

REPORT NUMBER: SINCAP-KAR-13-056

**NEW CAR ASSESSMENT PROGRAM (NCAP)
MOVING DEFORMABLE BARRIER SIDE IMPACT TEST**

**DAIMLER AG
2013 SMART ELECTRIC DRIVE 2-DOOR COUPE**

NHTSA No: MD0514

**PREPARED BY:
KARCO ENGINEERING, LLC.
9270 HOLLY ROAD
ADELANTO, CA 92301**



AUGUST 9, 2013

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
MAIL CODE: NVS-111
1200 NEW JERSEY AVE, SE, ROOM W43-410
WASHINGTON, D.C. 20590**

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. SINCAP-KAR-13-056	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Final Report of New Car Assessment Program Side Impact MDB Testing of a 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514		5. Report Date August 9, 2013
		6. Performing Organization Code KAR
7. Authors Mr. Steven D. Matsusaka, Engineering Department Supervisor, KARCO Mr. Frank Richardson, Program Manager, KARCO		8. Performing Organization Report No. TR-P33003-01-NC
9. Performing Organization Name and Address KARCO Engineering, LLC. 9270 Holly Rd. Adelanto, CA 92301		10. Work Unit No.
		11. Contract or Grant No. DTNH22-09-D-00122
12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NVS-111) 1200 New Jersey Ave., SE, Room W43-410 Washington, D.C. 20590		13. Type of Report and Period Covered Final Test Report, July 26 - Aug. 9, 2013
		14. Sponsoring Agency Code NVS-111
15. Supplementary Notes		

16. Abstract

A 55/28 km/h 90 deg. Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2013 Smart Electric Drive 2-door coupe in accordance with the specifications of the Office of Crash Worthiness Standards Test Procedure for the generation of consumer information on vehicle side crash protection. The test was conducted at the KARCO Engineering, LLC. facility in Adelanto, California on July 26, 2013.

The impact velocity of the Moving Deformable Barrier was 61.45 km/h and the outside ambient temperature at the struck (driver's) side of the vehicle was 32.8 deg. C. The target vehicle's maximum post-test static crush was 100 mm located at level 2. The test vehicle's occupant performance data is as follows:

Measurement Description	Driver ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC ₃₆)		1000	262.1
Maximum Thorax Rib Deflection	mm	44	25
Total Abdominal Force	N	2500	806
Pubic Symphysis Force	N	6000	2500

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC ₃₆)		1000	
Resultant Lower Spine Acceleration	g	82	
Total Pelvic Force (Sum of Acetubular and Iliac Forces)	N	5525	
Maximum Thoracic Rib Deflection	mm	38*	
Maximum Abdominal Rib Deflection	mm	45*	

The door on the struck side of the vehicle did not separate from the body at the hinges or latches. The opposite side door did not open during the side impact event.

* Proposed IARV

17. Key Words New Car Assessment Program (NCAP) Side Impact Moving Deformable Barrier (MDB) ES-2re SID-IIs		18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave., SE Washington, DC 20590 e-mail: tis@nhtsa.dot.gov FAX 202-493-2833	
19. Security Classification of this report UNCLASSIFIED	20. Security Classification of this page UNCLASSIFIED	21. No. of Pages 130	22. Price

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1	Test Purpose and Procedure	1
2	Summary of Test Results	2
3	Occupant and Vehicle Information/Data Sheets	4
<u>Data Sheet</u>		<u>Page</u>
1	General Test and Vehicle Parameter Data	5
2	Seat, Seat Belt, Steering Wheel Adjustment and Fuel System Data	9
3	Dummy Longitudinal Clearance Dimensions	13
4	Dummy Lateral Clearance Dimensions	14
5	Camera and Instrumentation Data	15
6	Test Vehicle Accelerometer Locations	16
7	MDB Accelerometer Locations	17
8	Post-Test Observations	18
9	MDB Summary of Results	20
10	Test Vehicle Profile Measurements	21
11	Test Vehicle Exterior Crush Measurements	22
12	MDB Exterior Static Crush Measurements	25
13	FMVSS No. 301 Static Rollover Results	26
14	Dummy/Vehicle Temperature and Humidity Stabilization	27
<u>Appendix</u>		<u>Page</u>
A	Photographs	A
B	Vehicle and Dummy Response Data Plots	B
C	Dummy Configuration and Performance Verification Data	C
D	Test Equipment and Instrumentation Calibration Data	D

SECTION 1

TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2013 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number DTNH22-09-D-00122. The purpose of this test is to generate comparative side impact performance in a 2013 Smart Electric Drive 2-door coupe. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure dated September 2012.

SECTION 2

SUMMARY OF TEST RESULTS

A 2013 Smart Electric Drive 2-door coupe 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 61.45 km/h (38.18 mph). The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by KARCO Engineering, LLC. in Adelanto, California, on July 26, 2013. Pre- and post-test photographs of the test vehicle, the MDB and the dummy (ES-2re) are included in Appendix A of this report.

The dummy was placed in the driver seating position according to instructions specified in the OCWS Side Impact Laboratory Test Procedure, dated September 2012. The side impact event was documented by 10 cameras. Camera locations are included in Data Sheet No. 5 of this report.

The dummy was instrumented in the following manner:

- DRIVER ATD (ES-2re)

- Primary and redundant head CG tri-axial accelerometers

- Chest upper rib, middle rib and lower rib y-axis displacement potentiometers

- Abdomen forward, middle, and rear y-axis load cells

- Lower spine (12) tri-axial accelerometers

- Pubic symphysis y-axis load cell

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

Dummy injury readings were recorded as follows:

Measurement Description	Units	Driver ATD (ES-2re)	
		Threshold	Result
Head Injury Criteria (HIC ₃₆)		1000	262.1
Maximum Thorax Rib Deflection	mm	44	25
Combined Abdominal Force	N	2500	806
Pubic Symphysis Force	N	6000	2500

Measurement Description	Units	Passenger ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC ₃₆)		1000	
Lower Spine (T12) Resultant Acceleration	g	82	
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	
Maximum Thoracic Rib Deflection	mm	38*	
Maximum Abdominal Rib Deflection	mm	45*	

*Proposed IARV

Supplemental restraint information is given below:

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Airbag 1 (Curtain)	Yes	Yes		
Side Airbag 2 (Torso/Pelvis)	Yes	Yes		
Seat Belt Pretensioner	Yes	Yes		
Seat Belt Load Limiter	Yes	Yes		
Other	No			

GENERAL COMMENTS

The door on the struck side of the vehicle remained closed and latched. There was no separation at the hinges or latches. The door on the non-struck side remained closed and latched. There were no ATD values that exceeded limits.

SECTION 3

OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

CONVERSION FACTORS

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	miles/hr	km/hr	1.609344
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.574
Pressure	Tire Pressures	lbf/in ²	kPa	6.895
Temperature	General Use	°F	°C	$=(T_f - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf-ft	N•m	1.355

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	MD0514
Model Year	2013
Make	Smart
Model	Electric Drive
Body Style	2-Door Coupe
VIN	WMEEJ9AAXDK677535
Body Color	Rally Red
Odometer Reading (km / mi)	23 / 14
Engine Displacement (L)	N/A
Type / No. of Cylinders	Electric
Engine Placement	Rear Transverse
Transmission Type	Automatic
Transmission Speeds	1
Overdrive	No
Final Drive	Rear
Roof Rack	No
Sunroof / T-Top	No
Running Boards	No
Tilt Steering Wheel	No
Power Seats	No
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
Auto-Leveling System	No
Automatic Door Locks	Yes
Power Window Auto-Reverse	Yes
Other Optional Feature	No
Driver Front Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	Yes
Rear Pass. Curtain Airbag	N/A
Rear Pass. Head/Torso Airbag	N/A
Rear Pass. Torso Airbag	N/A
Rear Pass. Torso/Pelvis Airbag	N/A
Rear Pass. Pelvis Airbag	N/A
Driver Seat Belt Pretensioner	Yes
Rear Pass. Seat Belt Pretensioner	N/A
Driver Load Limiter	Yes
Rear Pass. Load Limiter	N/A
Other Safety Restraint	No

Does Owner's Manual provide instructions to turn off automatic door locks?

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Daimler AG
Date of Manufacture	Feb-13
Vehicle Type	Passenger Car

GVWR (kg)	1150
GAWR Front (kg)	505
GAWR Rear (kg)	660

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity	2			2
Capacity Weight (VCW) (kg)				190.0
DSC x 68.04 (kg)				136.1
Cargo Weight (RCLW) (kg)				53.9

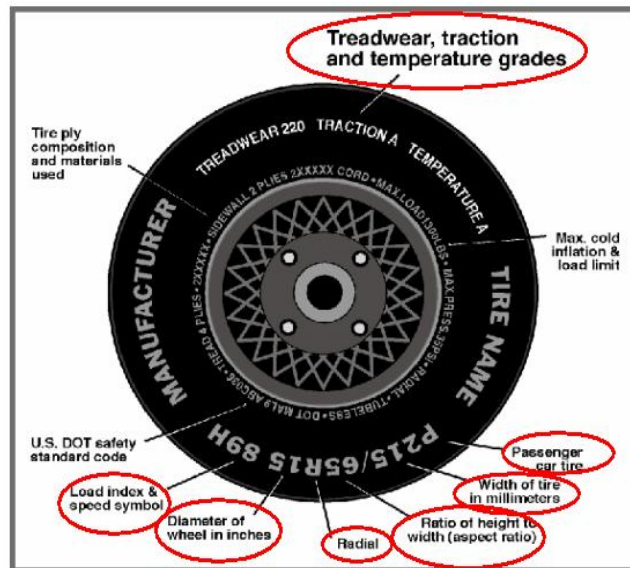
VEHICLE SEAT TYPE

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

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kpa)	300	300
Cold Pressure (kPa)	200	250
Recommended Tire Size	P155/60R15	P175/55R15
Tire Size on Vehicle	P155/60R15	P175/55R15
Tire Manufacturer	Kumho	Kumho
Tire Model	Solus KH16	Solus KH16
Treadware	440	440
Traction Grade	AA	AA
Temperature Grade	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	2 Steel, 1 Polyester	2 Steel, 1 Polyester, 1 Nylon
Load Index/Speed Symbol	74T	77T
Tire Material	Steel, Polyester	Steel, Polyester, Nylon
DOT Safety Code Left	H2DR YA5M 4112	H2N2 YA5M 3812
DOT Safety Code Right	H2DR YA5M 4112	H2N2 YA5M 3812

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	245	245	245	245
Tire Placard	kPa	200	200	250	250
Owner's Manual	kPa	200	200	250	250
As Tested	kPa	200	200	250	250

MDB TIRE SPECIFICATIONS

	Units	Requirement	LF	RF	LR	RR
Tire Size		P205/75R15	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	kPa	200 ± 21	200	200	200	200

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	227.5	252.5		259.0	298.5		258.0	309.5	
Right	kg	218.5	256.0		230.5	290.0		216.5	299.5	
Ratio	%	46.7%	53.3%	100.0%	45.4%	54.6%	100.0%	43.8%	56.2%	100.0%
Total	kg	446.0	508.5	954.5	489.5	588.5	1078.0	474.5	609.0	1083.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	954.5	A
Actual Weight of 2 P572 ATDs Used	kg	125.0	B
Rated Cargo/Luggage Wt (RCLW)	kg	53.9	C
Calculated Vehicle Target Wt (TVTW)	kg	1133.4	A+B+C

Does the measured As Tested Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight -4.5 kg to -9.0 kg)? ☒ Yes ☐ No

TEST VEHICLE ATTITUDE AND CG

Measurement Description	Units	Fully Loaded	As Tested	Meets Requirement***
LF	mm	596	590	Yes
RF	mm	610	602	Yes
RR	mm	612	619	Yes
LR	mm	620	622	Yes
Vehicle CG (Aft of Front Axle)	mm	1052	1021	
Vehicle CG (Left (+)/Right (-) from Longitudinal Centerline)	mm	32	23	

***The "As Tested" vehicle attitude measurements must be equal to or within ±10 mm of the "Fully Loaded" vehicle attitude measurements at each wheel well. Indicate "Yes" or "No" for "Meets Requirement"

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514

Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Headlights	3.0
Passenger Door Trim and Windows	10.0
Rear Interior Trim	5.5
Rear Floor Covering	4.5
Outboard Mirror	1.0
Battery Charger	2.0
Ballast / Equipment Added	67.3

DATA SHEET NO. 2

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

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and right front passenger's seat should be set to the mid-track, lowest, mid-angle position. The struck side rear passenger's seat, rear center seat, and non-struck side rear passenger's seats should be set to the rear-most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	Fixed	Fixed	Fixed
Front Passenger Seat	Fixed	Fixed	Fixed
Front Center Seat			
Struck Side Rear Seat			
Non-Struck Side Rear Seat			
Rear Center Seat			

SEAT HEIGHT AND ANGLE

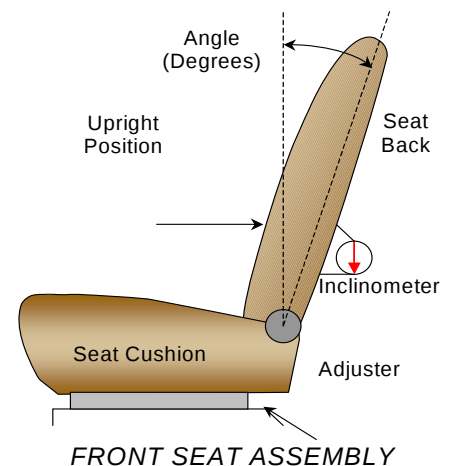
Seat	As Tested SCRL Angle	As Tested SCRP Height	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid Fore/Aft	Forwardmost
Driver Seat	Fixed	625	Max	616	625	634
			Mid	616	625	634
			Min	616	625	634
Front Passenger Seat	Fixed	639	Max	638	639	641
			Mid	638	639	641
			Min	638	639	641
Front Center Seat			Max			
			Mid			
			Min			
Struck Side Rear Seat			Max			
			Mid			
			Min			
Non-Struck Side Rear Seat			Max			
			Mid			
			Min			
Rear Center Seat			Max			
			Mid			
			Min			

DATA SHEET NO. 2 ... (CONTINUED)**SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA**Test Vehicle: 2013 Smart Electric Drive 2-Door CoupeNHTSA No. MD0514Test Program: NCAP MDB Side Impact TestTest Date: 07/26/13**SEAT FORE/AFT POSITION**

Seat	Total Fore/Aft Travel		Test Position From Forwardmost Position	
	mm	Detents	mm	Detent
Driver Seat	165	19	83	9
Front Passenger Seat	170	19	85	19
Front Center Seat				
Struck Side Rear Seat				
Non-Struck Side Rear Seat				
Rear Center Seat				

SEAT BACK ADJUSTMENT

The driver's seat back is positioned to the manufacturer's designated design angle. The right front passenger's seat back is positioned in a similar manner as the driver's seat back. The struck side rear seat back is positioned such that the dummy's head is level. The rear center and non-struck side rear outboard seat backs are positioned in a similar manner as the struck side rear seat back. Seat back angle is measured on the backside of the seat back at the seat centerline using a digital inclinometer between two supporting points: the upper seat structure and the mid seat cross beam. The forward most detent is zero (0).

**SEAT BACK POSITION**

Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents	Degree	Detent
Driver Seat w/Seated Dummy	76.2	40	82.5	37
Front Passenger Seat	93.8	45	82.5	40
Front Center Seat				
Struck Side Rear Seat w/Seated Dummy				
Non-Struck Side Rear Seat				
Rear Center Seat				

DATA SHEET NO. 2 ... (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEMS, AND STEERING WHEEL DATA

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514

Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. The positions are marked H, M1,..., L from top to bottom.

	Total No. of Positions	Placed in Position
Driver Seat	Fixed	Fixed
Rear Seat		

HEAD RESTRAINT ADJUSTMENT

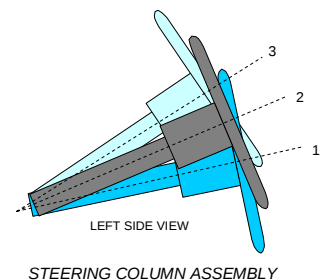
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total No. of Positions	Placed in Position
Driver Seat	Fixed	Fixed
Rear Seat		

STEERING COLUMN ADJUSTMENT

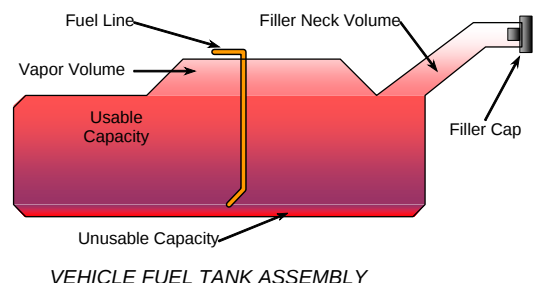
Steering wheel and column adjustments are made so that the steering wheel hub is at the center of the geometric locus it describes when it moves through its full range of motion.

	Degrees	Fore-Aft Position (mm)
Lowermost - Position 1	Fixed	Fixed
Geometric Center - Position 2	Fixed	Fixed
Uppermost - Position 3	Fixed	Fixed
Telescoping Steering Wheel Travel		
Test Position	Fixed	Fixed



FUEL PUMP

The vehicle is electric and is not equipped with a liquid fuel system.



DATA SHEET NO. 2 ... (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEMS, AND STEERING WHEEL DATA

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514

Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

FUEL TANK CAPACITY

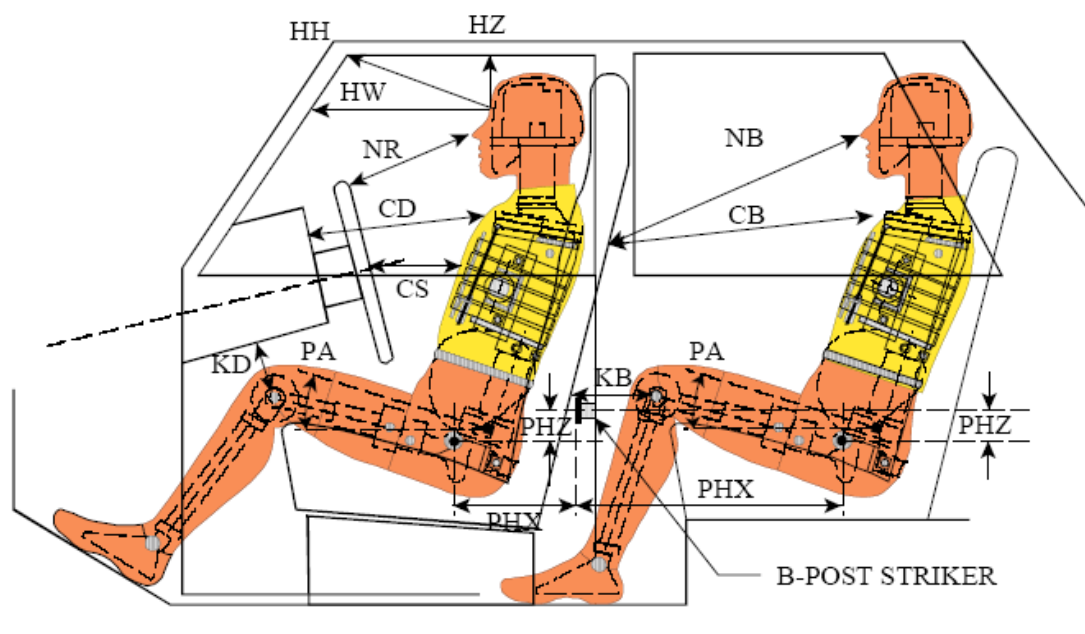
Description	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	
Usable Capacity of "Optional Tank" (see Form No. 1)	
Usable Capacity of "Standard Tank" (see Owner's Manual)	
Usable Capacity of "Optional Tank" (see Owner's Manual)	
93% of Usable Capacity	
Actual amount of Solvent Used in Test	
1/3 of Usable Capacity	

Is the Actual Amount of Solvent Used in the test equal to 93% $\pm$ 1% of the Usable Capacity stated in the Form No. 1? ☐ **Yes** ☐ **No**

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13



LEFT SIDE VIEW

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

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Description	Driver		Passenger	
			Length (mm)	Angle (°)	Length (mm)	Angle (°)
HH		Head to Header	534			
HW		Head to Windshield	691			
HZ	HZ	Head to Roof	193			
NR	NB	Nose to Rim/Seat Back	494			
CD	CB	Chest to Dash/Seat Back	663			
CS		Chest to Steering Wheel	360			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	131	35.2		
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	119	29.0		
PAX°	PAX°	Pelvic Tilt Angle X		15.9		
	PAY°	Pelvic Tilt Angle Y		0.2		
PHX	PHX	Hip Point to Striker (x-axis)	328			
PHZ	PHZ	Hip Point to Striker (z-axis)	209			

DATA SHEET NO. 4

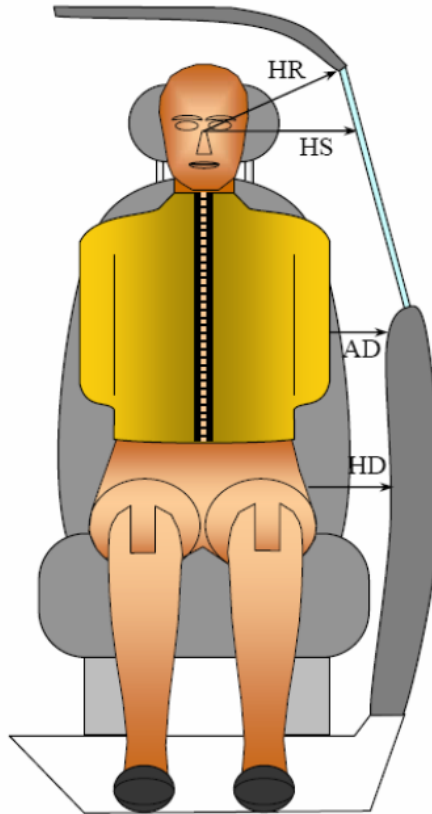
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe

NHTSA No. MD0514

Test Program: NCAP MDB Side Impact Test

Test Date: 07/26/13



FRONT VIEW OF DUMMY

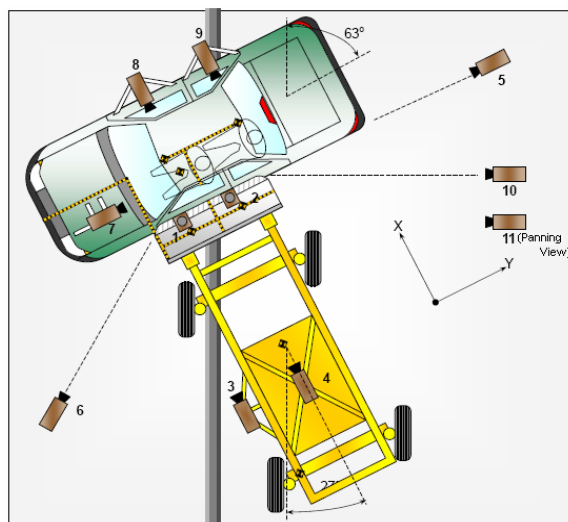
DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver	Passenger
HR	Head to Side Header	mm	192	
HS	Head to Side Window	mm	293	
AD	Arm to Door	mm	51	
HD	H-Point to Door	mm	116	

DATA SHEET NO. 5

CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13



CAMERA LOCATIONS AND DATA

No.	View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	1220	2287	-5486	14	1000
2	Overhead Close-Up	609	2287	-5102	35	1000
3	Left Impact Point (MDB)	-2134	0	-1143	25	1000
4	Side Overall (MDB)	-3912	838	-1829	12.5	1000
5	Rear	-64	2485	-1348	85	1000
6	Left Front	-2266	-3564	-1475	24	1000
7	Driver Front (On-Board)	421	-284	-554	35	1000
8	Driver Side (On-Board)	1335	937	-349	14	1000
9	Passenger Side (On-Board)				14	1000
10	Real Time Overall				Zoom	30
11	Real Time Inrun				Zoom	30

Reference: Impact Point Projected to Ground; +X = To Front of MDB, +Y = To Right of MDB, +Z = Down

*All measurements accurate to ± 6 mm

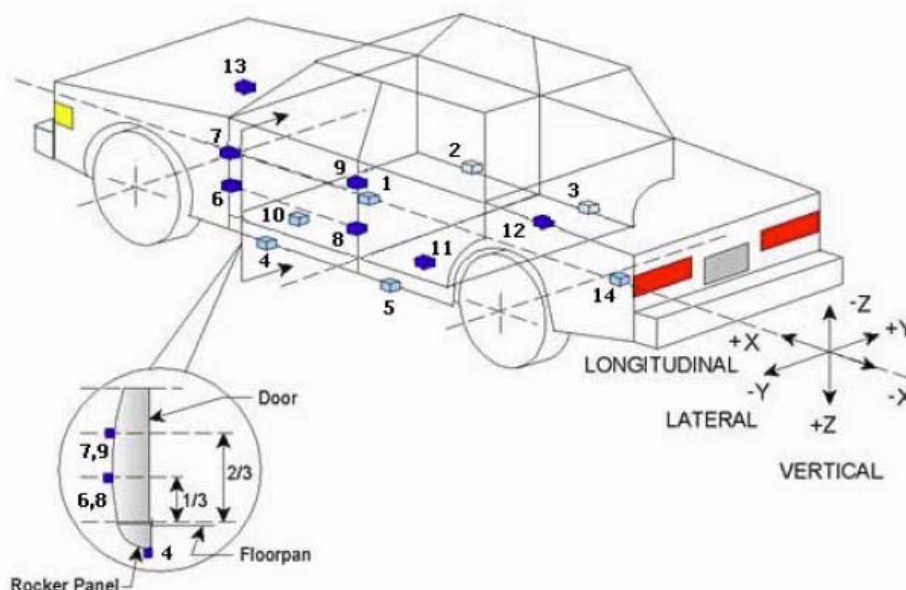
INSTRUMENTATION

Driver Dummy Channels	16
Passenger Dummy Channels	
Vehicle Structure Accelerometers	16
MDB Accelerometers	5
Total	37

DATA SHEET NO. 6

TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

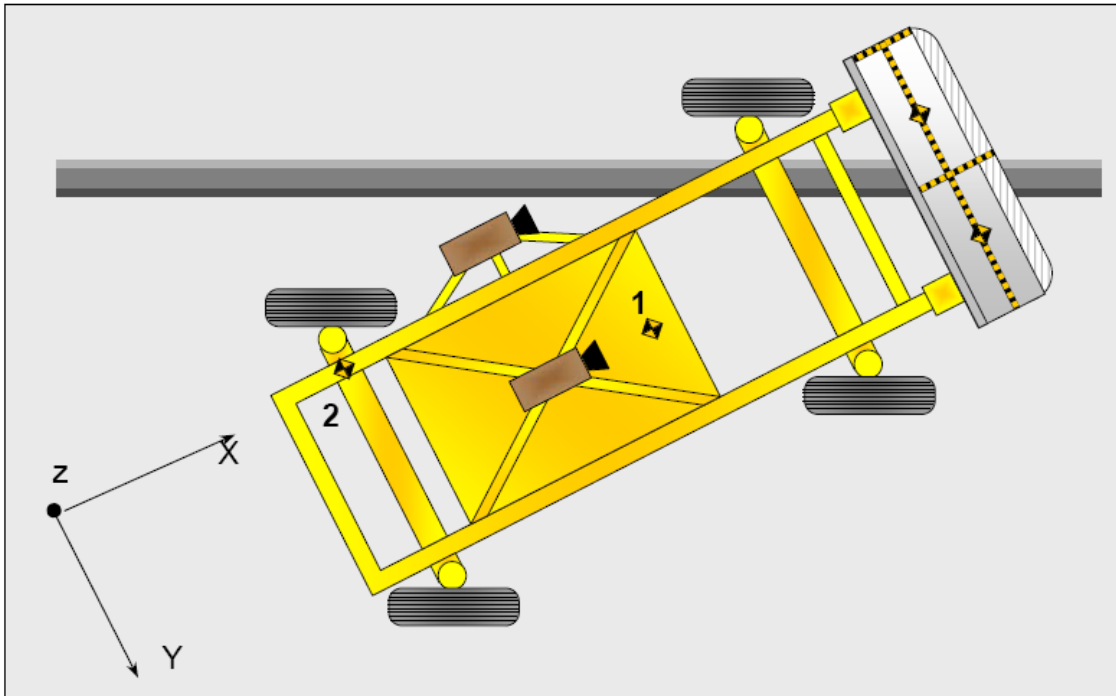
Loc. No.	Sensor Description	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	1685	65	-450
2	Right Sill at Front Seat	1232	575	-423
3	Right Sill at Rear Seat			
4	Left Sill at Front Door	1267	-550	-144
5	Left Sill at Rear Door			
6	A-Pillar Lower	1865	-619	-640
7	A-Pillar Middle	1865	-619	-886
8	B-Pillar Lower	943	-568	-580
9	B-Pillar Middle	807	-568	-830
10	Front Seat Track	1075	-450	-504
11	Rear Seat Structure			
12	Right Rear Occupant Compartment			
13	Engine Block	2350	-40	-823
14	Rear Floorpan Above Axle	523	0	-670

Reference: X – Rear surface of vehicle (+ forward)
 Y – Vehicle centerline (+ to right)
 Z – Ground plane (+ down)

DATA SHEET NO. 7

MDB ACCELEROMETER LOCATIONS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13



MDB ACCELEROMETER LOCATIONS

Loc. No.	Accelerometer Location	Measurement		
		X	Y	Z
1	MDB CG	-1195	0	-430
2	MDB Rear	-2642	-593	-608

Reference: X – Face of MDB (+ forward)
Y – MDB centerline (+ to right)
Z – Ground plane (+ down)

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

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Airbag	
Top of Head	Curtain Airbag, Side Header	
Left Side of Head	Curtain Airbag, Side Header	
Back of Head	Curtain Airbag, Side Header, Headrest	
Left Shoulder	Curtain Airbag, Door Panel	
Upper Torso	Seat, Torso/Pelvis Airbag	
Lower Torso	Seat, Torso/Pelvis Airbag	
Left Hip	Door Panel	
Left Knee	Door Panel, Right Knee	

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Rear Hatch/Other
	Front	Rear	Front	Rear	
Remained Closed and Operational	No		Yes		Yes
Total Separation from Vehicle at Hinges or Latches	No		No		No
Latch or Hinge System Pulled Out of Their Anchorages	No		No		No
Disengaged from Latched Position	No		No		No
Latch Separated from Striker	No		No		No
Jammed Shut	Yes		No		No
If Door Opened at Striker, Record Width of Opening at Striker (mm)	N/A		N/A		N/A

POST-TEST SEAT PERFORMANCE

Description	Struck Side		Non-Struck Side	
	Front	Rear	Front	Rear
Seat Movement Along Seat Track	No		No	
Seat Disengagement from Floor Pan	No		No	
Seat Back Movement from Initial Position	No		No	
Seat Back Collapse	No		No	

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No Separation
Sill Separation	No Separation
Windshield Damage	None
Side Window Damage	Driver window broken
Other Notable Effects	None

DATA SHEET NO. 8 ... (CONTINUED)**POST-TEST OBSERVATIONS**

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Airbag 1 (Curtain)	Yes	Yes		
Side Airbag 2 (Torso/Pelvis)	Yes	Yes		
Seat Belt Pretensioner	Yes	Yes		
Seat Belt Load Limiter	Yes	Yes		
Other	No			

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		1871
Vertical Impact Reference Line (Aft of Front Axle)(Intended Impact Point)	mm		-5
Actual Impact Point (Aft of Front Axle)	mm		-3
Horizontal Offset (+ forward / - rearward)	mm	± 50 of Intended Impact Point	-2
Vertical Offset (+ down / - up)	mm	± 20 of Intended Impact Point	18

DATA SHEET NO. 9**MDB SUMMARY OF RESULTS**

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1251
Overall Length including Honeycomb Face	4023
Wheel Base of Framework Carriage	2595
CG location aft of Front Axle	1118

MDB WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg	401.8	298.0	699.8
Right	kg	376.9	291.6	668.5
Ratio	%	56.9%	43.1%	100.0%
Totals	kg	778.7	589.6	1368.3

SPEED AND IMPACT DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	61.45
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	61.45
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.3
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	62.7
MDB Crabbed Angle to MDB Forward Line of Motion	degrees	26.0 to 28.0	27.6

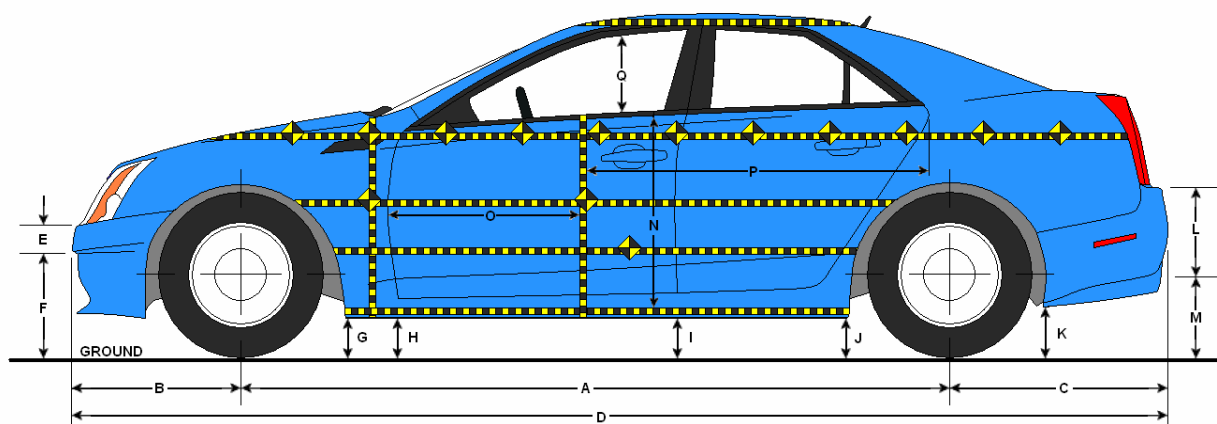
MAXIMUM STATIC CRUSH OF HONEYCOMB FACE

Vertical Location			From Centerline		Max. Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Right	230
B	Top of Bumper	533	800	Right	2
C	Mid Level	686	700	Right	127
D	Top of Stack	813	800	Left	148

DATA SHEET NO. 10

TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13



LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

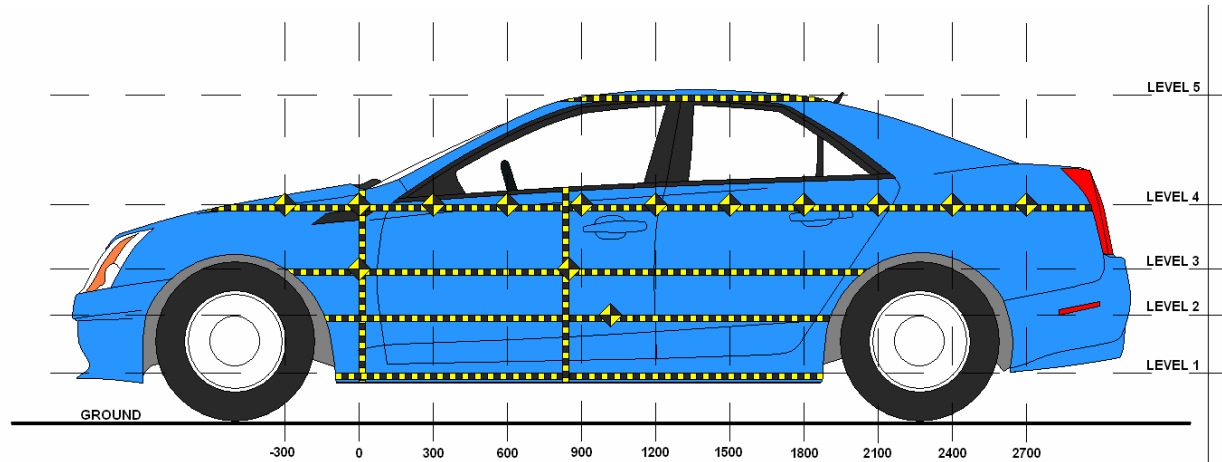
Code	Description	Pre-Test	Post-Test	Difference
A	Wheelbase	1871	1867	-4
B	Front Axle to FSOV	427	446	19
C	Rear Axle to RSOV	422	409	-13
D	Total Length at Centerline	2720	2722	2
E	Front Bumper Thickness	269	269	0
F	Front Bumper Bottom to Ground	196	205	9
G	Sill Height at Front Wheel Well	166	180	14
H	Sill Height at Front Door Leading Edge	172	186	14
I	Sill Height at B-Pillar	189	165	-24
J1	Sill Height at Rear Wheel Well	218	194	-24
J2	Pinch Weld Height at Rear Wheel Well	153	109	-44
K	Sill Height Aft of Rear Wheel Well	300	286	-14
L	Rear Bumper Thickness	298	295	-3
M	Rear Bumper Bottom to Ground	258	238	-20
N	Sill Height to Bottom of Front Window Sill	568	565	-3
O	Front Door Leading Edge to Impact CL	484	484	0
P	Rear Door Trailing Edge to Impact CL	915	-464	-1379
Q	Front Window Opening	462	434	-28
R	Right Side Length	2516	2520	4
S	Left Side Length	2514	2521	7
T	Vehicle Width at B-Pillar	1532	1419	-113

All measurements in mm with tolerance of ± 3 mm

DATA SHEET NO. 11

TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13



LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Description	Height Above Ground (mm)	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	627	49	750
2	Occupant H-Point	634	100	1500
3	Mid-Door	757	79	1500
4	Window Sill	897	57	1650
5	Window Top	1483	3	900

DATA SHEET NO. 11 ... (CONTINUED)

TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514

Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test (mm)					Post-Test (mm)					Difference (mm)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900															
-750															
-600															
-450															
-300															
-150		798	833				799	833				1	0		
0		768	800	873			761	797	878			-7	-3	5	
150		765	785	836			750	778	836			-15	-7	0	
300		769	775	809			735	760	814			-34	-15	5	
450	793	778	771	797		803	752	755	792		10	-26	-16	-5	
600	789	768	765	788		829	757	756	785		40	-11	-9	-3	
750	782	763	759	783		831	767	762	783		49	4	3	0	
900	774	761	757	779	998	813	778	773	784	1001	39	17	16	5	3
1050	774	762	762	777	993	814	791	789	790	992	40	29	27	13	-1
1200	777	765	762	776	989	813	812	788	785	988	36	47	26	9	-1
1350	773	770	767	778	988	807	838	807	788	988	34	68	40	10	0
1500	751	768	771	780	991	785	868	850	813	991	34	100	79	33	0
1650		745	767	783	1003		753	763	840	1003		8	-4	57	0
1800		718	770	785	1015		728	772	783	1017		10	2	-2	2
1950			783	798				787	800				4	2	
2100															
2250															
2400															
2550															
2700															
2850															

DATA SHEET NO. 11 ... (CONTINUED)

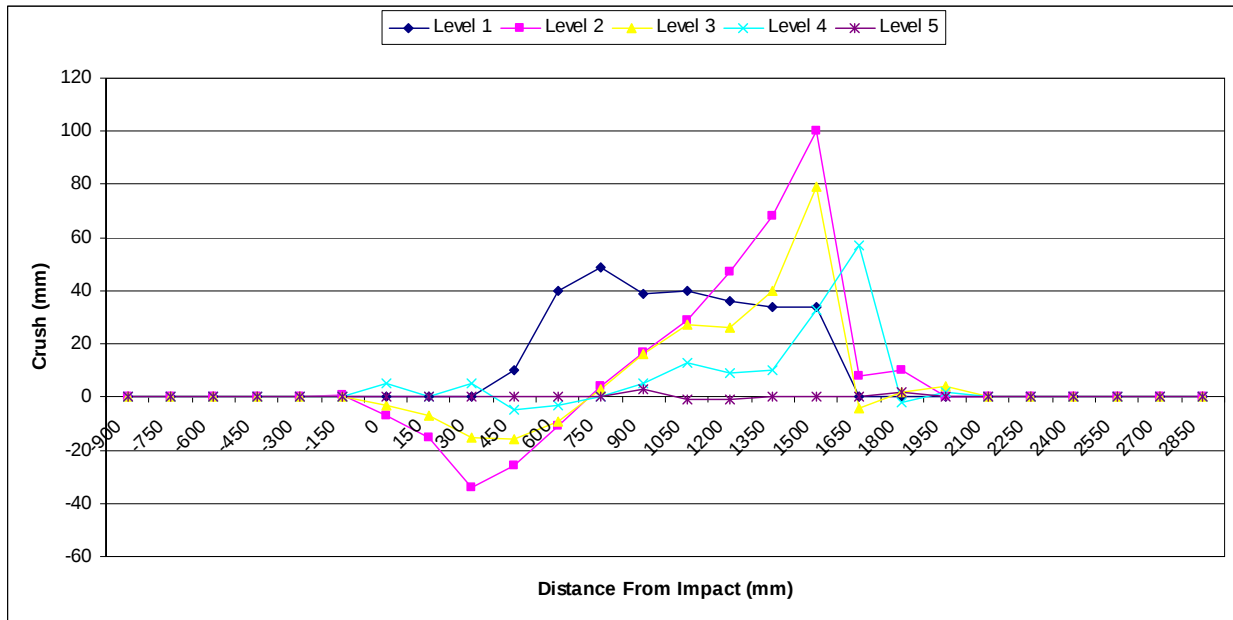
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe

NHTSA No. MD0514

Test Program: NCAP MDB Side Impact Test

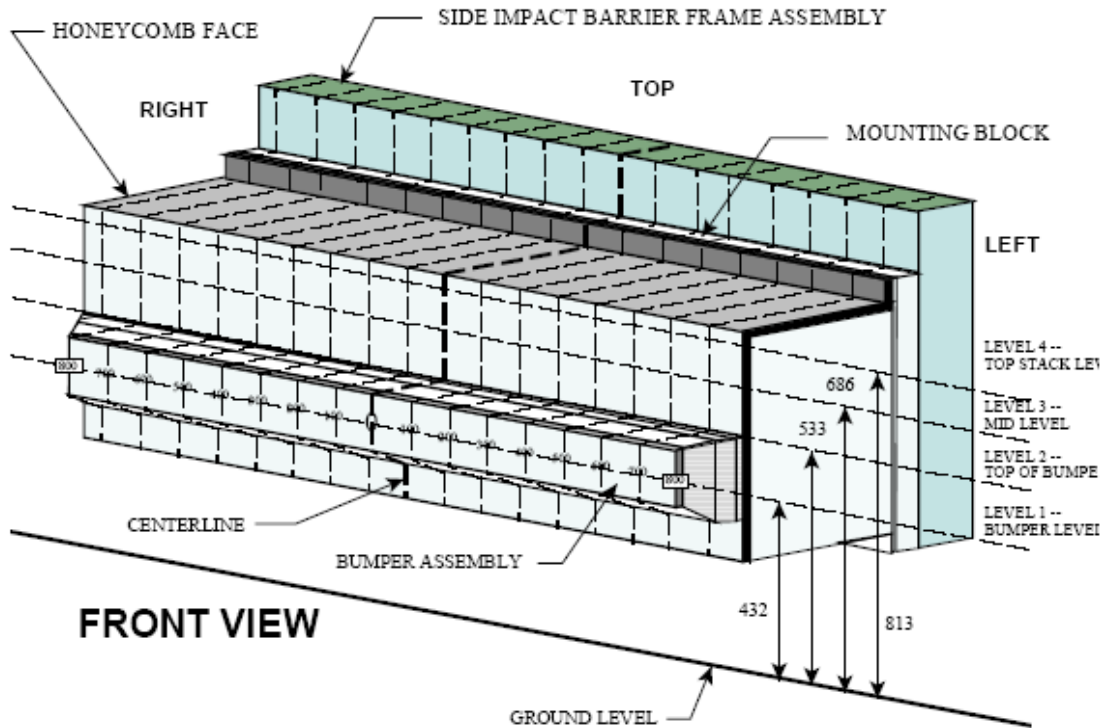
Test Date: 07/26/13



DATA SHEET NO. 12

MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13



NOTE: Dimensions are shown in millimeters, mm

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	230	214	214	219	209	194	189	189	185	190	186	188	190	189	191	189	204
2	142	127	132	137	124	112	107	107	113	119	120	125	127	127	127	129	130
3	122	127	117	97	81	60	43	43	47	43	49	57	72	107	107	113	117
4	147	137	117	103	78	47	20	20	27	41	47	59	77	98	123	127	148

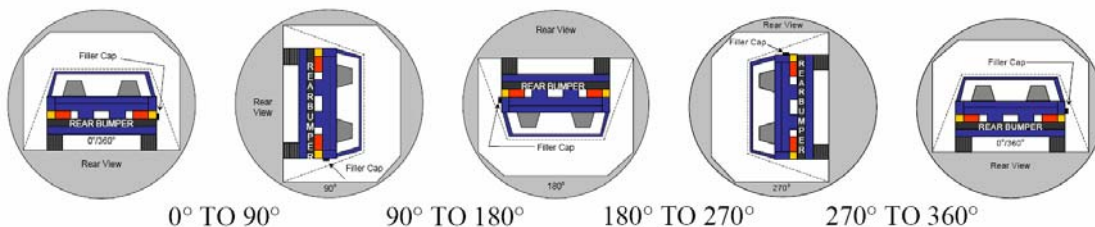
All dimensions in millimeters.

DATA SHEET NO. 13

FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe NHTSA No. MD0514
 Test Program: NCAP MDB Side Impact Test Test Date: 07/26/13
 Temperature at Time of Impact: 32.8° C Test Time: 10:45 AM

- A. From impact until vehicle motion ceases: N/A oz.
 (Maximum allowable = 1 oz.)
- B. For the 5 minute period after motion ceases: N/A oz.
 (Maximum allowable = 5 oz.)
- C. For the following 25 minutes: N/A oz.
 (Maximum allowable = 1 oz./minute)
- D. Spillage Details: N/A



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°			
90° To 180°			
180° To 270°			
270° To 360°			

FMVSS 301 SPILLAGE TABLE

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° To 90°				
90° To 180°				
180° To 270°				
270° To 360°				

SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 14

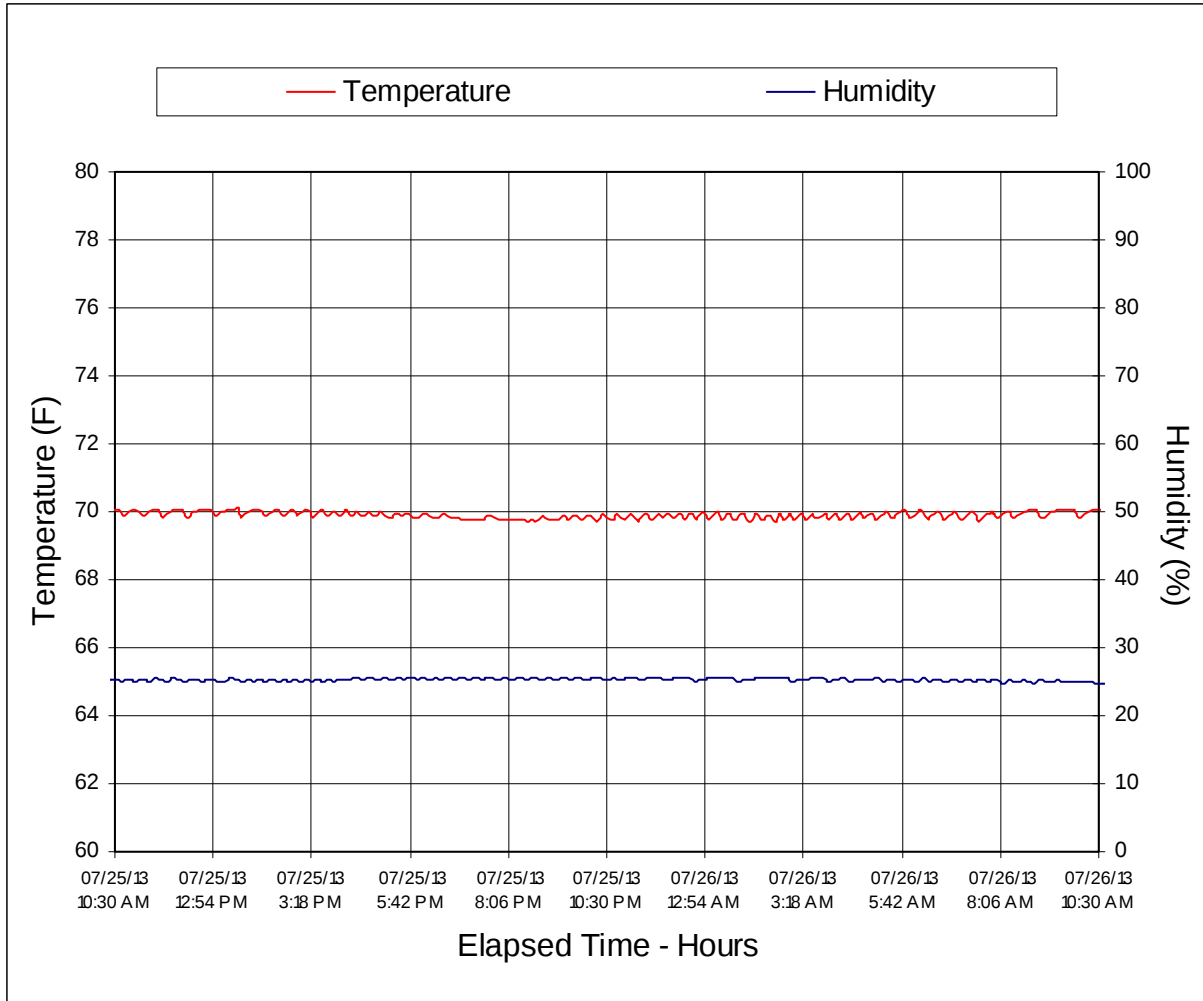
DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe

NHTSA No. MD0514

Test Program: NCAP MDB Side Impact Test

Test Date: 07/26/13



APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Figure		Page
1	As-Delivered Right Front $\frac{3}{4}$ View of Test Vehicle	A-1
2	As-Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle	A-1
3	Pre-Test Frontal View of Test Vehicle	A-2
4	Post-Test Frontal View of Test Vehicle	A-2
5	Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle	A-3
6	Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle	A-3
7	Pre-Test Left Side View of Test Vehicle	A-4
8	Post-Test Left Side View of Test Vehicle	A-4
9	Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle	A-5
10	Post-Test Left Rear $\frac{3}{4}$ View of Impact Zone	A-5
11	Pre-Test Rear View of Test Vehicle	A-6
12	Post-Test Rear View of Test Vehicle	A-6
13	Pre-Test Right Side View of Test Vehicle	A-7
14	Post-Test Right Side View of Test Vehicle	A-7
15	Pre-Test Overhead View of Test Area	A-8
16	Post-Test Overhead View of Test Area	A-8
17	Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle	A-9
18	Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle	A-9
19	Pre-Test Close-Up View of Impact Point Target	A-10
20	Post-Test Close-Up View of Impact Point Target	A-10
21	Pre-Test Left Front Door Latch Close-Up	A-11
22	Post-Test Left Front Door Latch Close-Up	A-11
23	Pre-Test Left Rear Door Latch Close-Up	A-12
24	Post-Test Left Rear Door Latch Close-Up	A-12
25	Pre-Test Front Close-Up View of Driver Dummy	A-13
26	Post-Test Front Close-Up View of Driver Dummy	A-13
27	Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking	A-14
28	Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View	A-14
29	Post-Test Left Side View of Driver Dummy Shoulder and Door Top View	A-15
30	Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning	A-15
31	Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint	A-16
32	Pre-Test Overhead View of Driver Seat Pan Prior to Dummy Positioning	A-16
33	Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan	A-17
34	Pre-Test Placement of Driver Dummy's Feet	A-17
35	Pre-Test View of Belt Anchorage for Driver Dummy	A-18

TABLE OF PHOTOGRAPHS ... (CONTINUED)

Figure		Page
36	Pre-Test Left Side View of Steering Wheel	A-18
37	View of Disengaged Parking Brake	A-19
38	Pre-Test View of Parking Brake	A-19
39	Pre-Test Close-Up Left Side View of Driver Seat Track	A-20
40	Pre-Test Close-Up Left Side View of Driver Seat Back	A-20
41	Pre-Test Close-Up View of Driver Seat Back or Head Restraint	A-21
42	Pre-Test Driver Dummy and Door Clearance View	A-21
43	Post-Test Driver Dummy and Door Clearance View	A-22
44	Pre-Test Right Side View of Driver Dummy and Front Seat Occupant Compartment	A-22
45	Post-Test Right Side View of Driver Dummy and Front Seat Occupant Compartment	A-23
46	Pre-Test Driver Inner Door Panel View	A-23
47	Post-Test Driver Inner Door Panel View Showing Driver Dummy Contact Locations	A-24
48	Post-Test Driver Dummy Close-Up Head Contact with Vehicle Interior View	A-24
49	Post-Test Driver Dummy Close-Up Head Contact with Side Airbag View	A-25
50	Post-Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View	A-25
51	Post-Test Driver Dummy Close-Up Torso Contact with Side Airbag View	A-26
52	Post-Test Driver Dummy Close-Up Pelvis Contact with Vehicle Interior View	A-26
53	Post-Test Driver Dummy Close-Up Pelvis Contact with Side Airbag View	A-27
54	Post-Test Driver Dummy Close-Up Knee Contact View	A-27
55	Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking	A-28
56	Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View	A-28
57	Post-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View	A-29
58	Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning	A-29
59	Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint	A-30
60	Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning	A-30
61	Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan	A-31
62	Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket	A-31
63	Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level	A-32
64	Pre-Test Placement of Rear Passenger Dummy's Feet	A-32
65	Pre-Test View of Belt Anchorage for Rear Passenger Dummy	A-33
66	Pre-Test Close-Up Left Side View of Rear Passenger Seat Track	A-33
67	Pre-Test Close-Up Left Side View of Rear Passenger Seat Back	A-34
68	Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint	A-34
69	Pre-Test Rear Passenger Dummy and Door Clearance View	A-35
70	Post-Test Rear Passenger Dummy and Door Clearance View	A-35

TABLE OF PHOTOGRAPHS ... (CONTINUED)

Figure		Page
71	Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment	A-36
72	Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment	A-36
73	Pre-Test Rear Passenger Inner Door Panel View	A-37
74	Post-Test Rear Passenger Inner Door Panel View Showing Rear Passenger Dummy Contact Locations	A-37
75	Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle Interior View	A-38
76	Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Airbag View	A-38
77	Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View	A-39
78	Post-Test Rear Passenger Dummy Close-Up Torso Contact with Side Airbag View	A-39
79	Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Vehicle Interior View	A-40
80	Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Airbag View	A-40
81	Post-Test Rear Passenger Dummy Close-Up Knee Contact View	A-41
82	Pre-Test View of Fuel Filler Cap or Fuel Filler Neck	A-41
83	Post-Test View of Fuel Filler Cap or Fuel Filler Neck	A-42
84	Pre-Test Front View of MDB Impactor Face	A-42
85	Post-Test Front View of MDB Impactor Face	A-43
86	Pre-Test Top View of MDB Impactor Face	A-43
87	Post-Test Top View of MDB Impactor Face	A-44
88	Pre-Test Left Side View of MDB Impactor Face	A-44
89	Post-Test Left Side View of MDB Impactor Face	A-45
90	Pre-Test Right Side View of MDB Impactor Face	A-45
91	Post-Test Right Side View of MDB Impactor Face	A-46
92	Close-Up View of Vehicle's Certification Label	A-46
93	Close-Up View of Vehicle's Tire Information Placard or Label	A-47
94	Pre-Test Ballast View	A-47
95	Post-Test Primary and Redundant Speed Trap Read-Out	A-48
96	FMVSS No. 301 Rollover 0 Degrees	A-48
97	FMVSS No. 301 Rollover 90 Degrees	A-49
98	FMVSS No. 301 Rollover 180 Degrees	A-49
99	FMVSS No. 301 Rollover 270 Degrees	A-50
100	FMVSS No. 301 Rollover 360 Degrees	A-50
101	Impact Event	A-51
102	Monroney Label	A-51
103	Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual	A-52
104	Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual	A-52



FIGURE 1. As-Delivered Right Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 2. As-Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 3. Pre-Test Frontal View of Test Vehicle



FIGURE 4. Post-Test Frontal View of Test Vehicle



FIGURE 5. Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 6. Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 7. Pre-Test Left Side View of Test Vehicle



FIGURE 8. Post-Test Left Side View of Test Vehicle



FIGURE 9. Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle

Photograph Not Available

FIGURE 10. Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 11. Pre-Test Rear View of Test Vehicle



FIGURE 12. Post-Test Rear View of Test Vehicle



FIGURE 13. Pre-Test Right Side View of Test Vehicle



FIGURE 14. Post-Test Right Side View of Test Vehicle



FIGURE 15. Pre-Test Overhead View of Test Area

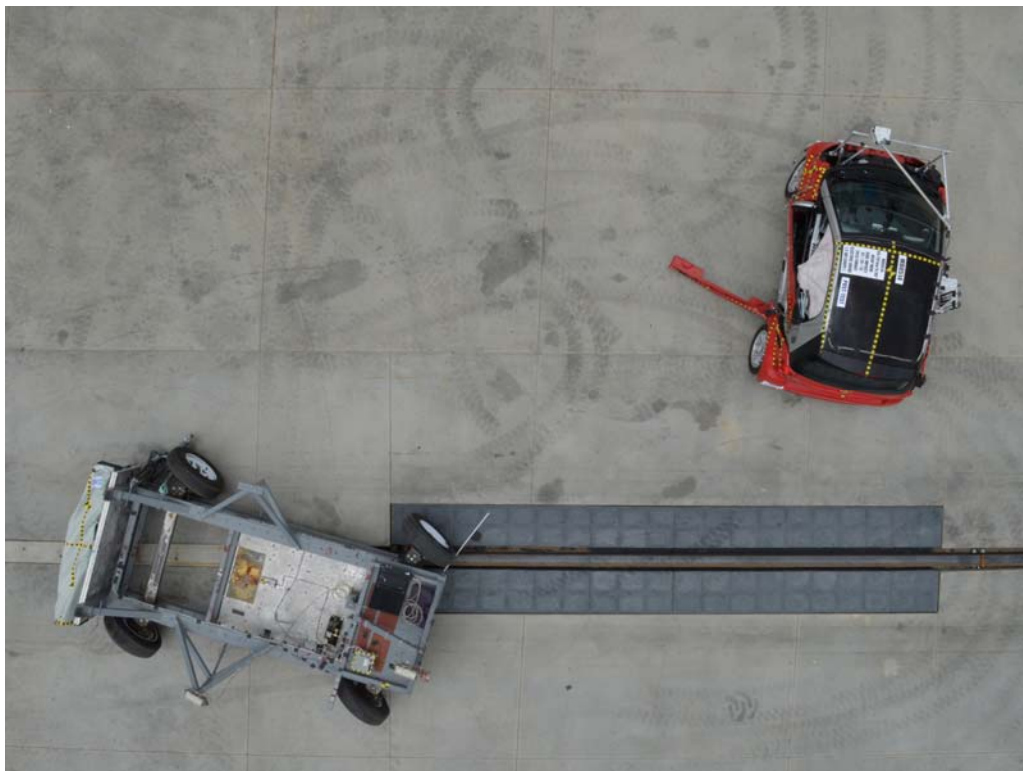


FIGURE 16. Post-Test Overhead View of Test Area



FIGURE 17. Pre-Test Left Side View of MDB Positioned
Against Side of Test Vehicle



FIGURE 18. Pre-Test Right Side View of MDB Positioned
Against Side of Test Vehicle



FIGURE 19. Pre-Test Close-Up View of Impact Point Target

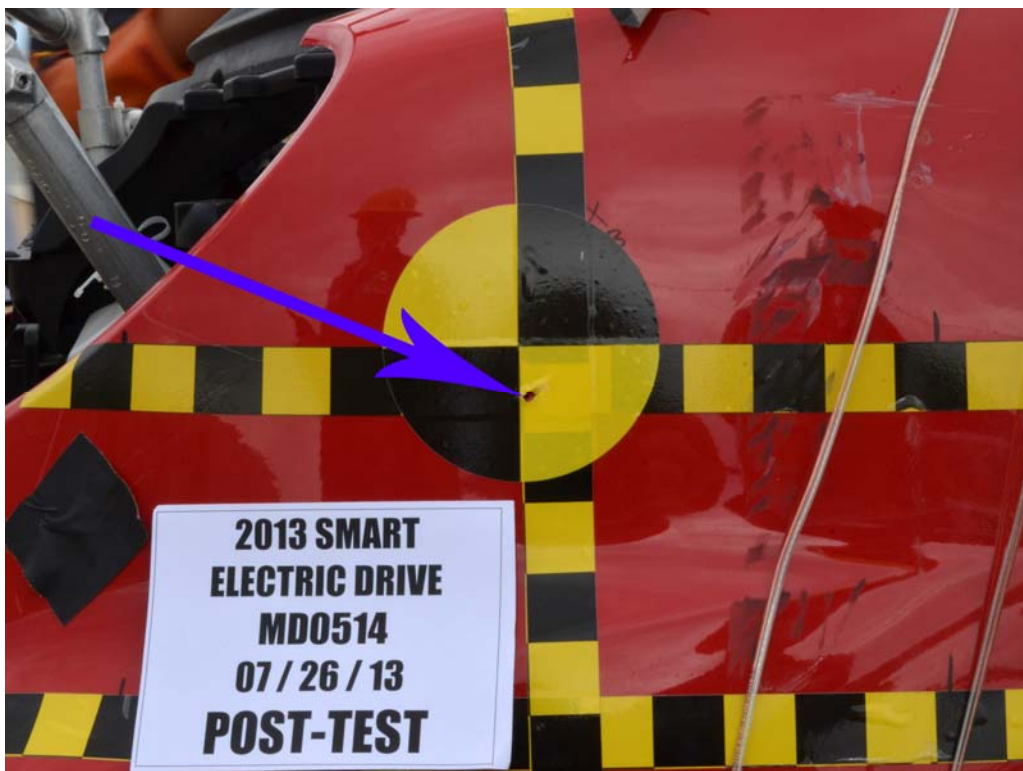


FIGURE 20. Post-Test Close-Up View of Impact Point Target



FIGURE 21. Pre-Test Left Front Door Latch Close-Up



FIGURE 22. Post-Test Left Front Door Latch Close-Up

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Door

FIGURE 23. Pre-Test Left Rear Door Latch Close-Up

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Door

FIGURE 24. Post-Test Left Rear Door Latch Close-Up



FIGURE 25. Pre-Test Front Close-Up View of Driver Dummy



FIGURE 26. Post-Test Front Close-Up View of Driver Dummy



FIGURE 27. Pre-Test Left Side View of Driver Dummy
Showing Belt and Chalking



FIGURE 28. Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View



FIGURE 29. Post-Test Left Side View of Driver Dummy Shoulder and Door Top View



FIGURE 30. Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning



FIGURE 31. Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint



FIGURE 32. Pre-Test Overhead View of Driver Seat Pan Prior to Dummy Positioning



FIGURE 33. Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan



FIGURE 34. Pre-Test Placement of Driver Dummy's Feet



FIGURE 35. Pre-Test View of Belt Anchorage for Driver Dummy



FIGURE 36. Pre-Test Left Side View of Steering Wheel



FIGURE 37. View of Disengaged Parking Brake



FIGURE 38. Pre-Test View of Parking Brake



FIGURE 39. Pre-Test Close-Up Left Side View of Driver Seat Track



FIGURE 40. Pre-Test Close-Up Left Side View of Driver Seat Back



FIGURE 41. Pre-Test Close-Up View of Driver Seat Back or Head Restraint



FIGURE 42. Pre-Test Driver Dummy and Door Clearance View



FIGURE 43. Post-Test Driver Dummy and Door Clearance View



FIGURE 44. Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment



FIGURE 45. Post-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment



FIGURE 46. Pre-Test Driver Inner Door Panel View



FIGURE 47. Post-Test Driver Inner Door Panel View

Showing Driver Dummy Contact Locations

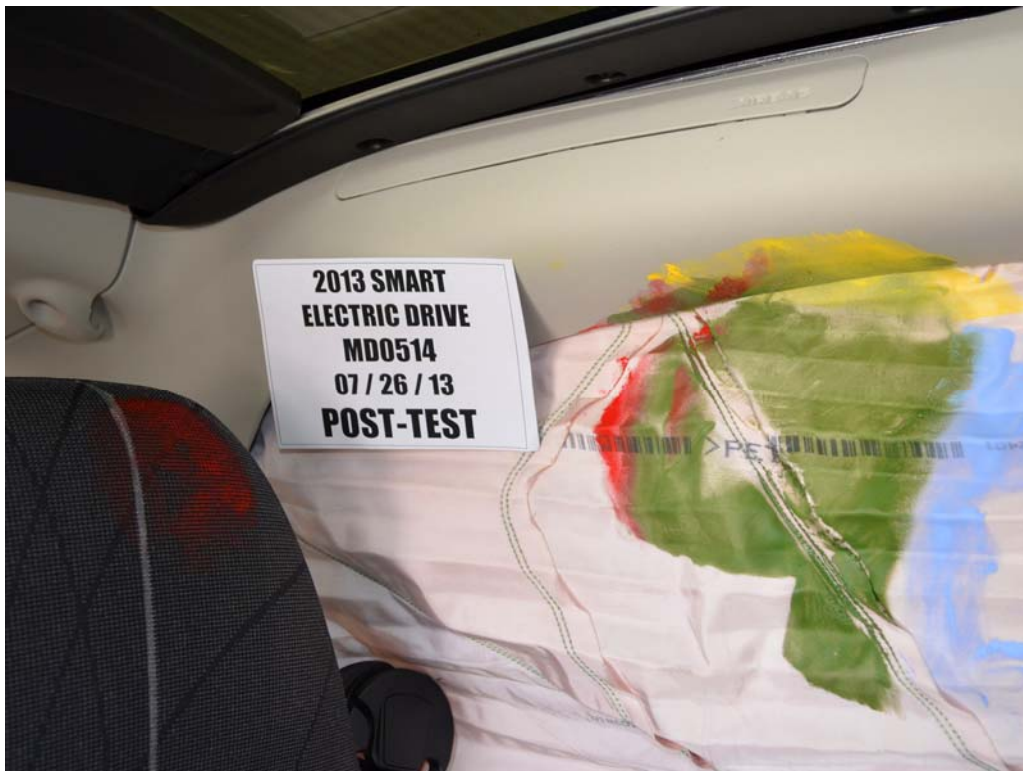


FIGURE 48. Post-Test Driver Dummy Close-Up Head Contact with Vehicle Interior View

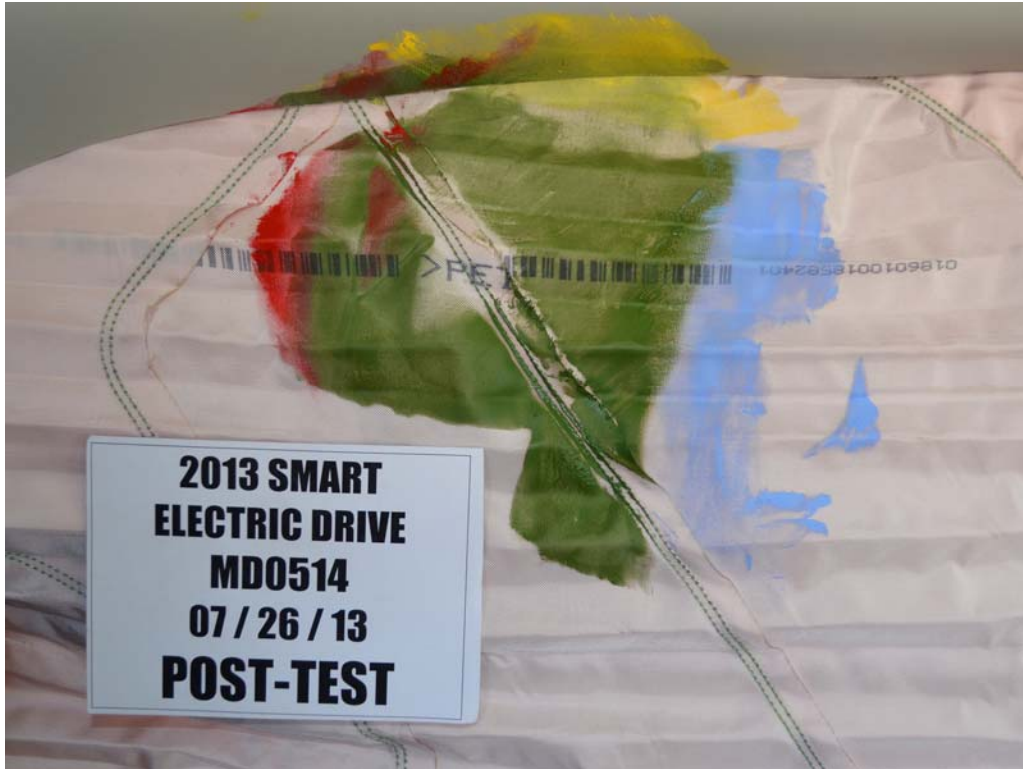


FIGURE 49. Post-Test Driver Dummy Close-Up Head Contact with Side Airbag View

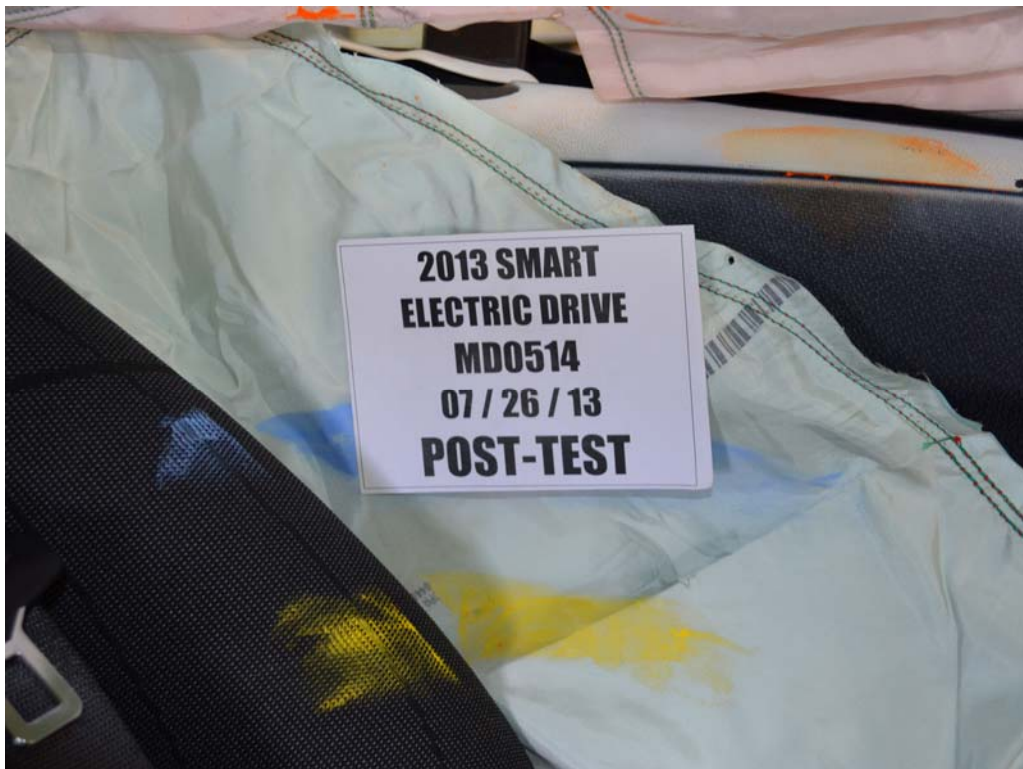


FIGURE 50. Post-Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View



FIGURE 51. Post-Test Driver Dummy Close-Up Torso Contact with Side Airbag View



FIGURE 52. Post-Test Driver Dummy Close-Up Pelvis Contact with Vehicle Interior View

Photograph Not Applicable

No Dummy Pelvis Contact With Vehicle Side Airbag

FIGURE 53. Post-Test Driver Dummy Close-Up Pelvis Contact with Side Airbag View



FIGURE 54. Post-Test Driver Dummy Close-Up Knee Contact View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 55. Pre-Test Left Side View of Rear Passenger Dummy
Showing Belt and Chalking

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 56. Pre-Test Left Side View of Rear Passenger Dummy
Shoulder and Door Top View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 57. Post-Test Left Side View of Rear Passenger Dummy
Shoulder and Door Top View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 58. Pre-Test Frontal View of Rear Passenger Seat Back
Prior to Dummy Positioning

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 59. Pre-Test Frontal View of Rear Passenger Dummy
Head and Shoulders in Relation to Head Restraint

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 60. Pre-Test Overhead View of Rear Passenger
Seat Pan Prior to Dummy Positioning

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 61. Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 62. Pre-Test View of Rear Passenger Dummy's Neck
Showing Position of Adjustable Neck Bracket

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 63. Pre-Test View of Rear Passenger Dummy's Head
Showing Dummy's Head is Level

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 64. Pre-Test Placement of Rear Passenger Dummy's Feet

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 65. Pre-Test View of Belt Anchorage for Rear Passenger Dummy

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 66. Pre-Test Close-Up Left Side View of Rear Passenger Seat Track

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 67. Pre-Test Close-Up Left Side View of Rear Passenger Seat Back

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 68. Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 69. Pre-Test Rear Passenger Dummy and Door Clearance View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 70. Post-Test Rear Passenger Dummy and Door Clearance View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 71. Pre-Test Right Side View of Rear Passenger Dummy
and Rear Seat Occupant Compartment

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 72. Post-Test Right Side View of Rear Passenger Dummy
and Rear Seat Occupant Compartment

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 73. Pre-Test Rear Passenger Inner Door Panel View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 74. Post-Test Rear Passenger Inner Door Panel View
Showing Rear Passenger Dummy Contact Locations

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 75. Post-Test Rear Passenger Dummy Close-Up
Head Contact with Vehicle Interior View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 76. Post-Test Rear Passenger Dummy Close-Up
Head Contact with Side Airbag View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 77. Post-Test Rear Passenger Dummy Close-Up
Torso Contact with Vehicle Interior View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 78. Post-Test Rear Passenger Dummy Close-Up
Torso Contact with Side Airbag View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 79. Post-Test Rear Passenger Dummy Close-Up
Pelvis Contact with Vehicle Interior View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 80. Post-Test Rear Passenger Dummy Close-Up
Pelvis Contact with Side Airbag View

Photograph Not Applicable

Vehicle Not Equipped with
Rear Passenger Seating

FIGURE 81. Post-Test Rear Passenger Dummy Close-Up Knee Contact View

Photograph Not Applicable

Vehicle Not Equipped
with Liquid Fuel System

FIGURE 82. Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

Photograph Not Applicable

Vehicle Not Equipped with Liquid Fuel System

FIGURE 83. Post-Test View of Fuel Filler Cap or Fuel Filler Neck



FIGURE 84. Pre-Test Front View of MDB Impactor Face



FIGURE 85. Post-Test Front View of MDB Impactor Face



FIGURE 86. Pre-Test Top View of MDB Impactor Face



FIGURE 87. Post-Test Top View of MDB Impactor Face



FIGURE 88. Pre-Test Left Side View of MDB Impactor Face



FIGURE 89. Post-Test Left Side View of MDB Impactor Face



FIGURE 90. Pre-Test Right Side View of MDB Impactor Face



FIGURE 91. Post-Test Right Side View of MDB Impactor Face



FIGURE 92. Close-Up View of Vehicle's Certification Label



FIGURE 93. Close-Up View of Vehicle's Tire Information Placard or Label



FIGURE 94. Pre-Test Ballast View

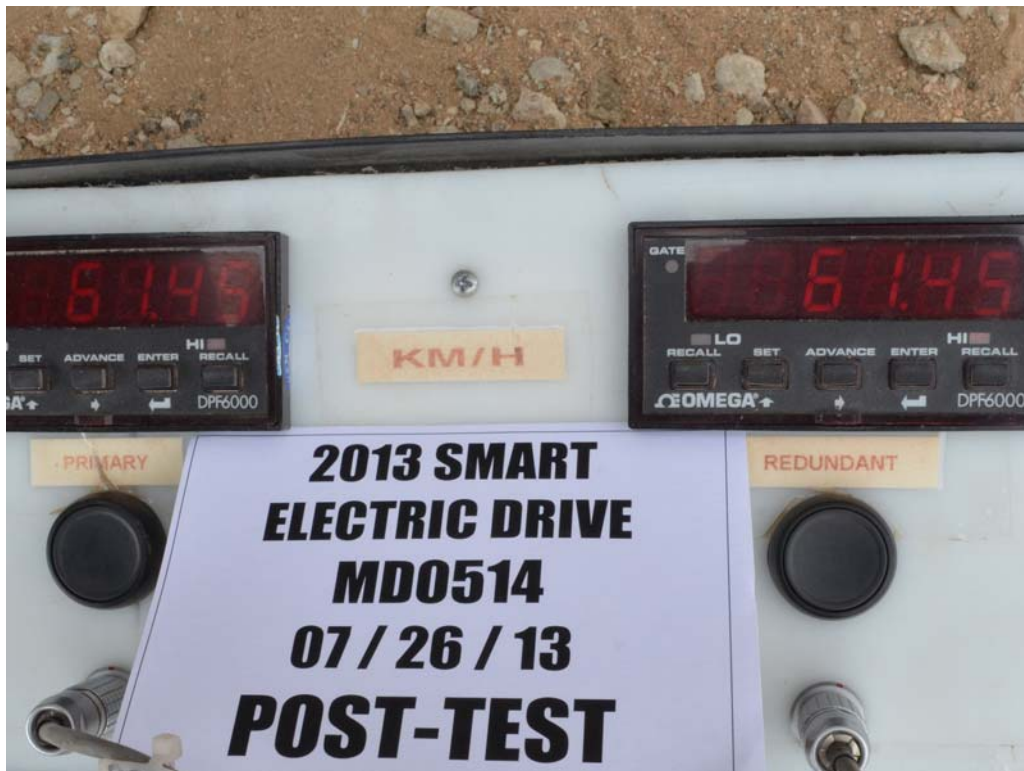


FIGURE 95. Post-Test Primary and Redundant Speed Trap Read-Out

Photograph Not Required

FMVSS No. 305
Performed Instead

FIGURE 96. FMVSS No. 301 Static Rollover 0 Degrees

Photograph Not Required

FMVSS No. 305
Performed Instead

FIGURE 97. FMVSS No. 301 Static Rollover 90 Degrees

Photograph Not Required

FMVSS No. 305
Performed Instead

FIGURE 98. FMVSS No. 301 Static Rollover 180 Degrees

Photograph Not Required

FMVSS No. 305
Performed Instead

FIGURE 99. FMVSS No. 301 Static Rollover 270 Degrees

Photograph Not Required

FMVSS No. 305
Performed Instead

FIGURE 100. FMVSS No. 301 Static Rollover 360 Degrees

Photograph Not Applicable

Owner's Manual Does Not
Include Head Restraint Use
And Adjustment Information

FIGURE 103. Driver Head Restraint Use and Adjustment
Information from Vehicle Owner's Manual

Photograph Not Applicable

Owner's Manual Does Not
Include Head Restraint Use
And Adjustment Information

FIGURE 104. Left Rear Passenger Head Restraint
Use and Adjustment Information from Vehicle Owner's Manual

APPENDIX B
DUMMY RESPONSE DATA

TABLE OF DATA PLOTS

Plot		Page
1	Driver Head Acceleration (X) Primary vs. Time	B-1
2	Driver Head Acceleration (Y) Primary vs. Time	B-1
3	Driver Head Acceleration (Z) Primary vs. Time	B-1
4	Driver Head Resultant Acceleration Primary vs. Time	B-1
5	Driver Upper Thorax Rib Deflection (Y) vs. Time	B-2
6	Driver Middle Thorax Rib Deflection (Y) vs. Time	B-2
7	Driver Lower Thorax Rib Deflection (Y) vs. Time	B-2
8	Driver Thorax Rib Deflection Maximum vs. Time	B-2
9	Driver Anterior Abdominal Force (Y) vs. Time	B-3
10	Driver Middle Abdominal Force (Y) vs. Time	B-3
11	Driver Posterior Abdominal Force (Y) vs. Time	B-3
12	Driver Total Abdominal Force (Y) vs. Time	B-3
13	Driver Pubic Symphysis Force (Y) vs. Time	B-4
14	Passenger Head Acceleration (X) vs. Time Primary	B-5
15	Passenger Head Acceleration (Y) vs. Time Primary	B-5
16	Passenger Head Acceleration (Z) vs. Time Primary	B-5
17	Passenger Head Resultant Acceleration Primary vs. Time	B-5
18	Passenger Lower Spine T12 Acceleration (X) vs. Time	B-6
19	Passenger Lower Spine T12 Acceleration (Y) vs. Time	B-6
20	Passenger Lower Spine T12 Acceleration (Z) vs. Time	B-6
21	Passenger Lower Spine T12 Resultant Acceleration vs. Time	B-6
22	Passenger Iliac Force on Impact Side (Y) vs. Time	B-7
23	Passenger Acetabulum Force on Impact Side (Y) vs. Time	B-7
24	Passenger Total Pelvic Force on Impact Side (Y) vs. Time	B-7

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

Additional Driver & Passenger Dummy Instrumentation Data

Driver Lower Spine T12 Acceleration (X)

Driver Lower Spine T12 Acceleration (Y)

Driver Lower Spine T12 Acceleration (Z)

Passenger Upper Thorax Rib Deflection (Y)

Passenger Middle Thorax Rib Deflection (Y)

Passenger Lower Thorax Rib Deflection (Y)

Passenger Upper Abdomen Rib Deflection (Y)
Passenger Lower Abdomen Rib Deflection (Y)
Driver Head Acceleration Redundant (X)
Driver Head Acceleration Redundant (Y)
Driver Head Acceleration Redundant (Z)
Passenger Head Acceleration Redundant (X)
Passenger Head Acceleration Redundant (Y)
Passenger Head Acceleration Redundant (Z)

Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)
Vehicle Center of Gravity Acceleration (Y)
Vehicle Center of Gravity Acceleration (Z)
Right Side Sill at Front Seat Acceleration (X)
Right Side Sill at Front Seat Acceleration (Y)
Right Side Sill at Front Seat Acceleration (Z)
Right Side Sill at Rear Seat Acceleration (X)
Right Side Sill at Rear Seat Acceleration (Y)
Right Side Sill at Rear Seat Acceleration (Z)
Left Side Sill at Front Seat Acceleration (Y)
Left Side Sill at Rear Seat Acceleration (Y)
Lower A-Post Acceleration (Y)
Middle A-Post Acceleration (Y)
Lower B-Post Acceleration (Y)
Middle B-Post Acceleration (Y)
Front Seat Track Acceleration (Y)
Rear Seat Structure Acceleration (Y)
Right Rear Occupant Compartment Acceleration (Y)
Engine Block (X)
Engine Block (Y)
Rear Floorpan Above Axle Acceleration (X)
Rear Floorpan Above Axle Acceleration (Y)
Rear Floorpan Above Axle Acceleration (Z)

MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)

MDB Center of Gravity Acceleration (Y)

MDB Center of Gravity Acceleration (Z)

MDB Rear Acceleration (X)

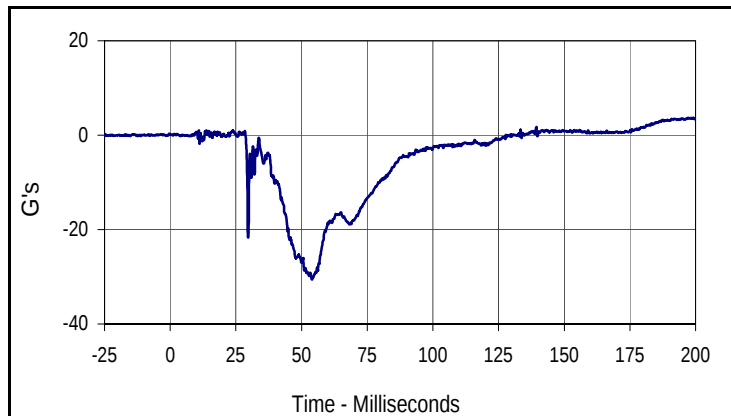
MDB Rear Acceleration (Y)

Left MDB Contact Switch

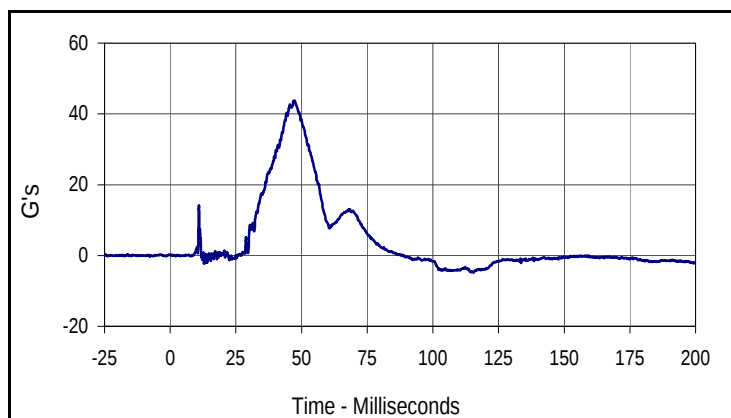
Right MDB Contact Switch

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe
 Test Program: 61 km/h (38 mph) Side Impact NCAP 27° Moving Deformable Barrier Test

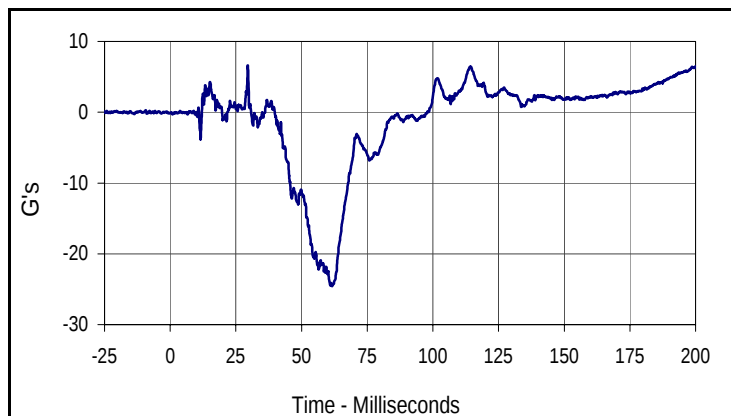
NHTSA No.: MD0514
 Test Date: 7/26/13



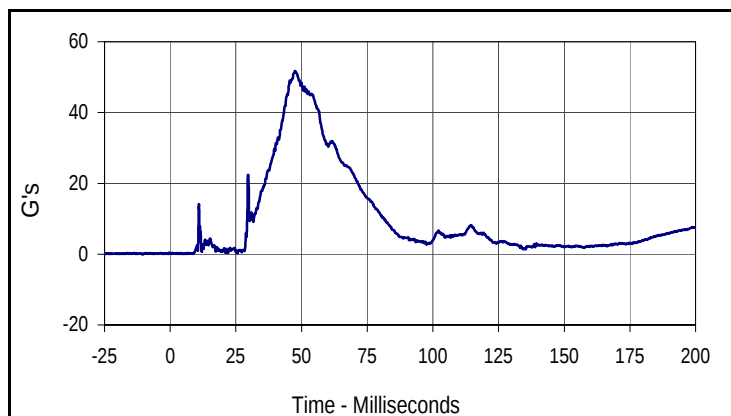
Curve Description			
Driver Head Acceleration X Primary			
Plot No.	Type	SAE Class	Units
001	FIL	1000	G's
Max	Time	Min	Time
3.7	199.1	-30.6	53.9



Curve Description			
Driver Head Acceleration Y Primary			
Plot No.	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
43.7	47.0	-4.8	115.5



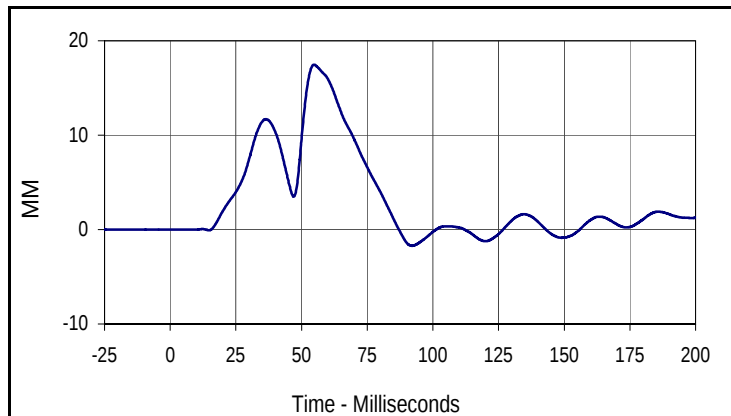
Curve Description			
Driver Head Acceleration Z Primary			
Plot No.	Type	SAE Class	Units
003	FIL	1000	G's
Max	Time	Min	Time
6.6	29.6	-24.6	61.6



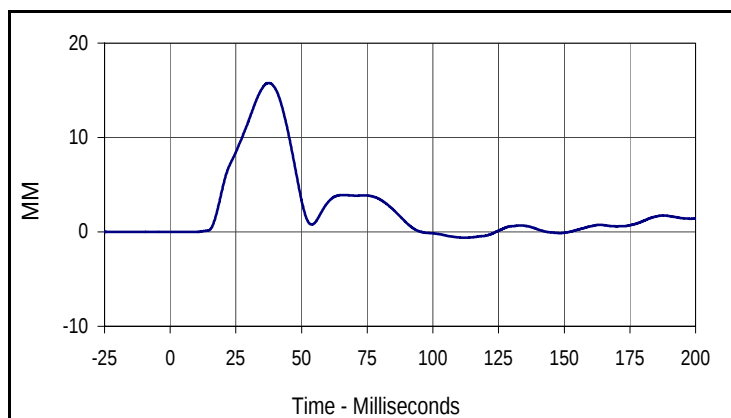
Curve Description			
Driver Head Resultant Acceleration Primary			
Plot No.	Type	SAE Class	Units
004	RES	1000	G's
Max	Time	Min	Time
51.7	47.5	0.0	5.0

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe
 Test Program: 61 km/h (38 mph) Side Impact NCAP 27° Moving Deformable Barrier Test

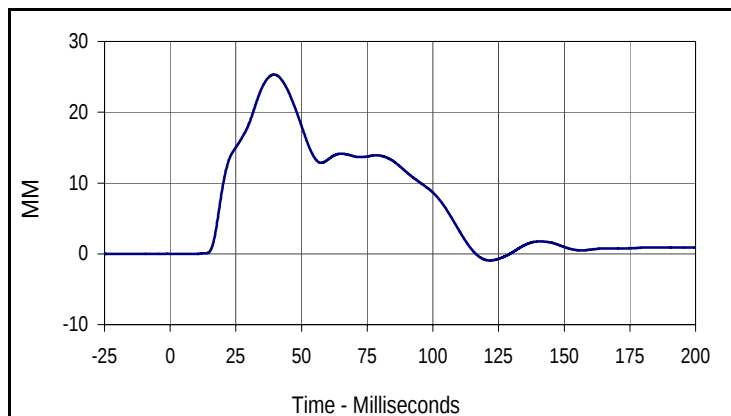
NHTSA No.: MD0514
 Test Date: 7/26/13



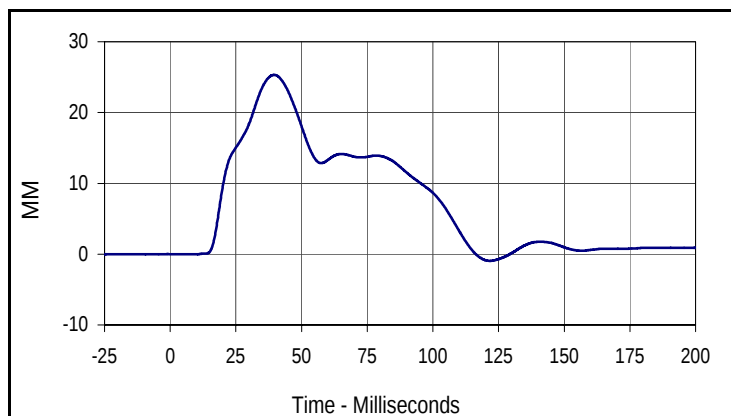
Curve Description			
Driver Upper Thorax Rib Deflection Y			
Plot No.	Type	SAE Class	Units
005	FIL	180	MM
Max	Time	Min	Time
17.5	54.7	-1.7	92.1



Curve Description			
Driver Middle Thorax Rib Deflection Y			
Plot No.	Type	SAE Class	Units
006	FIL	180	MM
Max	Time	Min	Time
15.8	37.5	-0.6	112.2



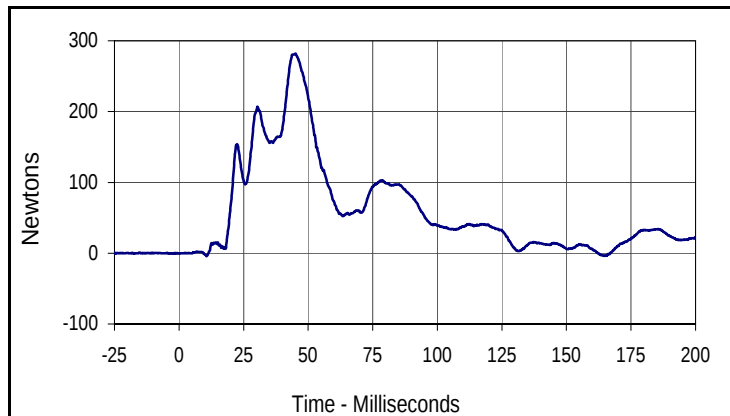
Curve Description			
Driver Lower Thorax Rib Deflection Y			
Plot No.	Type	SAE Class	Units
007	FIL	180	MM
Max	Time	Min	Time
25.3	39.6	-0.9	121.7



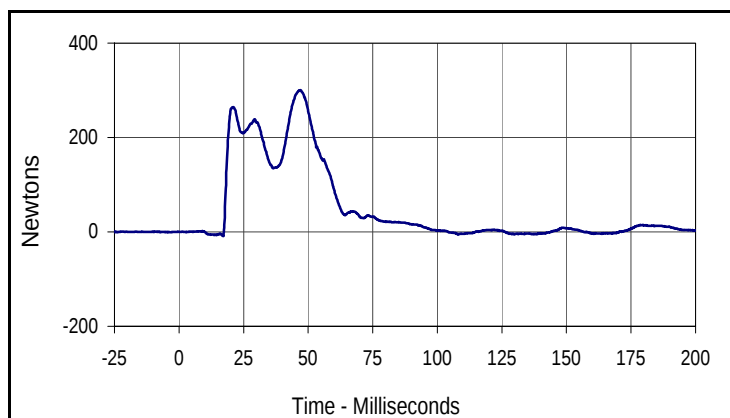
Curve Description			
Driver Thorax Rib Deflection Maximum			
Plot No.	Type	SAE Class	Units
010	FIL	180	MM
Max	Time	Min	Time
25.3	39.6	-0.9	121.7

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe
 Test Program: 61 km/h (38 mph) Side Impact NCAP 27° Moving Deformable Barrier Test

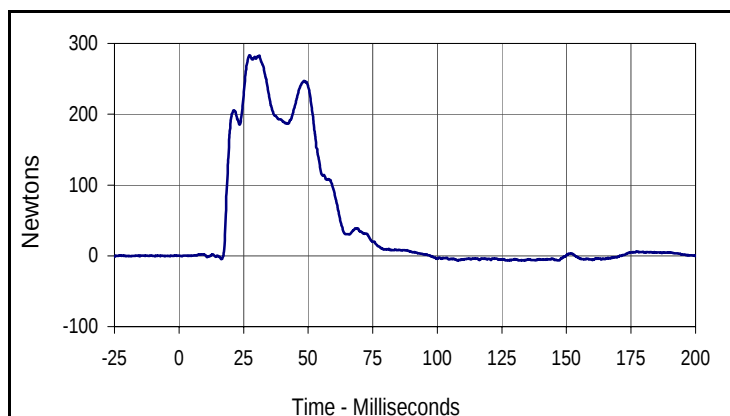
NHTSA No.: MD0514
 Test Date: 7/26/13



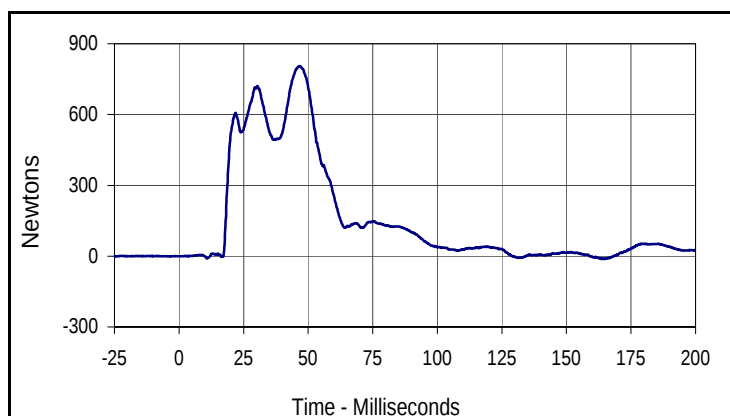
Curve Description			
Driver Anterior Abdominal Force Y			
Plot No.	Type	SAE Class	Units
008	FIL	600	Newtons
Max	Time	Min	Time
281.8	45.1	-4.0	10.7



Curve Description			
Driver Middle Abdominal Force Y			
Plot No.	Type	SAE Class	Units
009	FIL	600	Newtons
Max	Time	Min	Time
300.4	47.0	-8.5	17.1



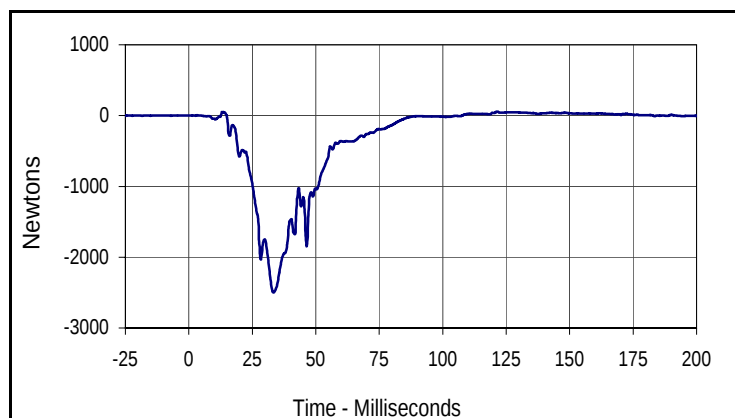
Curve Description			
Driver Posterior Abdominal Force Y			
Plot No.	Type	SAE Class	Units
011	FIL	600	Newtons
Max	Time	Min	Time
283.3	27.3	-6.7	107.9



Curve Description			
Driver Total Abdominal Force			
Plot No.	Type	SAE Class	Units
012	SUM	600	Newtons
Max	Time	Min	Time
805.6	46.7	-12.1	164.6

Test Vehicle: 2013 Smart Electric Drive 2-Door Coupe
 Test Program: 61 km/h (38 mph) Side Impact NCAP 27° Moving Deformable Barrier Test

NHTSA No.: MD0514
 Test Date: 7/26/13



Curve Description			
Driver Pubic Symphysis Force Y			
Plot No.	Type	SAE Class	Units
013	FIL	600	Newtons
Max	Time	Min	Time
54.9	121.6	-2500.3	33.3

APPENDIX C
DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

APPENDIX C
PRE-TEST / ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

Test Program: ES2re External Measurements
 ATD Serial No.: F037

Test Date: 7/15/13
 Test I.D.: N/A



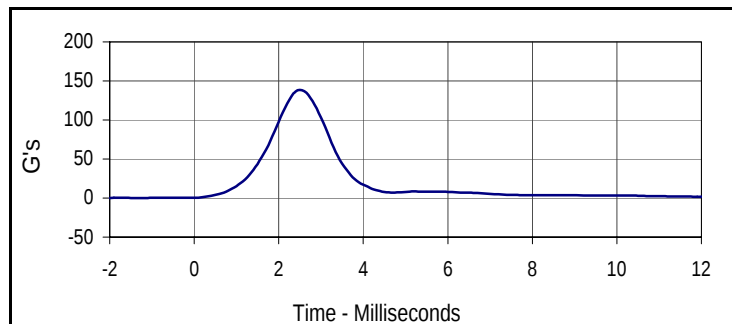
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	30.0	Pass
1	Sitting Height	mm	900 - 918	909	Pass
2	Seat to Shoulder Joint	mm	558 - 572	564	Pass
3	Seat to Lower Face of Thoracic Spine Box	mm	346 - 356	350	Pass
4	Seat to Hip Joint (Center of Bolt)	mm	97 - 103	99	Pass
5	Sole to Seat, Sitting	mm	333 - 451	395	Pass
6	Head Width	mm	152 - 158	156	Pass
7	Shoulder / Arm Width	mm	461 - 479	470	Pass
8	Thorax Width	mm	322 - 332	326	Pass
9	Abdomen Width	mm	273 - 287	280	Pass
10	Pelvis Lap Width	mm	359 - 373	363	Pass
11	Head Depth	mm	196 - 206	201	Pass
12	Thorax Depth	mm	262 - 272	270	Pass
13	Abdomen Width	mm	194 - 204	199	Pass
14	Pelvis Depth	mm	235 - 245	240	Pass
15	Back of Buttocks to Hip Joint (Center of Bolt)	mm	150 - 160	155	Pass
16	Back of Buttocks to Front Knee	mm	597 - 615	608	Pass
Overall Test Results					Pass

Test Program: ES2re Head Drop Test
 ATD Serial No.: F037

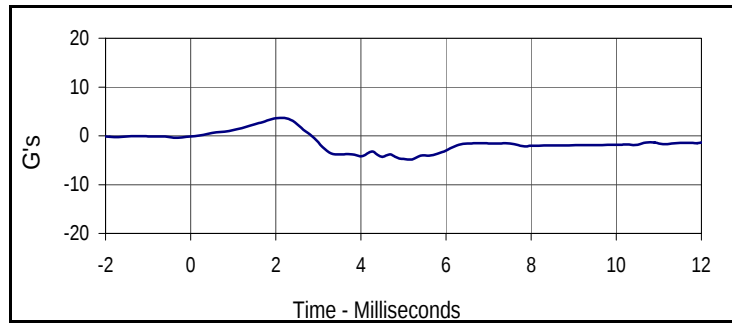
Test Date: 7/15/13
 Test I.D.: F037HD023



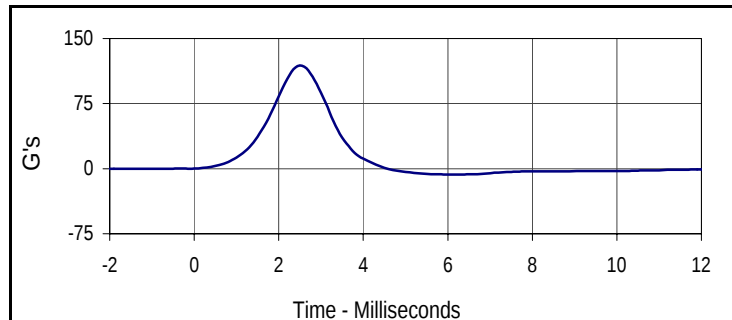
Tested Parameter	Units	Specification	Result	Pass/Fail
Head Assembly Soak Time	Minutes	≥240	415	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.4	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	34.2	Pass
Peak Head Resultant Acceleration	G's	125 to 155	138.5	Pass
Peak Head X Acceleration	G's	≤15	4.9	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Oscillations After Main Pulse	%	<15	6.1	Pass
Overall Test Results				Pass



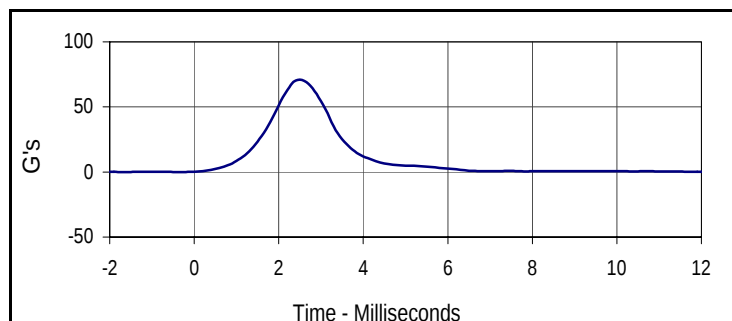
Curve Description			
Head Resultant			
Plot No.	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
138.5	2.5	0.1	-1.2



Curve Description			
Head X			
Plot No.	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
3.7	2.1	-4.9	5.2



Curve Description			
Head Y			
Plot No.	Type	SAE Class	Units
003	FIL	1000	G's
Max	Time	Min	Time
118.8	2.5	-6.8	6.0



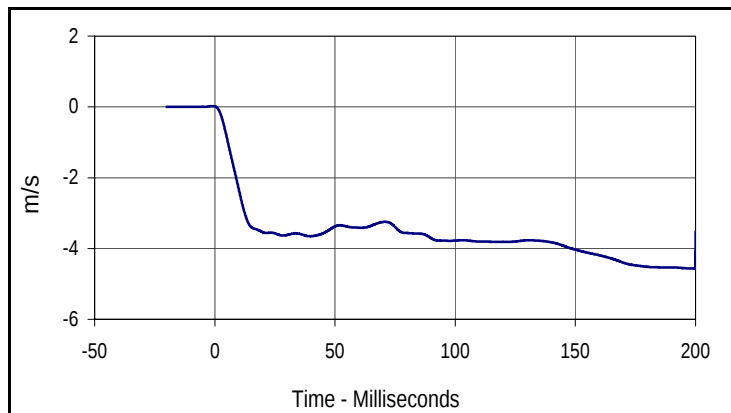
Curve Description			
Head Z			
Plot No.	Type	SAE Class	Units
004	FIL	1000	G's
Max	Time	Min	Time
71.1	2.5	-0.2	-0.3

Test Program: ES2re Neck Flexion Test
 ATD Serial No.: F037

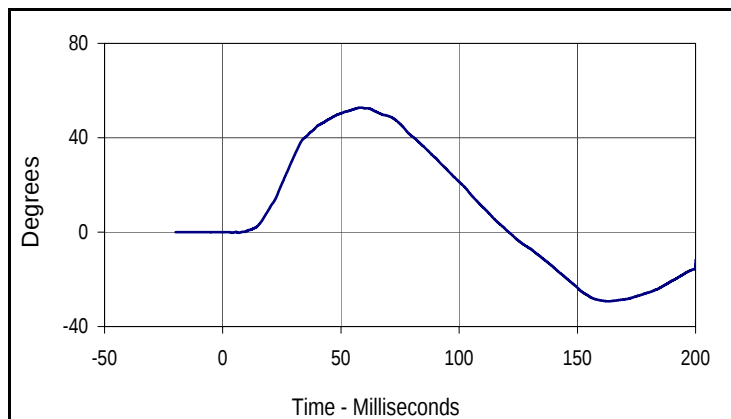
Test Date: 7/15/13
 Test I.D.: F037NB023



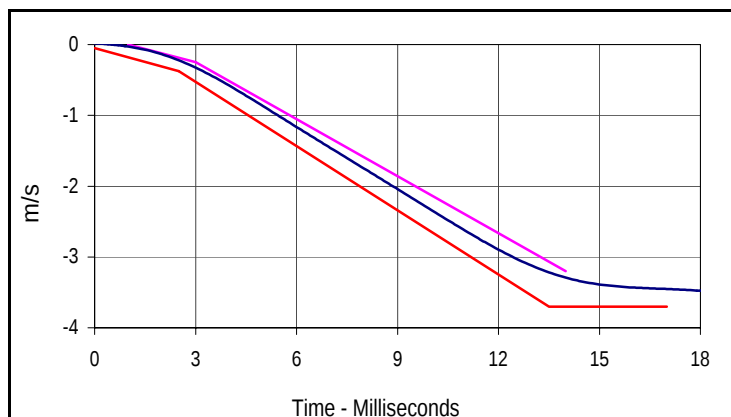
Tested Parameter	Units	Specification	Result	Pass/Fail
Neck Assembly Soak Time	Minutes	≥240	475	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.4	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	34.3	Pass
Pendulum Velocity	m/s	3.3 to 3.5	3.41	Pass
Headform Flexion	Max	49 to 59	52.8	Pass
	Time	54 to 66	58.3	Pass
Headform Flexion Decay (Peak to Zero)	msec	53 to 88	62.7	Pass
Overall Test Results				Pass



Curve Description			
Pendulum Velocity			
Plot No.	Type	SAE Class	Units
001	FIL	60	m/s
Max	Time	Min	Time
0.0	-0.8	-4.6	199.9



Curve Description			
Headform Rotation			
Plot No.	Type	SAE Class	Units
002	FIL	180	Degrees
Max	Time	Min	Time
52.8	58.3	-29.3	163.0



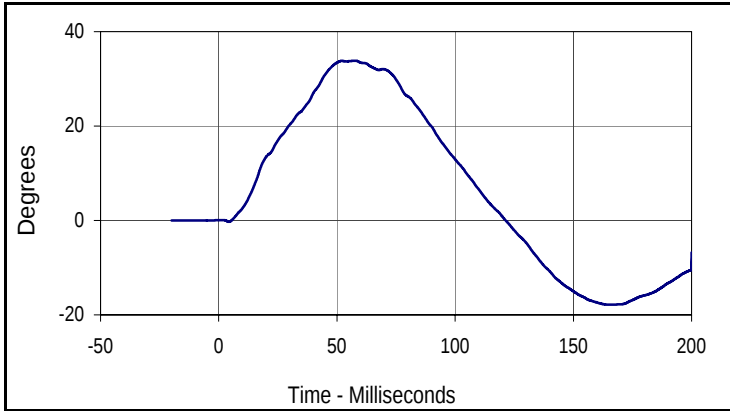
Curve Description			
Pendulum Velocity			
Plot No.	Type	SAE Class	Units
001	FIL	60	m/s
Max	Time	Min	Time
0.0	-0.8	-4.6	199.9

Velocity Corridors

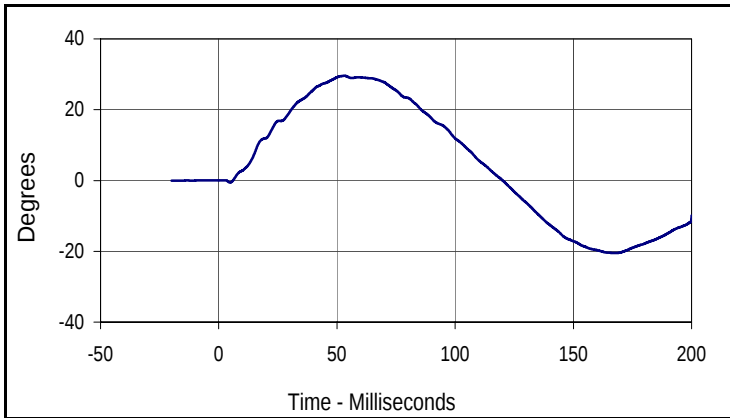
Upper Boundary		Lower Boundary	
Time (msec)	Velocity (m/s)	Time (msec)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.0	-0.03	2.5	-0.375
14.0	-3.20	13.5	-3.70
		17.0	-3.70

Test Program: ES2re Neck Flexion Test
 ATD Serial No.: F037

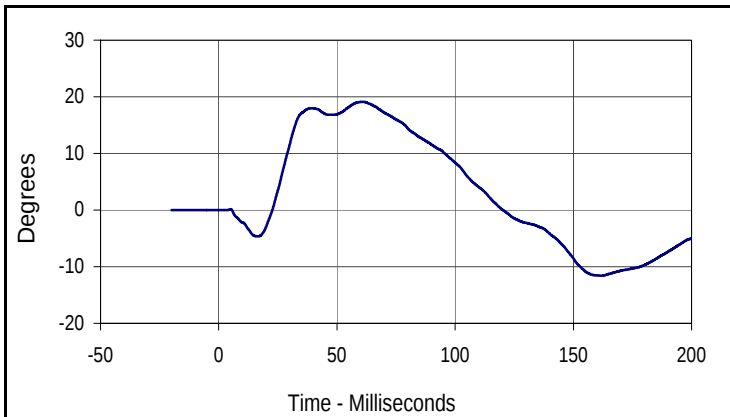
Test Date: 7/15/13
 Test I.D.: F037NB023



Curve Description			
Potentiometer A			
Plot No.	Type	SAE Class	Units
003	FIL	180	Degrees
Max	Time	Min	Time
33.8	57.8	-17.9	165.4



Curve Description			
Potentiometer B			
Plot No.	Type	SAE Class	Units
004	FIL	180	Degrees
Max	Time	Min	Time
29.6	53.1	-20.5	167.8



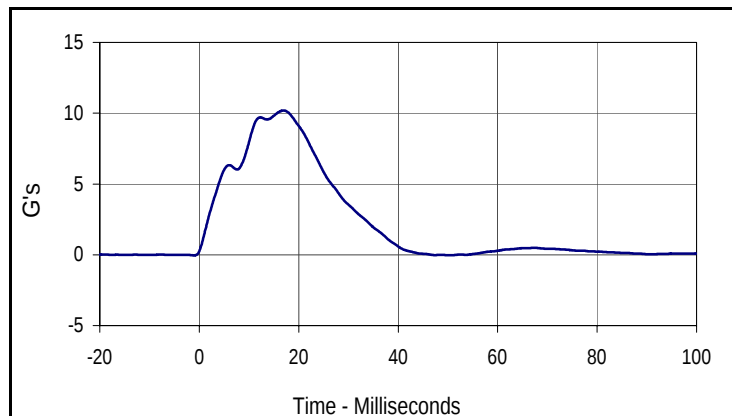
Curve Description			
Potentiometer C			
Plot No.	Type	SAE Class	Units
005	FIL	180	Degrees
Max	Time	Min	Time
19.1	61.4	-11.6	161.9

Test Program: ES2re Shoulder Impact Test
 ATD Serial No.: F037

Test Date: 7/15/13
 Test I.D.: F037SH023



Tested Parameter	Units	Specification	Result	Pass/Fail
Dummy Soak Time	Minutes	≥240	550	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.4	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	34.4	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.28	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	10.2	Pass
Overall Test Results				Pass



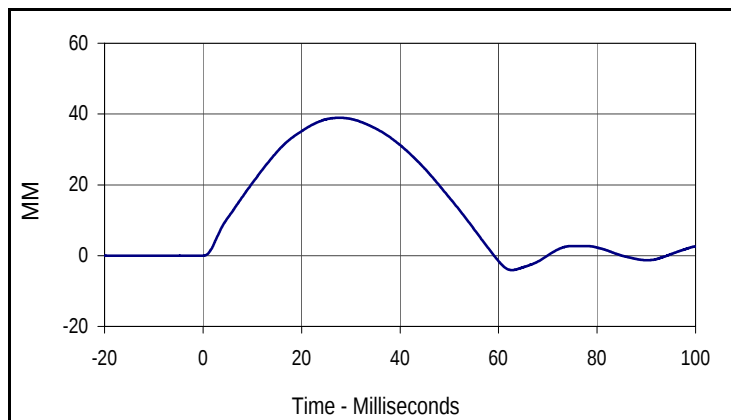
Curve Description			
Impactor Acceleration			
Plot No.	Type	SAE Class	Units
001	FIL	180	G's
Max	Time	Min	Time
10.2	16.9	0.0	-1.0

Test Program: ES2re Thorax - Rib Drop Test
 ATD Serial No.: F037 Rib # 1

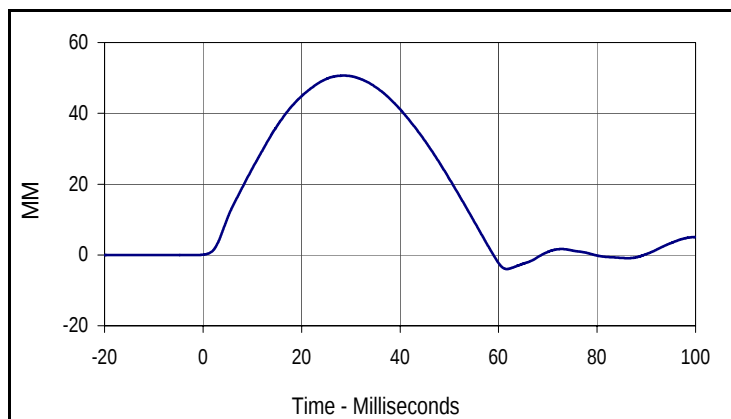
Test Date: 7/15/13
 Test I.D.: F037RB1023



Tested Parameter	Units	Specification	Result	Pass/Fail
Rib Module Soak Time	Minutes	≥240	615	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	34.4	Pass
Peak Rib Deflection at 459 +/- 5 mm Drop Height	mm	36 to 40	38.9	Pass
Peak Rib Deflection at 815 +/- 8 mm Drop Height	mm	46 to 51	50.7	Pass
Overall Test Results				Pass



Curve Description			
Upper Rib Deflection (459 mm Drop Height)			
Plot No.	Type	SAE Class	Units
001	FIL	180	MM
Max	Time	Min	Time
38.9	27.7	-4.1	62.7



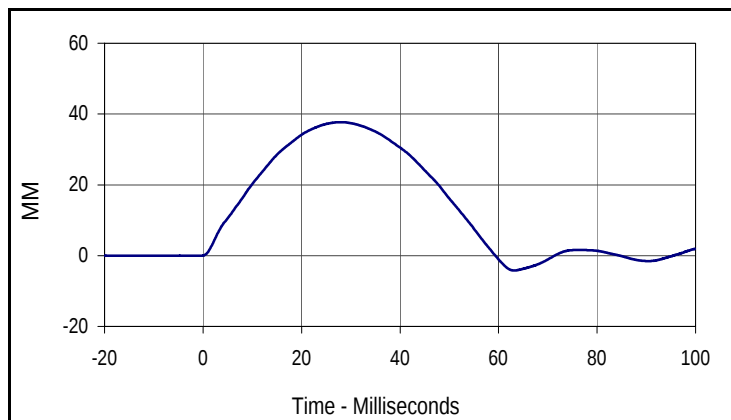
Curve Description			
Upper Rib Deflection (815 mm Drop Height)			
Plot No.	Type	SAE Class	Units
002	FIL	180	MM
Max	Time	Min	Time
50.7	28.6	-4.0	61.7

Test Program: ES2re Thorax - Rib Drop Test
 ATD Serial No.: F037 Rib # 2

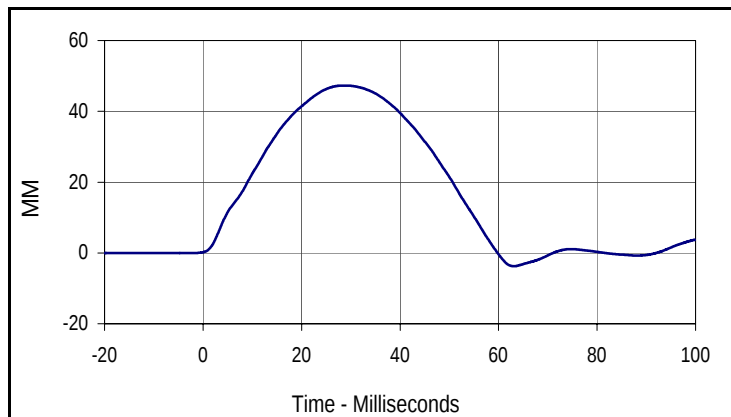
Test Date: 7/15/13
 Test I.D.: F037RB2023



Tested Parameter	Units	Specification	Result	Pass/Fail
Rib Module Soak Time	Minutes	≥240	645	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	34.4	Pass
Peak Rib Deflection at 459 +/- 5 mm Drop Height	mm	36 to 40	37.7	Pass
Peak Rib Deflection at 815 +/- 8 mm Drop Height	mm	46 to 51	47.3	Pass
Overall Test Results				Pass



Curve Description			
Middle Rib Deflection (459 mm Drop Height)			
Plot No.	Type	SAE Class	Units
001	FIL	180	MM
Max	Time	Min	Time
37.7	28.0	-4.2	63.2



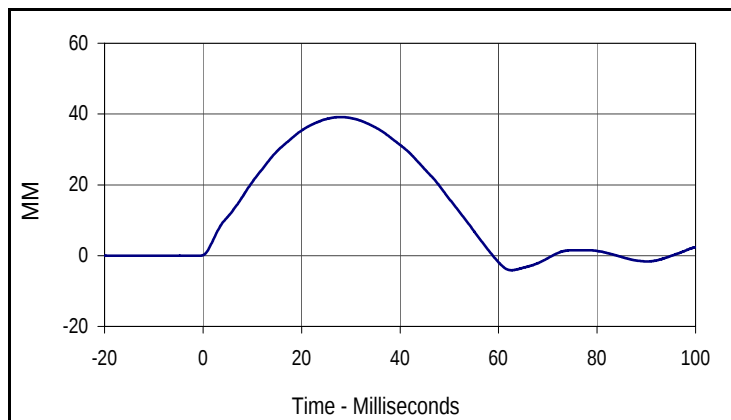
Curve Description			
Middle Rib Deflection (815 mm Drop Height)			
Plot No.	Type	SAE Class	Units
002	FIL	180	MM
Max	Time	Min	Time
47.3	28.7	-3.8	63.1

Test Program: ES2re Thorax - Rib Drop Test
 ATD Serial No.: F037 Rib # 3

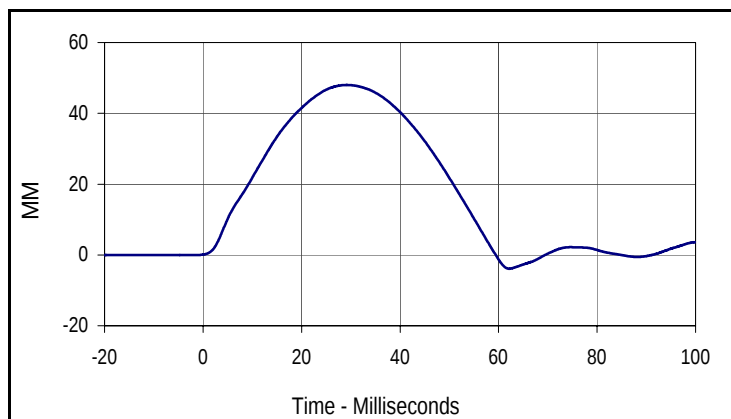
Test Date: 7/15/13
 Test I.D.: F037RB3023



Tested Parameter	Units	Specification	Result	Pass/Fail
Rib Module Soak Time	Minutes	≥240	680	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.4	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	34.5	Pass
Peak Rib Deflection at 459 +/- 5 mm Drop Height	mm	36 to 40	39.1	Pass
Peak Rib Deflection at 815 +/- 8 mm Drop Height	mm	46 to 51	48.0	Pass
Overall Test Results				Pass



Curve Description			
Lower Rib Deflection (459 mm Drop Height)			
Plot No.	Type	SAE Class	Units
001	FIL	180	MM
Max	Time	Min	Time
39.1	28.0	-4.1	62.6



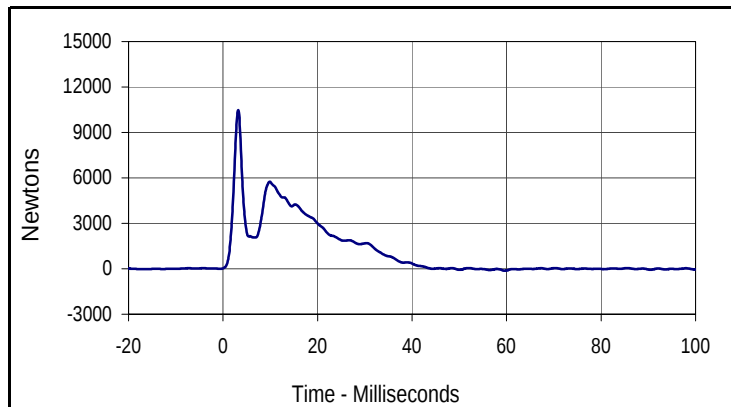
Curve Description			
Lower Rib Deflection (815 mm Drop Height)			
Plot No.	Type	SAE Class	Units
002	FIL	180	MM
Max	Time	Min	Time
48.0	29.2	-3.9	62.2

Test Program: ES2re Thorax - Full Body Impact Test
 ATD Serial No.: F037

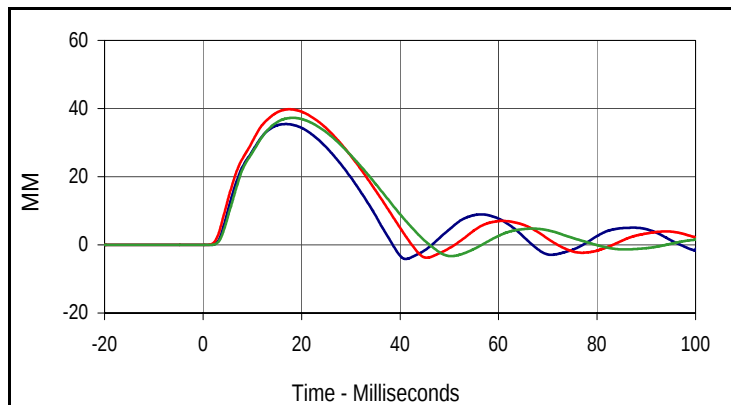
Test Date: 7/15/13
 Test I.D.: F037TH023



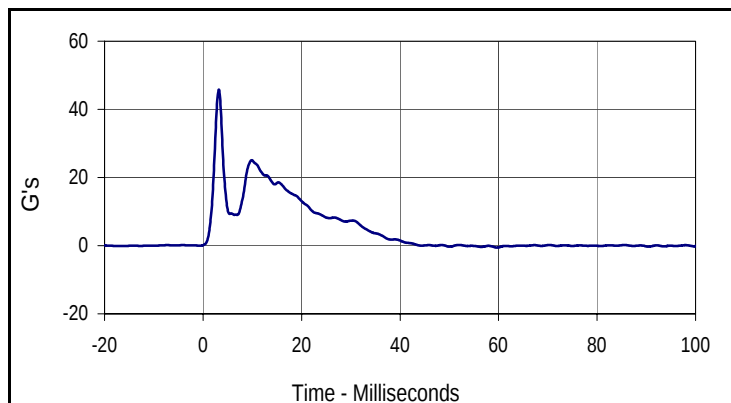
Tested Parameter	Units	Specification	Result	Pass/Fail
Dummy Soak Time	Minutes	≥240	755	Pass
Temperature During Soak	Max °C	20.6 to 22.2	21.4	Pass
	Min °C		21.2	Pass
Humidity During Soak	Max %	10.0 to 70.0	34.7	Pass
	Min %		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.4	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	34.5	Pass
Peak Impactor Velocity	m/s	5.4 to 5.6	5.56	Pass
Peak Impactor Force	N	5100 to 6200	5751.9	Pass
	msec	> 6.0 msec	9.9	Pass
Peak Upper Rib Deflection	mm	34 to 41	35.5	Pass
Peak Middle Rib Deflection	mm	37 to 45	39.8	Pass
Peak Lower Rib Deflection	mm	37 to 44	37.3	Pass
Overall Test Results				Pass



Curve Description			
Impactor Force			
Plot No.	Type	SAE Class	Units
001	FIL	180	Newtons
Max	Time	Min	Time
10488.3	3.2	-125.4	59.6



Curve Description			
Upper, Middle, Lower Rib Deflections			
Plot No.	Type	SAE Class	Units
002	FIL	180	MM
Max (Upper)	Time	Min (Upper)	Time
35.5	16.8	-4.1	41.2
Max (Middle)	Time	Min (Middle)	Time
39.8	17.5	-3.8	45.4
Max (Lower)	Time	Min (Lower)	Time
37.3	18.2	-3.3	50.4



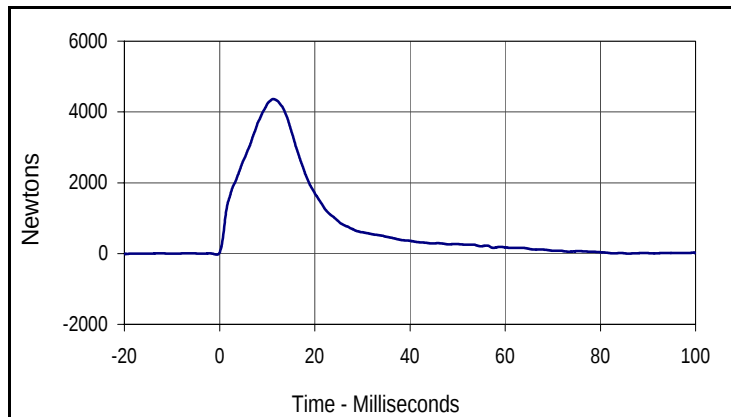
Curve Description			
Impactor Acceleration			
Plot No.	Type	SAE Class	Units
003	FIL	180	G's
Max	Time	Min	Time
45.8	3.2	-0.5	59.6

Test Program: ES2re Abdomen Impact Test
 ATD Serial No.: F037

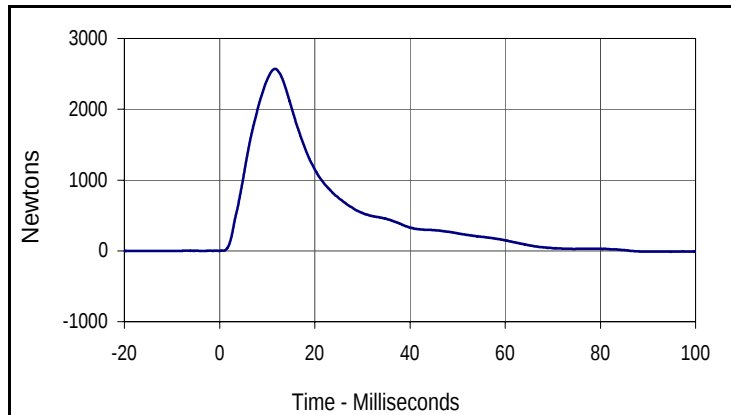
Test Date: 7/15/13
 Test I.D.: F037ABD023



Tested Parameter	Units	Specification	Result	Pass/Fail
Dummy Soak Time	Minutes	≥240	800	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.4	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	34.5	Pass
Probe Velocity	m/s	3.9 to 4.1	4.01	Pass
Peak Impactor Force	N	4000 to 4800	4367.4	Pass
	msec	10.6 to 13.0	11.3	Pass
Sum of Abdominal Forces	N	2200 to 2700	2570.8	Pass
	msec	10.0 to 12.3	11.7	Pass
Overall Test Results				Pass



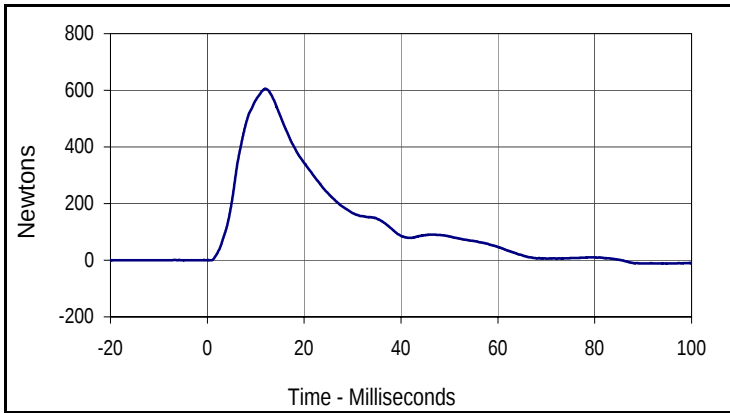
Curve Description			
Impactor Force			
Plot No.	Type	SAE Class	Units
001	FIL	180	Newtons
Max	Time	Min	Time
4367.4	11.3	-32.4	-0.6



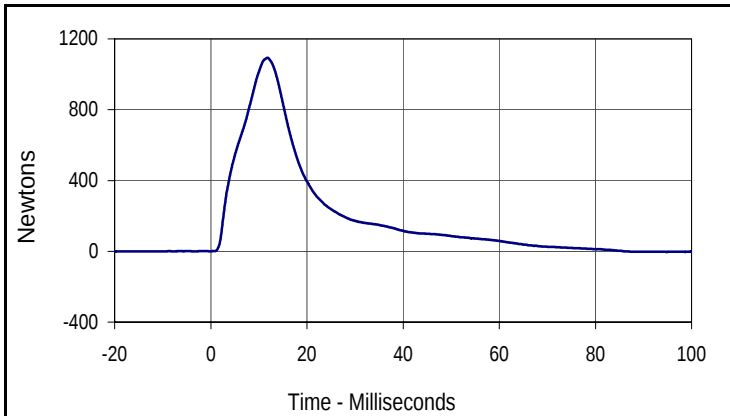
Curve Description			
Abdomen Sum Resultant			
Plot No.	Type	SAE Class	Units
002	RES	600	Newtons
Max	Time	Min	Time
2570.8	11.7	-12.5	94.8

Test Program: ES2re Abdomen Impact Test
 ATD Serial No.: F037

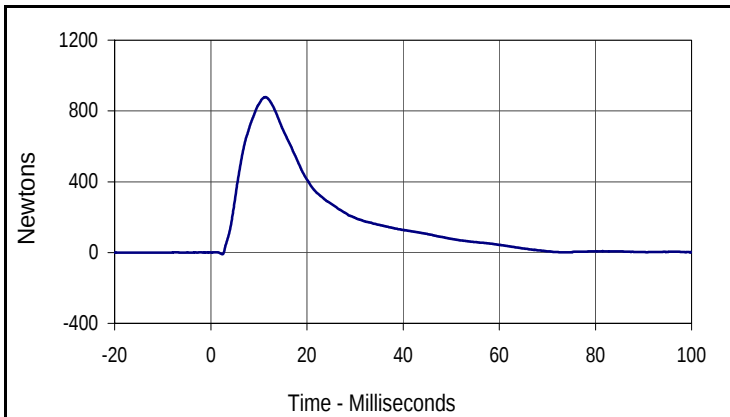
Test Date: 7/15/13
 Test I.D.: F037ABD023



Curve Description			
Front Abdomen Force			
Plot No.	Type	SAE Class	Units
003	FIL	600	Newtons
Max	Time	Min	Time
605.2	12.0	-12.0	94.8



Curve Description			
Middle Abdomen Force			
Plot No.	Type	SAE Class	Units
004	FIL	600	Newtons
Max	Time	Min	Time
1093.1	11.8	-5.0	100.0



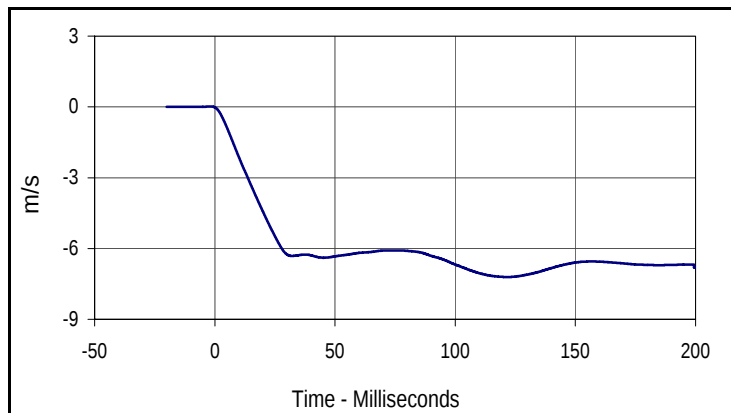
Curve Description			
Rear Abdomen Force			
Plot No.	Type	SAE Class	Units
005	FIL	600	Newtons
Max	Time	Min	Time
878.1	11.4	-10.0	2.4

Test Program: ES2re Lumbar Flexion Test
 ATD Serial No.: F037

Test Date: 7/15/13
 Test I.D.: F037LB023



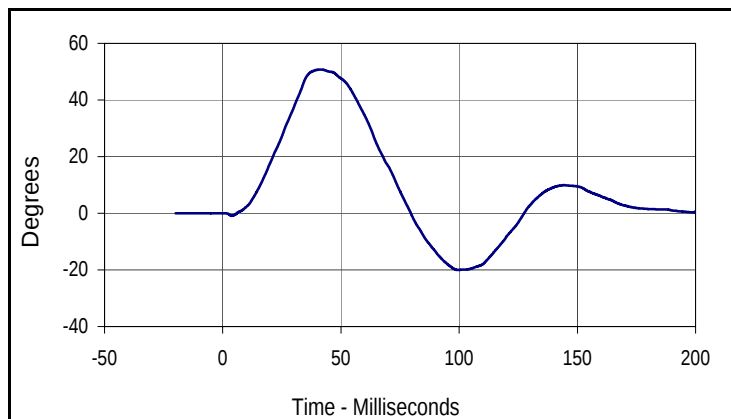
Tested Parameter	Units	Specification	Result	Pass/Fail
Lumbar Spine Assembly Soak Time	Minutes	≥240	870	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.4	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	34.6	Pass
Pendulum Velocity	m/s	5.95 to 6.15	5.97	Pass
Headform Rotation	Max	45 to 55	50.7	Pass
	Time	39 to 53	41.8	Pass
Time of Decay to Zero Angle from Peak	msec	37 to 57	44.5	Pass
Overall Test Results				Pass



Curve Description

Pendulum Velocity

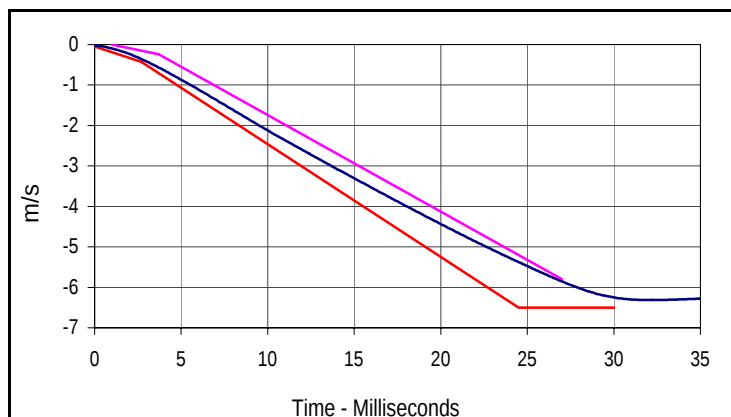
Plot No.	Type	SAE Class	Units
001	FIL	60	m/s
Max	Time	Min	Time
0.0	-1.2	-7.2	122.5



Curve Description

Headform Rotation

Plot No.	Type	SAE Class	Units
002	FIL	180	Degrees
Max	Time	Min	Time
50.7	41.8	-20.1	100.1



Curve Description

Pendulum Velocity

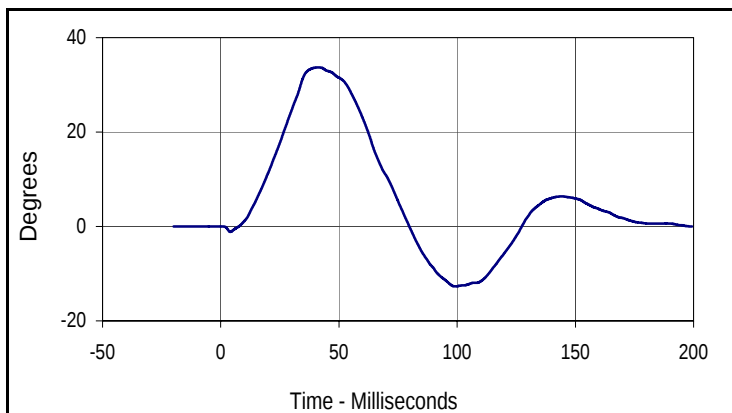
Plot No.	Type	SAE Class	Units
001	FIL	60	m/s
Max	Time	Min	Time
0.0	-1.2	-7.2	122.5

Velocity Corridors

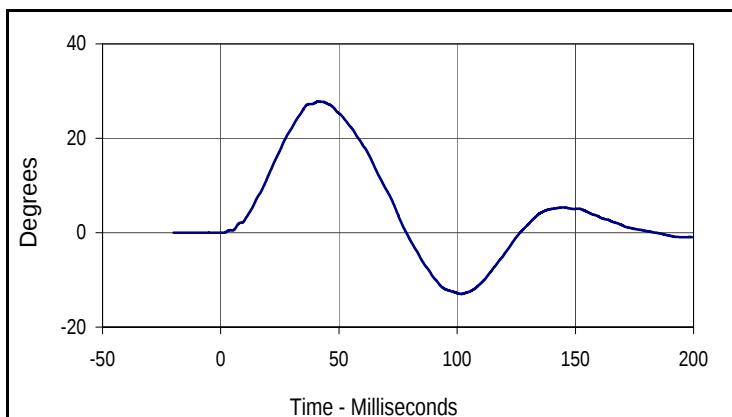
Upper Boundary		Lower Boundary	
Time (msec)	Velocity (m/s)	Time (msec)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.7	-0.24	2.7	-0.425
27.0	-5.80	24.5	-6.50
		30.0	-6.50

Test Program: ES2re Lumbar Flexion Test
 ATD Serial No.: F037

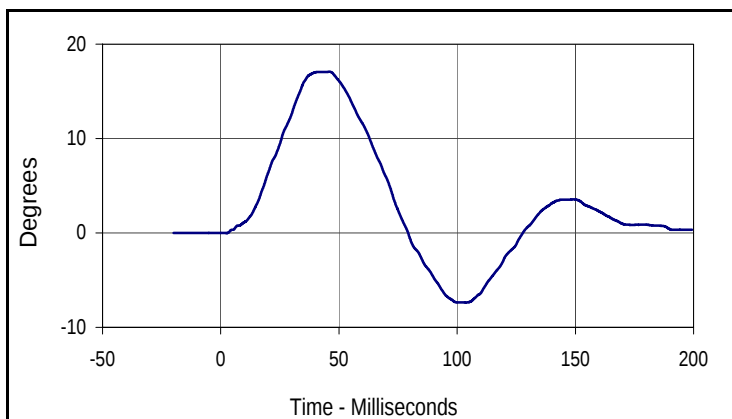
Test Date: 7/15/13
 Test I.D.: F037LB023



Curve Description			
Potentiometer A			
Plot No.	Type	SAE Class	Units
003	FIL	180	Degrees
Max	Time	Min	Time
33.7	41.8	-12.7	99.8



Curve Description			
Potentiometer B			
Plot No.	Type	SAE Class	Units
004	FIL	180	Degrees
Max	Time	Min	Time
27.8	41.9	-13.0	102.4



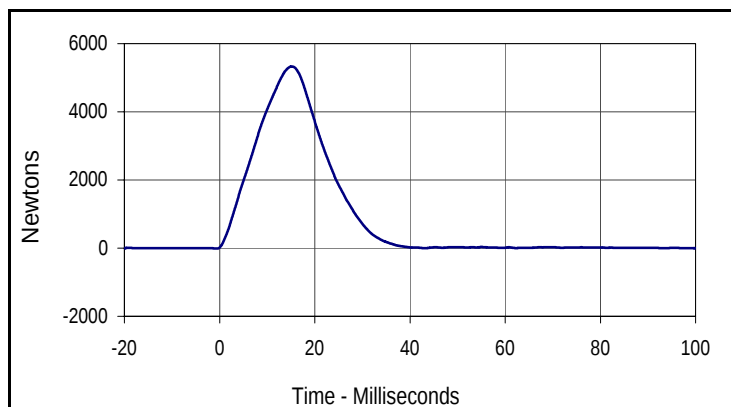
Curve Description			
Potentiometer C			
Plot No.	Type	SAE Class	Units
005	FIL	180	Degrees
Max	Time	Min	Time
17.1	46.6	-7.4	104.0

Test Program: ES2re Pelvis Impact Test
 ATD Serial No.: F037

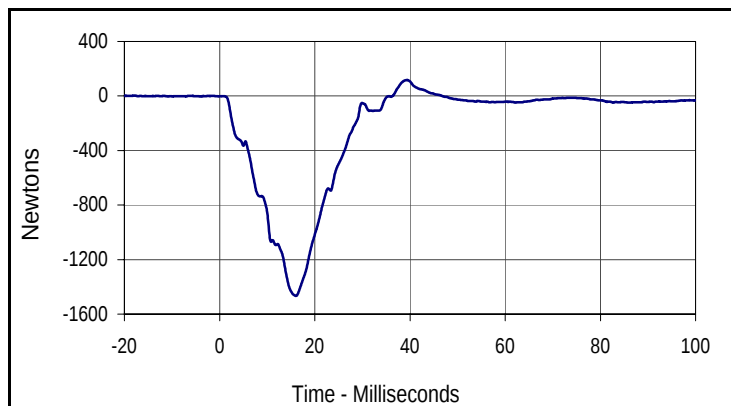
Test Date: 7/15/13
 Test I.D.: F037PL023



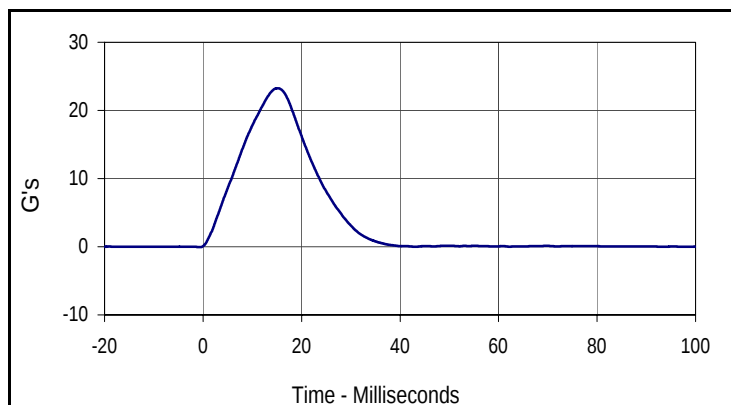
Tested Parameter	Units	Specification	Result	Pass/Fail
Dummy Soak Time	Minutes	≥240	935	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.4	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	34.6	Pass
Pendulum Velocity	m/s	4.2 to 4.4	4.38	Pass
Peak Impactor Force	N	4700 to 5400	5328.7	Pass
	msec	11.8 to 16.1	15.1	Pass
Peak Pubic Symphysis Load	N	-1230 to -1590	-1467.1	Pass
	msec	12.2 to 17.0	16	Pass
Overall Test Results				Pass



Curve Description			
Impactor Force			
Plot No.	Type	SAE Class	Units
001	FIL	180	Newtons
Max	Time	Min	Time
5328.7	15.1	-13.9	-0.7



Curve Description			
Pubic Symphysis Force Y			
Plot No.	Type	SAE Class	Units
002	FIL	600	Newtons
Max	Time	Min	Time
117.3	39.4	-1467.1	16.0



Curve Description			
Impactor Acceleration			
Plot No.	Type	SAE Class	Units
003	FIL	180	G's
Max	Time	Min	Time
23.3	15.1	-0.1	-0.7

APPENDIX C
POST-TEST / ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

Test Program: ES2re External Measurements
 ATD Serial No.: F037

Test Date: 8/1/13
 Test I.D.: N/A



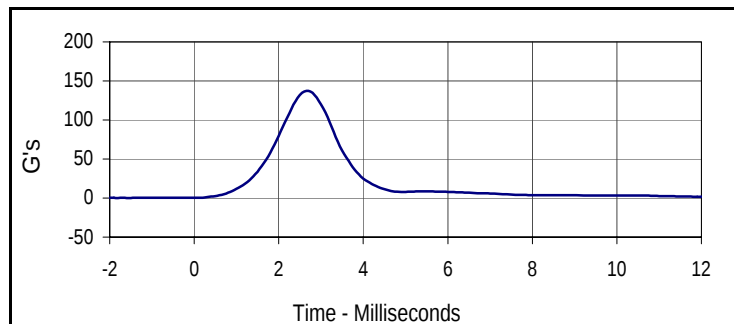
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	30.0	Pass
1	Sitting Height	mm	900 - 918	909	Pass
2	Seat to Shoulder Joint	mm	558 - 572	564	Pass
3	Seat to Lower Face of Thoracic Spine Box	mm	346 - 356	350	Pass
4	Seat to Hip Joint (Center of Bolt)	mm	97 - 103	99	Pass
5	Sole to Seat, Sitting	mm	333 - 451	395	Pass
6	Head Width	mm	152 - 158	156	Pass
7	Shoulder / Arm Width	mm	461 - 479	470	Pass
8	Thorax Width	mm	322 - 332	326	Pass
9	Abdomen Width	mm	273 - 287	280	Pass
10	Pelvis Lap Width	mm	359 - 373	363	Pass
11	Head Depth	mm	196 - 206	201	Pass
12	Thorax Depth	mm	262 - 272	270	Pass
13	Abdomen Width	mm	194 - 204	199	Pass
14	Pelvis Depth	mm	235 - 245	240	Pass
15	Back of Buttocks to Hip Joint (Center of Bolt)	mm	150 - 160	155	Pass
16	Back of Buttocks to Front Knee	mm	597 - 615	608	Pass
Overall Test Results					Pass

Test Program: ES2re Head Drop Test
 ATD Serial No.: F037

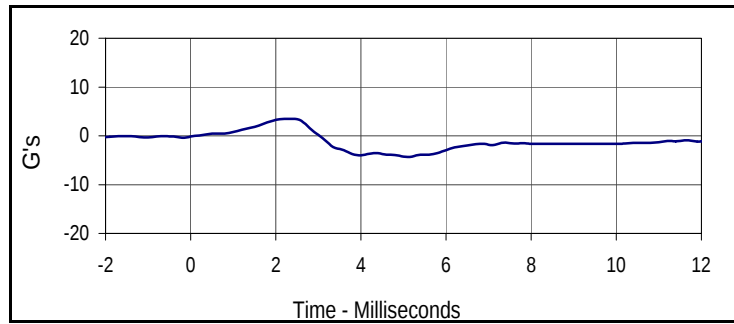
Test Date: 8/1/13
 Test I.D.: F037HD024



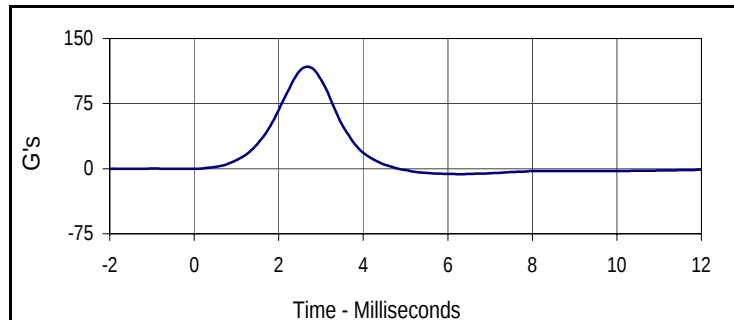
Tested Parameter	Units	Specification	Result	Pass/Fail
Head Assembly Soak Time	Minutes	≥240	250	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	33.3	Pass
Peak Head Resultant Acceleration	G's	125 to 155	137.3	Pass
Peak Head X Acceleration	G's	≤15	4.4	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Oscillations After Main Pulse	%	<15	6.3	Pass
Overall Test Results				Pass



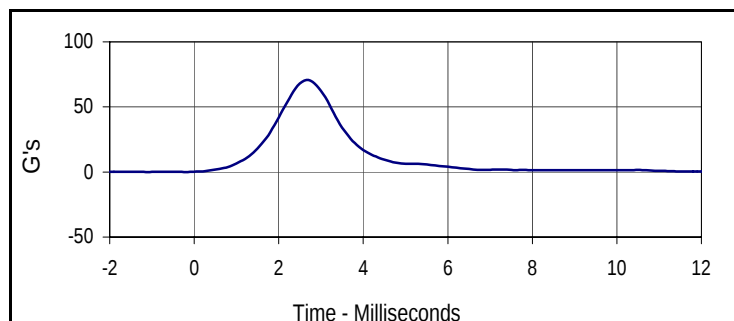
Curve Description			
Head Resultant			
Plot No.	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
137.3	2.7	0.2	-1.6



Curve Description			
Head X			
Plot No.	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
3.5	2.3	-4.4	5.1



Curve Description			
Head Y			
Plot No.	Type	SAE Class	Units
003	FIL	1000	G's
Max	Time	Min	Time
117.7	2.7	-6.3	6.3



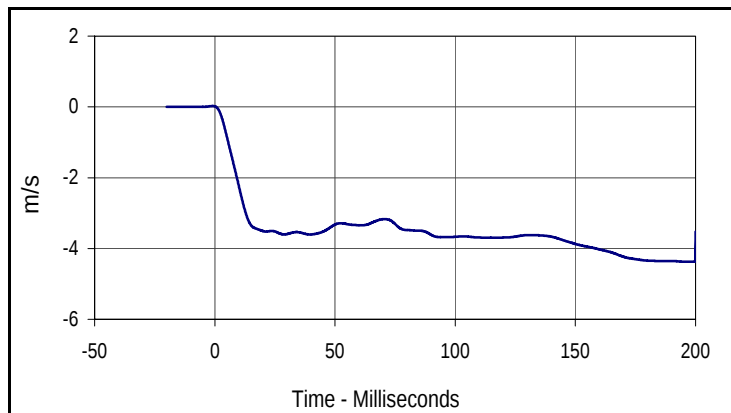
Curve Description			
Head Z			
Plot No.	Type	SAE Class	Units
004	FIL	1000	G's
Max	Time	Min	Time
70.6	2.7	0.0	-0.2

Test Program: ES2re Neck Flexion Test
 ATD Serial No.: F037

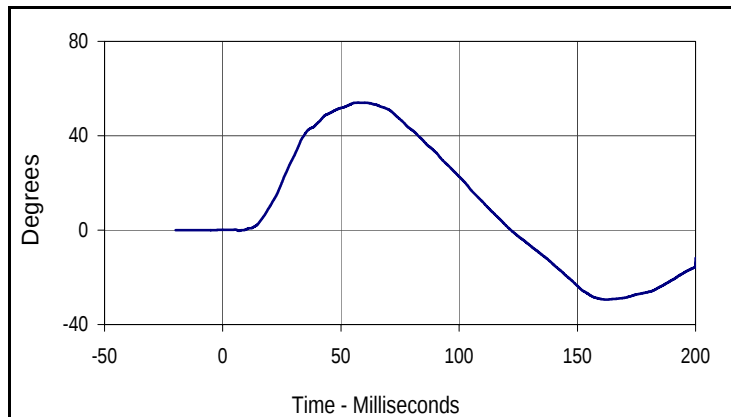
Test Date: 8/1/13
 Test I.D.: F037NB024



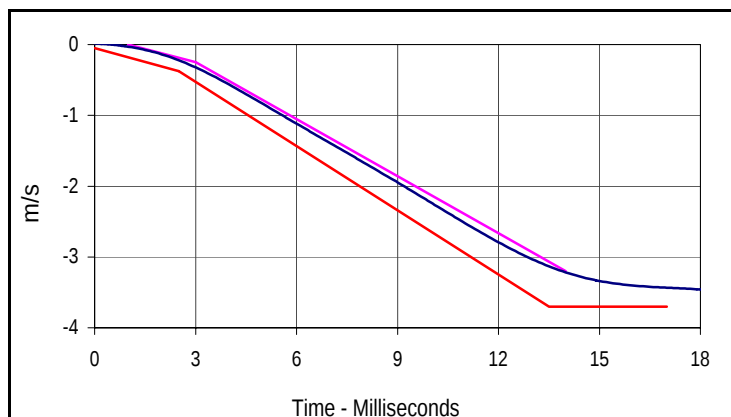
Tested Parameter	Units	Specification	Result	Pass/Fail
Neck Assembly Soak Time	Minutes	≥240	310	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	33.1	Pass
Pendulum Velocity	m/s	3.3 to 3.5	3.45	Pass
Headform Flexion	Max	49 to 59	54.0	Pass
	Time	54 to 66	57.3	Pass
Headform Flexion Decay (Peak to Zero)	msec	53 to 88	64.7	Pass
Overall Test Results				Pass



Curve Description			
Pendulum Velocity			
Plot No.	Type	SAE Class	Units
001	FIL	60	m/s
Max	Time	Min	Time
0.0	-0.9	-4.4	199.9



Curve Description			
Headform Rotation			
Plot No.	Type	SAE Class	Units
002	FIL	180	Degrees
Max	Time	Min	Time
54.0	57.3	-29.5	162.3



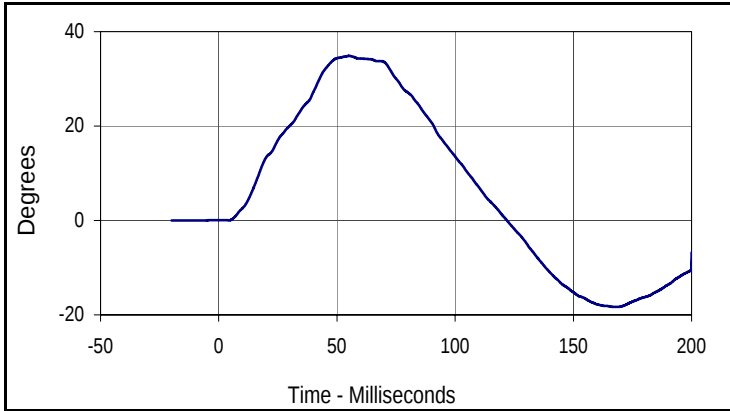
Curve Description			
Pendulum Velocity			
Plot No.	Type	SAE Class	Units
001	FIL	60	m/s
Max	Time	Min	Time
0.0	-0.9	-4.4	199.9

Velocity Corridors

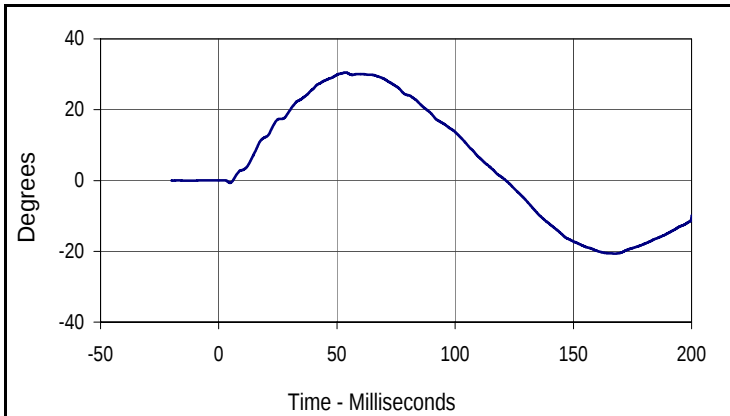
Upper Boundary		Lower Boundary	
Time (msec)	Velocity (m/s)	Time (msec)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.0	-0.03	2.5	-0.375
14.0	-3.20	13.5	-3.70
		17.0	-3.70

Test Program: ES2re Neck Flexion Test
 ATD Serial No.: F037

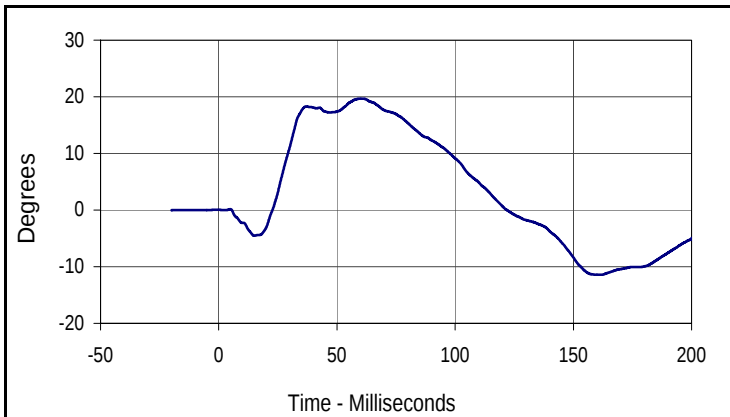
Test Date: 8/1/13
 Test I.D.: F037NB024



Curve Description			
Potentiometer A			
Plot No.	Type	SAE Class	Units
003	FIL	180	Degrees
Max	Time	Min	Time
34.9	55.1	-18.3	169.0



Curve Description			
Potentiometer B			
Plot No.	Type	SAE Class	Units
004	FIL	180	Degrees
Max	Time	Min	Time
30.5	53.6	-20.6	167.5



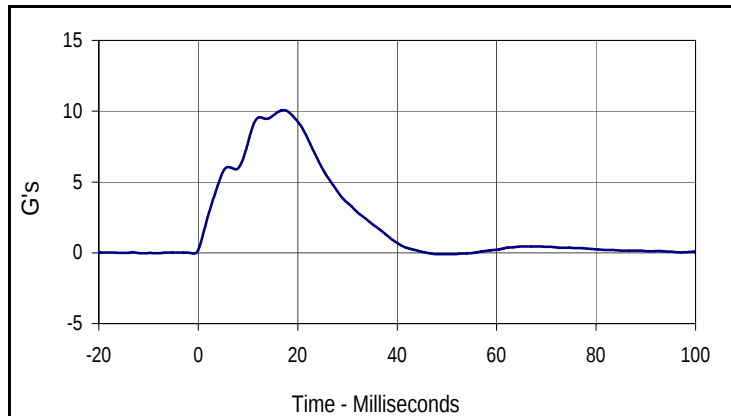
Curve Description			
Potentiometer C			
Plot No.	Type	SAE Class	Units
005	FIL	180	Degrees
Max	Time	Min	Time
19.6	60.9	-11.4	161.5

Test Program: ES2re Shoulder Impact Test
 ATD Serial No.: F037

Test Date: 8/1/13
 Test I.D.: F037SH024



Tested Parameter	Units	Specification	Result	Pass/Fail
Dummy Soak Time	Minutes	≥240	385	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	33.4	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.31	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	10.1	Pass
Overall Test Results				Pass



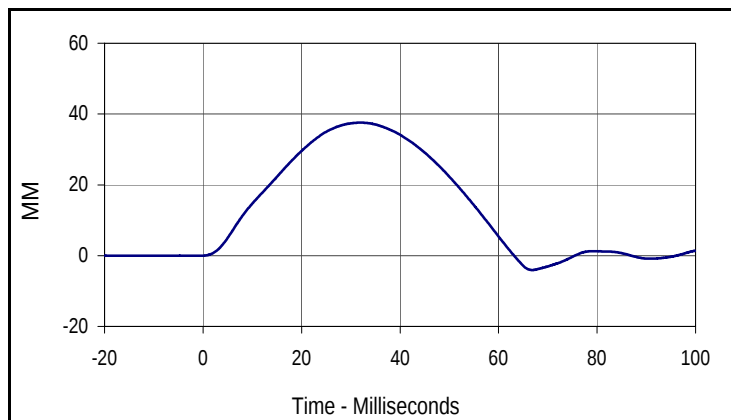
Curve Description			
Impactor Acceleration			
Plot No.	Type	SAE Class	Units
001	FIL	180	G's
Max	Time	Min	Time
10.1	17.1	-0.1	51.3

Test Program: ES2re Thorax - Rib Drop Test
 ATD Serial No.: F037 Rib # 1

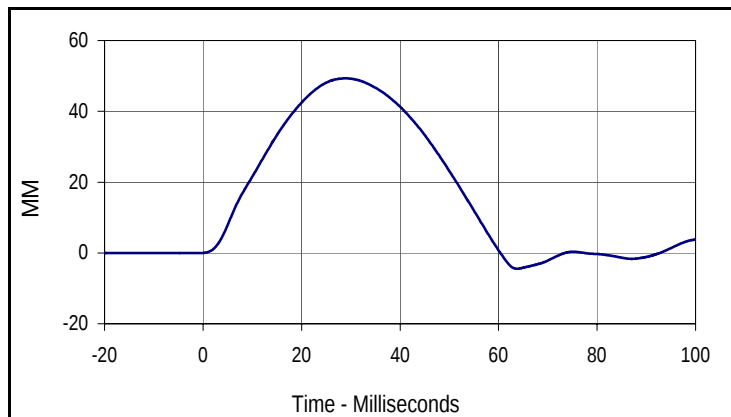
Test Date: 8/1/13
 Test I.D.: F037RB1024



Tested Parameter	Units	Specification	Result	Pass/Fail
Rib Module Soak Time	Minutes	≥240	450	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	33.3	Pass
Peak Rib Deflection at 459 +/- 5 mm Drop Height	mm	36 to 40	37.6	Pass
Peak Rib Deflection at 815 +/- 8 mm Drop Height	mm	46 to 51	49.3	Pass
Overall Test Results				Pass



Curve Description			
Upper Rib Deflection (459 mm Drop Height)			
Plot No.	Type	SAE Class	Units
001	FIL	180	MM
Max	Time	Min	Time
37.6	32.0	-4.1	66.8



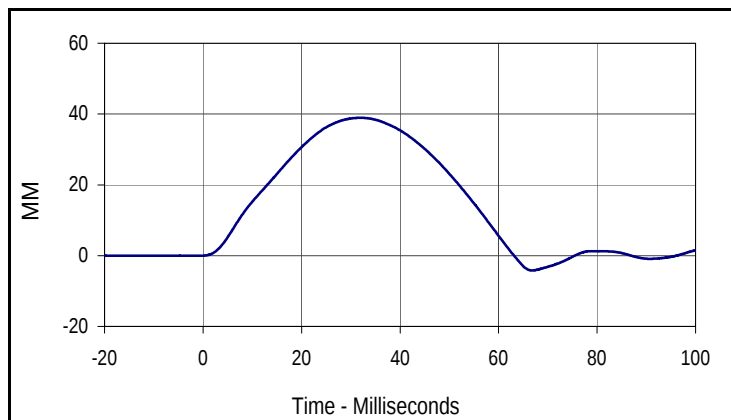
Curve Description			
Upper Rib Deflection (815 mm Drop Height)			
Plot No.	Type	SAE Class	Units
002	FIL	180	MM
Max	Time	Min	Time
49.3	28.9	-4.5	63.7

Test Program: ES2re Thorax - Rib Drop Test
 ATD Serial No.: F037 Rib # 2

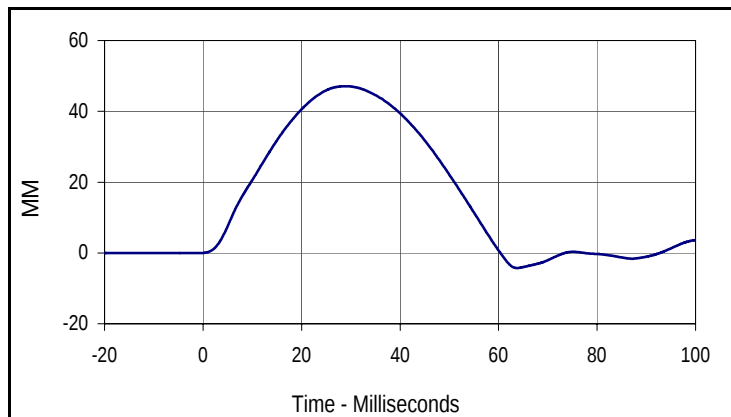
Test Date: 8/1/13
 Test I.D.: F037RB2024



Tested Parameter	Units	Specification	Result	Pass/Fail
Rib Module Soak Time	Minutes	≥240	480	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	33.3	Pass
Peak Rib Deflection at 459 +/- 5 mm Drop Height	mm	36 to 40	38.9	Pass
Peak Rib Deflection at 815 +/- 8 mm Drop Height	mm	46 to 51	47.1	Pass
Overall Test Results				Pass



Curve Description			
Middle Rib Deflection (459 mm Drop Height)			
Plot No.	Type	SAE Class	Units
001	FIL	180	MM
Max	Time	Min	Time
38.9	32.0	-4.2	66.8



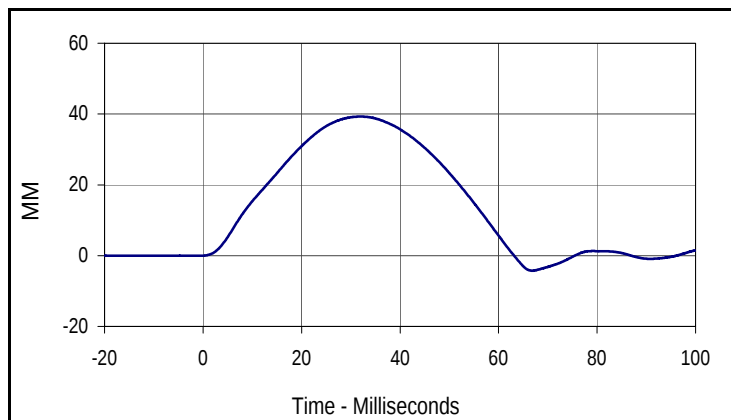
Curve Description			
Middle Rib Deflection (815 mm Drop Height)			
Plot No.	Type	SAE Class	Units
002	FIL	180	MM
Max	Time	Min	Time
47.1	28.9	-4.3	63.7

Test Program: ES2re Thorax - Rib Drop Test
 ATD Serial No.: F037 Rib # 3

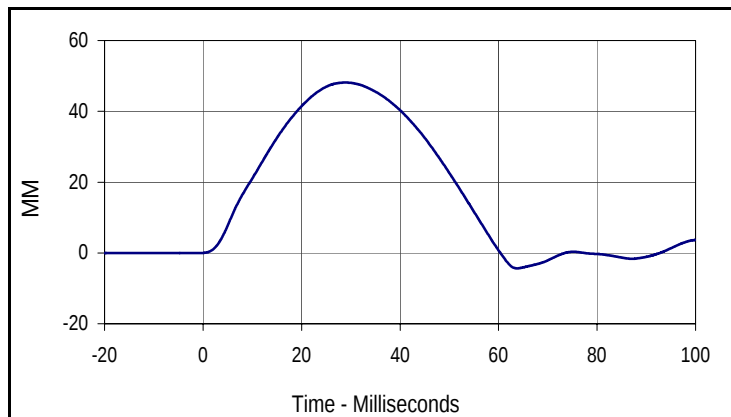
Test Date: 8/1/13
 Test I.D.: F037RB3024



Tested Parameter	Units	Specification	Result	Pass/Fail
Rib Module Soak Time	Minutes	≥240	515	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	33.4	Pass
Peak Rib Deflection at 459 +/- 5 mm Drop Height	mm	36 to 40	39.3	Pass
Peak Rib Deflection at 815 +/- 8 mm Drop Height	mm	46 to 51	48.1	Pass
Overall Test Results				Pass



Curve Description			
Lower Rib Deflection (459 mm Drop Height)			
Plot No.	Type	SAE Class	Units
001	FIL	180	MM
Max	Time	Min	Time
39.3	32.0	-4.3	66.8



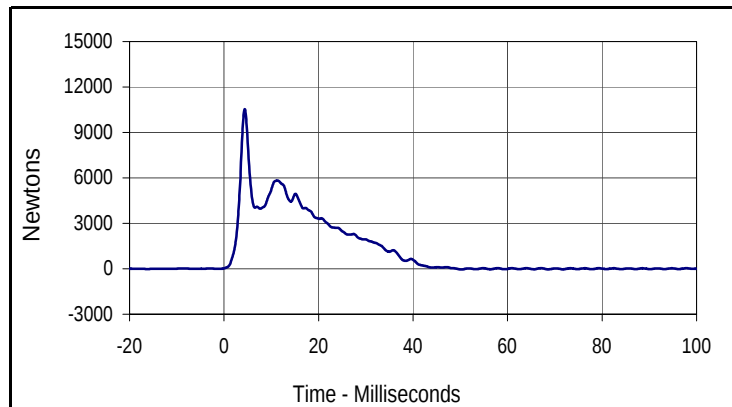
Curve Description			
Lower Rib Deflection (815 mm Drop Height)			
Plot No.	Type	SAE Class	Units
002	FIL	180	MM
Max	Time	Min	Time
48.1	28.9	-4.4	63.7

Test Program: ES2re Thorax - Full Body Impact Test
 ATD Serial No.: F037

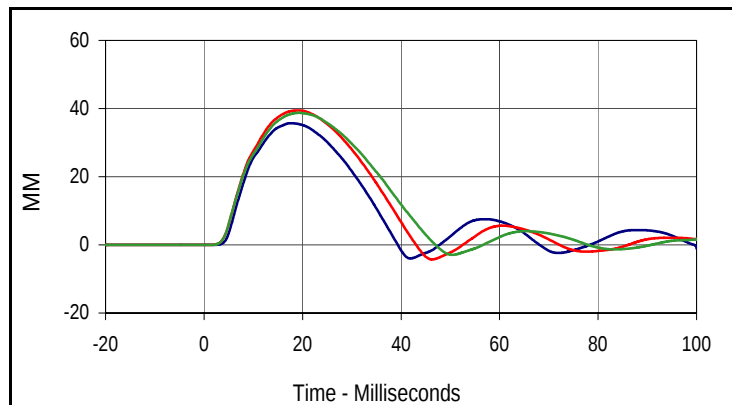
Test Date: 8/1/13
 Test I.D.: F037TH024



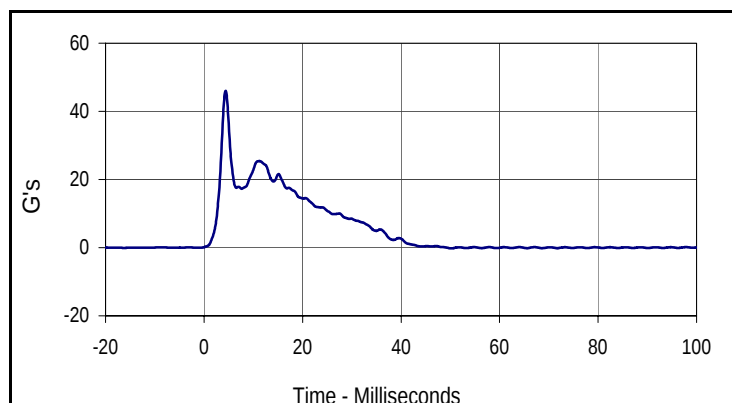
Tested Parameter	Units	Specification	Result	Pass/Fail
Dummy Soak Time	Minutes	≥240	590	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	33.4	Pass
Peak Impactor Velocity	m/s	5.4 to 5.6	5.57	Pass
Peak Impactor Force	N	5100 to 6200	5820.5	Pass
	msec	> 6.0 msec	11.3	Pass
Peak Upper Rib Deflection	mm	34 to 41	35.7	Pass
Peak Middle Rib Deflection	mm	37 to 45	39.4	Pass
Peak Lower Rib Deflection	mm	37 to 44	38.7	Pass
Overall Test Results			Pass	



Curve Description			
Impactor Force			
Plot No.	Type	SAE Class	Units
001	FIL	180	Newtons
Max	Time	Min	Time
10546.0	4.4	-44.7	50.3



Curve Description			
Upper, Middle, Lower Rib Deflections			
Plot No.	Type	SAE Class	Units
002	FIL	180	MM
Max (Upper)	Time	Min (Upper)	Time
35.7	17.7	-4.0	41.9
Max (Middle)	Time	Min (Middle)	Time
39.4	19.1	-4.3	46.3
Max (Lower)	Time	Min (Lower)	Time
38.7	19.3	-2.9	50.4



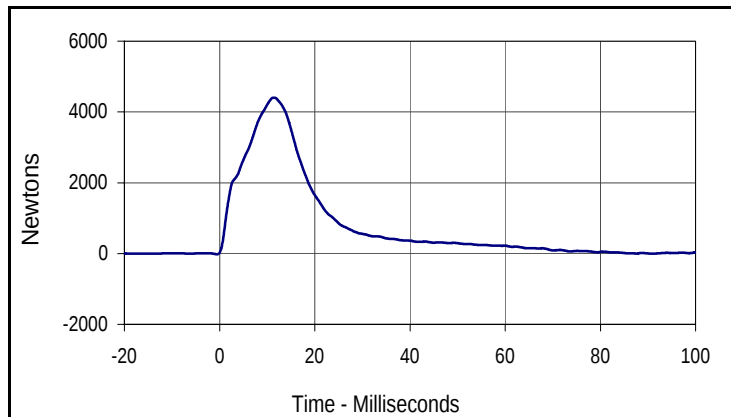
Curve Description			
Impactor Acceleration			
Plot No.	Type	SAE Class	Units
003	FIL	180	G's
Max	Time	Min	Time
46.0	4.4	-0.2	50.3

Test Program: ES2re Abdomen Impact Test
 ATD Serial No.: F037

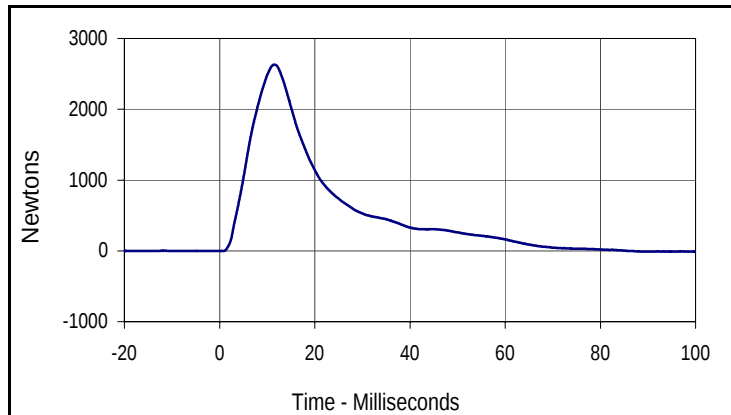
Test Date: 8/1/13
 Test I.D.: F037ABD024



Tested Parameter	Units	Specification	Result	Pass/Fail
Dummy Soak Time	Minutes	≥240	635	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	33.4	Pass
Probe Velocity	m/s	3.9 to 4.1	4.05	Pass
Peak Impactor Force	N	4000 to 4800	4404.0	Pass
	msec	10.6 to 13.0	11.4	Pass
Sum of Abdominal Forces	N	2200 to 2700	2628.9	Pass
	msec	10.0 to 12.3	11.6	Pass
Overall Test Results				Pass



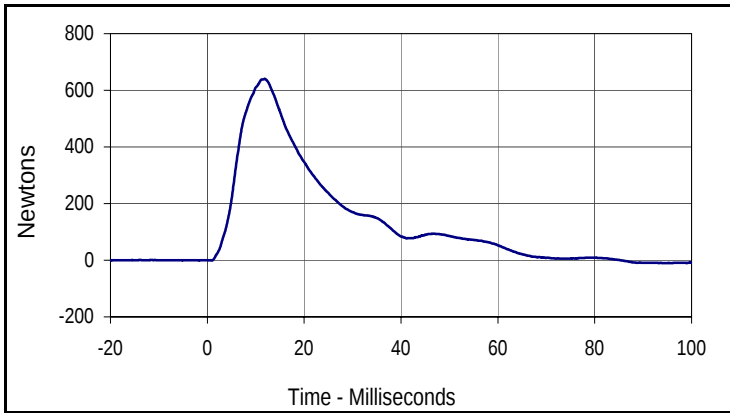
Curve Description			
Impactor Force			
Plot No.	Type	SAE Class	Units
001	FIL	180	Newtons
Max	Time	Min	Time
4404.0	11.4	-20.5	-0.6



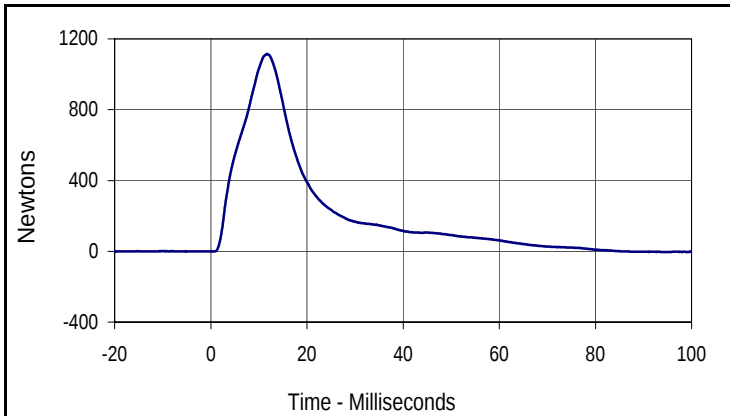
Curve Description			
Abdomen Sum Resultant			
Plot No.	Type	SAE Class	Units
002	RES	600	Newtons
Max	Time	Min	Time
2628.9	11.6	-11.3	99.0

Test Program: ES2re Abdomen Impact Test
 ATD Serial No.: F037

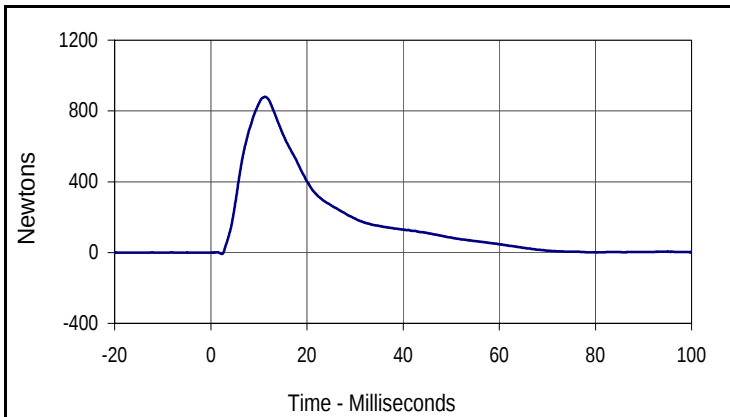
Test Date: 8/1/13
 Test I.D.: F037ABD024



Curve Description			
Front Abdomen Force			
Plot No.	Type	SAE Class	Units
003	FIL	600	Newtons
Max	Time	Min	Time
640.7	11.9	-10.4	94.1



Curve Description			
Middle Abdomen Force			
Plot No.	Type	SAE Class	Units
004	FIL	600	Newtons
Max	Time	Min	Time
1114.1	11.7	-5.0	100.0



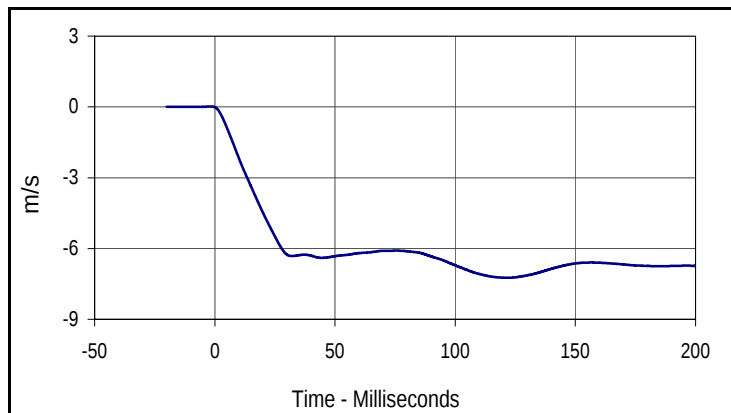
Curve Description			
Rear Abdomen Force			
Plot No.	Type	SAE Class	Units
005	FIL	600	Newtons
Max	Time	Min	Time
880.2	11.3	-8.4	2.3

Test Program: ES2re Lumbar Flexion Test
 ATD Serial No.: F037

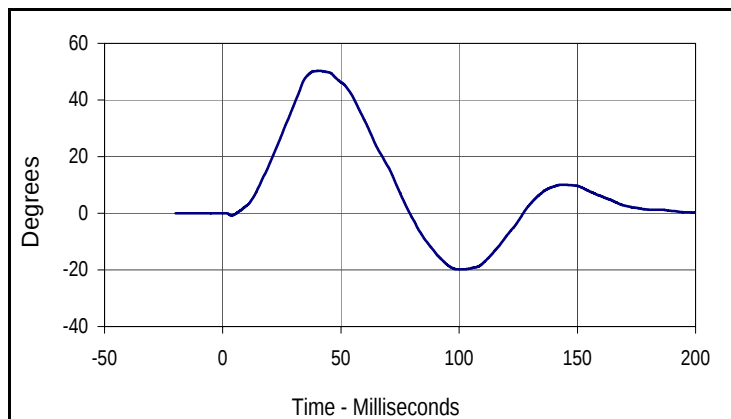
Test Date: 8/1/13
 Test I.D.: F037LB024



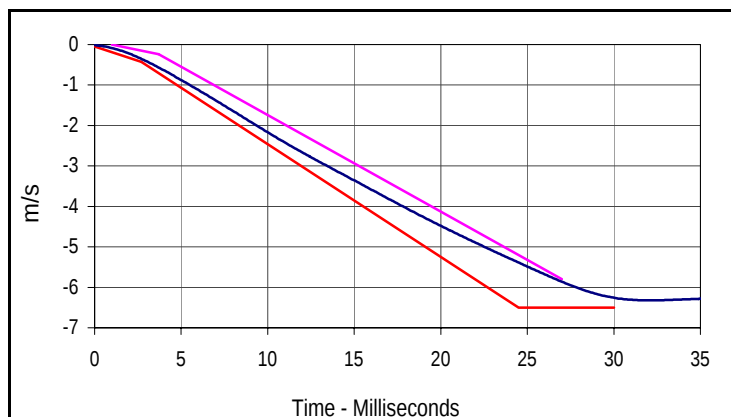
Tested Parameter	Units	Specification	Result	Pass/Fail
Lumbar Spine Assembly Soak Time	Minutes	≥240	705	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	33.4	Pass
Pendulum Velocity	m/s	5.95 to 6.15	5.96	Pass
Headform Rotation	Max	45 to 55	50.3	Pass
	Time	39 to 53	41.6	Pass
Time of Decay to Zero Angle from Peak	msec	37 to 57	44.7	Pass
Overall Test Results				Pass



Curve Description			
Pendulum Velocity			
Plot No.	Type	SAE Class	Units
001	FIL	60	m/s
Max	Time	Min	Time
0.0	-1.1	-7.2	122.3



Curve Description			
Headform Rotation			
Plot No.	Type	SAE Class	Units
002	FIL	180	Degrees
Max	Time	Min	Time
50.3	41.6	-19.8	99.8



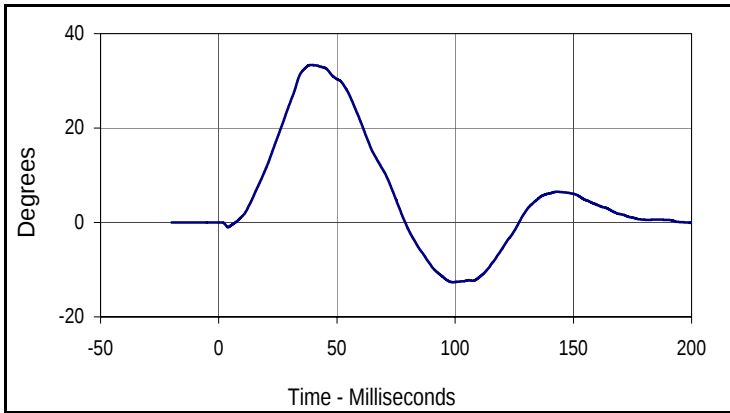
Curve Description			
Pendulum Velocity			
Plot No.	Type	SAE Class	Units
001	FIL	60	m/s
Max	Time	Min	Time
0.0	-1.1	-7.2	122.3

Velocity Corridors

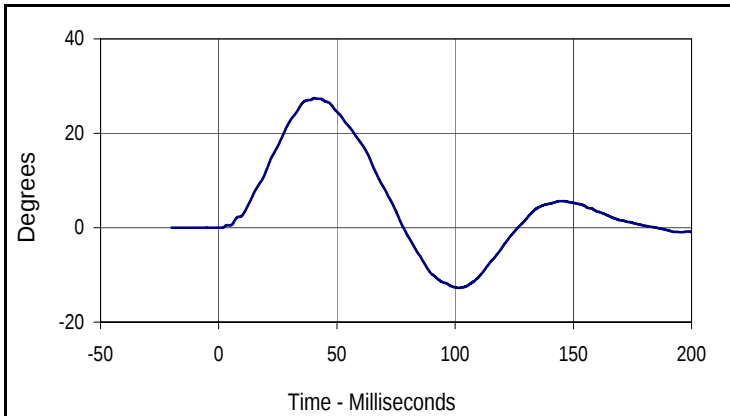
Upper Boundary		Lower Boundary	
Time (msec)	Velocity (m/s)	Time (msec)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.7	-0.24	2.7	-0.425
27.0	-5.80	24.5	-6.50
		30.0	-6.50

Test Program: ES2re Lumbar Flexion Test
 ATD Serial No.: F037

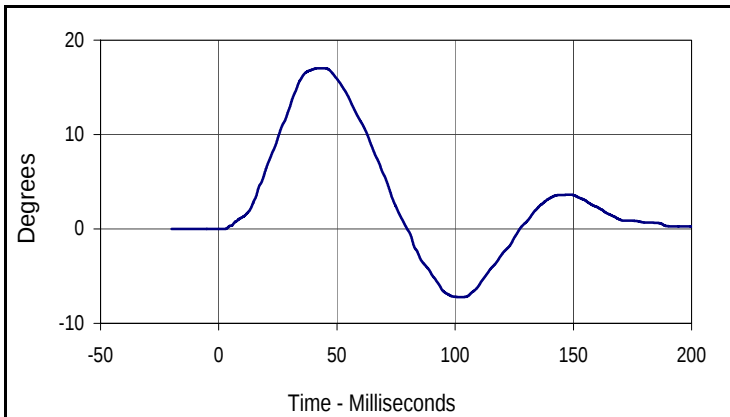
Test Date: 8/1/13
 Test I.D.: F037LB024



Curve Description			
Potentiometer A			
Plot No.	Type	SAE Class	Units
003	FIL	180	Degrees
Max	Time	Min	Time
33.4	39.5	-12.7	99.6



Curve Description			
Potentiometer B			
Plot No.	Type	SAE Class	Units
004	FIL	180	Degrees
Max	Time	Min	Time
27.5	40.9	-12.7	102.1



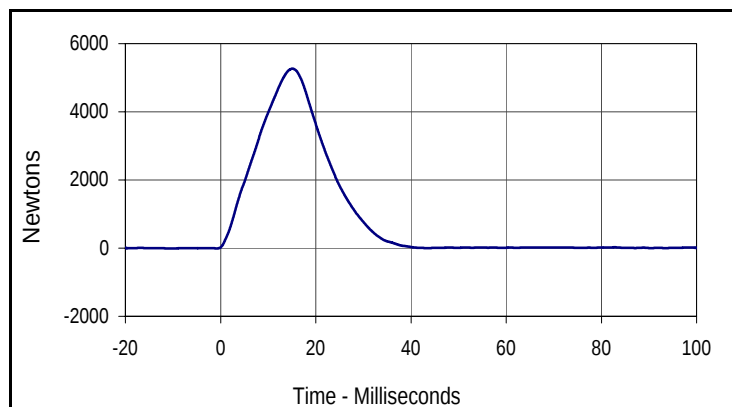
Curve Description			
Potentiometer C			
Plot No.	Type	SAE Class	Units
005	FIL	180	Degrees
Max	Time	Min	Time
17.0	43.0	-7.2	103.1

Test Program: ES2re Pelvis Impact Test
 ATD Serial No.: F037

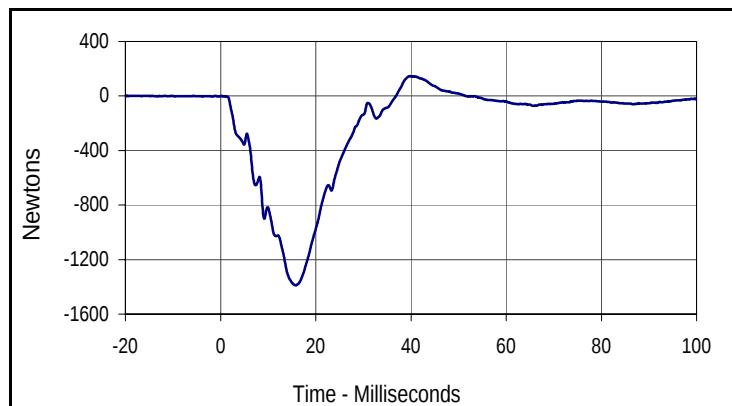
Test Date: 8/1/13
 Test I.D.: F037PL024



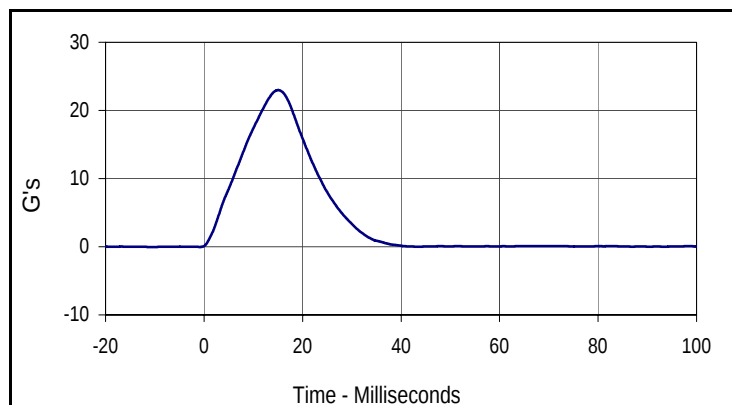
Tested Parameter	Units	Specification	Result	Pass/Fail
Dummy Soak Time	Minutes	≥240	770	Pass
Temperature During Soak	Max	20.6 to 22.2	21.4	Pass
	Min		21.2	Pass
Humidity During Soak	Max	10.0 to 70.0	34.7	Pass
	Min		30.3	Pass
Laboratory Temperature During Test	°C	20.6 to 22.2	21.3	Pass
Laboratory Humidity During Test	%	10.0 to 70.0	33.4	Pass
Pendulum Velocity	m/s	4.2 to 4.4	4.40	Pass
Peak Impactor Force	N	4700 to 5400	5265.8	Pass
	msec	11.8 to 16.1	15.1	Pass
Peak Pubic Symphysis Load	N	-1230 to -1590	-1388.0	Pass
	msec	12.2 to 17.0	15.8	Pass
Overall Test Results				Pass



Curve Description			
Impactor Force			
Plot No.	Type	SAE Class	Units
001	FIL	180	Newtons
Max	Time	Min	Time
5265.8	15.1	-6.8	-0.8



Curve Description			
Pubic Symphysis Force Y			
Plot No.	Type	SAE Class	Units
002	FIL	600	Newtons
Max	Time	Min	Time
145.4	39.8	-1388.0	15.8



Curve Description			
Impactor Acceleration			
Plot No.	Type	SAE Class	Units
003	FIL	180	G's
Max	Time	Min	Time
23.0	15.1	0.0	-0.8

APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

TABLE 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N F037		
			Serial Number	Manufacturer	Calibration
Head Accelerometers		X	P58858	Endevco	4/29/13
		Y	P58865	Endevco	4/29/13
		Z	P58867	Endevco	4/29/13
Thorax Rib Displacement Potentiometers	Upper	Y	209	FTSS	4/29/13
	Middle	Y	210	FTSS	4/29/13
	Lower	Y	207	FTSS	4/29/13
Abdomen Load Cells	Forward	Y	1504	Denton	5/9/13
	Middle	Y	1505	Denton	5/9/13
	Rear	Y	1506	Denton	5/9/13
Lower Spine Accelerometers (T12)		X	P16336	Endevco	7/25/13
		Y	P58876	Endevco	4/30/13
		Z	P58877	Endevco	4/30/13
Pubic Symphysis Load Cell		Y	DG6834	Denton	5/9/13

TABLE 2 – Vehicle Instrumentation

1	Vehicle Center of Gravity	Y	Ketx5b	ICSensor	6/28/13
	Vehicle Center of Gravity	Z	Ketx5c	ICSensor	6/28/13
2	Right Sill at Front Seat	X	13489	Endevco	4/17/13
	Right Sill at Front Seat	Y	13655	Endevco	4/19/13
	Right Sill at Front Seat	Z	13656	Endevco	4/17/13
3	Right Sill at Rear Seat	X	N/A	N/A	N/A
	Right Sill at Rear Seat	Y	N/A	N/A	N/A
	Right Sill at Rear Seat	Z	N/A	N/A	N/A
4	Left Sill at Front Door	Y	13680	Endevco	6/25/13
5	Left Sill at Rear Door	Y	N/A	N/A	N/A
6	Left A-Post Lower	Y	13665	Endevco	6/24/13
7	Left A-Post Middle	Y	13673	Endevco	7/1/13
8	Left B-Post Lower	Y	13666	Endevco	6/24/13
9	Left B-Post Middle	Y	13646	Endevco	6/18/13
10	Front Seat Track	Y	13479	Endevco	6/19/13
11	Rear Seat Structure	Y	N/A	N/A	N/A
12	Right Rear Occ. Compartment	Y	N/A	N/A	N/A
13	Engine Block	X	13496	Endevco	4/18/13
	Engine Block	Y	13748	Endevco	4/17/13
14	Rear Floorpan Above Axle	X	13661	Endevco	6/18/13
	Rear Floorpan Above Axle	Y	13723	Endevco	6/18/13
	Rear Floorpan Above Axle	Z	13348	Endevco	6/18/13

TABLE 4 – MDB Instrumentation

		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	13682	Endevco	6/24/13
MDB Center of Gravity	Y	13706	Endevco	6/24/13
MDB Center of Gravity	Z	13715	Endevco	6/24/13
Left Frame at Rear Axle Centerline	X	13705	Endevco	6/24/13
Left Frame at Rear Axle Centerline	Y	13711	Endevco	6/24/13