

REPORT NUMBER: SPNCAP-MGA-2011-055

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

**FUJI HEAVY INDUSTRIES LTD.
2011 Subaru Forester
NHTSA No.: MB5503**

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



Test Date: December 16, 2010

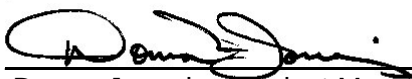
Final Report Date: February 4, 2011

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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Prepared by: 
Donna Janovicz, Project Manager

Approved by: 
Ben Fischer, Project Engineer

Approval Date: February 4, 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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15. Supplementary Notes																							
16. Abstract A 32.2 km/h (20 mph), 75° oblique impact NCAP Side Pole Test was conducted on the subject 2011 Subaru Forester 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 December 16, 2010. The impact velocity was 32.5 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 406 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></th> <th colspan="3">Driver ATD (SID-IIs)</th> </tr> <tr> <th>Measurement Description</th> <th>Units</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₃₆)</td> <td>N/A</td> <td>1000</td> <td>334</td> </tr> <tr> <td>Resultant Lower Spine Acceleration</td> <td>Gs</td> <td>82</td> <td>53</td> </tr> <tr> <td>Combined Acetabular and Iliac Pelvic Force</td> <td>N</td> <td>5525</td> <td>6063</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.					Driver ATD (SID-IIs)			Measurement Description	Units	Threshold	Result	Head Injury Criteria (HIC ₃₆)	N/A	1000	334	Resultant Lower Spine Acceleration	Gs	82	53	Combined Acetabular and Iliac Pelvic Force	N	5525	6063
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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																					
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SECTION 1
TEST PURPOSE AND PROCEDURE

This side impact test is part of the MY 2011 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-09-D-00124. The purpose of this test is to generate comparative side impact performance in a 2011 Subaru Forester. 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 2011 Subaru Forester. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 32.5 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin, on December 16, 2010. 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	334	53	Iliac Wing	3121
			Acetabular	3077
			Sum	6063

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	

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

GENERAL COMMENTS

There was no valid data collected for:
Left Mid A-Post Y after 50 msec.
Driver Seat Track Y after 40 msec.

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: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MB5503	Anti-Lock Brakes	Yes
Model Year	2011	All Wheel Drive	Yes
Make	Subaru	Power Steering	Yes
Model	Forester	Driver Front Airbag	Yes
Body Style	MPV	Driver Curtain Airbag	Yes
VIN	JF2SHBBC8BG700171	Driver Head/Torso Airbag	No
Body Color	Camellia Red Pearl	Driver Torso Airbag	No
Delivery Date	11/11/2010	Driver Torso/Pelvis Airbag	Yes
Odometer (mi)	64	Driver Pelvis Airbag	No
Odometer (km)	103	Driver Knee Airbag	No
Dealer	Sommer's Subaru	Rear Pass. Front Airbag	No
Transmission	Manual	Rear Pass. Curtain Airbag	Yes
Final Drive	AWD	Rear Pass. Head/Torso Airbag	No
Type/No. Cylinders	4	Rear Pass. Torso Airbag	No
Engine Displacement (L)	2.5	Rear Pass. Torso/Pelvis Airbag	No
Engine Placement	Longitudinal	Rear Pass. Pelvis Airbag	No
Roof Rack	Yes	Rear Pass. Knee Airbag	No
Sunroof/T-Top	No	Pretensioners	Yes
Tinted Glass	No	Load Limiters	Yes
Traction Control	Yes	Automatic Door Locks	No
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?			N/A

DATA FROM CERTIFICATION LABEL

Manufactured By	Fuji Heavy Industries Ltd.	GVWR (kg)	2035
Date of Manufacture	08/10	GAWR Front (kg)	1050
		GAWR Rear (kg)	1095

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3		5	
Capacity Weight (VCW) (kg)				408	(A)
DSC x 68.04 kg				340	(B)
Cargo Weight (RCLW) (kg)				68	(A-B)

VEHICLE SEAT TYPE

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

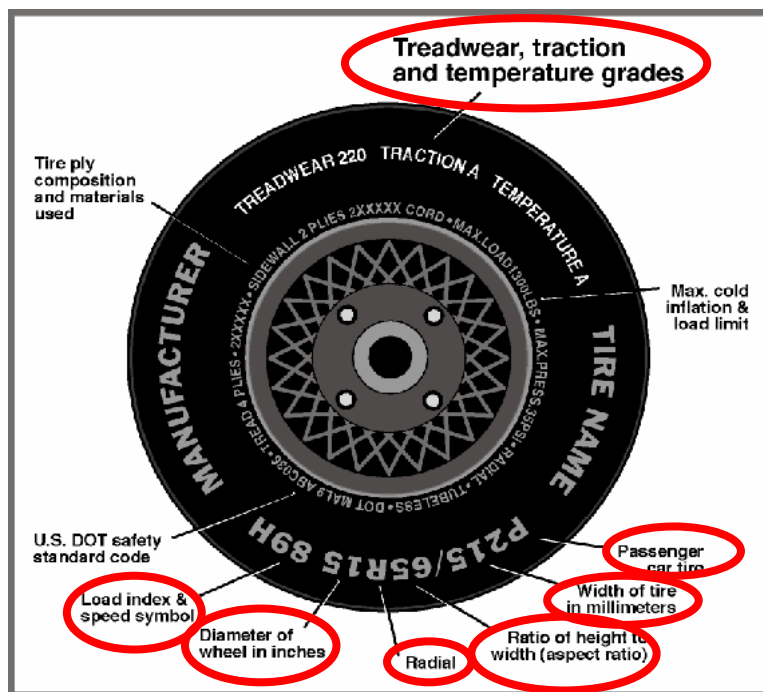
DATA SHEET NO. 1 (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	210	200
Recommended Tire Size	P215/65R16	P215/65R16
Tire Size on Vehicle	P215/65R16	P215/65R16
Tire Manufacturer	Bridgestone	Bridgestone
Tire Model	Dueler H/T	Dueler H/T
Treadwear	300	300
Traction	B	B
Temperature Grades	A	A
Tire Plies Sidewall	2	2
Tire Plies Body	4	4
Load Index & Speed Symbol	96H	96H
Tire Material	Rubber	Rubber
DOT Safety Code Right	EMHB DML2810	EMHB DML2810
DOT Safety Code Left	EMHB DML2810	EMHB DML2810

DATA SHEET NO. 1 (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	406.9	332.0		413.7	371.5		423.2	388.7	
Right	kg	390.1	326.6		412.3	371.0		391.5	372.4	
Ratio	%	54.8	45.2		52.7	47.3		51.7	48.3	
Totals	kg	797.0	658.6	1455.6	826.0	742.5	1568.5	814.7	761.1	1575.8

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1455.6	(A)
Actual Weight of 1 P572V ATD (SID-IIs) ATD Used	kg	52.2	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	68	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	1575.8	(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	0.0	0.3
Front Passenger Sill Angle (front-to-rear)*	deg	0.0	0.0	0.4
Front Bumper Angle (left-to-right)**	deg	0.0	-0.2	-0.3
Rear Bumper Angle (left-to-right)**	deg	0.0	-0.1	-0.1
Vehicle CG (Aft of Front Axle)	mm	1183	1238	1263
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	12	1	23

*Front up is positive ** Left up is positive

GENERAL VEHICLE TEST DATA

Measurement Description	Units	Value
Weight of Ballast in Cargo Area	kg	0.0
Weight of Vehicle Components Removed	kg	22.7

Vehicle components removed to meet target vehicle test weight: Right tail light, spare tire, jack & tools, trunk compartment and sub floor.

TEST VEHICLE IMPACT POINT DATA

Measurement Parameter	Units	Value
Vertical Impact Reference Line (Aft of Front Axle)	mm	1125
Actual Impact Point (Aft of Front Axle)	mm	1130
Impact Point Difference (- forward / + rearward)	mm	5

DATA SHEET NO. 2

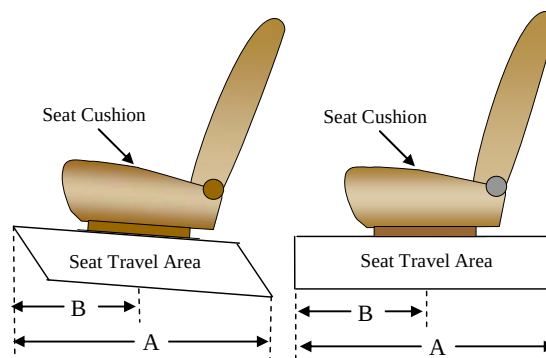
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010

SEAT FORE/AFT POSITIONS

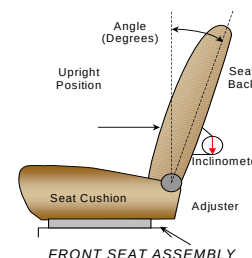
The driver seat was a manual fore/aft adjustable seat with manual height/angle adjustment. The seat travel was set as specified in Appendix B of the TP dated January 2010. The right front passenger seat was set to match the driver seat. The rear passenger seats were fixed.



SEAT FORE/AFT POSITIONING	Total Fore/Aft Travel	Placed in Detent # or Position
Driver Seat	19 detents (1 st as 1)	0 ((forward-most as 0)
Front Passenger Seat	20 detents (1 st as 1)	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. The seat back angle measurement was made relative to the rocker sill on the headrest post guide.



SEAT BACK ANGLE	Degrees	Detents
Driver Seat Back Angle with Seated Dummy	1.1	3 rd (first locking as 0)
Front Passenger Seat Back Angle	1.0	3 rd (first locking as 0)
Struck Side Rear Seat Back Angle		Fixed
Non-Struck Side Rear Passenger Seat Back Angle		Fixed

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	4 detents (1 st as 1)	1 (uppermost as 0)

DATA SHEET NO. 2 (CONTINUED)

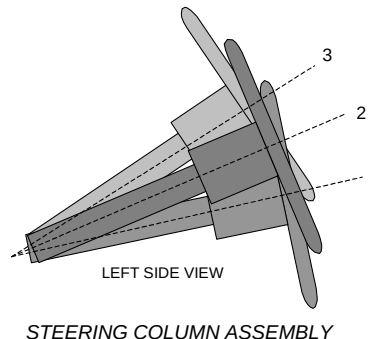
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010

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.

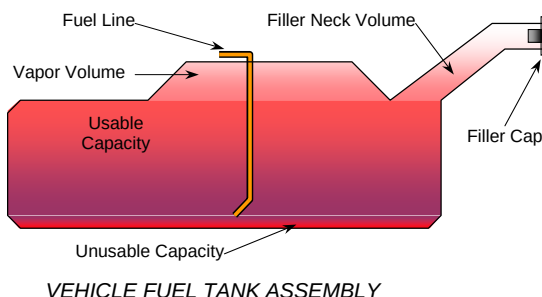


STEERING COLUMN POSITIONING

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	65.0	
Geometric Center – Position 2	63.7	
Uppermost – Position 3	62.4	
Telescoping Steering Wheel Travel		
Test Position	63.7	

FUEL PUMP

Describe the fuel pump type, its behavior, and the location of the fuel filler pipe. The vehicle is equipped with an electric fuel pump. Pump operates a few seconds after an ignition switch is turned ON. After that, pump operates only while engine is running. The fuel pipe is on the right side.



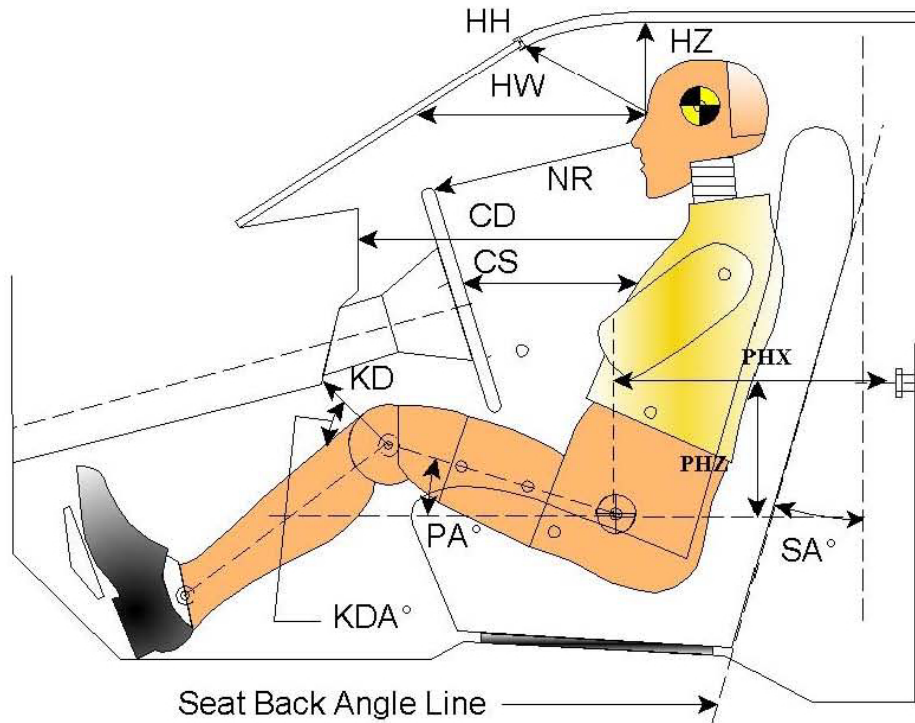
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard" Tank	64.0
Usable Capacity of "Optional" Tank	
Usable Capacity of Standard Tank as Specified in Owner's Manual	64.0
Usable Capacity of Optional Tank as Specified in Owner's Manual	
92-94% of Usable Capacity	58.9 to 60.2
Actual Amount of Solvent Used	59.4
1/3 of Usable Capacity	21.3

.DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010

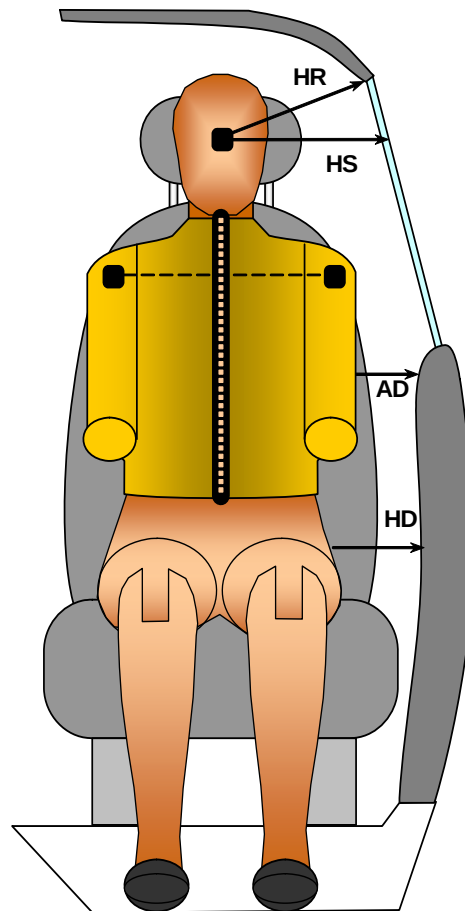


Code	Measurement Description	Driver S/N 296	
		Length (mm)	Angle (°)
HH	Head to Header	286	
HW	Head to Windshield	557	
HZ	Head to Roof	235	
NR	Nose to Rim	249	
CD	Chest to Dash	403	
CS	Chest to Steering Wheel	191	
KDL/KDAL	Left Knee to Dash	124	40.2
KDR/KDAR	Right Knee to Dash	116	37.6
PA	Pelvic Angle		18.2
PHX	H-Point to Striker (X-Axis)	334	
PHZ	H-Point to Striker (Z-Axis)	138	
SA	Seat Back Angle		1.1

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Subaru Forester
Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
Test Date: 12/16/2010



FRONT VIEW OF DUMMY

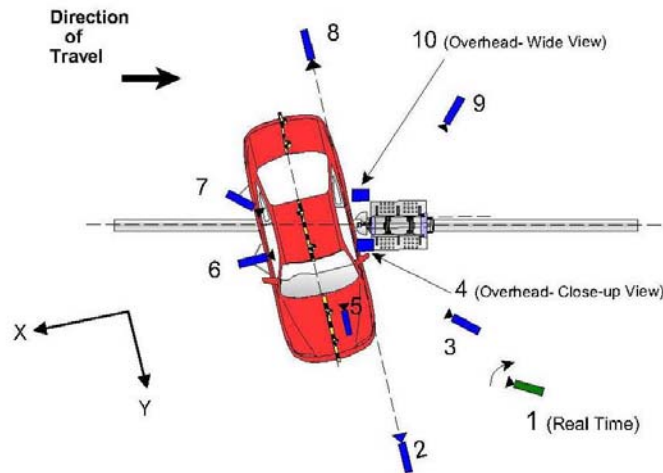
Code	Measurement Description	Driver S/N 296
		Length (mm)
HR	Head to Side Header	280
HS	Head to Side Window	379
AD	Arm to Door	146
HD	H-Point to Door	169

DATA SHEET NO. 5

CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010



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	5580	-1590	24	1000
3	Impact Side 45° Forward	-1770	4110	-1630	20	1000
4	Overhead Closeup	40	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	0	-6530	-1530	24	1000
9	Impact Side 45° Rearward	-3560	-2890	-1670	20	1000
10	Overhead Wide View	140	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

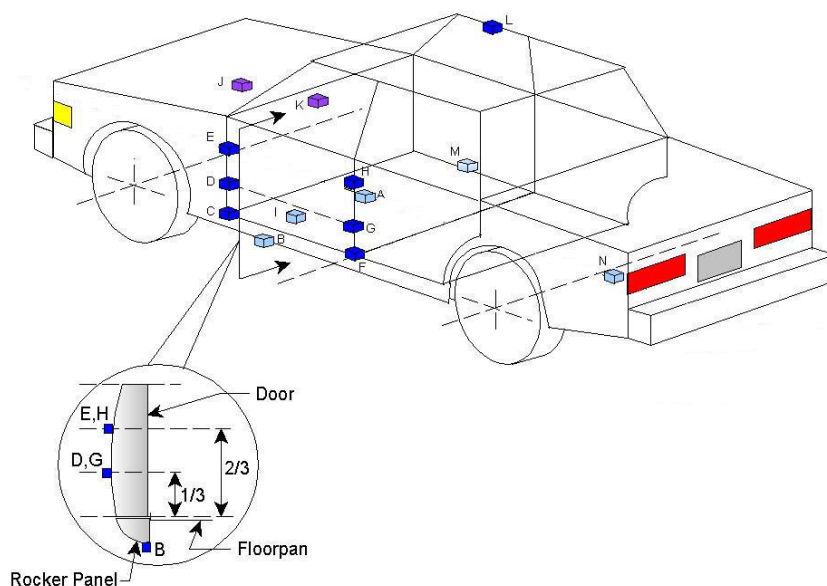
	Number of Channels
Driver Dummy	16
Vehicle Structure	21
Pole Load Cells – Not used	8
Contact Switches	3
Airbag Timing	2
Total No. of Data Channels	50

DATA SHEET NO. 6

VEHICLE ACCELEROMETER DATA

Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010



	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
A	Vehicle CG	2167	228	-268
	Vehicle CG Sensor	2167	-228	-268
B	Left Floor Sill	2828	-693	-275
C	A Pillar Sill	3095	-697	-280
D	A Pillar Low	3033	-681	-510
E	A Pillar Mid	3065	-783	-980
F	B Pillar Sill	2019	-692	-280
G	B Pillar Low	2040	-713	-730
H	B Pillar Mid	1995	-710	-1005
I	Driver Seat	2440	-590	-485
L	Engine Top	3858	0	-909
J	Firewall	3393	0	-893
K	Right Roof	2051	585	-1609
M	Right Floor Sill	2450	697	-285
N	Rear Floorpan	190	0	-379

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: 2011 Subaru Forester
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NHTSA No. MB5503
Test Date: 12/16/2010



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: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010

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	Door Panel
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

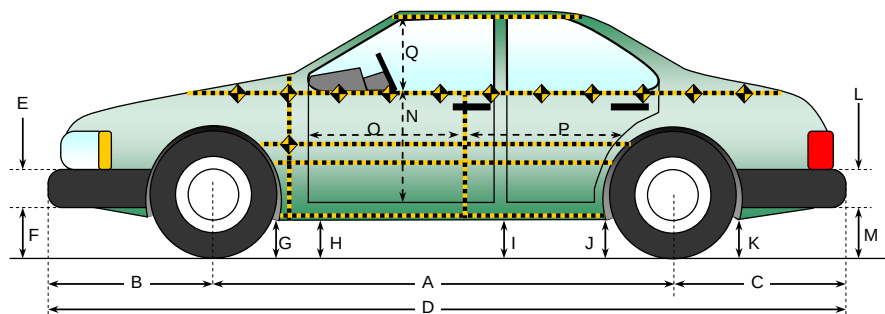
Measured Parameter	Units	Requirement	Value
Horizontal Offset from Vertical Impact Reference Line	mm	+/- 38	5
Trap No. 1 Velocity (Primary)	km/h	31.4 to 33.0	32.5
Trap No. 2 Velocity (Redundant)	km/h	31.4 to 33.0	32.7

DATA SHEET NO. 9

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
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All measurements in (mm) with tolerance of ± 3 mm

LEFT SIDE VIEW

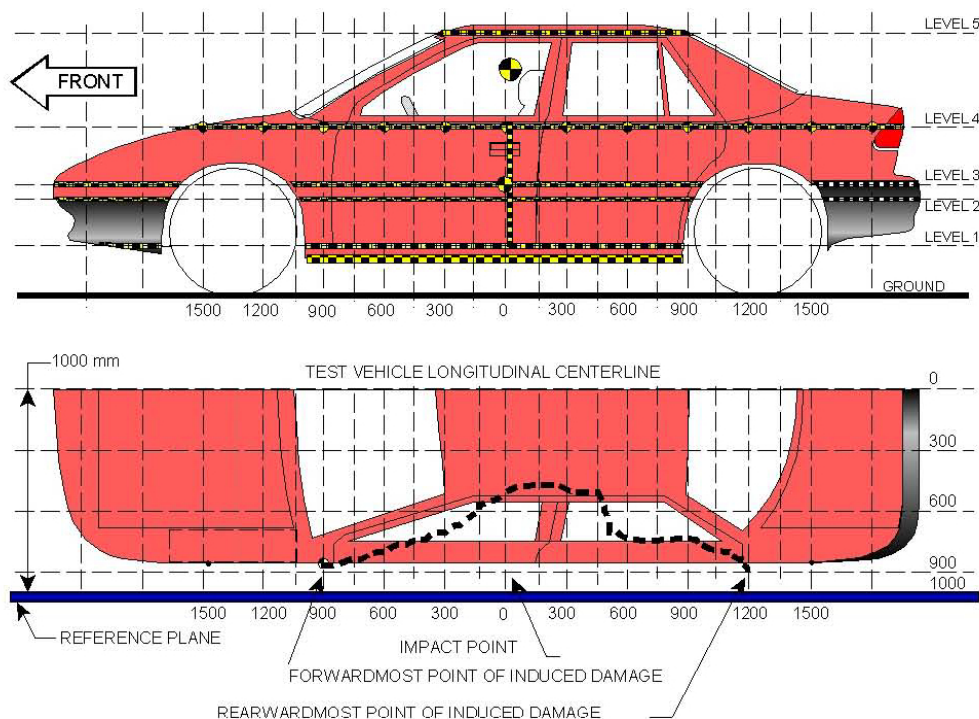
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2615	2475	140
B	Front Axle to FSOV	930	940	-10
C	Rear Axle to RSOV	1018	995	23
D1	Total Vehicle Length at Left Side	3833	3660	173
D2	Total Vehicle Length at Centerline	4563	4410	153
D3	Total Vehicle Length at Right Side	3833	3844	-11
E	Front Bumper Thickness	152	152	0
F	Front Bumper Bottom to Ground	330	362	-32
G	Sill Height at Front Wheel Well	265	261	4
H	Sill Height at Front Door Leading Edge	267	239	28
I	Sill Height at B Pillar	260	218	42
J1	Sill Height at Rear Wheel Well	268	275	-7
J2	Pinch Weld Height at Rear Wheel Well	269	280	-11
K	Sill Height Aft of Rear Wheel Well	321	235	86
L	Rear Bumper Thickness	117	117	0
M	Rear Bumper Bottom to Ground	392	391	1
N	Sill Height to Window Bottom Sill	724	720	4
O	Front Door Leading Edge to Impact CL	592	592	0
P	Rear Door Trailing Edge to Impact CL	1473	1435	38
Q	Front Window Opening	462	436	26
R	Right Side Length	3833	3844	-11
S	Left Side Length	3833	3660	173
T	Vehicle Width at B Post	1757	1613	144

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

Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010



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	390
2	Mid Door	675
3	Occupant H-Point	738
4	Window Sill	1054
5	Window Top	1556

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

Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1200				327					331					4	
-1050				313					326					13	
-900		213	214	303			229	227	328			16	13	25	
-750	259	235	235	294		288	256	255	320		29	21	20	26	
-600	287	237	234	290		350	274	266	295		63	37	32	5	
-525	294	236	233	289		385	309	303	331		91	73	70	42	
-450	292	235	232	287		418	353	352	371		126	118	120	84	
-375	291	234	231	285		447	404	399	414		156	170	168	129	
-300	290	233	230	283		474	450	444	452		184	217	214	169	
-225	290	232	228	282		514	507	501	504		224	275	273	222	
-150	289	232	228	280		563	558	554	560		274	326	326	280	
-75	285	231	227	277	481	621	603	603	609	665	336	372	376	332	184
0	288	230	227	275	480	625	622	633	627	670	337	392	406	352	190
75	287	230	226	274	480	614	627	626	619	659	327	397	400	345	179
150	287	230	226	274	479	559	581	583	583	624	272	351	357	309	145
225	287	230	226	272	480	517	523	526	528	609	230	293	300	256	129
300	288	230	226	268	481	468	455	461	461	583	180	225	235	193	102
375	287	231	227	269	483	415	396	397	406	566	128	165	170	137	83
450	289	232	228	267	485	413	362	353	382	544	124	130	125	115	59
525	290	233	229	264	487	398	360	350	373	534	108	127	121	109	47
600	292	235	230	261	487	342	325	324	339	505	50	90	94	78	18
750	294	238	233	260	488	308	302	395	317	509	14	64	162	57	21
900	267	239	235	259	491	243	257	272	289	508	-24	18	37	30	17
1050		214	220	261	495		191	211	265	512		-23	-9	4	17
1200			212	265	499			169	245	517			-43	-20	18
1350				271	508				273	521				2	13
1500				272	513				276	524				4	11
1650				285	523				285	535				0	12

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

368DATA SHEET NO. 10 (CONTINUED)
VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2011 Subaru Forester
Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
Test Date: 12/16/2010

MAXIMUM CRUSH DATA

	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	337	397	406	352	190
Distance From Impact (mm)	0	75	0	0	0

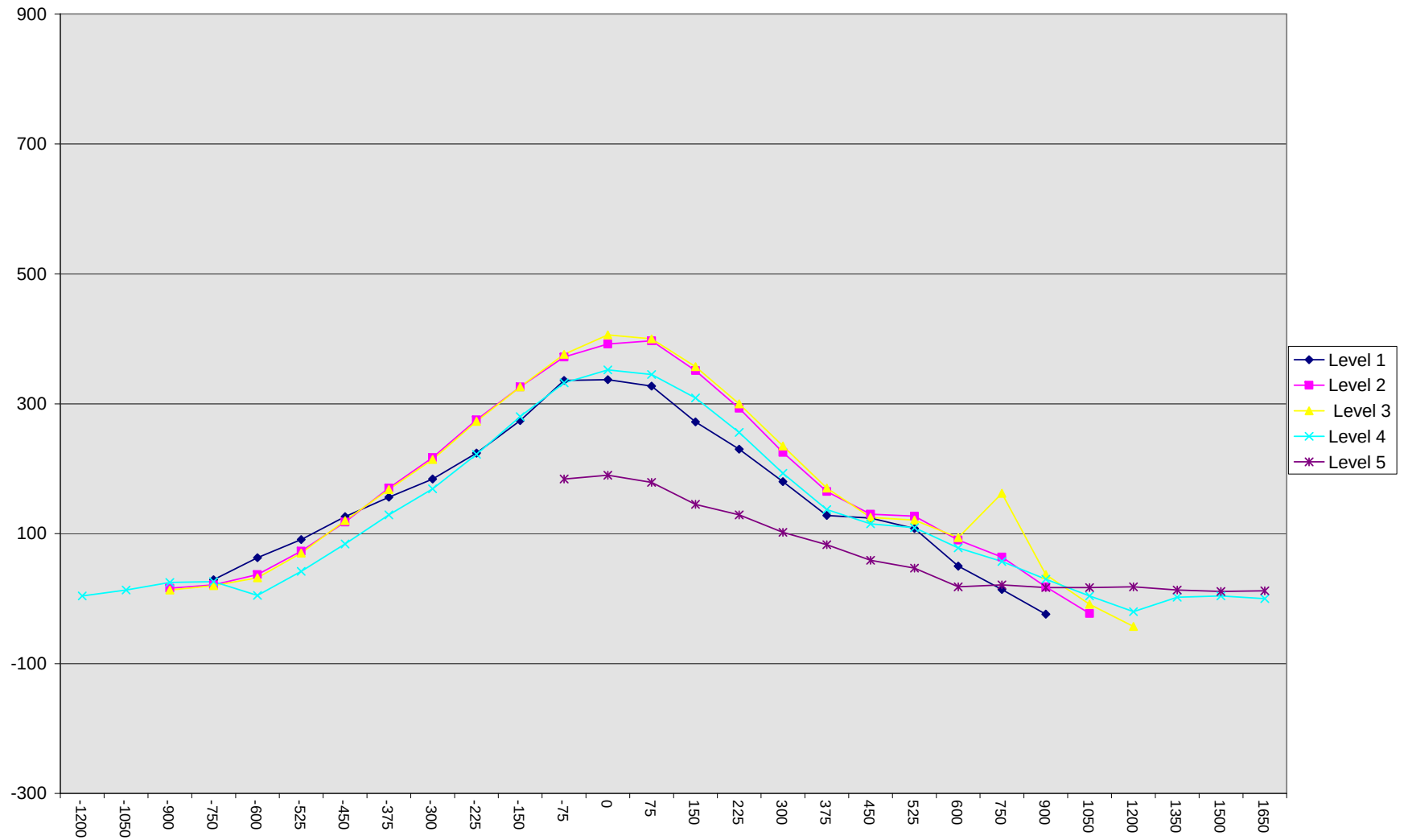
Note: Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush profile grid is established prior to test based on an estimated impact point. The final distance to impact is determined 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: 2011 Subaru Forester
Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
Test Date: 12/16/2010

20



DATA SHEET NO. 11

FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA

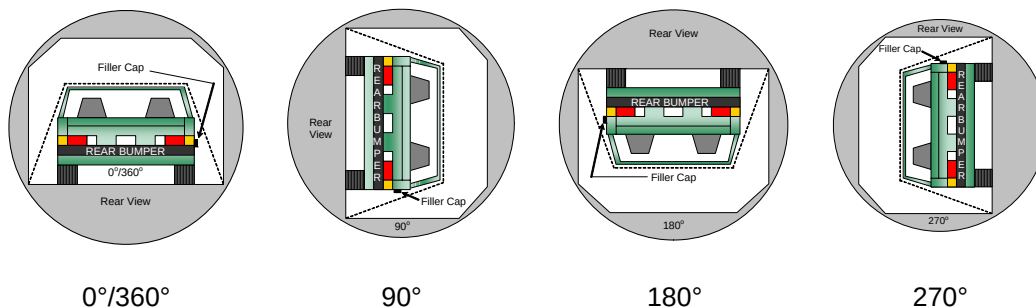
Test Vehicle: 2011 Subaru Forester
 Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
 Test Date: 12/16/2010

Test Time: 10:08 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°	118	300	418
90° to 180°	114	300	414
180° to 270°	108	300	408
270° to 360°	120	300	420

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

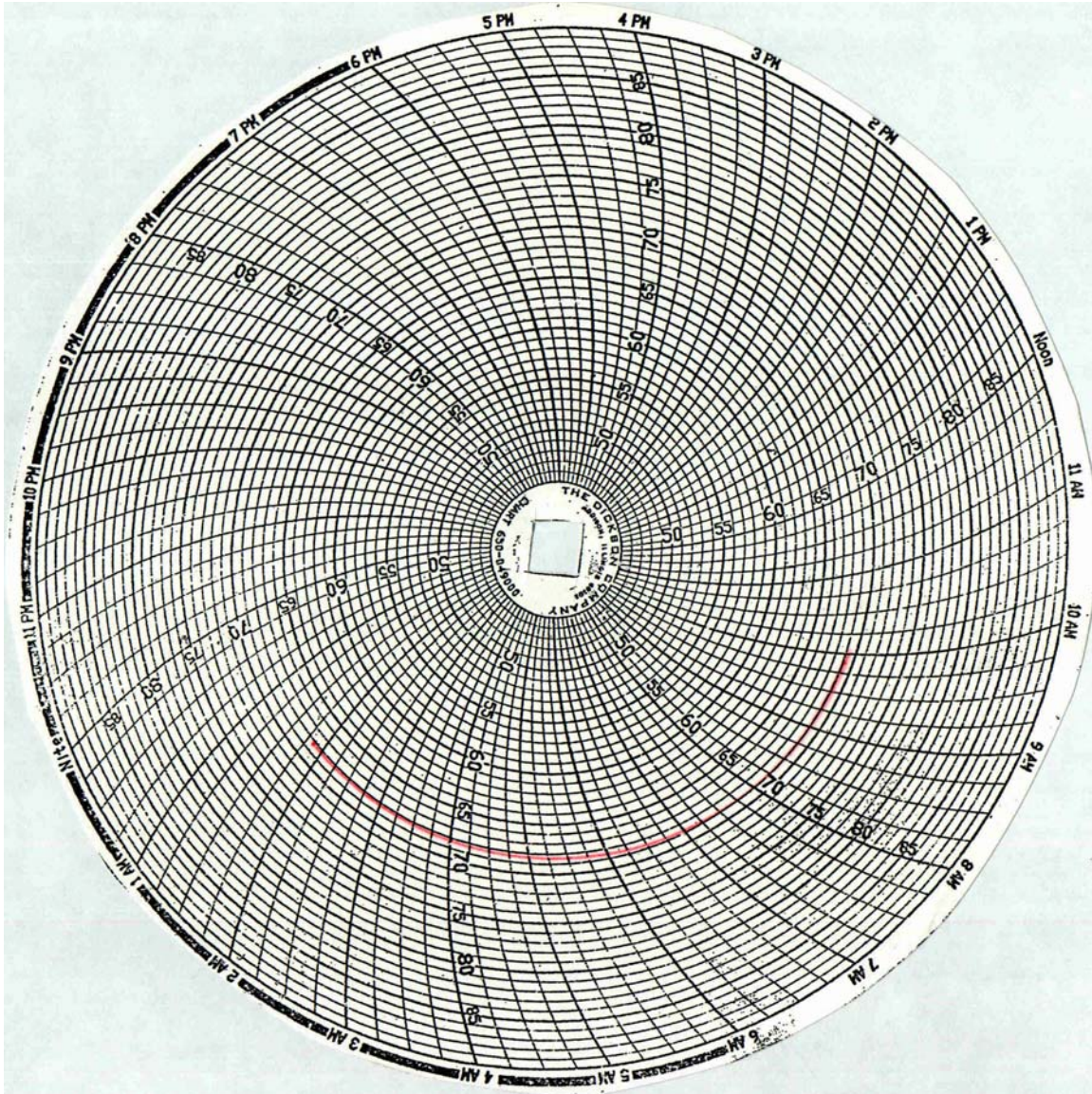
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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: 2011 Subaru Forester
Test Program: NCAP Side Pole Impact Test

NHTSA No. MB5503
Test Date: 12/16/2010



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



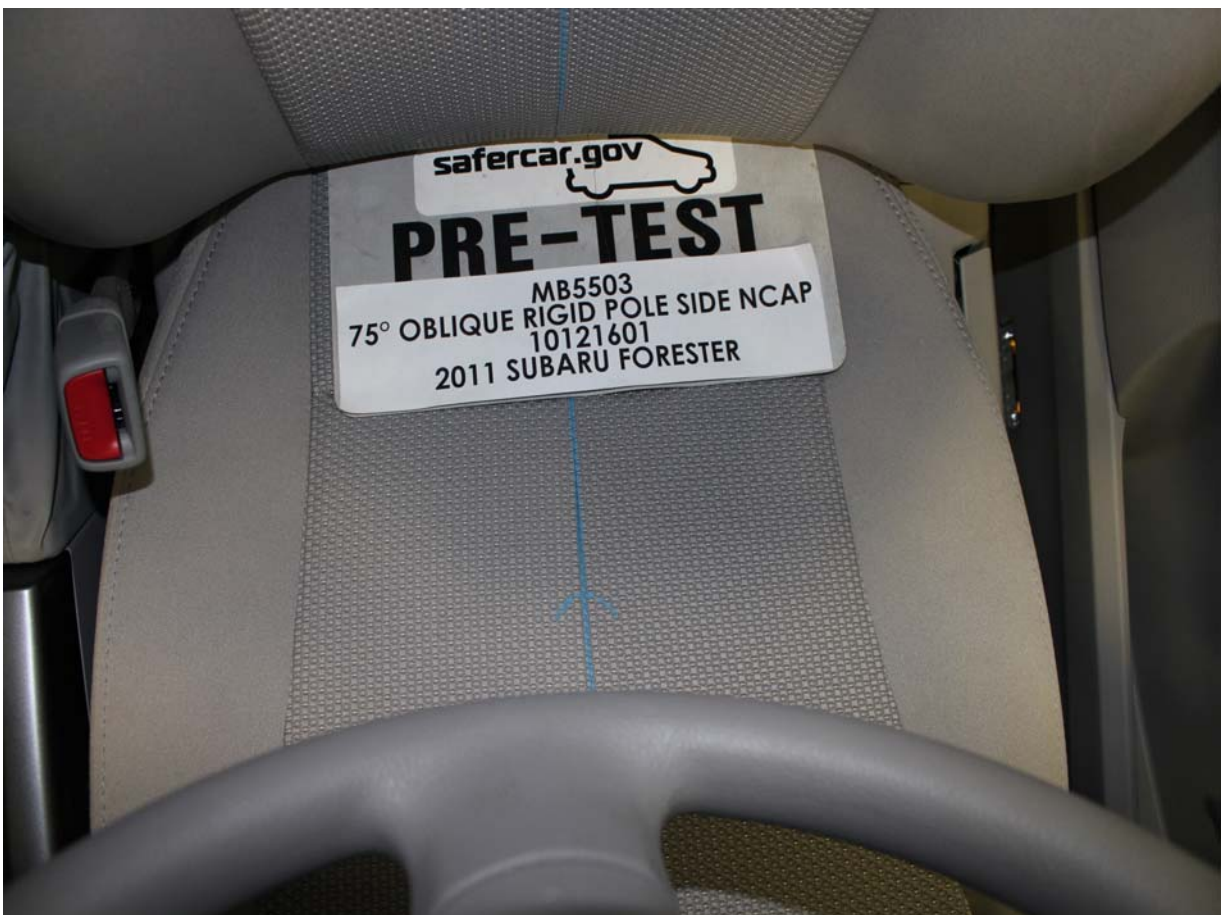
Post-Test Left Side View of Dummy Shoulder and Door Top View



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



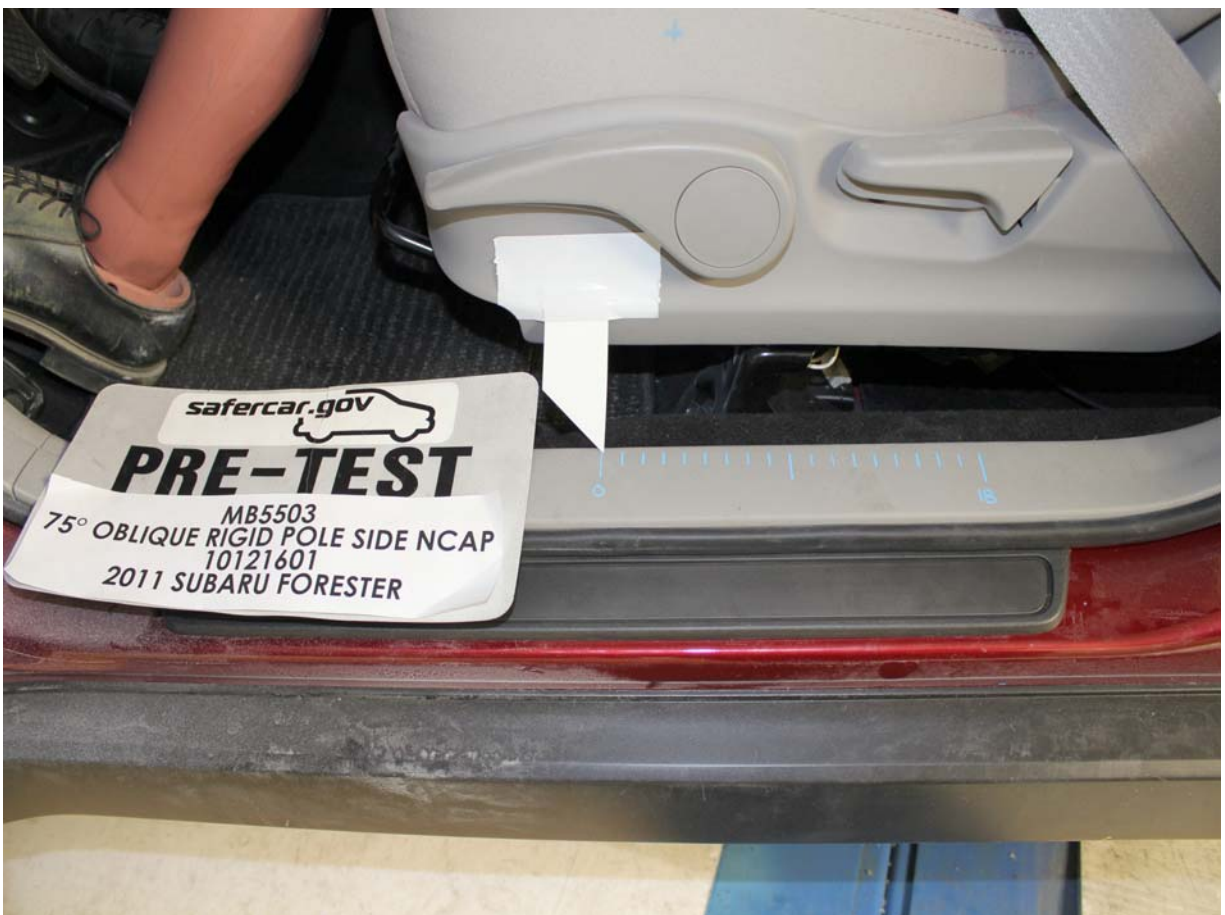
Pre-Test View of Belt Anchorage for Dummy to Show Position



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



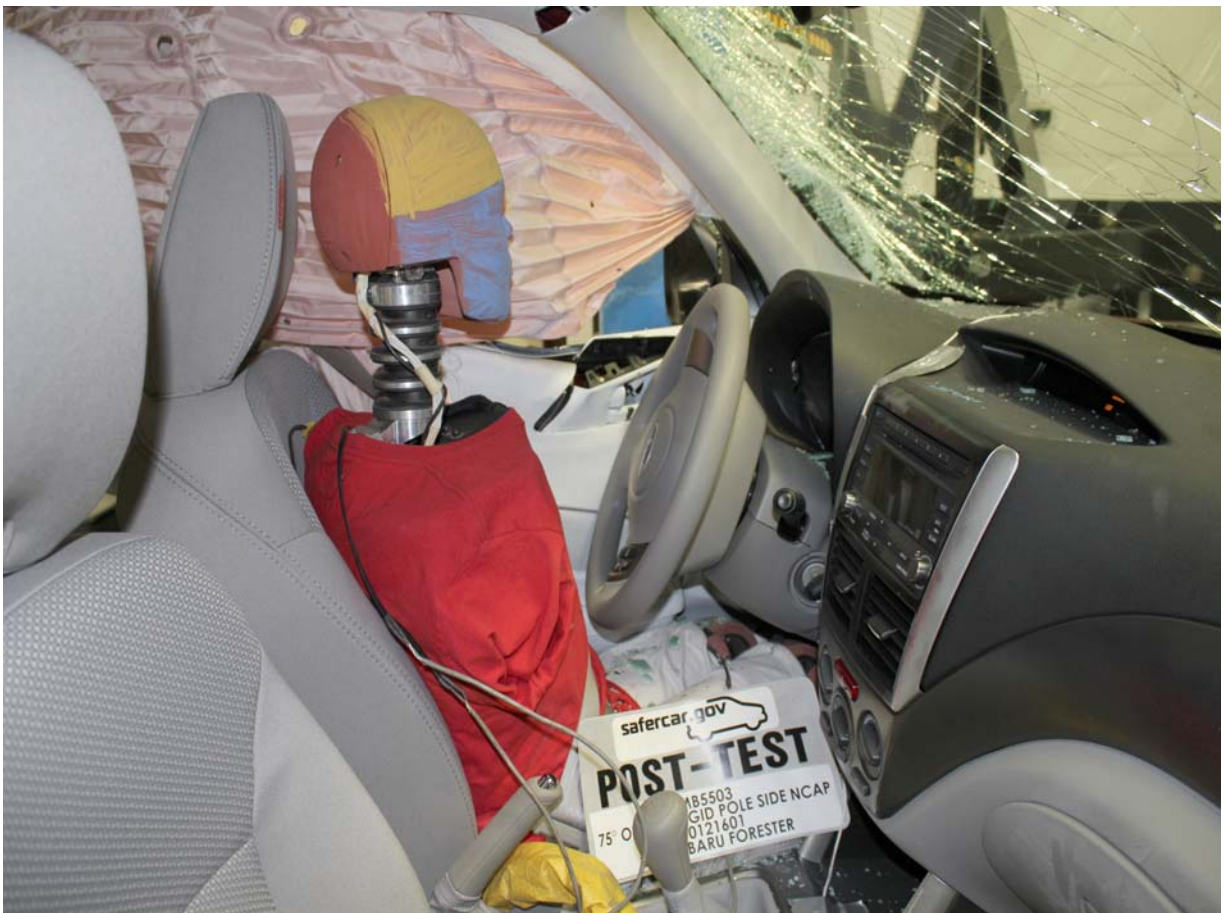
Pre-Test Dummy and Door Clearance View



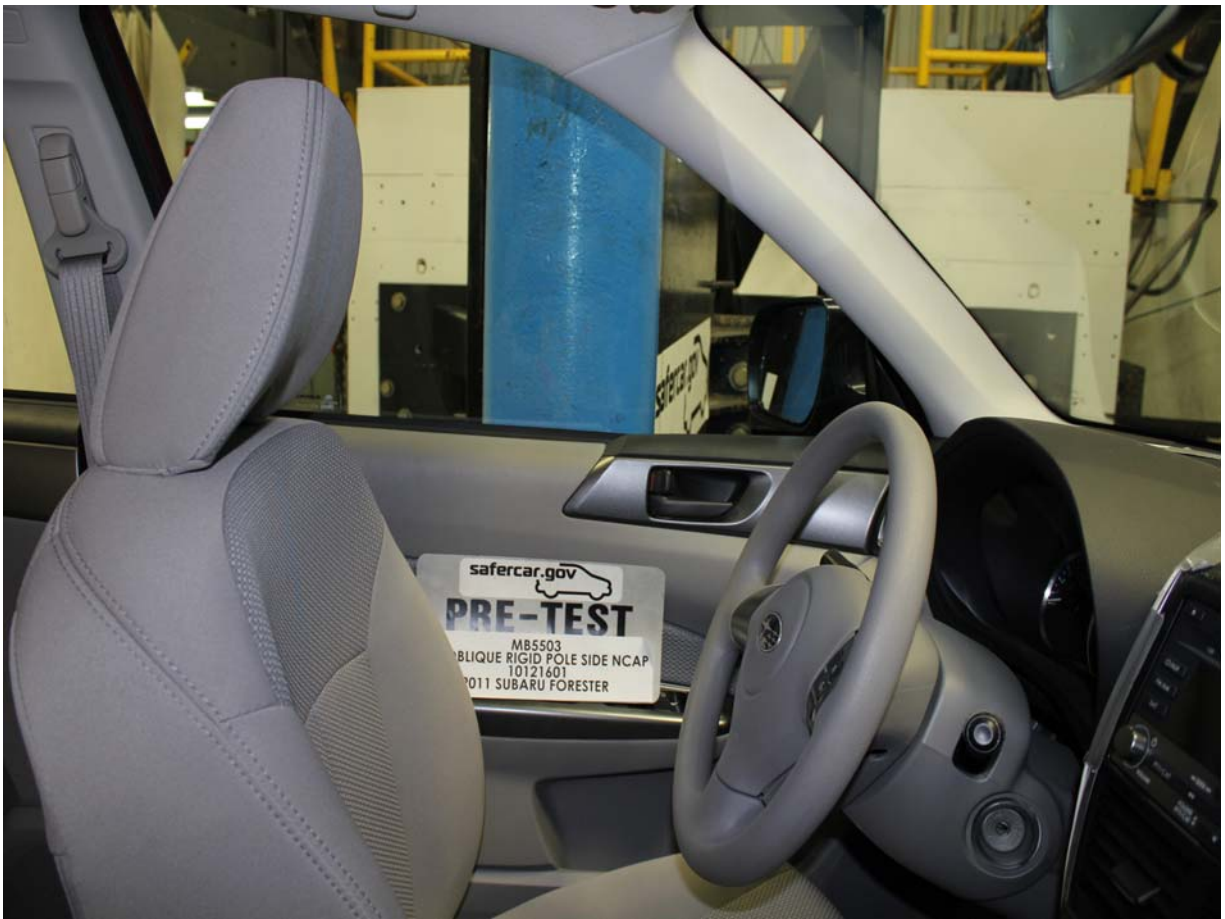
Post-Test Dummy and Door Clearance View



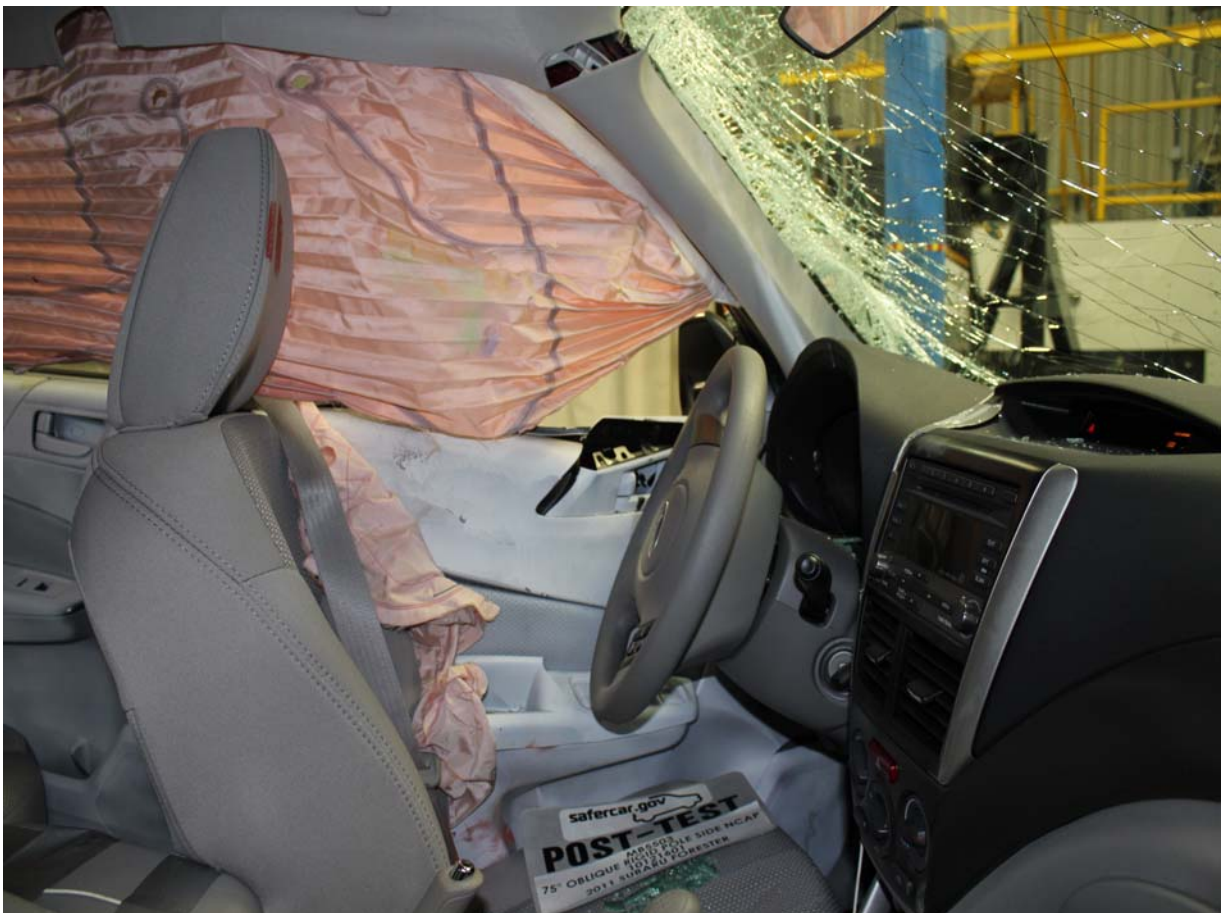
Pre-Test Right Side View of Dummy and Front Seat Occupant Compartment



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



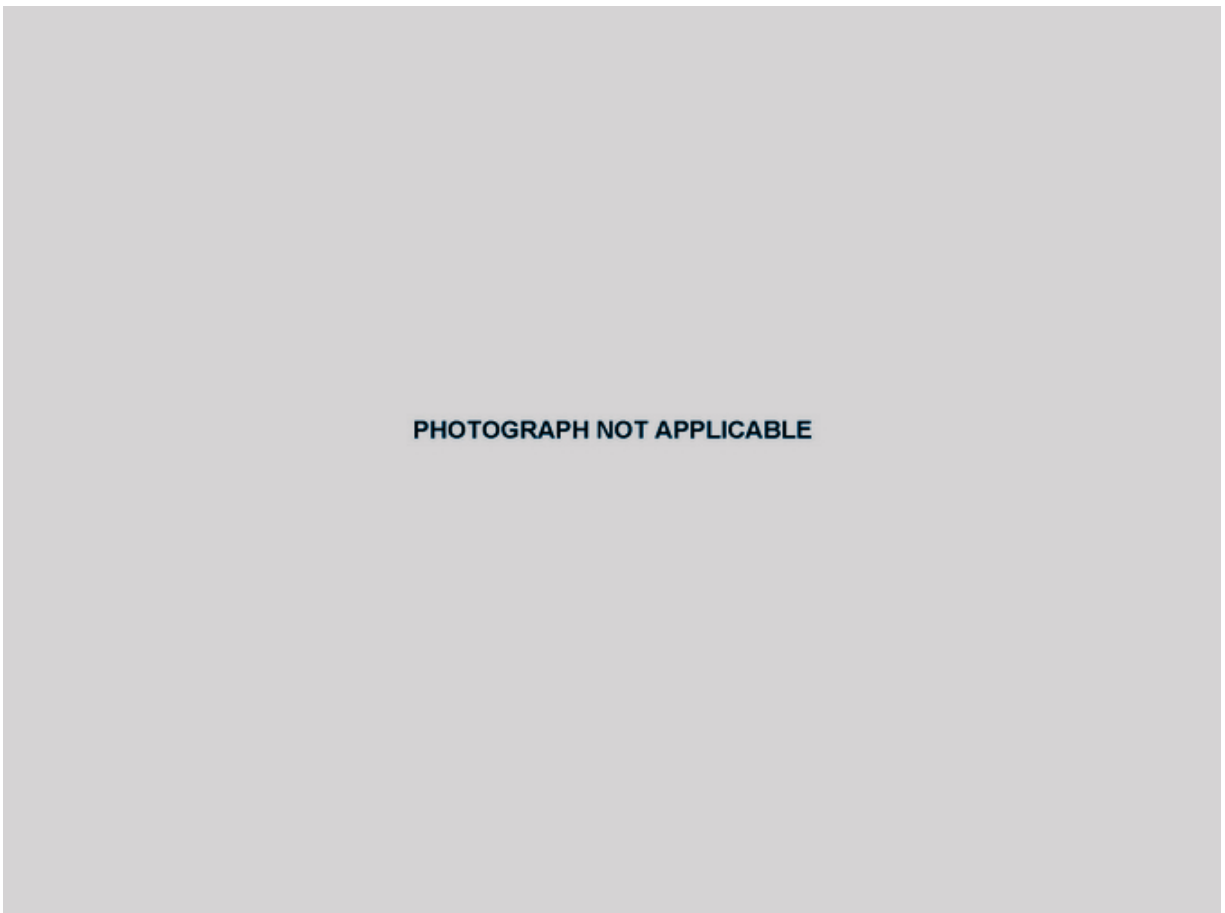
Post-Test Dummy Close-Up Torso Contact with Vehicle Interior View



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



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



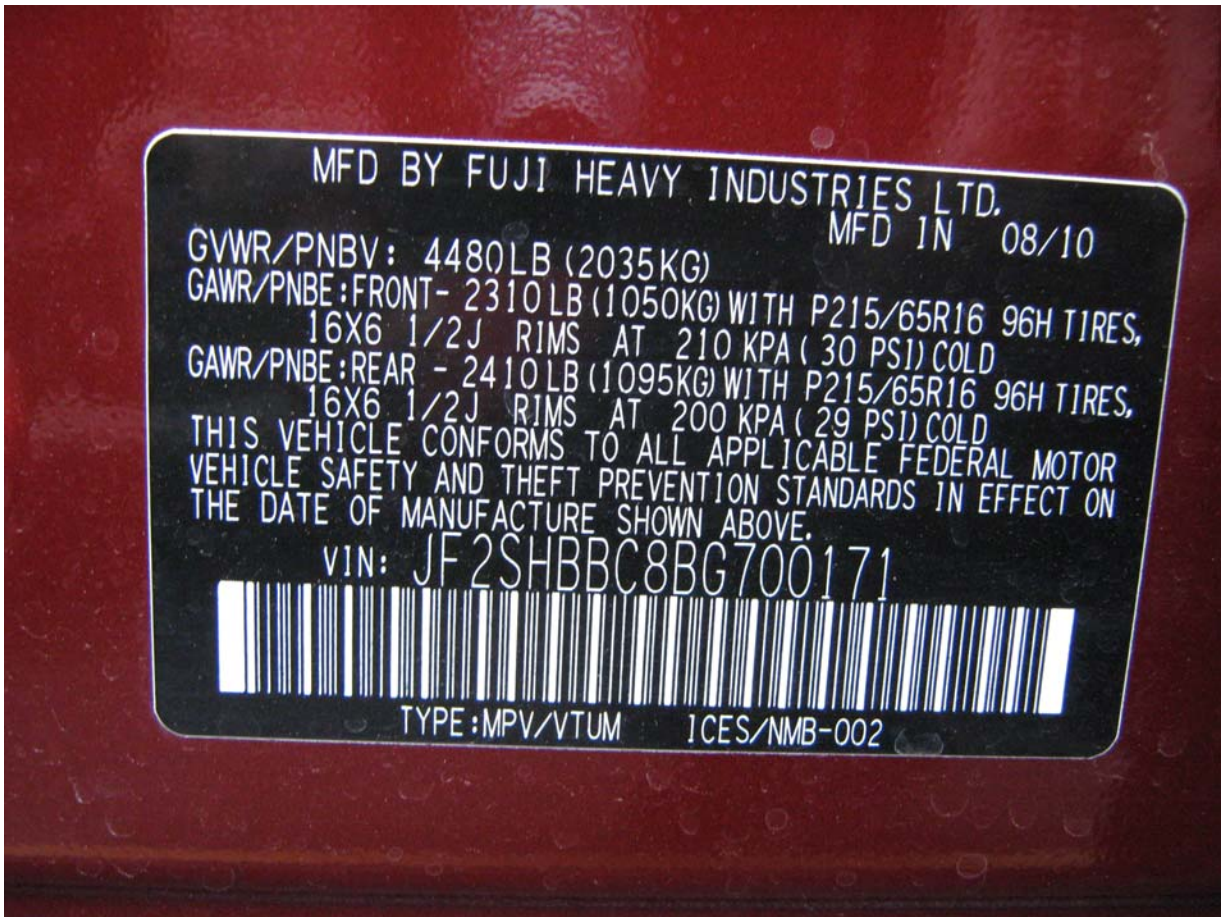
Post-Test Dummy Close-Up Pelvis Contact with Side Airbag View



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



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



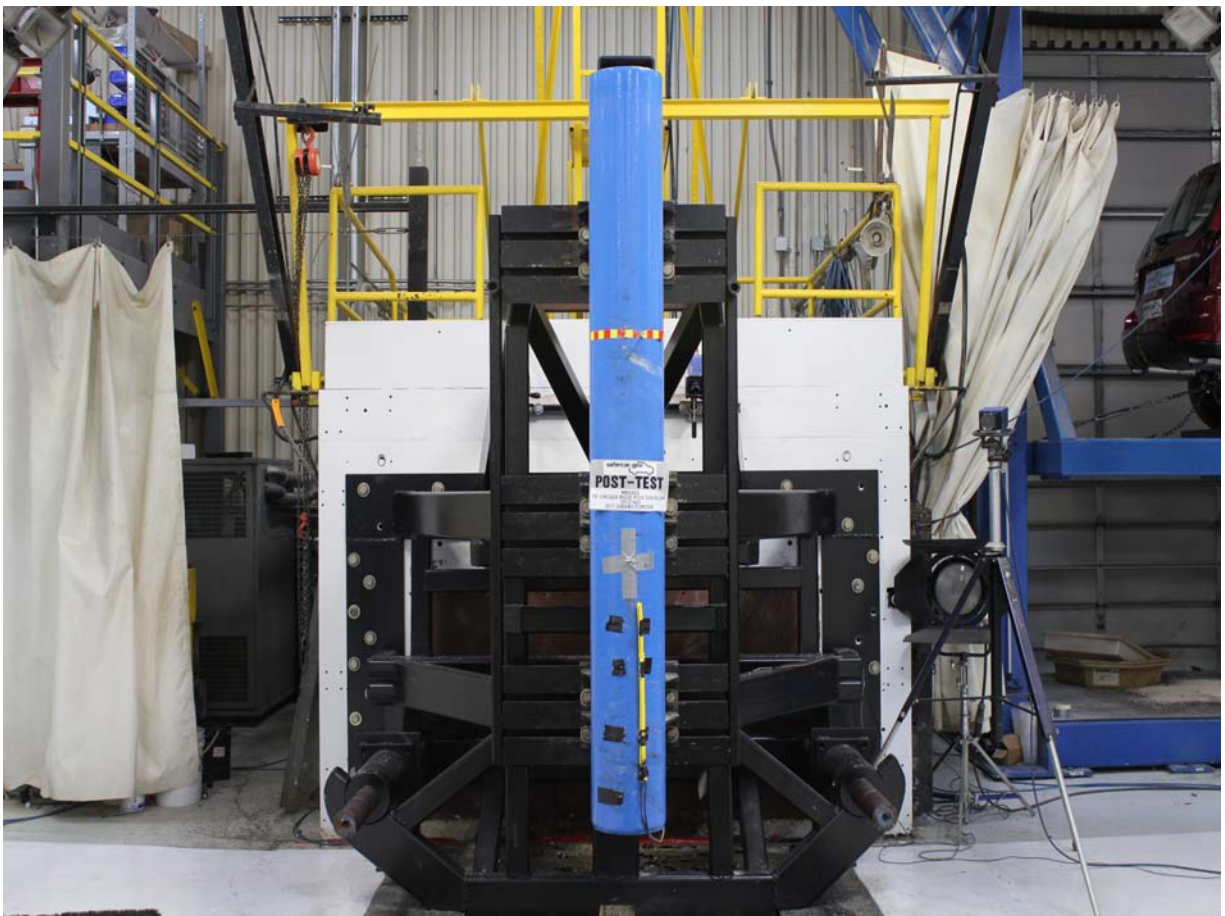
Close-Up View of Vehicle's Certification Label



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



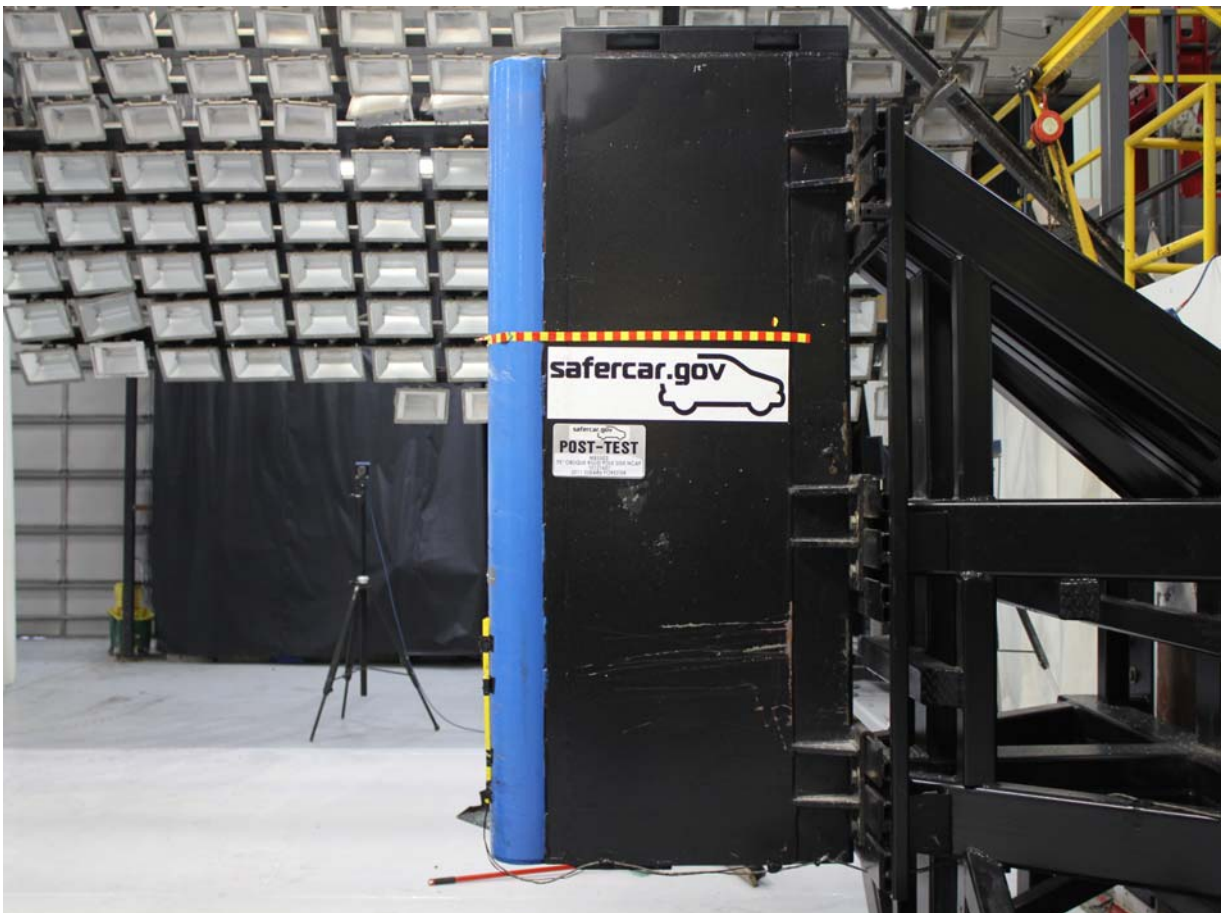
Pre-Test Pole Barrier Front View



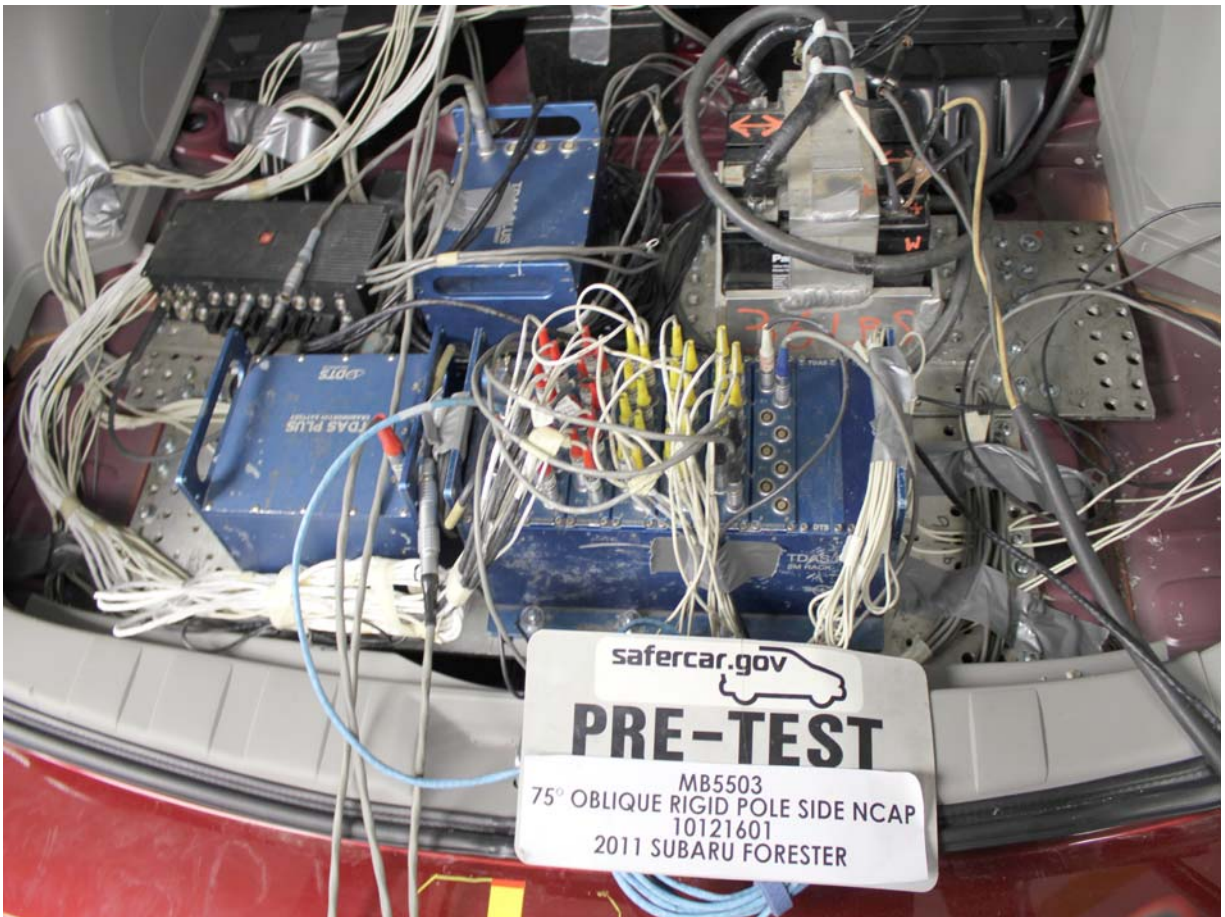
Post-Test Pole Barrier Front View



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



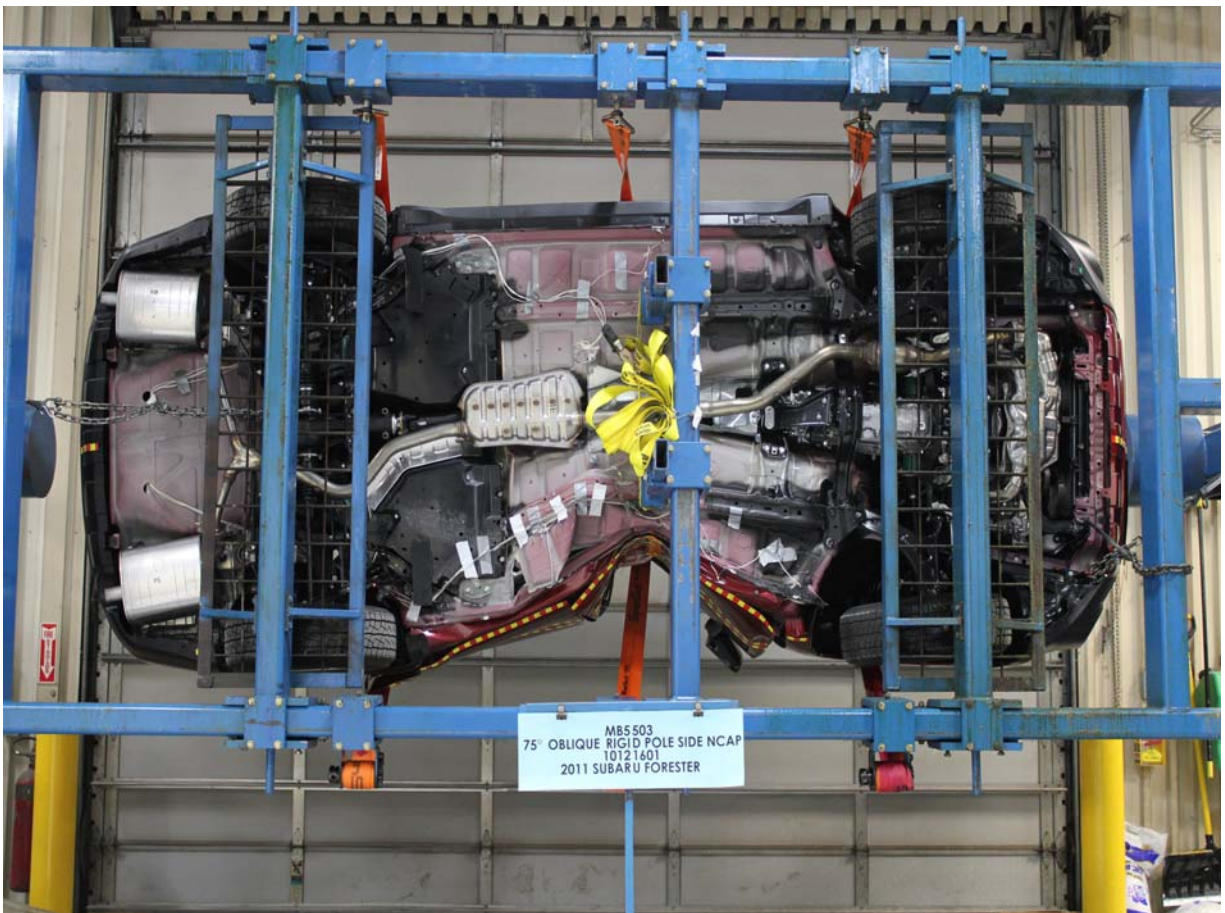
FMVSS No. 301/305 Rollover 0 Degrees



FMVSS No. 301/305 Rollover 90 Degrees



FMVSS No. 301/305 Rollover 180 Degrees



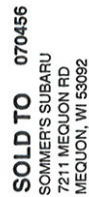
FMVSS No. 301/305 Rollover 270 Degrees



FMVSS No. 301/305 Rollover 360 Degrees



Impact Event



STANDARD EQUIPMENT SAFETY

Symmetrical All-Wheel Drive (AWD)
Vehicle Dynamics Control (VDC)
Subaru Advanced Frontal Air Bag System
Front Side-Impact Air Bags
Front Side-Impact Air Bags
Side Curtain Air Bags w/Rollover Sensor
Active Front Seat Head Restraints
Safety Pedal System
4-Wheel Disc Brakes w/Brake Assist
Anti-Lock Braking System (ABS)
Electronic Brake-Force Distribution
The Pressure Monitoring System (TPMS)
Ring-Shape Reinforcement Frame Design
Anti-Theft Alarm & Immobilizer System

Daytime Running Lights

PERFORMANCE AND EXTERIOR
2.2L 2.5L Horizontally-Opposed DOHC Engine
2005/95 R16 All-Season Tires
Variable Intermittent Windshield Wipers
Rear Window Wiper/Washer

COMFORT, CONVENIENCE AND INTERIOR
Air Conditioning w/Air Filtration System
AM/FM w/Single-Disc CD Player&Aux. Input
Off-Delay Dome Light & Accent Lighting
Cruise Control & Tilt Steering Column
Power Door Locks & Dual Power Mirrors

Daytime Running Lights

2.5L Horizontally-Opposed DOHC Engine
2005/05/16 All-Season Tires
Variable Intermittent Windshield Wipers
Rear Window Wiper/Washer
COMFORT, CONVENIENCE AND INTERIOR
Air Conditioning w/Air Filtration System
Auxiliary Disc CD Player & Aux Input
Off-Delay Dome Light & Accent Lighting
Cruise Control & Tilt Steering Column
Power Door Locks & Dual Power Mirrors

Remote Keyless Entry System
Power Windows With Driver's /
Height Adjustable Driver's Seat

60/40 Split Fold-Down Rear Seatback
Overhead Console w/ Dual Map Lights
Exterior Temperature Gauge
Multi-function Center Console Box
Cargo-Area Tie Down & Grocery Bag Hooks
12V Outlet In Dash, Console & Cargo Area

LIMITED WARRANTY/ROADSIDE ASSISTANCE

3 Years / 36,000 Miles Basic
5 Years / 60,000 Miles Powertrain

Remote Keyless Entry System
Power Windows With Driver's Auto Down
Height Adjustable Driver's Seat

60/40 Split Fold-Down Rear Seatback
Overhead Console w/ Dual Map Lights
Exterior Temperature Gauge
Multi-function Center Console Box
Cargo-Area Tie Down & Grocery Bag Hooks
12V Outlet In Dash, Console & Cargo Area

LIMITED WARRANTY/ROADSIDE ASSISTANCE

3 Years / 36,000 Miles Basic
5 Years / 60,000 Miles Powertrain

5 Yrs/Unlimited Mileage Rust Perforation
3 Yrs / 36,000 24/7 Roadside Assistance
See Owner Info Kit & Warranty For Details

See Owner into Manufacturer For Details

OPTIONAL EQUIPMENT

Manufacturer's Suggested Retail Price	\$20,495.00
Option Package: 21	
ALLOY WHEEL PACKAGE SUGGESTED VALUE	\$900.00
16-Inch Alloy Wheels	
Roof Rails	
ALLOY WHEEL VALUE PACKAGE DISCOUNT	-\$500.00
ALLOY WHEEL VALUE PACKAGE PRICE	\$400.00
Full Tank of Gas	
INCLD	

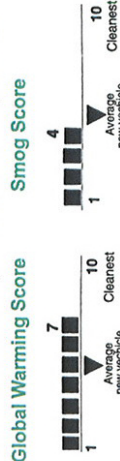
GOVERNMENT SAFETY RATINGS

Frontal	Driver	Not Rated
	Passenger	Not Rated
Star ratings based on the risk of injury in a frontal impact.		
Side	Front Seat	Not Rated
	Rear Seat	Not Rated
Star ratings based on the risk of injury in a side impact.		
Rollover		Not Rated

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

Environmental Performance

Protect the environment, choose vehicles with higher scores:



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**

EPA Fuel Economy Estimates



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

PART CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE: 0%

U.S./CANADIAN PARTS CONTENT:

MAJOR SOURCES OF FOREIGN PARTS

CONTENT: JAPAN: 100%

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

FOR THIS VEHICLE:
FINAL ASSEMBLY POINT: Ota Gunma, JAPAN
COUNTRY OF ORIGIN:
ENGINE: JAPAN

Destination and Delivery	\$725.00
Total Suggested Retail Price	\$21,620.00

THE ONLY EXTENDED SERVICE CONTRACT BACKED BY SUBARU.

ADDED SECURITY

It could be the most important option you choose.

After-warranty mechanical repair protection up to 100,000 miles.

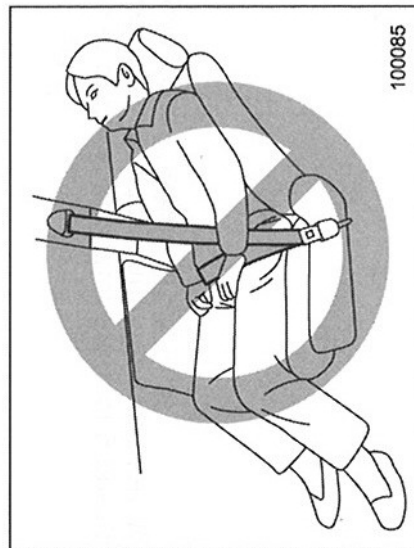

SUBARU.

IF2SHBBC8BG700171

iPod is a registered trade mark of Apple Inc. Harman International Industries, Inc. Bluetooth is a registered trademark of Bluetooth SIG, Inc. TomTom is a registered trademark of TomTom International B.V. Corporation.

justment of the seat, you cannot adjust the seat cushion angle or seat cushion height.

- 2) **Seat cushion angle control switch**
To adjust the seat cushion angle, pull up or push down the front end of the control switch.
- 3) **Seatback angle (reclining) control switch**
To adjust the angle of the seatback, move the control switch.
- 4) **Seat height control switch**
To adjust the seat height, pull up or push down the rear end of the control switch.
- 5) **Lumbar support control switch**
To increase lumbar support, push the front side of the switch. To decrease lumbar support, push the rear side of the switch.

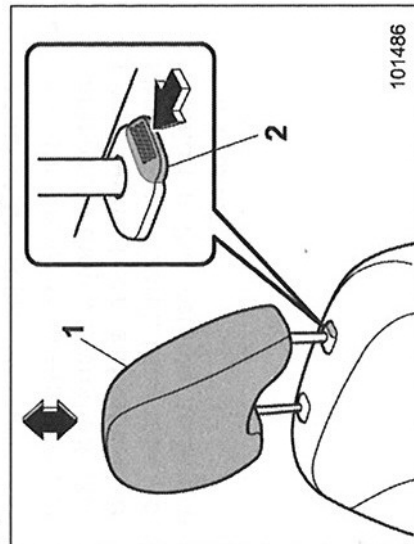


100085

WARNING

To prevent the passenger from sliding under the seatbelt in the event of a collision, always put the seatback in the upright position while the vehicle is in motion. Also, do not place objects such as cushions between the passenger and the seatback. If you do so, the risk of sliding under the lap belt and of the lap belt sliding up over the abdomen will increase, and both can result in serious internal injury or death.

Head restraint adjustment



101486

- 1) Head restraint
- 2) Release button

Both the driver's seat and the front passenger's seat are equipped with head restraints.

The head restraint should be adjusted so that the center of the head restraint is closest to the top of the occupant's ears.

To raise:

Pull the head restraint up.

To lower:

Push the head restraint down while pressing the release button on the top of the seatback.

To remove:

While pressing the release button, pull out the head restraint.

To install:

Install the head restraint into the holes that are located on the top of the seatback until the head restraint locks.

WARNING

- Never drive the vehicle with the head restraints removed because they are designed to reduce the risk of serious neck injury in the event that the vehicle is struck from the rear. Therefore, when you remove the head restraints, you must reinstall all head restraints to protect vehicle occupants.

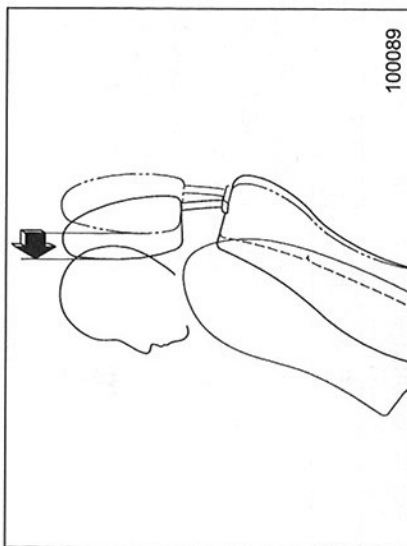
– CONTINUED –

1-6 Seat, seatbelt and SRS airbags

pants.

- All occupants, including the driver, should not operate a vehicle or sit in a vehicle's seat until the head restraints are placed in their proper positions in order to minimize the risk of neck injury in the event of a crash.

■ Active head restraint



100089

The front seats of your vehicle are equipped with active head restraints. They automatically tilt forward slightly in the event the vehicle is struck from the rear, decreasing the amount of rearward head movement and thus reducing the risk of whiplash. For maximum effectiveness, the head restraint should be adjusted so that

the center of the head restraint is closest to the top of the occupant's ears.

⚠ CAUTION

- Each active head restraint is effective only when its height is properly adjusted and driver/passenger sits in the correct position on the seat.
- If your vehicle is involved in a rear-end collision, have an authorized SUBARU dealer inspect the active head restraints.
- The active head restraints may not operate in the event the vehicle experiences only a slight impact in the rear.
- The active head restraints may be damaged if they are pushed hard from behind or subjected to shock. As a result, they may not function if the vehicle suffers a rear impact.

Seat heater (if equipped)

⚠ CAUTION

- There is a possibility that people with delicate skin may suffer slight burns even at low temperatures if they use the seat heater for a long period of time. When using the heater, always be sure to warn the persons concerned.
- Do not put anything on the seat which insulates against heat, such as a blanket, cushion, or similar items. This may cause the seat heater to overheat.

NOTE

Use of the seat heater for a long period of time while the engine is not running can cause battery discharge.

APPENDIX B
DUMMY RESPONSE DATA

TABLE OF DATA PLOTS

		<u>Page No.</u>
	List of Data Plots Provided in the Test Report	
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
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Figure No. 7.	Driver Lower Spine T12 Acceleration (Z) vs. Time	B-2
Figure No. 8.	Driver Lower Spine T12 Resultant Acceleration vs. Time	B-2
Figure No. 9.	Driver Iliac Wing Force on Impact Side (Y) vs. Time	B-3
Figure No. 10.	Driver Acetabulum Force on Impact Side (Y) vs. Time	B-3
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

Driver Torso Contact Switch

Driver Pelvis Contact Switch

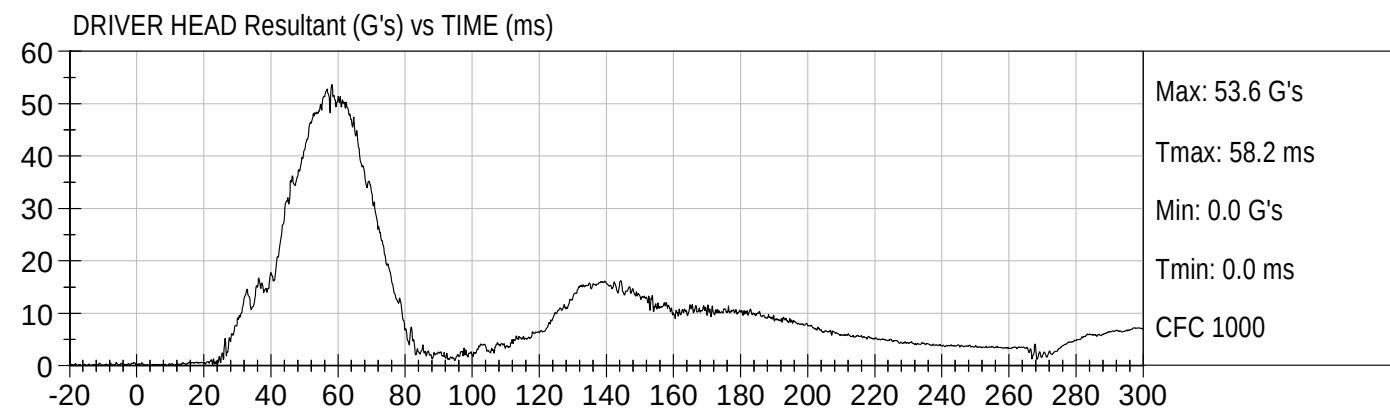
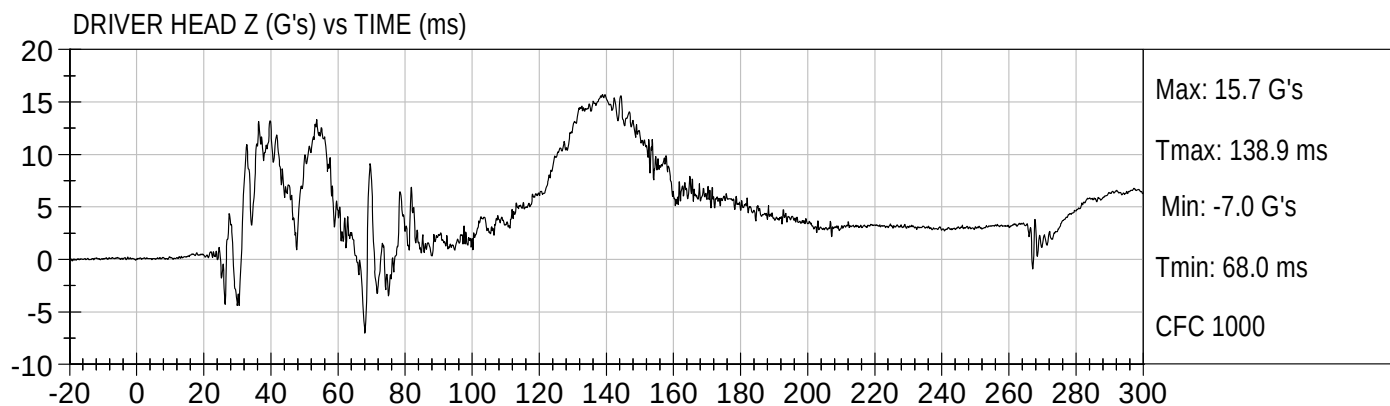
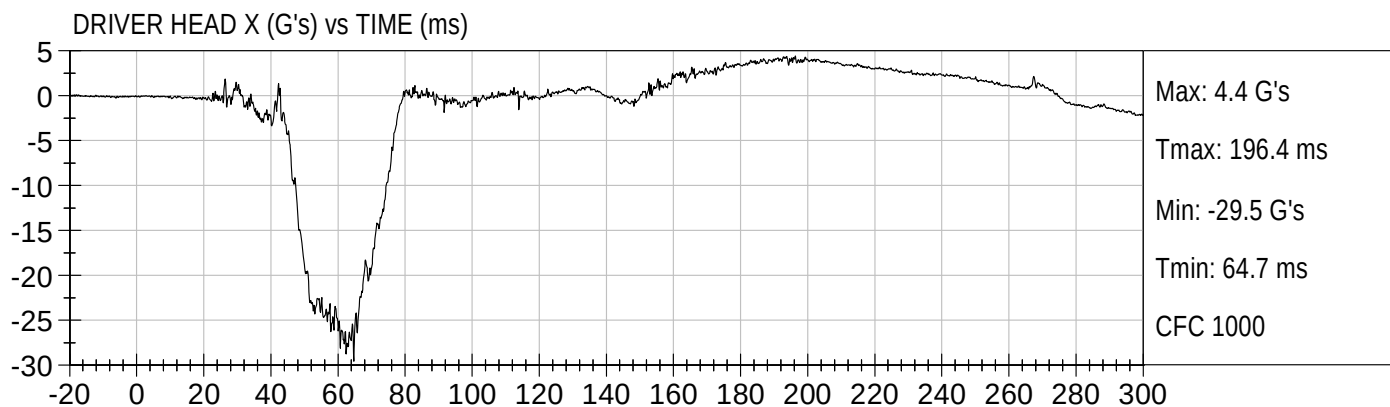
Vehicle CG Acceleration (X)

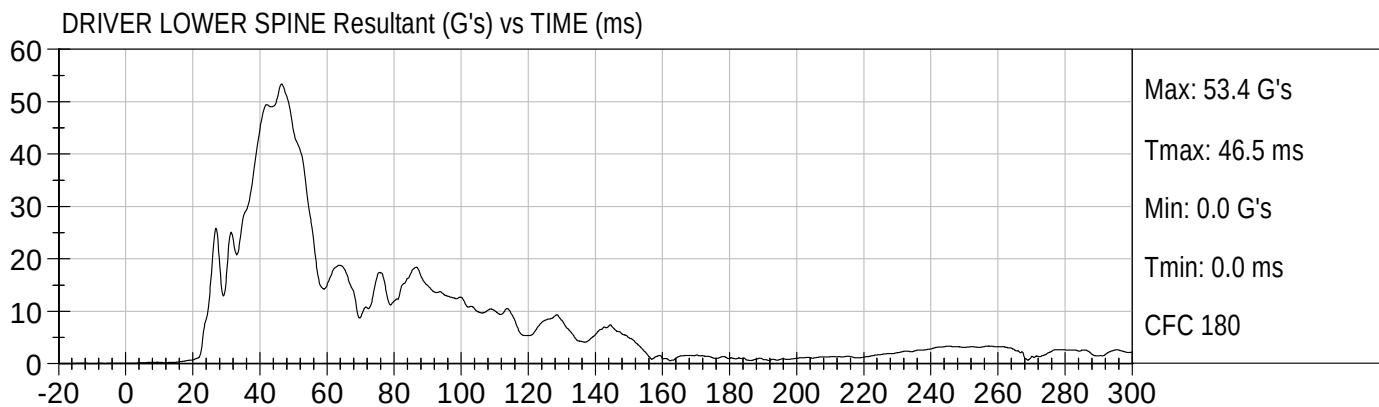
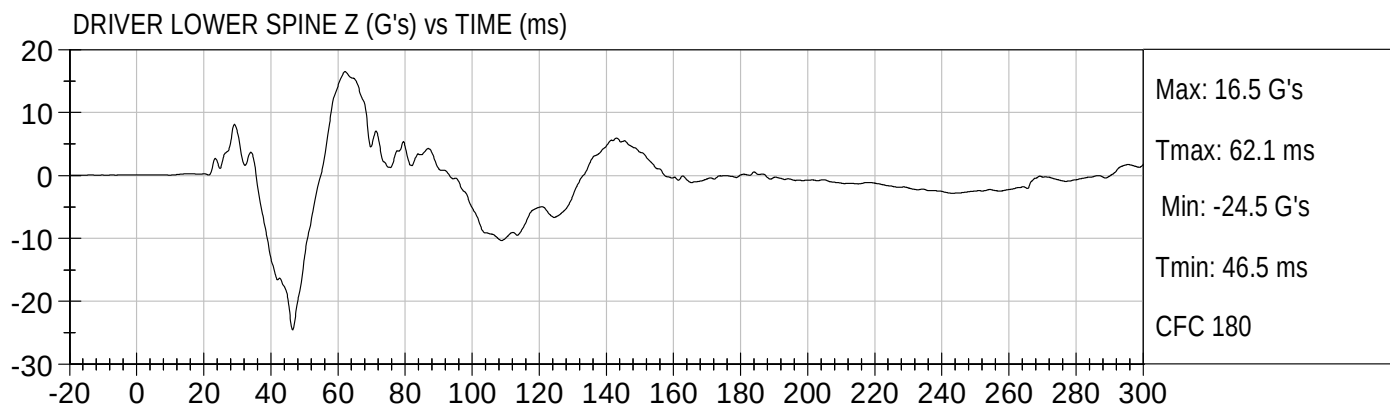
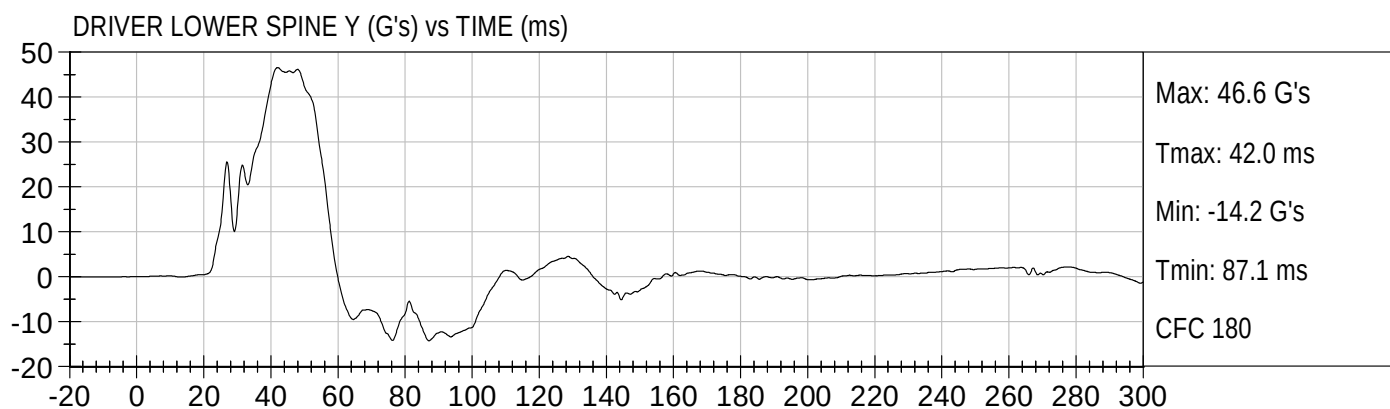
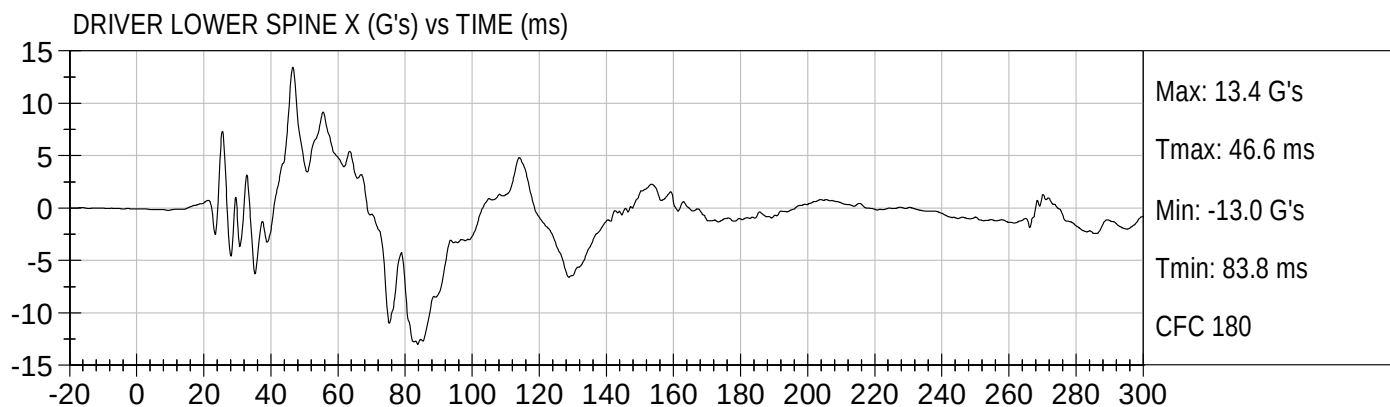
Vehicle CG Acceleration (Y)

Vehicle CG Acceleration (Z)

Vehicle CG Angular Rate About X (Roll)

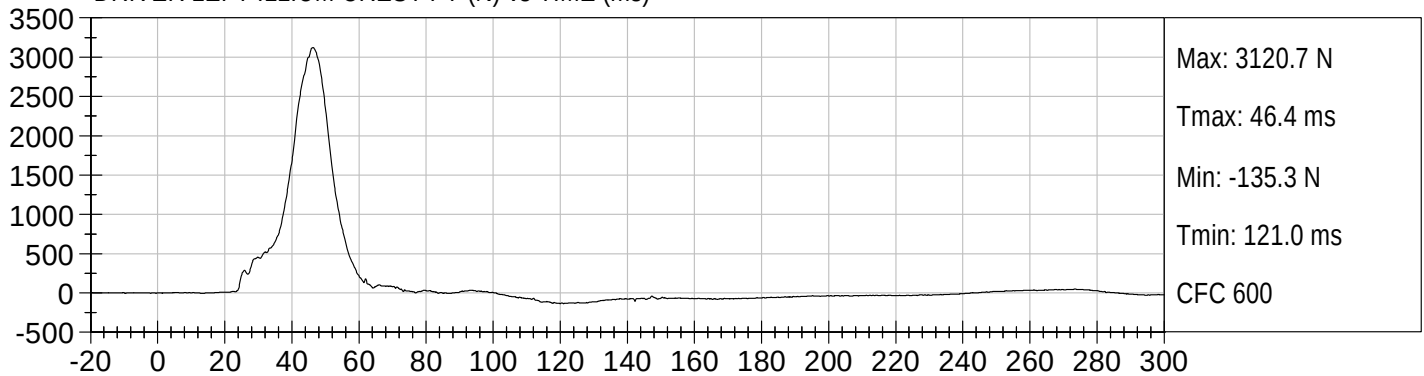
Vehicle CG Angular Rate About Y (Pitch)
Vehicle CG Angular Rate About Z (Yaw)
Left Floor Sill Acceleration (Y)
Left A-Pillar Sill Acceleration (Y)
Left Lower A-Pillar Acceleration (Y)
Left Mid A-Pillar Acceleration (Y)
Left B-Pillar Sill Acceleration (Y)
Left Lower B-Pillar Acceleration (Y)
Left Mid 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
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



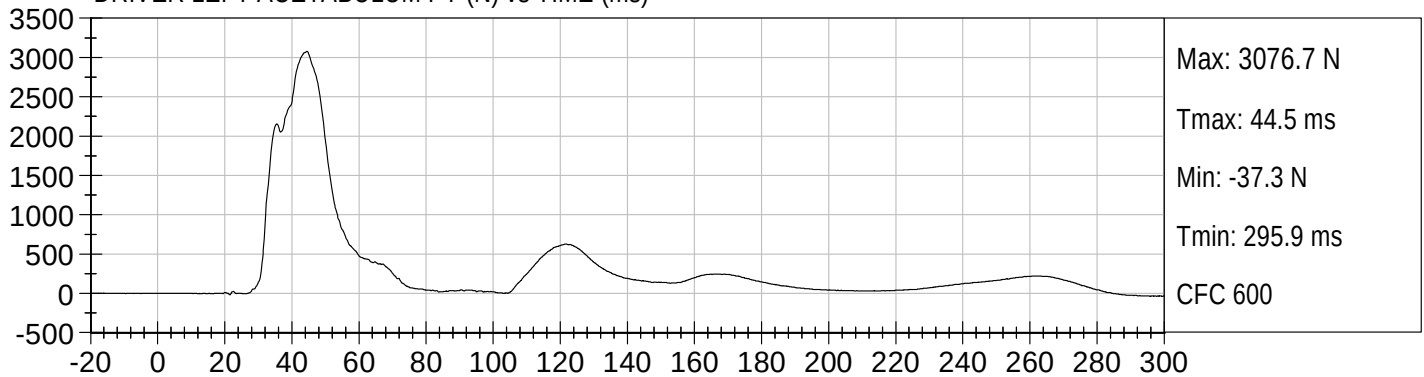




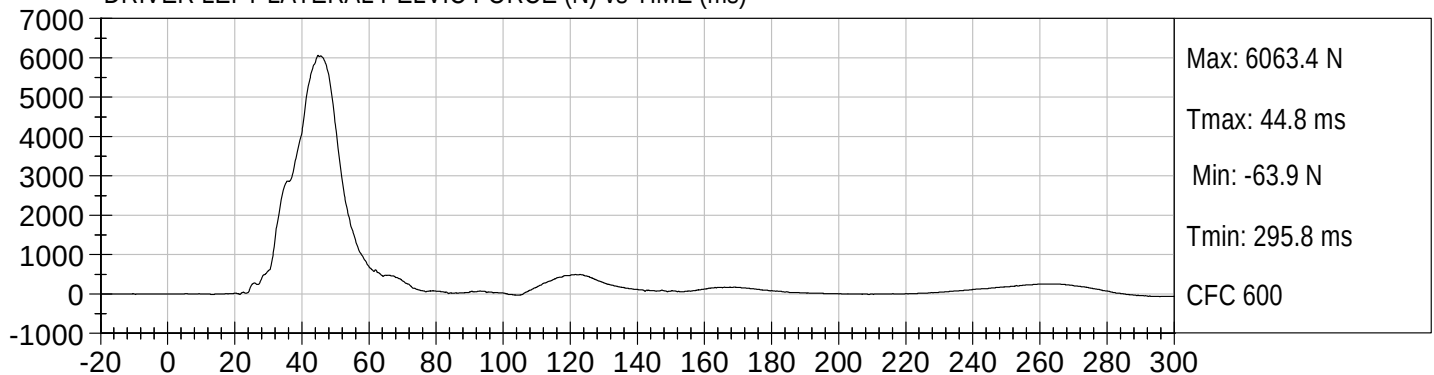
DRIVER LEFT ILLIUM CREST FY (N) vs TIME (ms)



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: D104301

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	15	Pass
Peak Resultant Acceleration	G's	115 to 137	120	Pass
Peak Lateral Acceleration	G's	+/- 15	-9.3	Pass
Unimodal	N/A	<15%	Yes	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

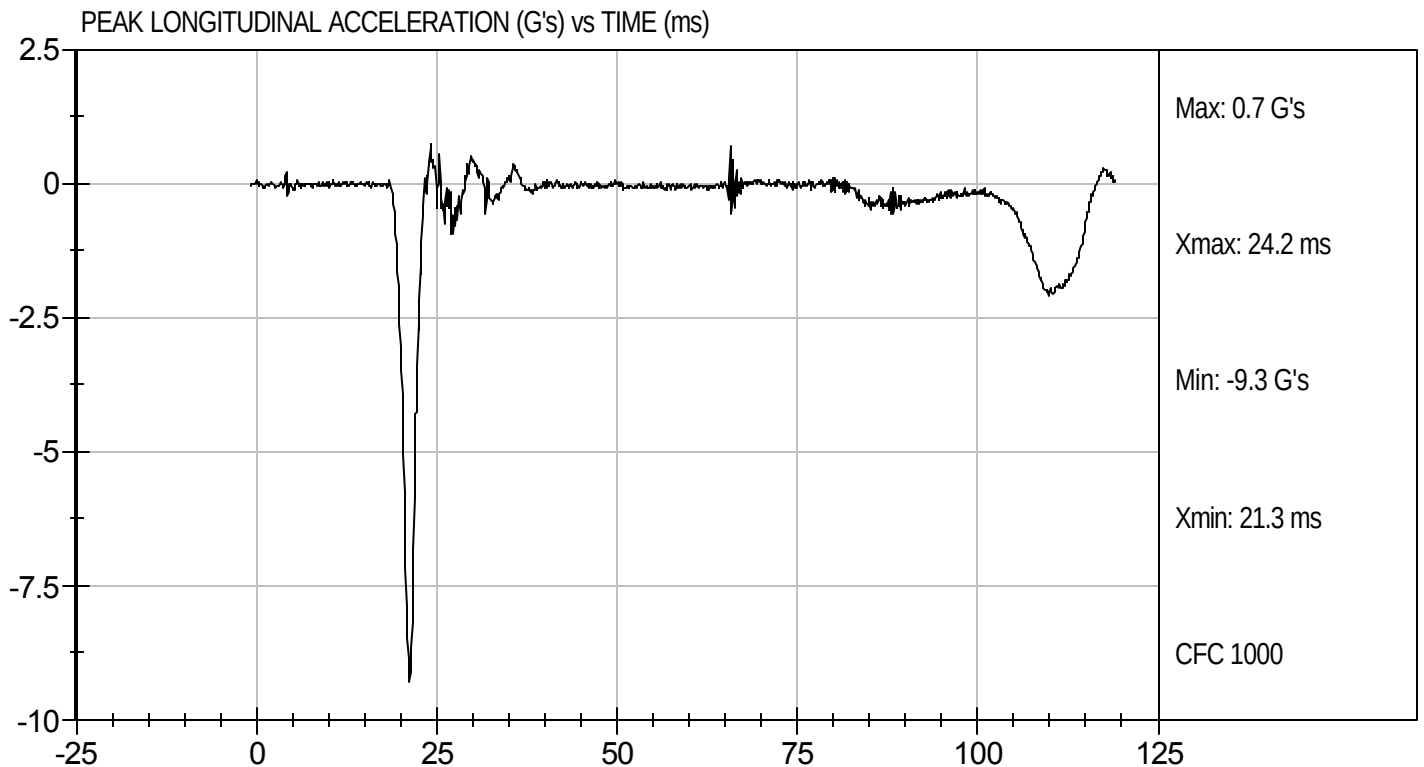
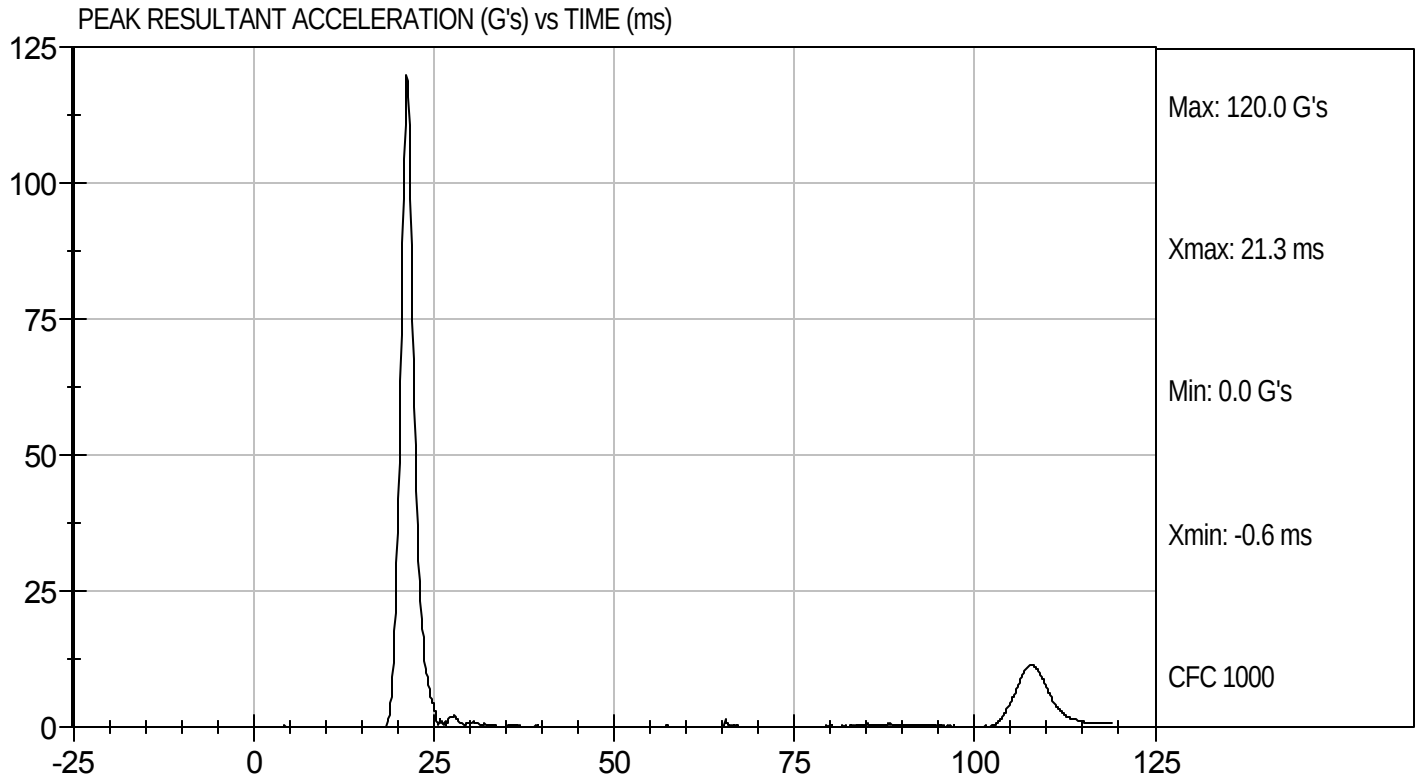
12/7/10
Test Date

David Winkelbauer
Approved By



Test Desc: Head Drop
Component ID: D104301

Test Date: 12/7/10
Velocity: 0 ft/s, 0 m/s

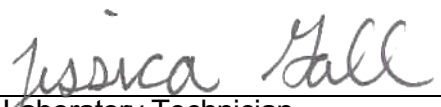


MGA RESEARCH CORPORATION
LATERAL NECK PENDULUM TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D104302

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	20.8	Pass
Humidity		%	10 to 70	16	Pass
Impact Velocity		m/s	5.51 to 5.63	5.52	Pass
Delta Velocity	10 ms	m/s	2.20 to 2.80	2.40	Pass
	15 ms	m/s	3.30 to 4.10	3.38	Pass
	20 ms	m/s	4.40 to 5.40	4.49	Pass
	25 ms	m/s	5.40 to 6.10	5.43	Pass
	25-100 ms	m/s	5.50 to 6.20	5.64	Pass
Maximum D-Plane Rotation		deg	71 to 81	74	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	65	Pass
Maximum Occipital Condyle Moment during Rotation Interval Nm			-44 to -36	-40	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	121	Pass
Overall Test Results				Pass	


 Laboratory Technician

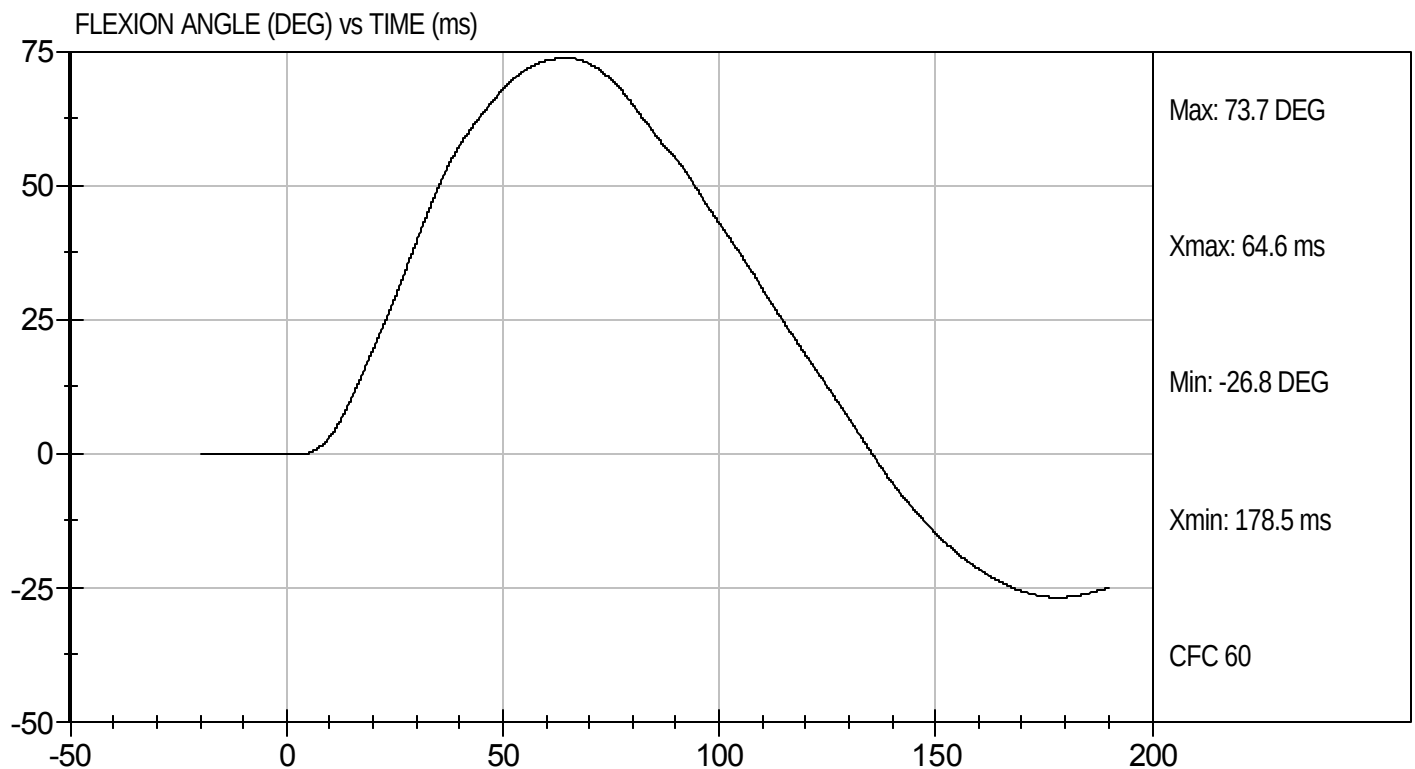
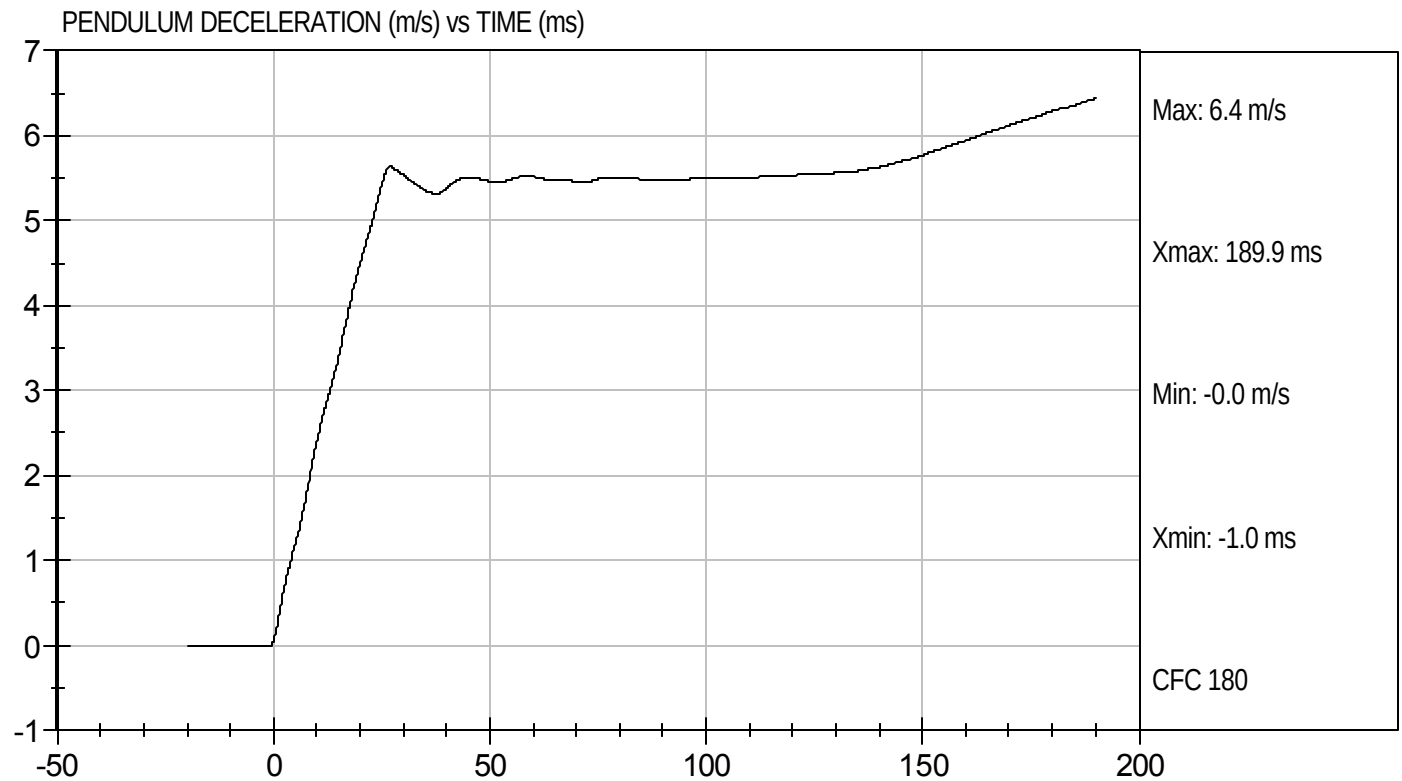
12/7/10
 Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D104302

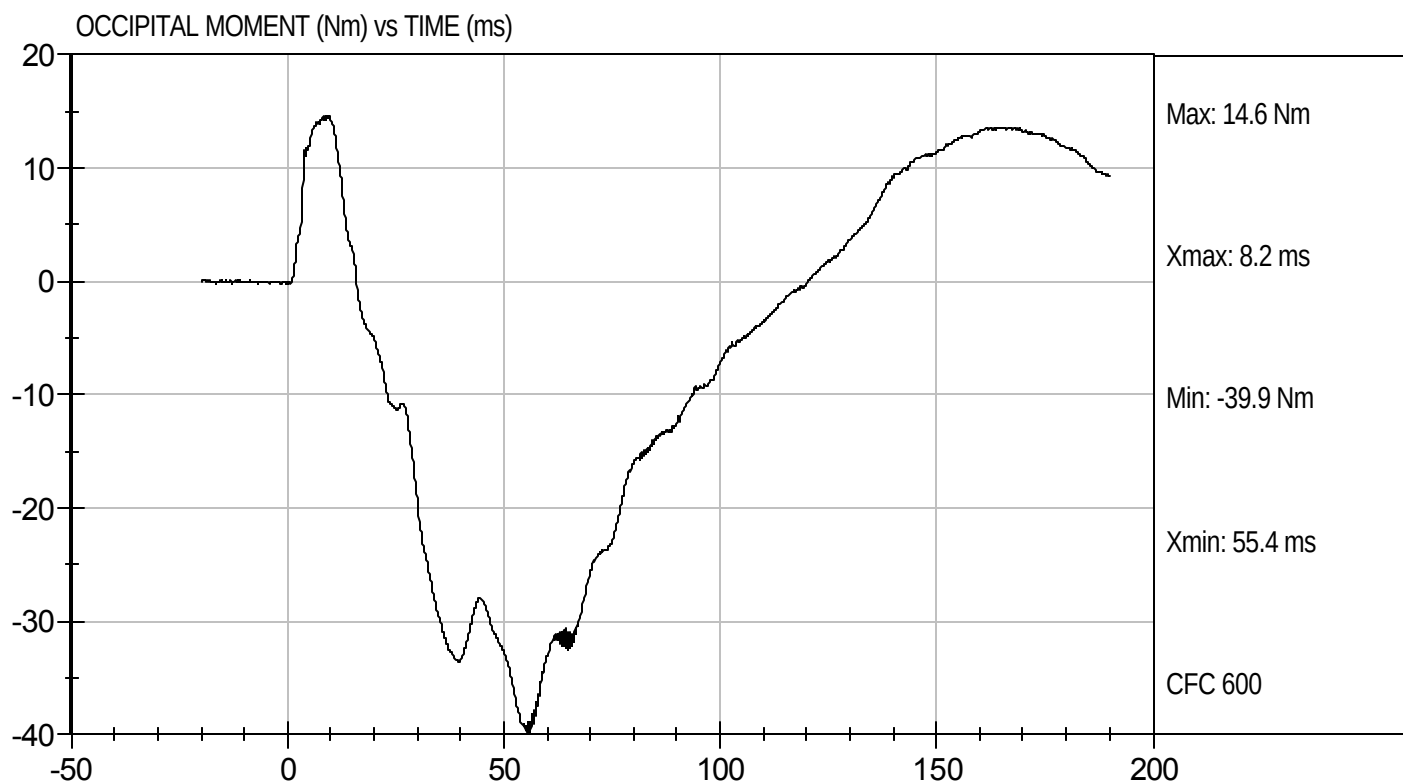
Test Date: 12/7/10
Velocity: 18.12 ft/s, 5.52 m/s





Test Desc: Neck Bending
Component ID: D104302

Test Date: 12/7/10
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: D104303

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	15	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	19	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

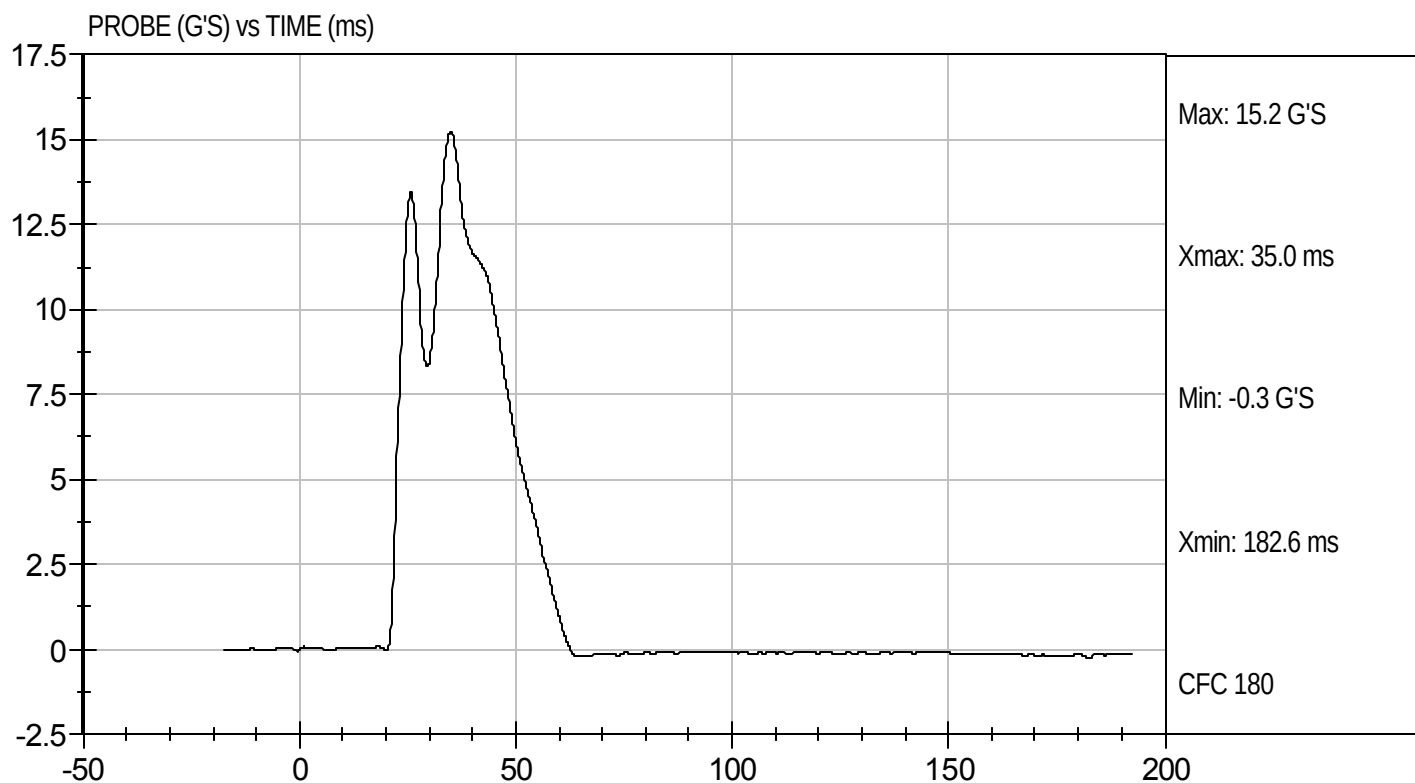
12/7/10
Test Date

David Winkelbauer
Approved By



Test Desc: Shoulder Impact
Component ID: D104303

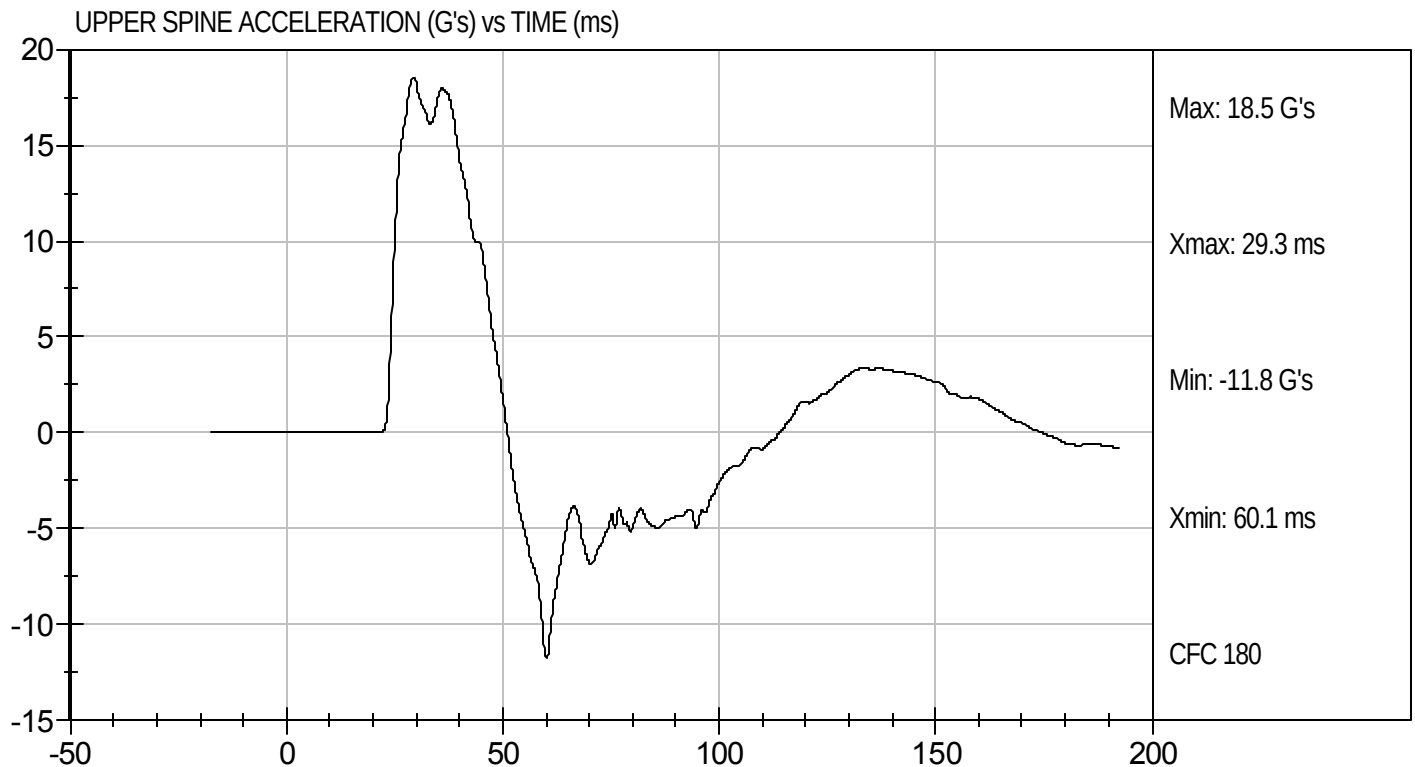
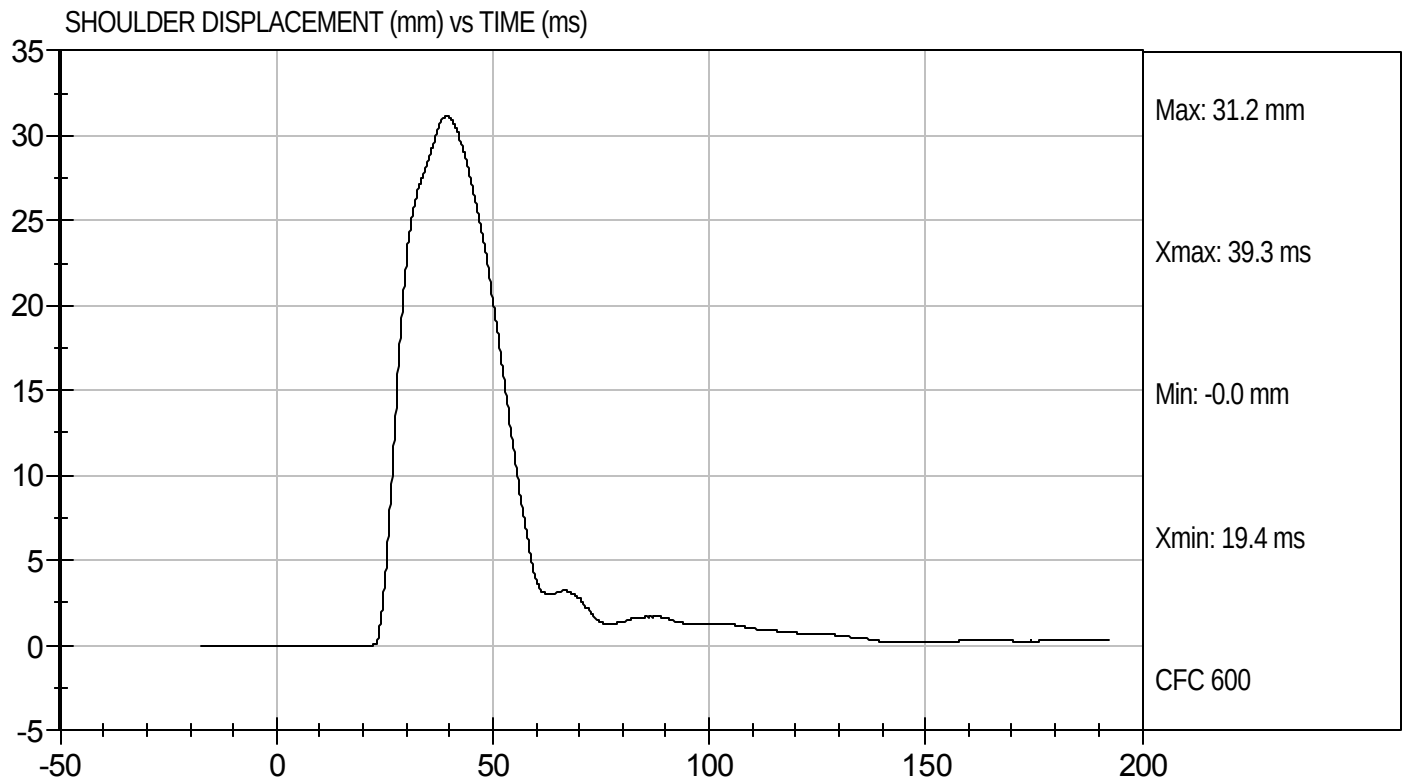
Test Date: 12/7/10
Velocity: 14.37 ft/s, 4.38 m/s





Test Desc: Shoulder Impact
Component ID: D104303

Test Date: 12/7/10
Velocity: 14.37 ft/s, 4.38 m/s



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

ATD Serial No: 296

Test I.D: D104304

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	15	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Peak Impactor Acceleration	G's	30 to 36	33	Pass
Shoulder Displacement	mm	31 to 40	35	Pass
Upper Rib Displacement	mm	25 to 32	30	Pass
Middle Rib Displacement	mm	30 to 36	31	Pass
Lower Rib Displacement	mm	32 to 38	33	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	38	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	33	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

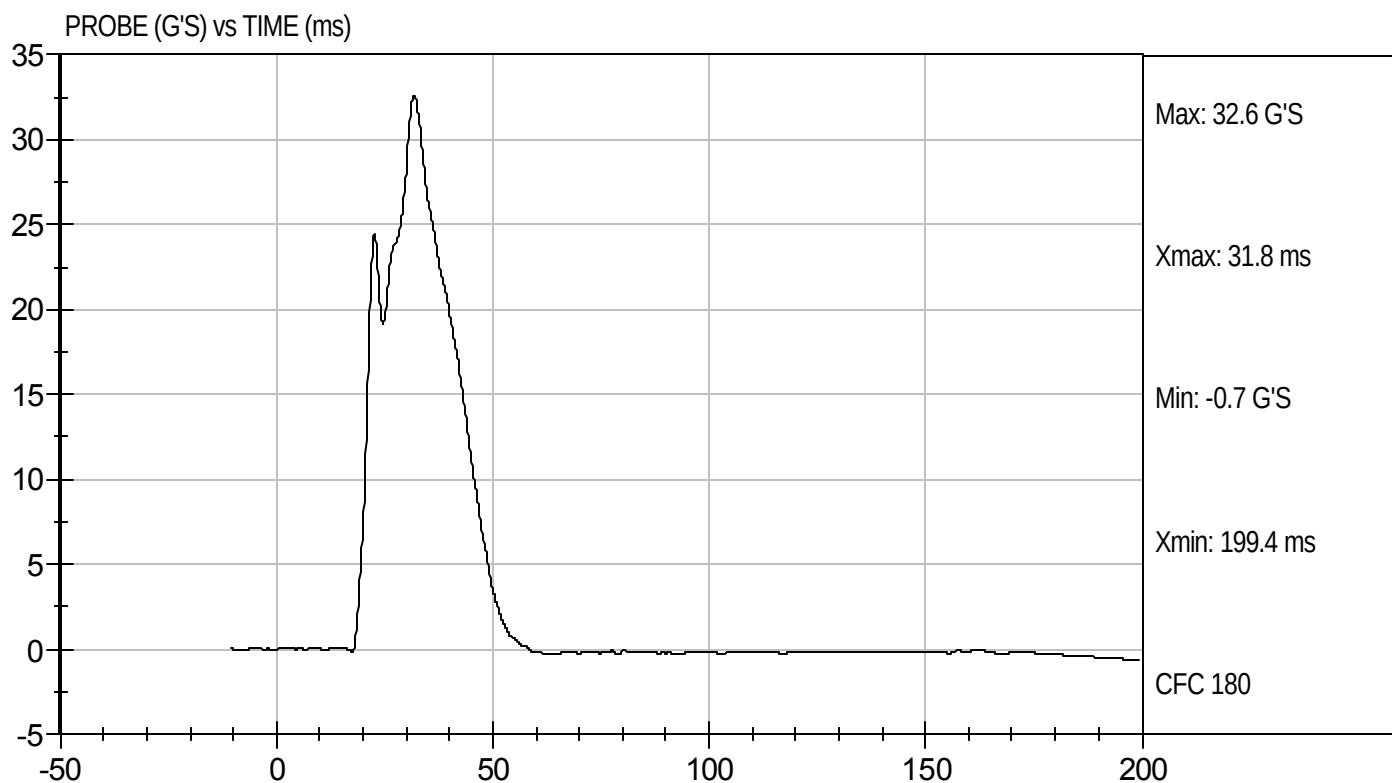
12/7/10
Test Date

David Winkelbauer
Approved By



Test Desc: Thorax With Arm
Component ID: D104304

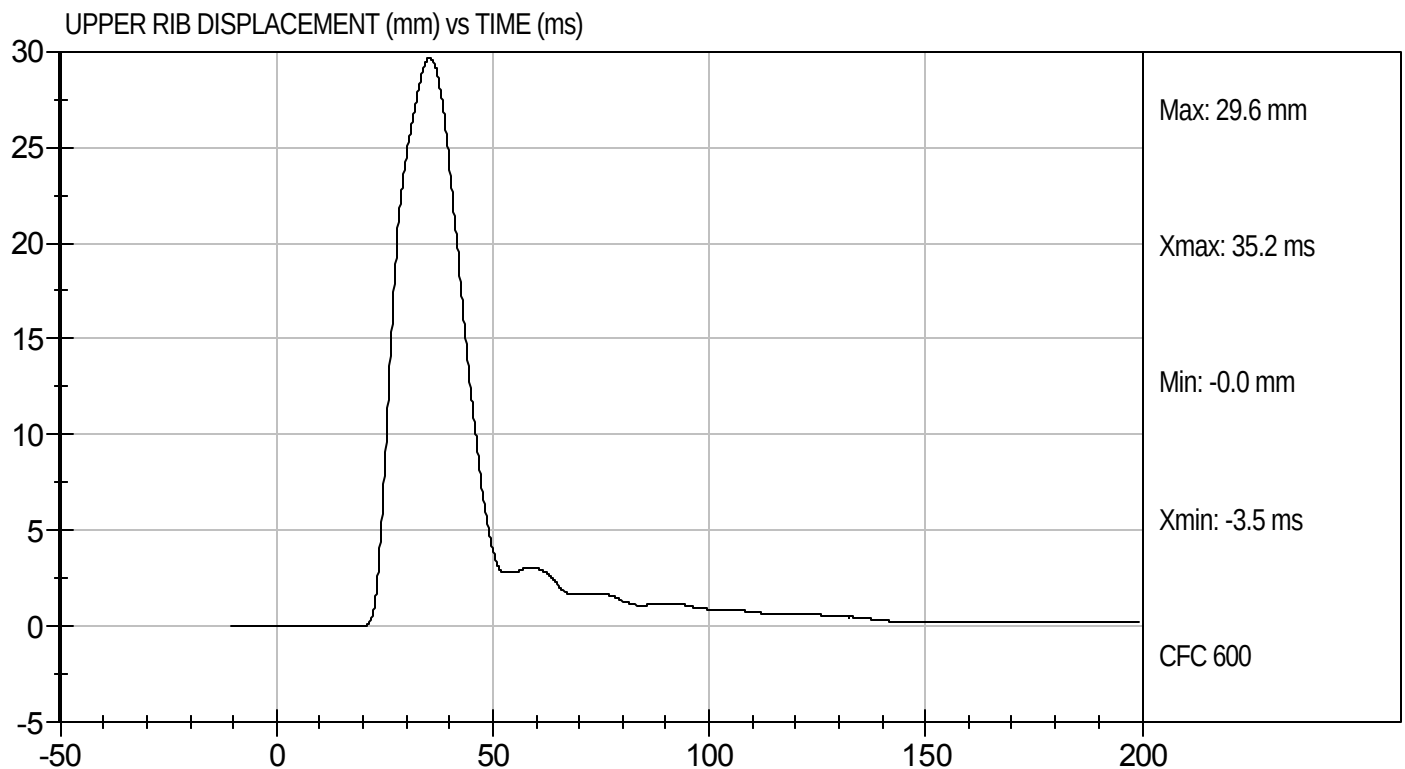
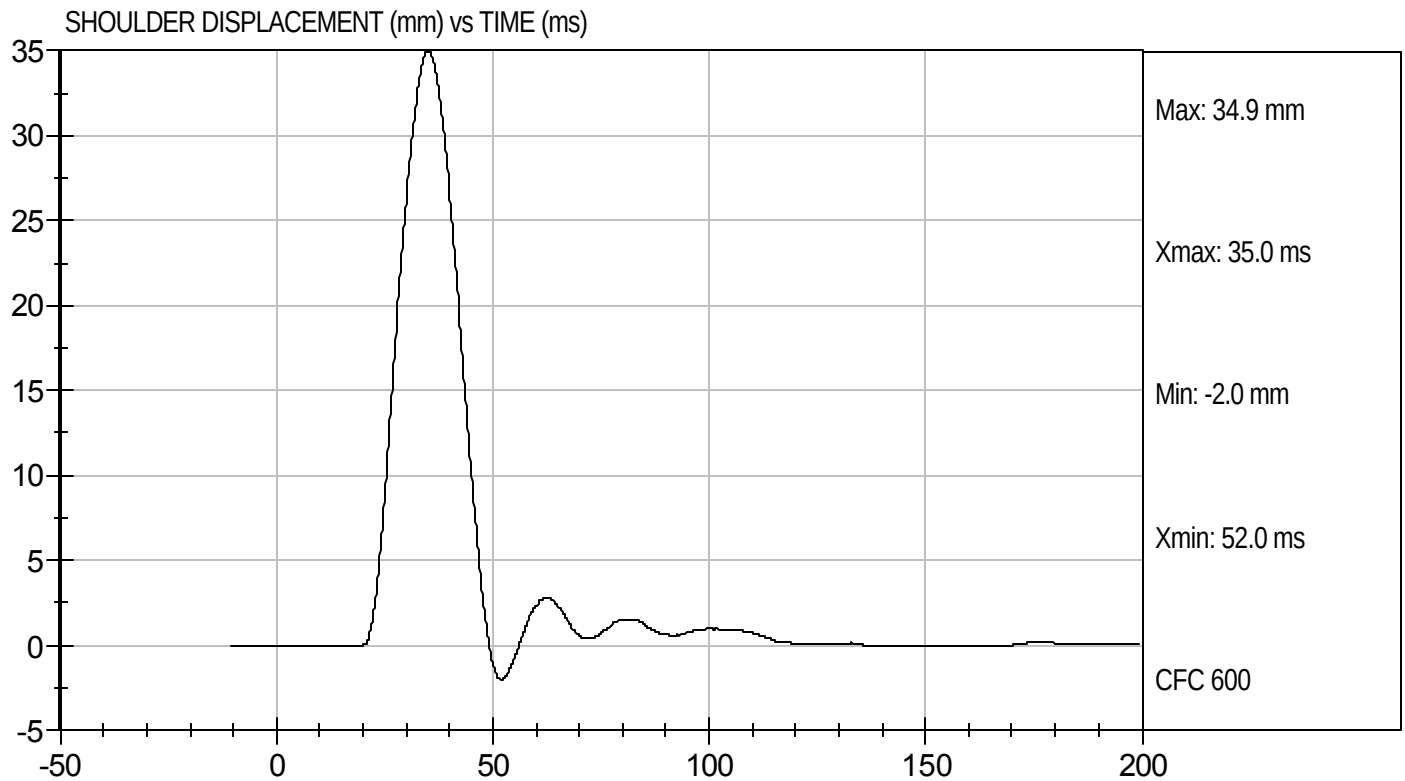
Test Date: 12/7/10
Velocity: 21.93 ft/s, 6.68 m/s





Test Desc: Thorax With Arm
Component ID: D104304

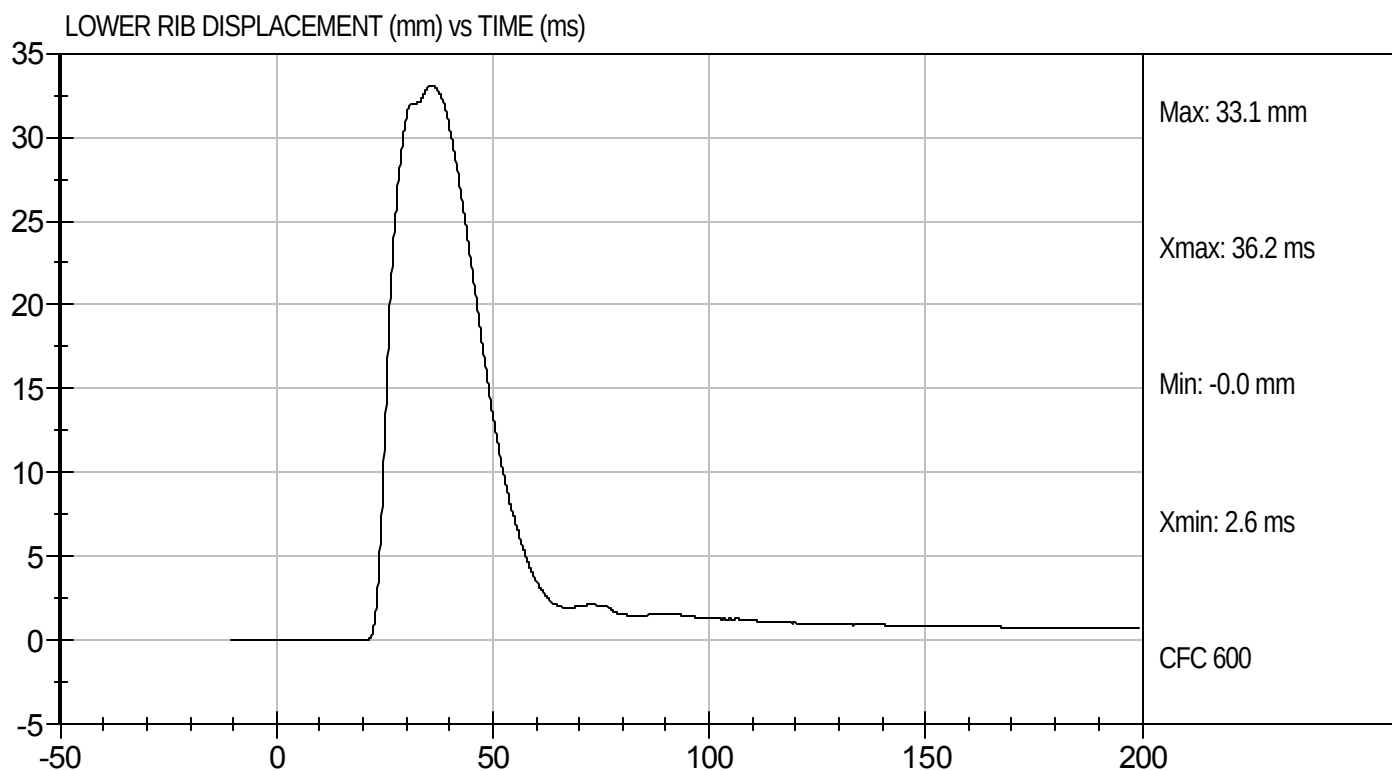
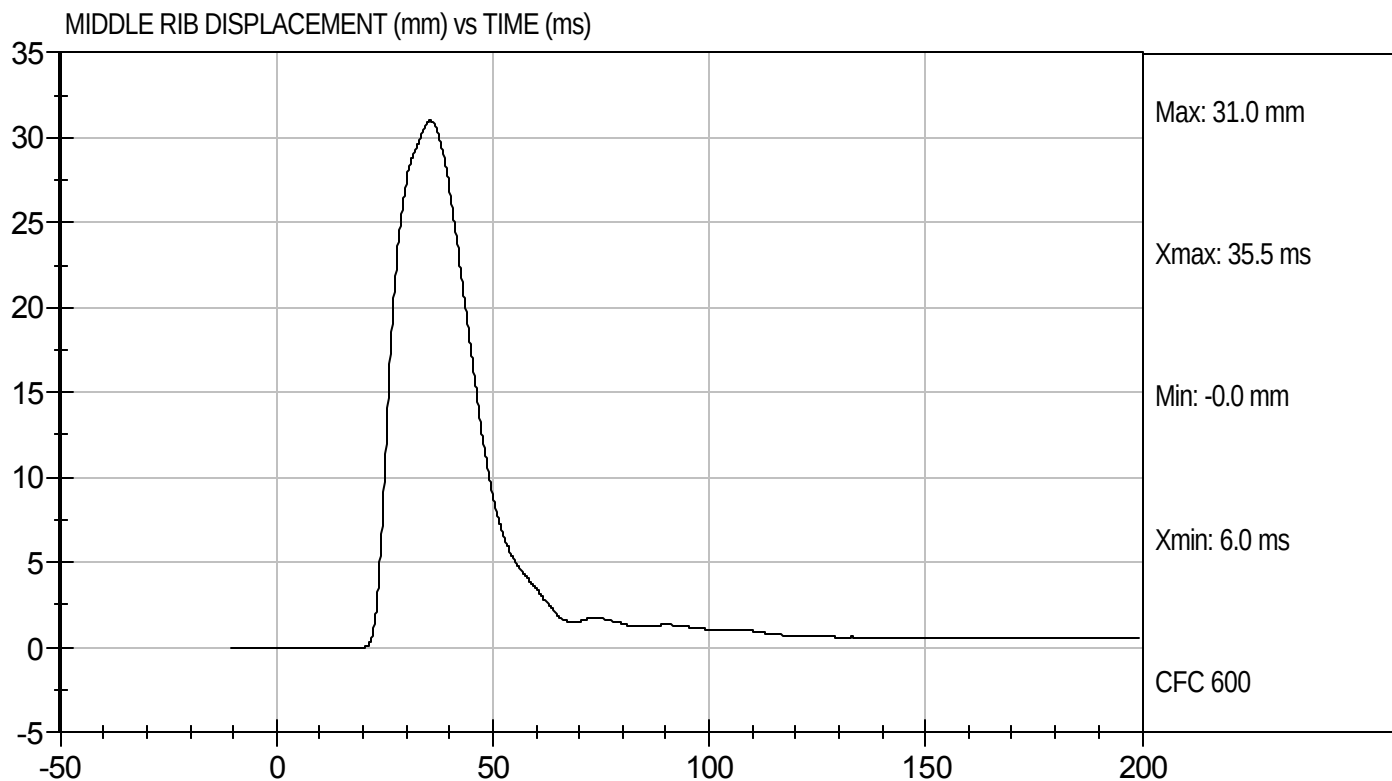
Test Date: 12/7/10
Velocity: 21.93 ft/s, 6.68 m/s





Test Desc: Thorax With Arm
Component ID: D104304

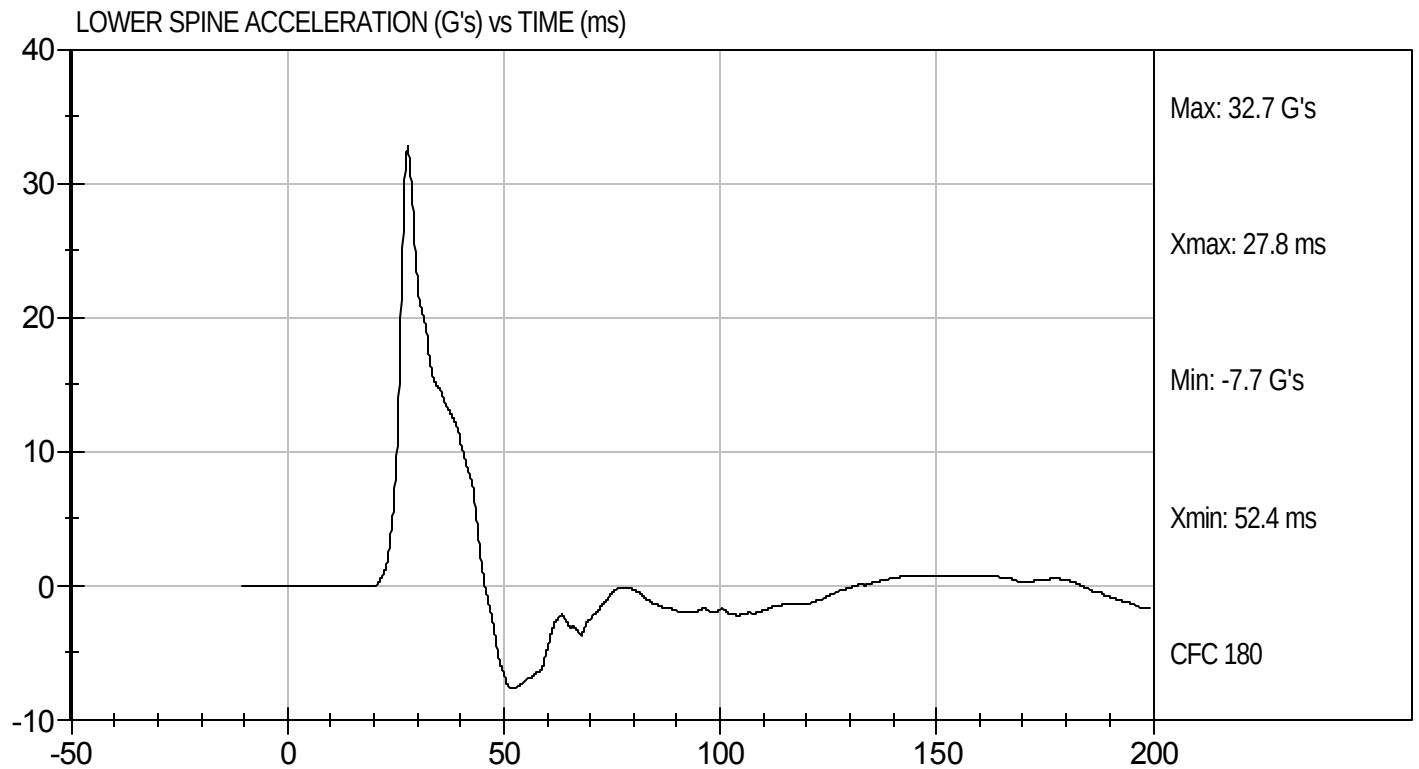
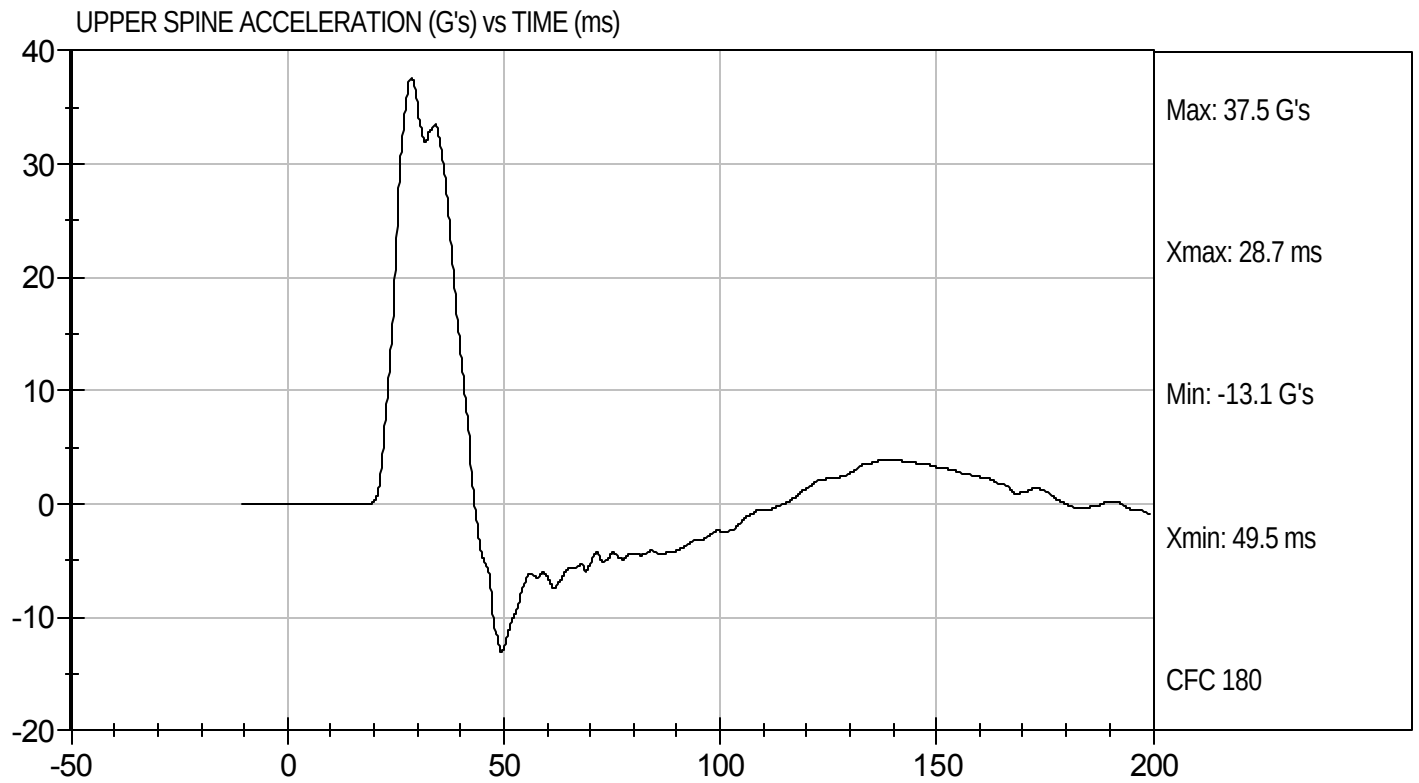
Test Date: 12/7/10
Velocity: 21.93 ft/s, 6.68 m/s





Test Desc: Thorax With Arm
Component ID: D104304

Test Date: 12/7/10
Velocity: 21.93 ft/s, 6.68 m/s



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

ATD Serial No: 296

Test I.D: D104305

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	15	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Peak Impactor Force	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	39	Pass
Middle Rib Displacement	mm	39 to 45	42	Pass
Lower Rib Displacement	mm	35 to 43	40	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
Overall Test Results				Pass


 Laboratory Technician

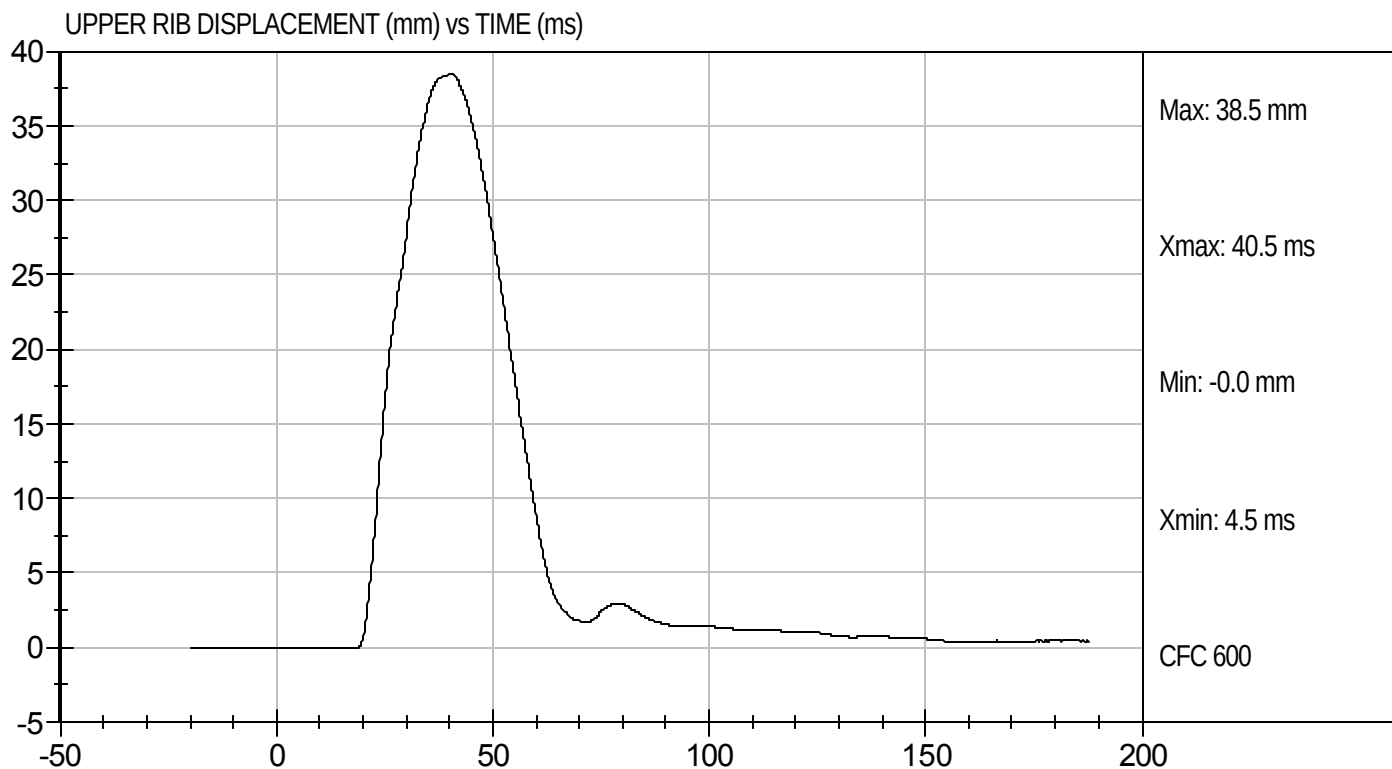
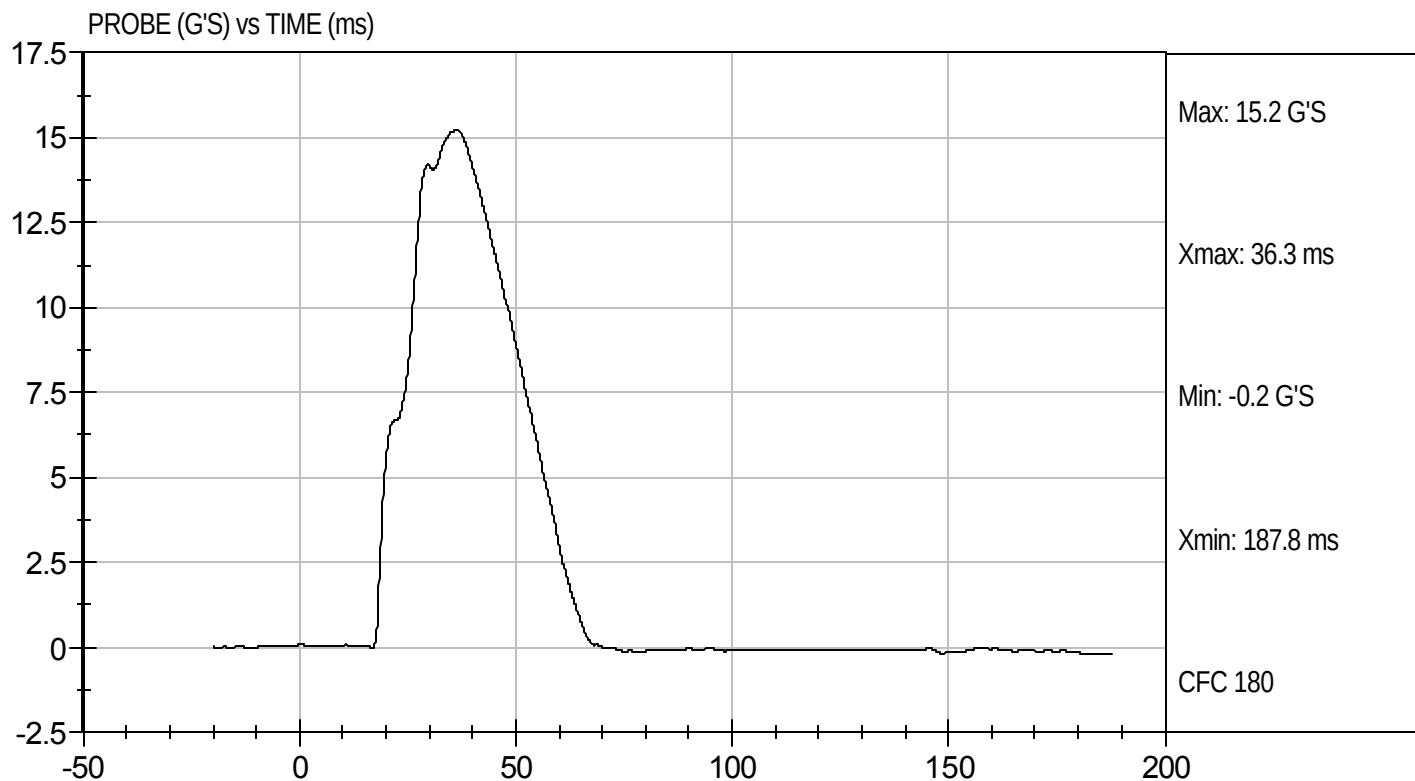
12/7/10
 Test Date


 Approved By



Test Desc: Thorax Without Arm
Component ID: D104305

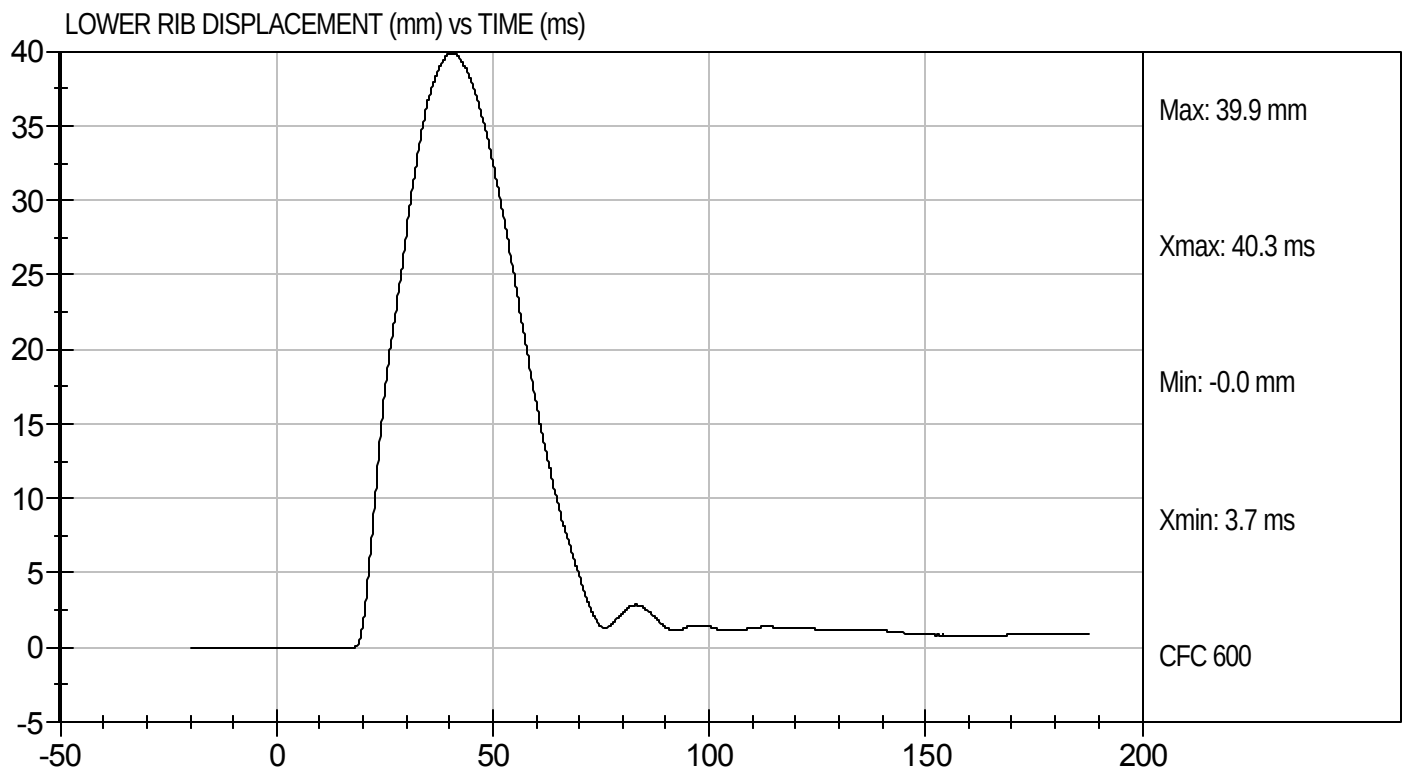
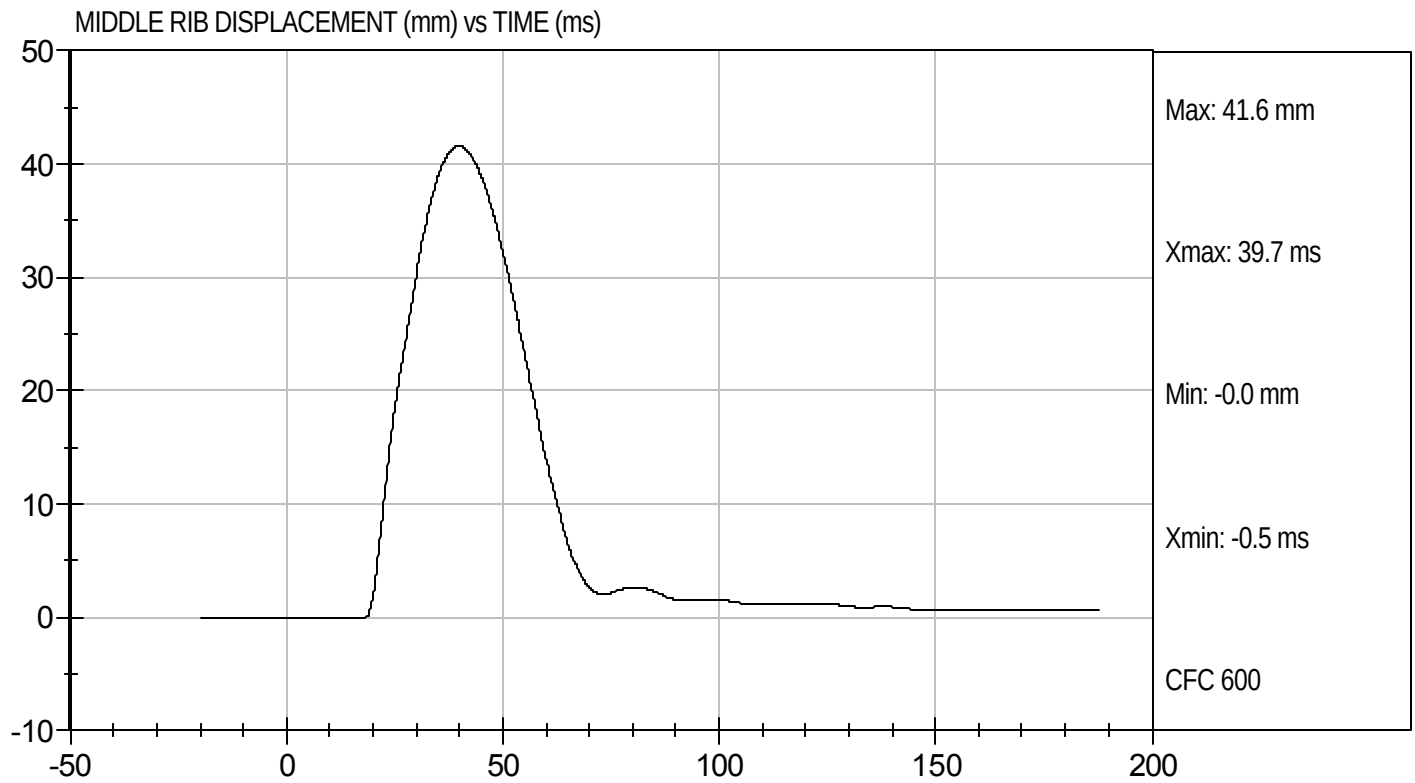
Test Date: 12/7/10
Velocity: 14.12 ft/s, 4.30 m/s





Test Desc: Thorax Without Arm
Component ID: D104305

Test Date: 12/7/10
Velocity: 14.12 ft/s, 4.30 m/s

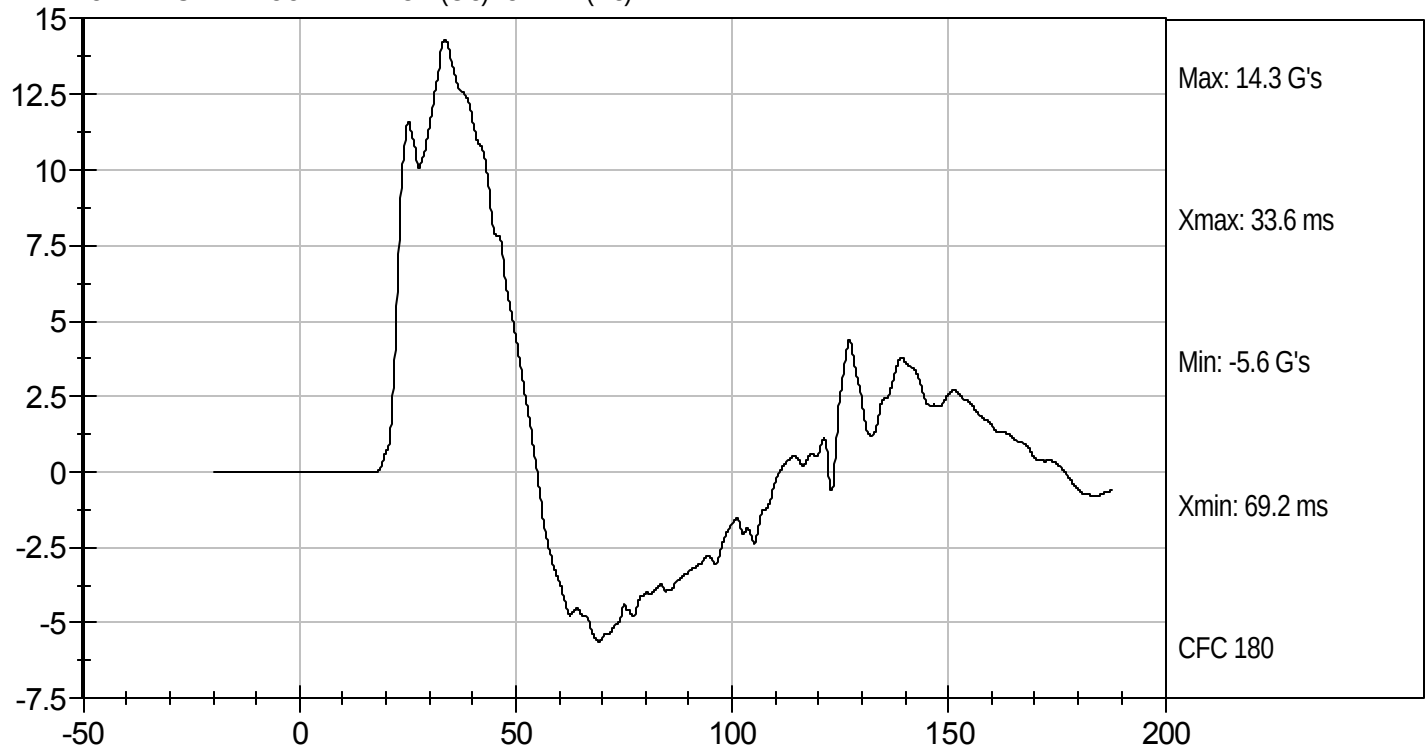




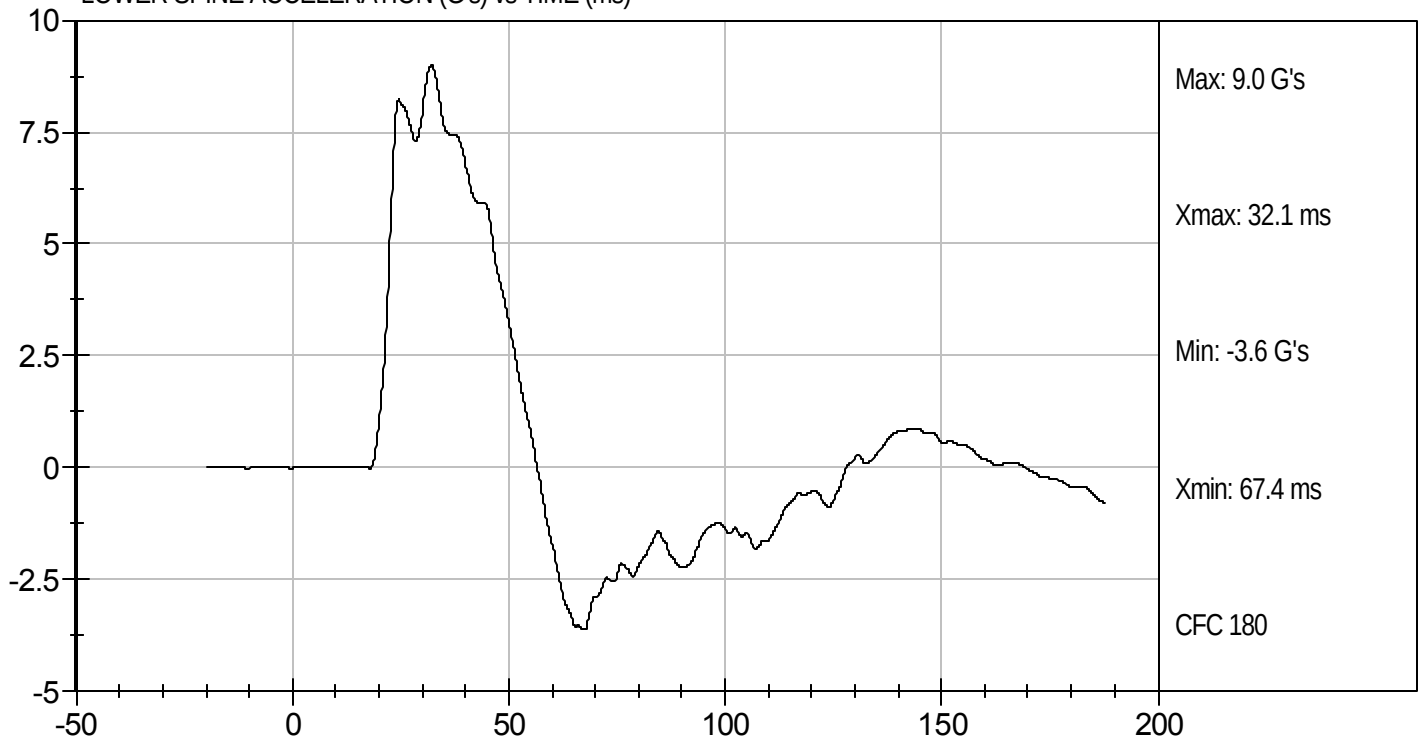
Test Desc: Thorax Without Arm
Component ID: D104305

Test Date: 12/7/10
Velocity: 14.12 ft/s, 4.30 m/s

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



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



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

ATD Serial No: 296

Test I.D: D104306

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Humidity	%	10 to 70	15	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	42	Pass
Lower Rib Displacement	mm	33 to 44	39	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
			Overall Test Results	Pass


Laboratory Technician

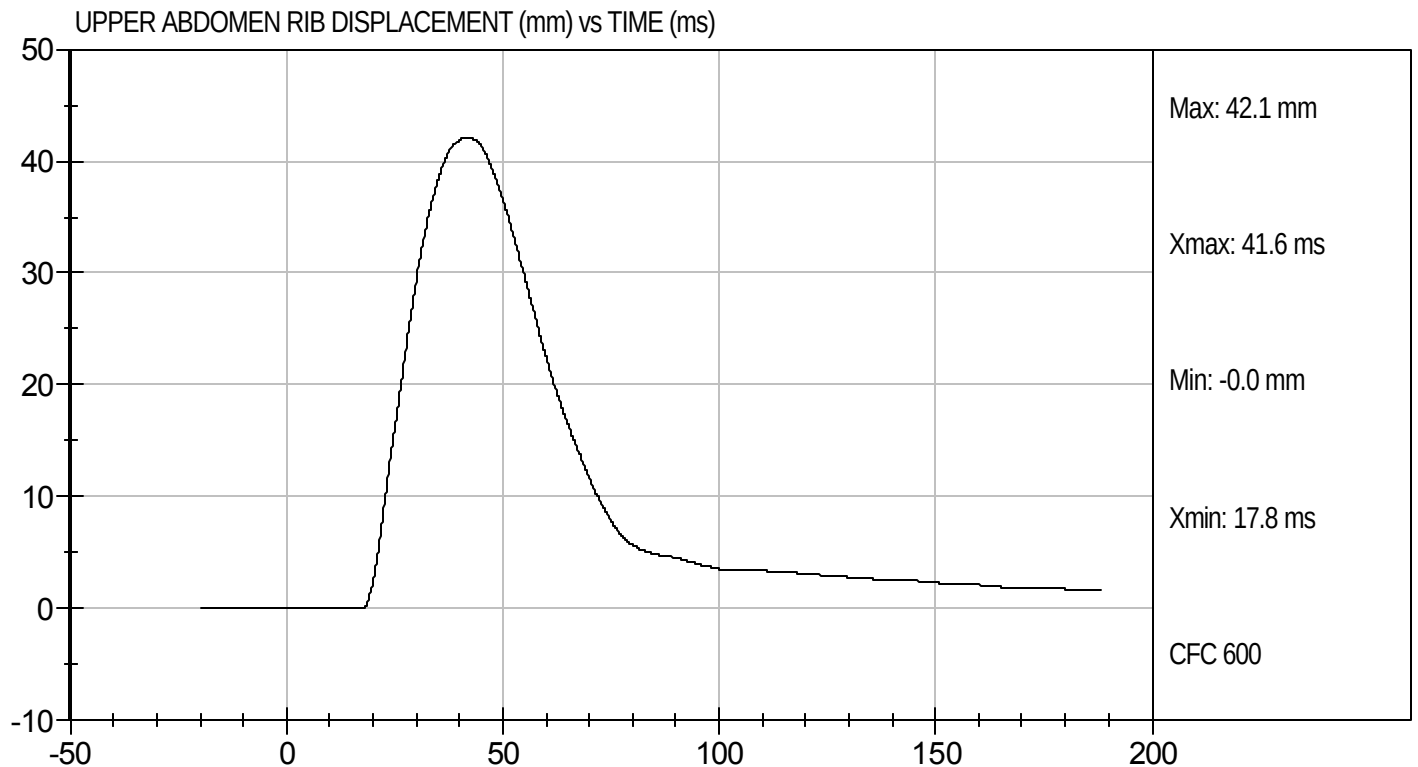
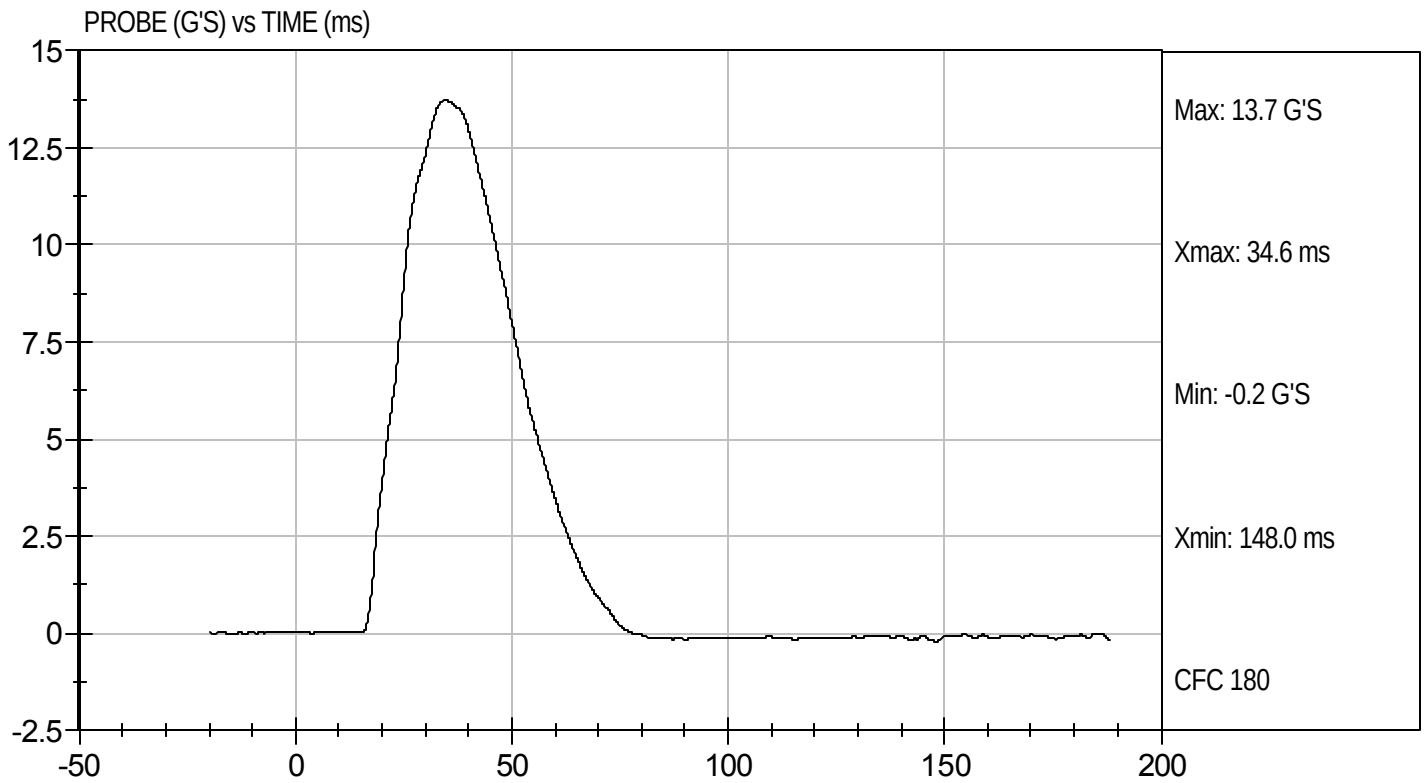
12/7/10
Test Date


Approved By



Test Desc: Abdomen Impact
Component ID: D104306

Test Date: 12/7/10
Velocity: 14.37 ft/s, 4.38 m/s

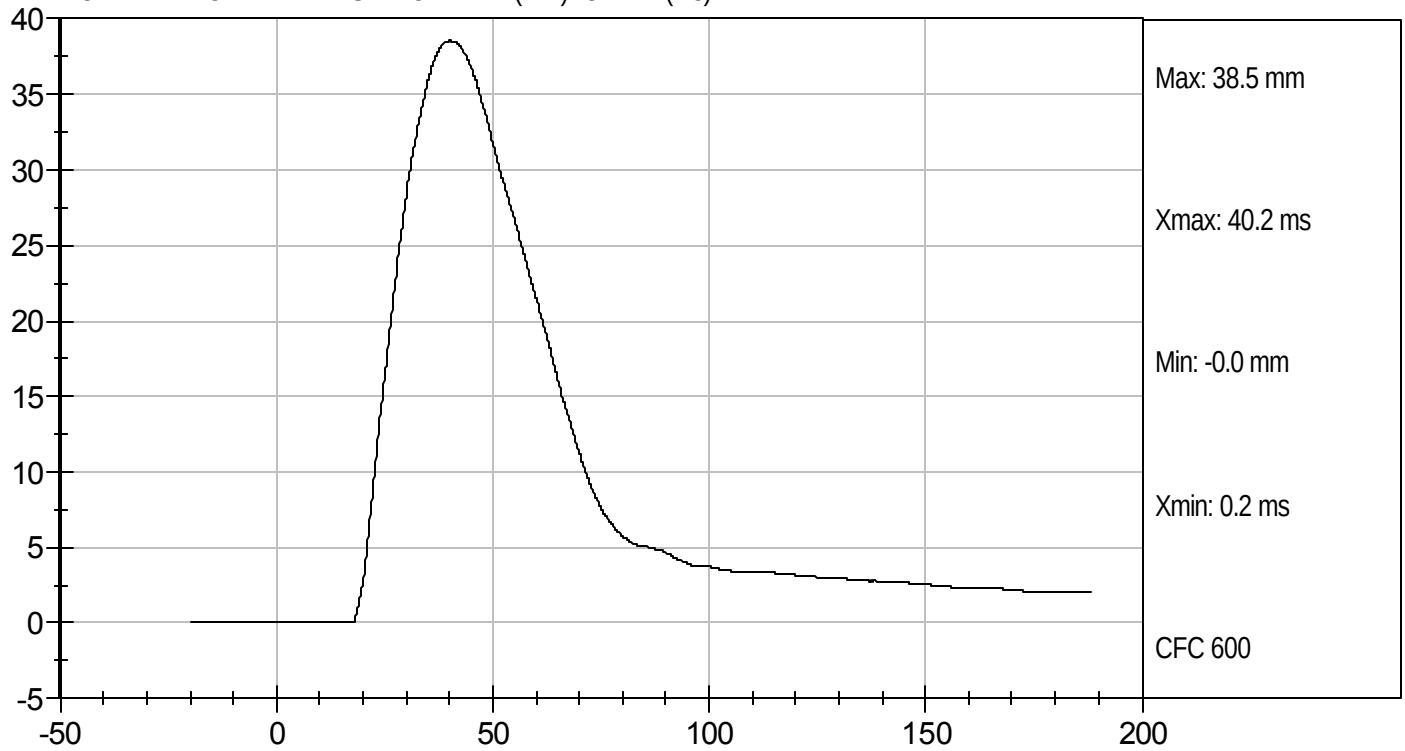




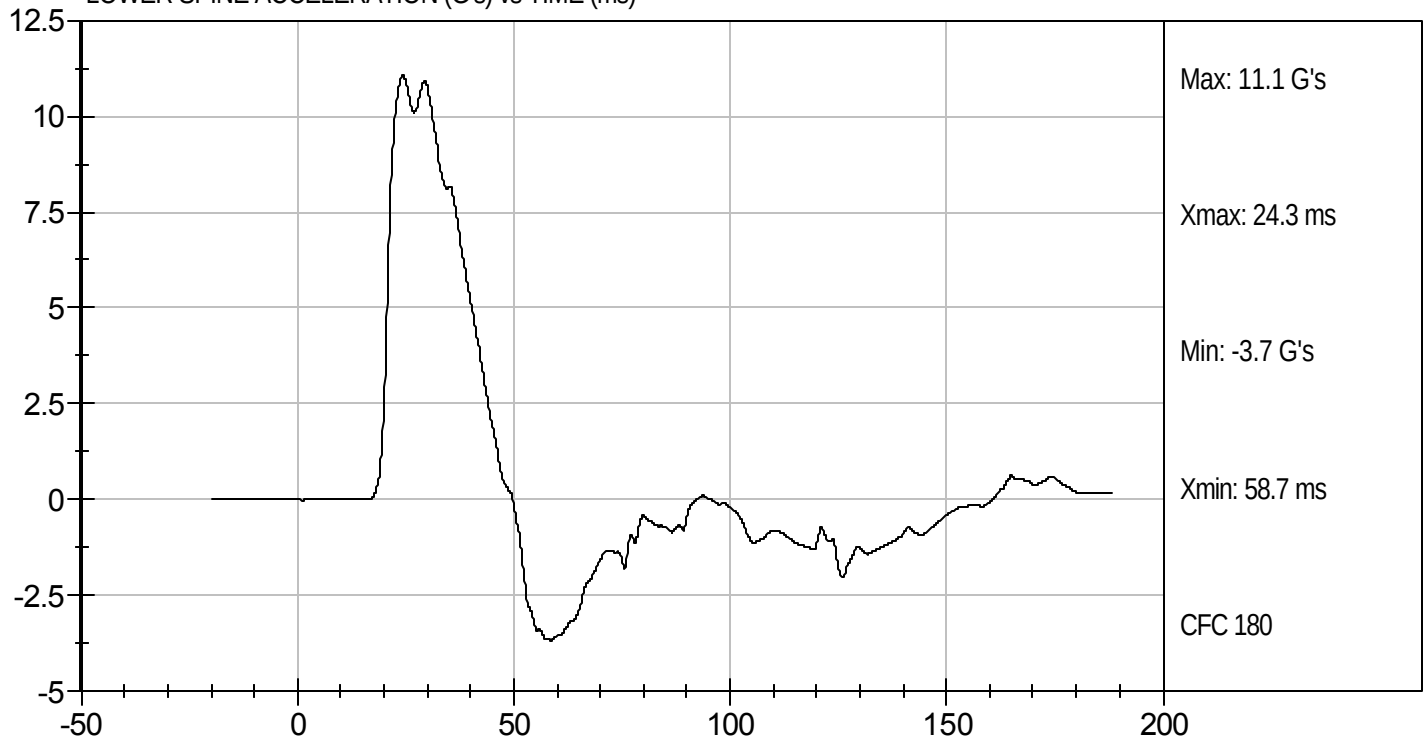
Test Desc: Abdomen Impact
Component ID: D104306

Test Date: 12/7/10
Velocity: 14.37 ft/s, 4.38 m/s

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



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



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

ATD Serial No: 296

Test I.D: D104307

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	14	Pass
Impact Velocity	m/s	6.60 to 6.80	6.64	Pass
Peak Impactor Acceleration	G's	38 to 47	44	Pass
Pelvis Y Acceleration after 6 ms	G's	34 to 42	40	Pass
Peak Acetabulum Force	N	3600 to 4300	4230	Pass
Overall Test Results				Pass


Laboratory Technician

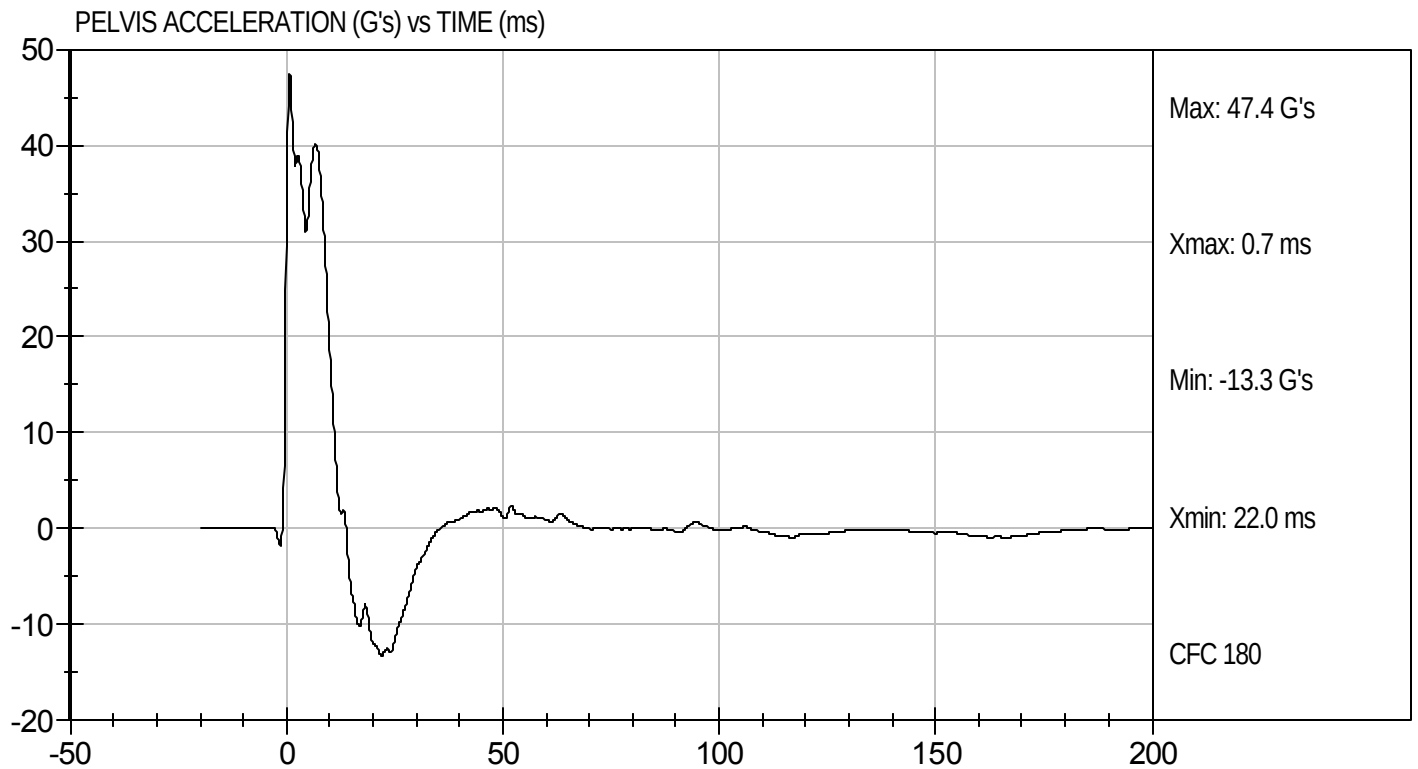
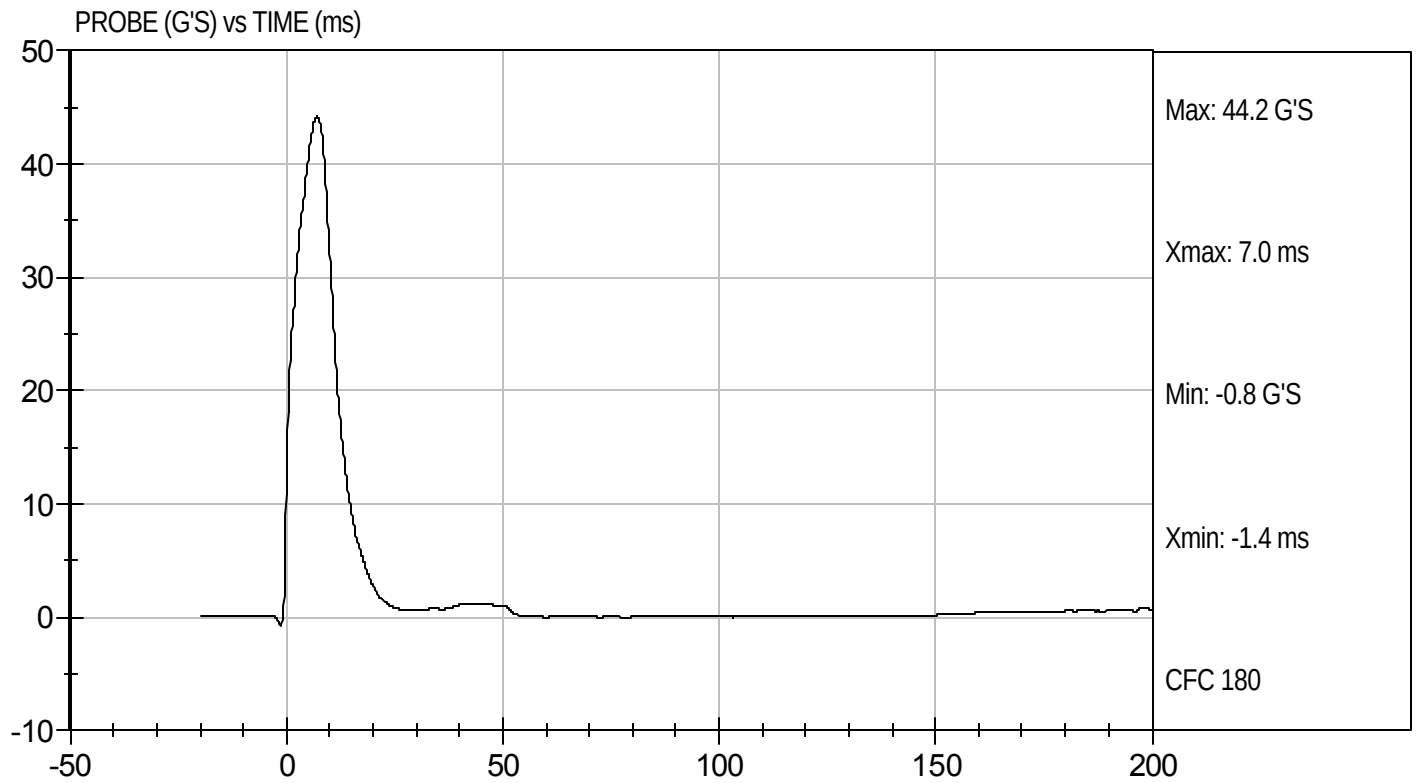
12/7/10
Test Date


Approved By



Test Desc: Pelvis Impact
Component ID: D104307

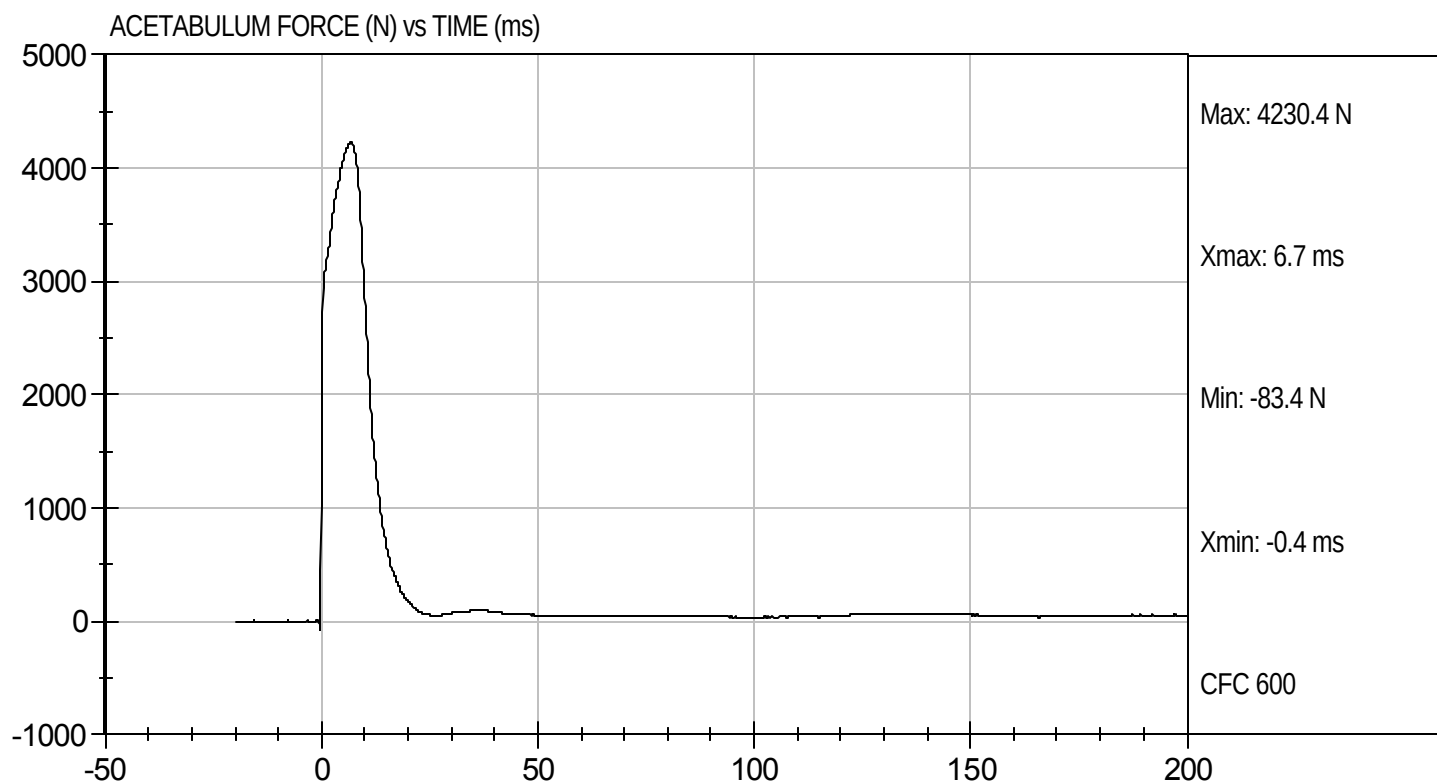
Test Date: 12/7/10
Velocity: 21.80 ft/s, 6.64 m/s





Test Desc: Pelvis Impact
Component ID: D104307

Test Date: 12/7/10
Velocity: 21.80 ft/s, 6.64 m/s



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

ATD Serial No: 296

Test I.D: D104308

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Humidity	%	10 to 70	14	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor Acceleration	G's	36 to 45	36	Pass
Pelvis Y Acceleration	G's	28 to 39	30	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4319	Pass
Overall Test Results			Pass	


Laboratory Technician

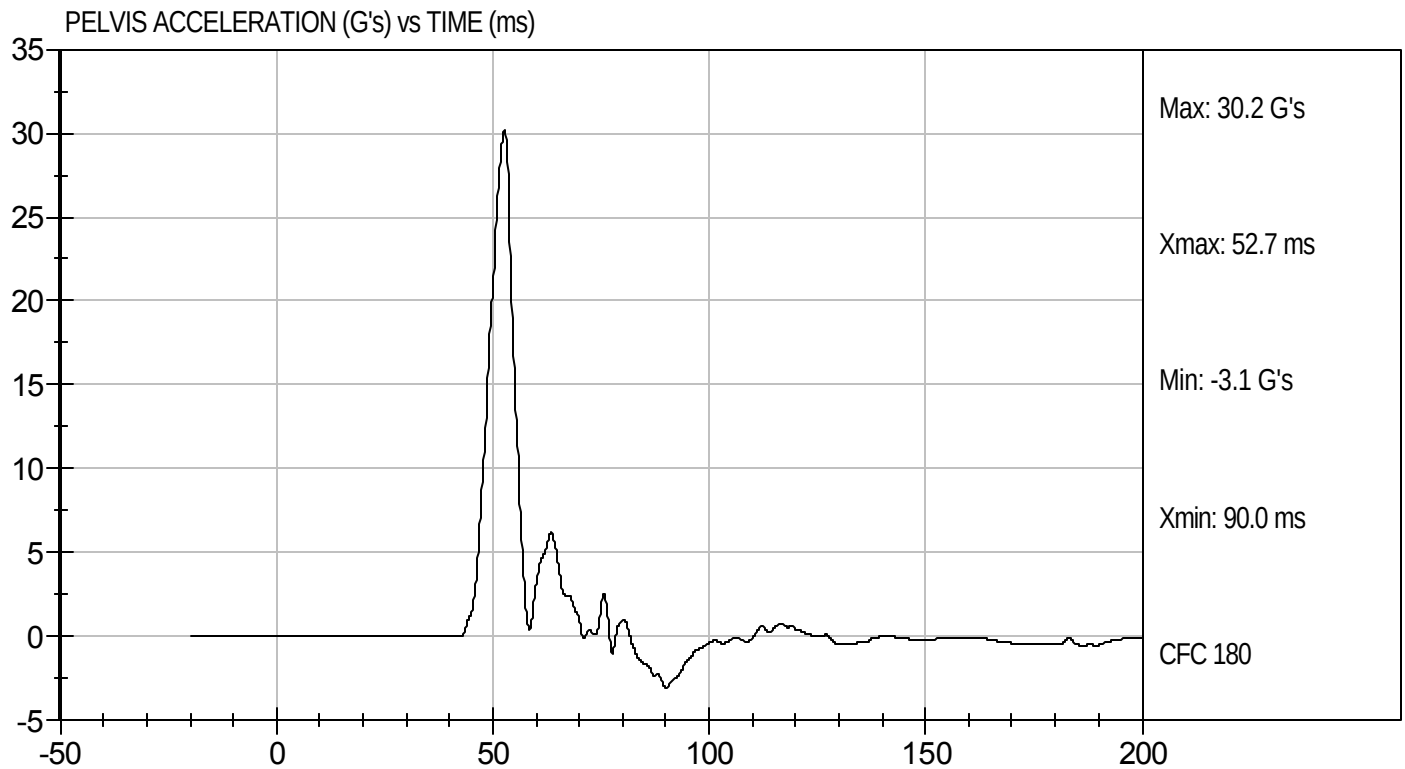
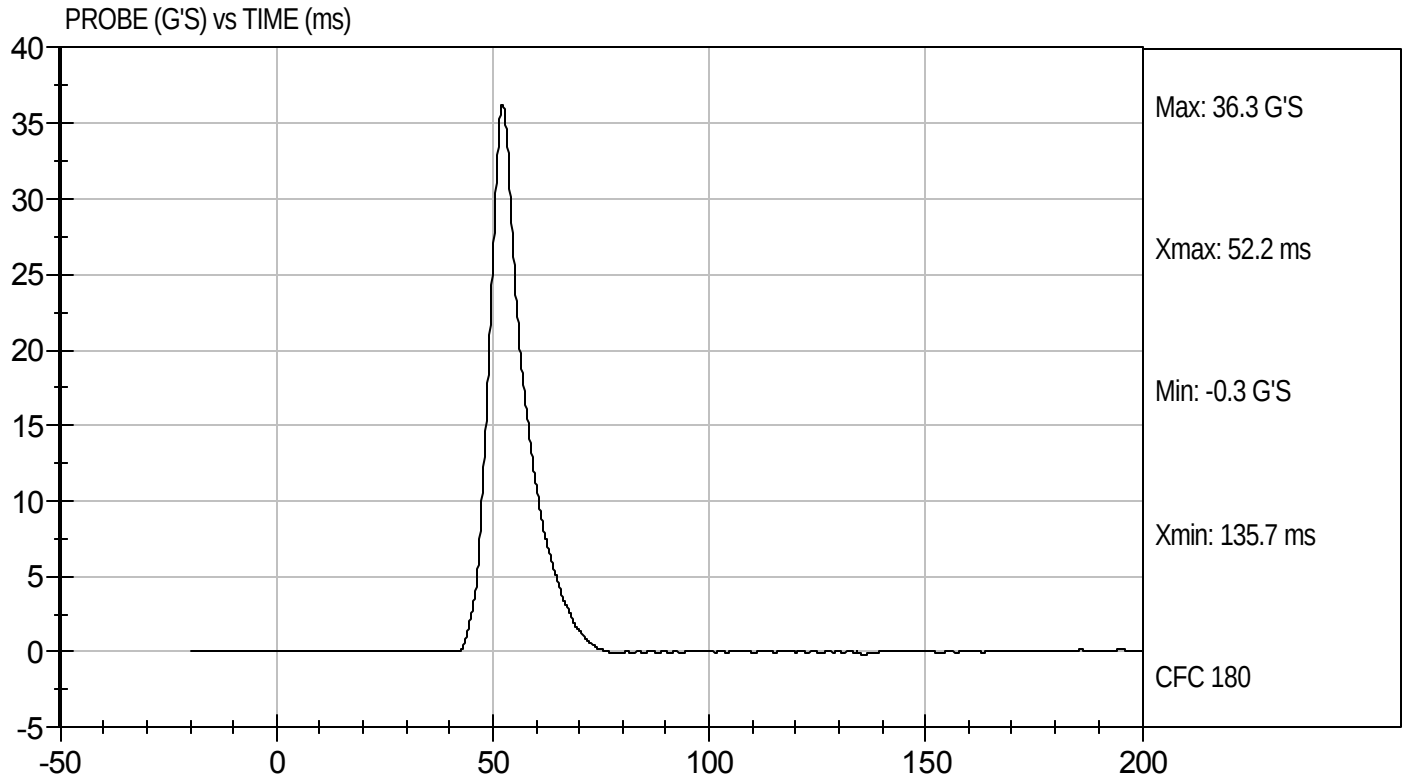
12/7/10
Test Date


Approved By



Test Desc: Iliac Impact
Component ID: D104308

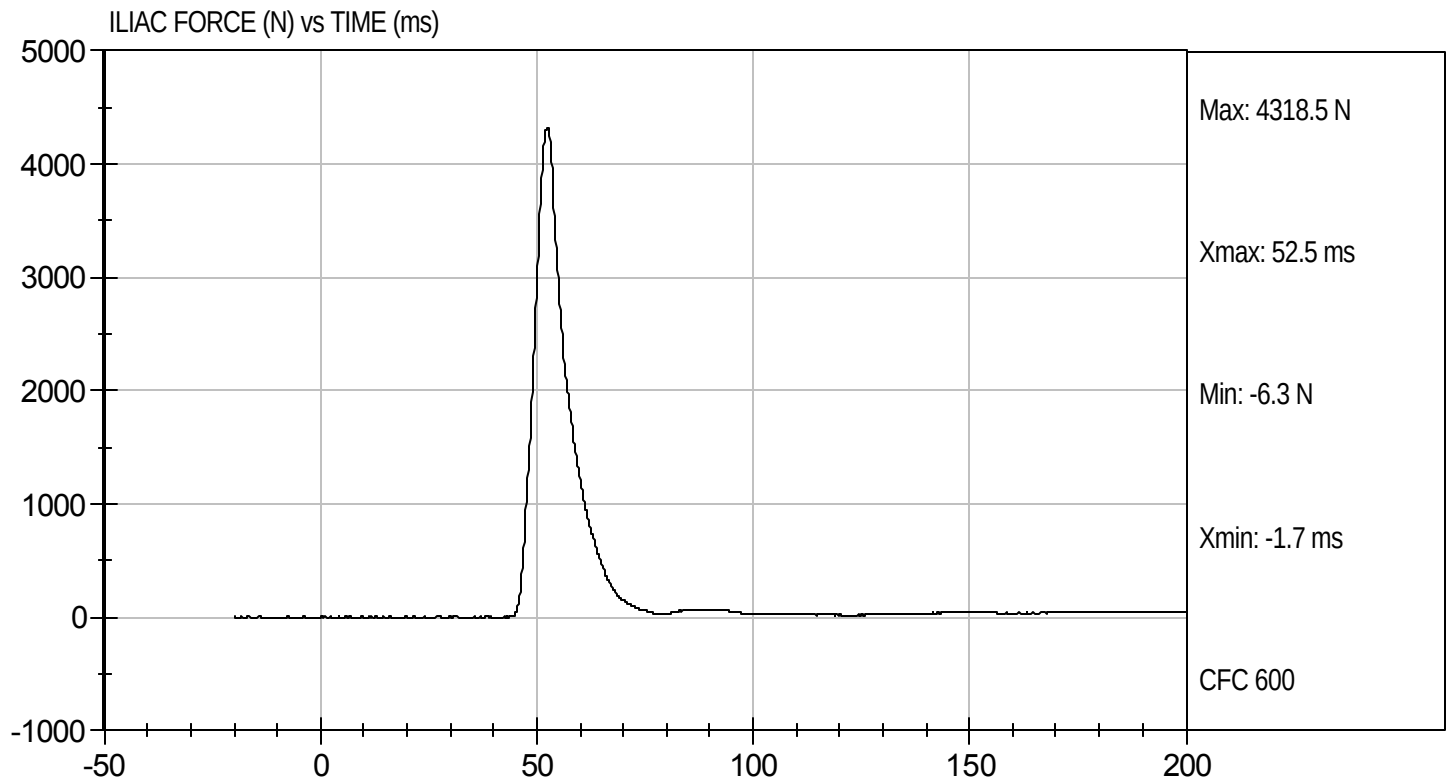
Test Date: 12/7/10
Velocity: 14.37 ft/s, 4.38 m/s





Test Desc: Iliac Impact
Component ID: D104308

Test Date: 12/7/10
Velocity: 14.37 ft/s, 4.38 m/s

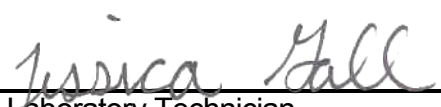


MGA RESEARCH CORPORATION
HEAD DROP TEST
SID-Its BUILD LEVEL D DUMMY

ATD Serial No: 296

Test ID: D104491

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Peak Resultant Acceleration	G's	115 to 137	121	Pass
Peak Lateral Acceleration	G's	+/- 15	-3.5	Pass
Unimodal	N/A	<15%	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

12/17/10
Test Date

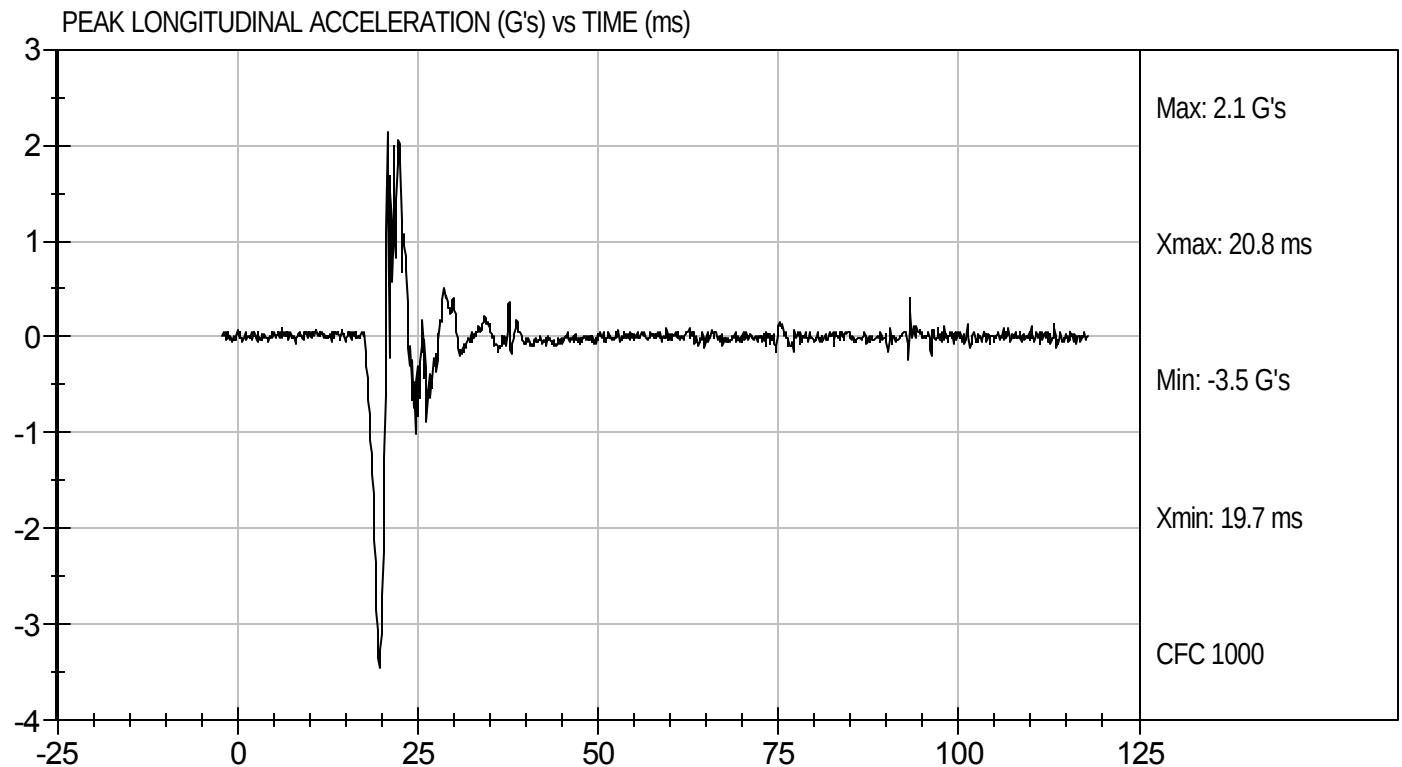
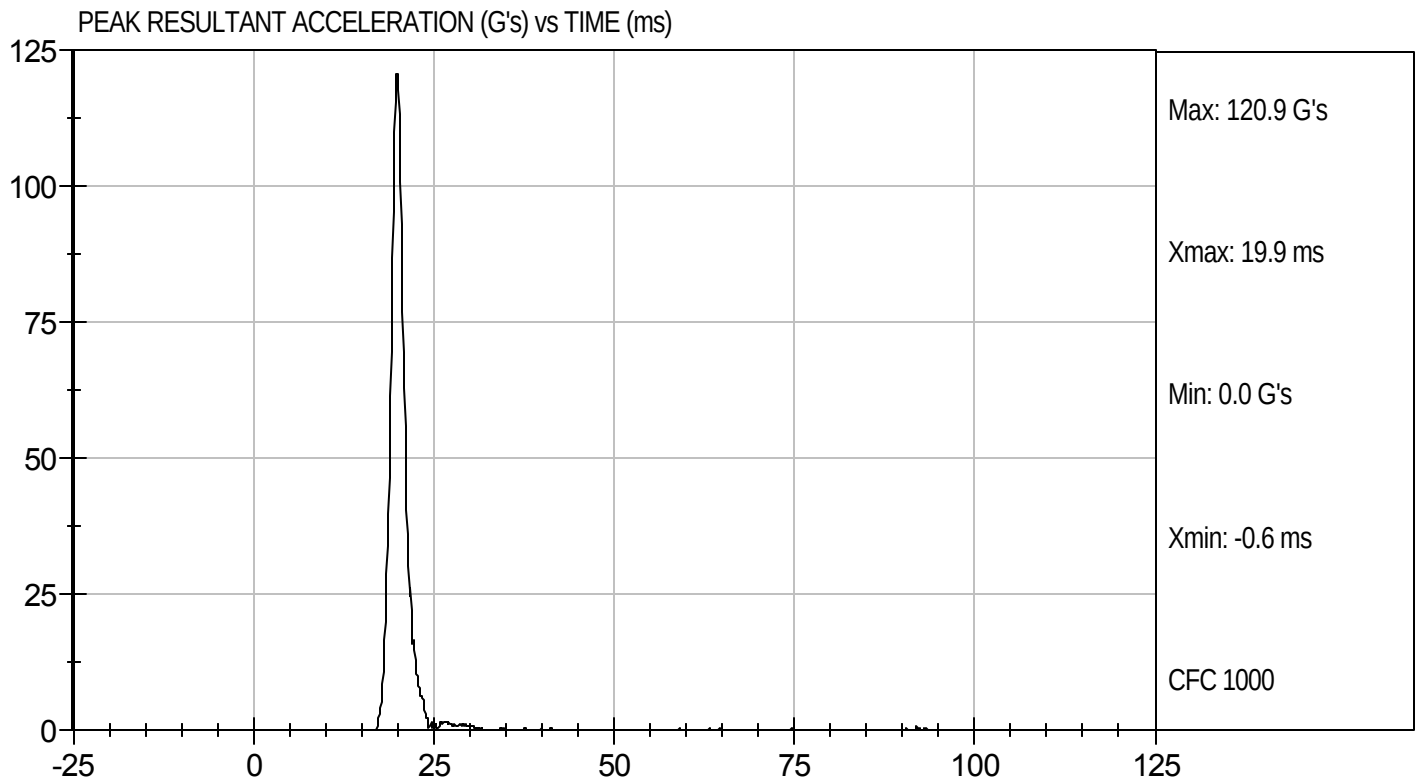


Approved By



Test Desc: Head Drop
Component ID: D104491

Test Date: 12/17/10
Velocity: 0 ft/s, 0 m/s

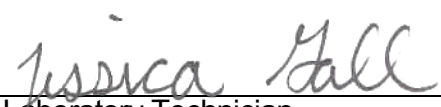


MGA RESEARCH CORPORATION
LATERAL NECK PENDULUM TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D104492

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	22.0	Pass
Humidity		%	10 to 70	16	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Delta Velocity	10 ms	m/s	2.20 to 2.80	2.39	Pass
	15 ms	m/s	3.30 to 4.10	3.36	Pass
	20 ms	m/s	4.40 to 5.40	4.52	Pass
	25 ms	m/s	5.40 to 6.10	5.45	Pass
	25-100 ms	m/s	5.50 to 6.20	5.59	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	63	Pass
Maximum Occipital Condyle Moment during Rotation Interval Nm			-44 to -36	-40	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	119	Pass
Overall Test Results				Pass	


 Laboratory Technician

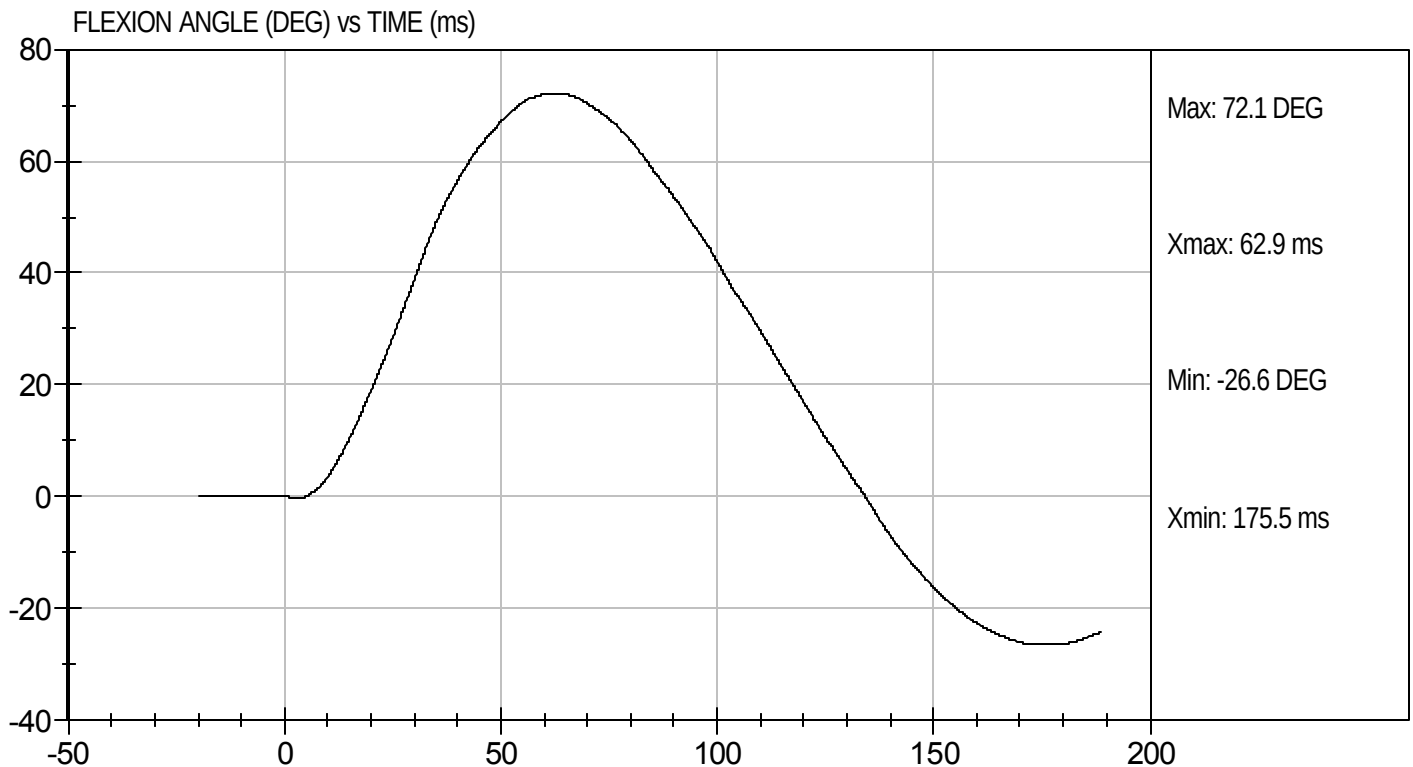
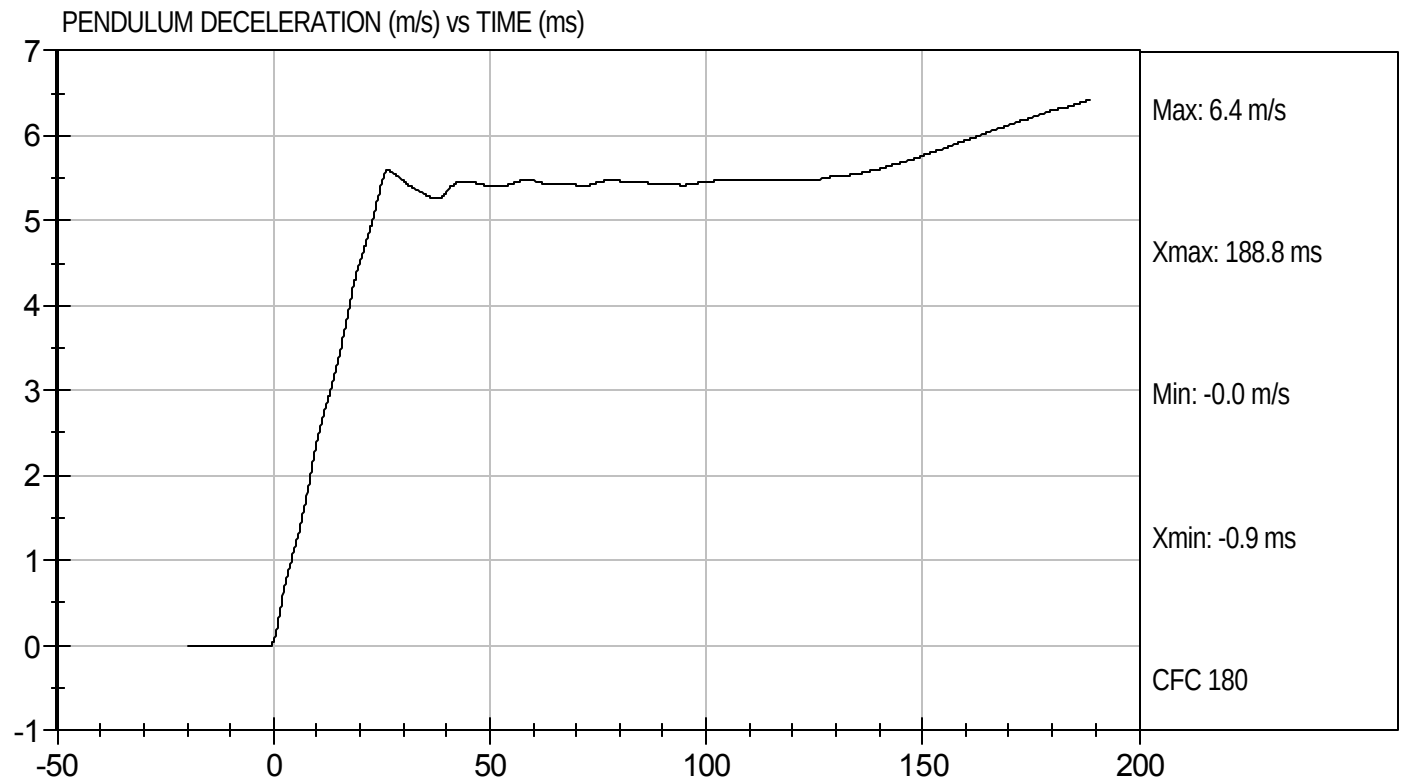
12/17/10
 Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D104492

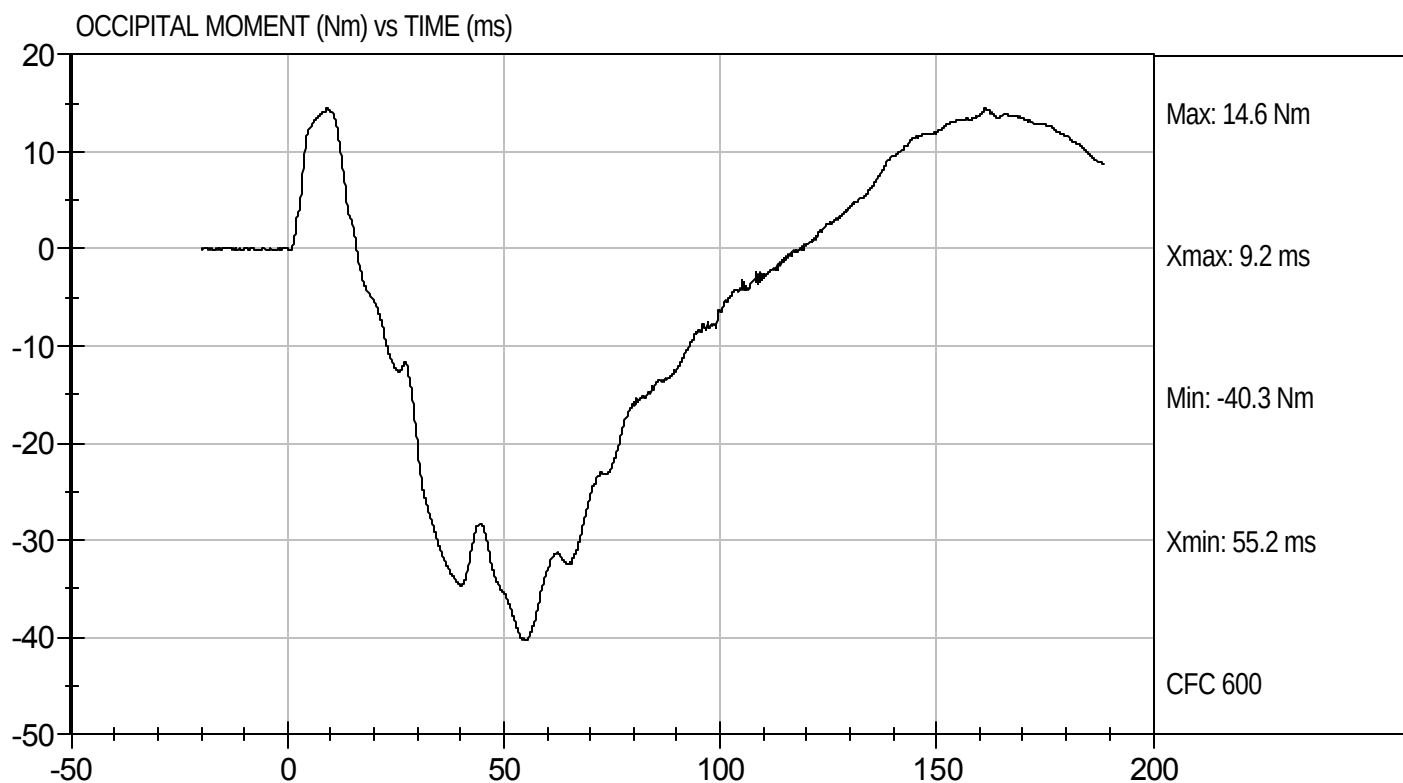
Test Date: 12/17/10
Velocity: 18.32 ft/s, 5.58 m/s





Test Desc: Neck Bending
Component ID: D104492

Test Date: 12/17/10
Velocity: 18.32 ft/s, 5.58 m/s



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

ATD Serial No: 296

Test ID: D104493

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	17	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

Jessica Hall
Laboratory Technician

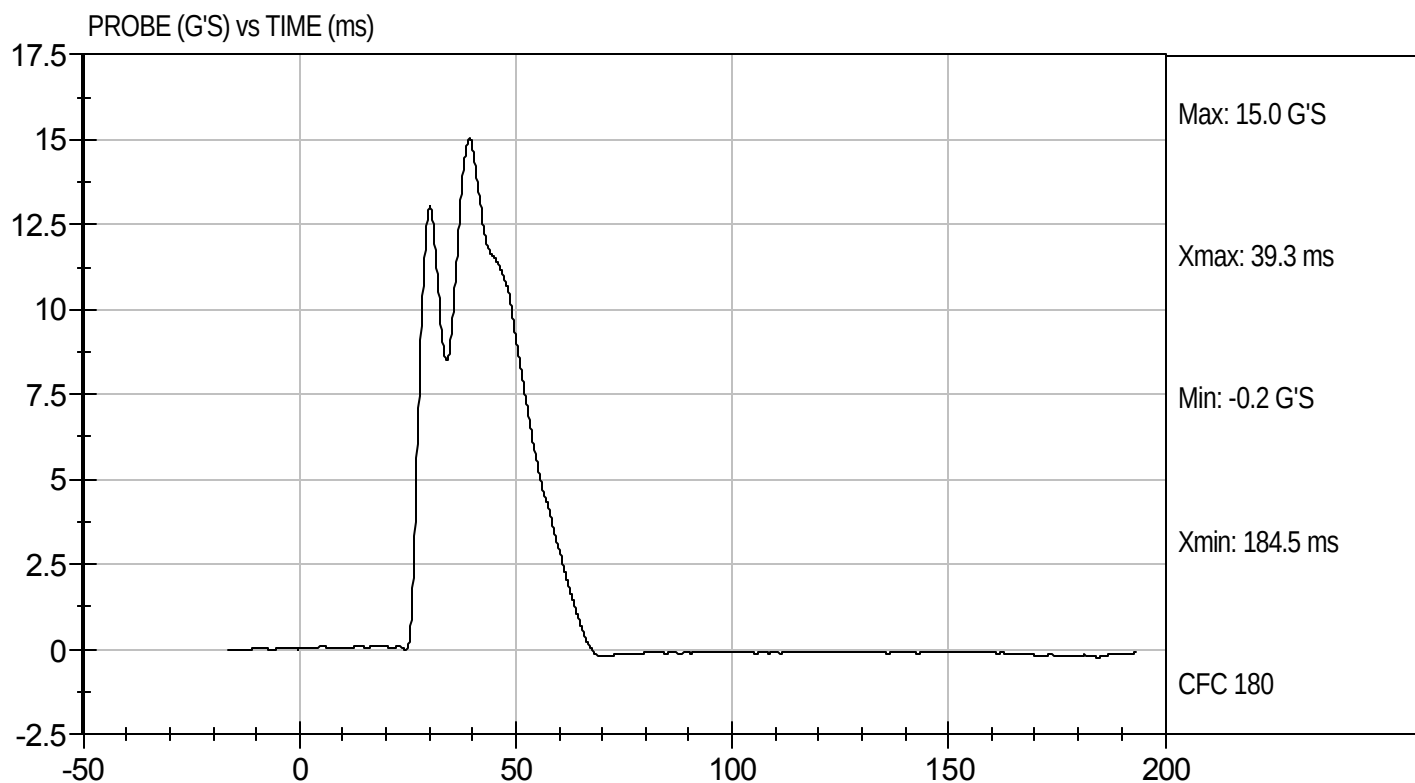
12/16/10
Test Date

David Winkelbauer
Approved By



Test Desc: Shoulder Impact
Component ID: D104493

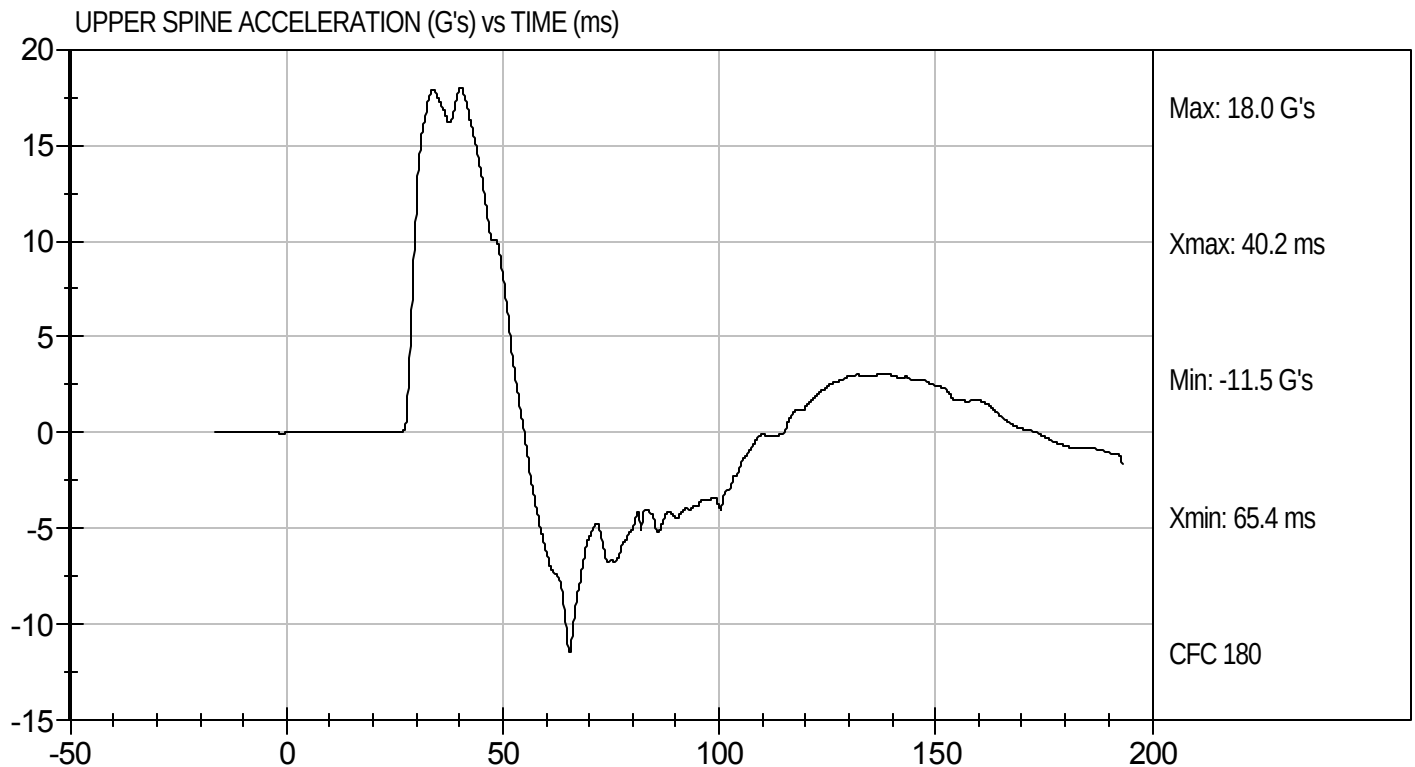
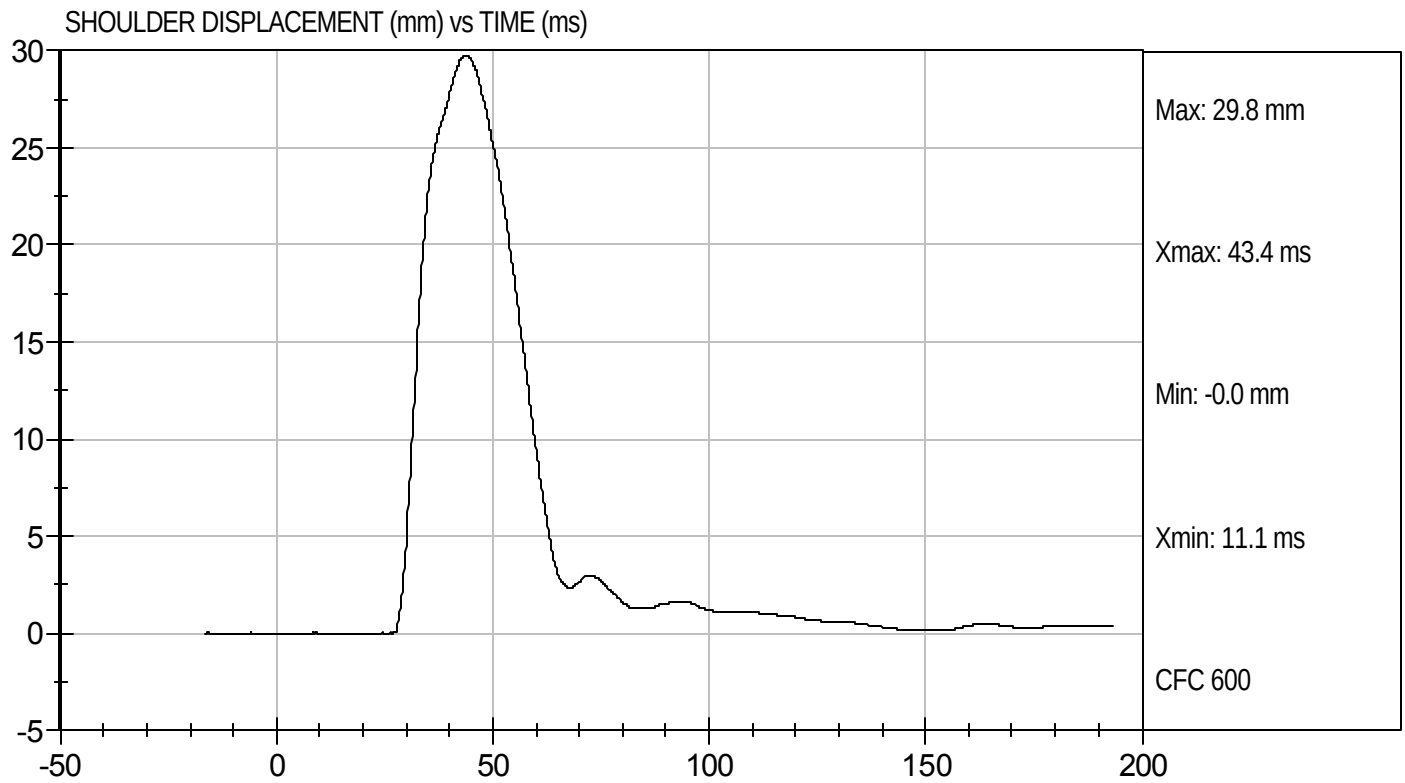
Test Date: 12/16/10
Velocity: 14.25 ft/s, 4.34 m/s





Test Desc: Shoulder Impact
Component ID: D104493

Test Date: 12/16/10
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: D104494

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	17	Pass
Impact Velocity	m/s	6.60 to 6.80	6.69	Pass
Peak Impactor Acceleration	G's	30 to 36	33	Pass
Shoulder Displacement	mm	31 to 40	35	Pass
Upper Rib Displacement	mm	25 to 32	30	Pass
Middle Rib Displacement	mm	30 to 36	31	Pass
Lower Rib Displacement	mm	32 to 38	33	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	38	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	34	Pass
Overall Test Results				Pass


Laboratory Technician

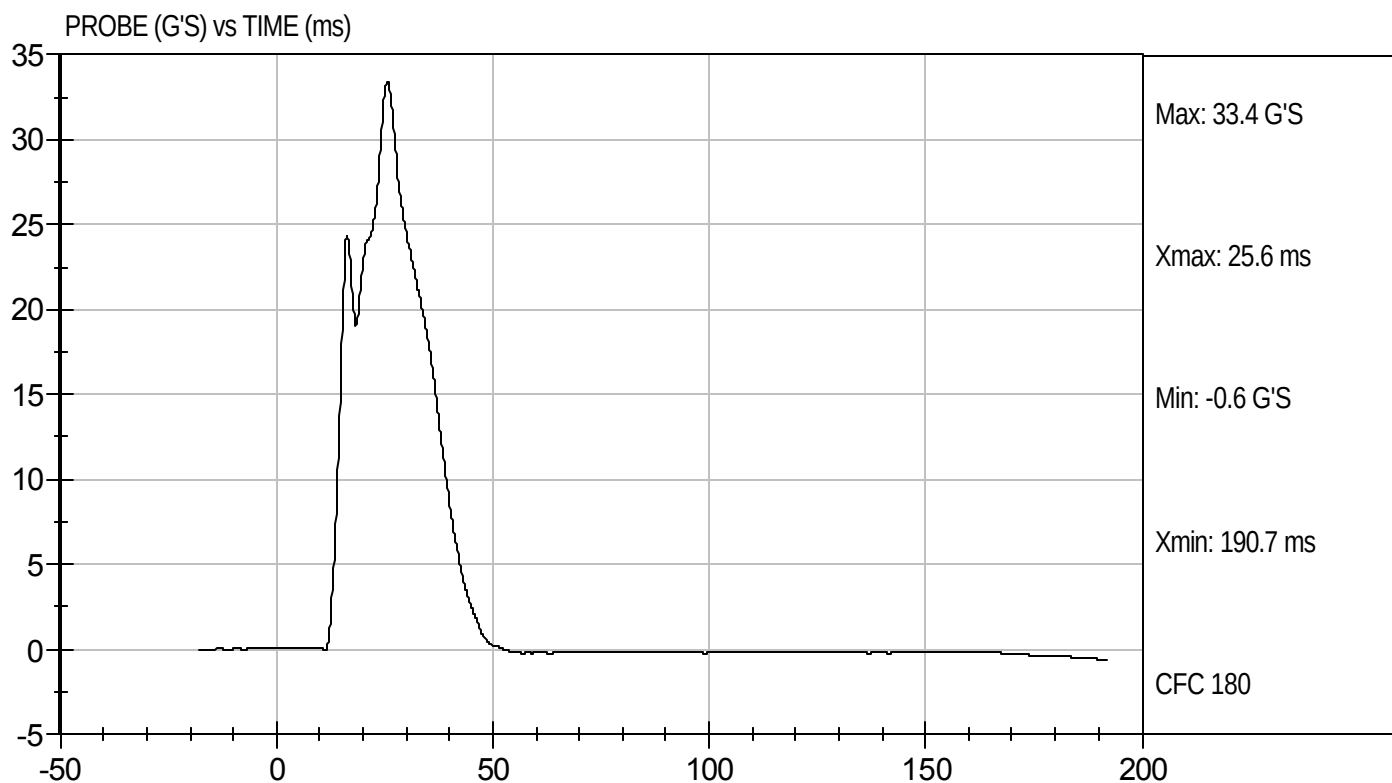
12/16/10
Test Date


Approved By



Test Desc: Thorax With Arm
Component ID: D104494

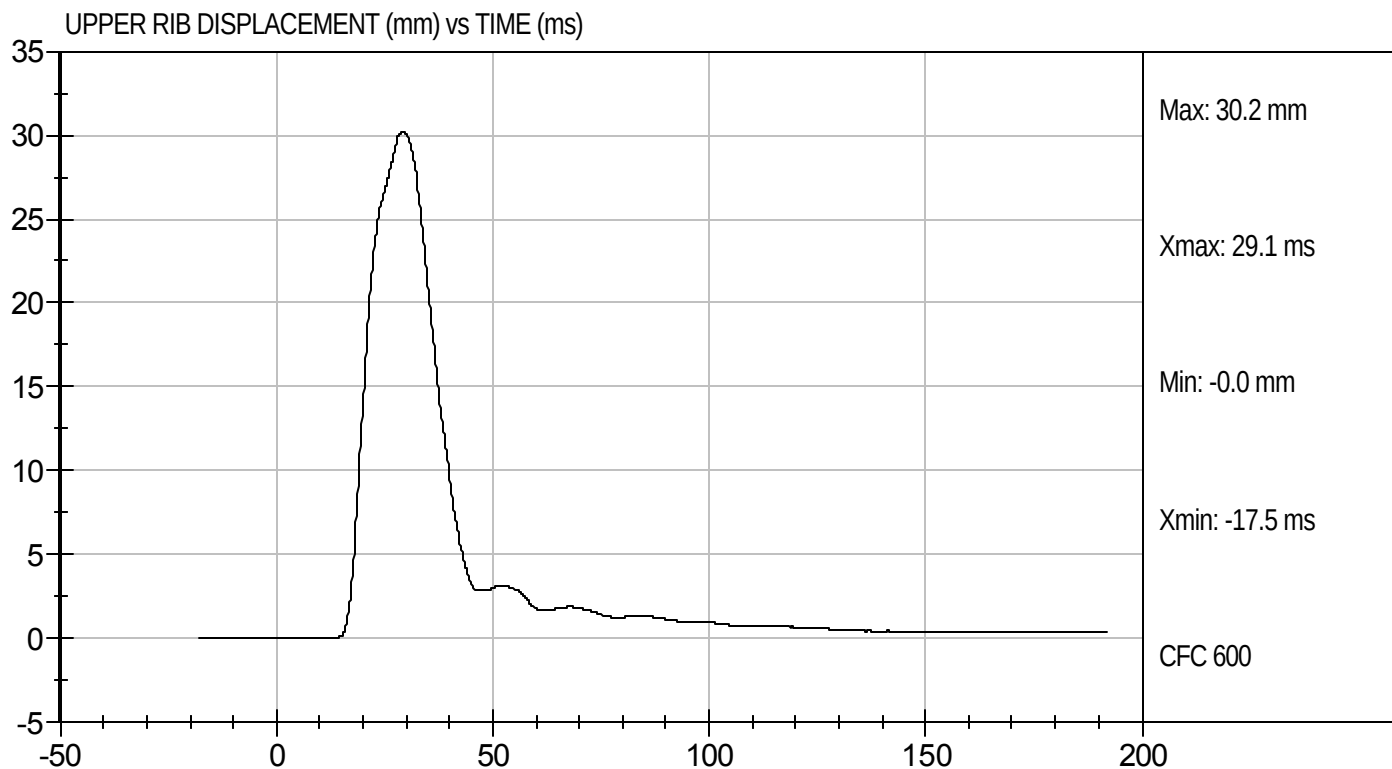
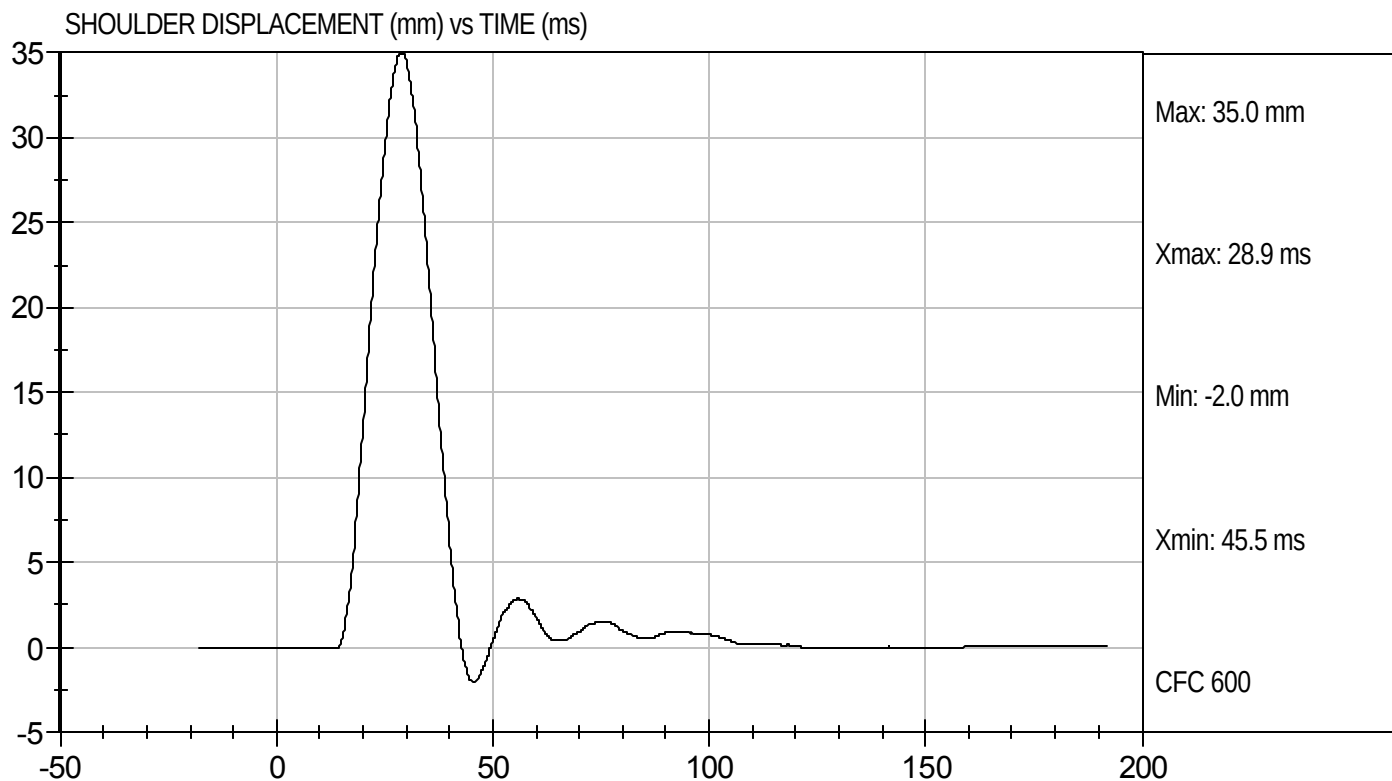
Test Date: 12/16/10
Velocity: 21.96 ft/s, 6.69 m/s





Test Desc: Thorax With Arm
Component ID: D104494

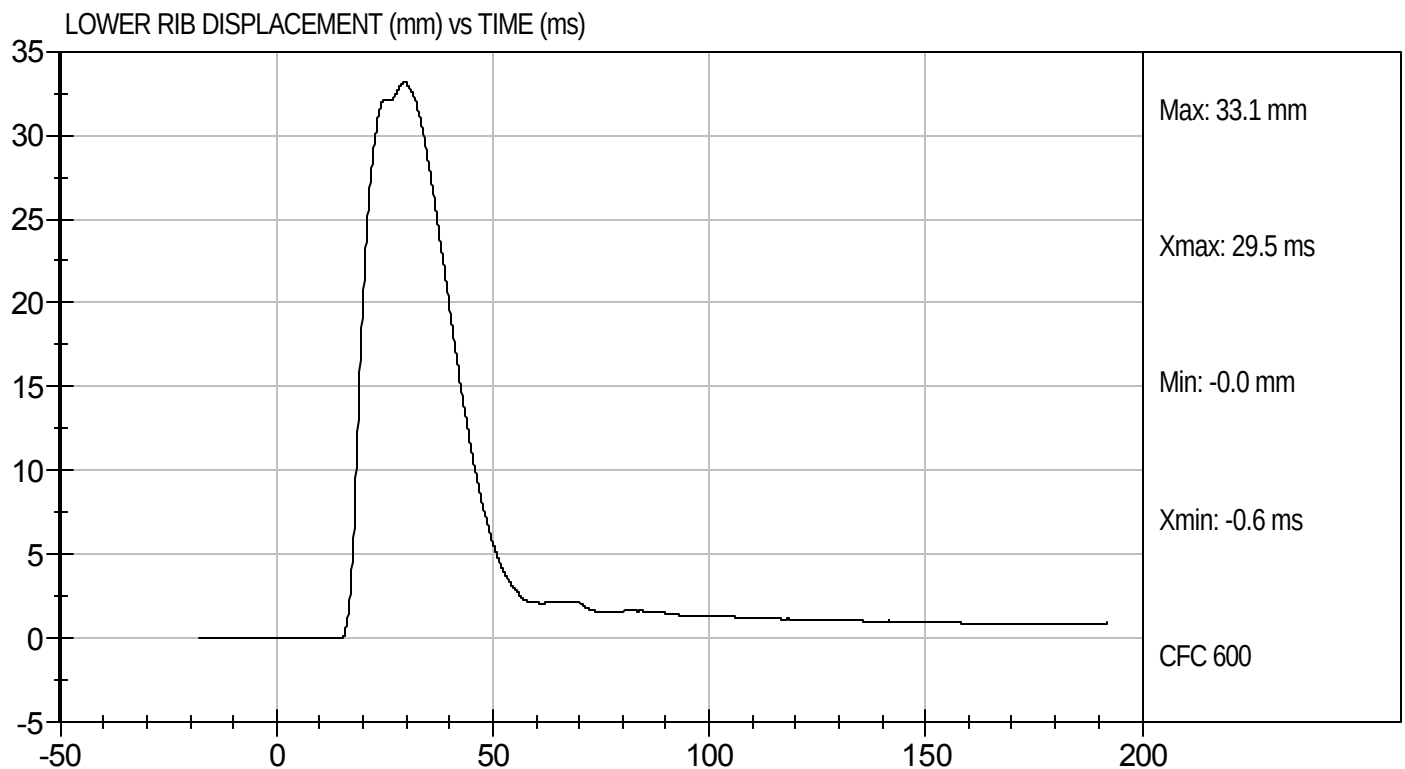
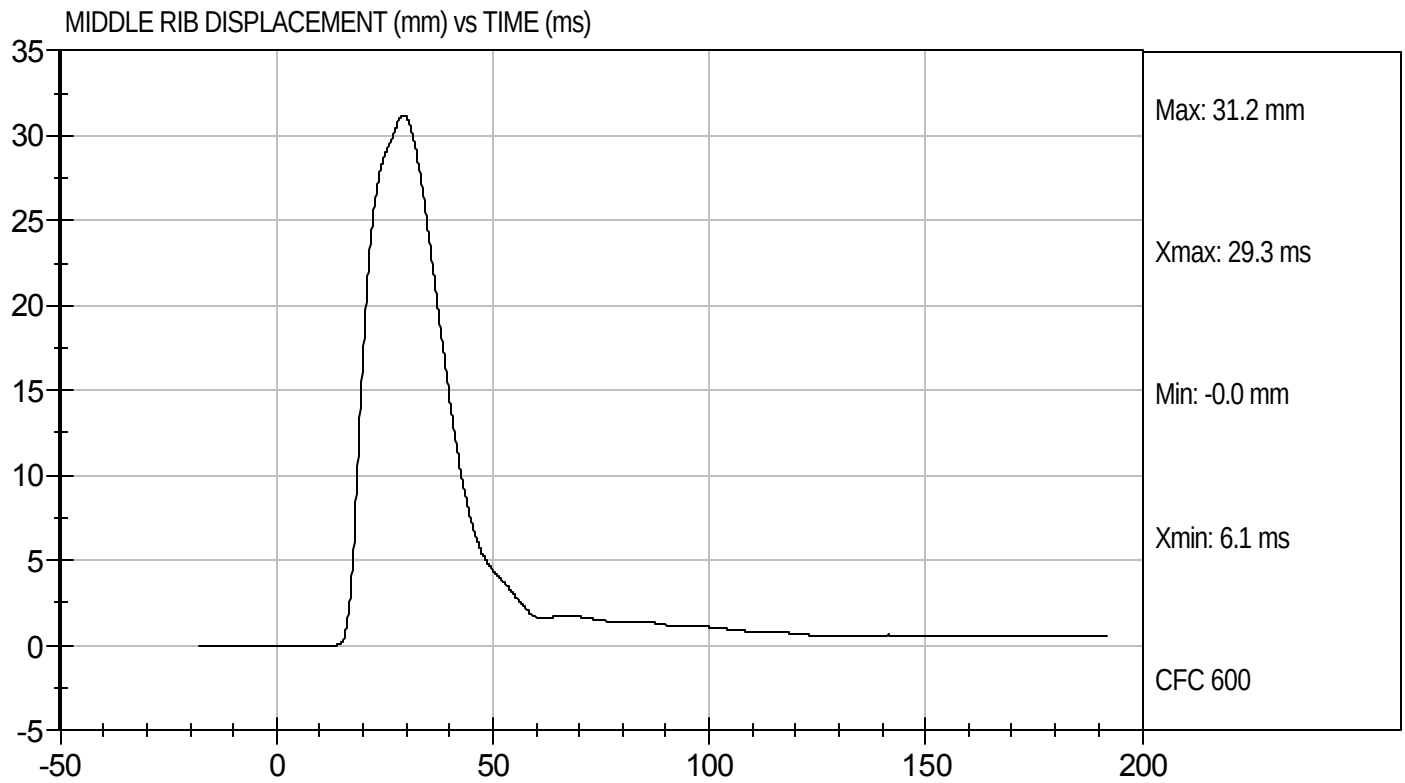
Test Date: 12/16/10
Velocity: 21.96 ft/s, 6.69 m/s





Test Desc: Thorax With Arm
Component ID: D104494

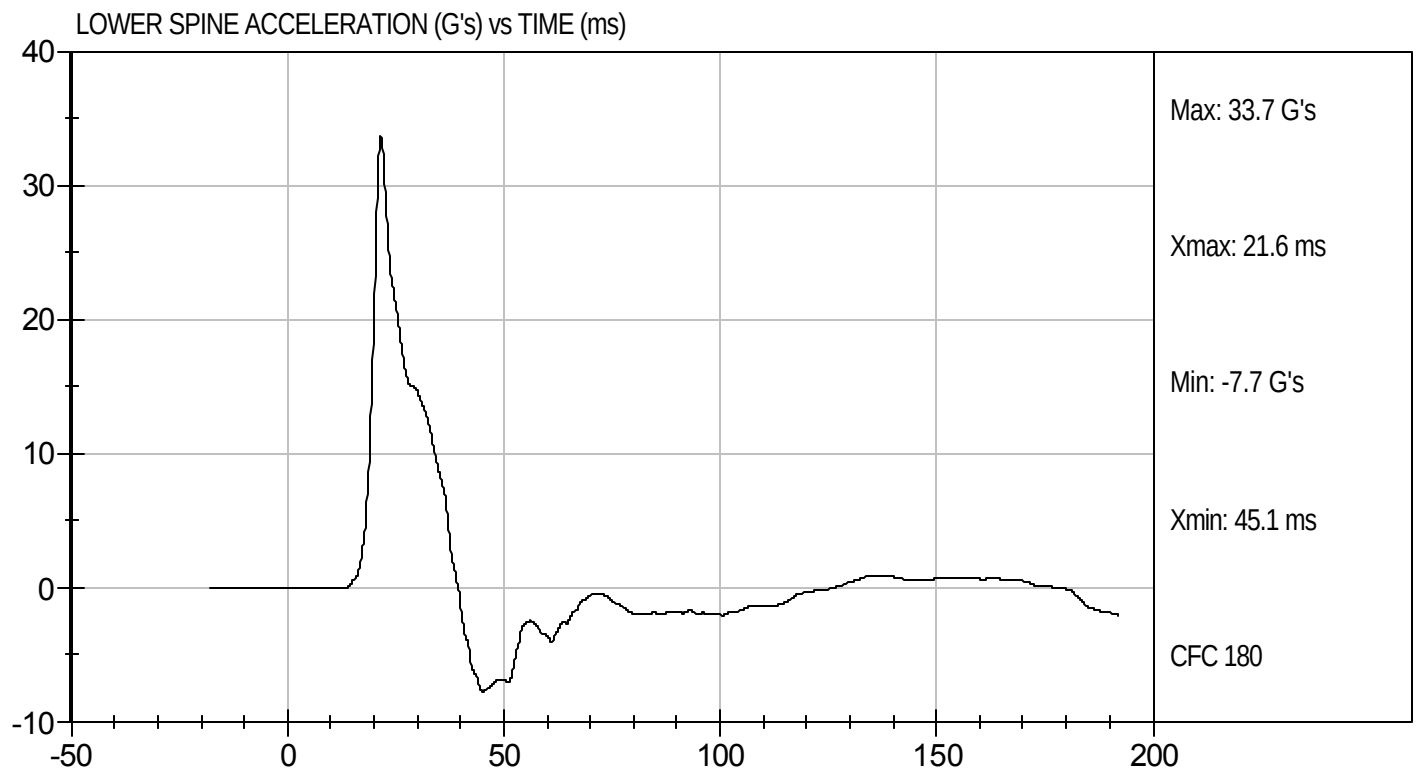
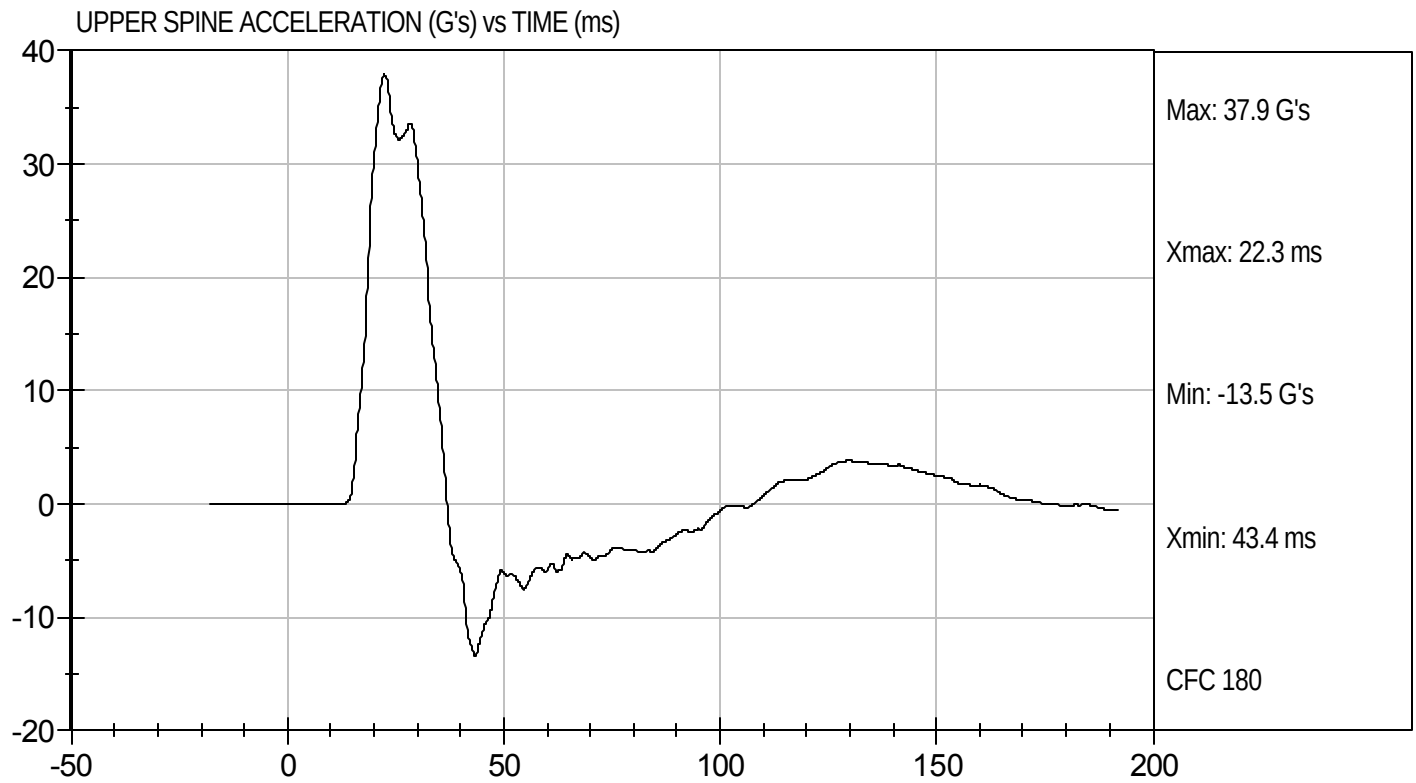
Test Date: 12/16/10
Velocity: 21.96 ft/s, 6.69 m/s





Test Desc: Thorax With Arm
Component ID: D104494

Test Date: 12/16/10
Velocity: 21.96 ft/s, 6.69 m/s



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

ATD Serial No: 296

Test I.D: D104495

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	17	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Peak Impactor Force	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	38	Pass
Middle Rib Displacement	mm	39 to 45	41	Pass
Lower Rib Displacement	mm	35 to 43	38	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
Overall Test Results			Pass	


Laboratory Technician

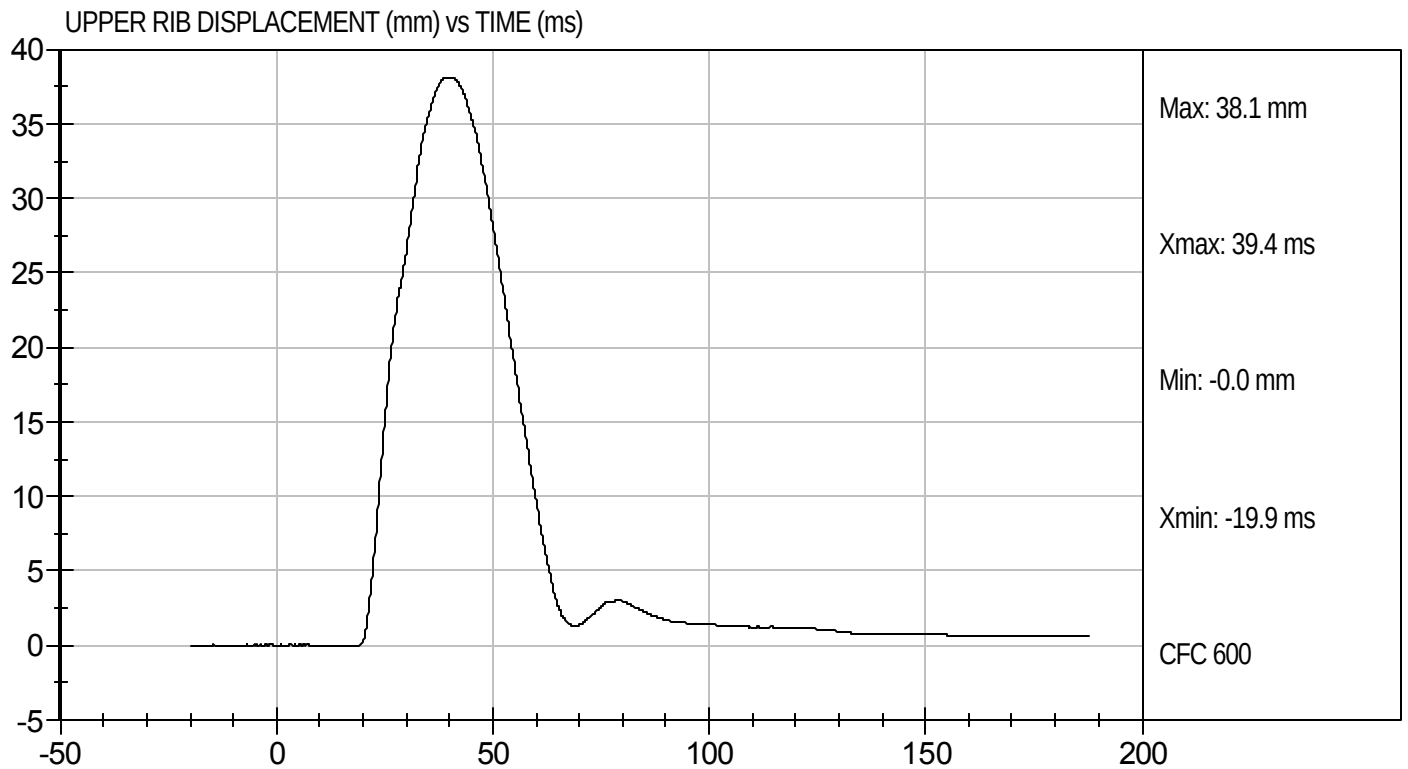
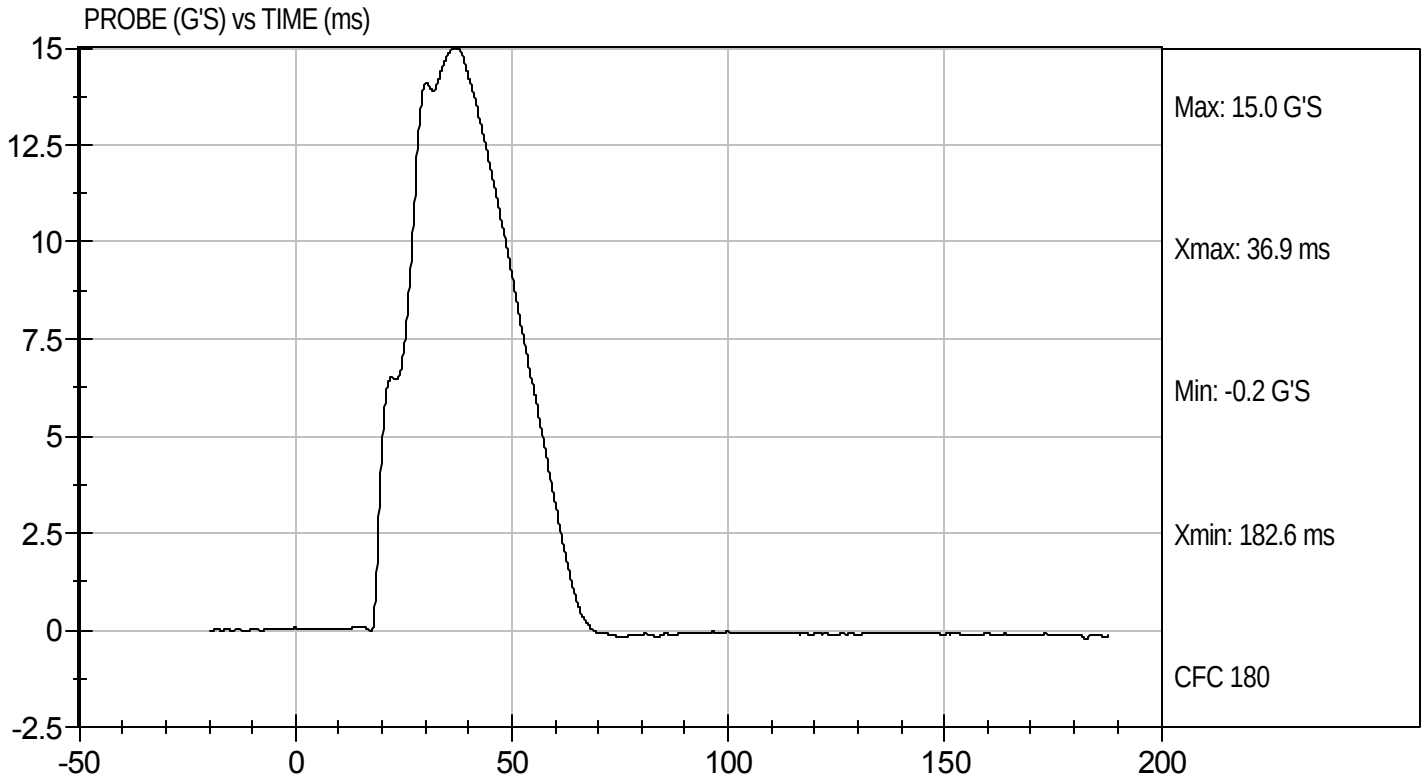
12/16/10
Test Date


Approved By



Test Desc: Thorax Without Arm
Component ID: D104495

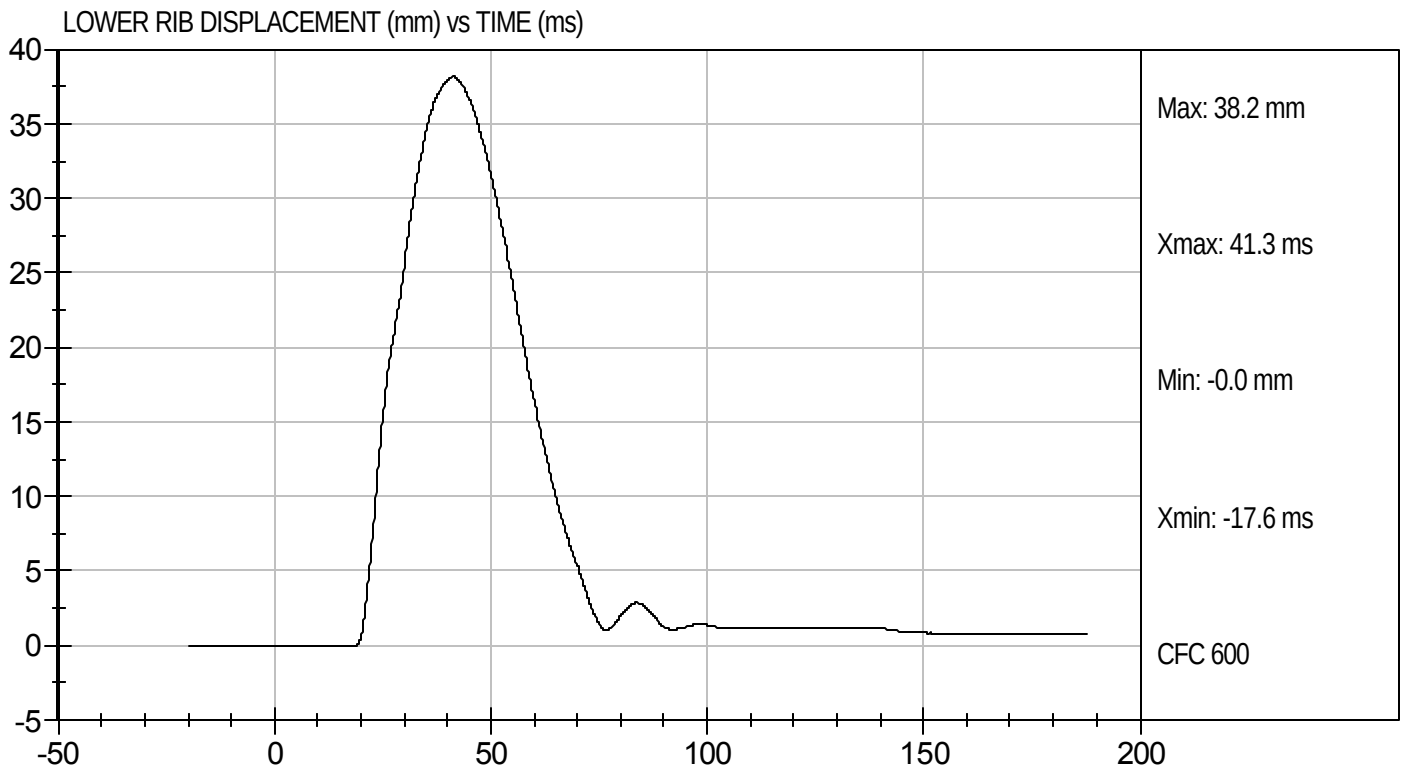
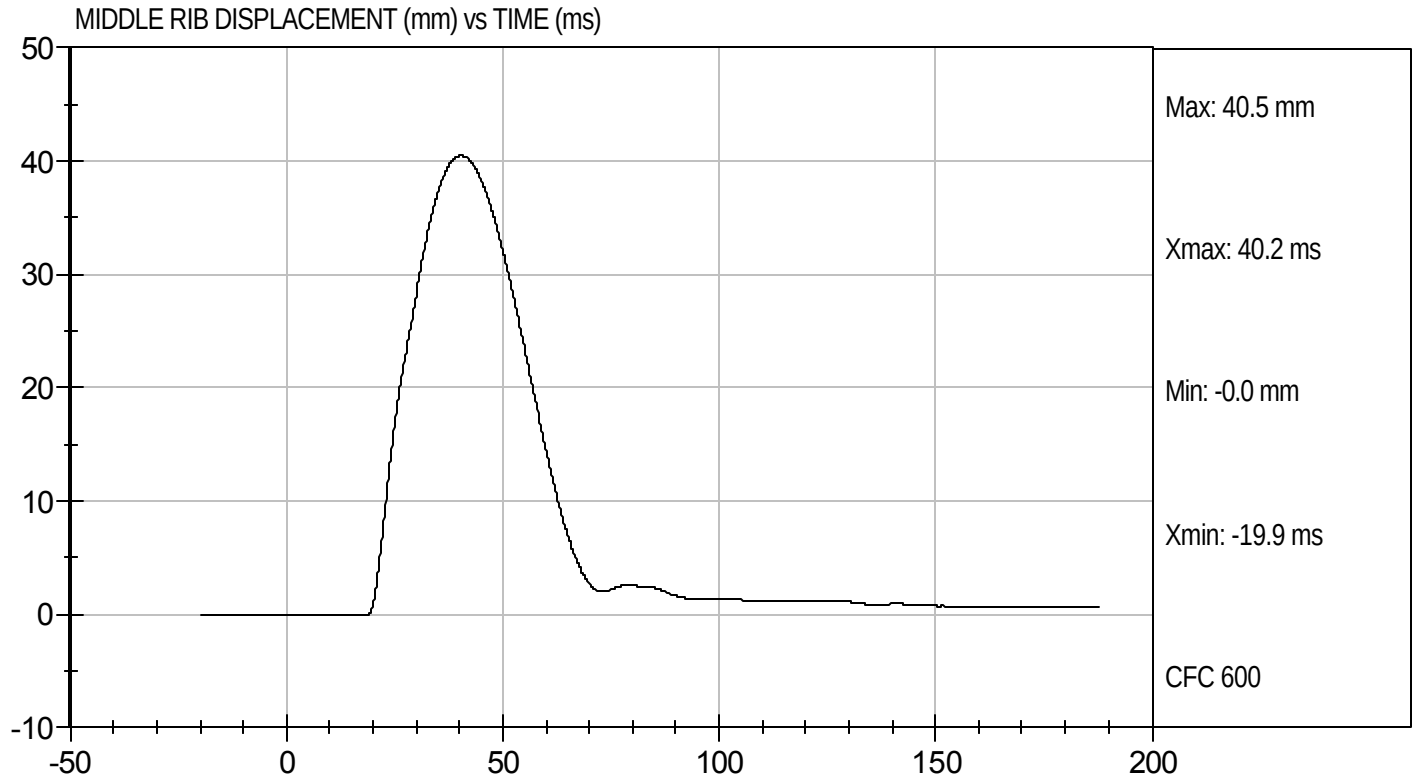
Test Date: 12/16/10
Velocity: 14.12 ft/s, 4.30 m/s





Test Desc: Thorax Without Arm
Component ID: D104495

Test Date: 12/16/10
Velocity: 14.12 ft/s, 4.30 m/s

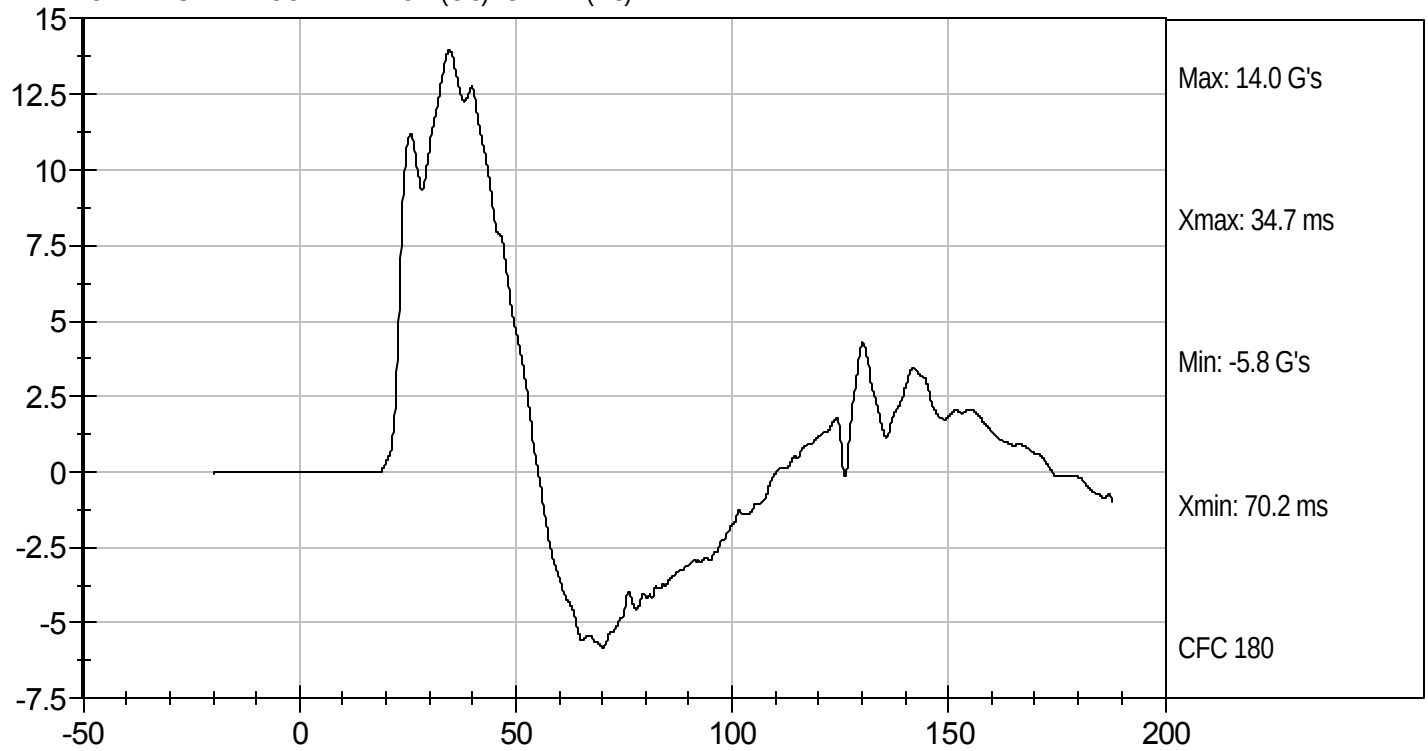




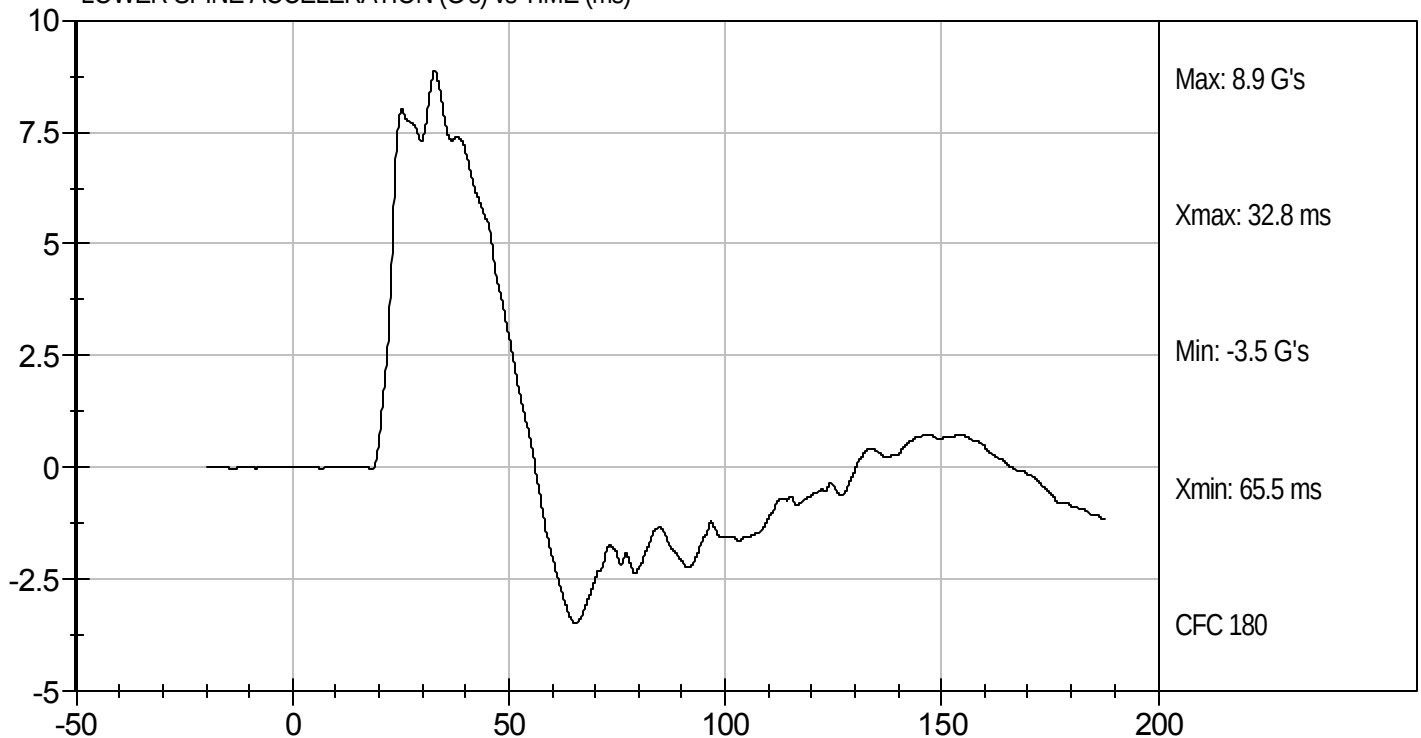
Test Desc: Thorax Without Arm
Component ID: D104495

Test Date: 12/16/10
Velocity: 14.12 ft/s, 4.30 m/s

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



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



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

ATD Serial No: 296

Test I.D: D104496

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	16	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Peak Impactor Acceleration	G's	12 to 16	14	Pass
Upper Rib Displacement	mm	36 to 47	36	Pass
Lower Rib Displacement	mm	33 to 44	38	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
			Overall Test Results	Pass


Laboratory Technician

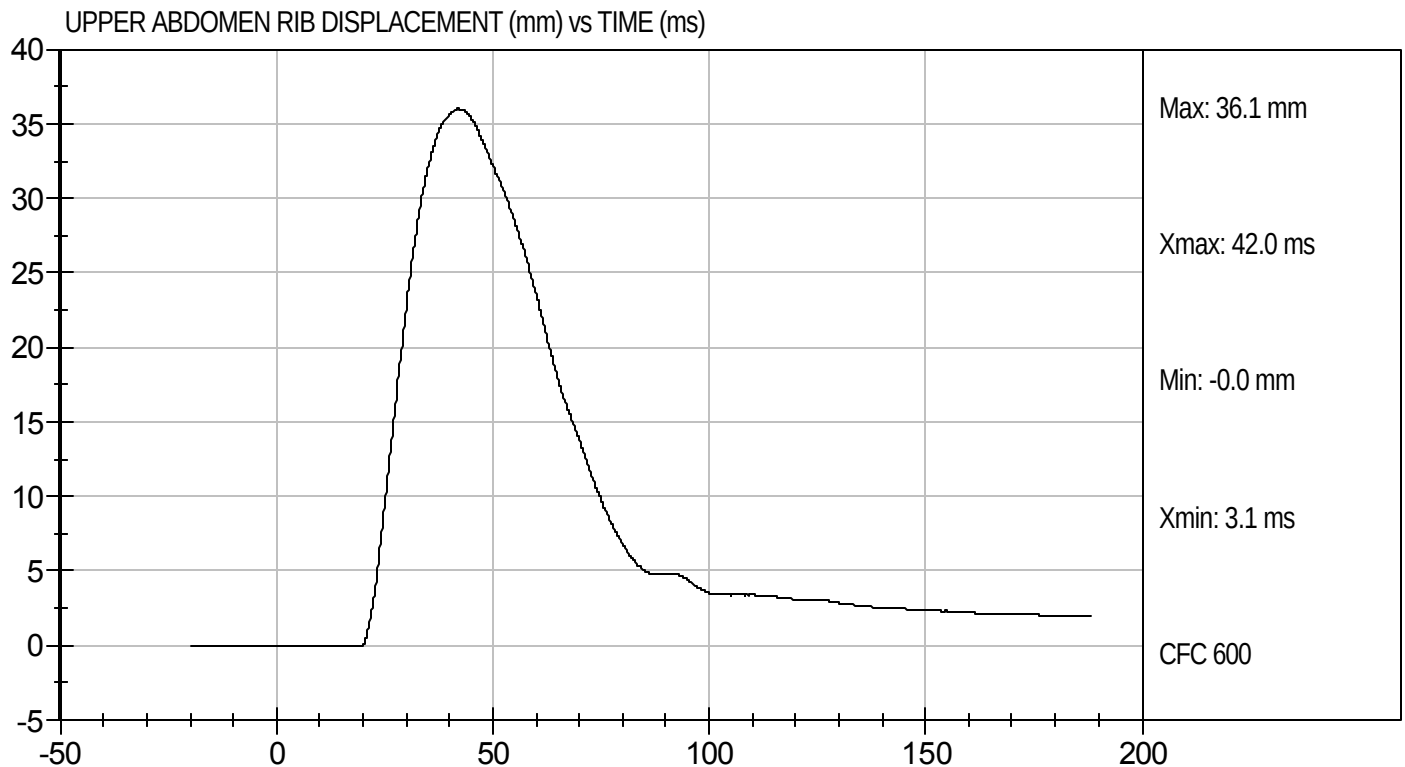
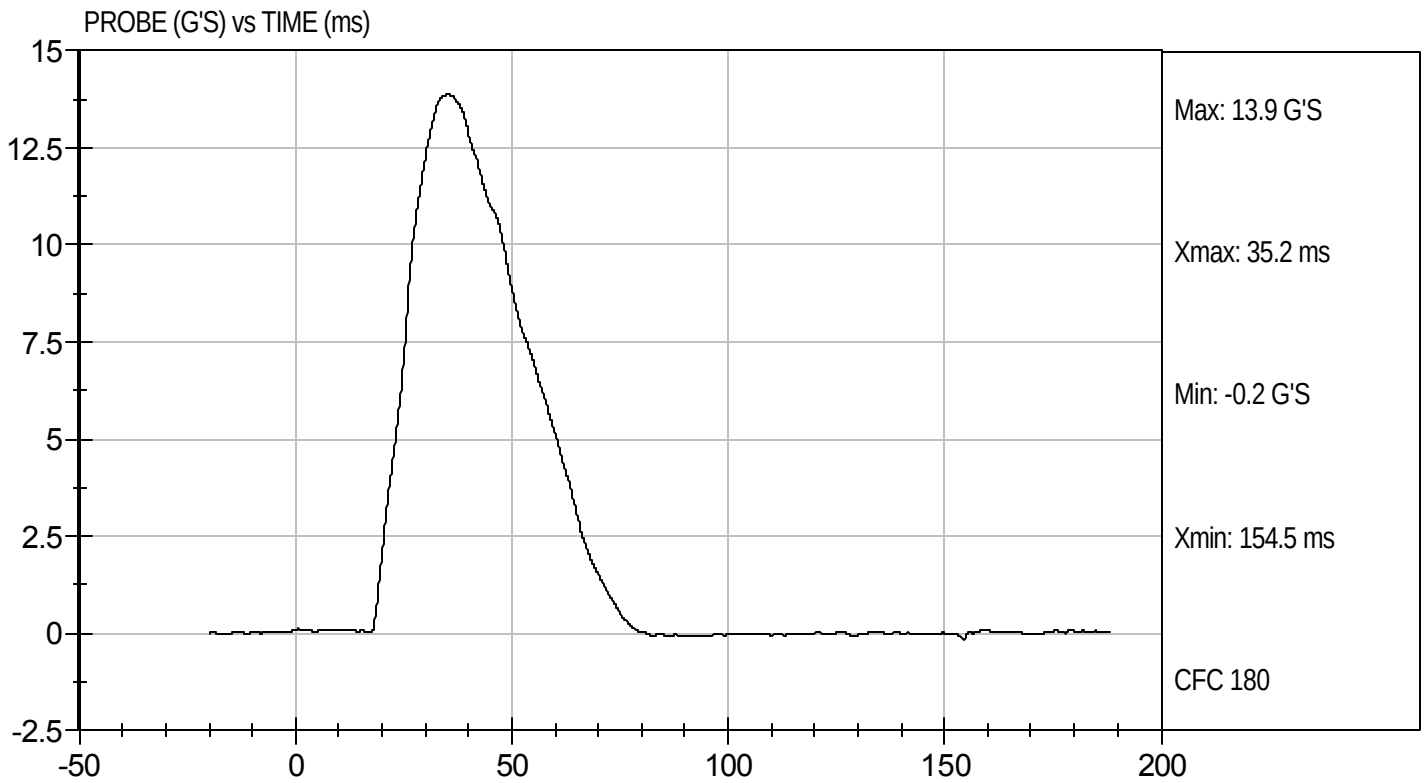
12/17/10
Test Date


Approved By



Test Desc: Abdomen Impact
Component ID: D104496

Test Date: 12/17/10
Velocity: 13.88 ft/s, 4.23 m/s

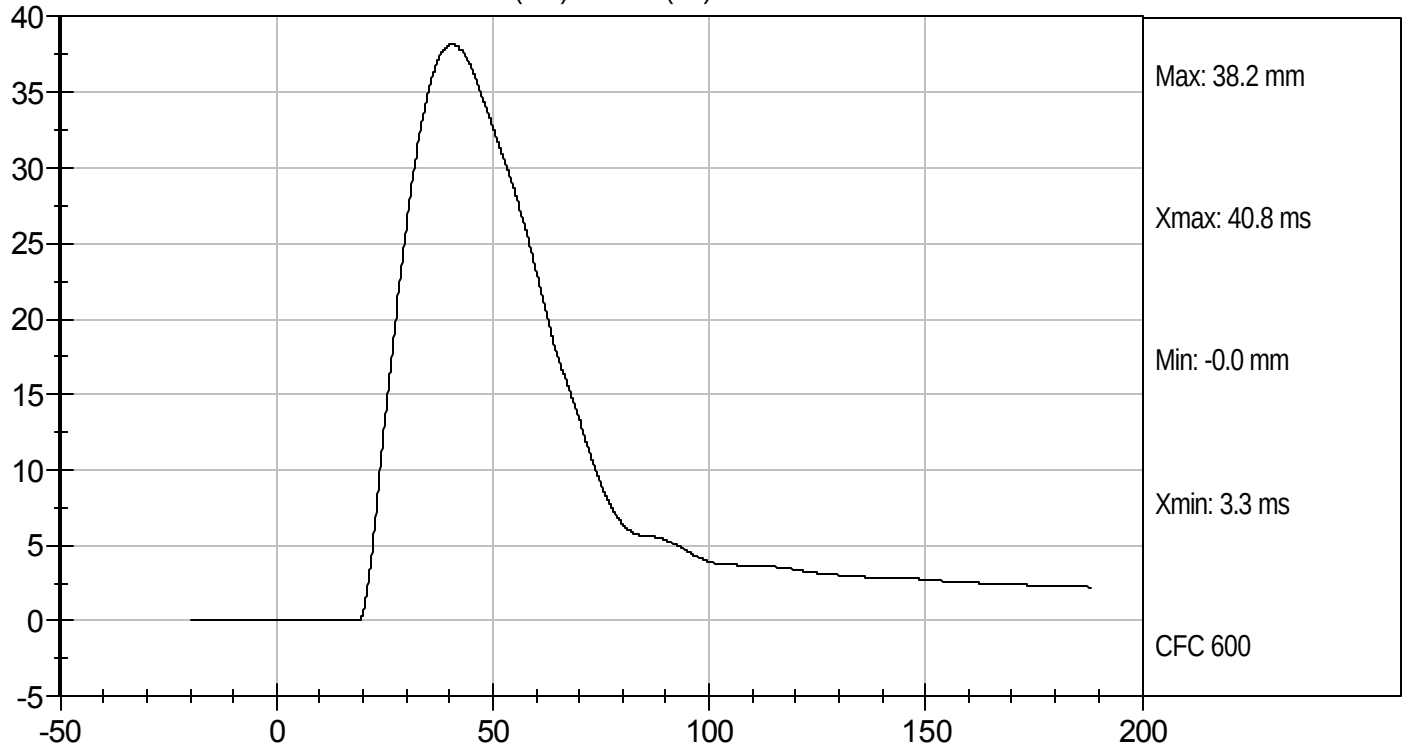




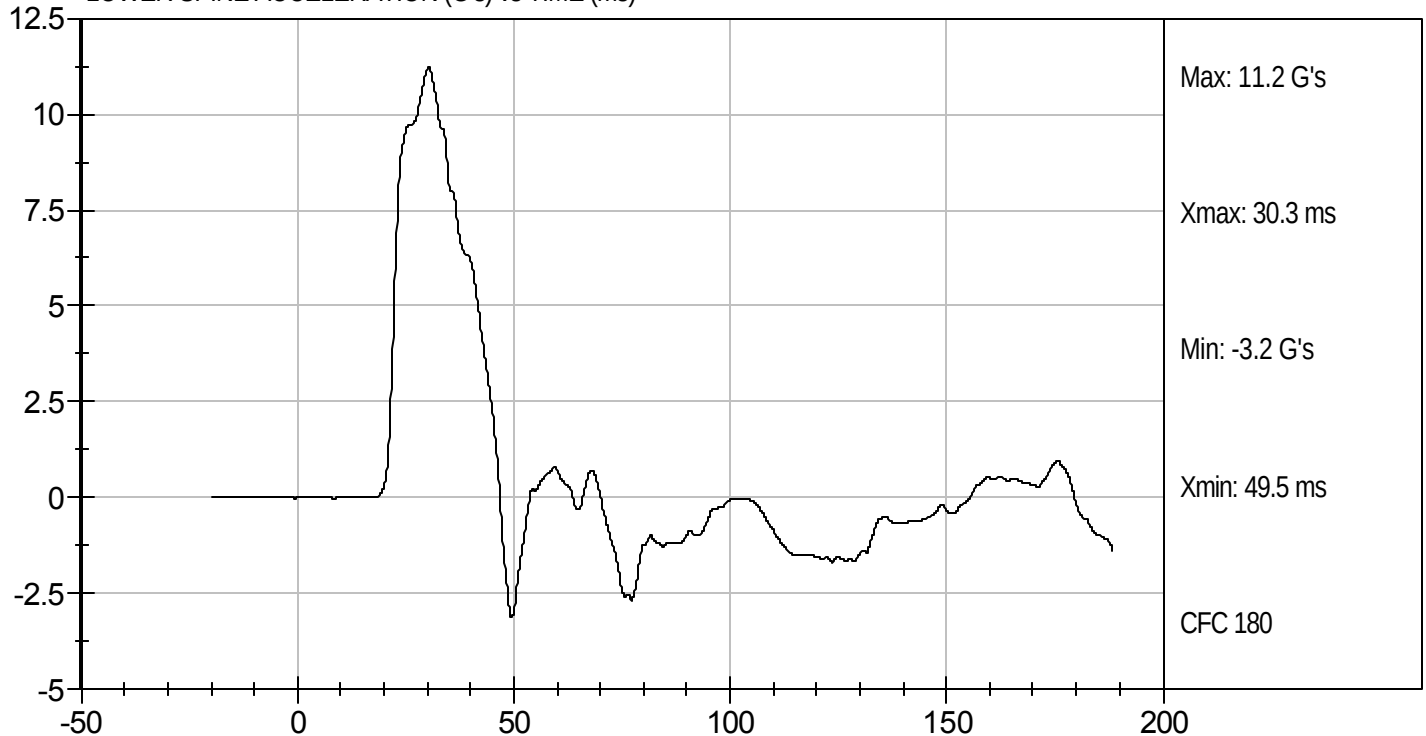
Test Desc: Abdomen Impact
Component ID: D104496

Test Date: 12/17/10
Velocity: 13.88 ft/s, 4.23 m/s

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



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



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

ATD Serial No: 296

Test I.D: D104497

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	16	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Peak Impactor 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	4038	Pass
Overall Test Results				Pass


Laboratory Technician

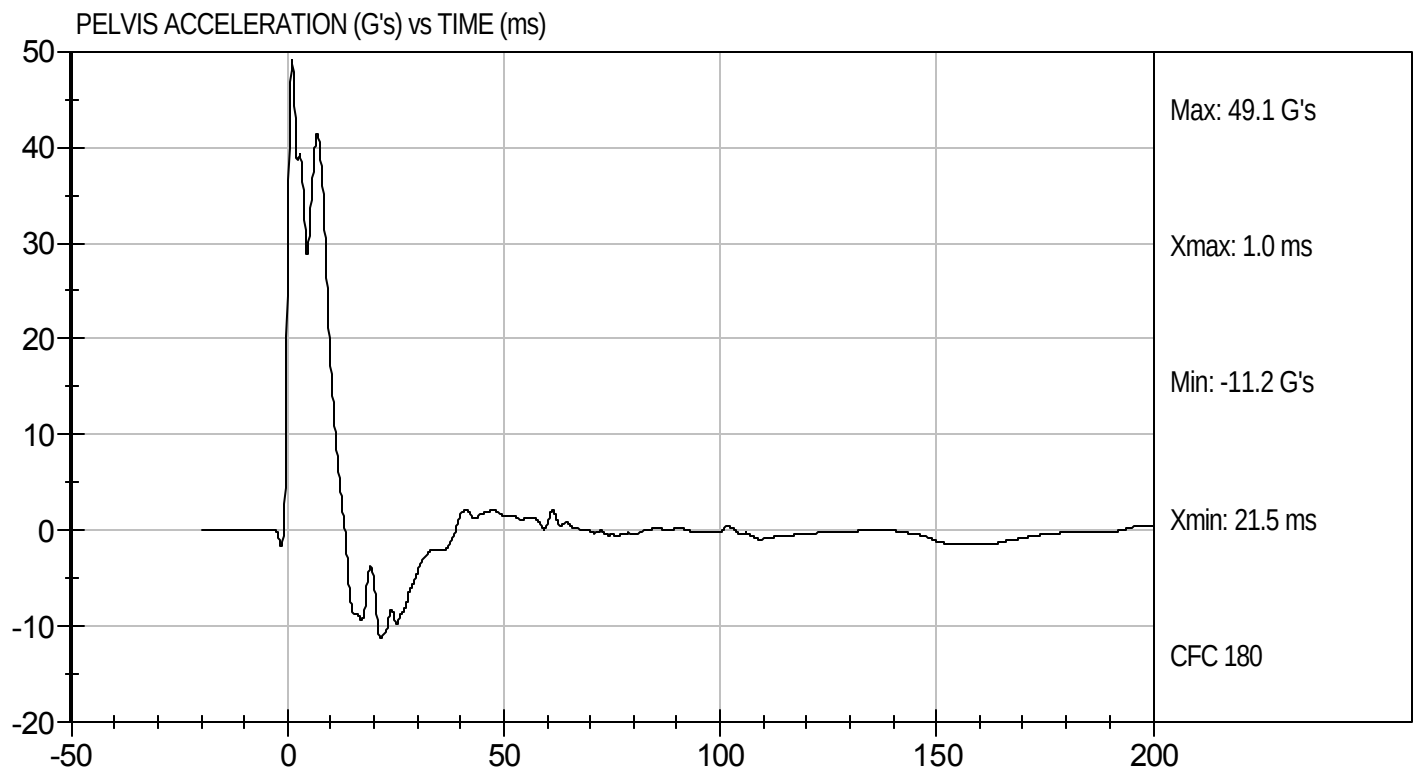
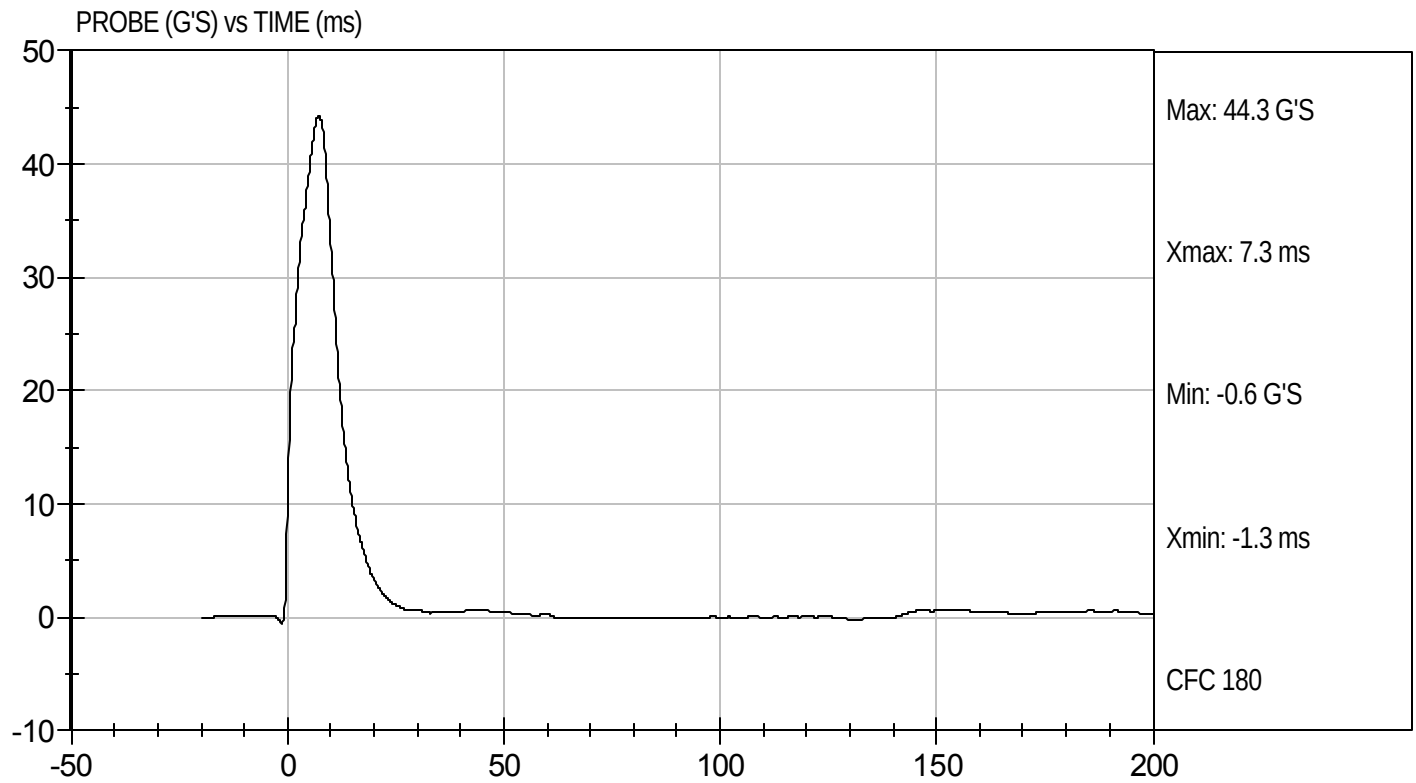
12/17/10
Test Date


Approved By



Test Desc: Pelvis Impact
Component ID: D104497

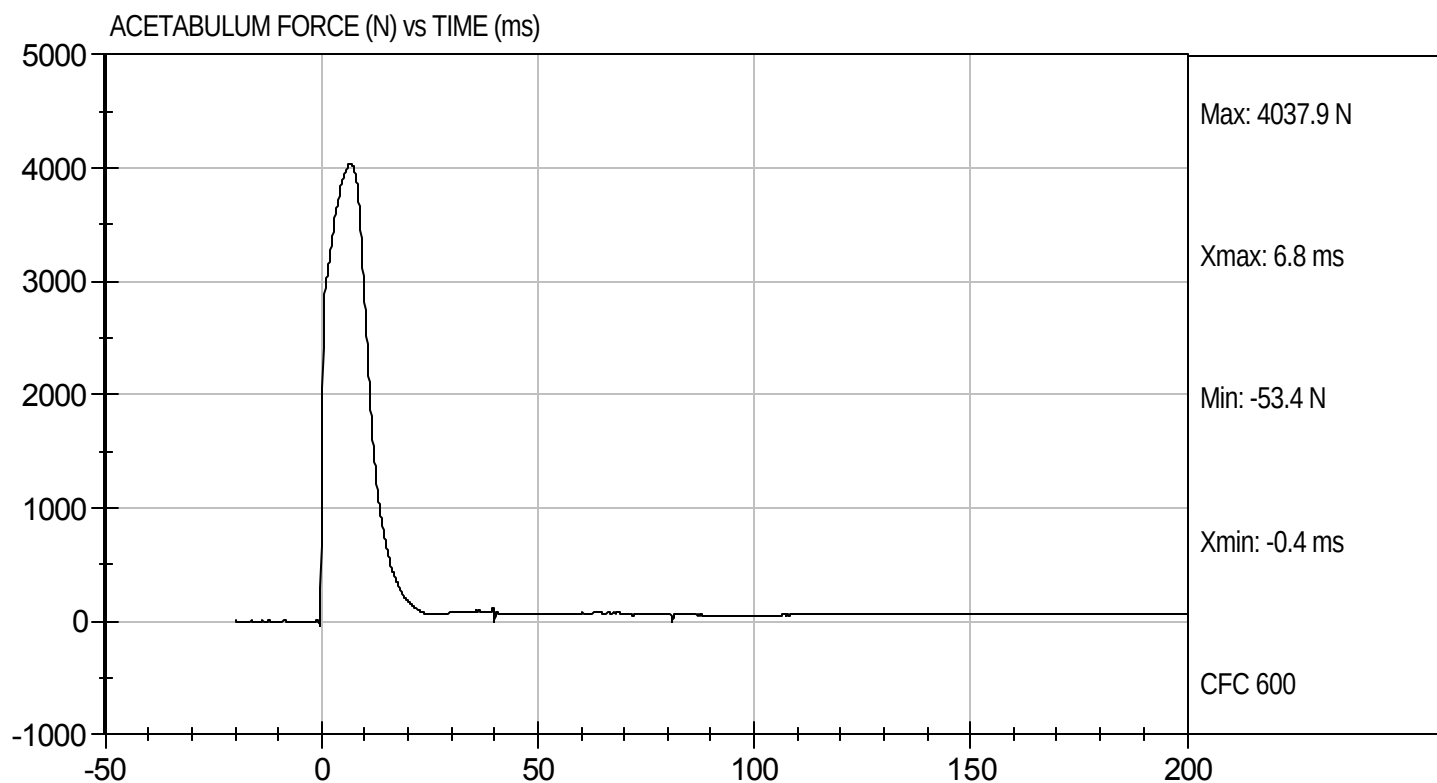
Test Date: 12/17/10
Velocity: 22.2 ft/s, 6.77 m/s





Test Desc: Pelvis Impact
Component ID: D104497

Test Date: 12/17/10
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: D104498

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	16	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor 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	4628	Pass
Overall Test Results			Pass	


Laboratory Technician

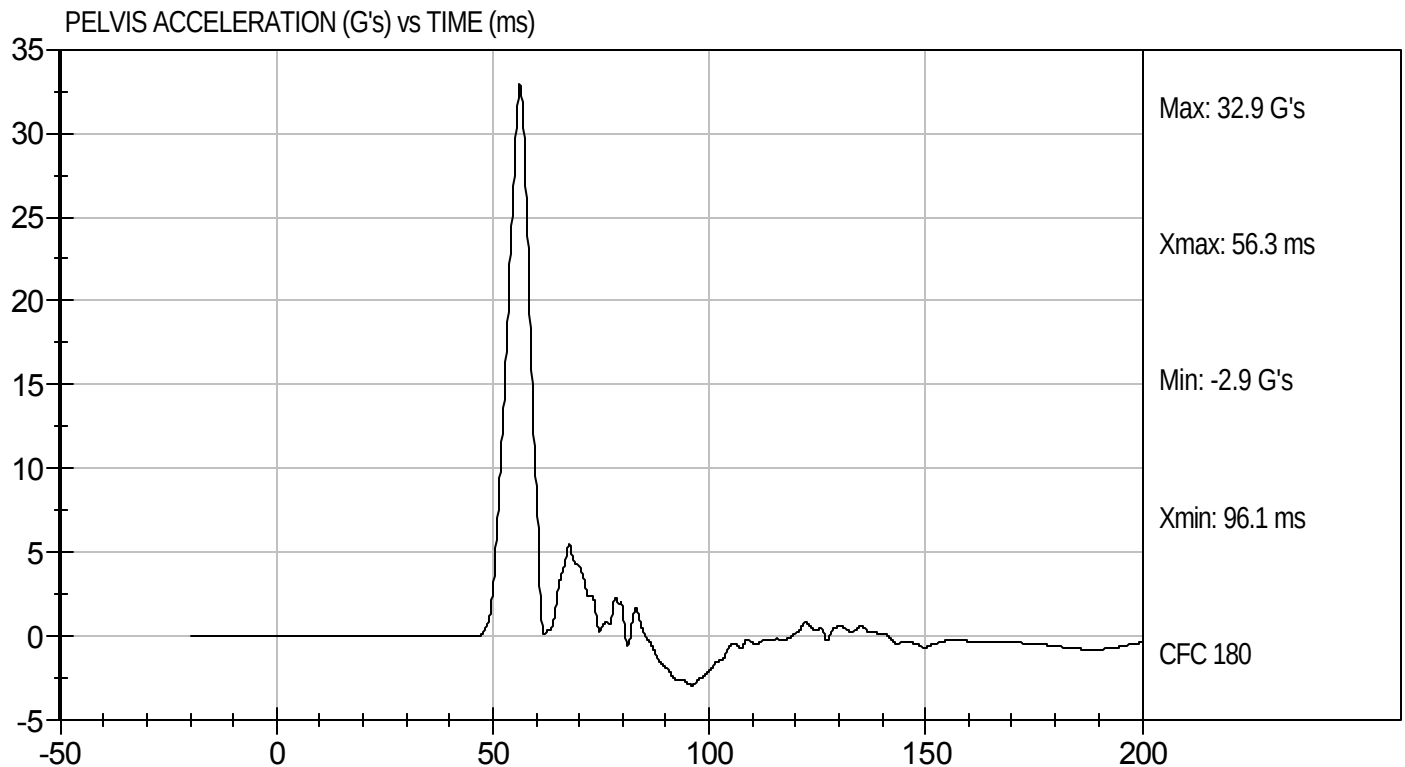
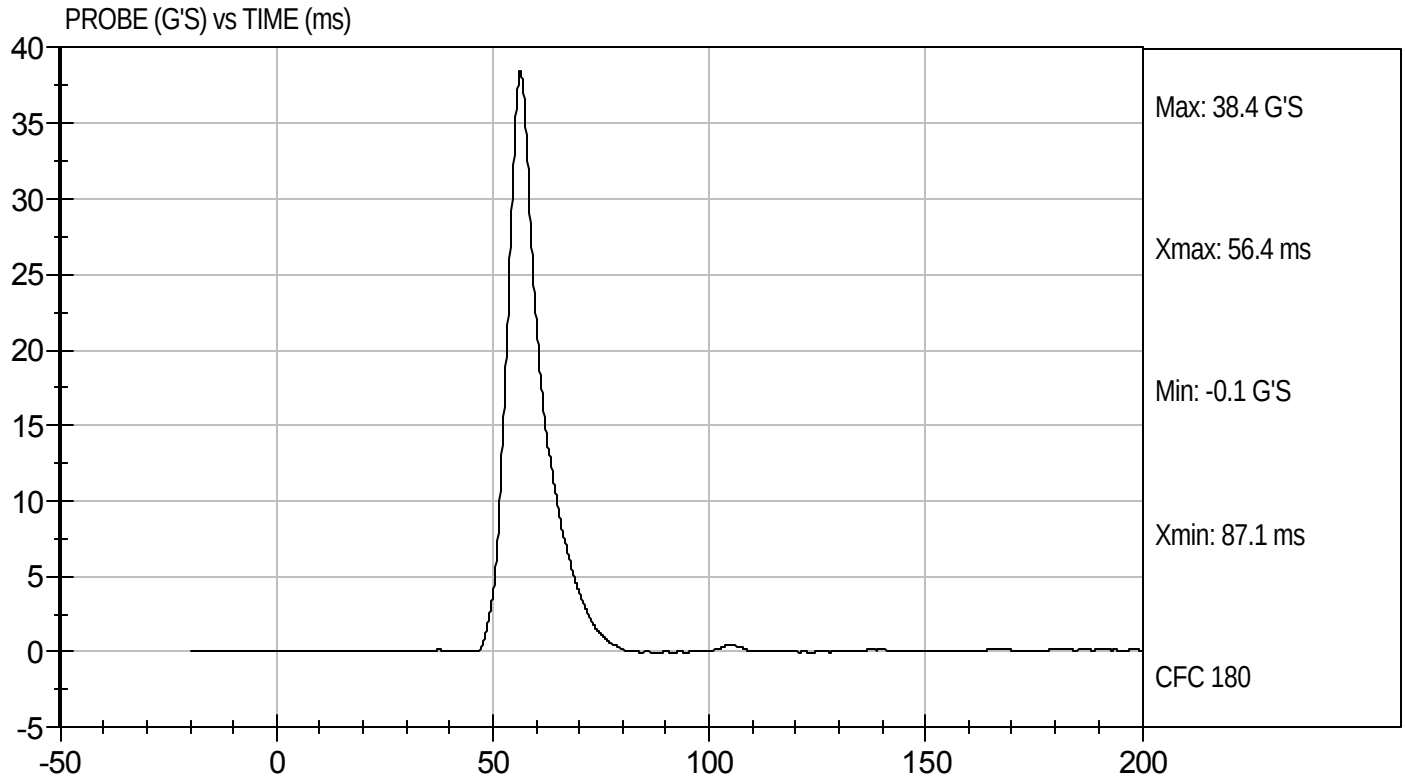
12/17/10
Test Date


Approved By



Test Desc: Iliac Impact
Component ID: D104498

Test Date: 12/17/10
Velocity: 14.36 ft/s, 4.38 m/s





Test Desc: Iliac Impact
Component ID: D104498

Test Date: 12/17/10
Velocity: 14.36 ft/s, 4.38 m/s

