

REPORT NUMBER: 214P-MGA-2012-013

**SAFETY COMPLIANCE TESTING FOR FMVSS 214
DYNAMIC SIDE IMPACT PROTECTION
RIGID POLE**

**GENERAL MOTORS LLC
2012 CHEVROLET VOLT 5-DR HATCHBACK
NHTSA NUMBER: CC0109**

**PREPARED BY:
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BURLINGTON, WI 53105**



Test Date: August 7, 2012

Report Date: August 16, 2012

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Accepted by: _____

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Technical Report Documentation Page

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7. Author(s) Joe Fleck, Project Engineer David Winkelbauer, Project Manager		8. Performing Organization Report No. 214P-MGA-2012-013													
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		10. Work Unit No.													
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15. Supplementary Notes															
16. Abstract A 32 km/h (20 mph), 75° oblique impact compliance test was conducted on the subject 2012 Chevrolet Volt 5-Dr Hatchback in accordance with the specifications of the Office of Vehicle Safety Compliance TP-214P-01 for the determination of FMVSS No. 214 Side Impact Protection compliance. The test was conducted at MGA Research Corporation, in Burlington, Wisconsin, on August 7, 2012. The impact velocity was 31.2 km/h, and the ambient temperature at the struck (driver's) side of the test vehicle at the time of impact was 21.3°C. The test vehicle post-test maximum crush was 342 mm at level 4. The test vehicle's performance follows: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="text-align: left;">Measurement Description</th> <th>Units</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₃₆)</td> <td>N/A</td> <td>201</td> </tr> <tr> <td>Resultant Lower Spine Acceleration</td> <td>G</td> <td>36</td> </tr> <tr> <td>Combined Acetabular and Iliac Pelvic Force</td> <td>N</td> <td>3868</td> </tr> </tbody> </table> The doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite side doors did not open during the side impact event.				Measurement Description	Units	Result	Head Injury Criteria (HIC ₃₆)	N/A	201	Resultant Lower Spine Acceleration	G	36	Combined Acetabular and Iliac Pelvic Force	N	3868
Measurement Description	Units	Result													
Head Injury Criteria (HIC ₃₆)	N/A	201													
Resultant Lower Spine Acceleration	G	36													
Combined Acetabular and Iliac Pelvic Force	N	3868													
17. Key Words Compliance Testing Side Impact Protection Pole Test ES-2re SID-IIs		18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services (TIS) Room E12-100 East Building 1200 New Jersey Ave. Washington, D.C. 20590 Telephone No. (202) 366-2588													
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This side impact test is part of the MY 2012 FMVSS 214 Side Impact Protection Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-07-D-00062. The purpose of this test was to evaluate side impact protection in a 2012 Chevrolet Volt 5-Dr Hatchback. The side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-214P-01, dated January 2010).

SUMMARY

A rigid pole side impact test was conducted on a 2012 Chevrolet Volt 5-Dr Hatchback. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 31.2 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin, on August 7, 2012. Pre-test and post-test photographs of the test vehicle and side impact dummy are included in Appendix A of this report.

One Part 572V dummy was placed in the left front outboard designated seating position according to instructions specified in TP-214P-01, dated January 2010. The side impact event was documented by eleven (11) cameras.

The SID-II's female dummy was instrumented with a triaxial accelerometer pack located in the head, 5 rib displacement transducers located in the thorax and abdomen, triaxial accelerometer pack located in the lower spine, a Iliac load cell, and an acetabulum load cell.

A summary of the test results follows:

DUMMY INJURY VALUES

Dummy	HIC (36ms)	Resultant Lower Spine Acceleration (G)	Pelvic Force (N)	
SID-IIs 5 th Percentile Female	201	36	Iliac Wing	1573
			Acetabular	2338
			Sum	3868

GENERAL COMMENTS

There was no valid data collected for:
Left Floor Sill Y after 10 msec.
Left Mid A-Post Y after 10 msec.
Left Lower B-Post Y after 10 msec.
Driver Seat Track Y after 9 msec.

Vehicle CG X is questionable from 69-73ms
Vehicle CG Y is questionable from 69-73ms
Left Lower A-Post Y is questionable from 15-30ms

Fully loaded weight was measured using 77kg in the driver's seat.

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

SECTION 2
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1

TEST VEHICLE INFORMATION AND OPTIONS

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
Test Program: FMVSS 214 Pole

NHTSA No. CC0109
Test Date: 8/07/2012

VEHICLE INFORMATION	
Make	Chevrolet
Model	Volt
Body Style	5-Dr Hatchback
VIN	1G1RA6E40CU126495
Body Color	Blue Topaz Metallic
Engine Displacement (L)	1.4
# of Cylinders	4
Engine Placement	Lateral
Transmission Type	Automatic
Transmission Speeds	1
Overdrive	No
Final Drive	Front
Odometer Reading	32 miles

OPTIONS	
ESC	Yes
All Wheel Drive	No
Power Steering	Yes
Tilt Steering Wheel	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso/Pelvis Airbag	Yes
Driver Knee Bag	Yes
Driver Seat Belt Pretensioners	Yes
Driver Seat Belt Load Limiters	Yes
Driver Power Seat	No
Rear Pass. Curtain Airbag	Yes
Rear Pass. Side Torso/Pelvis Airbag	No
Rear Pass. Seat Belt Pretensioners	No
Rear Pass. Seat Belt Load Limiters	No
Rear Pass. Power Seats	No
Power Windows	Yes
Air Conditioning	Yes
XM Radio	Yes
Automatic Door Locks (ADL)	Yes
Does owner's manual provide instructions to disable ADL's?	No
Anti-Lock Brakes	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	General Motors LLC
Date of Manufacture	05/12

GVWR (kg)	2052
GAWR Front (kg)	1135
GAWR Rear (kg)	917

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number of Occupants	2	2		4
Capacity Weight (VCW) (kg)				340
Cargo Weight (RCLW) (kg)				68

DATA SHEET NO. 2**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

NHTSA No. CC0109
 Test Date: 8/07/2012

TIRE PRESSURES

	Units	LF	RF	RR	LR
As Delivered	kPa	260	260	260	260
As Tested	kPa	260	260	260	260

TEST VEHICLE WEIGHTS

	Units	As Delivered			Fully Loaded			As Tested		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	524.8	338.4		554.3	398.7		540.3	367.4	
Right	kg	514.4	322.9		521.6	371.1		543.4	362.8	
Ratio	%	61.1	38.9		58.3	41.7		59.7	40.3	
Totals	kg	1039.2	661.3	1700.5	1075.9	769.8	1845.7	1083.7	730.2	1813.9

Regarding fully loaded weight and attitudes, see Test Notes on page 2.

TEST VEHICLE TARGET WEIGHT (TVTW) CALCULATION

Measured Parameter	Units	Value
As Delivered Weight	kg	1700.5
Weight of 1 P572V ATD (SID-IIs) Dummy	kg	52.2
Rated Cargo/Luggage Weight (RCLW)	kg	68
Calculated Target Vehicle Test Weight (TVTW)	kg	1820.7

TEST VEHICLE ATTITUDES

	Units	LF	RF	RR	LR
Fully Loaded	mm	693	699	694	688
As Tested	mm	694	699	700	700
Difference	mm	-1	0	-6	-12

CALCULATION OF THE VERTICAL IMPACT REFERENCE LINE

Measurement Parameter	Units	Value
Test Vehicle Wheel Base	mm	2688
Vertical Impact Reference Line (Aft of Front Axle)	mm	1144

**WEIGHT of BALLAST and VEHICLE COMPONENTS
 REMOVED TO MEET VEHICLE TEST WEIGHT**

Description of Component	Weight (kg)
Ballast	9.1
Right tail light, trunk plastic and lid, air pump, battery charger, right rear door panel.	14.5

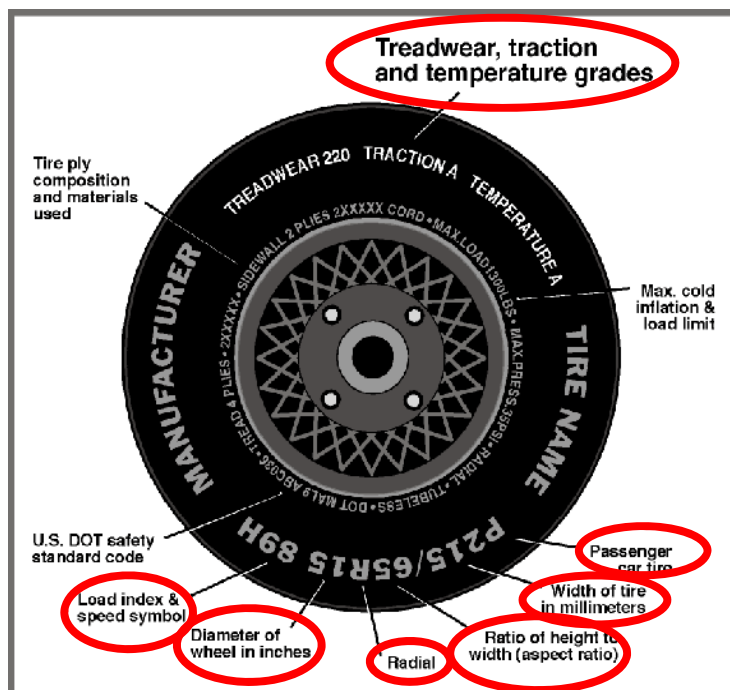
DATA SHEET NO. 3

VEHICLE TIRE INFORMATION

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

NHTSA No. CC0109
 Test Date: 8/07/2012

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	260	260
Recommended Tire Size	P215/55R17	P215/55R17
Tire Size on Vehicle	P215/55R17	P215/55R17
Tire Manufacturer	Goodyear	Goodyear
Tire Name	Assurance	Assurance
Tire Type	Passenger	Passenger
Tire Width	215	215
Aspect Ratio	55	55
Radial	Yes	Yes
Wheel Diameter	17	17
Load Index/Speed Symbol	94V	94V
Treadwear	580	580
Traction Grade	A	A
Temperature Grade	A	A

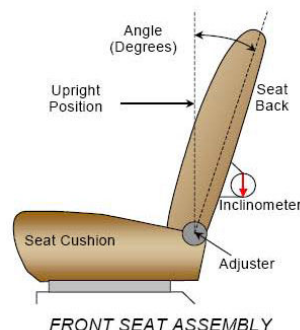
DATA SHEET NO. 4
SEAT AND SEAT BELT ADJUSTMENT DATA

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

NHTSA No. CC0109
 Test Date: 8/07/2012

NORMAL DESIGN RIDING POSITION

The seat back was set as specified in Appendix A of the TP dated January 2010.



SEAT BACK ANGLE

	Degrees	Detents
Driver with Seated Dummy	-17.9° at headrest post	

SEAT FORE/AFT POSITION

The seat was set as specified in Appendix A of the TP dated January 2010.

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Front Seat	54 detents (1 st as 0)	0 detent from forward-most (1 st as 0)

SEAT BELT UPPER ANCHORAGE

The seat belt upper anchorage was set to the manufacturer's design outlined in Form 1, Section 3.

SEAT BELT UPPER ANCHORAGE

	Total # of Positions	Placed in Position #
Driver Seat	Fixed	Fixed

HEADREST RESTRAINT

The headrest was placed in the full down position.

DATA SHEET NO. 5

FUEL SYSTEMS AND STEERING WHEEL POSITION DATA

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

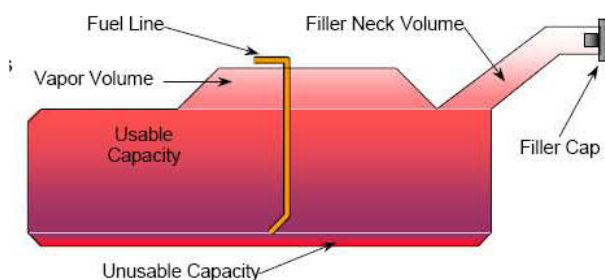
NHTSA No. CC0109
 Test Date: 8/07/2012

FUEL TANK CAPACITY

	Liters
Usable Capacity (Form 1)	35.2
Useable Capacity (Owner's Manual)	35.2
92-94% of Usable Capacity	32.4 to 33.1
Actual Amount of Solvent Used	32.7

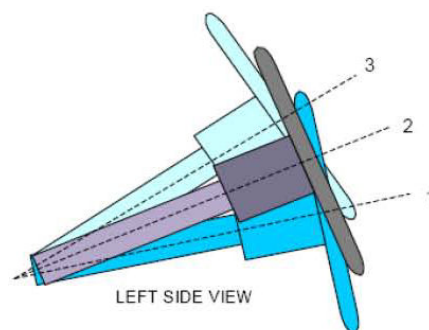
FUEL PUMP

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. Fuel pump will run when the gasoline generator is commanded to start. The fuel pipe is on the right side.



STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves 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

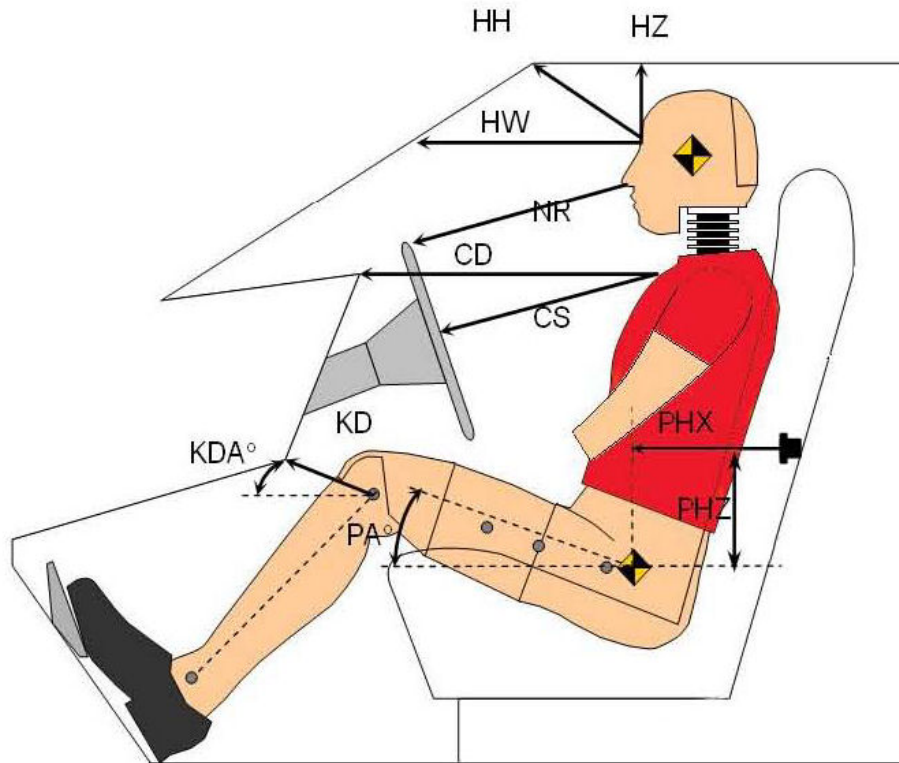
STEERING COLUMN POSITIONING

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	70.0	204
Geometric Center – Position 2	68.0	176
Uppermost – Position 3	66.0	148
Telescoping Steering Wheel Travel		56
Test Position	68.0	176

.DATA SHEET NO. 6
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

NHTSA No. CC0109
 Test Date: 8/07/2012

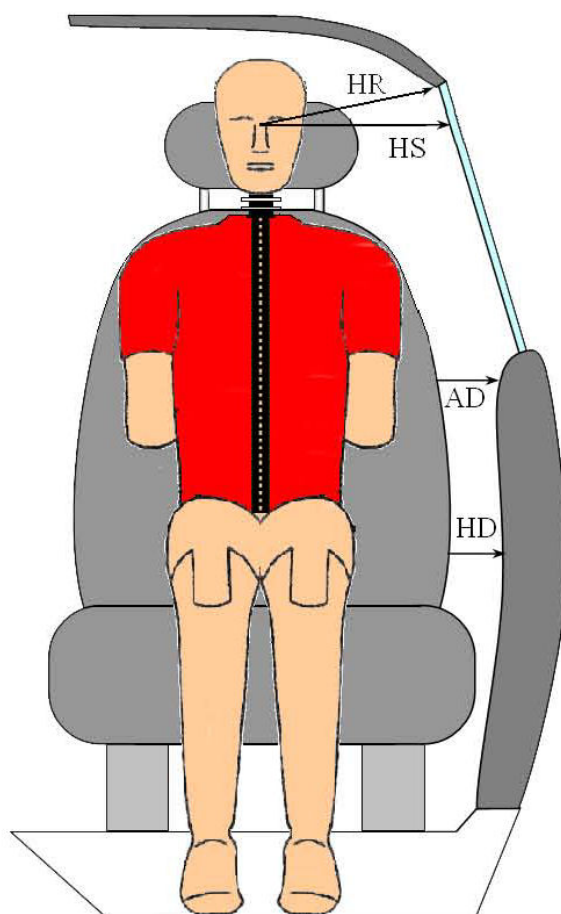


Driver Code	Measurement Description	Length (mm)	Angle (°)
HH	Head to Header	310	
HW	Head to Windshield	700	
HZ	Head to Roof	211	
NR	Nose to Rim	249	
CD	Chest to Dash	432	
CS	Chest to Steering Wheel	203	
KDL	Left Knee to Dash	166	27.2
KDR	Right Knee to Dash	156	30.3
PA	Pelvis Angle X		17.8
	Torso Angle Y		-1.1
PHX	H-Point to Striker (X-Axis)	278	
PHZ	H-Point to Striker (Z-Axis)	146	

DATA SHEET NO. 7
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
Test Program: FMVSS 214 Pole

NHTSA No. CC0109
Test Date: 8/07/2012

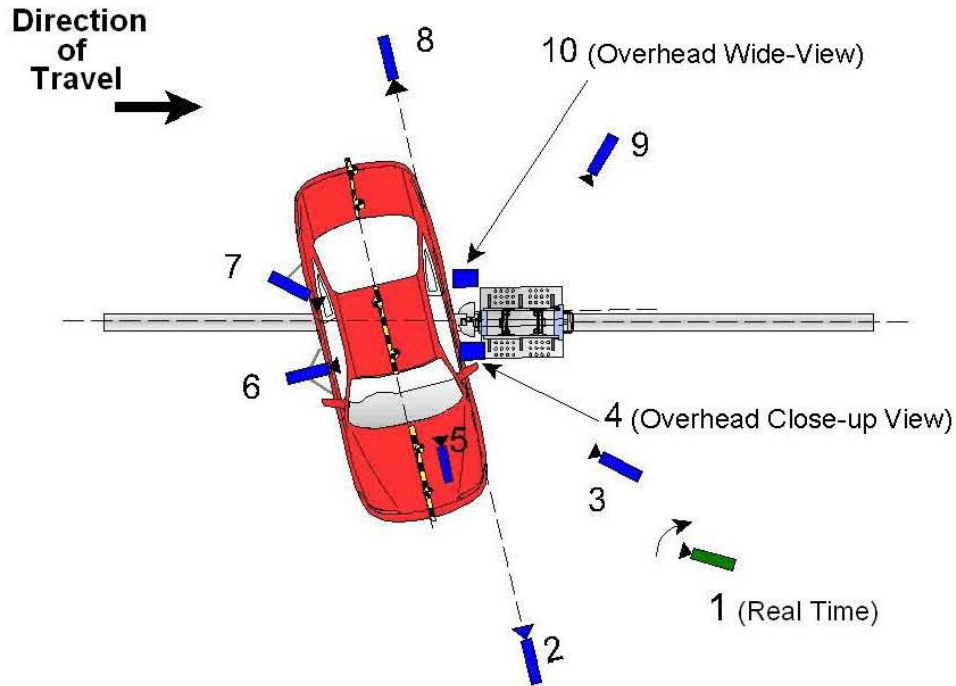


Code	Measurement Description	Units	Front Occupant
HR	Head to Side Header	mm	221
HS	Head to Side Window	mm	342
AD	Arm to Door	mm	160
HD	H-Point to Door	mm	158

DATA SHEET NO. 8
HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

NHTSA No. CC0109
 Test Date: 8/07/2012



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

Camera No.	View	Coordinates (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Real-Time					30
2	Front Ground Level	5440	90	1860	24	1000
3	Impact Side 45° Forward	4120	2460	1980	20	1000
4	Overhead Closeup	0	-70	4520	50	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	-5940	80	1880	24	1000
9	Impact Side 45° Rearward	-2840	3650	2010	20	1000
10	Overhead Wide	110	-180	4610	14	1000

DATA SHEET NO. 9

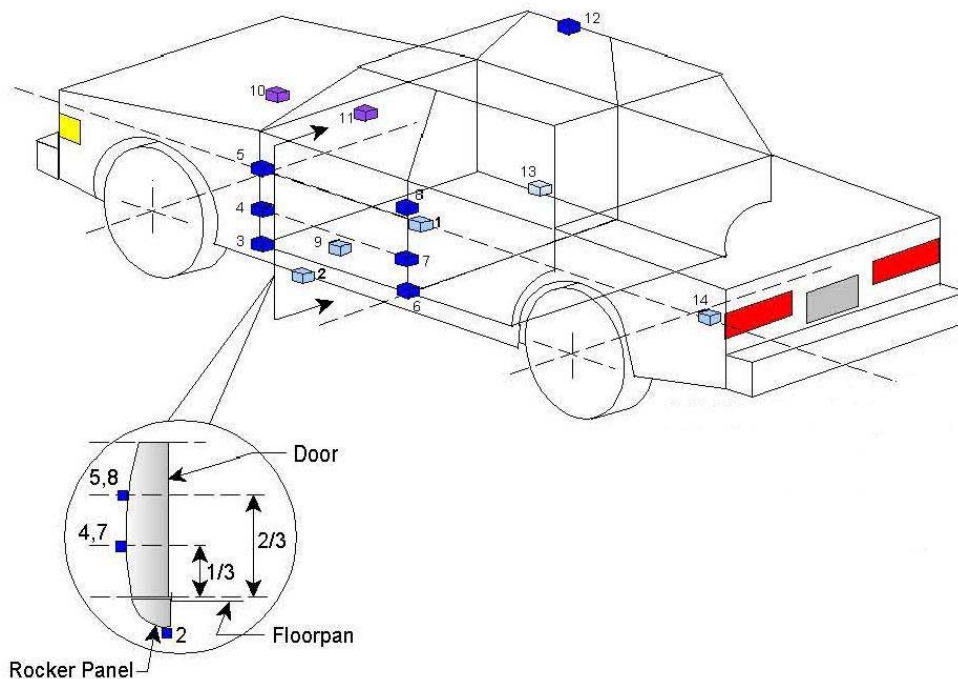
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback

NHTSA No. CC0109

Test Program: FMVSS 214 Pole

Test Date: 8/07/2012



Loc. No.	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2463	390	-162
2	Left Floor Sill	2573	-725	-173
3	A Pillar Sill	3021	-720	-168
4	A Pillar Low	2978	-792	-492
5	A Pillar Mid	2978	-790	-766
6	B Pillar Sill	1936	-725	-175
7	B Pillar Low	1894	-696	-492
8	B Pillar Mid	1884	-725	-767
9	Driver Seat Track	2002	-510	-291
10	Top of Engine	3686	67	-773
11	Firewall	3462	20	-878
12	Right Roof	1695	523	-1408
13	Right Sill	1653	725	-197
14	Floorpan @ Rear Axle	257	0	-348

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

DATA SHEET NO. 10
TEST VEHICLE ACCELEROMETER DATA SUMMARY

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

NHTSA No. CC0109
 Test Date: 8/07/2012

Loc. No.	Description	Peak Values (g's)			
		Max	Time (ms)	Min	Time (ms)
1	Vehicle CG (X)	(1)	(1)	(1)	(1)
	Vehicle CG (Y)	(1)	(1)	(1)	(1)
	Vehicle CG (Z)	8.2	40.0	-8.1	47.8
	Resultant	(1)	(1)		
2	Left Floor Sill (Y)	(2)	(2)	(2)	(2)
3	A Pillar Sill (Y)	27.0	25.0	-7.6	21.2
4	A Pillar Low (Y)	(3)	(3)	(3)	(1)
5	A Pillar Mid (Y)	(4)	(4)	(4)	(4)
6	B Pillar Sill (Y)	38.9	13.8	-33.0	17.7
7	B Pillar Low (Y)	(5)	(5)	(5)	(5)
8	B Pillar Mid (Y)	83.0	15.1	-8.6	23.2
9	Driver Seat Track (Y)	(6)	(6)	(6)	(6)
10	Top of Engine (X)	11.3	87.1	-13.9	53.5
	Top of Engine (Y)	14.5	51.9	-2.5	201.4
11	Firewall (Y)	20.3	40.7	-1.3	5.1
12	Right Roof (Y)	30.4	36.9	-1.3	298.8
13	Right Sill (Y)	20.5	37.3	-0.7	152.3
14	Floorpan @ Rear Axle (X)	5.0	116.9	-8.4	44.2
	Floorpan @ Rear Axle (Y)	24.2	42.7	-2.1	169.0

(1) Vehicle CG X and Y are questionable from 69-73ms

(2) No valid data collected for Left Floor Sill Y after 10ms

(3) Left Lower A-Post Y is questionable from 15-30ms

(4) No valid data collected for Left Mid A-Post Y after 10ms

(5) No valid data collected for Left Lower B-Post Y after 10ms

(6) No valid data collected for Driver Seat Track Y after 9ms

DATA SHEET NO. 11
DUMMY INJURY RESPONSE DATA

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

NHTSA No. CC0109
 Test Date: 8/07/2012

Dummy S/N 262	Positive		Negative	
	MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (G)				
Longitudinal (X)	11.5	119.2	14.3	56.4
Lateral (Y)	36.6	62.6	8.6	112.0
Vertical (Z)	19.3	38.0	5.5	86.1
Resultant (R)	39.4	62.6		
HIC36 (t1, t2)	201		t1 = 36.9	t2 = 72.9
THORAX DEFLECTION (mm)				
Upper Rib			17.2	41.6
Middle Rib			14.3	37.5
Lower Rib			14.7	36.6
ABDOMINAL DEFLECTION (mm)				
Upper Rib			14.4	49.9
Lower Rib			22.8	49.1
LOWER SPINE RESULTANT (G)				
Longitudinal (X)	12.4	47.8	17.2	23.8
Lateral (Y)	35.2	38.8	10.4	73.9
Vertical (Z)	10.4	17.0	14.2	45.1
Resultant (R)	36.1	38.6		
PELVIS FORCE (N)				
Iliac	1572.5	45.2		
Acetabulum	2337.8	44.1		
Sum	3867.8	44.9		

Reference: Positive Direction -Longitudinal (X) = forward
 -Lateral (Y) = to right
 -Vertical (Z) = down

DATA SHEET NO. 12
POST TEST OBSERVATIONS

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
Test Program: FMVSS 214 Pole

NHTSA No. CC0109
Test Date: 8/07/2012

TEST DUMMY INFORMATION AND CONTACT

Description	Front Occupant
Dummy Type / Serial No.	SID-IIs / 262
Head Contact	Curtain Airbag, Headrest
Upper Torso Contact	Side Airbag, Door Panel
Lower Torso Contact	Side Airbag
Left Knee Contact	None
Right Knee Contact	None

POST TEST DOOR OPENING AND SEAT TRACK INFORMATION

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

POST-TEST STRUCTURAL OBSERVATIONS

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

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Front Occupant	
	Installed	Operated
Frontal Airbag	Yes	No
Side Torso/Abdomen/Pelvis Airbag	Yes	Yes
Head Airbag	No	
Curtain Airbag	Yes	Yes
Knee Airbag	Yes	No
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	

DATA SHEET NO. 13

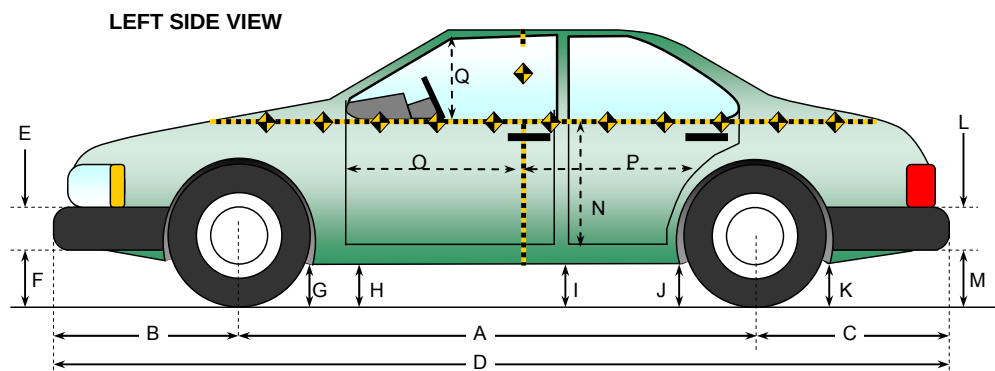
VEHICLE PRE TEST AND POST TEST MEASUREMENTS

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback

NHTSA No. CC0109

Test Program: FMVSS 214 Pole

Test Date: 8/07/2012

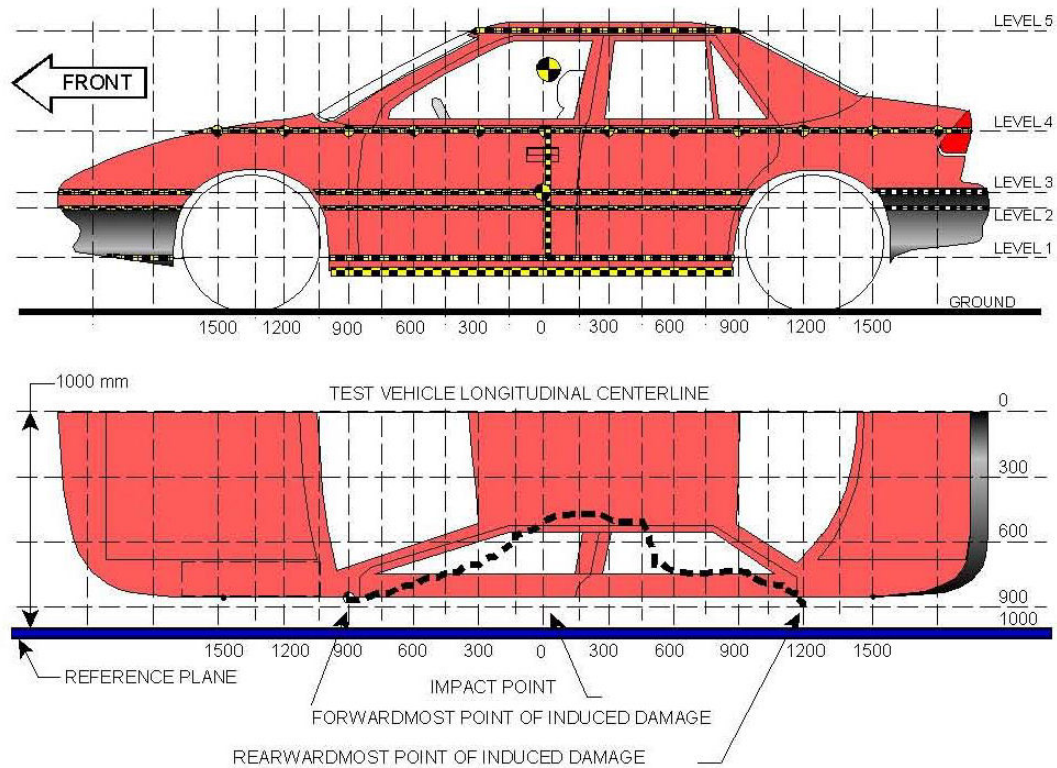


Code	Measurement Description	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
A	Wheelbase	2688	2620	68
B	Front Axle to FSOV	990	990	0
C	Rear Axle to RSOV	822	821	1
D	Total Vehicle Length at Centerline	4500	4431	69
E	Front Bumper Thickness	150	150	0
F	Front Bumper Bottom to Ground	209	237	-28
G	Sill Height at Front Wheel Well	166	170	-4
H	Sill Height at Front Door Leading Edge	170	175	-5
I	Sill Height at B Pillar	170	162	8
J1	Sill Height at Rear Wheel Well	163	180	-17
J2	Pinch Weld Height at Rear Wheel Well	170	185	-15
K	Sill Height Aft of Rear Wheel Well	235	218	17
L	Rear Bumper Thickness	100	100	0
M	Rear Bumper Bottom to Ground	245	240	5
N	Sill Height to Window Bottom Sill	752	745	7
O	Front Door Leading Edge to Impact CL	903	900	3
P	Rear Door Trailing Edge to Impact CL	982	1040	-58
Q	Front Window Opening	374	349	25
R	Right Side Length	3408	3413	-5
S	Left Side Length	3408	3332	76
T	Vehicle Width at B Post	1780	1711	69

DATA SHEET NO. 14 **EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

NHTSA No. CC0109
 Test Date: 8/07/2012



NOTE: All measurements are in millimeters (mm)

Maximum Exterior Crush Measurements

Level	Measurement Description	Maximum Exterior Static Crush	Distance from Impact	Height Above Ground (mm)
1	Sill Top	293	0	187
2	Occupant H-Point	332	0	540
3	Mid-Door	340	0	609
4	Window Sill	342	0	791
5	Window Top	117	-75	1364

DATA SHEET NO. 15

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
Test Program: FMVSS 214 Pole

NHTSA No. CC0109
Test Date: 8/07/2012

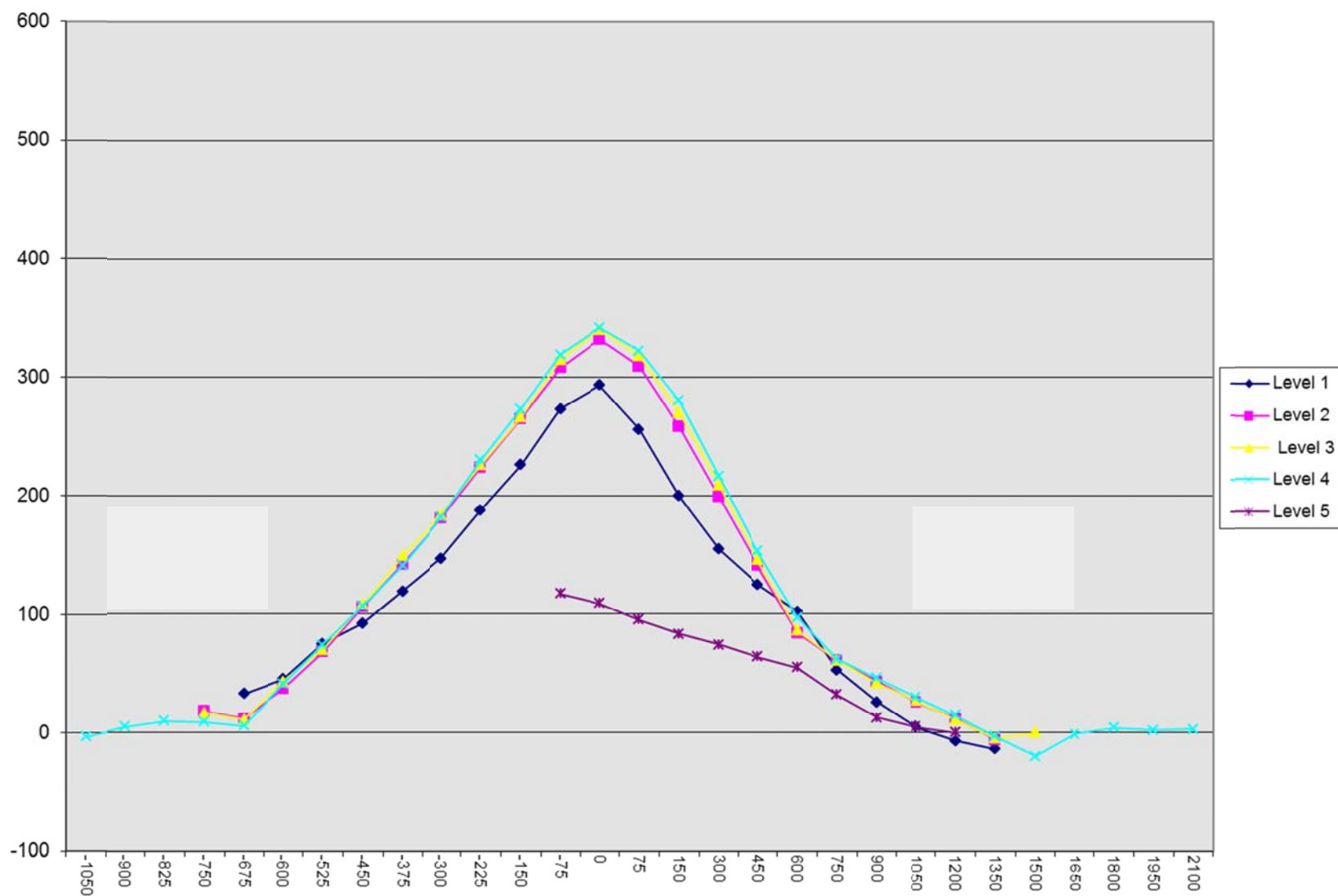
	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	293	332	340	342	117
Distance From Impact (mm)	0	0	0	0	-75

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1050				262					259					-3	
-900				245					250					5	
-825				243					253					10	
-750		211	211	241			229	228	250			18	17	9	
-675	242	222	224	235		275	234	235	241		33	12	11	6	
-600	242	226	223	232		287	263	266	273		45	37	43	41	
-525	240	227	222	229		315	295	292	303		75	68	70	74	
-450	239	227	221	226		331	333	329	333		92	106	108	107	
-375	240	227	221	225		359	369	370	366		119	142	149	141	
-300	240	225	220	223		387	406	404	405		147	181	184	182	
-225	240	223	219	222		428	447	445	452		188	224	226	230	
-150	240	222	219	220		466	487	485	493		226	265	266	273	
-75	240	220	216	220	520	513	528	531	539	637	273	308	315	319	117
0	240	220	215	219	517	533	552	555	561	626	293	332	340	342	109
75	239	219	215	218	512	495	528	533	540	607	256	309	318	322	95
150	239	219	215	217	512	439	477	485	497	595	200	258	270	280	83
300	239	217	214	220	508	394	416	423	436	582	155	199	209	216	74
450	239	216	214	217	508	364	357	360	370	572	125	141	146	153	64
600	239	215	214	218	510	341	299	300	315	565	102	84	86	97	55
750	238	213	212	219	510	291	274	273	281	542	53	61	61	62	32
900	238	213	212	220	514	264	256	254	266	527	26	43	42	46	13
1050	237	212	212	221	513	242	238	239	251	518	5	26	27	30	5
1200	237	211	212	222	523	230	223	223	237	523	-7	12	11	15	0
1350	236	210	211	225		222	204	206	222		-14	-6	-5	-3	
1500			208	226				208	206				0	-20	
1650				220					219					-1	
1800				218					222					4	
1950				232					234					2	
2100				250					253					3	

DATA SHEET NO. 15 (CONTINUED)
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
Test Program: FMVSS 214 Pole

NHTSA No. CC0109
Test Date: 8/07/2012



DATA SHEET NO. 16

SUMMARY OF FMVSS 301 FUEL SYSTEM DATA

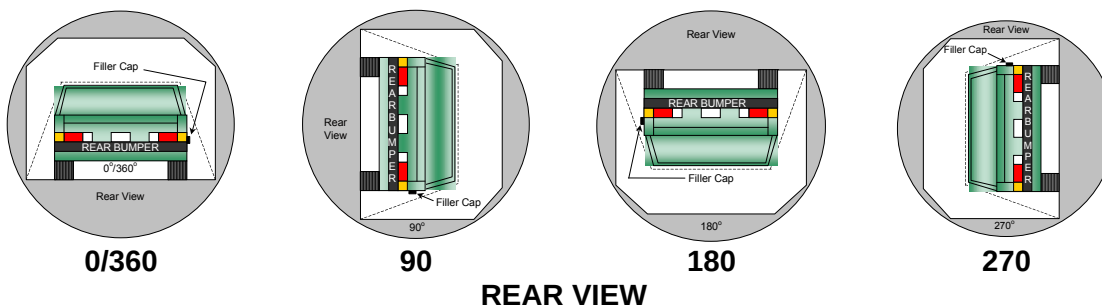
Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

NHTSA No. CC0109
 Test Date: 8/07/2012

FUEL SYSTEM INTEGRITY POST IMPACT DATA

Time Interval	FMVSS 301 Maximum Allowable Spillage	Spillage (g)
Impact Until Motion Ceases	28 g	0
First Five Minutes Following Impact	142 g	0
Next 25 Minutes	28 g / 1 minute	0

STATIC ROLLOVER DATA



Rollover Stage	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	2	minutes	52	seconds	5	minutes	7	minutes	52	seconds	8	minutes
90° - 180°	2	minutes	31	seconds	5	minutes	7	minutes	31	seconds	8	minutes
180° - 270°	2	minutes	09	seconds	5	minutes	7	minutes	09	seconds	8	minutes
270° - 360°	2	minutes	35	seconds	5	minutes	7	minutes	35	seconds	8	minutes

Rollover Stage	Spillage (g)			
	First 5 min. from onset of rotation	6 th min.	7 th min.	8 th min. (if required)
0° - 90°	0	0	0	
90° - 180°	0	0	0	
180° - 270°	0	0	0	
270° - 360°	0	0	0	
FMVSS 301 Maximum Allowable (for each 90° stage)	142	28	28	28

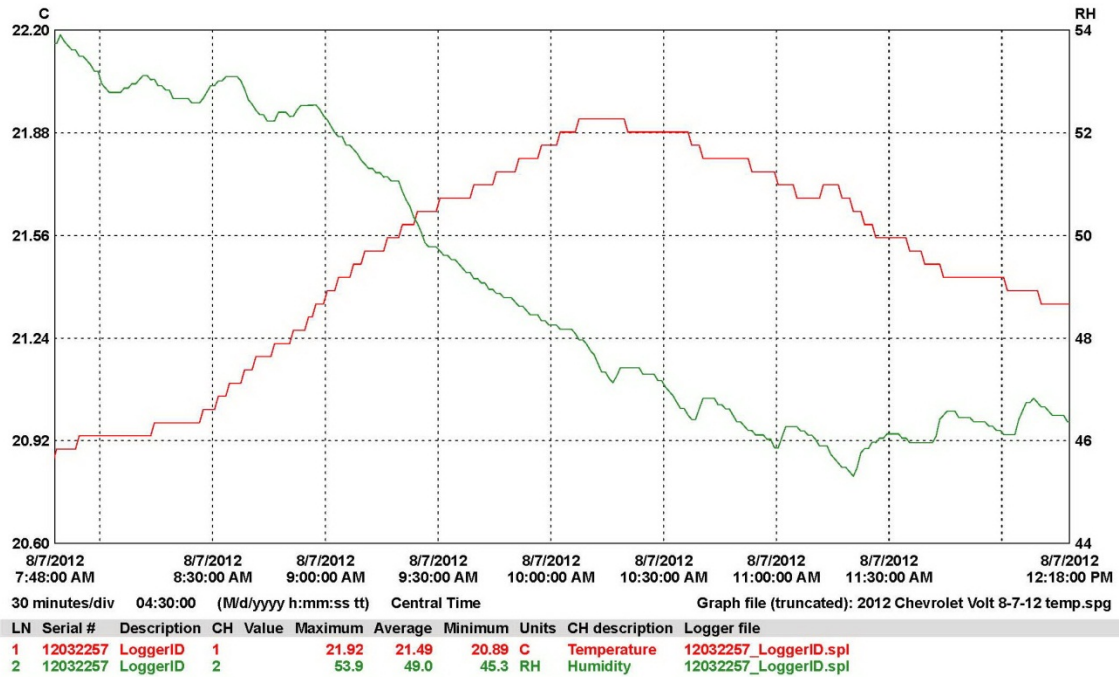
Rollover Stage	Spillage Location(s)
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 17 **TEMPERATURE AND HUMIDITY TRACES**

Test Vehicle: 2012 Chevrolet Volt 5-Dr Hatchback
 Test Program: FMVSS 214 Pole

NHTSA No. CC0109
 Test Date: 8/07/2012

Time of Impact: 12:18 pm



APPENDIX A
PHOTOGRAPHS

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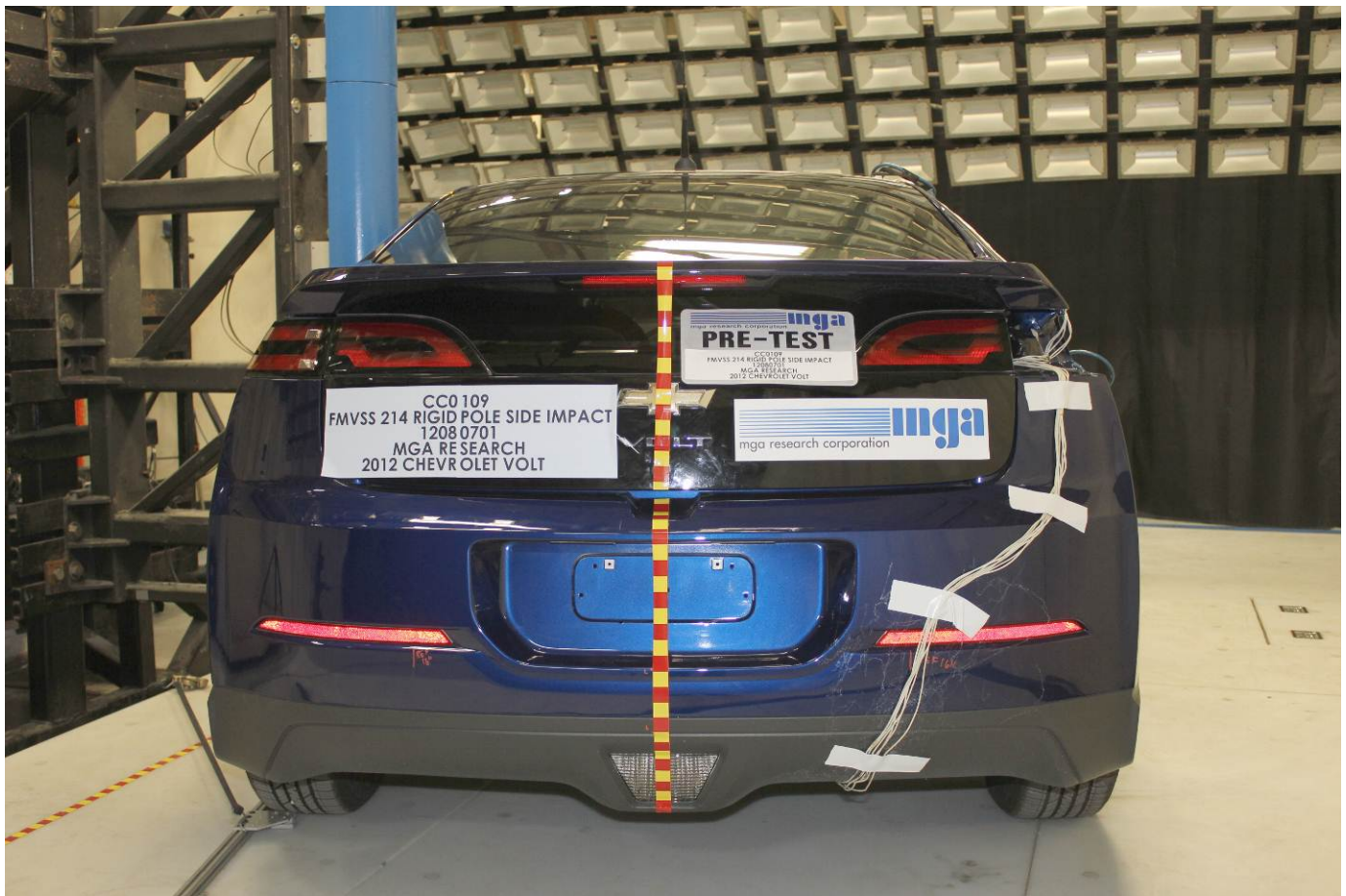
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Pre-Test Frontal View of Test Vehicle



Post-Test Frontal View of Test Vehicle



Pre-Test Rear View of Test Vehicle



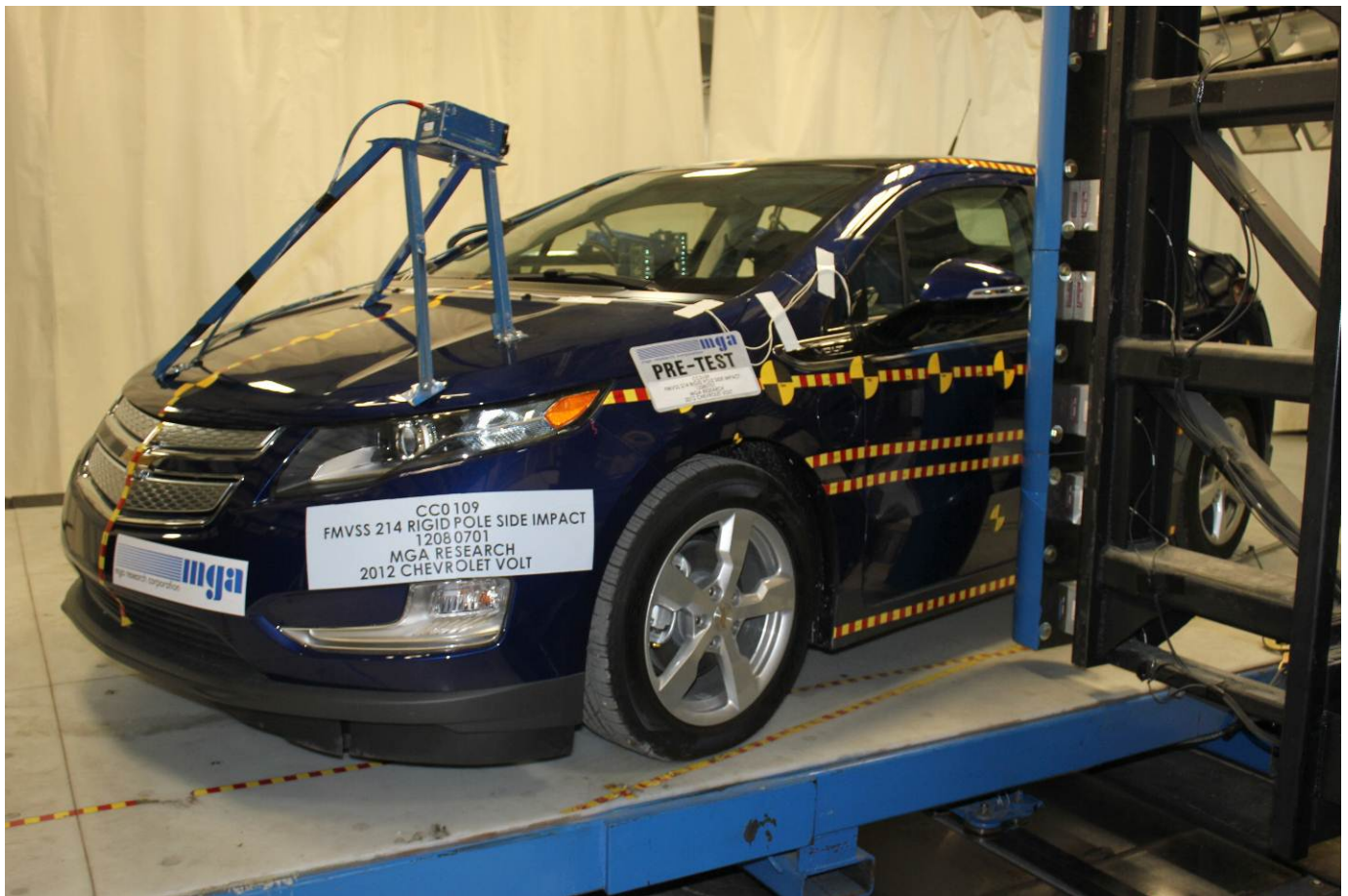
Post-Test Rear View of Test Vehicle



Pre-Test Impacted Side View of Test Vehicle



Post-Test Impacted Side View of Test Vehicle



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



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



Pre-Test Overhead View of Test Vehicle



Post-Test Overhead View of Test Vehicle



Pre-Test Dummy Through Opposite Window



Post-Test Dummy Through Opposite Window



Pre-Test Close-up of Dummy with Door Closed (Impact Side)



Post-Test Dummy with Door Closed (Impact Side)



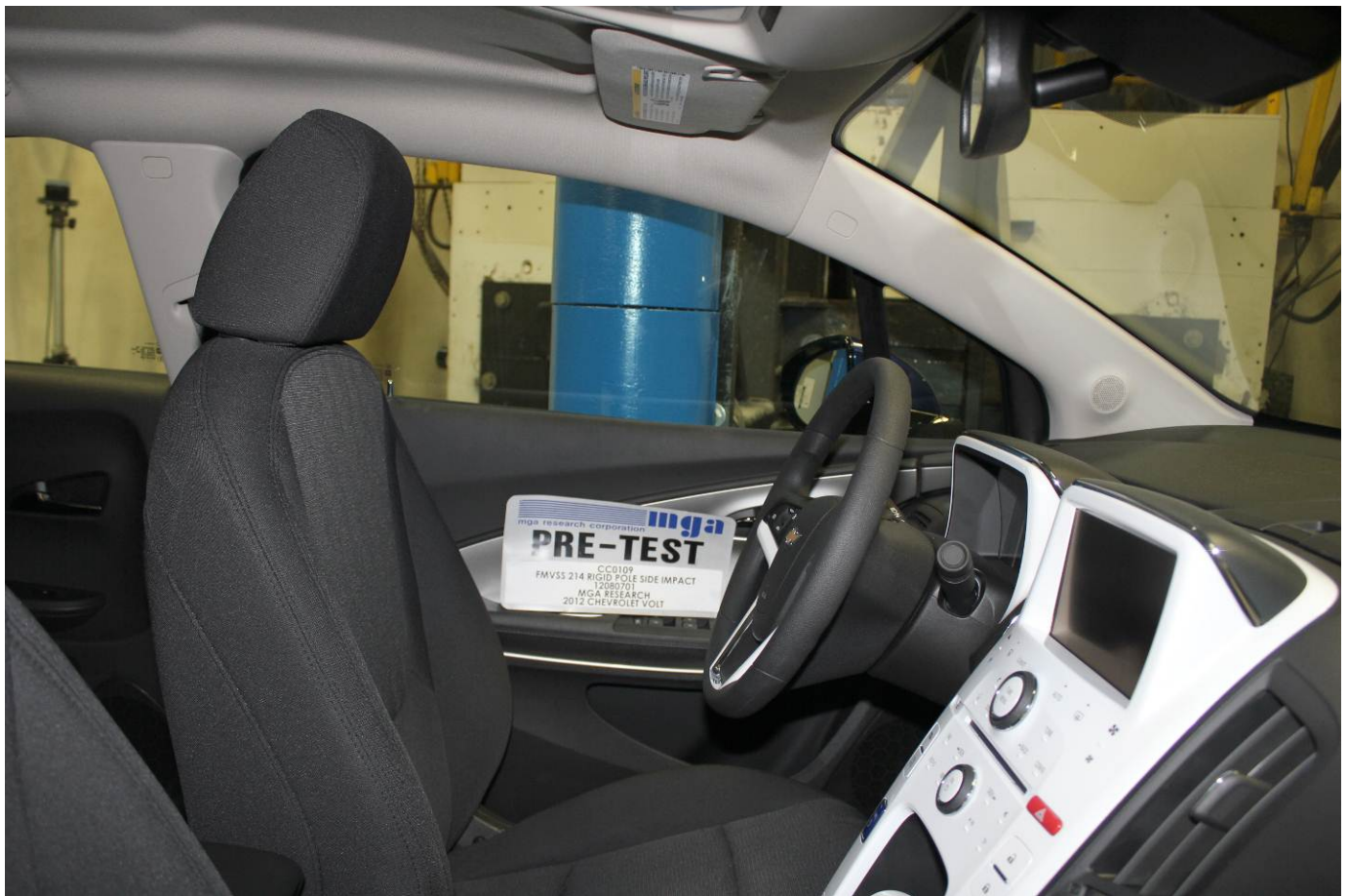
Pre-Test Dummy Door Open



Pre-Test Dummy Shoulder and Door Top View



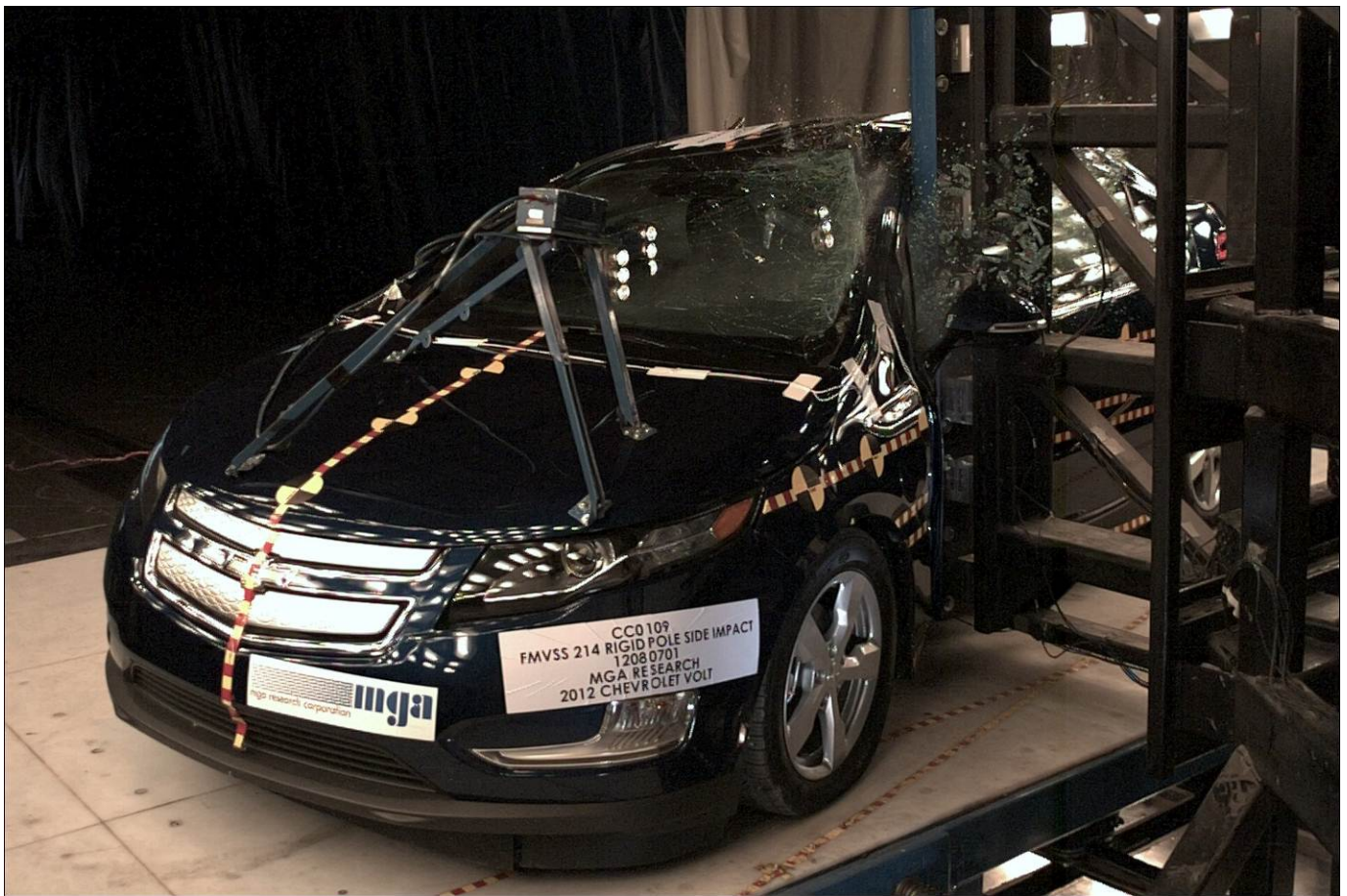
Post-Test Dummy Shoulder and Door Top View



Pre-Test Interior of Front Door Closed



Post-Test Interior of Front Door Showing Dummy Impact Locations



Impact Event



Post-Test Impact Zone Close-up View



Post-Test $\frac{3}{4}$ Front View of Impact Zone

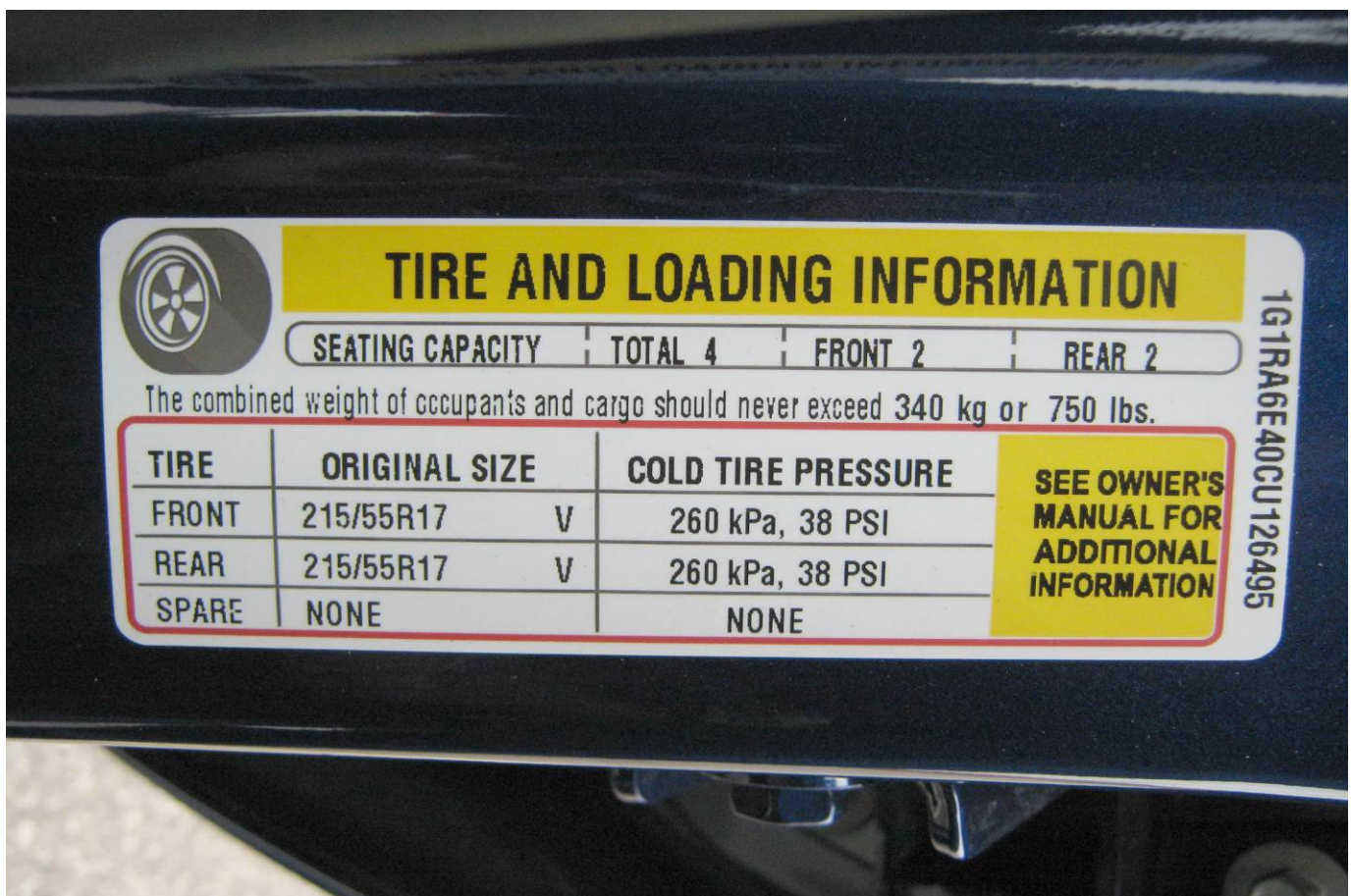


Post-Test $\frac{3}{4}$ Rear View of Impact Zone





Close-up View of Vehicle's Certification Label



Close-up View of Vehicle's Tire Placard Label



Post-Test Vehicle at 90 Degree Rollover



Post-Test Vehicle at 180 Degree Rollover



Post-Test Vehicle at 270 Degree Rollover



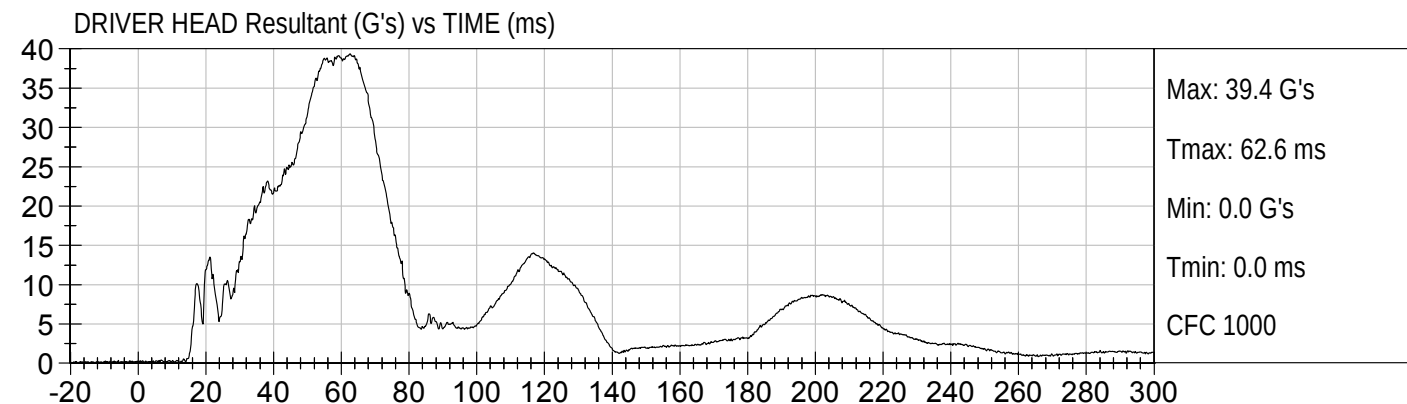
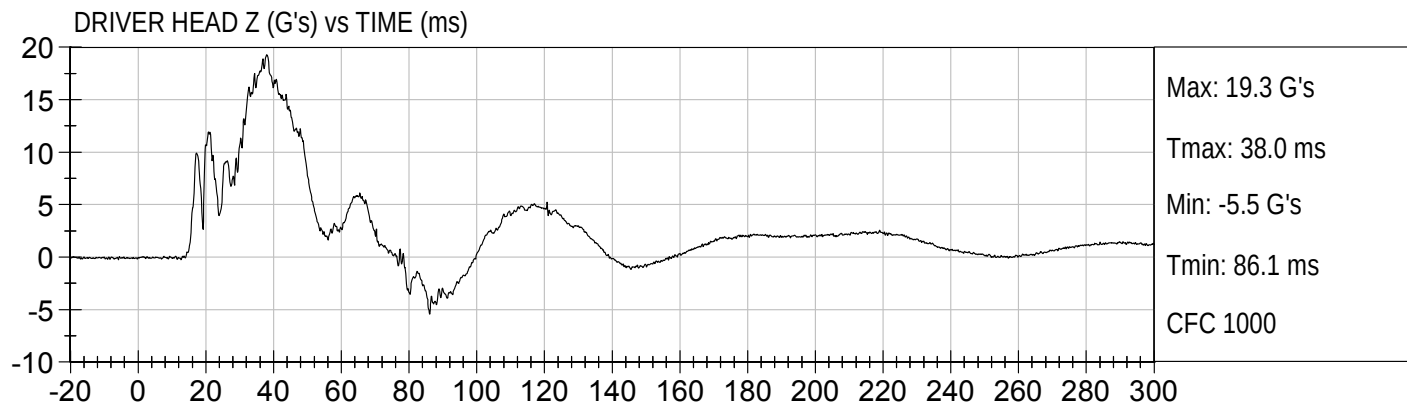
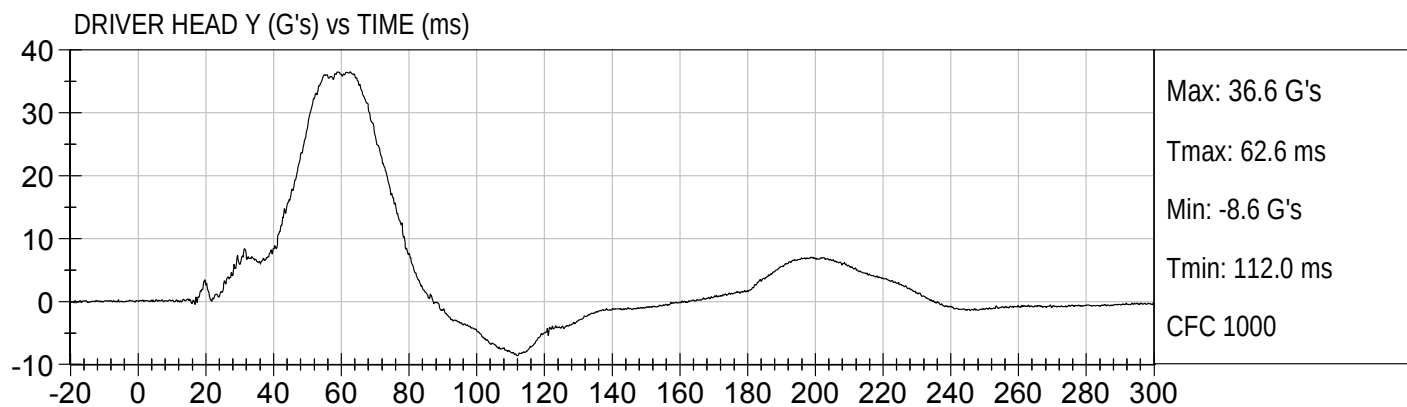
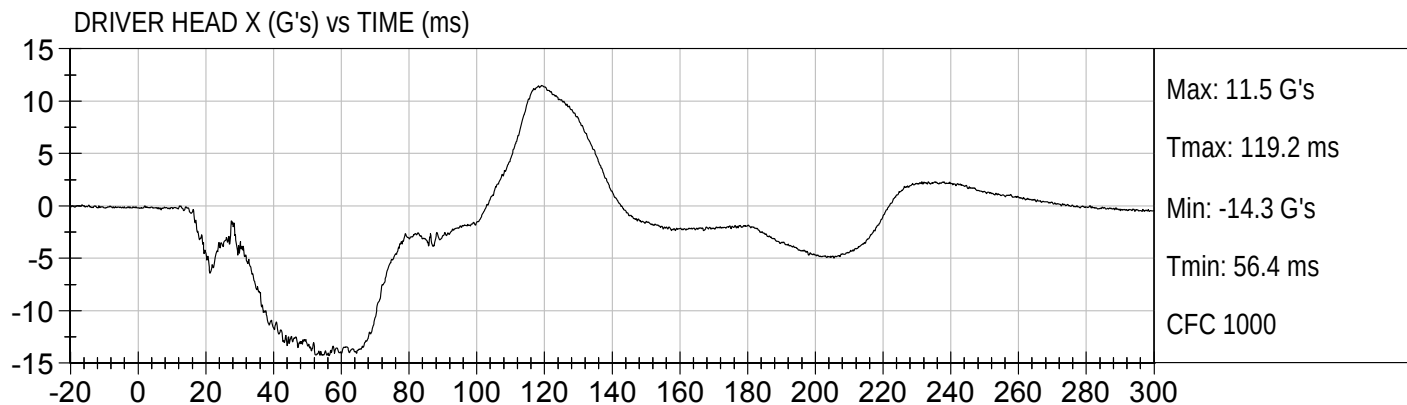
Post-Test Vehicle at 360 Degree Rollover

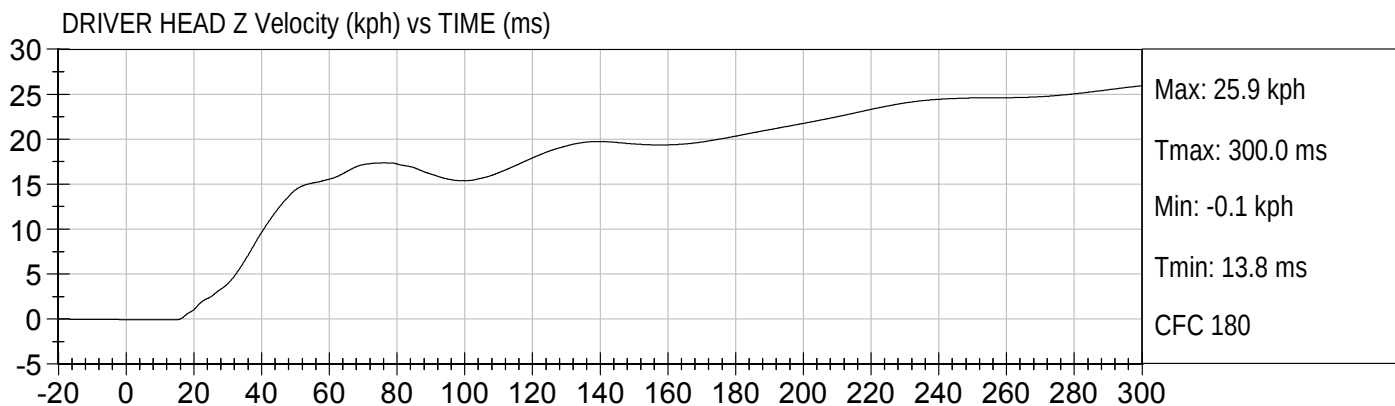
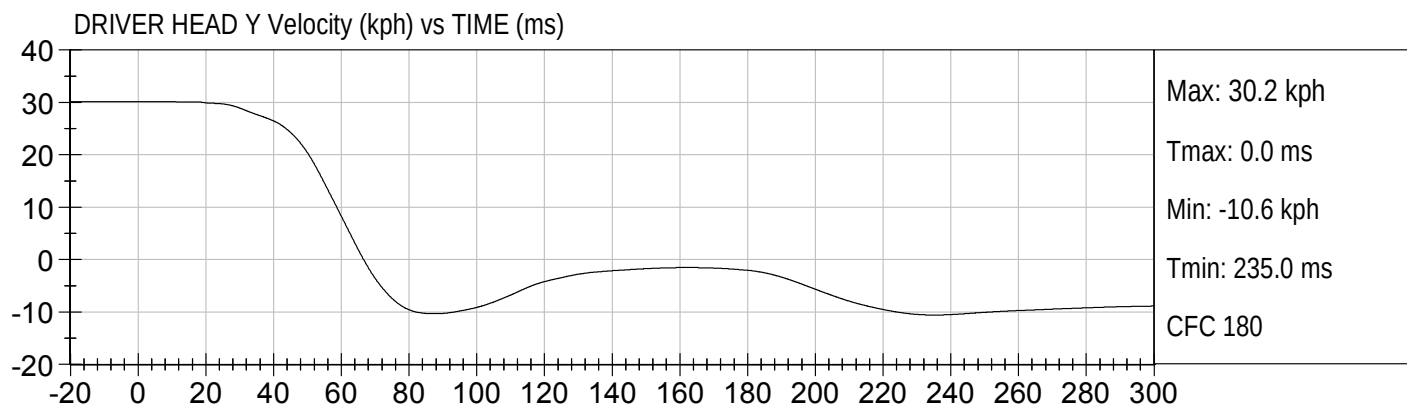
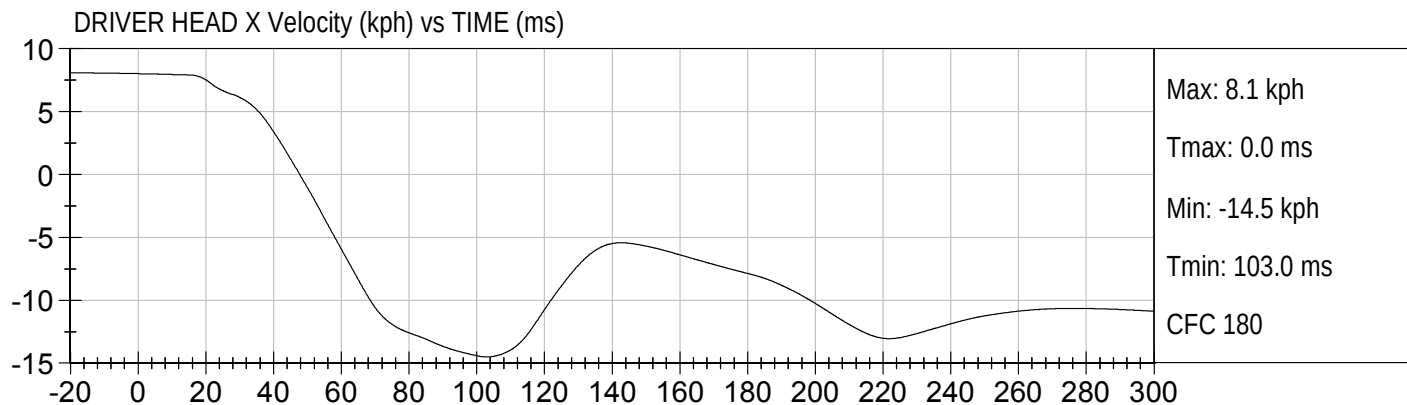
APPENDIX B
DUMMY RESPONSE DATA

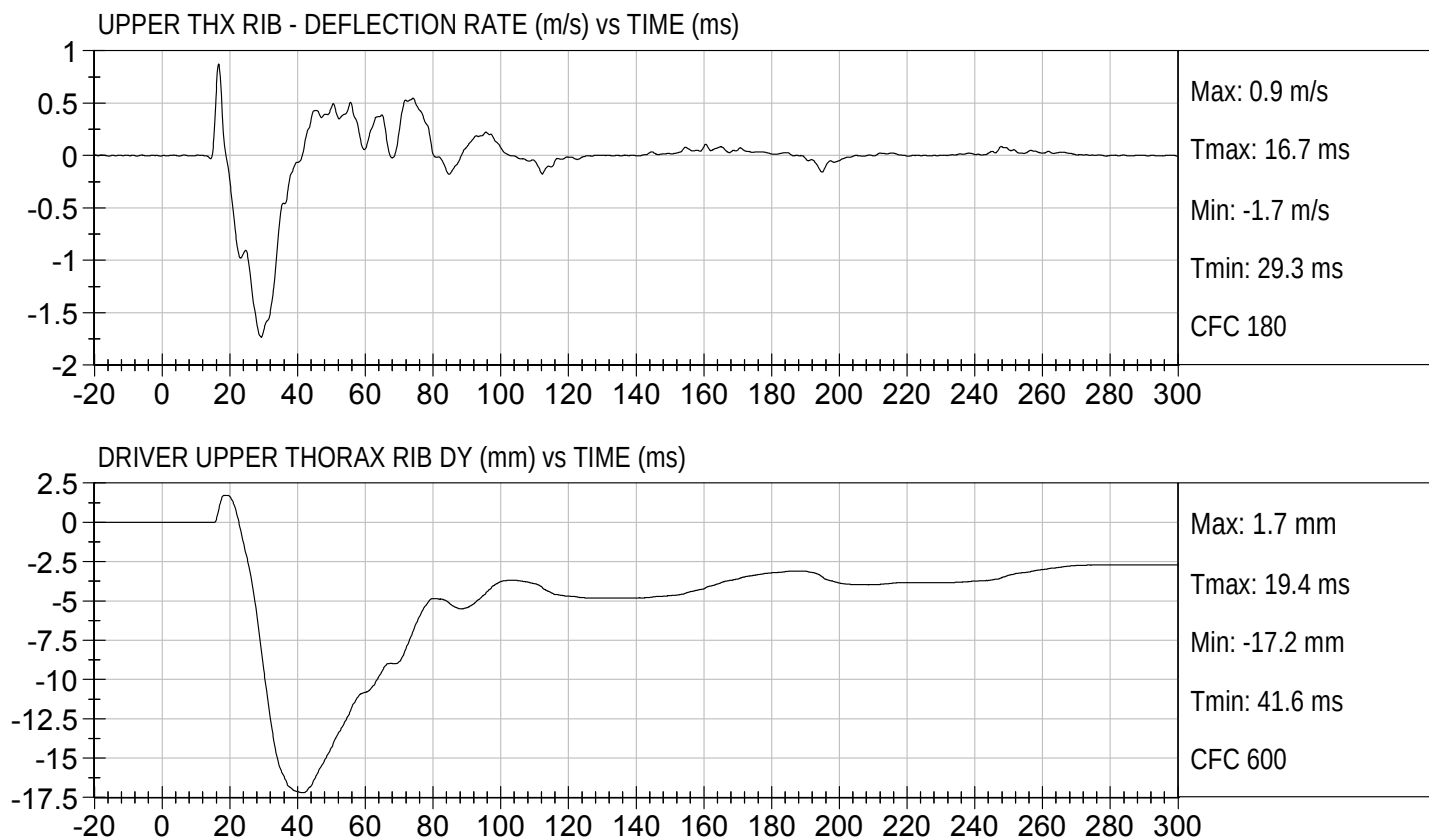
TABLE OF DATA PLOTS

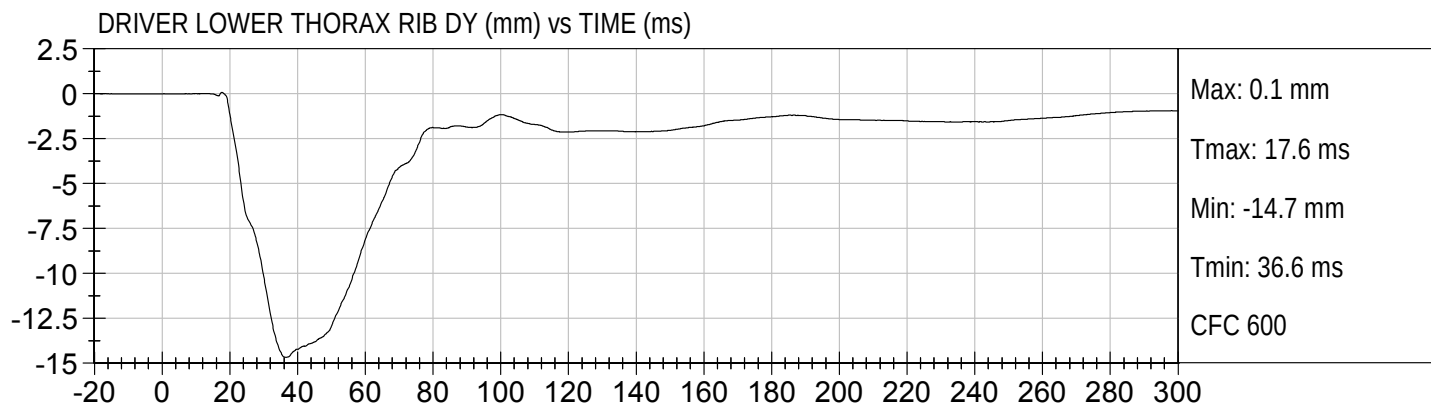
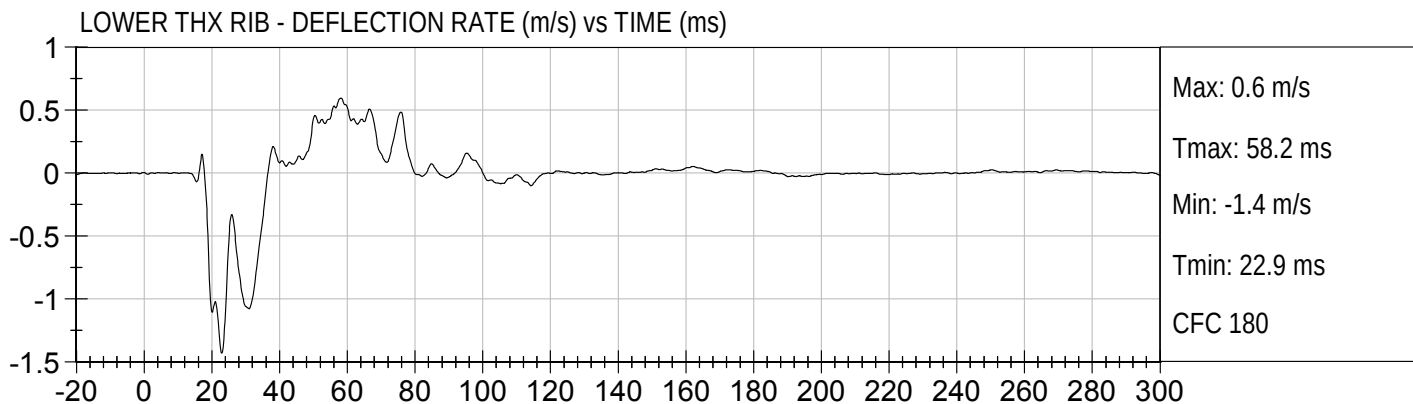
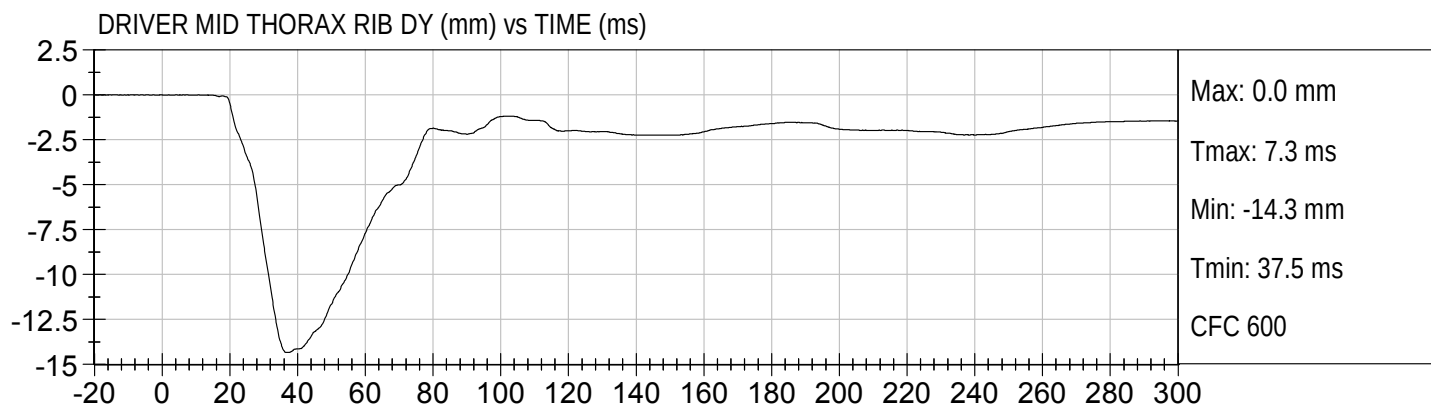
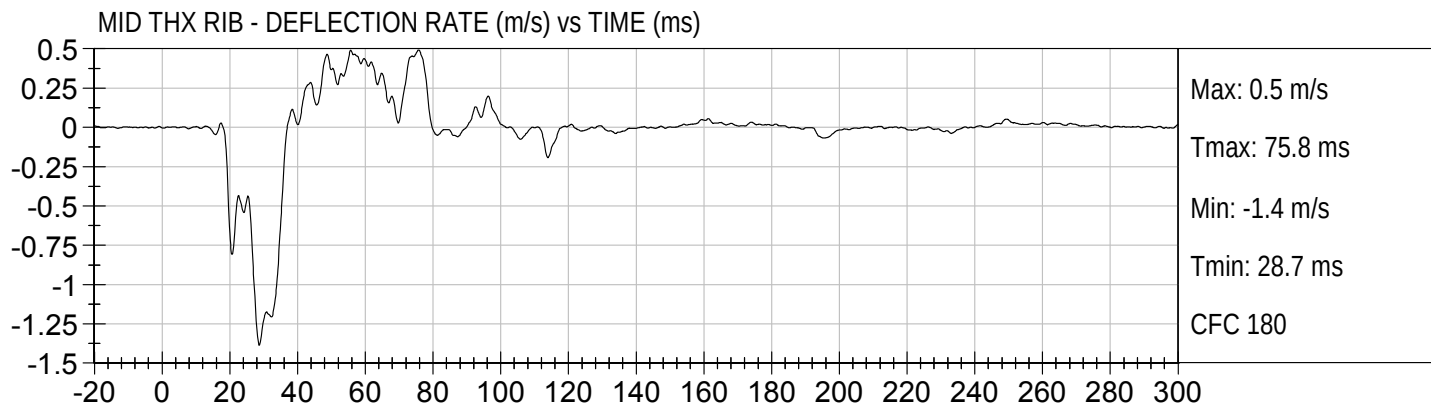
Dummy Instrumentation Plots FILTERED DATA

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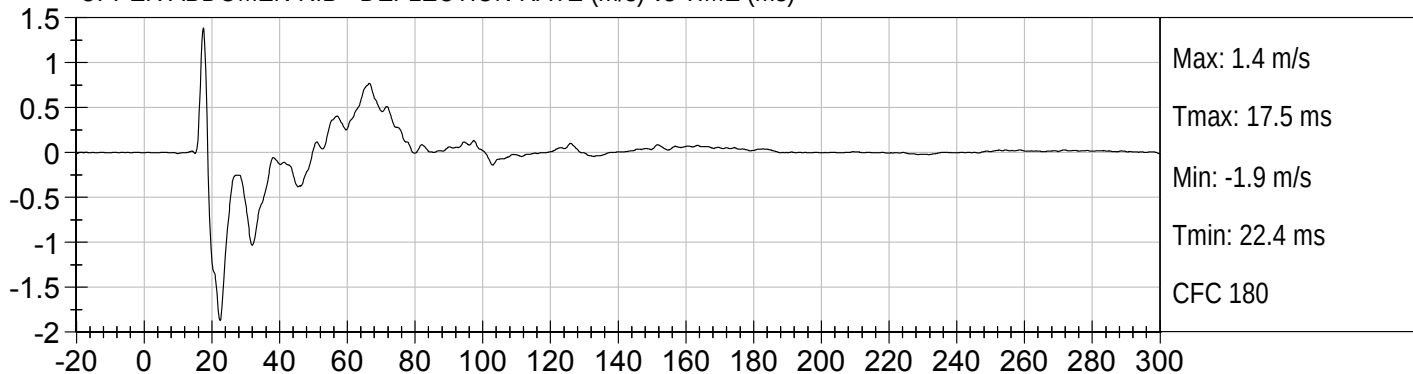




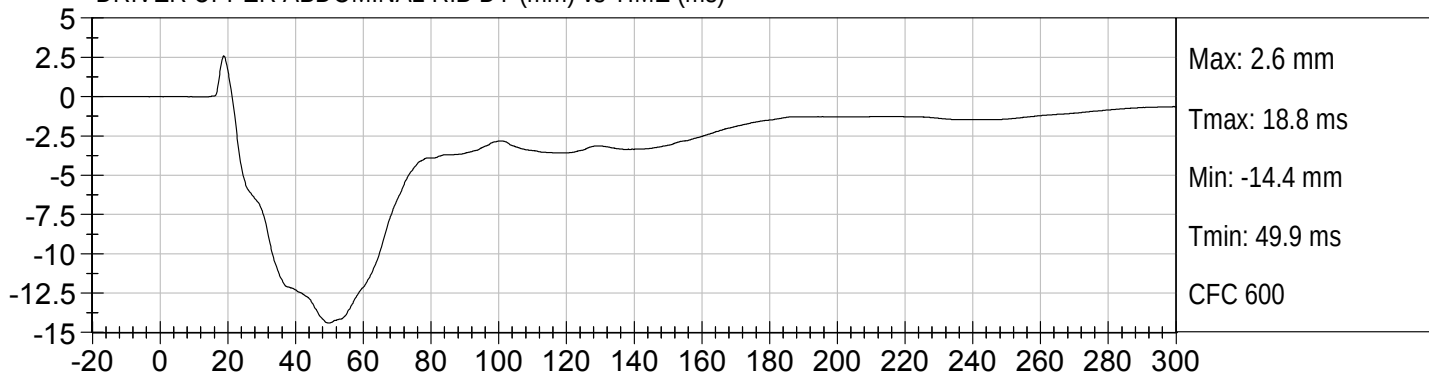




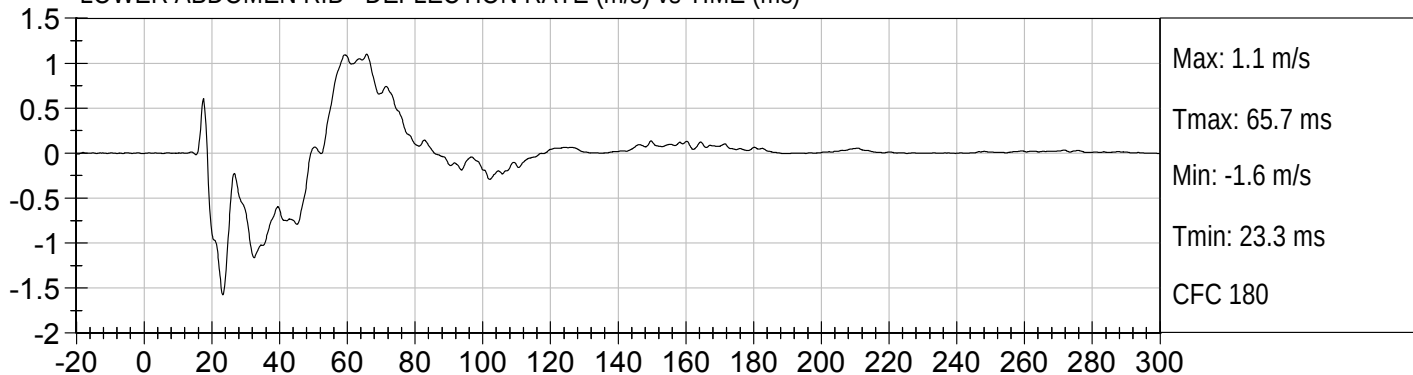
UPPER ABDOMEN RIB - DEFLECTION RATE (m/s) vs TIME (ms)



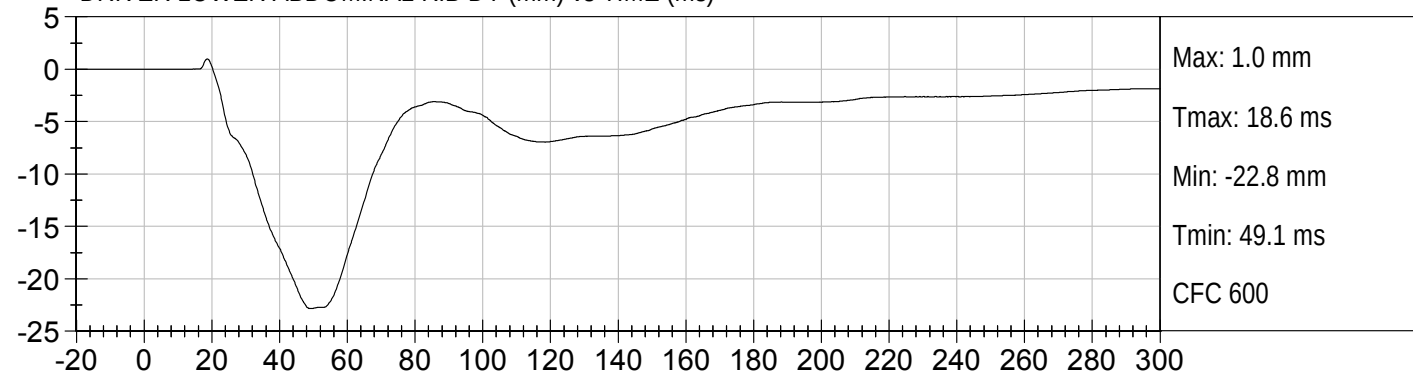
DRIVER UPPER ABDOMINAL RIB DY (mm) vs TIME (ms)

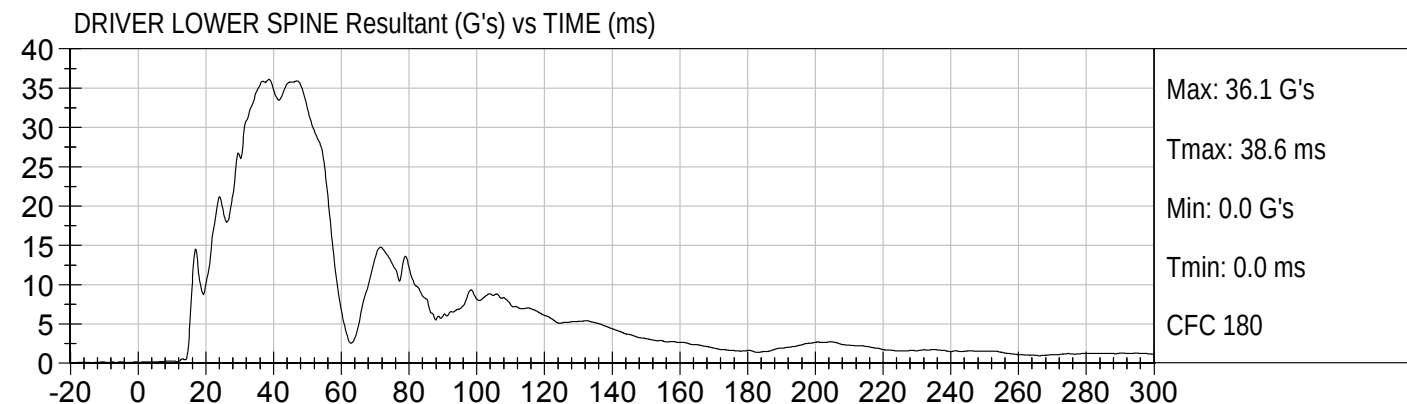
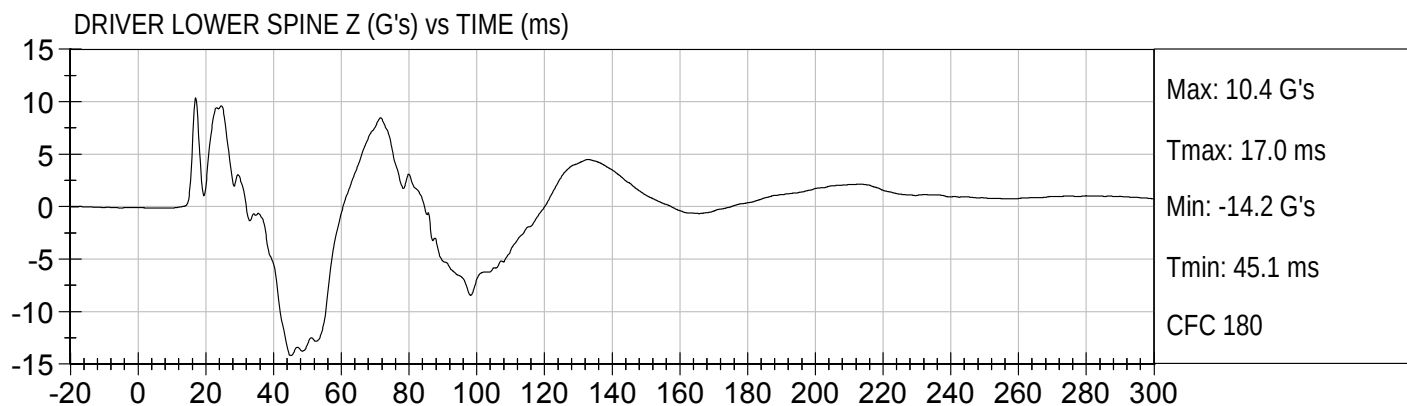
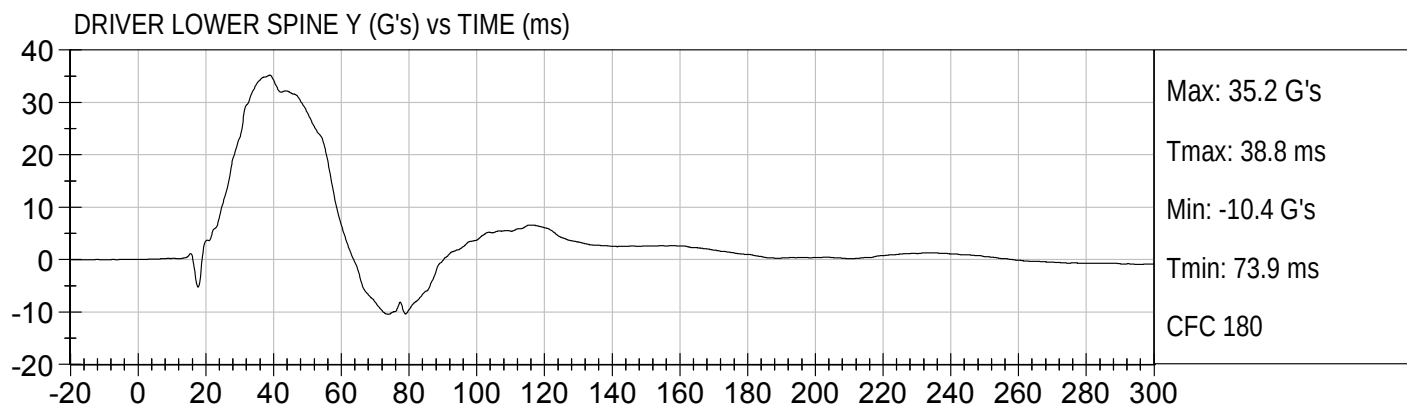
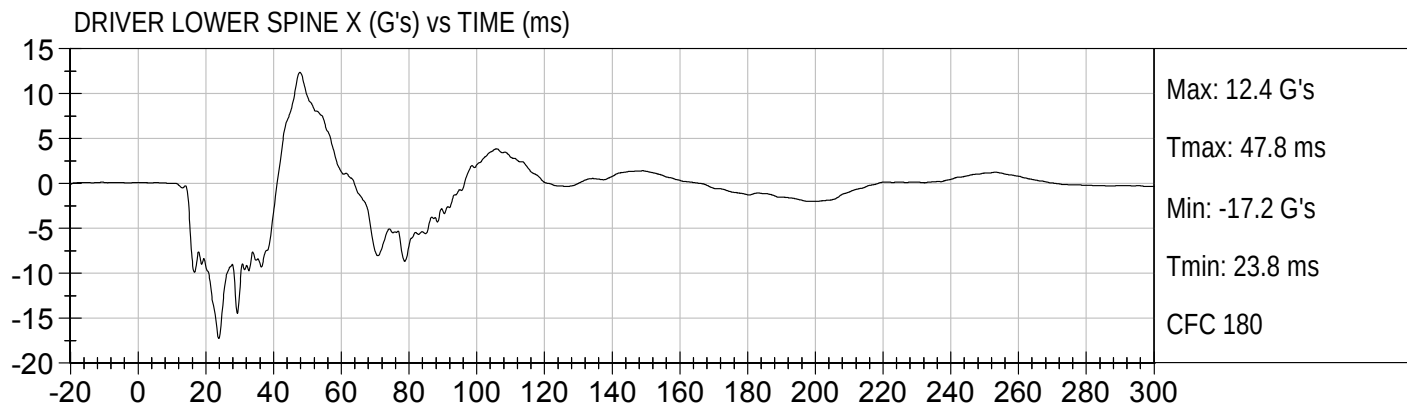


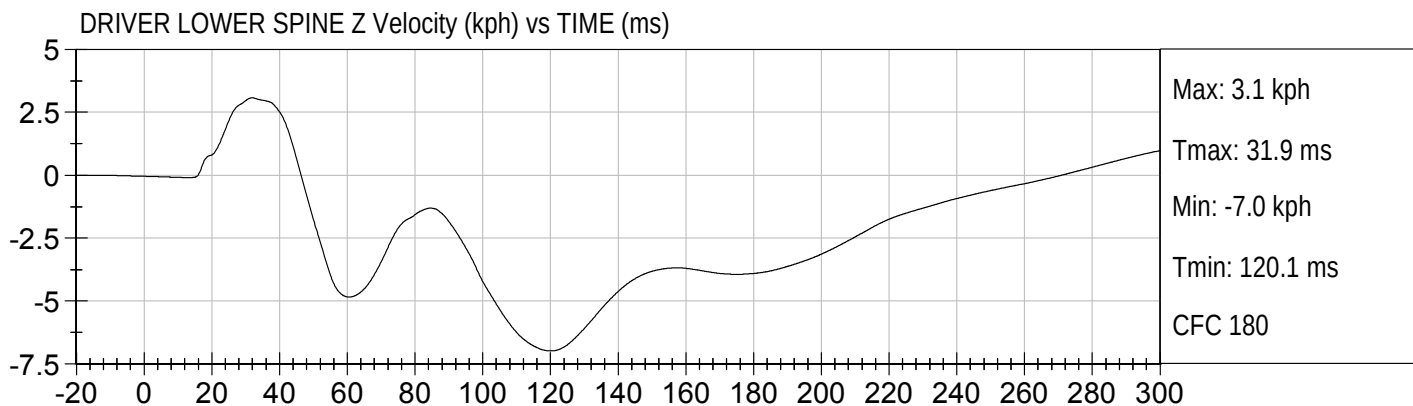
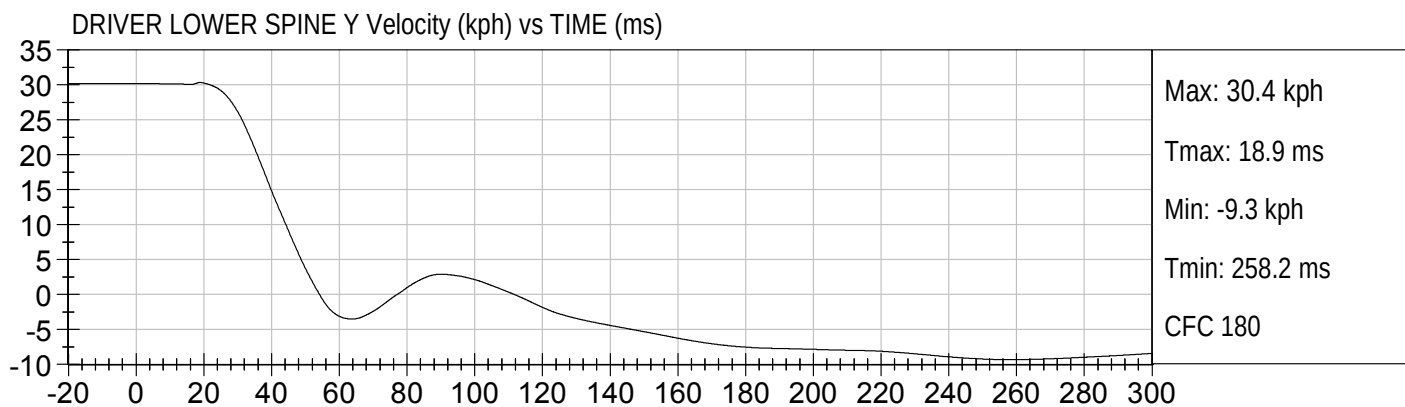
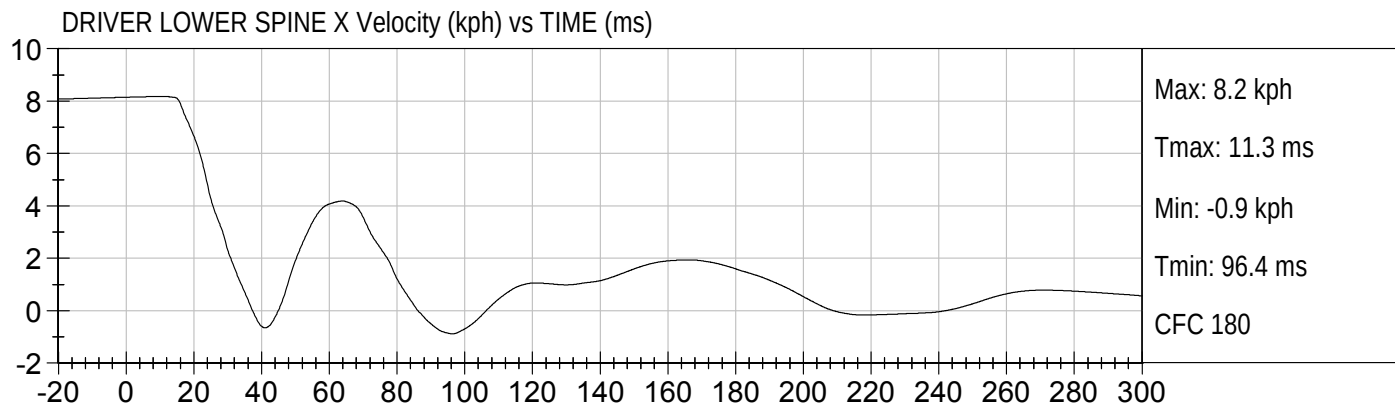
LOWER ABDOMEN RIB - DEFLECTION RATE (m/s) vs TIME (ms)



DRIVER LOWER ABDOMINAL RIB DY (mm) vs TIME (ms)

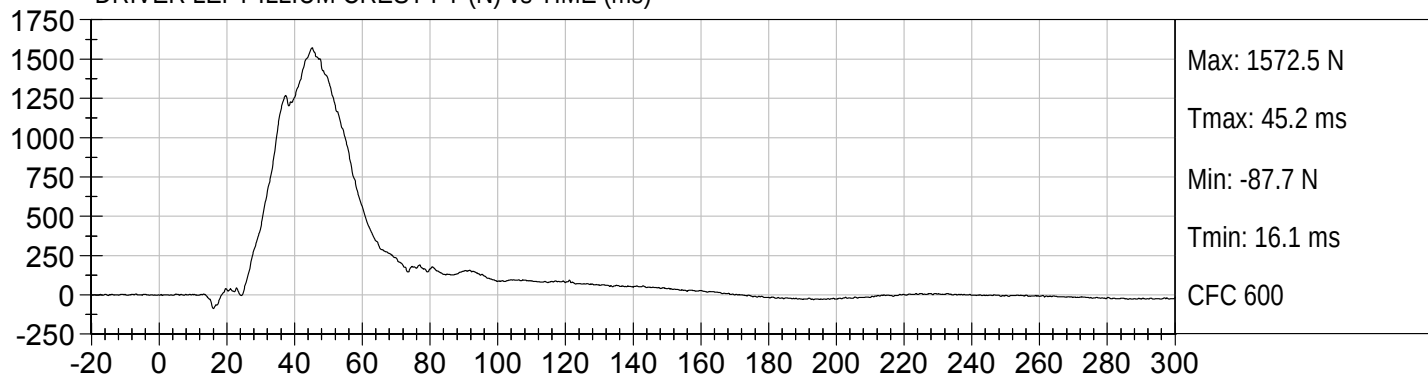




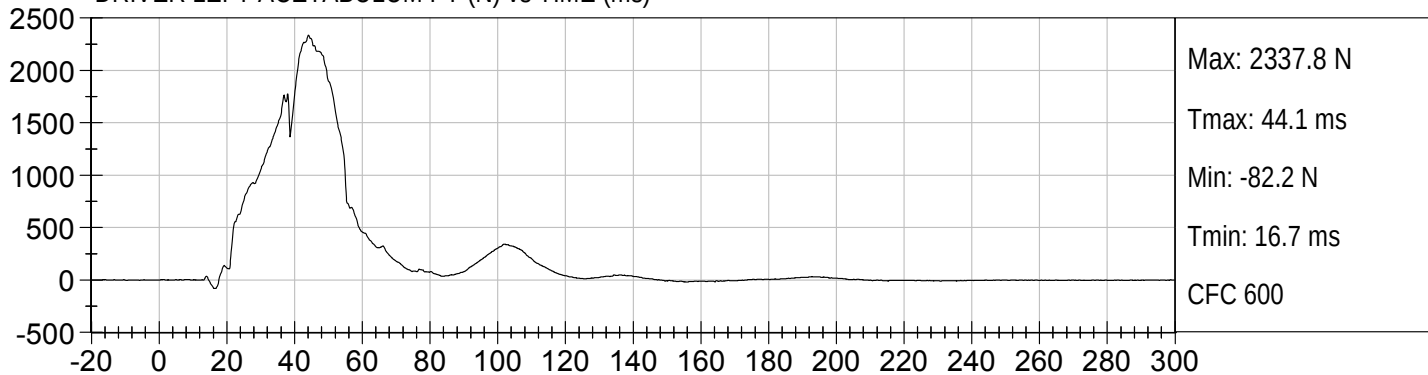




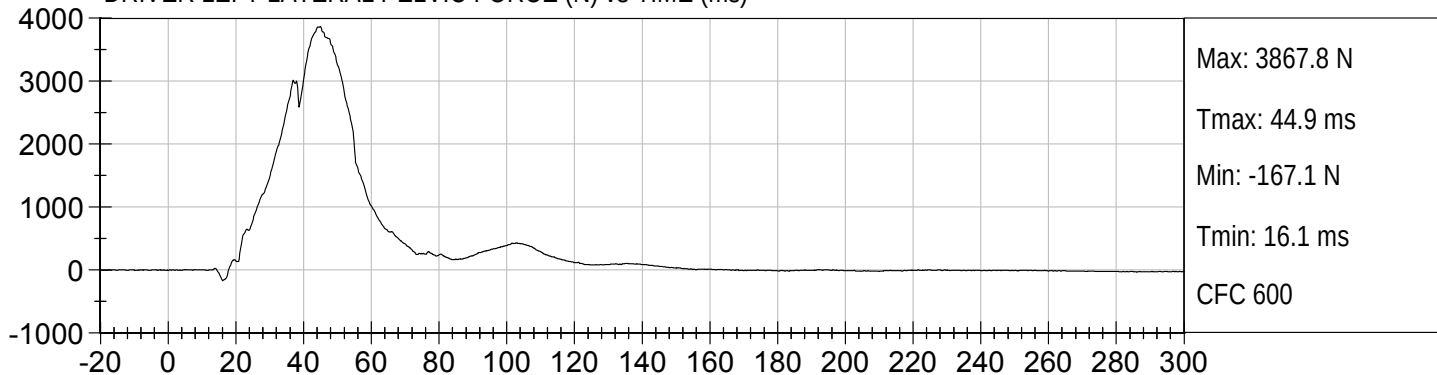
DRIVER LEFT ILLIUM CREST FY (N) vs TIME (ms)



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



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



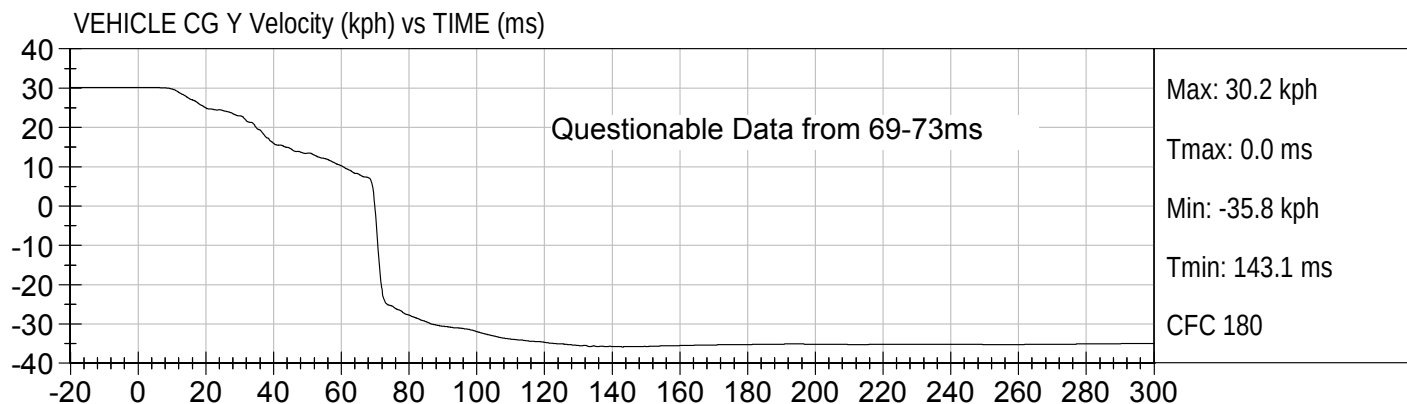
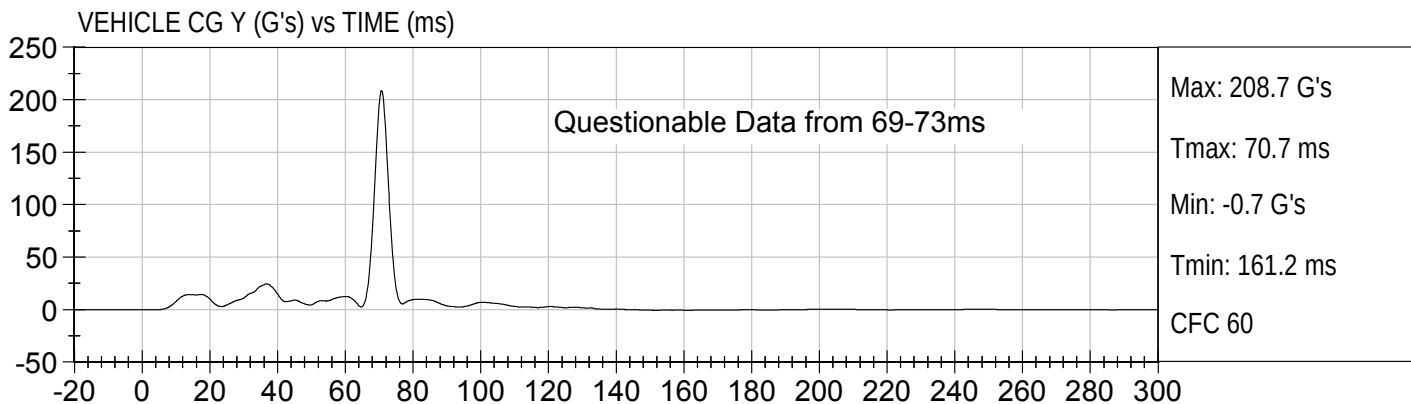
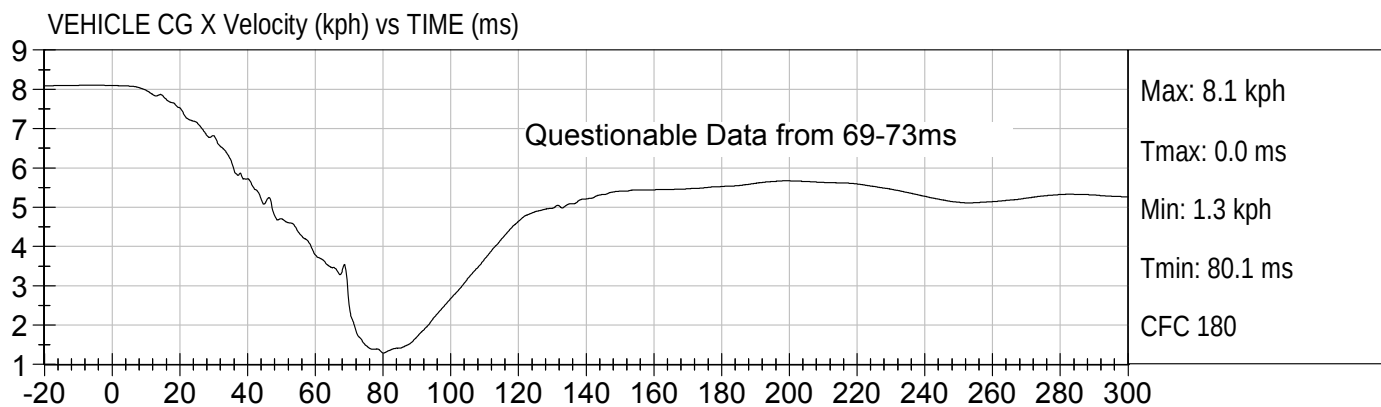
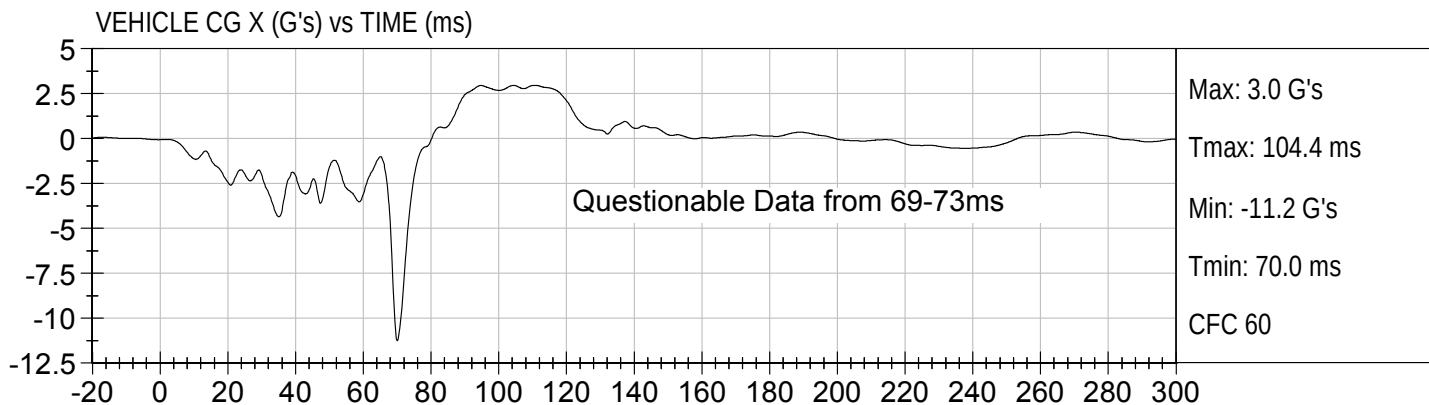
APPENDIX C

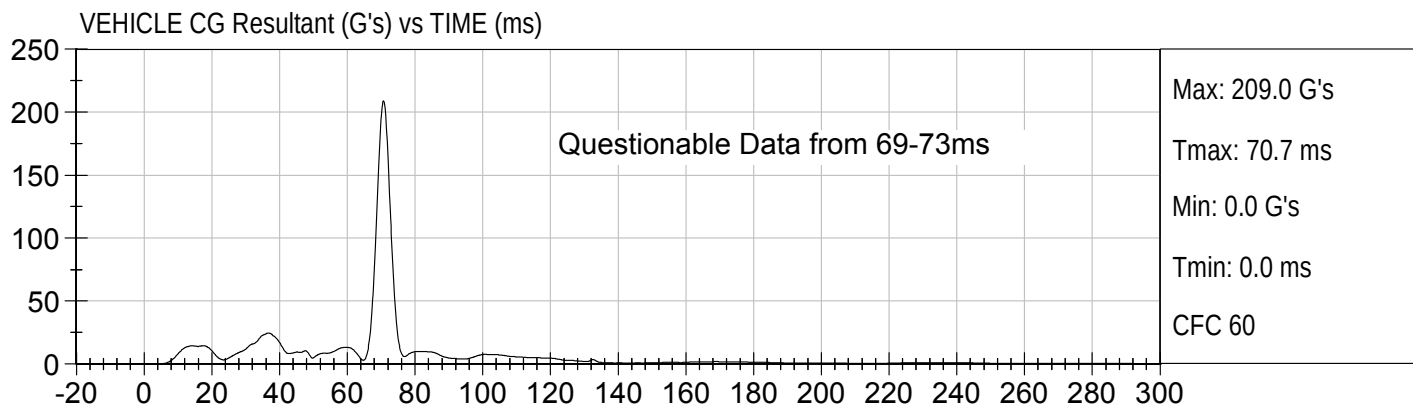
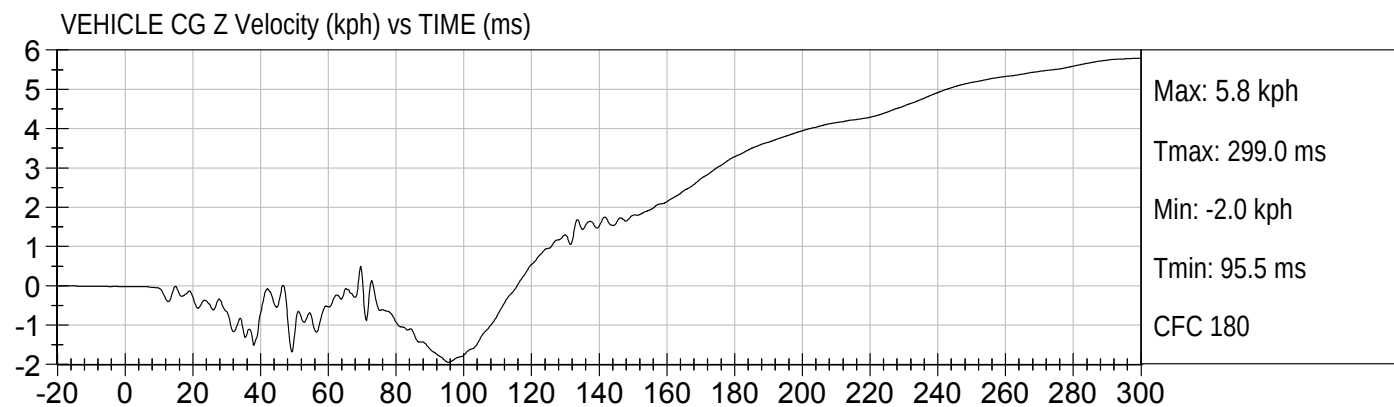
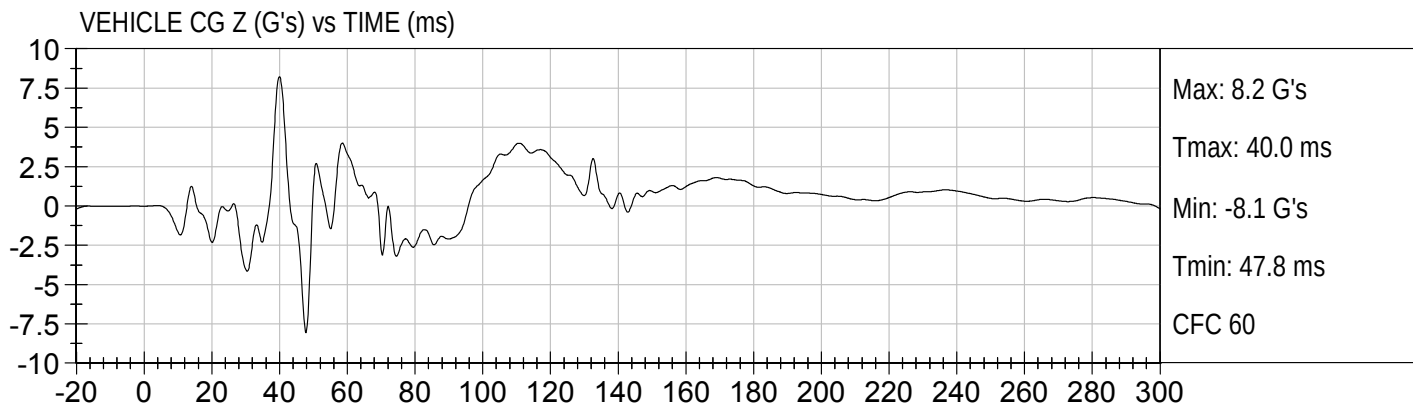
VEHICLE ACCELEROMETER RESPONSE DATA

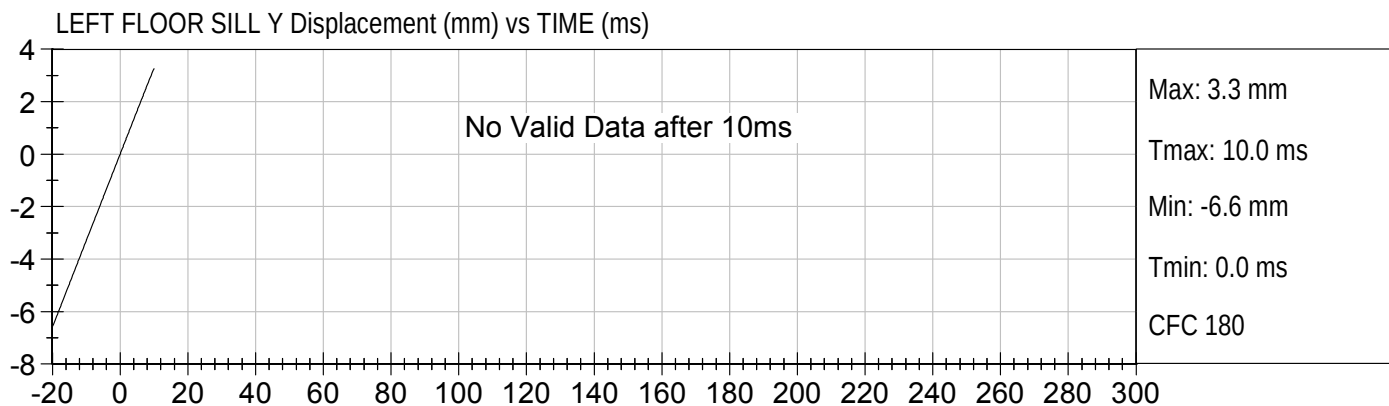
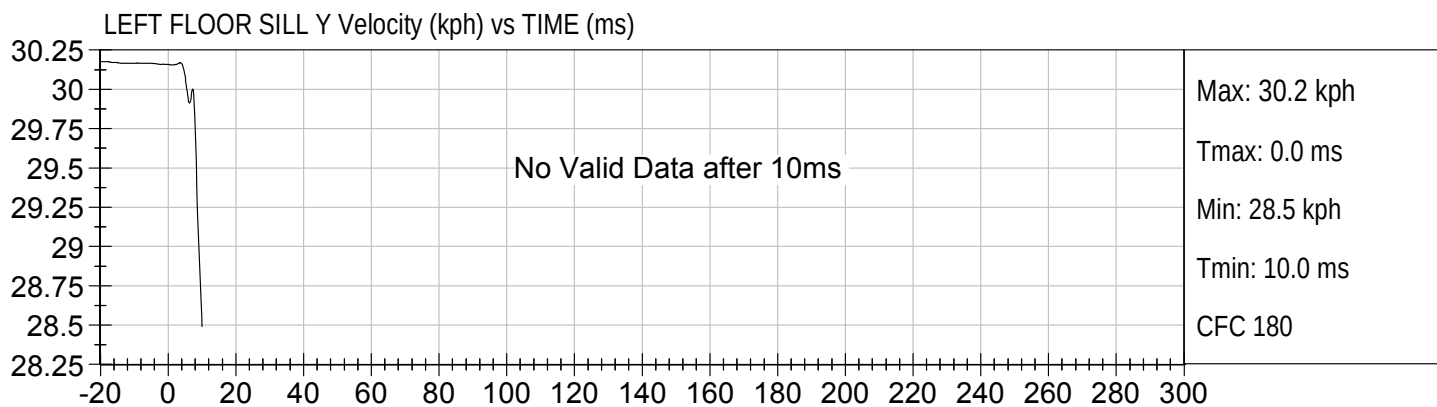
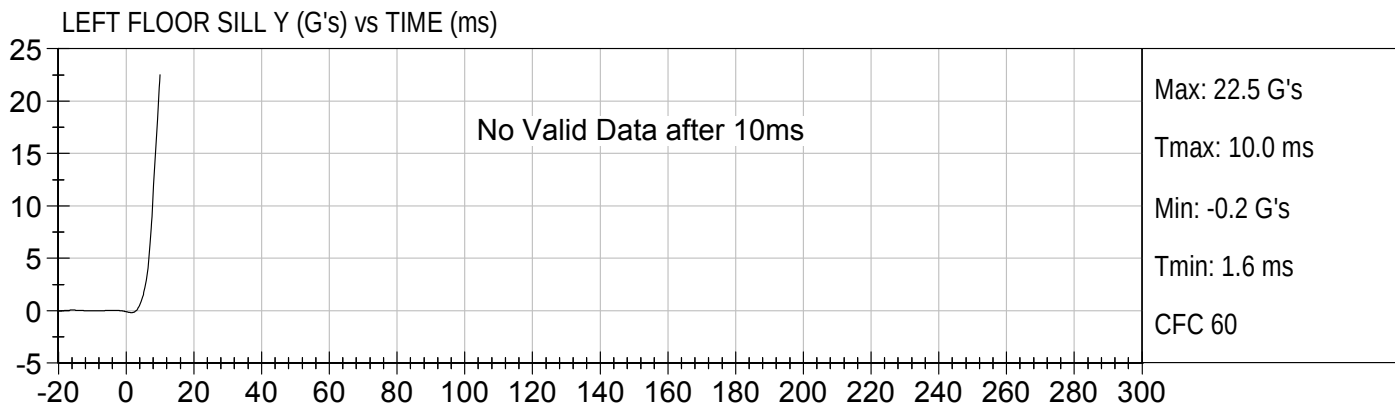
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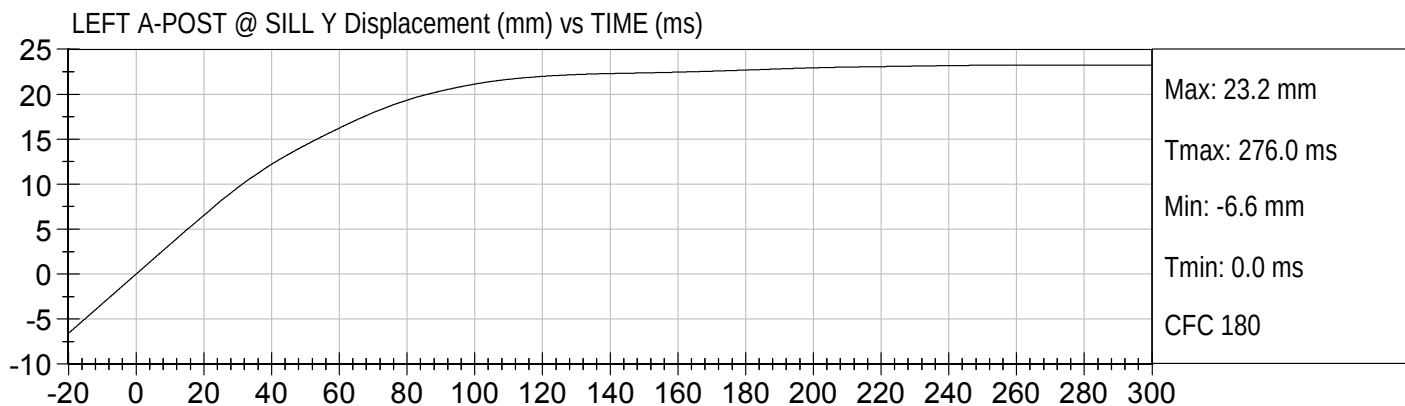
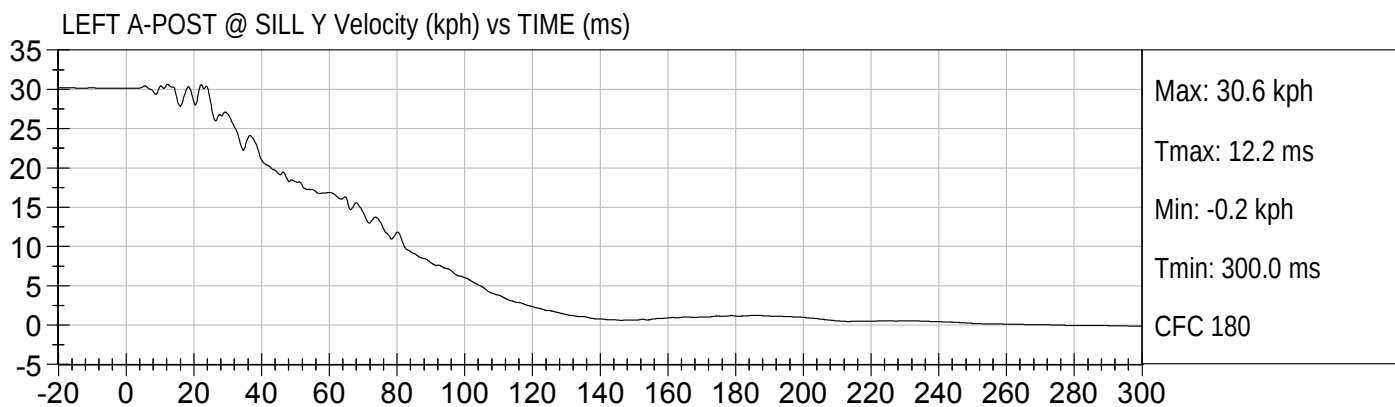
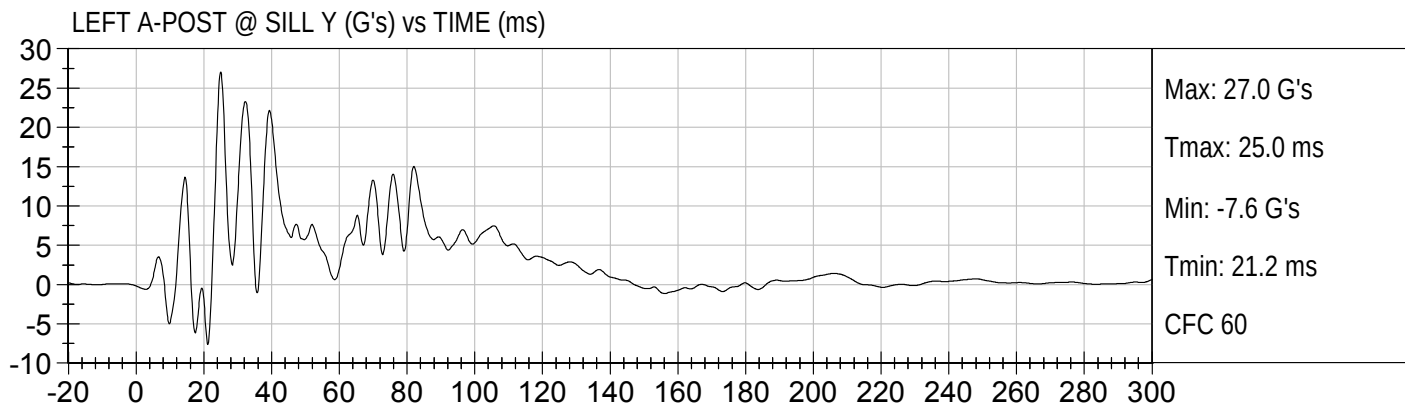
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Figure No. 10. Left Floor Sill (Y) Displacement vs. Time	C-3
Figure No. 11. Left A-Pillar Sill (Y) Acceleration vs. Time	C-4
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Figure No. 13. Left A-Pillar Sill (Y) Displacement vs. Time	C-4
Figure No. 14. Left Lower A-Pillar (Y) Acceleration vs. Time	C-5
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Figure No. 17. Left Mid A-Pillar (Y) Acceleration vs. Time	C-6
Figure No. 18. Left Mid A-Pillar (Y) Velocity vs. Time	C-6
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Figure No. 20. Left B-Pillar Sill (Y) Acceleration vs. Time	C-7
Figure No. 21. Left B-Pillar Sill (Y) Velocity vs. Time	C-7
Figure No. 22. Left B-Pillar Sill (Y) Displacement vs. Time	C-7
Figure No. 23. Left Lower B-Pillar (Y) Acceleration vs. Time	C-8
Figure No. 24. Left Lower B-Pillar (Y) Velocity vs. Time	C-8
Figure No. 25. Left Lower B-Pillar (Y) Displacement vs. Time	C-8
Figure No. 26. Left Mid B-Pillar (Y) Acceleration vs. Time	C-9
Figure No. 27. Left Mid B-Pillar (Y) Velocity vs. Time	C-9
Figure No. 28. Left Mid B-Pillar (Y) Displacement vs. Time	C-9
Figure No. 29. Driver Seat Track (Y) Acceleration vs. Time	C-10

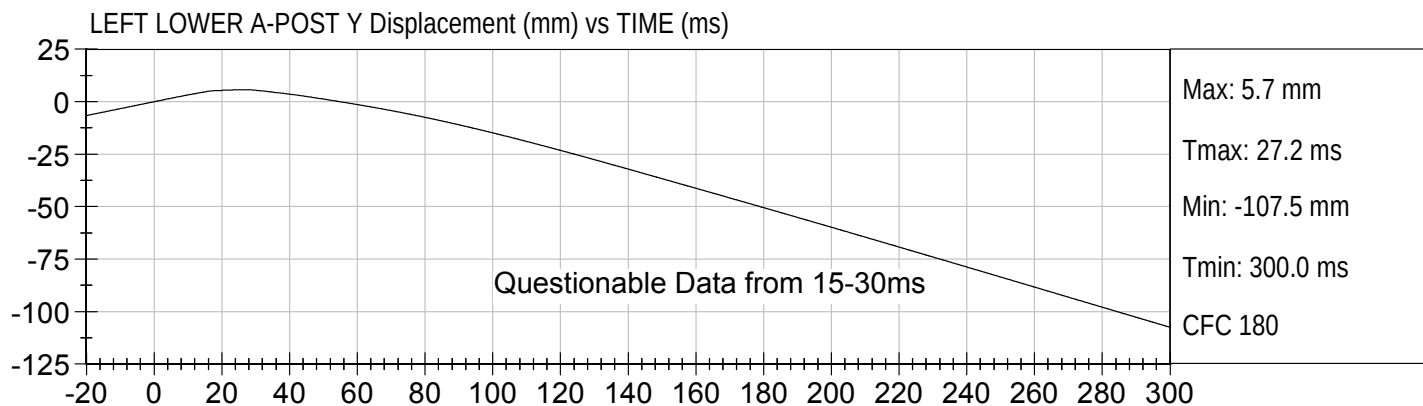
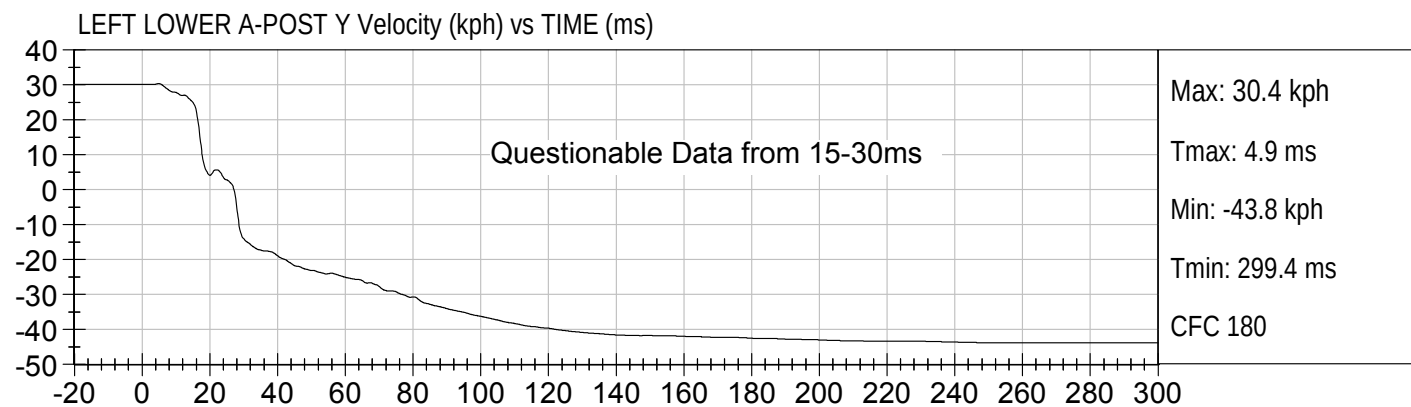
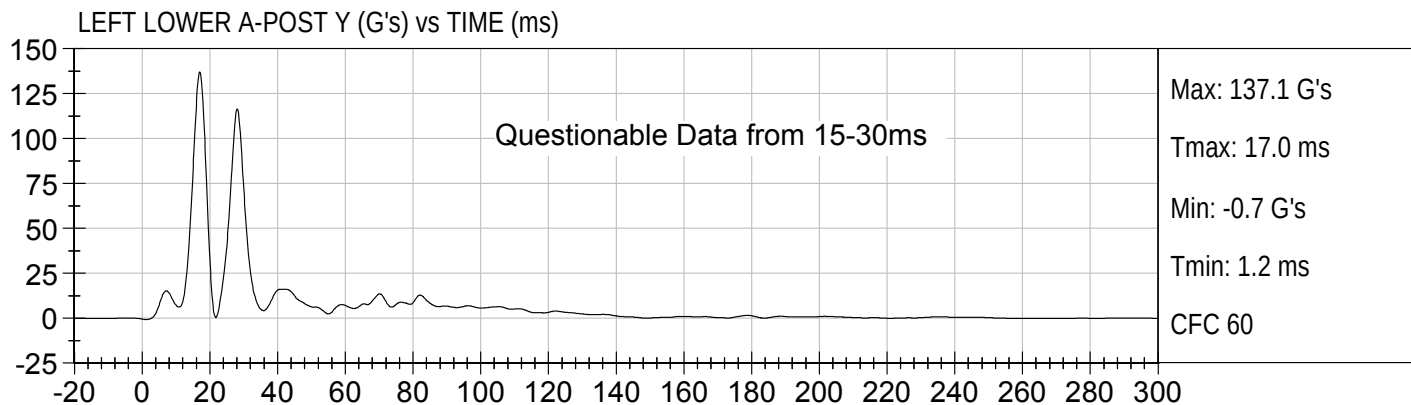
	<u>Page No.</u>
Figure No. 30. Driver Seat Track (Y) Velocity vs. Time	C-10
Figure No. 31. Driver Seat Track (Y) Displacement vs. Time	C-10
Figure No. 32. Engine Top (X) Acceleration vs. Time	C-11
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Figure No. 36. Firewall (Y) Acceleration vs. Time	C-12
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Figure No. 40. Right Sill (Y) Acceleration vs. Time	C-13
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Figure No. 43. Floorpan @ Rear Axle (X) Velocity vs. Time	C-14
Figure No. 44. Floorpan @ Rear Axle (Y) Acceleration vs. Time	C-14
Figure No. 45. Floorpan @ Rear Axle (Y) Velocity vs. Time	C-14





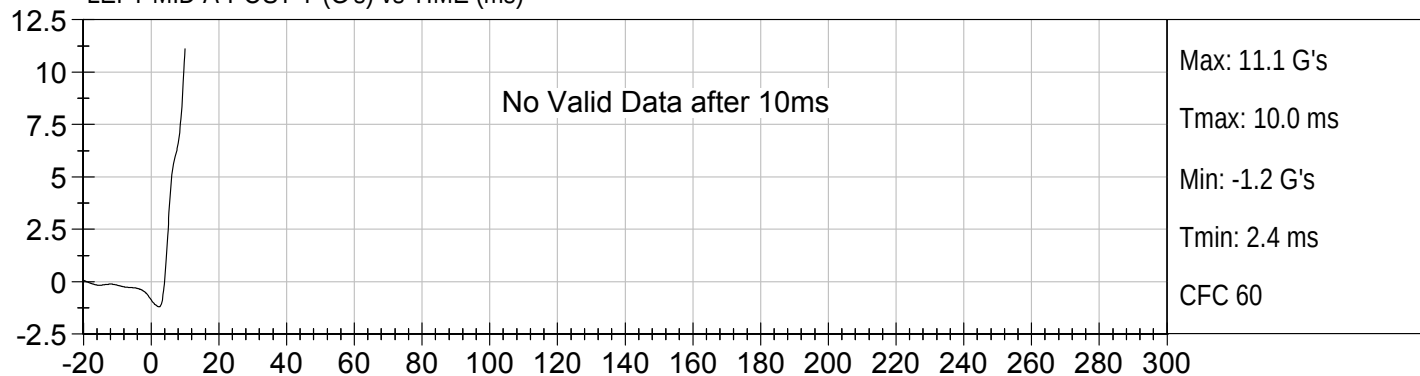




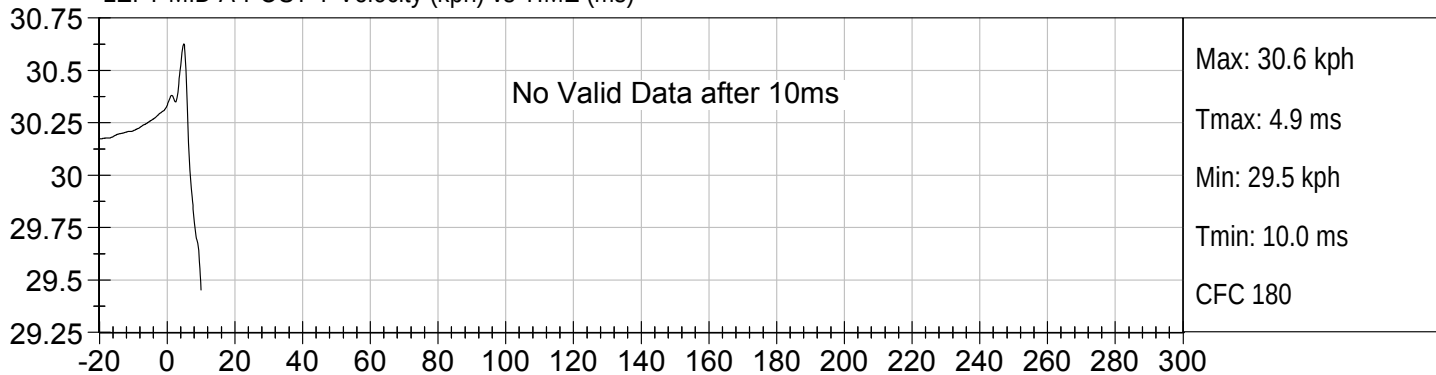




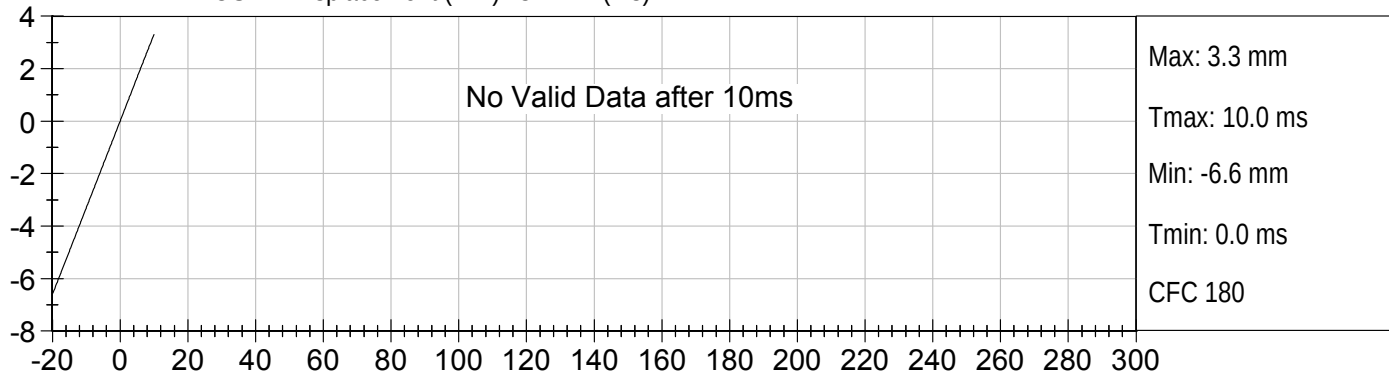
LEFT MID A-POST Y (G's) vs TIME (ms)

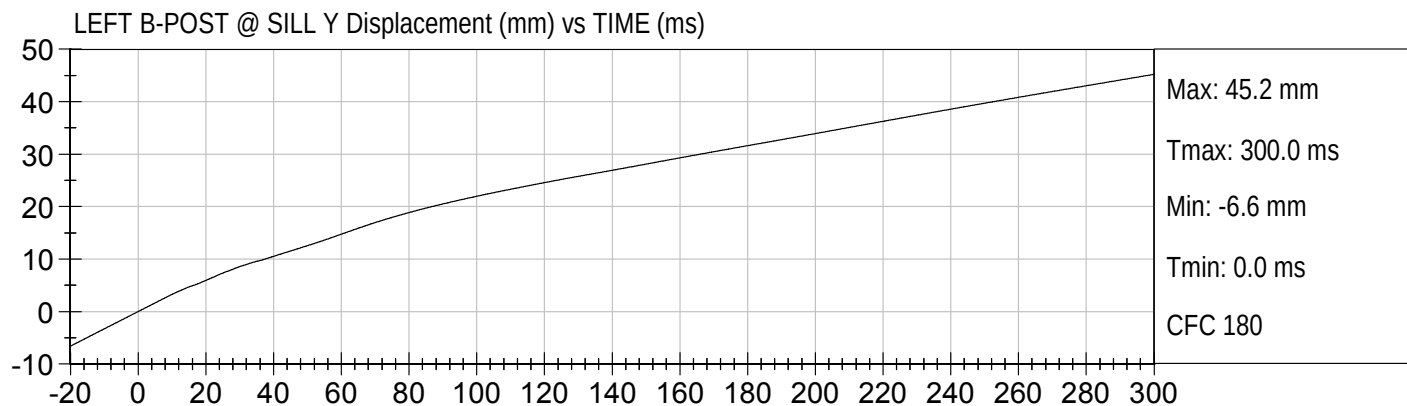
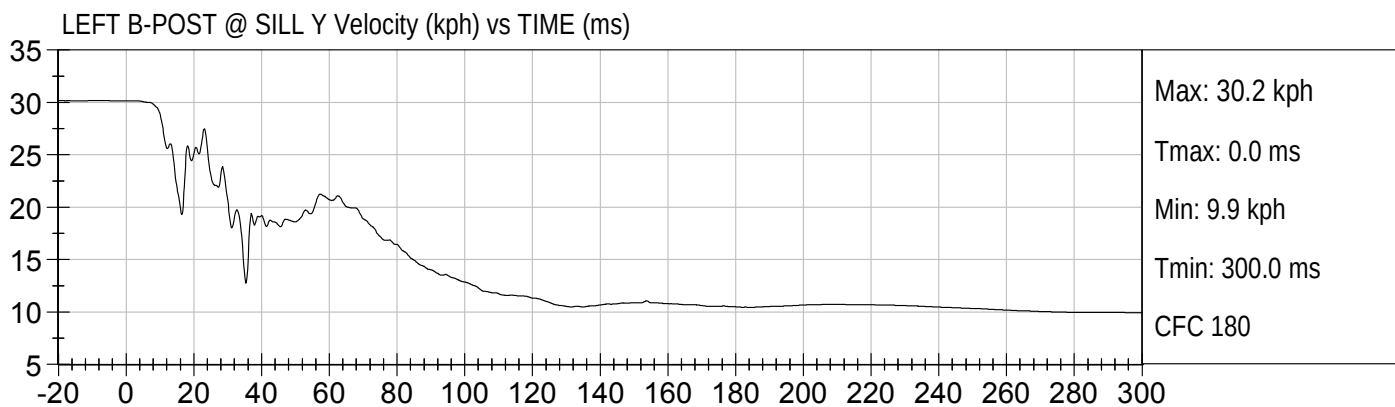
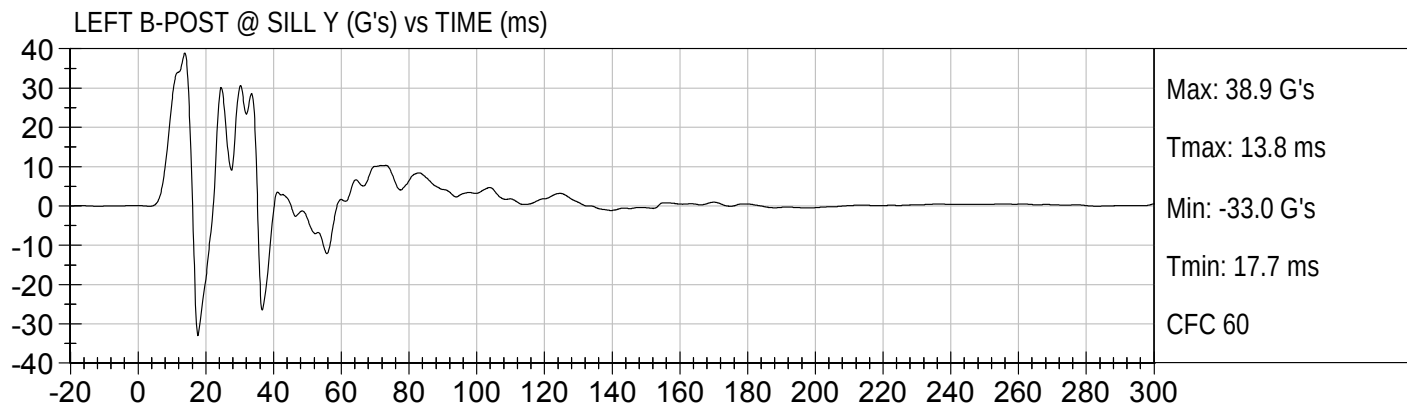


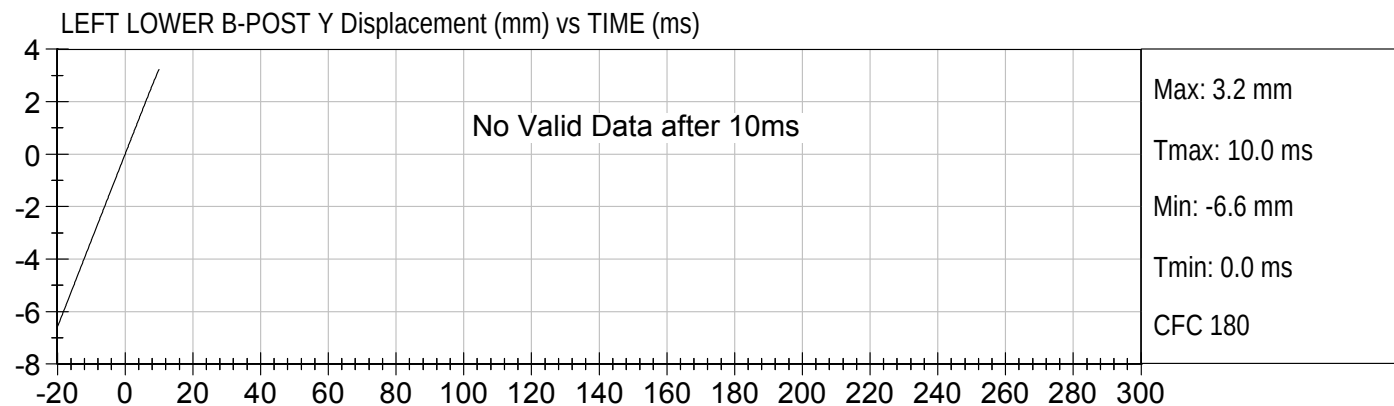
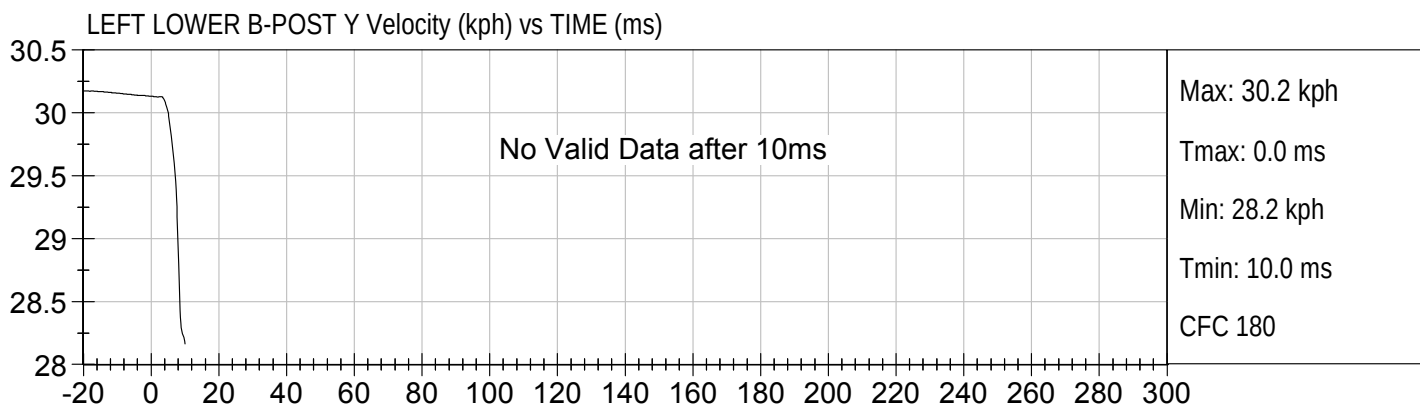
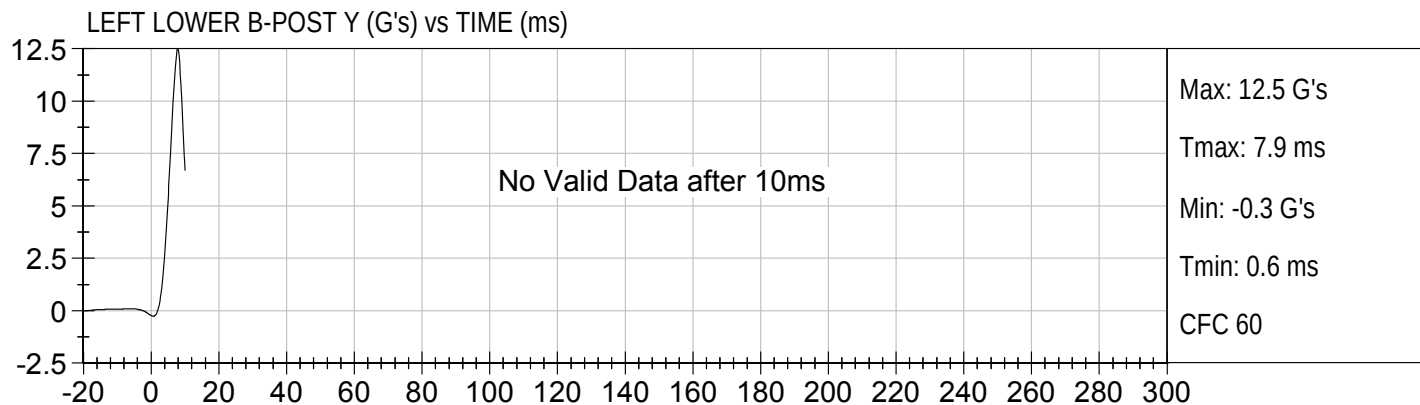
LEFT MID A-POST Y Velocity (kph) vs TIME (ms)

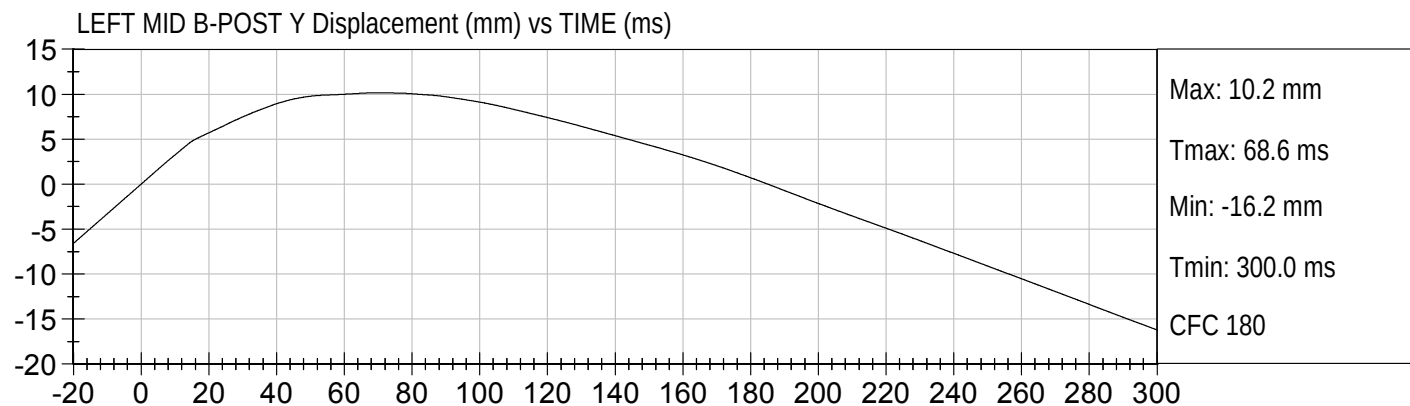
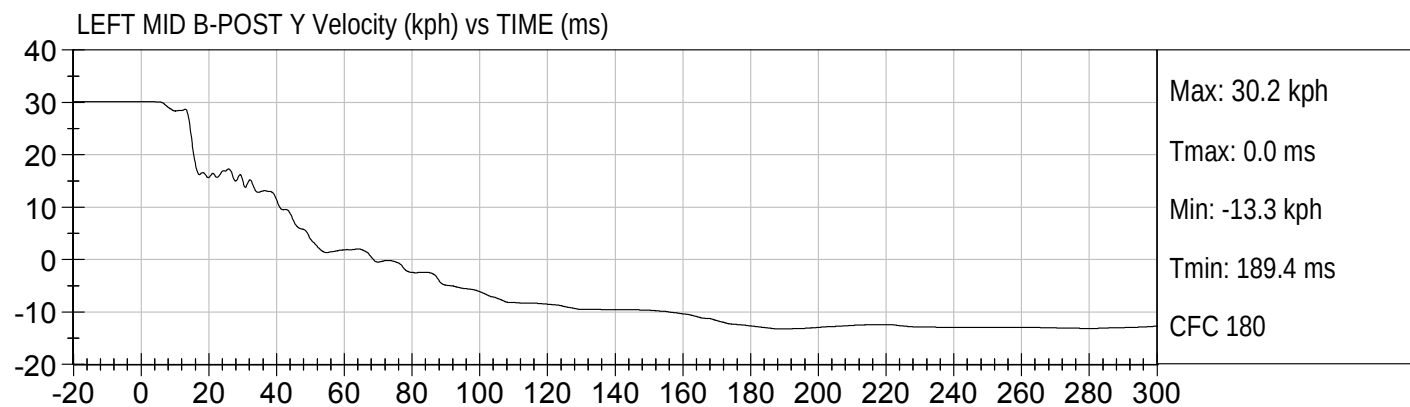
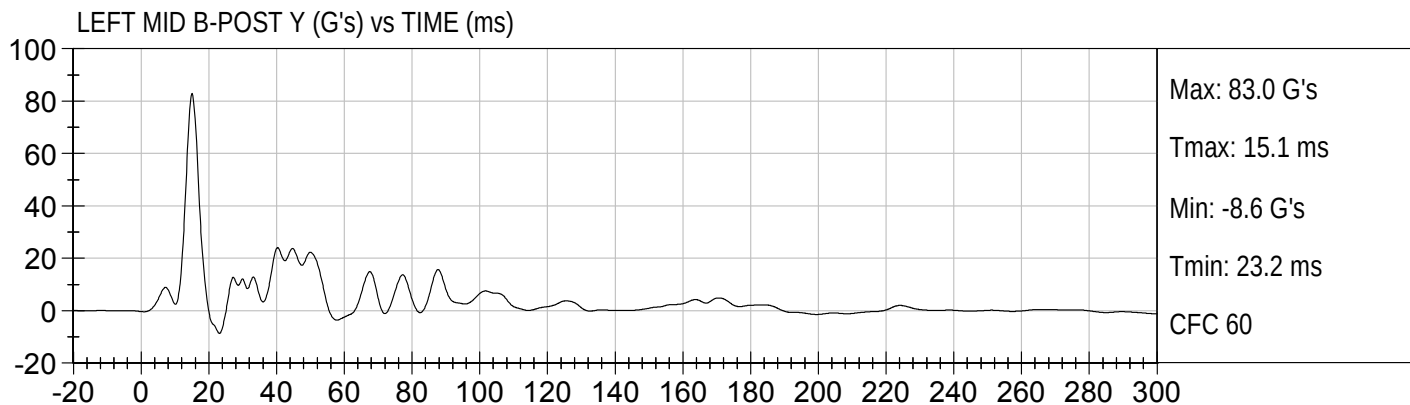


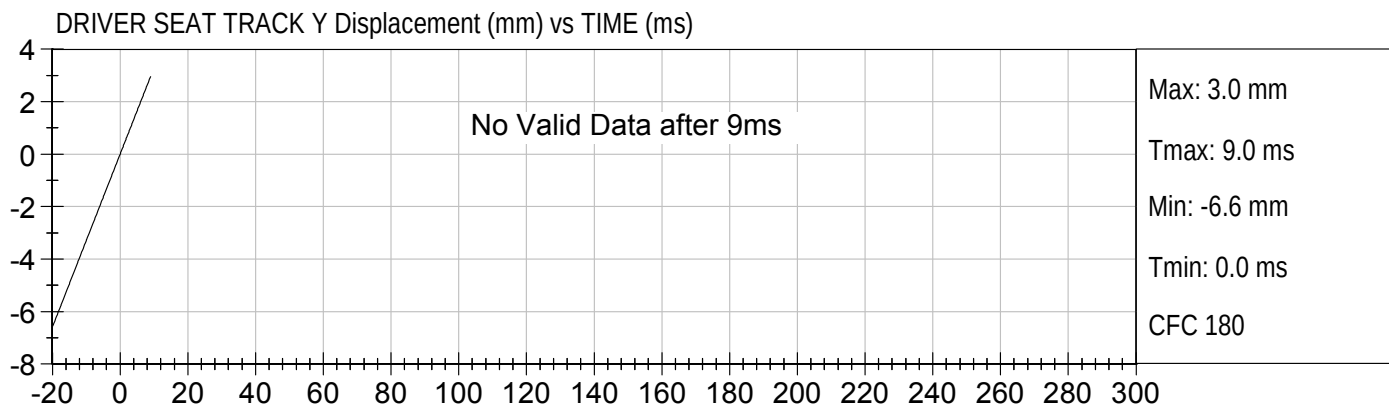
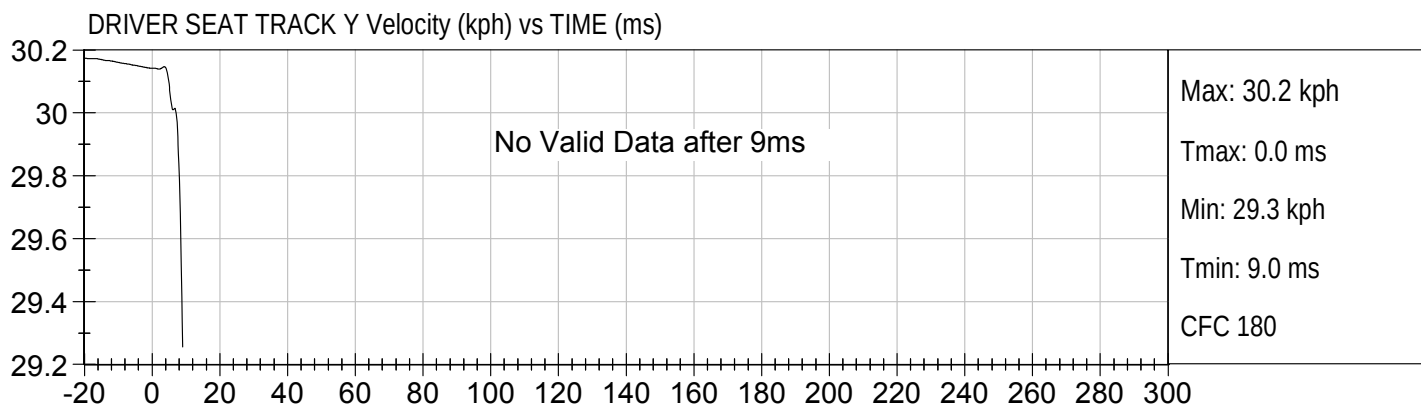
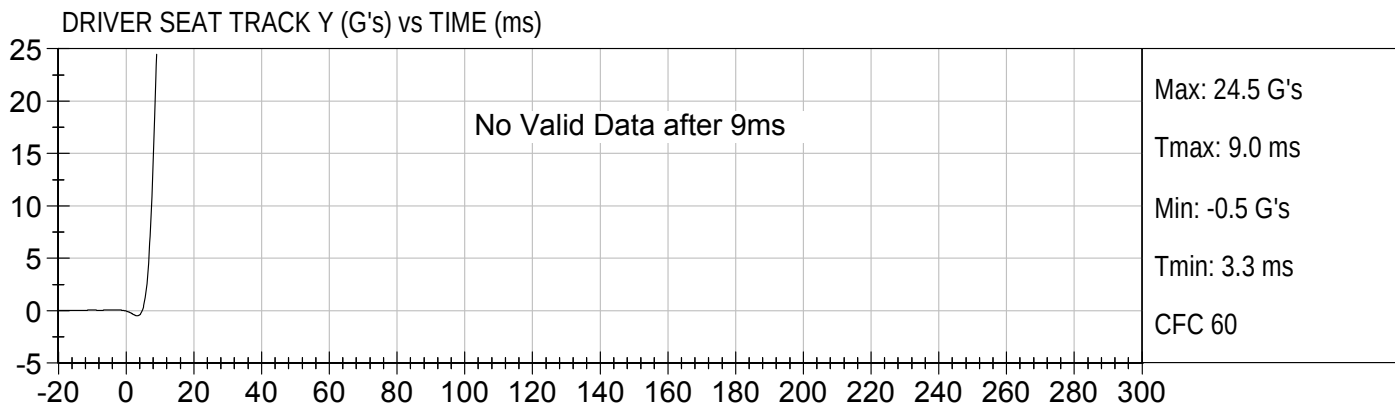
LEFT MID A-POST Y Displacement (mm) vs TIME (ms)

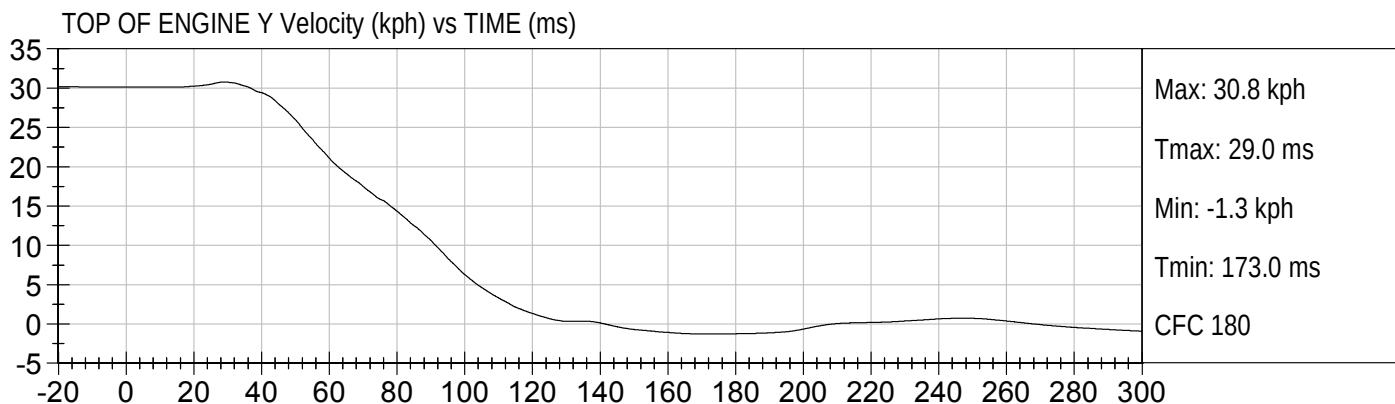
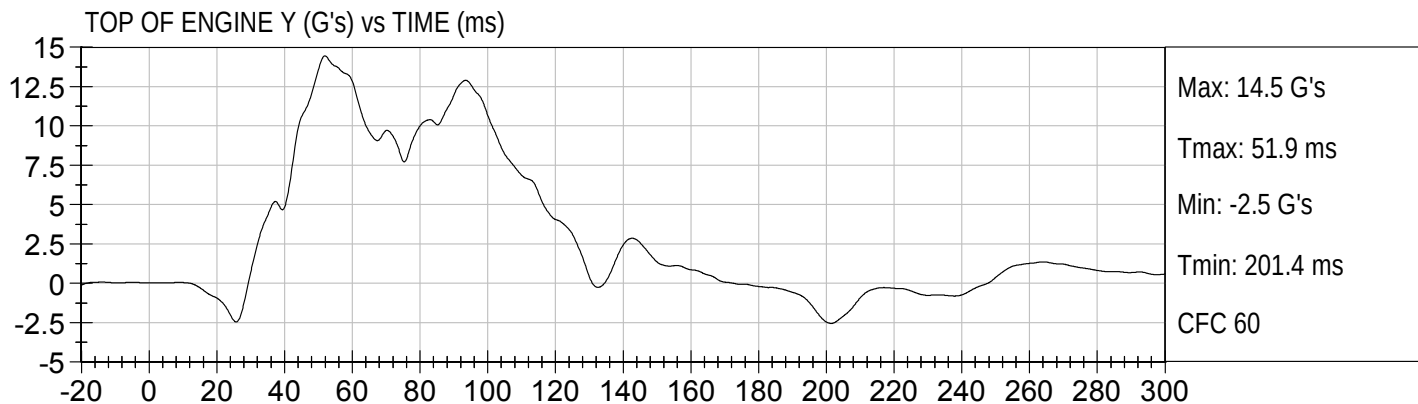
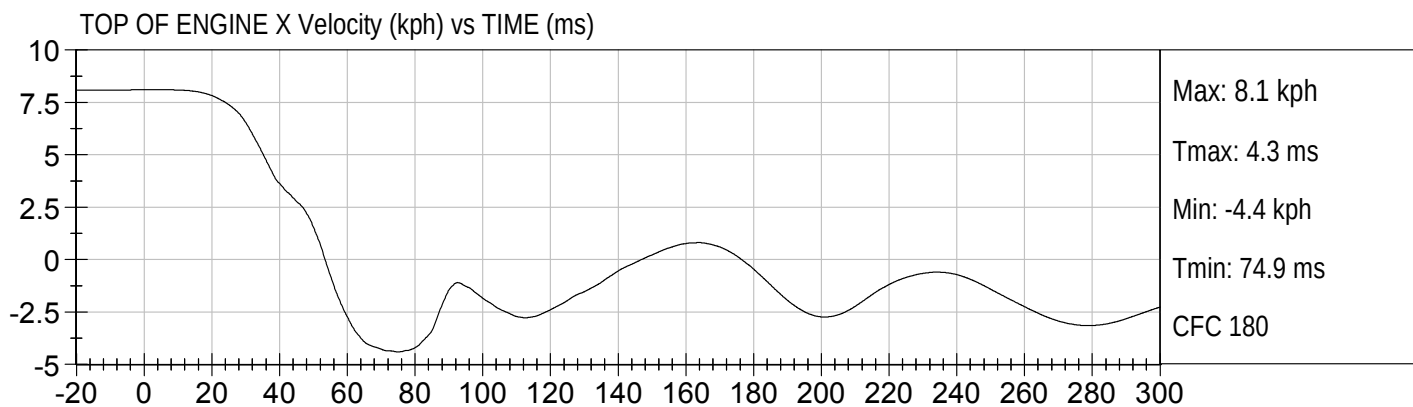
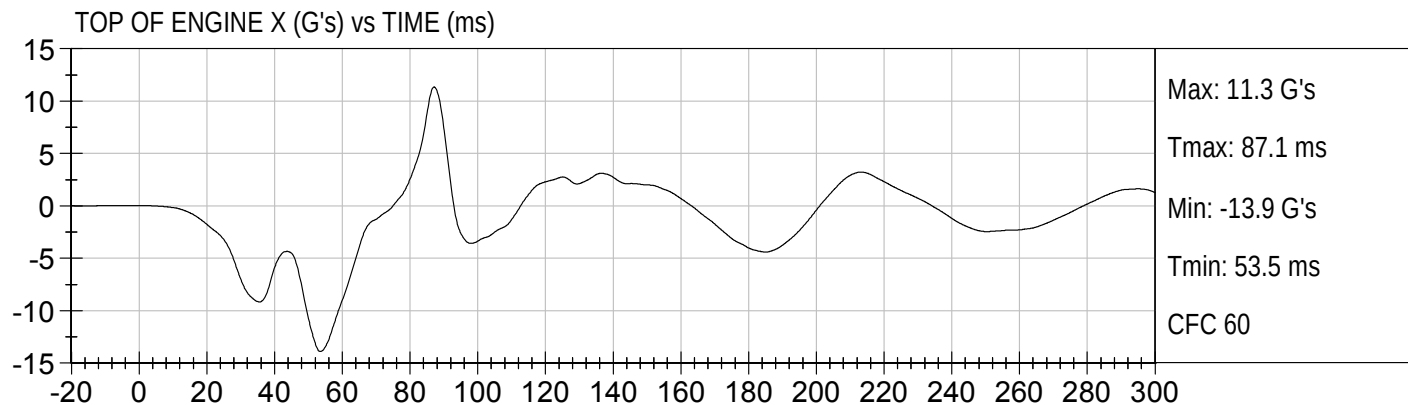


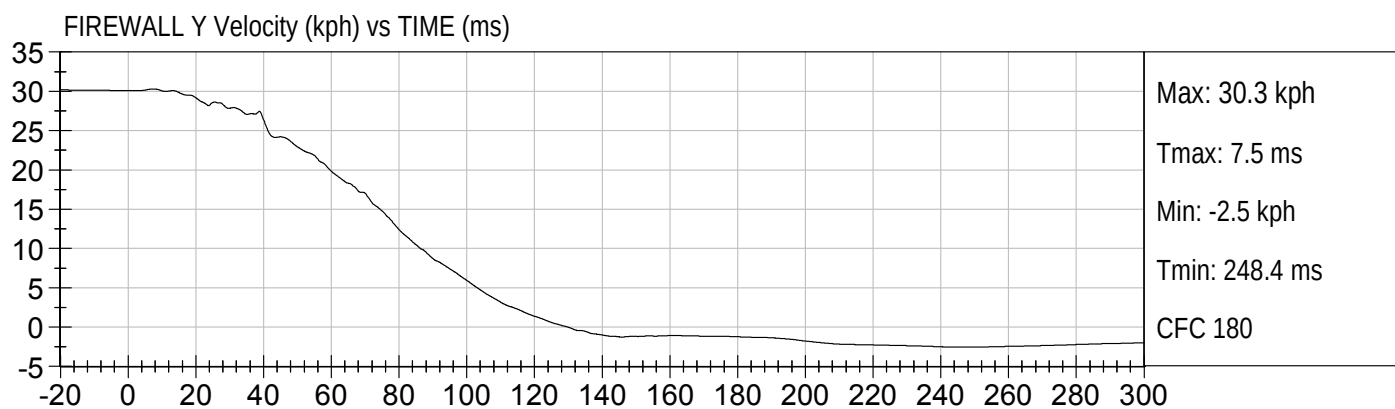


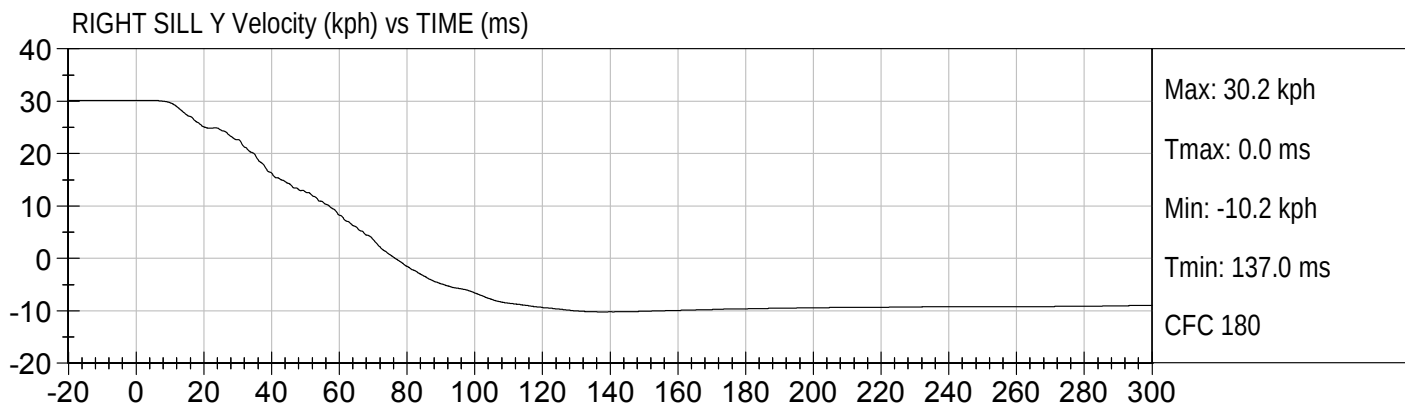
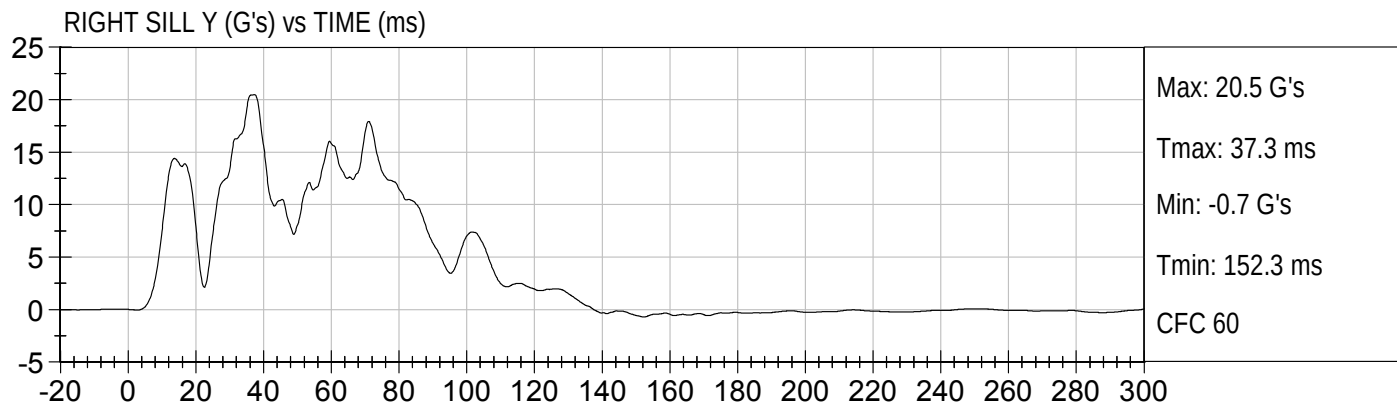
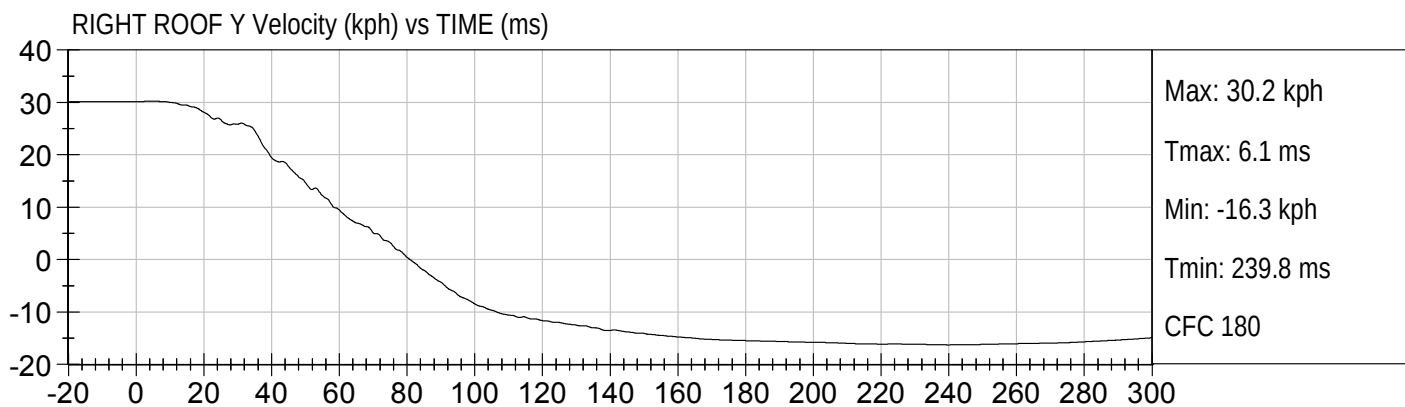
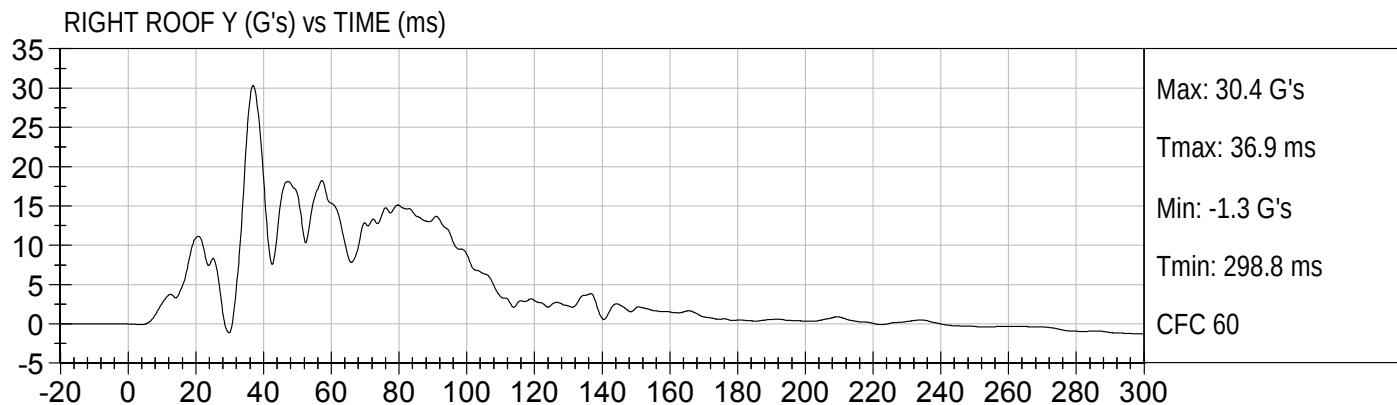


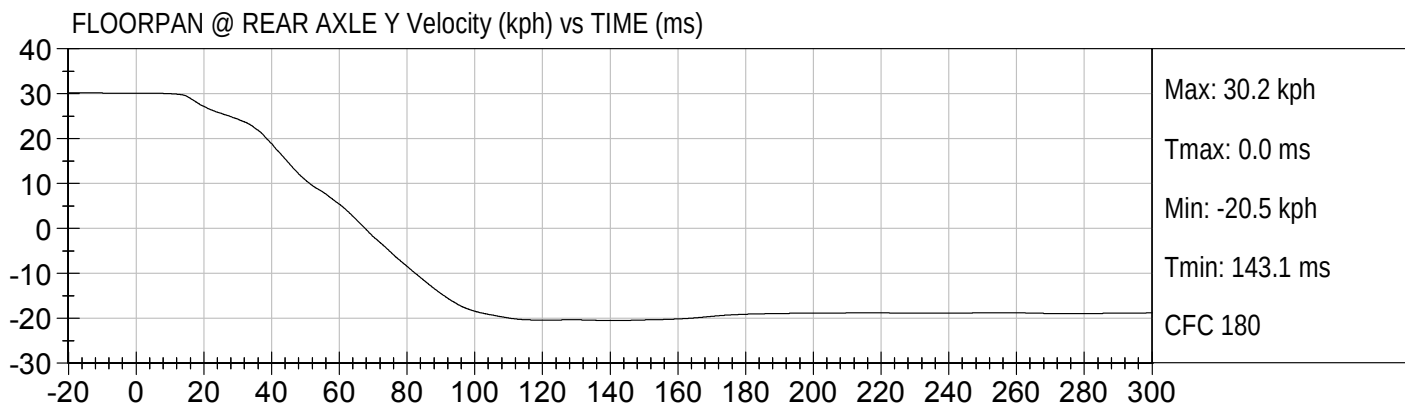
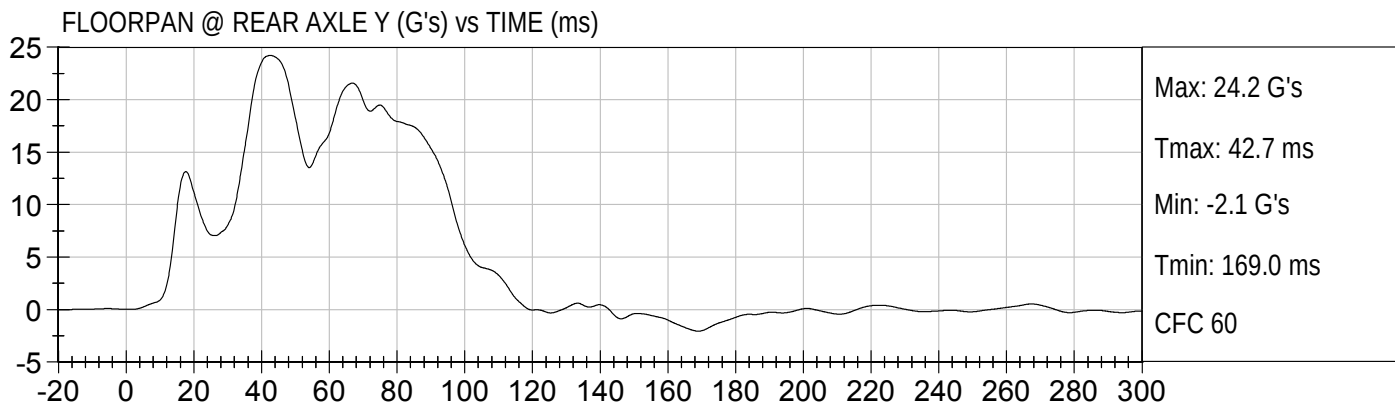
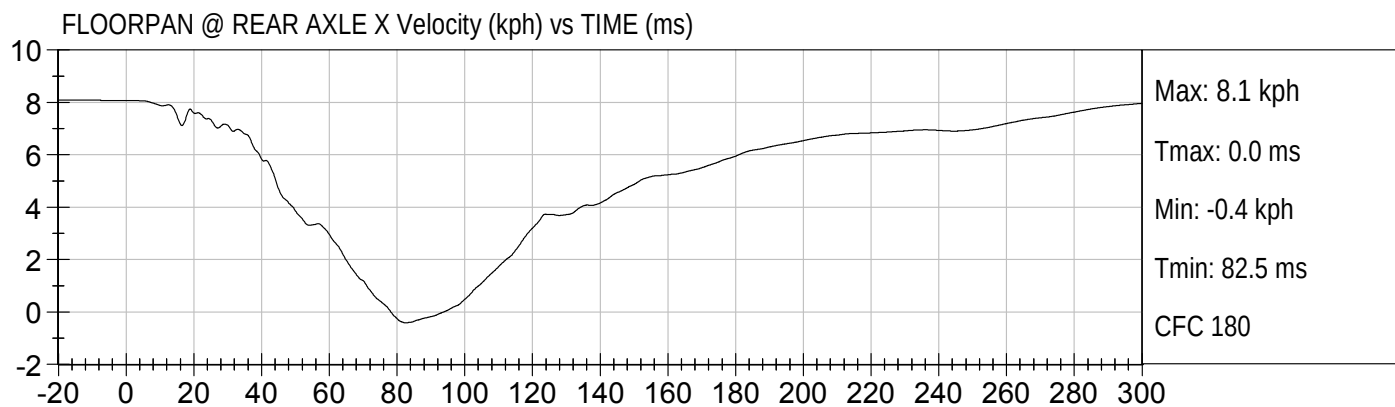
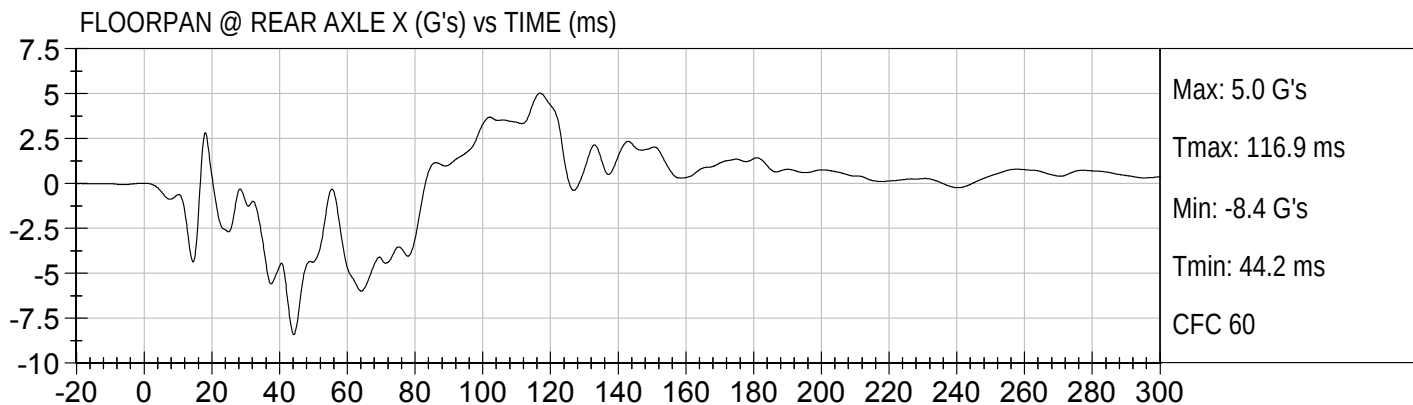












APPENDIX D

DUMMY PERFORMANCE CALIBRATION TEST DATA

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

ATD Serial No: 262

Test ID: D122901

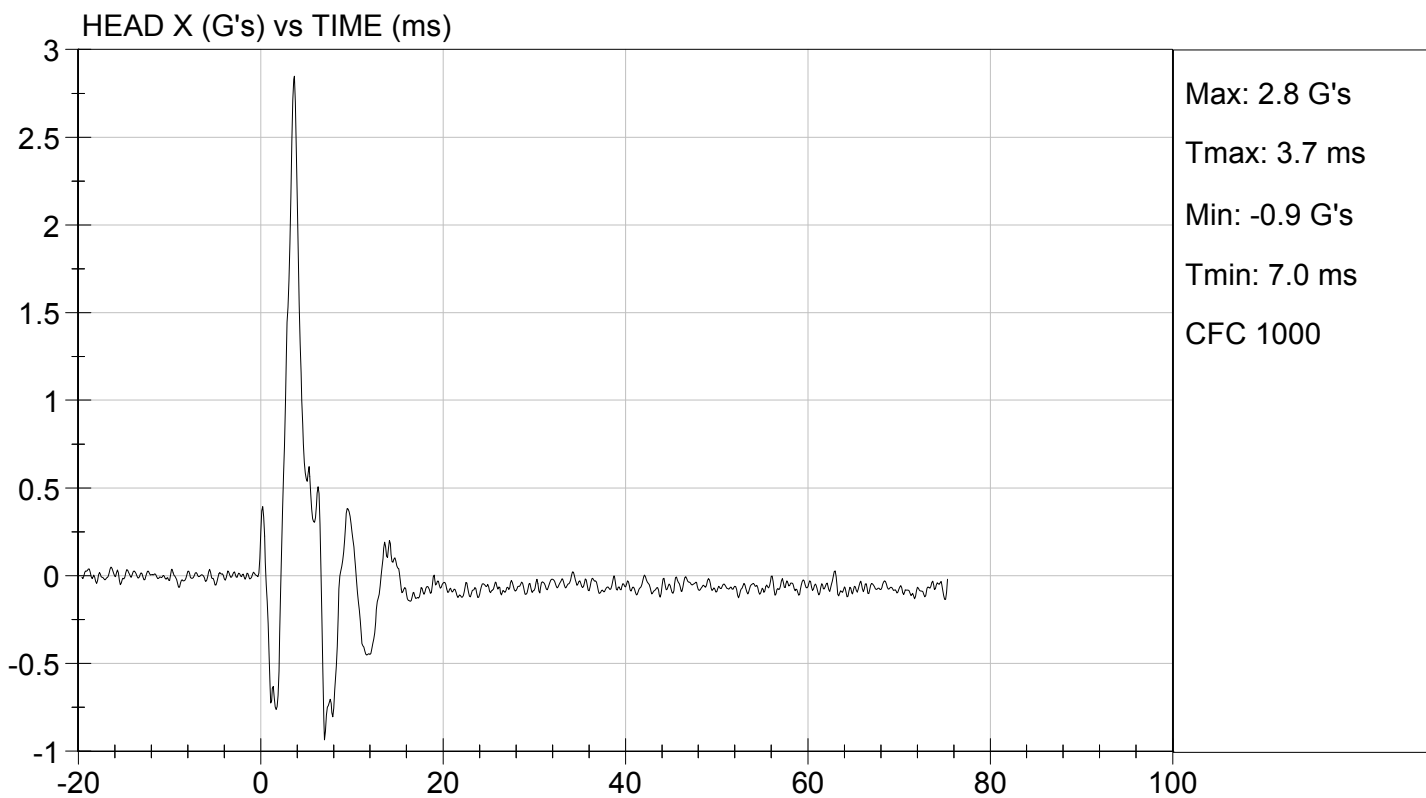
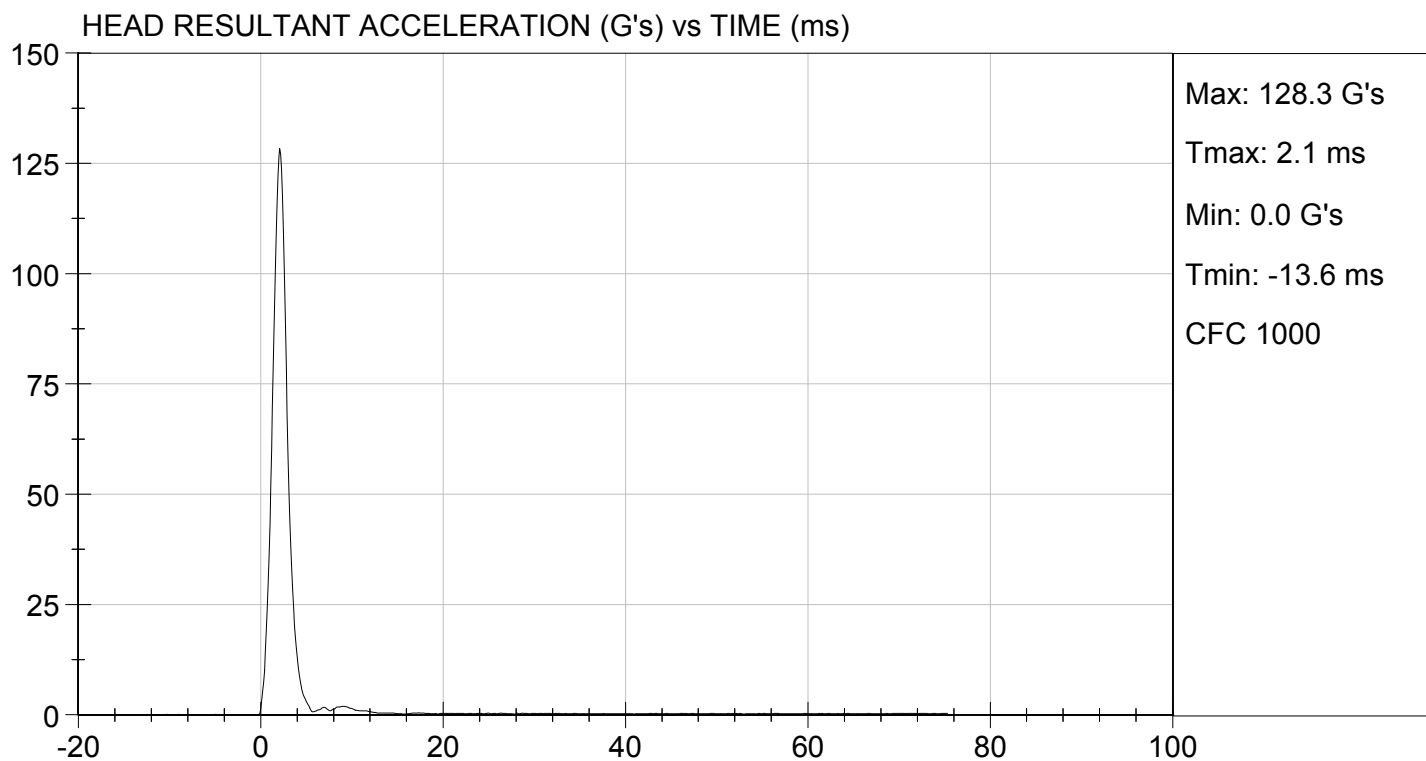
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Peak Resultant Acceleration	G's	115 to 137	128	Pass
Peak Longitudinal Acceleration	G's	+/- 15	2.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
			Overall Test Results	Pass

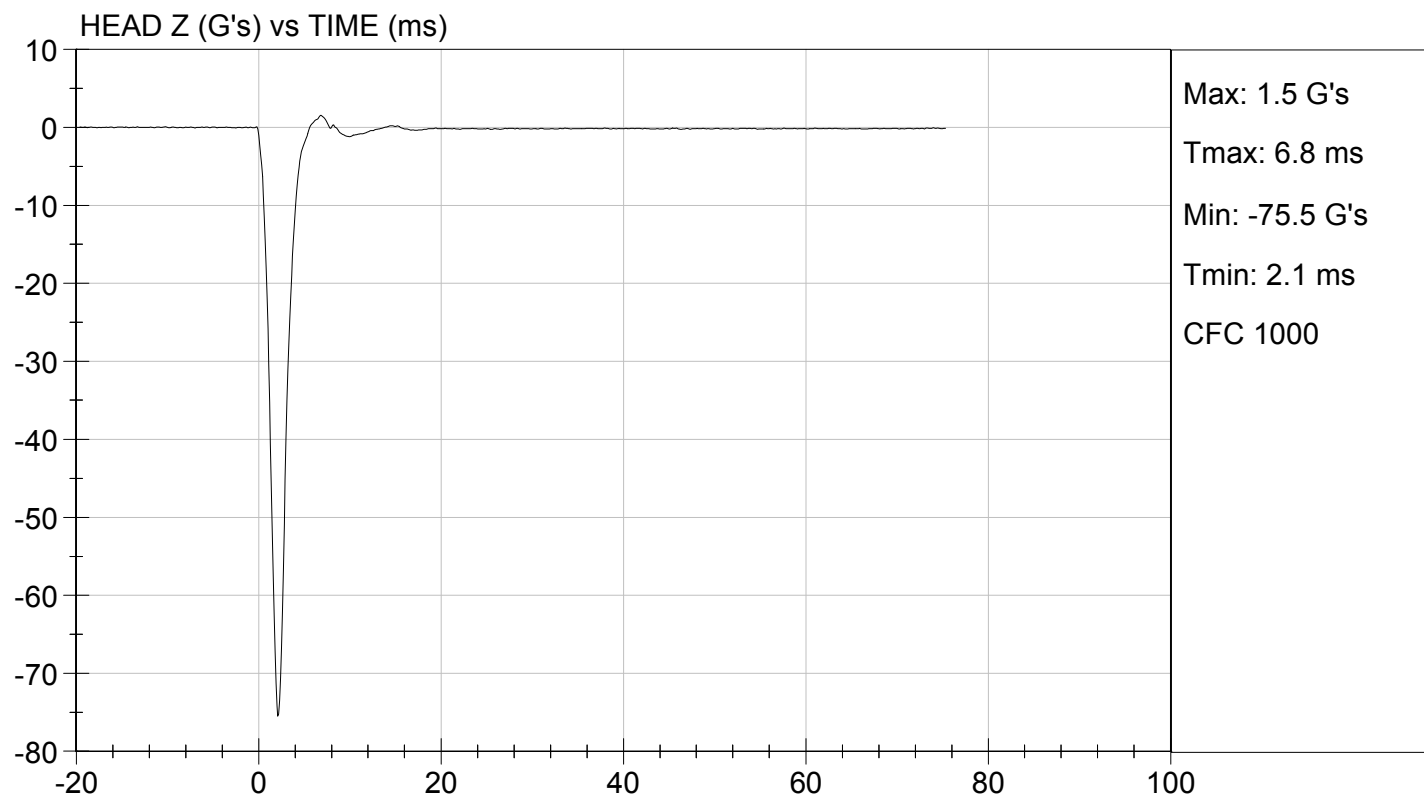
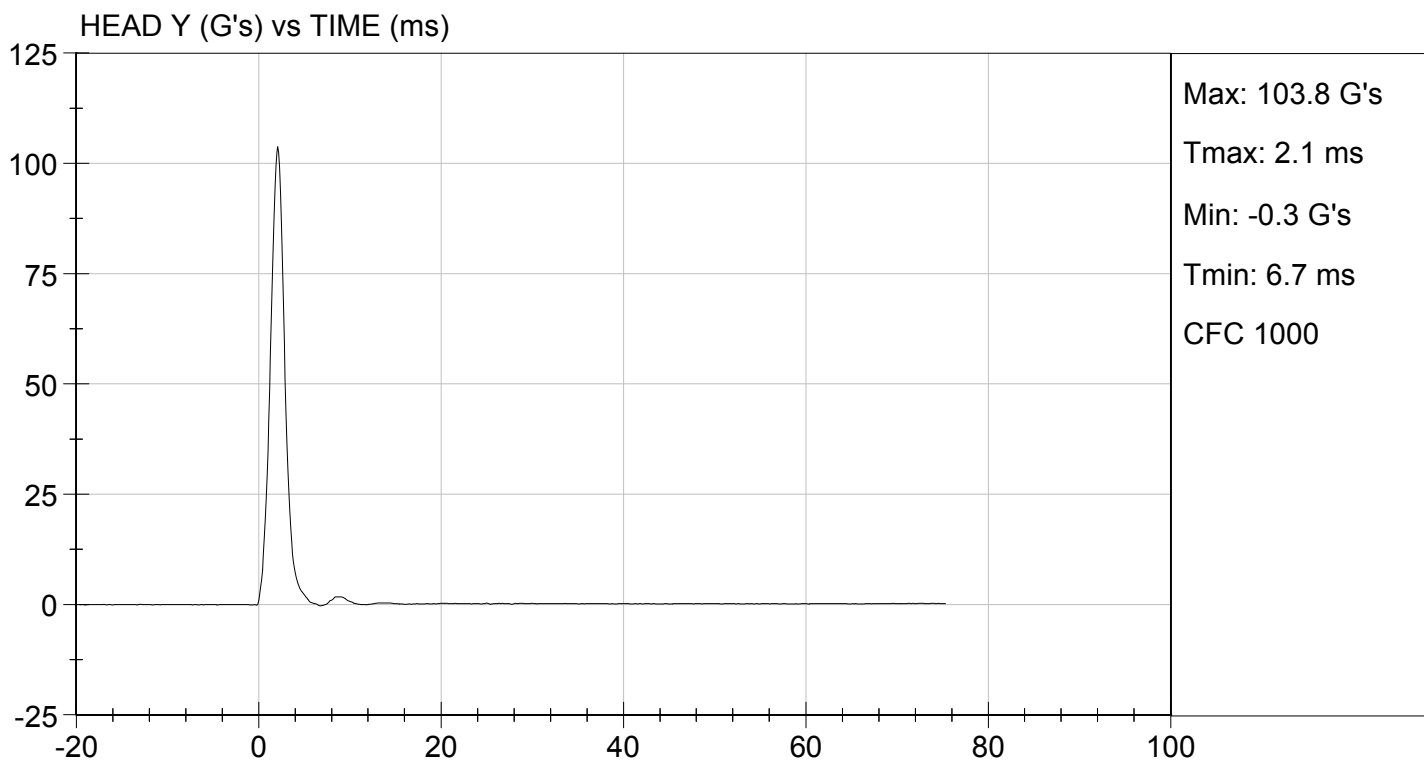

Laboratory Technician

08/06/2012

Test Date


Approved By





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

ATD Serial No: 262

Test I.D: D122902

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.5	Pass
Humidity		%	10 to 70	47	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.77	Pass
	15 ms	m/s	3.30 to 4.10	4.03	Pass
	20 ms	m/s	4.40 to 5.40	5.20	Pass
	25 ms	m/s	5.40 to 6.10	5.43	Pass
	25-100 ms	m/s	5.50 to 6.20	5.53	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	59	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-38	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	113	Pass
Overall Test Results					Pass


 Laboratory Technician

08/06/2012

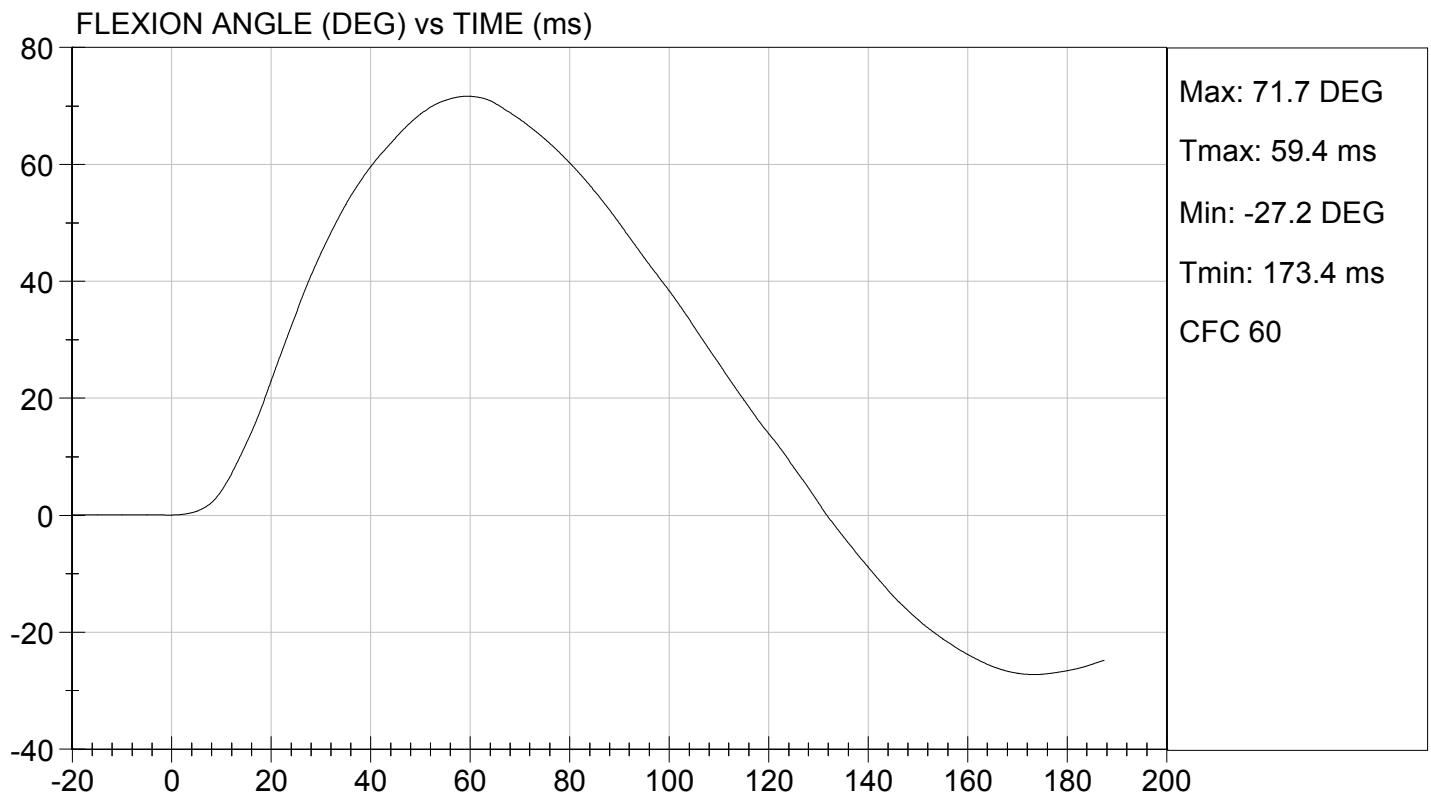
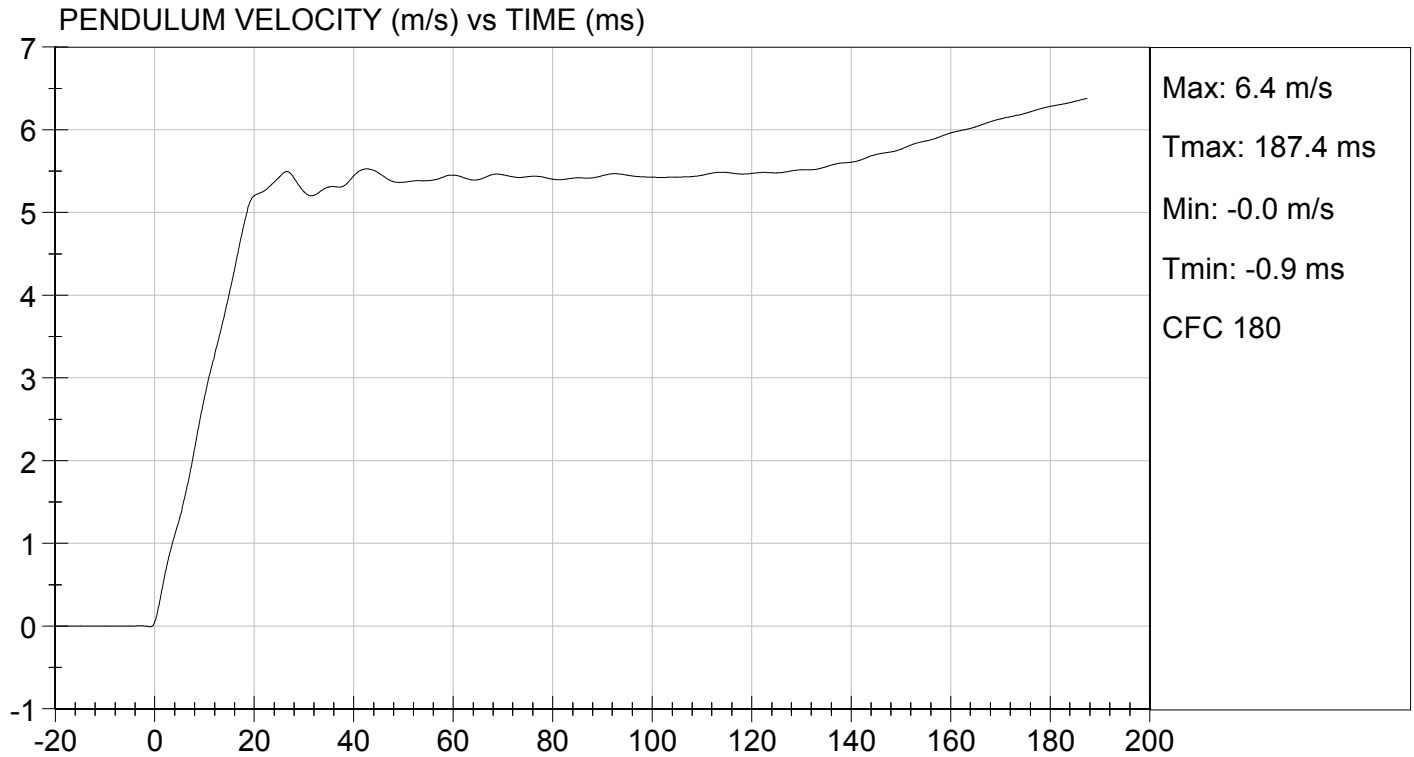
Test Date


 Approved By



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

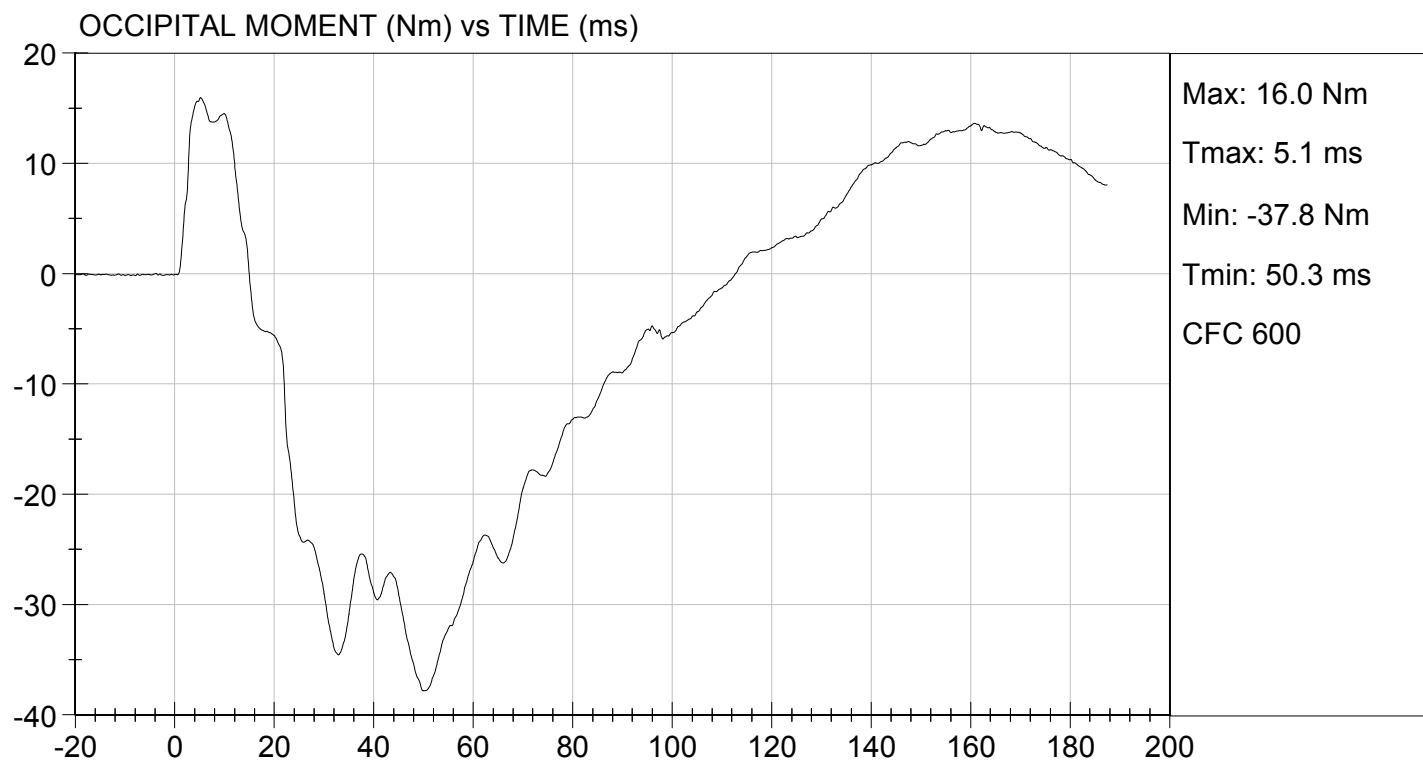
TEST DATE: 08/06/2012
TEST #: D122902





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

TEST DATE: 08/06/2012
TEST #: D122902

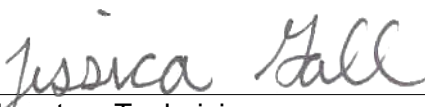


MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 262

Test ID: D122903

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	13 to 18	16	Pass
Shoulder Displacement	mm	28 to 37	29	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	19	Pass
Overall Test Results			Pass	


Laboratory Technician

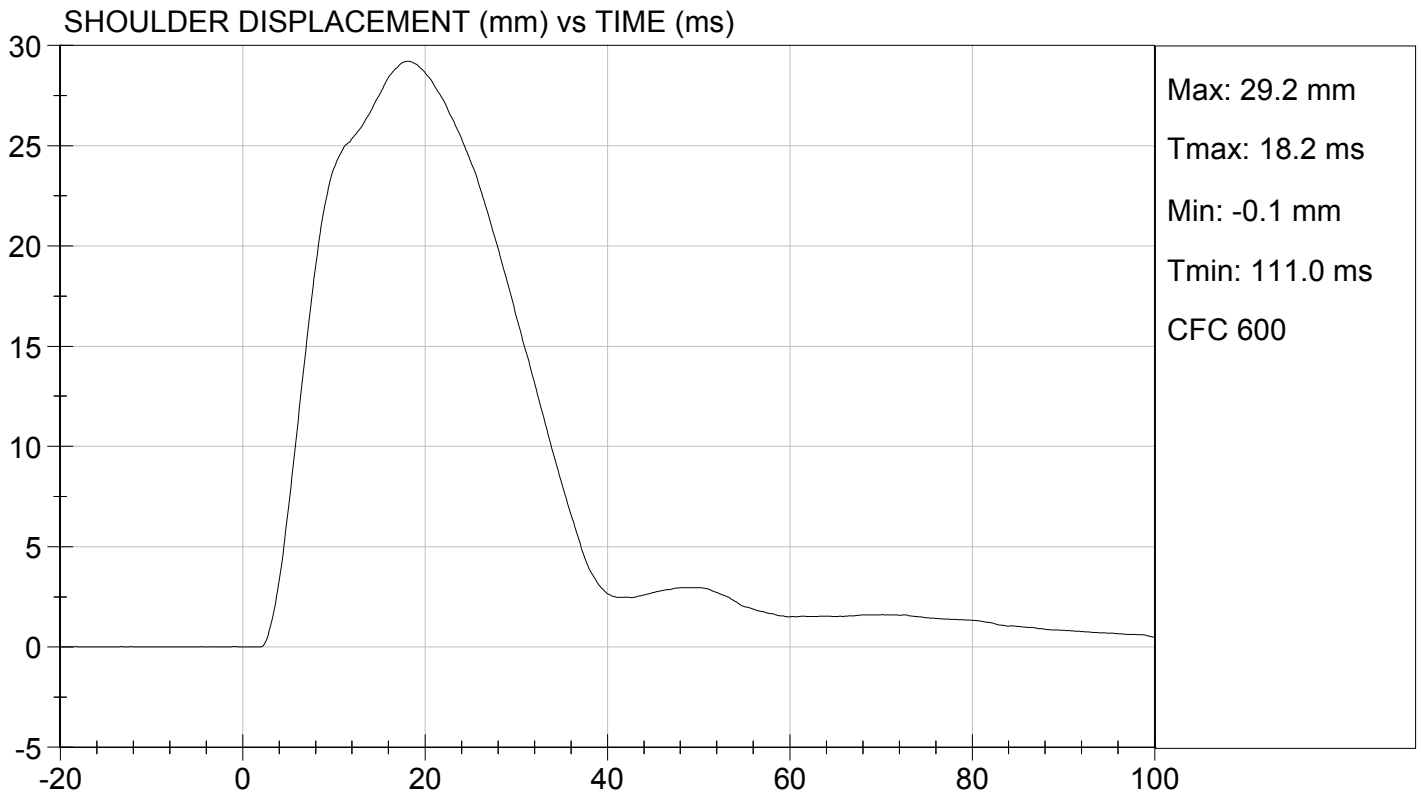
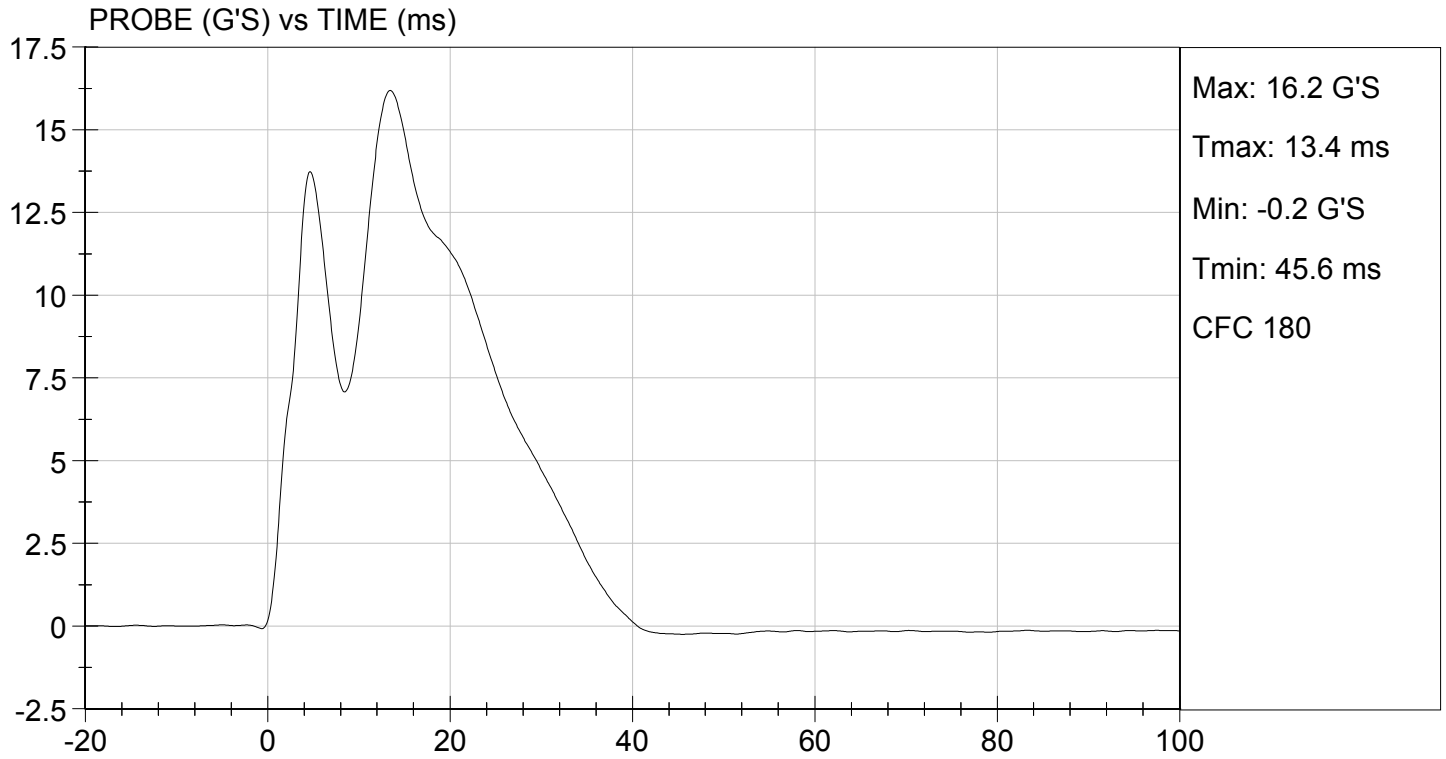
08/06/2012
Test Date


Approved By



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

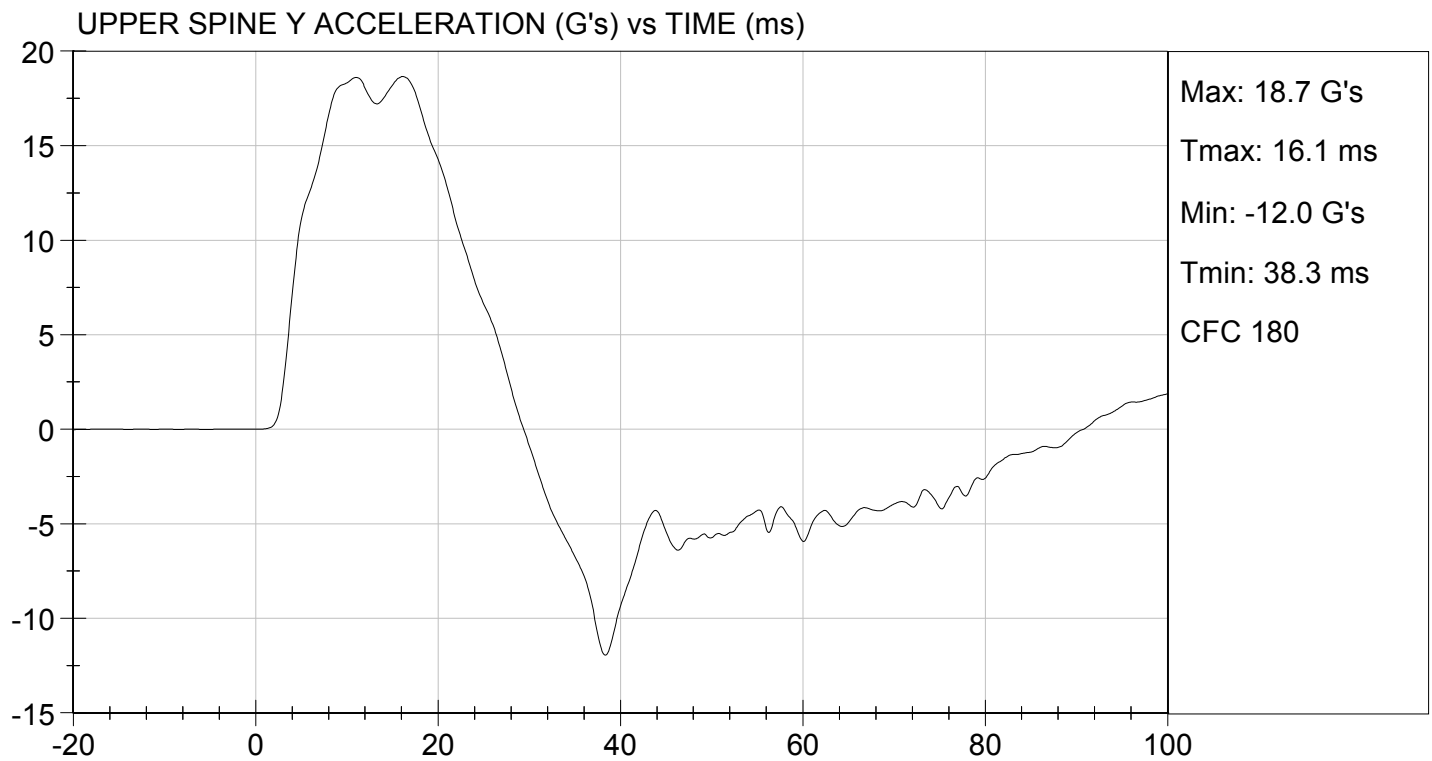
TEST DATE: 08/06/2012
TEST #: D122903





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

TEST DATE: 08/06/2012
TEST #: D122903

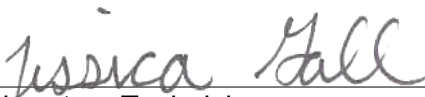


MGA RESEARCH CORPORATION
THORAX (WITH ARM) IMPACT TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 262

Test I.D: D122904

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.0	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	33	Pass
Shoulder Displacement	mm	31 to 40	36	Pass
Upper Rib Displacement	mm	25 to 32	29	Pass
Middle Rib Displacement	mm	30 to 36	33	Pass
Lower Rib Displacement	mm	32 to 38	35	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	37	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	31	Pass
Overall Test Results				Pass


 Laboratory Technician

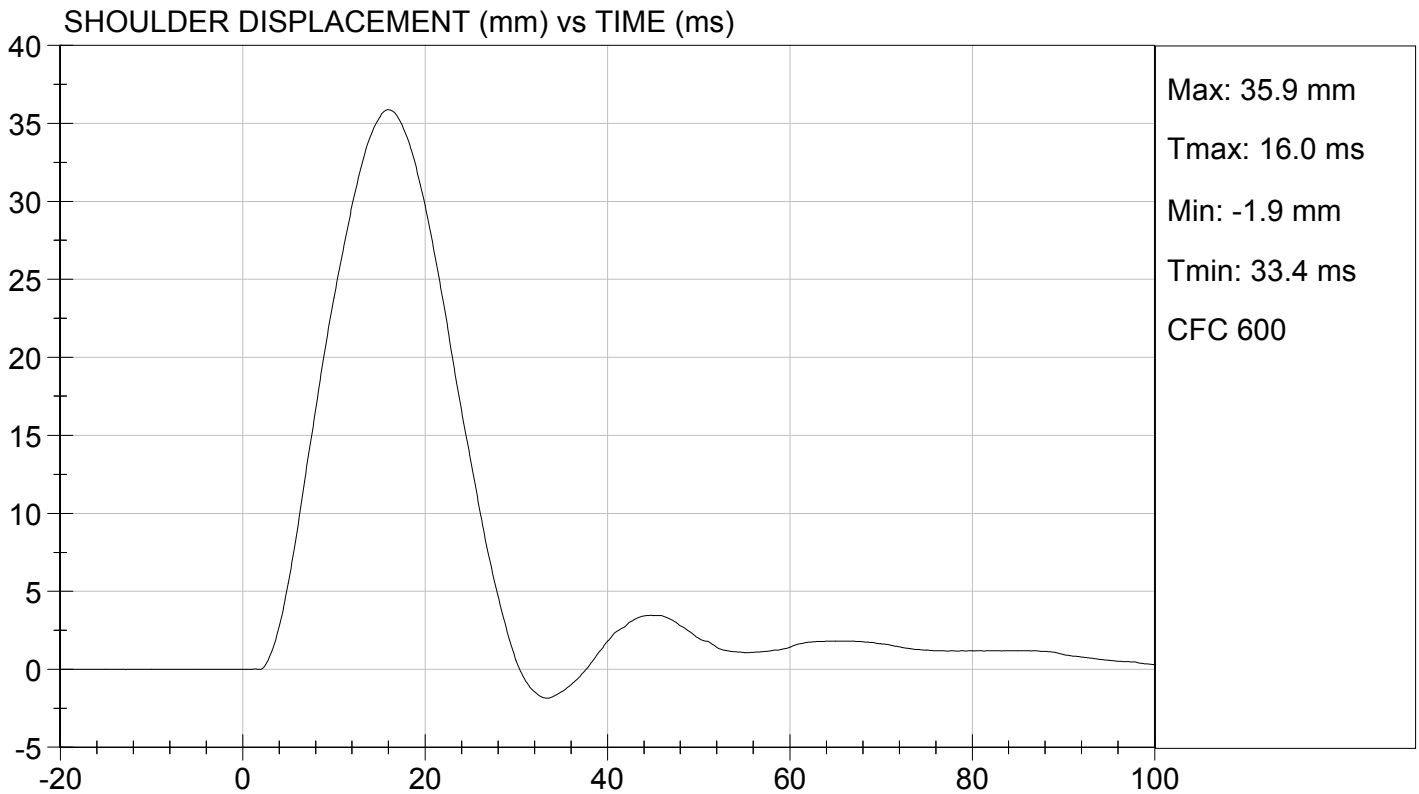
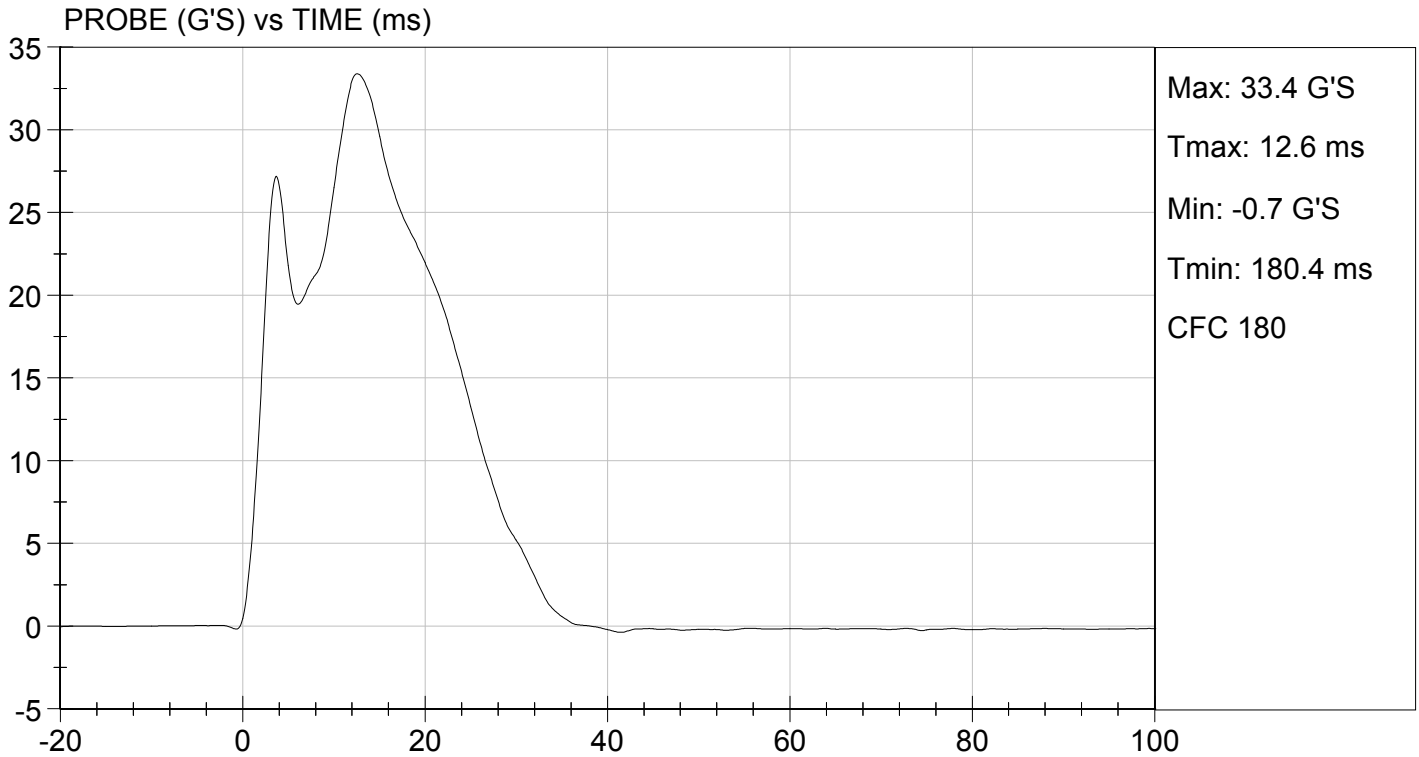
08/06/2012
 Test Date


 Approved By



TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

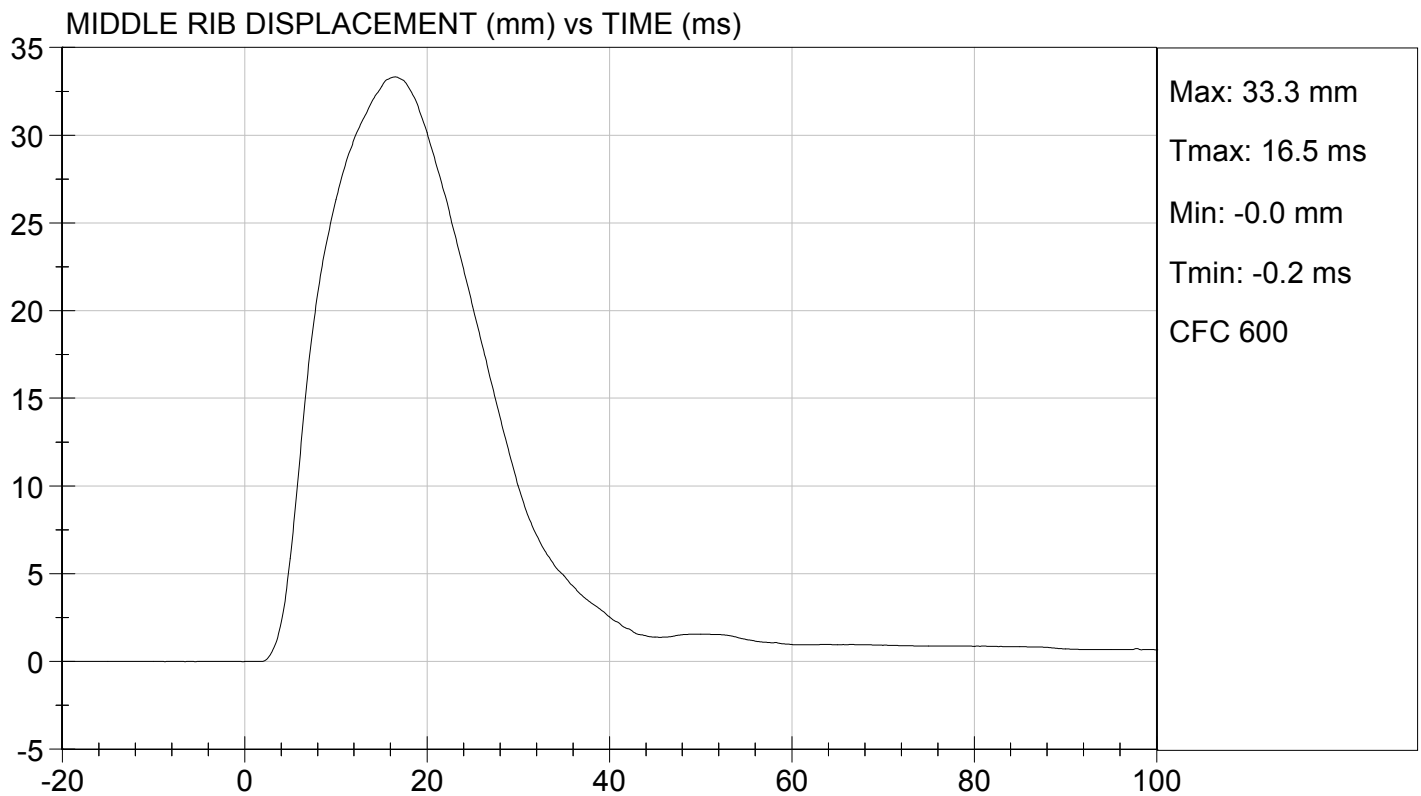
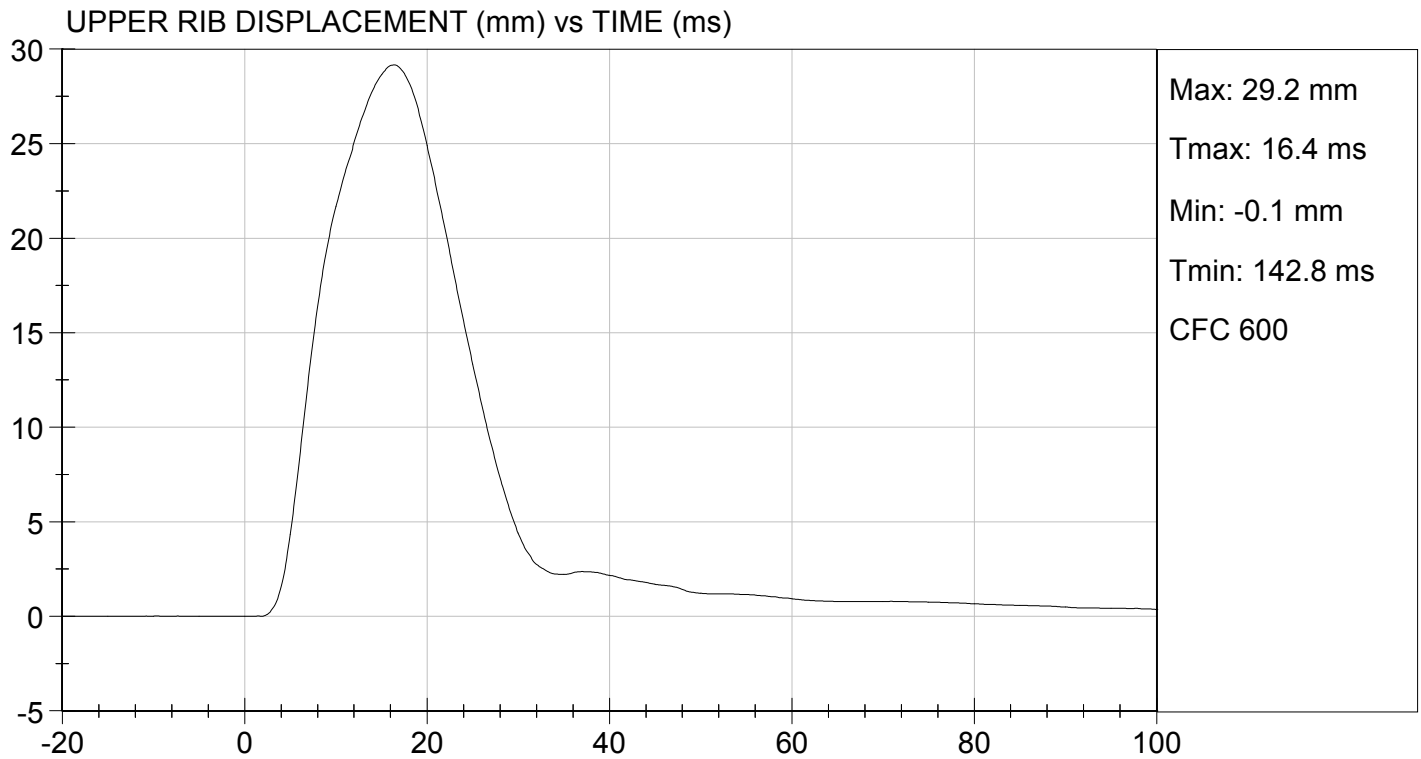
TEST DATE: 08/06/2012
TEST #: D122904





TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

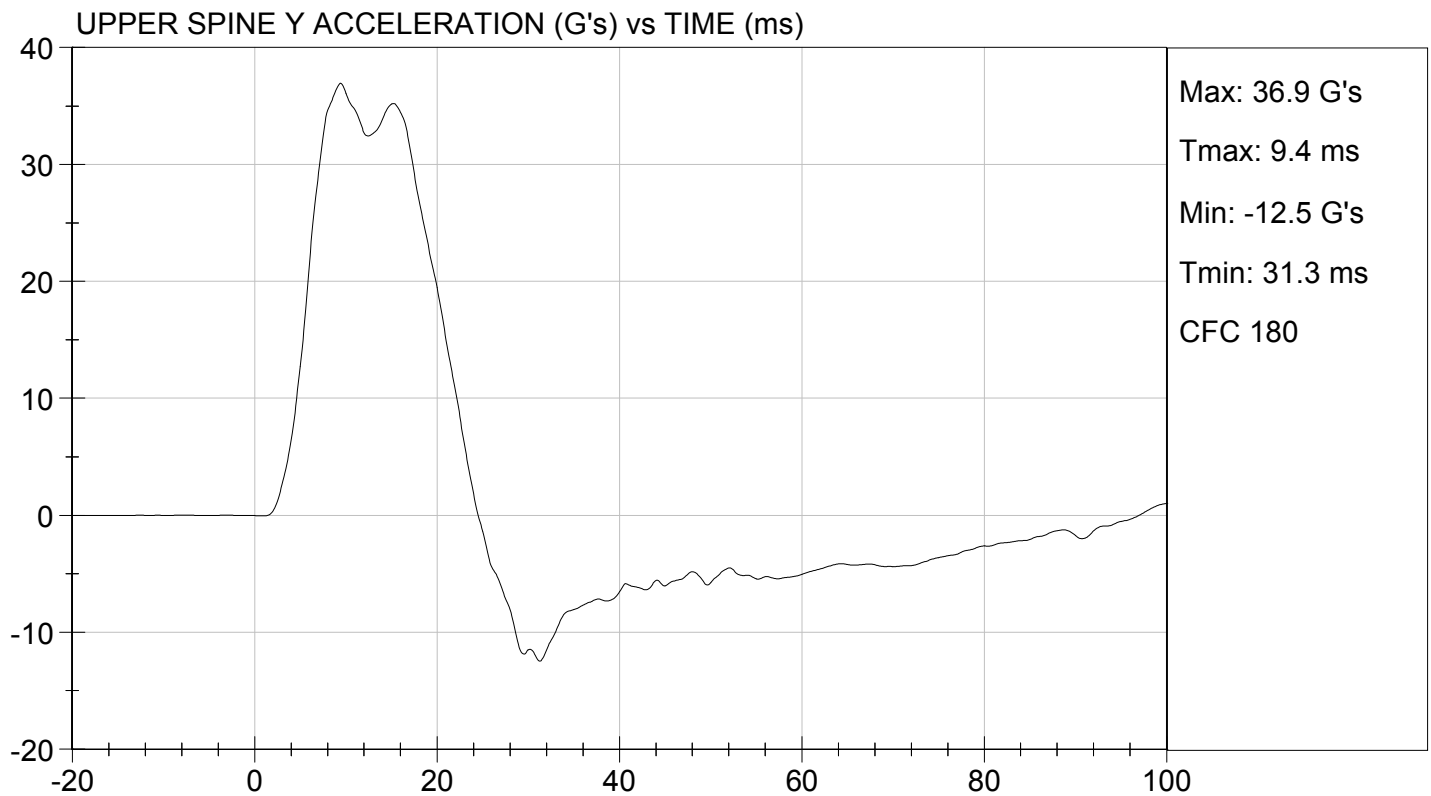
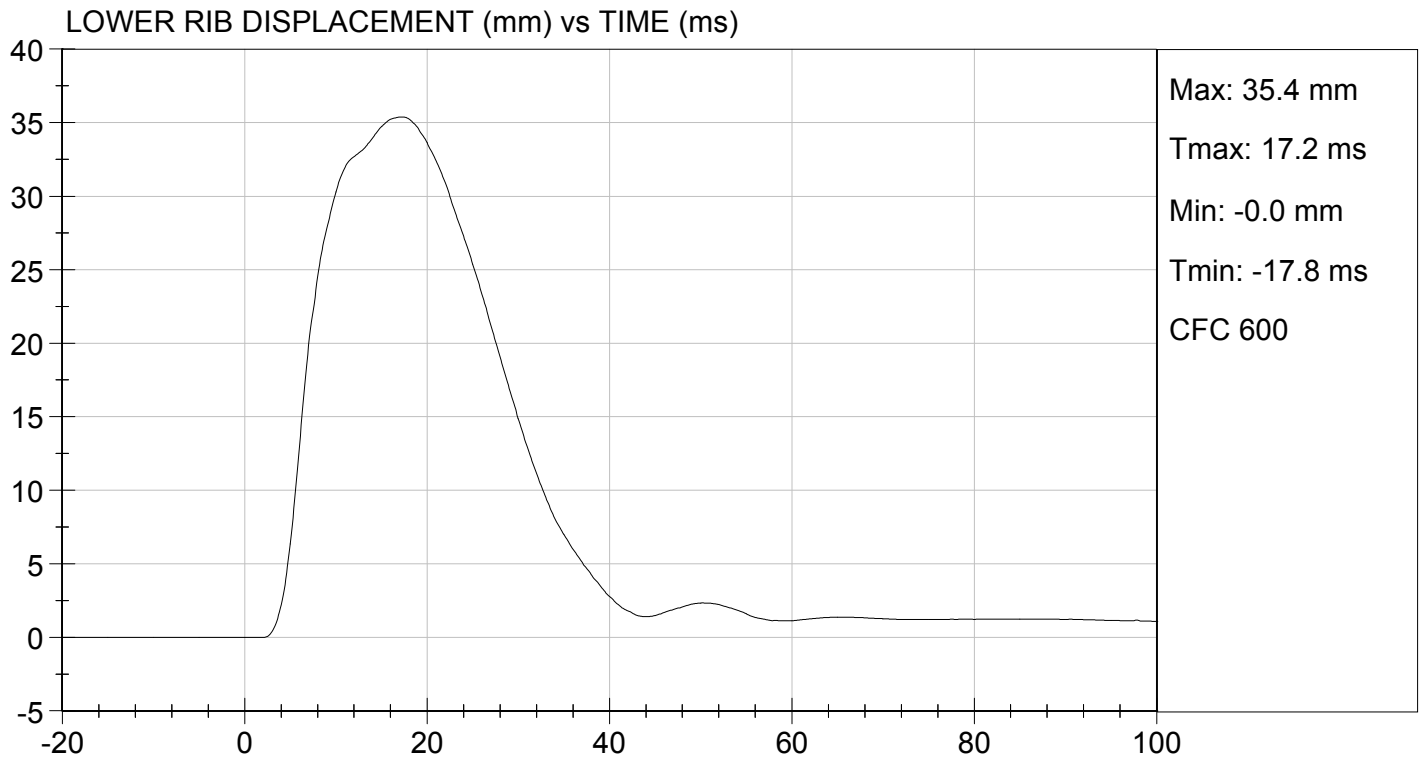
TEST DATE: 08/06/2012
TEST #: D122904





TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

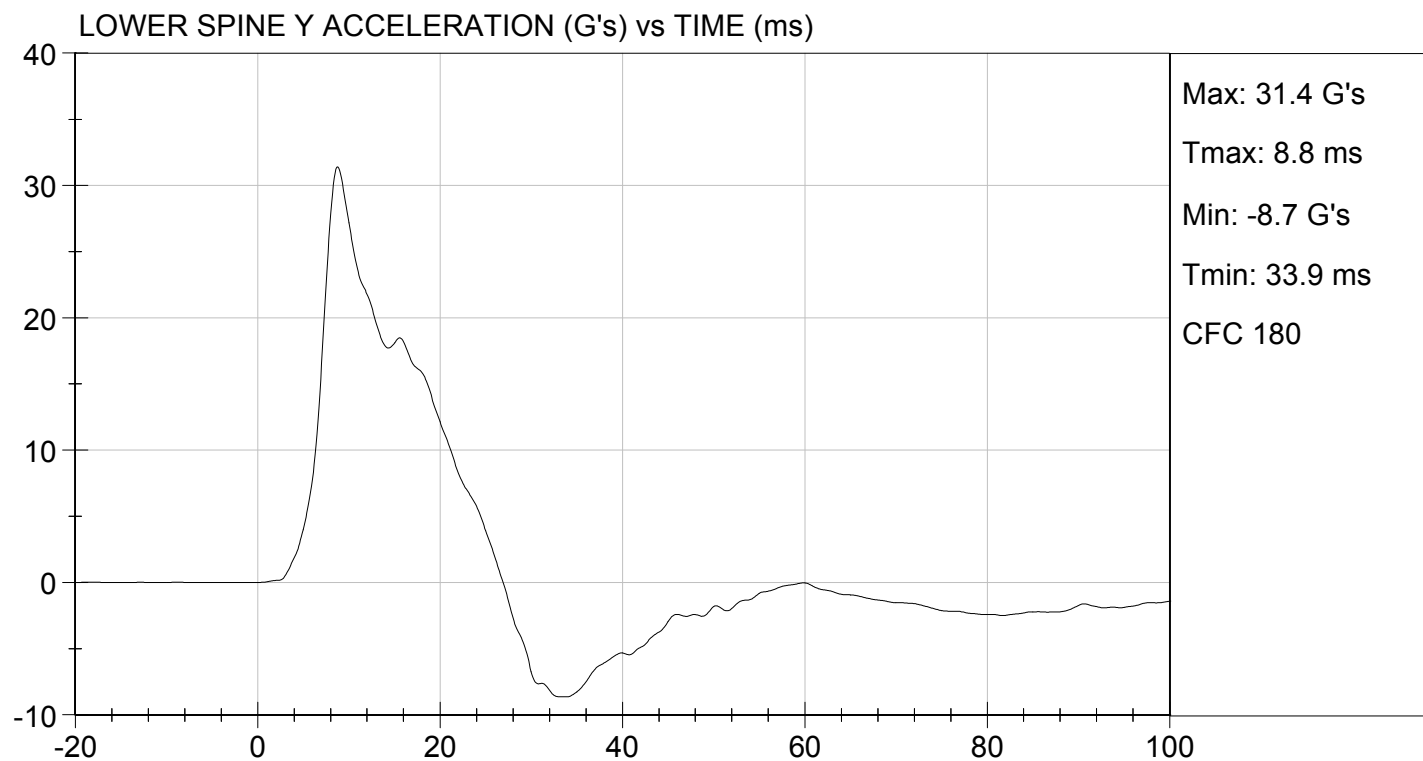
TEST DATE: 08/06/2012
TEST #: D122904





TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 08/06/2012
TEST #: D122904

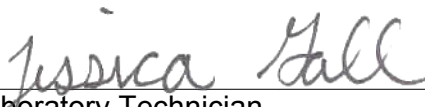


MGA RESEARCH CORPORATION
THORAX (WITHOUT ARM) IMPACT TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 262

Test I.D: D122905

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	14 to 18	16	Pass
Upper Rib Displacement	mm	32 to 40	34	Pass
Middle Rib Displacement	mm	39 to 45	39	Pass
Lower Rib Displacement	mm	35 to 43	36	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	16	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	10	Pass
Overall Test Results				Pass


 Laboratory Technician

08/06/2012

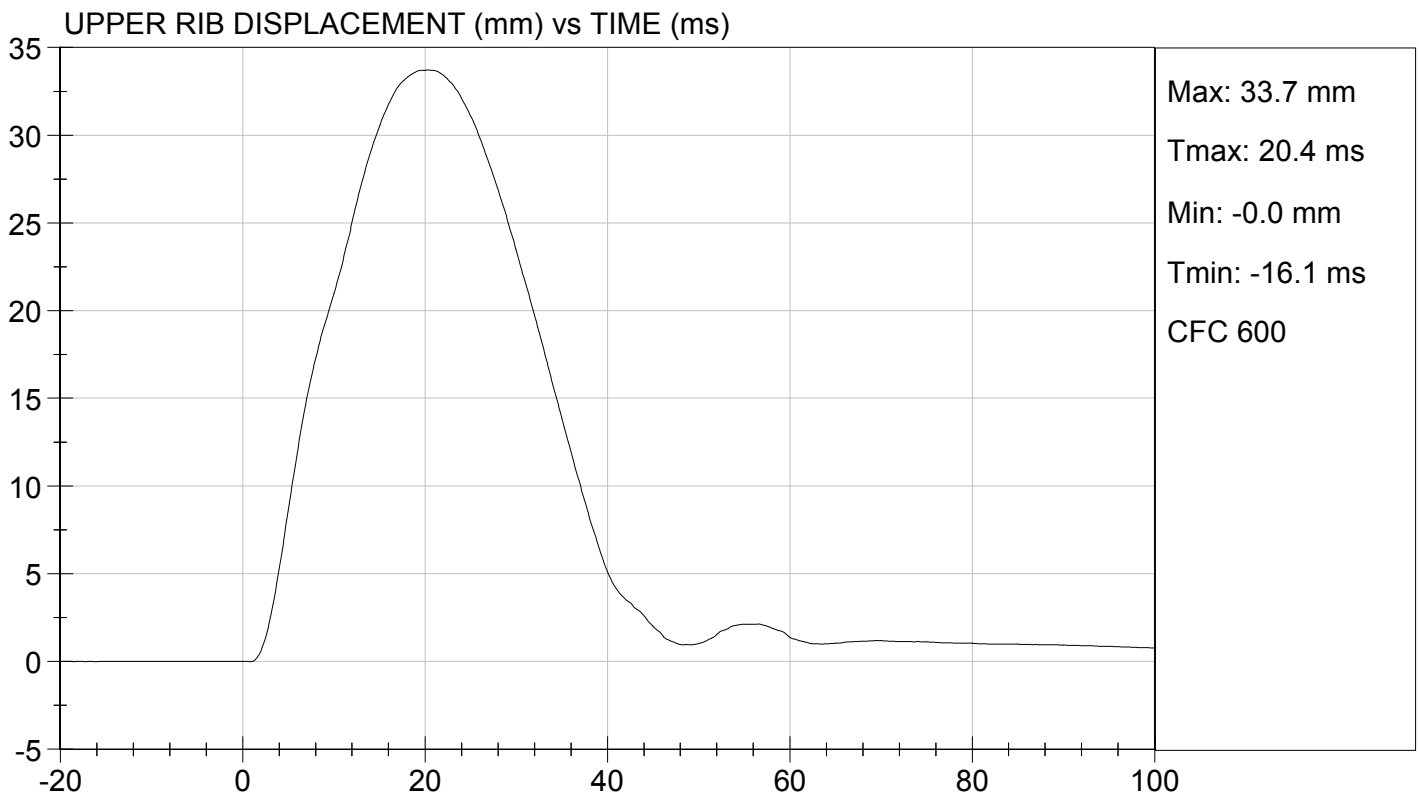
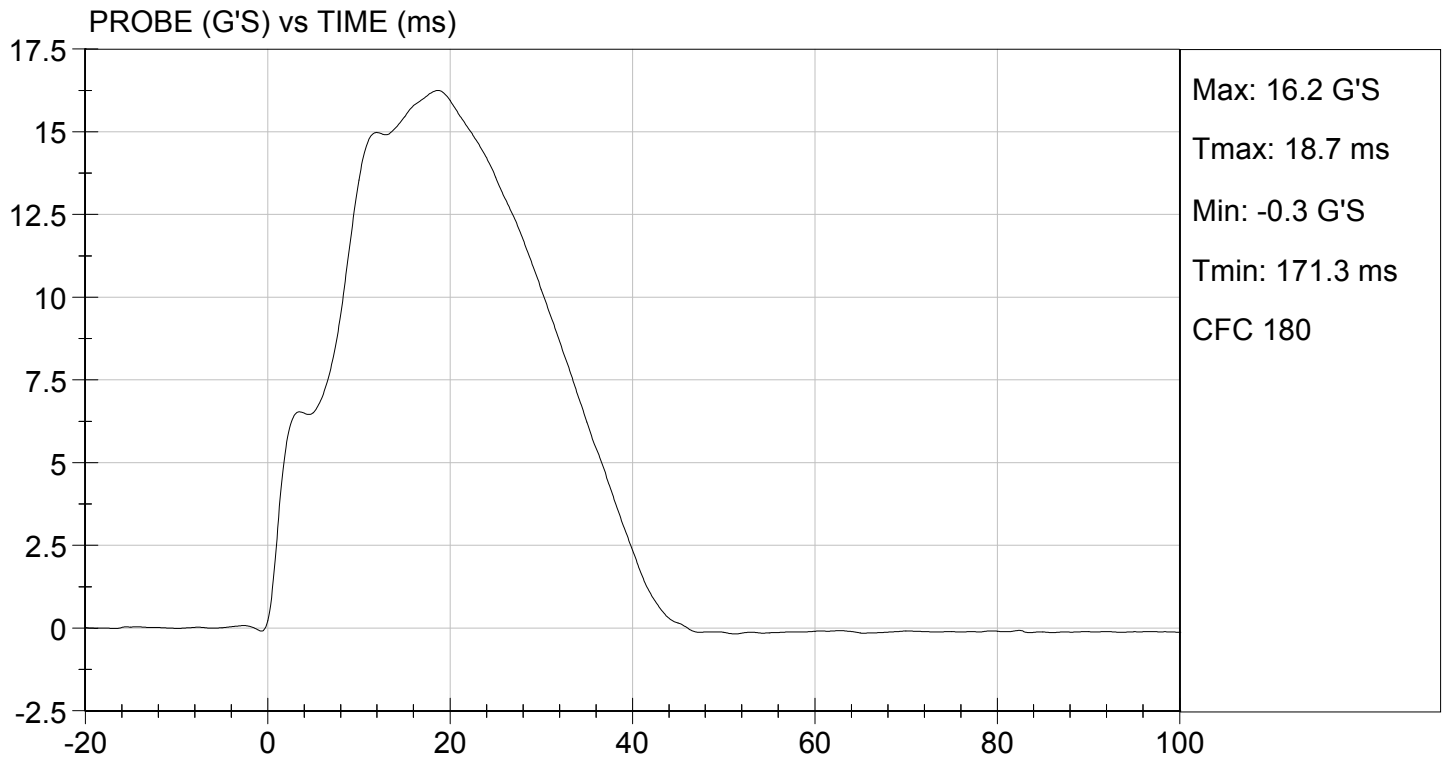
Test Date


 Approved By



TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

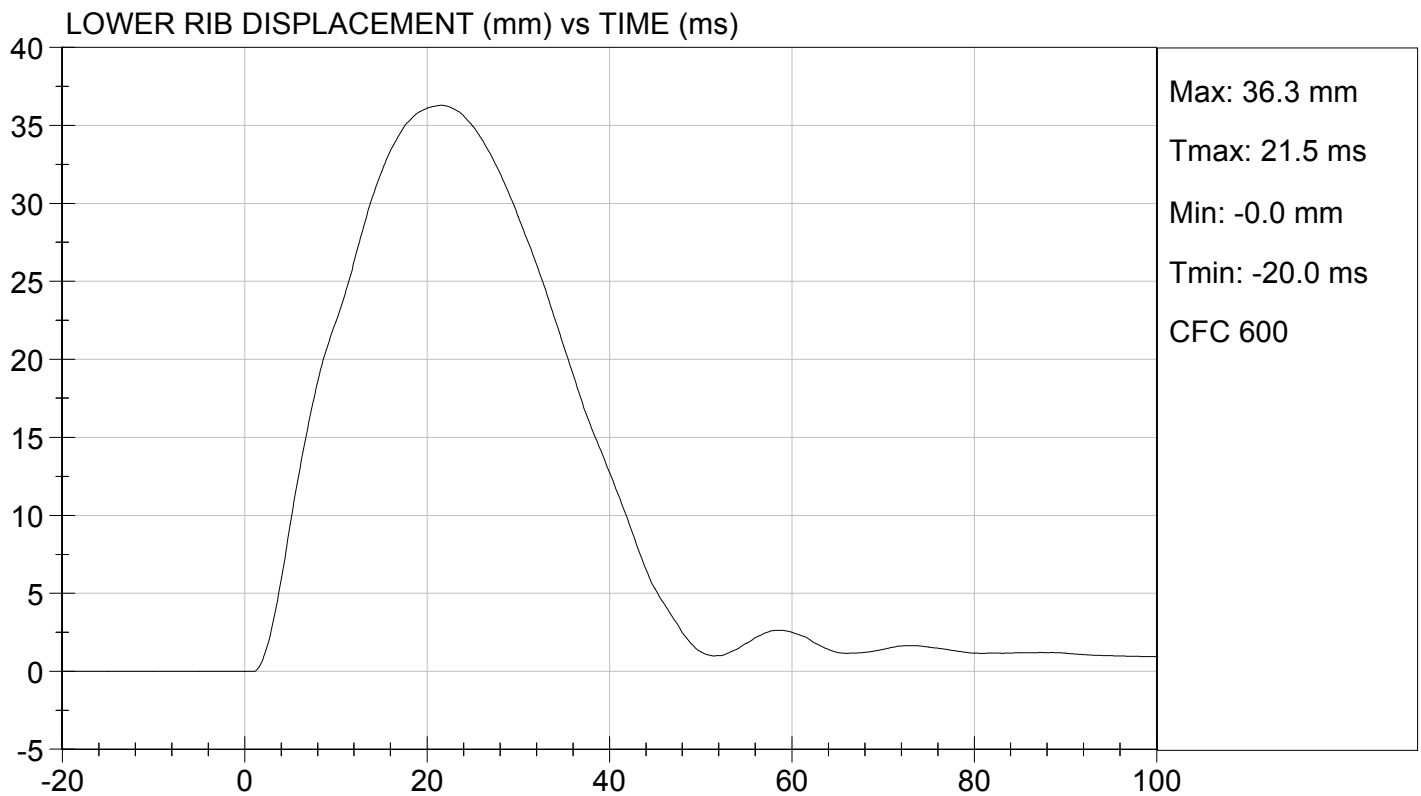
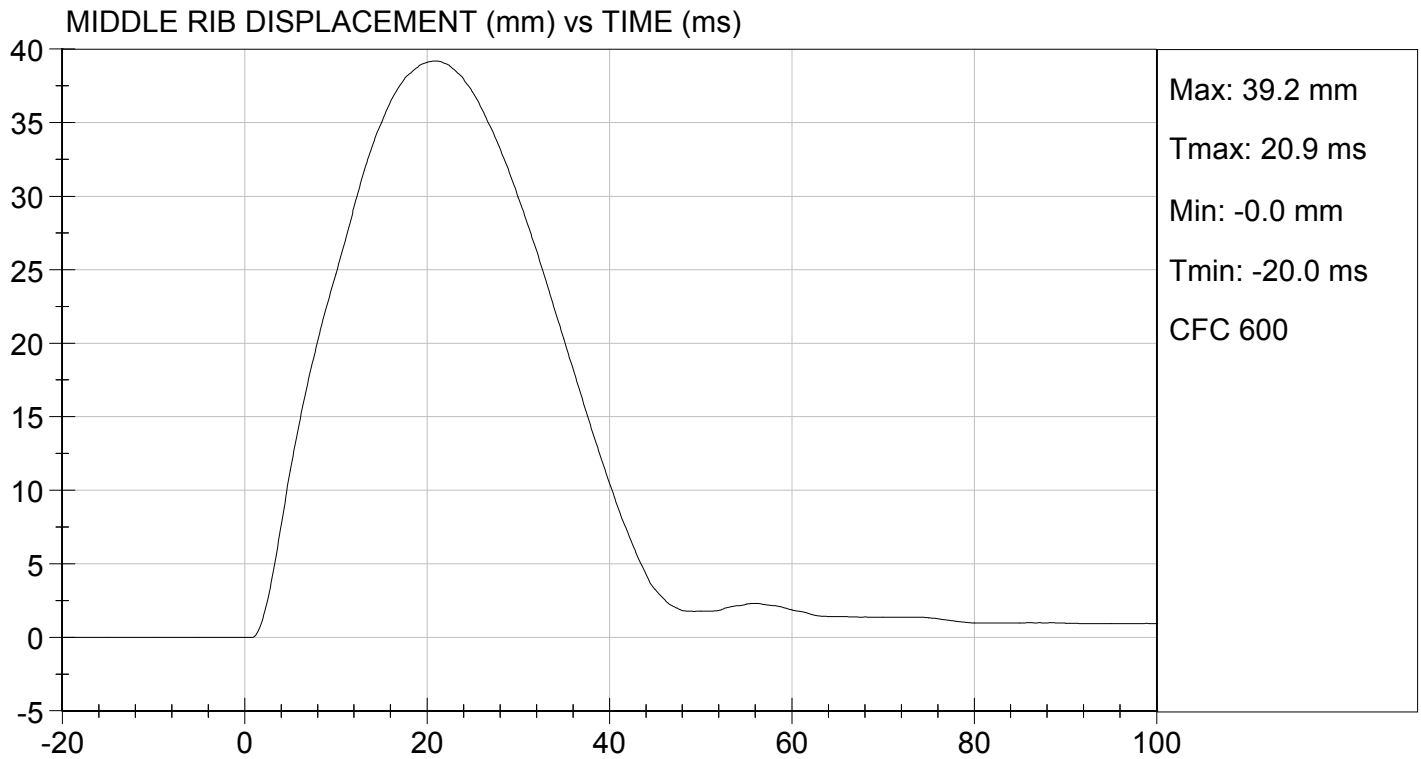
TEST DATE: 08/06/2012
TEST #: D122905





TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

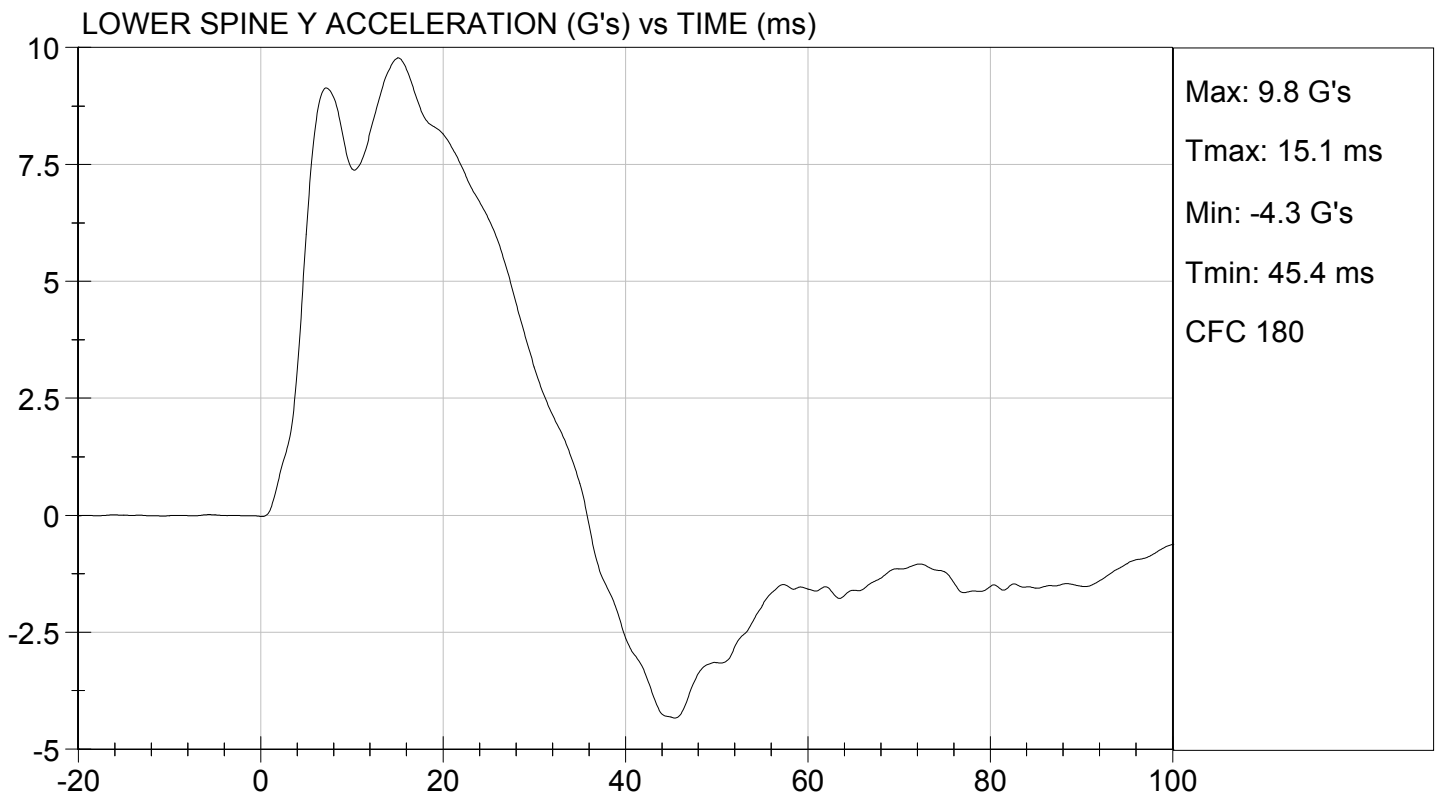
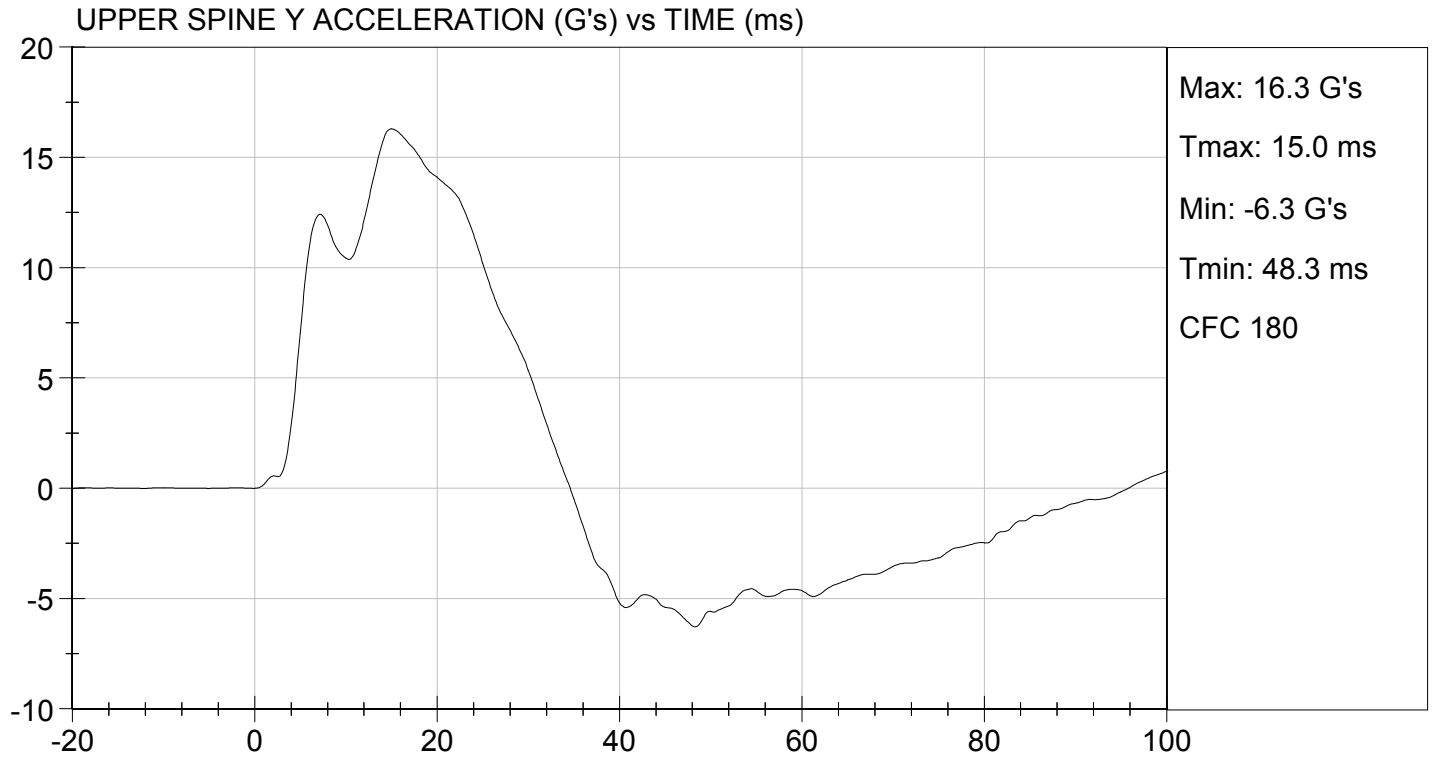
TEST DATE: 08/06/2012
TEST #: D122905





TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/06/2012
TEST #: D122905



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 262

Test I.D: D122906

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	12 to 16	13	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	42	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	39	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	10	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

08/06/2012

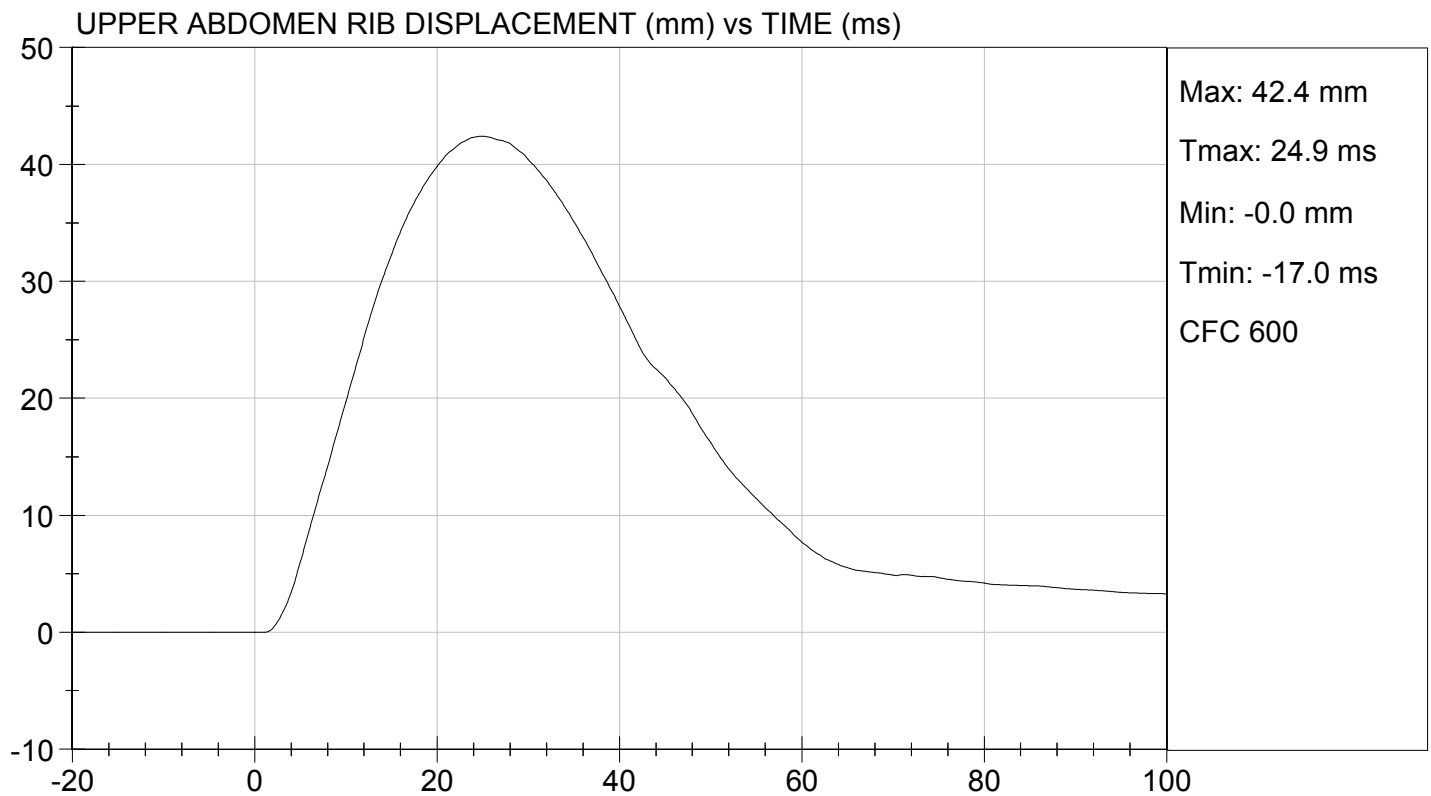
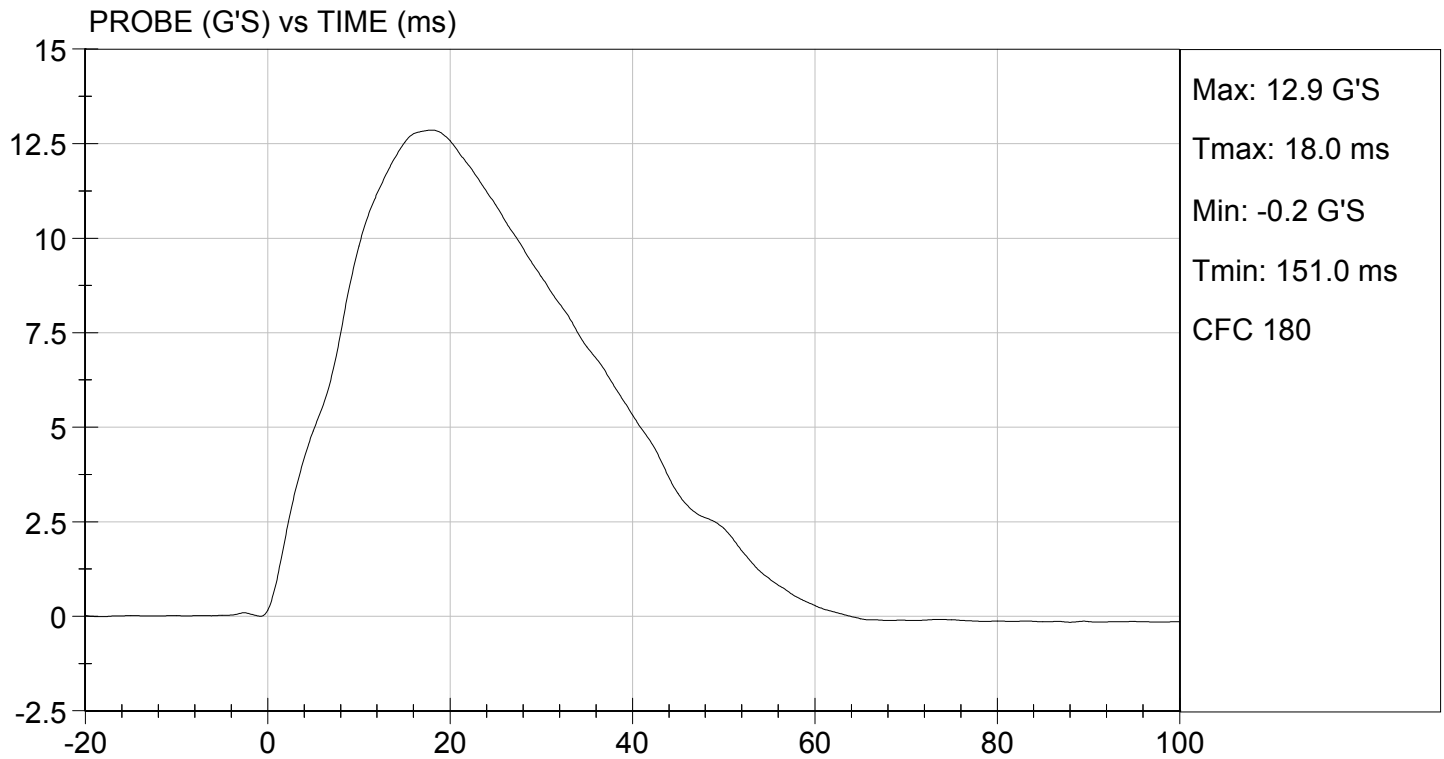
Test Date

David Winkelbauer
Approved By



TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/06/2012
TEST #: D122906

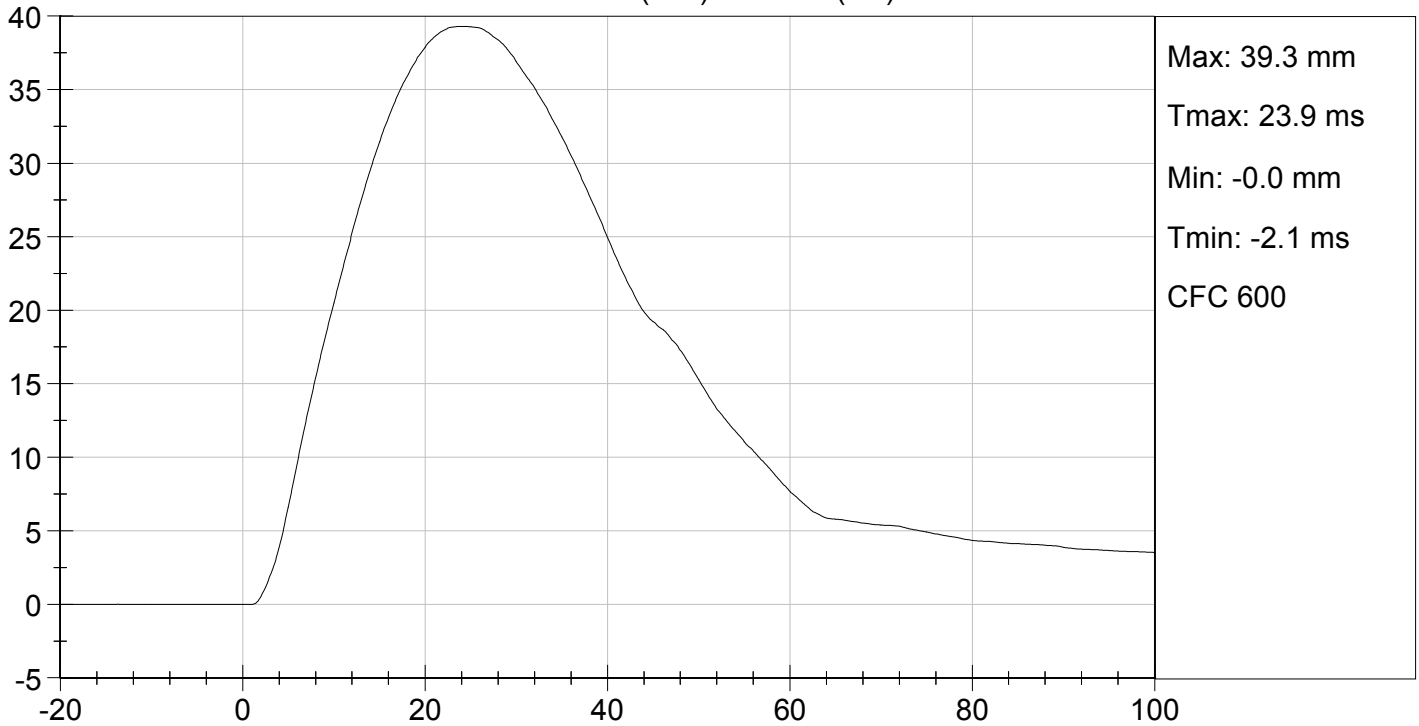




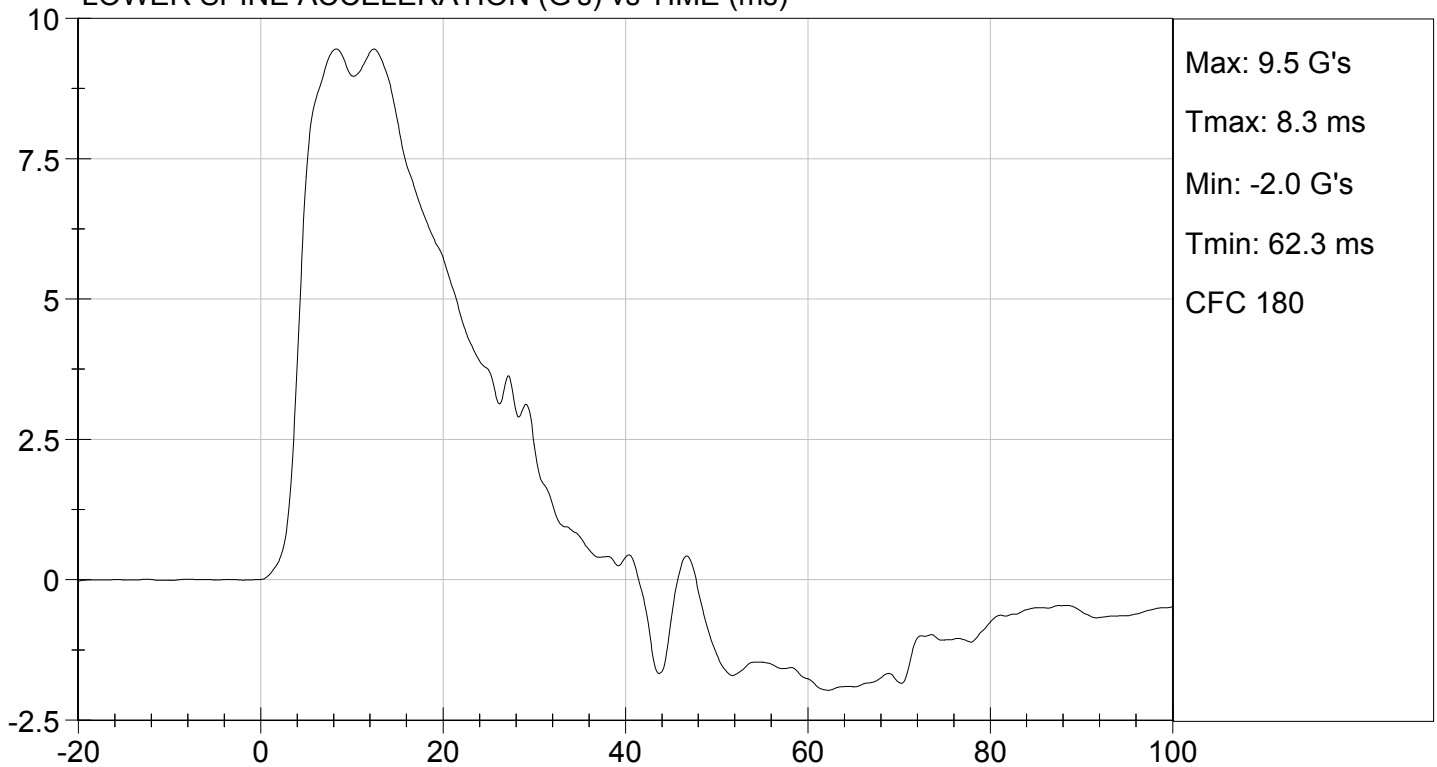
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/06/2012
TEST #: D122906

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: 262

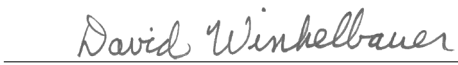
Test I.D: D122907

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	38 to 47	45	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	40	Pass
Peak Acetabulum Force	N	3600 to 4300	4,061	Pass
Overall Test Results				Pass


Laboratory Technician

08/06/2012

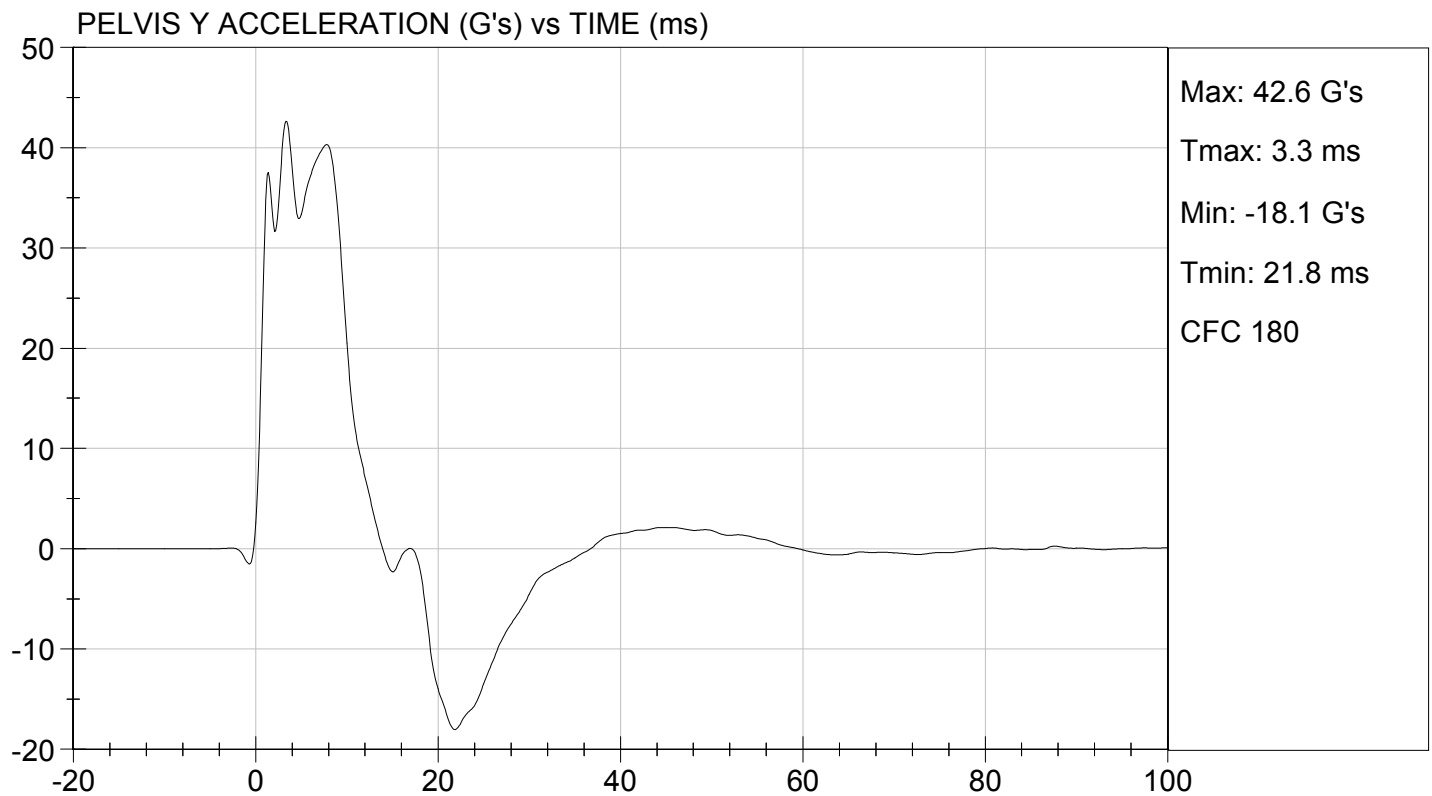
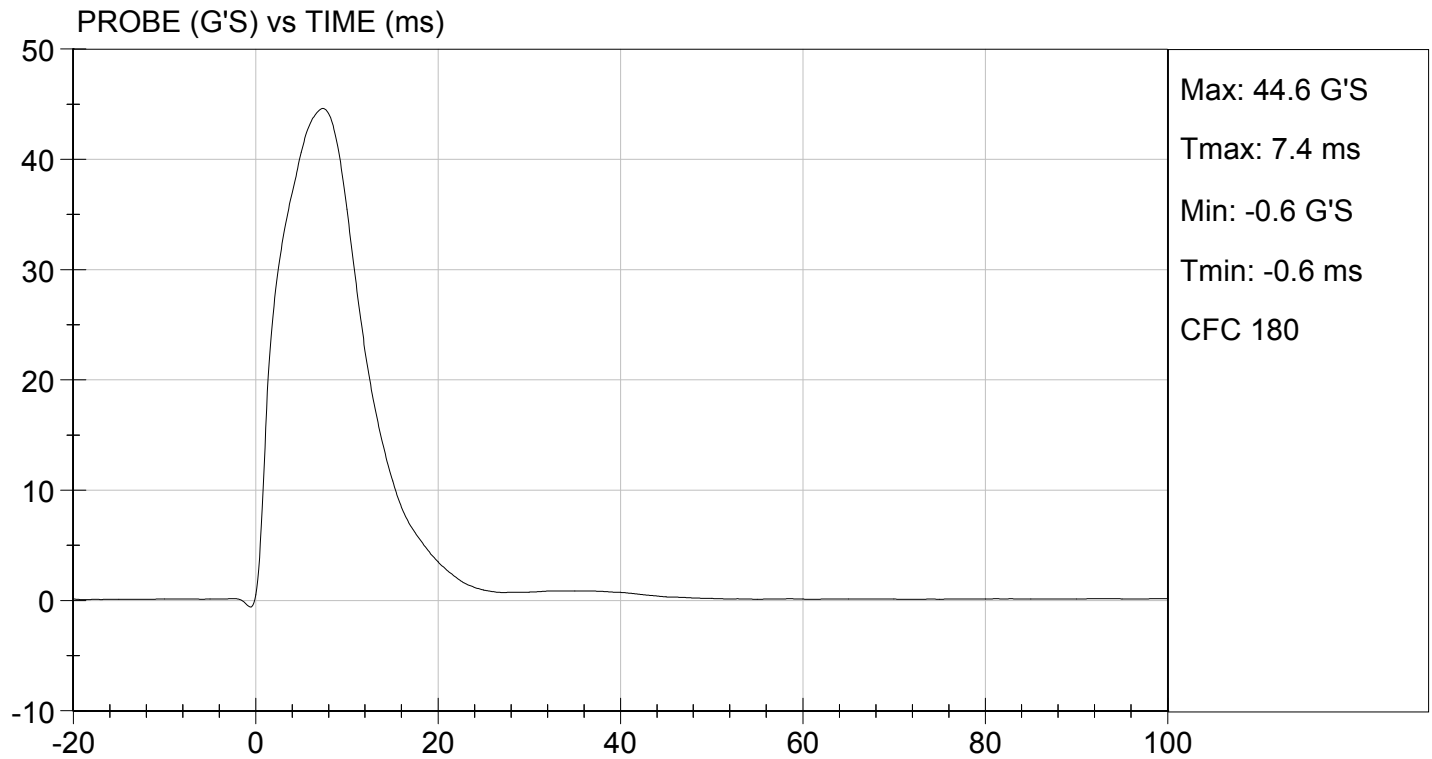
Test Date


Approved By



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

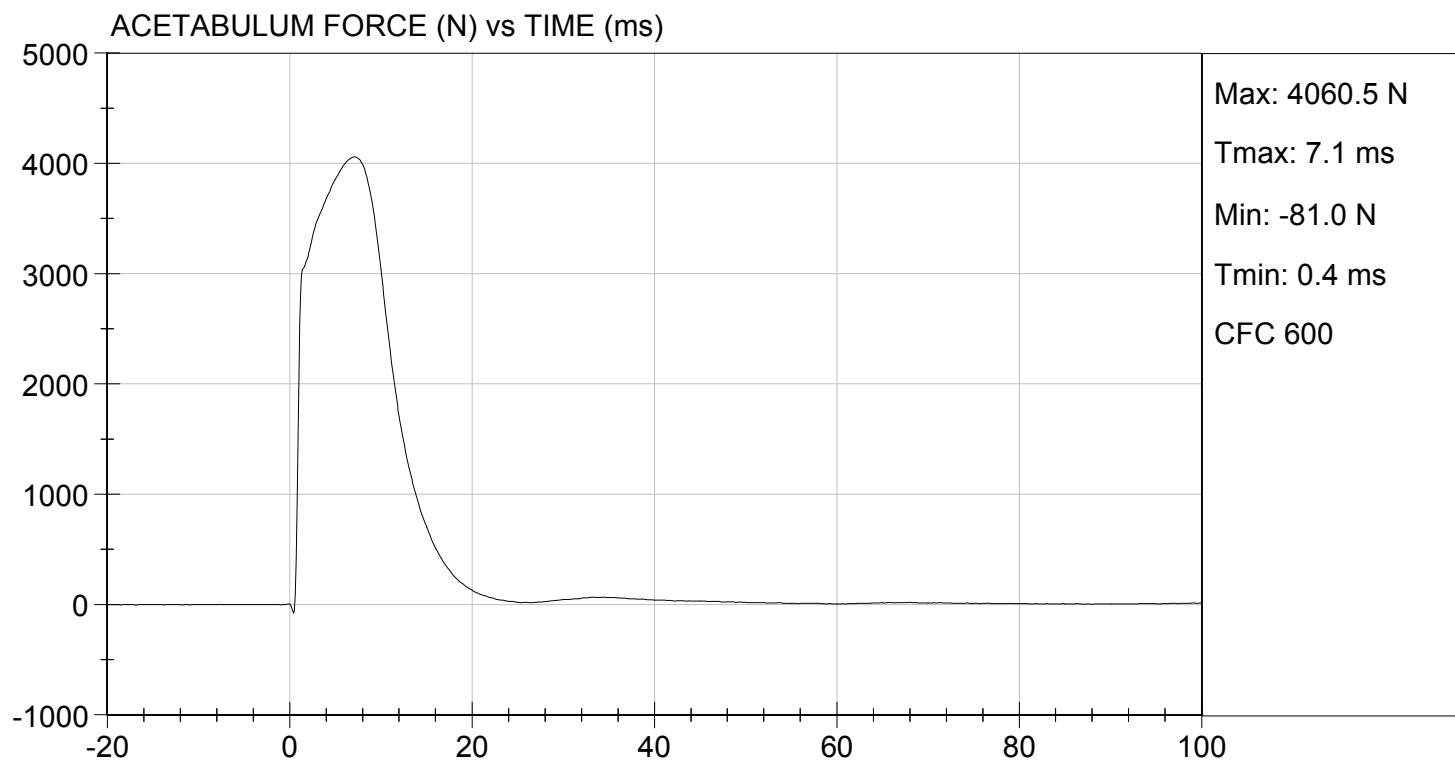
TEST DATE: 08/06/2012
TEST #: D122907





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

TEST DATE: 08/06/2012
TEST #: D122907



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 262

Test I.D: D122908

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	36 to 45	38	Pass
Pelvis Y Acceleration	G's	28 to 39	30	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,269	Pass
Overall Test Results				Pass


Laboratory Technician

08/06/2012

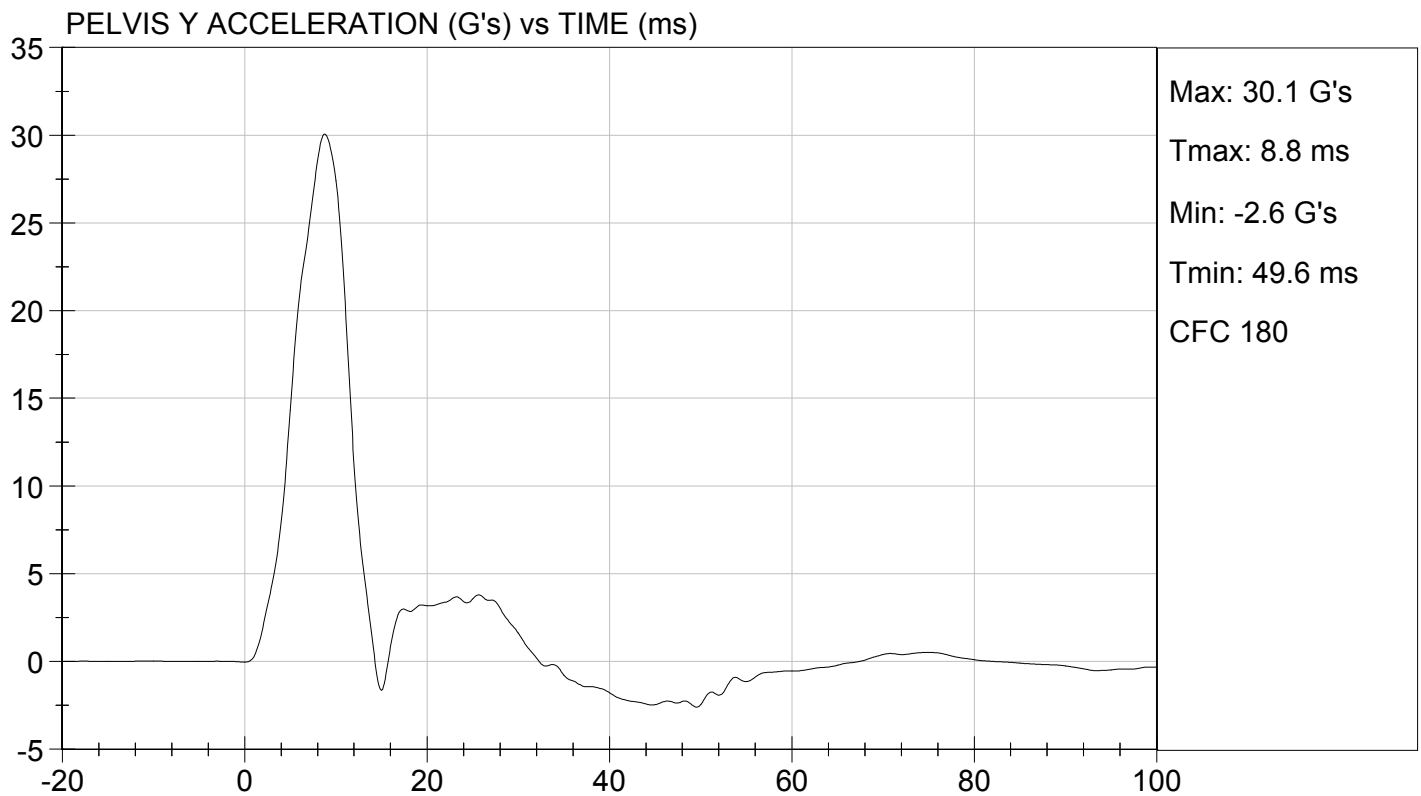
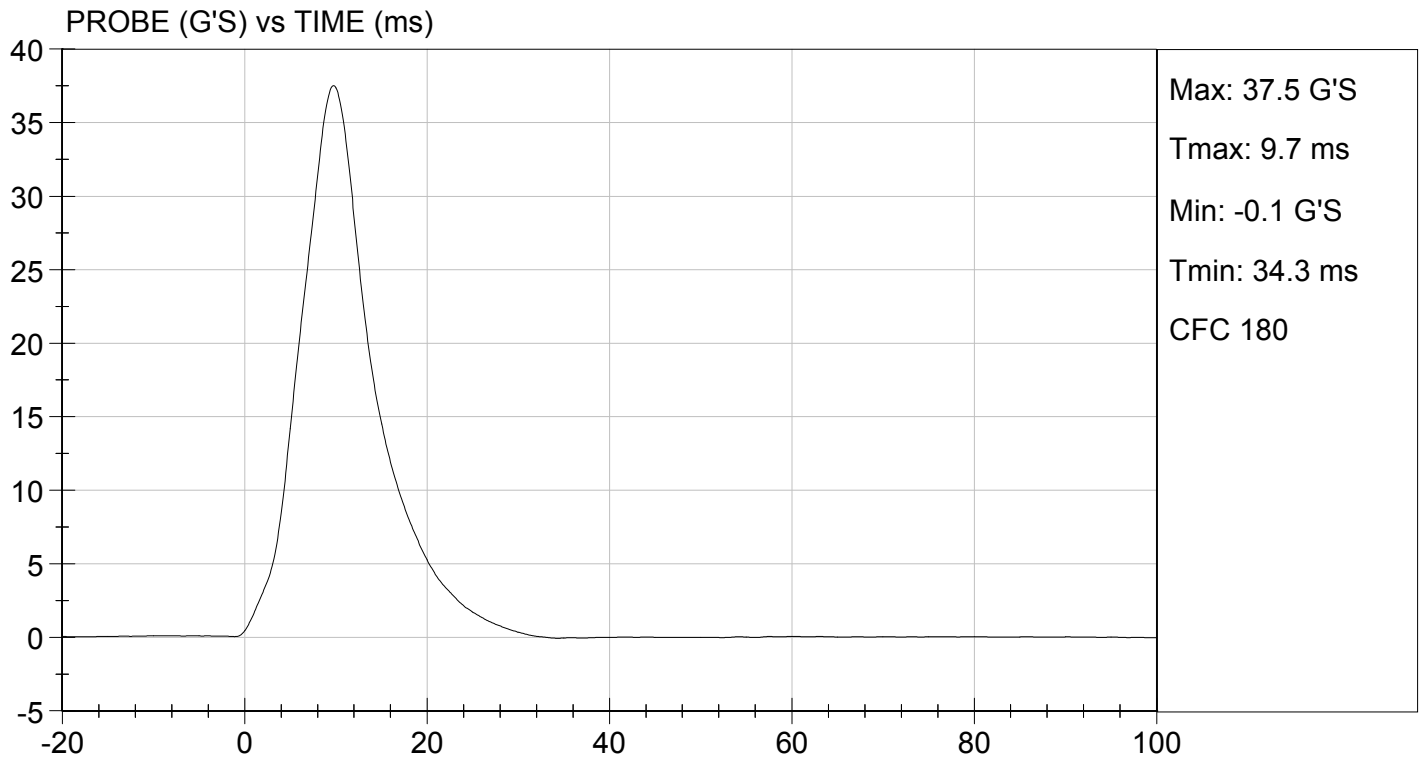
Test Date


Approved By



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

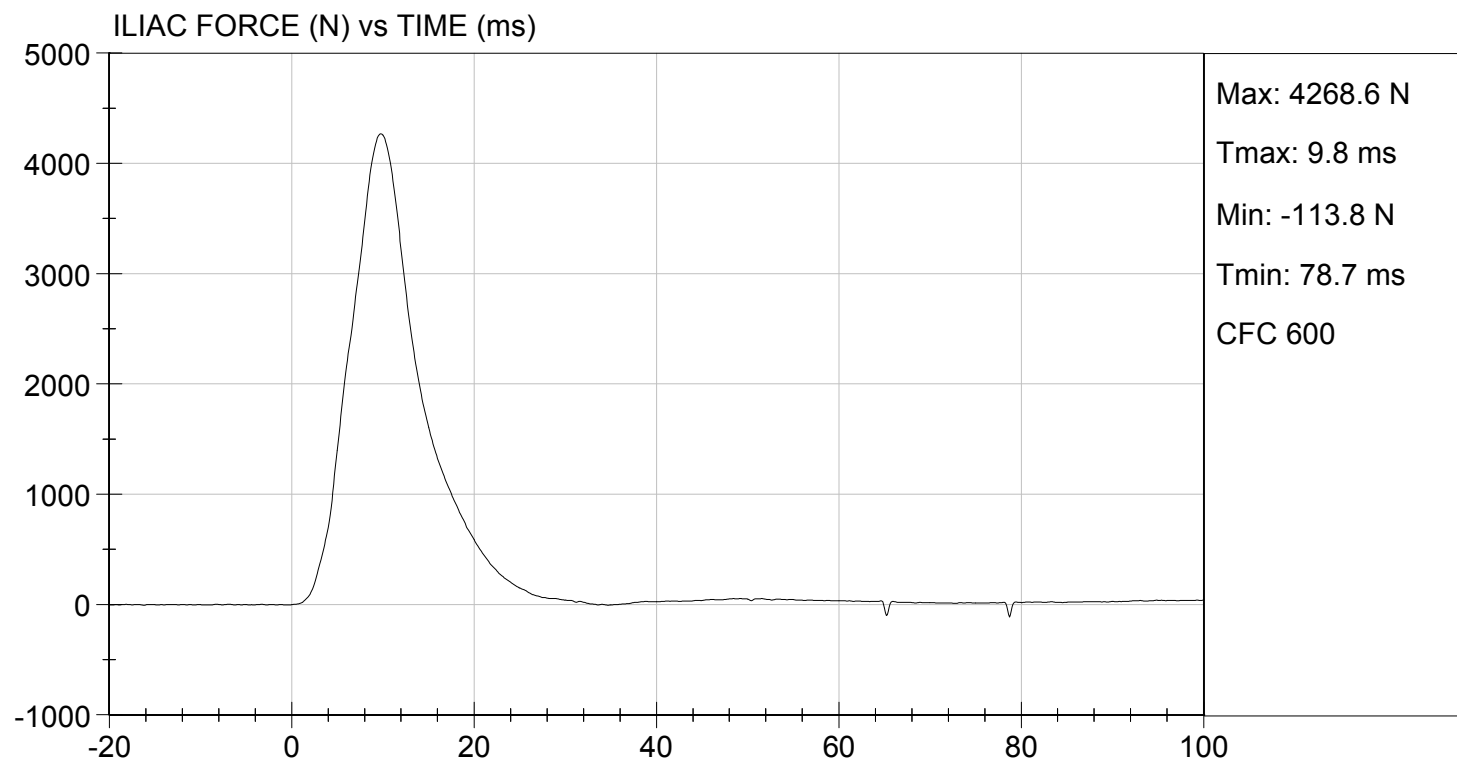
TEST DATE: 08/06/2012
TEST #: D122908





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

TEST DATE: 08/06/2012
TEST #: D122908

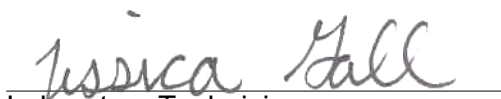


MGA RESEARCH CORPORATION
HEAD DROP TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 262

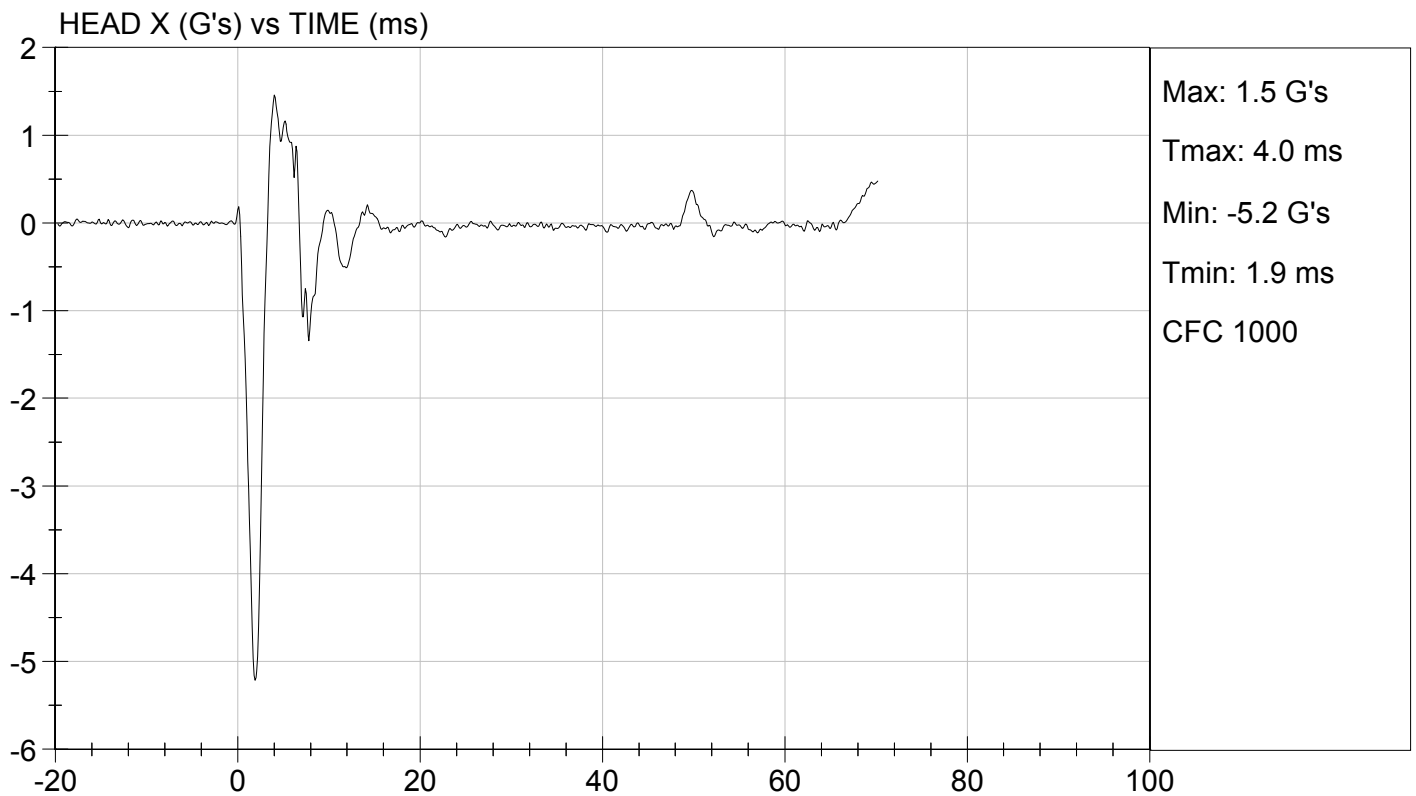
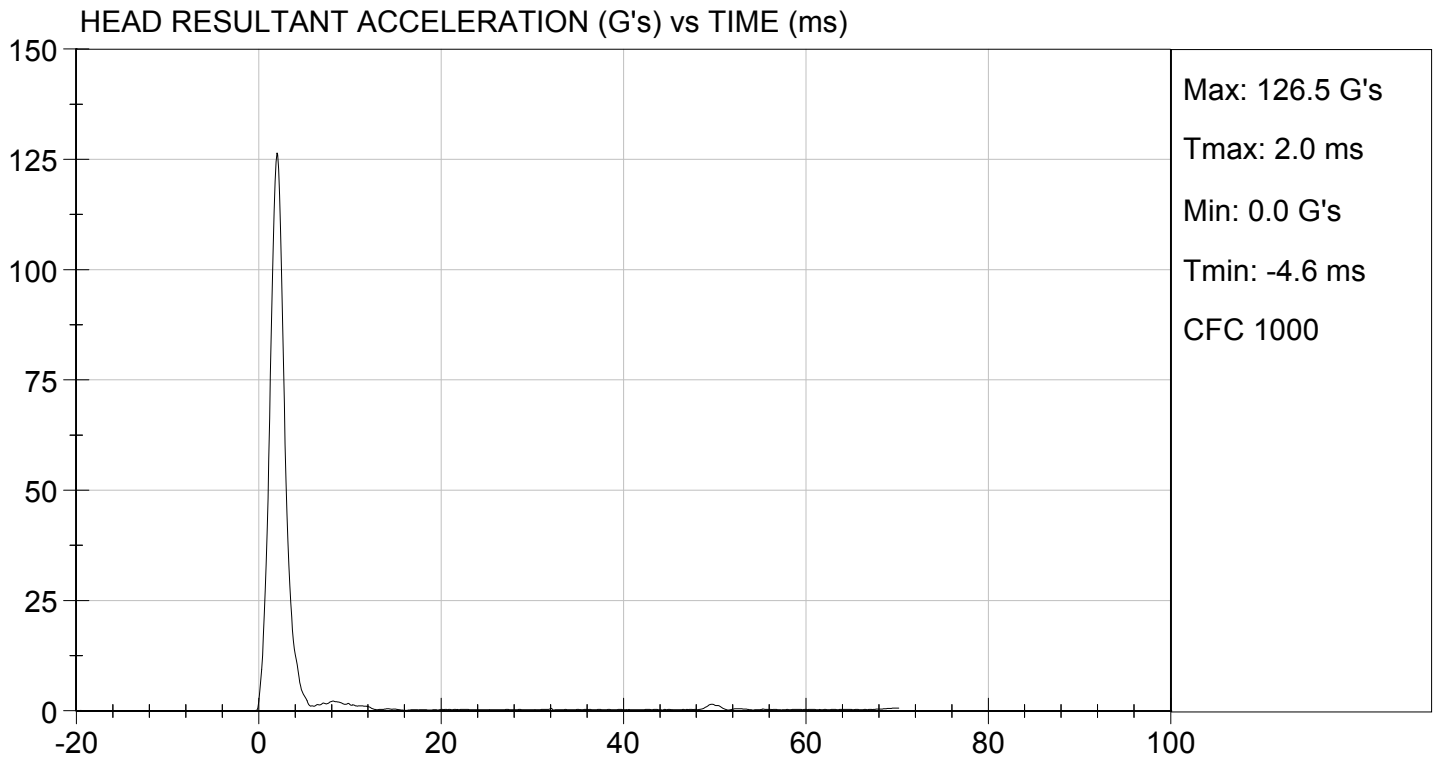
Test ID: D122931

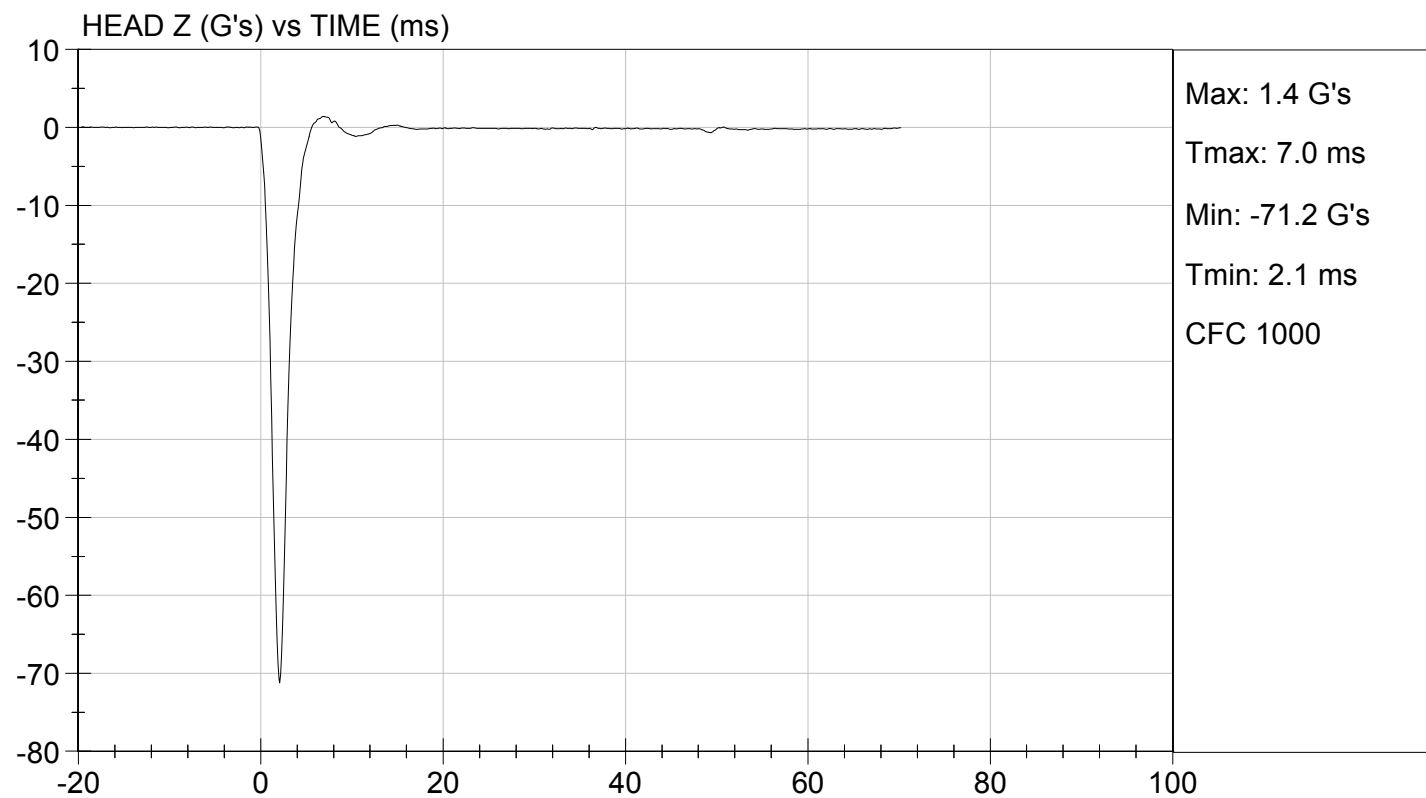
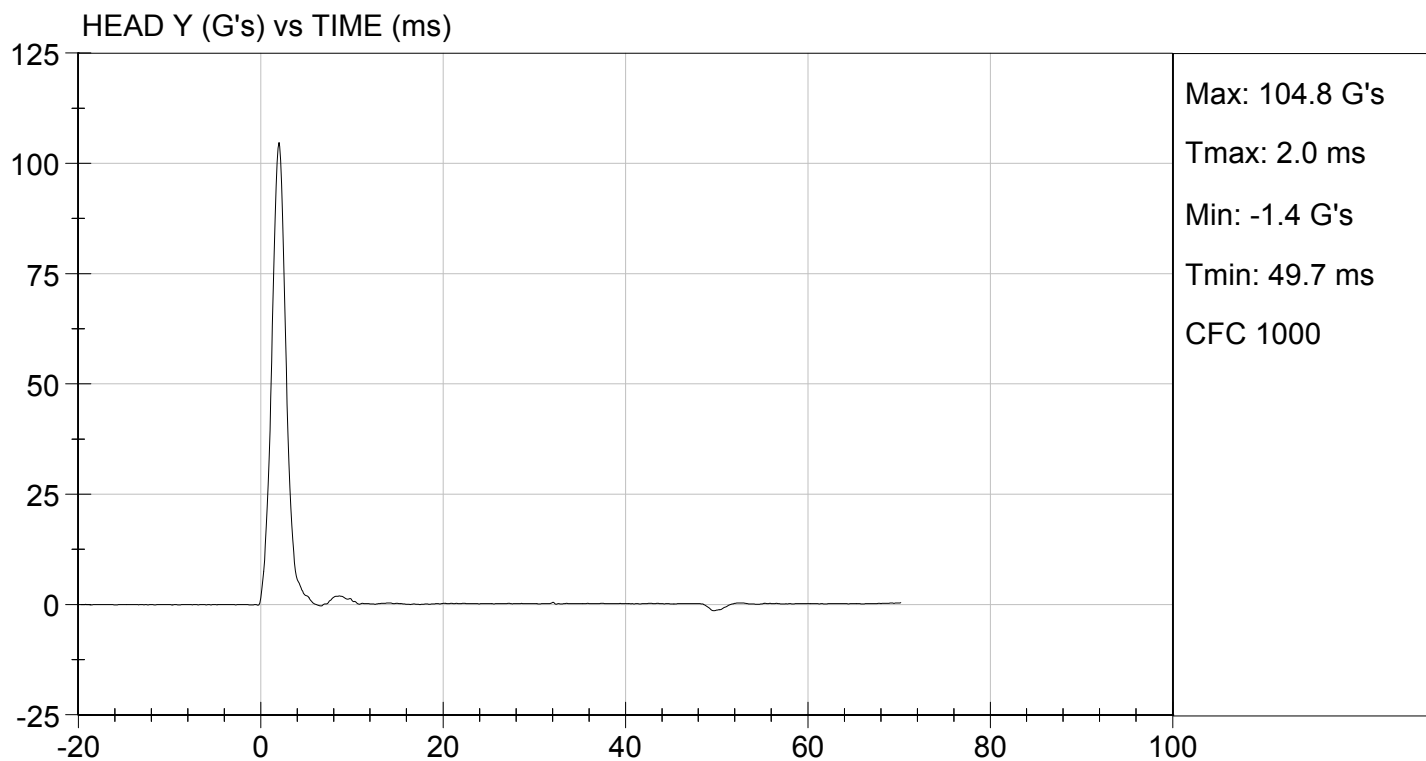
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Peak Resultant Acceleration	G's	115 to 137	127	Pass
Peak Longitudinal Acceleration	G's	+/- 15	-5.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
			Overall Test Results	Pass


Laboratory Technician

08/08/2012
Test Date


Approved By



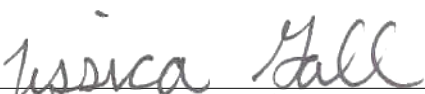


MGA RESEARCH CORPORATION
LATERAL NECK PENDULUM TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 262

Test I.D: D122932

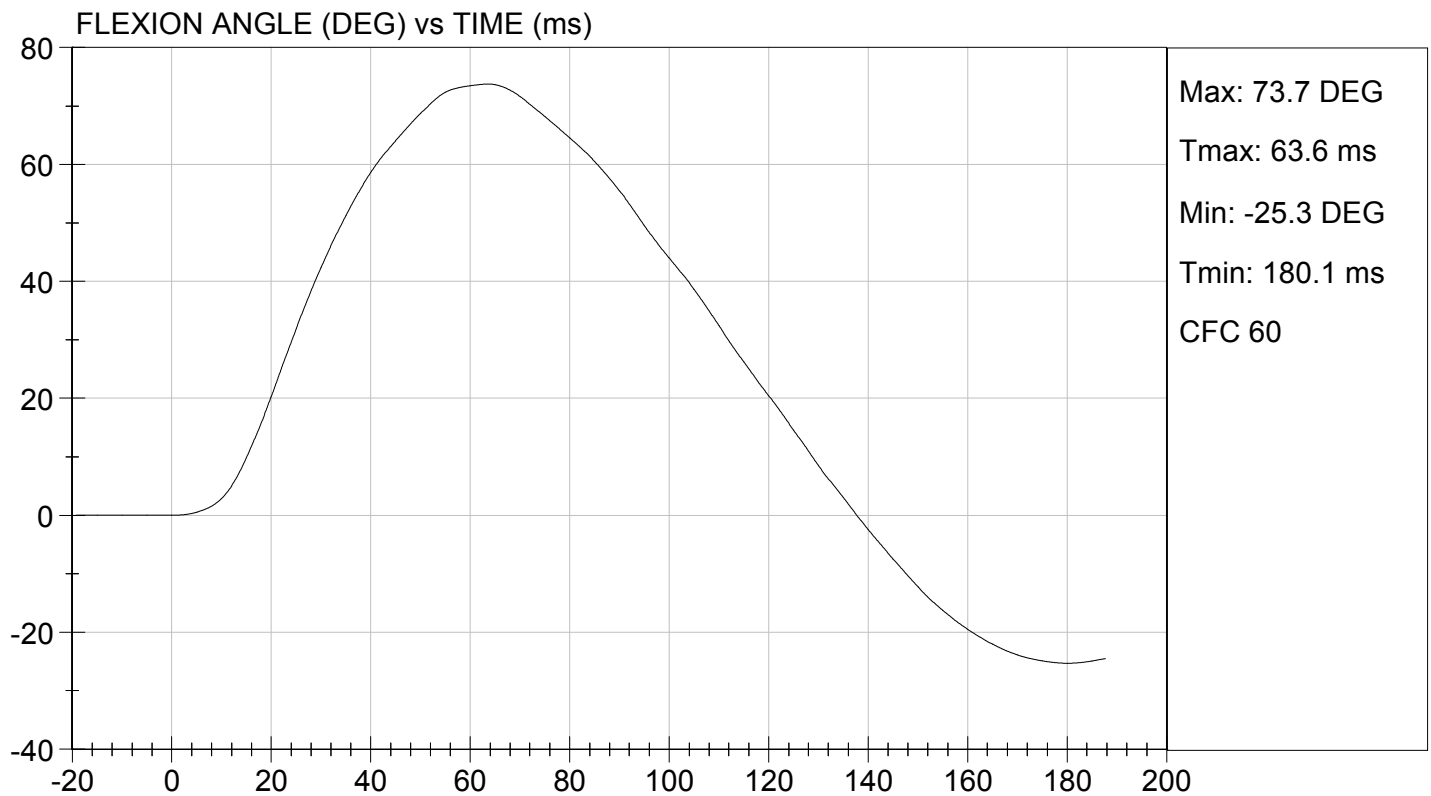
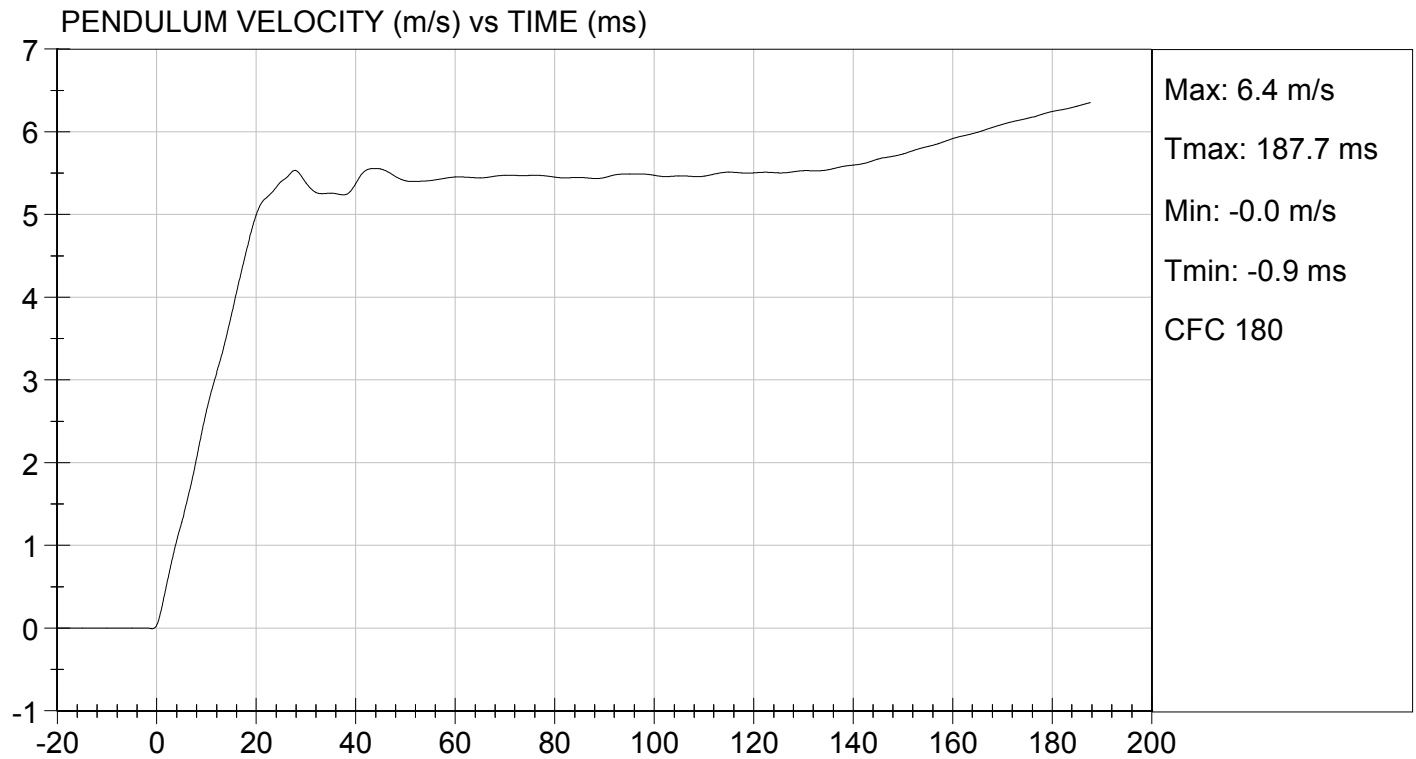
Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.6	Pass
Humidity		%	10 to 70	50	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.63	Pass
	15 ms	m/s	3.30 to 4.10	3.79	Pass
	20 ms	m/s	4.40 to 5.40	5.00	Pass
	25 ms	m/s	5.40 to 6.10	5.40	Pass
	25-100 ms	m/s	5.50 to 6.20	5.56	Pass
Maximum D-Plane Rotation		deg	71 to 81	74	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	64	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-38	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	116	Pass
Overall Test Results					Pass


 Laboratory Technician

08/08/2012

Test Date

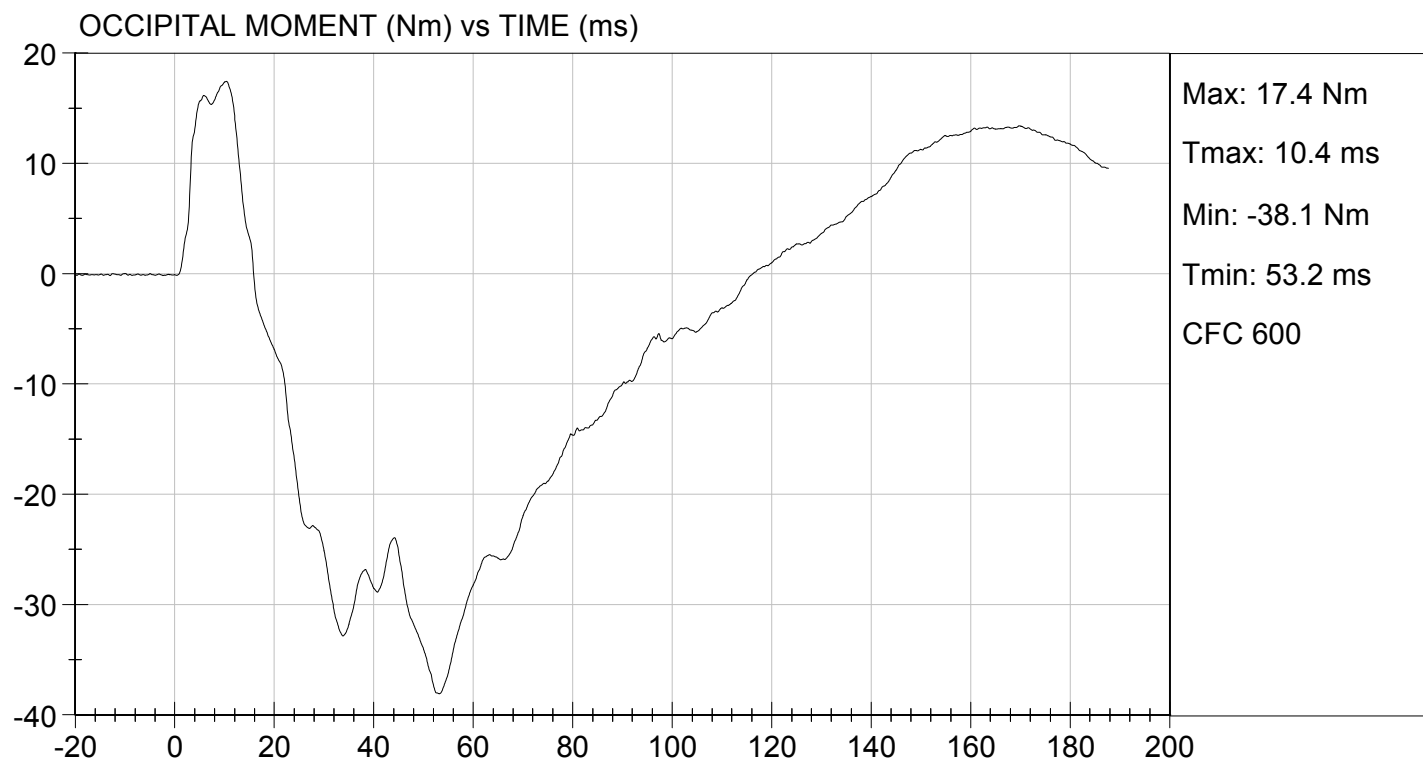

 Approved By





TEST DESC: NECK BENDING
VELOCITY: 18.31 ft/s, 5.58 m/s

TEST DATE: 08/08/2012
TEST #: D122932

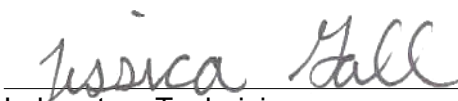


MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
SID-IIs BUILD LEVEL D DUMMY

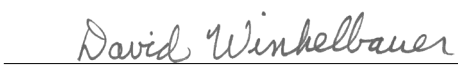
ATD Serial No: 262

Test ID: D122933

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	48	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	33	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
Overall Test Results				Pass


Laboratory Technician

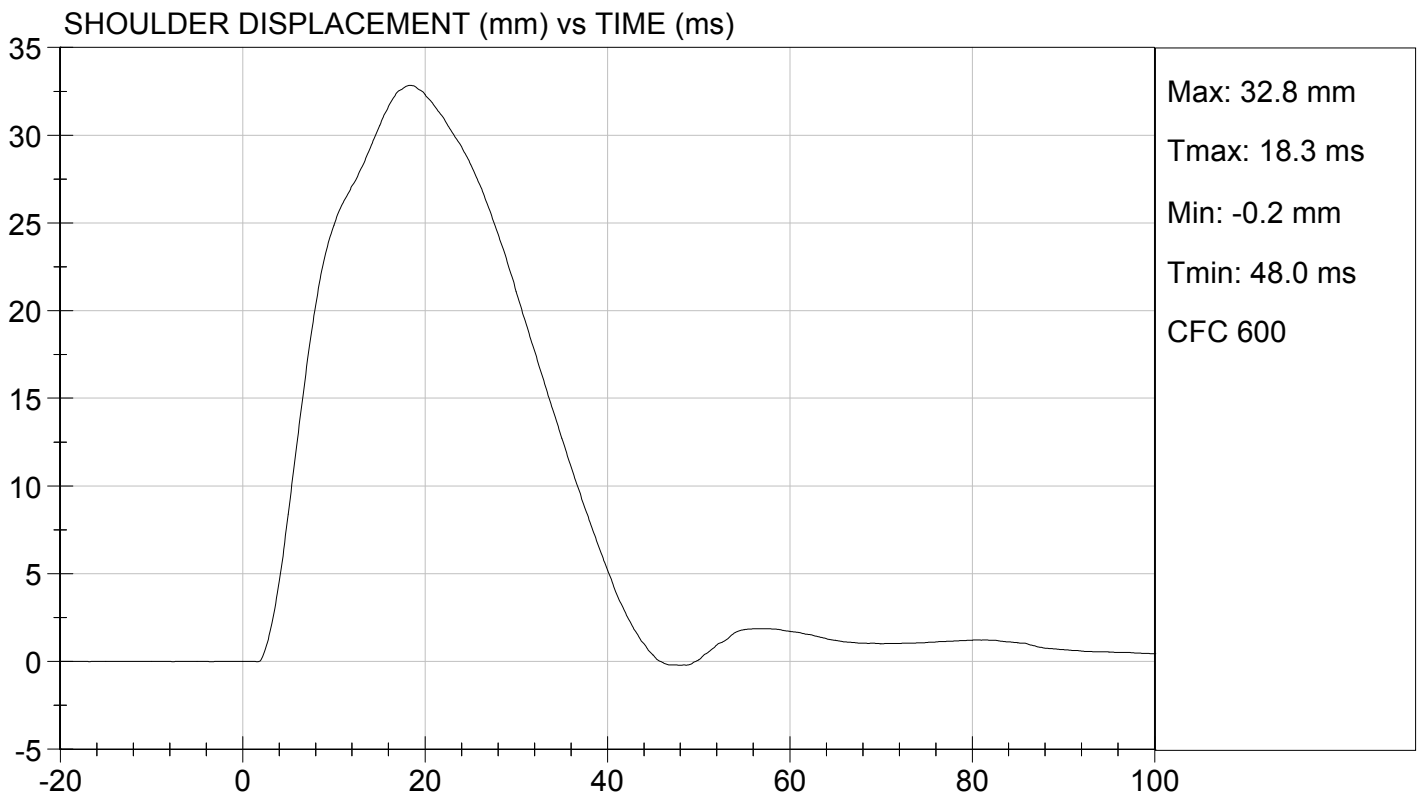
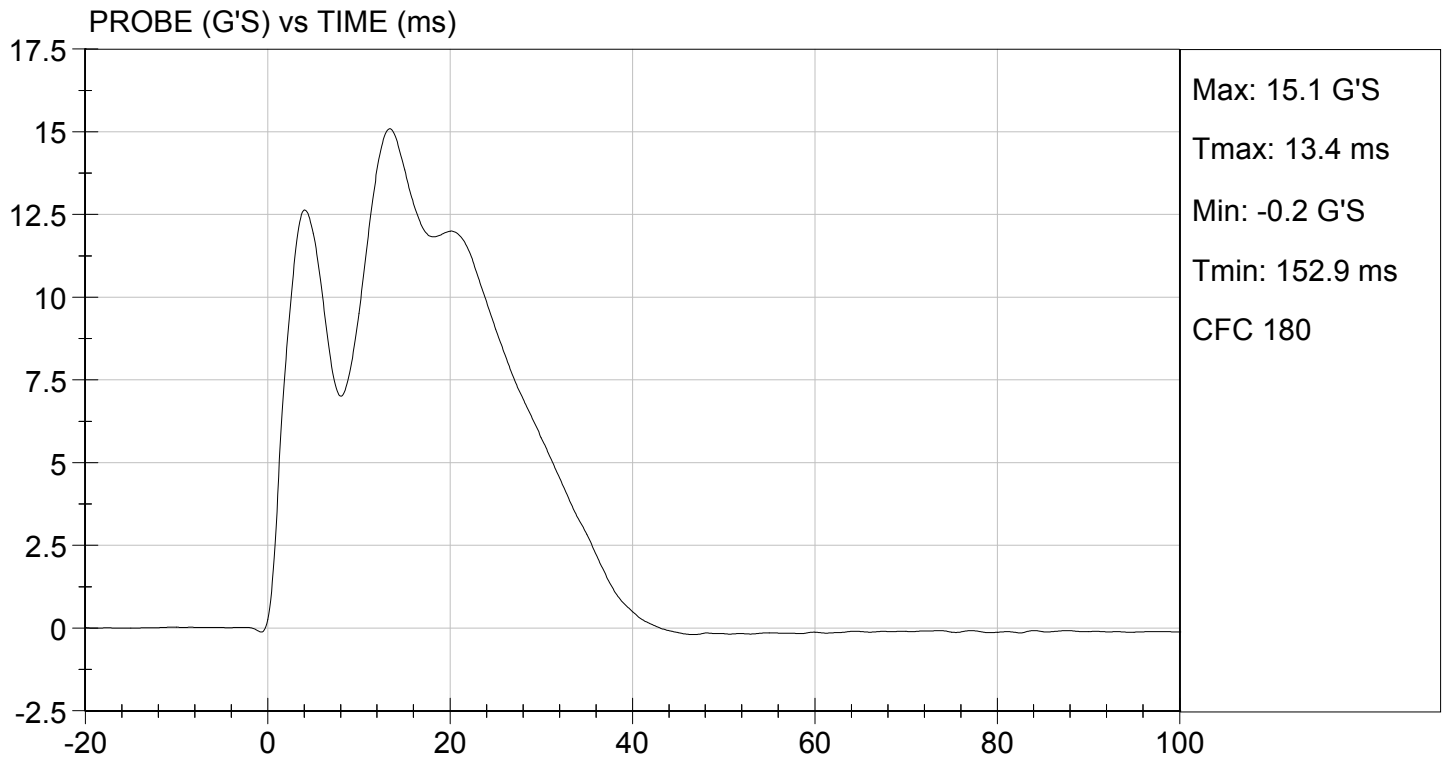
08/08/2012
Test Date


Approved By



TEST DESC: SHOULDER IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

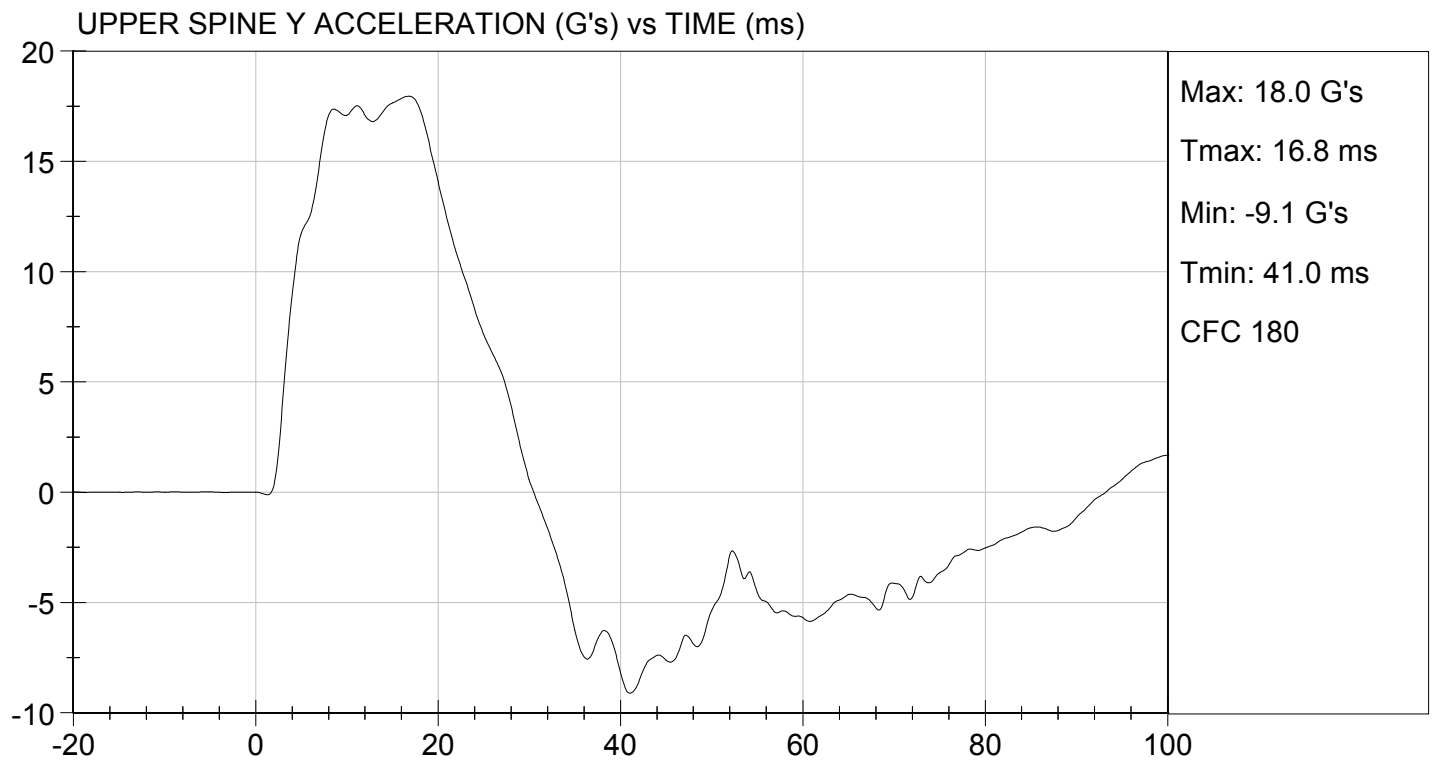
TEST DATE: 08/08/2012
TEST #: D122933





TEST DESC: SHOULDER IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/08/2012
TEST #: D122933

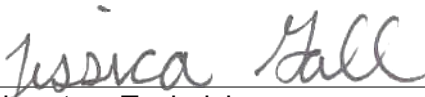


MGA RESEARCH CORPORATION
THORAX (WITH ARM) IMPACT TEST
SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 262

Test I.D: D122934

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Humidity	%	10 to 70	48	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	32	Pass
Shoulder Displacement	mm	31 to 40	33	Pass
Upper Rib Displacement	mm	25 to 32	28	Pass
Middle Rib Displacement	mm	30 to 36	33	Pass
Lower Rib Displacement	mm	32 to 38	36	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	35	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	31	Pass
Overall Test Results				Pass


 Laboratory Technician

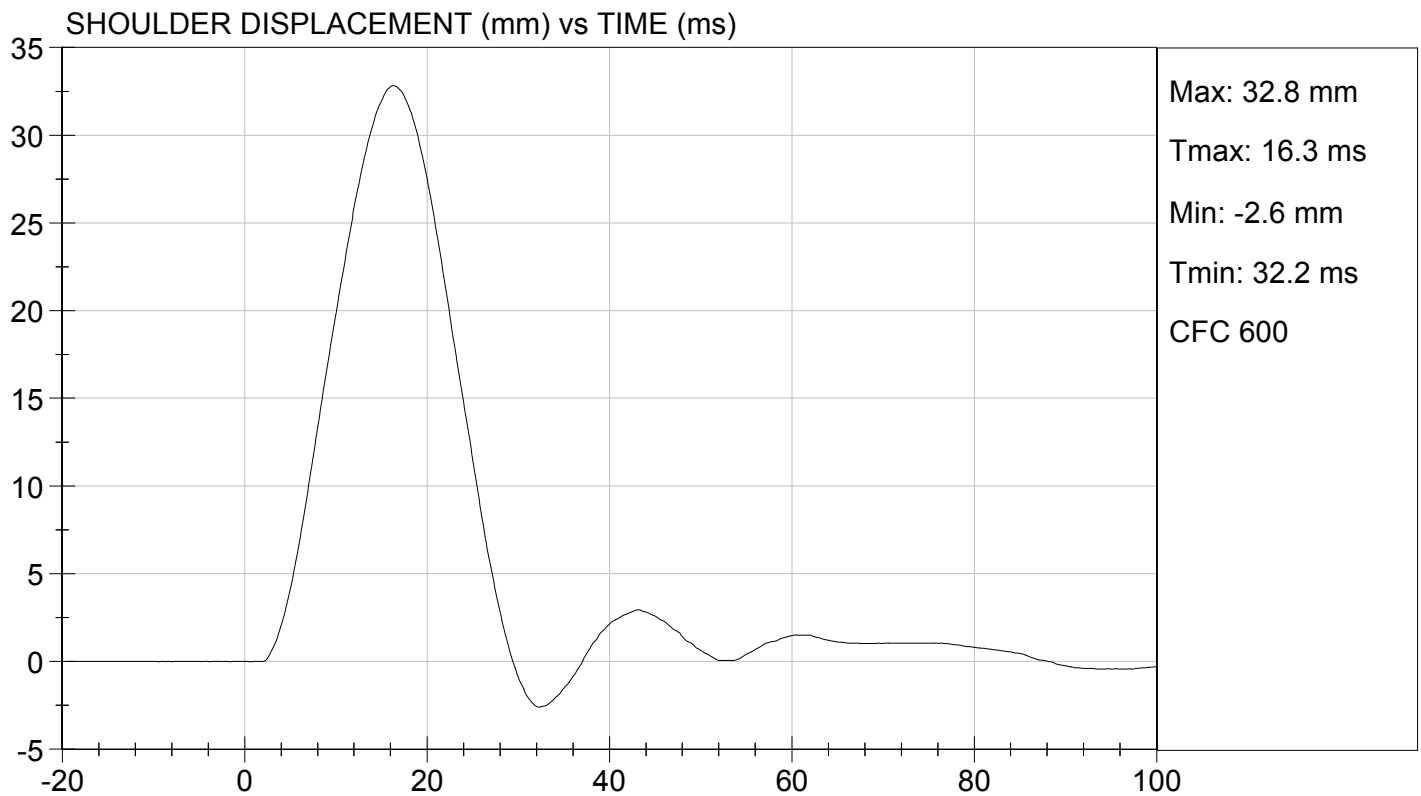
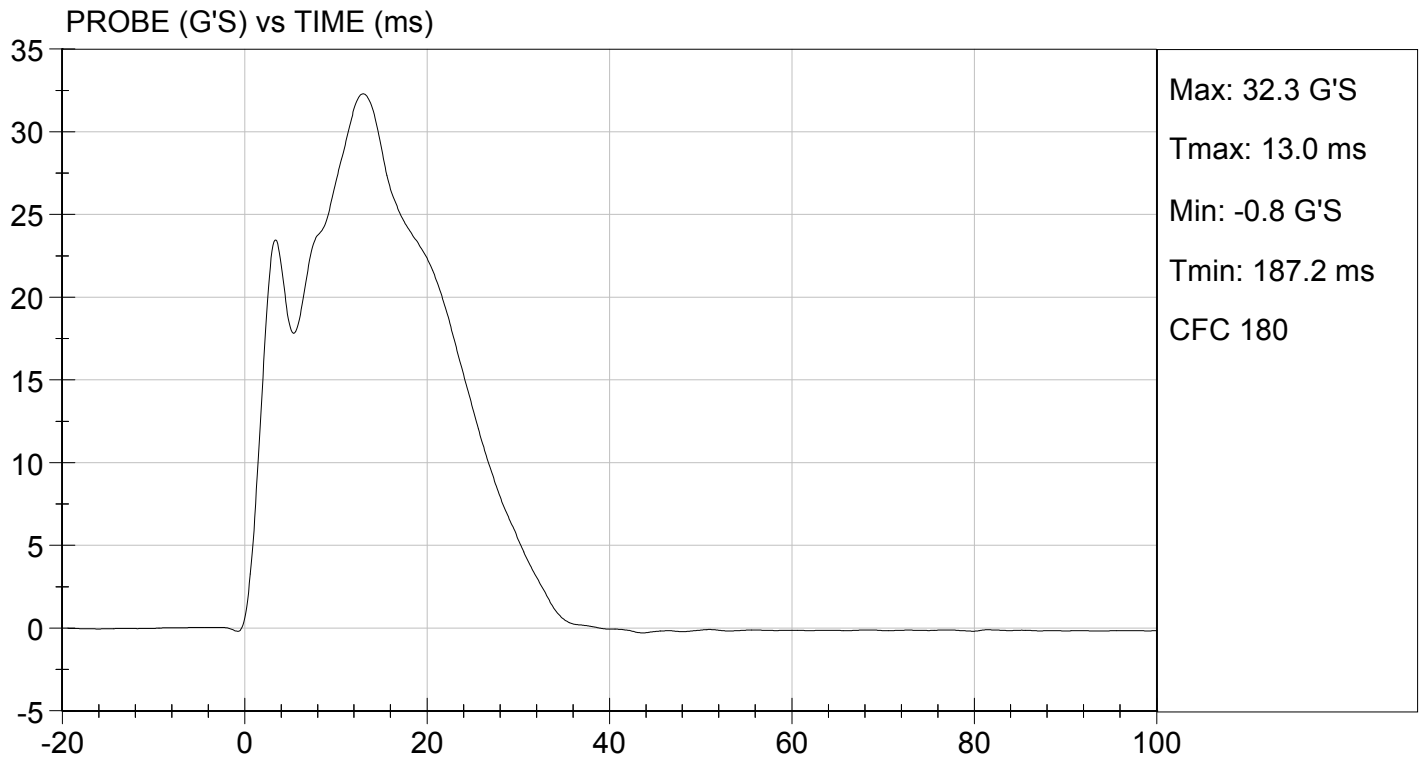
08/08/2012
 Test Date


 Approved By



TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

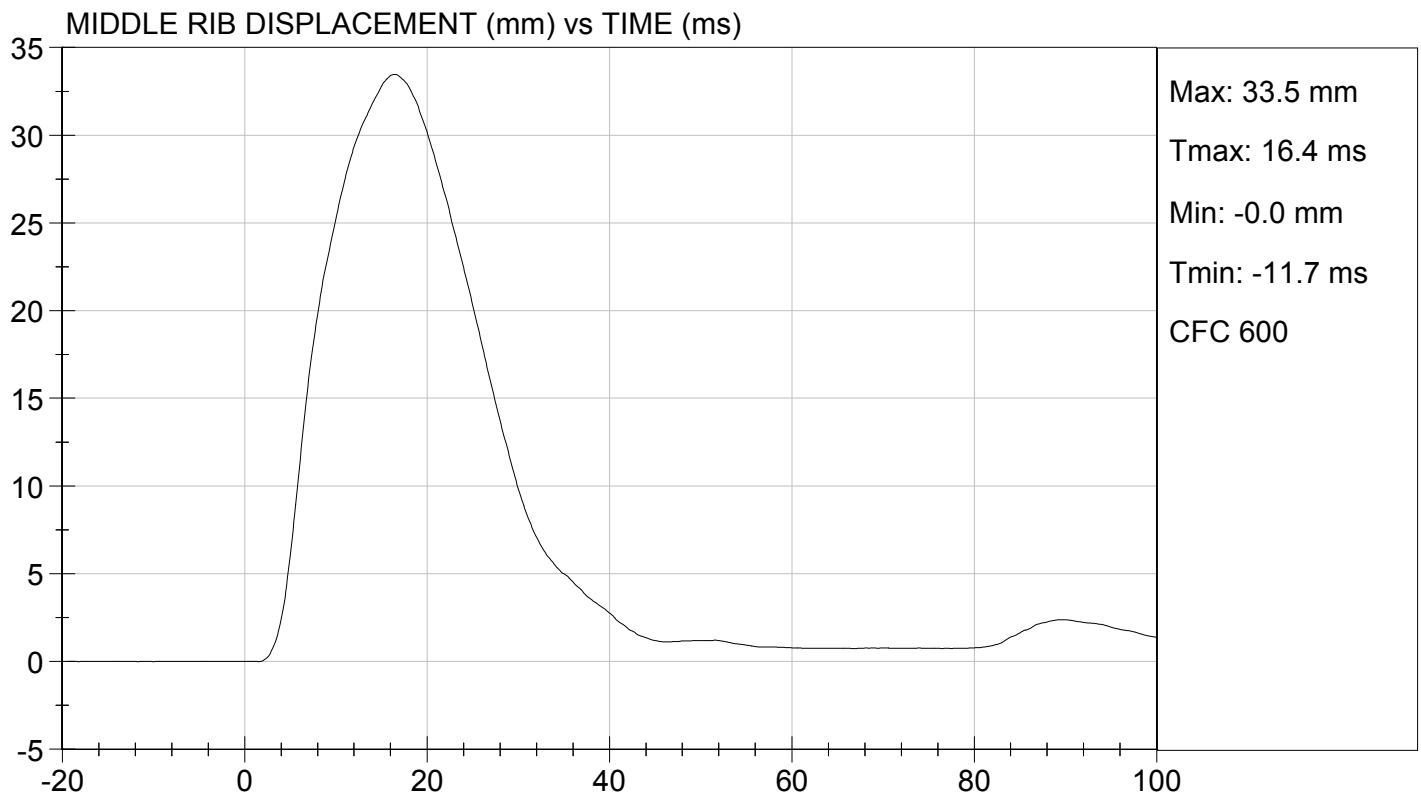
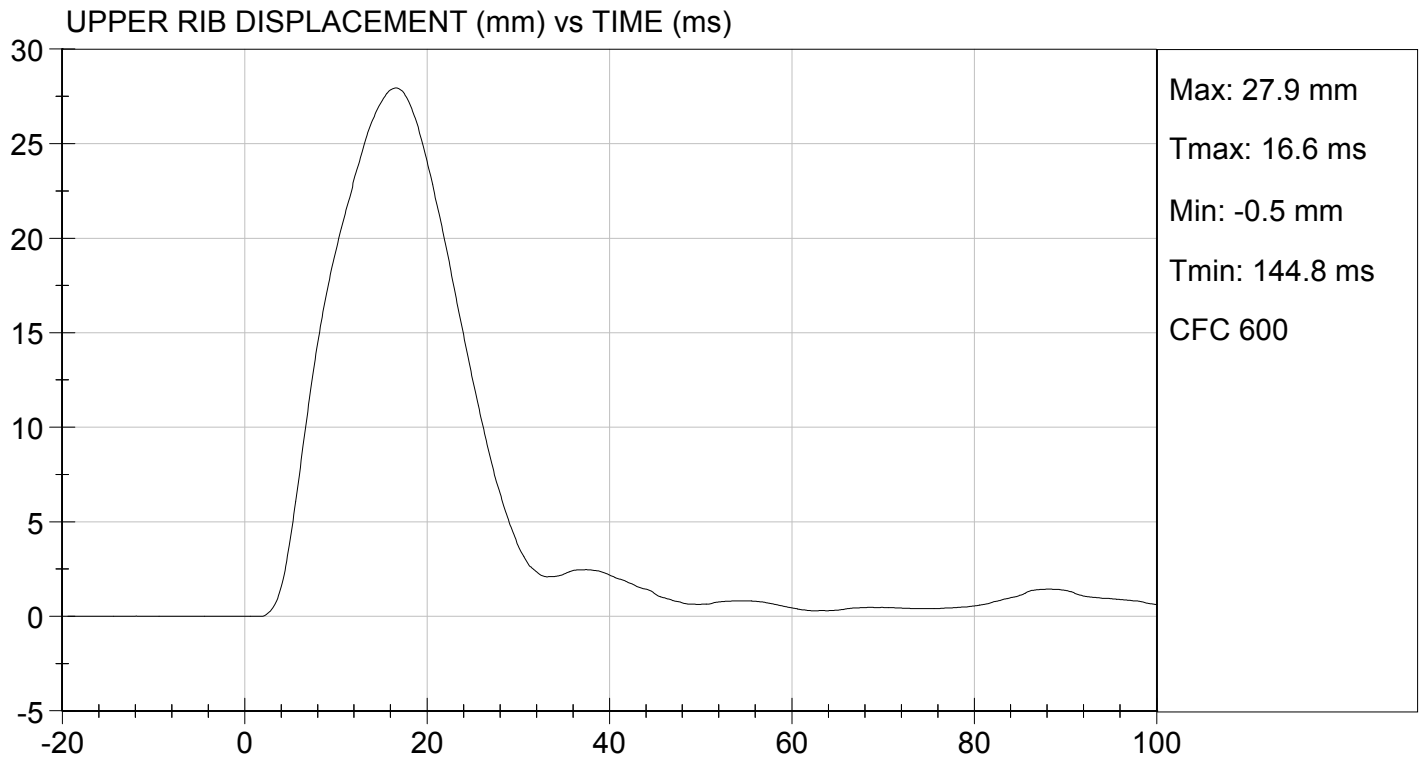
TEST DATE: 08/08/2012
TEST #: D122934





TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

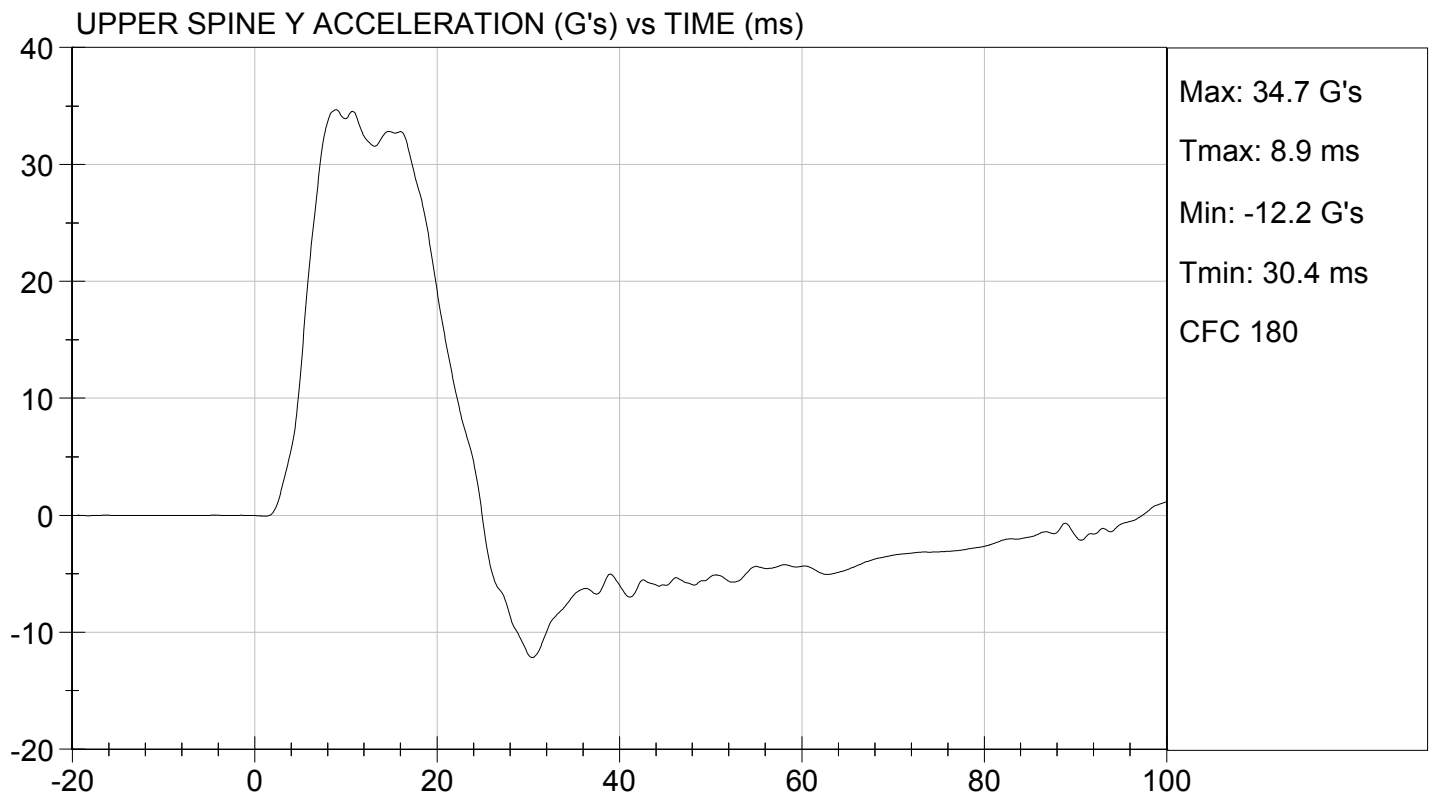
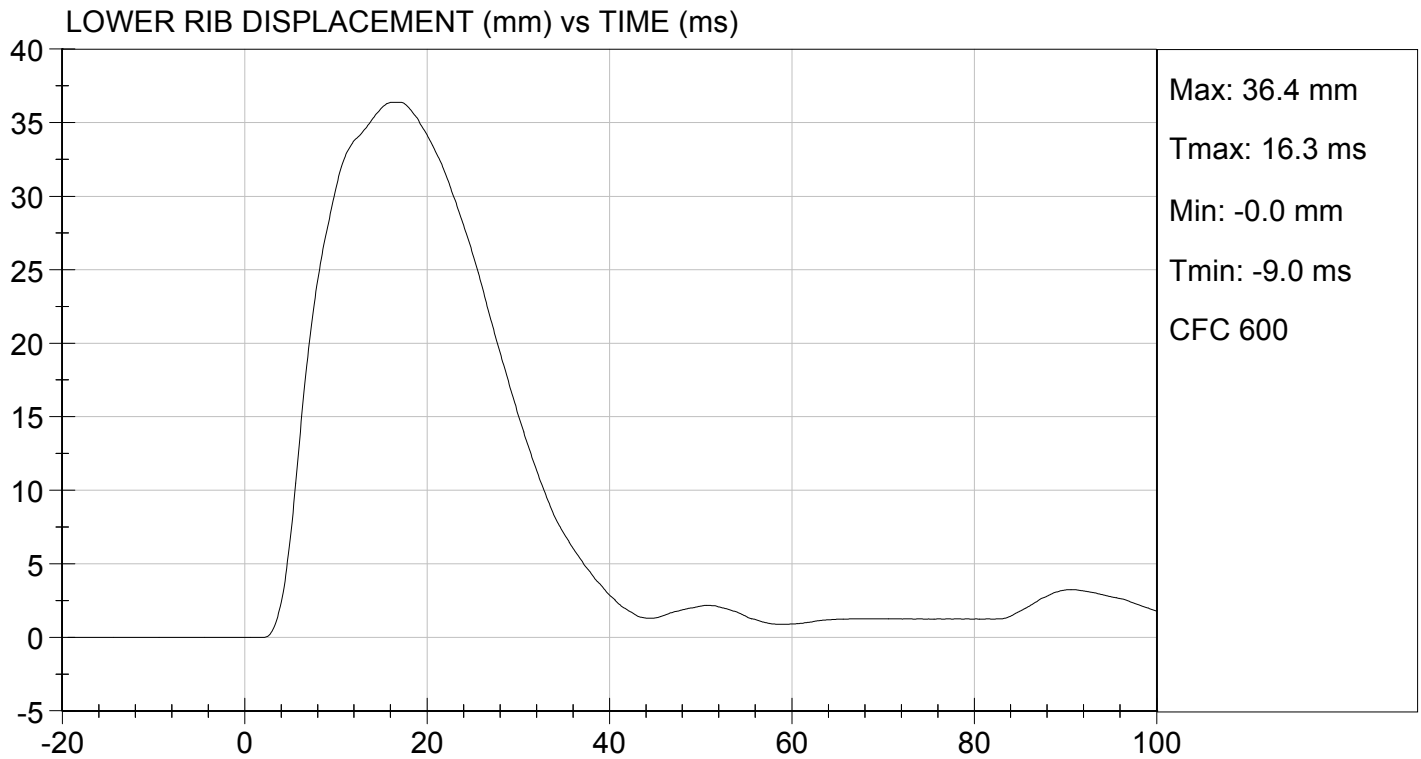
TEST DATE: 08/08/2012
TEST #: D122934





TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

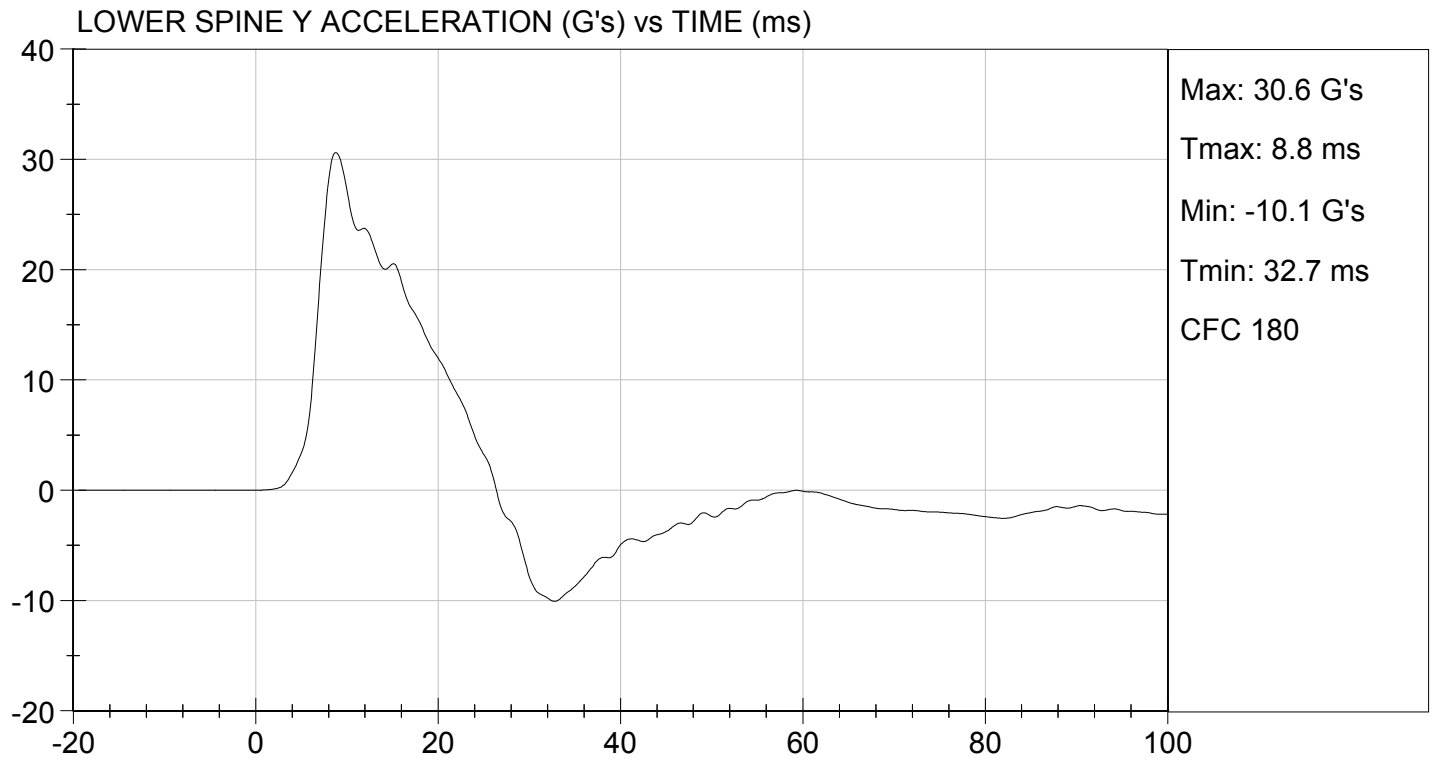
TEST DATE: 08/08/2012
TEST #: D122934





TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 08/08/2012
TEST #: D122934



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

ATD Serial No: 262

Test I.D: D122935

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	48	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	14 to 18	17	Pass
Upper Rib Displacement	mm	32 to 40	33	Pass
Middle Rib Displacement	mm	39 to 45	40	Pass
Lower Rib Displacement	mm	35 to 43	38	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	16	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	11	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

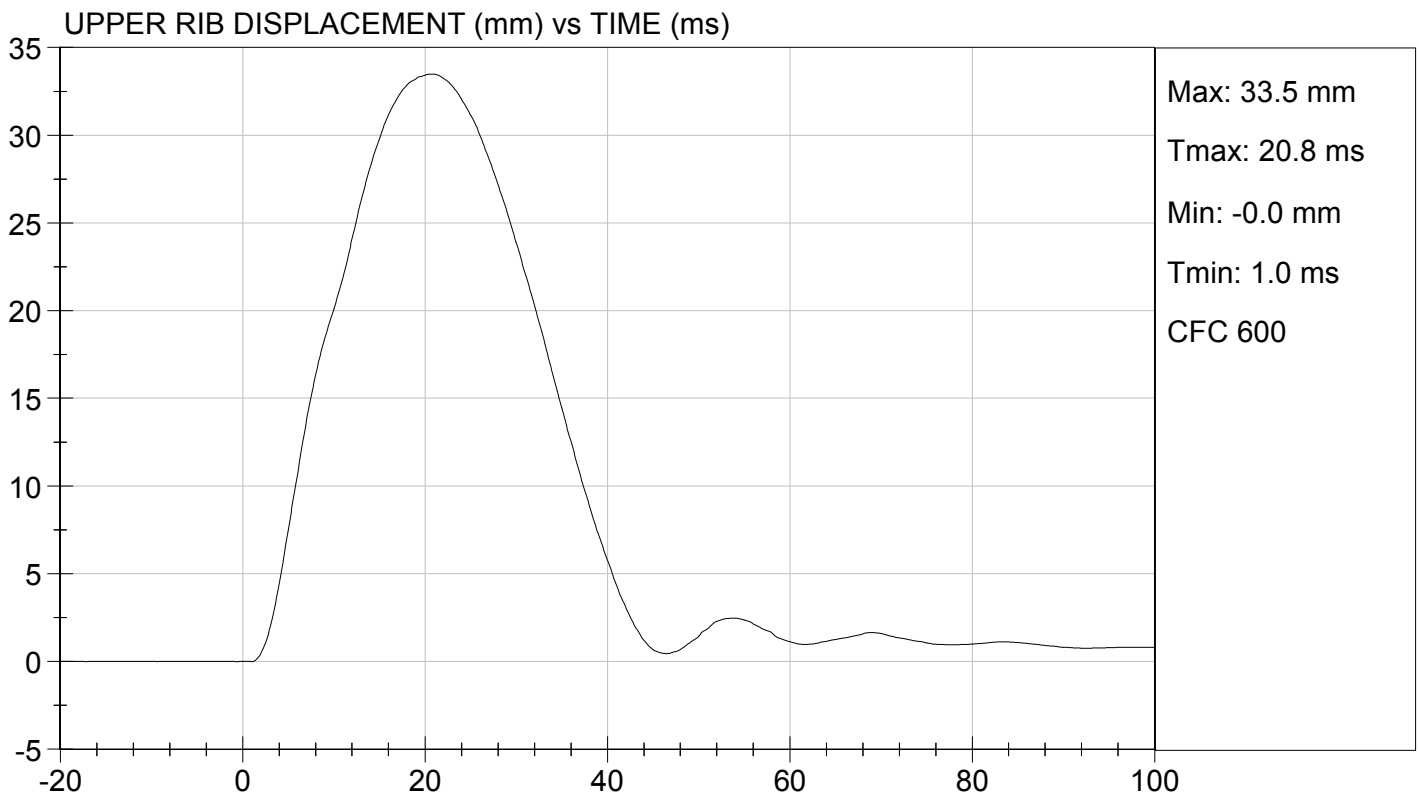
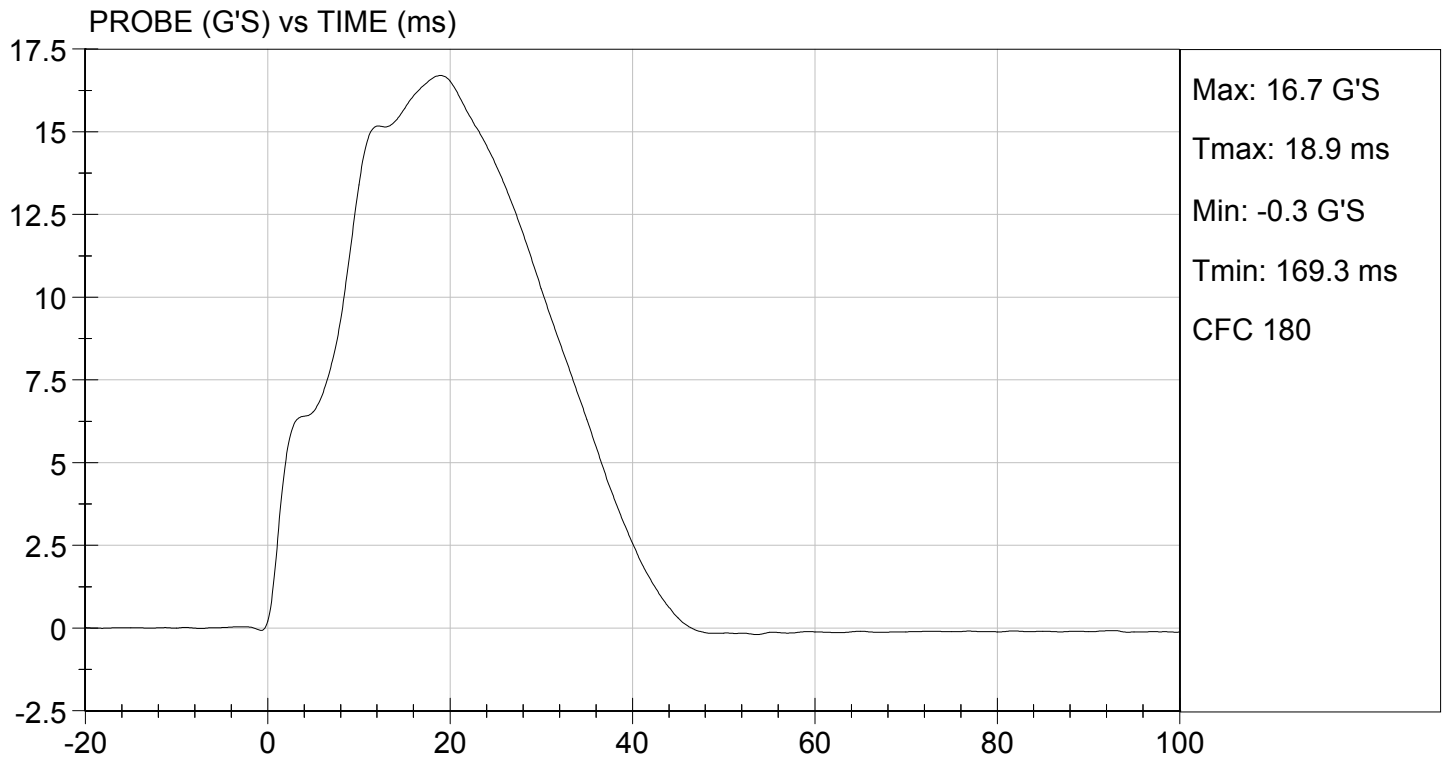
08/08/2012
Test Date

David Winkelbauer
Approved By



TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/08/2012
TEST #: D122935

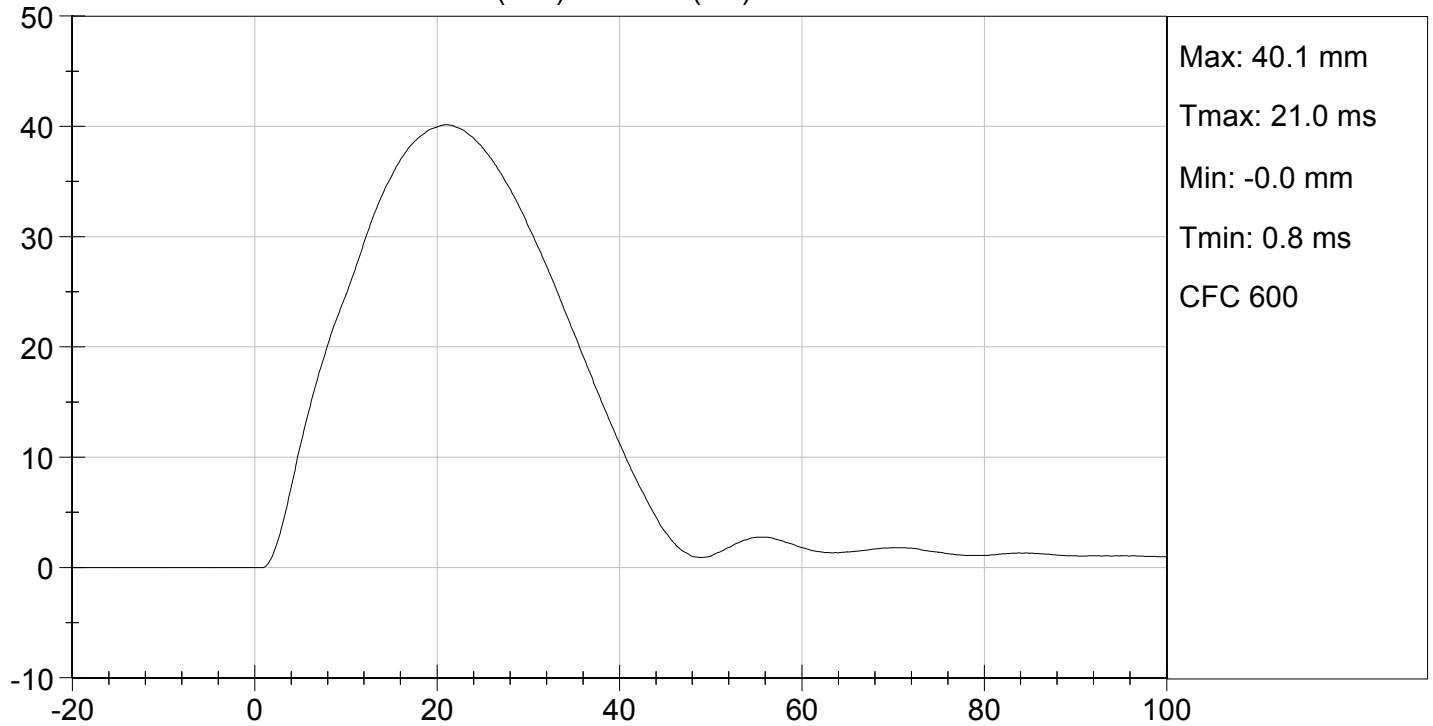




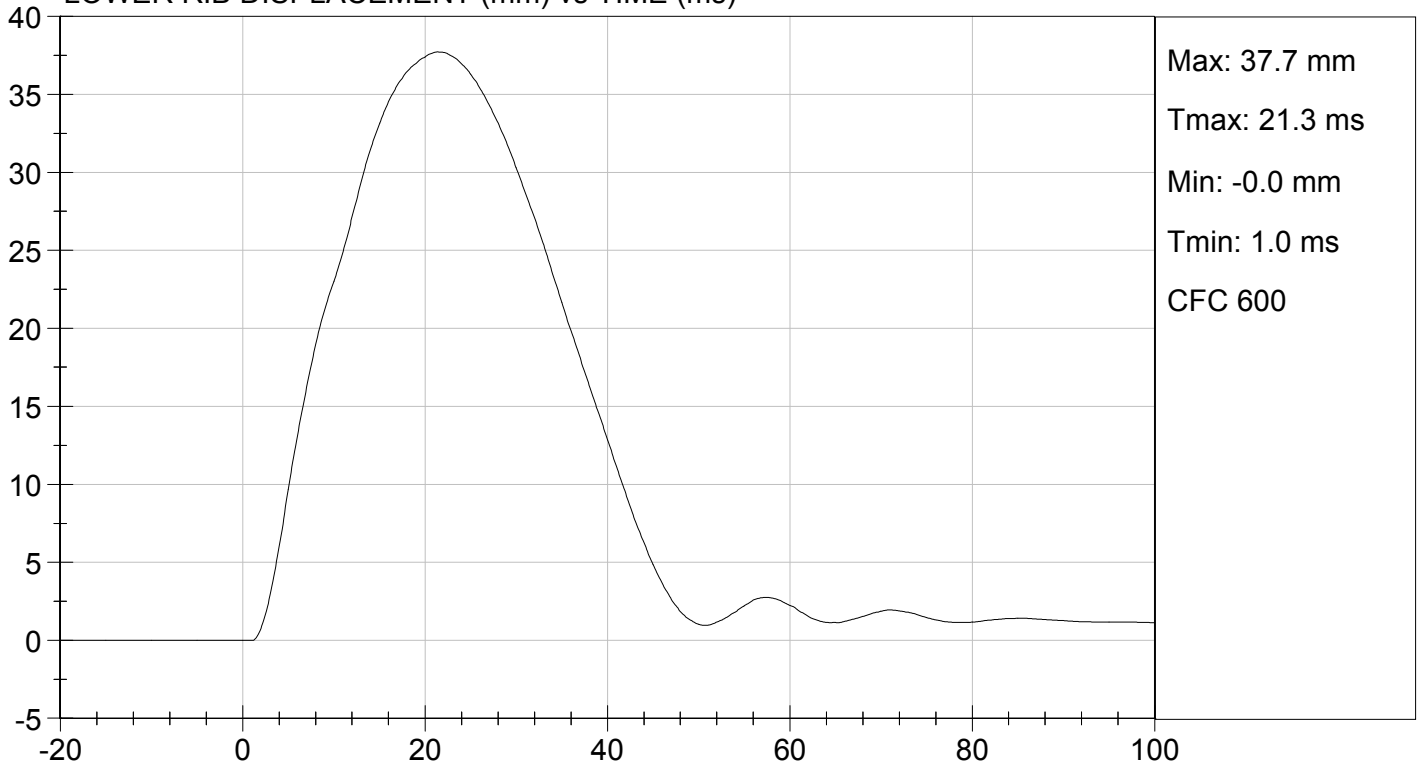
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

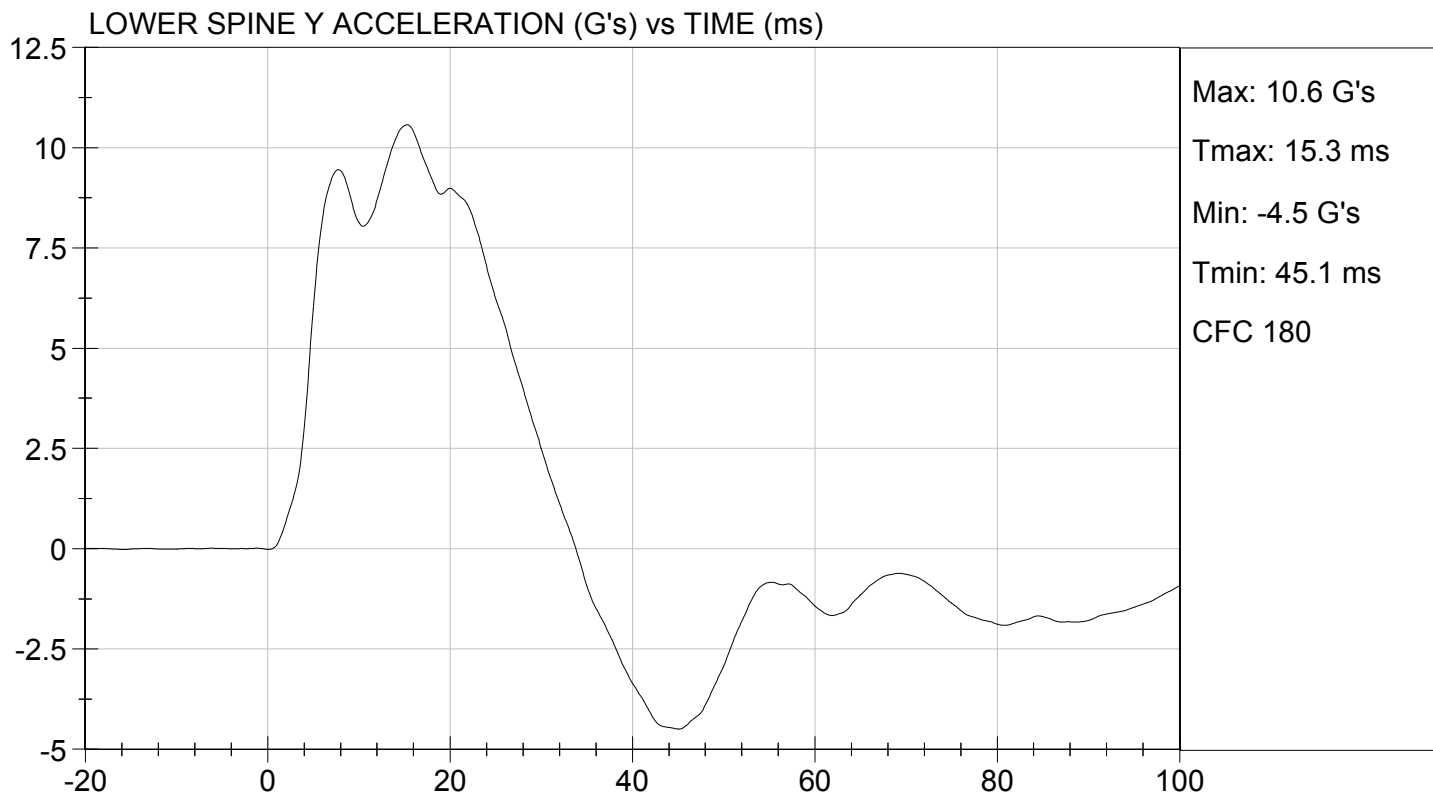
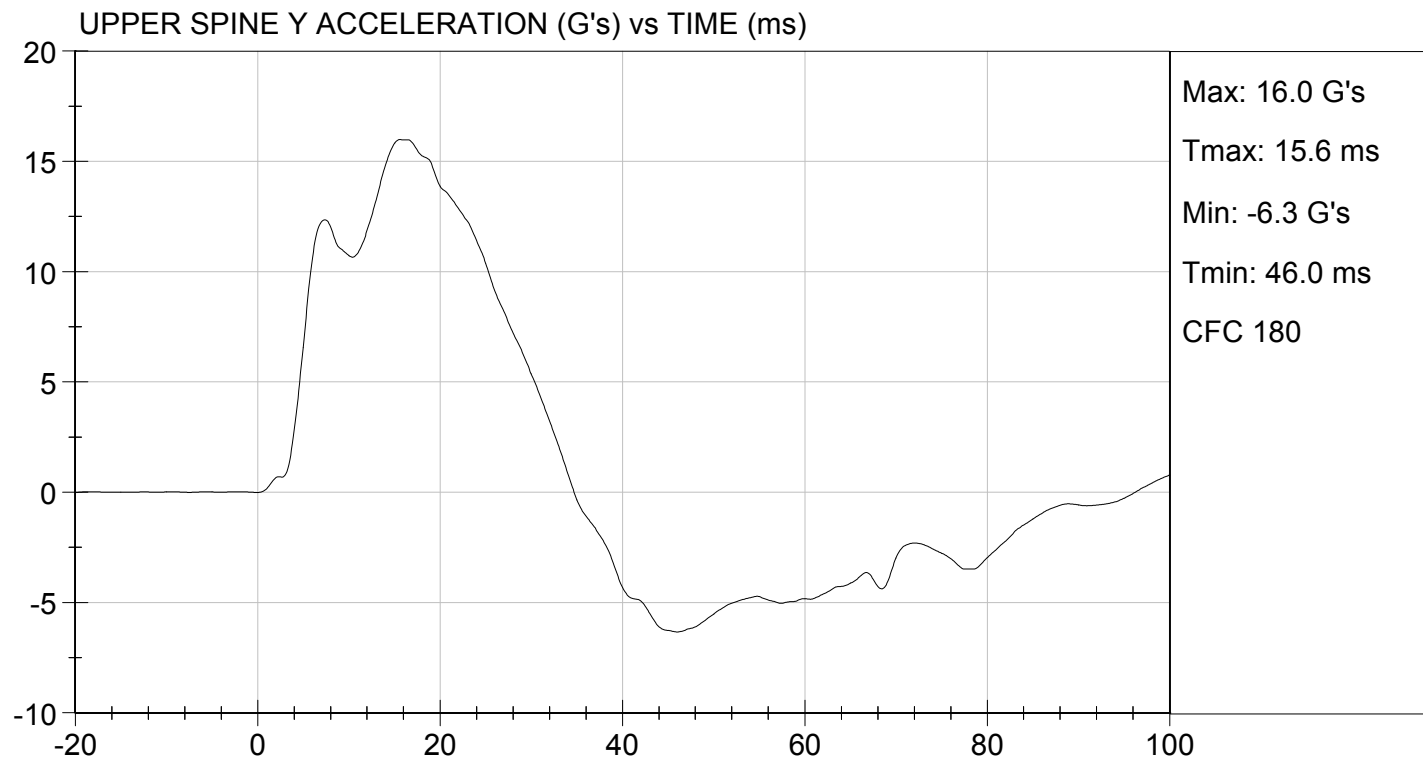
TEST DATE: 08/08/2012
TEST #: D122935

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)





MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 262

Test I.D: D122936

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	48	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	12 to 16	13	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	47	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	40	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	10	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

08/08/2012

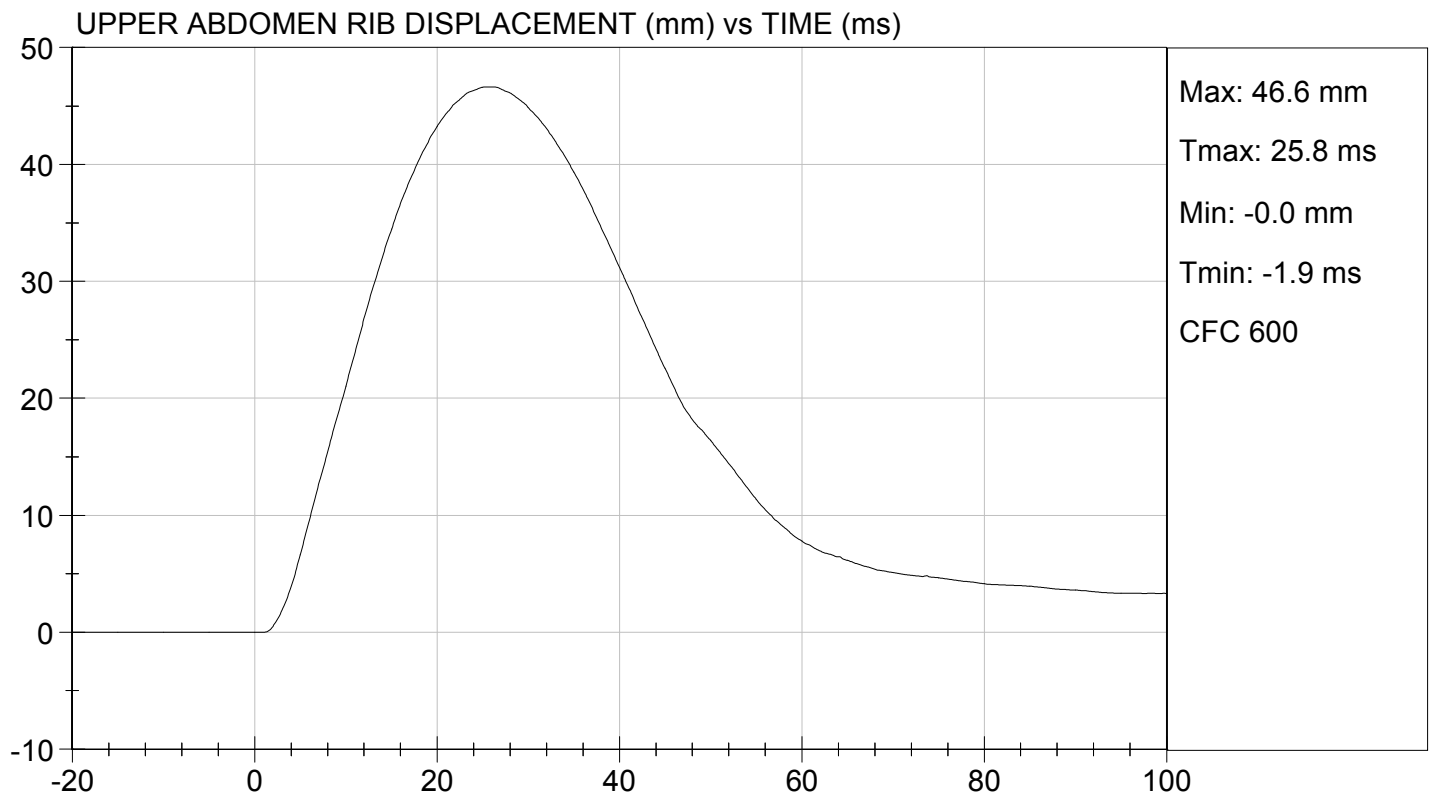
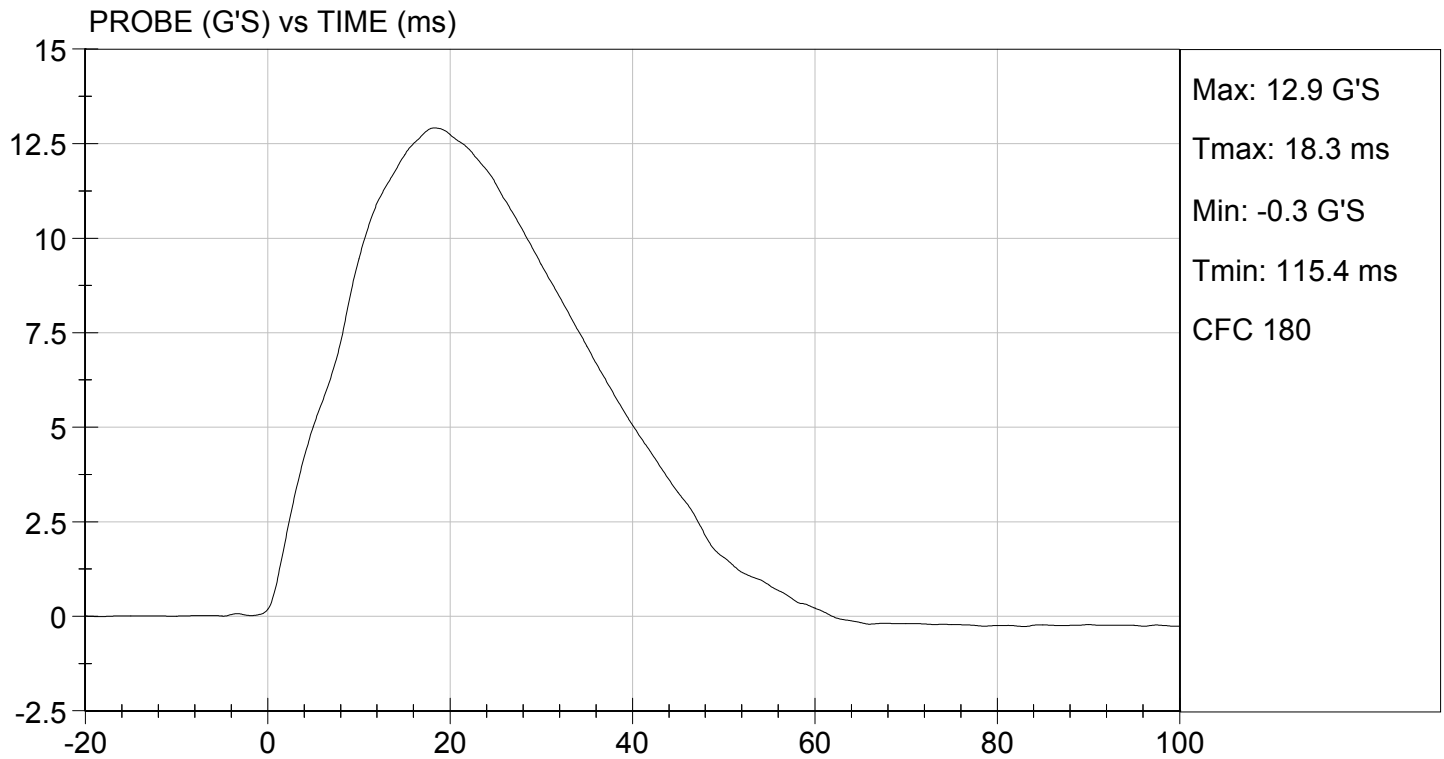
Test Date

David Winkelbauer
Approved By



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

TEST DATE: 08/08/2012
TEST #: D122936

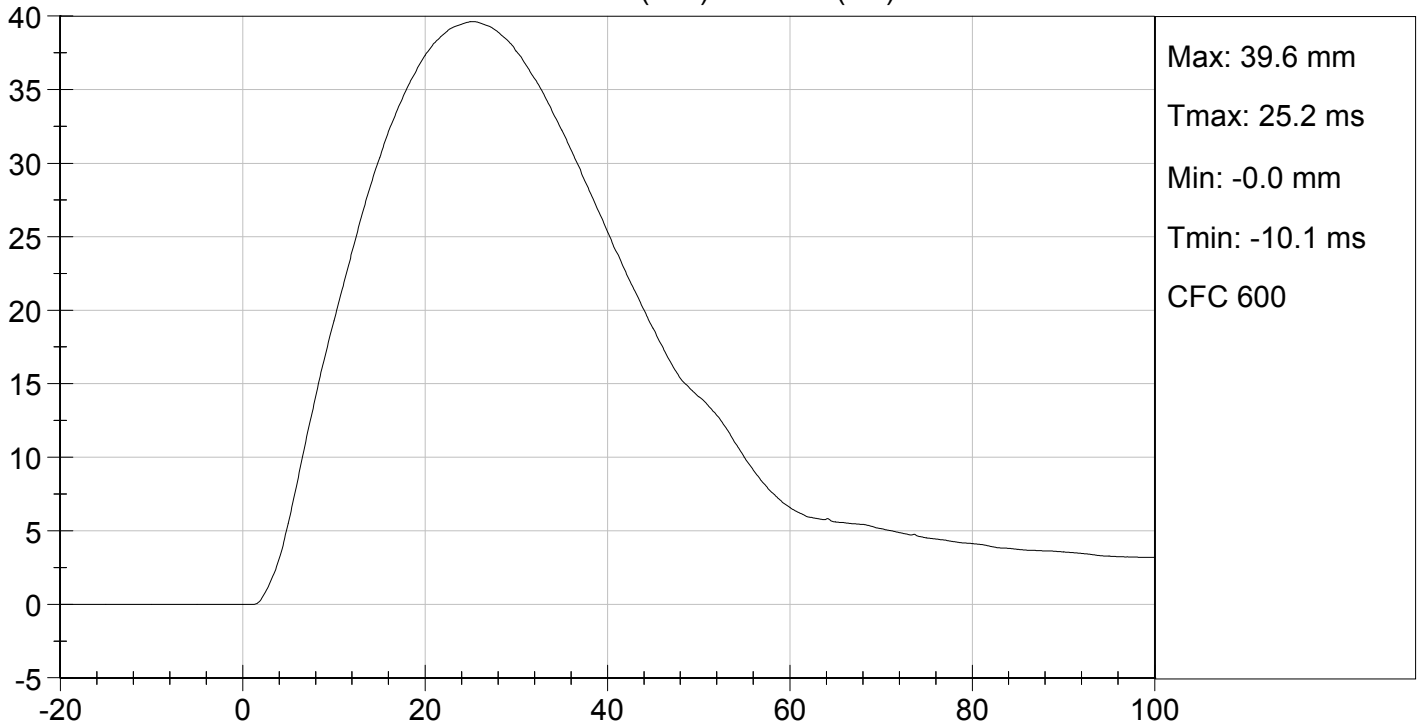




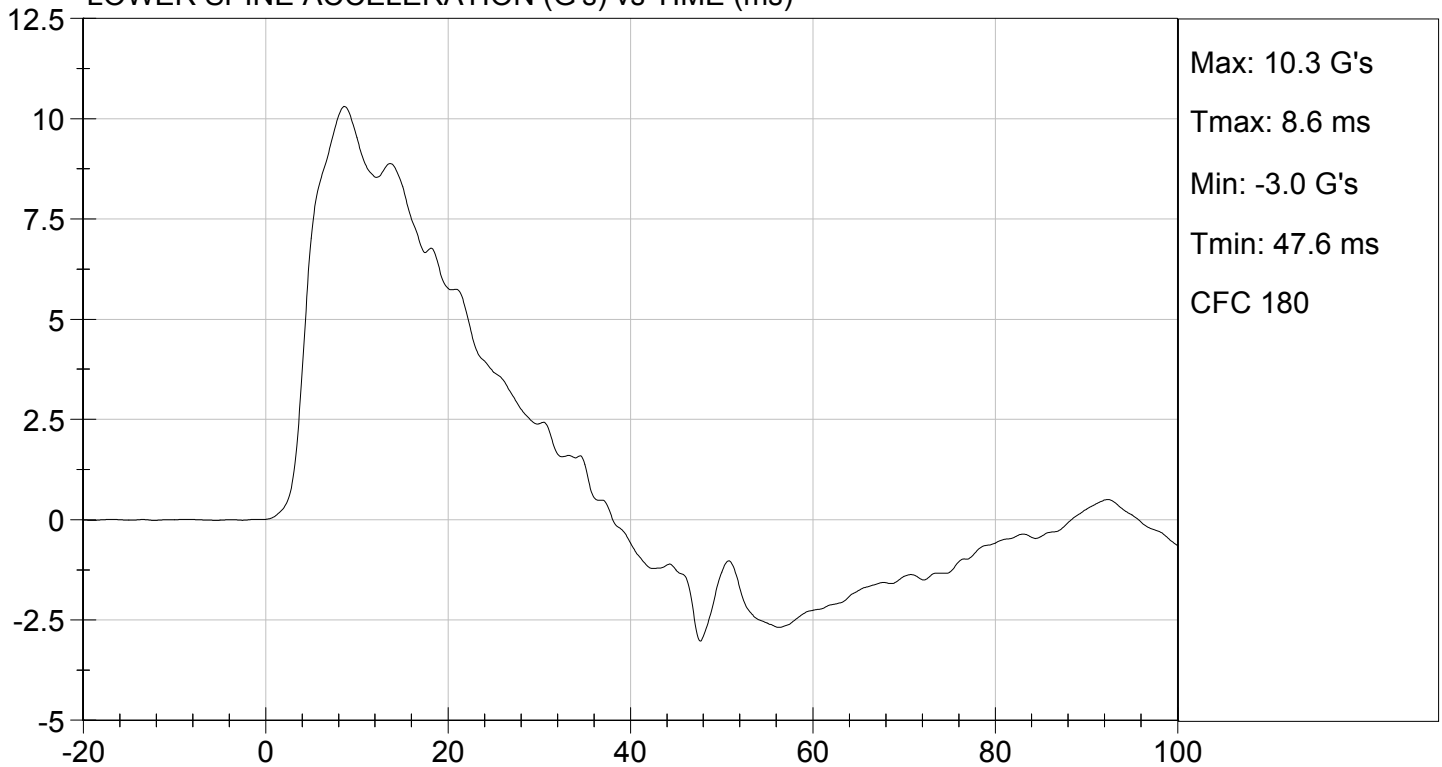
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 08/08/2012
TEST #: D122936

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: 262

Test I.D: D122937

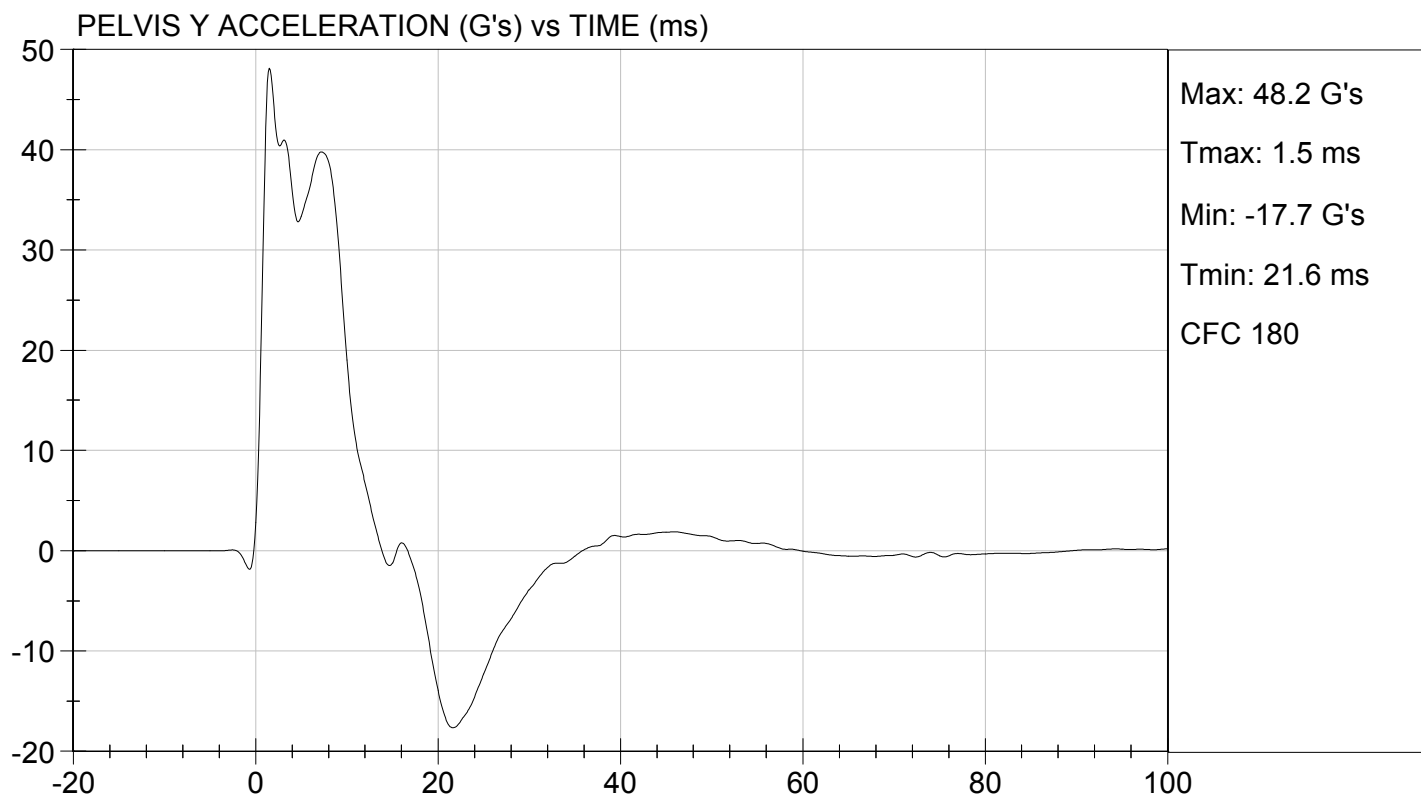
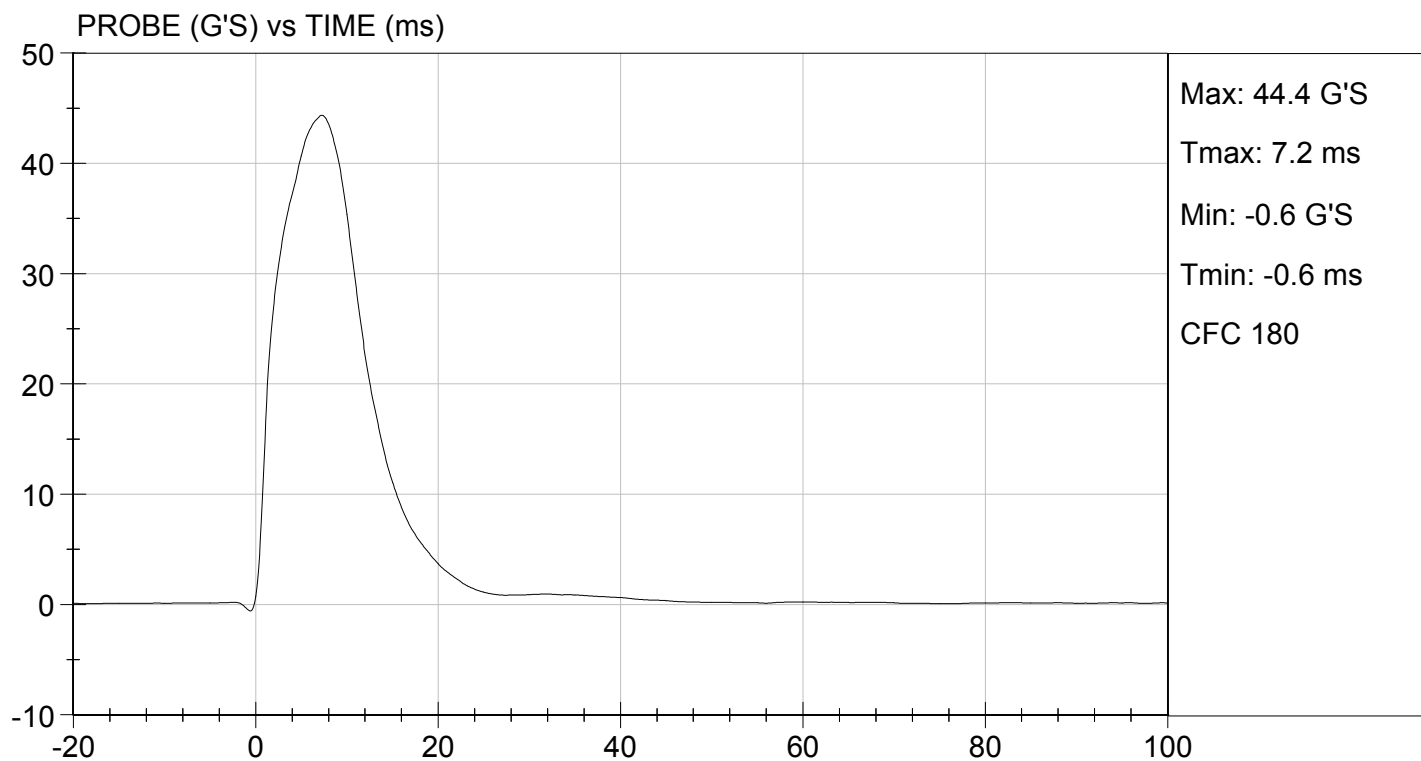
Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	6.60 to 6.80	6.71	Pass
Maximum Probe Acceleration	G's	38 to 47	44	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	40	Pass
Peak Acetabulum Force	N	3600 to 4300	4,049	Pass
Overall Test Results				Pass


Laboratory Technician

08/08/2012

Test Date

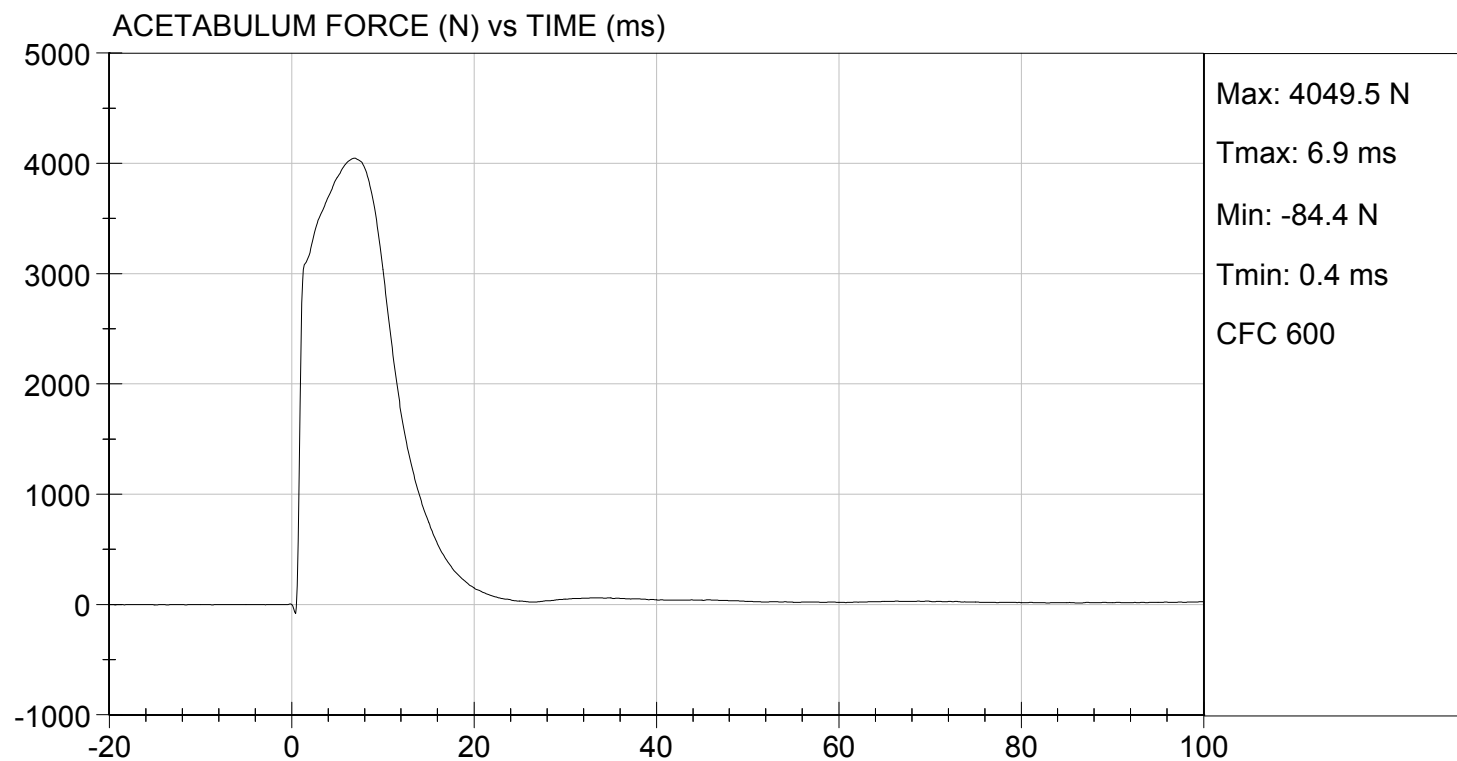

Approved By





TEST DESC: PELVIS IMPACT
VELOCITY: 22.00 ft/s, 6.71 m/s

TEST DATE: 08/08/2012
TEST #: D122937



MGA RESEARCH CORPORATION

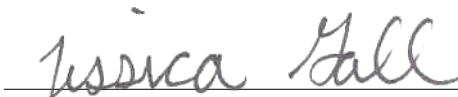
ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 262

Test I.D: D122938

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	36 to 45	37	Pass
Pelvis Y Acceleration	G's	28 to 39	30	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,275	Pass
Overall Test Results				Pass


Laboratory Technician

08/08/2012

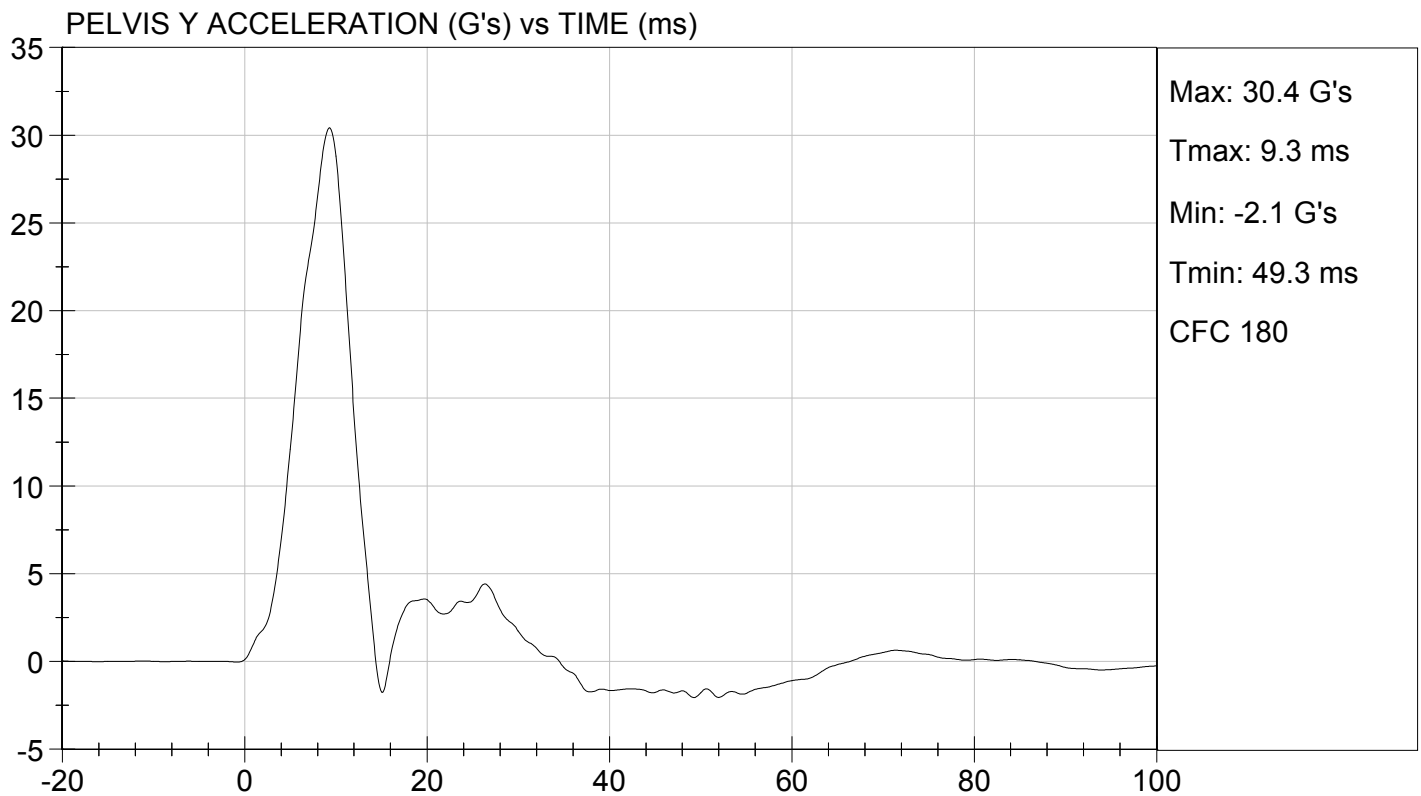
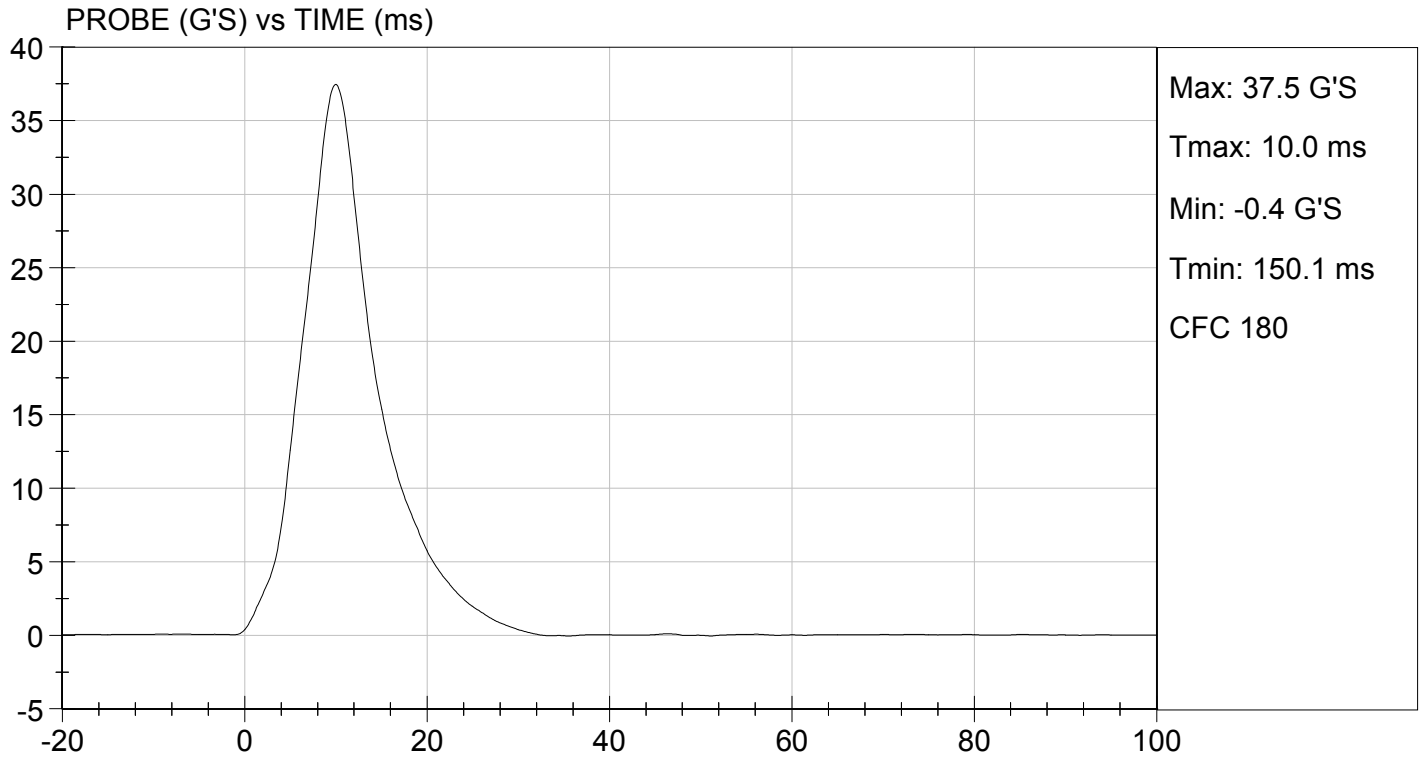
Test Date


Approved By



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

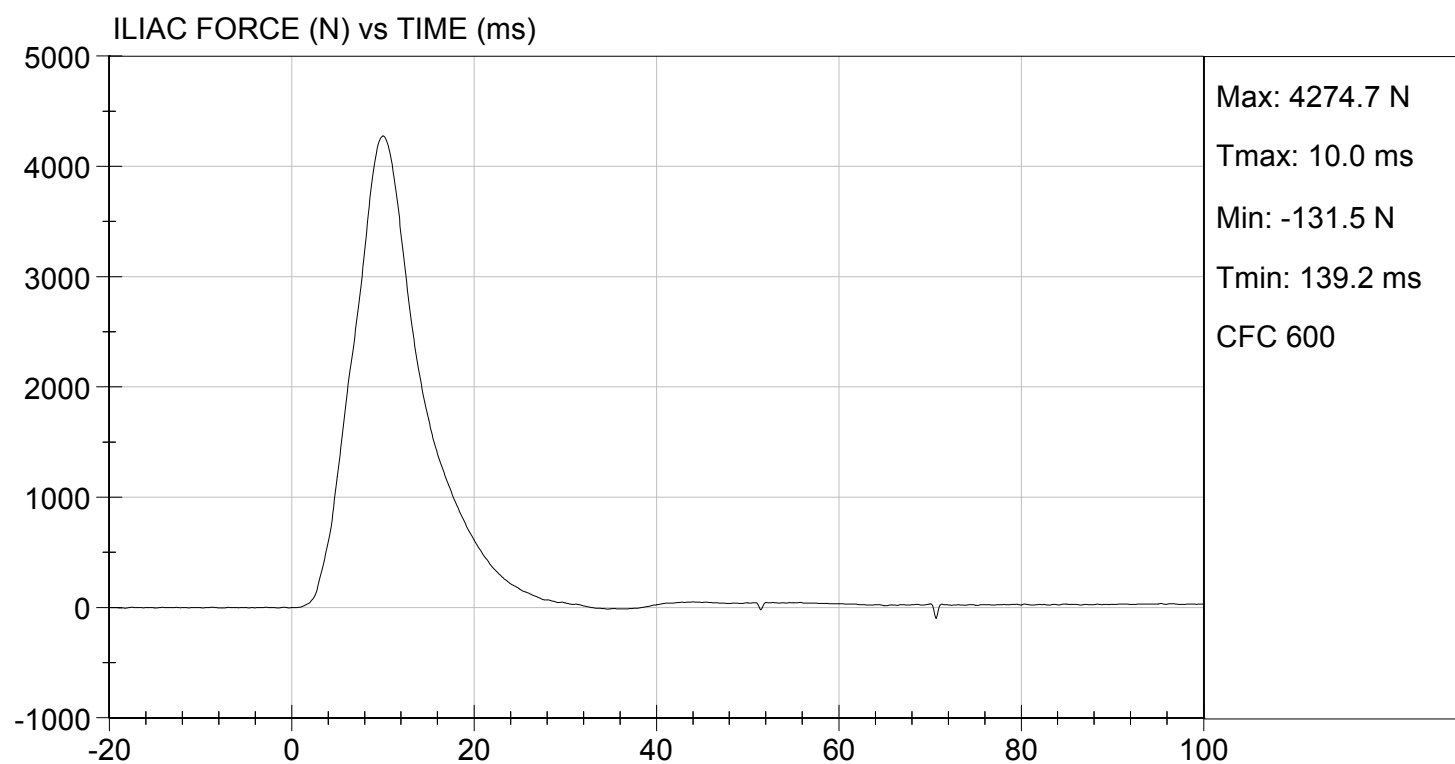
TEST DATE: 08/08/2012
TEST #: D122938





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

TEST DATE: 08/08/2012
TEST #: D122938



APPENDIX E

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

Table 1 – Dummy Instrumentation

			SID-IIs S/N: 262		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers		X	P73993	Endevco	02/29/12
		Y	P73994	Endevco	02/29/12
		Z	P73995	Endevco	02/29/12
Rib Displacement Transducers	Thorax	Upper	G257	FTSS	03/09/12
		Middle	G503	Servo	03/05/12
		Lower	G509	Servo	03/05/12
	Abdominal	Upper	G545	Servo	03/05/12
		Lower	G573	Servo	03/05/12
Lower Spine Accelerometers (T12)		X	P74014	Endevco	02/29/12
		Y	P74297	Endevco	02/29/12
		Z	P74302	Endevco	02/29/12
Acetabulum Load Cell		Y	ACG271	Denton	01/11/12
Illiatic Wing Load Cell		Y	IWG194	Denton	01/11/12

Table 2 – Vehicle Instrumentation

	Serial Number	Manufacturer	Calibration Date
Vehicle CG (X)	P63257	Endevco	04/23/12
Vehicle CG (Y)	P63256	Endevco	04/23/12
Vehicle CG (Z)	P63258	Endevco	04/23/12
Left Floor Sill (Y)	P47115	Endevco	03/13/12
A Pillar Sill (Y)	P66775	Endevco	07/31/12
A Pillar Low (Y)	P63516	Endevco	06/12/12
A Pillar Mid (Y)	P59251	Endevco	06/12/12
B Pillar Sill (Y)	P63397	Endevco	07/18/12
B Pillar Low (Y)	P66658	Endevco	06/13/12
B Pillar Mid (Y)	P66755	Endevco	06/14/12
Driver Seat Track (Y)	P59390	Endevco	06/12/12
Top of Engine (X)	P72806	Endevco	03/16/12
Top of Engine (Y)	P72805	Endevco	03/16/12
Firewall (Y)	P47889	Endevco	05/01/12
Right Roof (Y)	P63348	Endevco	05/01/12
Right Sill (Y)	P47881	Endevco	05/01/12
Floorpan @ Rear Axle (X)	P59320	Endevco	03/14/12
Floorpan @ Rear Axle (Y)	P59321	Endevco	03/14/12