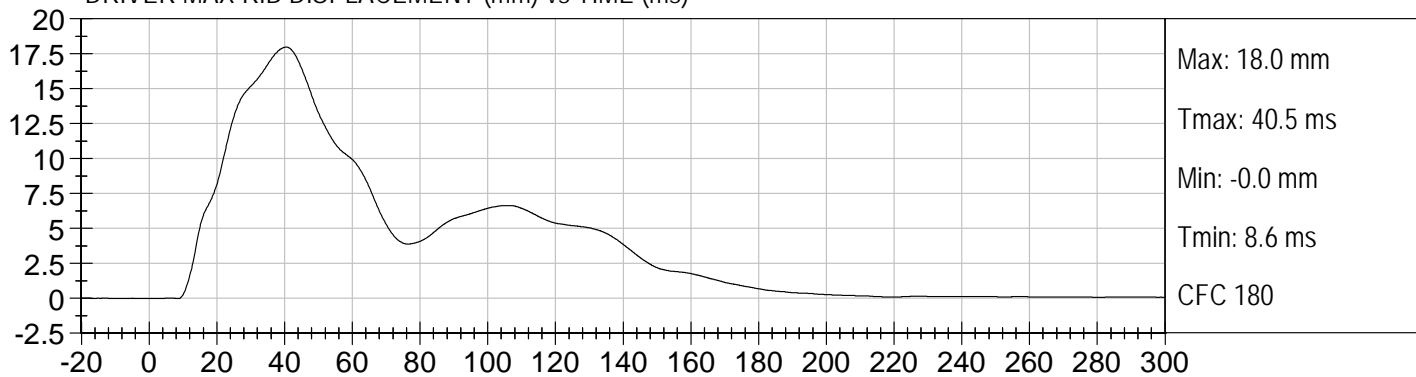
DRIVER MID RIB DISPLACEMENT (mm) vs TIME (ms)

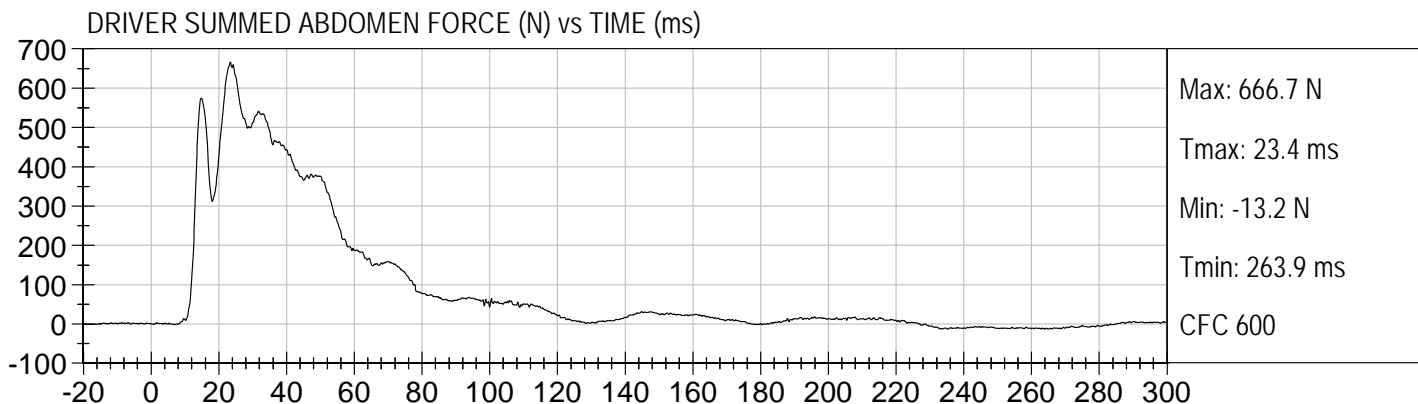
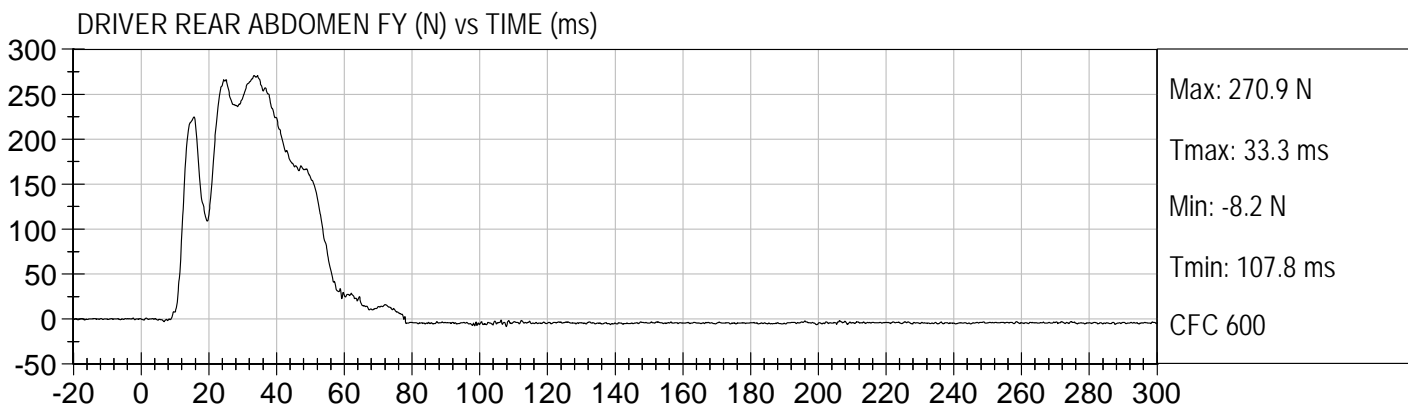
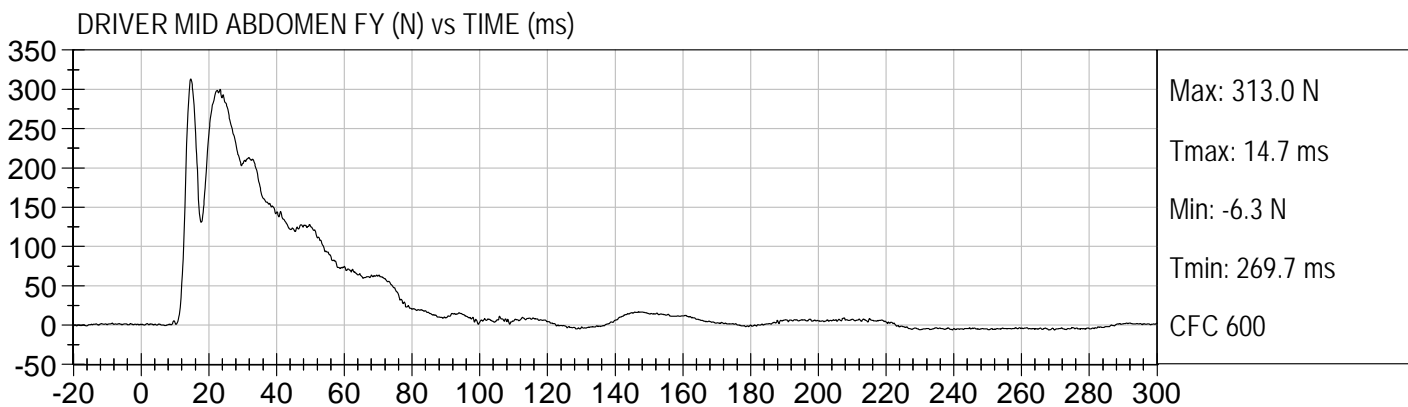
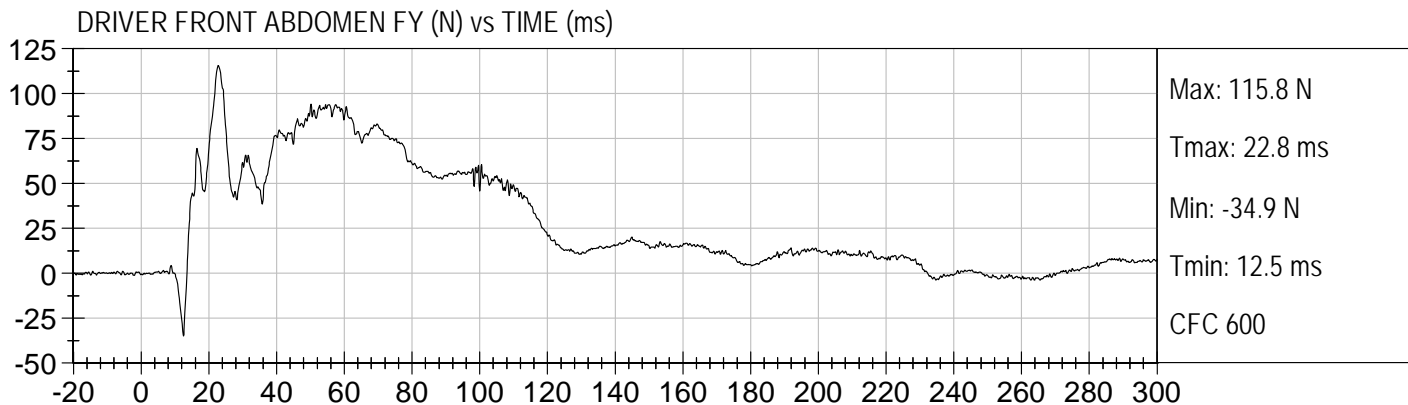


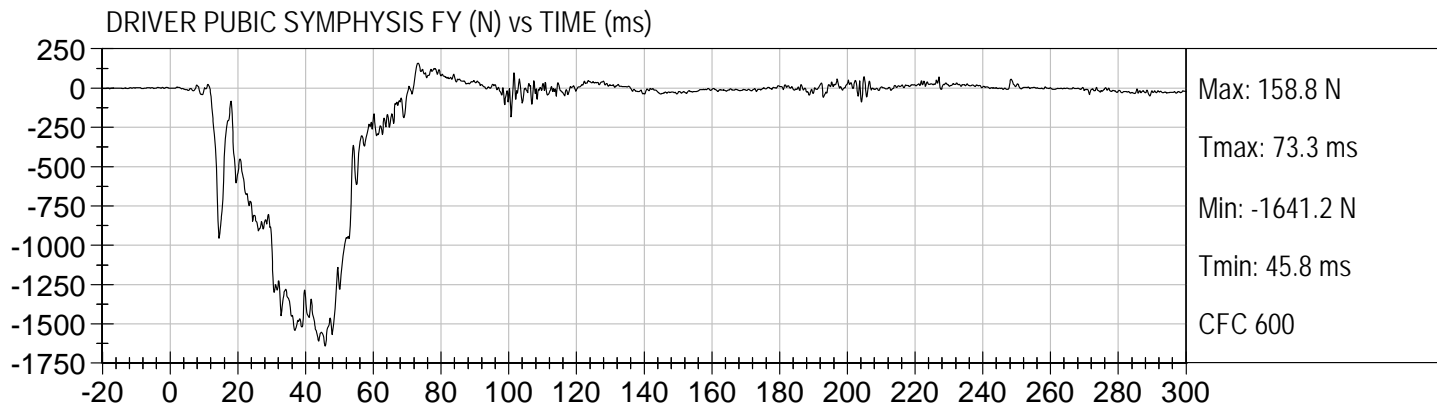
DRIVER LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

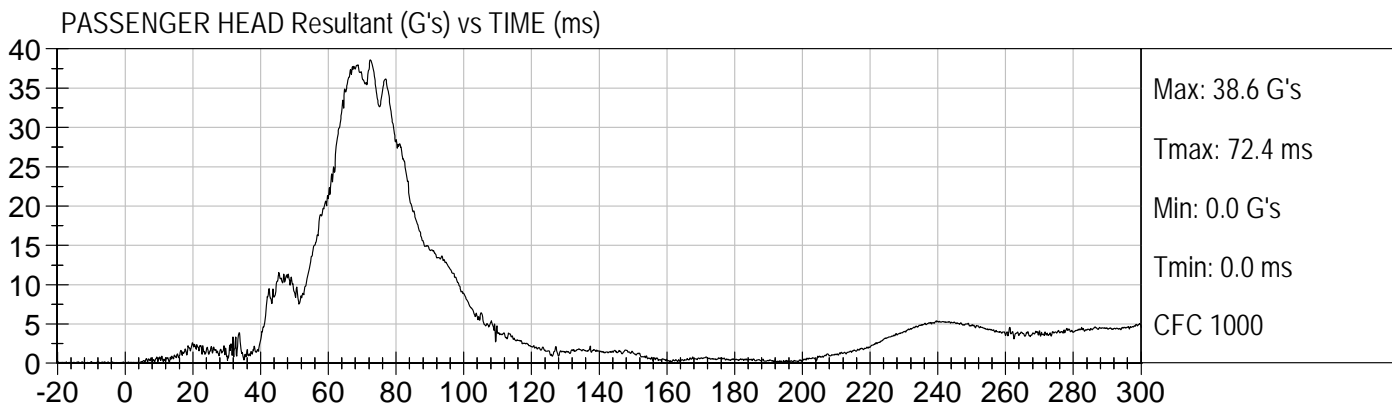
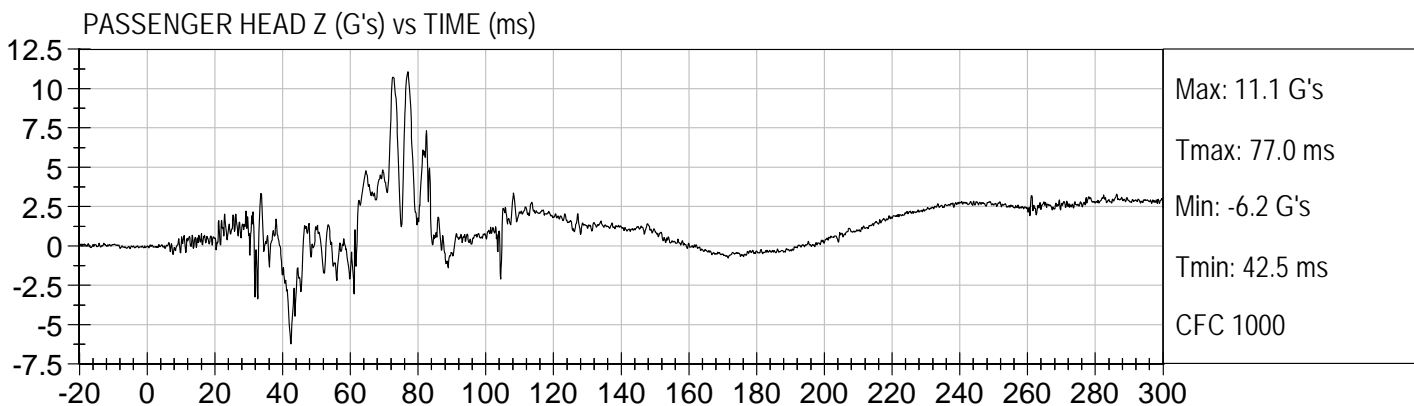
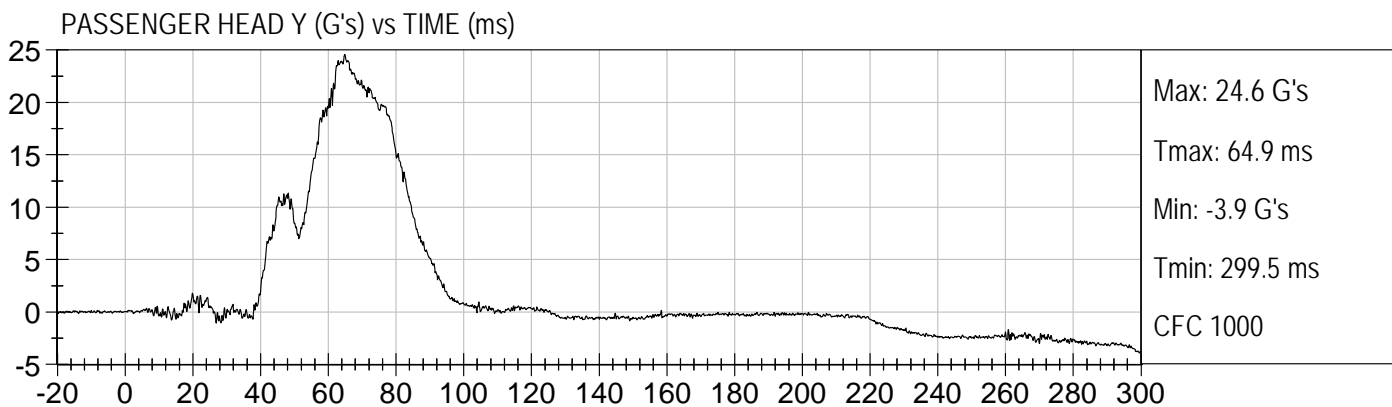
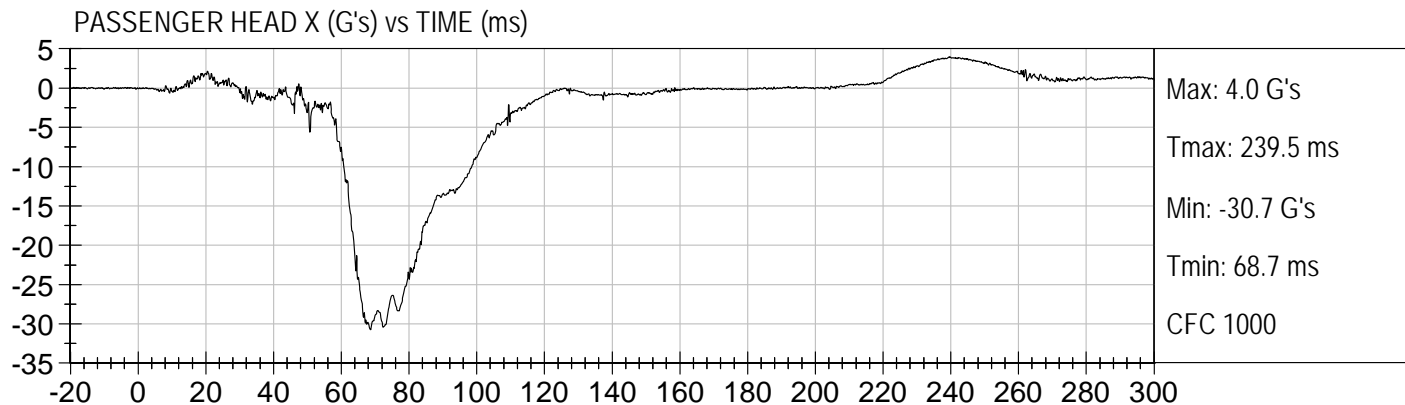


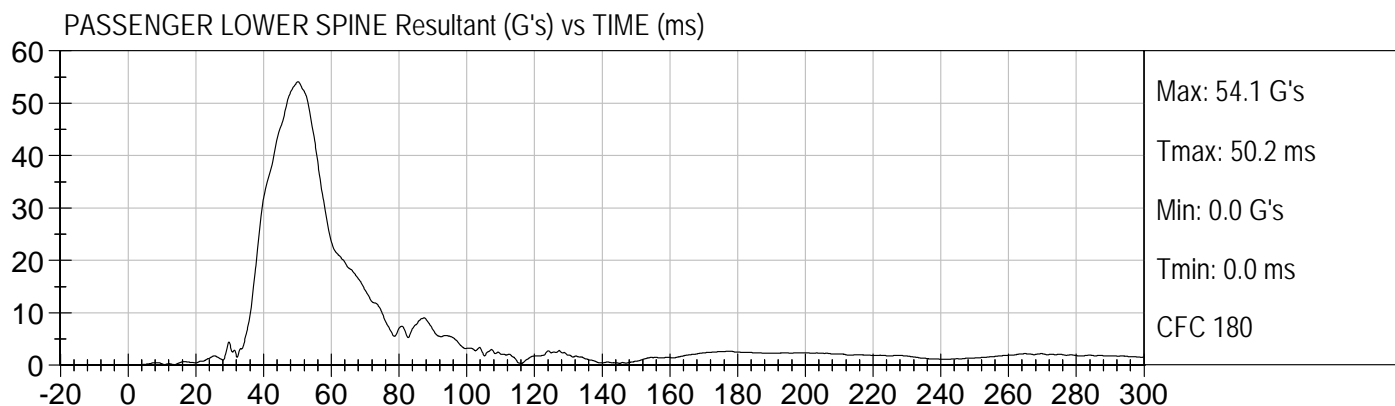
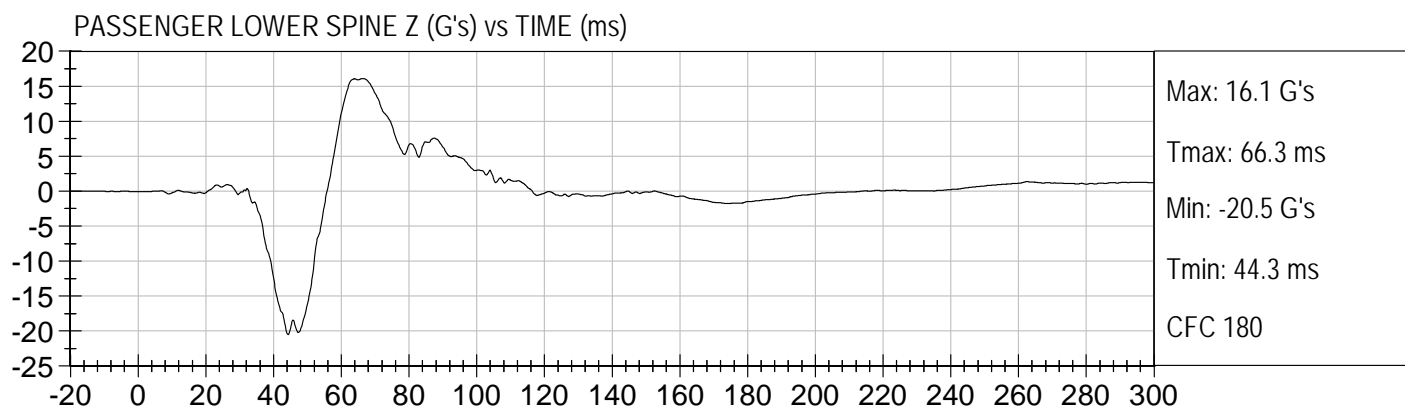
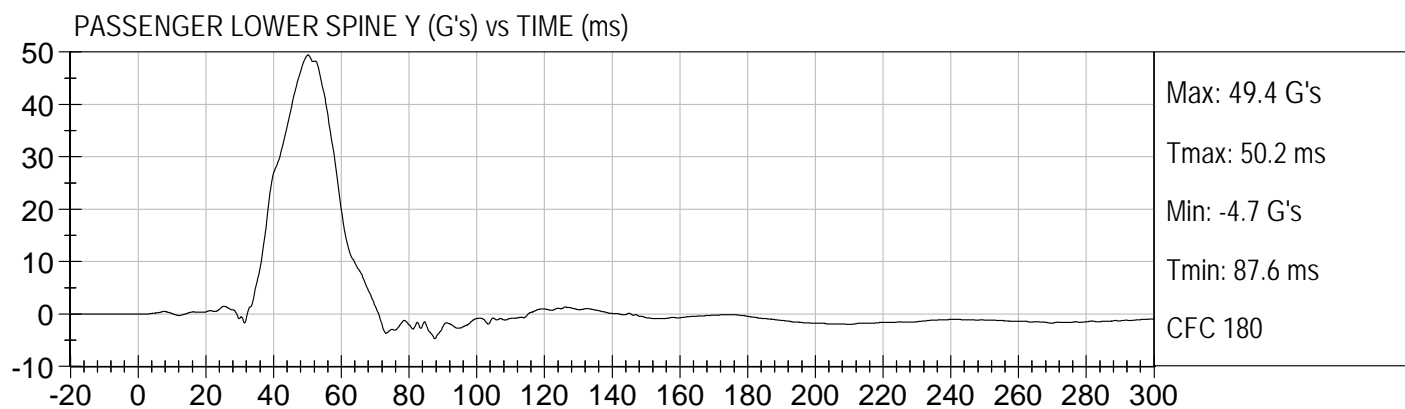
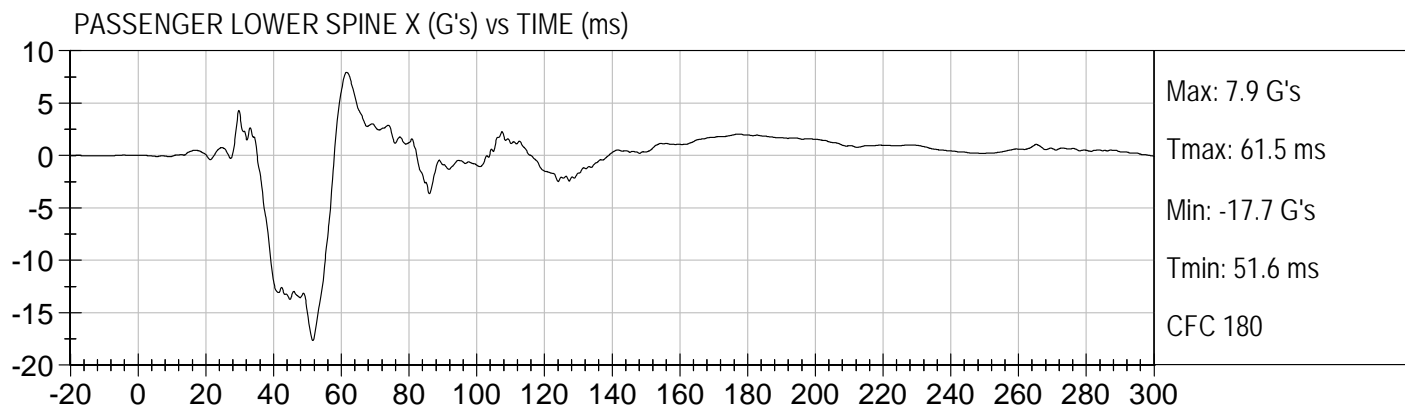
DRIVER MAX RIB DISPLACEMENT (mm) vs TIME (ms)

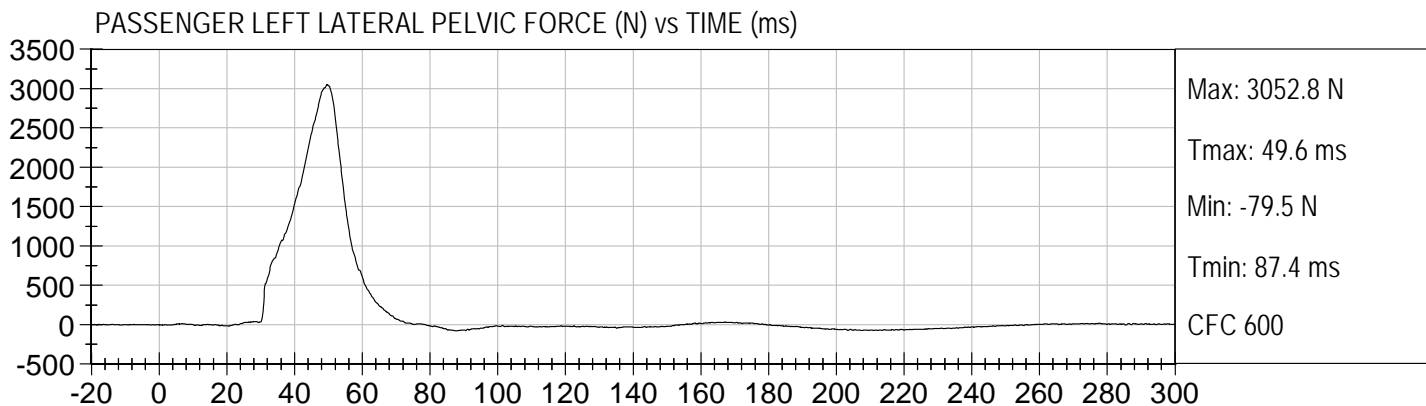
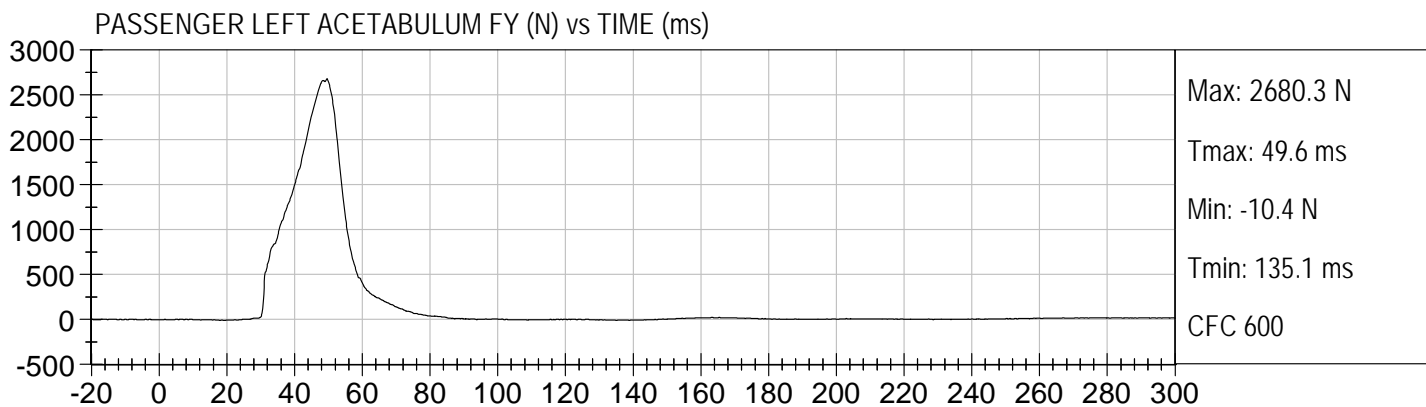
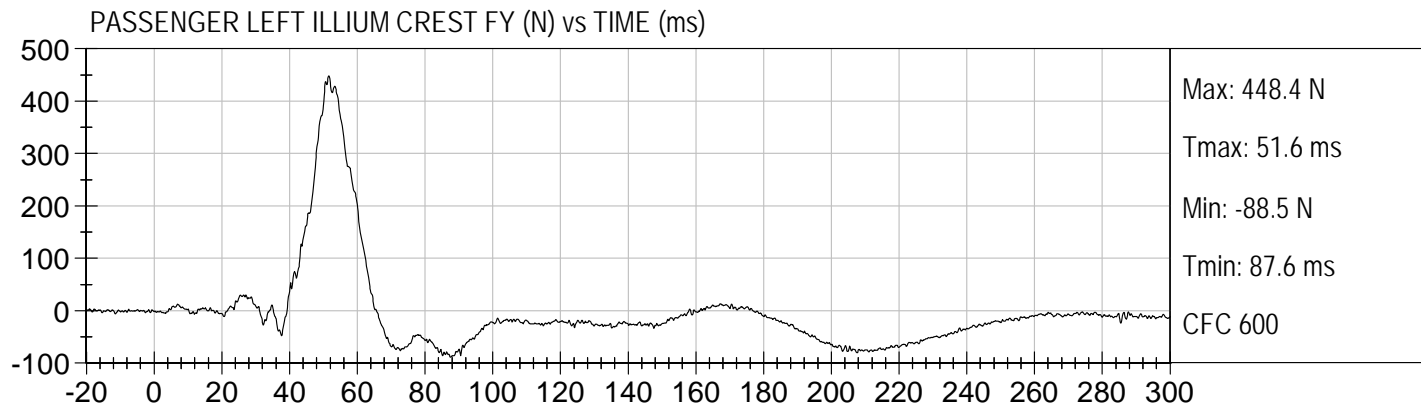












## **APPENDIX C**

### **DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA**

**ES-2re External Measurements**  
**SN: 032**

<b>No.</b>	<b>Name</b>	<b>Spec. (mm)</b>	<b>Result</b>	<b>Pass/Fail</b>
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

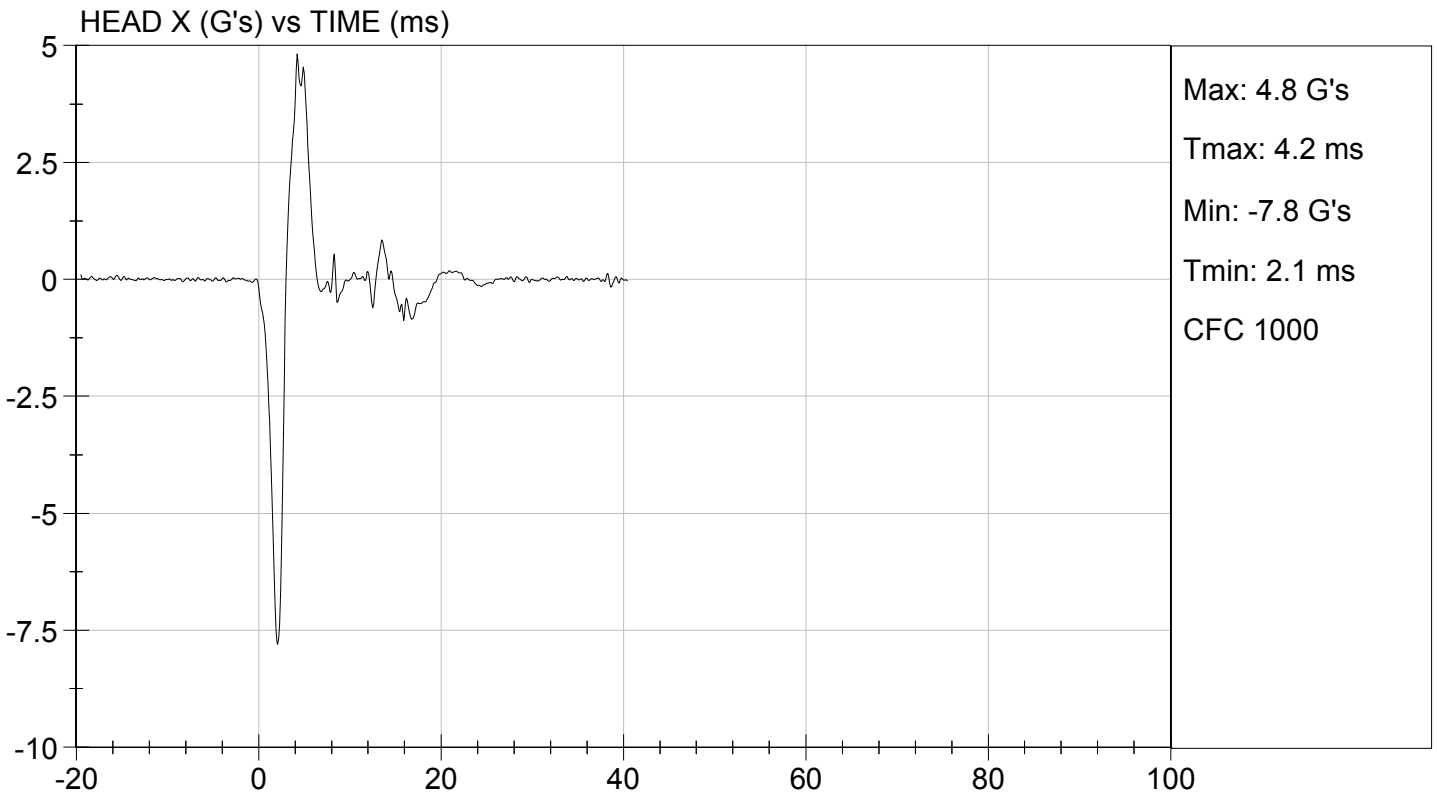
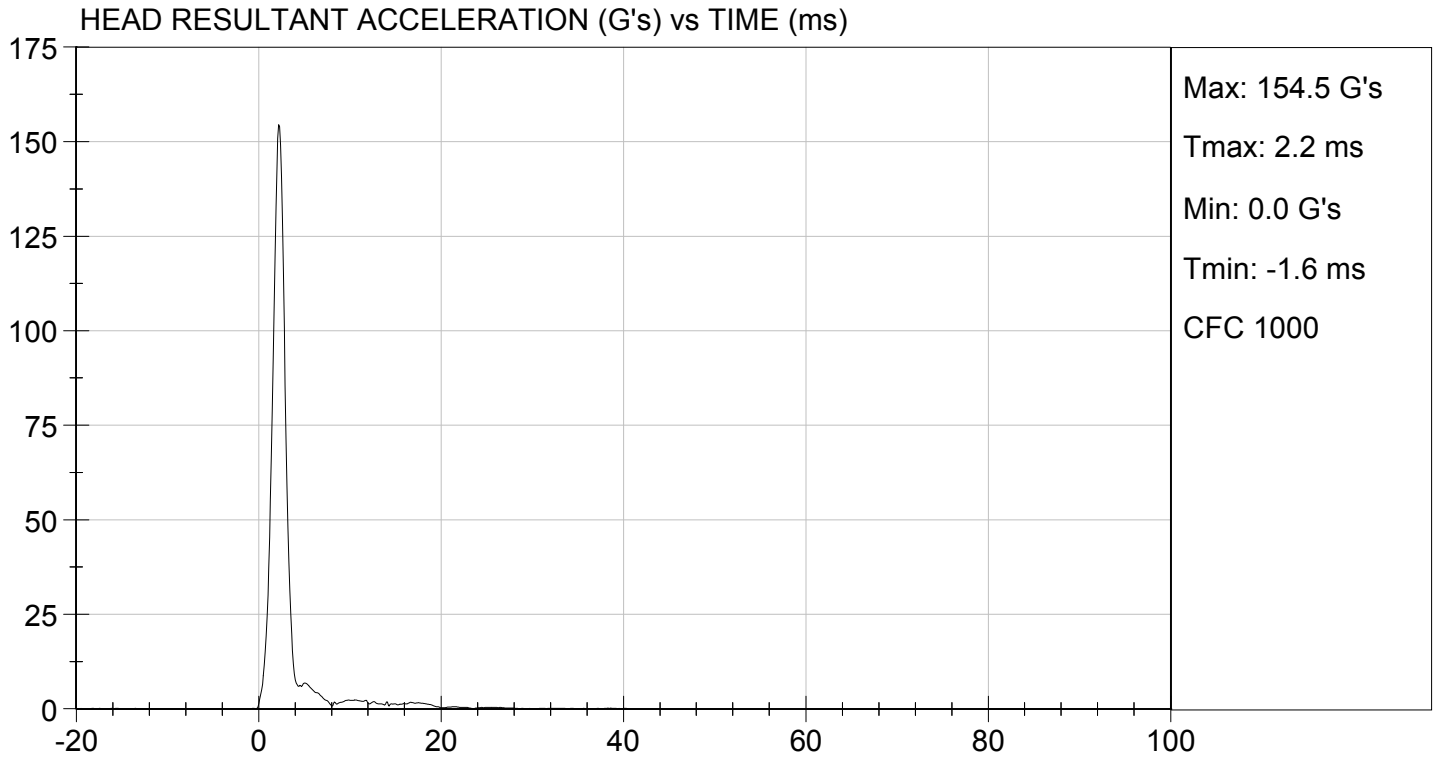
Test ID: D123711

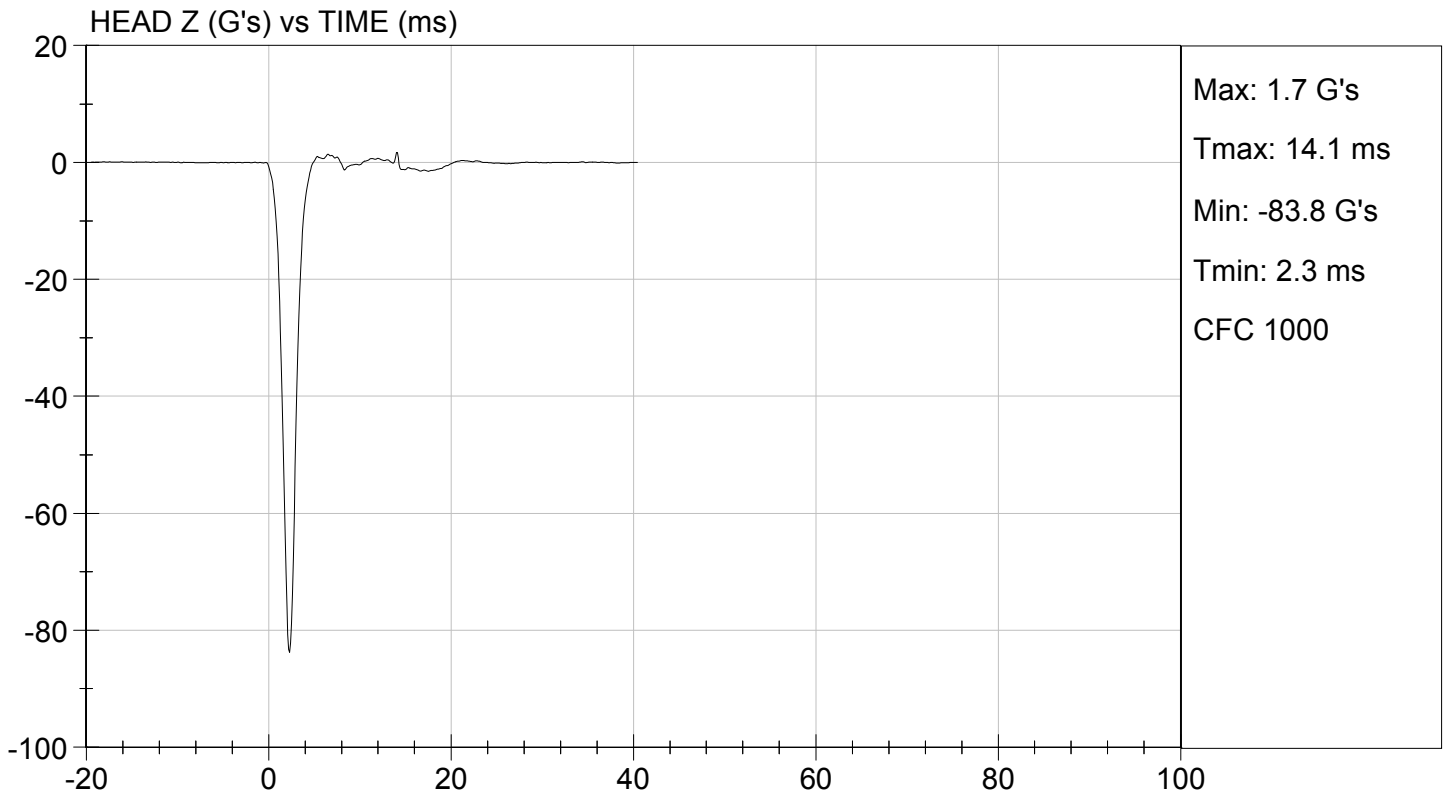
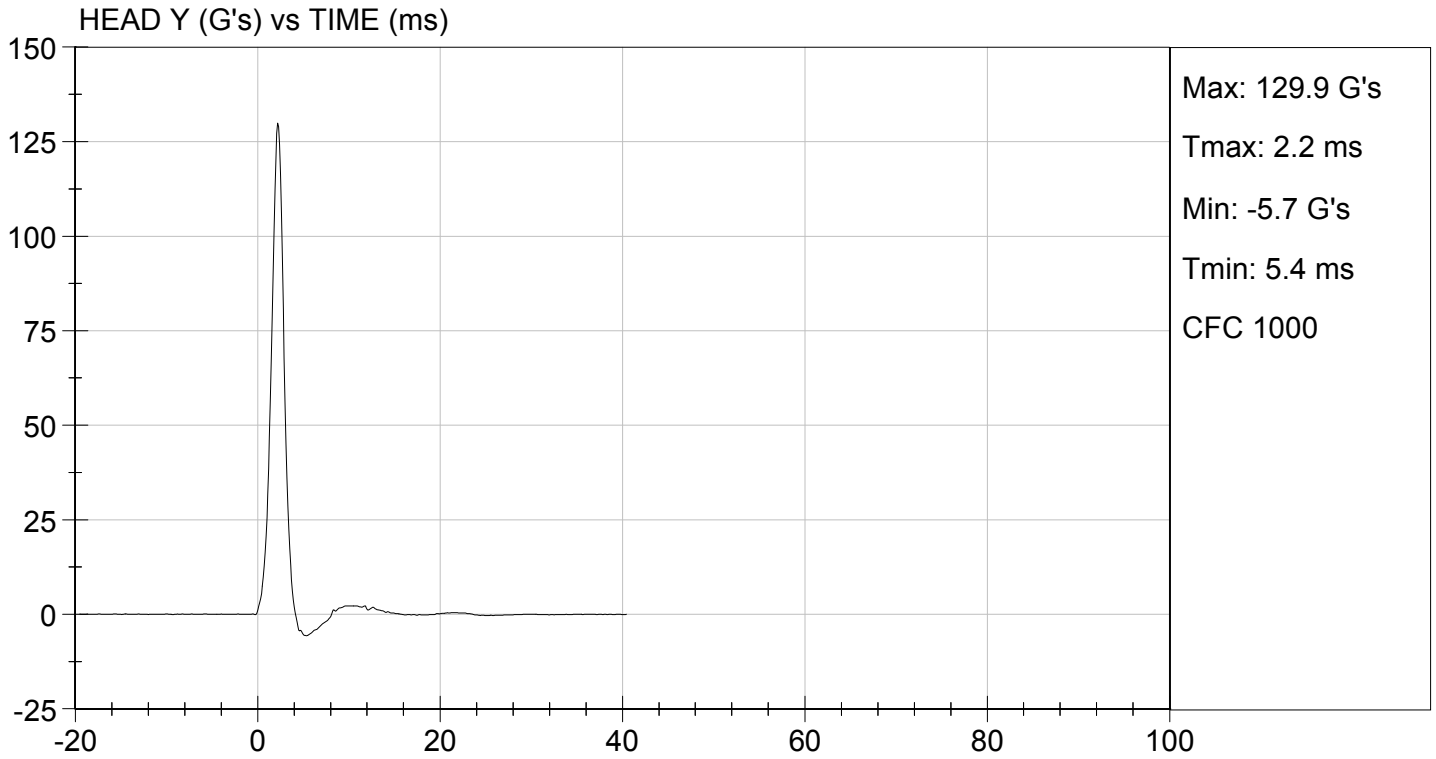
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Peak Resultant Acceleration	G's	125 to 155	154	Pass
Peak Longitudinal Acceleration	G's	<= +/- 15.0	-7.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Hall  
 Laboratory Technician

10/02/2012  
 Test Date

David Winkelbauer  
 Approved By





**MGA RESEARCH CORPORATION  
NECK PENDULUM TEST  
ES-2re DUMMY**

**ATD Serial No:** 032

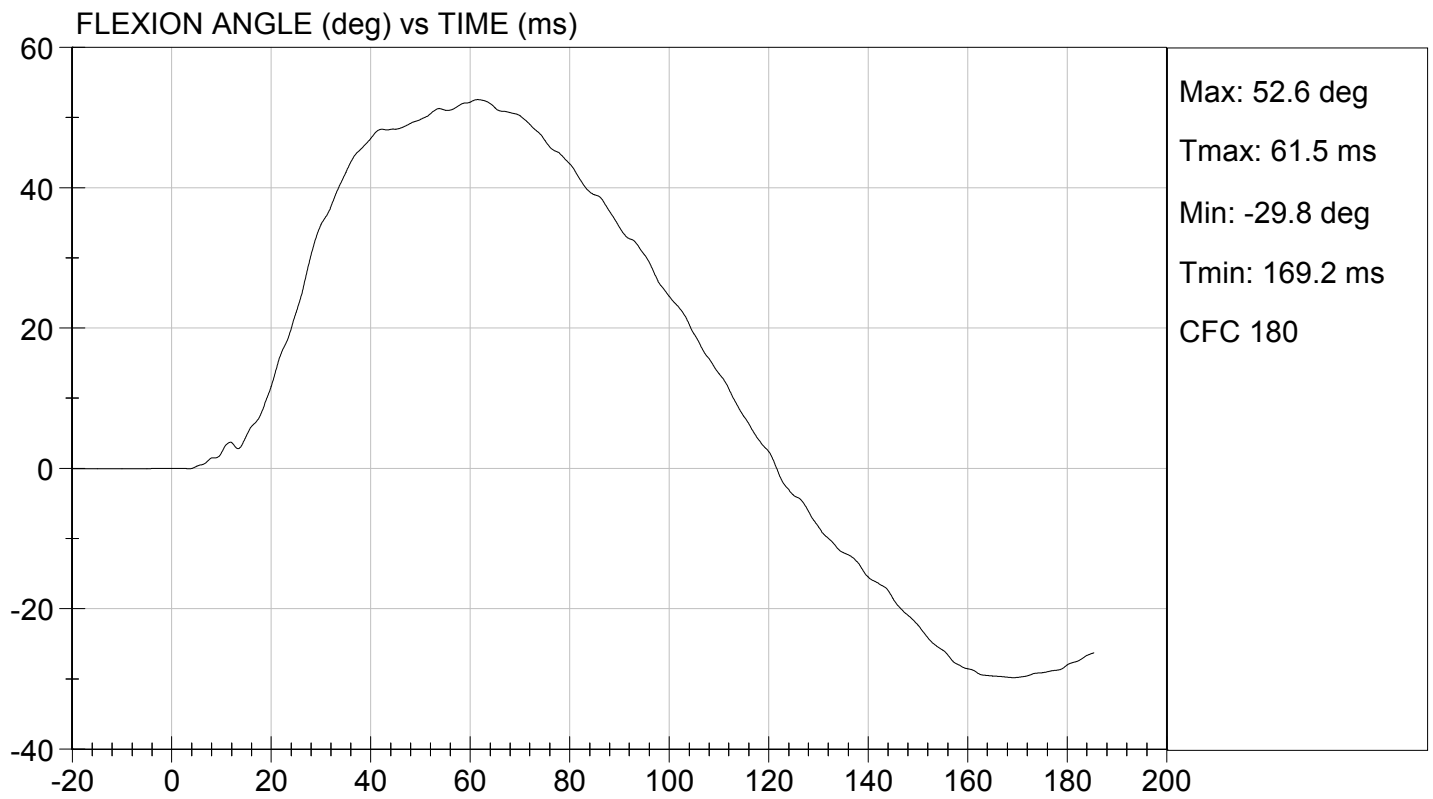
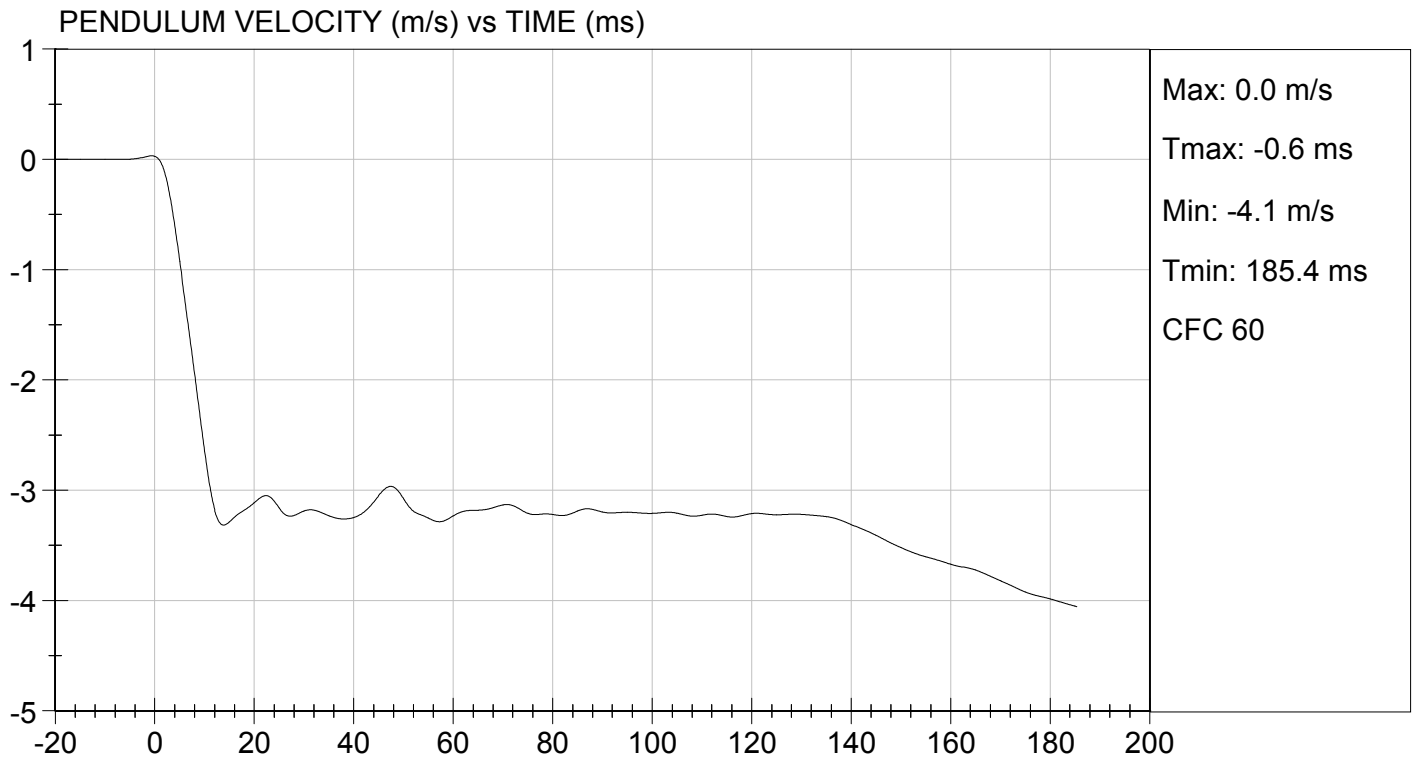
**Test I.D.:** D123712

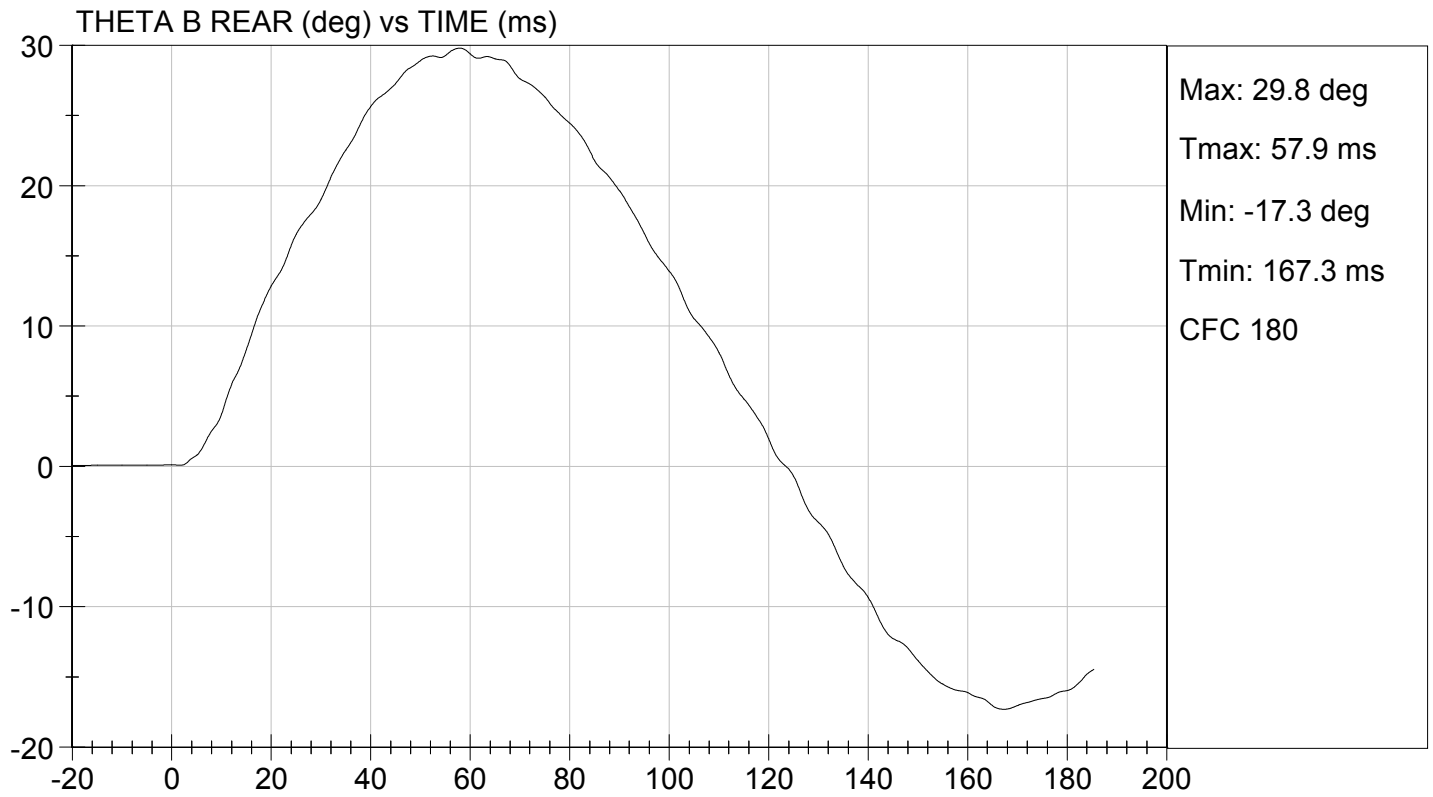
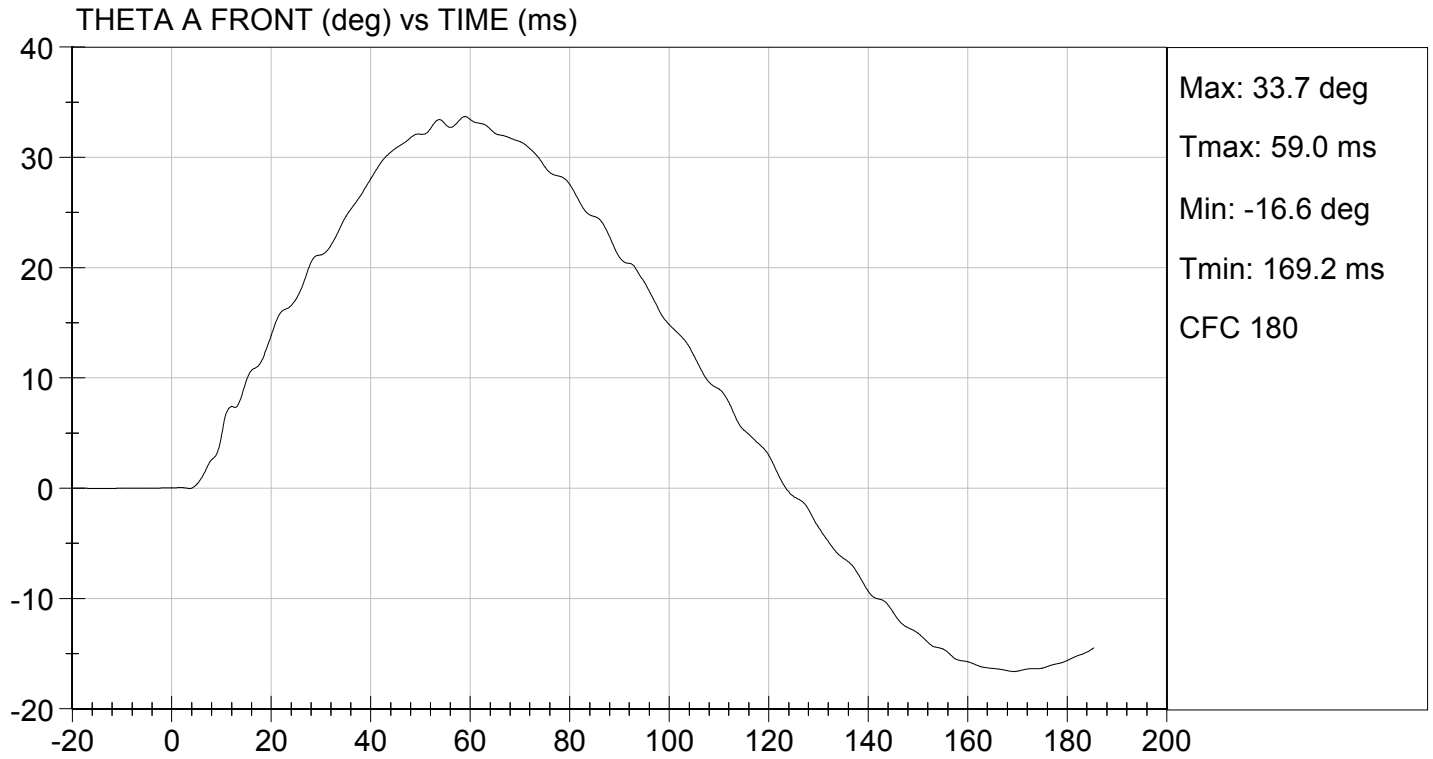
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	41	Pass
Pendulum Speed		m/s	3.30 to 3.50	3.41	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3 ms	m/s	-0.25 to -0.375	-0.32	Pass
	14 ms	m/s	-3.20 to -3.70	-3.31	Pass
	17 ms	m/s	>= -3.70	-3.21	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	52.6	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	61.5	Pass
Head Rotation Decay Time to 0 Degree		ms	53.0 to 88.0	57.9	Pass
<b>Overall Results</b>					<b>Pass</b>

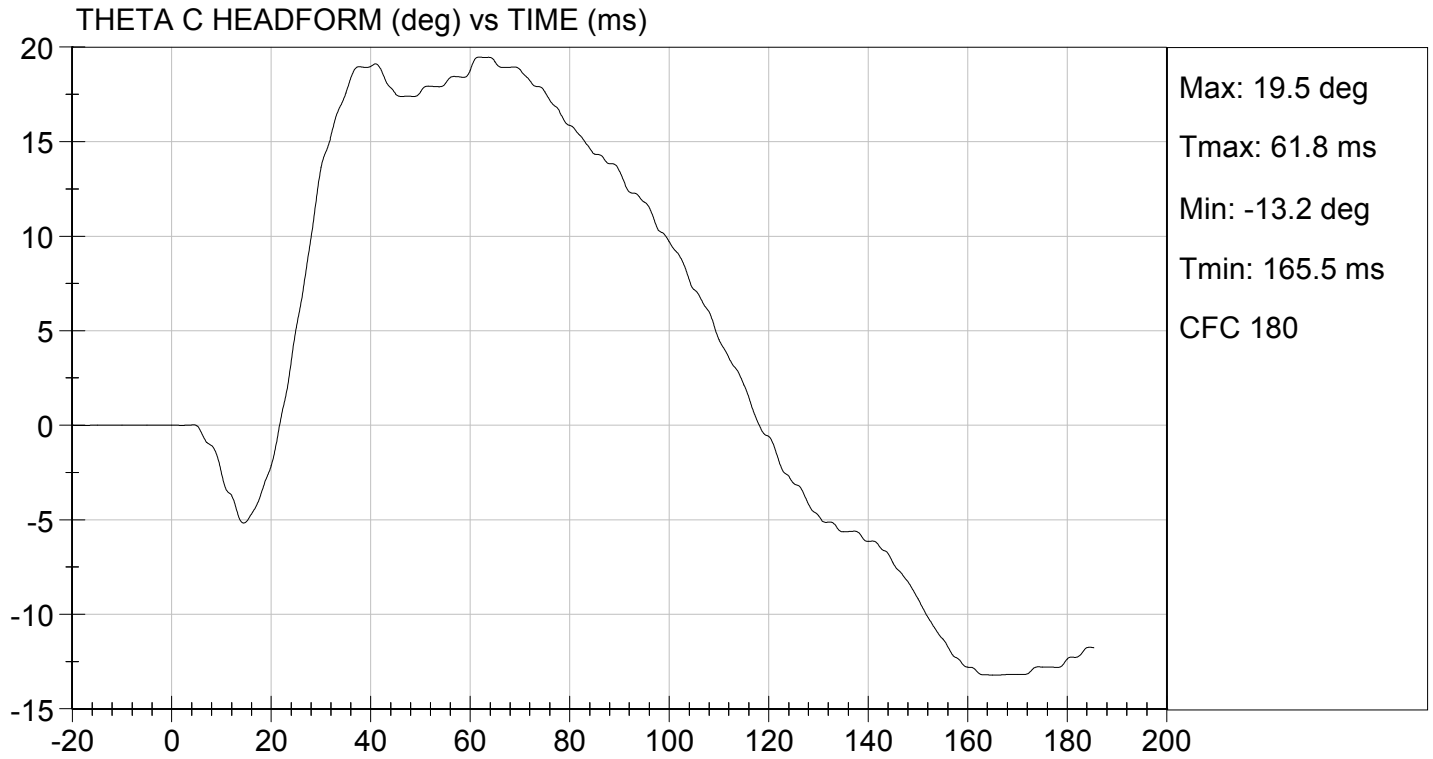
Jessica Gall  
Laboratory Technician

10/02/2012  
Test Date

David Winkelbauer  
Approved By







**MGA RESEARCH CORPORATION**  
**SHOULDER IMPACT TEST**  
**ES-2re DUMMY**

**ATD Serial No:** 032

**Test I.D:** D123713

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	38	Pass
Pendulum Speed	m/s	4.20 to 4.40	4.3	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	9.7	Pass
Overall Test Results				Pass

Jessica Hall  
 Laboratory Technician

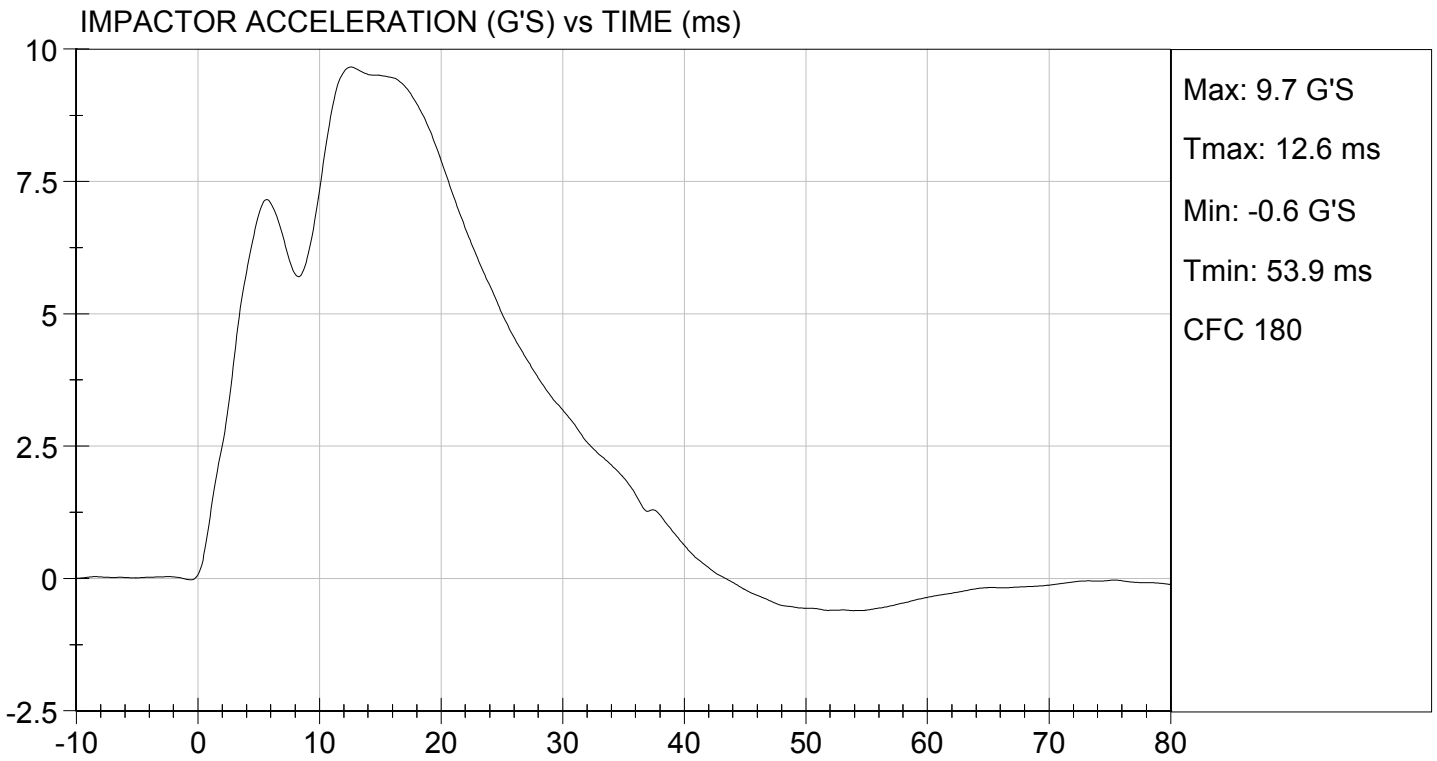
10/02/2012  
 Test Date

David Winkelbauer  
 Approved By



TEST DESC: SHOULDER IMPACT  
VELOCITY: 14.12 ft/s, 4.3 m/s

TEST DATE: 10/02/2012  
TEST #: D123713



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 032

Test I.D: D123714

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	38	Pass
Displacement at 459 mm	mm	36.0 to 40.0	38.3	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.0	Pass
Overall Test Results				Pass

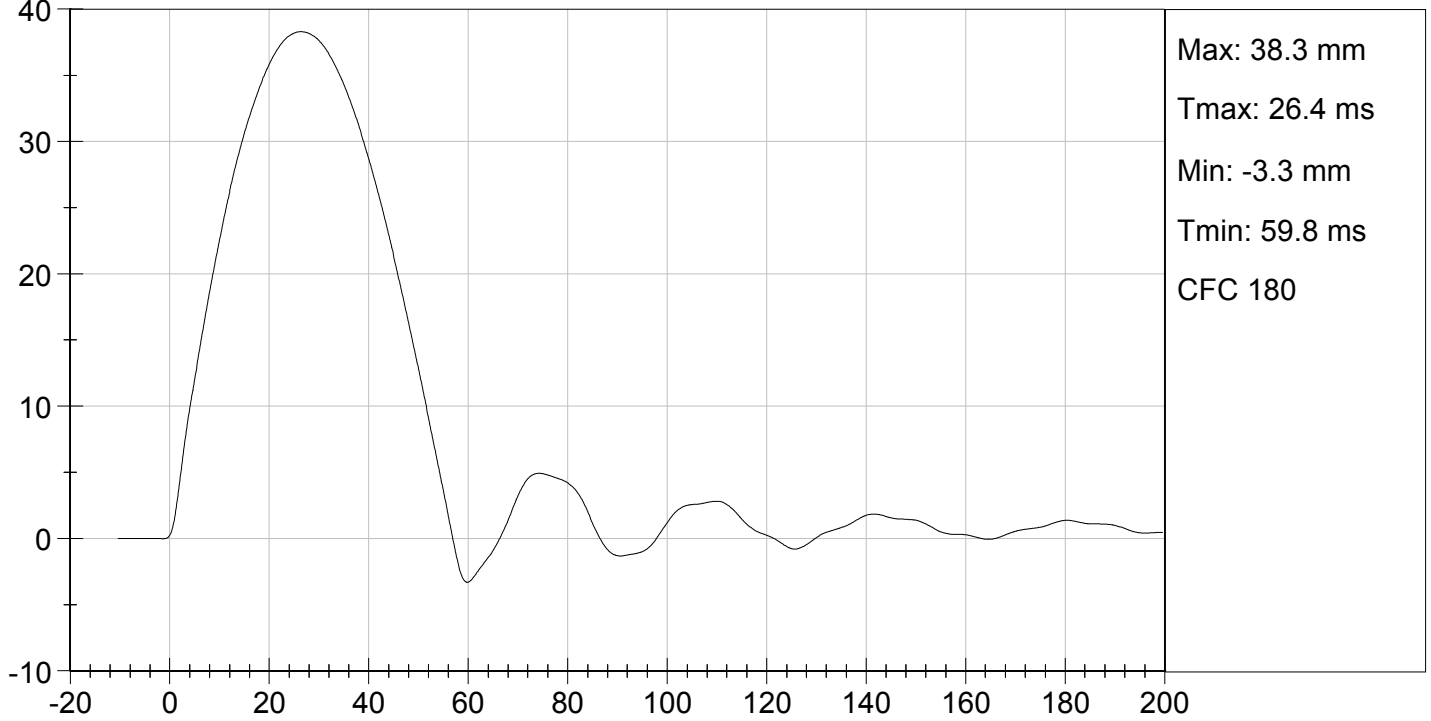
Jessica Hall  
Laboratory Technician

10/02/2012  
Test Date

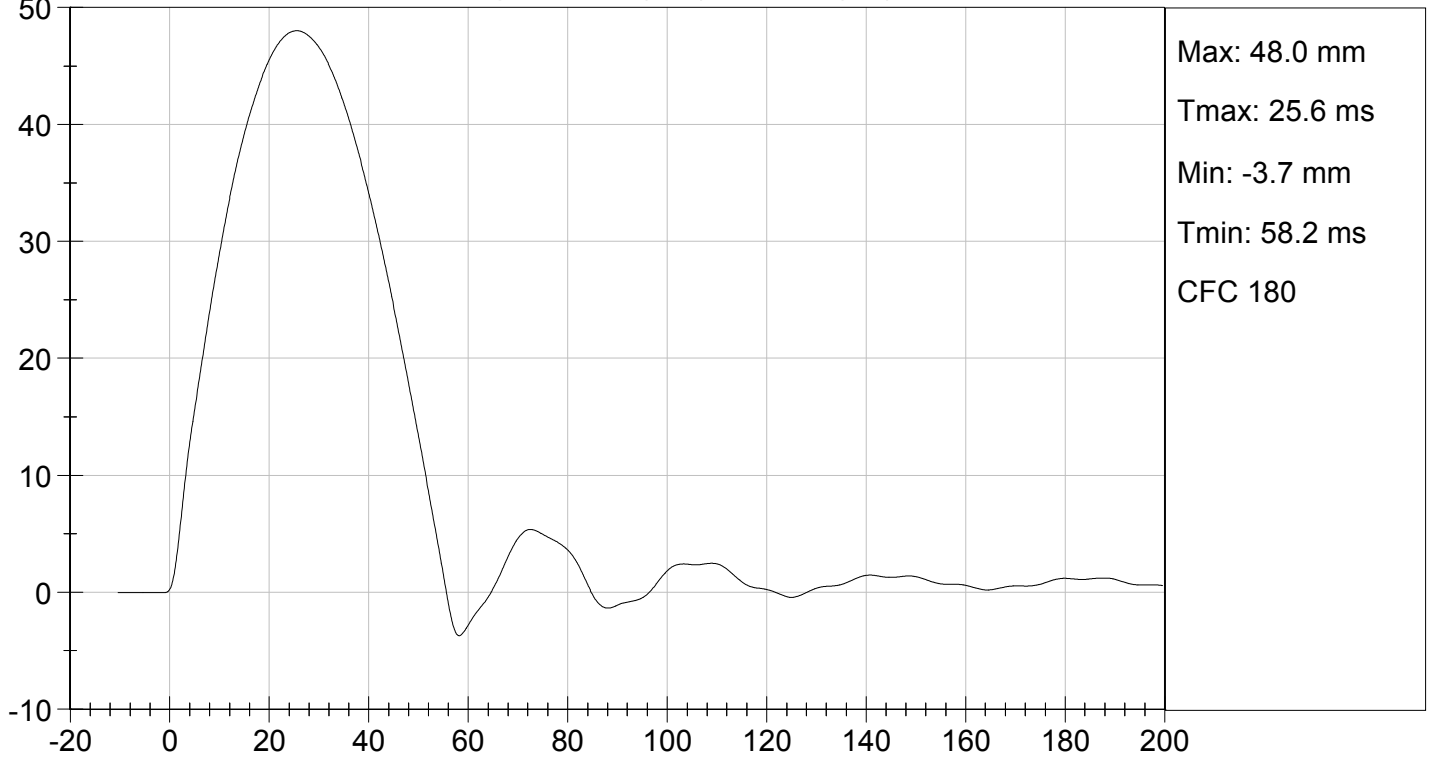
David Winkelbauer  
Approved By



UPPER RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)



**MGA RESEARCH CORPORATION**

**MID RIB TEST**

**ES-2re DUMMY**

**ATD Serial No:** 032

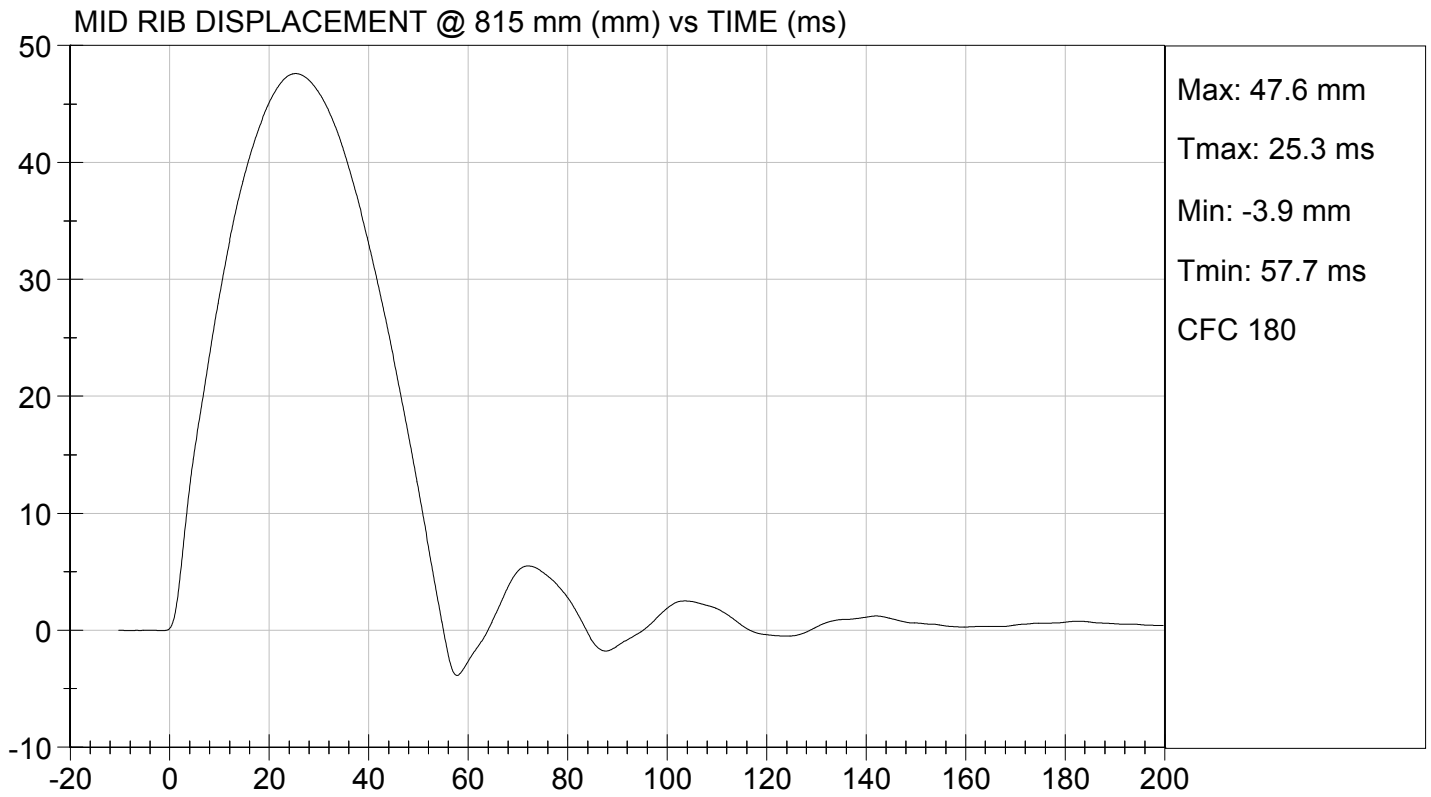
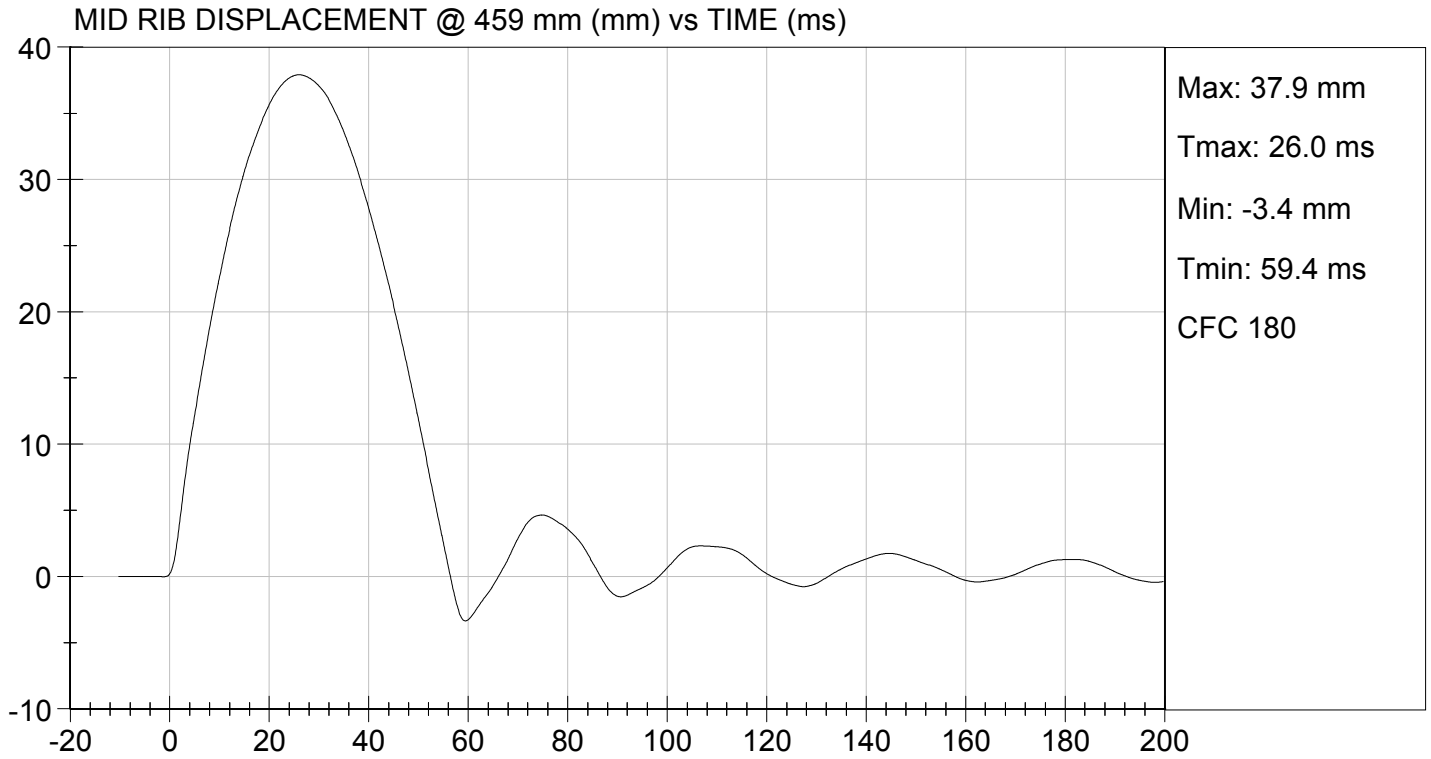
**Test I.D.:** D123715

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	38	Pass
Displacement at 459 mm	mm	36.0 to 40.0	37.9	Pass
Displacement at 815 mm	mm	46.0 to 51.0	47.6	Pass
Overall Test Results				Pass

  
Laboratory Technician

10/02/2012  
Test Date

  
Approved By



**MGA RESEARCH CORPORATION**

**LOWER RIB TEST**

**ES-2re DUMMY**

**ATD Serial No:** 032

**Test I.D:** D123716

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	38	Pass
Displacement at 459 mm	mm	36.0 to 40.0	38.1	Pass
Displacement at 815 mm	mm	46.0 to 51.0	47.6	Pass
Overall Test Results				Pass

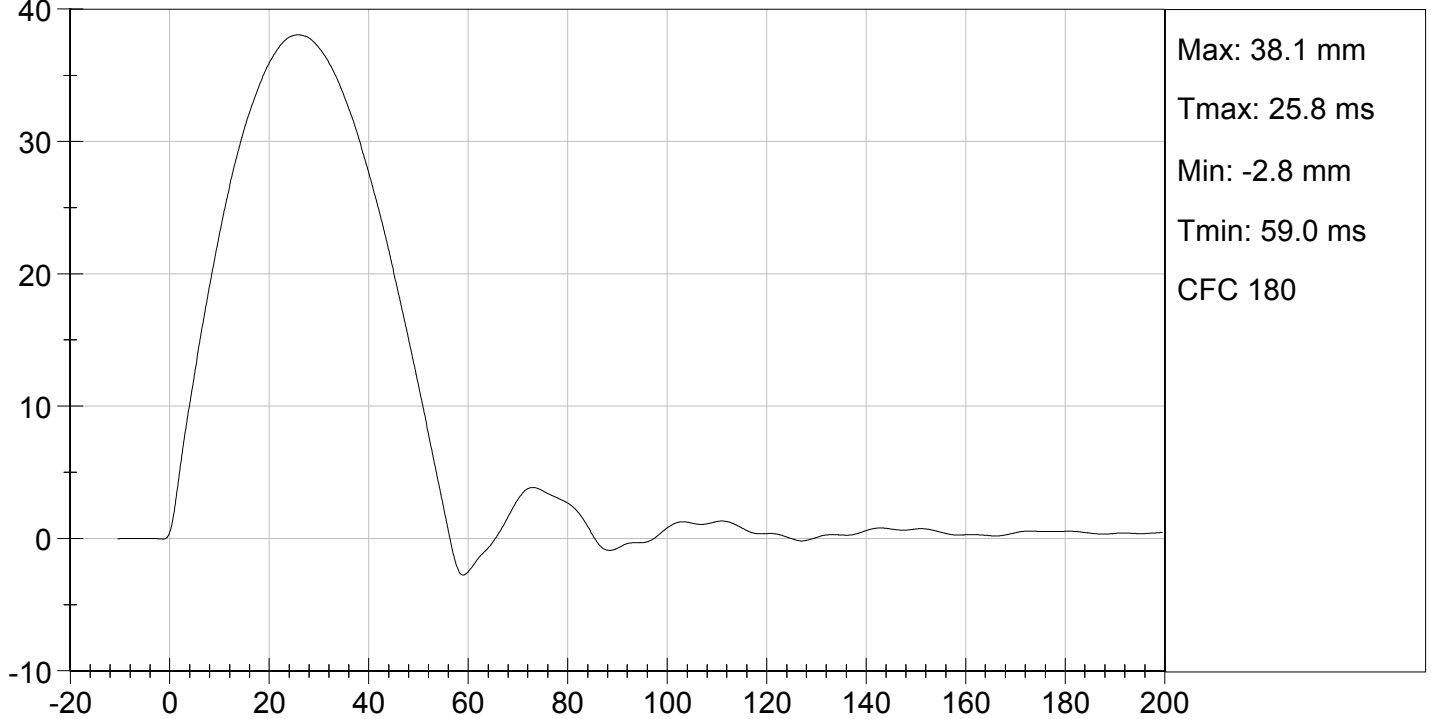
Jessica Gall  
Laboratory Technician

10/02/2012  
Test Date

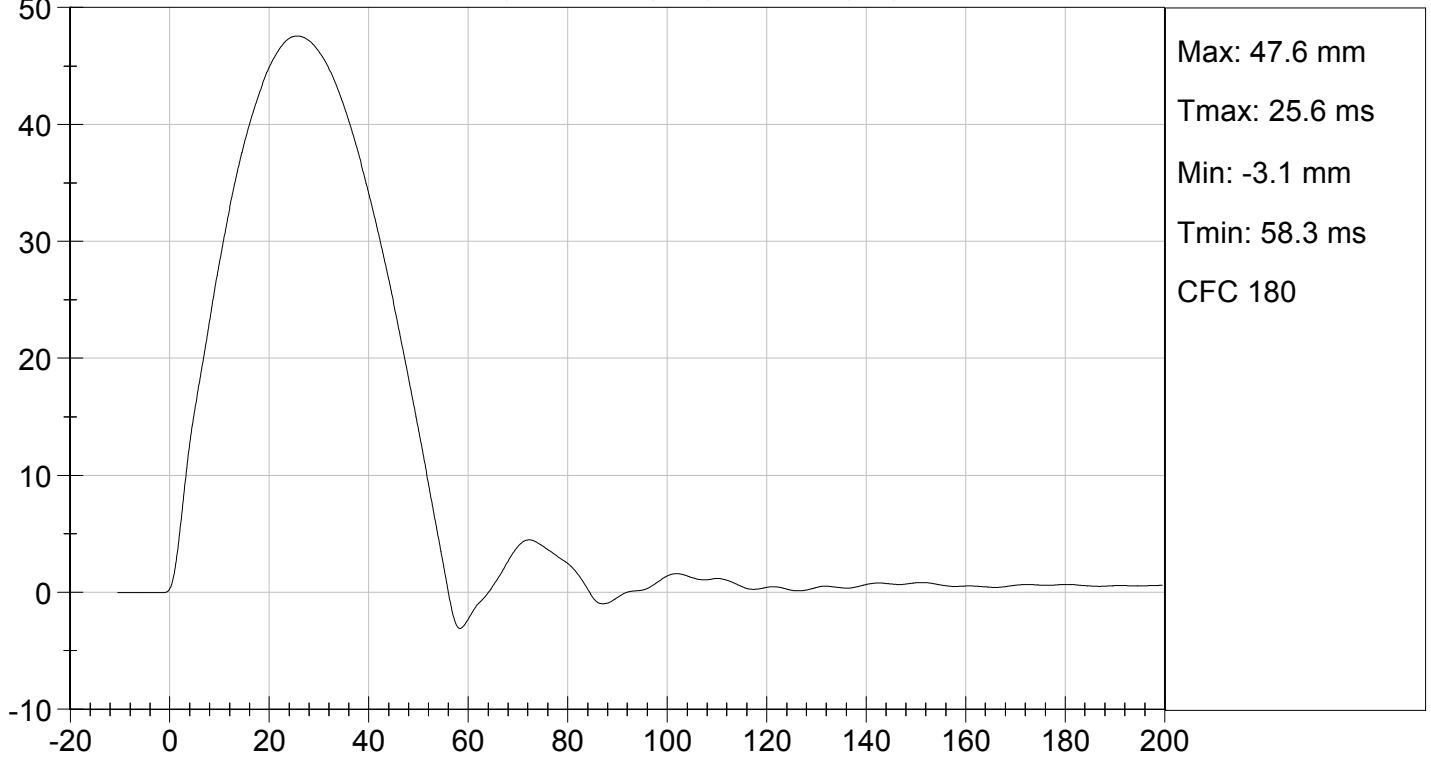
David Winkelbauer  
Approved By



LOWER RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)



**MGA RESEARCH CORPORATION**  
**THORAX IMPACT TEST**  
**ES-2re DUMMY**

ATD Serial No: 032

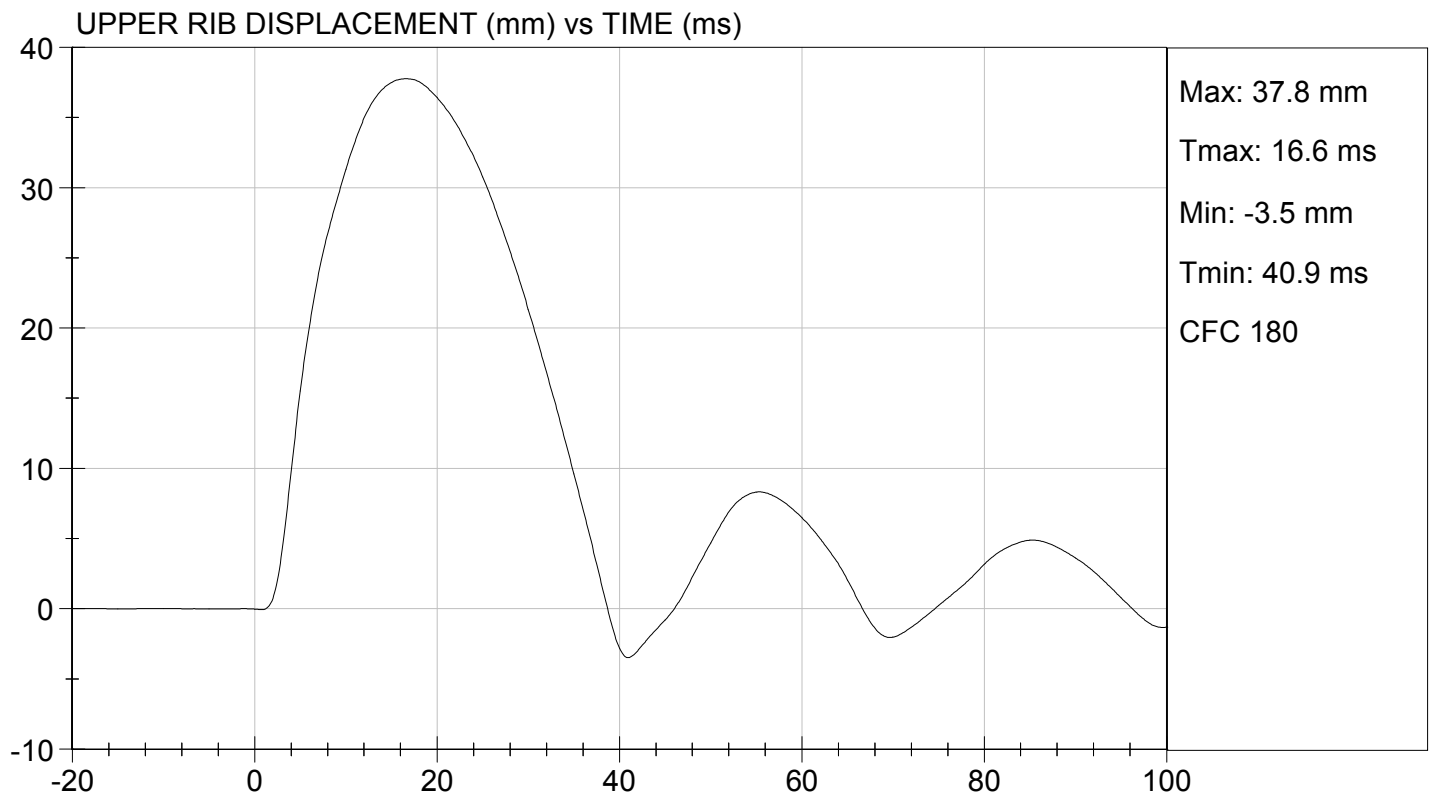
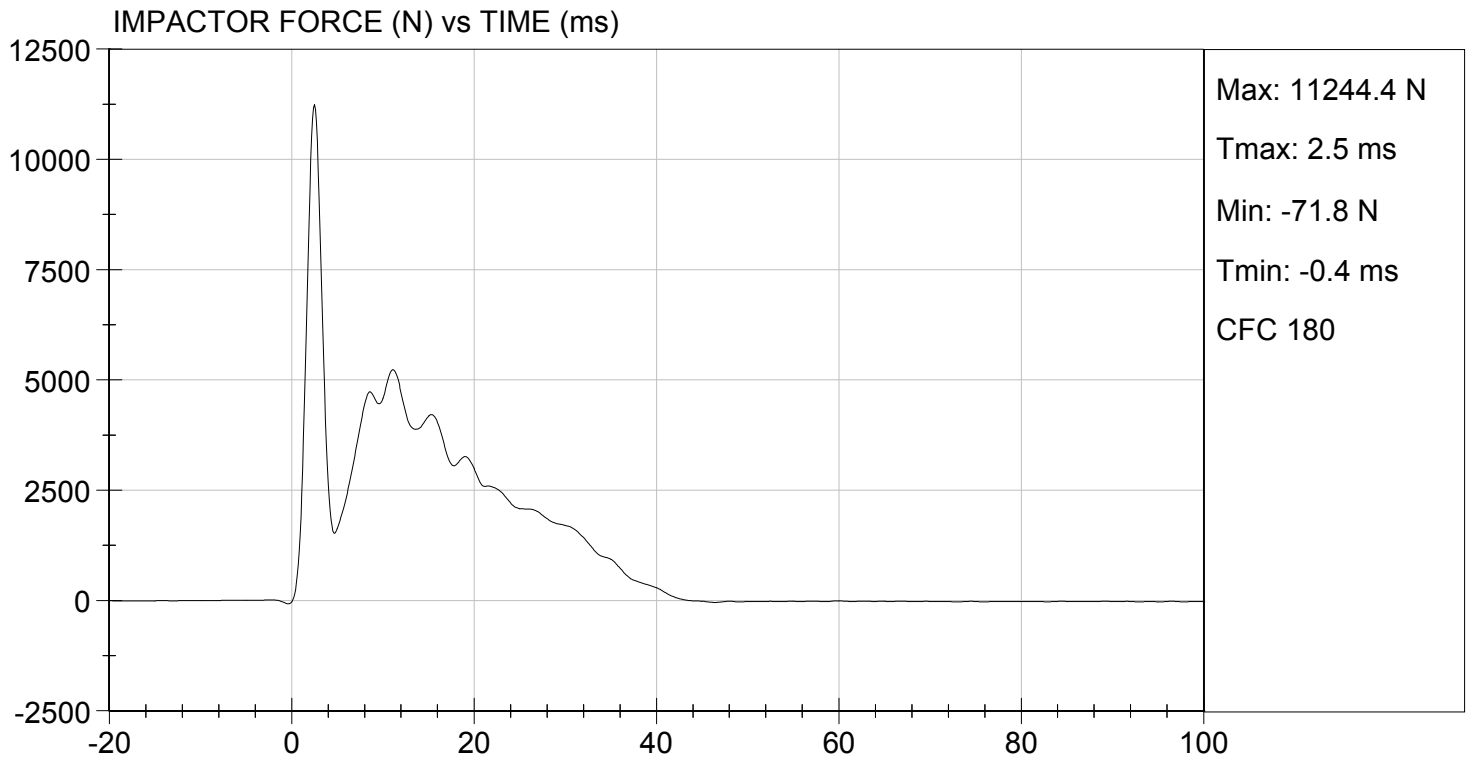
Test I.D: D123710

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	38	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	N	5100 to 6200	5233	Pass
Upper Rib Displacement	mm	34.0 to 41.0	37.8	Pass
Middle Rib Displacement	mm	37.0 to 45.0	40.1	Pass
Lower Rib Displacement	mm	37.0 to 44.0	38.8	Pass
Overall Test Results				Pass

*Jessica Hall*  
 Laboratory Technician

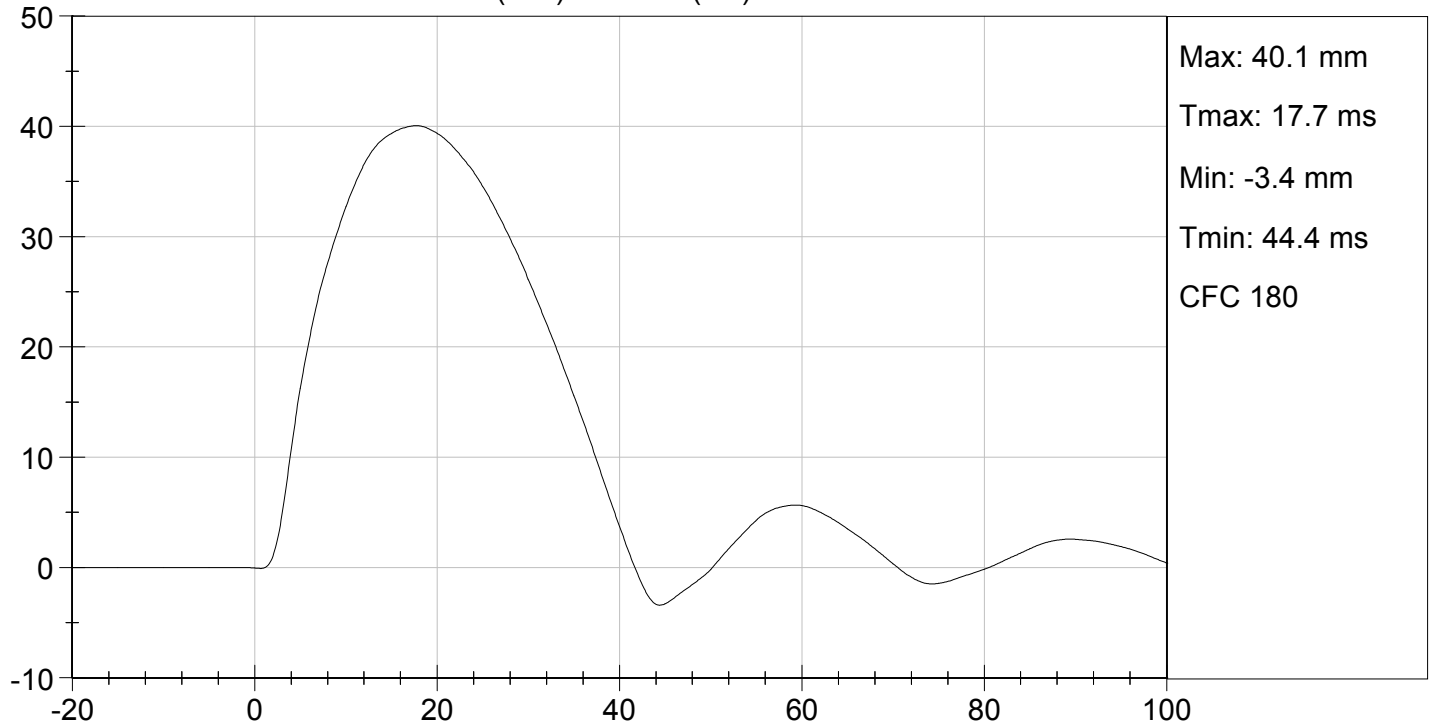
10/02/2012  
 Test Date

*David Winkelbauer*  
 Approved By

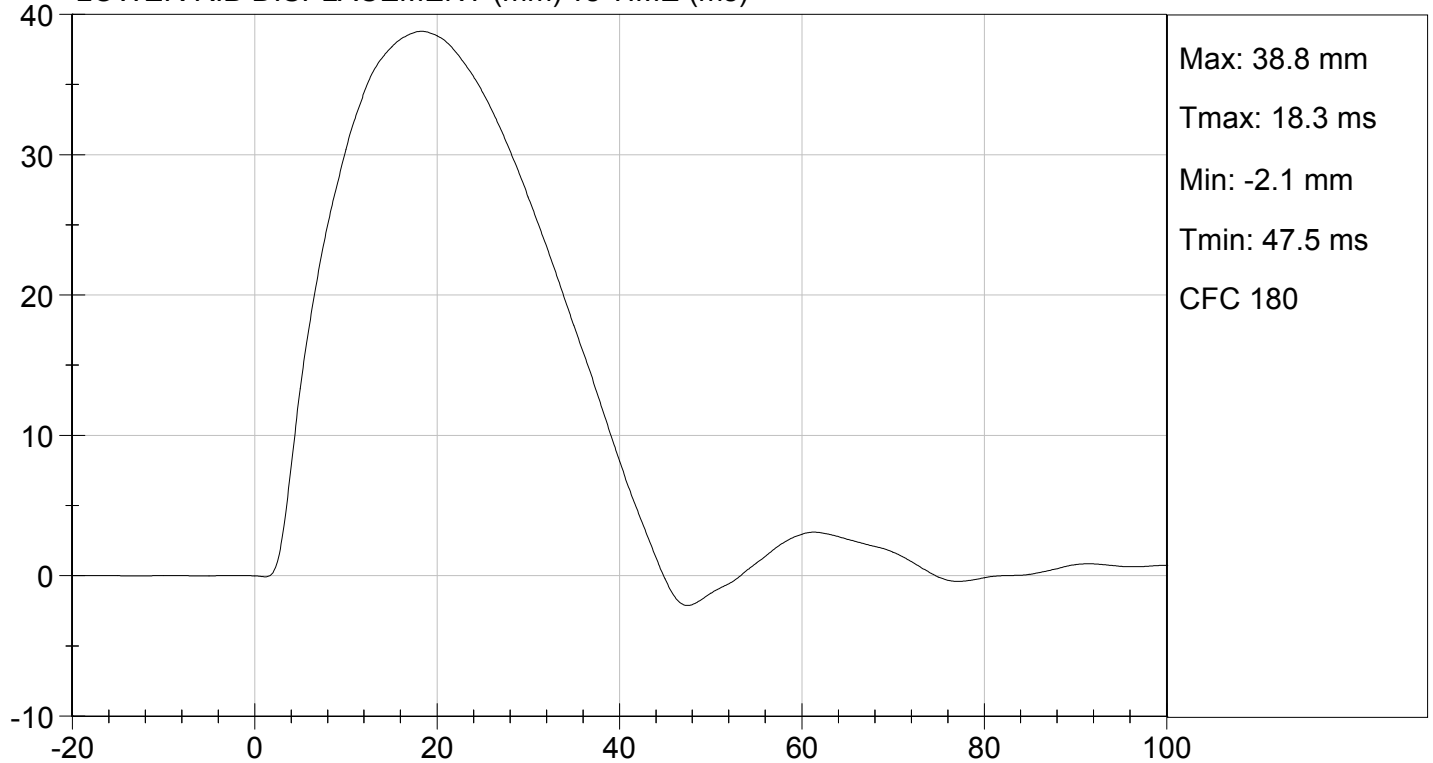




MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



**MGA RESEARCH CORPORATION**

**ABDOMEN TEST**

**ES-2re DUMMY**

**ATD Serial No:** 032

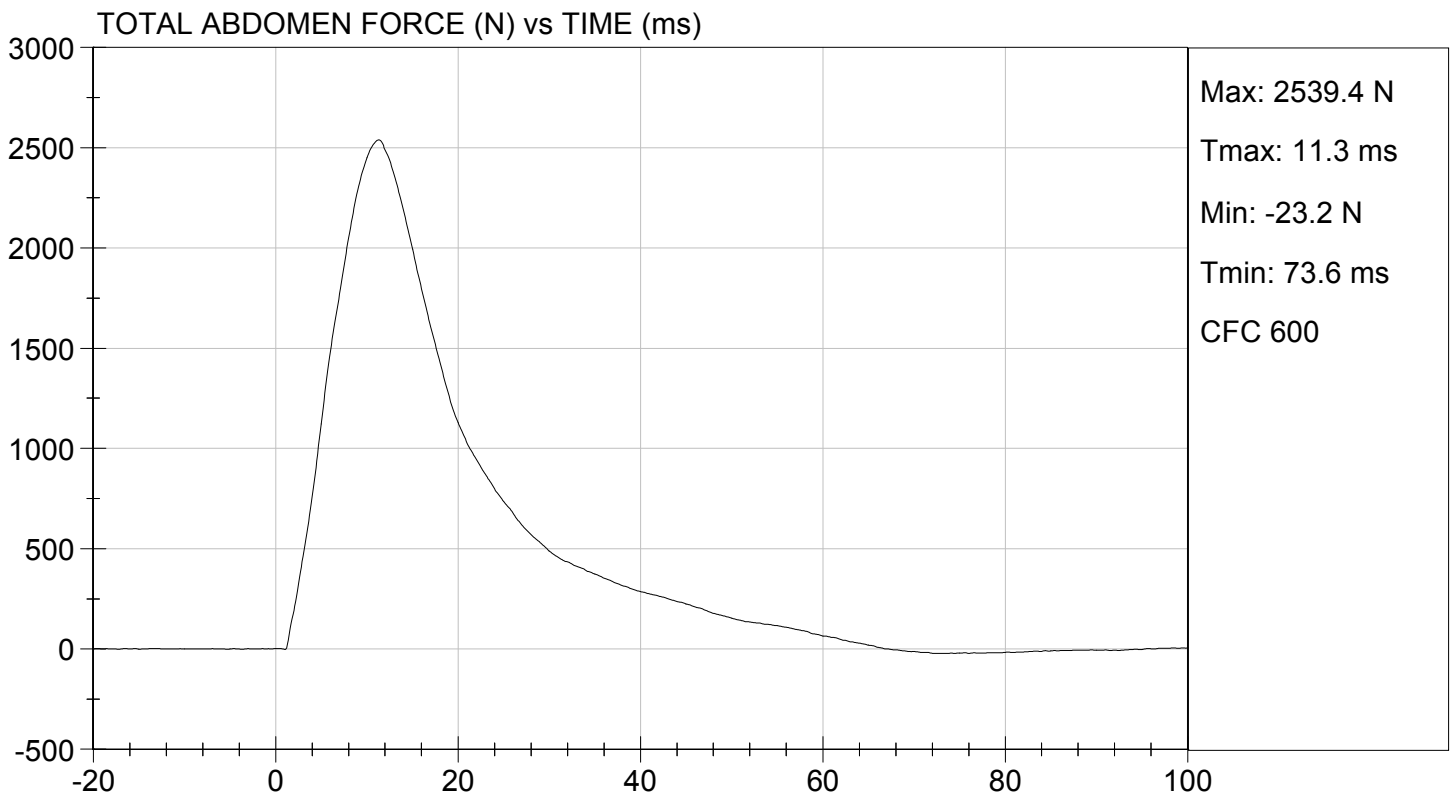
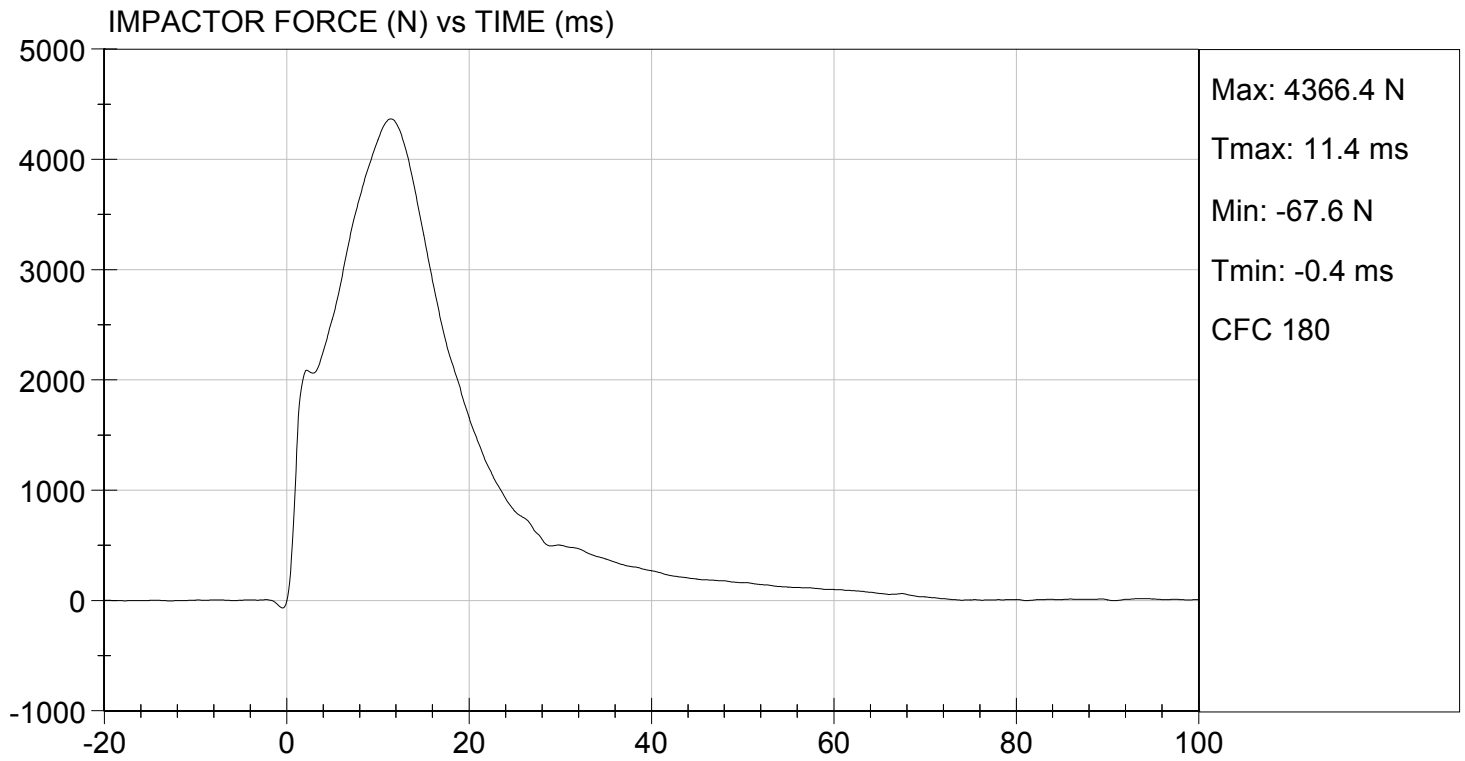
**Test I.D:** D123717

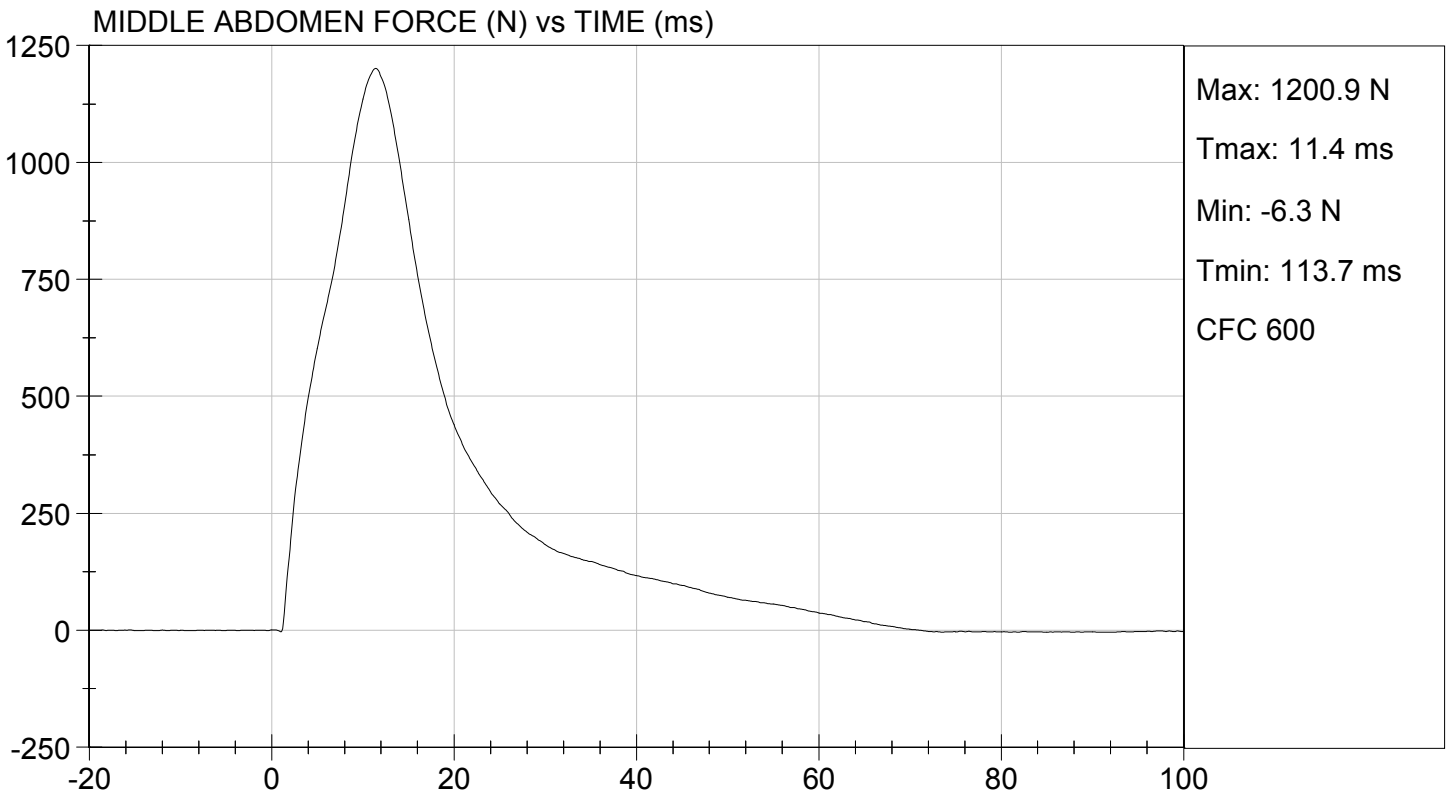
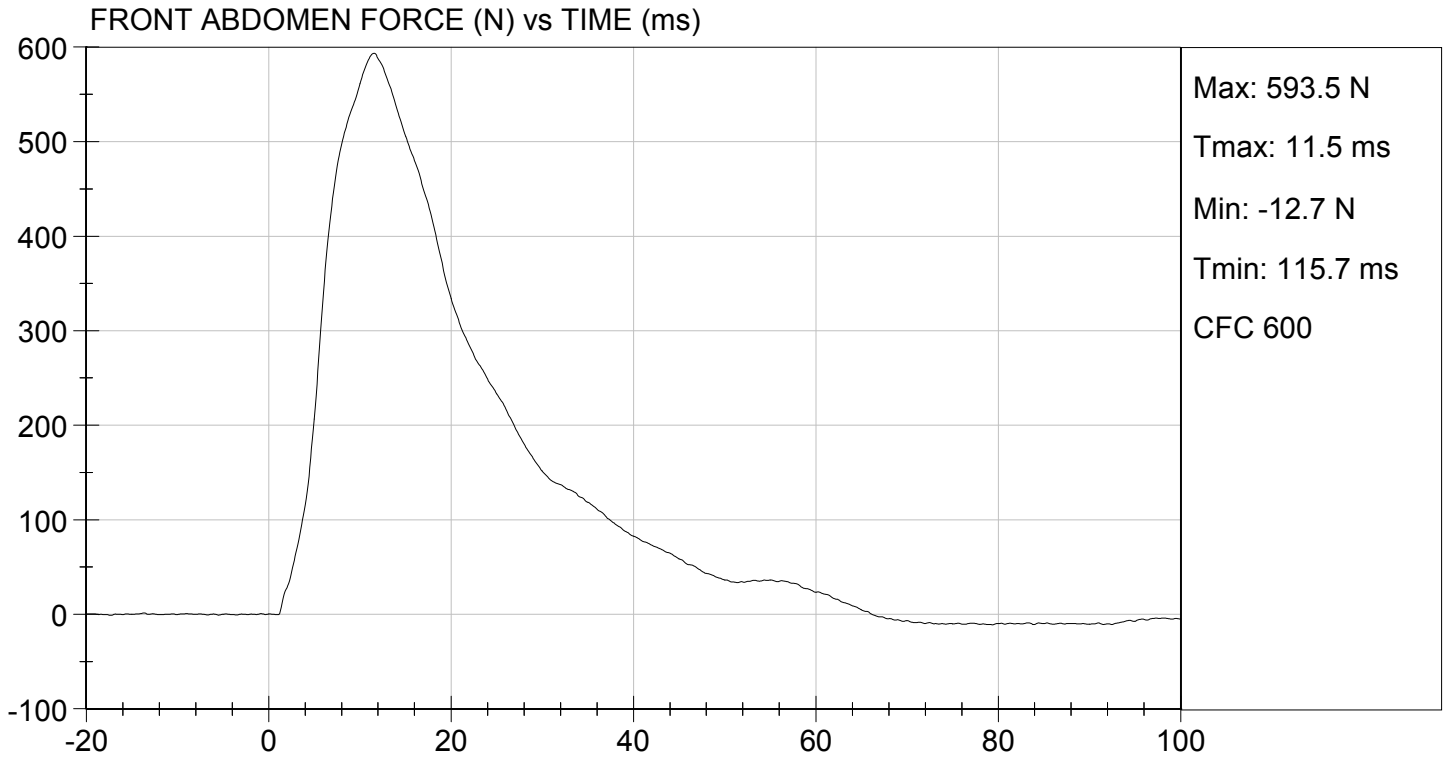
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	38	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impactor Force	N	4000 to 4800	4366	Pass
Time of Maximum Impactor Force	ms	10.6 to 13.0	11.4	Pass
Maximum Total Abdomen Force	N	2200 to 2700	2539	Pass
Time of Maximum Abdomen Force	ms	10.0 to 12.3	11.3	Pass
Overall Test Results				Pass

  
Laboratory Technician

10/02/2012  
Test Date

  
Approved By

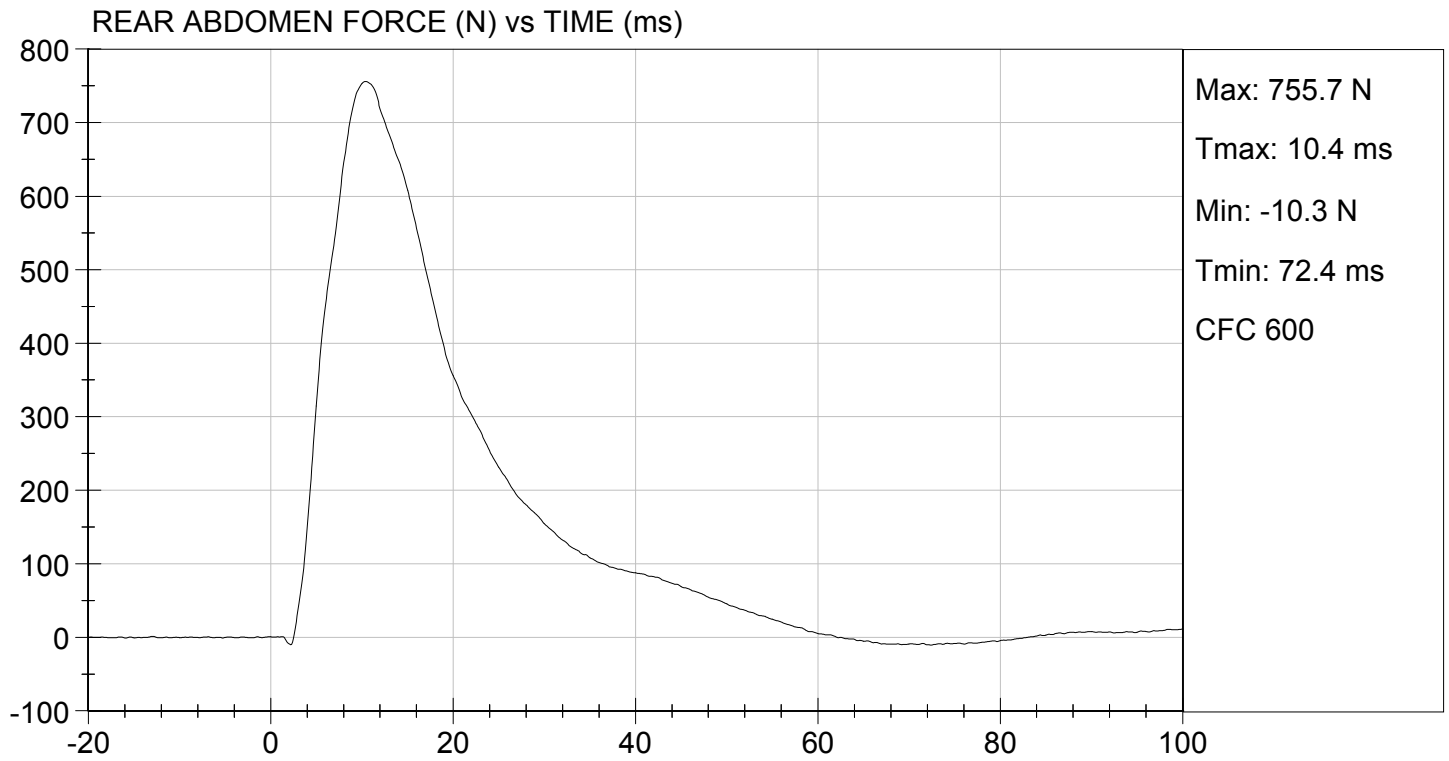






TEST DESC: ABDOMEN IMPACT  
VELOCITY: 13.33 ft/s, 4.06 m/s

TEST DATE: 10/02/2012  
TEST #: D123717



**MGA RESEARCH CORPORATION**  
**LUMBAR SPINE TEST**  
**ES-2re DUMMY**

**ATD Serial No:** 032

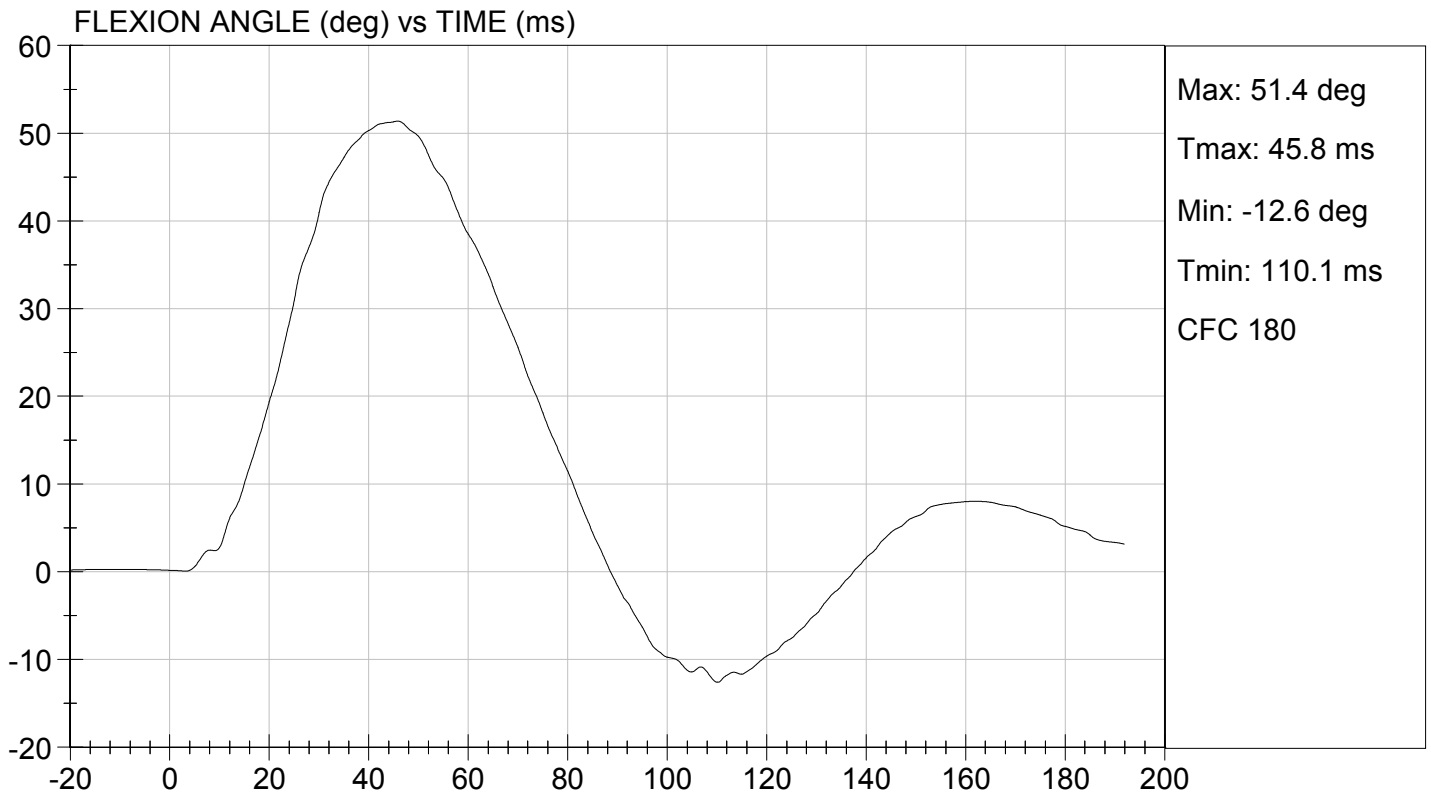
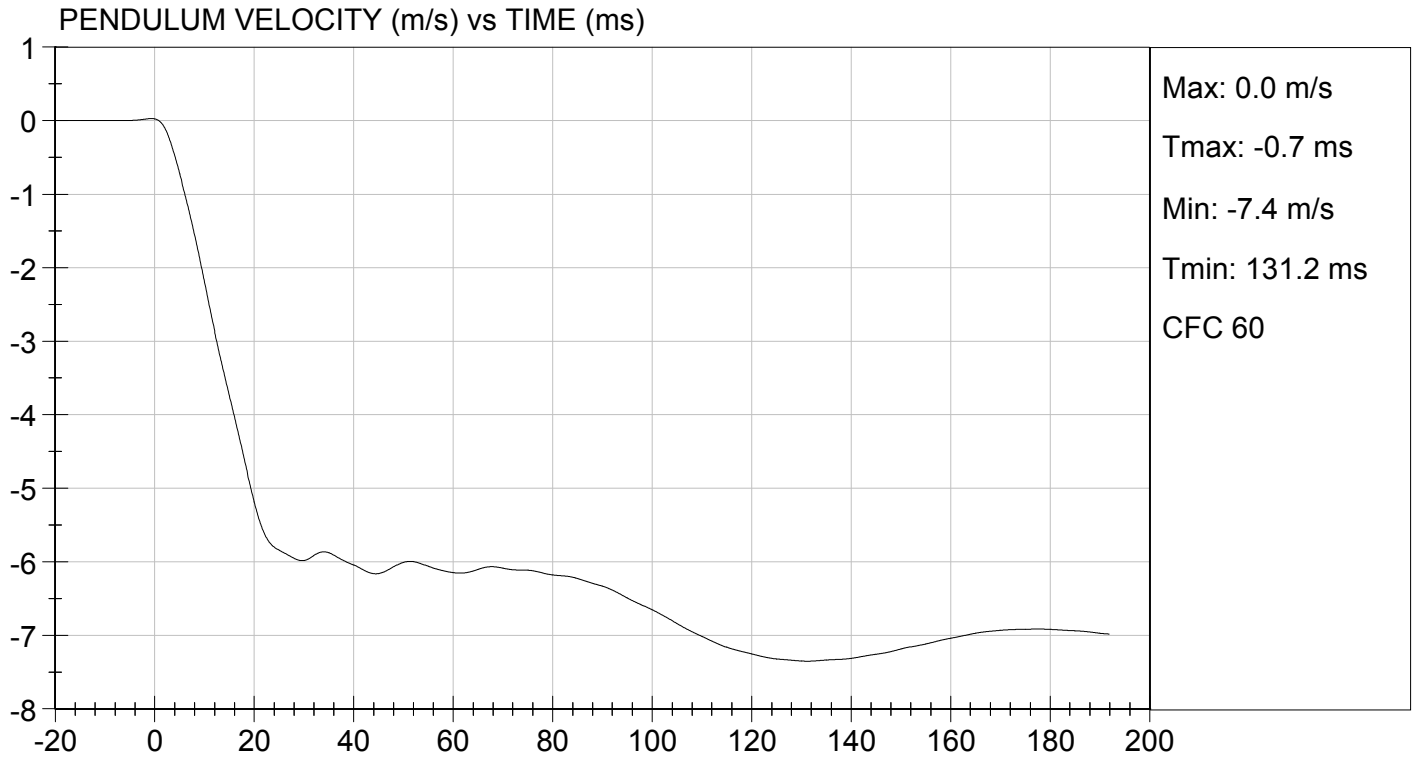
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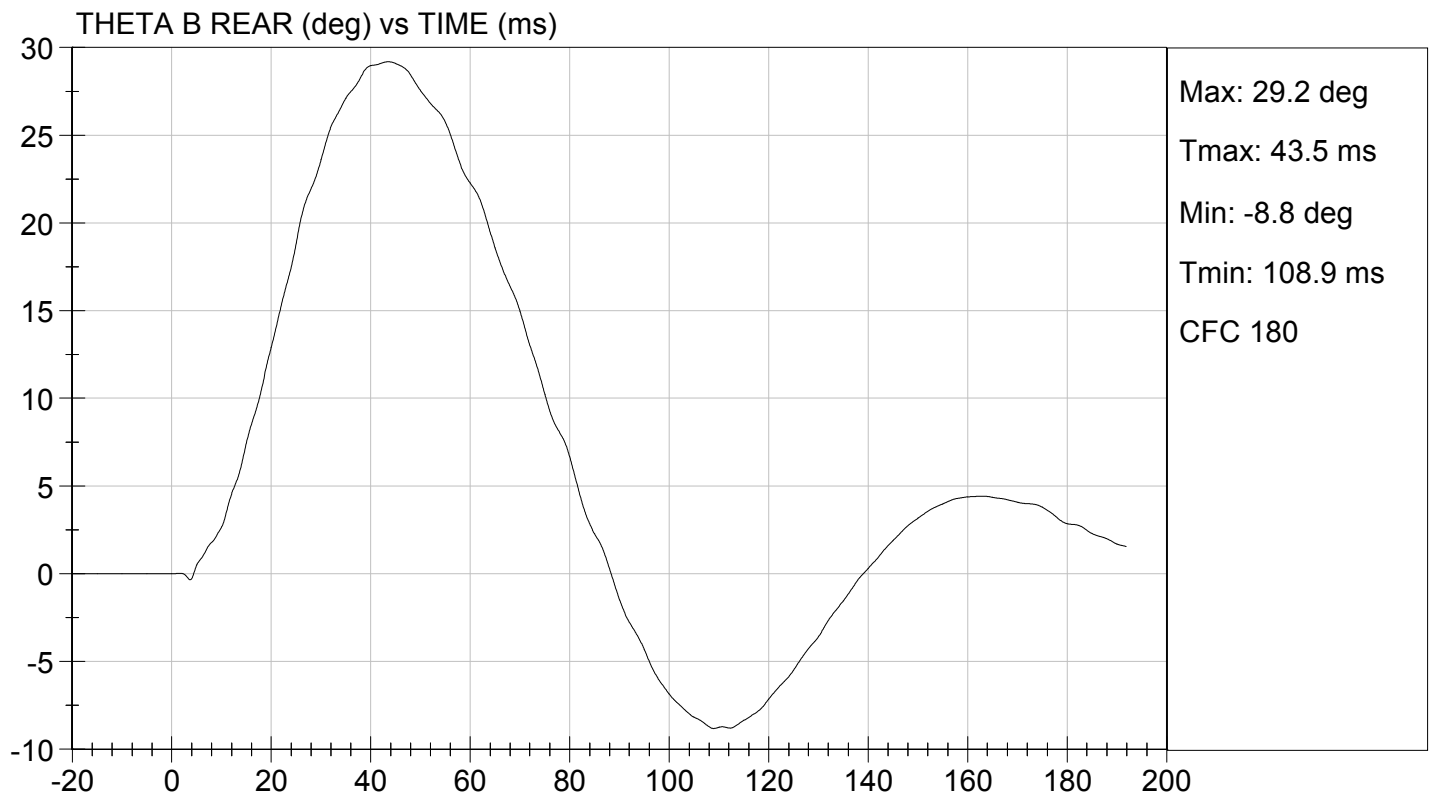
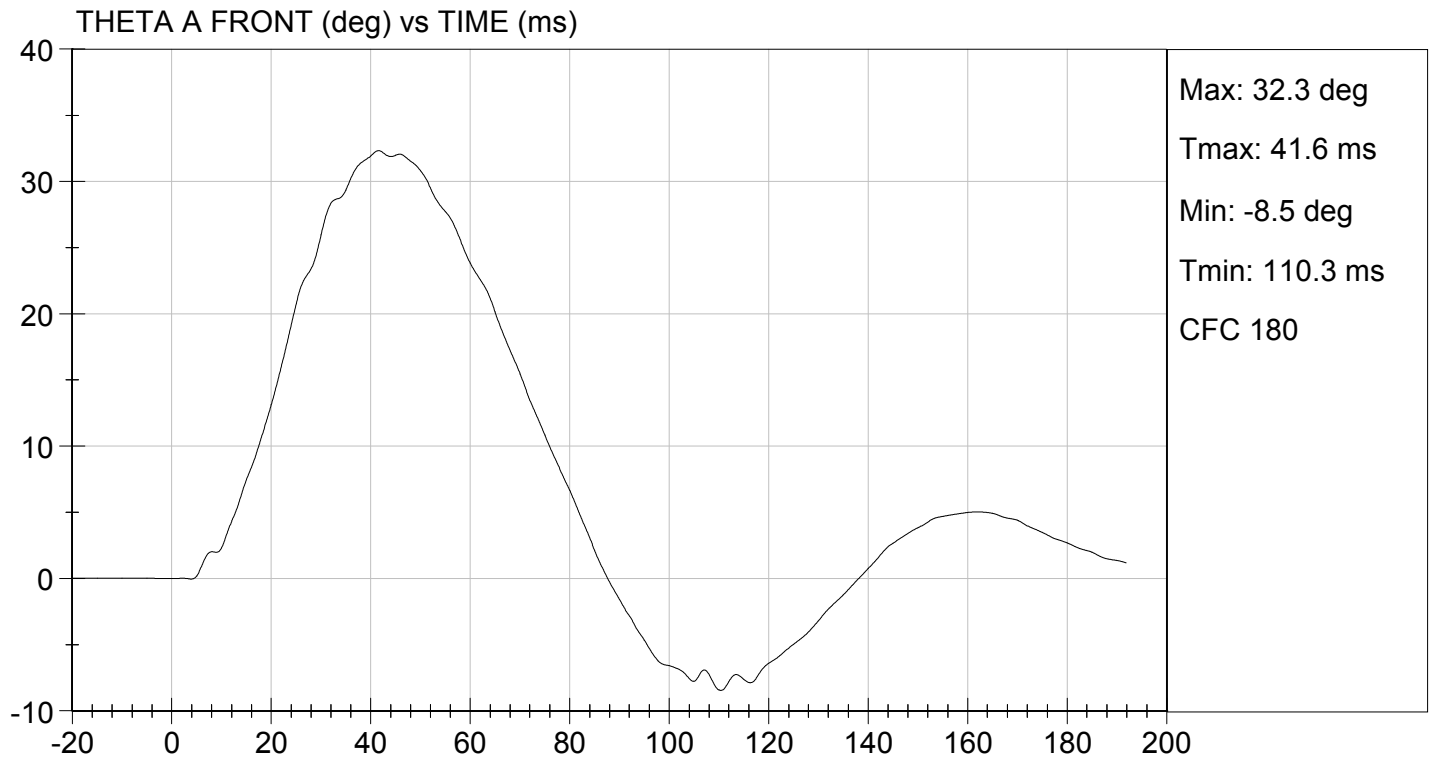
Tested Parameter	Units	Specification	Result	Pass/Fail	
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass	
Laboratory Relative Humidity	%	10 to 70	41	Pass	
Pendulum Speed	m/s	5.95 to 6.15	6.12	Pass	
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.410	Pass
	27 ms	m/s	-6.50 to -5.80	-5.91	Pass
	30 ms	m/s	>= -6.50	-5.98	Pass
Maximum Flexion Angle	deg	45.0 to 55.0	51.4	Pass	
Time of Maximum Flexion Angle	ms	39.0 to 53.0	45.8	Pass	
Headform Rotation Decay to Initial Position	ms	37 to 57	44	Pass	
<b>Overall Results</b>				<b>Pass</b>	

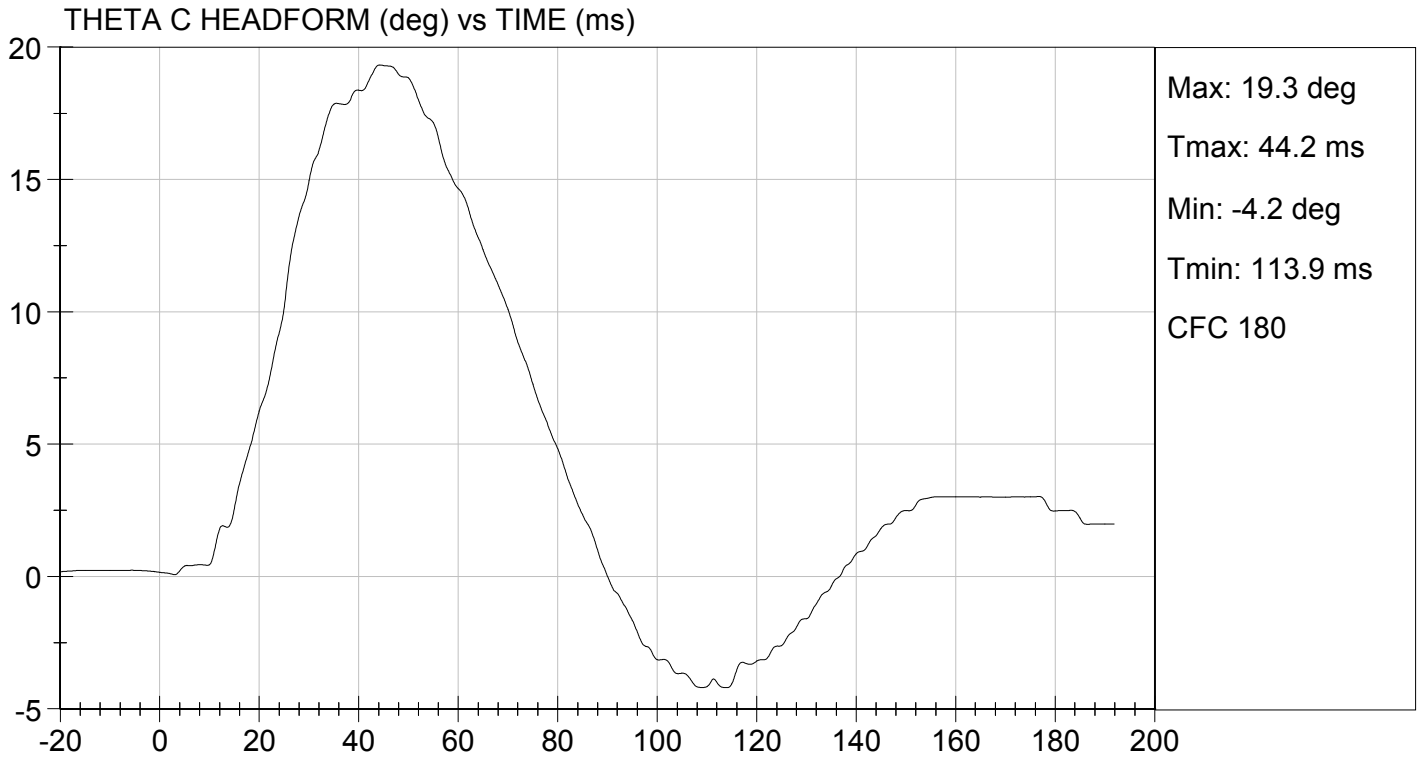
  
 Laboratory Technician

10/02/2012  
 Test Date

  
 Approved By







**MGA RESEARCH CORPORATION**

**PELVIS TEST**

**ES-2re DUMMY**

**ATD Serial No:** 032

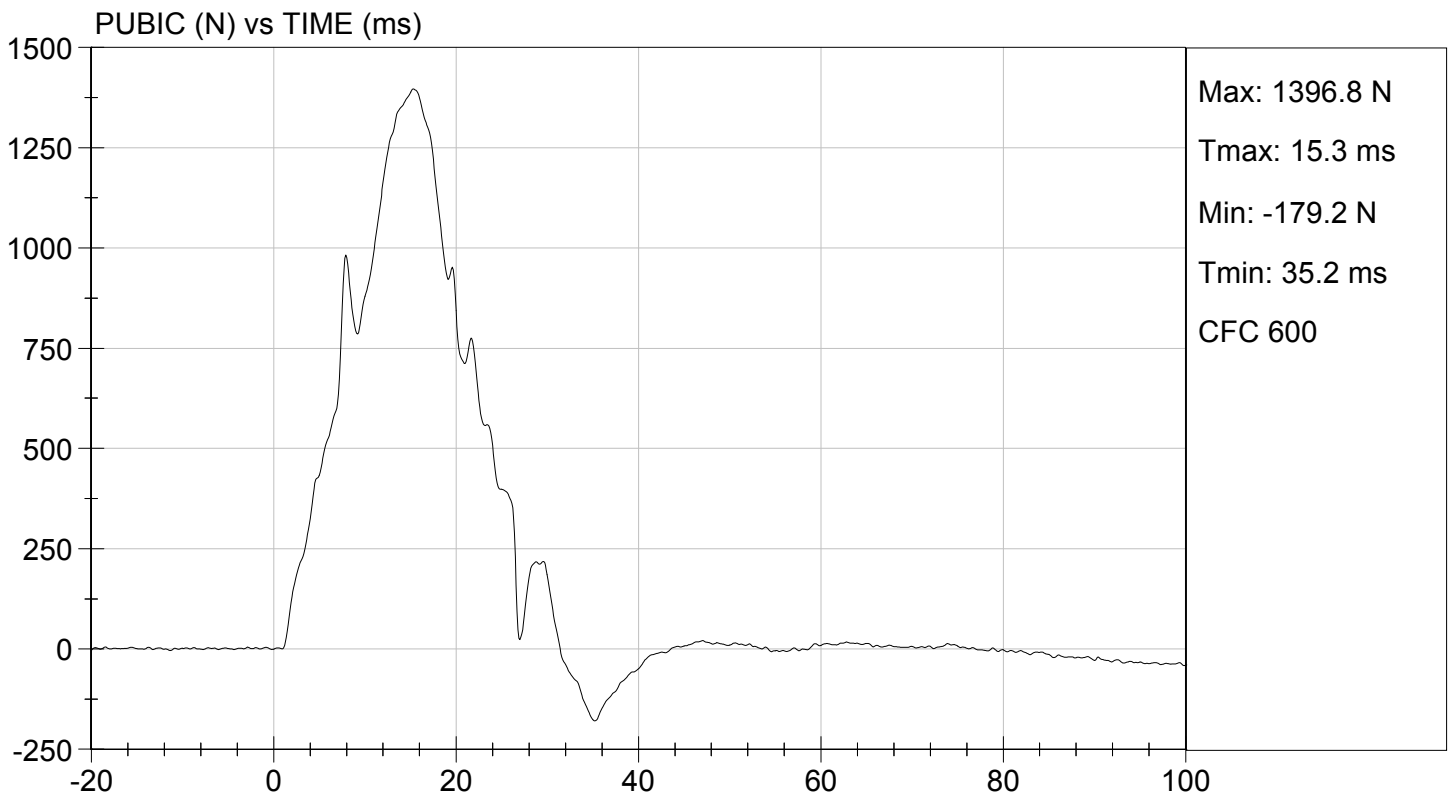
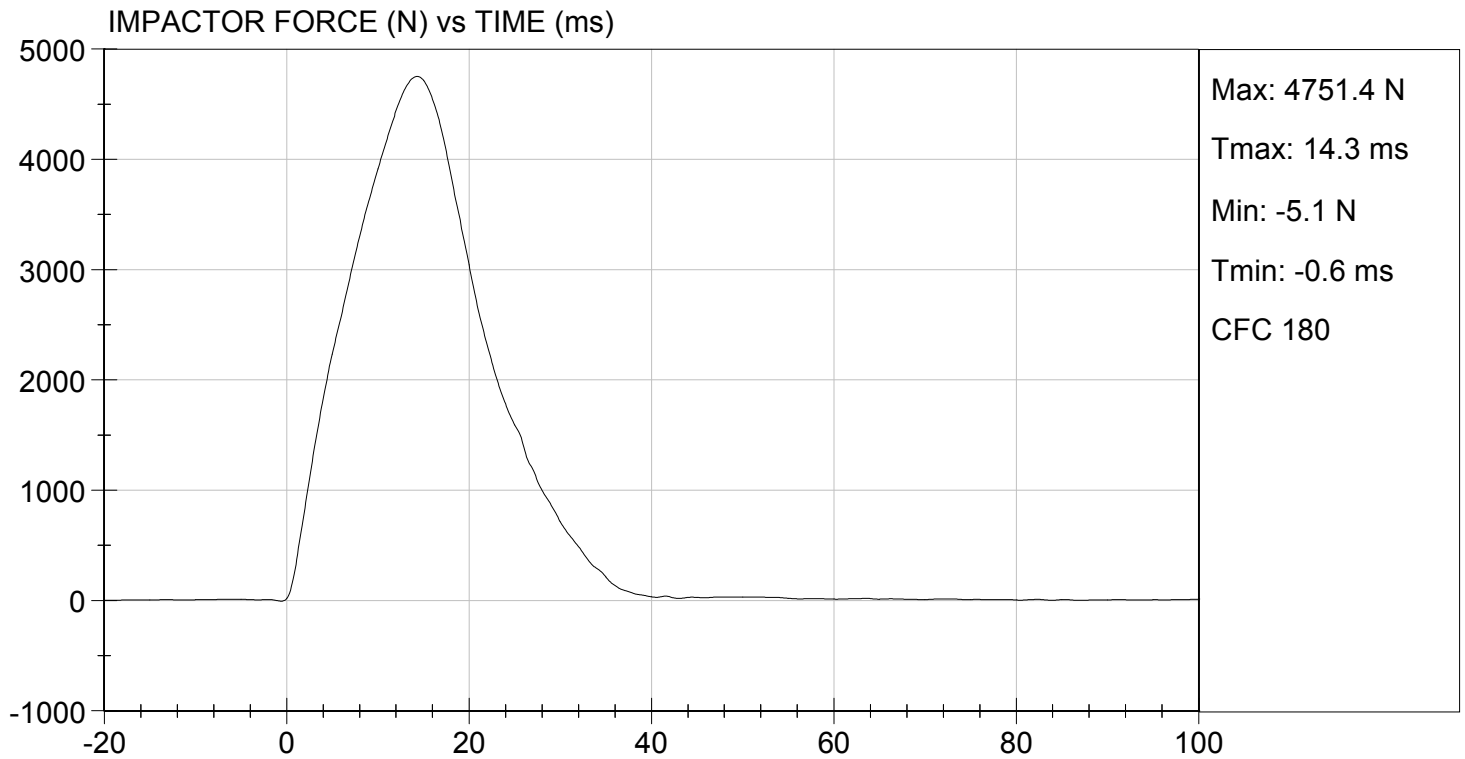
**Test I.D:** D123719

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	38	Pass
Probe Speed	m/s	4.20 to 4.40	4.23	Pass
Maximum Impactor Force	N	4700 to 5400	4751	Pass
Time of Maximum Impactor Force	ms	11.8 to 16.1	14.3	Pass
Maximum Pubic Force	N	1230 to 1590	1397	Pass
Time of Maximum Pubic Force	ms	12.2 to 17.0	15.3	Pass
Overall Test Results				Pass

  
Laboratory Technician

10/02/2012  
Test Date

  
Approved By



**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**ES-2re DUMMY**

ATD Serial No: 032

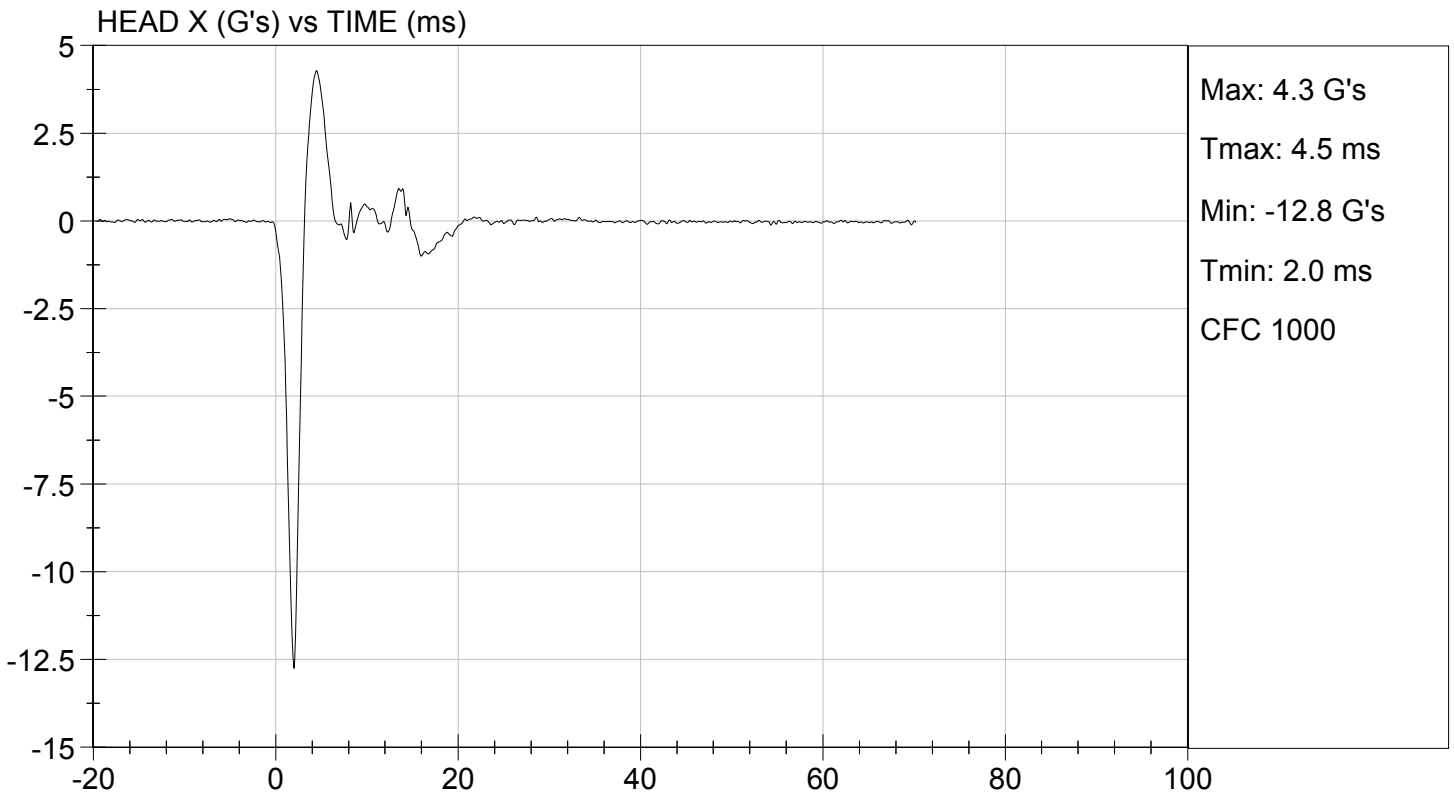
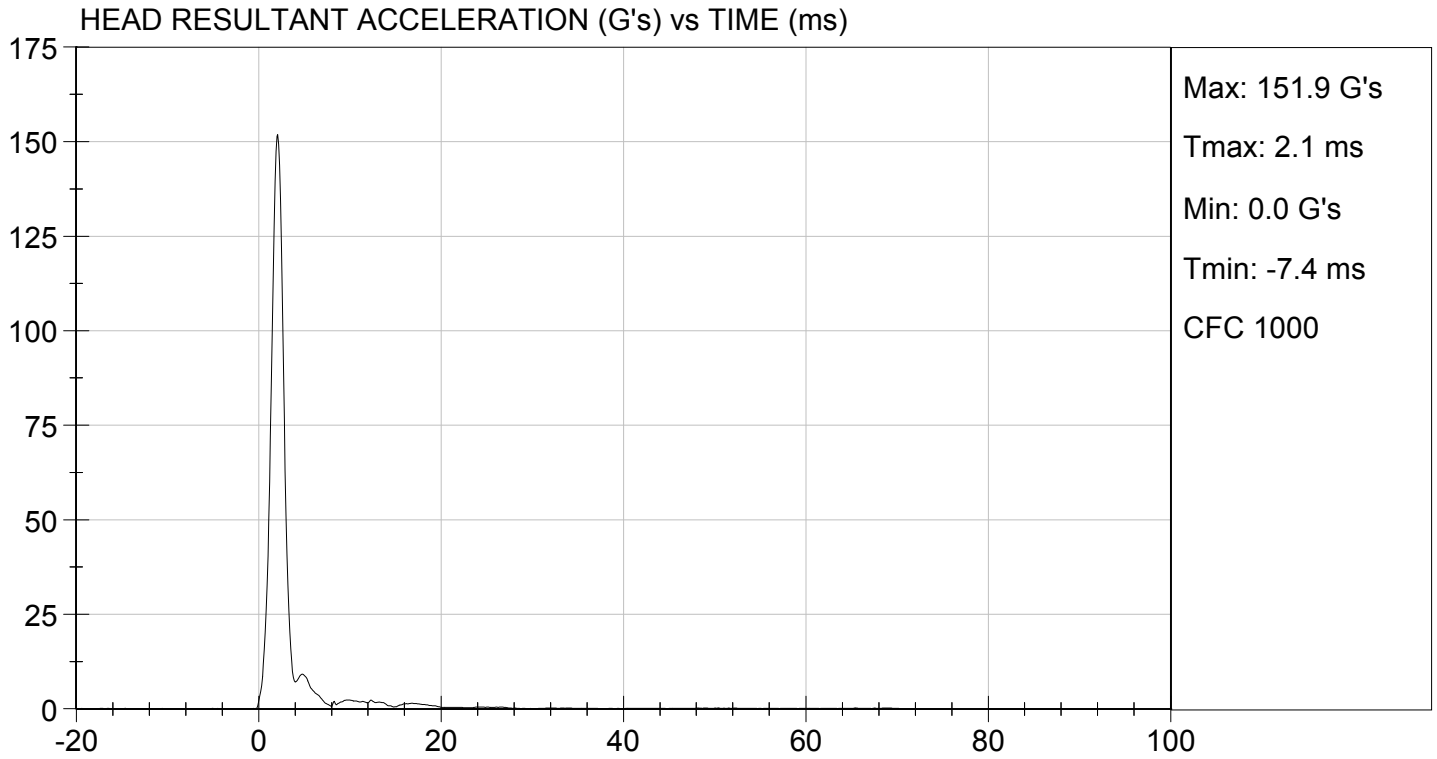
Test ID: D123851

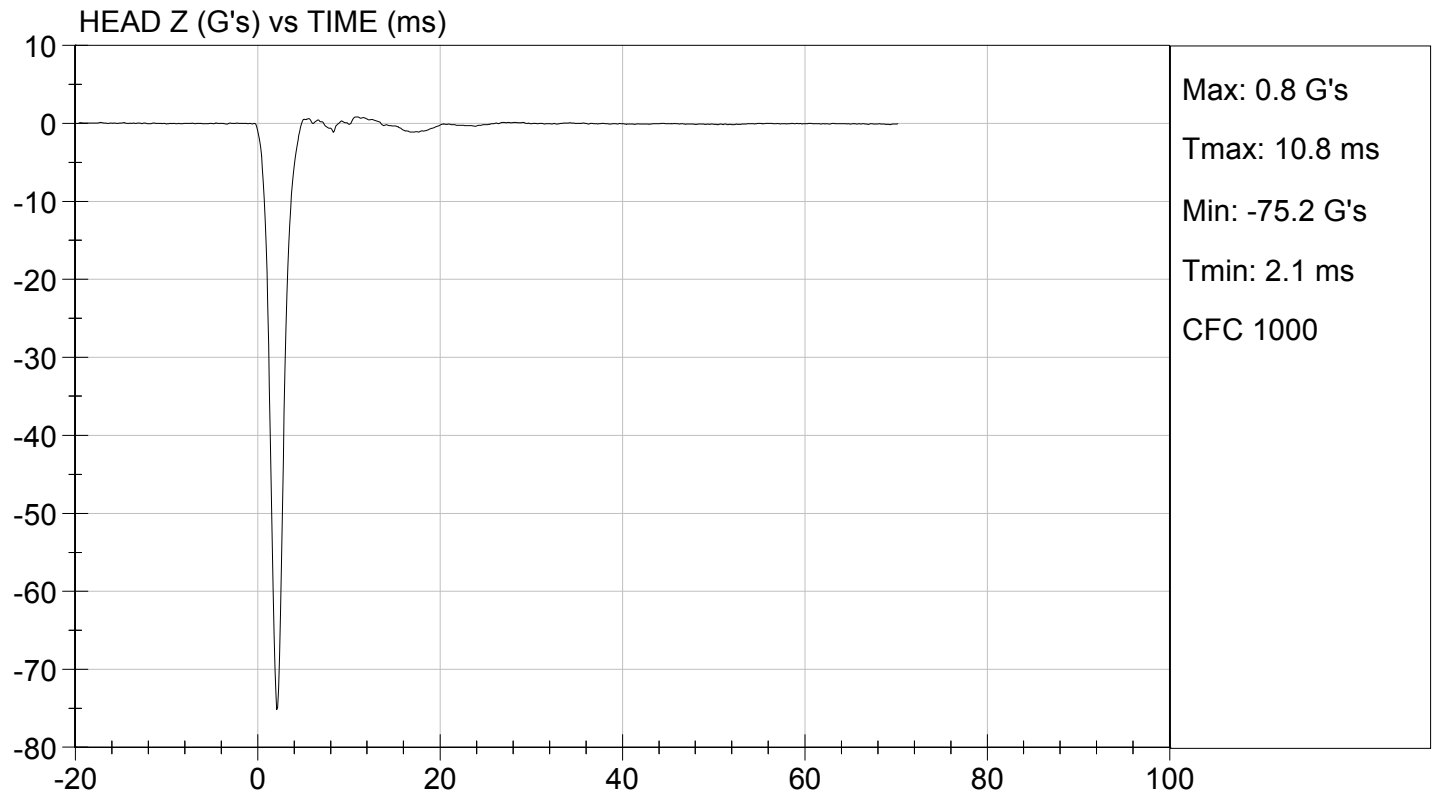
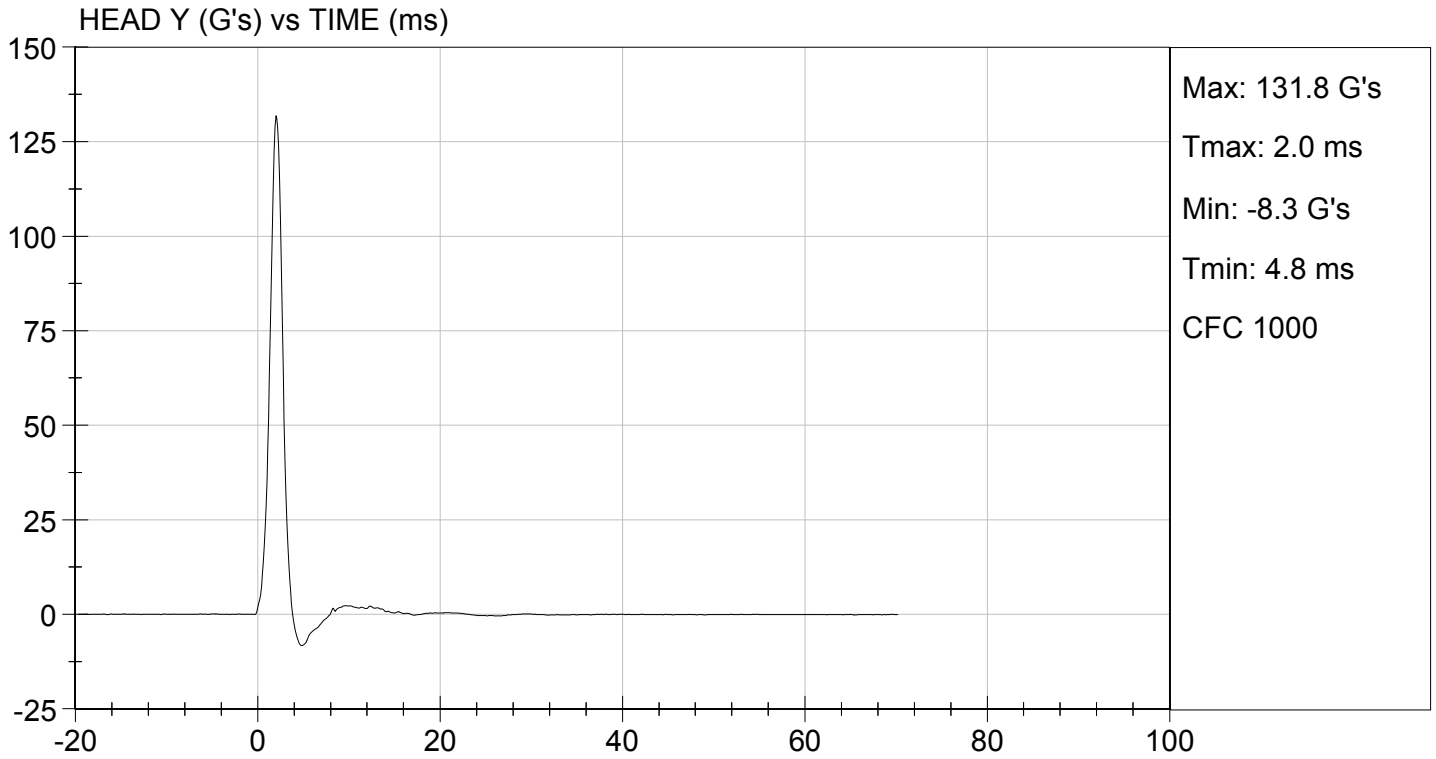
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Peak Resultant Acceleration	G's	125 to 155	152	Pass
Peak Longitudinal Acceleration	G's	<= +/- 15.0	-12.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
<b>Overall Test Results</b>				<b>Pass</b>

  
 Laboratory Technician

10/10/2012  
 Test Date

  
 Approved By





**MGA RESEARCH CORPORATION**  
**NECK PENDULUM TEST**  
**ES-2re DUMMY**

**ATD Serial No:** 032

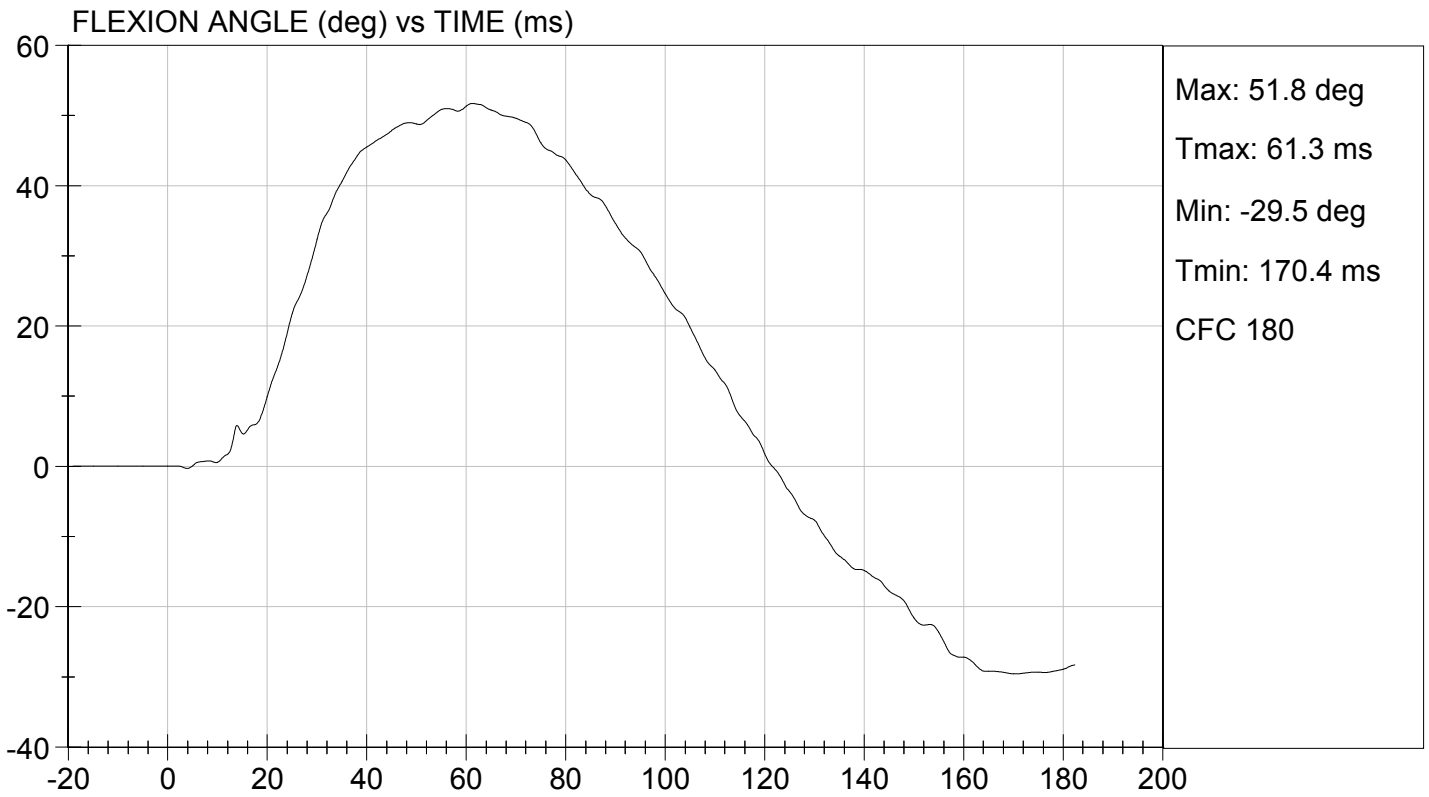
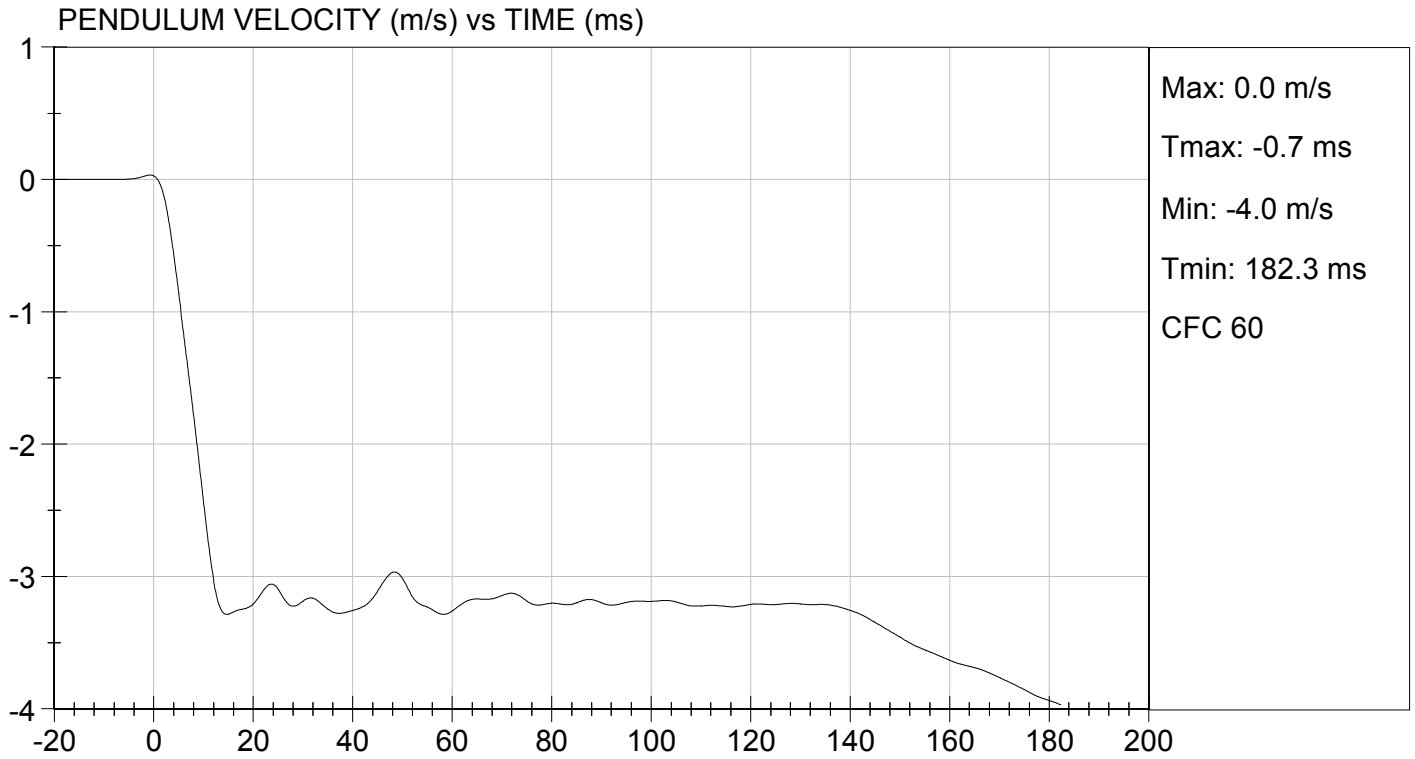
**Test I.D.:** D123852

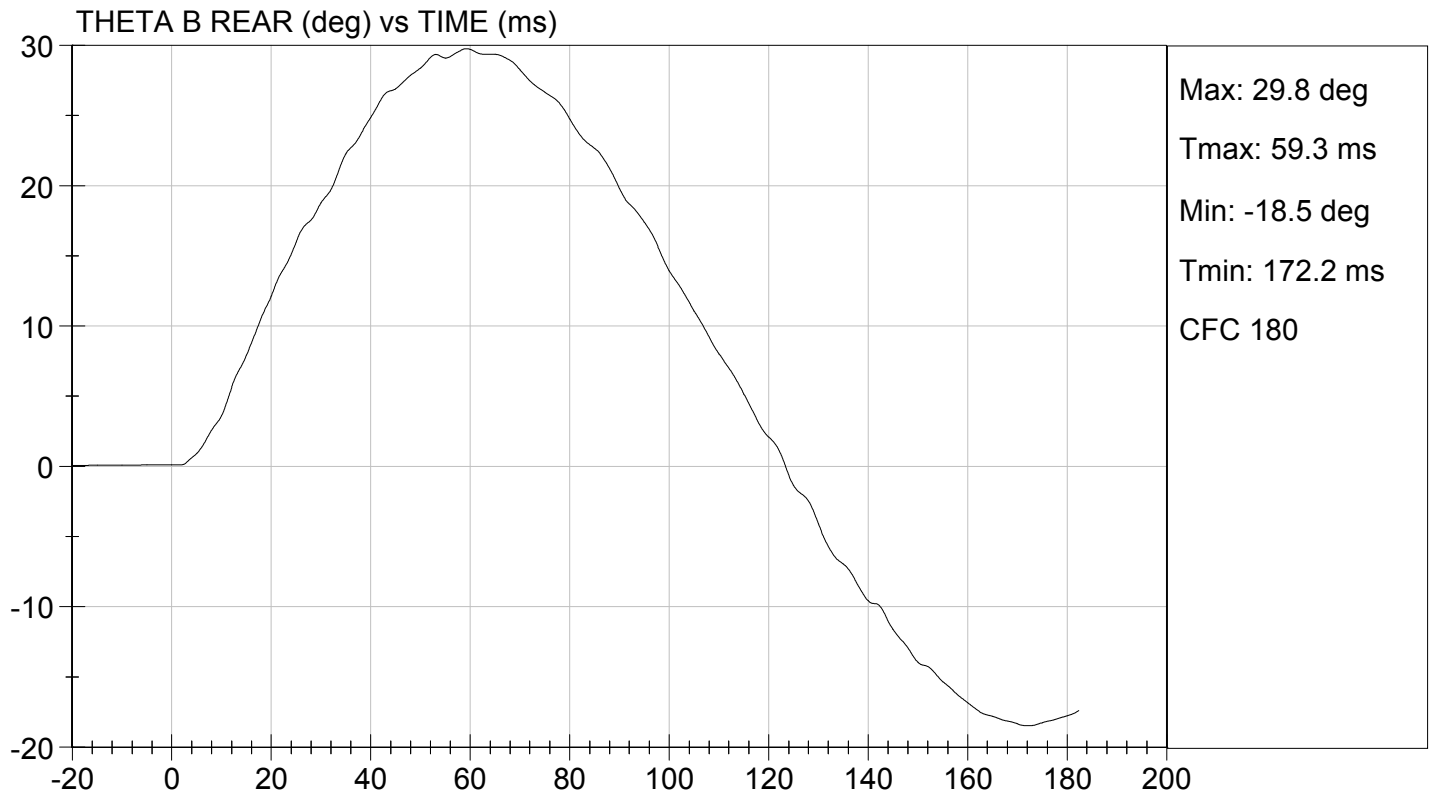
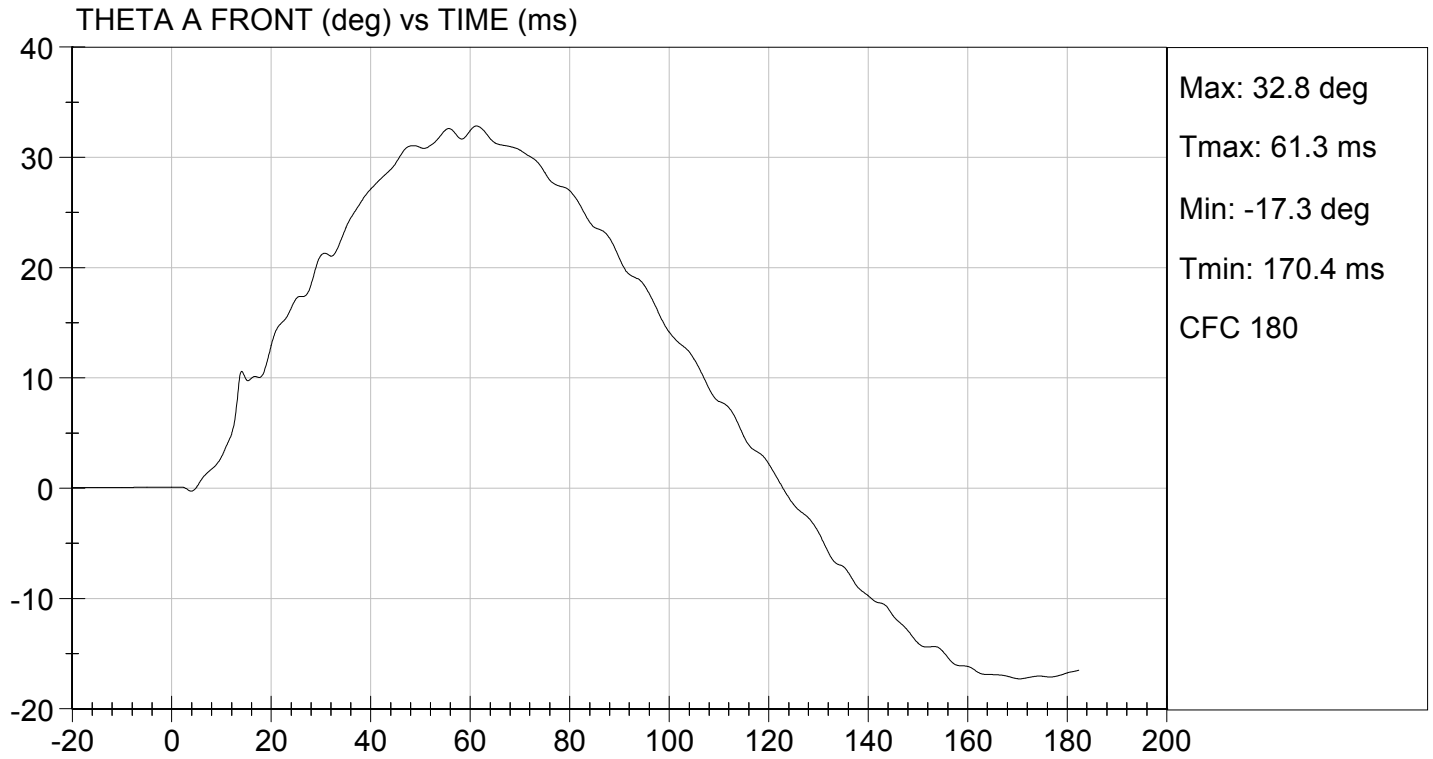
Tested Parameter	Units	Specification	Result	Pass/Fail	
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass	
Laboratory Relative Humidity	%	10 to 70	34	Pass	
Pendulum Speed	m/s	3.30 to 3.50	3.39	Pass	
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3 ms	m/s	-0.25 to -0.375	-0.31	Pass
	14 ms	m/s	-3.20 to -3.70	-3.28	Pass
	17 ms	m/s	>= -3.70	-3.25	Pass
Maximum Flexion Angle	deg	49.0 to 59.0	51.8	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	59.3	Pass	
<b>Overall Results</b>				<b>Pass</b>	

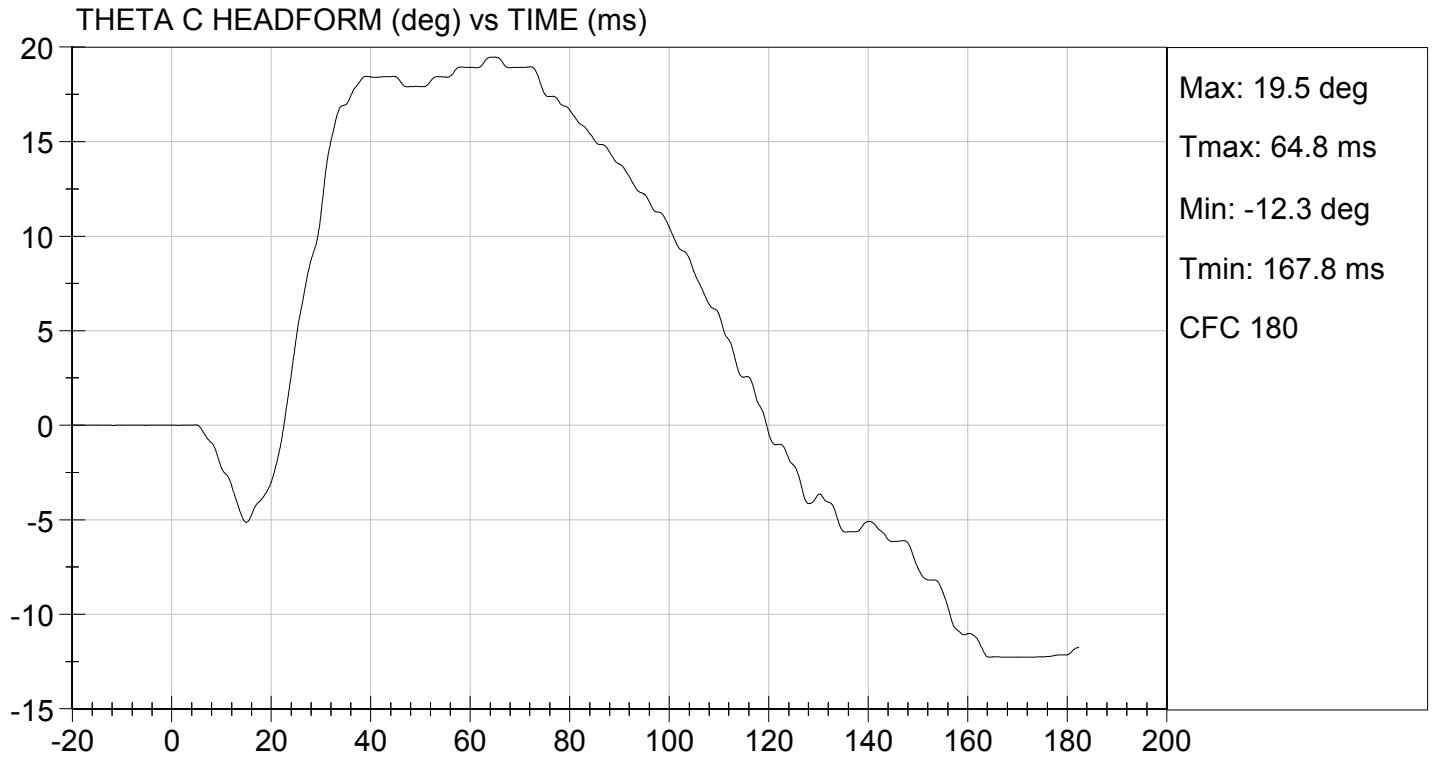
Jessica Hall  
 Laboratory Technician

10/10/2012  
 Test Date

David Winkelbauer  
 Approved By







**MGA RESEARCH CORPORATION**  
**SHOULDER IMPACT TEST**  
**ES-2re DUMMY**

**ATD Serial No:** 032

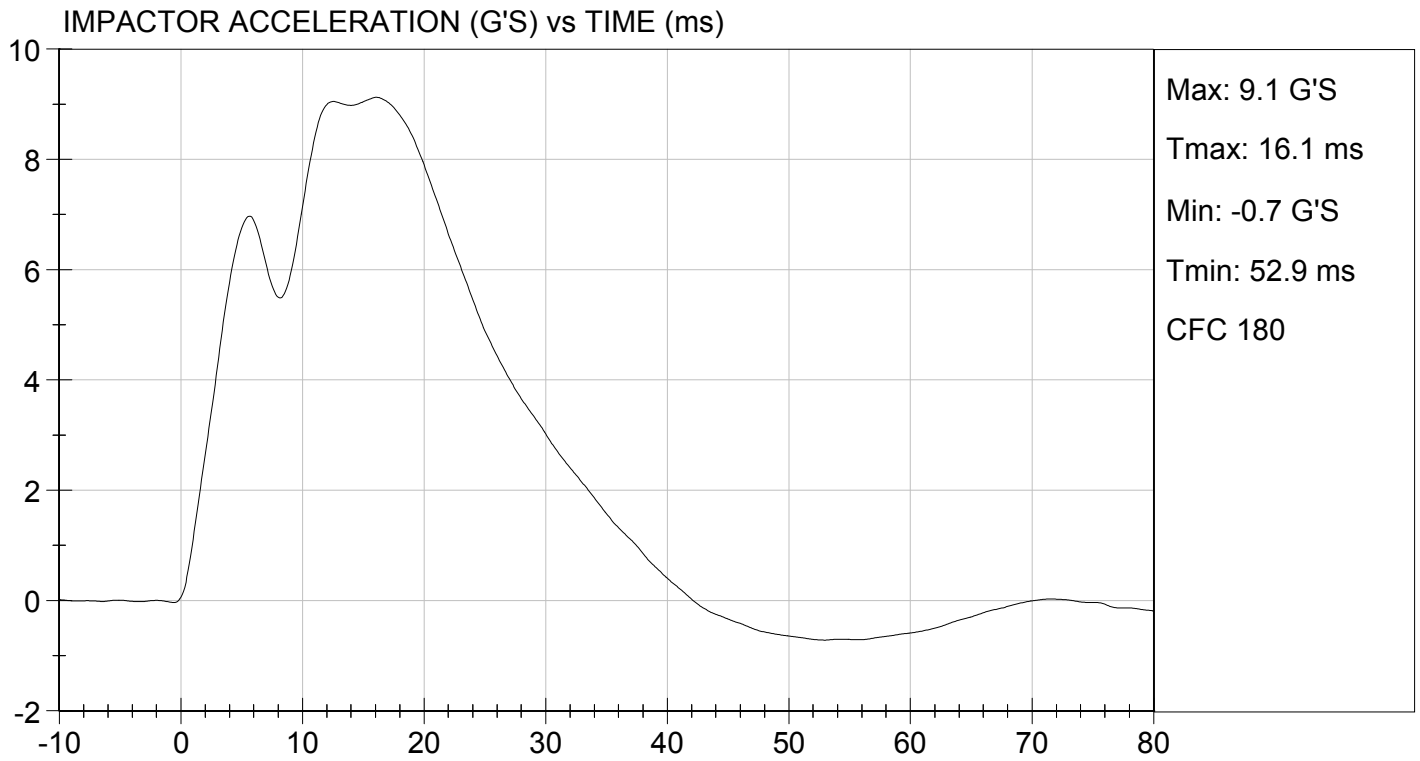
**Test I.D:** D123853

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Pendulum Speed	m/s	4.20 to 4.40	4.27	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	9.1	Pass
Overall Test Results				Pass

*Jessica Gall*  
 Laboratory Technician

10/10/2012  
 Test Date

*David Winkelbauer*  
 Approved By



**MGA RESEARCH CORPORATION**

**UPPER RIB TEST**

**ES-2re DUMMY**

**ATD Serial No:** 032

**Test I.D:** D123854

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Displacement at 459 mm	mm	36.0 to 40.0	38.4	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.0	Pass
Overall Test Results				Pass

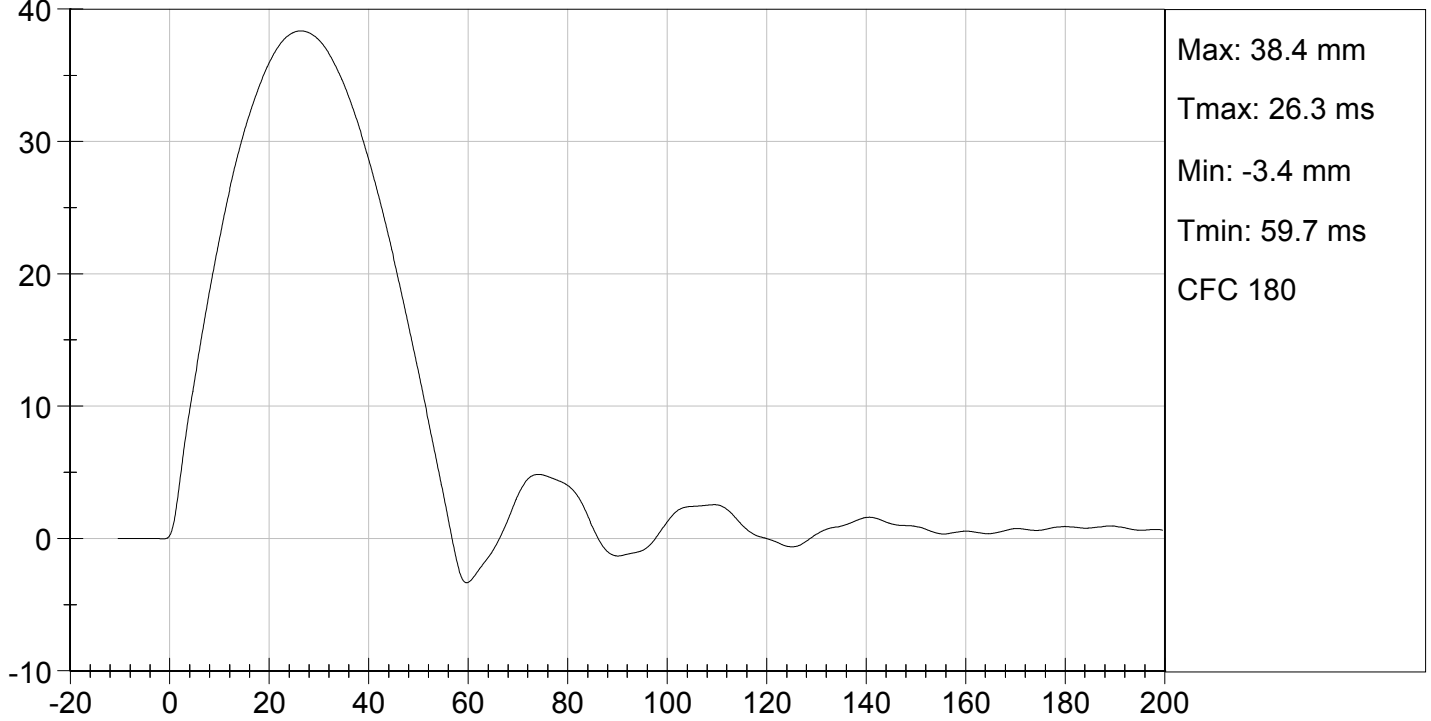
*Jessica Hall*  
Laboratory Technician

10/10/2012  
Test Date

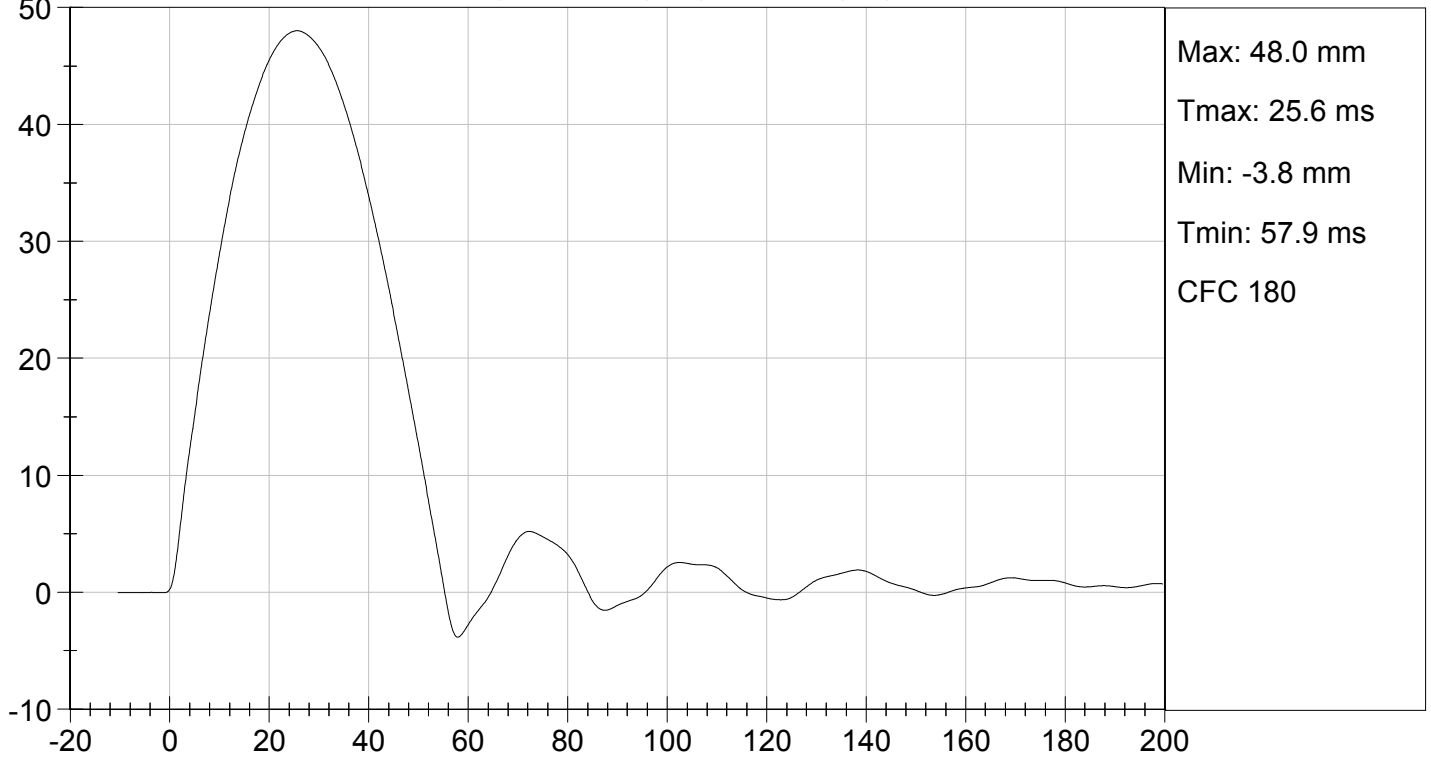
*David Winkelbauer*  
Approved By



UPPER RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: 032

Test I.D: D123855

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Displacement at 459 mm	mm	36.0 to 40.0	37.3	Pass
Displacement at 815 mm	mm	46.0 to 51.0	47.8	Pass
Overall Test Results				Pass

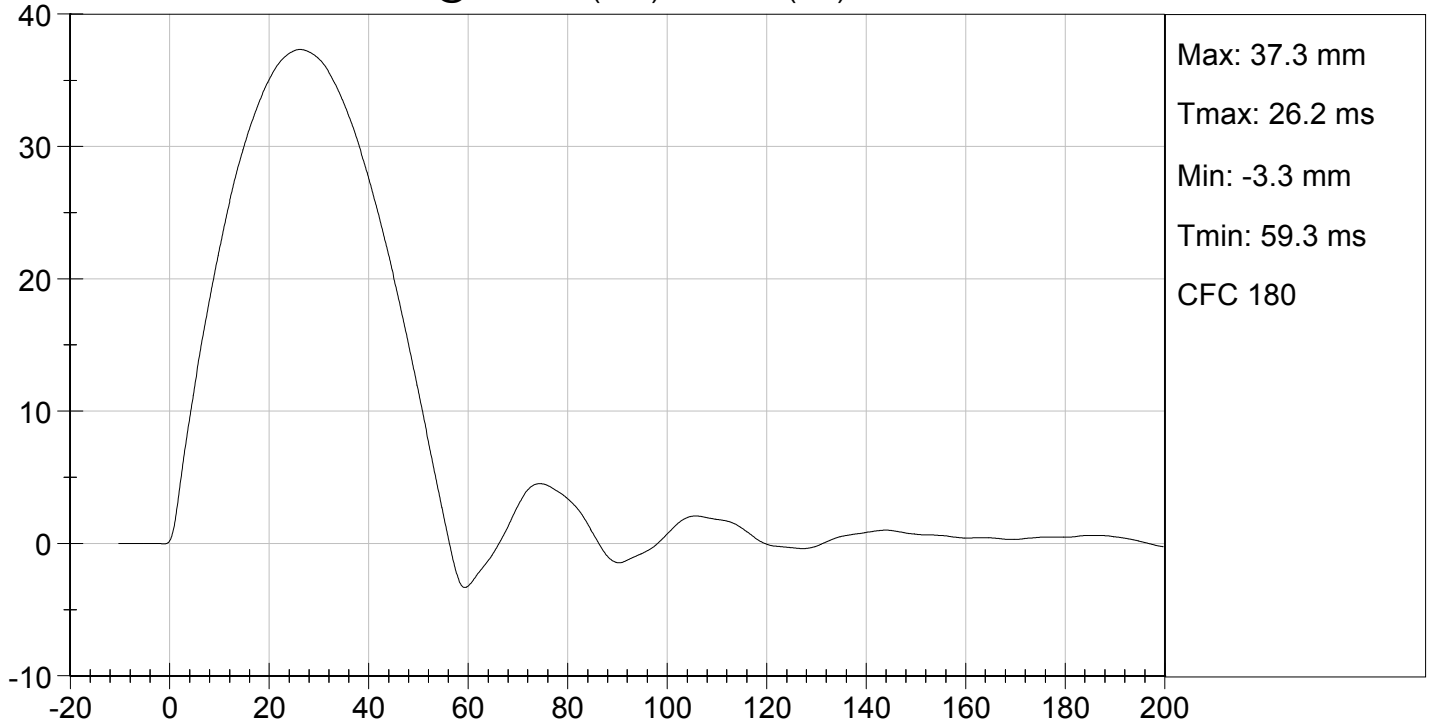
Jessica Gall  
Laboratory Technician

10/10/2012  
Test Date

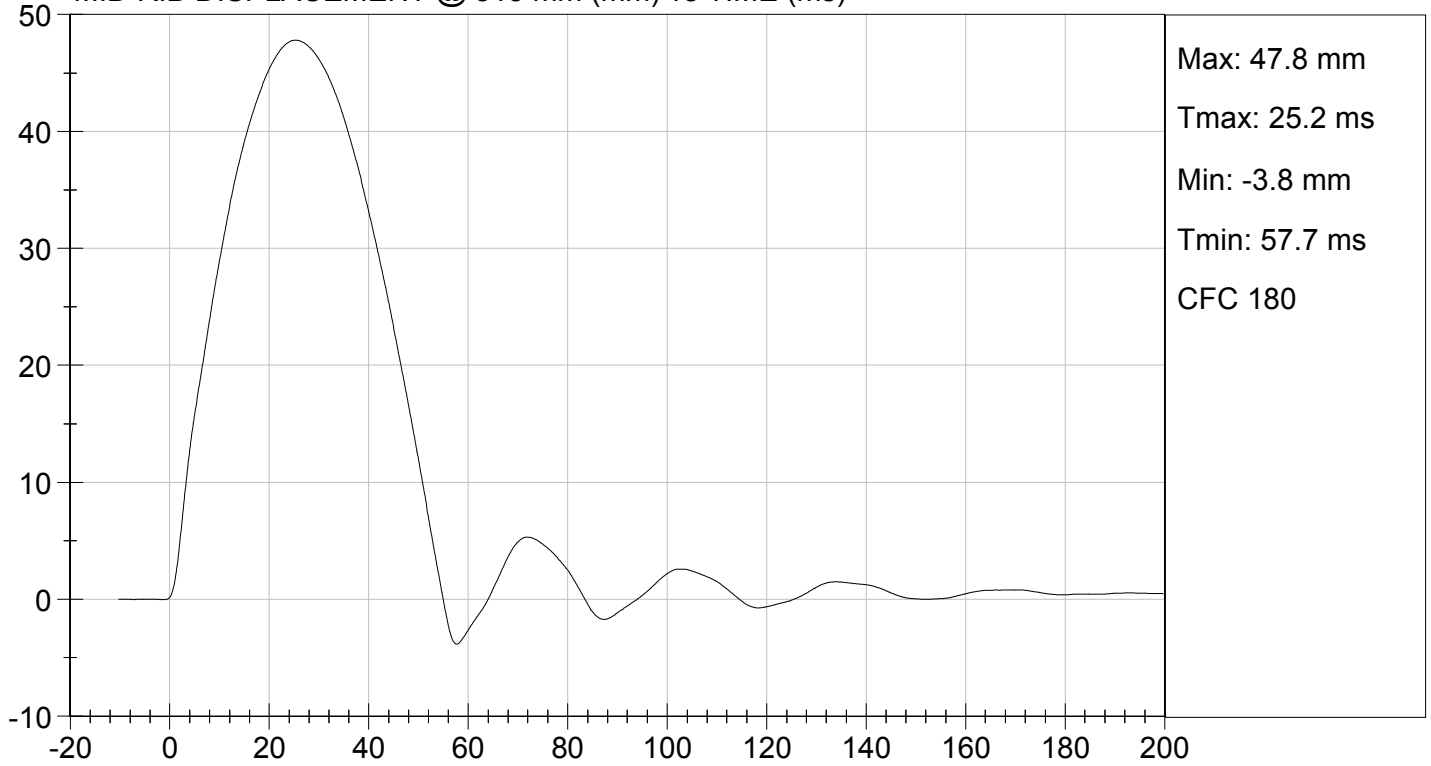
David Winkelbauer  
Approved By



MID RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)



MID RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)



**MGA RESEARCH CORPORATION**

**LOWER RIB TEST**

**ES-2re DUMMY**

**ATD Serial No:** 032

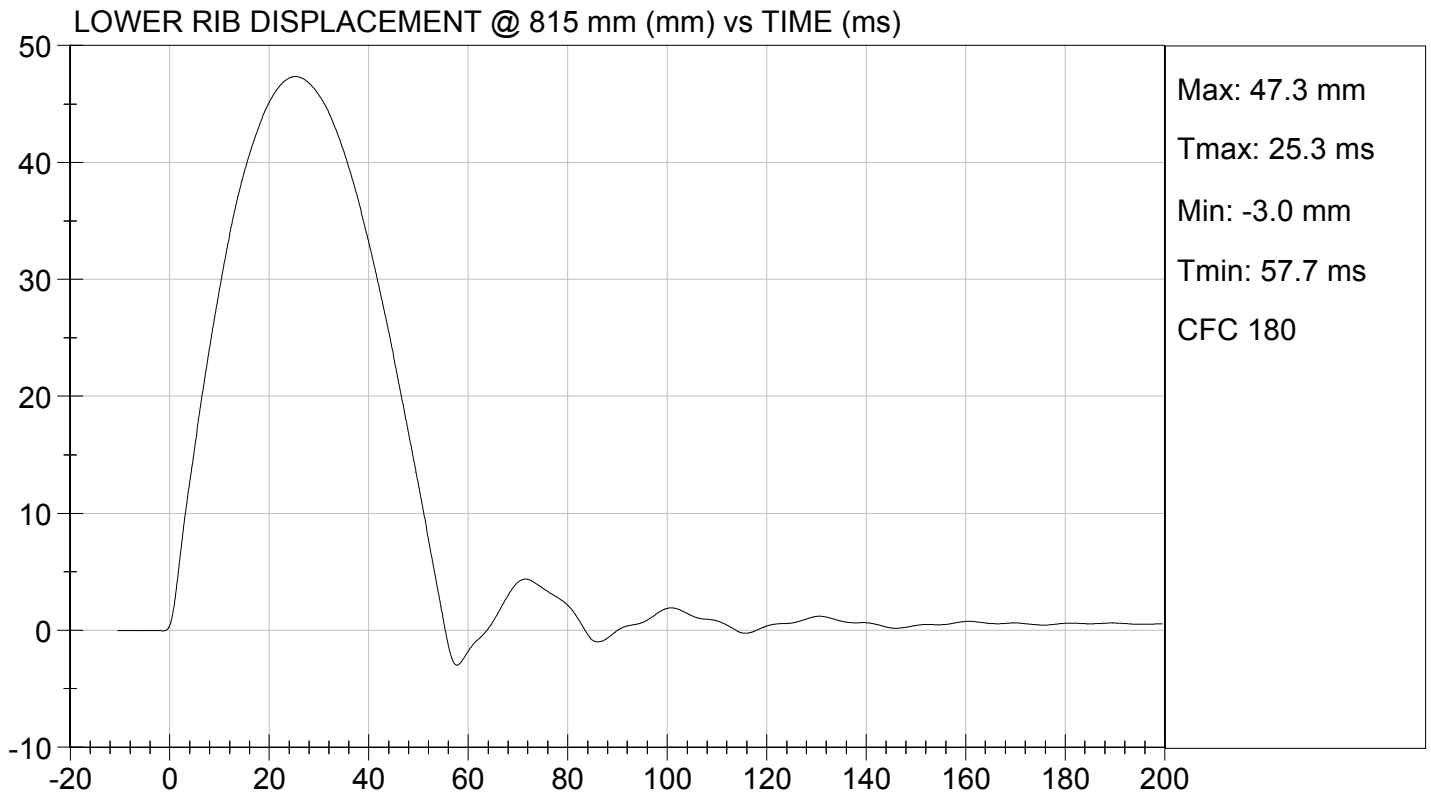
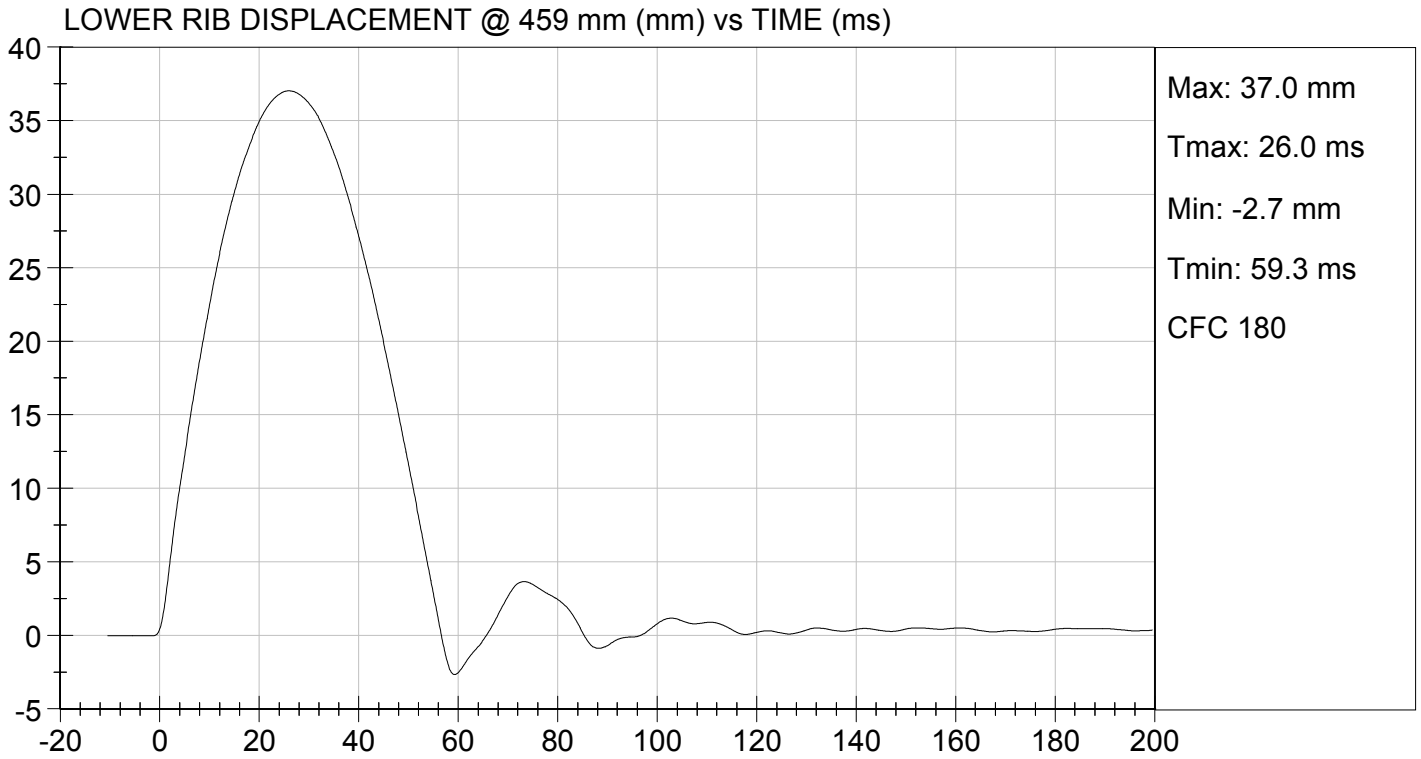
**Test I.D:** D123856

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Displacement at 459 mm	mm	36.0 to 40.0	37.0	Pass
Displacement at 815 mm	mm	46.0 to 51.0	47.3	Pass
Overall Test Results				Pass

  
Laboratory Technician

10/10/2012  
Test Date

  
Approved By



**MGA RESEARCH CORPORATION**  
**THORAX IMPACT TEST**  
**ES-2re DUMMY**

**ATD Serial No:** 032

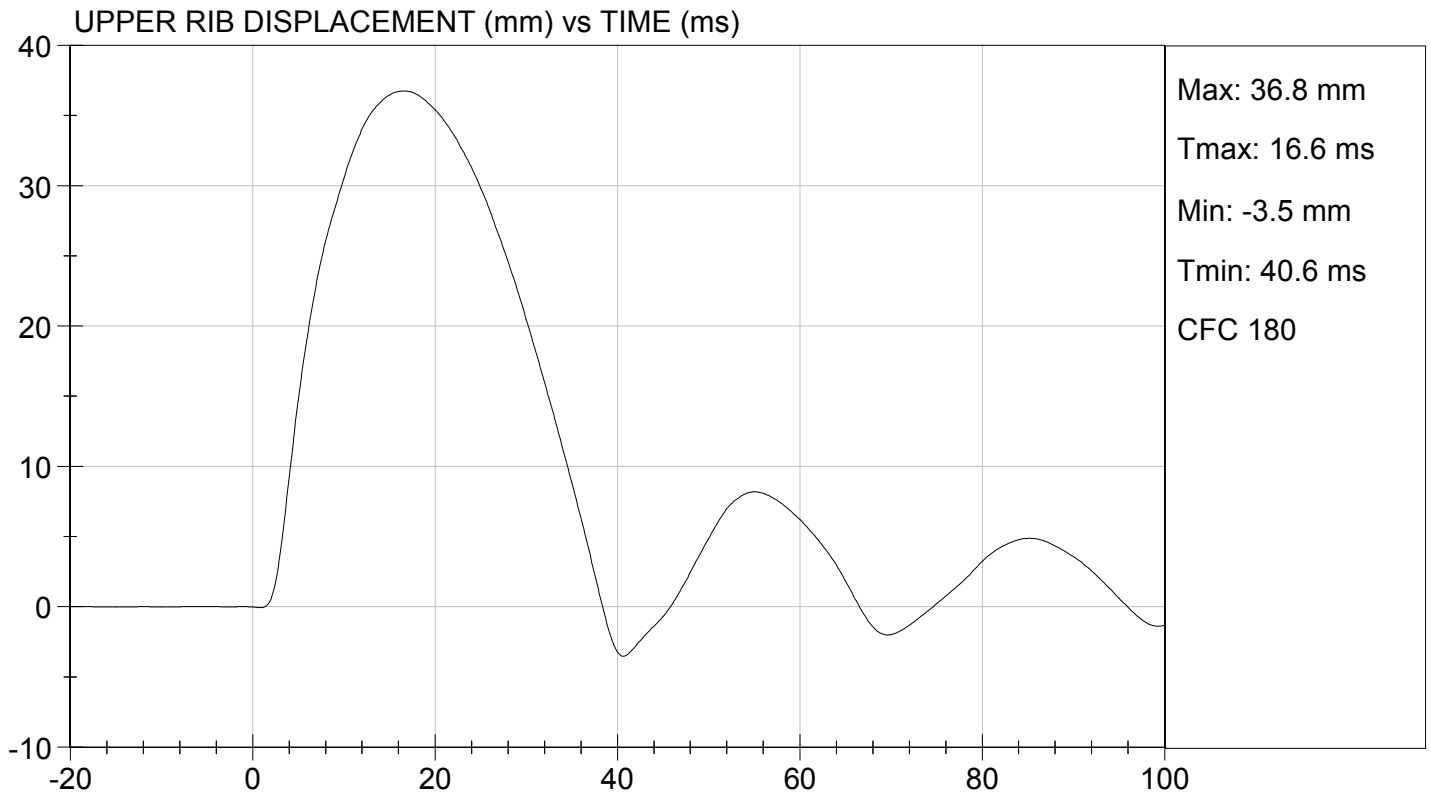
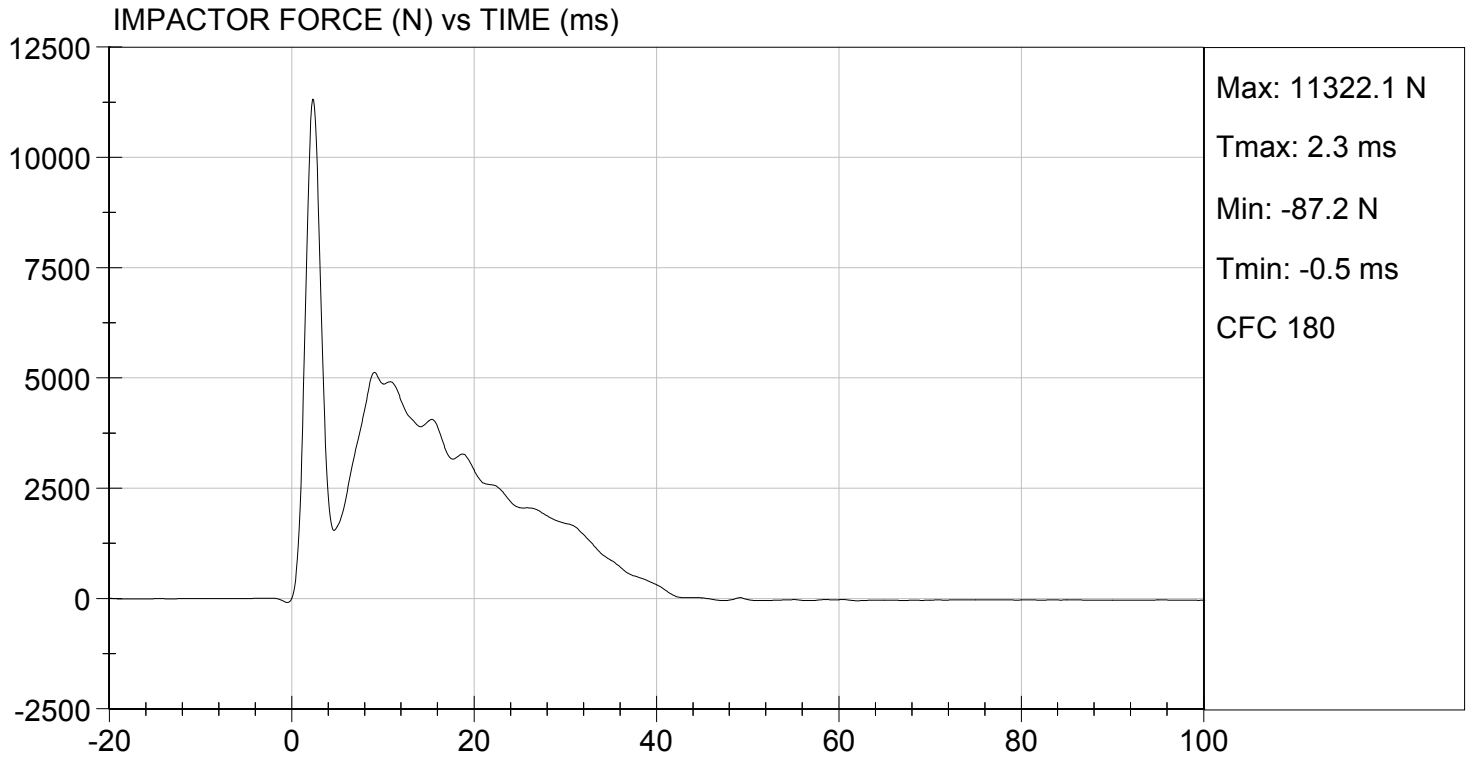
**Test I.D.:** D123850

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.0	Pass
Humidity	%	10 to 70	23	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	N	5100 to 6200	5126	Pass
Upper Rib Displacement	mm	34.0 to 41.0	36.8	Pass
Middle Rib Displacement	mm	37.0 to 45.0	40.1	Pass
Lower Rib Displacement	mm	37.0 to 44.0	39.7	Pass
<b>Overall Test Results</b>				<b>Pass</b>

*Jessica Hall*  
 Laboratory Technician

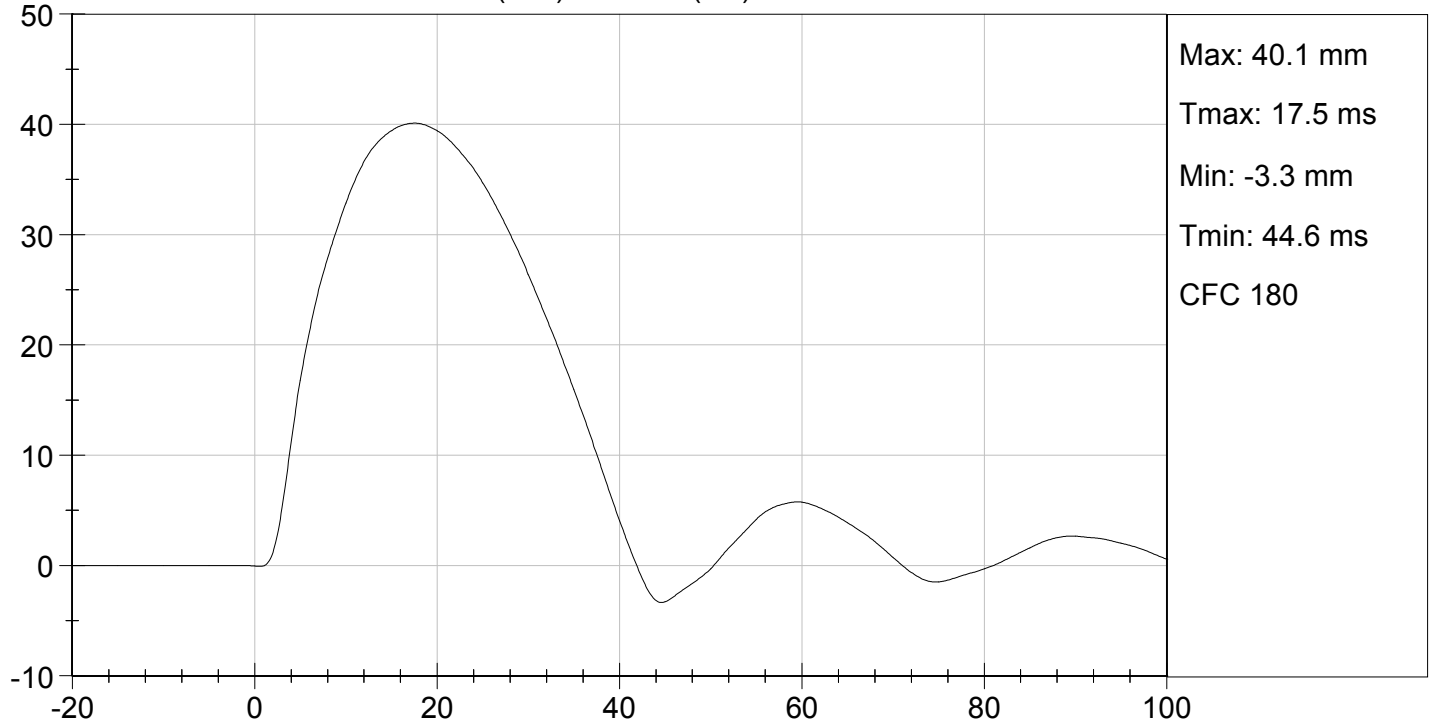
10/10/2012  
 Test Date

*David Winkelbauer*  
 Approved By

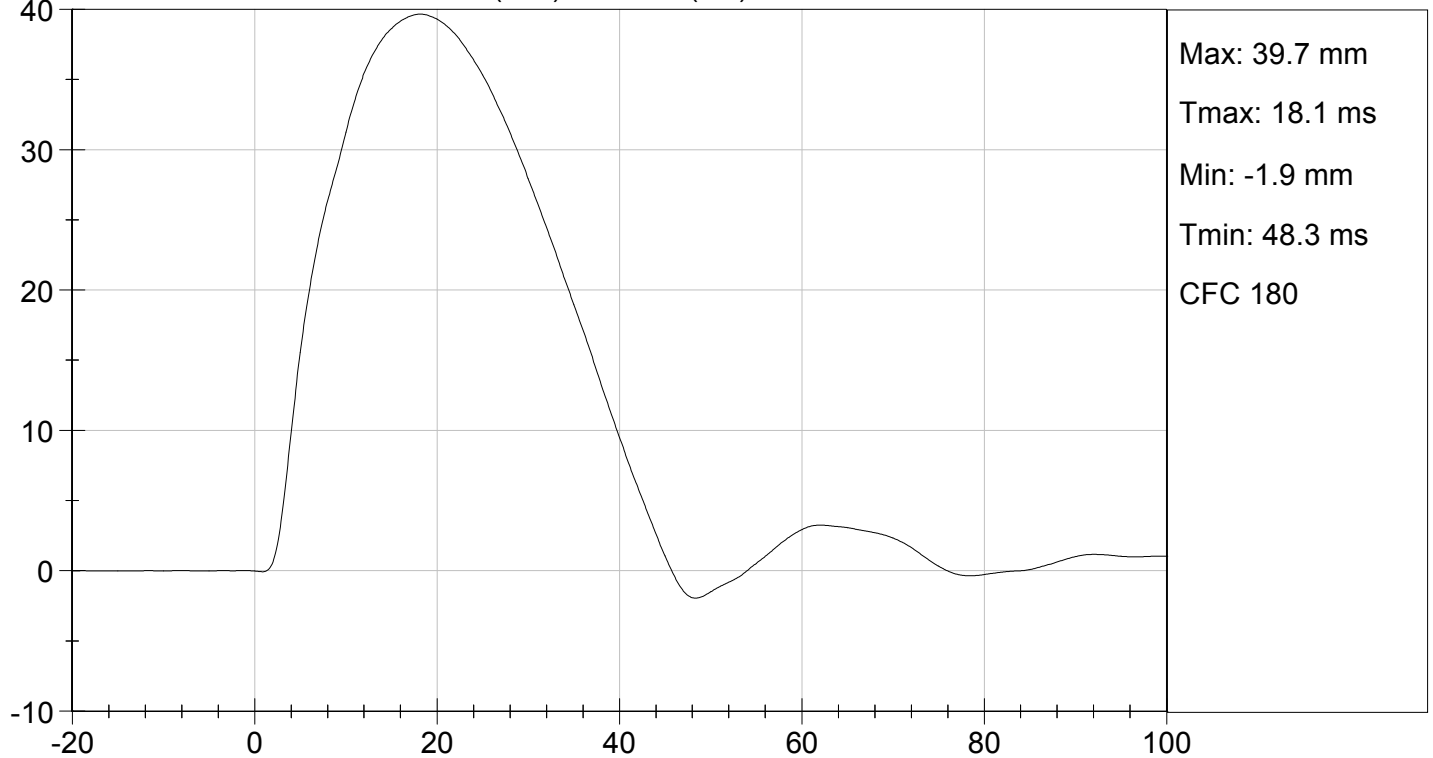




MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



**MGA RESEARCH CORPORATION**

**ABDOMEN TEST**

**ES-2re DUMMY**

**ATD Serial No:** 032

**Test I.D:** D123857

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Probe Speed	m/s	3.90 to 4.10	4.10	Pass
Maximum Impactor Force	N	4000 to 4800	4340	Pass
Time of Maximum Impactor Force	ms	10.6 to 13.0	11.4	Pass
Maximum Total Abdomen Force	N	2200 to 2700	2444	Pass
Time of Maximum Abdomen Force	ms	10.0 to 12.3	11.2	Pass
Overall Test Results				Pass

  
Laboratory Technician

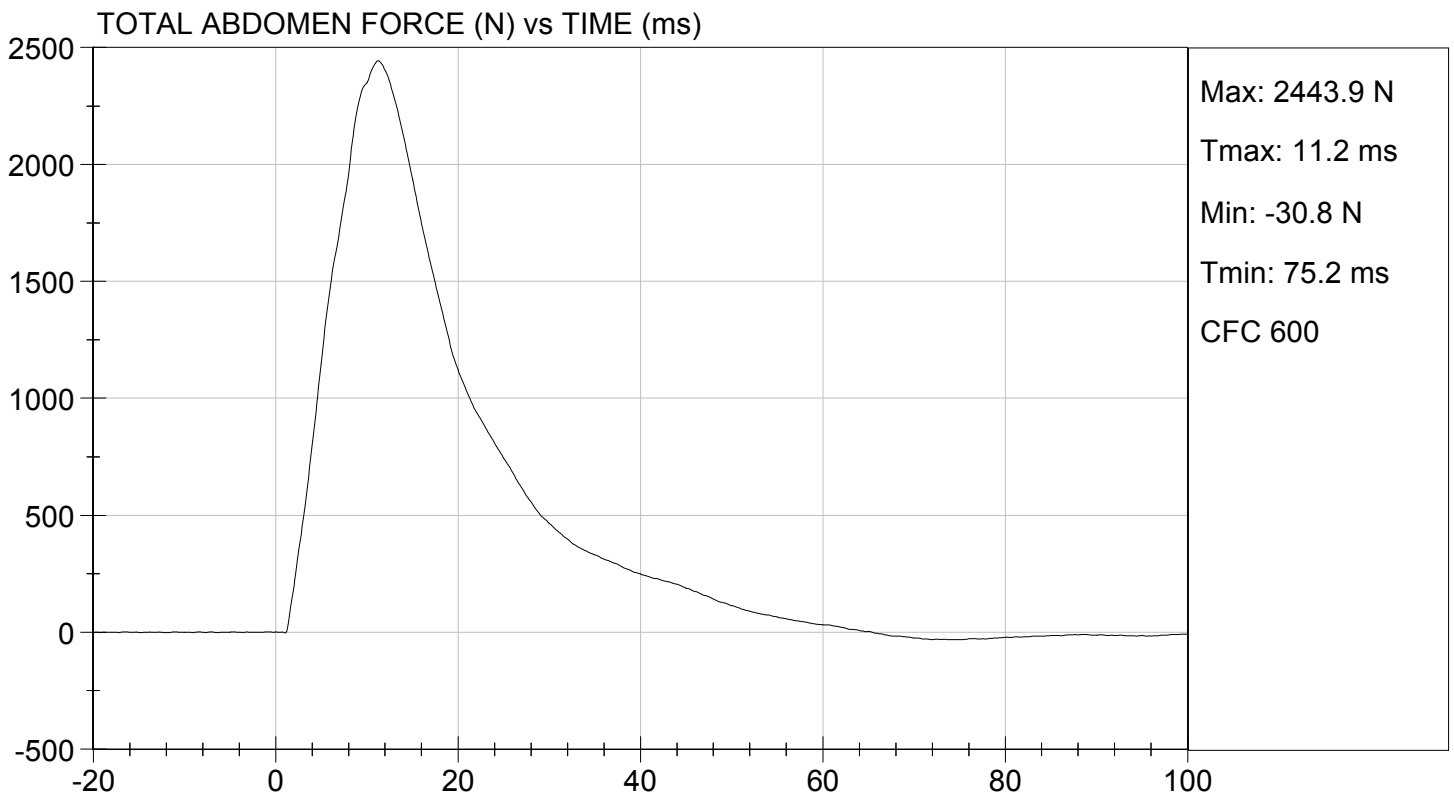
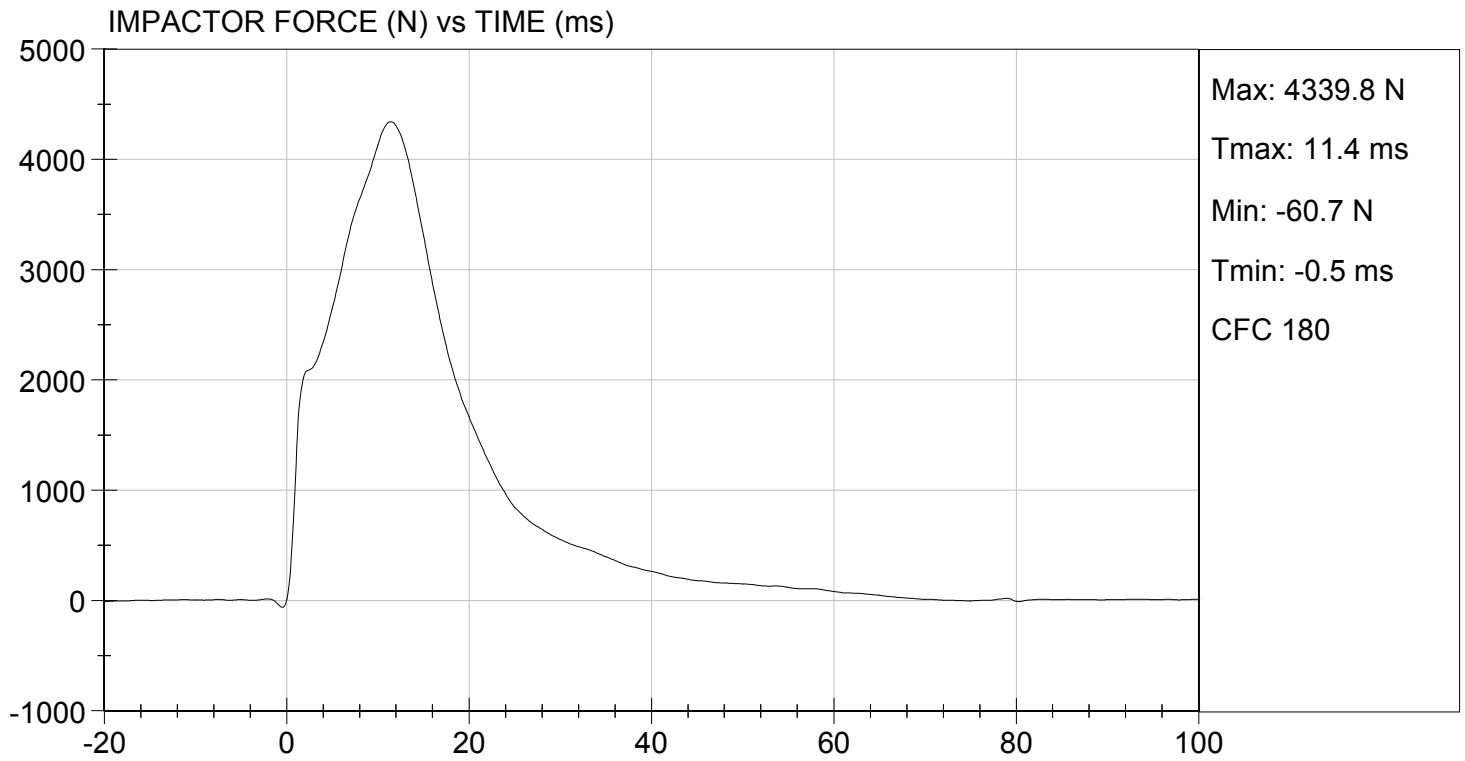
10/10/2012  
Test Date

  
Approved By



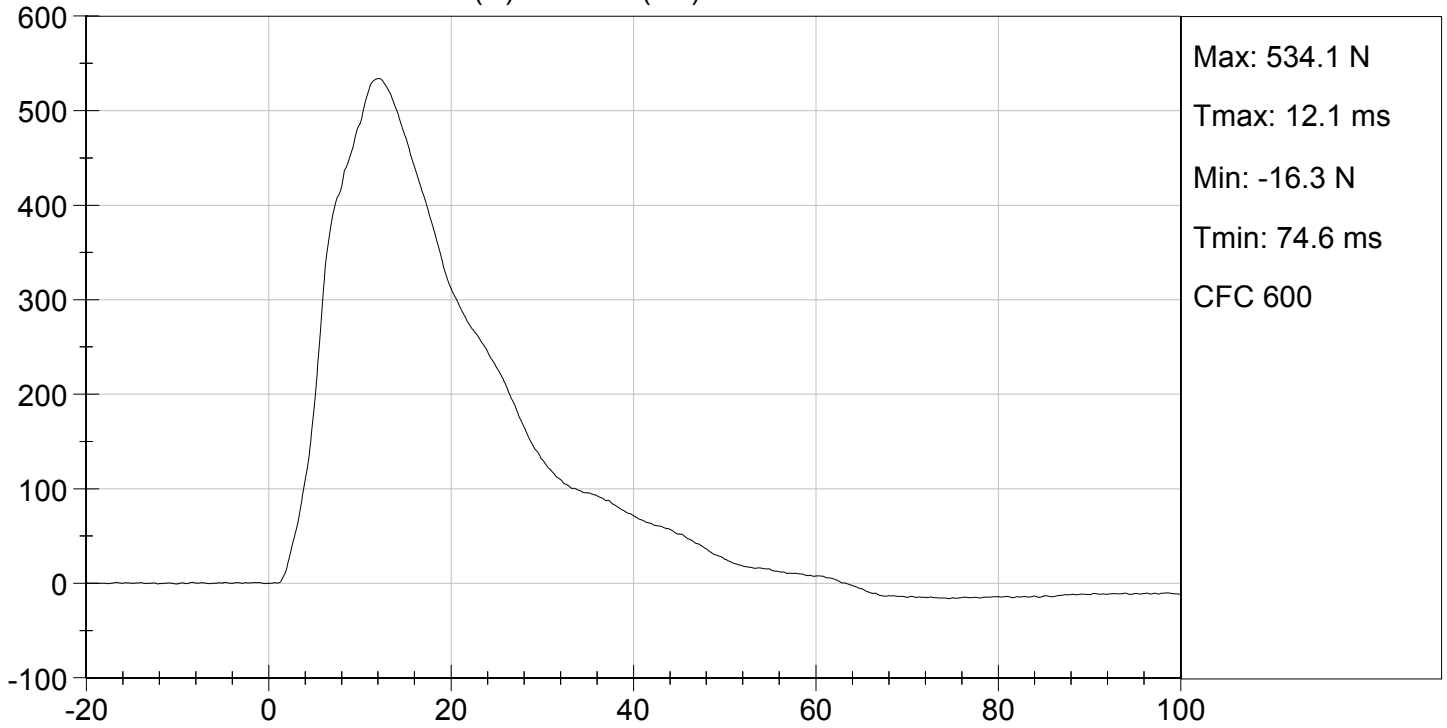
TEST DESC: ABDOMEN IMPACT  
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 10/10/2012  
TEST #: D123857

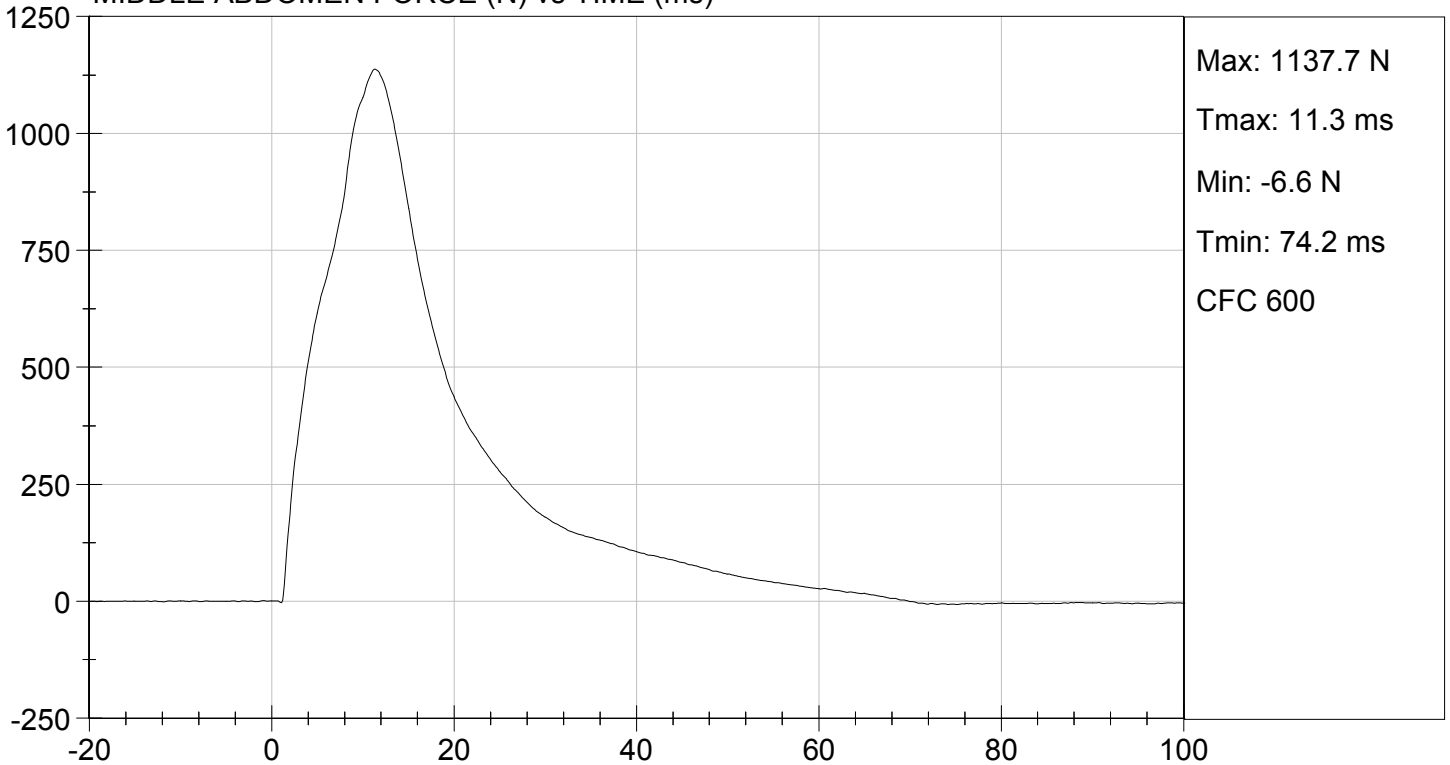




FRONT ABDOMEN FORCE (N) vs TIME (ms)



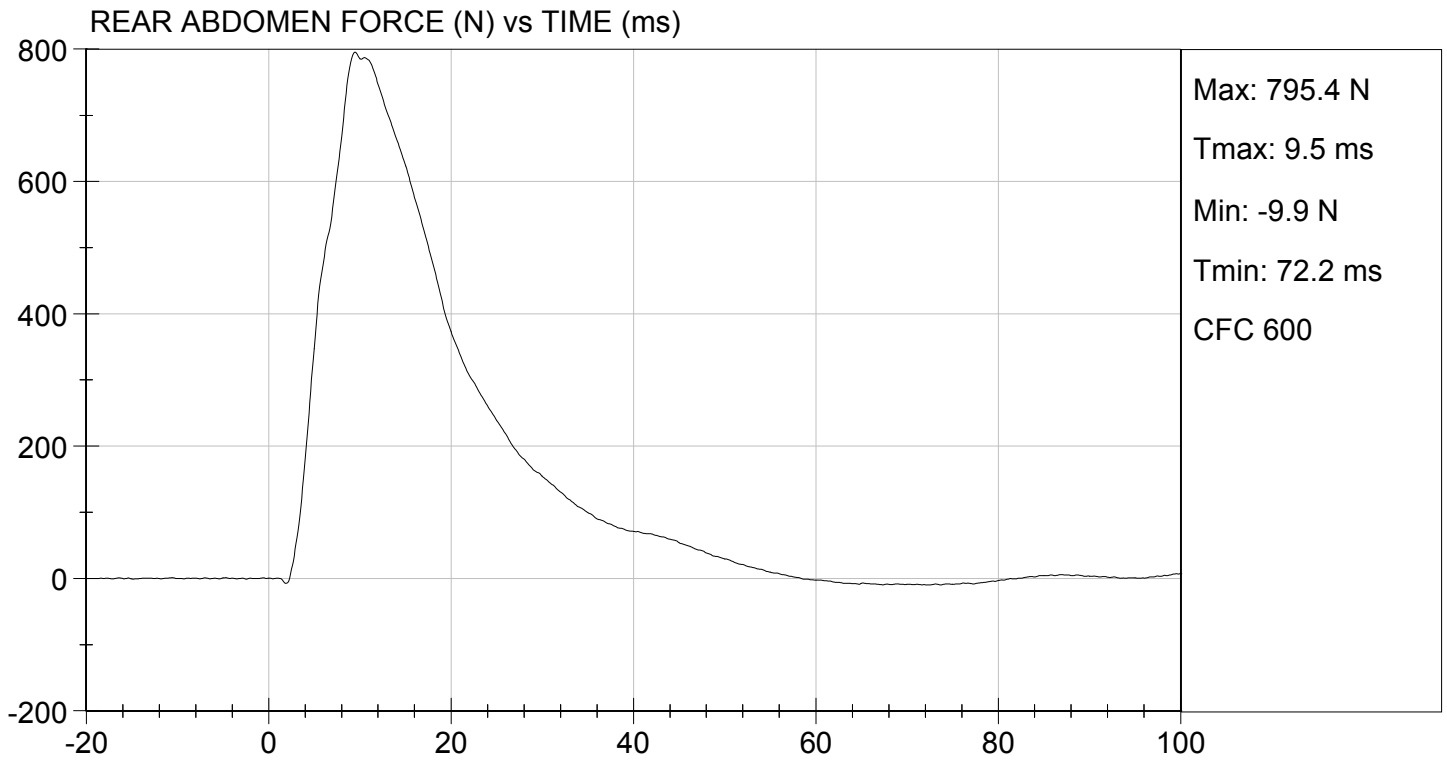
MIDDLE ABDOMEN FORCE (N) vs TIME (ms)





TEST DESC: ABDOMEN IMPACT  
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 10/10/2012  
TEST #: D123857



**MGA RESEARCH CORPORATION**  
**LUMBAR SPINE TEST**  
**ES-2re DUMMY**

**ATD Serial No:** 032

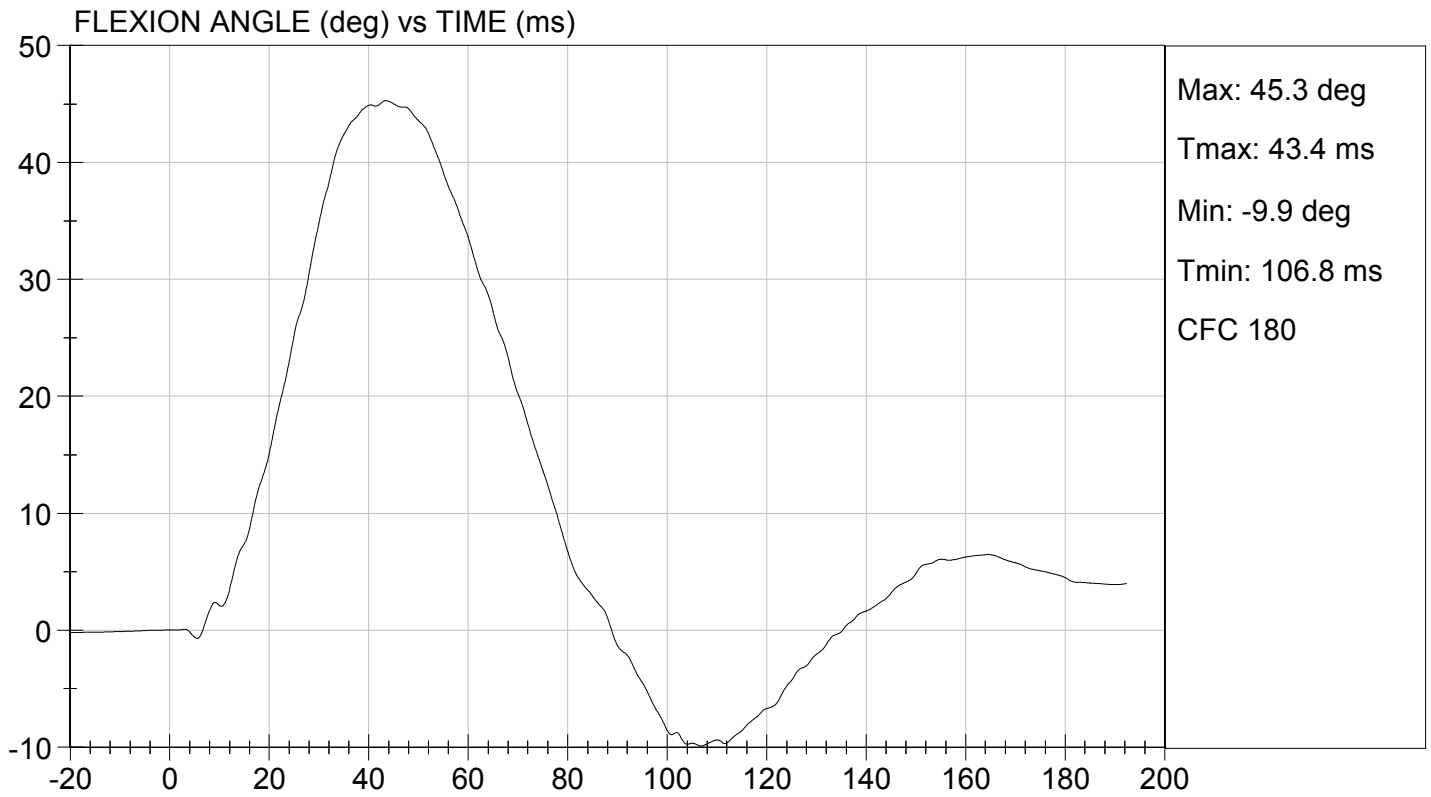
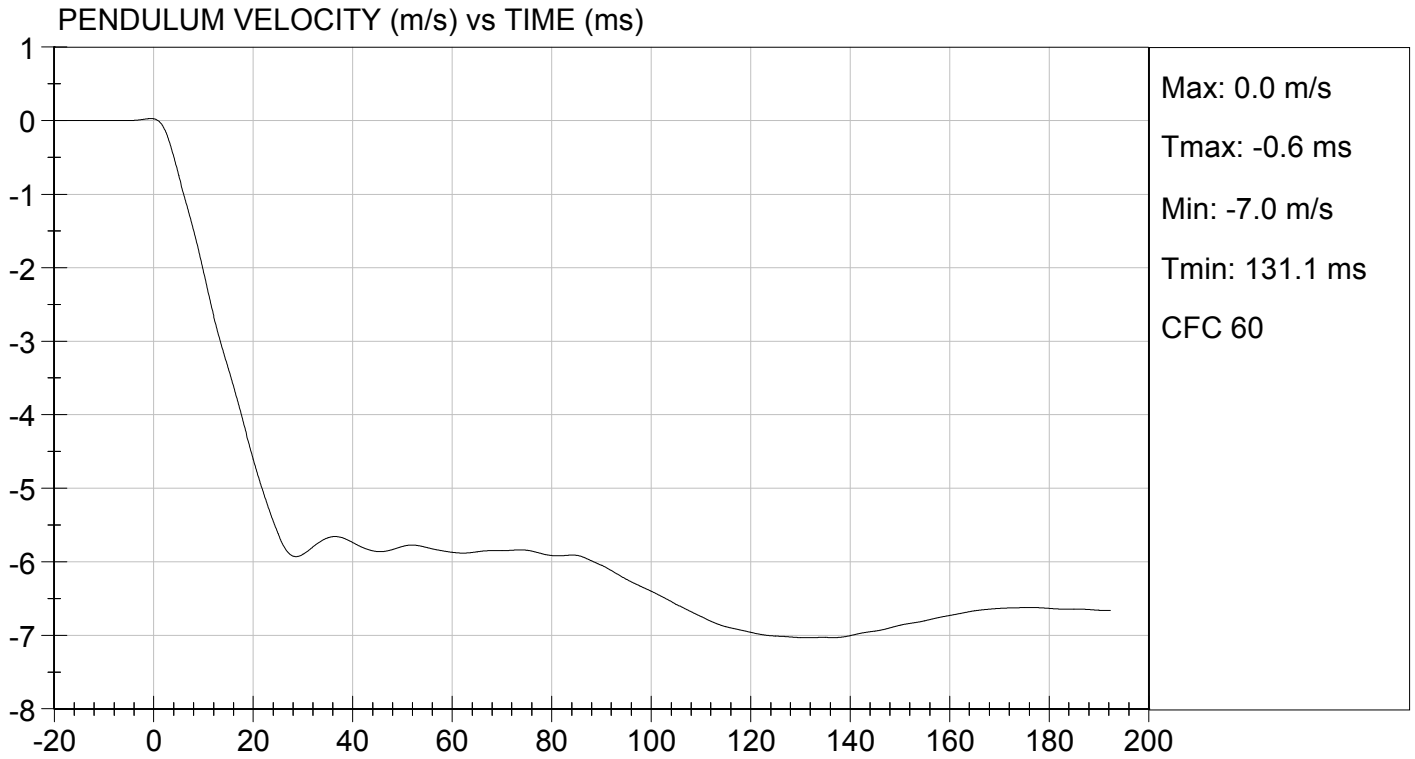
**Test I.D.:** D123858

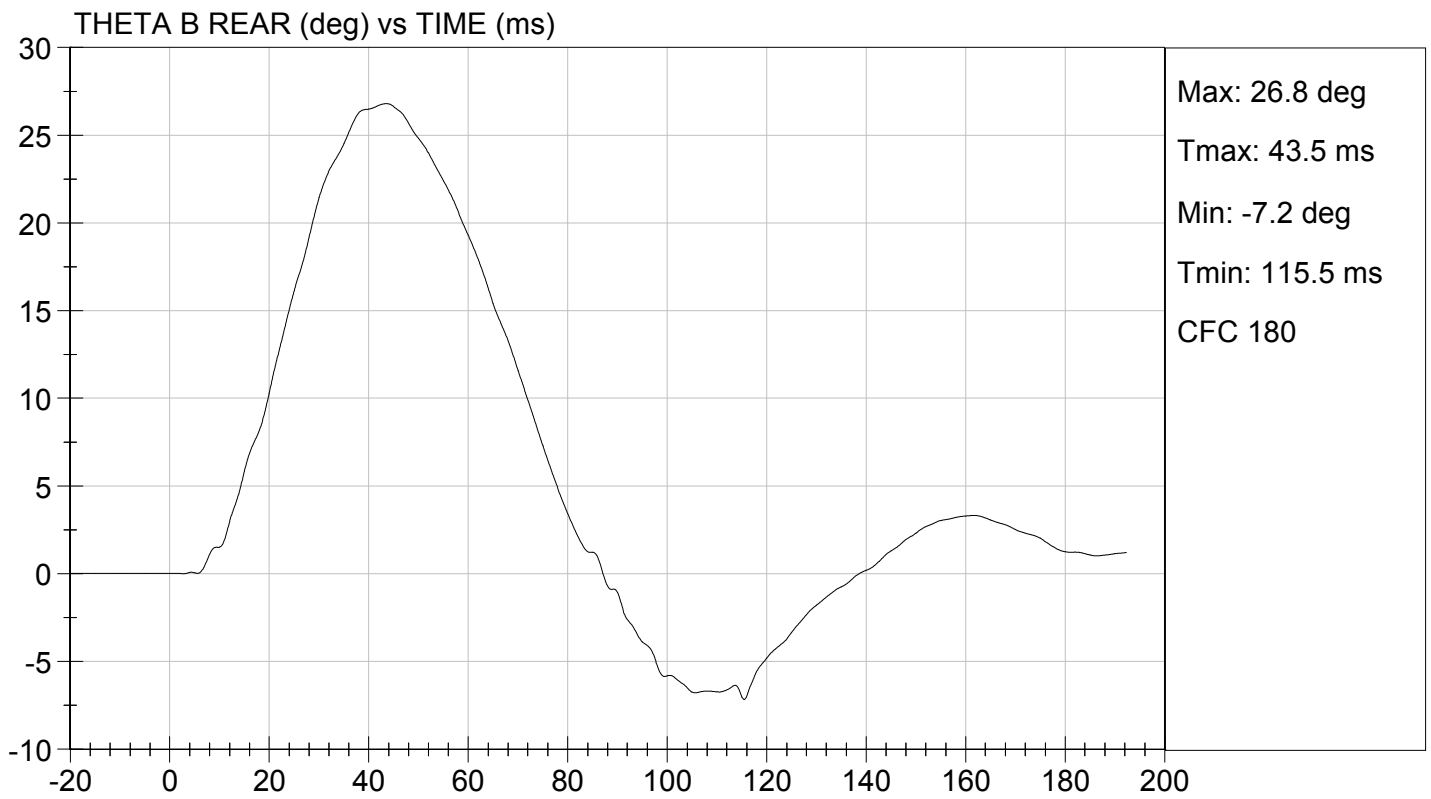
Tested Parameter	Units	Specification	Result	Pass/Fail	
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass	
Laboratory Relative Humidity	%	10 to 70	34	Pass	
Pendulum Speed	m/s	5.95 to 6.15	6.12	Pass	
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.419	Pass
	27 ms	m/s	-6.50 to -5.80	-5.87	Pass
	30 ms	m/s	>= -6.50	-5.90	Pass
Maximum Flexion Angle	deg	45.0 to 55.0	45.3	Pass	
Time of Maximum Flexion Angle	ms	39.0 to 53.0	43.4	Pass	
Headform Rotation Decay to Initial Position	ms	37 to 57	44	Pass	
<b>Overall Results</b>				<b>Pass</b>	

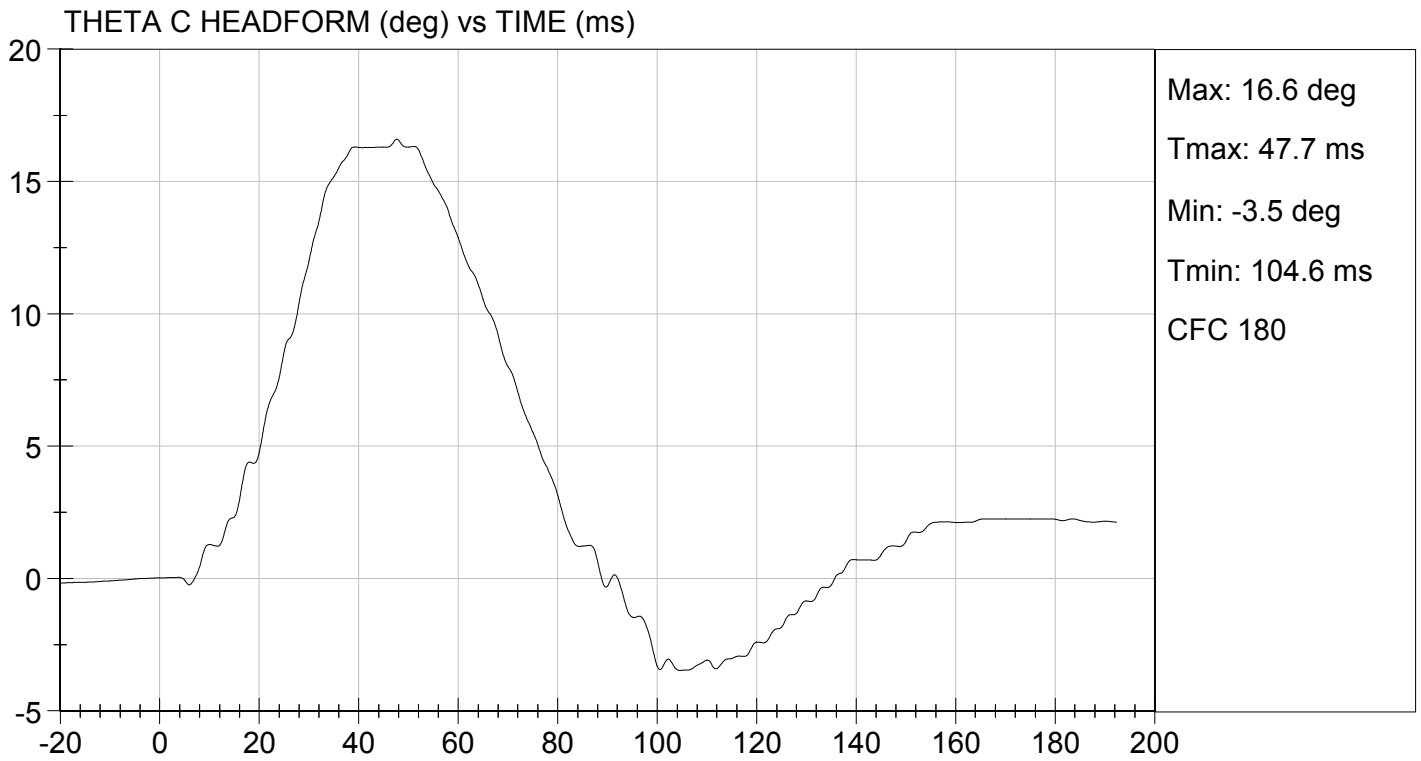
  
 Laboratory Technician

10/10/2012  
 Test Date

  
 Approved By







**MGA RESEARCH CORPORATION**

**PELVIS TEST**

**ES-2re DUMMY**

**ATD Serial No:** 032

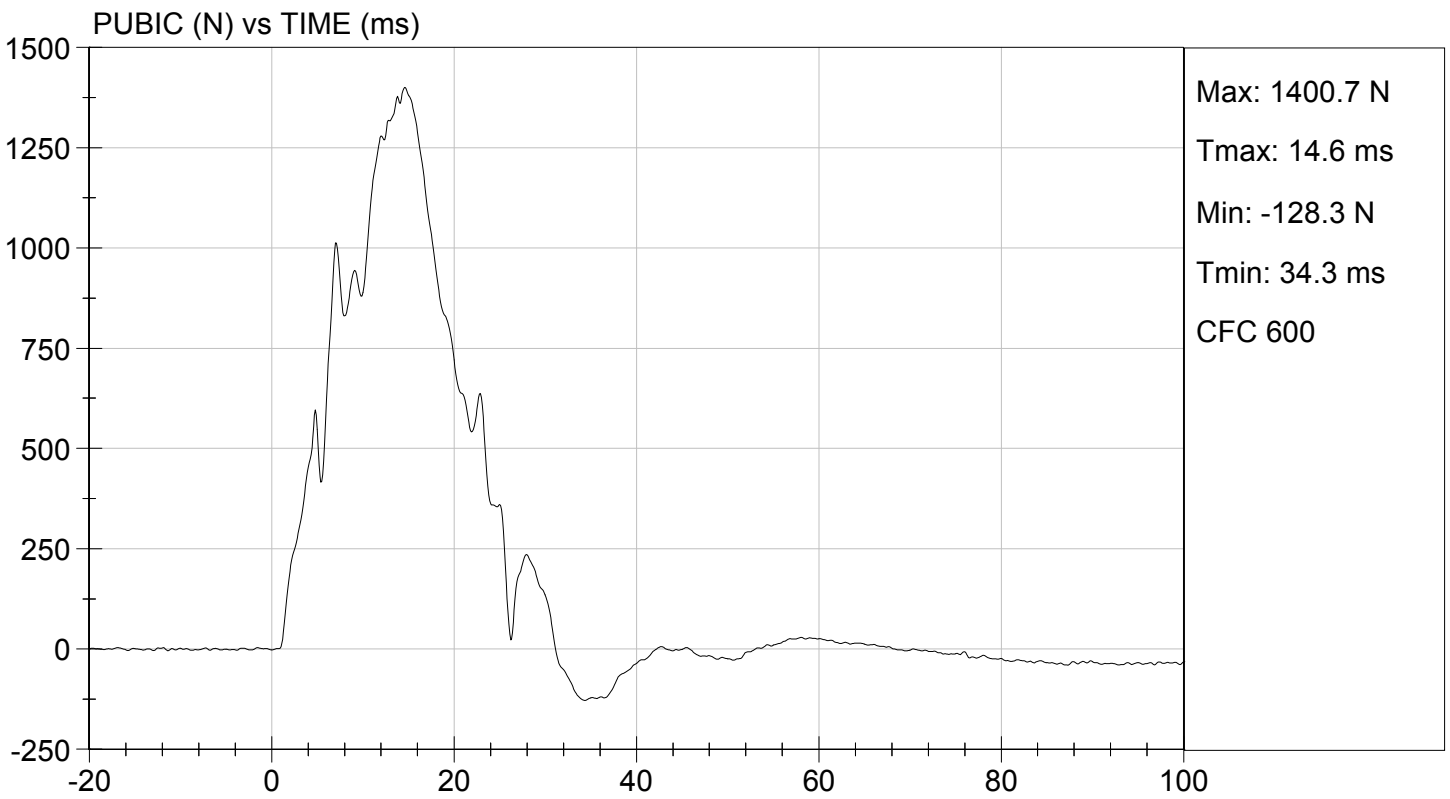
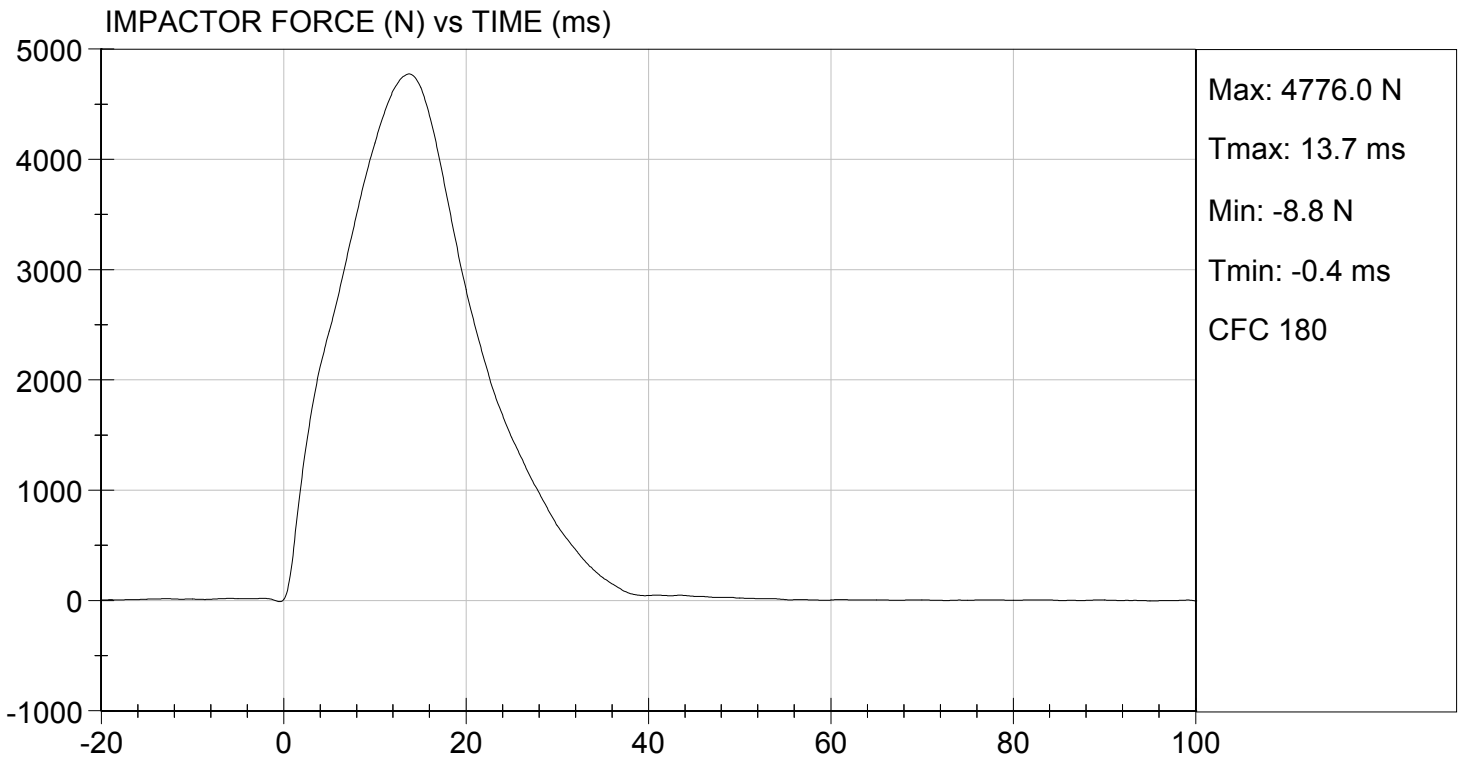
**Test I.D:** D123859

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Probe Speed	m/s	4.20 to 4.40	4.30	Pass
Maximum Impactor Force	N	4700 to 5400	4776	Pass
Time of Maximum Impactor Force	ms	11.8 to 16.1	13.7	Pass
Maximum Pubic Force	N	1230 to 1590	1401	Pass
Time of Maximum Pubic Force	ms	12.2 to 17.0	14.6	Pass
Overall Test Results				Pass

  
Laboratory Technician

10/10/2012  
Test Date

  
Approved By



**SID-IIsD External Measurements**  
**SN: 296**

<b>No.</b>	<b>Name</b>	<b>Spec. (mm)</b>	<b>Result</b>	<b>Pass/Fail</b>
<b>A</b>	Sitting Height	772 - 788	784	Pass
<b>B</b>	Shoulder Pivot Height	437 - 453	442	Pass
<b>C</b>	H-point Height	79 - 89	83	Pass
<b>D</b>	H-point from Seatback	141 - 151	145	Pass
<b>E</b>	Shoulder Pivot from Backline	97 - 107	99	Pass
<b>F</b>	Thigh Clearance	119 - 135	121	Pass
<b>G</b>	Head Breadth	140 - 148	142	Pass
<b>H</b>	Head Back from Backline	40 - 46	45	Pass
<b>I</b>	Head Depth	178 - 188	180	Pass
<b>J</b>	Head Circumference	541 - 551	548	Pass
<b>K</b>	Buttock to Knee Length	514 - 540	535	Pass
<b>L</b>	Popliteal Height	343 - 369	358	Pass
<b>M</b>	Knee Pivot to Floor Height	392 - 409	404	Pass
<b>N</b>	Buttock Popliteal Length	416 - 442	435	Pass
<b>O</b>	Chest Depth w/o Jacket	195 - 211	206	Pass
<b>P</b>	Foot Length	216 - 232	219	Pass
<b>Q</b>	Hip Breadth (w/ pelvic plugs)	313 - 323	316	Pass
<b>R</b>	Arm Length	249 - 259	250	Pass
<b>S</b>	Knee Joint to Seatback	477 - 493	481	Pass
<b>V</b>	Shoulder Width	341 - 357	346	Pass
<b>W</b>	Foot Width	78 - 94	85	Pass
<b>Y</b>	Chest Circumference w/ jacket	851 - 881	870	Pass
<b>Z</b>	Waist Circumference	761 - 791	772	Pass

**MGA RESEARCH CORPORATION  
HEAD DROP TEST  
SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

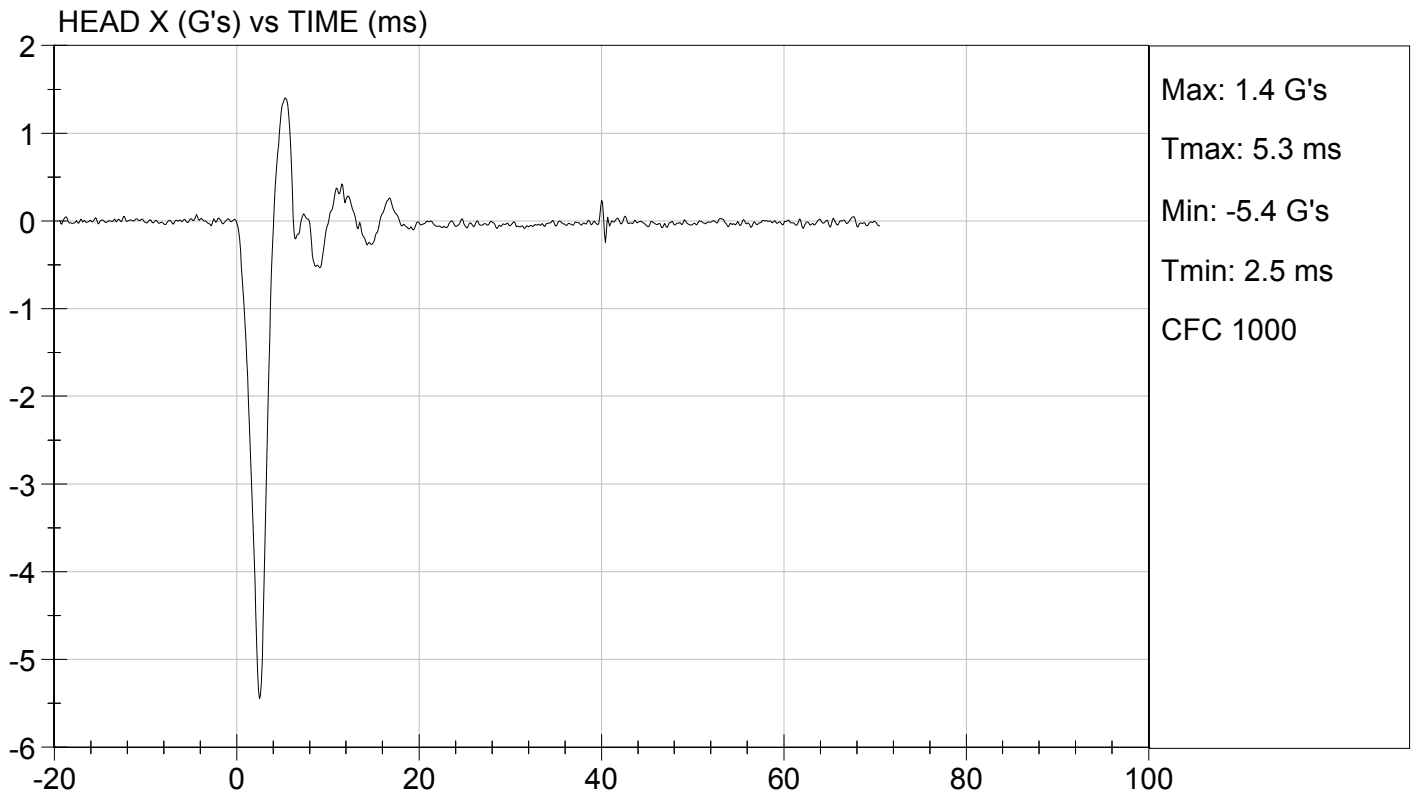
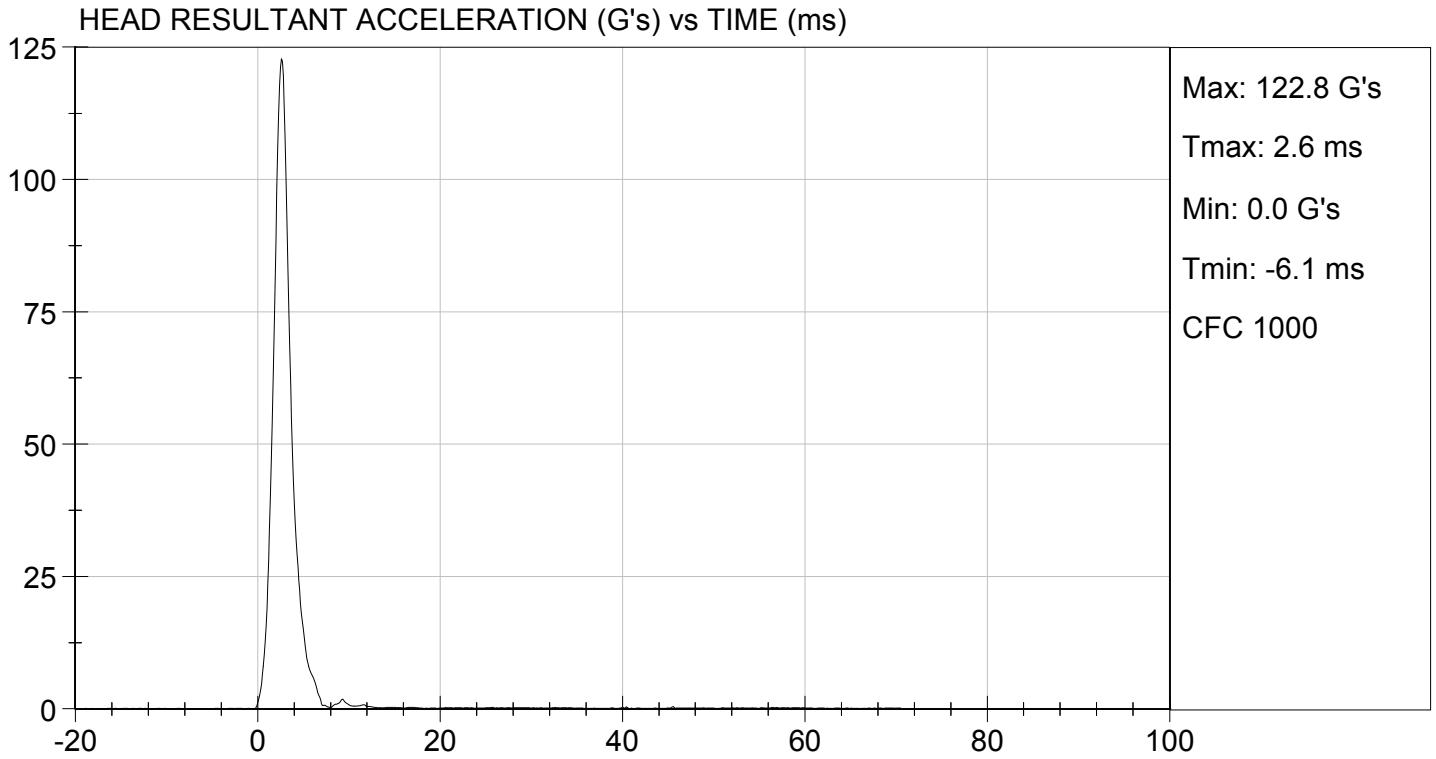
**Test ID:** D123701

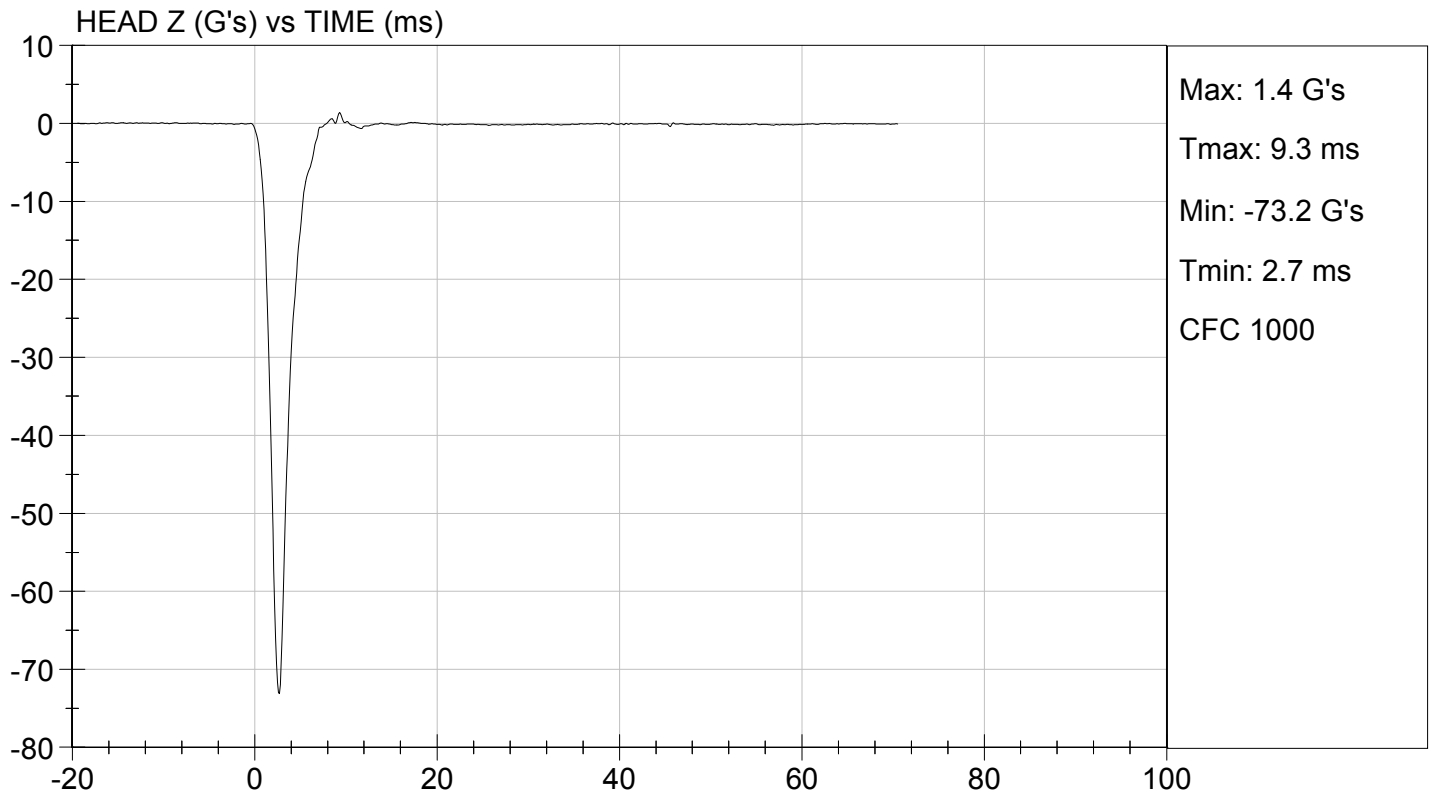
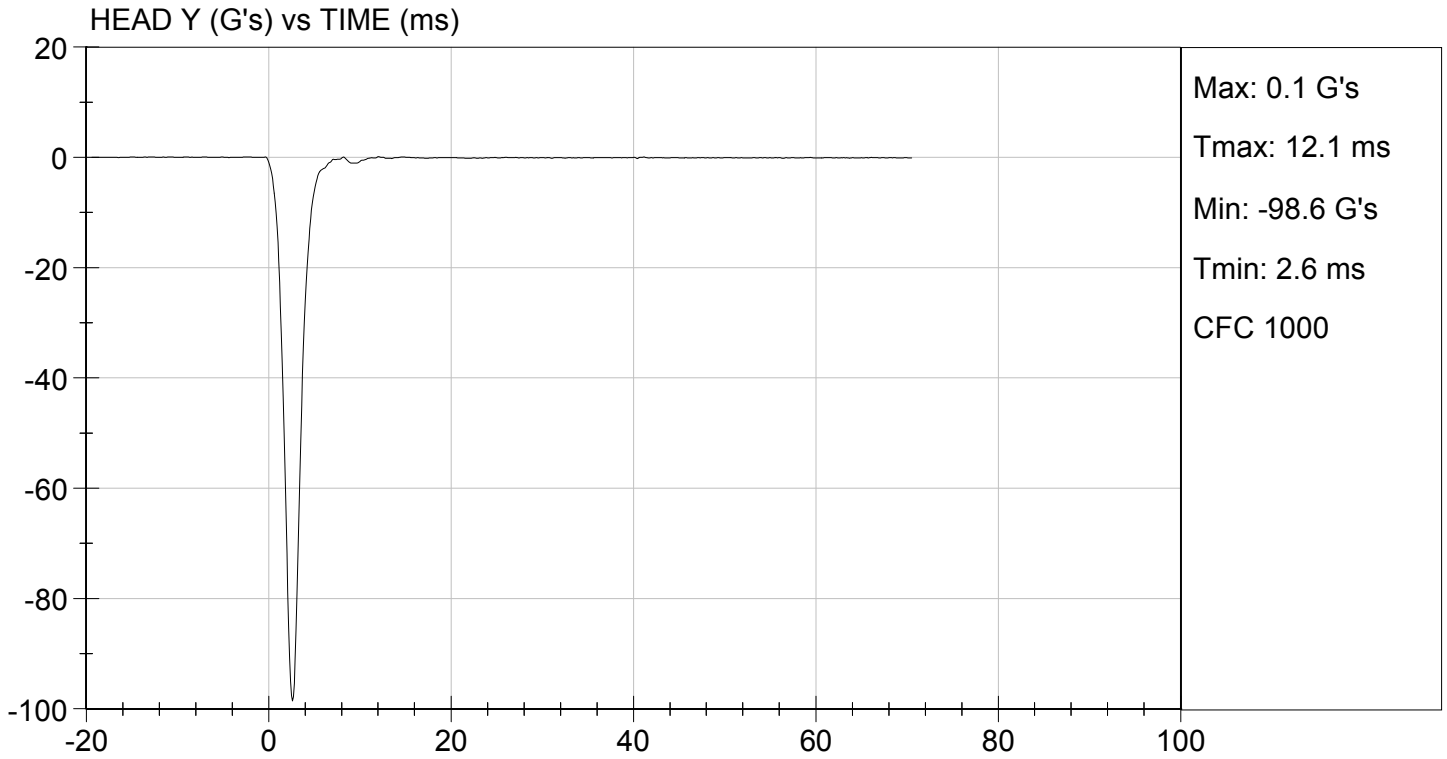
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	38	Pass
Peak Resultant Acceleration	G's	115 to 137	123	Pass
Peak Longitudinal Acceleration	G's	+/- 15	-5.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
<b>Overall Test Results</b>				<b>Pass</b>

*Jessica Gall*  
 \_\_\_\_\_  
 Laboratory Technician

10/02/2012  
 \_\_\_\_\_  
 Test Date

*David Winkelbauer*  
 \_\_\_\_\_  
 Approved By





**MGA RESEARCH CORPORATION  
LATERAL NECK PENDULUM TEST  
SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

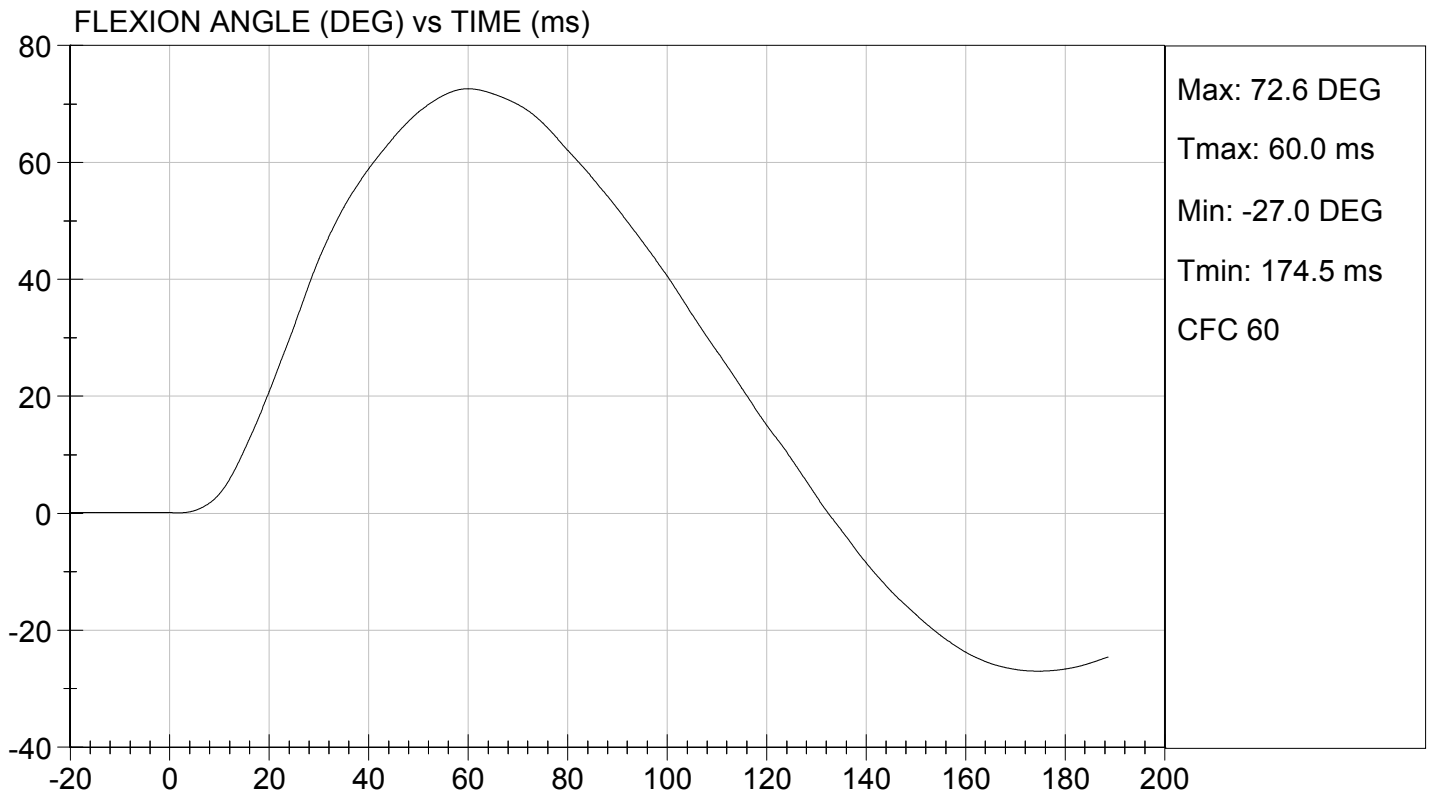
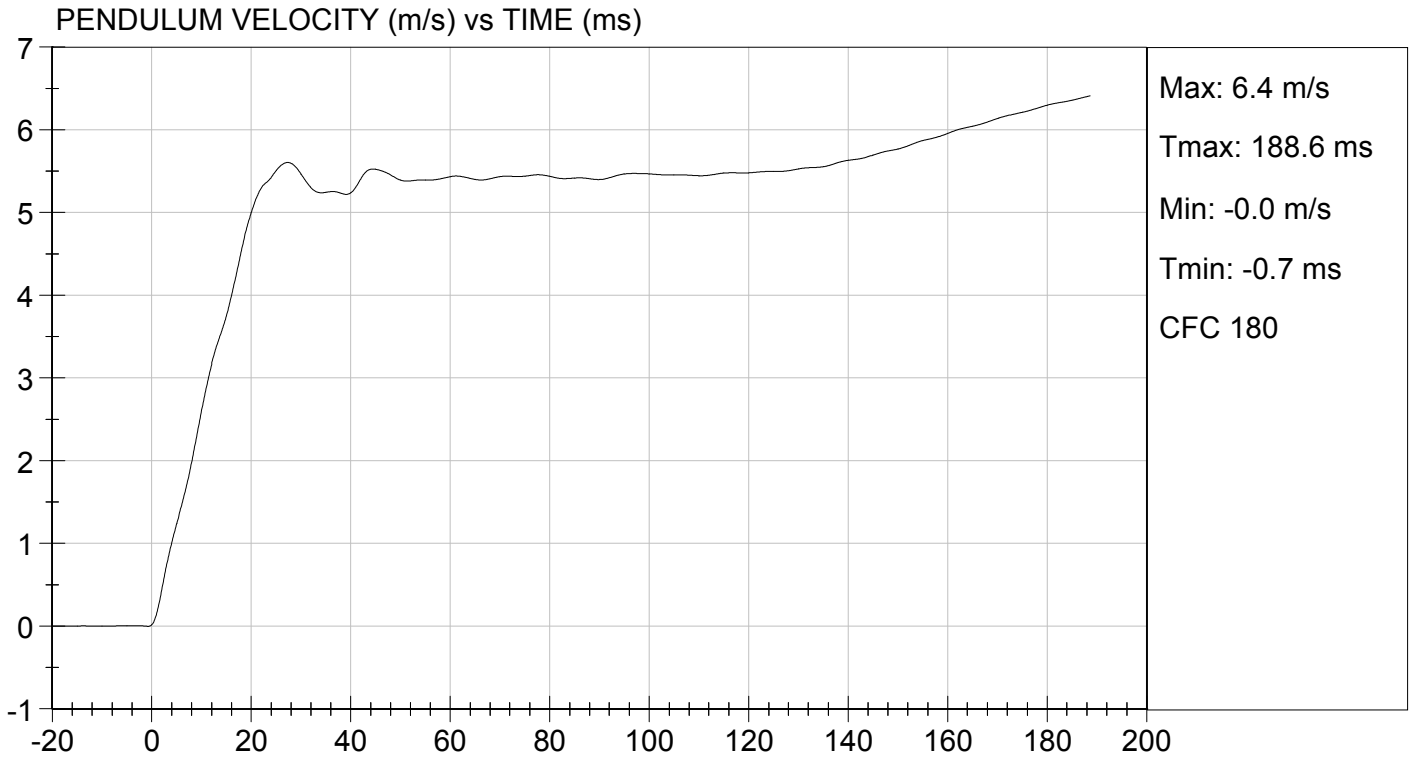
**Test I.D.:** D123702

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.3	Pass
Humidity		%	10 to 70	38	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.61	Pass
	15 ms	m/s	3.30 to 4.10	3.75	Pass
	20 ms	m/s	4.40 to 5.40	5.00	Pass
	25 ms	m/s	5.40 to 6.10	5.51	Pass
	25-100 ms	m/s	5.50 to 6.20	5.60	Pass
Maximum D-Plane Rotation		deg	71 to 81	73	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	60	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-41	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	115	Pass
<b>Overall Test Results</b>					<b>Pass</b>

Jessica Hall  
Laboratory Technician

10/02/2012  
Test Date

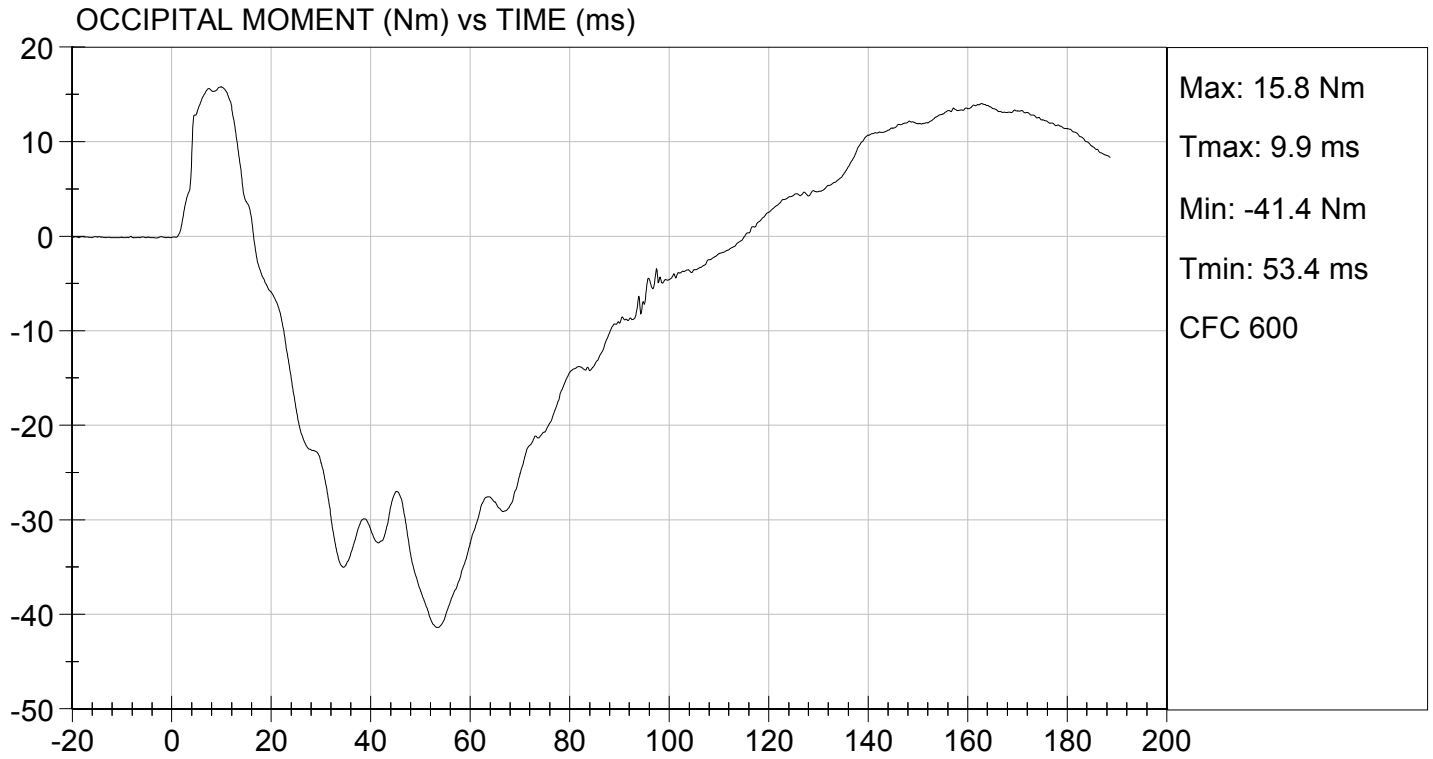
David Winkelbauer  
Approved By





TEST DESC: NECK BENDING  
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 10/02/2012  
TEST #: D123702



**MGA RESEARCH CORPORATION  
SHOULDER IMPACT TEST  
SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

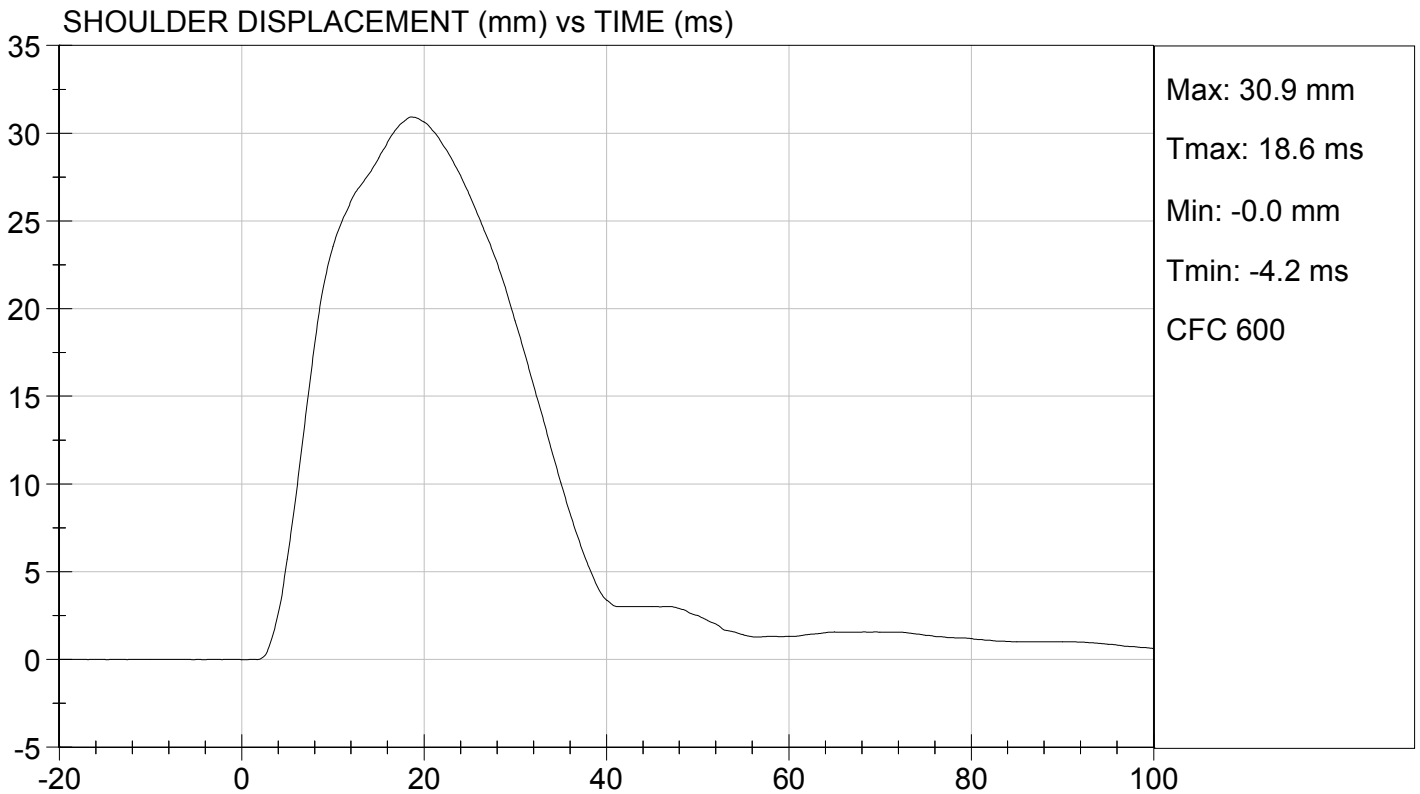
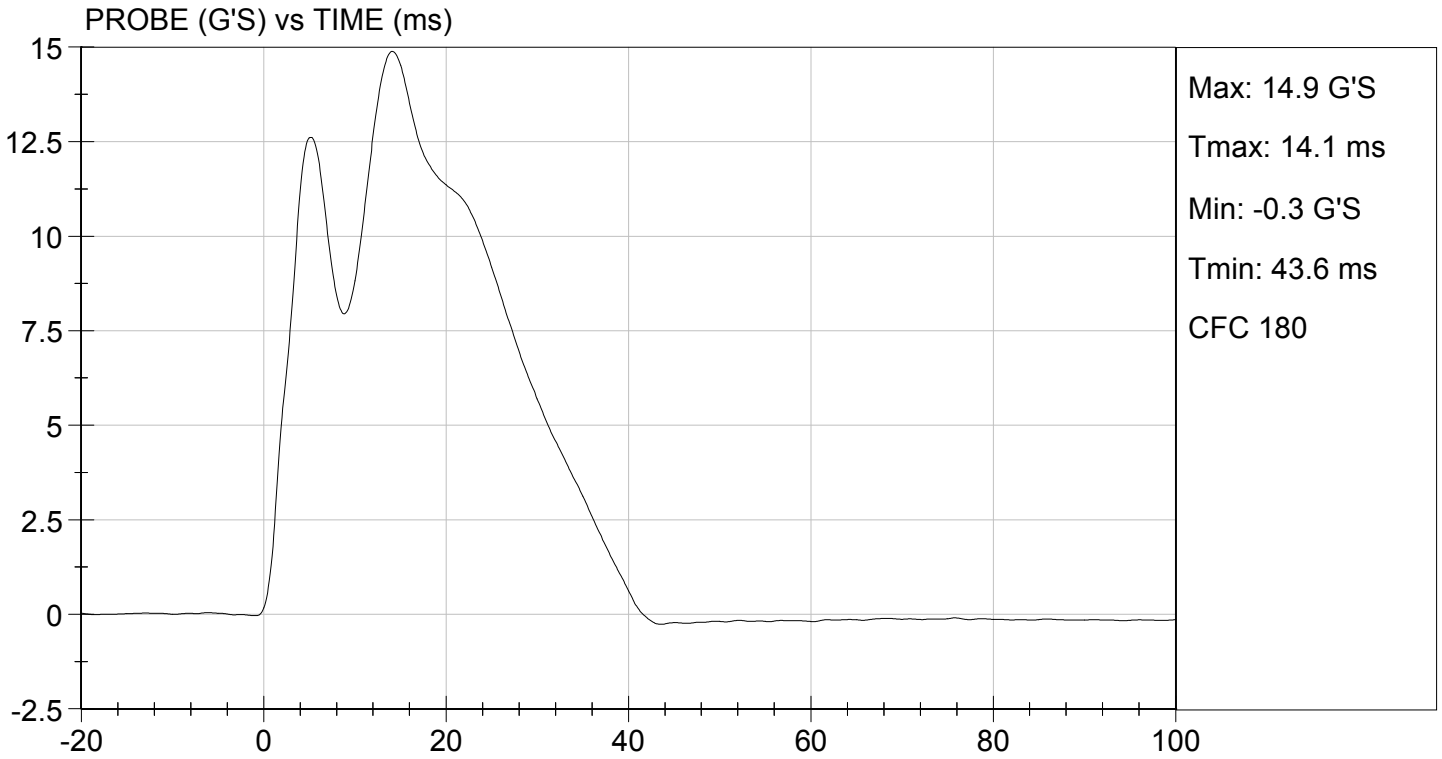
**Test ID:** D123703

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	31	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
Overall Test Results				Pass

Jessica Hall  
Laboratory Technician

10/02/2012  
Test Date

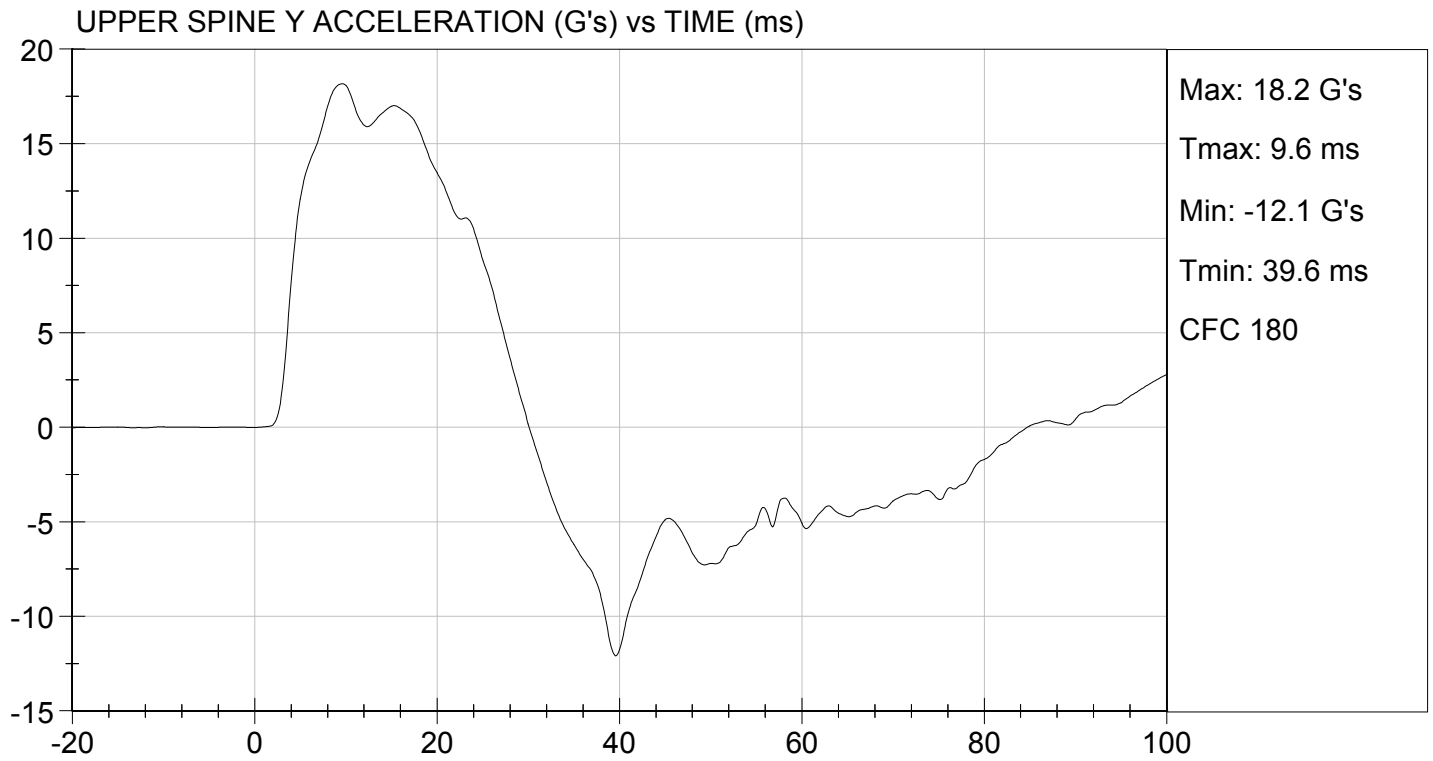
David Winkelbauer  
Approved By





TEST DESC: SHOULDER IMPACT  
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 10/02/2012  
TEST #: D123703



**MGA RESEARCH CORPORATION  
THORAX (WITH ARM) IMPACT TEST  
SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

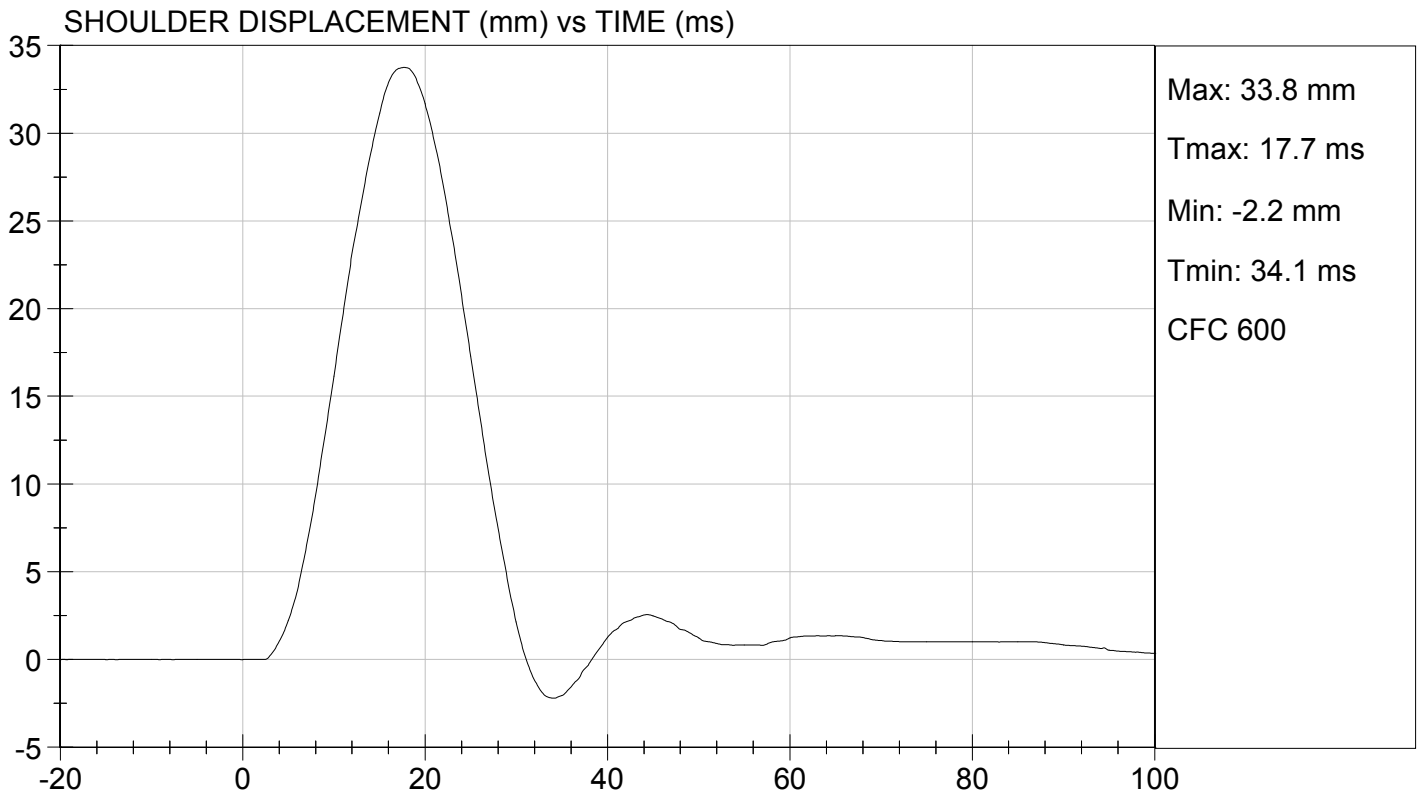
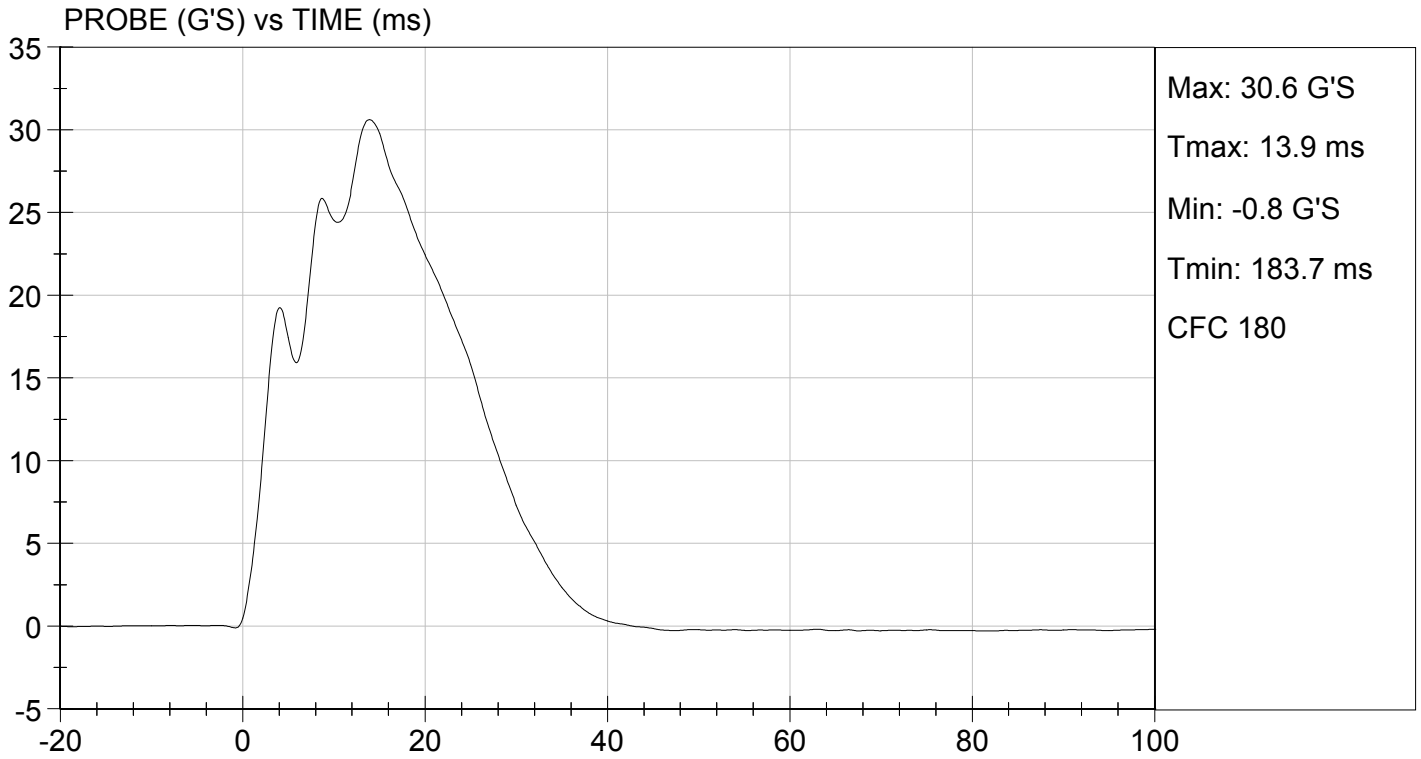
**Test I.D:** D123704

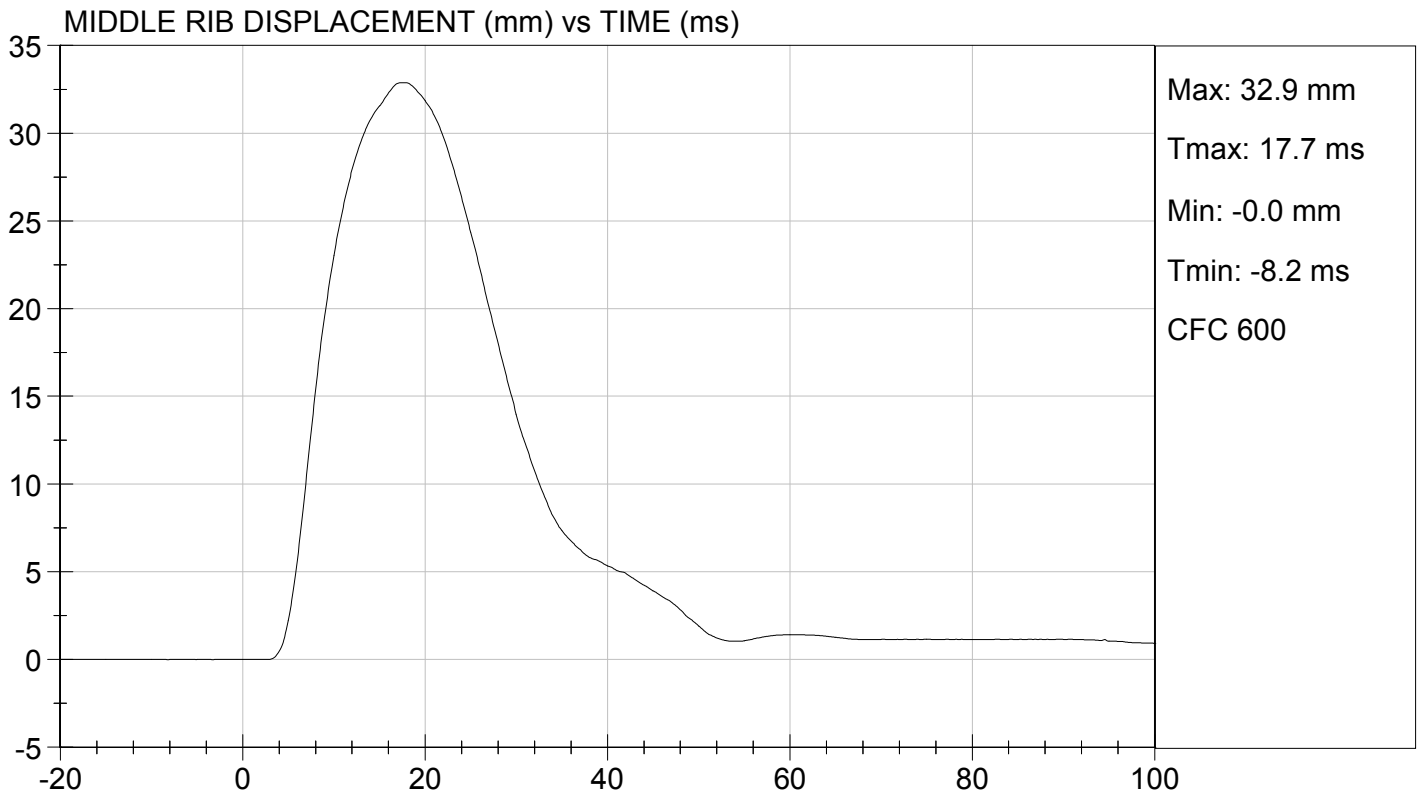
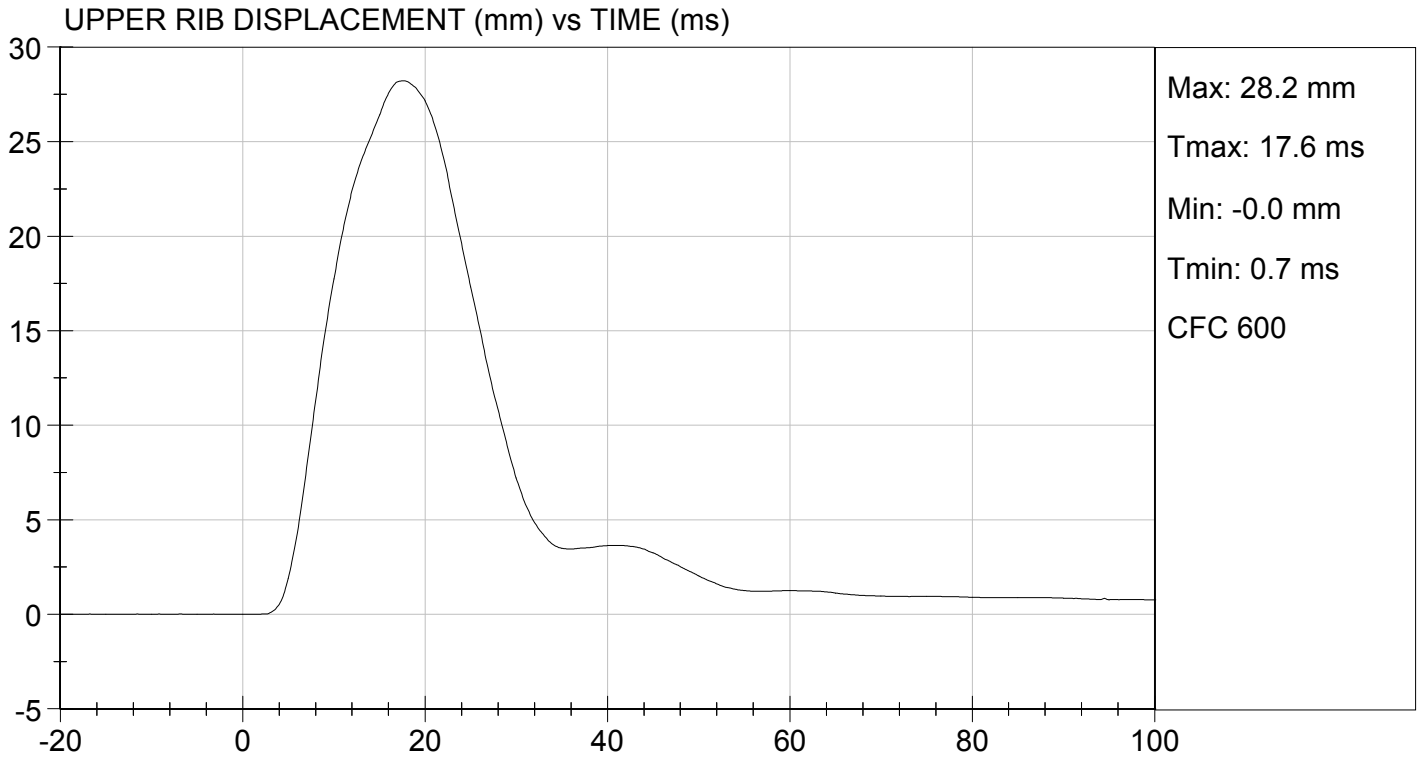
Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Humidity	%	10 to 70	41	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	31	Pass
Shoulder Displacement	mm	31 to 40	34	Pass
Upper Rib Displacement	mm	25 to 32	28	Pass
Middle Rib Displacement	mm	30 to 36	33	Pass
Lower Rib Displacement	mm	32 to 38	36	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	35	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	30	Pass
<b>Overall Test Results</b>				<b>Pass</b>

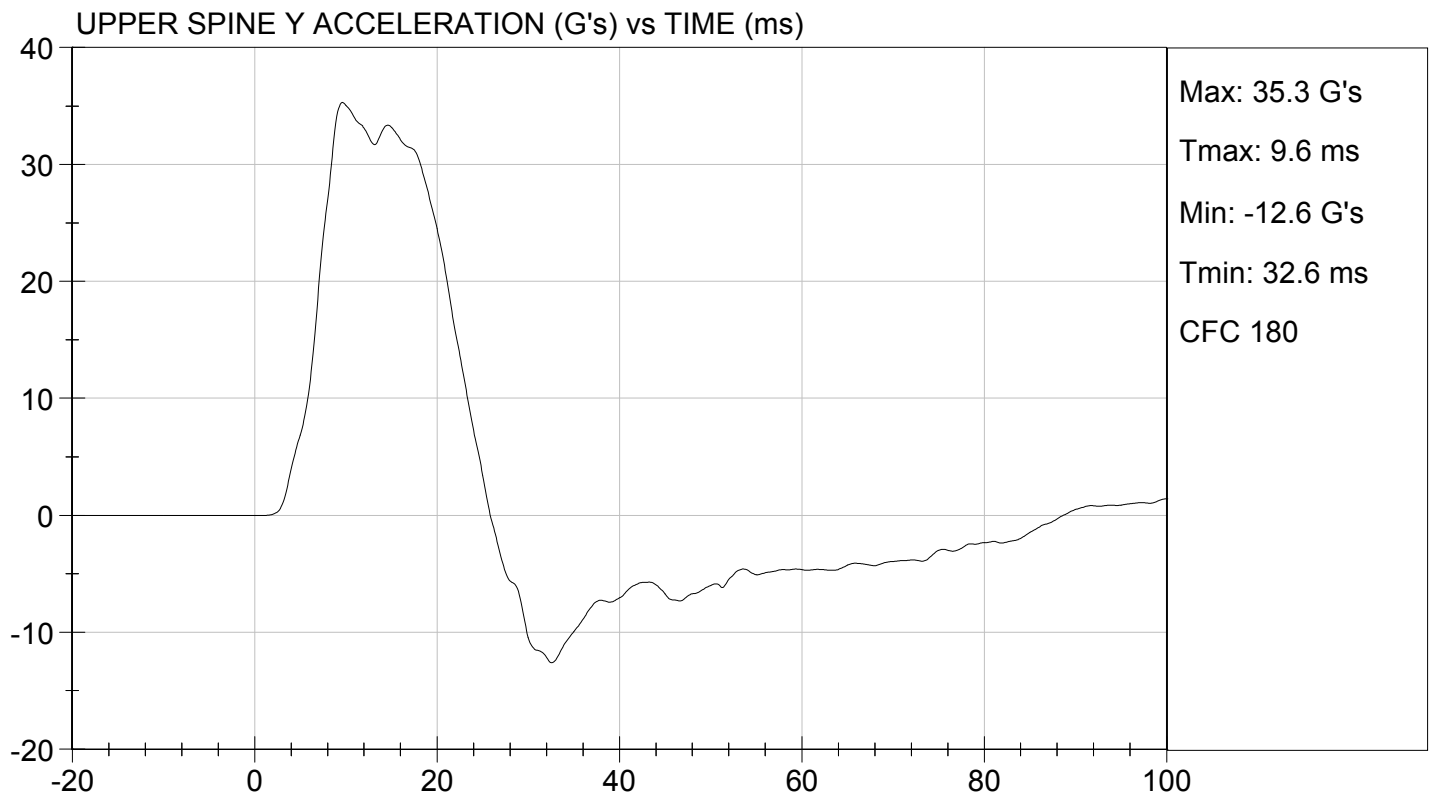
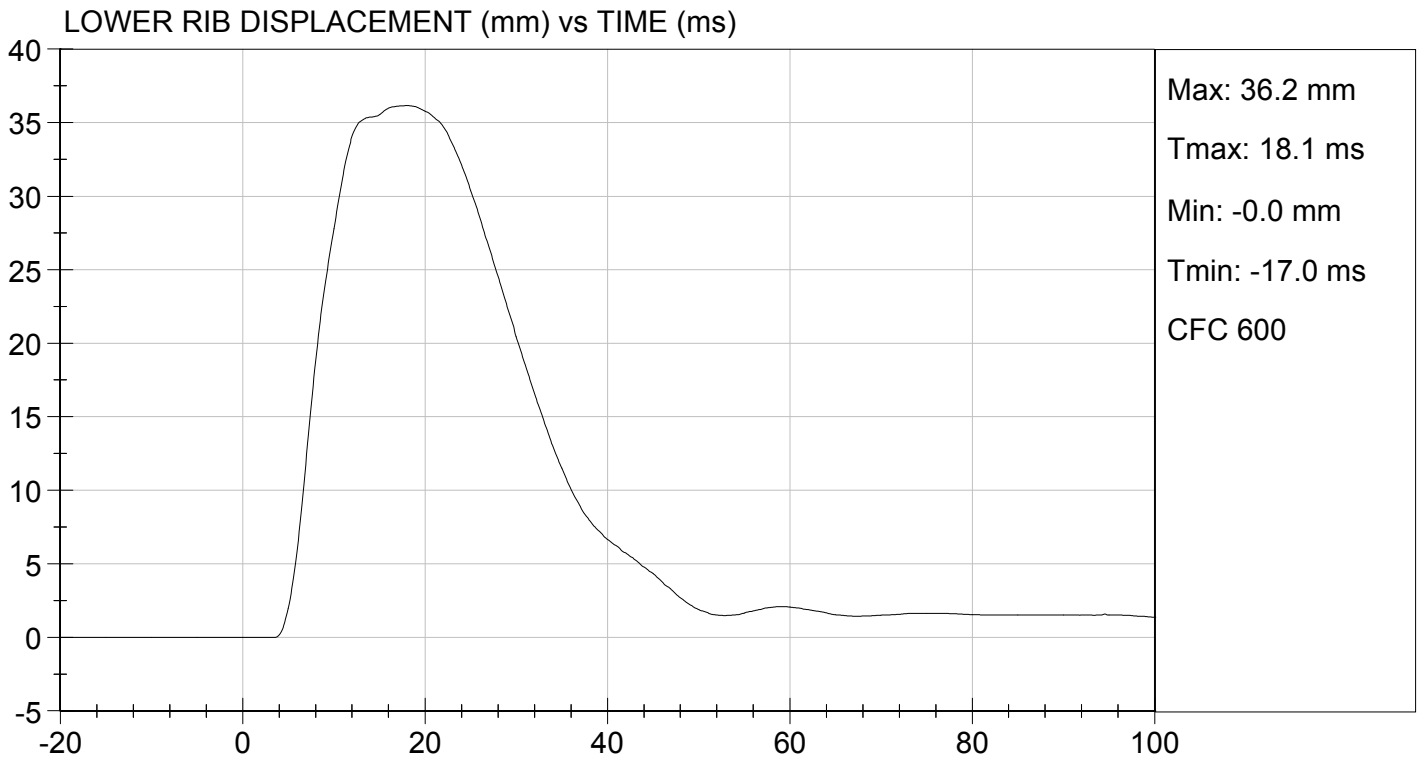
Jessica Hall  
Laboratory Technician

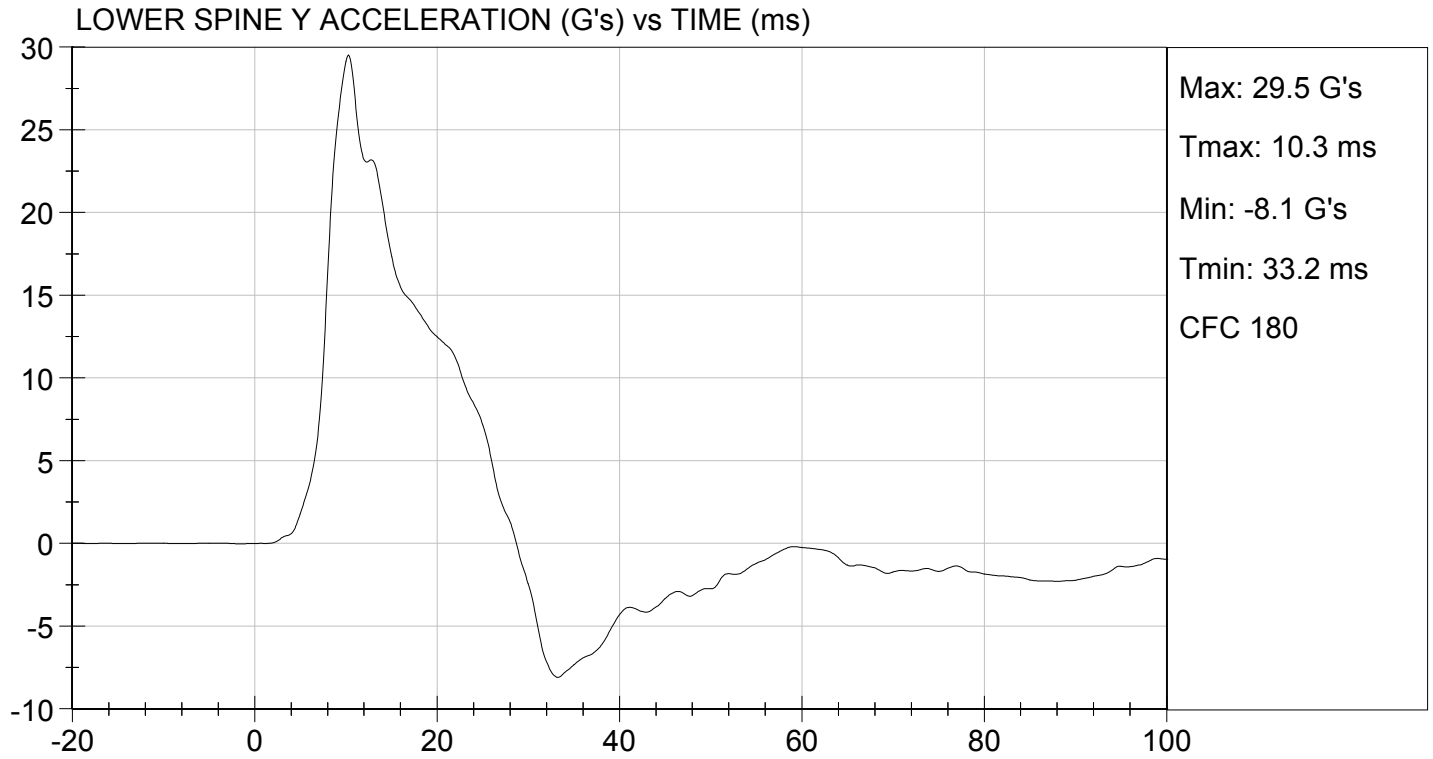
10/02/2012  
Test Date

David Winkelbauer  
Approved By









**MGA RESEARCH CORPORATION**  
**THORAX (WITHOUT ARM) IMPACT TEST**  
**SID-IIs BUILD LEVEL D DUMMY**

ATD Serial No: 296

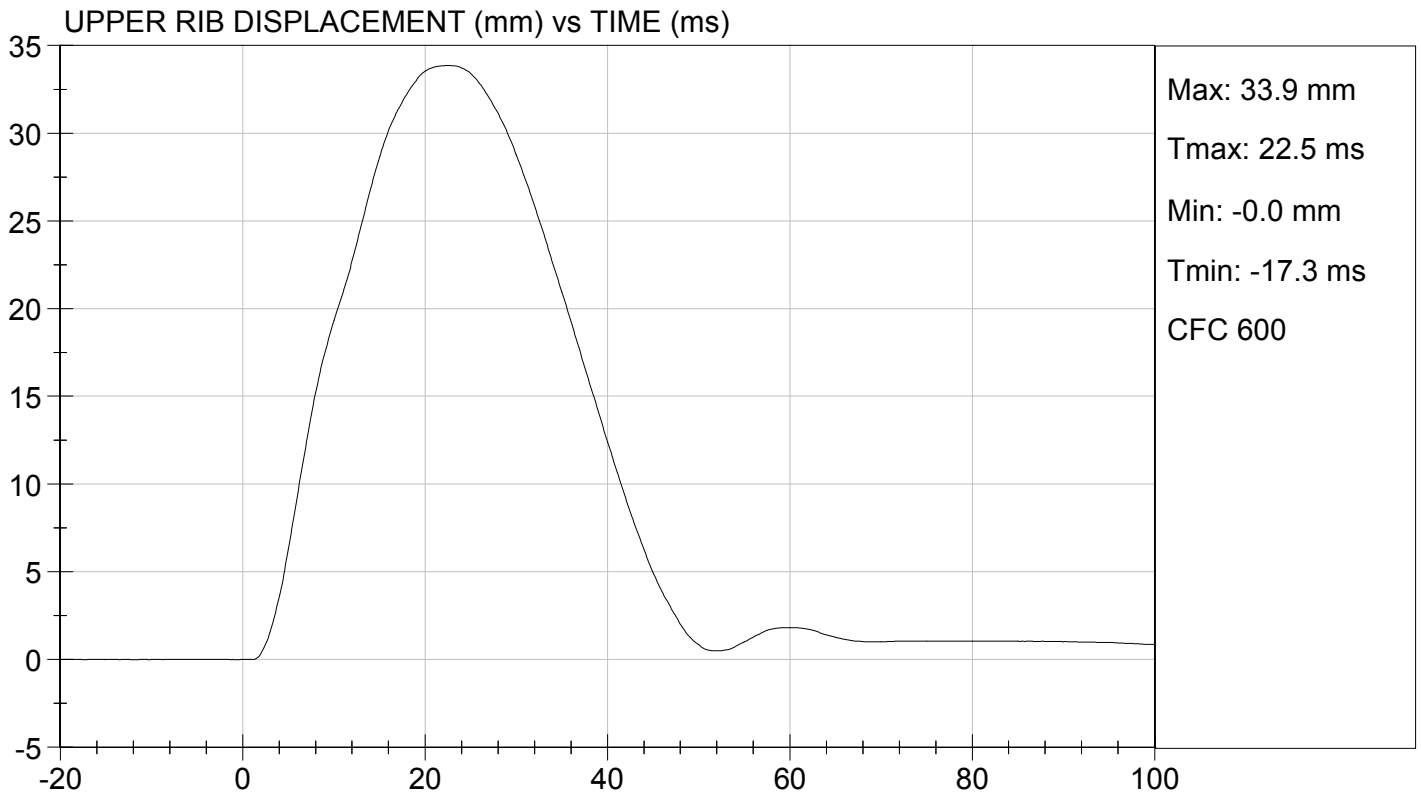
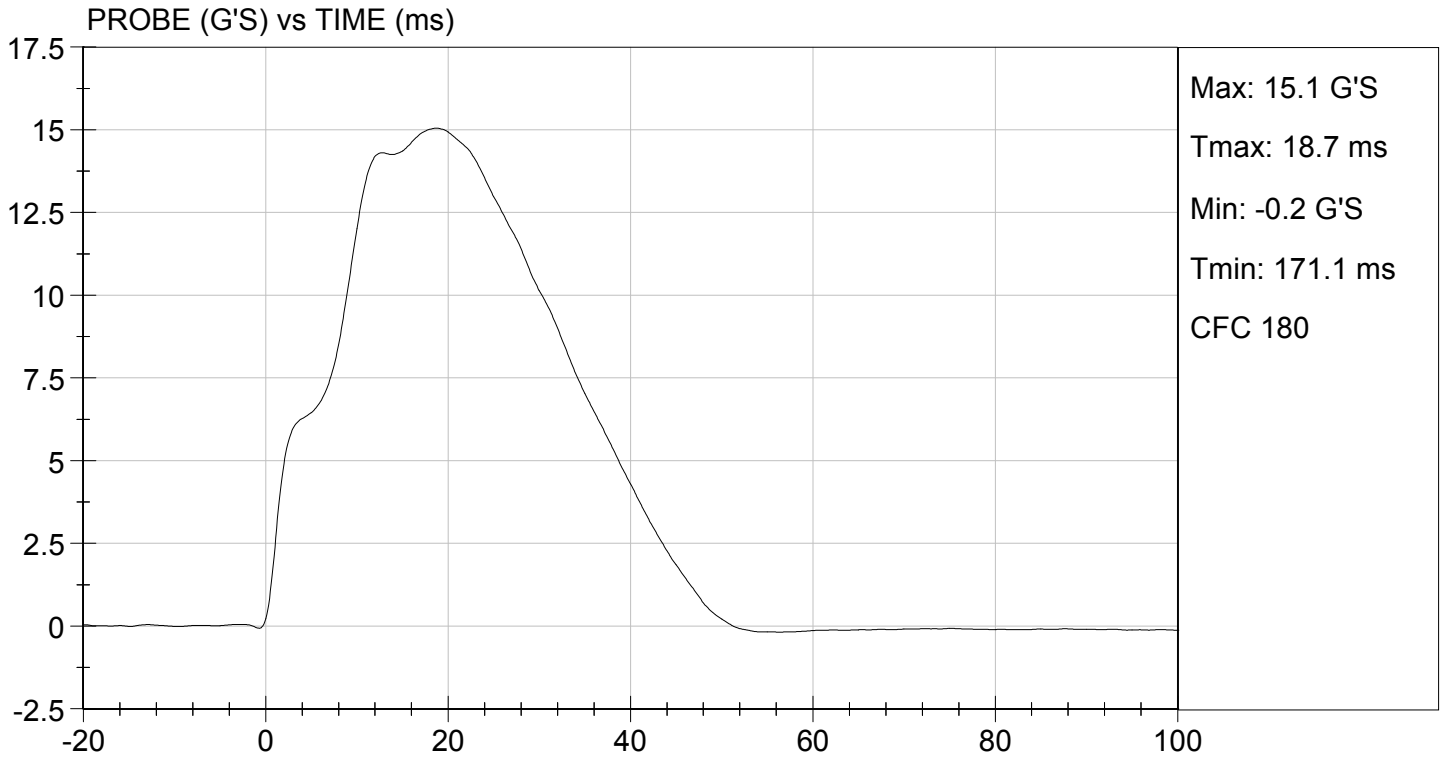
Test I.D: D123705

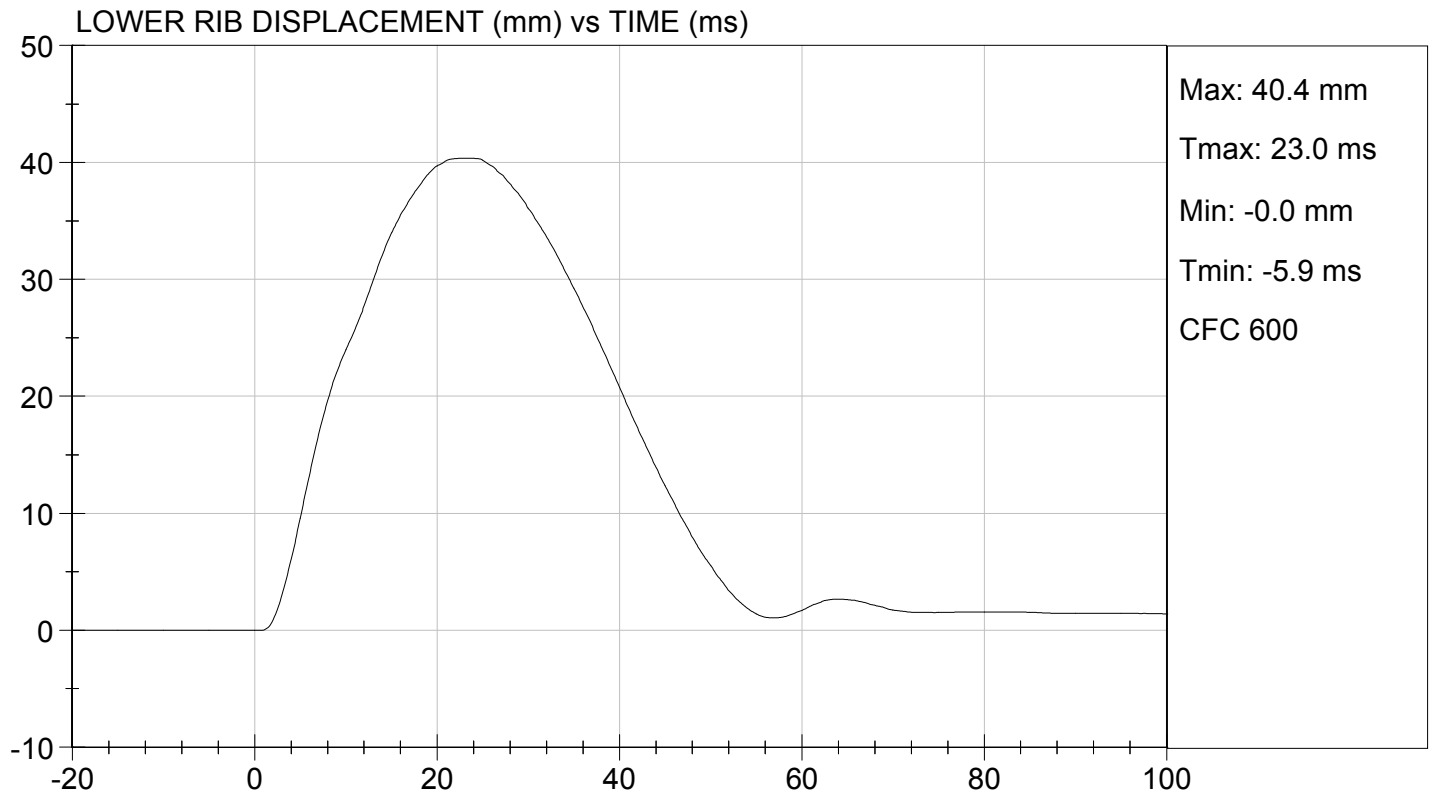
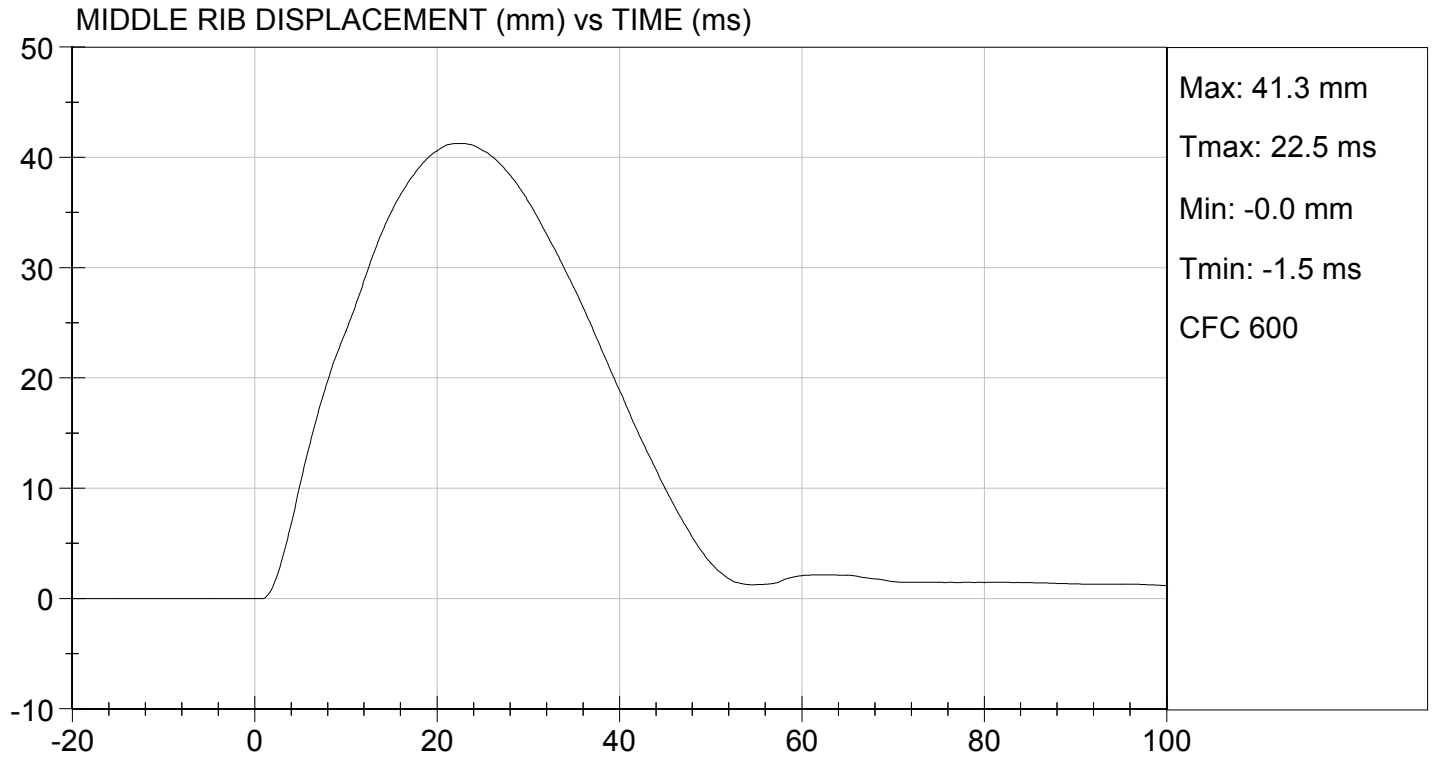
Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.0	Pass
Humidity	%	10 to 70	41	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	34	Pass
Middle Rib Displacement	mm	39 to 45	41	Pass
Lower Rib Displacement	mm	35 to 43	40	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	13	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	10	Pass
			Overall Test Results	Pass

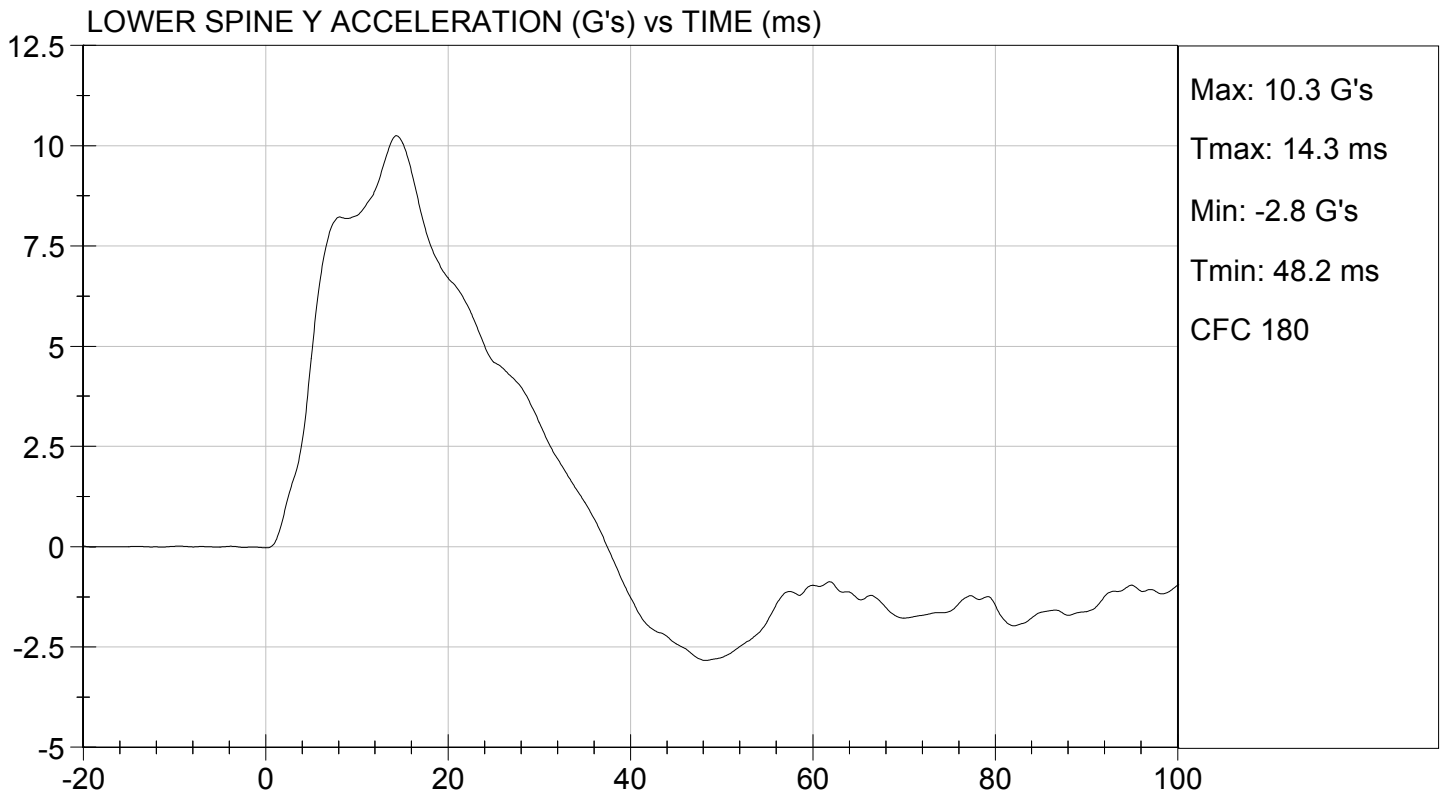
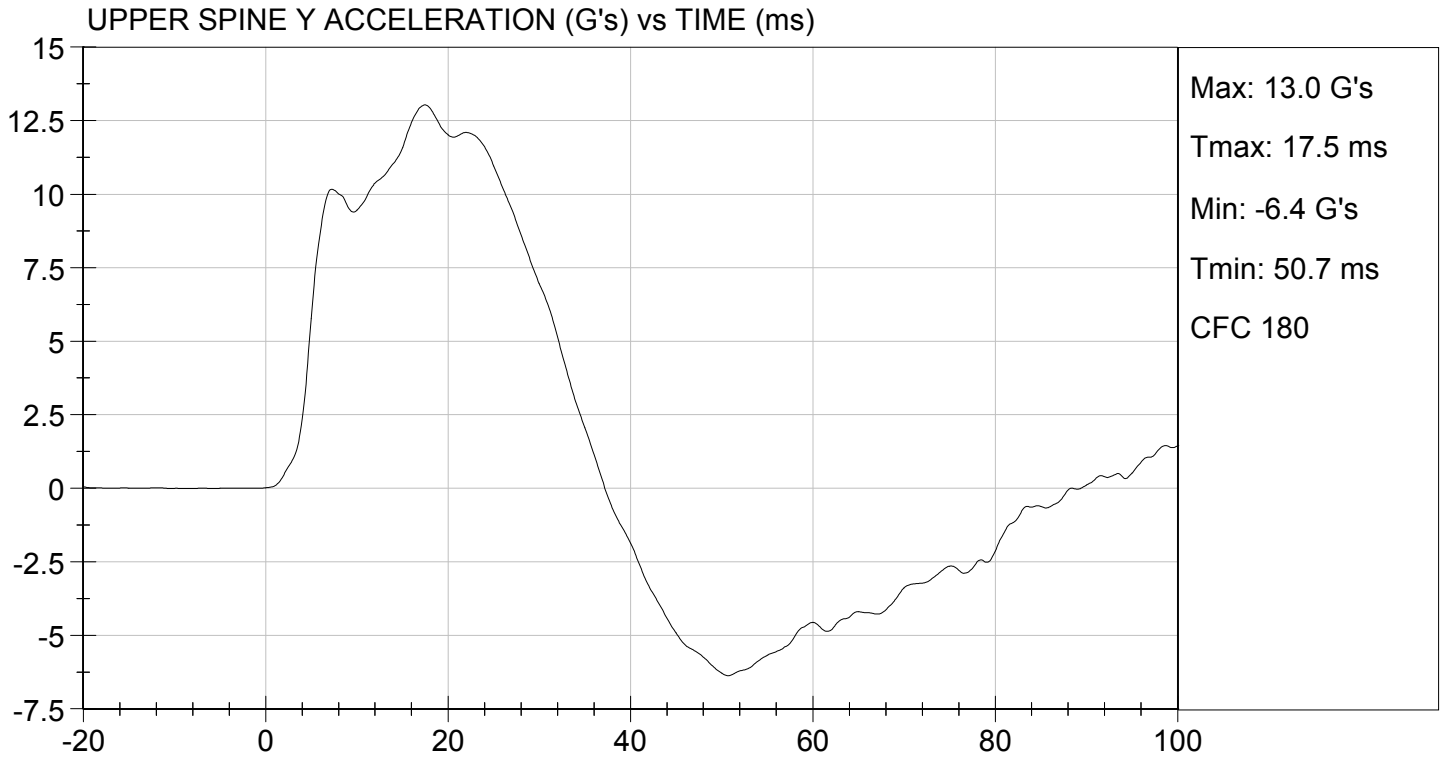
*Jessica Hall*  
 Laboratory Technician

10/02/2012  
 Test Date

*David Winkelbauer*  
 Approved By







**MGA RESEARCH CORPORATION**  
**ABDOMINAL IMPACT TEST**  
**SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

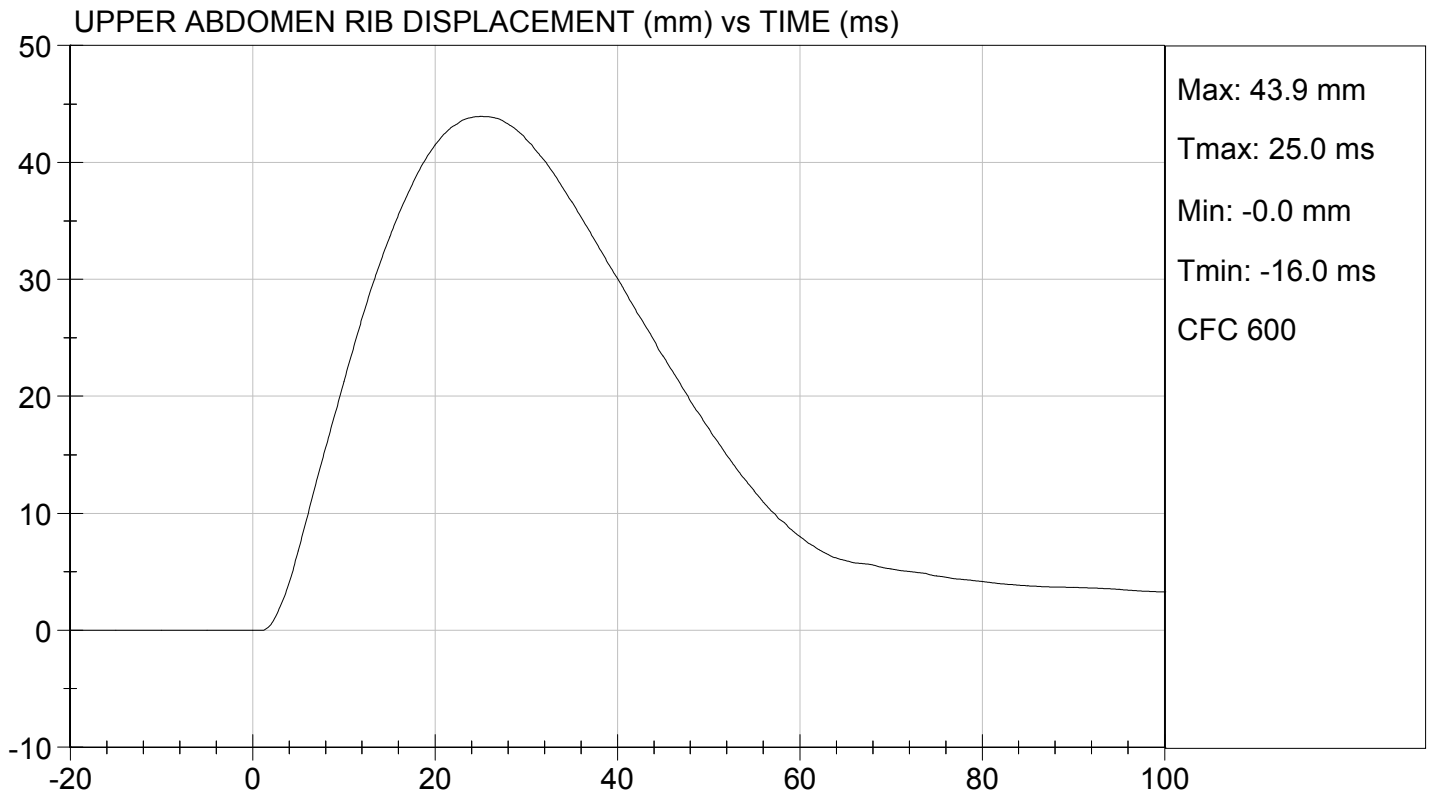
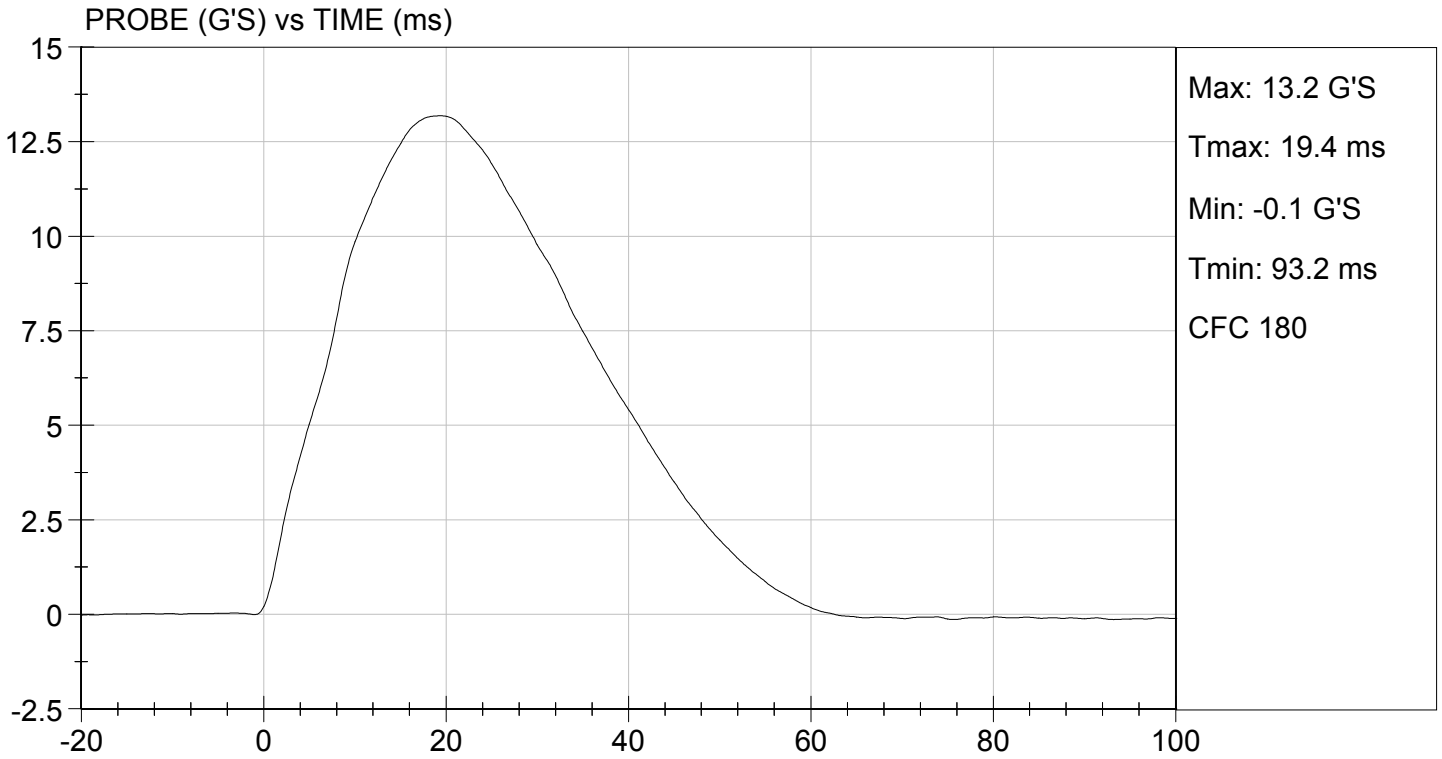
**Test I.D:** D123706

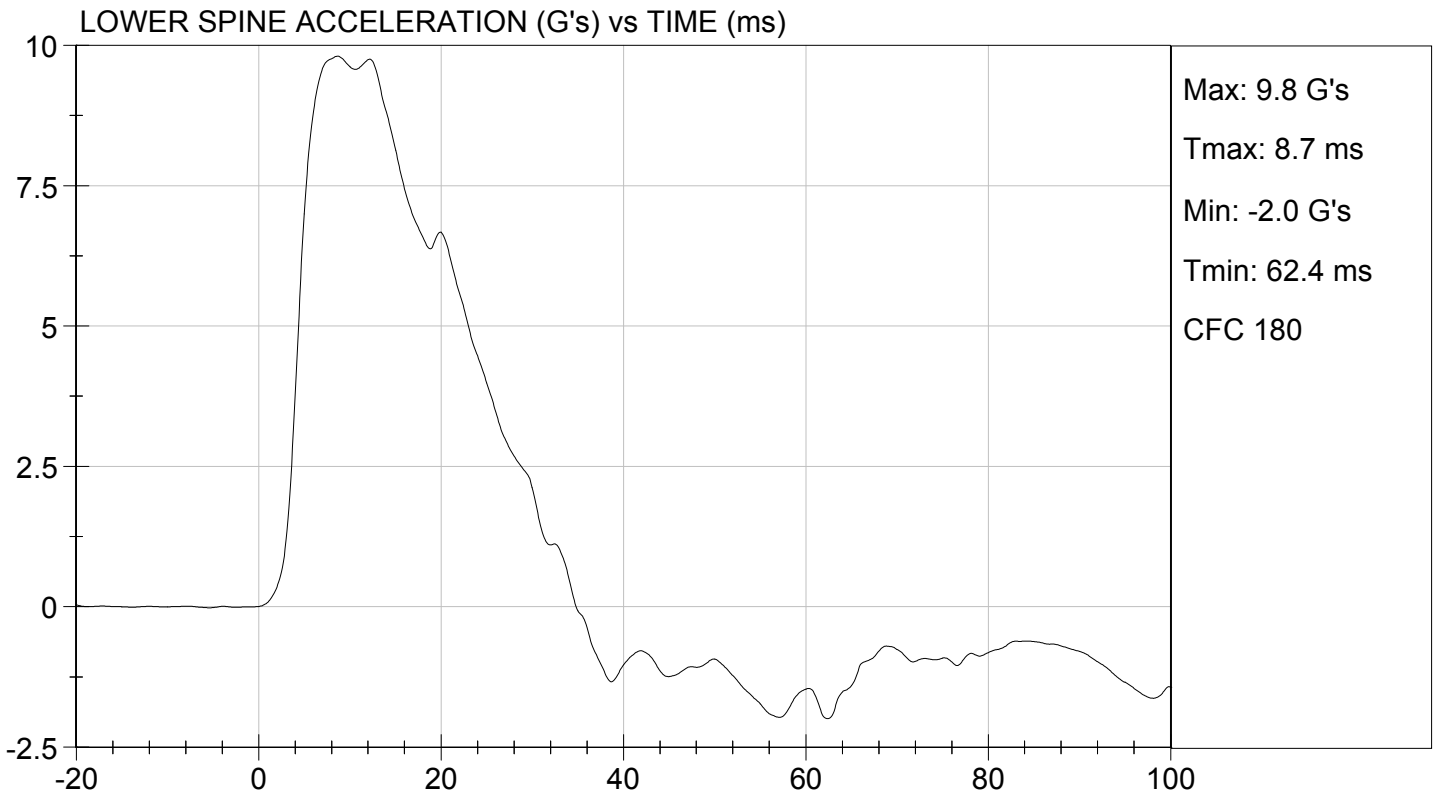
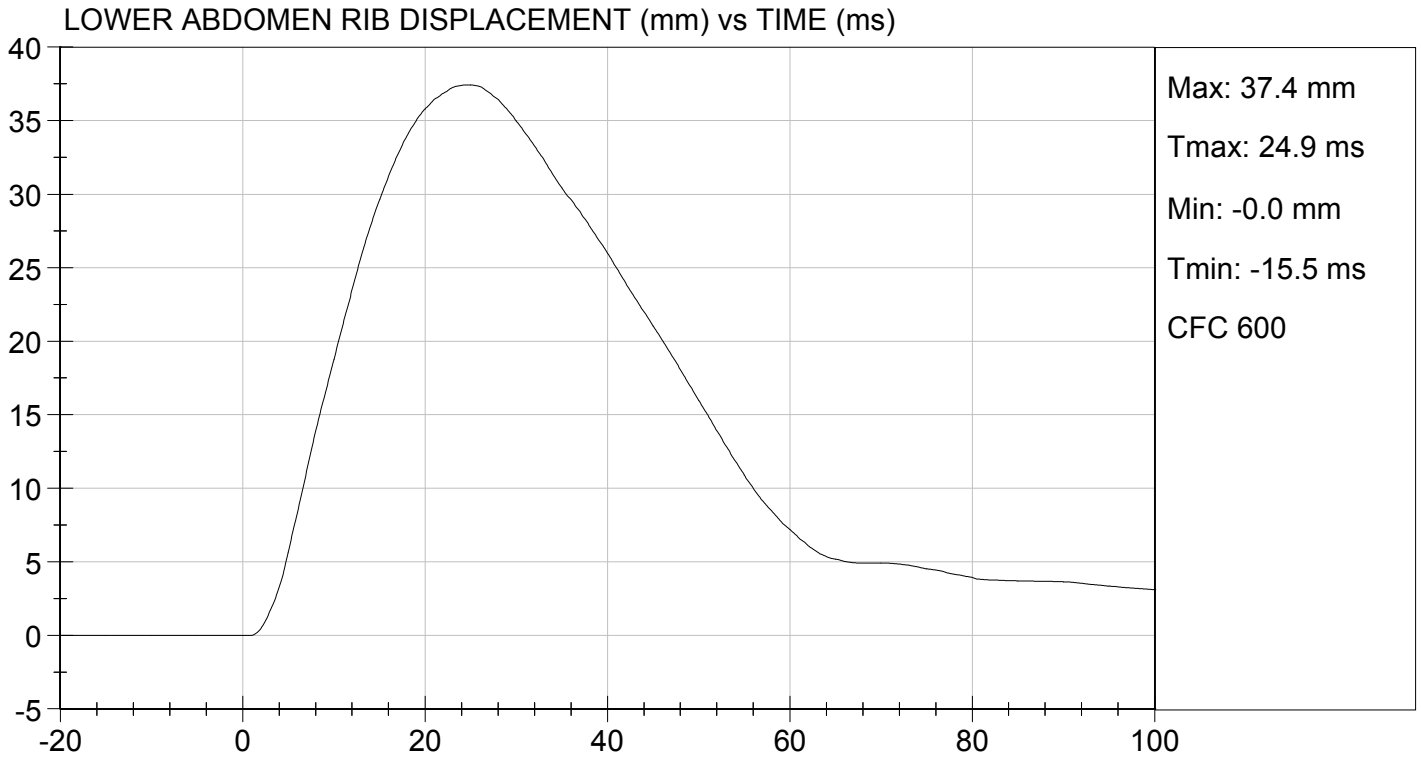
Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.0	Pass
Humidity	%	10 to 70	41	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	12 to 16	13	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	44	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	37	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	10	Pass
Overall Test Results				Pass

Jessica Hall  
 Laboratory Technician

10/02/2012  
 Test Date

David Winkelbauer  
 Approved By





**MGA RESEARCH CORPORATION**  
**PELVIS IMPACT TEST**  
**SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

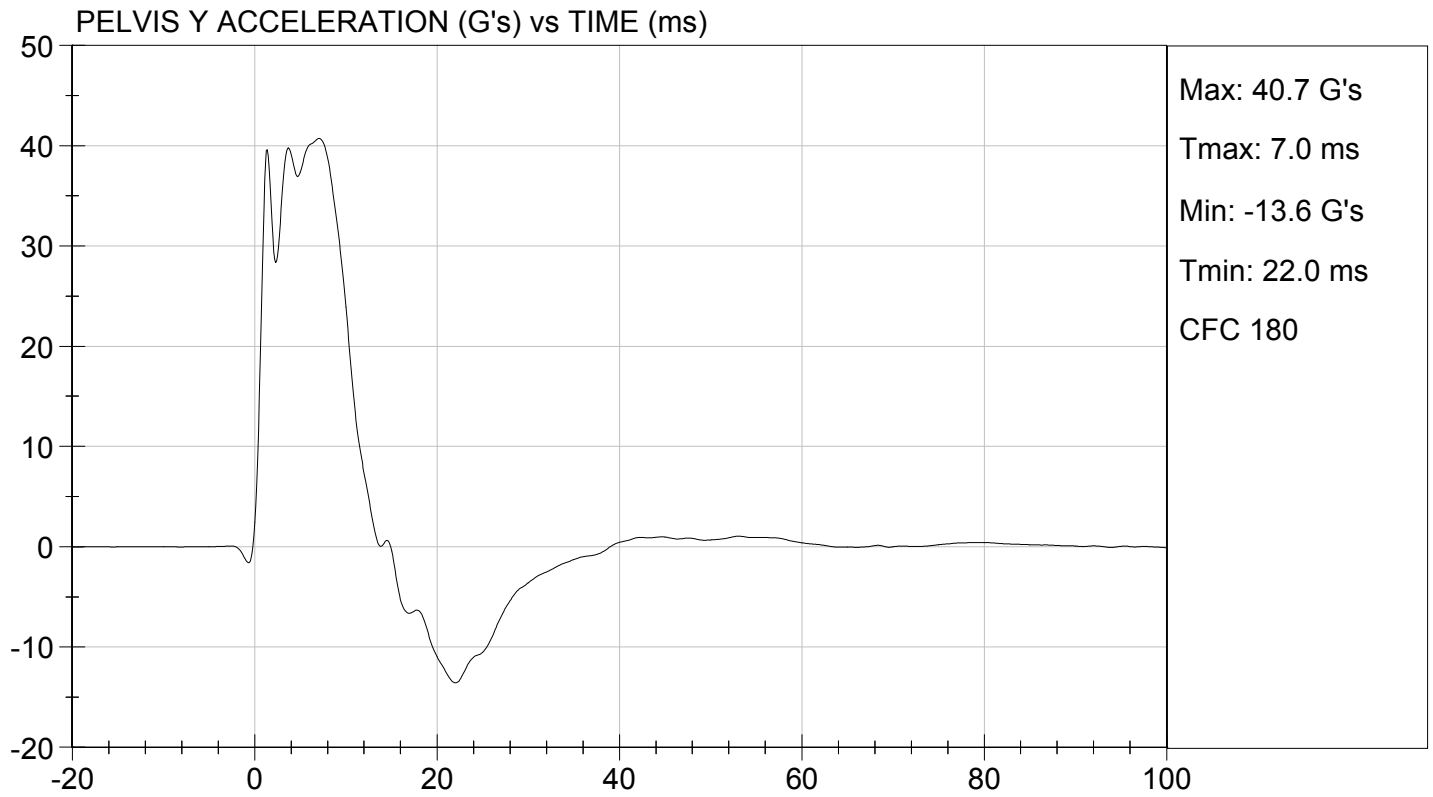
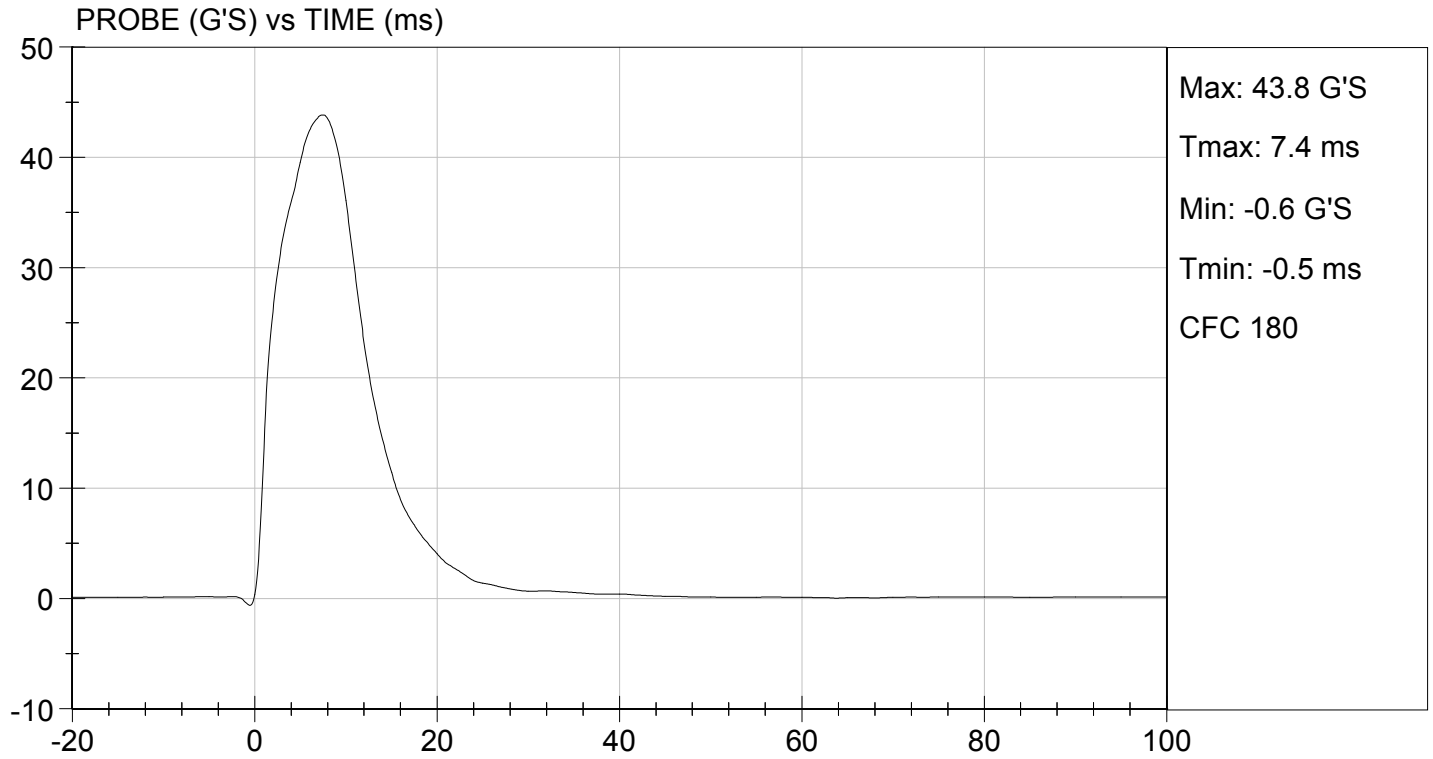
**Test I.D:** D123707

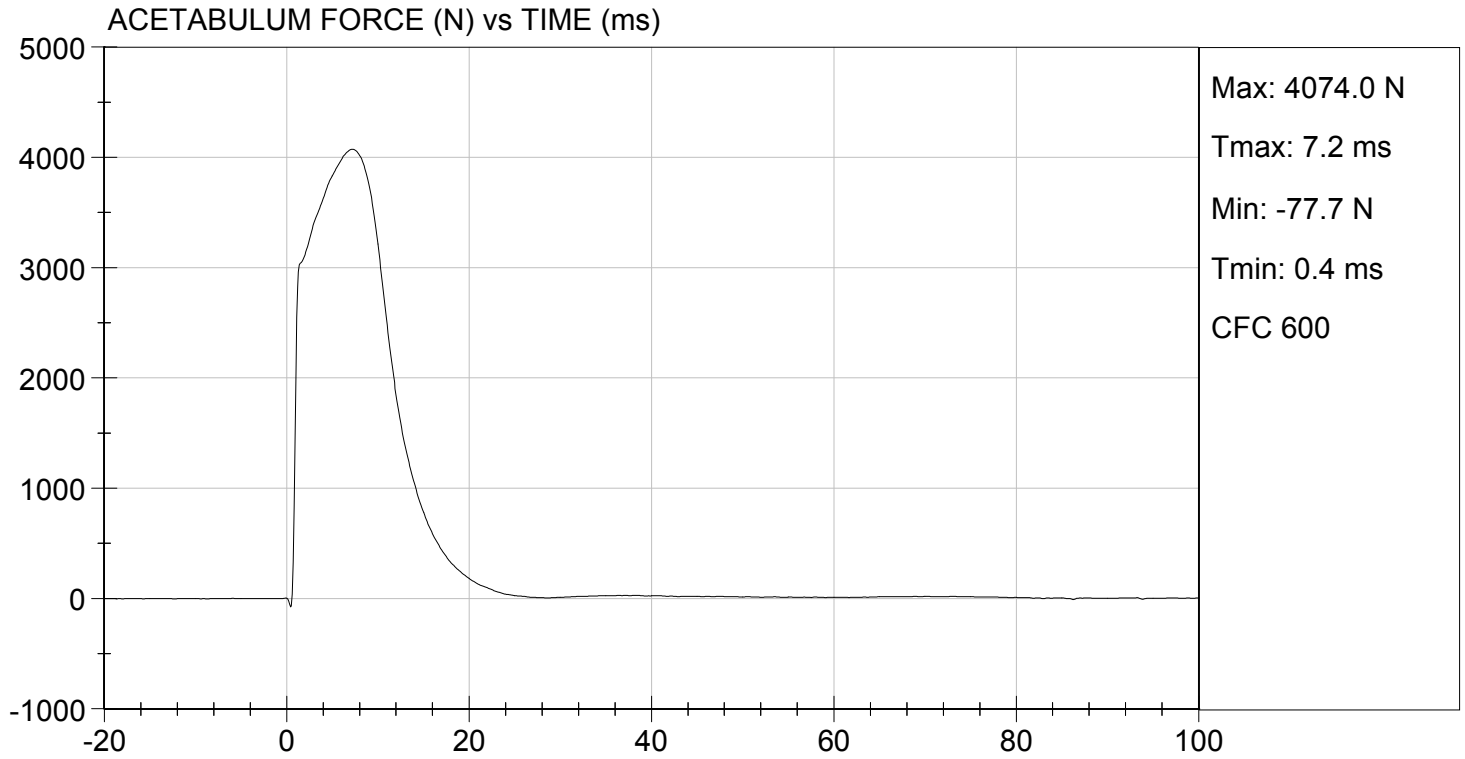
Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.0	Pass
Humidity	%	10 to 70	41	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	38 to 47	44	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	41	Pass
Peak Acetabulum Force	N	3600 to 4300	4,074	Pass
<b>Overall Test Results</b>				<b>Pass</b>

Jessica Gall  
 Laboratory Technician

10/02/2012  
 Test Date

David Winkelbauer  
 Approved By





**MGA RESEARCH CORPORATION**  
**ILIAC IMPACT TEST**  
**SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

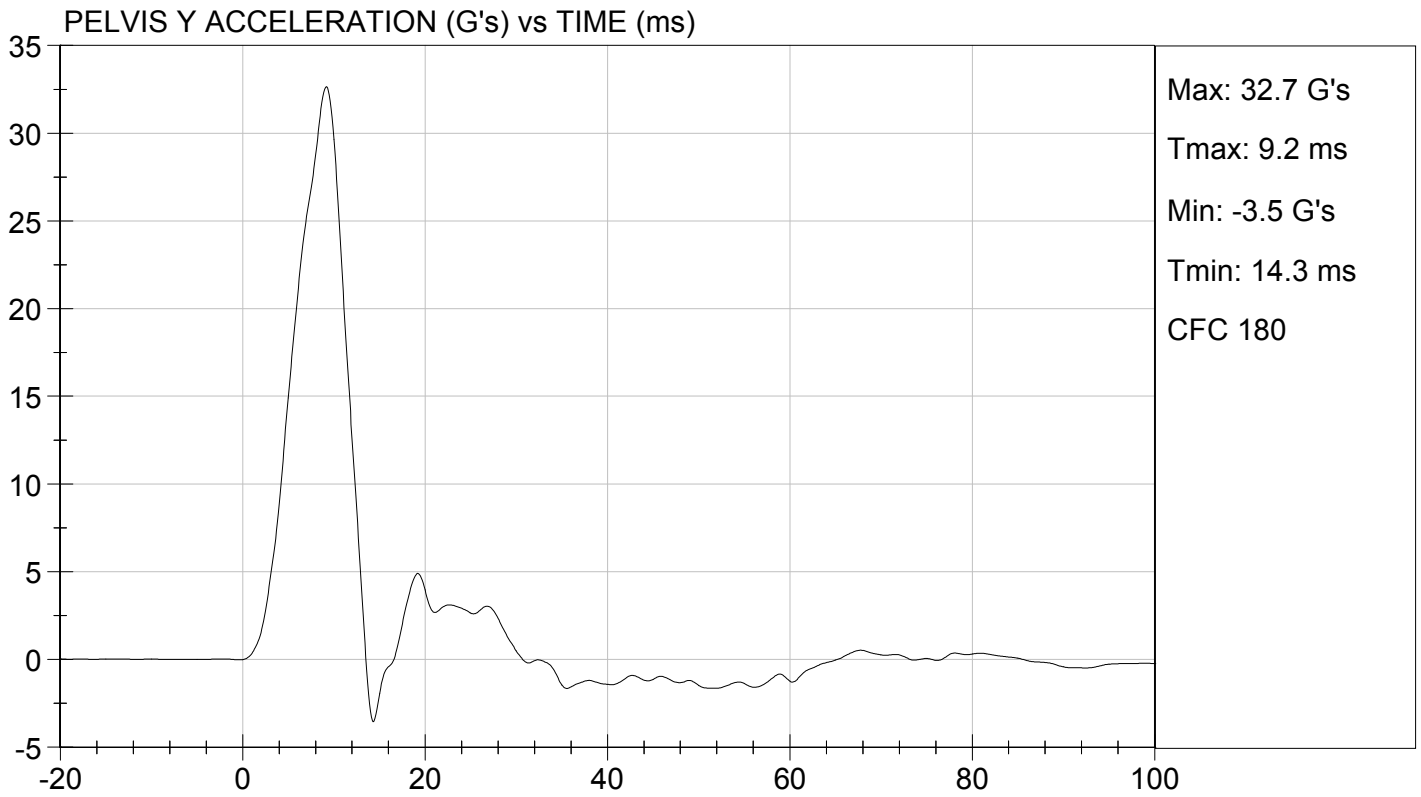
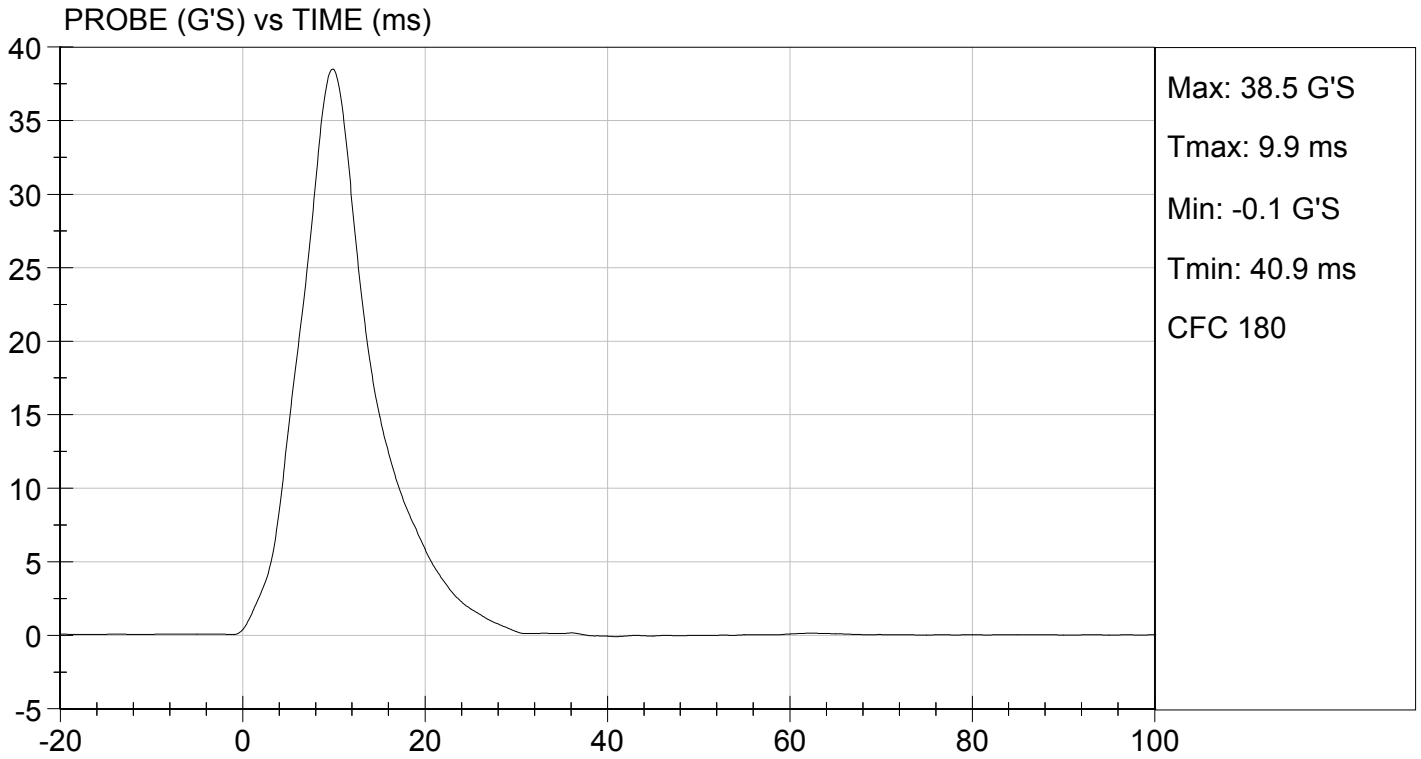
**Test I.D:** D123708

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.0	Pass
Humidity	%	10 to 70	41	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe 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	4,640	Pass
<b>Overall Test Results</b>				<b>Pass</b>

*Jessica Hall*  
 Laboratory Technician

10/02/2012  
 Test Date

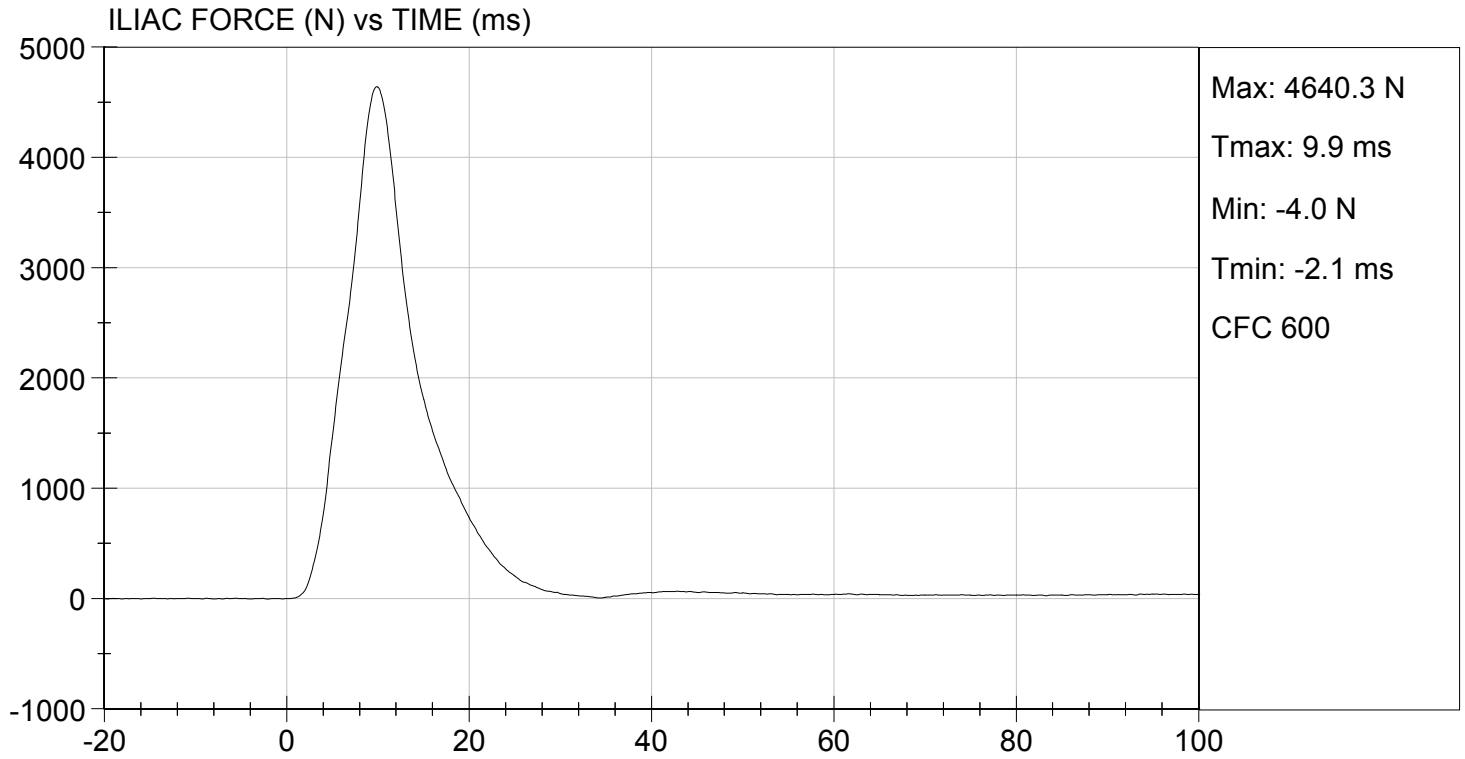
*David Winkelbauer*  
 Approved By





TEST DESC: ILLIAC  
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 10/02/2012  
TEST #: D123708



**MGA RESEARCH CORPORATION  
HEAD DROP TEST  
SID-IIs BUILD LEVEL D DUMMY**

ATD Serial No: 296

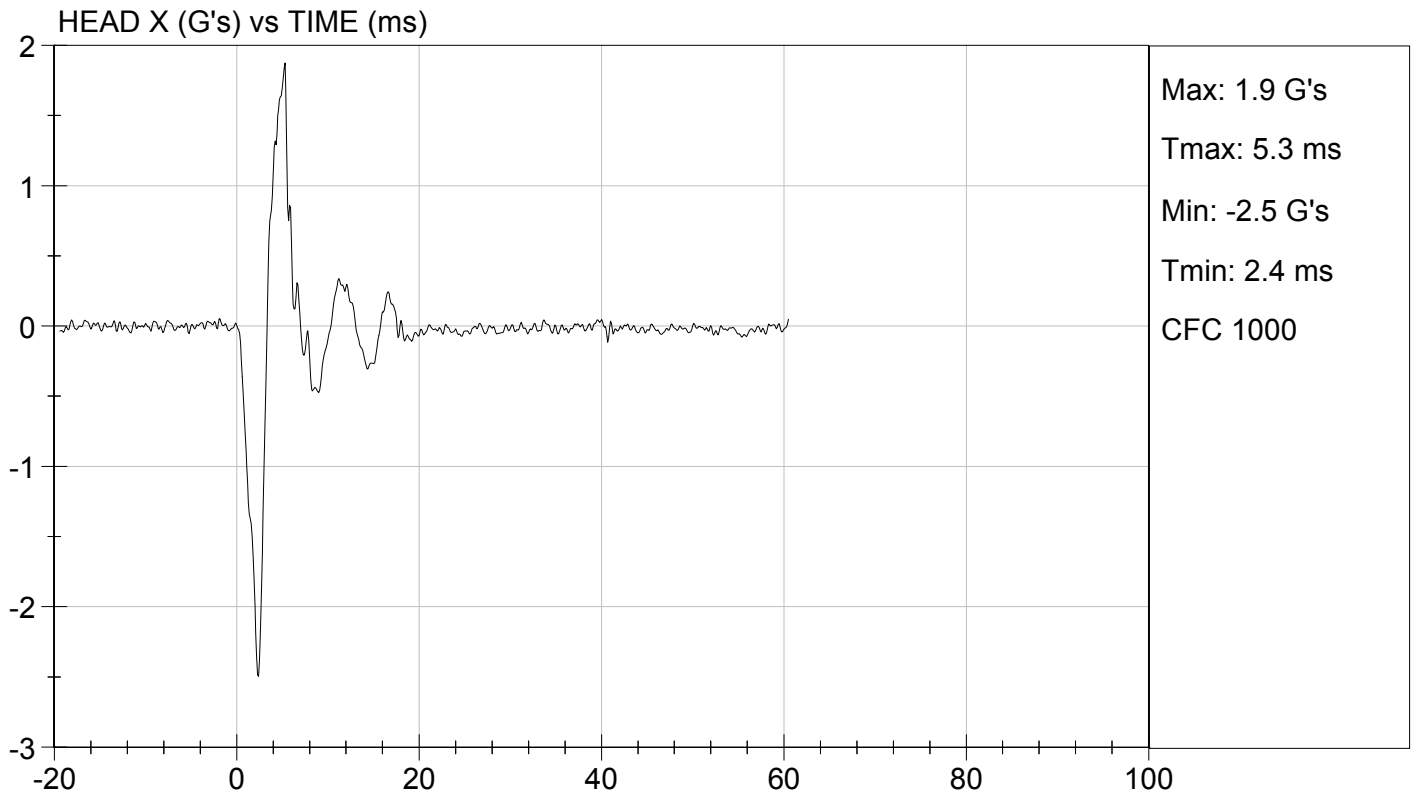
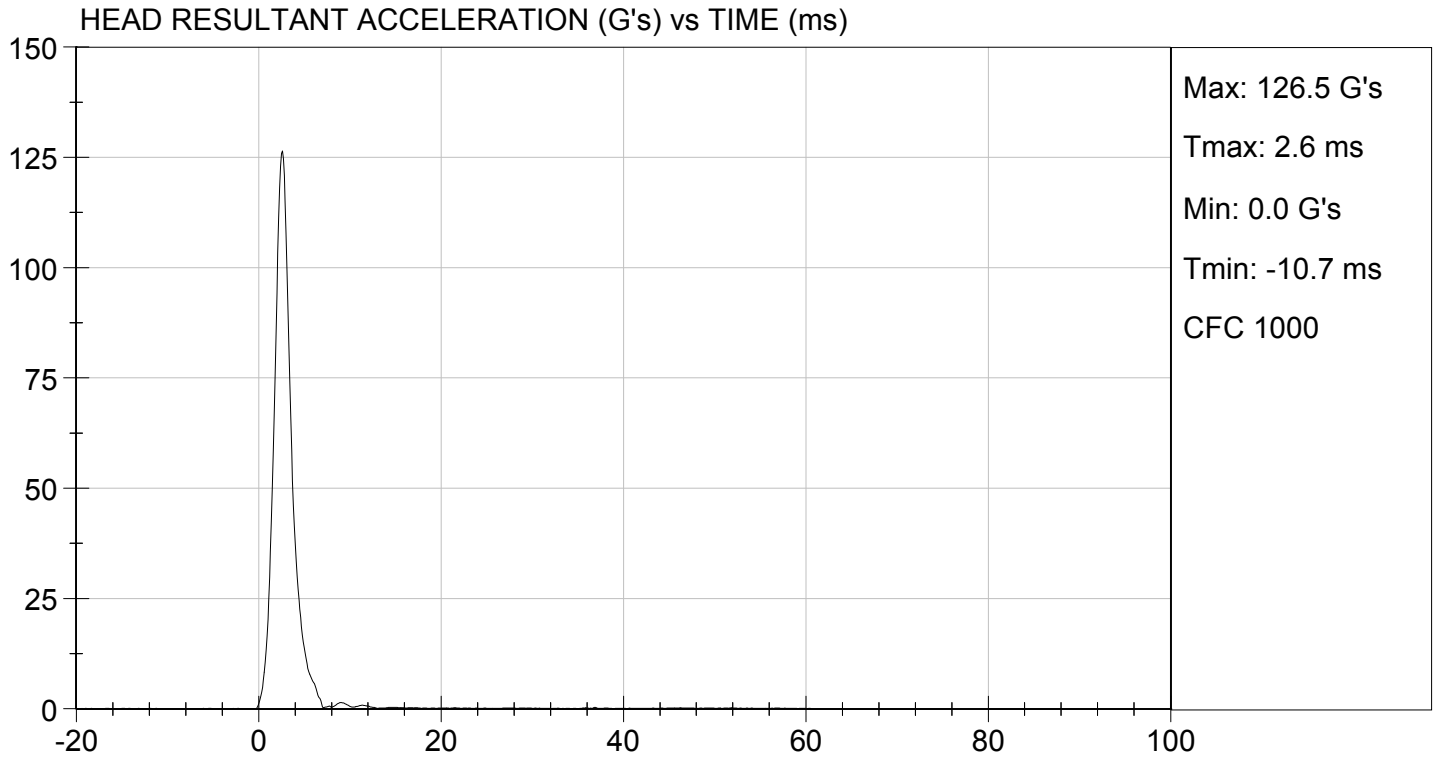
Test ID: D123841

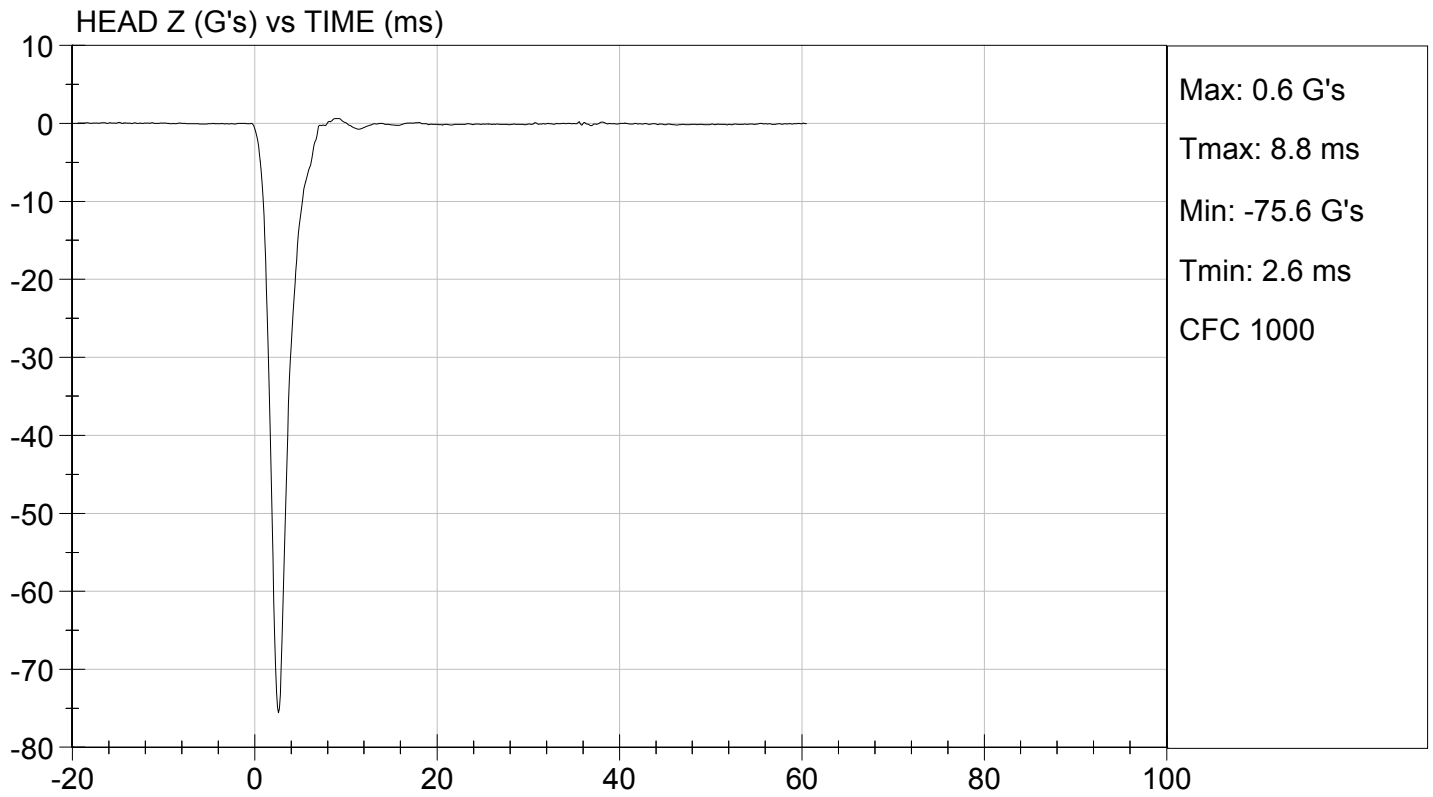
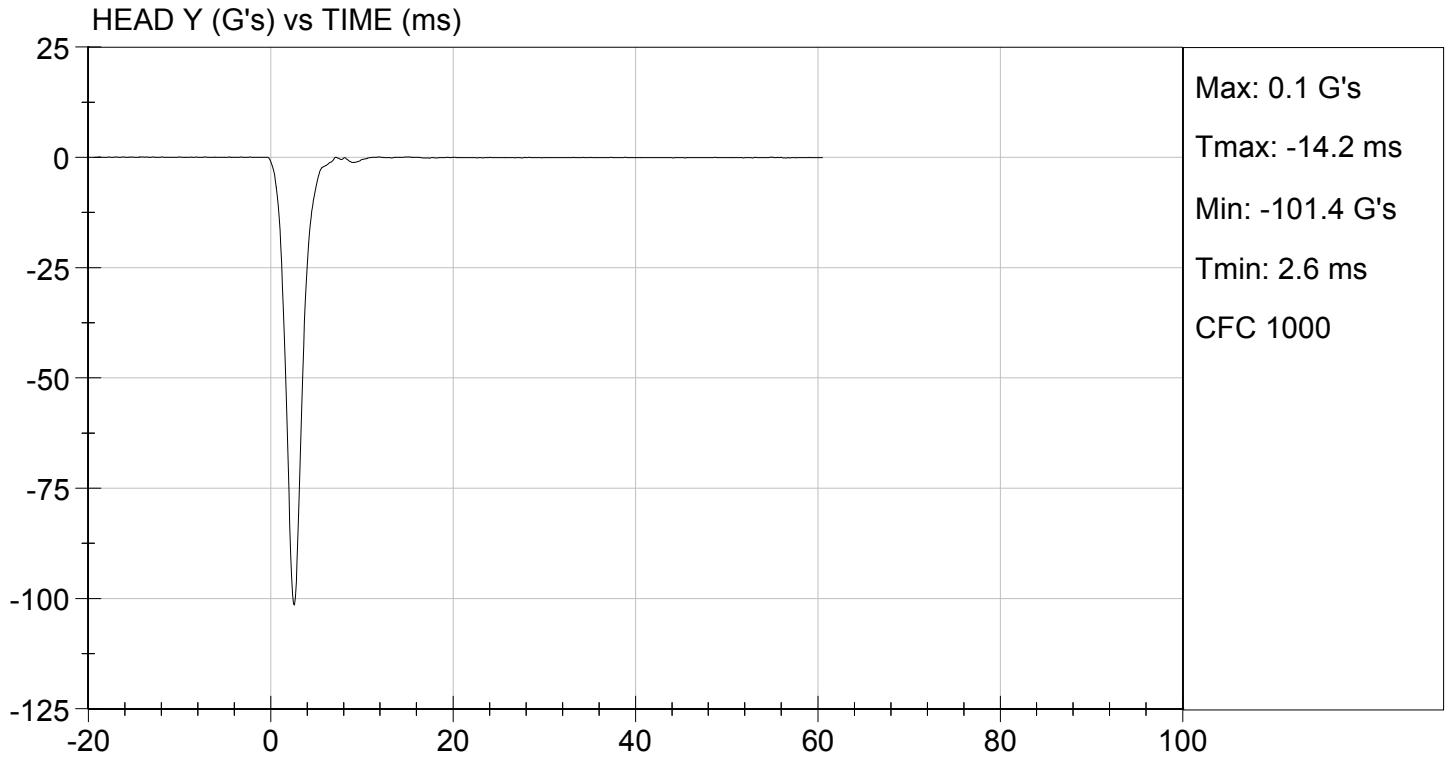
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Peak Resultant Acceleration	G's	115 to 137	126	Pass
Peak Longitudinal Acceleration	G's	+/- 15	-2.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
Overall Test Results				Pass

Jessica Hall  
Laboratory Technician

10/10/2012  
Test Date

David Winkelbauer  
Approved By





**MGA RESEARCH CORPORATION  
LATERAL NECK PENDULUM TEST  
SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

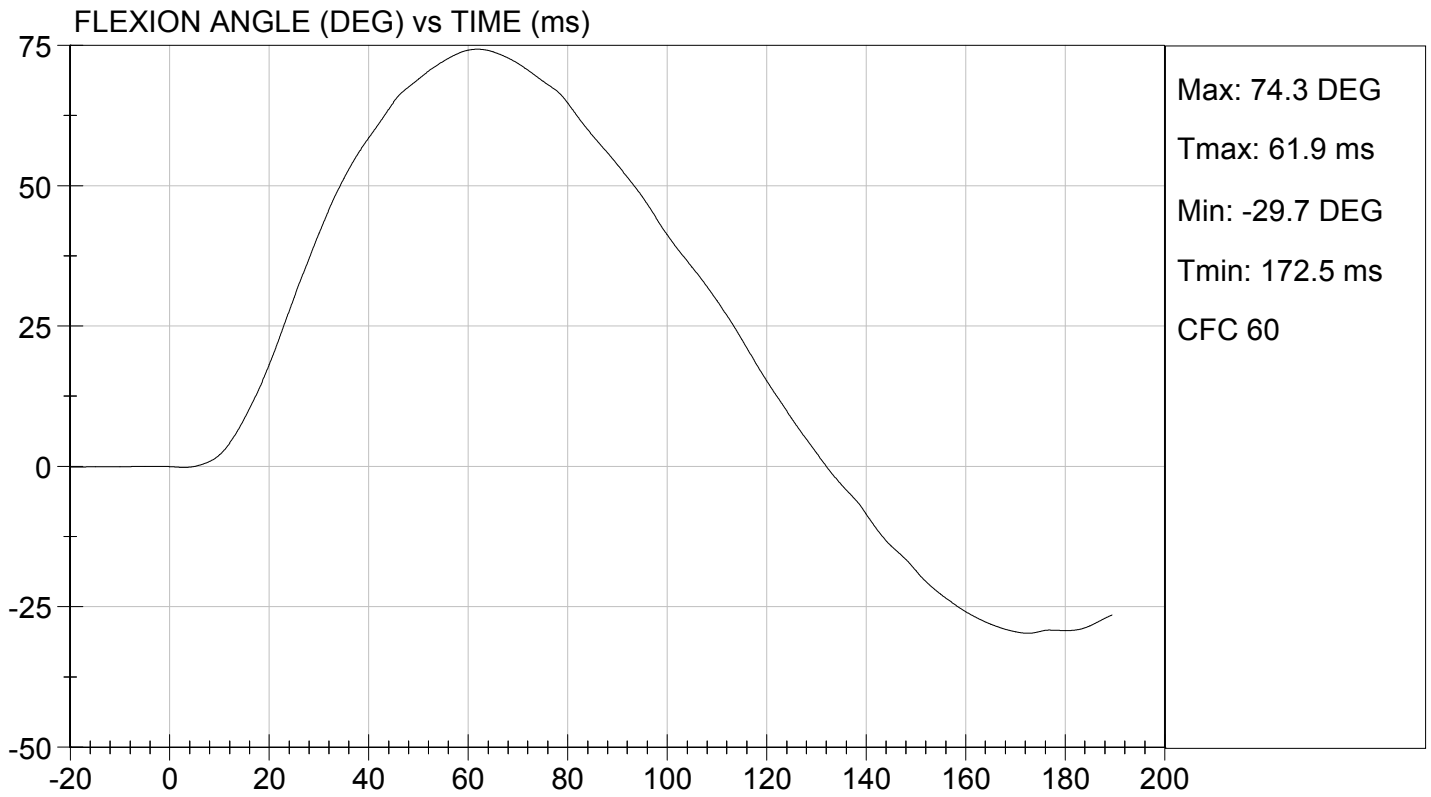
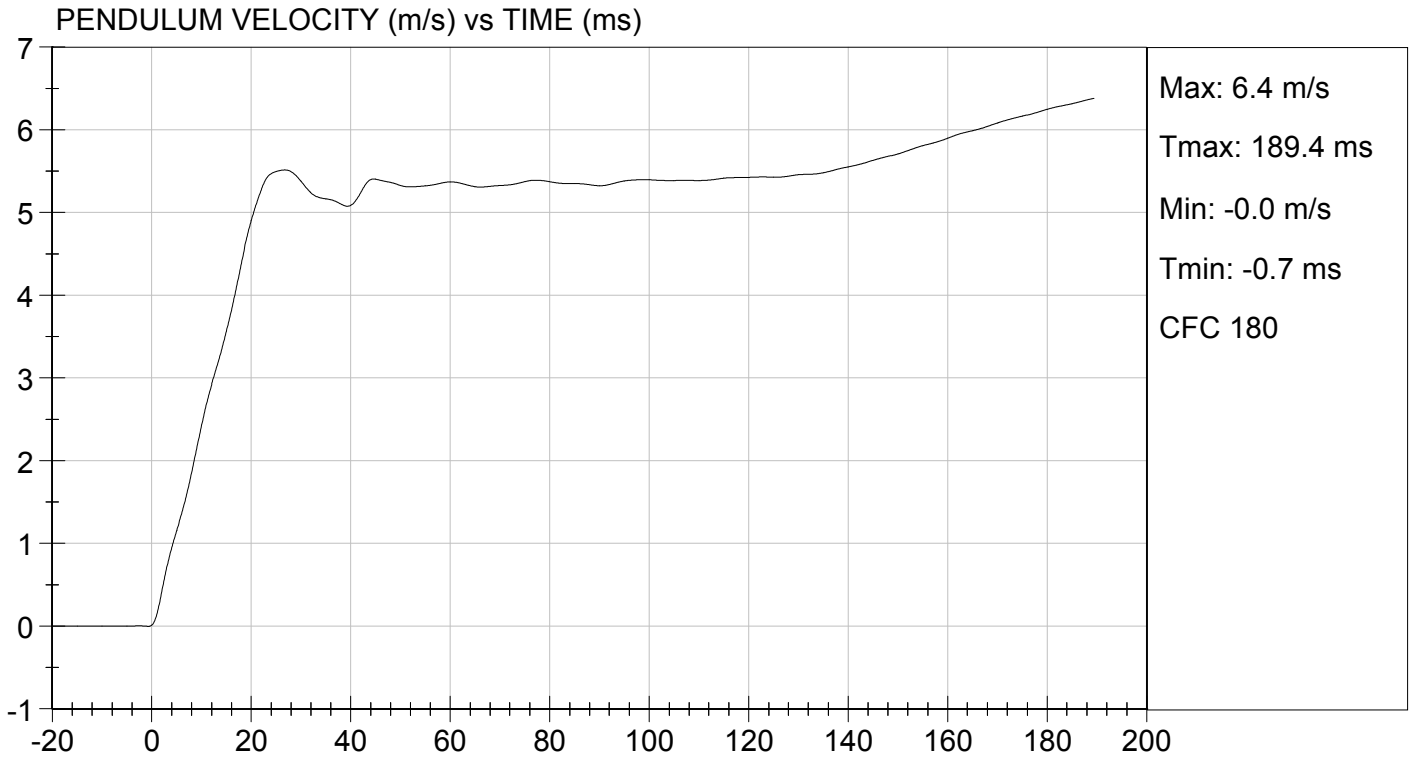
**Test I.D.:** D123842

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.9	Pass
Humidity		%	10 to 70	34	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.43	Pass
	15 ms	m/s	3.30 to 4.10	3.57	Pass
	20 ms	m/s	4.40 to 5.40	4.90	Pass
	25 ms	m/s	5.40 to 6.10	5.50	Pass
	25-100 ms	m/s	5.50 to 6.20	5.51	Pass
Maximum D-Plane Rotation		deg	71 to 81	74	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	62	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-43	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	118	Pass
<b>Overall Test Results</b>					<b>Pass</b>

Jessica Hall  
Laboratory Technician

10/10/2012  
Test Date

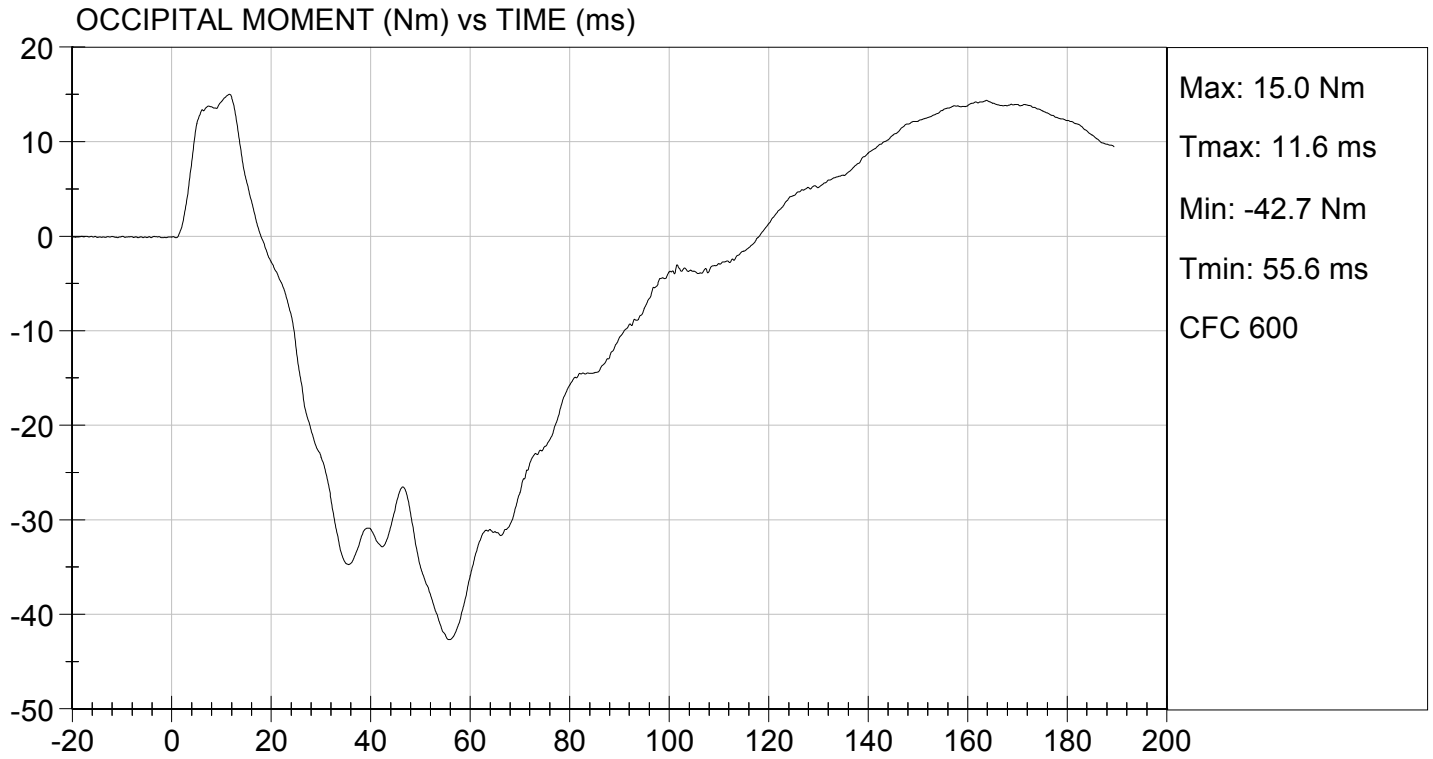
David Winkelbauer  
Approved By





TEST DESC: NECK BENDING  
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 10/10/2012  
TEST #: D123842



**MGA RESEARCH CORPORATION  
SHOULDER IMPACT TEST  
SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

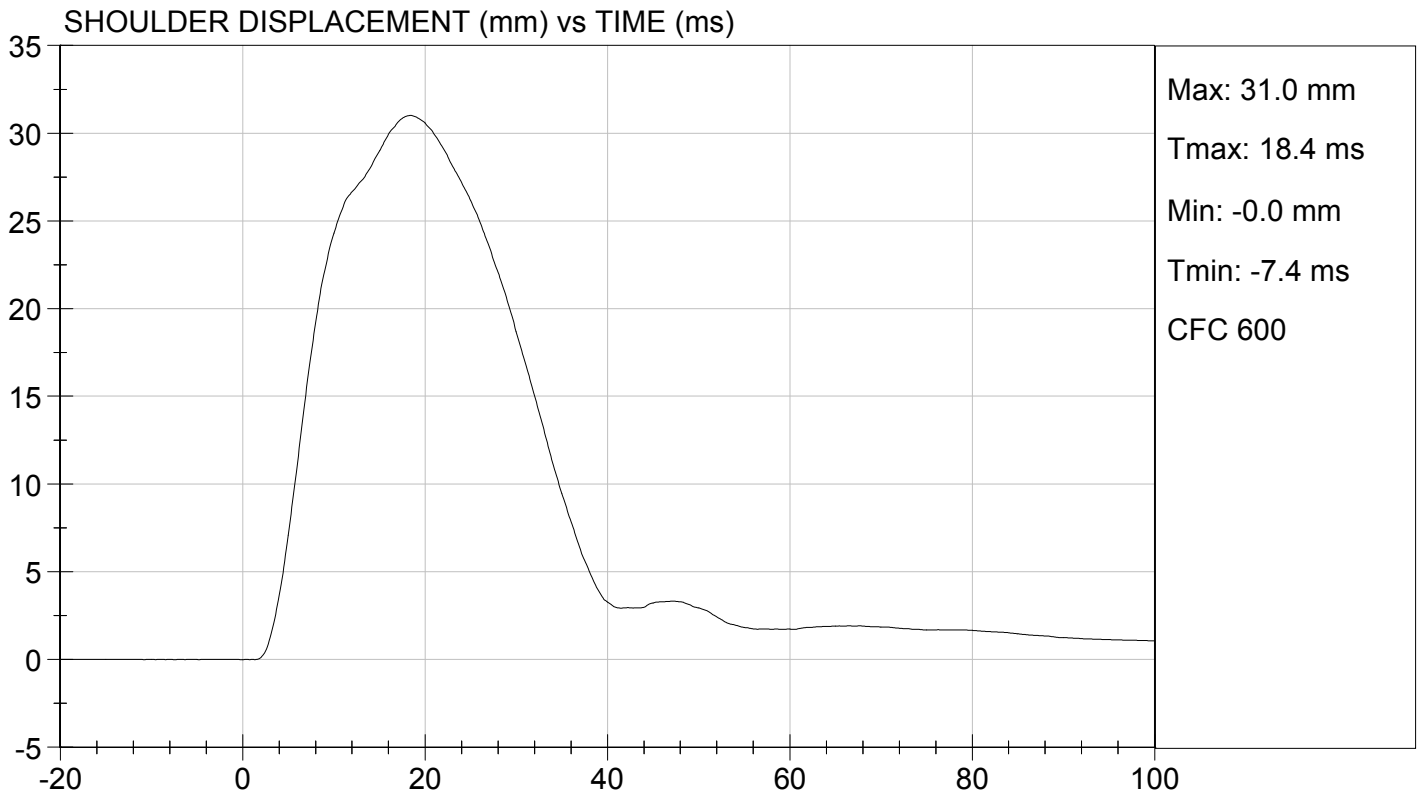
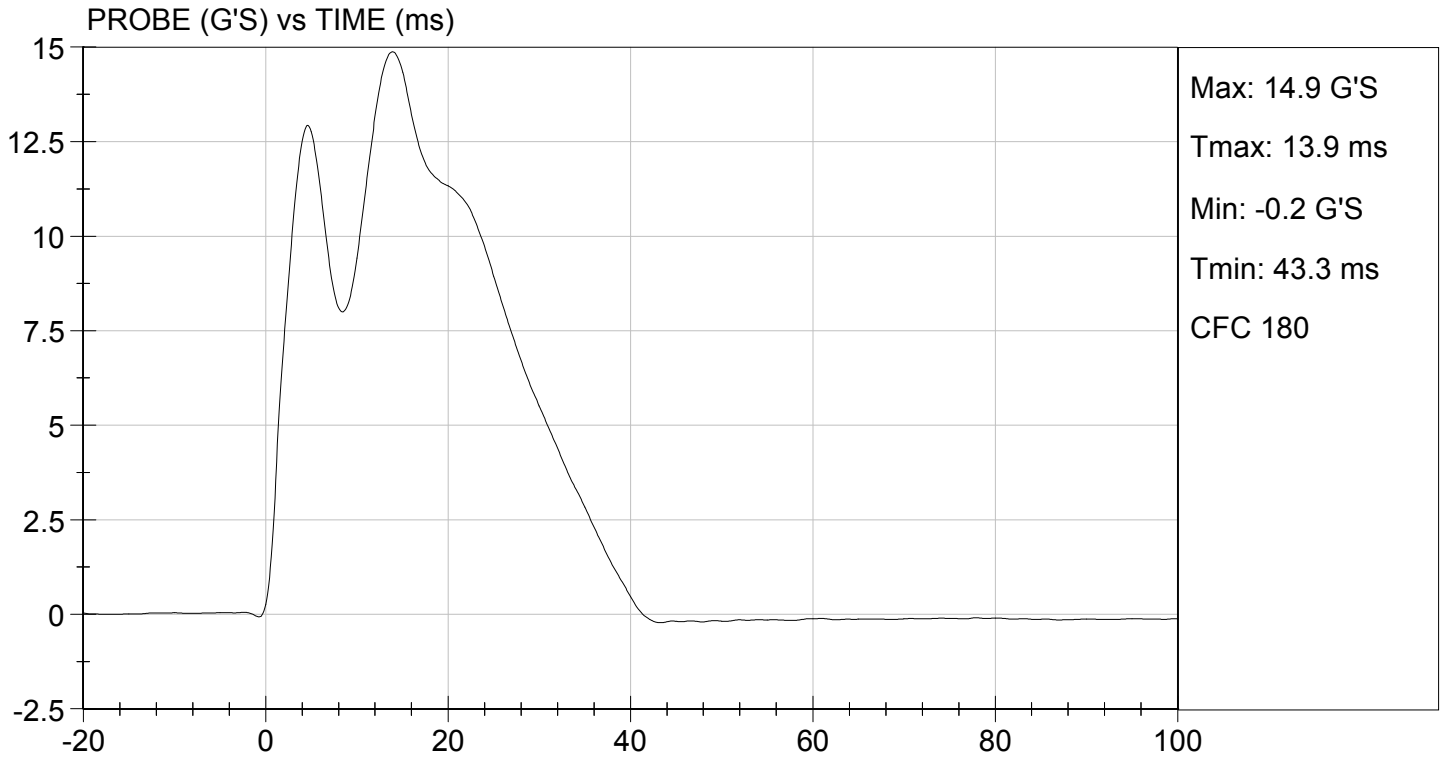
**Test ID:** D123843

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	31	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
Overall Test Results				Pass

*Jessica Gall*  
Laboratory Technician

10/10/2012  
Test Date

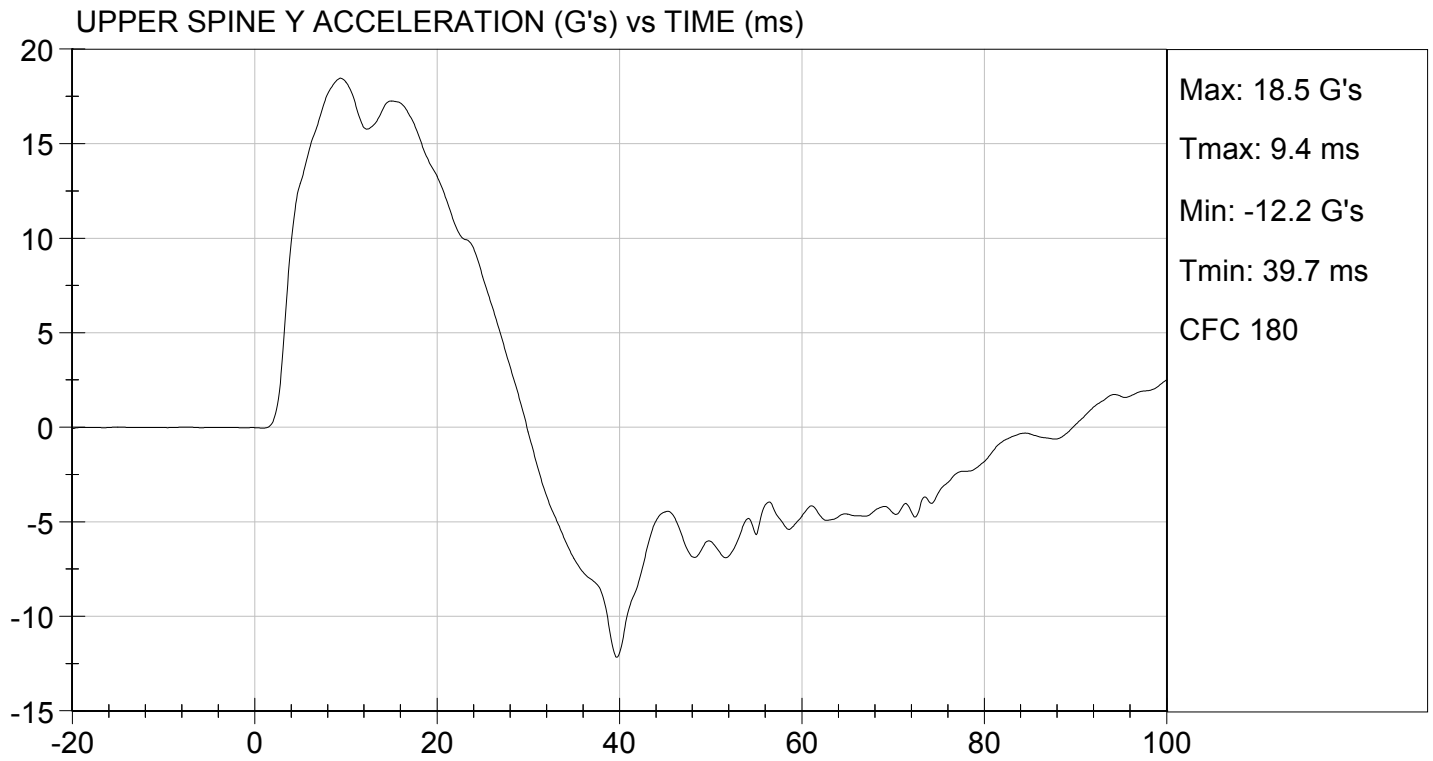
*David Winkelbauer*  
Approved By





TEST DESC: SHOULDER IMPACT  
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 10/10/2012  
TEST #: D123843



**MGA RESEARCH CORPORATION  
THORAX (WITH ARM) IMPACT TEST  
SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

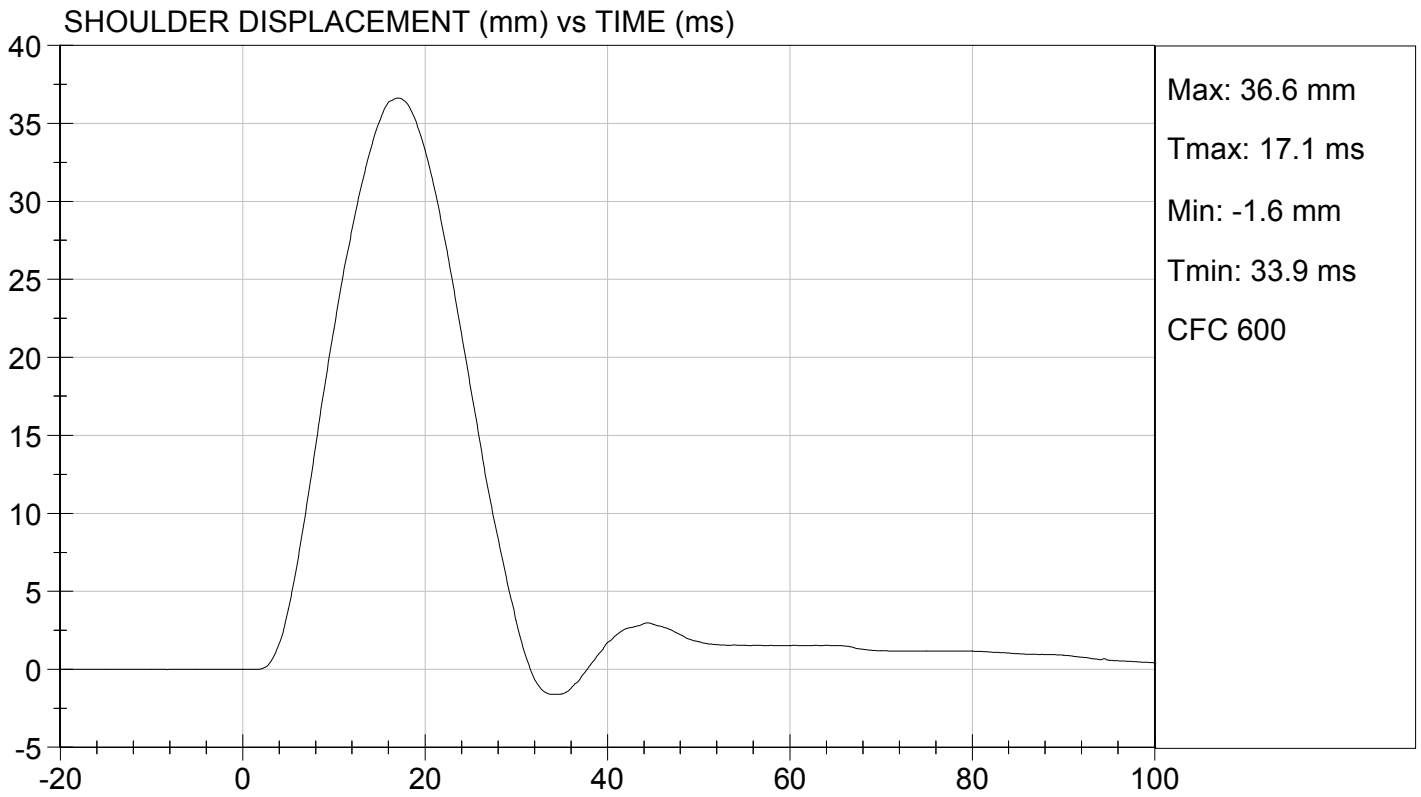
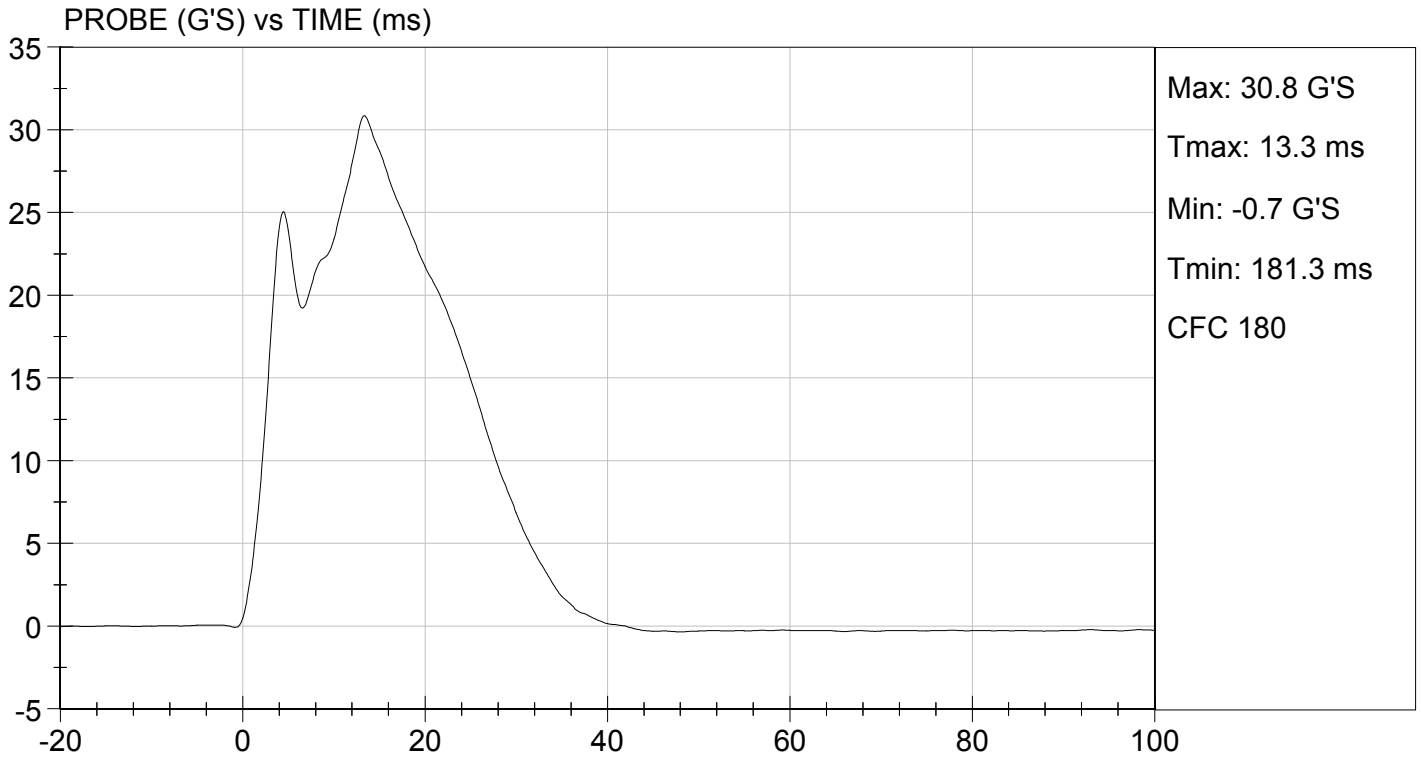
**Test I.D:** D123844

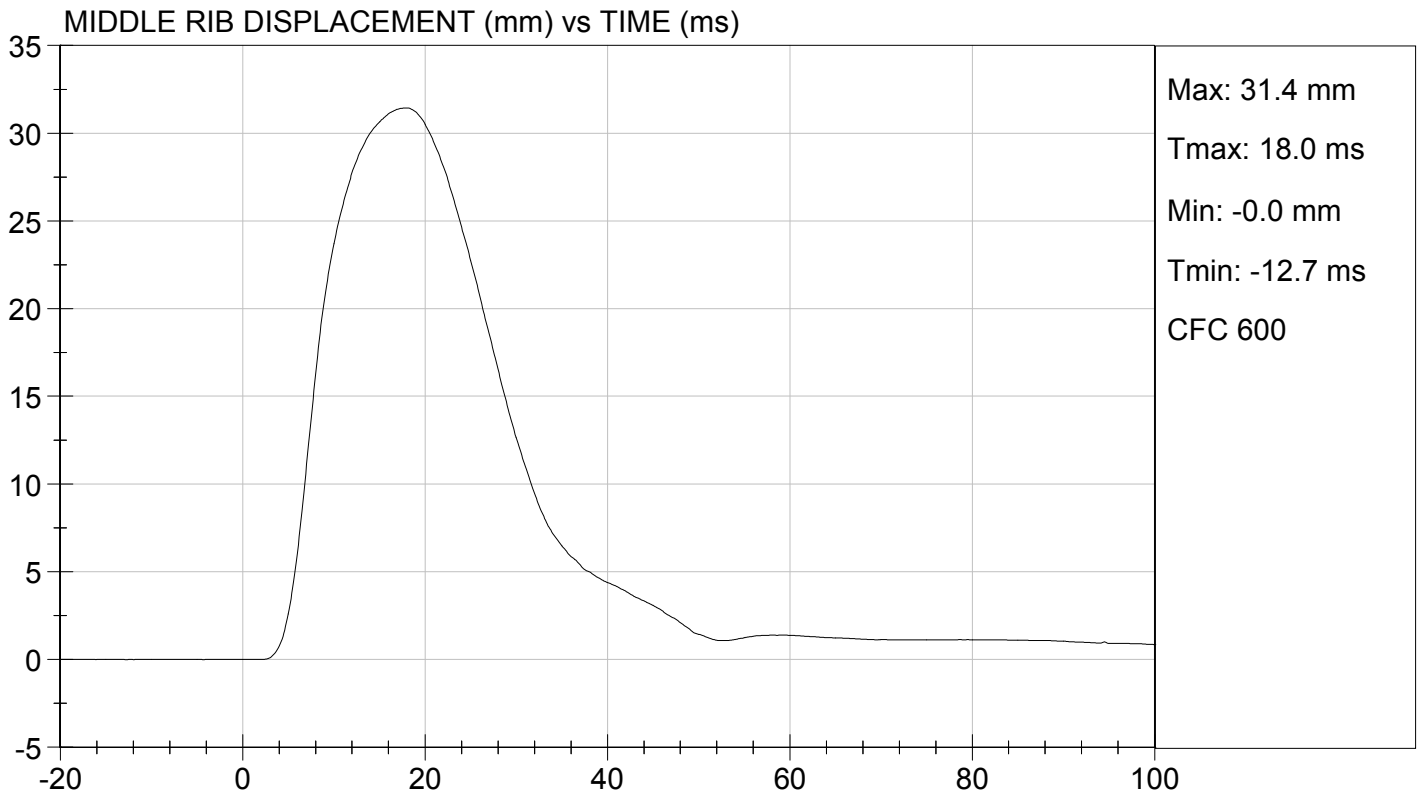
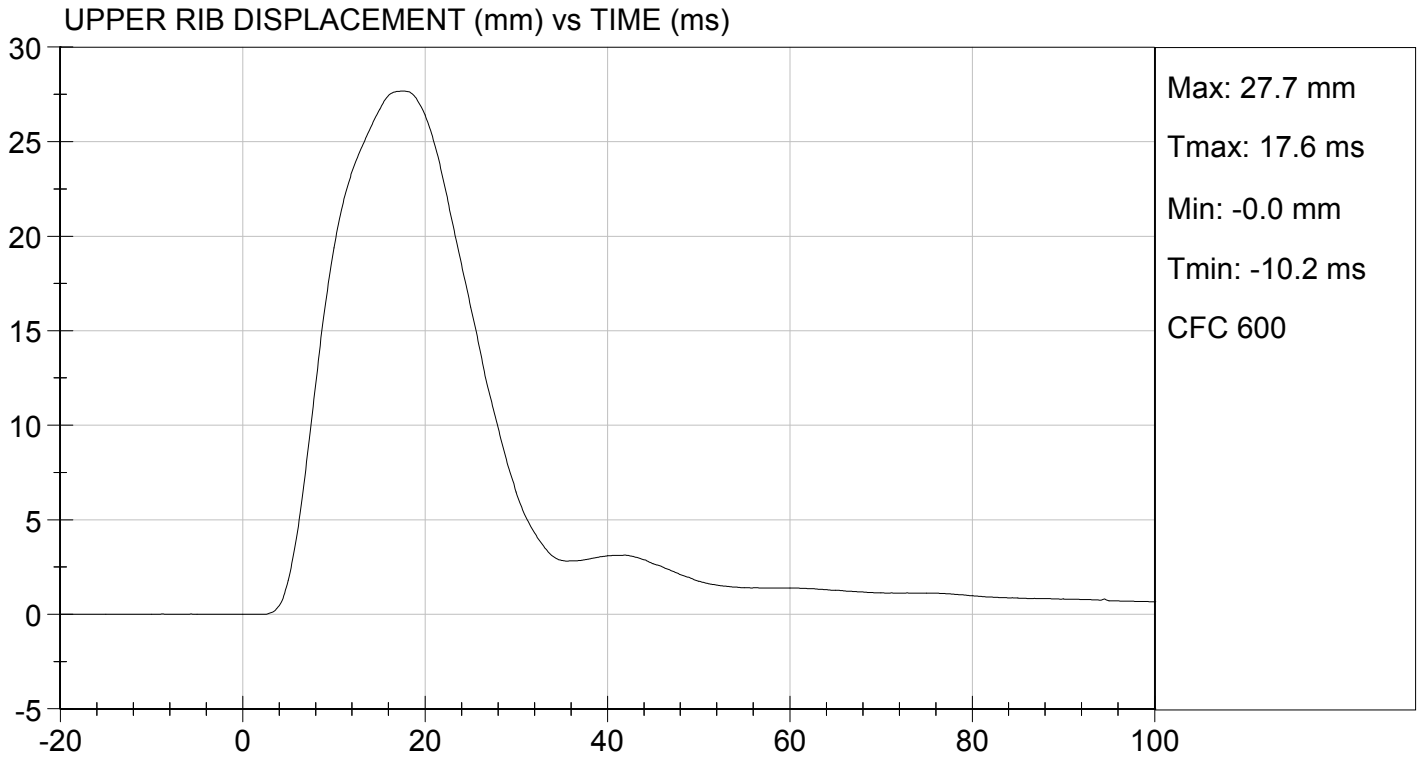
Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	31	Pass
Shoulder Displacement	mm	31 to 40	37	Pass
Upper Rib Displacement	mm	25 to 32	28	Pass
Middle 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	37	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	31	Pass
<b>Overall Test Results</b>				<b>Pass</b>

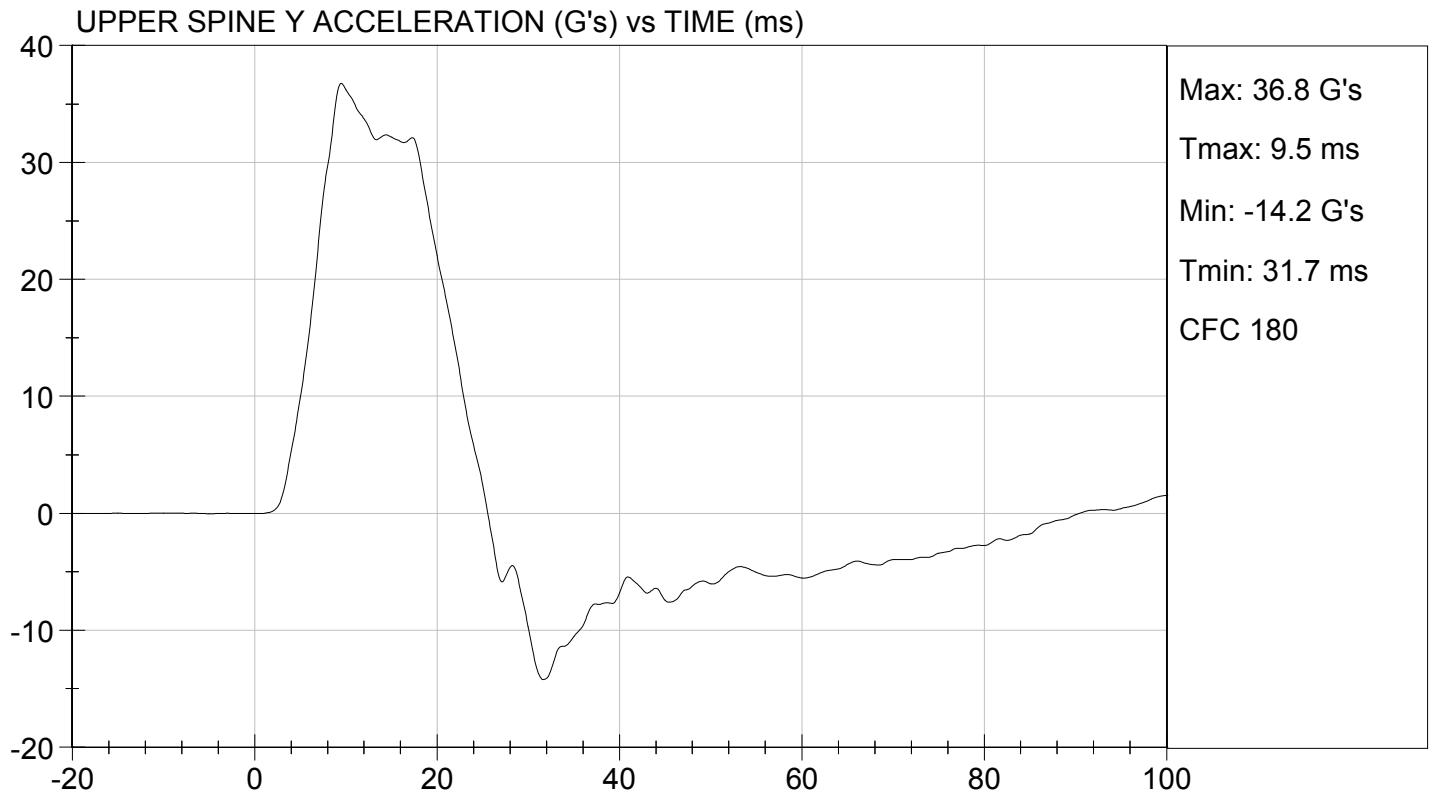
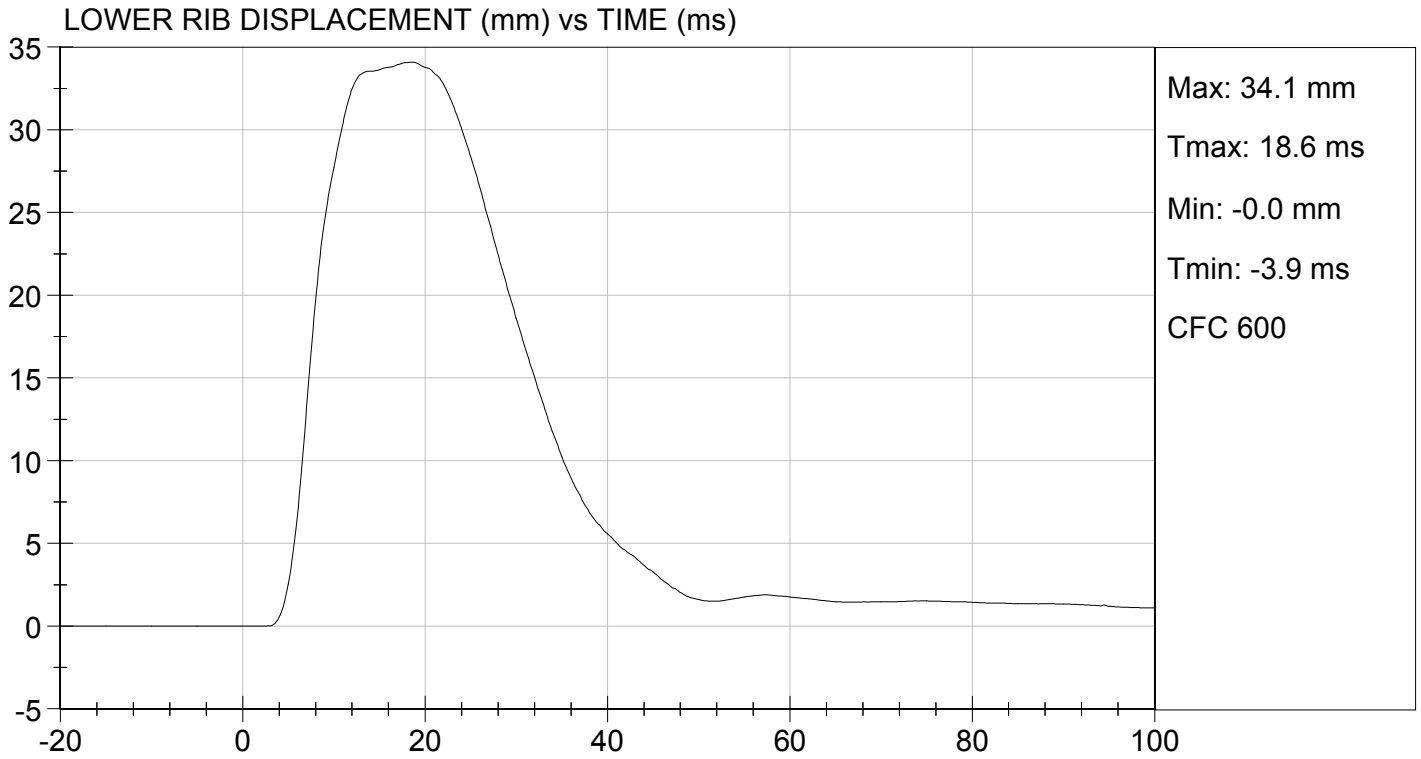
Jessica Hall  
Laboratory Technician

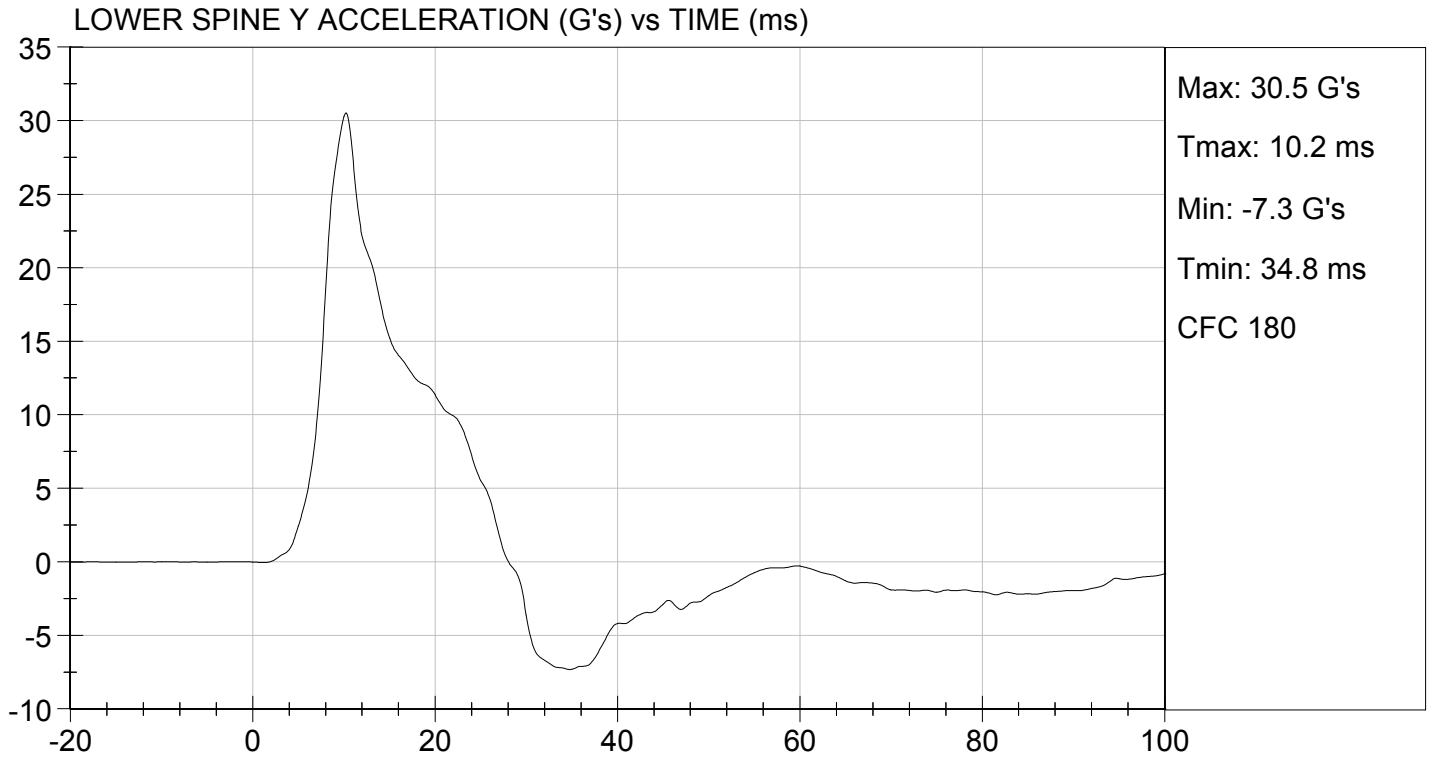
10/10/2012  
Test Date

David Winkelbauer  
Approved By









**MGA RESEARCH CORPORATION**  
**THORAX (WITHOUT ARM) IMPACT TEST**  
**SID-IIs BUILD LEVEL D DUMMY**

ATD Serial No: 296

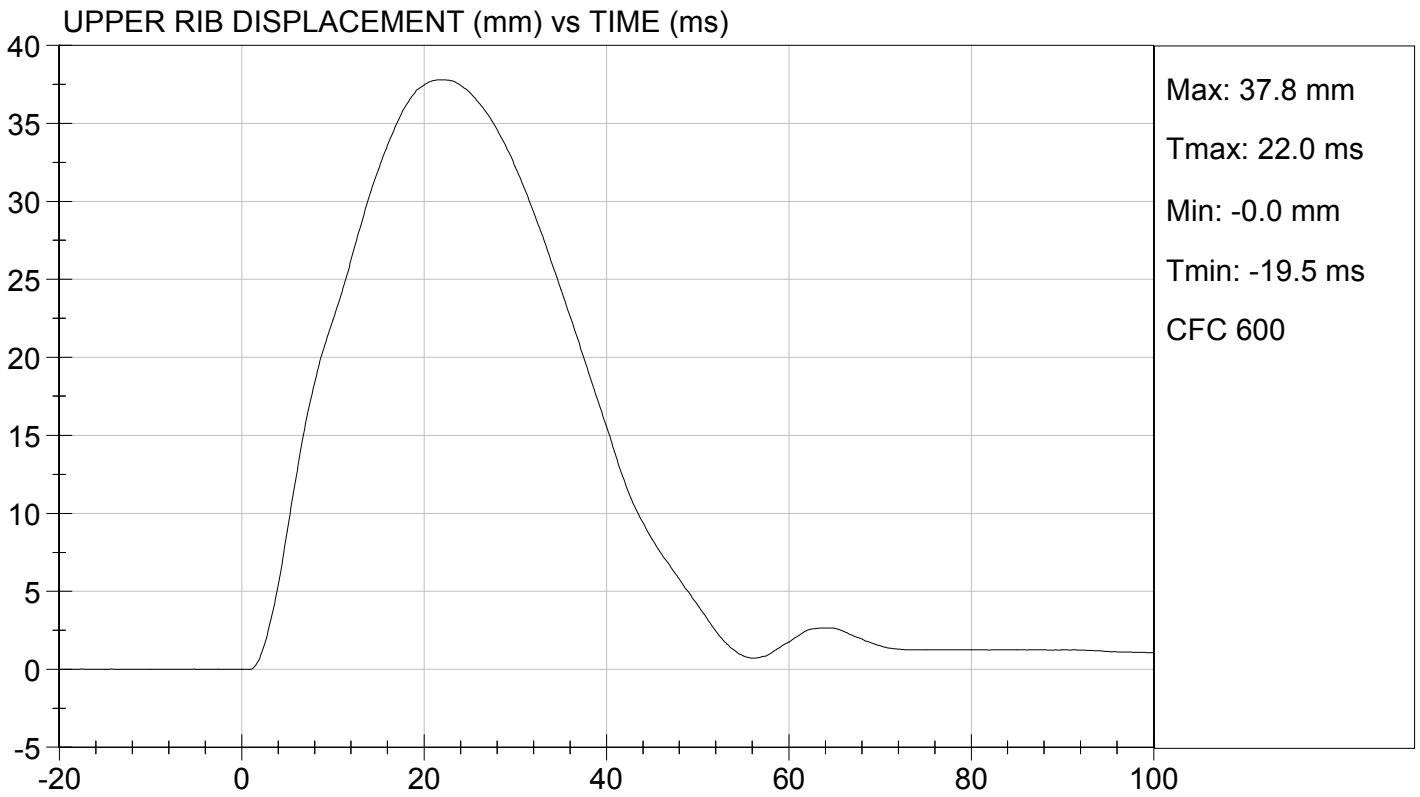
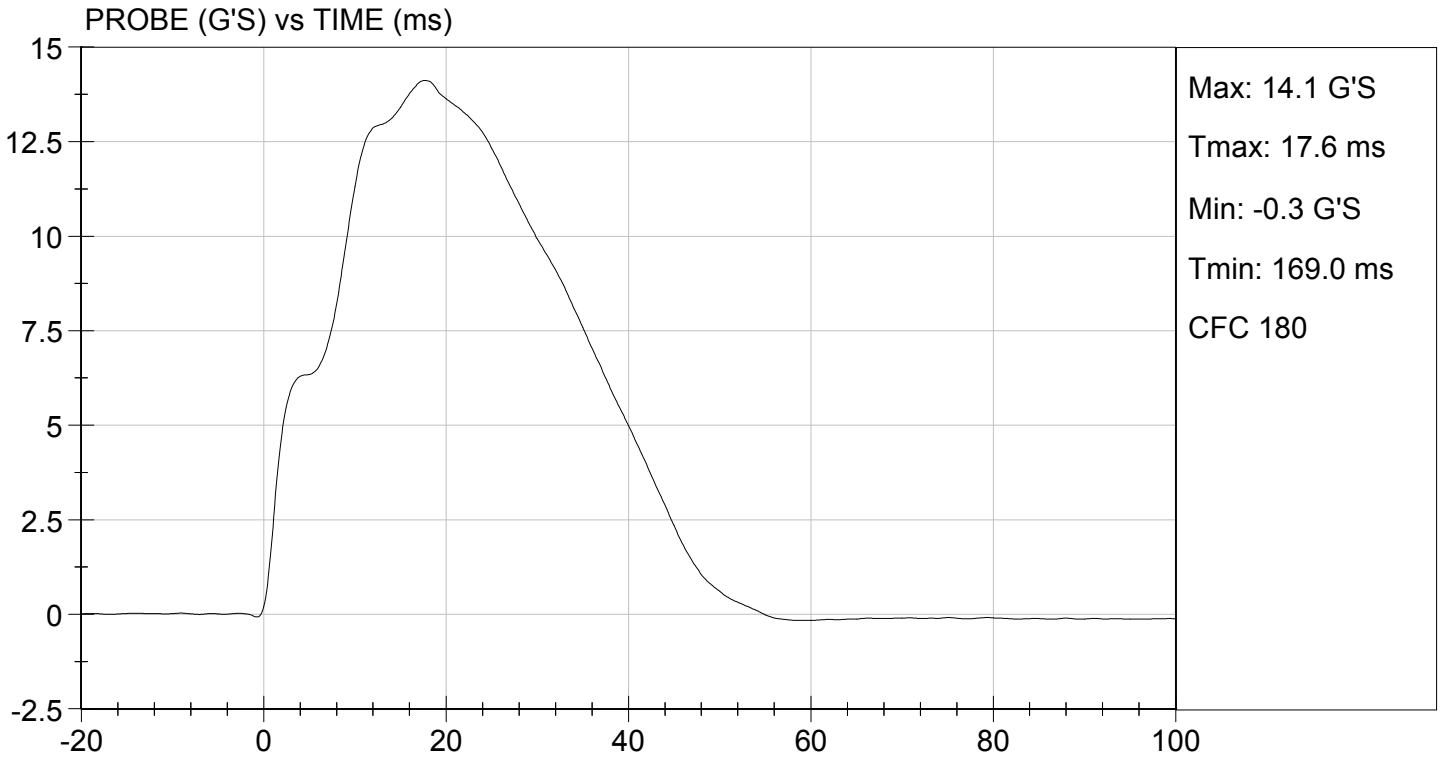
Test I.D: D123845

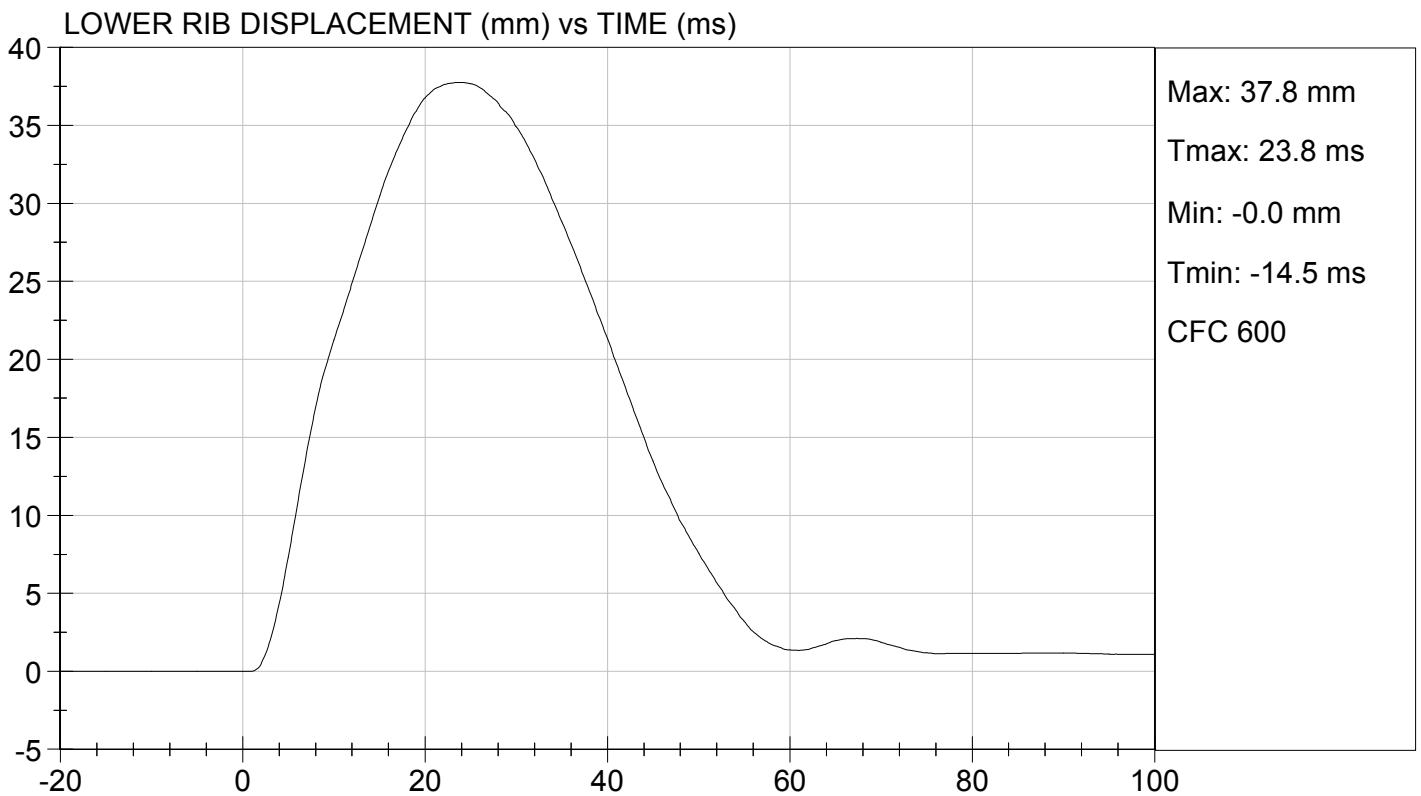
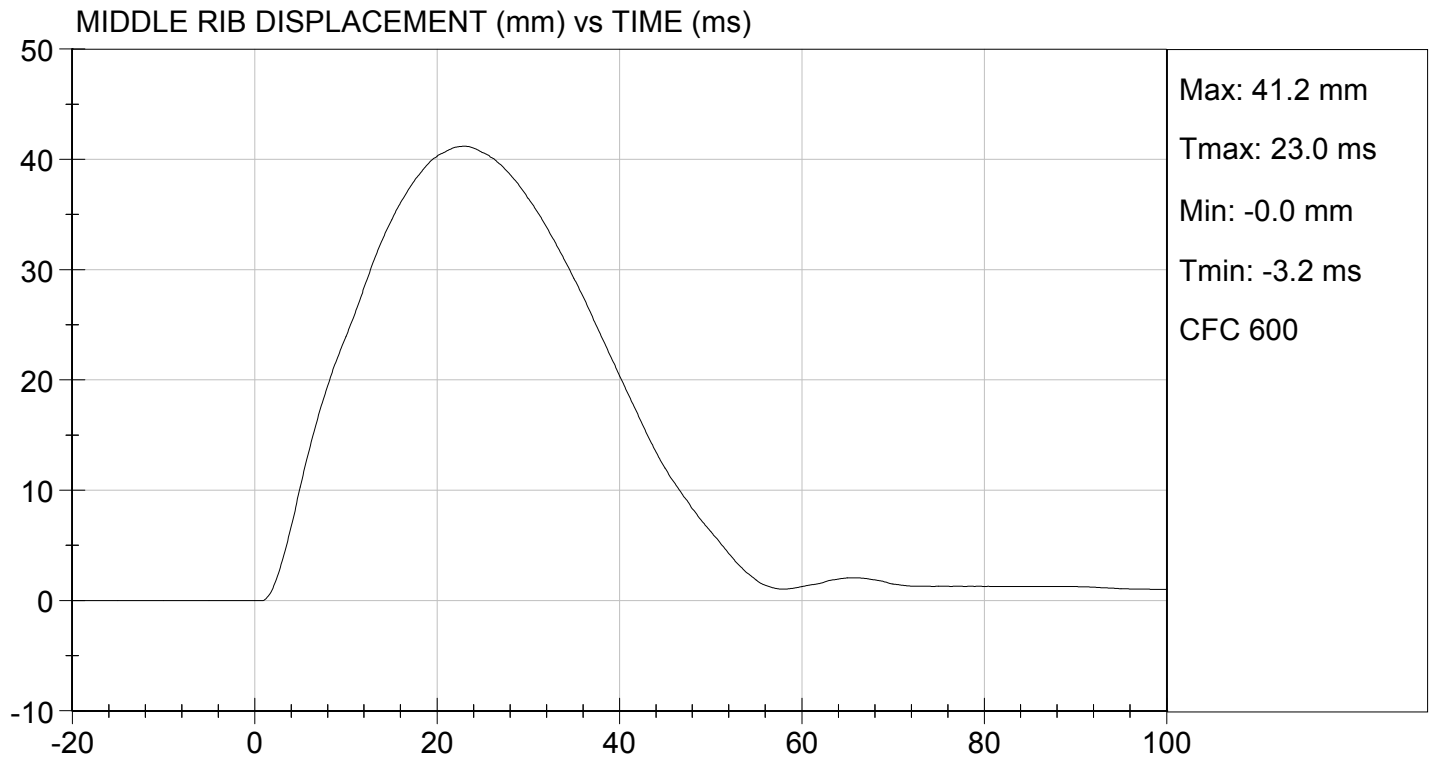
Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	14 to 18	14	Pass
Upper Rib Displacement	mm	32 to 40	38	Pass
Middle Rib Displacement	mm	39 to 45	41	Pass
Lower Rib Displacement	mm	35 to 43	38	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	13	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	8	Pass
<b>Overall Test Results</b>				<b>Pass</b>

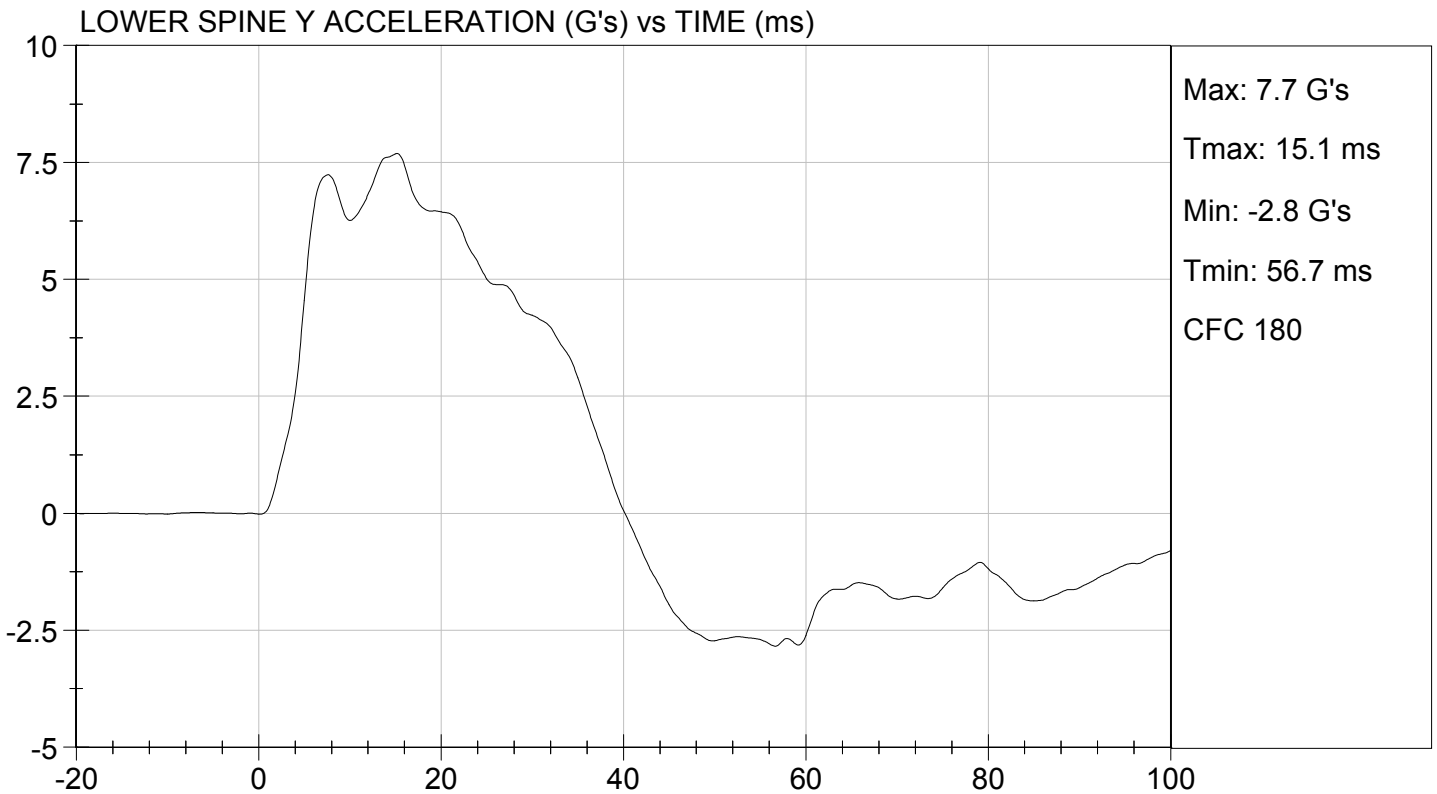
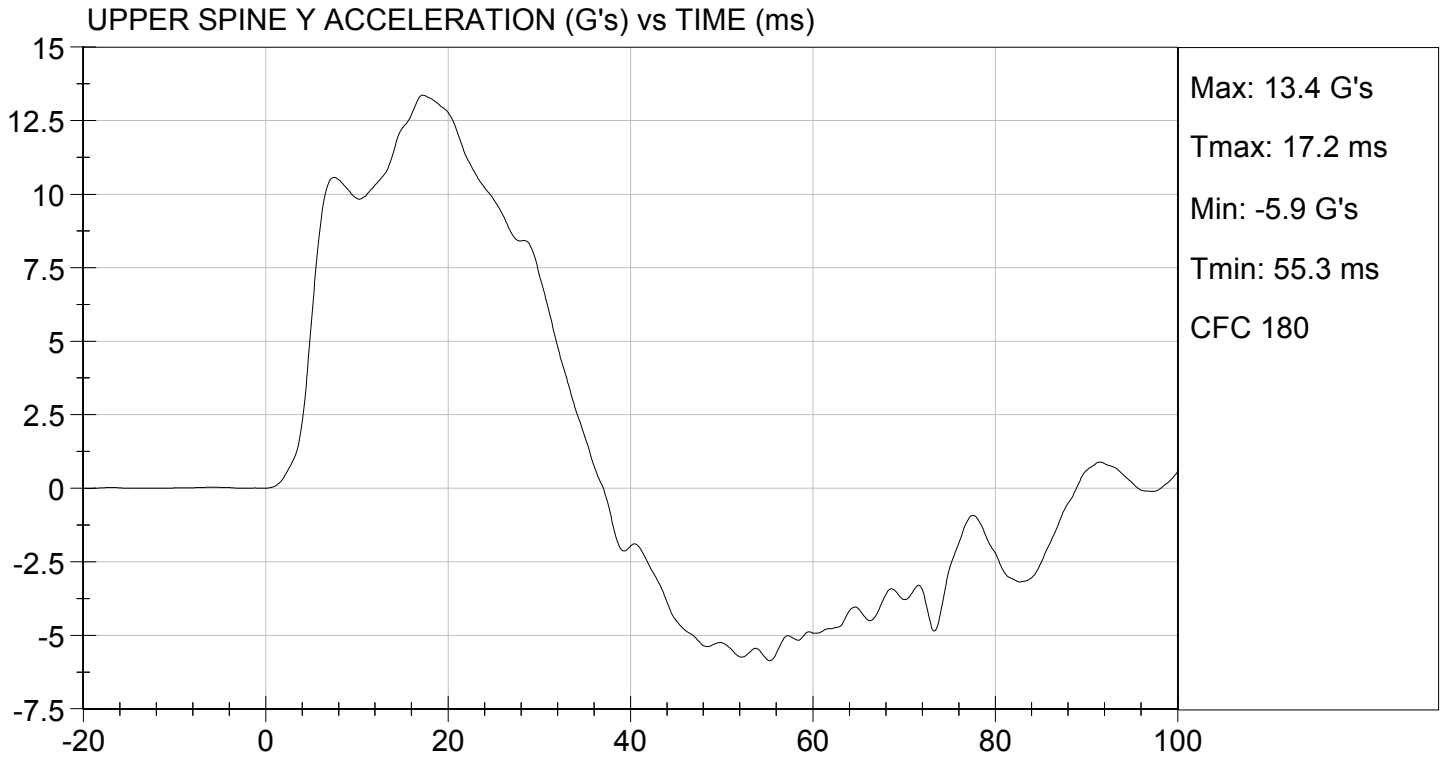
Jessica Hall  
 Laboratory Technician

10/10/2012  
 Test Date

David Winkelbauer  
 Approved By







**MGA RESEARCH CORPORATION**  
**ABDOMINAL IMPACT TEST**  
**SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

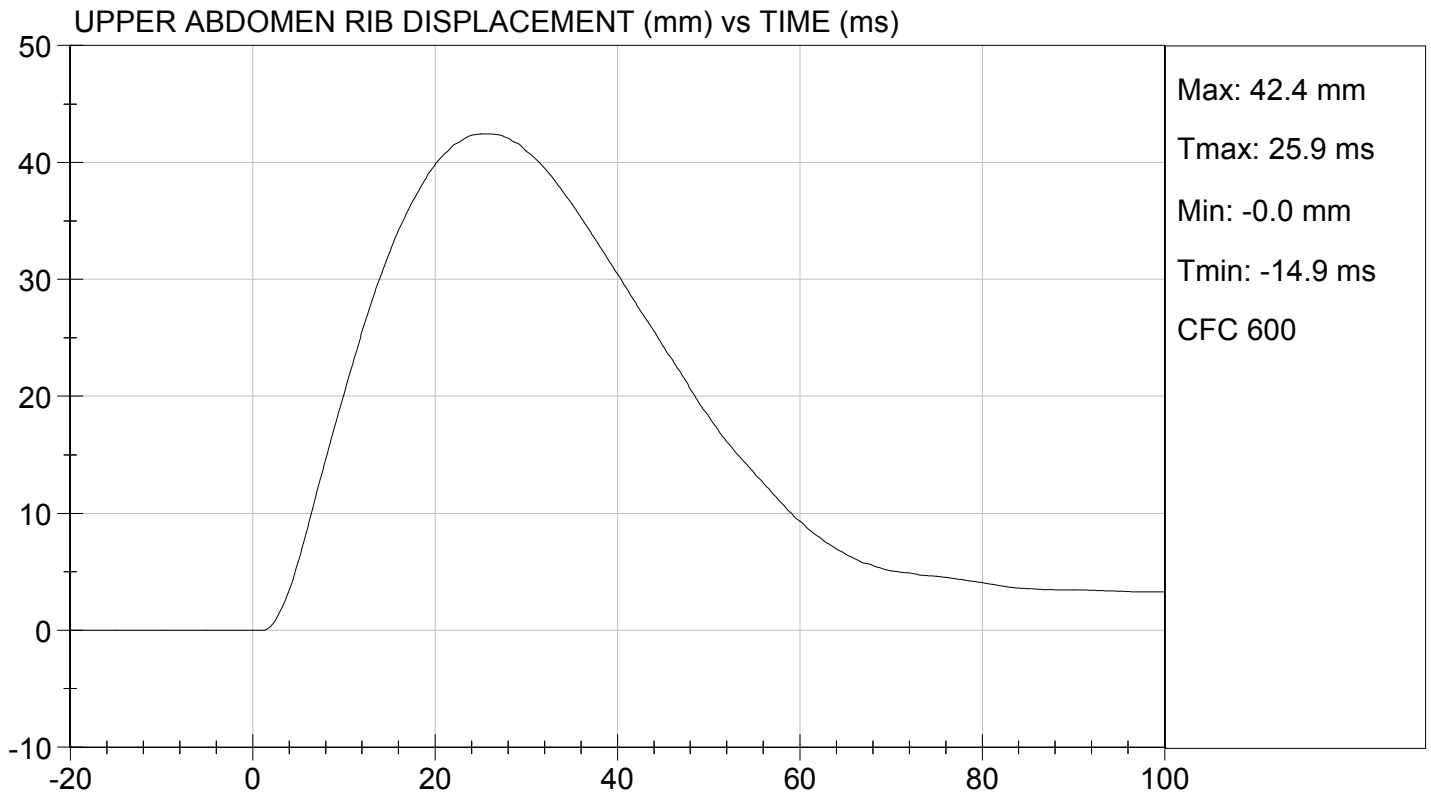
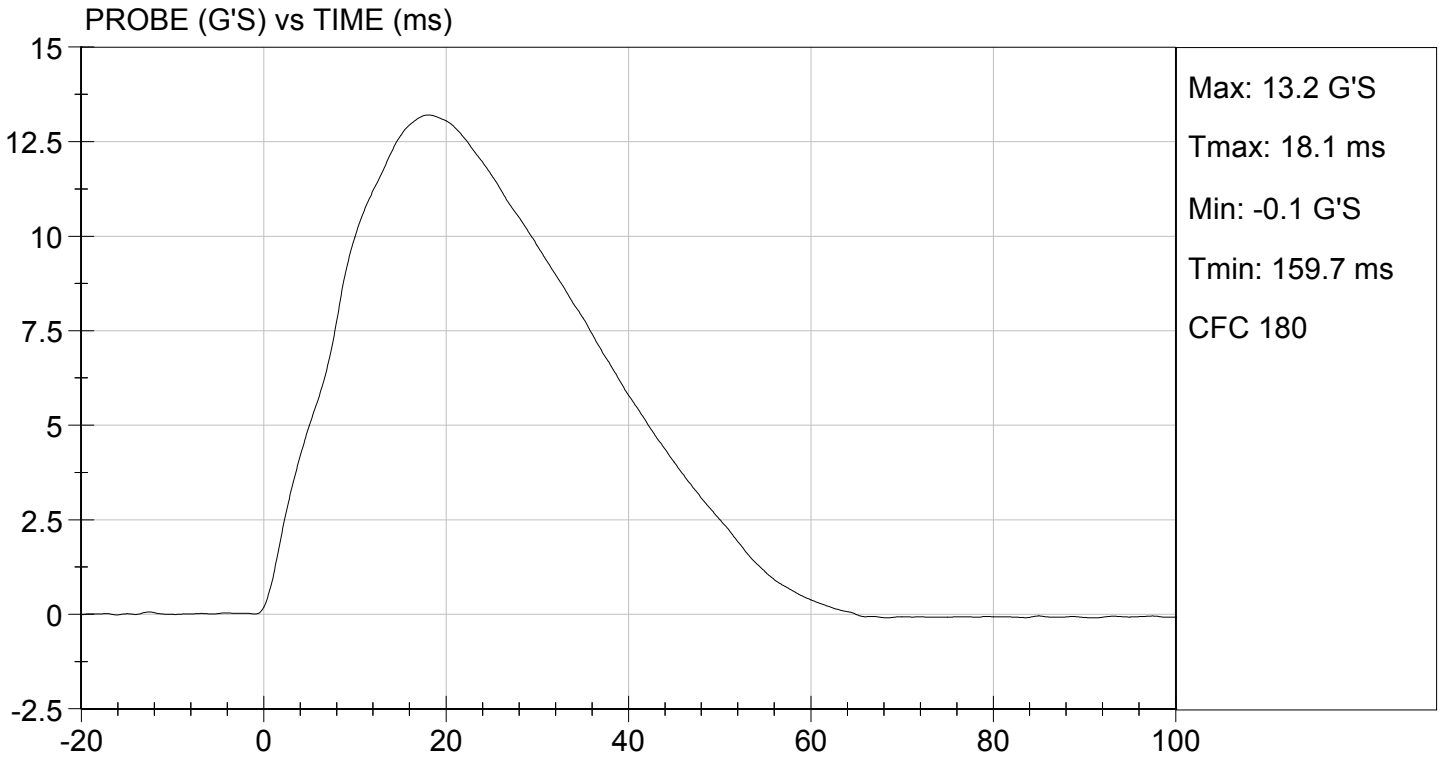
**Test I.D:** D123846

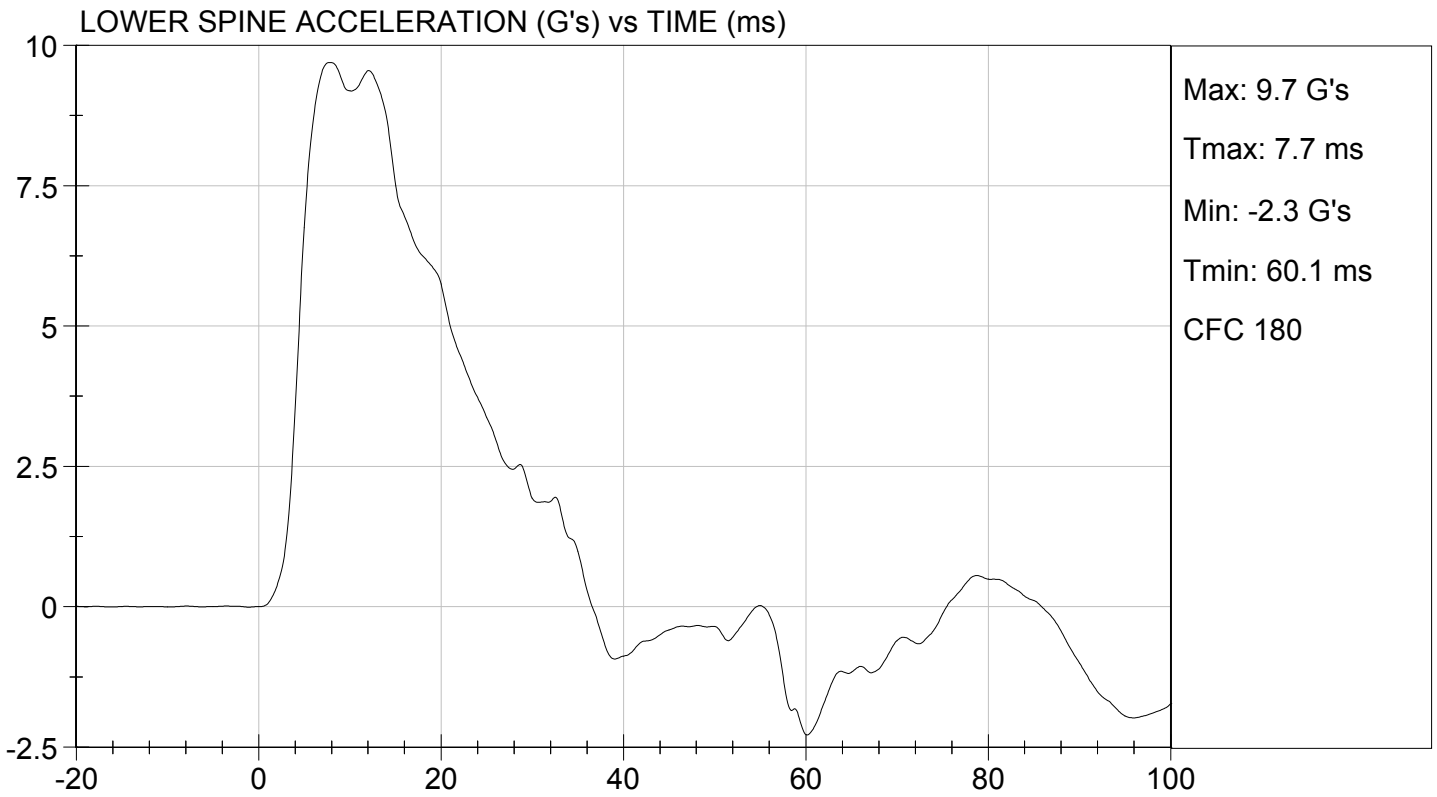
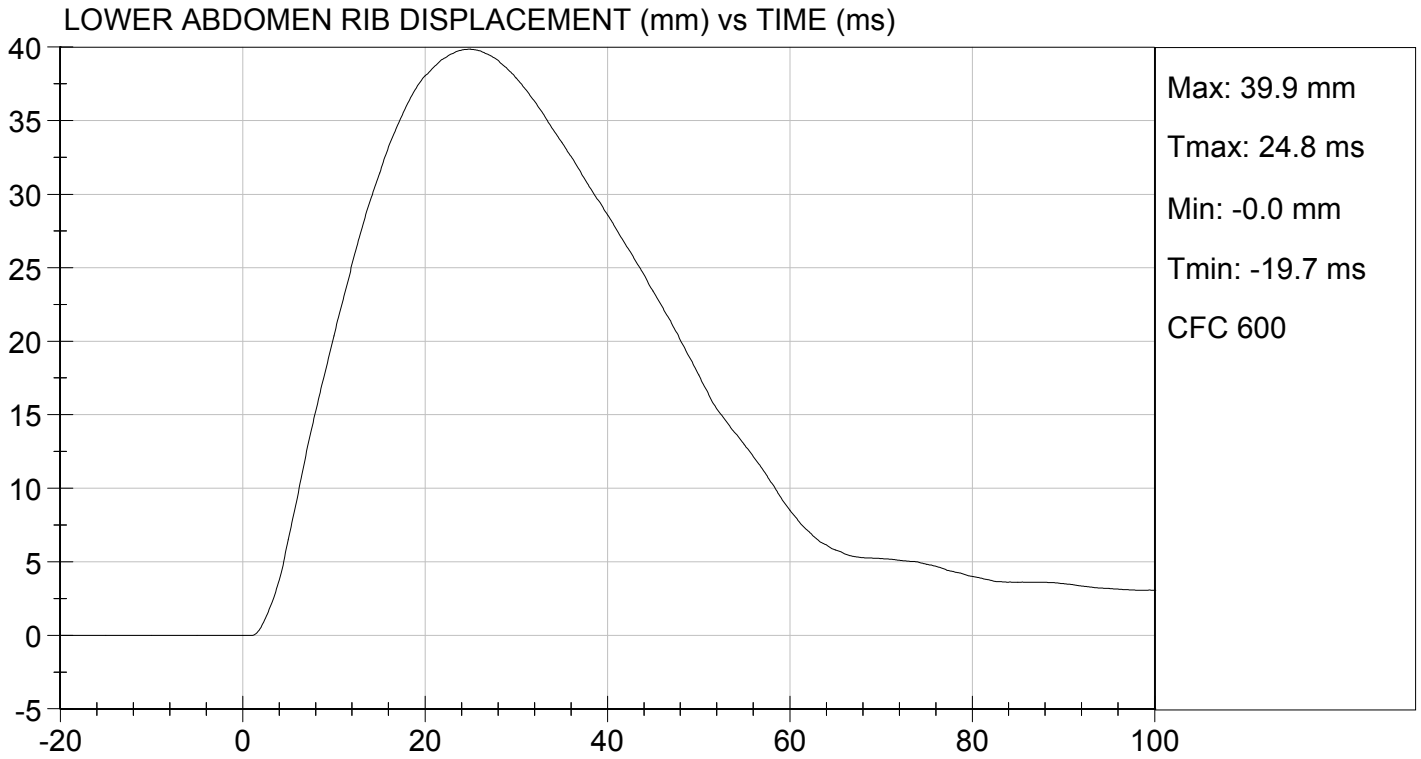
Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	12 to 16	13	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	42	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	40	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	10	Pass
Overall Test Results				Pass

Jessica Hall  
 Laboratory Technician

10/10/2012  
 Test Date

David Winkelbauer  
 Approved By





**MGA RESEARCH CORPORATION**  
**PELVIS IMPACT TEST**  
**SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

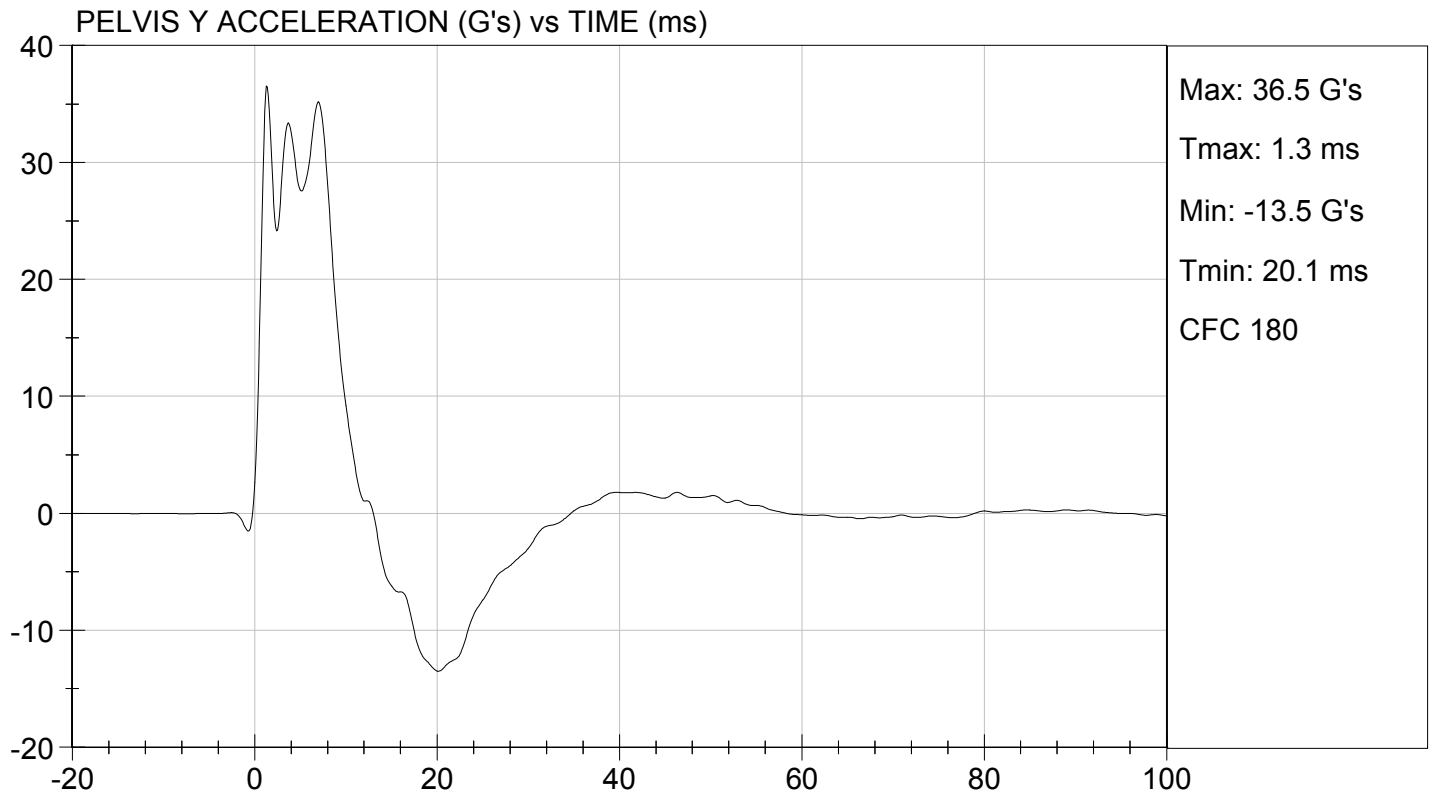
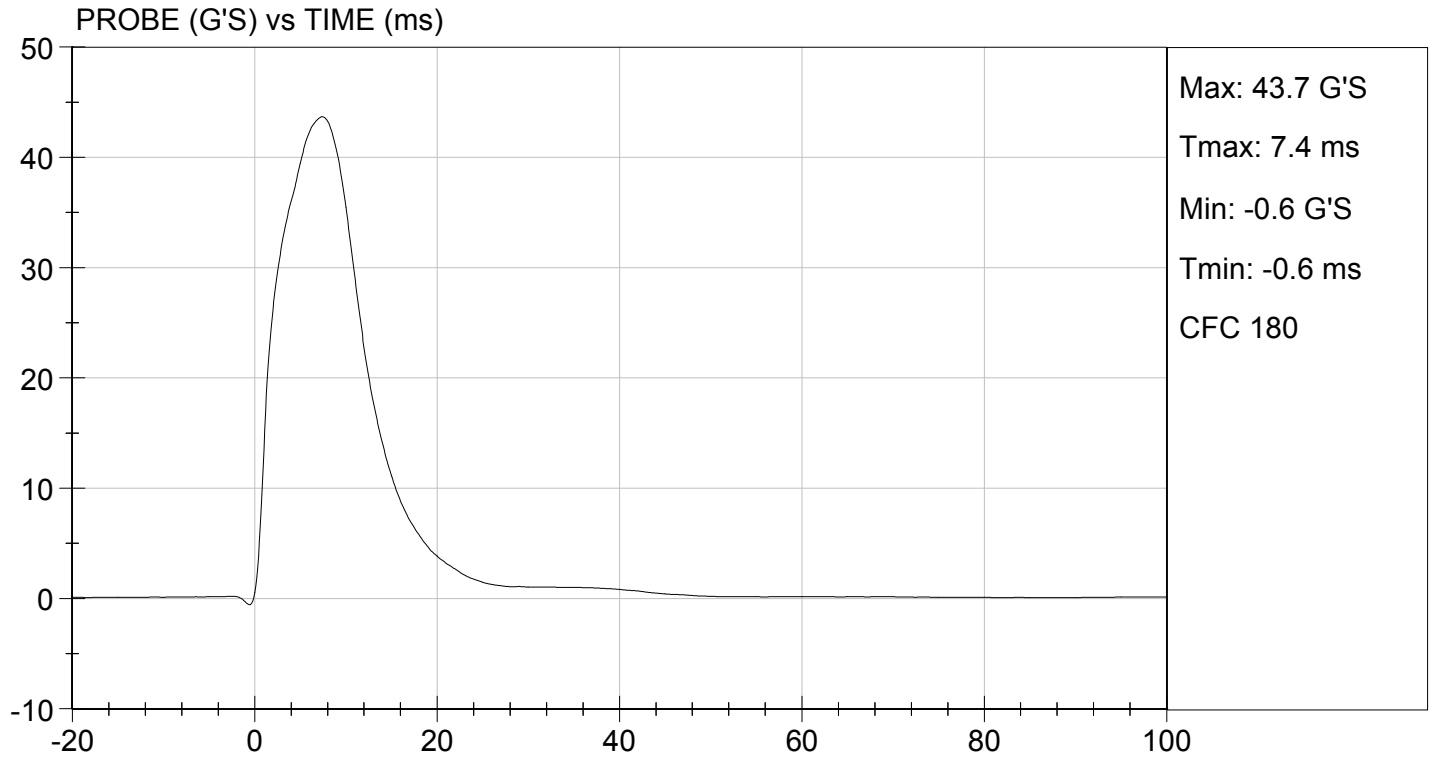
**Test I.D:** D123847

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	38 to 47	44	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	35	Pass
Peak Acetabulum Force	N	3600 to 4300	4,009	Pass
<b>Overall Test Results</b>				<b>Pass</b>

*Jessica Gall*  
 Laboratory Technician

10/10/2012  
 Test Date

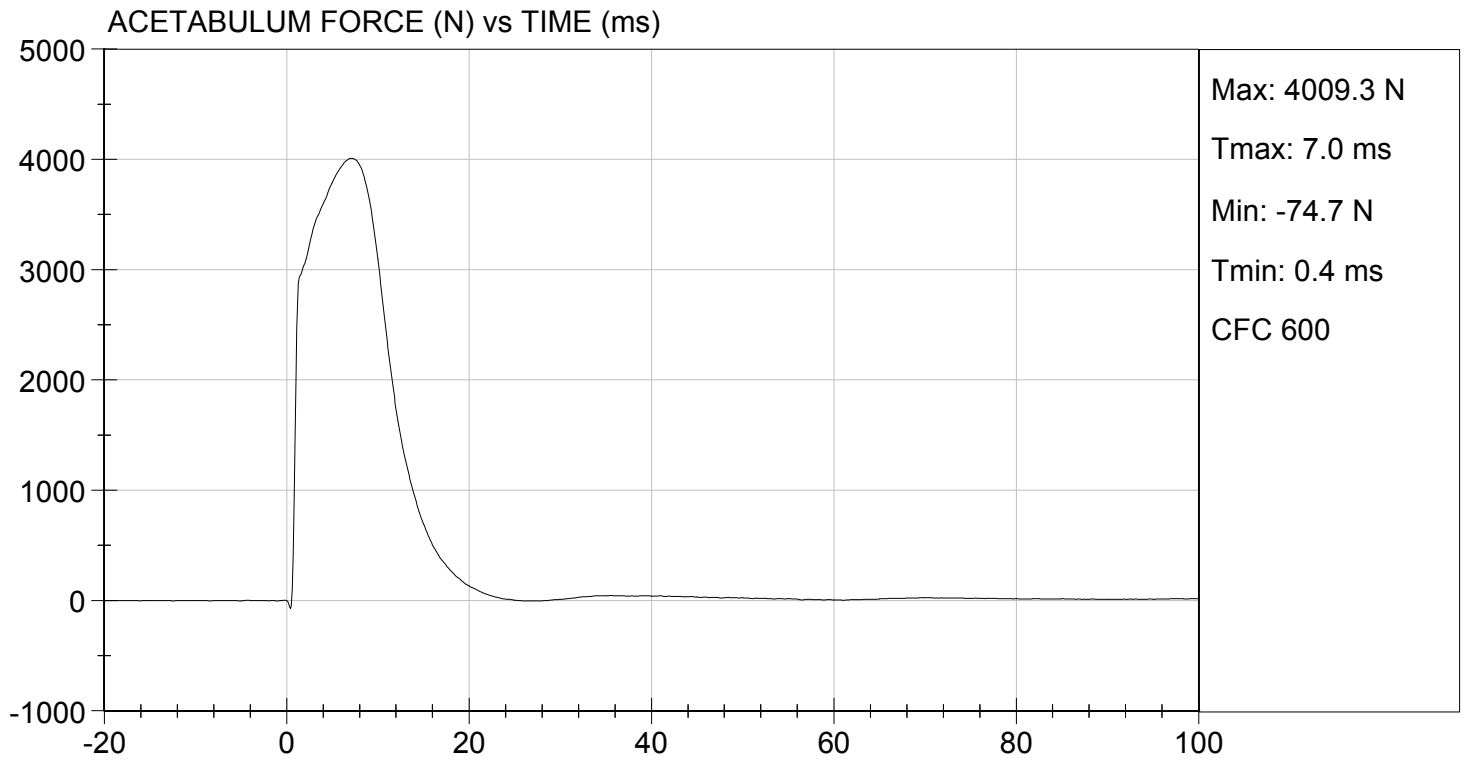
*David Winkelbauer*  
 Approved By





TEST DESC: PELVIS IMPACT  
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 10/10/2012  
TEST #: D123847



**MGA RESEARCH CORPORATION**  
**ILIAC IMPACT TEST**  
**SID-IIs BUILD LEVEL D DUMMY**

**ATD Serial No:** 296

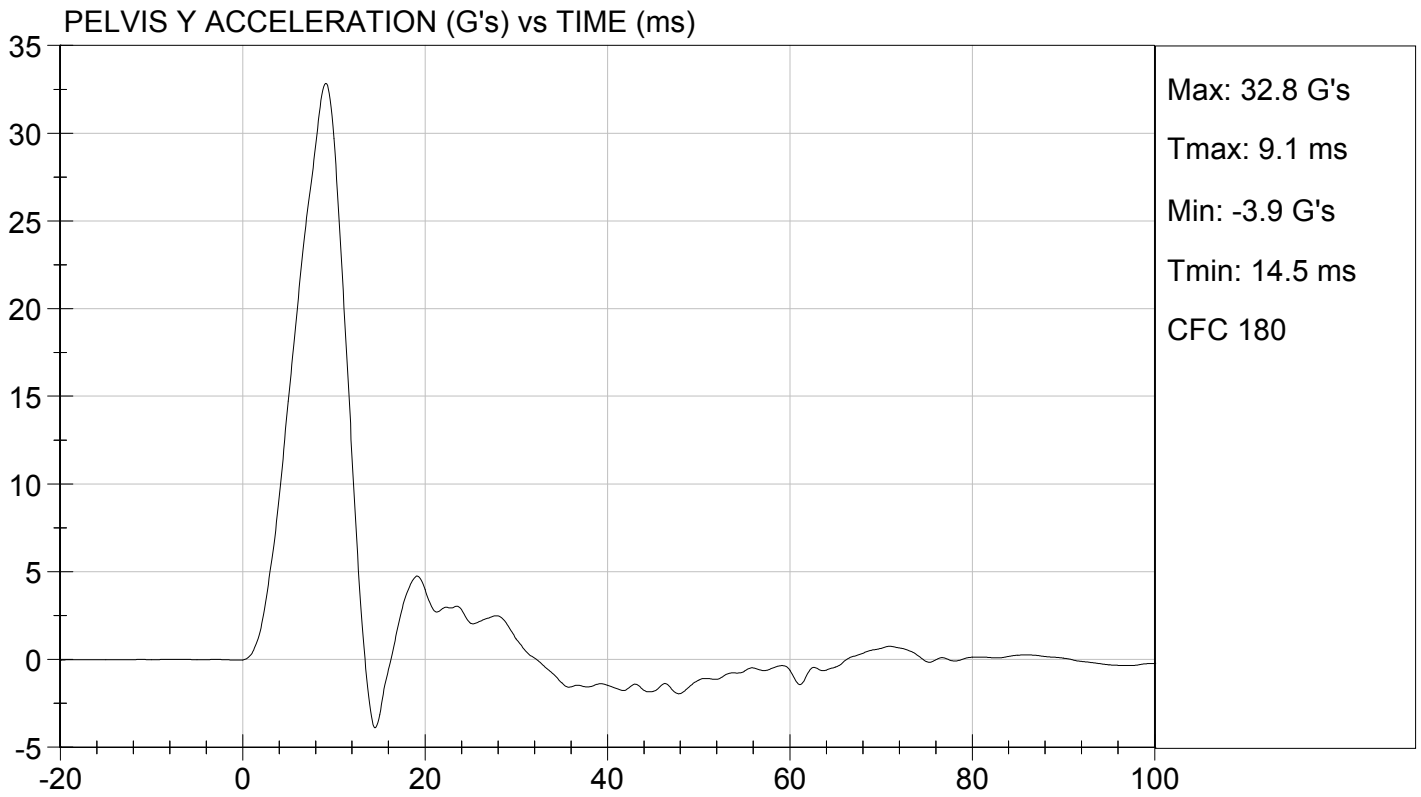
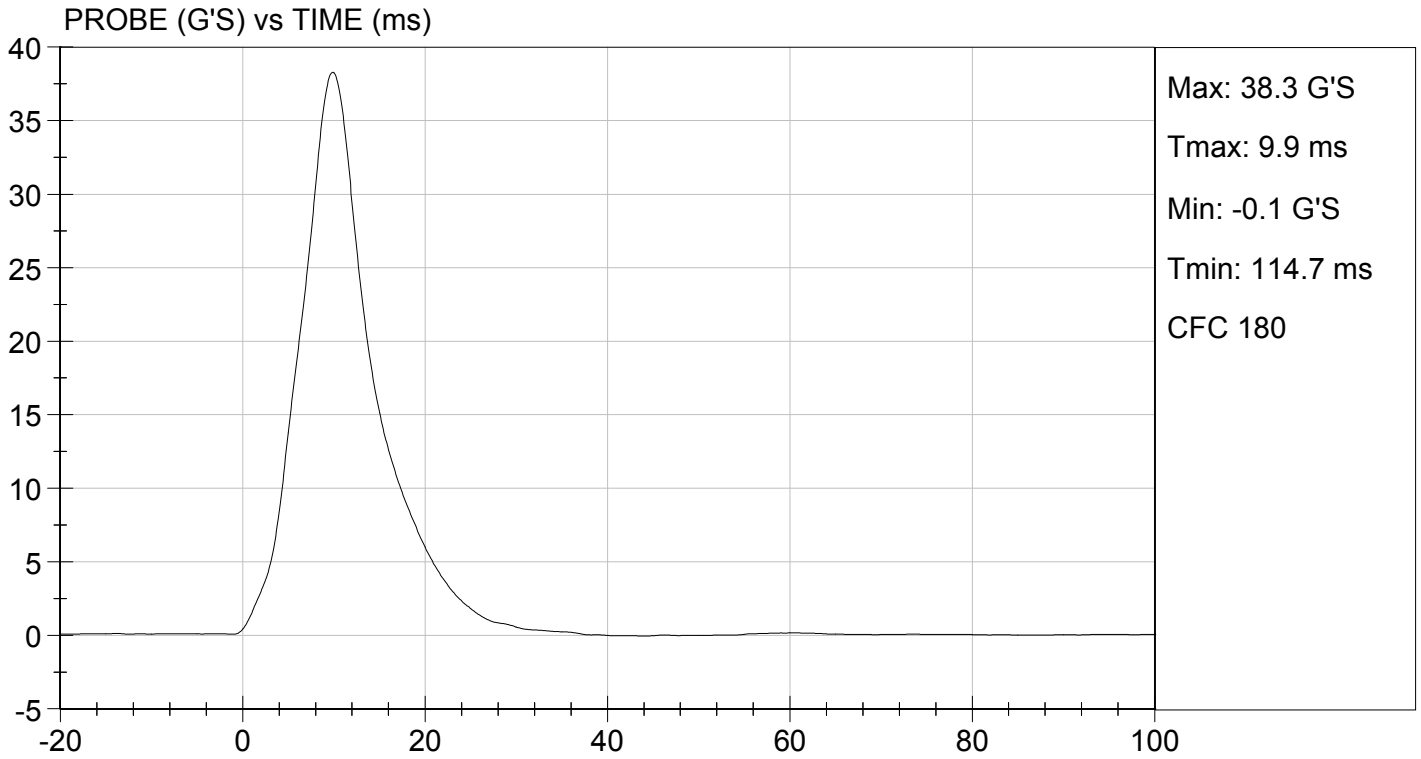
**Test I.D:** D123848

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	36 to 45	38	Pass
Pelvis Y Acceleration	G's	28 to 39	33	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,596	Pass
<b>Overall Test Results</b>				<b>Pass</b>

Jessica Hall  
 Laboratory Technician

10/10/2012  
 Test Date

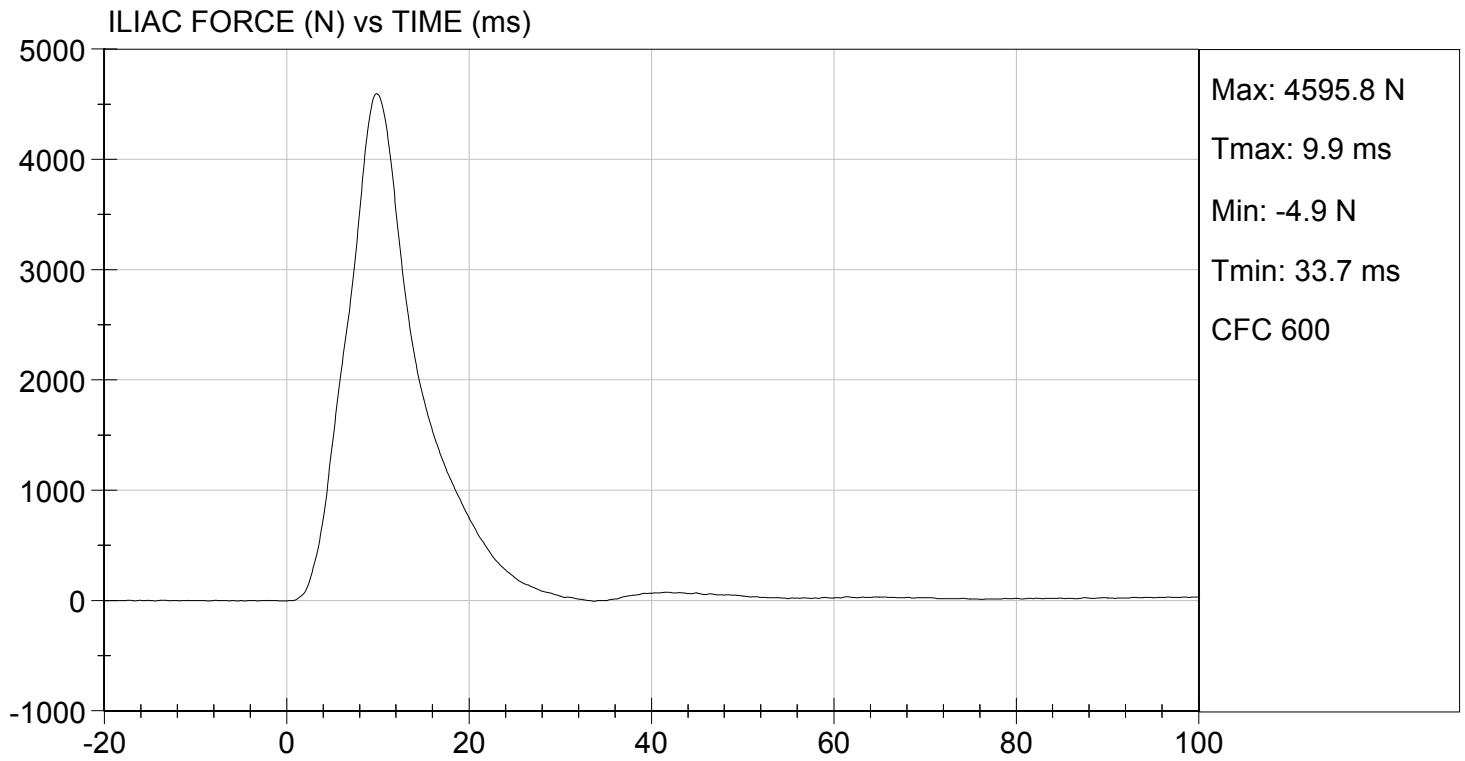
David Winkelbauer  
 Approved By



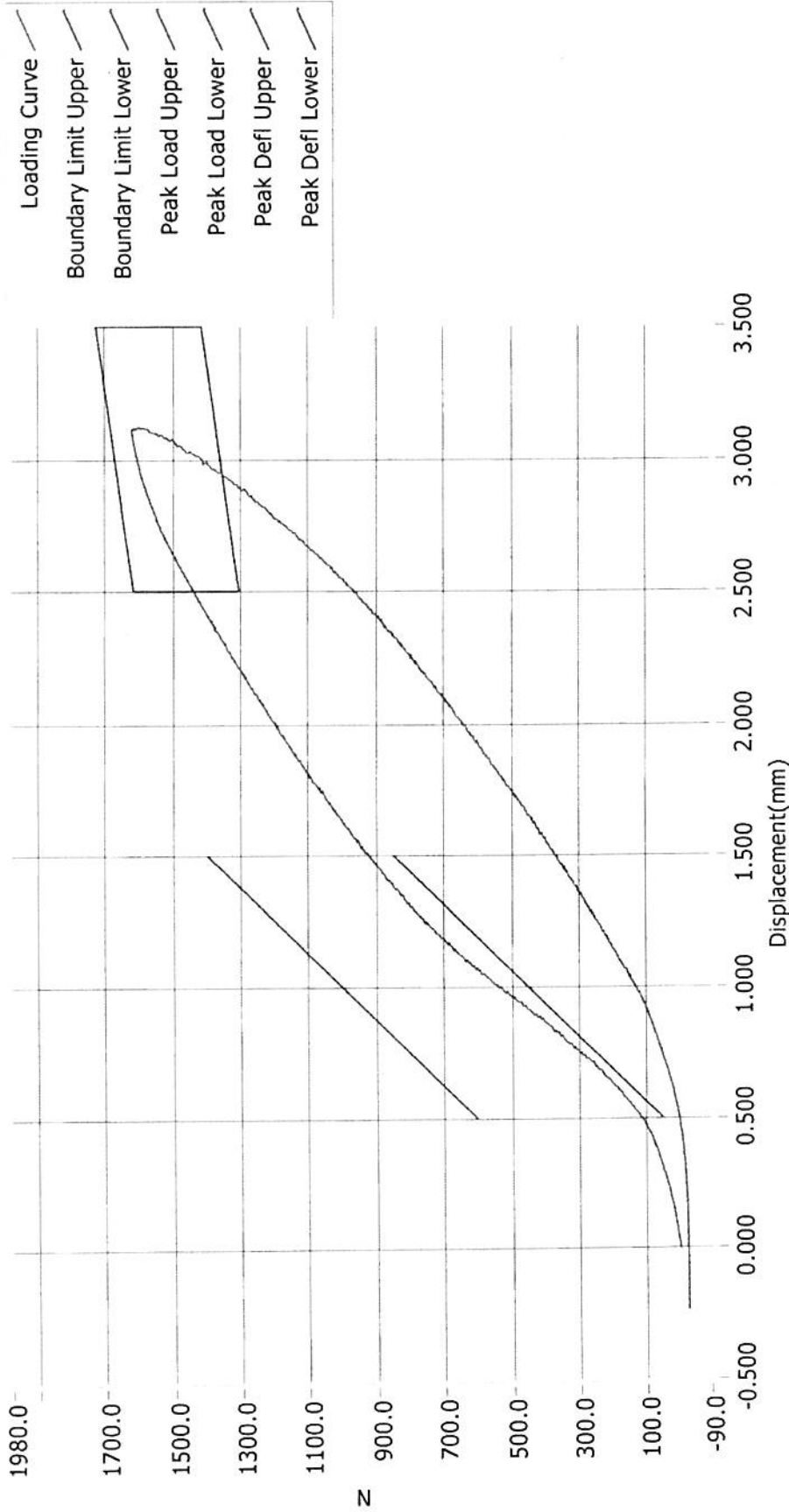


TEST DESC: ILLIAC  
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 10/10/2012  
TEST #: D123848



# Resultant Data - SIDIIs Plug Compression



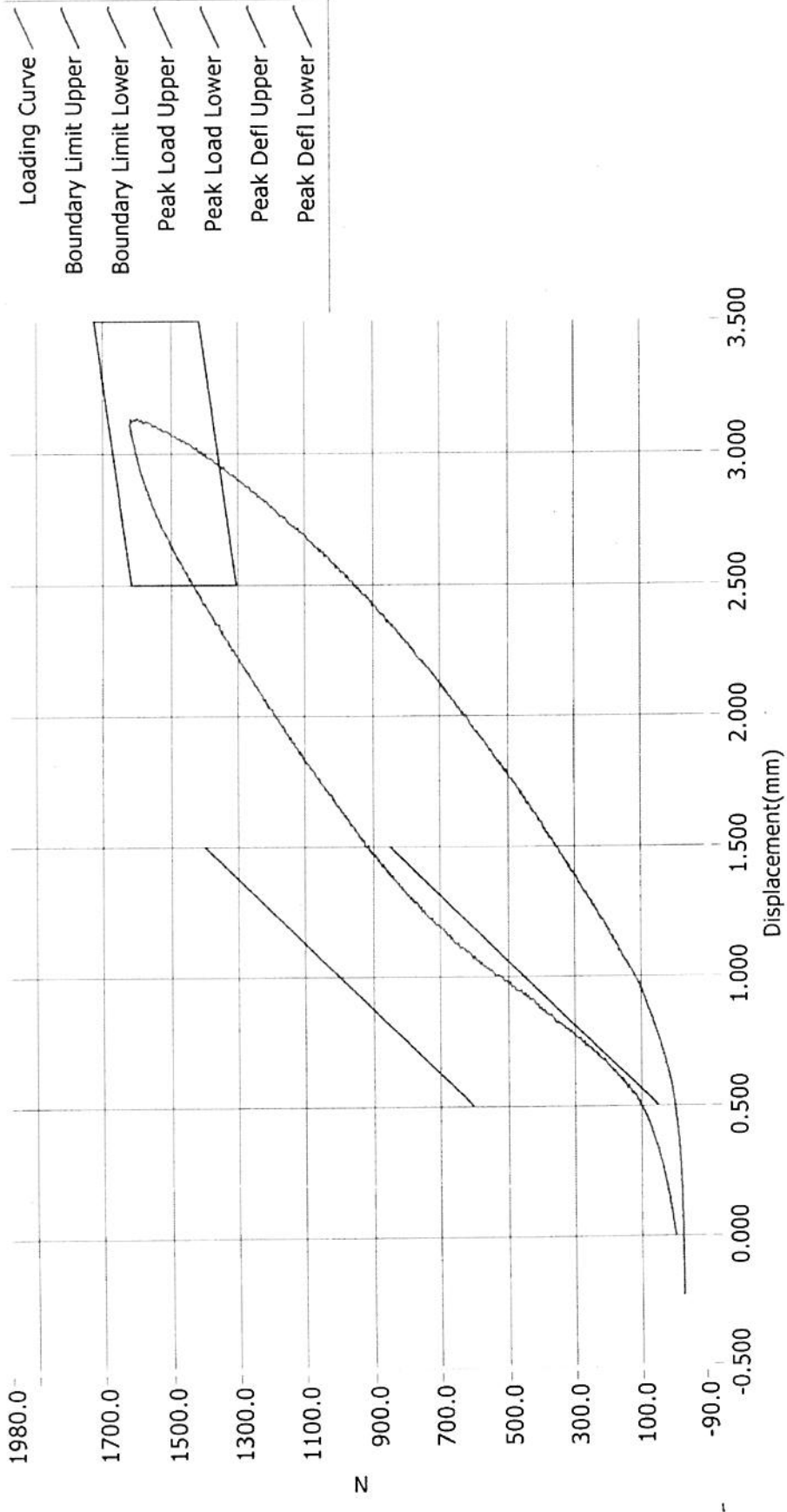
ATD Calibration Lab

<u>Test ID</u>	<u>Part Serial Number</u>	<u>Test Date</u>	<u>Test Time</u>
	49087	12/7/2011	9:28 PM
<u>Cert ID</u>	<u>ATD Serial Number</u>	<u>ATD Type</u>	
	N/A	SIDIIs	

Current Date : 12/7/2011

Current Time : 21:29:09

# Resultant Data - SIDIIs Plug Compression



ATD Calibration Lab

<u>Test ID</u>	<u>Part Serial Number</u>	<u>Test Date</u>	<u>Test Time</u>
	49161	12/8/2011	1:02 AM
<u>Cert ID</u>	<u>ATD Serial Number</u>	<u>ATD Type</u>	
	N/A	SIDIIs	

Current Date : 12/8/2011      Current Time : 01:03:31

**APPENDIX D**

**TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA**

**Table 1 – Dummy Instrumentation (ES-2re)**

			ES-2re S/N 032		
			Serial Number	Manufacturer	Calibration Date
9 Axis Head CG Accelerometers	Primary	X	P66592	Endevco	04/23/12
		Y	P66593	Endevco	04/23/12
		Z	P66594	Endevco	04/23/12
	Redundant	X	P66595	Endevco	04/23/12
		Y	P66596	Endevco	04/23/12
		Z	P66597	Endevco	04/23/12
9 Axis Head X		Y	P72788	Endevco	08/08/12
		Z	P72789	Endevco	08/08/12
9 Axis Head Y		X	P72790	Endevco	08/08/12
		Z	P73984	Endevco	08/08/12
9 Axis Head Z		X	P73986	Endevco	08/08/12
		Y	P73987	Endevco	08/08/12
Thorax Rib Displacement Potentiometers	Upper	Y	G176	Honeywell	04/25/12
	Middle	Y	G169	Honeywell	04/25/12
	Lower	Y	G164	Honeywell	04/25/12
Abdomen Load Cells	Forward	Y	ABG1532	Denton	01/03/12
	Middle	Y	ABG1534	Denton	01/03/12
	Rear	Y	ABG1535	Denton	01/03/12
Lower Spine Accelerometers (T12)		X	P73744	Endevco	04/23/12
		Y	P73747	Endevco	04/23/12
		Z	P73748	Endevco	04/23/12
Public Symphysis Load Cell		Y	PG461	Denton	01/03/12

**Table 2 – Dummy Instrumentation (SID-IIs)**

				SID-IIs S/N 296		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers		Primary	X	P66535	Endevco	04/12/12
			Y	P66536	Endevco	04/12/12
			Z	P66537	Endevco	04/12/12
		Redundant	X	P75042	Endevco	07/16/12
			Y	P77605	Endevco	07/23/12
			Z	P77606	Endevco	07/23/12
Displacement Potentiometers	Thoracic Rib	Upper	Y	G012	FTSS	04/27/12
		Middle	Y	G1163	FTSS	04/27/12
		Lower	Y	G1158	FTSS	04/27/12
	Abdominal Rib	Upper	Y	G1146	FTSS	04/27/12
		Lower	Y	G1126	FTSS	05/23/12
Lower Spine Accelerometers (T12)			X	P66668	Endevco	04/23/12
			Y	P66862	Endevco	04/23/12
			Z	P67590	Endevco	04/23/12
Acetabulum Load Cell			Y	ACG268	Denton	01/11/12
Iliac Wing Load Cell			Y	IWG282	Denton	12/23/11
Pelvis Plug (struck side)				49087	FTSS	12/07/11
Pelvis Plug (non-struck side)				49161	FTSS	12/08/11

**Table 3 – Vehicle Instrumentation**

			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	P77708	Endevco	07/31/12
	Vehicle Center of Gravity	Y	P77707	Endevco	07/31/12
	Vehicle Center of Gravity	Z	P77706	Endevco	07/31/12
2	Right Sill at Front Seat	X	P66757	Endevco	06/13/12
	Right Sill at Front Seat	Y	P66758	Endevco	06/13/12
	Right Sill at Front Seat	Z	P66756	Endevco	06/13/12
3	Right Sill at Rear Seat	X	P66529	Endevco	07/18/12
	Right Sill at Rear Seat	Y	P66528	Endevco	07/18/12
	Right Sill at Rear Seat	Z	P66527	Endevco	07/18/12
4	Left Sill at Front Door	Y	P63210	Endevco	07/12/12
5	Left Sill at Rear Door	Y	P63878	Endevco	07/12/12
6	Left A-Post Lower	Y	P66775	Endevco	07/31/12
7	Left A-Post Middle	Y	P66755	Endevco	06/14/12
8	Left B-Post Lower	Y	P67954	Endevco	07/05/12
9	Left B-Post Middle	Y	P66773	Endevco	07/31/12
10	Front Seat Track	Y	P63902	Endevco	07/05/12
11	Rear Seat Track or Structure	Y	P63518	Endevco	05/01/12
12	Right Rear Occ. Compartment	Y	P67376	Endevco	05/07/12
13	Engine Block	X	P63215	Endevco	04/10/12
	Engine Block	Y	P63216	Endevco	04/10/12
14	Rear Floorpan Above Axle	X	P77768	Endevco	07/23/12
	Rear Floorpan Above Axle	Y	P77769	Endevco	07/23/12
	Rear Floorpan Above Axle	Z	P77767	Endevco	07/23/12

**Table 4 – MDB Instrumentation**

		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	P59379	Endevco	06/12/12
MDB Center of Gravity	Y	P59380	Endevco	06/12/12
MDB Center of Gravity	Z	P59381	Endevco	06/12/12
Left Frame at Rear Axle Centerline	X	P59279	Endevco	06/12/12
Left Frame at Rear Axle Centerline	Y	P59280	Endevco	06/12/12