

REPORT NUMBER: SNCAP-MGA-2009-016

**VALIDATION
MOVING DEFORMABLE BARRIER SIDE IMPACT TEST**

**TOYOTA MOTOR CORPORATION
2010 TOYOTA COROLLA 4-DR SEDAN
NHTSA NUMBER: MA5116**

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105**



Test Date: June 10, 2009

Report Date: August 28, 2009

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
1200 NEW JERSEY AVENUE, SE
ROOM W43-410
WASHINGTON, D.C. 20590**

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-03-D-12005.

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Approval Date: August 28, 2009

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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16. Abstract A 55/28 km/h 90° Moving Deformable Barrier NCAP Side Validation Test was conducted on the subject 2010 Toyota Corolla 4-Dr Sedan in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the generation of consumer information on vehicle side crash protection. The test was conducted at MGA Research Corporation, in Burlington, Wisconsin, on June 10, 2009. The impact velocity of the Moving Deformable Barrier (MDB) was 62.3 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21°C. The target vehicle post test maximum crush was 223 mm at level 2. The test vehicle's occupant performance was as follows: <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th colspan="3">Driver ATD (ES-2re)</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>131</td> </tr> <tr> <td>Maximum Thorax Rib Deflection</td> <td>mm</td> <td>44</td> <td>25</td> </tr> <tr> <td>Combined Abdominal Force</td> <td>N</td> <td>2500</td> <td>964</td> </tr> <tr> <td>Pubic Symphysis Force</td> <td>N</td> <td>6000</td> <td>2296</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th colspan="3">Passenger 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>185</td> </tr> <tr> <td>Lower Spine (T12) Resultant Acceleration</td> <td>G</td> <td>82</td> <td>78</td> </tr> <tr> <td>Total Pelvic Force (sum of acetabular and iliac forces)</td> <td>N</td> <td>5525</td> <td>5706</td> </tr> </tbody> </table>					Driver ATD (ES-2re)			Measurement Description	Units	Threshold	Result	Head Injury Criteria (HIC ₃₆)	N/A	1000	131	Maximum Thorax Rib Deflection	mm	44	25	Combined Abdominal Force	N	2500	964	Pubic Symphysis Force	N	6000	2296		Passenger ATD (SID-IIs)			Measurement Description	Units	Threshold	Result	Head Injury Criteria (HIC ₃₆)	N/A	1000	185	Lower Spine (T12) Resultant Acceleration	G	82	78	Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	5706
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This moving deformable barrier side impact test is part of the NCAP Side Validation Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-03-D-12005. The purpose of this test is to generate comparative side impact performance in a 2010 Toyota Corolla 4-Dr Sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure dated April 2009.

SUMMARY

A 2010 Toyota Corolla 4-Dr Sedan was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 62.3 km/h (38.7 mph). The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by MGA Research Corporation in Burlington, Wisconsin, on June 10, 2009. Pretest and post test photographs of the test vehicle, the MDB, and the dummies (ES-2re and SID-IIs) are included in this report.

Dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OCWS Side Impact Laboratory Test Procedure, dated April 2009. The side impact event was documented by eleven (11) cameras. Camera locations are included in this report.

The dummies were instrumented in the following manner:

DRIVER ATD (ES-2re)

- Head Accelerometers
- Thorax Rib 1 to Rib 3 Potentiometers
- Abdomen Forward, Middle, and Rear Load Cells
- Lower Spine Accelerometers
- Pubic Load Cell

PASSENGER ATD (SID-IIs)

- Head Accelerometers
- Upper Neck Load Cells
- Shoulder Displacement Potentiometer
- Thorax Upper, Middle, and Lower Rib Potentiometers
- Abdomen Upper and Lower Rib Potentiometers
- Lower Spine Accelerometers
- Iliac Load Cell
- Acetabulum Load Cell

DUMMY INJURY VALUES

Measurement Description	Driver ATD (ES-2re)		
	Units	Threshold	Result
Head Injury Criteria (HIC ₃₆)	N/A	1000	131
Maximum Thorax Rib Deflection	mm	44	25
Combined Abdominal Force	N	2500	964
Pubic Symphysis Force	N	6000	2296

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC ₃₆)	N/A	1000	185
Lower Spine (T12) Resultant Acceleration	G	82	78
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	5706

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front Driver		Left Rear Passenger	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	No	No	
Knee Airbag	No		No	
Side Torso Airbag	Yes	Yes	No	
Head/Torso Airbag	No		No	
Side Head Curtain/Tube Airbag	Yes	Yes	Yes	Yes
Pretensioner	Yes	No	No	
Load Limiter	Yes	No	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:

- Floorpan @ Rear Axle X after 30 msec.
- Floorpan @ Rear Axle Y after 30 msec.
- Floorpan @ Rear Axle Z after 30 msec.
- Left Front Sill Y
- Left Lower B-Post Y
- Left Mid B-Post Y

The following accelerometers were not used:

- Front Door Centerline
- Front Door Mid-Rear
- Front Door Upper Centerline
- Rear Door Mid-Rear
- Rear Door Upper Centerline

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

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MA5116	Anti-Lock Brakes	Yes
Model Year	2010	All Wheel Drive	No
Make	Toyota	Power Steering	Yes
Model	Corolla	Driver Front Airbag	Yes
Body Style	Sedan	Driver Side Torso Airbag	Yes
VIN	JTDBU4EE0AJ055052	Driver Side Head Airbag	No
Body Color	Magnetic Gray Met.	Driver Curtain Airbag	Yes
Delivery Date	6/3/09	Driver Knee Airbag	No
Odometer (km/mi)	132 km / 82 mi	Driver Head/Torso Combo Airbag	No
Dealer	Jack Safto Toyota	Rear Pass. Front Airbag	No
Transmission	Automatic	Rear Pass. Side Torso Airbag	No
Final Drive	Front	Rear Pass. Side Head Airbag	No
Type/No. Cylinders	4	Rear Pass. Curtain Airbag	Yes
Engine Displacement (L)	1.8	Rear Pass. Combo Airbag	No
Engine Placement	Lateral	Pretensioners	Yes
Roof Rack	No	Load Limiters	Yes
Sunroof/T-Top	No	Air Conditioning	Yes
Tinted Glass	No	AM/FM CD	Yes
Traction Control	Yes	Tilt Steering	Yes
Power Brakes	Yes	Automatic Door Locks	No
Front Disc	Yes	Power Windows	No
Rear Disc	No	Power Seats	No
Does owner's manual provide instructions to turn off automatic door locks?	N/A		

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Corporation	GVWR (kg)	1742
Date of Manufacture	01/09	GAWR Front (kg)	948
		GAWR Rear (kg)	839

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3		5	(A)
Capacity Wt. (VCW) (kg)				370	(B)
DSC x 68.04 (kg)				340	(A-B)
Cargo Wt. (RCLW) (kg)				30	

VEHICLE SEAT TYPE

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

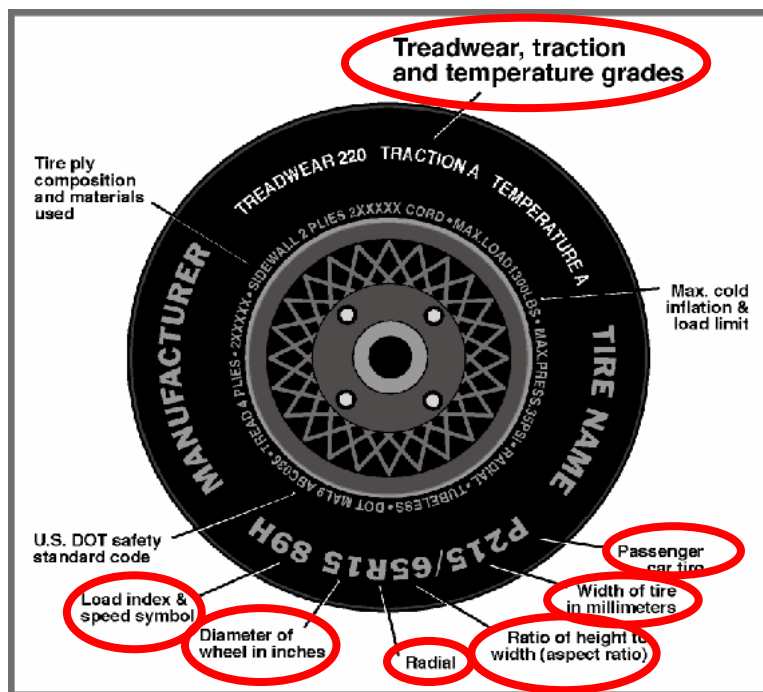
DATA SHEET NO. 1 (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009

VEHICLE TIRE INFORMATION



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	210	210
Recommended Tire Size	P195/65R15	P195/65R15
Tire Size on Vehicle	P195/65R15	P195/65R15
Tire Manufacturer	Goodyear	Goodyear
Tire Model	Eagle LS	Eagle LS
Treadwear	400	400
Traction	A	A
Temperature Grades	B	B
Tire Plies Sidewall	1	1
Tire Plies Body	3	3
Load Index & Speed Symbol	89S	89S
Tire Material	Rubber	Rubber
DOT Safety Code Left	U29N 2KAR 4408	U29N 2KAR 4408
DOT Safety Code Right	U29N 2KAR 4408	U29N 2KAR 4408

DATA SHEET NO. 1 (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW) (Axle)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	378.3	246.7		422.8	313.4		418.2	319.3	
Right	kg	377.4	240.0		380.1	280.3		377.8	290.3	
Ratio	%	60.8	39.2		57.5	42.5		56.6	43.4	
Totals	kg	755.7	486.7	1242.4	802.9	593.7	1396.6	796.0	609.6	1405.6

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1242.4	(A)
Sum of Actual Weight of 2 P572 ATDs Used	kg	129.3	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	30	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	1401.7	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
Fully Loaded	mm	670	680	670	681	
As Tested (Fully Loaded $\pm$ 10mm at each wheel well)	mm	670	685	675	685	1108

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2606
Total Vehicle Length at Left Side	mm	3482
Total Vehicle Length at Centerline	mm	4539
Total Vehicle Length at Right Side	mm	3482
Weight of Ballast in Cargo Area	kg	0
Weight of Vehicle Components Removed	kg	38.1
Amount of Stoddard Solvent in Fuel Tank	L	46.2

Vehicle components removed to meet Test Weight: Right front and right rear door panels and windows, tail lights, right side mirror, right front and right rear headrests, right rear speaker, right side window mechanisms.

TEST VEHICLE VERTICAL IMPACT LINE DATA

Measurement Description	Units	Value
Target Impact Point Aft of Front Axle	mm	363
Actual Impact Point Aft of Front Axle	mm	374

DATA SHEET NO. 2

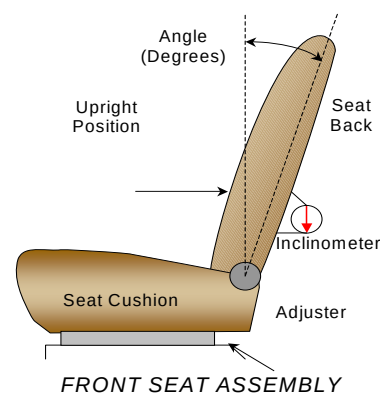
SEAT ADJUSTMENT, FUEL SYSTEMS, AND STEERING WHEEL DATA

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
Test Program: Side Validation Testing

NHTSA No. MA5116
Test Date: 6/10/2009

NORMAL DESIGN RIDING POSITION

The driver and passenger seat backs are positioned to the manufacturer's designated angle. The procedure is as follows:
For the driver seat, the setting dent is 3rd dents from forward-most. This angle is measured against rocker sill.



SEAT BACK ANGLES

	Degrees
Driver with Seated Dummy	-3.1° at headrest post
Passenger with Seated Dummy	Fixed

SEAT FORE/AFT POSITIONS

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	17 detents	8 th detent (forward-most as 0)
Rear Seat	Fixed	Fixed

Describe method: Using only the controls that primarily move the seat in the fore-aft direction, the seat was placed in the full rear position. The seat was moved forward marking each detent position until the forward-most position was reached. The seat was placed in the mid point of travel or next rearward locking detent.

SEAT BELT UPPER ANCHORAGES

	Total # of Positions	Placed in Position #
Driver Seat	4 detents	0 (uppermost as 0)
Rear Seat	Fixed	

Describe method: The driver seat anchorages were set in the uppermost position. The rear seat anchorages are non-adjustable.

DATA SHEET NO. 2 (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEMS, AND STEERING WHEEL DATA

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

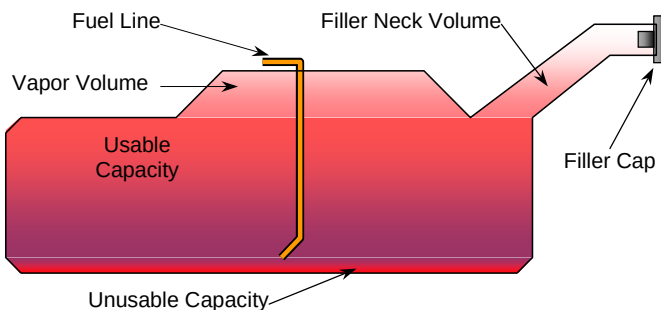
NHTSA No. MA5116
 Test Date: 6/10/2009

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	50.0
Usable Capacity of "Optional" Tank	
Usable Capacity Used for FMVSS 301	46.0 to 47.0
Actual Amount of Solvent used	46.2

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

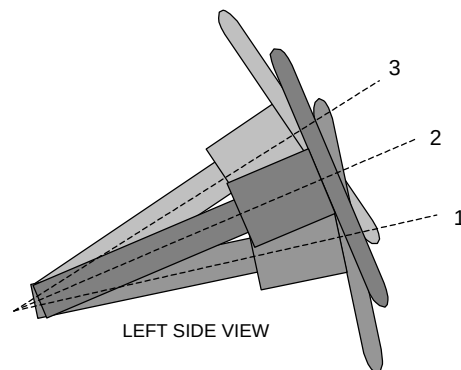
The test vehicle is equipped with an electric fuel pump. The fuel pump is activated when the ignition is turned on. The fuel pipe is on the left side.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

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



STEERING COLUMN ASSEMBLY

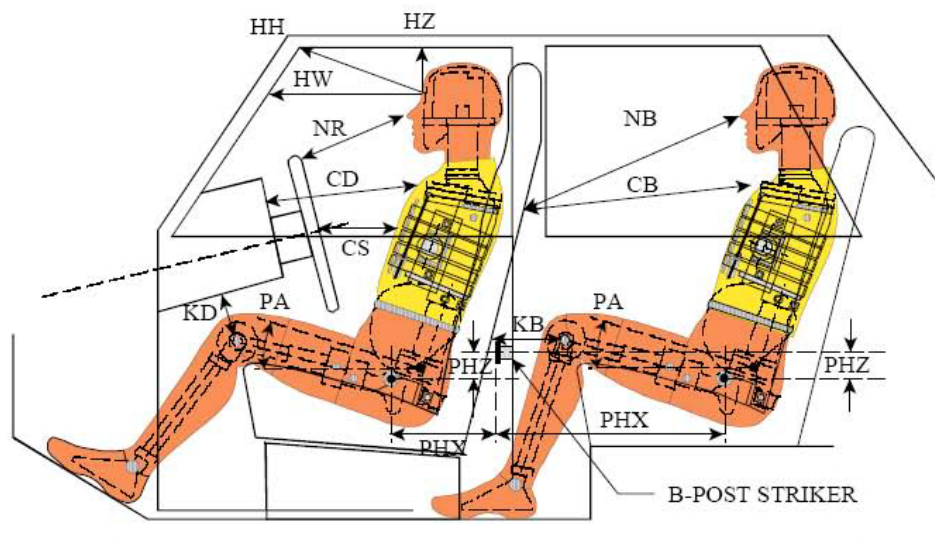
STEERING COLUMN POSITION

	Fore/Aft (mm)	Degrees
Lowermost - Position 1	0	64.6
Geometric Center – Position 2	19	66.1
Uppermost – Position 3	37	67.6
Telescoping Steering Wheel Travel	37	
Test Position	19	66.1

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009



LEFT SIDE VIEW

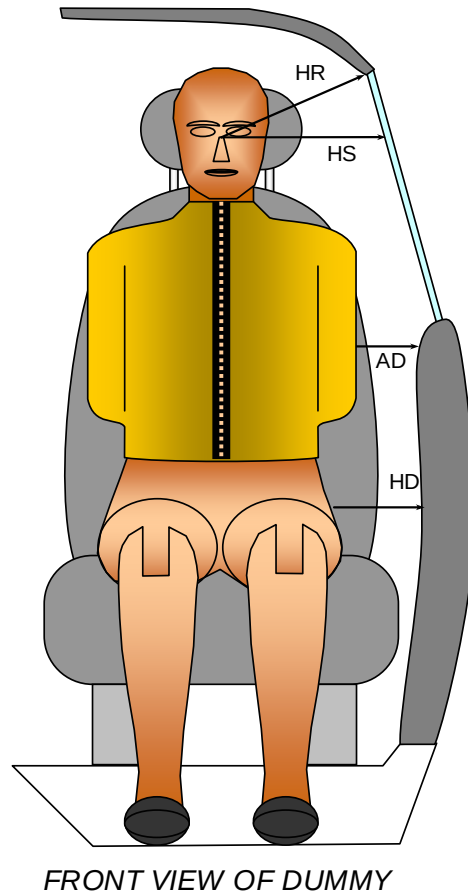
NOTE: 2-DOOR VEHICLE SHOWN.
 REAR DUMMY PHX & PHZ
 MEASUREMENTS FOR A 4-DOOR
 VEHICLE WOULD USE THE C-POST
 STRIKER AS A REFERENCE POINT

Driver Code	Pass. Code	Measurement Description	Driver S/N 032		Passenger S/N 296	
			Length (mm)	Angle(°)	Length (mm)	Angle(°)
HH		Head to Header	279	17.1		
HW		Head to Windshield	497	0		
HZ	HZ	Head to Roof	108	90	247	90
NR	NB	Nose to Rim/Seat Back	351	21.8	589	12.9
CD	CB	Chest to Dash/Seat Back	459	4.5	562	-7.2
CS		Chest to Steering Wheel	273	16.4		
KDL	KBL	Left Knee to Dash/Seat Back	130	24.4	295	27.3
KDR	KBR	Right Knee to Dash/Seat Back	120	35.5	283	29.1
PA	PA	Pelvic Angle		15.7		21.9
PHX	PHX	H-Point to Striker (X-Axis)	216	0	296	0
PHZ	PHZ	H-Point to Striker (Z-Axis)	215	90	300	90
SA	SA	Seat Back Angle (headrest post)		-3.1		Fixed

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
Test Program: Side Validation Testing

NHTSA No. MA5116
Test Date: 6/10/2009

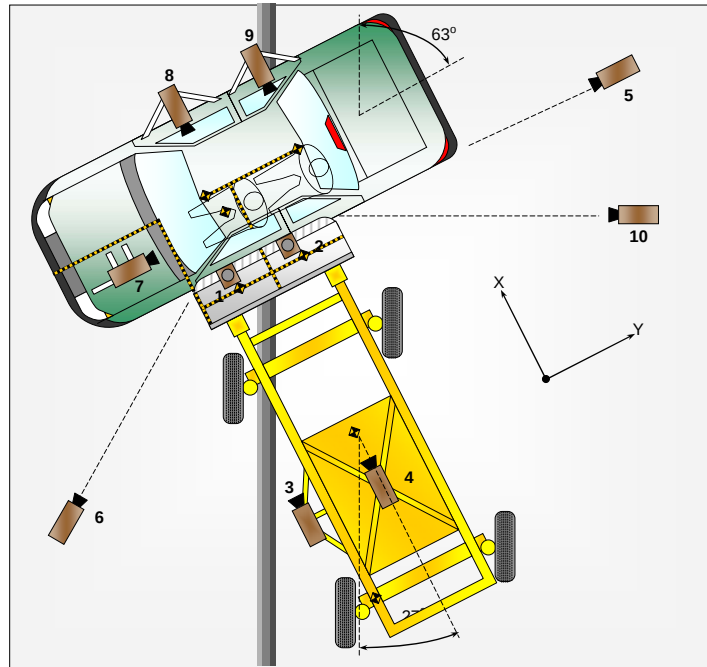


Code	Measurement Description	Units	Driver S/N 032	Passenger S/N 296
HR	Head to Side Header	mm	247	236
HS	Head to Side Window	mm	292	361
AD	Arm to Door	mm	99	178
HD	H-Point to Door	mm	146	181

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

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009



No.	Camera View	Location (mm)			Angle	Lens (mm)	Film Speed (fps)
		X	Y	Z			
1	Overhead Overall	650	1300	-5050	88.4	14	1000
2	Overhead Close-up	-530	-240	-5055	81.8	50	1000
3	Left Impact Point (MDB)					50	1000
4	Side Overall (MDB)					16	1000
5	Rear	30	7250	-1100	5.3	24	1000
6	Left Front	-3170	-4840	-1250	5.0	24	1000
7	Driver Front (OB)					12.5	1000
8	Driver Side (OB)					8	1000
9	Passenger Side (OB)					8	1000
10	Real Time Left Front					13	24
11	Real Time Inrun					13	24

Reference: Impact Point projected to Ground
 +X = To Front of MDB, +Y = To Right of MDB, +Z = Down
 * All measurements accurate to ± 6 mm

DATA SHEET NO. 6

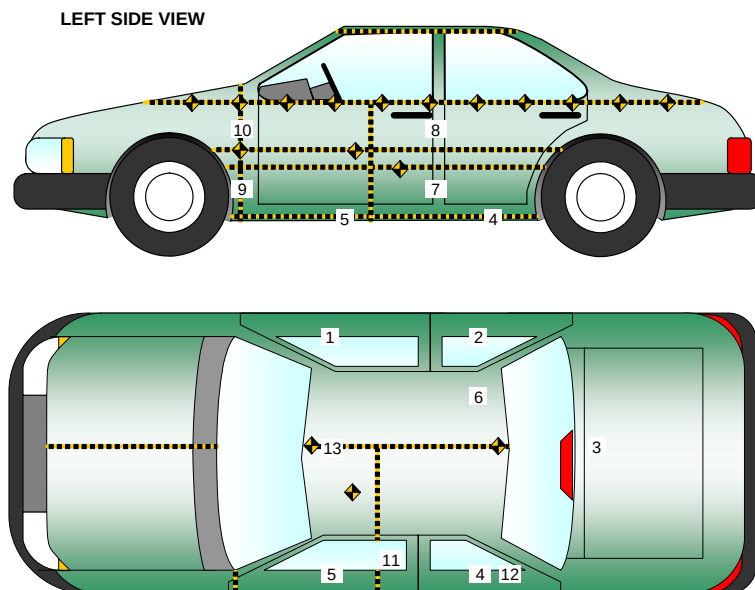
VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan

NHTSA No. MA5116

Test Program: Side Validation Testing

Test Date: 6/10/2009



Loc. No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Right Sill at Front Seat	2633	690	-218
2	Right Sill at Rear Seat	1552	705	-230
3	Rear Floorpan Above Axle	932	0	-498
4	Left Sill at Rear Door	1424	-705	-232
5	Left Sill at Front Door	2618	-690	-215
6	Rt. Rear Occ. Compartment	1808	347	-367
7	Left Lower B-Post	2252	-701	-478
8	Left Middle B-Post	2132	-704	-722
9	Left Lower A-Post	3105	-671	-509
10	Left Middle A-Post	3097	-794	-786
11	Front Seat Track	2157	-554	-340
12	Rear Seat Track or Structure			
13	Vehicle CG	2096	0	-277

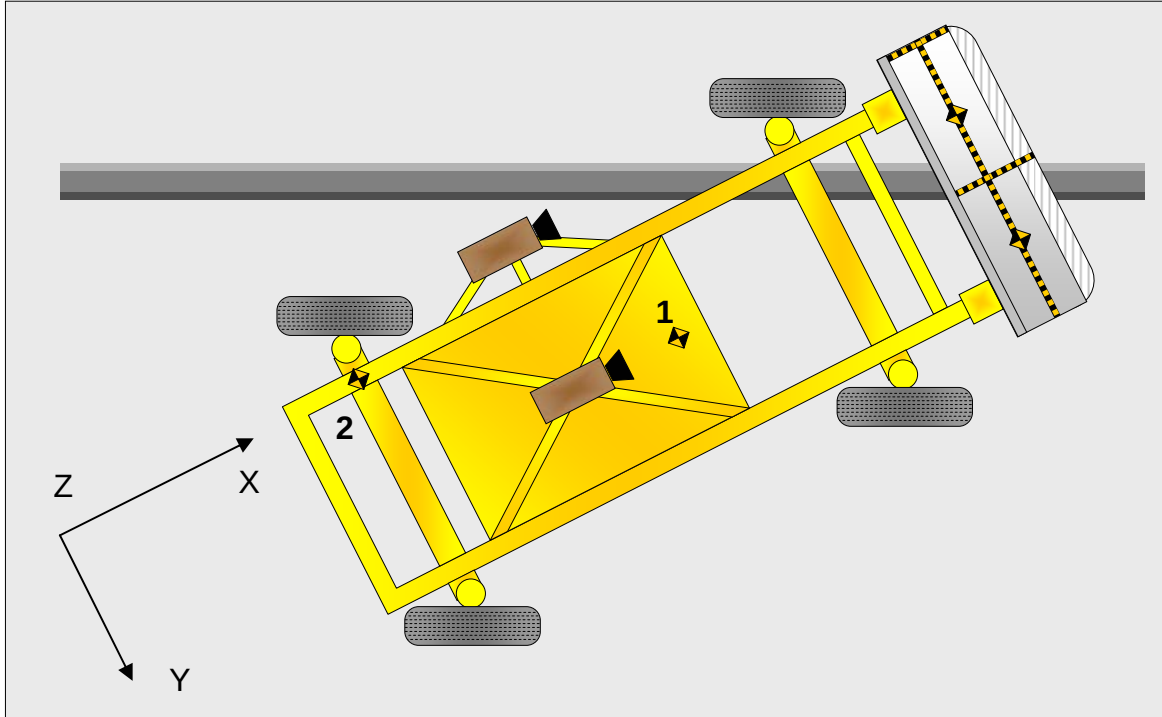
Reference: X - Test Vehicle Rear Bumper (+ forward)
Y - Test Vehicle Centerline (+ to right)
Z - Ground Plane (+ down)

DATA SHEET NO. 7

MOVING DEFORMABLE BARRIER ACCELEROMETER LOCATIONS

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
Test Program: Side Validation Testing

NHTSA No. MA5116
Test Date: 6/10/2009



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

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

DATA SHEET NO. 8
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009

MAXIMUM EXTERIOR STATIC CRUSH

Level	Measurement Description	Units	Maximum Crush	Above Ground
1	Sill Top Height	mm	85	285
2	Occupant H-Point	mm	223	450
3	Mid Door	mm	209	635
4	Window Sill	mm	110	960
5	Window Top	mm	35	1390
	Maximum Penetration	mm	223	450

INSTRUMENTATION

Driver Dummy Channels	16
Passenger Dummy Channels	23
Vehicle Structure Accelerometers	20
MDB Accelerometers	5
Total No. of Contact Switches	8
Monitoring Channels	1
Total	73

CAMERA COVERAGE

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

DATA SHEET NO. 9**MOVING DEFORMABLE BARRIER SUMMARY OF RESULTS**

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009

MDB SPECIFICATIONS

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

MDB WEIGHTS

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

SPEED AND IMPACT DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	62.3
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	62.4
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	89.9

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush
Row	Description	Height	Distance	Direction	
A	Center of Bumper	432	800	Right	157
B	Top of Bumper	533	800	Right	81
C	Mid-Level	686	800	Left	81
D	Top of Stack	813	800	Left	109

MDB INSTRUMENTATION AND CAMERAS

Accelerometers	5
Contact Switches	2
High-Speed Cameras	2

DATA SHEET NO. 10

POST-TEST OBSERVATIONS

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009

TEST DUMMY INFORMATION AND CONTACT

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

POST TEST DOOR OPENING AND SEAT TRACK INFORMATION

Description	Left Front	Left 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	None
Window Damage	None
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front Driver		Left Rear Passenger	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	No	No	
Knee Airbag	No		No	
Side Torso Airbag	Yes	Yes	No	
Head/Torso Airbag	No		No	
Side Head Curtain/Tube Airbag	Yes	Yes	Yes	Yes
Pretensioner	Yes	No	No	
Load Limiter	Yes	No	No	

MDB LEFT EDGE IMPACT POINT DATA

Measured Parameter	Units	Requirement	Value
Horizontal Offset	mm	+/- 50	11 rearward
Vertical Offset	mm	+/-20	7 up

DATA SHEET NO. 11

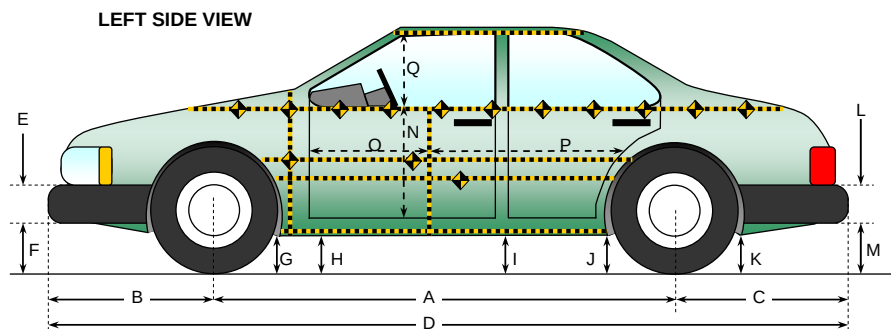
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan

NHTSA No. MA5116

Test Program: Side Validation Testing

Test Date: 6/10/2009



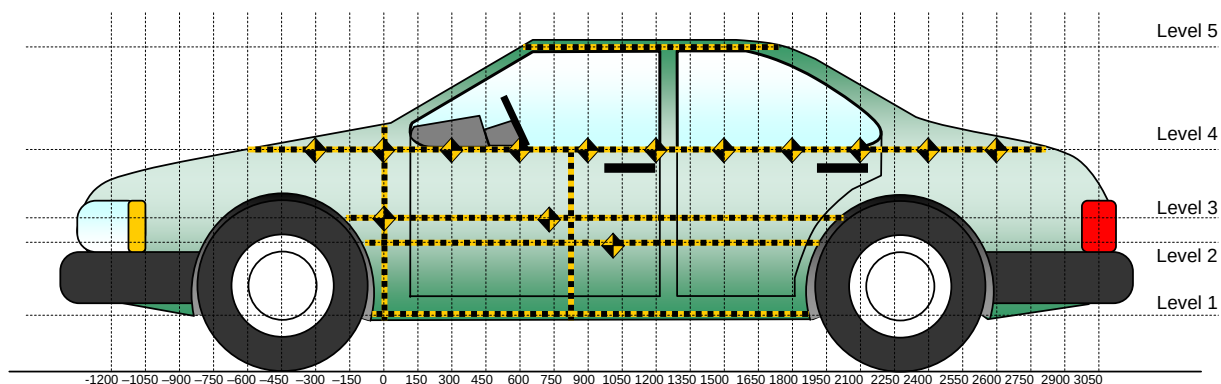
All Measurements in mm

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2606	2605	1
B	Front Axle to FSOV	930	930	0
C	Rear Axle to RSOV	1003	1003	0
D	Total Length at Centerline	4539	4538	1
E	Front Bumper Thickness			
F	Front Bumper Bottom to Ground	390	400	-10
G	Sill Height at Front Wheel Well	172	191	-19
H	Sill Height at Front Door Leading Edge	184	205	-21
I	Sill Height at B Pillar	185	196	-11
J1	Sill Height at Rear Wheel Well	190	205	-15
J2	Pinch Weld Height at Rear Wheel Well	183	187	-4
K	Sill Height Aft of Rear Wheel Well	230	225	5
L	Rear Bumper Thickness			
M	Rear Bumper Bottom to Ground	340	359	-19
N	Sill Height to Window Bottom Sill	705	563	142
O	Front Door Leading Edge to Impact CL	494	475	19
P	Rear Door Trailing Edge to Impact CL	1429	1386	43
Q	Front Window Opening	325	322	3
R	Right Side Length	3482	3480	2
S	Left Side Length	3482	3451	31
T	Vehicle Width at B Post	1759	1609	150

DATA SHEET NO. 12 **VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009



All Measurements Shown in mm

LEFT SIDE VIEW

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

Level	Measurement Description	Height Above Ground (mm)
1	Sill Top	285
2	Occupant H-Point	450
3	Mid-Door	635
4	Window Sill	960
5	Window Top	1390

DATA SHEET NO. 12 (CONTINUED)
VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-750				309					312					3	
-600				294					302					8	
-450				287					305					18	
-300				282					309					27	
-150			217	285				251	315				34	30	
0		225	222	284			316	273	315			91	51	31	
150	261	237	230	286		338	418	412	345		77	181	182	59	
300	270	241	230	290		355	460	433	351		85	219	203	61	
450	270	240	227	292		349	463	436	362		79	223	209	70	
600	269	237	224	293	524	348	459	421	367	536	79	222	197	74	12
750	268	236	221	295	518	341	443	417	364	532	73	207	196	69	14
900	266	234	220	295	514	339	443	419	375	535	73	209	199	80	21
1050	265	233	219	299	514	339	437	416	396	538	74	204	197	97	24
1200	265	233	220	302	513	328	412	391	412	548	63	179	171	110	35
1350	264	234	220	308	515	329	425	403	402	547	65	191	183	94	32
1500	264	235	222	312	518	323	419	415	391	550	59	184	193	79	32
1650	263	234	223	318	522	323	412	415	378	548	60	178	192	60	26
1800	248	230	224	324	531	303	385	407	360	545	55	155	183	36	14
1950			220	332	547			321	346	561			101	14	14
2100				339					357					18	
2250				350					385					35	
2400				361					366					5	
2550				378					376					-2	
2700				394					396					2	
2850				416					417					1	

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

MAXIMUM CRUSH DATA

	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	85	223	209	110	35
Distance From Impact (mm)	300	450	450	1200	1200

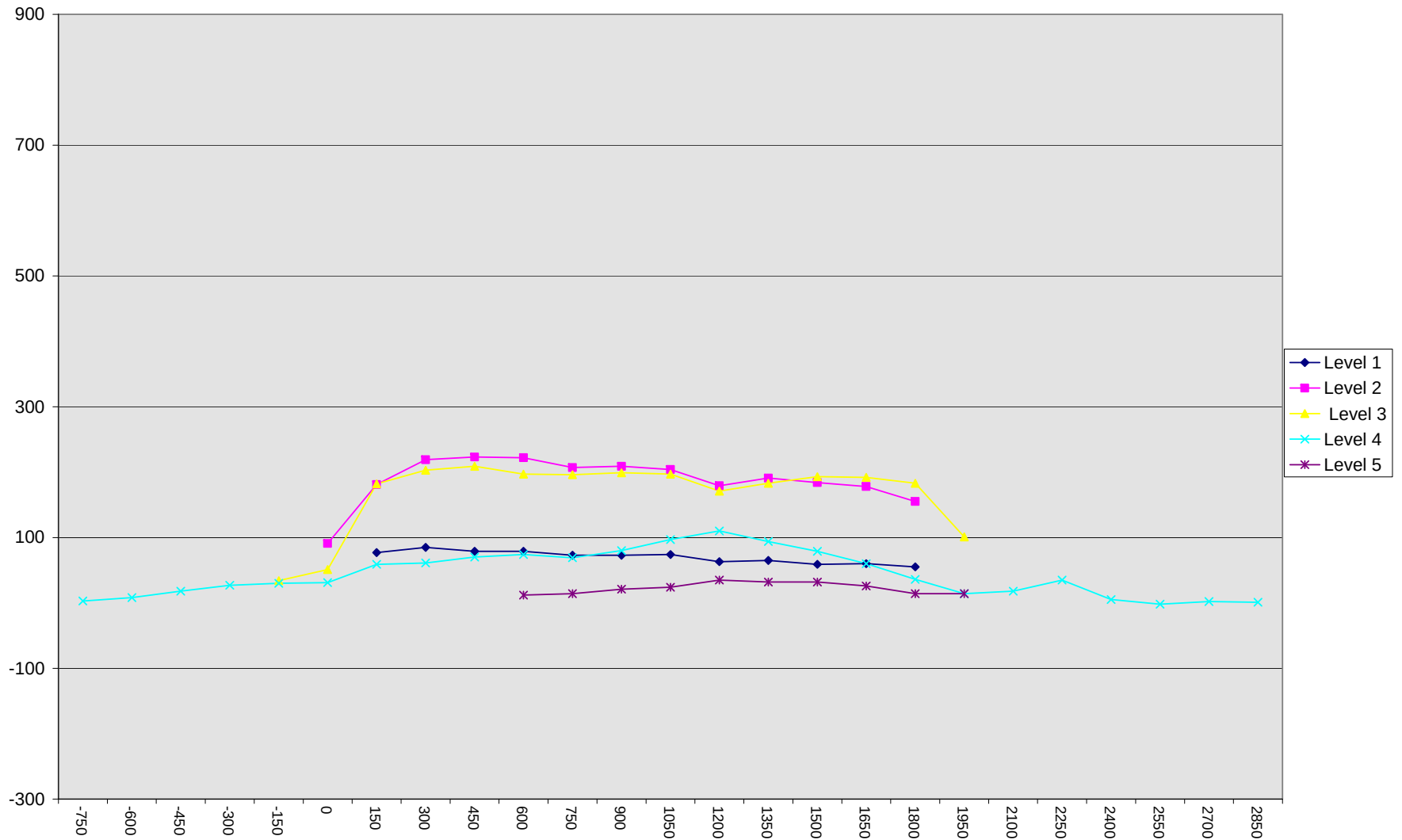
DATA SHEET NO. 12 (continued)

VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
Test Program: Side Validation Testing

NHTSA No. MA5116
Test Date: 6/10/2009

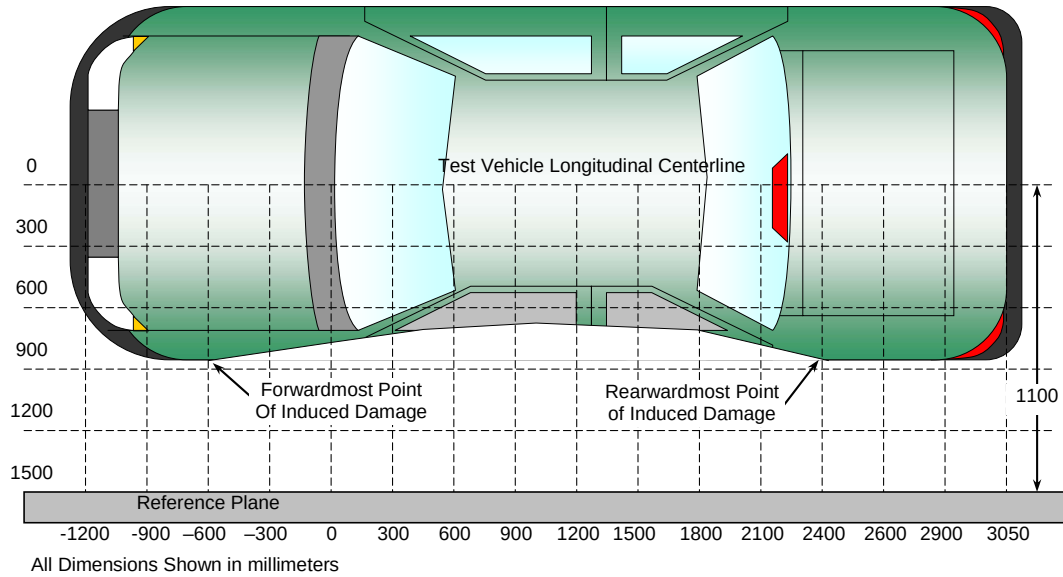
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DATA SHEET NO. 13
VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009



TOP VIEW

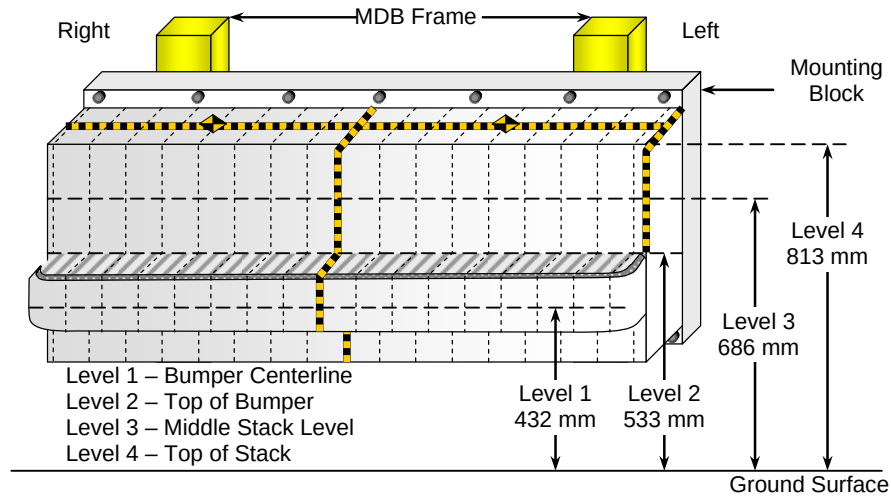
DPD	Distance from Impact Point (mm)	Level	Pre-Test (mm)	Post-Test (mm)	Max. Static Crush (mm)
1	2550	4	378	376	-2
2	1920	4	329	395	66
3	1220	3	220	440	220
4	525	3	225	468	243
5	-75	3	220	277	57
6	-750	4	309	312	3

DATA SHEET NO. 14

EXTERIOR STATIC CRUSH FOR IMPACTOR FACE

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009



DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center (mm)								C _L	Distance Left of Center (mm)							
	800	700	600	500	400	300	200	100		100	200	300	400	500	600	700	800
4	34	21	18	20	27	48	85	88	67	31	20	21	34	44	61	82	109
3	57	42	36	32	34	40	65	67	40	23	18	16	17	22	28	42	81
2	81	77	66	57	49	47	48	56	52	48	58	61	66	66	65	68	71
1	157	154	145	135	135	136	134	130	124	125	123	123	121	19	121	133	148

DATA SHEET NO. 15

FMVSS 301 FUEL INTEGRITY POST-IMPACT DATA

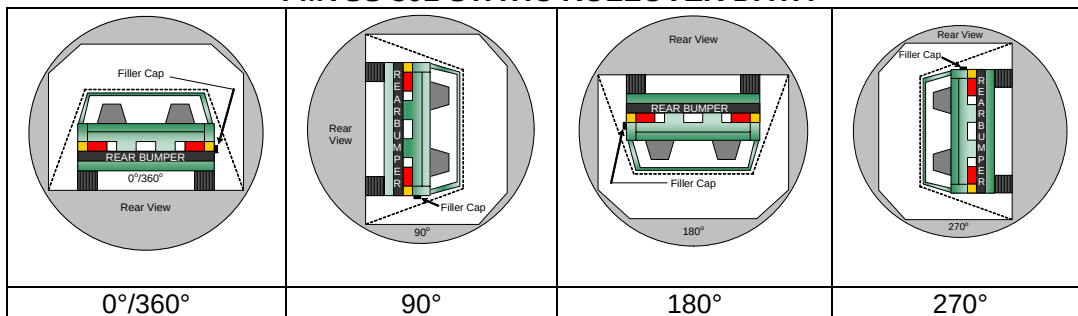
Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
 Test Program: Side Validation Testing

NHTSA No. MA5116
 Test Date: 6/10/2009

Test Time: 11:31 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°	121	300	421
90° to 180°	118	300	418
180° to 270°	113	300	413
270° to 360°	118	300	418

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

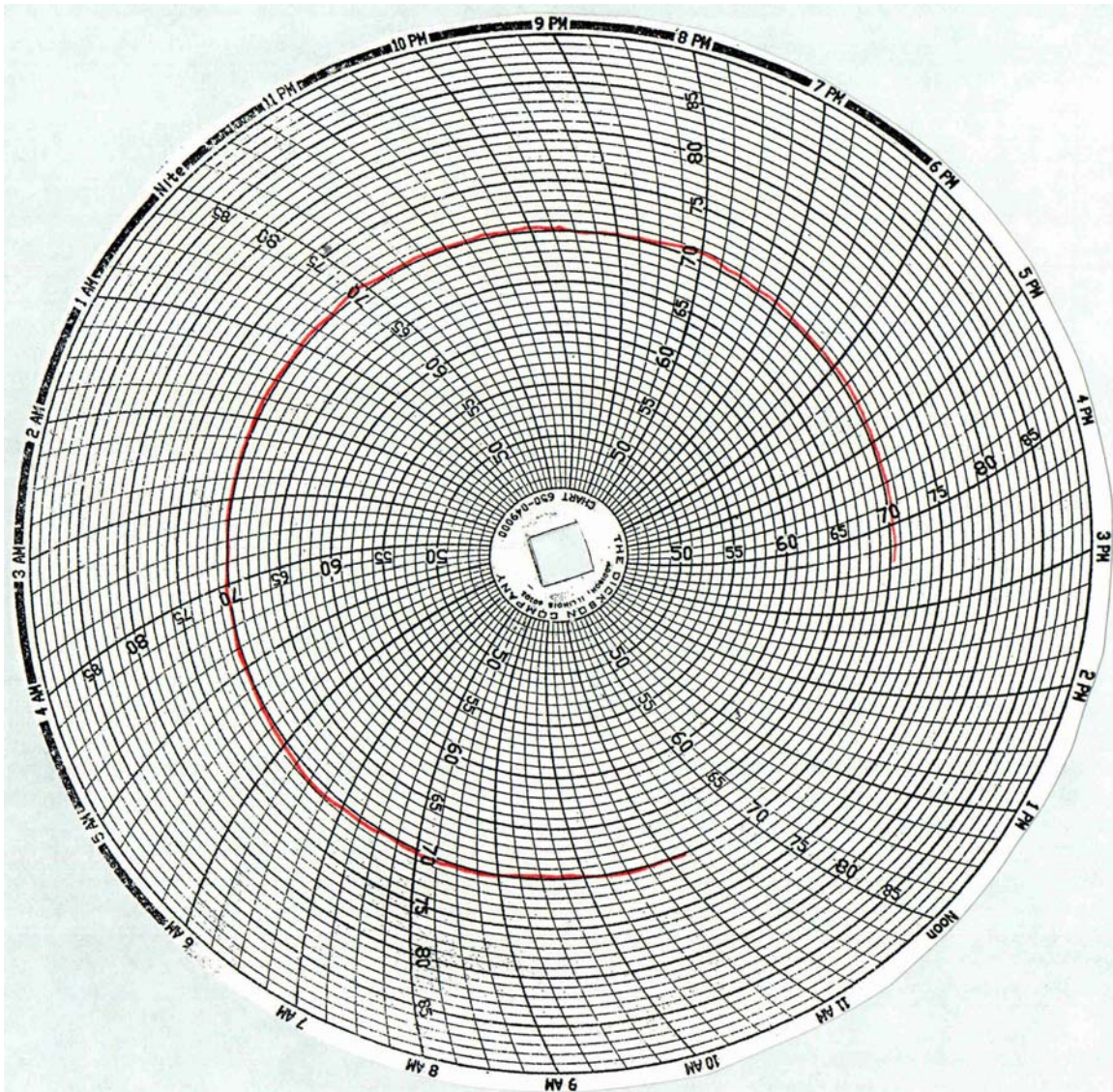
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 16
DUMMY/VEHICLE TEMPERATURE STABILIZATION

Test Vehicle: 2010 Toyota Corolla 4-Dr Sedan
Test Program: Side Validation Testing

NHTSA No. MA5116
Test Date: 6/10/2009



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



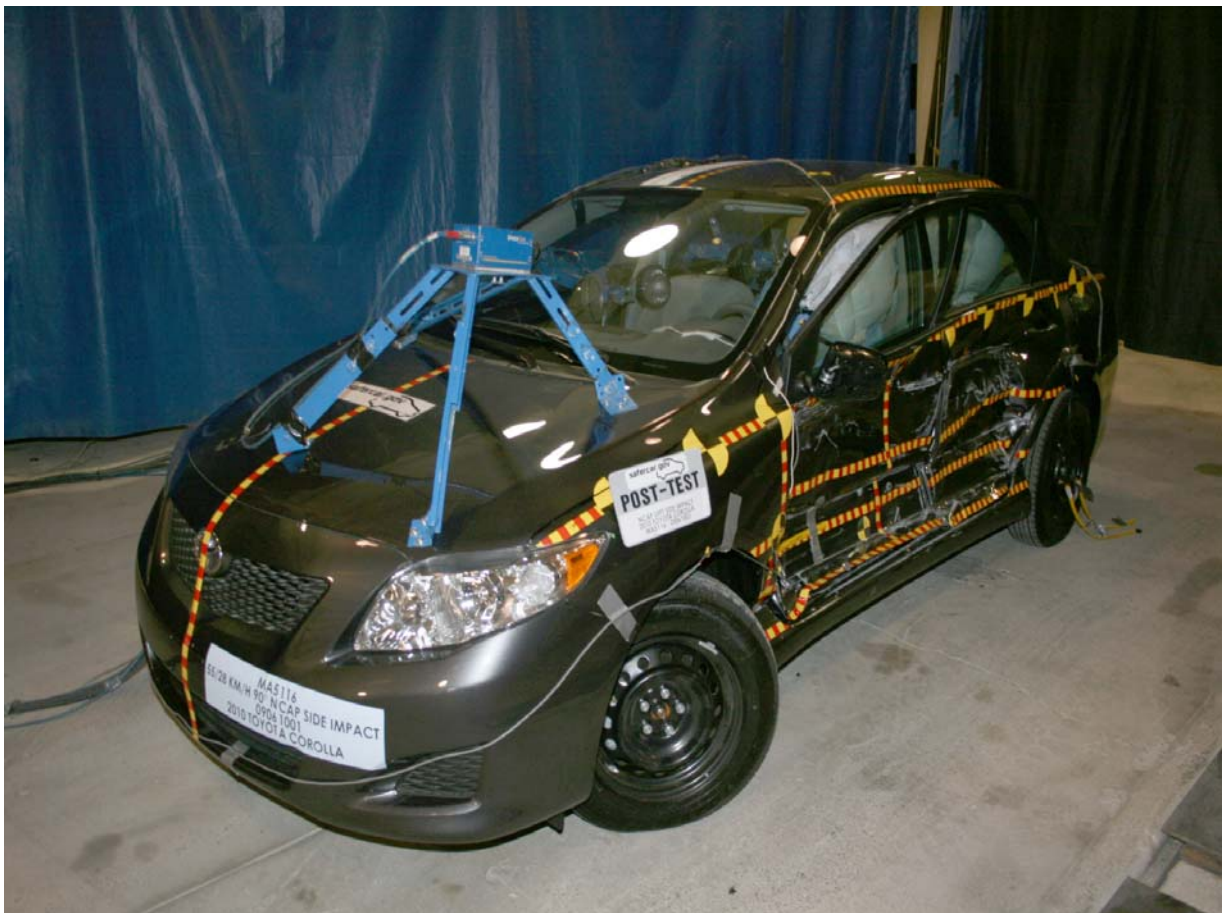
Pre-Test Frontal View of Test Vehicle



Post-Test Frontal View of Test Vehicle



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



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



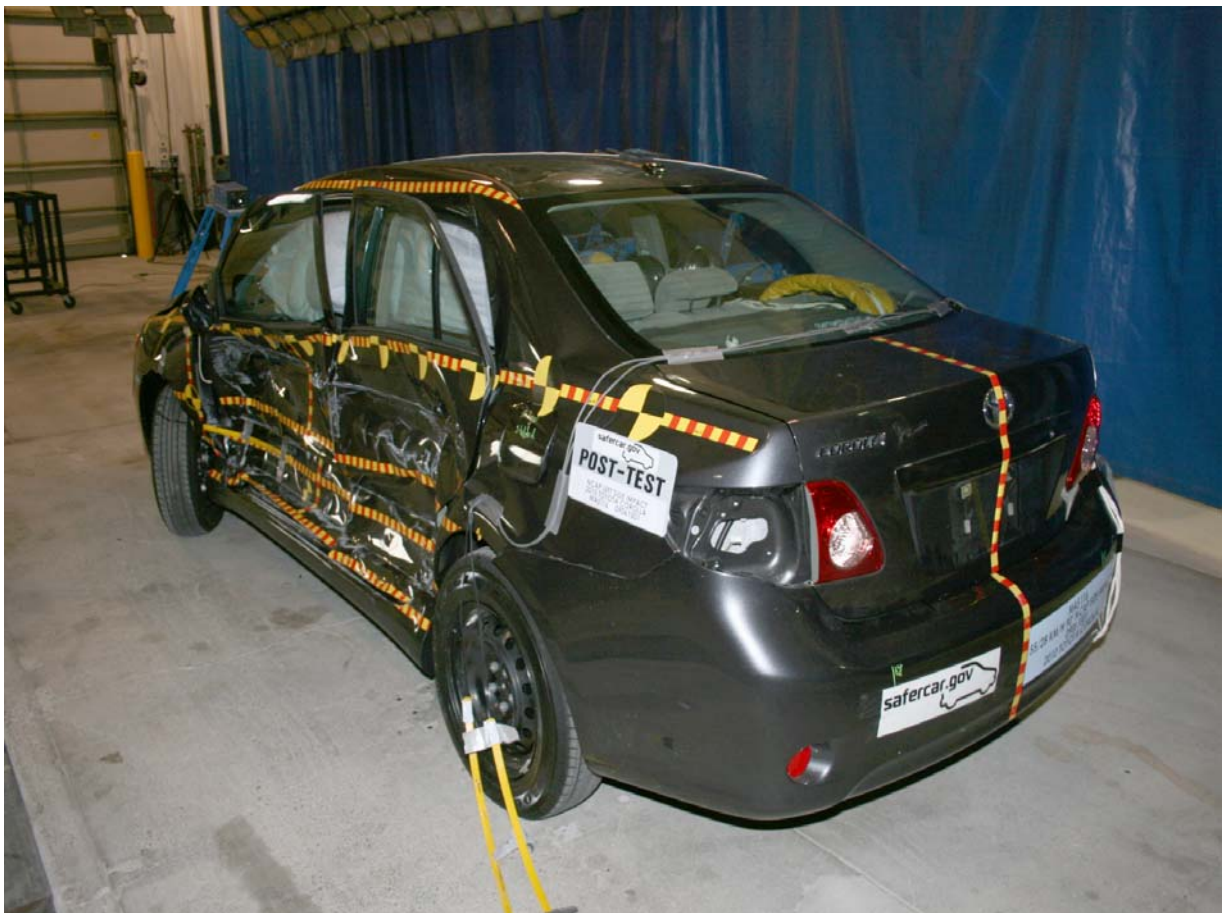
Pre-Test Left Side View of Test Vehicle



Post-Test Left Side View of Test Vehicle



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



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



Pre-Test Rear View of Test Vehicle



Post-Test Rear View of Test Vehicle



Pre-Test Right Side View of Test Vehicle



Post-Test Right Side View of Test Vehicle



Pre-Test Overhead View of the Test Vehicle with MDB Positioned Against the Side of the Test Vehicle at the Ideal Impact Point



Post-Test Overhead View of the Test Vehicle and MDB



Pre-Test Left Side View of MDB Positioned Against the Side of the Test Vehicle at the Ideal Impact Point



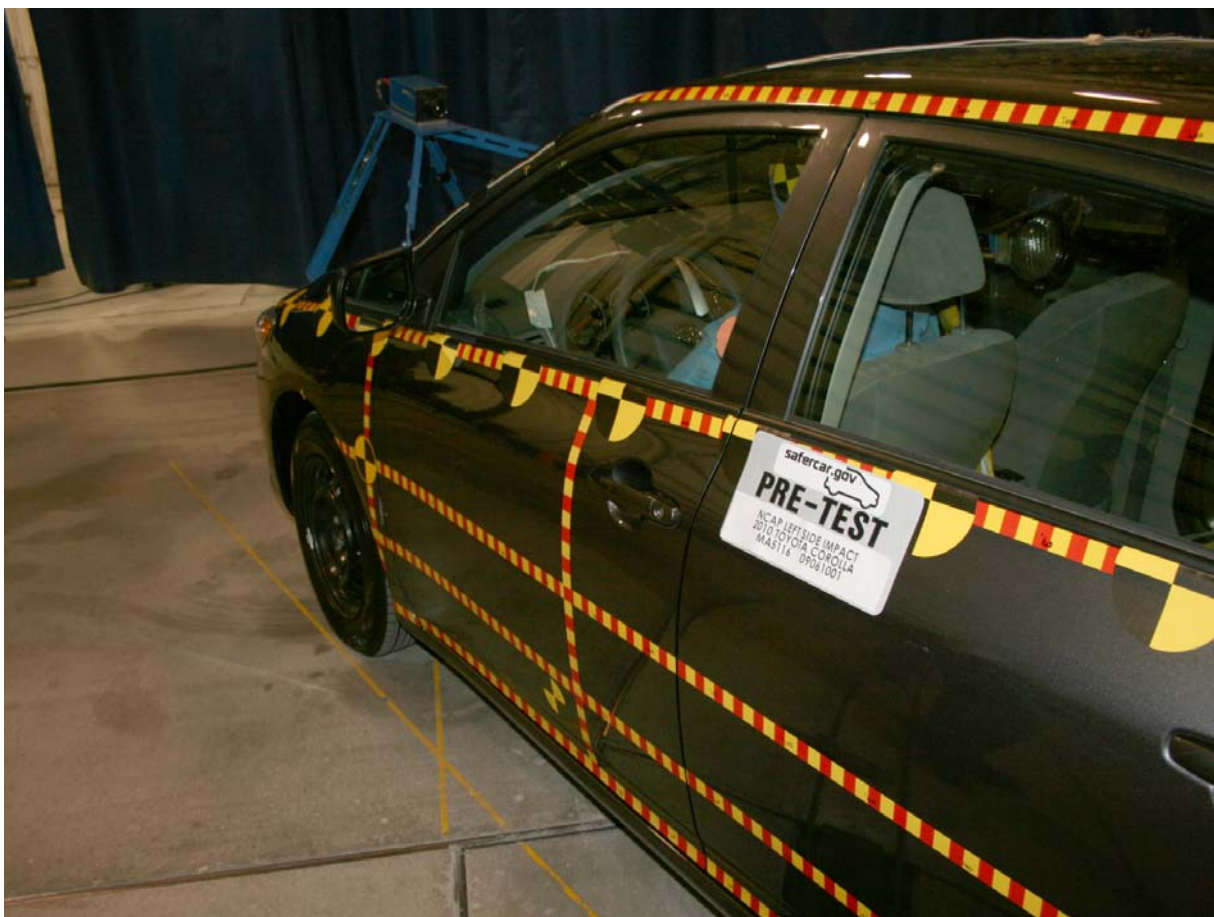
Pre-Test Right Side View of MDB Positioned Against the Side of the Test Vehicle at the Ideal Impact Point



Pre-Test Close-Up View of Impact Point Target



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



Pre-Test Left Front Door Latch Close-Up



Post-Test Left Front Door Latch Close-Up



Pre-Test Left Rear Door Latch Close-Up



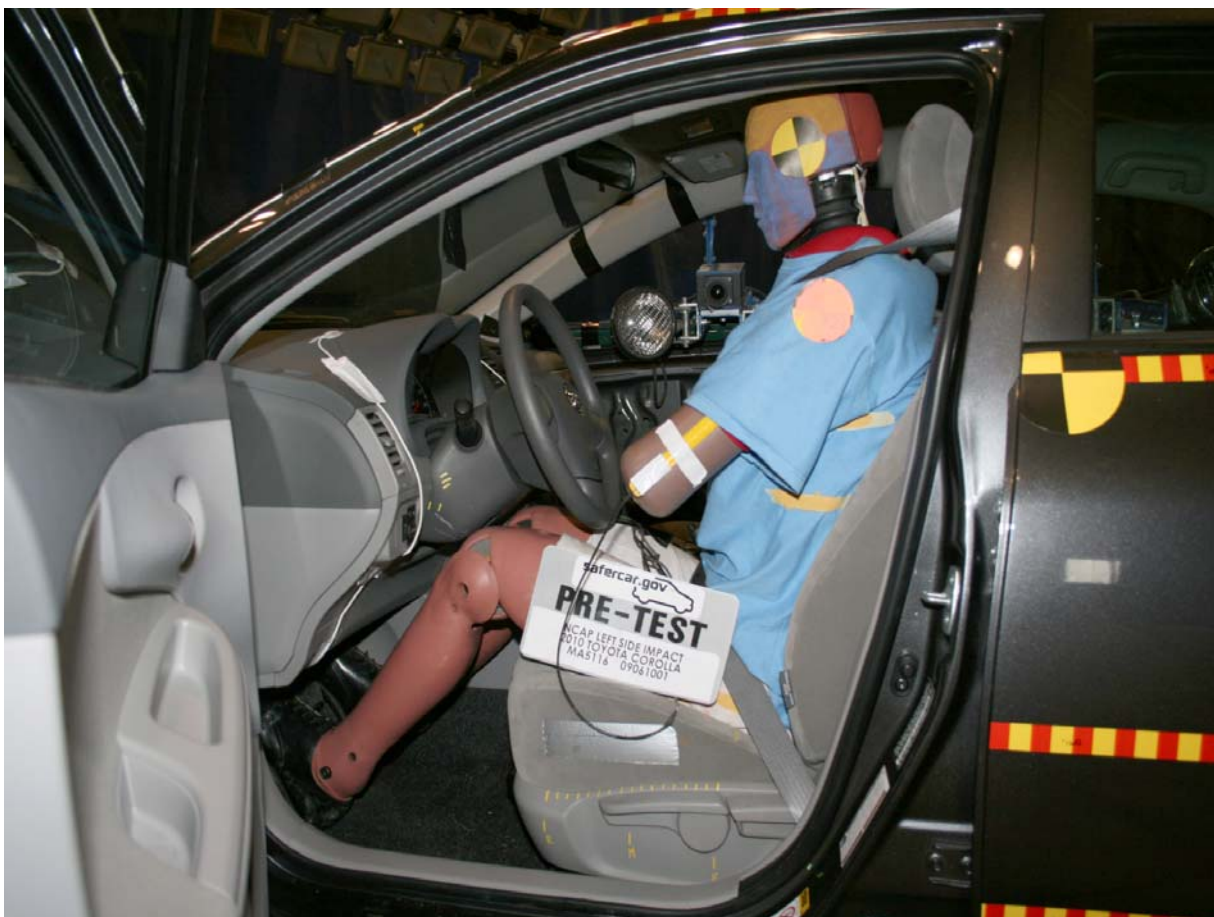
Post-Test Left Rear Door Latch Close-Up



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



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



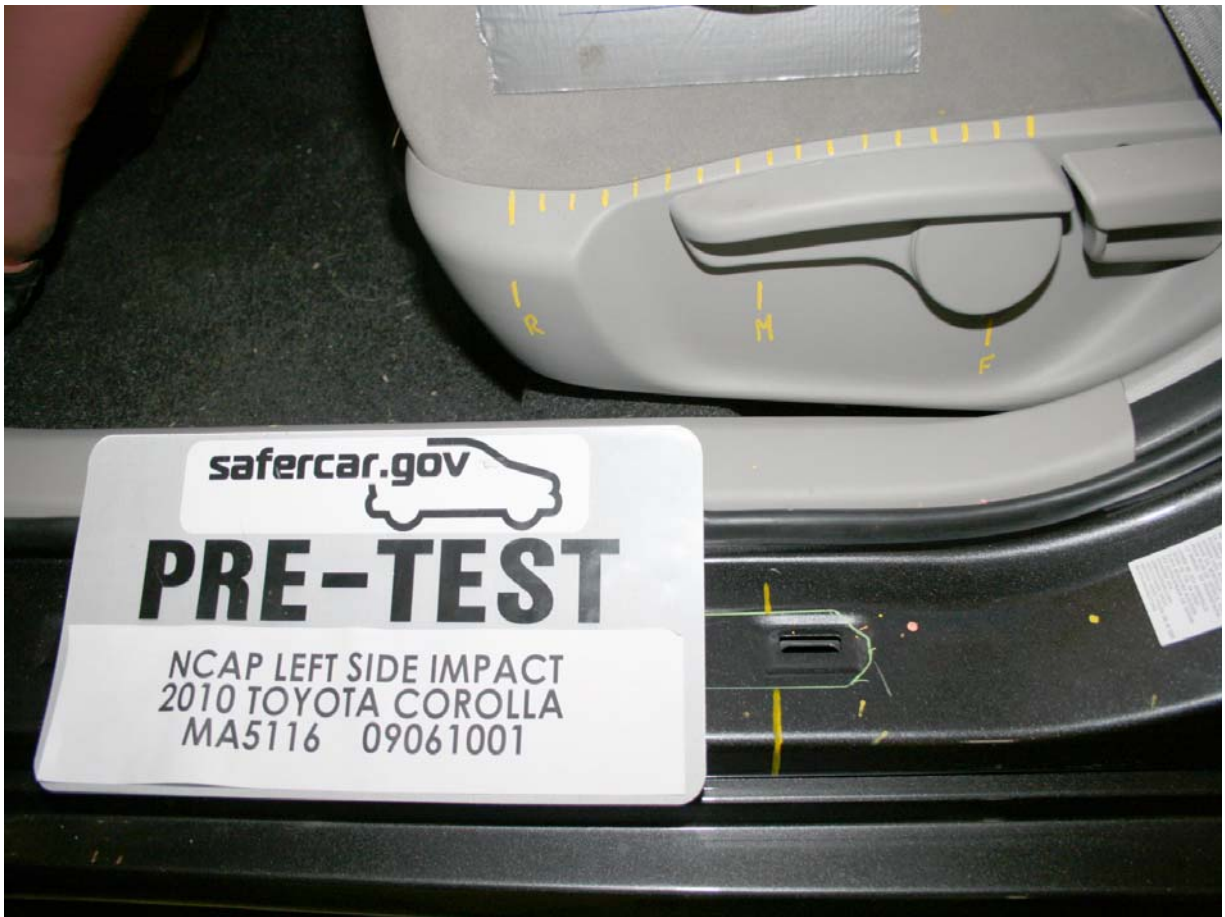
Pre-Test Left Side View of Driver Dummy Showing Belt, Chalking, and Contact Switches (Door Open)



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



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



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

NO PHOTO AVAILABLE

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



Pre-Test Driver Dummy and Door Clearance View



Post-Test Driver Dummy and Door Clearance View



Pre-Test Right Side View of Front Seat of Occupant Compartment (through window with dummy)



Post-Test Right Side View of Front Seat of Occupant Compartment (through window with dummy)



Pre-Test Driver Inner Door Panel View



Post-Test Driver Inner Door Panel View (with dummy removed)



Post-Test Driver Dummy Head Contact View



Post-Test Driver Dummy Door Contact View



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



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



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



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



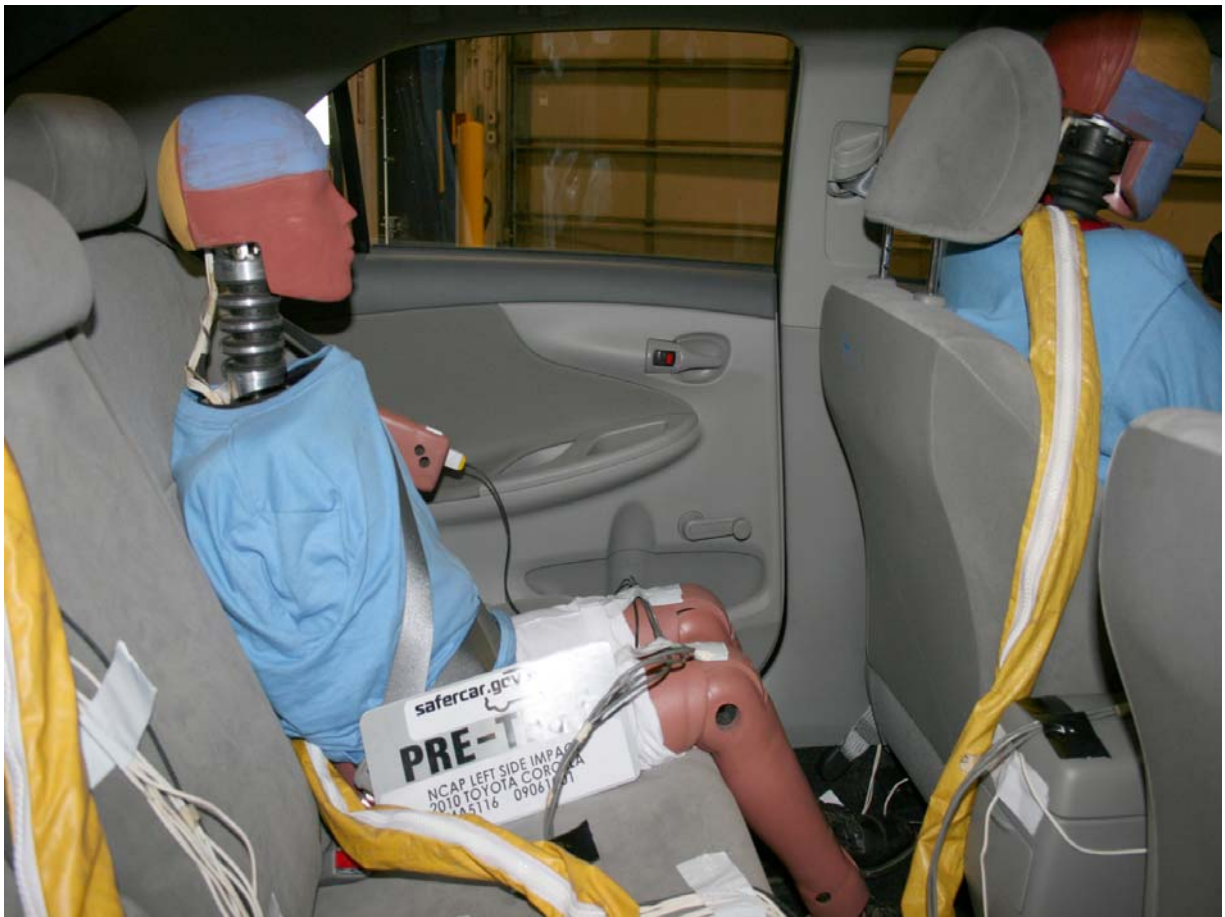
Pre-Test Close-Up Left Side View of Passenger Seat Back Showing Seat Back Positioning



Pre-Test Passenger Dummy and Door Clearance View



Post-Test Passenger Dummy and Door Clearance View



Pre-Test Right Side View of Rear Seat of Occupant Compartment (through window with dummy)



Post-Test Right Side View of Rear Seat of Occupant Compartment (through window with dummy)



Pre-Test Passenger Inner Door Panel View



Post-Test Passenger Inner Door Panel View (with dummy removed)



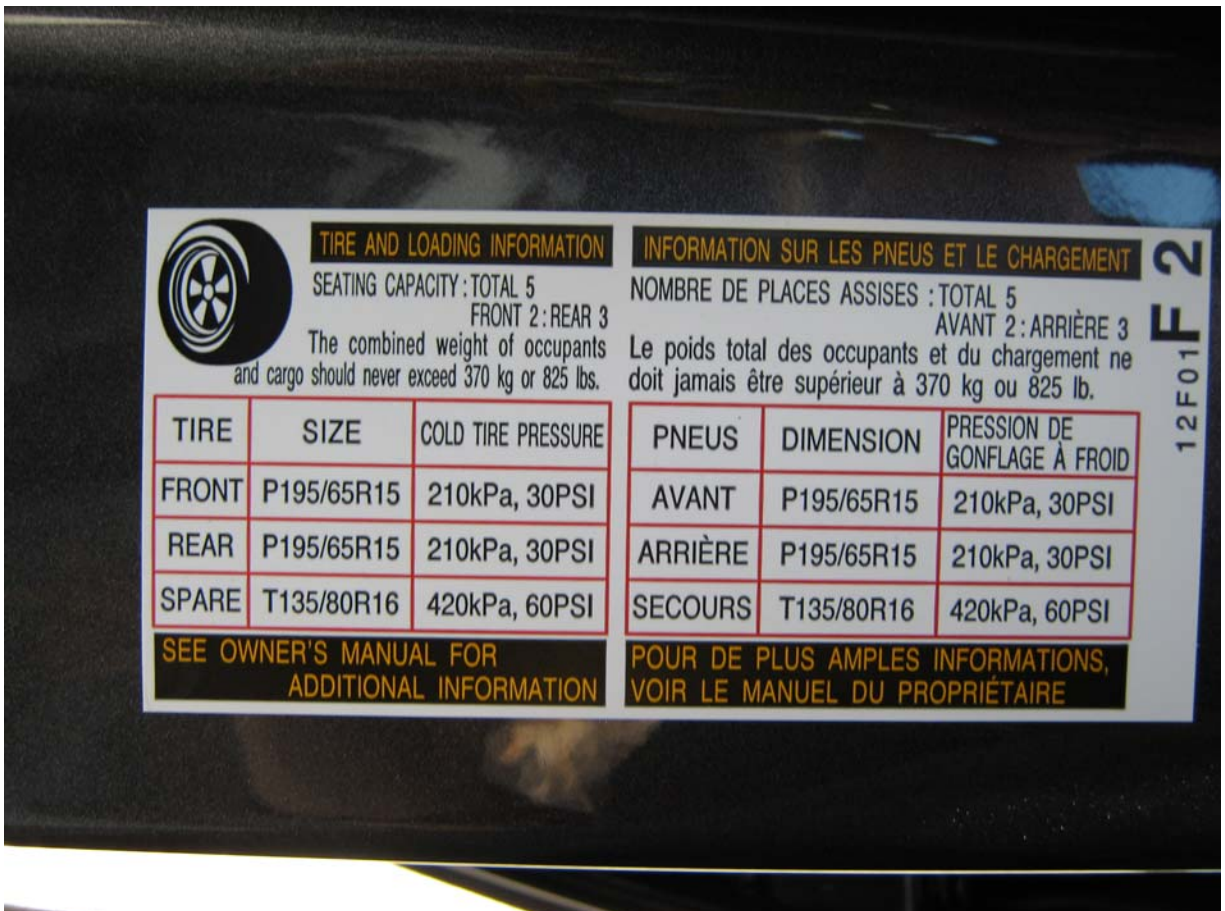
Post-Test Passenger Dummy Head Contact View



Post-Test Passenger Dummy Door Contact View



Close-Up View of Vehicle's Certification Label



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



Pre-Test Front View of MDB Impactor Face



Post-Test Front View of MDB Impactor Face



Pre-Test Top View of MDB Impactor Face



Post-Test Top View of MDB Impactor Face



Pre-Test Left Side View of MDB Impactor Face



Post-Test Left Side View of MDB Impactor Face



Pre-Test Right Side View of MDB Impactor Face



Post-Test Right Side View of MDB Impactor Face



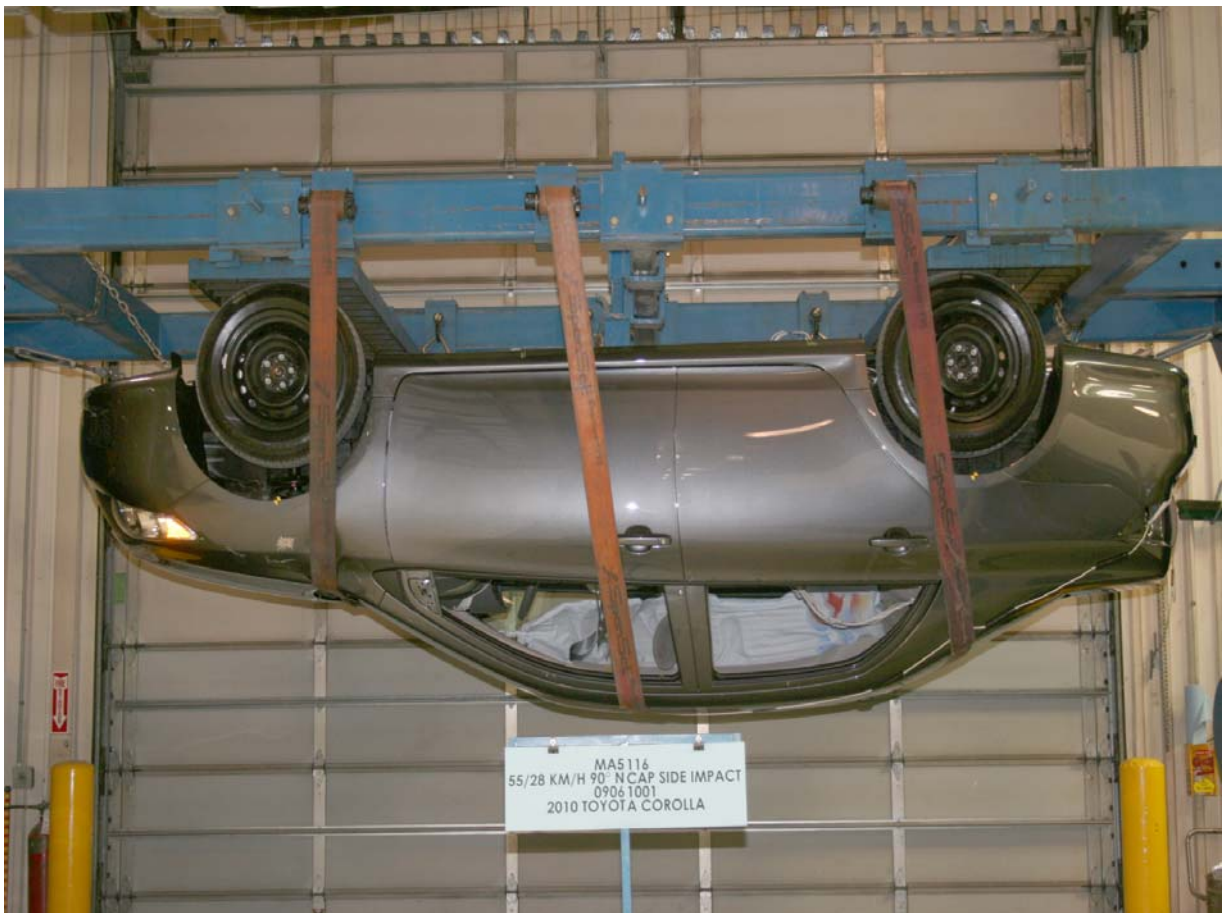
Post-Test Primary and Redundant Speed Trap Velocity Read-Out with Placard Showing NHTSA Number



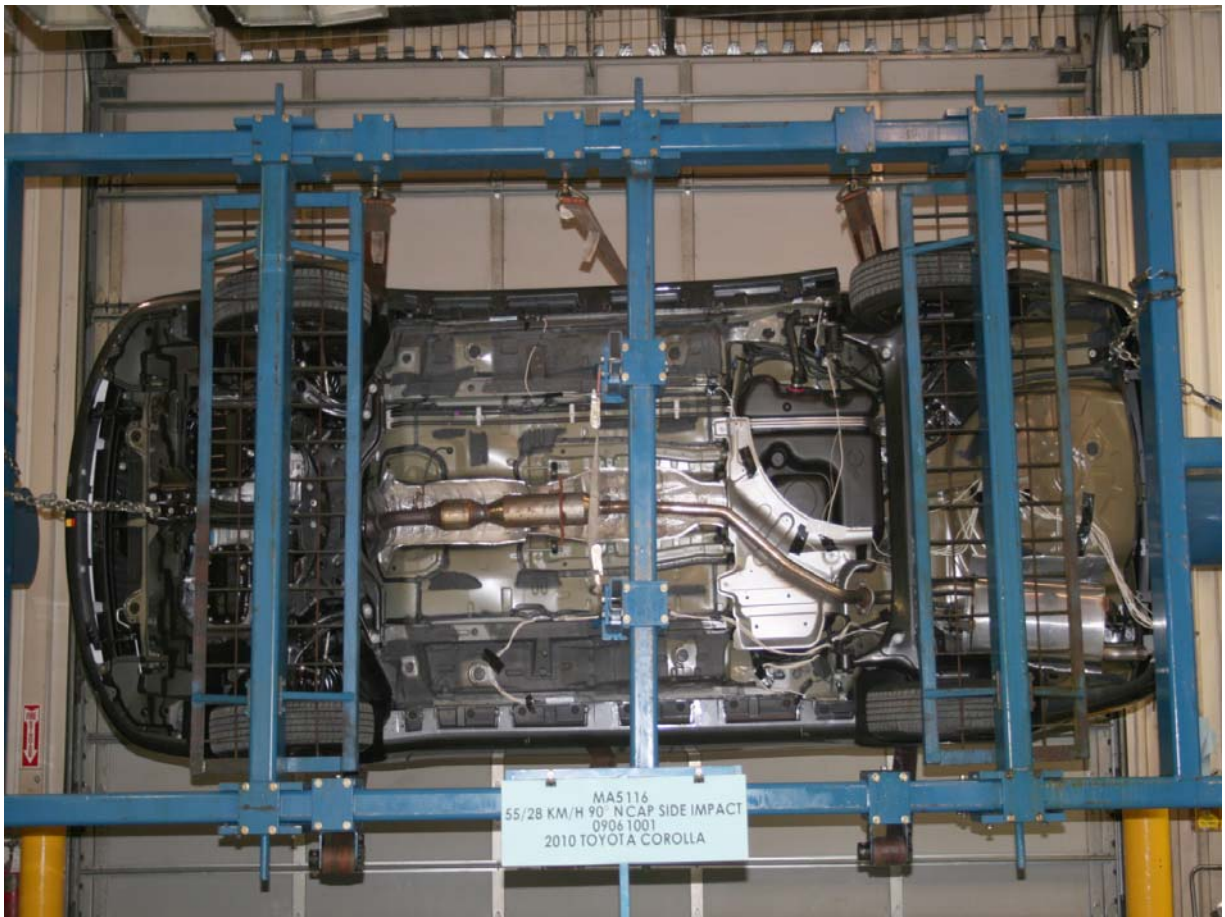
FMVSS No. 301/305 Rollover 0 Degrees



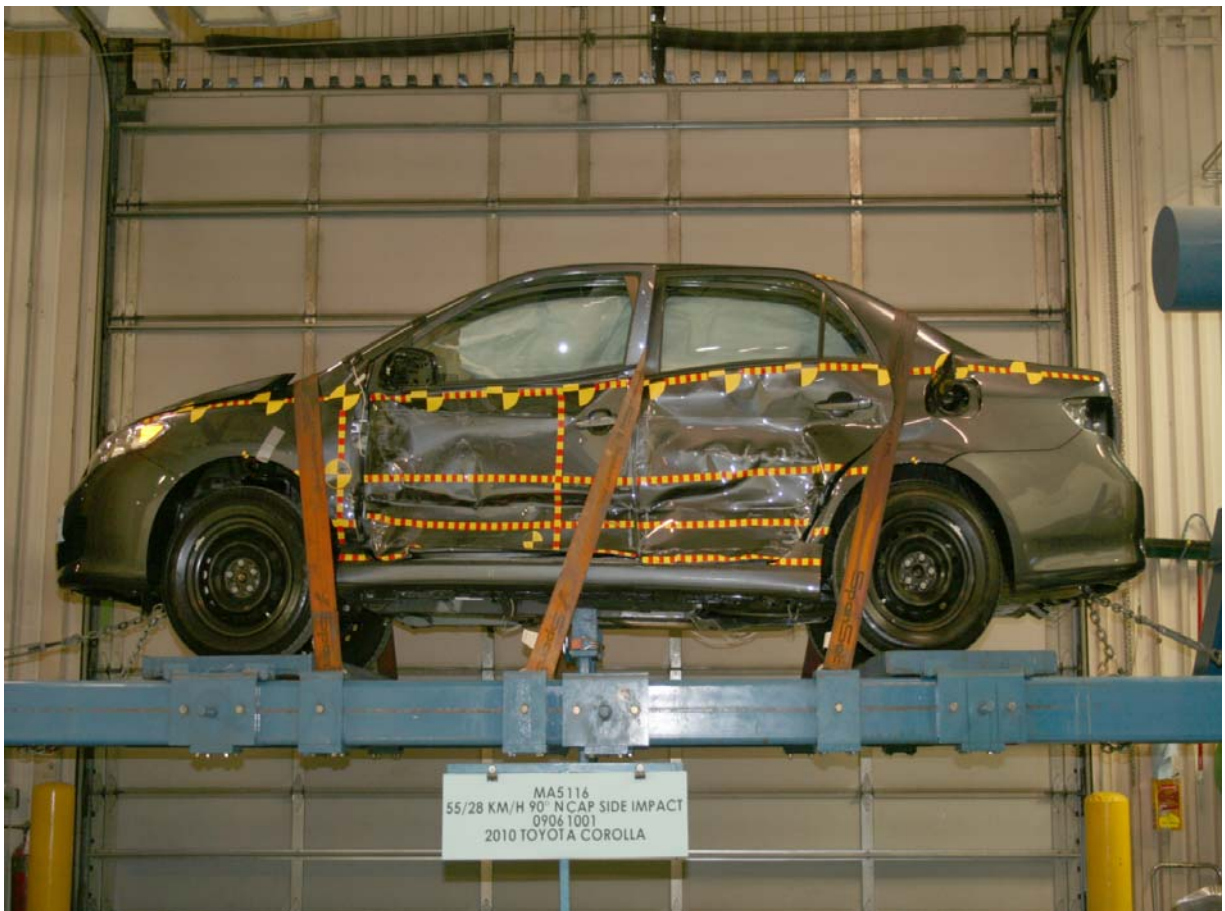
FMVSS No. 301/305 Rollover 90 Degrees



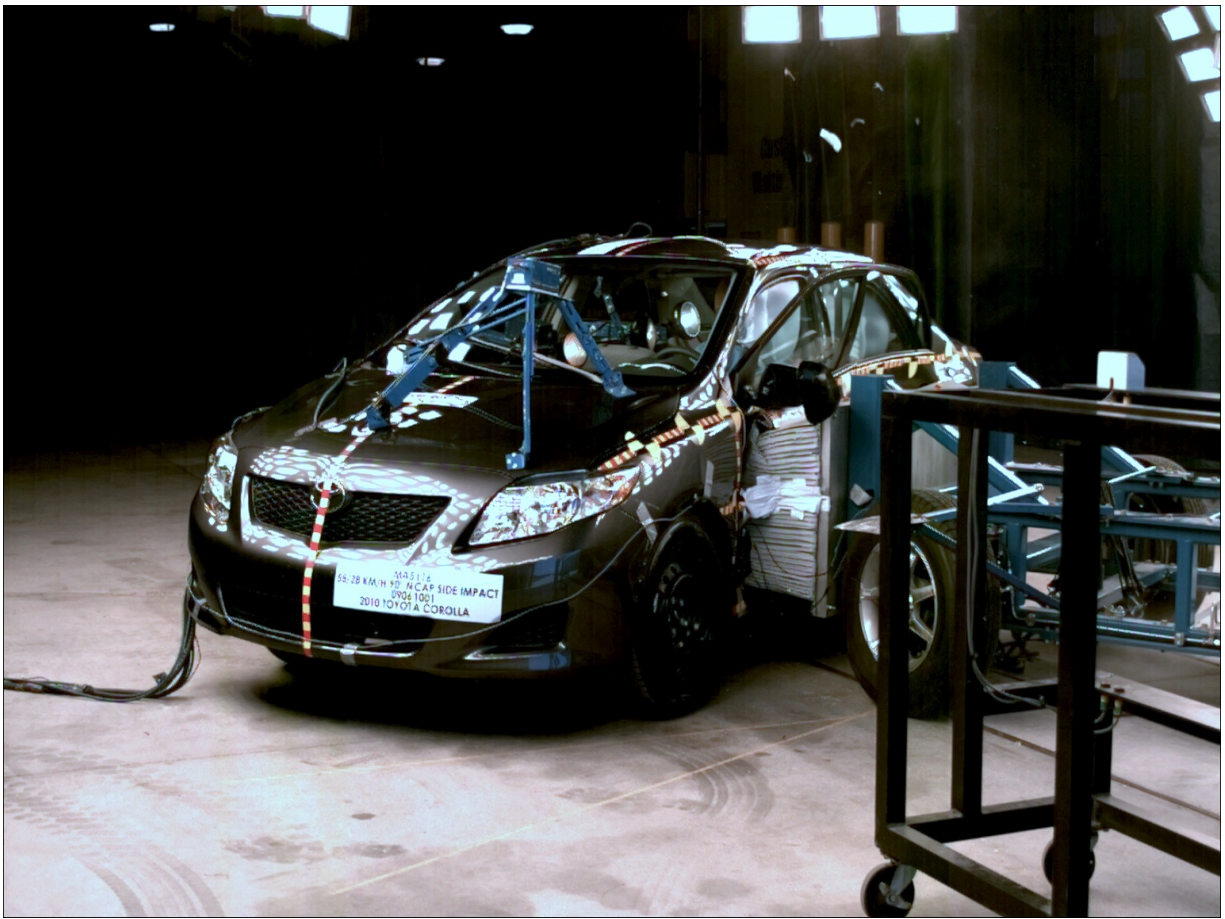
FMVSS No. 301/305 Rollover 180 Degrees



FMVSS No. 301/305 Rollover 270 Degrees



FMVSS No. 301/305 Rollover 360 Degrees



Impact Event (Impact Side)



Post-Test Driver Dummy Door Contact View 2



Post-Test Passenger Dummy Door Contact View 2



Post-Test Passenger Dummy Head Contact View 2

APPENDIX B
DUMMY RESPONSE DATA

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Driver & Passenger Dummy Instrumentation Plots
FILTERED DATA

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The following additional data for this test can be obtained from the Research and Development section of the NHTSA website. The website can be found at www.nhtsa.dot.gov

Driver & Passenger Dummy Instrumentation Data

Driver Lower Spine T12 Acceleration (X)

Driver Lower Spine T12 Acceleration (Y)

Driver Lower Spine T12 Acceleration (Z)

Passenger Upper Neck Force (X)

Passenger Upper Neck Force (Y)

Passenger Upper Neck Force (Z)

Passenger Upper Neck Moment About X

Passenger Upper Neck Moment About Y

Passenger Upper Neck Moment About Z

Passenger Shoulder Deflection (Y)

Passenger Upper Thorax Rib Deflection (Y)

Passenger Middle Thorax Rib Deflection (Y)

Passenger Lower Thorax Rib Deflection (Y)

Passenger Upper Abdomen Rib Deflection (Y)

Passenger Lower Abdomen Rib Deflection (Y)

Driver Head Acceleration Redundant (X)

Driver Head Acceleration Redundant (Y)

Driver Head Acceleration Redundant (Z)

Driver Shoulder Contact Switch

Driver Torso Contact Switch

Driver Pelvis Contact Switch

Passenger Head Acceleration Redundant (X)

Passenger Head Acceleration Redundant (Y)

Passenger Head Acceleration Redundant (Z)

Passenger Shoulder Contact Switch

Passenger Torso Contact Switch

Passenger Pelvis Contact Switch

Vehicle Instrumentation Data

Driver Side Airbag Timing

Driver Side Curtain Airbag Timing (not installed)

Passenger Side Airbag Timing (not installed)

Passenger Side Curtain Airbag Timing (not installed)

Right Side Sill at Front Seat Acceleration (X)

Right Side Sill at Front Seat Acceleration (Y)

Right Side Sill at Front Seat Acceleration (Z)

Right Side Sill at Rear Seat Acceleration (X)

Right Side Sill at Rear Seat Acceleration (Y)

Right Side Sill at Rear Seat Acceleration (Z)

Rear Floorpan Above Axle Acceleration (X)

Rear Floorpan Above Axle Acceleration (Y)

Rear Floorpan Above Axle Acceleration (Z)

Left Side Sill at Front Seat Acceleration (Y)

Left Side Sill at Rear Seat Acceleration (Y)

Right Rear Occupant Compartment Acceleration (Y)

Lower A-Post Acceleration (Y)

Upper A-Post Acceleration (Y)

Lower B-Post Acceleration (Y)

Upper B-Post Acceleration (Y)

Front Seat Track Acceleration (Y)

Rear Seat Track Acceleration (Y) (not installed)

Vehicle Center of Gravity Acceleration (X)

Vehicle Center of Gravity Acceleration (Y)

Vehicle Center of Gravity Acceleration (Z)

MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)

MDB Center of Gravity Acceleration (Y)

MDB Center of Gravity Acceleration (Z)

MDB Center of Gravity Resultant Acceleration (not recorded)

MDB Rear Acceleration (X)

MDB Rear Acceleration (Y)

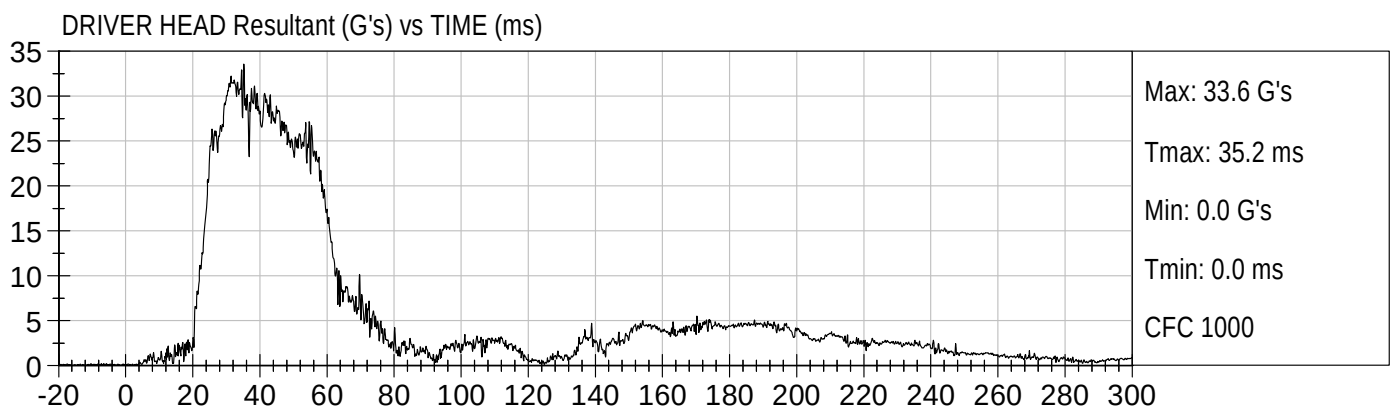
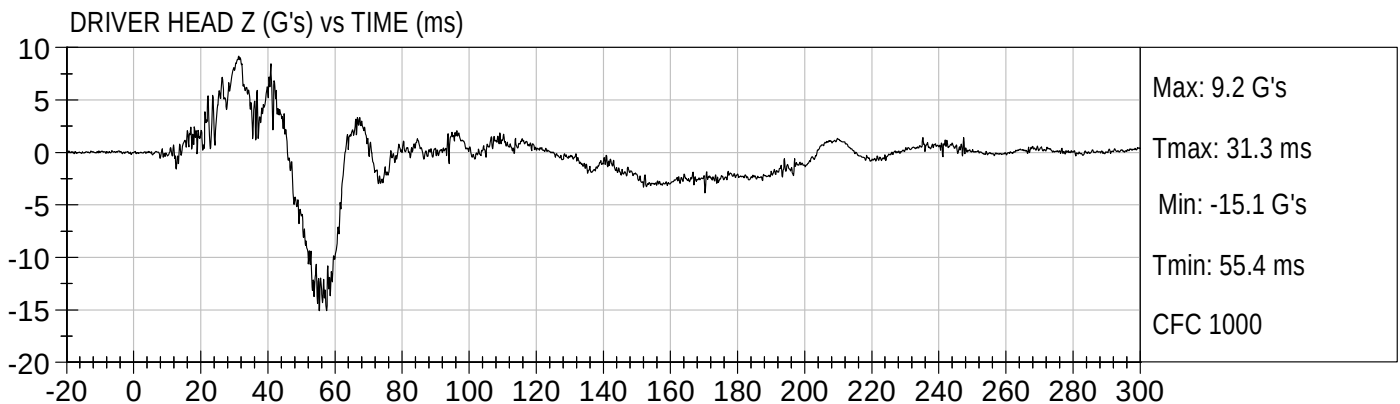
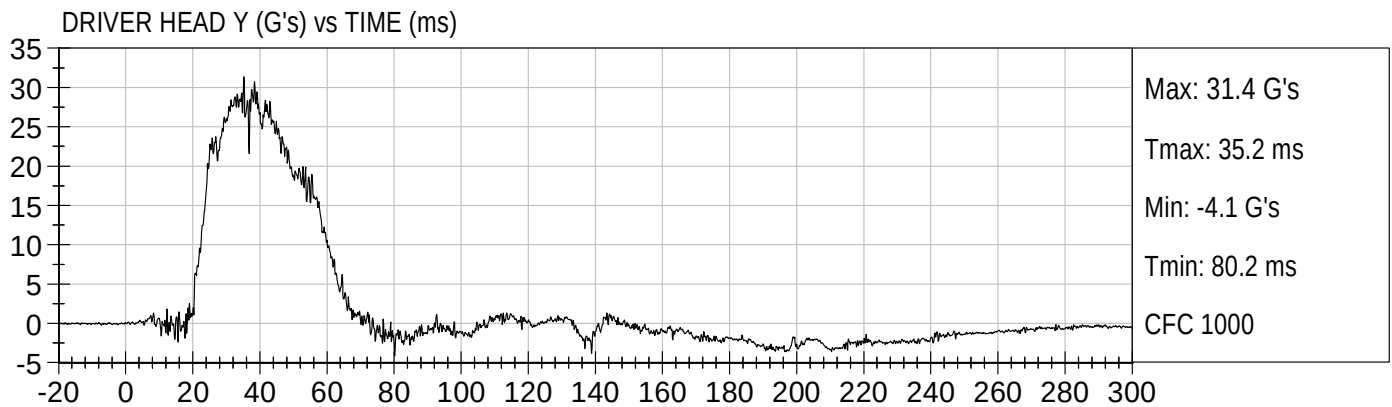
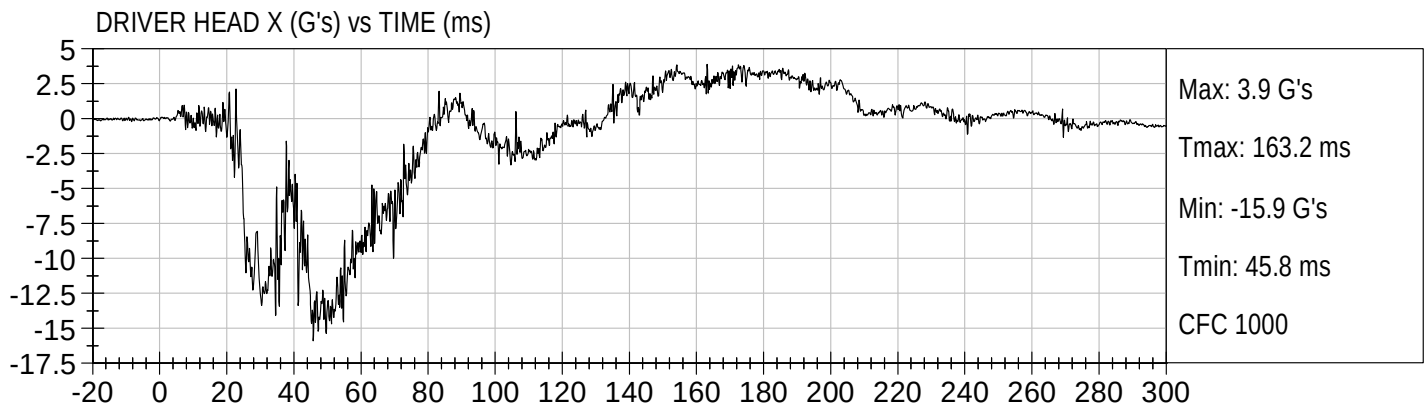
Left MDB Contact Switch

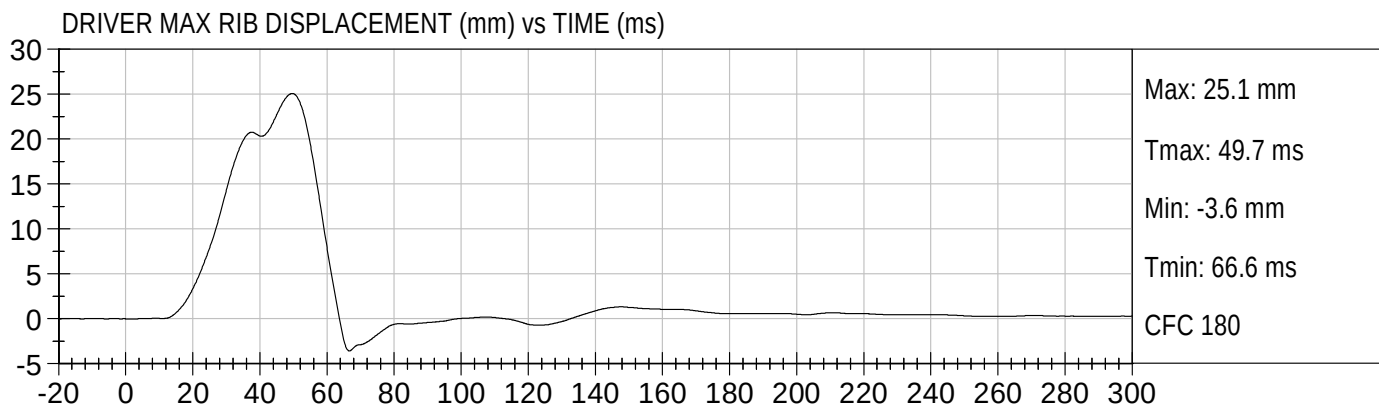
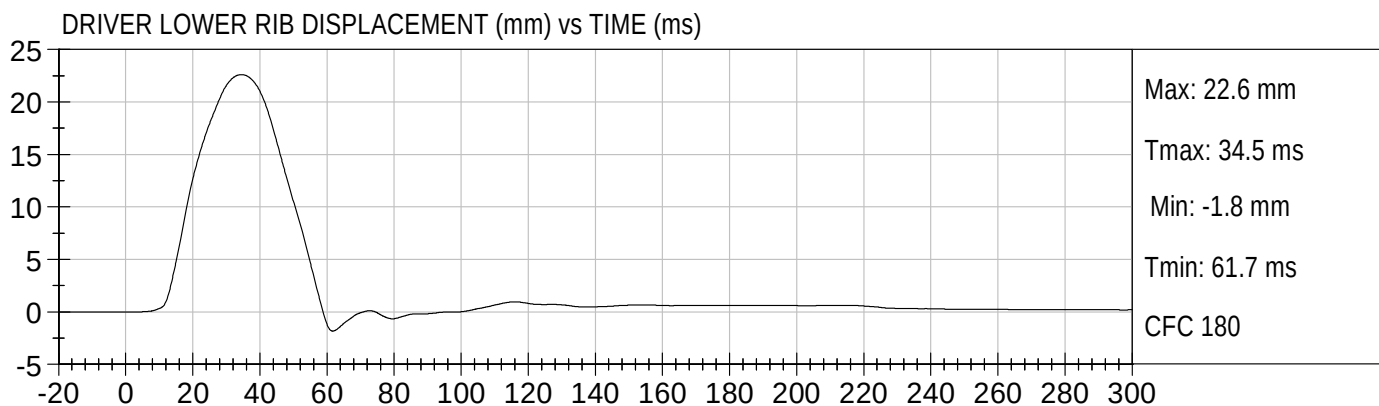
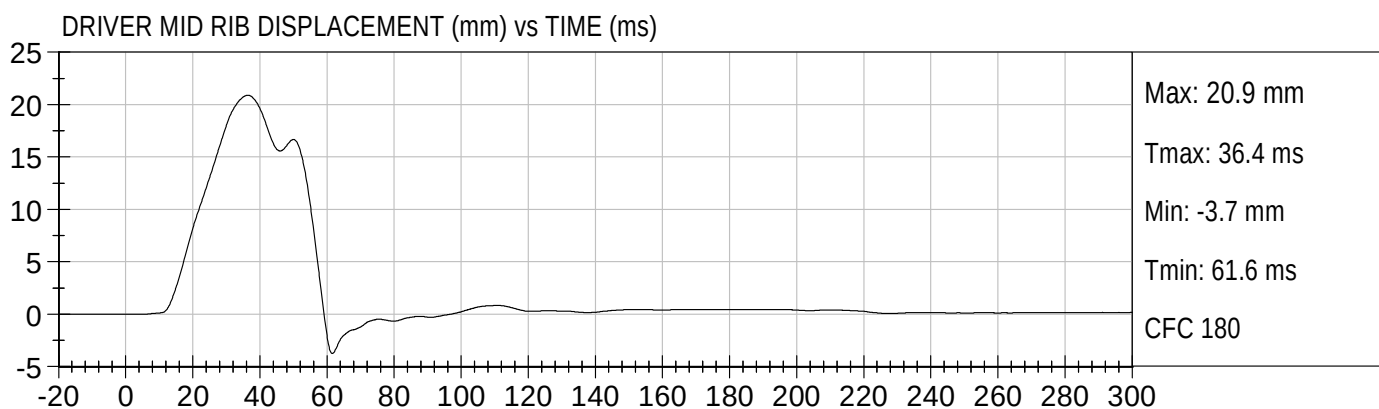
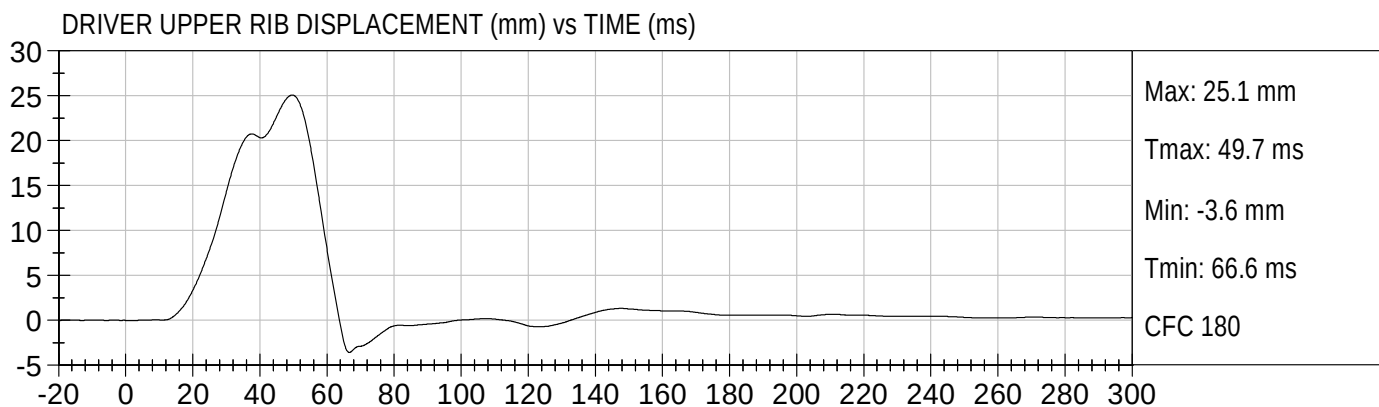
Right MDB Contact Switch



55/28 km/h 90° NCAP Side Impact
2010 Toyota Corolla - MA5116

Test Date: 06/10/2009
Speed: 38.7 mph (62.3 km/h)



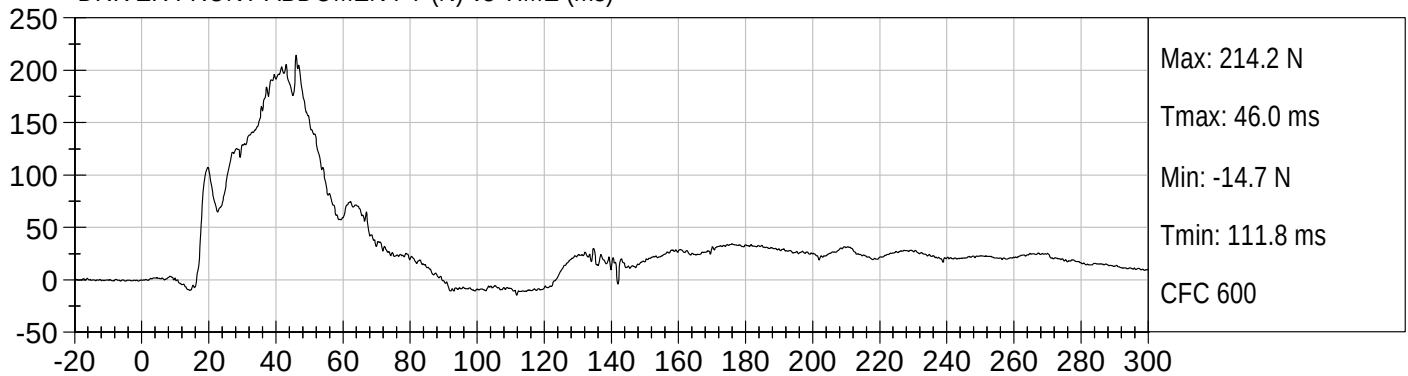




55/28 km/h 90° NCAP Side Impact
2010 Toyota Corolla - MA5116

Test Date: 06/10/2009
Speed: 38.7 mph (62.3 km/h)

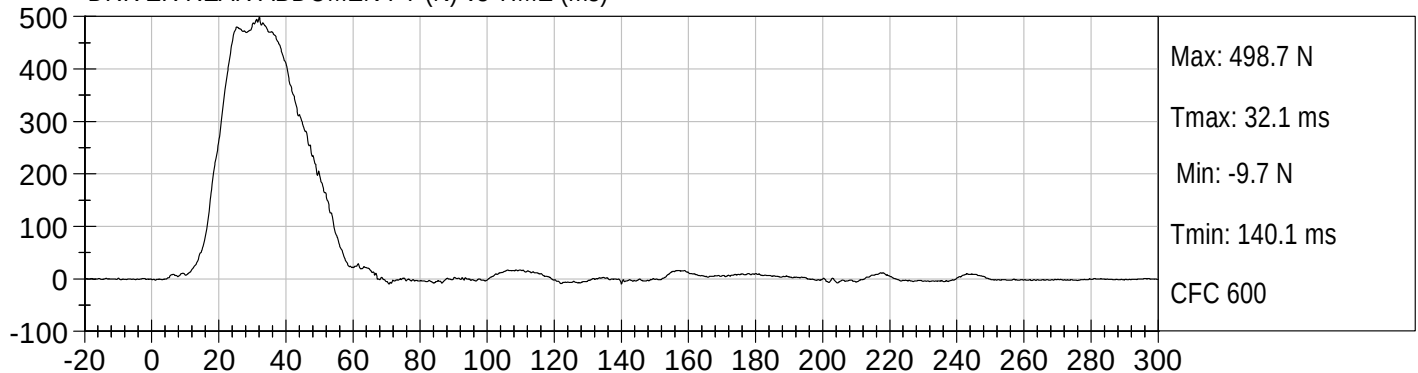
DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)



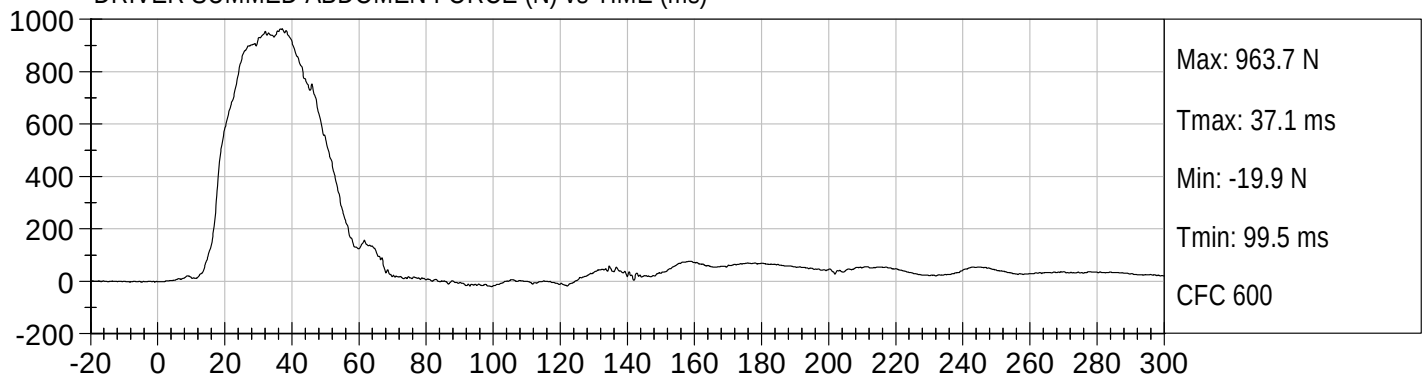
DRIVER MID ABDOMEN FY (N) vs TIME (ms)



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



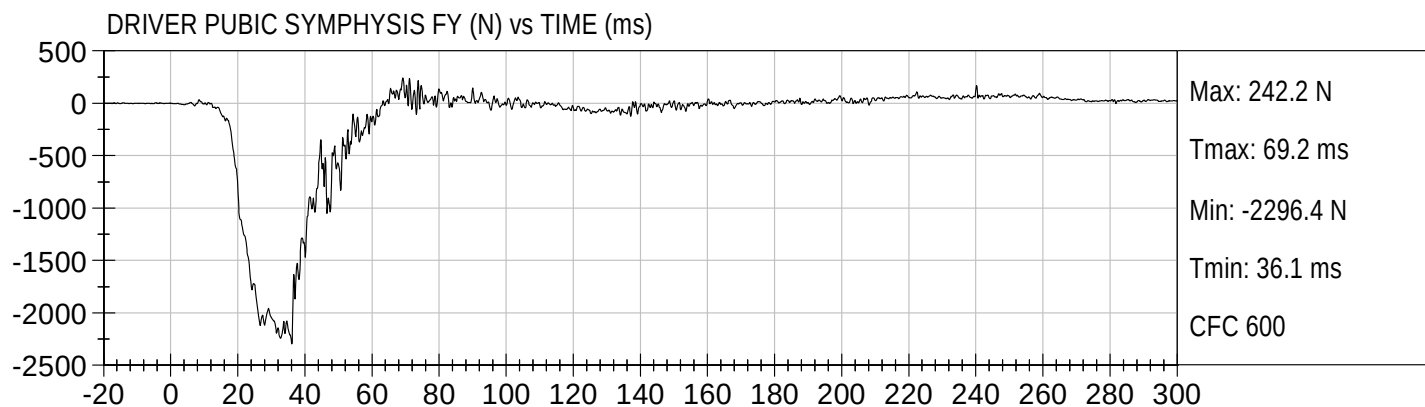
DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)





55/28 km/h 90° NCAP Side Impact
2010 Toyota Corolla - MA5116

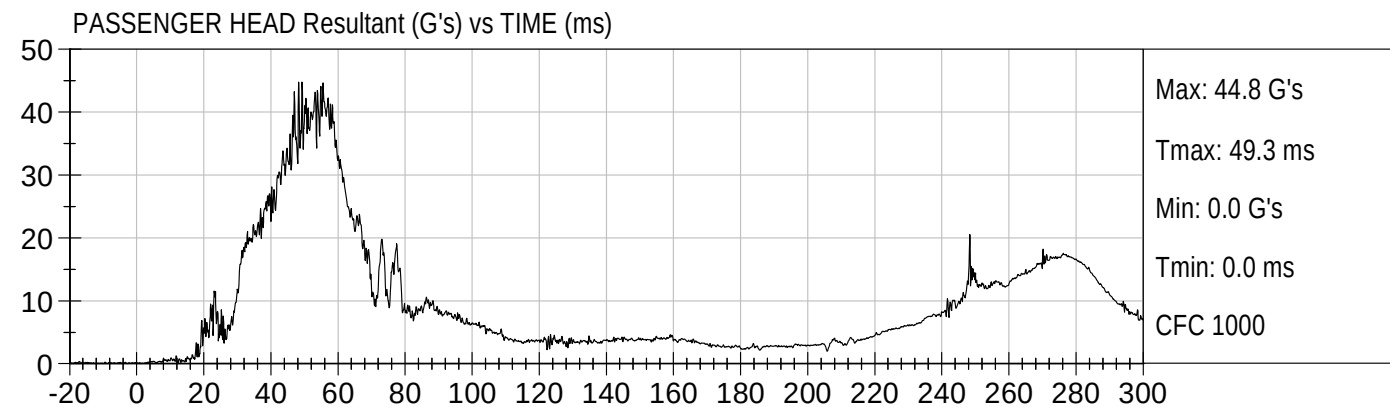
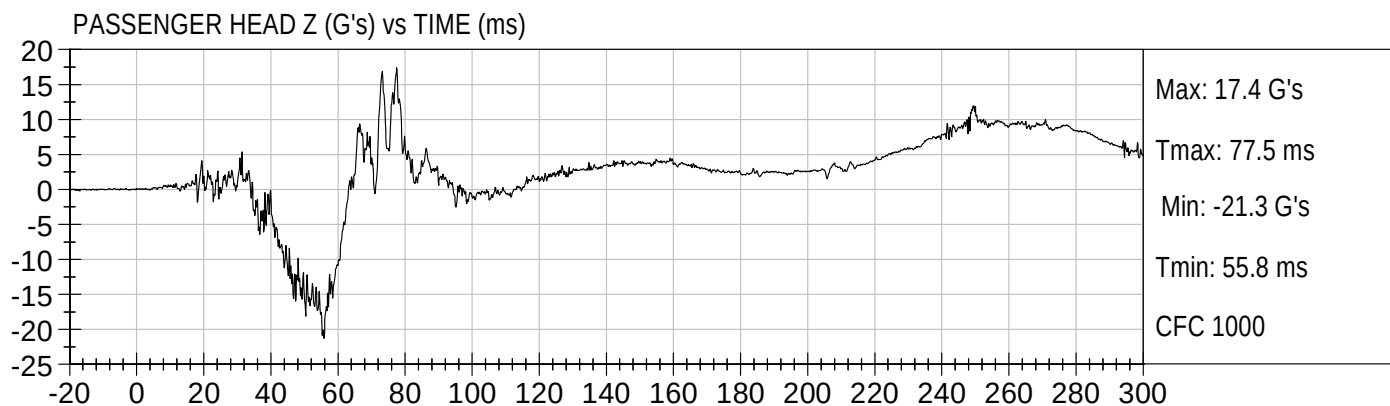
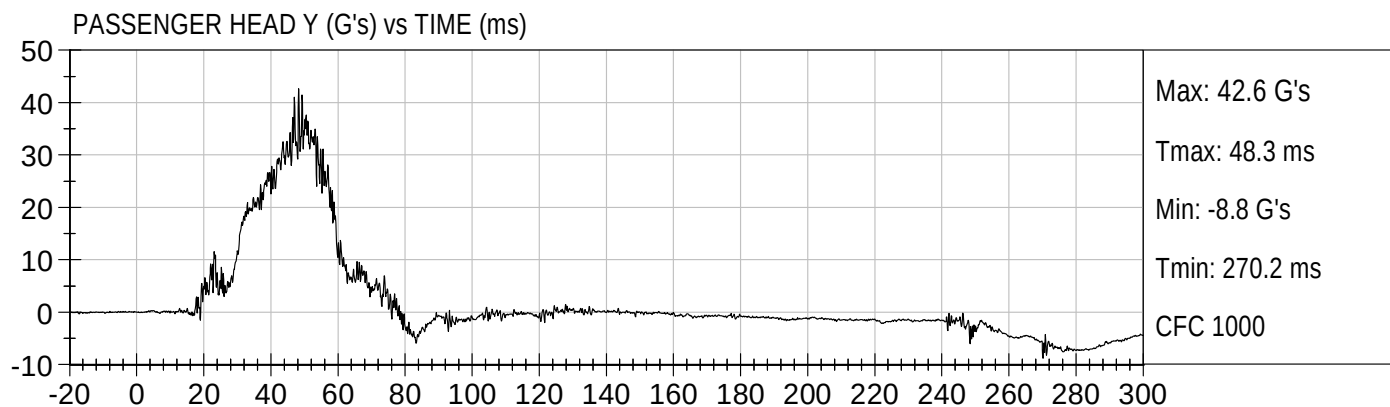
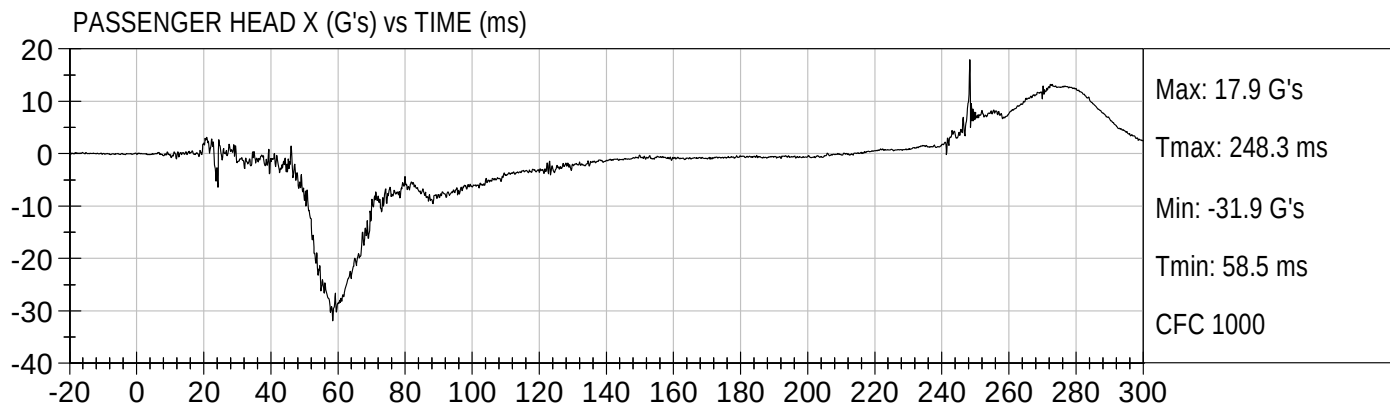
Test Date: 06/10/2009
Speed: 38.7 mph (62.3 km/h)





55/28 km/h 90° NCAP Side Impact
2010 Toyota Corolla - MA5116

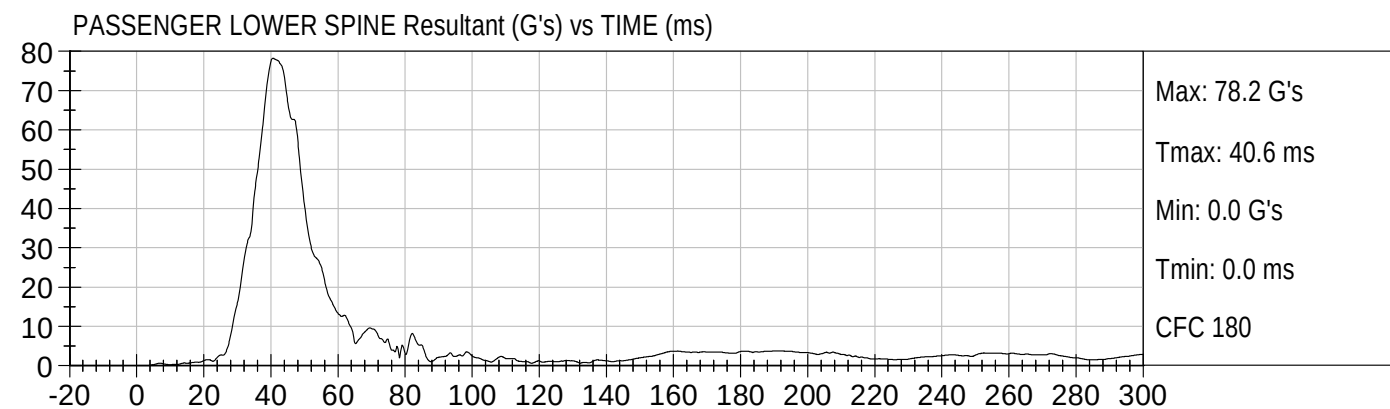
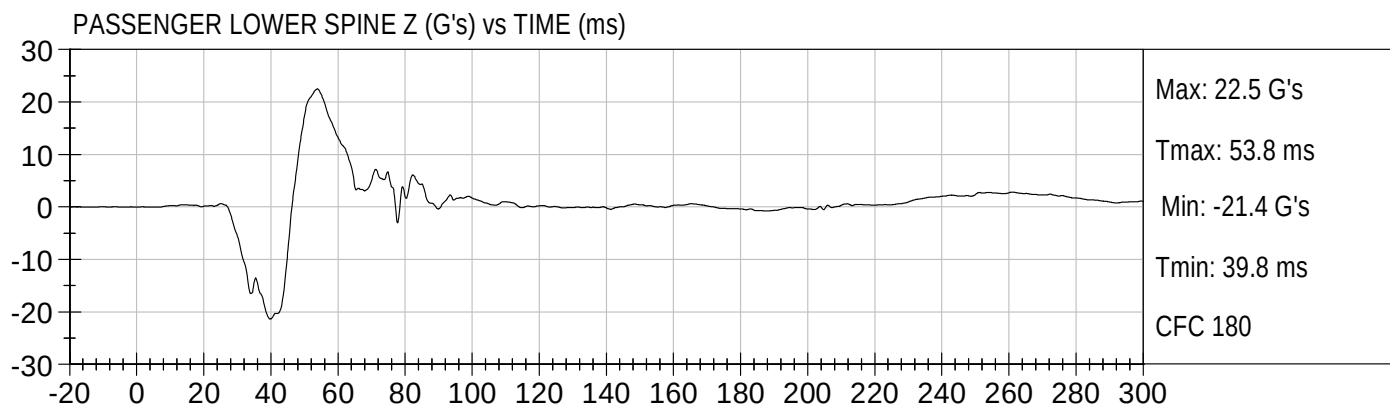
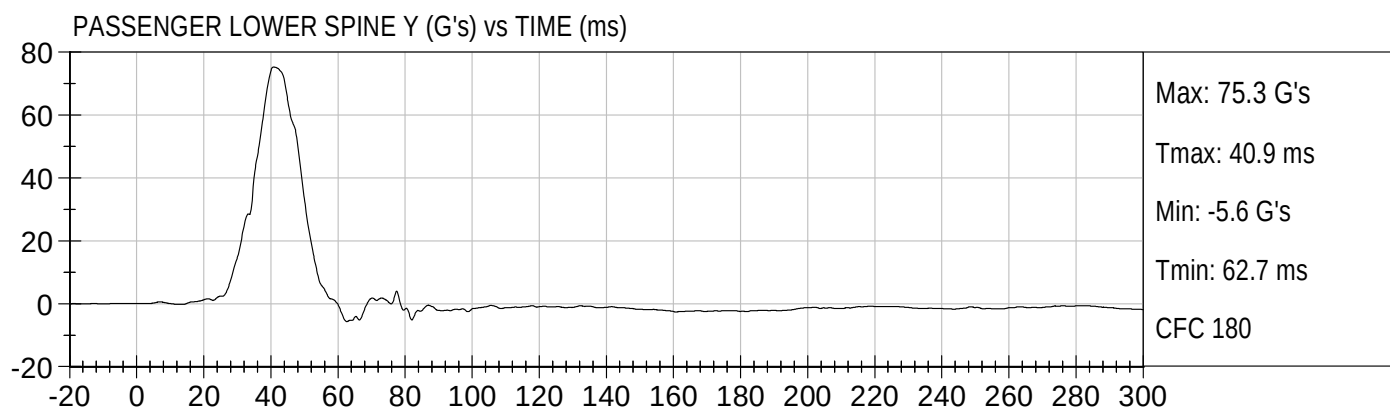
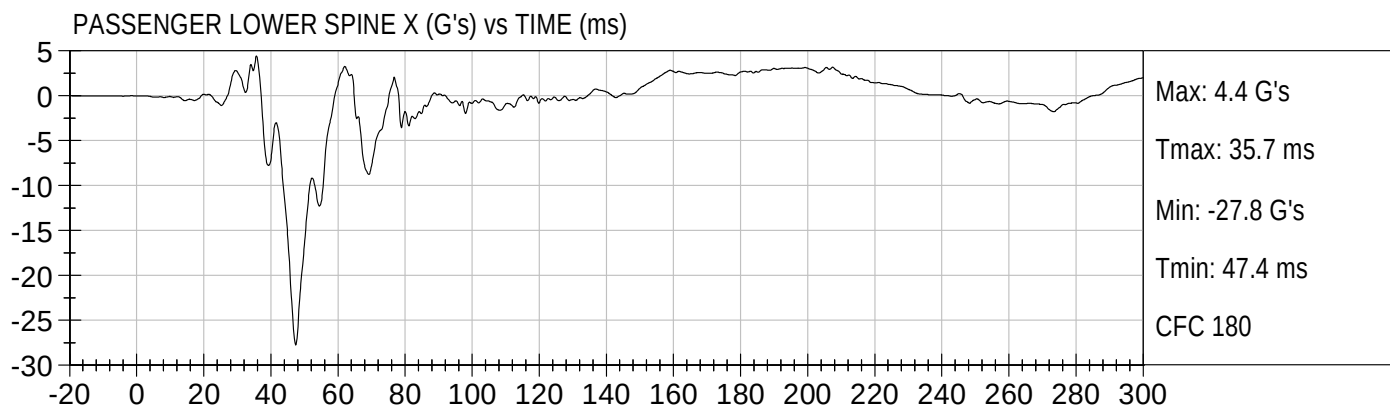
Test Date: 06/10/2009
Speed: 38.7 mph (62.3 km/h)





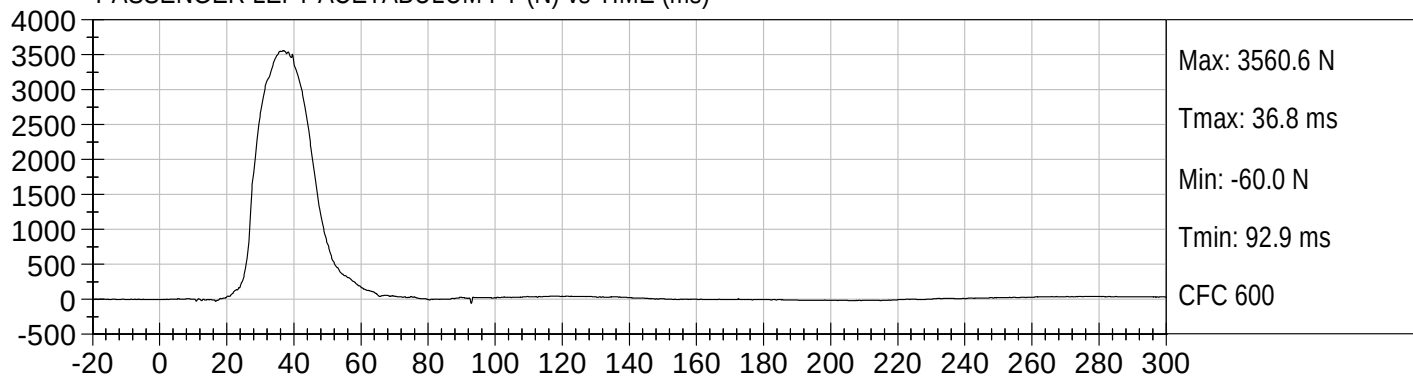
55/28 km/h 90° NCAP Side Impact
2010 Toyota Corolla - MA5116

Test Date: 06/10/2009
Speed: 38.7 mph (62.3 km/h)

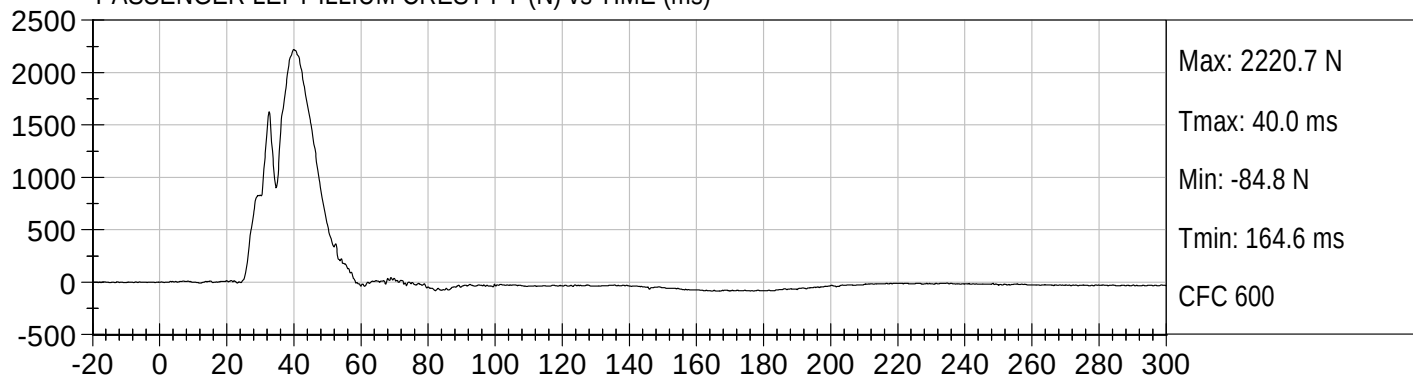




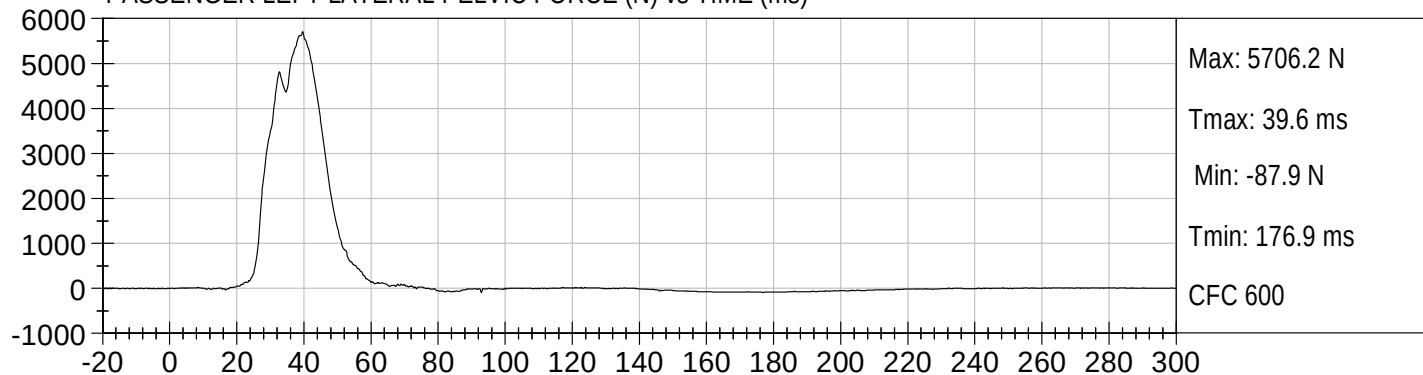
PASSENGER LEFT ACETABULUM FY (N) vs TIME (ms)



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



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



APPENDIX C
DUMMY CALIBRATION DATA

MGA RESEARCH CORPORATION
HEAD DROP TEST
ES-2re DUMMY

ATD Serial No: 032

Test ID: D091371

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	37	Pass
Peak Resultant Acceleration	G's	125 to 155	147	Pass
Peak Lateral Acceleration	G's	+/- 15	-10.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

6/2/09
Test Date

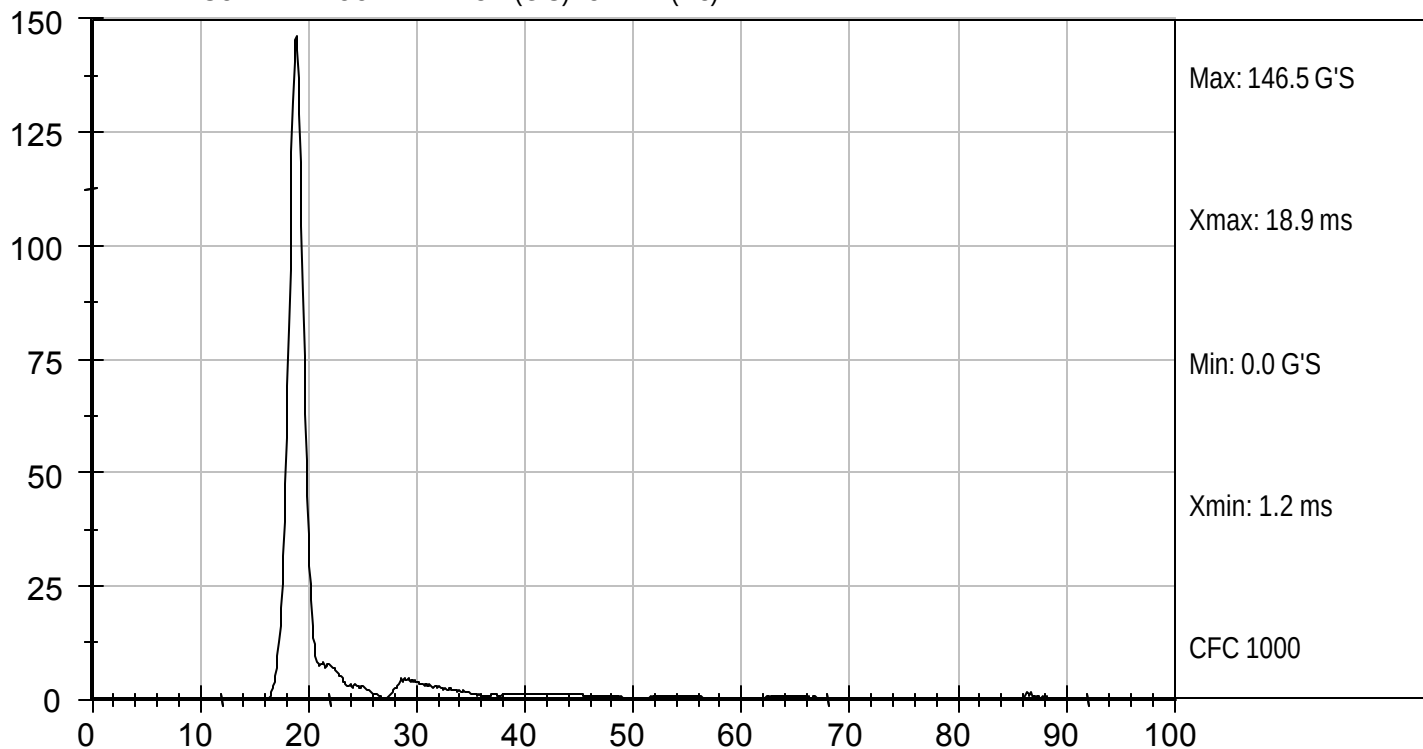

Approved By



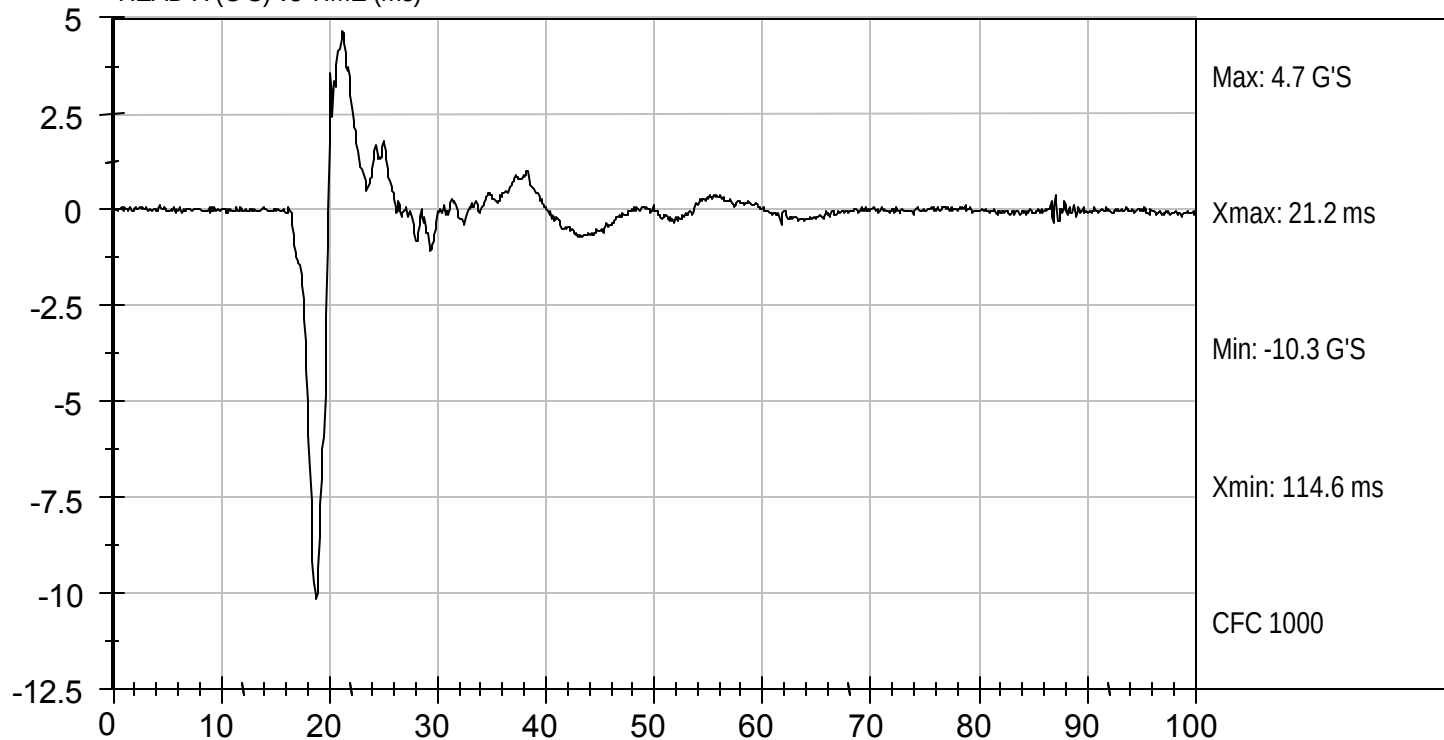
Test Desc: Head Drop
Component ID: D091371

Test Date: 6/2/09
Velocity: 0 ft/s, 0 m/s

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



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

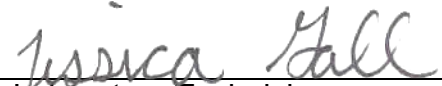


MGA RESEARCH CORPORATION
NECK PENDULUM TEST
ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091372

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	20.6	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.4	Pass
Pendulum Deceleration	1 msec	G's	0.00 to -0.05	-0.02	Pass
	3 msec	G's	-0.25 to -0.375	-0.33	Pass
	14 msec	G's	-3.20 to -3.70	-3.21	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	51.2	Pass
Time of Maximum Flexion Angle		msec	54.0 to 66.0	61.2	Pass
Head Rotation Decay Time to 0 degree		msec	53.0 to 88.0	54.9	Pass
Overall Test Results					Pass


 Laboratory Technician

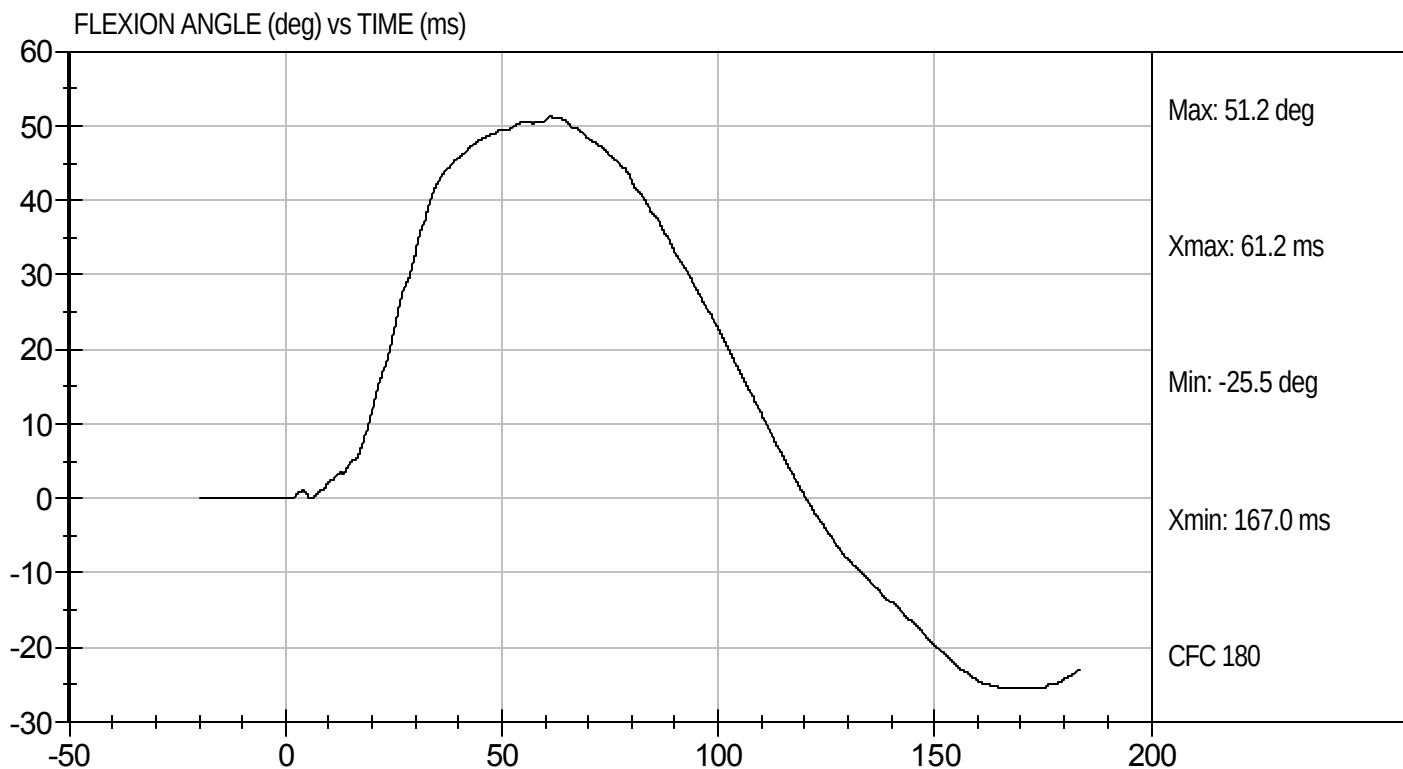
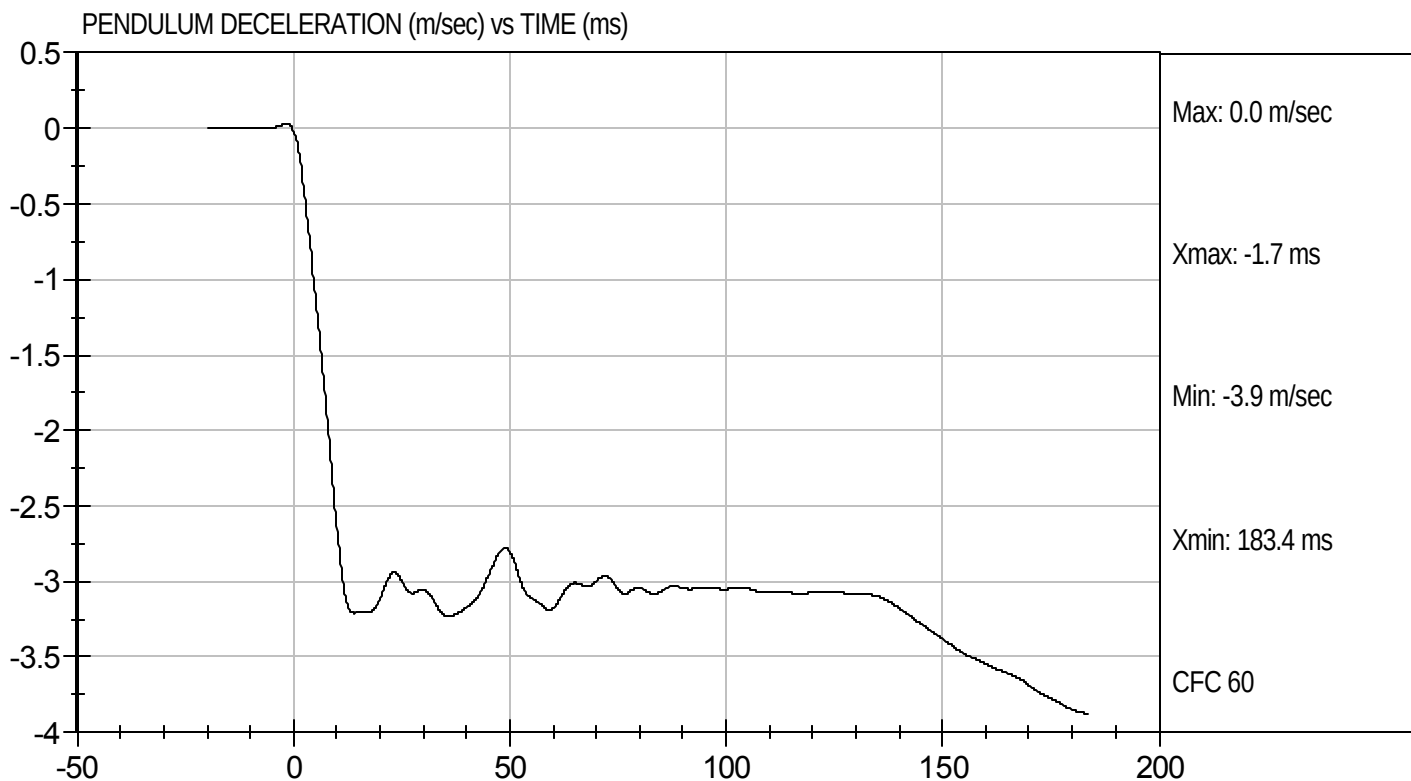
6/1/09
 Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D091372

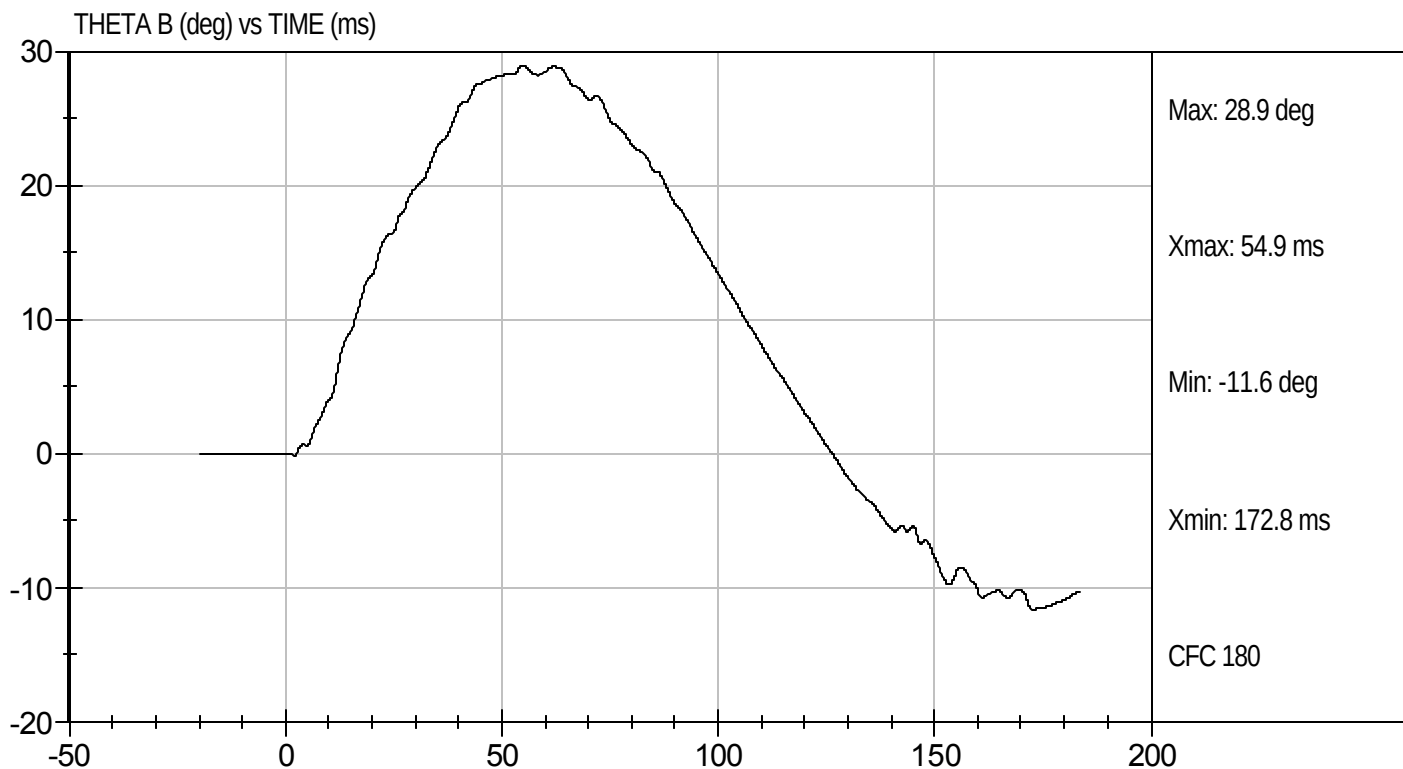
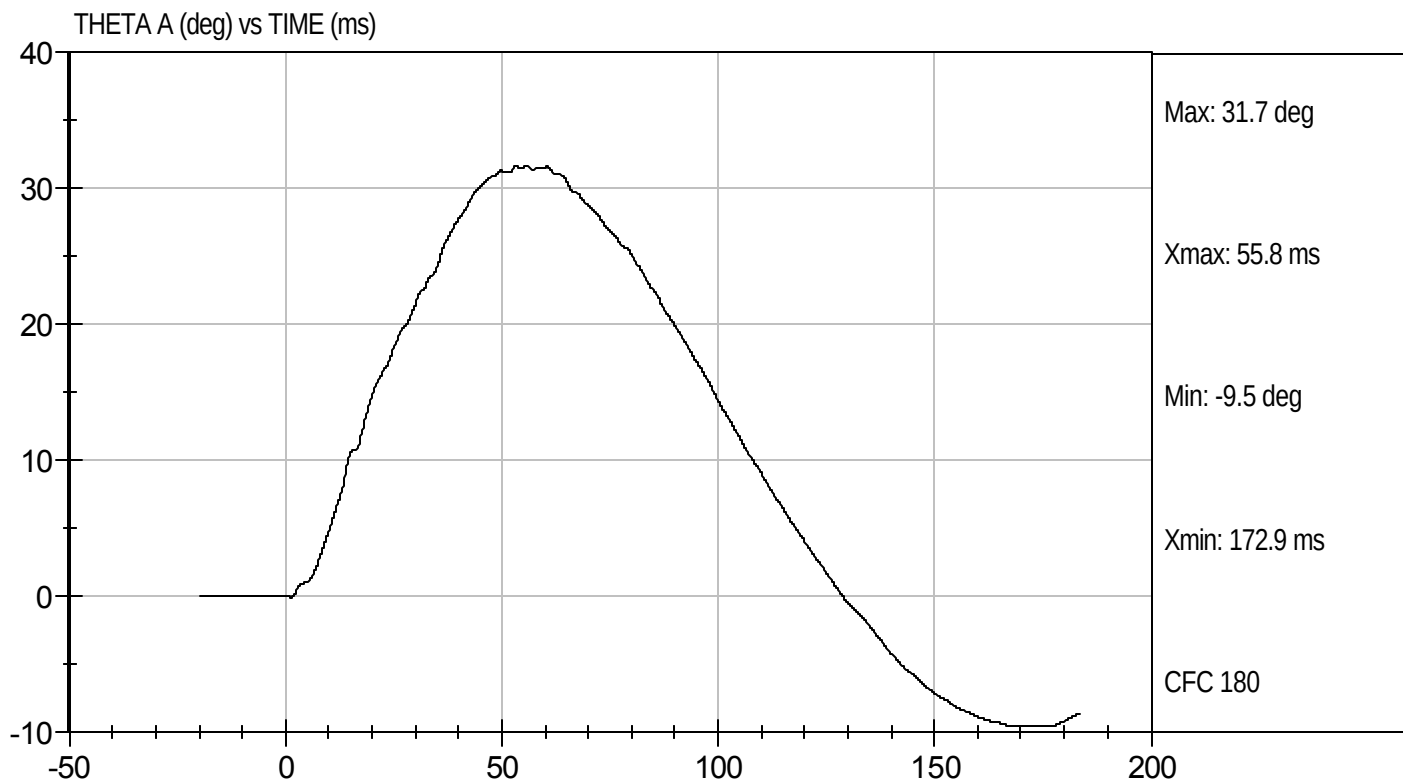
Test Date: 6/1/09
Velocity: 11.11 ft/s, 3.4 m/s





Test Desc: Neck Bending
Component ID: D091372

Test Date: 6/1/09
Velocity: 11.11 ft/s, 3.4 m/s

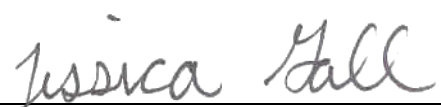


MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091373

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	48	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.2	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	10.3	Pass
Time of Peak Shoulder Acceleration	msec	NA	17.4	Pass
Overall Test Results			Pass	


Laboratory Technician

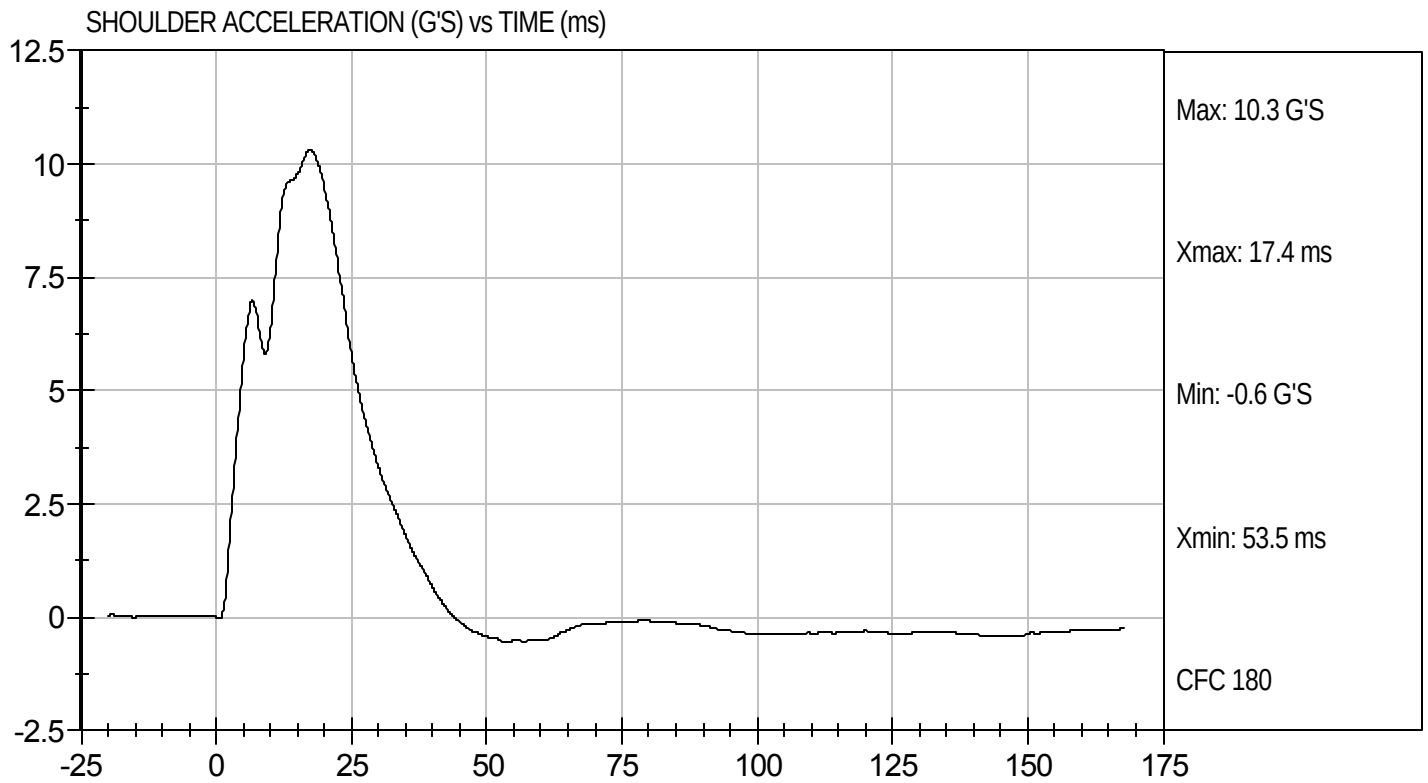
6/1/09
Test Date


Approved By



Test Desc: Shoulder Impact
Component ID: D091373

Test Date: 6/1/09
Velocity: 13.8 ft/s, 4.2 m/s



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091374

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	36.9	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.0	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

6/1/09
Test Date

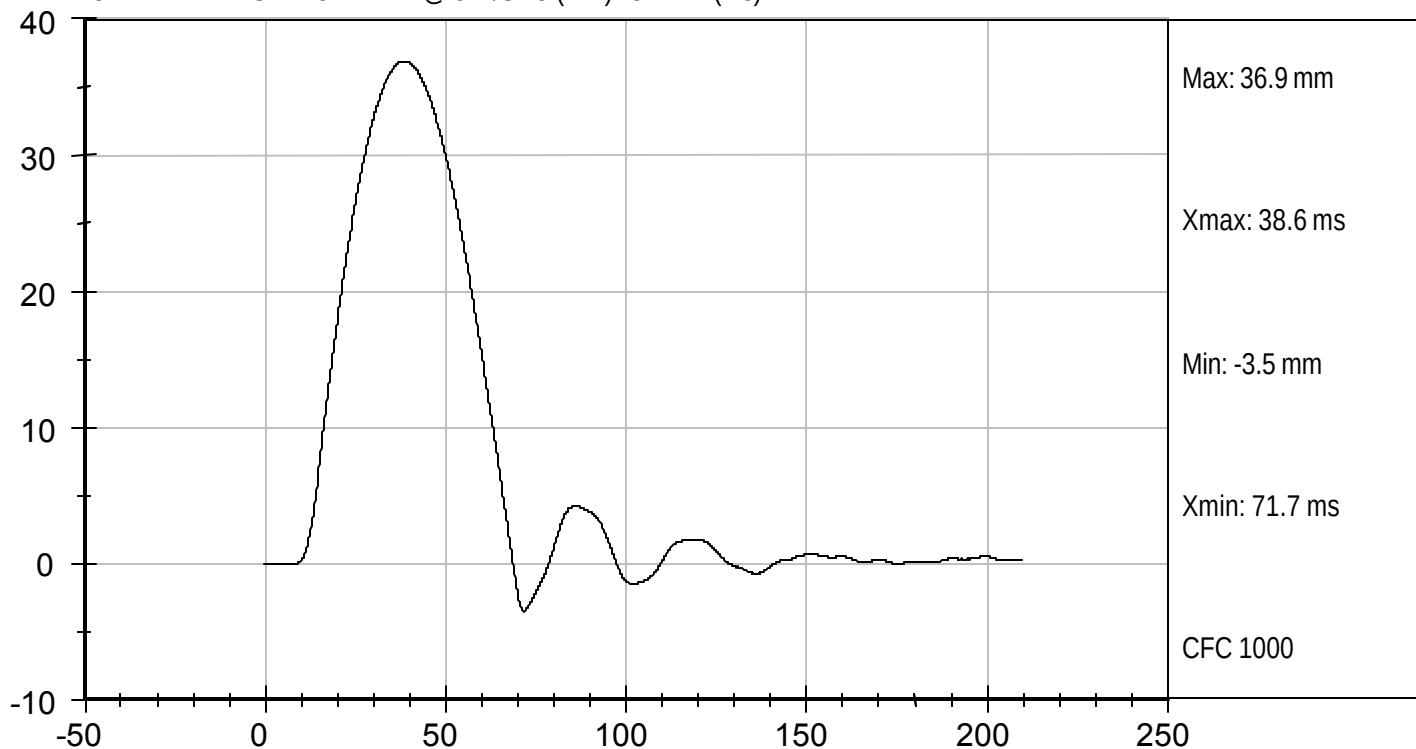
David Winkelbauer
Approved By



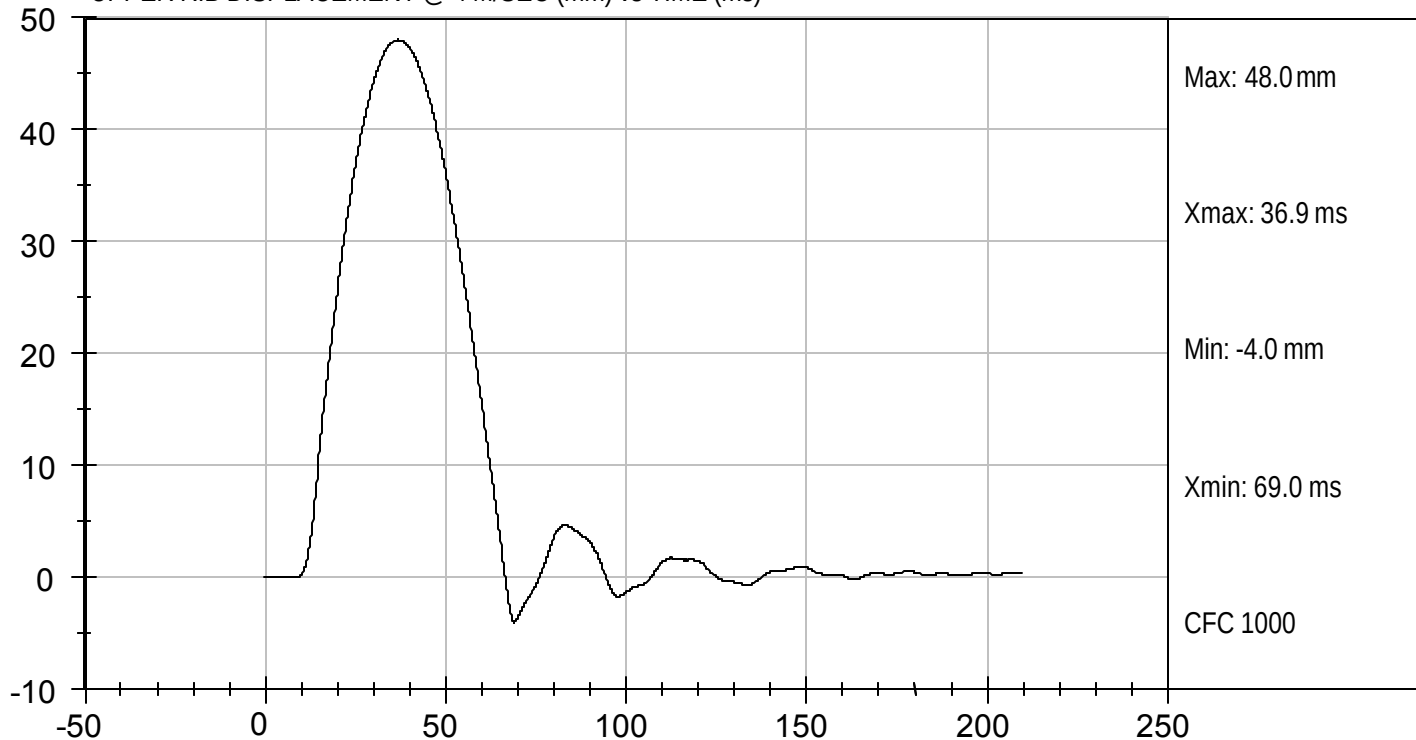
Test Desc: Rib Impact - Upper
Component ID: D091374

Test Date: 6/1/09

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



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



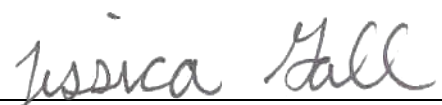
MGA RESEARCH CORPORATION

MID RIB TEST
ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091375

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	37.0	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.1	Pass
Overall Test Results				Pass


Laboratory Technician

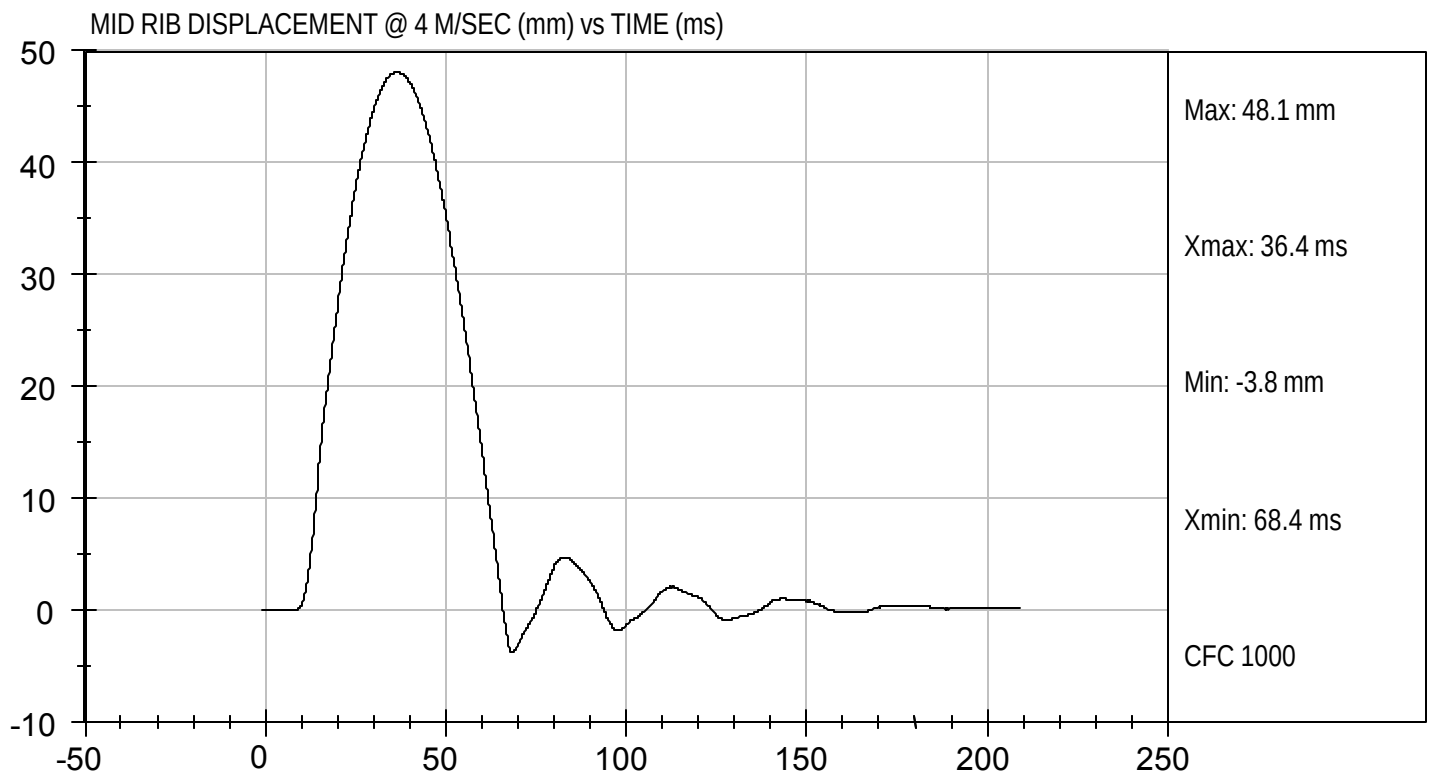
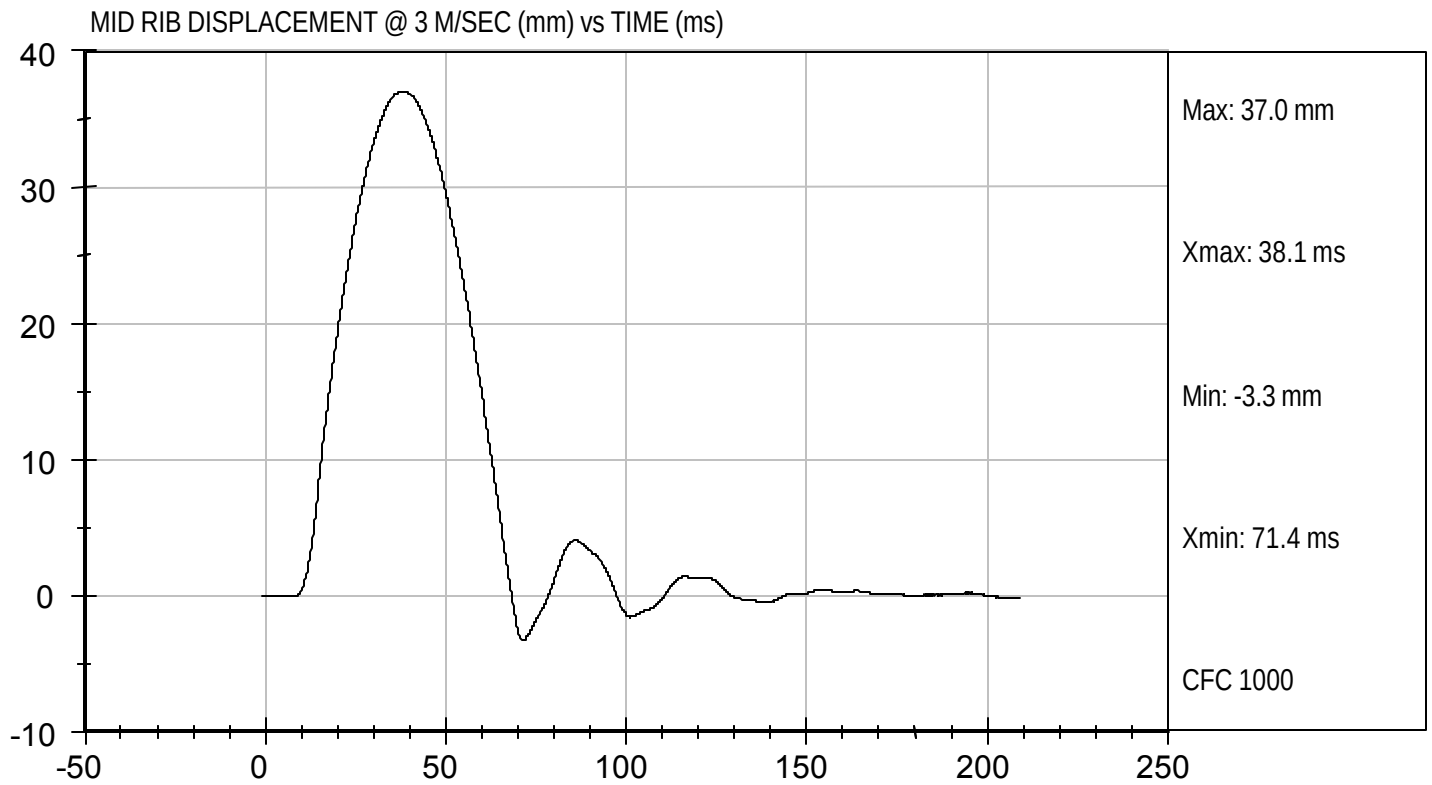
6/1/09
Test Date


Approved By



Test Desc: Rib Impact - Mid
Component ID: D091375

Test Date: 6/1/09



MGA RESEARCH CORPORATION

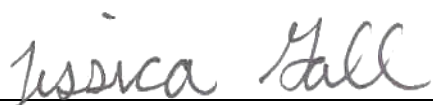
LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091376

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	36.9	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	47.7	Pass
Overall Test Results				Pass


Laboratory Technician

6/1/09
Test Date

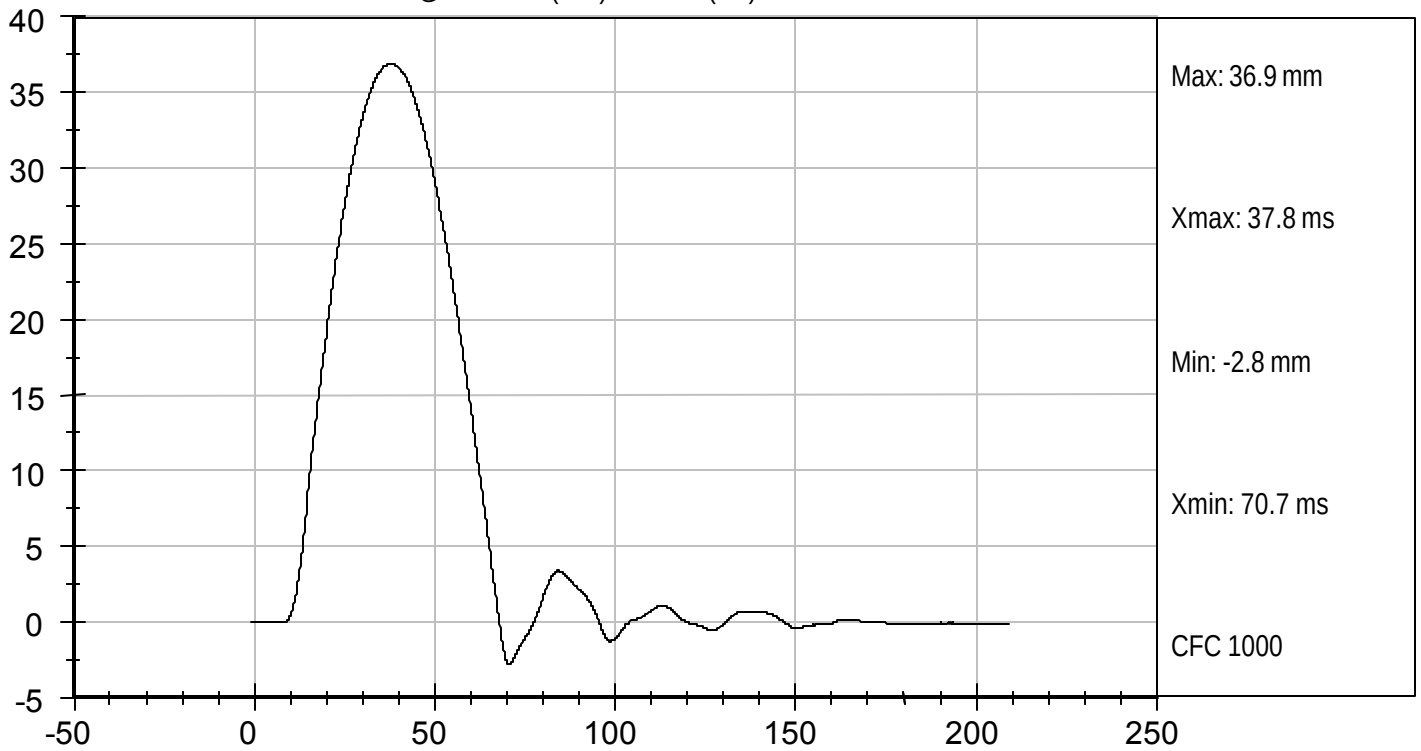

Approved By



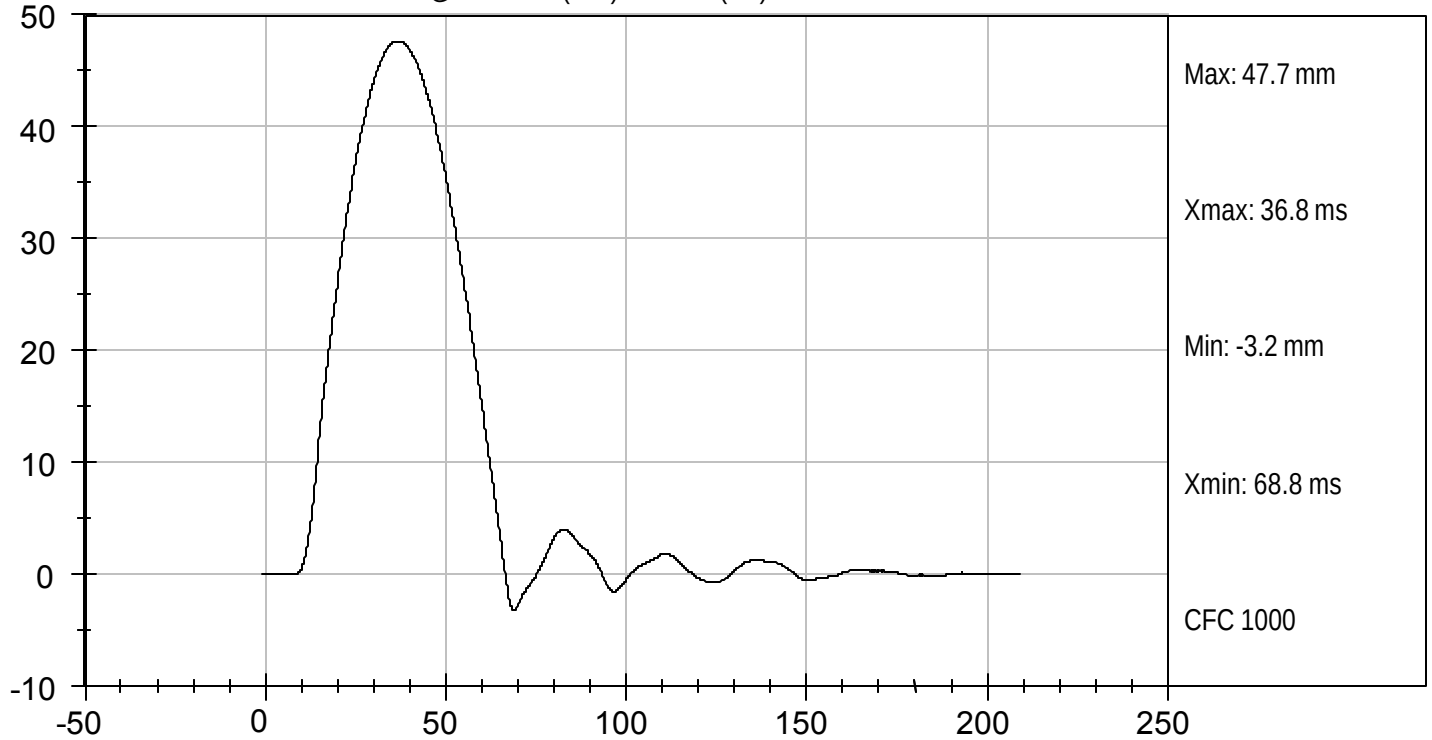
Test Desc: Rib Impact - Lower
Component ID: D091376

Test Date: 6/1/09

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



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



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091377

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/s	3.90 to 4.10	4.05	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.04	Pass
Time of Maximum Impactor Force	msec	10.60 to 13.00	11.60	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.41	Pass
Time of Maximum Abdomen Force	msec	10.00 to 12.30	11.50	Pass
Overall Test Results				Pass


Laboratory Technician

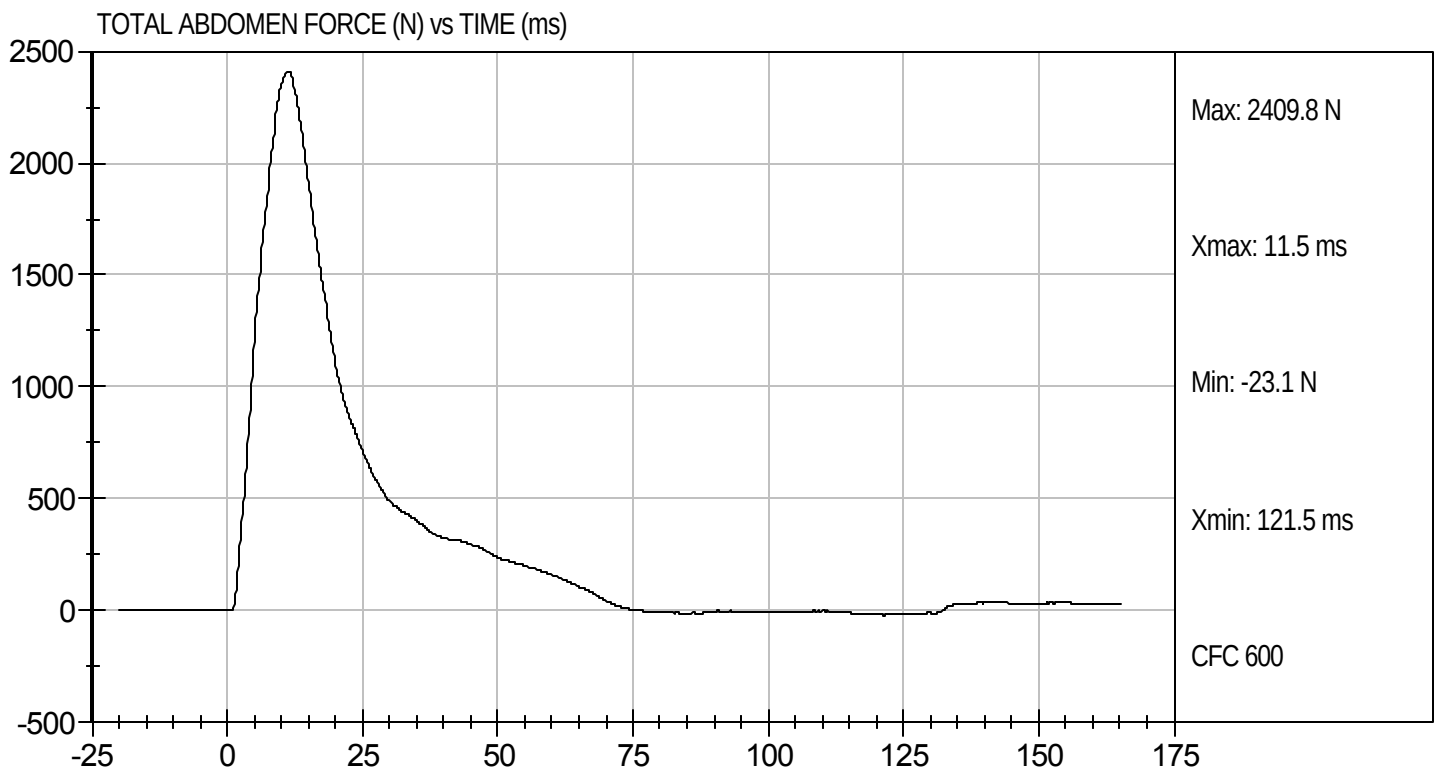
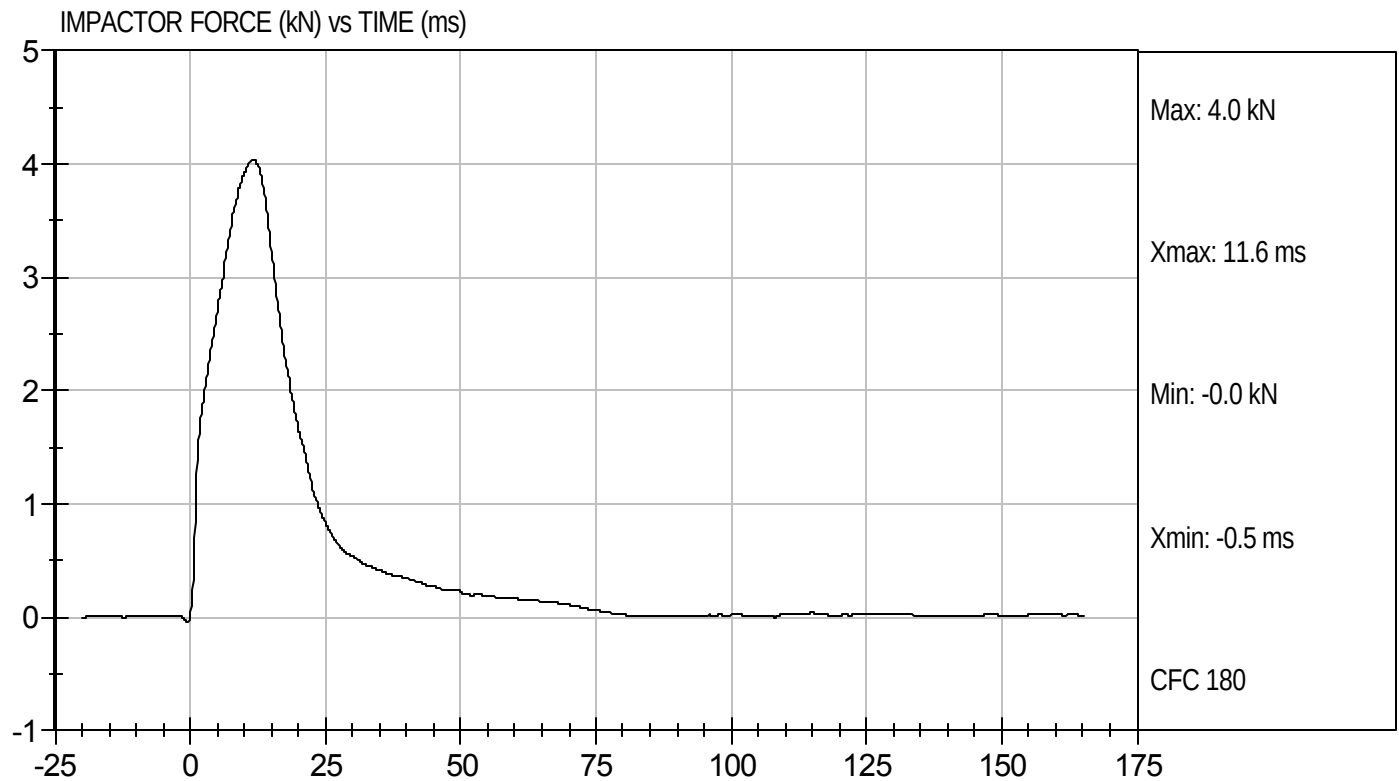
6/1/09
Test Date


Approved By



Test Desc: Abdomen Impact
Component ID: D091377

Test Date: 6/1/09
Velocity: 13.3 ft/s, 4.05 m/s



MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091378

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	47	Pass
Pendulum Speed		m/sec	5.95 to 6.15	6.13	Pass
Pendulum Deceleration	1 msec	m/sec	-0.05 to 0.00	-0.02	Pass
	3.7 msec	m/sec	-0.425 to -0.24	-0.42	Pass
	27 msec	m/sec	-6.50 to -5.80	-5.93	Pass
	30 msec	m/sec	>= -6.5	-6.13	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	48.4	Pass
Time of Maximum Flexion Angle		msec	39.0 to 53.0	44.3	Pass
Headform Rotation Decay to Initial Position		msec	37 to 57	44.8	Pass
Overall Results				Pass	


 Laboratory Technician

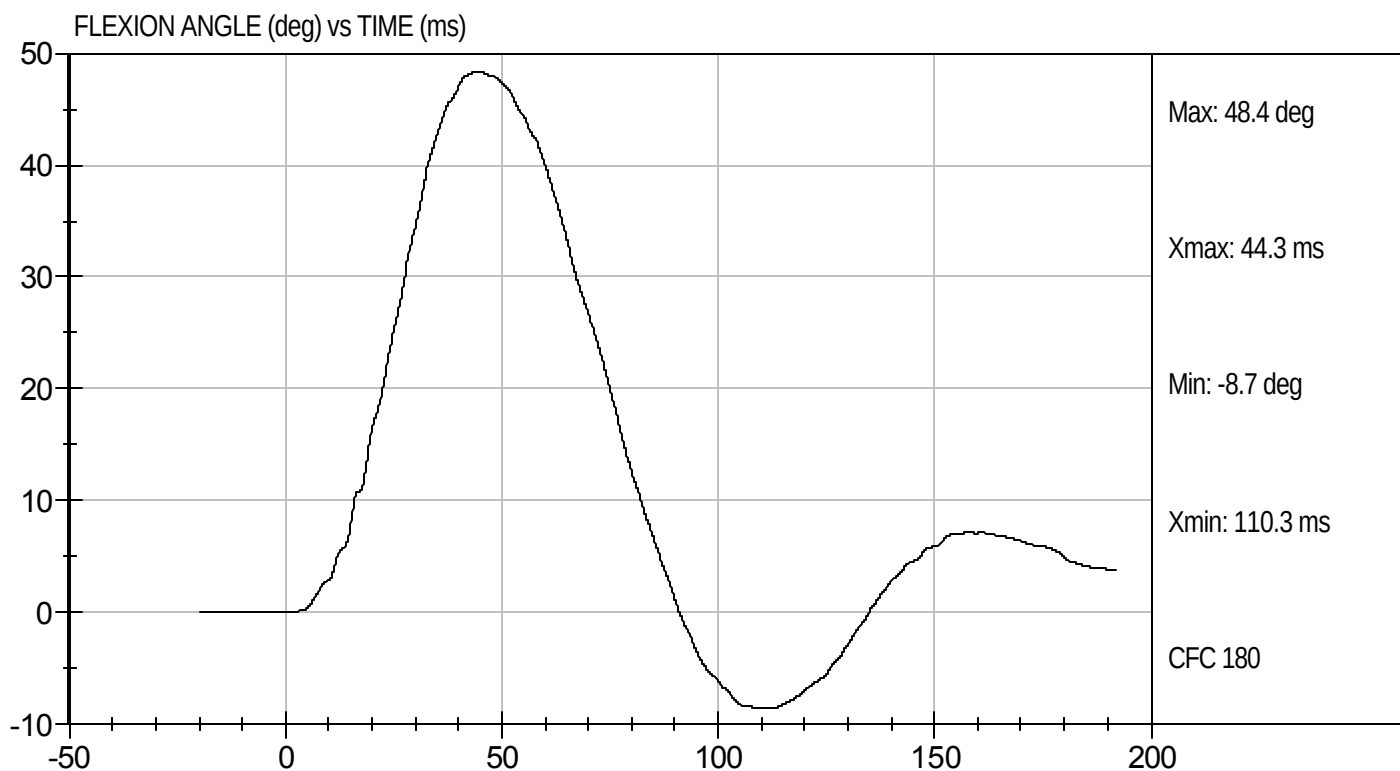
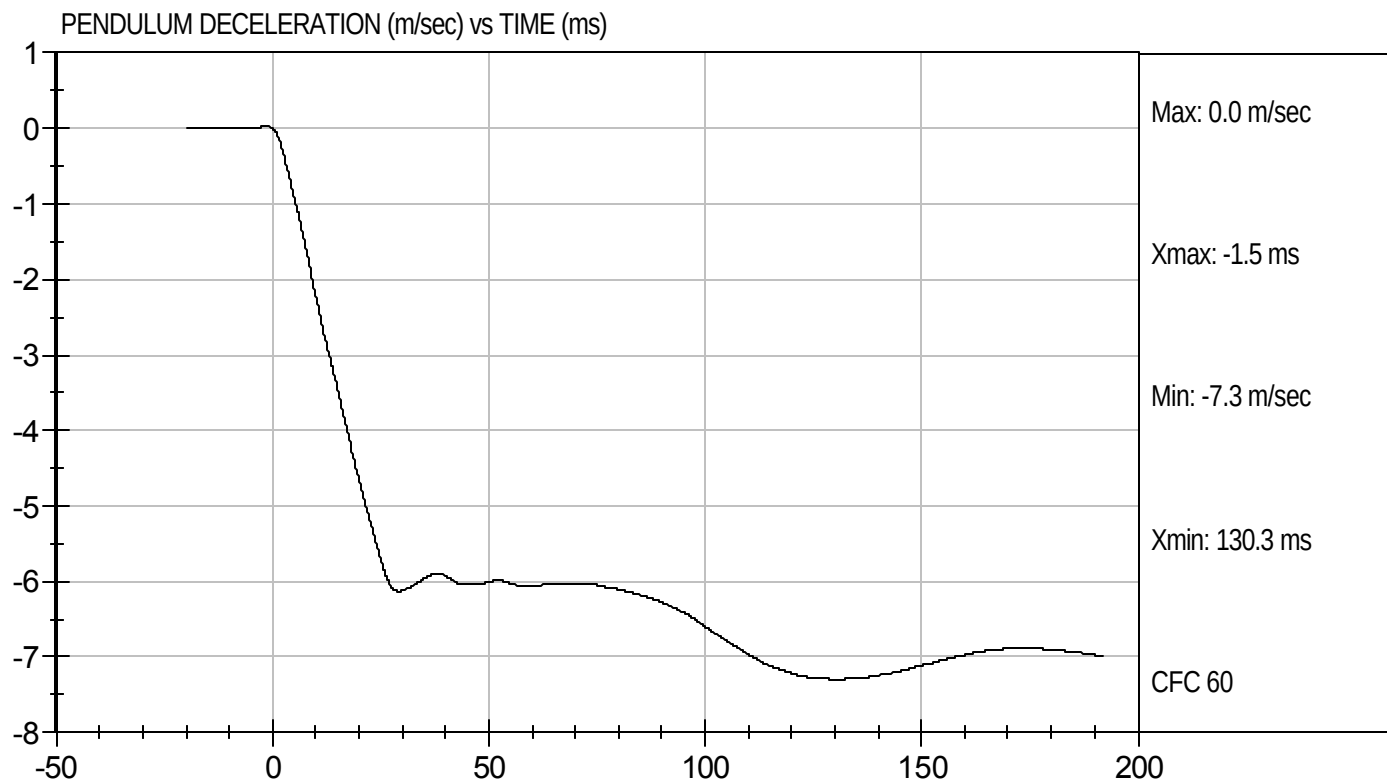
6/2/09
 Test Date


 Approved By



Test Desc: Lumbar Bending
Component ID: D091378

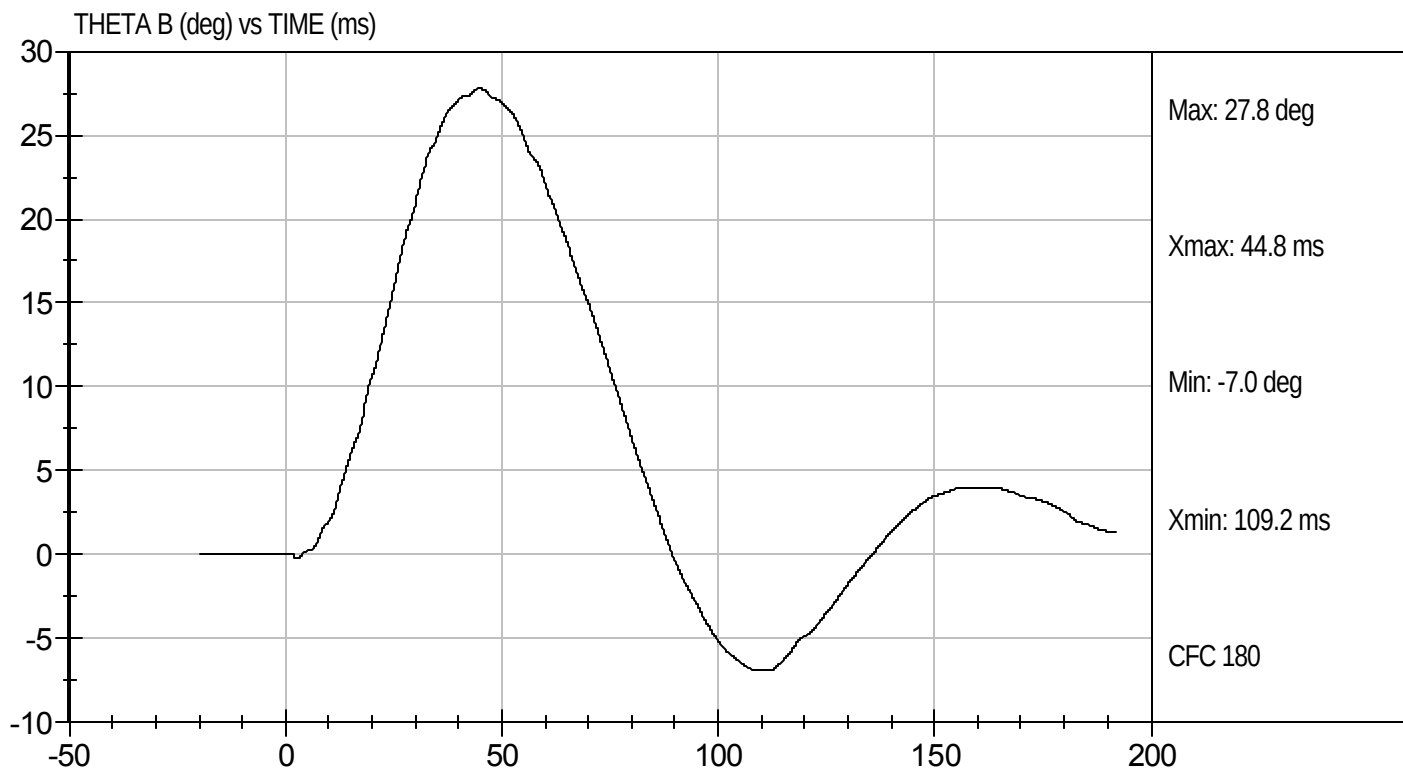
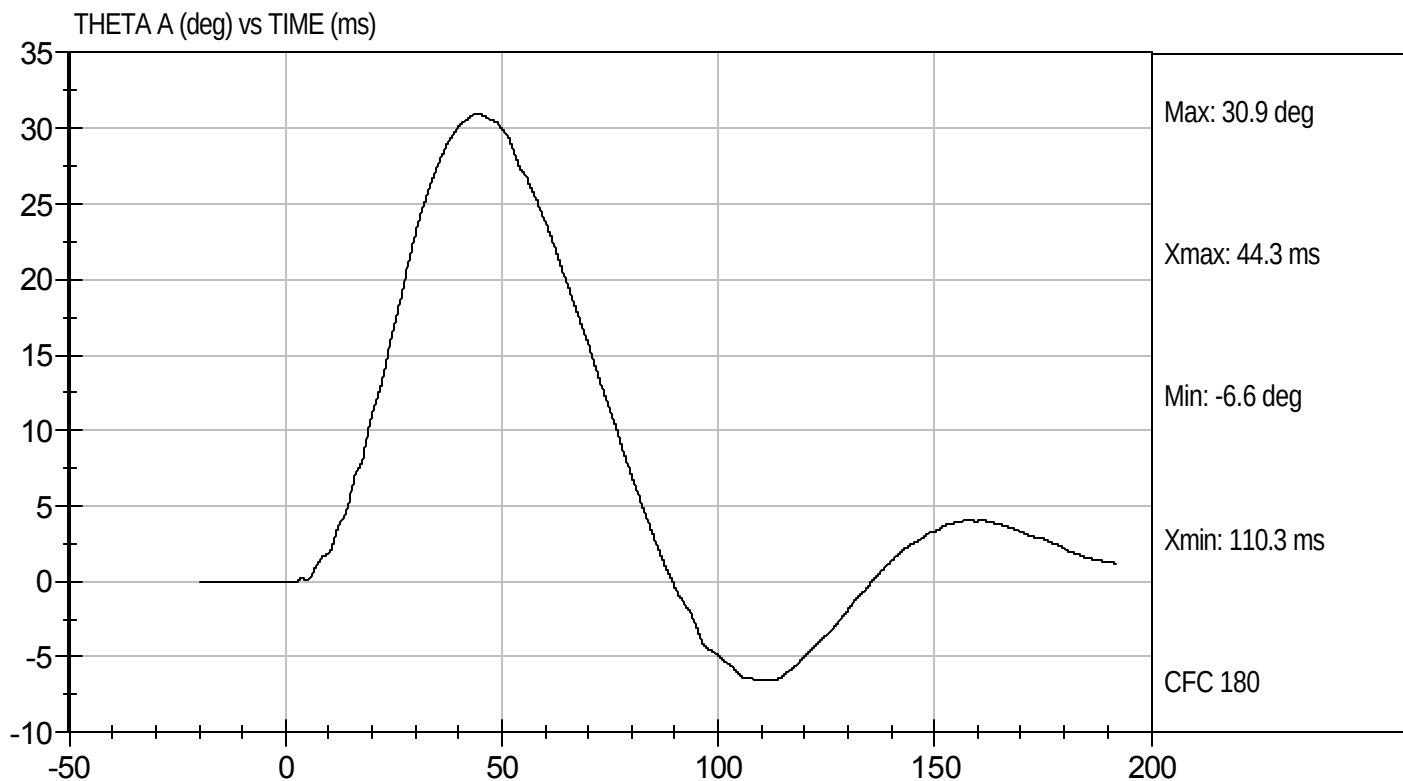
Test Date: 6/2/09
Velocity: 20.1 ft/s, 6.13 m/s





Test Desc: Lumbar Bending
Component ID: D091378

Test Date: 6/2/09
Velocity: 20.1 ft/s, 6.13 m/s



MGA RESEARCH CORPORATION

**PELVIS TEST
ES-2re DUMMY**

ATD Serial No: 032

Test I.D: D091379

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/s	4.20 to 4.40	4.30	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.74	Pass
Time of Maximum Impactor Force	msec	11.80 to 16.10	13.20	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.40	Pass
Time of Maximum Pubic Force	msec	12.20 to 17.00	14.00	Pass
Overall Test Results				Pass


Laboratory Technician

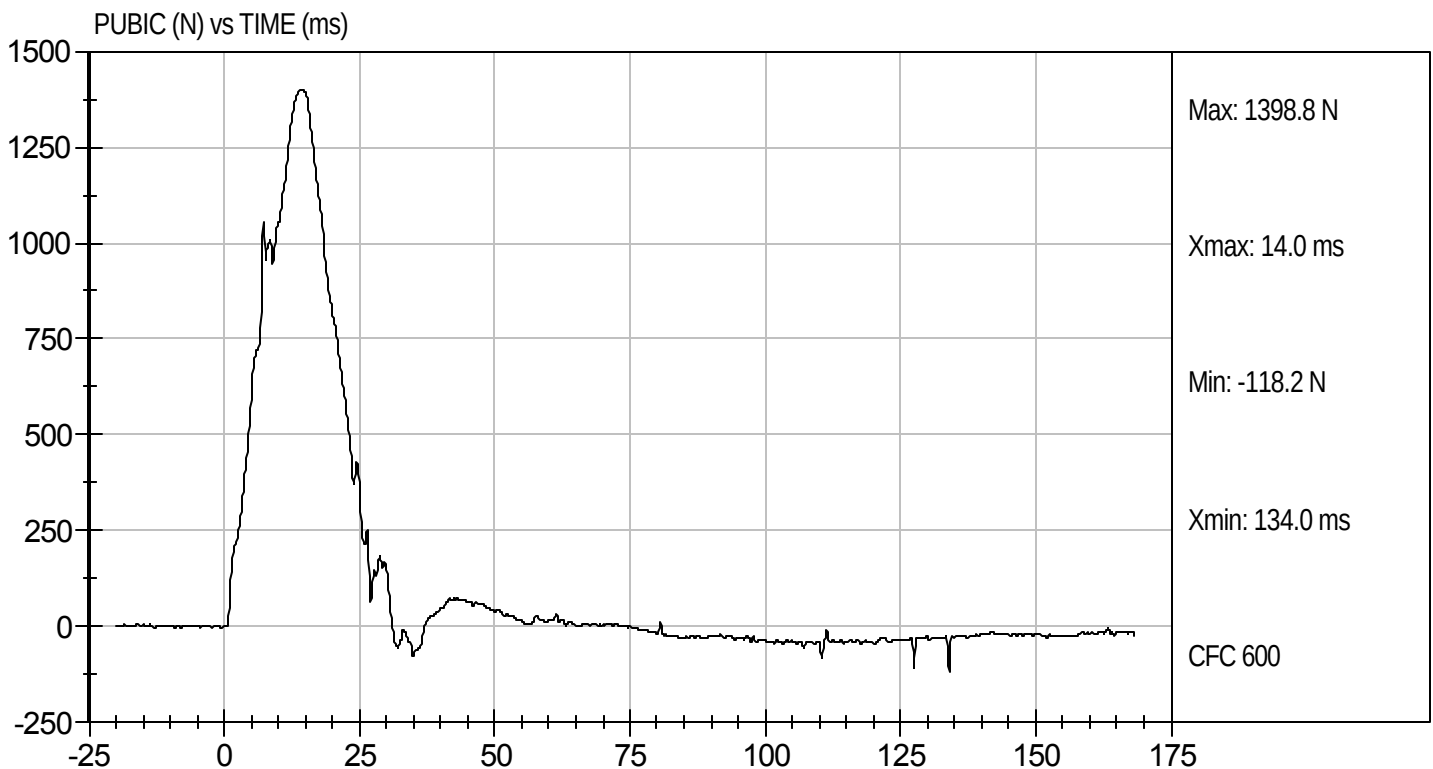
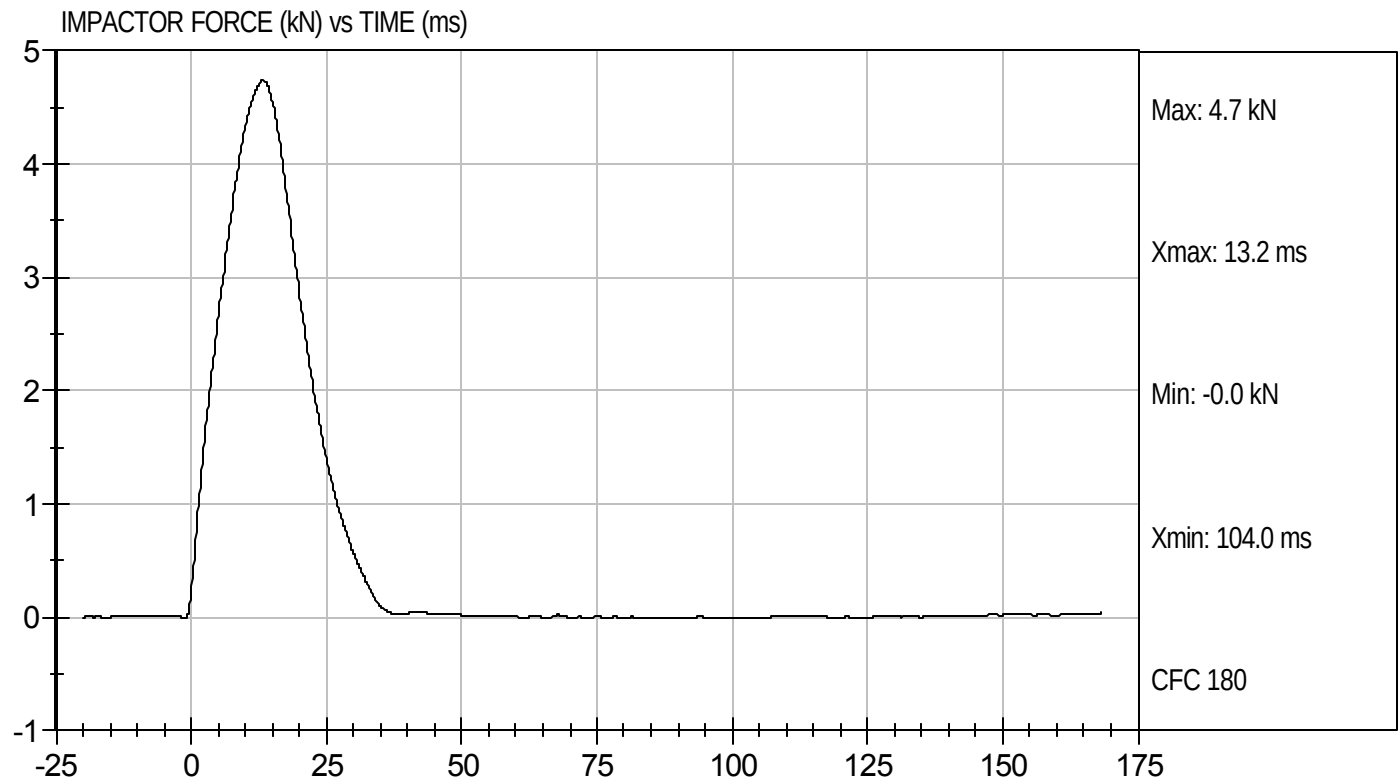
6/1/09
Test Date


Approved By



Test Desc: Pelvis Impact
Component ID: D091379

Test Date: 6/1/09
Velocity: 14.1 ft/s, 5.52 m/s

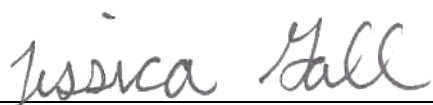


MGA RESEARCH CORPORATION
FULL BODY THORAX IMPACT TEST
ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091370

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Humidity	%	10 to 70	48	Pass
Probe Speed	m/s	5.40 to 5.60	5.52	Pass
Maximum Impactor Force (after 6 ms)	kN	5.17 to 6.12	5.24	Pass
Upper Rib Displacement	mm	33.2 to 41.3	36.7	Pass
Middle Rib Displacement	mm	37.1 to 45.4	39.8	Pass
Lower Rib Displacement	mm	35.6 to 43.0	38.9	Pass
			Overall Test Results	Pass


Laboratory Technician

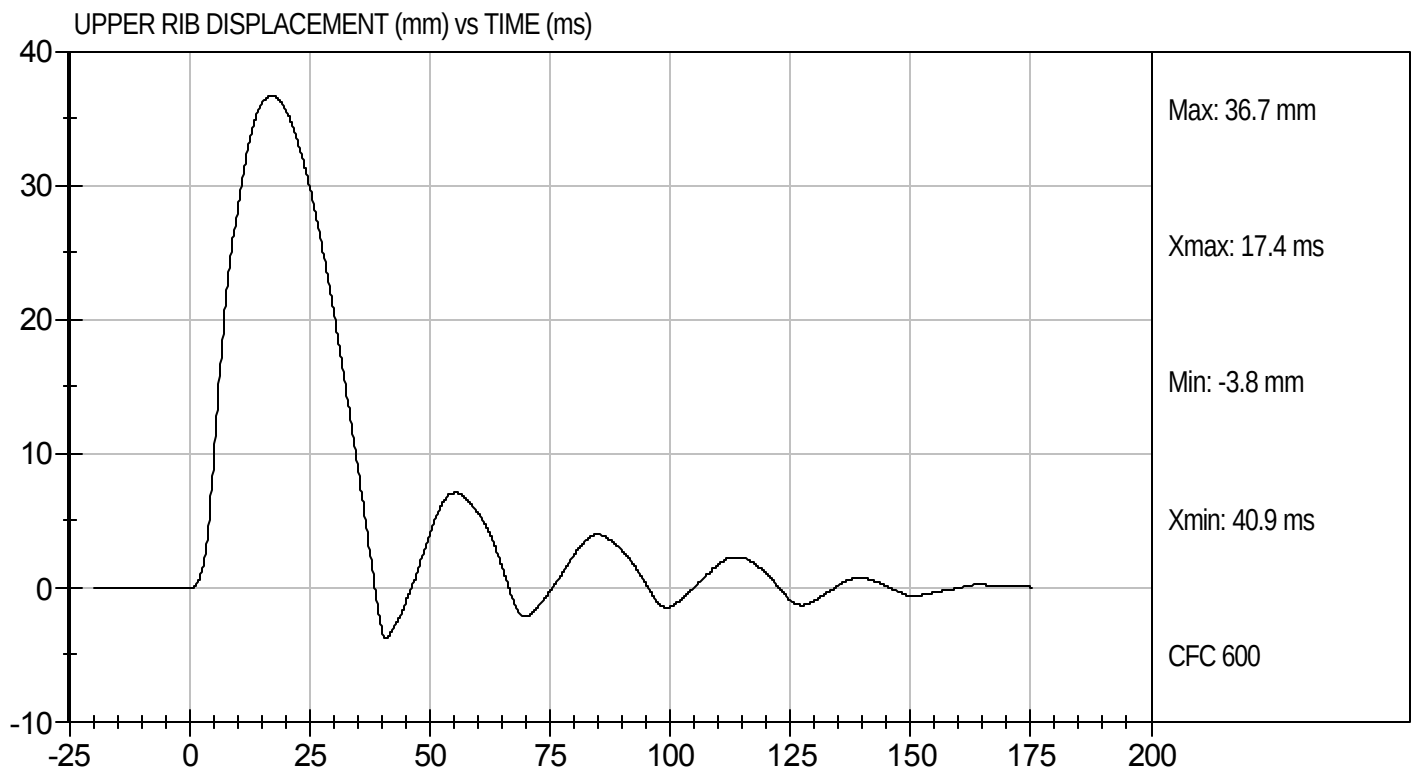
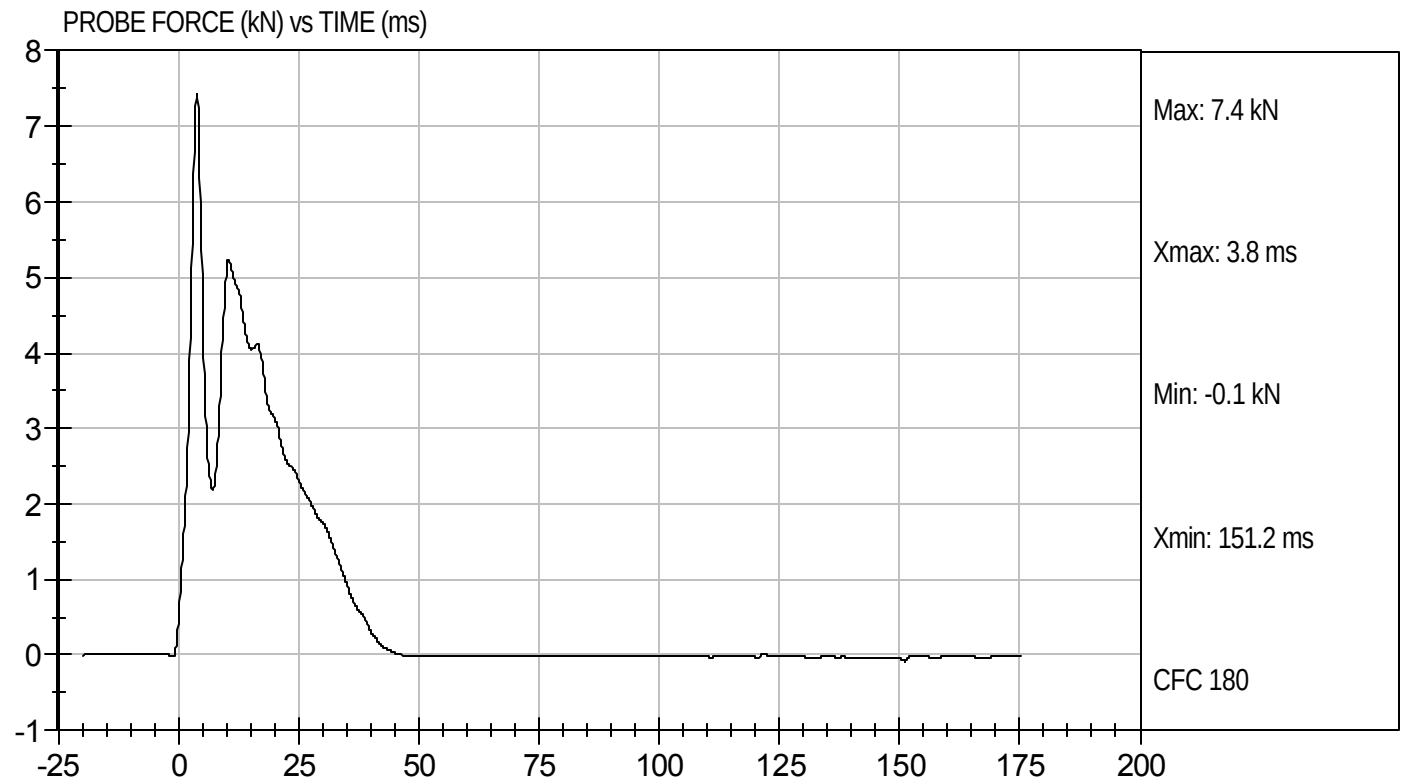
6/1/09
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D091370

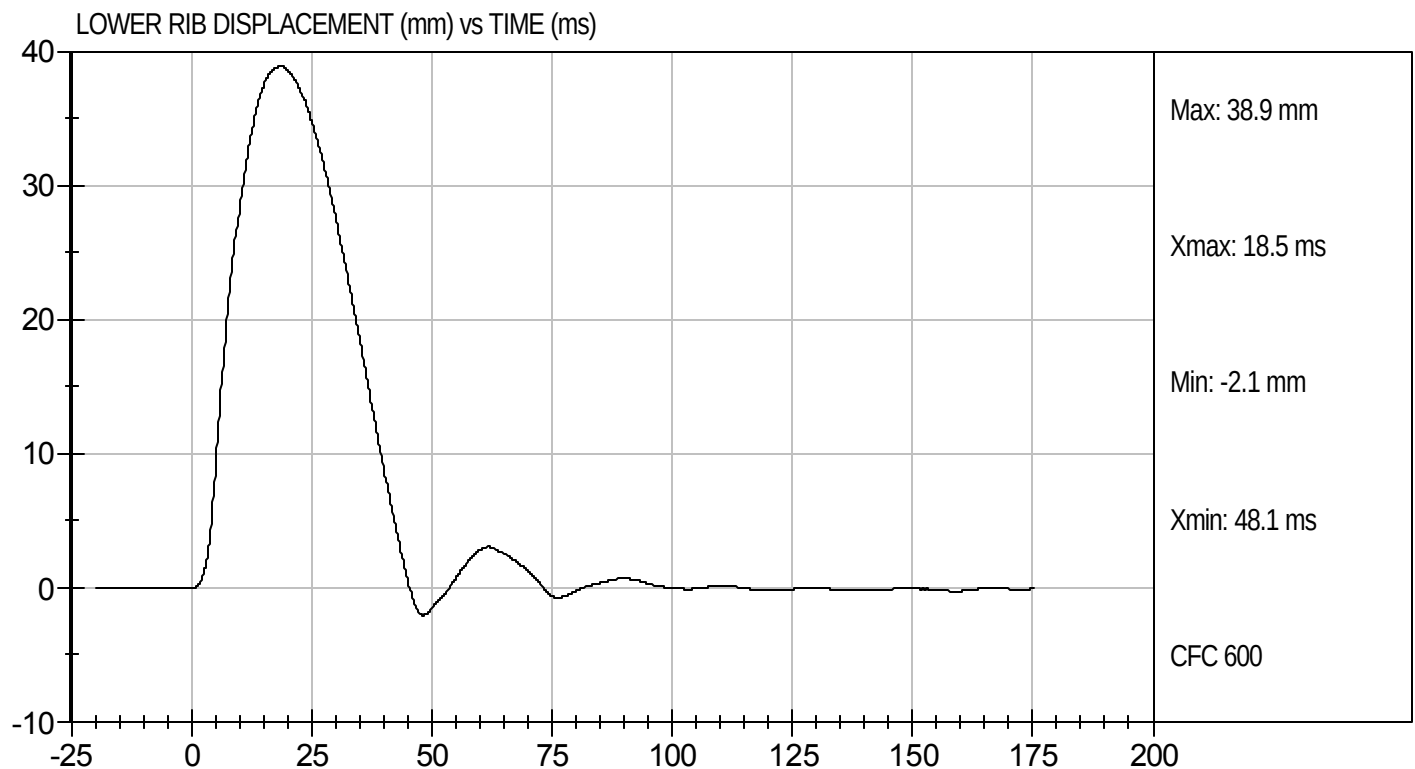
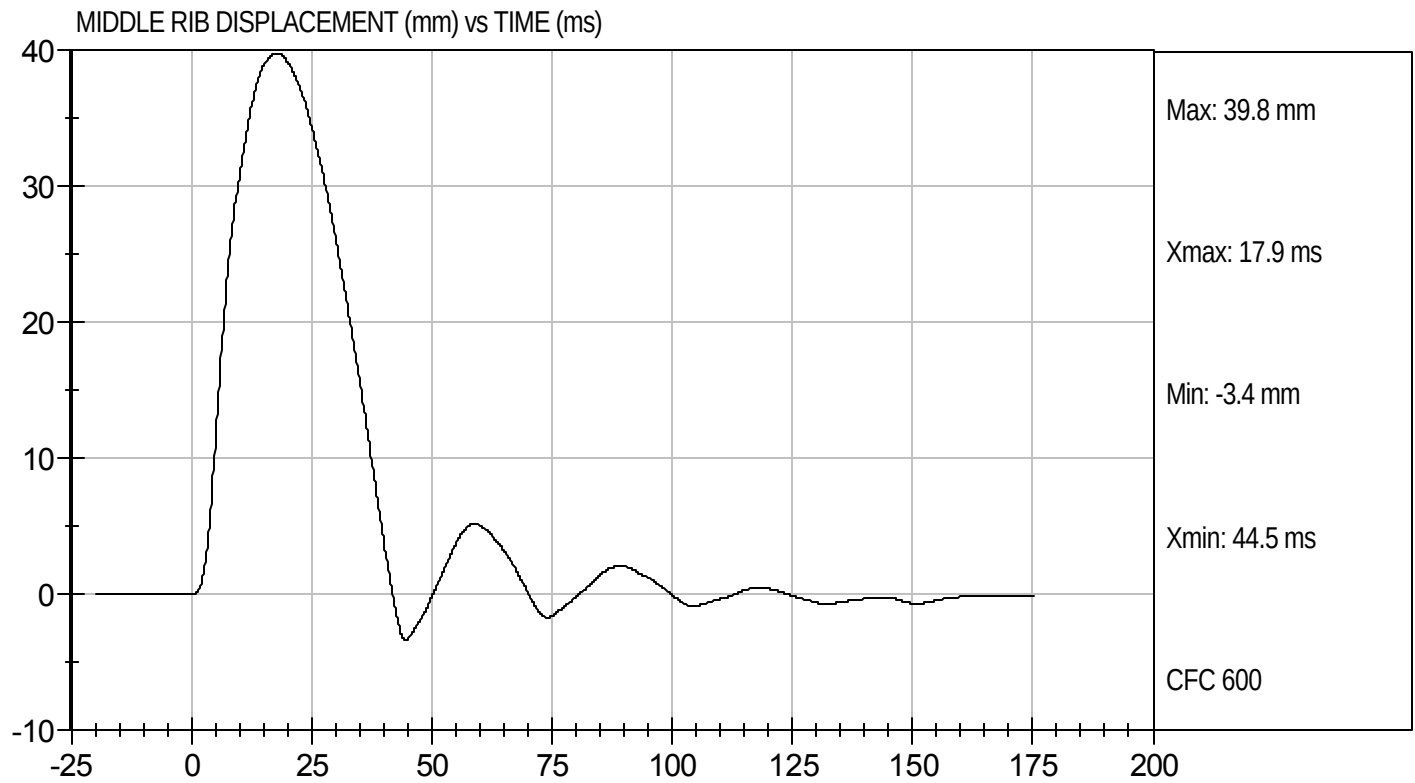
Test Date: 6/1/09
Velocity: 18.1 ft/s, 5.52 m/s





Test Desc: Thorax Impact
Component ID: D091370

Test Date: 6/1/09
Velocity: 18.1 ft/s, 5.52 m/s



MGA RESEARCH CORPORATION
HEAD DROP TEST
ES-2re DUMMY

ATD Serial No: 032

Test ID: D091451

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Peak Resultant Acceleration	G's	125 to 155	146	Pass
Peak Lateral Acceleration	G's	+/- 15	-12.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

6/10/09
Test Date

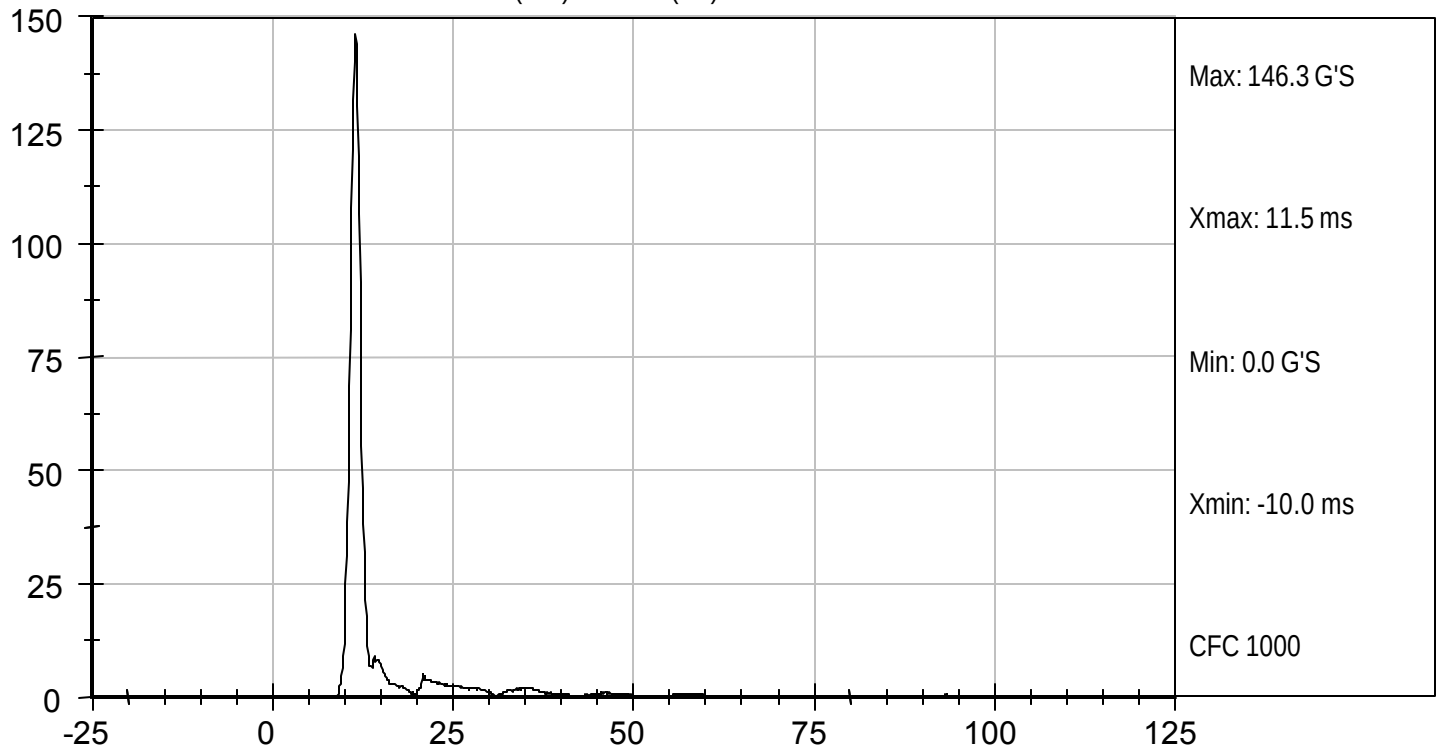

Approved By



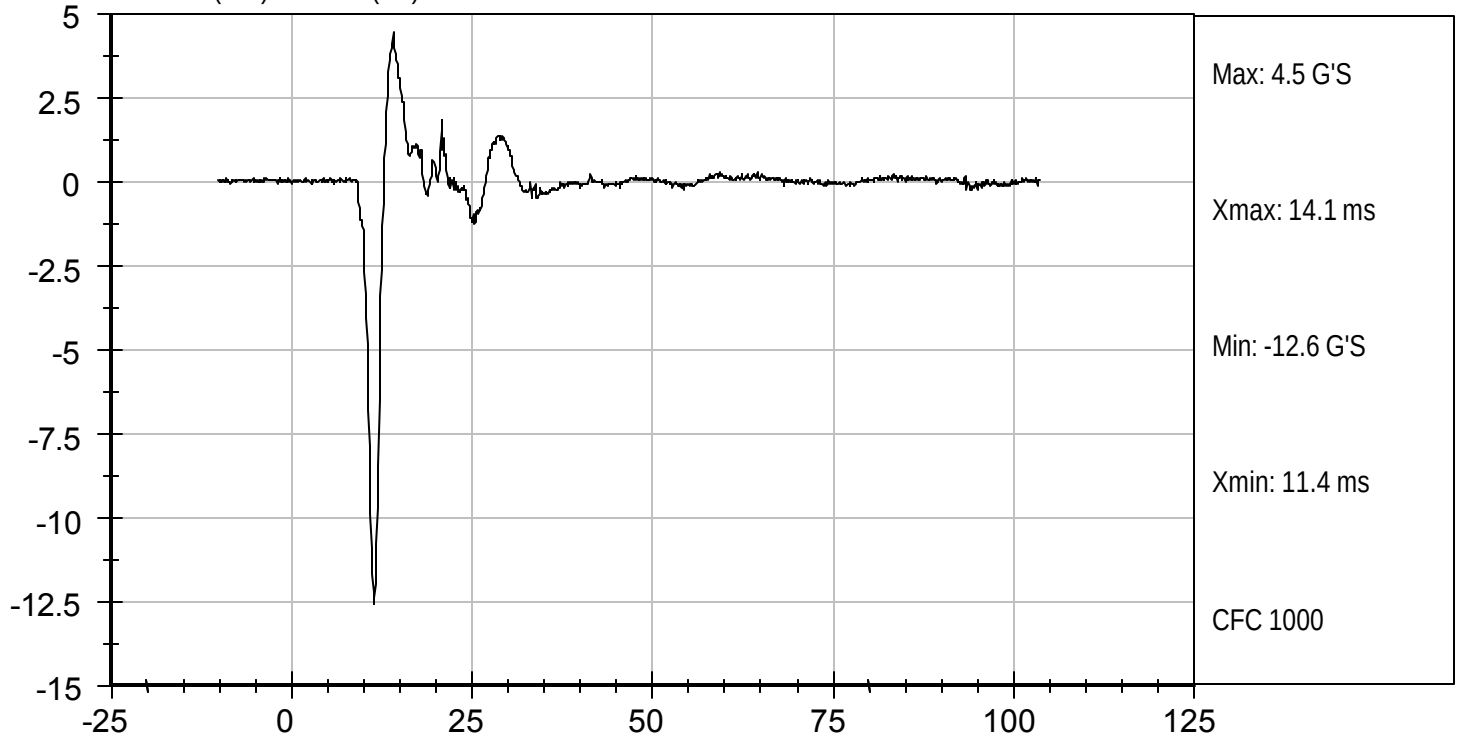
Test Desc: Head Drop
Component ID: D091451

Test Date: 6/10/09
Velocity: 0 ft/s, 0 m/s

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



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



MGA RESEARCH CORPORATION
NECK PENDULUM TEST
ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091452

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	40	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.5	Pass
Pendulum Deceleration	1 msec	G's	0.00 to -0.05	-0.02	Pass
	3 msec	G's	-0.25 to -0.375	-0.31	Pass
	14 msec	G's	-3.20 to -3.70	-3.34	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	52.3	Pass
Time of Maximum Flexion Angle		msec	54.0 to 66.0	58.0	Pass
Head Rotation Decay Time to 0 degree		msec	53.0 to 88.0	64.8	Pass
Overall Test Results				Pass	


 Laboratory Technician

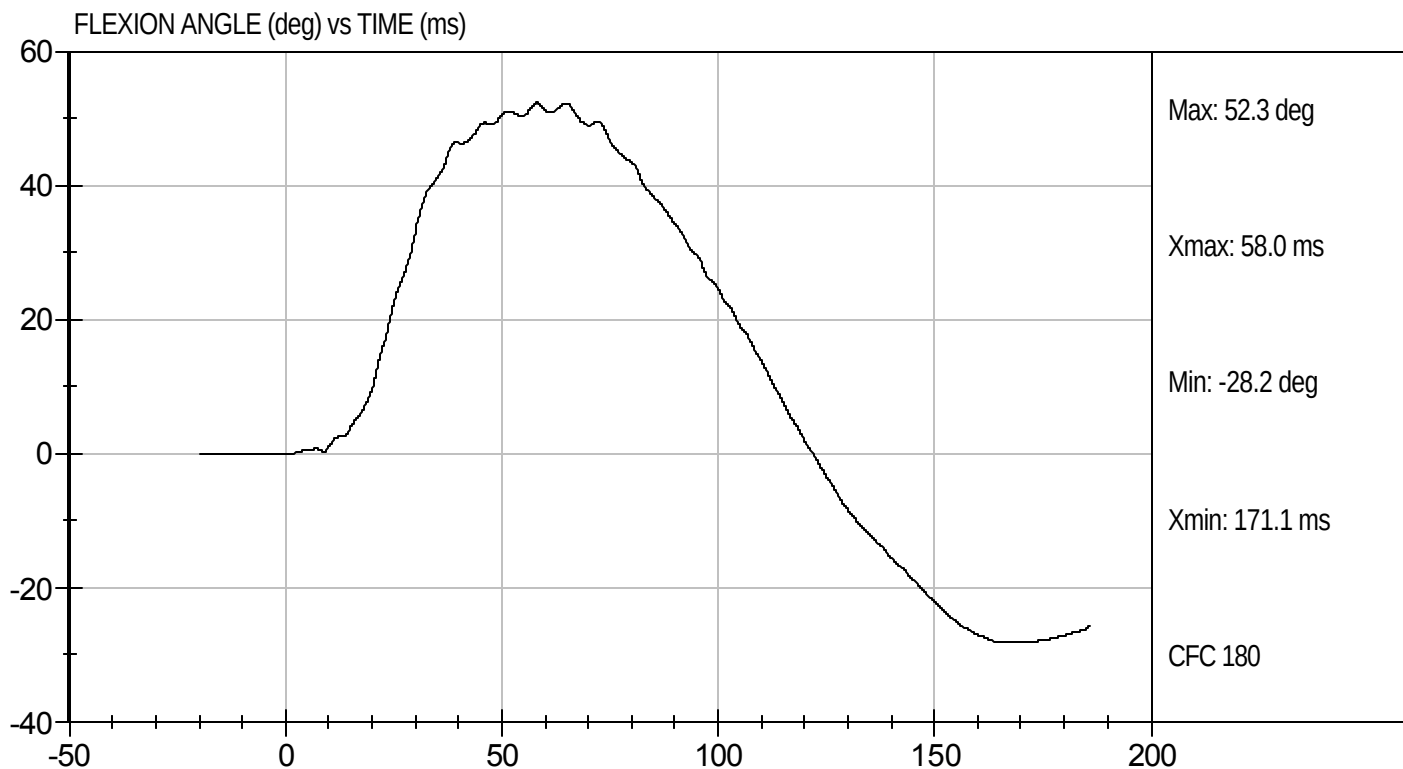
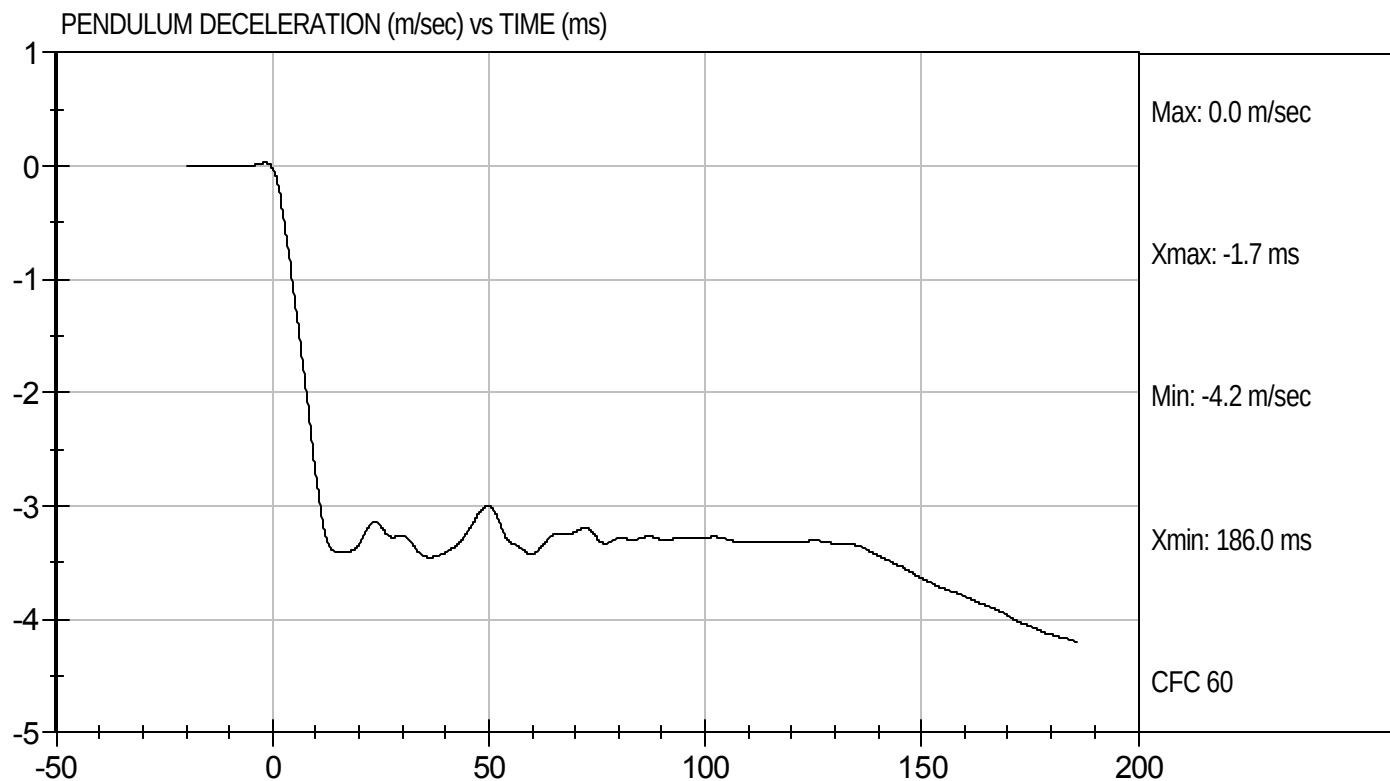
6/10/09
 Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D091452

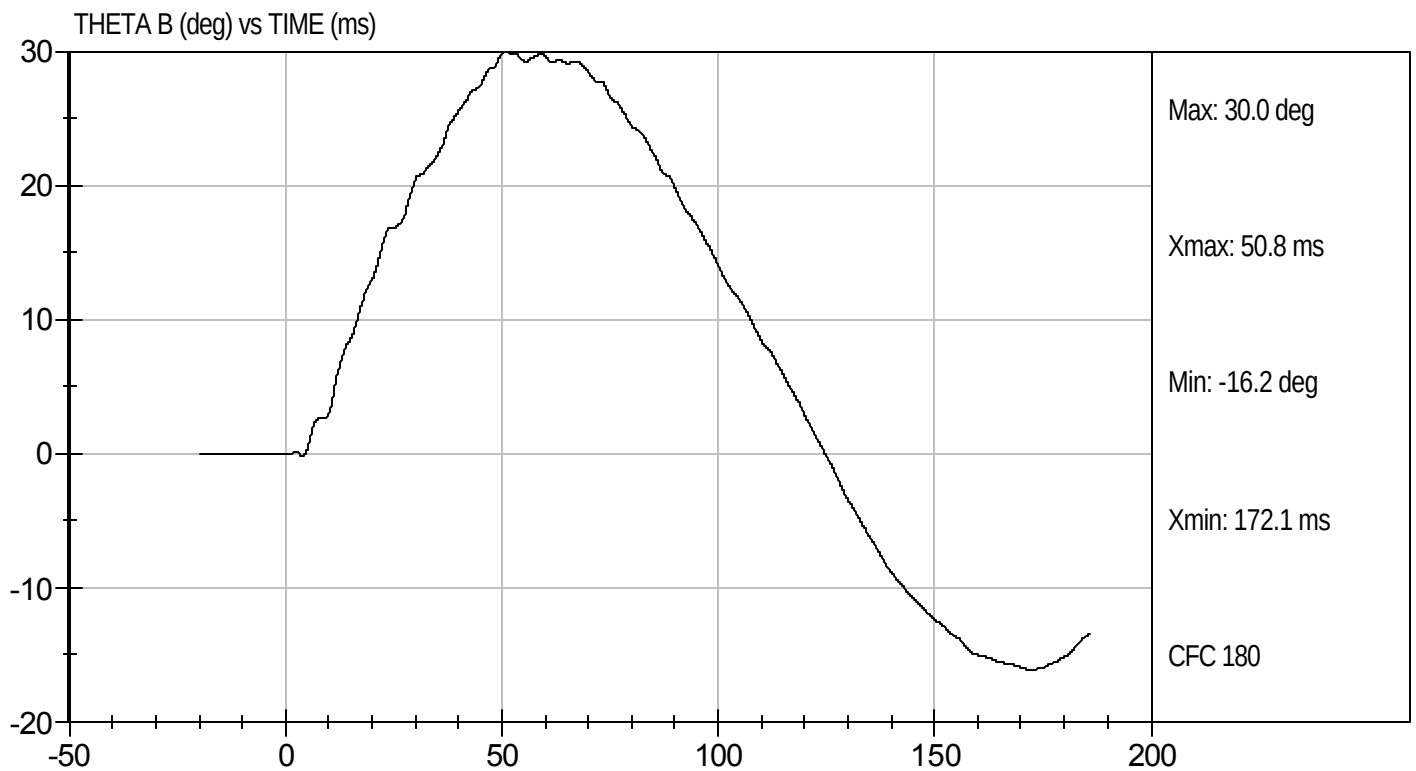
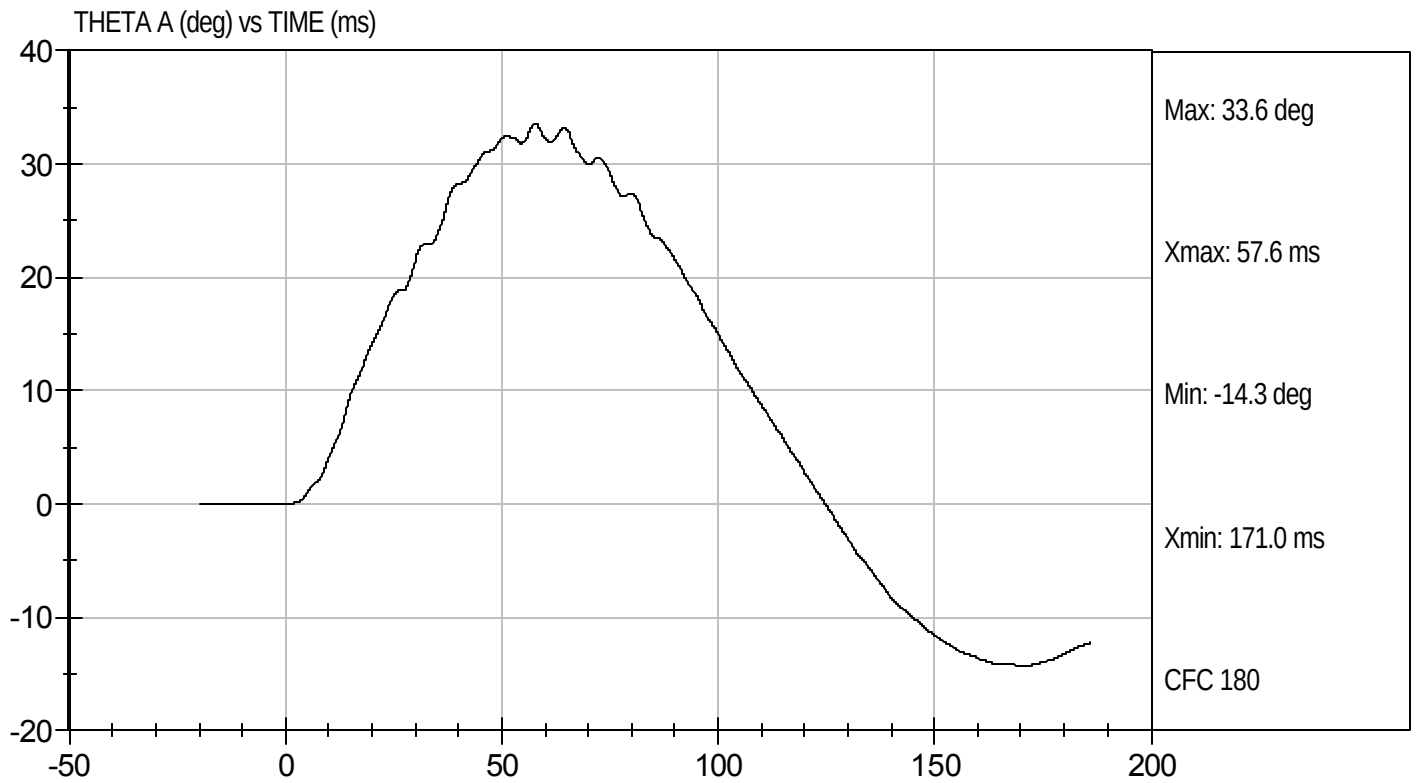
Test Date: 6/10/09
Velocity: 11.41 ft/s, 3.5 m/s





Test Desc: Neck Bending
Component ID: D091452

Test Date: 6/10/09
Velocity: 11.41 ft/s, 3.5 m/s



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091453

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.2	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	10.1	Pass
Time of Peak Shoulder Acceleration	msec	NA	17.8	Pass
Overall Test Results			Pass	


Laboratory Technician

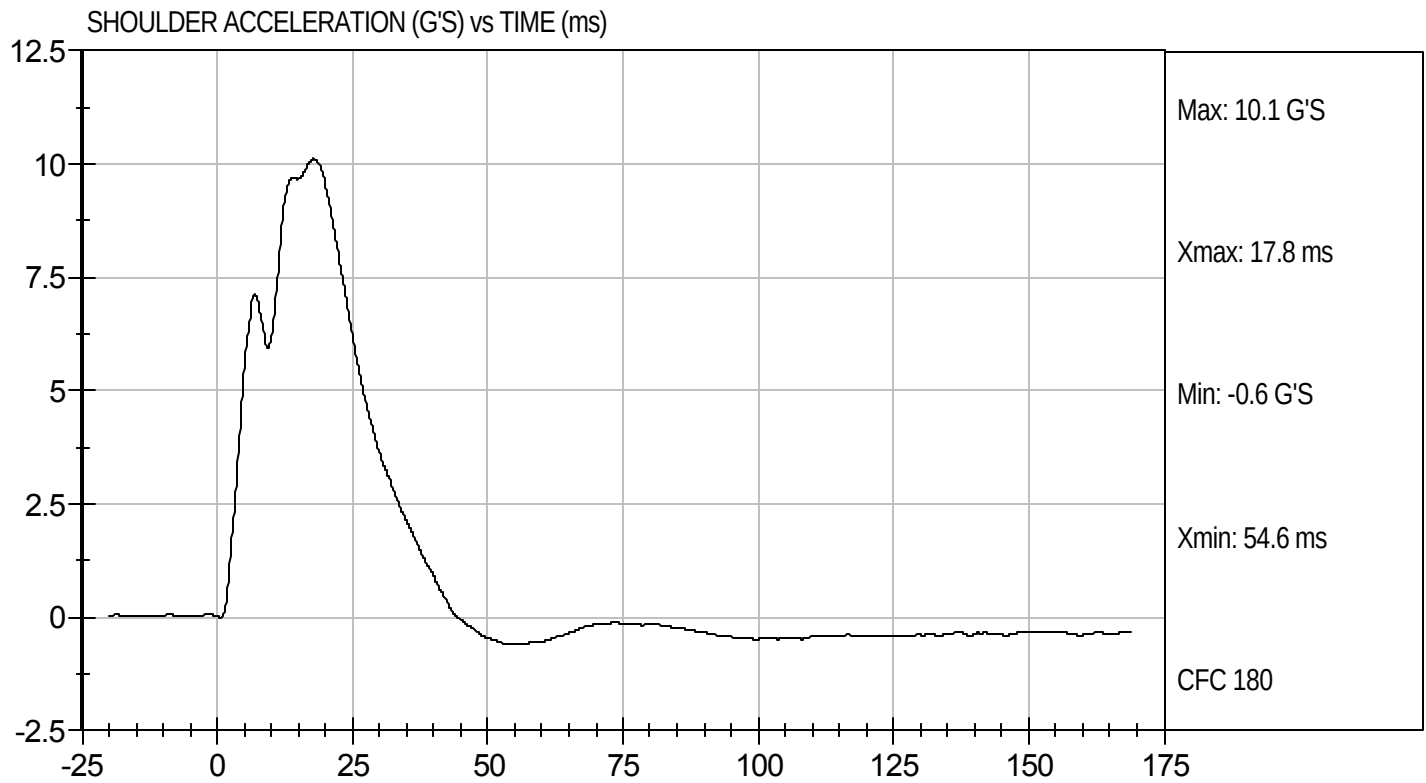
6/11/09
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D091453

Test Date: 6/11/09
Velocity: 13.88 ft/s, 4.2 m/s



MGA RESEARCH CORPORATION

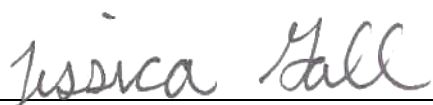
UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091454

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	36.8	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	47.9	Pass
Overall Test Results			Pass	


Laboratory Technician

6/11/09
Test Date

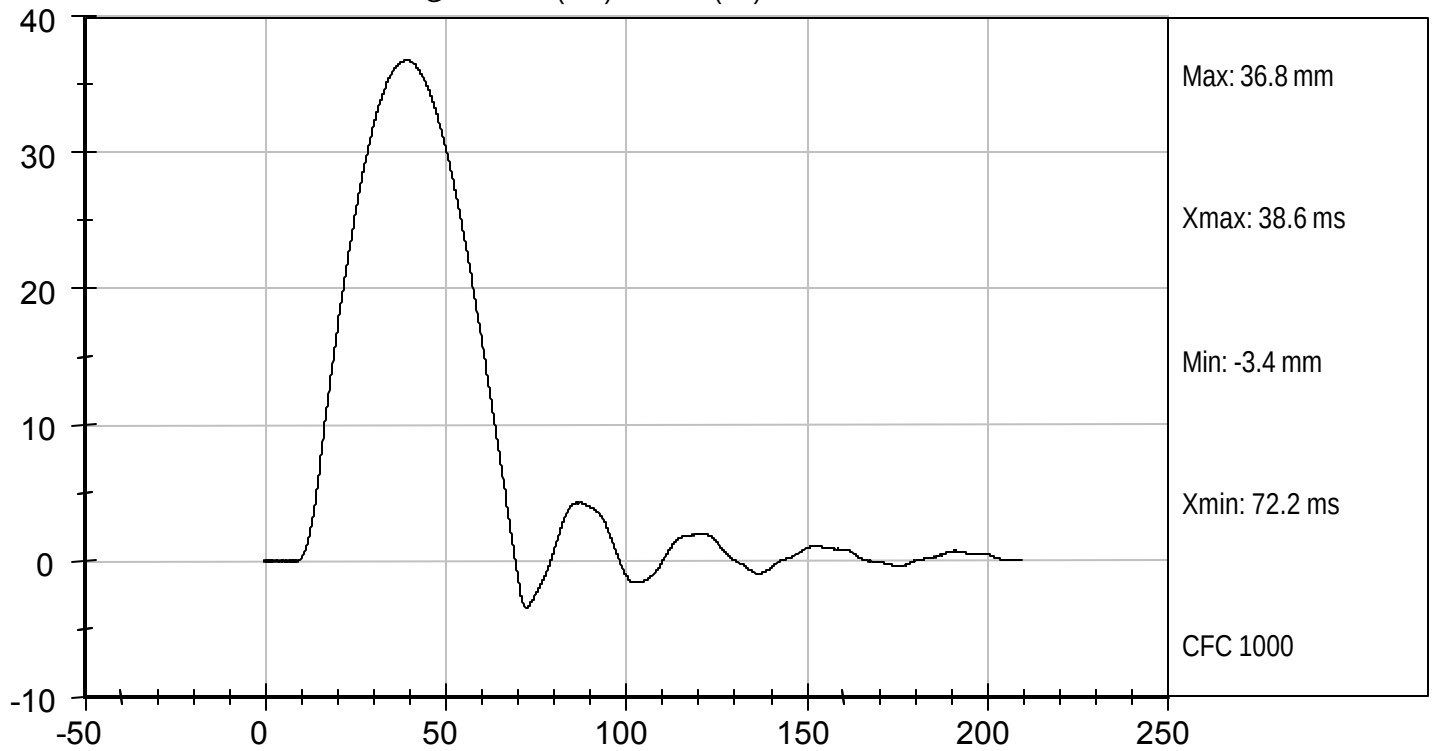

Approved By



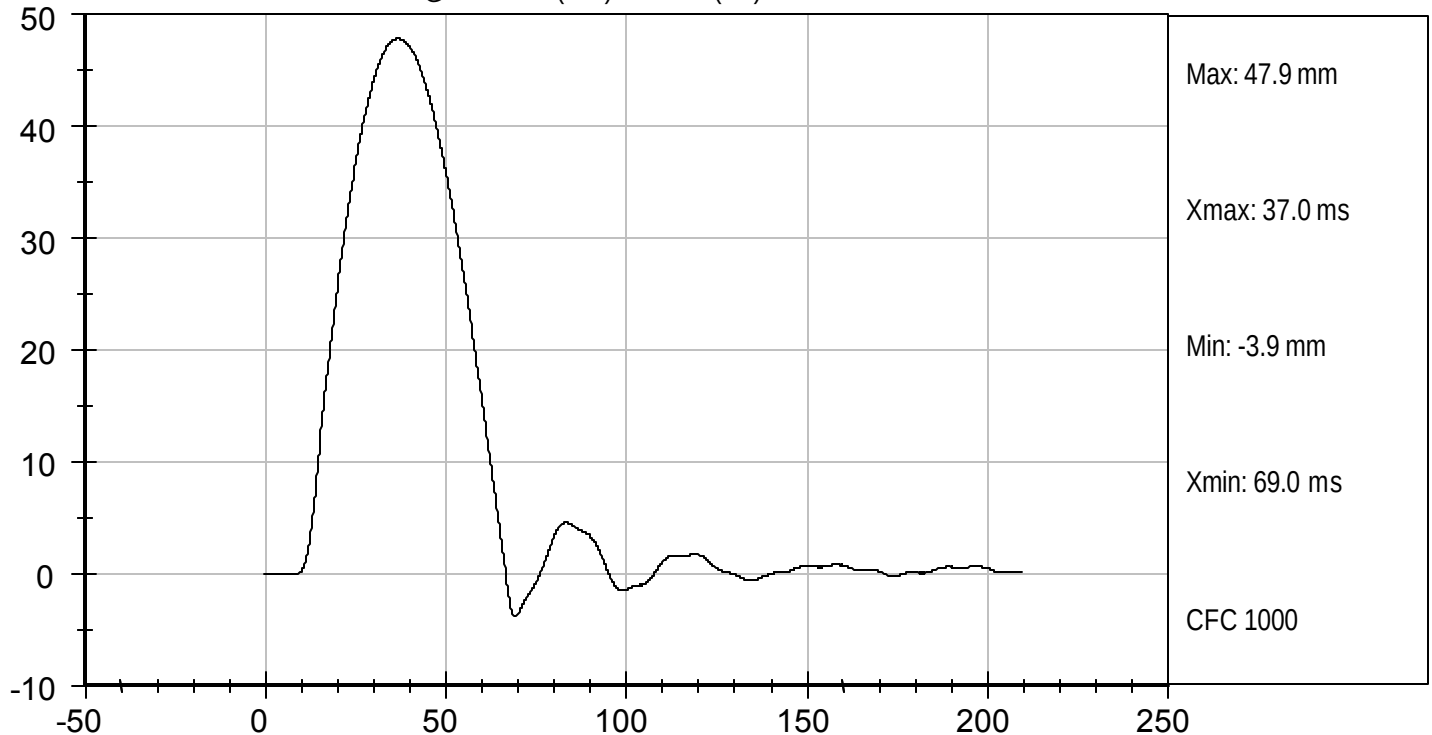
Test Desc: Rib Impact - Upper
Component ID: D091454

Test Date: 6/11/09

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



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



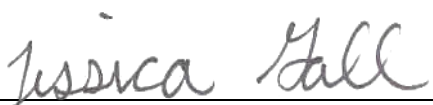
MGA RESEARCH CORPORATION

**MID RIB TEST
ES-2re DUMMY**

ATD Serial No: 032

Test I.D: D091455

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	37.7	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.5	Pass
Overall Test Results				Pass


Laboratory Technician

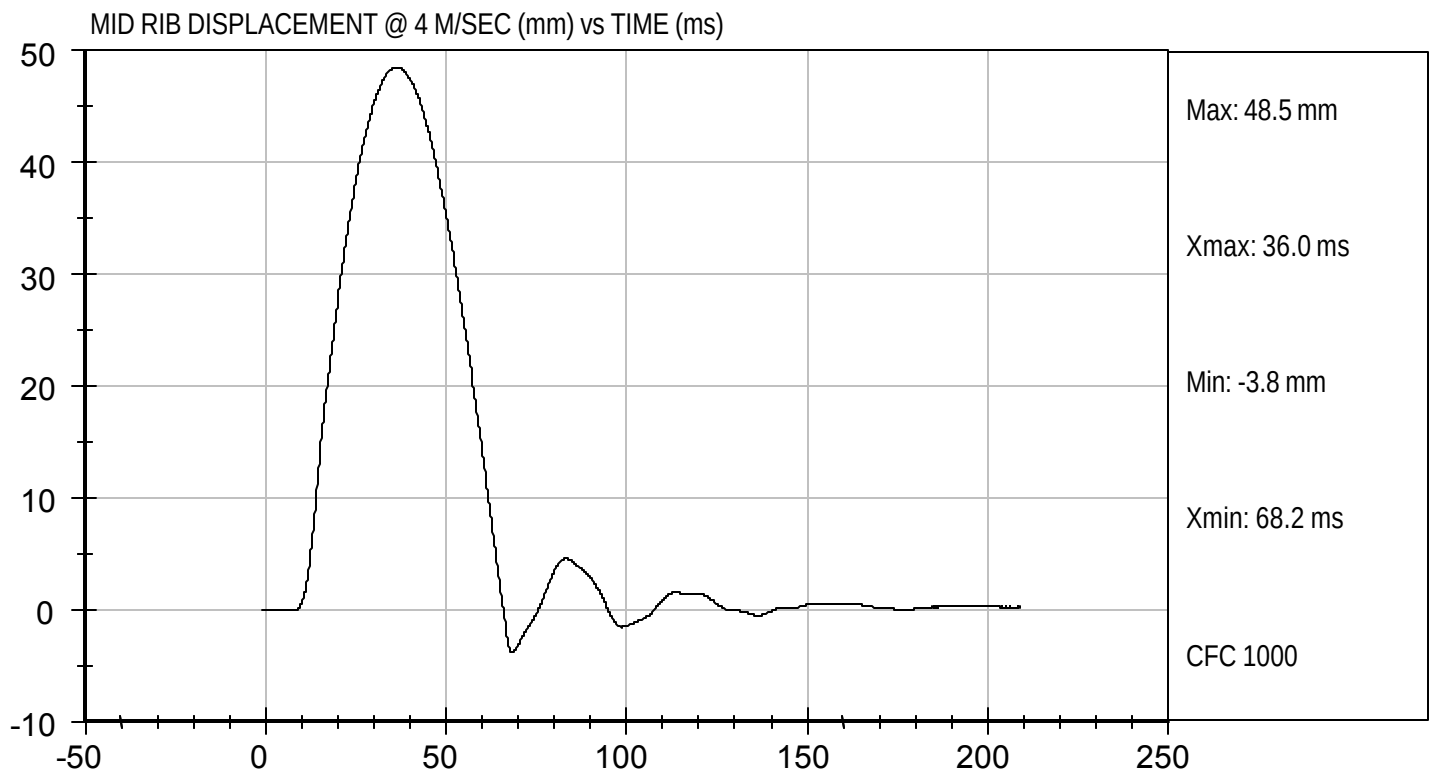
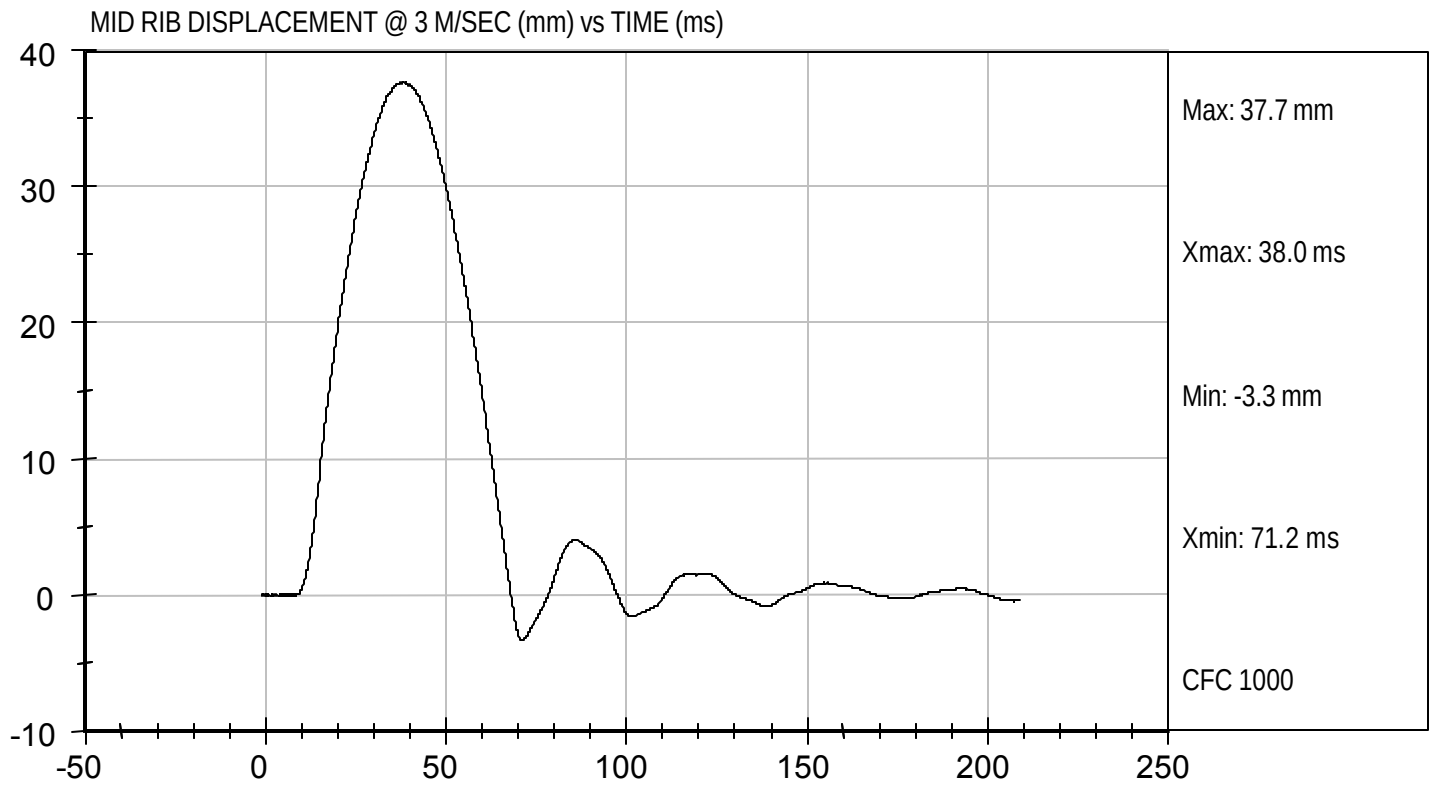
6/11/09
Test Date


Approved By



Test Desc: Rib Impact - Mid
Component ID: D091455

Test Date: 6/11/09



MGA RESEARCH CORPORATION

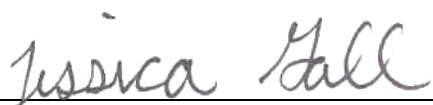
LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091456

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	36.9	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.1	Pass
Overall Test Results			Pass	


Laboratory Technician

6/11/09
Test Date

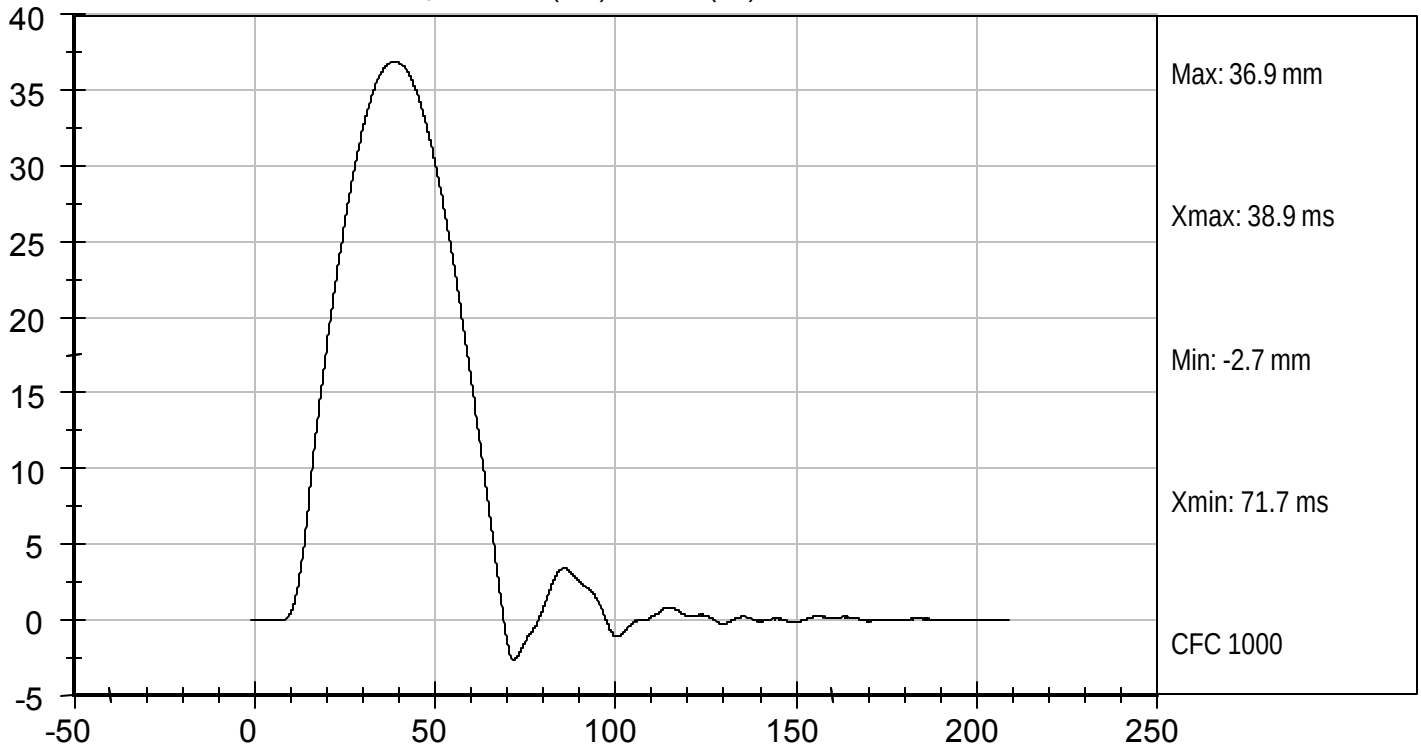

Approved By



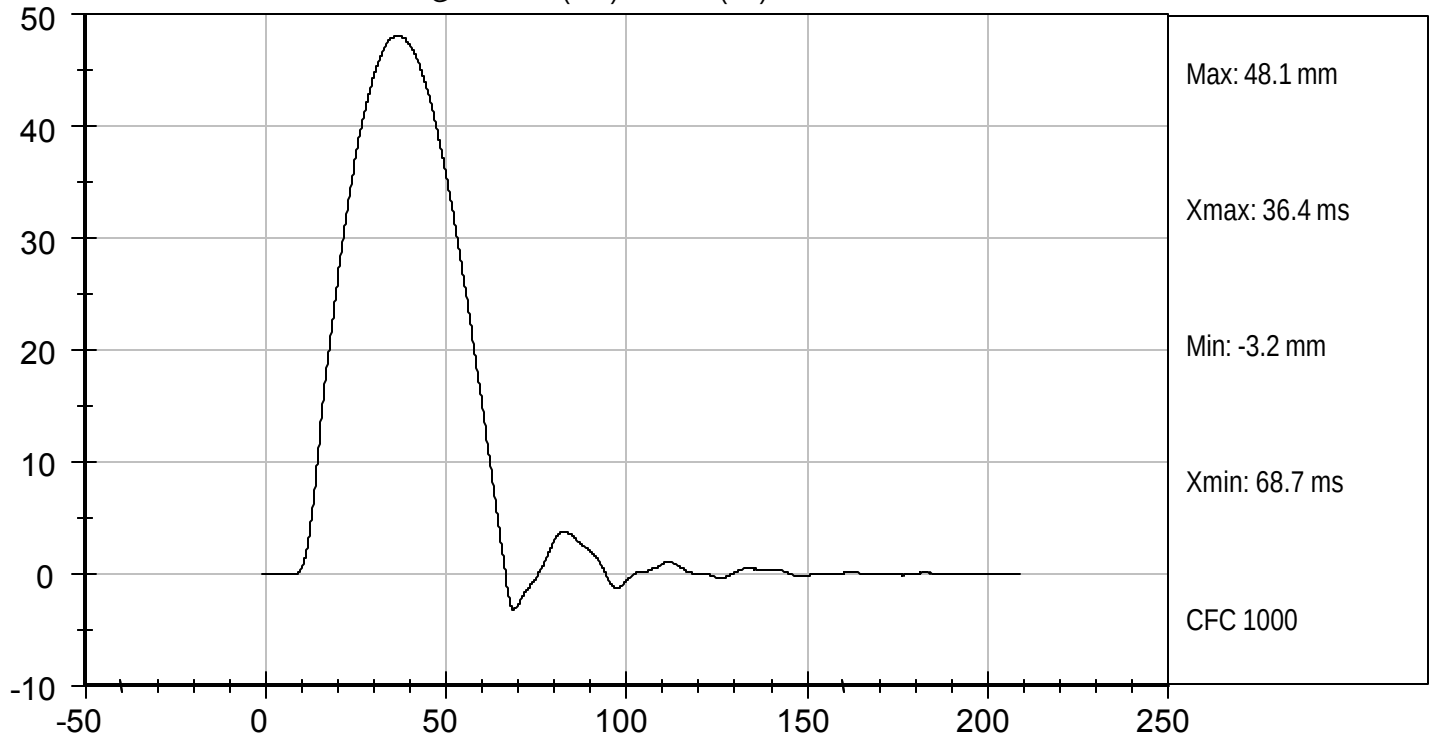
Test Desc: Rib Impact - Lower
Component ID: D091456

Test Date: 6/11/09

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



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



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091457

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Probe Speed	m/s	3.90 to 4.10	4.02	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.08	Pass
Time of Maximum Impactor Force	msec	10.60 to 13.00	11.40	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.41	Pass
Time of Maximum Abdomen Force	msec	10.00 to 12.30	11.00	Pass
Overall Test Results				Pass


Laboratory Technician

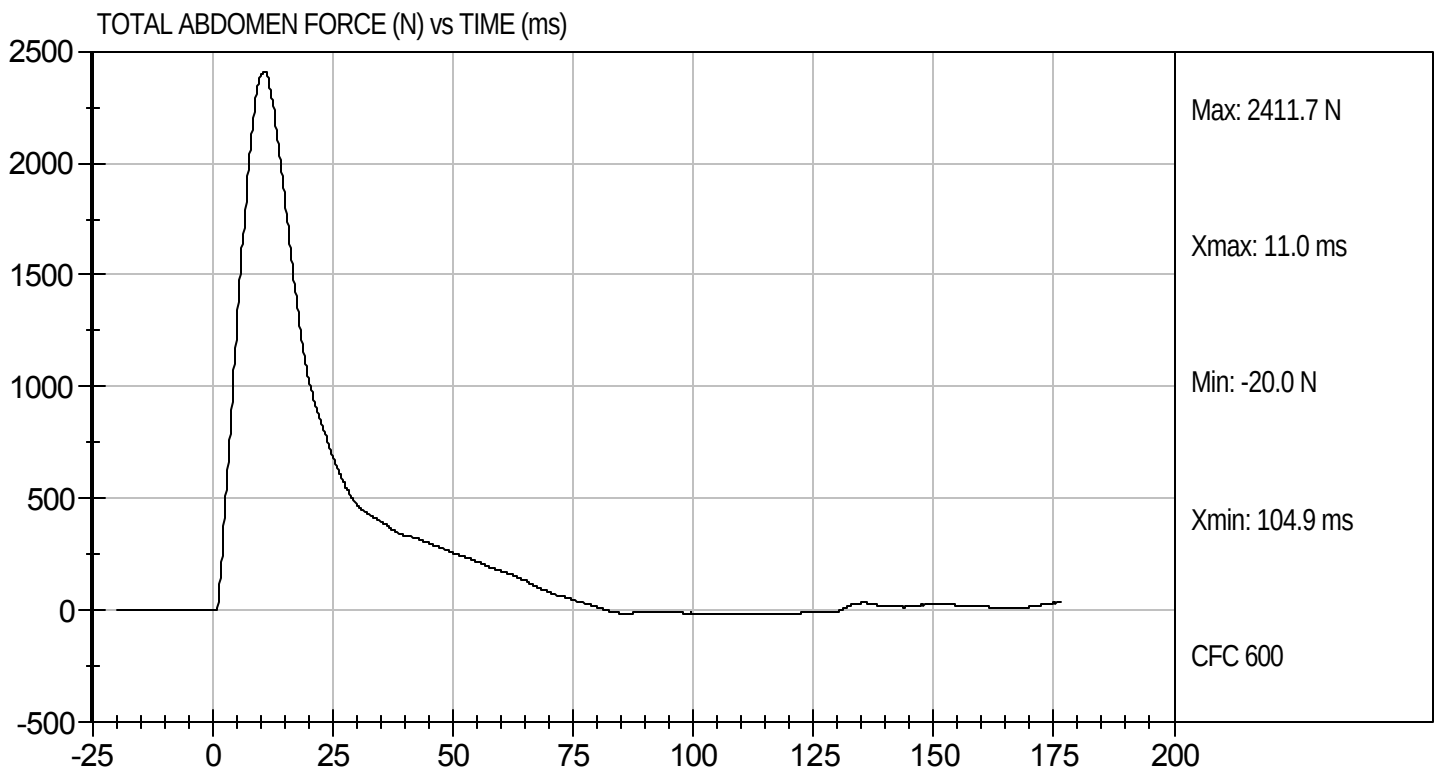
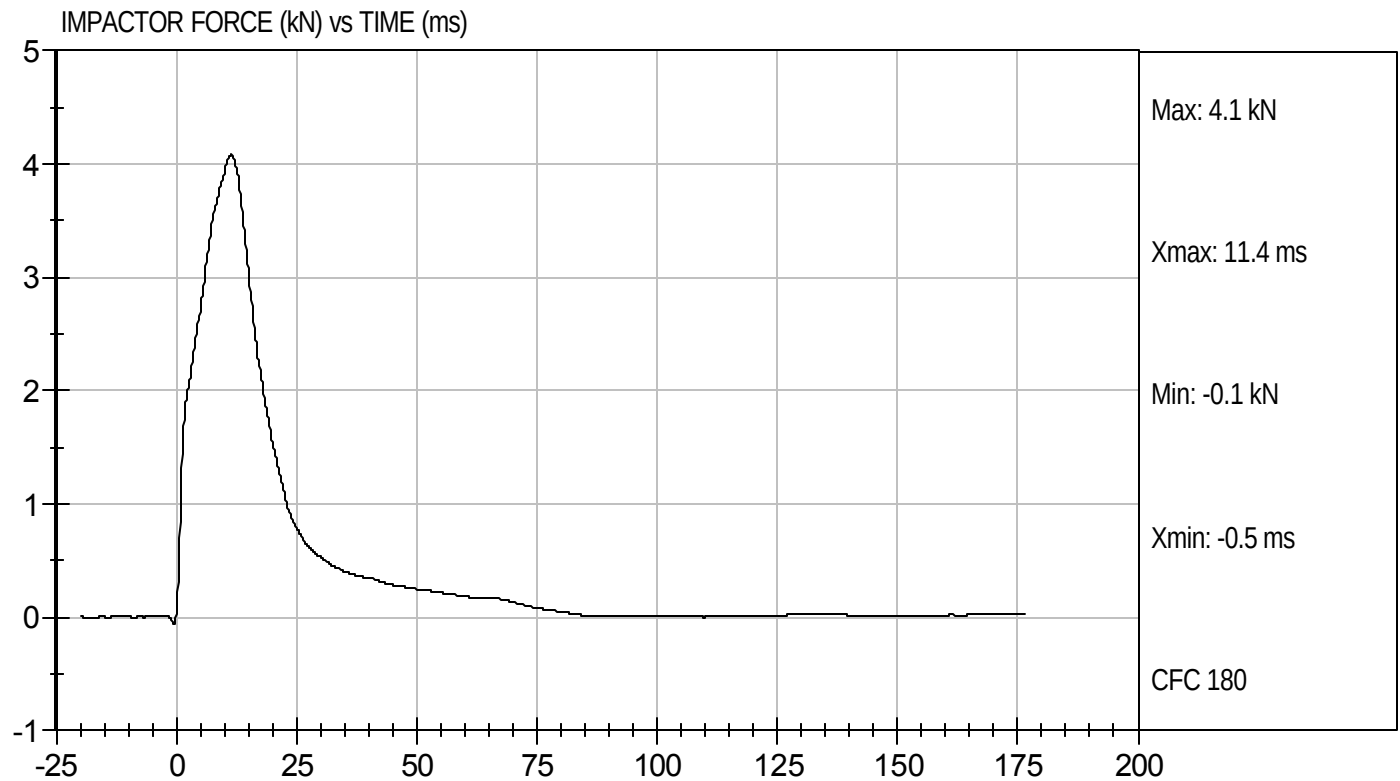
6/11/09
Test Date


Approved By



Test Desc: Abdomen Impact
Component ID: D091457

Test Date: 6/11/09
Velocity: 13.2 ft/s, 4.02 m/s

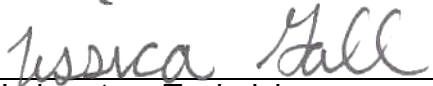


MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091458

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	40	Pass
Pendulum Speed		m/sec	5.95 to 6.15	6.12	Pass
Pendulum Deceleration	1 msec	m/sec	-0.05 to 0.00	-0.02	Pass
	3.7 msec	m/sec	-0.425 to -0.24	-0.42	Pass
	27 msec	m/sec	-6.50 to -5.80	-5.97	Pass
	30 msec	m/sec	>= -6.5	-5.94	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	49.9	Pass
Time of Maximum Flexion Angle		msec	39.0 to 53.0	45.5	Pass
Headform Rotation Decay to Initial Position		msec	37 to 57	45	Pass
Overall Results				Pass	


 Laboratory Technician

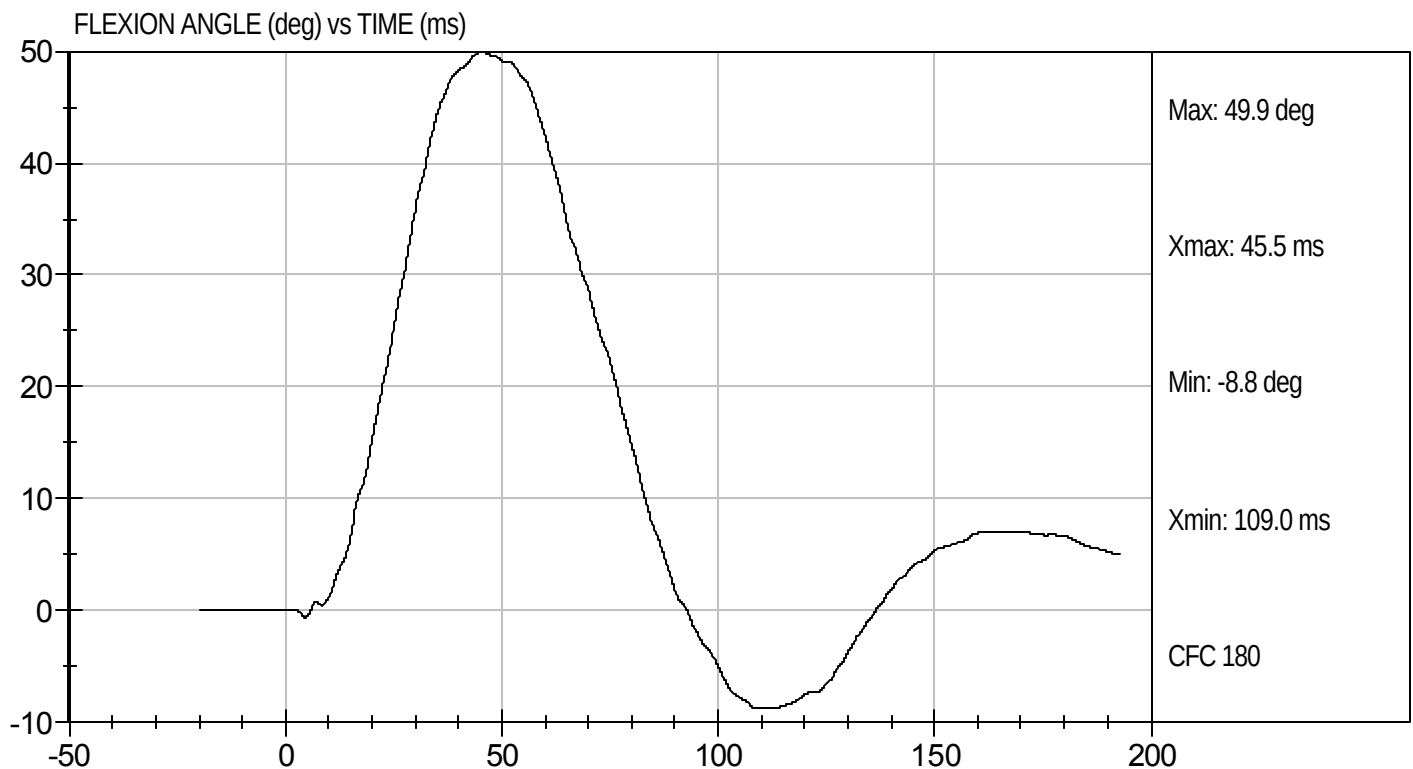
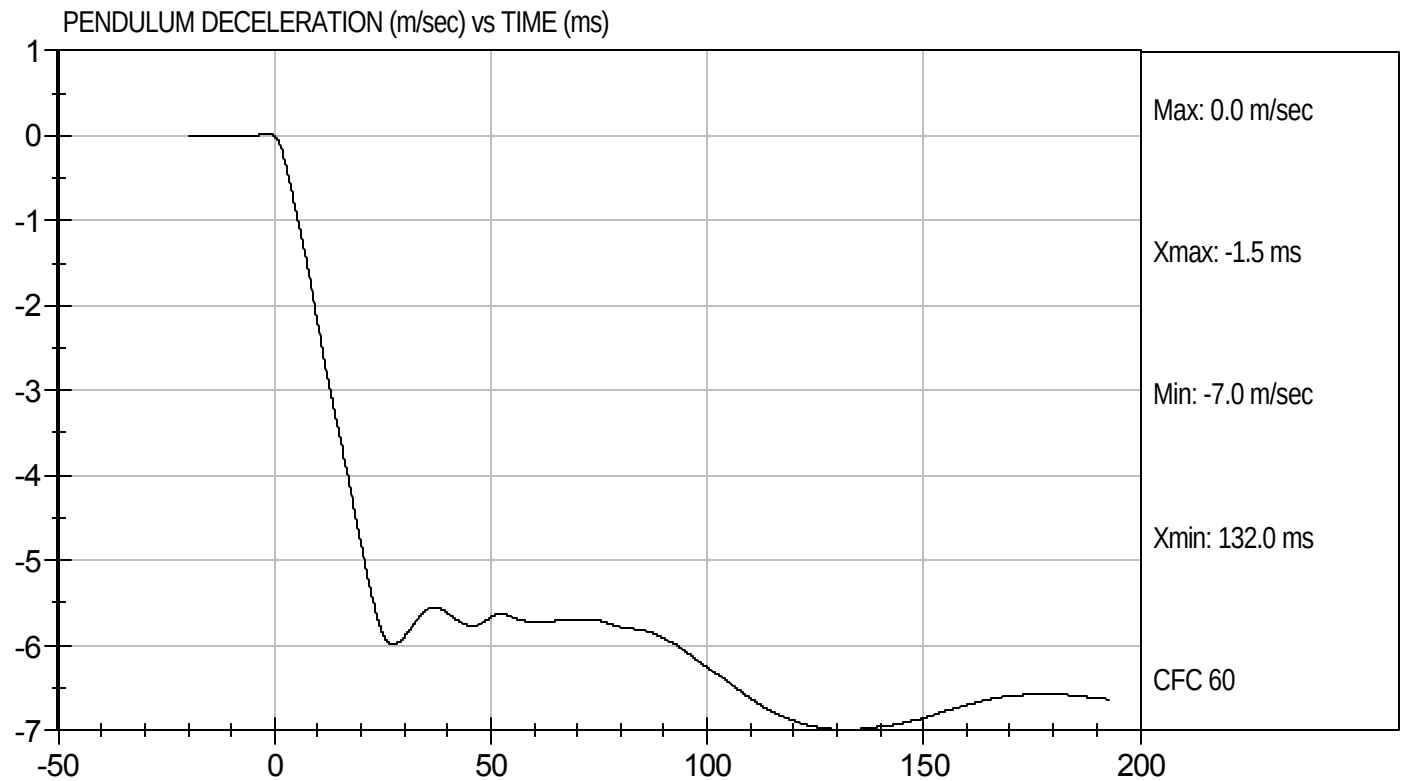
6/10/09
 Test Date


 Approved By



Test Desc: Lumbar Bending
Component ID: D091458

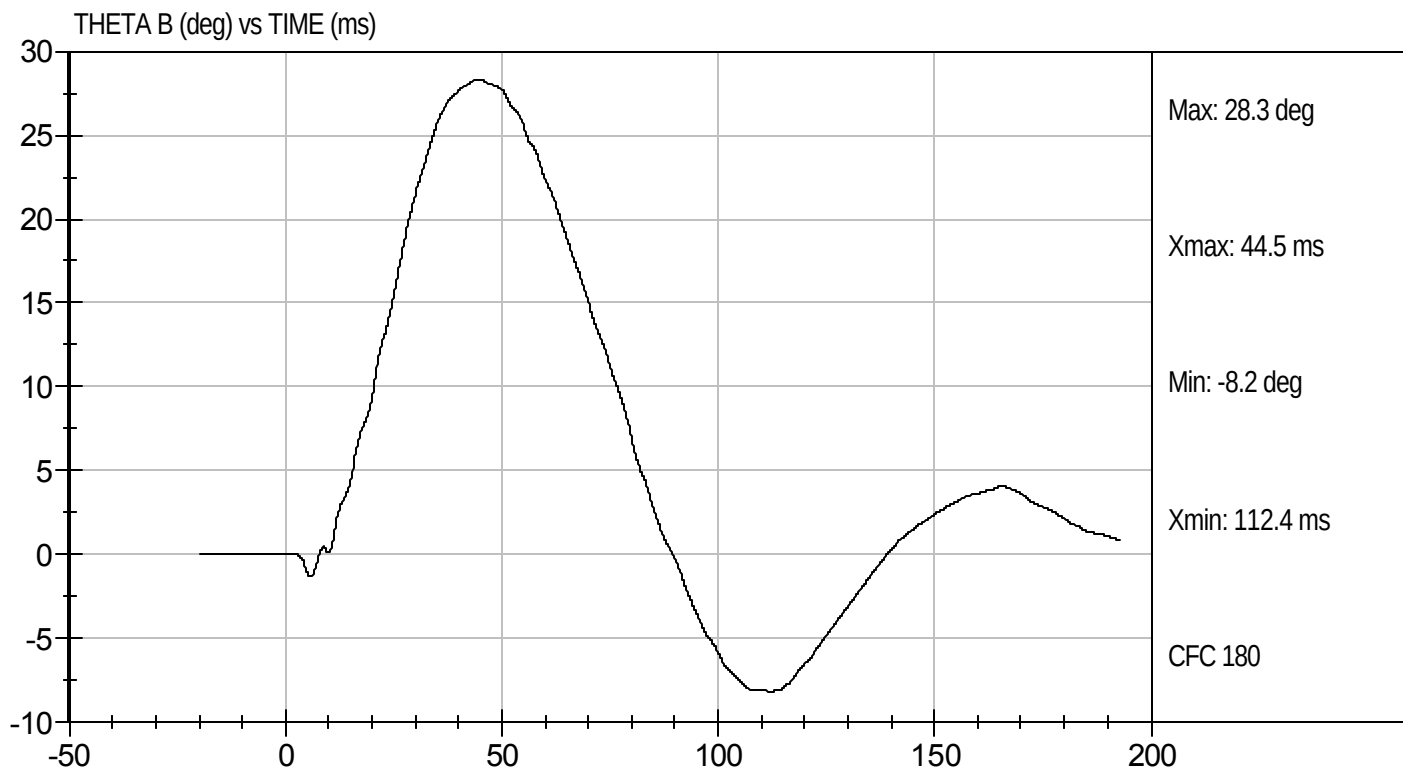
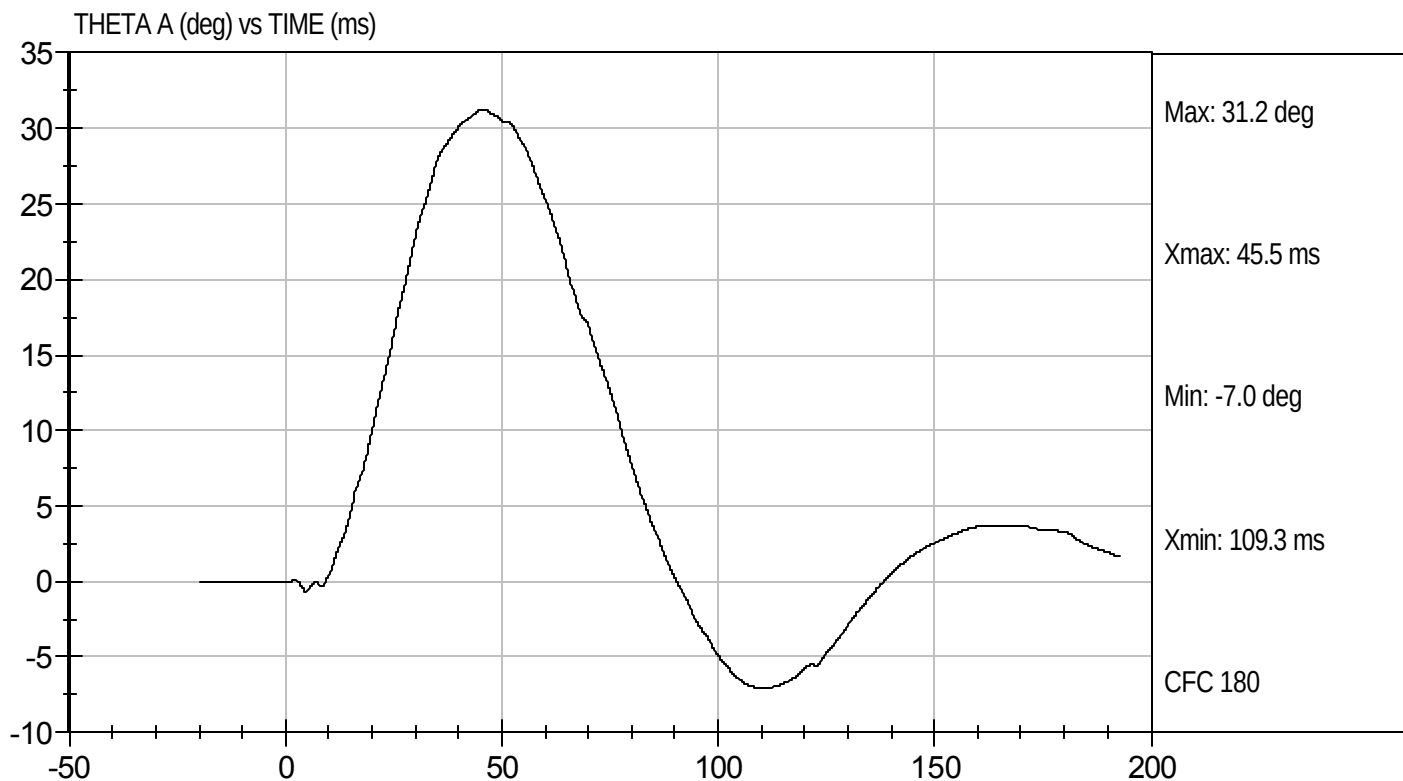
Test Date: 6/10/09
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Lumbar Bending
Component ID: D091458

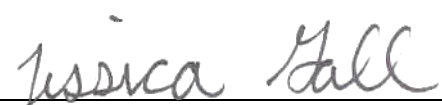
Test Date: 6/10/09
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION

PELVIS TEST
ES-2re DUMMYATD Serial No: 032Test I.D: D091459

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Probe Speed	m/s	4.20 to 4.40	4.27	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.76	Pass
Time of Maximum Impactor Force	msec	11.80 to 16.10	13.20	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.46	Pass
Time of Maximum Pubic Force	msec	12.20 to 17.00	14.60	Pass
Overall Test Results				Pass


Laboratory Technician

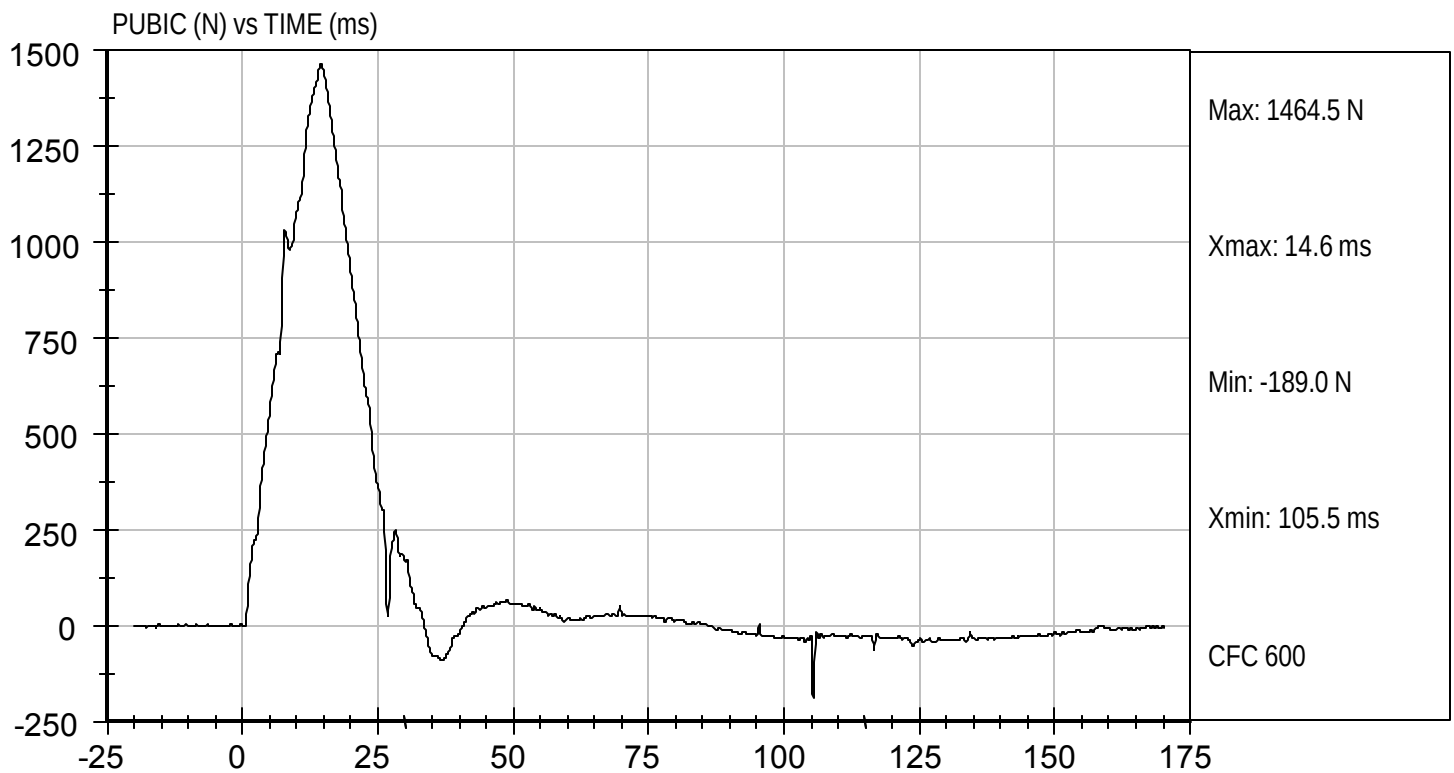
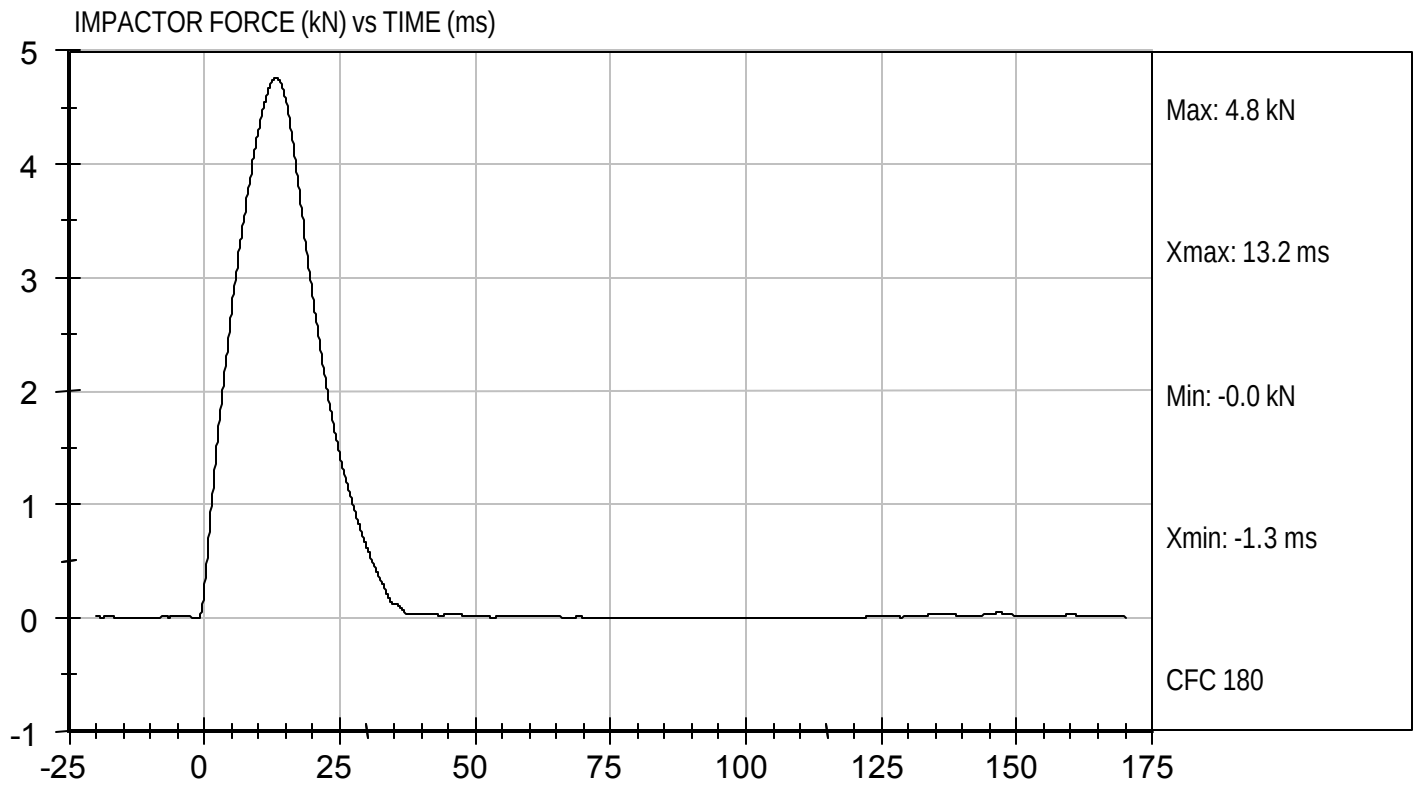
6/11/09
Test Date


Approved By



Test Desc: Pelvis Impact
Component ID: D091459

Test Date: 6/11/09
Velocity: 14.01 ft/s, 4.27 m/s

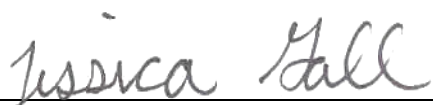


MGA RESEARCH CORPORATION
FULL BODY THORAX IMPACT TEST
ES-2re DUMMY

ATD Serial No: 032

Test I.D: D091450

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	46	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	kN	5.17 to 6.12	5.18	Pass
Upper Rib Displacement	mm	33.2 to 41.3	37.9	Pass
Middle Rib Displacement	mm	37.1 to 45.4	41.0	Pass
Lower Rib Displacement	mm	35.6 to 43.0	40.0	Pass
			Overall Test Results	Pass


Laboratory Technician

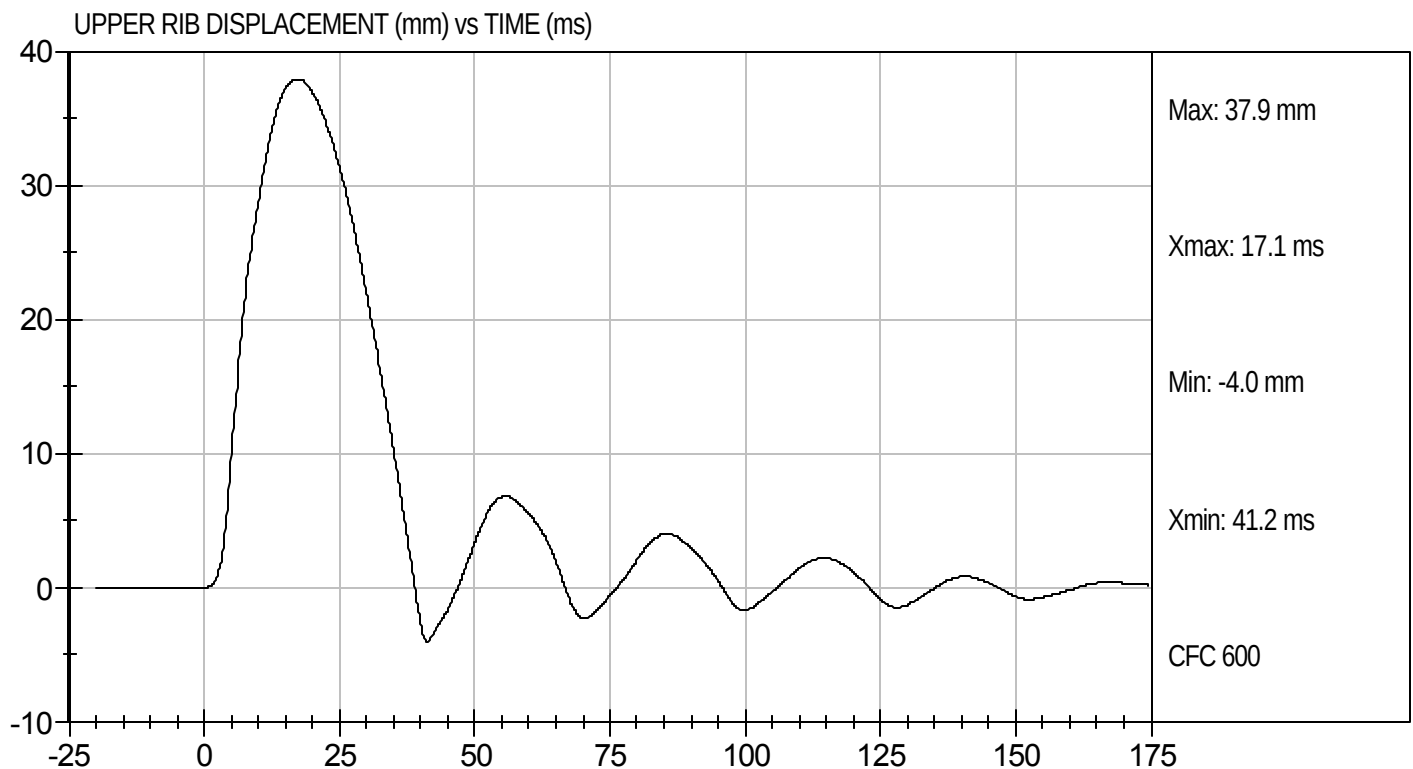
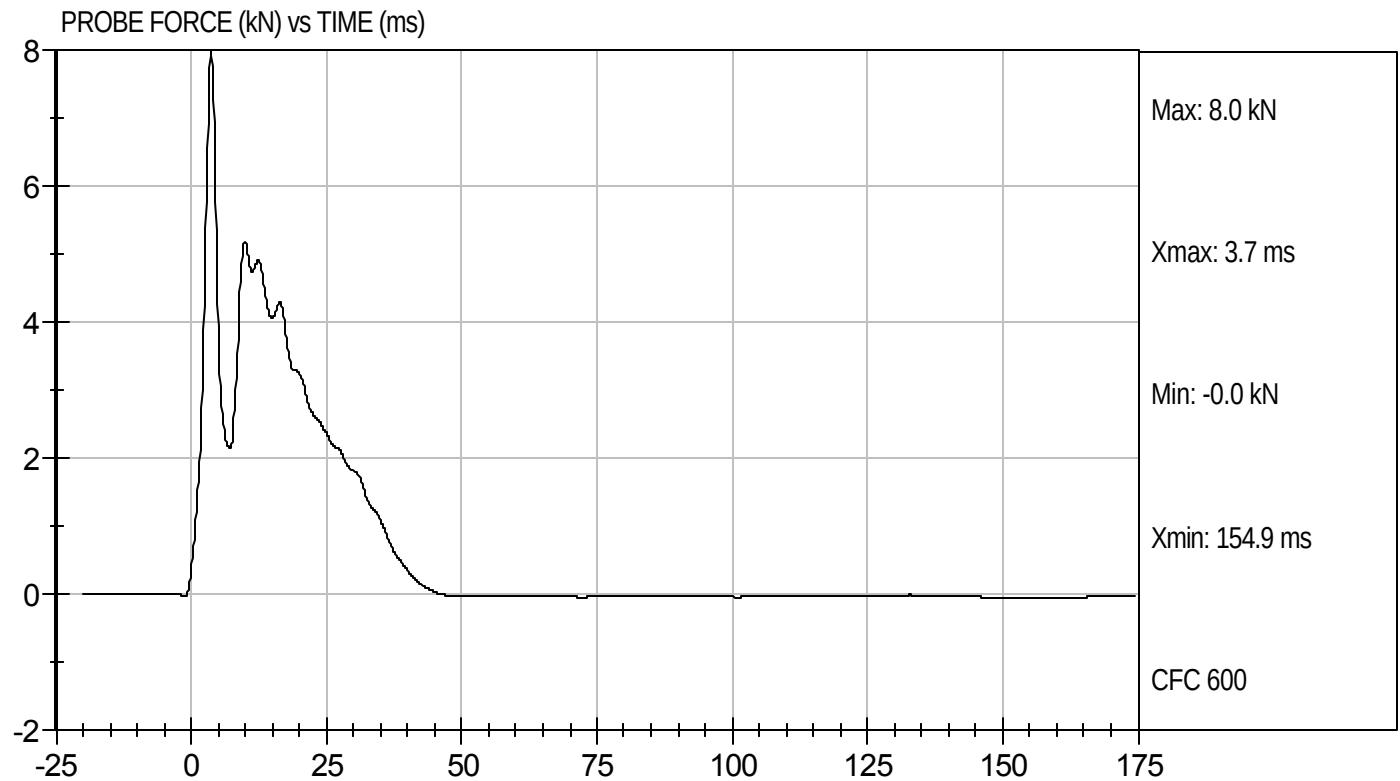
6/11/09
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D091450

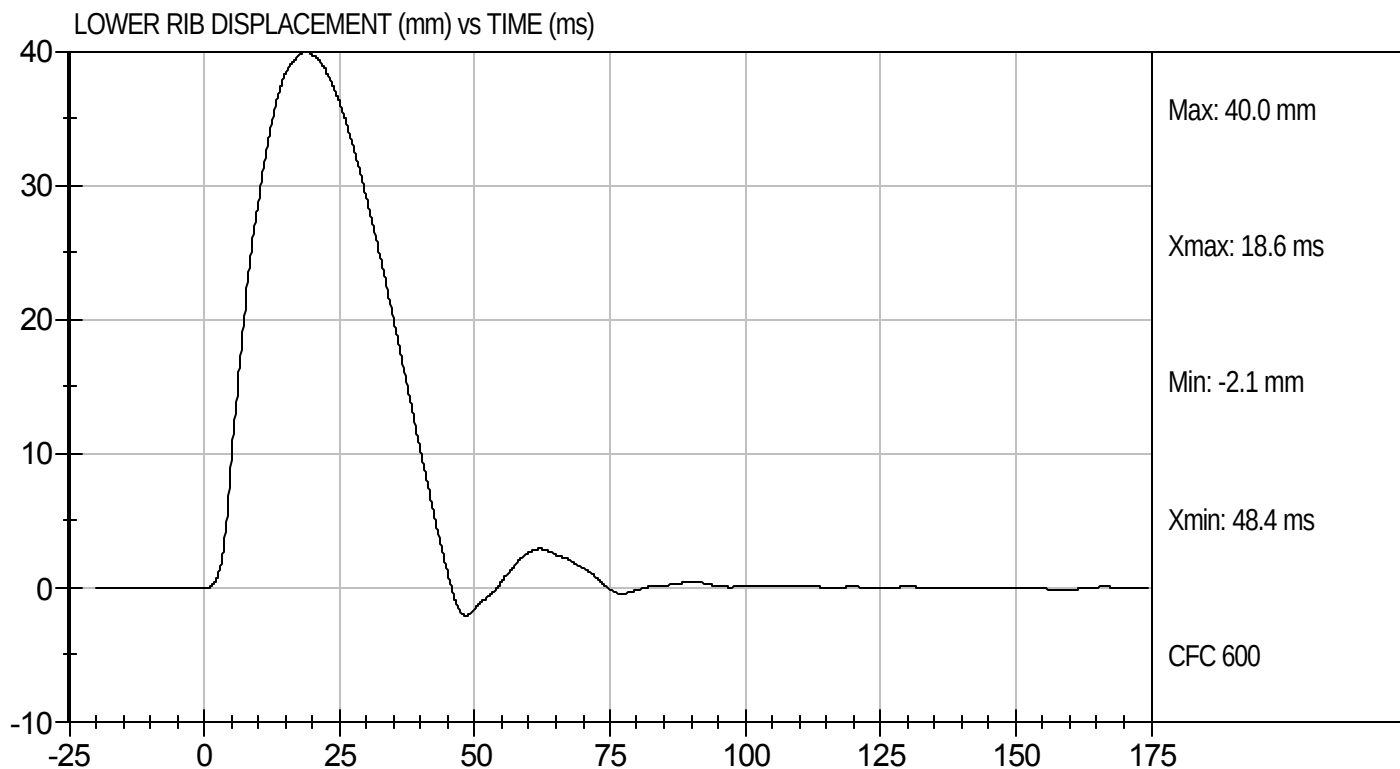
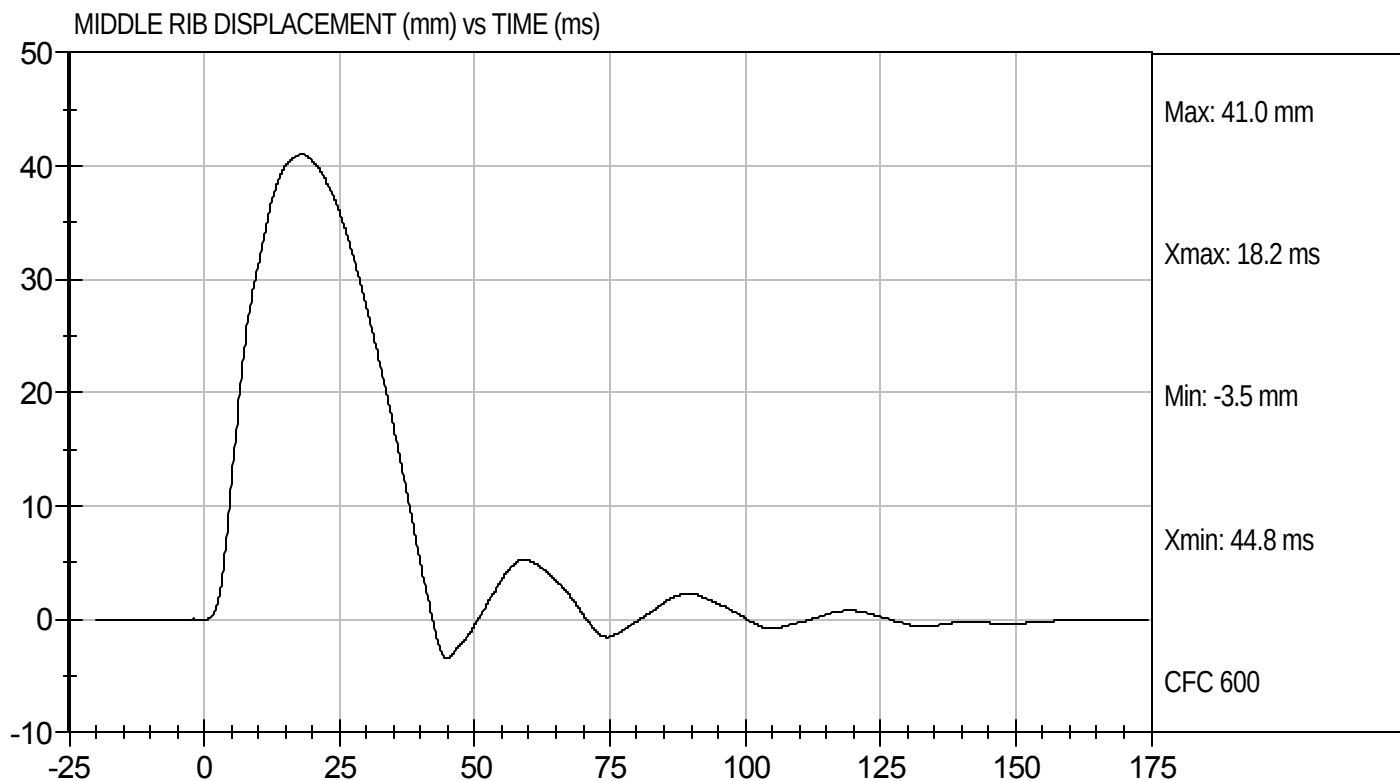
Test Date: 6/11/09
Velocity: 18.3 ft/s, 5.58 m/s





Test Desc: Thorax Impact
Component ID: D091450

Test Date: 6/11/09
Velocity: 18.3 ft/s, 5.58 m/s



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

ATD Serial No: 296

Test ID: D091431

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	46	Pass
Peak Resultant Acceleration	G's	115 to 137	116	Pass
Peak Lateral Acceleration	G's	+/- 15	-4.2	Pass
Unimodal	N/A	<15%	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

6/8/09
Test Date

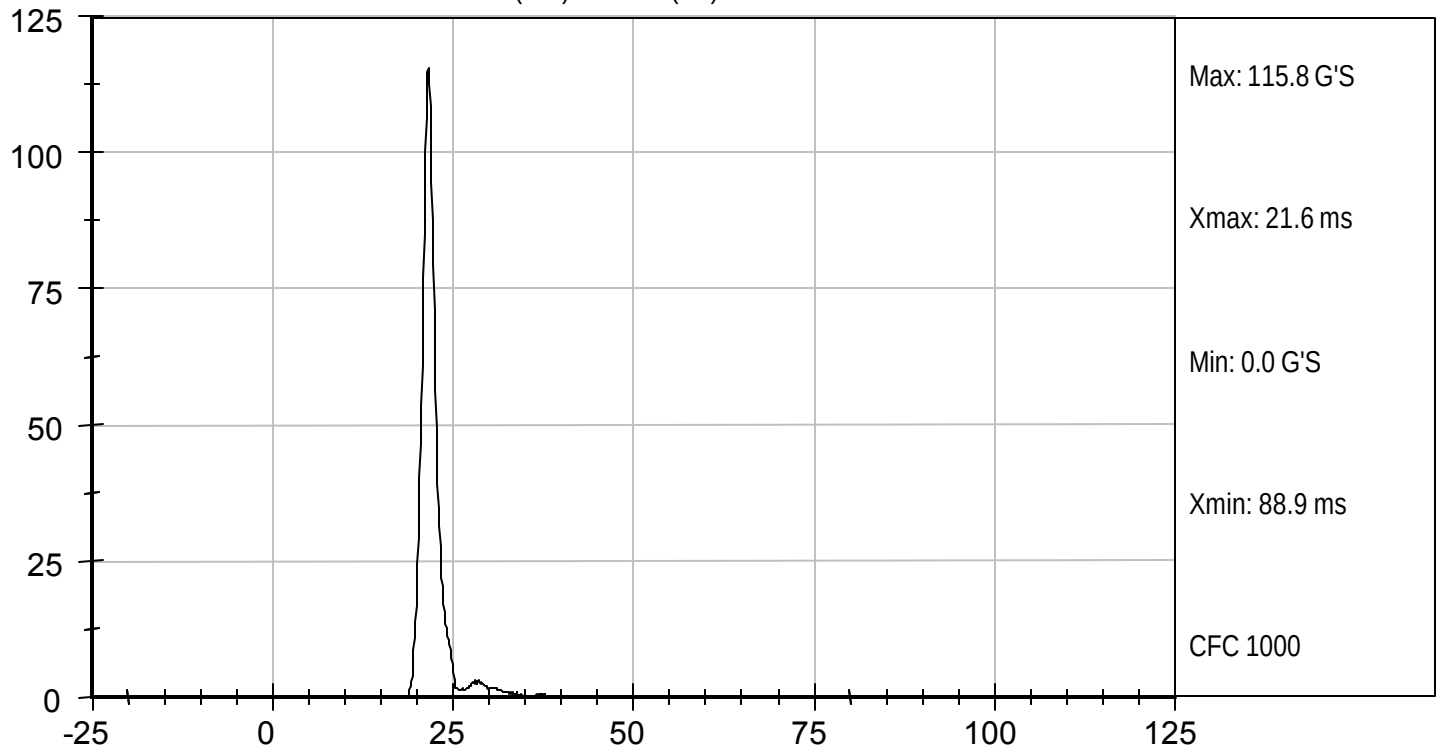

Approved By



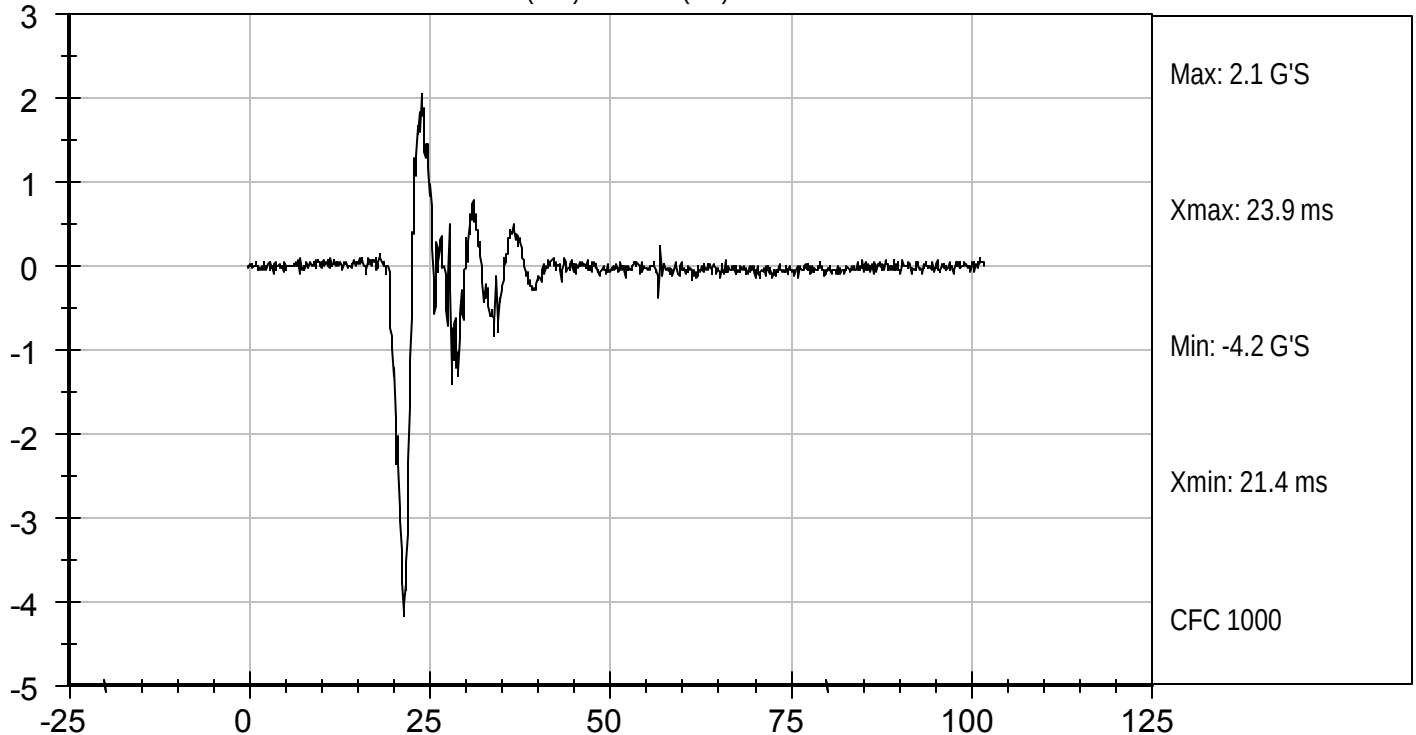
Test Desc: Head Drop
Component ID: D091431

Test Date: 6/8/09
Velocity: 0 ft/s, 0 m/s

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



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

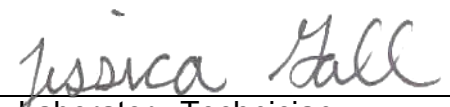


MGA RESEARCH CORPORATION
LATERAL NECK PENDULUM TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D091432

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.9	Pass
Humidity		%	10 to 70	45	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Delta Velocity	10 msec	m/s	2.20 to 2.80	2.74	Pass
	15 msec	m/s	3.30 to 4.10	3.97	Pass
	20 msec	m/s	4.40 to 5.40	5.38	Pass
	25 msec	m/s	5.40 to 6.10	5.68	Pass
	25-100 msec	m/s	5.50 to 6.20	5.70	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		msec	50 to 70	58	Pass
Maximum Occipital Condyle Moment during Rotation Interval		Nm	-44 to -36	-44	Pass
Time of Moment Decay to 0 Nm		msec	102 to 126	110	Pass
Overall Test Results					Pass


 Laboratory Technician

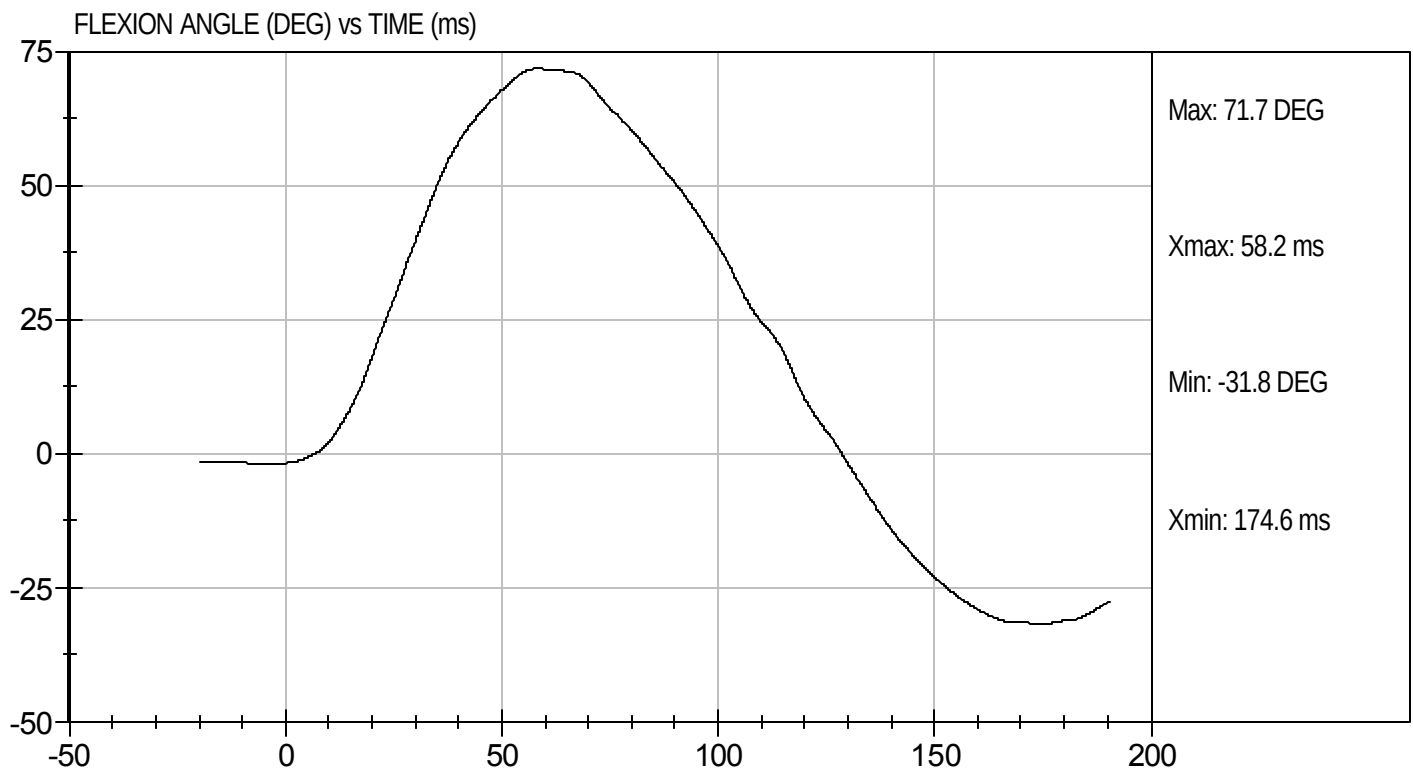
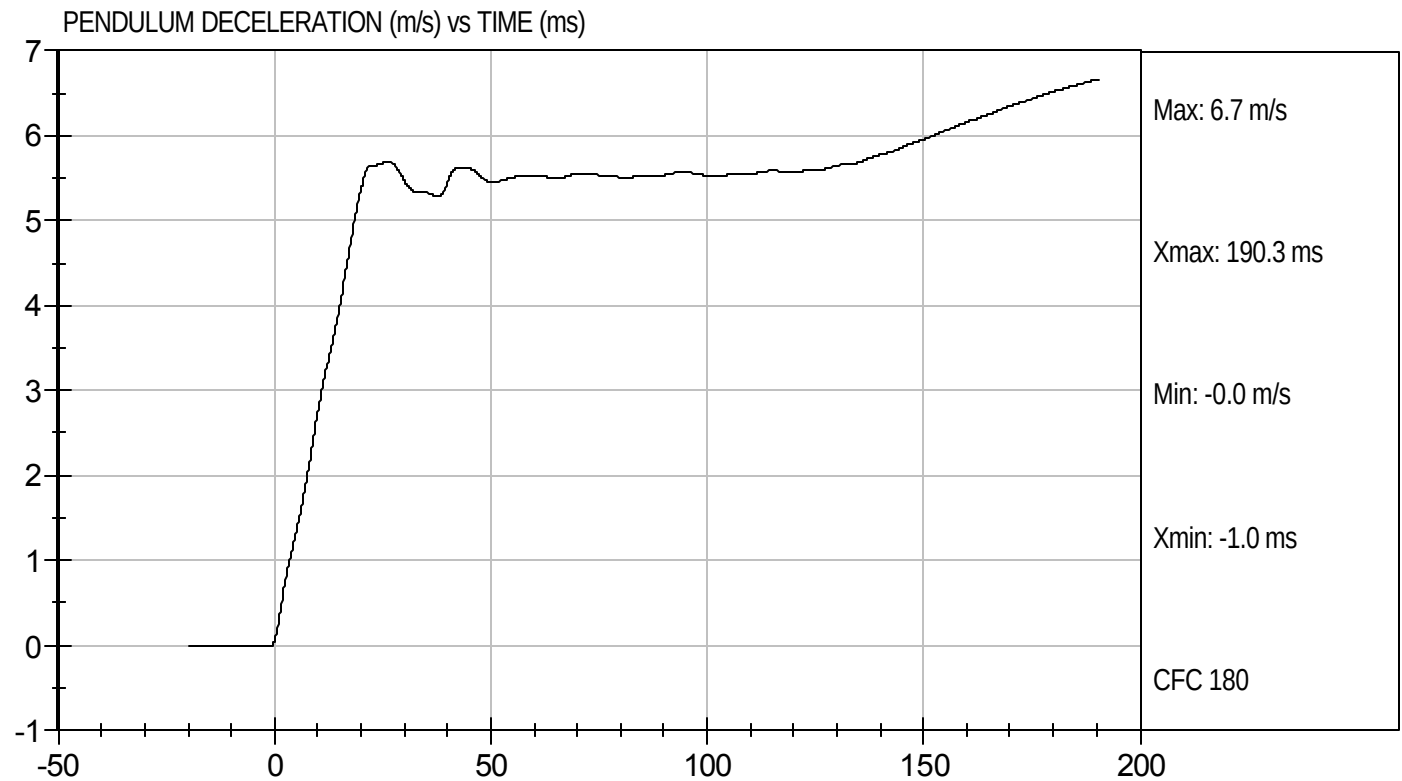
6/8/09
 Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D091432

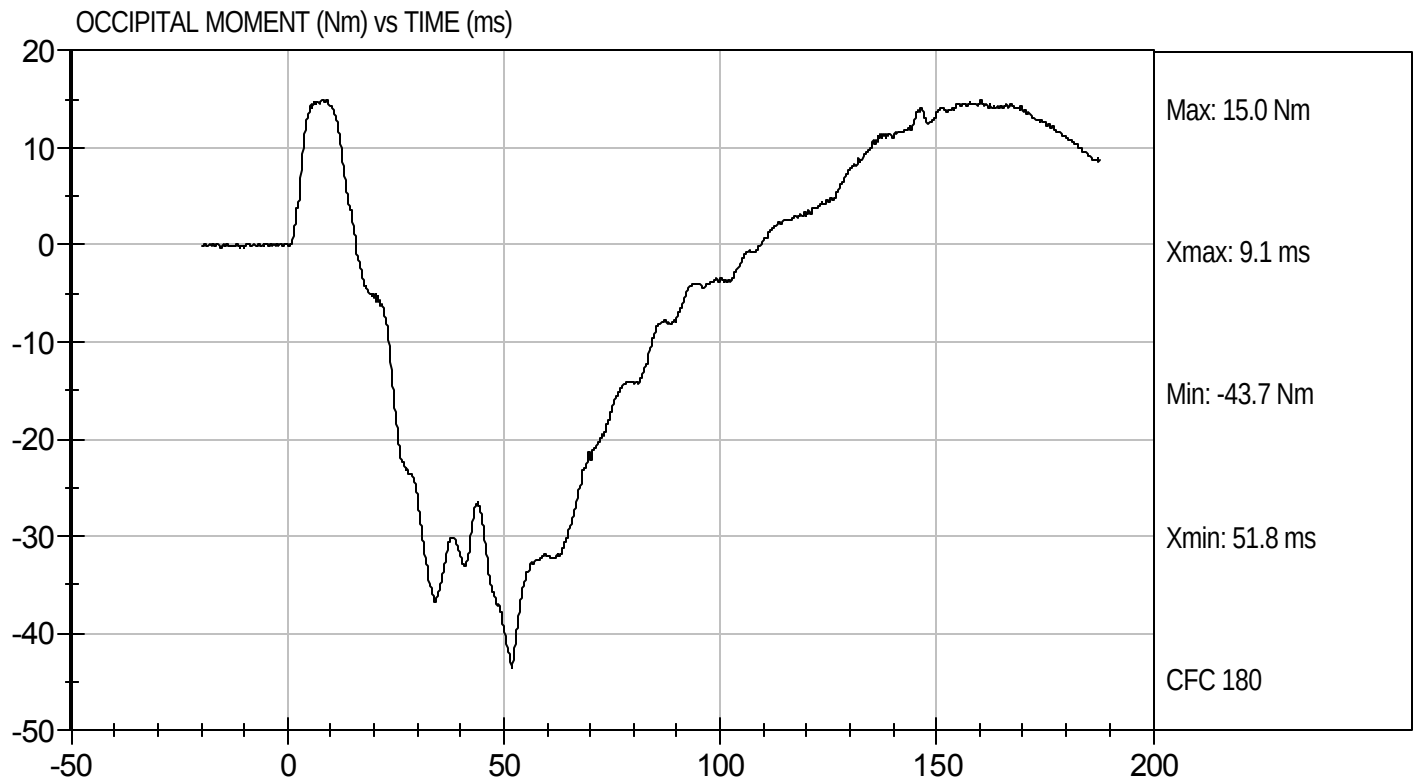
Test Date: 6/8/09
Velocity: 18.32 ft/s, 5.58 m/s





Test Desc: Neck Bending
Component ID: D091432

Test Date: 6/8/09
Velocity: 18.32 ft/s, 5.58 m/s

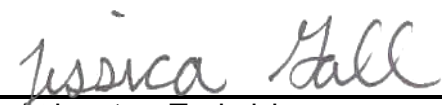


MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296

Test ID: D091433

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	31	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
Overall Test Results				Pass


Laboratory Technician

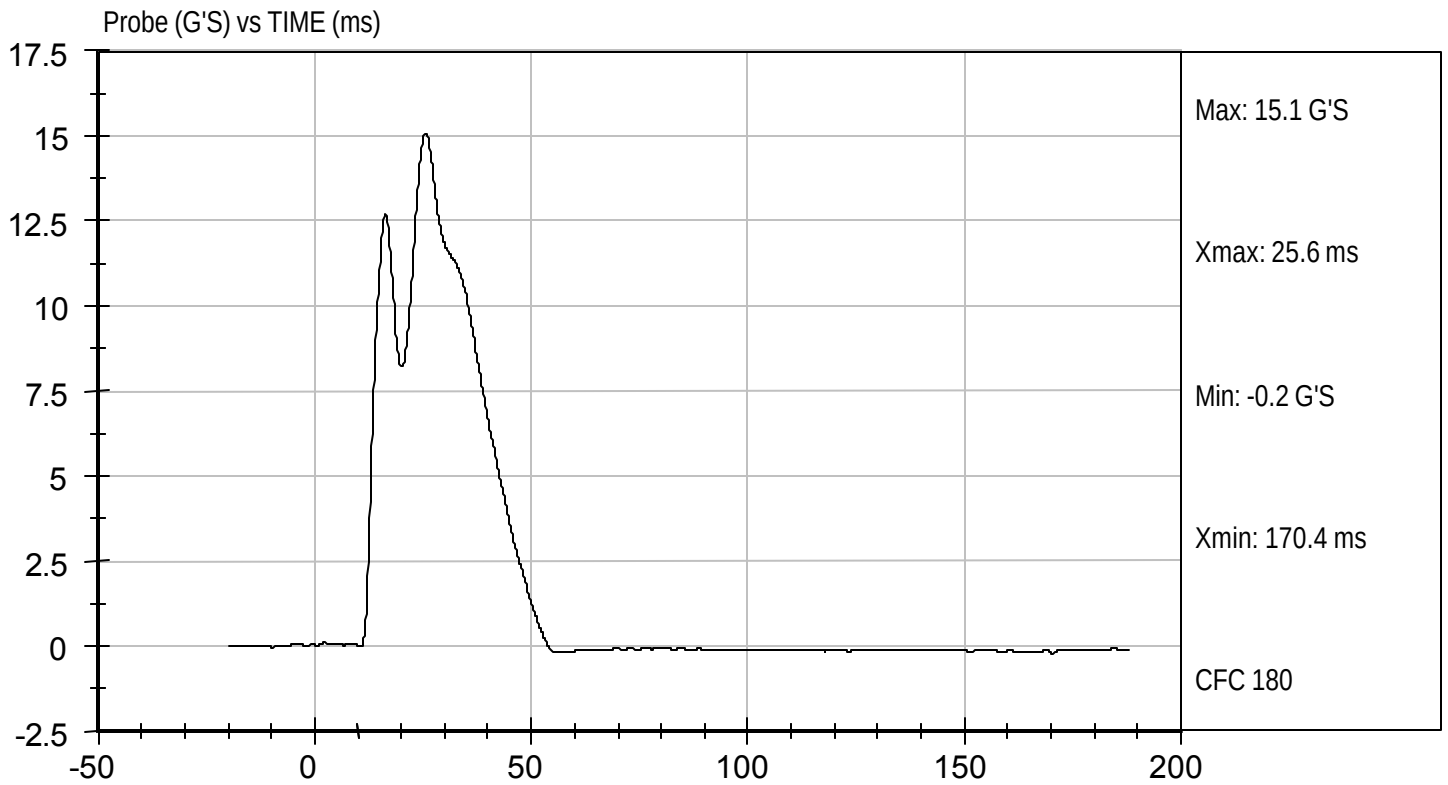
6/8/09
Test Date


Approved By



Test Desc: Shoulder Impact
Component ID: D091433

Test Date: 6/8/09
Velocity: 14.0 ft/s, 4.27 m/s

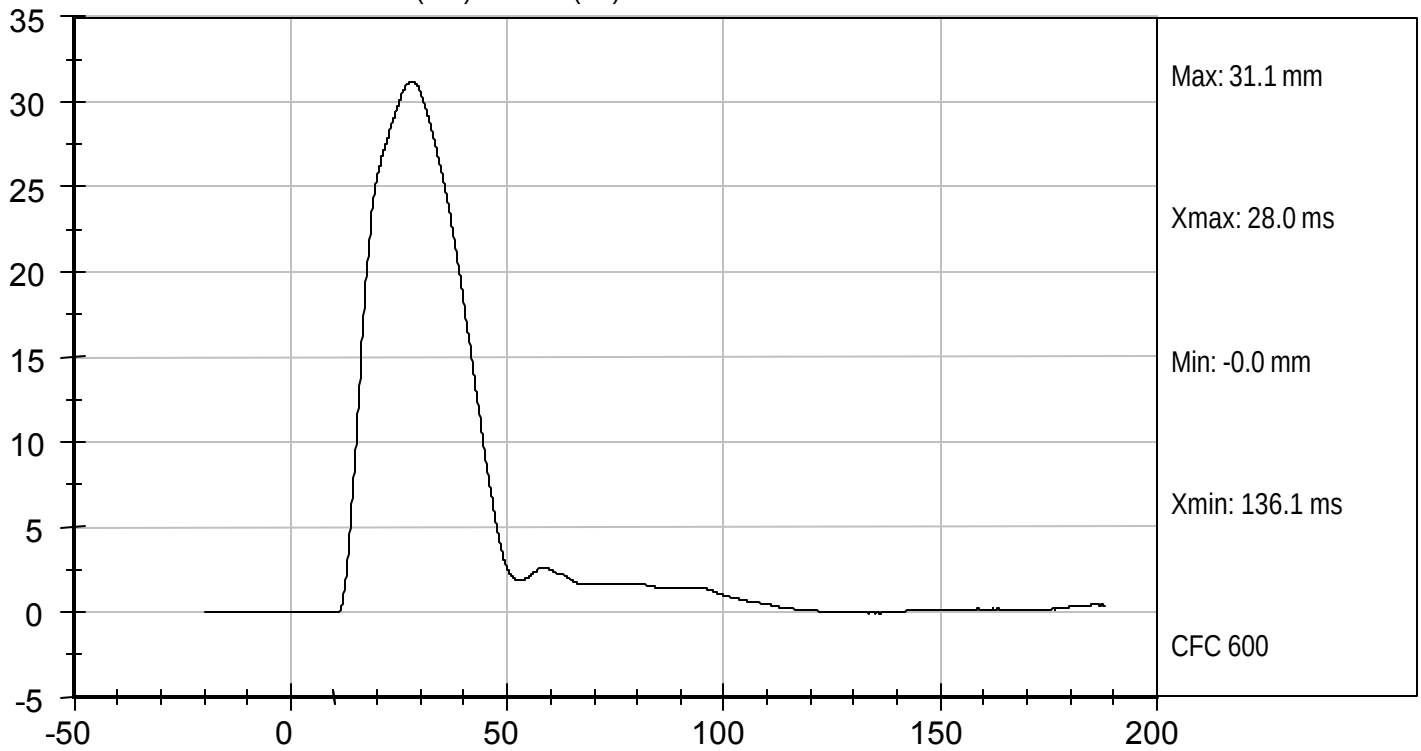




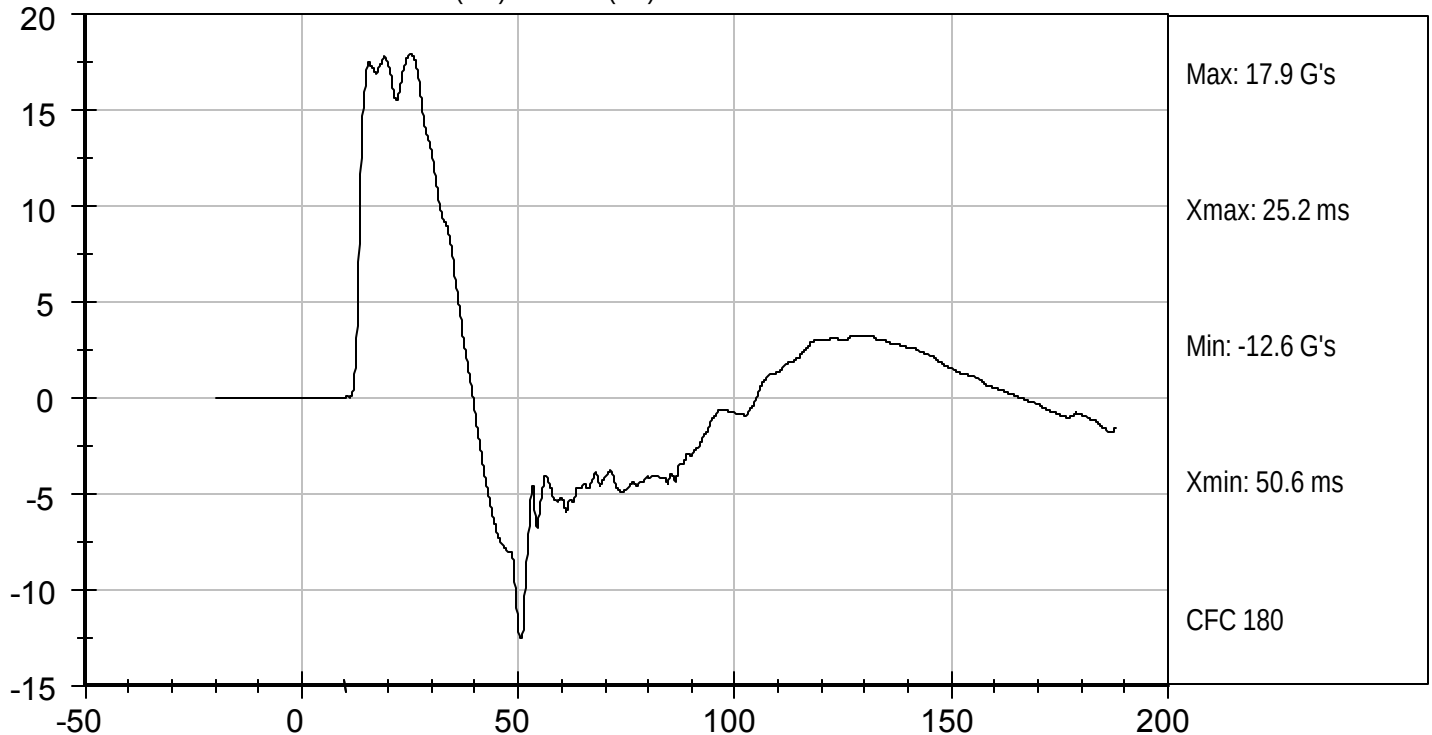
Test Desc: Shoulder Impact
Component ID: D091433

Test Date: 6/8/09
Velocity: 14.0 ft/s, 4.27 m/s

SHOULDER DISPLACEMENT (mm) vs TIME (ms)



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

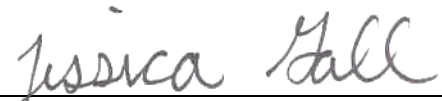


MGA RESEARCH CORPORATION
THORAX (WITH ARM) IMPACT TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D091434

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	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	27	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	36	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	34	Pass
Overall Test Results			Pass	


 Laboratory Technician

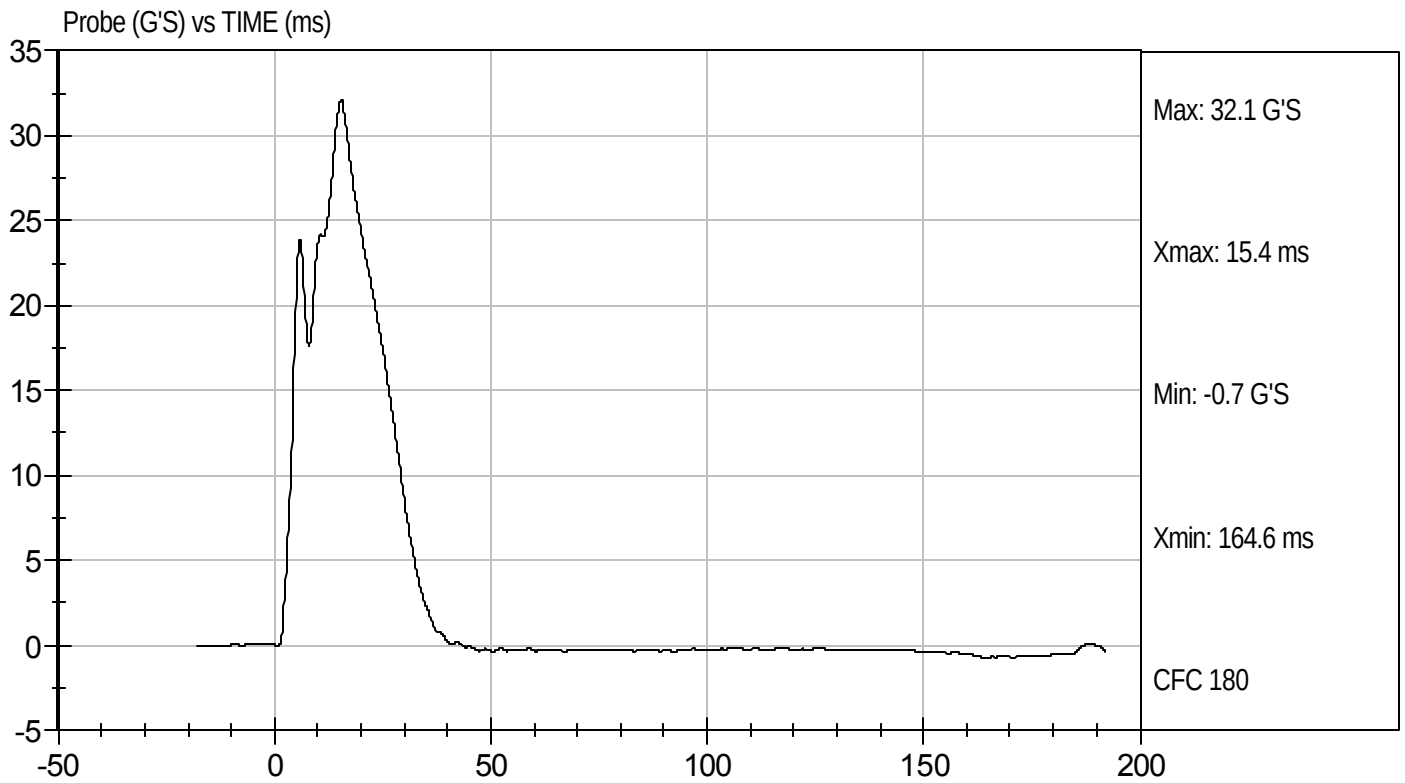
6/8/09
 Test Date


 Approved By



Test Desc: Thorax Impact
Component ID: D091434

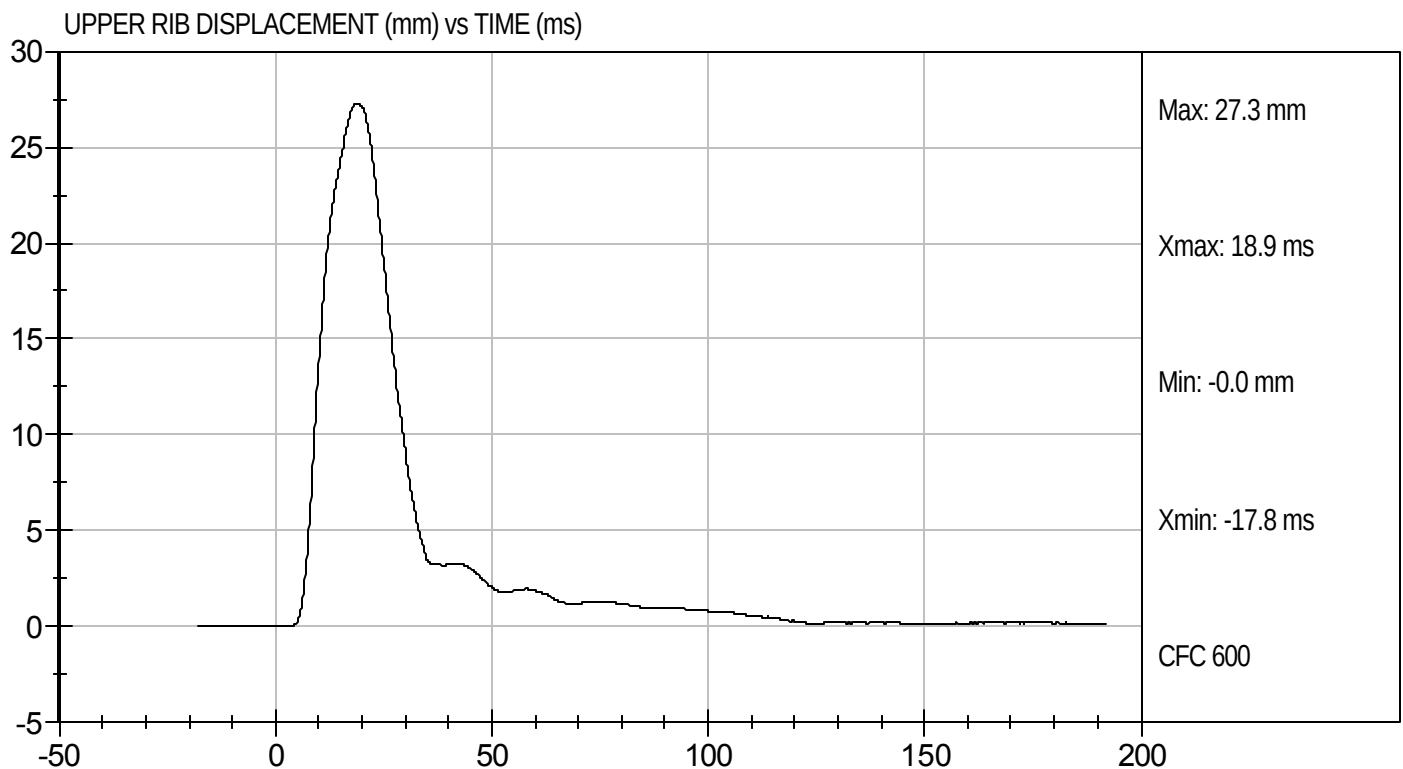
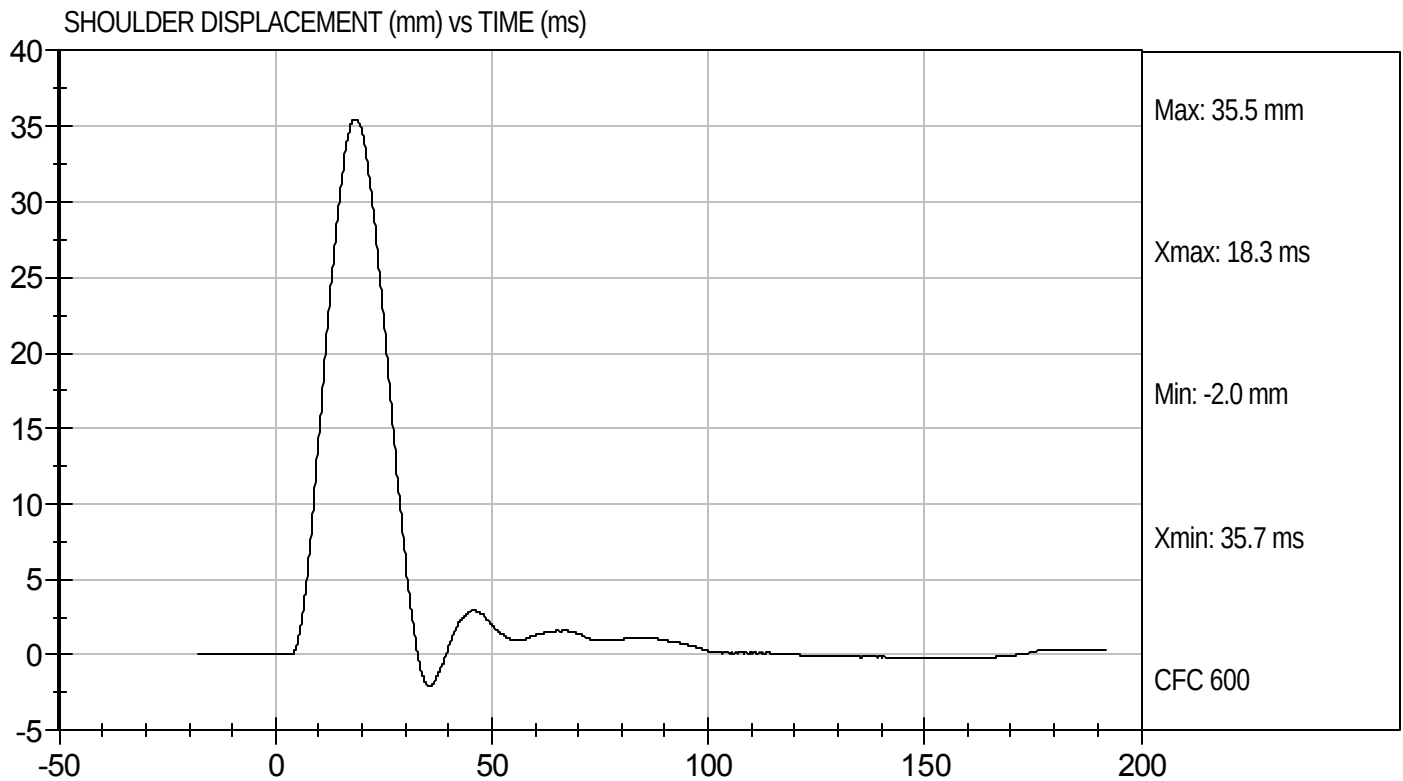
Test Date: 6/8/09
Velocity: 21.9 ft/s, 6.68 m/s





Test Desc: Thorax Impact
Component ID: D091434

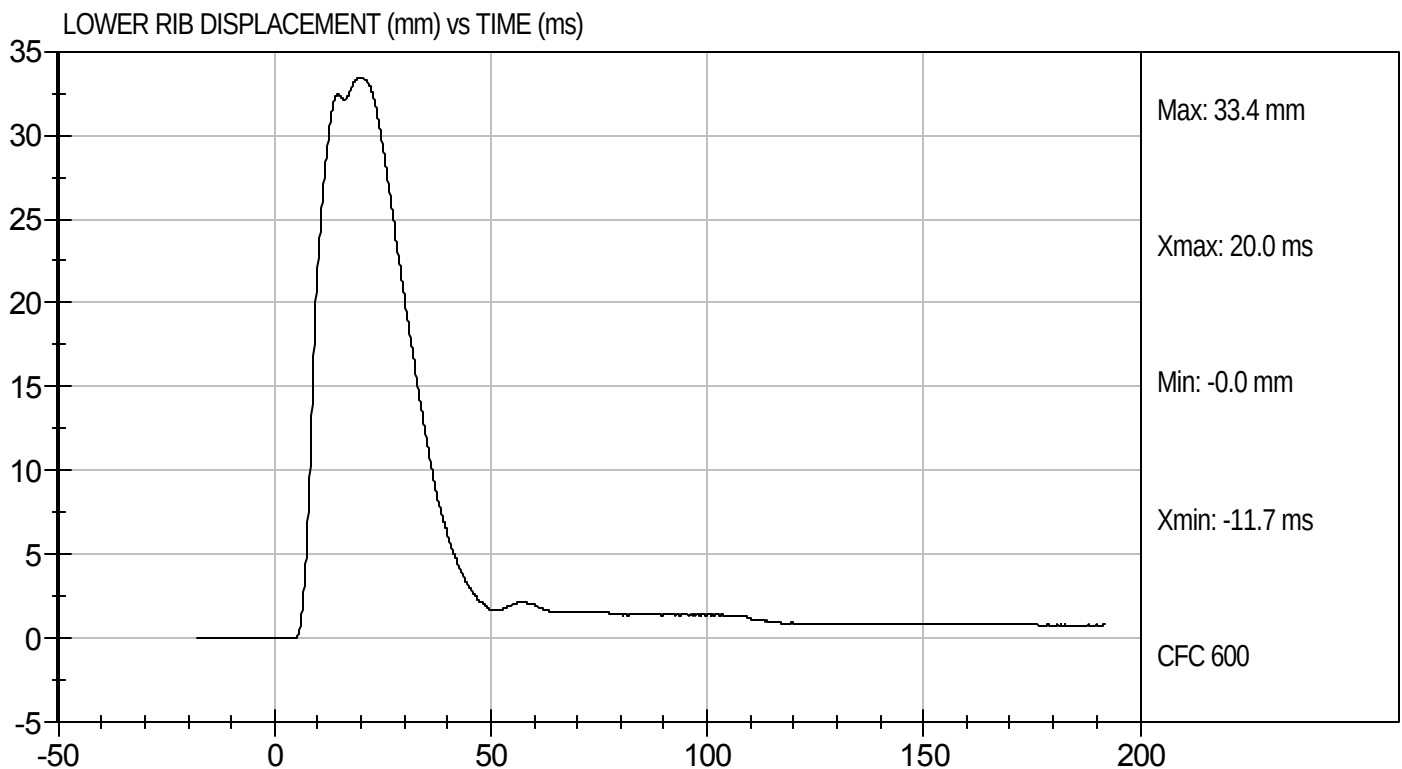
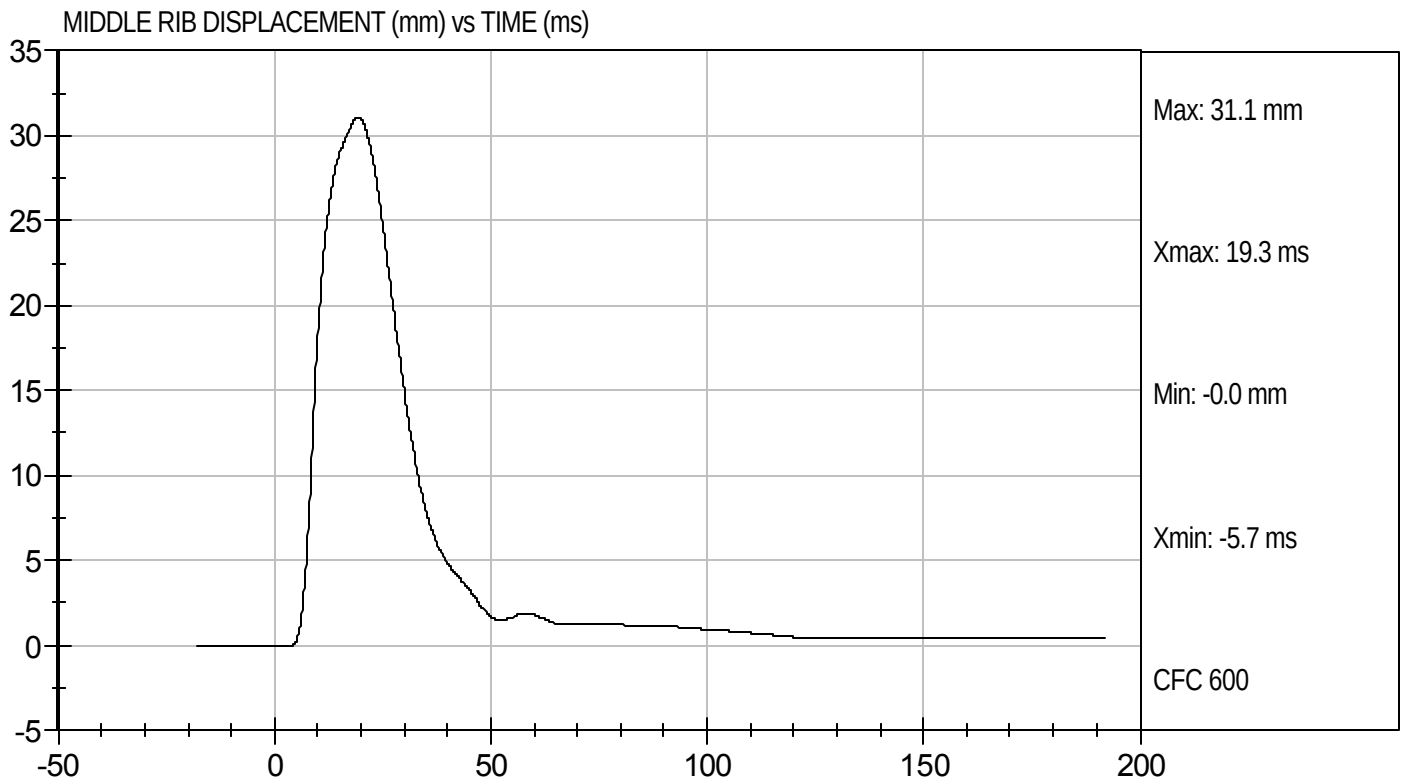
Test Date: 6/8/09
Velocity: 21.9 ft/s, 6.68 m/s





Test Desc: Thorax Impact
Component ID: D091434

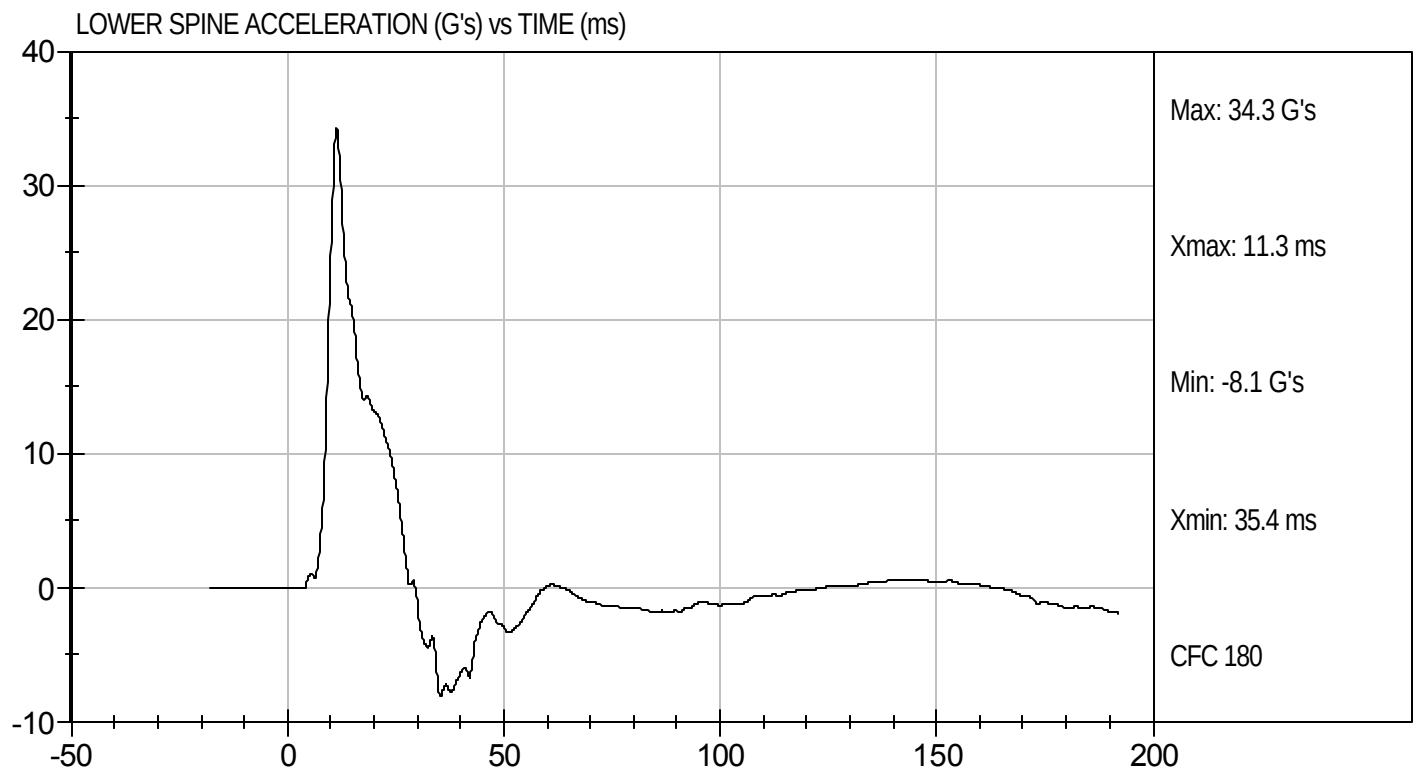
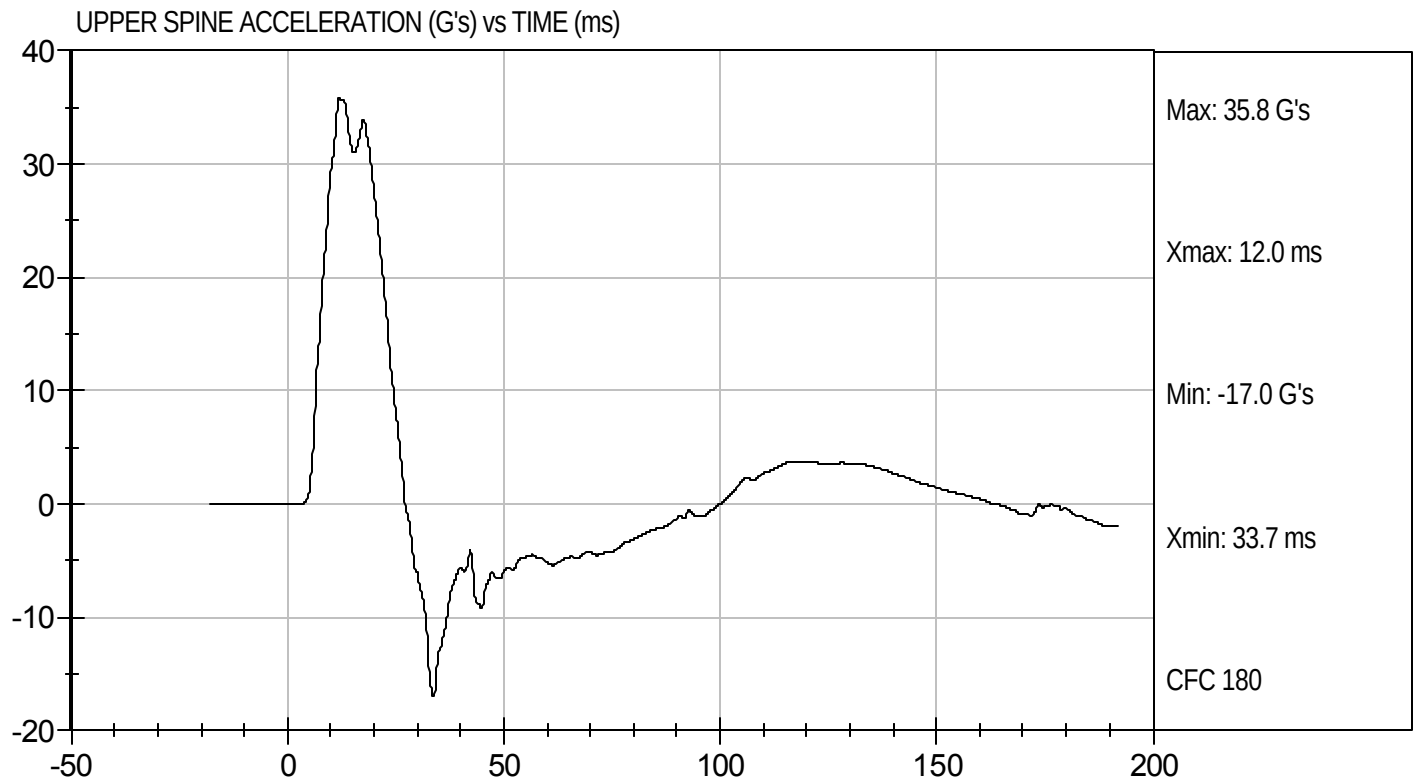
Test Date: 6/8/09
Velocity: 21.9 ft/s, 6.68 m/s





Test Desc: Thorax Impact
Component ID: D091434

Test Date: 6/8/09
Velocity: 21.9 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: D091435

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	47	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	40	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	9	Pass
Overall Test Results				Pass


 Laboratory Technician

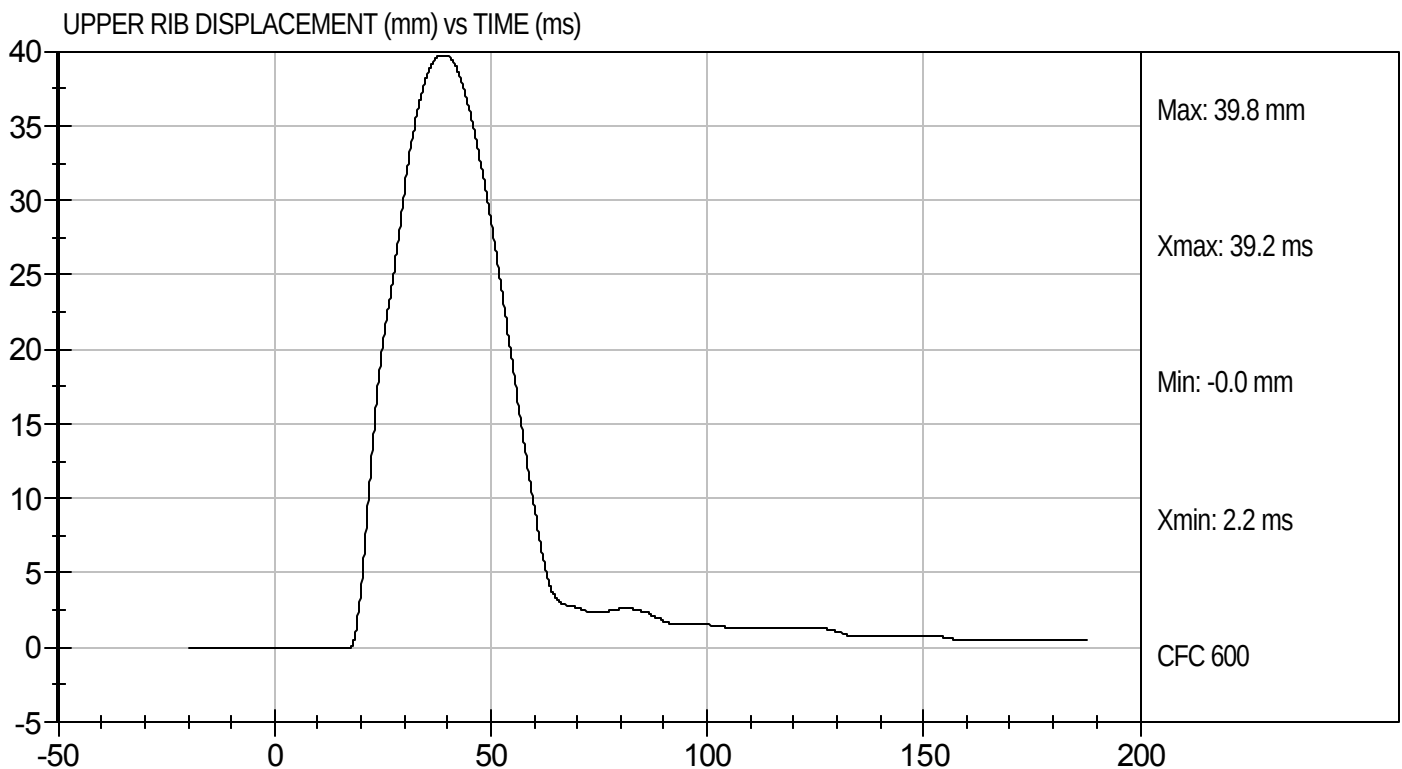
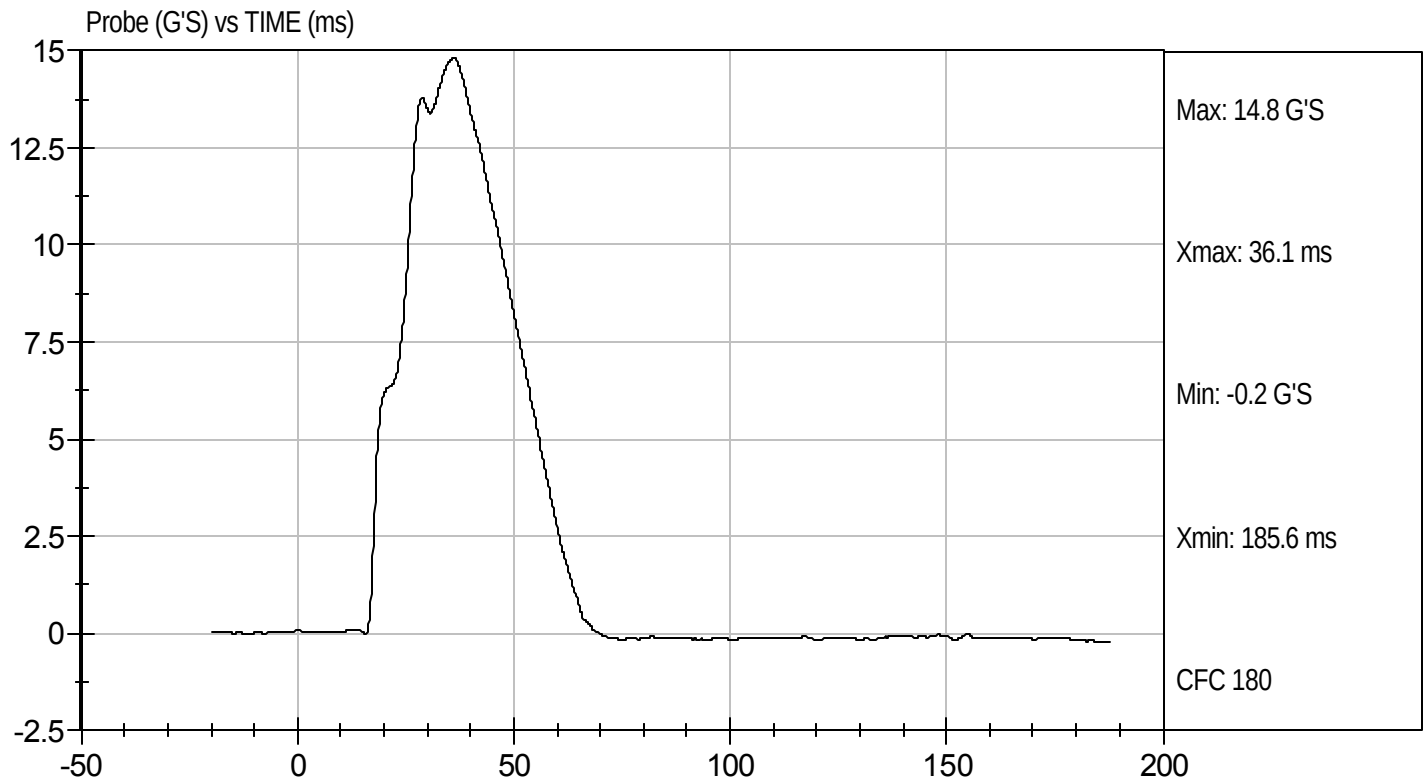
6/8/09
 Test Date


 Approved By



Test Desc: Thorax Impact
Component ID: D091435

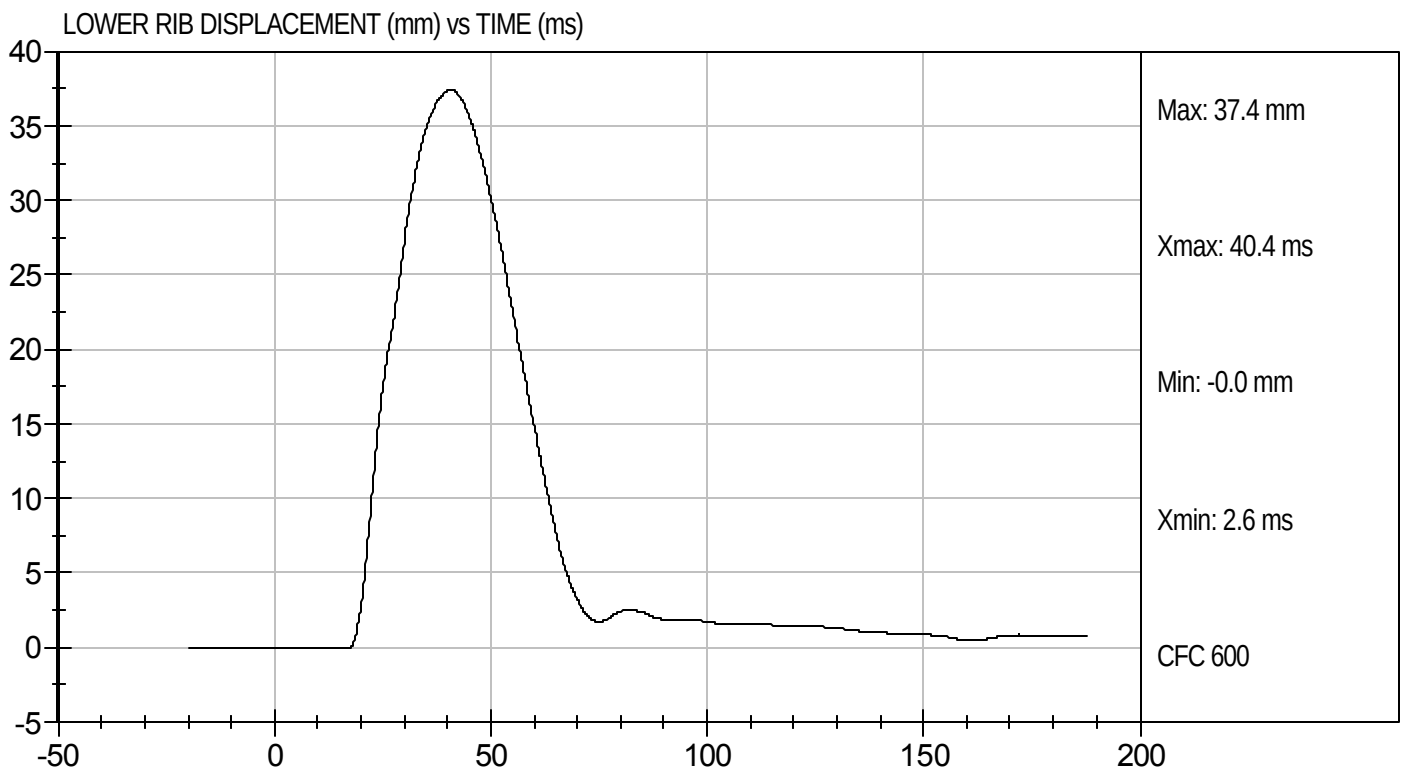
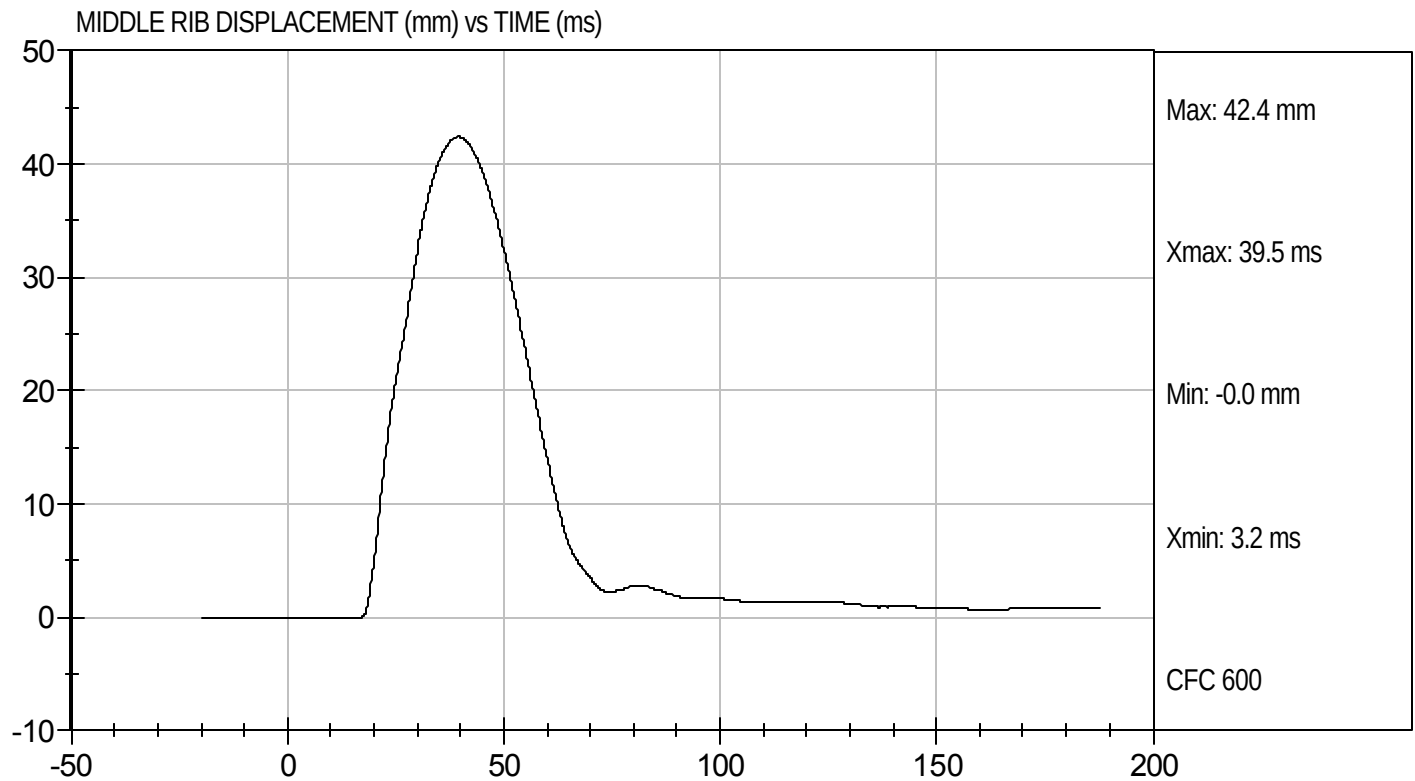
Test Date: 6/8/09
Velocity: 14.1 ft/s, 4.30 m/s





Test Desc: Thorax Impact
Component ID: D091435

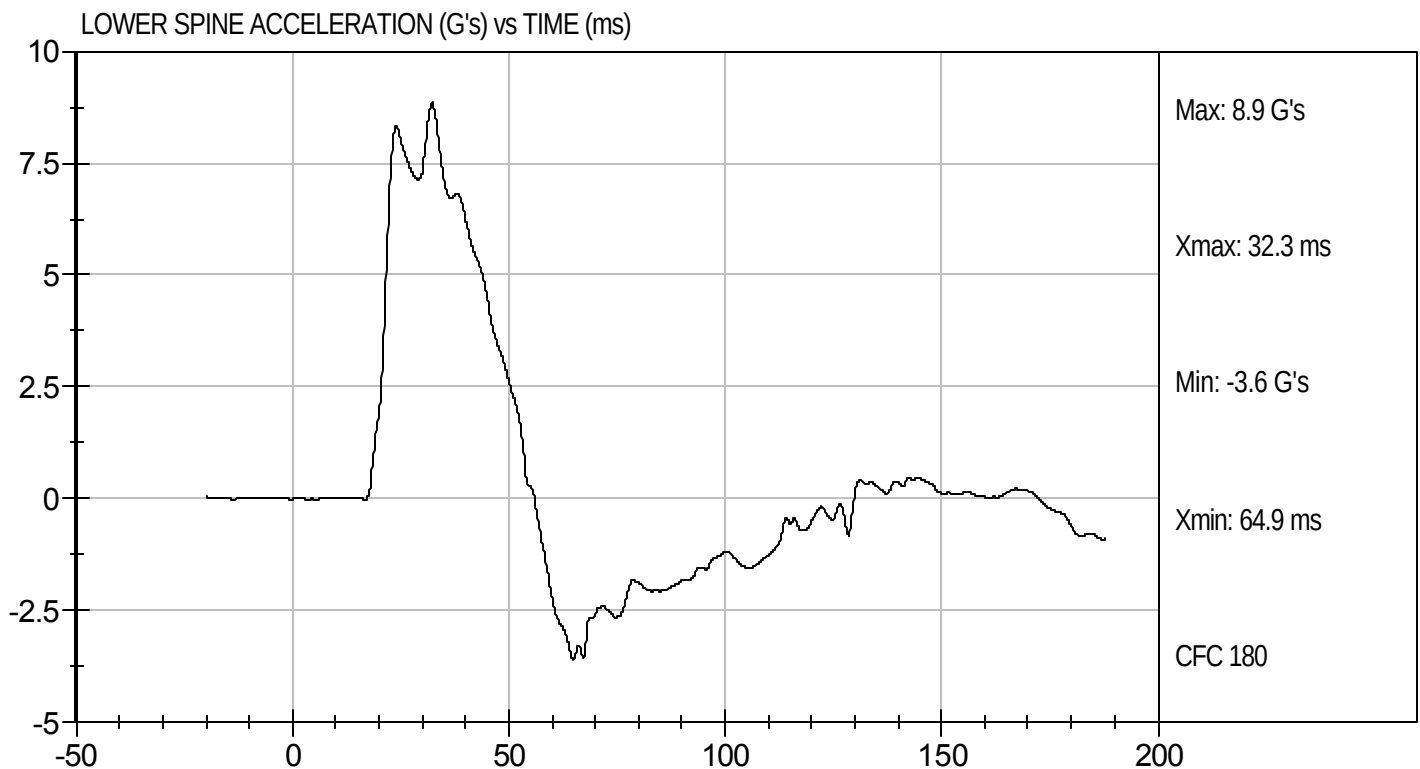
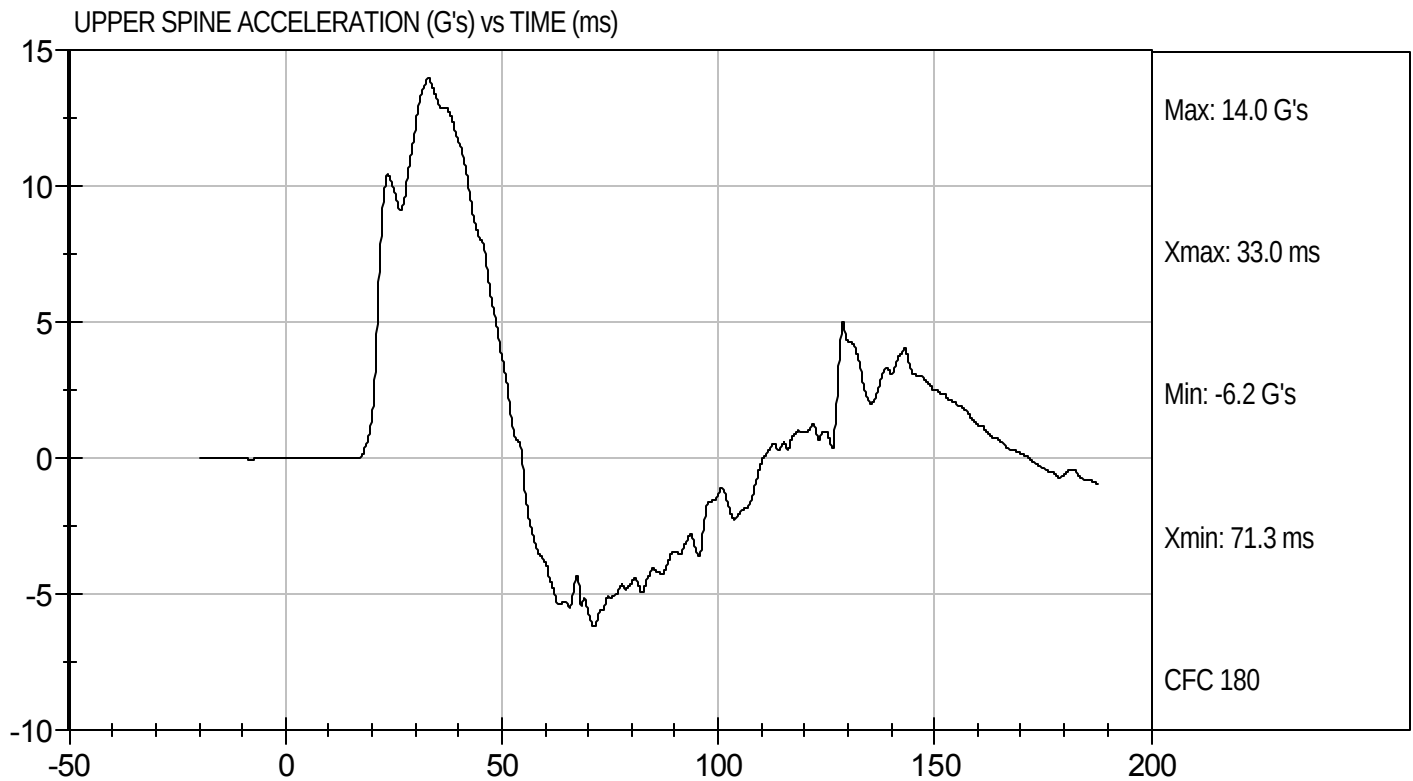
Test Date: 6/8/09
Velocity: 14.1 ft/s, 4.30 m/s





Test Desc: Thorax Impact
Component ID: D091435

Test Date: 6/8/09
Velocity: 14.1 ft/s, 4.30 m/s



MGA RESEARCH CORPORATION
ABDOMINAL IMPACT TEST
SID-II's BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D091436

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Peak Impactor Acceleration	G's	12 to 16	14	Pass
Upper Rib Displacement	mm	36 to 47	40	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

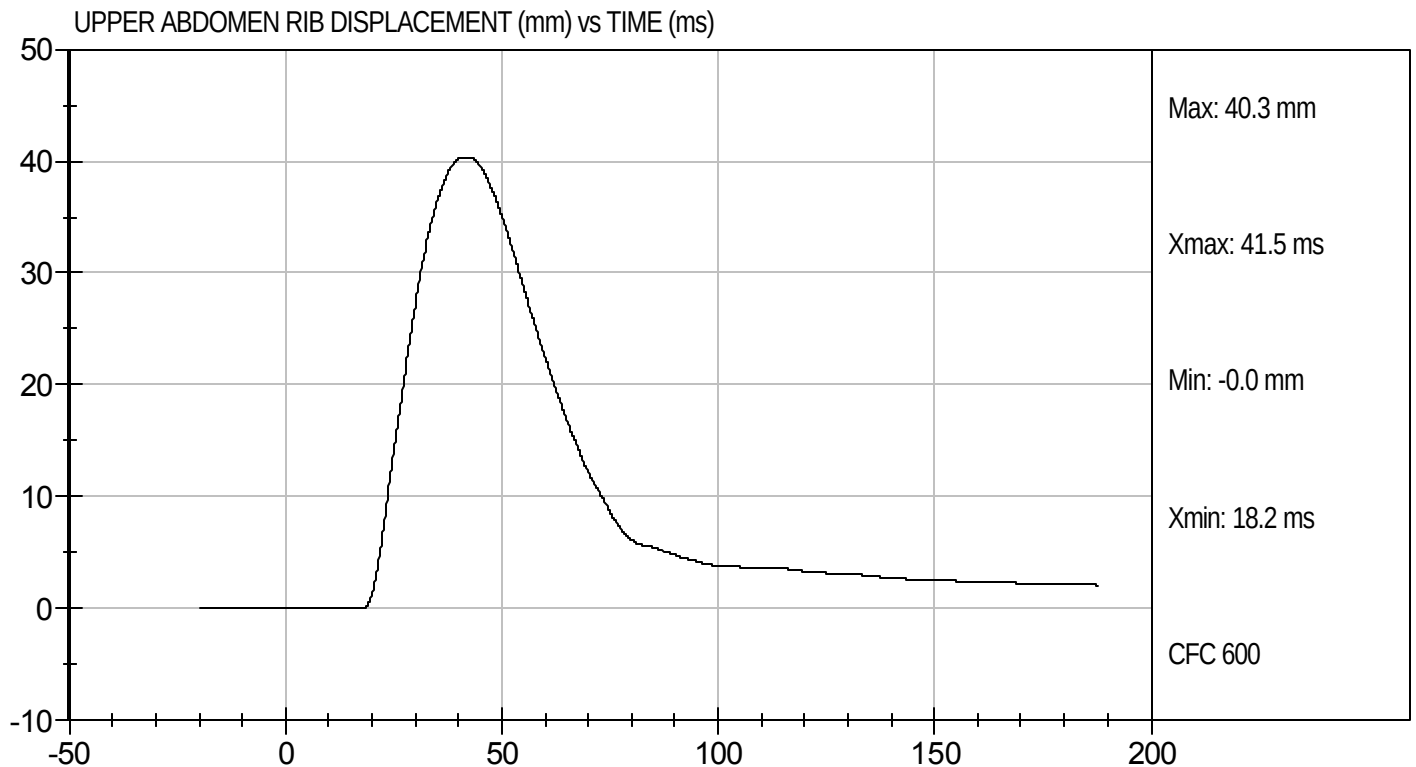
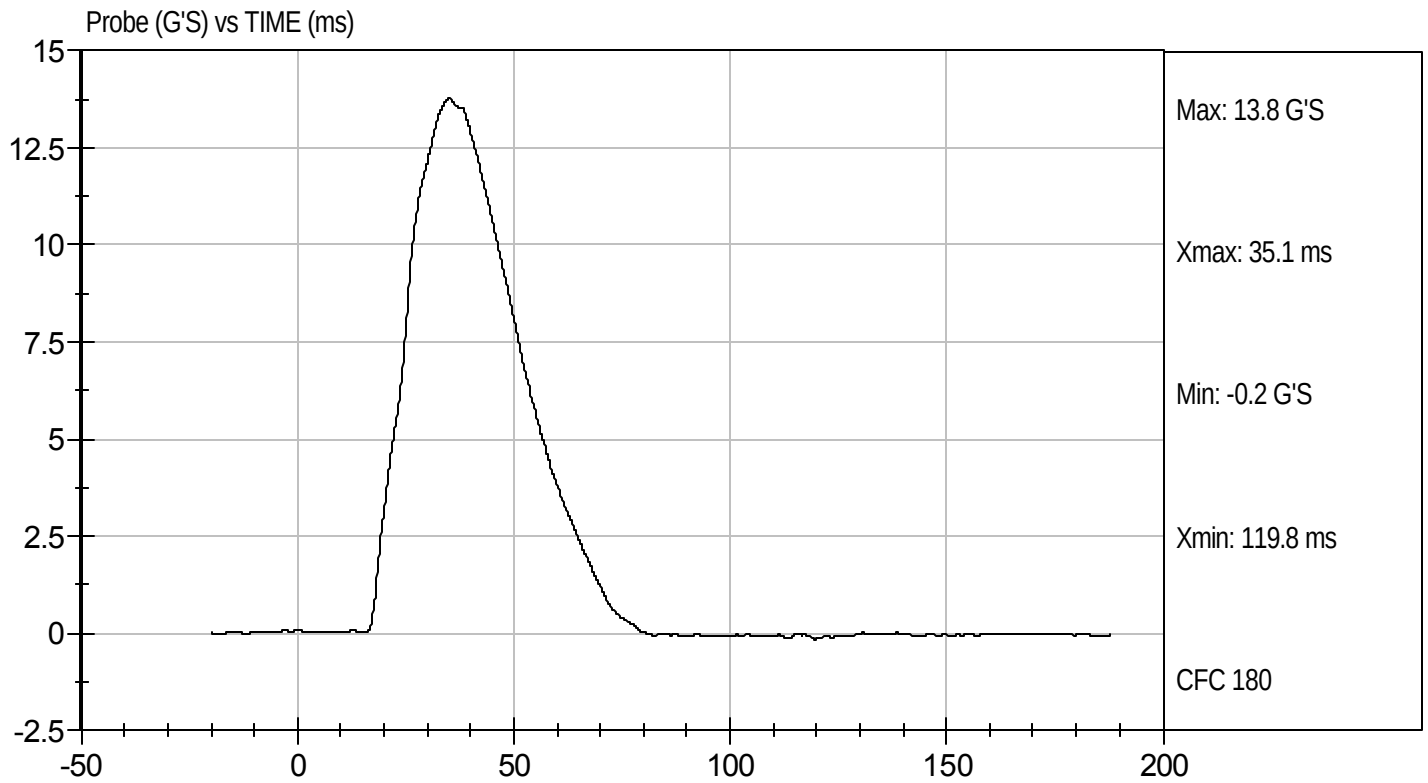
6/8/09
Test Date


Approved By



Test Desc: Abdomen Impact
Component ID: D091436

Test Date: 6/8/09
Velocity: 14.1 ft/s, 4.30 m/s

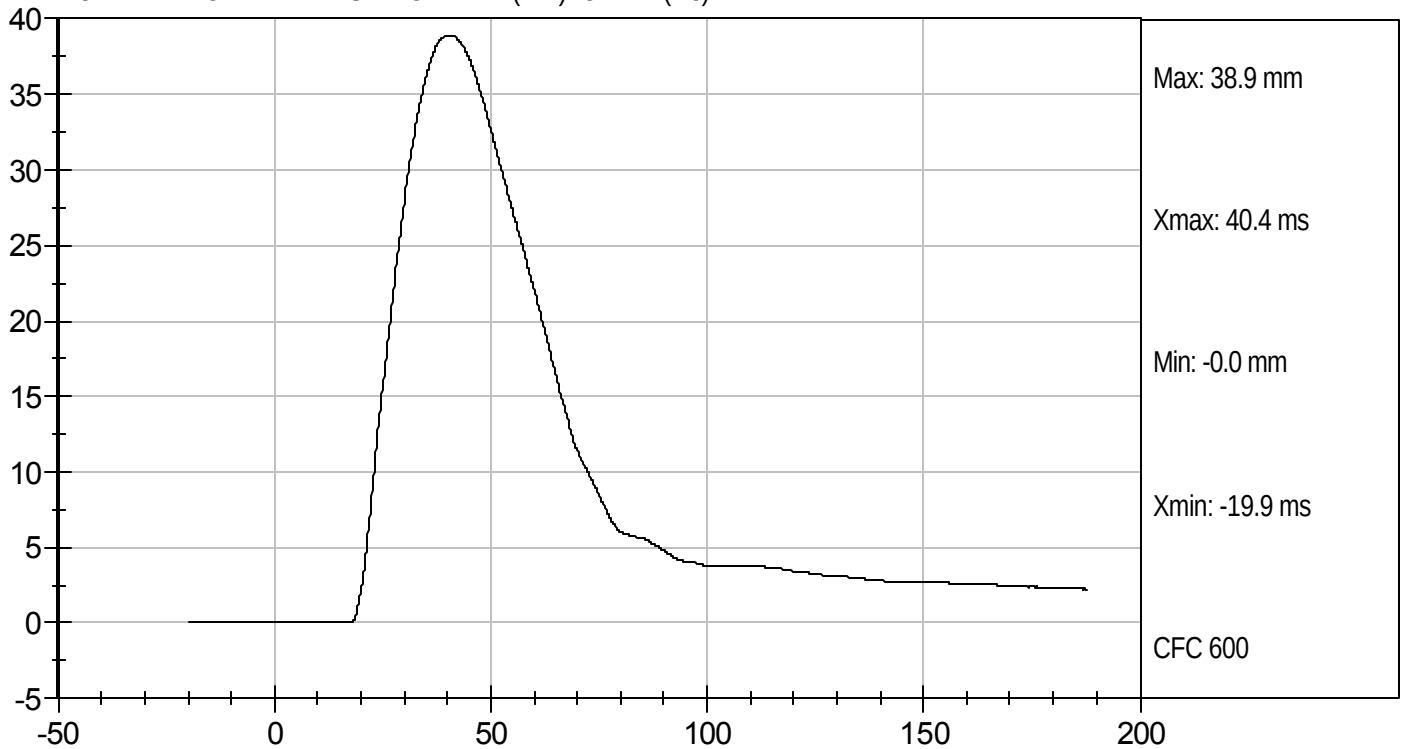




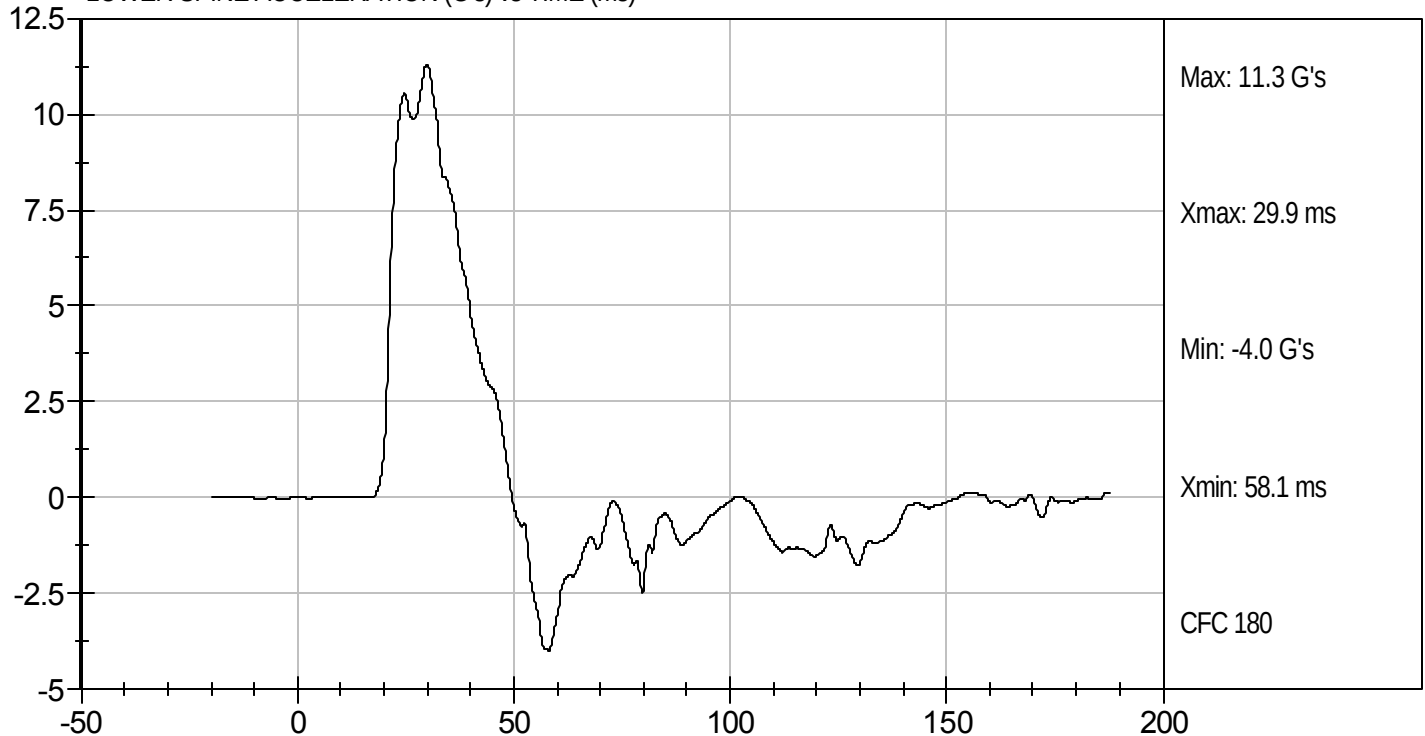
Test Desc: Abdomen Impact
Component ID: D091436

Test Date: 6/8/09
Velocity: 14.1 ft/s, 4.30 m/s

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



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



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

ATD Serial No: 296

Test I.D: D091437

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.2	Pass
Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Peak Impactor Acceleration	G's	38 to 47	43	Pass
Pelvis Y Acceleration after 6 ms	G's	34 to 42	38	Pass
Peak Acetabulum Force	N	3600 to 4300	4114	Pass
Overall Test Results			Pass	


Laboratory Technician

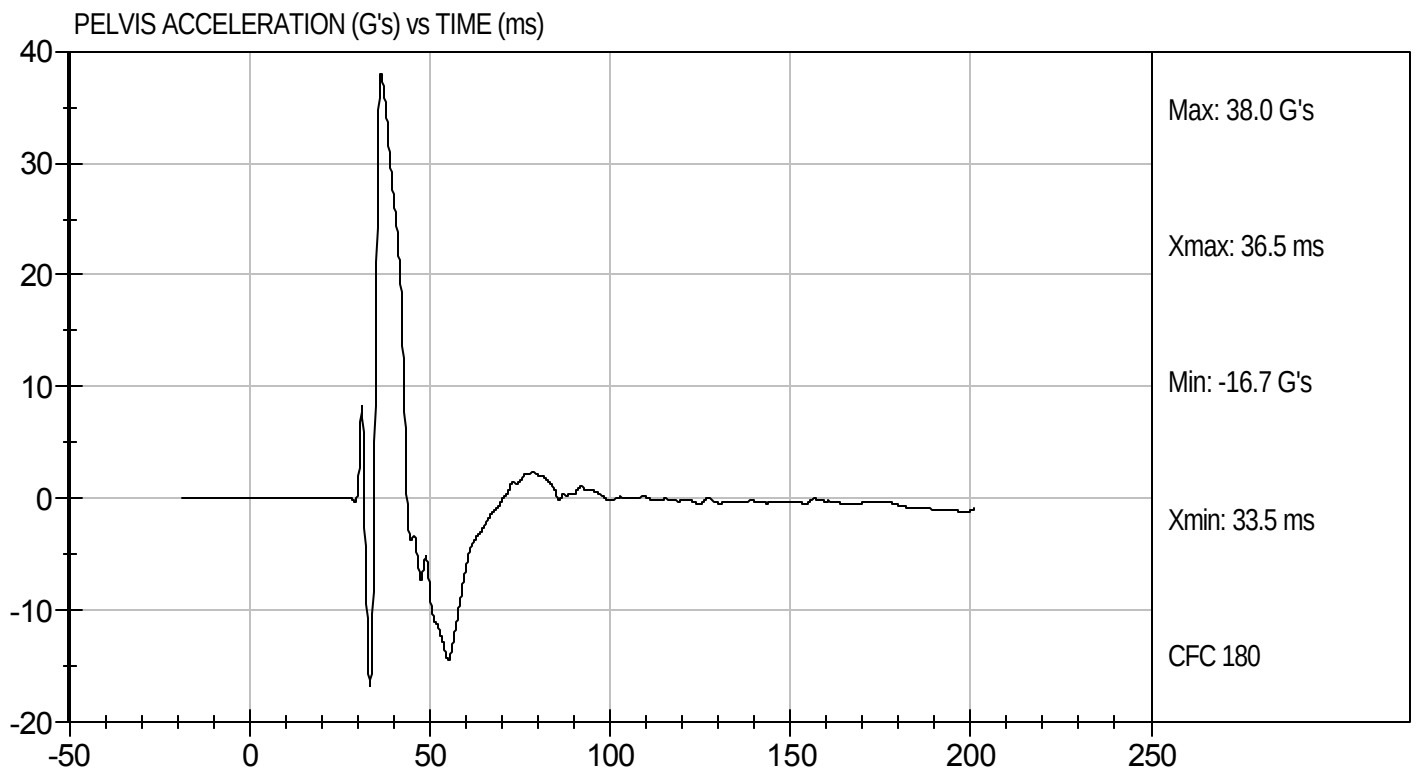
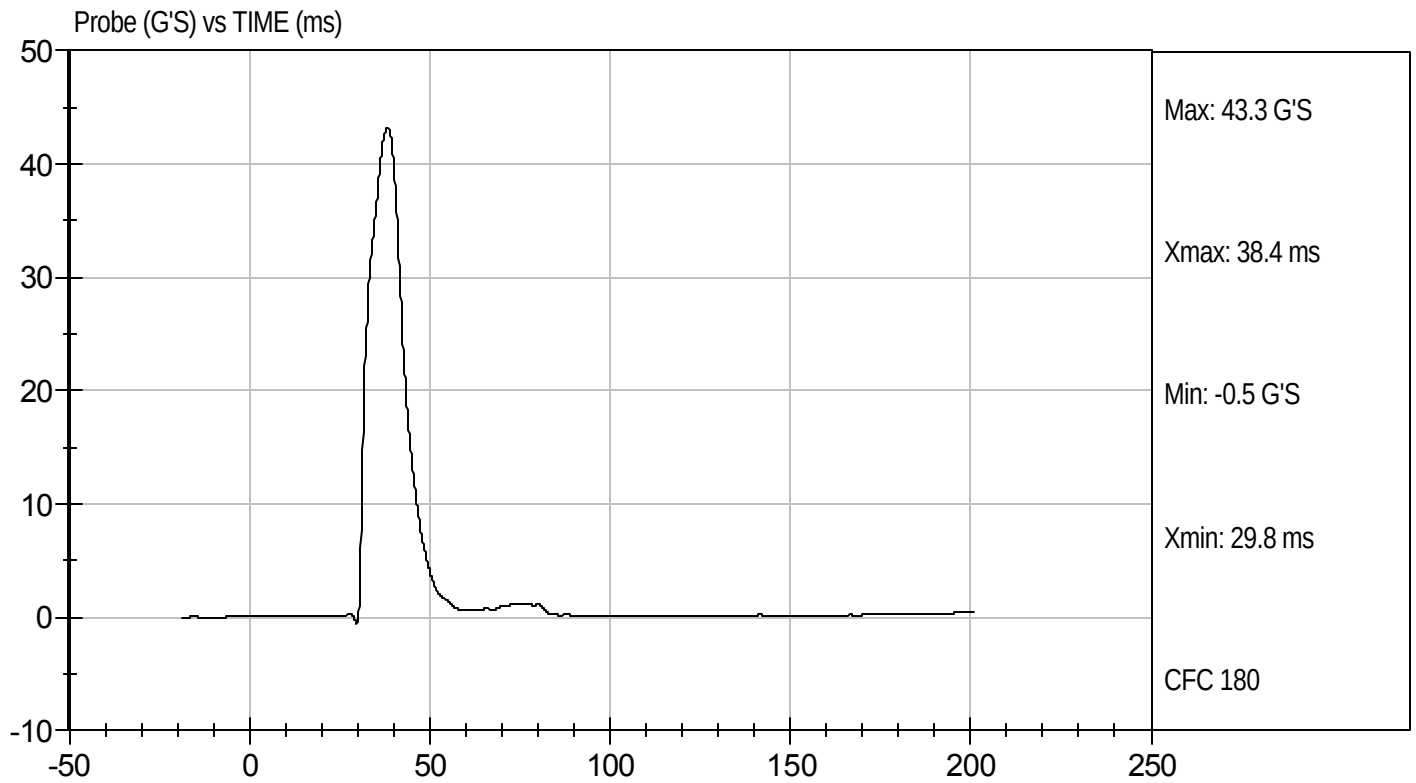
6/8/09
Test Date


Approved By



Test Desc: Pelvis Impact
Component ID: D091437

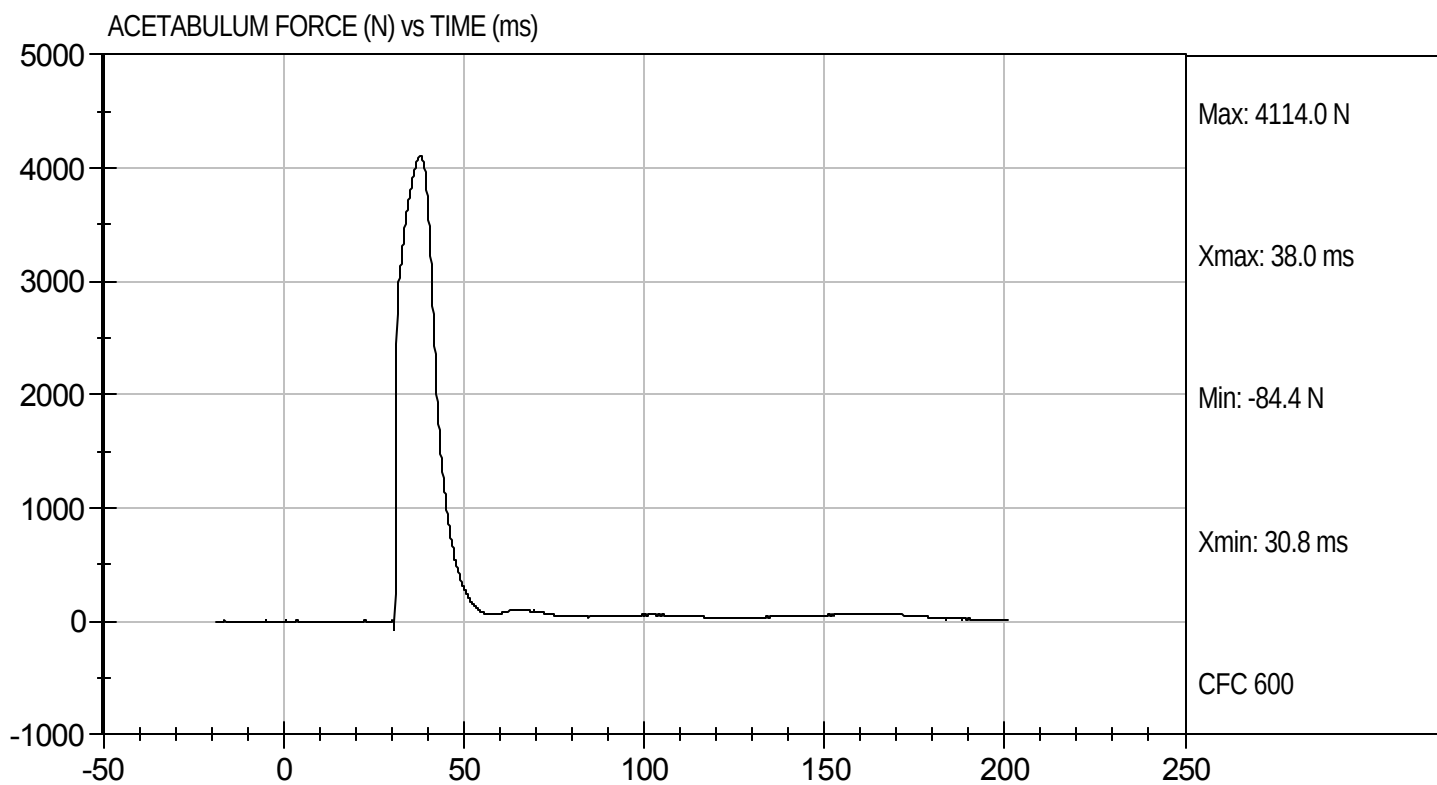
Test Date: 6/8/09
Velocity: 22.2 ft/s, 6.77 m/s





Test Desc: Pelvis Impact
Component ID: D091437

Test Date: 6/8/09
Velocity: 22.2 ft/s, 6.77 m/s



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

ATD Serial No: 296

Test I.D: D091438

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.2	Pass
Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Peak Impactor Acceleration	G's	36 to 45	38	Pass
Pelvis Y Acceleration	G's	28 to 39	31	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4430	Pass
Overall Test Results			Pass	


Laboratory Technician

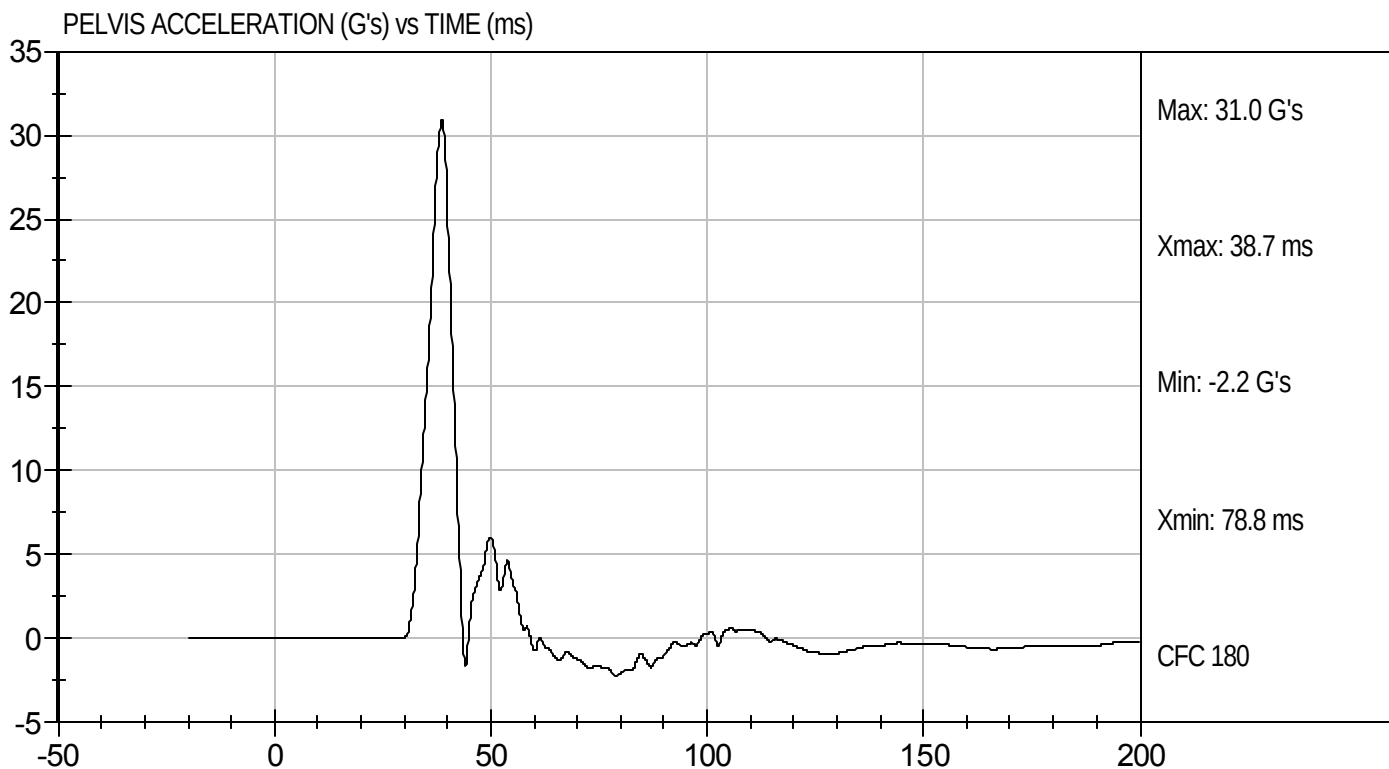
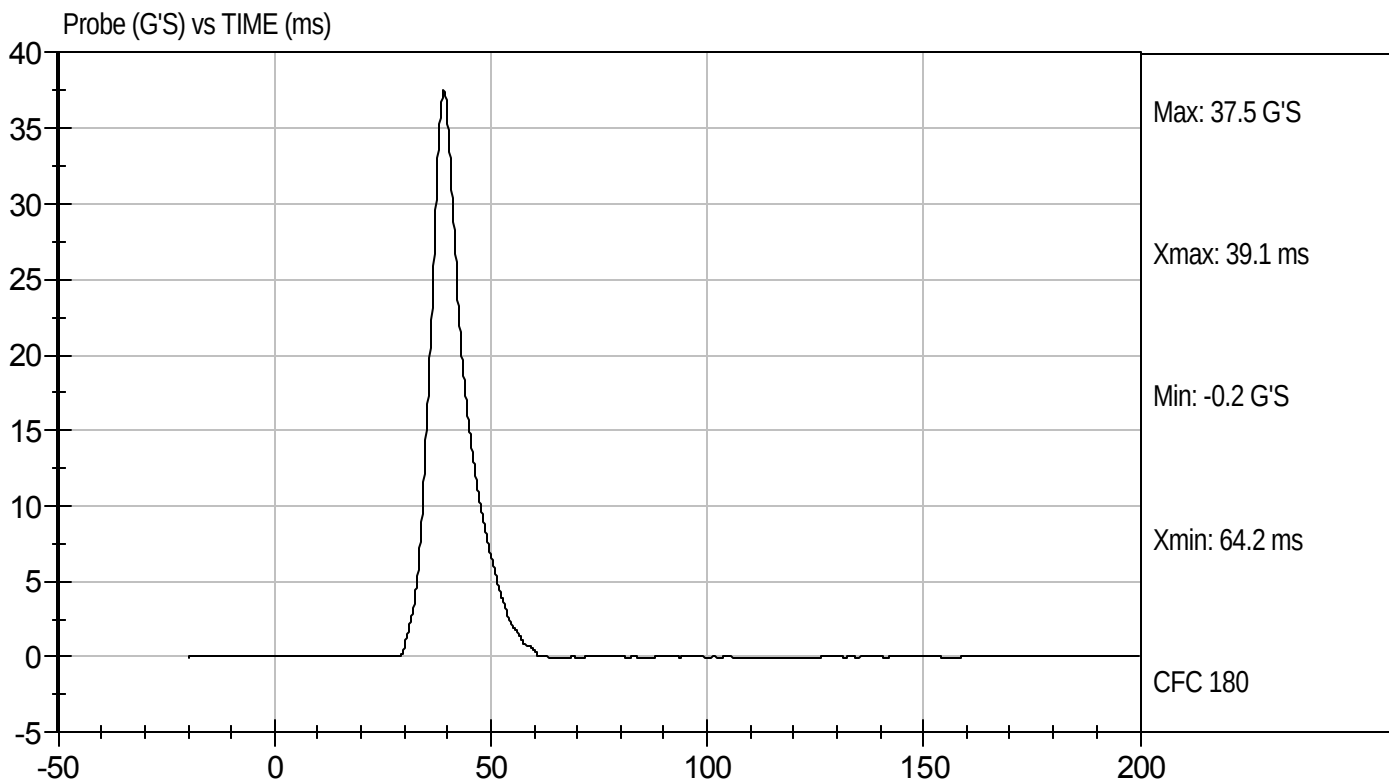
6/8/09
Test Date


Approved By



Test Desc: Iliac Impact
Component ID: D091438

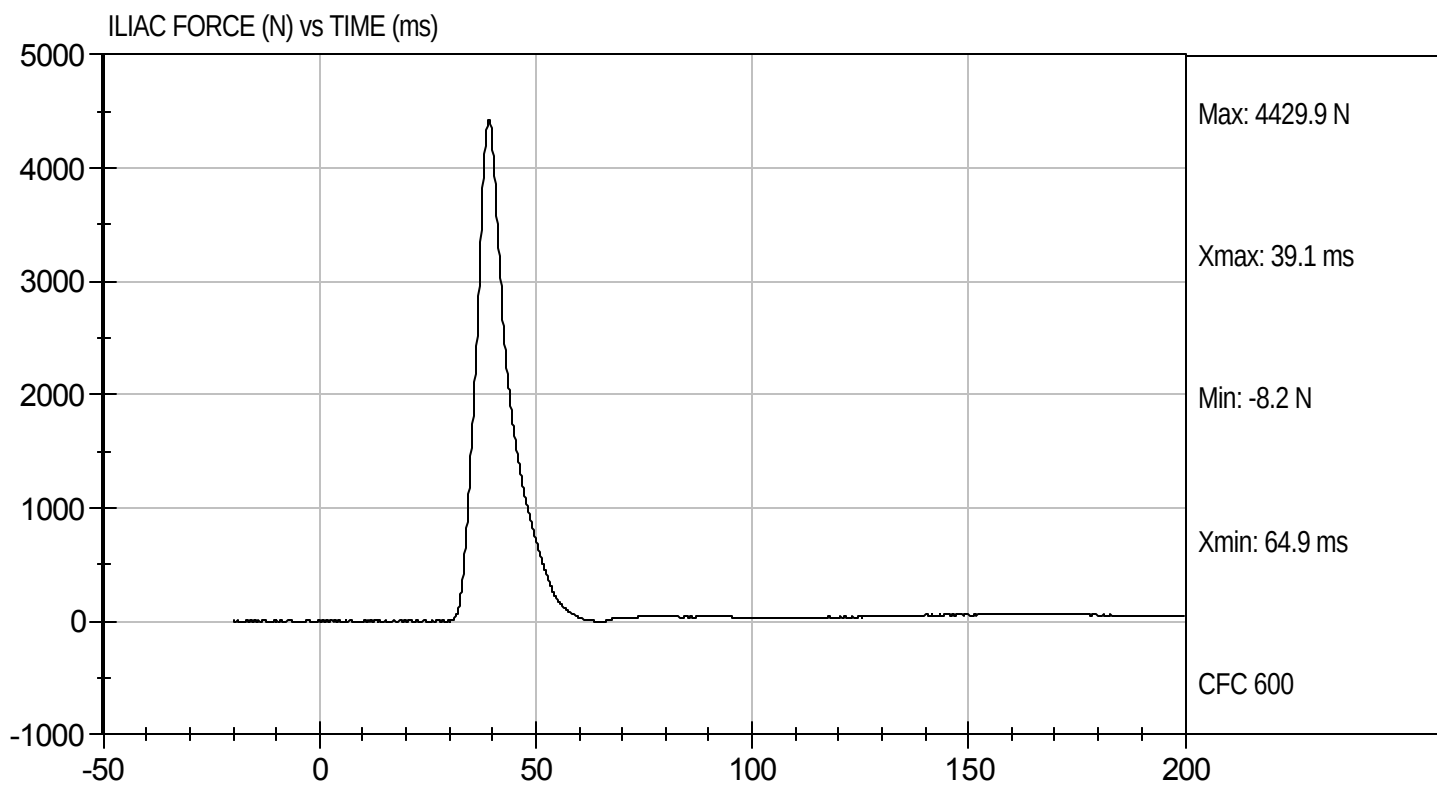
Test Date: 6/8/09
Velocity: 14.1 ft/s, 4.30 m/s





Test Desc: Iliac Impact
Component ID: D091438

Test Date: 6/8/09
Velocity: 14.1 ft/s, 4.30 m/s



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

ATD Serial No: 296

Test ID: D091441

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Peak Resultant Acceleration	G's	115 to 137	119	Pass
Peak Lateral Acceleration	G's	+/- 15	4.5	Pass
Unimodal	N/A	<15%	Yes	Pass
Overall Test Results			Pass	



Laboratory Technician

6/10/09
Test Date



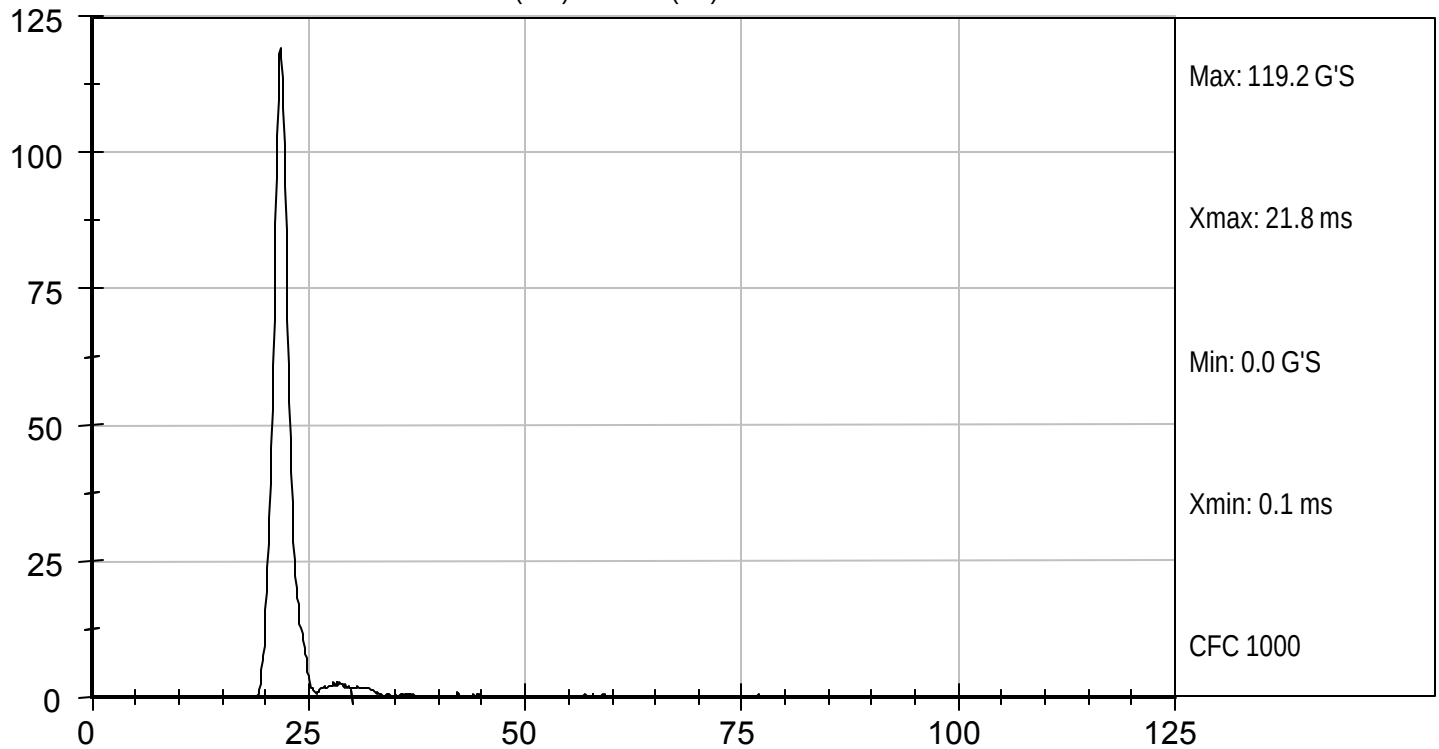
Approved By



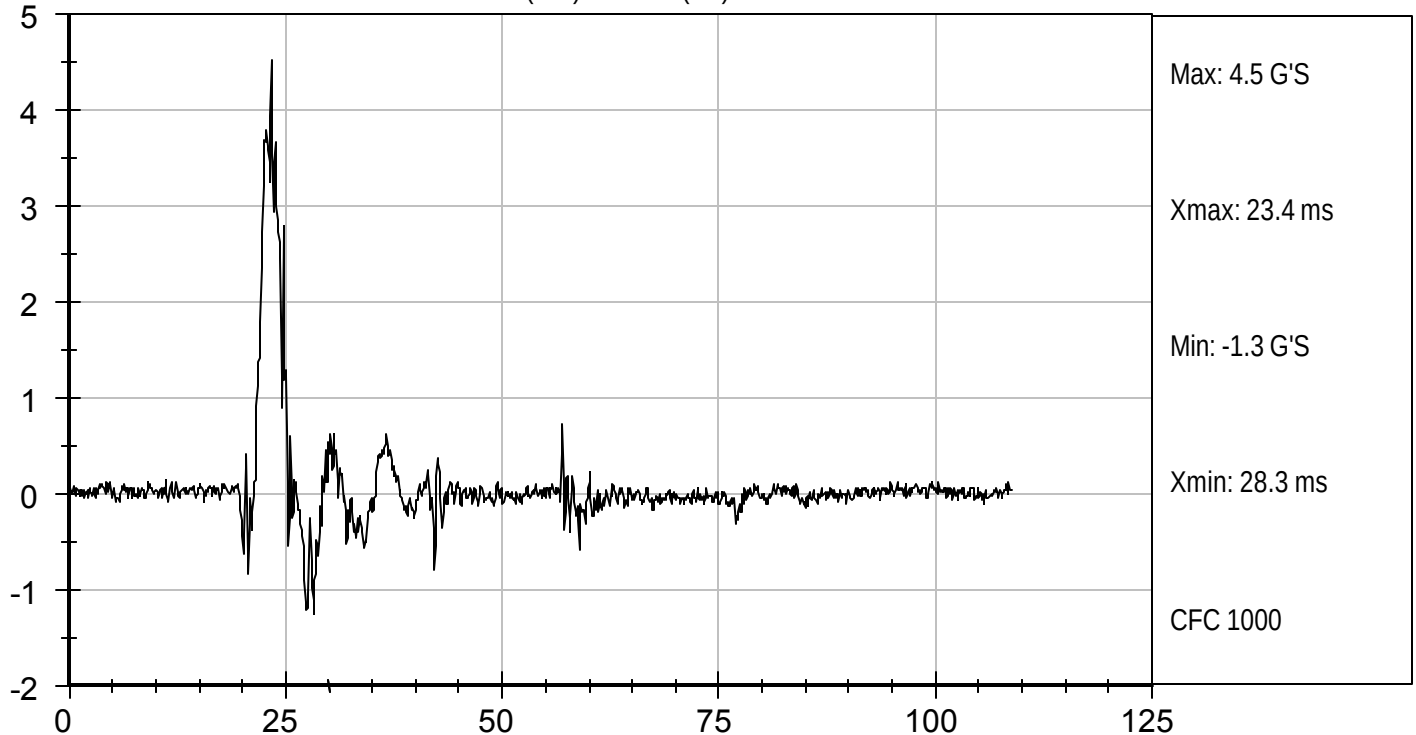
Test Desc: Head Drop
Component ID: D091441

Test Date: 6/10/09
Velocity: 0 ft/s, 0 m/s

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



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

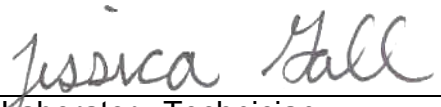


MGA RESEARCH CORPORATION
LATERAL NECK PENDULUM TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D091442

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	22.2	Pass
Humidity		%	10 to 70	41	Pass
Impact Velocity		m/s	5.51 to 5.63	5.52	Pass
Delta Velocity	10 msec	m/s	2.20 to 2.80	2.52	Pass
	15 msec	m/s	3.30 to 4.10	3.51	Pass
	20 msec	m/s	4.40 to 5.40	4.63	Pass
	25 msec	m/s	5.40 to 6.10	5.55	Pass
	25-100 msec	m/s	5.50 to 6.20	5.60	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		msec	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		msec	102 to 126	115	Pass
Overall Test Results					Pass


 Laboratory Technician

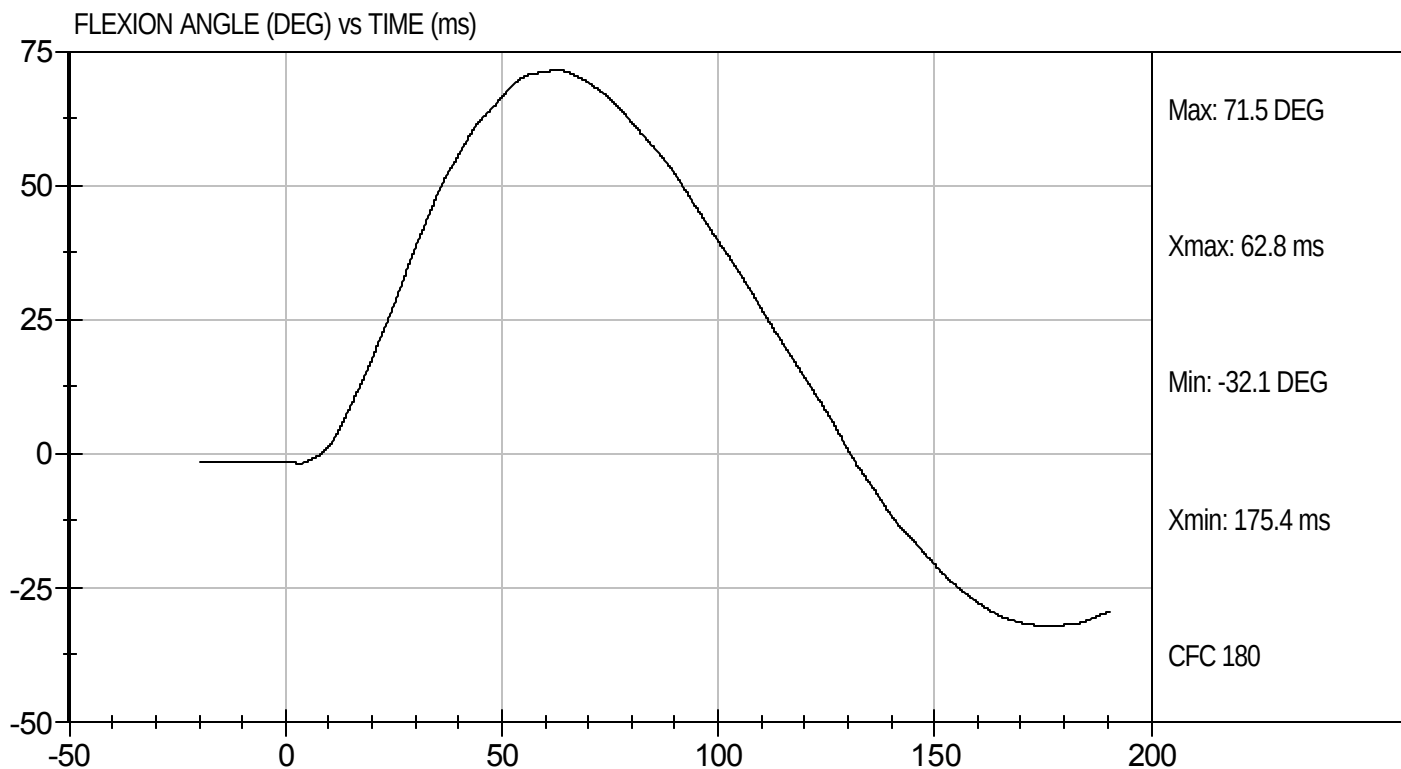
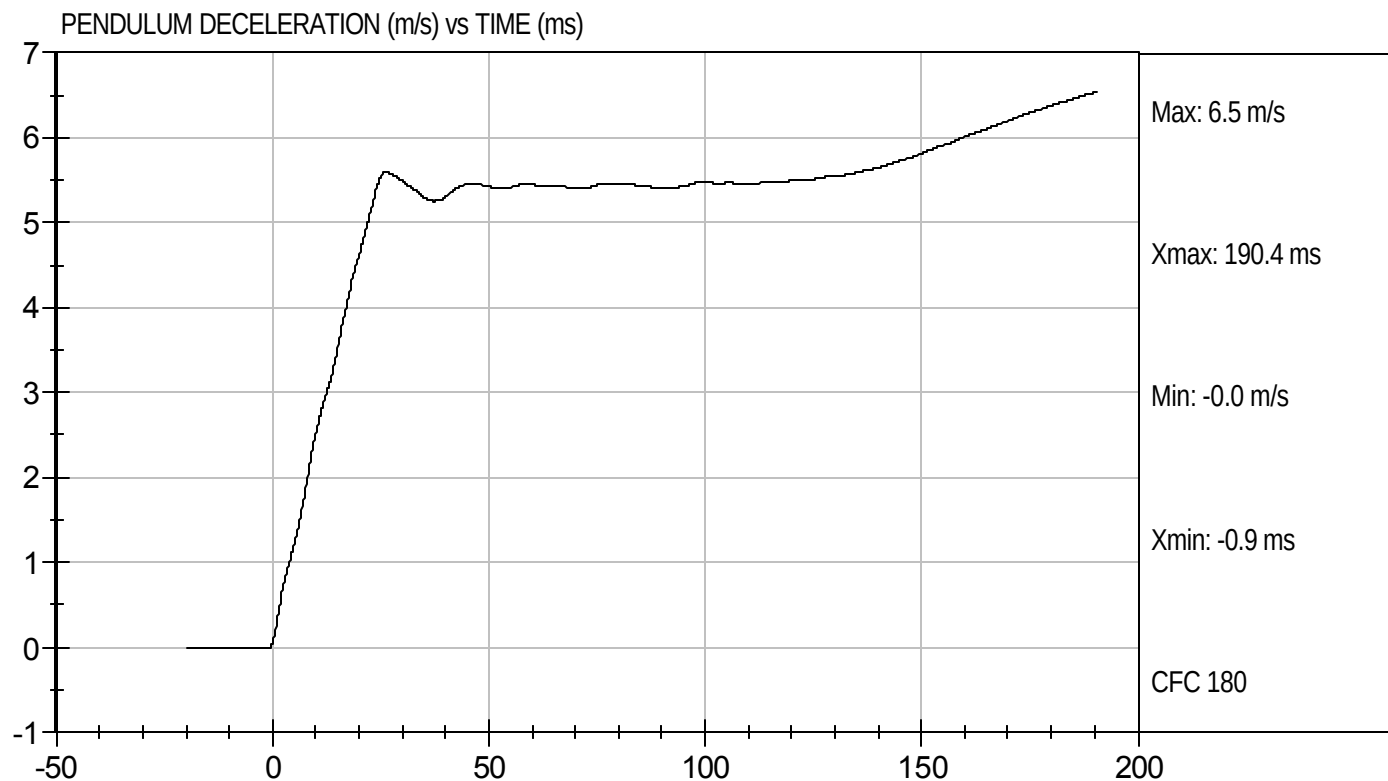
6/11/09
 Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D091442

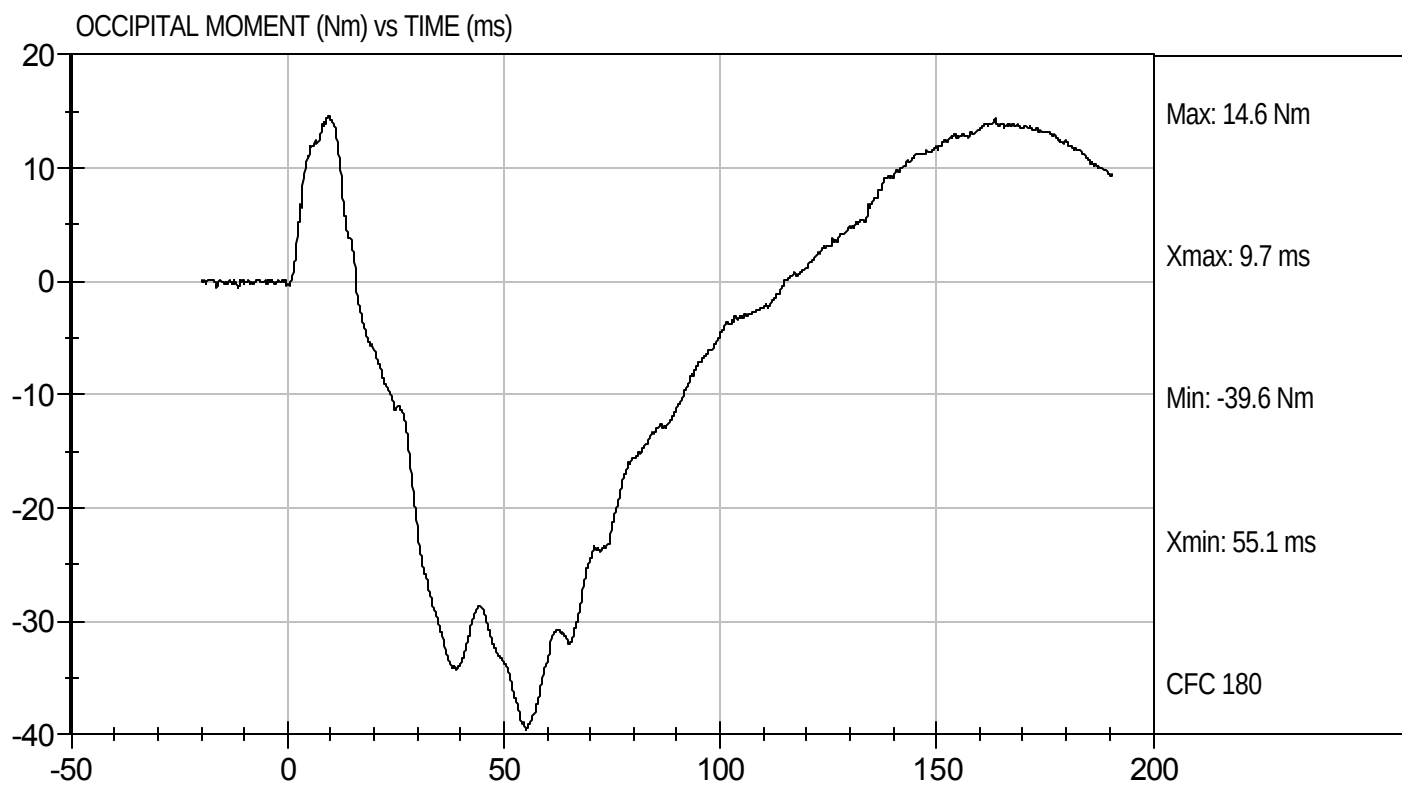
Test Date: 6/11/09
Velocity: 18.1 ft/s, 5.52 m/s





Test Desc: Neck Bending
Component ID: D091442

Test Date: 6/11/09
Velocity: 18.1 ft/s, 5.52 m/s



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

ATD Serial No: 296

Test ID: D091443

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	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

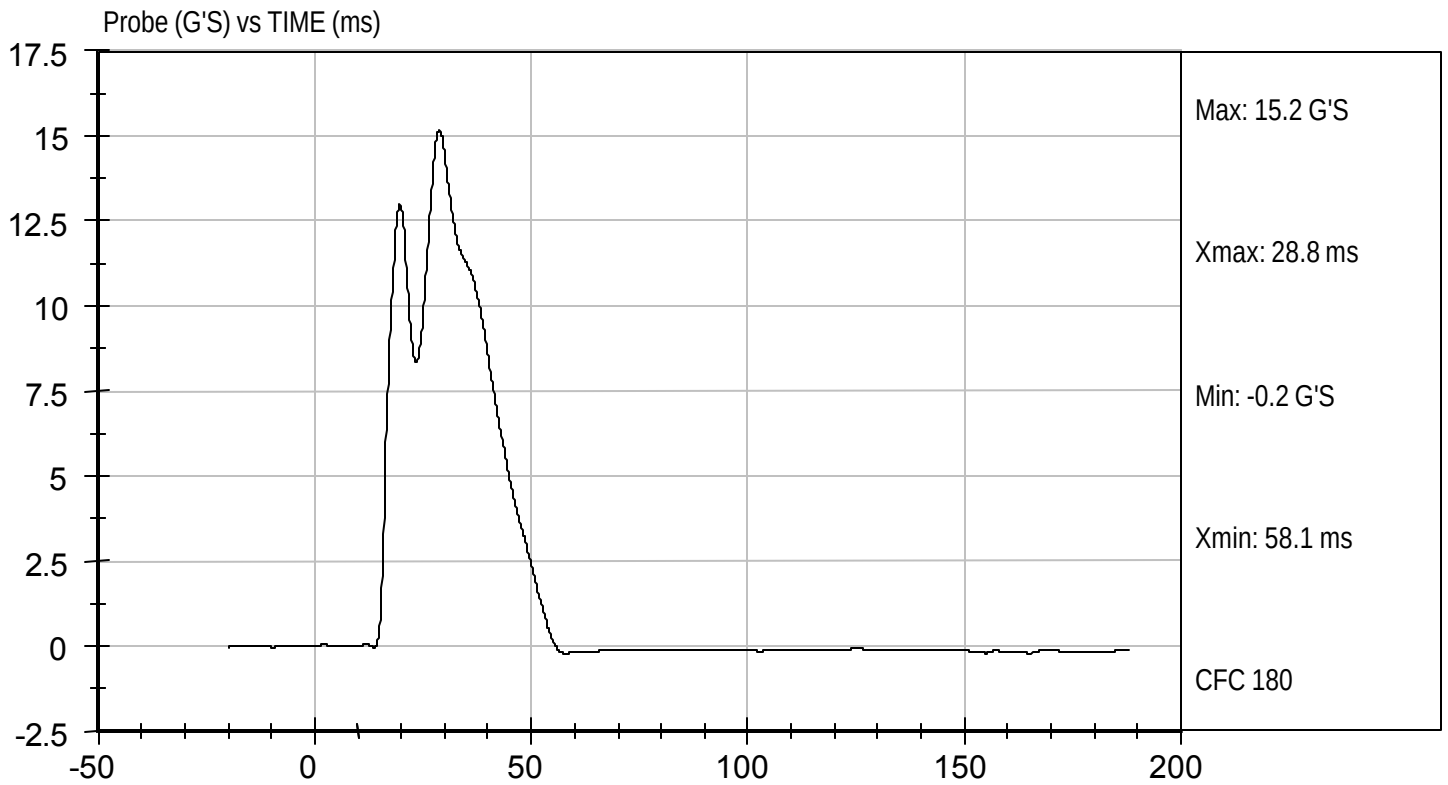
6/10/09
Test Date


Approved By



Test Desc: Shoulder Impact
Component ID: D091443

Test Date: 6/10/09
Velocity: 14.0 ft/s, 4.27 m/s

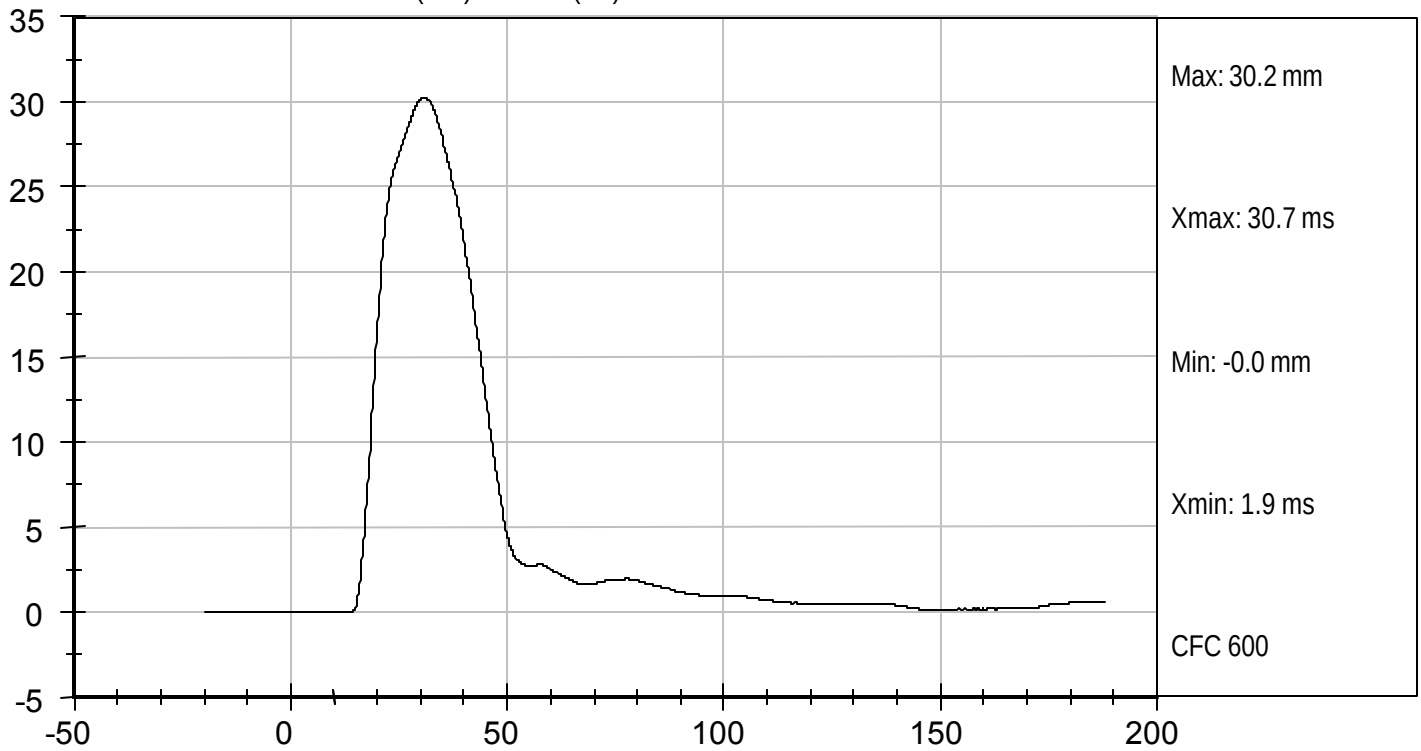




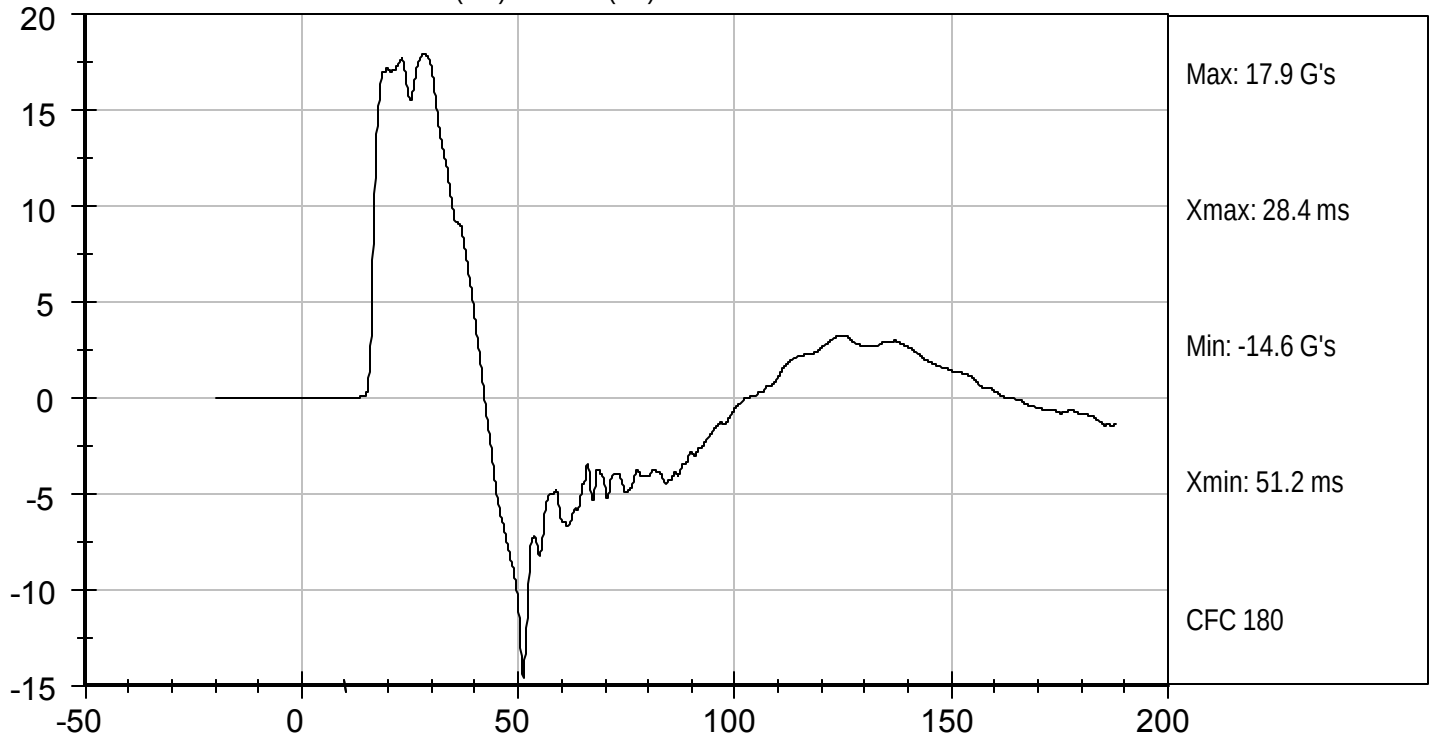
Test Desc: Shoulder Impact
Component ID: D091443

Test Date: 6/10/09
Velocity: 14.0 ft/s, 4.27 m/s

SHOULDER DISPLACEMENT (mm) vs TIME (ms)



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



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

ATD Serial No: 296

Test I.D: D091444

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Peak Impactor Acceleration	G's	30 to 36	32	Pass
Shoulder Displacement	mm	31 to 40	35	Pass
Upper Rib Displacement	mm	25 to 32	27	Pass
Middle Rib Displacement	mm	30 to 36	31	Pass
Lower Rib Displacement	mm	32 to 38	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	37	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	33	Pass
Overall Test Results			Pass	


 Laboratory Technician

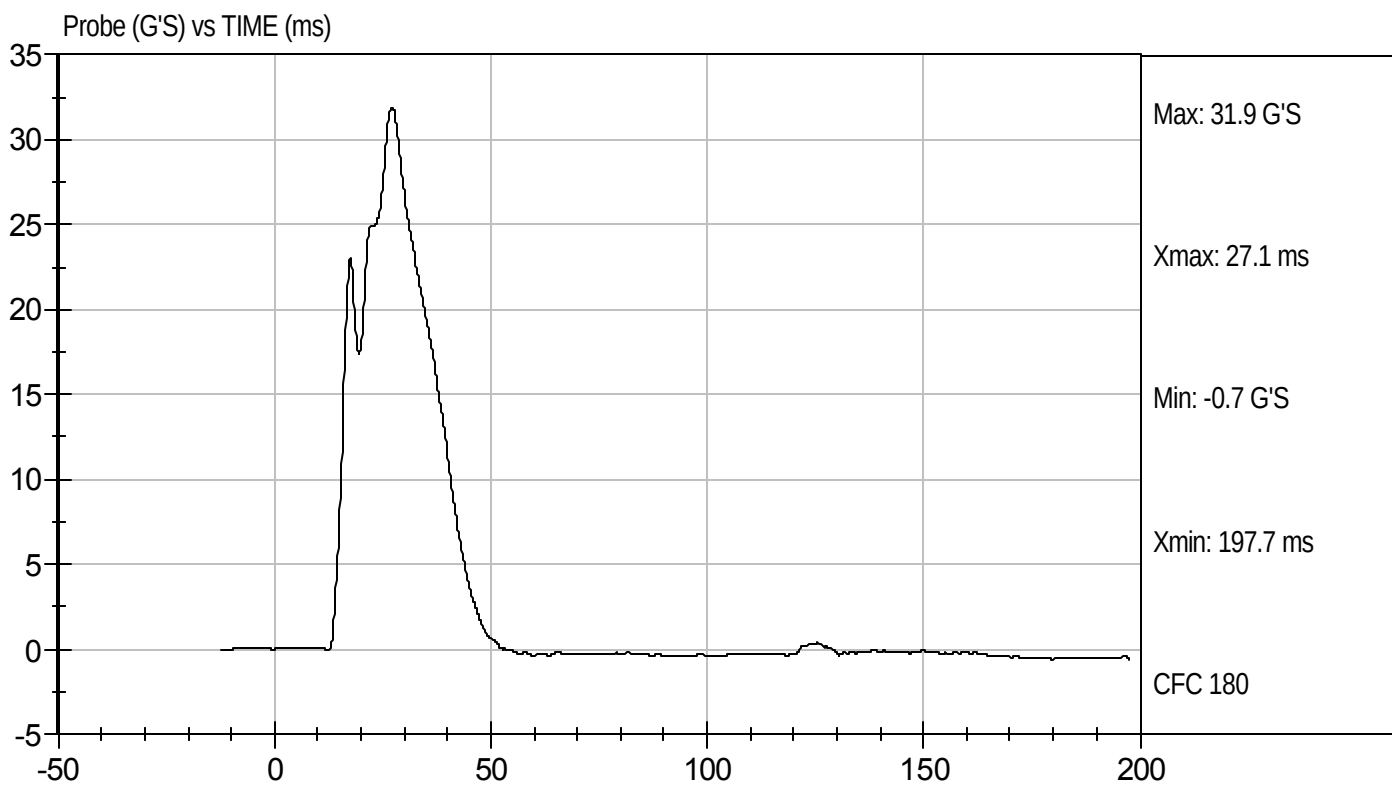
6/10/09
 Test Date


 Approved By



Test Desc: Thorax With Arm
Component ID: D091444

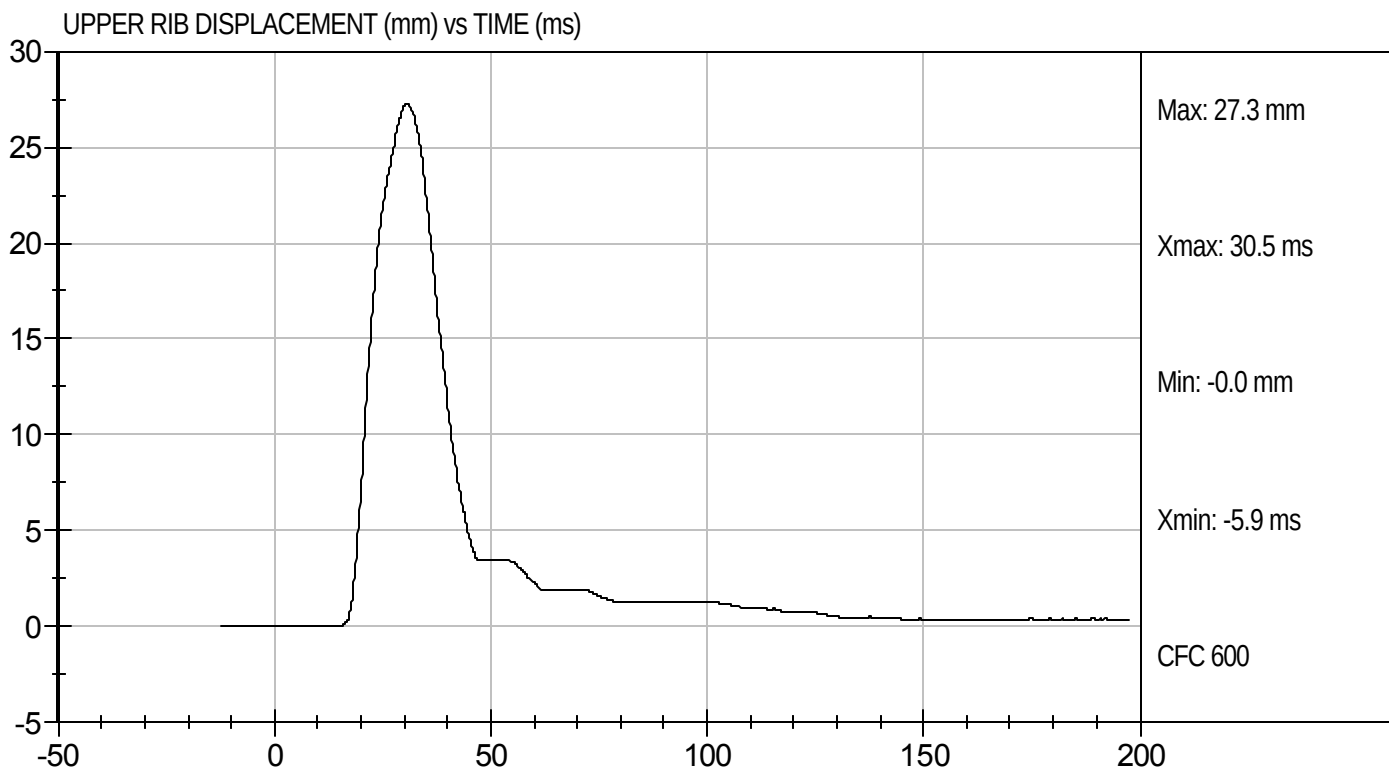
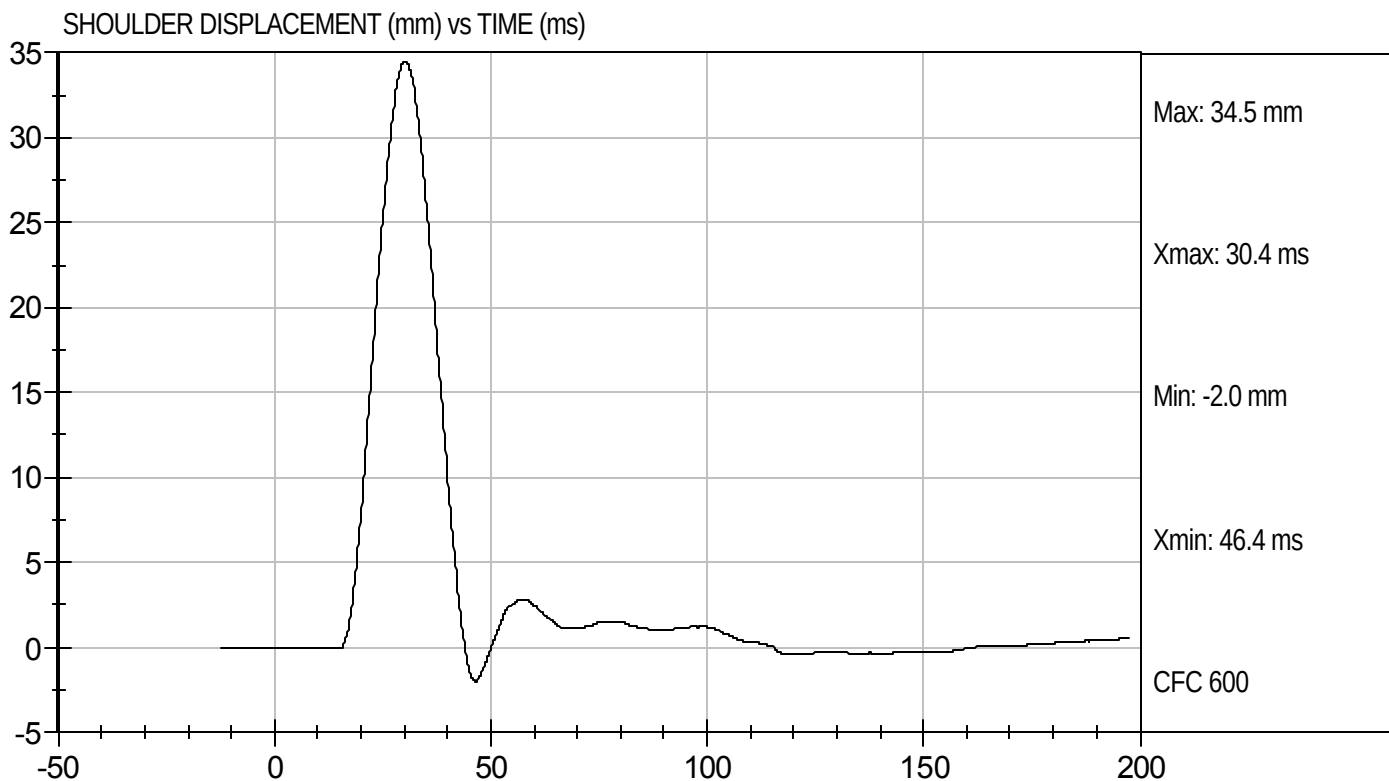
Test Date: 6/10/09
Velocity: 21.9 ft/s, 6.68 m/s





Test Desc: Thorax With Arm
Component ID: D091444

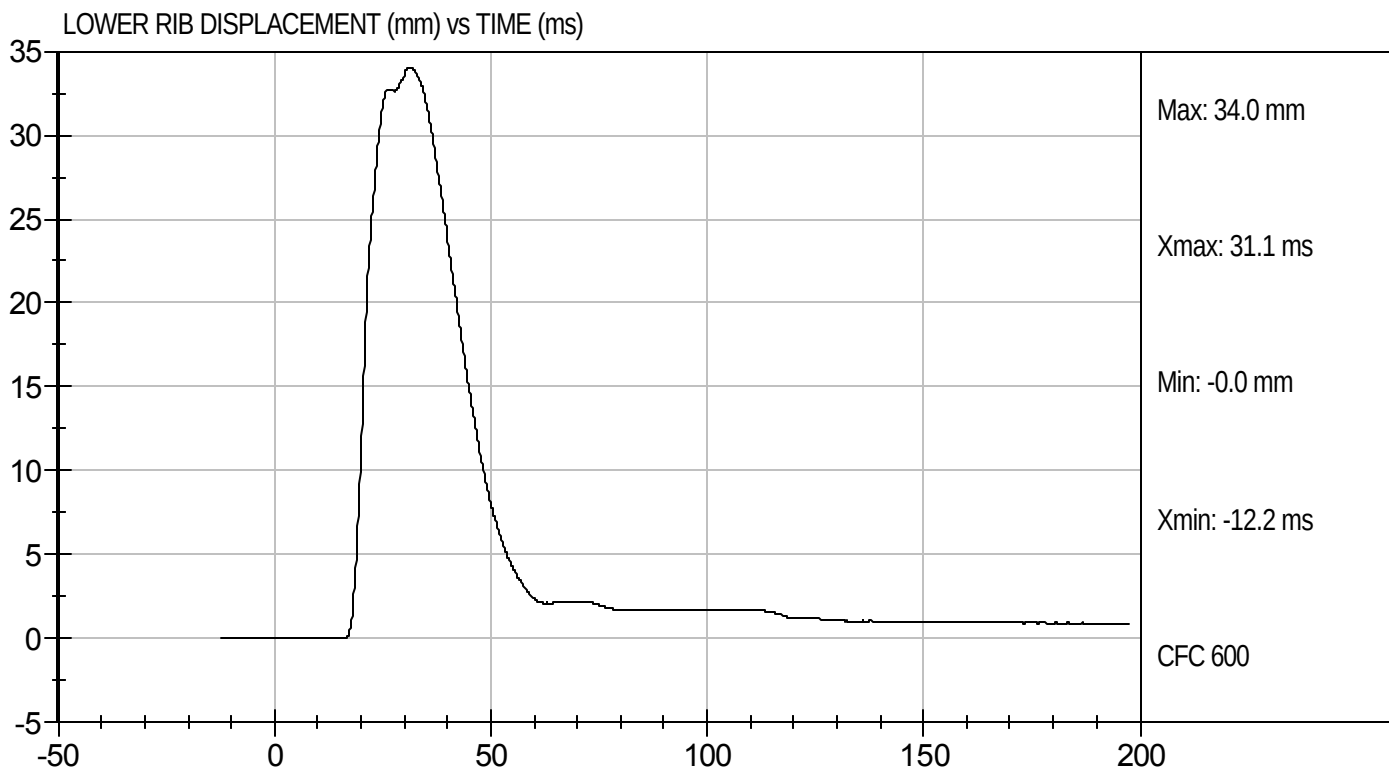
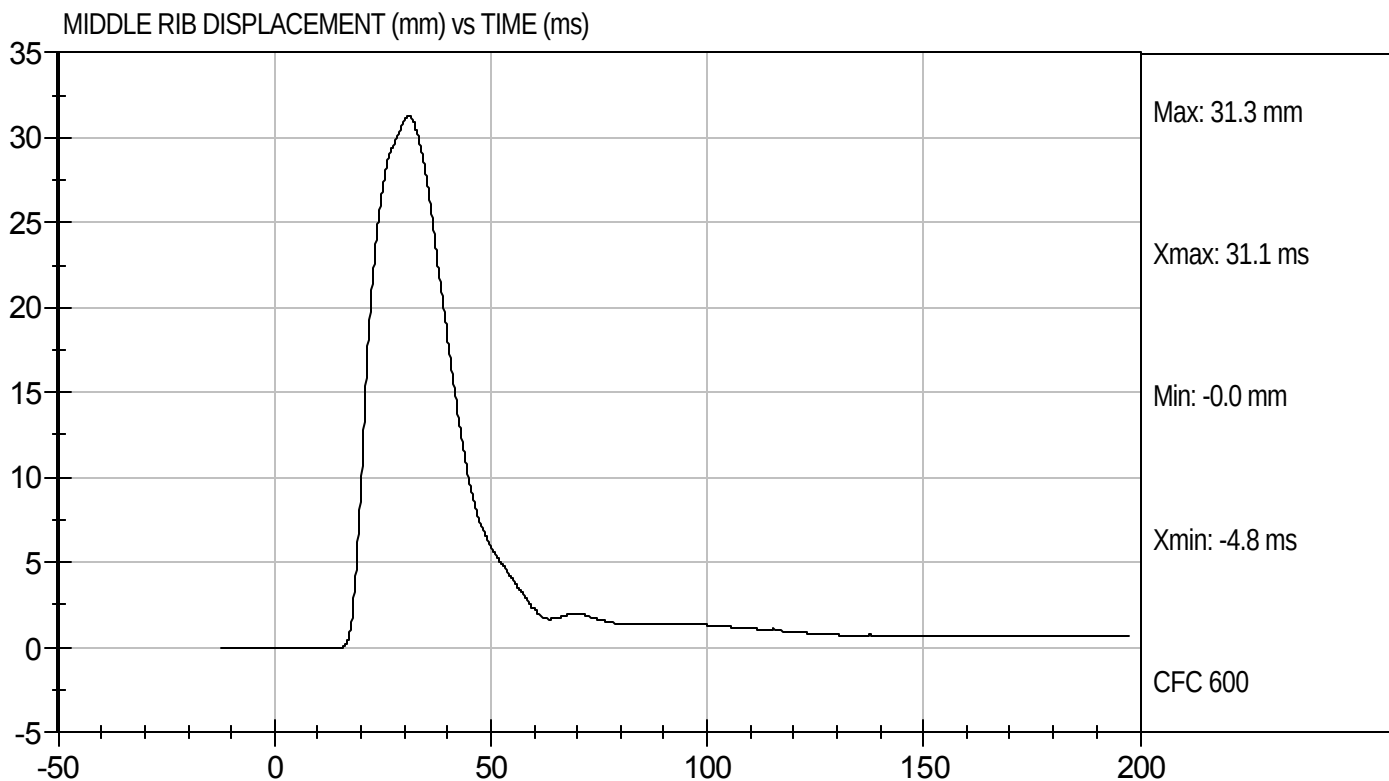
Test Date: 6/10/09
Velocity: 21.9 ft/s, 6.68 m/s





Test Desc: Thorax With Arm
Component ID: D091444

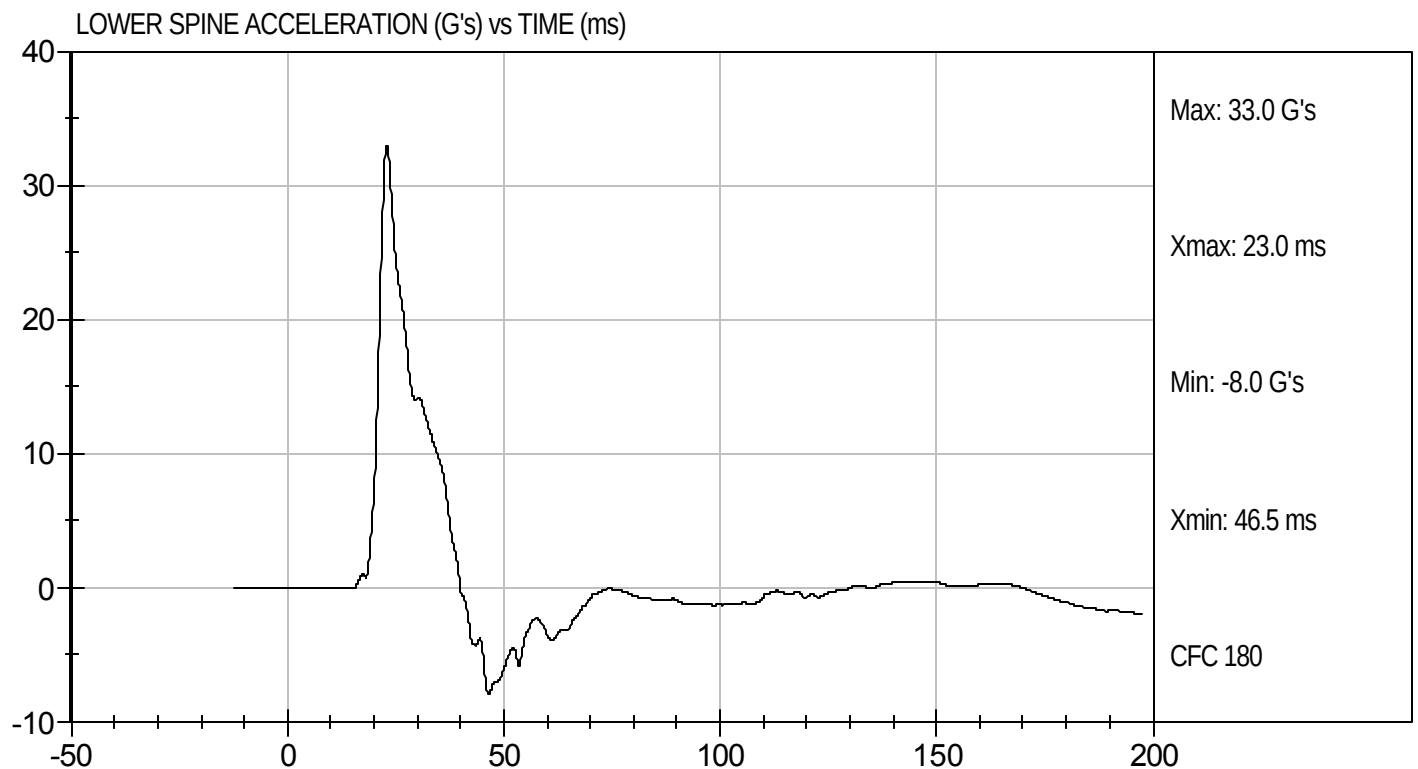
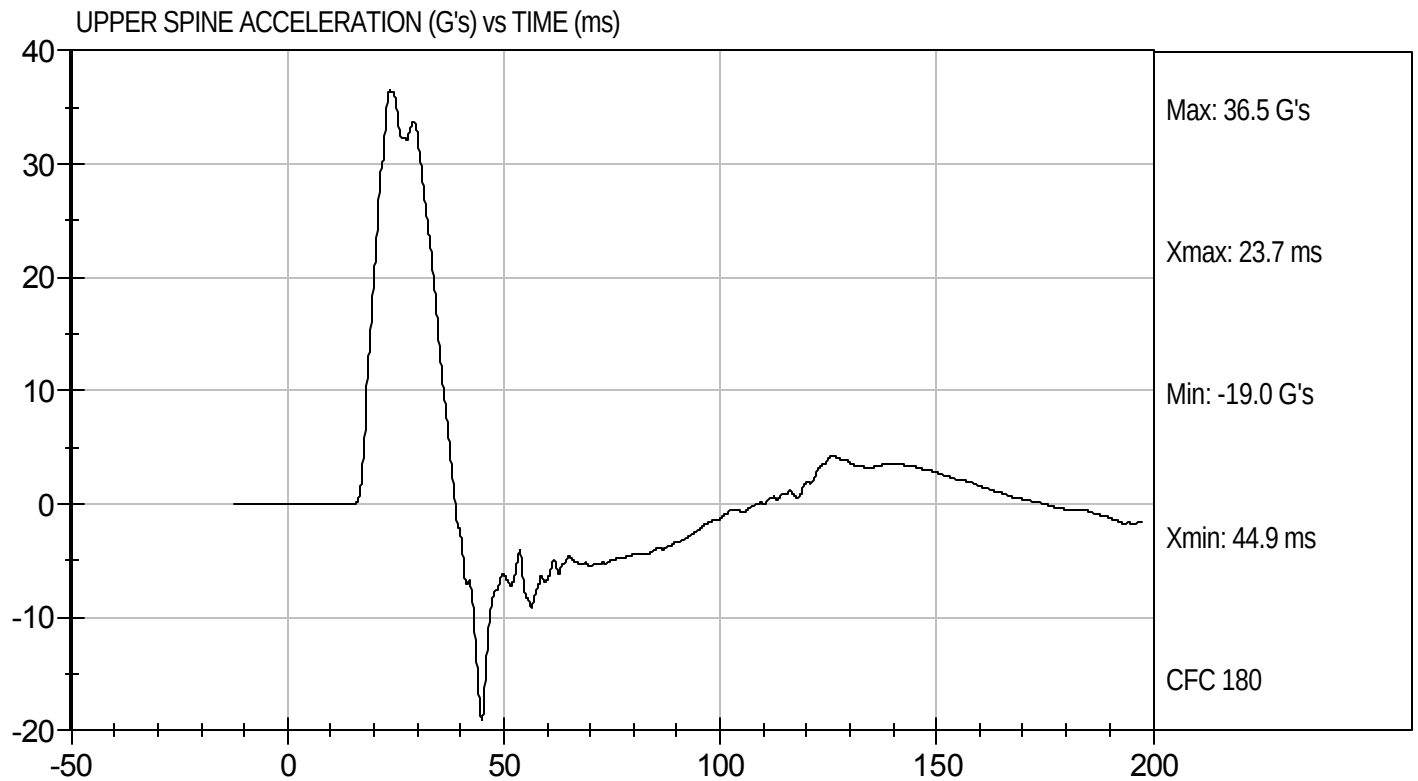
Test Date: 6/10/09
Velocity: 21.9 ft/s, 6.68 m/s





Test Desc: Thorax With Arm
Component ID: D091444

Test Date: 6/10/09
Velocity: 21.9 ft/s, 6.68 m/s



MGA RESEARCH CORPORATION
THORAX (WITHOUT ARM) IMPACT TEST
SID-11s BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D091445

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Peak Impactor Force	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	36	Pass
Middle Rib Displacement	mm	39 to 45	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

Jessica Hall
Laboratory Technician

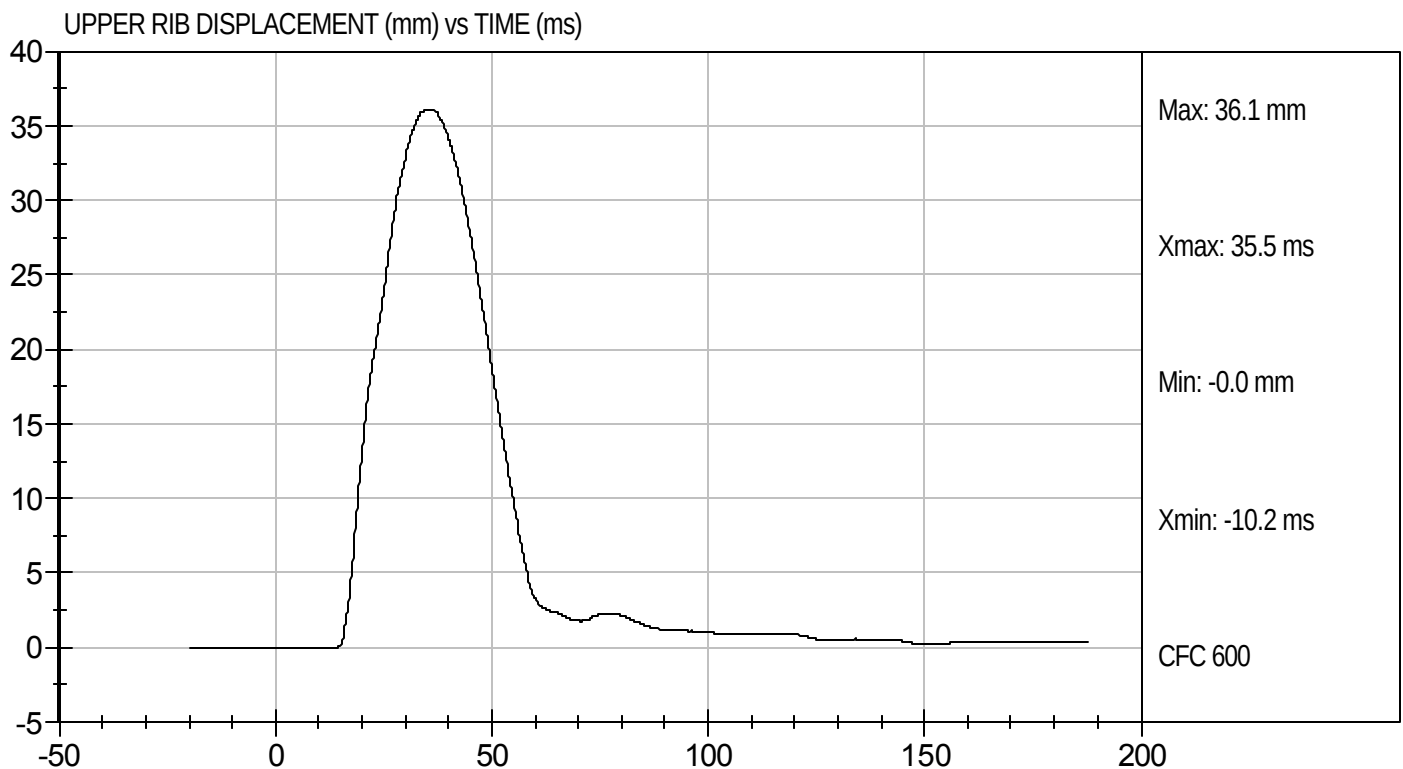
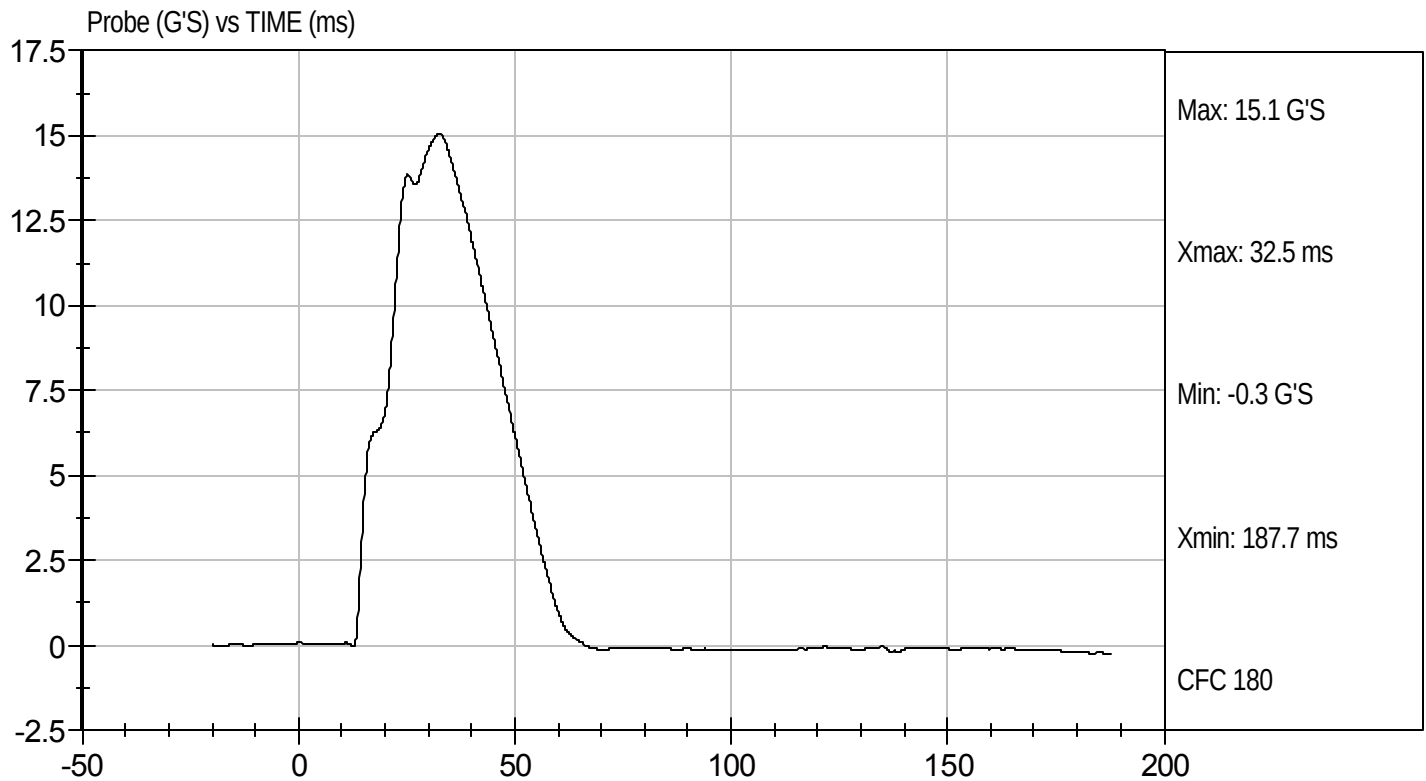
6/10/09
Test Date

David Winkelbauer
Approved By



Test Desc: Thorax Without Arm
Component ID: D091445

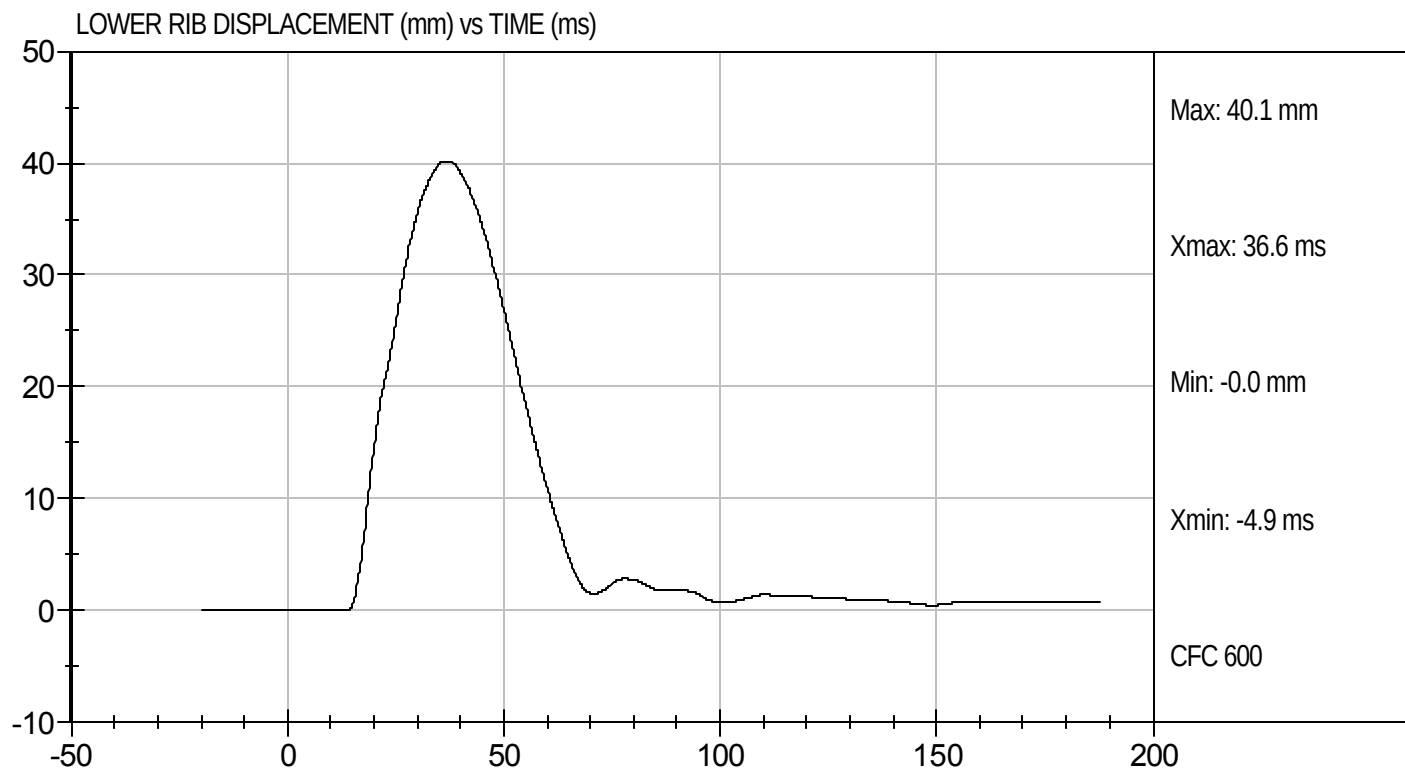
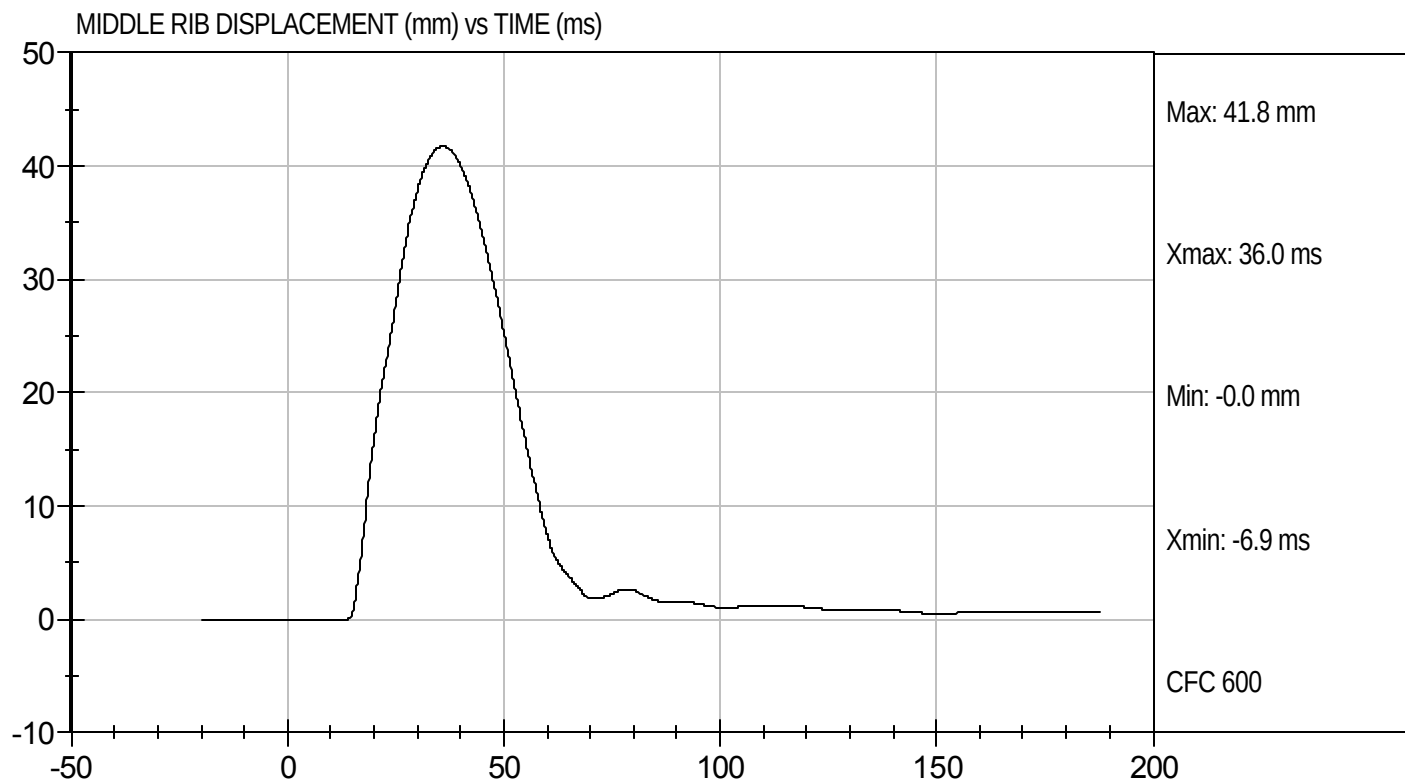
Test Date: 6/10/09
Velocity: 14.0 ft/s, 4.27 m/s





Test Desc: Thorax Without Arm
Component ID: D091445

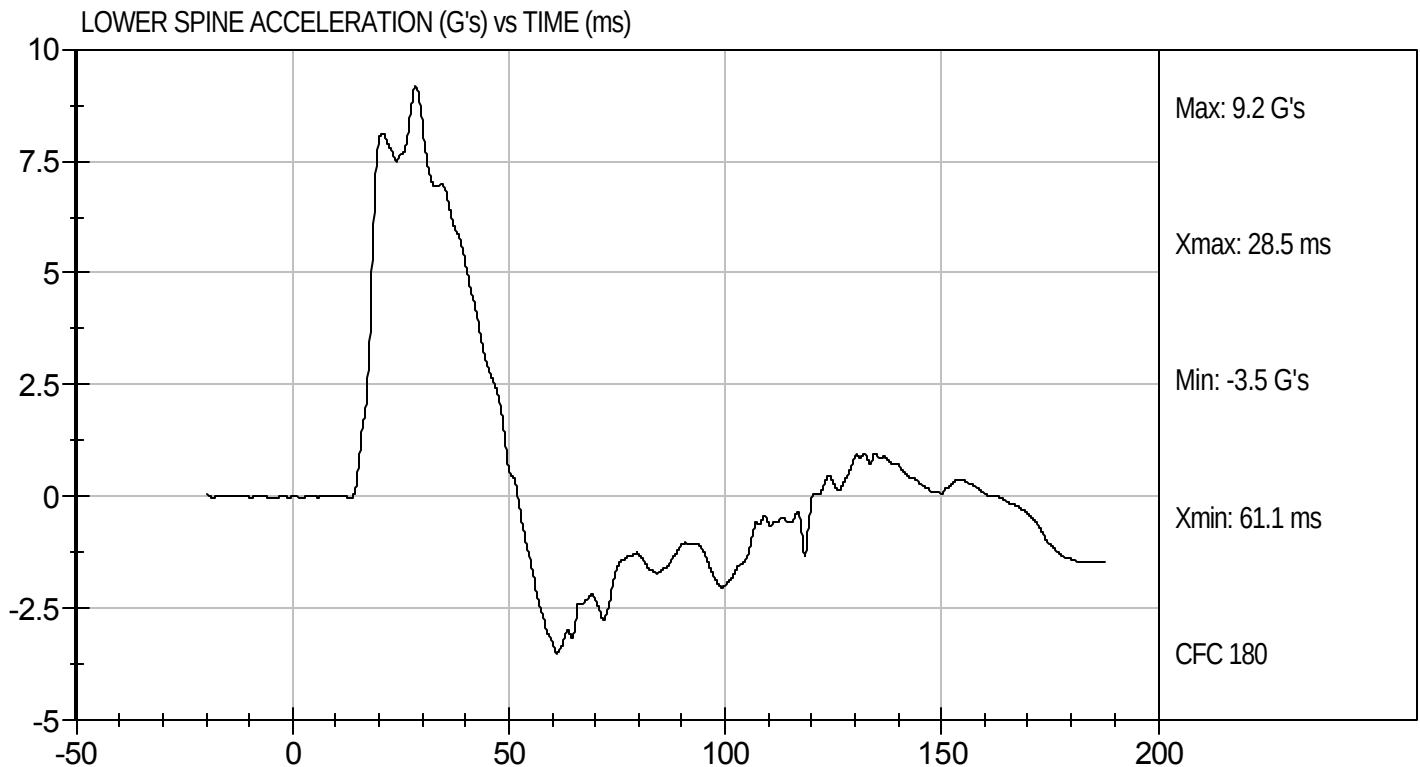
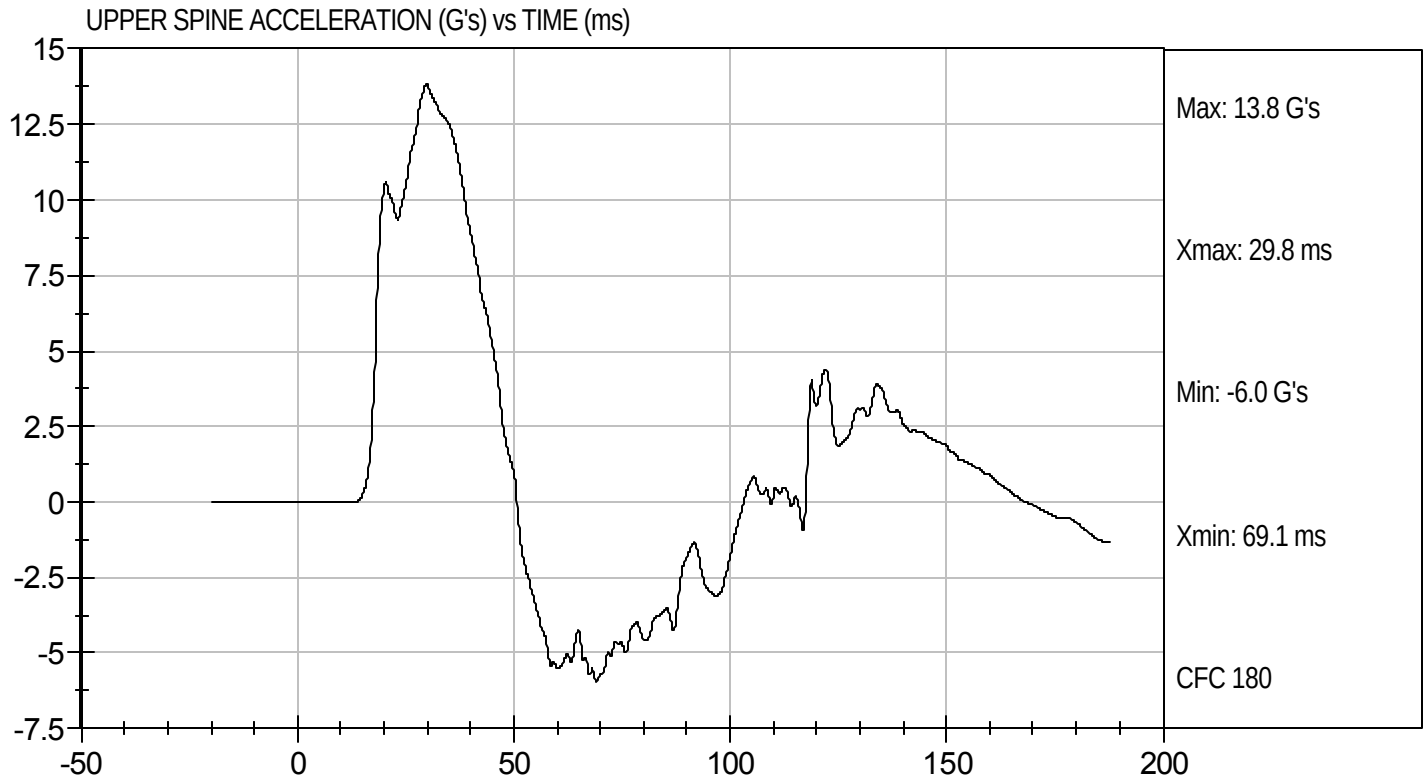
Test Date: 6/10/09
Velocity: 14.0 ft/s, 4.27 m/s





Test Desc: Thorax Without Arm
Component ID: D091445

Test Date: 6/10/09
Velocity: 14.0 ft/s, 4.27 m/s

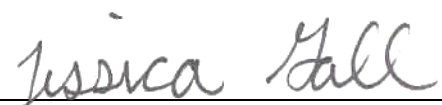


MGA RESEARCH CORPORATION
ABDOMINAL IMPACT TEST
SID-II's BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D091446

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	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	42	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
Overall Test Results				Pass


Laboratory Technician

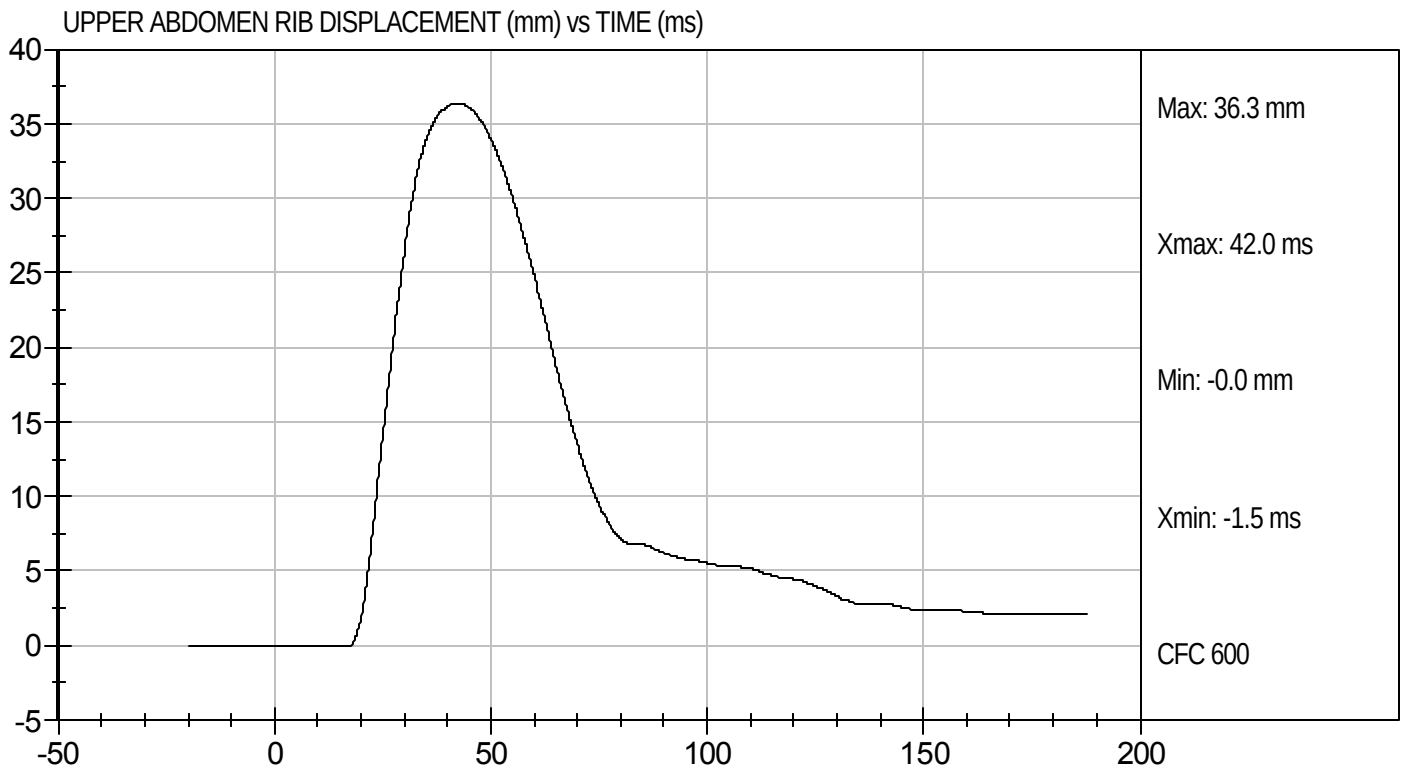
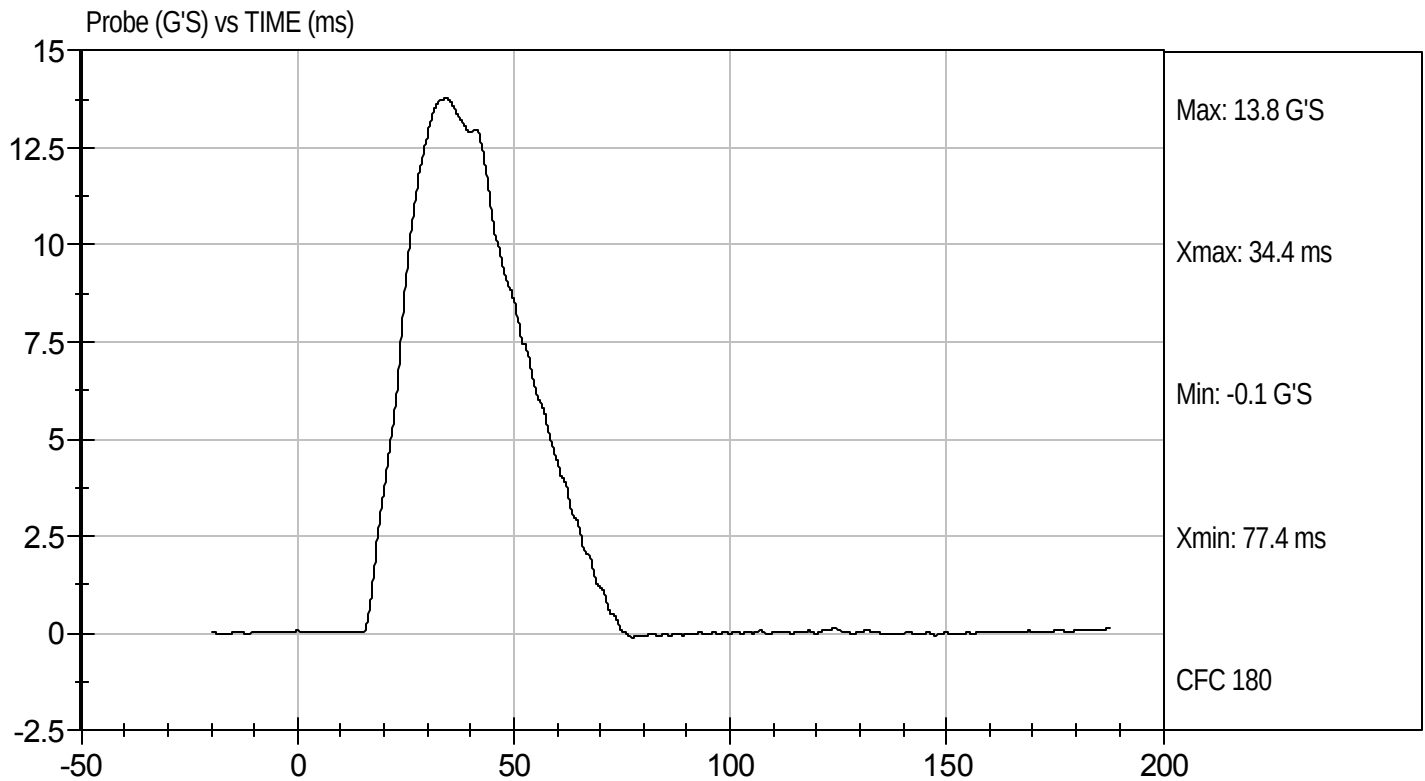
6/10/09
Test Date


Approved By



Test Desc: Abdomen Impact
Component ID: D091446

Test Date: 6/10/09
Velocity: 14.0 ft/s, 4.27 m/s

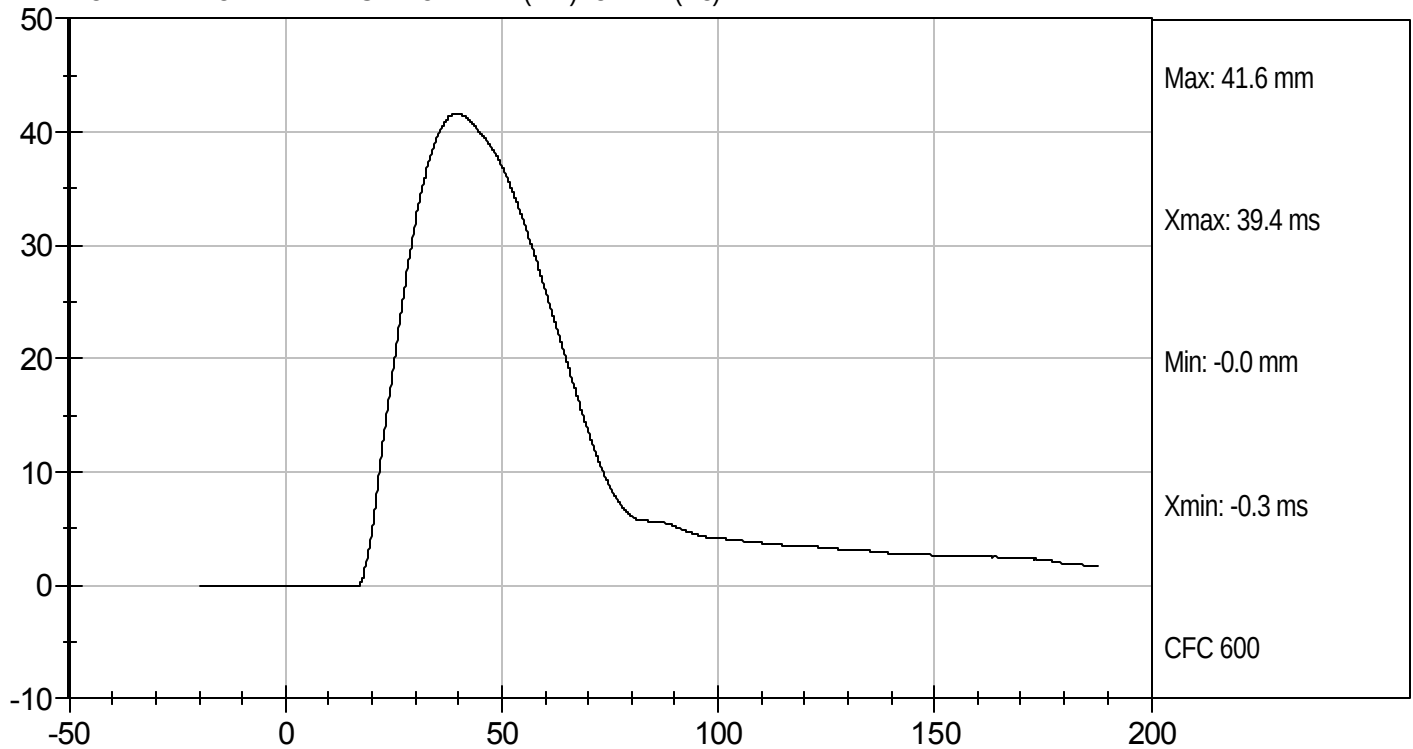




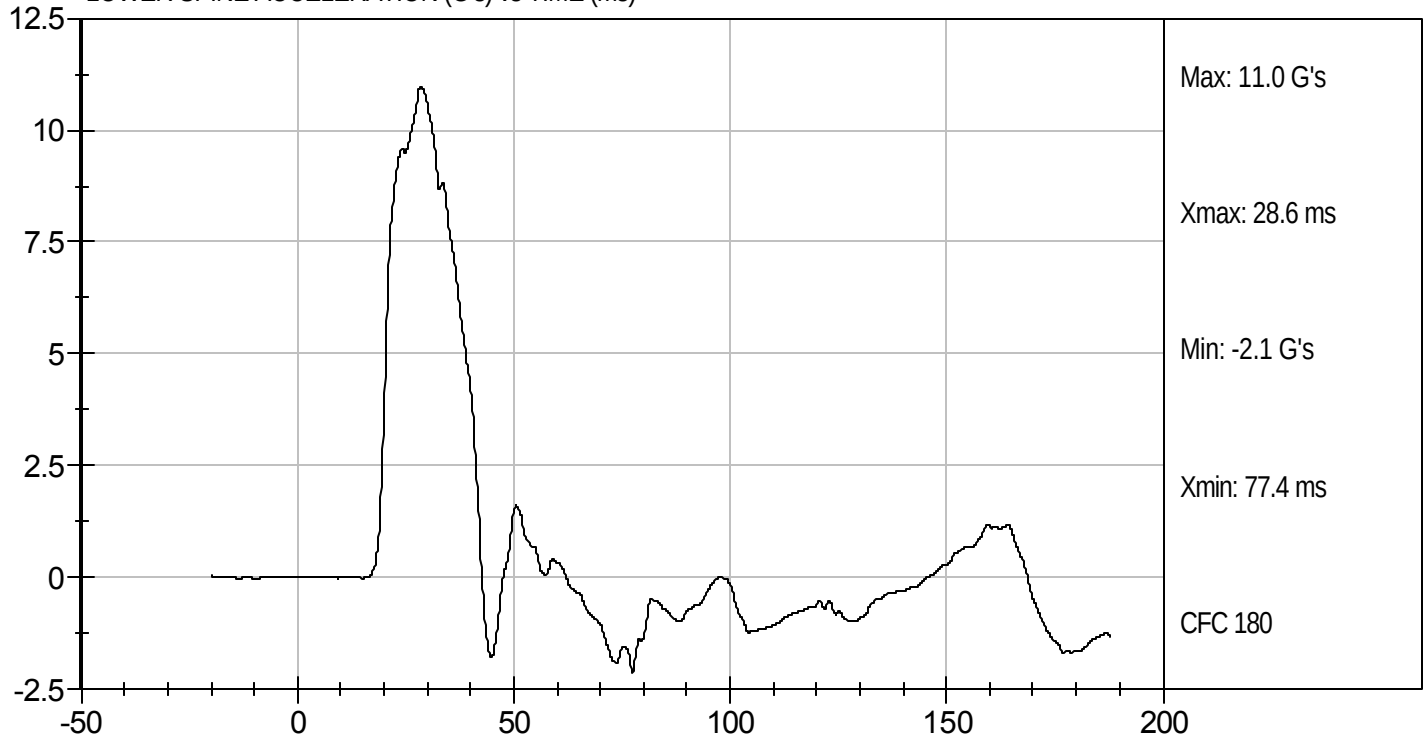
Test Desc: Abdomen Impact
Component ID: D091446

Test Date: 6/10/09
Velocity: 14.0 ft/s, 4.27 m/s

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



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

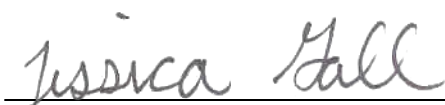


MGA RESEARCH CORPORATION
PELVIS IMPACT TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296

Test I.D: D091447

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	40	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	39	Pass
Peak Acetabulum Force	N	3600 to 4300	4136	Pass
Overall Test Results			Pass	


Laboratory Technician

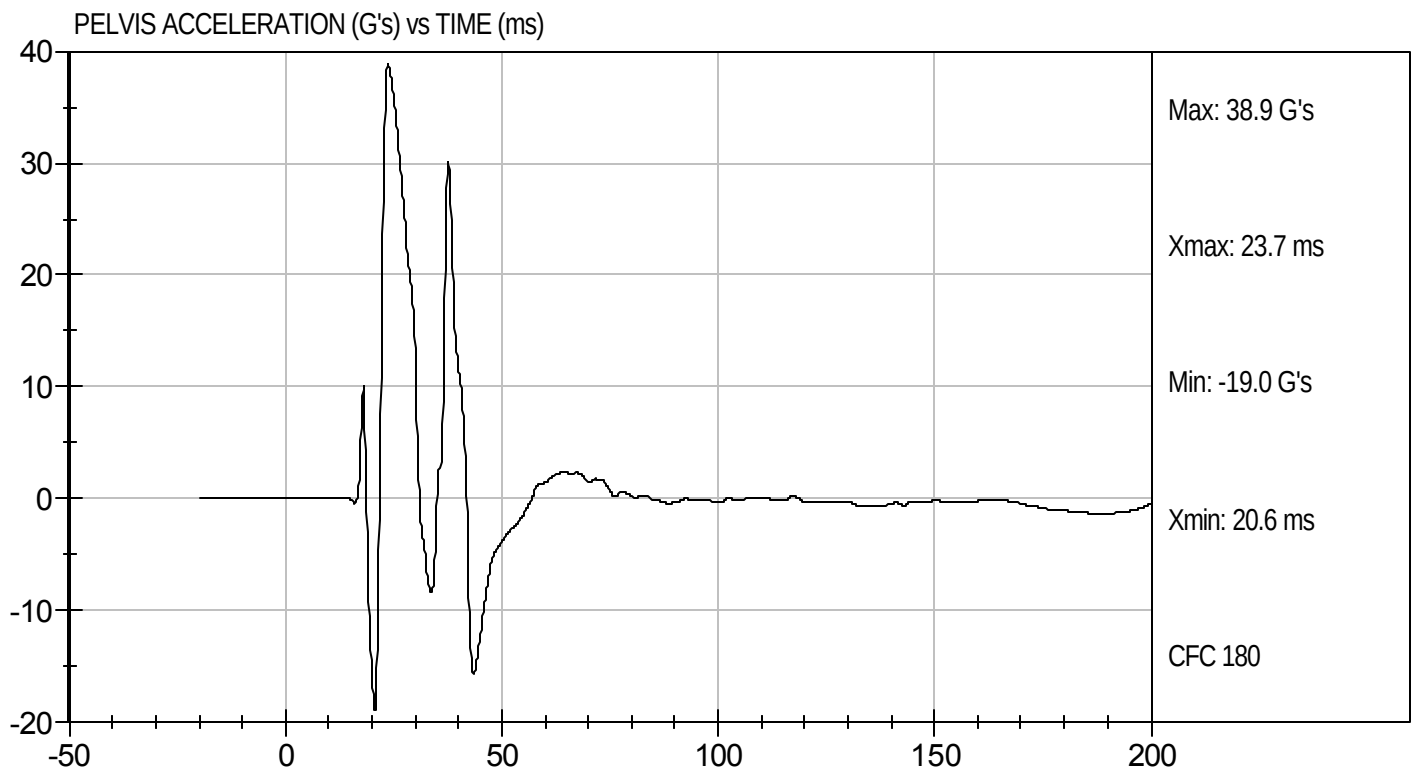
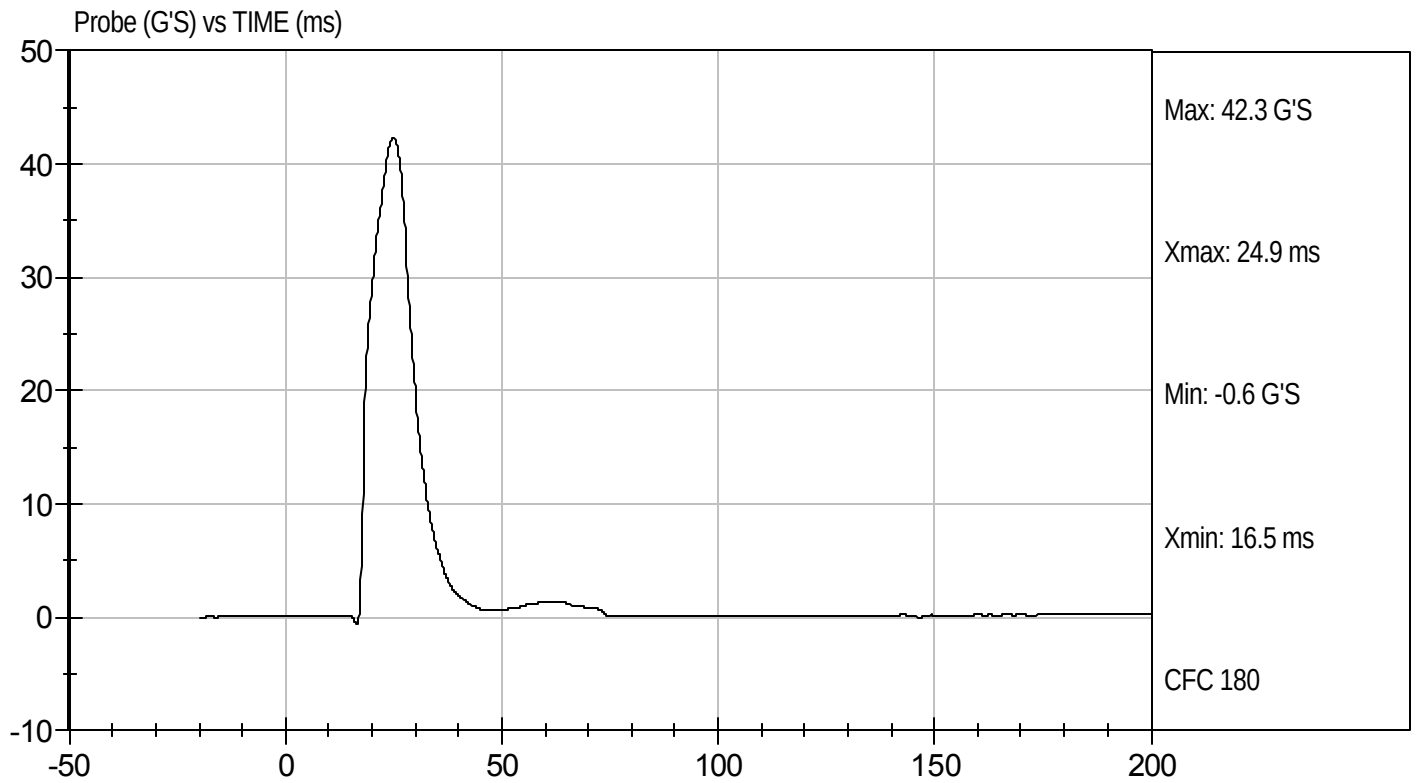
6/10/09
Test Date


Approved By



Test Desc: Pelvis Impact
Component ID: D091447

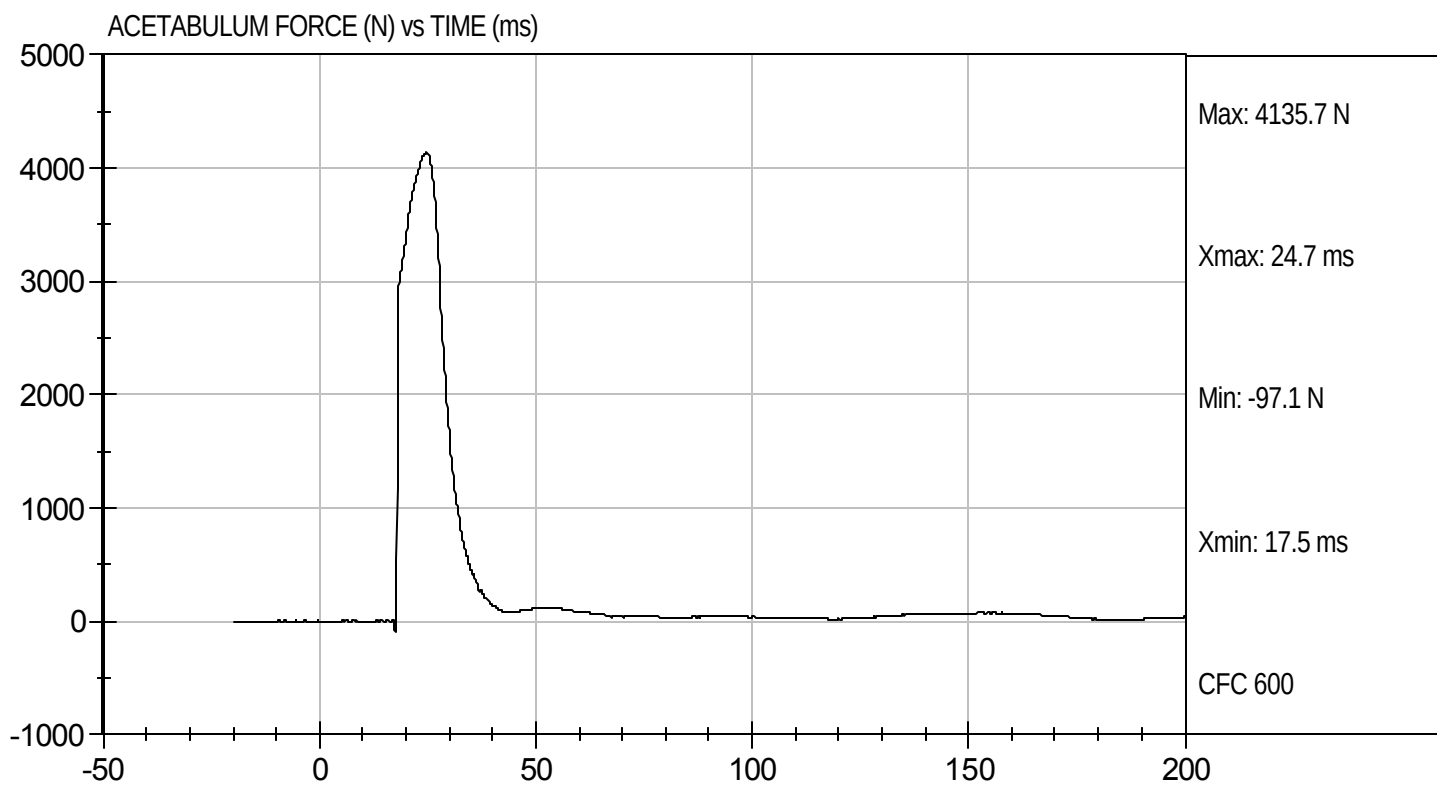
Test Date: 6/10/09
Velocity: 22.2 ft/s, 6.77 m/s





Test Desc: Pelvis Impact
Component ID: D091447

Test Date: 6/10/09
Velocity: 22.2 ft/s, 6.77 m/s



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

ATD Serial No: 296

Test I.D: D091448

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Humidity	%	10 to 70	40	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Peak Impactor Acceleration	G's	36 to 45	38	Pass
Pelvis Y Acceleration	G's	28 to 39	34	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4561	Pass
Overall Test Results			Pass	


Laboratory Technician

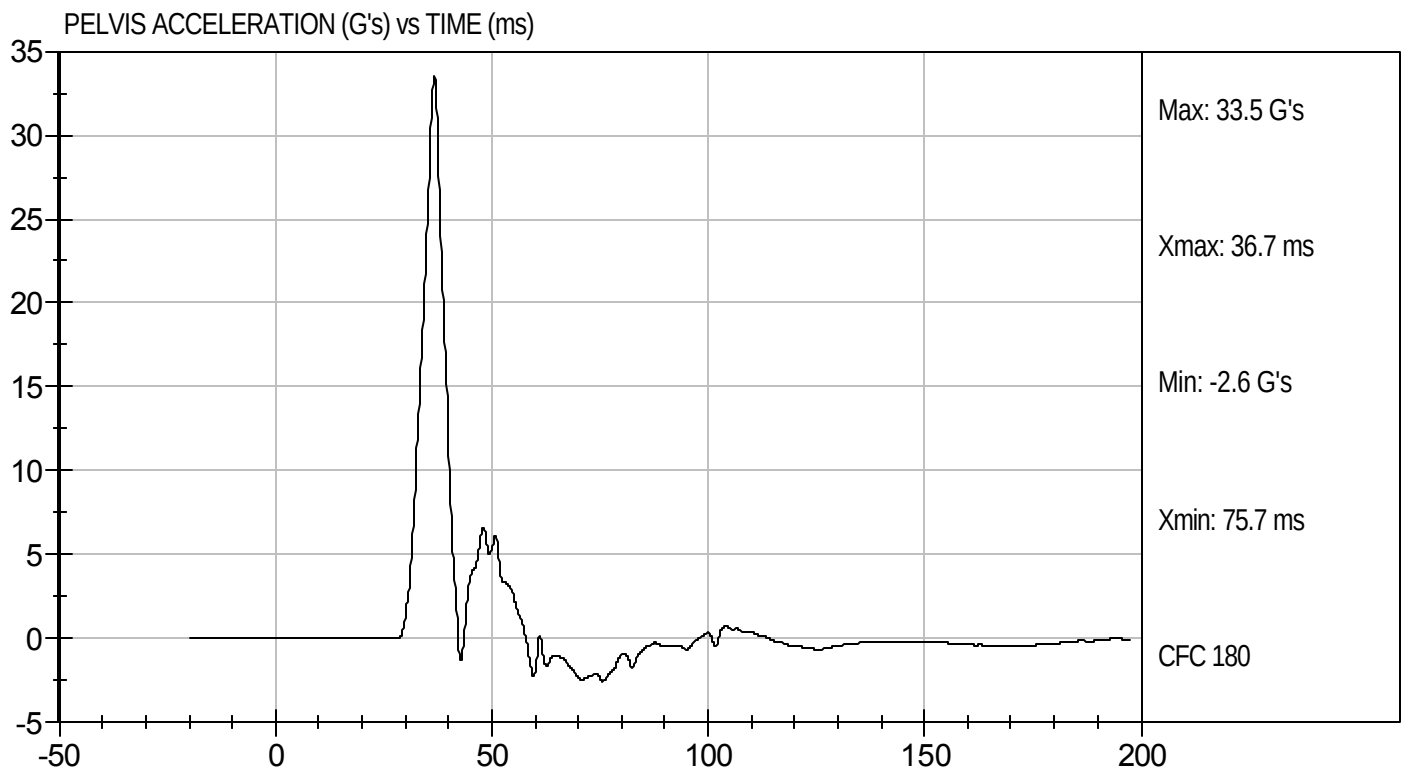
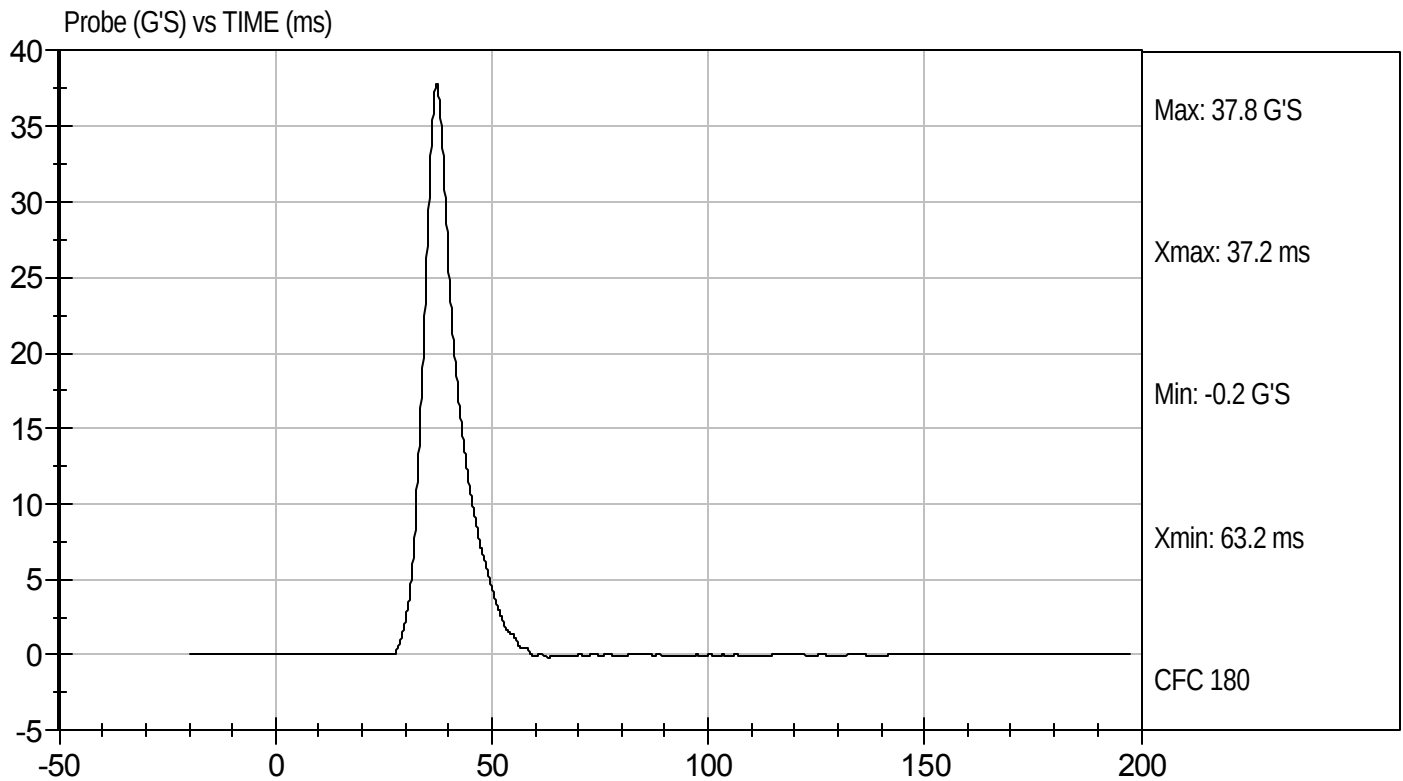
6/10/09
Test Date


Approved By



Test Desc: Iliac Impact
Component ID: D091448

Test Date: 6/10/09
Velocity: 14.1 ft/s, 4.30 m/s





Test Desc: Iliac Impact
Component ID: D091448

Test Date: 6/10/09
Velocity: 14.1 ft/s, 4.30 m/s

