

REPORT NUMBER: 214I-MGA-2010-007

**SAFETY COMPLIANCE TESTING FOR
FMVSS 214 INDICANT
SIDE IMPACT PROTECTION**

**HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC
2010 HYUNDAI SANTA FE GLS
NHTSA NUMBER: MA0520**

**PREPARED BY:
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Test Date: February 10, 2010

Report Date: March 10, 2010

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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WASHINGTON, D.C. 20590**

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Date of Acceptance

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16. Abstract A 55/28 km/h 90° Moving Deformable Barrier side impact was conducted on the subject 2010 Hyundai Santa Fe GLS to obtain new car assessment and research data indicant of FMVSS No. 214D performance. The test was conducted at MGA Research Corporation, in Burlington, Wisconsin, on February 10, 2010. The impact velocity of the Moving Deformable Barrier (MDB) was 62.4 km/h, and the ambient temperature at the struck side (drivers) of the vehicle was 21°C. The target vehicle's maximum post test static crush was 293 mm at level 3. The test vehicle's occupant performance is as follows: <table style="margin-left: auto; margin-right: auto; border: none; width: 80%;"> <thead> <tr> <th></th> <th style="text-align: center;"><u>DRIVER</u></th> <th style="text-align: center;"><u>PASS.</u></th> </tr> </thead> <tbody> <tr> <td>Left Upper Rib (LUR) Accel., g</td> <td style="text-align: center;">27.6</td> <td style="text-align: center;">34.3</td> </tr> <tr> <td>Left Lower Rib (LLR) Accel., g</td> <td style="text-align: center;">34.8</td> <td style="text-align: center;">45.8</td> </tr> <tr> <td>Lower Spine (T₁₂) Accel., g</td> <td style="text-align: center;">30.7</td> <td style="text-align: center;">40.4</td> </tr> <tr> <td>Thoracic Trauma Index (TTI)</td> <td style="text-align: center;">33</td> <td style="text-align: center;">43</td> </tr> <tr> <td>Pelvis (PEV) Accel., g</td> <td style="text-align: center;">45.8</td> <td style="text-align: center;">56.4</td> </tr> <tr> <td>HIC</td> <td style="text-align: center;">36</td> <td style="text-align: center;">130</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 doors did not open during the side impact event.					<u>DRIVER</u>	<u>PASS.</u>	Left Upper Rib (LUR) Accel., g	27.6	34.3	Left Lower Rib (LLR) Accel., g	34.8	45.8	Lower Spine (T ₁₂) Accel., g	30.7	40.4	Thoracic Trauma Index (TTI)	33	43	Pelvis (PEV) Accel., g	45.8	56.4	HIC	36	130
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17. Key Words FMVSS 214 Indicant Side Impact Side Impact Hybrid III Dummy (SID/HIII) Occupant Side Impact Protection		18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Adm. Technical Ref. Division, 1200 New Jersey Ave, SE Washington, D.C. 20590																						
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SECTION 1

PURPOSE AND TEST PROCEDURE

PURPOSE

This side impact test was conducted as part of the MY' 2010 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 2010 Hyundai Santa Fe GLS manufactured by Hyundai Motor Manufacturing Alabama, LLC.

TEST PROCEDURE

The side impact test was conducted in accordance with the Laboratory Test Procedure for New Car Assessment Program Side Impact Testing dated November 2002 and the corresponding MGA Research Corporation Test Procedure MGA-NHTSA5. The procedures for receiving, inspection, testing, and reporting of test results are described in the test procedures and are not repeated in this report.

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

SECTION 2

SUMMARY OF FMVSS 214 INDICANT TEST

A model year 2010 Hyundai Santa Fe GLS was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 62.4 km/h. The specified impact velocity range is from 61.1 to 62.7 km/h. The test (target) vehicle was stationary and positioned 63° to the line of forward motion. The weight of the vehicle as tested was 1903.8 kg and the test weight of the MDB was 1361.5 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on February 10, 2010.

One (1) real-time motion picture camera and nine (9) high-speed motion picture cameras were used to document the impact event. The pre-test and post-test conditions were recorded by one (1) real-time motion picture camera. Camera locations and pertinent camera information are documented in the data sheets. Pre- and post-test photographs of the vehicle and Side Impact Dummies (SID/HIIIs) can be found in Appendix A. Two 50th percentile adult male SID/HIIIs were placed in the driver and left rear passenger designated seating positions according to instructions specified in the Laboratory Test Procedure for New Car Assessment Program Side Impact Testing dated November 2002. Each SID/HIII was instrumented in the following locations:

- Left Upper Rib (LUR) uni-axial accelerometer (Y-axis primary and redundant)
- Left Lower Rib (LLR) uni-axial accelerometer (Y-axis primary and redundant)
- Lower Thoracic Spine (T12) uni-axial accelerometer (Y-axis primary and redundant)
- Pelvic (PEV) section uni-axial accelerometer (Y-axis primary and redundant)
- Head Center of Gravity (CG) tri-axial accelerometers (X, Y and Z axes primary and redundant)
- Upper Neck load cell (Fx, Fy, Fz, Mx, My, Mz)

The test vehicle was instrumented with twenty (20) structural accelerometers and the MDB was instrumented with five (5) accelerometers and two (2) contact switches on the bumper to compare left side to right side bumper impact timing. All data channels were recorded with a fully self contained on-board DTS TDAS Pro Data Acquisition System. The data was digitally sampled at 10,000 samples per second and processed per Appendix V of the Test Procedure.

2.2 GENERAL COMMENTS

The test vehicle sustained a maximum static crush of 293 mm at level 3, 1500 mm rearward of the vertical impact point. The driver and passenger SID/HIIIs, Serial Numbers 272 and 271 respectively, were calibrated just prior to this test.

Appendix A contains the still photograph prints. Appendix B contains the SID/HIII response data traces. Appendix C contains the dummy calibration data.

The occupant data is summarized below:

ATD position	HIC	T ¹	T ²	TTI (G's)	Peak Pelvis (G's)
Driver	36	47.9	83.9	33	45.8
Passenger	130	48.4	80.3	43	56.4

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Information	Left Front (Driver)		Left Rear (Passenger)	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	No	No	
Side Torso/Pelvis Airbag	Yes	Yes	No	
Curtain Airbag	Yes	Yes	Yes	Yes

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

TEST NOTES

There was no valid data collected for:

Driver Neck Force Y – Questionable Data, Excessive Noise

Left Front Sill Y

Driver Seat Track Y after 20 msec.

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010

TEST VEHICLE INFORMATION

Make	Hyundai
Model	Santa Fe
Body Style	MPV
NHTSA No.	MA0520
VIN	5NMSG3AB5AH349324
Color	Phantom Black Metallic
Delivery Date	1/20/2010
Odometer Reading (mile)	11
Dealer	Transitowne Hyundai
Transmission	Automatic
Final Drive	Front
Number of Cylinders	4
Engine Displacement (L)	2.4
Engine Placement	Lateral
Automatic Door Locks (ADL)	Yes
Owner's Manual Details Instructions on Disabling ADLs	No

TEST VEHICLE OPTIONS

Driver Front Airbag	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso/Pelvis Airbag	Yes
Rear Passenger Side Curtain Airbag	Yes
Rear Passenger Side Torso Airbag	No
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Anti-lock Brakes	Yes
Traction Control	Yes
All Wheel Drive	No
Power Seats	No
Pretensioners	Yes
Load Limiters	Yes
Bucket Seats	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Hyundai Motor Manufacturing Alabama, LLC
Date of Manufacture	Dec/07/09

GVWR (kg)	2230
GAWR Front (kg)	1350
GAWR Rear (kg)	1450

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Folding		
Number Of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				420
Cargo Wt. (RCLW) (kg)				80

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

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	479.0	360.2		533.0	469.0	
Right	kg	476.3	353.3		471.3	430.5	
Ratio	%	57.2	42.8		52.8	47.2	
Totals	kg	955.3	713.5	1668.8	1004.3	899.5	1903.8

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1668.8
Weight of 2 P572M ATDs	kg	161.5
Rated Cargo/Luggage Weight (RCLW)	kg	80
Calculated Vehicle Target Weight (TVTW)	kg	1910.3

* Actual As Tested Weight (ATW) will be TVTW -5/-10 kg

Weight of Ballast in Trunk: 68.9 kg

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	822	823	822	826	1154
As Tested	mm	812	820	784	798	1276
Fully Loaded	mm	811	819	784	797	

TEST VEHICLE VERTICAL IMPACT LINE DATA

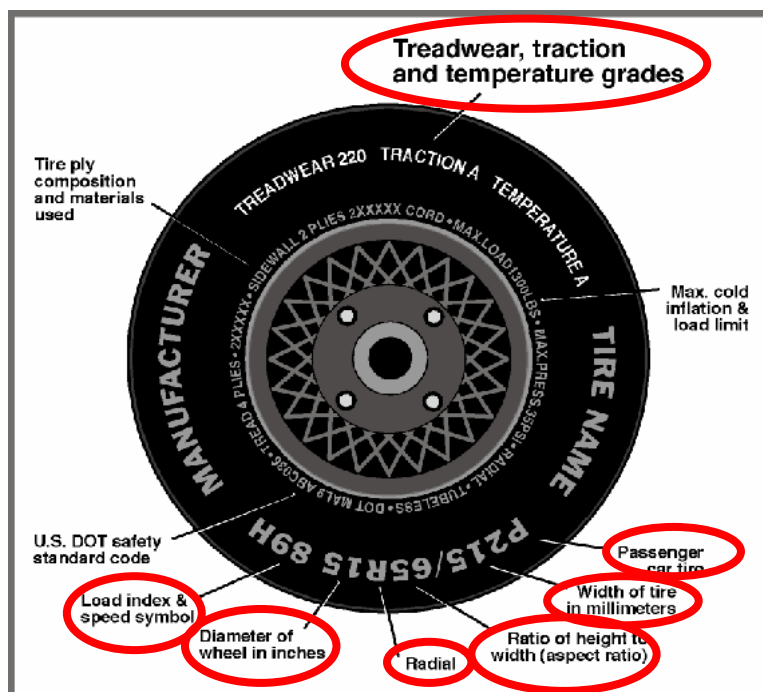
Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2700
Target Impact Point Aft of Front Axle	mm	410
Actual Impact Point Aft of Front Axle	mm	400

DATA SHEET NO. 2

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold / Test Pressure (kPa)	230	230
Recommended Tire Size	P235/65R17	P235/65R17
Tire Size on Vehicle	P235/65R17	P235/65R17
Tire Manufacturer	Kumho	Kumho
Tire Name	Solus KL21	Solus KL21
Tire Type	Passenger	Passenger
Tire Width (mm)	235	235
Ratio of Height to Width (aspect ratio)	65	65
Radial	R	R
Wheel Diameter	17	17
Load Index & Speed Symbol	103T	103T
Treadwear	500	500
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 3

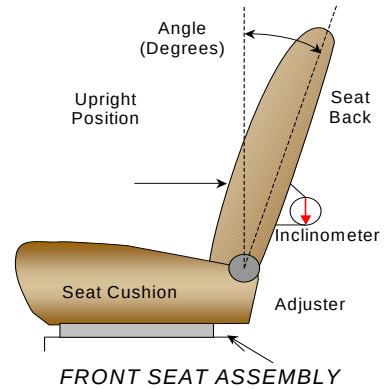
TEST VEHICLE INFORMATION

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010

NORMAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated placement. The procedure is as follows: For the driver, set the seat back in the 12th detent with the forward-most detent defined as 0. For the 2nd row passenger, set the seat back in the 7th detent with the forward-most detent defined as 0.

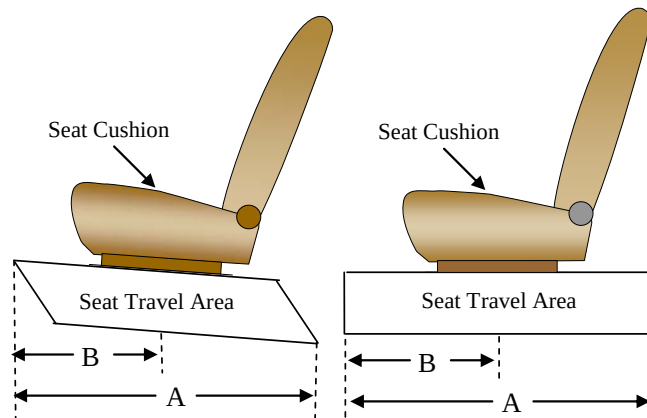


Driver seat back placement: 12th detent (forward-most detent defined as 0)

Passenger seat back placement: 7th detent (forward-most detent defined as 0)

SEAT FORE/AFT POSITIONS

	Total Fore/Aft Travel	Placed in position #
Driver Seat	24 detents	11 th detent (forward-most as 0)
Rear Seat	Fixed	Fixed



DATA SHEET NO. 3 (CONTINUED)

TEST VEHICLE INFORMATION

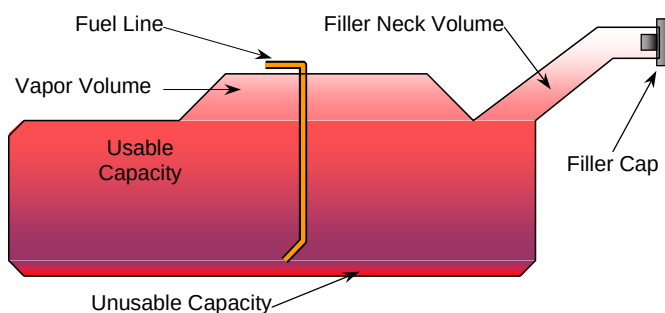
Test Vehicle: 2010 Hyundai Santa Fe GLS
Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
Test Date: 2/10/2010

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	68.0
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	62.6 to 63.9
Actual Amount of Solvent used	62.8
1/3 of Usable Capacity	22.7

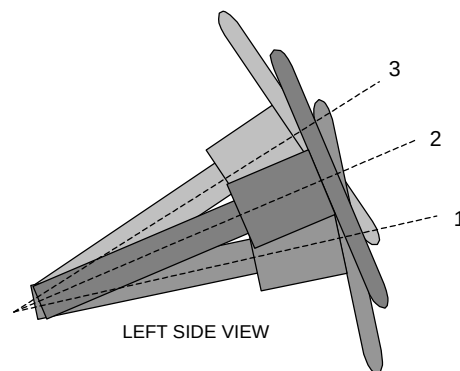
The test vehicle is equipped with an electric fuel pump. Fuel pump will operate when engine system is normally operating.



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 No. 1		68.5
Geometric center position No. 2		61.5
Uppermost position No. 3		54.5

DATA SHEET NO. 4
MOVING DEFORMABLE BARRIER (MDB) SUMMARY OF RESULTS

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1252
Overall Length Including Honeycomb Face	4115
Wheel base of Framework Carriage	2592
C.G. 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 ANGLE DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	62.4
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	62.1
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	89.8

POST TEST OBSERVATIONS
MDB LEFT EDGE IMPACT POINT DATA

Measured Parameter	Units	Requirement	Value
Horizontal Offset	mm	+/- 50	10 forward
Vertical Offset	mm	+/-20	3 down

DATA SHEET NO. 5**POST TEST OBSERVATIONS**

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Front Seat SID/HIII	Rear Seat SID/HIII
Dummy Type / Serial No.	SID HIII / 272	SID HIII / 271
Head Contact	Curtain Airbag, Headrest	Curtain Airbag
Upper Torso Contact	Side Airbag	Door Panel
Lower Torso Contact	Side Airbag	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	Front	Rear
Locked/Unlocked Doors	Struck side door was locked	Struck side door was locked
Left Side Door Opening	Door remained closed and latched	Door remained closed and latched
Right Side Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
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

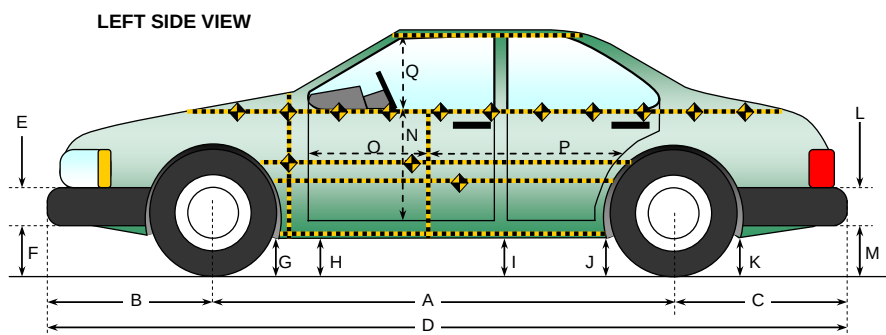
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Information	Left Front (Driver)		Left Rear (Passenger)	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	No	No	
Side Torso/Pelvis Airbag	Yes	Yes	No	
Curtain Airbag	Yes	Yes	Yes	Yes

DATA SHEET NO. 6
VEHICLE PRE-TEST AND POST-TEST MEASUREMENTS

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010



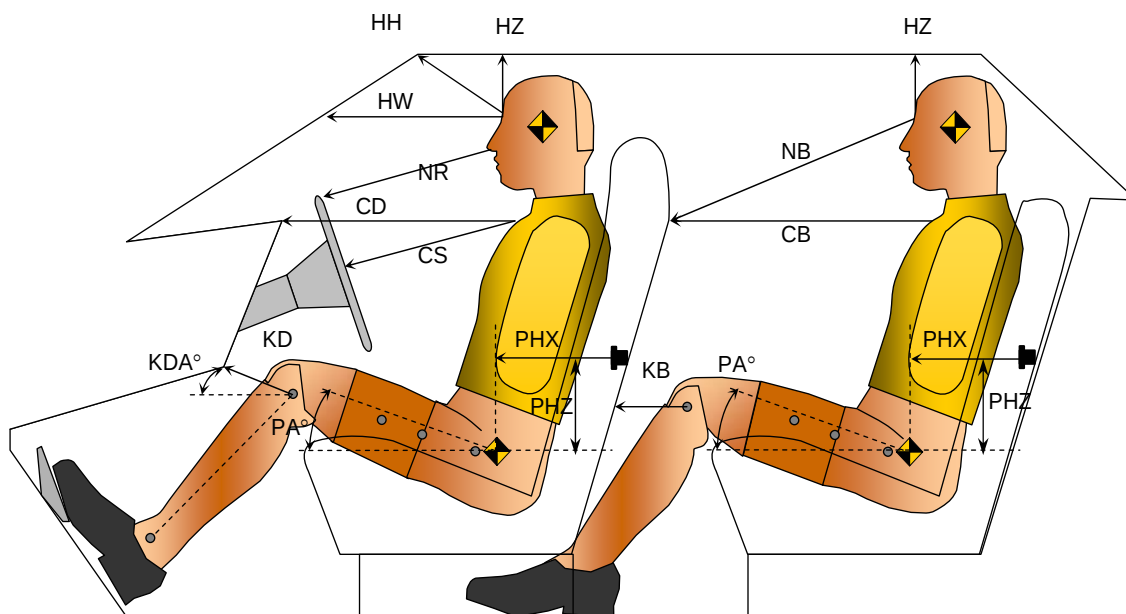
All Measurements in mm

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2700	2661	-39
B	Front Axle to FSOV	924	929	5
C	Rear Axle to RSOV	1041	1040	-1
D	Total Length at Centerline	4665	4630	-35
E	Front Bumper Thickness	92	92	0
F	Front Bumper Bottom to Ground	485	475	-10
G	Sill Height at Front Wheel Well	274	283	9
H	Sill Height at Front Door Leading Edge	275	282	7
I	Sill Height at "B" Pillar	272	275	3
J1	Sill Height at Rear Wheel Well	268	296	28
J2	Pinch Weld Height at Rear Wheel Well	265	290	25
K	Sill Height Aft of Rear Wheel Well	303	308	5
L	Rear Bumper Thickness	132	132	0
M	Rear Bumper Bottom to Ground	437	435	-2
N	Sill Height to Window Bottom Sill	747	683	-64
O	Front Door Leading Edge to Impact CL	746	732	-14
P	Rear Door Trailing Edge to Impact CL	1201	1141	-60
Q	Front Window Opening	477	477	0
R	Right Side Length	3476	3481	5
S	Left Side Length	3476	3430	-46
T	Vehicle Width at "B" Post	1845	1626	-219

DATA SHEET NO. 7
SID/HIII LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010

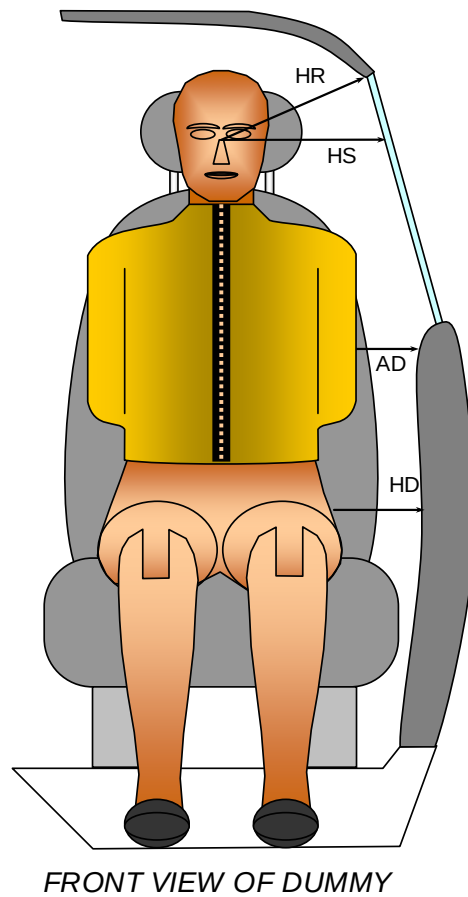


Driver Code	Pass. Code	Measurement Description	Driver S/N 272		Passenger S/N 271	
			Length(mm)	Angle(°)	Length(mm)	Angle(°)
HH		Head to Header	304			
HW		Head to Windshield	536			
HZ	HZ	Head to Roof	151		190	
NR	NB	Nose to Rim/Nose to Seatback	437		648	
CD	CB	Chest to Dash or Seatback	517		548	
CS		Chest to Steering Wheel	322			
KDL	KBL	Left Knee to Dash or Seatback	144	27.2	242	9.3
KDR	KBR	Right Knee to Dash or Seatback	138	27.7	241	8.8
PA	PA	Pelvic Angle		23.3		23.1
PHX	PHX	H-Point to Striker (X-Axis)	238		294	
PHZ	PHZ	H-Point to Striker (Z-Axis)	168		173	

DATA SHEET NO. 8
SID/HIII LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010

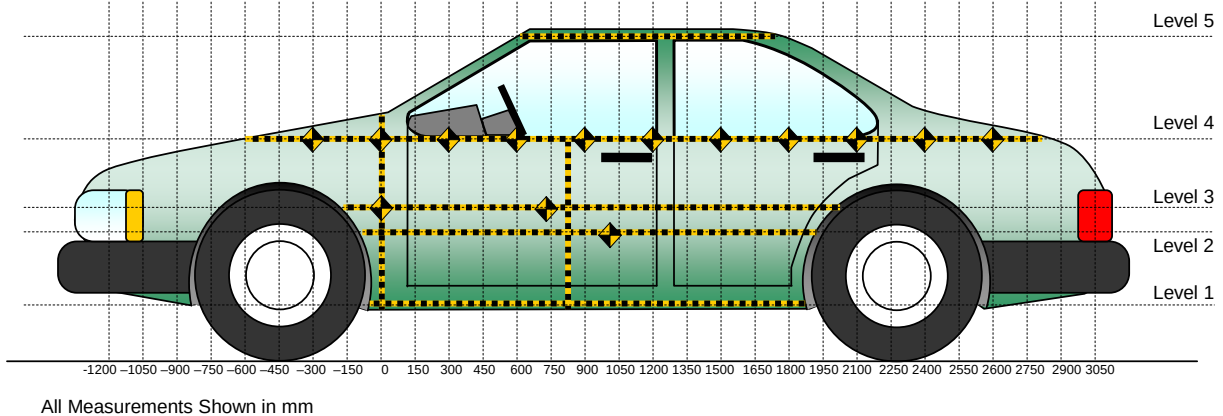


Code	Measurement Description	Units	Driver S/N 272	Passenger S/N 271
HR	Head to Side Header	mm	253	258
HS	Head to Side Window	mm	318	332
AD	Arm to Door	mm	141	121
HD	H-Point to Door	mm	225	144

DATA SHEET NO. 9 **VEHICLE SIDE MEASUREMENTS**

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010



LEFT SIDE VIEW

Measurements are taken with vehicle in the as tested condition.
 Measurements along the vertical 800 mm.
 All measurements below in mm.

Level	Measurement Description	Maximum Exterior Static Crush	Distance From Impact	Height Above Ground
5	Window	28	2250	1605
4	Window Sill	176	1050	1100
3	Mid Door	293	1500	758
2	Occupant H-Point	292	1500	732
1	Sill Top	197	1800	378
	Maximum Penetration	293		

DATA SHEET NO. 10
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-150		160	158	251			194	191	274			34	33	23	
0		165	166	252			222	226	279			57	60	27	
150	213	173	172	252		293	345	326	249		80	172	154	-3	
300	213	176	174	252		307	400	388	281		94	224	214	29	
450	213	178	176	253		321	426	421	287		108	248	245	34	
600	213	180	177	249		331	436	433	295		118	256	256	46	
750	213	181	178	242	438	344	445	443	304	464	131	264	265	62	26
900	212	183	180	238	433	353	448	449	317	307	141	265	269	79	-126
1050	212	183	180	235	434	361	440	441	332	315	149	257	261	176	-119
1200	212	185	182	230	434	372	441	432	372	326	160	256	250	142	-108
1350	212	187	184	228	435	383	471	471	353	377	171	284	287	125	-58
1500	212	187	185	225	436	394	479	478	346	348	182	292	293	121	-88
1650	213	185	183	226	437	405	477	476	332	320	192	292	293	106	-117
1800	214	179	178	225	438	411	409	414	301	291	197	230	236	76	-147
1950		164	165	221	438		319	321	264	265		155	156	43	-173
2100			162	217	437			263	239	465			101	22	28
2250				213	438				218	466				5	28

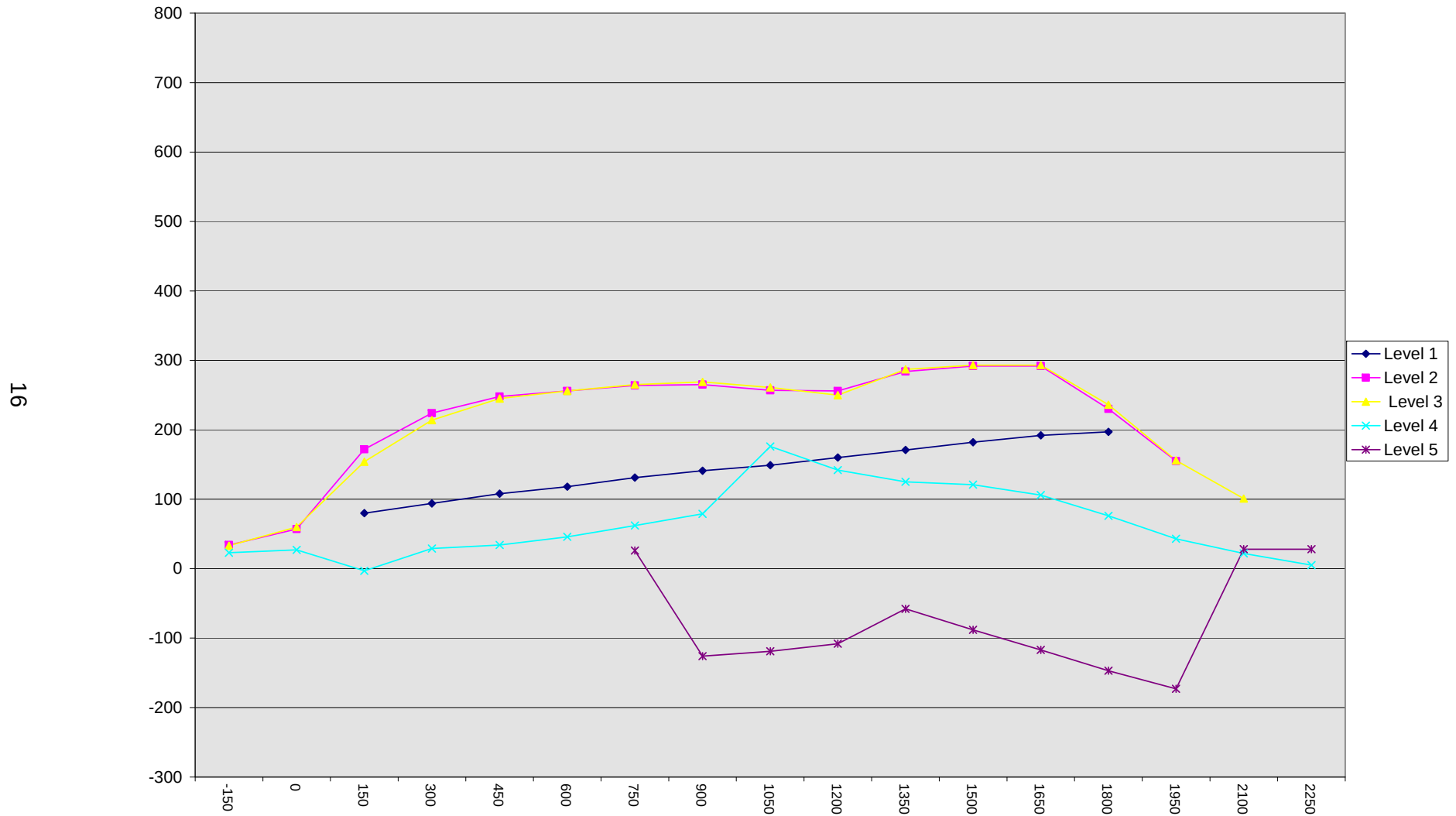
Reference plane is parallel to test vehicle longitudinal centerline.

Given dimensions = Reference plane to car body

DATA SHEET NO. 10... (continued)
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2010 Hyundai Santa Fe GLS
Test Program: FMVSS 214 Indicant

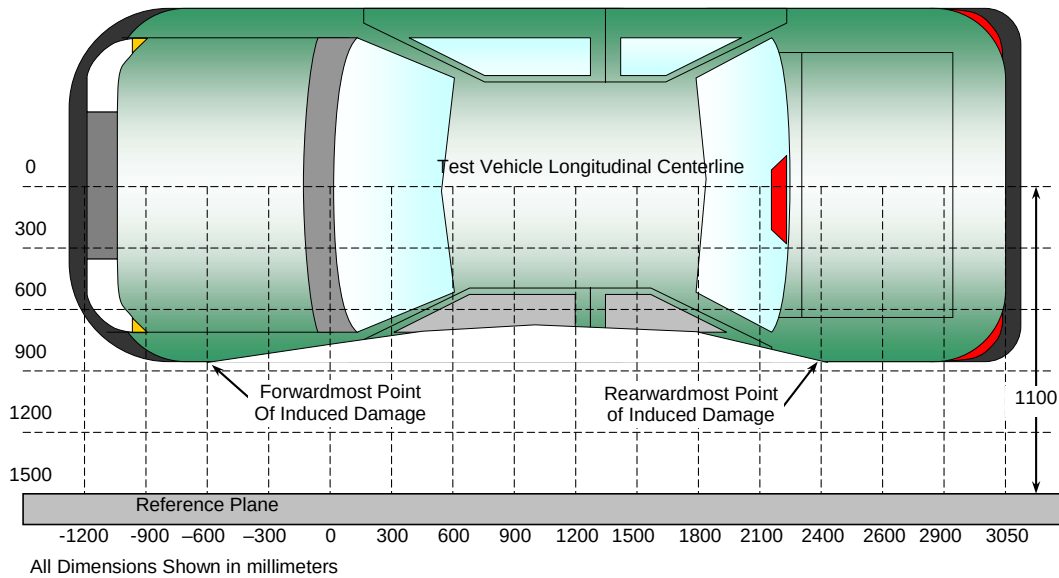
NHTSA No. MA0520
Test Date: 2/10/2010



DATA SHEET NO. 11
VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010



TOP VIEW

DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point in mm	Level	Pre-Test (mm)	Post-Test (mm)	Max Static Crush (mm)
1	2250	4	213	218	5
2	1845	2	177	434	257
3	1410	2	187	475	288
4	965	3	180	449	269
5	560	2	179	432	253
6	150	4	249	252	3

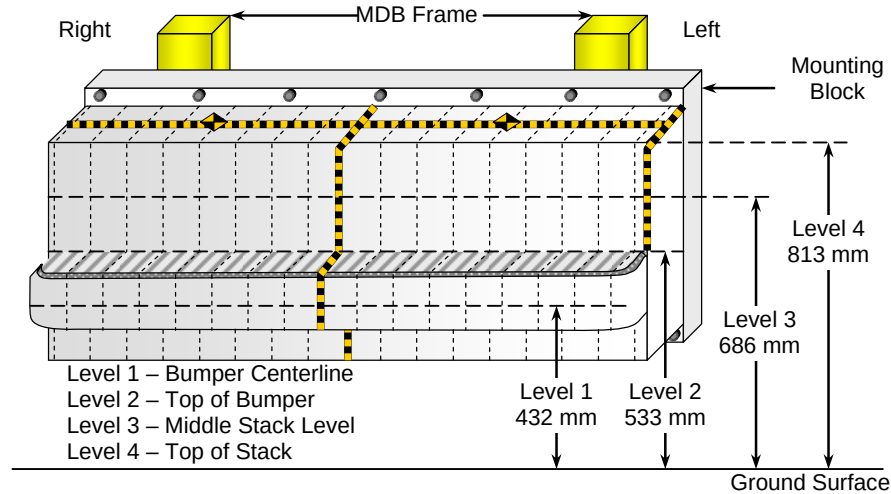
Reference plane is parallel to test vehicle longitudinal centerline.
 Given dimensions = Reference plane to car body.

DATA SHEET NO. 12

DEFORMABLE BARRIER HONEYCOMB FACE STATIC CRUSH

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010



DEFORMABLE BARRIER STATIC CRUSH

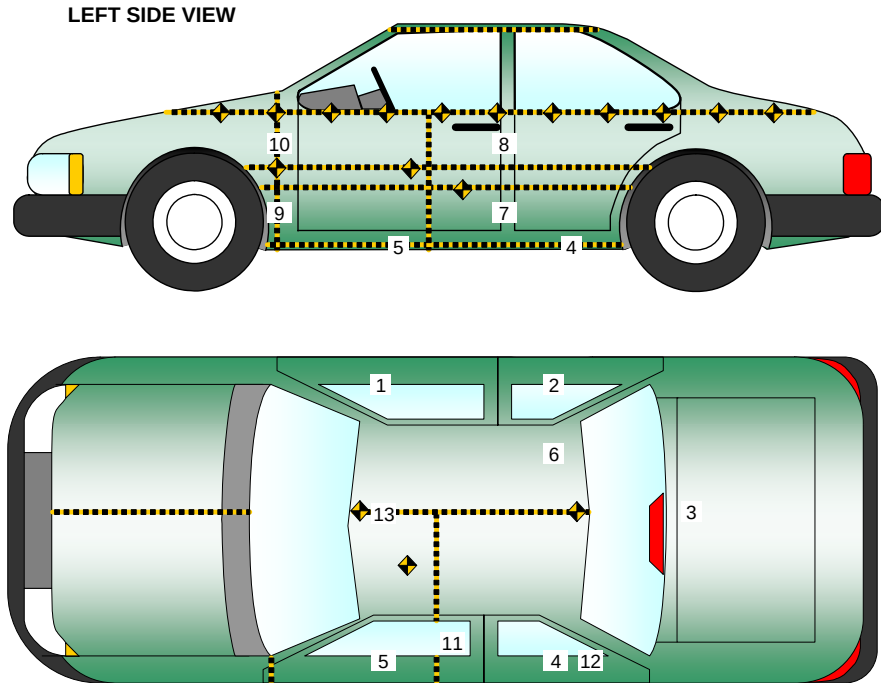
Stack Level	Distance Right of Center								C _L	Distance Left of Center							
	800	700	600	500	400	300	200	100		100	200	300	400	500	600	700	800
1	202	201	196	196	199	203	207	211	217	221	225	231	235	242	248	254	251
2	155	150	150	147	150	152	155	159	160	165	170	174	181	185	192	193	199
3	125	87	87	81	80	83	103	97	85	87	90	91	96	105	113	127	113
4	166	105	90	85	90	101	125	100	100	100	109	117	127	133	152	189	229

All Dimensions in mm

DATA SHEET NO. 13
VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010



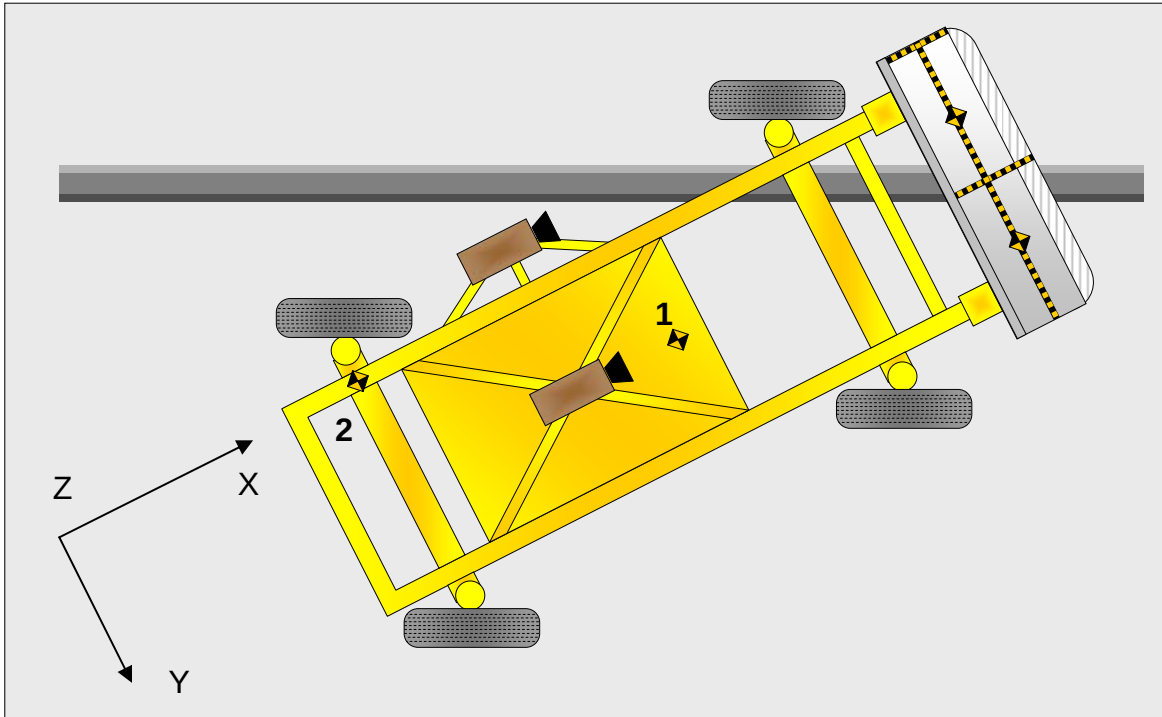
Loc. No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Right Sill at Front Seat	2590	789	-307
2	Right Sill at Rear Seat	1720	789	-315
3	Rear Floorpan Above Axle	947	0	-583
4	Left Sill at Rear Door	1581	-784	-318
5	Left Sill at Front Door	2664	-784	-311
6	Rear Occupant Compartment	1850	384	-443
7	Left Lower B-Post	2239	-722	-711
8	Left Middle B-Post	2209	-726	-935
9	Left Lower A-Post	3119	-714	-635
10	Left Middle A-Post	3164	-837	-890
11	Front Seat Track	1987	-575	-560
12	Rear Seat Track or Structure			
13	Vehicle CG	2424	-24	-466

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

DATA SHEET NO. 14
MDB ACCELEROMETER LOCATIONS

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010



Loc. No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	MDB CG	-1092	0	-483
2	MDB Rear	-2591	-625	-622

Reference Points X - MDB Front Axle (+ forward)
 Y - MDB Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 15
VEHICLE STRUCTURAL MEASUREMENTS

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

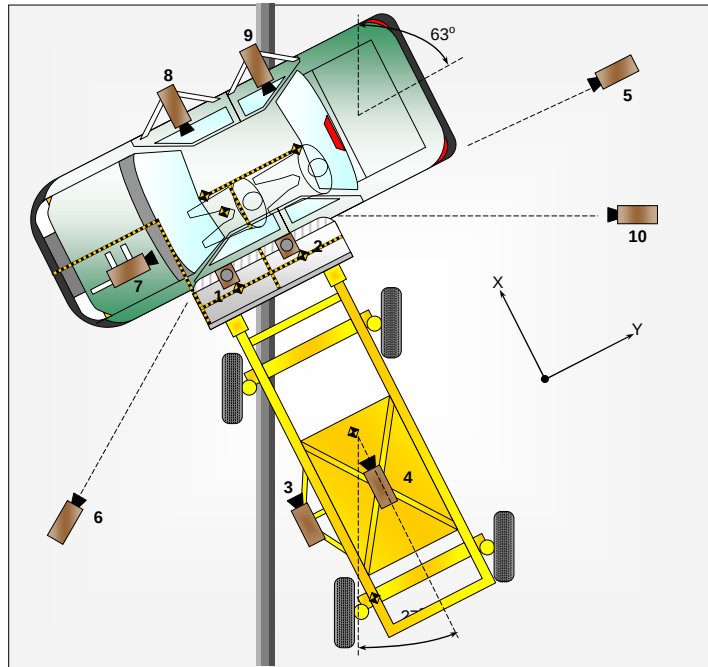
NHTSA No. MA0520
 Test Date: 2/10/2010

	Elements	Pre-Test (mm)
1	Total Length	4665
2	Total Width	1845
3	Bumper Top Height	575
4	Bumper Bottom Height	468
5	Longitudinal Member Top Height	707
6	Distance between Longitudinal Members	921
7	Longitudinal Member Width	120
8	Engine Top Height	876
9	Engine Bottom Height	254
10	Engine and gearbox width	836
11	Front bumper-engine distance	431
12	Front shock absorber fixing height	1034
13	Bonnet leading edge height	944
14	Front shock absorber fixing width	1163
15	Front bumper – front axle distance	924
16	Front axle – a pillar distance	485
17	A-pillar – B-pillar distance	943
18	B-Pillar – rear axle distance	1098
19	B-pillar – C-pillar distance	925
20	Roof sill bottom height	1659
21	Roof sill top height	1699
22	Floor sill bottom height	296
23	Floor sill top height	454

DATA SHEET NO. 16
HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010



No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Overhead Close-up	-510	-265	-5050	50	1000
2	Overhead Overall	680	1290	-5050	14	1000
3	MDB Onboard, Impact Point Close-up				50	1000
4	MDB Onboard, Centerline of Impact				16	1000
5	Right Side, Ground Level, Overall	45	7280	-1230	24	1000
6	Left Side, Ground Level, Overall	-1460	-5235	-1240	24	1000
7	Vehicle Onboard Front SID/HIII, Front				12.5	1000
8	Vehicle Onboard Front SID/HIII, Side				8	1000
9	Vehicle Onboard Rear SID/HIII, Side				8	1000
10	Real Time Coverage				13	24

Reference Points X - Impact Line
 Y - MDB Left Edge Impact Point
 Z - Ground Plane

DATA SHEET NO. 17
SUMMARY OF FMVSS 301 DATA

Test Vehicle: 2010 Hyundai Santa Fe GLS
 Test Program: FMVSS 214 Indicant

NHTSA No. MA0520
 Test Date: 2/10/2010

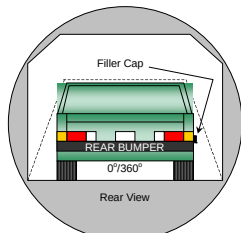
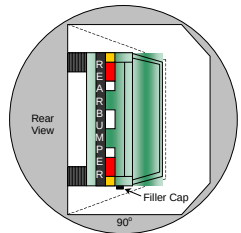
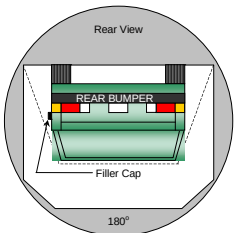
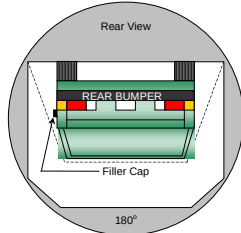
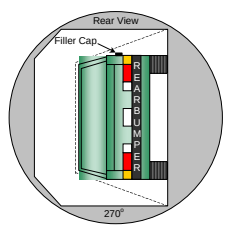
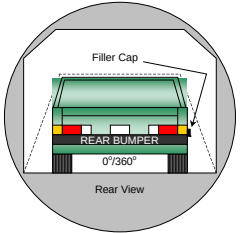
FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 11:36 am

Stoddard Solvent Spillage Measurements

- 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

			1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds. 2. The position hold time at each position is 300 seconds (minimum). 3. Details of Stoddard Solvent spillage locations: None
0° to 90° 90° to 180°			
			
180° to 270° 270° to 360°			

Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage Collection Time (min)	Spillage (oz.)
0° to 90°	117	300	First 5	0
90° to 180°	110	300	First 5	0
180° to 270°	108	300	First 5	0
270° to 360°	113	300	First 5	0

APPENDIX A
PHOTOGRAPHS

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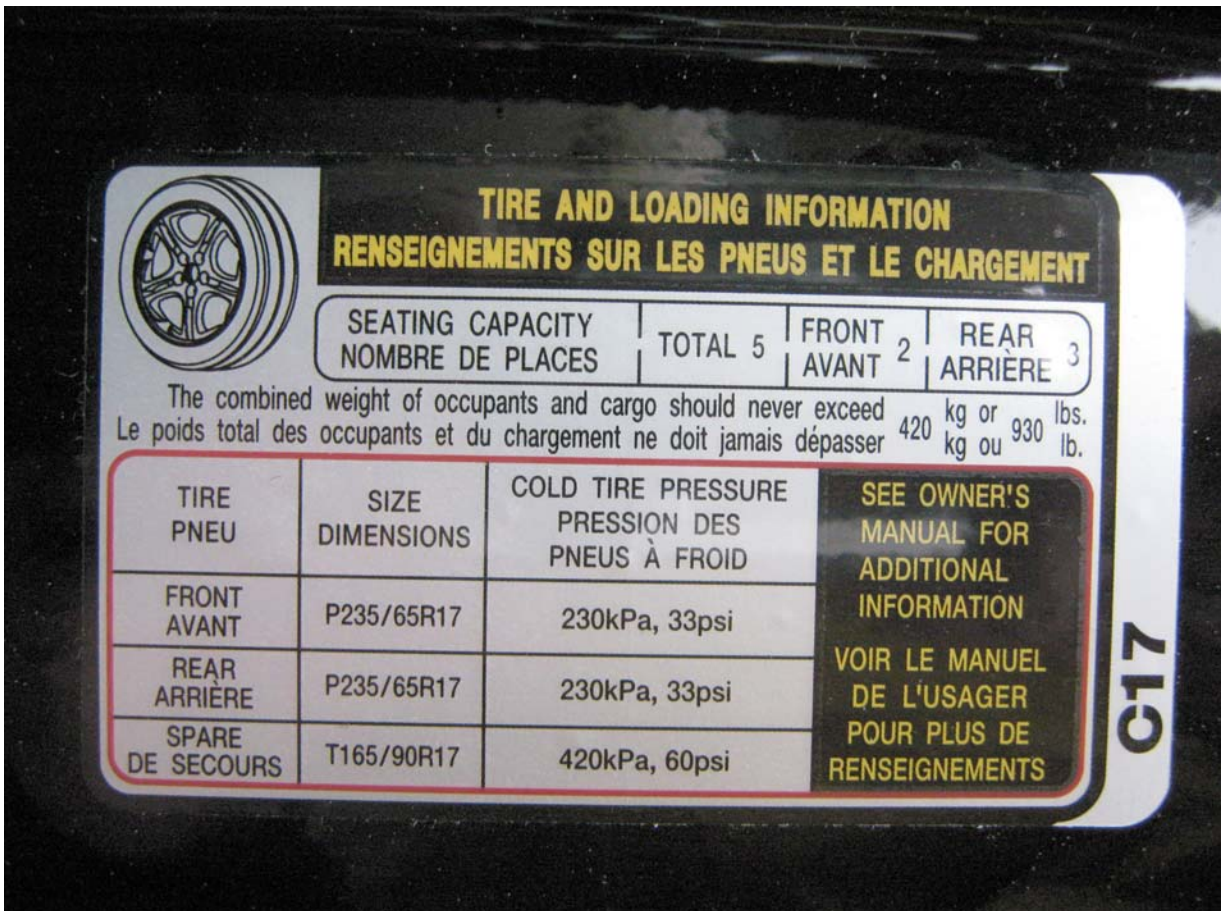
Right Front $\frac{3}{4}$ View, As Received



Left Rear $\frac{3}{4}$ View, As Received



Manufacturer's Label



Tire Placard



Pre-Test Front View



Post-Test Front View



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



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



Pre-Test Left Side View



Post-Test Left Side View



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



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



Pre-Test Rear View



Post-Test Rear View



Pre-Test Right Rear $\frac{3}{4}$ View



Post-Test Right Rear $\frac{3}{4}$ View



Pre-Test Right Side View



Post-Test Right Side View



Pre-Test Right Front $\frac{3}{4}$ View



Post-Test Right Front $\frac{3}{4}$ View



Pre-Test Left Impact Point



Post-Test Left Impact Point



Pre-Test Front ¾ View of Left Side Doors



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



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



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



Pre-Test Left Side Impact Close-up



Post-Test Left Side Impact Close-up



Pre-Test Overhead View



Post-Test Overhead View



Pre-Test Overhead Close-up View



Post-Test Overhead Close-up View



Pre-Test Driver Dummy (Door Open)



Pre-Test Driver Dummy Clearance From Door



Post-Test Driver Dummy Clearance From Door



Pre-Test Driver Dummy (Through Window)



Post-Test Driver Dummy (Through Window)



Pre-Test Driver Dummy Right Side View



Post-Test Driver Dummy Right Side View



Pre-Test Passenger Dummy (Door Open)



Pre-Test Passenger Dummy Clearance From Door



Post-Test Passenger Dummy Clearance From Door



Pre-Test Passenger Dummy (Through Window)



Post-Test Passenger Dummy (Through Window)



Pre-Test Passenger Dummy Right Side View



Post-Test Passenger Dummy Right Side View



Pre-Test Front View of Deformable Barrier



Post-Test Front View of Deformable Barrier



Pre-Test Top View of Deformable Barrier



Post-Test Top View of Deformable Barrier



Pre-Test Right Side View of Deformable Barrier



Post-Test Right Side View of Deformable Barrier



Pre-Test Left Side View of Deformable Barrier



Post-Test Left Side View of Deformable Barrier



Vehicle on Rollover Device (90 Degrees)



Vehicle on Rollover Device (180 Degrees)



Vehicle on Rollover Device (270 Degrees)



Vehicle on Rollover Device (360 Degrees)



Vehicle Impact



Post-Test Driver Dummy Head Contact View



Post-Test Driver Dummy Torso Contact



Post-Test Driver Dummy Contact



Post-Test Passenger Dummy Head Contact View



Post-Test Passenger Dummy Torso Contact



Post-Test Passenger Dummy Contact

APPENDIX B

SID/HIII RESPONSE DATA TRACES

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

Driver Head X Primary

Driver Head Y Primary

Driver Head Z Primary

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Upper Neck Force X

Driver Upper Neck Force Y

Driver Upper Neck Force Z

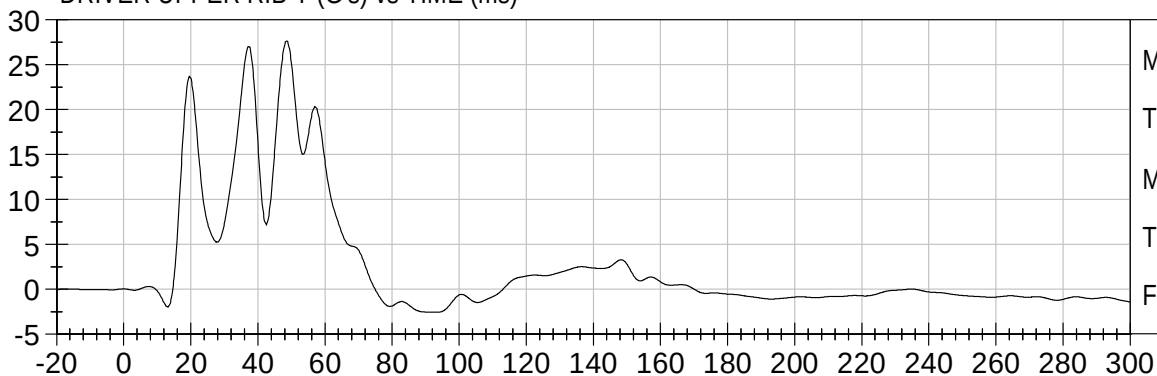
Driver Upper Neck Moment X

Driver Upper Neck Moment Y
Driver Upper Neck Moment Z
Driver Upper Rib Redundant Y
Driver Lower Rib Redundant Y
Driver Lower Spine Redundant Y
Driver Pelvis Redundant Y
Driver Thorax Contact
Driver Pelvis Contact
Passenger Head X Primary
Passenger Head Y Primary
Passenger Head Z Primary
Passenger Head X Redundant
Passenger Head Y Redundant
Passenger Head Z Redundant
Passenger Upper Neck Force X
Passenger Upper Neck Force Y
Passenger Upper Neck Force Z
Passenger Upper Neck Moment X
Passenger Upper Neck Moment Y
Passenger Upper Neck Moment Z
Passenger Upper Rib Redundant Y
Passenger Lower Rib Redundant Y
Passenger Lower Spine Redundant Y
Passenger Pelvis Redundant Y
Passenger Thorax Contact
Passenger Pelvis Contact
Vehicle Right Sill at Front Seat X
Vehicle Right Sill at Front Seat Y
Vehicle Right Sill at Front Seat Z
Vehicle Right Sill at Rear Seat X
Vehicle Right Sill at Rear Seat Y
Vehicle Right Sill at Rear Seat Z

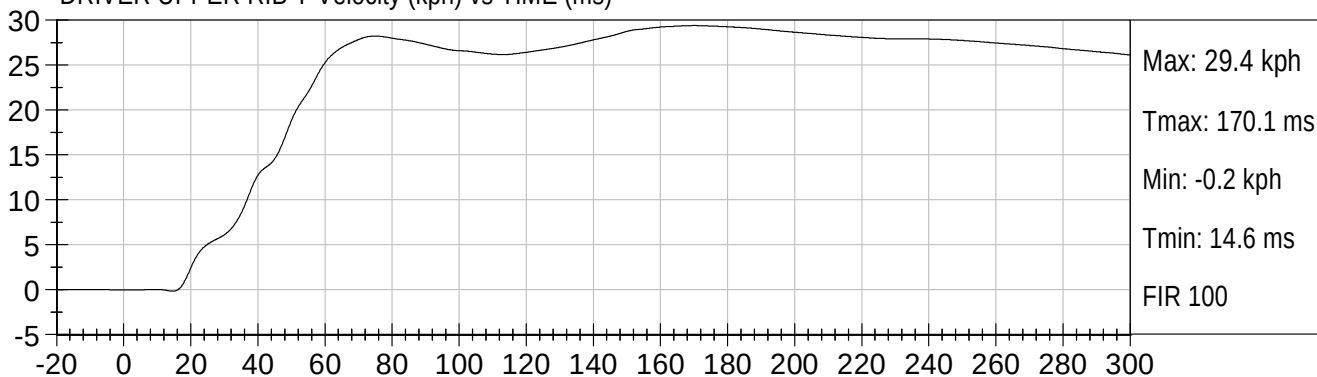
Vehicle Rear Floor Above Axle X
Vehicle Rear Floor Above Axle Y
Vehicle Rear Floor Above Axle Z
Vehicle Left Sill at Rear Door Y
Vehicle Left Sill at Front Door Y
Vehicle Right Rear Occupant Compartment
Vehicle B-Post Lower Y
Vehicle B-Post Middle Y
Vehicle A-Post Lower Y
Vehicle A-Post Middle Y
Vehicle Left Front Seat Track
Vehicle CG X
Vehicle CG Y
Vehicle CG Z
MDB CG X
MDB CG Y
MDB CG Z
MDB Rear X
MDB Rear Y
MDB Left Bumper Contact
MDB Right Bumper Contact



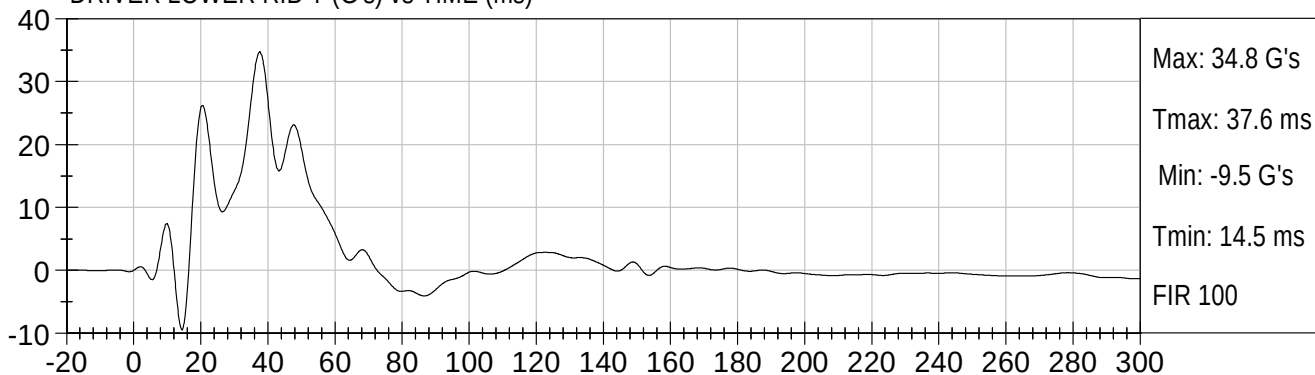
DRIVER UPPER RIB Y (G's) vs TIME (ms)



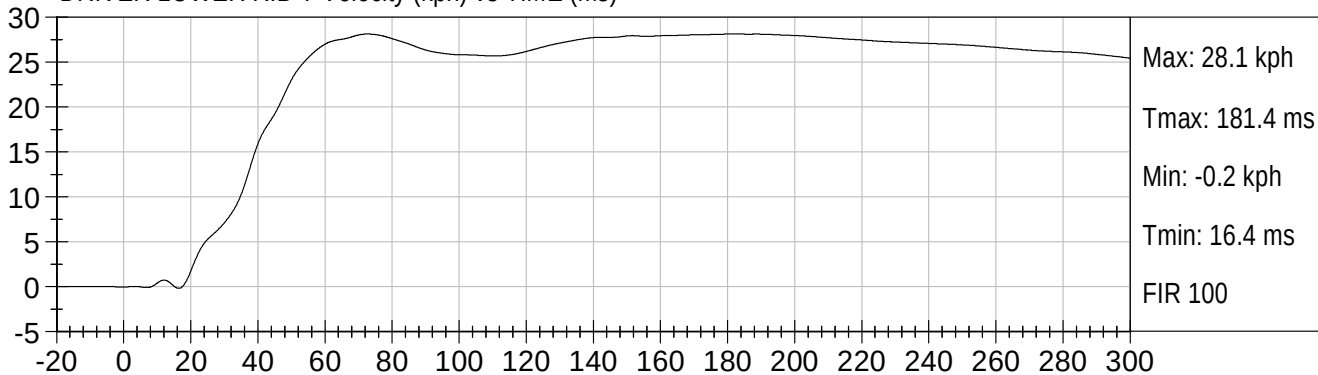
DRIVER UPPER RIB Y Velocity (kph) vs TIME (ms)



DRIVER LOWER RIB Y (G's) vs TIME (ms)

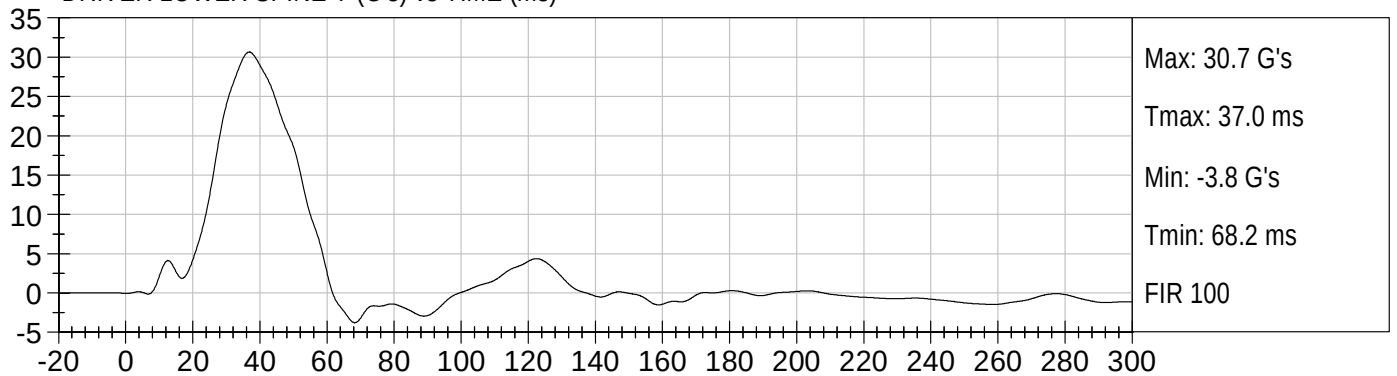


DRIVER LOWER RIB Y Velocity (kph) vs TIME (ms)

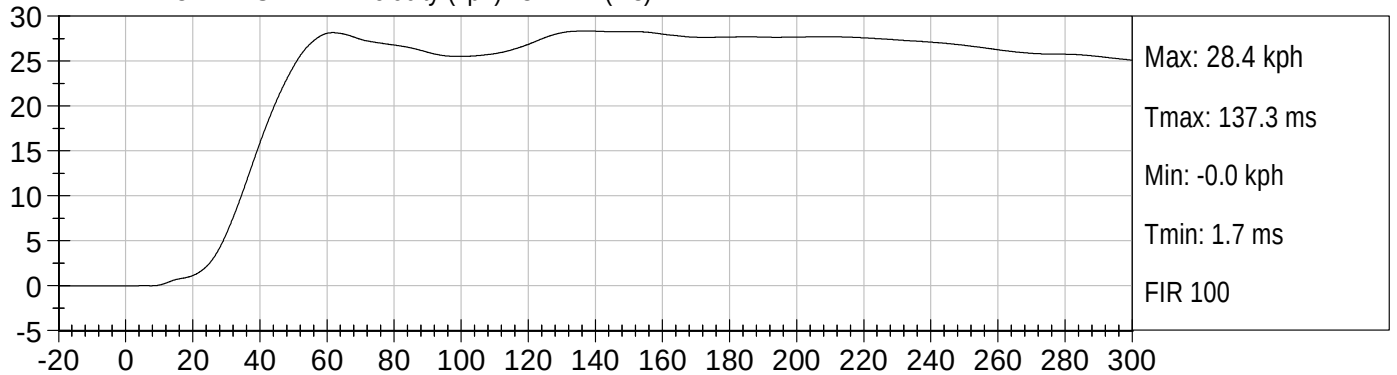




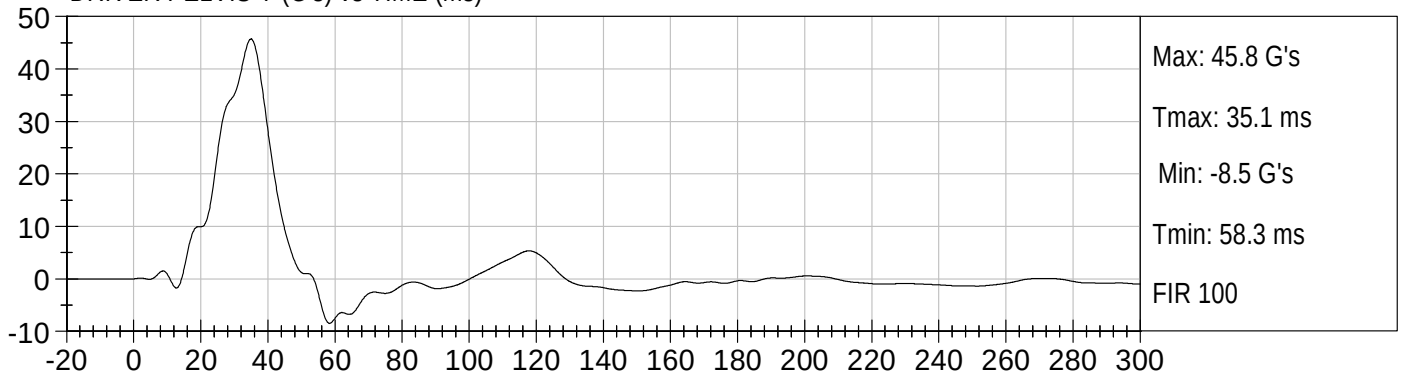
DRIVER LOWER SPINE Y (G's) vs TIME (ms)



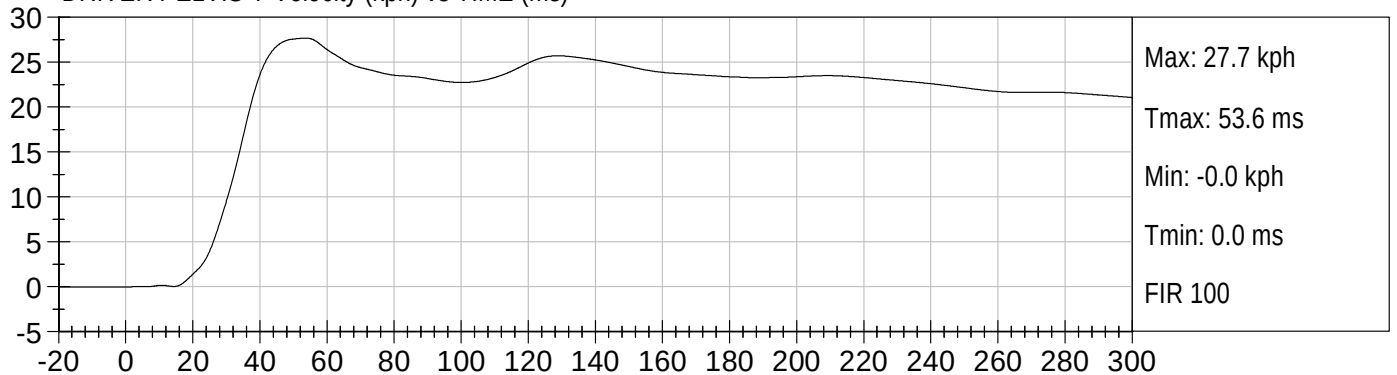
DRIVER LOWER SPINE Y Velocity (kph) vs TIME (ms)



DRIVER PELVIS Y (G's) vs TIME (ms)

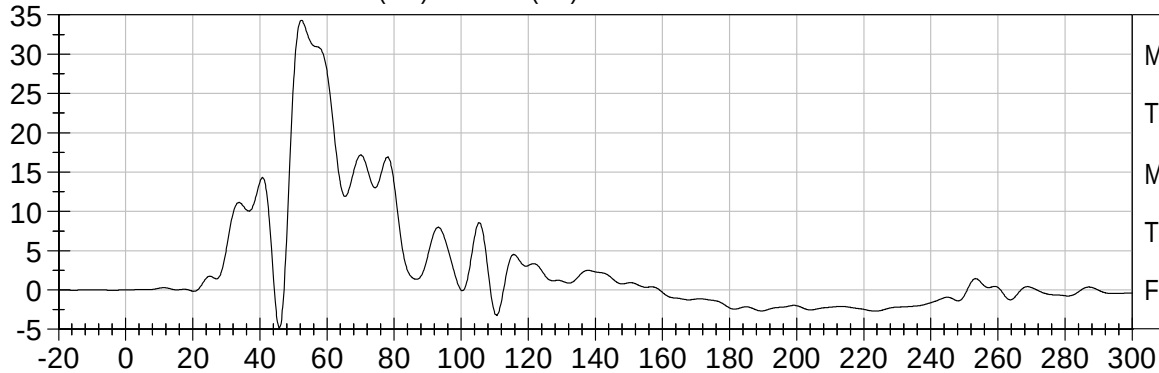


DRIVER PELVIS Y Velocity (kph) vs TIME (ms)



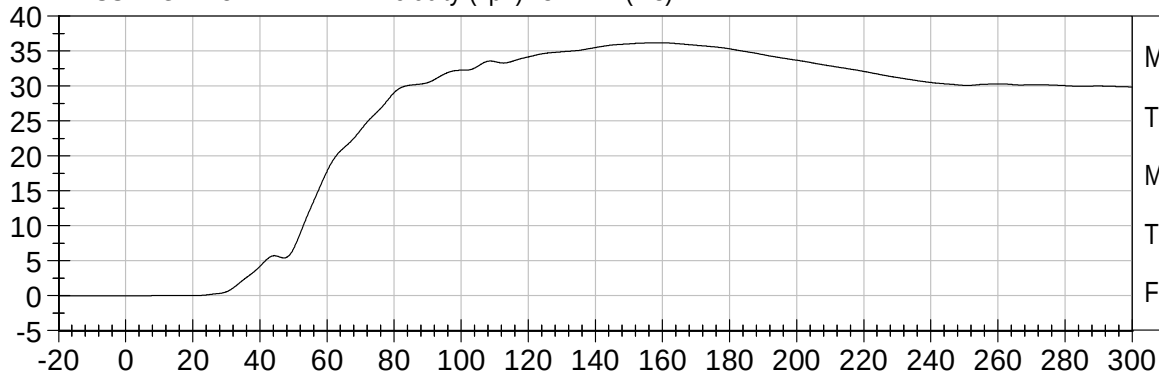


PASSENGER UPPER RIB Y (G's) vs TIME (ms)



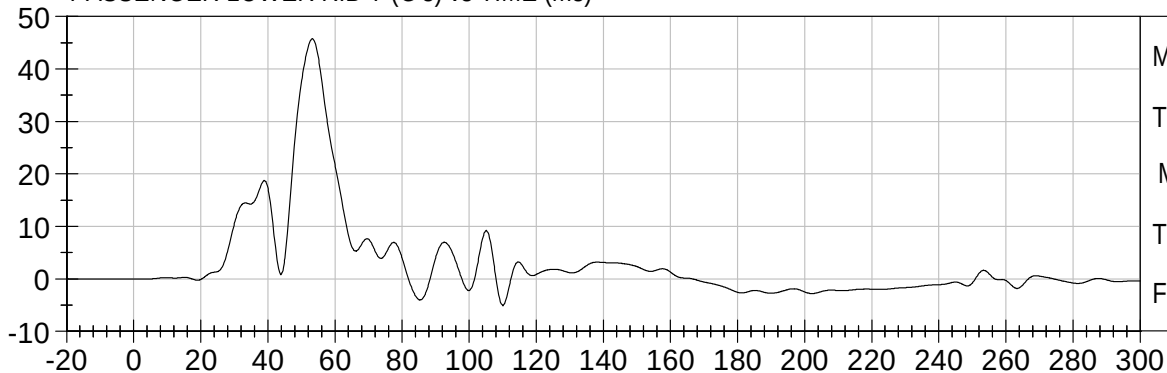
Max: 34.3 G's
Tmax: 52.6 ms
Min: -4.9 G's
Tmin: 45.7 ms
FIR 100

PASSENGER UPPER RIB Y Velocity (kph) vs TIME (ms)



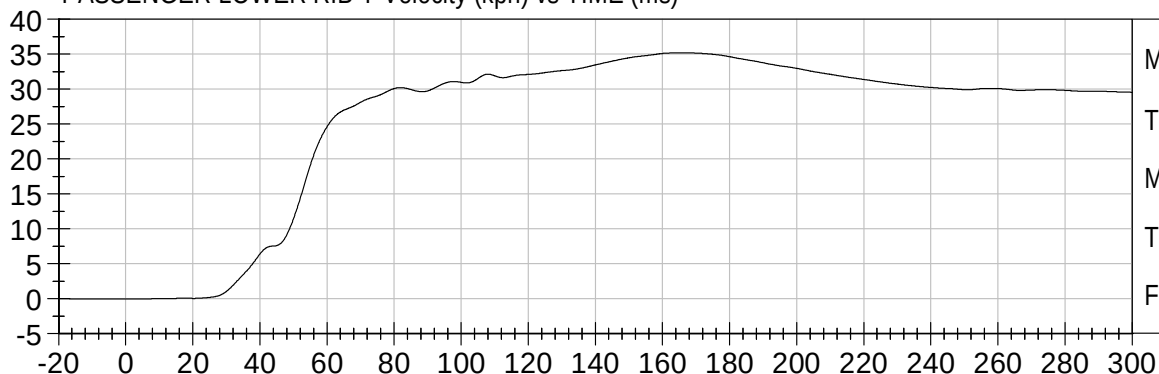
Max: 36.2 kph
Tmax: 159.1 ms
Min: -0.0 kph
Tmin: 0.0 ms
FIR 100

PASSENGER LOWER RIB Y (G's) vs TIME (ms)

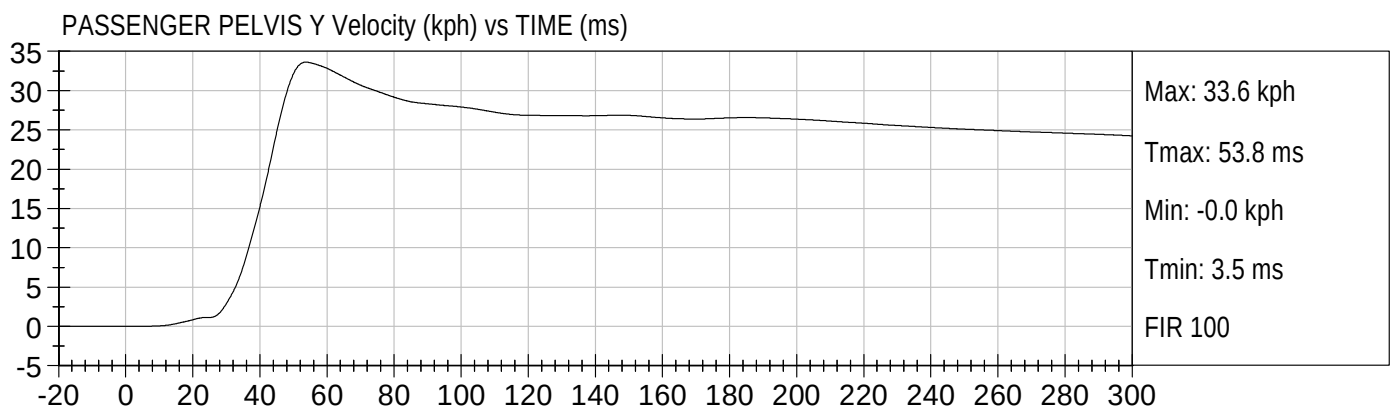
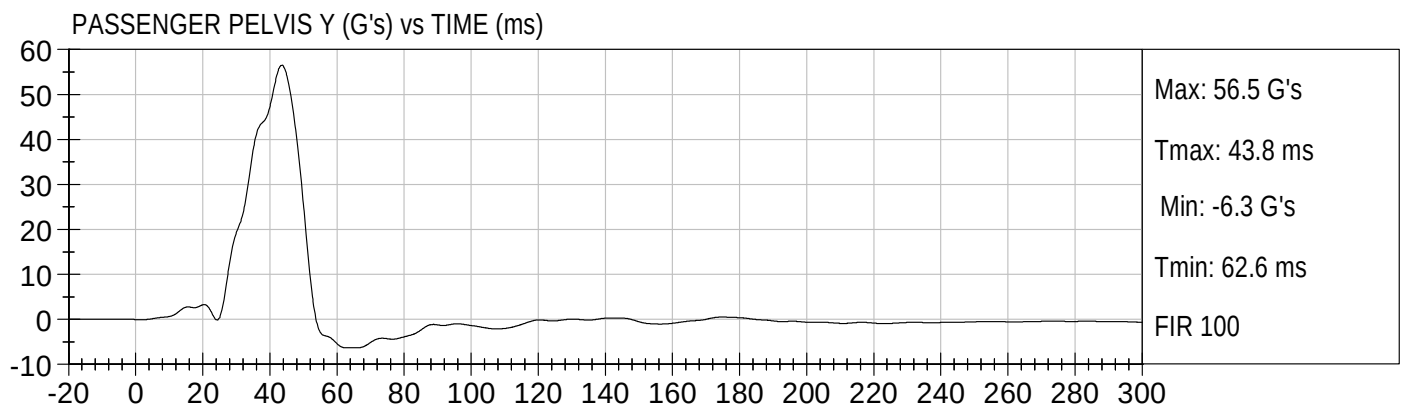
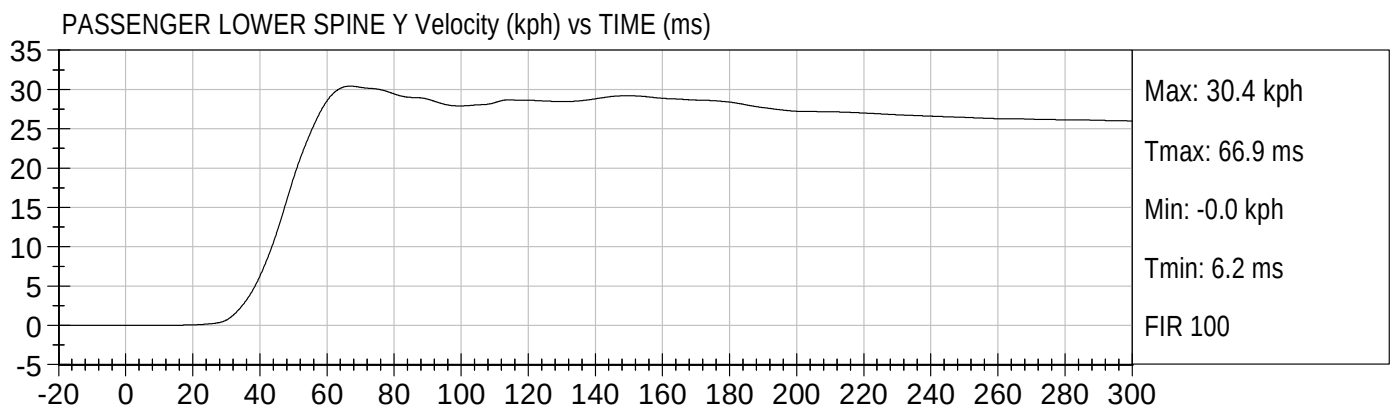
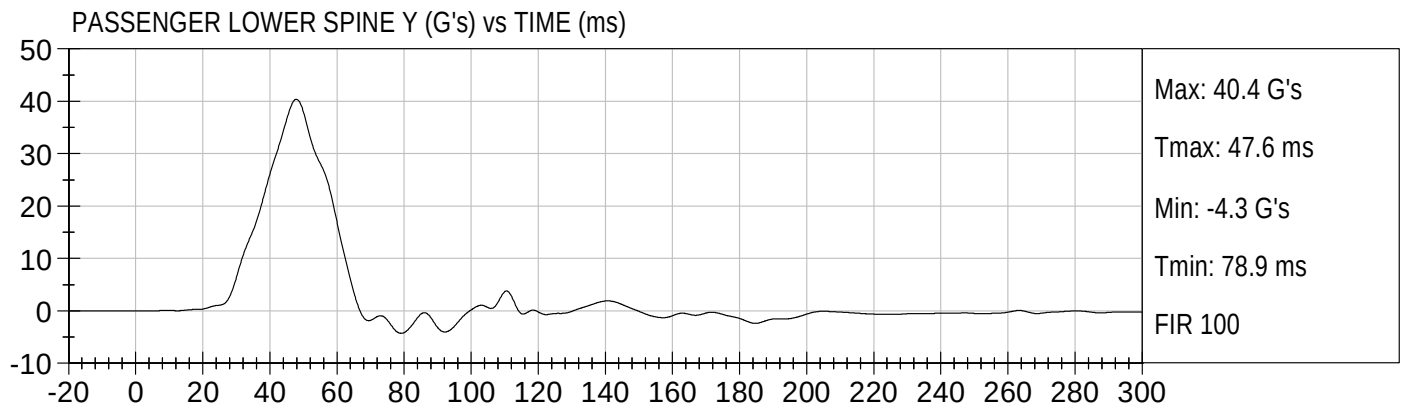


Max: 45.8 G's
Tmax: 53.2 ms
Min: -5.1 G's
Tmin: 110.1 ms
FIR 100

PASSENGER LOWER RIB Y Velocity (kph) vs TIME (ms)



Max: 35.2 kph
Tmax: 166.6 ms
Min: -0.0 kph
Tmin: 5.0 ms
FIR 100



APPENDIX C
DUMMY CALIBRATION DATA

CERTIFICATION DATA

Dummy Serial Number: 272

Calibration Test Results Summary

Dummy Serial Number: 272

Pre-Test Calibration

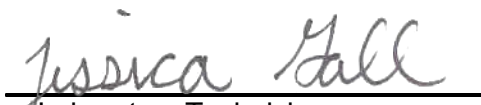
External Dimensions:	The dummy passed all external dimension requirements.
Head Drop Test:	The head passed all drop test requirements.
Neck Pendulum Test:	The neck passed all pendulum test requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements. -2

SID Calibration Data Sheet
Side Impact Dummy
External Measurements

ATD Serial No: 272

Test I.D: D1007

Tested Parameter	Units	Specification	Result	Pass/Fail
SH - Seated Height	mm	889 - 909	907	Pass
RH - Rib Height	mm	501 - 521	520	Pass
HP - Hip Pivot Height	mm	99 ref.	99	Pass
RD - Rib from Back Line	mm	229 - 241	230	Pass
KV - Knee Pivot to Back Line	mm	511 - 526	525	Pass
SW - Knee Pivot to Floor	mm	490 - 505	495	Pass
HW - Hip Width	mm	356 - 391	358	Pass
Overall Test Results			Pass	


Laboratory Technician

1/13/2010

Test Date

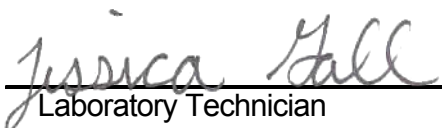

Approved By

SID/HIII Calibration Data Sheet
Side Impact Dummy
Head Drop Calibration (Lateral)

ATD Serial No: 272

Test I.D: D10071

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Peak Resultant Acceleration	G's	120 to 150	131	Pass
Is Resultant Curve Unimodal?	N/A	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	9.1	Pass
			Overall Test Results	Pass


Laboratory Technician


Approved By

1/13/10
Test Date



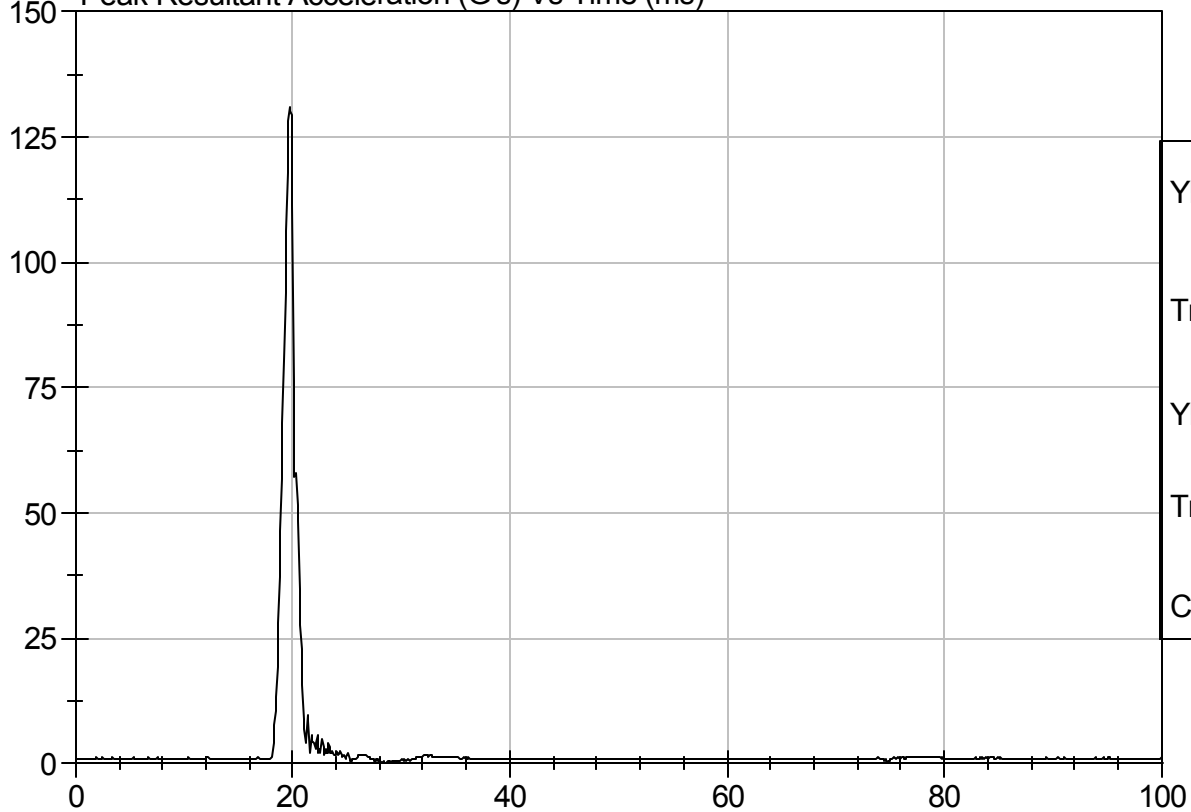
Test Description: Head Drop

Test Date: 1/13/10

Component: D10071

Speed: 0 ft/s, 0 m/s

Peak Resultant Acceleration (G's) Vs Time (ms)



YMax: 130.9 G

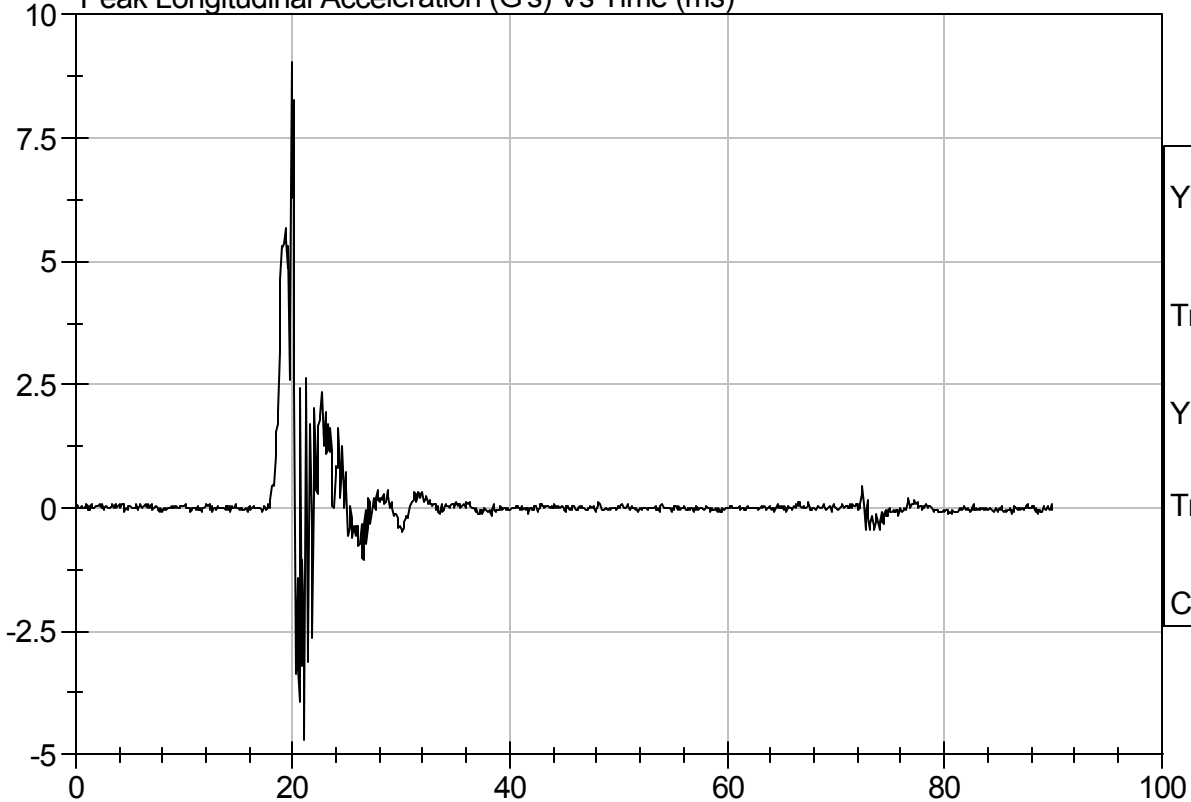
Tmax: 19.7 ms

YMin: 0.1 G

Tmin: 29.1 ms

CFC 1000

Peak Longitudinal Acceleration (G's) Vs Time (ms)



YMax: 9.1 G

Tmax: 19.9 ms

YMin: -4.7 G

Tmin: 21.1 ms

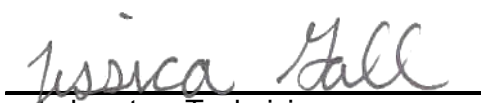
CFC 1000

SID/HIII Calibration Data Sheet
Side Impact Dummy
Thorax Impact Test

ATD Serial No: 272

Test I.D: D10072

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Velocity	m/s	4.22 - 4.31	4.30	Pass
Upper Rib	G's	37 - 46	39	Pass
Lower Rib	G's	37 - 46	39	Pass
Lower Spine	G's	15 - 22	20	Pass
Overall Test Results				Pass


Laboratory Technician

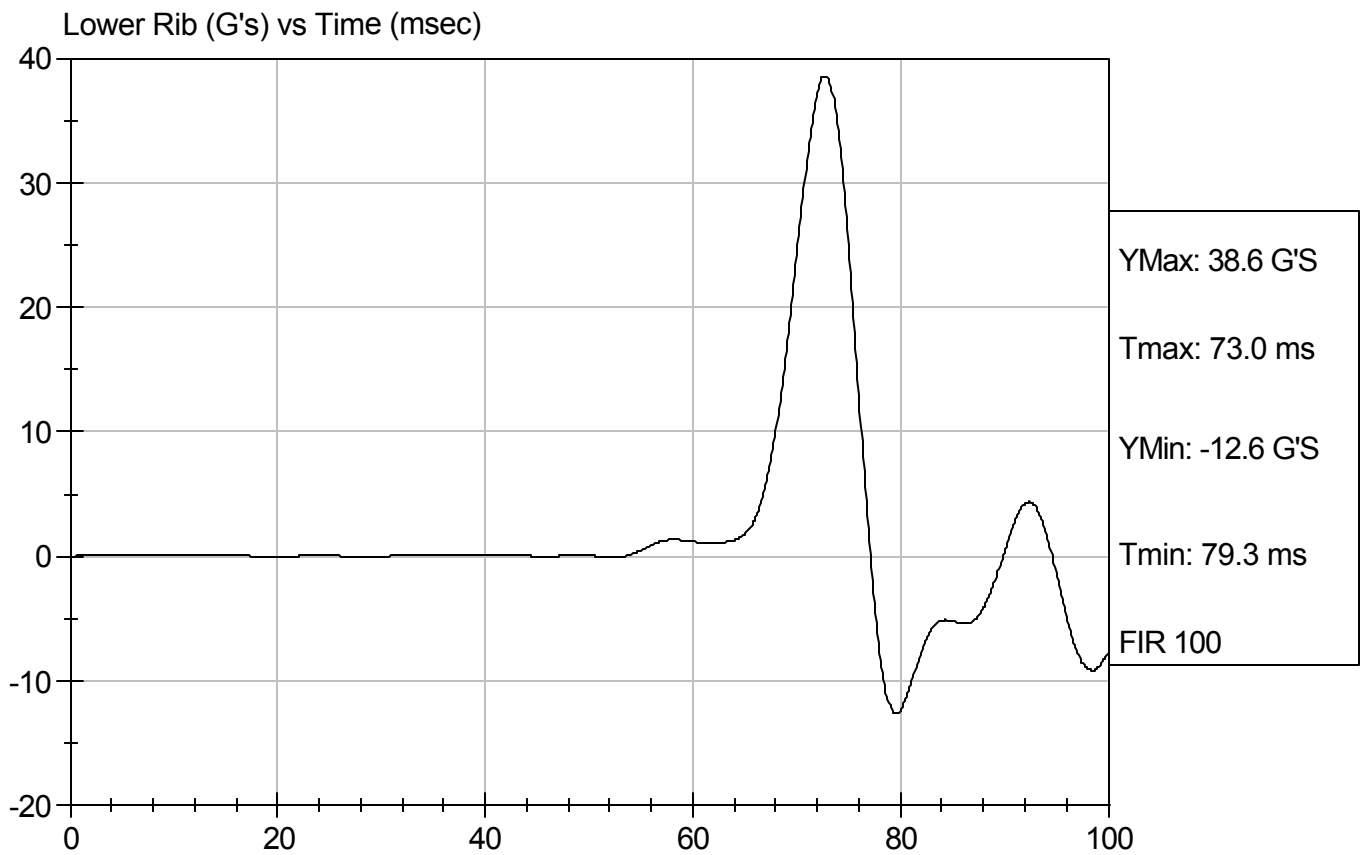
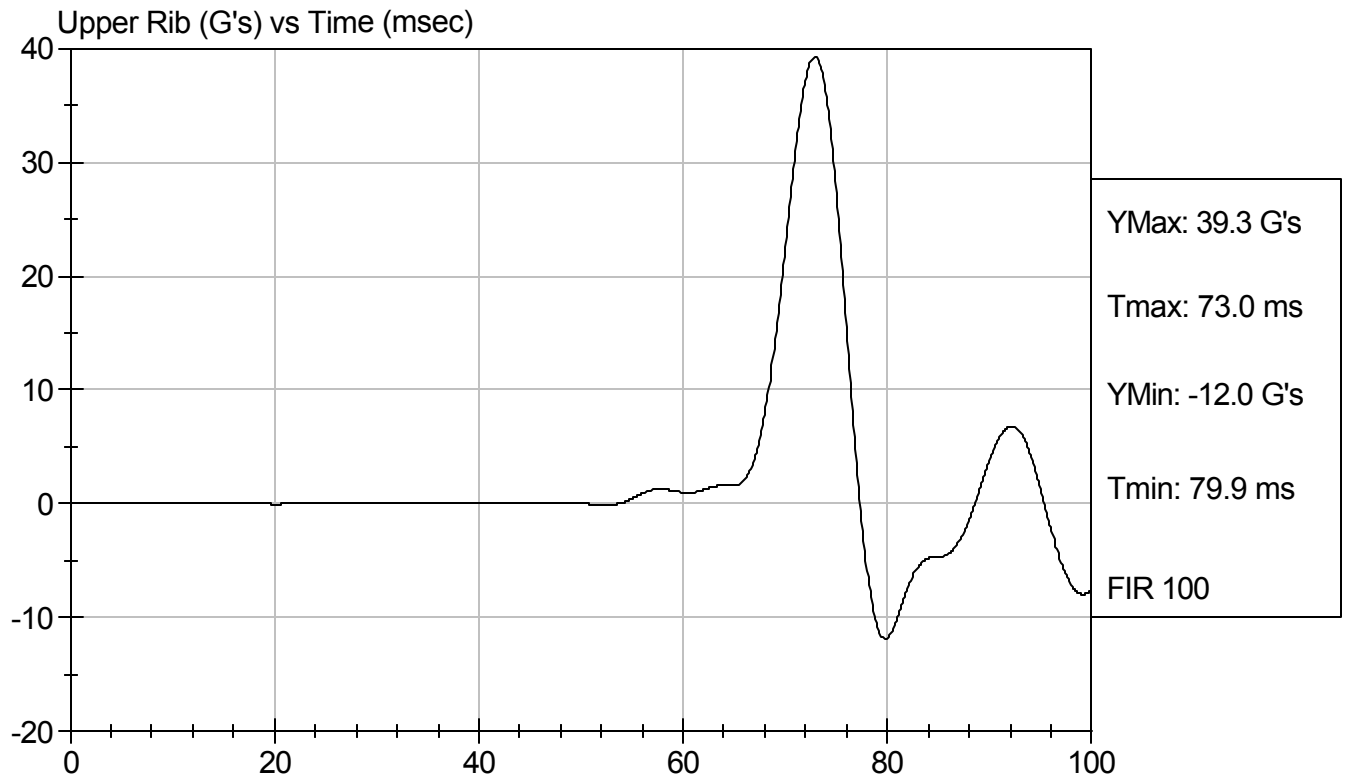
1/13/10
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D10072

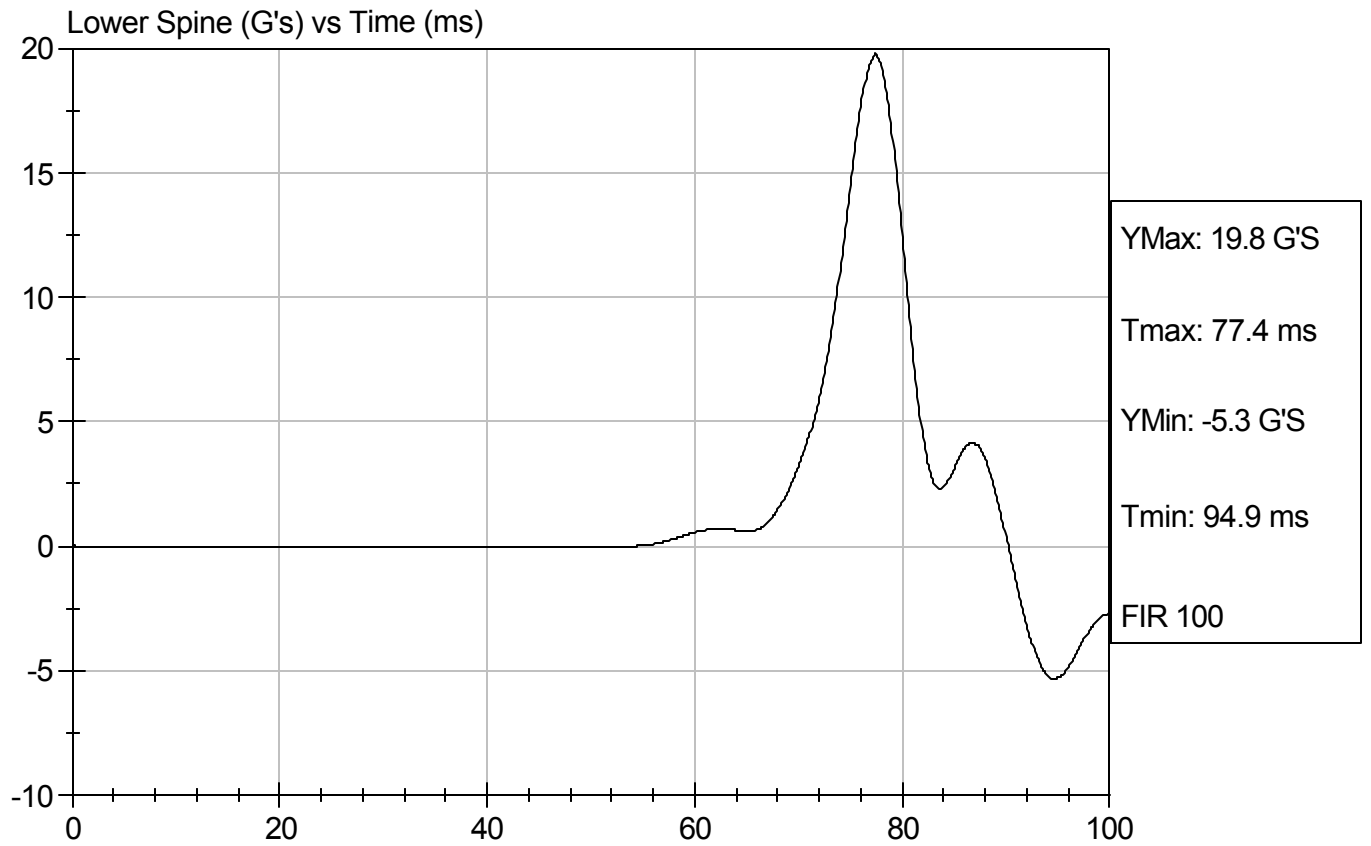
Test Date: 1/13/10
Speed: 14.12 ft/s, 4.30 m/s





Test Desc: Thorax Impact
Component ID: D10072

Test Date: 1/13/10
Speed: 14.12 ft/s, 4.30 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Pelvis Impact Test

ATD Serial No: 272

Test I.D: D10073

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Velocity	m/s	4.27 - 4.33	4.30	Pass
Pelvis Acceleration	G's	40 - 60	42	Pass
Overall Test Results			Pass	

Jessica Gall
Laboratory Technician

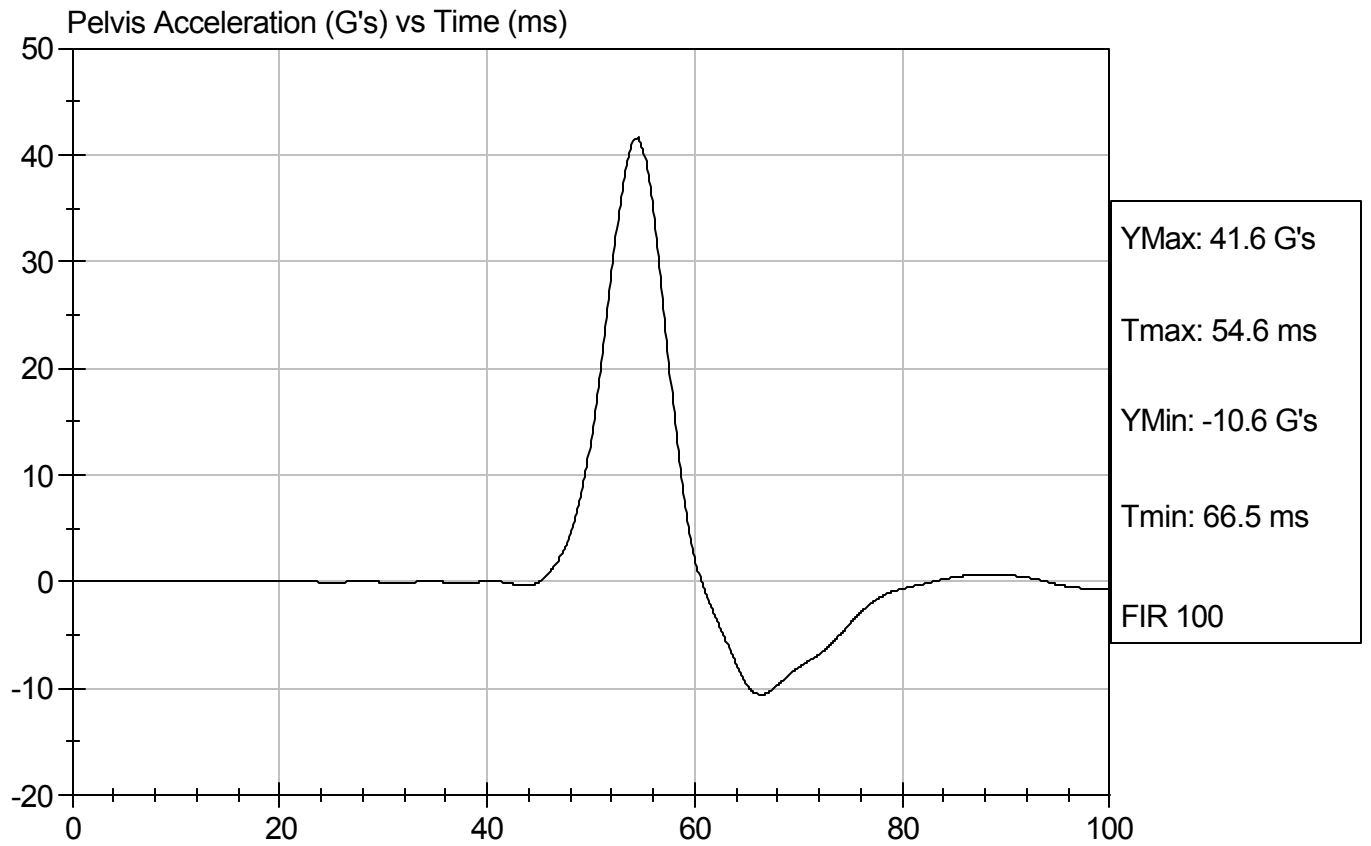
David Winkelbauer
Approved By

1/13/10
Test Date



Test Desc: Pelvis Impact
Component ID: D10073

Test Date: 1/13/10
Speed: 14.12 ft/s, 4.30 m/s

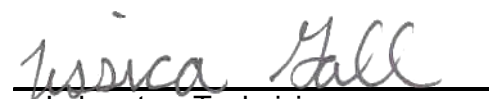


SID/HIII Calibration Data Sheet
Side Impact Dummy
Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 272

Test I.D: D10074

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Force At 12.7 mm	N	104 -162	126	Pass
Force At 19 mm	N	163 - 222	179	Pass
Force At 25.4 mm	N	222 - 280	242	Pass
Force At 33 mm	N	325 - 391	330	Pass
Overall Test Results			Pass	


Laboratory Technician


Approved By

1/13/10
Test Date

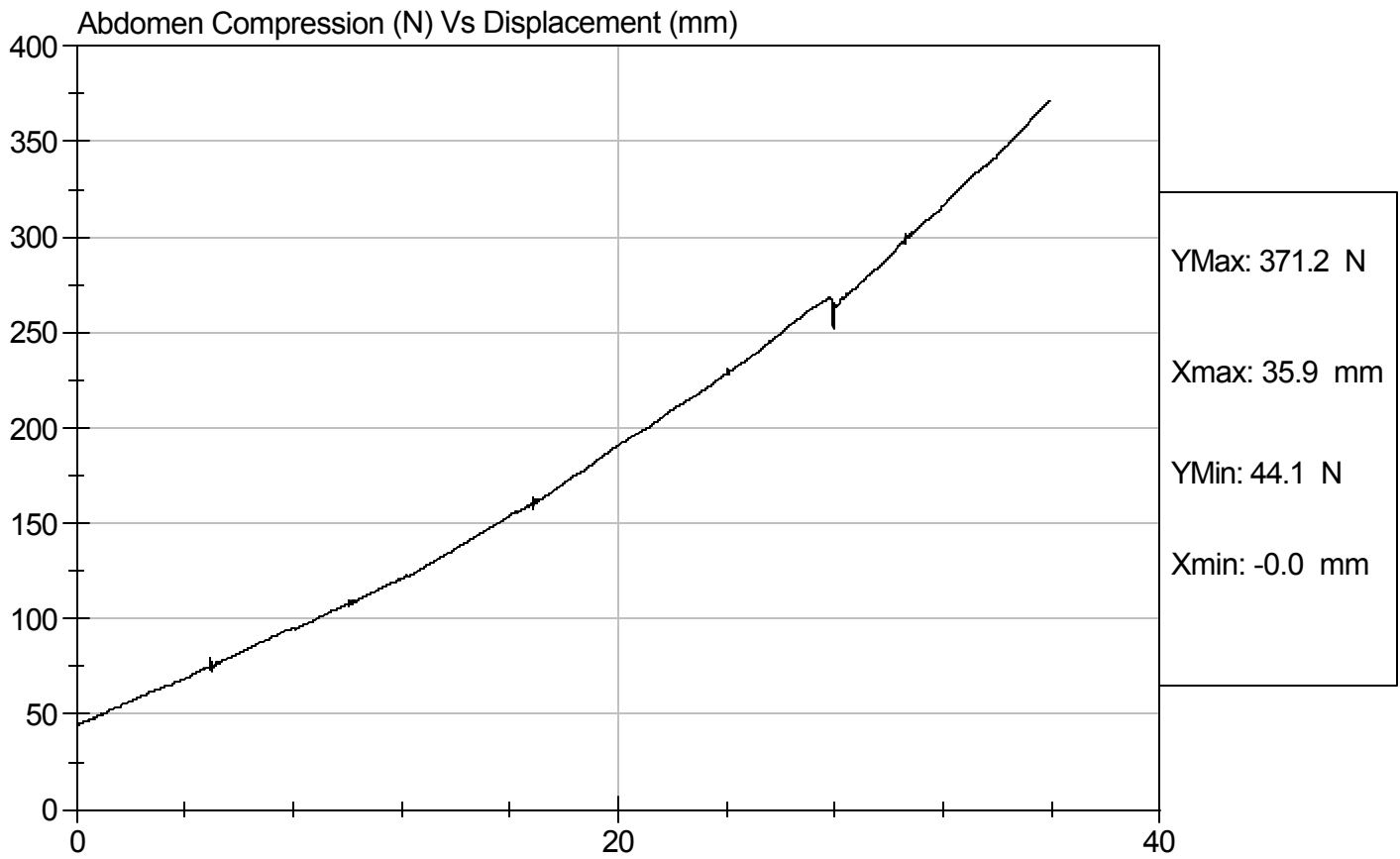


Test Description: Abdomen Compression

Test Date: 1/13/10

Component: D10074

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Lumbar Flexion Calibration

ATD Serial No: 272

Test I.D: D10075

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Force At 0 deg	N	0 - 26.7	0	Pass
Force At 20 deg	N	97.9 - 151.2	139.0	Pass
Force At 30 deg	N	151.2 - 204.6	177.5	Pass
Force At 40 deg	N	204.6 - 258.0	221.3	Pass
Return Angle	Deg	12 Maximum	2	Pass
Overall Test Results			Pass	


Laboratory Technician

1/13/10
Test Date


Approved By

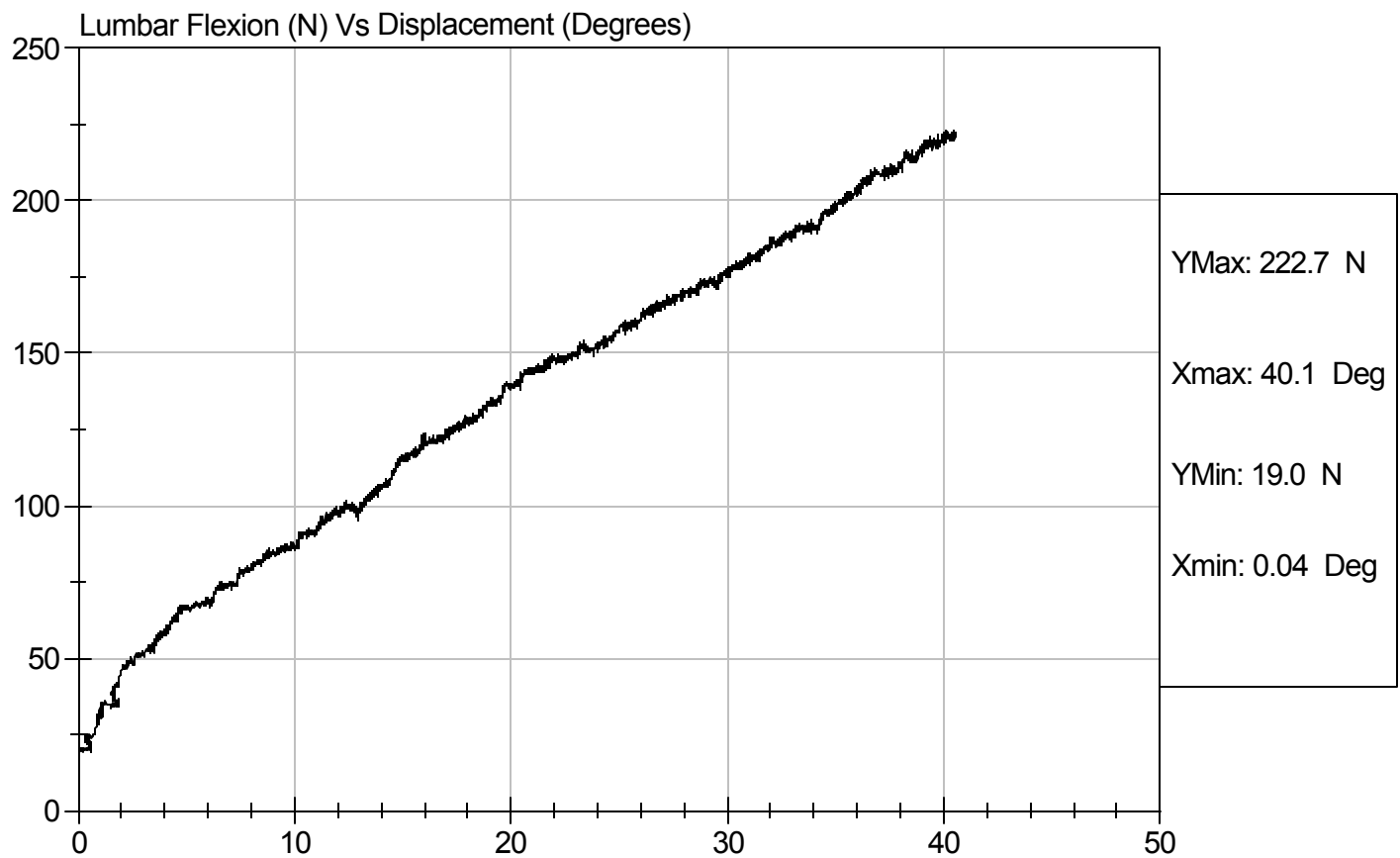


Test Description: Lumbar Flexion

Test Date: 1/13/10

Component: D10075

Speed: 0 ft/s, 0 m/s

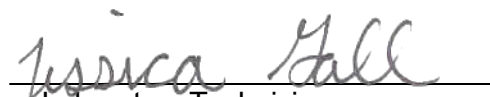


SID/HIII Calibration Data Sheet
Side Impact Dummy
Neck Pendulum Test

ATD Serial No: 272

Test I.D: D10079

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	18	Pass
Impact Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	1.96 to 2.55	2.39	Pass
	20 ms	m/s	4.12 to 5.10	4.69	Pass
	30 ms	m/s	5.73 to 7.01	6.47	Pass
	40 to 70 ms	m/s	6.27 to 7.64	6.77	Pass
Midsagittal Plane Max Rotation		deg	66 to 82	73	Pass
Head Rotation Peak to Zero - Decay Time		ms	58 to 67	58	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	73	Pass
Mx Peak To Zero - Decay Time		ms	49 to 64	56	Pass
Mx Peak to Max. Head Rotation		ms	2 to 16	15	Pass


 Laboratory Technician

1/13/10

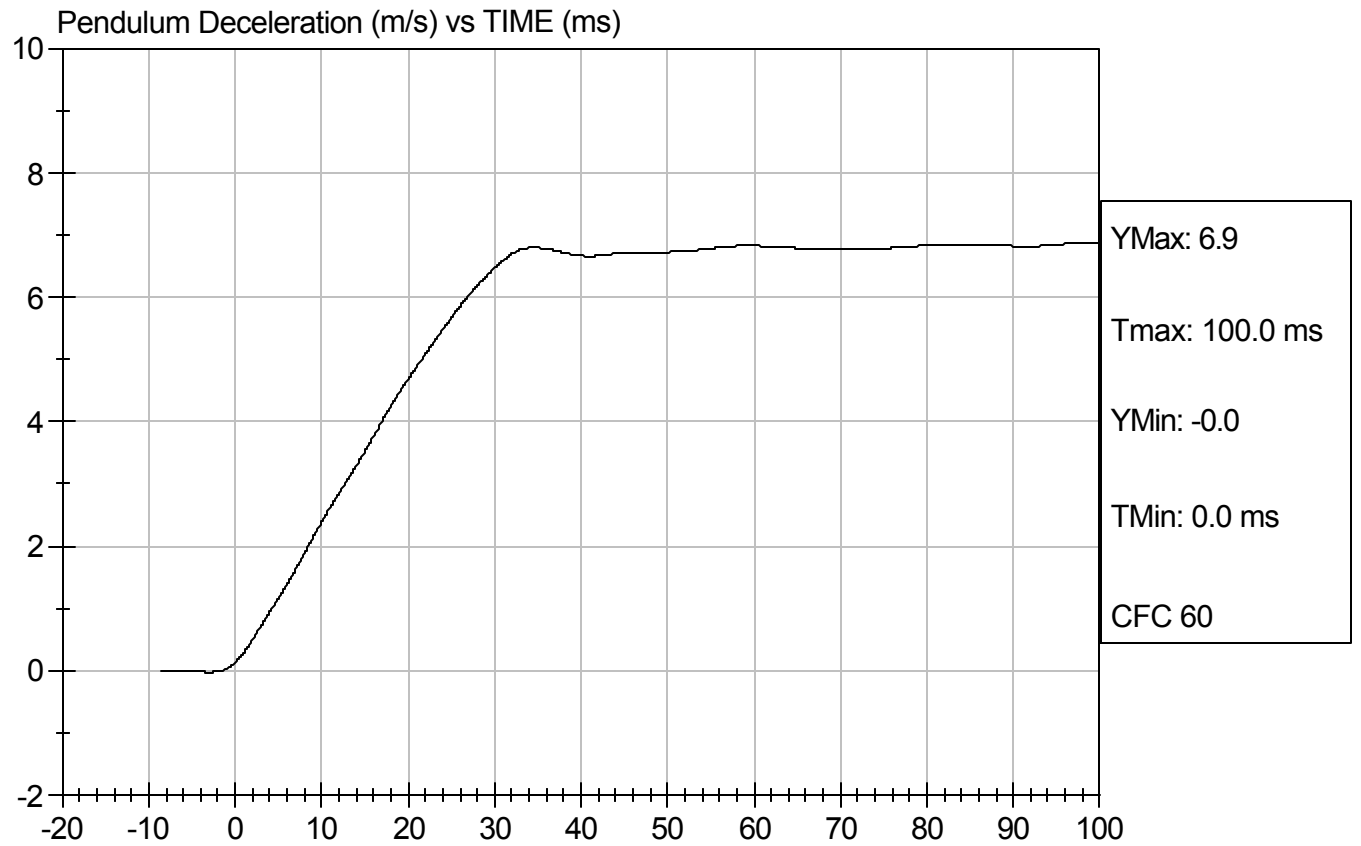
Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D10079

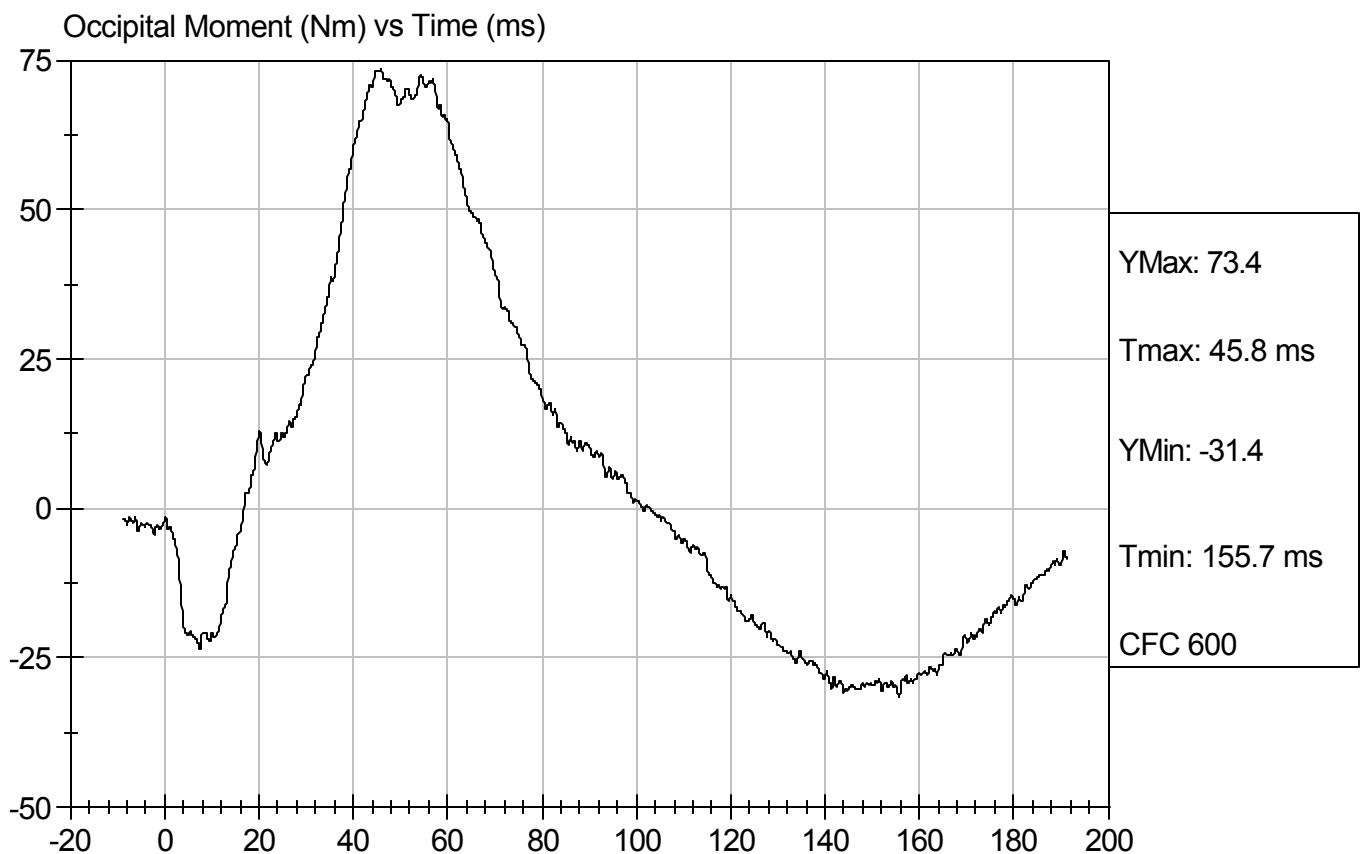
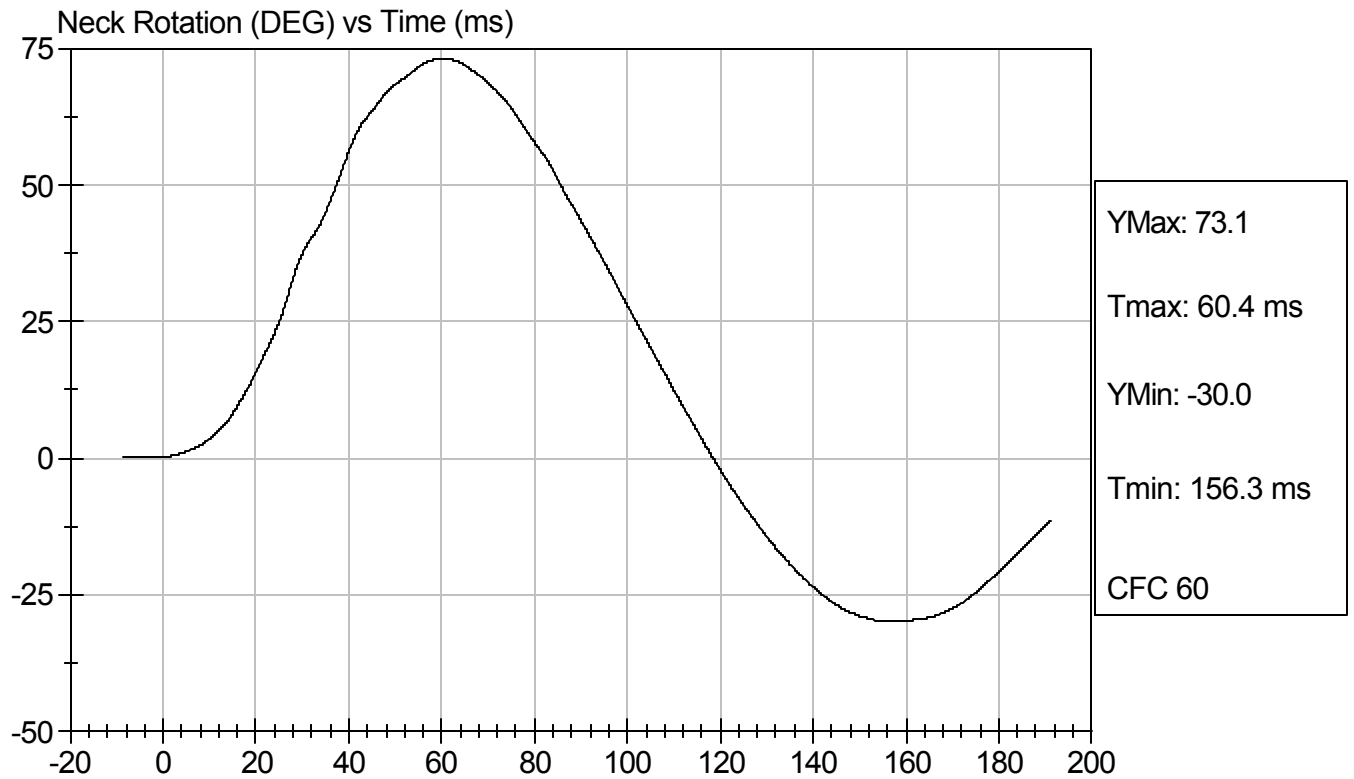
Test Date: 1/13/10
Speed: 23.148 ft/s, 7.06 m/s





Test Desc: Neck Bending
Component ID: D10079

Test Date: 1/13/10
Speed: 23.148 ft/s, 7.06 m/s



Calibration Test Results Summary

Dummy Serial Number: 272

Post-Test Calibration

External Dimensions:	The dummy passed all external dimension requirements.
Head Drop Test:	The head passed all drop test requirements.
Neck Pendulum Test:	The neck passed all pendulum test requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements. -2

SID/HIII Calibration Data Sheet
Side Impact Dummy
Head Drop Calibration (Lateral)

ATD Serial No: 272

Test I.D: D10401

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Peak Resultant Acceleration	G's	120 to 150	124	Pass
Is Resultant Curve Unimodal?	N/A	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	-9	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

David Winkelbauer
Approved By

02/11/2010
Test Date

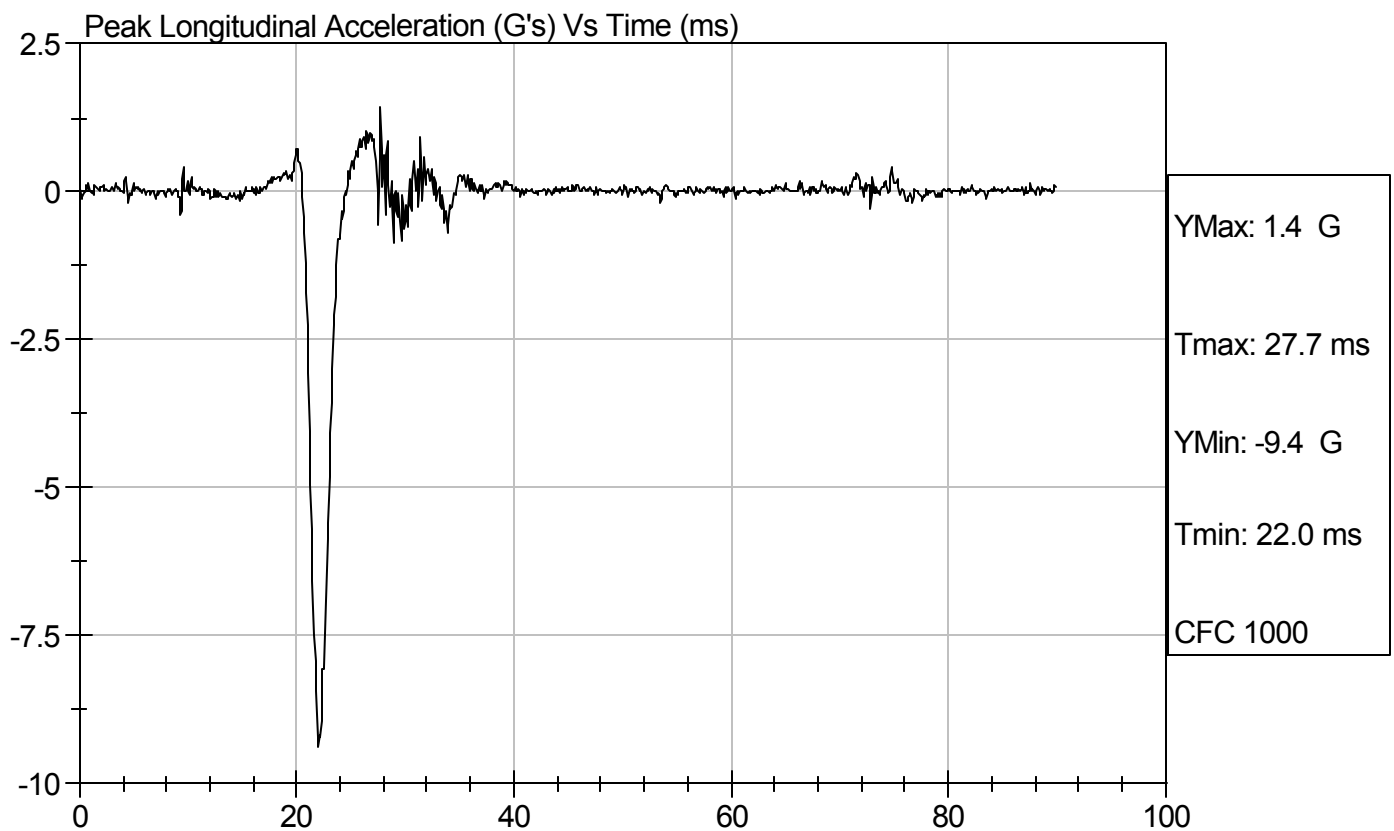
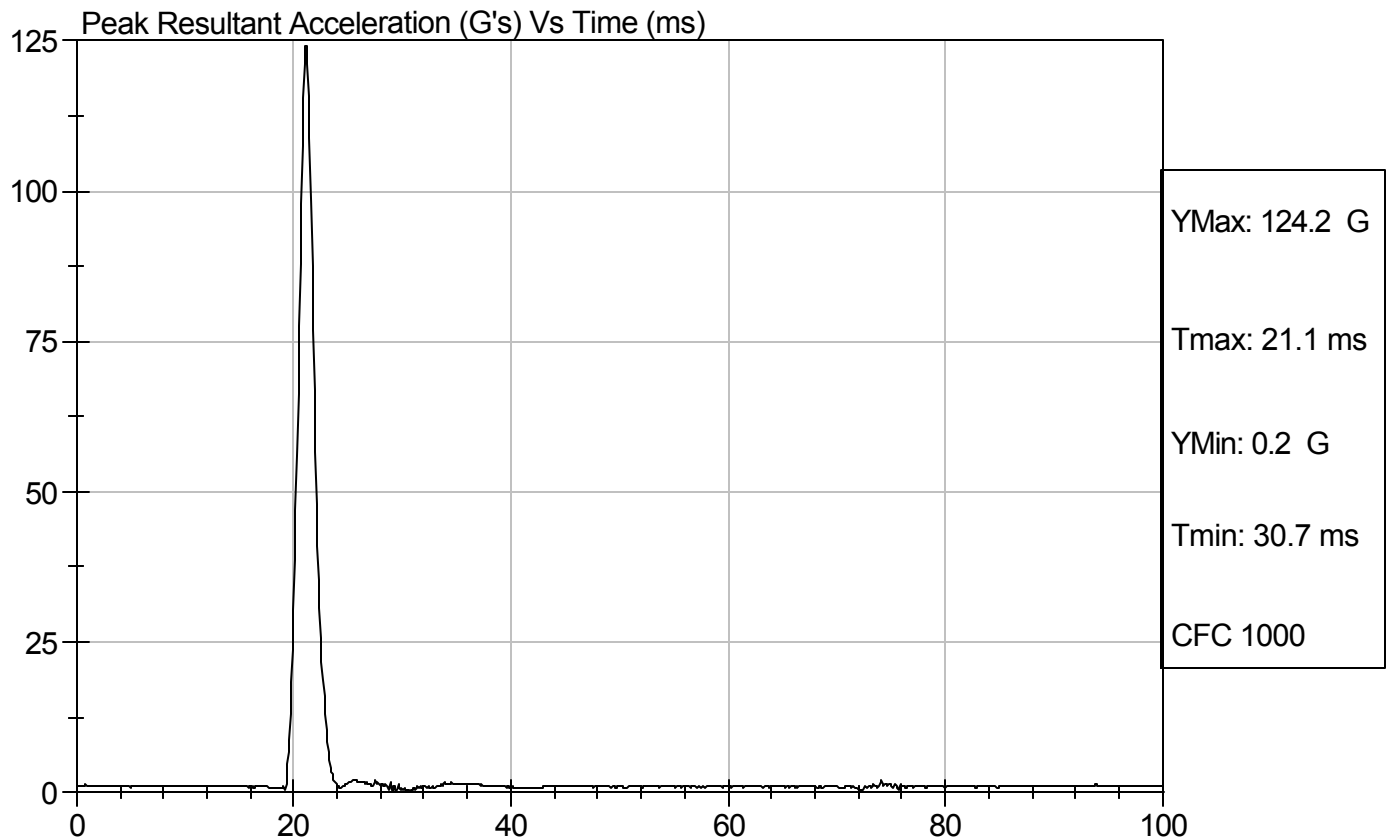


Test Description: Head Drop

Test Date: 02/11/2010

Component: D10401

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Thorax Impact Test

ATD Serial No: 272

Test I.D: D10402

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Velocity	m/s	4.22 - 4.31	4.27	Pass
Upper Rib	G's	37 - 46	40	Pass
Lower Rib	G's	37 - 46	38	Pass
Lower Spine	G's	15 - 22	19	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

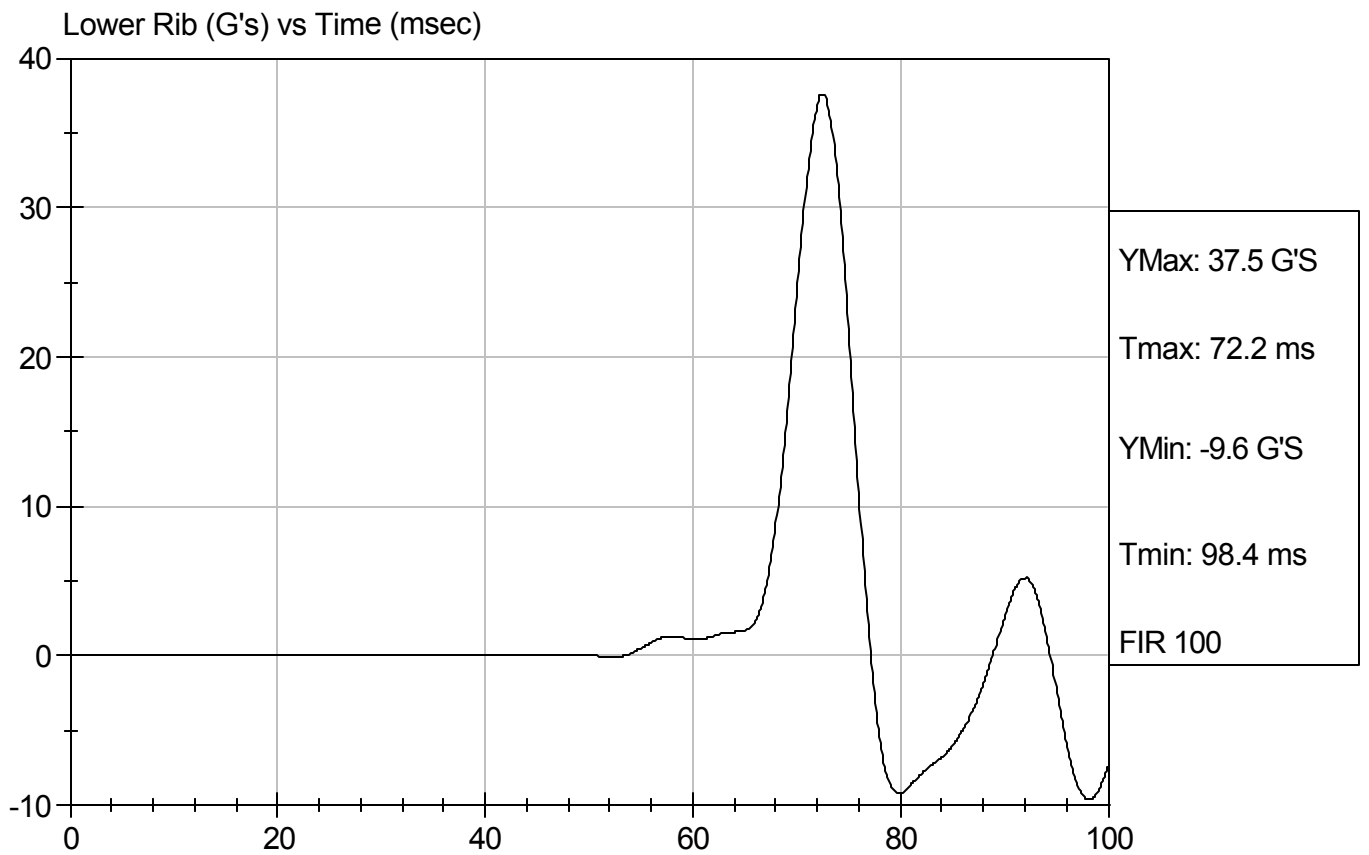
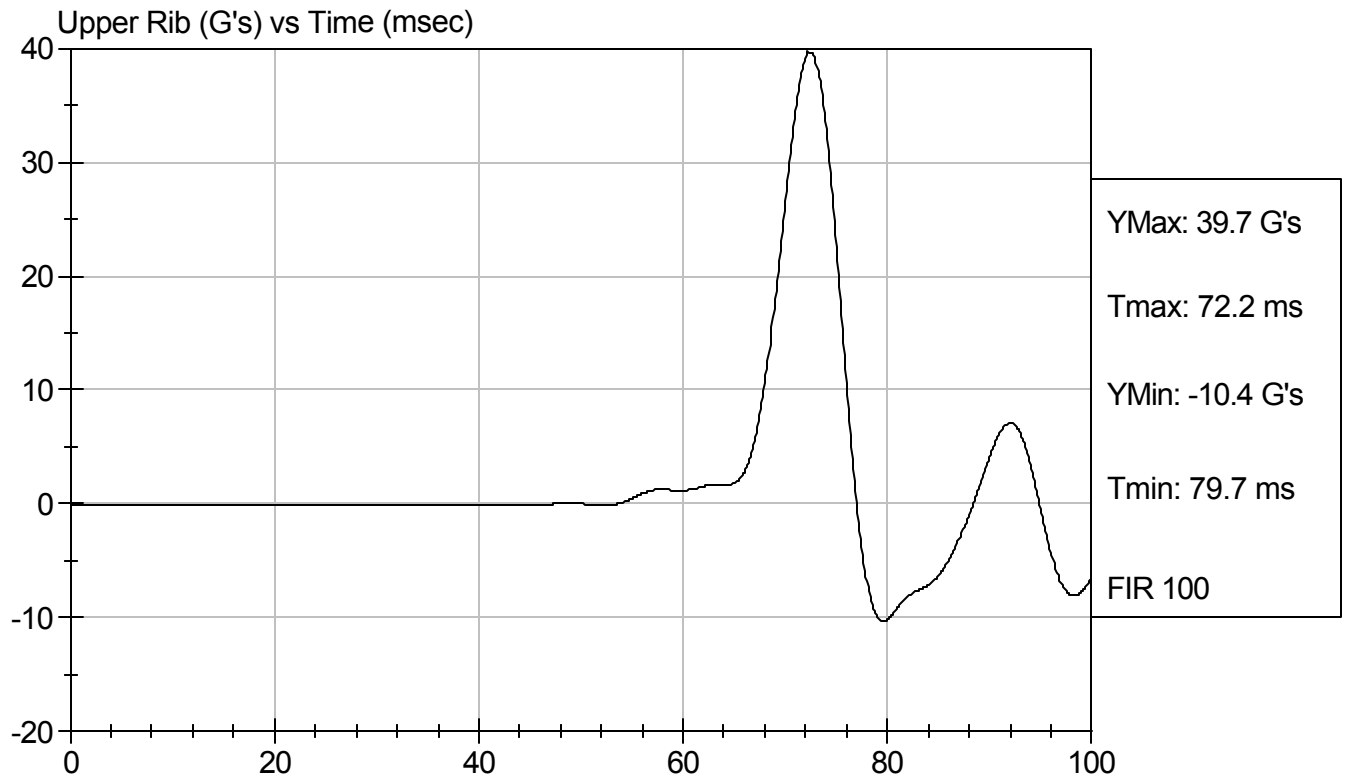
David Winkelbauer
Approved By

02/10/2010
Test Date



Test Desc: Thorax Impact
Component ID: D10402

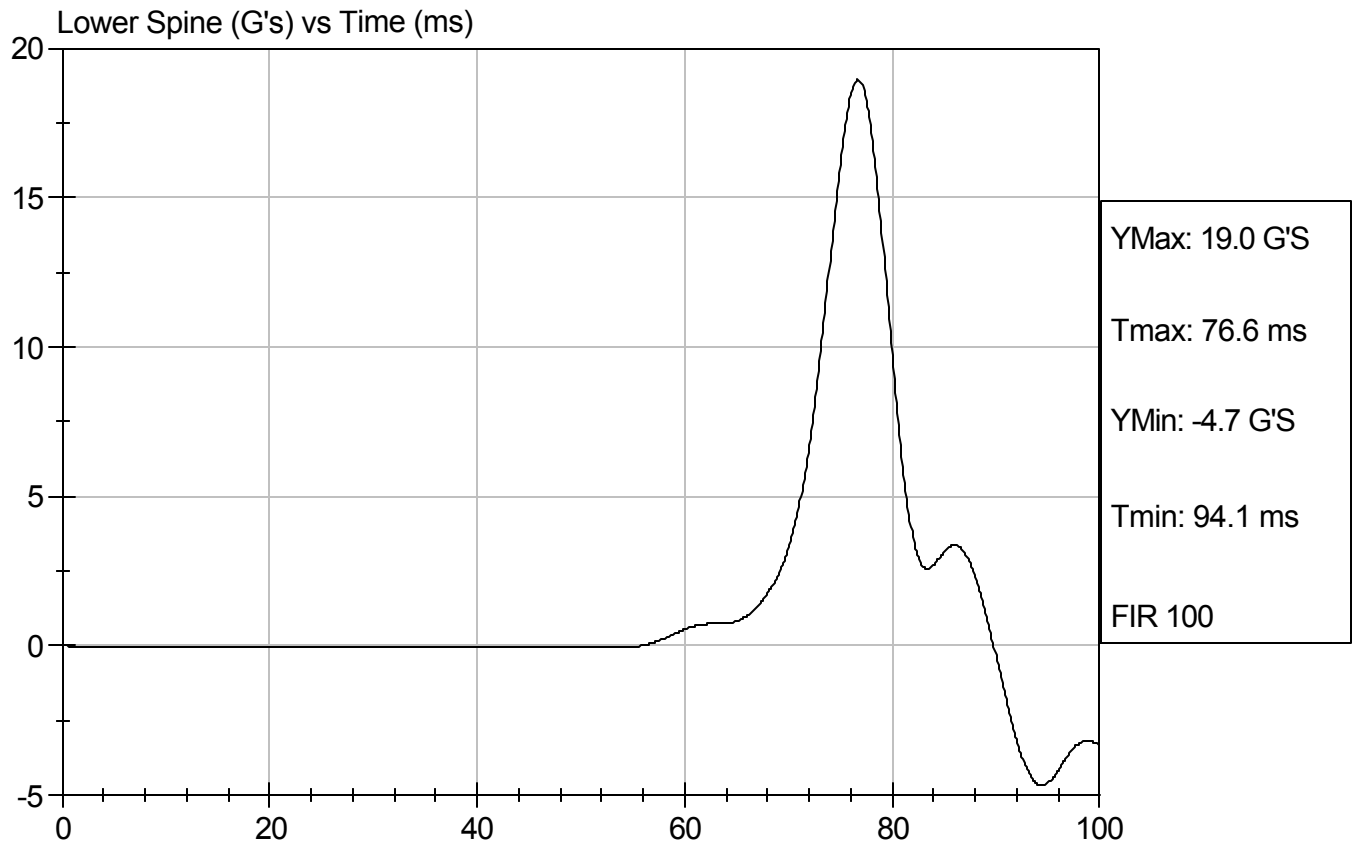
Test Date: 02/10/2010
Speed: 14.01 ft/s, 4.27 m/s





Test Desc: Thorax Impact
Component ID: D10402

Test Date: 02/10/2010
Speed: 14.01 ft/s, 4.27 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Pelvis Impact Test

ATD Serial No: 272

Test I.D: D10403

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/s	4.27 - 4.33	4.30	Pass
Pelvis Acceleration	G's	40 - 60	42	Pass
			Overall Test Results	Pass

Jessica Hall
Laboratory Technician

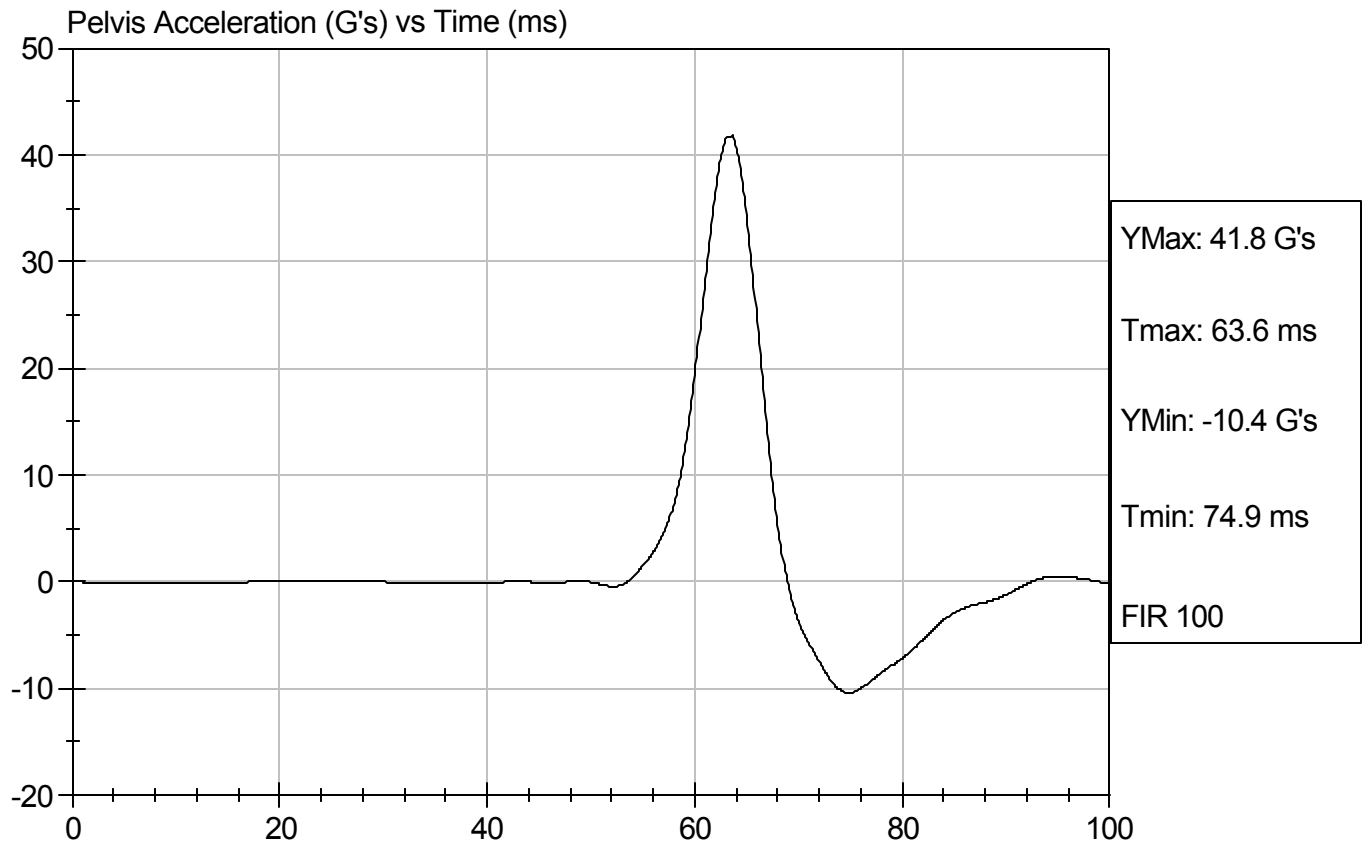
02/10/2010
Test Date

David Winkelbauer
Approved By



Test Desc: Pelvis Impact
Component ID: D10403

Test Date: 02/10/2010
Speed: 14.12 ft/s, 4.30 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 272

Test I.D: D10404

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Force At 12.7 mm	N	104 -162	131	Pass
Force At 19 mm	N	163 - 222	185	Pass
Force At 25.4 mm	N	222 - 280	251	Pass
Force At 33 mm	N	325 - 391	355	Pass
Overall Test Results			Pass	


Laboratory Technician

02/11/2010

Test Date


Approved By

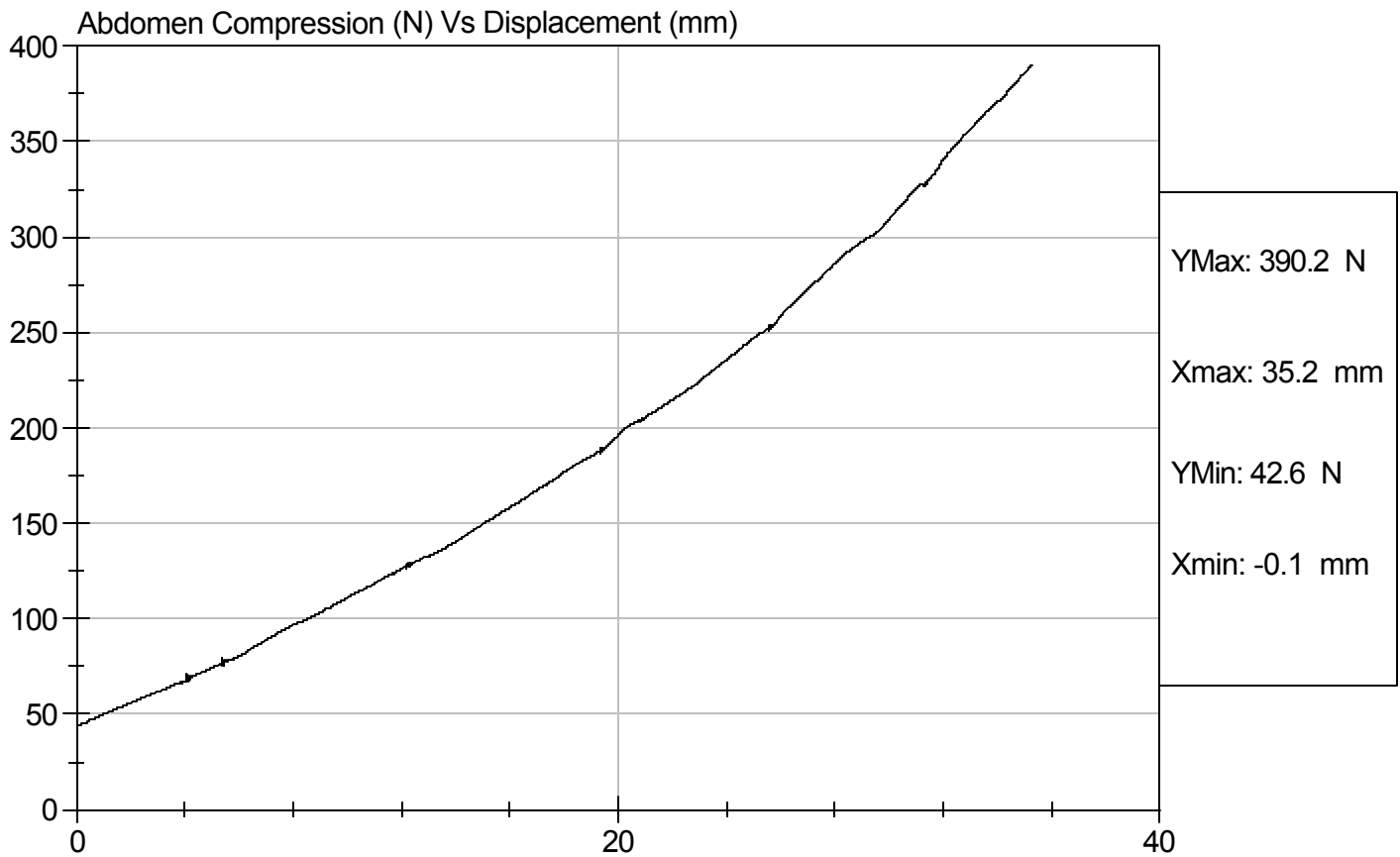


Test Description: Abdomen Compression

Test Date: 02/11/2010

Component: D10404

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Lumbar Flexion Calibration

ATD Serial No: 272

Test I.D: D10405

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Force At 0 deg	N	0 - 26.7	0	Pass
Force At 20 deg	N	97.9 - 151.2	140.6	Pass
Force At 30 deg	N	151.2 - 204.6	190.3	Pass
Force At 40 deg	N	204.6 - 258.0	251.1	Pass
Return Angle	Deg	12 Maximum	3	Pass
Overall Test Results			Pass	


Laboratory Technician


Approved By

02/11/2010
Test Date

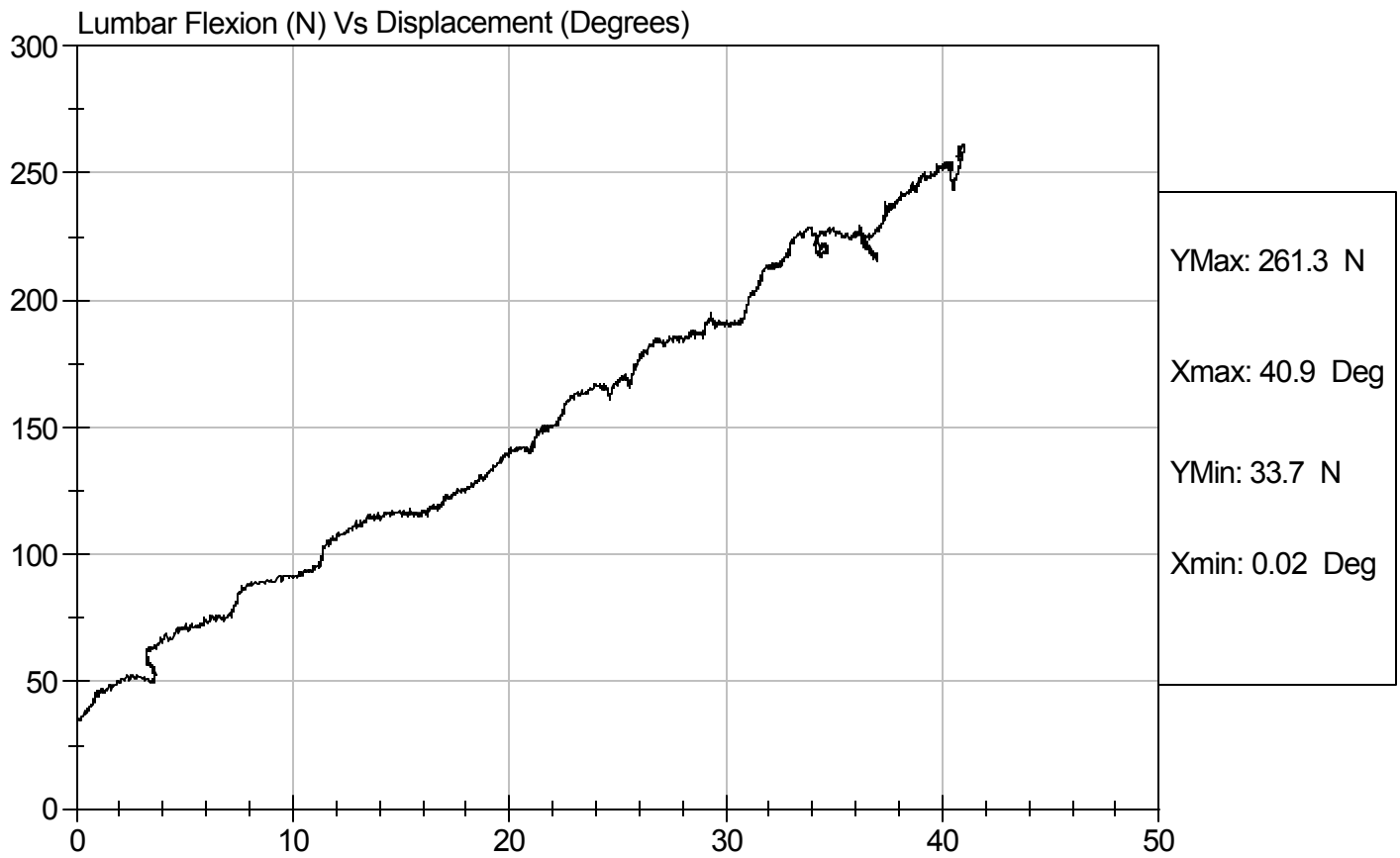


Test Description: Lumbar Flexion

Test Date: 02/11/2010

Component: D10405

Speed: 0 ft/sec, 0 m/sec

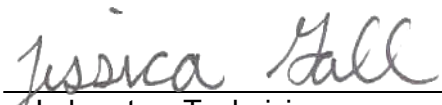


SID/HIII Calibration Data Sheet
Side Impact Dummy
Neck Pendulum Test

ATD Serial No: 272

Test I.D: D10409

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	18	Pass
Impact Velocity		m/s	6.89 to 7.13	7.05	Pass
Pendulum Deceleration	10 ms	m/s	1.96 to 2.55	2.38	Pass
	20 ms	m/s	4.12 to 5.10	4.67	Pass
	30 ms	m/s	5.73 to 7.01	6.37	Pass
	40 to 70 ms	m/s	6.27 to 7.64	6.73	Pass
Midsagittal Plane Max Rotation		deg	66 to 82	71	Pass
Head Rotation Peak to Zero - Decay Time		ms	58 to 67	59	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	74	Pass
Mx Peak To Zero - Decay Time		ms	49 to 64	56	Pass
Mx Peak to Max. Head Rotation		ms	2 to 16	15	Pass


 Laboratory Technician


 Approved By

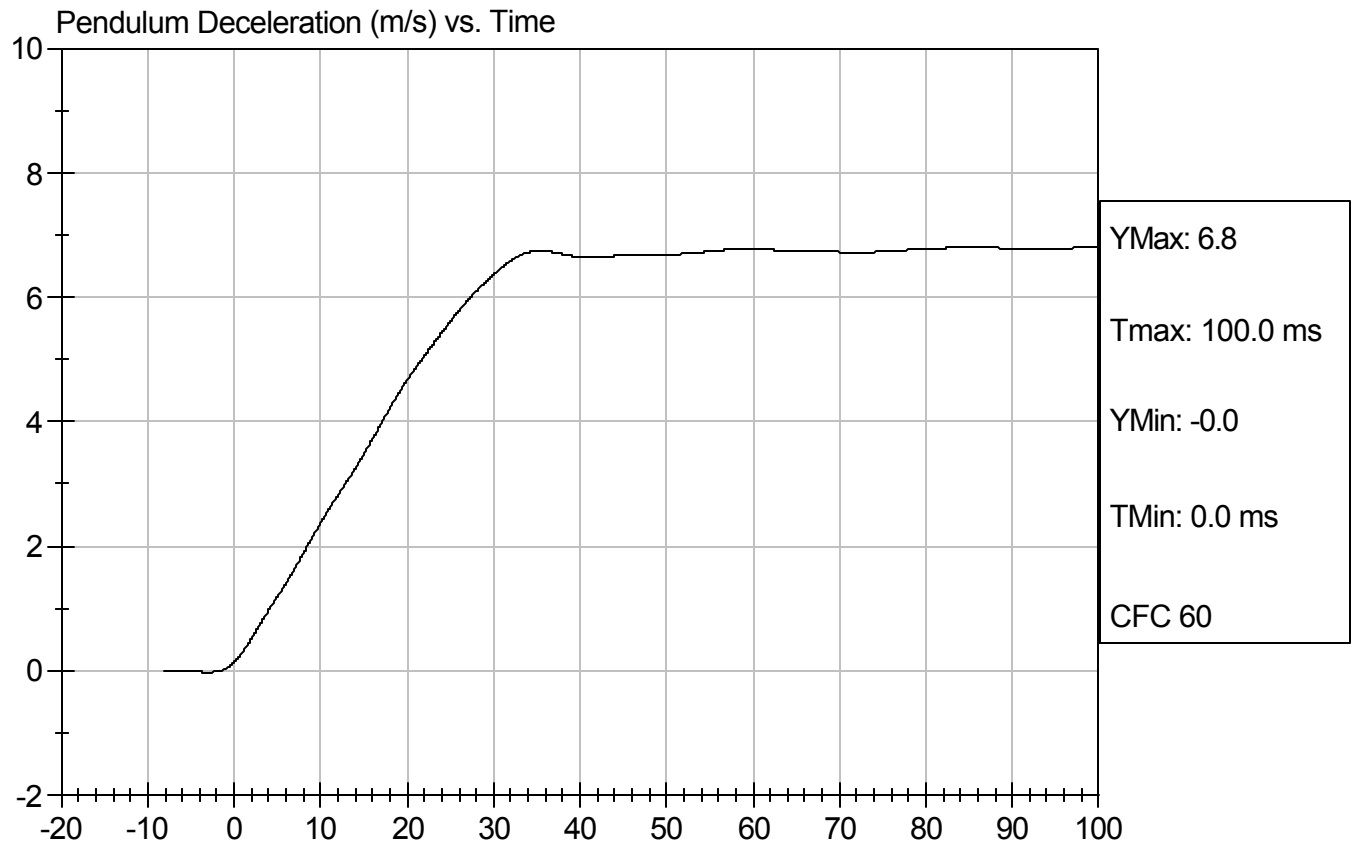
02/11/2010

Test Date



Test Desc: Neck Bending
Component ID: D10409

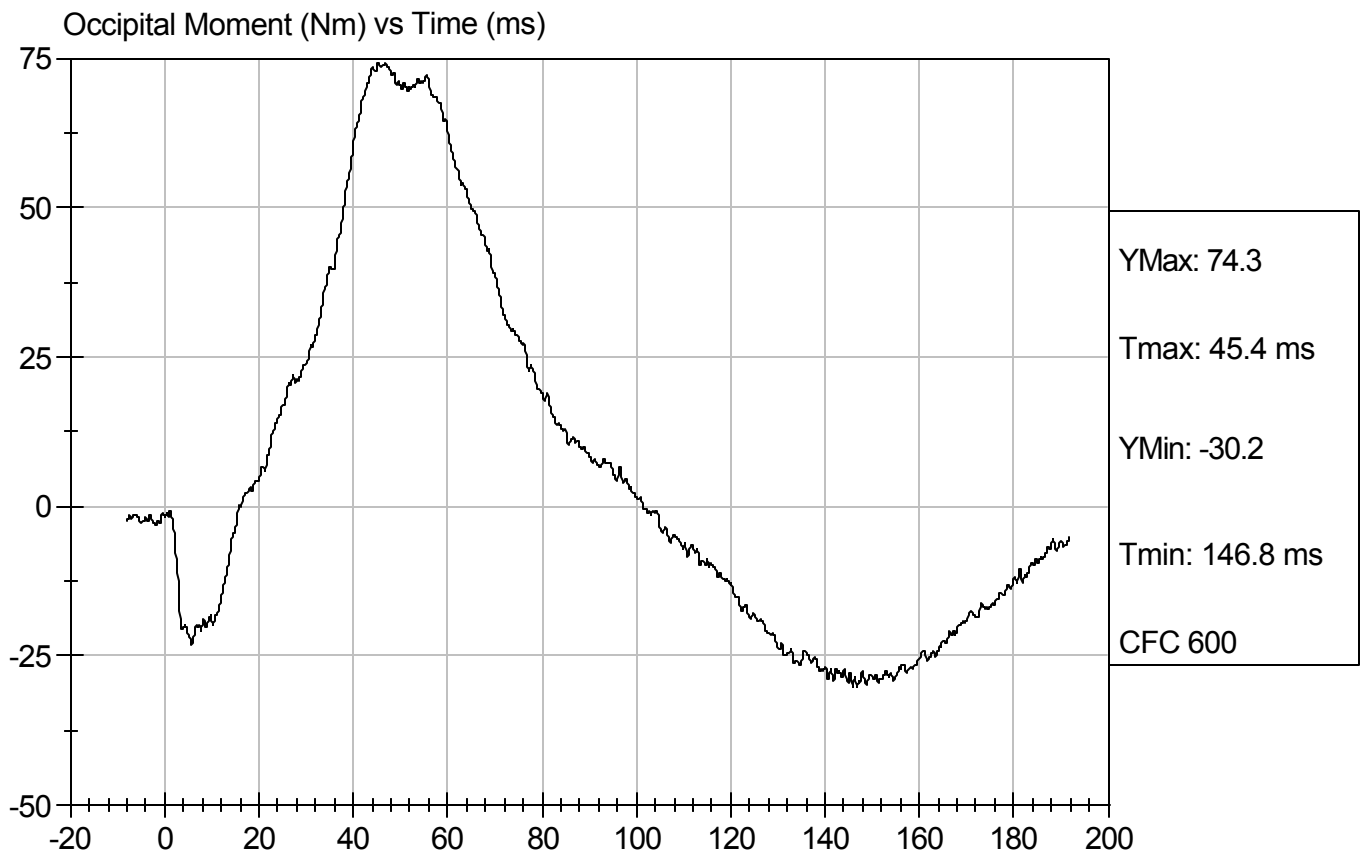
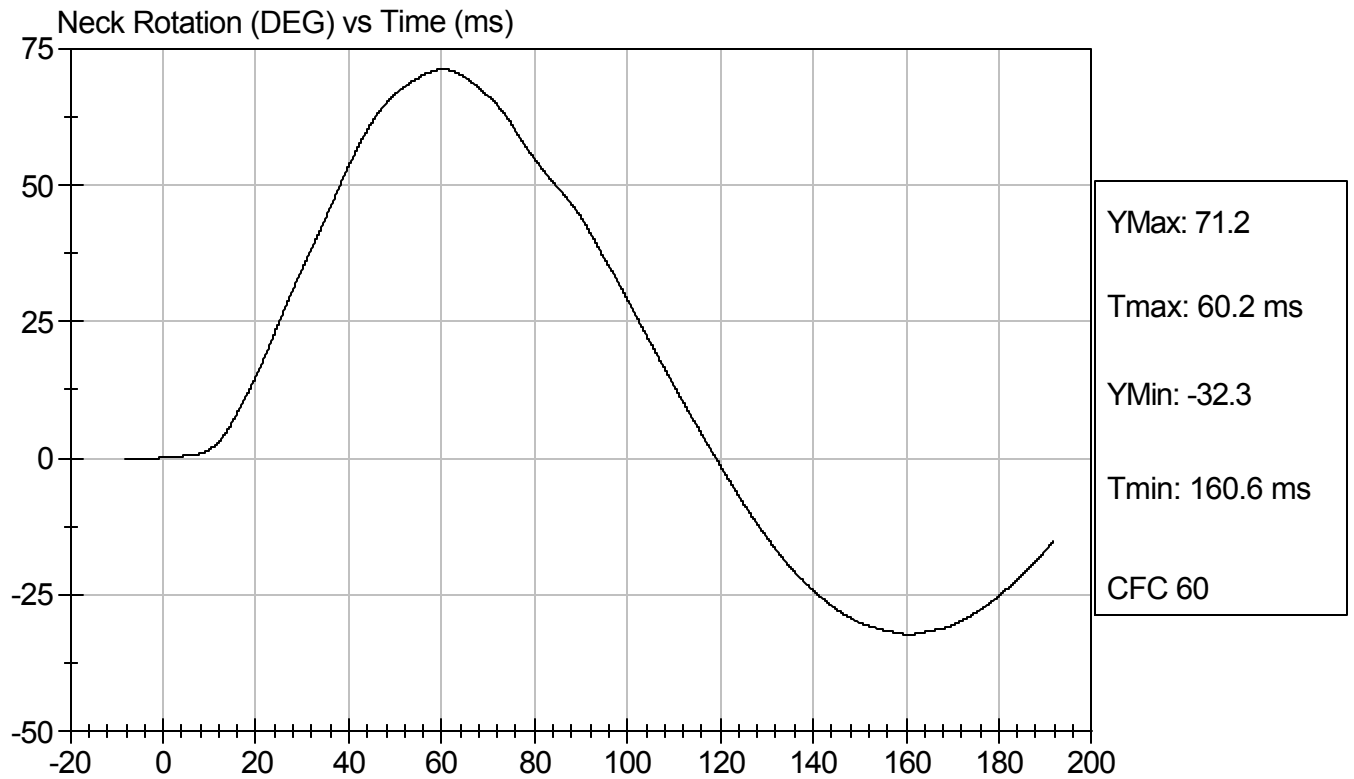
Test Date: 02/11/2010
Speed: 23.14 ft/s, 7.05 m/s





Test Desc: Neck Bending
Component ID: D10409

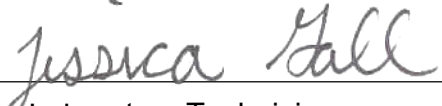
Test Date: 02/11/2010
Speed: 23.14 ft/s, 7.05 m/s



SID Calibration Data Sheet
Side Impact Dummy
Inspection Checklist

ATD Serial No: 272

Test Part	Items Checked	Result
Skin	Visual inspection	Pass
Head	Visual, ballast, accelerometer mount	Pass
Neck	Visual	Pass
Spine Box	Visual, ballast, accelerometer mount	Pass
Rib Cage	Visual, measure	Pass
Sternum	Visual	Pass
Lumbar Spine	Visual	Pass
Abdomen	Visual	Pass
Pelvis	Visual, palpate, accelerometer mount	Pass
Upper Legs	Visual	Pass
Knees	Visual	Pass
Lower Legs	Visual, range of motion	Pass
Ankles	Visual, range of motion	Pass
Feet	Visual, range of motion	Pass
Joints	1 to 2 g range	Pass
Other		Pass


Laboratory Technician

Approved By

2/11/2010
Test Date

CERTIFICATION DATA

Dummy Serial Number: 271

Calibration Test Results Summary

Dummy Serial Number: 271

Pre-Test Calibration

External Dimensions:	The dummy passed all external dimension requirements.
Head Drop Test:	The head passed all drop test requirements.
Neck Pendulum Test:	The neck passed all pendulum test requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements.

SID Calibration Data Sheet
Side Impact Dummy
External Measurements

ATD Serial No: 271

Test I.D: D1006

Tested Parameter	Units	Specification	Result	Pass/Fail
SH - Seated Height	mm	889 - 909	905	Pass
RH - Rib Height	mm	501 - 521	502	Pass
HP - Hip Pivot Height	mm	99 ref.	99	Pass
RD - Rib from Back Line	mm	229 - 241	239	Pass
KV - Knee Pivot to Back Line	mm	511 - 526	526	Pass
SW - Knee Pivot to Floor	mm	490 - 505	497	Pass
HW - Hip Width	mm	356 - 391	371	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

David Winkelbauer
Approved By

1/13/2010
Test Date

SID/HIII Calibration Data Sheet
Side Impact Dummy
Head Drop Calibration (Lateral)

ATD Serial No: 271

Test I.D: D10061

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Peak Resultant Acceleration	G's	120 to 150	137	Pass
Is Resultant Curve Unimodal?	N/A	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	6.8	Pass
			Overall Test Results	Pass


Laboratory Technician

1/13/10
Test Date


Approved By



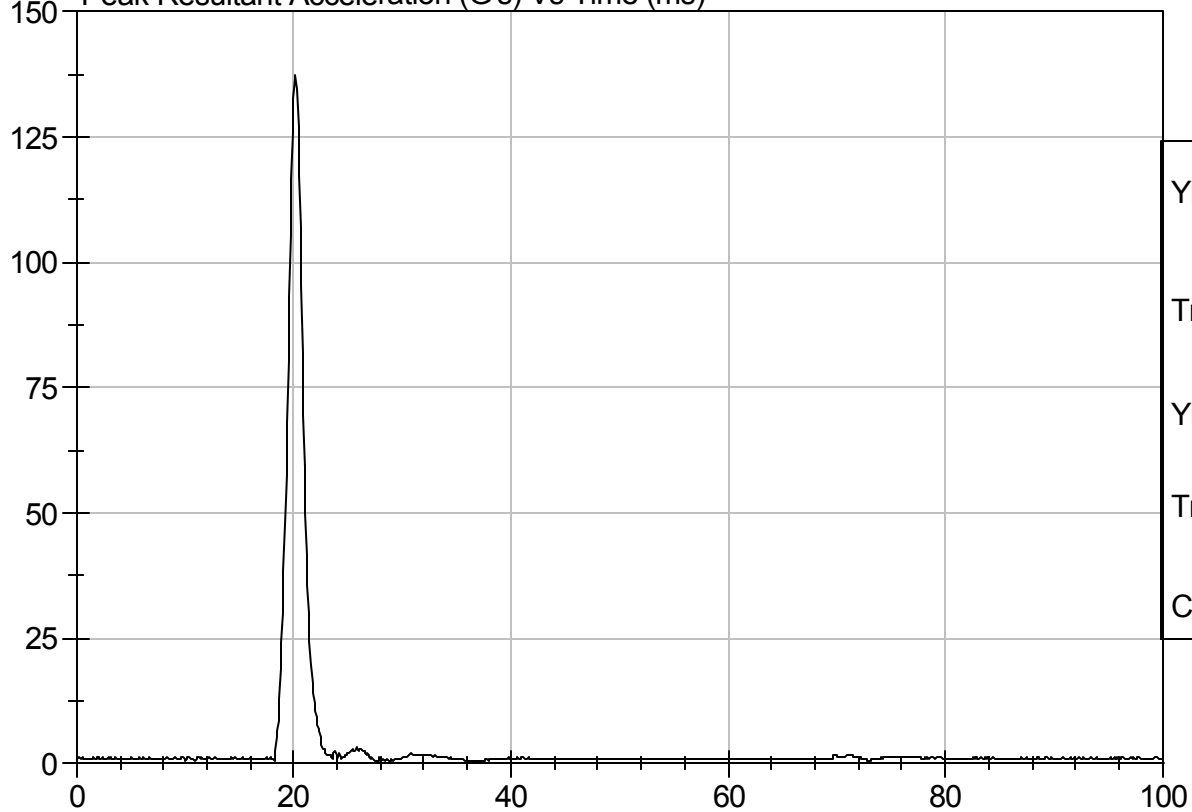
Test Description: Head Drop

Test Date: 1/13/10

Component: D10061

Speed: 0 ft/s, 0 m/s

Peak Resultant Acceleration (G's) Vs Time (ms)



YMax: 137.4 G

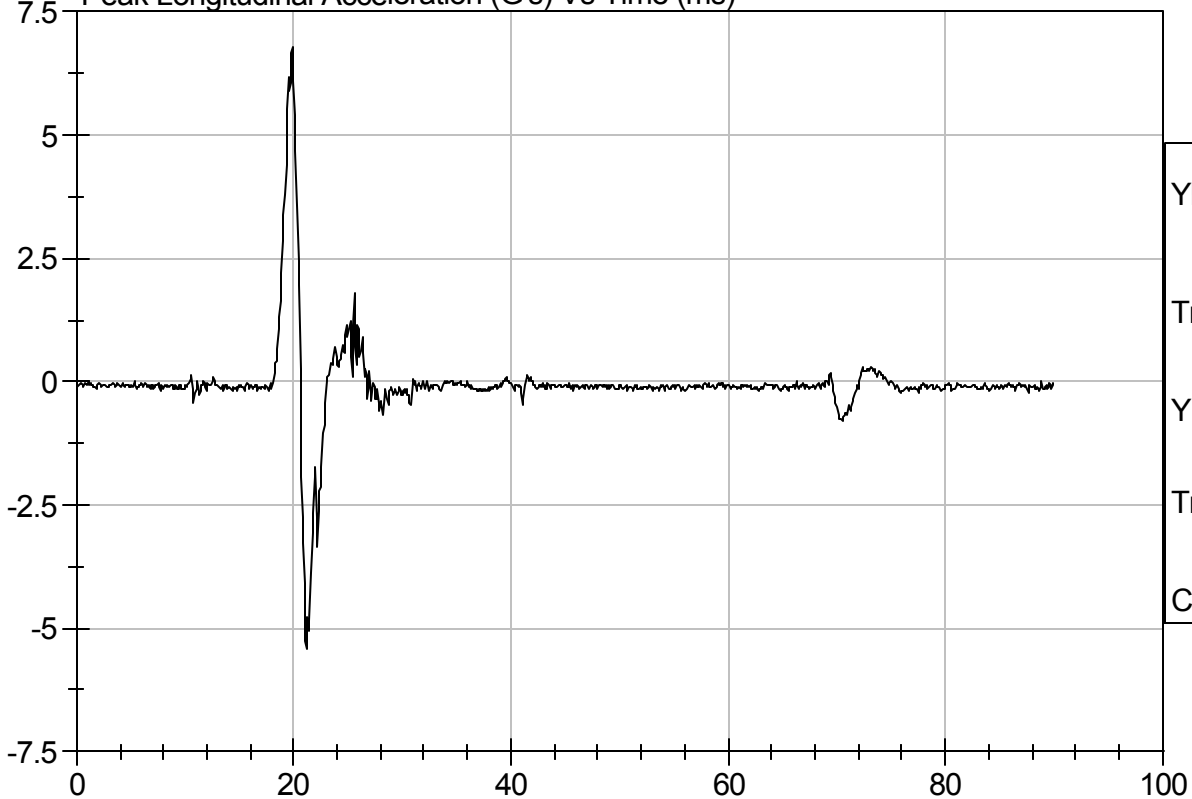
Tmax: 20.2 ms

YMin: 0.4 G

Tmin: 18.2 ms

CFC 1000

Peak Longitudinal Acceleration (G's) Vs Time (ms)



YMax: 6.8 G

Tmax: 19.9 ms

YMin: -5.4 G

Tmin: 21.2 ms

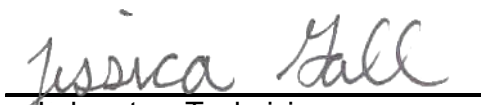
CFC 1000

SID/HIII Calibration Data Sheet
Side Impact Dummy
Thorax Impact Test

ATD Serial No: 271

Test I.D: D10062

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Velocity	m/s	4.22 - 4.31	4.30	Pass
Upper Rib	G's	37 - 46	39	Pass
Lower Rib	G's	37 - 46	39	Pass
Lower Spine	G's	15 - 22	19	Pass
Overall Test Results				Pass


Laboratory Technician

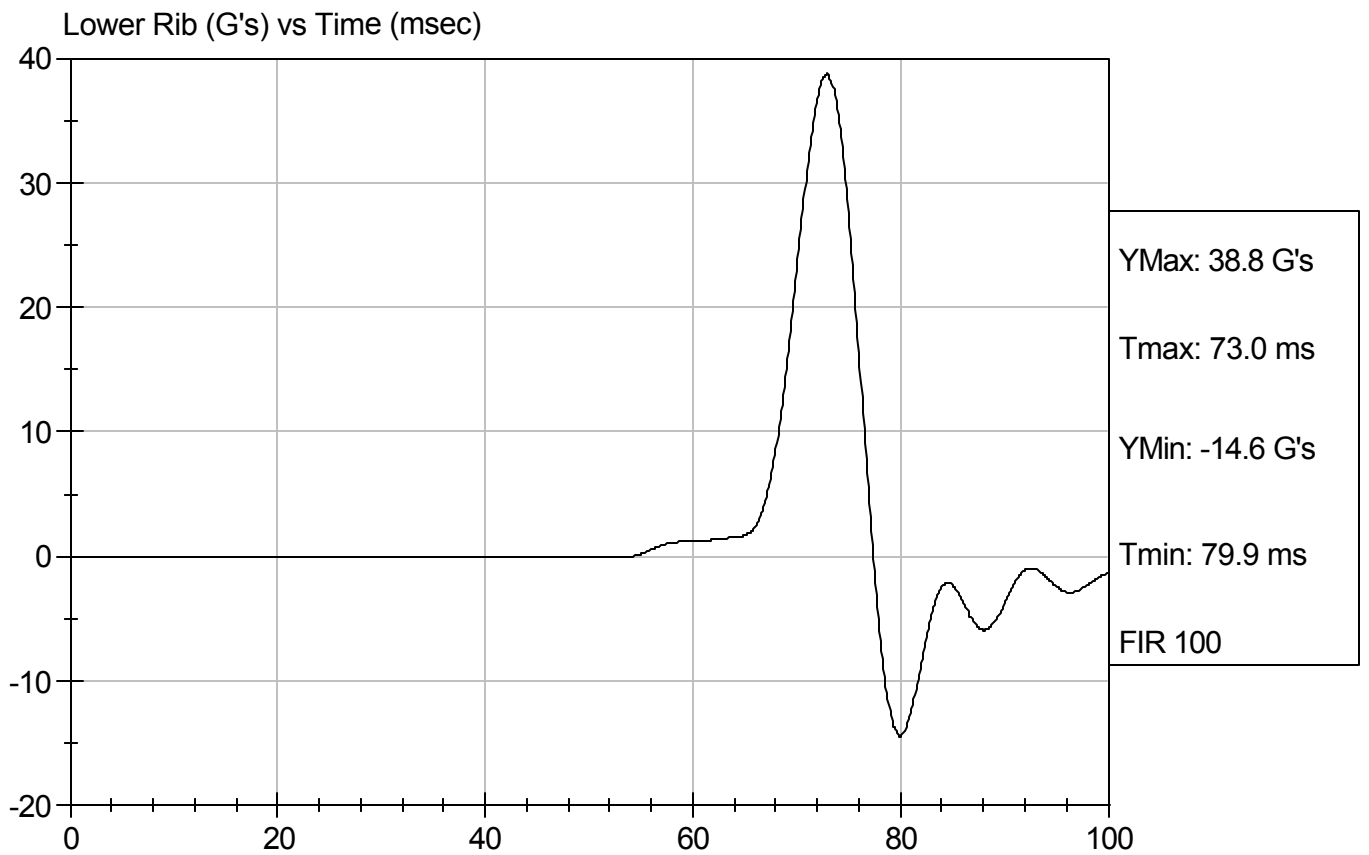
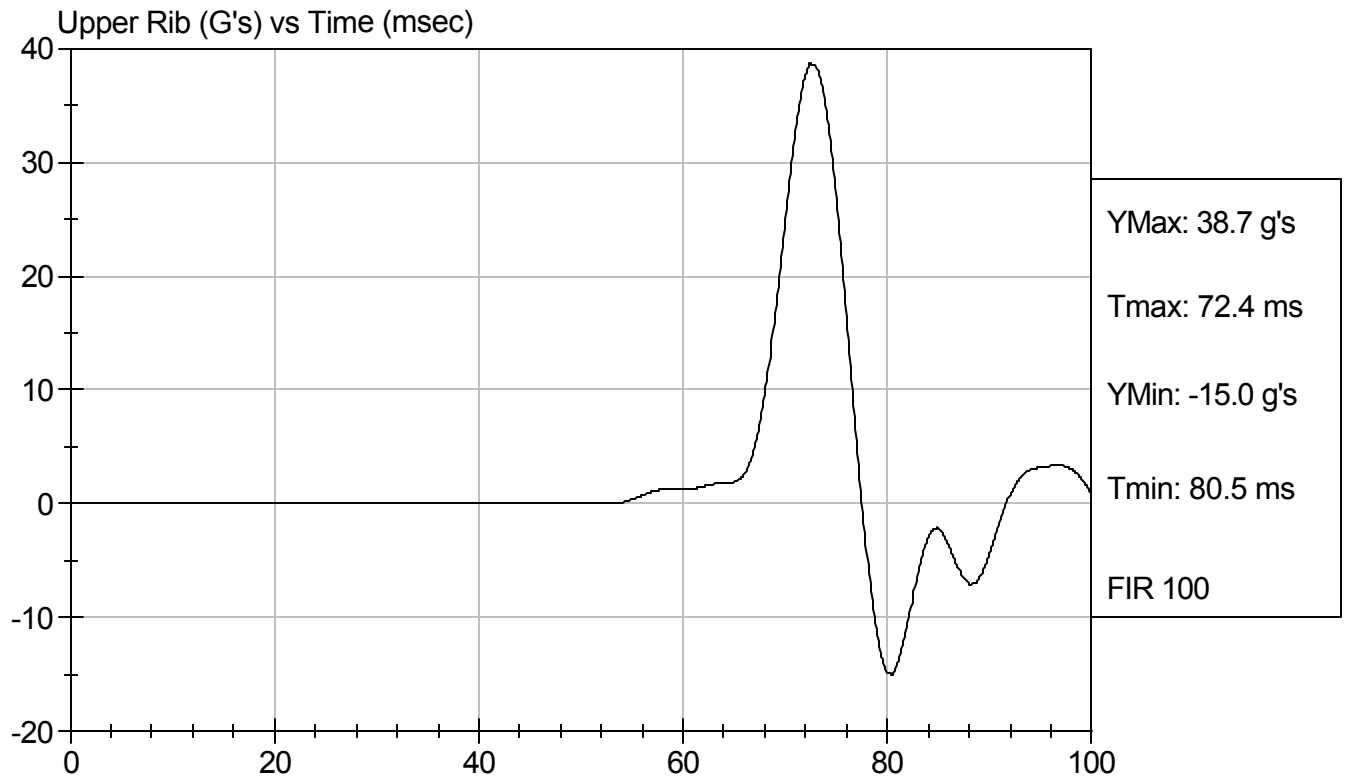
1/13/10
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D10062

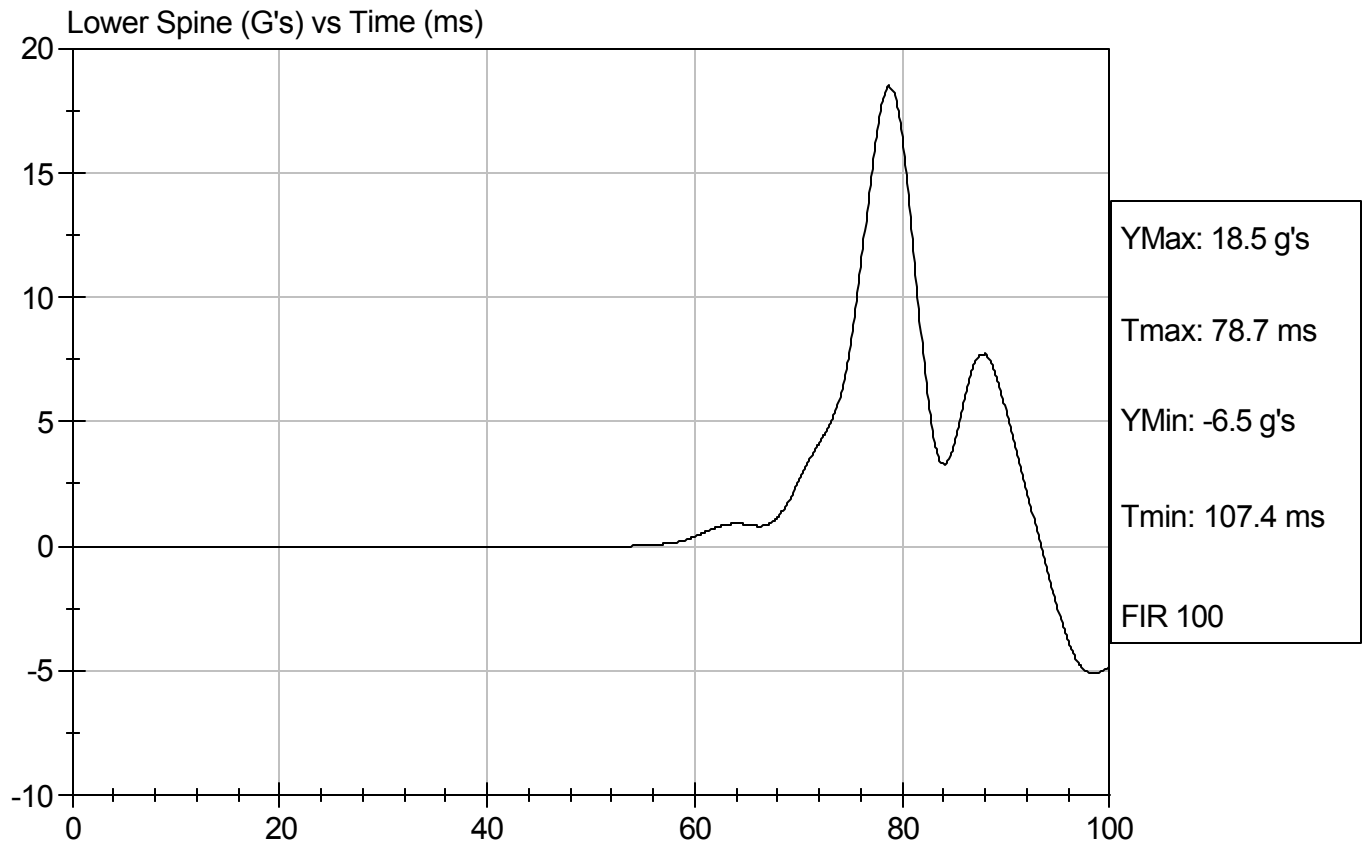
Test Date: 1/13/10
Speed: 14.12 ft/s, 4.30 m/s





Test Desc: Thorax Impact
Component ID: D10062

Test Date: 1/13/10
Speed: 14.12 ft/s, 4.30 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Pelvis Impact Test

ATD Serial No: 271

Test I.D: D10063

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Velocity	m/s	4.27 - 4.33	4.30	Pass
Pelvis Acceleration	G's	40 - 60	44	Pass
			Overall Test Results	Pass

Jessica Hall
Laboratory Technician

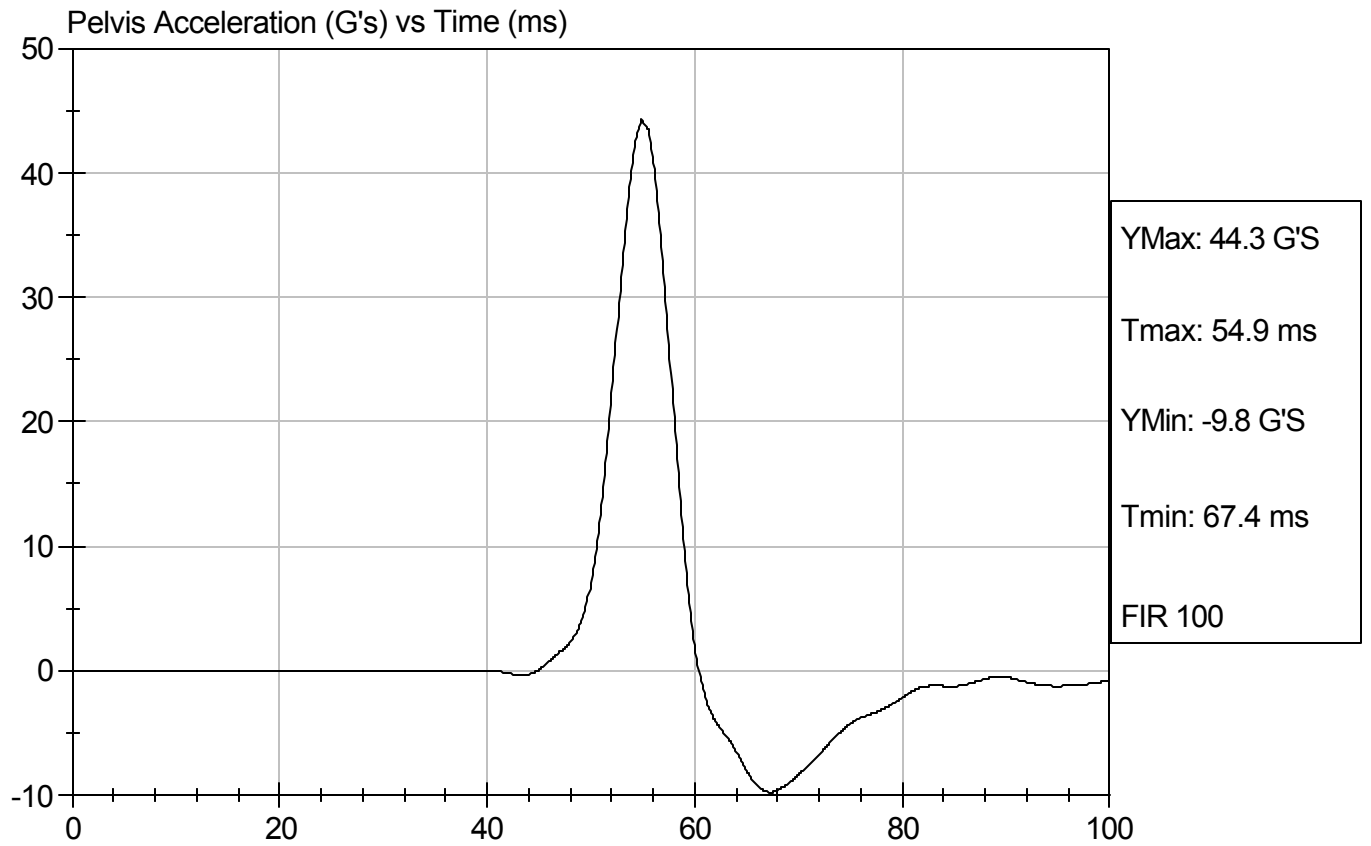
1/13/10
Test Date

David Winkelbauer
Approved By



Test Desc: Pelvis Impact
Component ID: D10063

Test Date: 1/13/10
Speed: 14.12 ft/s, 4.30 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 271

Test I.D: D10064

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Force At 12.7 mm	N	104 -162	139	Pass
Force At 19 mm	N	163 - 222	203	Pass
Force At 25.4 mm	N	222 - 280	278	Pass
Force At 33 mm	N	325 - 391	387	Pass
			Overall Test Results	Pass

Jessica Hall
Laboratory Technician

David Winkelbauer
Approved By

1/13/10
Test Date

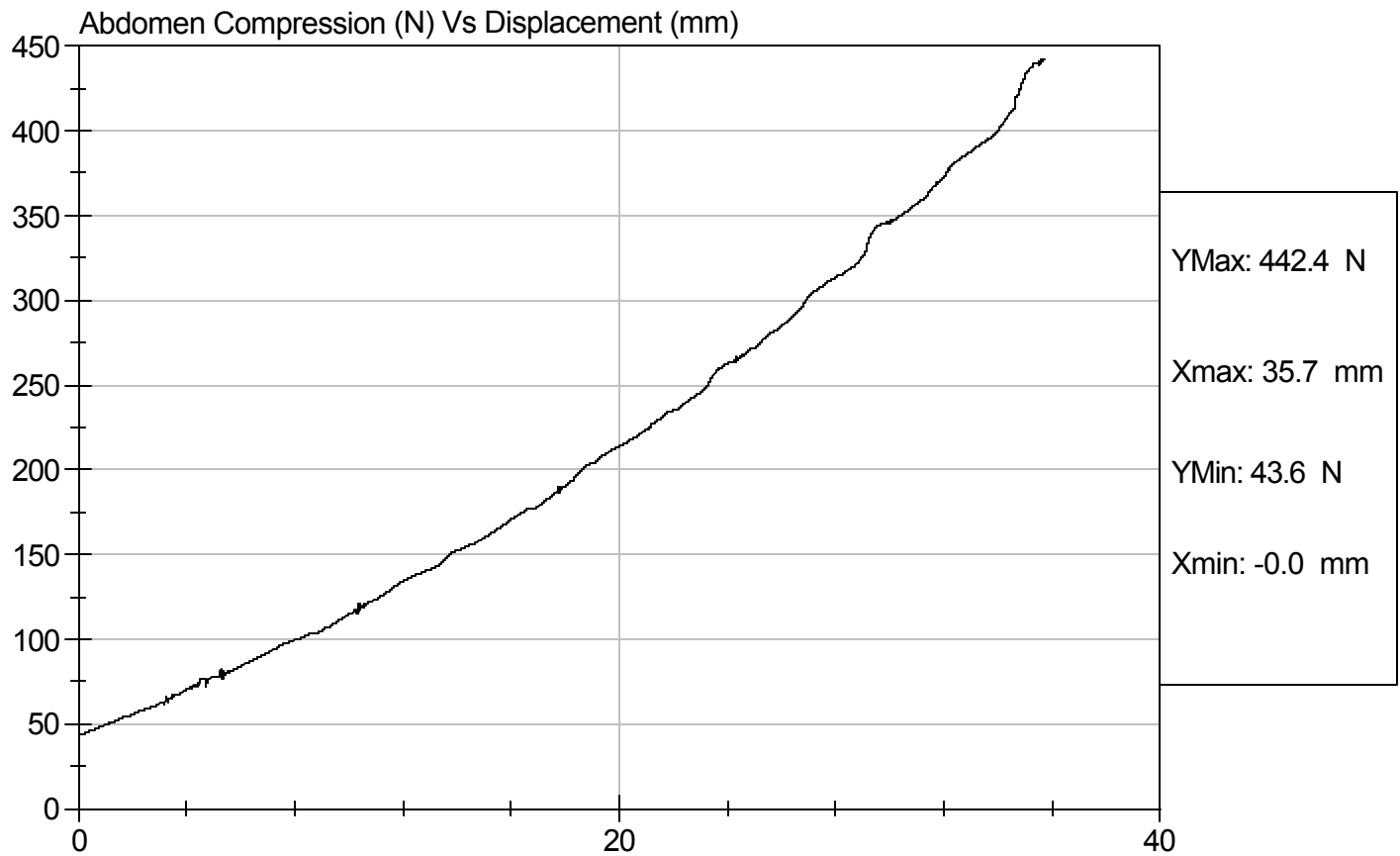


Test Description: Abdomen Compression

Test Date: 1/13/10

Component: D10064

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Lumbar Flexion Calibration

ATD Serial No: 271

Test I.D: D10065

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Force At 0 deg	N	0 - 26.7	0	Pass
Force At 20 deg	N	97.9 - 151.2	125.5	Pass
Force At 30 deg	N	151.2 - 204.6	191.9	Pass
Force At 40 deg	N	204.6 - 258.0	257.0	Pass
Return Angle	Deg	12 Maximum	5	Pass
Overall Test Results			Pass	


 Laboratory Technician


 Approved By

1/13/10
 Test Date

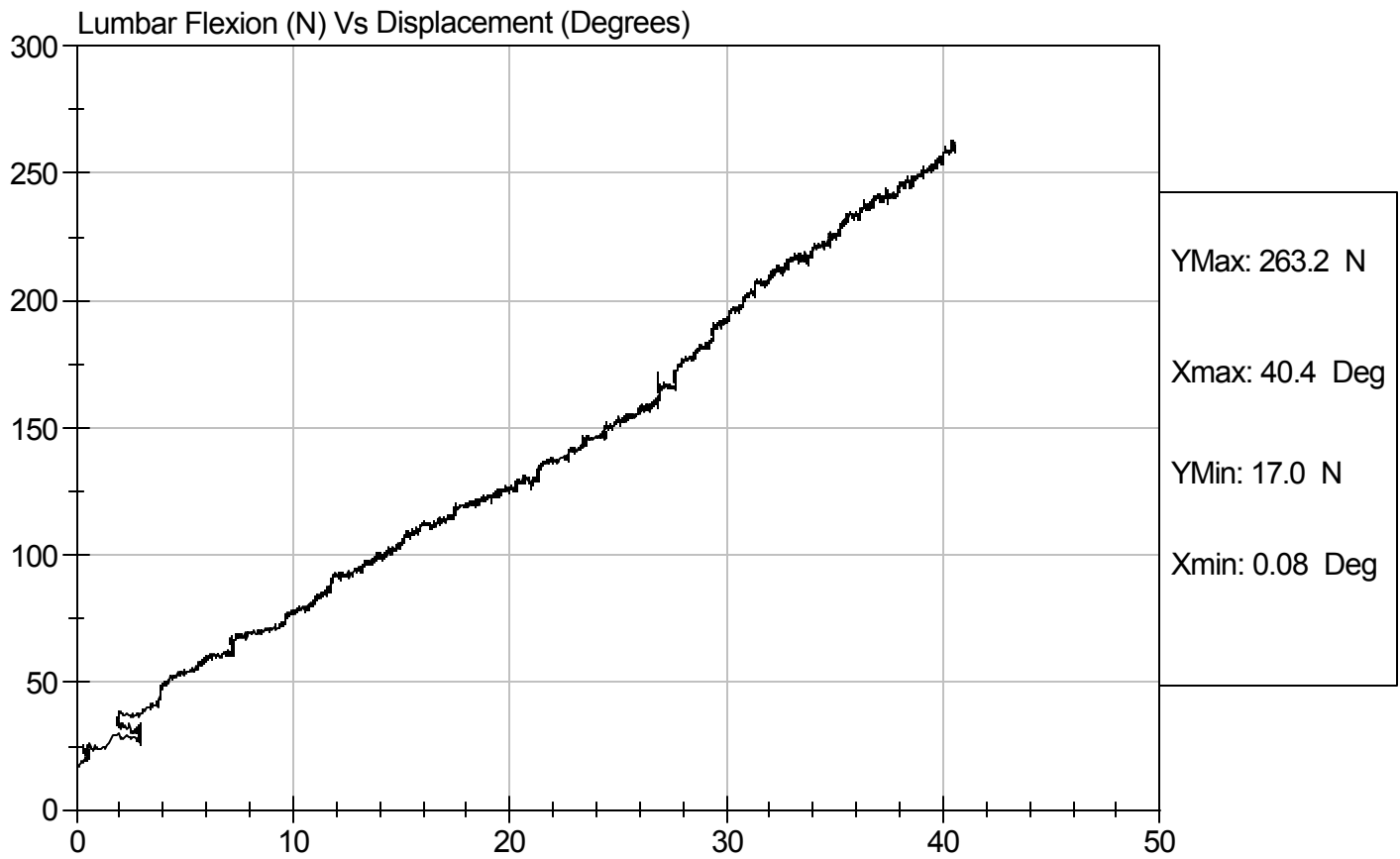


Test Description: Lumbar Flexion

Test Date: 1/13/10

Component: D10065

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Neck Pendulum Test

ATD Serial No: 271

Test I.D: D10069

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	18	Pass
Impact Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	1.96 to 2.55	2.11	Pass
	20 ms	m/s	4.12 to 5.10	4.41	Pass
	30 ms	m/s	5.73 to 7.01	6.29	Pass
	40 to 70 ms	m/s	6.27 to 7.64	6.86	Pass
Midsagittal Plane Max Rotation		deg	66 to 82	74	Pass
Head Rotation Peak to Zero - Decay Time		ms	58 to 67	63	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	76	Pass
Mx Peak To Zero - Decay Time		ms	49 to 64	50	Pass
Mx Peak to Max. Head Rotation		ms	2 to 16	2	Pass


 Laboratory Technician

1/13/10

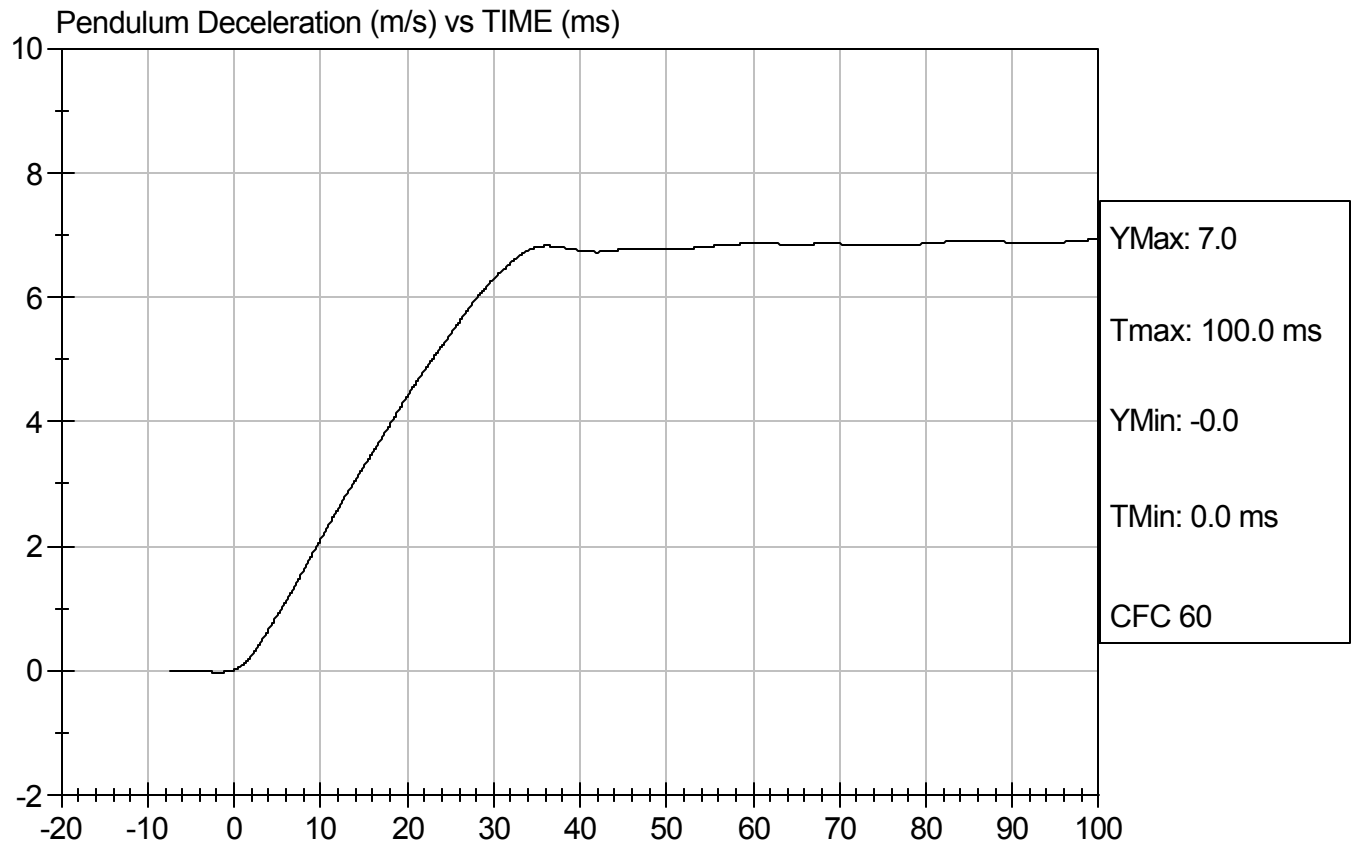
Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D10069

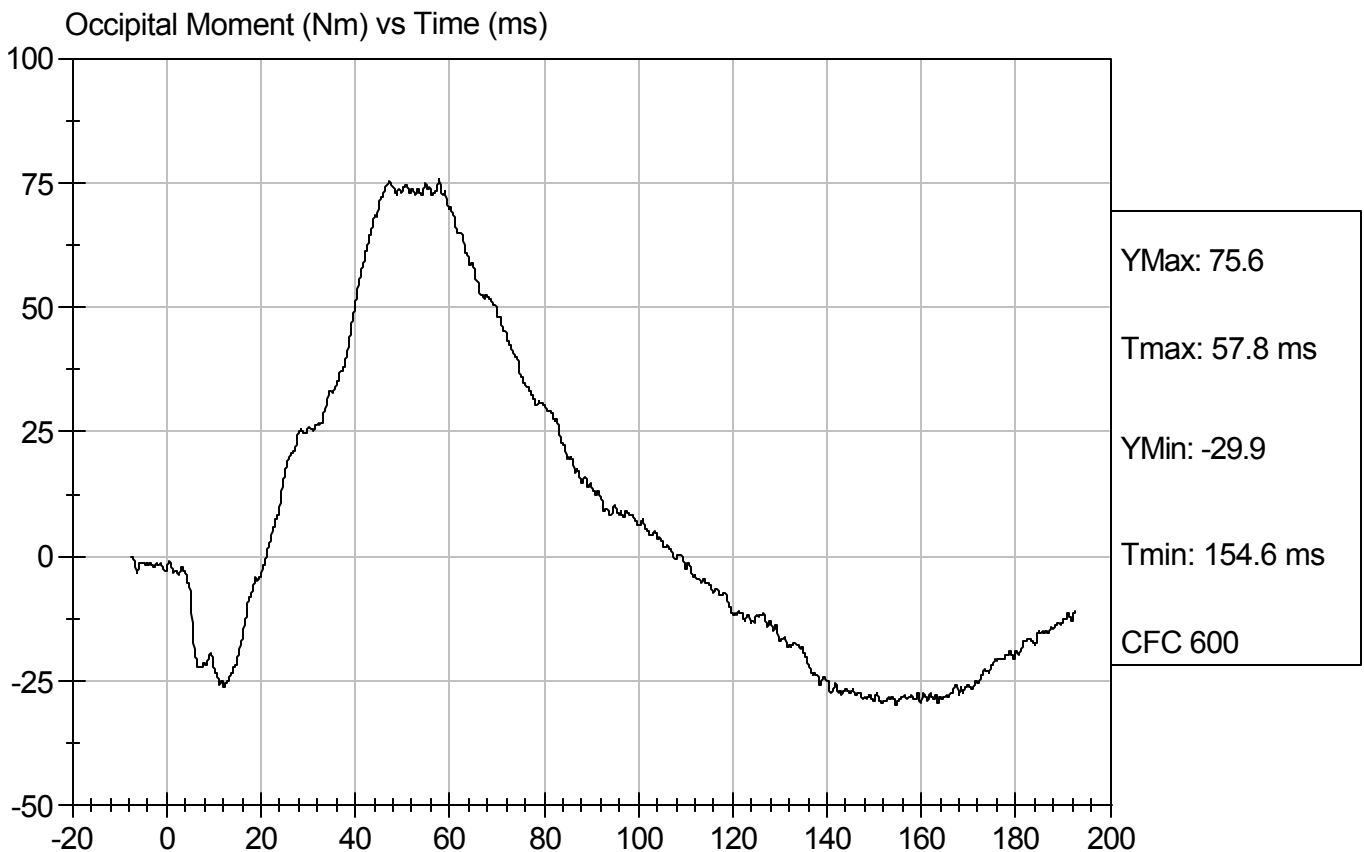
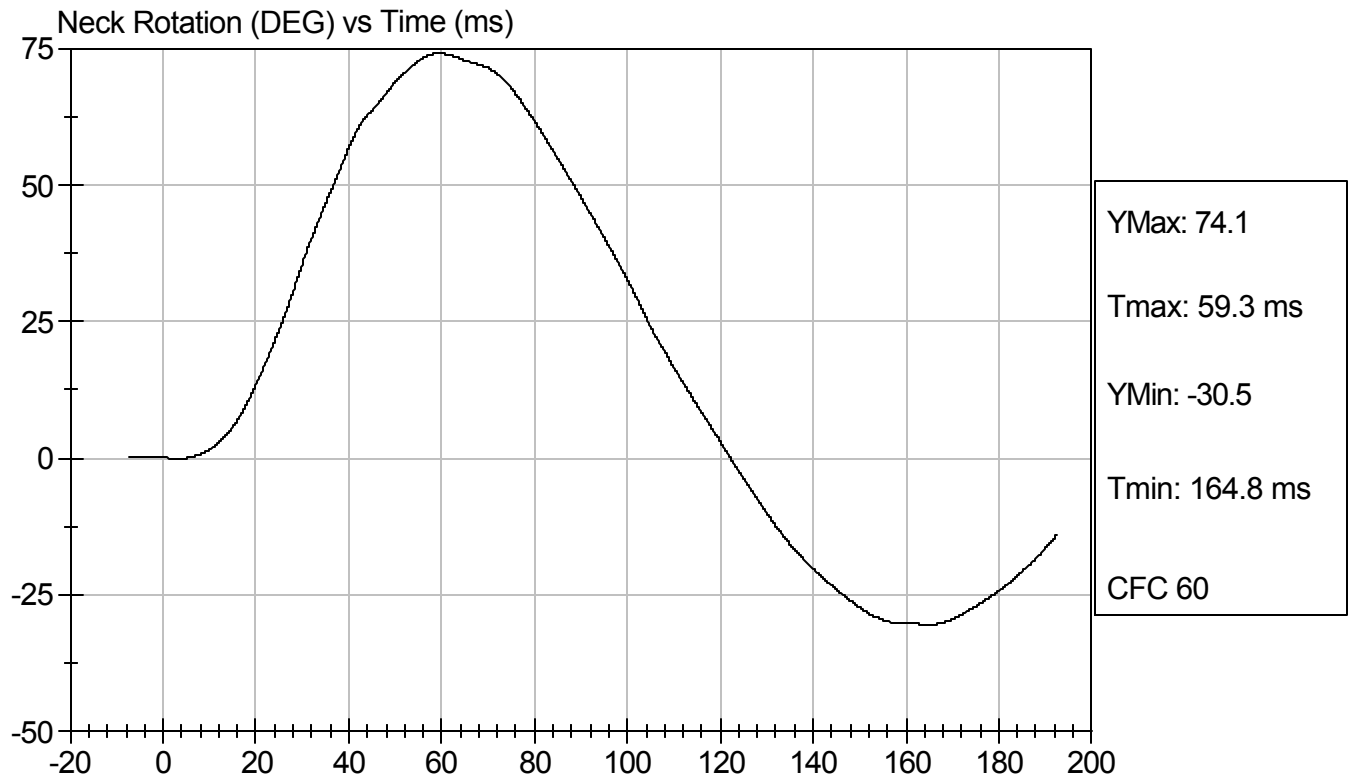
Test Date: 1/13/10
Speed: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Bending
Component ID: D10069

Test Date: 1/13/10
Speed: 23.15 ft/s, 7.06 m/s



Calibration Test Results Summary

Dummy Serial Number: 271

Post-Test Calibration

External Dimensions:	The dummy passed all external dimension requirements.
Head Drop Test:	The head passed all drop test requirements.
Neck Pendulum Test:	The neck passed all pendulum test requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements. -2

SID/HIII Calibration Data Sheet
Side Impact Dummy
Head Drop Calibration (Lateral)

ATD Serial No: 271

Test I.D: D10391

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Peak Resultant Acceleration	G's	120 to 150	139	Pass
Is Resultant Curve Unimodal?	N/A	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	7	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

David Winkelbauer
Approved By

02/11/2010
Test Date



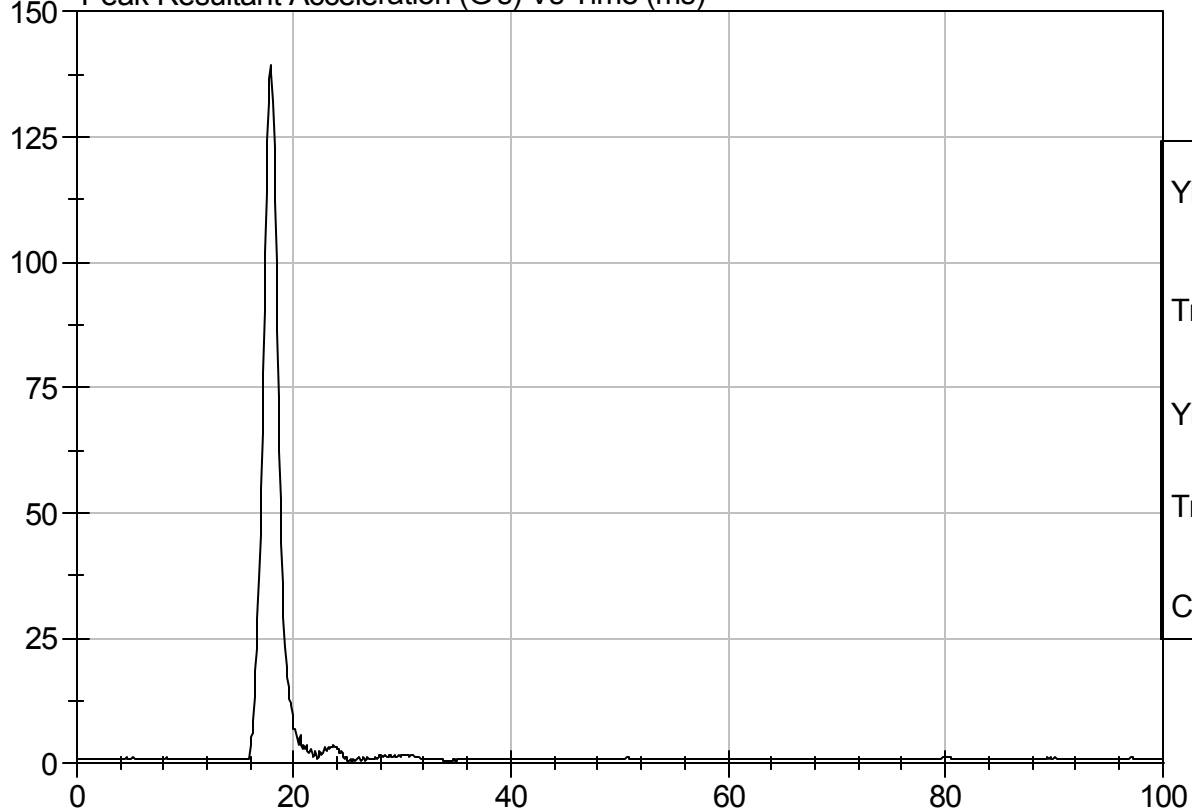
Test Description: Head Drop

Test Date: 02/11/2010

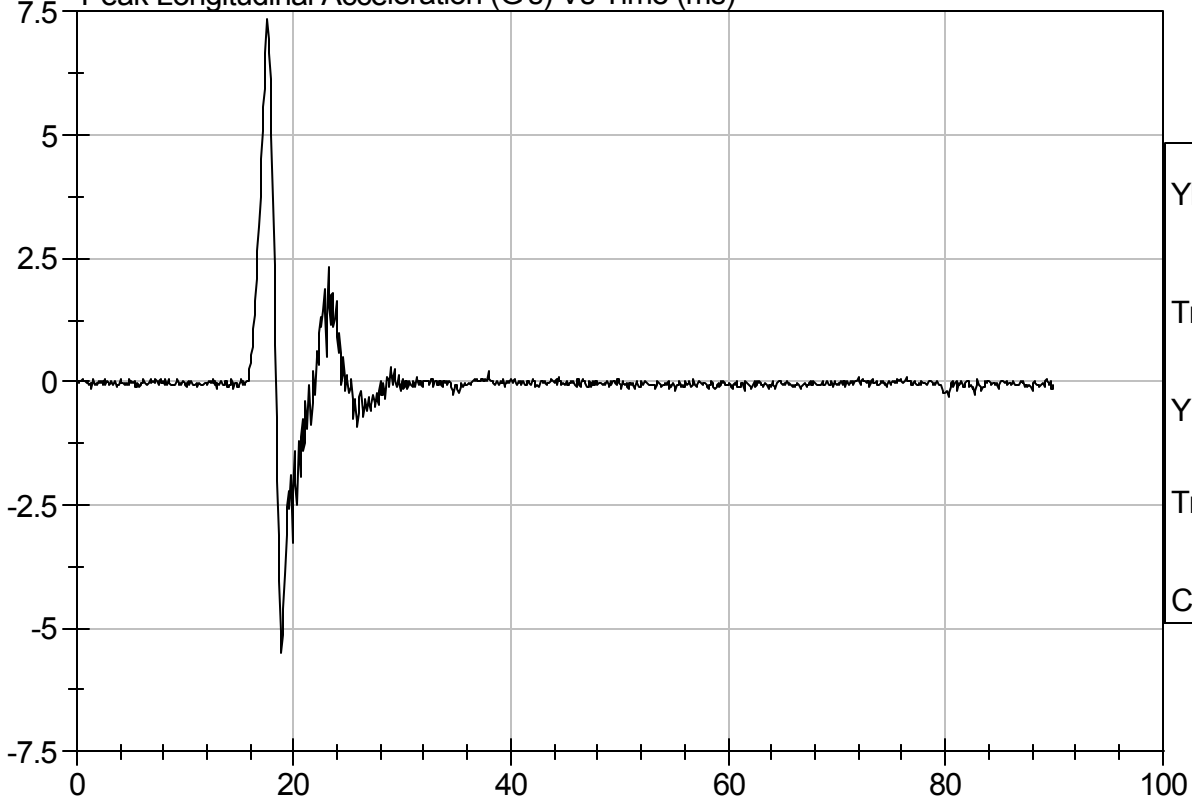
Component: D10391

Speed: 0 ft/s, 0 m/s

Peak Resultant Acceleration (G's) Vs Time (ms)



Peak Longitudinal Acceleration (G's) Vs Time (ms)



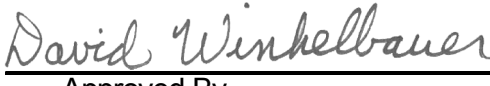
SID/HIII Calibration Data Sheet
Side Impact Dummy
Thorax Impact Test

ATD Serial No: 271

Test I.D: D10392

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Velocity	m/s	4.22 - 4.31	4.23	Pass
Upper Rib	G's	37 - 46	40	Pass
Lower Rib	G's	37 - 46	40	Pass
Lower Spine	G's	15 - 22	21	Pass
Overall Test Results				Pass


Laboratory Technician

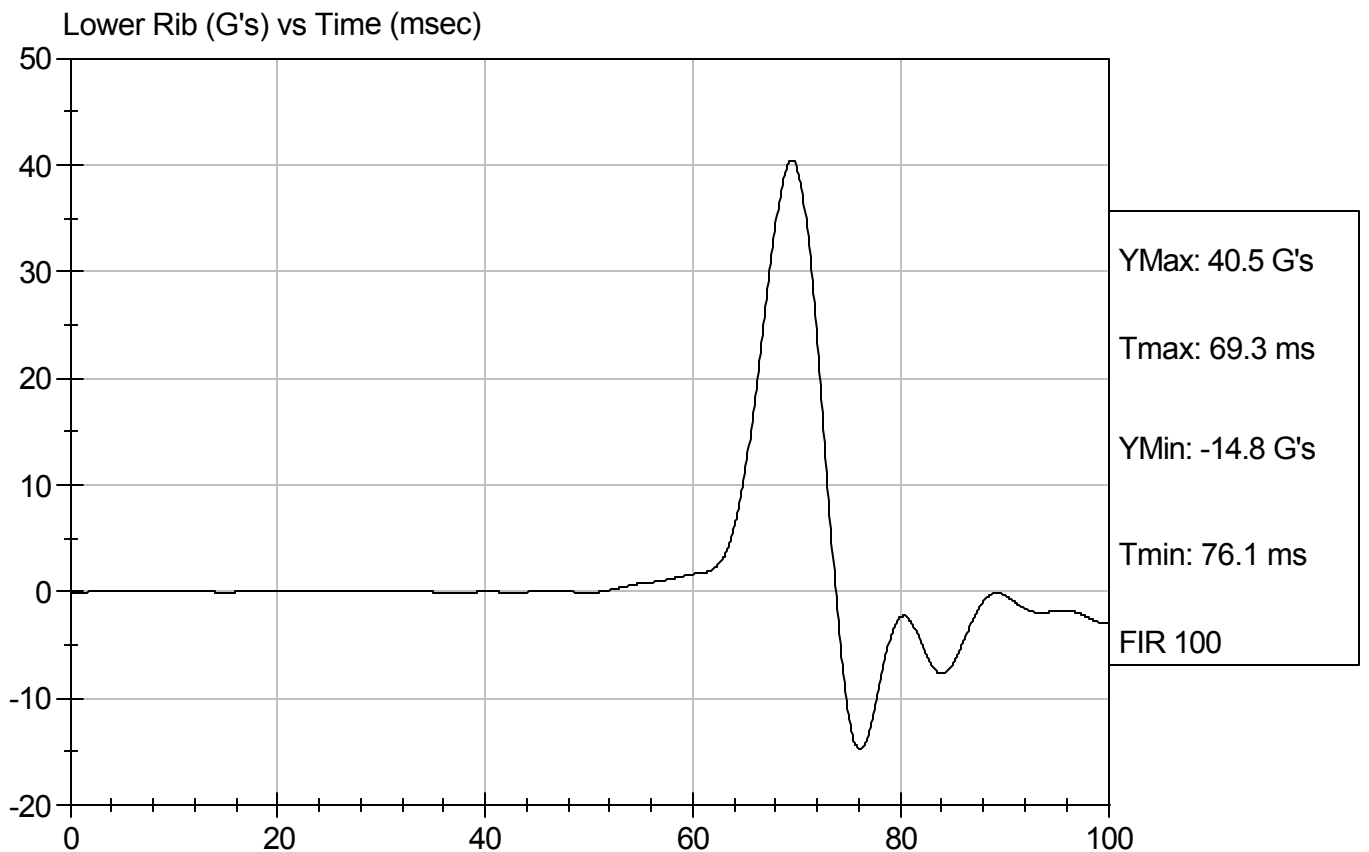
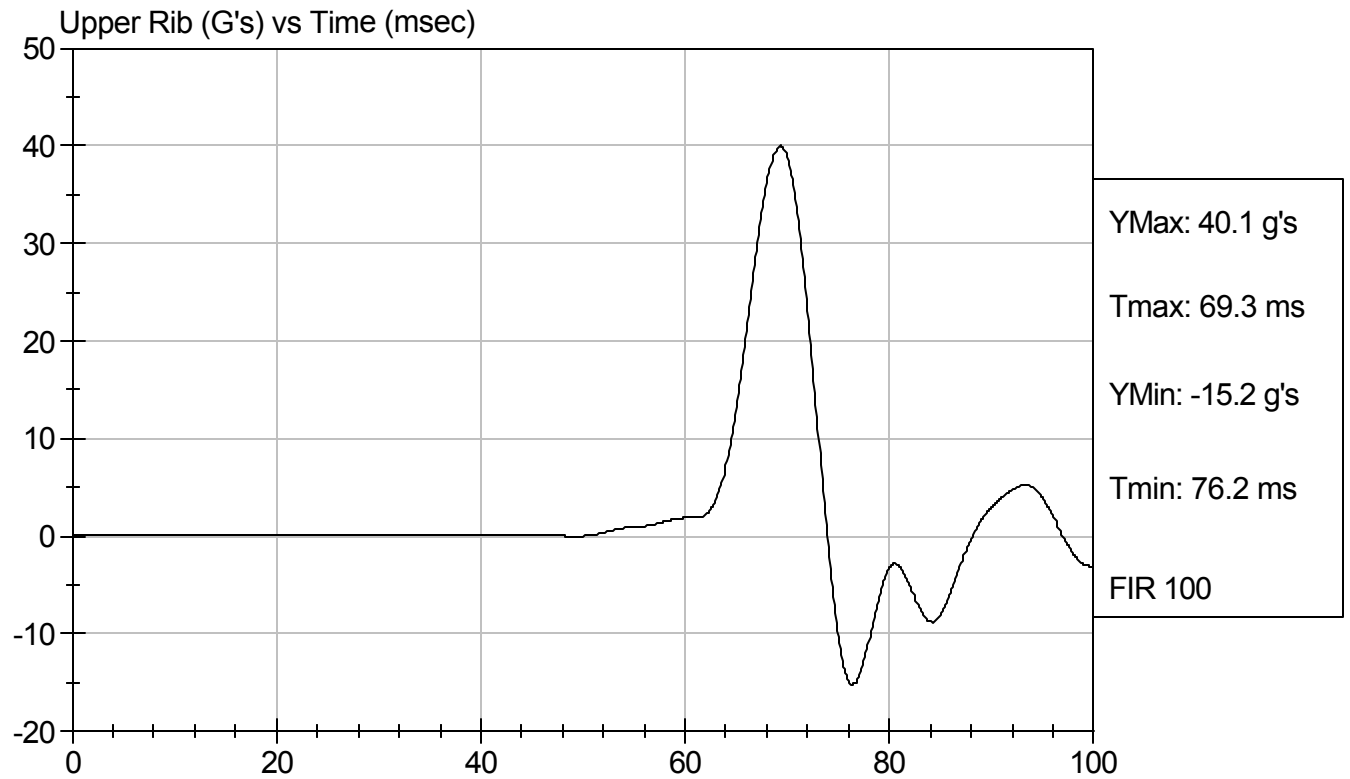

Approved By

02/10/2010
Test Date



Test Desc: Thorax Impact
Component ID: D10392

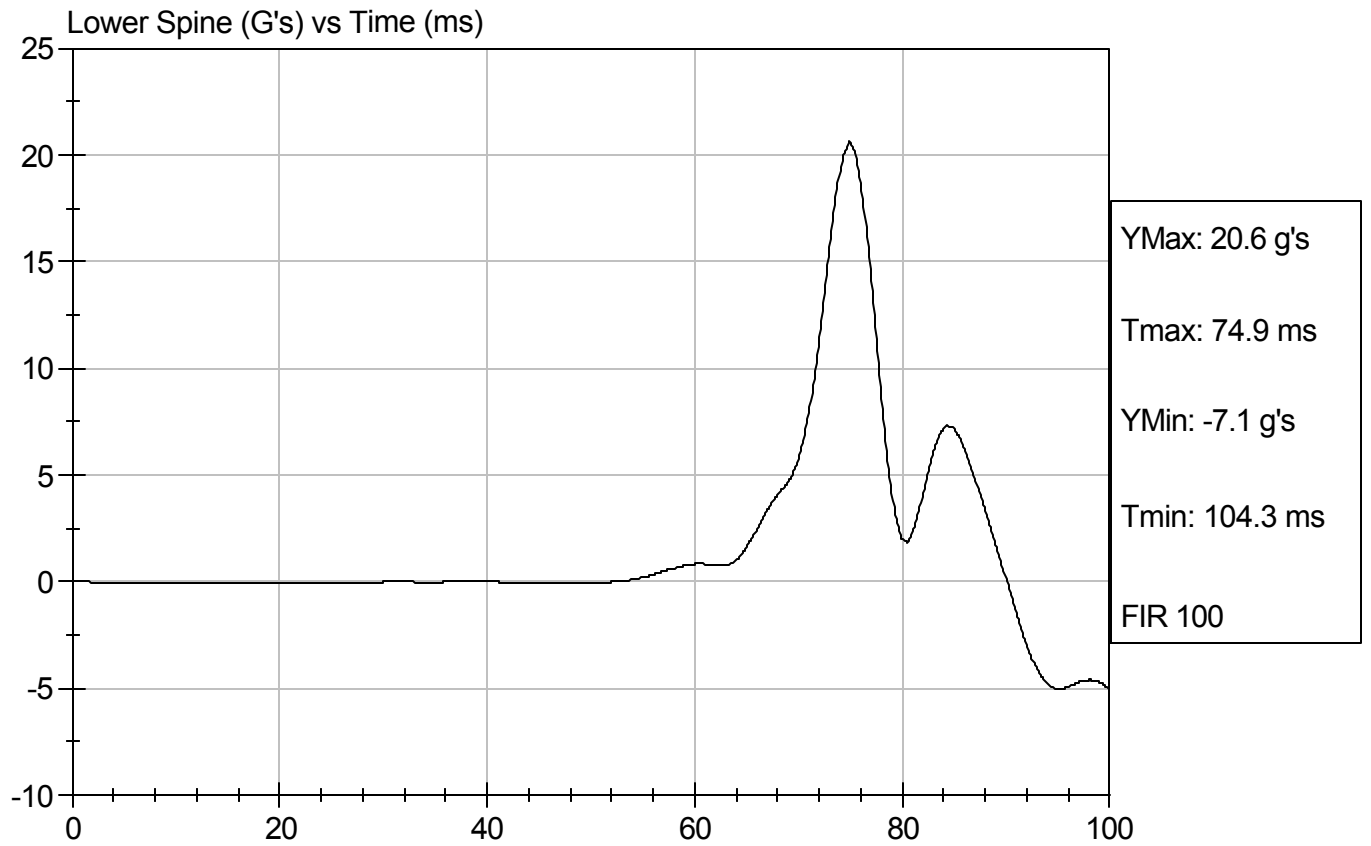
Test Date: 02/10/2010
Speed: 13.89 ft/s, 4.23 m/s





Test Desc: Thorax Impact
Component ID: D10392

Test Date: 02/10/2010
Speed: 13.89 ft/s, 4.23 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Pelvis Impact Test

ATD Serial No: 271

Test I.D: D10393

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Velocity	m/s	4.27 - 4.33	4.30	Pass
Pelvis Acceleration	G's	40 - 60	47	Pass
			Overall Test Results	Pass

Jessica Gall
Laboratory Technician

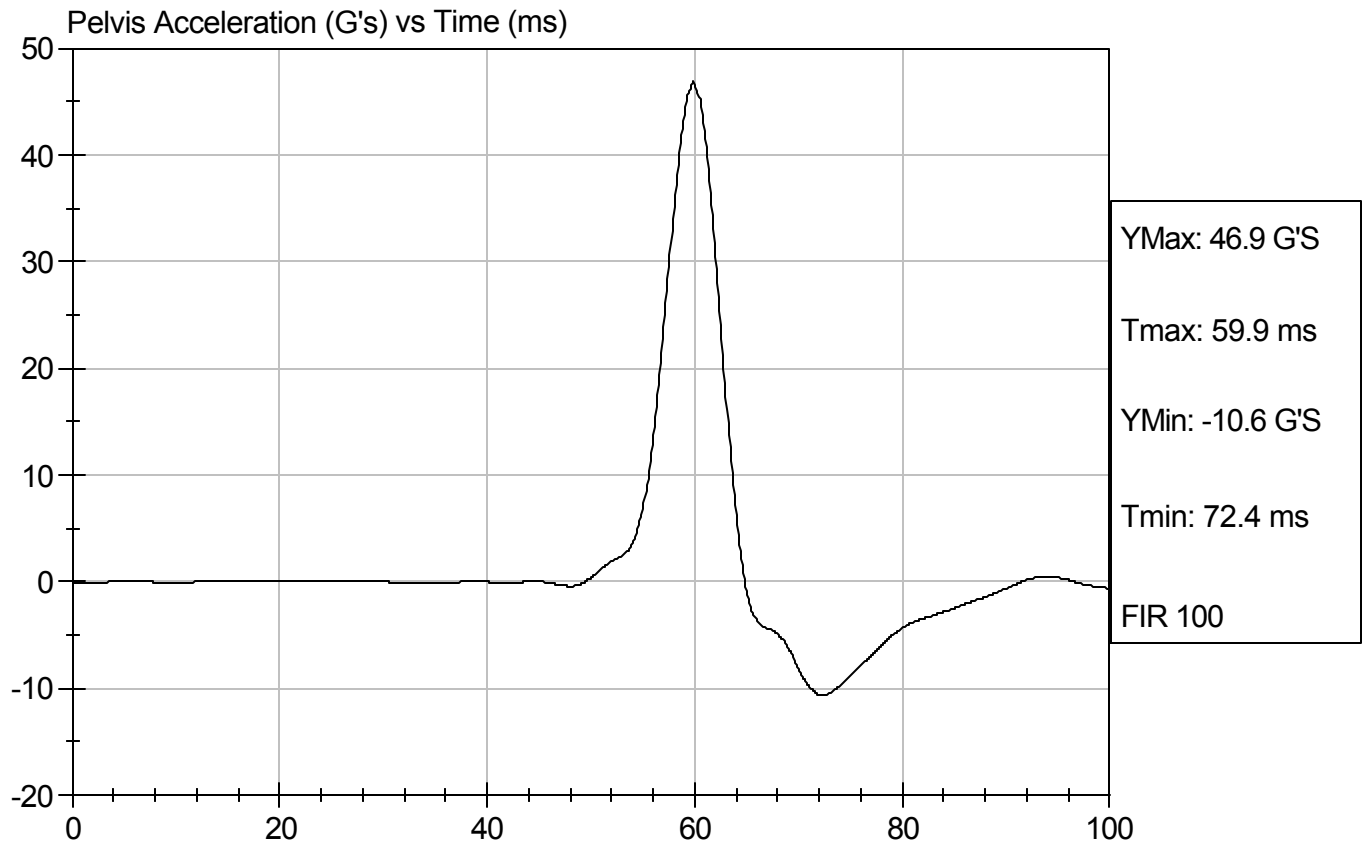
David Winkelbauer
Approved By

02/10/2010
Test Date



Test Desc: Pelvis Impact
Component ID: D10393

Test Date: 02/10/2010
Speed: 14.12 ft/s, 4.30 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 271

Test I.D: D10394

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Force At 12.7 mm	N	104 -162	155	Pass
Force At 19 mm	N	163 - 222	210	Pass
Force At 25.4 mm	N	222 - 280	279	Pass
Force At 33 mm	N	325 - 391	380	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

David Winkelbauer
Approved By

02/11/2010
Test Date

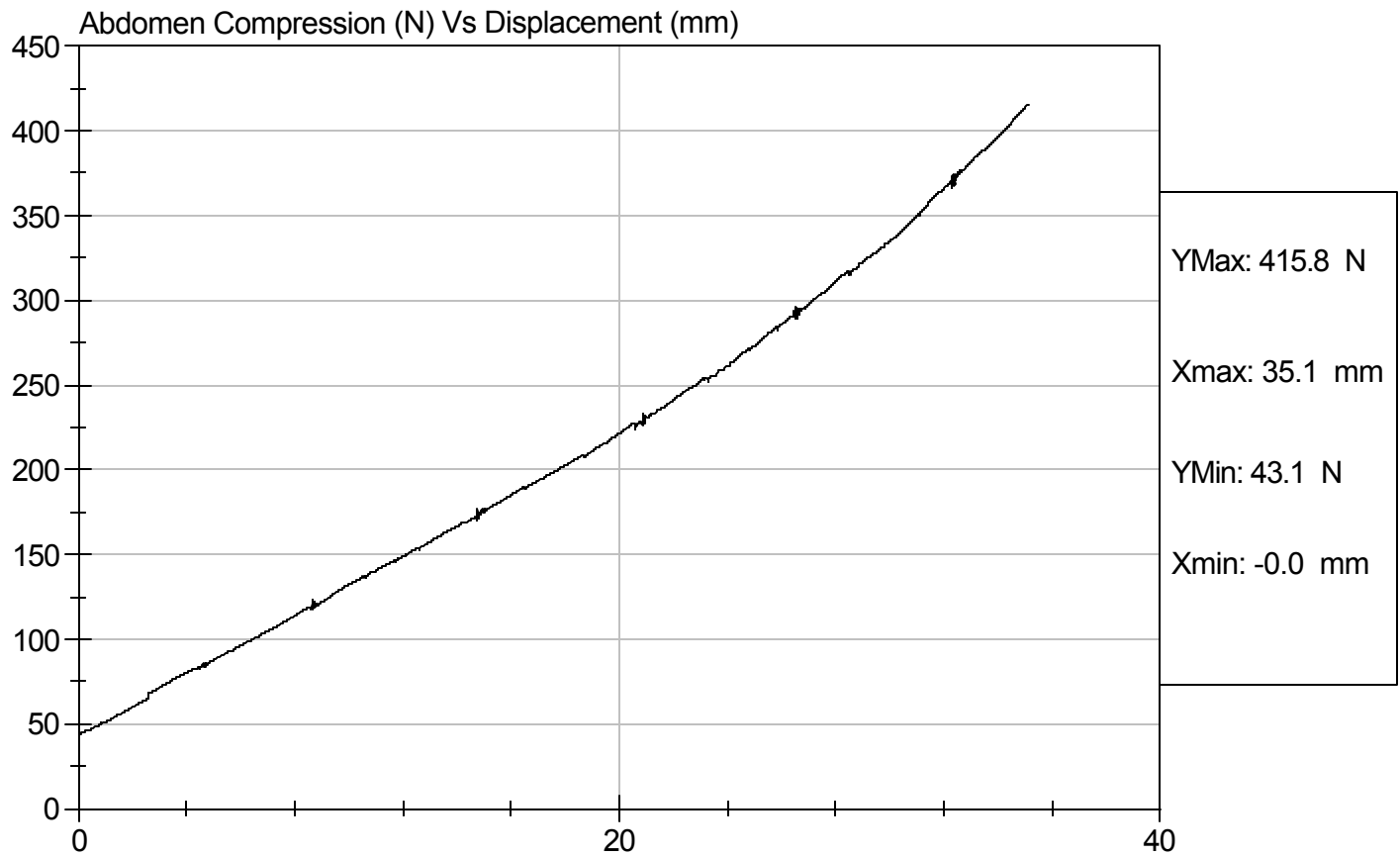


Test Description: Abdomen Compression

Test Date: 02/11/2010

Component: D10394

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Lumbar Flexion Calibration

ATD Serial No: 271

Test I.D: D10395

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Force At 0 deg	N	0 - 26.7	0	Pass
Force At 20 deg	N	97.9 - 151.2	130.1	Pass
Force At 30 deg	N	151.2 - 204.6	188.0	Pass
Force At 40 deg	N	204.6 - 258.0	248.8	Pass
Return Angle	Deg	12 Maximum	3	Pass
Overall Test Results			Pass	


Laboratory Technician

02/11/2010

Test Date


Approved By

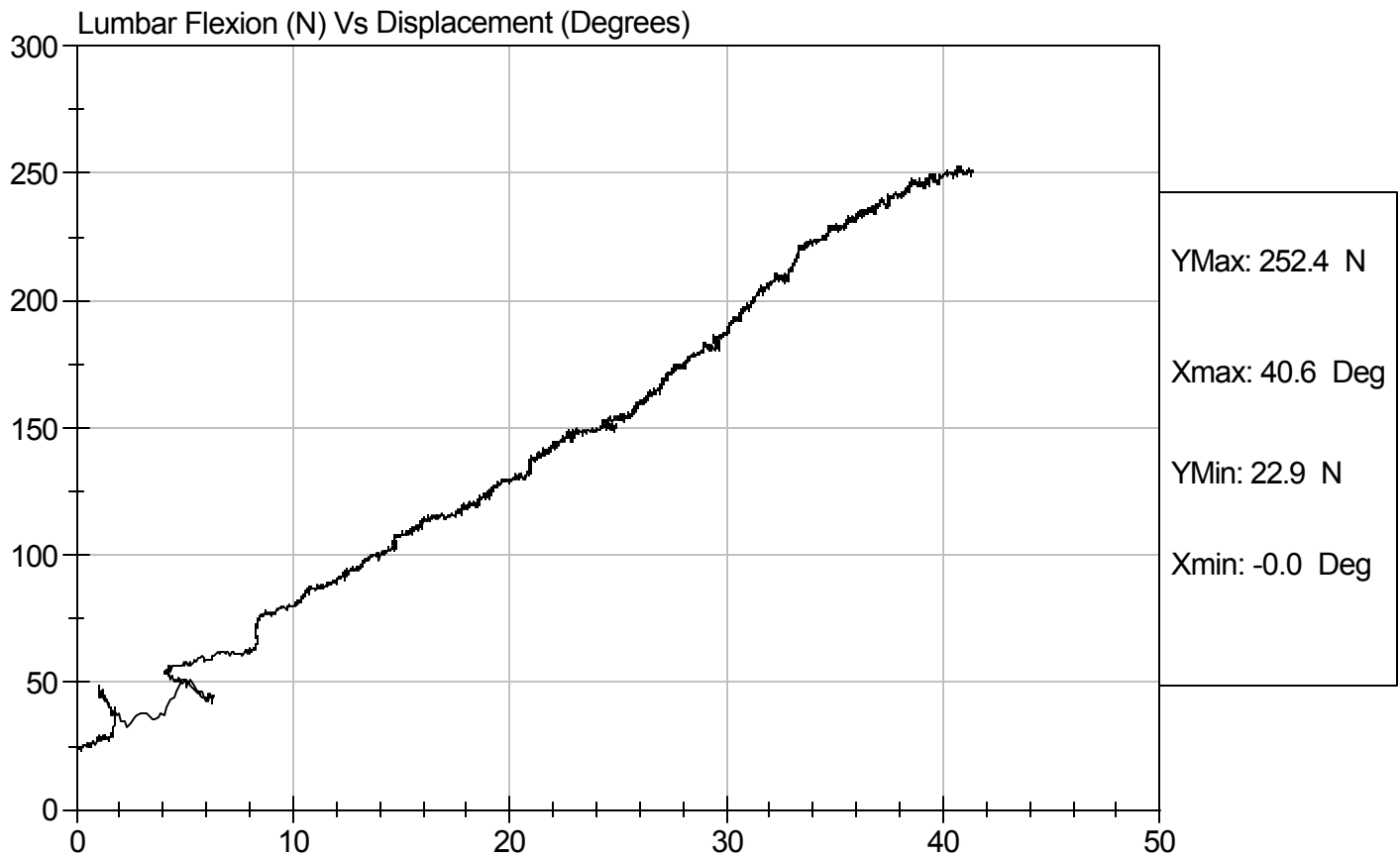


Test Description: Abdomen Compression

Test Date: 02/11/2010

Component: D10395

Speed: 0 ft/s, 0 m/s

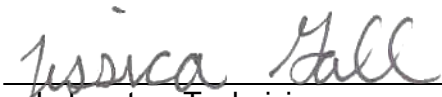


SID/HIII Calibration Data Sheet
Side Impact Dummy
Neck Pendulum Test

ATD Serial No: 271

Test I.D: D10399

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	17	Pass
Impact Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	1.96 to 2.55	2.25	Pass
	20 ms	m/s	4.12 to 5.10	4.44	Pass
	30 ms	m/s	5.73 to 7.01	6.28	Pass
	40 to 70 ms	m/s	6.27 to 7.64	6.69	Pass
Midsagittal Plane Max Rotation		deg	66 to 82	69	Pass
Head Rotation Peak to Zero - Decay Time		ms	58 to 67	59	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	75	Pass
Mx Peak To Zero - Decay Time		ms	49 to 64	59	Pass
Mx Peak to Max. Head Rotation		ms	2 to 16	13	Pass


 Laboratory Technician


 Approved By

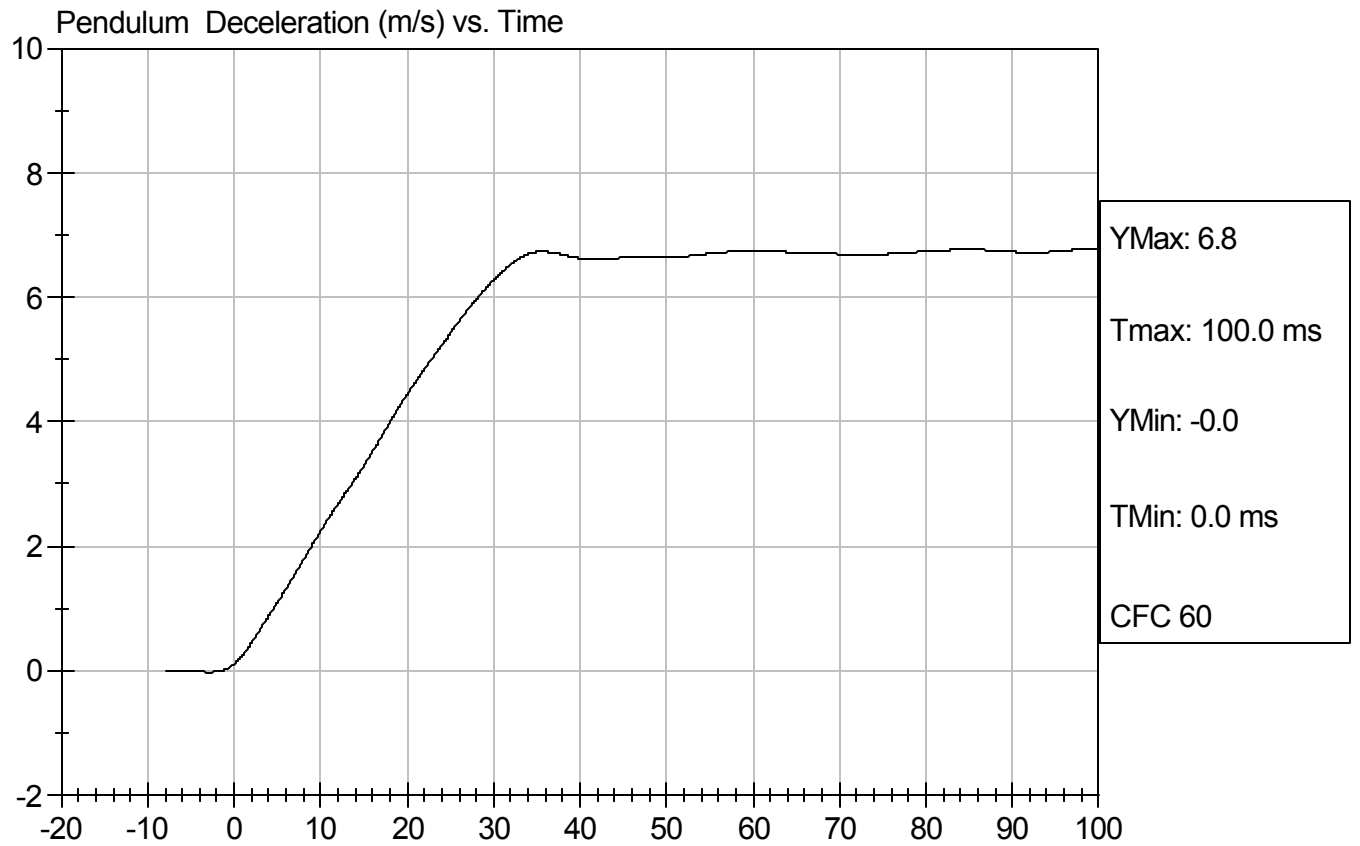
02/11/2010

Test Date



Test Desc: Neck Bending
Component ID: D10399

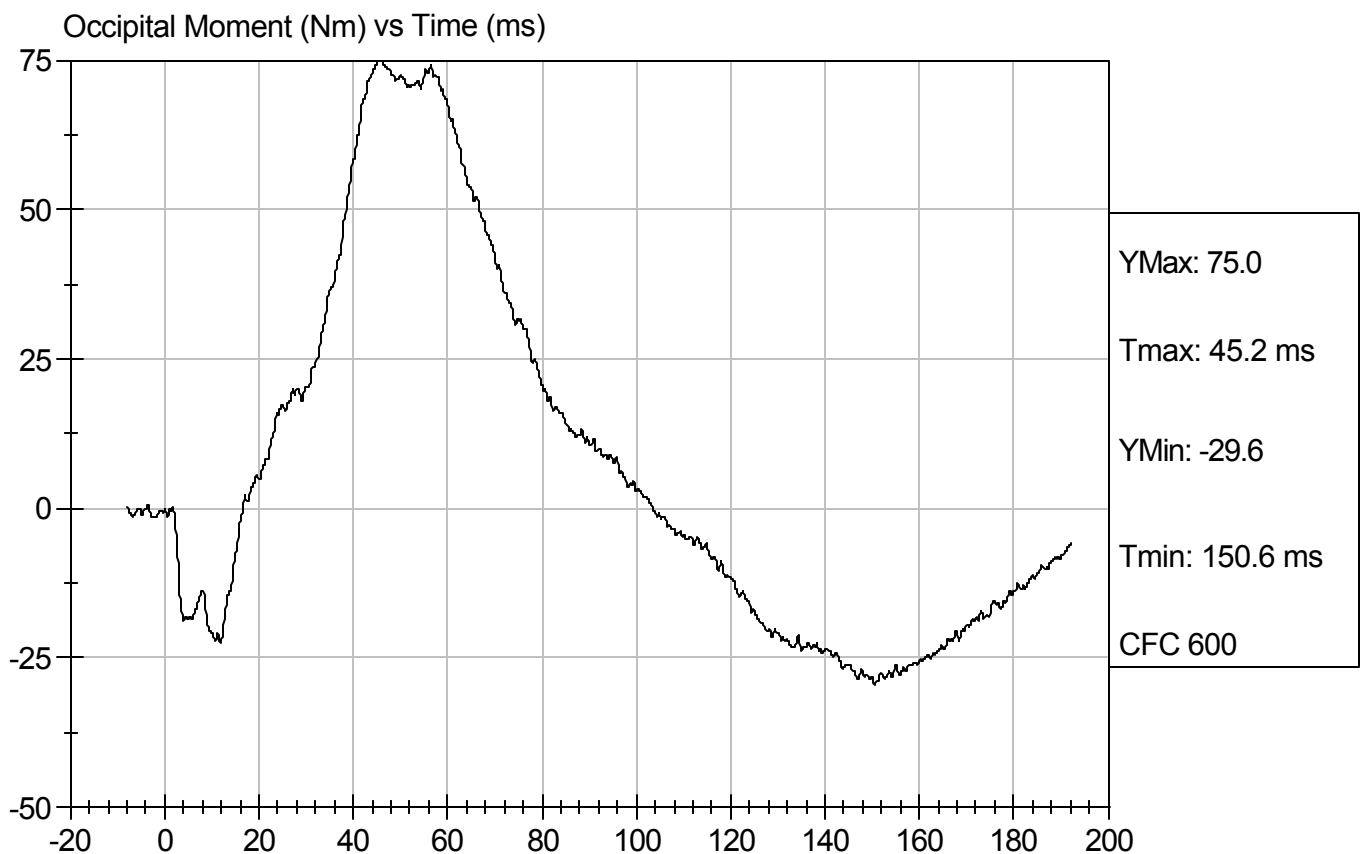
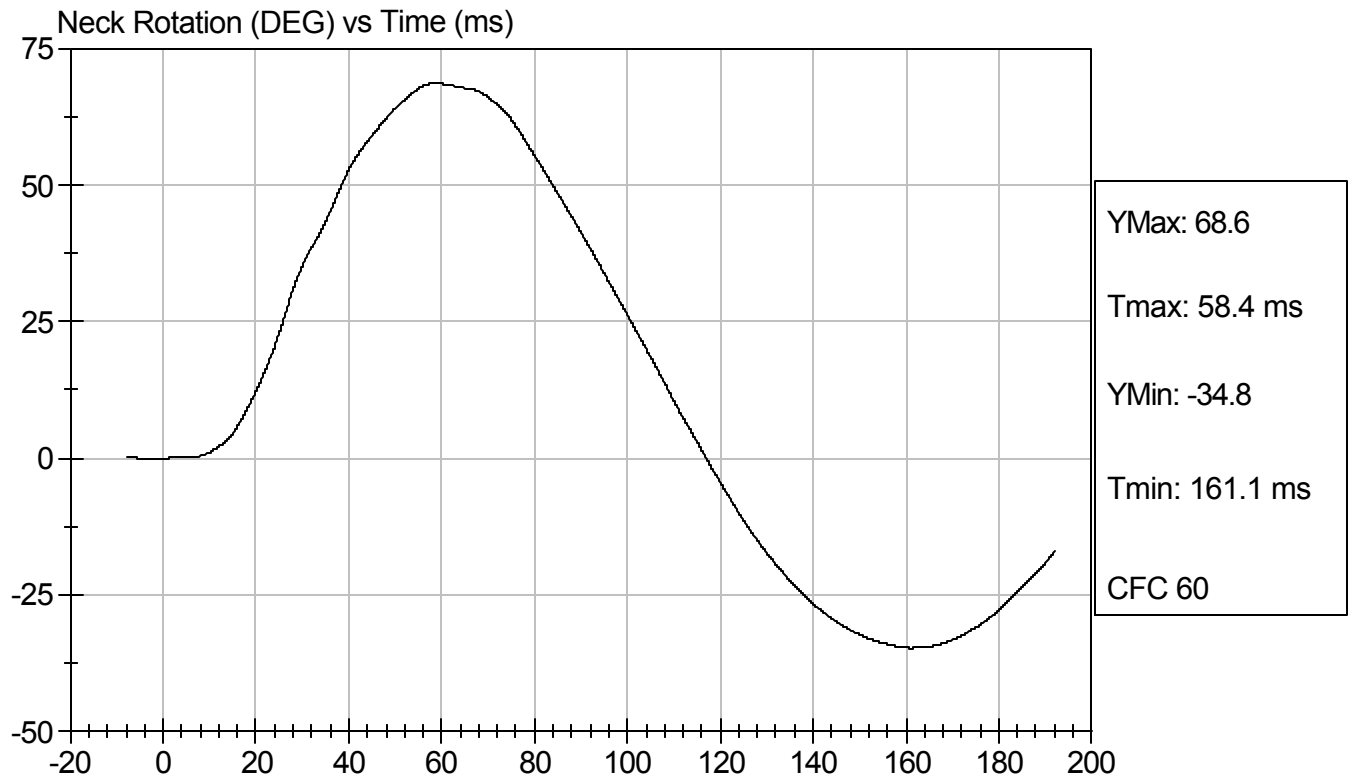
Test Date: 02/11/2010
Speed: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Bending
Component ID: D10399

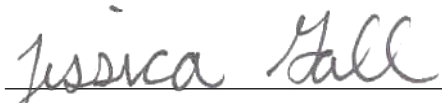
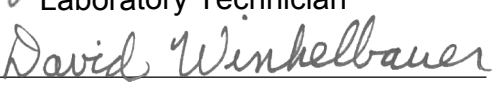
Test Date: 02/11/2010
Speed: 23.15 ft/s, 7.06 m/s



SID Calibration Data Sheet
Side Impact Dummy
Inspection Checklist

ATD Serial No: 271

Test Part	Items Checked	Result
Skin	Visual inspection	Pass
Head	Visual, ballast, accelerometer mount	Pass
Neck	Visual	Pass
Spine Box	Visual, ballast, accelerometer mount	Pass
Rib Cage	Visual, measure	Pass
Sternum	Visual	Pass
Lumbar Spine	Visual	Pass
Abdomen	Visual	Pass
Pelvis	Visual, palpate, accelerometer mount	Pass
Upper Legs	Visual	Pass
Knees	Visual	Pass
Lower Legs	Visual, range of motion	Pass
Ankles	Visual, range of motion	Pass
Feet	Visual, range of motion	Pass
Joints	1 to 2 g range	Pass
Other		Pass


Laboratory Technician

Approved By

2/11/2010
Test Date