

REPORT NUMBER: SPNCAP-MGA-2012-001

**NEW CAR ASSESSMENT PROGRAM (NCAP)
Side Impact Pole Test**

**KIA MOTORS MANUFACTURING GEORGIA, INC.
2012 Kia Sorento LX SUV
NHTSA No.: KC0502**

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



Test Date: August 8, 2011

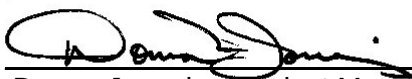
Final Report Date: August 29, 2011

FINAL REPORT

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

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-09-D-00124.

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Approved by: 
Ben Fischer, Project Engineer

Approval Date: August 29, 2011

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

Technical Report Documentation Page

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4. Title and Subtitle Final Report of New Car Assessment Program Side Impact Pole Testing of a 2012 Kia Sorento LX SUV NHTSA No.: KC0502		5. Report Date August 29, 2011																				
		6. Performing Organization Code MGA																				
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9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		10. Work Unit No.																				
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15. Supplementary Notes																						
16. Abstract A 32.2 km/h (20 mph), 75° oblique impact NCAP Side Pole Test was conducted on the subject 2012 Kia Sorento LX SUV in accordance with the specifications of the Office of Crashworthiness Standards NCAP Side Pole Laboratory Test Procedure for the generation of consumer information on vehicle side pole crash protection. The test was conducted at MGA Research Corporation, in Burlington, Wisconsin, on August 8, 2011. The impact velocity was 32.0 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21°C. The test vehicle post-test maximum crush was 414 mm at level 3. The test vehicle's performance was as follows: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2" style="text-align: left;">Measurement Description</th> <th colspan="3">Driver ATD (SID-IIs)</th> </tr> <tr> <th>Units</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">Head Injury Criteria (HIC₃₆)</td> <td>N/A</td> <td>1000</td> <td>187</td> </tr> <tr> <td style="text-align: left;">Resultant Lower Spine Acceleration</td> <td>Gs</td> <td>82</td> <td>42</td> </tr> <tr> <td style="text-align: left;">Combined Acetabular and Iliac Pelvic Force</td> <td>N</td> <td>5525</td> <td>3875</td> </tr> </tbody> </table> 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.				Measurement Description	Driver ATD (SID-IIs)			Units	Threshold	Result	Head Injury Criteria (HIC ₃₆)	N/A	1000	187	Resultant Lower Spine Acceleration	Gs	82	42	Combined Acetabular and Iliac Pelvic Force	N	5525	3875
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17. Key Words New Car Assessment Program (NCAP) Side Impact Pole Part 572V SID-IIs		18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Adm. Technical Reference Division 1200 New Jersey Ave, SE Washington, D.C. 20590																				
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 126	22. Price																			

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SECTION 1
TEST PURPOSE AND PROCEDURE

This side impact test is part of the MY 2012 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-09-D-00124. The purpose of this test is to generate comparative side impact performance in a 2012 Kia Sorento LX SUV. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Pole Laboratory Test Procedure, dated January 2010.

SECTION 2

SUMMARY OF TEST RESULTS

A rigid pole side impact test was conducted on a 2012 Kia Sorento LX SUV. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 32.0 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin, on August 8, 2011. Pre-test and post-test photographs of the test vehicle and side impact dummy (SID-IIs) are included in Appendix A of this report.

One Part 572V (SID-IIs) dummy was placed in the driver designated seating position according to instructions specified in the OCWS NCAP Side Pole Laboratory Test Procedure dated January 2010. Camera locations and other pertinent camera information are included in this report.

The Part 572V (SID-IIs) dummy was instrumented accordingly:

Head CG Triaxial Accelerometers
 Thorax Upper, Middle, and Lower Rib Displacement Potentiometers
 Abdomen Upper and Lower Rib Displacement Potentiometers
 Lower Spine Triaxial Accelerometers
 Iliac Load Cell
 Acetabulum Load Cell

Appendix B contains the vehicle and dummy response data. Dummy configuration and performance verification data can be found in Appendix C of this report.

The following table summarizes the results of the test:

DUMMY INJURY VALUES				
Dummy	HIC (36ms)	Resultant Lower Spine Acceleration	Pelvic Force (N)	
SID-IIs 5 th Percentile Female	187	42	Iliac Wing	991
			Acetabular	2944
			Sum	3875

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Left Rear (Passenger) P4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No	No	
Knee Airbag	No		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	

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

GENERAL COMMENTS

There was no valid data collected for:

Driver Seat Track Y at 20 msec.

Left Mid A-Post Y – Noise spike between 39-48 msec.

Camera No. 11 - Real Time View of Dummy Movement real-time video was not used.

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

SECTION 3
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2012 Kia Sorento LX SUV
Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
Test Date: 8/08/2011

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	KC0502	Anti-Lock Brakes	Yes
Model Year	2012	All Wheel Drive	No
Make	Kia	Power Steering	Yes
Model	Sorento	Driver Front Airbag	Yes
Body Style	MPV	Driver Curtain Airbag	Yes
VIN	5XYKT3A17CG204379	Driver Head/Torso Airbag	No
Body Color	White Sand	Driver Torso Airbag	No
Delivery Date	7/21/2011	Driver Torso/Pelvis Airbag	Yes
Odometer (mi)	58	Driver Pelvis Airbag	No
Odometer (km)	93	Driver Knee Airbag	No
Dealer	Palmen Kia	Rear Pass. Front Airbag	No
Transmission	Automatic	Rear Pass. Curtain Airbag	Yes
Final Drive	Front	Rear Pass. Head/Torso Airbag	No
Type/No. Cylinders	4	Rear Pass. Torso Airbag	No
Engine Displacement (L)	2.4	Rear Pass. Torso/Pelvis Airbag	No
Engine Placement	Lateral	Rear Pass. Pelvis Airbag	No
Roof Rack	No	Rear Pass. Knee Airbag	No
Sunroof/T-Top	No	Pretensioners	Yes
Tinted Glass	Yes	Load Limiters	Yes
Traction Control	Yes	Automatic Door Locks	Yes
Power Brakes	Yes	Bucket Seats	Yes
Front Disc	Yes	Tilt Steering	Yes
Rear Disc	Yes	Power Seats	No
Does owner's manual provide instruction to turn off automatic door locks?			No

DATA FROM CERTIFICATION LABEL

Manufactured By	Kia Motors Manufacturing Georgia, Inc.	GVWR (kg)	2190
Date of Manufacture	MAY/31/11	GAWR Front (kg)	1350
		GAWR Rear (kg)	1450

VEHICLE SEATING AND WEIGHT CAPACITY DATA

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

VEHICLE SEAT TYPE

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

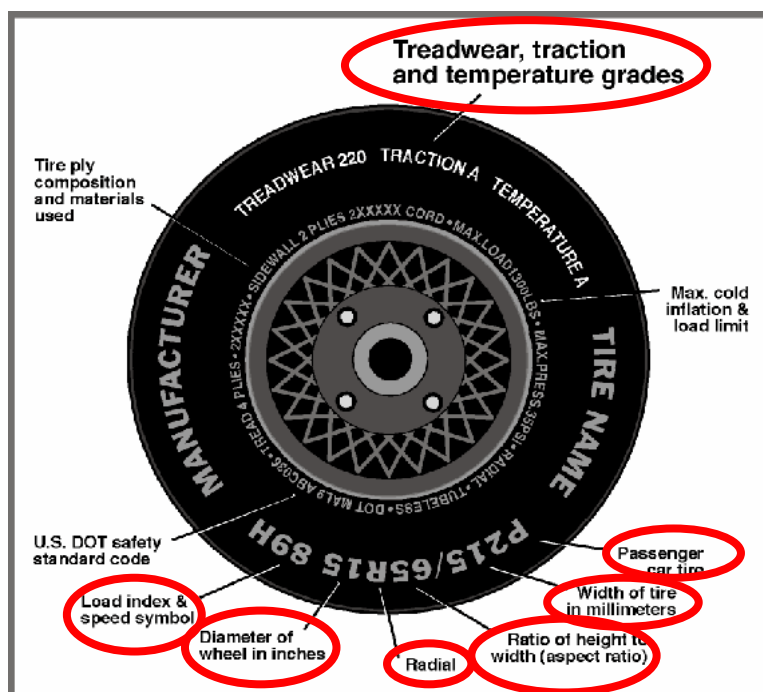
DATA SHEET NO. 1 (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Maximum 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	Kumho	Kumho
Tire Model	Solus	Solus
Treadwear	500	500
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2	2
Tire Plies Body	5	5
Load Index & Speed Symbol	103T	103T
Tire Material	Rubber	Rubber
DOT Safety Code Right	H2B9 YPL9	H2B9 YPL9
DOT Safety Code Left	H2B9 YPL9	H2B9 YPL9

DATA SHEET NO. 1 (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	488.5	352.9		498.5	409.6		511.6	412.8	
Right	kg	475.9	348.8		481.3	402.8		477.2	394.2	
Ratio	%	57.9	42.1		54.7	45.3		55.1	44.9	
Totals	kg	964.4	701.7	1666.1	979.8	812.4	1792.2	988.8	807.0	1795.8

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1666.1	(A)
Actual Weight of 1 P572V ATD (SID-IIs) ATD Used	kg	52.2	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	80	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	1798.3	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

	Units	As Delivered	As Tested	Fully Loaded
Driver Door Sill Angle (front-to-rear)*	deg	0.0	0.2	0.3
Front Passenger Sill Angle (front-to-rear)*	deg	-0.2	-0.1	0.2
Front Bumper Angle (left-to-right)**	deg	-0.5	-0.7	-0.7
Rear Bumper Angle (left-to-right)**	deg	-0.7	-0.7	-0.9
Vehicle CG (Aft of Front Axle)	mm	1141	1228	1218
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	8	11	24

*Front up is positive ** Left up is positive

GENERAL VEHICLE TEST DATA

Measurement Description	Units	Value
Weight of Ballast in Cargo Area	kg	36.7
Weight of Vehicle Components Removed	kg	23.6

Vehicle components removed to meet target vehicle test weight: Tail light, right side mirror, trunk carpet, and right side door panel.

TEST VEHICLE IMPACT POINT DATA

Measurement Parameter	Units	Value
Vertical Impact Reference Line (Aft of Front Axle)	mm	1071
Actual Impact Point (Aft of Front Axle)	mm	1062
Impact Point Difference (- forward / + rearward)	mm	-9

DATA SHEET NO. 2

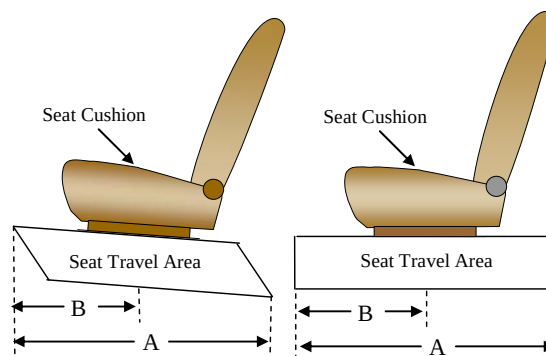
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011

SEAT FORE/AFT POSITIONS

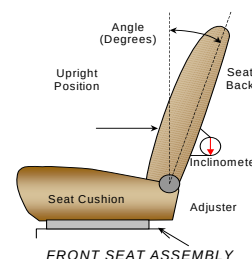
The driver seat was a manual adjustable seat with manual height adjustment. The seat travel was set as specified in Appendix B of the TP dated January 2010. The right front passenger seat was set to match the driver seat. The rear passenger seats were fixed.



SEAT FORE/AFT POSITIONING	Total Fore/Aft Travel	Placed in Detent # or Position
Driver Seat	24 detents	0 (forward-most as 0)
Front Passenger Seat	22 detents	0 (forward-most as 0)
Rear Seat – Struck Side		Fixed
Rear Seat – Non-Struck Side		Fixed

SEAT BACK ANGLE POSITION

The seat back was set as specified in Appendix B of the TP dated January 2010. For the front seats, the seat back angle measurement was made relative to the door sill on the headrest post. For the rear seats, the seat back angle measurement was made relative to the driver door sill on the seat back release lever.



SEAT BACK ANGLE	Degrees	Detents
Driver Seat Back Angle with Seated Dummy	-10.4	5 th detent (1 st as 0)
Front Passenger Seat Back Angle	-11.1	5 th detent (1 st as 0)
Struck Side Rear Seat Back Angle	-2.2	3 rd detent (1 st as 0)
Non-Struck Side Rear Passenger Seat Back Angle	-1.7	3 rd detent (1 st as 0)

SEAT BELT UPPER ANCHORAGE

The driver seat belt upper anchorage was set at the manufacturer's specified placement in Form 1.

SEAT BELT UPPER ANCHORAGES	Total # of Positions	Placed in Position #
Driver Seat	3 detents (1 st as 0)	2 (uppermost as 0)

DATA SHEET NO. 2 (CONTINUED)

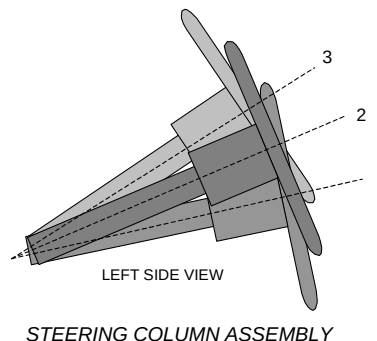
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011

STEERING COLUMN ADJUSTMENT

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

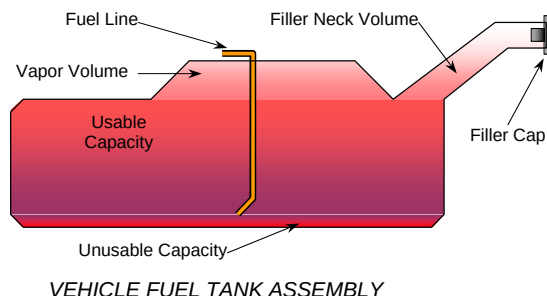


STEERING COLUMN POSITIONING

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	65.9	140
Geometric Center – Position 2	63.7	120
Uppermost – Position 3	61.4	100
Telescoping Steering Wheel Travel		40
Test Position	63.7	120

FUEL PUMP

Describe the fuel pump type, its behavior, and the location of the fuel filler pipe. The vehicle is equipped with an electric fuel pump. Key is “ON” position. The fuel pipe is on the left side.



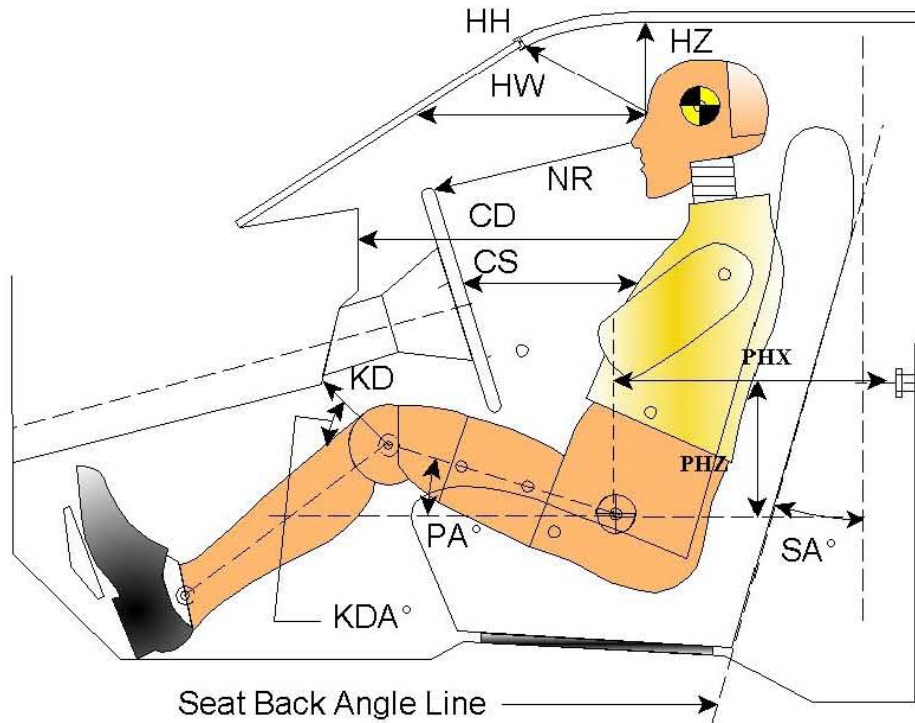
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of “Standard” Tank	68.0
Usable Capacity of “Optional” Tank	
Usable Capacity of Standard Tank as Specified in Owner’s Manual	68.0
Usable Capacity of Optional Tank as Specified in Owner’s Manual	
92-94% of Usable Capacity	62.6 to 63.9
Actual Amount of Solvent Used	63.2
1/3 of Usable Capacity	22.7

.DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011

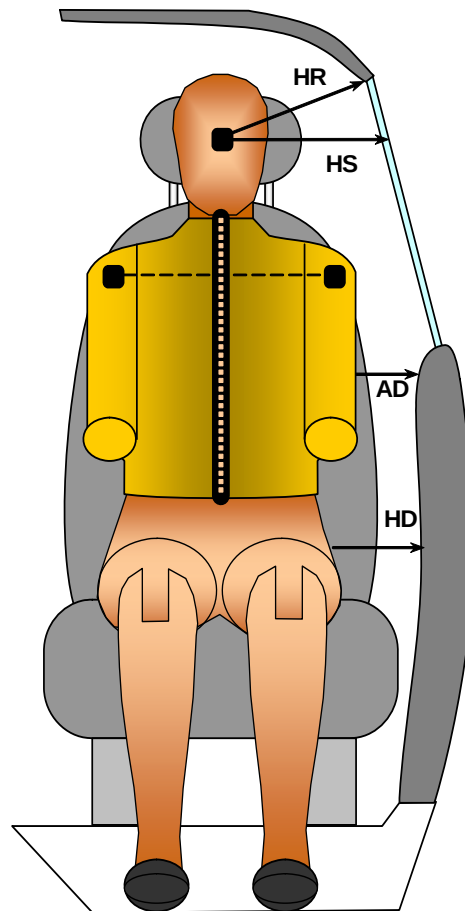


Code	Measurement Description	Driver S/N 296	
		Length (mm)	Angle (°)
HH	Head to Header	236	
HW	Head to Windshield	534	
HZ	Head to Roof	174	
NR	Nose to Rim	210	
CD	Chest to Dash	391	
CS	Chest to Steering Wheel	148	
KDL/KDAL	Left Knee to Dash	84	34.8
KDR/KDAR	Right Knee to Dash	79	31.5
PA	Pelvic Angle		18.7
PHX	H-Point to Striker (X-Axis)	365	
PHZ	H-Point to Striker (Z-Axis)	181	
SA	Seat Back Angle		-10.4

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011



FRONT VIEW OF DUMMY

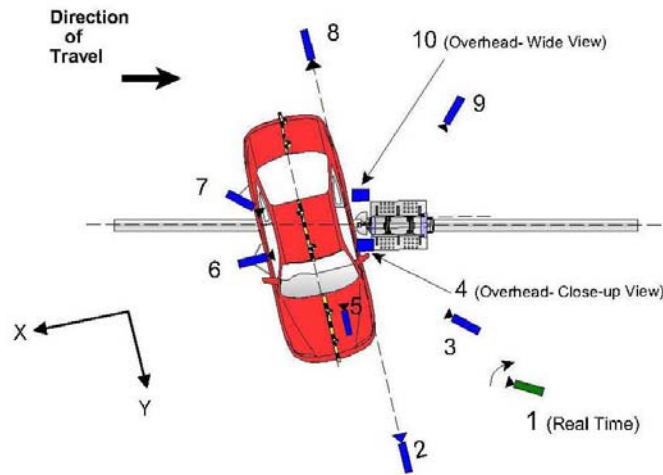
Code	Measurement Description	Driver S/N 296
		Length (mm)
HR	Head to Side Header	244
HS	Head to Side Window	363
AD	Arm to Door	186
HD	H-Point to Door	214

DATA SHEET NO. 5

CAMERA LOCATIONS AND DATA

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011



Reference: (from Point of Impact for X and Y; from Ground for Z):
 +X = Forward of Impact, + Y = Right of Impact, +Z = Down

Camera No.	View	Coordinates (mm)			Lens (mm)	Film Speed (fps)
		X*	Y*	Z*		
1	Real-Time Pan View					30
2	Front Ground Level	50	5320	-1670	24	1000
3	Impact Side 45° Forward	-2530	3780	-1740	20	1000
4	Overhead Closeup	70	0	-4520	50	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	60	-5460	-1690	24	1000
9	Impact Side 45° Rearward	-3430	-3270	-1760	20	1000
10	Overhead Wide View	540	0	-4610	14	1000
11	Real-Time Dummy Front View					30

* All measurements accurate to ± 6 mm

Note: Vehicle was at a 15° angle to the rigid pole.

INSTRUMENTATION

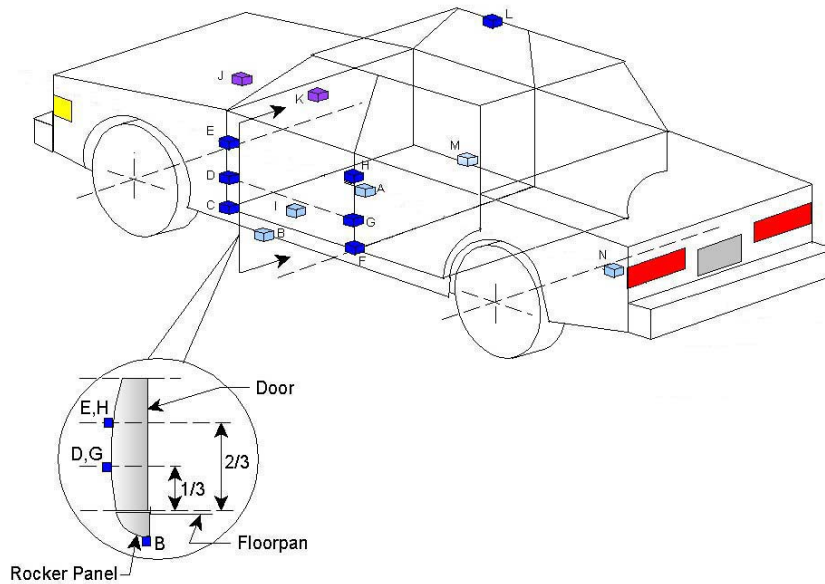
	Number of Channels
Driver Dummy	16
Vehicle Structure	21
Pole Load Cells – Not used	8
Contact Switches – Not installed	3
Airbag Timing – Not installed	2
Total No. of Data Channels	50

DATA SHEET NO. 6

VEHICLE ACCELEROMETER DATA

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011



	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
A	Vehicle CG	2500	-60	-500
	Vehicle CG Sensor	2500	50	-500
B	Left Floor Sill	2970	-730	-295
C	A Pillar Sill	3214	-730	-290
D	A Pillar Low	3140	-742	-634
E	A Pillar Mid	3180	-855	-906
F	B Pillar Sill	2195	-730	-295
G	B Pillar Low	2090	-755	-707
H	B Pillar Mid	2140	-742	-996
I	Driver Seat	2275	-580	-522
L	Engine Top	3945	0	-880
J	Firewall	3651	0	-1061
K	Right Roof	2217	603	-1685
M	Right Floor Sill	2217	730	-300
N	Rear Floorpan	640	0	-570

Reference: From Point of Impact for X and Y; from Ground for Z):
 +X = Forward of Vehicle, + Y = Right of Vehicle, +Z = Down

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA

Test Vehicle: 2012 Kia Sorento LX SUV
Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
Test Date: 8/08/2011



254 mm Diameter Rigid Pole

The pole was not instrumented.

Load Cell Locations	
ID	Height From Ground (m)
1	
2	
3	
4	
5	
6	
7	
8	

DATA SHEET NO. 8**POST-TEST OBSERVATIONS**

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011

TEST DUMMY INFORMATION AND CONTACT

Description	Driver
Dummy Type / Serial No.	SID-IIs / 296
Head Contact	Curtain Airbag, Headrest
Upper Torso Contact	Side Airbag
Lower Torso Contact	Side Airbag
Left Knee Contact	Door Panel
Right Knee Contact	Left Knee

POST TEST DOOR OPENING AND SEAT TRACK INFORMATION

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

POST-TEST STRUCTURAL OBSERVATIONS

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

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

VEHICLE SPEED AND IMPACT DATA

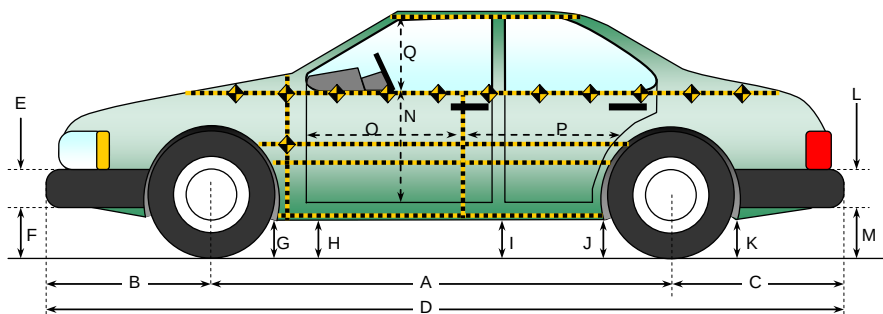
Measured Parameter	Units	Requirement	Value
Horizontal Offset from Vertical Impact Reference Line	mm	+/- 38	9
Trap No. 1 Velocity (Primary)	km/h	31.4 to 33.0	32.0
Trap No. 2 Velocity (Redundant)	km/h	31.4 to 33.0	32.1

DATA SHEET NO. 9

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011



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

LEFT SIDE VIEW

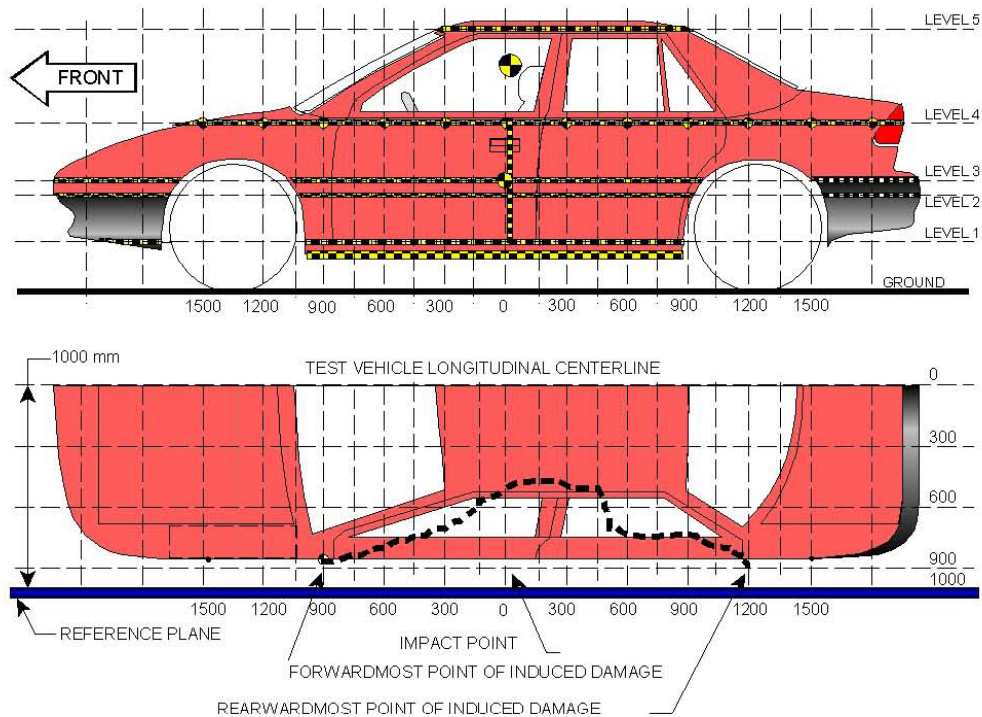
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2710	2595	115
B	Front Axle to FSOV	926	925	1
C	Rear Axle to RSOV	1039	1037	2
D1	Total Vehicle Length at Left Side	3734	3572	162
D2	Total Vehicle Length at Centerline	4675	4557	118
D3	Total Vehicle Length at Right Side	3734	3740	-6
E	Front Bumper Thickness	136	136	0
F	Front Bumper Bottom to Ground	293	312	-19
G	Sill Height at Front Wheel Well	270	258	12
H	Sill Height at Front Door Leading Edge	270	240	30
I	Sill Height at B Pillar	268	235	33
J1	Sill Height at Rear Wheel Well	263	279	-16
J2	Pinch Weld Height at Rear Wheel Well	261	281	-20
K	Sill Height Aft of Rear Wheel Well	295	320	-25
L	Rear Bumper Thickness	120	120	0
M	Rear Bumper Bottom to Ground	340	345	-5
N	Sill Height to Window Bottom Sill	788	785	3
O	Front Door Leading Edge to Impact CL	566	565	1
P	Rear Door Trailing Edge to Impact CL	1346	1365	-19
Q	Front Window Opening	458	415	43
R	Right Side Length	3734	3740	-6
S	Left Side Length	3734	3572	162
T	Vehicle Width at B Post	1860	1730	130

DATA SHEET NO. 10 **VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011



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

Level	Measurement Description	Height Above Ground (mm)
1	Sill Top	343
2	Mid Door	715
3	Occupant H-Point	750
4	Window Sill	1099
5	Window Top	1618

DATA SHEET NO. 10 (CONTINUED)

VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1050				257					243					-14	
-900				248					245					-3	
-750				242					240					-2	
-600	213	172	174	250		238	186	188	253		25	14	14	3	
-525	213	178	177	254		273	210	207	270		60	32	30	16	
-450	214	178	177	254		312	270	262	305		98	92	85	51	
-375	214	176	177	252		350	323	320	344		136	147	143	92	
-300	215	176	176	248		388	376	371	386		173	200	195	138	
-225	215	176	175	245		432	433	431	434		217	257	256	189	
-150	215	175	175	242		487	489	487	487		272	314	312	245	
-75	216	175	174	238	463	548	544	547	559	604	332	369	373	321	141
0	216	175	174	235	455	588	585	587	587	633	372	410	413	352	178
75	215	175	174	233	455	572	587	588	587	615	357	412	414	354	160
150	215	175	174	231	452	520	550	547	553	587	305	375	373	322	135
225	215	174	174	228	452	462	489	491	490	562	247	315	317	262	110
300	216	174	174	226	454	402	419	422	427	535	186	245	248	201	81
375	215	174	174	224	454	354	355	364	370	516	139	181	190	146	62
450	214	174	173	222	456	316	307	312	317	498	102	133	139	95	42
525	214	176	175	221	457	290	257	265	295	480	76	81	90	74	23
600	215	176	175	219	458	269	249	249	289	474	54	73	74	70	16
750	215	178	177	218	459	243	235	234	274	488	28	57	57	56	29
900	215	180	179	218	460	212	210	212	249	467	-3	30	33	31	7
1050	214	182	181	217	461	194	192	194	234	467	-20	10	13	17	6
1200		172	174	218	465		165	168	220	471		-7	-6	2	6
1350				221	467				205	474				-16	7
1500				224	475				196	489				-28	14
1650				230	482				236	492				6	10
1800				236	494				242	499				6	5

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. 10 (CONTINUED)
VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2012 Kia Sorento LX SUV
Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
Test Date: 8/08/2011

MAXIMUM CRUSH DATA

	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	372	412	414	354	178
Distance From Impact (mm)	0	75	75	75	0

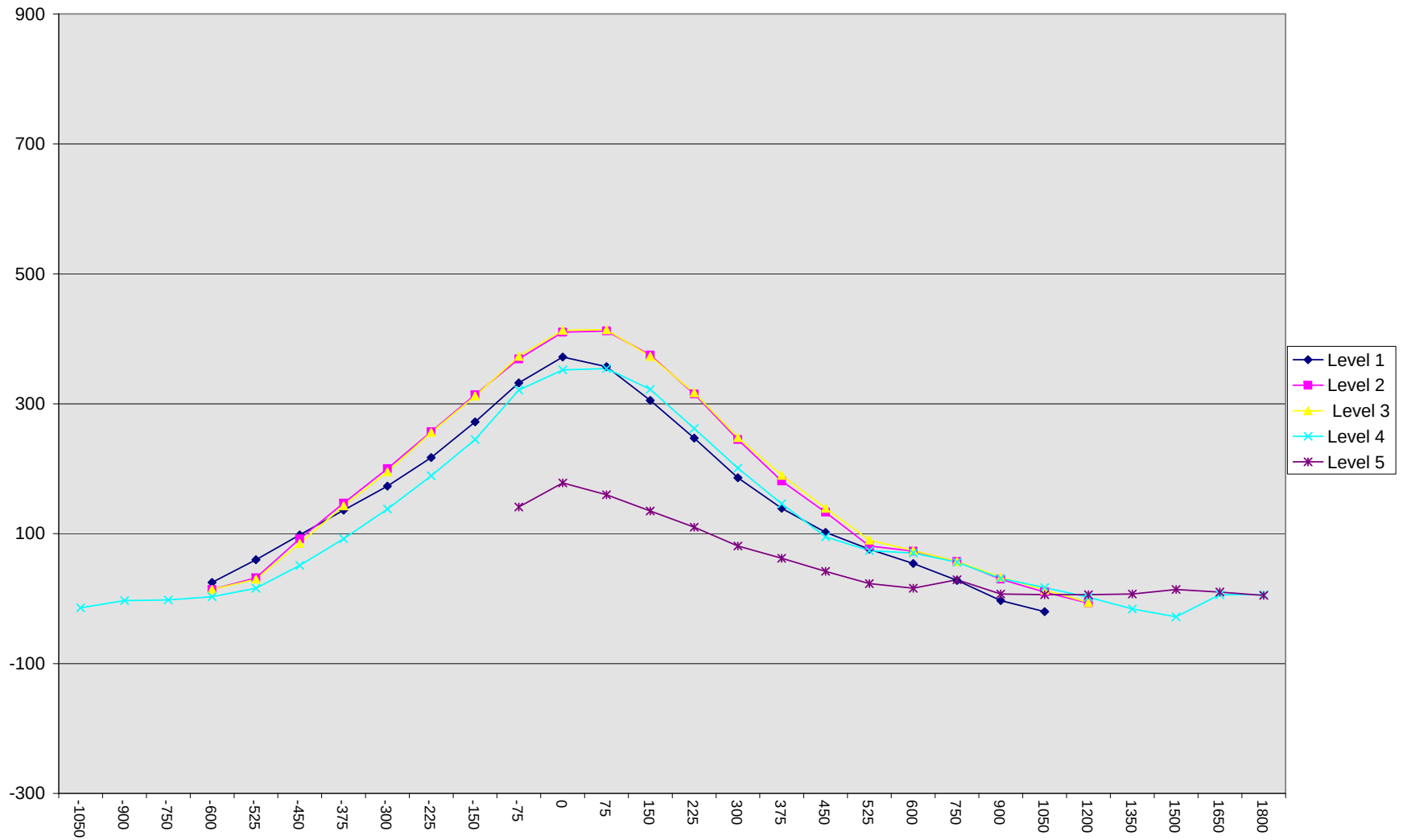
Note: Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush profile grid is established prior to test based on an estimated impact point. The final distance to impact is determined after the final dummy positioning and the pole is aligned with the center of gravity of the dummy's head.

DATA SHEET NO. 10 (CONTINUED)
VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2012 Kia Sorento LX SUV
Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
Test Date: 8/08/2011

20



DATA SHEET NO. 11

FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA

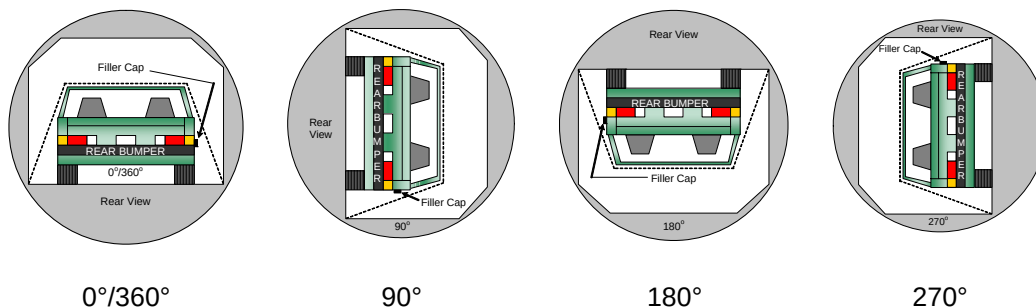
Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011

Test Time: 10:49 am Temperature: 21° C

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

FMVSS 301 STATIC ROLLOVER DATA



ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	117	300	417
90° to 180°	112	300	412
180° to 270°	109	300	409
270° to 360°	114	300	414

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

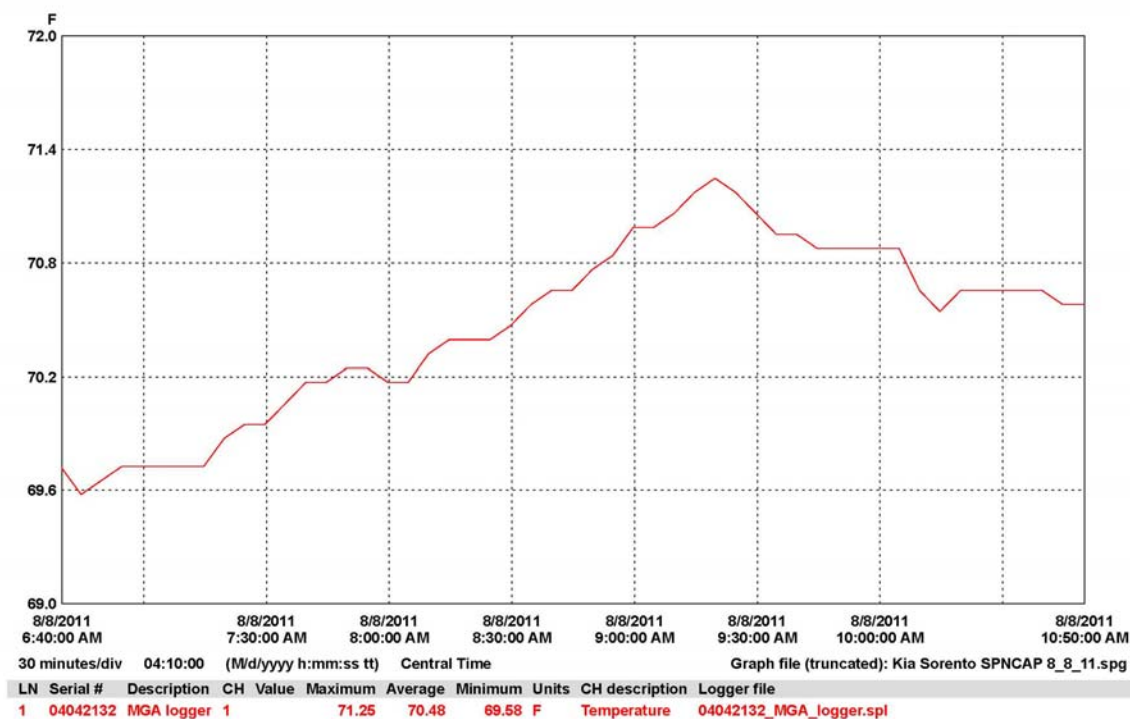
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 12 **DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA**

Test Vehicle: 2012 Kia Sorento LX SUV
 Test Program: NCAP Side Pole Impact Test

NHTSA No. KC0502
 Test Date: 8/08/2011



APPENDIX A
PHOTOGRAPHS

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As Delivered Right Front $\frac{3}{4}$ View of Test Vehicle



As Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle



Pre-Test Frontal View of Test Vehicle



Post-Test Frontal View of Test Vehicle



Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



Pre-Test Left Side View of Test Vehicle



Post-Test Left Side View of Test Vehicle



Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



Pre-Test Rear View of Test Vehicle



Post-Test Rear View of Test Vehicle



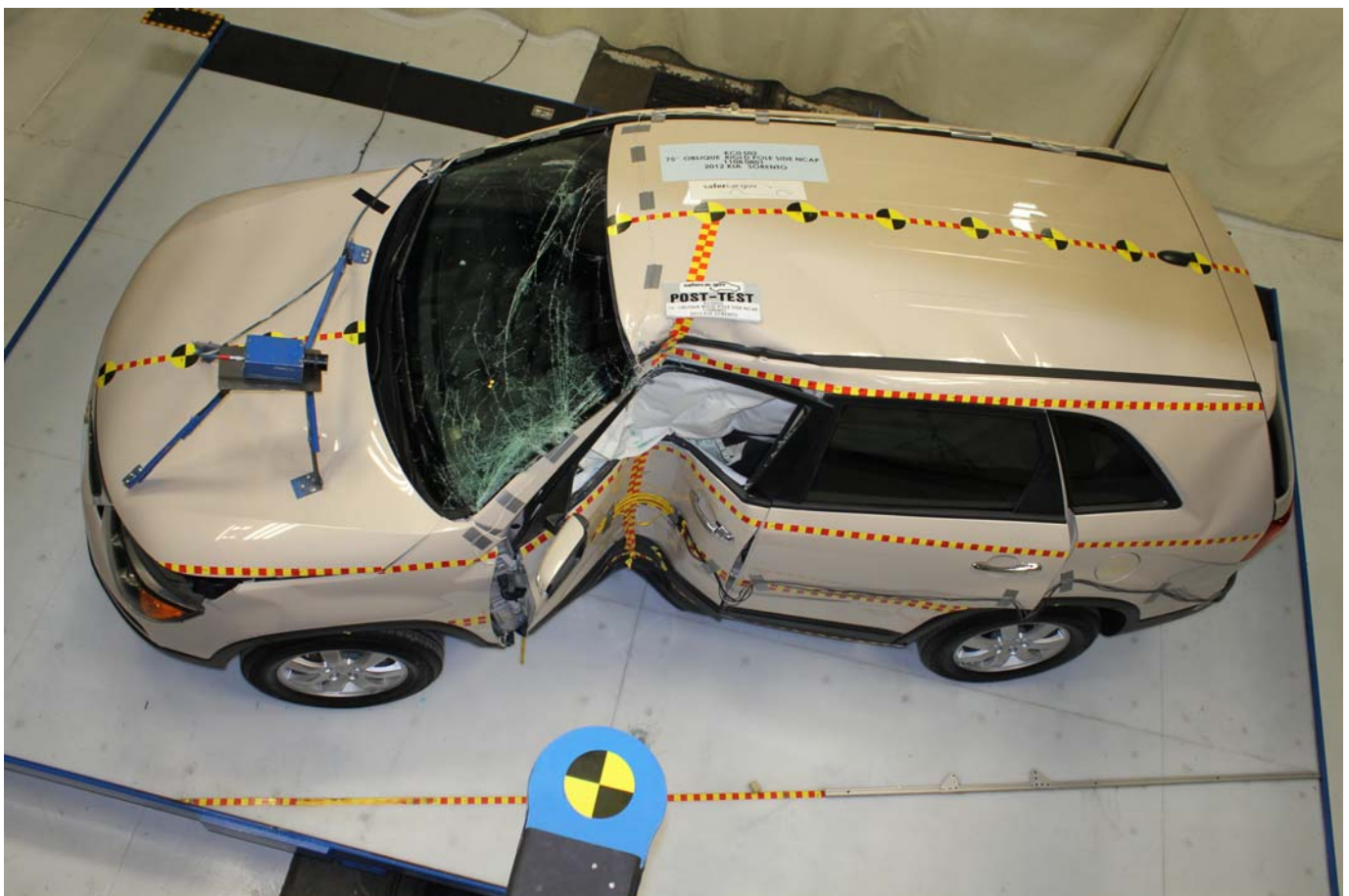
Pre-Test Right Side View of Test Vehicle



Post-Test Right Side View of Test Vehicle



Pre-Test Overhead View of Test Vehicle and Pole



Post-Test Overhead View of Test Vehicle and Pole



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



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



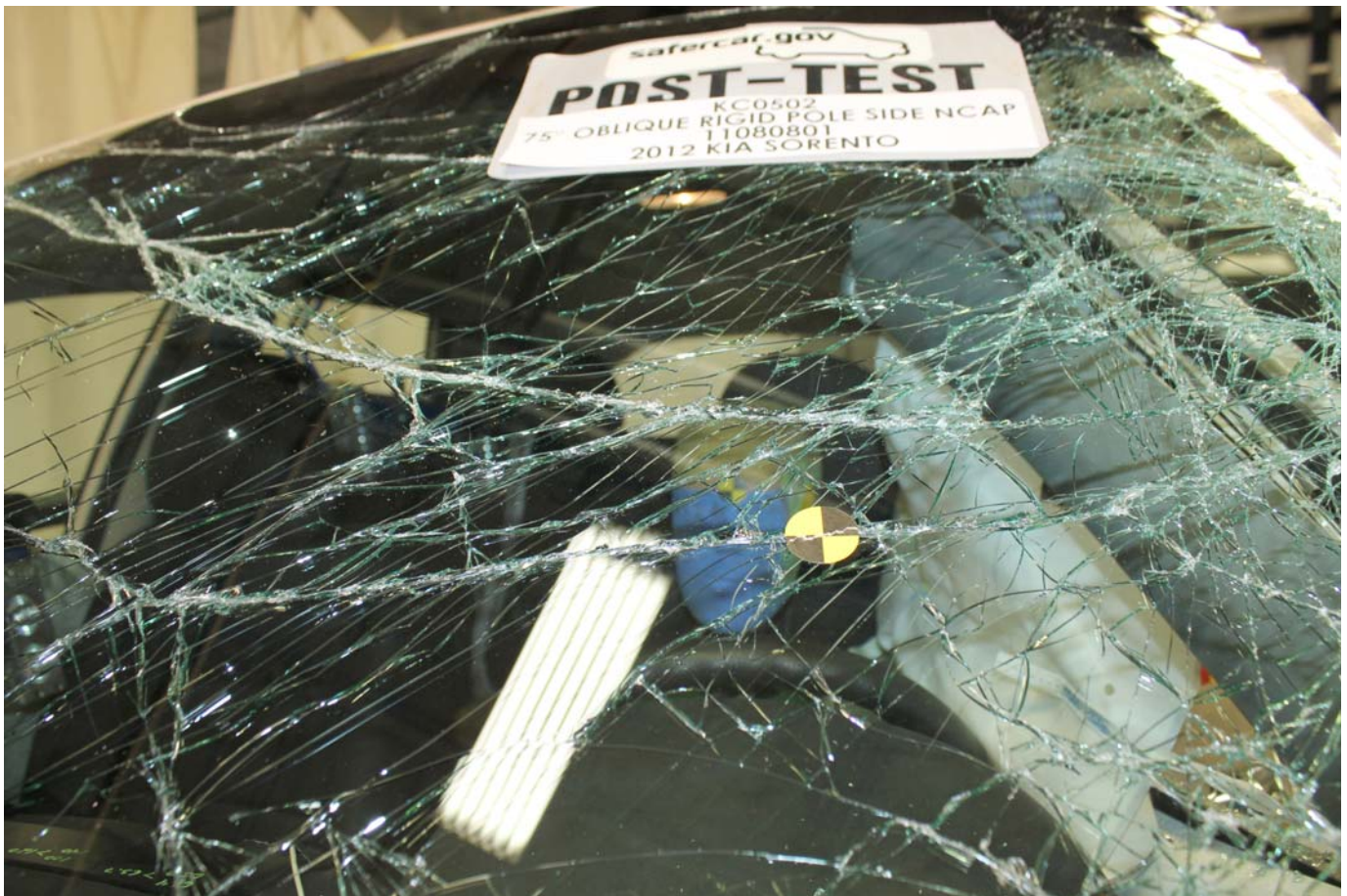
Pre-Test Close-Up View of Impact Point Target



Post-Test Close-Up View of Impact Point Target Showing Impact Location



Pre-Test Front Close-Up View of Dummy (through front window)



Post-Test Front Close-Up View of Dummy (through front window)



Pre-Test Left Side View of Dummy Showing Belts, Chalking, and Contact Switches (Door Open)



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



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



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



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



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



Pre-Test Overhead View of Dummy Thighs on Seat Pan



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



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



Pre-Test Placement of Dummy's Feet



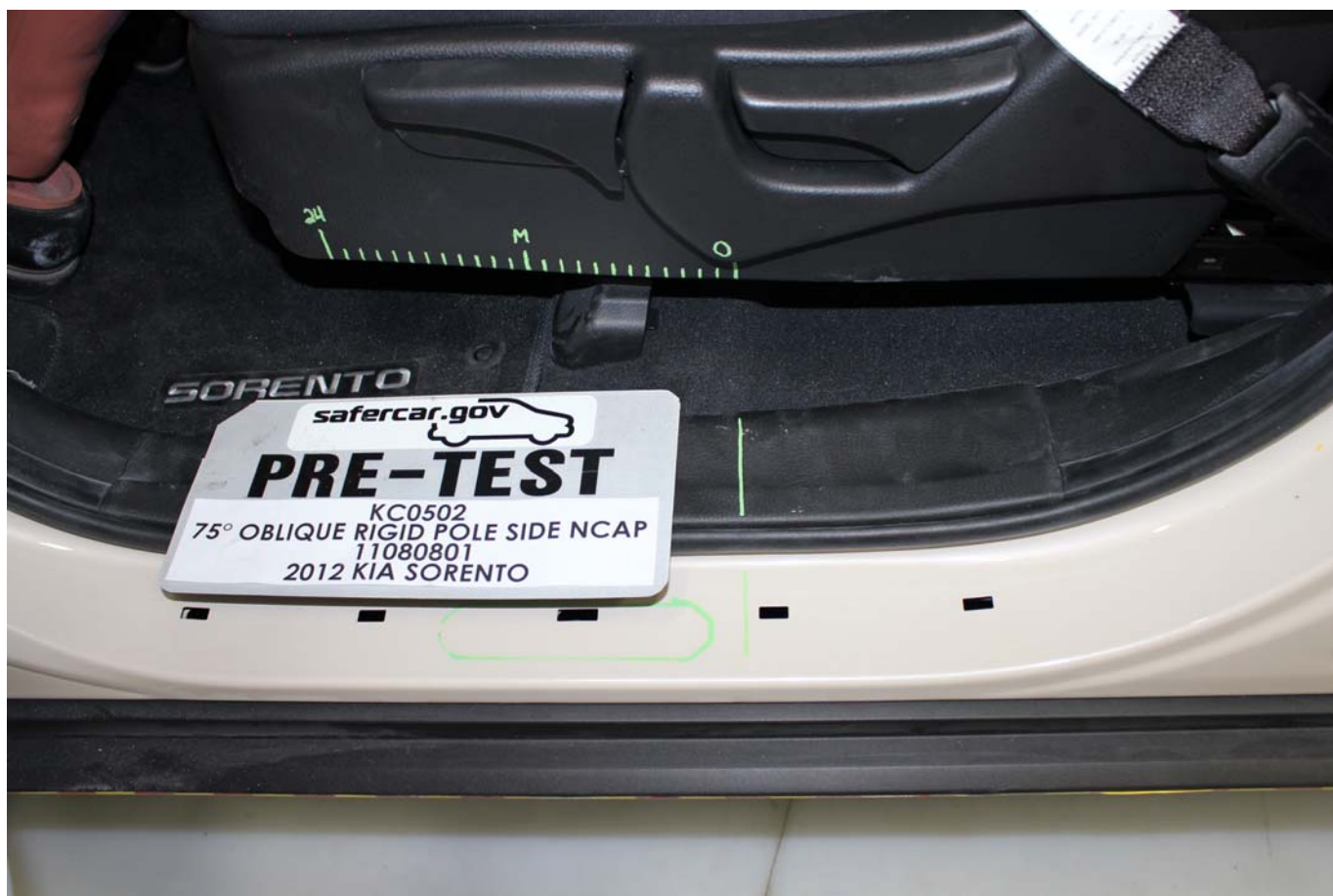
Pre-Test View of Belt Anchorage for Dummy to Show Position



Pre-Test Left Side View of Steering Wheel to Show Position



Pre-Test View of Parking Brake



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



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



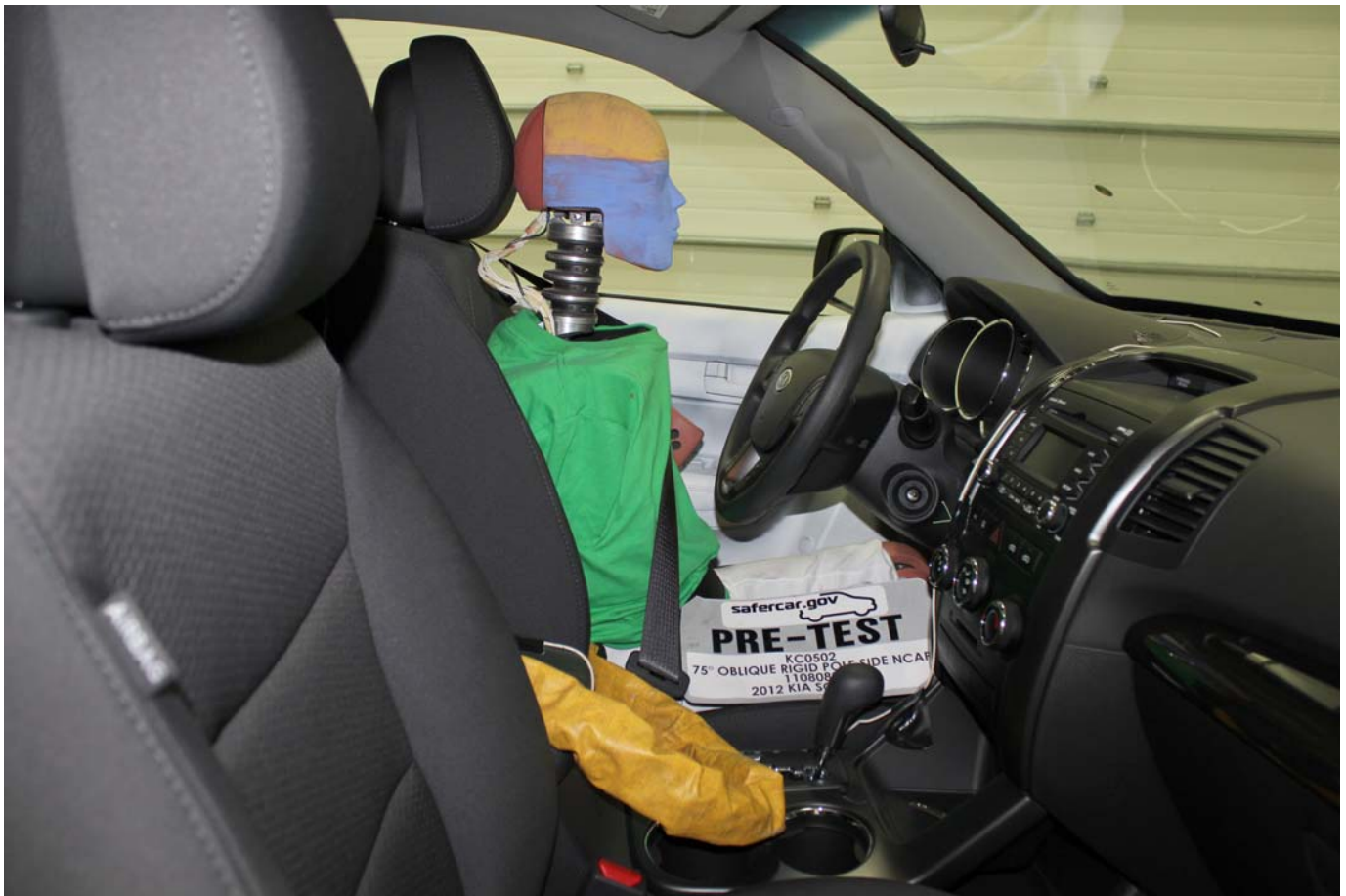
Pre-Test Close-Up View of Driver Seat Back or Head Restraint Showing Seat Back Test Position



Pre-Test Dummy and Door Clearance View



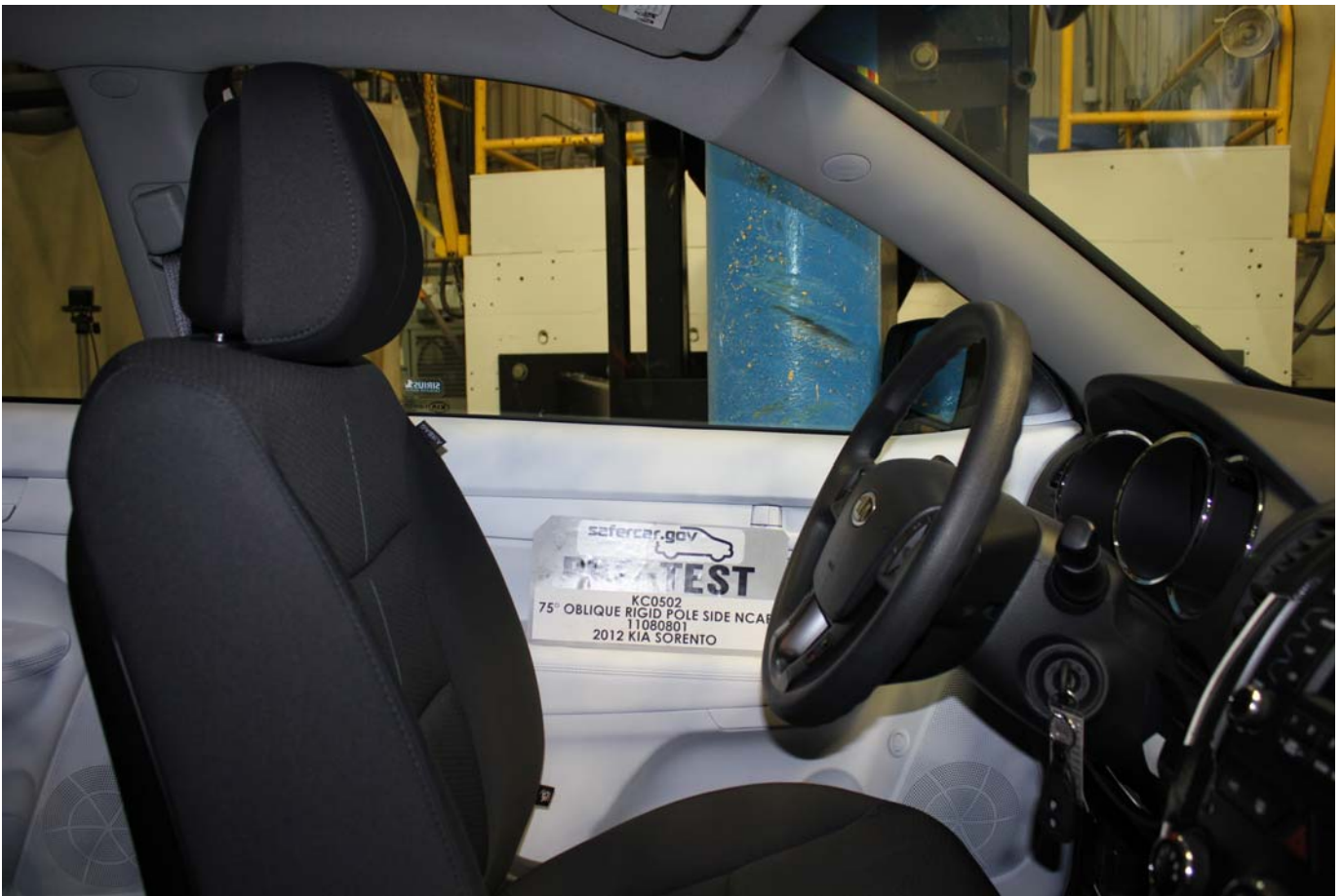
Post-Test Dummy and Door Clearance View



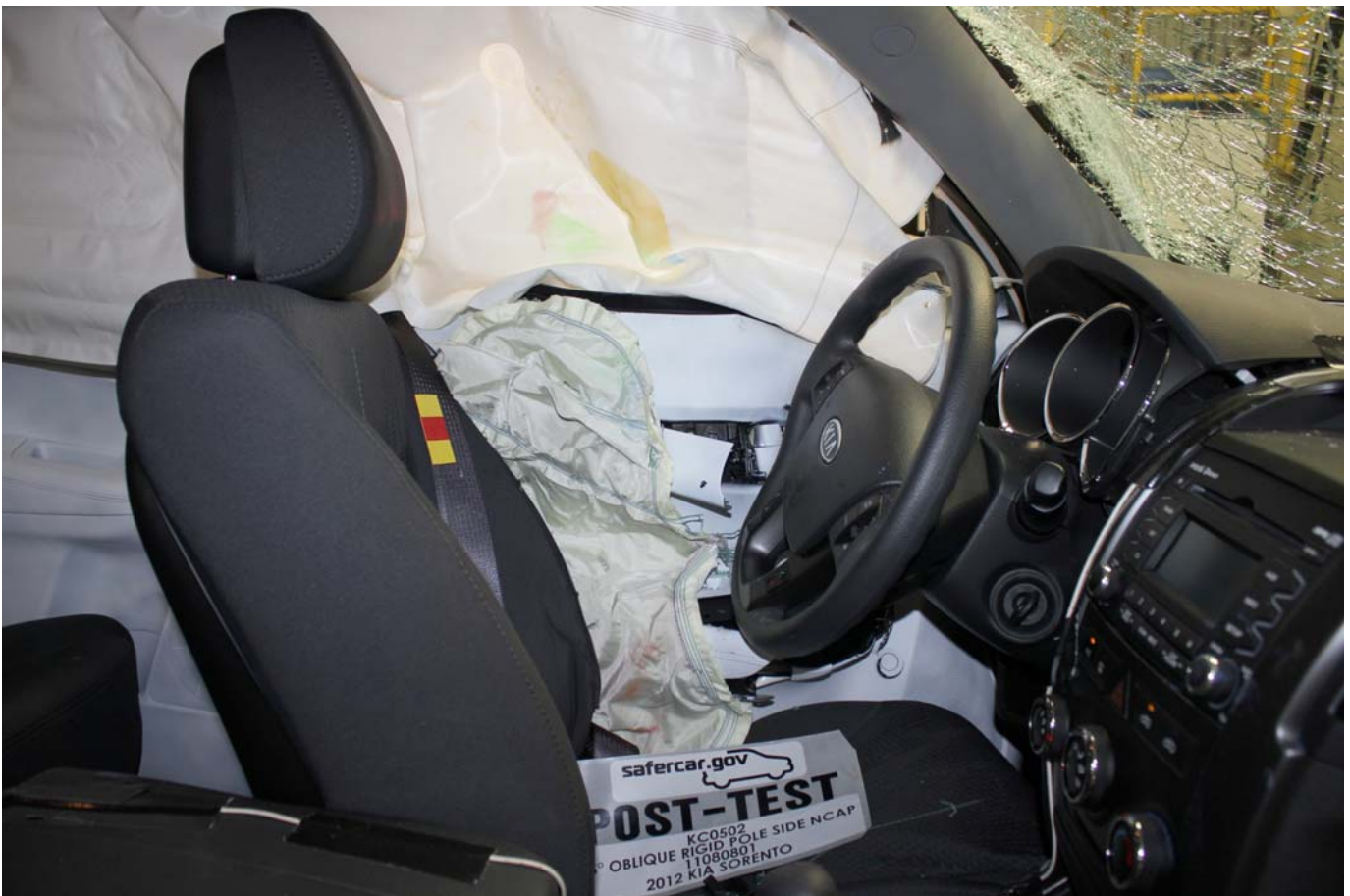
Pre-Test Right Side View of Dummy and Front Seat Occupant Compartment



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



Pre-Test Inner Driver Door Panel View



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



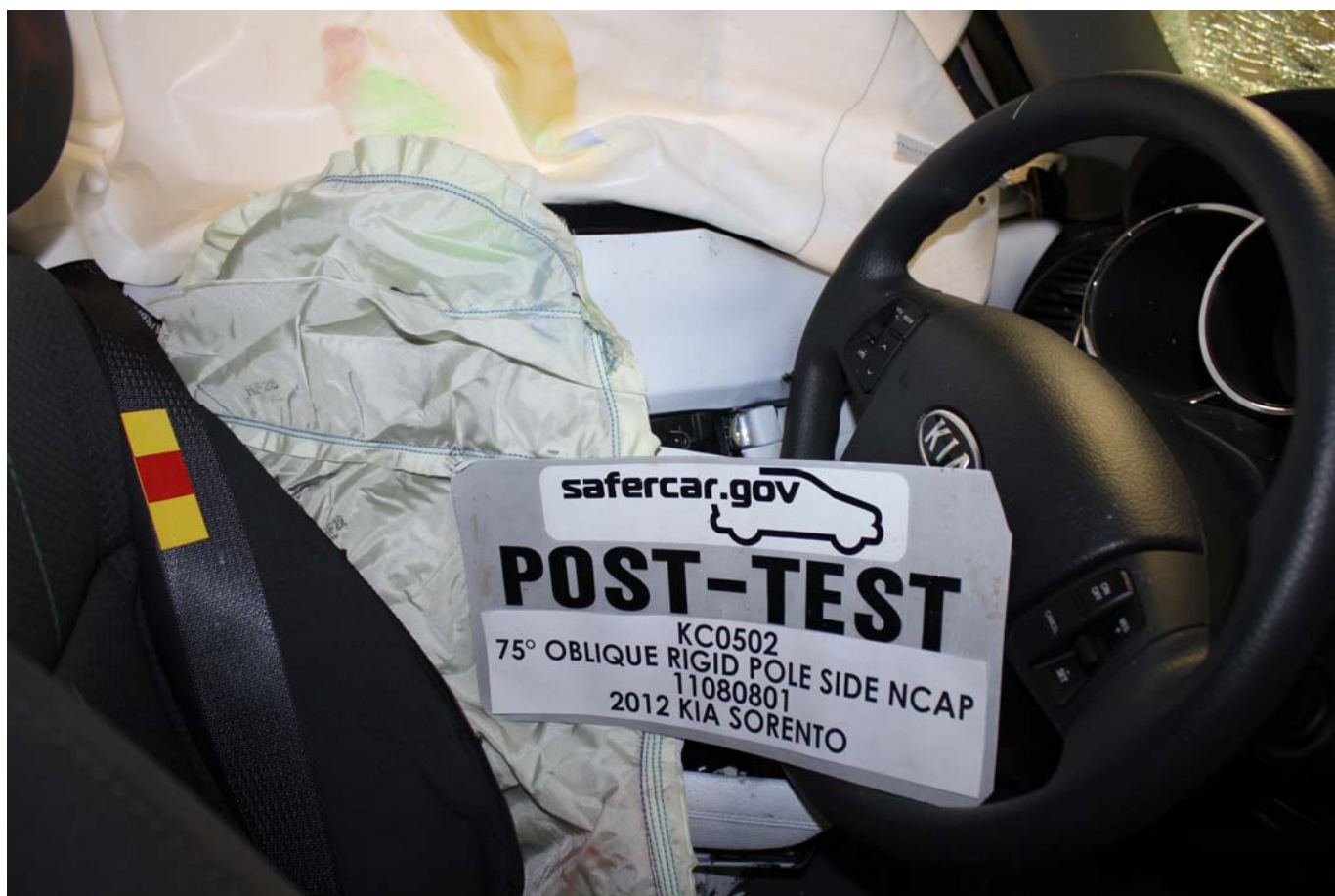
Post-Test Dummy Close-Up Head Contact with Vehicle Interior View



Post-Test Dummy Close-Up Head Contact with Side Airbag View

PHOTOGRAPH NOT APPLICABLE

Post-Test Dummy Close-Up Torso Contact with Vehicle Interior View



Post-Test Dummy Close-Up Torso Contact with Side Airbag View

PHOTOGRAPH NOT APPLICABLE

Post-Test Dummy Close-Up Pelvis Contact with Vehicle Interior View



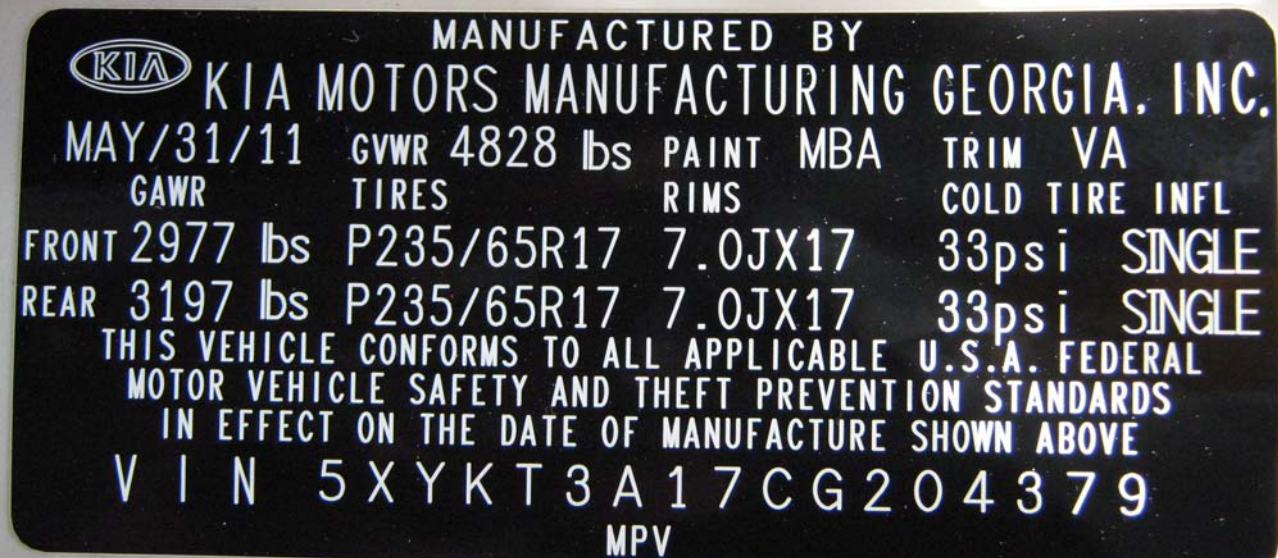
Post-Test Dummy Close-Up Pelvis Contact with Side Airbag View



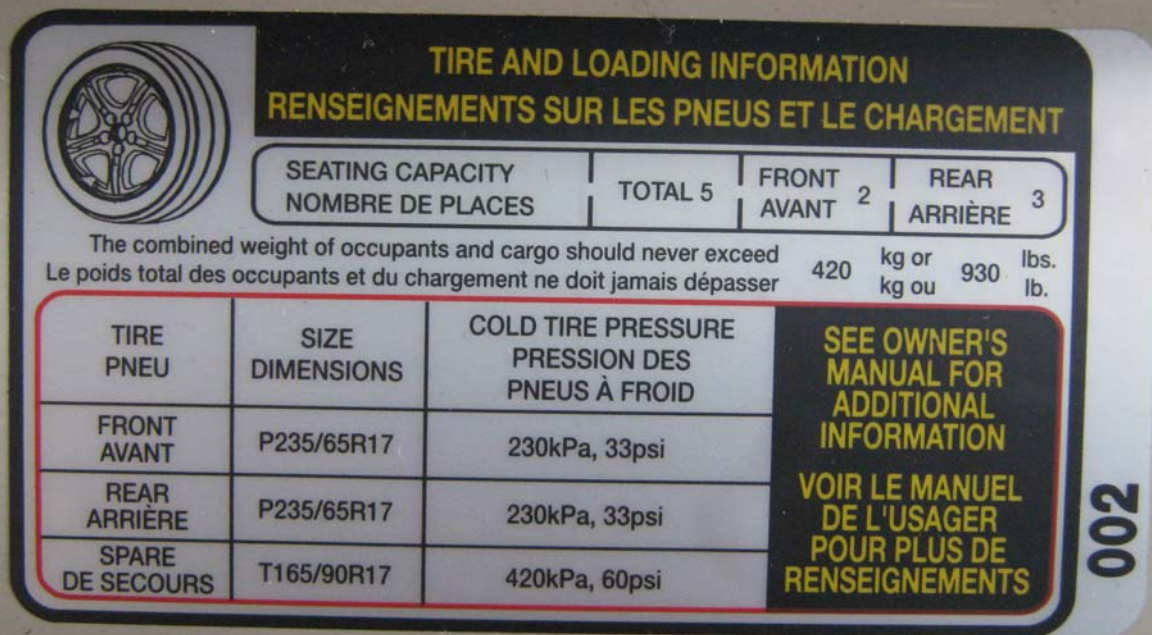
Pre-Test View of Fuel Filler Cap or Fuel Filler Neck



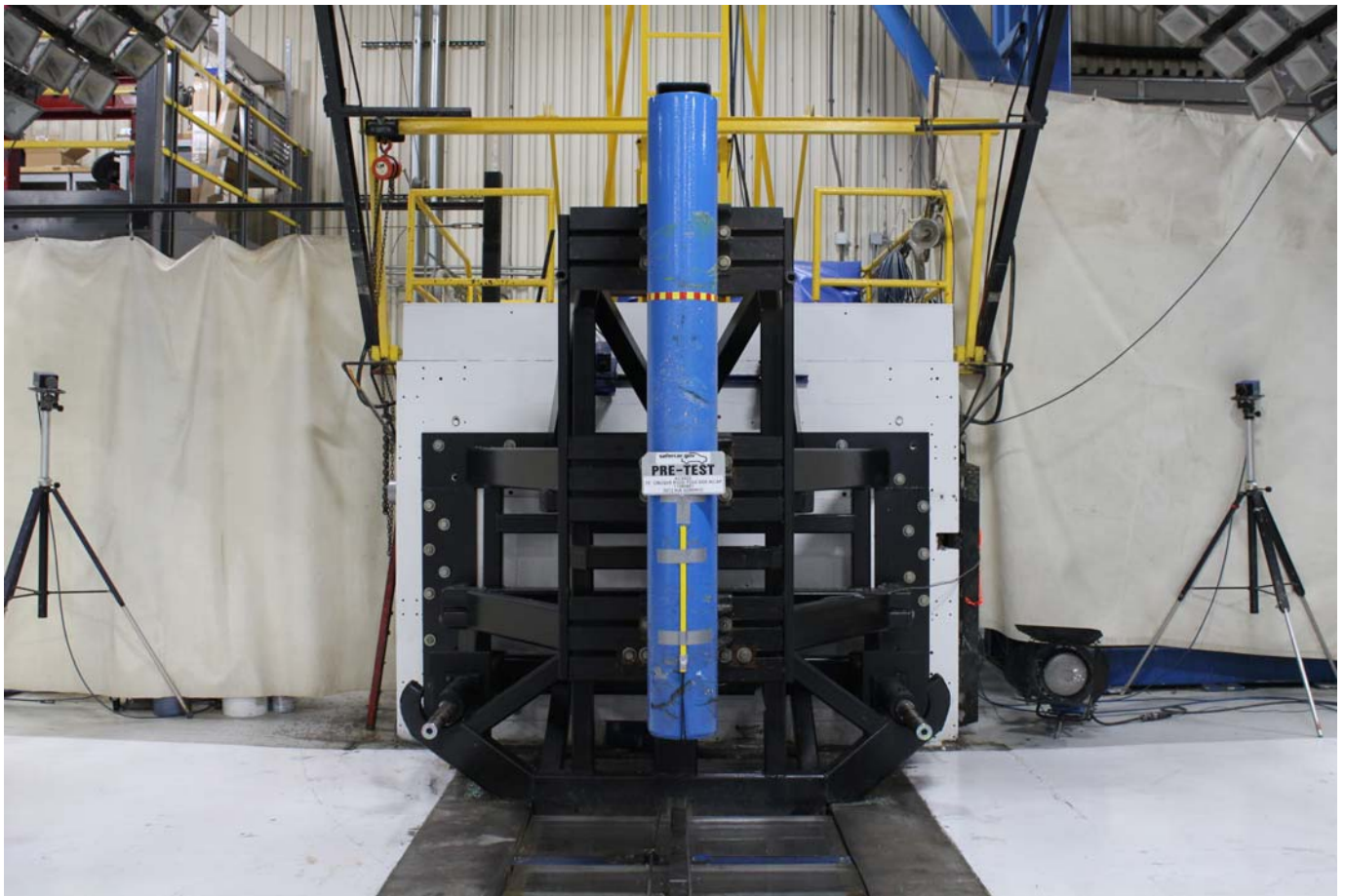
Post-Test View of Fuel Filler Cap or Fuel Filler Neck



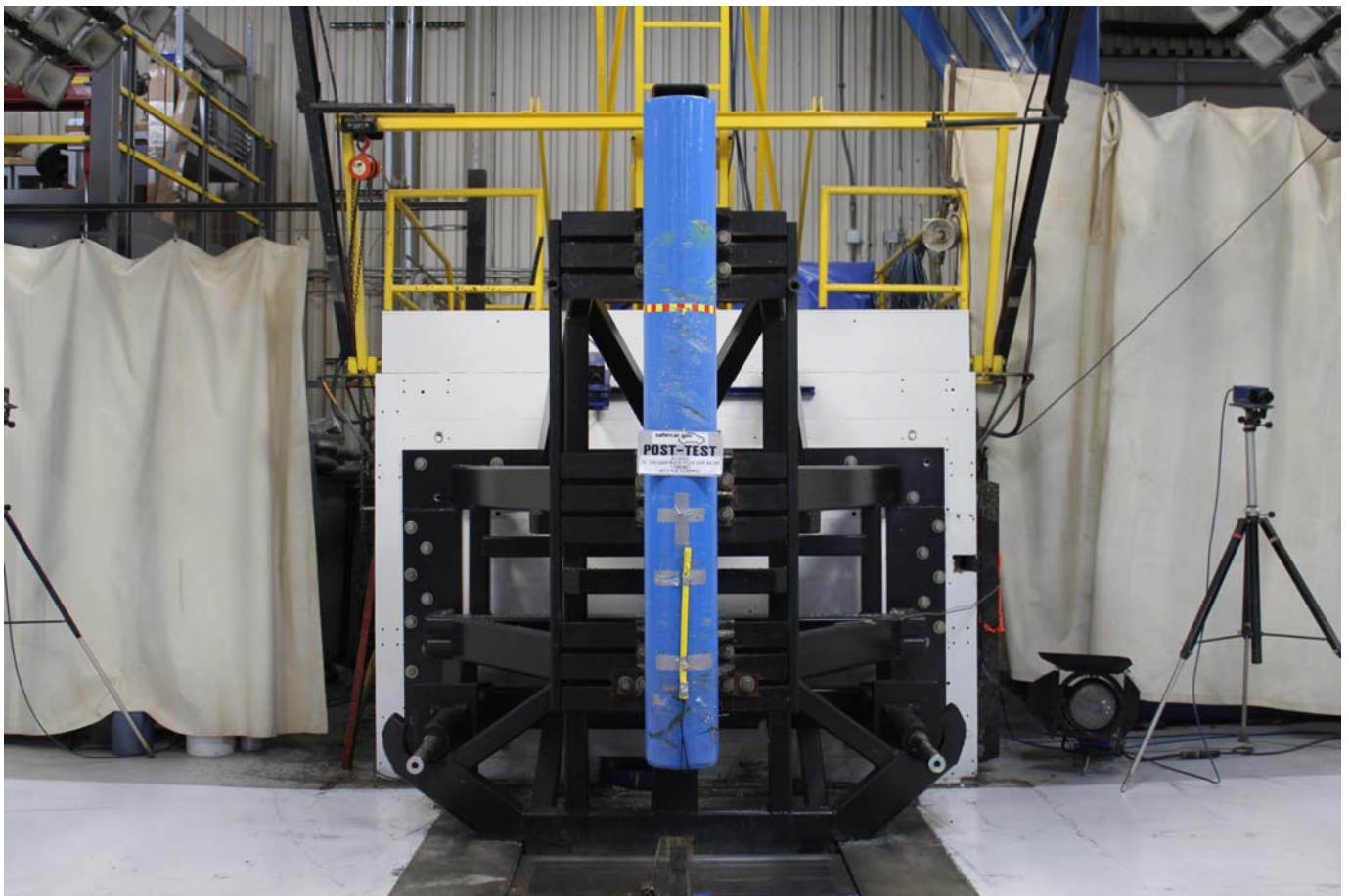
Close-Up View of Vehicle's Certification Label



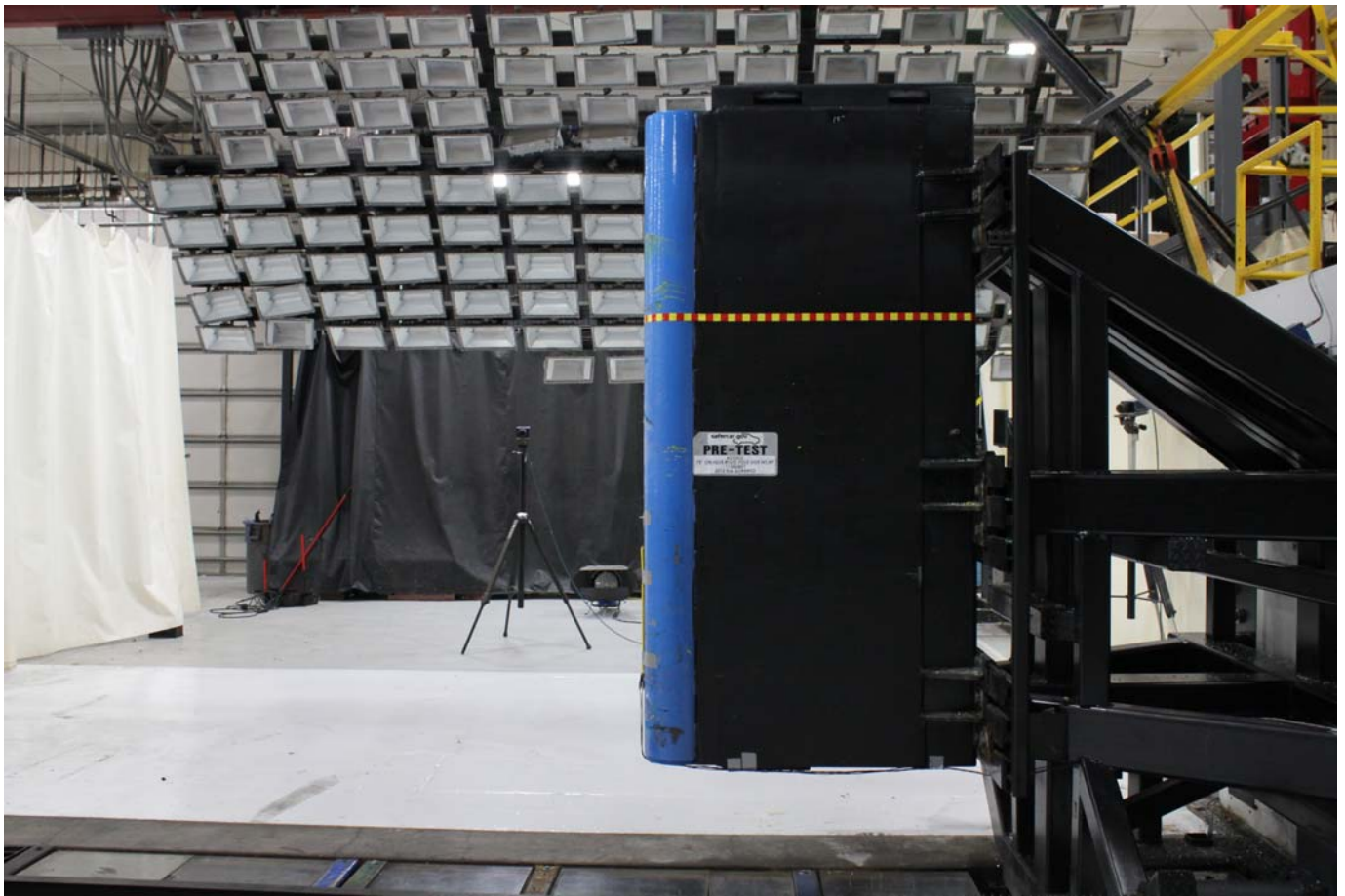
Close-Up View of Vehicle's Tire Information Placard or Label



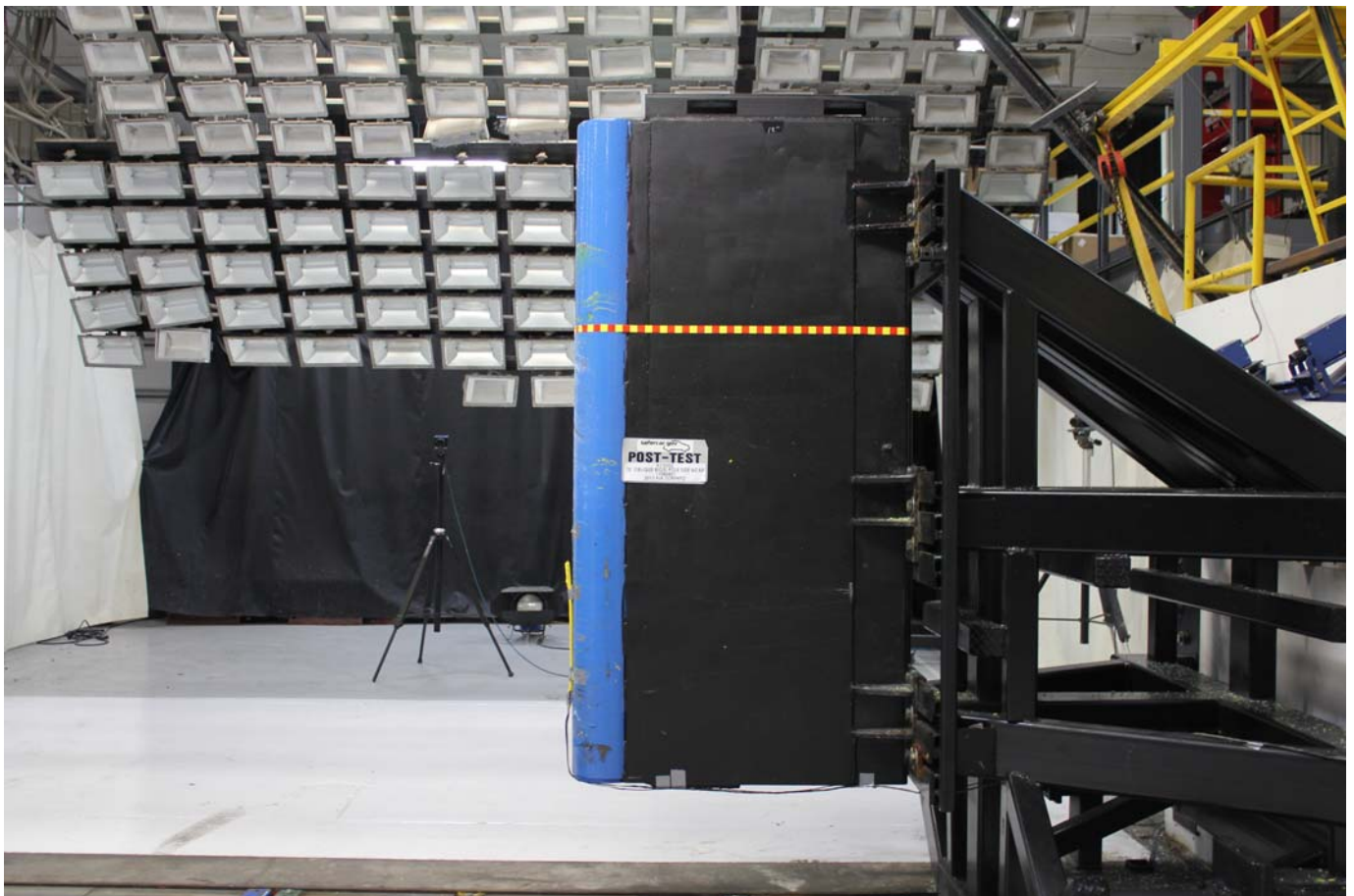
Pre-Test Pole Barrier Front View



Post-Test Pole Barrier Front View



Pre-Test Pole Barrier Side View



Post-Test Pole Barrier Side View



Pre-Test Ballast View



Post-Test Primary and Redundant Speed Trap Read-Out



FMVSS No. 301/305 Rollover 0 Degrees



FMVSS No. 301/305 Rollover 90 Degrees



FMVSS No. 301/305 Rollover 180 Degrees



FMVSS No. 301/305 Rollover 270 Degrees



FMVSS No. 301/305 Rollover 360 Degrees



Impact Event

2012 7222 KIA SORENTO LX FWD MODEL YEAR MODEL MODEL DESCRIPTION WHITE SAND BEIGE/BLACK EXTERIOR / INTERIOR COLOR 5XYKT3A17CG204379 G4KEBK33 VEHICLE NUMBER ENGINE NUMBER WEST POINT TRUCK PORT OF ENTRY MODE OF TRANSPORTATION		SOLD TO: W008 PALMEN KIA OF KENOSHA 5301 75TH STREET 5431 75TH STREET KENOSHA WI 53142 SHIP TO: W008	
STANDARD FEATURES MECHANICAL 2.4L 16-Valve DOHC CVT 4-Cylinder Engine 6-Speed Automatic Transmission w/ Sportmatic Independent Front and Rear Suspension Alloy Wheels SAFETY Dual Front Advanced Airbags Front Seat-Mounted Side Airbags Side Curtain Airbags (1st & 2nd Row) Front Active Headrests Lower Anchors and Tethers for Children (LATCH) Anti-Lock Brake System (ABS) Traction Control System (TCS) Electronic Stability Control (ESC) Downhill Brake/Hill-start Assist Control (DBC/HAC) Tire Pressure Monitoring System (TPMS) INTERIOR Air Conditioning Power Windows, Door Locks & Outside Mirrors AM/FM/CD/MP3 Audio System SIRIUS Satellite Radio w/ free 3-mo. subscription ** USB/Auxiliary Input Jacks BLUETOOTH® WIRELESS TECHNOLOGY 60/40 Split Folding and Reclining Rear Seats YES Essentials Seat Fabric Material Rear Center Armrest with Cupholders Remote Keyless Entry Cruise Control Steering Wheel Controls (Bluetooth/Audio/Cruise) Tilt Telescopic Steering Column Dual Illuminated Visor Vanity Mirrors ECOMINDER™ Indicator EXTERIOR Privacy Glass Heated Outside Mirrors w/ Turn Signal Indicators		MANUFACTURER'S SUGGESTED RETAIL PRICE ADDITIONAL INSTALLED EQUIPMENT: Carpeted Floor Mats Cargo Cover \$23,150.00 \$115.00 \$125.00	
WARRANTY 10 Year/100,000 Mile Limited Powertrain Warranty 5 Year/60,000 Mile Limited Basic Warranty 5 Year/60,000 Mile Roadside Assistance ** Ask dealer for details		MSRP INCLUDING OPTIONS INLAND FREIGHT AND HANDLING \$23,390.00 \$800.00 TOTAL MANUFACTURER'S SUGGESTED RETAIL PRICE \$24,190.00 Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. License and title fees, state and local taxes and other dealer installed options and accessories are not included in the manufacturer's suggested retail price.	

TOTAL ADDITIONAL WEIGHT: 19.1



EPA Fuel Economy Estimates

These estimates reflect new EPA methods beginning with 2008 models.

HIGHWAY MPG

29

Expected range for most drivers
24 to 34 MPG

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

CITY MPG

21

Expected range for most drivers
17 to 25 MPG

Estimated Annual Fuel Cost
\$1876.00

based on 15,000 miles
at \$3.00 per gallon

Combined Fuel Economy

This Vehicle

10 ——— 24 ——— 32
ALL SUVs

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

GOVERNMENT SAFETY RATINGS

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CAR
LINE U.S./CANADIAN
PARTS CONTENT: 60%
MAJOR SOURCES OF
FOREIGN PARTS:

KOREA: 40%

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

FOR THIS VEHICLE
FINAL ASSEMBLY POINT:
USA

COUNTRY OF ORIGIN
ENGINE: USA

TRANSMISSION: USA

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

Environmental Performance

Protect the environment, choose vehicles with higher scores:

Global Warming Score



Smog Score



Using alternative fuels may improve scores. See www.DriveClean.ca.gov

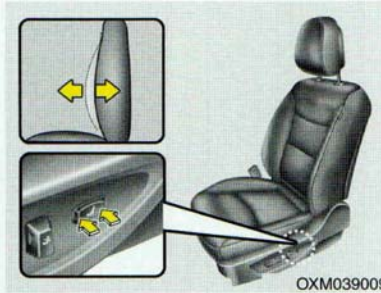
Vehicle emissions are a primary contributor to global warming and smog. Scores are determined by the California Air Resources Board based on this vehicle's measured emissions. Please visit www.DriveClean.ca.gov for more information. AIR RESOURCES BOARD



OXM039008

Seat height (for driver's seat)

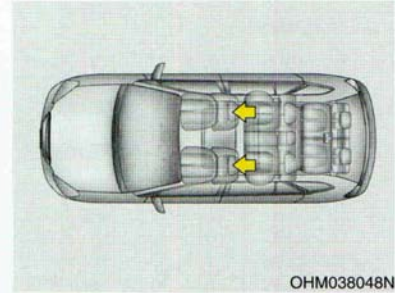
Pull the front portion of the control switch up to raise or press down to lower the front part of the seat cushion. Pull the rear portion of the control switch up to raise or press down to lower the rear part of the seat cushion. Release the switch once the seat reaches the desired position.



OXM039009

Lumbar support (for driver's seat)

The lumbar support can be adjusted by pressing the button.



OXM038048N

C010104AHM

Headrest

The driver's and front passenger's seats are equipped with a headrest for the occupant's safety and comfort.

The headrest not only provides comfort for the driver and front passenger, but also helps protect the head and neck in the event of a rear collision.

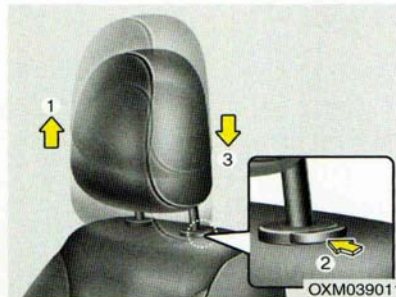
3 | 7

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

Safety features of your vehicle

⚠ WARNING

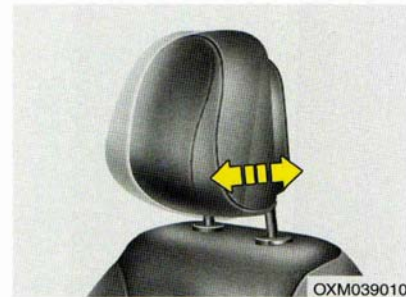
- For maximum effectiveness in case of an accident, the headrest should be adjusted so the middle of the headrest is at the same height of the center of gravity of an occupant's head. Generally, the center of gravity of most people's head is similar with the height of the top of their eyes. Also, adjust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



OXM039011

Adjusting the height up and down

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



OXM039010

Adjusting the angle (if equipped)

The headrest angle may be adjusted by pulling or pushing the lower part of the headrest.

Adjust the headrest so that it properly supports the head and neck.

⚠ CAUTION

Excessive pulling or pushing may damage the headrest.

3 | 8

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



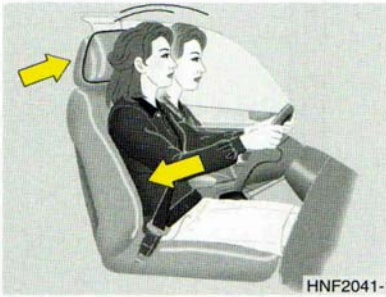
Removal (except active headrest)

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

To reinstall the headrest, put the headrest poles (3) into the holes while pressing the release button (1). Then adjust it to the appropriate height.

⚠ WARNING

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



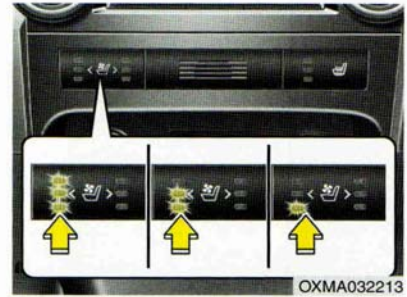
Active headrest (if equipped)

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

For your safety, the active headrest can't be removed. If there is any problem with the active headrest, take your vehicle to an authorized KIA dealer and have the system checked.

⚠ WARNING

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



Seat heater (if equipped)

The seat heater is provided to warm the front seats during cold weather. With the ignition switch in the ON position, push either of the switches to warm the driver's seat or the front passenger's seat.

APPENDIX B
DUMMY RESPONSE DATA

TABLE OF DATA PLOTS

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Figure No. 1.	Driver Head Acceleration (X) Primary vs. Time	B-1
Figure No. 2.	Driver Head Acceleration (Y) Primary vs. Time	B-1
Figure No. 3.	Driver Head Acceleration (Z) Primary vs. Time	B-1
Figure No. 4.	Driver Head Resultant Primary Acceleration vs. Time	B-1
Figure No. 5.	Driver Lower Spine T12 Acceleration (X) vs. Time	B-2
Figure No. 6.	Driver Lower Spine T12 Acceleration (Y) vs. Time	B-2
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Figure No. 9.	Driver Iliac Wing Force on Impact Side (Y) vs. Time	B-3
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Figure No. 11.	Driver Total Pelvis Force on Impact Side (Y) vs. Time	B-3

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

Driver Head Acceleration (X) Redundant

Driver Head Acceleration (Y) Redundant

Driver Head Acceleration (Z) Redundant

Driver Upper Thorax Rib Deflection (Y)

Driver Middle Thorax Rib Deflection (Y)

Driver Lower Thorax Rib Deflection (Y)

Driver Upper Abdomen Rib Deflection (Y)

Driver Lower Abdomen Rib Deflection (Y)

Driver Shoulder Contact Switch – Not Installed

Driver Torso Contact Switch – Not Installed

Driver Pelvis Contact Switch – Not Installed

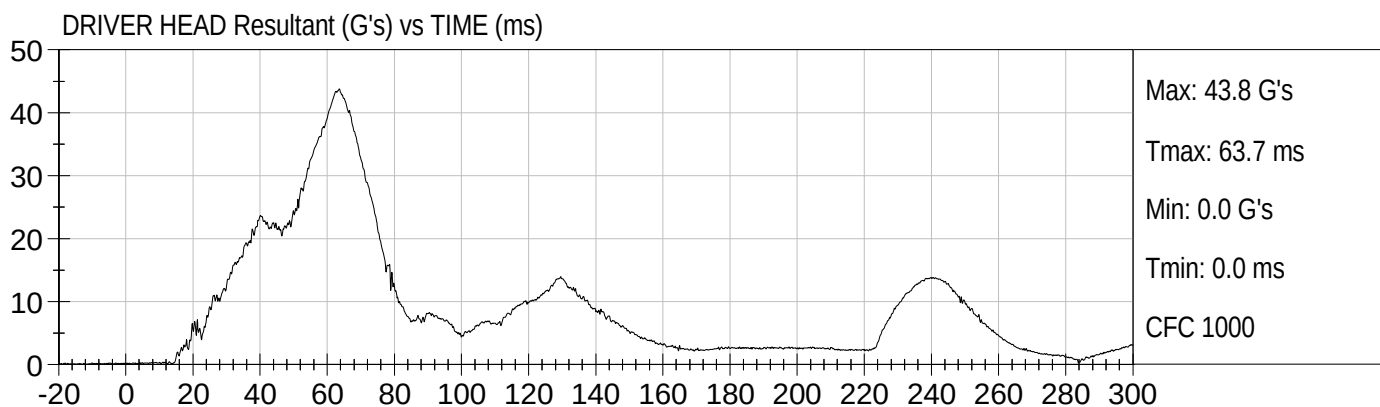
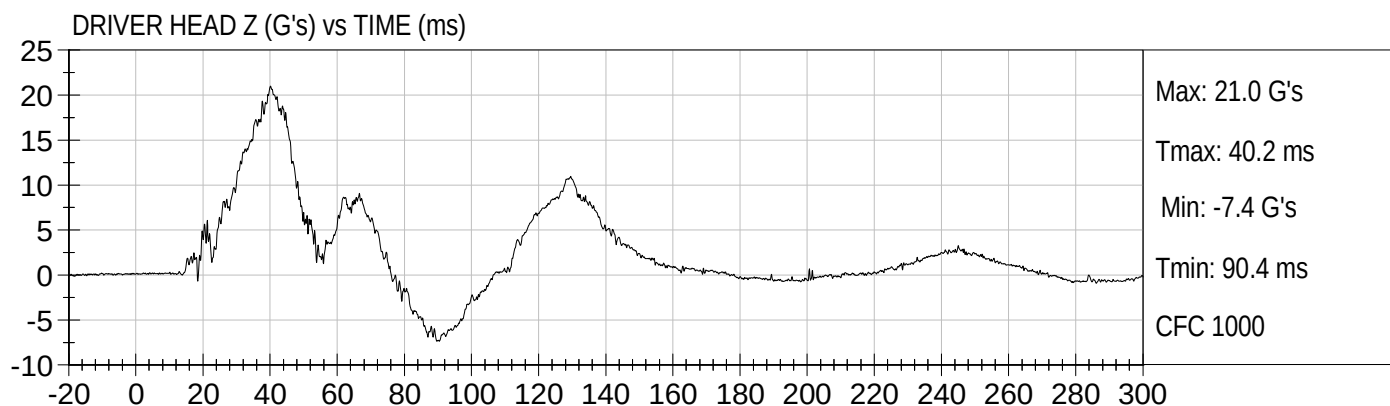
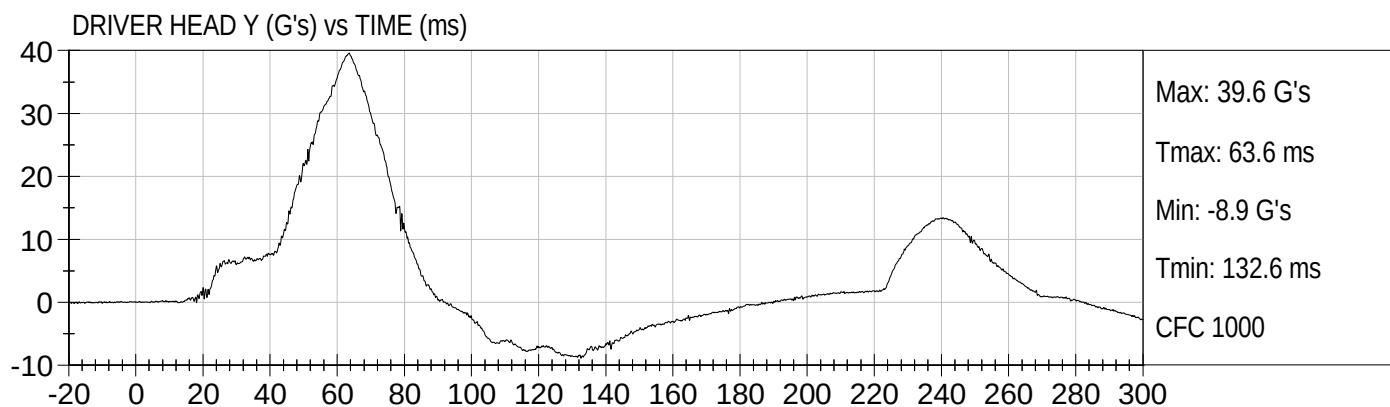
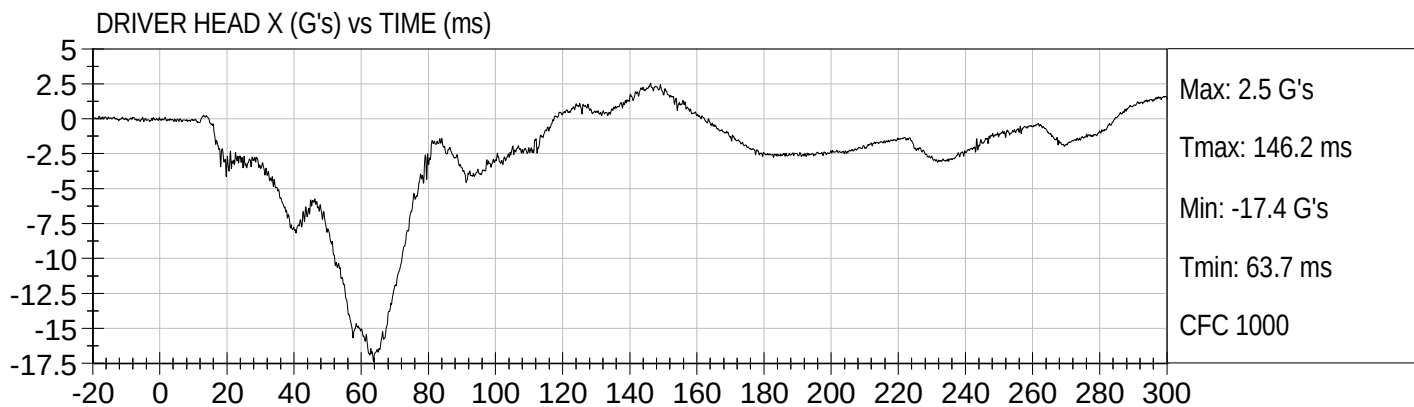
Vehicle CG Acceleration (X)

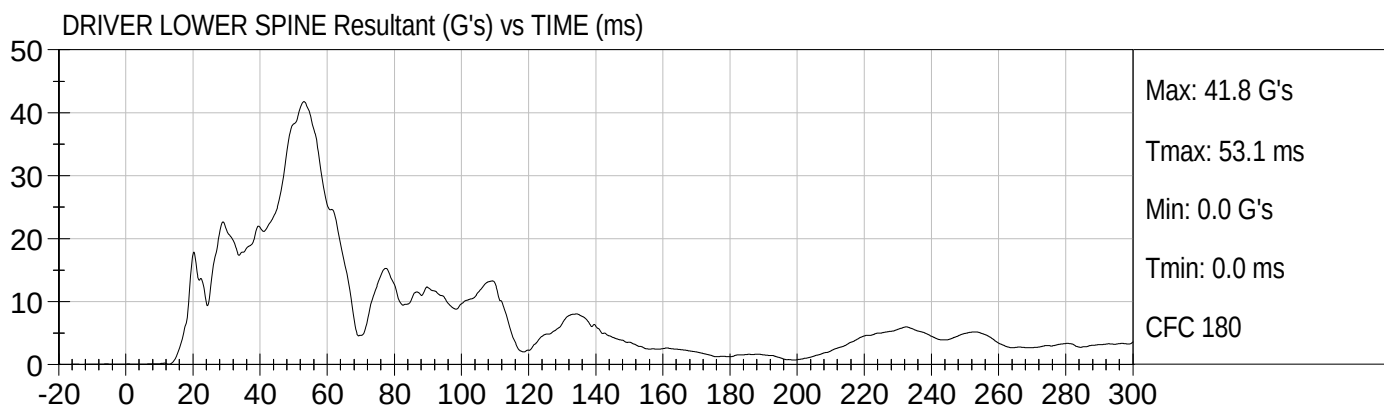
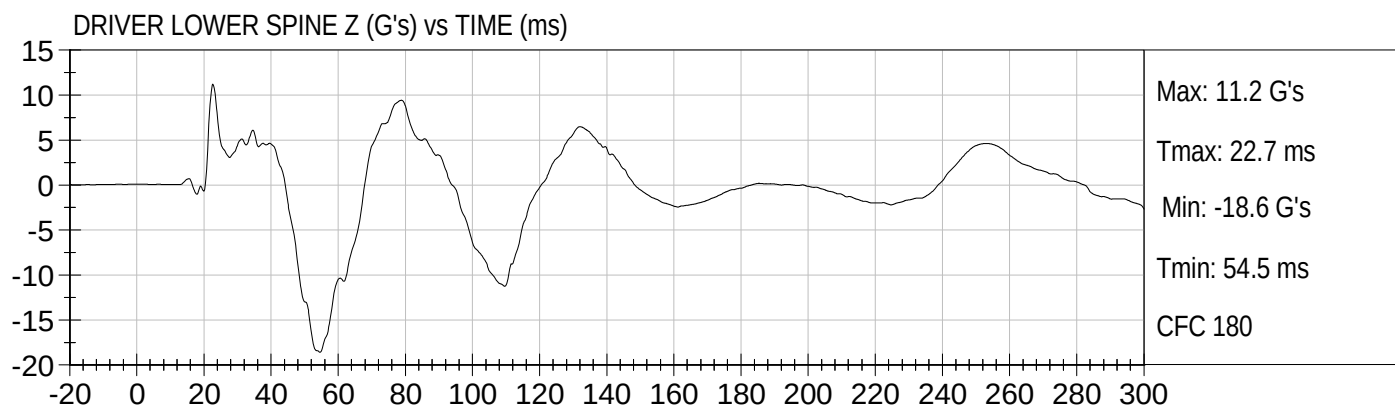
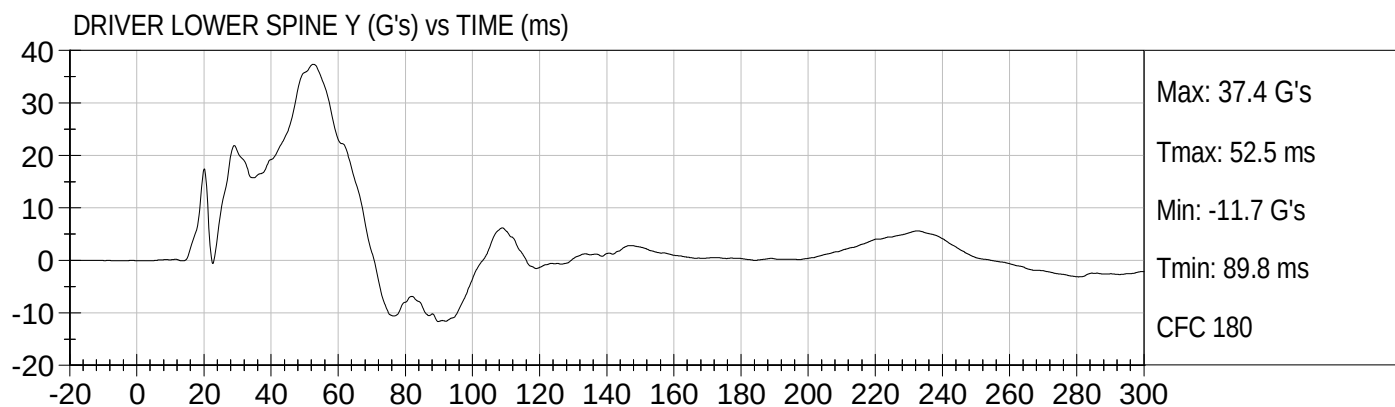
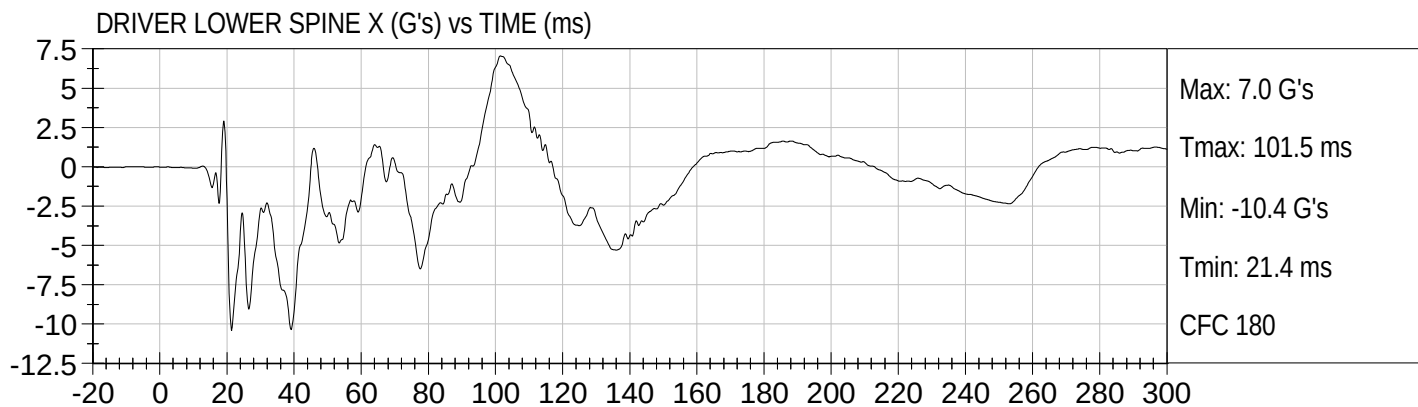
Vehicle CG Acceleration (Y)

Vehicle CG Acceleration (Z)

Vehicle CG Angular Rate About X (Roll)

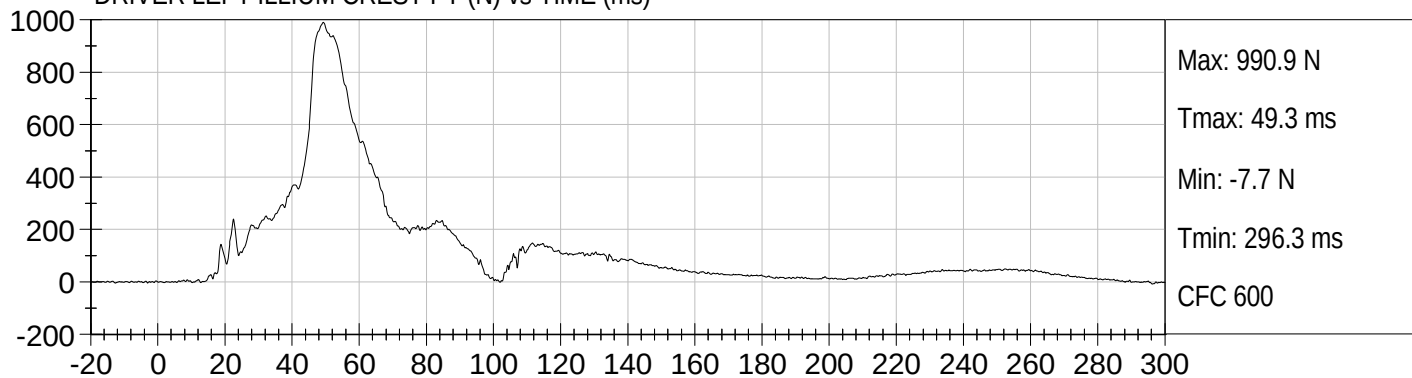
Vehicle CG Angular Rate About Y (Pitch)
Vehicle CG Angular Rate About Z (Yaw)
Left Floor Sill Acceleration (Y)
Left A-Pillar Sill Acceleration (Y)
Left Lower A-Pillar Acceleration (Y)
Left Mid A-Pillar Acceleration (Y)
Left B-Pillar Sill Acceleration (Y)
Left Lower B-Pillar Acceleration (Y)
Left Mid B-Pillar Acceleration (Y)
Driver Seat Track at Dummy H-Point Acceleration (Y)
Engine Top Acceleration (X)
Engine Top Acceleration (Y)
Firewall Center Acceleration (Y)
Right Roof at Vertical Impact Reference Line Acceleration (Y)
Right Sill at Vertical Impact Reference Line Acceleration (Y)
Rear Floorpan Behind Rear Axle at Centerline Acceleration (X)
Rear Floorpan Behind Rear Axle at Centerline Acceleration (Y)
Driver Side Airbag Timing – Not Installed
Driver Side Curtain Airbag Timing – Not Installed
Load Cell Pole Barrier #1 Force (Y) – Not used
Load Cell Pole Barrier #2 Force (Y) – Not used
Load Cell Pole Barrier #3 Force (Y) – Not used
Load Cell Pole Barrier #4 Force (Y) – Not used
Load Cell Pole Barrier #5 Force (Y) – Not used
Load Cell Pole Barrier #6 Force (Y) – Not used
Load Cell Pole Barrier #7 Force (Y) – Not used
Load Cell Pole Barrier #8 Force (Y) – Not used



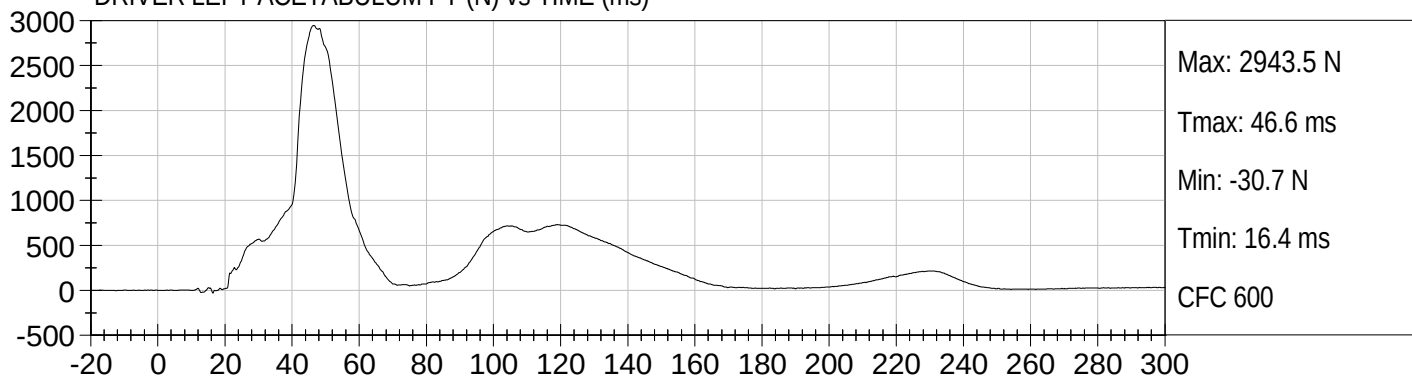




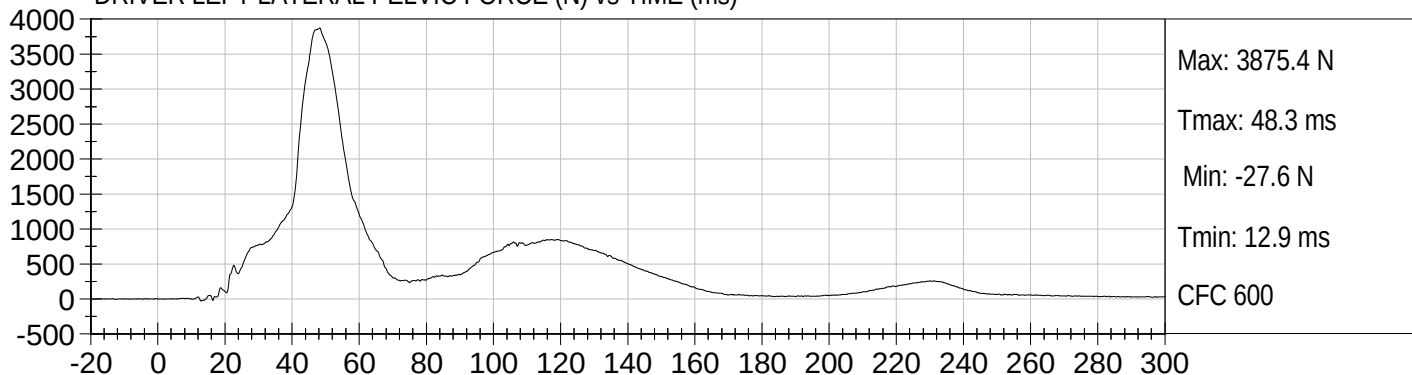
DRIVER LEFT ILLIUM CREST FY (N) vs TIME (ms)



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



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



APPENDIX C

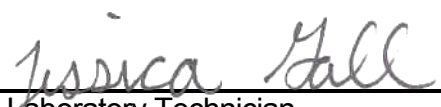
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

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

ATD Serial No: 296

Test ID: D112171

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	53	Pass
Peak Resultant Acceleration	G's	115 to 137	121	Pass
Peak Lateral Acceleration	G's	+/- 15	-5.3	Pass
Unimodal	N/A	<15%	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

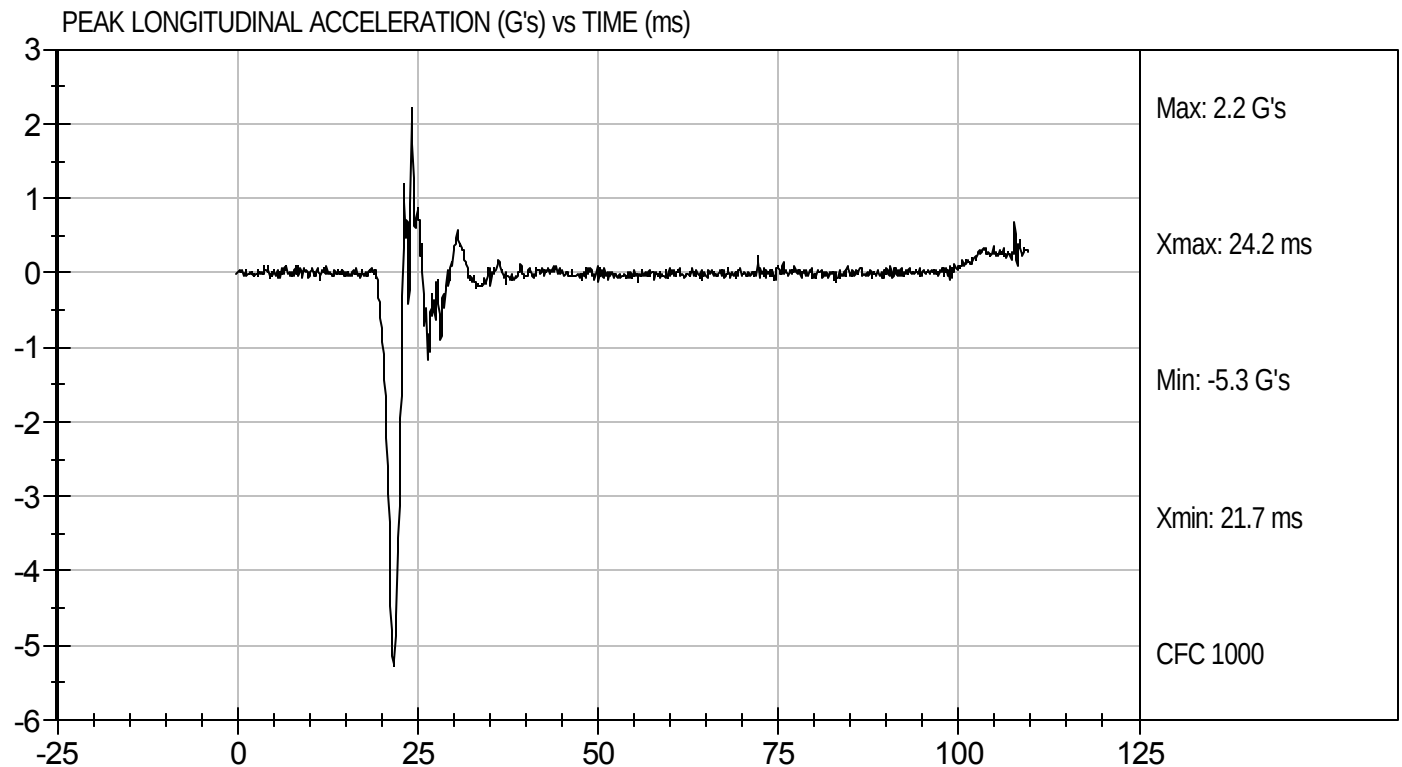
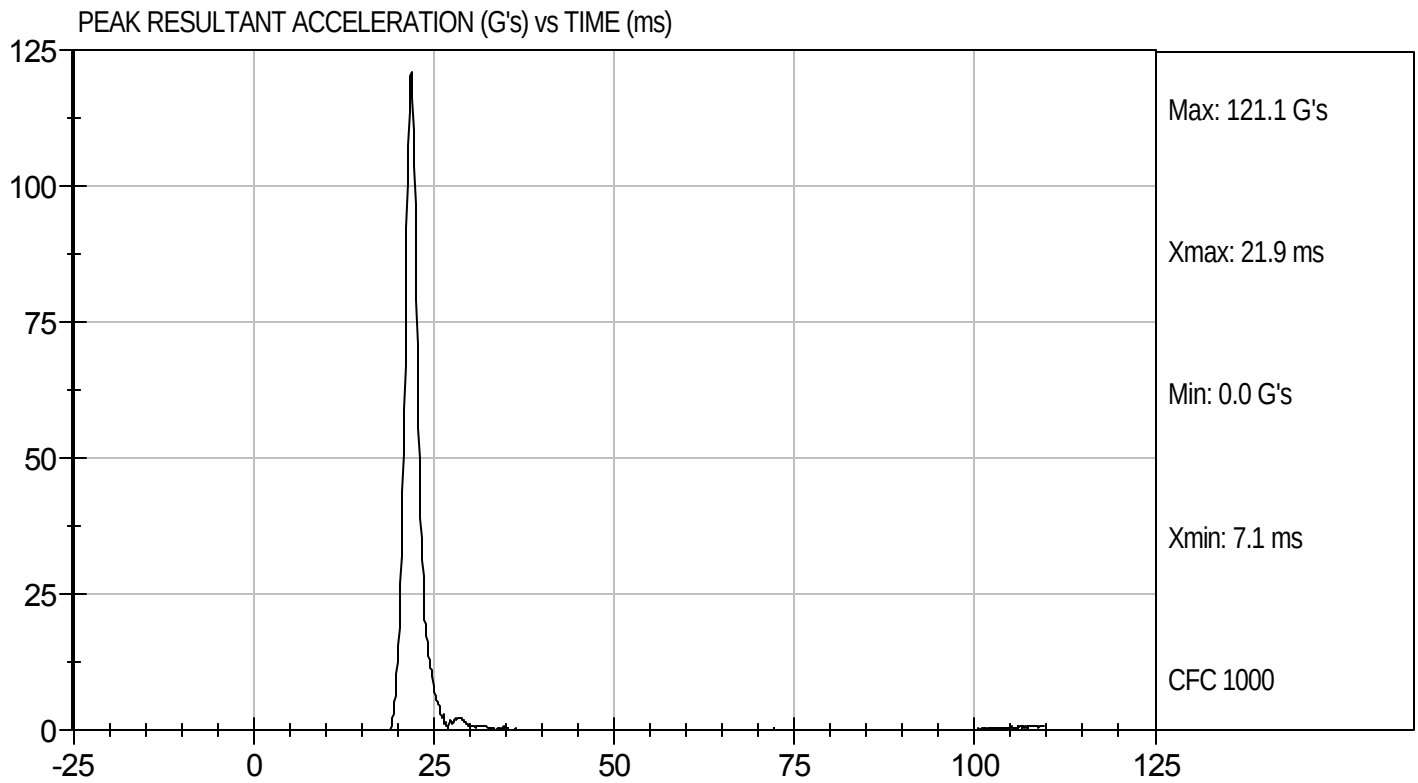
6/22/11
Test Date


Approved By



Test Desc: Head Drop
Component ID: D112171

Test Date: 6/22/11
Velocity: 0 ft/s, 0 m/s

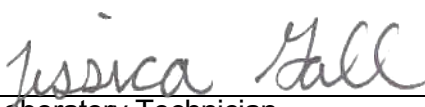


MGA RESEARCH CORPORATION
LATERAL NECK PENDULUM TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D112172

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	22.0	Pass
Humidity		%	10 to 70	58	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Delta Velocity	10 ms	m/s	2.20 to 2.80	2.68	Pass
	15 ms	m/s	3.30 to 4.10	3.79	Pass
	20 ms	m/s	4.40 to 5.40	4.92	Pass
	25 ms	m/s	5.40 to 6.10	5.54	Pass
	25-100 ms	m/s	5.50 to 6.20	5.54	Pass
Maximum D-Plane Rotation		deg	71 to 81	75	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	55	Pass
Maximum Occipital Condyle Moment during Rotation Interval Nm			-44 to -36	-43	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	114	Pass
Overall Test Results				Pass	


 Laboratory Technician

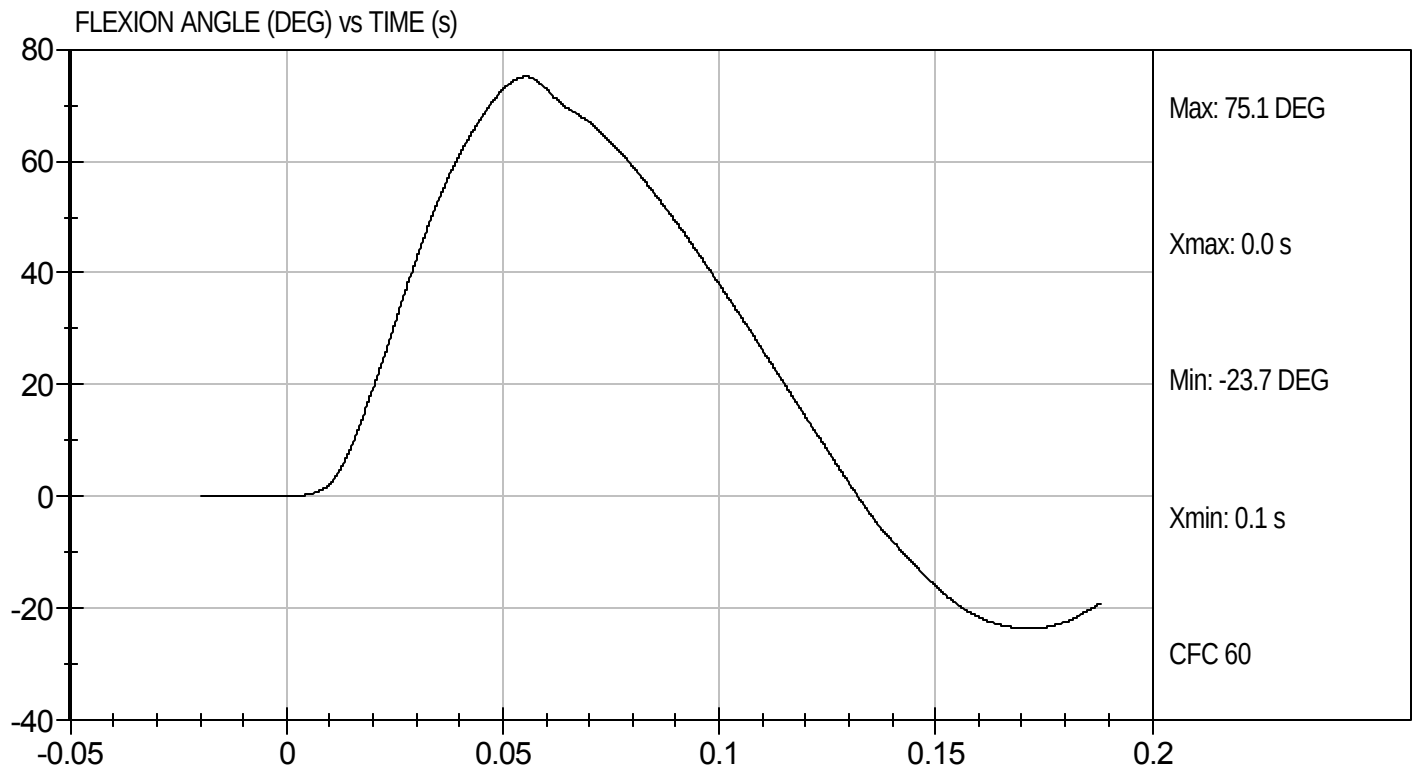
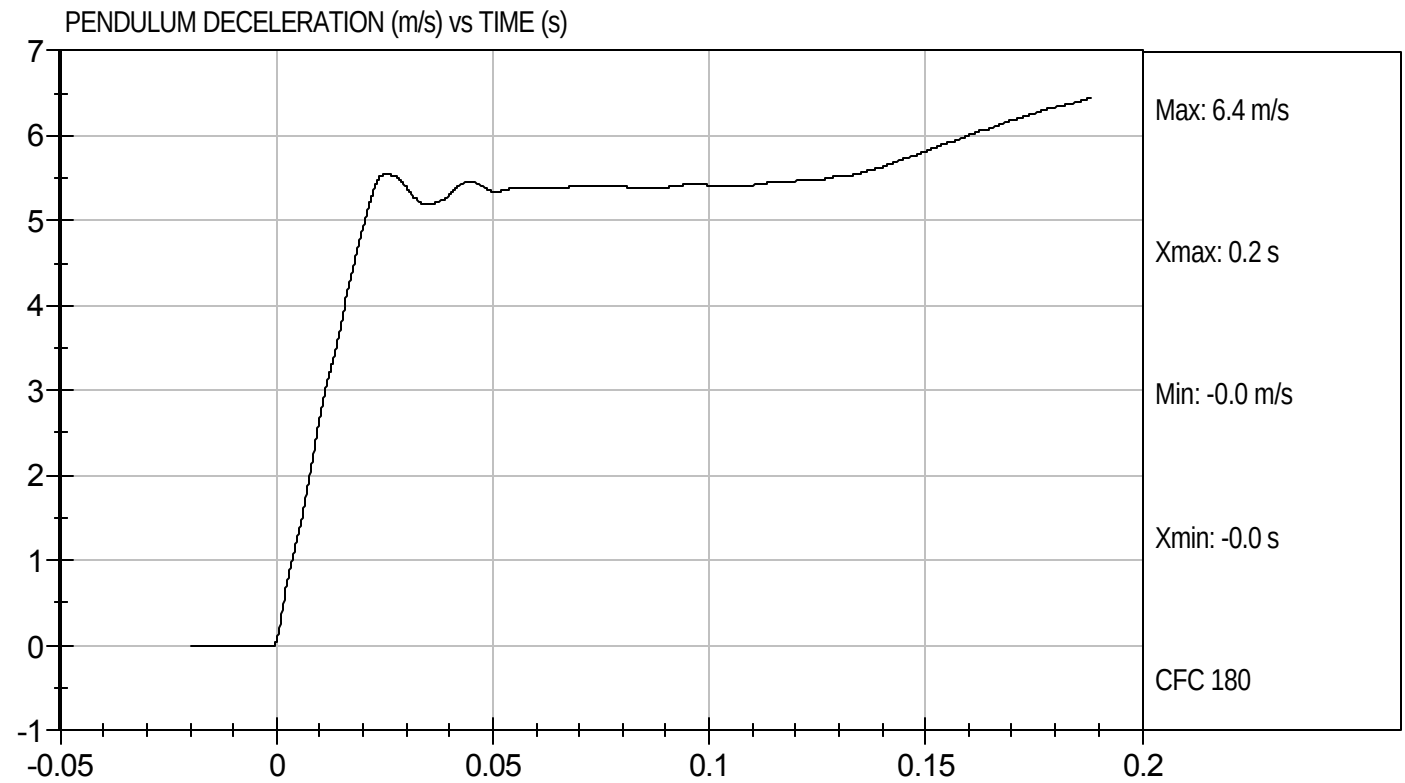
6/22/11
 Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D112172

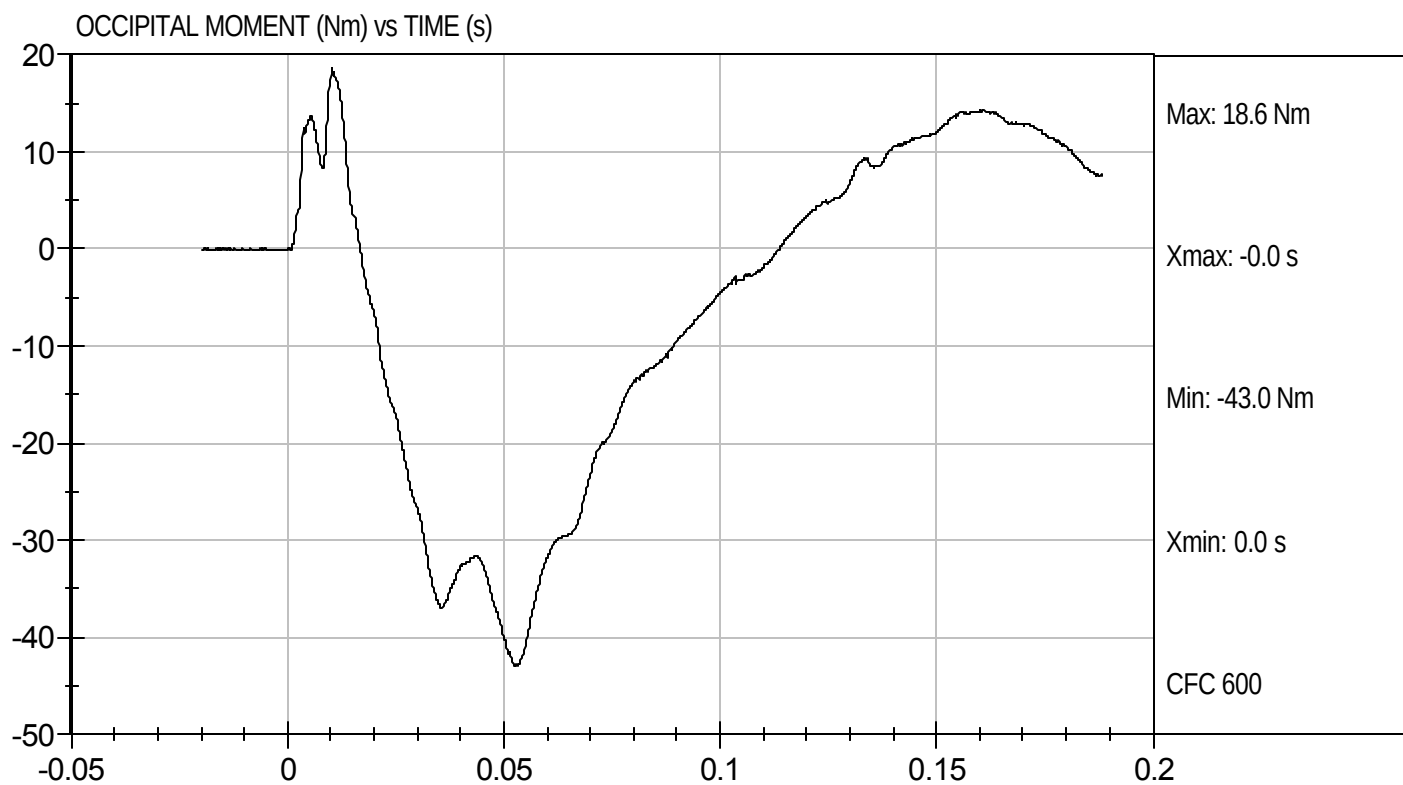
Test Date: 6/22/11
Velocity: 18.32 ft/s, 5.58 m/s





Test Desc: Neck Bending
Component ID: D112172

Test Date: 6/22/11
Velocity: 18.32 ft/s, 5.58 m/s



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
SID-11s BUILD LEVEL D DUMMY

ATD Serial No: 296

Test ID: D112173

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	53	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	13 to 18	14	Pass
Shoulder Displacement	mm	28 to 37	32	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	21	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

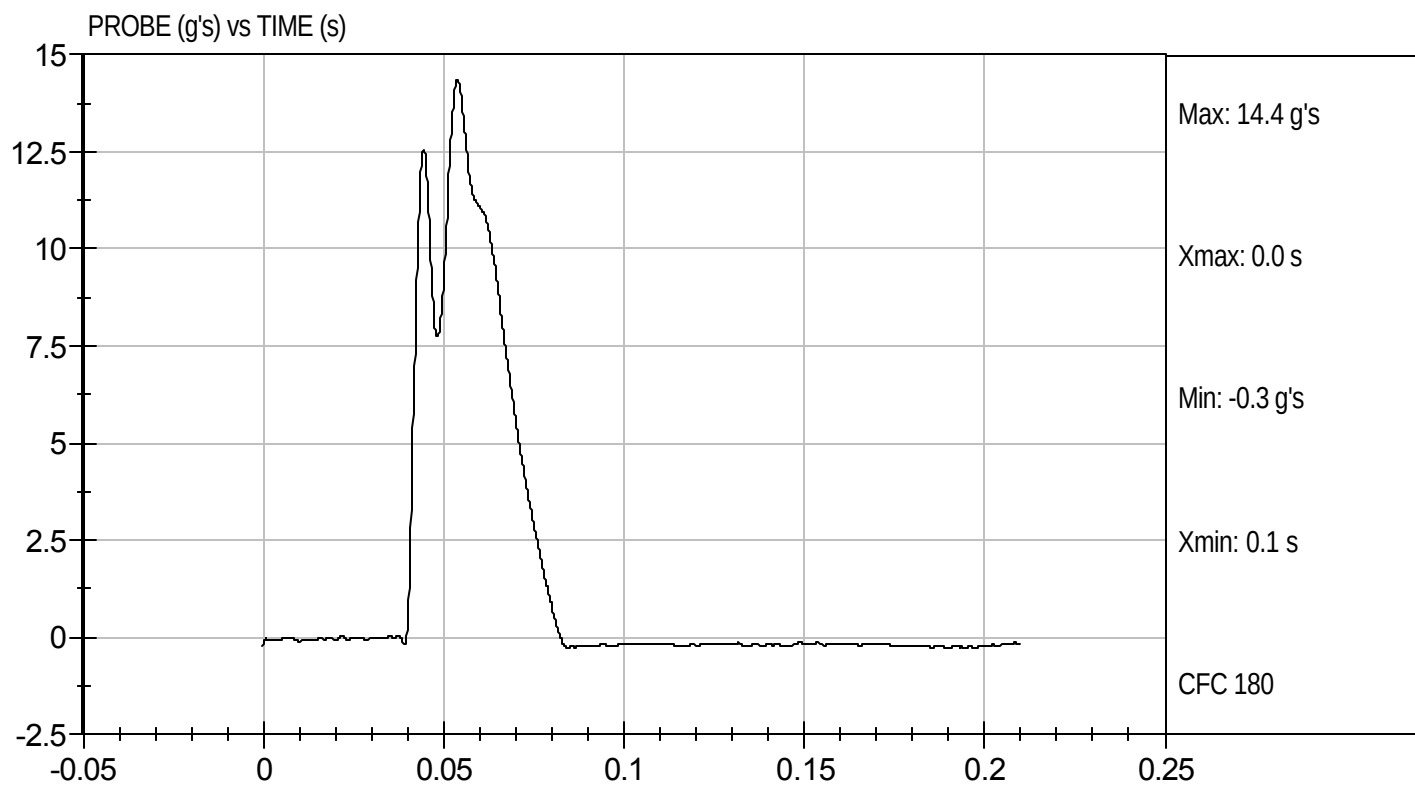
6/21/11
Test Date

David Winkelbauer
Approved By



Test Desc: Shoulder Impact
Component ID: D112173

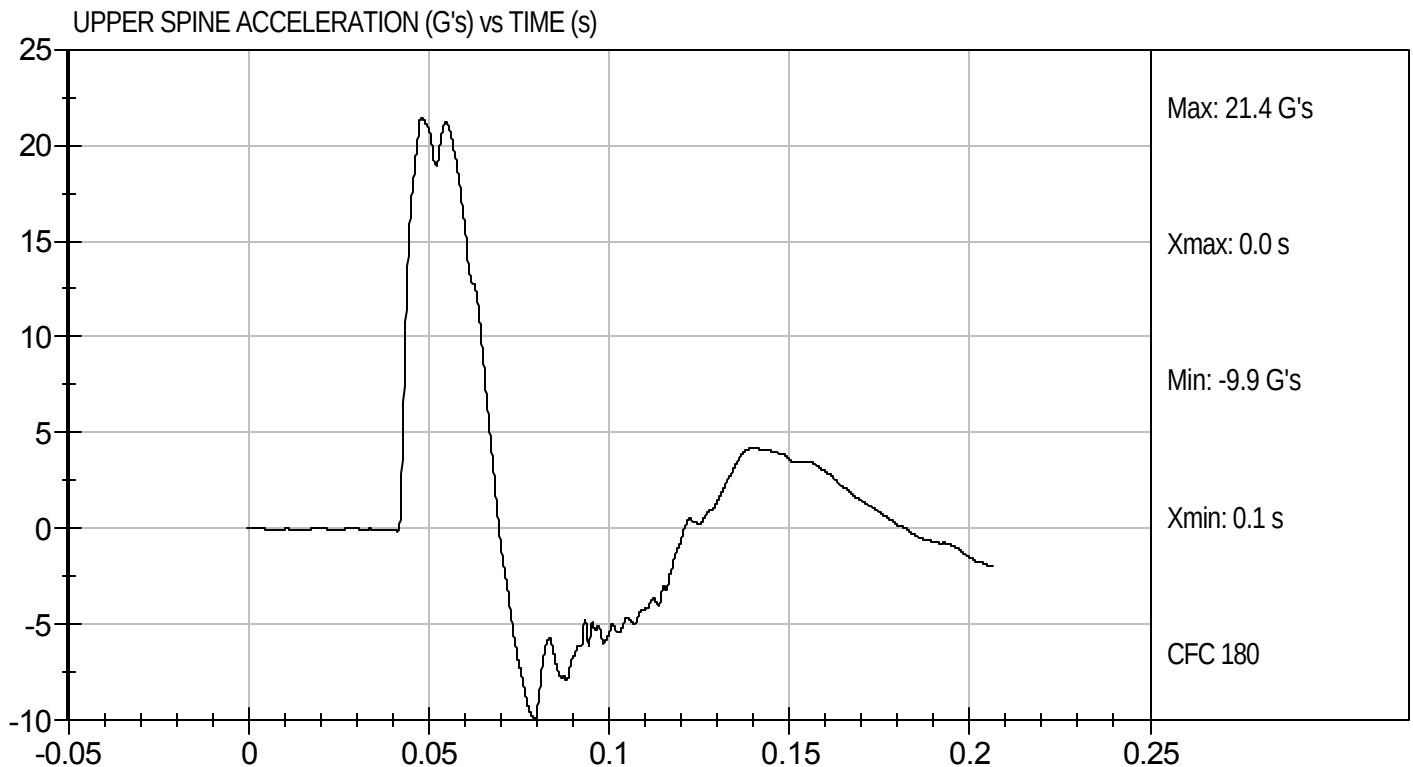
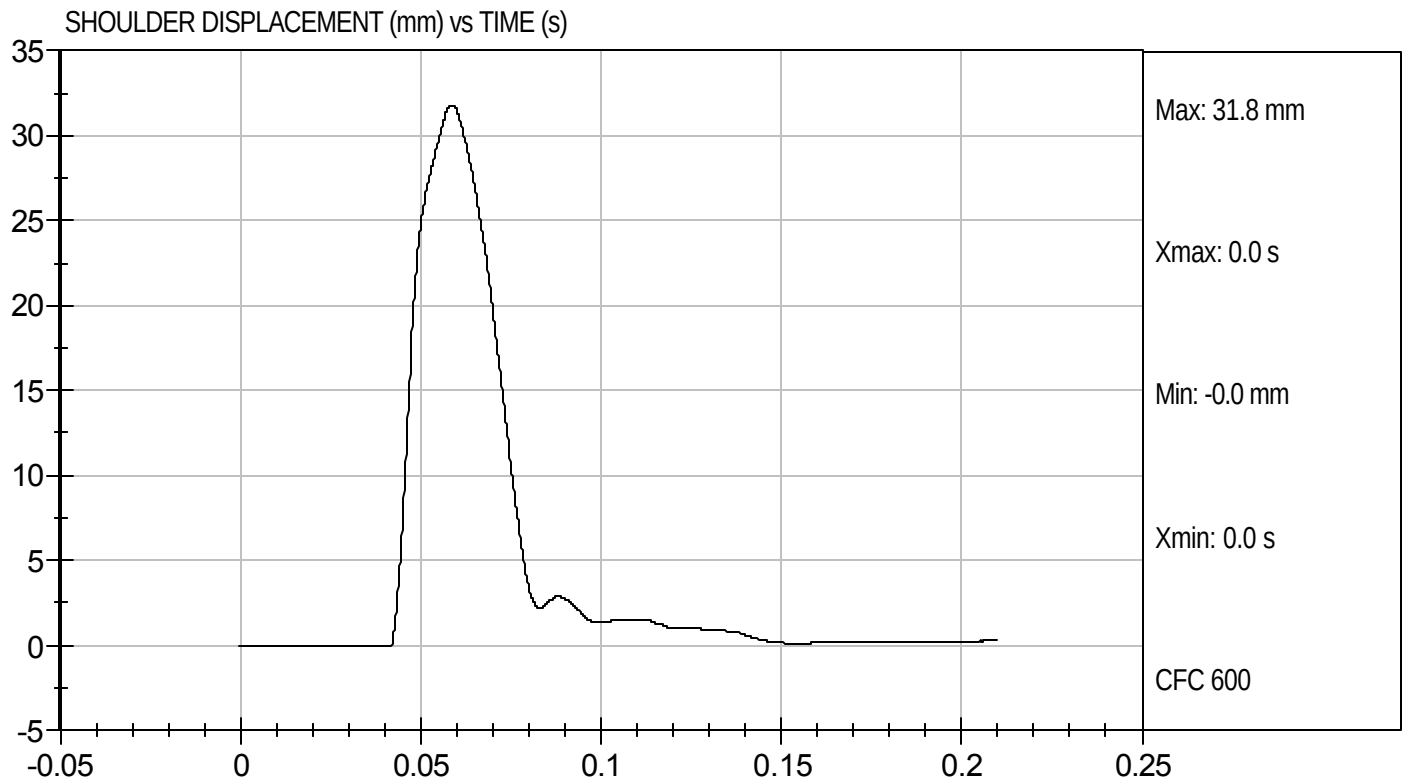
Test Date: 6/21/11
Velocity: 14.25 ft/s, 4.34 m/s





Test Desc: Shoulder Impact
Component ID: D112173

Test Date: 6/21/11
Velocity: 14.25 ft/s, 4.34 m/s

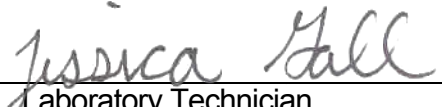


MGA RESEARCH CORPORATION
THORAX (WITH ARM) IMPACT TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D112174

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	53	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Peak Impactor Acceleration	G's	30 to 36	30	Pass
Shoulder Displacement	mm	31 to 40	38	Pass
Upper Rib Displacement	mm	25 to 32	28	Pass
Middle Rib Displacement	mm	30 to 36	32	Pass
Lower Rib Displacement	mm	32 to 38	33	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	36	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	33	Pass
Overall Test Results			Pass	


Laboratory Technician

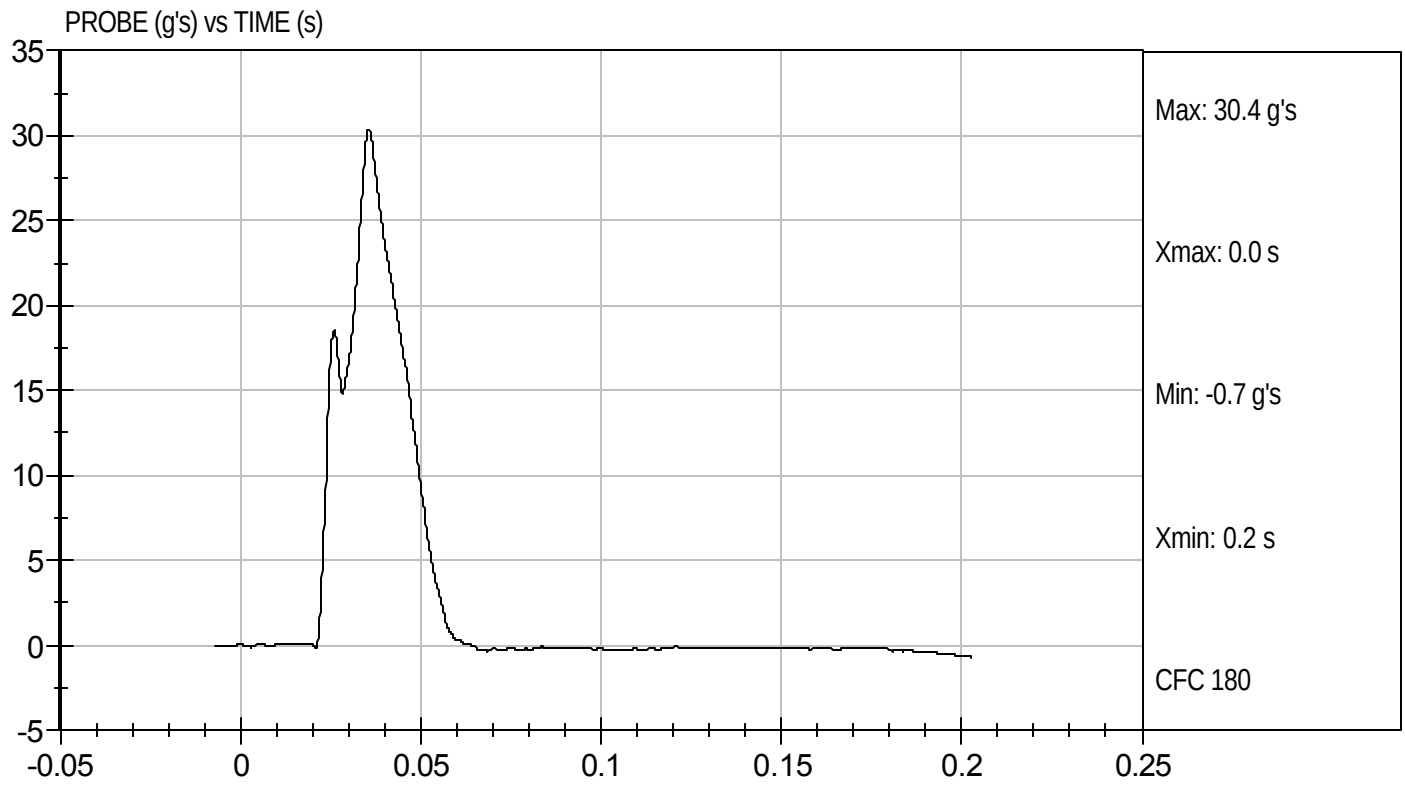
6/21/11
Test Date


Approved By



Test Desc: Thorax With Arm
Component ID: D112174

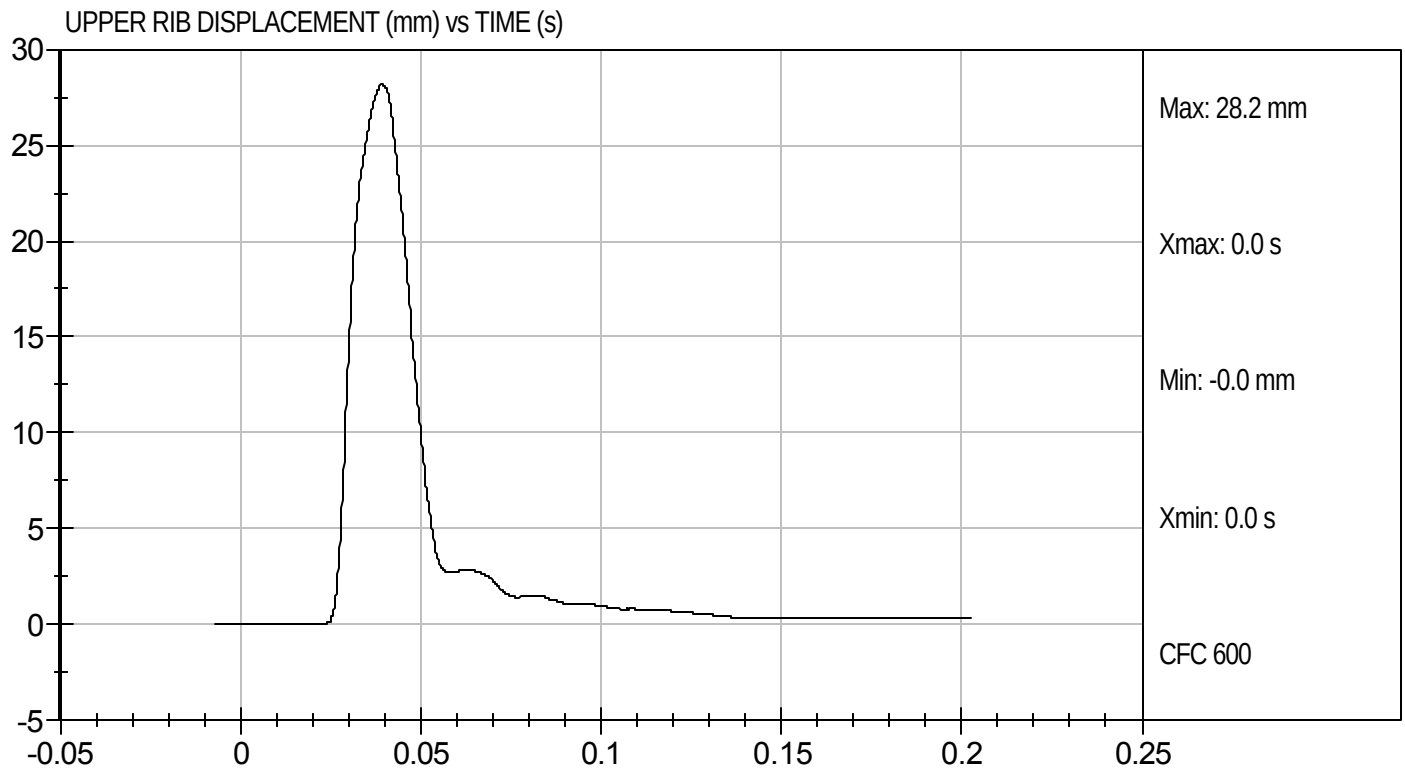
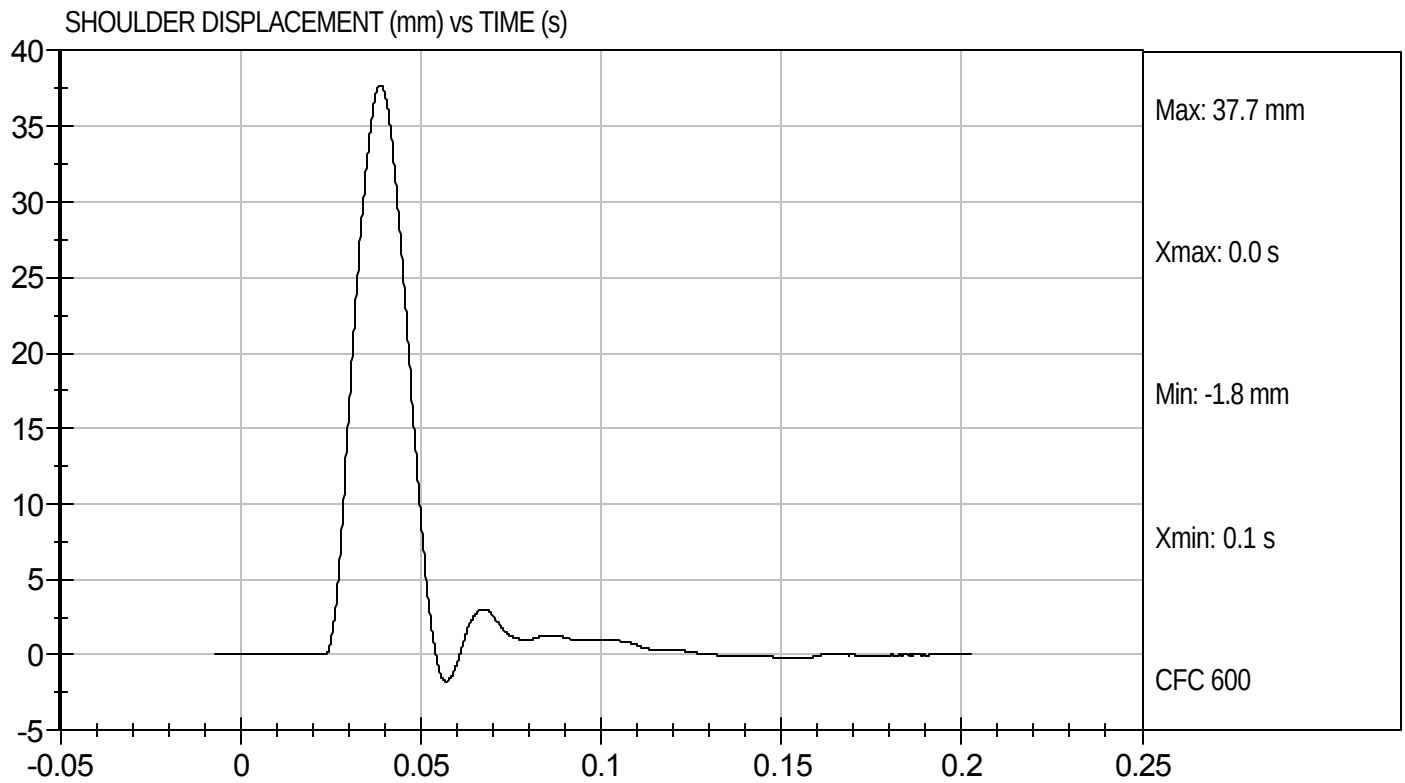
Test Date: 6/21/11
Velocity: 22.2 ft/s, 6.77 m/s





Test Desc: Thorax With Arm
Component ID: D112174

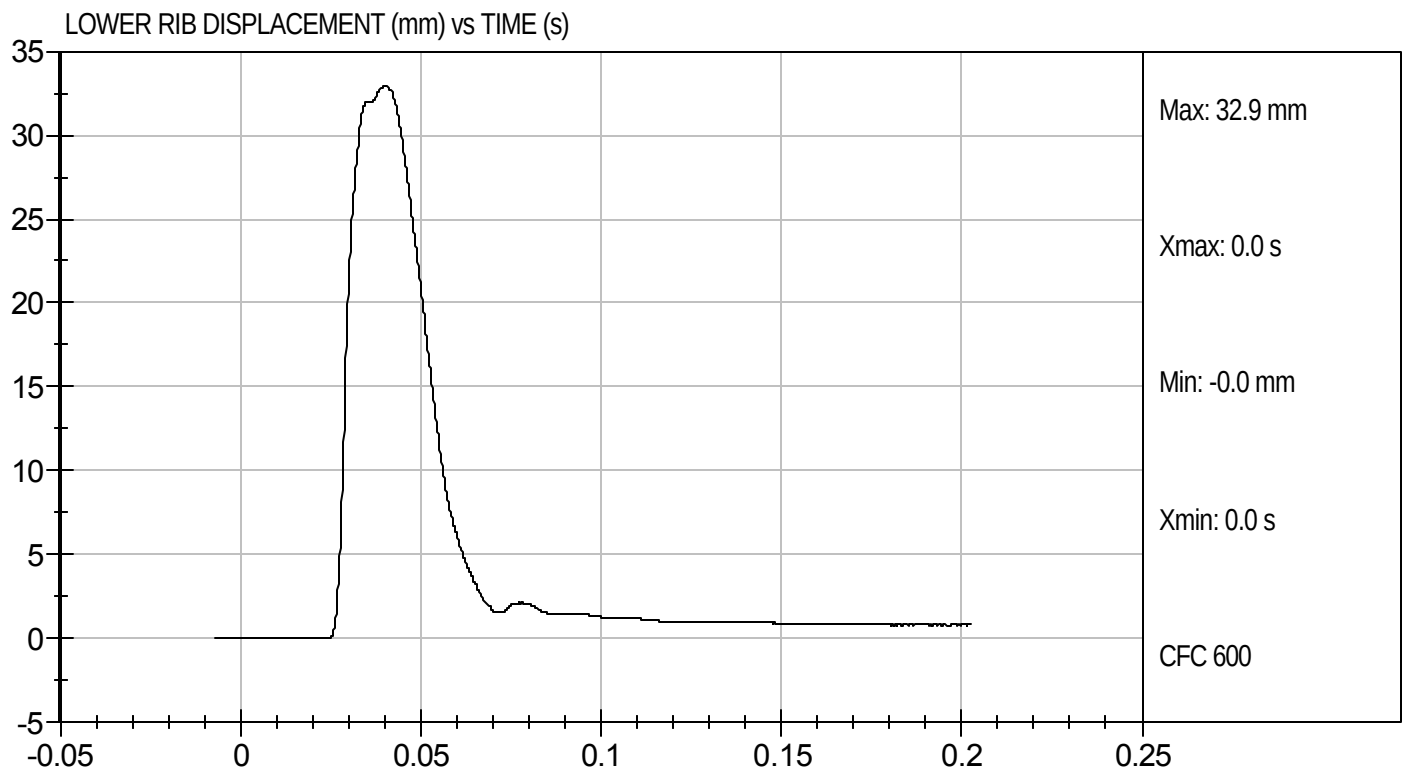
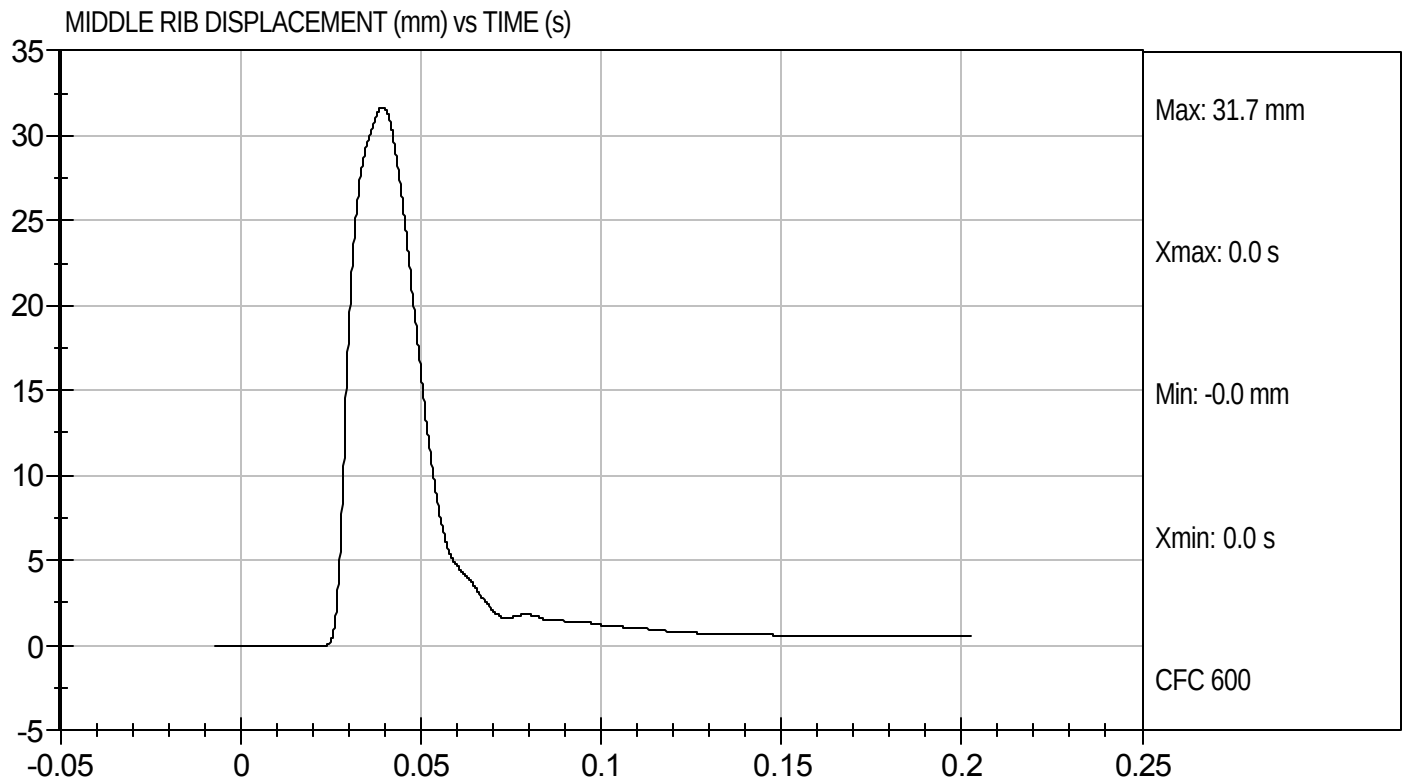
Test Date: 6/21/11
Velocity: 22.2 ft/s, 6.77 m/s





Test Desc: Thorax With Arm
Component ID: D112174

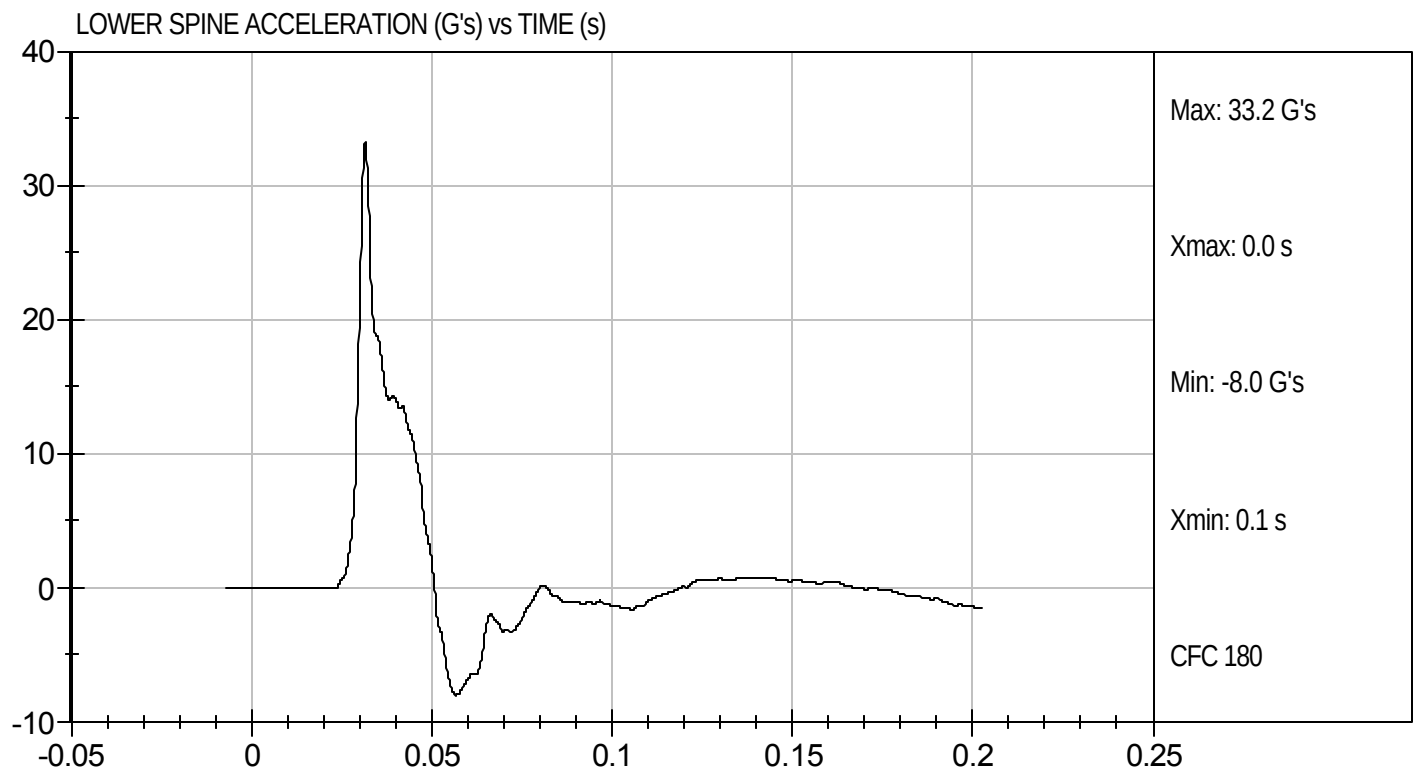
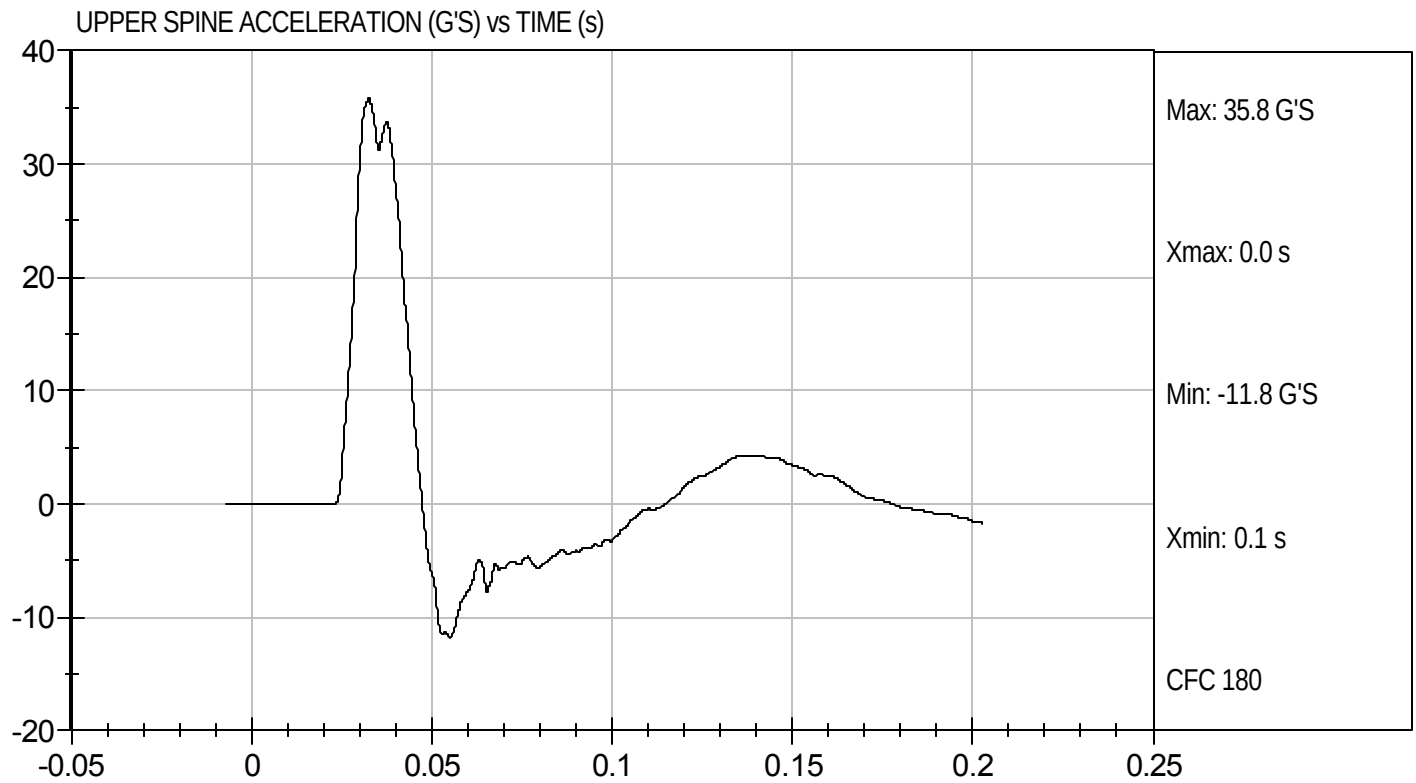
Test Date: 6/21/11
Velocity: 22.2 ft/s, 6.77 m/s





Test Desc: Thorax With Arm
Component ID: D112174

Test Date: 6/21/11
Velocity: 22.2 ft/s, 6.77 m/s



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

ATD Serial No: 296

Test I.D: D112175

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	53	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor Force	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	39	Pass
Middle Rib Displacement	mm	39 to 45	43	Pass
Lower Rib Displacement	mm	35 to 43	40	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
Overall Test Results			Pass	


Laboratory Technician

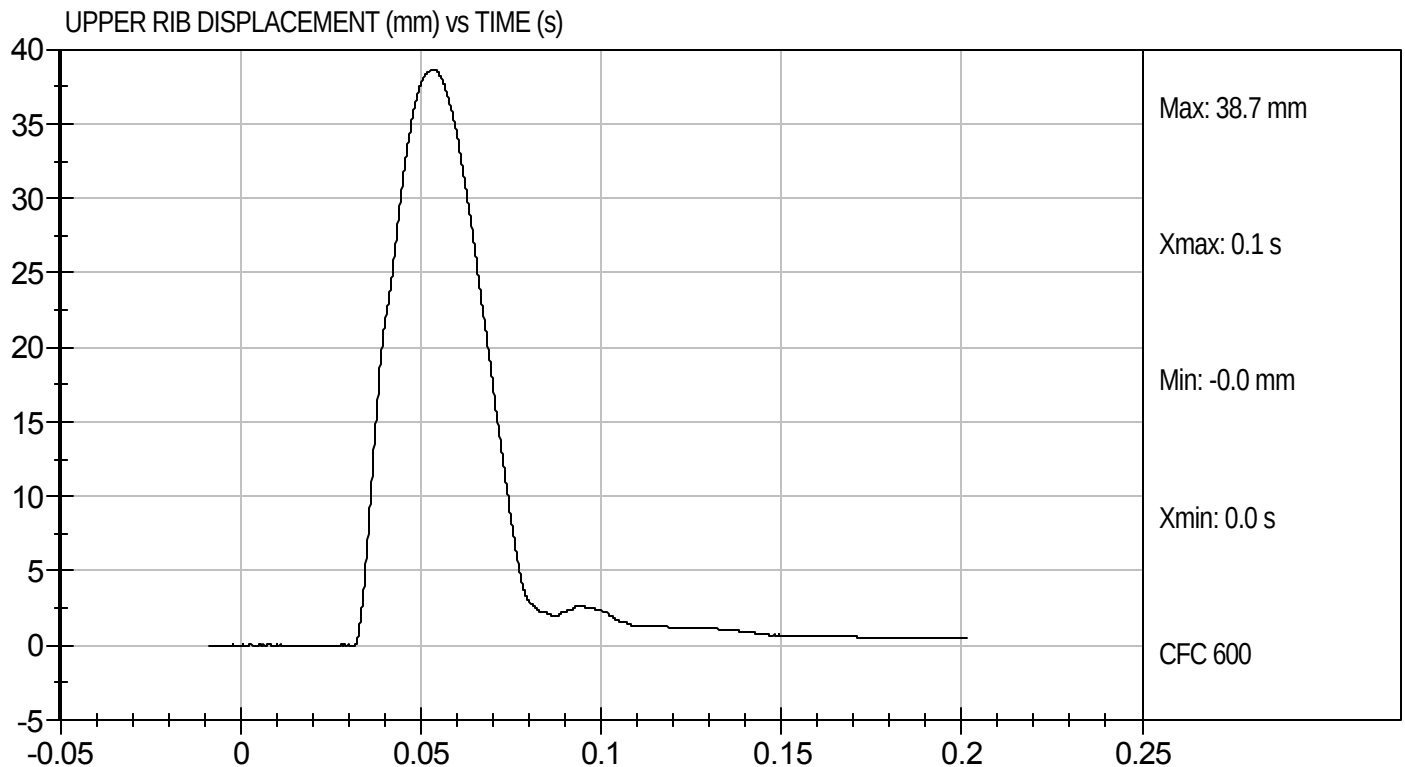
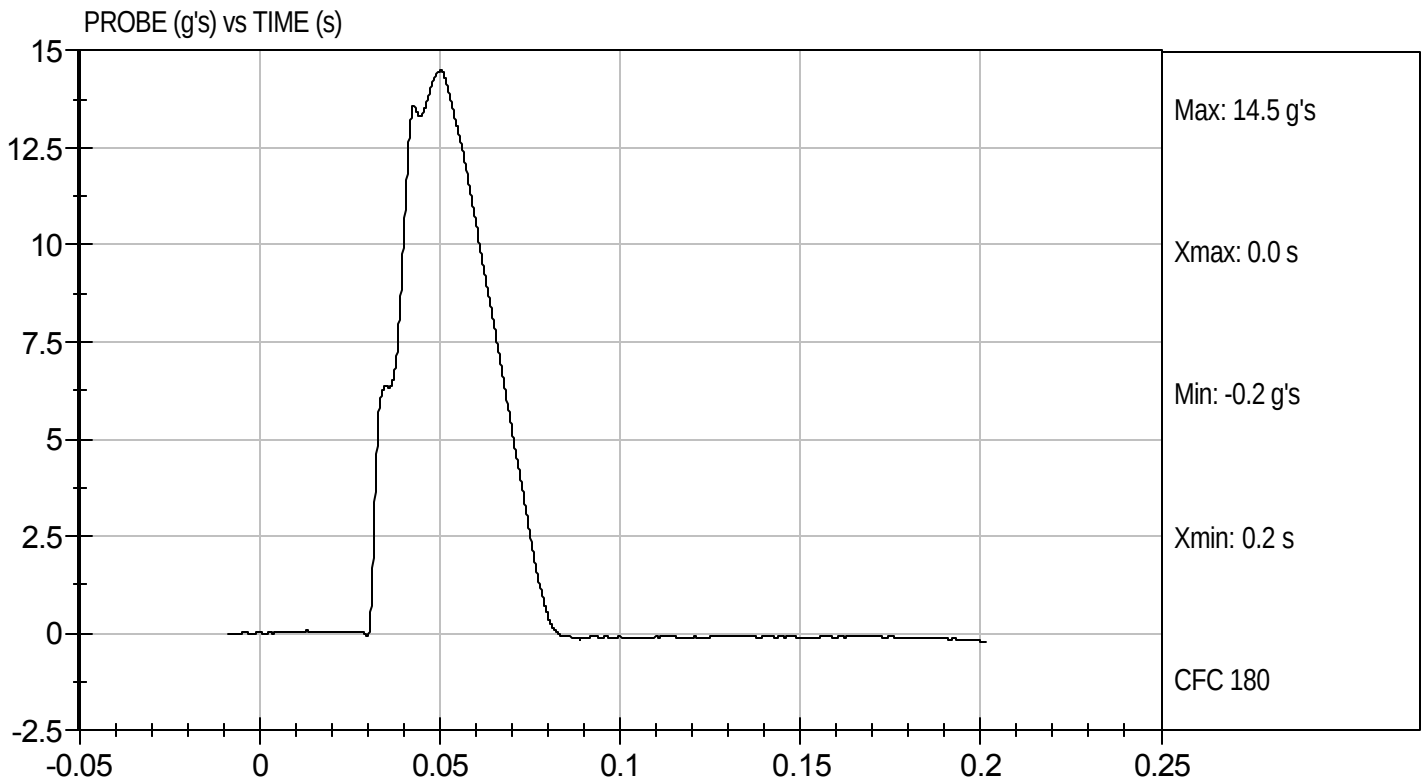
6/21/11
Test Date


Approved By



Test Desc: Thorax Without Arm
Component ID: D112175

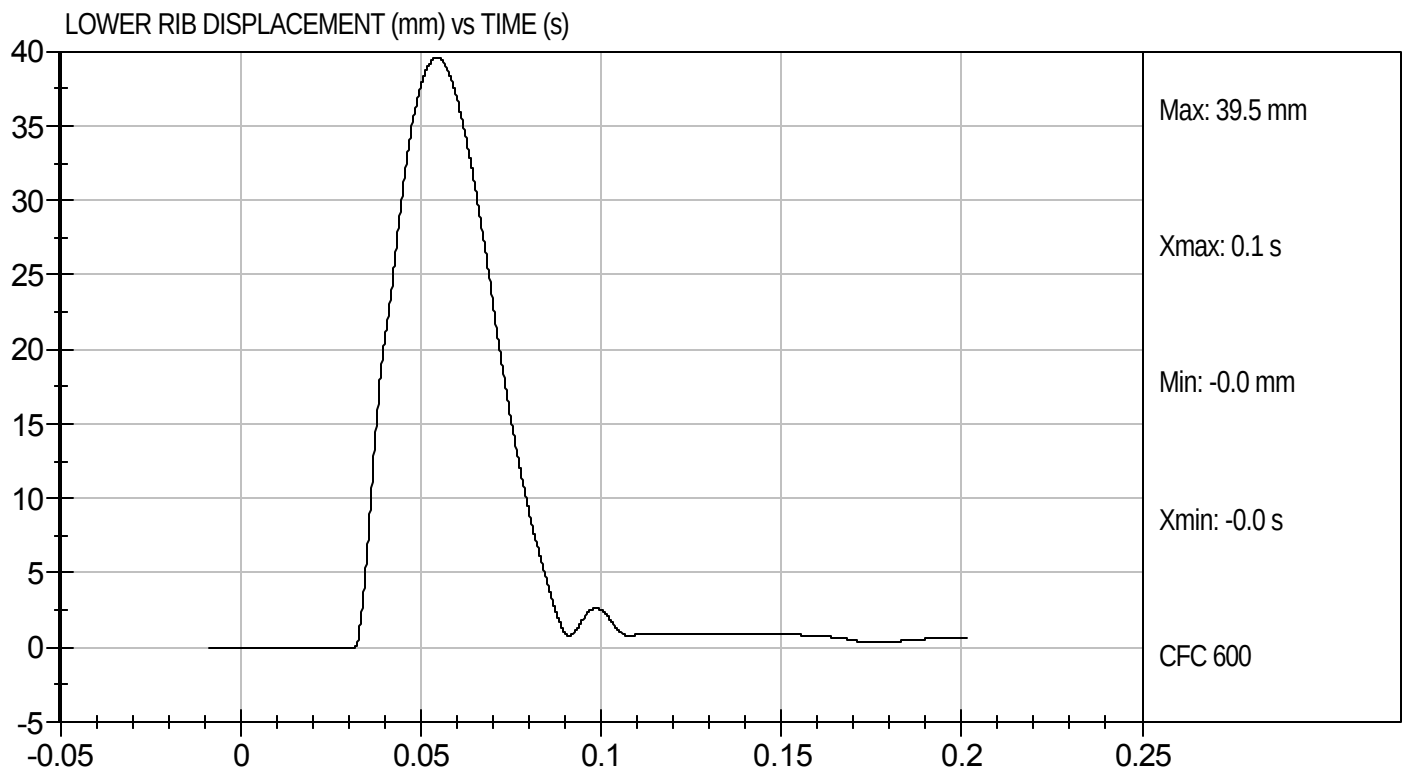
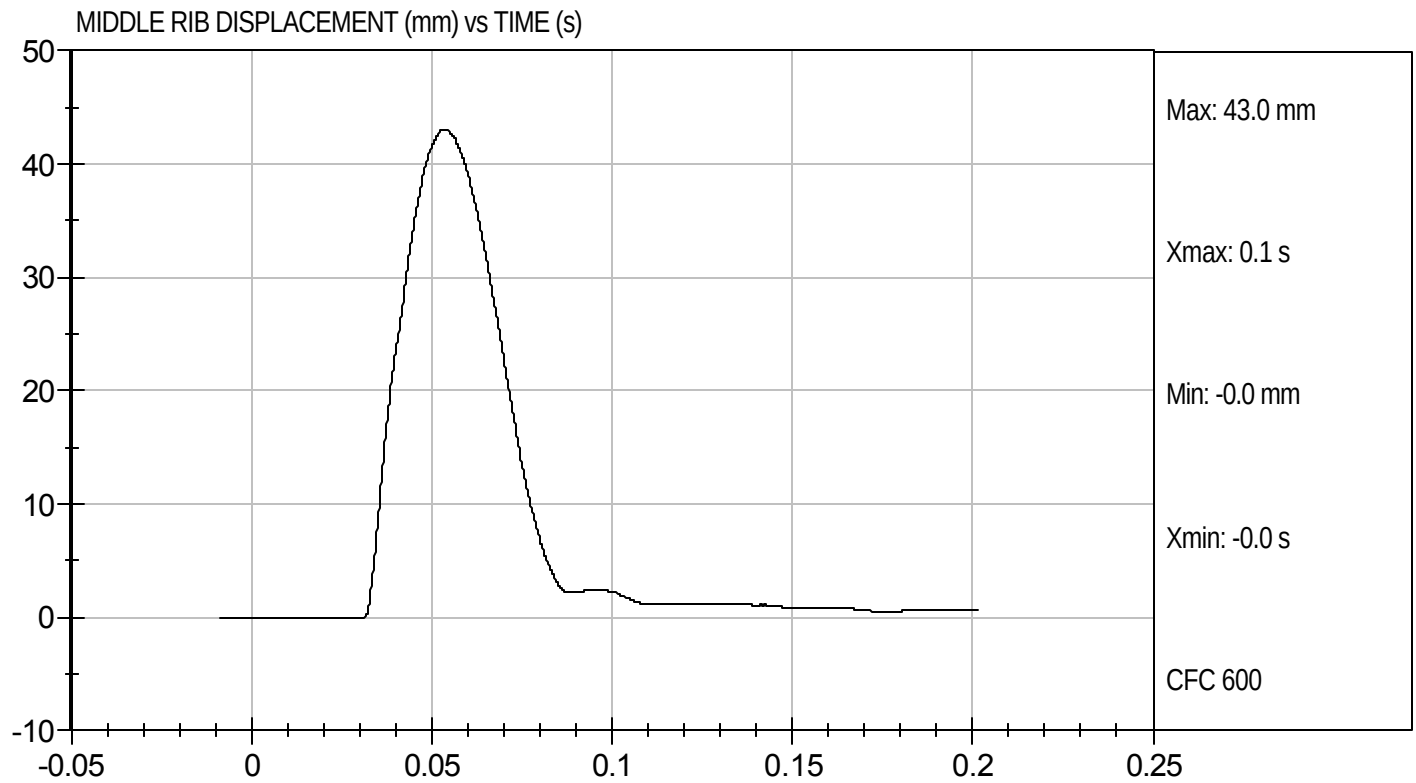
Test Date: 6/21/11
Velocity: 14.36 ft/s, 4.38 m/s





Test Desc: Thorax Without Arm
Component ID: D112175

Test Date: 6/21/11
Velocity: 14.36 ft/s, 4.38 m/s

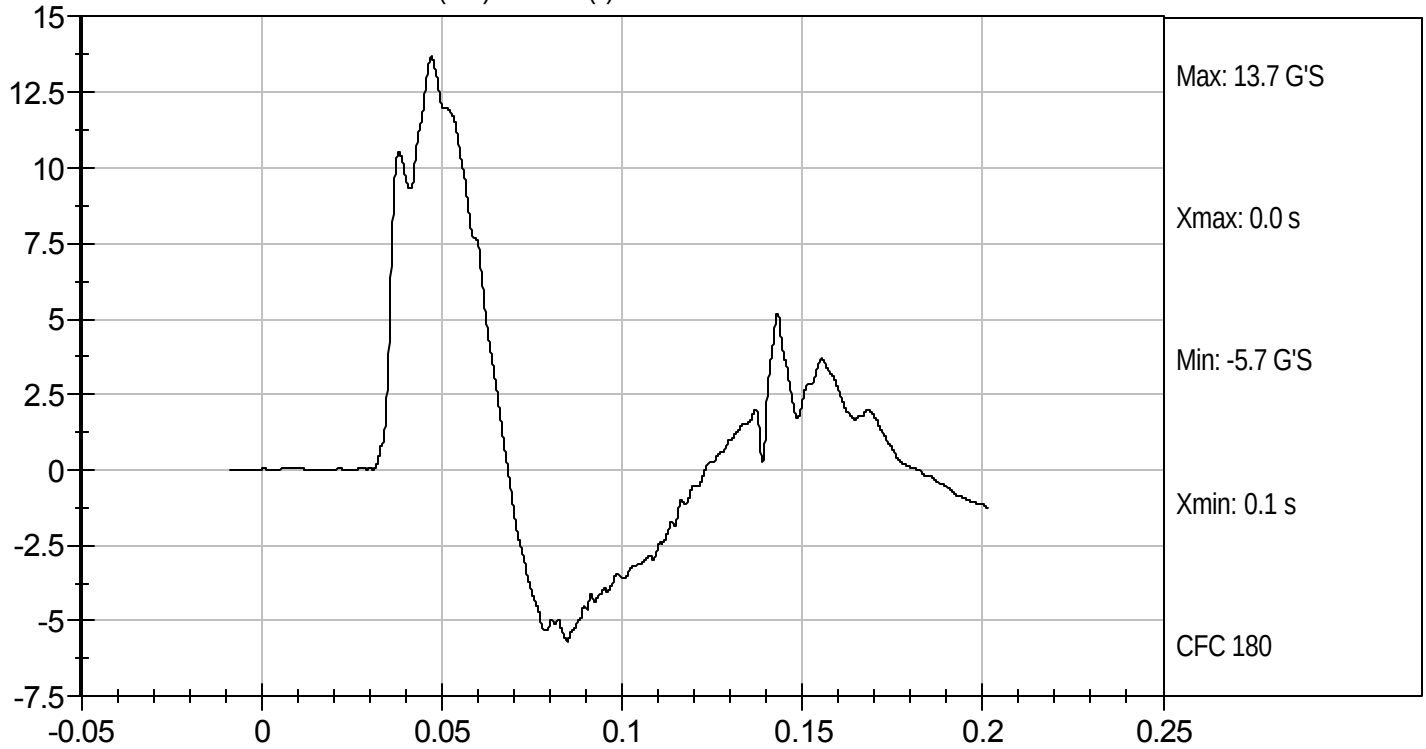




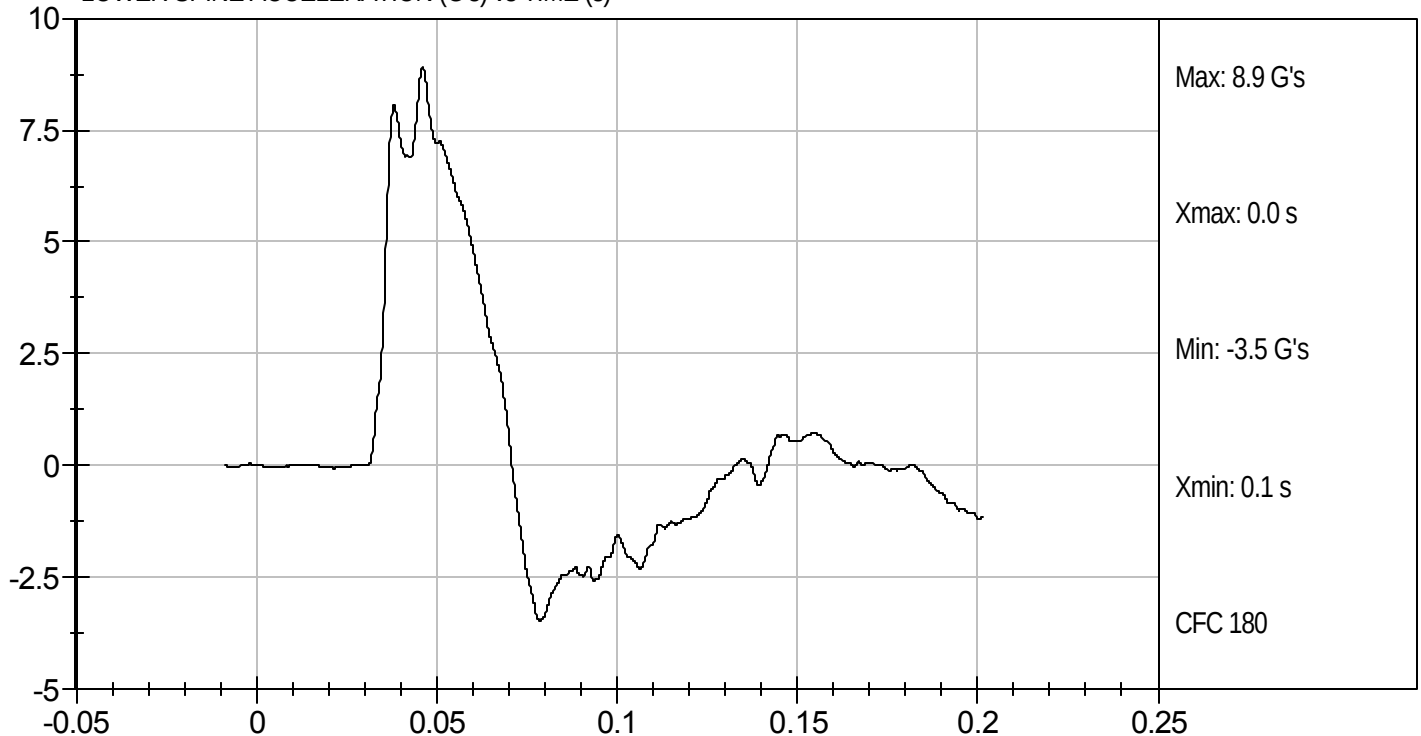
Test Desc: Thorax Without Arm
Component ID: D112175

Test Date: 6/21/11
Velocity: 14.36 ft/s, 4.38 m/s

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



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



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

ATD Serial No: 296

Test I.D: D112176

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	53	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor Acceleration	G's	12 to 16	14	Pass
Upper Rib Displacement	mm	36 to 47	39	Pass
Lower Rib Displacement	mm	33 to 44	42	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	10	Pass
Overall Test Results			Pass	


Laboratory Technician

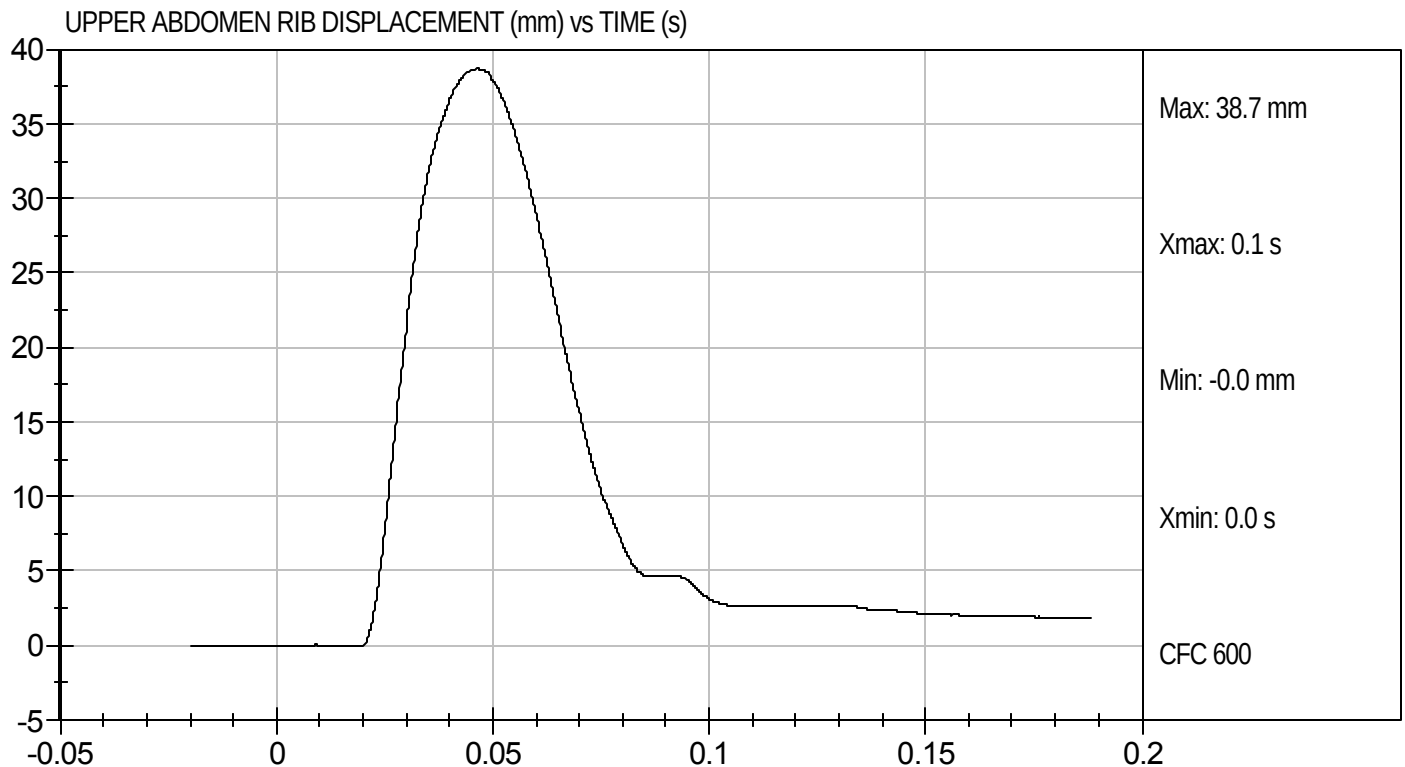
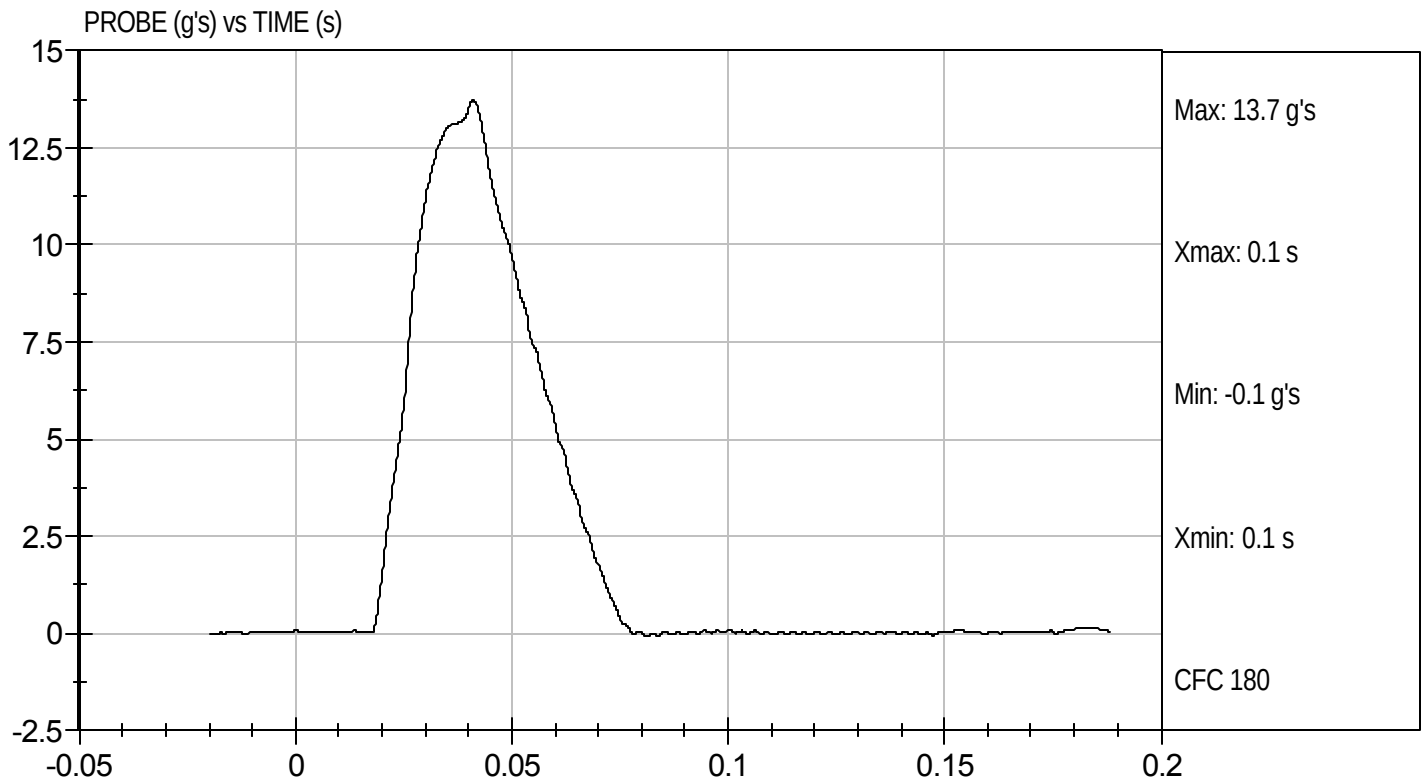
6/21/11
Test Date


Approved By



Test Desc: Abdomen Impact
Component ID: D112176

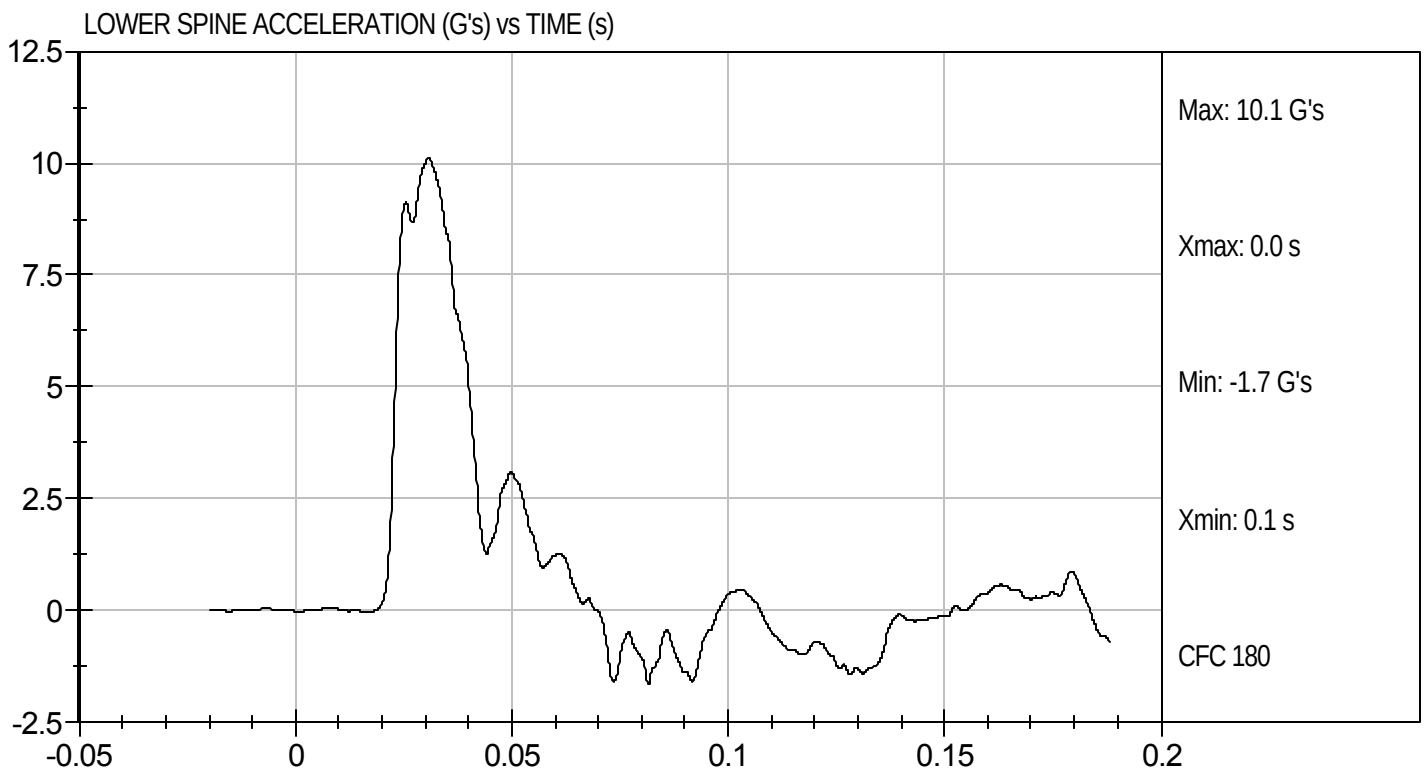
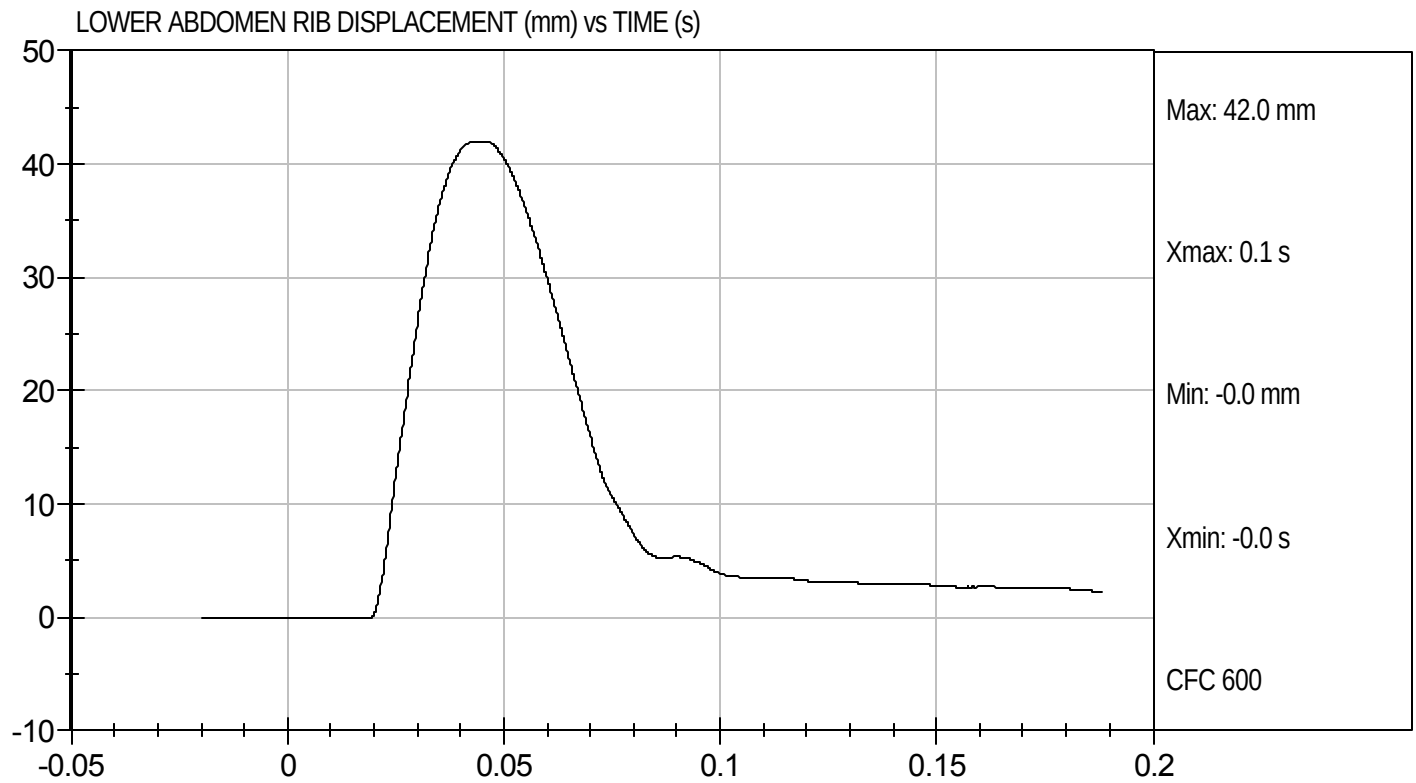
Test Date: 6/21/11
Velocity: 14.36 ft/s, 4.38 m/s





Test Desc: Abdomen Impact
Component ID: D112176

Test Date: 6/21/11
Velocity: 14.36 ft/s, 4.38 m/s



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

ATD Serial No: 296

Test I.D: D112177

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	53	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Peak Impactor Acceleration	G's	38 to 47	42	Pass
Pelvis Y Acceleration after 6 ms	G's	34 to 42	40	Pass
Peak Acetabulum Force	N	3600 to 4300	3897	Pass
Overall Test Results				Pass


Laboratory Technician

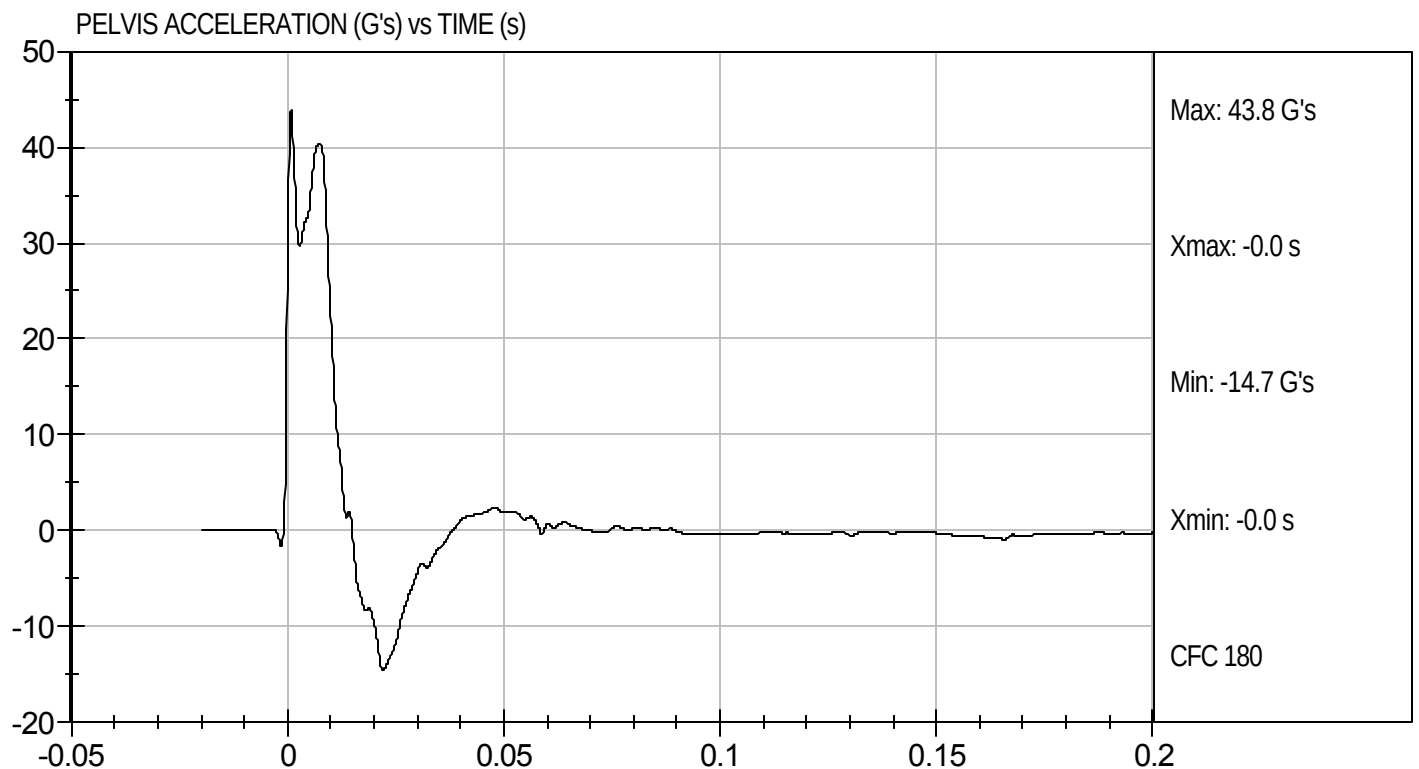
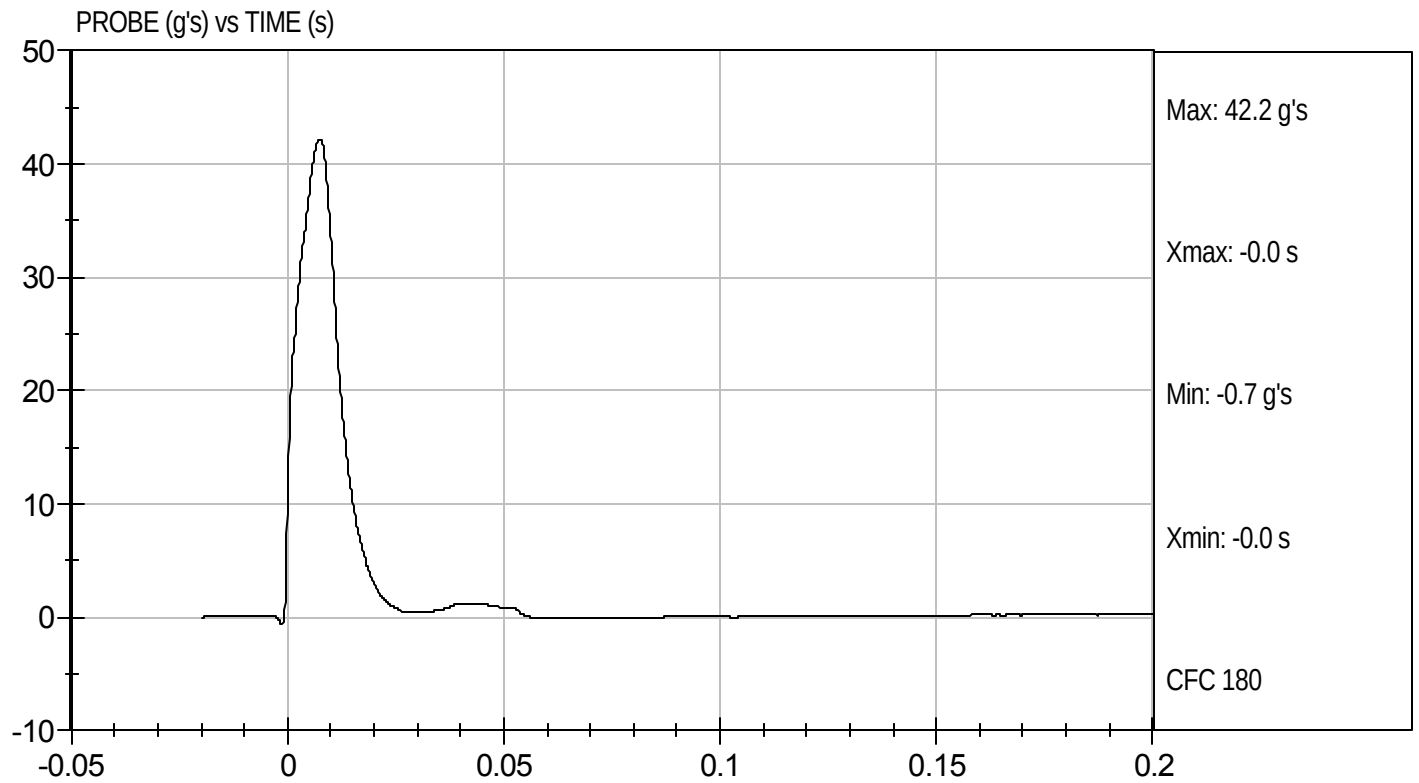
6/21/11
Test Date


Approved By



Test Desc: Pelvis Impact
Component ID: D112177

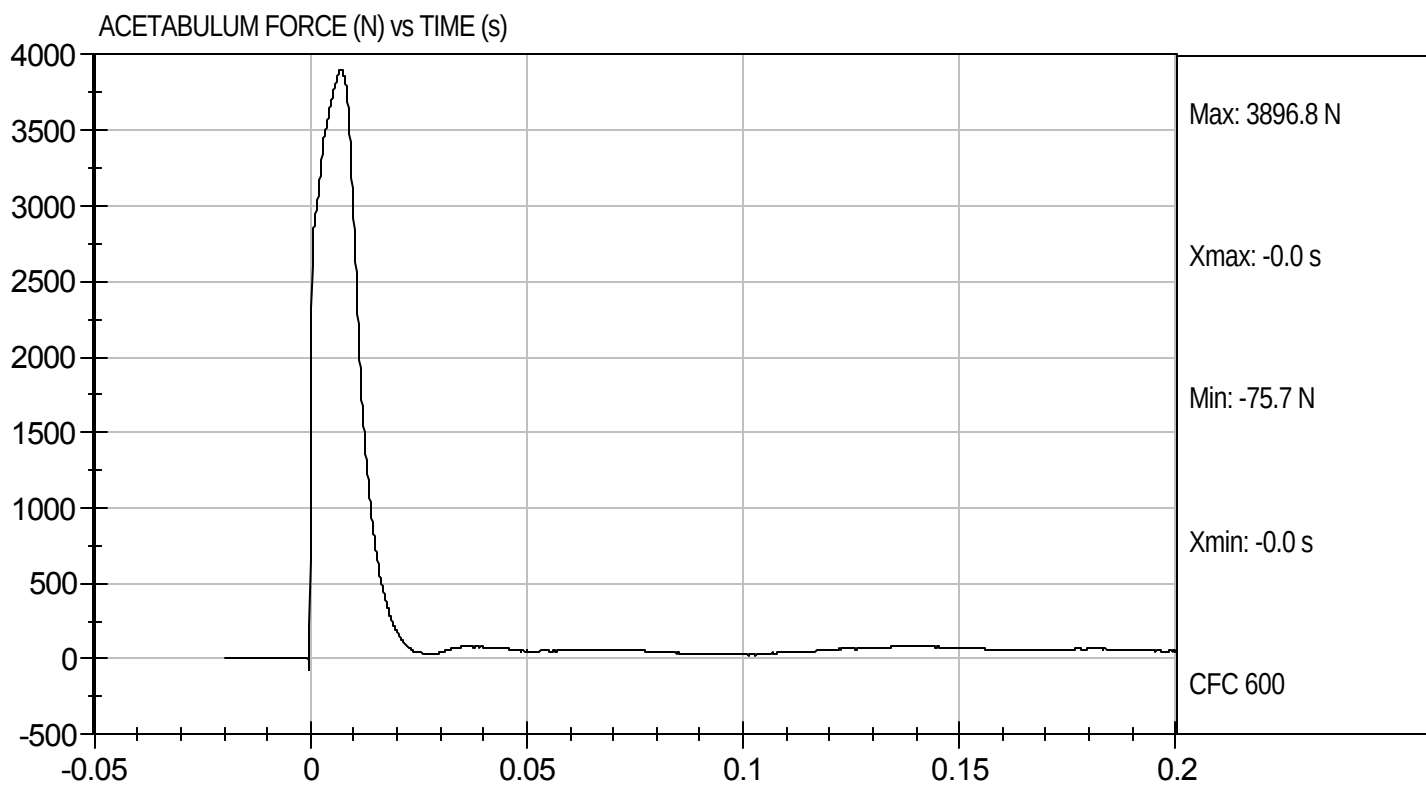
Test Date: 6/21/11
Velocity: 22.2 ft/s, 6.77 m/s





Test Desc: Pelvis Impact
Component ID: D112177

Test Date: 6/21/11
Velocity: 22.2 ft/s, 6.77 m/s



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

ATD Serial No: 296

Test I.D: D112178

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	53	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor Acceleration	G's	36 to 45	37	Pass
Pelvis Y Acceleration	G's	28 to 39	31	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4773	Pass
Overall Test Results			Pass	


Laboratory Technician

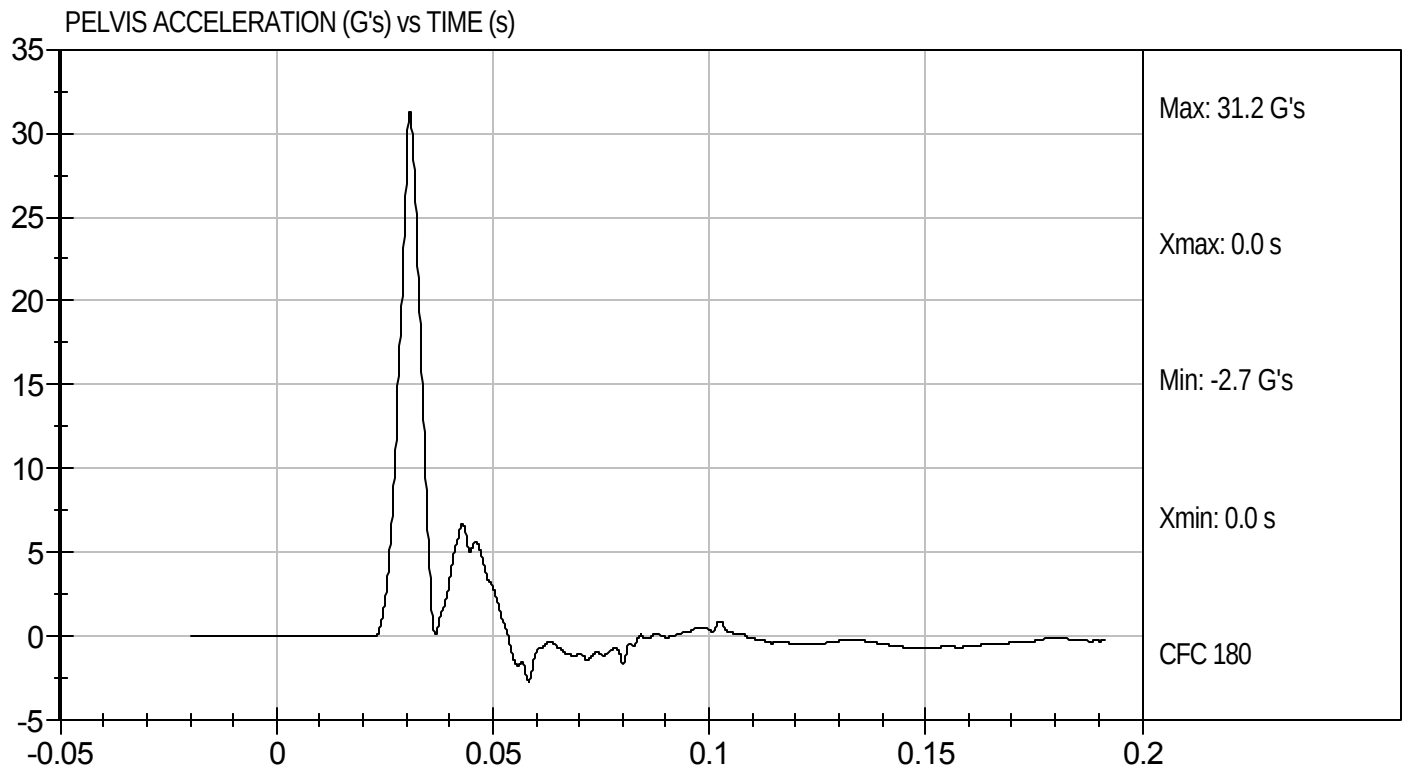
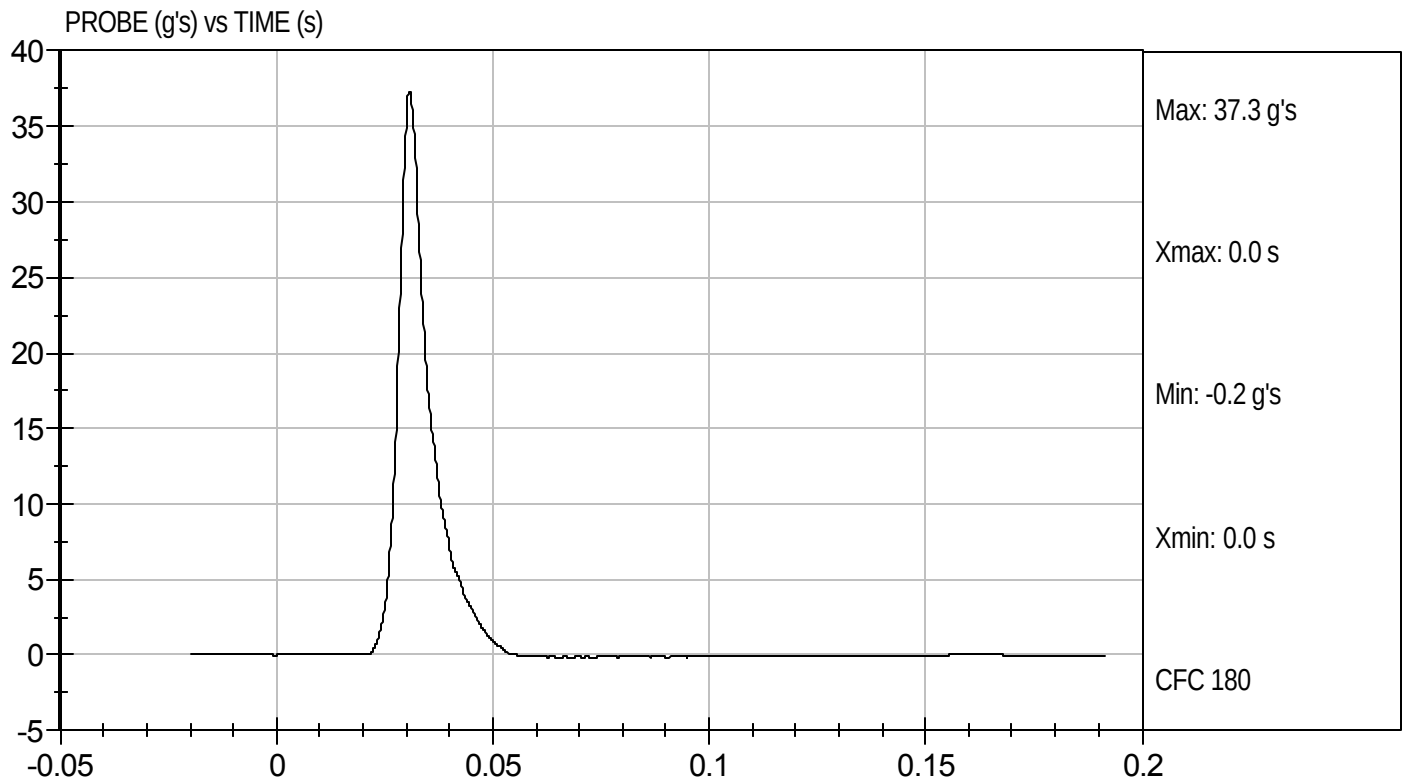
6/21/11
Test Date


Approved By



Test Desc: Iliac Impact
Component ID: D112178

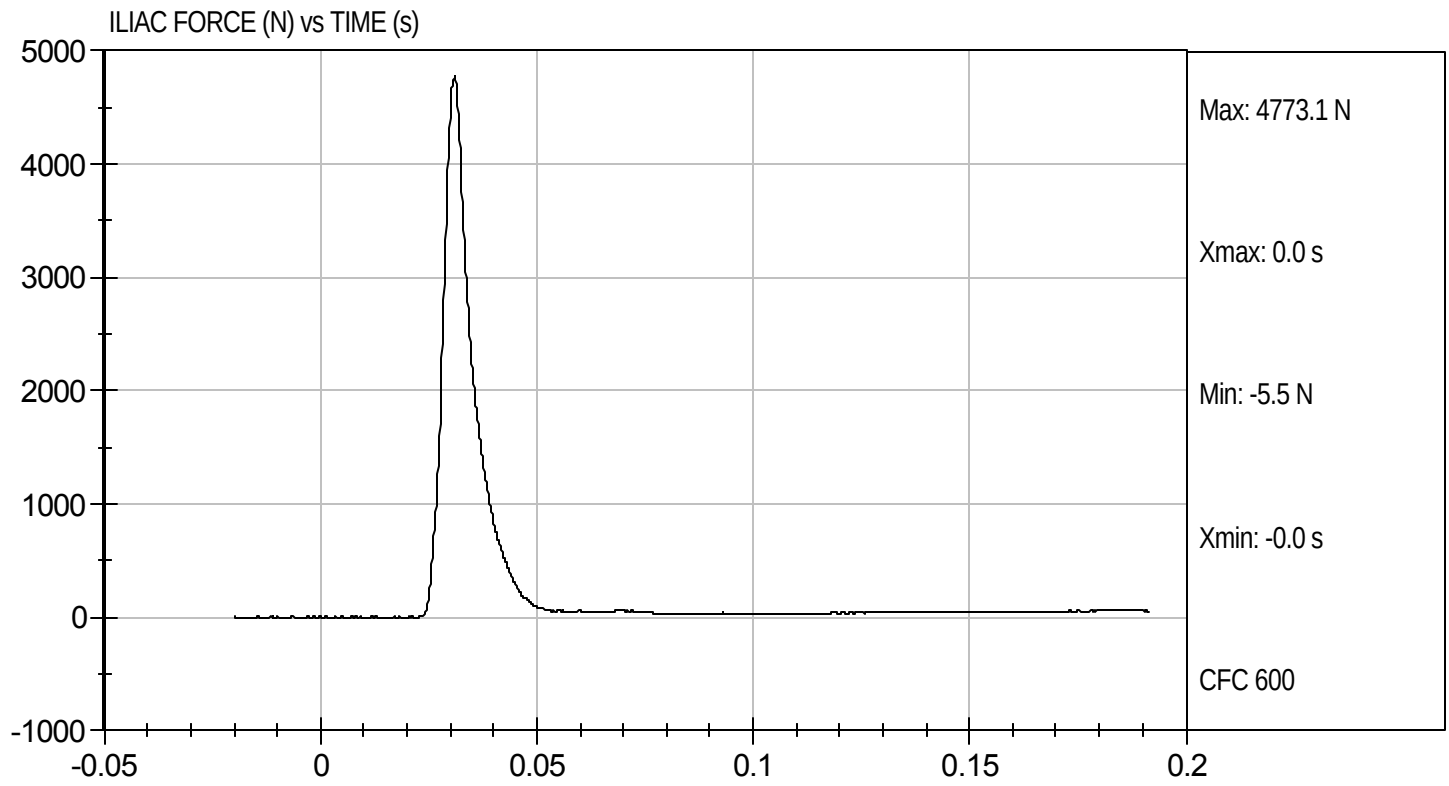
Test Date: 6/21/11
Velocity: 14.36 ft/s, 4.38 m/s





Test Desc: Iliac Impact
Component ID: D112178

Test Date: 6/21/11
Velocity: 14.36 ft/s, 4.38 m/s



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

ATD Serial No: 296

Test ID: D112681

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Peak Resultant Acceleration	G's	115 to 137	125	Pass
Peak Lateral Acceleration	G's	+/- 15	3.6	Pass
Unimodal	N/A	<15%	Yes	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

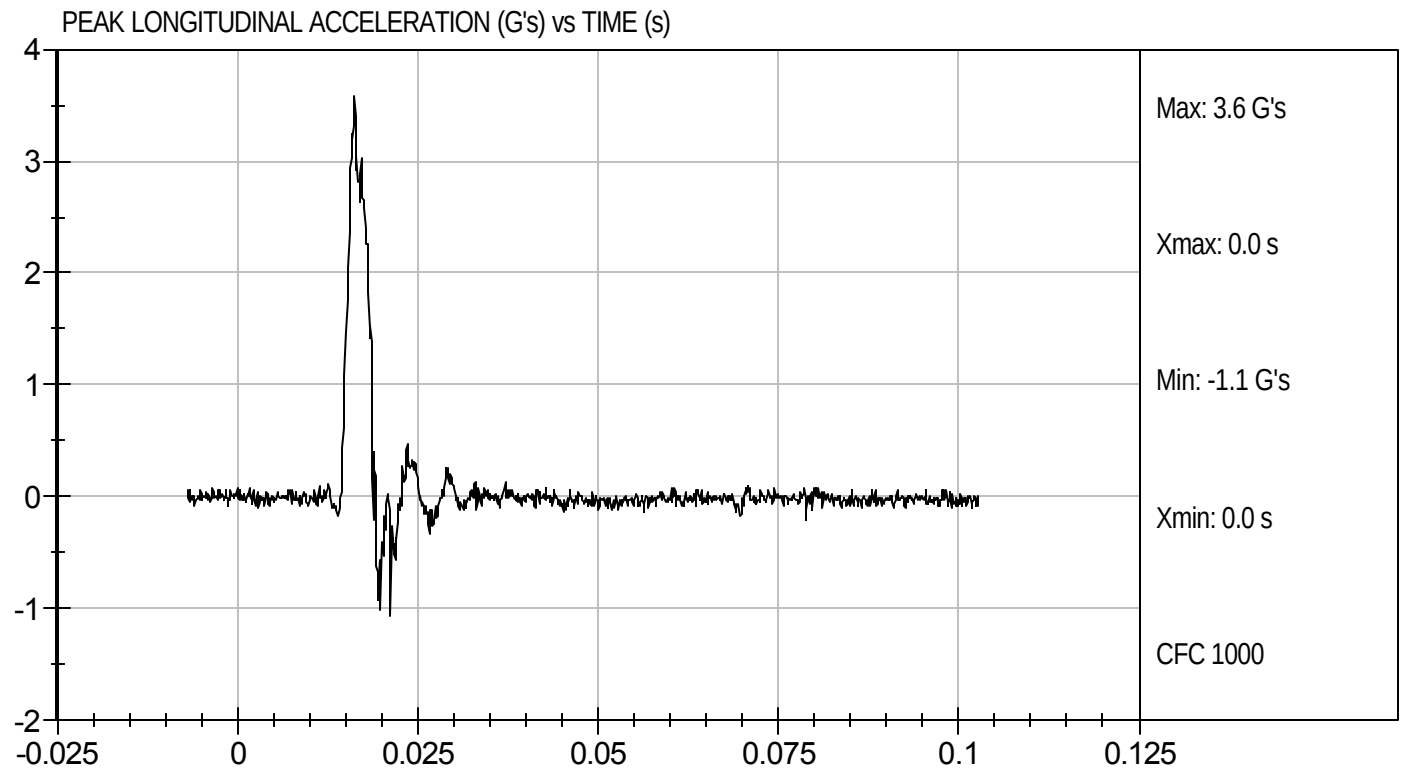
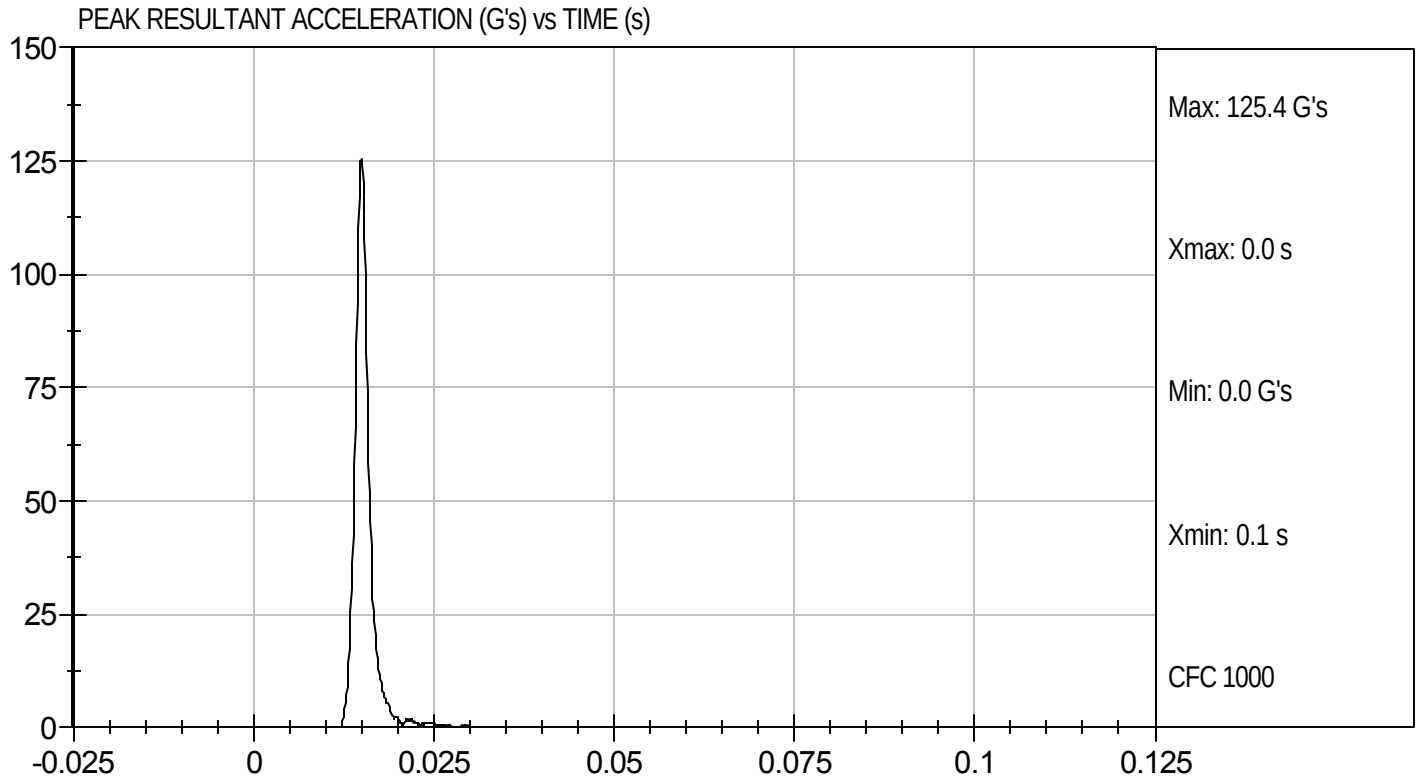
8/8/11
Test Date

David Winkelbauer
Approved By



Test Desc: Head Drop
Component ID: D112681

Test Date: 8/8/11
Velocity: 0 ft/s, 0 m/s

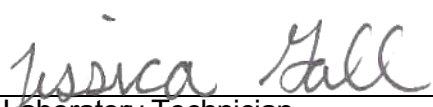


MGA RESEARCH CORPORATION
LATERAL NECK PENDULUM TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D112682

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.0	Pass
Humidity		%	10 to 70	50	Pass
Impact Velocity		m/s	5.51 to 5.63	5.52	Pass
Delta Velocity	10 ms	m/s	2.20 to 2.80	2.70	Pass
	15 ms	m/s	3.30 to 4.10	3.79	Pass
	20 ms	m/s	4.40 to 5.40	4.98	Pass
	25 ms	m/s	5.40 to 6.10	5.51	Pass
	25-100 ms	m/s	5.50 to 6.20	5.51	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	58	Pass
Maximum Occipital Condyle Moment during Rotation Interval Nm			-44 to -36	-39	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	114	Pass
Overall Test Results				Pass	


 Laboratory Technician

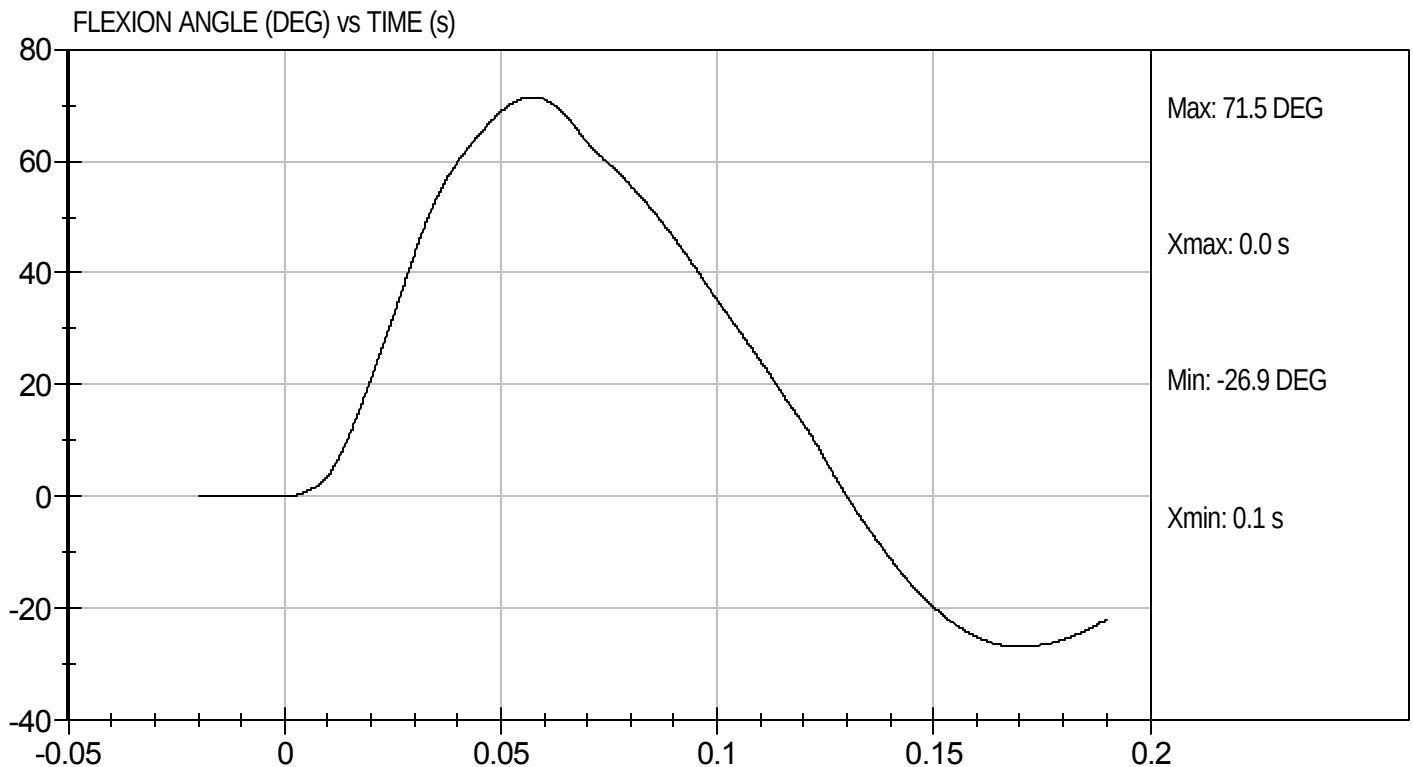
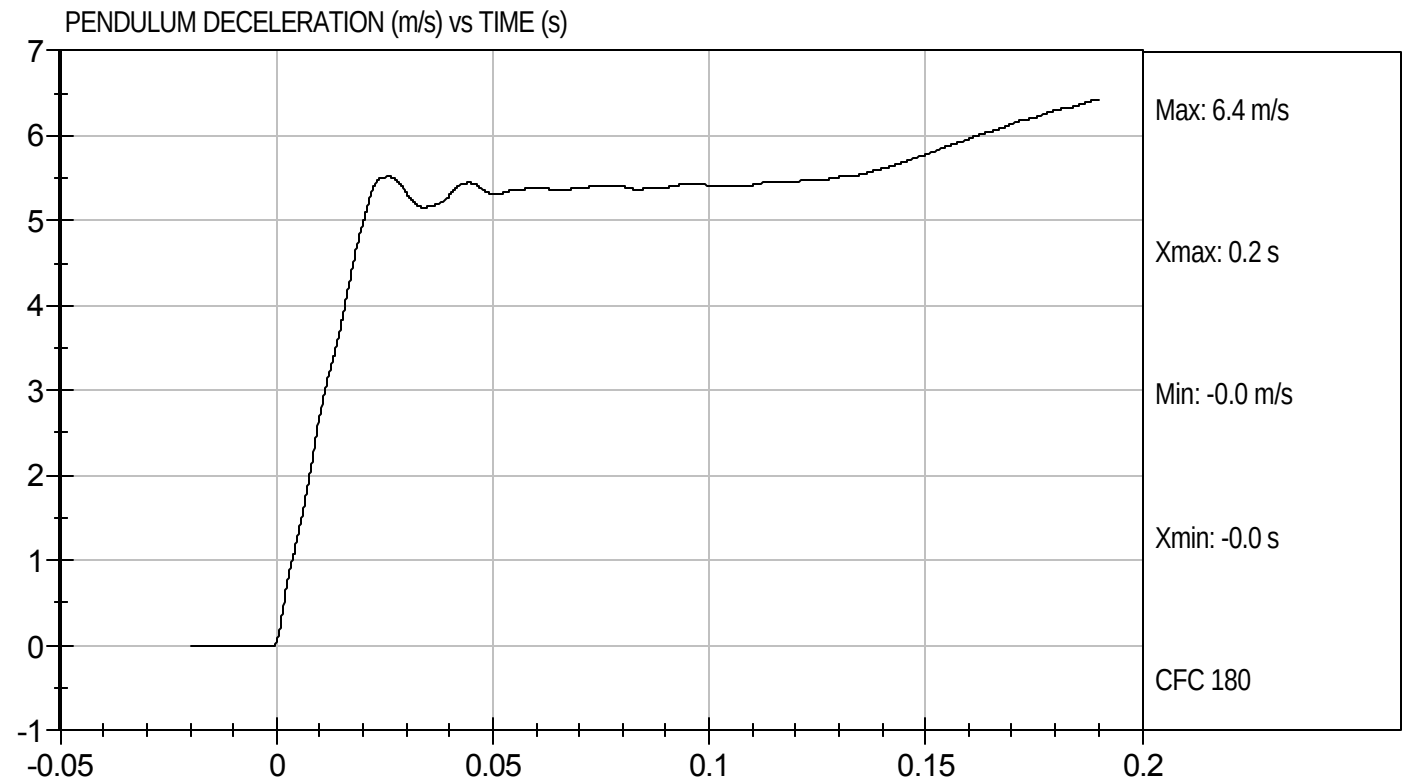
8/8/11
 Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D112682

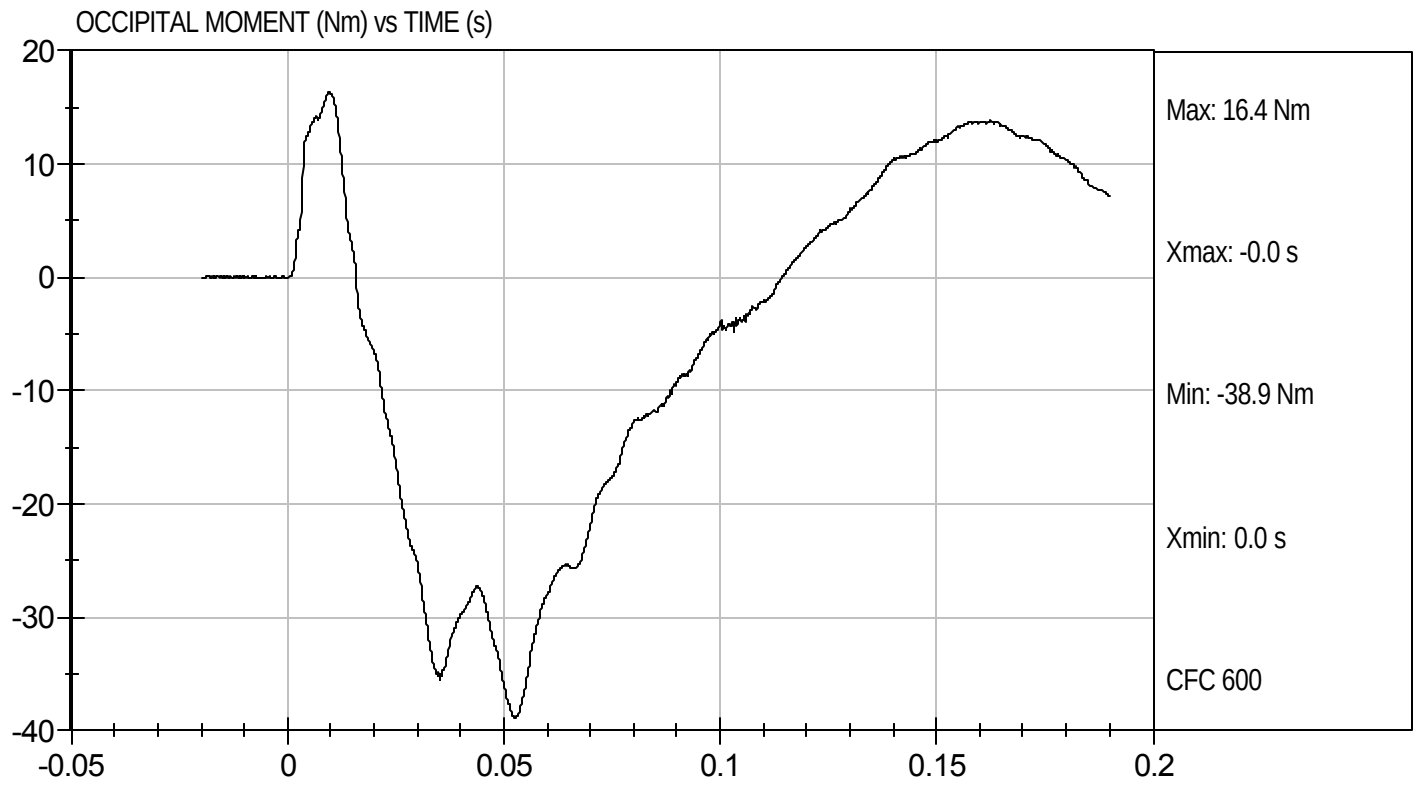
Test Date: 8/8/11
Velocity: 18.12 ft/s, 5.52 m/s





Test Desc: Neck Bending
Component ID: D112682

Test Date: 8/8/11
Velocity: 18.12 ft/s, 5.52 m/s



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
SID-11s BUILD LEVEL D DUMMY

ATD Serial No: 296

Test ID: D112683

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	30	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
Overall Test Results				Pass


Laboratory Technician

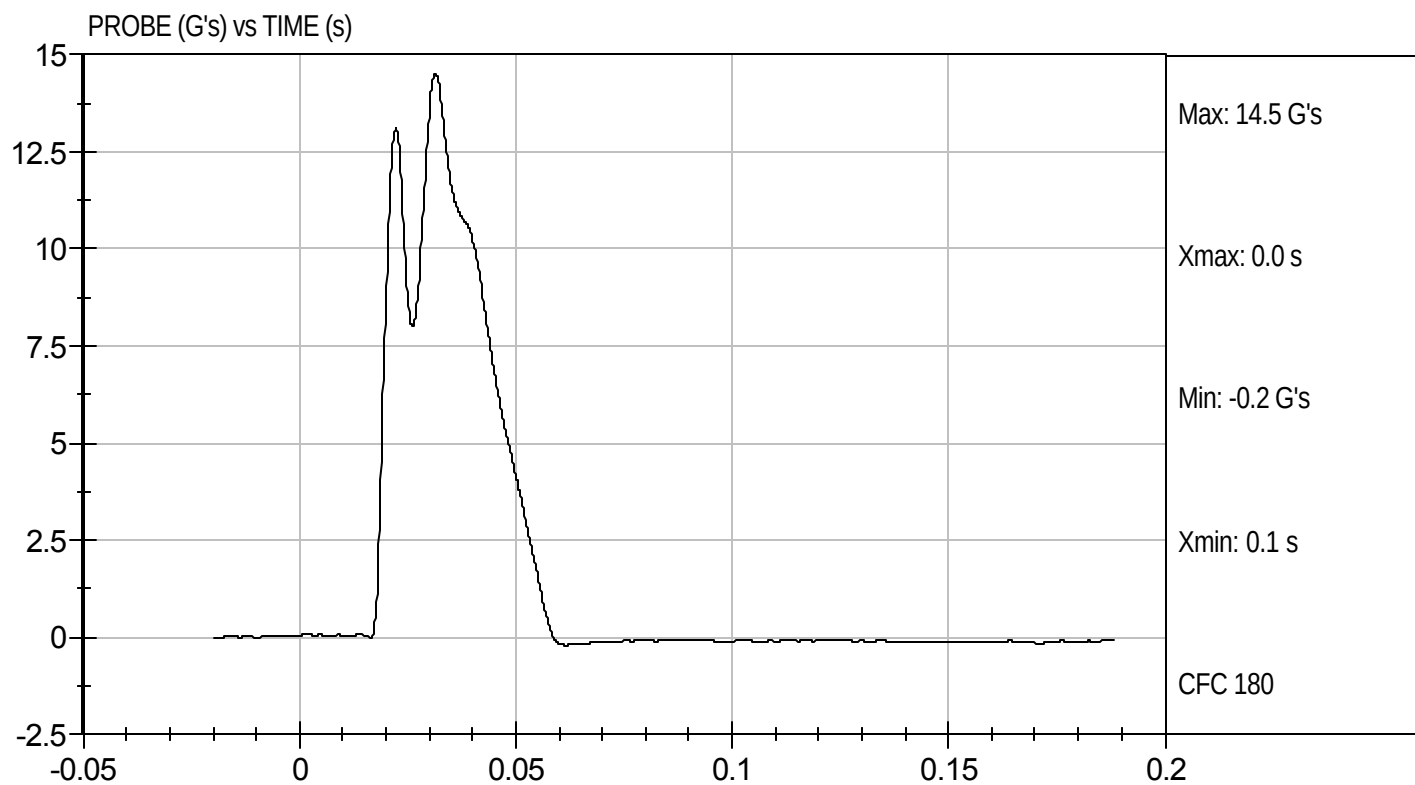
8/8/11
Test Date


Approved By



Test Desc: Shoulder Impact
Component ID: D112683

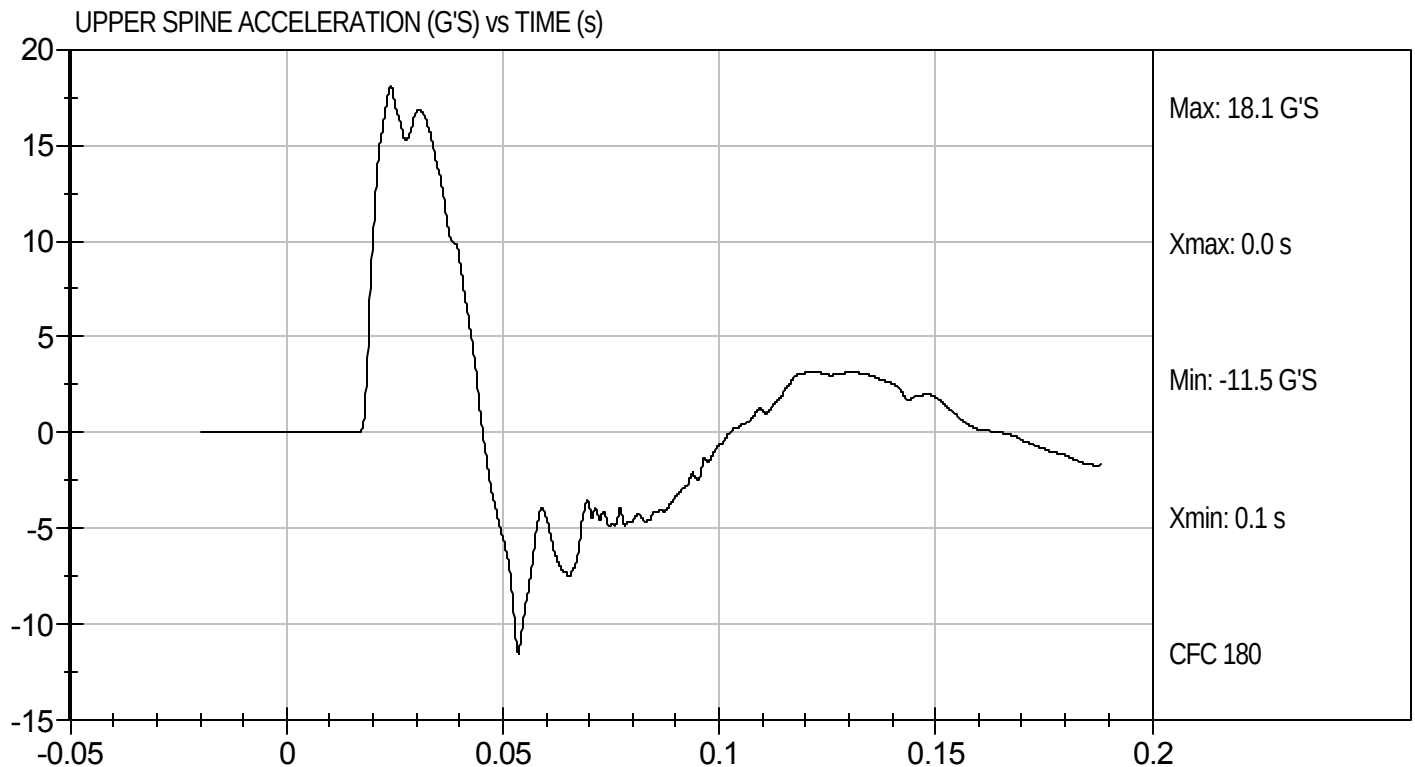
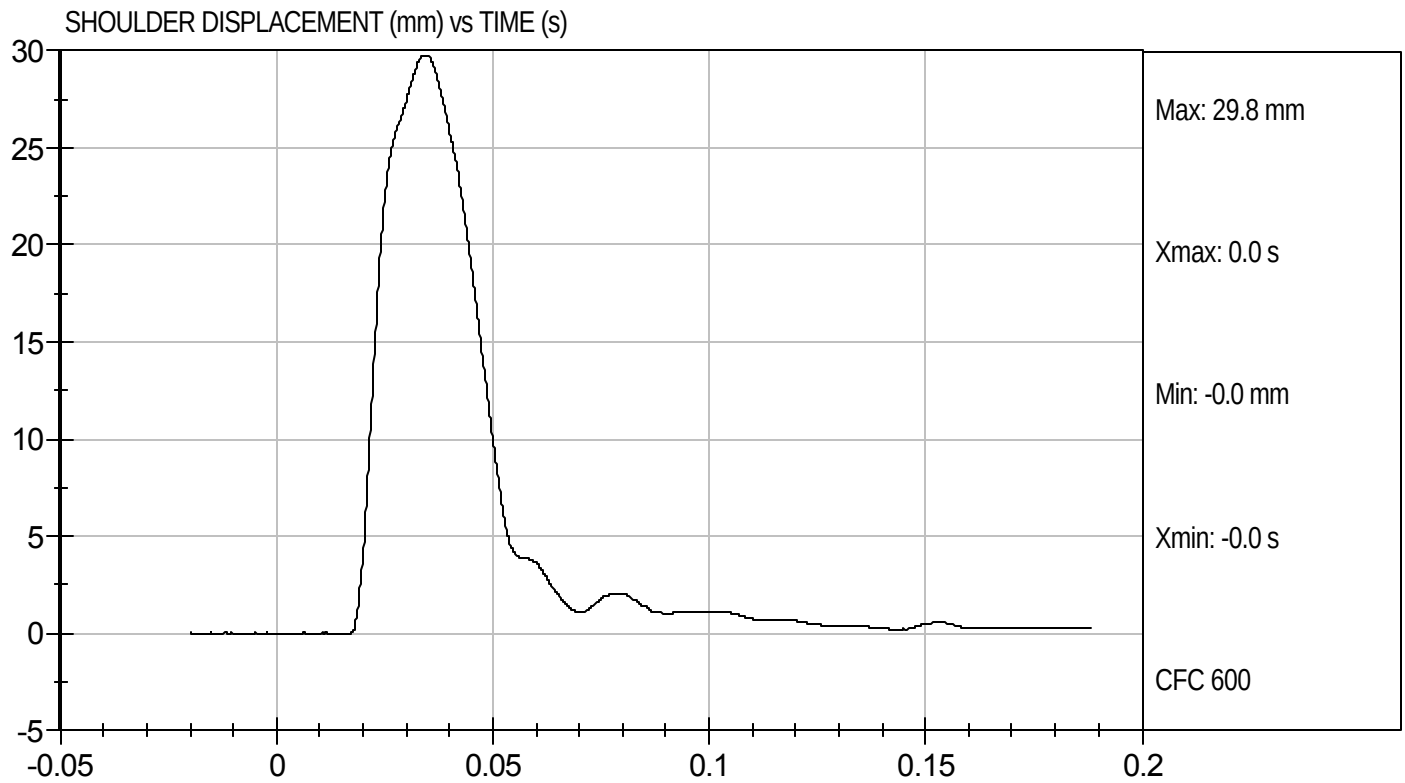
Test Date: 8/8/11
Velocity: 14.25 ft/s, 4.34 m/s





Test Desc: Shoulder Impact
Component ID: D112683

Test Date: 8/8/11
Velocity: 14.25 ft/s, 4.34 m/s



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

ATD Serial No: 296

Test I.D: D112684

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	50	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Peak Impactor Acceleration	G's	30 to 36	32	Pass
Shoulder Displacement	mm	31 to 40	36	Pass
Upper Rib Displacement	mm	25 to 32	28	Pass
Middle Rib Displacement	mm	30 to 36	32	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
Overall Test Results				Pass


 Laboratory Technician

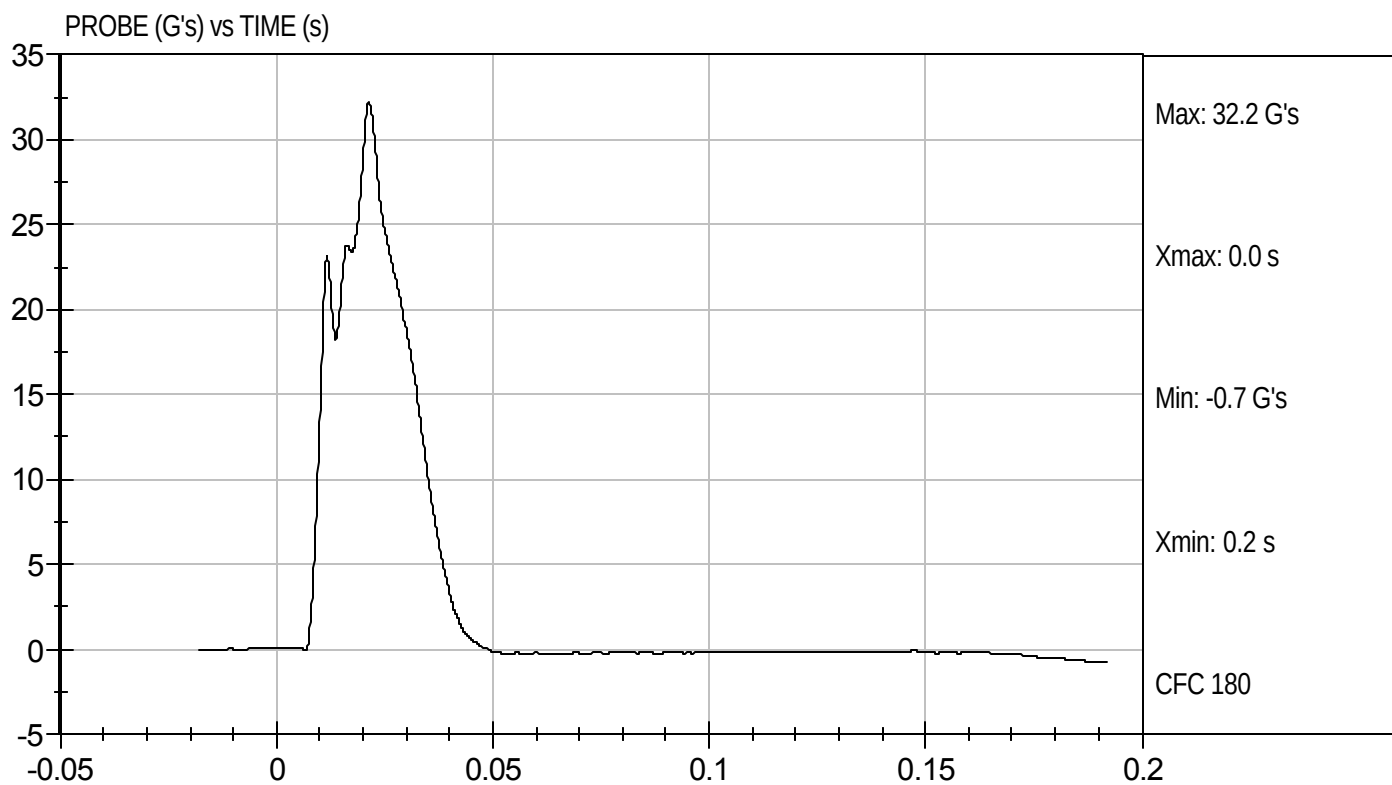
8/8/11
 Test Date


 Approved By



Test Desc: Thorax With Arm
Component ID: D112684

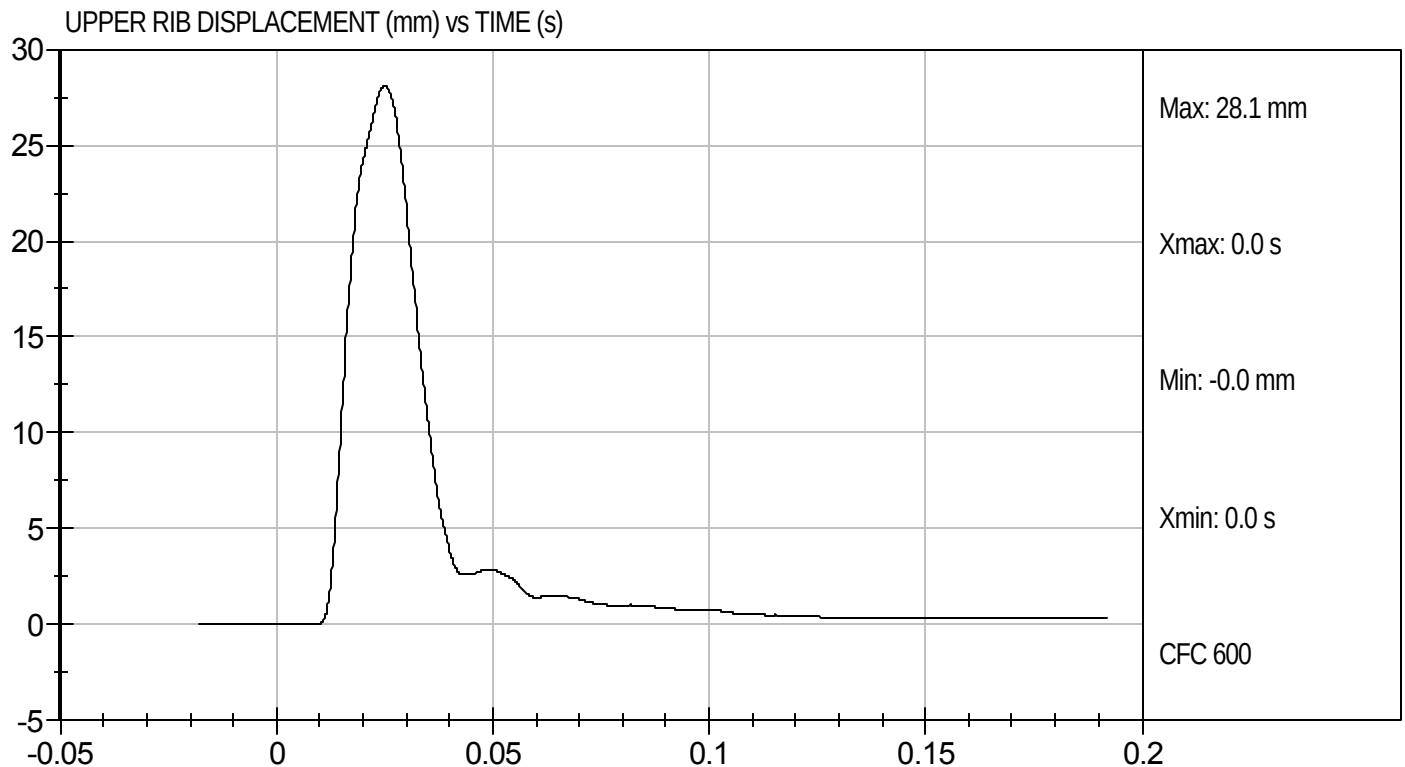
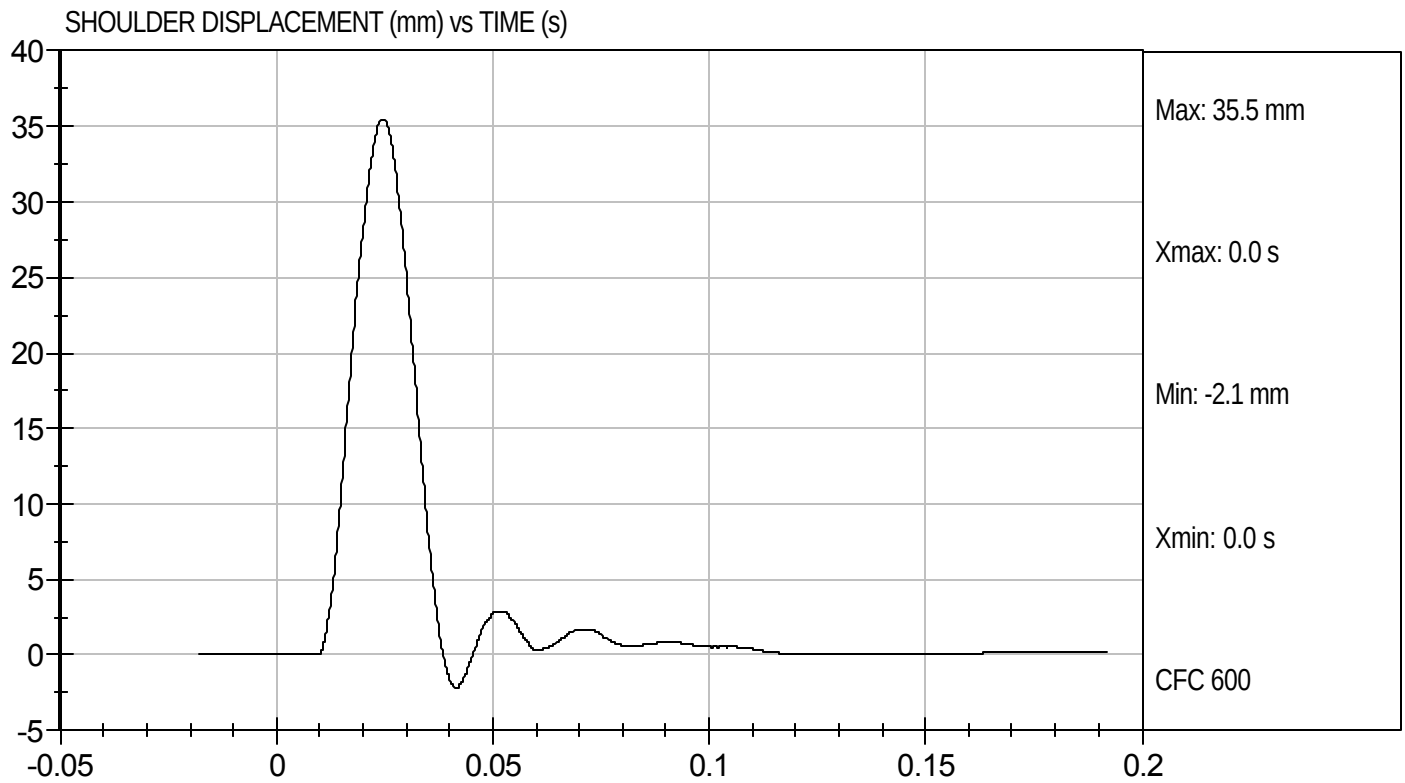
Test Date: 8/8/11
Velocity: 22.22 ft/s, 6.77 m/s





Test Desc: Thorax With Arm
Component ID: D112684

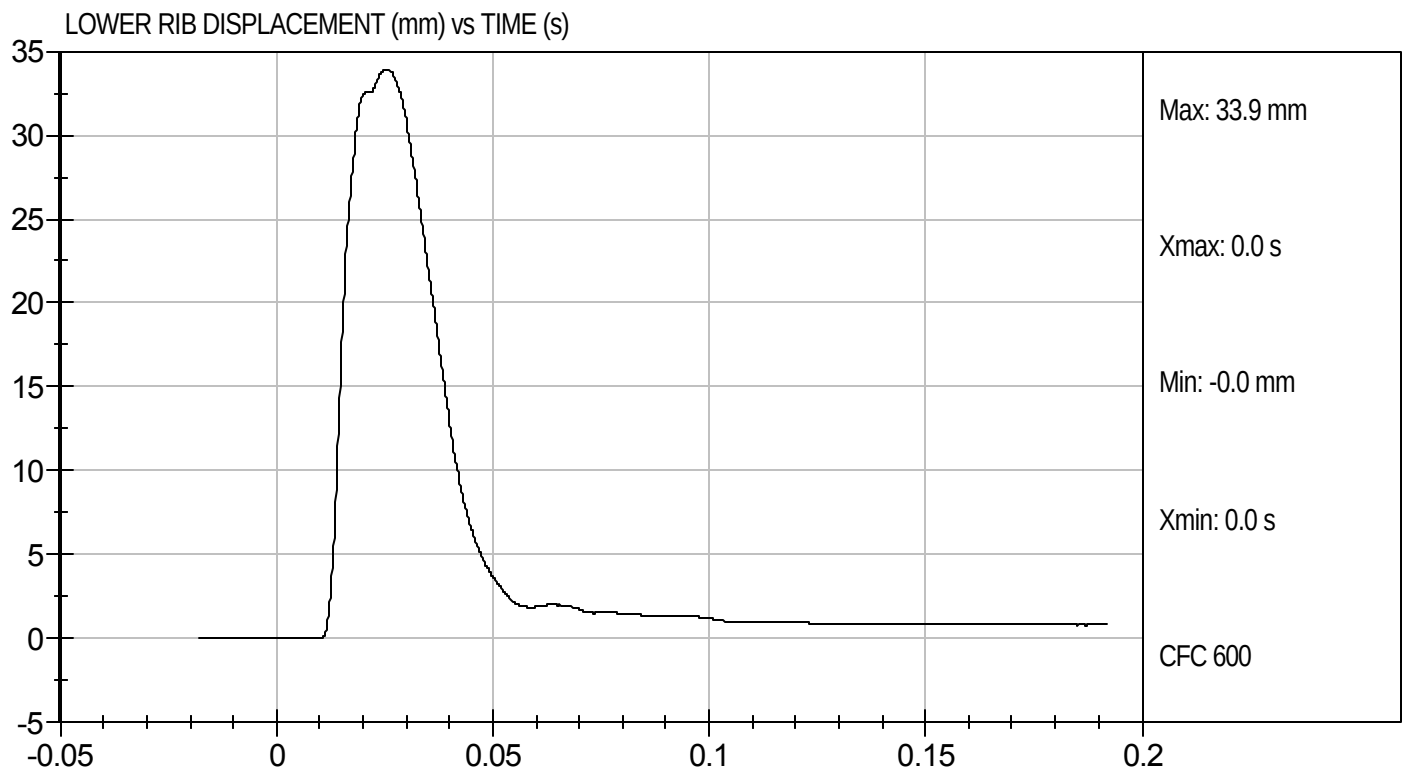
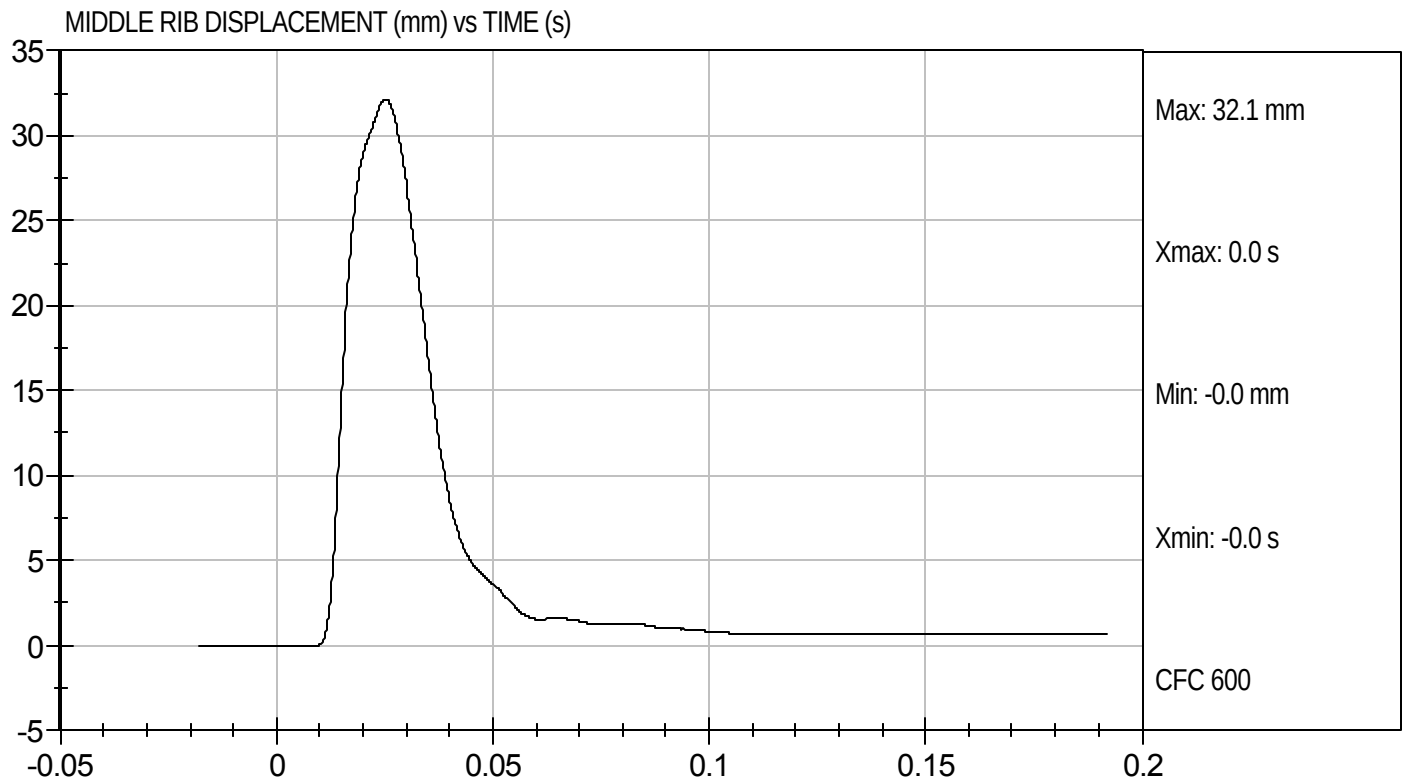
Test Date: 8/8/11
Velocity: 22.22 ft/s, 6.77 m/s





Test Desc: Thorax With Arm
Component ID: D112684

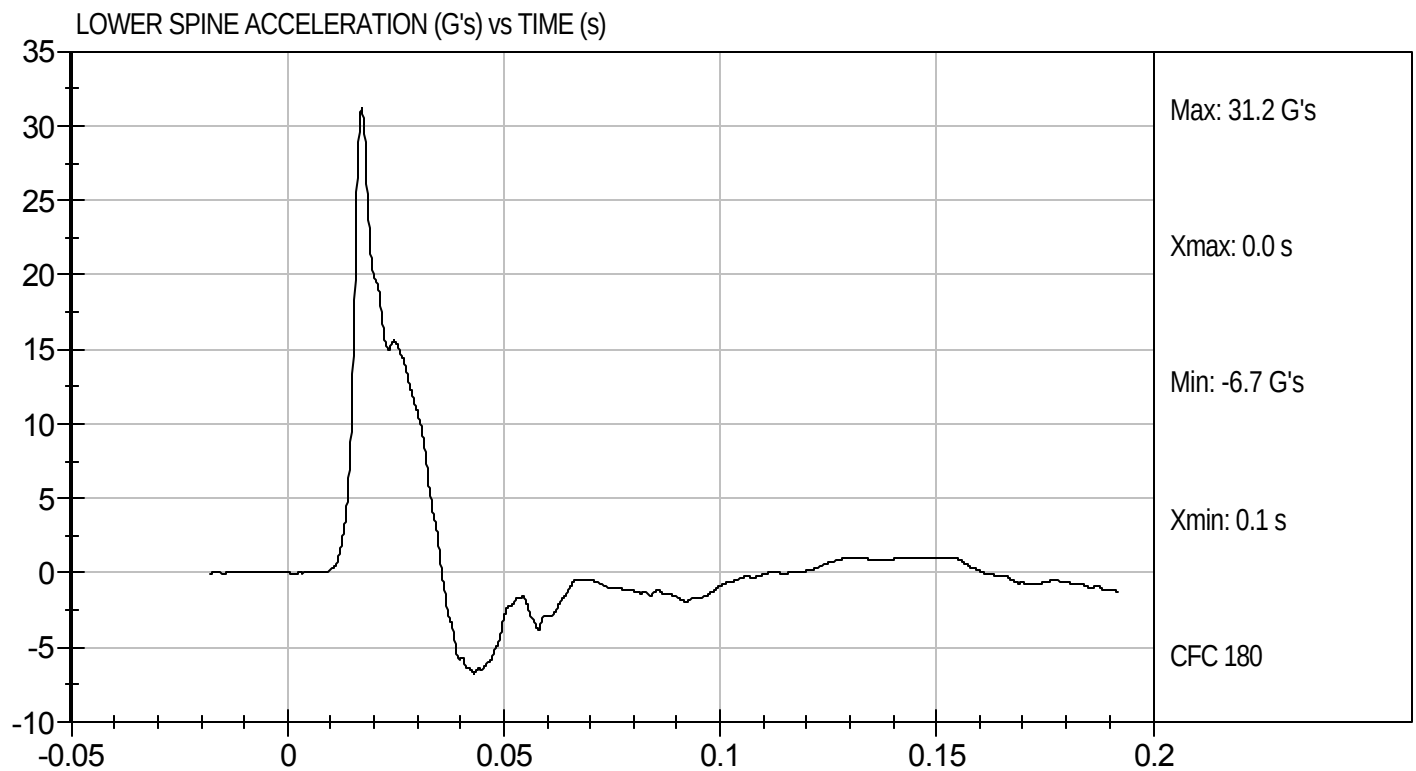
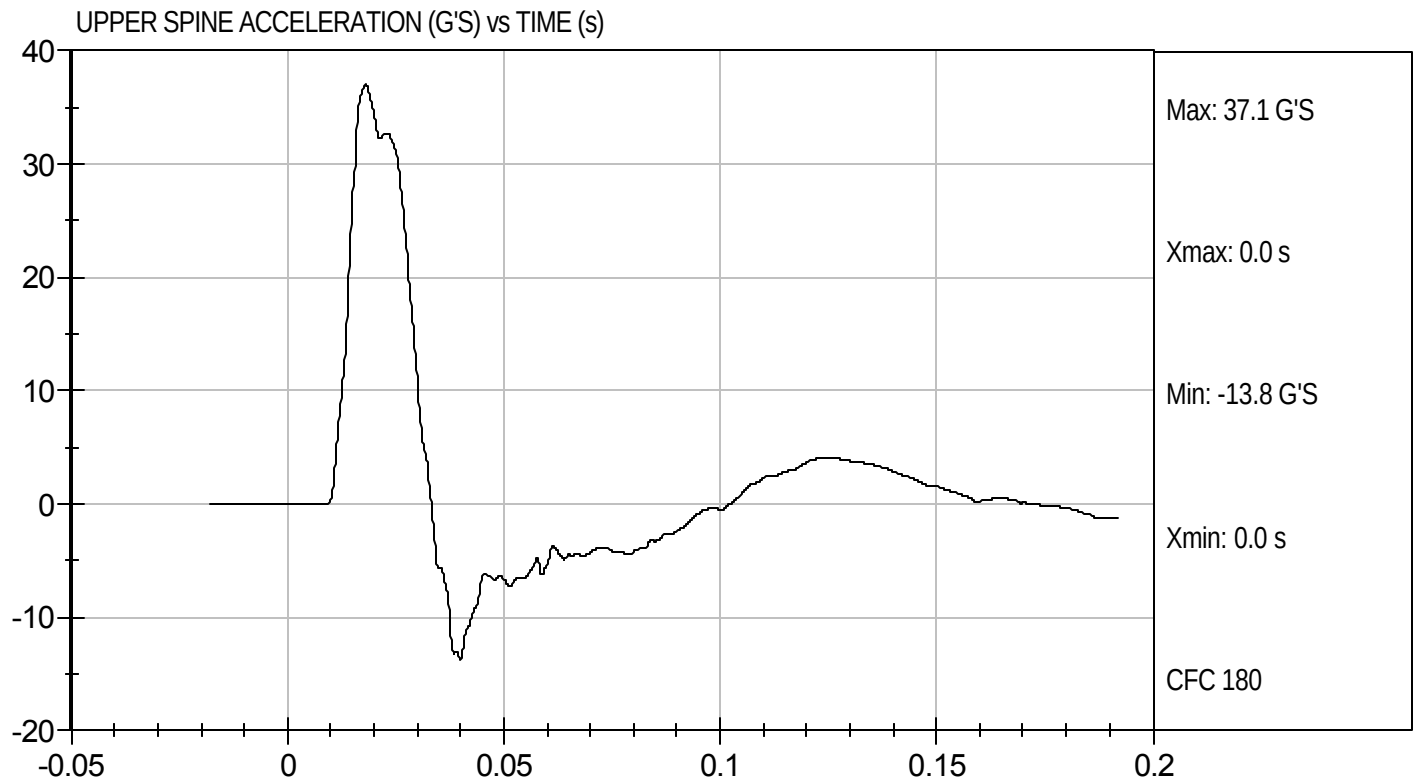
Test Date: 8/8/11
Velocity: 22.22 ft/s, 6.77 m/s





Test Desc: Thorax With Arm
Component ID: D112684

Test Date: 8/8/11
Velocity: 22.22 ft/s, 6.77 m/s



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

ATD Serial No: 296

Test I.D: D112685

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Peak Impactor Force	G's	14 to 18	14	Pass
Upper Rib Displacement	mm	32 to 40	39	Pass
Middle Rib Displacement	mm	39 to 45	42	Pass
Lower Rib Displacement	mm	35 to 43	37	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	8	Pass
Overall Test Results				Pass


Laboratory Technician

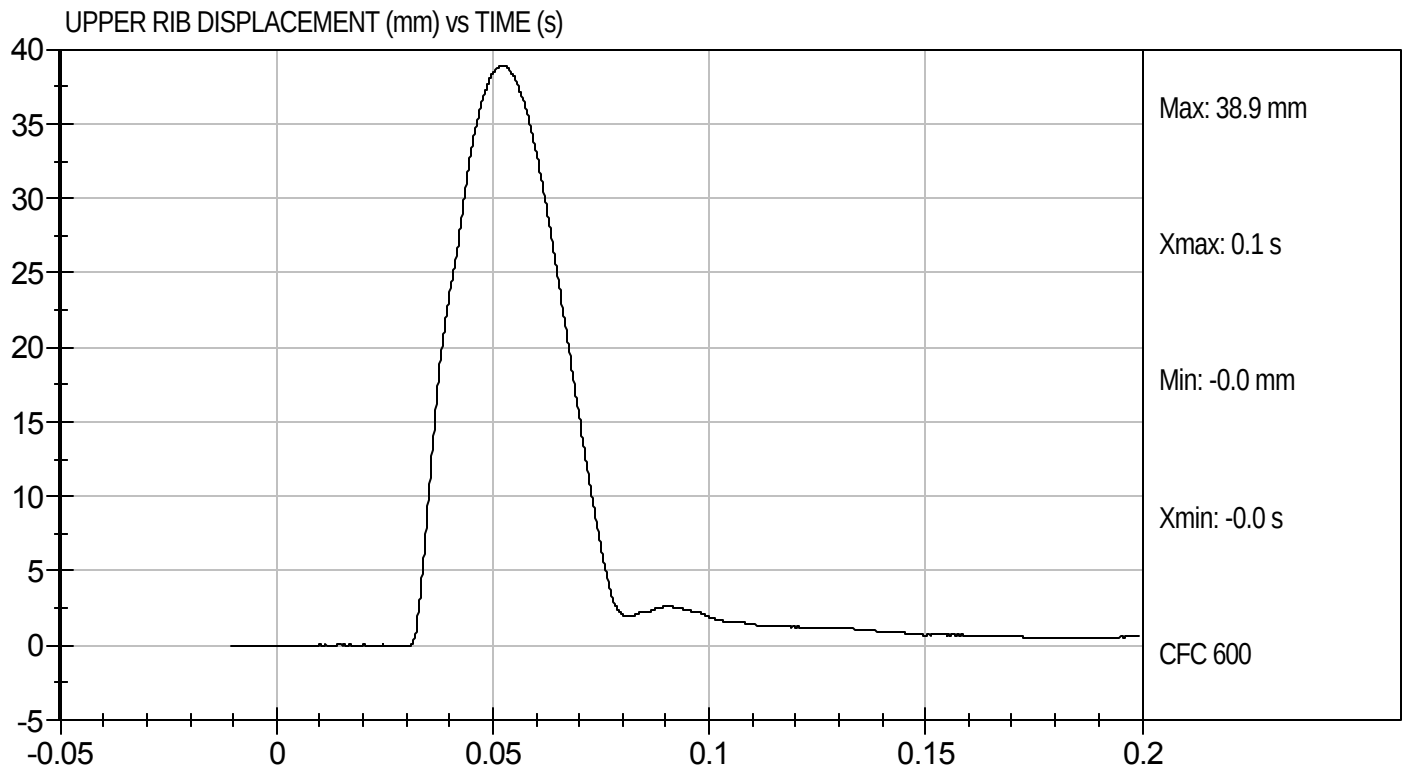
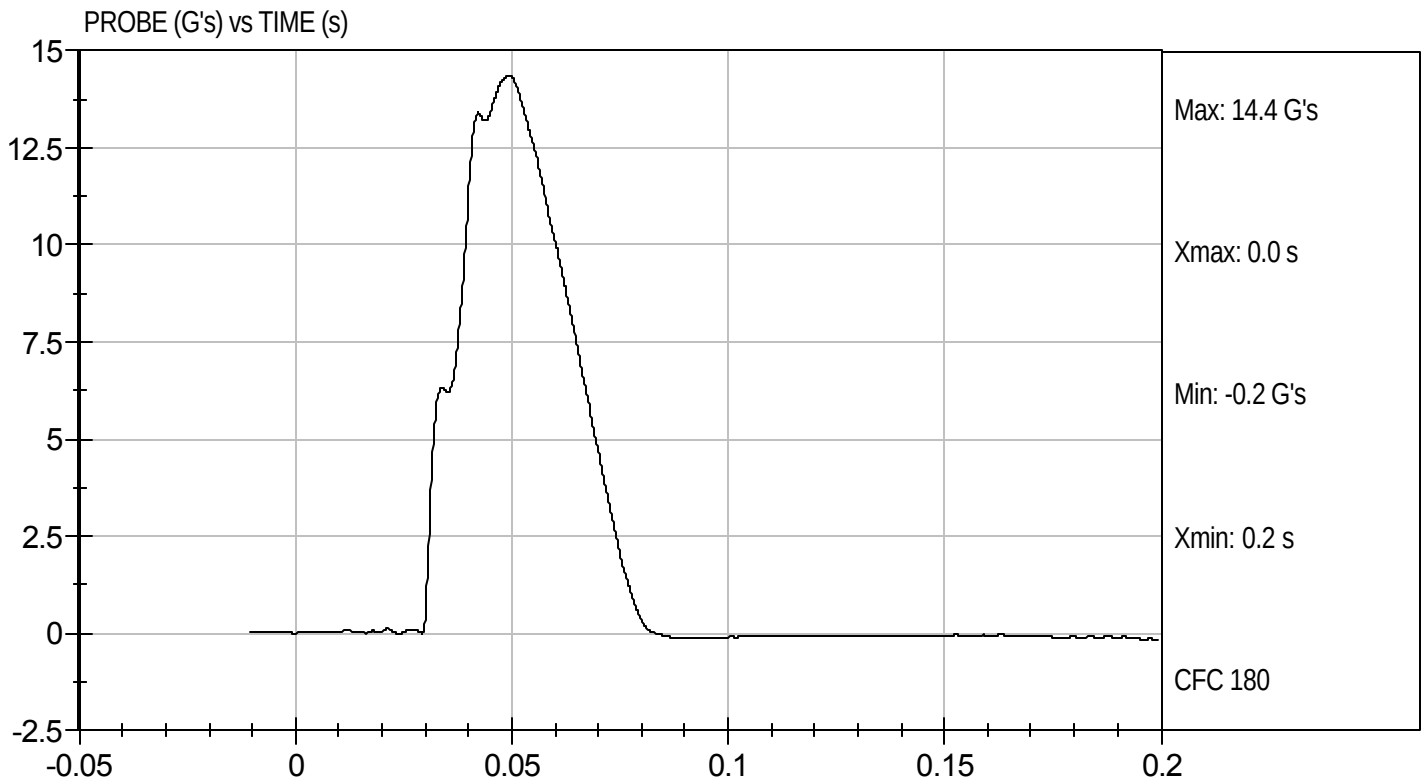
8/8/11
Test Date


Approved By



Test Desc: Thorax Without Arm
Component ID: D112685

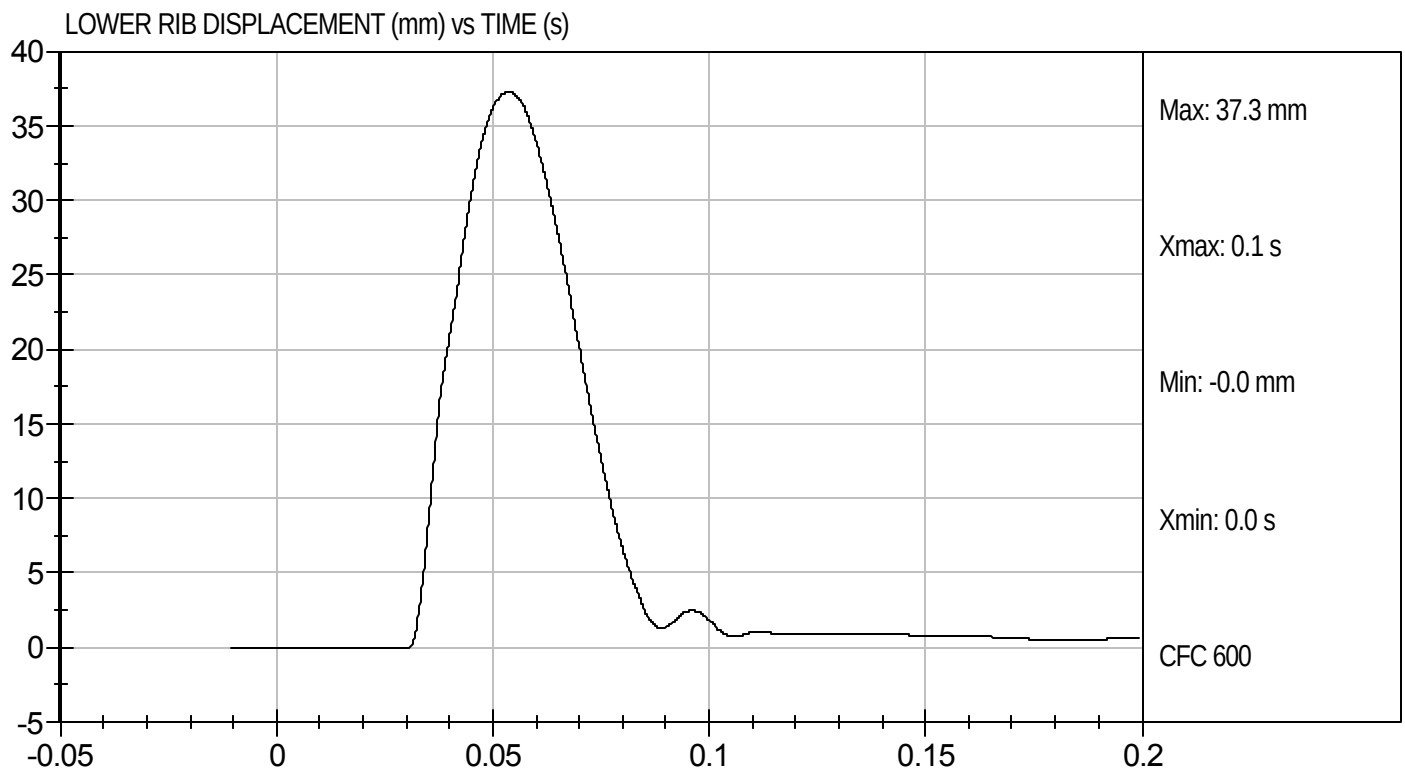
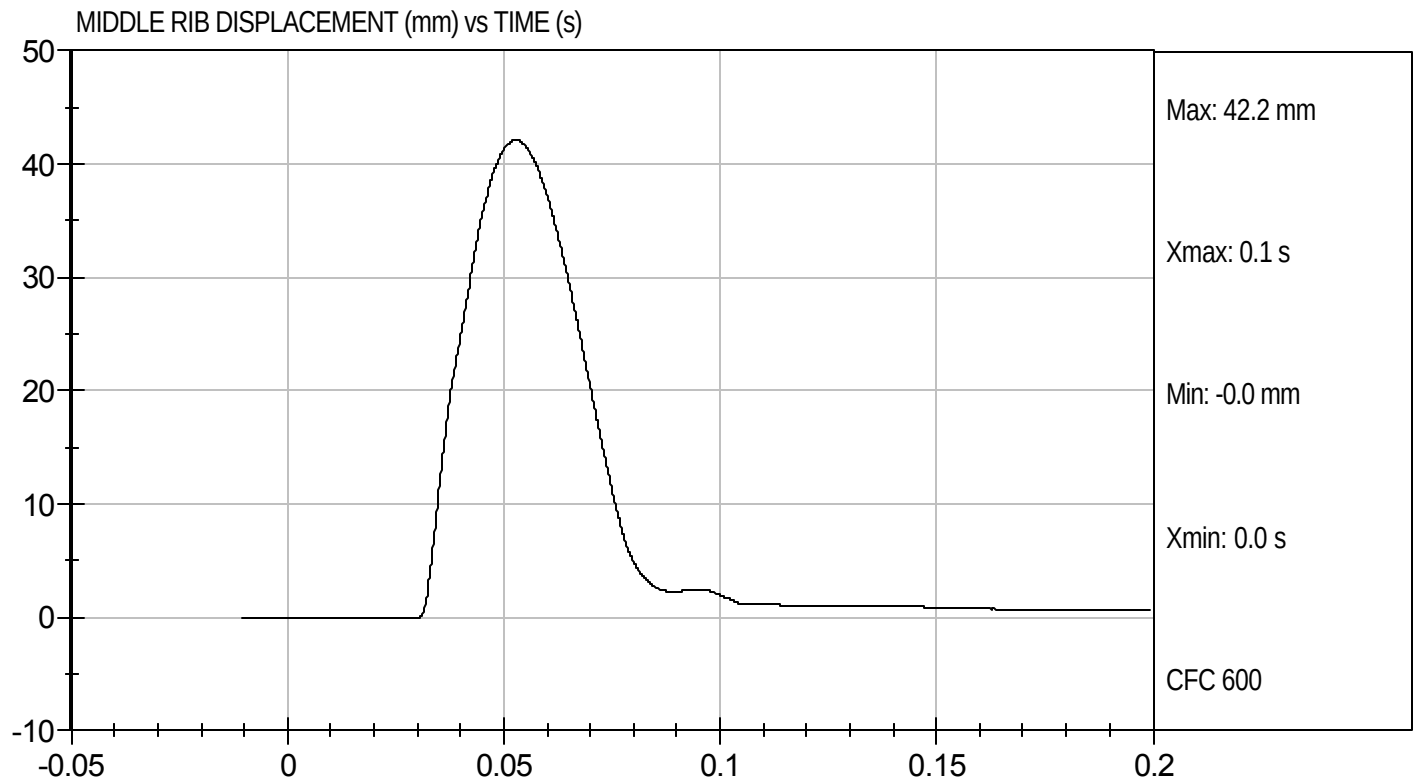
Test Date: 8/8/11
Velocity: 14.12 ft/s, 4.30 m/s





Test Desc: Thorax Without Arm
Component ID: D112685

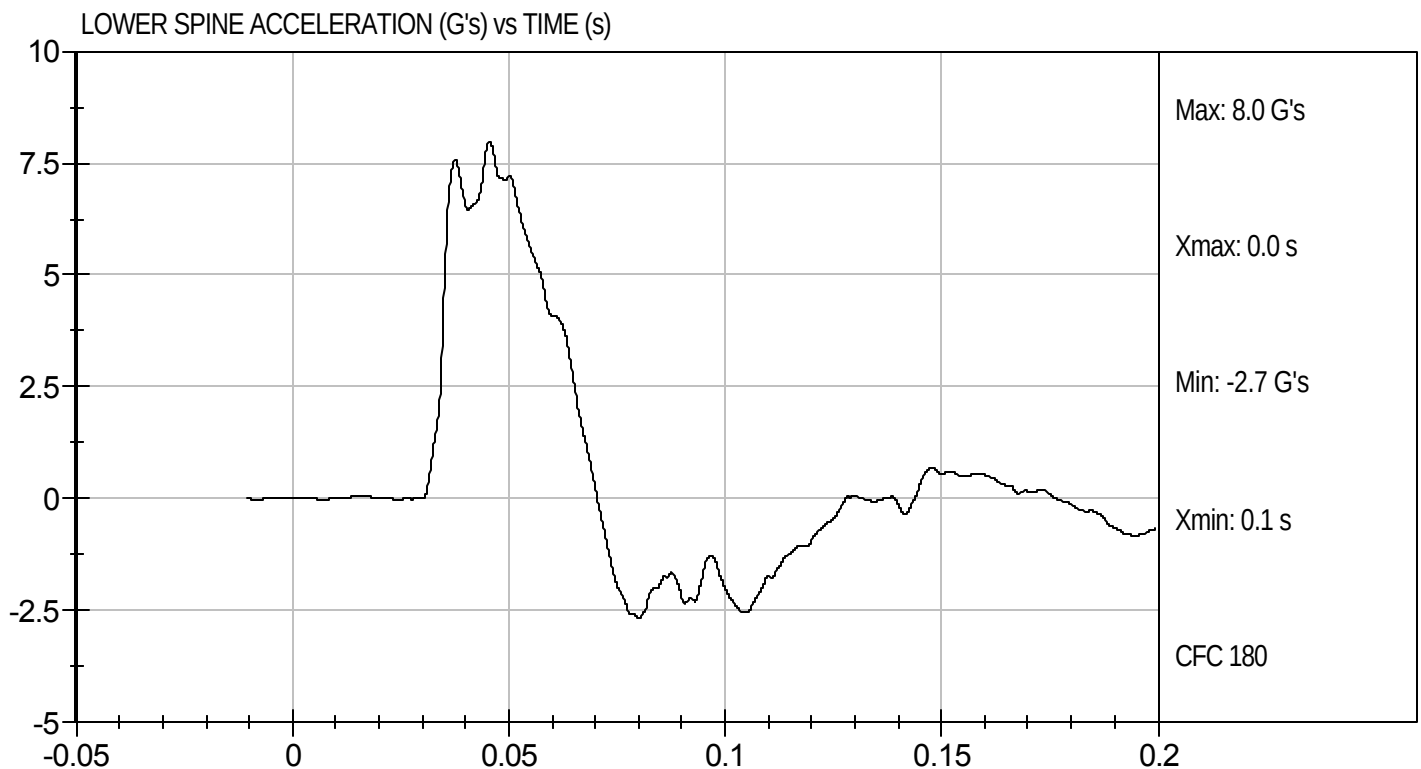
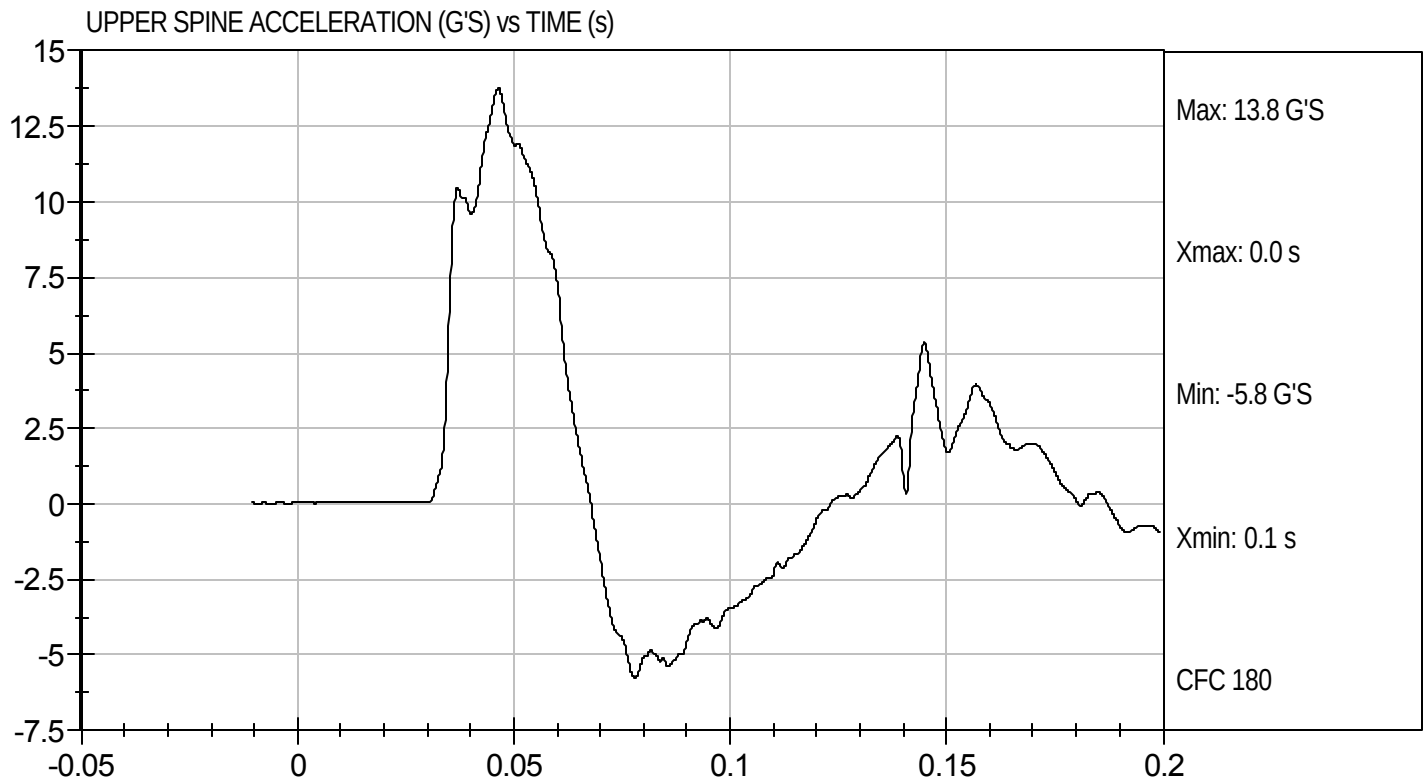
Test Date: 8/8/11
Velocity: 14.12 ft/s, 4.30 m/s





Test Desc: Thorax Without Arm
Component ID: D112685

Test Date: 8/8/11
Velocity: 14.12 ft/s, 4.30 m/s



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

ATD Serial No: 296

Test I.D: D112686

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Peak Impactor Acceleration	G's	12 to 16	13	Pass
Upper Rib Displacement	mm	36 to 47	42	Pass
Lower Rib Displacement	mm	33 to 44	38	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	10	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

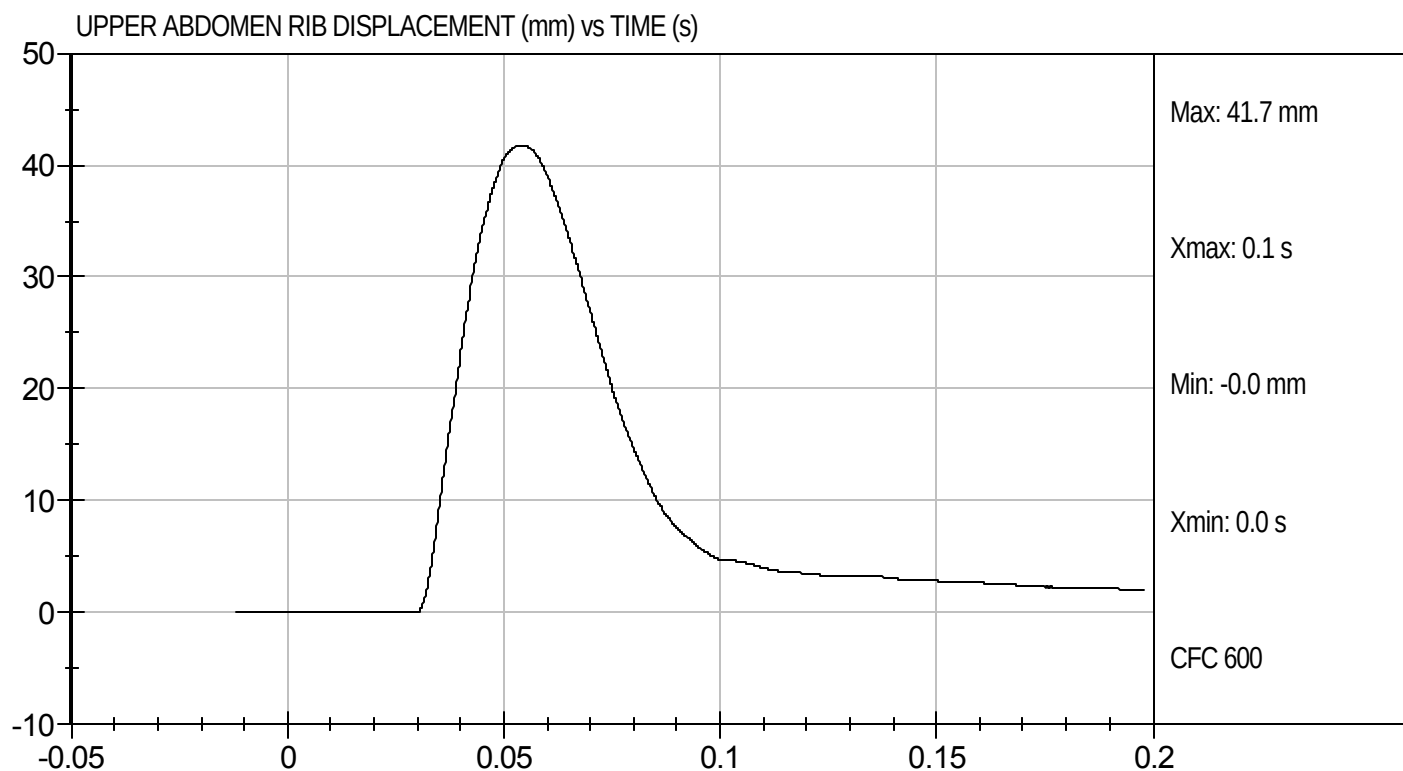
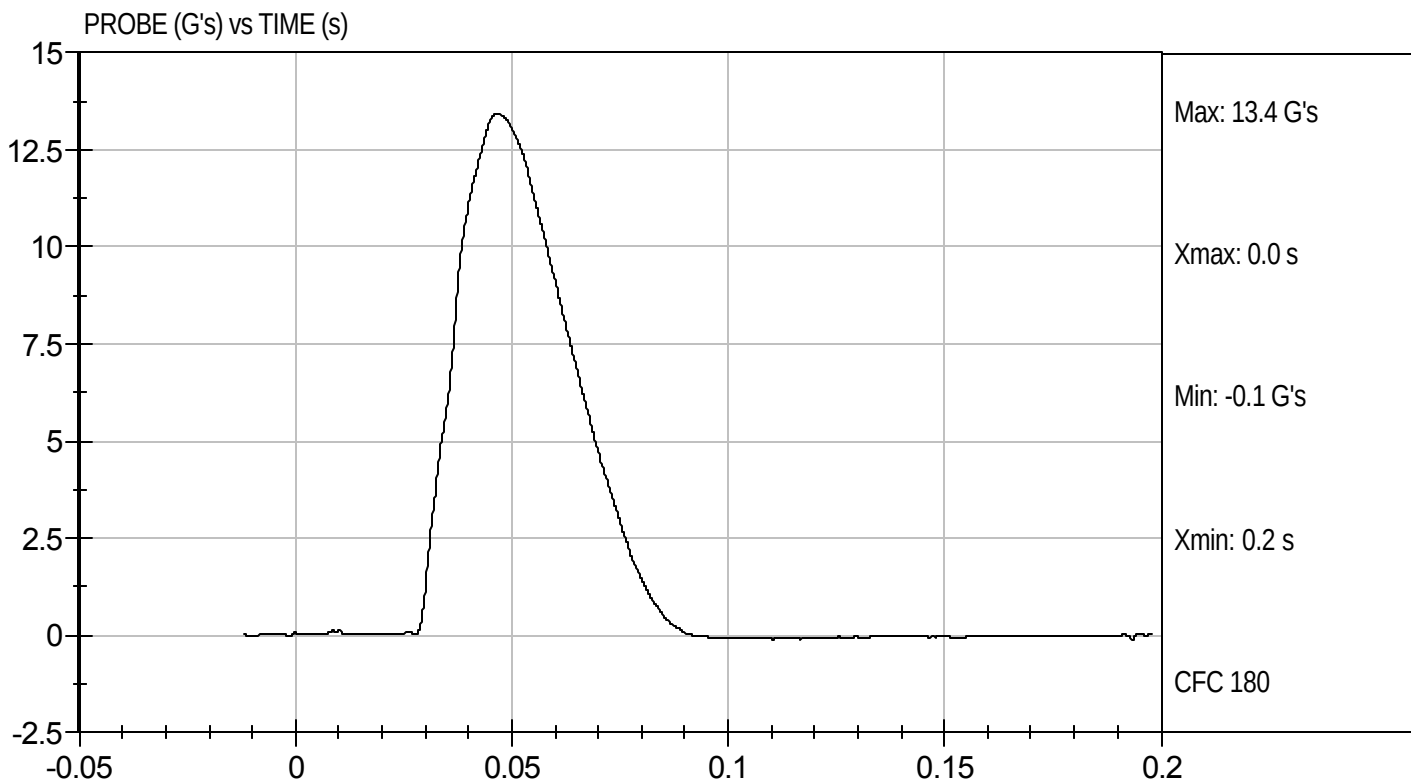
8/8/11
Test Date

David Winkelbauer
Approved By



Test Desc: Abdomen Impact
Component ID: D112686

Test Date: 8/8/11
Velocity: 14.12 ft/s, 4.30 m/s

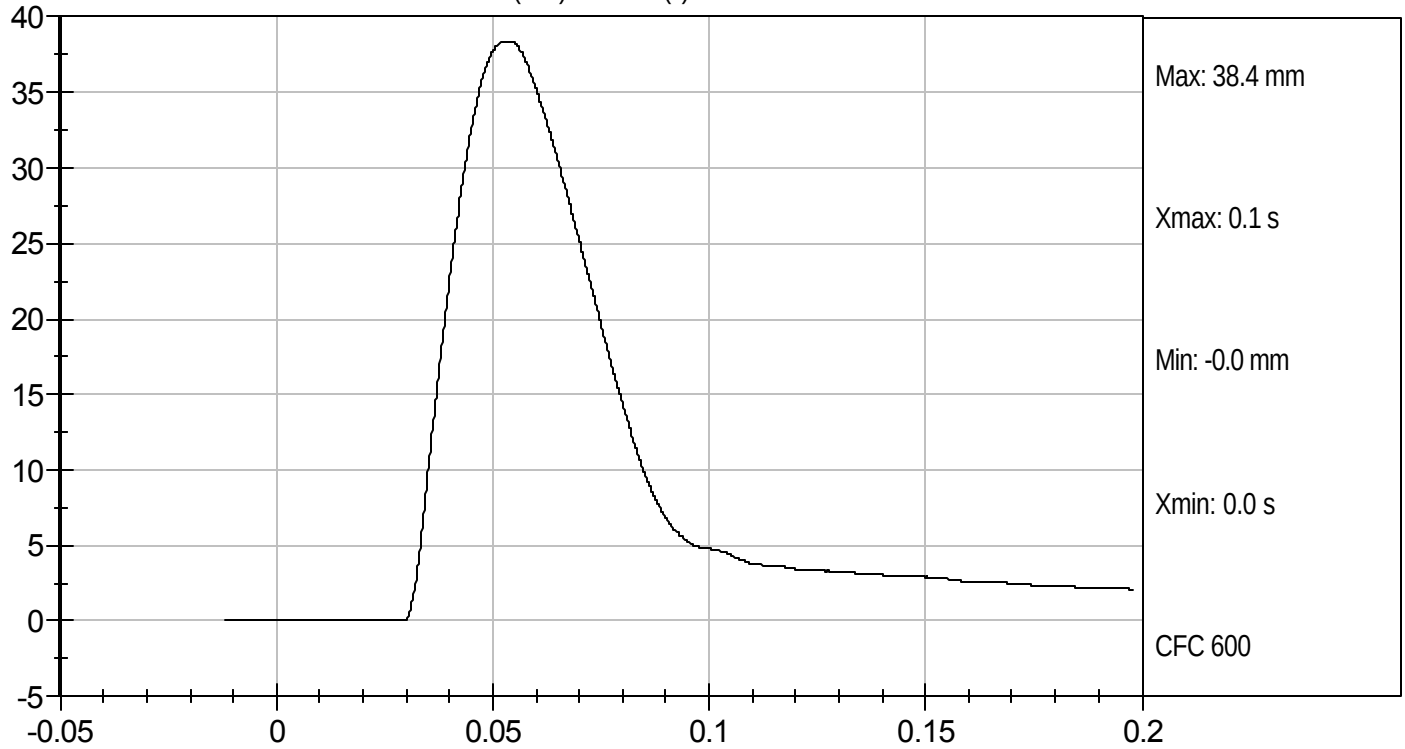




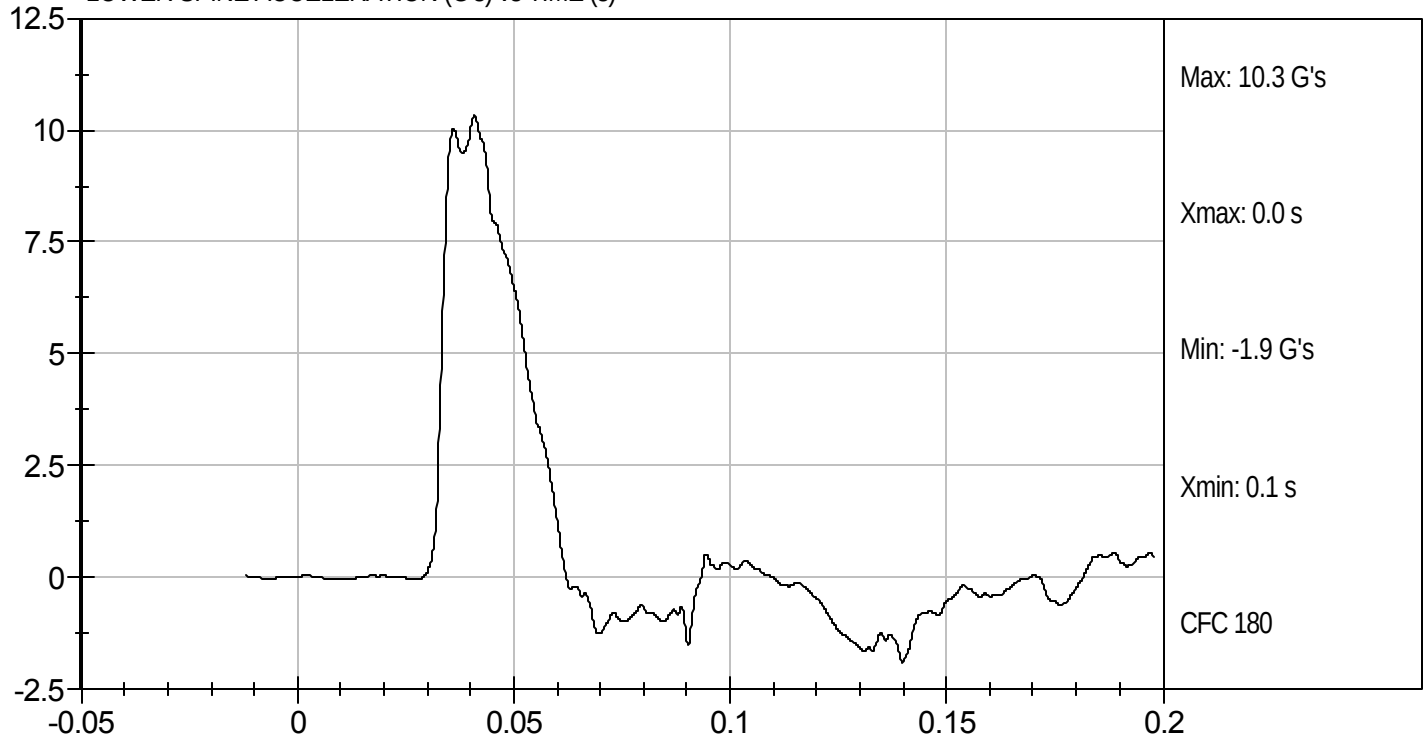
Test Desc: Abdomen Impact
Component ID: D112686

Test Date: 8/8/11
Velocity: 14.12 ft/s, 4.30 m/s

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



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



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

ATD Serial No: 296

Test I.D: D112687

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	6.60 to 6.80	6.71	Pass
Peak Impactor Acceleration	G's	38 to 47	43	Pass
Pelvis Y Acceleration after 6 ms	G's	34 to 42	42	Pass
Peak Acetabulum Force	N	3600 to 4300	3872	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

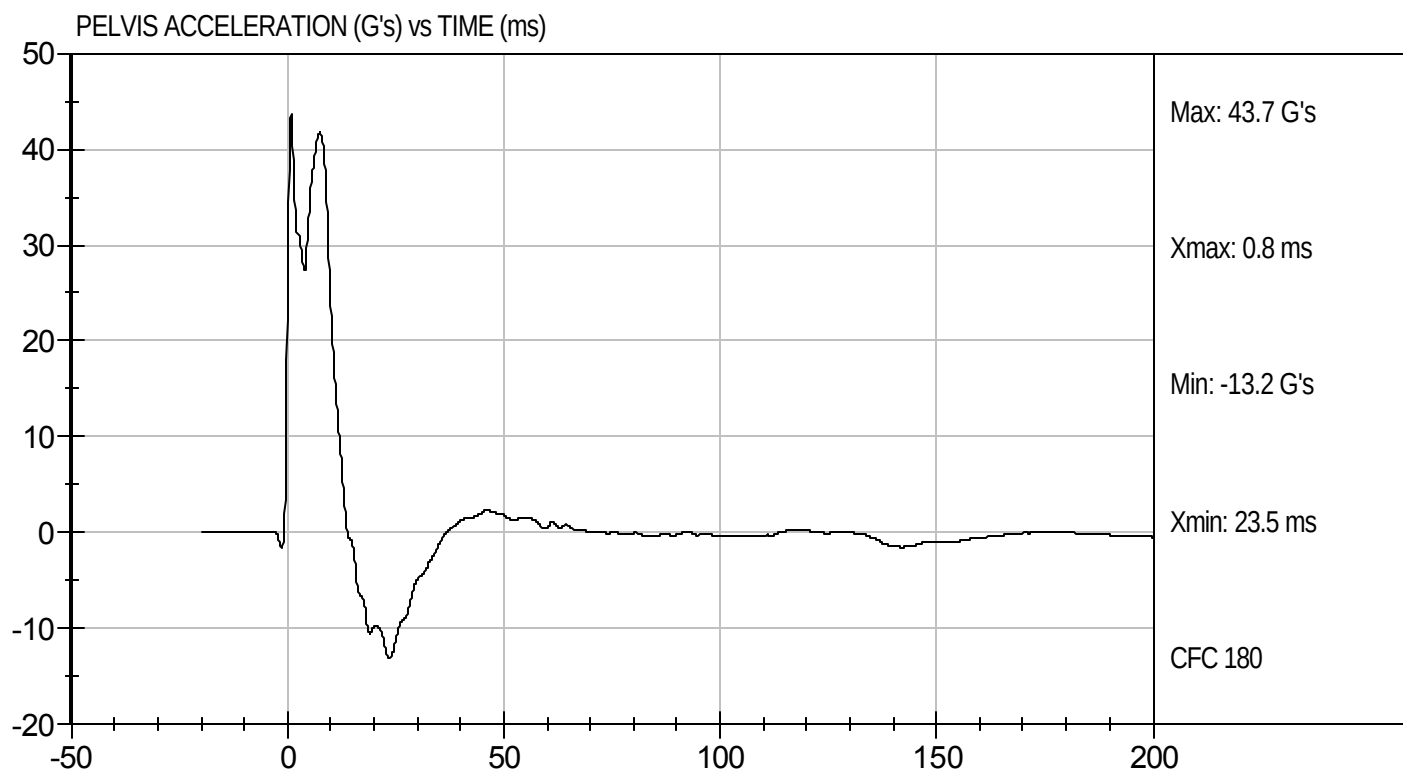
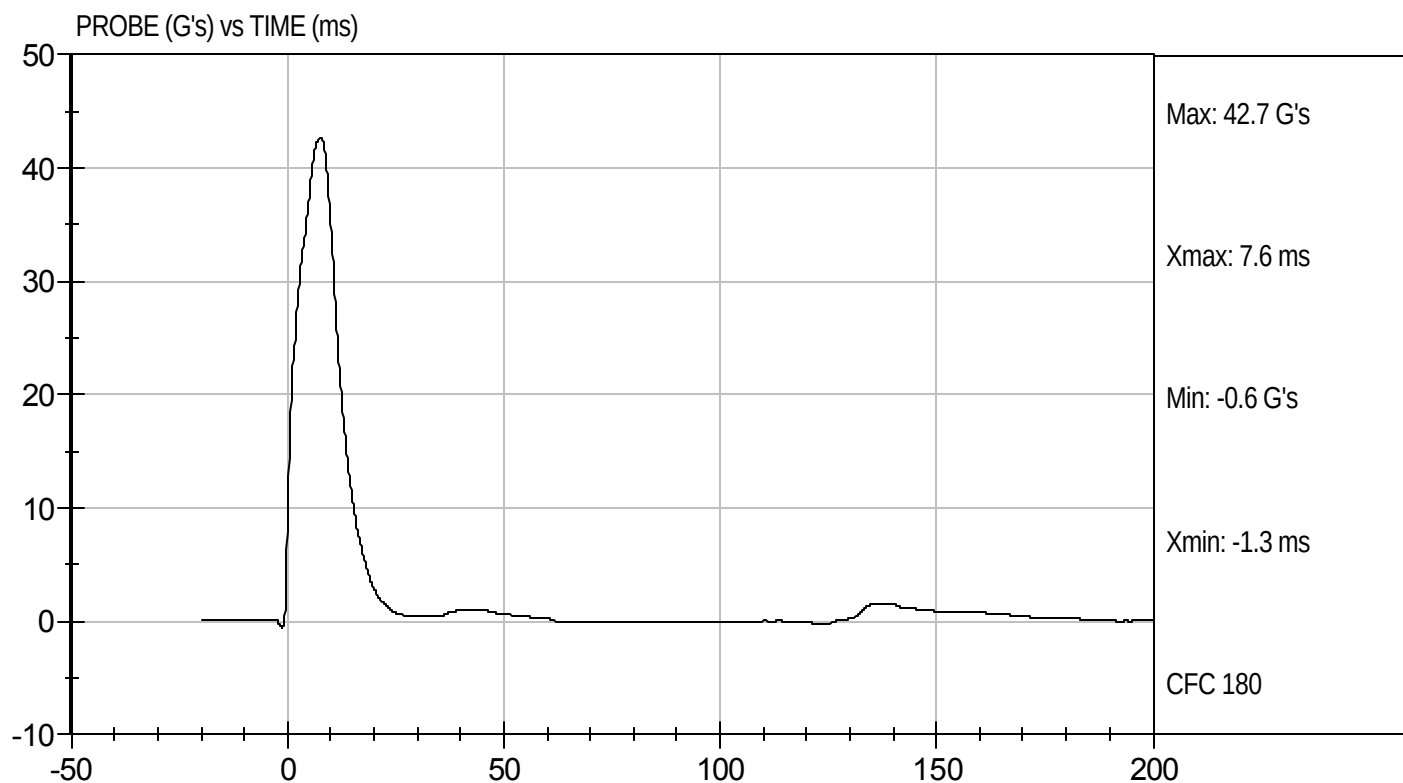
8/8/11
Test Date

David Winkelbauer
Approved By



Test Desc: Pelvis Impact
Component ID: D112687

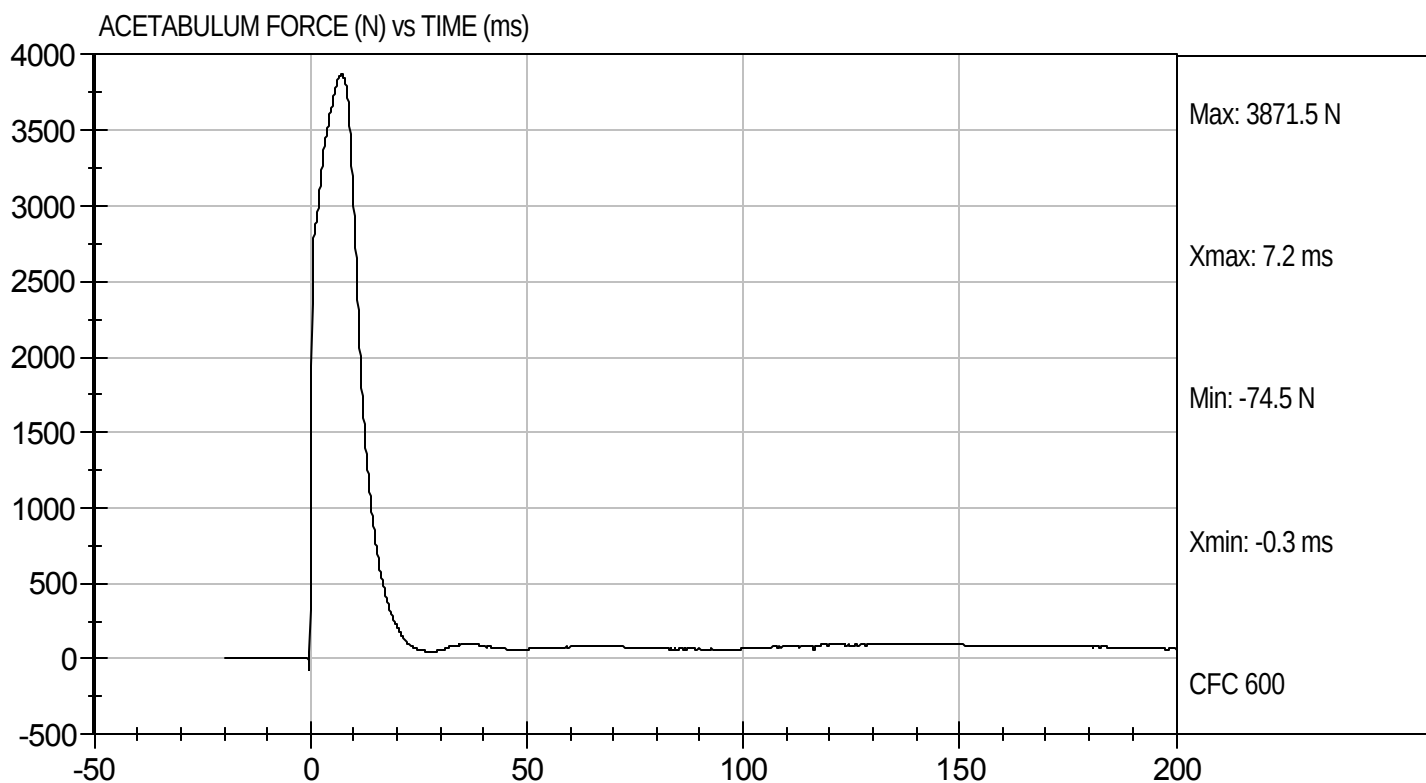
Test Date: 8/8/11
Velocity: 22.00 ft/s, 6.71 m/s





Test Desc: Pelvis Impact
Component ID: D112687

Test Date: 8/8/11
Velocity: 22.00 ft/s, 6.71 m/s



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

ATD Serial No: 296

Test I.D: D112688

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	52	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Peak Impactor Acceleration	G's	36 to 45	37	Pass
Pelvis Y Acceleration	G's	28 to 39	28	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4475	Pass
Overall Test Results			Pass	


Laboratory Technician

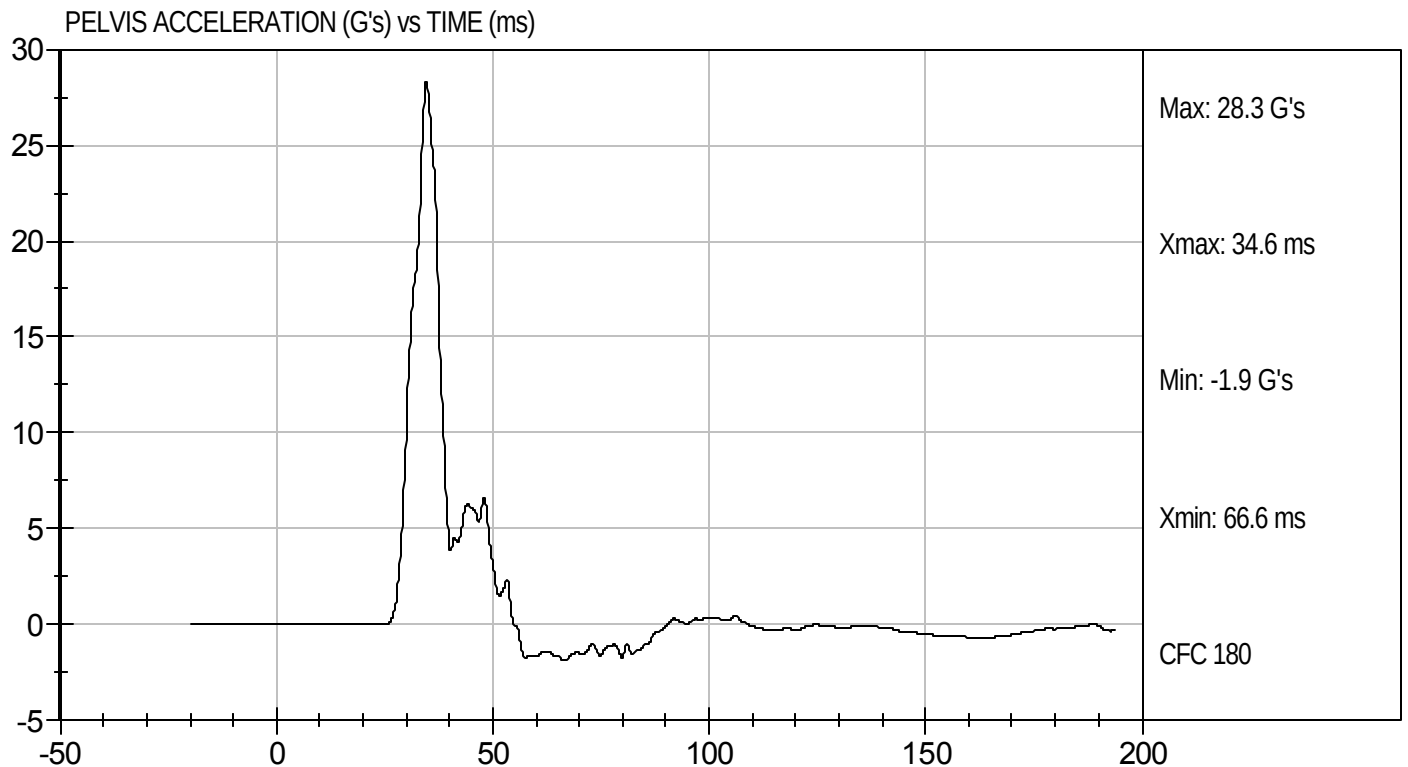
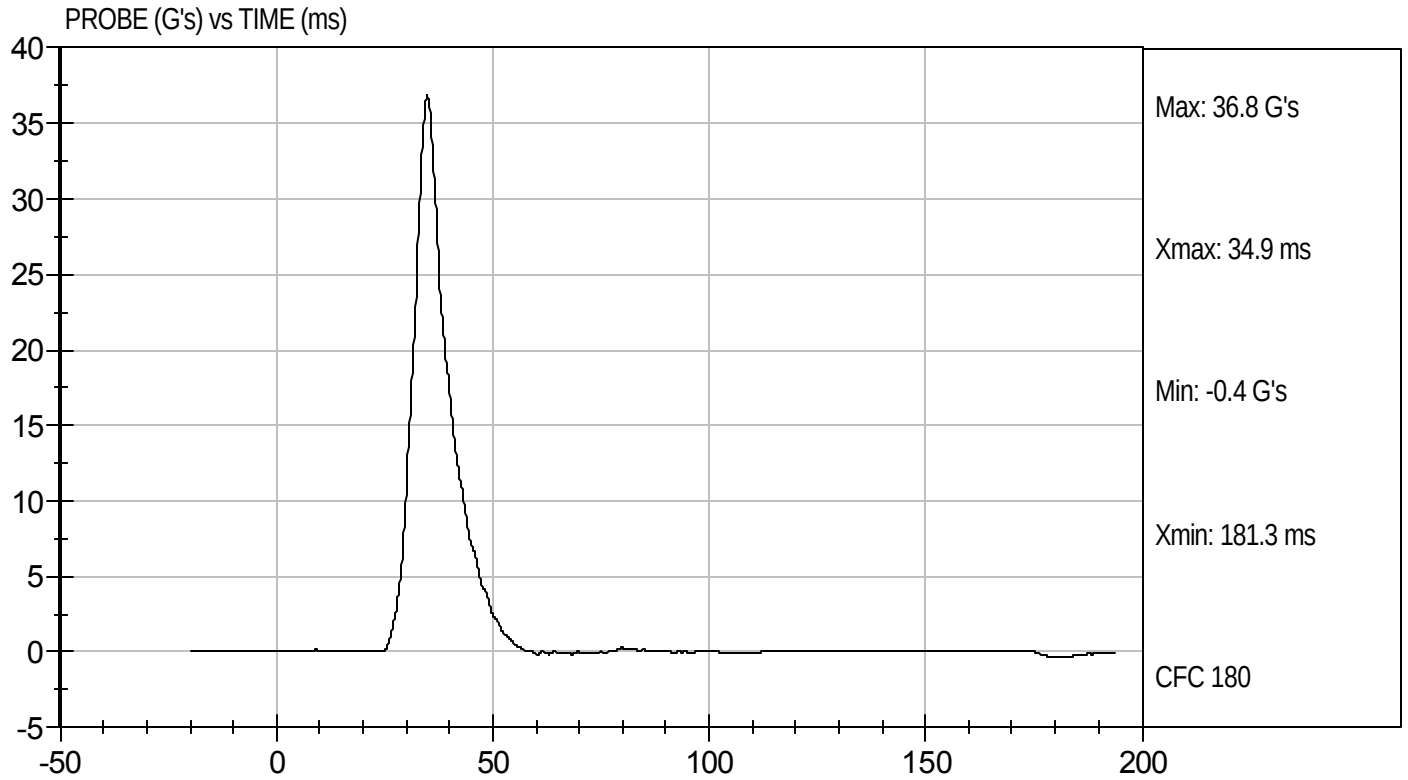
8/9/11
Test Date


Approved By



Test Desc: Iliac Impact
Component ID: D112688

Test Date: 8/9/11
Velocity: 14.25 ft/s, 4.34 m/s





Test Desc: Iliac Impact
Component ID: D112688

Test Date: 8/9/11
Velocity: 14.25 ft/s, 4.34 m/s

