REPORT NUMBER: SINCAP-MGA-2015-069

NEW CAR ASSESSMENT PROGRAM (NCAP)
Moving Deformable Barrier Side Impact Test

BAYERISCHE MOTOREN WERKE AG
2015 Mini Cooper Hardtop 3-Dr. Hatchback
NHTSA No.: O20154100

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: June 19, 2015

Final Report Date: August 3, 2015

FINAL REPORT

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, DC 20590

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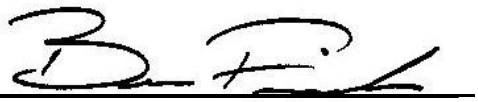
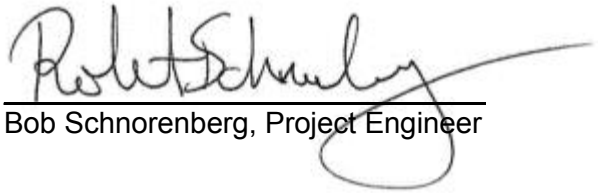
Prepared by: 
Ben Fischer, Project Engineer

Approved by: 
Bob Schnorenberg, Project Engineer

Approval Date: August 3, 2015

FINAL REPORT ACCEPTANCE BY OCWS:

_____
Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

_____
COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

Technical Report Documentation Page

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7. Author(s) Ben Fischer, Project Engineer		*8. Performing Organization Report No.* SINCAP-MGA-2015-069
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-14-D-00353
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 June 19, 2015 to August 3, 2015 *14. Sponsoring Agency Code* NVS-111
15. Supplementary Notes		

16. Abstract

A 55/28 km/h 90° Moving Deformable Barrier NCAP Side Impact Test was conducted on the 2015 Mini Cooper Hardtop 3-Dr. Hatchback in accordance with the specifications of the Office of Crashworthiness Standards NCAP Side Laboratory Test Procedure for the generation of consumer information on vehicle side crash protection. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on June 19, 2015.

The impact velocity of the Moving Deformable Barrier (MDB) was 62.3 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 22.0° C. The target vehicle post-test maximum crush was 168 mm at level 2. The test vehicle's performance was as follows:

	Driver ATD (ES-2re)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	293
Maximum Thorax Rib Deflection	mm	44	27
Total Abdominal Force	N	2500	806
Pubic Symphysis Force	N	6000	1567

	Passenger ATD (SID-IIs)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	704
Resultant Lower Spine Acceleration	Gs	82	80
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	4158
Maximum Thoracic Rib Deflection	mm	38*	34
Maximum Abdomen Rib Deflection	mm	45*	37

*Proposed IARV

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

17. Key Words New Car Assessment Program (NCAP) Side Impact 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	
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SECTION 1
TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2015 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-14-D-00353. The purpose of this test is to generate comparative side impact performance in a 2015 Mini Cooper Hardtop 3-Dr. Hatchback. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Laboratory Test Procedure dated September 2013.

SECTION 2
SUMMARY OF TEST RESULTS

A 2015 Mini Cooper Hardtop 3-Dr. Hatchback was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 62.3 km/h. The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by MGA Research Corporation in Burlington, Wisconsin on June 19, 2015. Pre-test and post-test photographs of the test vehicle, the MDB, and the dummies (ES-2re and SID-IIs) are included in this report.

Dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OCWS NCAP Side Laboratory Test Procedure dated September 2013. The side impact event was documented by eleven (11) cameras. Camera locations are included in this report.

The dummies were instrumented in the following manner:

DRIVER ATD (ES-2re)
Primary and Redundant Head CG Triaxial Accelerometers
Chest Upper Rib, Middle Rib, and Lower Rib Y-Axis Displacement Potentiometers
Abdomen Forward, Middle, and Rear Y-Axis Load Cells
Lower Spine (T12) Triaxial Accelerometers
Pubic Symphysis Y-Axis Load Cell

PASSENGER ATD (SID-IIs)
Primary and Redundant Head CG Triaxial Accelerometers
Primary Head CG Angular Rate Sensors
Chest Upper Rib, Middle Rib, and Lower Rib Y-Axis Displacement Potentiometers
Abdomen Upper Rib and Lower Rib Y-Axis Displacement Potentiometers
Lower Spine (T12) Triaxial Accelerometers
Acetabulum and Iliac Wing Y-Axis Load Cells

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

Dummy Injury readings were recorded as follows:

DUMMY INJURY VALUES

	Driver ATD (ES-2re)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	293
Maximum Thorax Rib Deflection	mm	44	27
Total Abdominal Force	N	2500	806
Pubic Symphysis Force	N	6000	1567

	Passenger ATD (SID-IIs)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	704
Resultant Lower Spine Acceleration	Gs	82	80
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	4158
Maximum Thoracic Rib Deflection	mm	38*	34
Maximum Abdomen Rib Deflection	mm	45*	37

*Proposed IARV

Supplemental restraint information is given below:

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	No	
Seat Belt Load Limiter	Yes		No	
Other				

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

GENERAL COMMENTS

Left Lower A-Post Y has no valid data after 20ms.
Left Lower B-Post Y was not installed.
Left Mid B-Post Y was not installed.

SECTION 3
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20154100
Model Year	2015
Make	Mini
Model	Cooper Hardtop
Body Style	3-Dr. Hatchback
VIN	WMWXM5C59FT942091
Body Color	Volcanic Orange
Odometer Reading (km/mi)	69 / 43
Engine Displacement (L)	1.5
Type/No. Cylinders	3
Engine Placement	Lateral
Transmission Type	Automatic
Transmission Speeds	6
Overdrive	Yes
Final Drive	Front
Roof Rack	No
Sunroof/T-Top	Yes
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes

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

Does owner's manual provide instruction to turn off automatic door locks?	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Bayerische Motoren Werke AG
Date of Manufacture	04/15
Vehicle Type	Passenger Car

GVWR (kg)	1617
GAWR Front (kg)	903
GAWR Rear (kg)	764

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	2		4	
Capacity Weight (VCW) (kg)				325	(A)
DSC x 68.04 kg				272	(B)
Rated Cargo and Luggage Weight (RCLW)				53	(A-B)

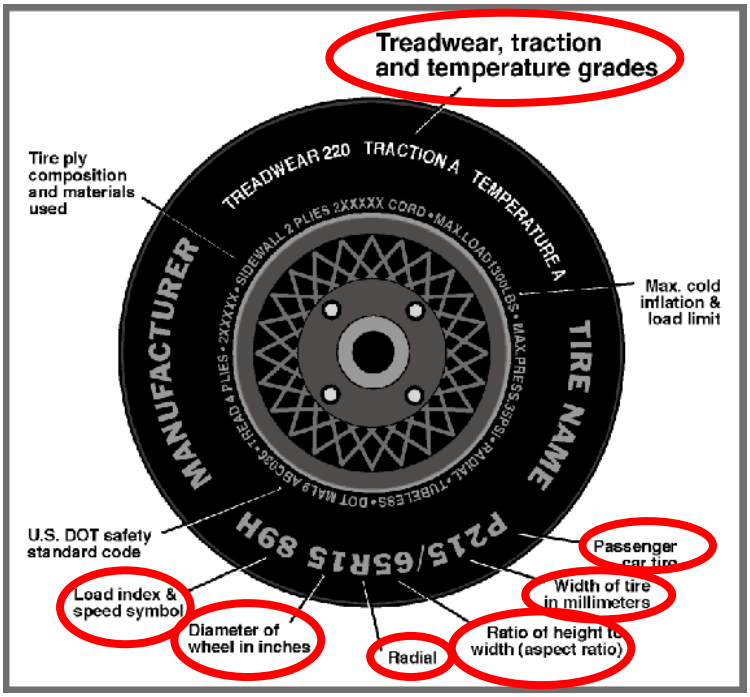
VEHICLE SEAT TYPE

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

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

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	175/65R15	175/65R15
Tire Size on Vehicle	175/65R15	175/65R15
Tire Manufacturer	Hankook	Hankook
Tire Model	Optimo	Optimo
Treadwear	400	400
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1 Rayon	1 Rayon
Tire Plies Body	2 Steel, 1 Rayon, 1 Nylon	2 Steel, 1 Rayon, 1 Nylon
Load Index/Speed Symbol	84H	84H
Tire Material	Rubber	Rubber
DOT Safety Code Left	2XAJ DLH 0415	2XAJ DLH 0415
DOT Safety Code Right	2XAJ DLH 0415	2XAJ DLH 0415

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

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

TEST PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	248	248	255	241
Tire Placard	kPa	240	240	240	240
Owner's Manual	kPa	240	240	240	240
As Tested	kPa	240	240	240	240

MDB TIRE SPECIFICATIONS

	Requirement	Units	LF	RF	LR	RR
Tire Size	P205/75R15	N/A	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	200 ± 21	kPa	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	383.5	243.0		421.0	317.0		423.0	328.0	
Right	kg	383.5	232.5		399.0	280.5		386.5	286.5	
Ratio	%	61.7	38.3		57.8	42.2		56.8	43.2	
Totals	kg	767.0	475.5	1242.5	820.0	597.5	1417.5	809.5	614.5	1424.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1242.5	(A)
Sum of Actual Weight of 2 P572 ATDs Used	kg	129	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	53	(C)
Calculated Test Vehicle Target Weight (TVTW)	kg	1424.5	(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 kg)? **YES**

TEST VEHICLE ATTITUDES AND CG

	Units	Fully Loaded	As Tested	Meets Requirement***
Left Front	mm	650	641	Yes
Right Front	mm	650	651	Yes
Right Rear	mm	633	630	Yes
Left Rear	mm	623	629	Yes
Vehicle CG (Aft of Front Axle)	mm	1077	1052	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	6	31	

*** 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.

Test height adjustable suspension setting, if applicable:	Not Applicable

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

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Weight of Ballast, if any	10
None	

DATA SHEET NO. 2
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

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	22.8	17.8	20.3
Front Passenger Seat	22.3	17.3	19.8
Front Center Seat			
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat			
Rear Center Seat	Fixed	Fixed	Fixed

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rear-most	Mid-Fore/Aft	Forward-Most
Driver Seat	20.3	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Front Passenger Seat	19.8	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Front Center Seat			Max			
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Rear Center Seat			Max			
			Mid			
			Min			

DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

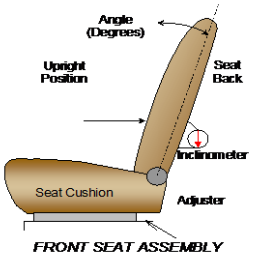
Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

SEAT FORE/AFT POSITIONS

Seat	Total Fore/Aft Travel		Test Position from Forward-most Position	
	mm	Detents	mm	Detent
Driver Seat	250	26 (1st as 1)	130	13th (1st as 0)
Front Passenger Seat	250	26 (1st as 1)	130	13th (1st as 0)
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side	Fixed	Fixed	Fixed	Fixed
Rear Center Seat				

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned to the manufacturer's designated design angle. The front passenger's seat back is positioned in a similar manner as the driver's seat back. The struck side rear seat back is adjusted following Appendix C, "Positioning Dummies in the Test Vehicle" in the NCAP Laboratory Test Procedure dated September 2013. The rear center and non-struck side rear outboard seat backs are positioned to match the struck side rear seat back.



Seat	Total Seat Back Angle Range		Test Position from Vertical	
	Degrees	Detents	Degrees	Detent
Driver Seat w/Seated Dummy	56.7	29 (1st as 1)	19.9	6th (1st as 0)
Front Passenger Seat	29.8	16 (1st as 1)	21.0	5th (1st as 0)
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	19.5	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	19.5	Fixed
Rear Center Seat				

Seat back angles measured with level on seatback.

DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1.

	Total # of Positions	Placed in Position #
Driver Seat	Fixed	Not Applicable
Rear Seat	Fixed	Not Applicable

HEAD RESTRAINT ADJUSTMENT

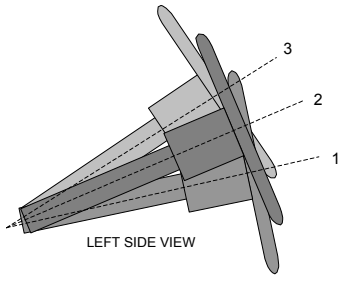
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	5	Highest
Rear Seat	3	Lowest

STEERING COLUMN ADJUSTMENT

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

	Degrees	Fore/Aft Position (mm)
Lowermost, Position 1	72.7	79
Geometric Center, Position 2	70.3	109
Uppermost, Position 3	67.9	139
Telescoping Steering Wheel Travel		60
Test Position	67.9	109

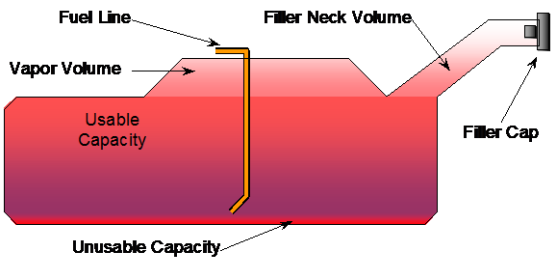


STEERING COLUMN ASSEMBLY

FUEL PUMP

Describe the fuel pump type, details about how it operates and the location of the fuel filler pipe.

The vehicle is equipped with an electric fuel pump. Fuel pump starts when ignition is on. The fuel pump will operate for 5 seconds. After pressure has been built up the fuel pump switches to sleep mode until the engine will be started or the pressure decreases.



VEHICLE FUEL TANK ASSEMBLY

DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

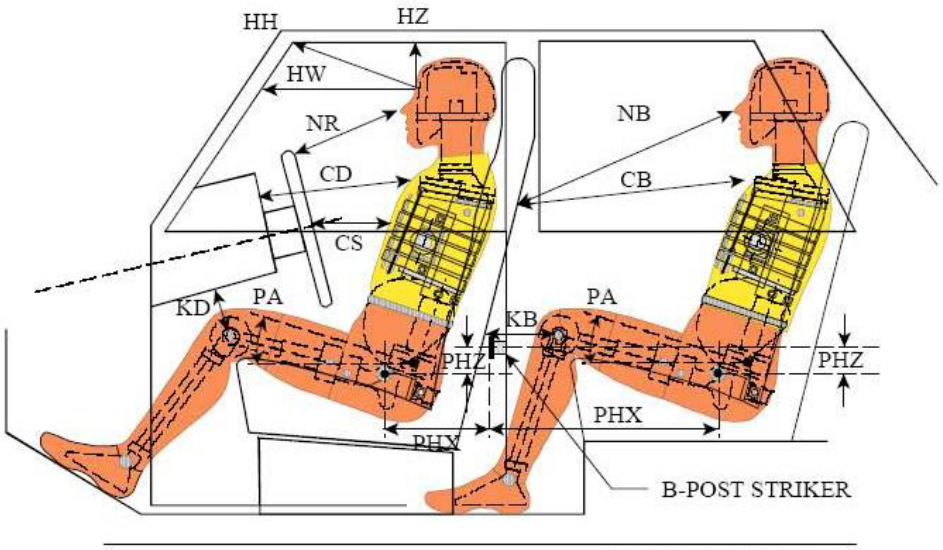
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard" Tank (see Form No. 1)	40.1
Usable Capacity of "Optional" Tank (see Form No. 1)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	44.0
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	37.3
Actual Amount of Solvent Used	37.5
1/3 of Usable Capacity	13.4

Is the actual amount of solvent used in the test equal to 93% ± 1%
of the Usable Capacity stated in Form No. 1? **YES**

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015



LEFT SIDE VIEW

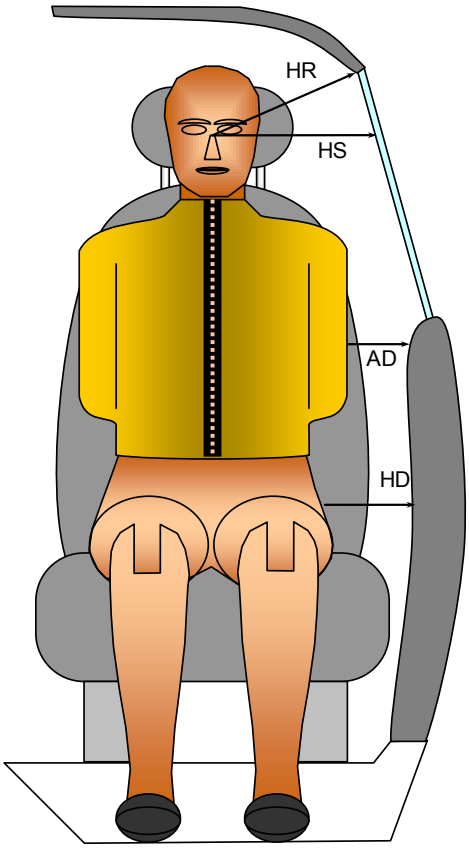
NOTE: 2-DOOR VEHICLE SHOWN. REAR DUMMY PHX & PHZ MEASUREMENTS FOR A 4-DOOR VEHICLE WOULD USE THE C-POST STRIKER AS A REFERENCE POINT

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Measurement Description	Driver		Passenger	
			Length (mm)	Angle(°)	Length (mm)	Angle(°)
HH		Head to Header	622	9.2		
HW		Head to Windshield	762			
HZ	HZ	Head to Roof Liner	118		244	
NR	NB	Nose to Rim/Seat Back	465	12.4	387	14.6
CD	CB	Chest to Dashboard/Seat Back	497	10.2	390	11.8
CS		Chest to Steering Wheel	368	5.6		
KDL	KBL	Left Knee to Dash/Seat Back	217	24.8	114	9.1
KDR	KBR	Right Knee to Dash/Seat Back	113	25.6	117	10.4
PAX	PAX	Pelvic Tilt Angle X		24.3		24.8
	PAY	Pelvic Tilt Angle Y		-1.4		1.4
PHX	PHX	Hip Point to Striker (X-Axis)	327		N/A	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	195		N/A	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015



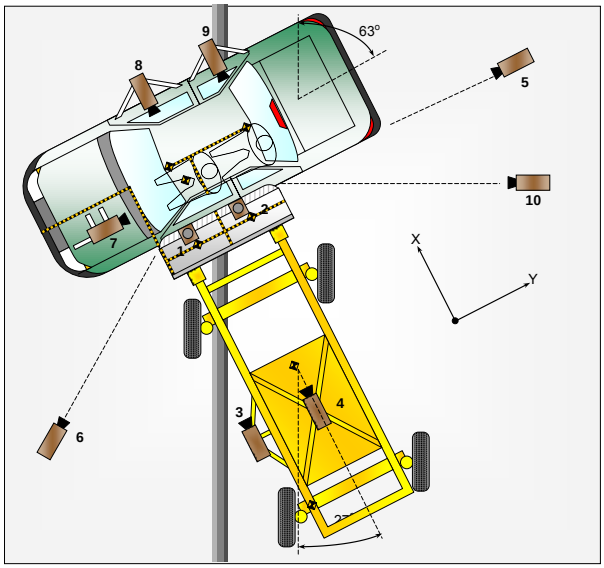
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver	Passenger
HR	Head to Side Header	mm	159	250
HS	Head to Side Window	mm	286	378
AD	Arm to Door	mm	81	131
HD	Hip Point to Door	mm	148	95

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X*	Y*	Z*		
1	Overhead Overall	120	-80	-5040	14	1000
2	Overhead Close-Up	50	0	-5090	20	1000
3	Left Impact Point (MDB)				50	1000
4	Side Overall (MDB)				16	1000
5	Rear	-20	5610	-1150	24	1000
6	Left Front	-1660	-5360	-1130	24	1000
7	Driver Front (OB)				16	1000
8	Driver Side (OB)				8	1000
9	Passenger Side (OB)				8	1000
10	Real Time Left Rear					30
11	Real Time Inrun					30

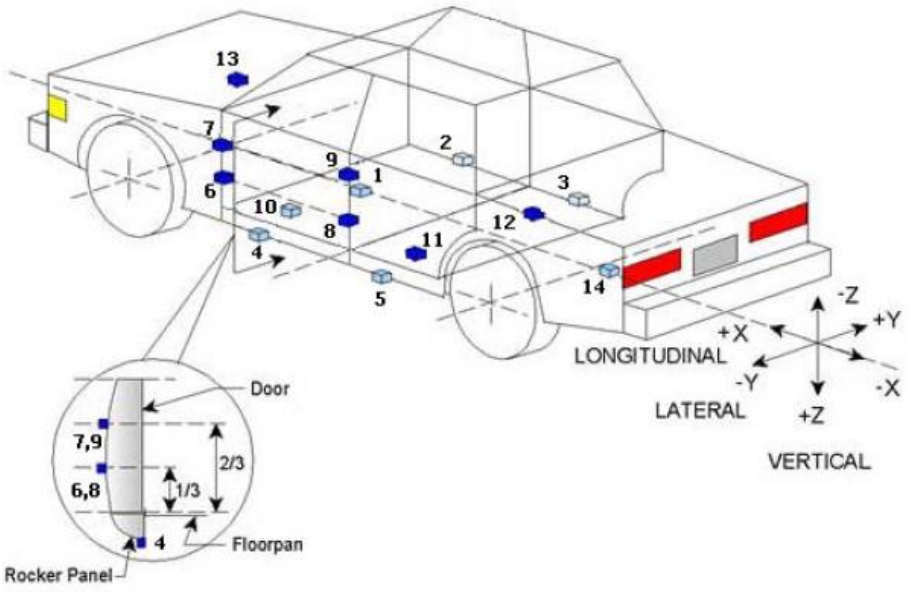
Reference: Impact Point projected to Ground; +X = To Front of MDB, + Y = To Right of MDB, +Z = Down
* All measurements accurate to ± 6 mm

INSTRUMENTATION

	Number of Channels
Driver Dummy	16
Passenger Dummy	19
Vehicle Structure	21
MDB Accelerometers	5
MDB Contacts	2
Total	63

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015



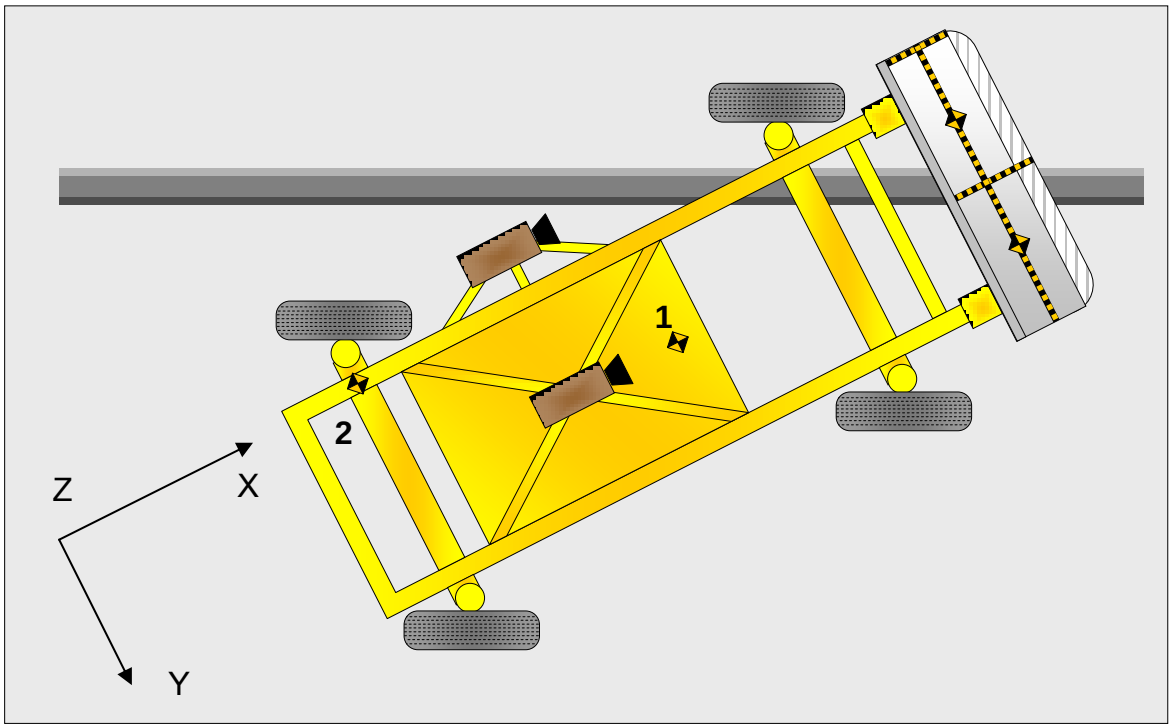
TEST VEHICLE ACCELEROMETER LOCATIONS

Accelerometer Location				
No.	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	1945	110	-263
2	Right Sill at Front Seat	1513	671	-190
3	Right Sill at Rear Seat	954	671	-395
4	Left Sill at Front Door	1882	-671	-180
5	Left Sill at Rear Door	1137	-671	-195
6	Left Lower A-Post	2461	-751	-501
7	Left Middle A-Post	2474	-744	-723
8	Left Lower B-Post			
9	Left Middle B-Post			
10	Front Seat Track	1646	-330	-229
11	Rear Seat Structure	1316	-314	-328
12	Rt. Rear Occ. Compartment	1330	350	-206
13	Engine Block	3204	-20	-814
14	Rear Above Axle	673	30	-524

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: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015



MDB ACCELEROMETER LOCATIONS

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

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

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle:	2015 Mini Cooper Hardtop 3-Dr. Hatchback	NHTSA No.	O20154100
Test Program:	NCAP Side MDB Impact Test	Test Date:	6/19/2015

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Airbag	Curtain Airbag, Right Rear Seatback
Top of Head	Headliner, Side Visor	Curtain Airbag, Headliner, Right Rear Seatback
Left Side of Head	Curtain Airbag, Headliner	Curtain Airbag
Back of Head	Headrest, Headliner	Right Rear Seatback
Left Shoulder	None	Door Panel
Upper Torso	Side Airbag, Seatback	Seatback
Lower Torso	Side Airbag, Seatback	Seatback, Door Panel
Left Hip	Seat Cushion, Door Panel	Door Panel
Left Knee	Door Panel	Door Panel

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Rear Hatch/ Other Door
	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 Systems 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

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

POST-TEST STRUCTURAL OBSERVATIONS

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

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

Test Vehicle:	2015 Mini Cooper Hardtop 3-Dr. Hatchback	NHTSA No.	O20154100
Test Program:	NCAP Side MDB Impact Test	Test Date:	6/19/2015

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	No	
Seat Belt Load Limiter	Yes		No	
Other				

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2496
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		308
Actual Impact Point (Aft of Front Axle)	mm		300
Horizontal Offset (+forward / -rearward)	mm	+/- 50 of intended impact point	8
Vertical Offset (+down / -up)	mm	+/- 20 of intended impact point	-6

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1251
Overall Length Including Honeycomb Face	4115
Wheelbase of Framework Carriage	2588
CG Location aft of Front Axle	1138

MDB WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg	406.0	283.3	
Right	kg	357.9	316.4	
Ratio	%	56.0	44.0	
Totals	kg	763.9	599.7	1363.5

SPEED AND ANGLE AT IMPACT DATA

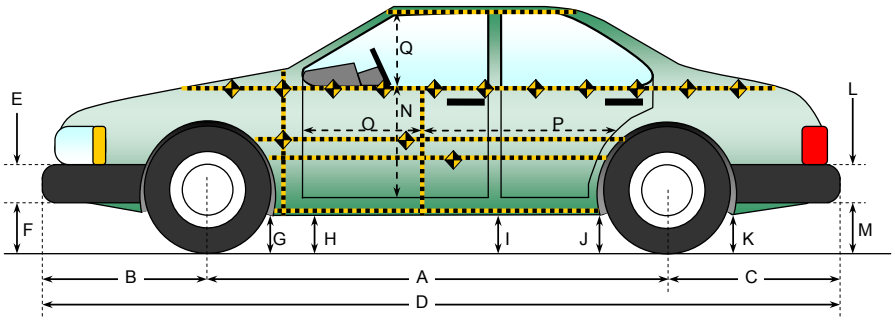
Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	62.3
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	62.6
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	89.8
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	62.9
MDB Crabbed Angle to MDB Forward Line of Motion	degrees	26 to 28	27.3

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush
Row	Description	Height	Distance	Direction	
A	Center of Bumper	432	600	Right	259
B	Top of Bumper	533	600	Right	204
C	Mid-Level	686	800	Left	172
D	Top of Stack	813	800	Left	165

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015



All measurements in (mm) with tolerance of ± 3 mm

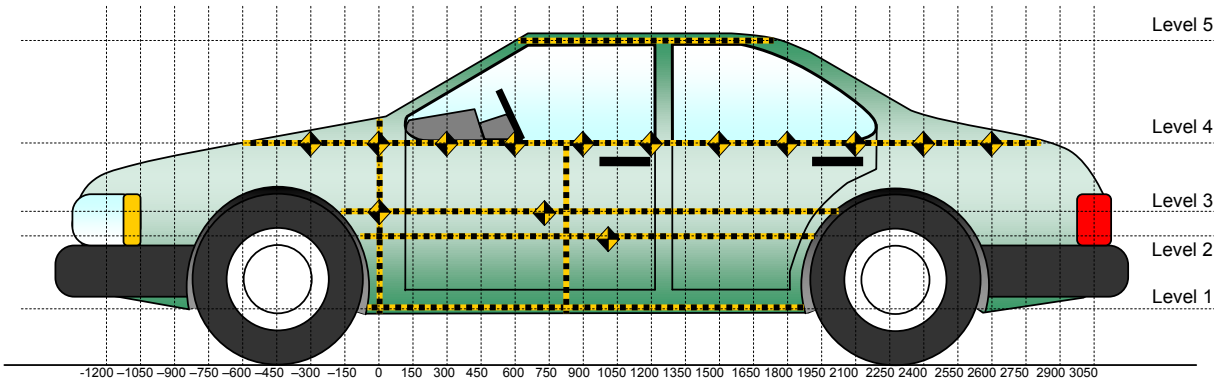
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2496	2495	1
B	Front Axle to FSOV	752	764	-12
C	Rear Axle to RSOV	572	572	0
D	Total Length at Centerline	3824	3831	-7
E	Front Bumper Thickness	80	80	0
F	Front Bumper Bottom to Ground	192	205	-13
G	Sill Height at Front Wheel Well	135	143	-8
H	Sill Height at Front Door Leading Edge	125	130	-5
I	Sill Height at B Pillar	153	142	11
J1	Sill Height at Rear Wheel Well	146	145	1
J2	Pinch Weld Height at Rear Wheel Well	136	129	7
K	Sill Height Aft of Rear Wheel Well	205	202	3
L	Rear Bumper Thickness	130	130	0
M	Rear Bumper Bottom to Ground	188	200	-12
N	Sill Height to Window Bottom Sill	690	608	82
O	Front Door Leading Edge to Impact CL	630	627	3
P	Rear Door Trailing Edge to Impact CL	634	614	20
Q	Front Window Opening	425	412	13
R	Right Side Length	3080	3082	-2
S	Left Side Length	3080	3070	10
T	Vehicle Width at B Post	1698	1658	40

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015



All Measurements Shown in mm

LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEAUREMENTS

Level	Measurement Description	Height Above Ground (mm)	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	292	121	1200
2	Mid Door	477	168	1200
3	Occupant Hip Point	620	165	1050
4	Window Sill	903	59	1500
5	Window Top	1335	15	1500

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

DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

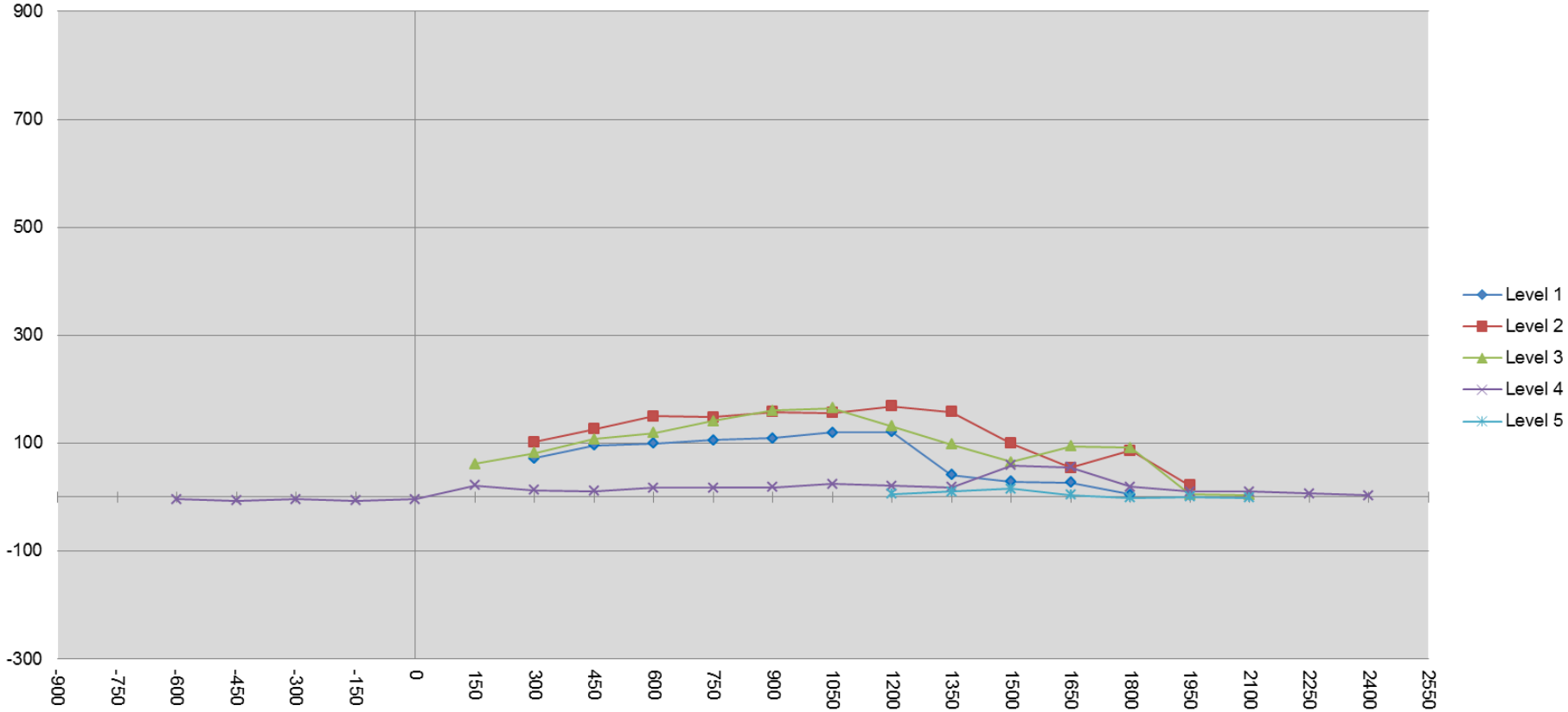
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-600				514					510					-4	
-450				478					471					-7	
-300				444					440					-4	
-150			246	418				244	411				-2	-7	
0			254	391				253	387				-1	-4	
150	280	254	258	370		297	256	319	392		17	2	61	22	
300	280	262	258	355		352	364	340	368		72	102	82	13	
450	275	266	257	350		371	392	364	361		96	126	107	11	
600	271	268	256	339		370	418	375	356		99	150	119	17	
750	269	267	254	332	554	375	415	395	349	557	106	148	141	17	3
900	267	265	253	328	549	376	423	413	346	552	109	158	160	18	3
1050	265	265	252	321	545	385	421	417	345	549	120	156	165	24	4
1200	263	264	252	319	542	384	432	383	340	548	121	168	131	21	6
1350	265	264	253	316	543	306	422	351	334	553	41	158	98	18	10
1500	268	264	254	316	543	297	363	319	375	558	29	99	65	59	15
1650	270	265	254	318	546	297	319	348	373	550	27	54	94	55	4
1800	267	260	250	320	554	272	346	341	339	553	5	86	91	19	-1
1950		253	245	325	564		275	250	335	564		22	5	10	0
2100			244	330	582			248	340	581			4	10	-1
2250				342					349					7	
2400				365					368					3	

NOTE: Pre-test measurements are taken when the vehicle is in the “As Tested” weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush profile grid is established prior to the test based on an estimated impact point.

DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

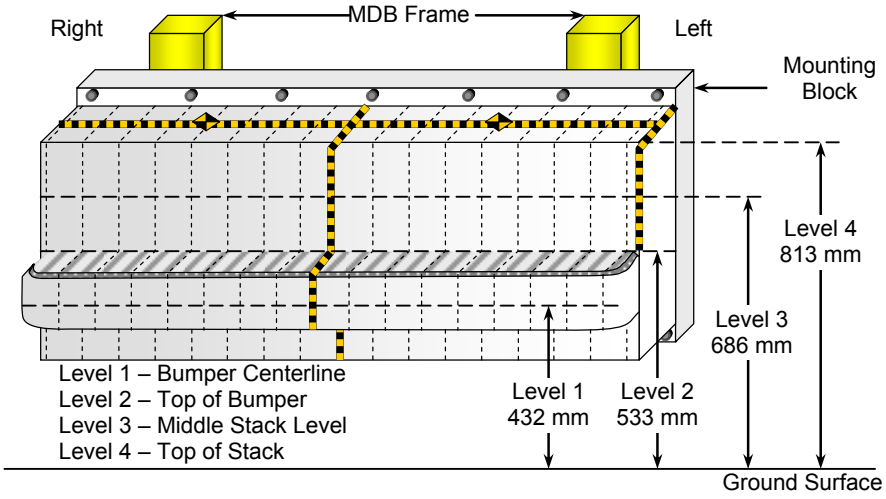
Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback
Test Program: NCAP Side MDB Impact Test

NHTSA No. O20154100
Test Date: 6/19/2015



DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015



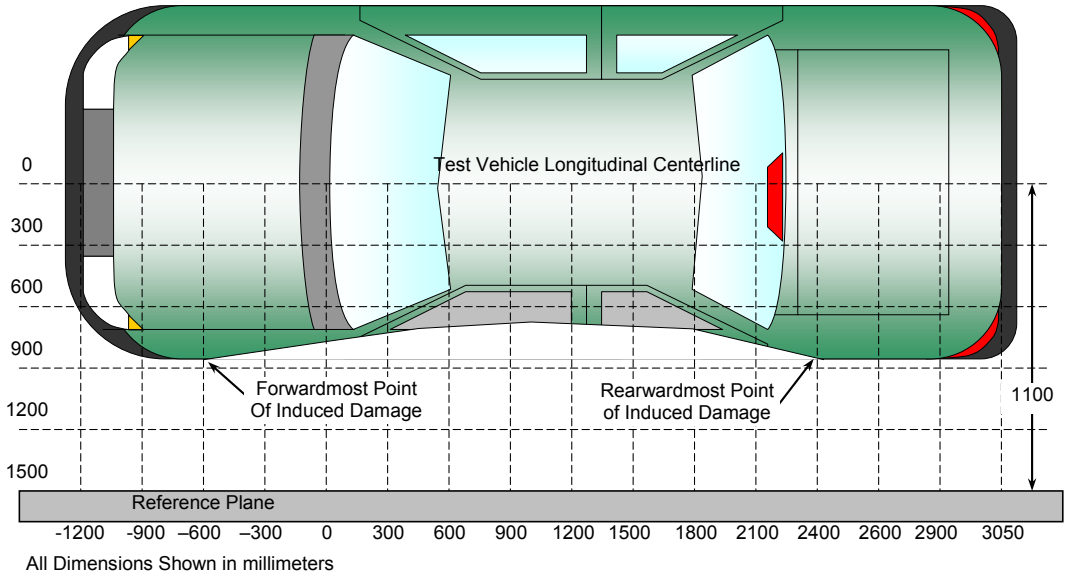
FRONT VIEW

DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center (mm)								C_L	Distance Left of Center (mm)							
	800	700	600	500	400	300	200	100	0	100	200	300	400	500	600	700	800
4	86	84	107	129	114	74	54	56	73	83	94	95	106	128	140	163	165
3	94	109	140	144	105	75	49	35	32	30	36	51	76	98	133	166	172
2	189	198	204	199	141	90	78	78	91	99	106	114	121	128	143	169	191
1	240	246	259	243	191	146	125	119	121	129	135	140	148	164	196	211	214

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015



TOP VIEW

VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Pre-Test (mm)	Post-Test (mm)	Max. Static Crush (mm)
1	1900	3	245	255	10
2	1520	3	254	323	69
3	1140	3	252	397	145
4	760	3	254	396	142
5	380	3	257	357	100
6	0	3	254	253	-1

MDB DAMAGE PROFILE DISTANCES

DPD	Distance from Center of MDB	Level	Post-Test (mm)
1	800 mm right of center	1	240
2	480 mm right of center	1	243
3	160 mm right of center	1	125
4	160 mm left of center	1	135
5	480 mm left of center	1	164
6	800 mm left of center	1	214

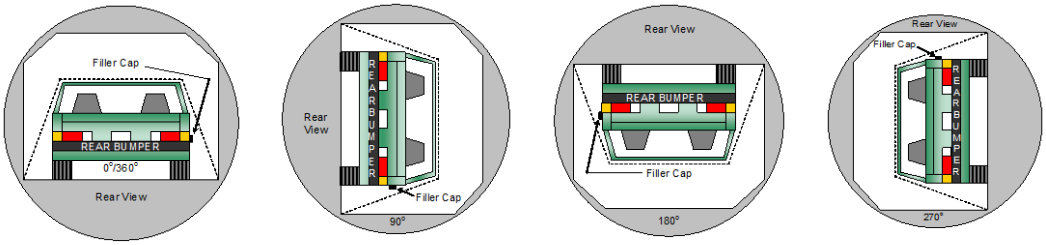
DATA SHEET NO. 14
FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2015 Mini Cooper Hardtop 3-Dr. Hatchback NHTSA No. O20154100
Test Program: NCAP Side MDB Impact Test Test Date: 6/19/2015

Test Time: 11:32 am Temperature: 22.0° C

A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)
B. For the 5 minute period after motion ceases: None
(Maximum allowable = 5 ounces)
C. For the following 25 minutes: None
(Maximum allowable = 1 oz./minute)
D. Spillage Details: None

FMVSS 301 STATIC ROLLOVER DATA



0°/360° 90° 180° 270°

ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	115	300	415
90° to 180°	110	300	410
180° to 270°	107	300	407
270° to 360°	114	300	414

FMVSS 301 ROLLOVER SPILLAGE TABLE (units in ounces)

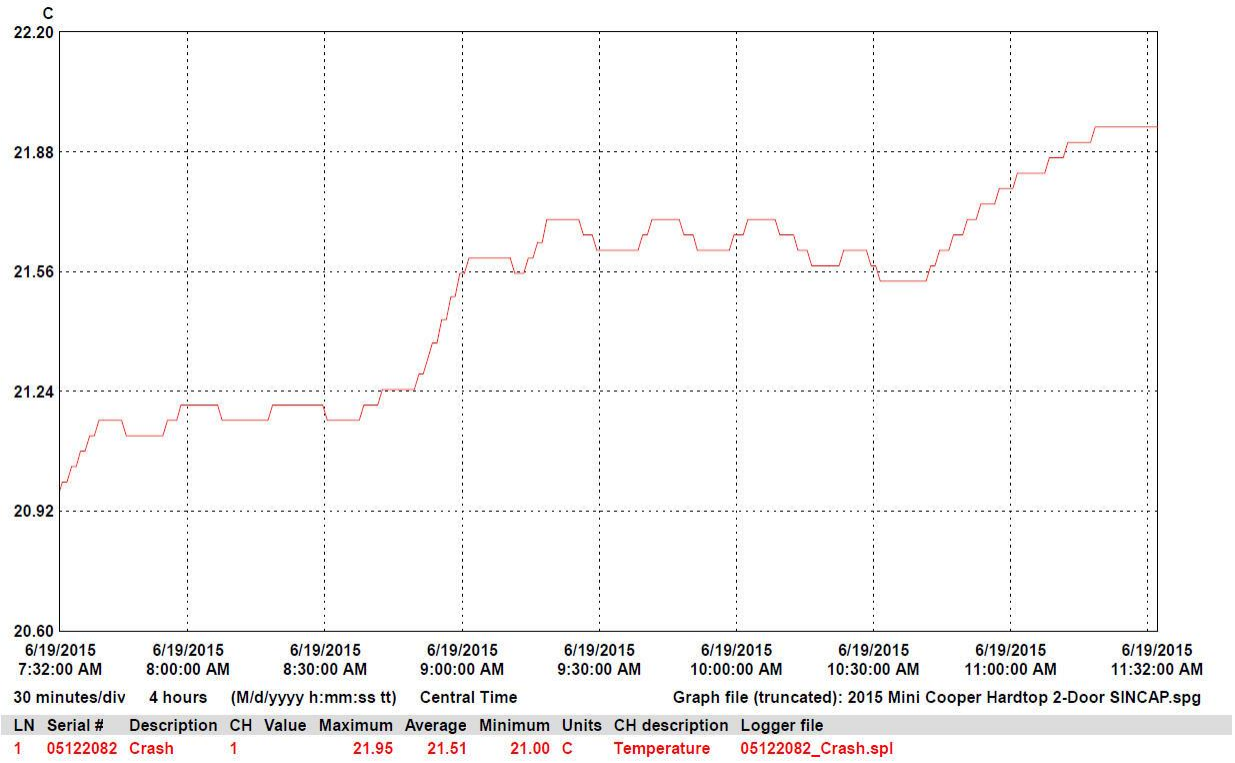
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 15
DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle:	2015 Mini Cooper Hardtop 3-Dr. Hatchback	NHTSA No.	O20154100
Test Program:	NCAP Side MDB Impact Test	Test Date:	6/19/2015



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	05122082	Crash	1		21.95	21.51	21.00	C	Temperature	05122082_Crash.spl

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Photo No. 001 - As Delivered Right Front Three-Quarter View of Test Vehicle

Photo No. 002 - As Delivered Left Rear Three-Quarter View of Test Vehicle

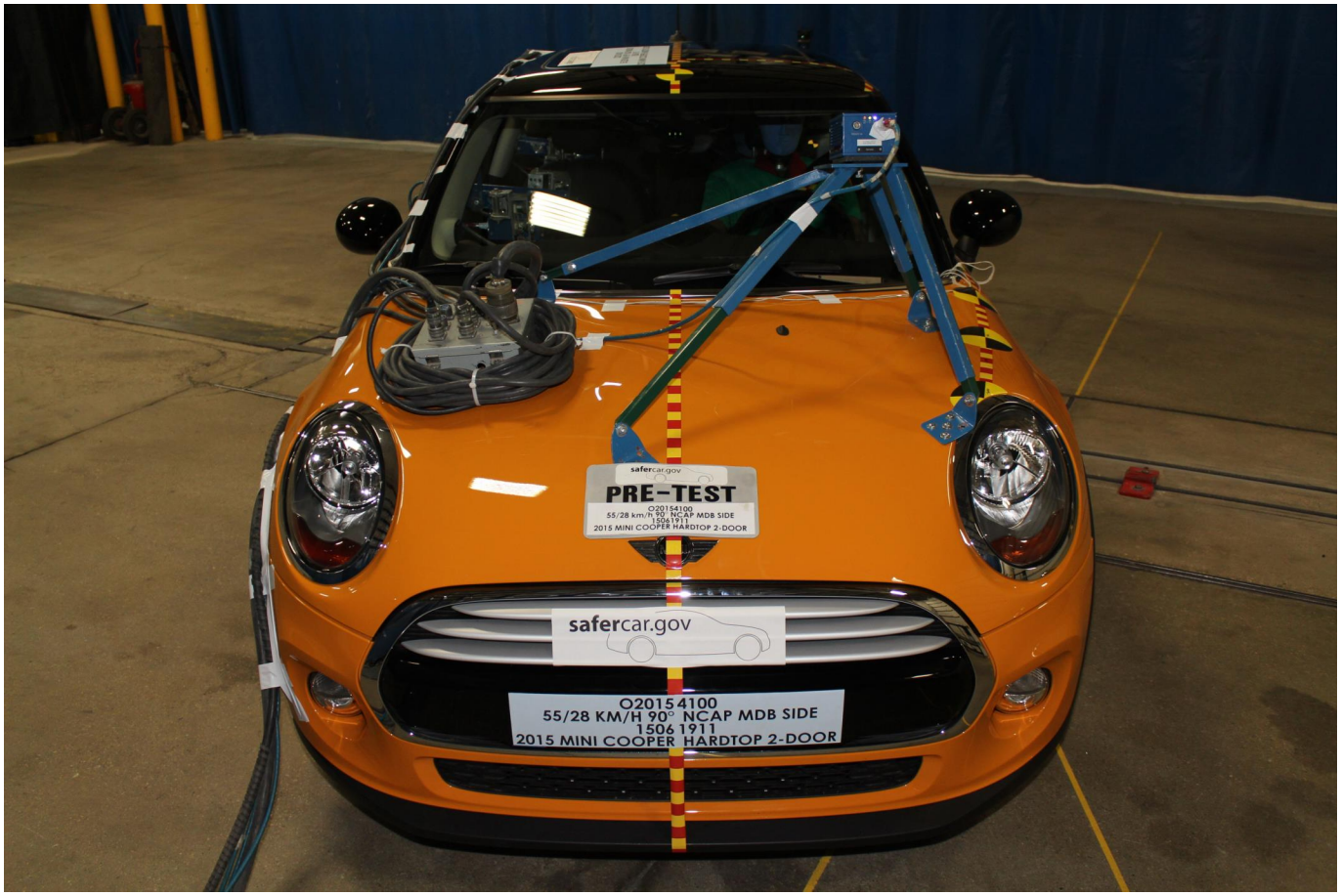


Photo No. 003 - Pre-Test Frontal View of Test Vehicle

Photo No. 004 - Post-Test Frontal View of Test Vehicle

Photo No. 005 - Pre-Test Left Front Three-Quarter View of Test Vehicle

Photo No. 006 - Post-Test Left Front Three-Quarter View of Test Vehicle

Photo No. 007 - Pre-Test Left Side View of Test Vehicle

Photo No. 008 - Post-Test Left Side View of Test Vehicle

Photo No. 009 - Pre-Test Left Three-Quarter Rear View of Test Vehicle

Photo No. 010 - Post-Test Left Three-Quarter Rear View of Test Vehicle

Photo No. 011 - Pre-Test Rear View of Test Vehicle

Photo No. 012 - Post-Test Rear View of Test Vehicle

Photo No. 013 - Pre-Test Right Side View of Test Vehicle

Photo No. 014 - Post-Test Right Side View of Test Vehicle

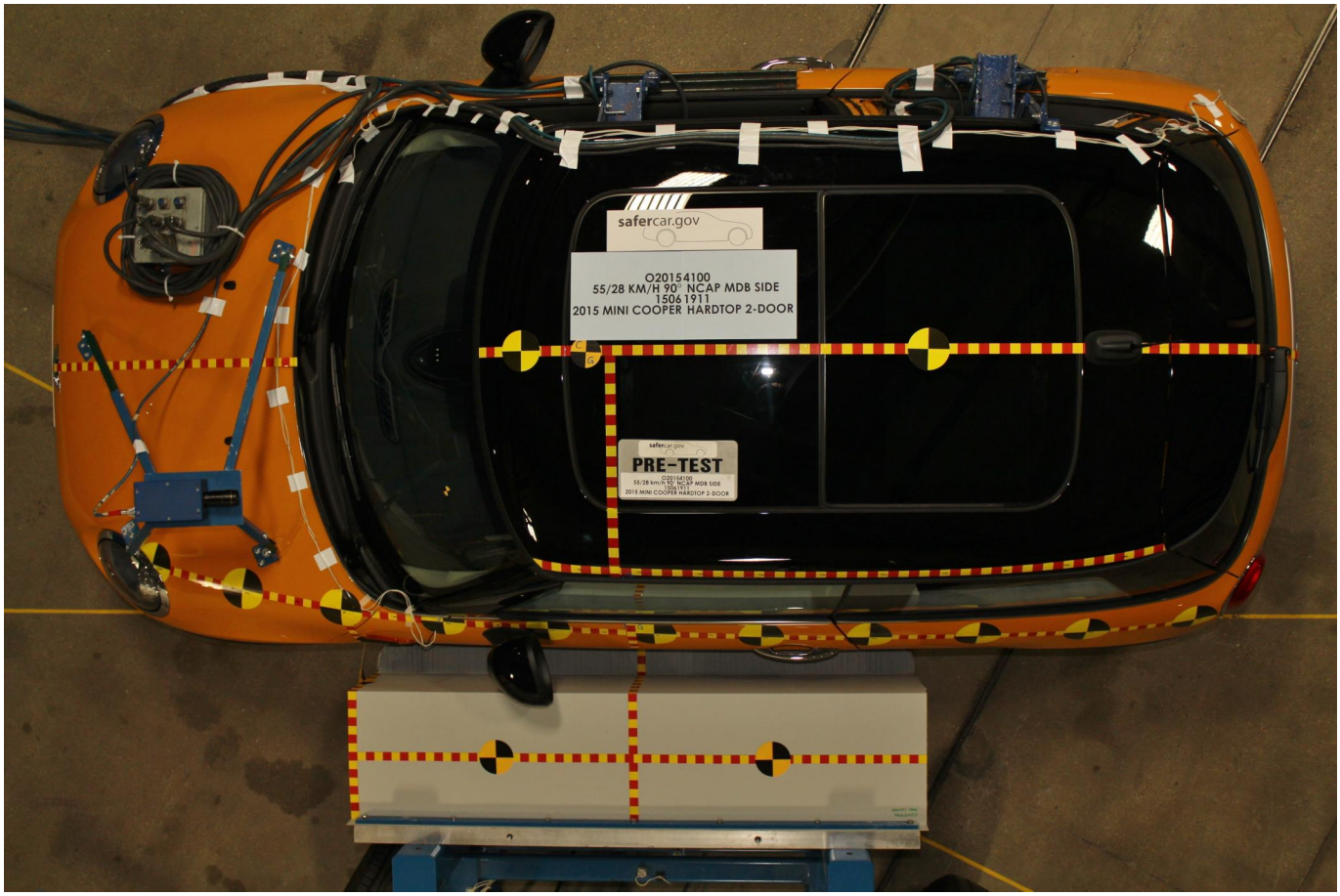


Photo No. 015 - Pre-Test Overhead View of Test Area

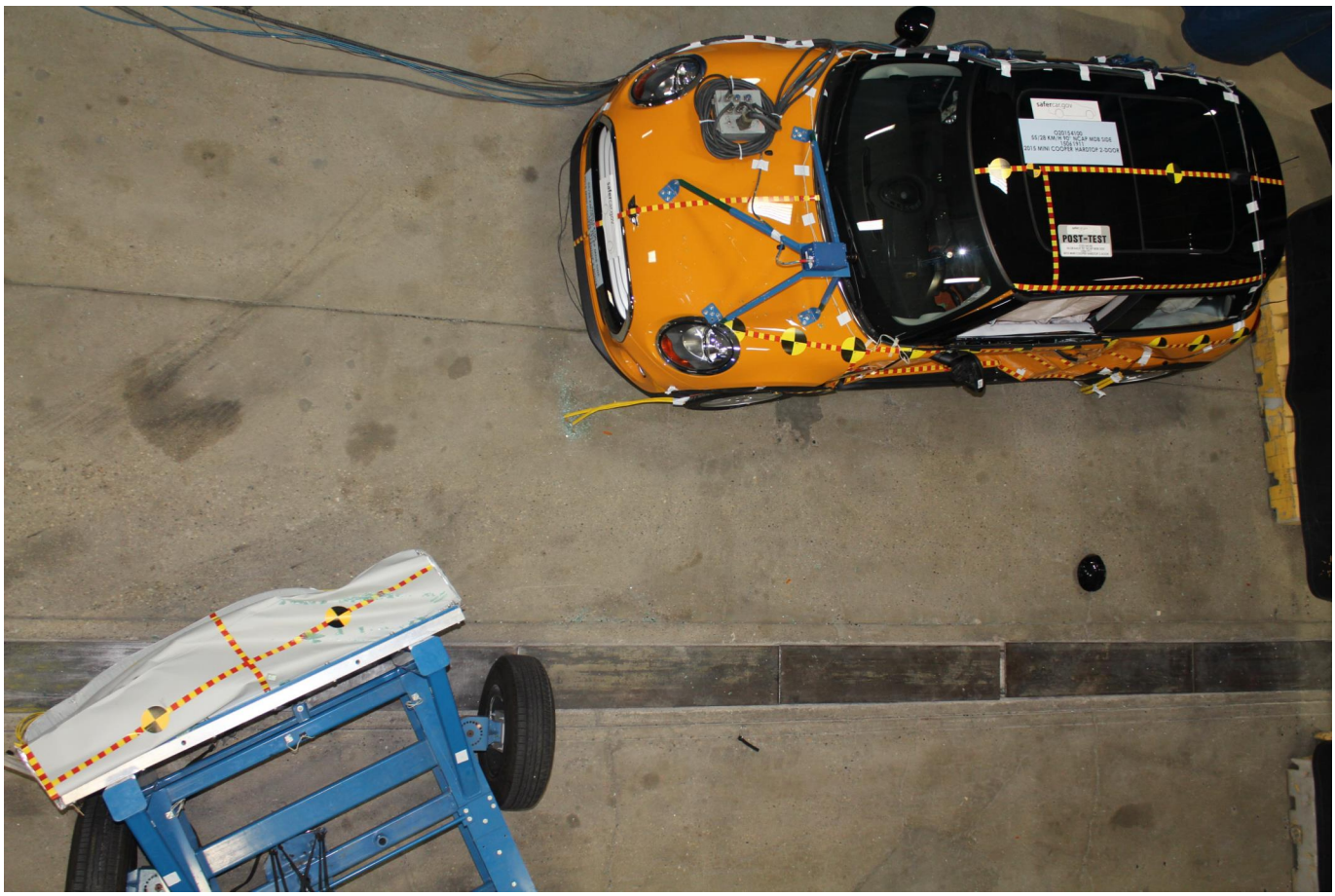


Photo No. 016 - Post-Test Overhead View of Test Area

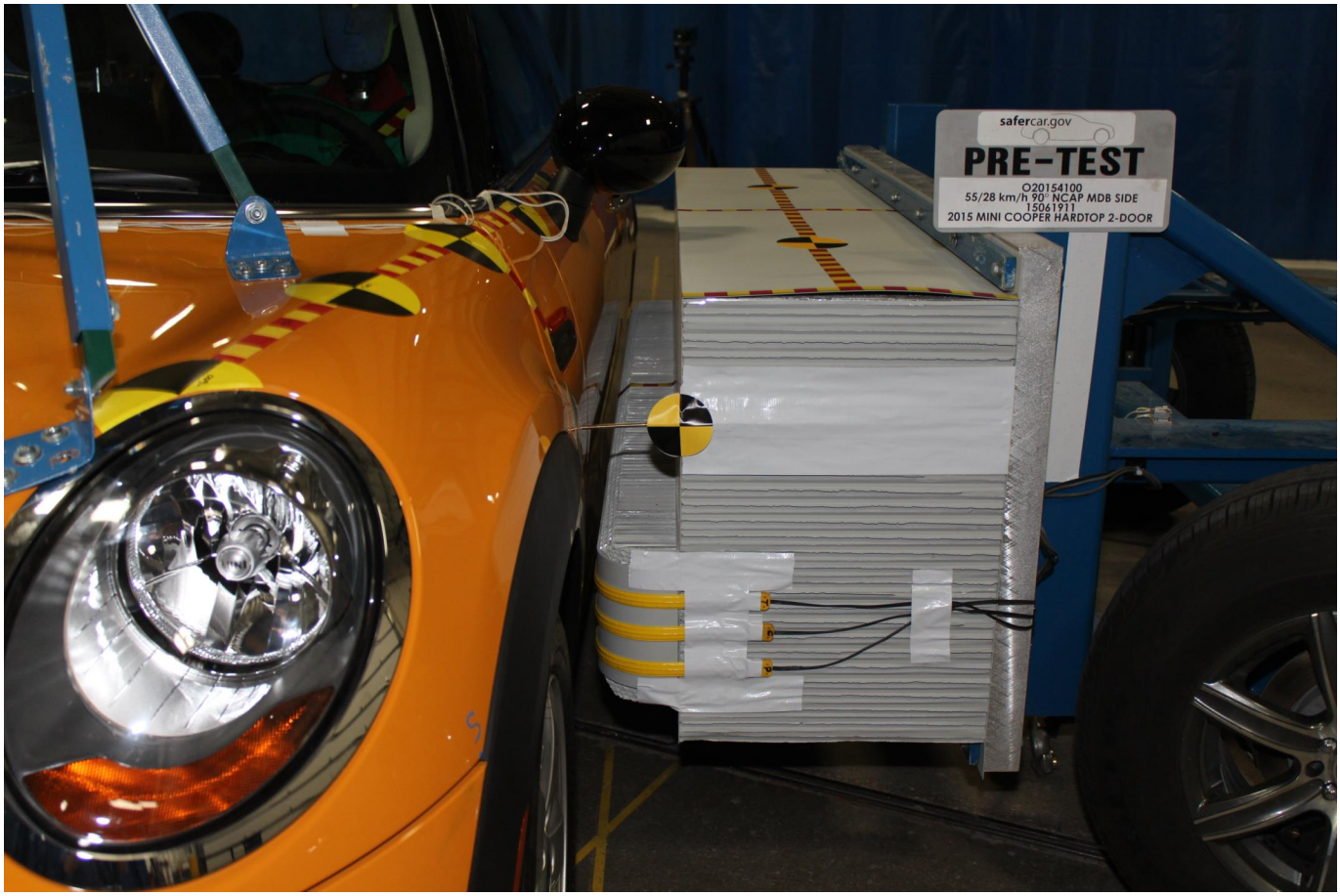


Photo No. 017 - Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle

Photo No. 018 - Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle

Photo No. 019 - Pre-Test Close-Up View of Impact Point Target

Photo No. 020 - Post-Test Close-Up View of Impact Point Target

Photo No. 021 - Pre-Test Left Front Door Latch Close-Up

Photo No. 022 - Post-Test Left Front Door Latch Close-Up

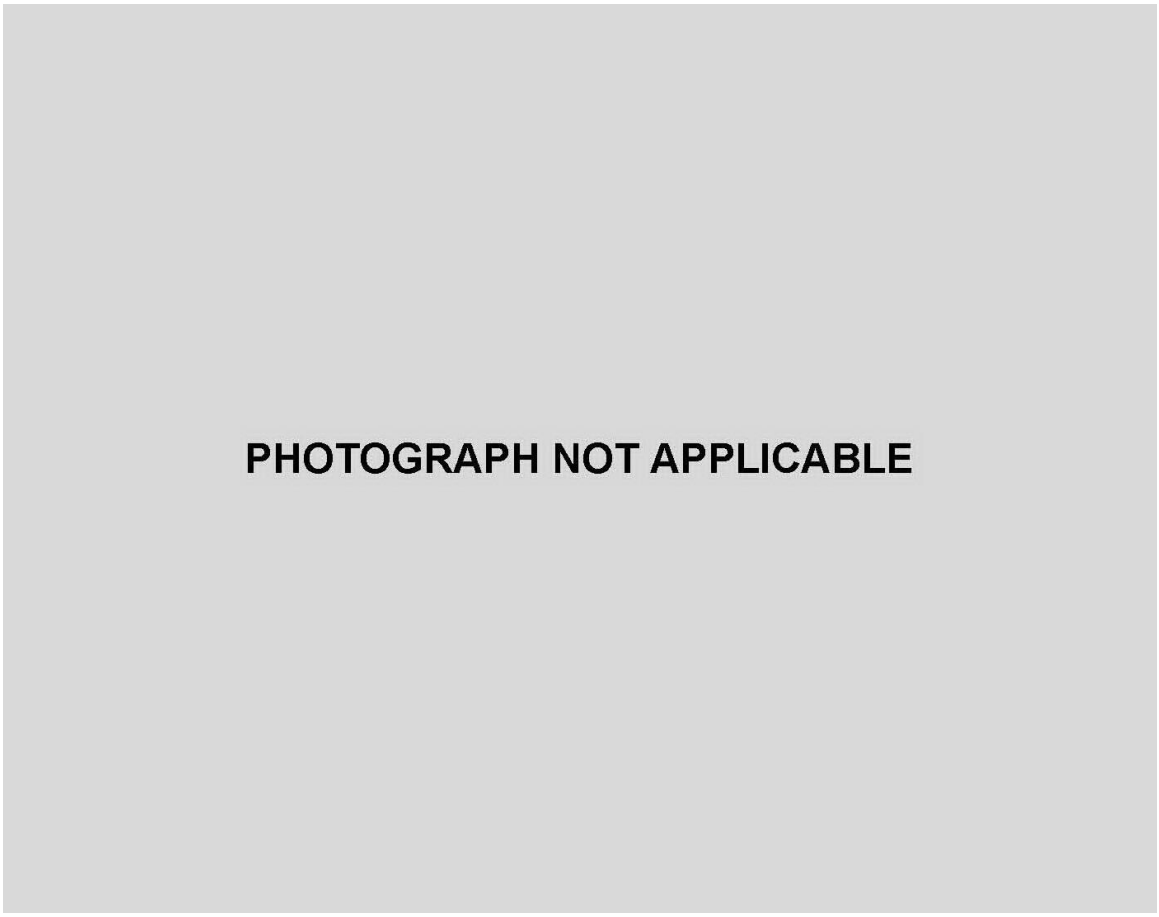


Photo No. 023 - Pre-Test Left Rear Door Latch Close-Up

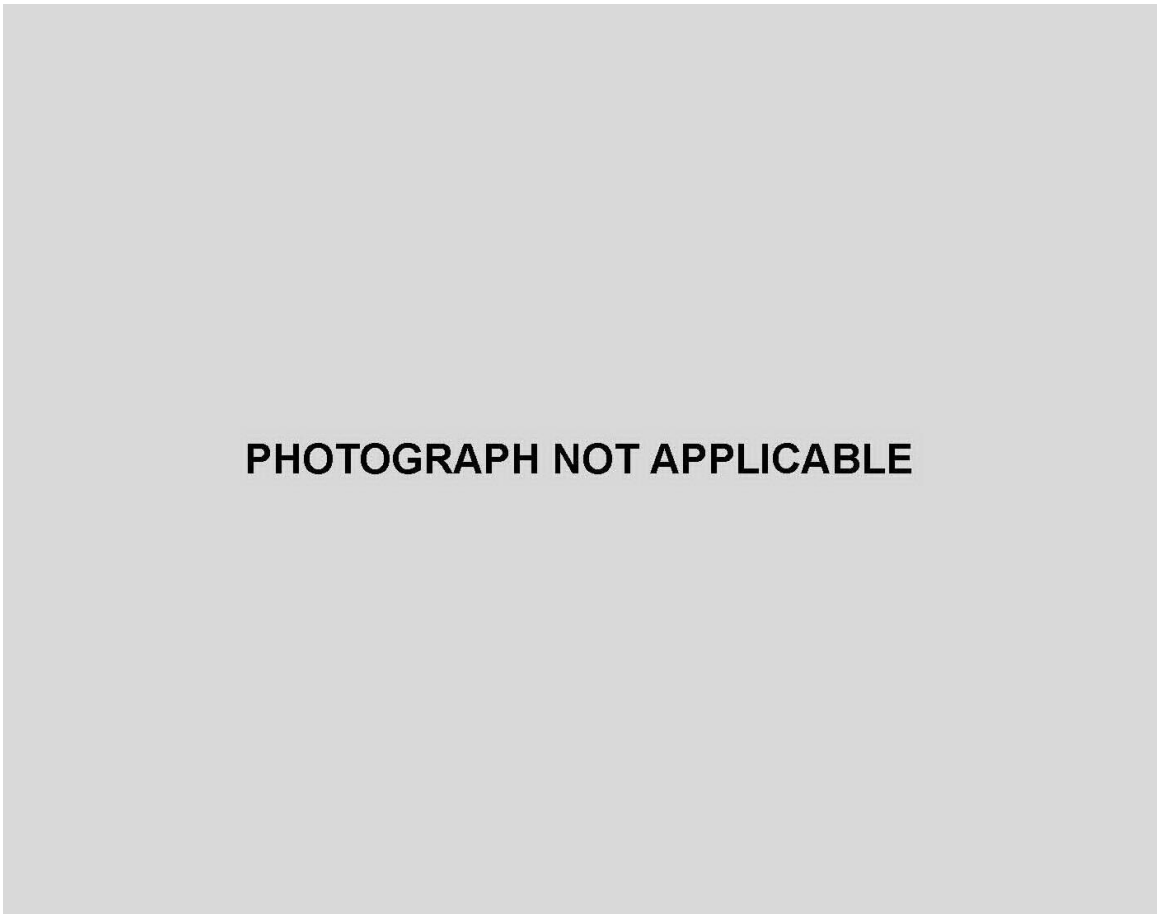


Photo No. 024 - Post-Test Left Rear Door Latch Close-Up

Photo No. 025 - Pre-Test Front Close-Up View of Driver Dummy

Photo No. 026 - Post-Test Front Close-Up View of Driver Dummy

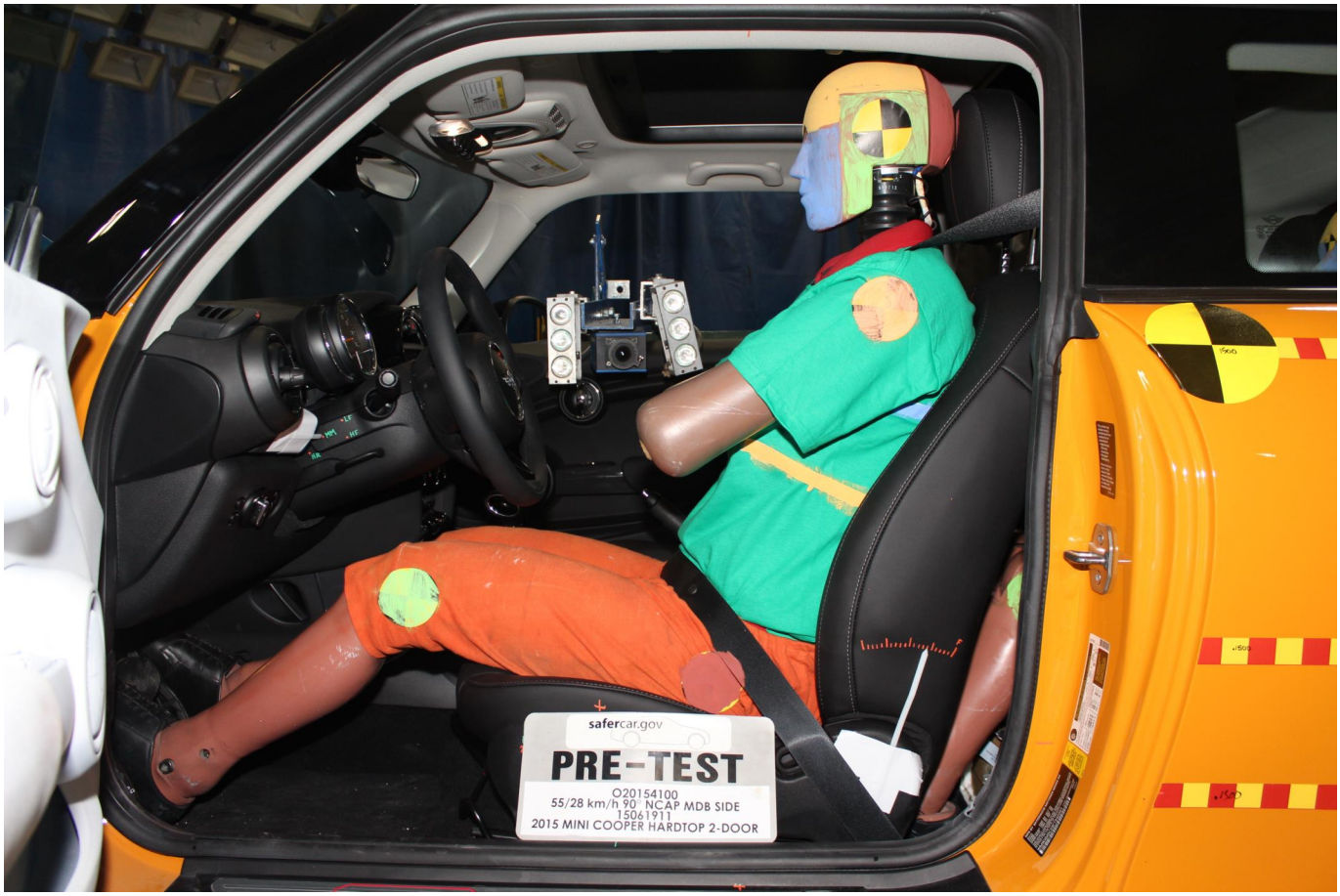


Photo No. 027 - Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking

Photo No. 028 - Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View

Photo No. 029 - Post-Test Left Side View of Driver Dummy Shoulder and Door Top View

Photo No. 030 - Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning

Photo No. 031 - Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint

Photo No. 032 - Pre-Test Frontal View of Driver Seat Pan Prior to Dummy Positioning

Photo No. 033 - Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan

Photo No. 034 - Pre-Test Placement of Driver Dummyûs Feet

Photo No. 035 - Pre-Test View of Belt Anchorage for Driver Dummy

Photo No. 036 - Pre-Test Left Side View of Steering Wheel

Photo No. 037 - Pre-Test View of Disengaged Parking Brake

Photo No. 038 - Pre-Test View of Parking Brake

Photo No. 039 - Pre-Test Close-Up Left Side View of Driver Seat Track

Photo No. 040 - Pre-Test Close-Up Left Side View of Driver Seat Back

Photo No. 041 - Pre-Test Close-Up View of Driver Seat Back or Head Restraint

Photo No. 042 - Pre-Test Driver Dummy and Door Clearance View

Photo No. 043 - Post-Test Driver Dummy and Door Clearance View

Photo No. 044 - Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment

Photo No. 045 - Post-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment

Photo No. 046 - Pre-Test Driver Inner Door Panel View

Photo No. 047 - Post-Test Driver Inner Door Panel View

Photo No. 048 - Post-Test Driver Dummy Close-up Head Contact with Vehicle Interior View

Photo No. 049 - Post-Test Driver Dummy Close-up Head Contact with Side Airbag View

Photo No. 050 - Post-Test Driver Dummy Close-up Torso Contact with Vehicle Interior View

Photo No. 051 - Post-Test Driver Dummy Close-up Torso Contact with Side Airbag View

Photo No. 052 - Post-Test Driver Dummy Close-up Pelvis Contact with Vehicle Interior View

Photo No. 053 - Post-Test Driver Dummy Close-up Pelvis Contact with Side Airbag View

Photo No. 054 - Post-Test Driver Dummy Close-up Knee Contact View

PHOTOGRAPH NOT APPLICABLE

Photo No. 055 - Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking

Photo No. 056 - Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View

Photo No. 057 - Post-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View

Photo No. 058 - Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning

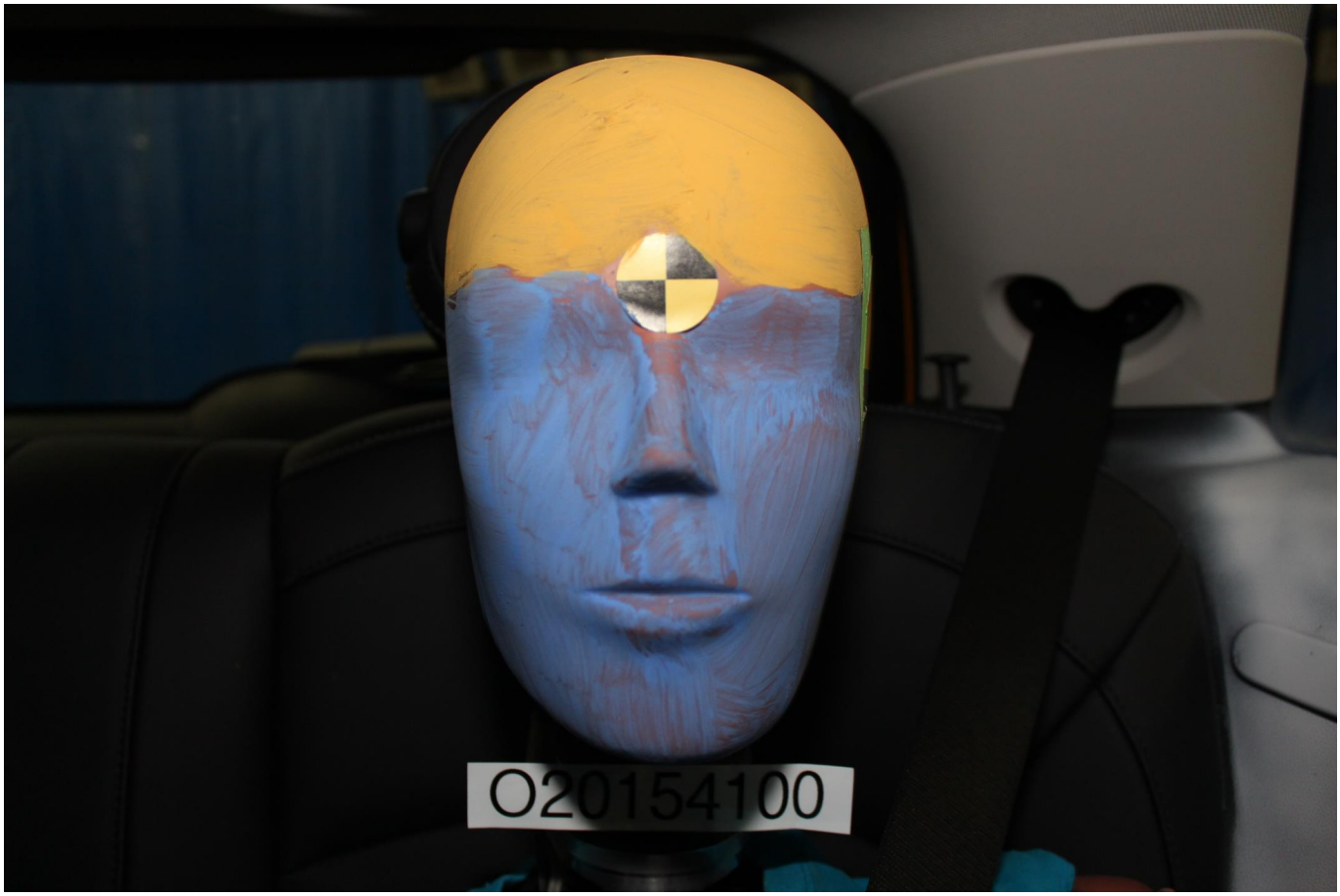


Photo No. 059 - Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head

Photo No. 060 - Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning

Photo No. 061 - Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan

Photo No. 062 - Pre-Test View of Rear Passenger Dummyís Neck Showing Position of Adjustable Neck

Photo No. 063 - Pre-Test View of Rear Passenger Dummyûs Head Showing Dummyûs Head is Level

Photo No. 064 - Pre-Test Placement of Rear Passenger Dummyûs Feet

Photo No. 065 - Pre-Test View of Belt Anchorage for Rear Passenger Dummy

PHOTOGRAPH NOT APPLICABLE

Photo No. 066 - Pre-Test Close-Up Left Side View of Rear Passenger Seat Track

PHOTOGRAPH NOT APPLICABLE

Photo No. 067 - Pre-Test Close-Up Left Side View of Rear Passenger Seat Back

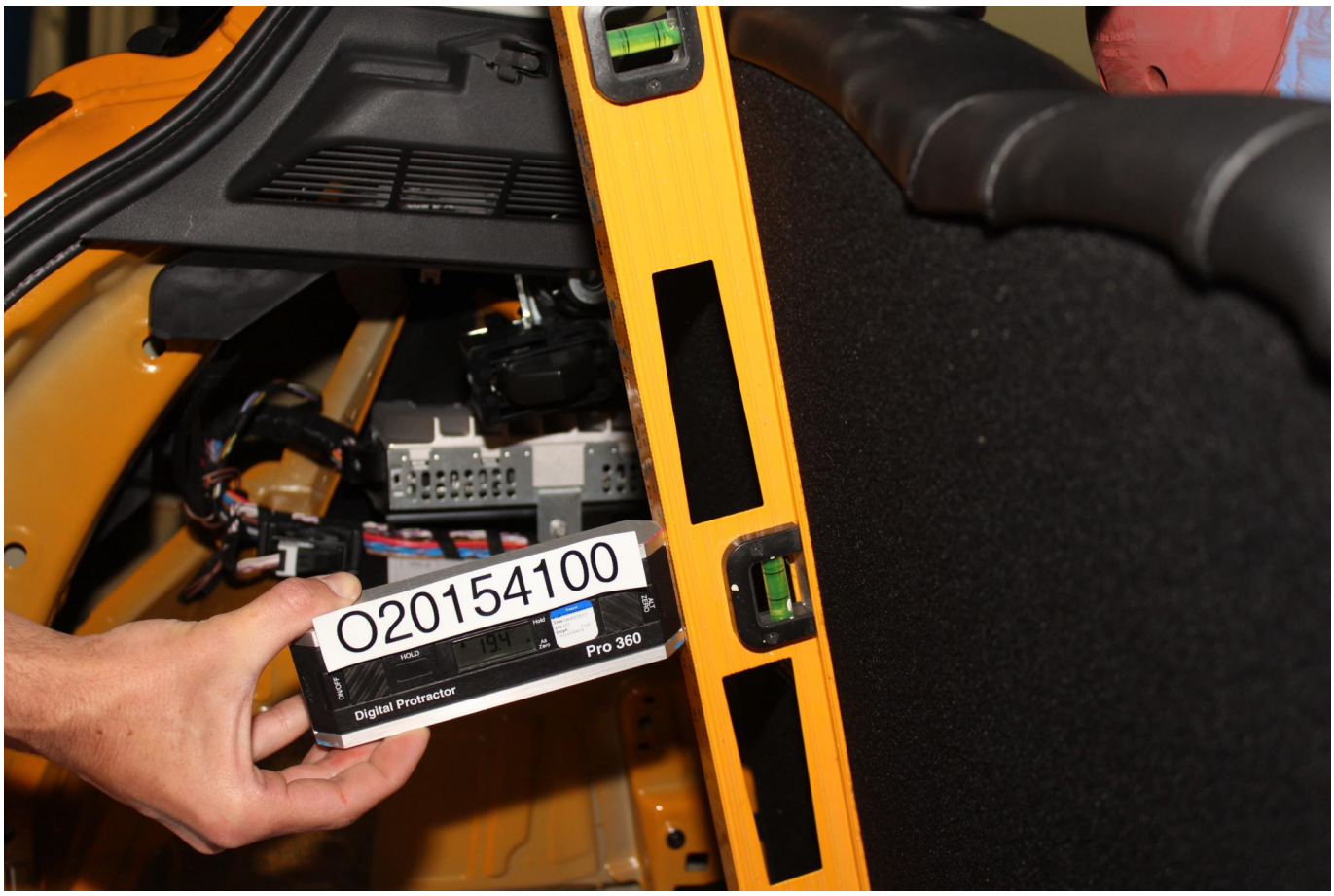


Photo No. 068 - Pre-Test Close-up View of Rear Passenger Seat Back or Head Restraint

Photo No. 069 - Pre-Test Rear Passenger Dummy and Door Clearance View

Photo No. 070 - Post-Test Rear Passenger Dummy and Door Clearance View

Photo No. 071 - Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant

Photo No. 072 - Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant

Photo No. 073 - Pre-Test Rear Passenger Inner Door Panel View

Photo No. 074 - Post-Test Rear Passenger Inner Door Panel View

Photo No. 075 - Post-Test Rear Passenger Dummy Close-up Head Contact with Vehicle Interior View

Photo No. 076 - Post-Test Rear Passenger Dummy Close-up Head Contact with Side Airbag View

Photo No. 077 - Post-Test Rear Passenger Dummy Close-up Torso Contact with Vehicle Interior View

PHOTOGRAPH NOT APPLICABLE

Photo No. 078 - Post-Test Rear Passenger Dummy Close-up Torso Contact with Side Airbag View

Photo No. 079 - Post-Test Rear Passenger Dummy Close-up Pelvis Contact with Vehicle Interior View

PHOTOGRAPH NOT APPLICABLE

Photo No. 080 - Post-Test Rear Passenger Dummy Close-up Pelvis Contact with Side Airbag View

Photo No. 081 - Post-Test Rear Passenger Dummy Close-up Knee Contact View

Photo No. 082 - Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

Photo No. 083 - Post-Test View of Fuel Filler Cap or Fuel Filler Neck

Photo No. 084 - Pre-Test Front View of MDB Impactor Face

Photo No. 085 - Post-Test Front View of MDB Impactor Face

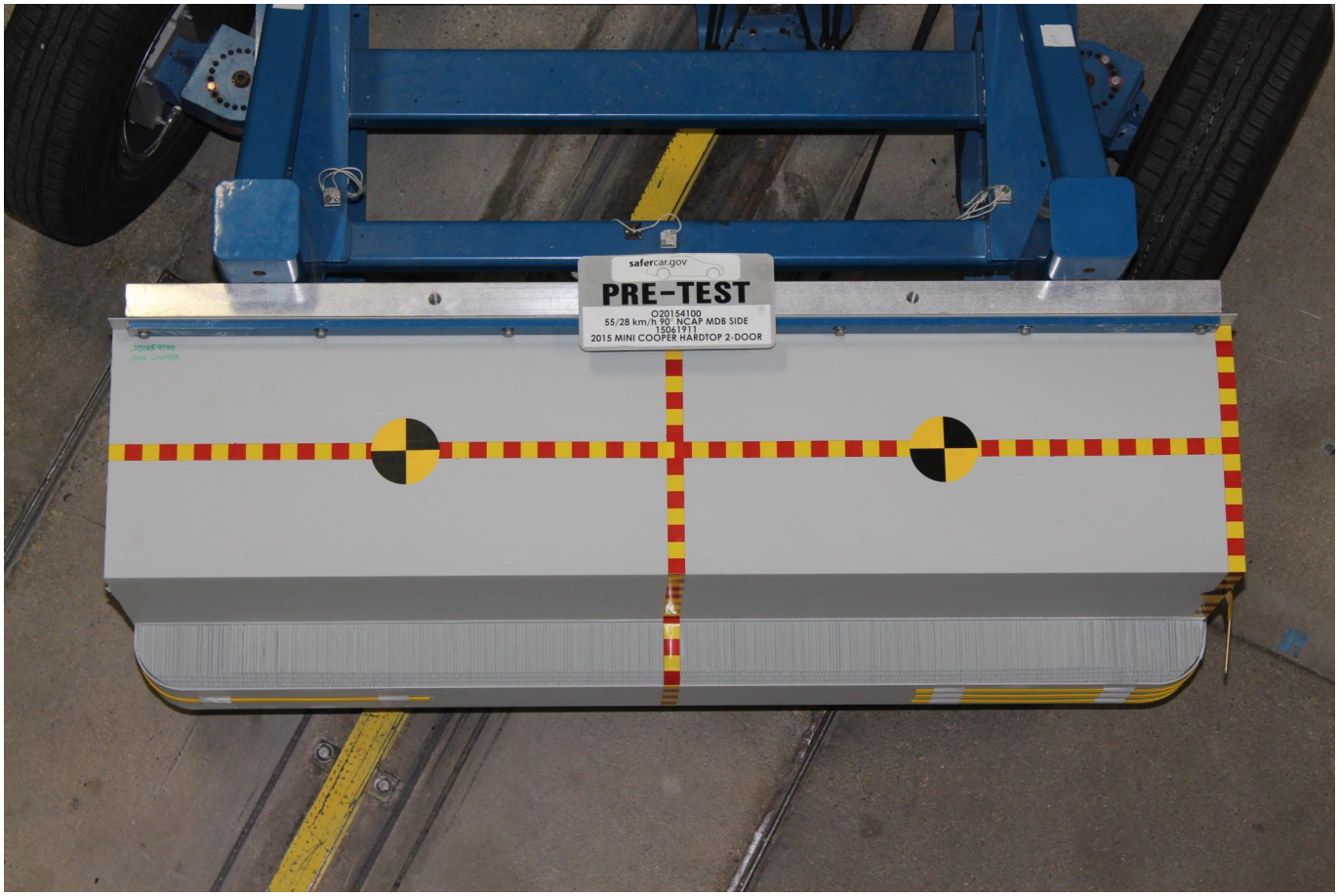


Photo No. 086 - Pre-Test Top View of MDB Impactor Face

Photo No. 087 - Post-Test Top View of MDB Impactor Face

Photo No. 088 - Pre-Test Left Side View of MDB Impactor Face

Photo No. 089 - Post-Test Left Side View of MDB Impactor Face

Photo No. 090 - Pre-Test Right Side View of MDB Impactor Face

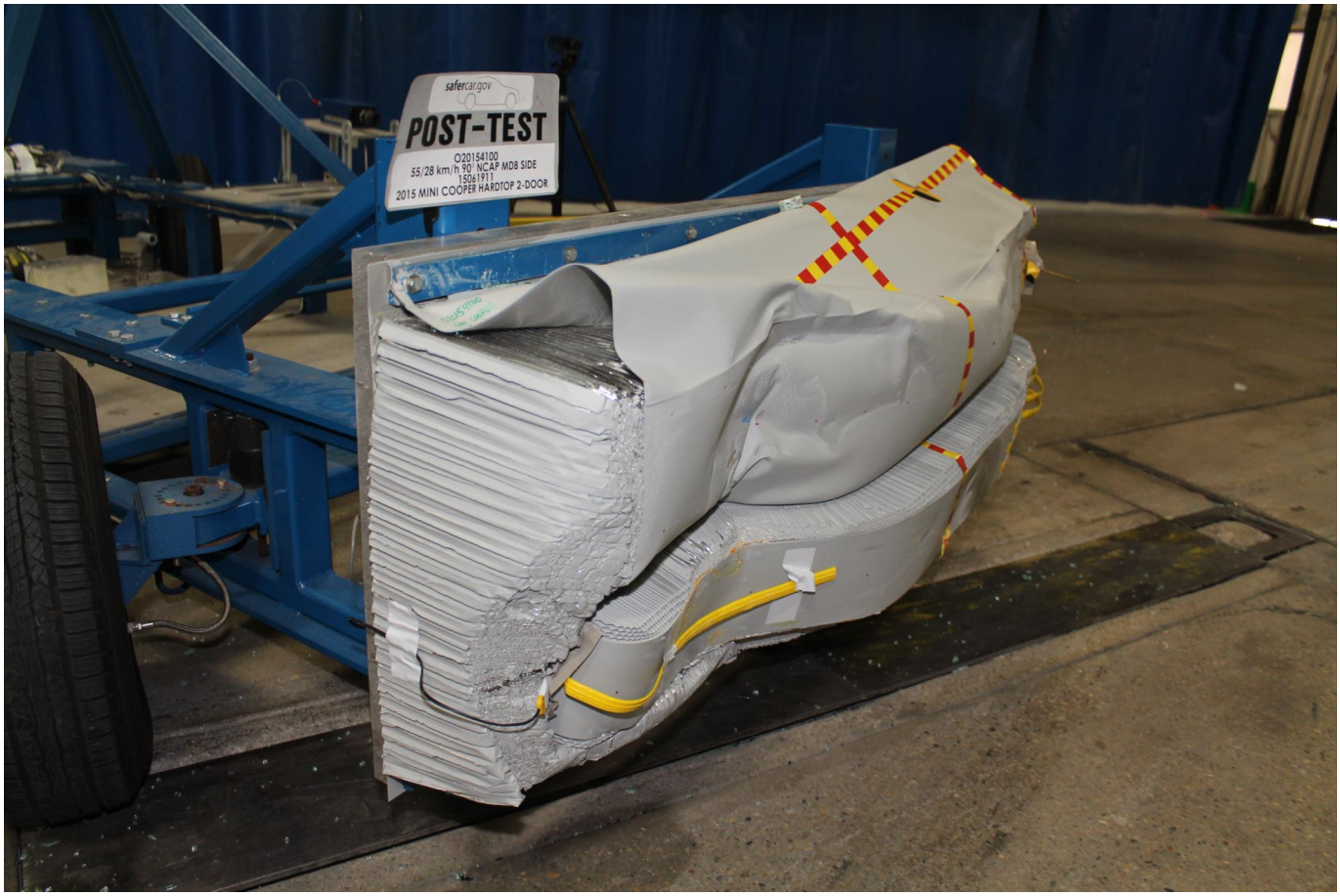


Photo No. 091 - Post-Test Right Side View of MDB Impactor Face

Photo No. 092 - Close-Up View of Vehicle's Certification Label

Photo No. 093 - Close-Up View of Vehicleês Tire Information Placard or Label

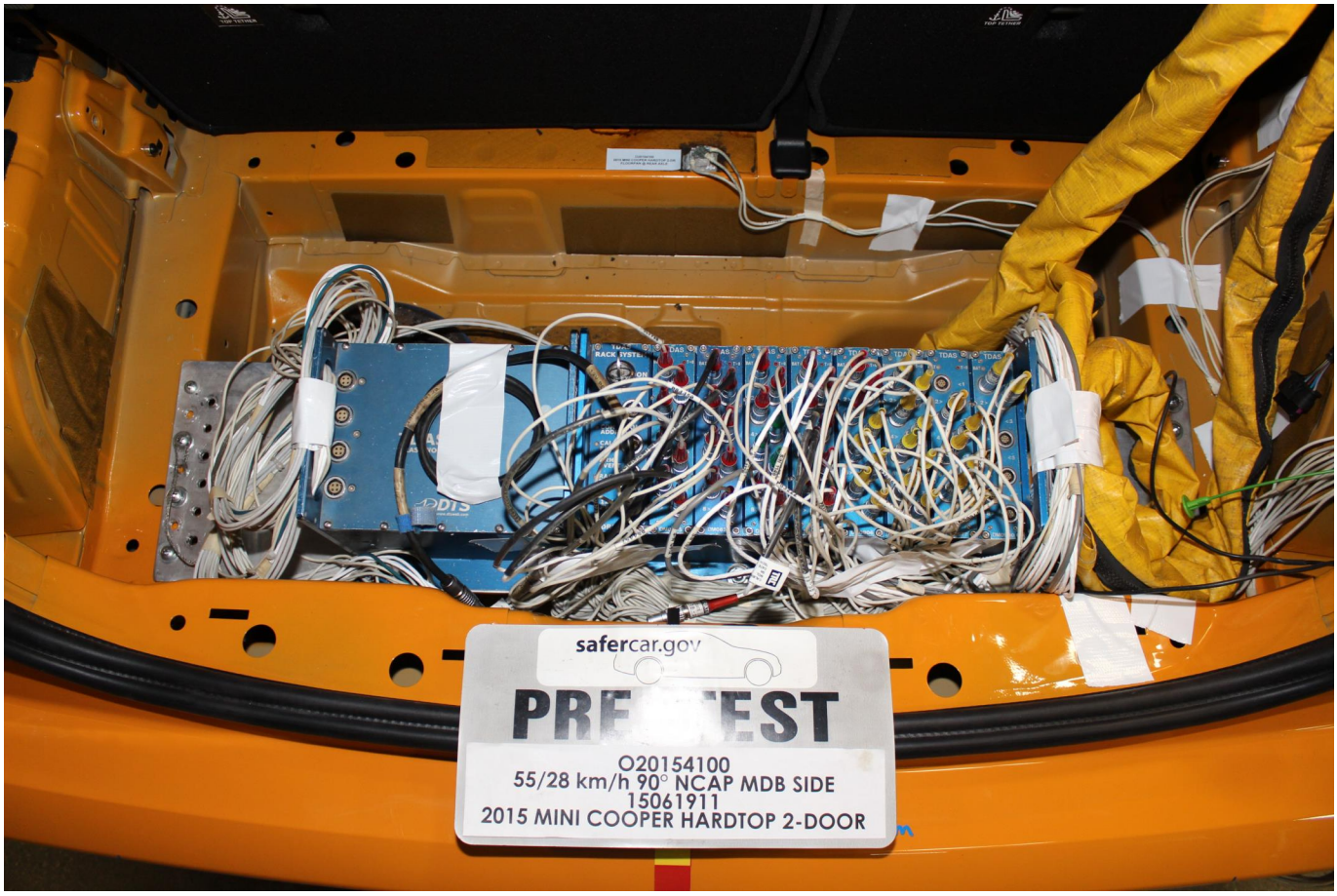


Photo No. 094 - Pre-Test Ballast View

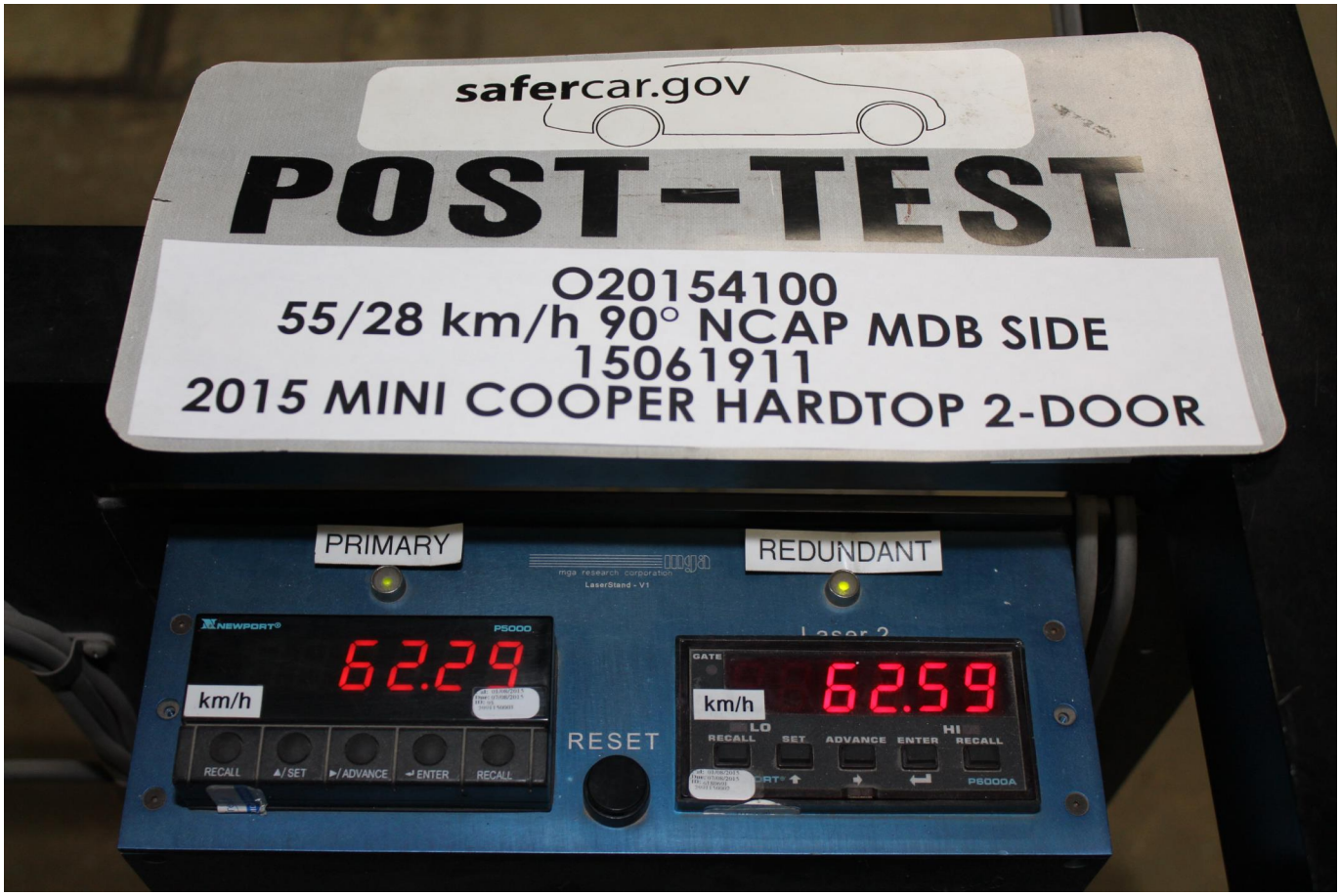


Photo No. 095 - Post-Test Primary and Redundant Speed Trap Read-Out

Photo No. 096 - FMVSS No. 301 Static Rollover 0 Degrees

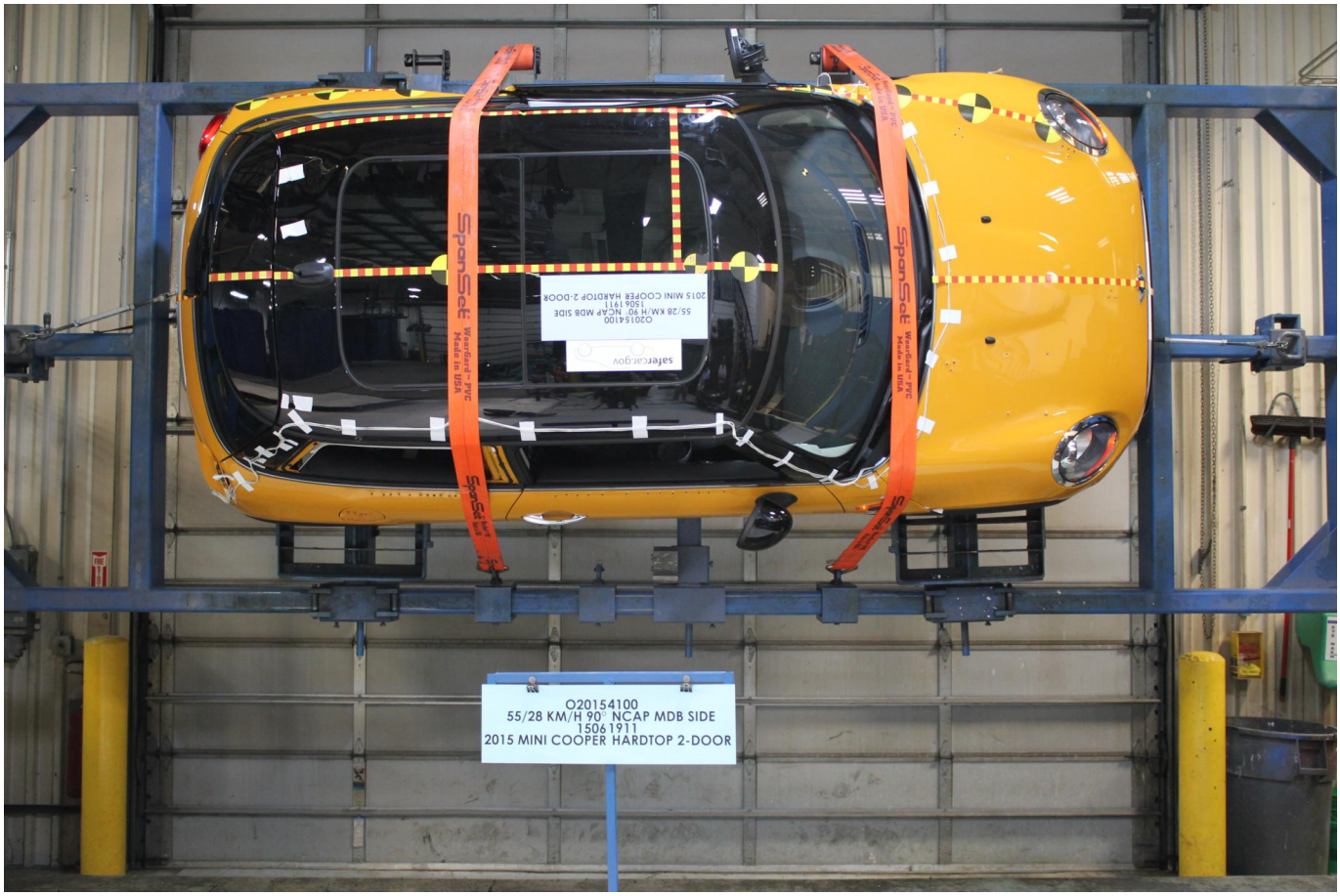


Photo No. 097 - FMVSS No. 301 Static Rollover 90 Degrees

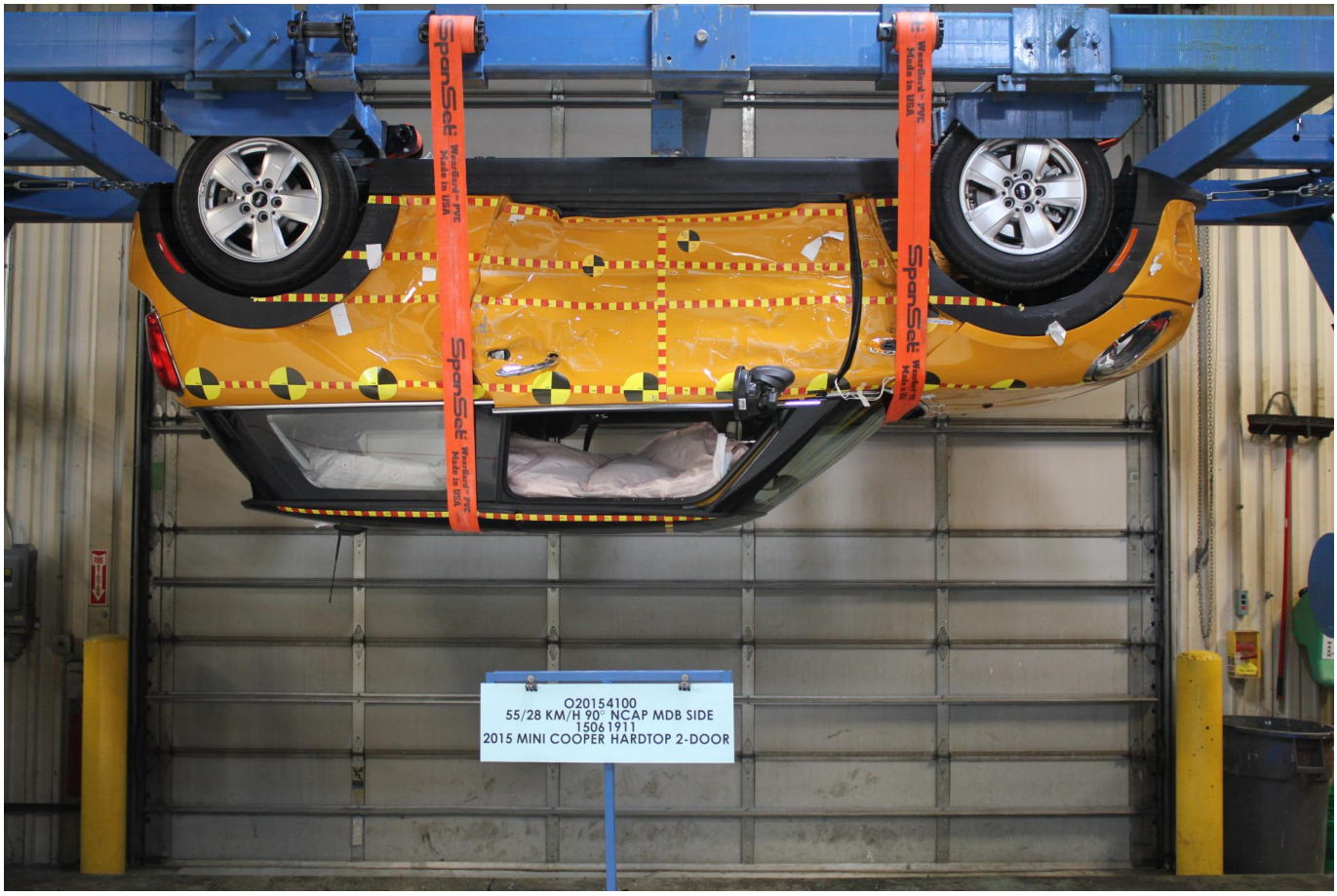


Photo No. 098 - FMVSS No. 301 Static Rollover 180 Degrees

Photo No. 099 - FMVSS No. 301 Static Rollover 270 Degrees

Photo No. 100 - FMVSS No. 301 Static Rollover 360 Degrees

Photo No. 101 - Impact Event

Photo No. 102 - Monroney Label

Height

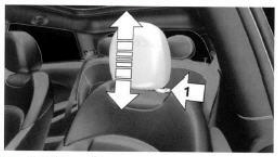
Adjust the head restraint so that its center is approximately at ear level.

Distance

Adjust the distance so that the head restraint is as close as possible to the back of the head.

If necessary, adjust the distance by adjusting the tilt of the backrest.

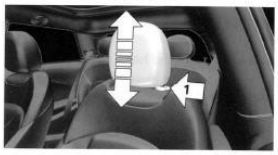
Adjusting the height



- To raise: pull.
- To lower: press button, arrow 1, and push headrest down.

Removing

Only remove the head restraint if no one will be sitting in the seat in question.



1. Pull head restraint up as far as possible.
2. Press button, arrow 1, and pull the head restraint out completely.

To remove the headrest, fold the backrest rearward if it is in the upright position.

Before transporting passengers

Reinstall the head restraint before transporting anyone in the seat; otherwise, the protective function of the head restraint is unavailable.◂

REAR HEAD RESTRAINTS

Correctly adjusted head restraint

A correctly adjusted head restraint reduces the risk of injury to cervical vertebrae in the event of an accident.

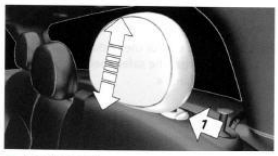
Adjusting the head restraint

Adjust the head restraints of all occupied seats properly; otherwise, there is an increased risk of injury in an accident.◂

Height

Adjust the head restraint so that its center is approximately at ear level.

Adjusting the height



- To raise: push.
- To lower: press button, arrow 1, and push headrest down.

Folding down head restraints

Extending/retracting head restraint

Only fold down head restraint if no passengers are in the rear. Fold out retracted headrests again if passengers are being carried

Hints

One person per safety belt

Never allow more than one person to wear a single safety belt. Never allow infants or small children to ride on a passenger's lap.◂

Putting on the belt

Lay the belt, without twisting, snugly across the lap and shoulders, as close to the body as possible. Make sure that the belt lies low around the hips in the lap area and does not press on the abdomen. Otherwise, the belt can slip over the hips in a frontal impact and injure the abdomen.

The safety belt must not lie across the neck, rub on sharp edges, be routed over breakable objects, or be pinched.◂

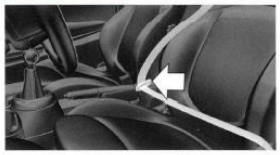
What reduces the restraining effect

Avoid wearing bulky clothing, and pull the shoulder belt periodically to readjust the tension. Make sure that the belt is not jammed; otherwise, the belt can be damaged and the restraining effect is reduced.◂

Using the middle safety belt

If the middle safety belt in the rear is used, the larger side of the backrest must be locked. Otherwise, the safety belt will not have a restraining effect.◂

Buckling the belt



Make sure you hear the latch plate engage in the belt buckle.

Unbuckling the belt

1. Hold the belt firmly.
2. Press the red button in the belt buckle.
3. Guide the belt back into its roll-up mechanism.

Safety belt reminder for driver's seat and front passenger seat

The indicator lamp lights up and a signal sounds. Make sure that the safety belts are positioned correctly. The safety belt reminder is active at speeds above approx. 6 mph/10 km/h. It can also be activated if objects are placed on the front passenger seat.

Damage to safety belts

Wear and tear after accidents or when damaged otherwise:

Have the safety belts, including the safety belt tensioners, replaced and have the belt anchors checked.

Check and replace safety belts

This should only be done by your service center; otherwise, this safety feature might not work properly.◂

FRONT HEAD RESTRAINTS

Correctly adjusted head restraint

A correctly adjusted head restraint reduces the risk of injury to cervical vertebrae in the event of an accident.

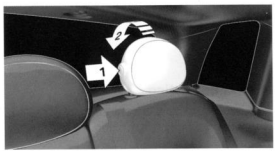
Adjust the headrest via the backrest tilt as needed.

Adjusting the head restraint

Adjust the head restraints of all occupied seats properly; otherwise, there is an increased risk of injury in an accident.◂

Photo No. 103 - Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

in the rear; otherwise, there is increased risk of injury in the event of an accident.◂

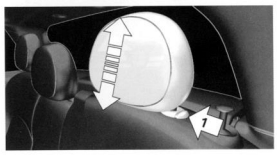


- To lower flaps: press the button, arrow 1, and press down the head restraint.
- Fold back up: pull up head restraints.

Removing

Only remove the head restraint if no one will be sitting in the seat in question.

Fold the seat down, refer to page 145, before removing the head restraint, otherwise the head restraint cannot be removed.



1. Pull head restraint up against the resistance.
2. Press button, arrow 1, and pull the head restraint out completely.

Before transporting passengers

Reinstall the head restraint before transporting anyone in the seat; otherwise, the protective function of the head restraint is unavailable.◂

MIRRORS

Exterior mirrors

General information

The mirror on the passenger side is more curved than the driver's side mirror.

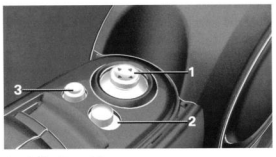
Depending on the vehicle equipment, the mirror setting is stored for the profile currently in use. When the vehicle is unlocked via the remote control, the position is automatically retrieved if this function is active.

Note

Estimating distances correctly

Objects reflected in the mirror are closer than they appear. Do not estimate the distance to the traffic behind you based on what you see in the mirror, as this will increase your risk of an accident.◂

Overview



1 Adjusting 54
2 Left/right, Automatic Curb Monitor
3 Fold in and out 54

Selecting a mirror

To change over to the other mirror: Slide the switch.

Photo No. 103a - Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

APPENDIX B
DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS
Driver Dummy Instrumentation Plots

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

Additional Driver & Passenger Dummy Instrumentation Data

Passenger Head Angular Velocity (X)

Passenger Head Angular Velocity (Y)

Passenger Head Angular Velocity (Z)

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 Track 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)

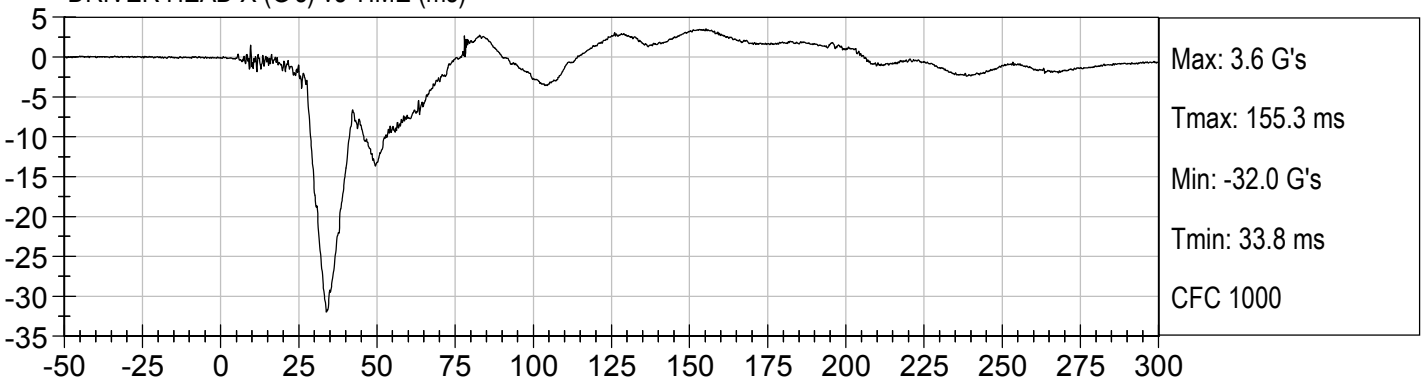
MDB Rear Acceleration (X)

MDB Rear Acceleration (Y)

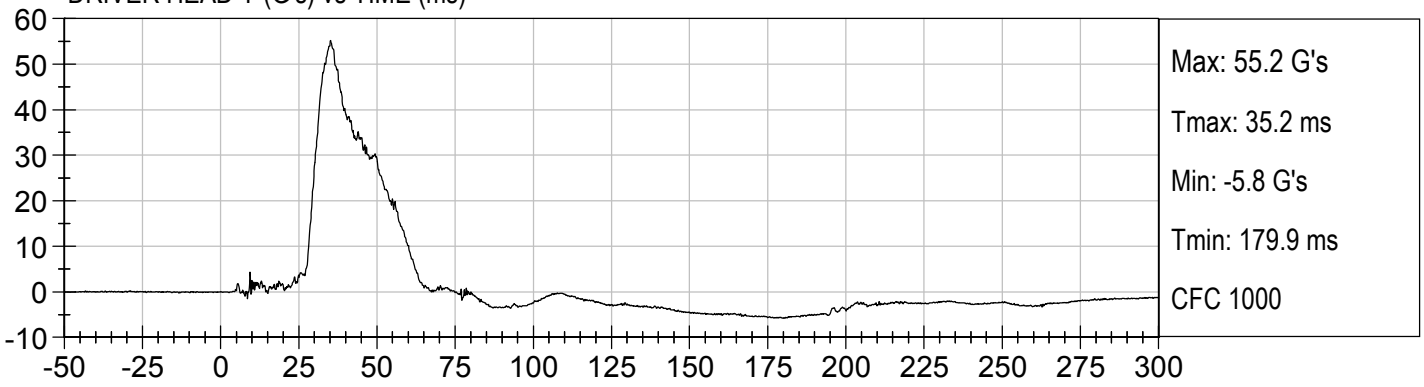
Left MDB Contact Switch

Right MDB Contact Switch

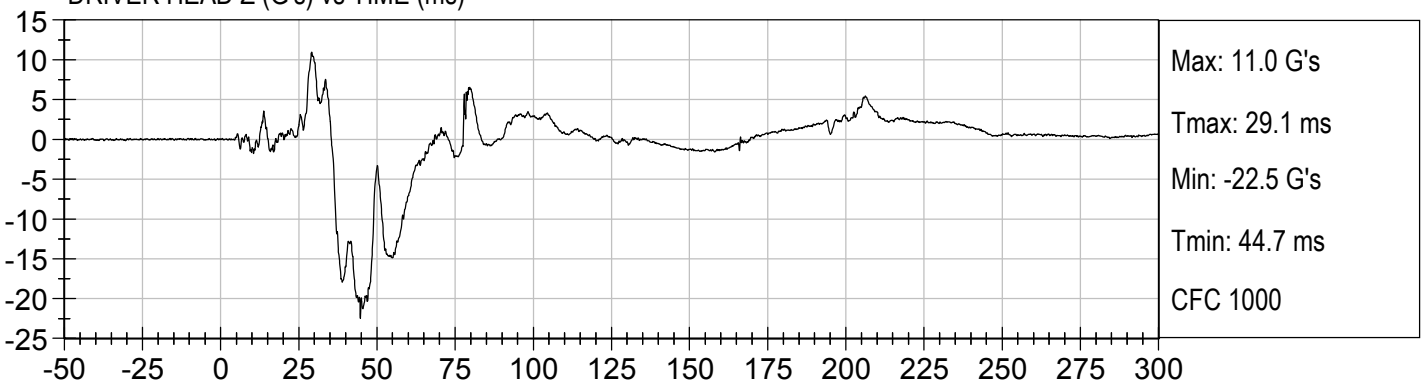
DRIVER HEAD X (G's) vs TIME (ms)



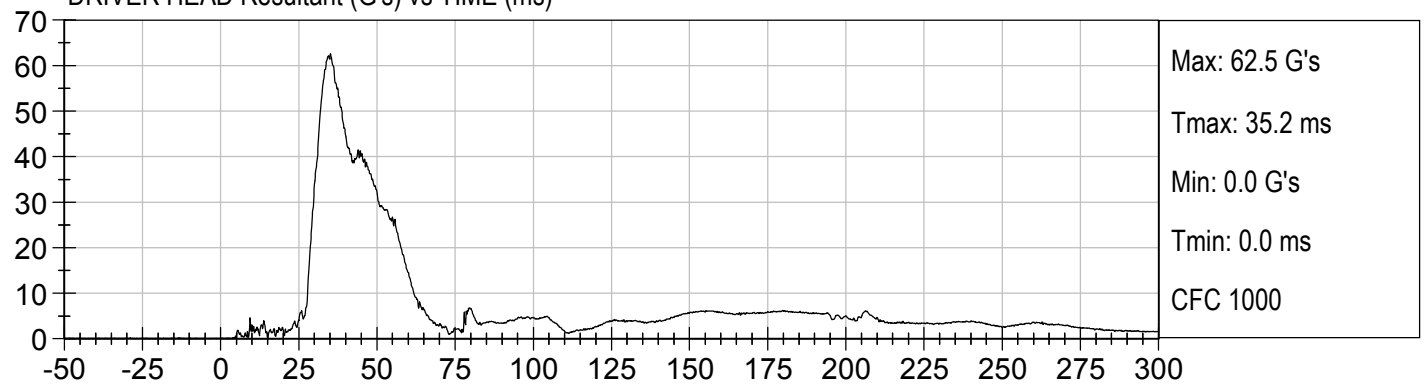
DRIVER HEAD Y (G's) vs TIME (ms)



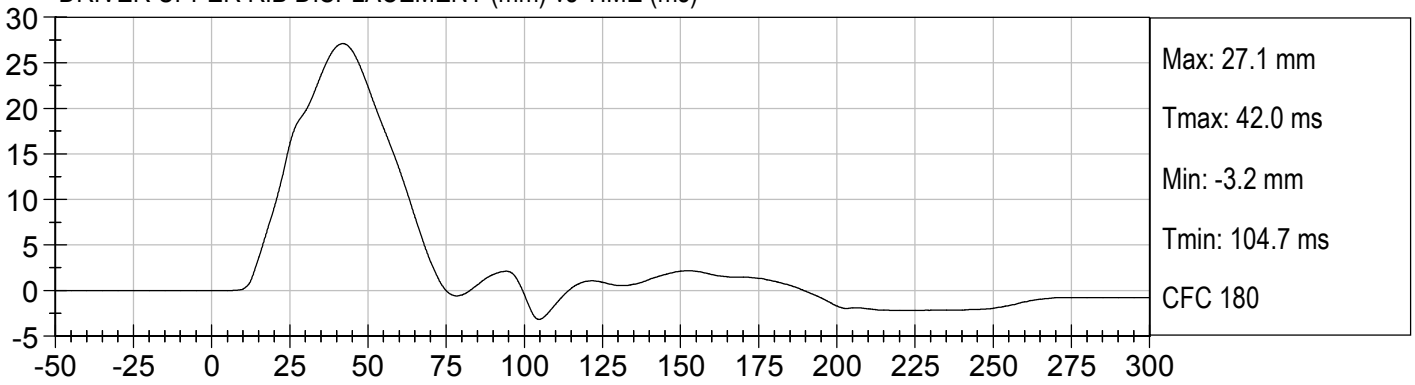
DRIVER HEAD Z (G's) vs TIME (ms)



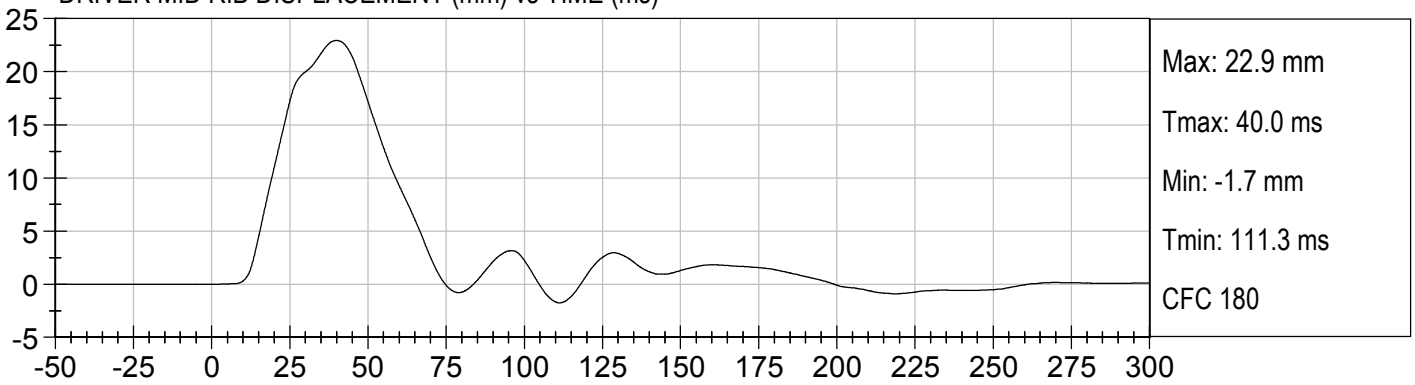
DRIVER HEAD Resultant (G's) vs TIME (ms)



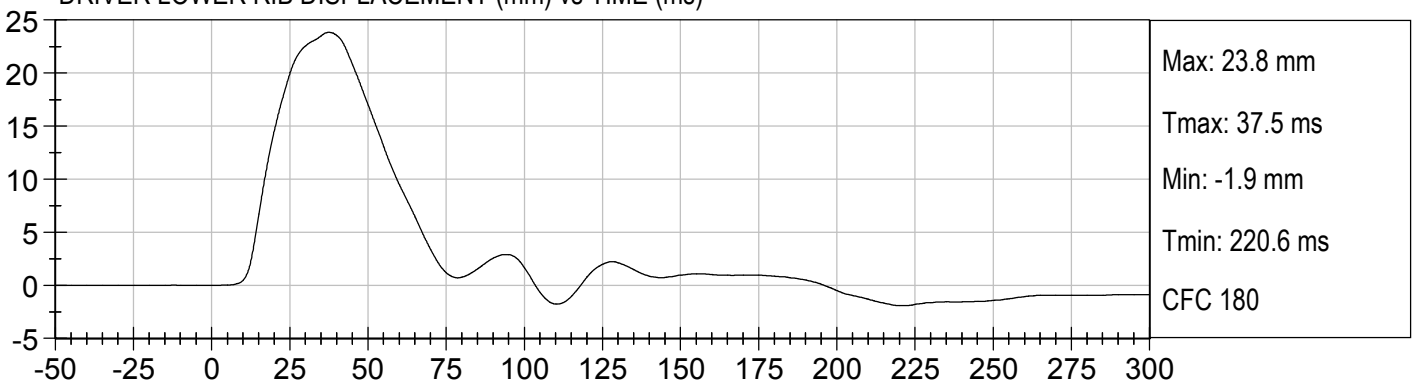
DRIVER UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



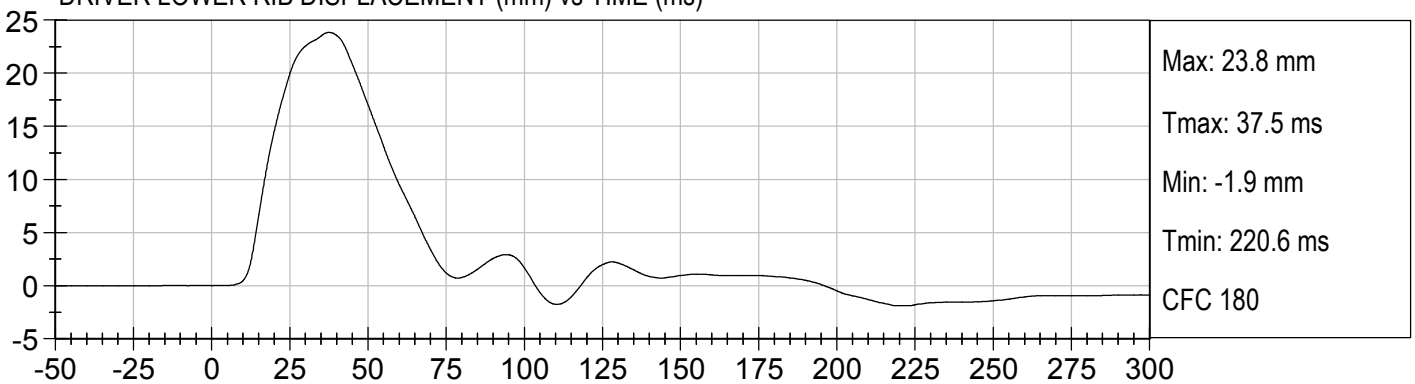
DRIVER MID RIB DISPLACEMENT (mm) vs TIME (ms)



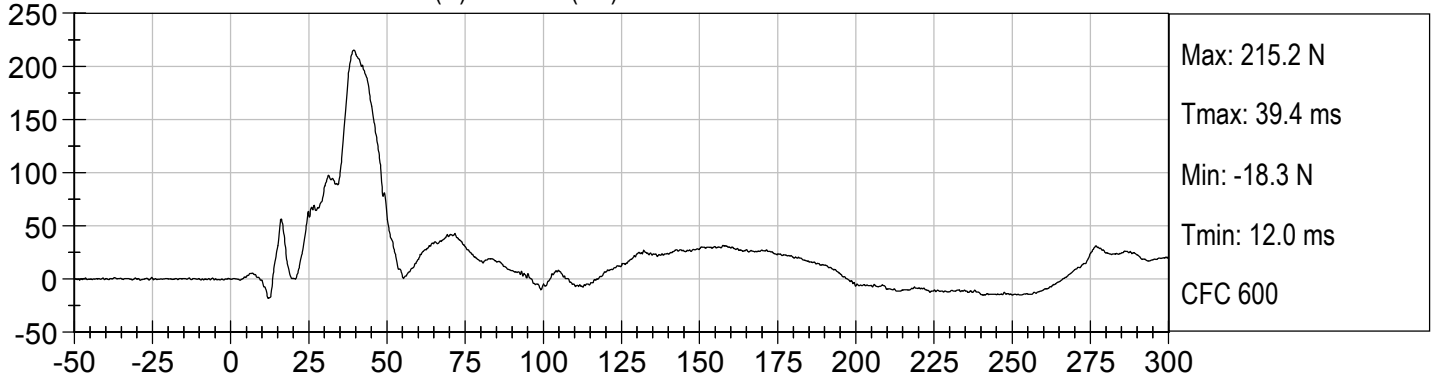
DRIVER LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



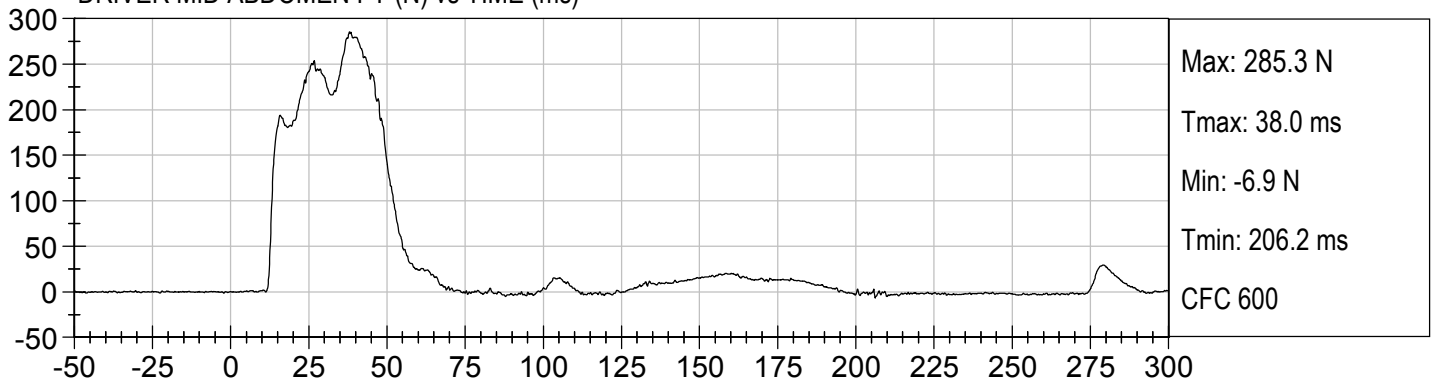
DRIVER LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



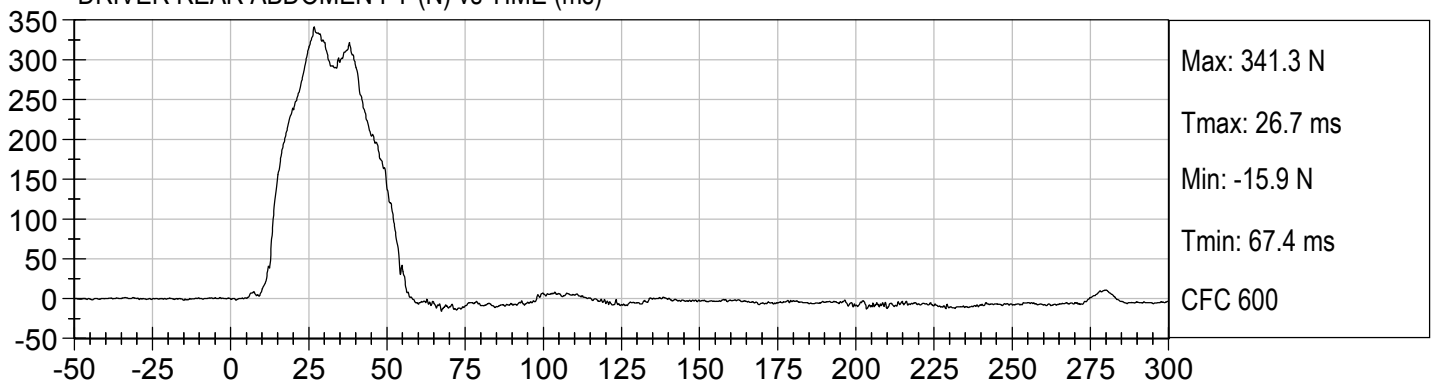
DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)



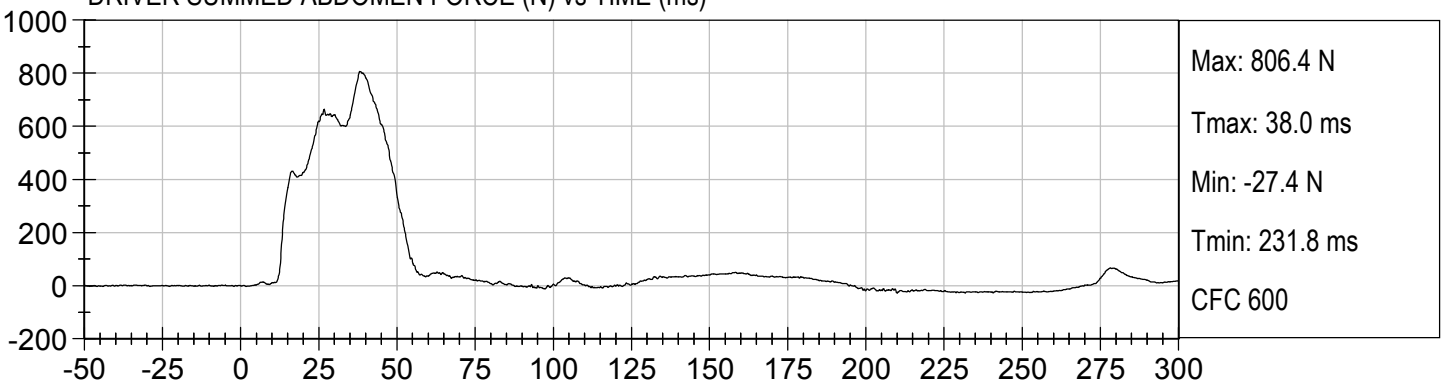
DRIVER MID ABDOMEN FY (N) vs TIME (ms)



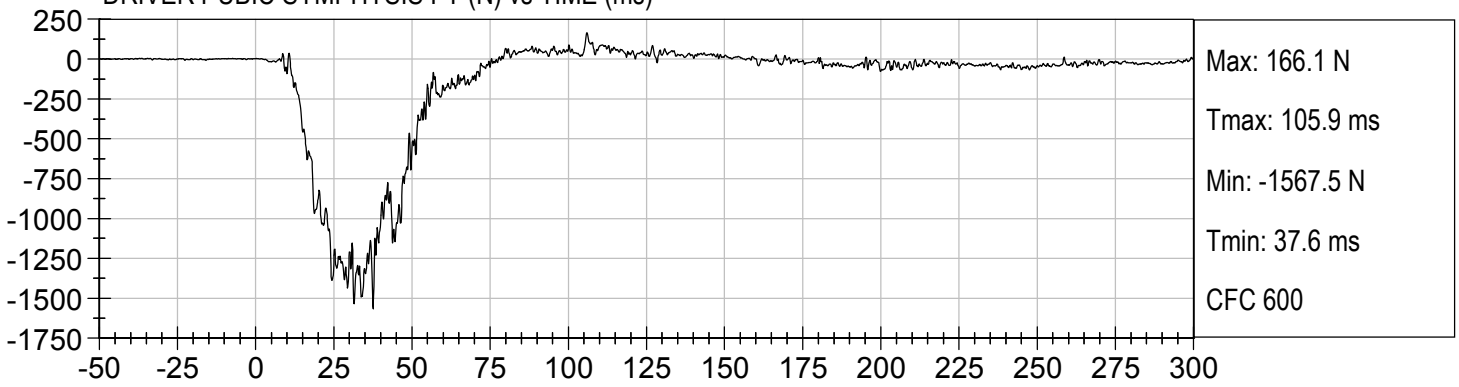
DRIVER REAR ABDOMEN FY (N) vs TIME (ms)



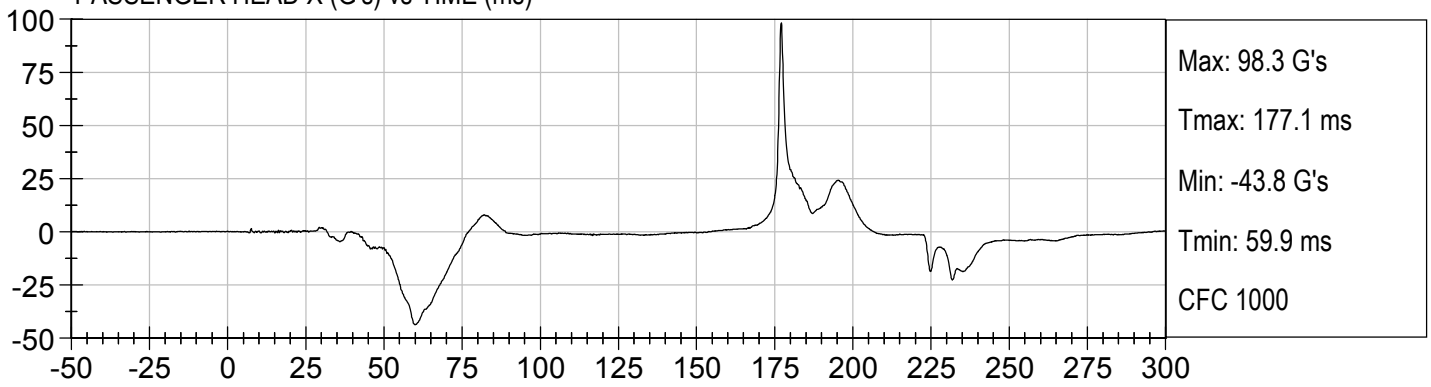
DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)



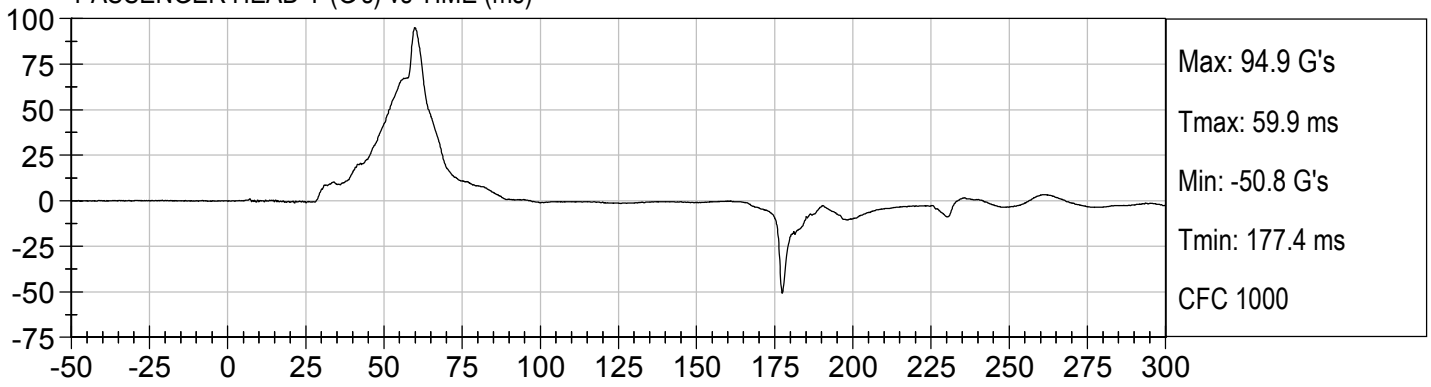
DRIVER PUBIC SYMPHYSIS FY (N) vs TIME (ms)



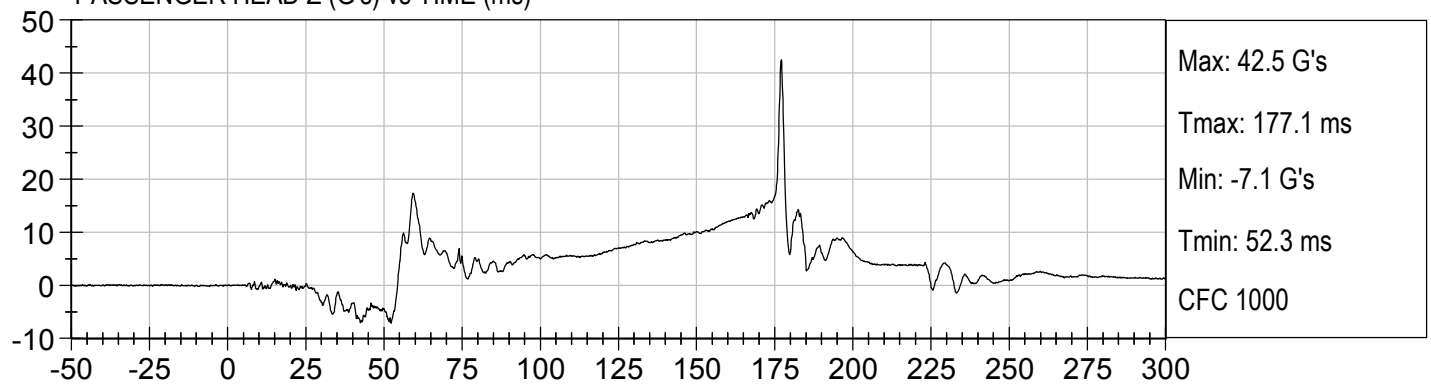
PASSENGER HEAD X (G's) vs TIME (ms)



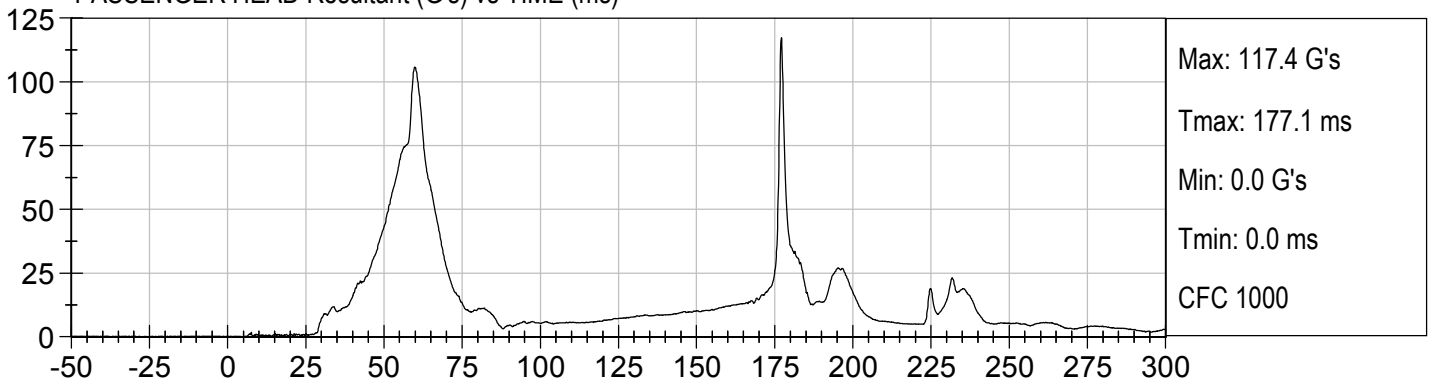
PASSENGER HEAD Y (G's) vs TIME (ms)



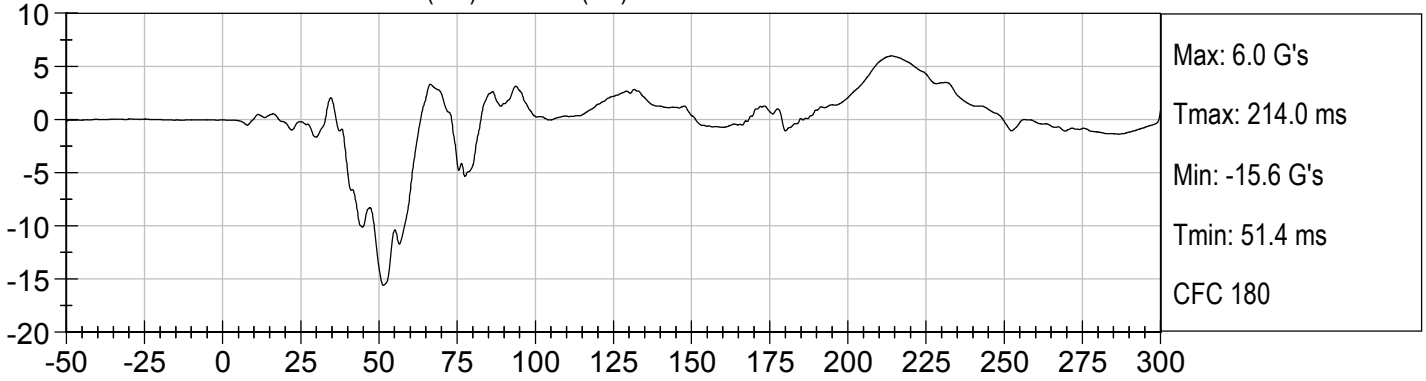
PASSENGER HEAD Z (G's) vs TIME (ms)



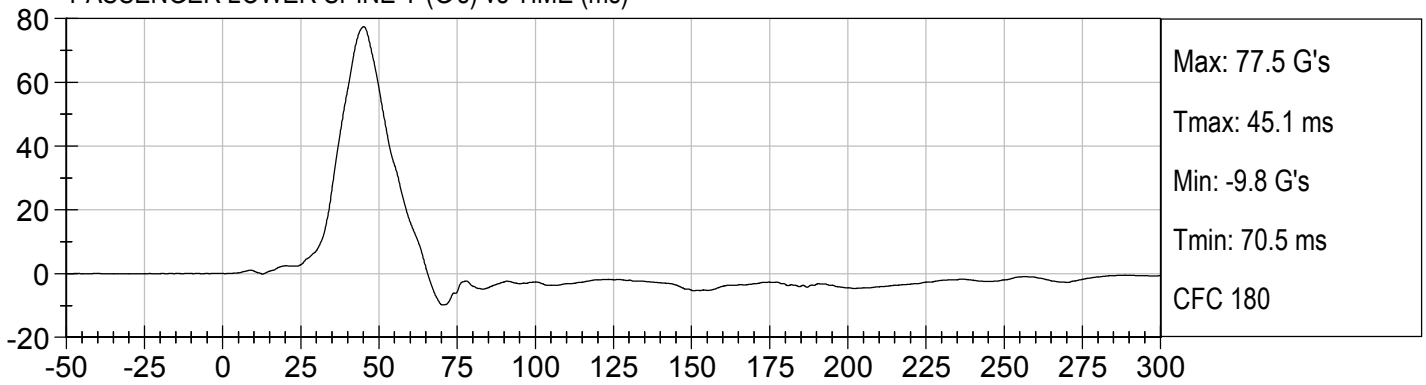
PASSENGER HEAD Resultant (G's) vs TIME (ms)



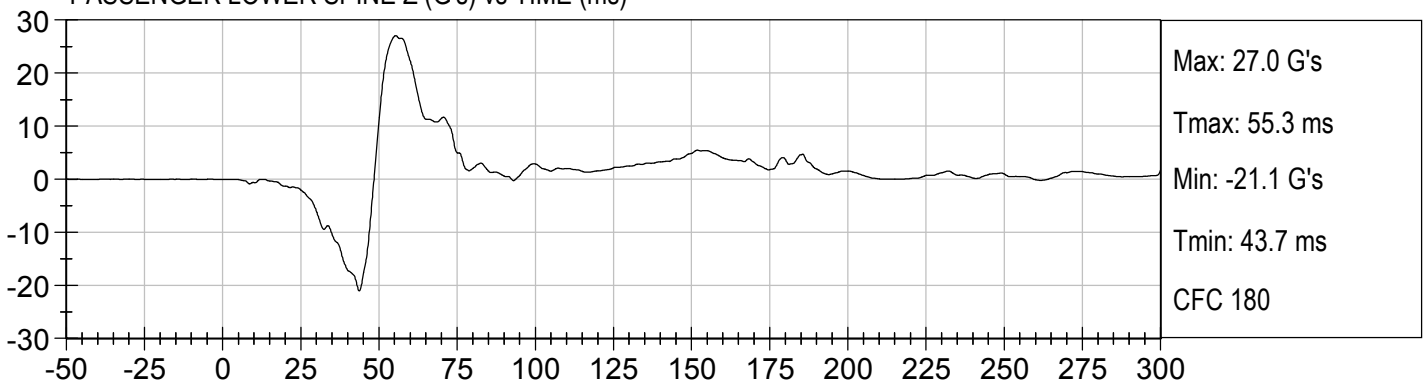
PASSENGER LOWER SPINE X (G's) vs TIME (ms)



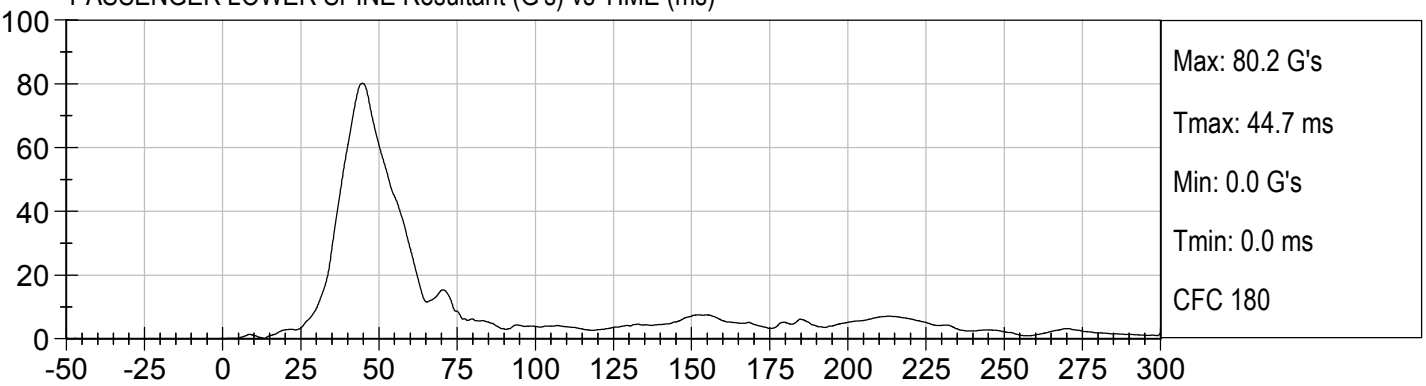
PASSENGER LOWER SPINE Y (G's) vs TIME (ms)



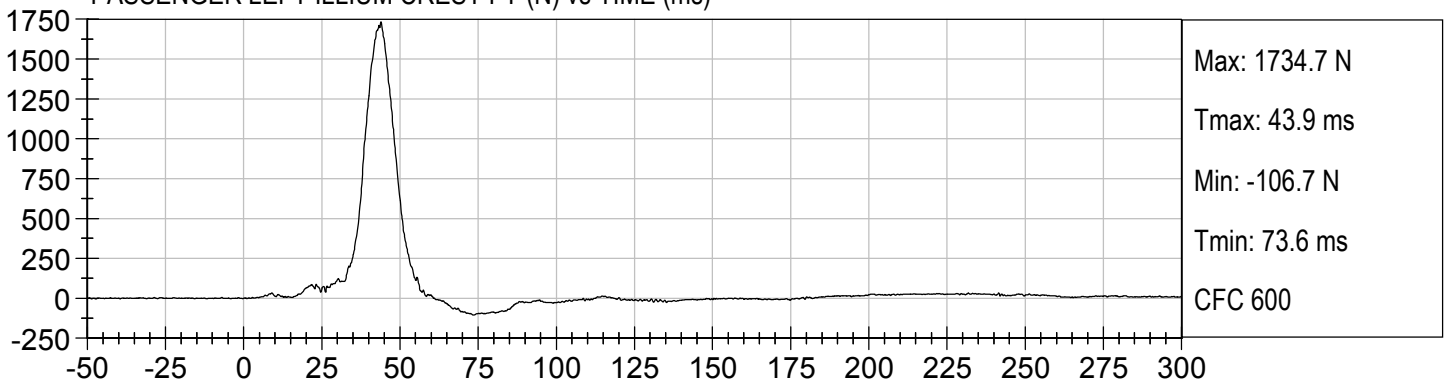
PASSENGER LOWER SPINE Z (G's) vs TIME (ms)



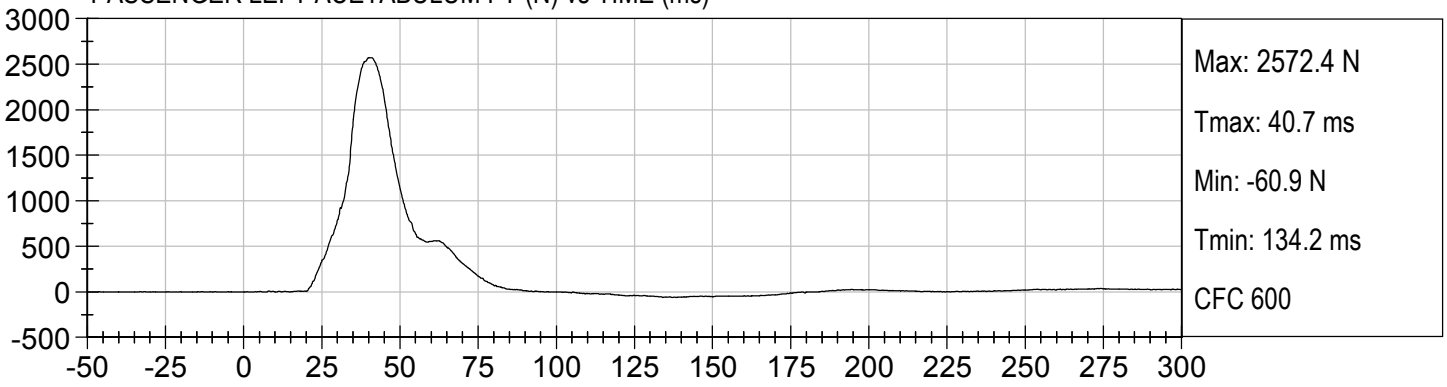
PASSENGER LOWER SPINE Resultant (G's) vs TIME (ms)



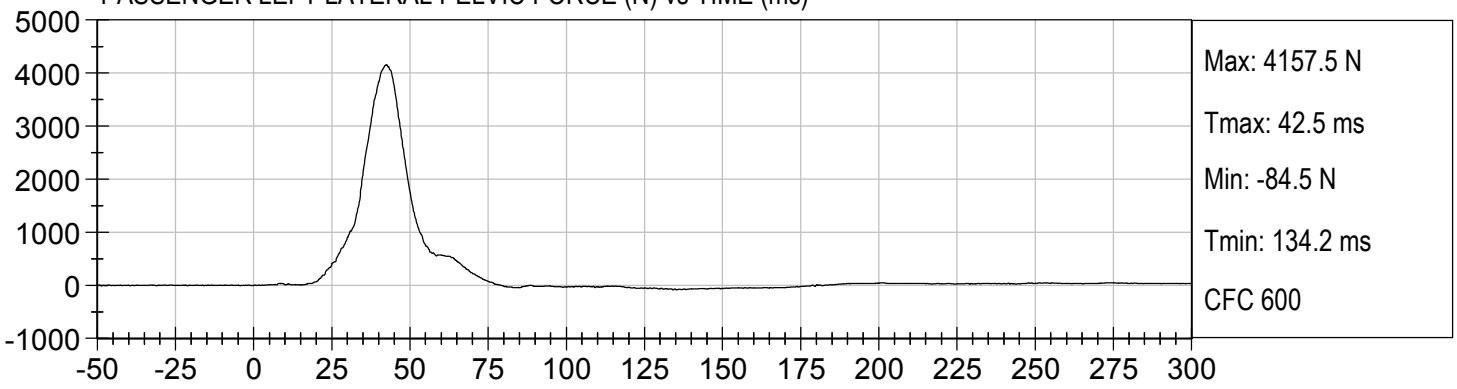
PASSENGER LEFT ILLIUM CREST FY (N) vs TIME (ms)



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



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



APPENDIX C
DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

ES-2re External Measurements
SN: 032

No.	Name	Spec. (mm)	Result	Pass/Fail
1	Sitting Height	900 - 918	915	Pass
2	Seat to Shoulder Joint	558 - 572	568	Pass
3	Seat to Lower Face of Thoracic Spine Box	346 - 356	355	Pass
4	Seat to Hip Joint (center of bolt)	97 - 103	98	Pass
5	Sole to Seat, Sitting	333 - 451	440	Pass
6	Head Width	152 - 158	157	Pass
7	Shoulder/Arm Width	461 - 479	464	Pass
8	Thorax Width	322 - 332	323	Pass
9	Abdomen Width	273 - 287	281	Pass
10	Pelvis Lap Width	359 - 373	370	Pass
11	Head Depth	196 - 206	203	Pass
12	Thorax Depth	262 - 272	264	Pass
13	Abdomen Depth	194 - 204	196	Pass
14	Pelvis Depth	235 - 245	236	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150 - 160	151	Pass
16	Back of Buttocks to Front Knee	597 - 615	607	Pass

MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 032 **Test ID:** D151781

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Peak Resultant Acceleration	G's	125 to 155	131	Pass
Peak Longitudinal Acceleration	G's	<= +/- 15.0	-6.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

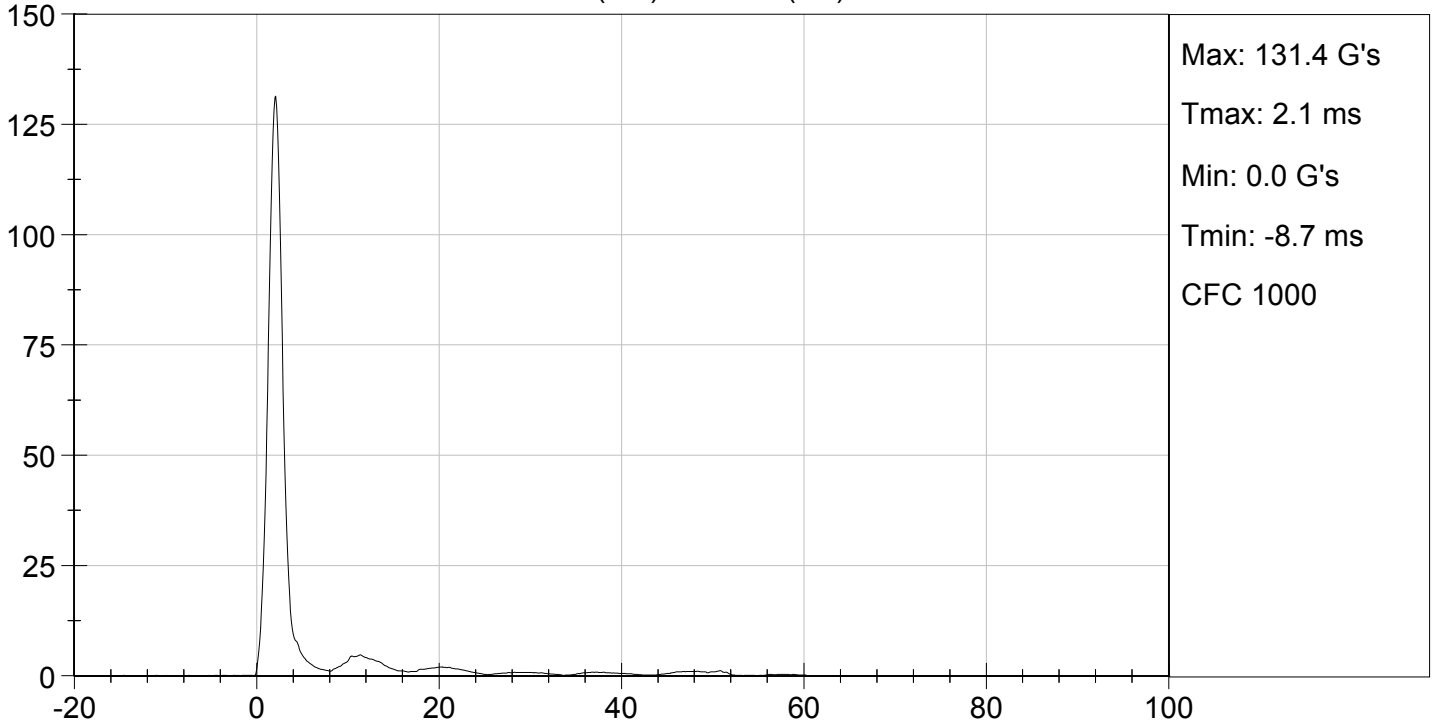
06/17/2015
Test Date

Jessica Hall
Approved By

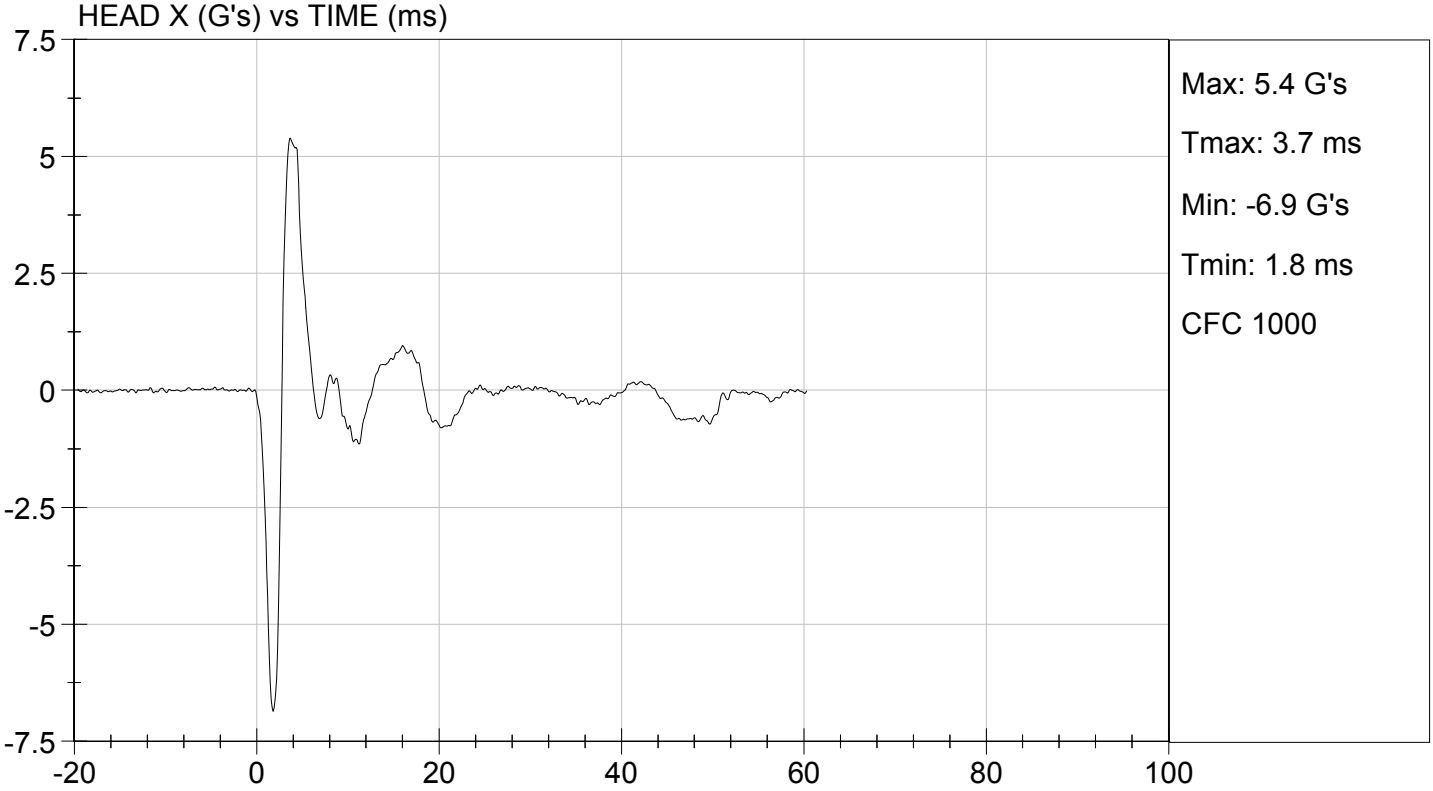
TEST DESC: HEAD DROP

TEST DATE: 06/17/2015
TEST #: D151781

HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)

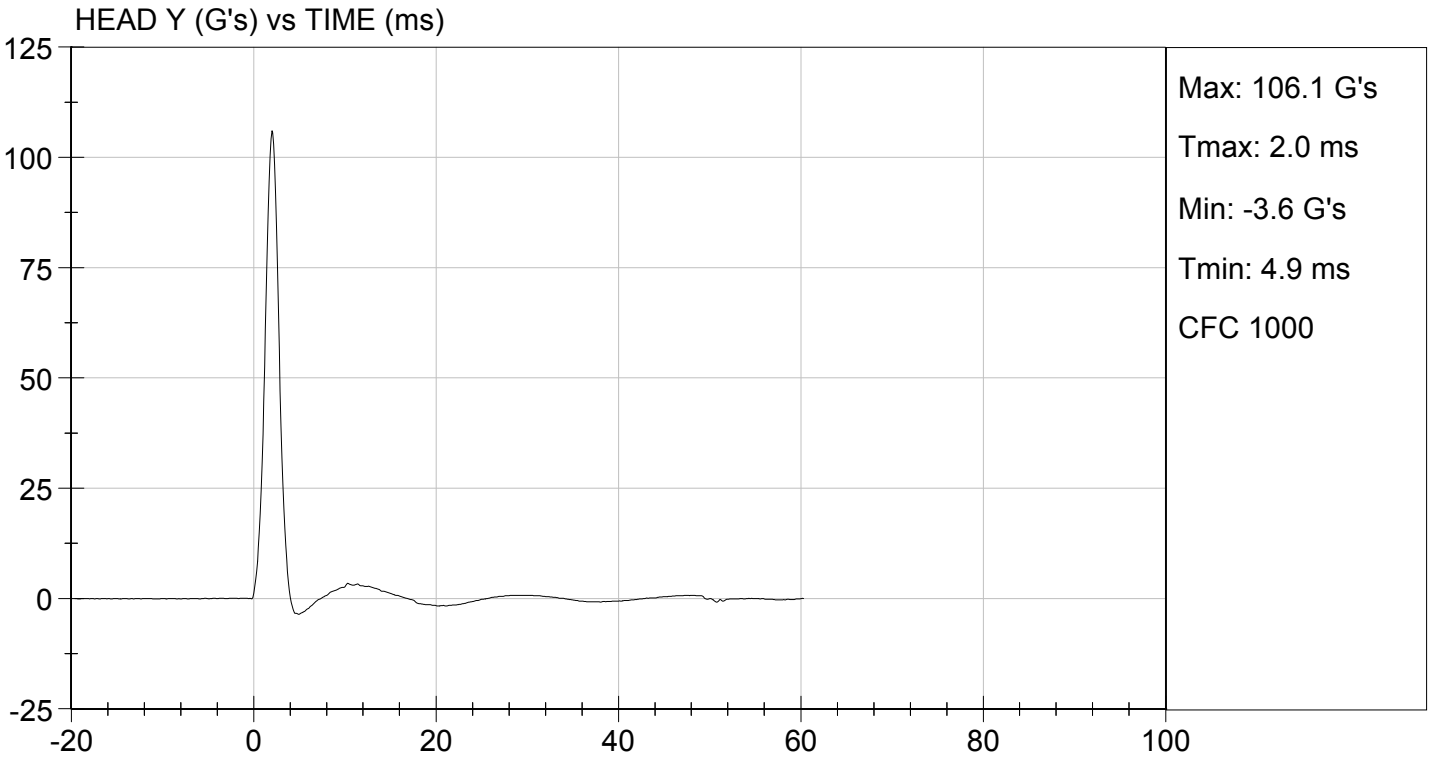


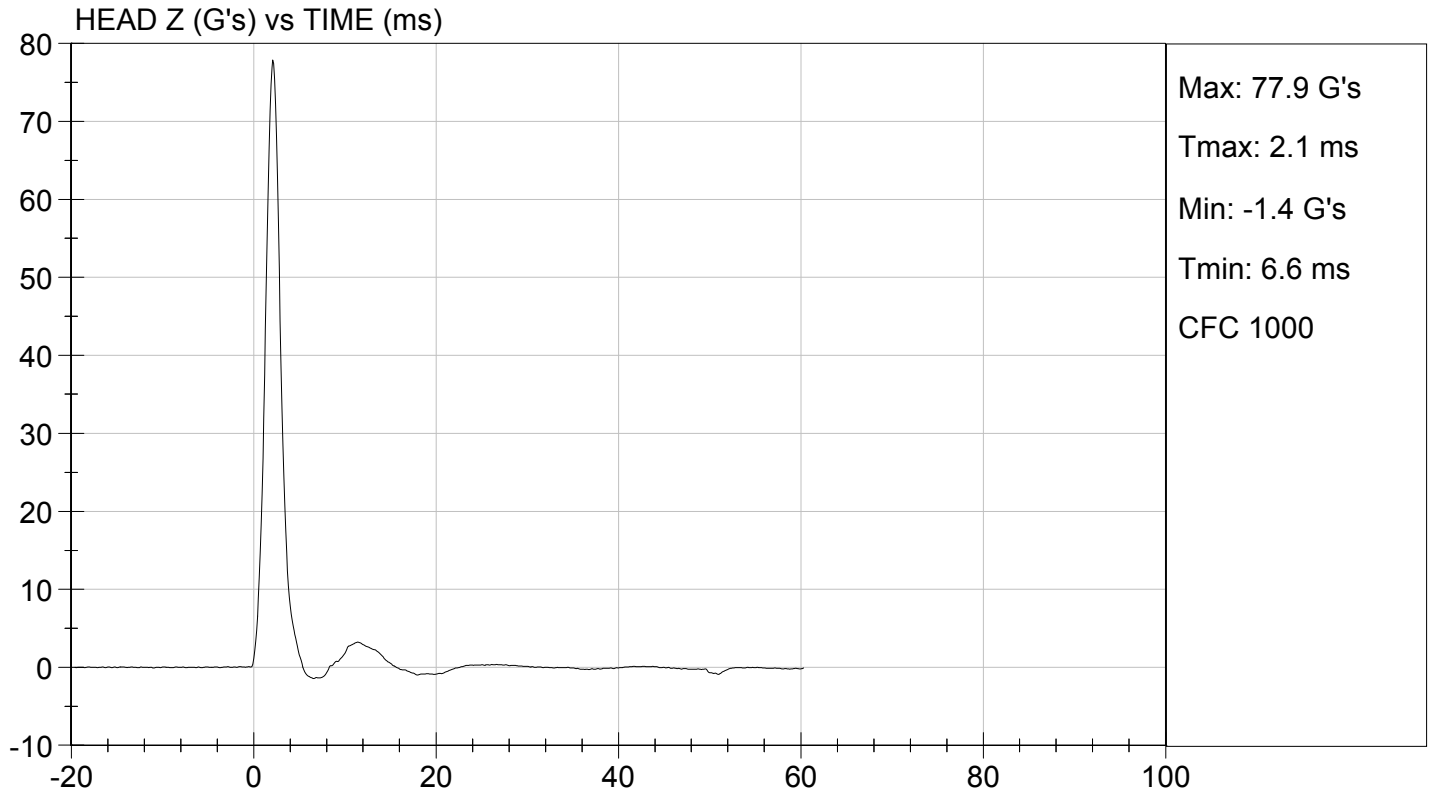
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 06/17/2015
TEST #: D151781





MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151782

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Speed		m/s	3.30 to 3.50	3.34	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.02	Pass
	3 ms	m/s	-0.25 to -0.375	-0.32	Pass
	14 ms	m/s	-3.20 to -3.70	-3.31	Pass
	17 ms	m/s	>= -3.70	-3.54	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	49.1	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	59.1	Pass
Head Rotation Decay Time to 0 Degree		ms	53.0 to 88.0	57.7	Pass
			Overall Results		Pass

Jack Coleman
Laboratory Technician

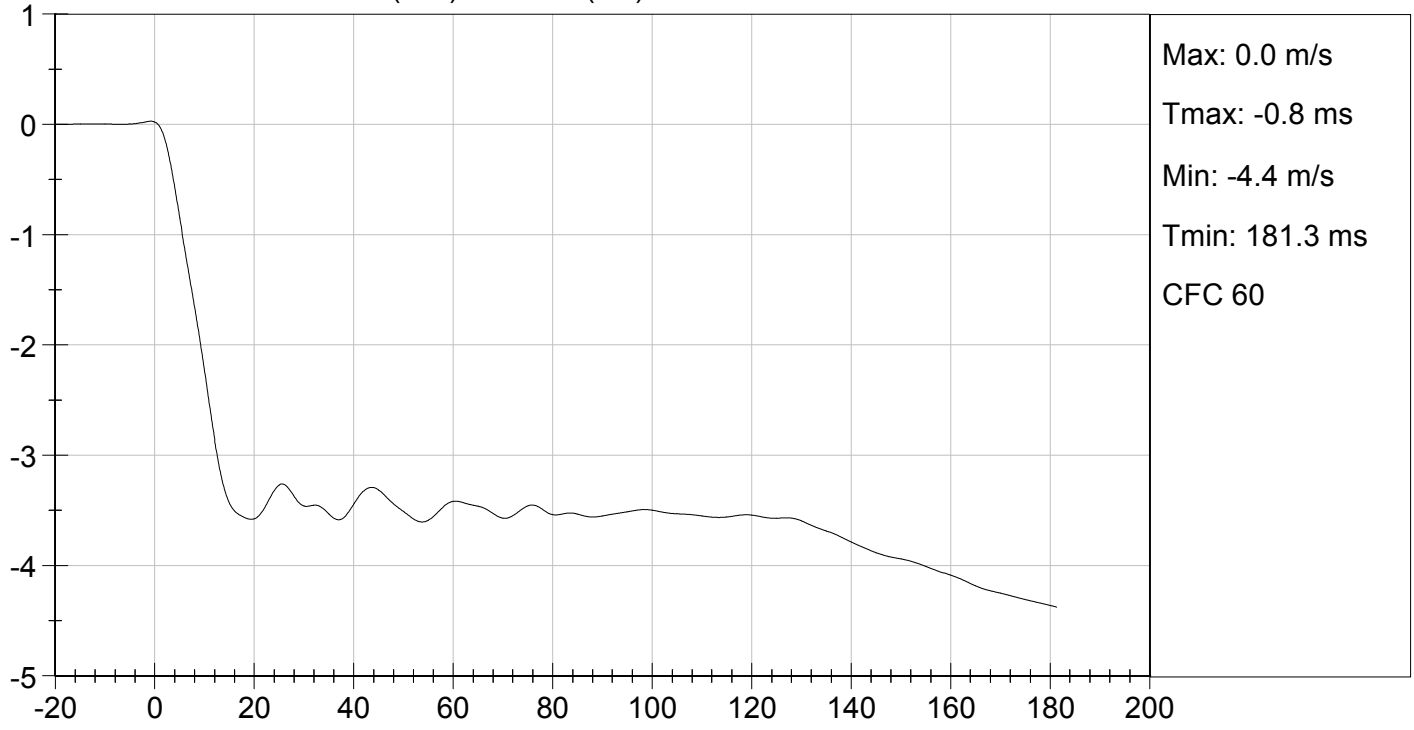
06/17/2015
Test Date

Jessica Gall
Approved By

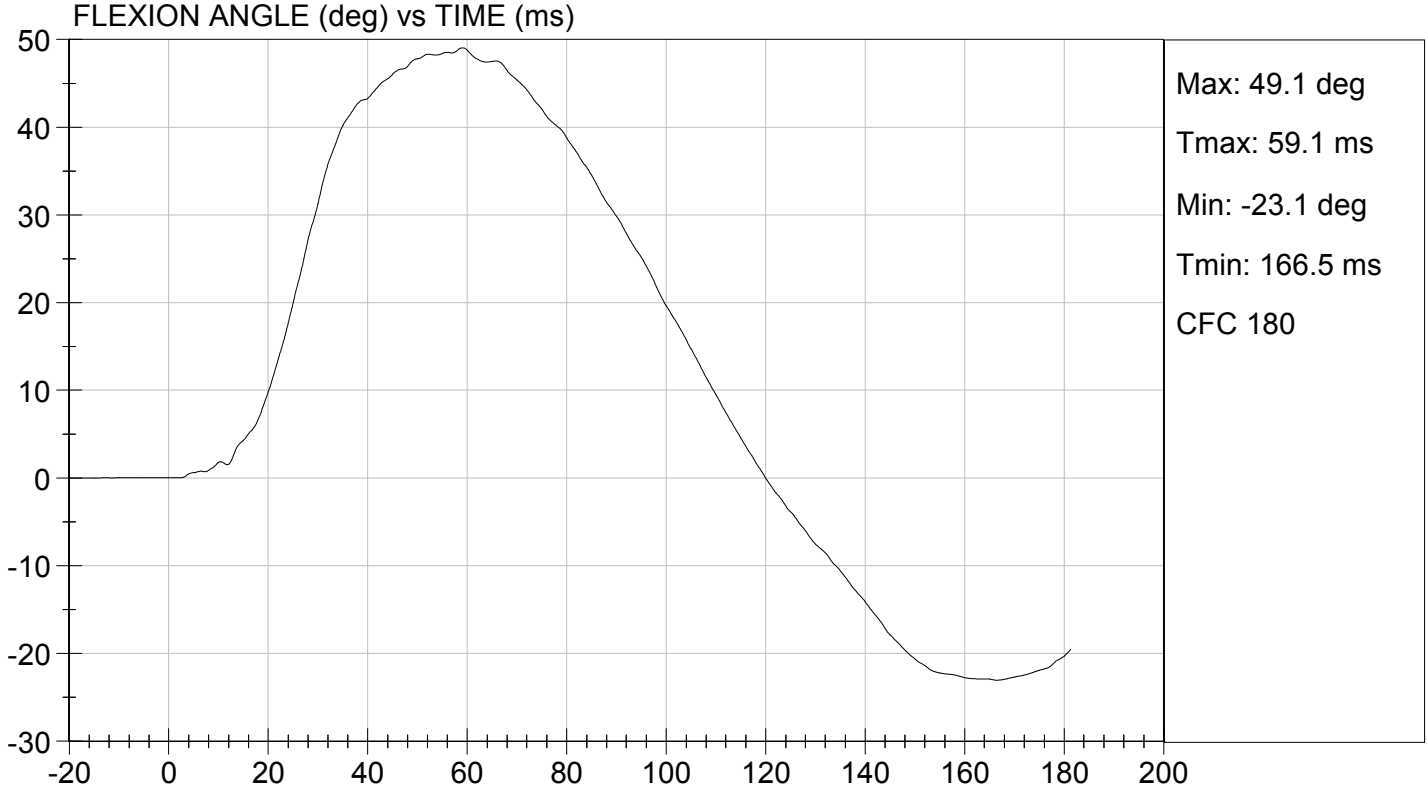
TEST DESC: NECK BENDING
VELOCITY: 10.96 ft/s, 3.34 m/s

TEST DATE: 06/17/2015
TEST #: D151782

PENDULUM VELOCITY (m/s) vs TIME (ms)



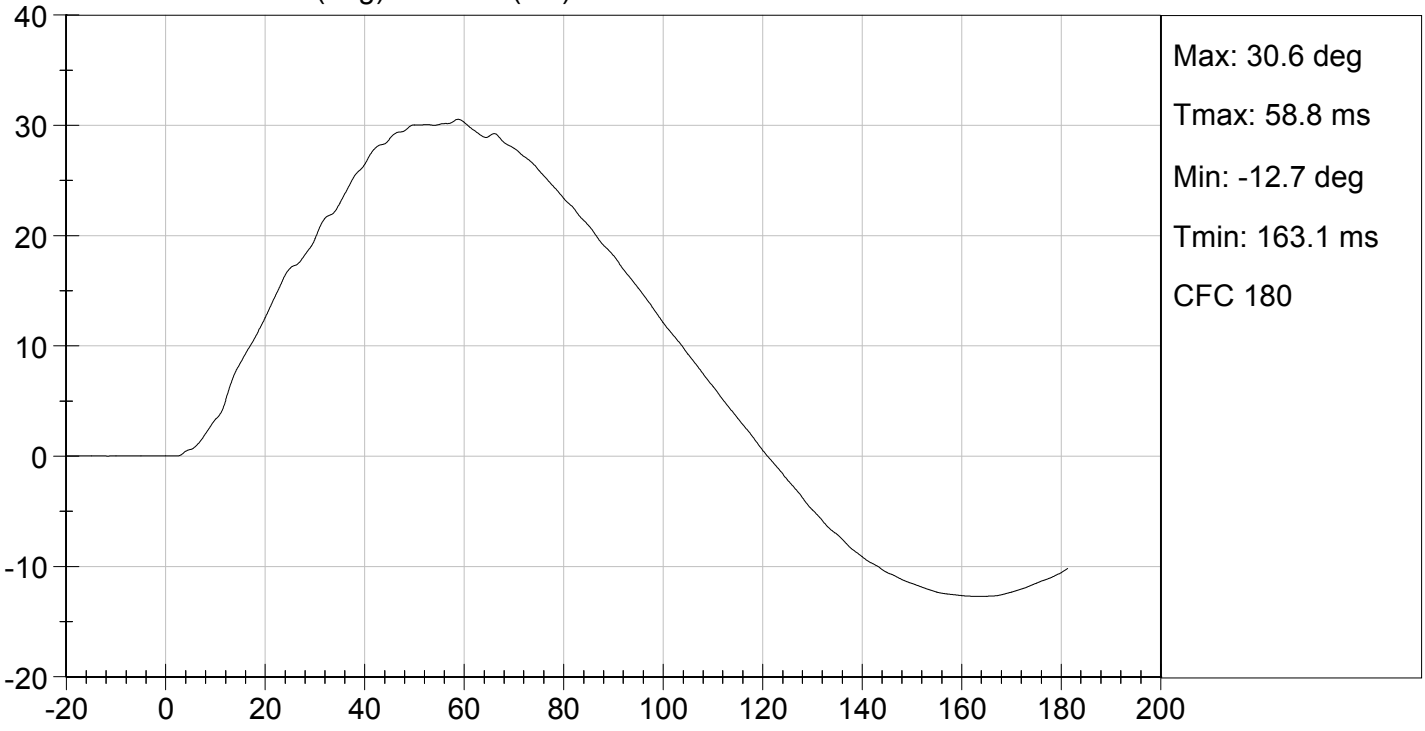
FLEXION ANGLE (deg) vs TIME (ms)



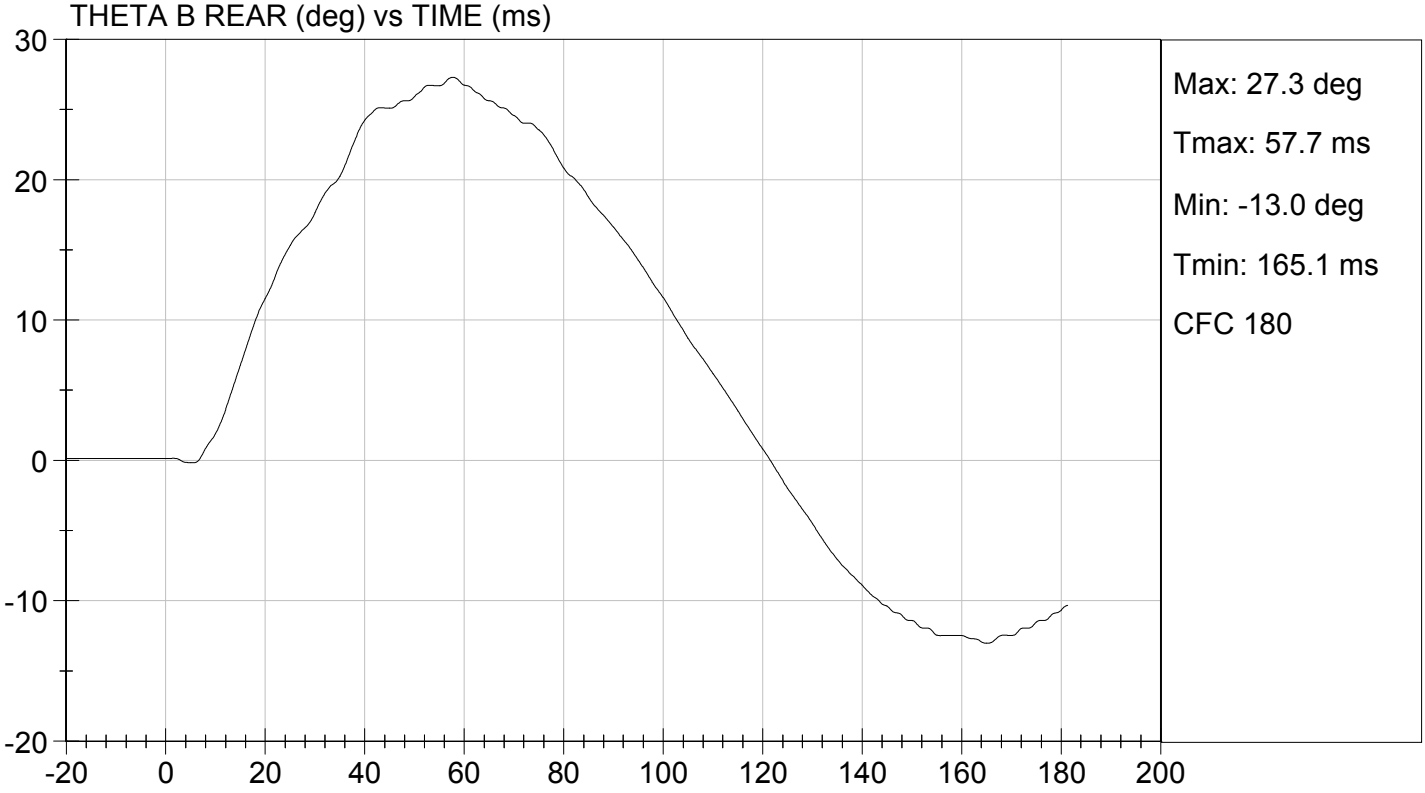
TEST DESC: NECK BENDING
VELOCITY: 10.96 ft/s, 3.34 m/s

TEST DATE: 06/17/2015
TEST #: D151782

THETA A FRONT (deg) vs TIME (ms)

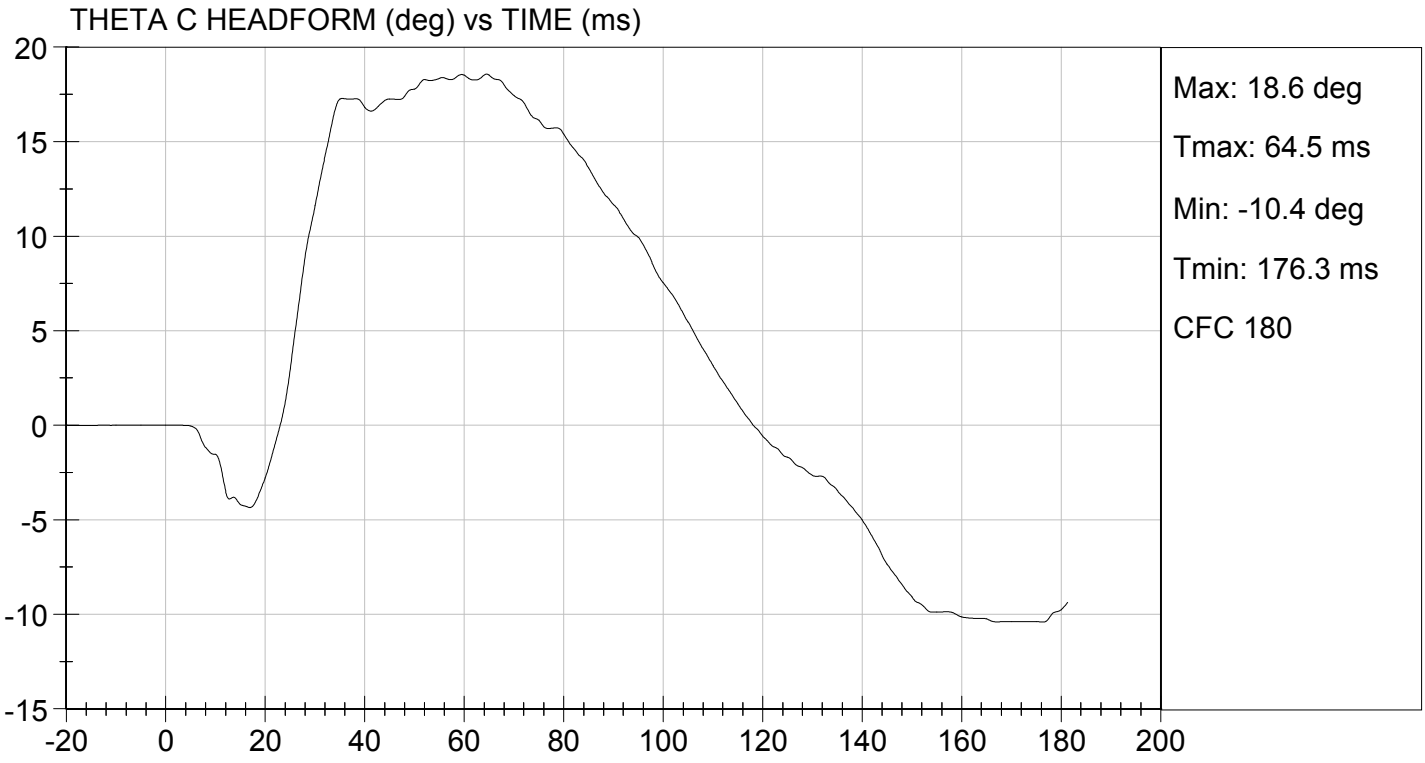


THETA B REAR (deg) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 10.96 ft/s, 3.34 m/s

TEST DATE: 06/17/2015
TEST #: D151782



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151783

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Pendulum Speed	m/s	4.20 to 4.40	4.38	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	9.3	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

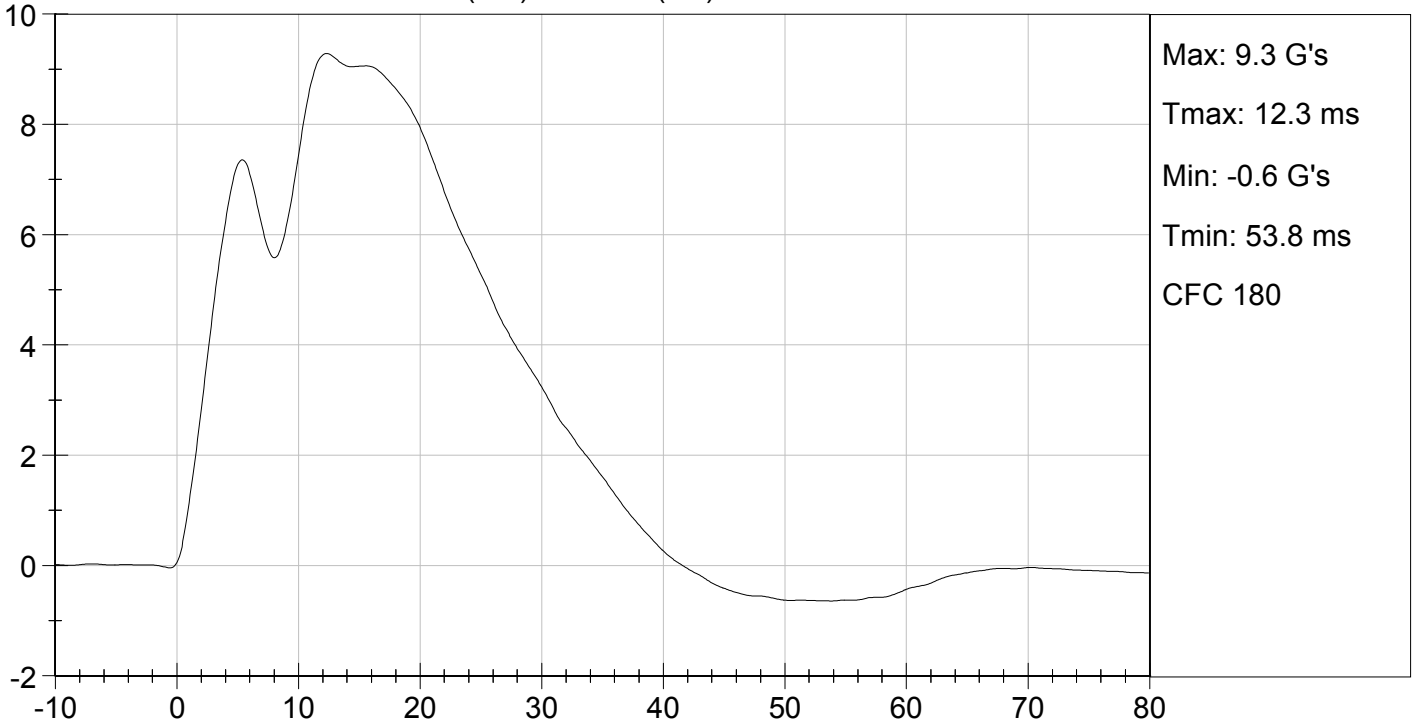
06/18/2015
Test Date

Jessica Hall
Approved By

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

TEST DATE: 06/18/2015
TEST #: D151783

IMPACTOR ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

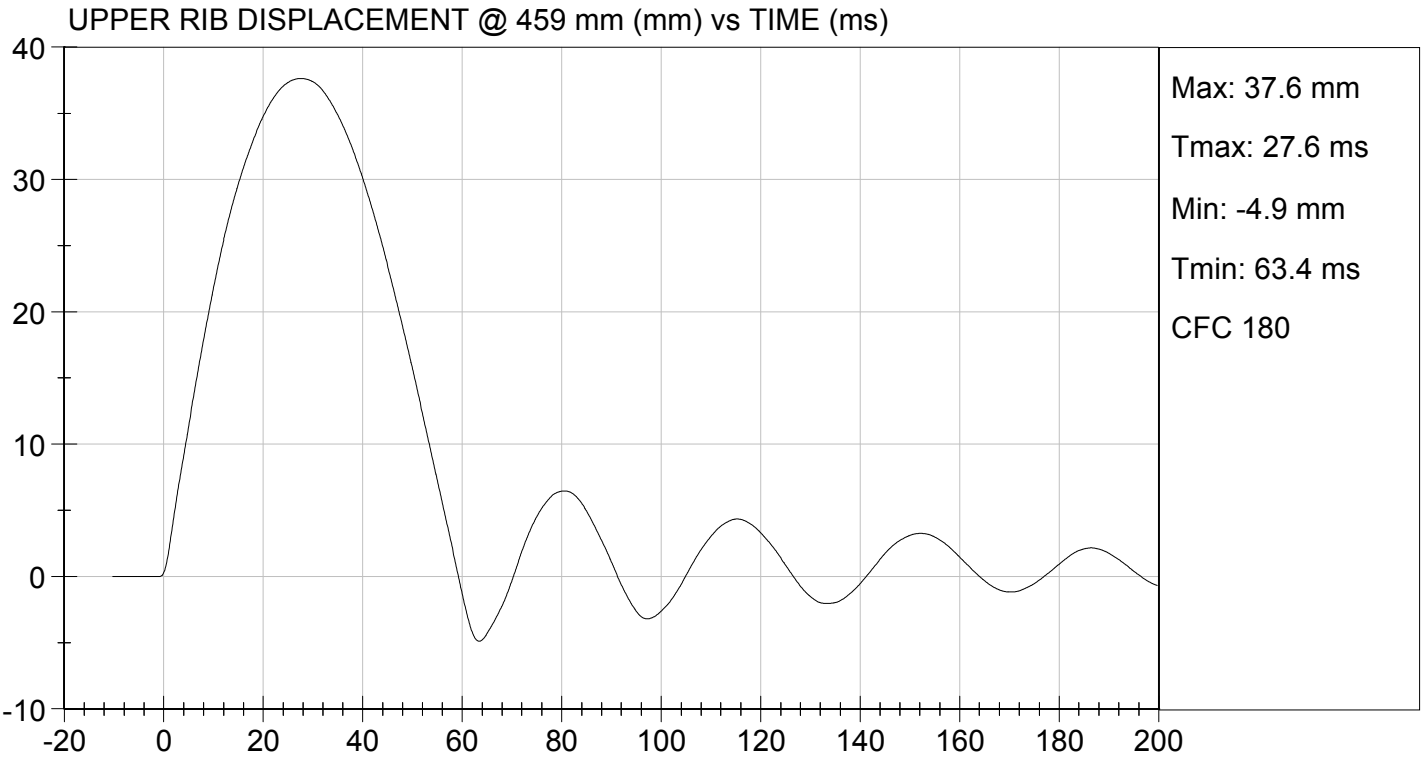
ATD Serial No: 032 **Test I.D:** D151784

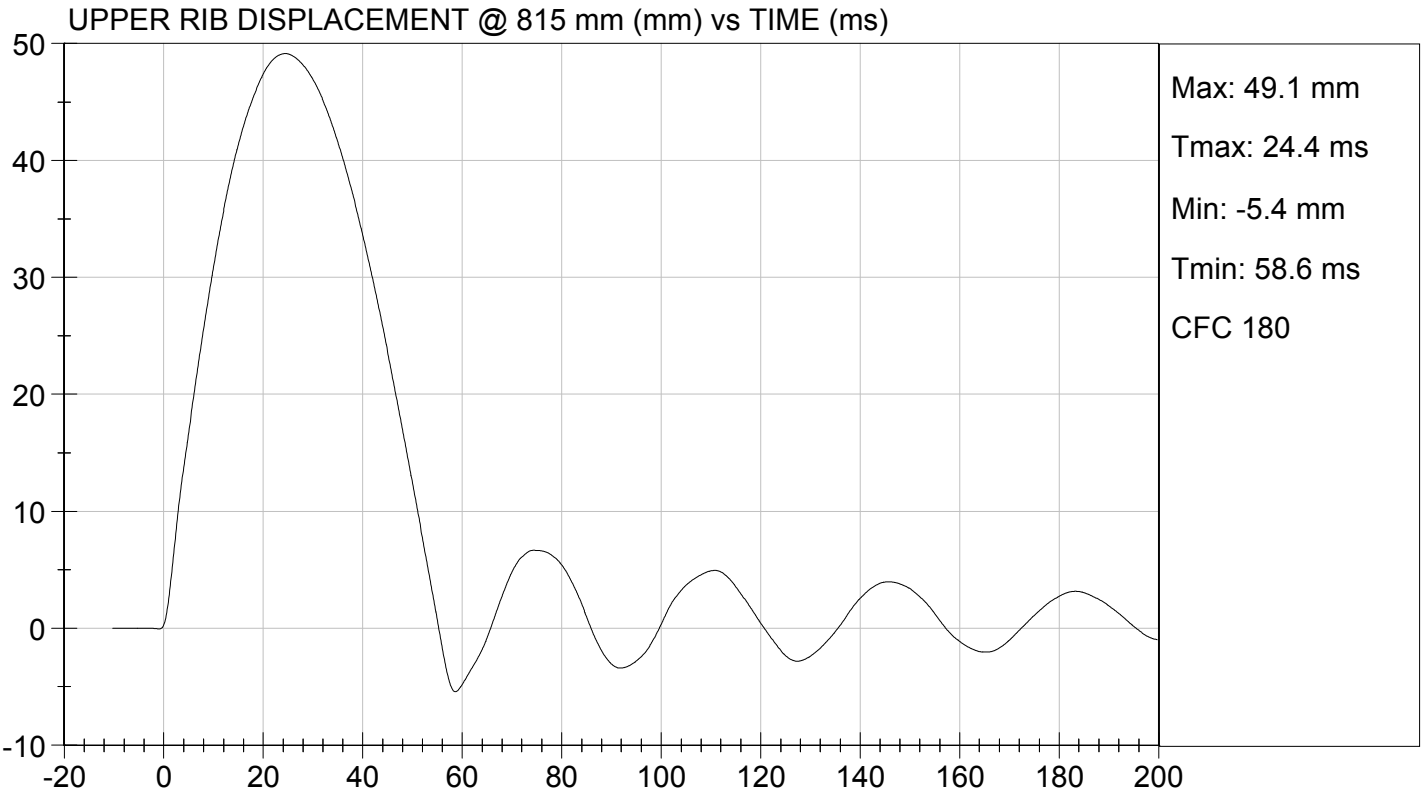
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Displacement at 459 mm	mm	36.0 to 40.0	37.6	Pass
Displacement at 815 mm	mm	46.0 to 51.0	49.1	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

06/17/2015
Test Date

Jessica Hall
Approved By


UPPER RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 37.6 mm
Tmax: 27.6 ms
Min: -4.9 mm
Tmin: 63.4 ms
CFC 180


UPPER RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)
50
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 49.1 mm
Tmax: 24.4 ms
Min: -5.4 mm
Tmin: 58.6 ms
CFC 180

MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151785

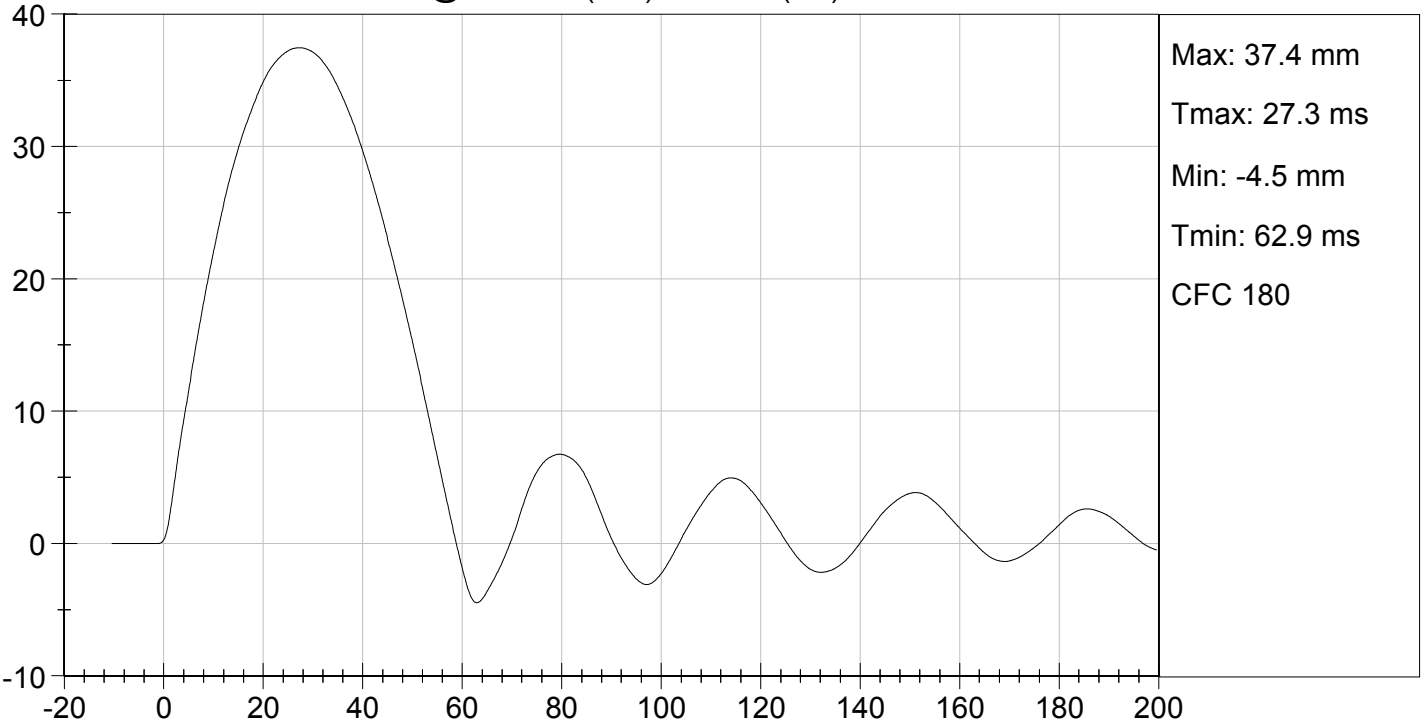
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Displacement at 459 mm	mm	36.0 to 40.0	37.4	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.0	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

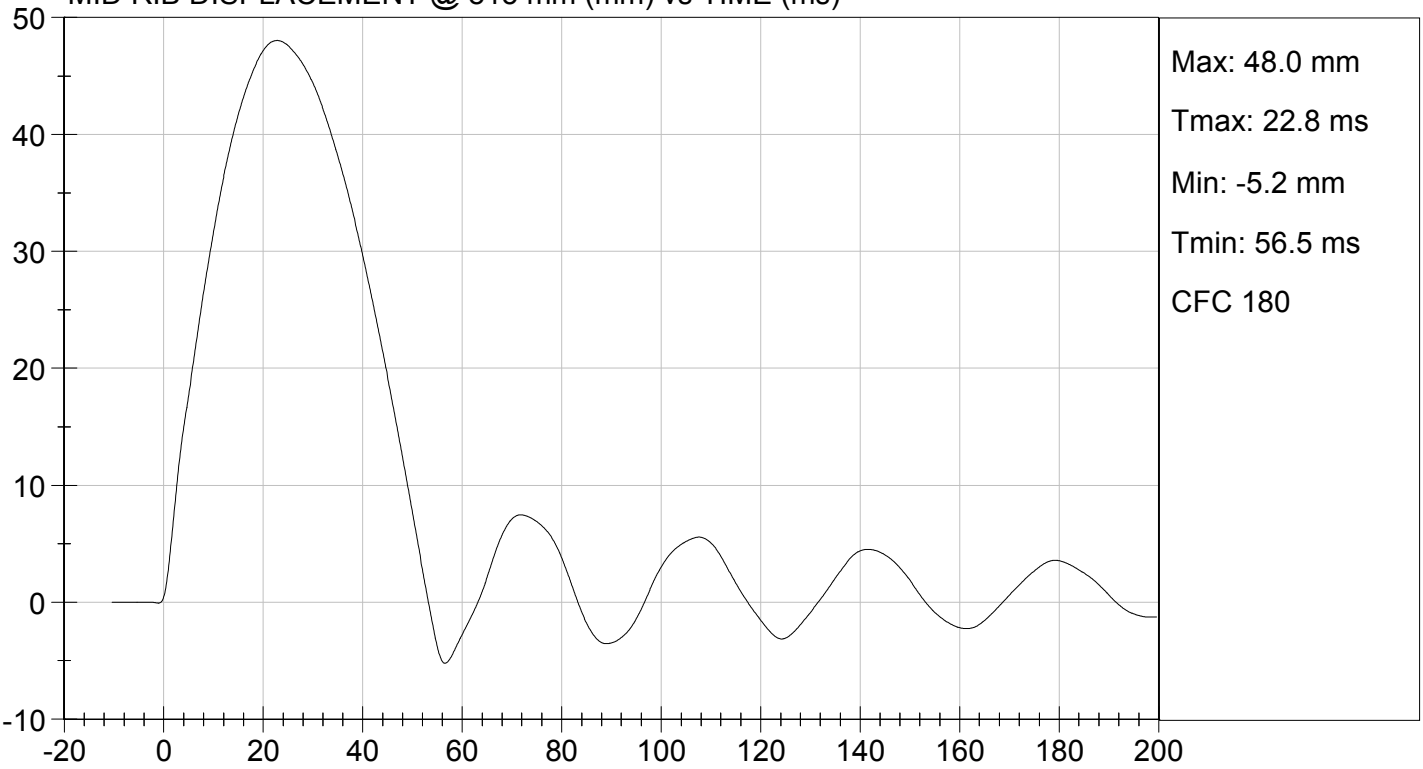
06/17/2015
Test Date

Jessica Gall
Approved By

MID RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)



MID RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151786

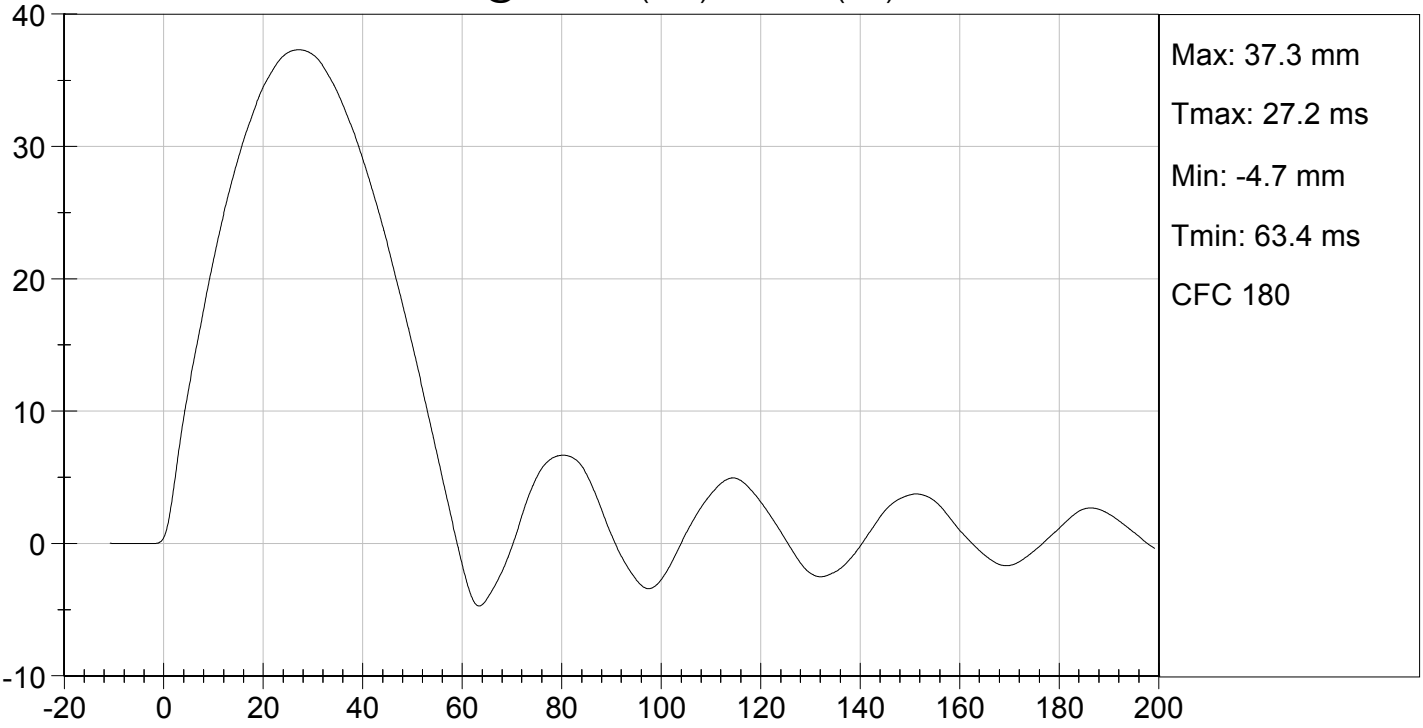
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Displacement at 459 mm	mm	36.0 to 40.0	37.3	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.4	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

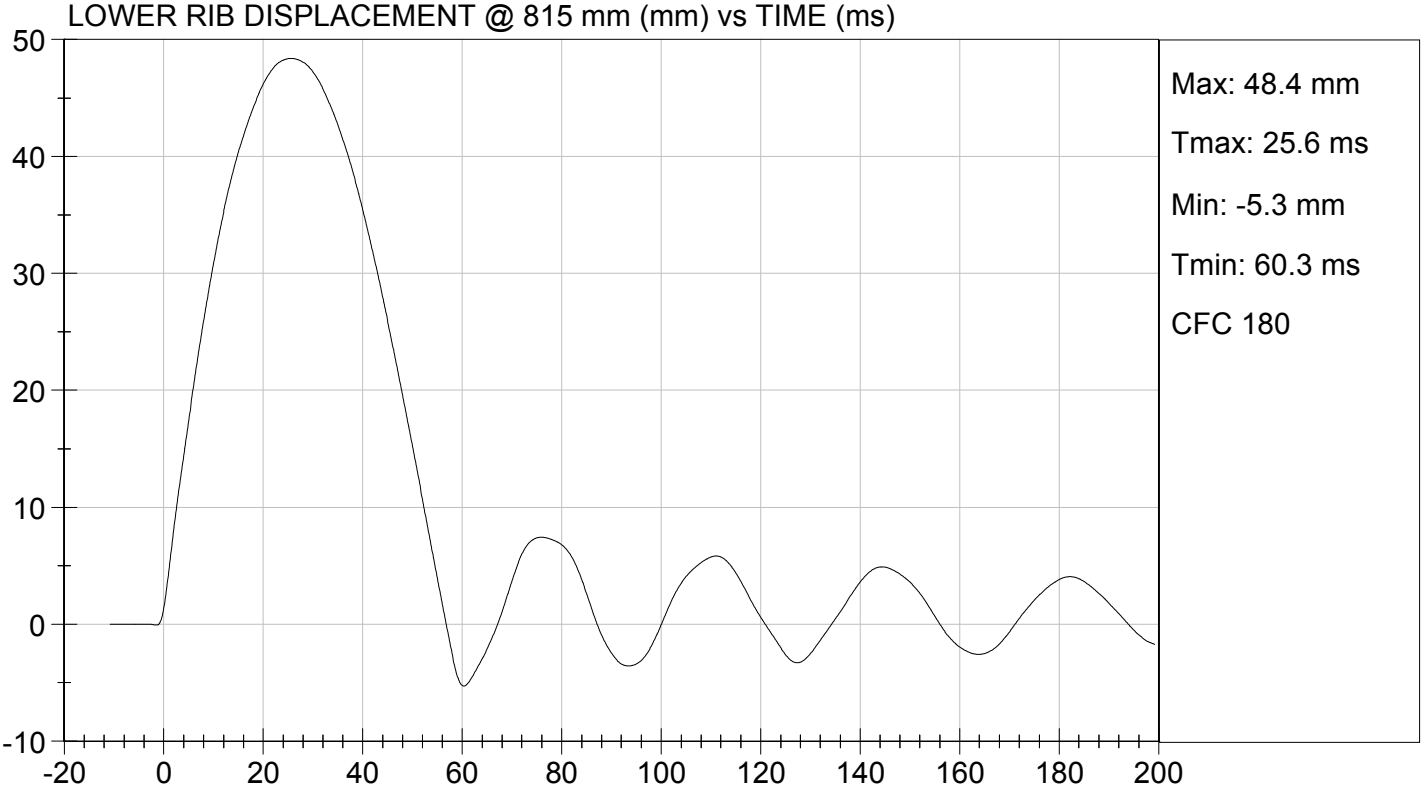
06/17/2015
Test Date

Jessica Gall
Approved By

LOWER RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151780

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	48	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	N	5100 to 6200	5252	Pass
Upper Rib Displacement	mm	34.0 to 41.0	39.4	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.5	Pass
Lower Rib Displacement	mm	37.0 to 44.0	41.3	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

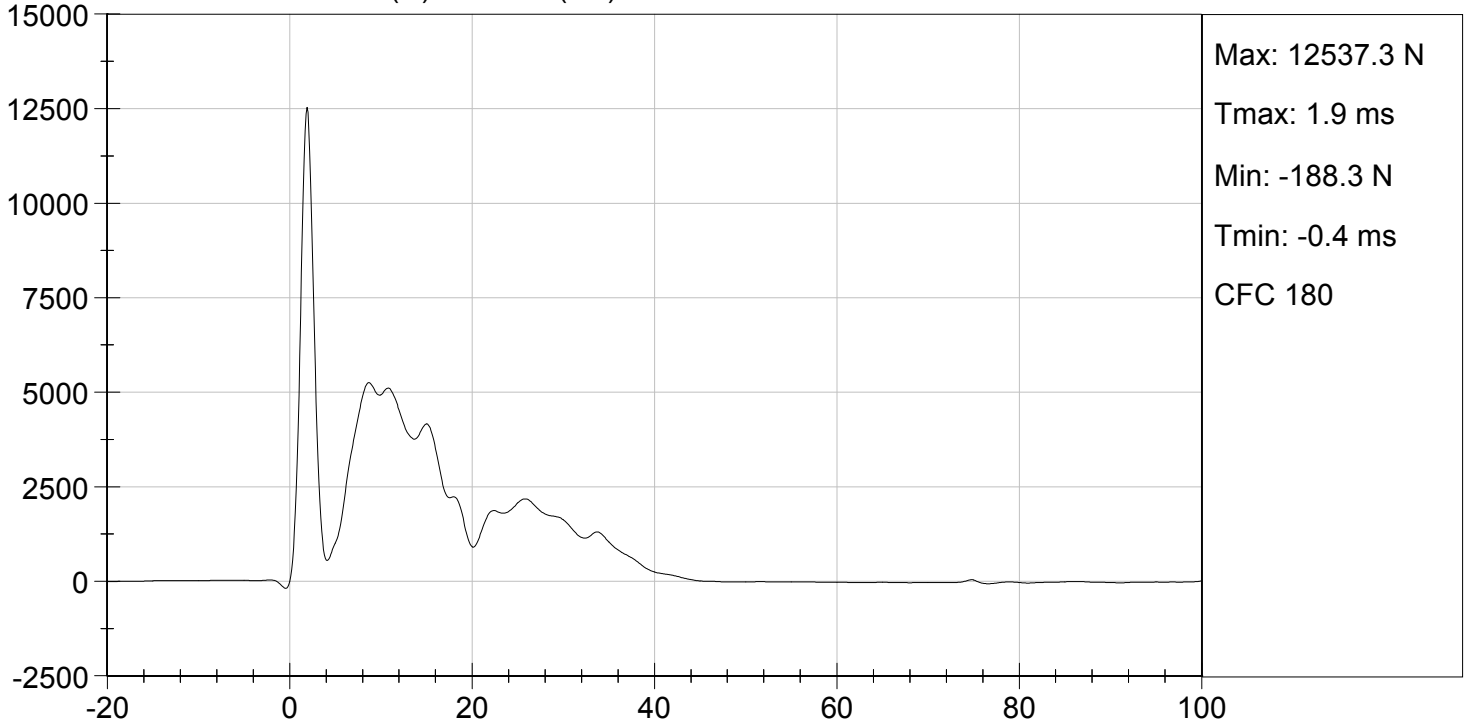
06/18/2015
Test Date

Jessica Hall
Approved By

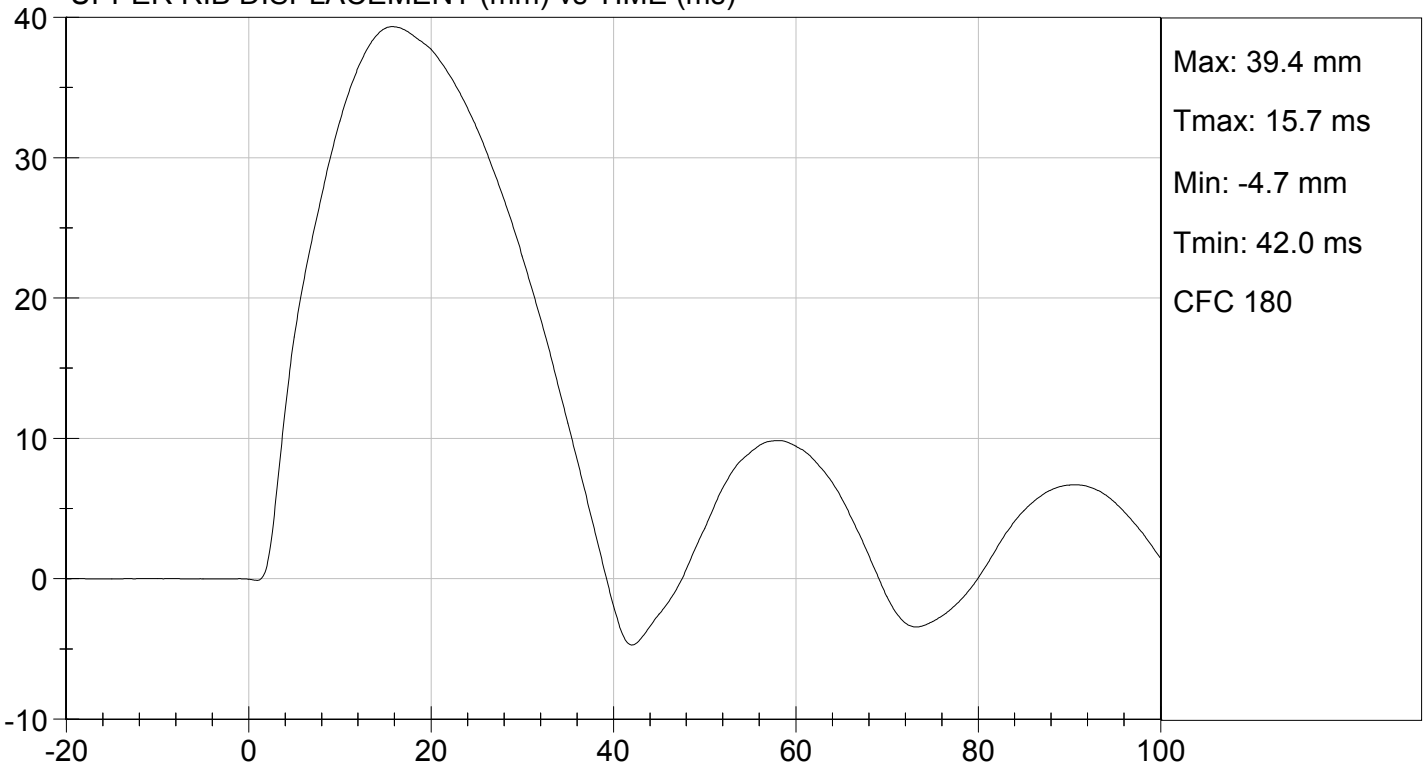
TEST DESC: THORAX IMPACT
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 06/18/2015
TEST #: D151780

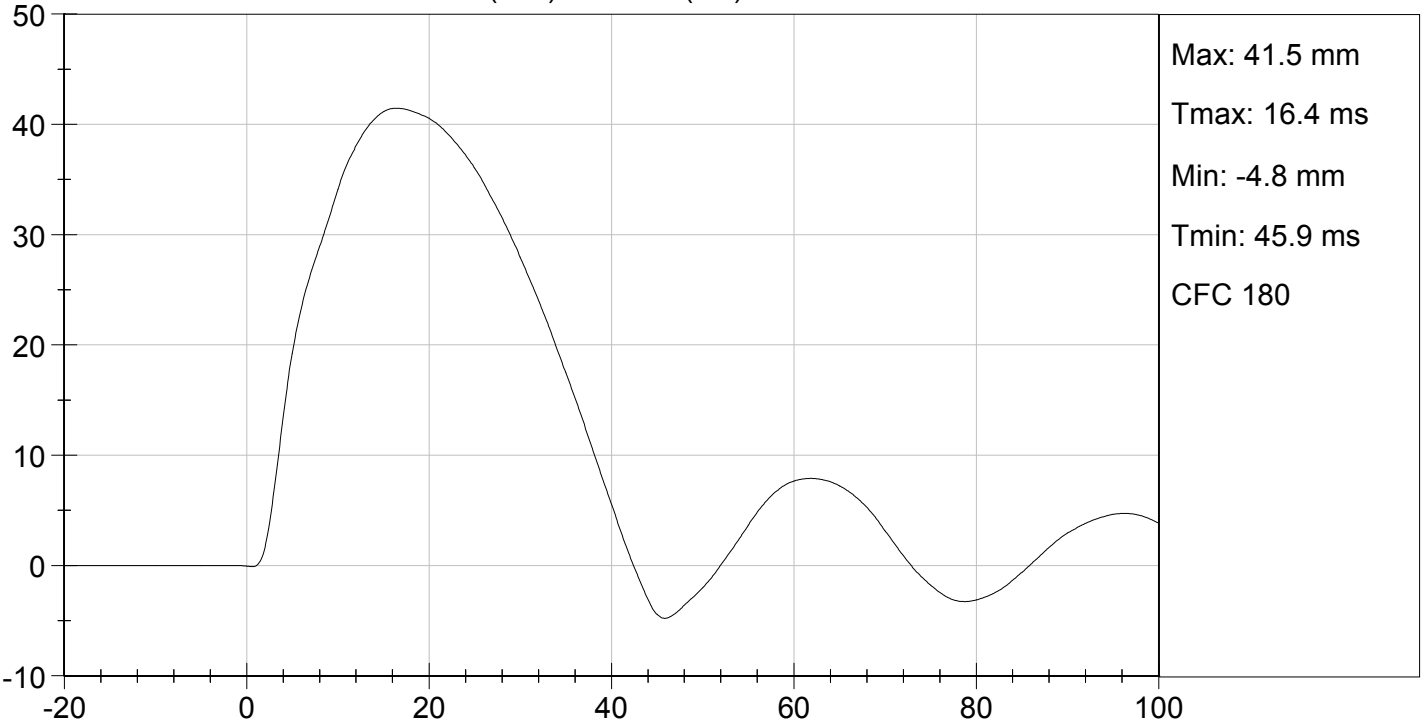
IMPACTOR FORCE (N) vs TIME (ms)



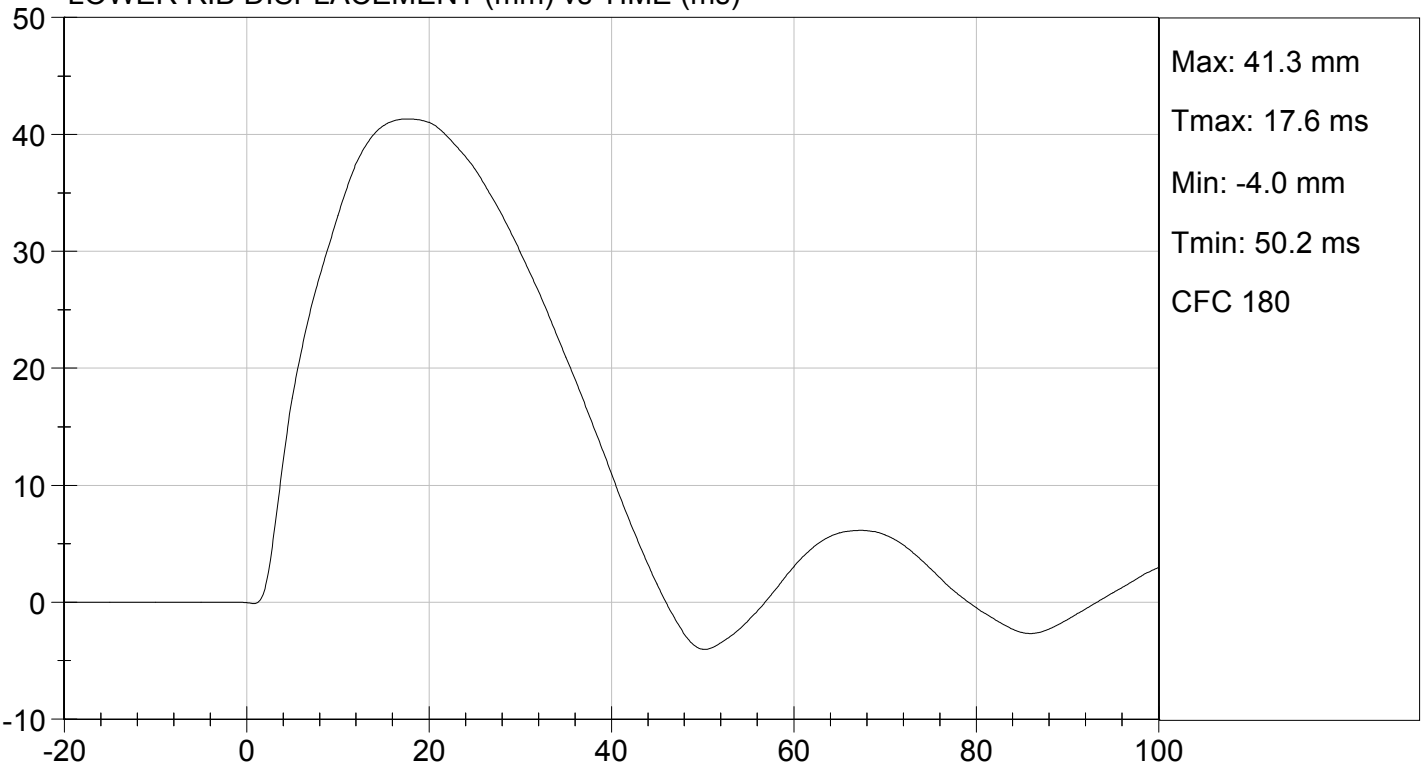
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151787

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impactor Force	N	4000 to 4800	4510	Pass
Time of Maximum Impactor Force	ms	10.6 to 13.0	11.8	Pass
Maximum Total Abdomen Force	N	2200 to 2700	2355	Pass
Time of Maximum Abdomen Force	ms	10.0 to 12.3	11.7	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

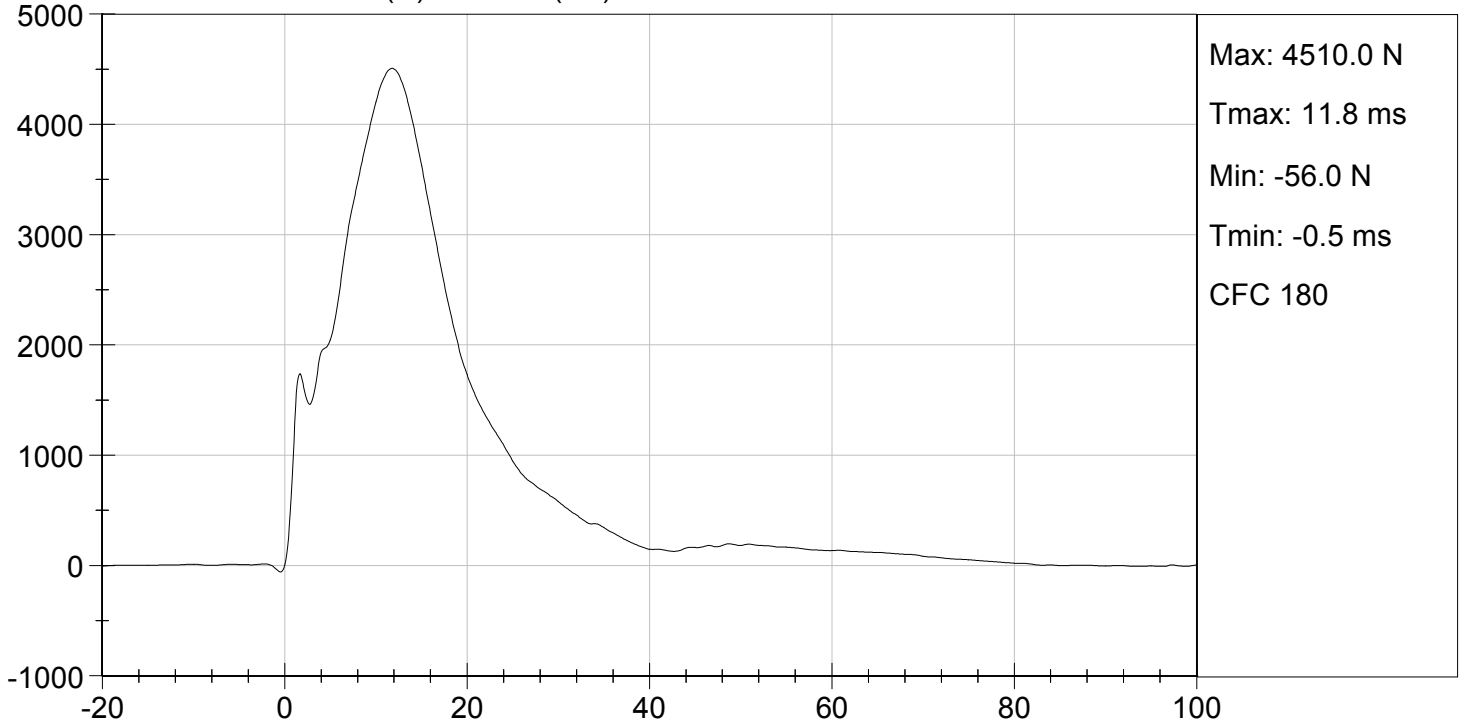
06/18/2015
Test Date

Jessica Gall
Approved By

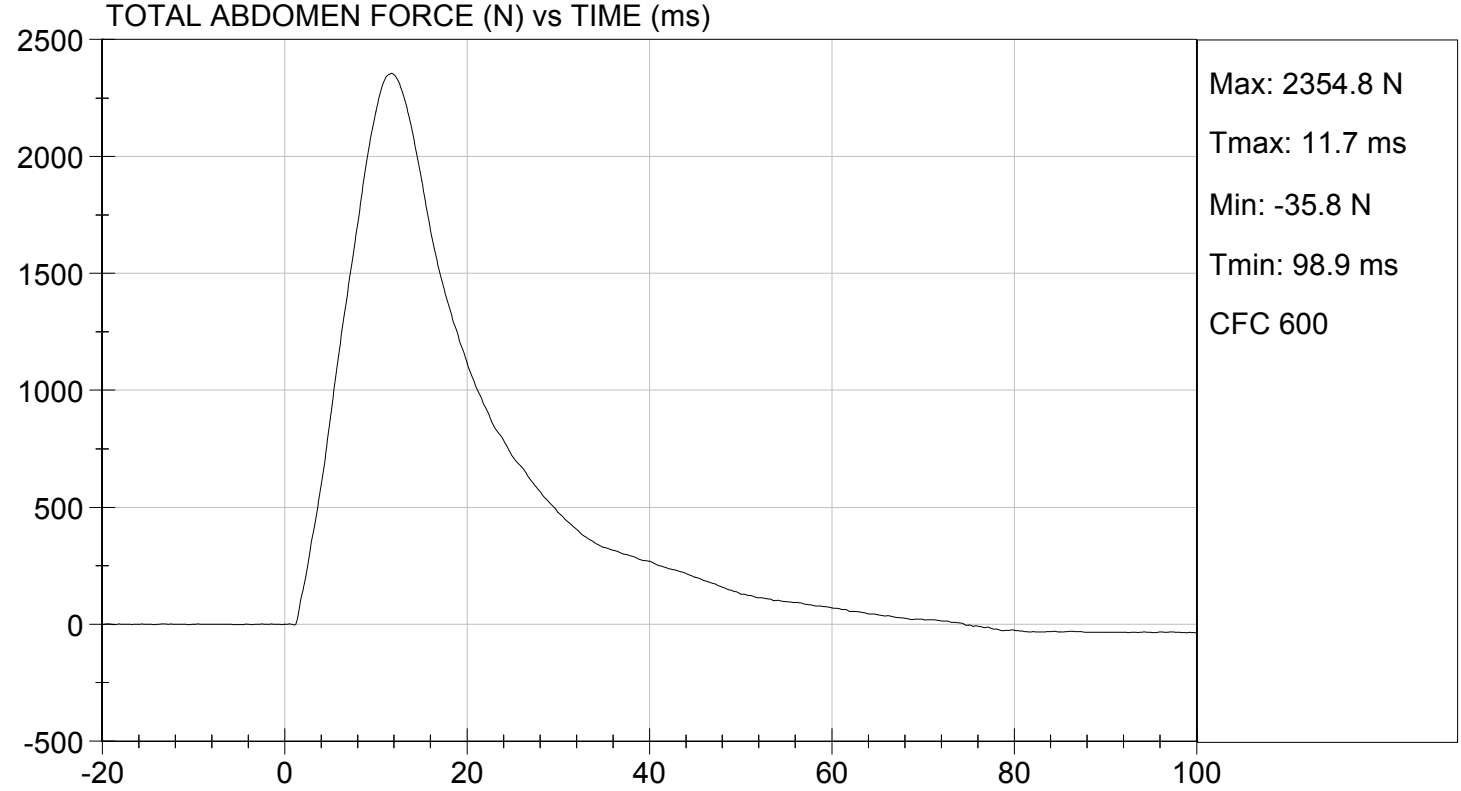
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.33 ft/s, 4.06 m/s

TEST DATE: 06/18/2015
TEST #: D151787

IMPACTOR FORCE (N) vs TIME (ms)



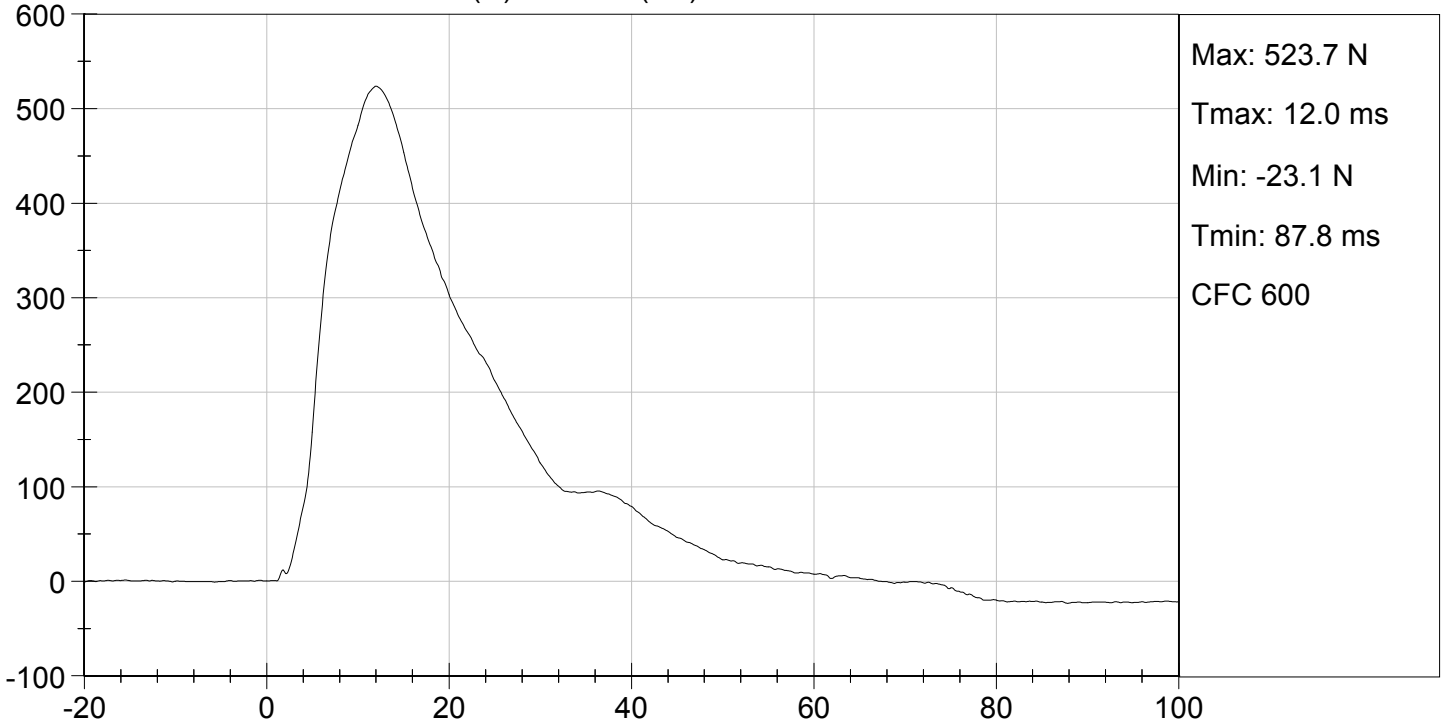
TOTAL ABDOMEN FORCE (N) vs TIME (ms)



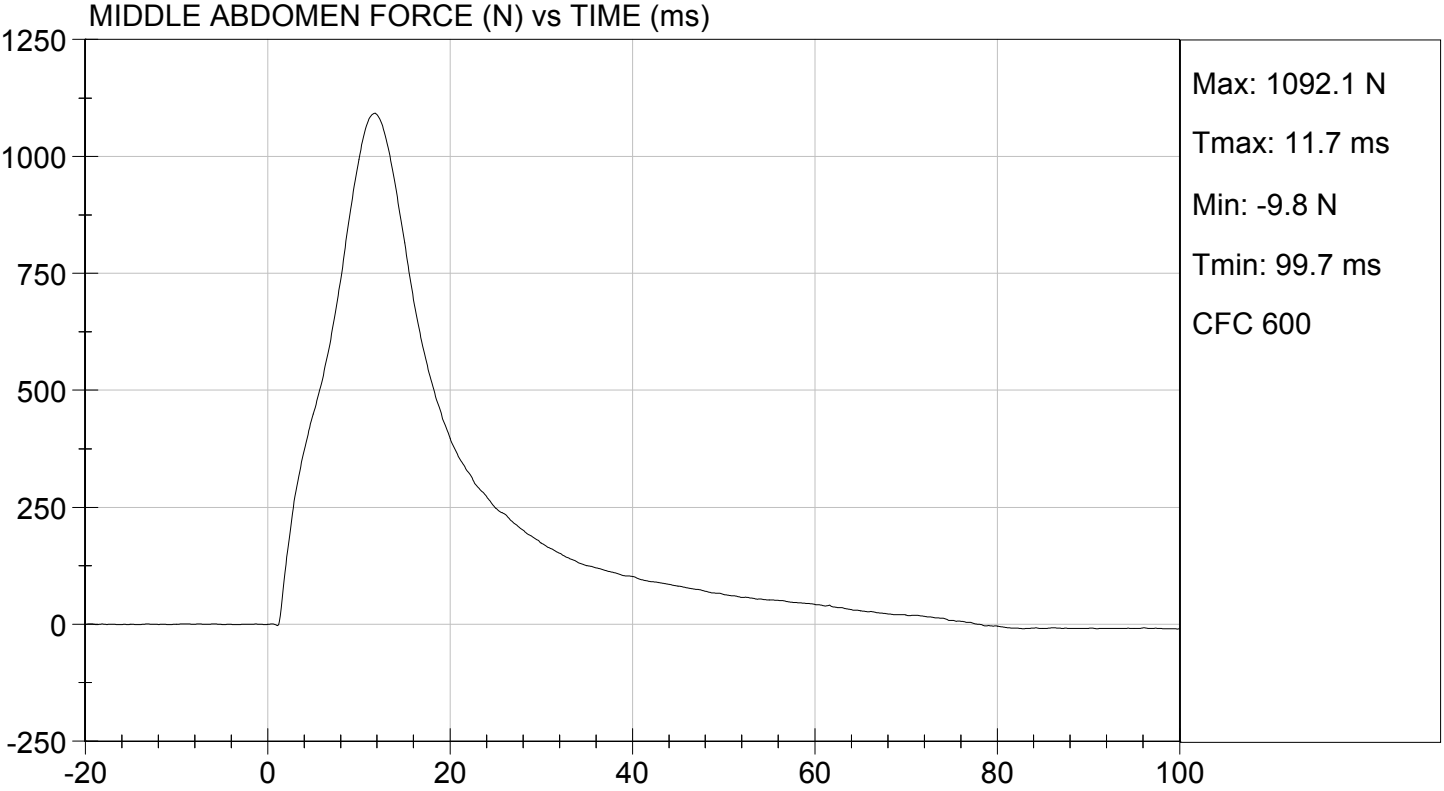
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.33 ft/s, 4.06 m/s

TEST DATE: 06/18/2015
TEST #: D151787

FRONT ABDOMEN FORCE (N) vs TIME (ms)



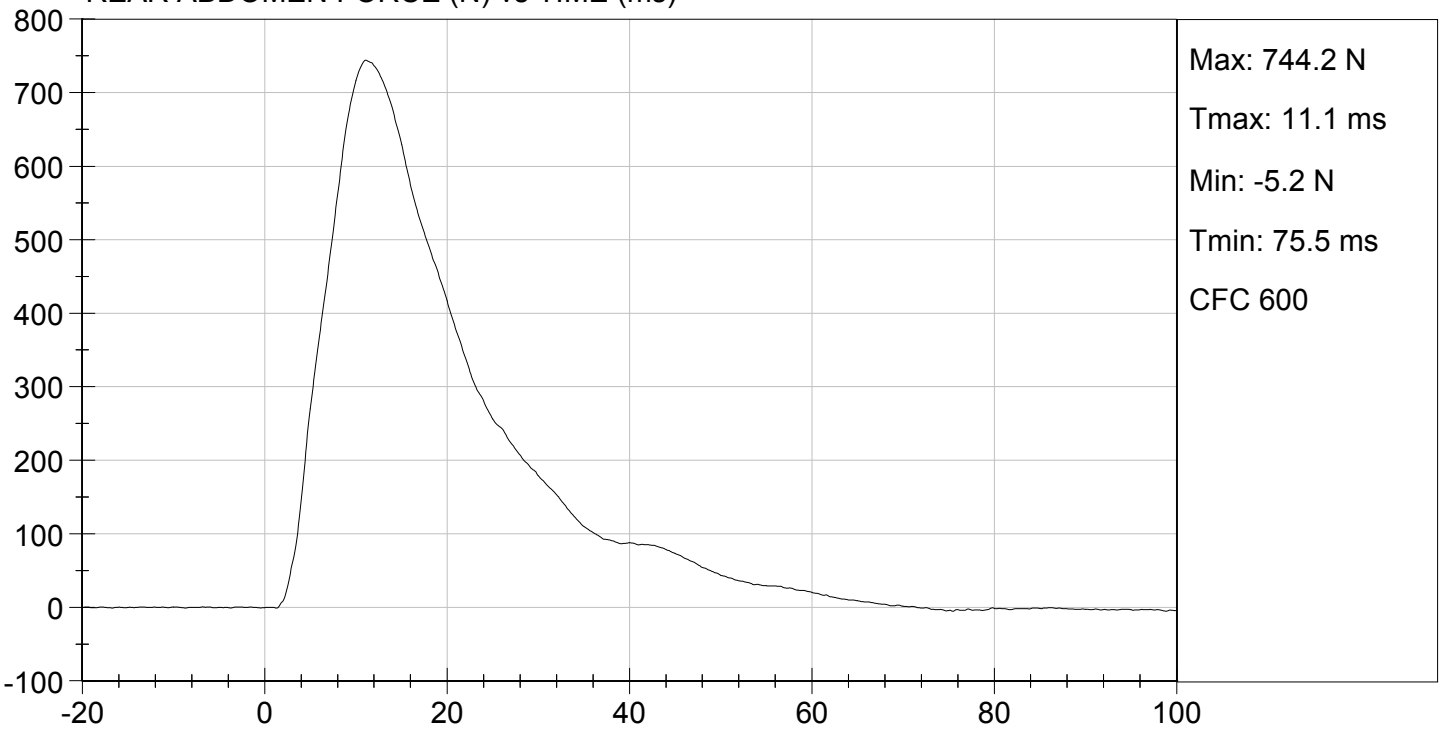
MIDDLE ABDOMEN FORCE (N) vs TIME (ms)



TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.33 ft/s, 4.06 m/s

TEST DATE: 06/18/2015
TEST #: D151787

REAR ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151788

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.05	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.402	Pass
	27 ms	m/s	-6.50 to -5.80	-5.81	Pass
	30 ms	m/s	>= -6.50	-6.18	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.7	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	45.9	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	46	Pass
			Overall Results		Pass

Jack Coleman
Laboratory Technician

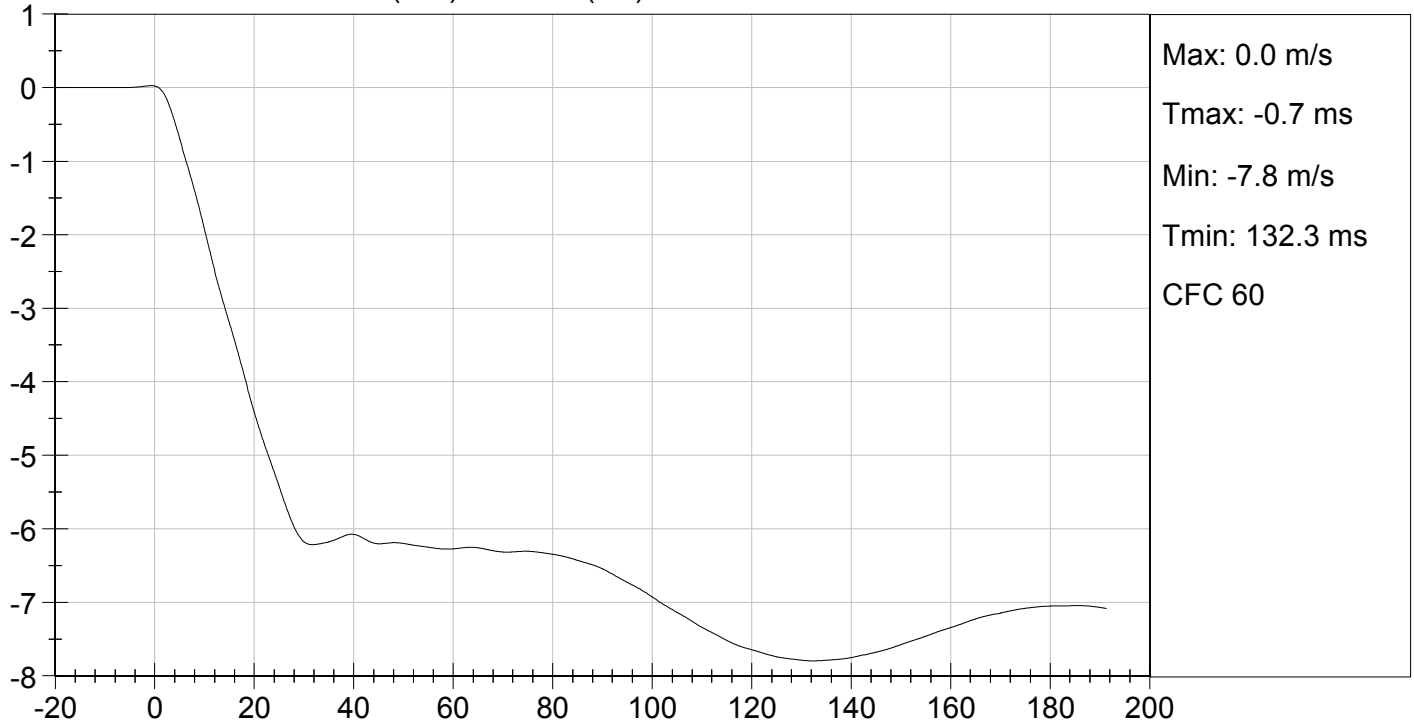
06/17/2015
Test Date

Jessica Hall
Approved By

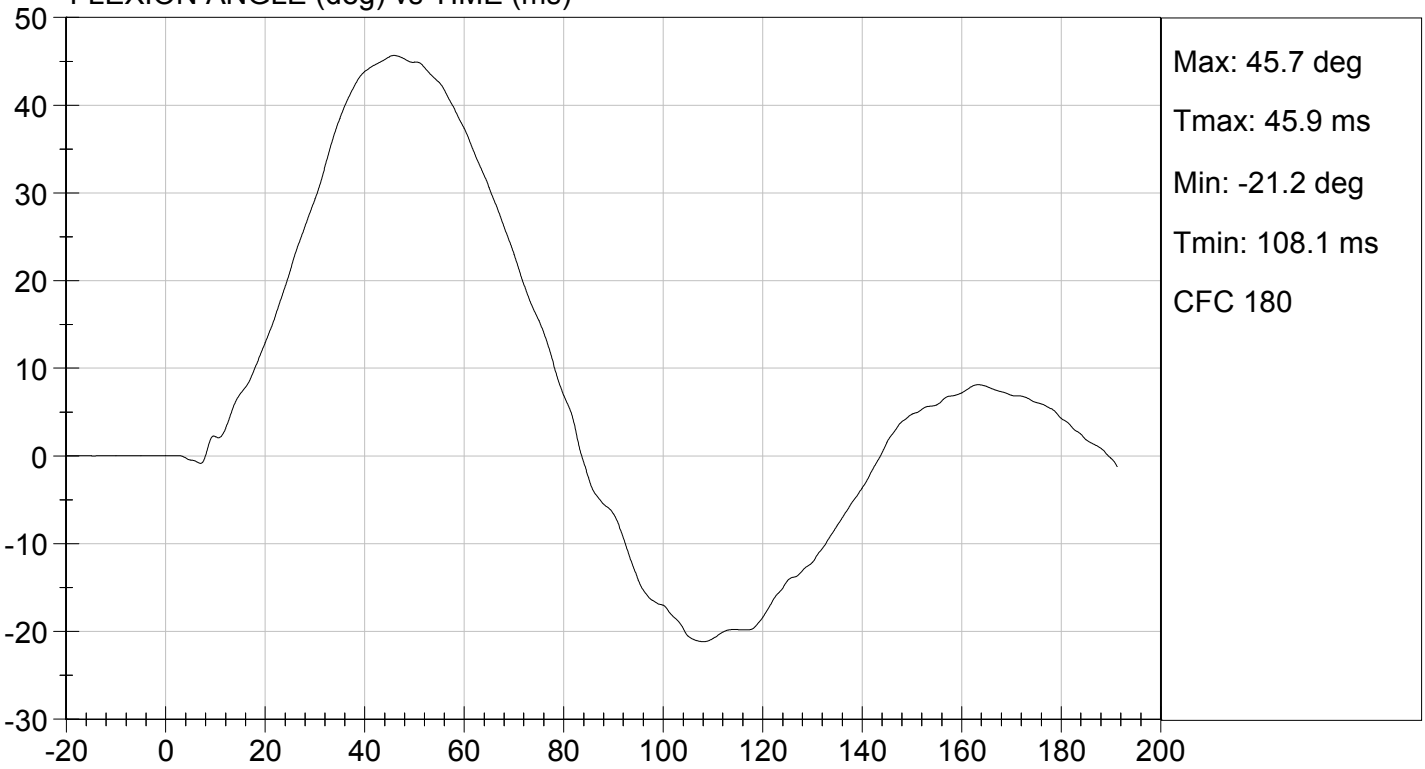
TEST DESC: LUMBAR BENDING
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 06/17/2015
TEST #: D151788

PENDULUM VELOCITY (m/s) vs TIME (ms)

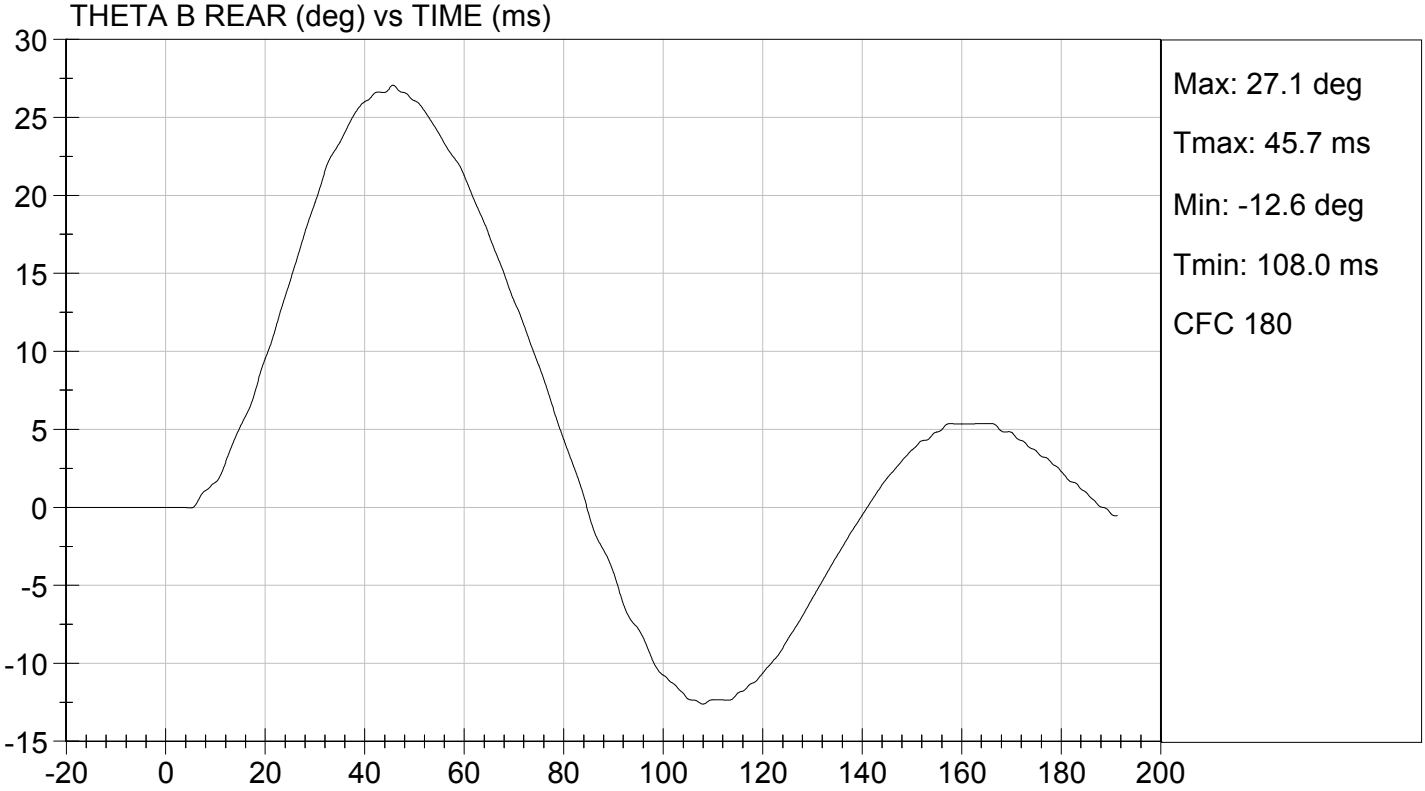


FLEXION ANGLE (deg) vs TIME (ms)



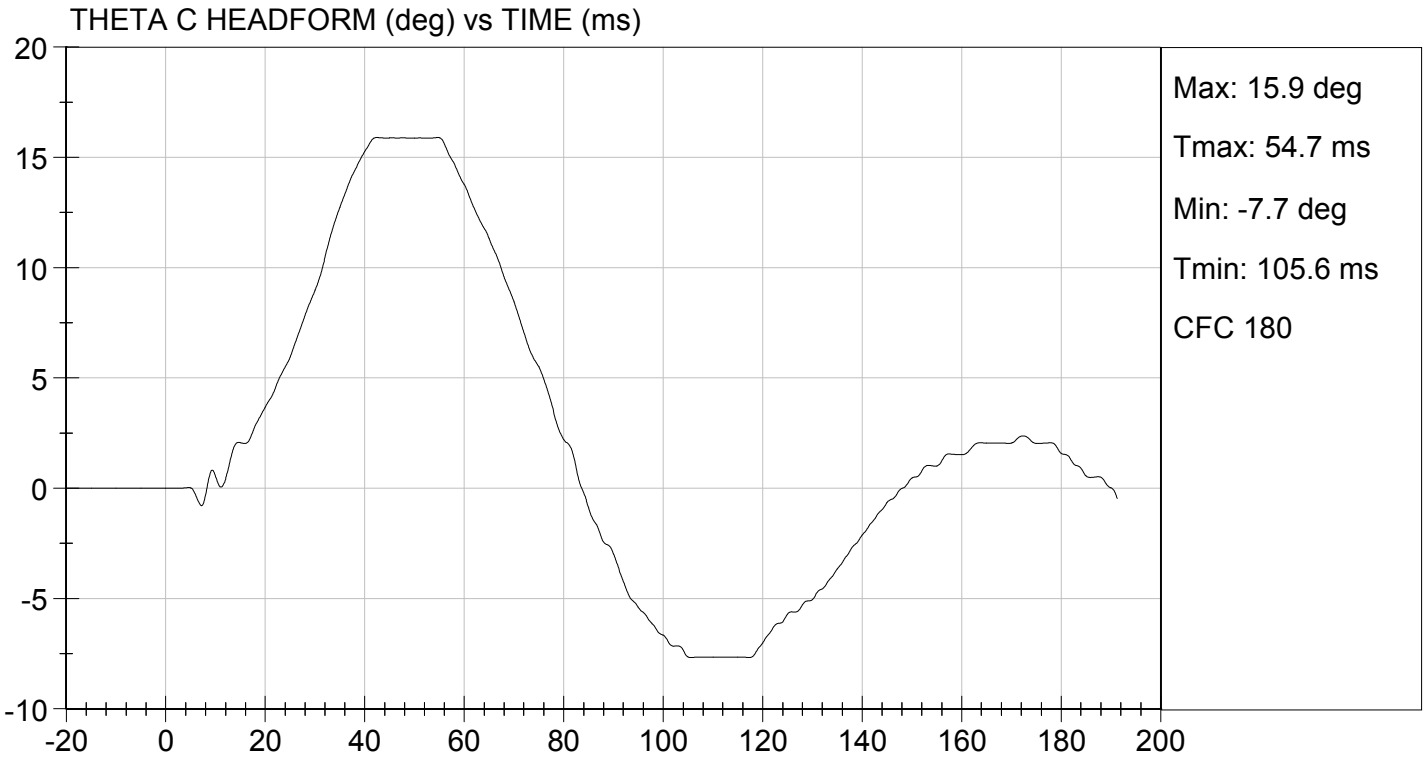
THETA A FRONT (deg) vs TIME (ms)

THETA B REAR (deg) vs TIME (ms)



TEST DESC: LUMBAR BENDING
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 06/17/2015
TEST #: D151788



MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151789

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/s	4.20 to 4.40	4.27	Pass
Maximum Impactor Force	N	4700 to 5400	4887	Pass
Time of Maximum Impactor Force	ms	11.8 to 16.1	14.4	Pass
Maximum Pubic Force	N	1230 to 1590	1255	Pass
Time of Maximum Pubic Force	ms	12.2 to 17.0	14.0	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

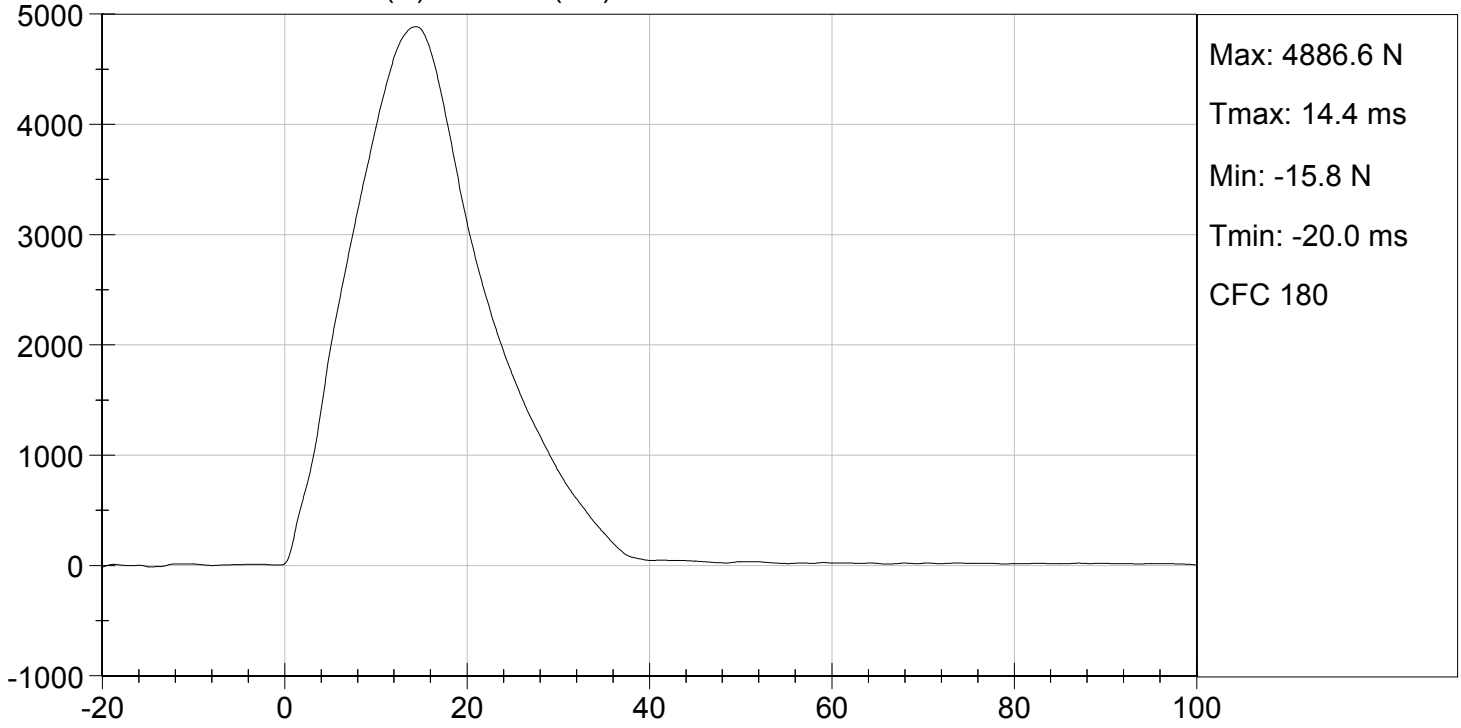
06/18/2015
Test Date

Jessica Hall
Approved By

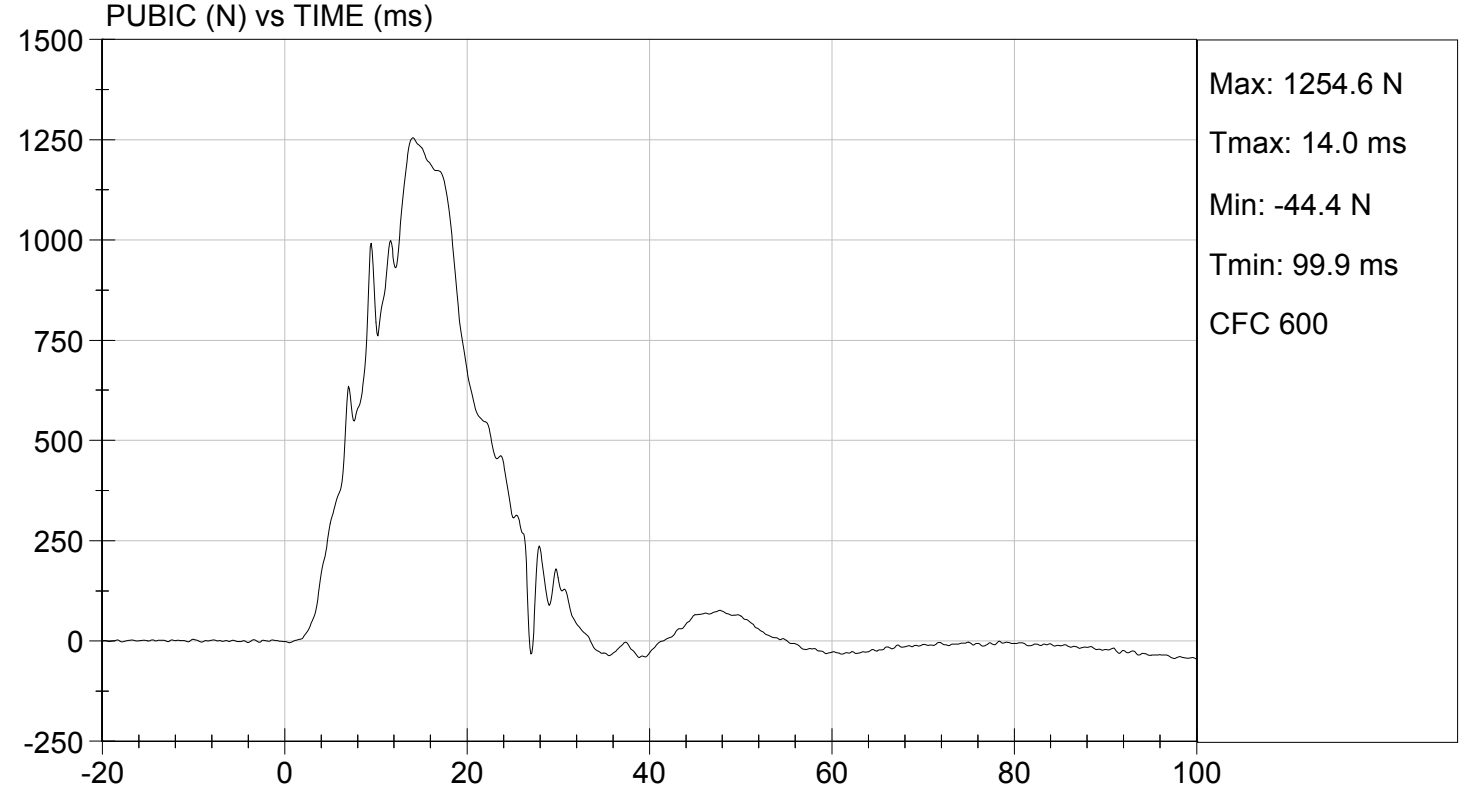
TEST DESC: PELVIS IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 06/18/2015
TEST #: D151789

IMPACTOR FORCE (N) vs TIME (ms)



PUBIC (N) vs TIME (ms)



MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 032 **Test ID:** D151801

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Peak Resultant Acceleration	G's	125 to 155	137	Pass
Peak Longitudinal Acceleration	G's	<= +/- 15.0	8.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

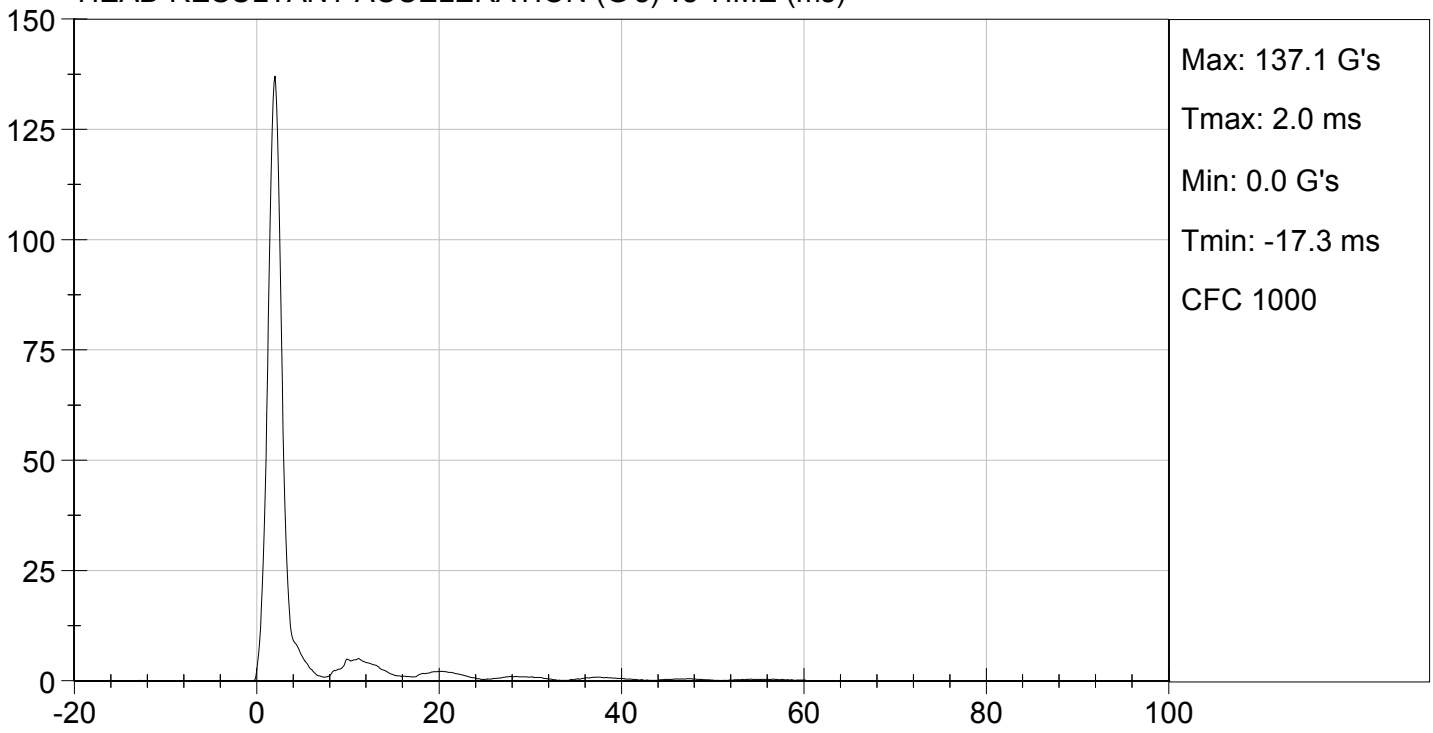
06/19/2015
Test Date

Jessica Hall
Approved By

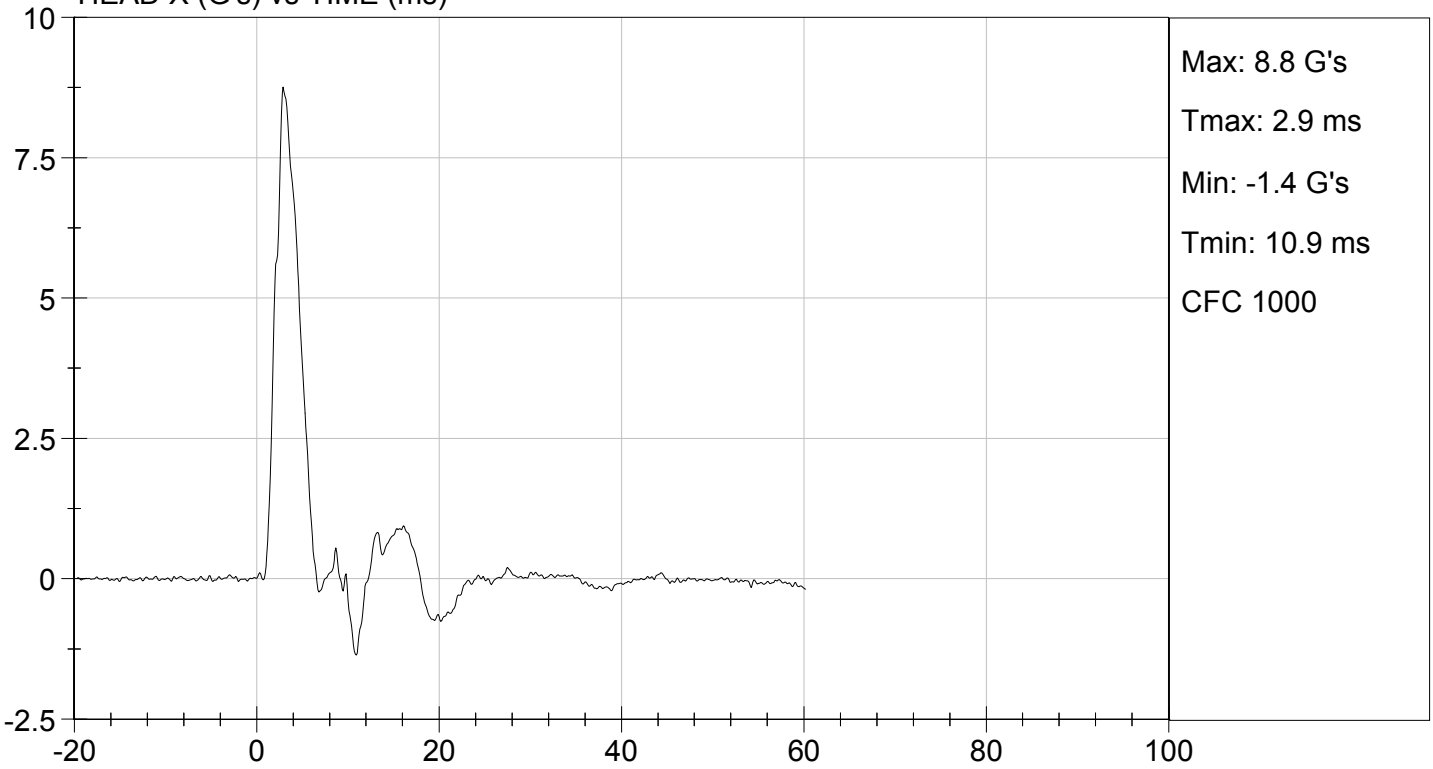
TEST DESC: HEAD DROP

TEST DATE: 06/19/2015
TEST #: D151801

HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)

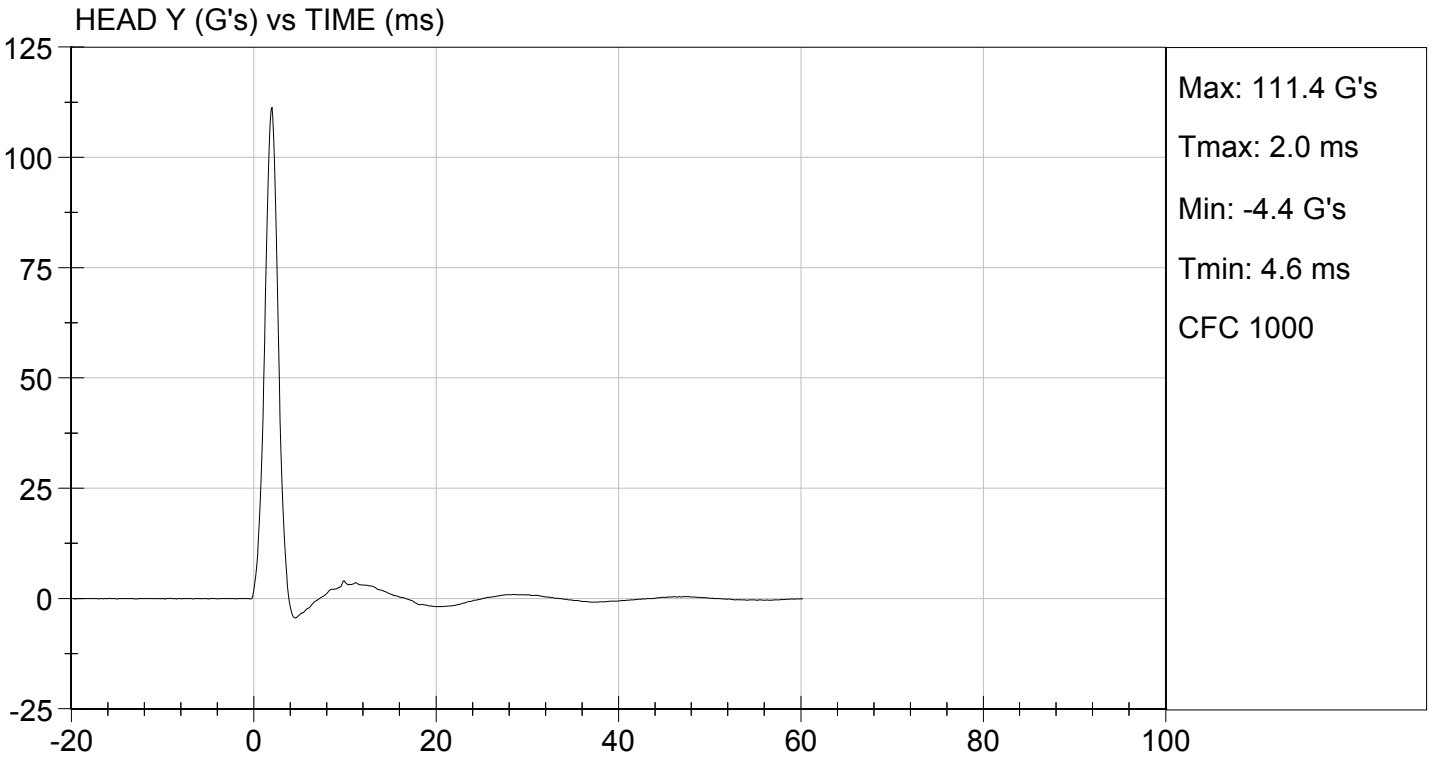


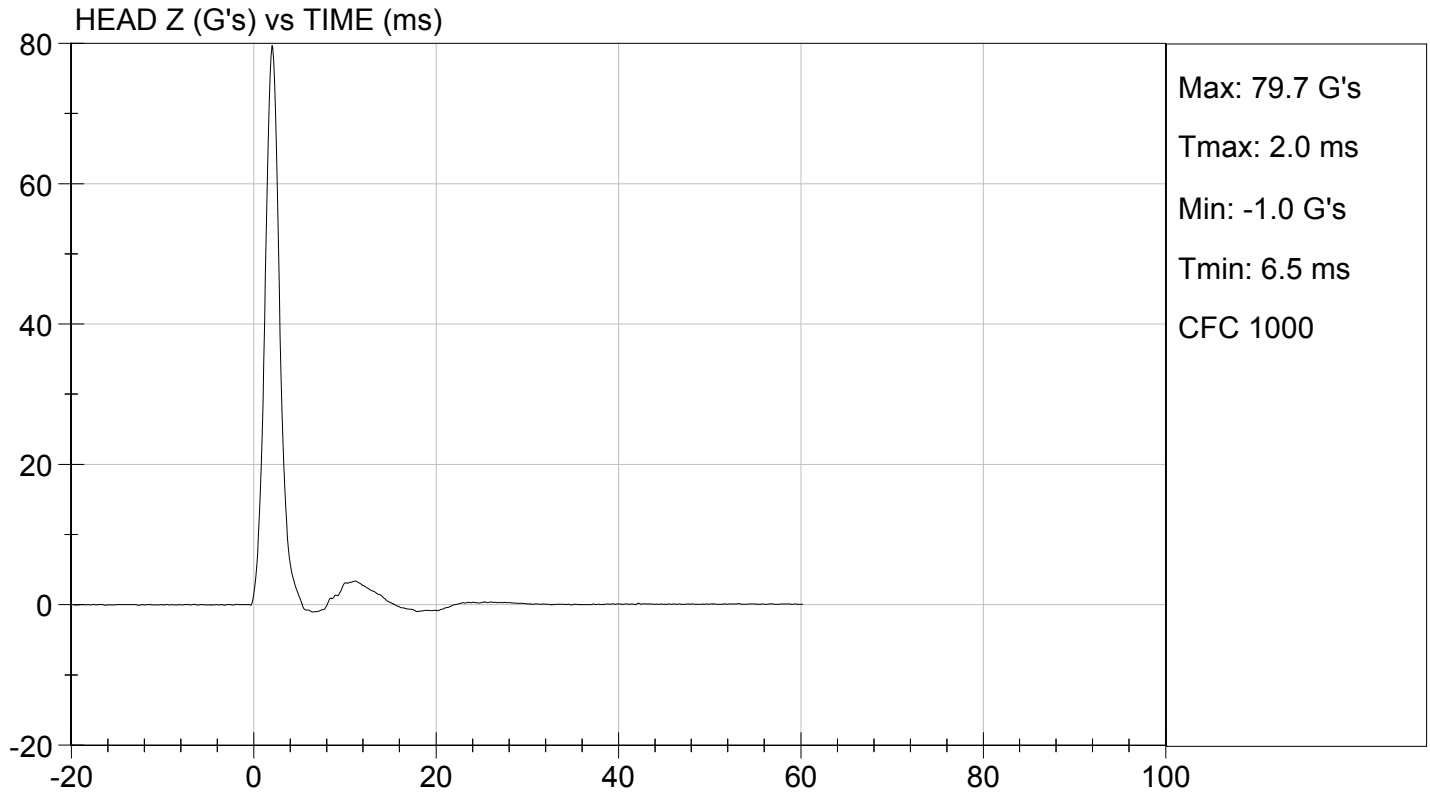
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 06/19/2015
TEST #: D151801





MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151802

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Speed		m/s	3.30 to 3.50	3.48	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.04	Pass
	3 ms	m/s	-0.25 to -0.375	-0.34	Pass
	14 ms	m/s	-3.20 to -3.70	-3.28	Pass
	17 ms	m/s	>= -3.70	-3.57	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	50.6	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	61.2	Pass
Head Rotation Decay Time to 0 Degree		ms	53.0 to 88.0	56.4	Pass
			Overall Results		Pass

David Schoedel
Laboratory Technician

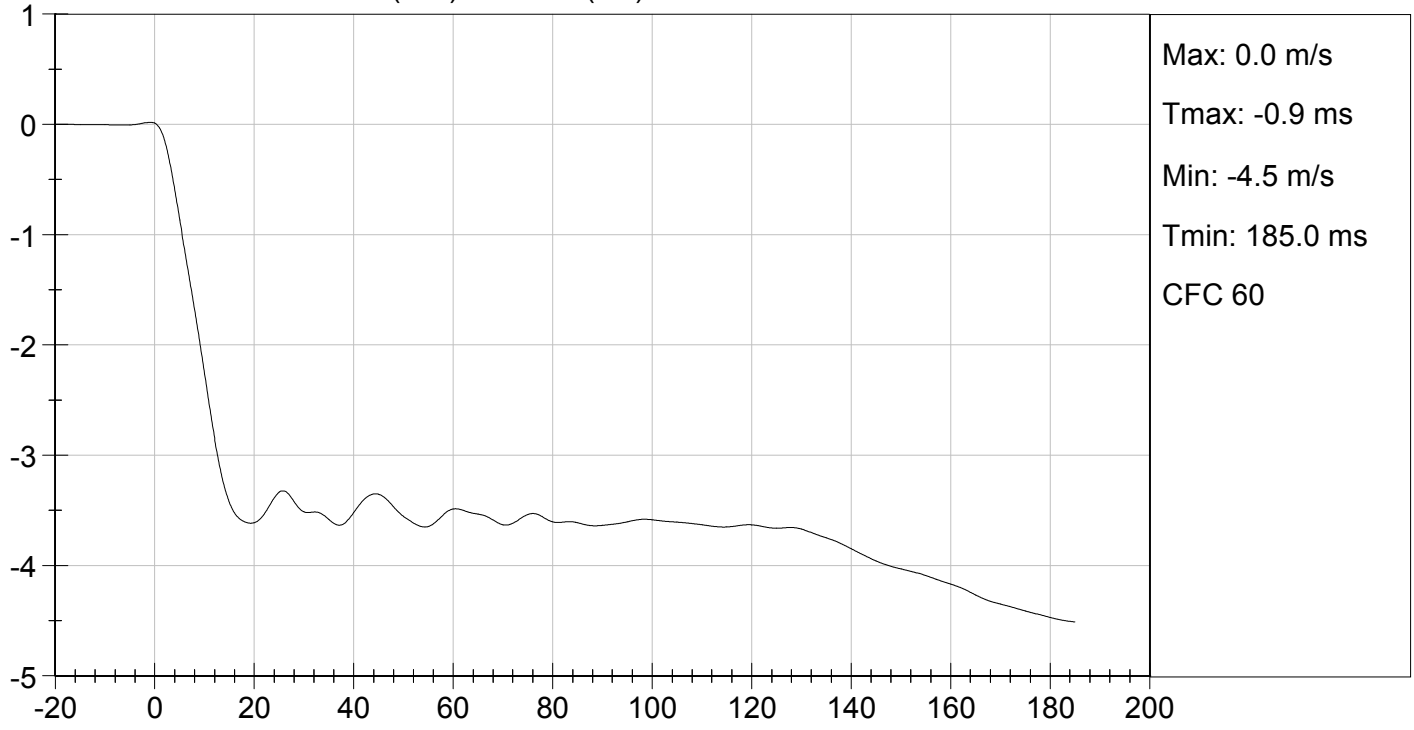
06/19/2015
Test Date

Jessica Gall
Approved By

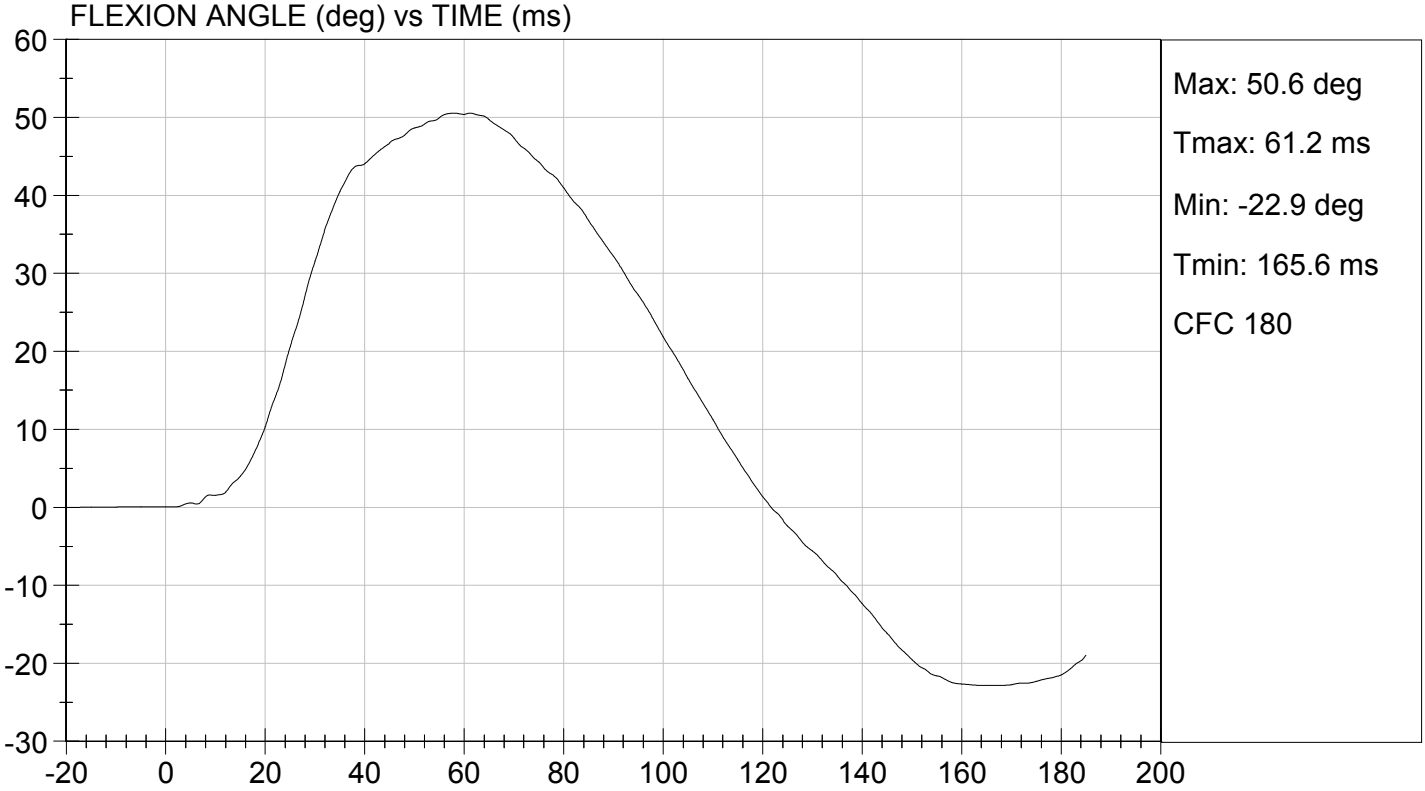
TEST DESC: NECK BENDING
VELOCITY: 11.43 ft/s, 3.48 m/s

TEST DATE: 06/19/2015
TEST #: D151802

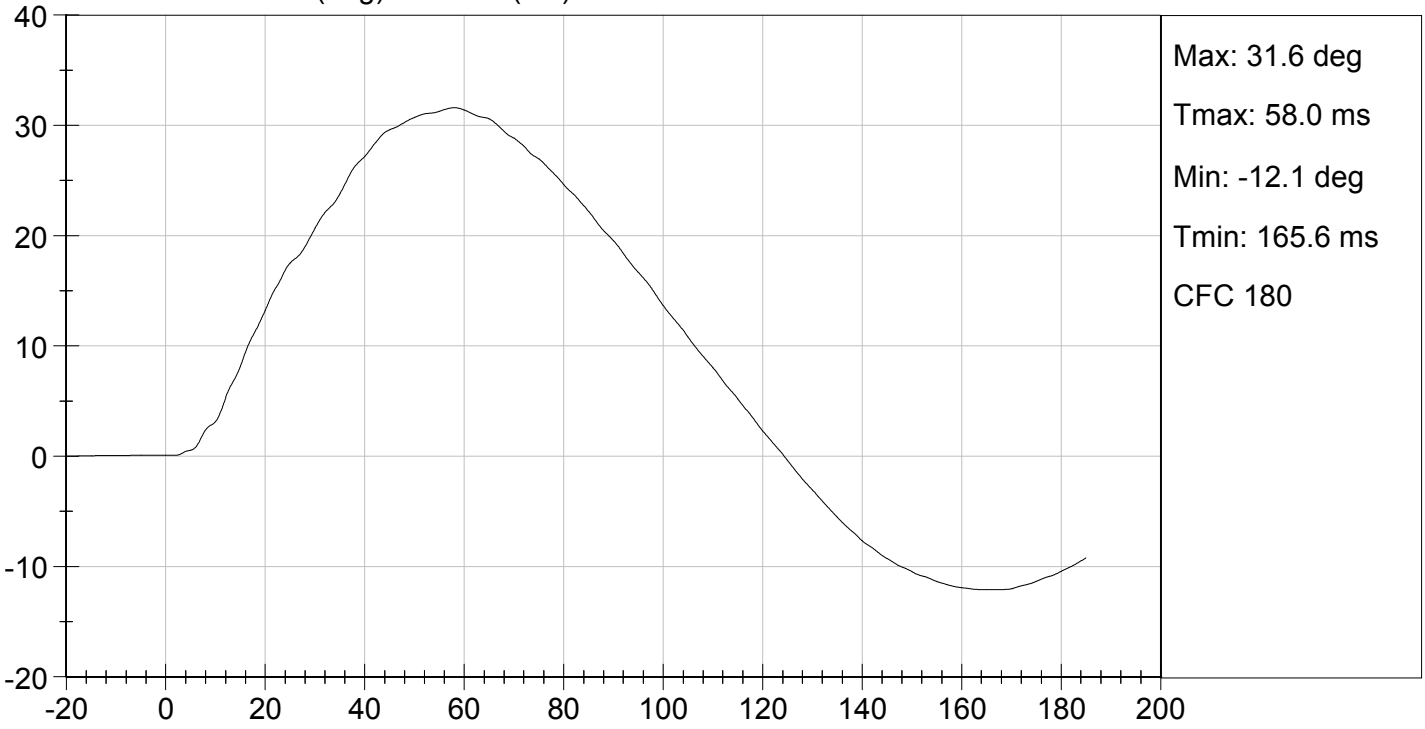
PENDULUM VELOCITY (m/s) vs TIME (ms)



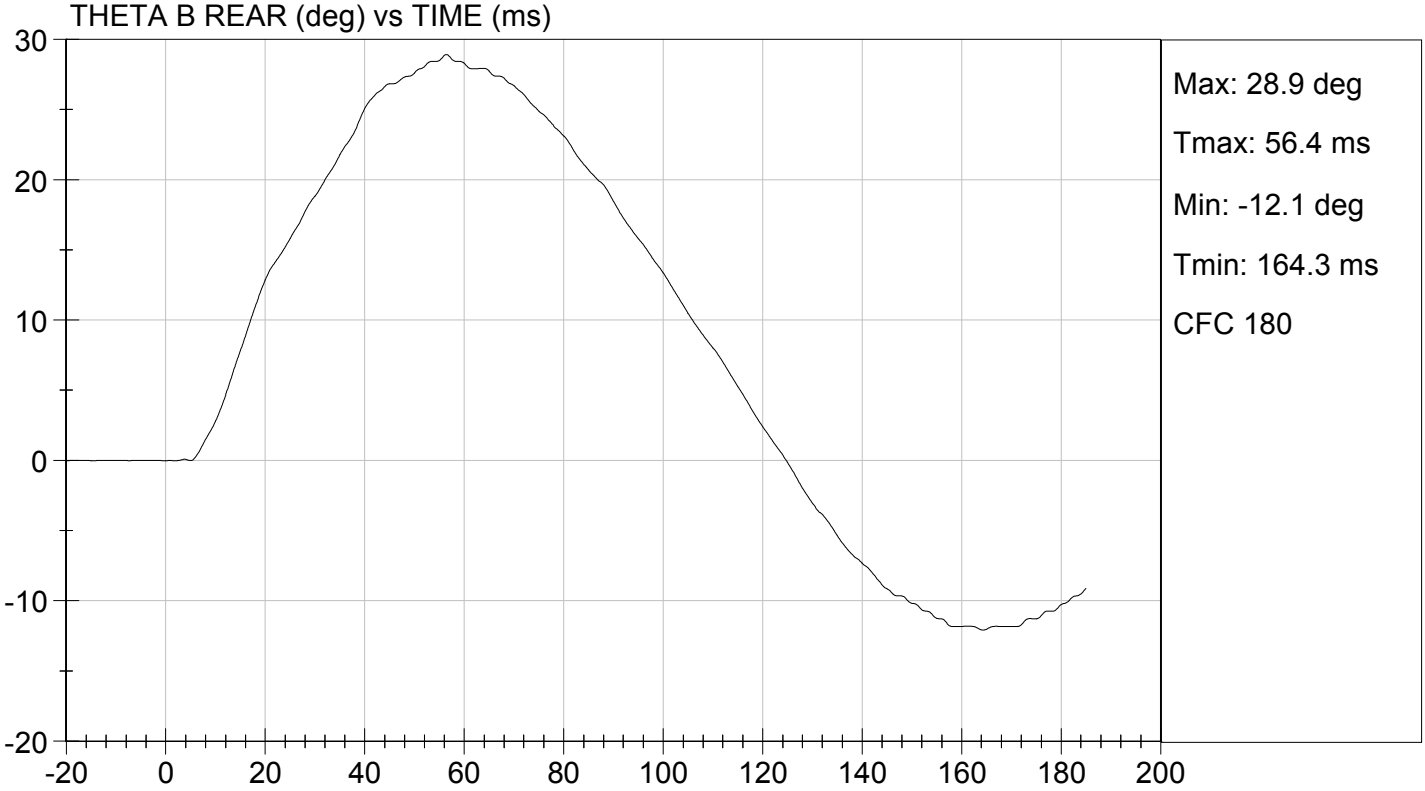
FLEXION ANGLE (deg) vs TIME (ms)



THETA A FRONT (deg) vs TIME (ms)

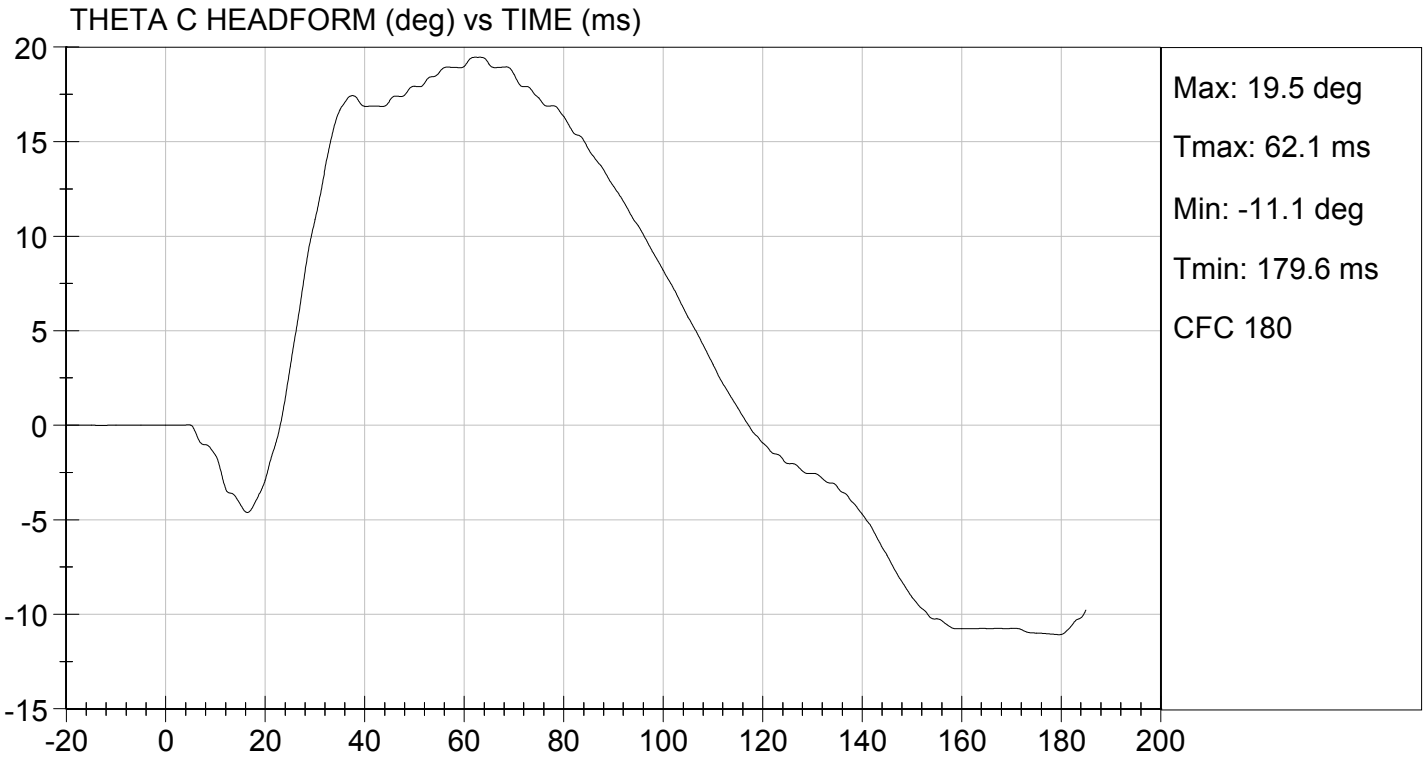


THETA B REAR (deg) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 11.43 ft/s, 3.48 m/s

TEST DATE: 06/19/2015
TEST #: D151802



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151803

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Pendulum Speed	m/s	4.20 to 4.40	4.34	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	8.3	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

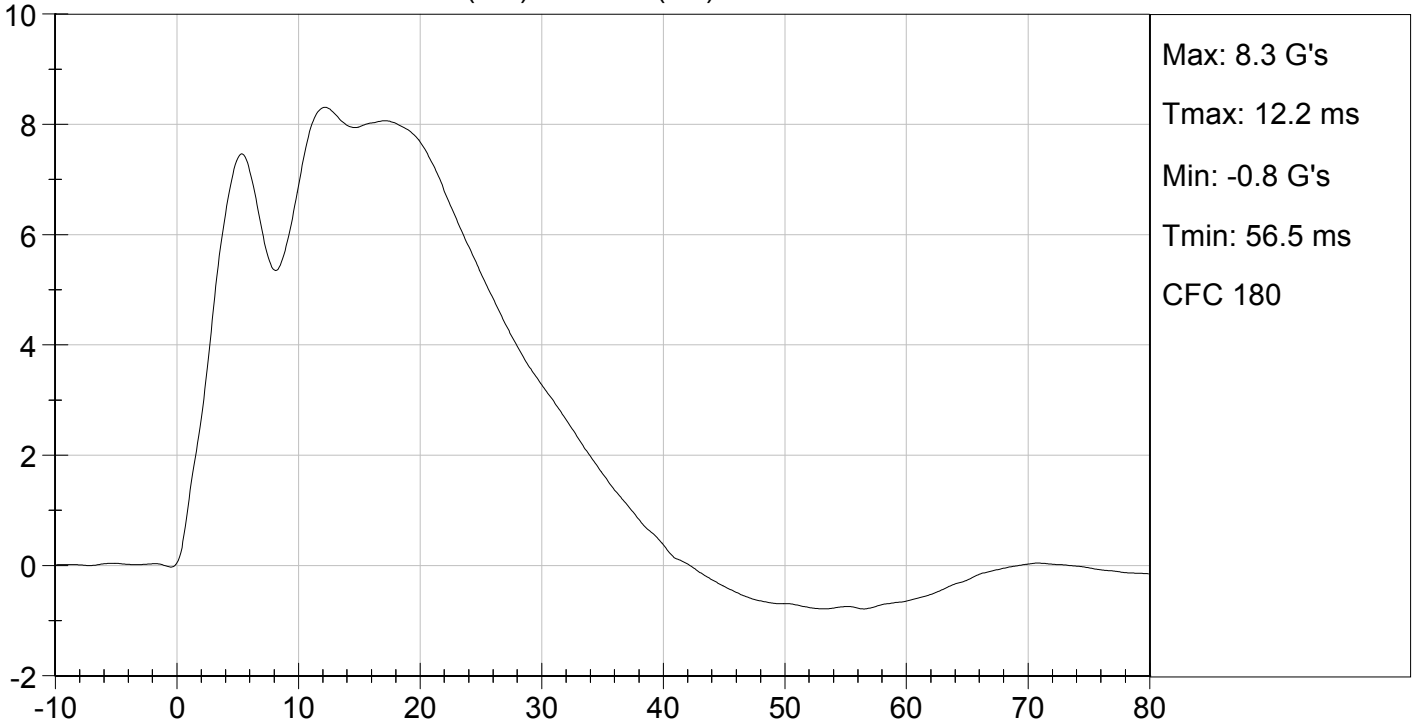
06/19/2015
Test Date

Jessica Hall
Approved By

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

TEST DATE: 06/19/2015
TEST #: D151803

IMPACTOR ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

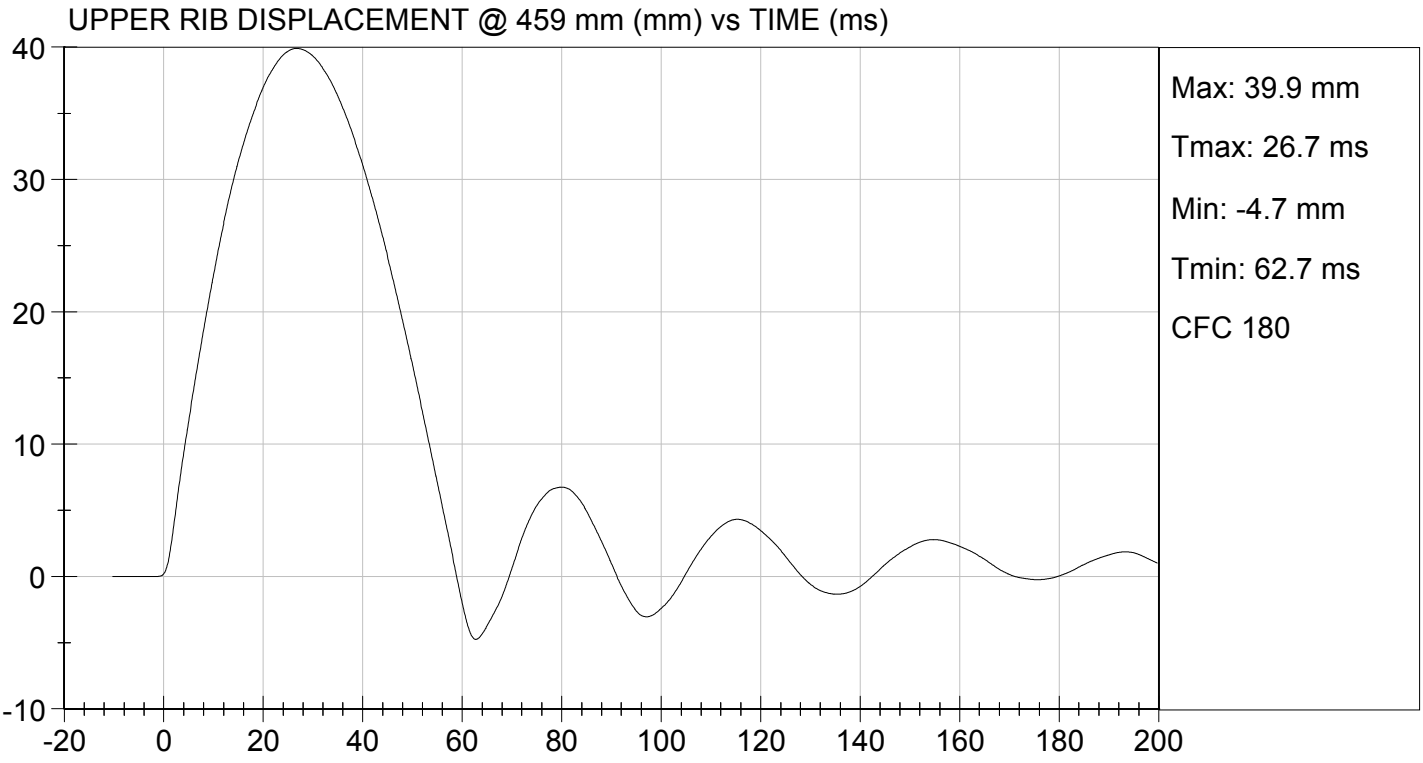
ATD Serial No: 032 **Test I.D:** D151804

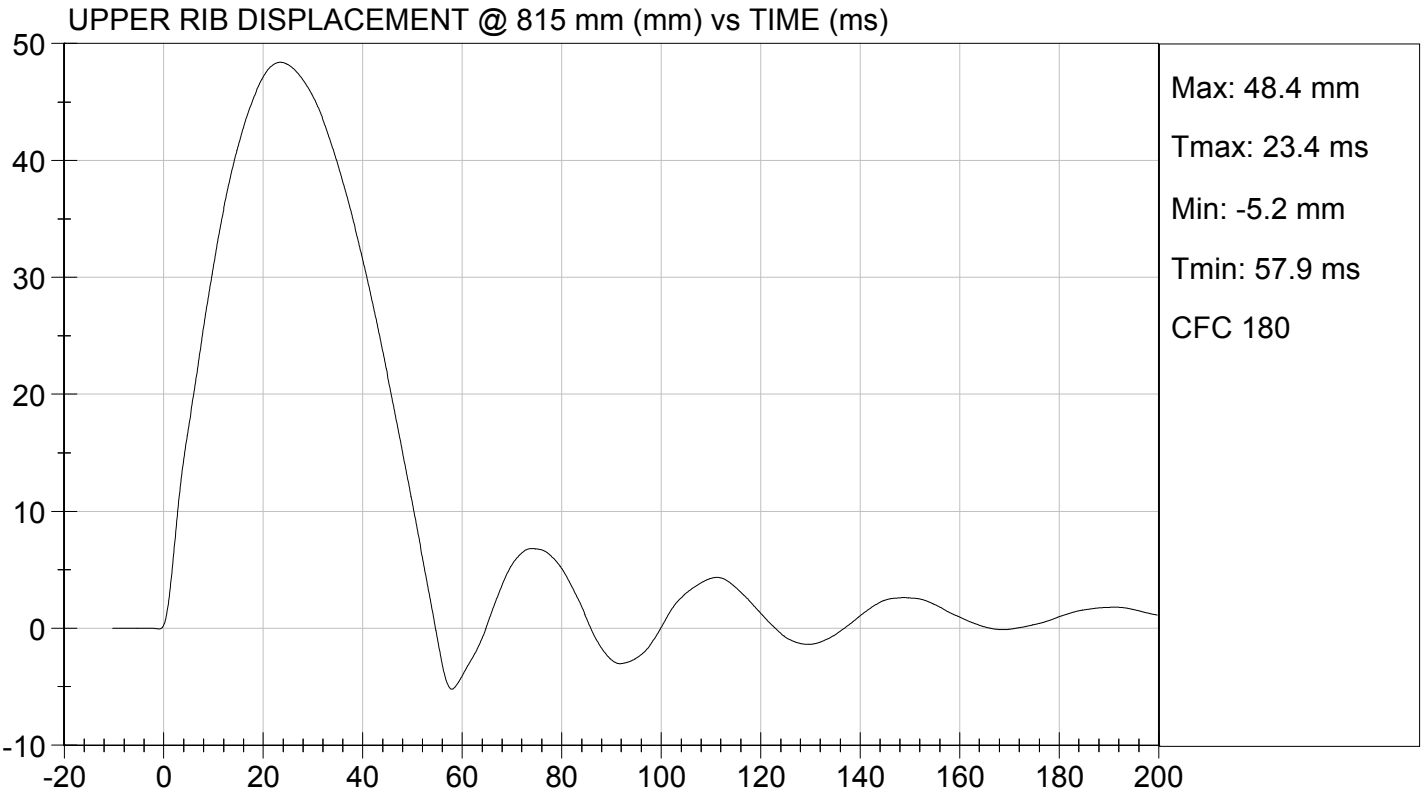
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Displacement at 459 mm	mm	36.0 to 40.0	39.9	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.4	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

06/19/2015
Test Date

Jessica Hall
Approved By


UPPER RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 39.9 mm
Tmax: 26.7 ms
Min: -4.7 mm
Tmin: 62.7 ms
CFC 180


UPPER RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)
50
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 48.4 mm
Tmax: 23.4 ms
Min: -5.2 mm
Tmin: 57.9 ms
CFC 180

MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151805

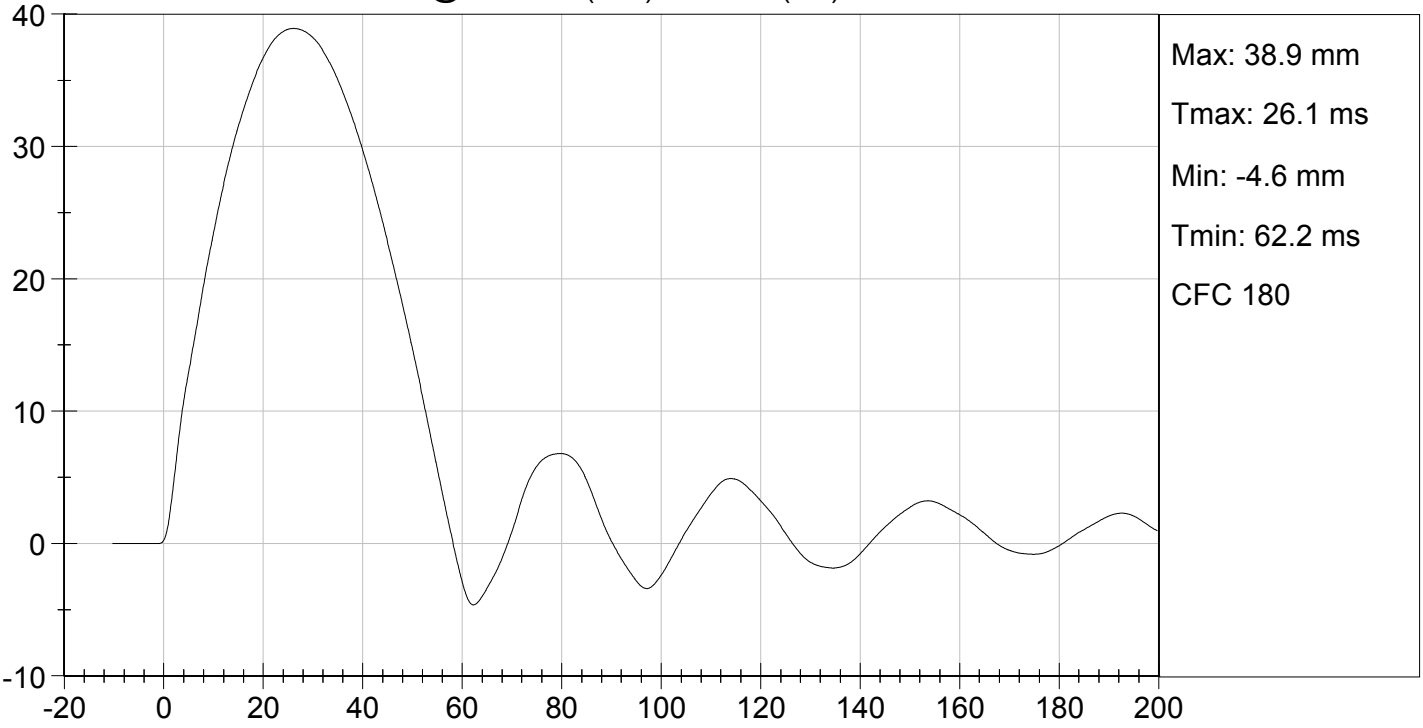
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Displacement at 459 mm	mm	36.0 to 40.0	38.9	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.3	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

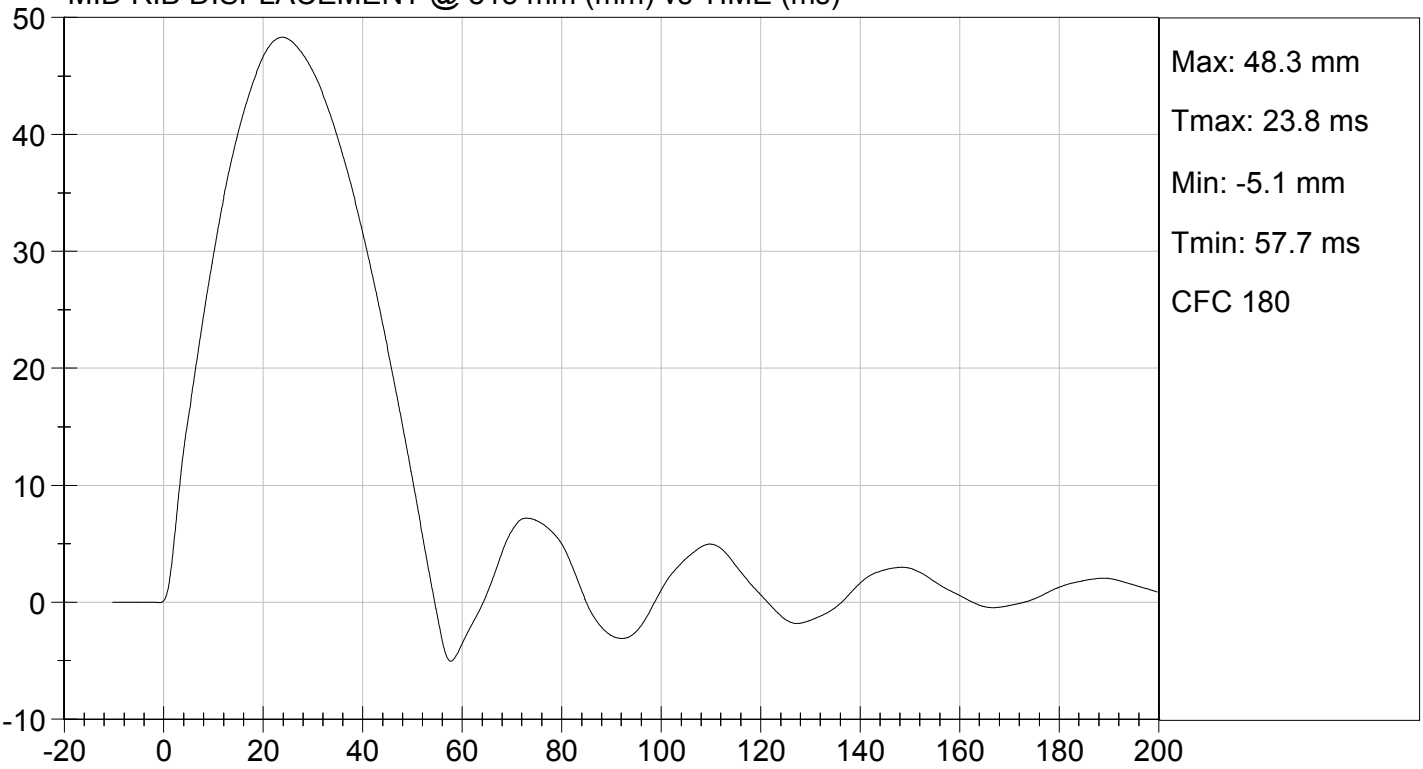
06/19/2015
Test Date

Jessica Hall
Approved By

MID RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)



MID RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151806

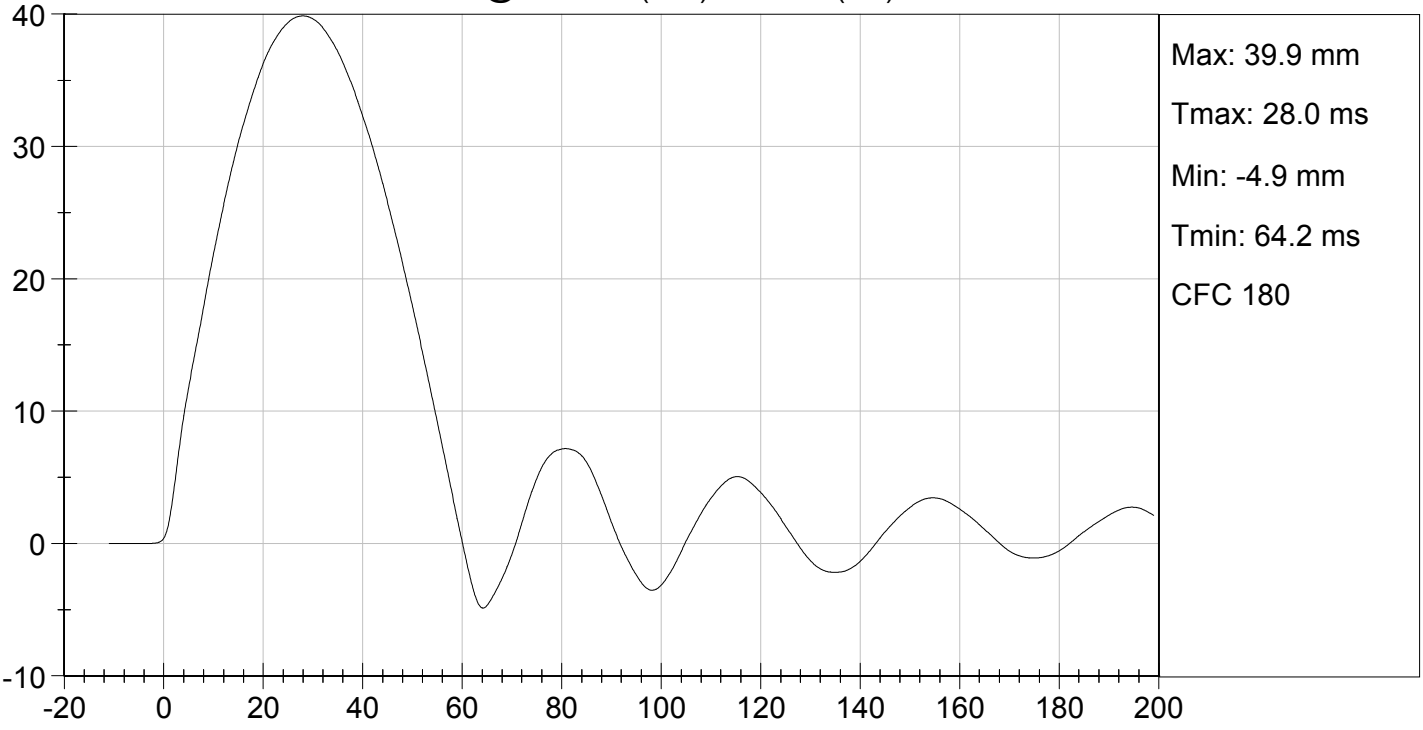
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Displacement at 459 mm	mm	36.0 to 40.0	39.9	Pass
Displacement at 815 mm	mm	46.0 to 51.0	50.6	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

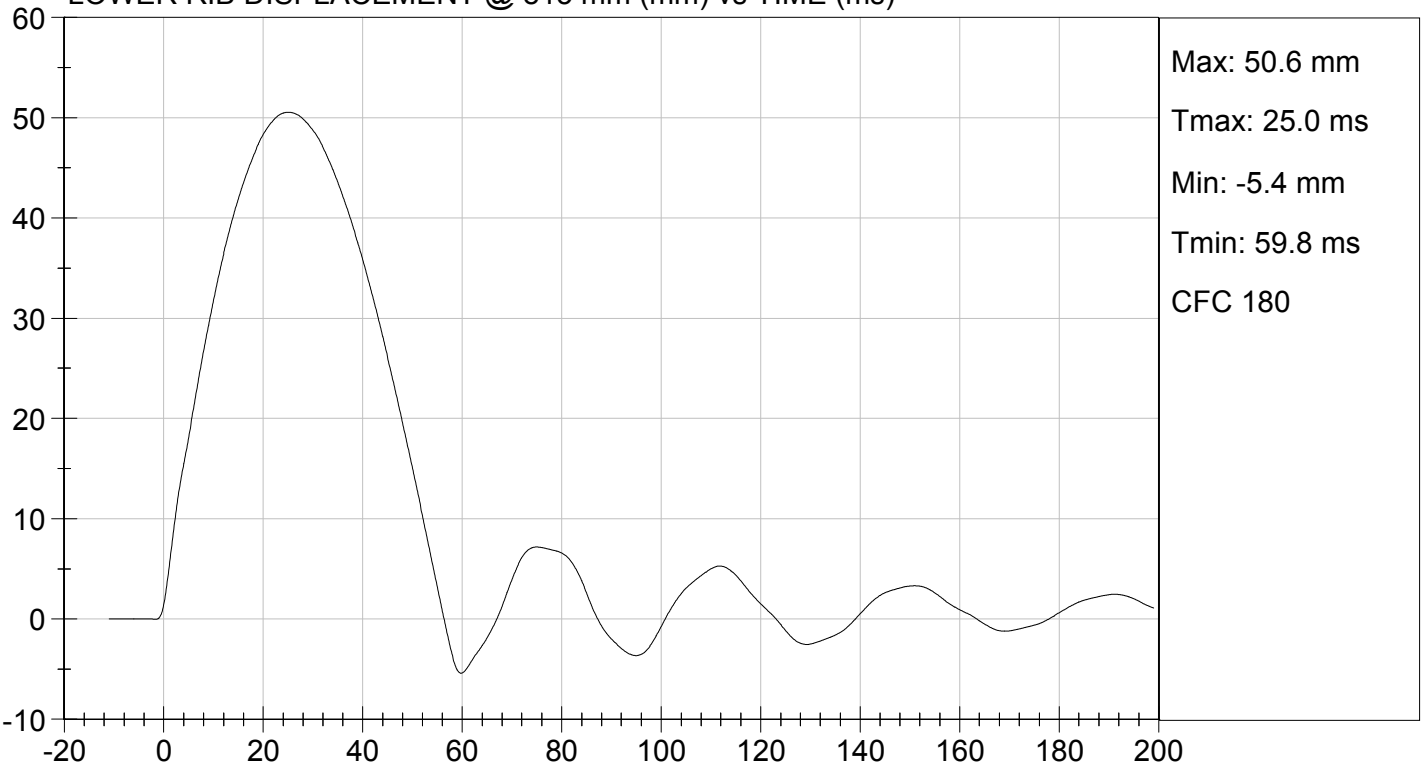
06/19/2015
Test Date

Jessica Hall
Approved By

LOWER RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151800

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	N	5100 to 6200	5577	Pass
Upper Rib Displacement	mm	34.0 to 41.0	39.3	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.5	Pass
Lower Rib Displacement	mm	37.0 to 44.0	41.4	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

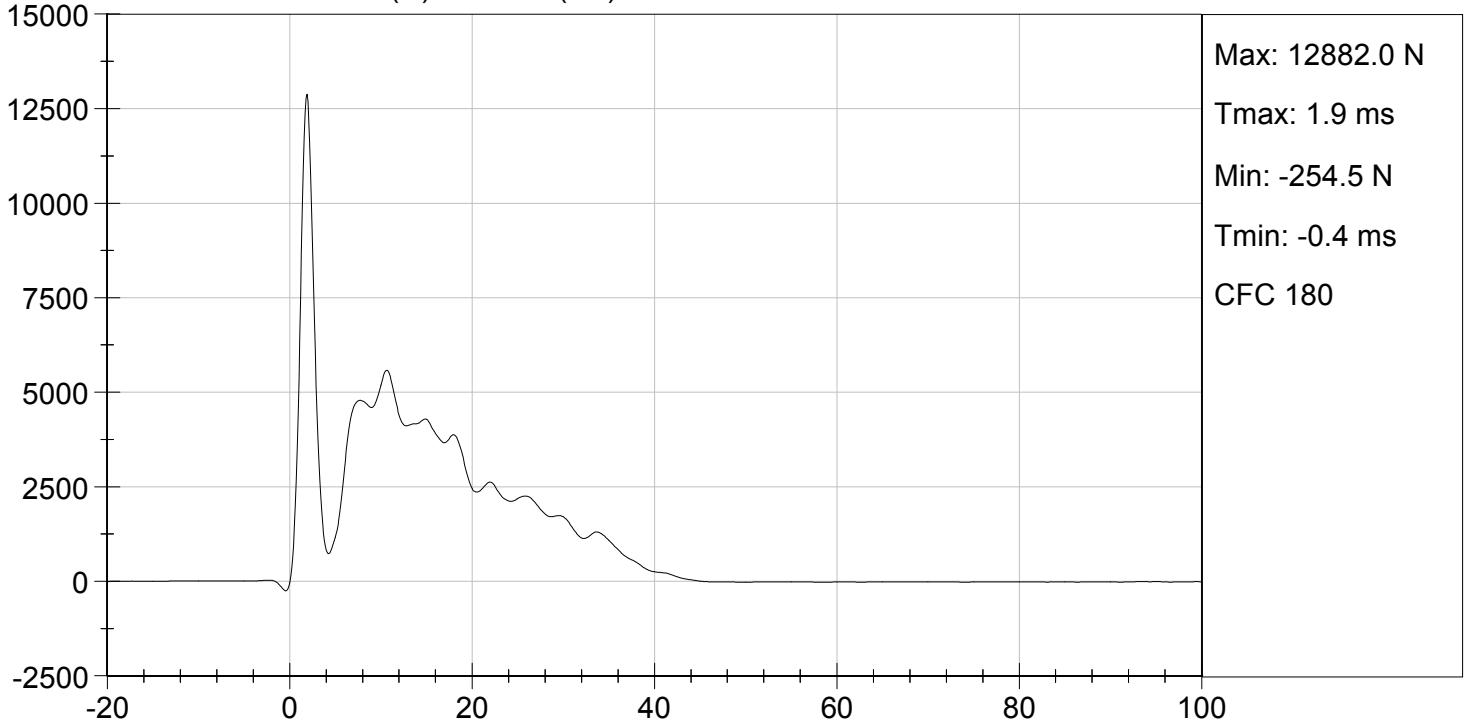
06/19/2015
Test Date

Jessica Gall
Approved By

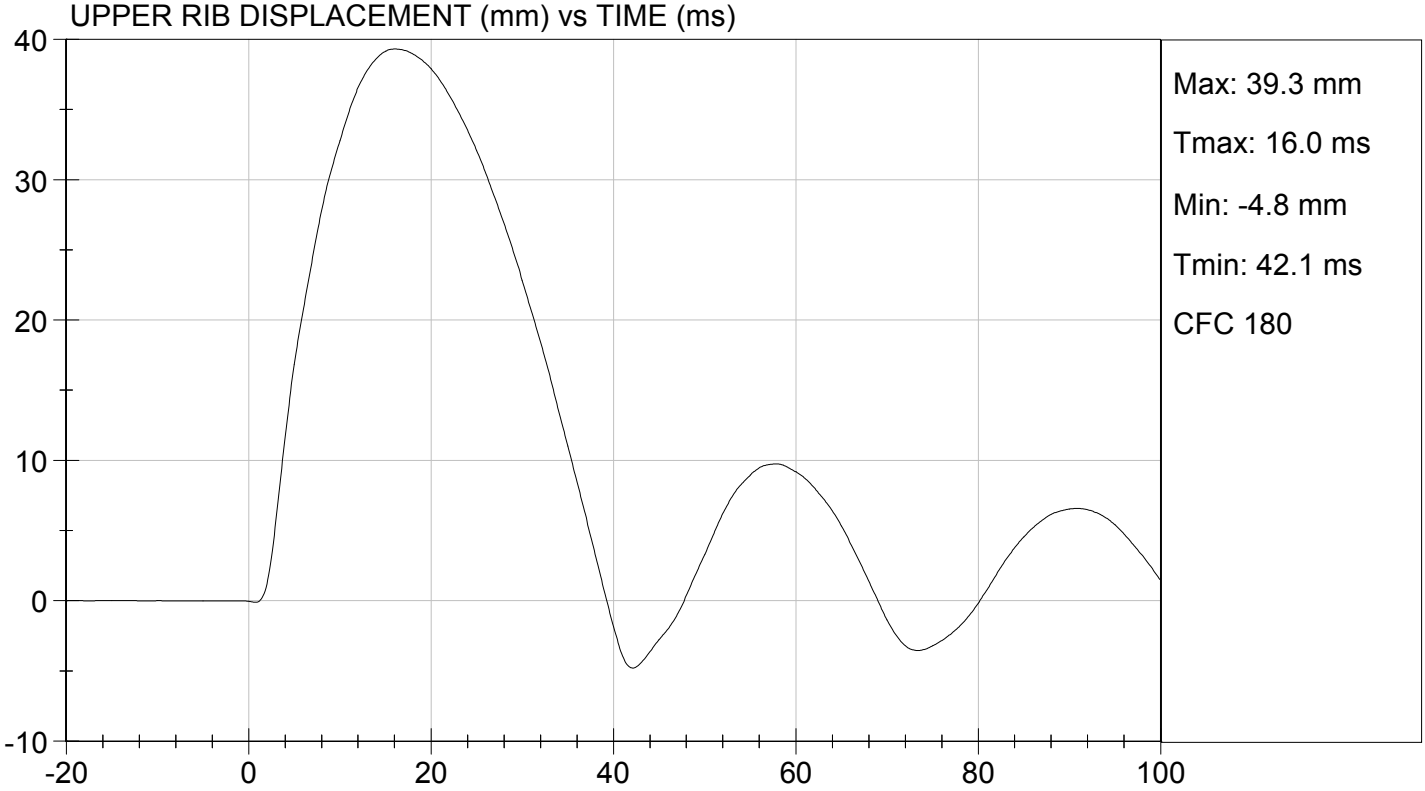
TEST DESC: THORAX IMPACT
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 06/19/2015
TEST #: D151800

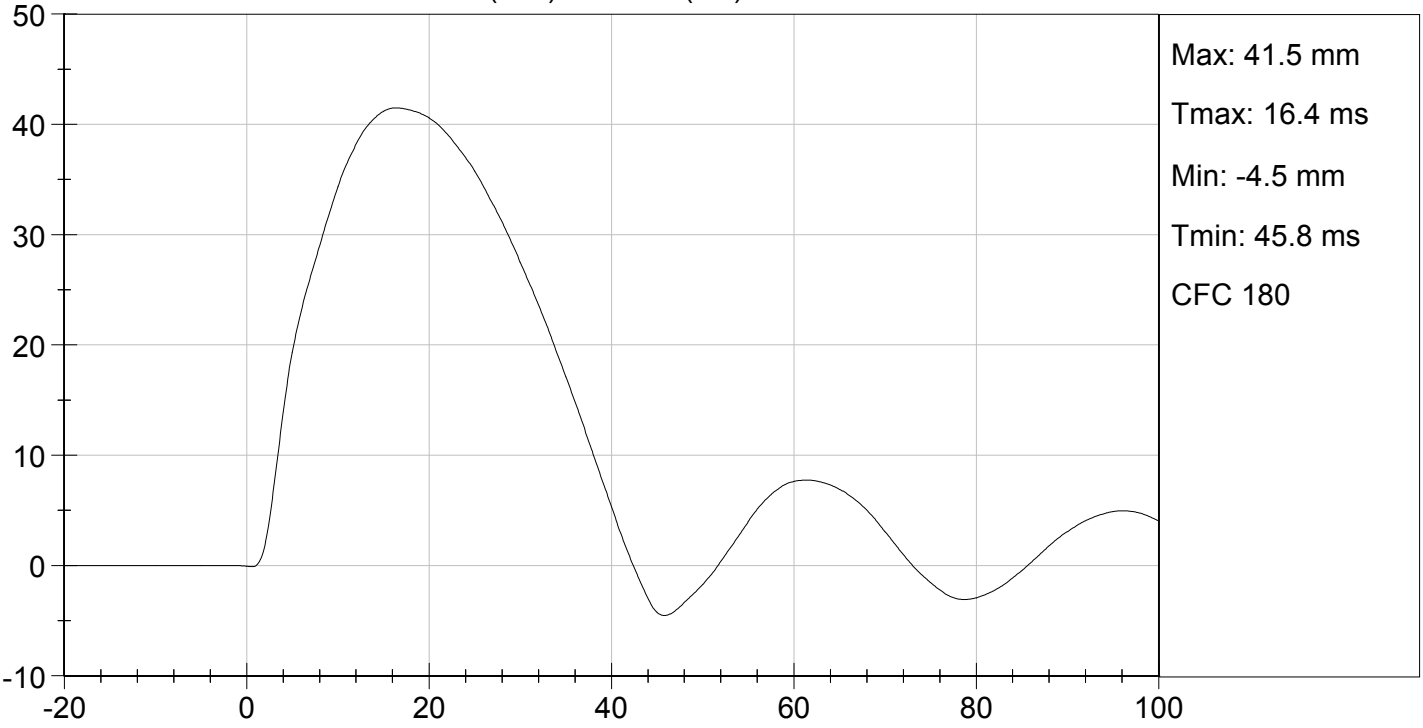
IMPACTOR FORCE (N) vs TIME (ms)



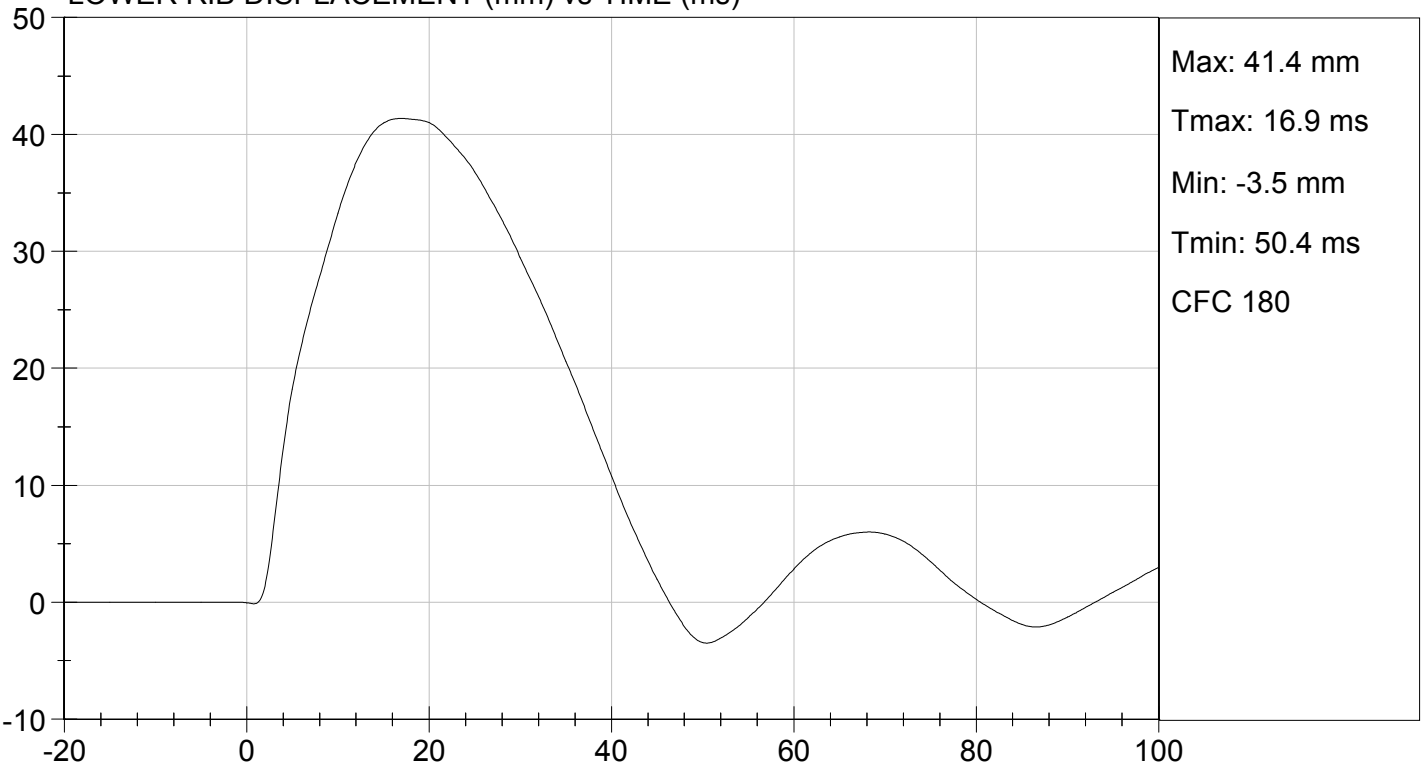
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151807

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impactor Force	N	4000 to 4800	4442	Pass
Time of Maximum Impactor Force	ms	10.6 to 13.0	11.8	Pass
Maximum Total Abdomen Force	N	2200 to 2700	2275	Pass
Time of Maximum Abdomen Force	ms	10.0 to 12.3	11.5	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

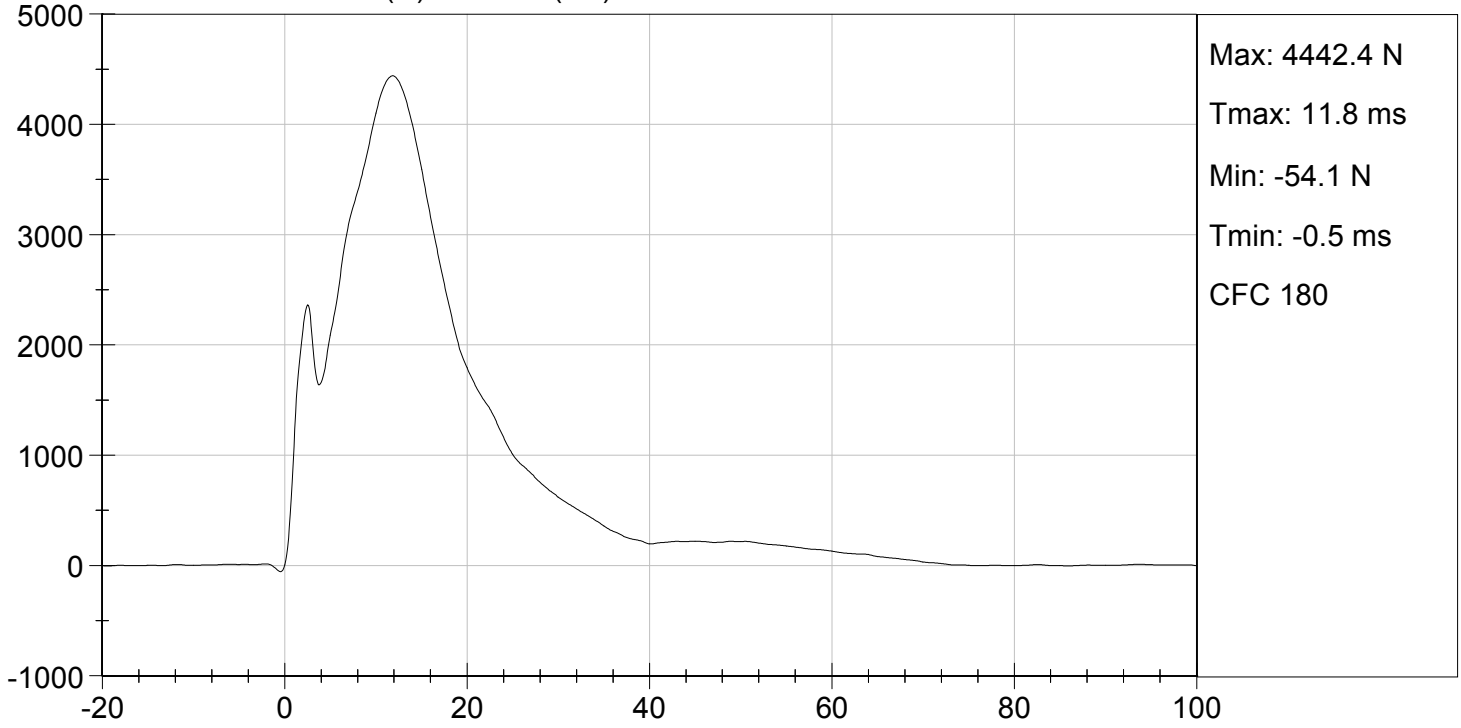
06/19/2015
Test Date

Jessica Hall
Approved By

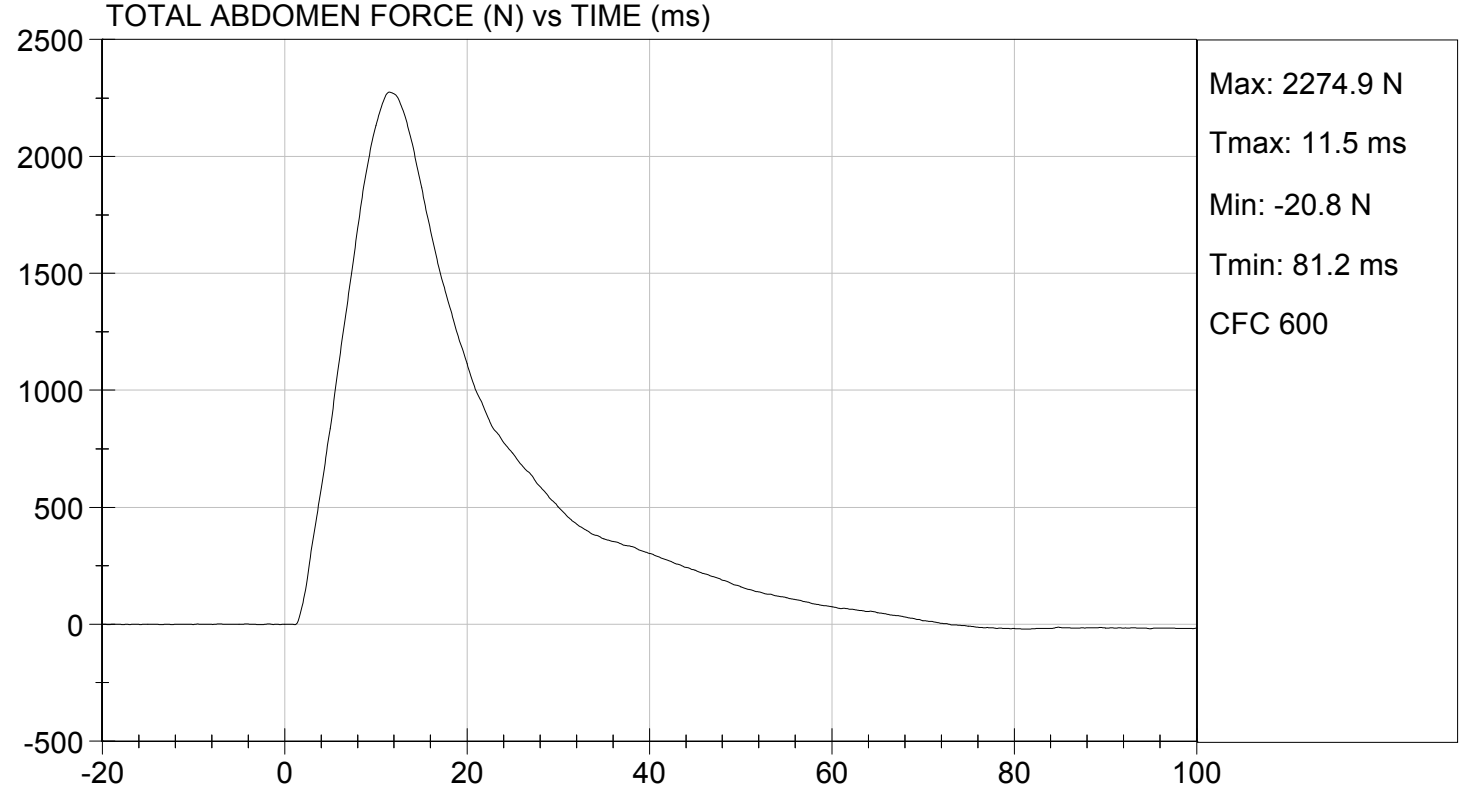
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.33 ft/s, 4.06 m/s

TEST DATE: 06/19/2015
TEST #: D151807

IMPACTOR FORCE (N) vs TIME (ms)



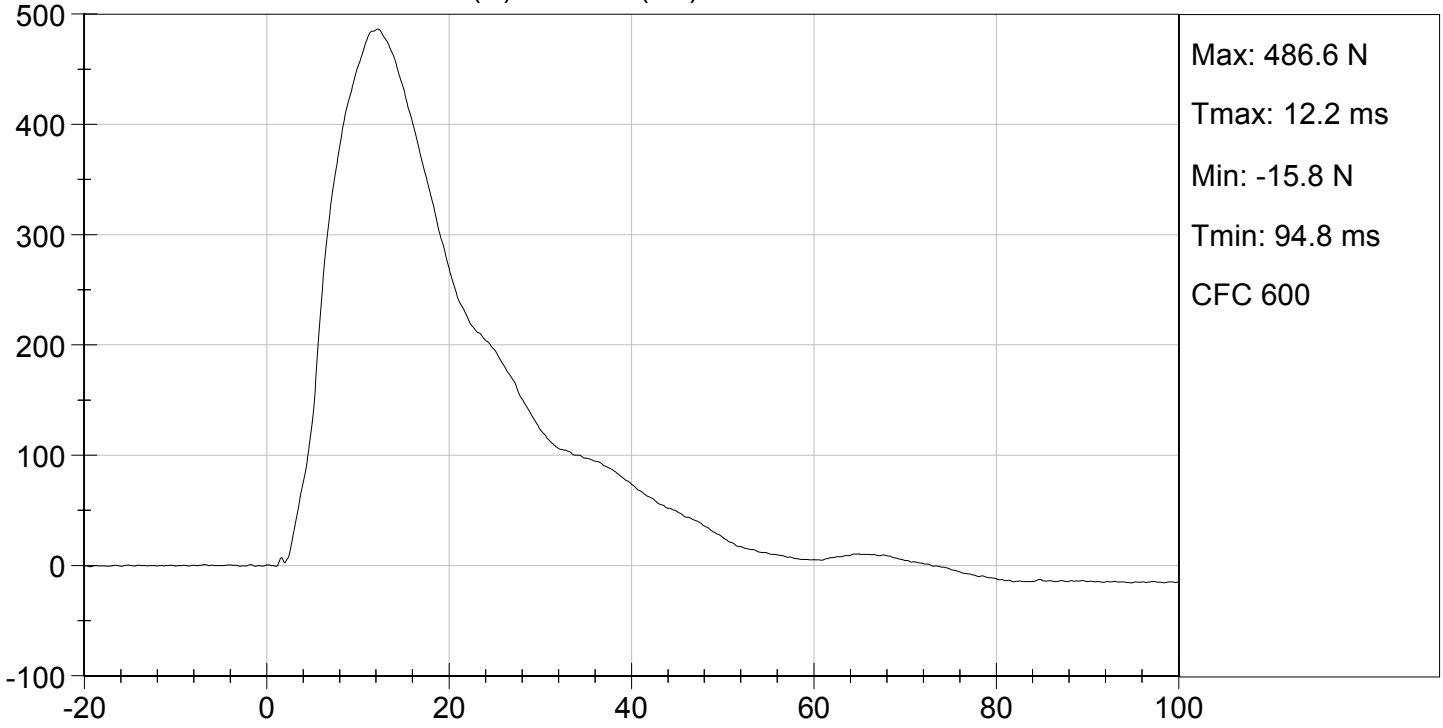
TOTAL ABDOMEN FORCE (N) vs TIME (ms)



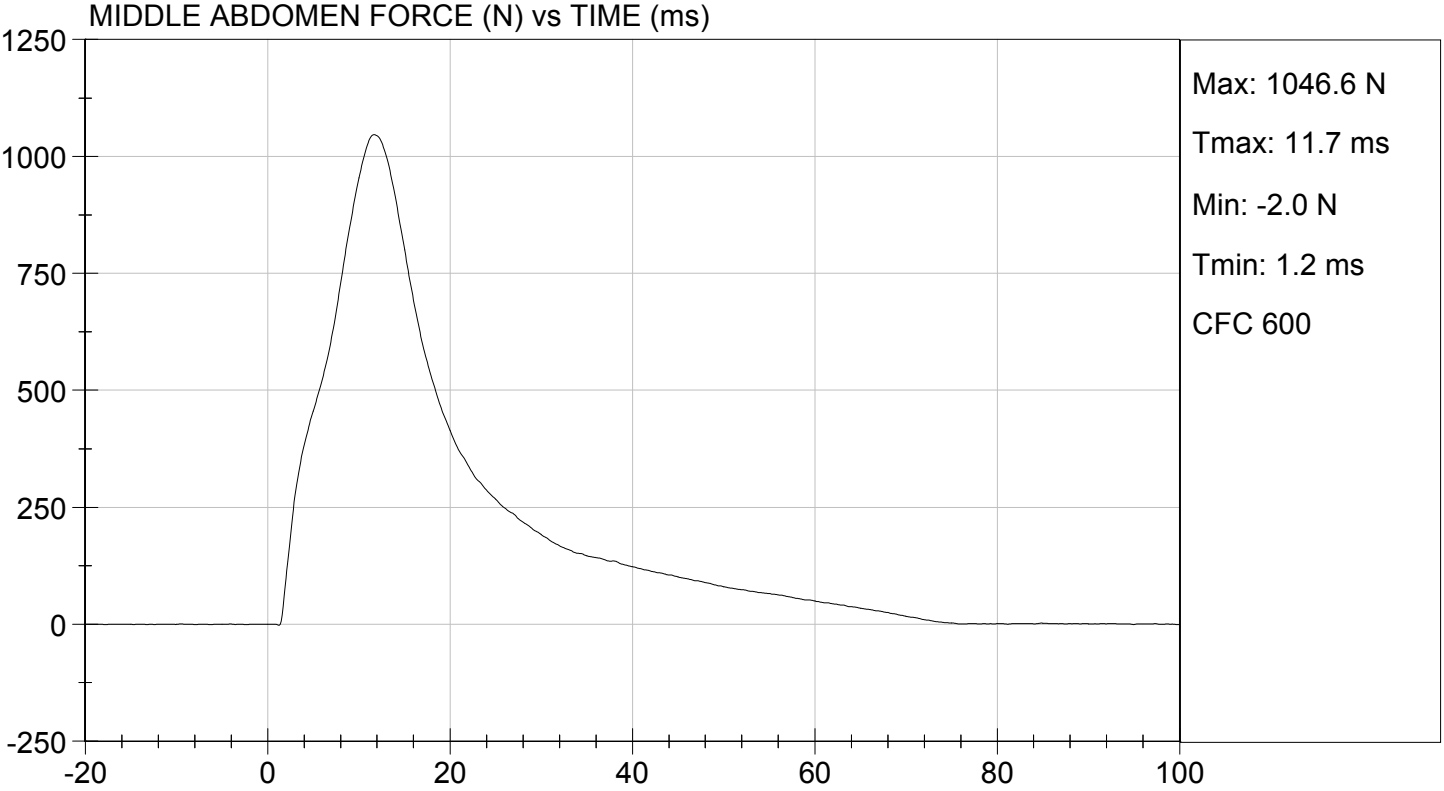
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.33 ft/s, 4.06 m/s

TEST DATE: 06/19/2015
TEST #: D151807

FRONT ABDOMEN FORCE (N) vs TIME (ms)



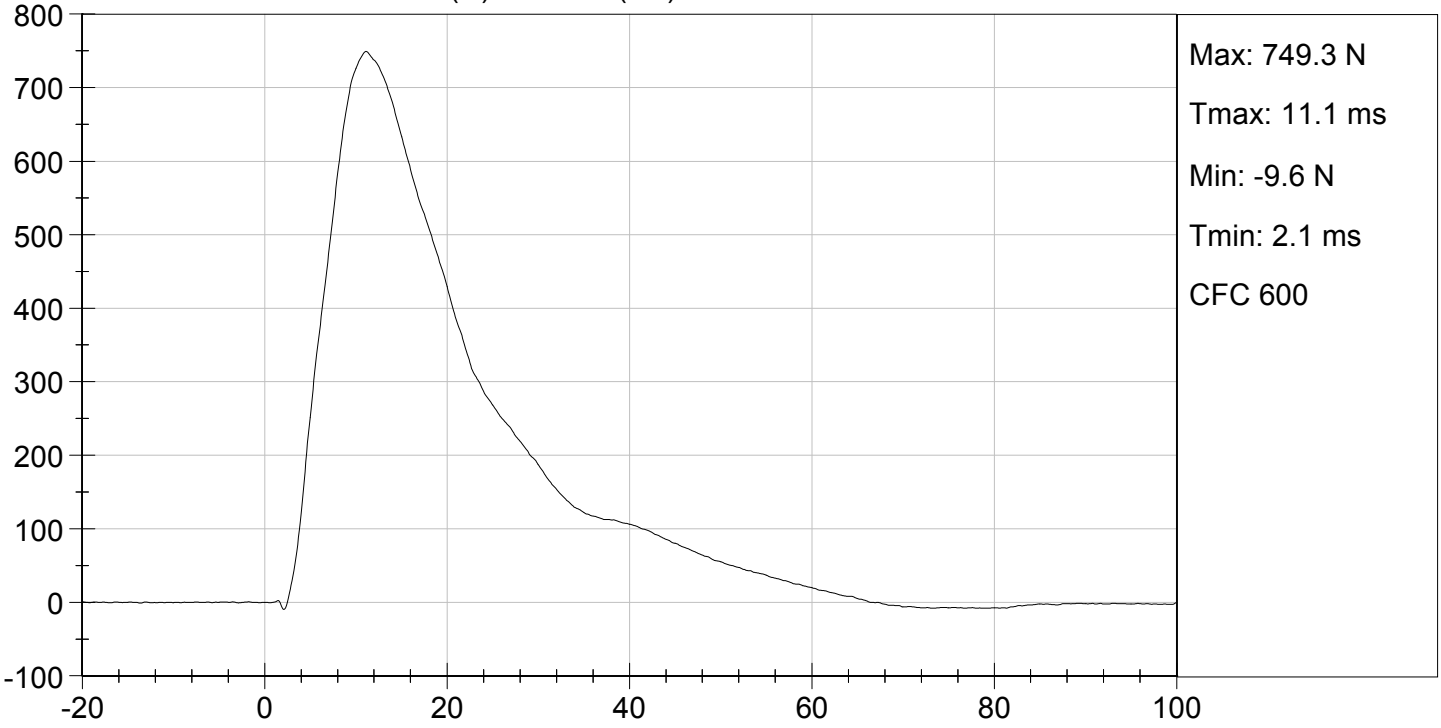
MIDDLE ABDOMEN FORCE (N) vs TIME (ms)



TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.33 ft/s, 4.06 m/s

TEST DATE: 06/19/2015
TEST #: D151807

REAR ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151808

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.397	Pass
	27 ms	m/s	-6.50 to -5.80	-5.89	Pass
	30 ms	m/s	>= -6.50	-6.45	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	46.5	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	46.4	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	48	Pass
			Overall Results		Pass

David Schoedel
Laboratory Technician

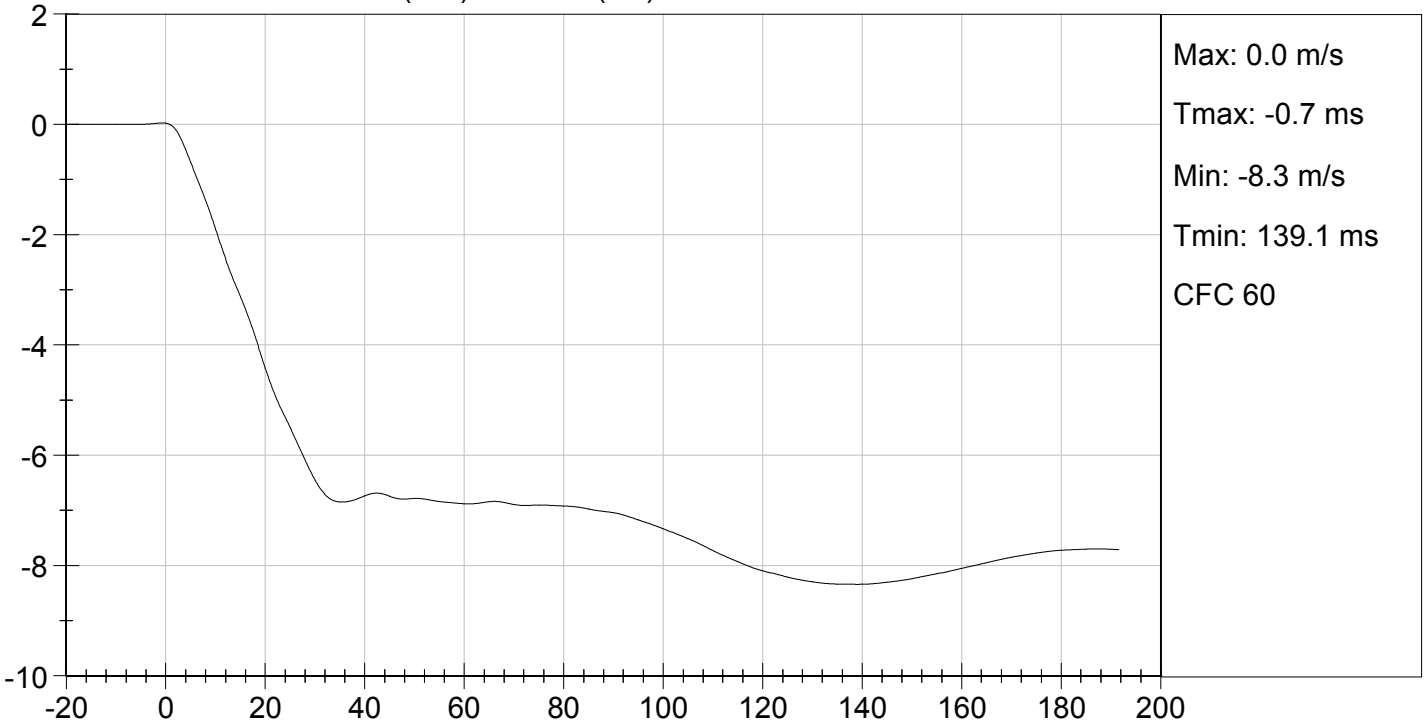
06/19/2015
Test Date

Jessica Hall
Approved By

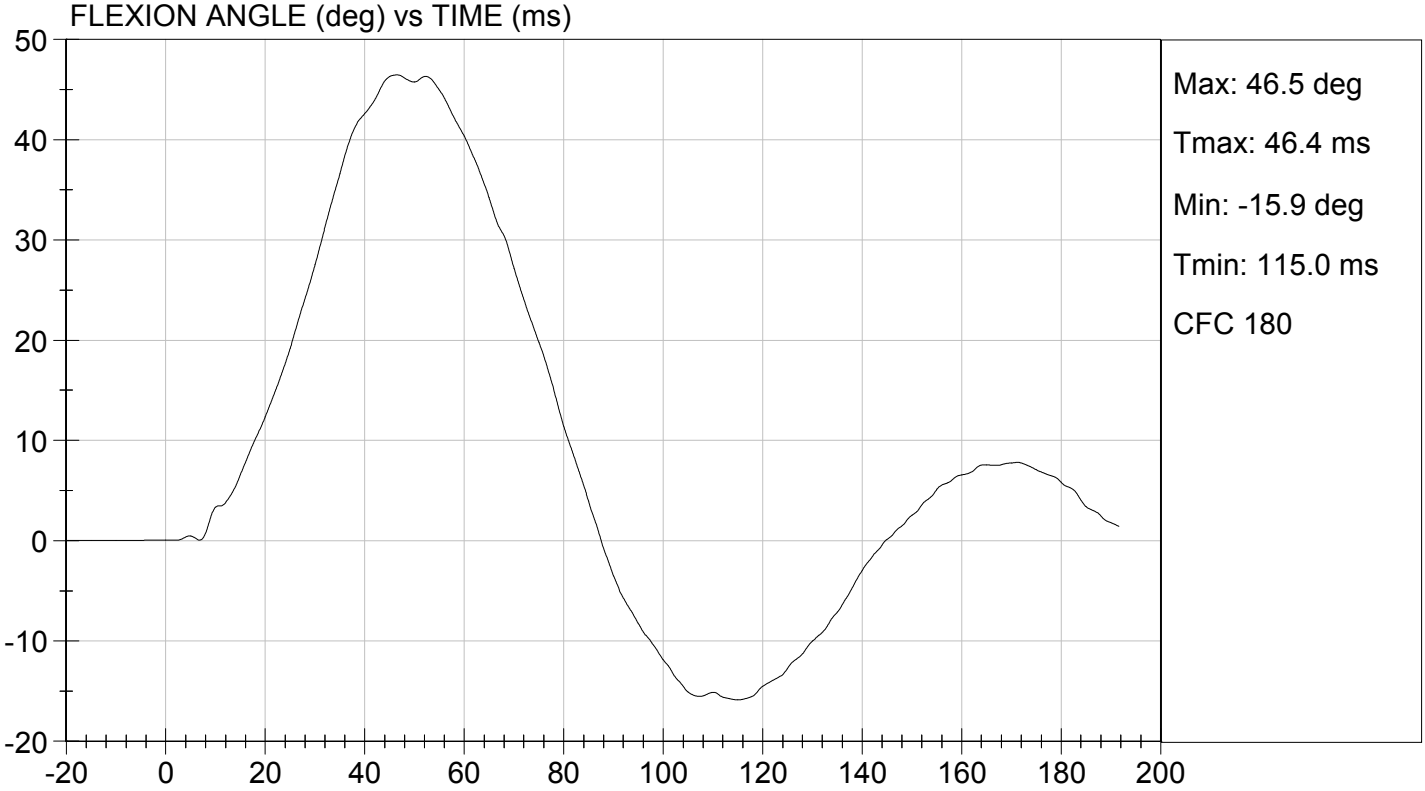
TEST DESC: LUMBAR BENDING
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 06/19/2015
TEST #: D151808

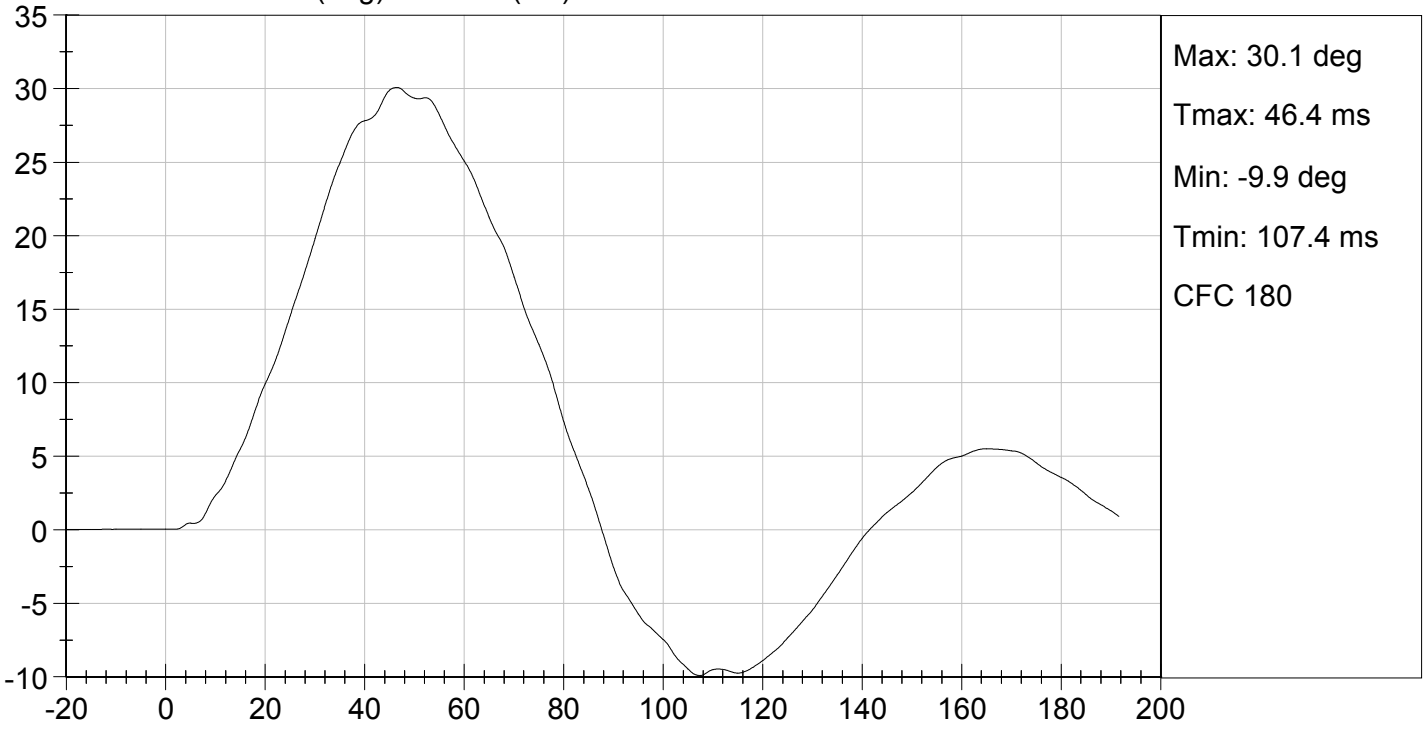
PENDULUM VELOCITY (m/s) vs TIME (ms)



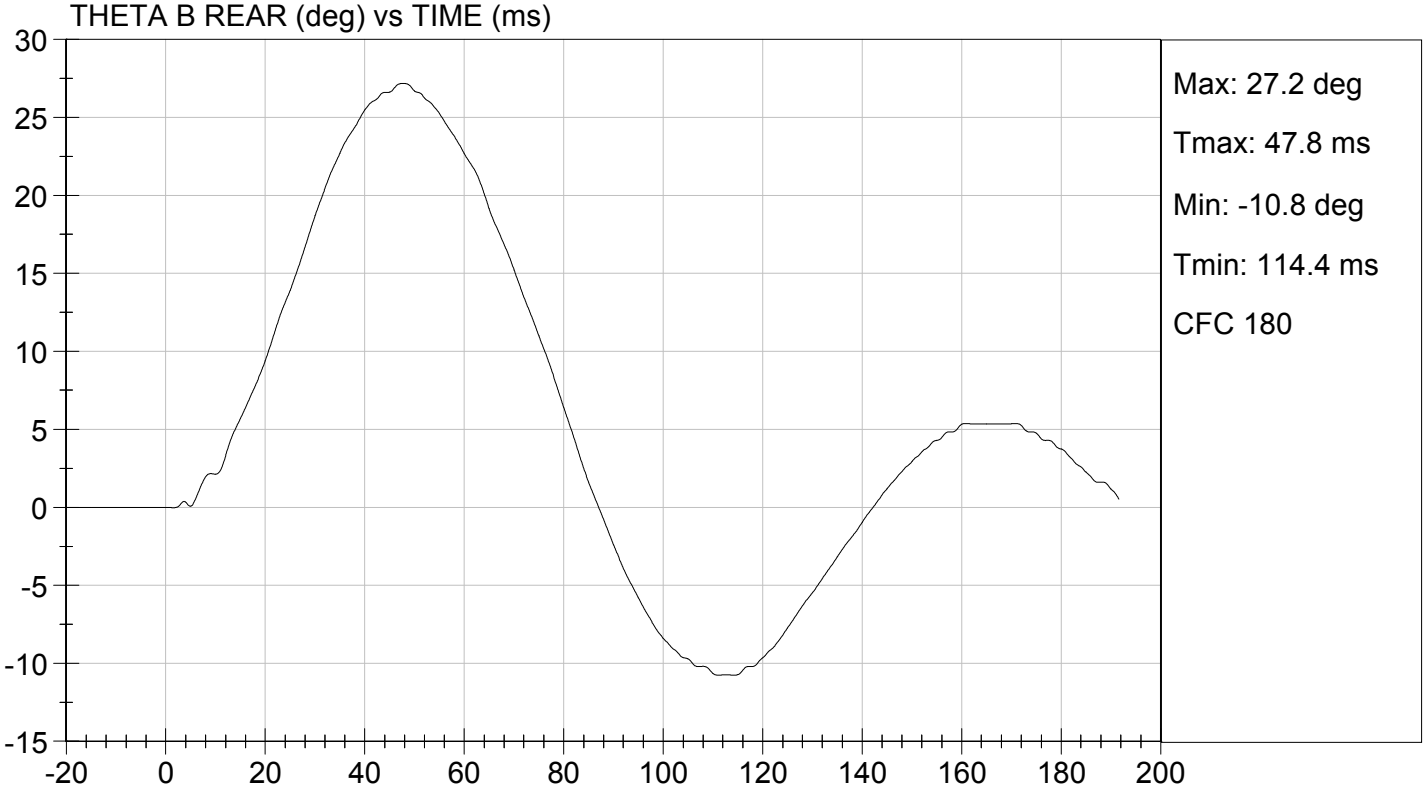
FLEXION ANGLE (deg) vs TIME (ms)



THETA A FRONT (deg) vs TIME (ms)

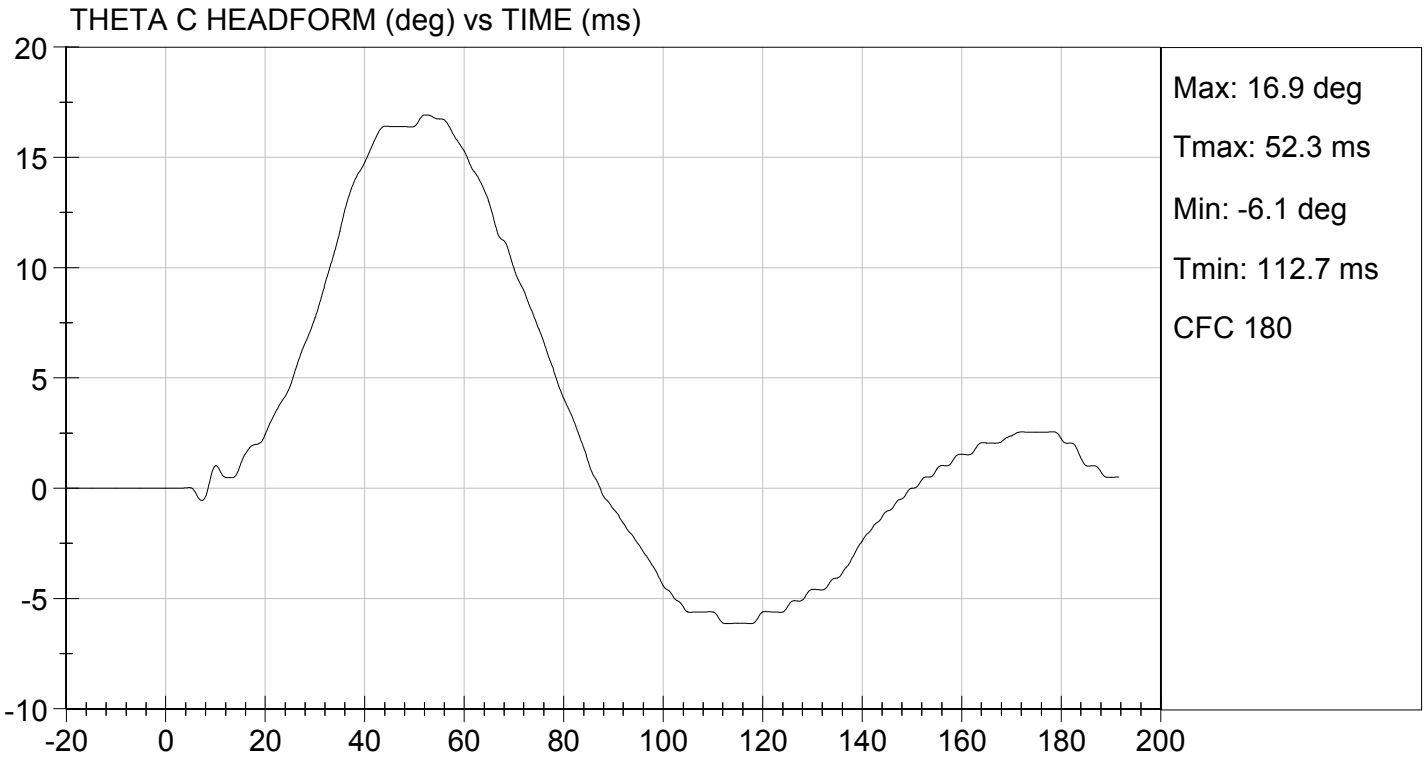


THETA B REAR (deg) vs TIME (ms)



TEST DESC: LUMBAR BENDING
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 06/19/2015
TEST #: D151808



MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 032 **Test I.D:** D151809

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	4.20 to 4.40	4.30	Pass
Maximum Impactor Force	N	4700 to 5400	4974	Pass
Time of Maximum Impactor Force	ms	11.8 to 16.1	14.2	Pass
Maximum Pubic Force	N	1230 to 1590	1294	Pass
Time of Maximum Pubic Force	ms	12.2 to 17.0	13.8	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

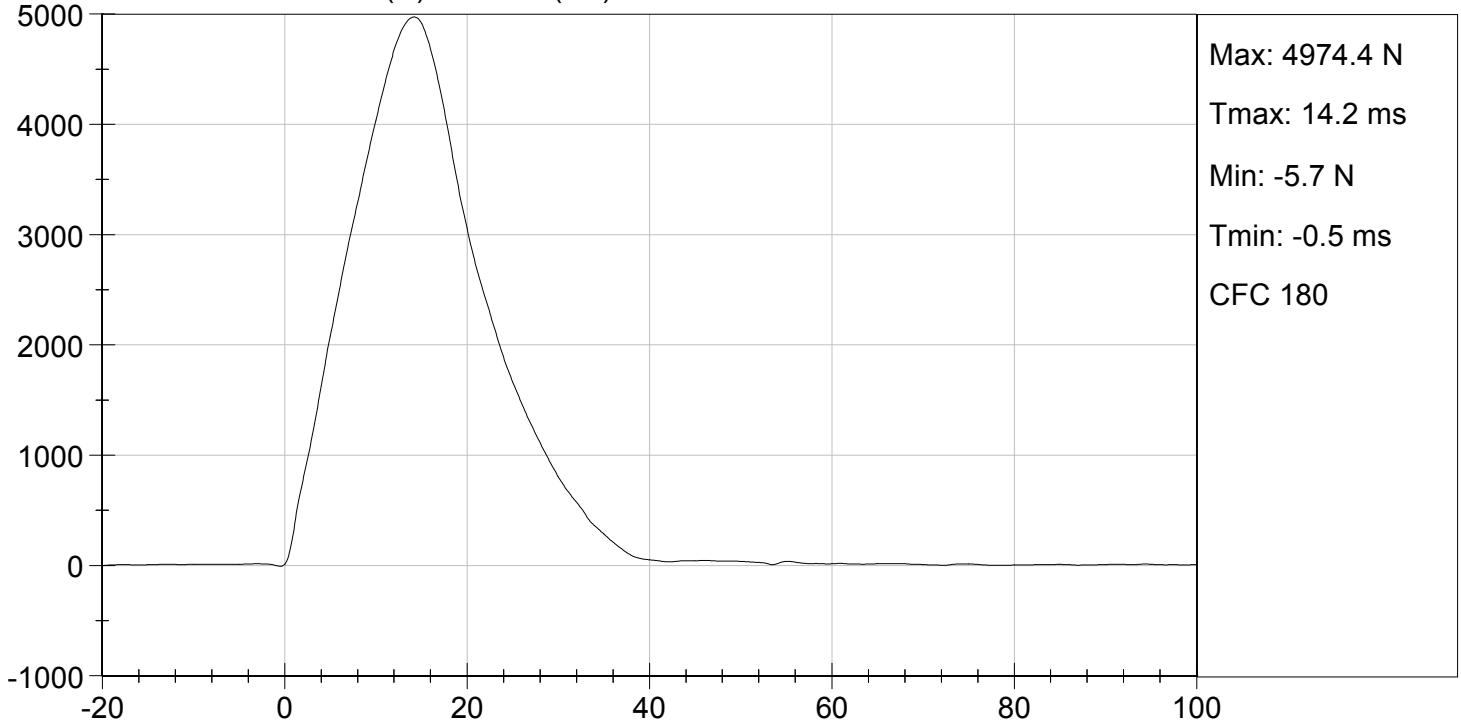
06/19/2015
Test Date

Jessica Hall
Approved By

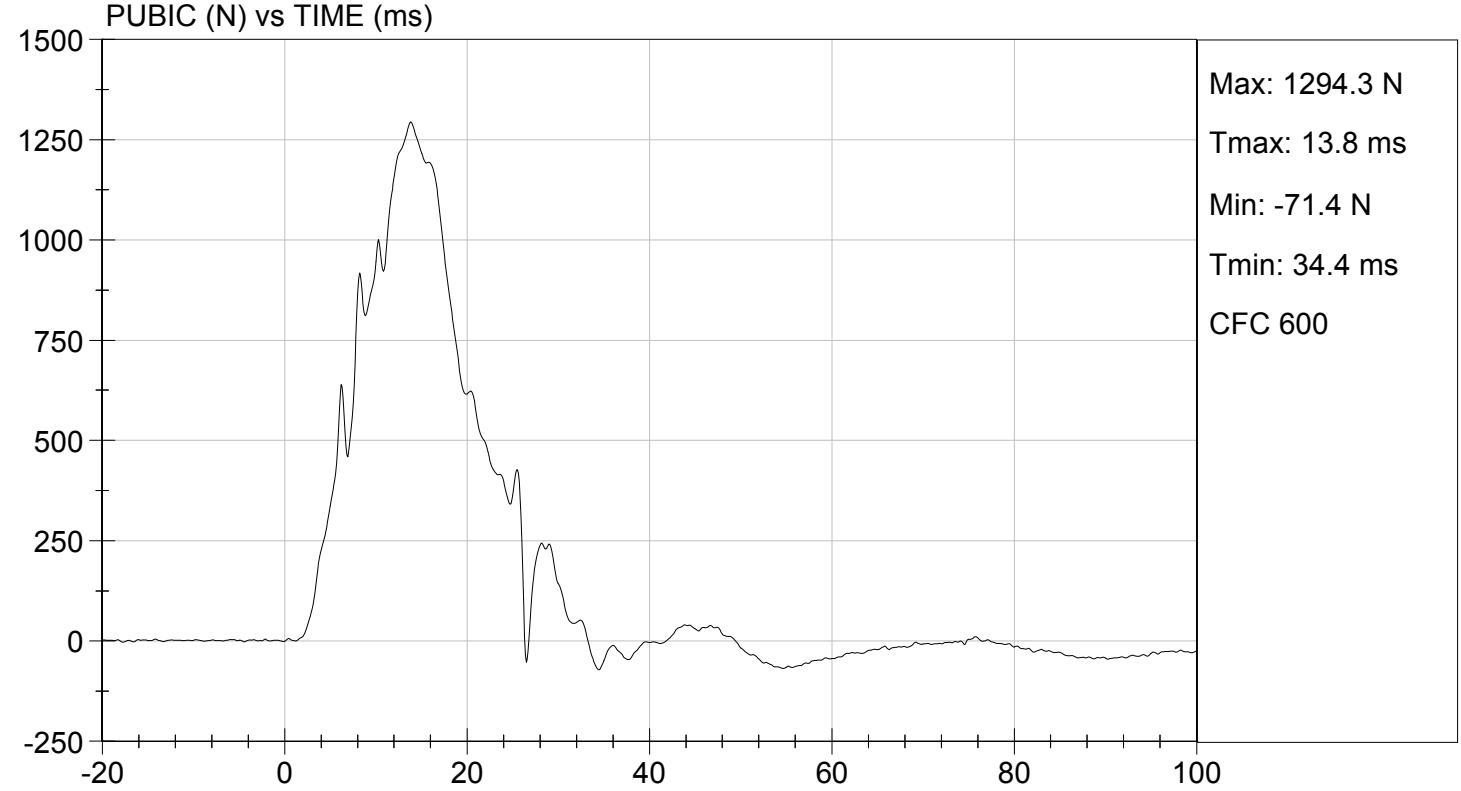
TEST DESC: PELVIS IMPACT
VELOCITY: 14.12 ft/s, 4.3 m/s

TEST DATE: 06/19/2015
TEST #: D151809

IMPACTOR FORCE (N) vs TIME (ms)



PUBIC (N) vs TIME (ms)



SID-IIsD External Measurements
SN: 296

No.	Name	Spec. (mm)	Result	Pass/Fail
A	Sitting Height	772 - 788	784	Pass
B	Shoulder Pivot Height	437 - 453	442	Pass
C	H-point Height	79 - 89	83	Pass
D	H-point from Seatback	141 - 151	145	Pass
E	Shoulder Pivot from Backline	97 - 107	99	Pass
F	Thigh Clearance	119 -135	121	Pass
G	Head Breadth	140 - 148	142	Pass
H	Head Back from Backline	40 - 46	45	Pass
I	Head Depth	178 - 188	180	Pass
J	Head Circumference	541 - 551	548	Pass
K	Buttock to Knee Length	514 - 540	535	Pass
L	Popliteal Height	343 - 369	358	Pass
M	Knee Pivot to Floor Height	392 - 409	404	Pass
N	Buttock Popliteal Length	416 - 442	435	Pass
O	Chest Depth w/o Jacket	195 - 211	206	Pass
P	Foot Length	216 - 232	219	Pass
Q	Hip Breadth (w/ pelvic plugs)	313 - 323	316	Pass
R	Arm Length	249 - 259	250	Pass
S	Knee Joint to Seatback	477 - 493	481	Pass
V	Shoulder Width	341 - 357	346	Pass
W	Foot Width	78 - 94	85	Pass
Y	Chest Circumference w/ jacket	851 - 881	870	Pass
Z	Waist Circumference	761 - 791	772	Pass

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D151771

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Peak Resultant Acceleration	G's	115 to 137	124	Pass
Peak Longitudinal Acceleration	G's	+/- 15	2.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

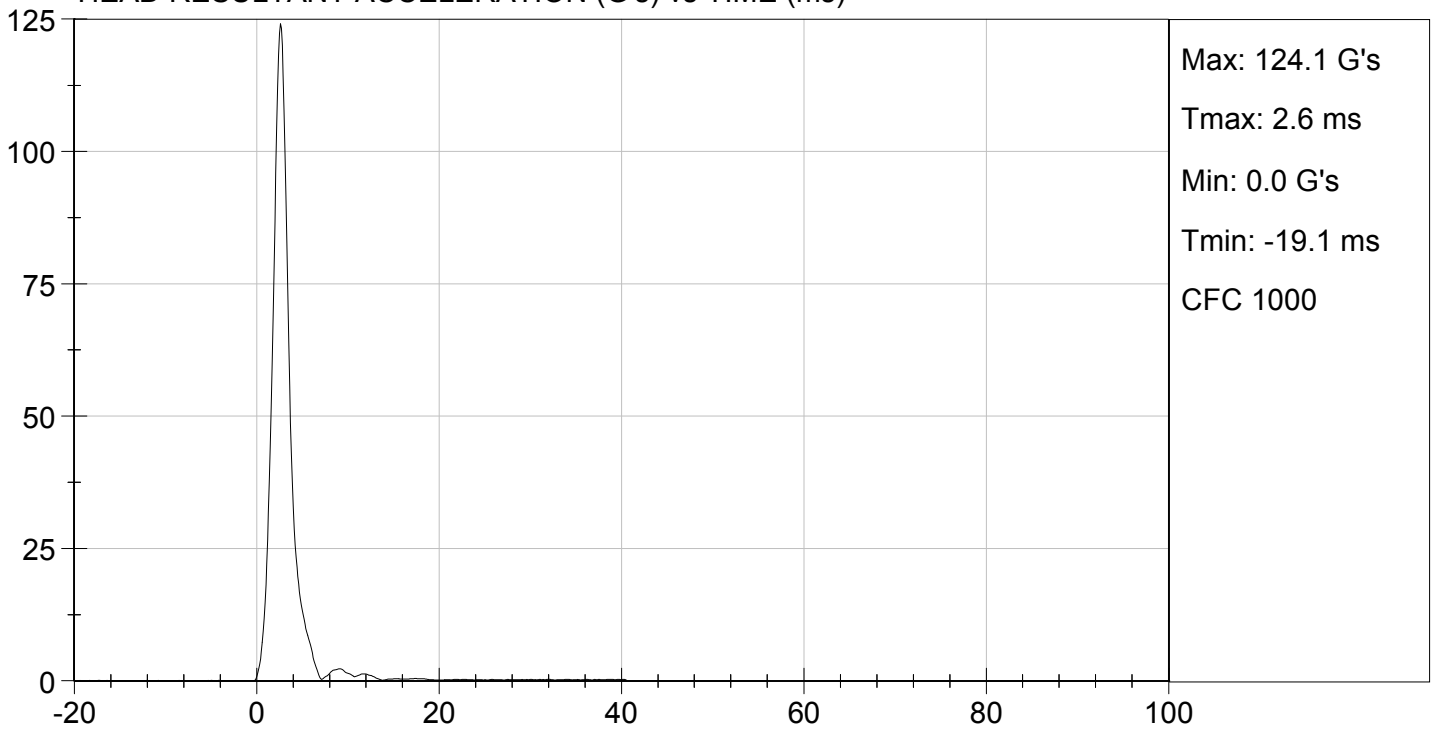
06/17/2015
Test Date

Jessica Hall
Approved By

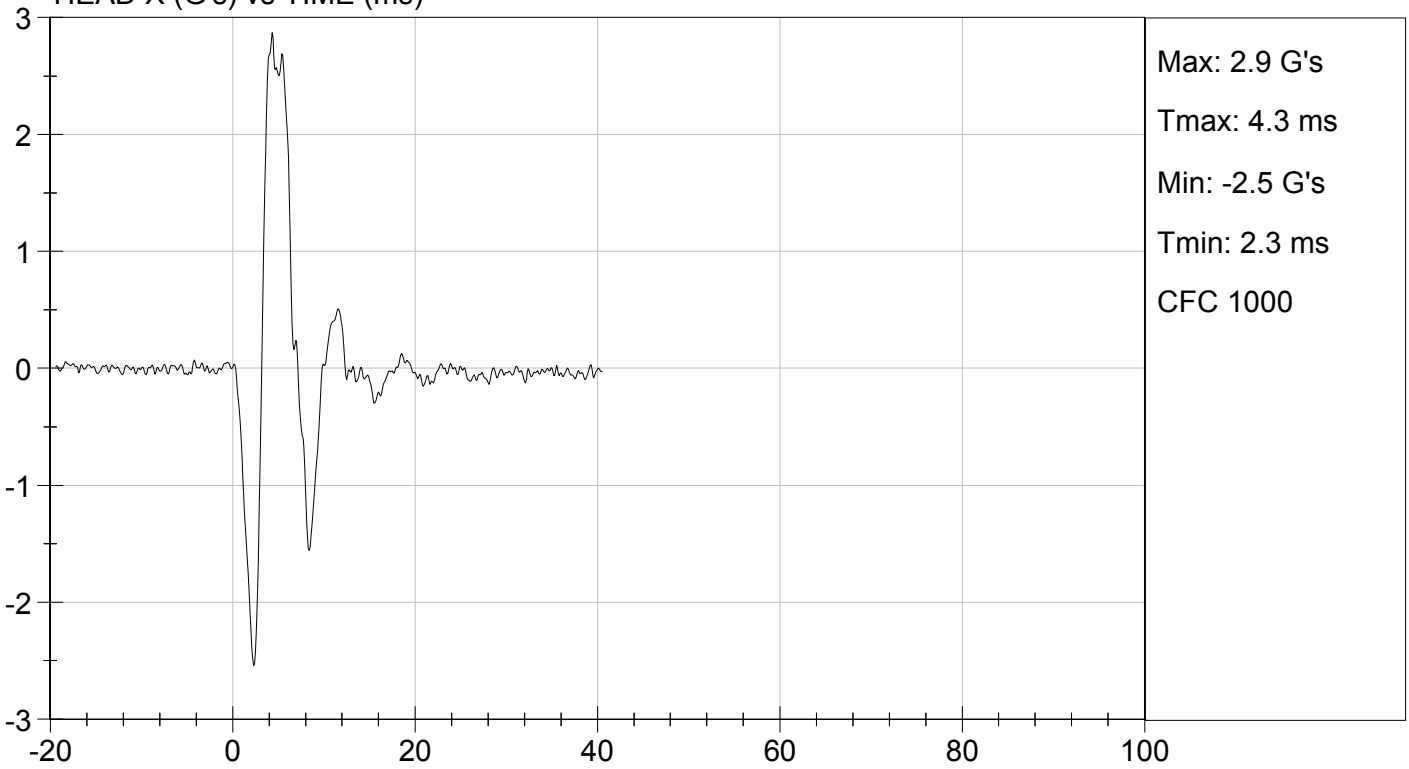
TEST DESC: HEAD DROP

TEST DATE: 06/17/2015
TEST #: D151771

HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)

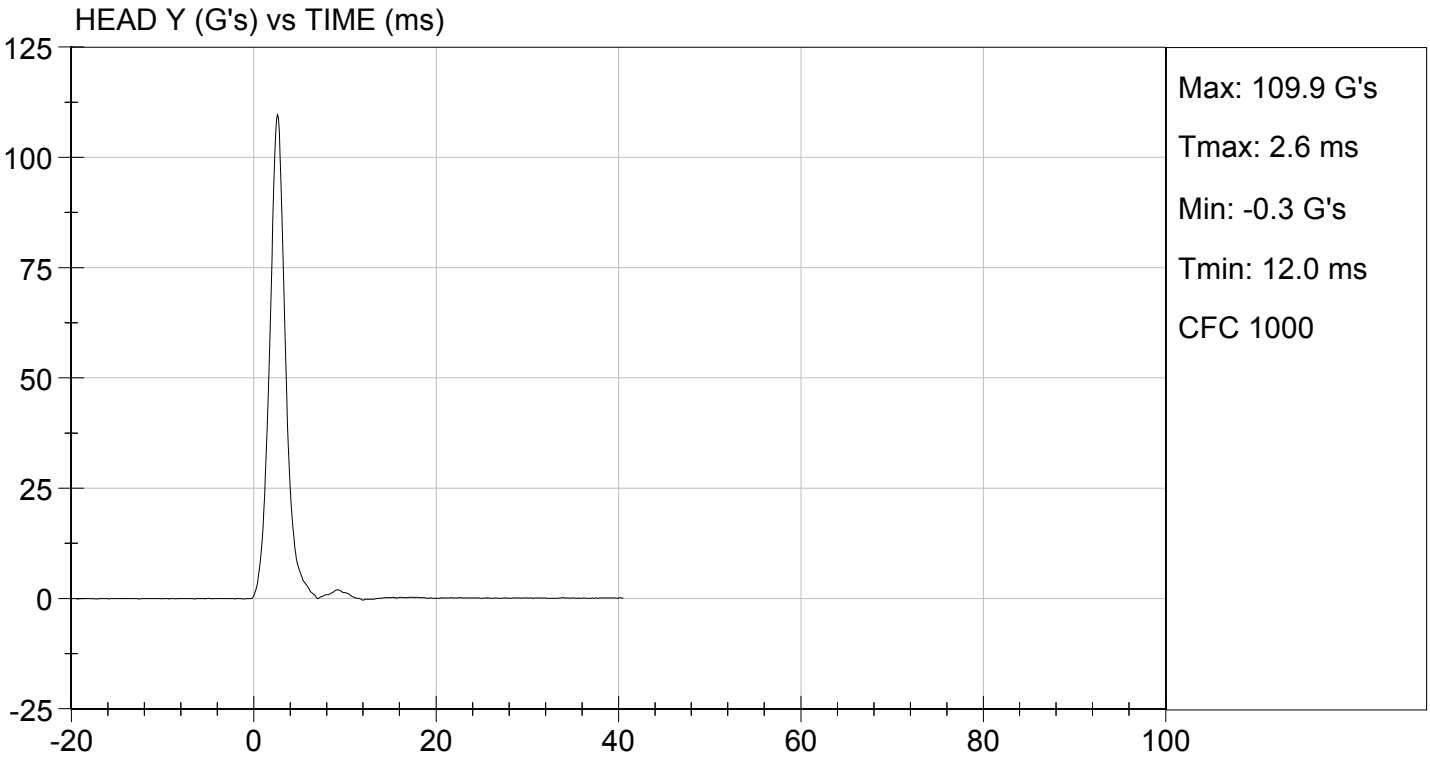


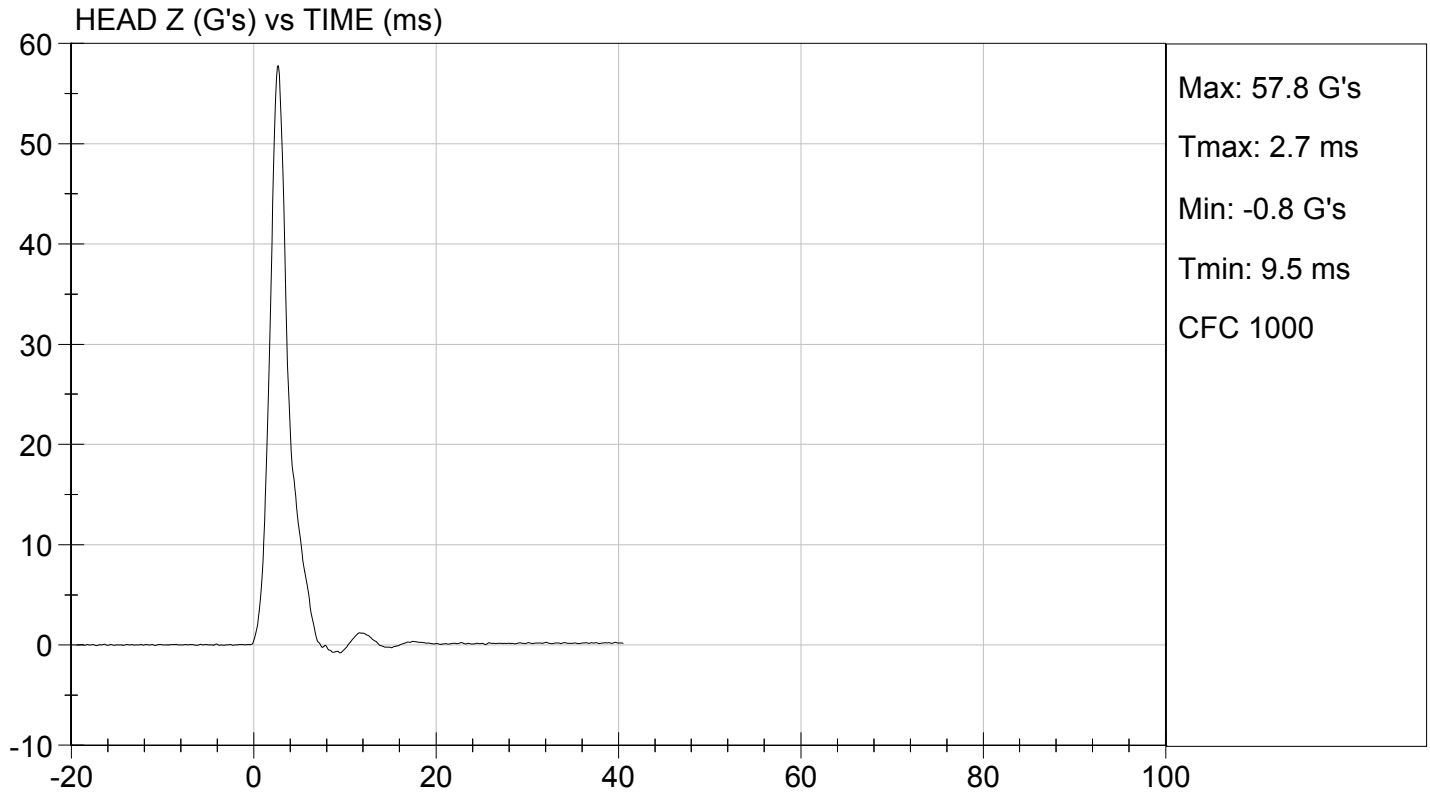
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 06/17/2015
TEST #: D151771





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151772

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.6	Pass
Humidity		%	10 to 70	45	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.45	Pass
	15 ms	m/s	3.30 to 4.10	3.43	Pass
	20 ms	m/s	4.40 to 5.40	4.55	Pass
	25 ms	m/s	5.40 to 6.10	5.44	Pass
	25-100 ms	m/s	5.50 to 6.20	5.71	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	64	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-38	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	115	Pass
			Overall Test Results		Pass

David Schoedel
Laboratory Technician

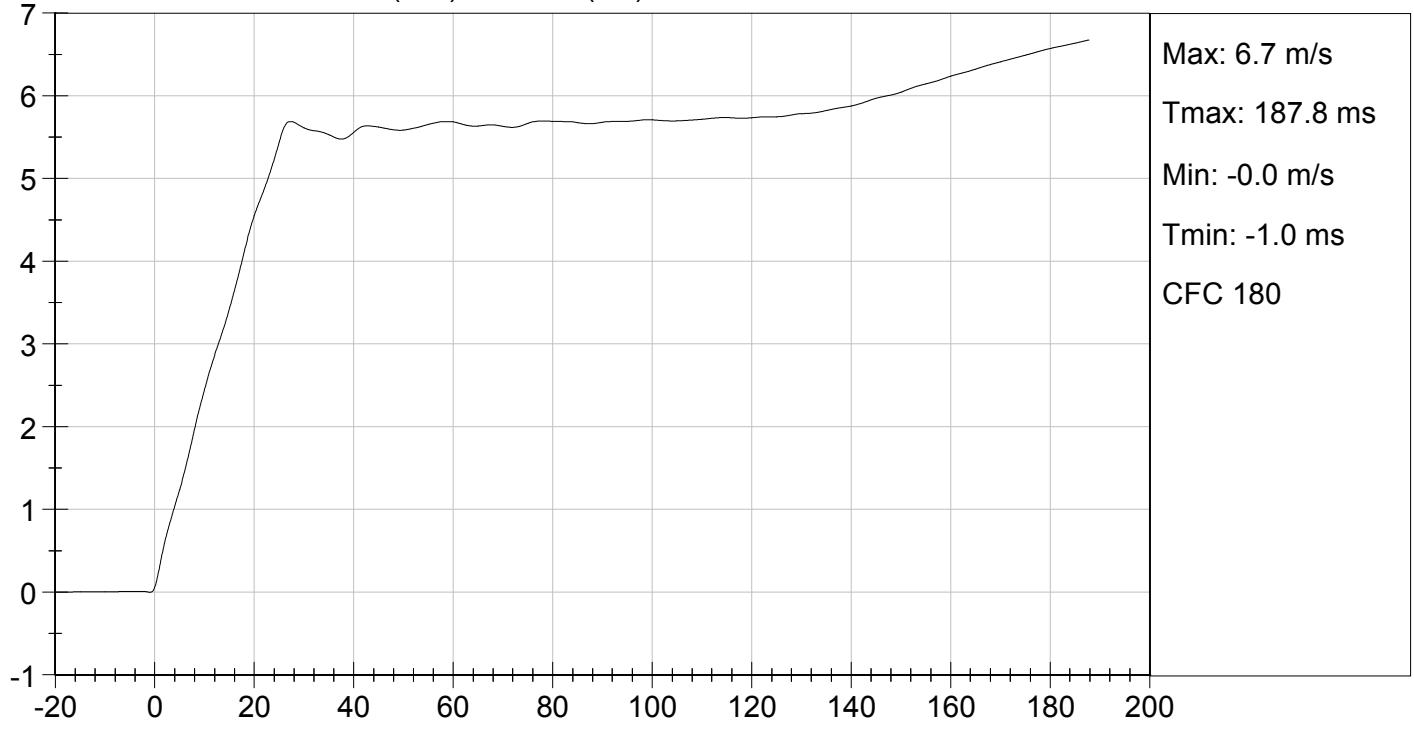
06/17/2015
Test Date

Jessica Gall
Approved By

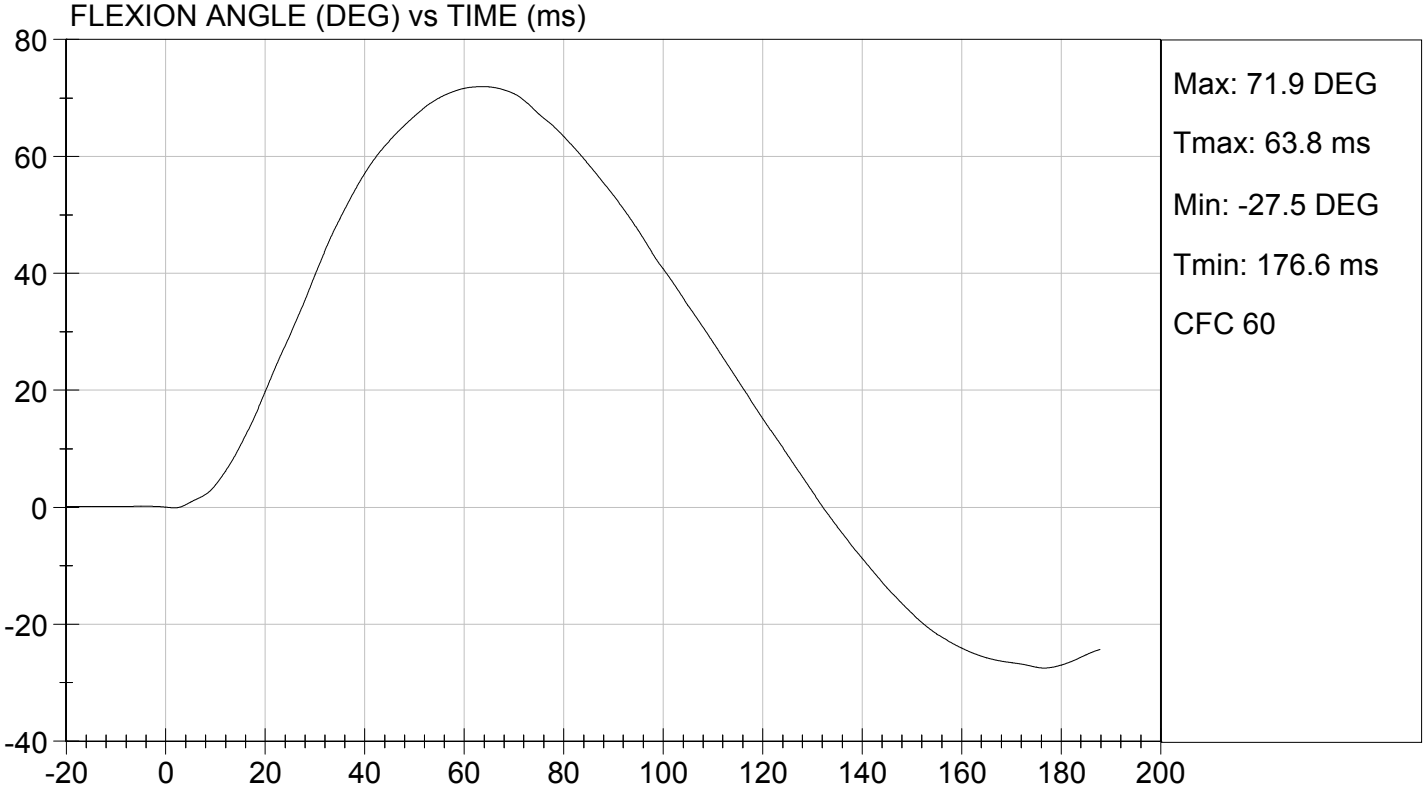
TEST DESC: NECK BENDING
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 06/17/2015
TEST #: D151772

PENDULUM VELOCITY (m/s) vs TIME (ms)

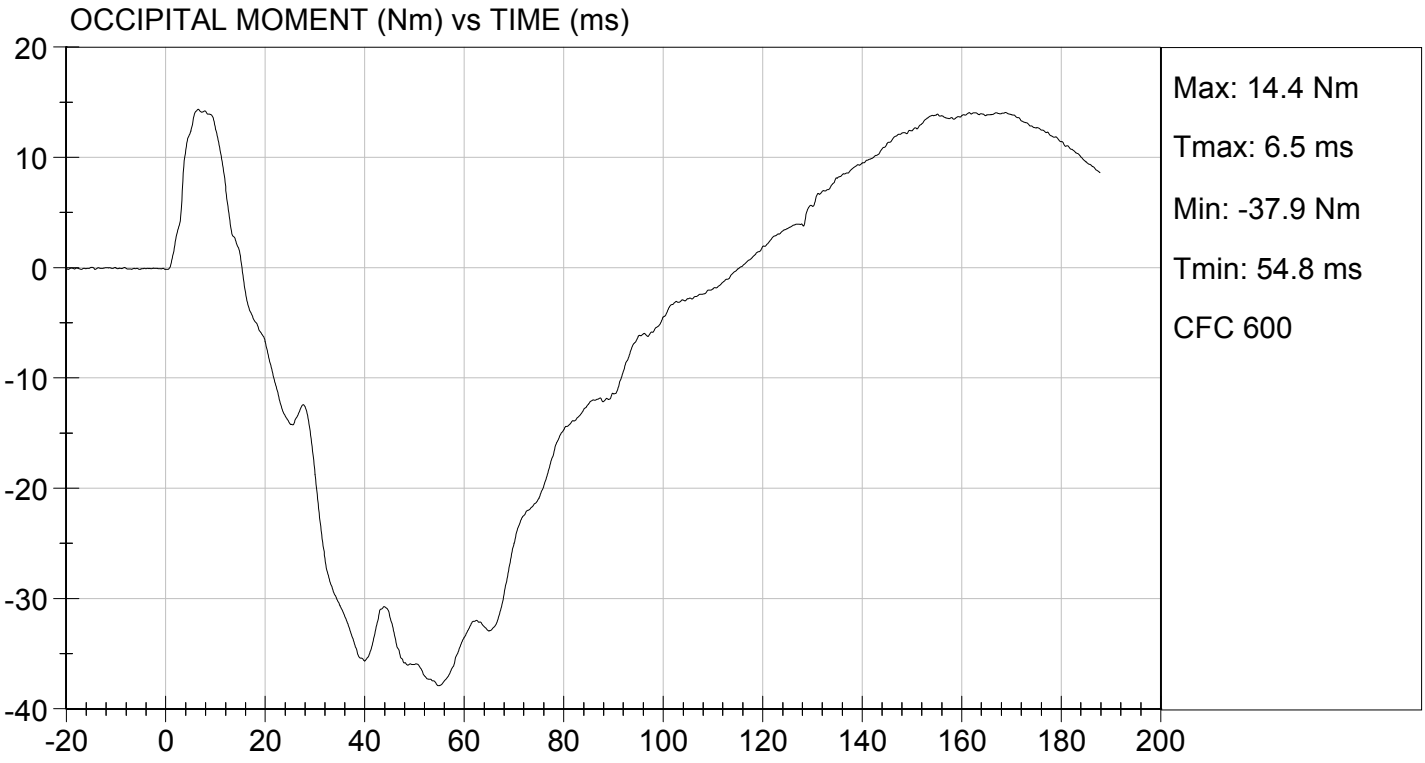


FLEXION ANGLE (DEG) vs TIME (ms)



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

TEST DATE: 06/17/2015
TEST #: D151772



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D151773

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	32	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

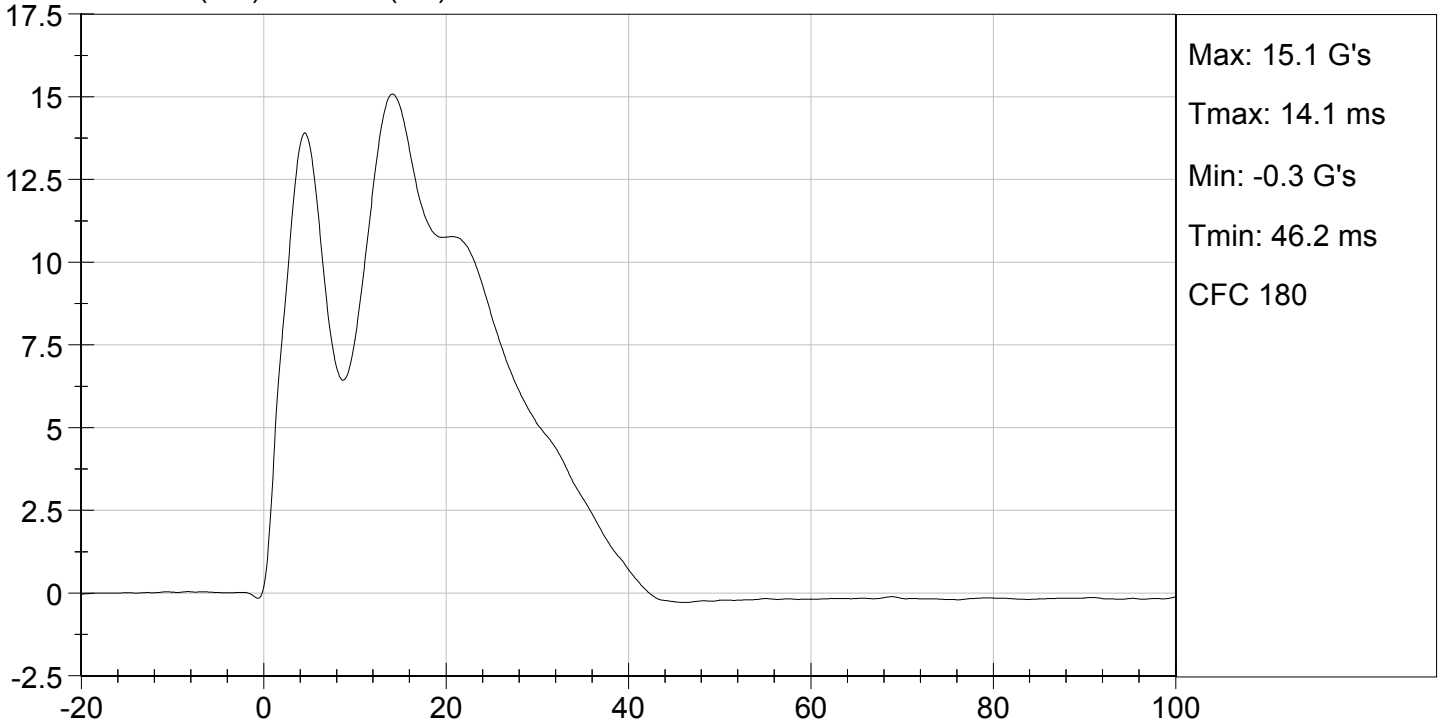
06/17/2015
Test Date

Jessica Hall
Approved By

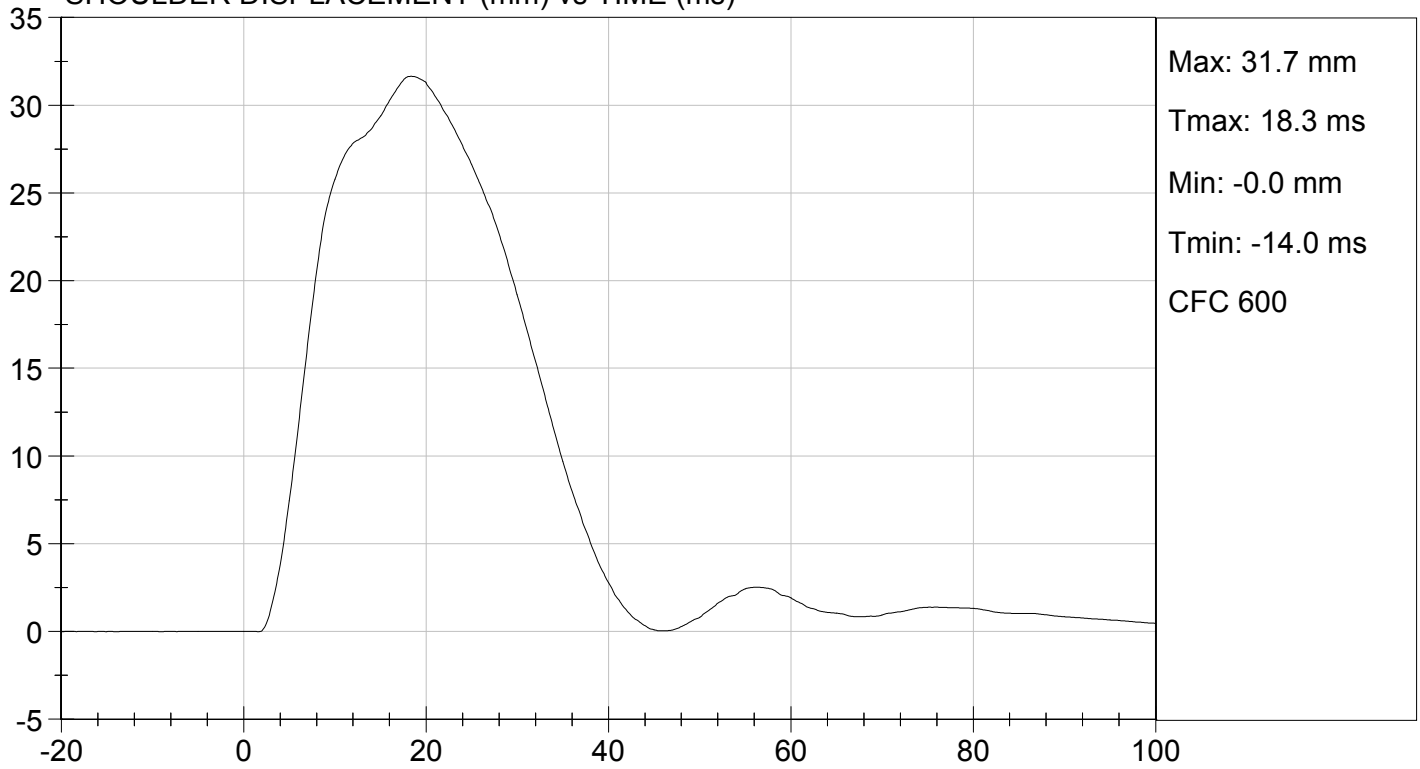
TEST DESC: SHOULDER IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 06/17/2015
TEST #: D151773

PROBE (G's) vs TIME (ms)

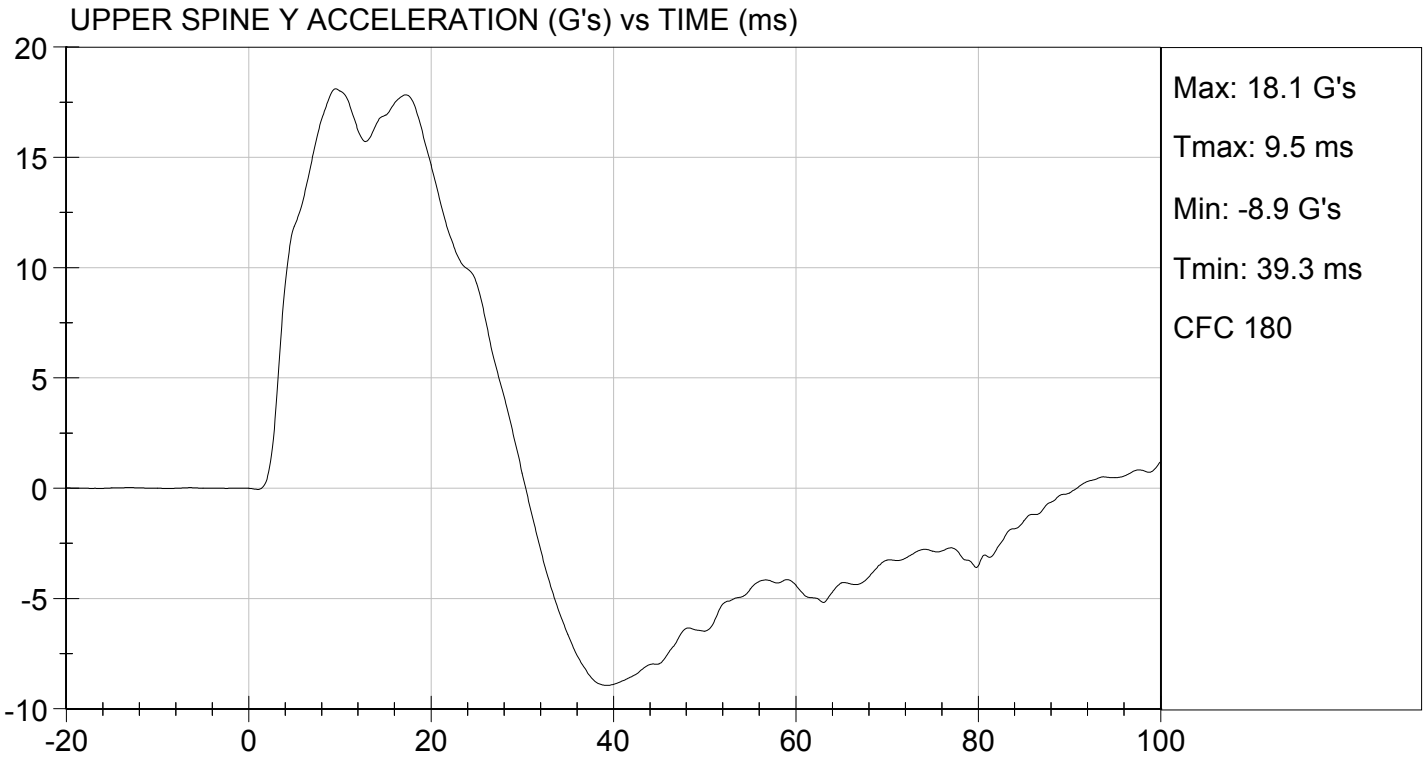


SHOULDER DISPLACEMENT (mm) vs TIME (ms)



TEST DESC: SHOULDER IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 06/17/2015
TEST #: D151773



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151774

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	31	Pass
Shoulder Displacement	mm	31 to 40	40	Pass
Upper Rib Displacement	mm	25 to 32	31	Pass
Middle Rib Displacement	mm	30 to 36	34	Pass
Lower Rib Displacement	mm	32 to 38	36	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	35	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	30	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

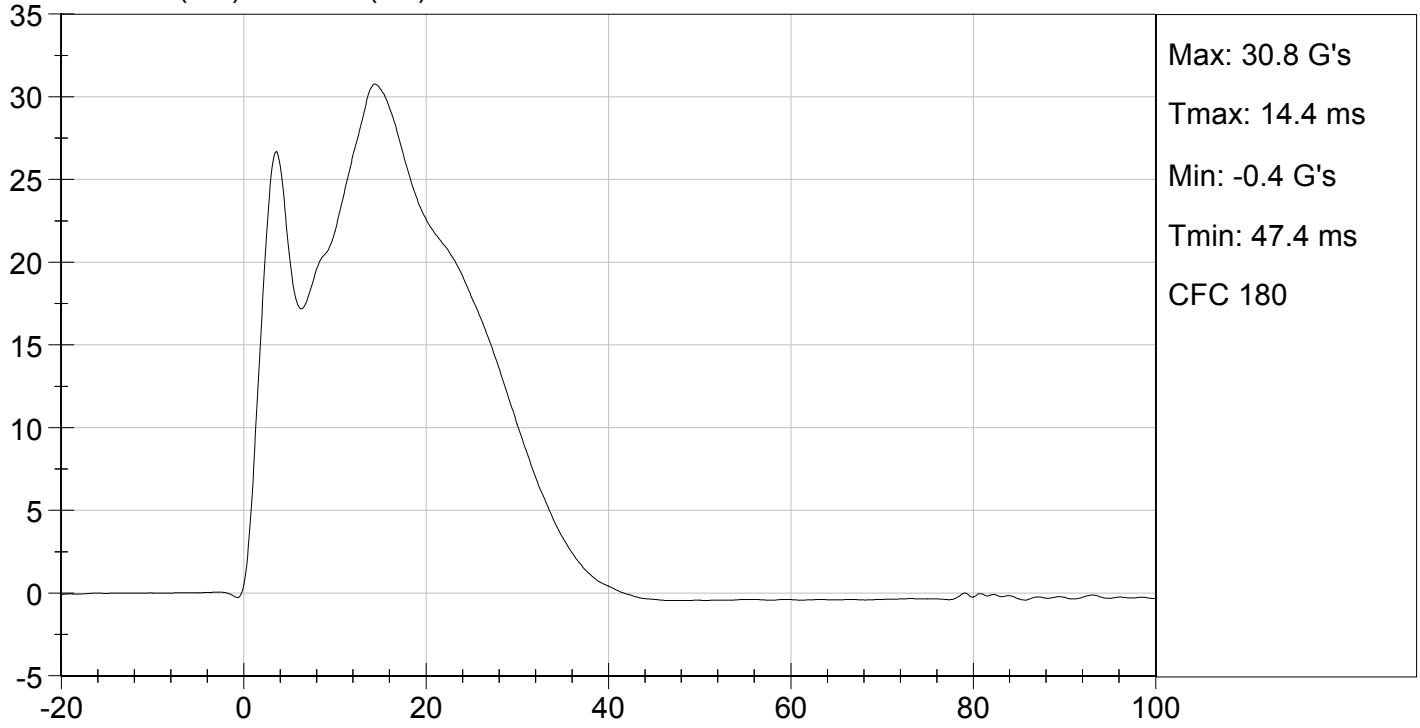
06/17/2015
Test Date

Jessica Gall
Approved By

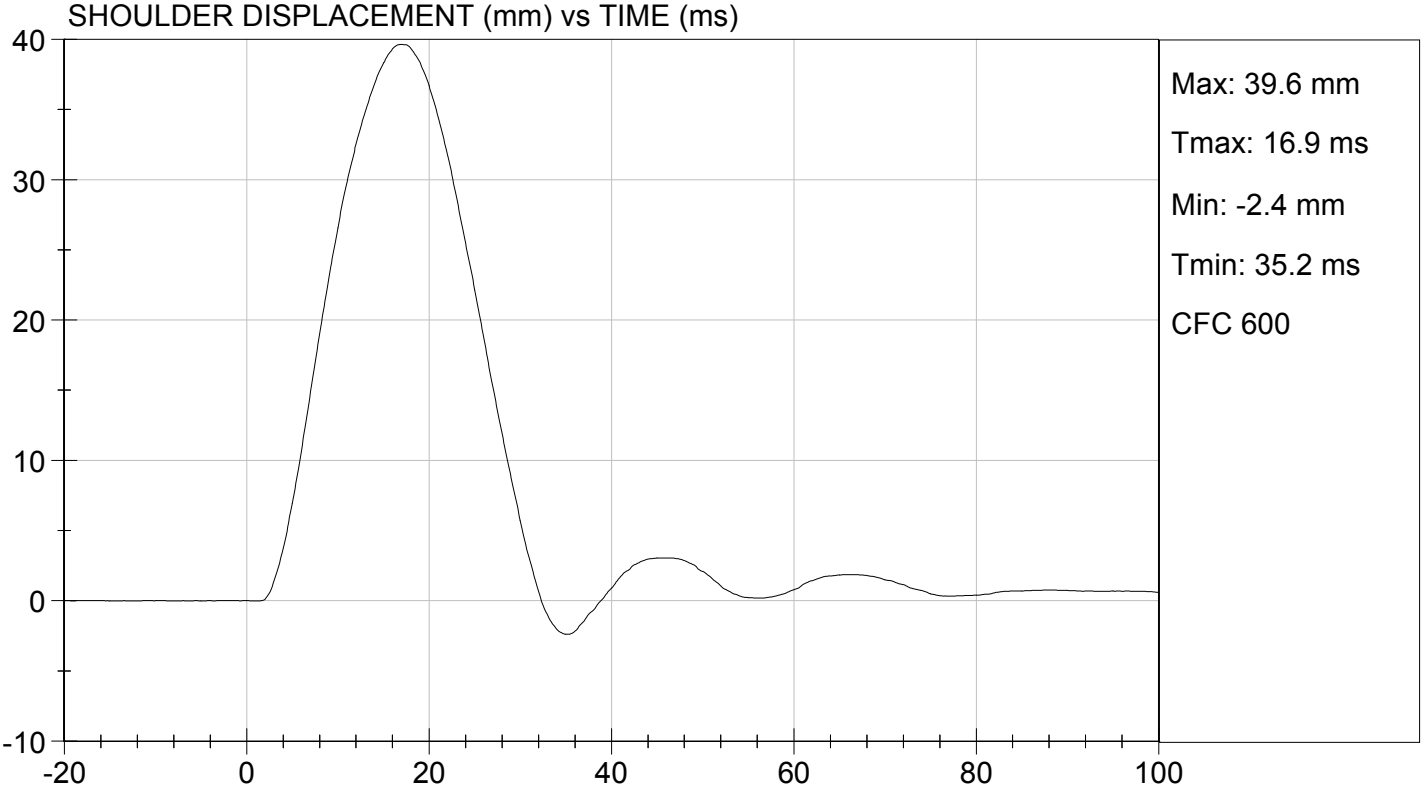
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 06/17/2015
TEST #: D151774

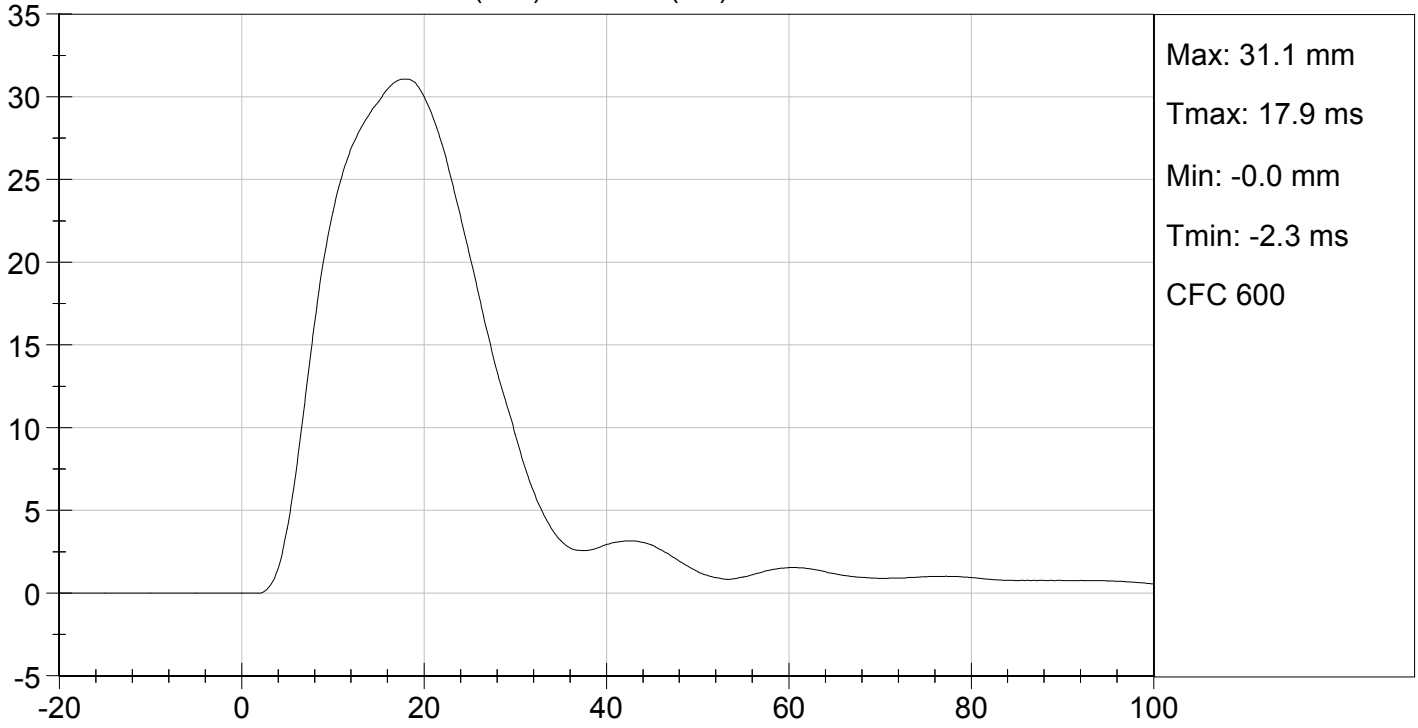
PROBE (G's) vs TIME (ms)



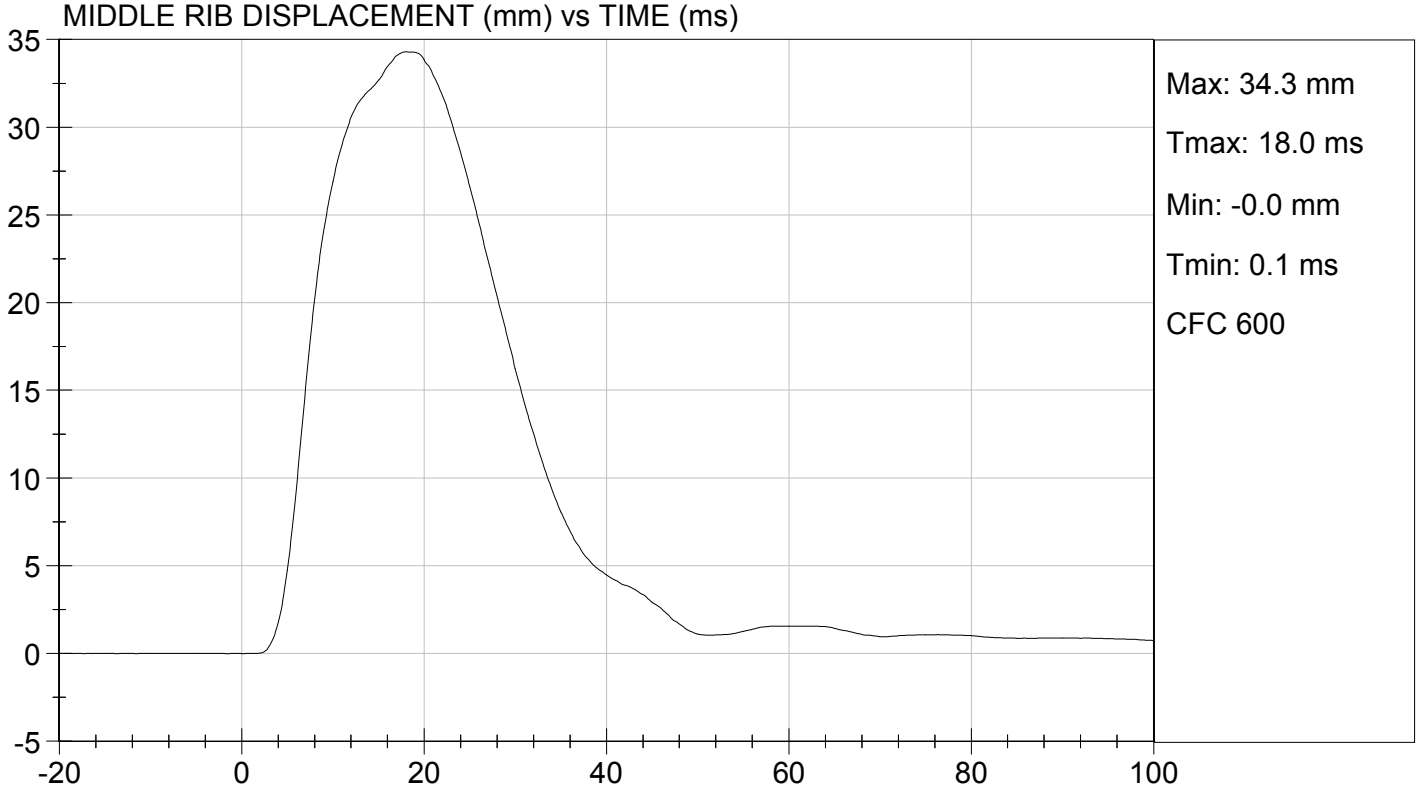
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



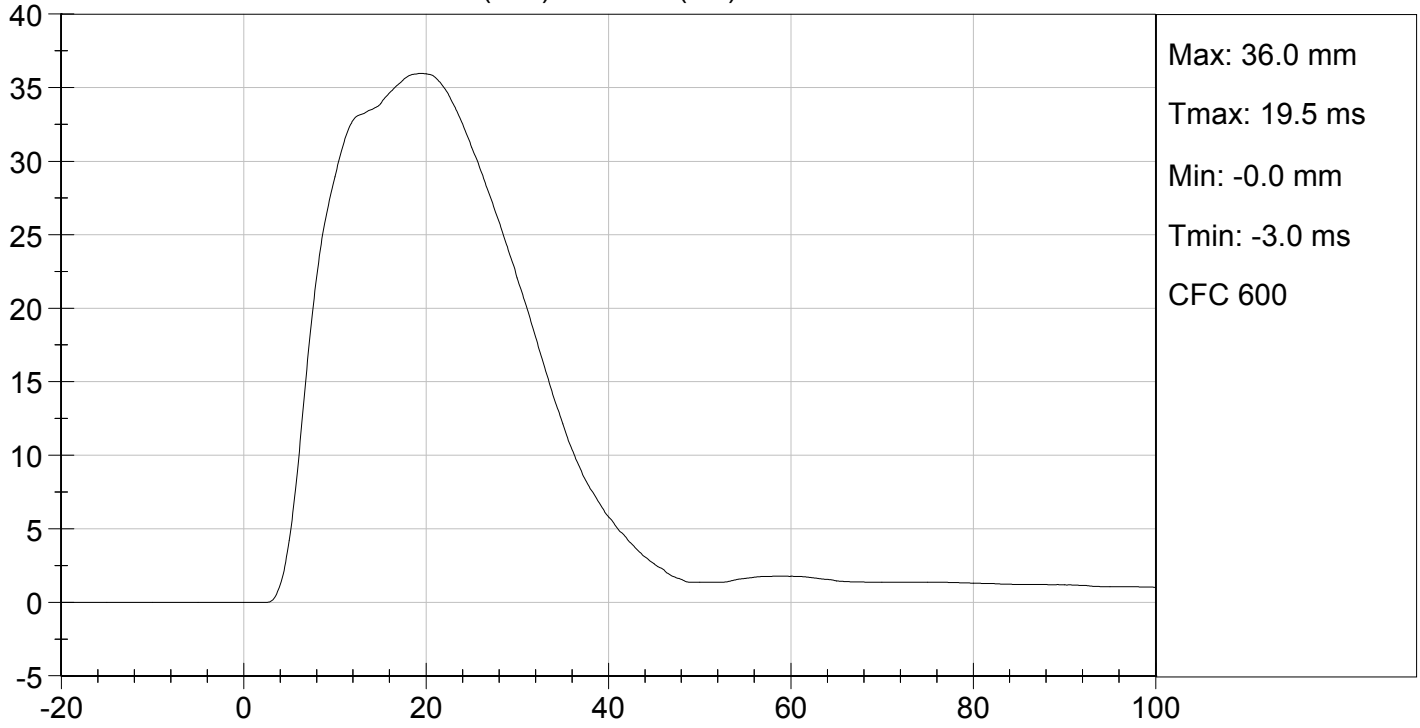
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



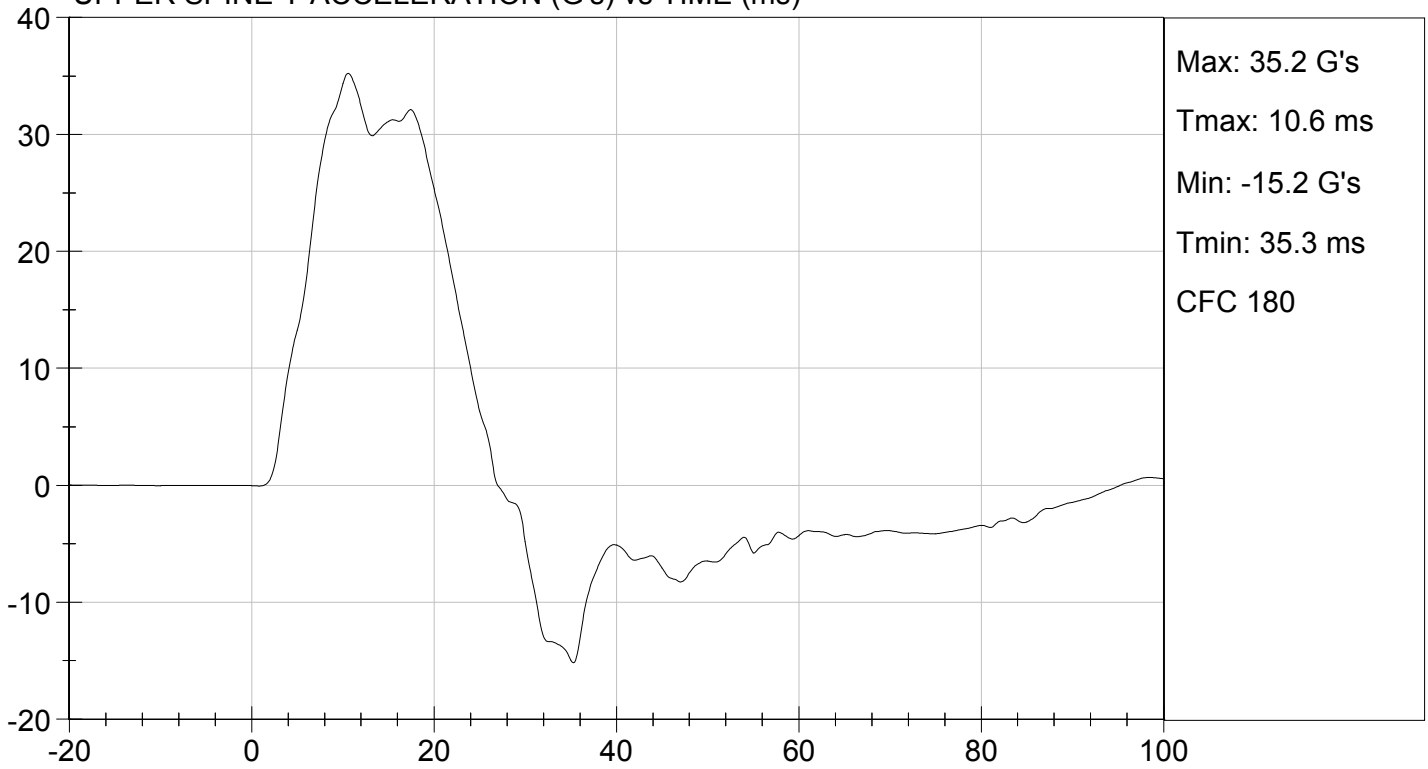
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



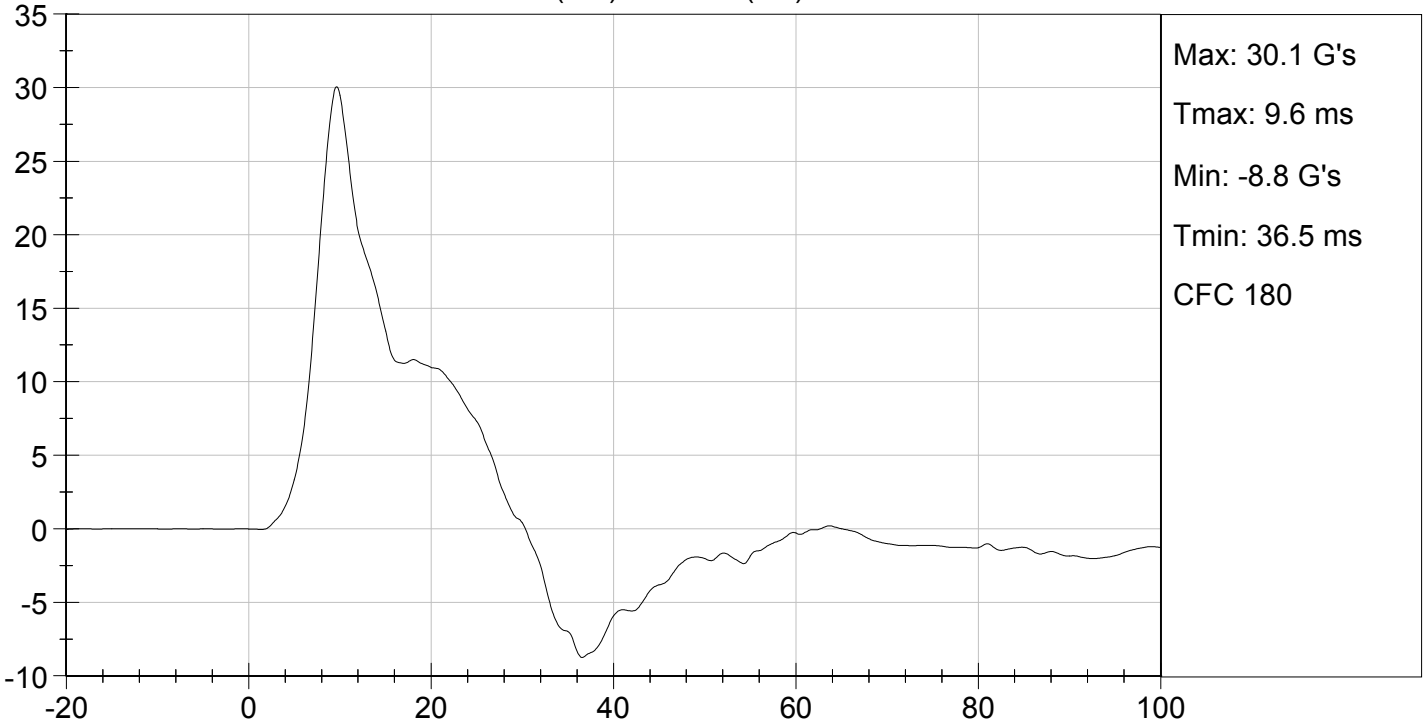
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 06/17/2015
TEST #: D151774

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



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151775

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	14 to 18	14	Pass
Upper Rib Displacement	mm	32 to 40	38	Pass
Middle Rib Displacement	mm	39 to 45	45	Pass
Lower Rib Displacement	mm	35 to 43	43	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	8	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

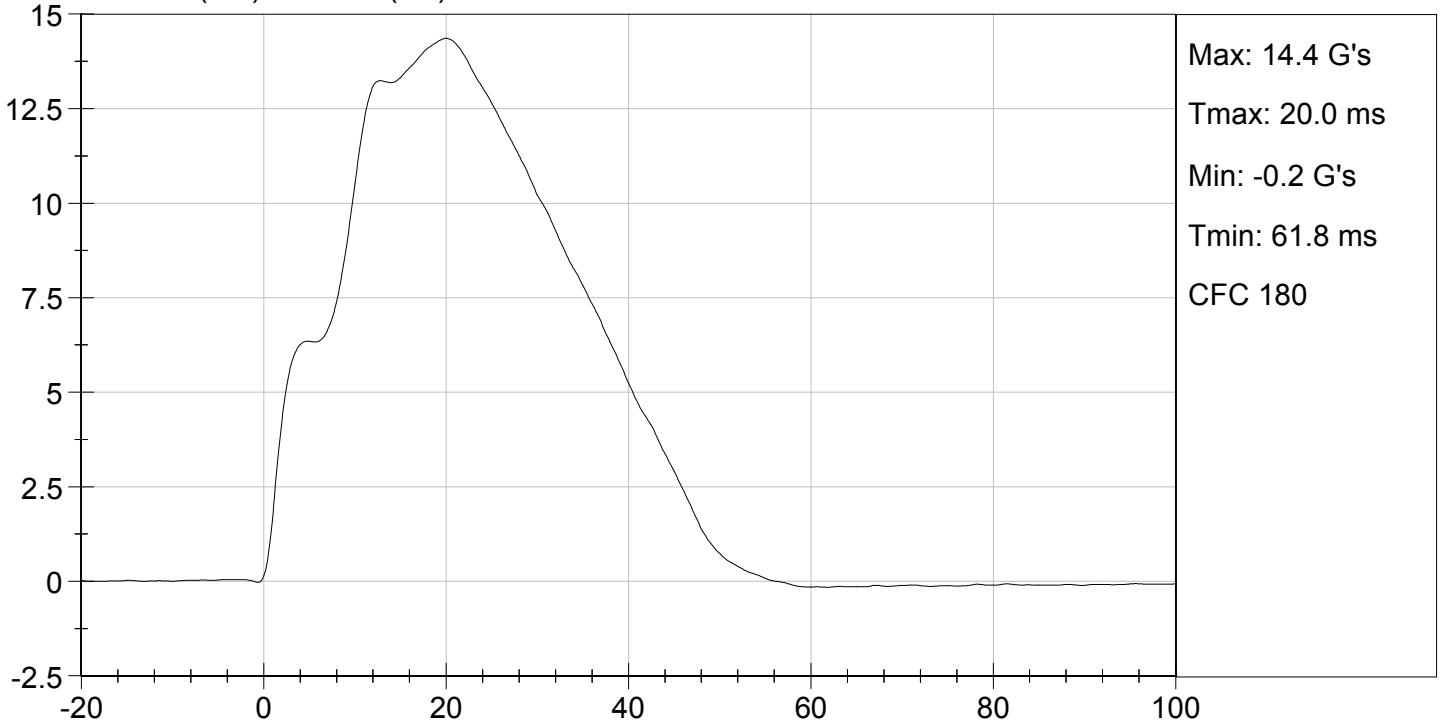
06/17/2015
Test Date

Jessica Hall
Approved By

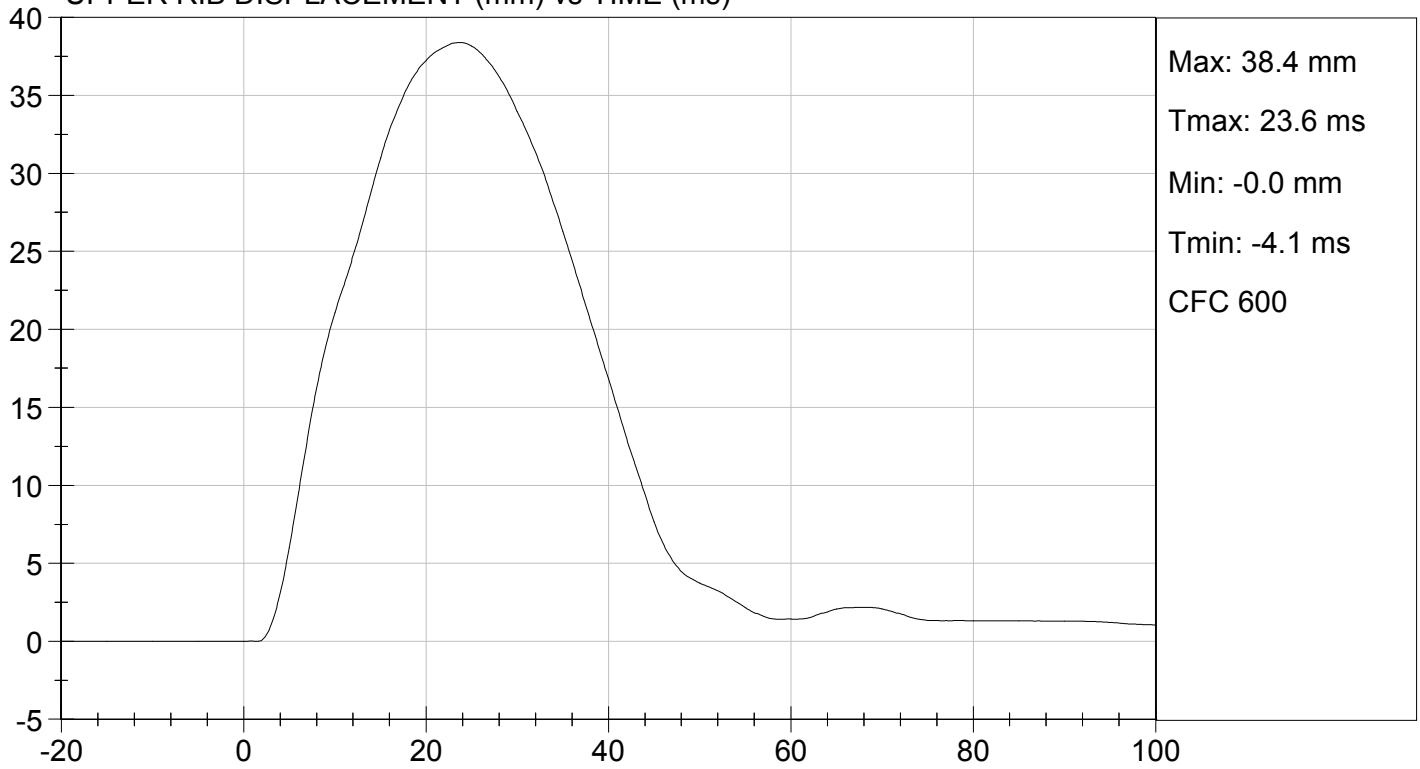
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 06/17/2015
TEST #: D151775

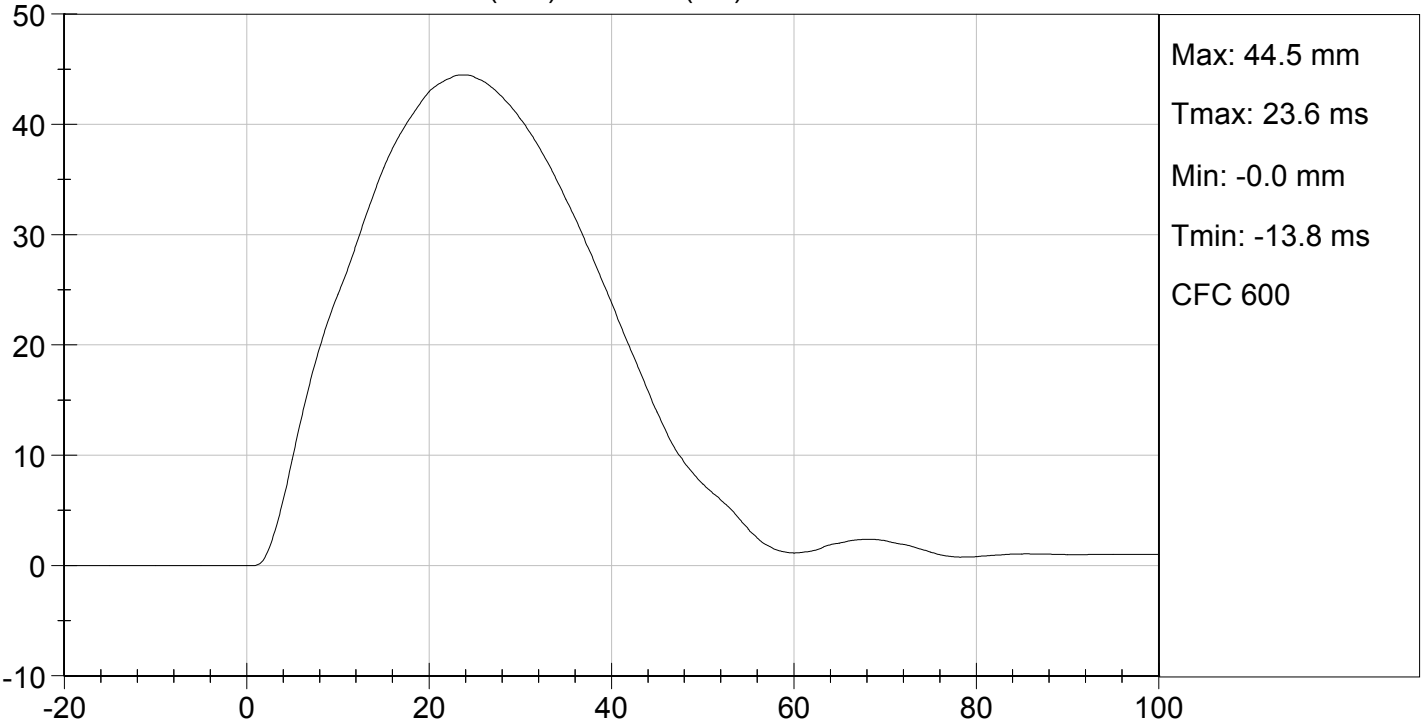
PROBE (G's) vs TIME (ms)



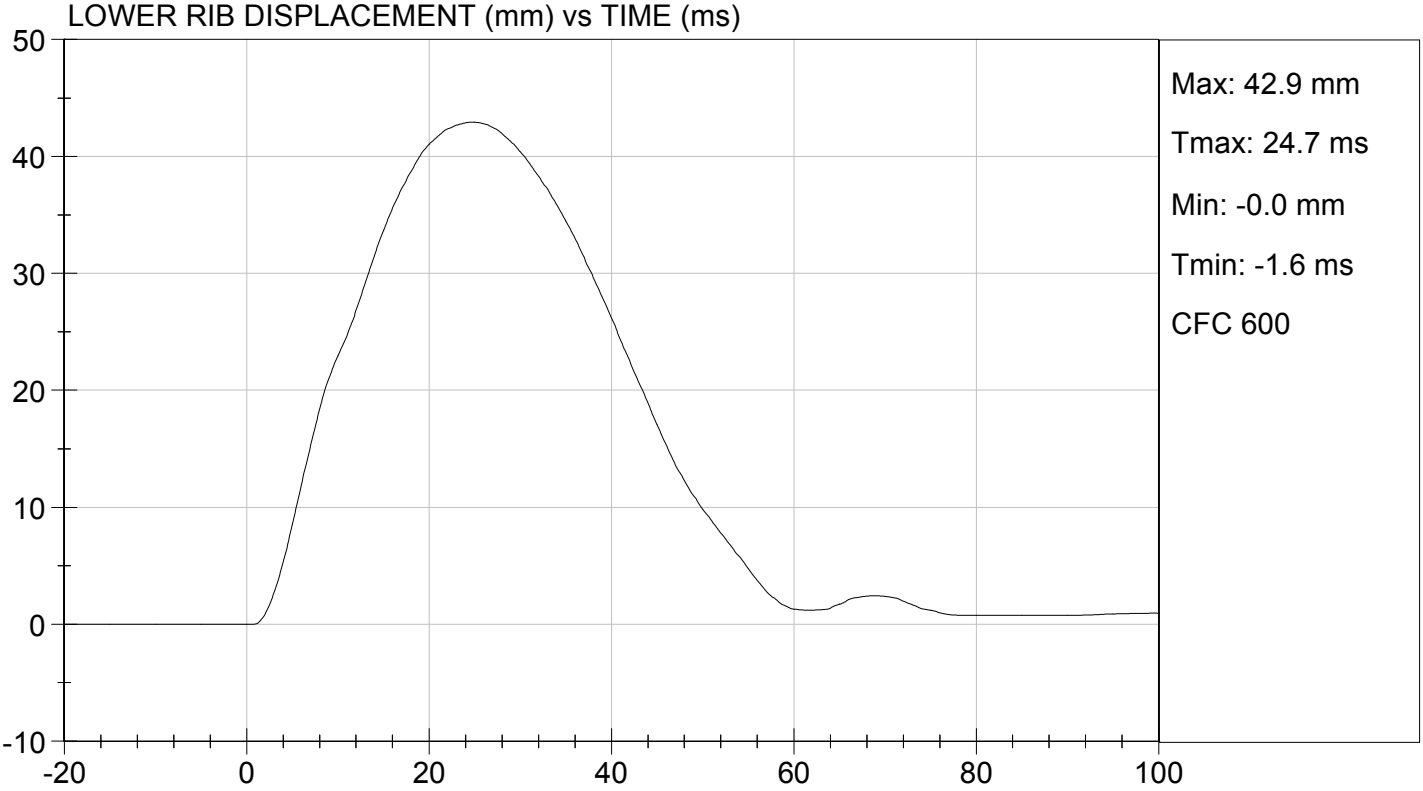
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



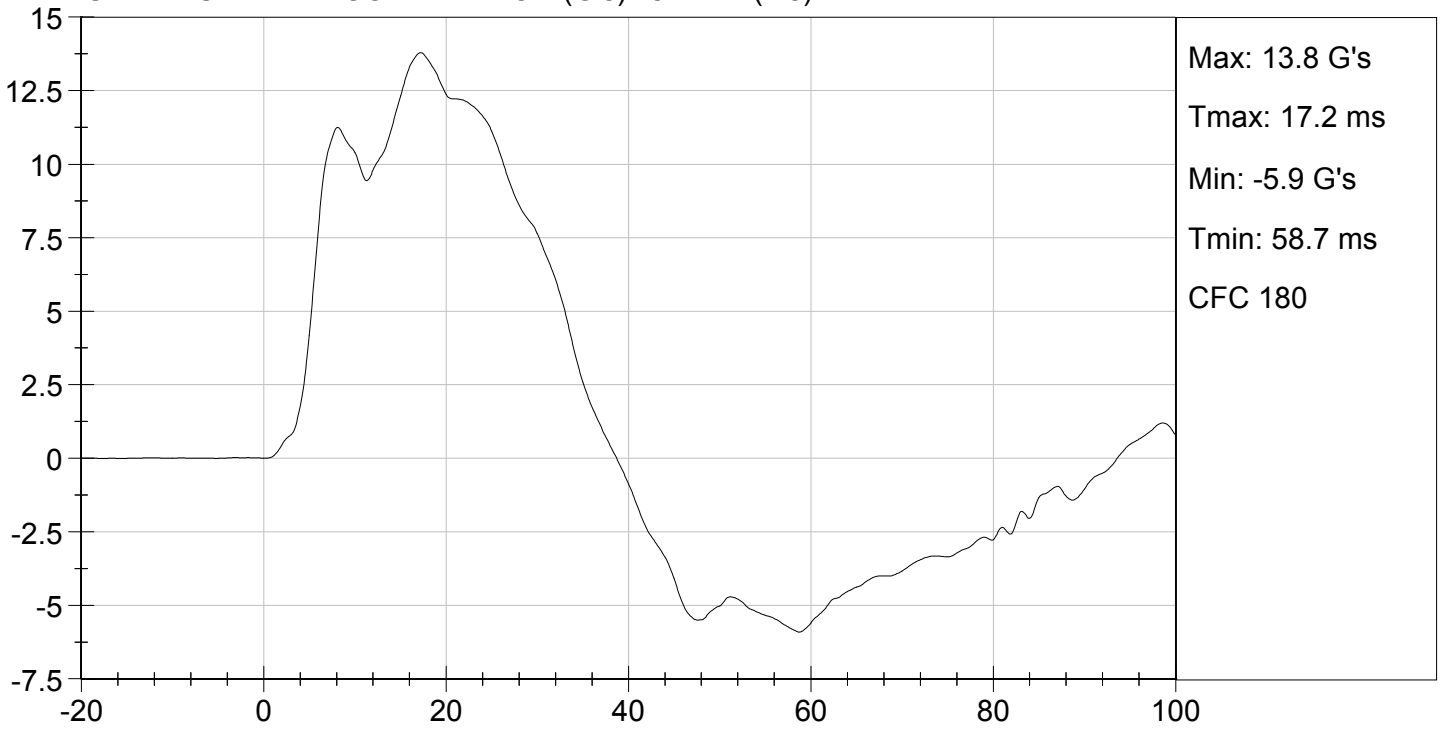
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



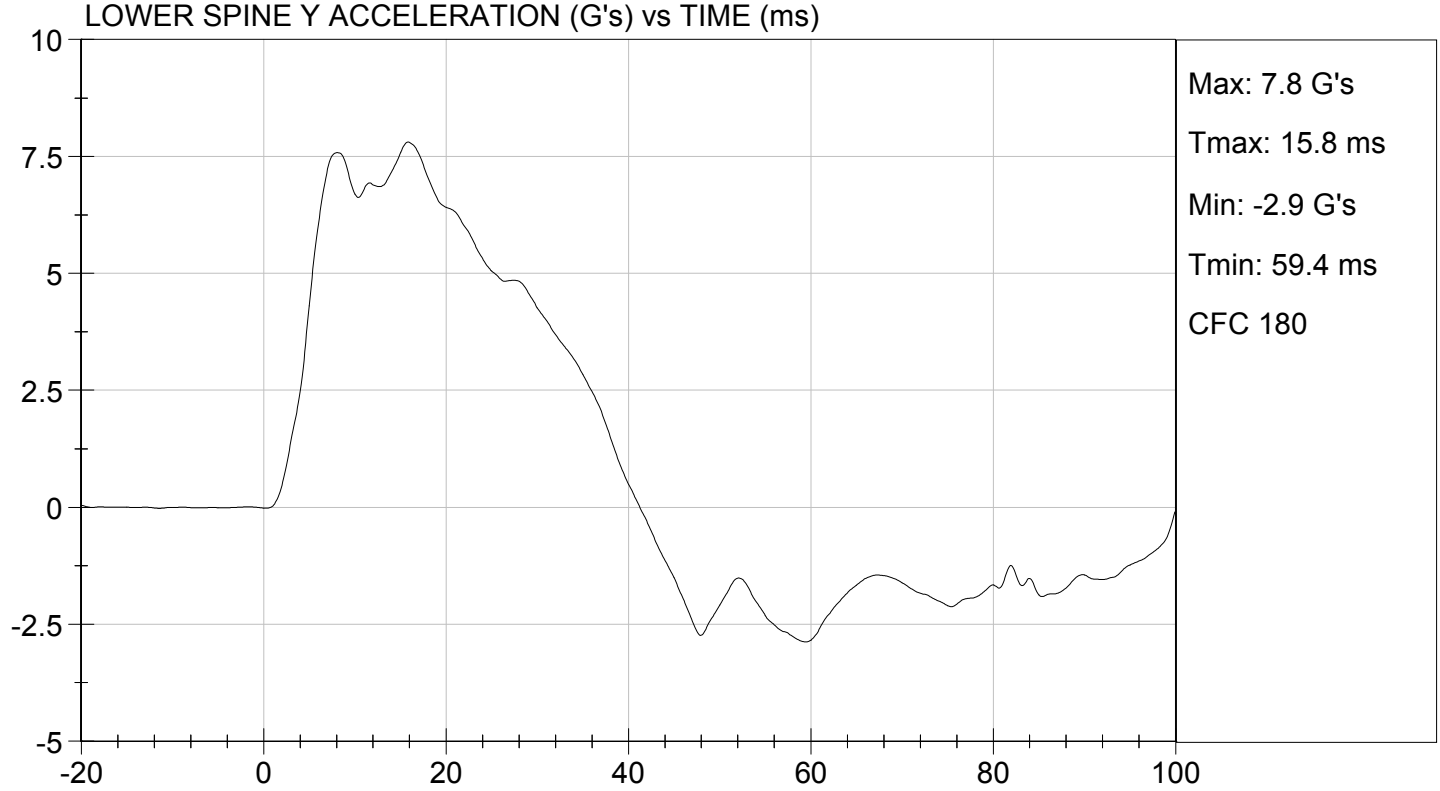
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 06/17/2015
TEST #: D151775

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



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



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151776

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	12 to 16	13	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	43	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	44	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	10	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

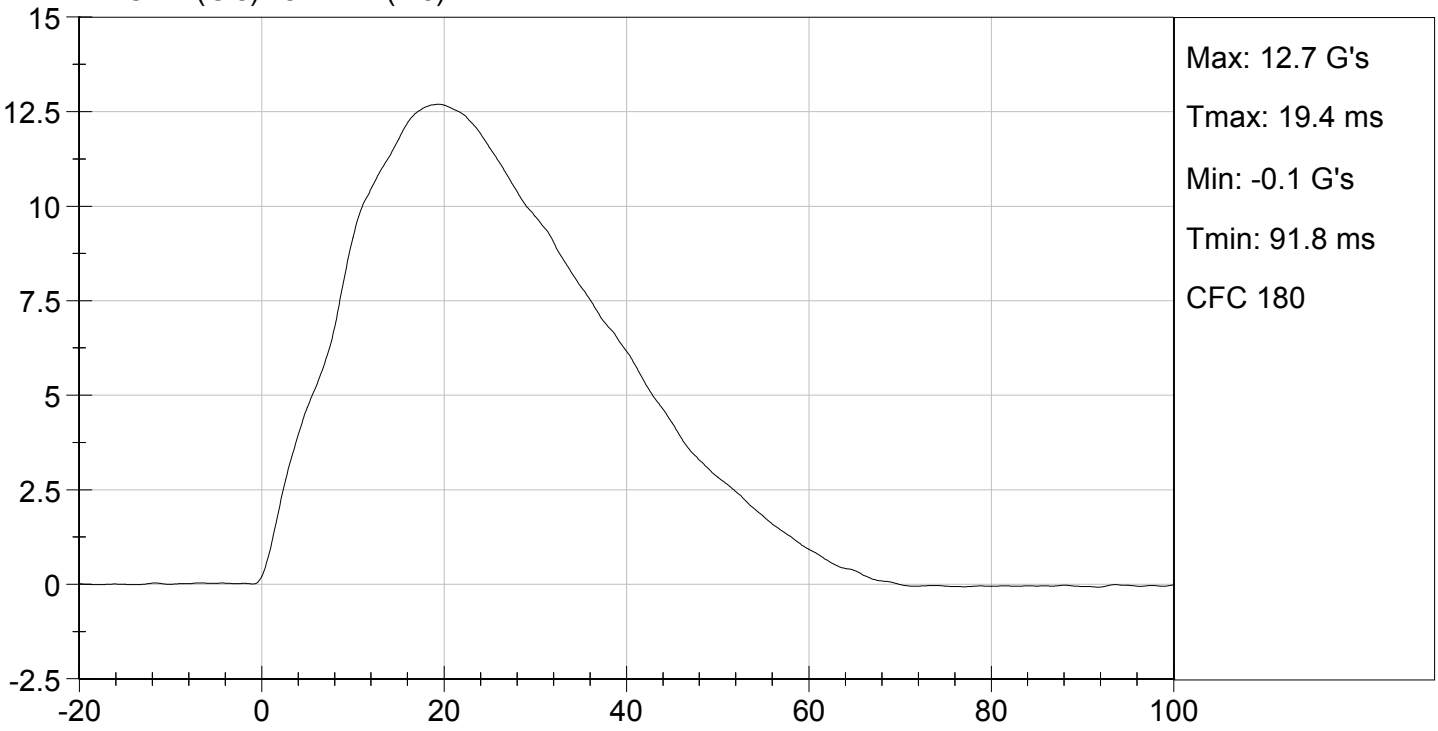
06/17/2015
Test Date

Jessica Hall
Approved By

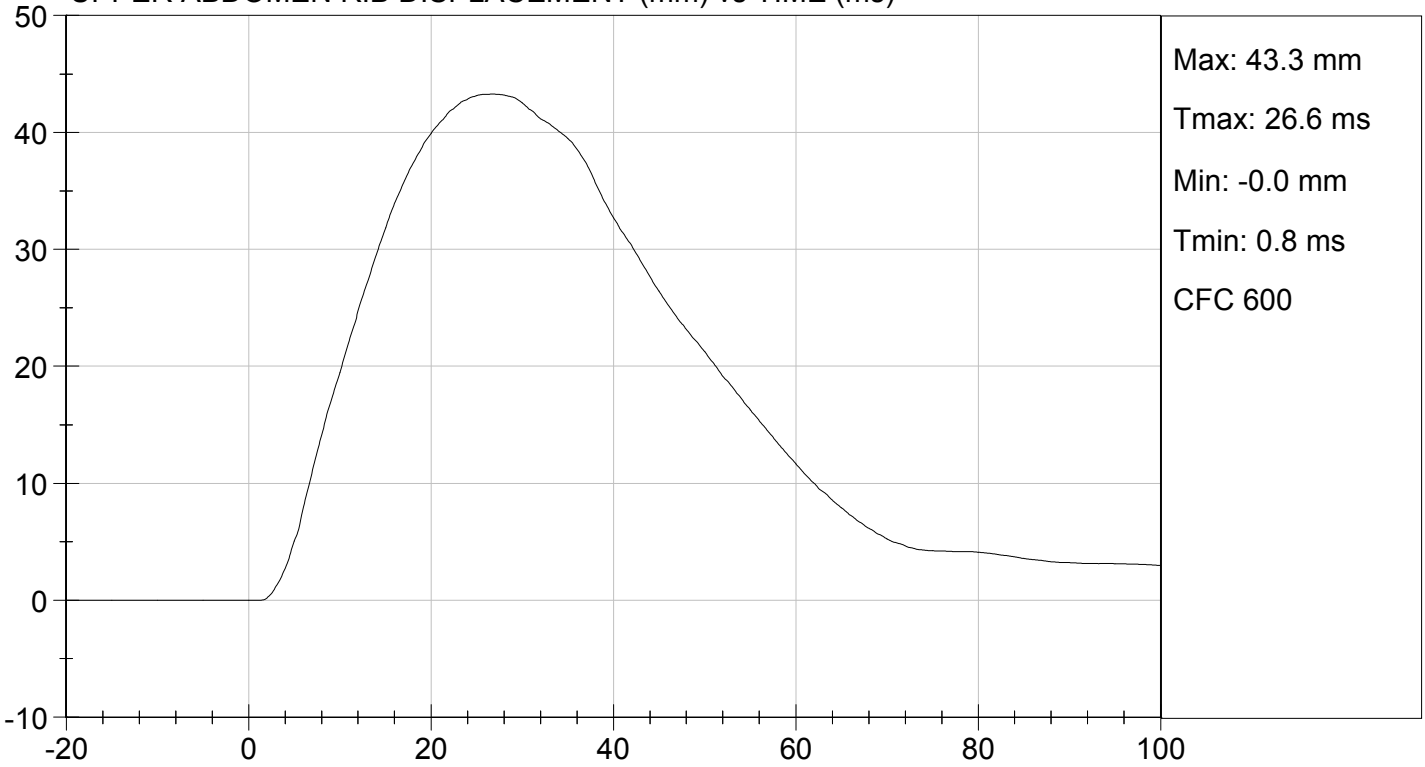
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 06/17/2015
TEST #: D151776

PROBE (G's) vs TIME (ms)



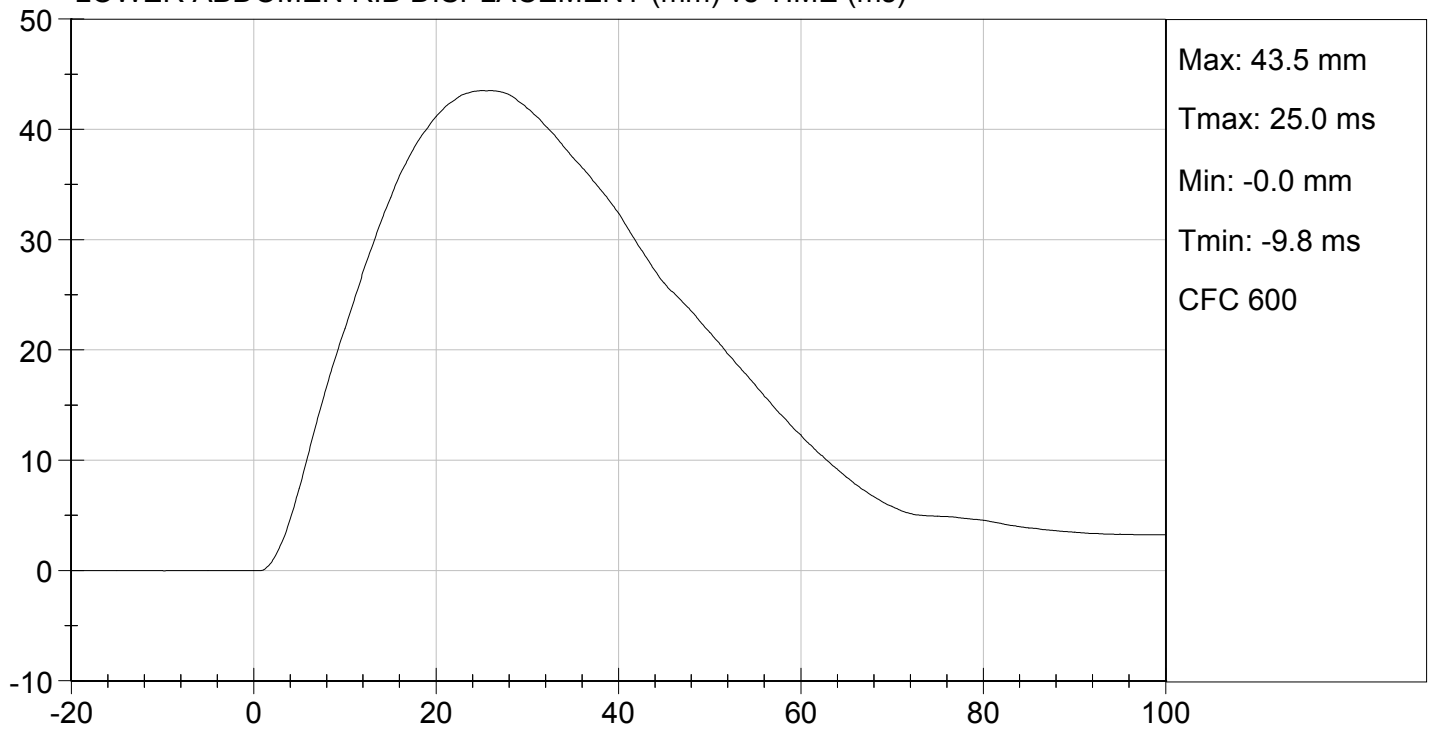
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



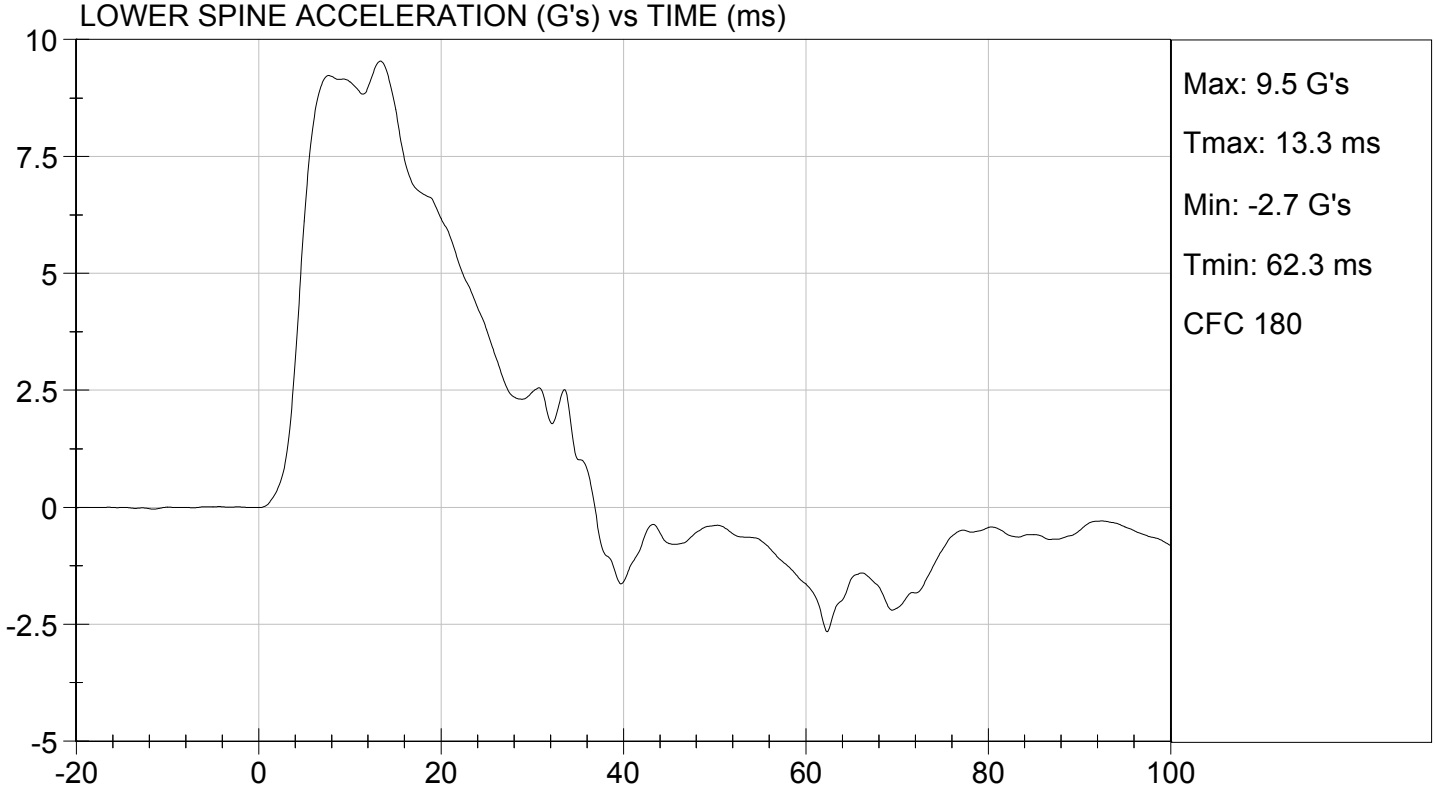
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 06/17/2015
TEST #: D151776

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



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



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151777

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Maximum Probe Acceleration	G's	38 to 47	43	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	40	Pass
Peak Acetabulum Force	N	3600 to 4300	4,139	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

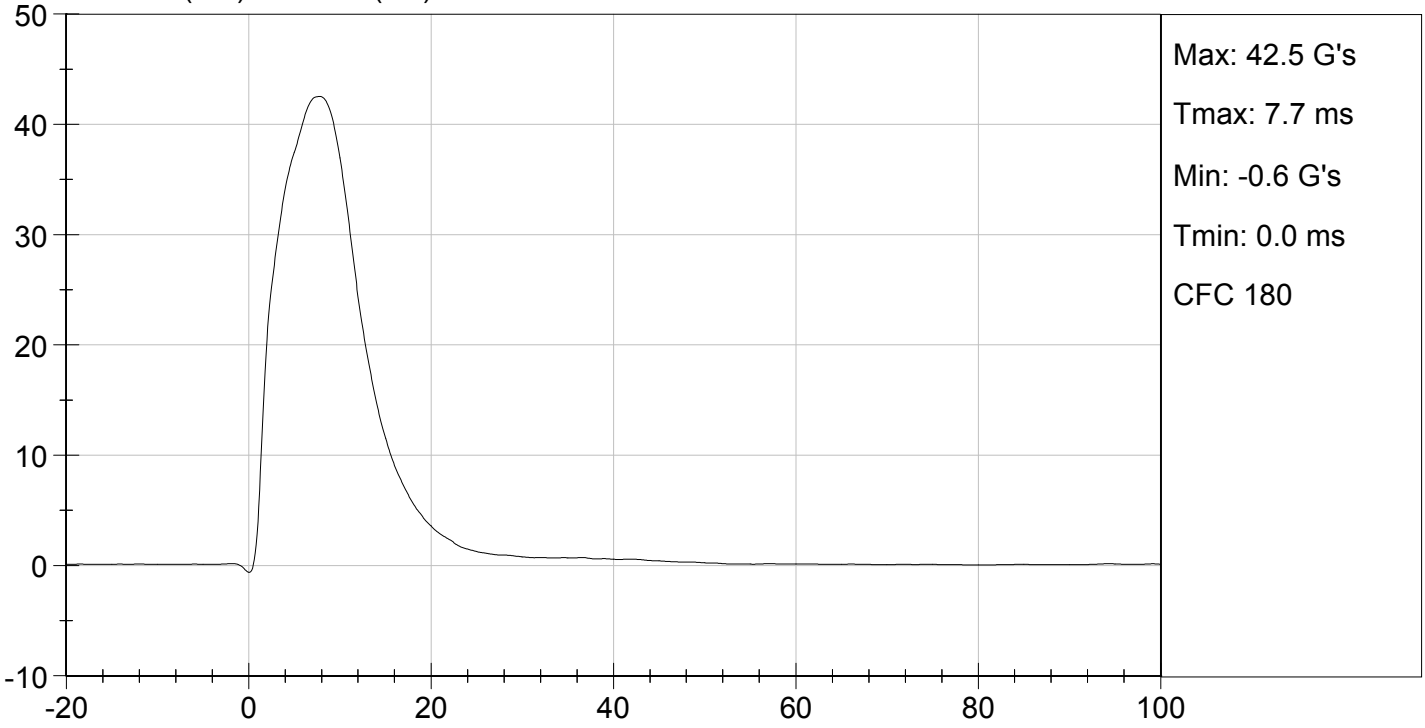
06/17/2015
Test Date

Jessica Hall
Approved By

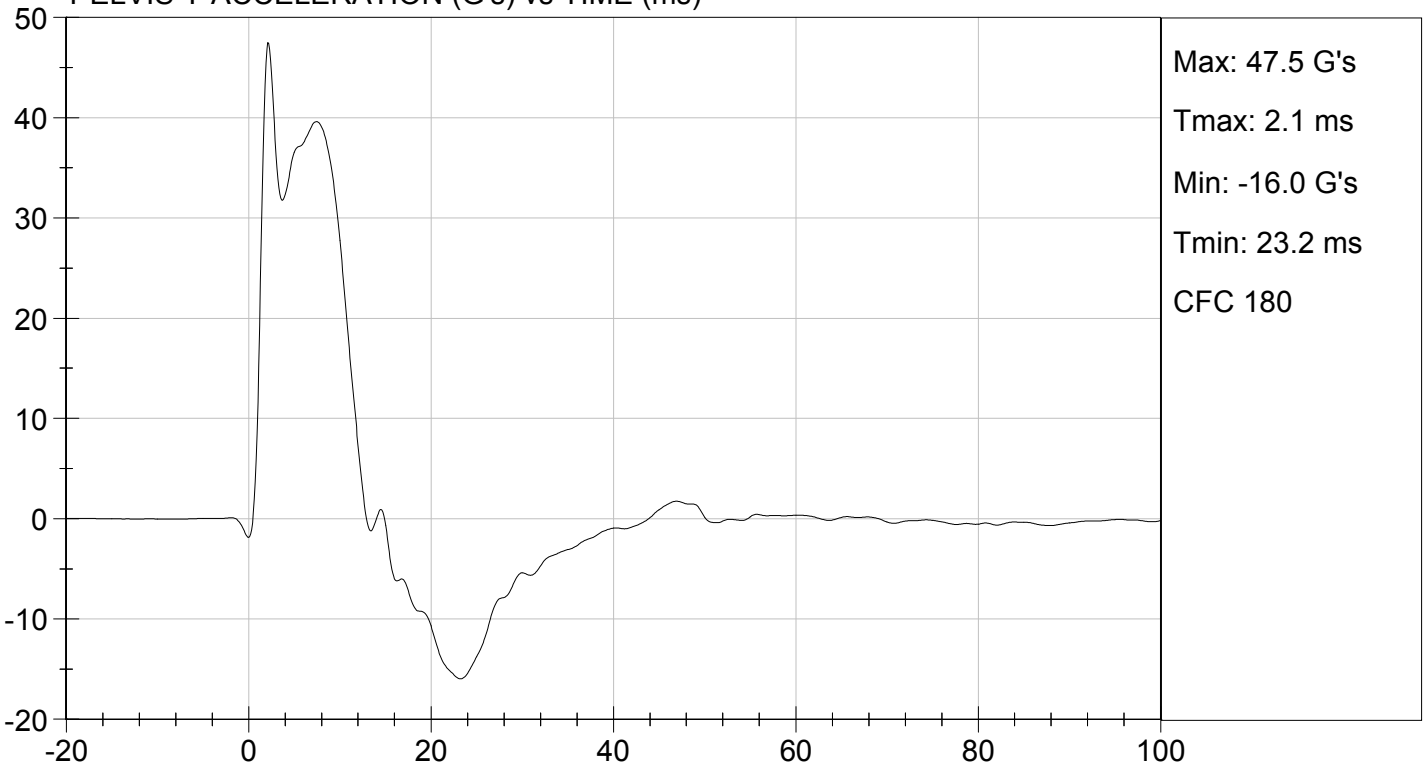
TEST DESC: PELVIS IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 06/17/2015
TEST #: D151777

PROBE (G's) vs TIME (ms)

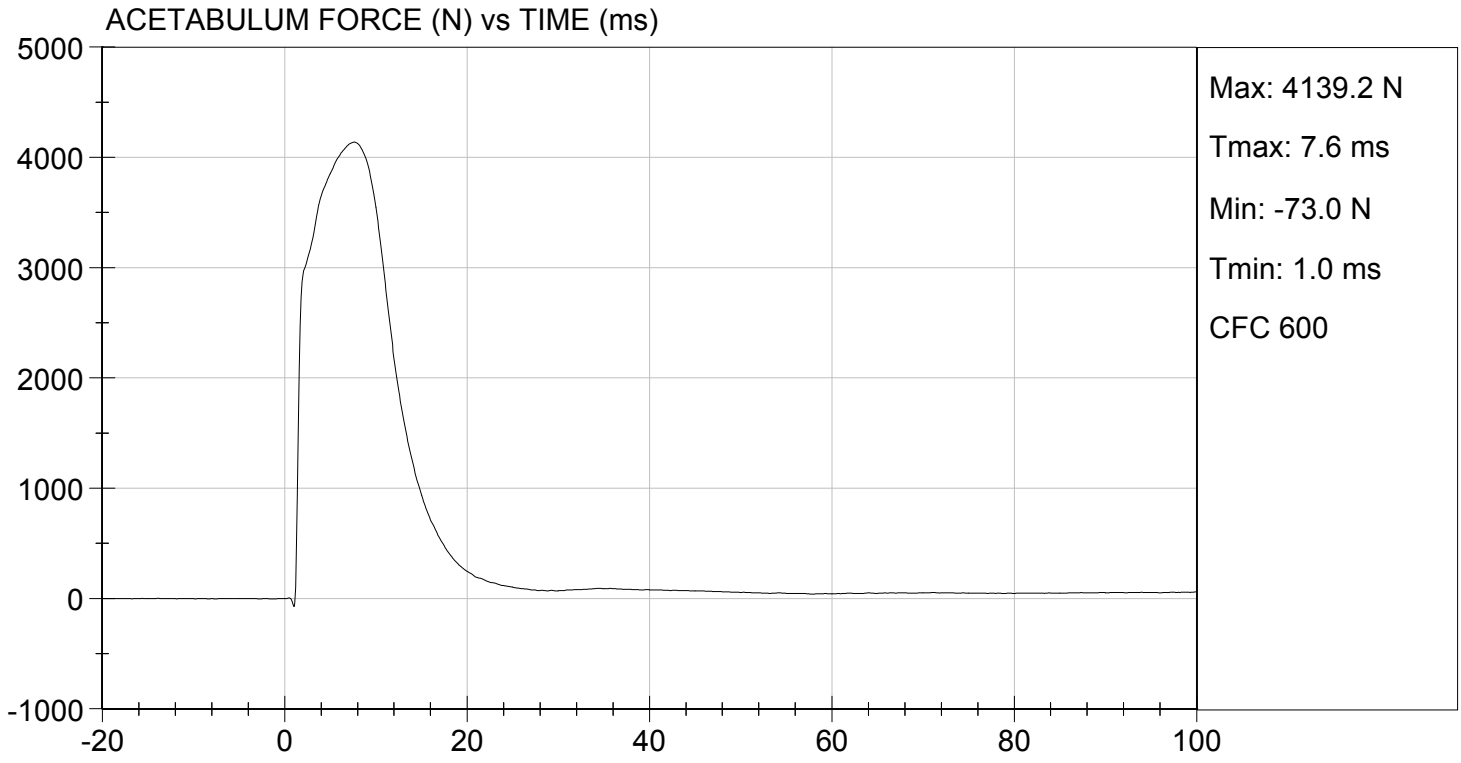


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: PELVIS IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 06/17/2015
TEST #: D151777



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151778

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	36 to 45	42	Pass
Pelvis Y Acceleration	G's	28 to 39	34	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	5,055	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

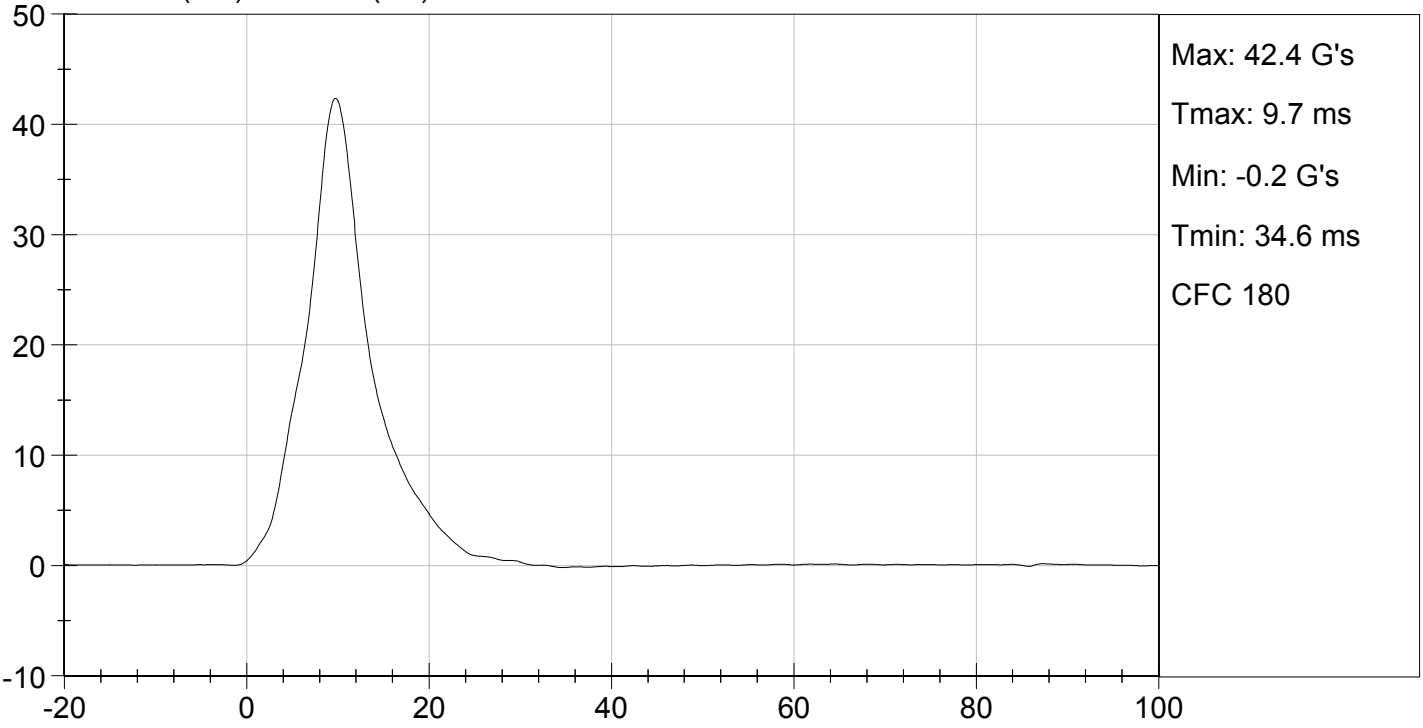
06/17/2015
Test Date

Jessica Hall
Approved By

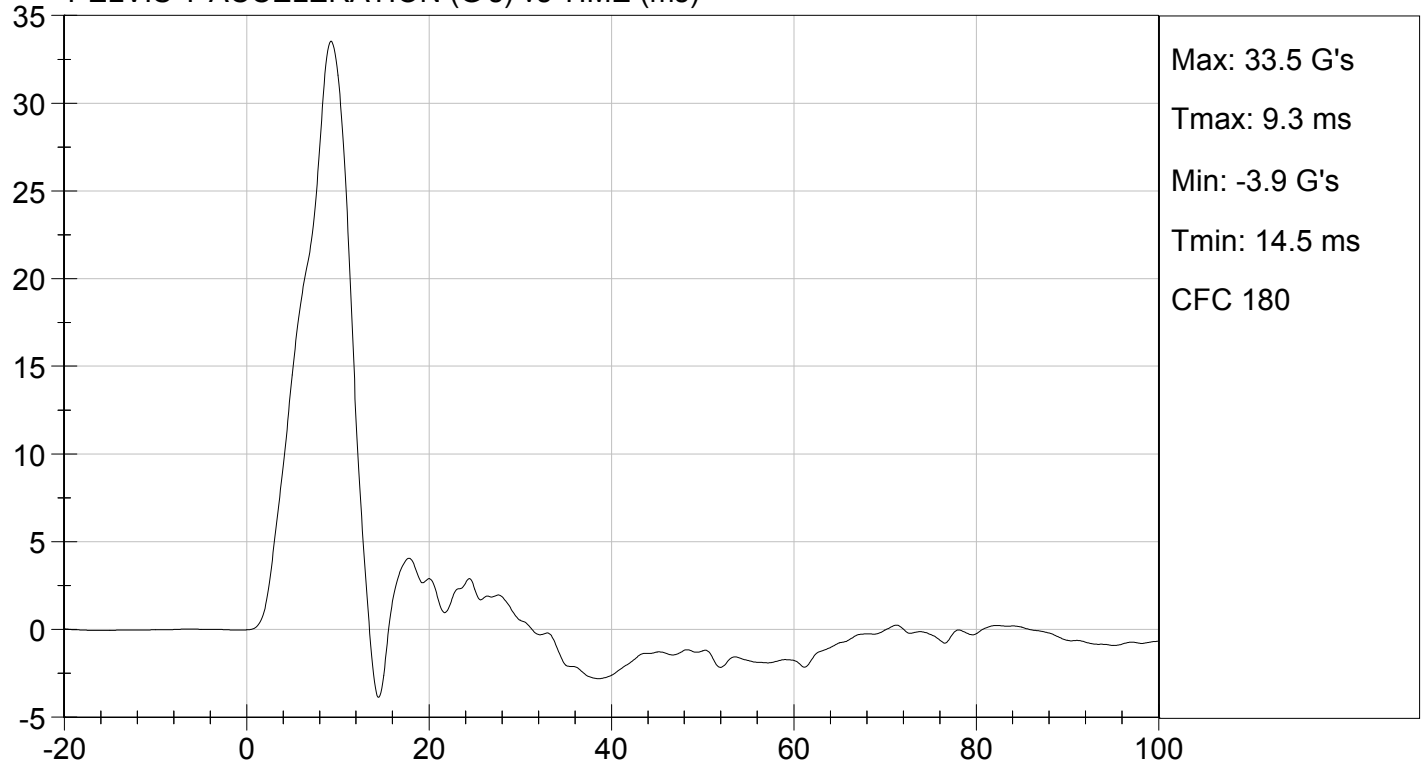
TEST DESC: ILLIAC
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 06/17/2015
TEST #: D151778

PROBE (G's) vs TIME (ms)

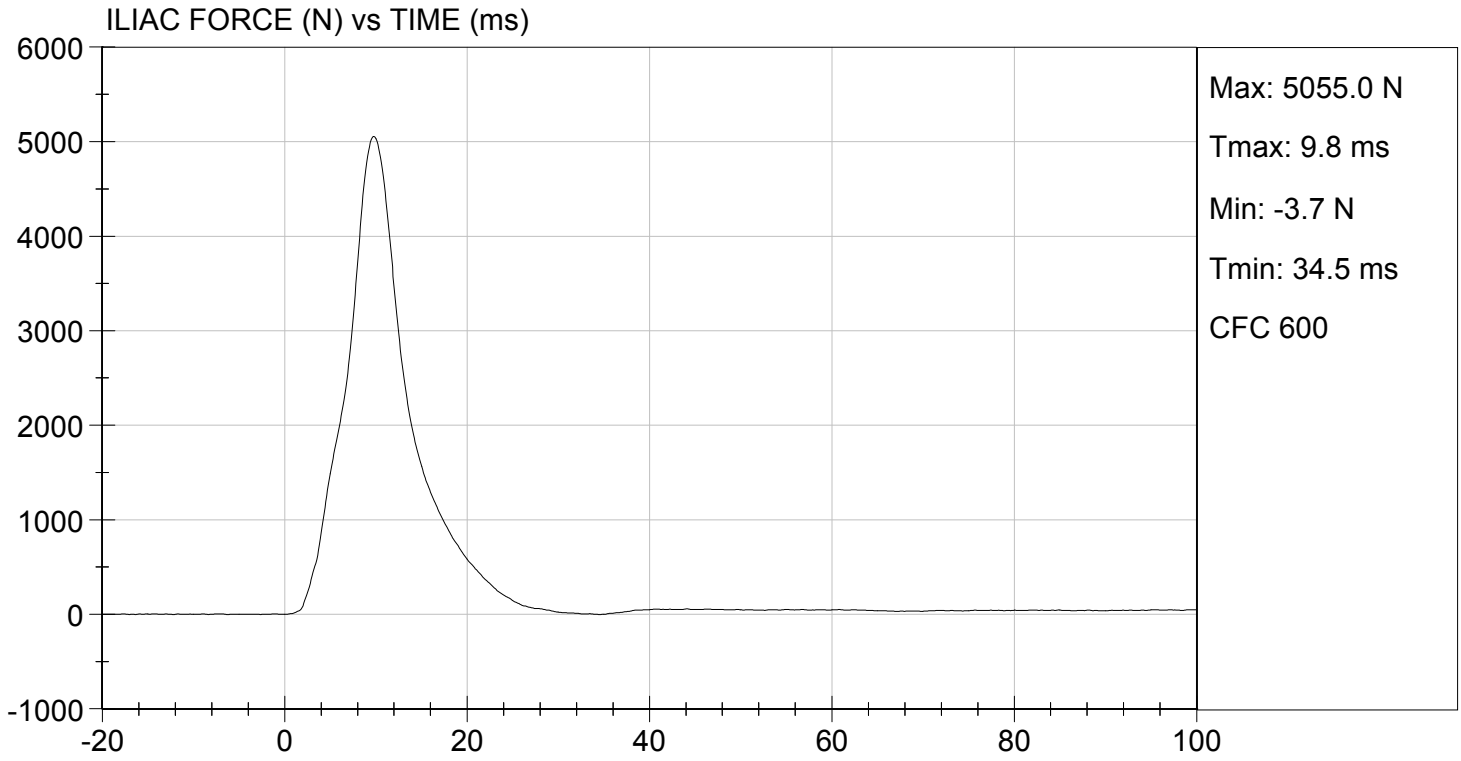


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: ILLIAC
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 06/17/2015
TEST #: D151778



MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D151791

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	115 to 137	126	Pass
Peak Longitudinal Acceleration	G's	+/- 15	2.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

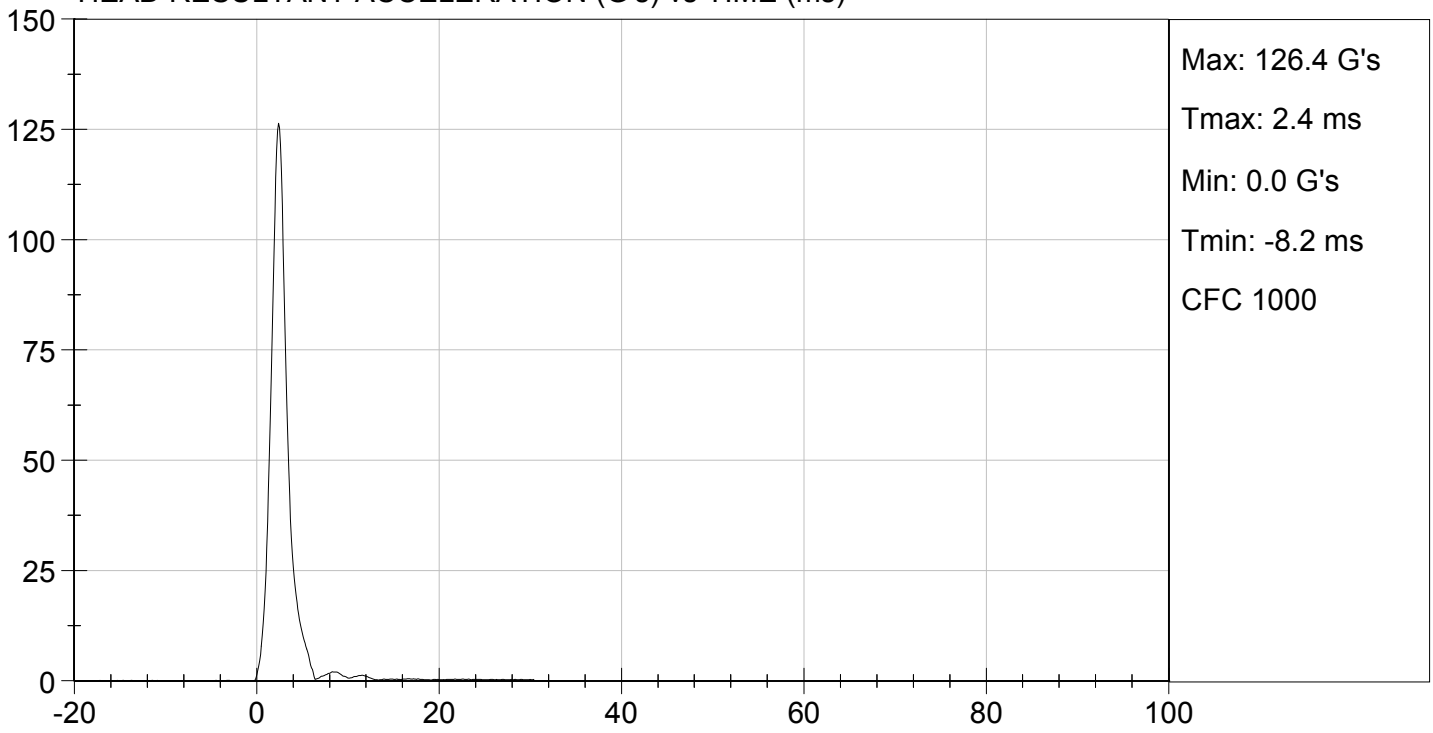
06/19/2015
Test Date

Jessica Hall
Approved By

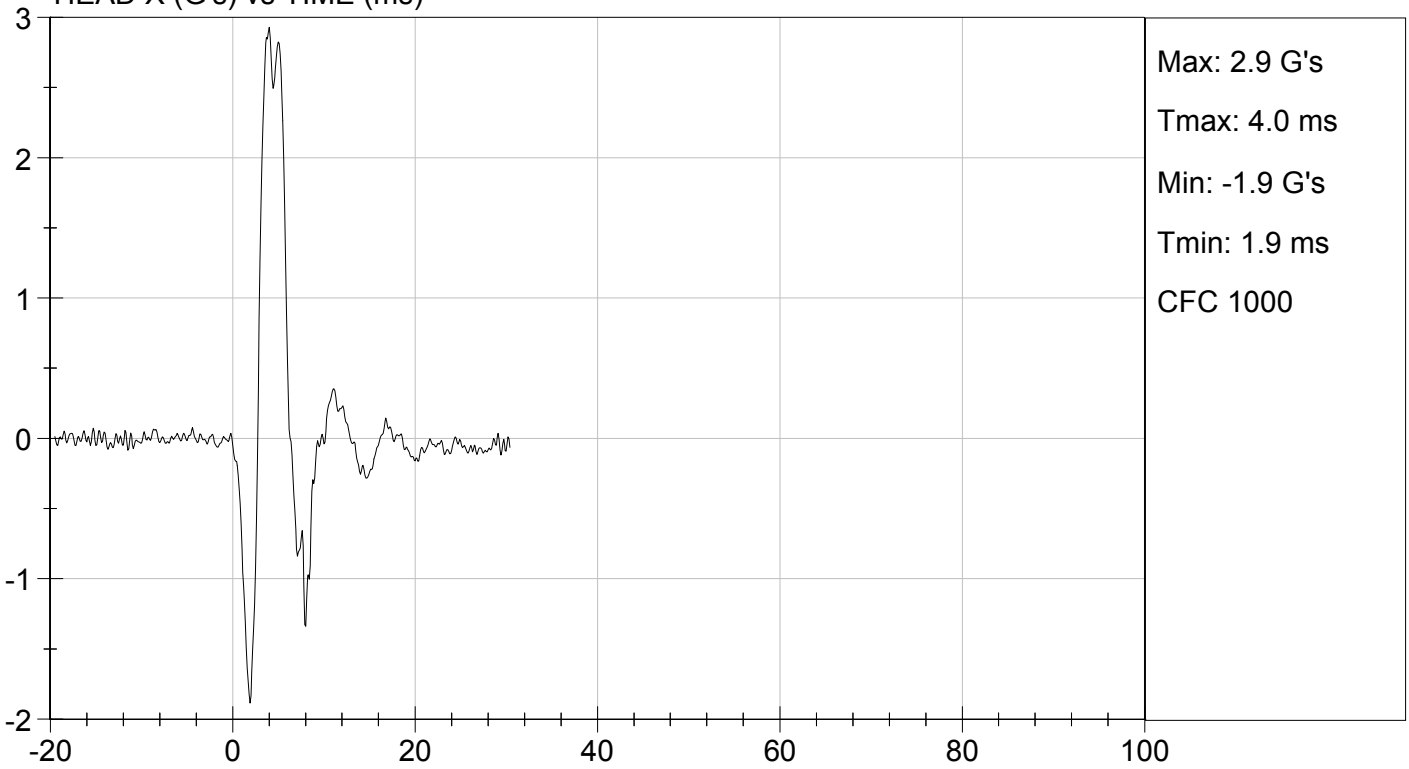
TEST DESC: HEAD DROP

TEST DATE: 06/19/2015
TEST #: D151791

HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)



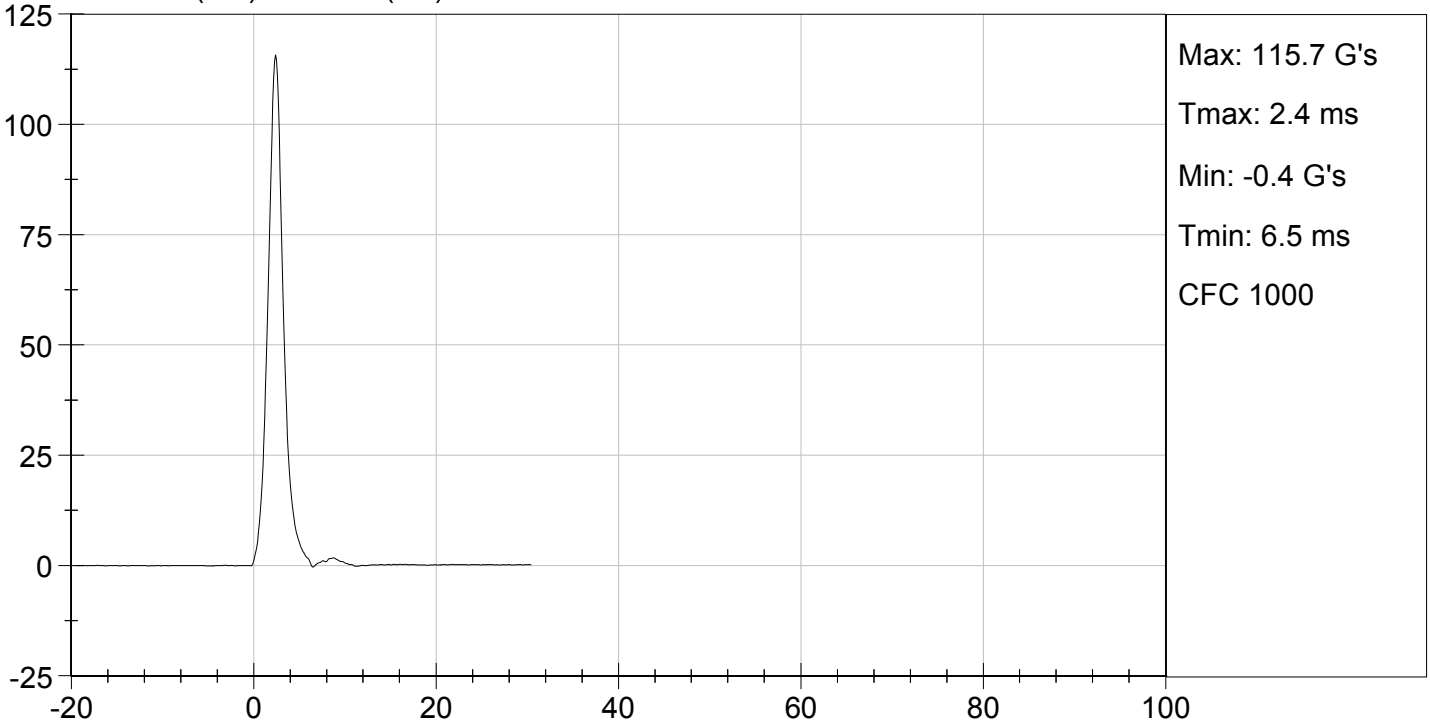
HEAD X (G's) vs TIME (ms)



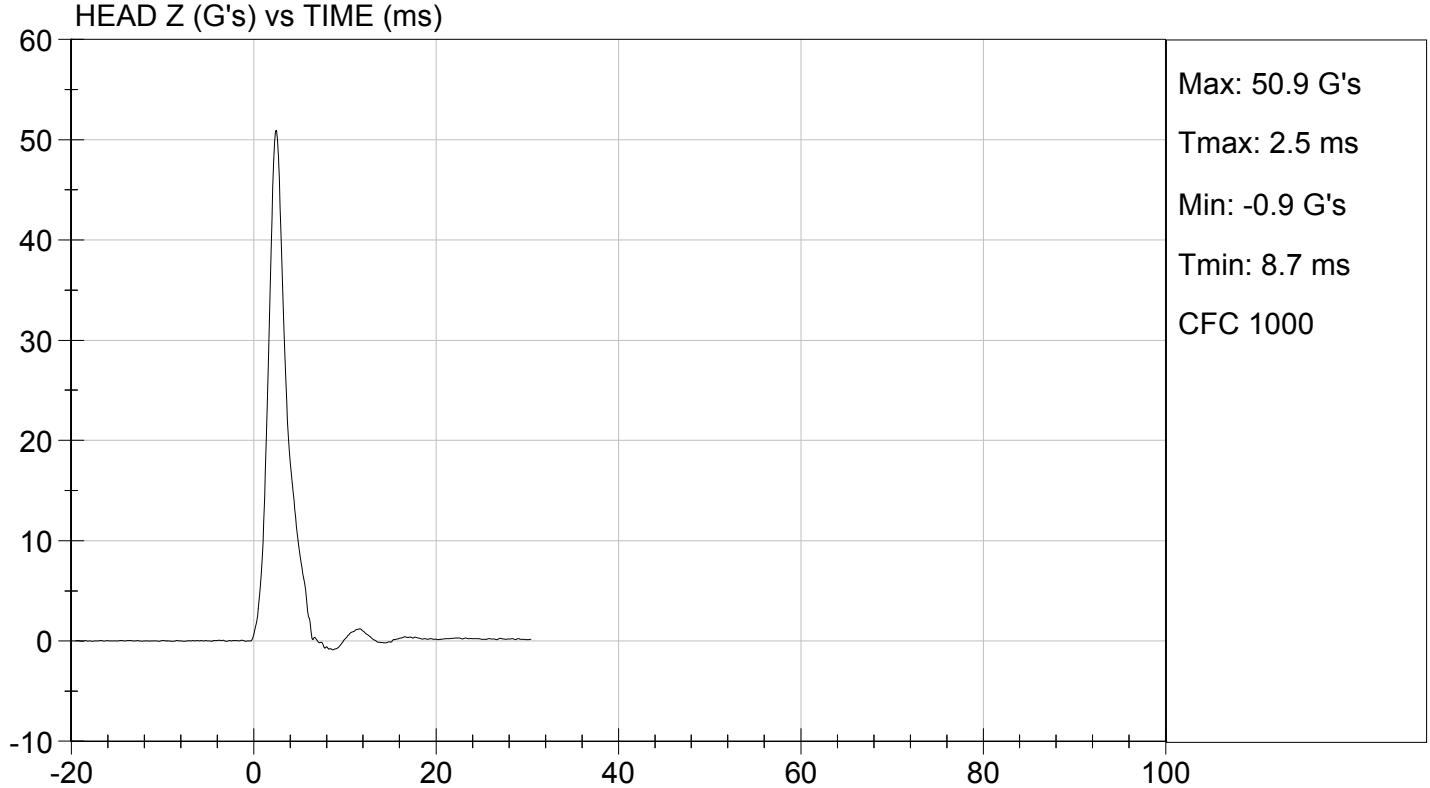
TEST DESC: HEAD DROP

TEST DATE: 06/19/2015
TEST #: D151791

HEAD Y (G's) vs TIME (ms)



HEAD Z (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151792

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.5	Pass
Humidity		%	10 to 70	54	Pass
Impact Velocity		m/s	5.51 to 5.63	5.52	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.47	Pass
	15 ms	m/s	3.30 to 4.10	3.46	Pass
	20 ms	m/s	4.40 to 5.40	4.59	Pass
	25 ms	m/s	5.40 to 6.10	5.47	Pass
	25-100 ms	m/s	5.50 to 6.20	5.65	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	67	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-38	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	117	Pass
			Overall Test Results		Pass

David Schoedel
Laboratory Technician

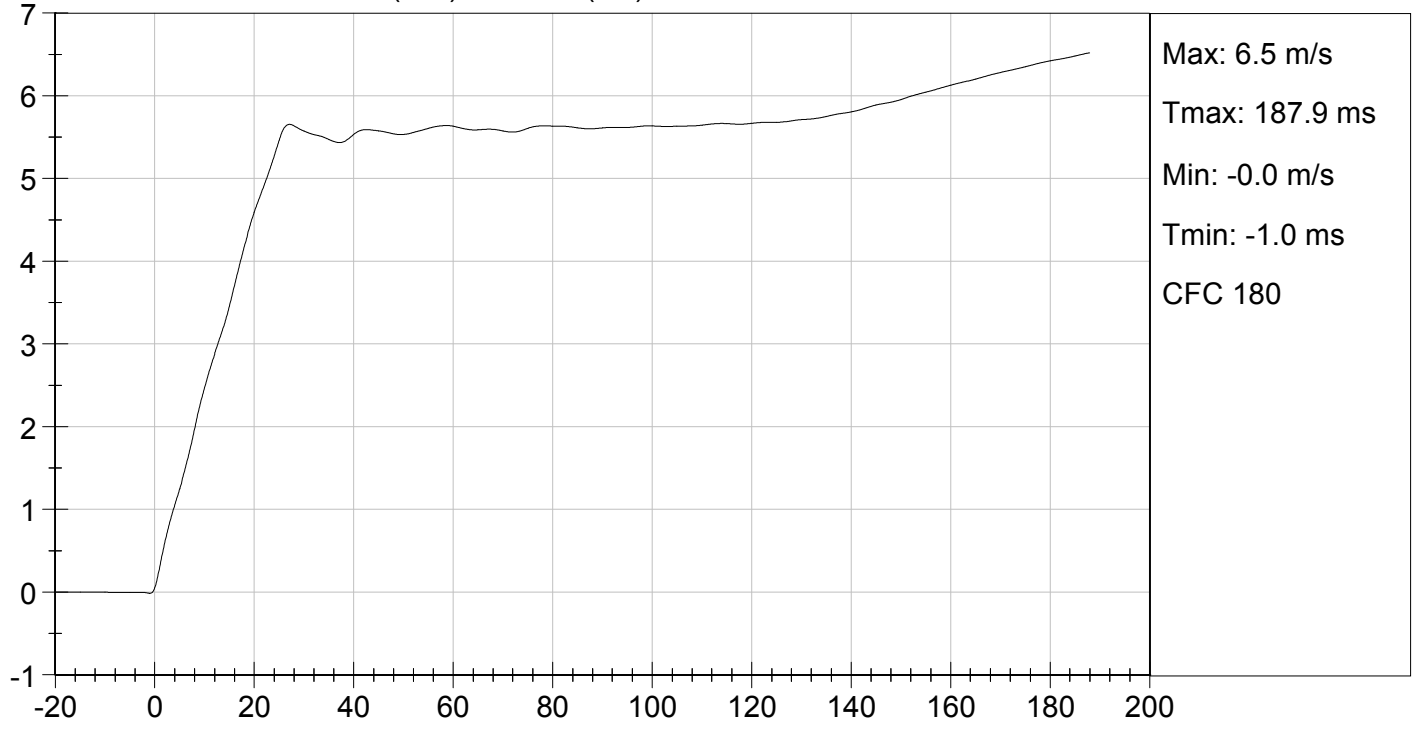
06/19/2015
Test Date

Jessica Gall
Approved By

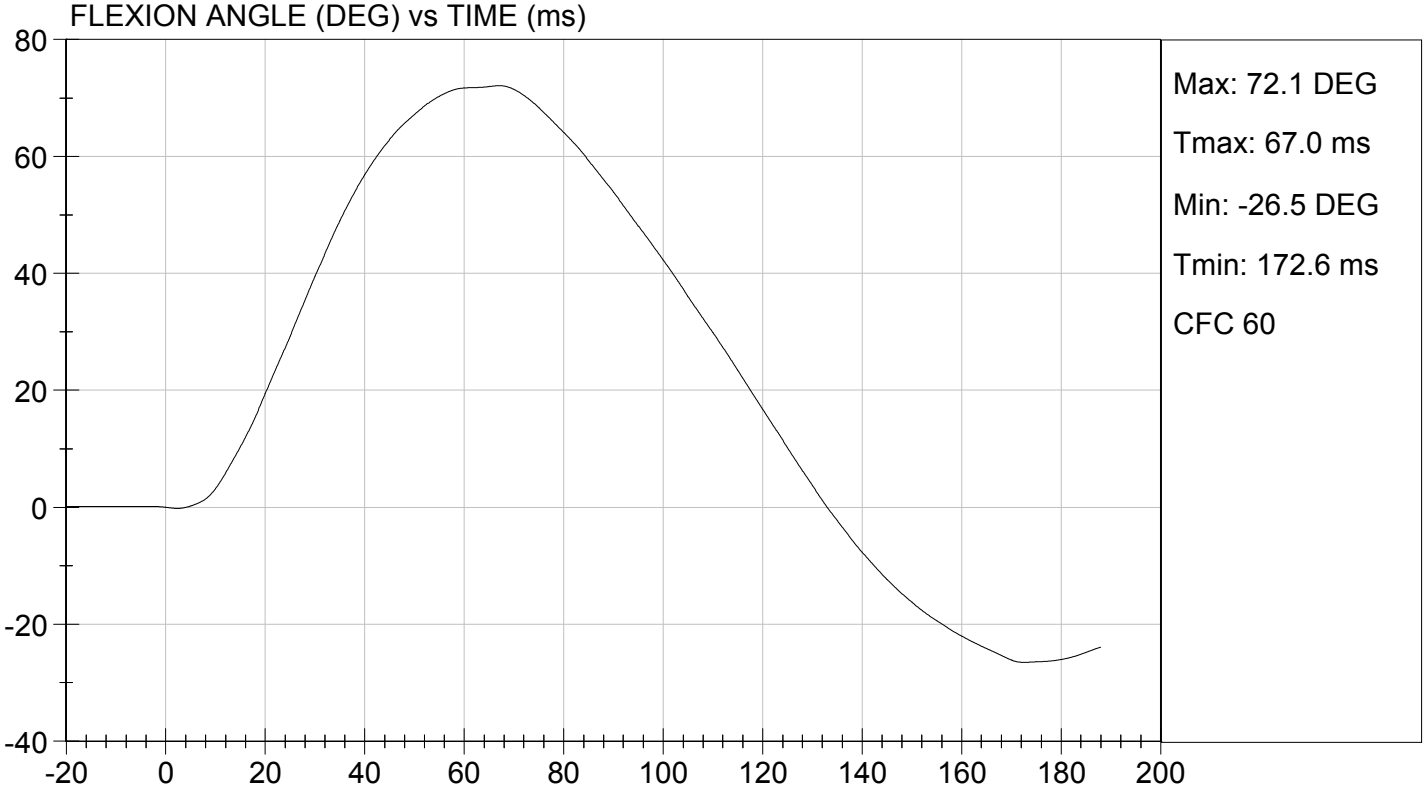
TEST DESC: NECK BENDING
VELOCITY: 18.12 ft/s, 5.52 m/s

TEST DATE: 06/19/2015
TEST #: D151792

PENDULUM VELOCITY (m/s) vs TIME (ms)

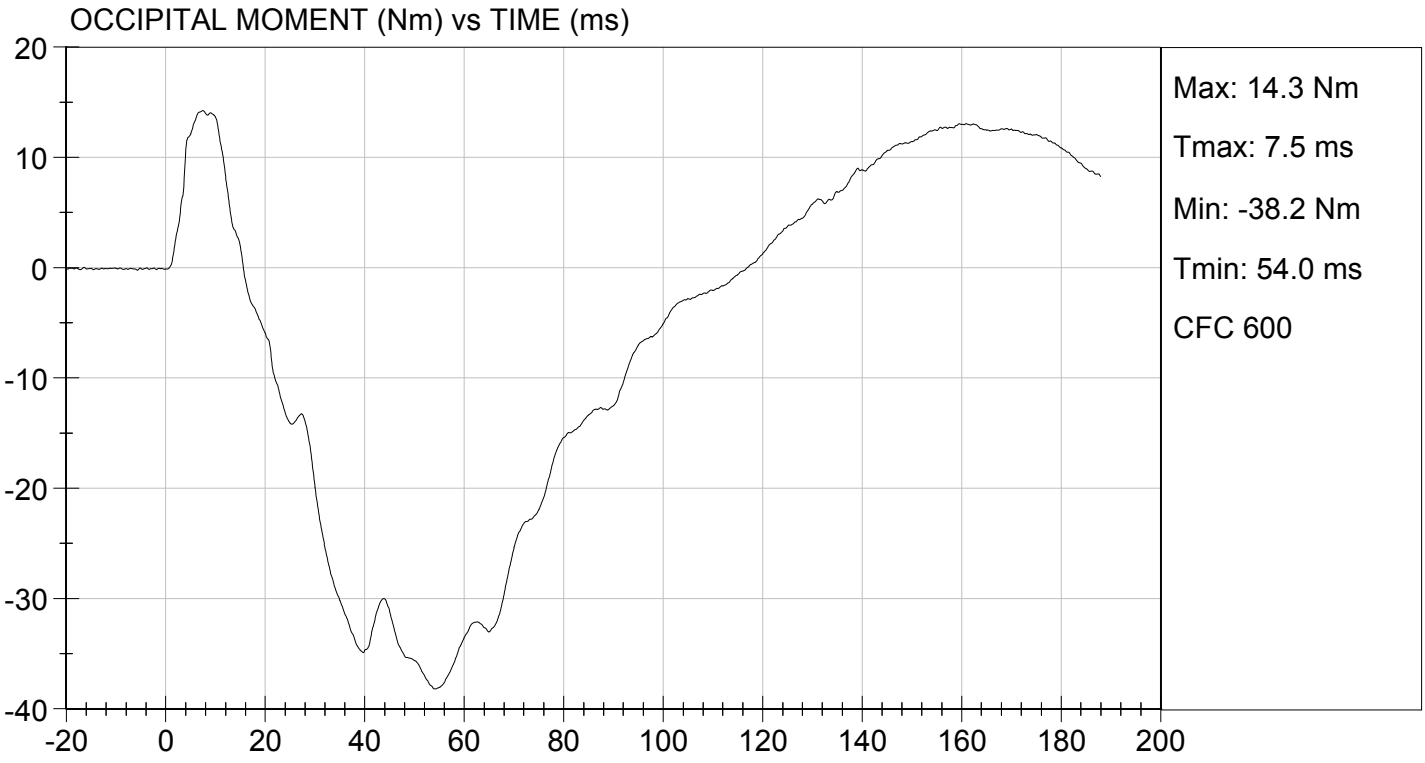


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.12 ft/s, 5.52 m/s

TEST DATE: 06/19/2015
TEST #: D151792



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D151793

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	31	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	19	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

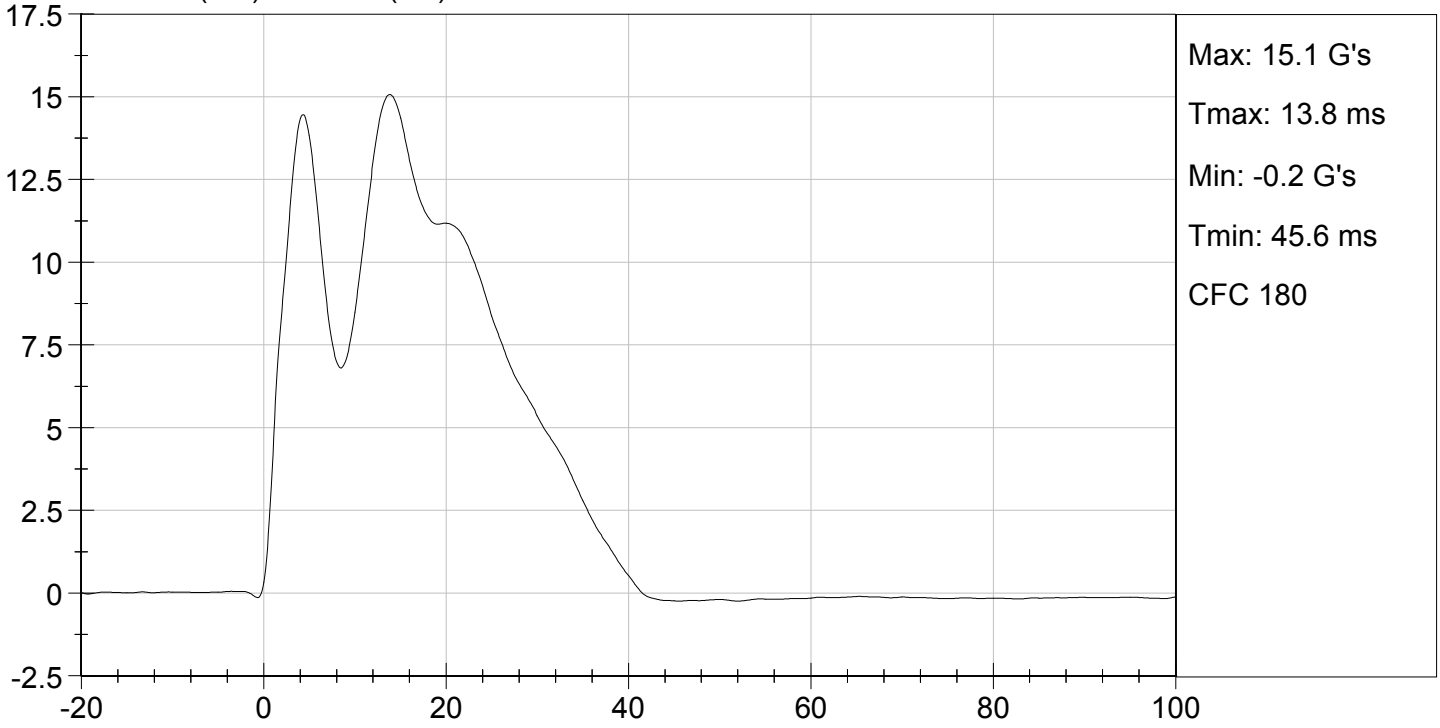
06/19/2015
Test Date

Jessica Hall
Approved By

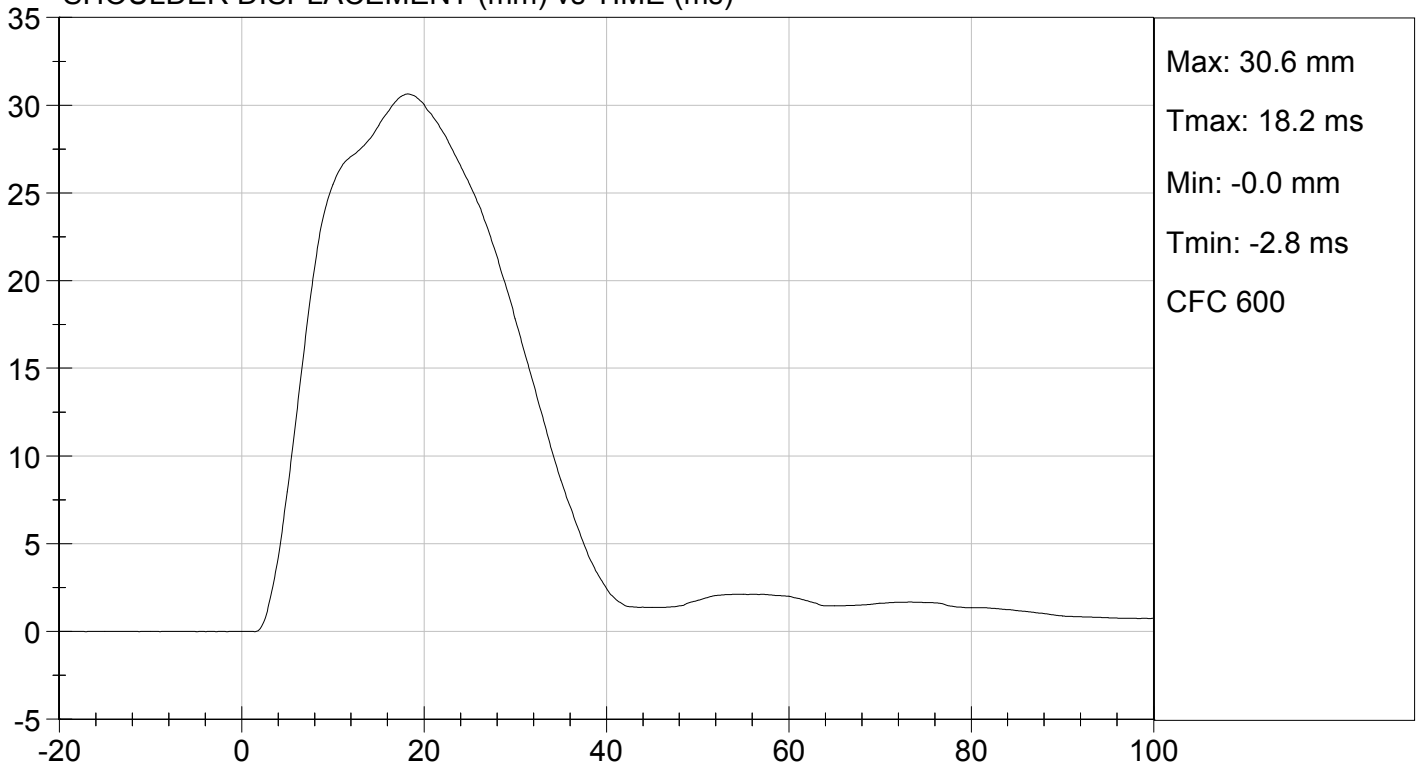
TEST DESC: SHOULDER IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 06/19/2015
TEST #: D151793

PROBE (G's) vs TIME (ms)

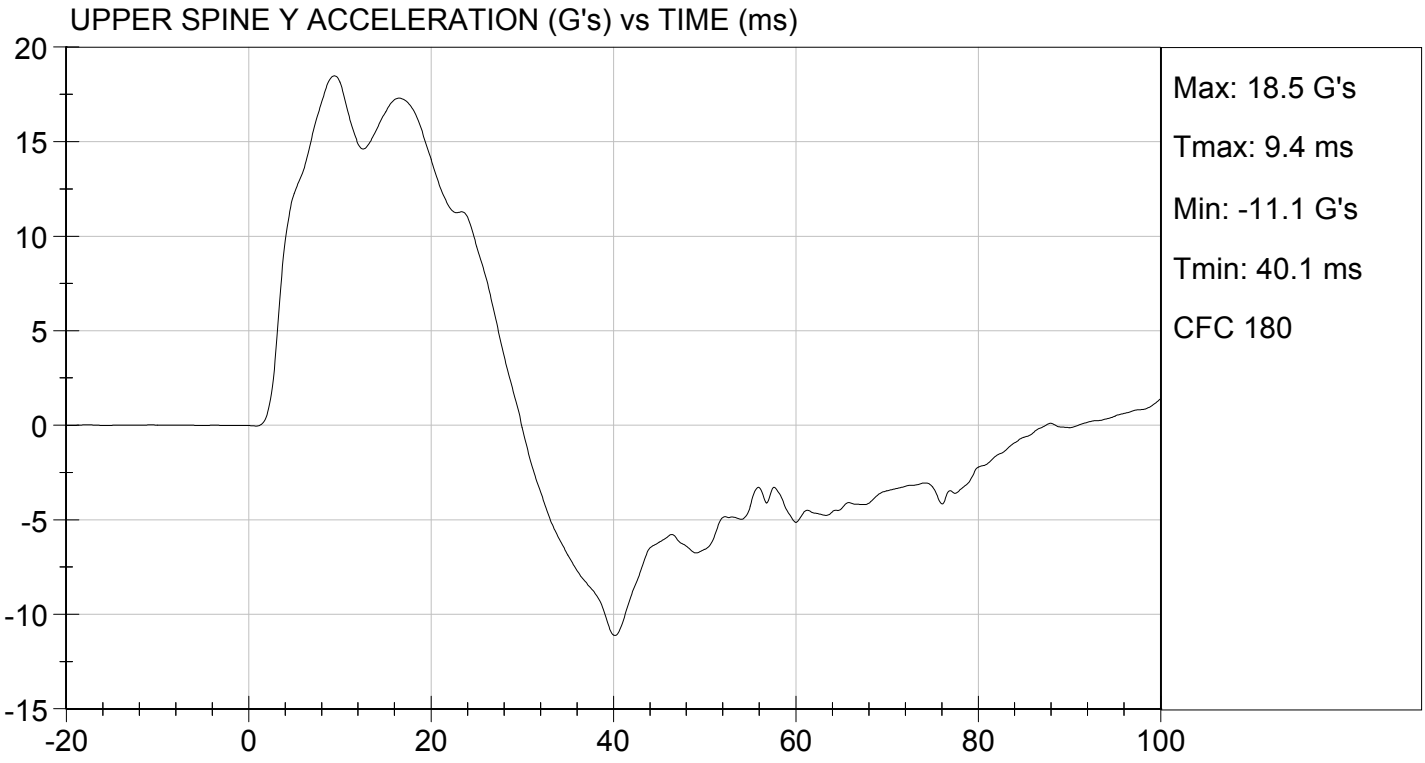


SHOULDER DISPLACEMENT (mm) vs TIME (ms)



TEST DESC: SHOULDER IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 06/19/2015
TEST #: D151793



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151794

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	45	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Maximum Probe Acceleration	G's	30 to 36	31	Pass
Shoulder Displacement	mm	31 to 40	36	Pass
Upper Rib Displacement	mm	25 to 32	28	Pass
Middle Rib Displacement	mm	30 to 36	32	Pass
Lower Rib Displacement	mm	32 to 38	35	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	35	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	31	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

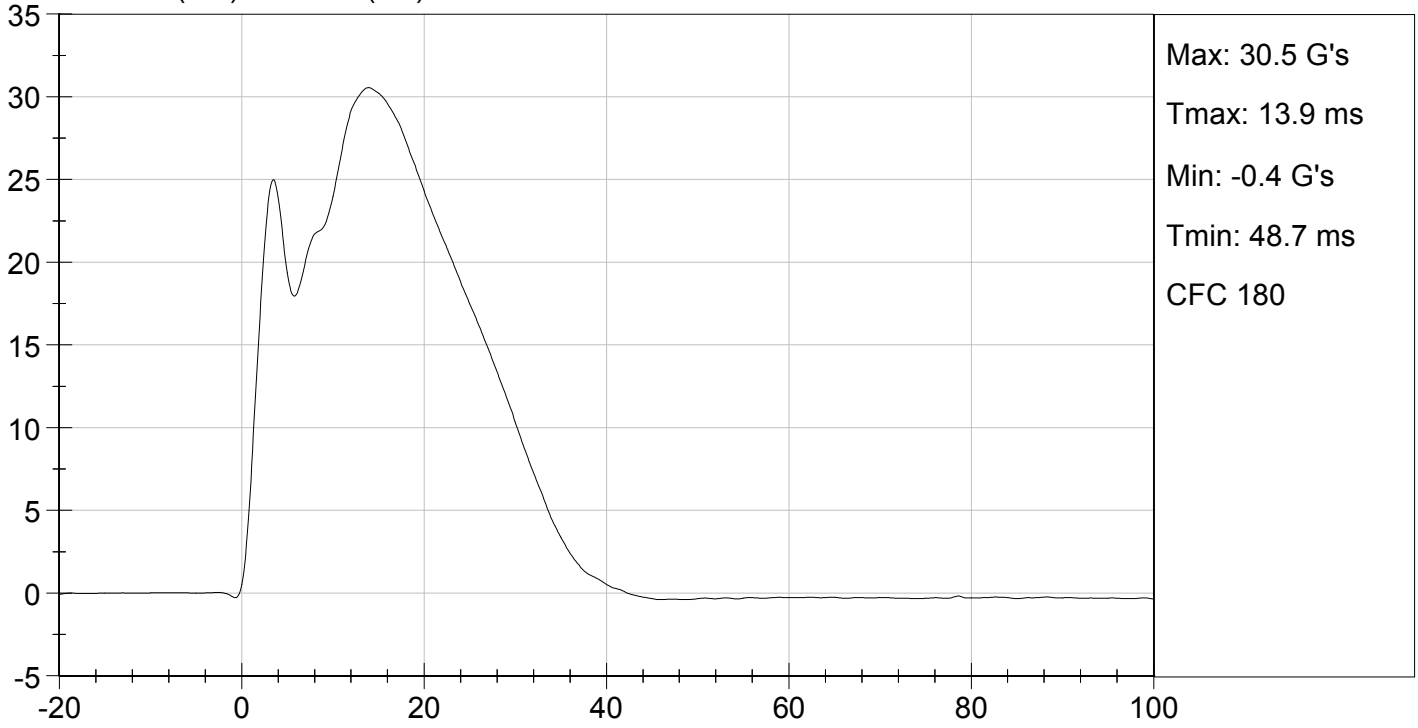
06/19/2015
Test Date

Jessica Gall
Approved By

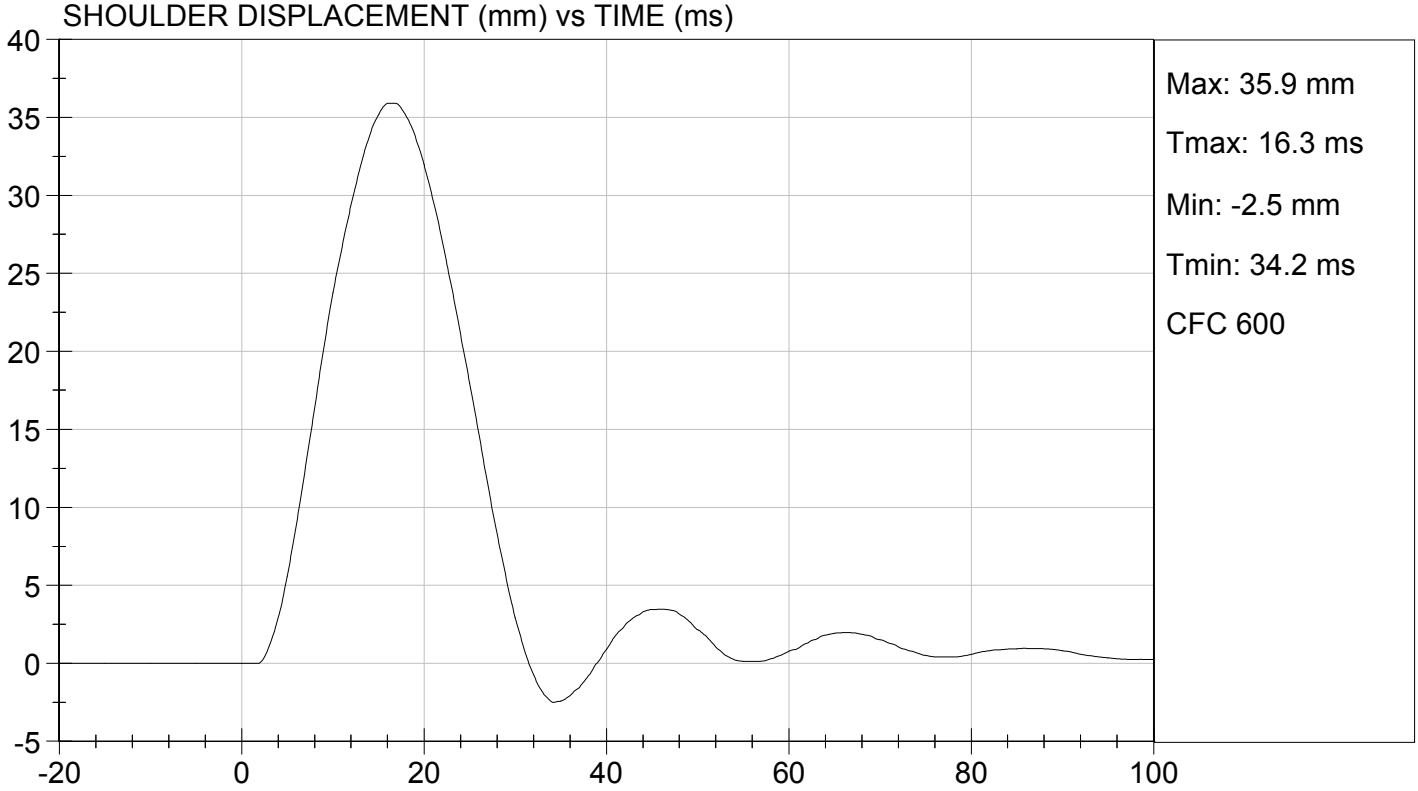
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 06/19/2015
TEST #: D151794

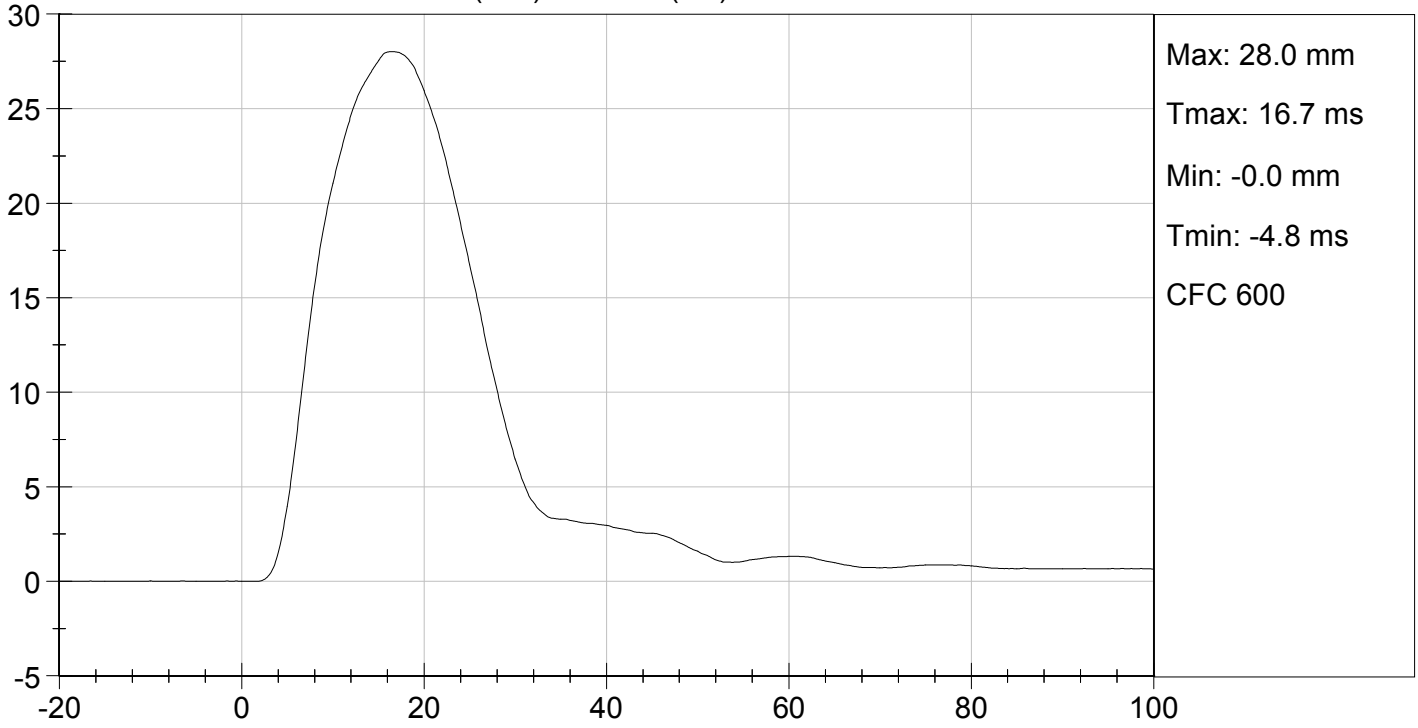
PROBE (G's) vs TIME (ms)



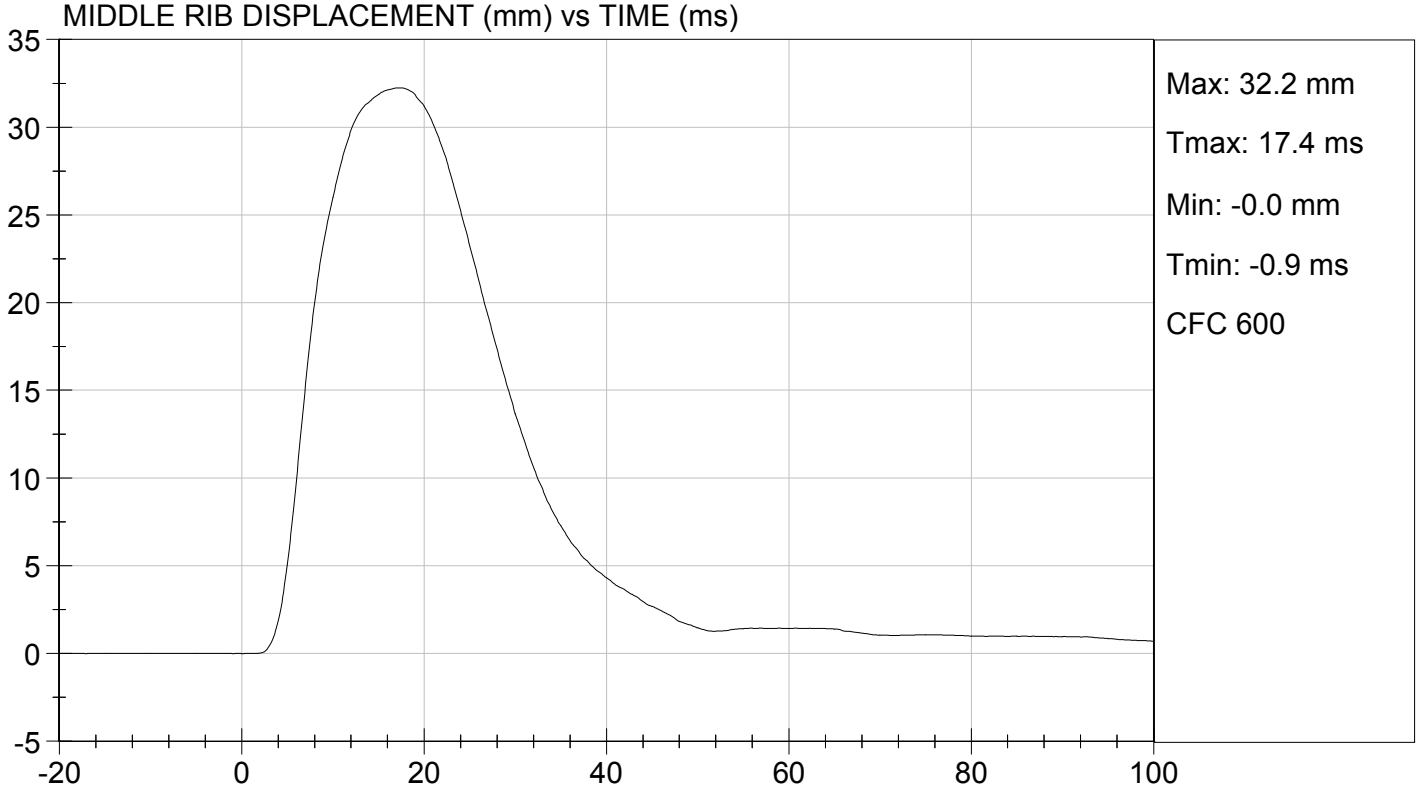
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



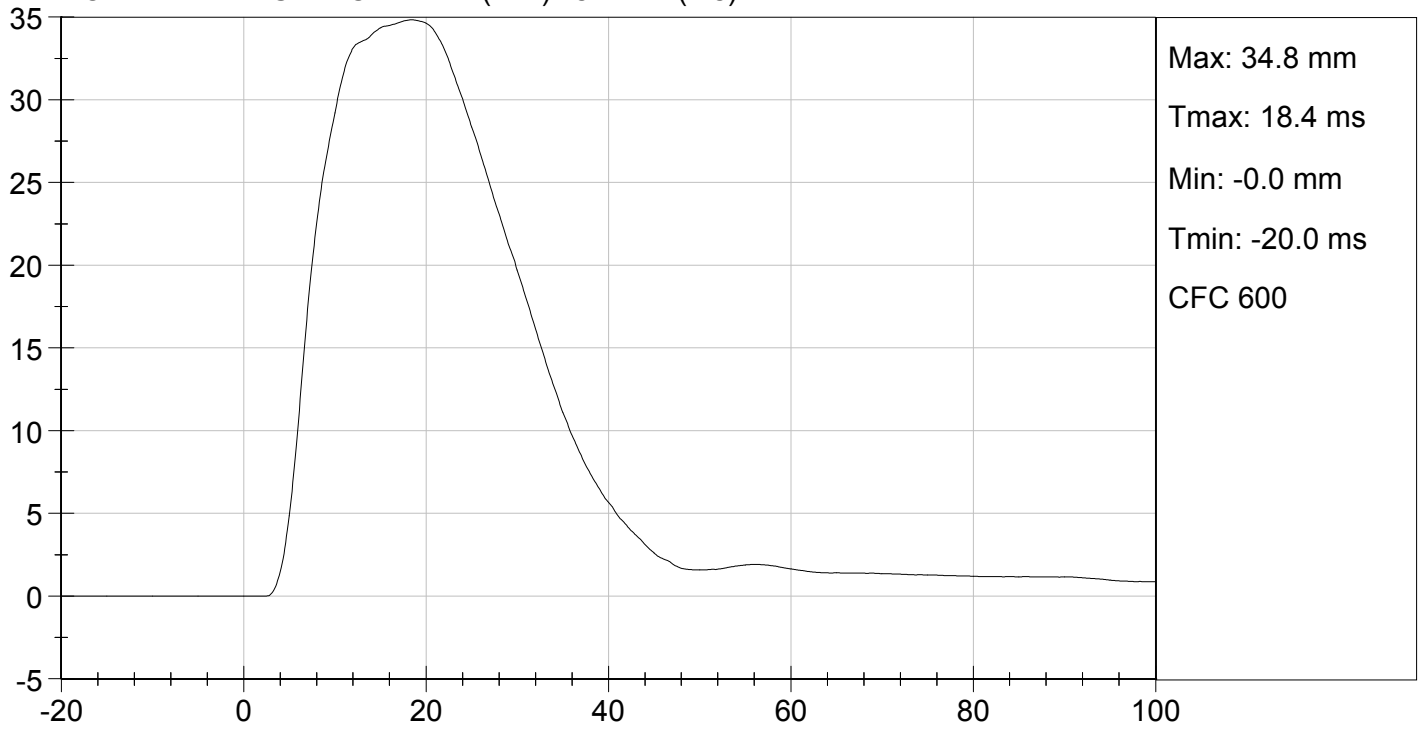
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



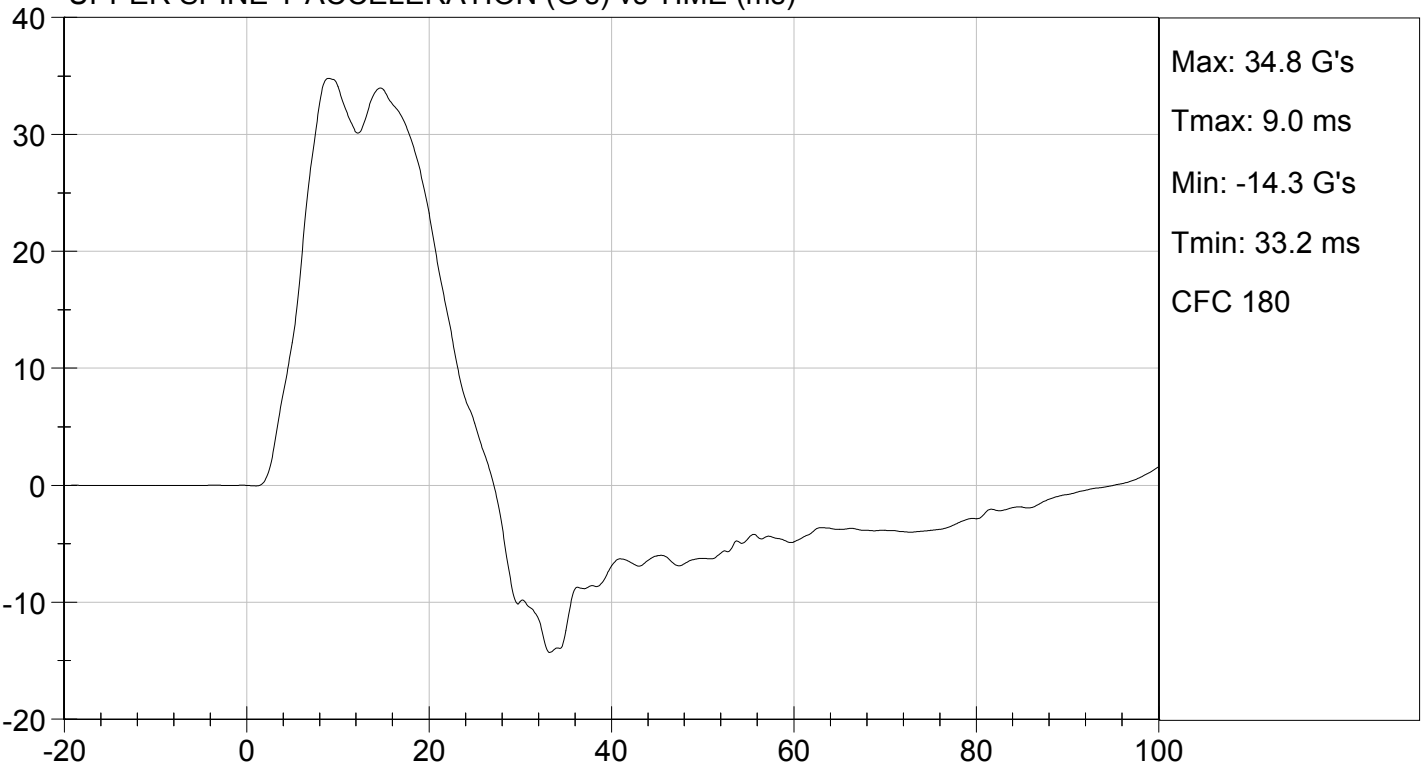
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 06/19/2015
TEST #: D151794

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



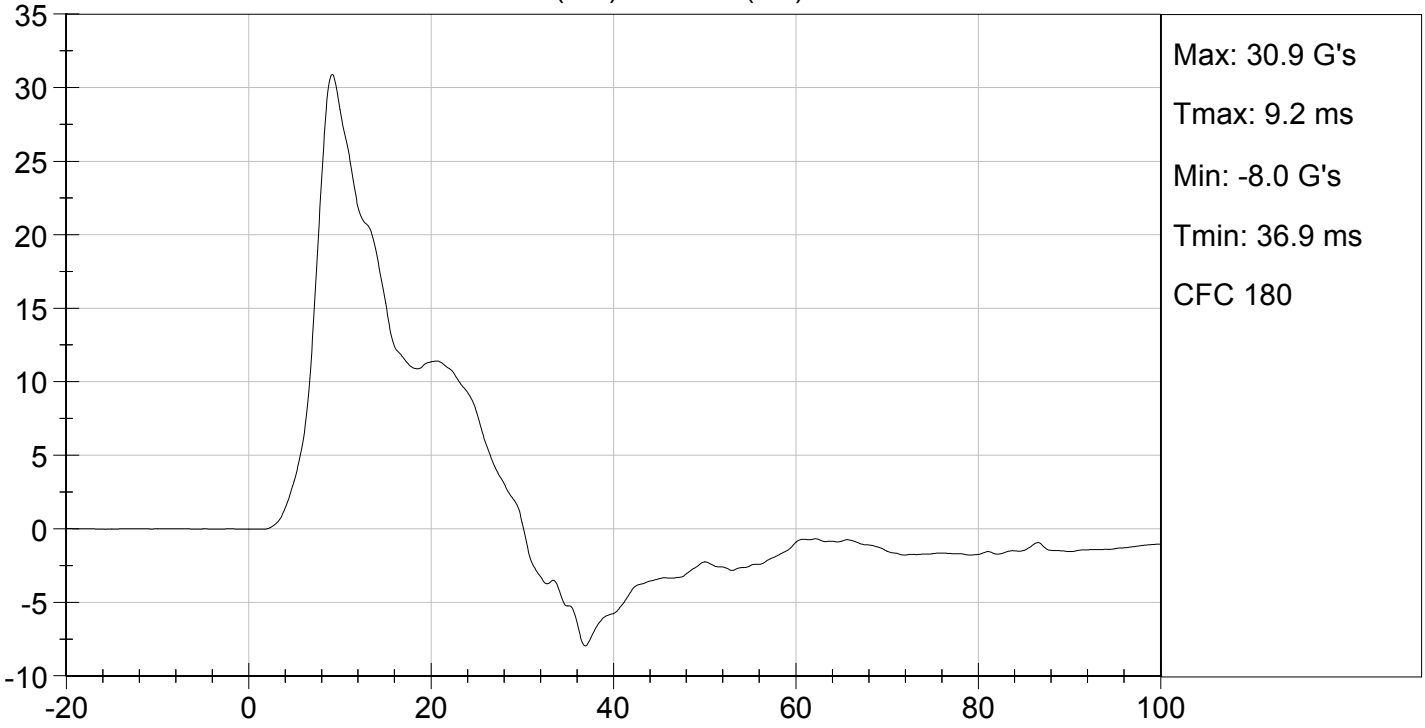
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 06/19/2015
TEST #: D151794

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



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151795

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	45	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	38	Pass
Middle Rib Displacement	mm	39 to 45	44	Pass
Lower Rib Displacement	mm	35 to 43	43	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	13	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	8	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

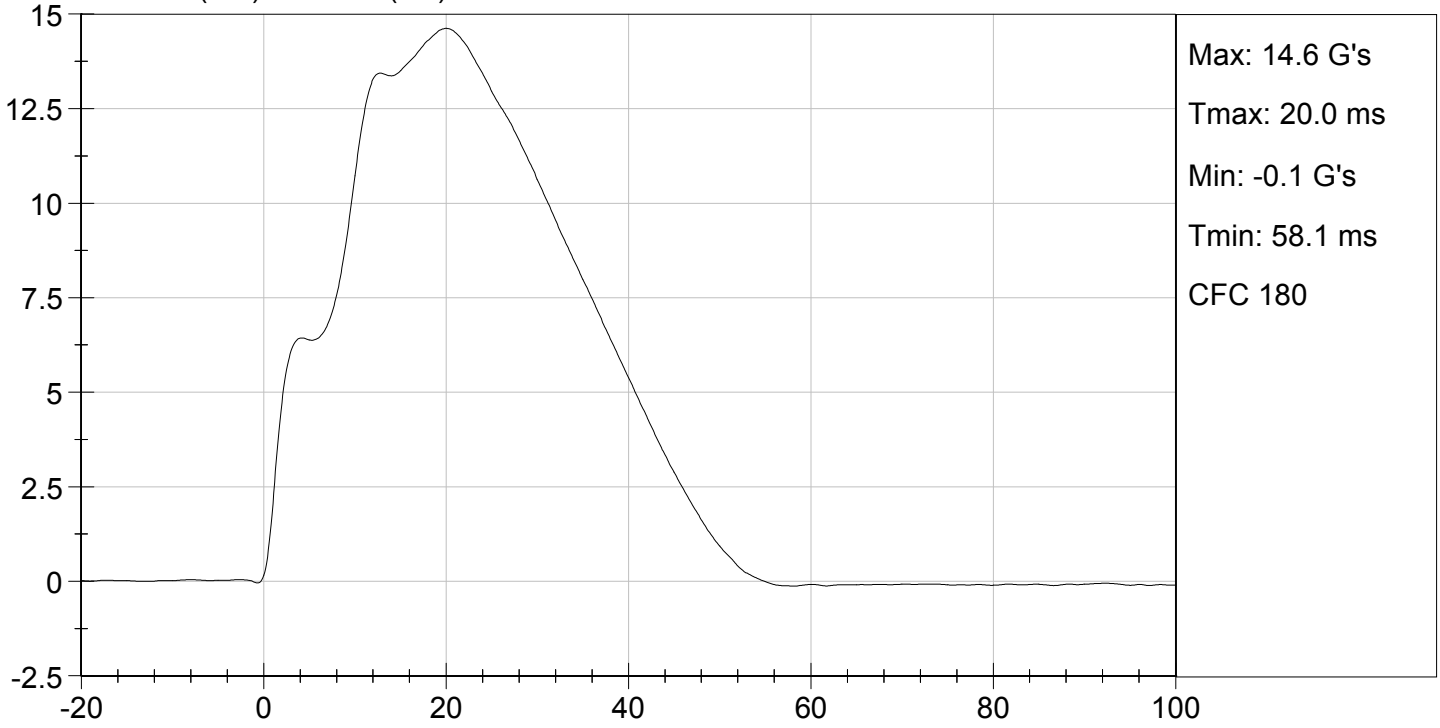
06/19/2015
Test Date

Jessica Gall
Approved By

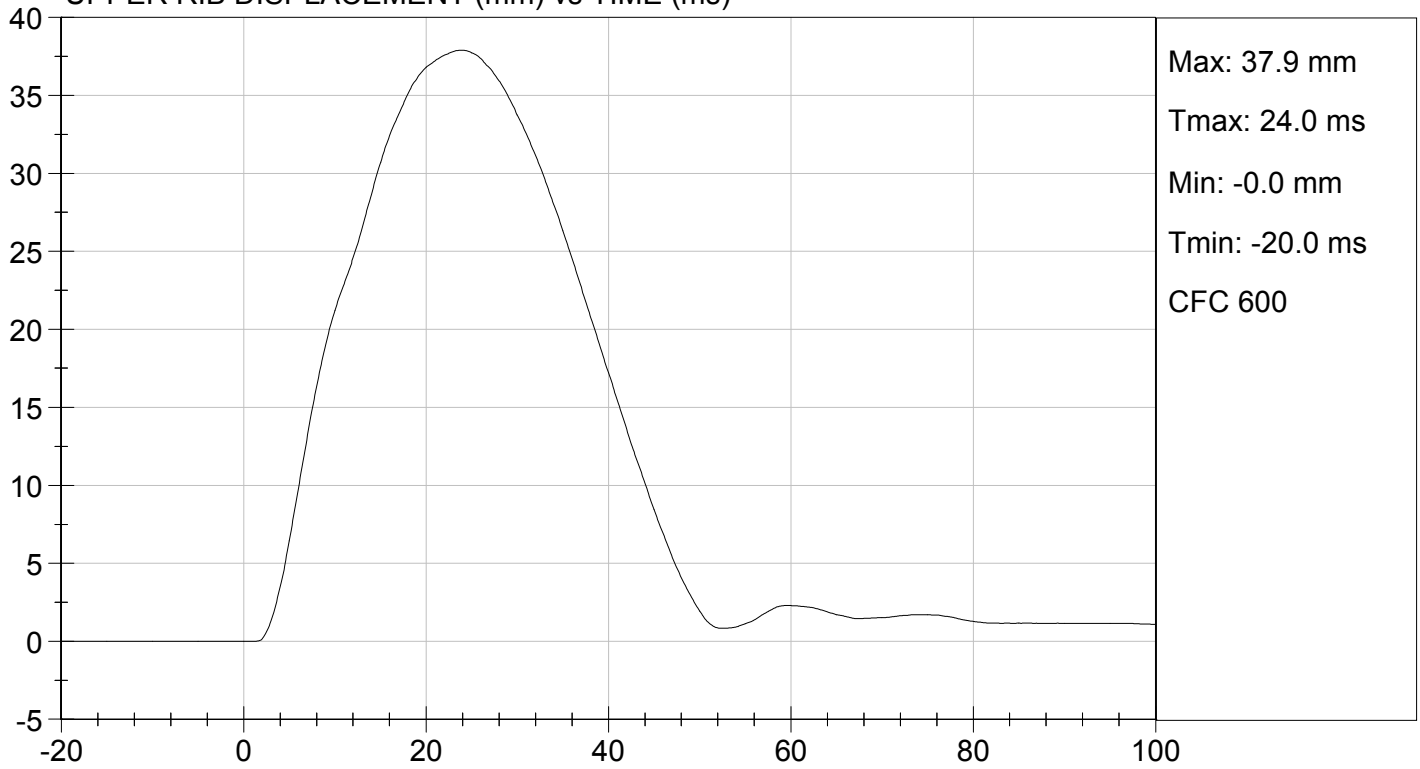
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 06/19/2015
TEST #: D151795

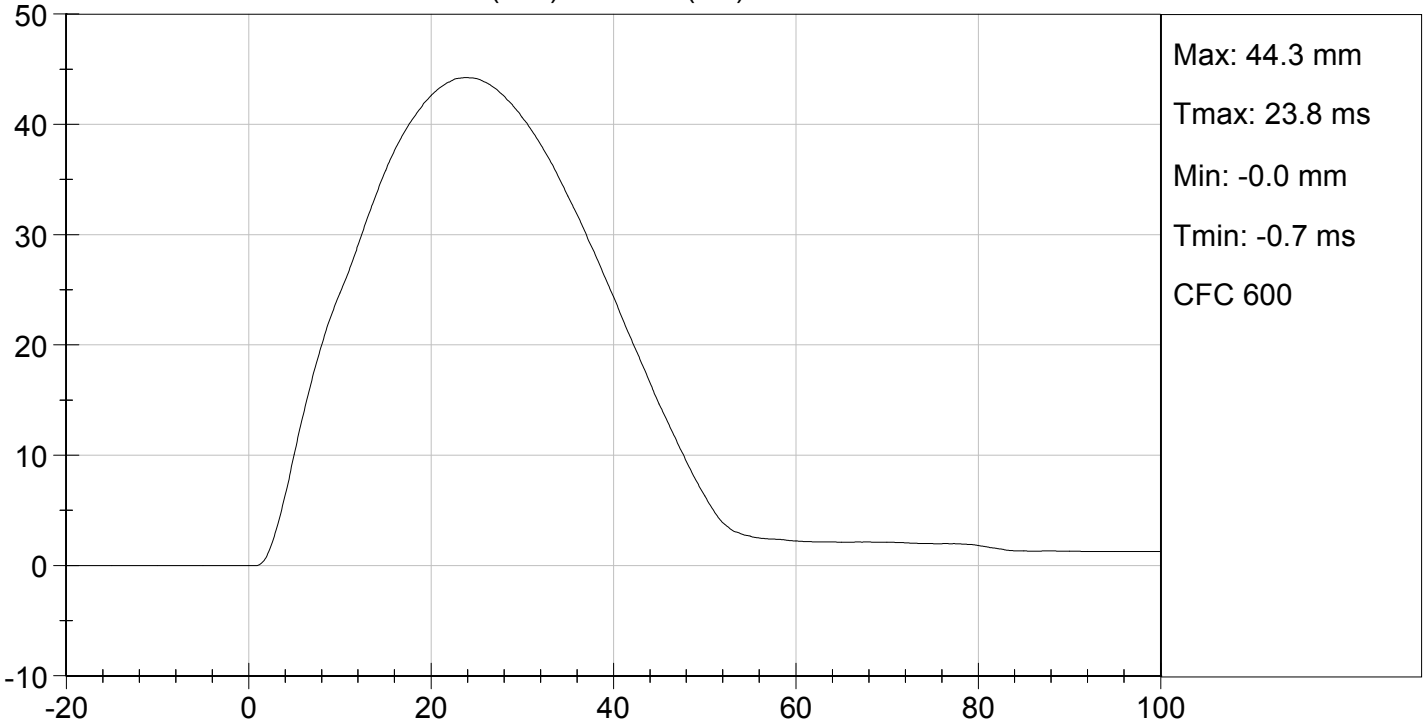
PROBE (G's) vs TIME (ms)



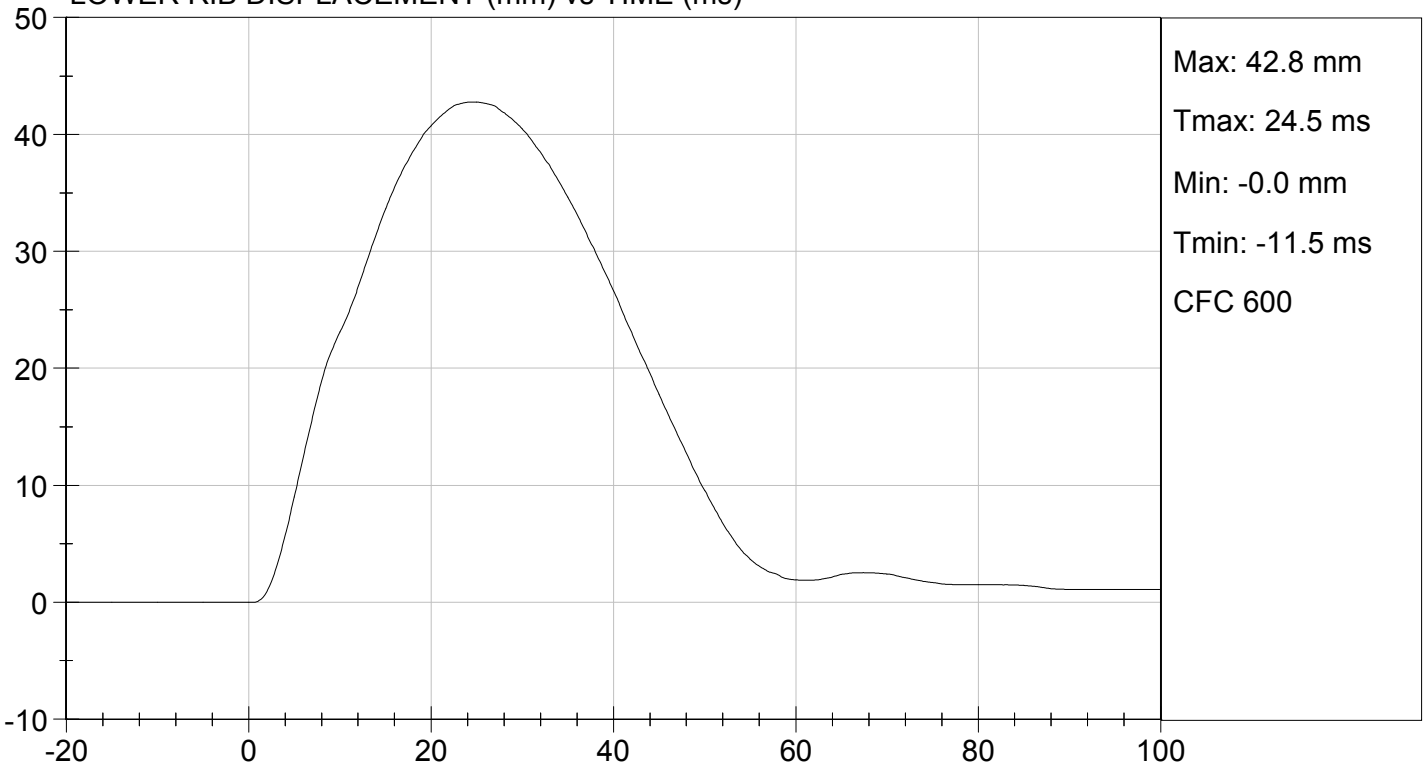
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



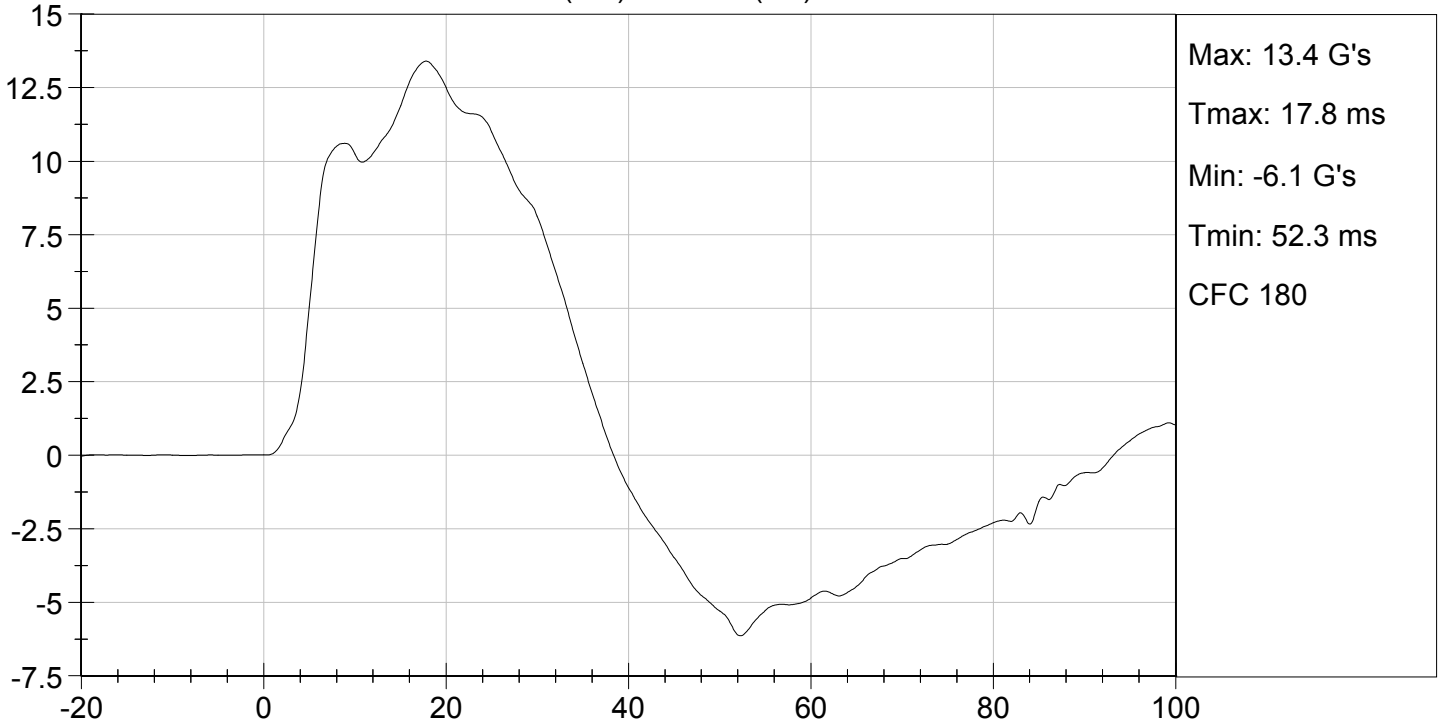
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



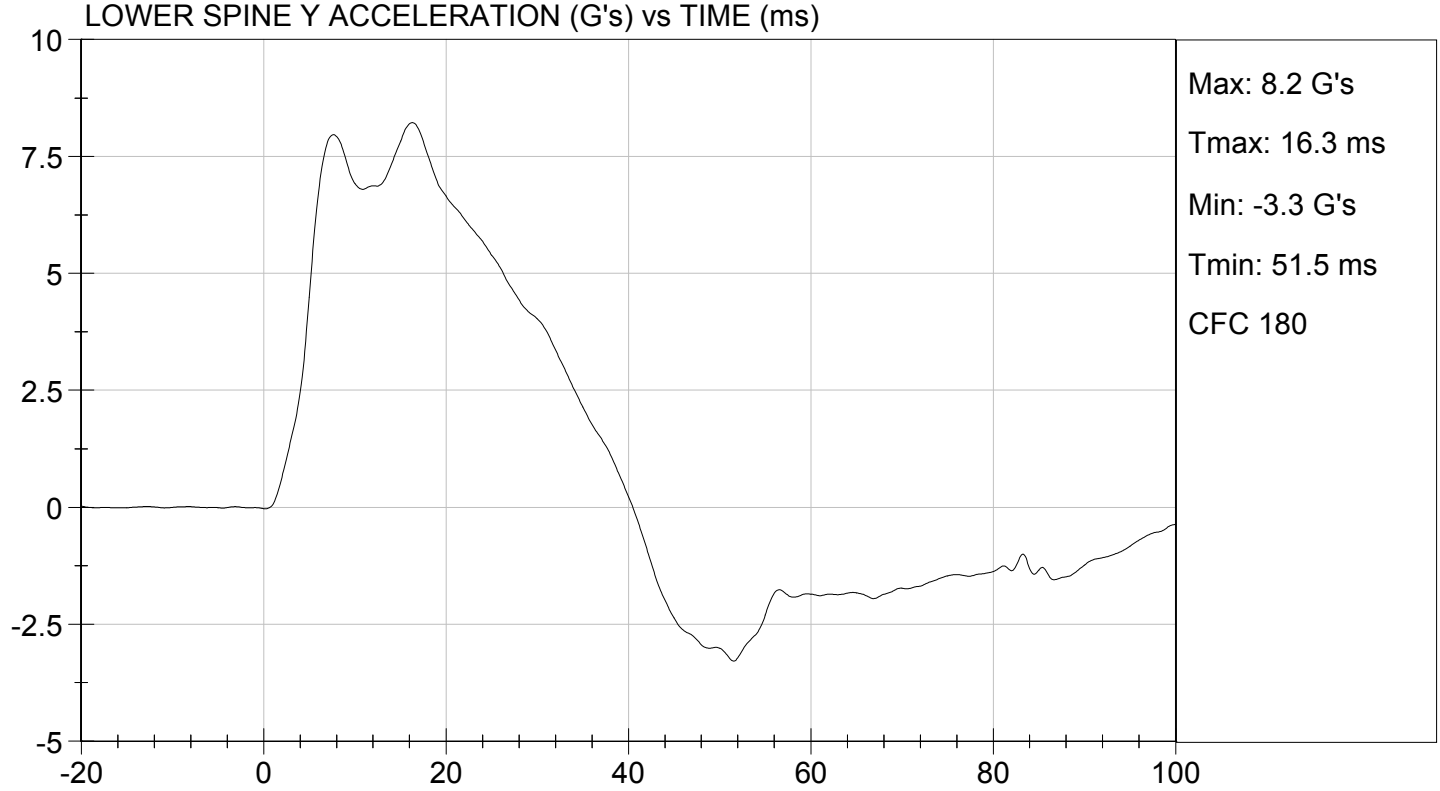
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 06/19/2015
TEST #: D151795

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



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



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151796

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	45	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	12 to 16	13	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	44	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	43	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	10	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

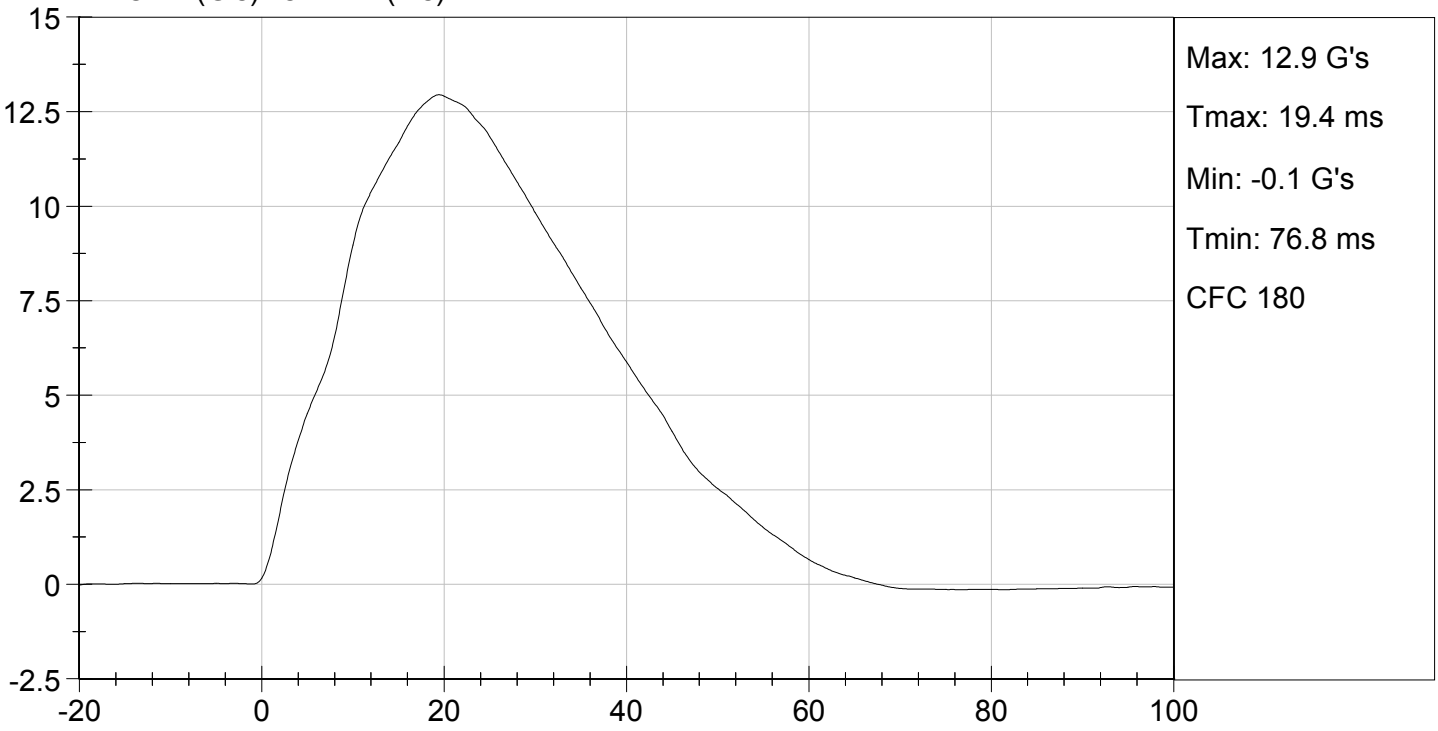
06/19/2015
Test Date

Jessica Hall
Approved By

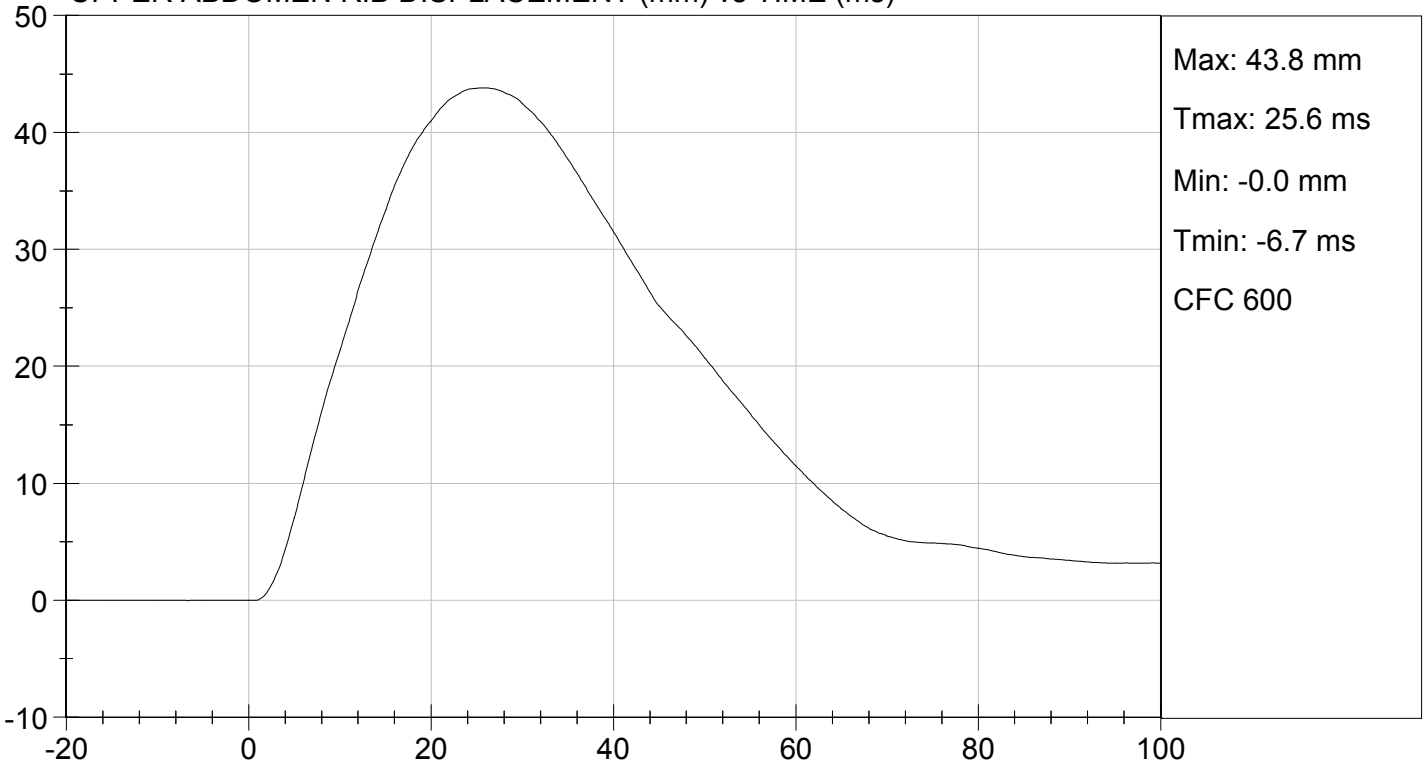
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 06/19/2015
TEST #: D151796

PROBE (G's) vs TIME (ms)



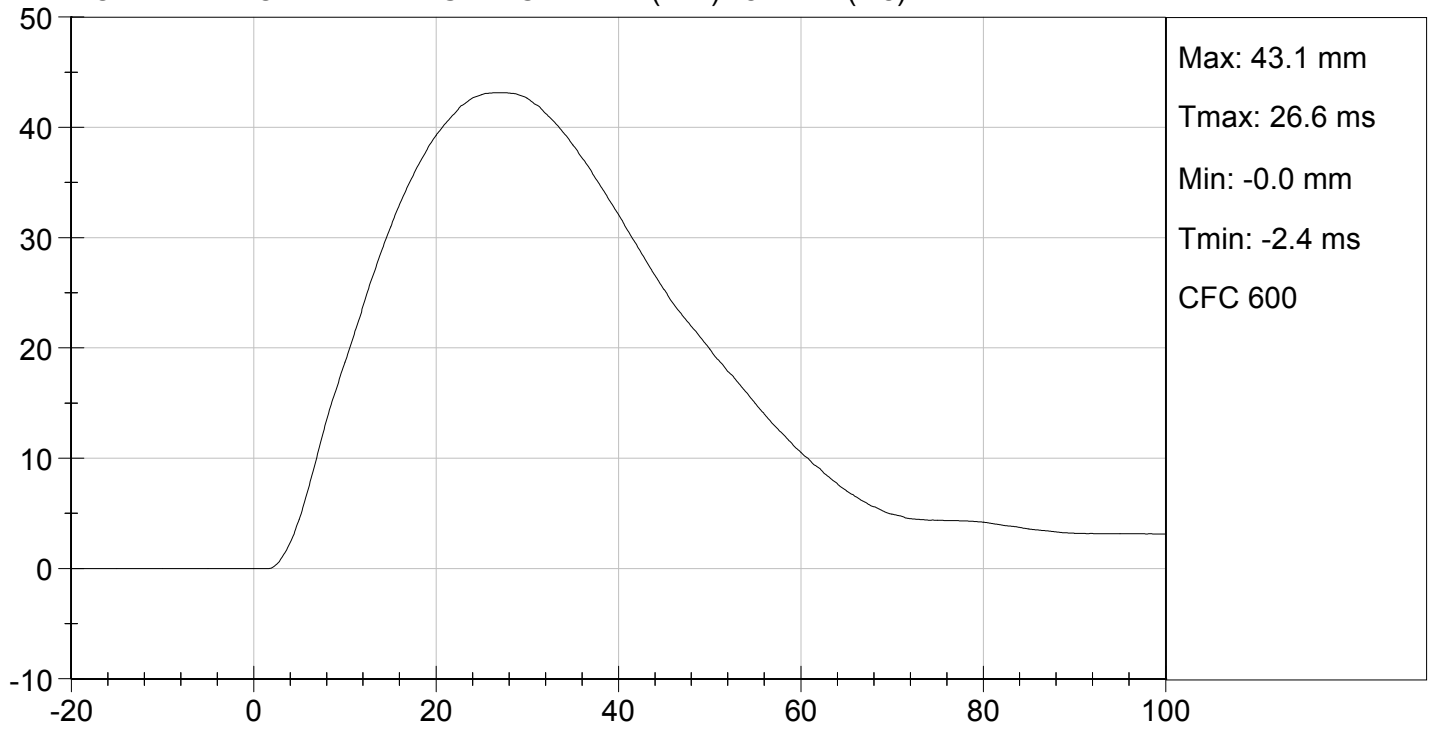
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



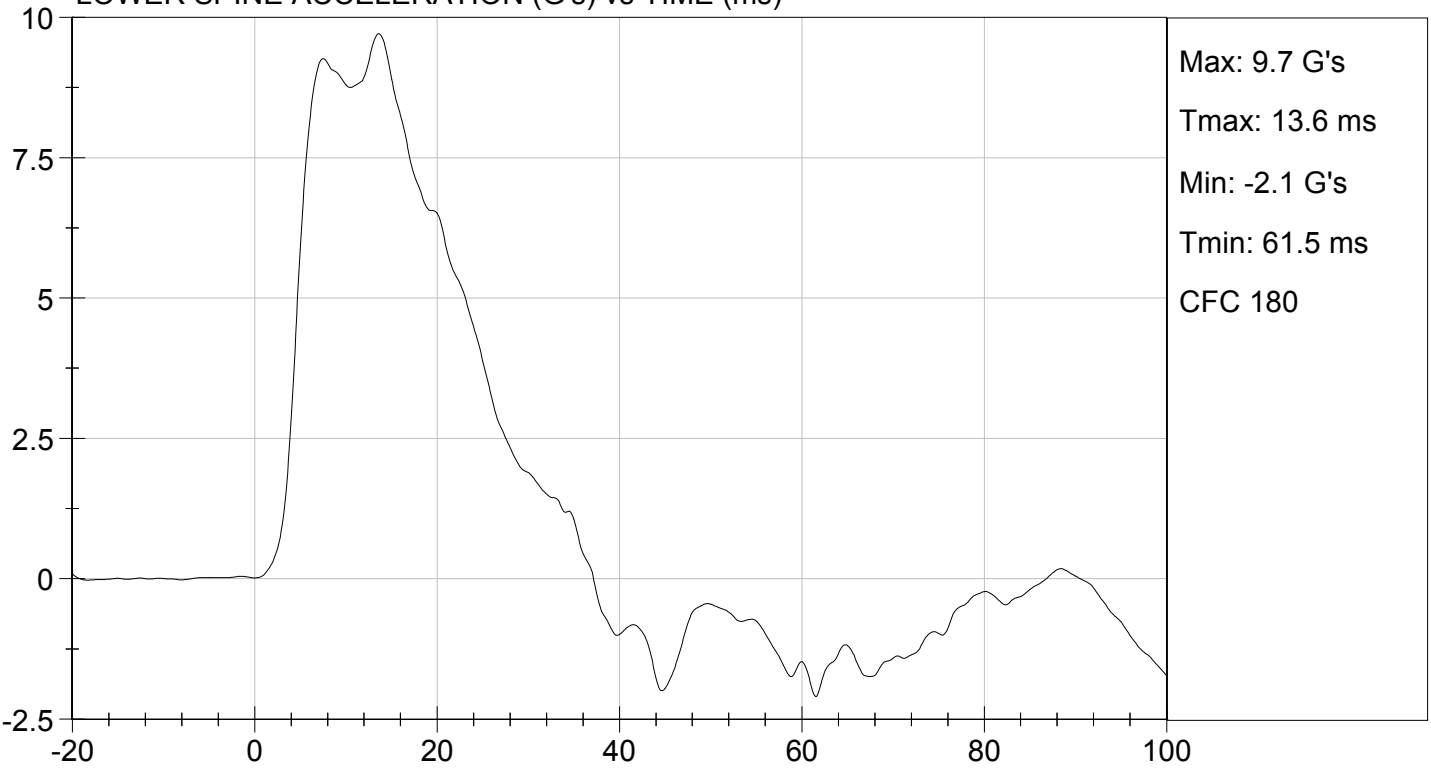
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 06/19/2015
TEST #: D151796

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



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



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151797

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	45	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Maximum Probe Acceleration	G's	38 to 47	44	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	41	Pass
Peak Acetabulum Force	N	3600 to 4300	4,230	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

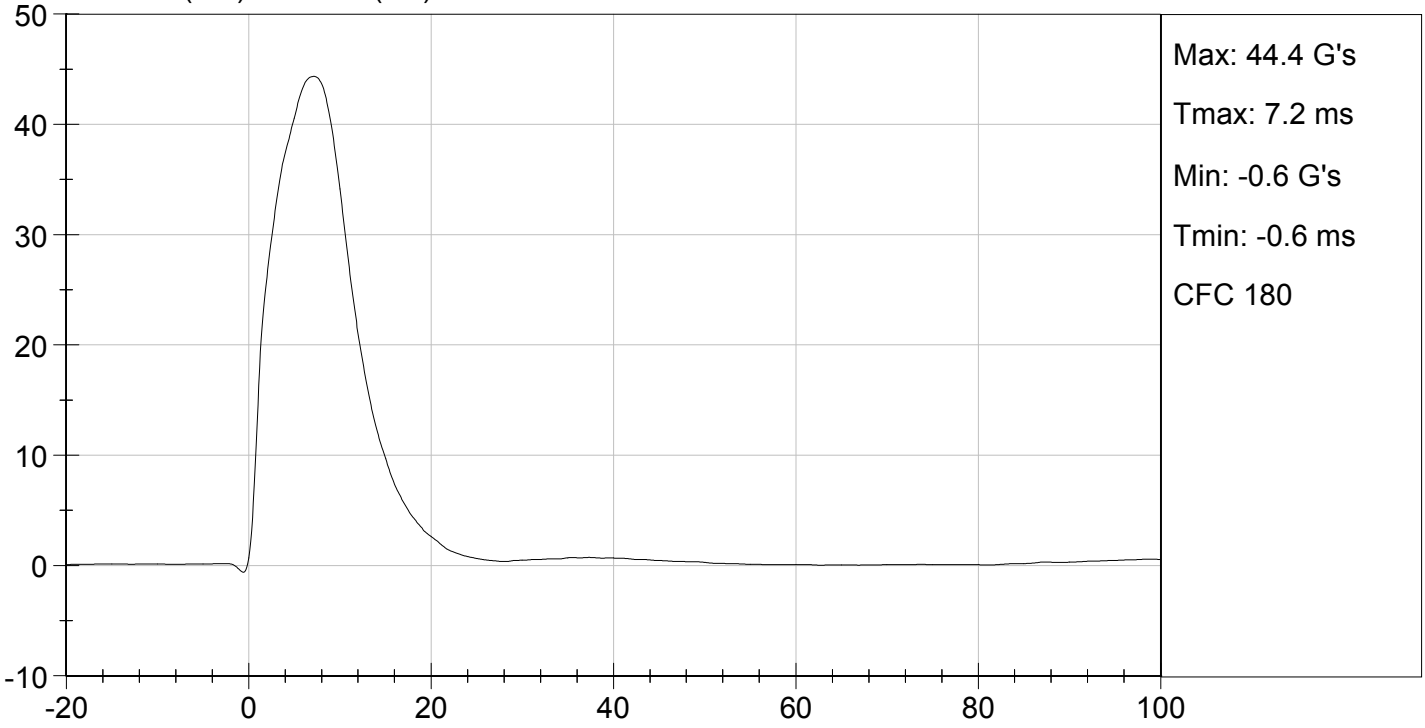
06/19/2015
Test Date

Jessica Hall
Approved By

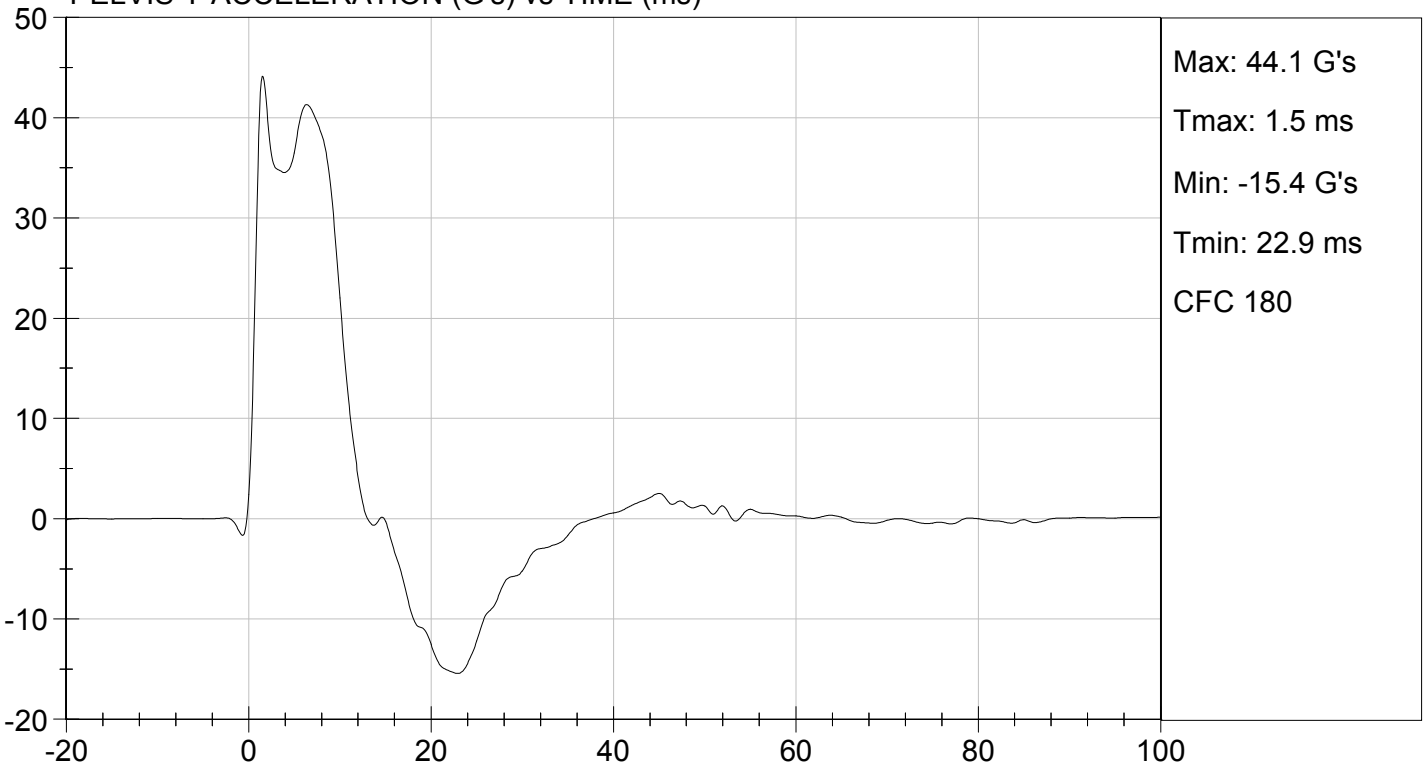
TEST DESC: PELVIS IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 06/19/2015
TEST #: D151797

PROBE (G's) vs TIME (ms)

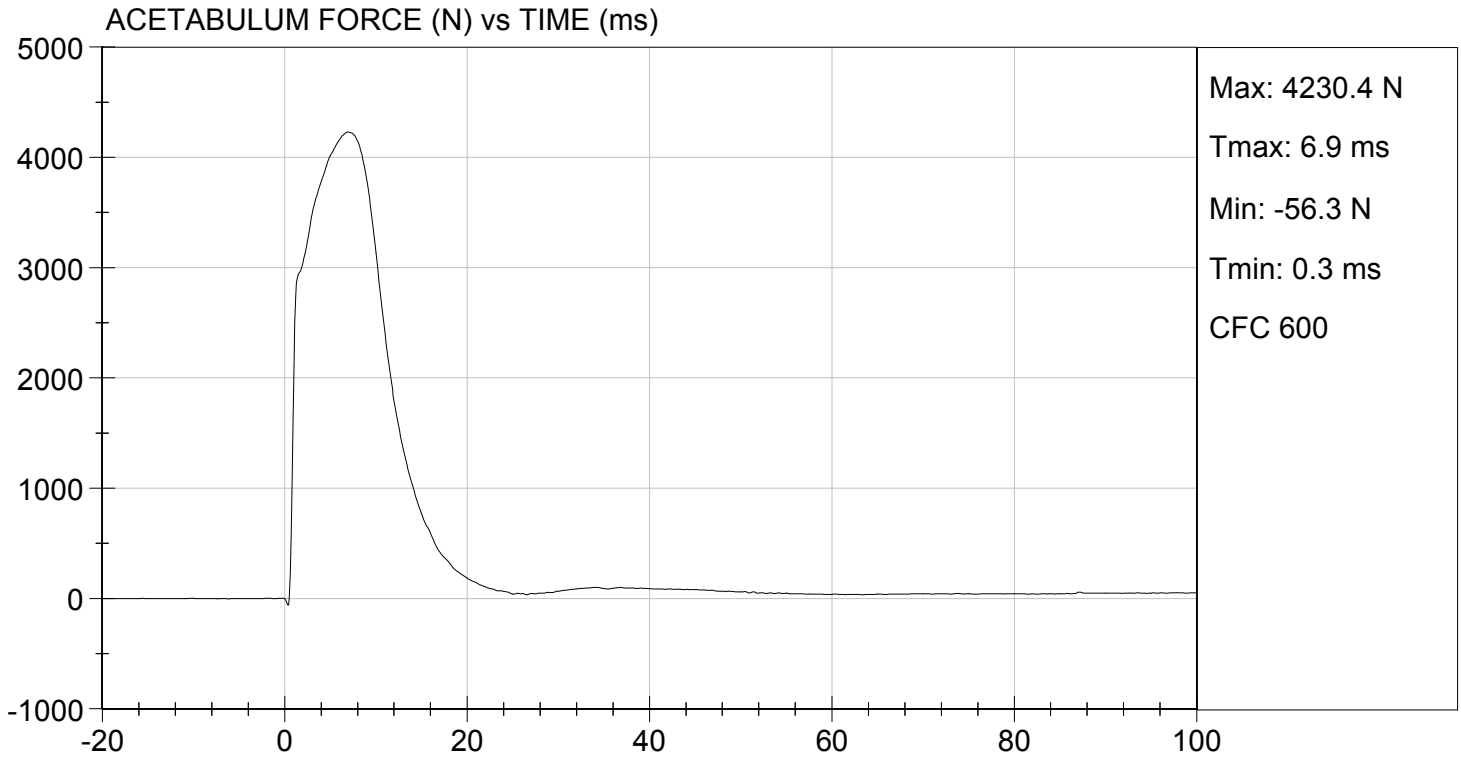


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: PELVIS IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 06/19/2015
TEST #: D151797



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D151798

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	45	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	36 to 45	42	Pass
Pelvis Y Acceleration	G's	28 to 39	34	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,980	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

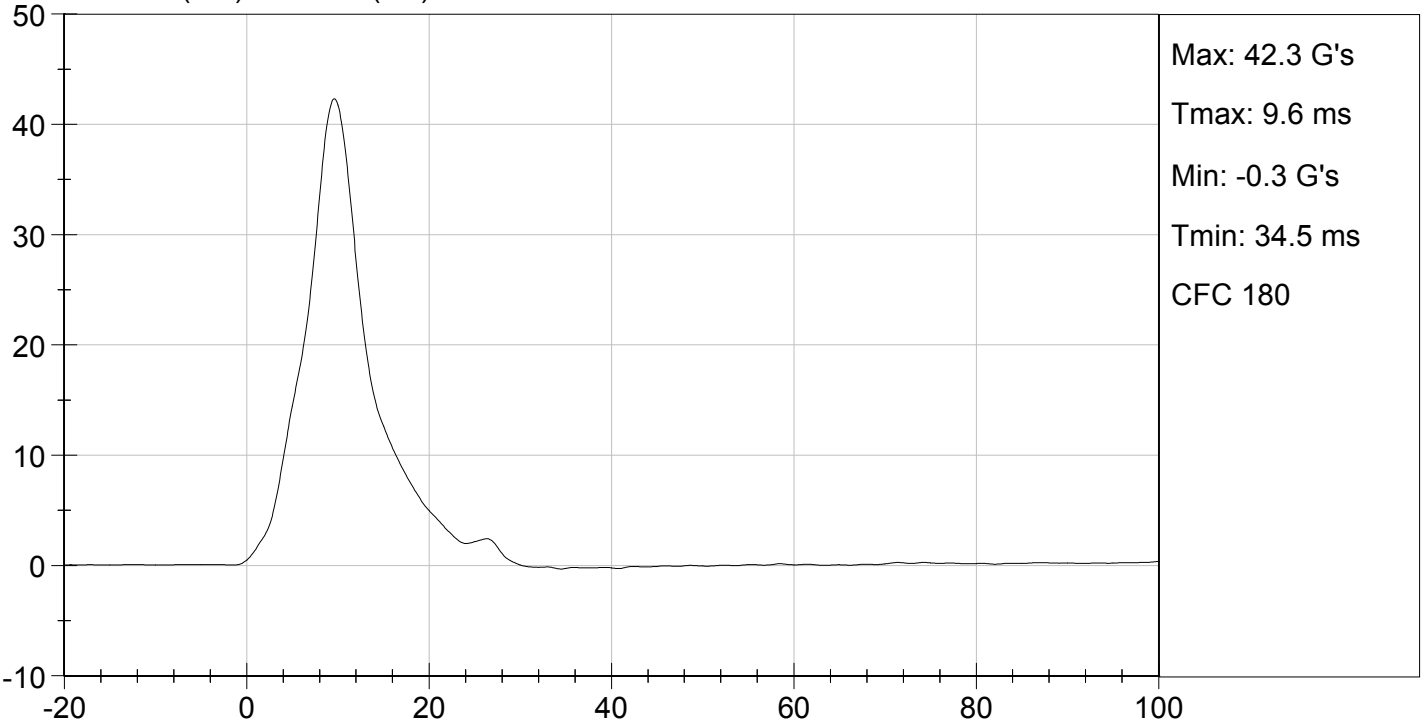
06/19/2015
Test Date

Jessica Hall
Approved By

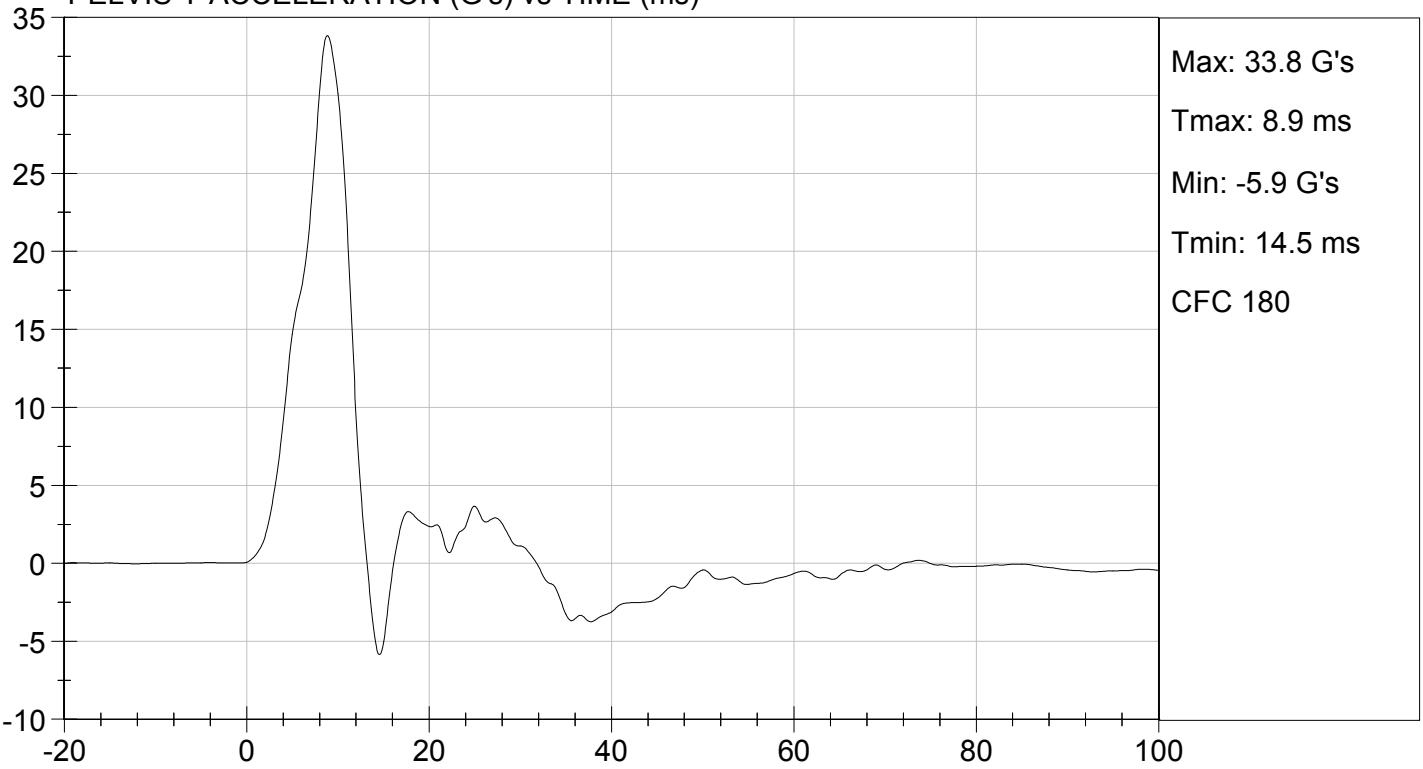
TEST DESC: ILLIAC
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 06/19/2015
TEST #: D151798

PROBE (G's) vs TIME (ms)



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



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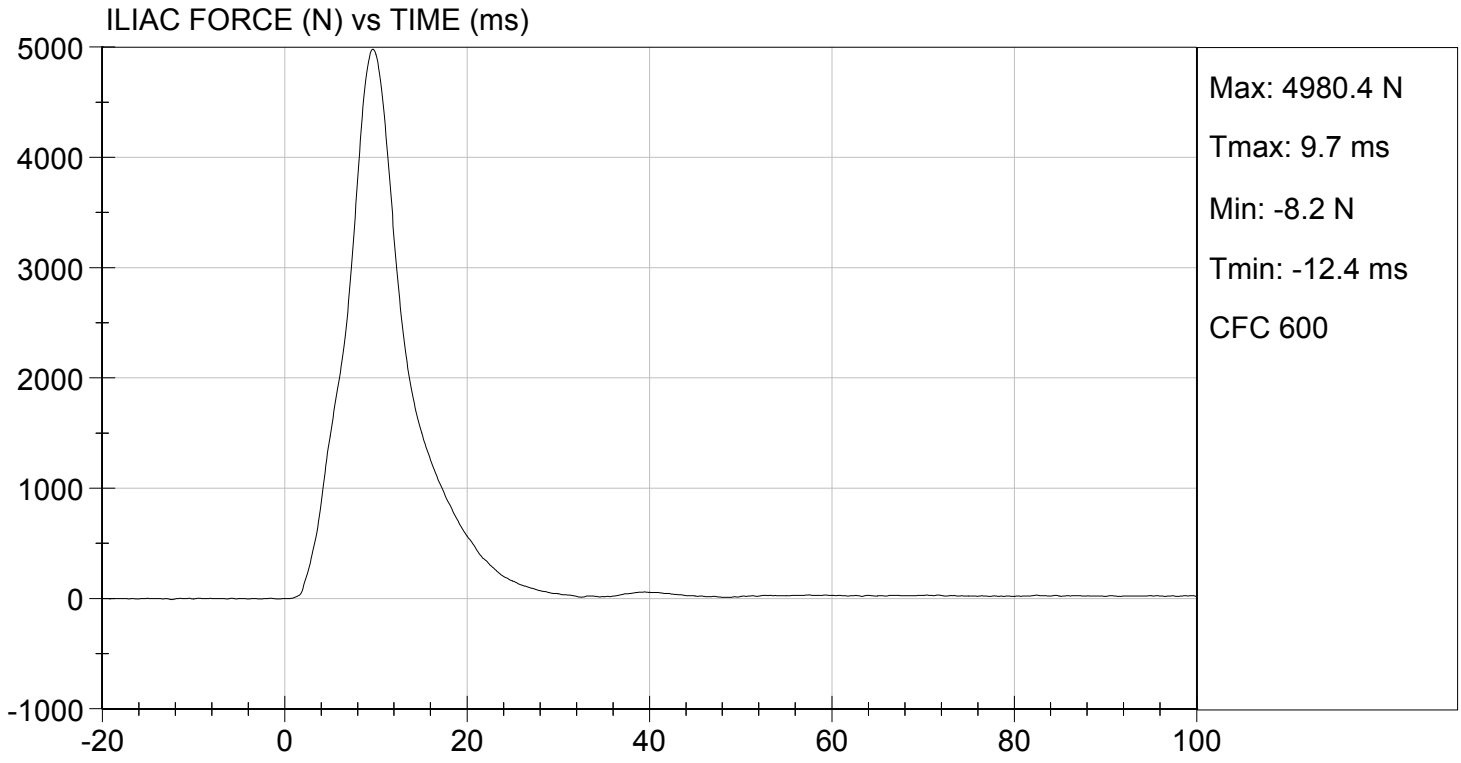
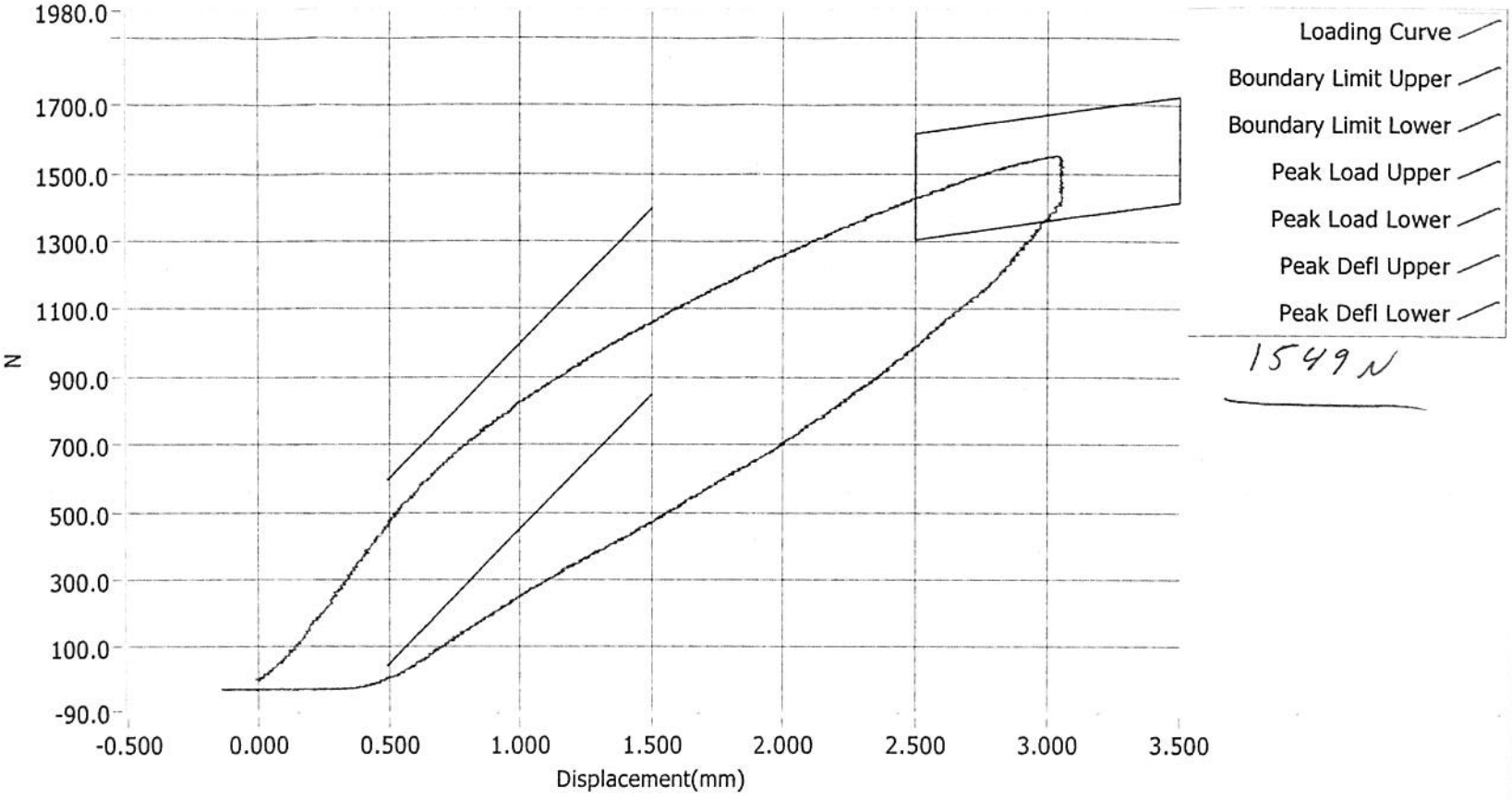


Resultant Data - SIDIIs Plug Compression



1549 N

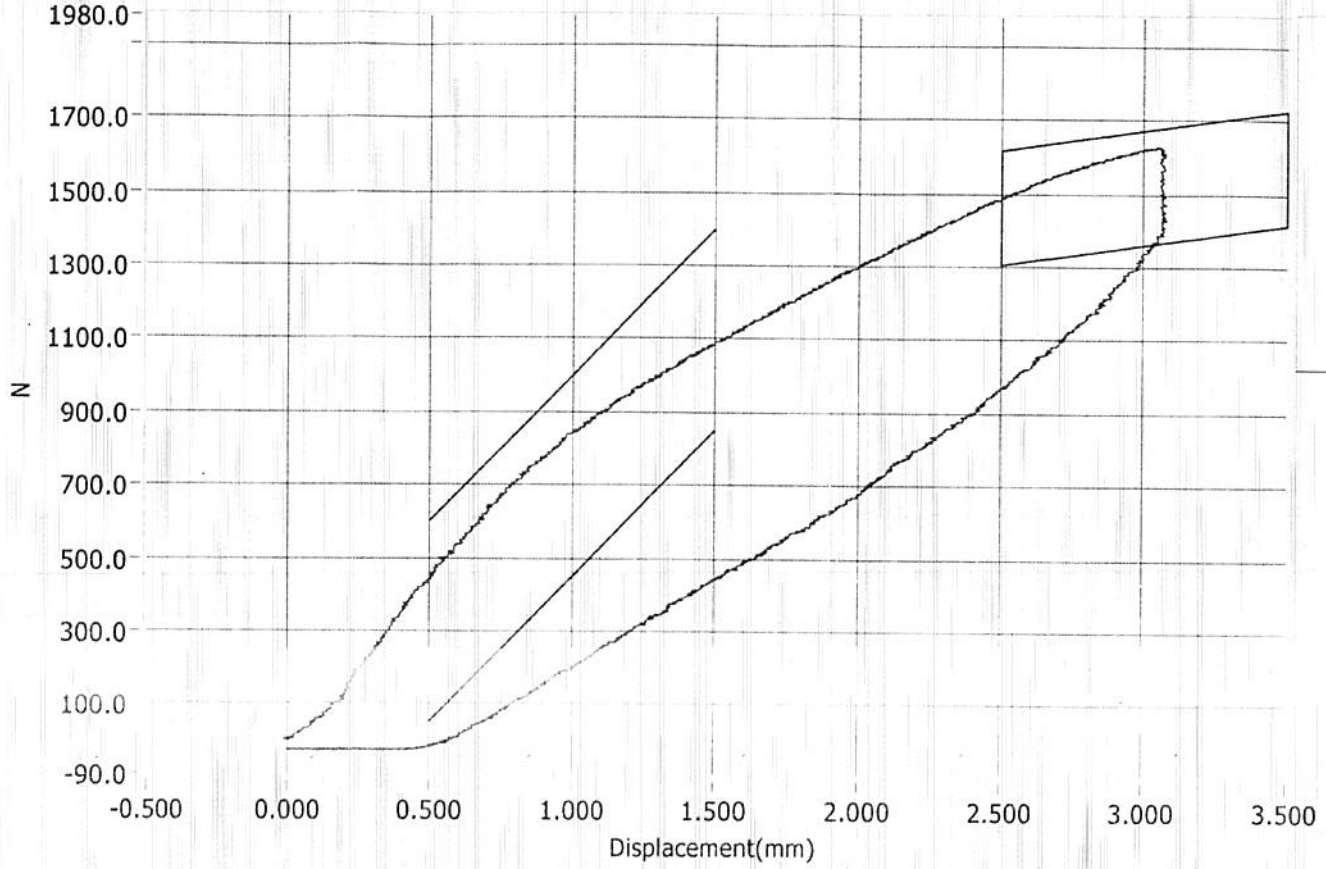
C-113

ATD Calibration Lab

Test ID	Part Serial Number	Test Date	Test Time
	71015	12/13/2013	11:30 PM
Cert ID	ATD Serial Number	ATD Type	
	N/A	SIDIIs	

Current Date : 12/13/2013 Current Time : 23:31:18

Resultant Data - SIDIIs Plug Compression



1622 N

ATD Calibration Lab

Test ID	Part Serial Number	Test Date	Test Time
	71367	12/19/2013	10:28 PM
Cert ID	ATD Serial Number	ATD Type	
	N/A	SIDIIs	

Current Date : 12/19/2013 Current Time : 22:29:23

APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N 032		
			Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers		X	P84436	Endevco	01/28/15
		Y	P84439	Endevco	01/28/15
		Z	P84440	Endevco	01/28/15
		Xr	P84450	Endevco	01/28/15
		Yr	P84456	Endevco	01/28/15
		Zr	P84457	Endevco	01/28/15
Thorax Rib Displacement Potentiometers	Upper	Y	G176	Honeywell	01/30/15
	Middle	Y	G169	Honeywell	01/30/15
	Lower	Y	G164	Honeywell	01/30/15
Abdomen Load Cells	Forward	Y	ABG1513	Denton	12/15/14
	Middle	Y	ABG1531	Denton	12/15/14
	Rear	Y	ABG1536	Denton	12/15/14
Lower Spine Accelerometers (T12)		X	P79783	Endevco	02/19/15
		Y	P79598	Endevco	01/07/15
		Z	P79600	Endevco	01/07/15
Public Symphysis Load Cell		Y	PG462	Denton	12/15/14

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N 296		
				Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers			X	P83220	Endevco	01/27/15
			Y	P83221	Endevco	01/27/15
			Z	P83222	Endevco	01/27/15
			Xr	P83223	Endevco	01/27/15
			Yr	P83224	Endevco	01/27/15
			Zr	P83225	Endevco	01/27/15
Head Angular Rate Sensors			X	ARS7413	DTS	07/15/14
			Y	ARS7421	DTS	07/15/14
			Z	ARS7423	DTS	07/15/14
Displacement Potentiometers	Thoracic Rib	Upper	Y	G012	Servo	01/28/15
		Middle	Y	G1163	FTSS	01/28/15
		Lower	Y	G1158	FTSS	01/28/15
	Abdominal Rib	Upper	Y	G1146	FTSS	01/28/15
		Lower	Y	G1126	FTSS	01/28/15
Lower Spine Accelerometers (T12)			X	P86751	Endevco	01/22/15
			Y	P86752	Endevco	01/22/15
			Z	P86753	Endevco	01/22/15
Acetabulum Load Cell			Y	ACG268	Denton	01/06/15
Iliac Wing Load Cell			Y	IWG282	Denton	01/06/15
Pelvis Plug (struck side)				71015	FTSS	12/13/13
Pelvis Plug (non-struck side)				71367	FTSS	12/19/13

Table 3 – Vehicle Instrumentation

			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	P73967	Endevco	01/05/2015
	Vehicle Center of Gravity	Y	P73968	Endevco	01/05/2015
	Vehicle Center of Gravity	Z	P73966	Endevco	01/05/2015
2	Right Sill at Front Seat	X	P77610	Endevco	01/23/2015
	Right Sill at Front Seat	Y	P77609	Endevco	01/23/2015
	Right Sill at Front Seat	Z	P77608	Endevco	01/23/2015
3	Right Sill at Rear Seat	X	P78852	Endevco	05/27/2015
	Right Sill at Rear Seat	Y	P78851	Endevco	05/27/2015
	Right Sill at Rear Seat	Z	P78850	Endevco	05/27/2015
4	Left Sill at Front Door	Y	P79830	Endevco	04/14/2015
5	Left Sill at Rear Door	Y	P86824	Endevco	03/31/2015
6	Left A-Post Lower	Y	P63206	Endevco	05/22/2015
7	Left A-Post Middle	Y	P78488	Endevco	04/22/2015
8	Left B-Post Lower	Y			
9	Left B-Post Middle	Y			
10	Front Seat Track	Y	P63546	Endevco	06/11/2015
11	Rear Seat Track or Structure	Y	P68881	Endevco	04/22/2015
12	Right Rear Occ. Compartment	Y	P66531	Endevco	06/11/2015
13	Engine Block	X	P78700	Endevco	02/05/2015
	Engine Block	Y	P78278	Endevco	05/22/2015
14	Rear Floorpan Above Axle	X	P77605	Endevco	02/13/2015
	Rear Floorpan Above Axle	Y	P77607	Endevco	02/13/2015
	Rear Floorpan Above Axle	Z	P77606	Endevco	02/13/2015

Table 4 – MDB Instrumentation

		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	P85036	Endevco	01/16/2015
MDB Center of Gravity	Y	P85037	Endevco	01/16/2015
MDB Center of Gravity	Z	P85038	Endevco	01/16/2015
Left Frame at Rear Axle Centerline	X	P67517	Endevco	01/16/2015
Left Frame at Rear Axle Centerline	Y	P67518	Endevco	01/16/2015