REPORT NUMBER: SINCAP-MGA-20-012

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

HYUNDAI MOTOR COMPANY
2020 Hyundai Accent SE 4-Door Sedan
NHTSA No.: M20204202

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: January 7, 2020

Final Report Date: March 23, 2020

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NRM-110
1200 New Jersey Ave, SE
Room W43-410
Washington, DC 20590

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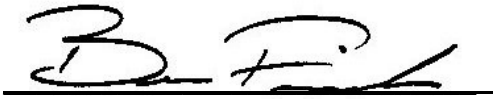
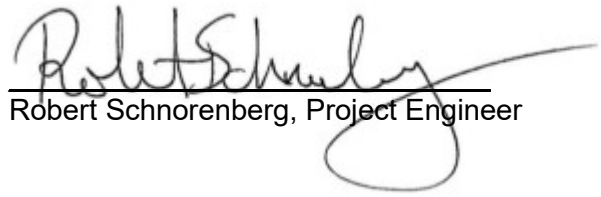
Prepared by: 
Ben Fischer, Project Engineer

Approved by: 
Robert Schnorenberg, Project Engineer

Approval Date: March 23, 2020

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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SINCAP-MGA-20-012		

4. Title and Subtitle	5. Report Date
Final Report of New Car Assessment Program Side Impact MDB Testing of 2020 Hyundai Accent SE 4-Door Sedan, NHTSA No.: M20204202	March 23, 2020
	6. Performing Organization Code MGA
7. Author(s) Ben Fischer, Project Engineer	**8. Performing Organization Report No.** SINCAP-MGA-20-012
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105	**10. Work Unit No.**
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12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C. 20590	**13. Type of Report and Period Covered:** Final Test Report January 7, 2020 to March 23, 2020
	14. Sponsoring Agency Code NRM-110
15. Supplementary Notes	

16. Abstract

A 55/28 km/h 90° Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2020 Hyundai Accent SE 4-Door Sedan in accordance with the specifications of the Office of Crashworthiness Standards Side NCAP MDB 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 January 7, 2020.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.69 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21.6°C. The target vehicle post-test maximum crush was 217 mm at level 2. The test vehicle's performance was as follows:

Measurement Description	Units	Driver ATD (ES-2re)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	194
Maximum Thorax Rib Deflection	mm	44	33
Total Abdominal Force	N	2500	1149
Pubic Symphysis Force	N	6000	1380
Resultant Lower Spine Acceleration	g	82*	44

Measurement Description	Units	Passenger ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	527
Resultant Lower Spine Acceleration	g	82	84
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2825
Maximum Thoracic Rib Deflection	mm	38*	41
Maximum Abdomen Rib Deflection	mm	45*	46

*Proposed IARV

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

17. Key Words	*18. Distribution Statement*
New Car Assessment Program (NCAP) Side Impact MDB ES-2re SID-IIs	Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division 1200 New Jersey Ave, SE Washington, DC 20590

19. Security Classification of Report	20. Security Classification of Page	21. No. of Pages	22. Price
Unclassified	Unclassified	225	

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SECTION 1
PURPOSE AND SUMMARY OF TEST

PURPOSE

This moving deformable barrier side impact test is part of the MY 2020 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 2020 Hyundai Accent SE 4-Door Sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Laboratory Test Procedure dated October 2018.

SUMMARY

A 2020 Hyundai Accent SE 4-Door Sedan was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 61.69 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 January 7, 2020. 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 October 2018. 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
Head Triaxial 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

Measurement Description	Units	Driver ATD (ES-2re)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	194
Maximum Thorax Rib Deflection	mm	44	33
Total Abdominal Force	N	2500	1149
Pubic Symphysis Force	N	6000	1380
Resultant Lower Spine Acceleration	g	82*	44

Measurement Description	Units	Passenger ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	527
Resultant Lower Spine Acceleration	g	82	84
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2825
Maximum Thoracic Rib Deflection	mm	38*	41
Maximum Abdomen Rib Deflection	mm	45*	46

*Proposed IARV

Supplemental restraint information is given below:

Restraint Type	Struck Side Driver		Struck Side Left Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	No			
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	
Side Airbag (Other)				
Seat Belt Pretensioner	Yes	Yes	No	
Seat Belt Load Limiter	Yes		No	
Other:	No		No	

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

GENERAL COMMENTS

Left Rear Passenger thoracic and abdominal rib deflections and lower spine acceleration exceeded proposed Injury Assessment Reference Values (IARVs).

Left Mid B-Post Y recorded no valid data after 200 ms.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20204202	Traction Control System (TCS)	Yes
Model Year	2020	Auto-Leveling System	No
Make	Hyundai	Automatic Door Locks (ADL)	Yes
Model	Accent SE	Power Window Auto-Reverse	No
Body Style	4-Door Sedan	Other Optional Feature	No
VIN	3KPC24A66LE103968	Driver Front Airbag	Yes
Body Color	Urban Gray	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	77 km / 48 mi	Driver Head/Torso Airbag	No
Engine Displacement (L)	1.6 L	Driver Torso Airbag	No
Type/No. Cylinders	Inline 4	Driver Torso/Pelvis Airbag	Yes
Engine Placement	Lateral	Driver Pelvis Airbag	No
Transmission Type	Manual	Driver Knee Airbag	No
Transmission Speeds	6	Rear Pass. Curtain Airbag	Yes
Overdrive	Yes	Rear Pass. Head/Torso Airbag	No
Final Drive	FWD	Rear Pass. Torso Airbag	No
Roof Rack	No	Rear Pass. Torso/Pelvis Airbag	No
Sunroof/T-Top	No	Rear Pass. Pelvis Airbag	No
Running Boards	No	Driver Seat Belt Pretensioner	Yes
Tilt Steering Wheel	Yes	Rear Pass. Seat Belt Pretensioner	No
Power Seats	No	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Rear Pass. Load Limiter	No
		Other Safety Restraint	N/A

Does owner's manual provide instruction to turn off automatic door locks?	No

DATA FROM CERTIFICATION LABEL

Manufactured By	HYUNDAI MOTOR COMPANY
Date of Manufacture	09/19
Vehicle Type	Passenger Car

GVWR (kg)	3439
GAWR Front (kg)	1940
GAWR Rear (kg)	1852

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3		5	
Capacity Weight (VCW) (kg)				385	(A)
DSC x 68.04 kg				340	(B)
Rated Cargo and Luggage Weight (RCLW) (kg)				45	(A-B)

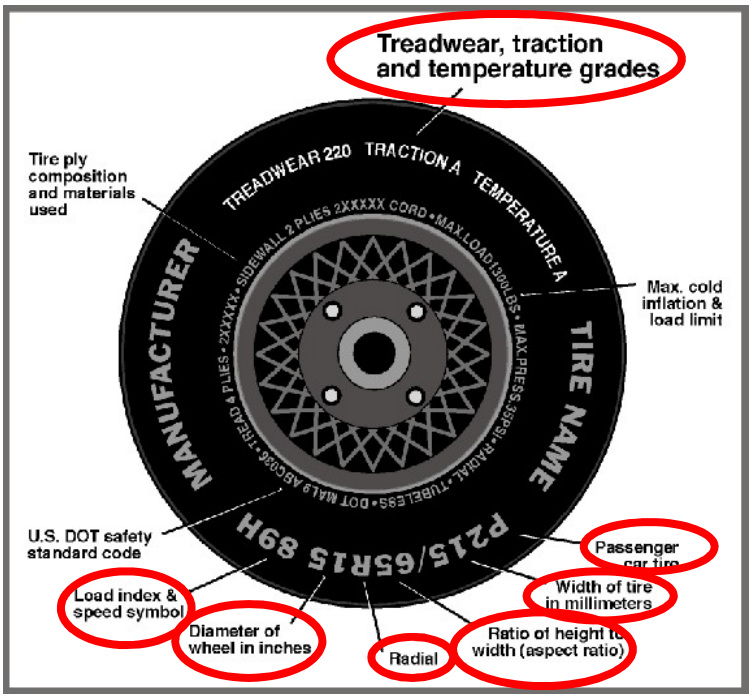
VEHICLE SEAT TYPE

Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable w/ Lever	Adjustable w/ Knob
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: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	230	230
Recommended Tire Size	185/65R15	185/65R15
Tire Size on Vehicle	185/65R15	185/65R15
Tire Manufacturer	Continental	Continental
Tire Model	ProContact	ProContact
Treadwear	500	500
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 2 Steel, 1 Polyamide	1 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	88H	88H
Tire Material	Rubber	Rubber
DOT Safety Code Left	P519 WCET 1719	P519 WCET 1619
DOT Safety Code Right	P519 WCET 1619	P519 WCET 1619

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

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

TEST VEHICLE TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	240	235	240	240
Tire Placard	kPa	230	230	230	230
Owner's Manual	kPa	230	230	230	230
As Tested	kPa	230	230	230	230

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	353.0	230.0		389.0	306.0		383.5	313.5	
Right	kg	342.0	229.0		346.0	280.0		351.5	279.5	
Ratio	%	60.2%	39.8%		55.6%	44.4%		55.3%	44.7%	
Totals	kg	695.0	459.0	1154.0	735.0	586.0	1321.0	735.0	593.0	1328.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1154.0	(A)
Sum of Actual Weight of 2 P572 ATDs Used	kg	129	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	45	(C)
Calculated Test Vehicle Target Weight (TVTW)	kg	1328.0	(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	647	649	Yes
Right Front	mm	659	649	Yes
Right Rear	mm	633	641	Yes
Left Rear	mm	626	625	Yes
Vehicle CG (Aft of Front Axle)	mm	1151	1144	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	38	40	

* ND=Nose Down (-), NU=Nose Up (+) ** LD=Left Down (-), LU=Left Up (+)
*** 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: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Units	Weight
Weight of Ballast Added	kg	21
Components Removed: none	kg	

TEST SURFACE MARKINGS

	Units	Distance from 63° Impact Angle Line
Fore 25 mm Target	mm	
Aft 25 mm Target	mm	
Pre-Impact Angle Line	mm	

Parallel Track Target	Units	X Location	Y Location
A	mm	0	0
B	mm		
C	mm		
D	mm		

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

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

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	17.5	14.8	16.2
Front Passenger Seat	Fixed	Fixed	Fixed
Front Center Seat			
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
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	Forward-Most
Driver Seat	16.2	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Front Passenger Seat	Fixed	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	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed

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

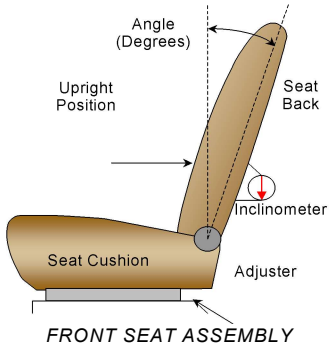
Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

SEAT FORE/AFT POSITIONS

Seat	Total Fore/Aft Travel		Test Position from Forward-Most Position	
	mm	Detents (1st as 1)	mm	Detent (1st as 0)
Driver Seat	240	38	124	19
Front Passenger Seat	240	38	124	19
Front Center Seat				
Struck Side Rear Seat	Fixed		Fixed	
Non-Struck Side Rear Seat	Fixed		Fixed	
Rear Center Seat	Fixed		Fixed	

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 October 2018. 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 (1st as 1)	Degrees	Detent (1st as 0)
Driver Seat	61.9	32	0.6	6
Front Passenger Seat	60.1	32	1.8	7
Front Center Seat				
Struck Side Rear Seat	Fixed		18.2	
Non-Struck Side Rear Seat	Fixed		18.2	
Rear Center Seat	Fixed		18.2	

Seat back angles measured on outboard headrest post.

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

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

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	3	0 (Uppermost as 0)
Rear Seat	Fixed	

HEAD RESTRAINT ADJUSTMENT

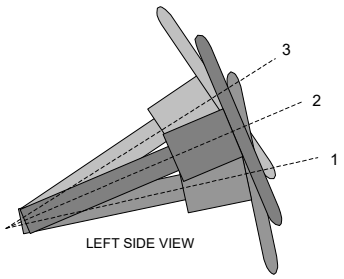
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	6	5 (Lowest as 0) / Fixed Fore-Aft
Rear Seat	4	0 (Lowest as 0) / Fixed Fore-Aft

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.

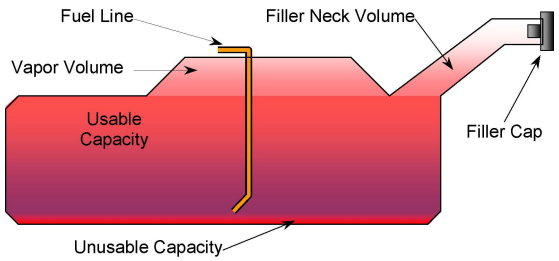
	Wheel Angle (°)	Fore/Aft Position (mm)
Lowermost, Position 1	69.1	
Geometric Center, Position 2	66.4	
Uppermost, Position 3	63.7	
Telescoping Steering Wheel Travel		
Test Position	66.4	



STEERING COLUMN ASSEMBLY

FUEL PUMP

The vehicle is equipped with an electronic fuel pump. The fuel pump will run when the engine is running. The pump will also briefly run when the ignition key is turned to the "on" position. The filler neck is located on the driver's side.



VEHICLE FUEL TANK ASSEMBLY

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

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

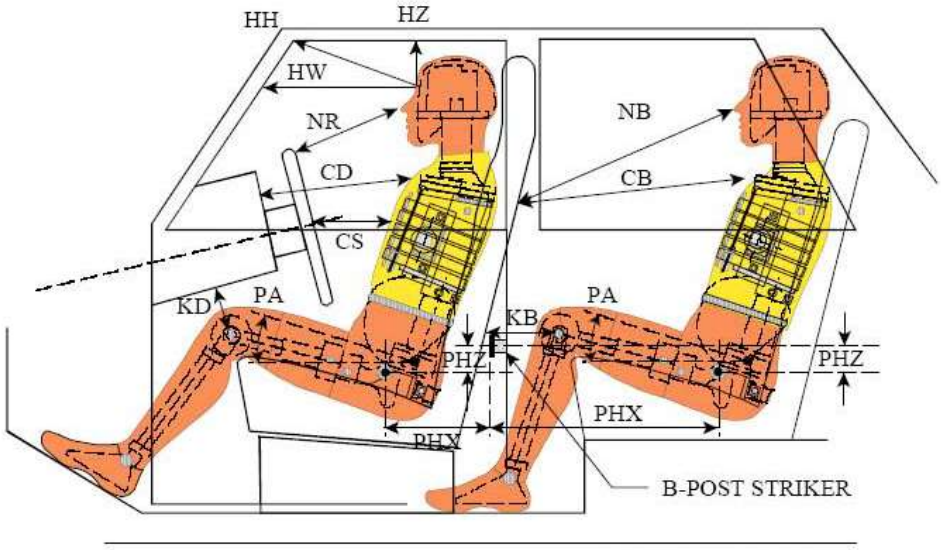
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of Standard Tank (see Form No. 1)	45.0
Usable Capacity of Optional Tank (see Form No. 1)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	45.0
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	41.9
Actual Amount of Solvent Used	41.6
1/3 of Usable Capacity	15.0

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: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020



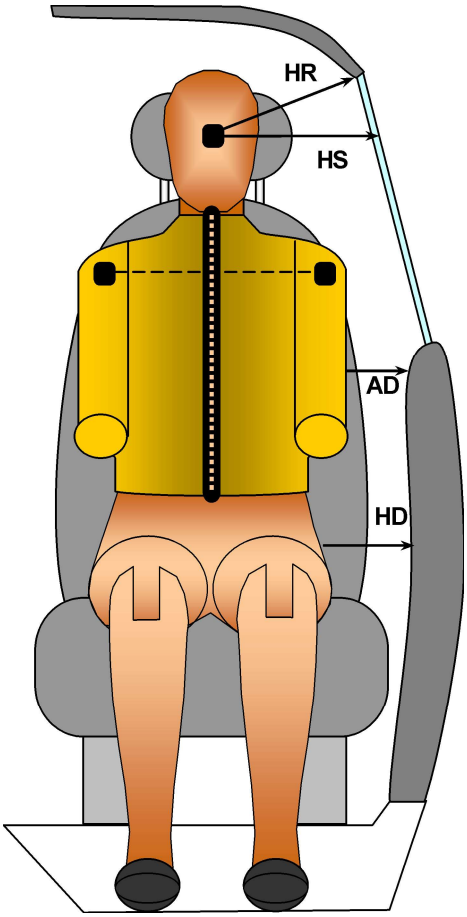
LEFT SIDE VIEW

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

Driver Code	Pass. Code	Measurement Description	Driver		Passenger	
			Length (mm)	Angle (°)	Length (mm)	Angle (°)
HH		Head to Header	390	13.8		
HW		Head to Windshield	634	0		
HZ	HZ	Head to Roof Liner	160	90	255	90
NR	NB	Nose to Rim/Seat Back	437	13.3	508	11.2
CD	CB	Chest to Dashboard/Seat Back	553	4.8	493	10.1
CS		Chest to Steering Wheel	342	6.2		
KDL	KBL	Left Knee to Dash/Seat Back	185	23.8	189	20.4
KDR	KBR	Right Knee to Dash/Seat Back	160	25.0	201	20.9
PAX	PAX	Pelvic Tilt Angle X		21.3		29.2
PAY	PAY	Pelvic Tilt Angle Y		0.6		0.8
PHX	PHX	Hip Point to Striker (X-Axis)	170		267	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	226		274	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20204202
Test Date: 1/7/2020

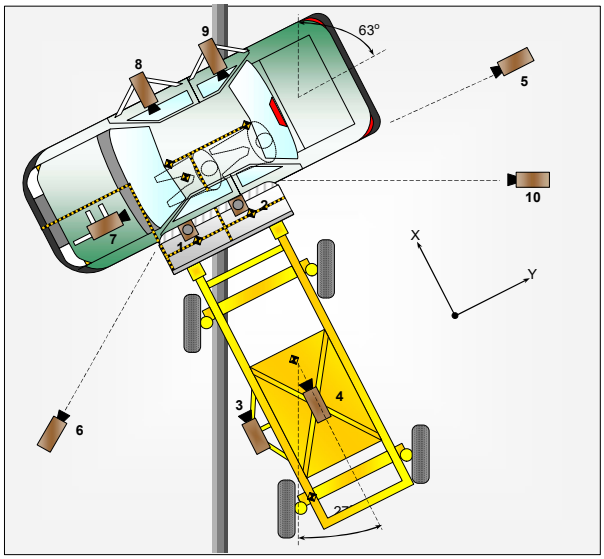


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
HR	Head to Side Header	184	261
HS	Head to Side Window	232	387
AD	Arm to Door	105	177
HD	Hip Point to Door	143	169

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20204202
Test Date: 1/7/2020



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates* (mm)			Lens (mm)	Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	910	500	-4995	8.5	1000
2	Overhead Close-Up	250	0	-4895	20	1000
3	Left Impact Point (MDB)				50	1000
4	Side Overall (MDB)				16	1000
5	Rear	-20	6300	-1410	24	1000
6	Left Front	-2050	-5930	-1460	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

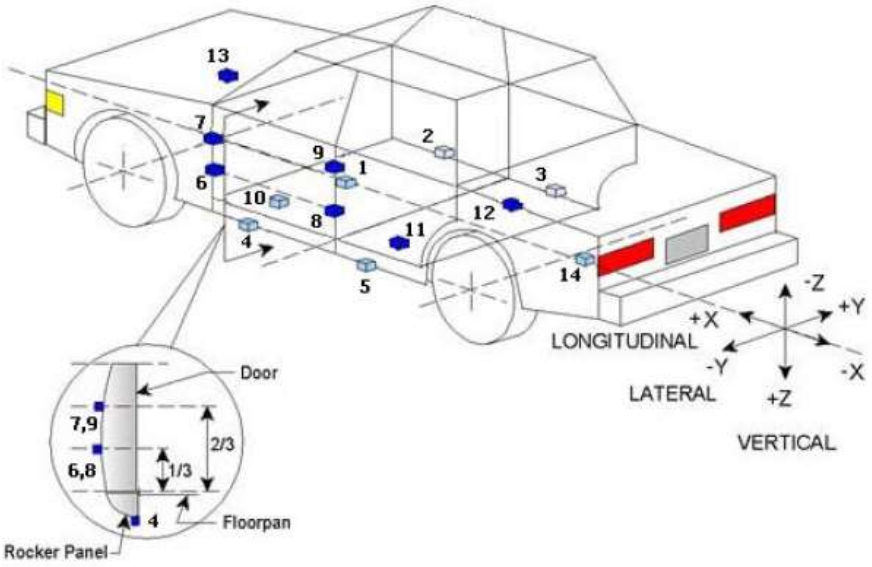
Reference: Impact Point projected to Ground; +X = To Front of MDB, + Y = To Right of MDB, +Z = Down
*All measurements accurate to ±6 mm

INSTRUMENTATION

	Number of Channels
Driver Dummy	16
Passenger Dummy	19
Vehicle Structure	23
MDB Accelerometers	5
MDB Contacts	2
Total	65

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020



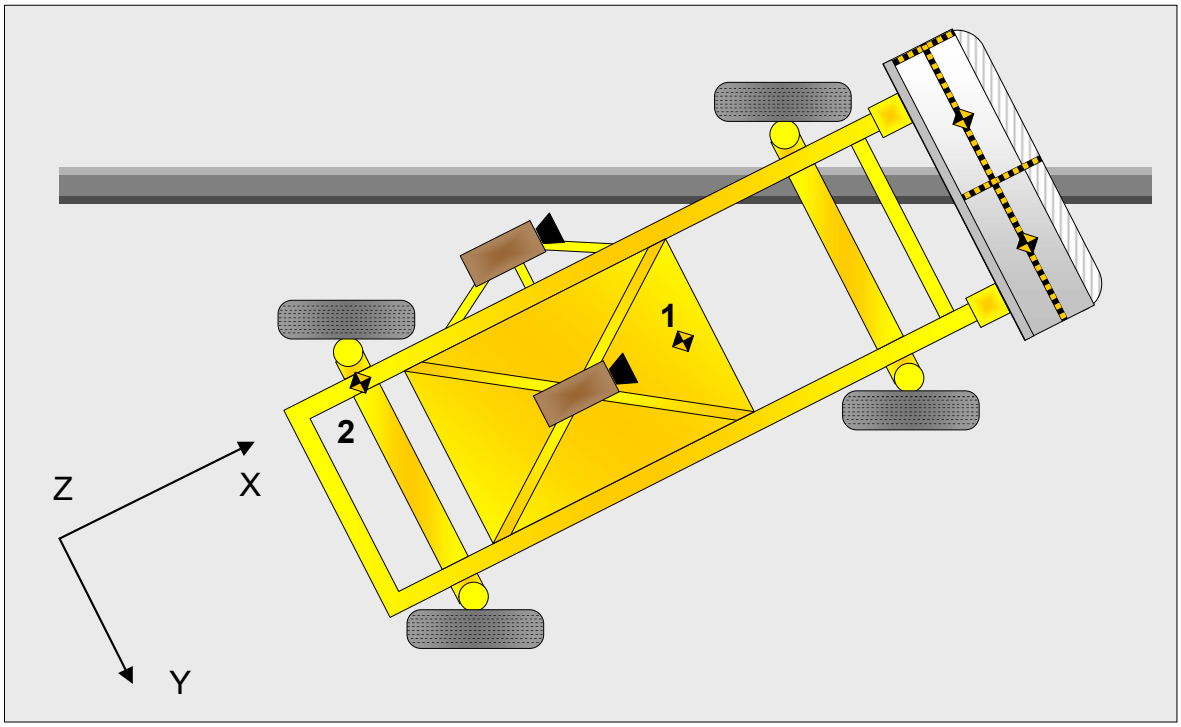
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2394	136	-190
2	Right Sill at Front Seat	2196	696	-186
3	Right Sill at Rear Seat	1390	696	-186
4	Left Sill at Front Door	2531	-696	-186
5	Left Sill at Rear Door	1537	-696	-186
6	Left Lower A-Post	3027	-802	-518
7	Left Middle A-Post	3026	-808	-723
8	Left Lower B-Post	1928	-678	-537
9	Left Middle B-Post	2033	-684	-776
10	Front Seat Track	2128	-357	-227
11	Rear Seat Structure	1748	-330	-244
12	Rt. Rear Occ. Compartment	1780	352	-210
13	Engine Block	3669	0	-828
14	Rear Above Axle	1014	0	-481

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: 2020 Hyundai Accent SE 4-Door Sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20204202
Test Date: 1/7/2020



MDB ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (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)

Width between left and right MDB contact switches	mm	1409

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

TEST DUMMY INFORMATION AND CONTACT POINTS

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

POST-TEST DOOR PERFORMANCE

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

POST-TEST SEAT PERFORMANCE

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

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No Separation
Sill Separation	None
Windshield Damage	None
Side Window Damage	LF, LR windows broken
Other Notable Effects	None

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

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Left Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	No			
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	
Side Airbag (Other)				
Seat Belt Pretensioner	Yes	Yes	No	
Seat Belt Load Limiter	Yes		No	
Other:	No		No	

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2578
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		349
Actual Impact Point (Aft of Front Axle)	mm		349
Horizontal Offset (+forward / -rearward)	mm	+/- 50 of intended impact point	0
Vertical Offset (+down / -up)	mm	+/- 20 of intended impact point	-4

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20204202
Test Date: 1/7/2020

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1250
Overall Length Including Honeycomb Face	4119
Wheelbase of Framework Carriage	2591
CG Location aft of Front Axle	1127

MDB WEIGHTS

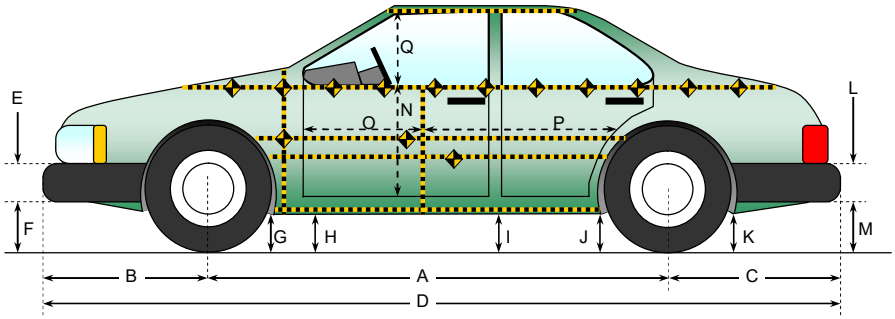
	Units	Front Axle	Rear Axle	Total
Left	kg	368.2	320.6	
Right	kg	400.7	271.4	
Ratio	%	56.5	43.5	
Totals	kg	768.9	592.0	1360.9

SPEED AND ANGLE AT IMPACT DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	61.69
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	61.72
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.9
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.1
MDB Crabbed Angle to MDB Forward Line of Motion	degrees	26 to 28	26.8

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20204202
Test Date: 1/7/2020



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

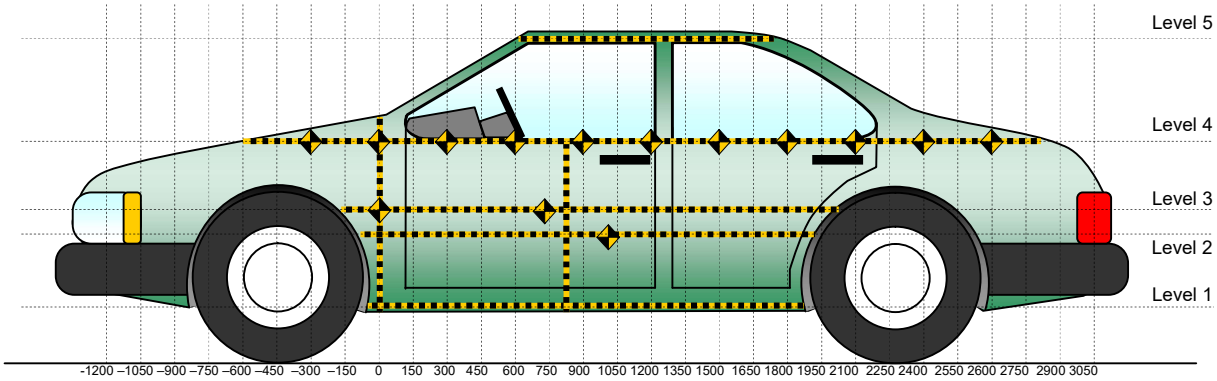
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2578	2582	-4
B	Front Axle to FSOV	830	825	5
C	Rear Axle to RSOV	977	965	12
D	Total Length at Centerline	4385	4372	13
E	Front Bumper Thickness	107	107	0
F	Front Bumper Bottom to Ground	198	216	-18
G	Sill Height at Front Wheel Well	150	157	-7
H	Sill Height at Front Door Leading Edge	150	155	-5
I	Sill Height at B Pillar	151	159	-8
J1	Sill Height at Rear Wheel Well	145	158	-13
J2	Pinch Weld Height at Rear Wheel Well	148	158	-10
K	Sill Height Aft of Rear Wheel Well	204	208	-4
L	Rear Bumper Thickness	106	106	0
M	Rear Bumper Bottom to Ground	202	209	-7
N	Sill Height to Window Bottom Sill	703	605	98
O	Front Door Leading Edge to Impact CL	754	728	26
P	Rear Door Trailing Edge to Impact CL	1137	1077	60
Q	Front Window Opening	412	403	9
R	Right Side Length	3674	3680	-6
S	Left Side Length	3674	3657	17
T	Vehicle Width at B Post	1710	1566	144
U	Front Wheel Track Width	2578	2582	-4
V	Rear Wheel Track Width	830	825	5

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020



All Measurements Shown in mm

LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEAUREMENTS

Level	Measurement Description	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	222	54	900
2	Occupant H-Point	490	217	1650
3	Mid Door	601	187	1200
4	Window Sill	851	180	1650
5	Window Top	1375	23	1350

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

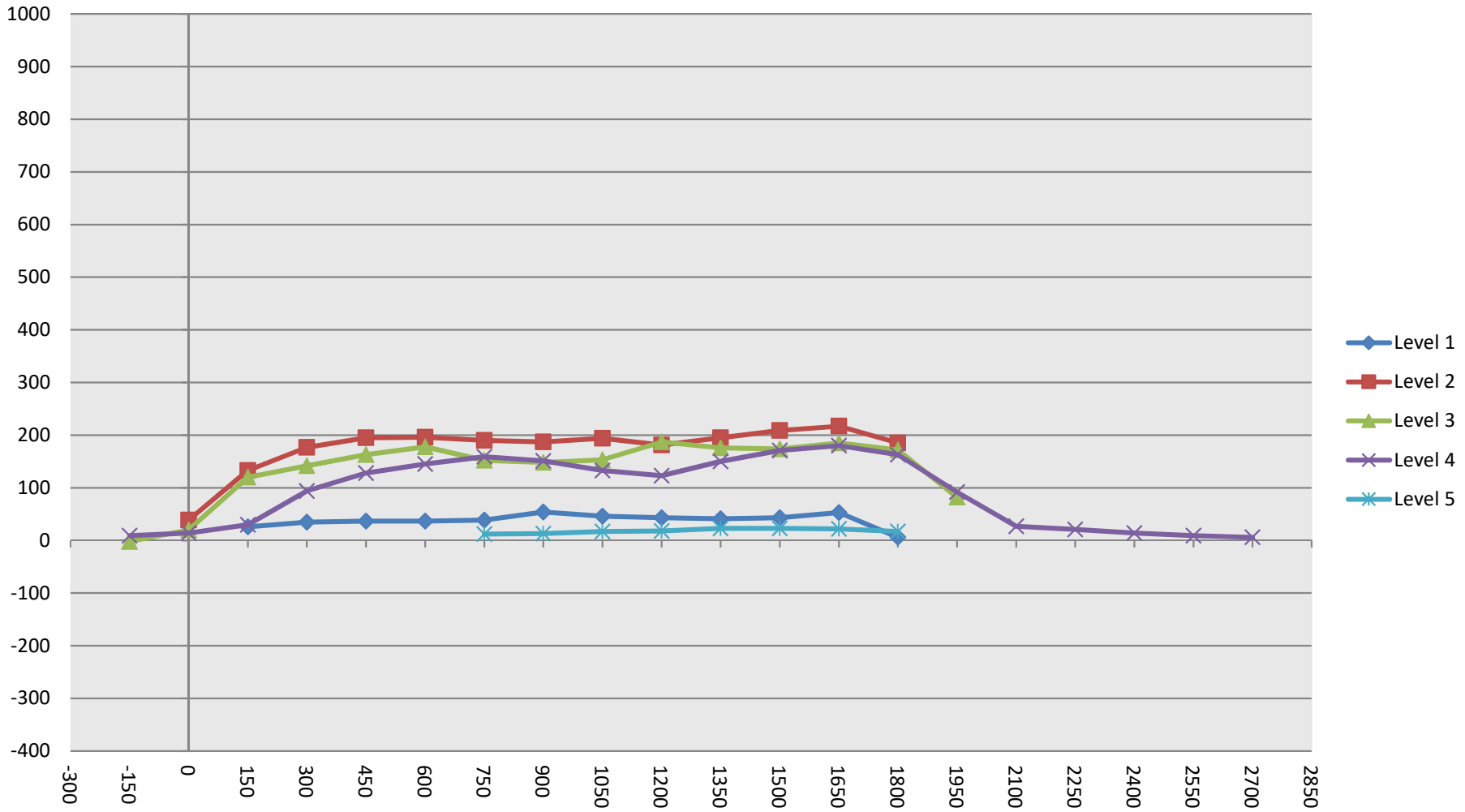
Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-2100															
-1950															
-1800															
-1650															
-1500															
-1350															
-1200															
-1050															
-900															
-750															
-600															
-450															
-300															
-150			241	331				239	340				-2	9	
0		241	244	322			280	264	336			39	20	14	
150	281	254	250	312		307	387	370	342		26	133	120	30	
300	283	259	251	299		318	436	393	393		35	177	142	94	
450	282	259	250	289		319	454	413	417		37	195	163	128	
600	281	258	249	282		318	454	427	427		37	196	178	145	
750	280	258	248	278	555	319	448	400	437	567	39	190	152	159	12
900	280	257	248	279	521	334	444	396	430	534	54	187	148	151	13
1050	280	257	248	280	516	326	451	401	413	533	46	194	153	133	17
1200	281	258	248	280	515	324	439	435	403	533	43	181	187	123	18
1350	283	259	250	280	515	324	454	426	430	538	41	195	176	150	23
1500	286	259	251	280	518	329	468	425	451	541	43	209	174	171	23
1650	291	256	250	279	525	344	473	435	459	547	53	217	185	180	22
1800	287	246	246	280	543	293	431	418	443	560	6	185	172	163	17
1950			239	289				321	381				82	92	
2100				275					302					27	
2250				275					296					21	
2400				281					295					14	
2550				291					300					9	
2700				309					315					6	
2850															
3000															
3150															
3300															
3450															
3600															
3750															
3900															

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.

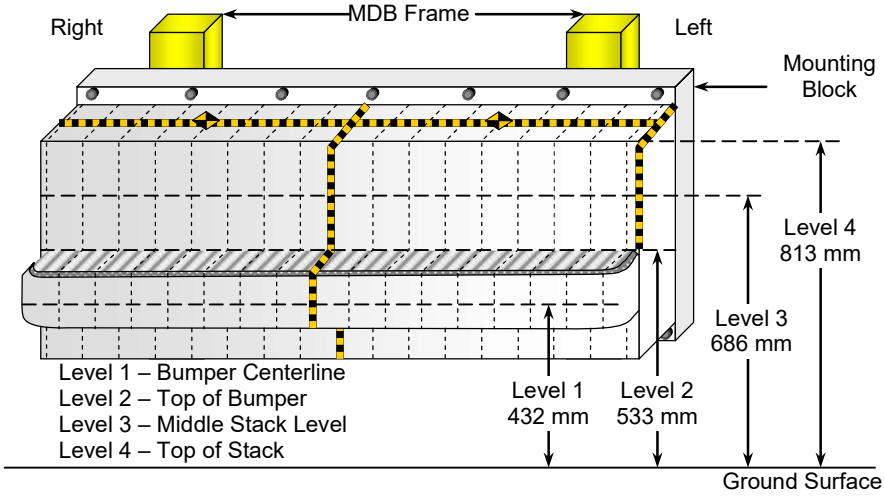
DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20204202
Test Date: 1/7/2020



DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20204202
Test Date: 1/7/2020



FRONT VIEW

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

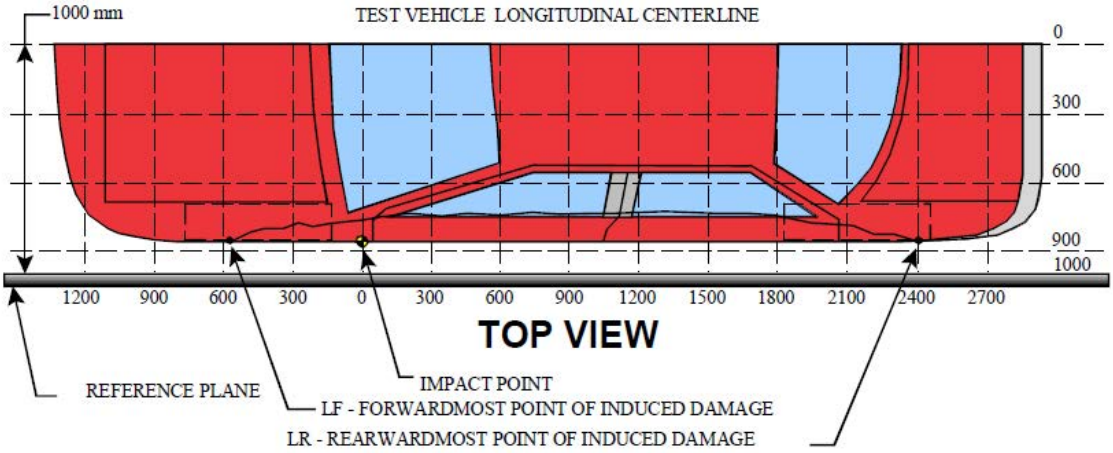
Vertical Location			From Centerline		Maximum Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	700	Left	146
B	Top of Bumper	533	800	Left	112
C	Mid-Level	686	800	Left	137
D	Top of Stack	813	800	Left	147

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	33	17	16	20	34	62	65	61	40	37	43	48	53	51	73	104	147
3	41	127	123	118	25	47	69	55	132	118	15	16	20	28	45	75	137
2	85	81	78	77	77	76	74	73	68	65	63	60	60	59	65	92	112
1	134	140	137	132	131	131	127	125	120	117	112	112	105	109	123	146	145

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020



MEASUREMENT CONVENTIONS:
Forward of the impact point (towards front of vehicle) is considered negative (—).
Rearward of the impact point (toward rearend of vehicle) is considered positive (+).

VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Max. Static Crush (mm)
1	1970	3	303	247	56
2	1592	3	436	250	186
3	1214	3	420	248	172
4	836	3	400	248	152
5	458	3	413	250	163
6	80	3	335	247	88

MDB DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Max. Static Crush (mm)
1	800 mm right of center	1	610	476	134
2	480 mm right of center	1	598	463	135
3	160 mm right of center	1	589	463	126
4	160 mm left of center	1	569	463	106
5	480 mm left of center	1	588	463	125
6	800 mm left of center	1	621	476	145

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

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan
NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test
Test Date: 1/7/2020

Test Time: 11:54 am
Temperature: 21.6°C

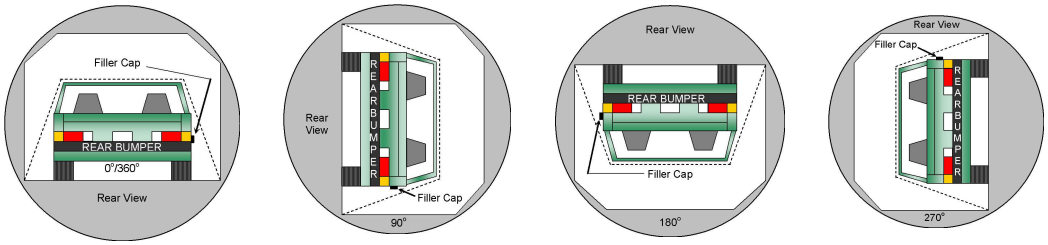
A. From impact until vehicle motion ceases: (Maximum Allowable = 1 ounce) 0.0 oz.

B. For the 5 minute period after motion ceases: (Maximum Allowable = 5 ounces) 0.0 oz.

C. For the following 25 minutes: (Maximum Allowable = 1 ounce / minute) None

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°	112	300	412
90° to 180°	111	300	411
180° to 270°	108	300	408
270° to 360°	110	300	410

FMVSS 301 ROLLOVER SPILLAGE TABLE (UNITS IN OUNCES)

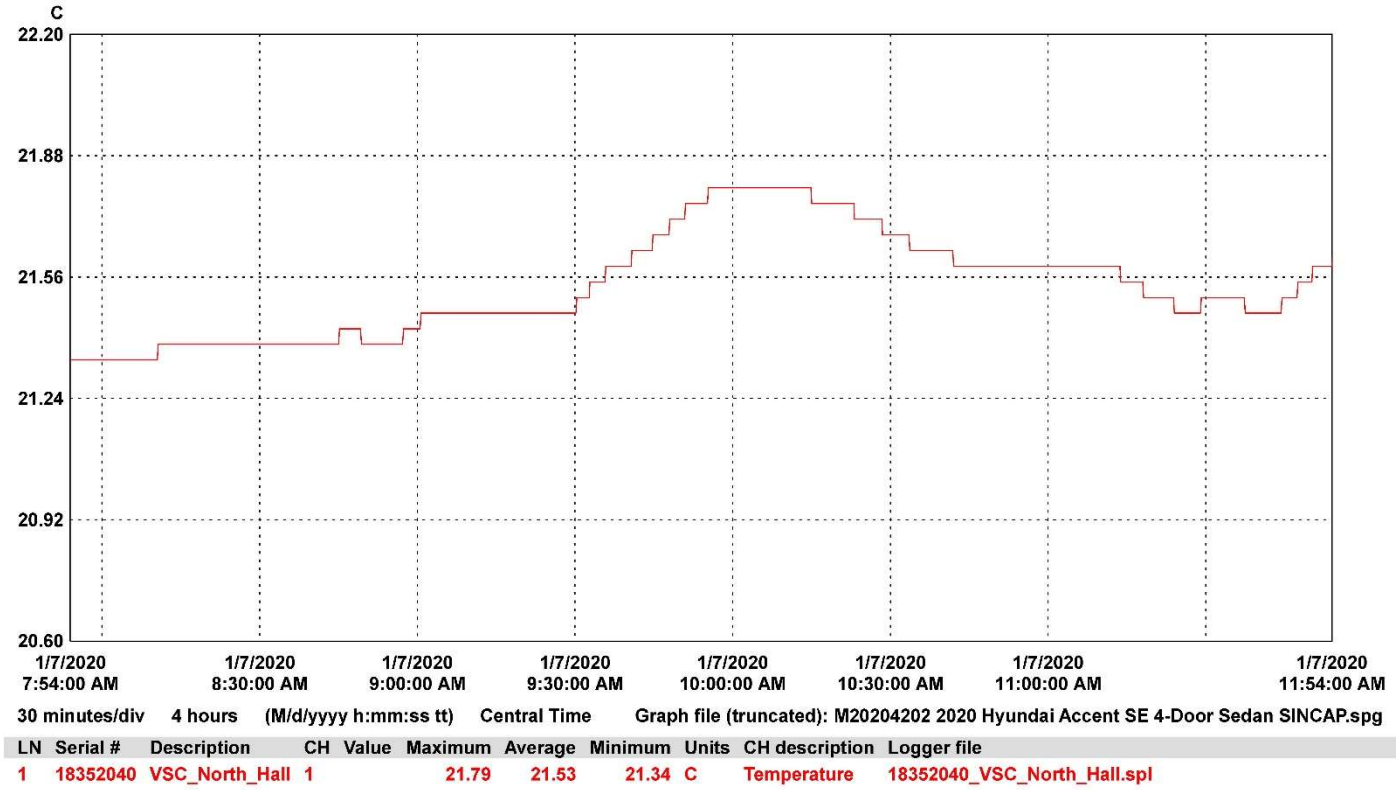
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0.0	0.0	0.0	
90° to 180°	0.0	0.0	0.0	
180° to 270°	0.0	0.0	0.0	
270° to 360°	0.0	0.0	0.0	

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 AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2020 Hyundai Accent SE 4-Door Sedan NHTSA No.: M20204202
Test Program: NCAP Side MDB Impact Test Test Date: 1/7/2020



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	18352040	VSC_North_Hall	1		21.79	21.53	21.34	C	Temperature	18352040_VSC_North_Hall.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

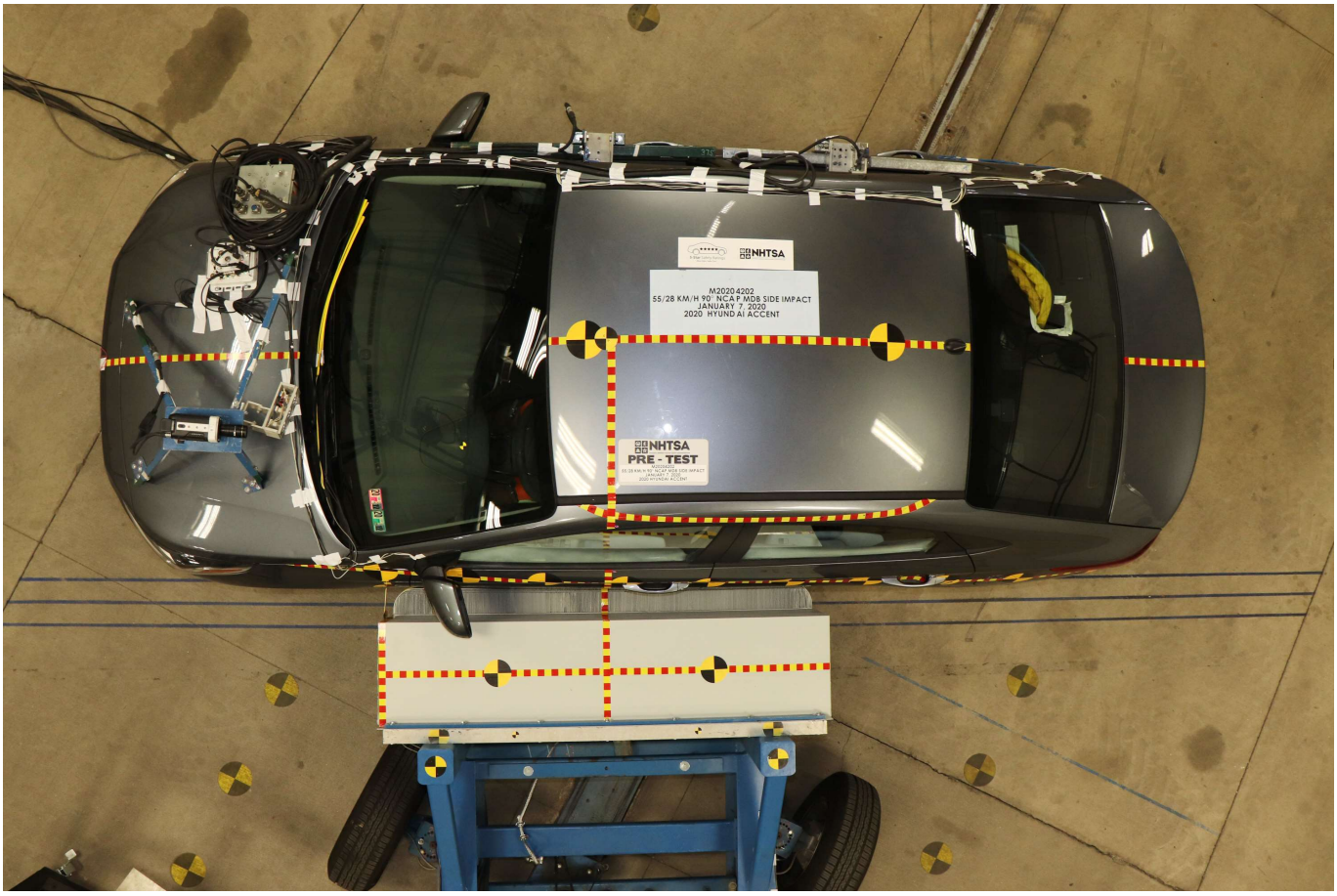


Photo No. 015 - Pre-Test Overhead View of Test Area

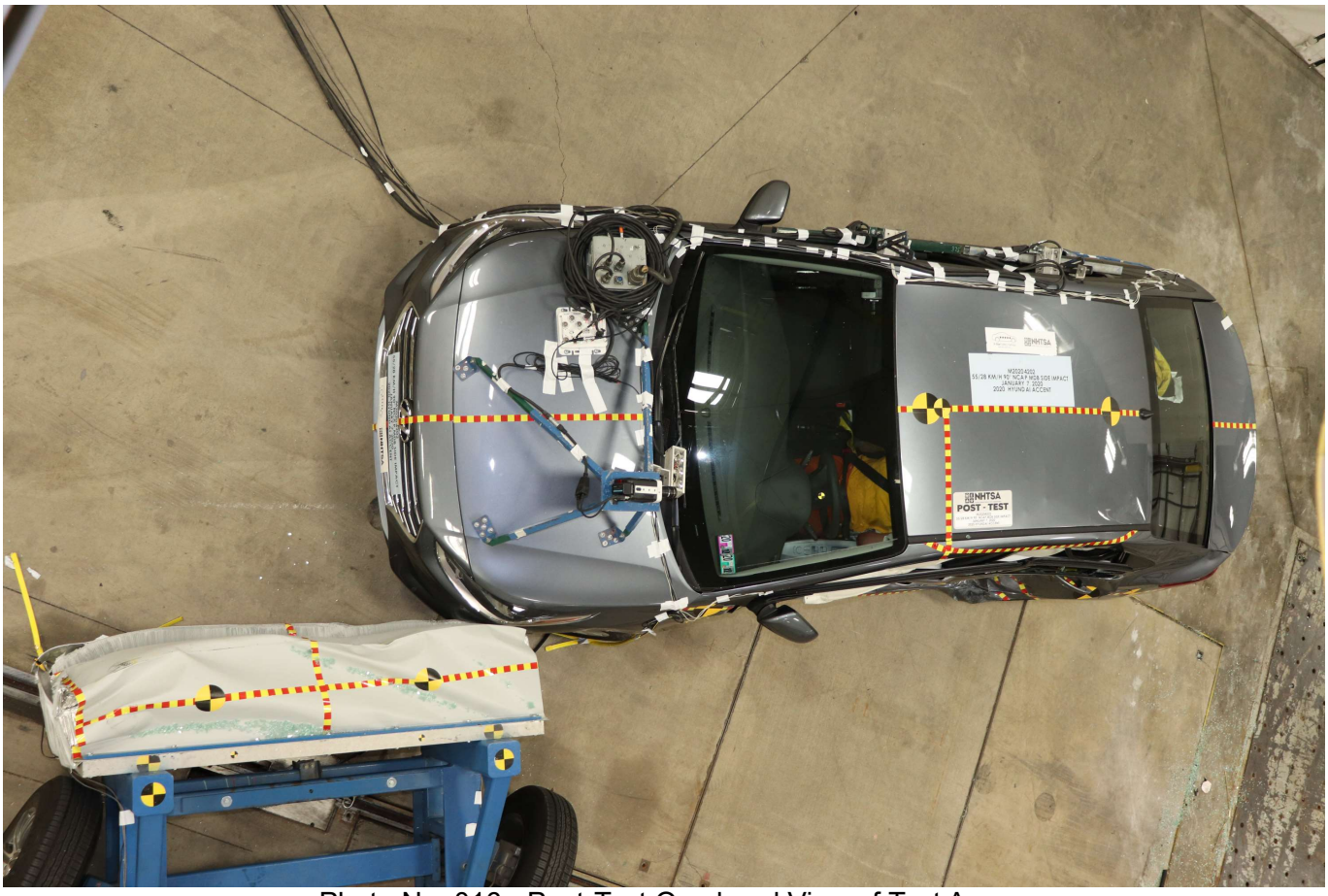


Photo No. 016 - Post-Test Overhead View of Test Area

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

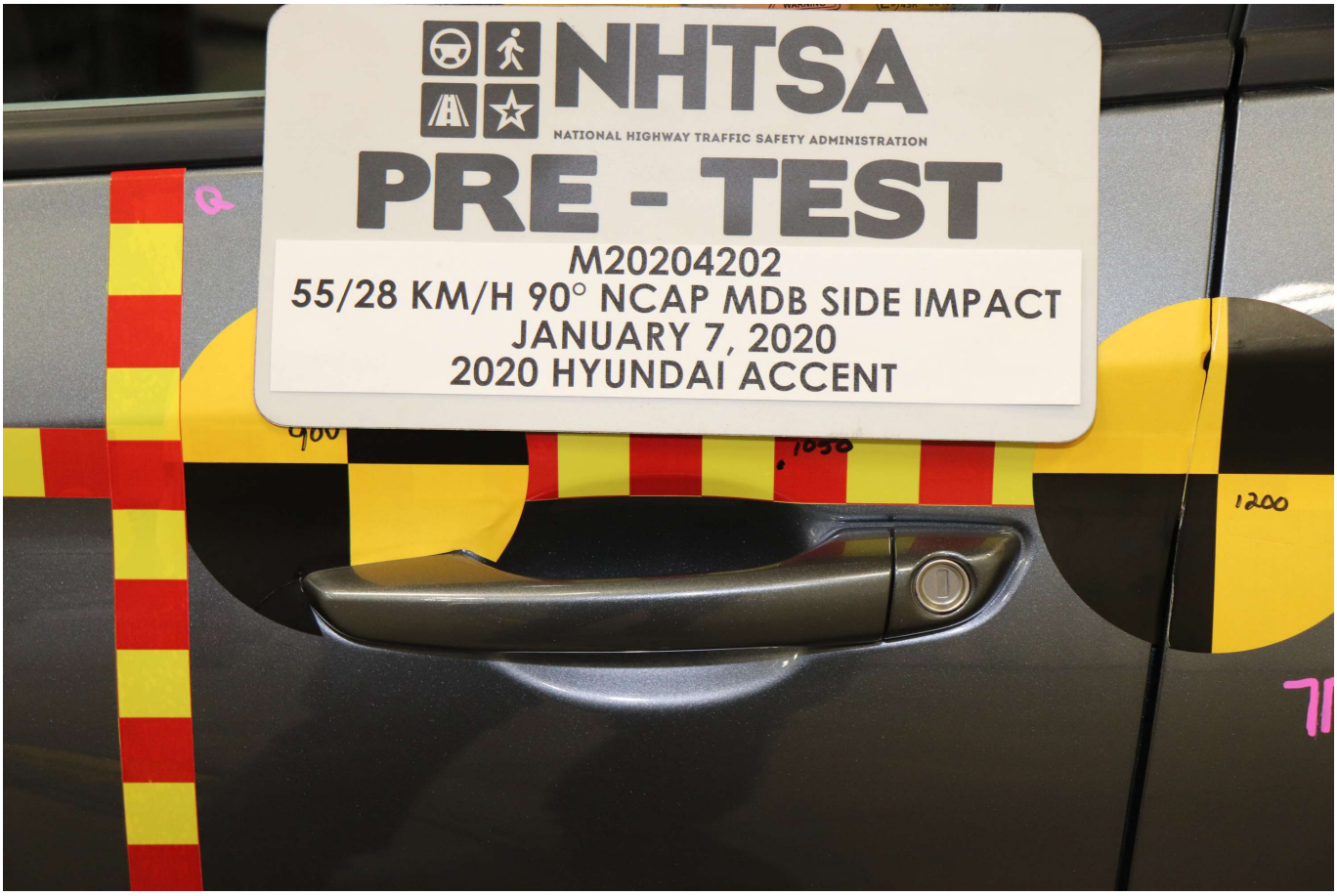


Photo No. 021 - Pre-Test Left Front Door Latch Close-Up

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

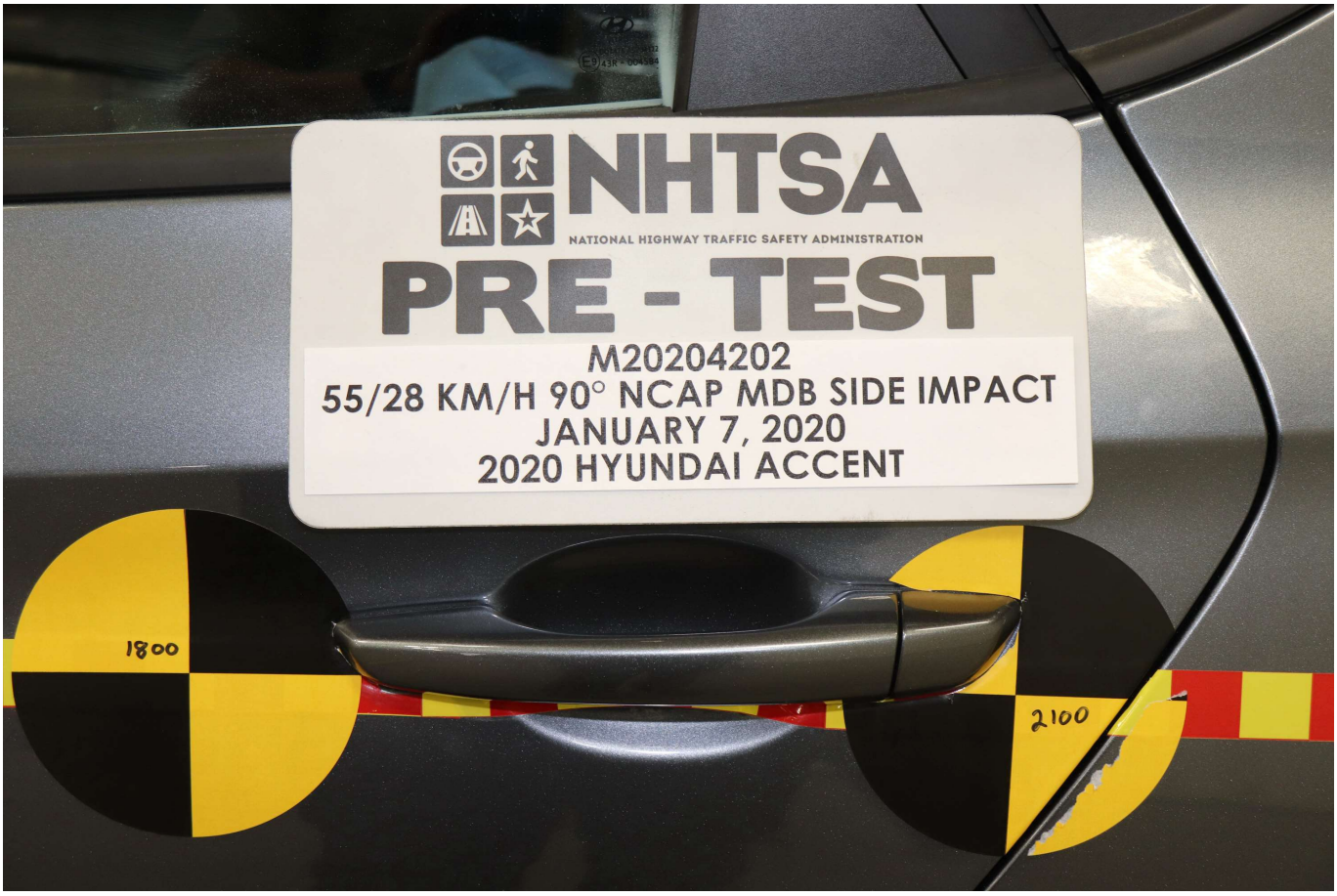


Photo No. 023 - Pre-Test Left Rear Door Latch Close-Up

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 Dummy 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

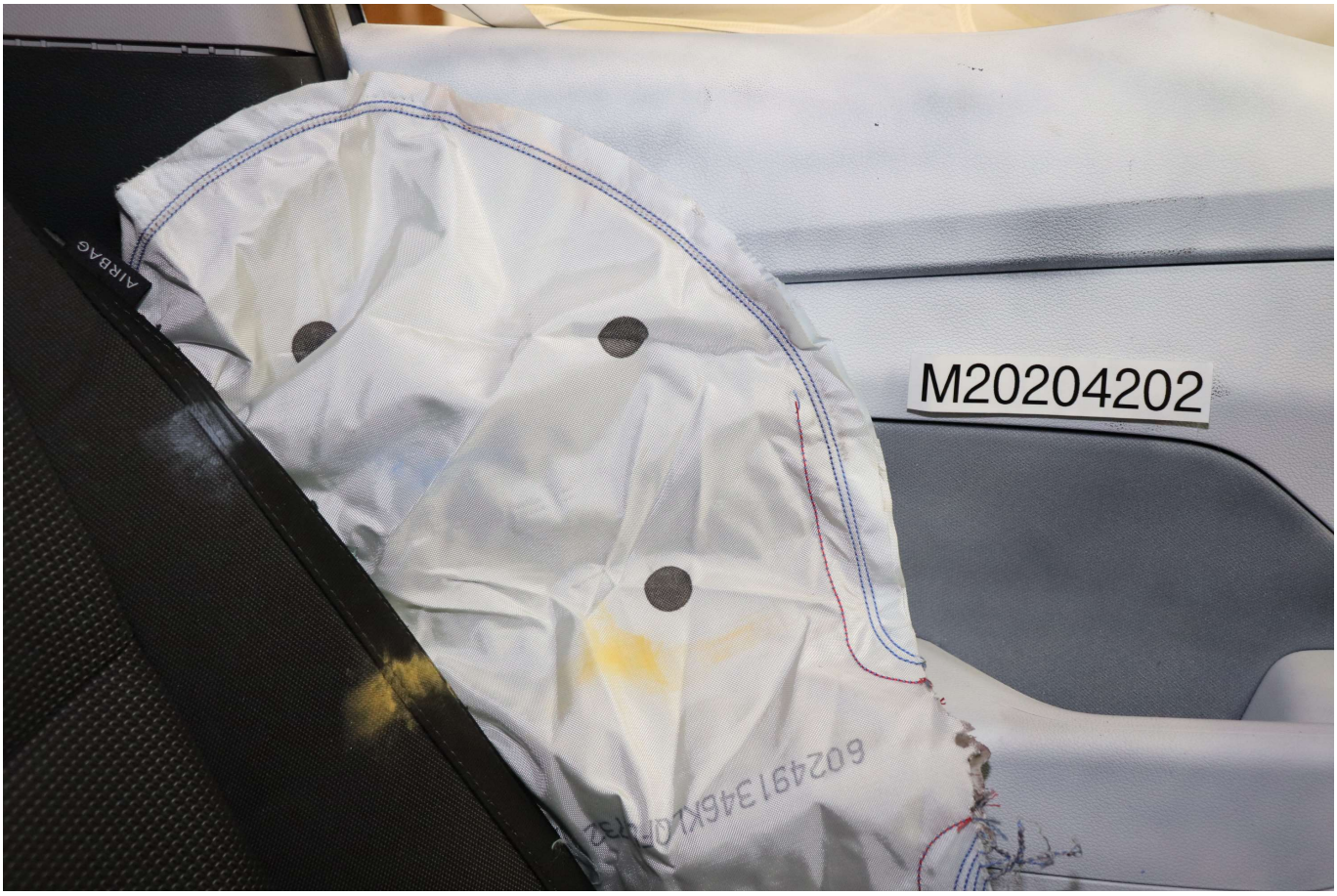


Photo No. 051 - Post-Test Driver Dummy Close-up Torso Contact with Side Airbag View

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

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

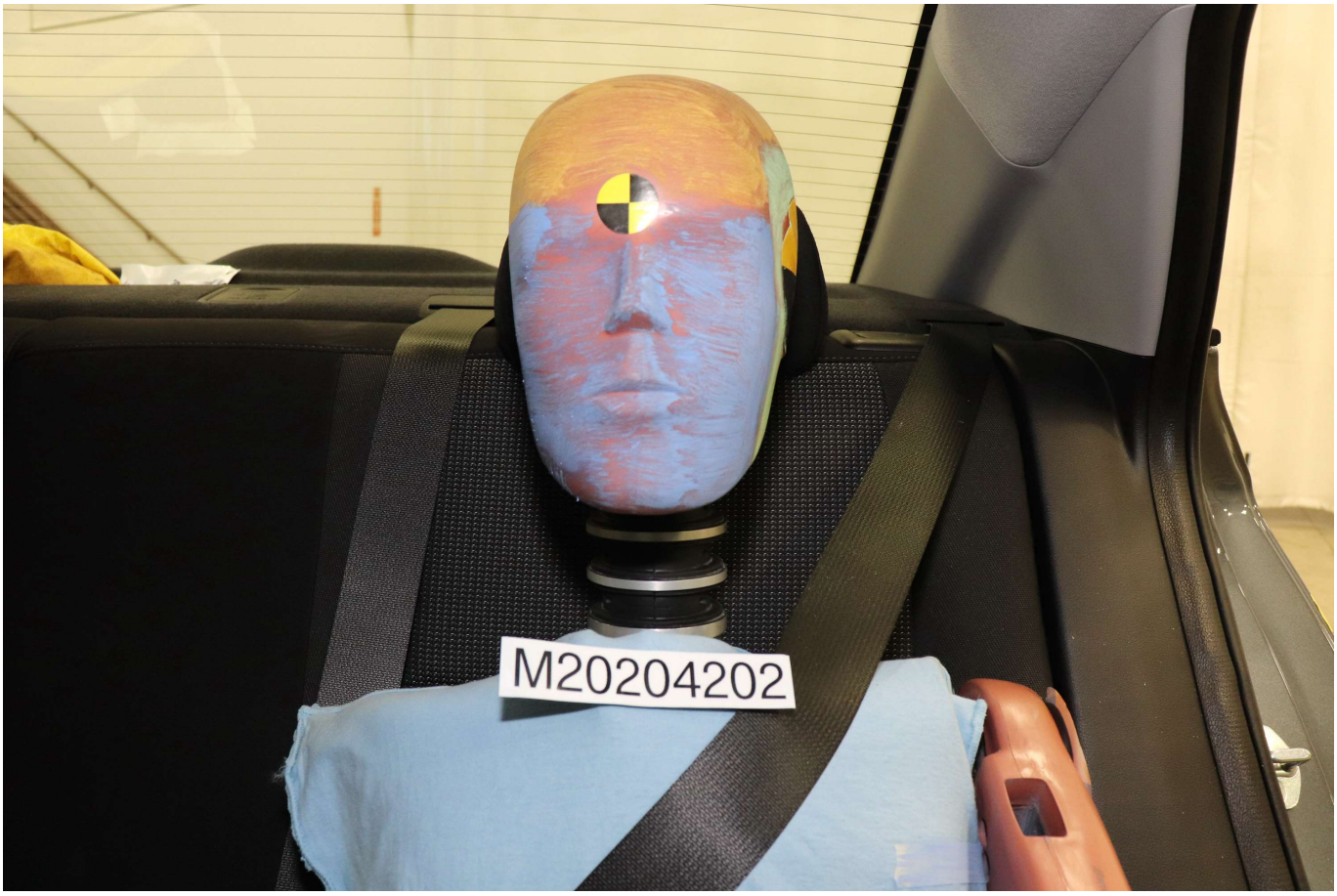


Photo No. 059 - Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint

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 Dummy Neck Showing Position of Adjustable Neck Bracket

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

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

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

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

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 Compartment

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

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

PHOTOGRAPH NOT AVAILABLE

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

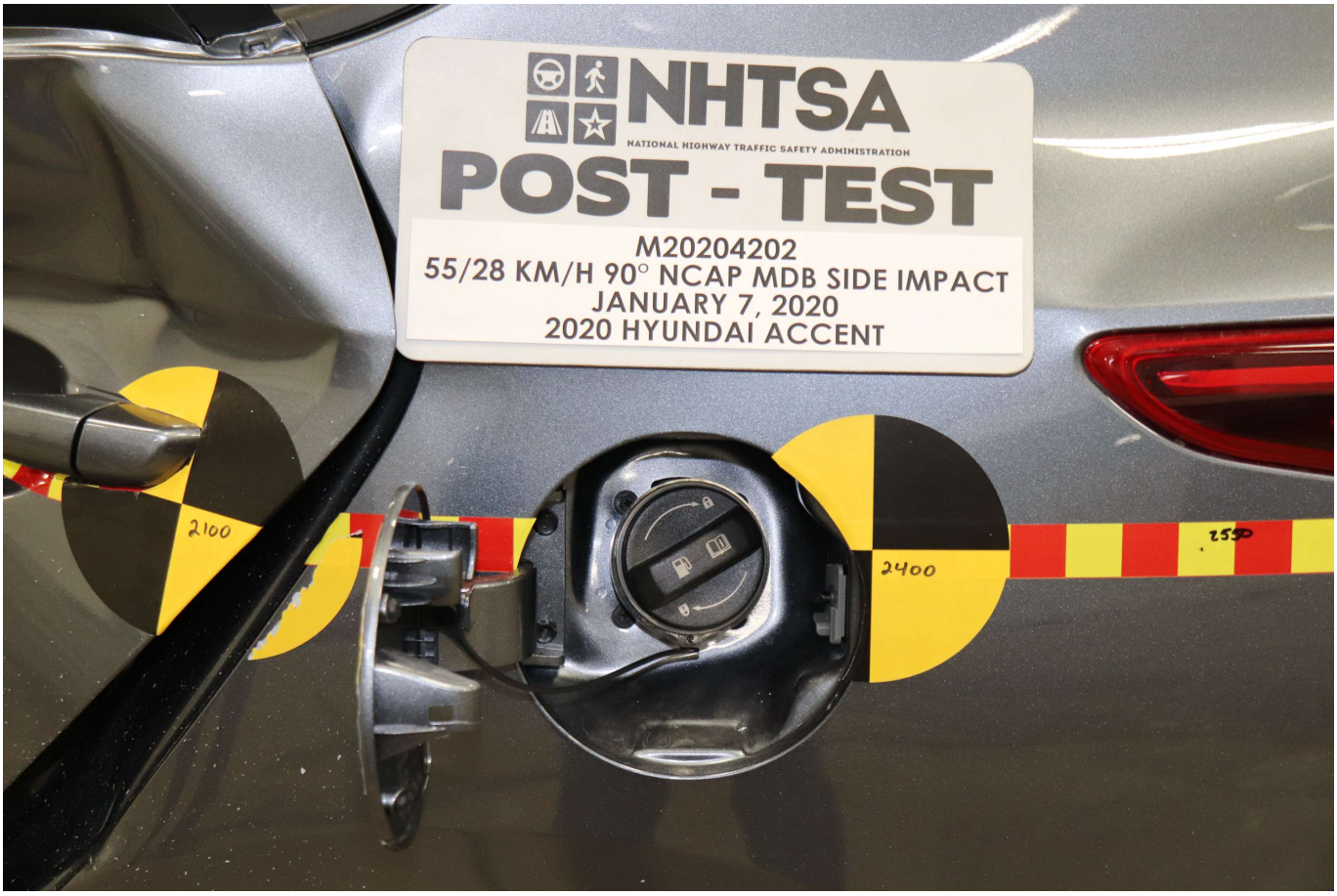


Photo No. 083 - Post-Test View of Fuel Filler Cap or Fuel Filler Neck

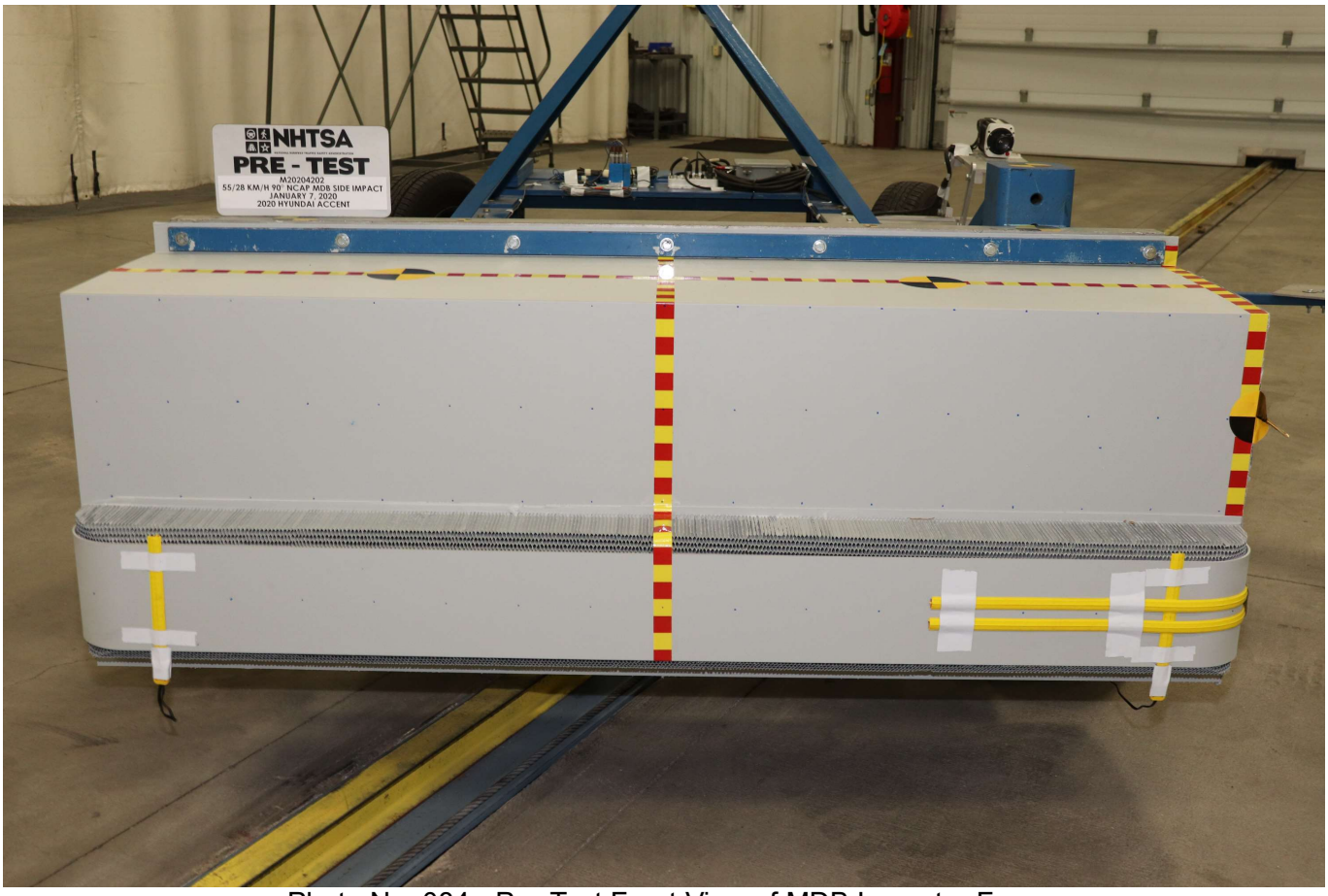


Photo No. 084 - Pre-Test Front View of MDB Impactor Face

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

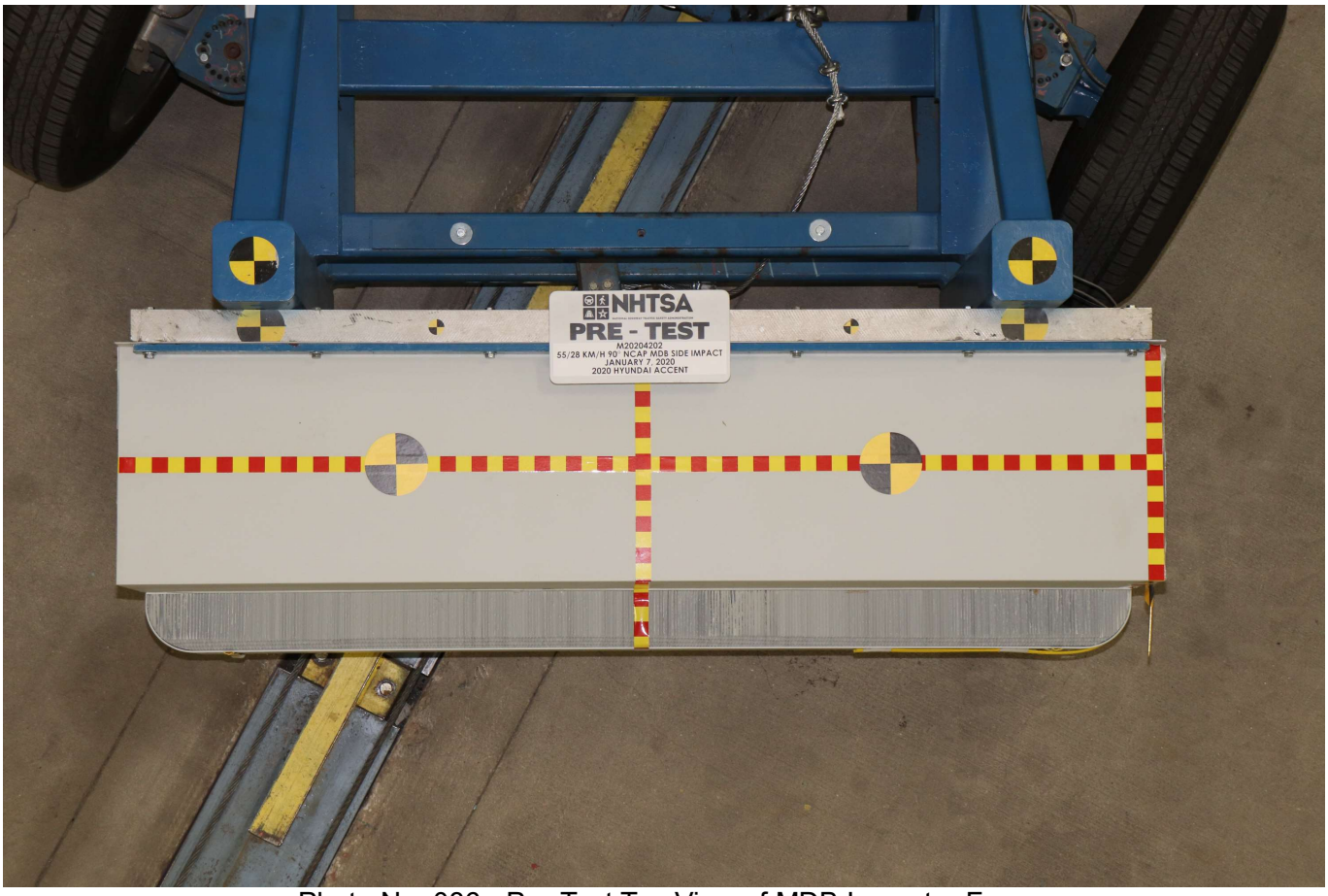


Photo No. 086 - Pre-Test Top View of MDB Impactor Face

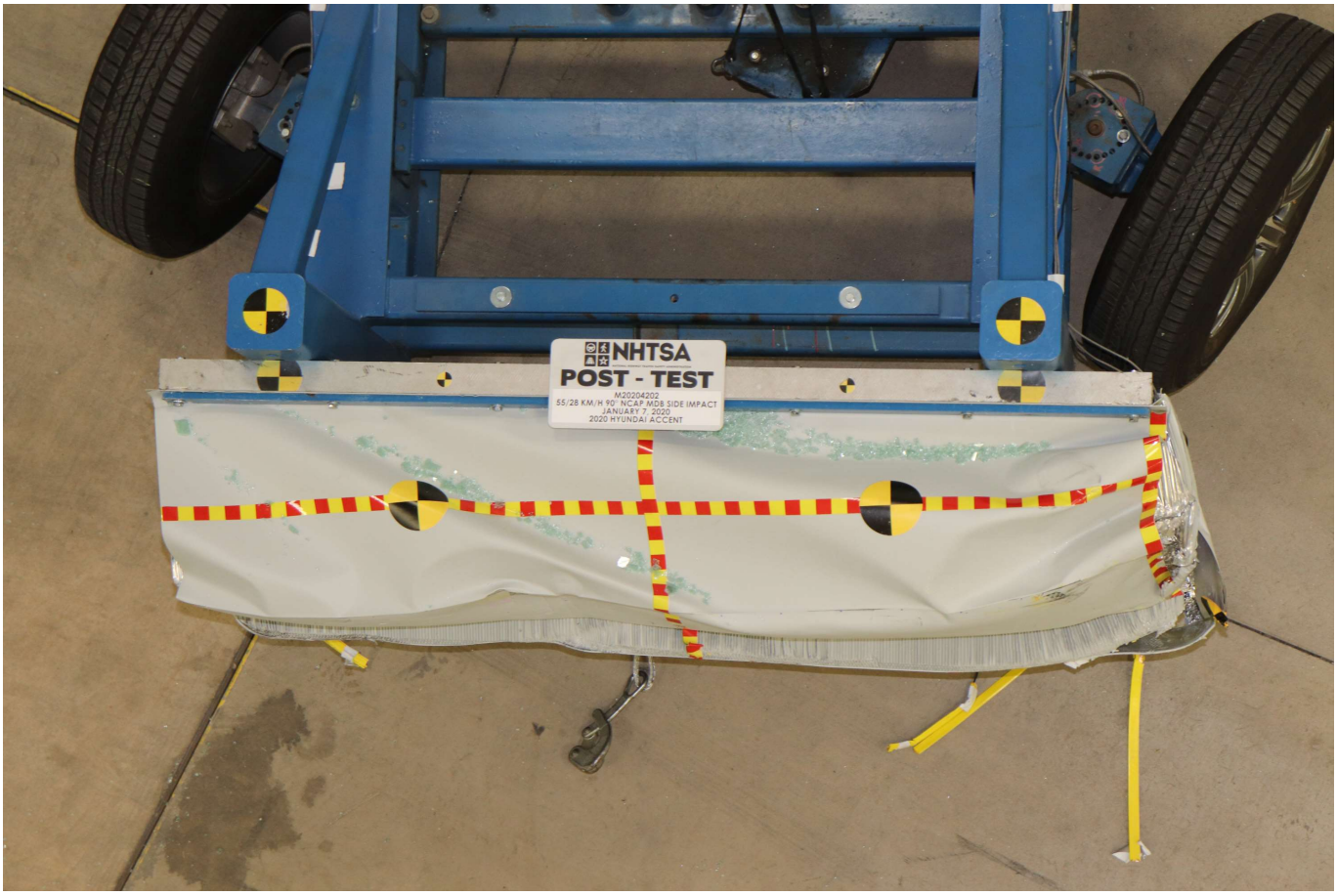


Photo No. 087 - Post-Test Top View of MDB Impactor Face

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 Certification Label

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

Photo No. 093a - Close-Up View of Vehicle Load Carrying Capacity Reduction Label

Photo No. 094 - Pre-Test Ballast View

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

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

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

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

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

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

Photo No. 101 - Impact Event

HYUNDAI

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Smarts, Style & Safety
Accent Has It All

Hyundai Hope On Wheels® Helping kids fight cancer

SOLD TO: PA077
BLAISE ALEXANDER HYUNDAI
1703 WEST COLLEGE AVENUE
STATE COLLEGE PA 16801

SHIPPED TO: PA077

VIN:	3KPC24A66LE103968
MODEL:	17413F45
ENGINE:	G4FMKE315451
PORT OF ENTRY:	PH
EXTERIOR COLOR:	URBAN GRAY
INTERIOR/SEAT COLOR:	BLACK/BLACK
TRANSPORT:	TRUCK
ACCESSORY WEIGHT:	15 lbs./ 7 kgs.
EMISSIONS:	This vehicle is certified to meet emission requirements in all 50 states

GOVERNMENT 5-STAR SAFETY RATINGS

This vehicle has not been rated by the goverment for overall vehicle score, frontal crash, side crash or rollover risk.

Source: National Highway Traffic Safety Administration (NHTSA).
www.safercar.gov or 1-888-327-4236

EPA DOT Fuel Economy and Environment — Gasoline Vehicle

Fuel Economy
33 combined city/hwy MPG (**29** city, **39** highway)
Compact Cars range from 14 to 119 MPG. The best vehicle rates 136 MPGe.
3.0 gallons per 100 miles

You **save** **$1,250** in fuel costs over 5 years compared to the average new vehicle.

Annual fuel **cost** **$1,250**

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 7 (1 – 10, Best)
Smog Rating (tailpipe only): 3 (1 – 10, Best)
This vehicle emits 273 grams CO_2 per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fueleconomy.gov.

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 27 MPG and costs $7,500 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $ 2.70 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fueleconomy.gov
Calculate personalized estimates and compare vehicles

Smartphone QR Code™

STANDARD FEATURES:

AMERICA'S BEST WARRANTY	
5-year/60,000-mile New Vehicle Warranty*	INCLUDED
10-year/100,000-mile Powertrain Warranty*	INCLUDED
7-year/Unlimited-mile Anti-perforation Warranty*	INCLUDED
5-year/Unlimited-mile Roadside Assistance	INCLUDED
*Limited warranties, see dealer for details	
ADVANCED SAFETY TECHNOLOGY	
Electronic Stability Control (ESC) w/ Traction Control	INCLUDED
ABS w/ Electronic Brake Force Distribution & Brake Assist	INCLUDED
Front, Front Side Impact & Side Curtain Airbags	INCLUDED
Rearview Camera w/ Dynamic Guidelines	
Tire Pressure Monitoring System	INCLUDED
POWERTRAIN TECHNOLOGY	
1.6L DPI, 120 HP, 113 lbs-ft Torque, DOHC 4-Cylinder	INCLUDED
Continuously Variable Valve Timing	INCLUDED
6-Speed Manual Transmission	INCLUDED
EXTERIOR	
15-Inch Wheels w/ Full Covers and 185/65R15 Tires	INCLUDED
Body Color Outside Mirrors & Door Handles	INCLUDED
One Touch Triple Turn Signal	INCLUDED
Hood Insulator	INCLUDED
COMFORT & CONVENIENCE	
AM/FM Audio System w/ 4 Speakers	INCLUDED
5-inch color touchscreen	INCLUDED
Smartphone/USB & Auxiliary Input Jacks	INCLUDED
Cruise Control	INCLUDED
Air Conditioning	INCLUDED
Bluetooth® Hands Free Phone System	INCLUDED
Dual Vanity Mirrors with Sliding Sunvisors	INCLUDED
Steering Wheel Mounted Audio & Cruise Controls	INCLUDED
Tilt Steering Wheel	INCLUDED
6-way Adjustable Driver Seat Including Height Adjustment	INCLUDED
60/40 Split-Folding Rear Seat	INCLUDED
Map, Dome & Cargo Lights	INCLUDED
Remote Keyless Entry w/ Panic Alert	INCLUDED
Compact Temporary Spare Tire	INCLUDED
*Full Tank of Gas	INCLUDED

Manufacturer's Suggested Retail Price: $15,195.00

ADDED FEATURES:

*Carpeted Floor Mats	$135.00
*Cargo Net	$50.00
*Cargo Tray	$115.00

Inland Freight & Handling : $930.00
Total Price : $16,425.00

Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. Gasoline license and title fees state and local taxes and dealer installed options and accessories are not included in the manufacturer's suggested retail price. This label has been affixed to this vehicle by Hyundai Motor America, pursuant to the requirements of 15 U.S.C. 1231 et seq. which prohibits its removal or alteration prior to delivery to the ultimate purchaser.

PARTS CONTENT INFORMATION
FOR VEHICLE IN THIS CARLINE:
U.S./CANADIAN PARTS CONTENT: 3 %
MAJOR SOURCES OF FOREIGN PARTS CONTENT: MEXICO: 53 %, KOREA: 44 %
Note: Parts content does not include final assembly, distribution, or other non-parts costs.
FOR THIS VEHICLE:
FINAL ASSEMBLY POINT: NUEVO LEON, MEXICO
COUNTRY OF ORIGIN:
ENGINE: MEXICO
TRANSMISSION: KOREA/MEXICO

274 A 2840QDONG- 34

Photo No. 102 - Monroney Label

Head Restraints

The vehicle's front and rear seats have adjustable head restraints. The head restraints provide comfort for passengers, but more importantly they are designed to help protect passengers from whiplash and other neck and spinal injuries during an accident, especially in a rear impact collision.

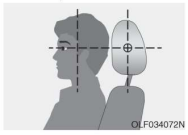
⚠ WARNING

To reduce the risk of serious injury or death in an accident, take the following precautions when adjusting your head restraints:

- **Always properly adjust the head restraints for all passengers BEFORE starting the vehicle.**
- **NEVER let anyone ride in a seat with the head restraints removed or reversed.**

(Continued)

(Continued)


OLF034072N

Adjust the head restraints so the middle of the head restraint is at the same height as the height of the top of the eyes.

- **NEVER adjust the head restraint position of the driver's seat when the vehicle is in motion.**
- **Adjust the head restraint as close to the passenger's head as possible. Do not use a seat cushion that holds the body away from the seatback.**
- **Make sure the head restraint locks into position after adjusting it.**

NOTICE

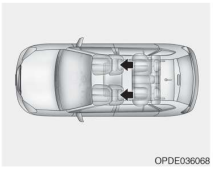
To prevent damage, NEVER hit or pull on the head restraints.

⚠ CAUTION

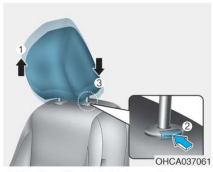
When there is no occupant in the rear seats, adjust the height of the headrest to the lowest position. The rear seat headrest can reduce the visibility of the rear area.

2 Safety system of your vehicle

Front seat head restraints


OPDE036068

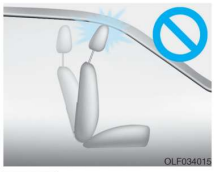
The vehicle's front and passenger's seats are equipped with adjustable head restraints for the passengers safety and comfort.


OHCA037061

Adjusting the height up and down

To raise the head restraint:
1. Pull it up to the desired position (1).

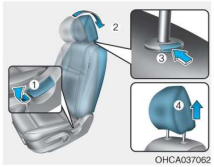
To lower the head restraint:
1. Push and hold the release button (2) on the head restraint support.
2. Lower the head restraint to the desired position (3).


OLE034015

NOTICE

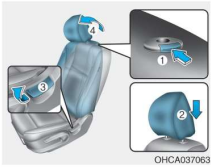
If you recline the seatback towards the front with the head restraint and seat cushion raised, the head restraint may come in contact with the sunvisor or other parts of the vehicle.

2-11 2-12


OHCA037062

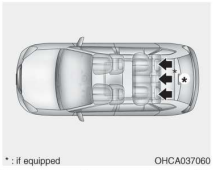
Removal/Reinstallation

To remove the head restraint:
1. Recline the seatback (2) rearward using the seatback angle lever (1).
2. Raise the head restraint as far as it can go.
3. Press the head restraint release button (3) while pulling the head restraint up (4).


OHCA037063

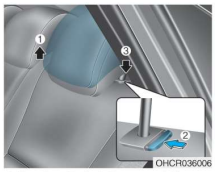
To reinstall the head restraint:
1. Put the head restraint poles (2) into the holes while pressing the release button (1).
2. Adjust the head restraint to the appropriate height.
3. Adjust the seatback (4) forward using the seatback angle lever (3).

Rear seat head restraints


*: if equipped OHCA037060

The rear seats are equipped with head restraints in all the seating positions for the passenger's safety and comfort.

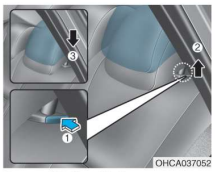
2 Safety system of your vehicle


OHCR036006

Adjusting the height up and down

To raise the head restraint:
1. Pull it up to the desired position (1).

To lower the head restraint:
1. Push and hold the release button (2) on the head restraint support.
2. Lower the head restraint to the desired position (3).


OHCA037052

Removal/Reinstallation

To remove the head restraint:
1. Raise the head restraint as far as it can go.
2. Press the head restraint release button (1) while pulling the head restraint up (2).

To reinstall the head restraint:
1. Put the head restraint poles into the holes (3) while pressing the release button (1).
2. Adjust the head restraint to the appropriate height.

Seat Warmers (if equipped)

Seat warmers are provided to warm the seats during cold weather.

⚠ WARNING

The seat warmers can cause a SERIOUS BURN, even at low temperatures and especially if used for long periods of time.

Passengers must be able to feel if the seat is becoming too warm so they can turn it off, if needed.

People who cannot detect temperature change or pain to the skin should use extreme caution, especially the following types of passengers:

- **Infants, children, elderly or disabled persons, or hospital outpatients.**
- **People with sensitive skin or who burn easily.**
- **Fatigued individuals.**
- **Intoxicated individuals.**
- **People taking medication that can cause drowsiness or sleepiness.**

2-13 2-14

Photo No. 103 - Head Restraint Use and Adjustment Information from Vehicle Owners 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.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)

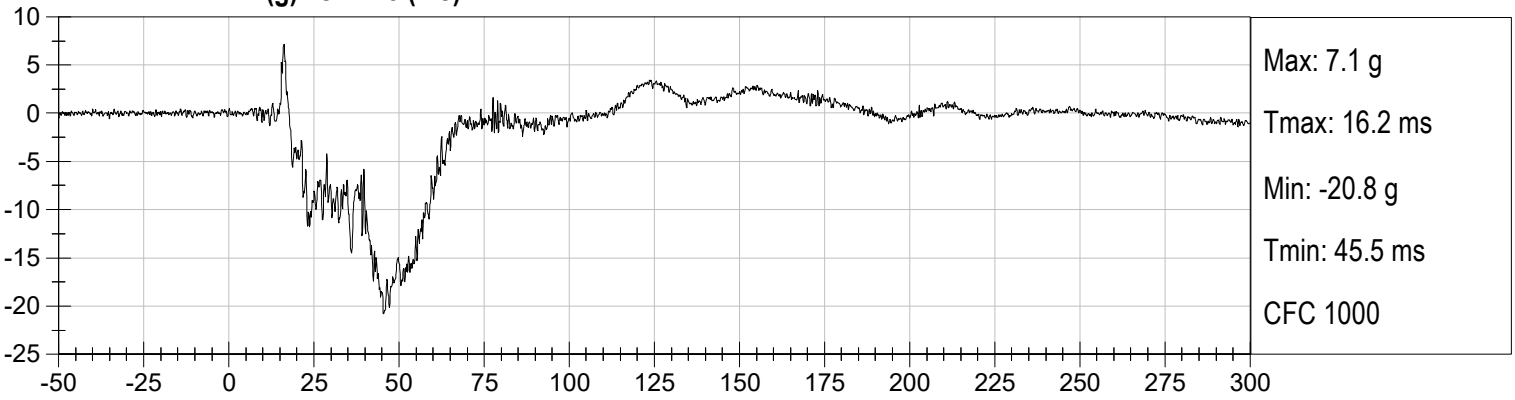
MDB Rear Acceleration (X)

MDB Rear Acceleration (Y)

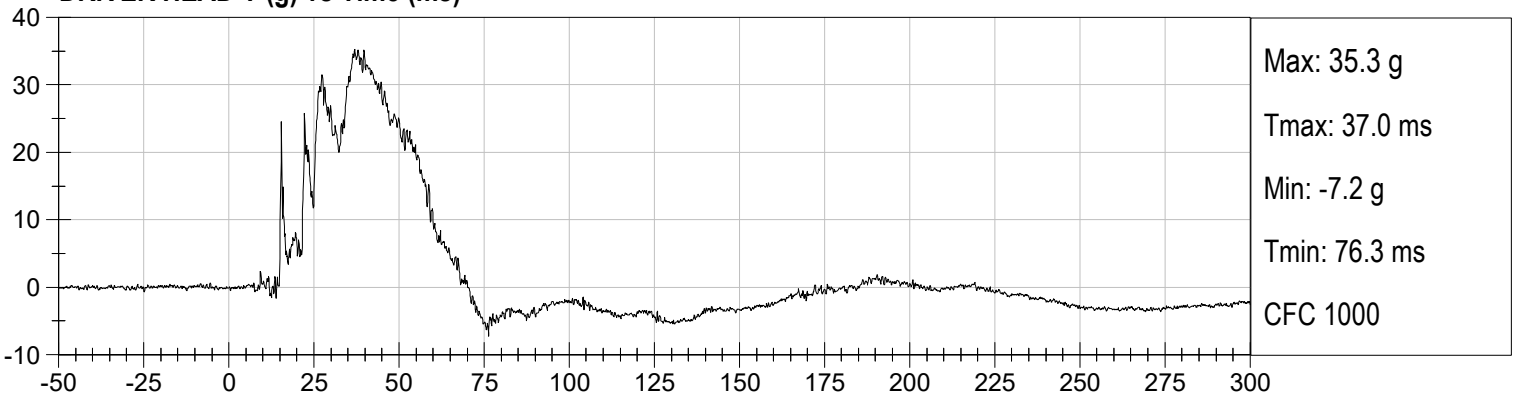
Left MDB Contact Switch

Right MDB Contact Switch

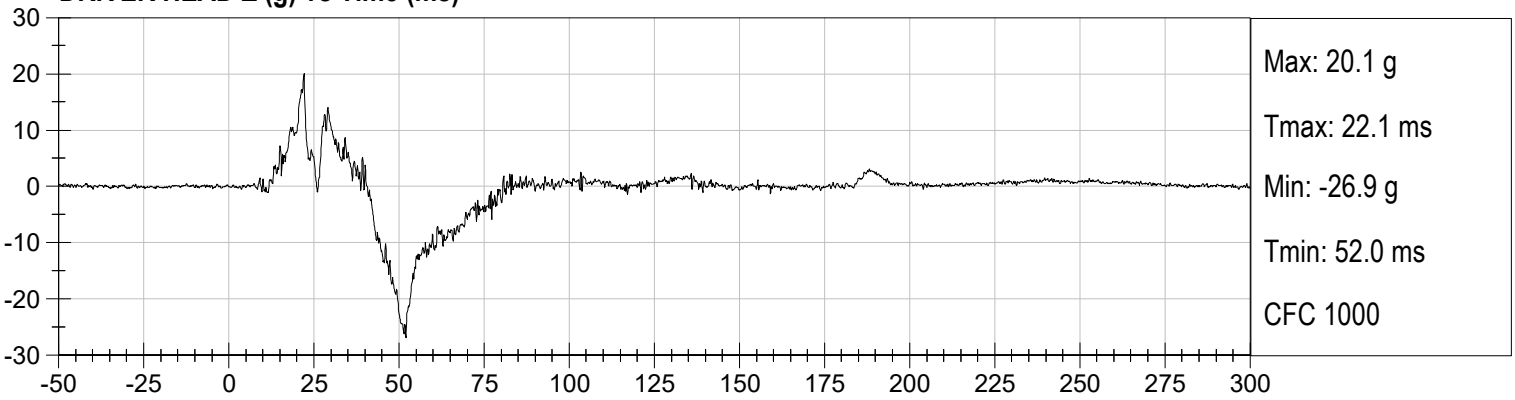
DRIVER HEAD X (g) vs Time (ms)



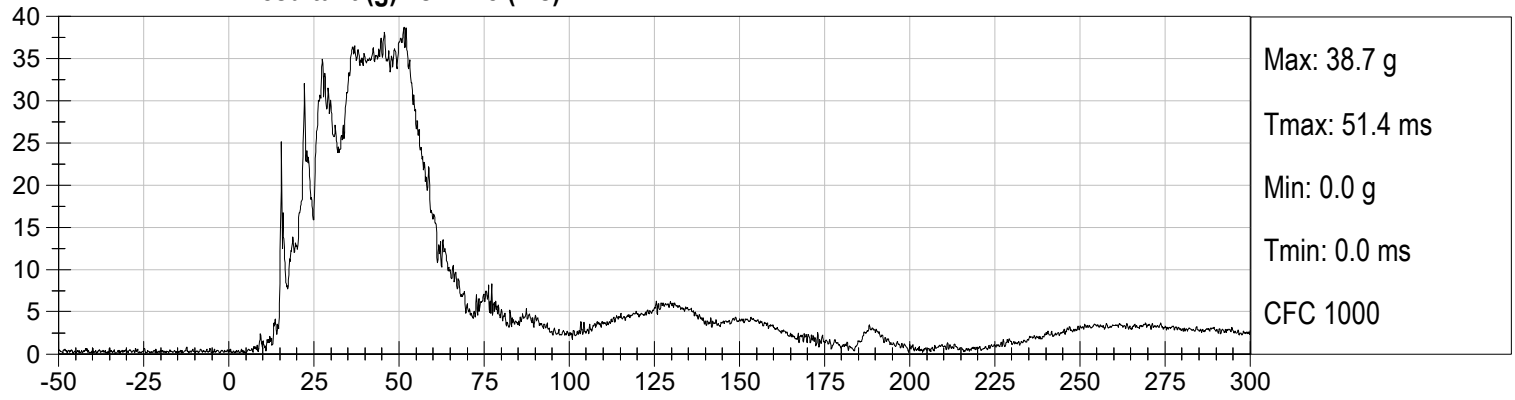
DRIVER HEAD Y (g) vs Time (ms)



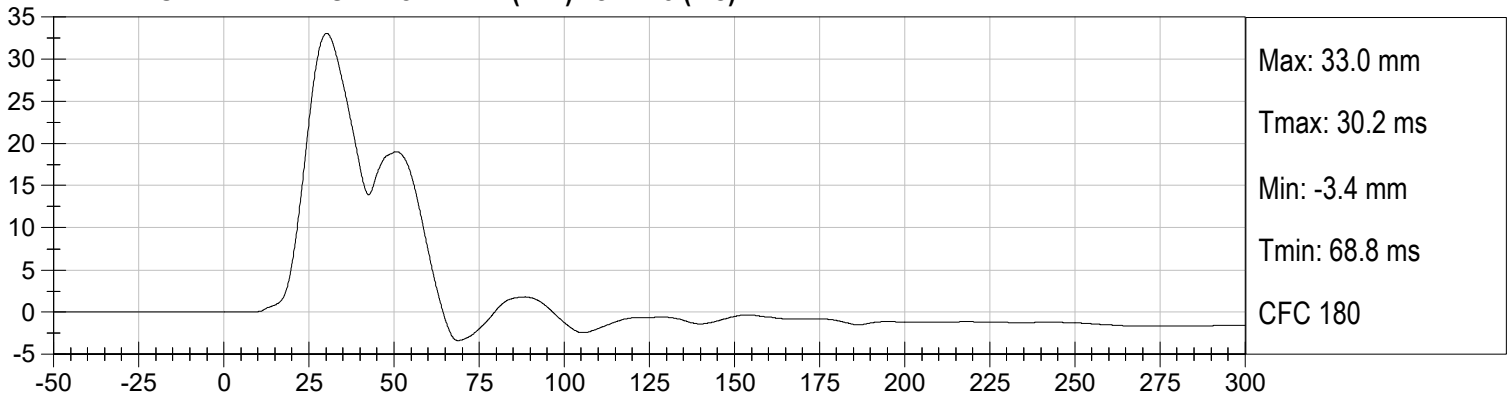
DRIVER HEAD Z (g) vs Time (ms)



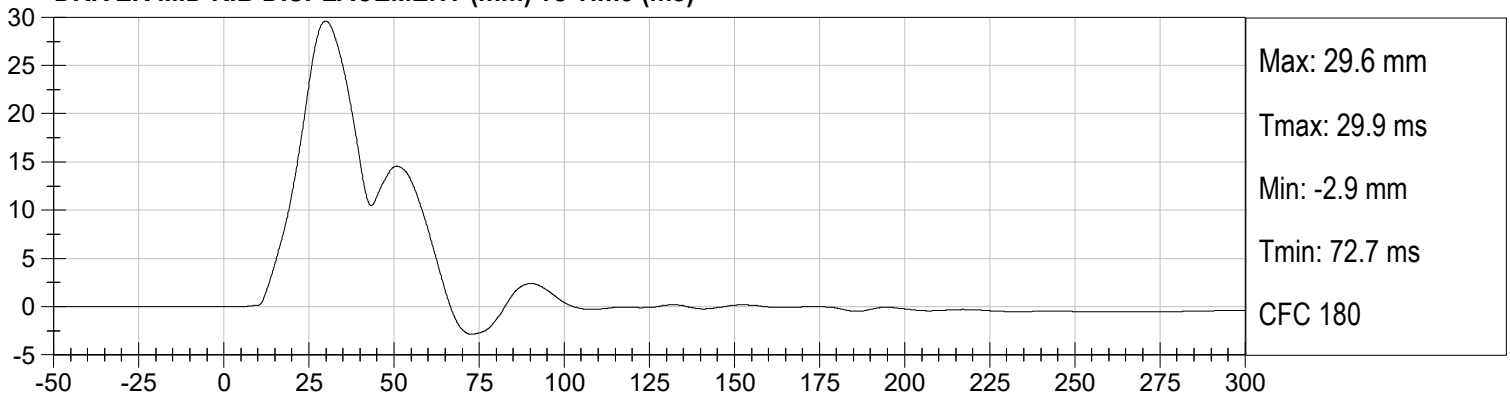
DRIVER HEAD Resultant (g) vs Time (ms)



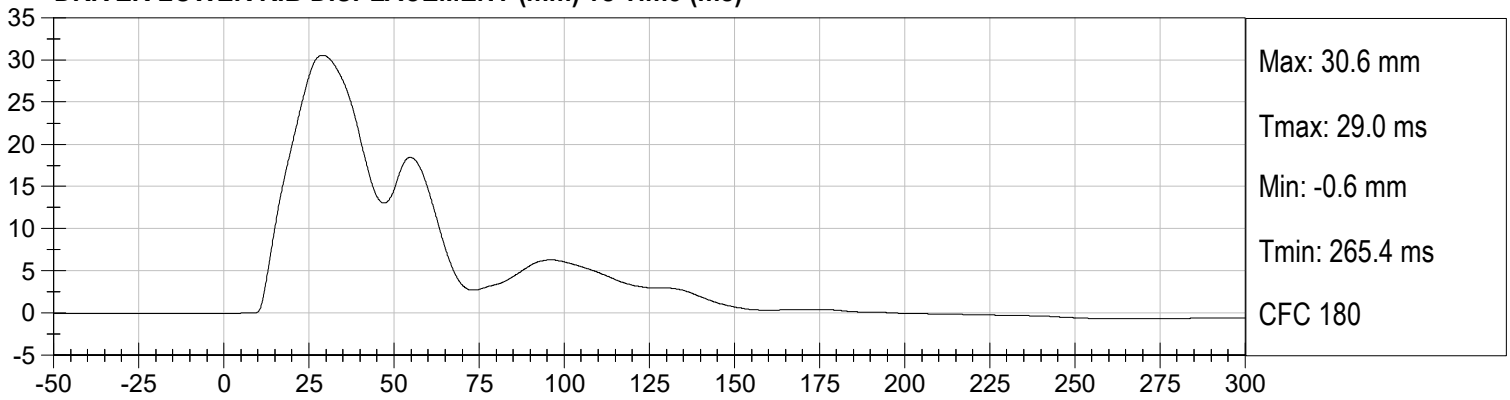
DRIVER UPPER RIB DISPLACEMENT (mm) vs Time (ms)



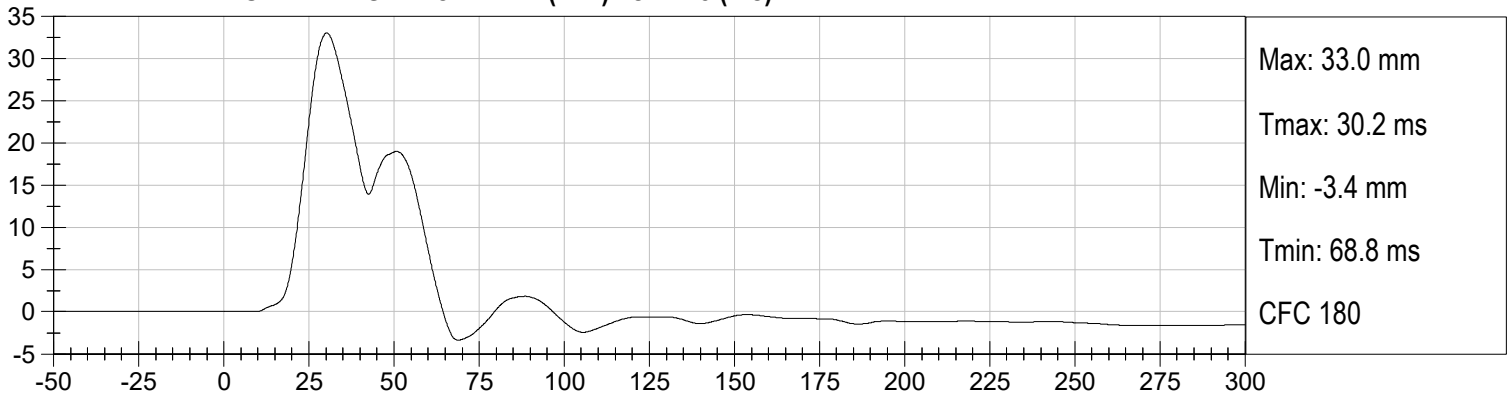
DRIVER MID RIB DISPLACEMENT (mm) vs Time (ms)



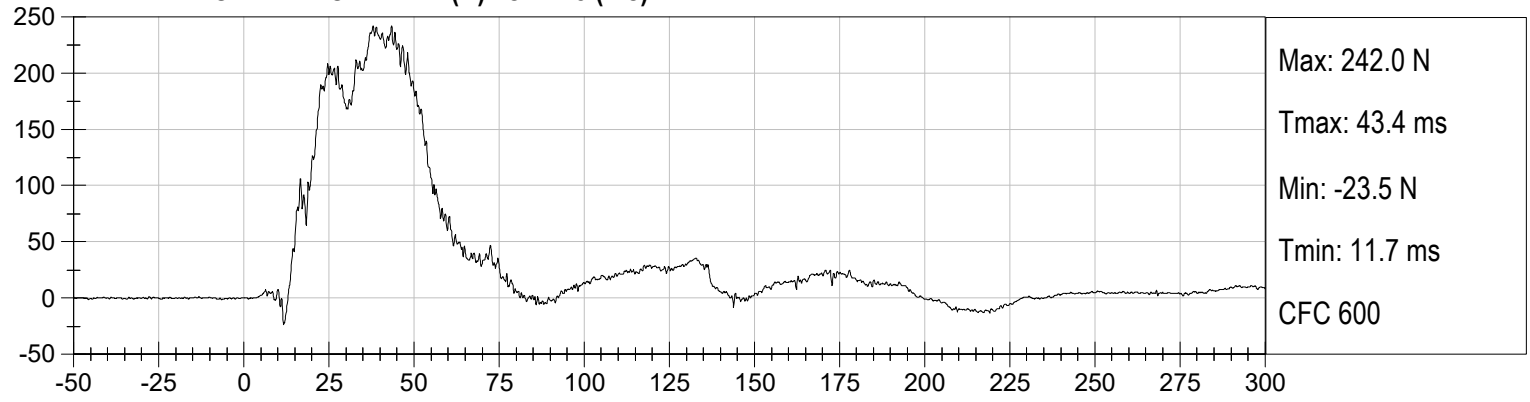
DRIVER LOWER RIB DISPLACEMENT (mm) vs Time (ms)



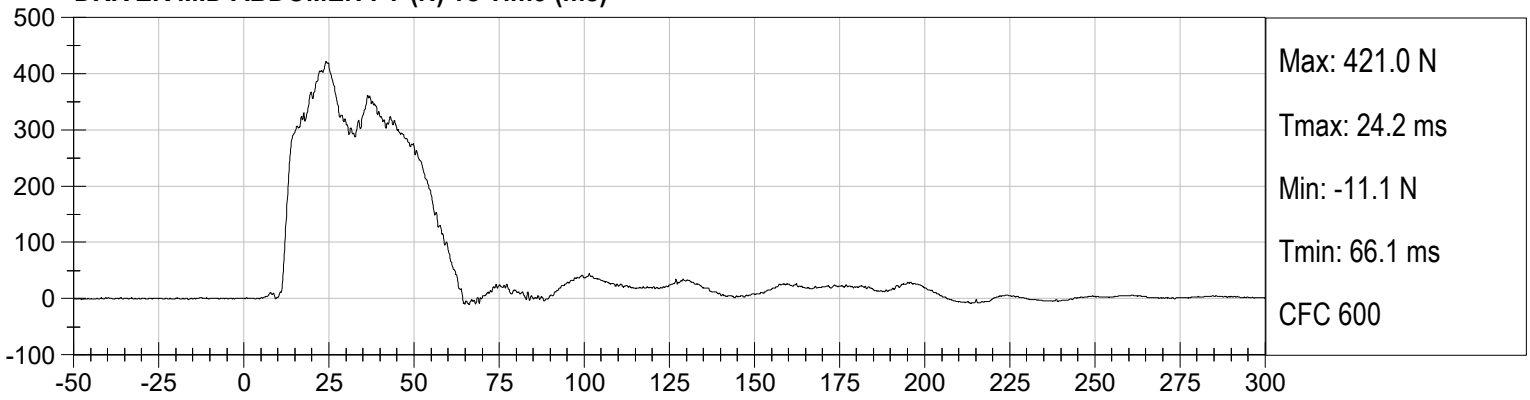
DRIVER MAXIMUM RIB DISPLACEMENT (mm) vs Time (ms)



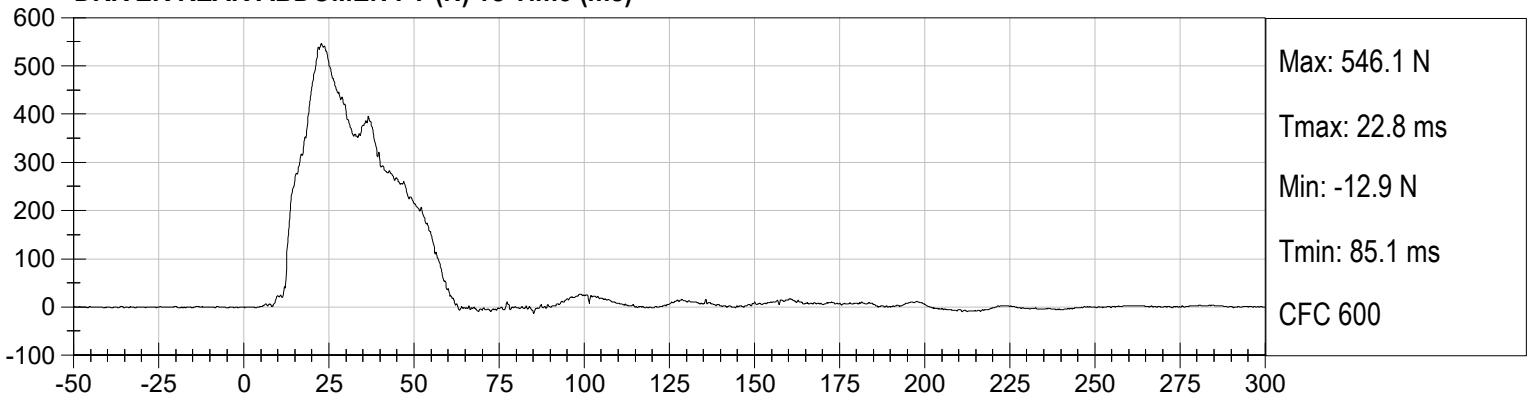
DRIVER FRONT ABDOMEN FY (N) vs Time (ms)



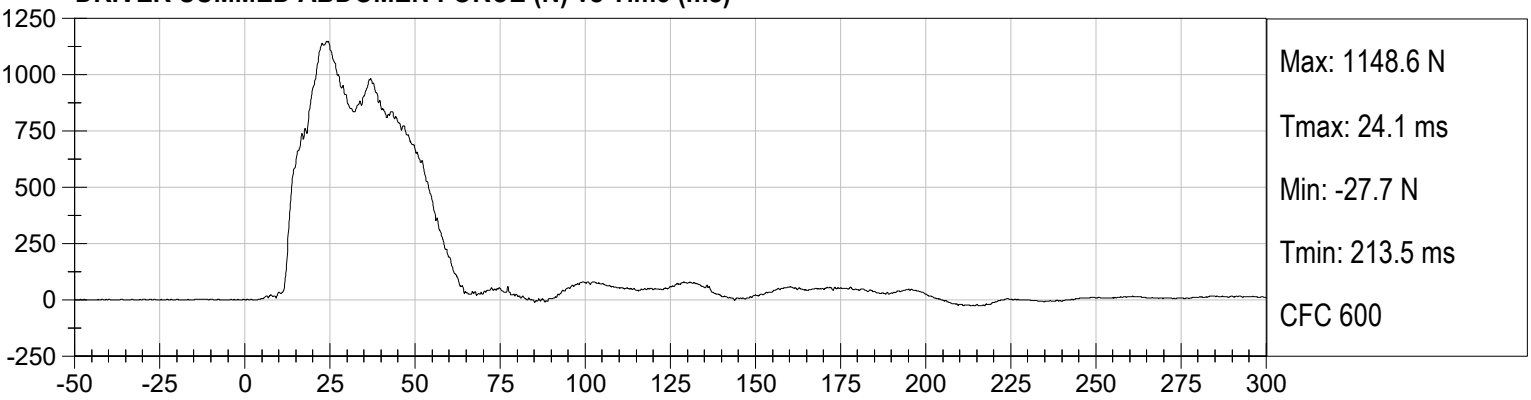
DRIVER MID ABDOMEN FY (N) vs Time (ms)



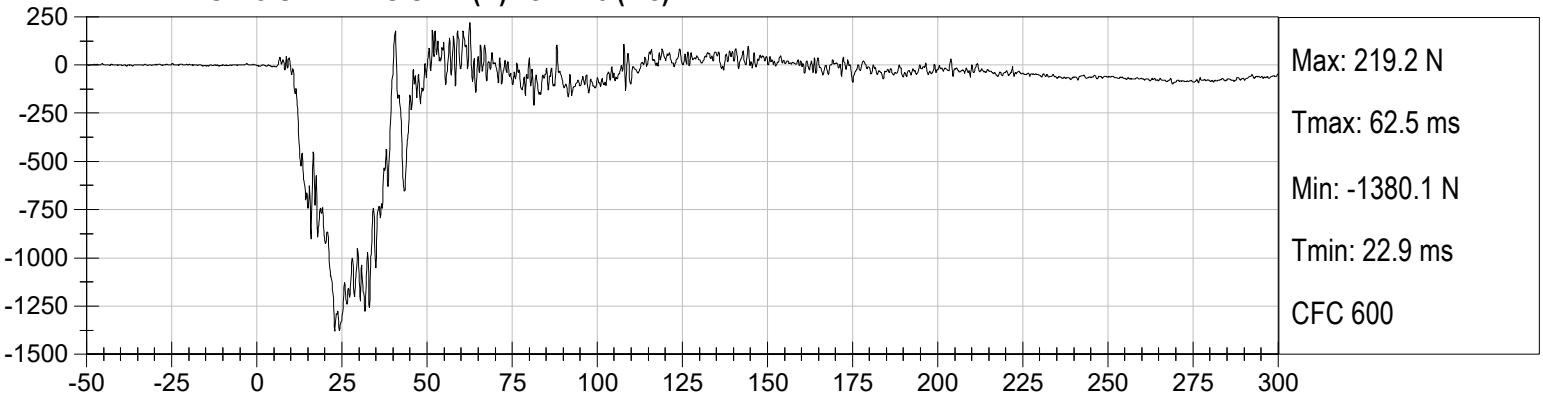
DRIVER REAR ABDOMEN FY (N) vs Time (ms)



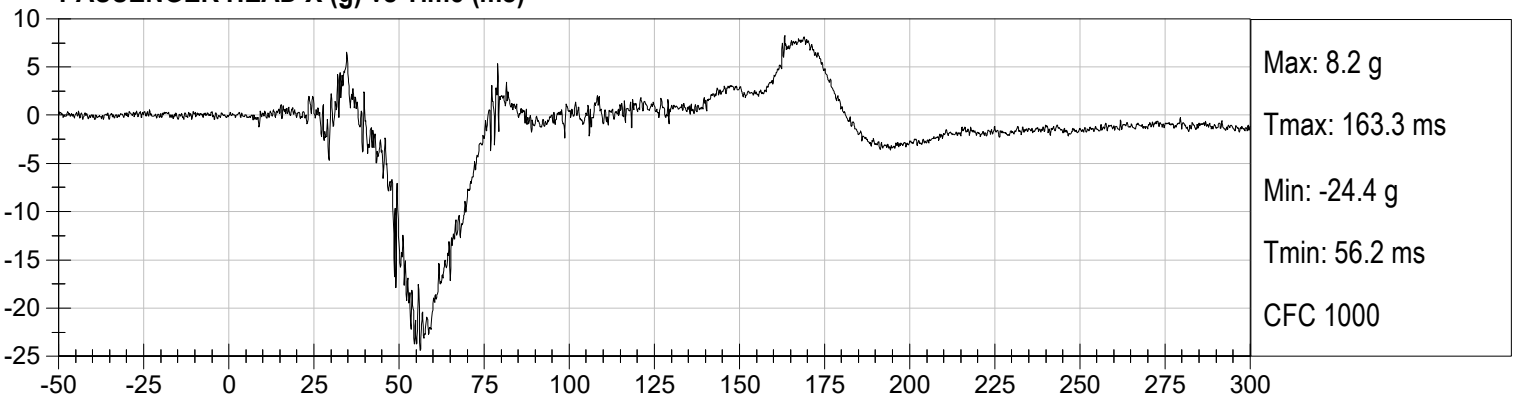
DRIVER SUMMED ABDOMEN FORCE (N) vs Time (ms)



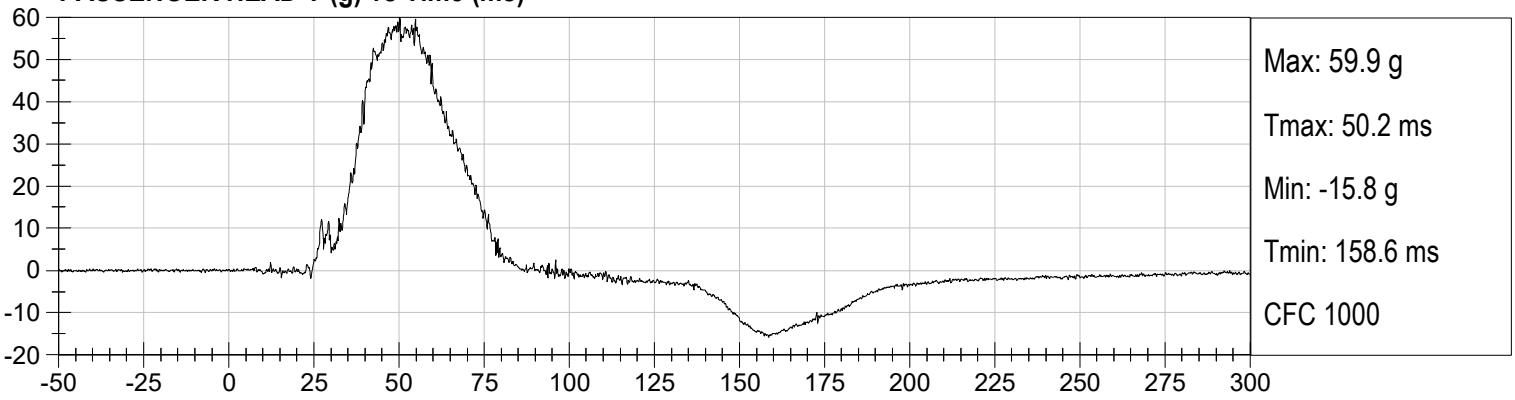
DRIVER PUBIC SYMPHYSIS FY (N) vs Time (ms)



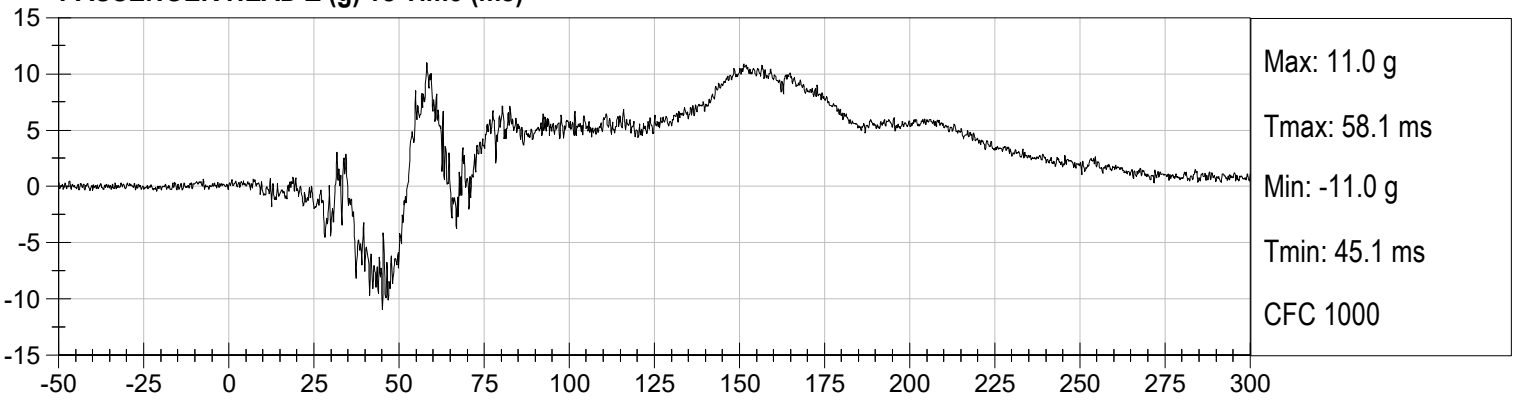
PASSENGER HEAD X (g) vs Time (ms)



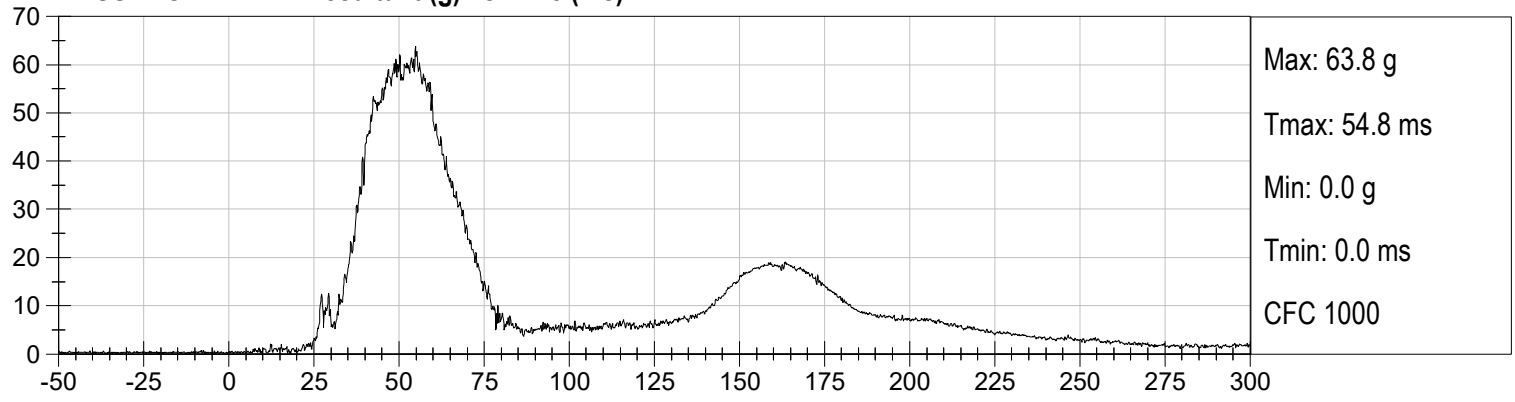
PASSENGER HEAD Y (g) vs Time (ms)



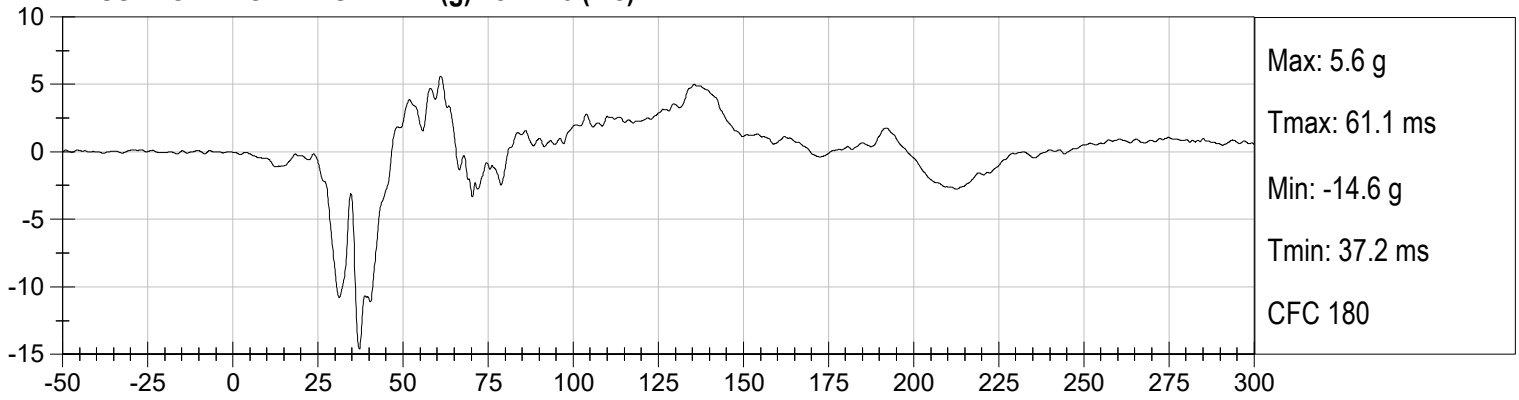
PASSENGER HEAD Z (g) vs Time (ms)



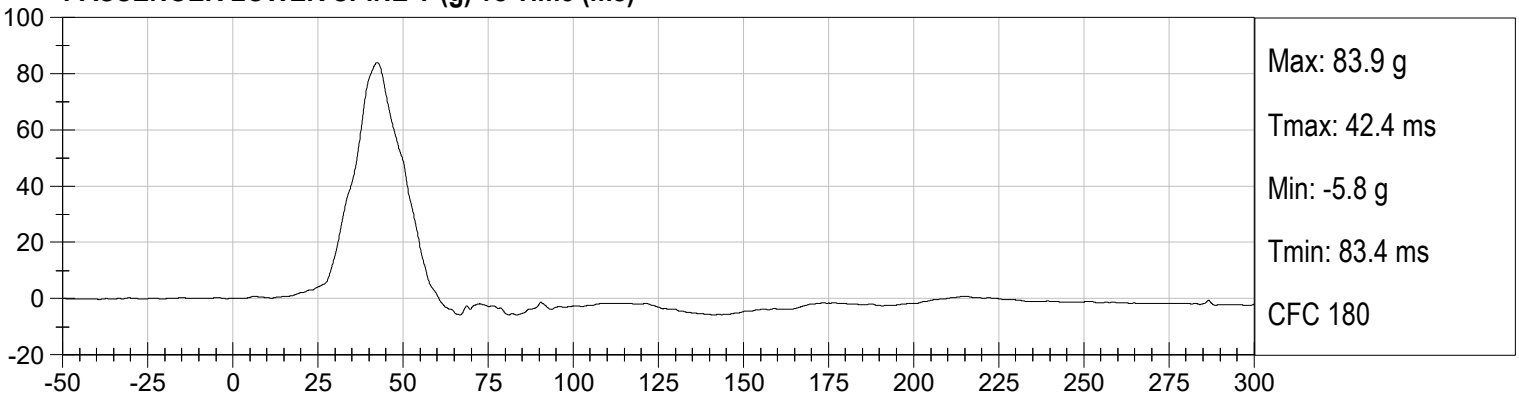
PASSENGER HEAD Resultant (g) vs Time (ms)



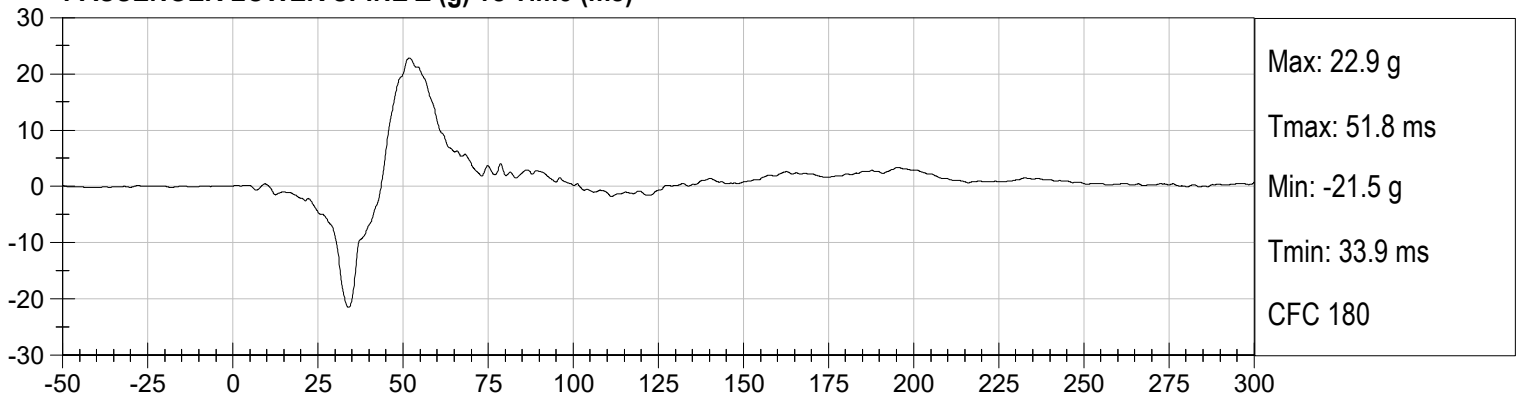
PASSENGER LOWER SPINE X (g) vs Time (ms)



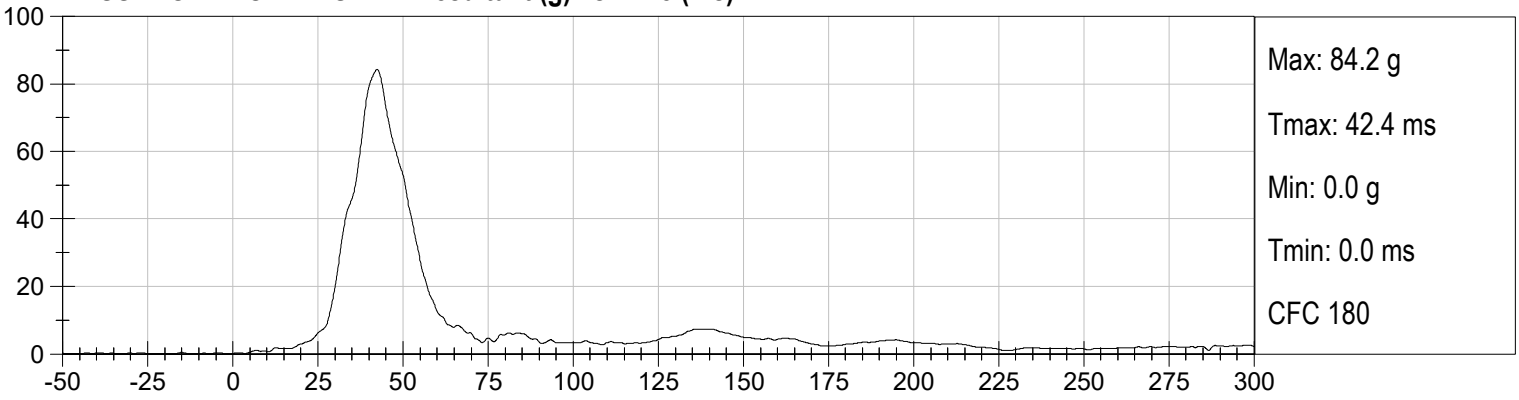
PASSENGER LOWER SPINE Y (g) vs Time (ms)



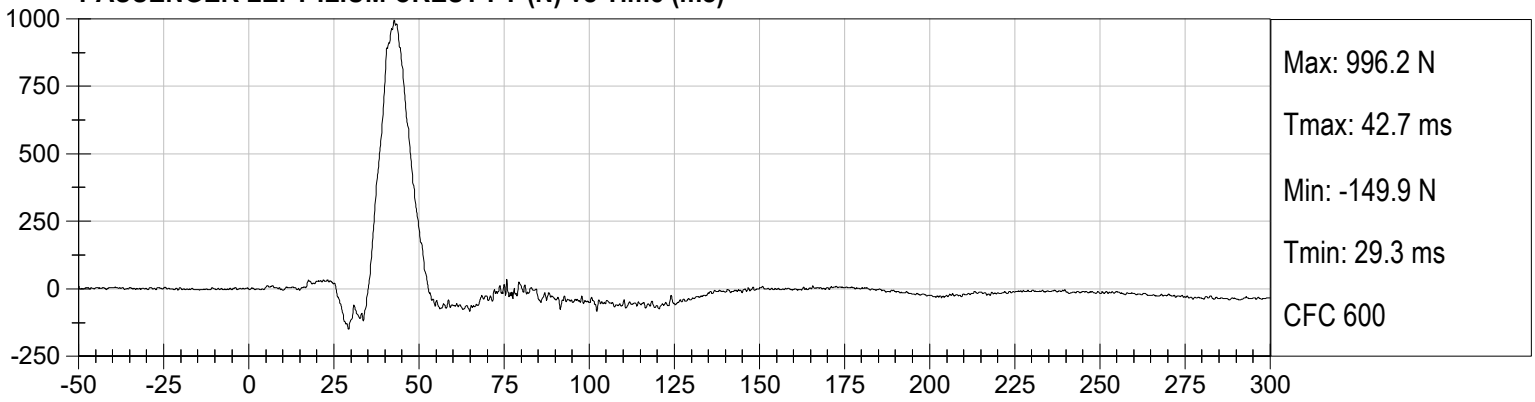
PASSENGER LOWER SPINE Z (g) vs Time (ms)



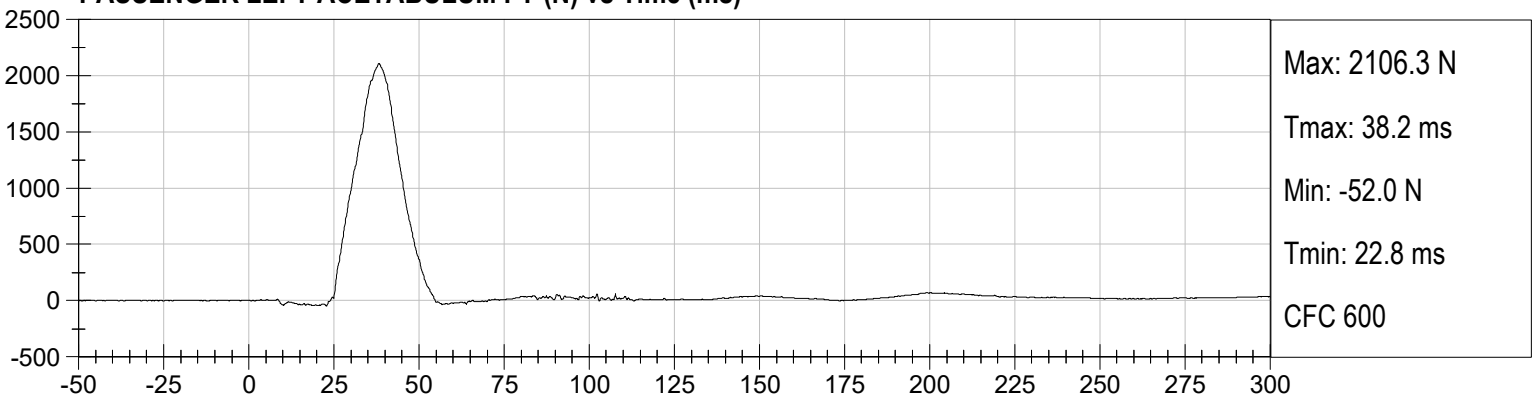
PASSENGER LOWER SPINE Resultant (g) vs Time (ms)



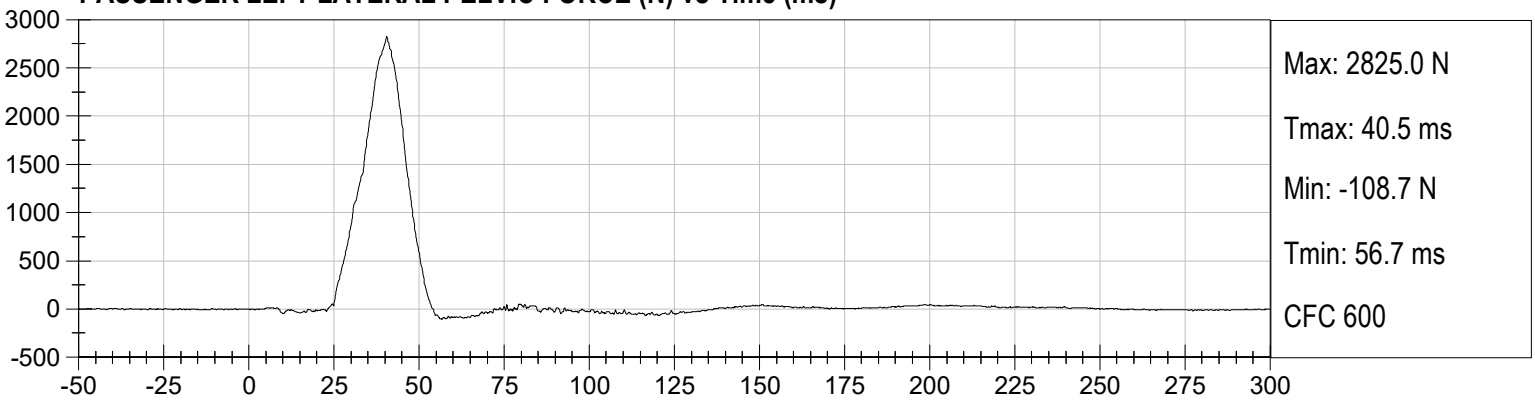
PASSENGER LEFT ILIUM CREST FY (N) vs Time (ms)



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

CALIBRATION TEST RESULTS

PRE-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

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: F032 **Test ID:** D193931

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Peak Resultant Acceleration	G's	125 to 155	137	Pass
Peak Longitudinal Acceleration	G's	<= +/- 15.0	7.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

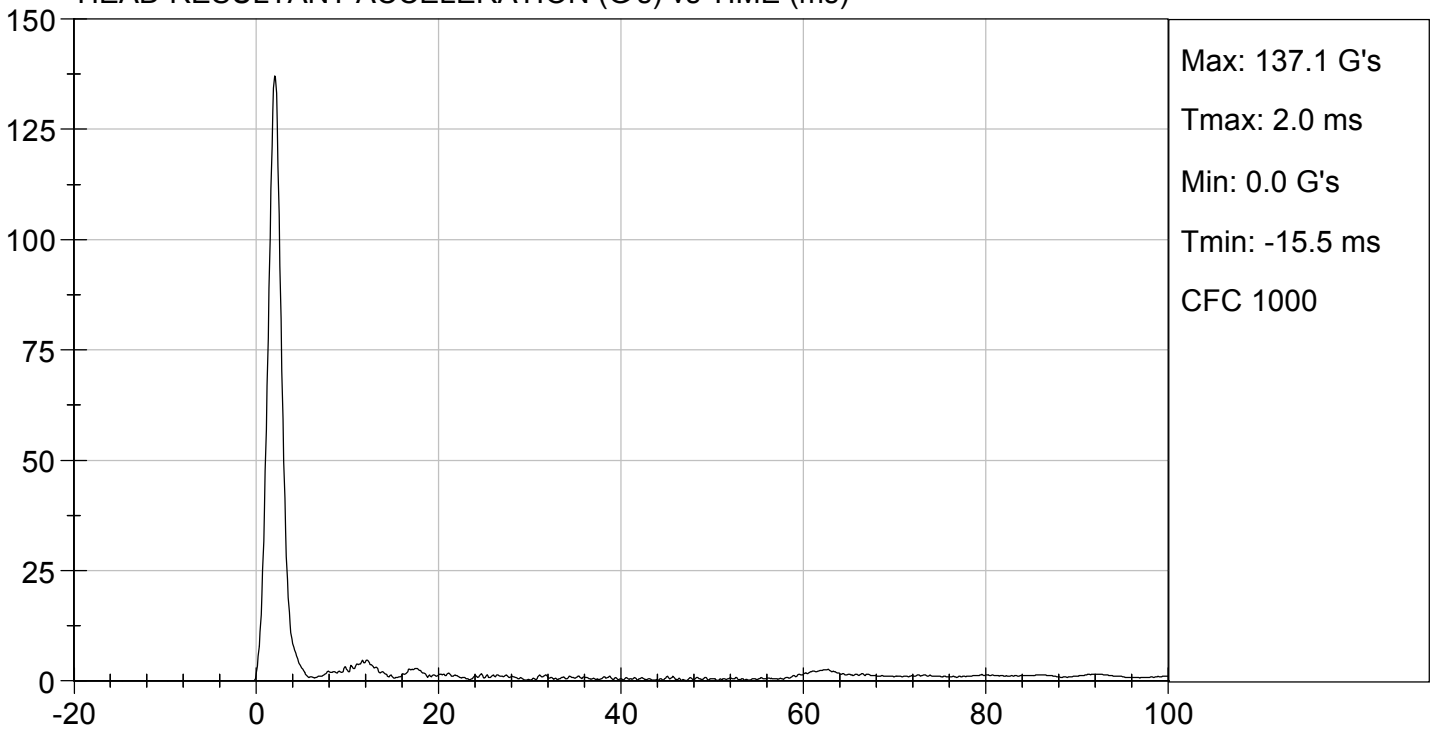
12/18/2019
Test Date

Approved By

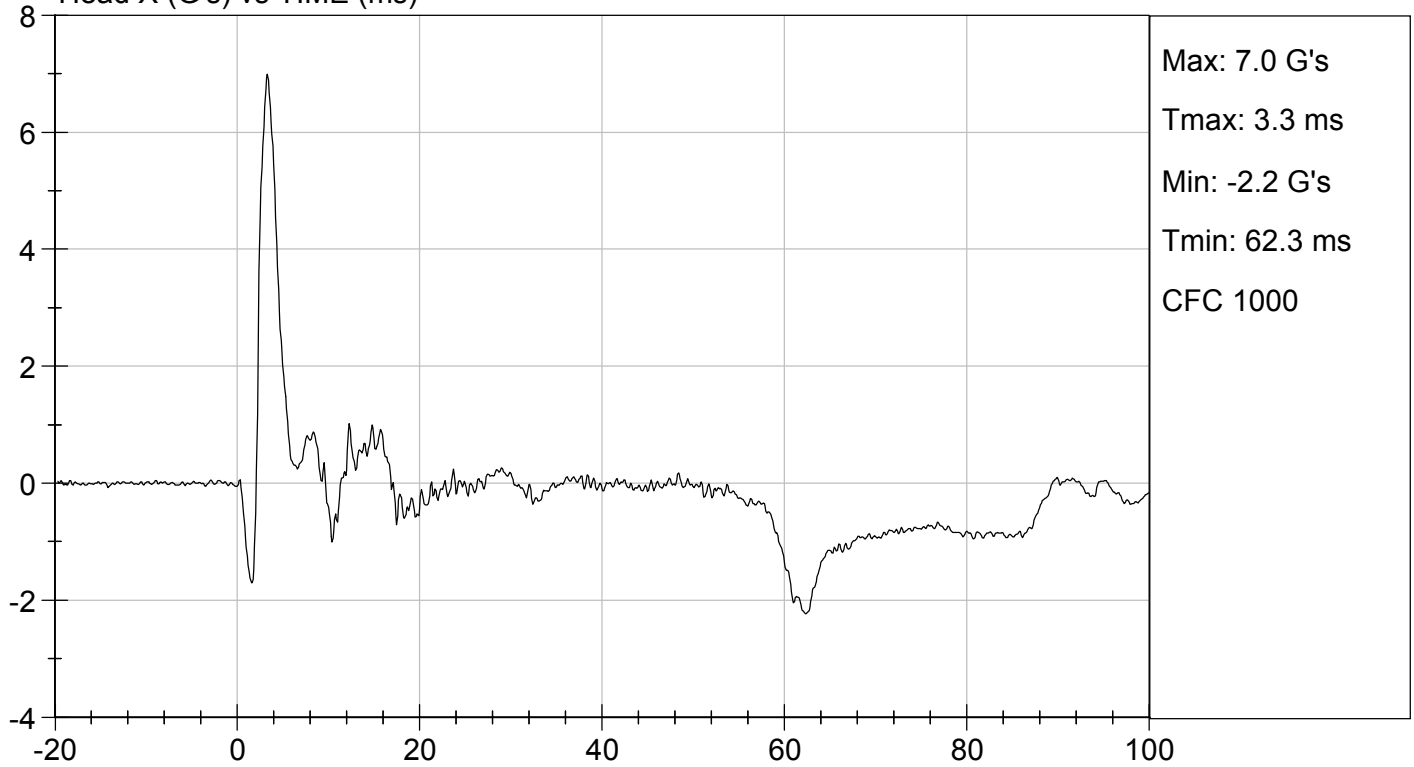
TEST DESC: HEAD DROP

TEST DATE: 12/18/2019
TEST #: D193931

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



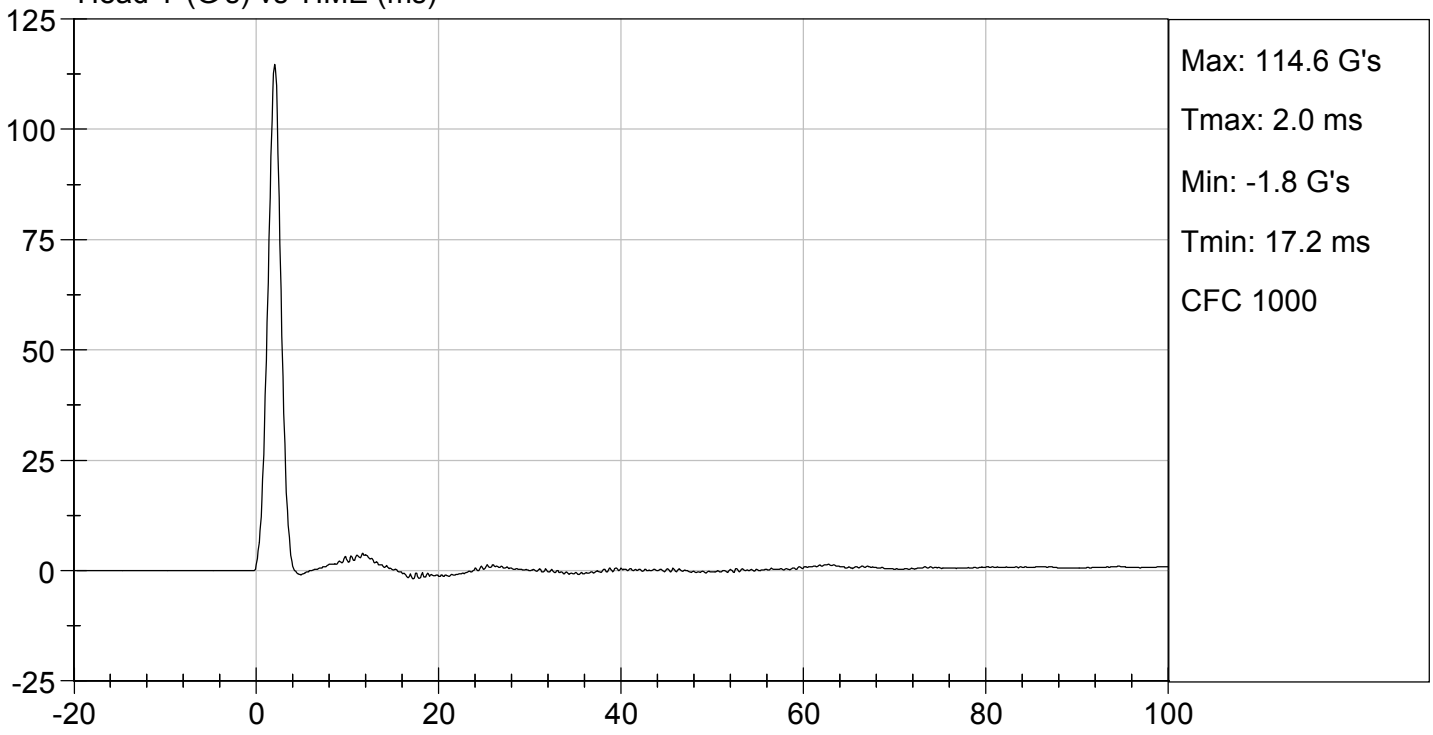
Head X (G's) vs TIME (ms)



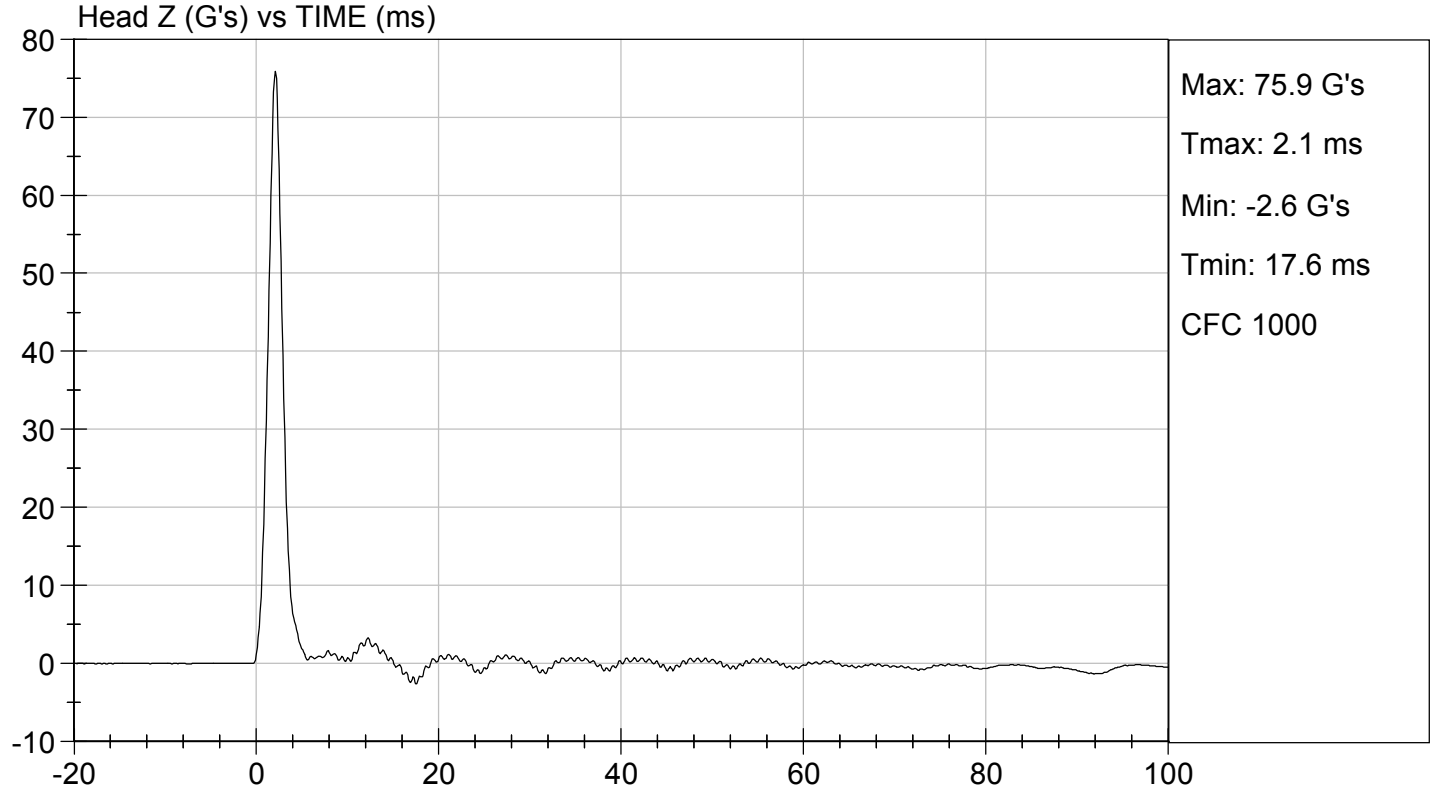
TEST DESC: HEAD DROP

TEST DATE: 12/18/2019
TEST #: D193931

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



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



MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193932

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity		%	10 to 70	18	Pass
Pendulum Speed		m/s	3.30 to 3.50	3.49	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	0.01	Pass
	3 ms	m/s	-0.25 to -0.375	-0.35	Pass
	14 ms	m/s	-3.20 to -3.70	-3.57	Pass
	17 ms	m/s	>= -3.70	-3.44	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	49.1	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	54.8	Pass
Head Rotation Decay Time to 0 Degree		ms	53.0 to 88.0	63.0	Pass
			Overall Results		Pass

Laboratory Technician

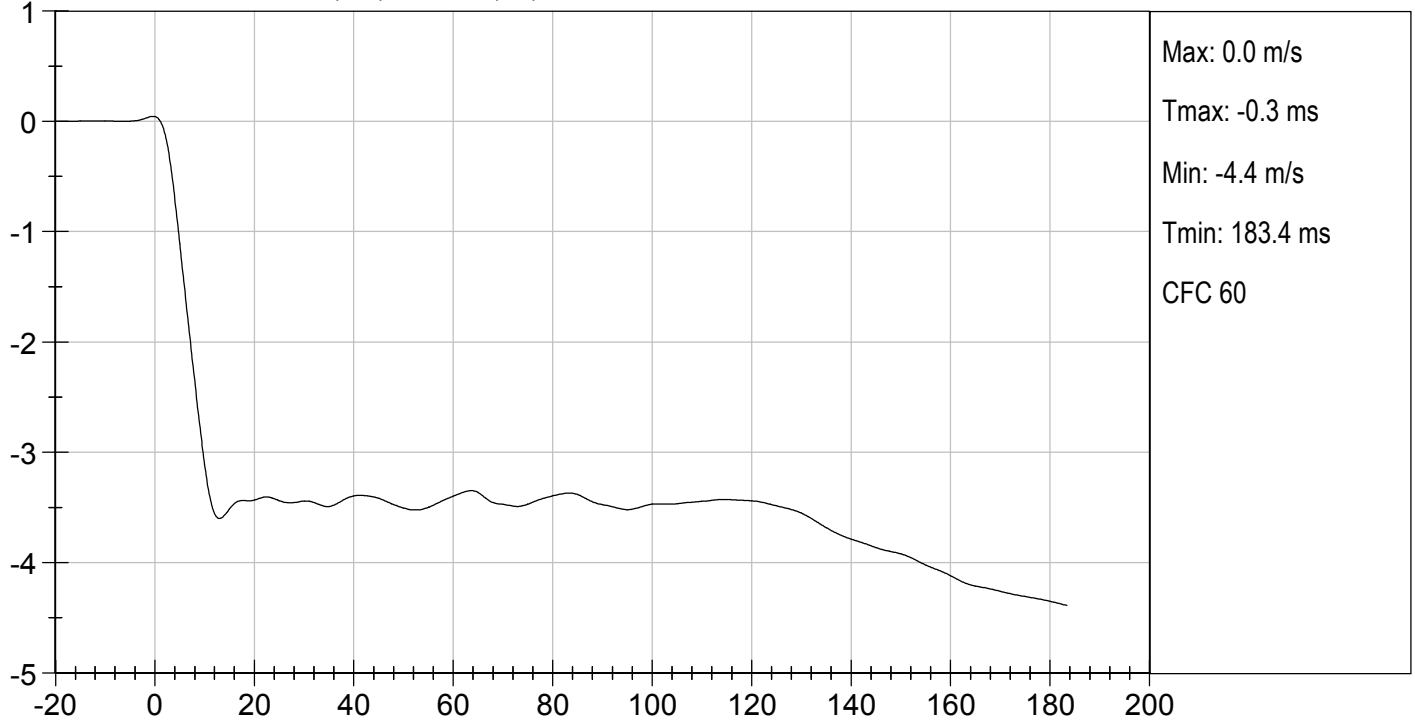
12/18/2019
Test Date

Approved By

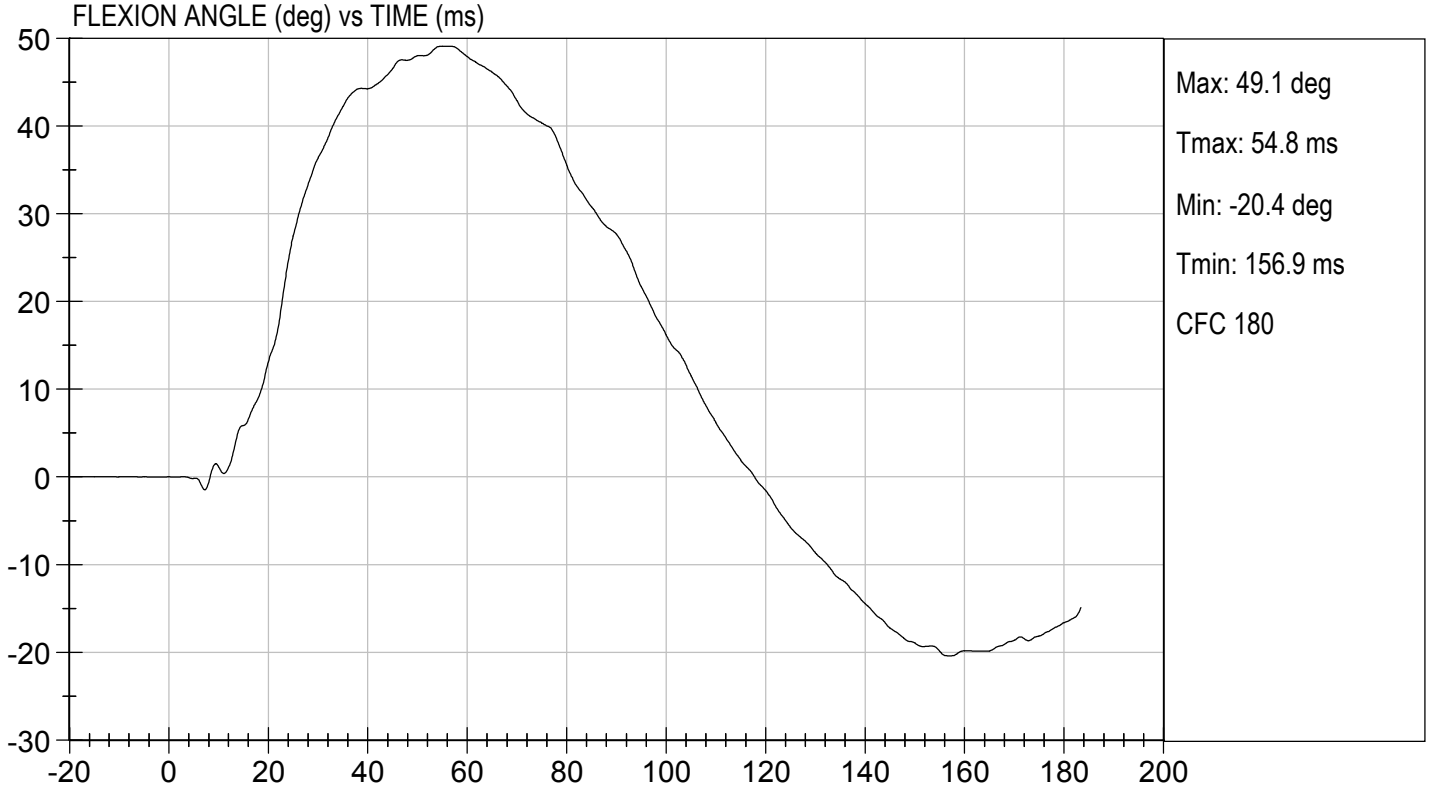
TEST DESC: NECK BENDING
VELOCITY: 11.44 ft/s, 3.49 m/s

TEST DATE: 12/18/2019
TEST #: D193932

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



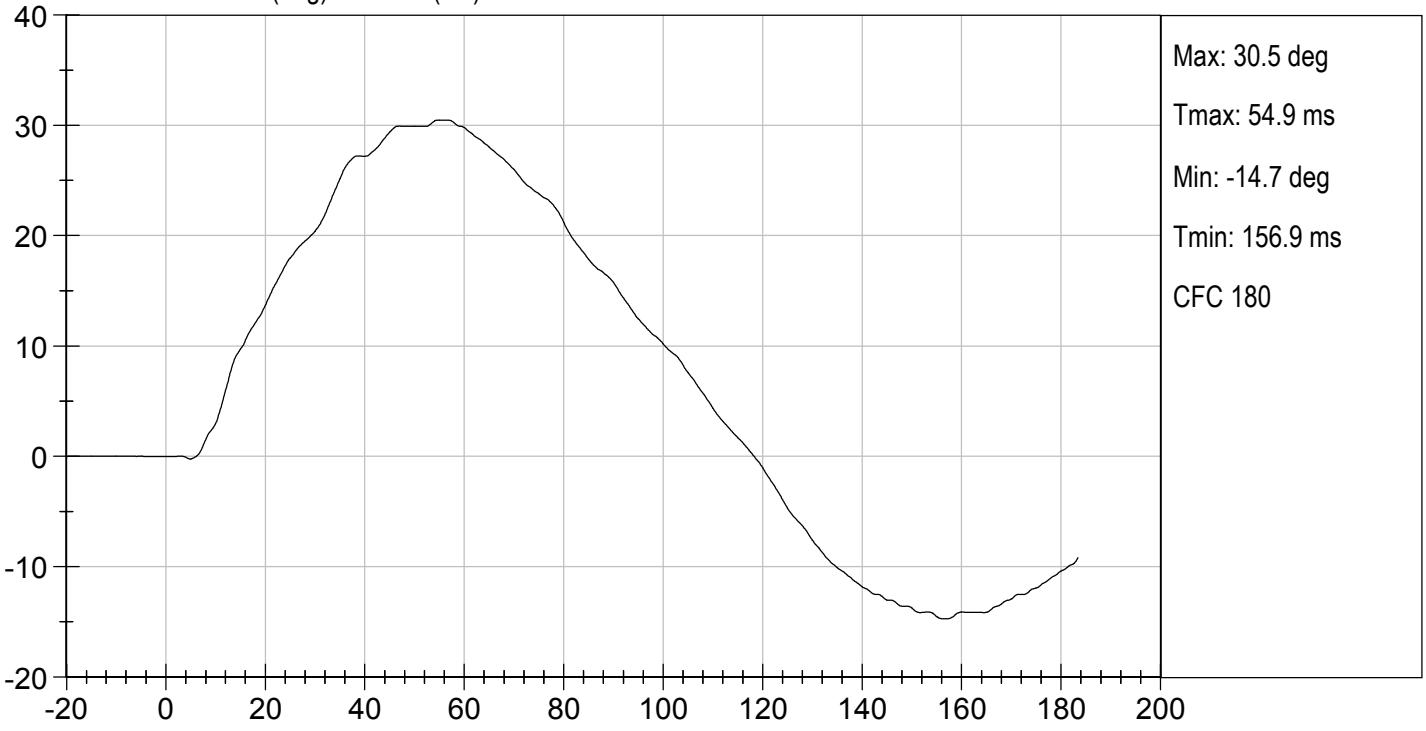
FLEXION ANGLE (deg) vs TIME (ms)



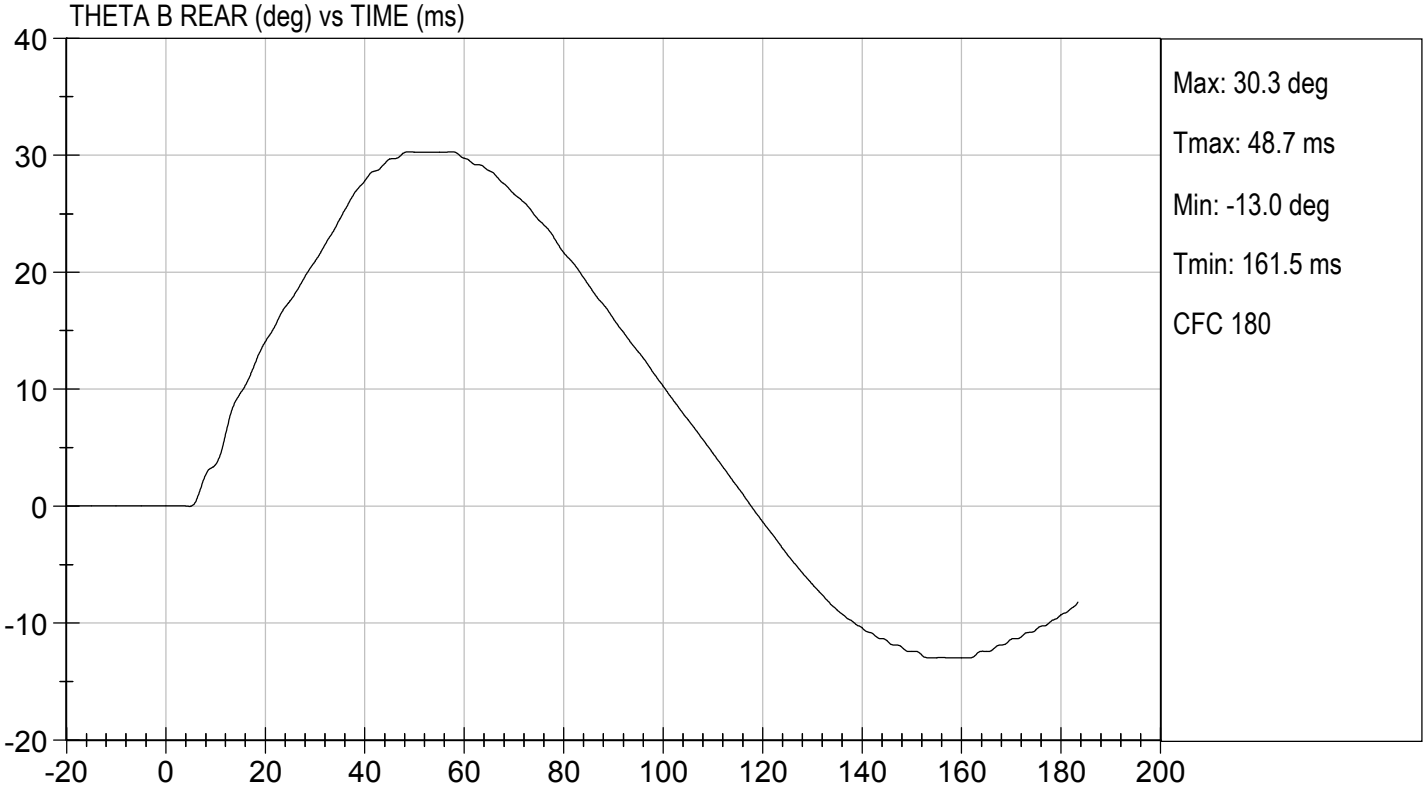
TEST DESC: NECK BENDING
VELOCITY: 11.44 ft/s, 3.49 m/s

TEST DATE: 12/18/2019
TEST #: D193932

THETA A FRONT (deg) vs TIME (ms)

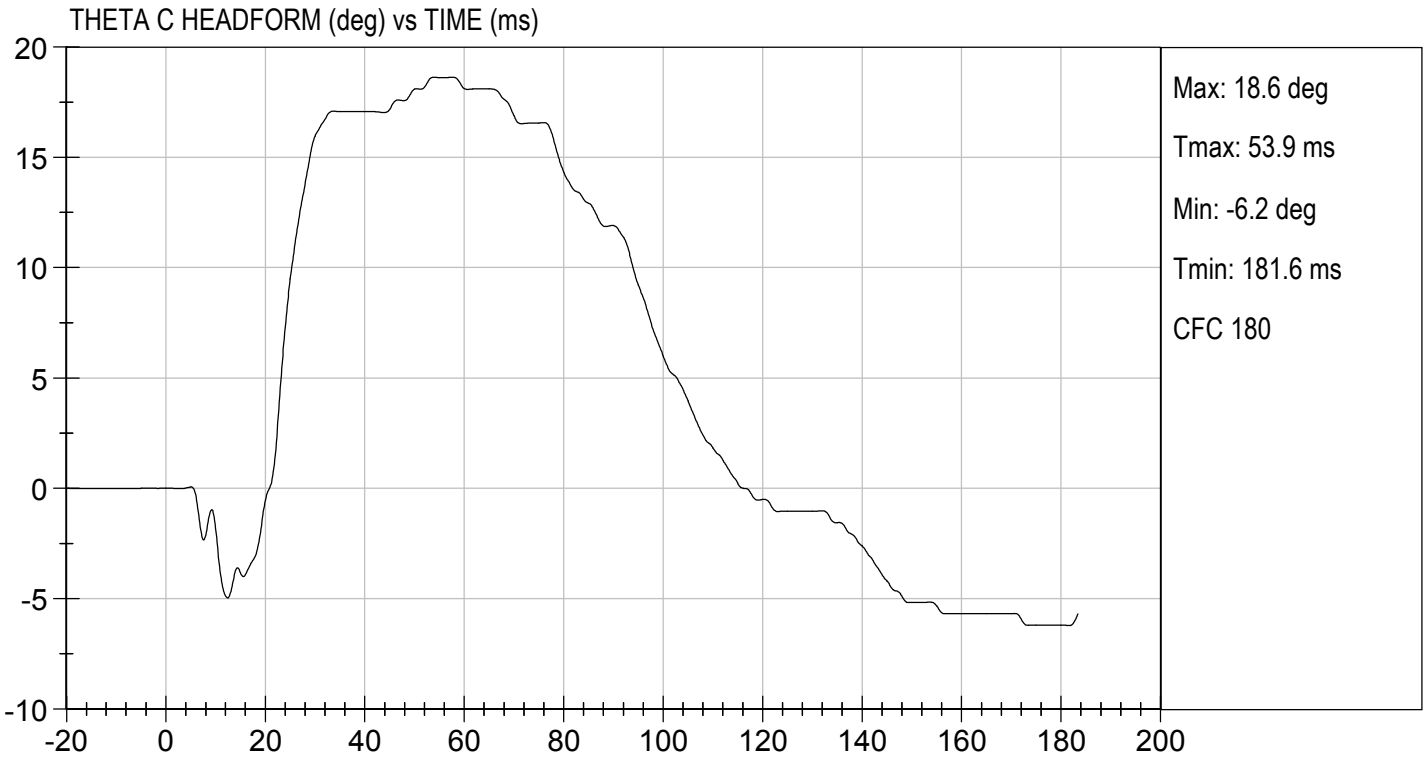


THETA B REAR (deg) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 11.44 ft/s, 3.49 m/s

TEST DATE: 12/18/2019
TEST #: D193932



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193933

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Pendulum Speed	m/s	4.20 to 4.40	4.2	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	9.0	Pass
		Overall Test Results		Pass

Laboratory Technician

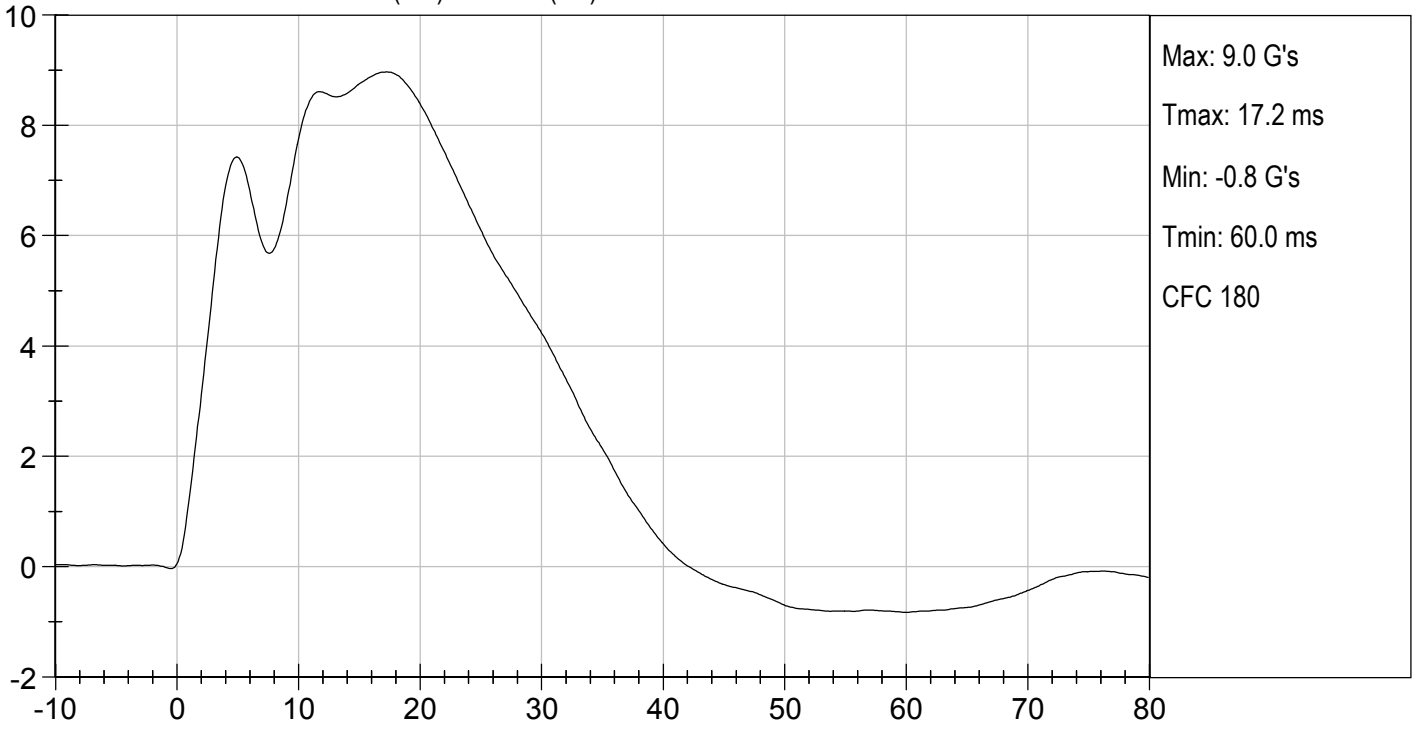
12/17/2019
Test Date

Approved By

TEST DESC: SHOULDER IMPACT
VELOCITY: 13.77 ft/s, 4.2 m/s

TEST DATE: 12/17/2019
TEST #: D193933

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



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193934

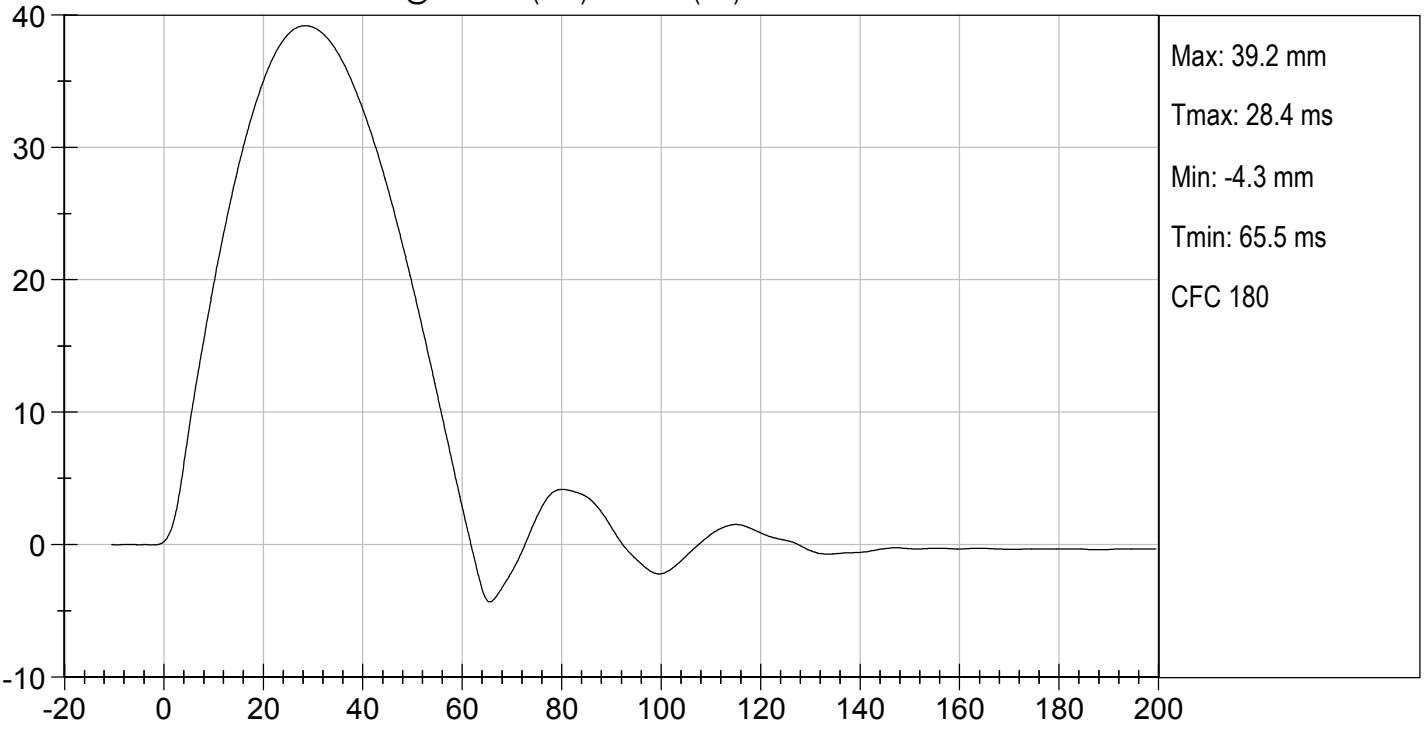
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Displacement at 459 mm	mm	36.0 to 40.0	39.2	Pass
Displacement at 815 mm	mm	46.0 to 51.0	49.5	Pass
		Overall Test Results		Pass

Laboratory Technician

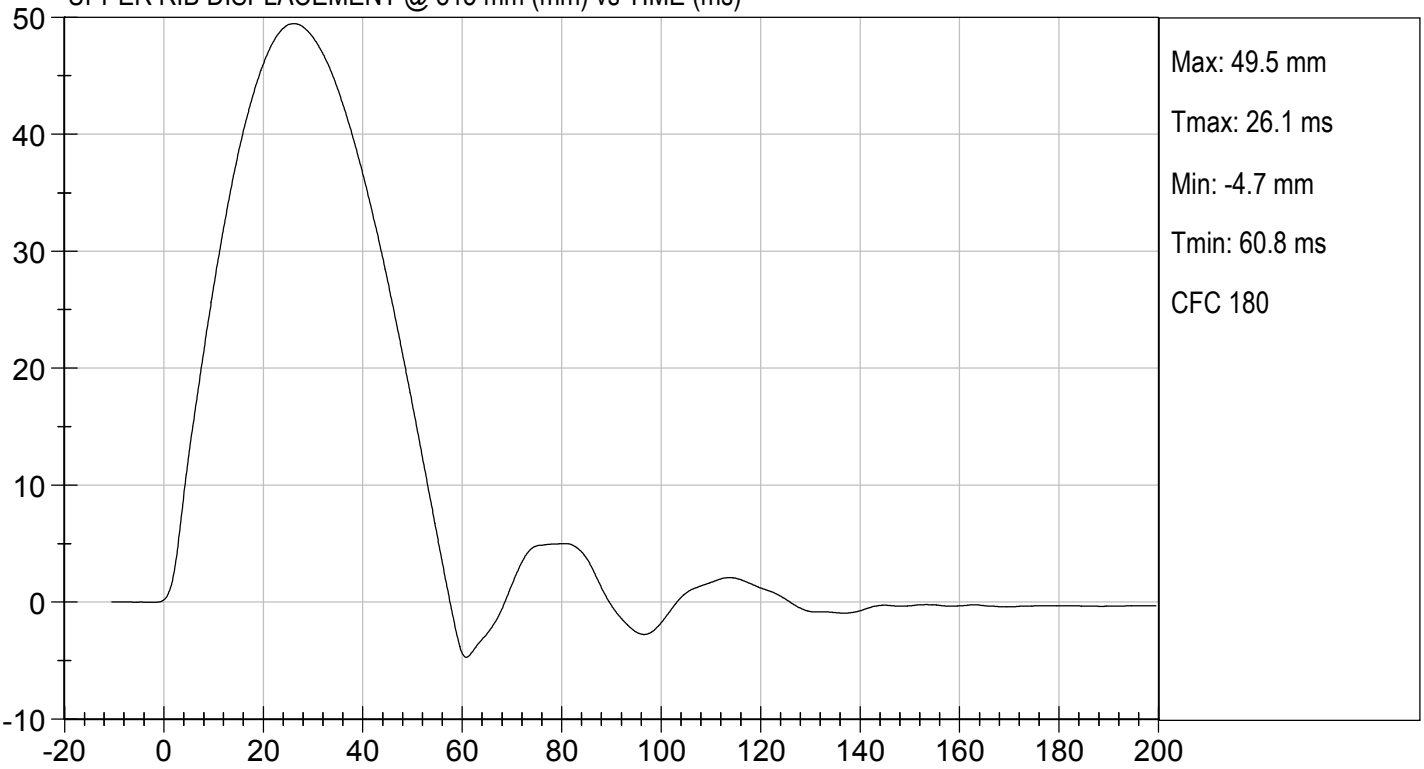
12/17/2019
Test Date

Approved By

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



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



MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193935

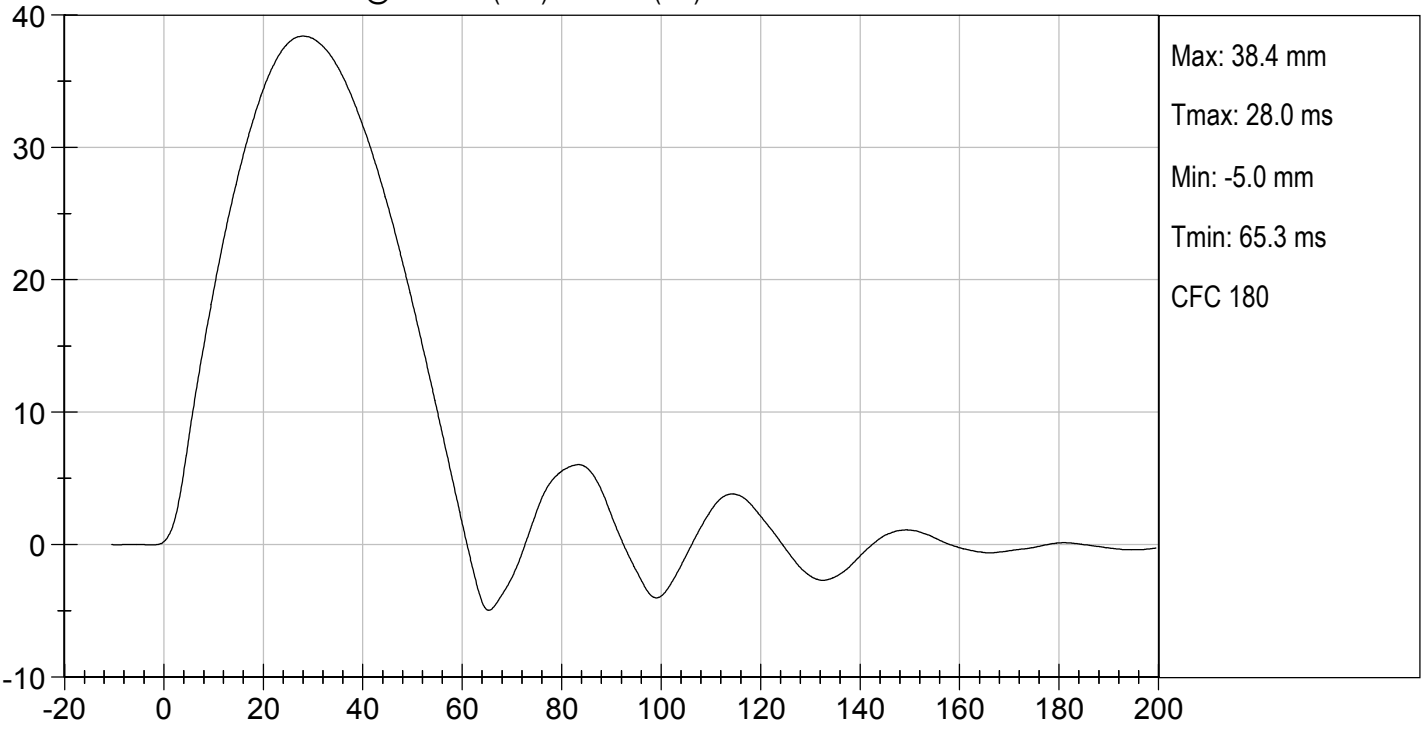
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Displacement at 459 mm	mm	36.0 to 40.0	38.4	Pass
Displacement at 815 mm	mm	46.0 to 51.0	47.0	Pass
		Overall Test Results		Pass

Laboratory Technician

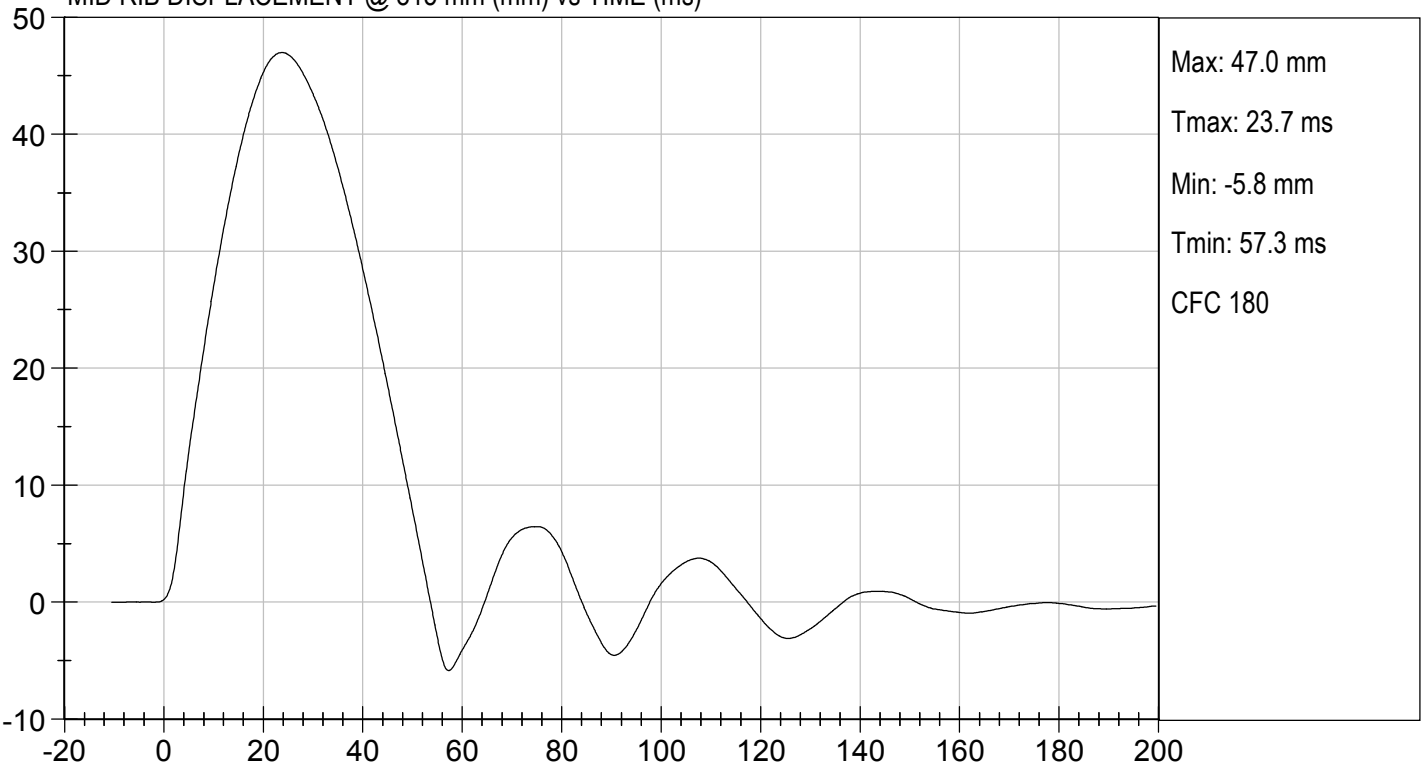
12/17/2019
Test Date

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: F032 **Test I.D:** D193936

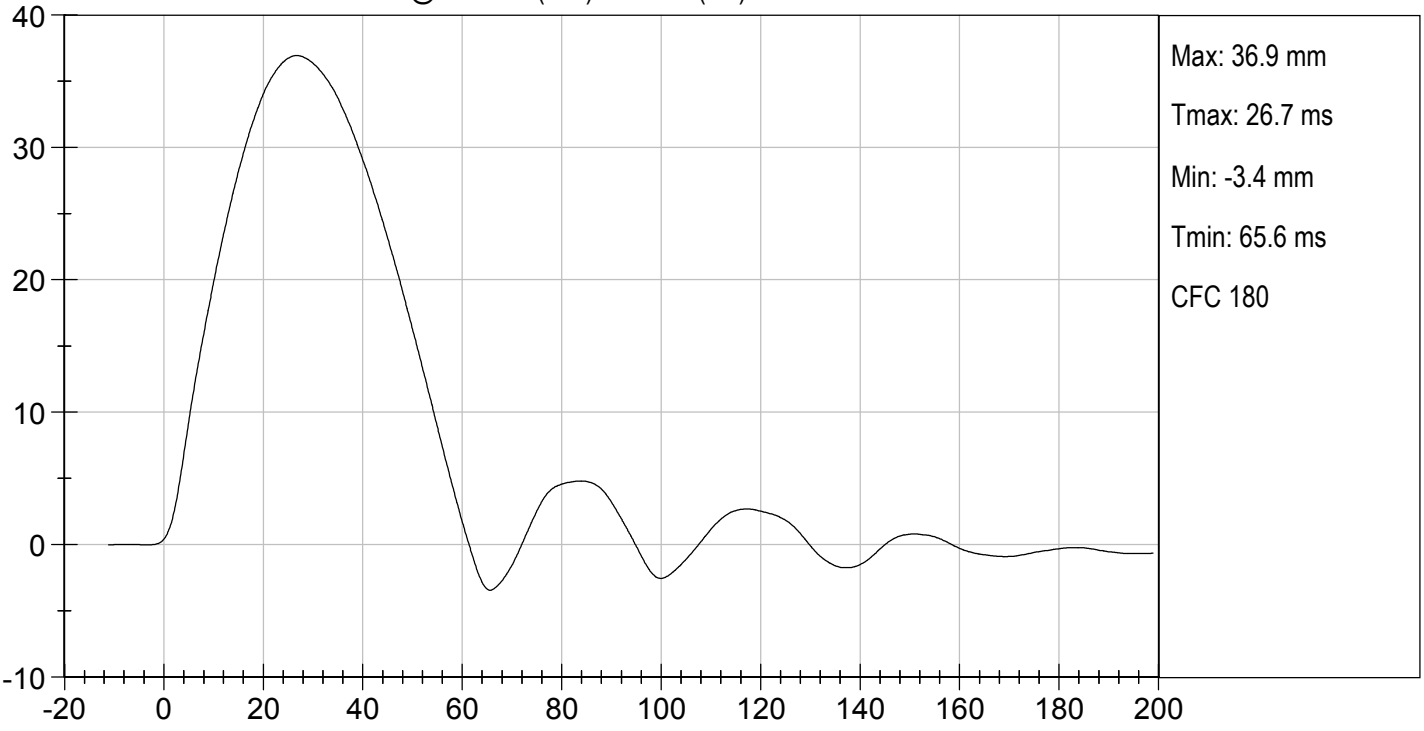
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Displacement at 459 mm	mm	36.0 to 40.0	36.9	Pass
Displacement at 815 mm	mm	46.0 to 51.0	46.3	Pass
		Overall Test Results		Pass

Laboratory Technician

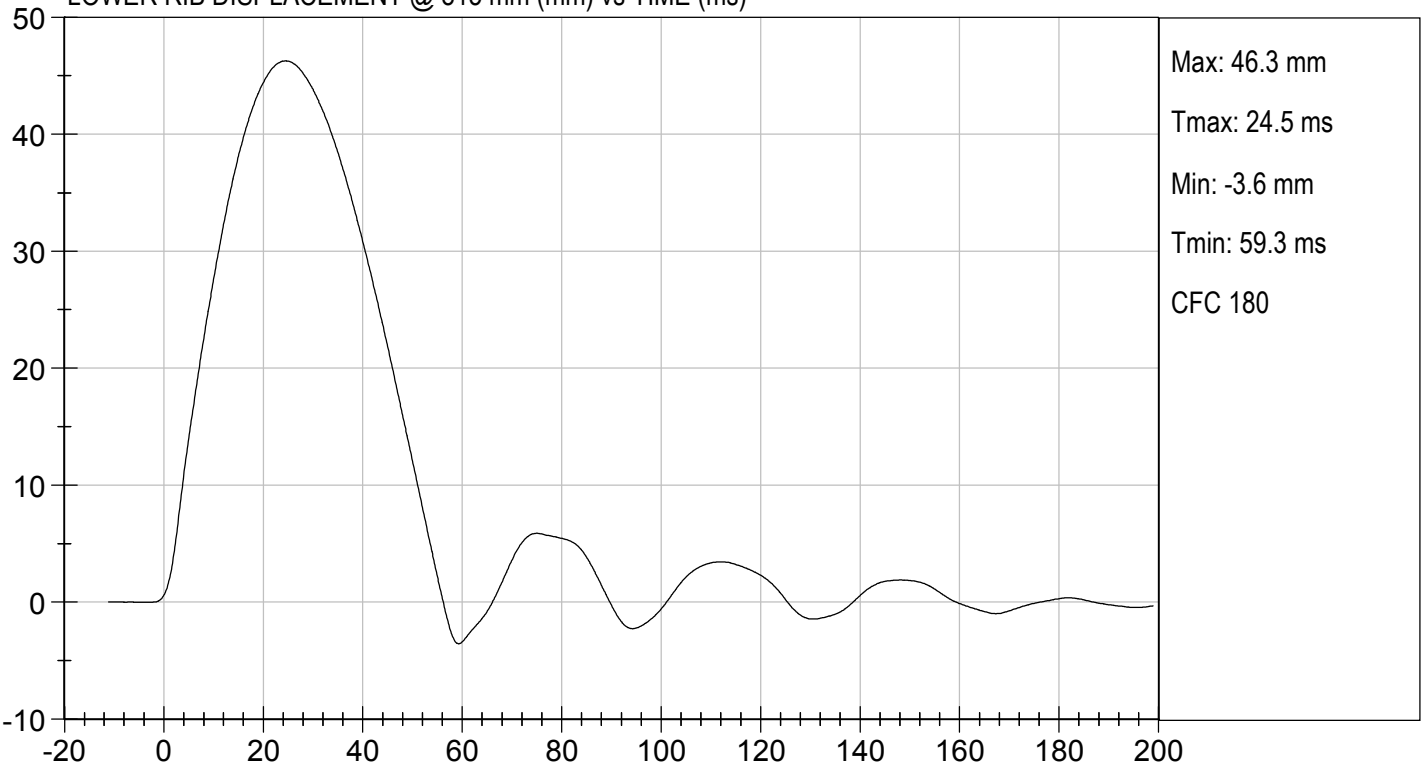
12/17/2019
Test Date

Approved By

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



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



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193937

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Speed	m/s	3.90 to 4.10	4.10	Pass
Maximum Impactor Force	N	4000 to 4800	4207	Pass
Time of Maximum Impactor Force	ms	10.6 to 13.0	11.2	Pass
Maximum Total Abdomen Force	N	2200 to 2700	2434	Pass
Time of Maximum Abdomen Force	ms	10.0 to 12.3	10.9	Pass
		Overall Test Results		Pass

Laboratory Technician

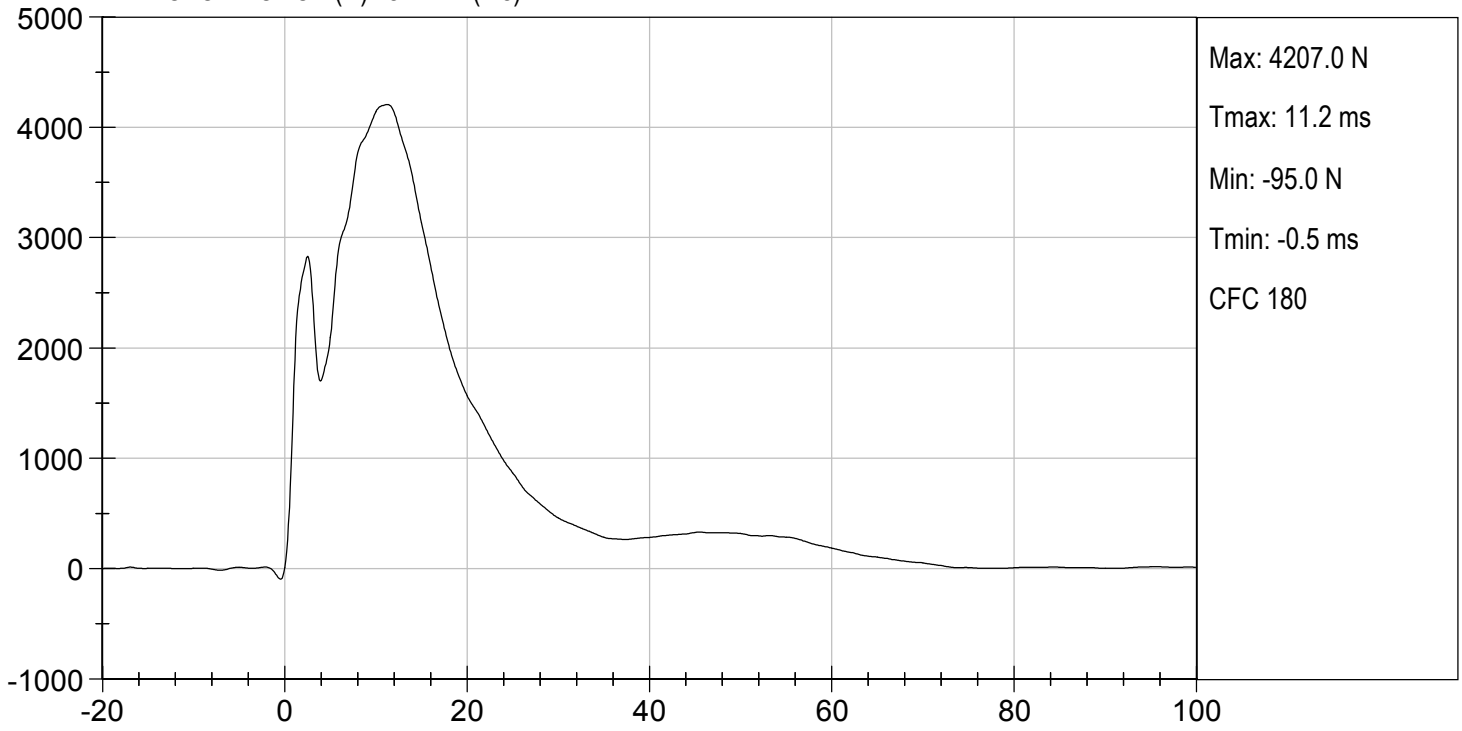
12/17/2019
Test Date

Approved By

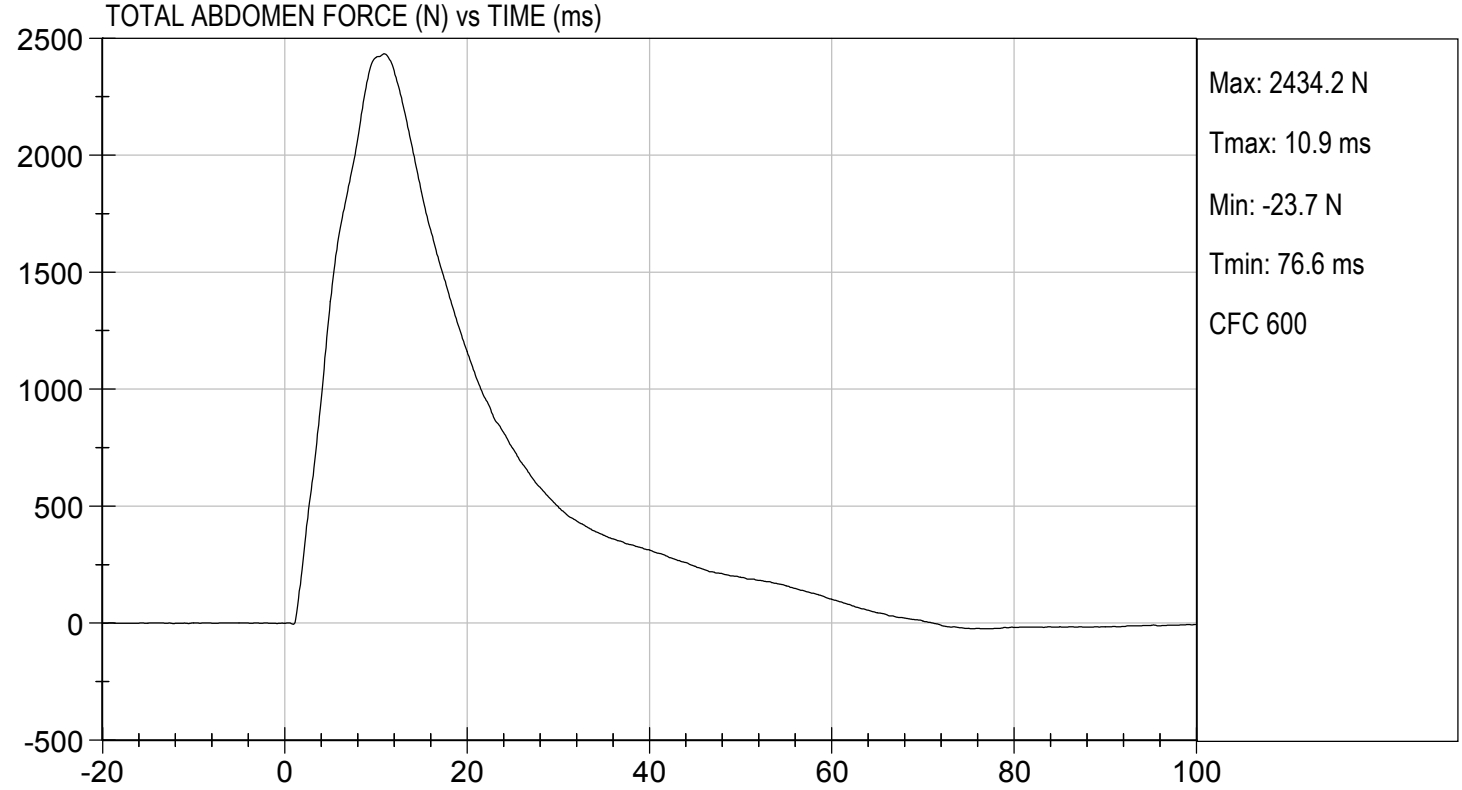
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 12/17/2019
TEST #: D193937

IMPACTOR FORCE (N) vs TIME (ms)



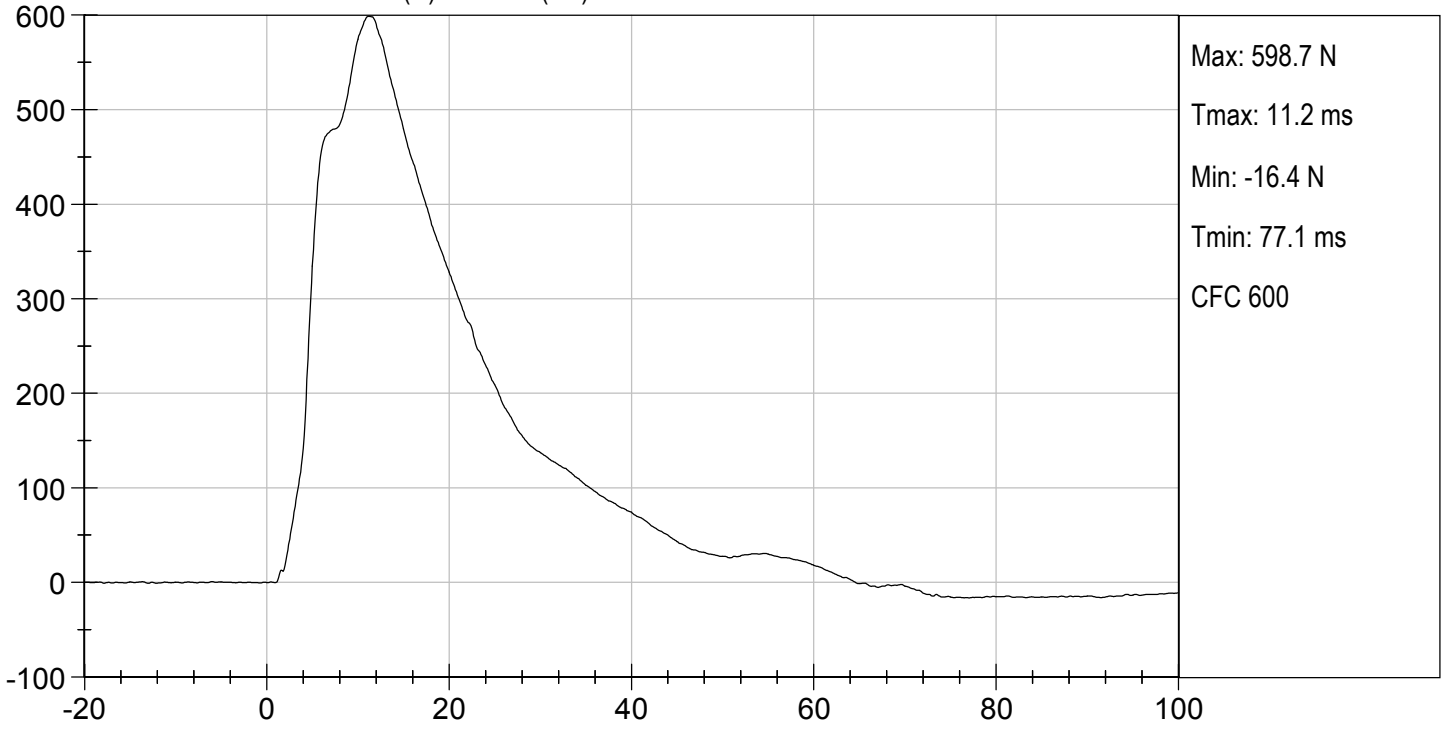
TOTAL ABDOMEN FORCE (N) vs TIME (ms)



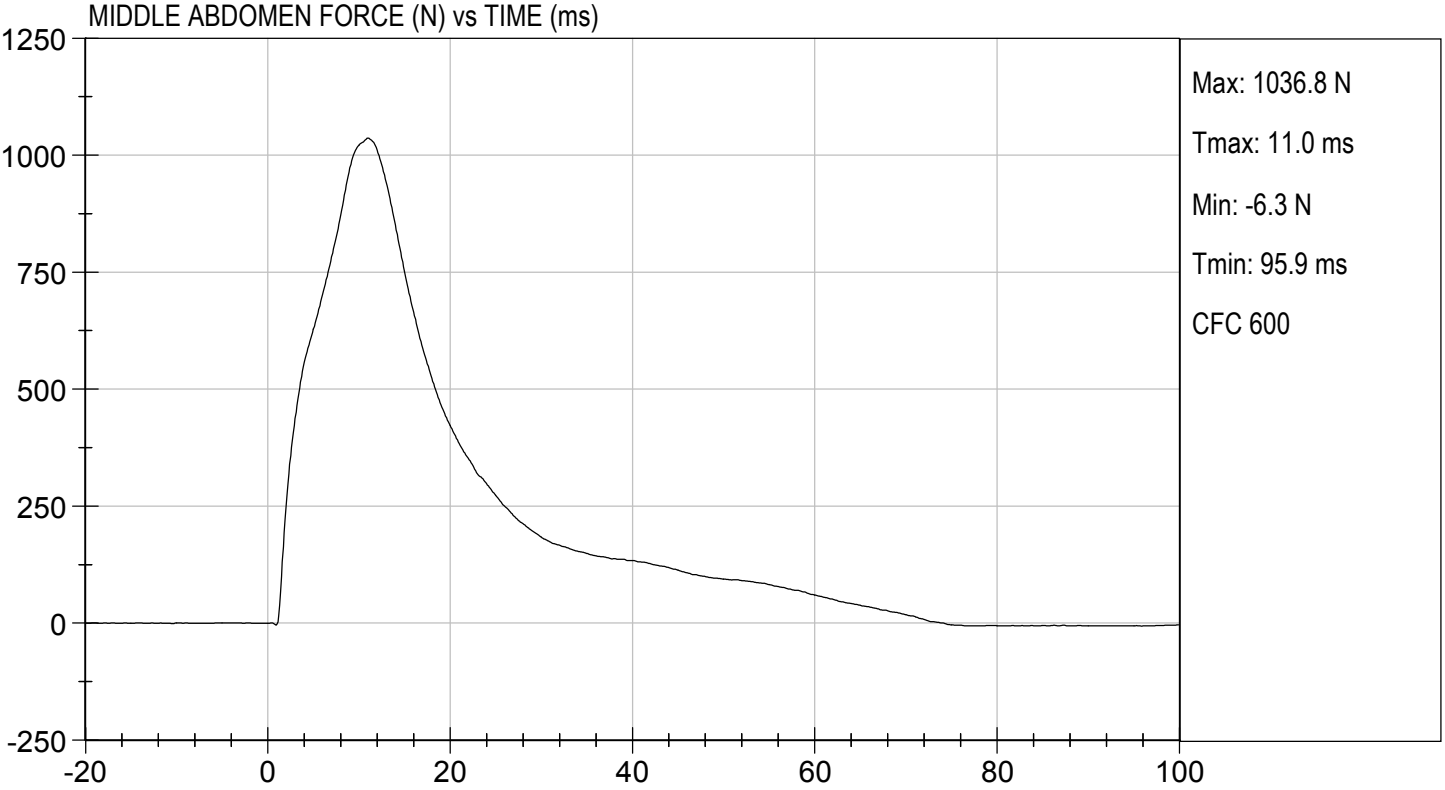
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 12/17/2019
TEST #: D193937

FRONT ABDOMEN FORCE (N) vs TIME (ms)



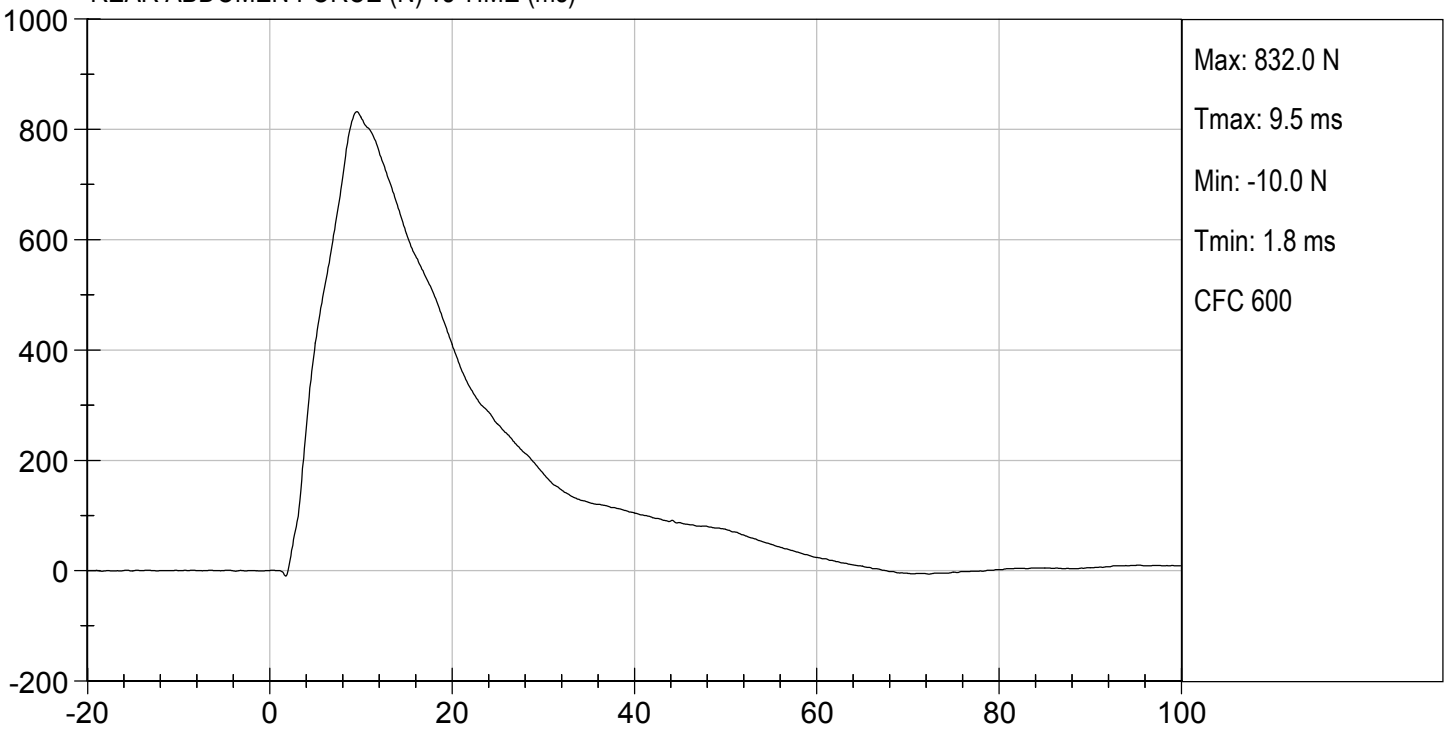
MIDDLE ABDOMEN FORCE (N) vs TIME (ms)



TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 12/17/2019
TEST #: D193937

REAR ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193938

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity		%	10 to 70	18	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	-0.421	Pass
	27 ms	m/s	-6.50 to -5.80	-5.99	Pass
	30 ms	m/s	>= -6.50	-5.85	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.1	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	43.8	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	39	Pass
			Overall Results		Pass

Laboratory Technician

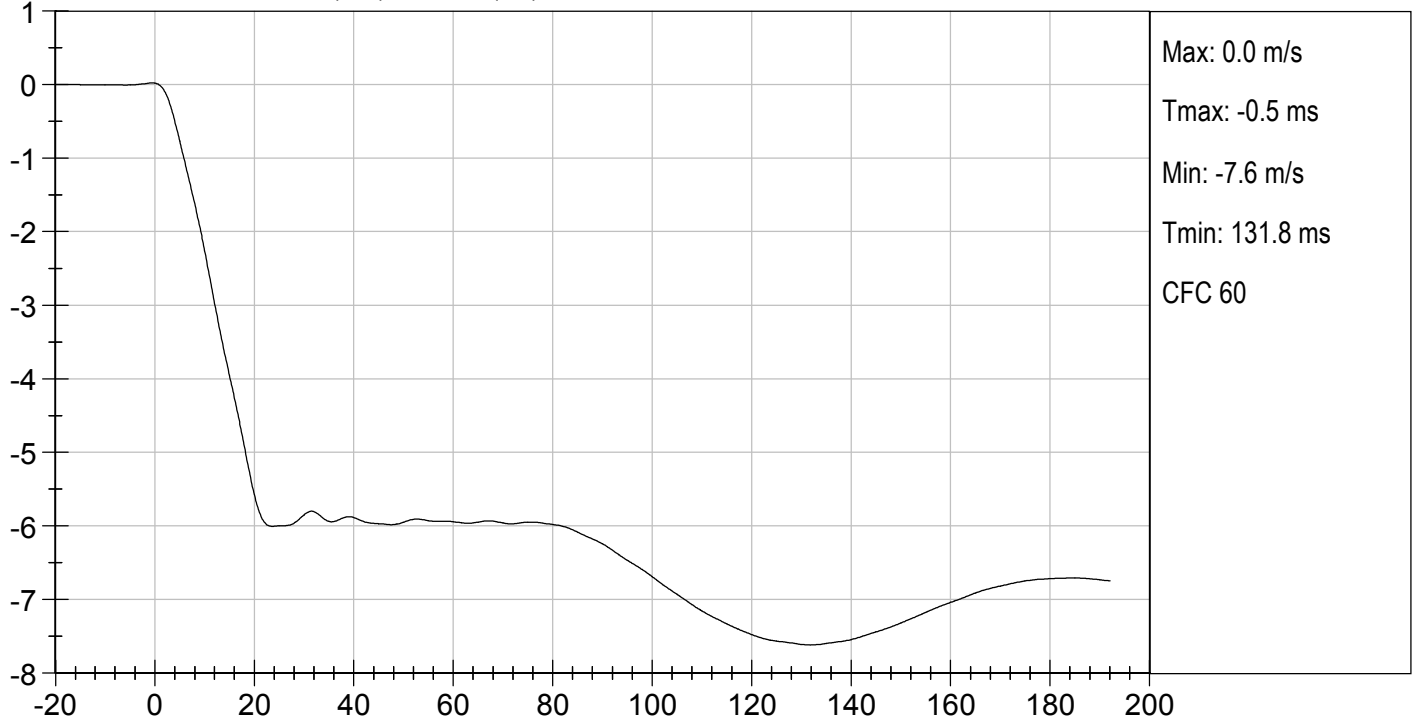
12/18/2019
Test Date

Approved By

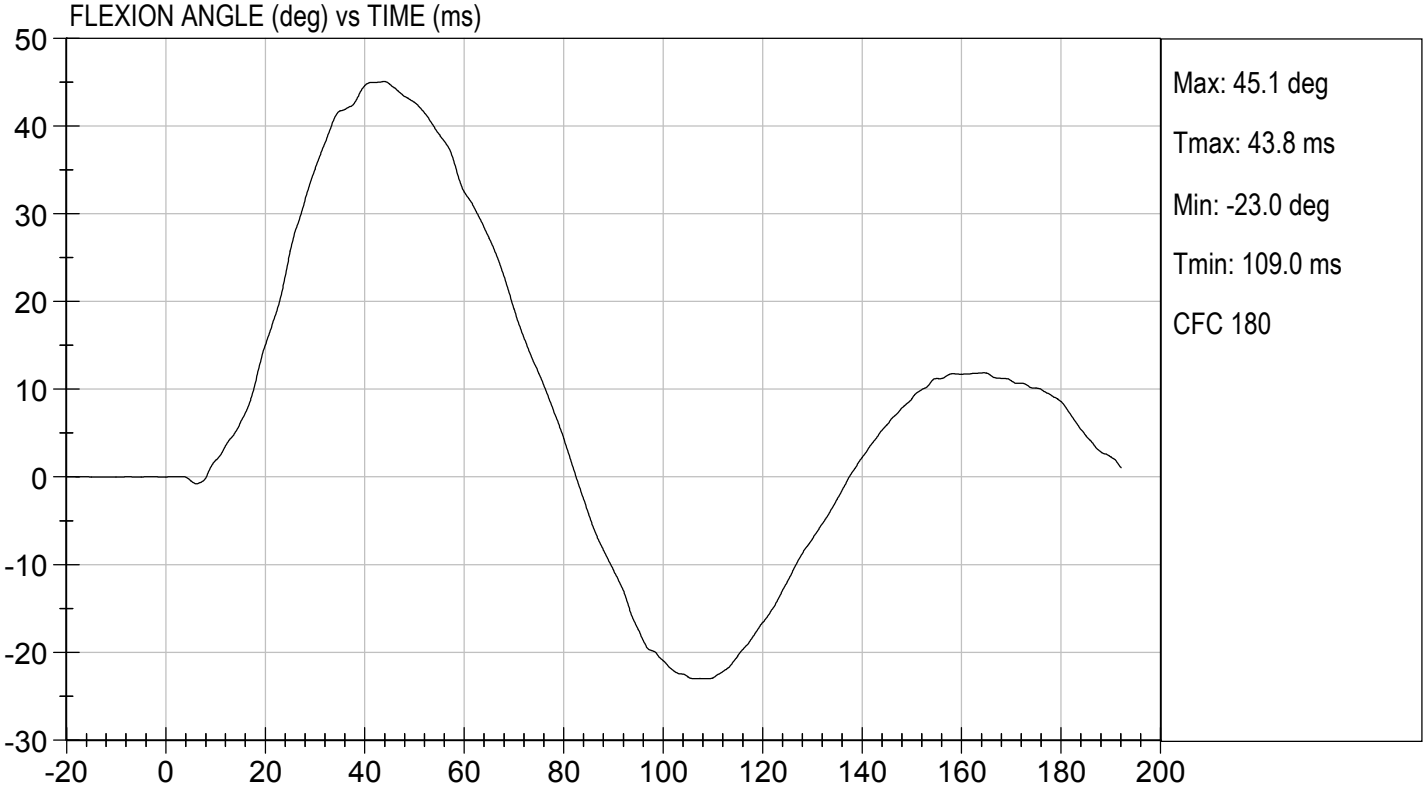
TEST DESC: LUMBAR BENDING
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 12/18/2019
TEST #: D193938

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



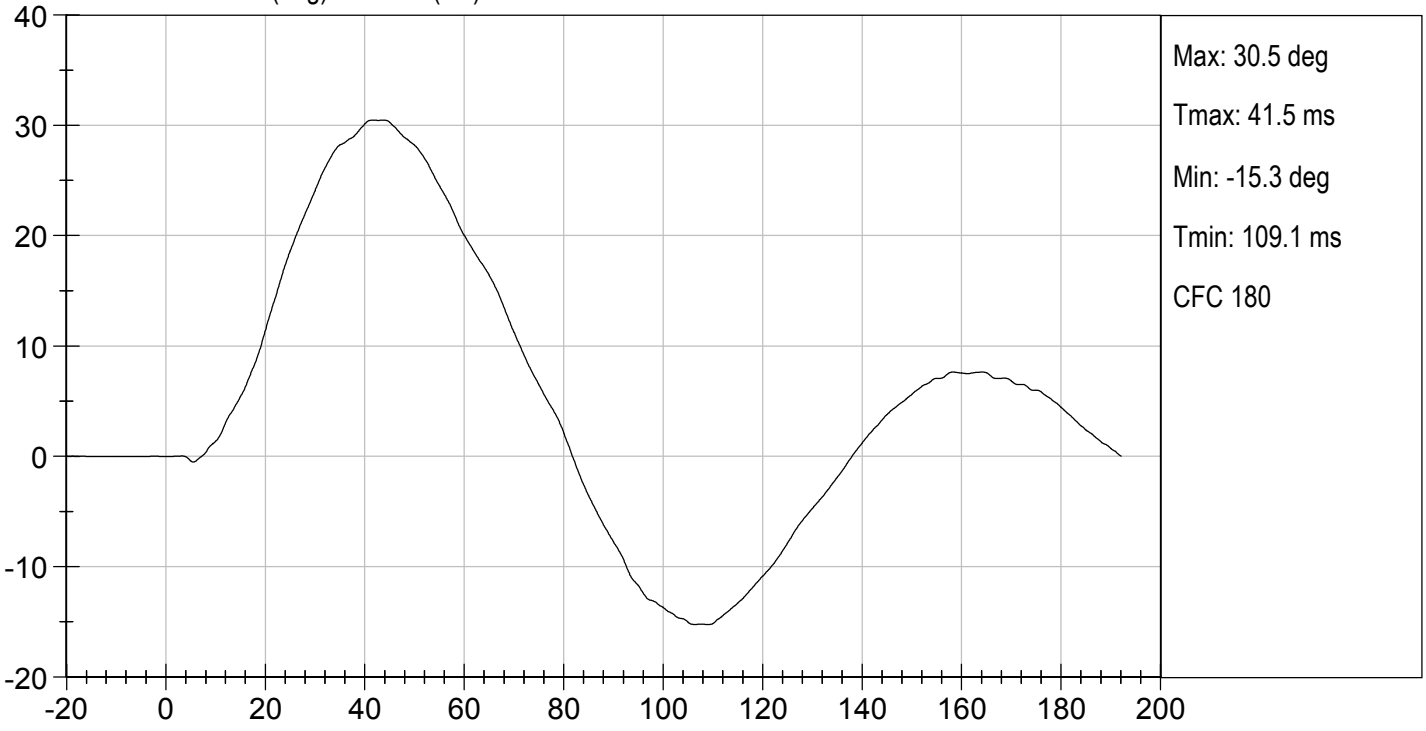
FLEXION ANGLE (deg) vs TIME (ms)



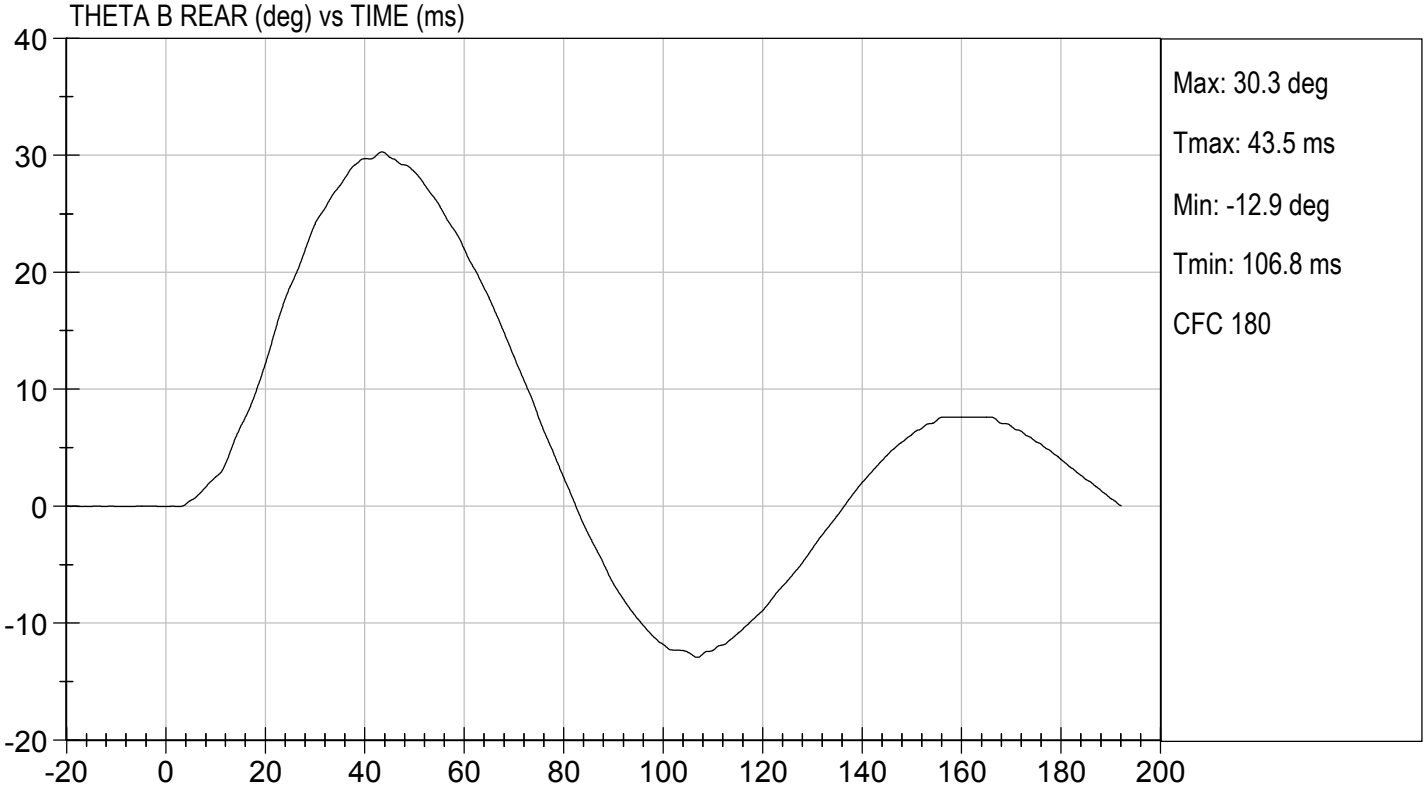
TEST DESC: LUMBAR BENDING
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 12/18/2019
TEST #: D193938

THETA A FRONT (deg) vs TIME (ms)

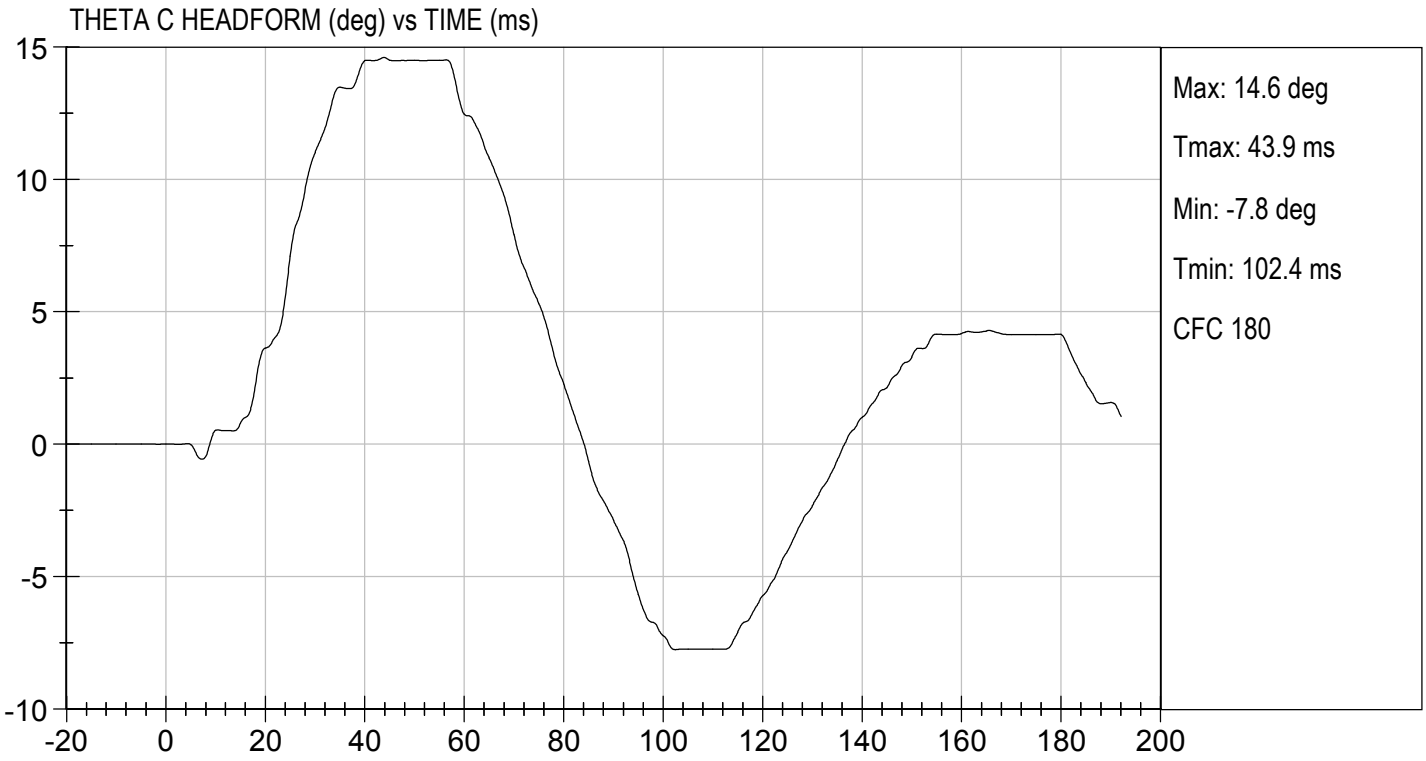


THETA B REAR (deg) vs TIME (ms)



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

TEST DATE: 12/18/2019
TEST #: D193938



MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193939

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	N	4700 to 5400	5199	Pass
Time of Maximum Impactor Force	ms	11.8 to 16.1	12.2	Pass
Maximum Pubic Force	N	1230 to 1590	1397	Pass
Time of Maximum Pubic Force	ms	12.2 to 17.0	13.4	Pass
		Overall Test Results		Pass

Laboratory Technician

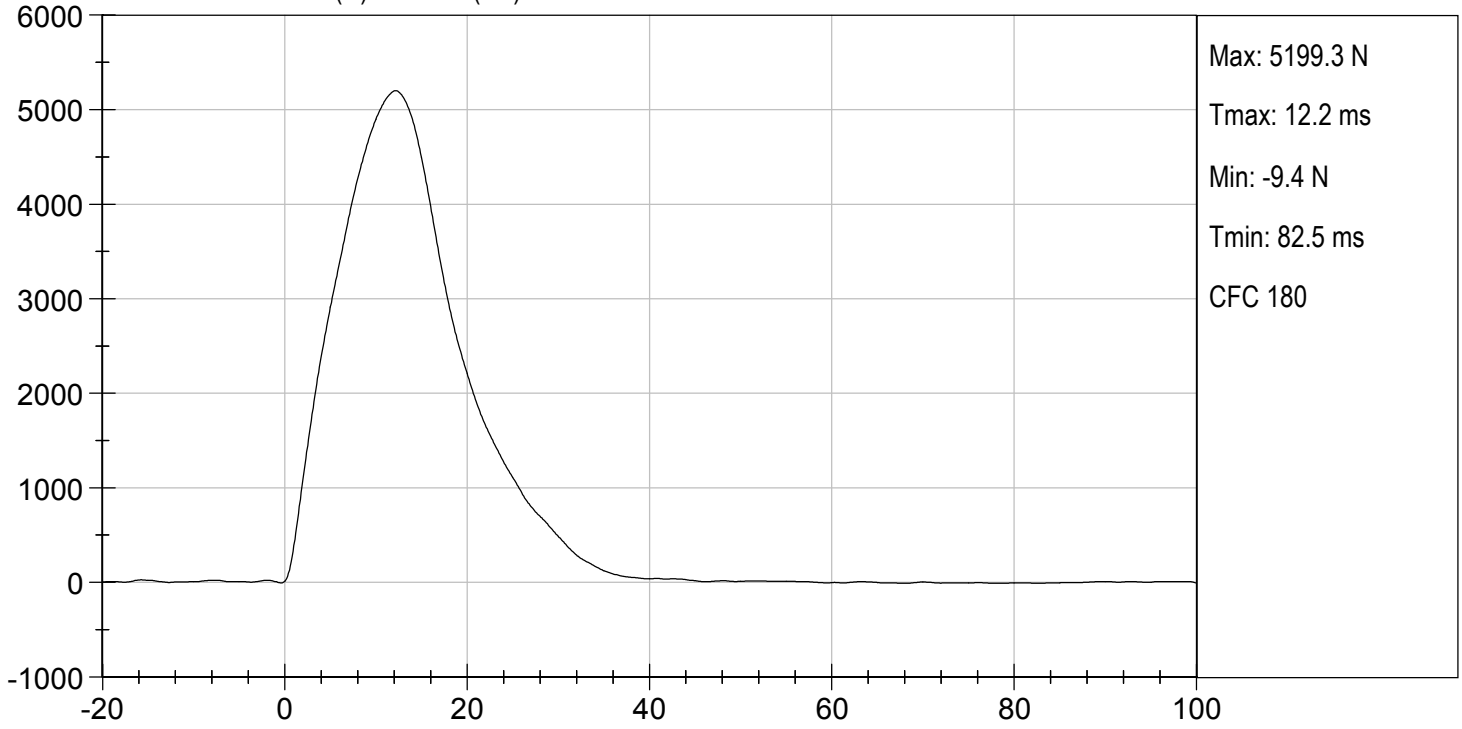
12/17/2019
Test Date

Approved By

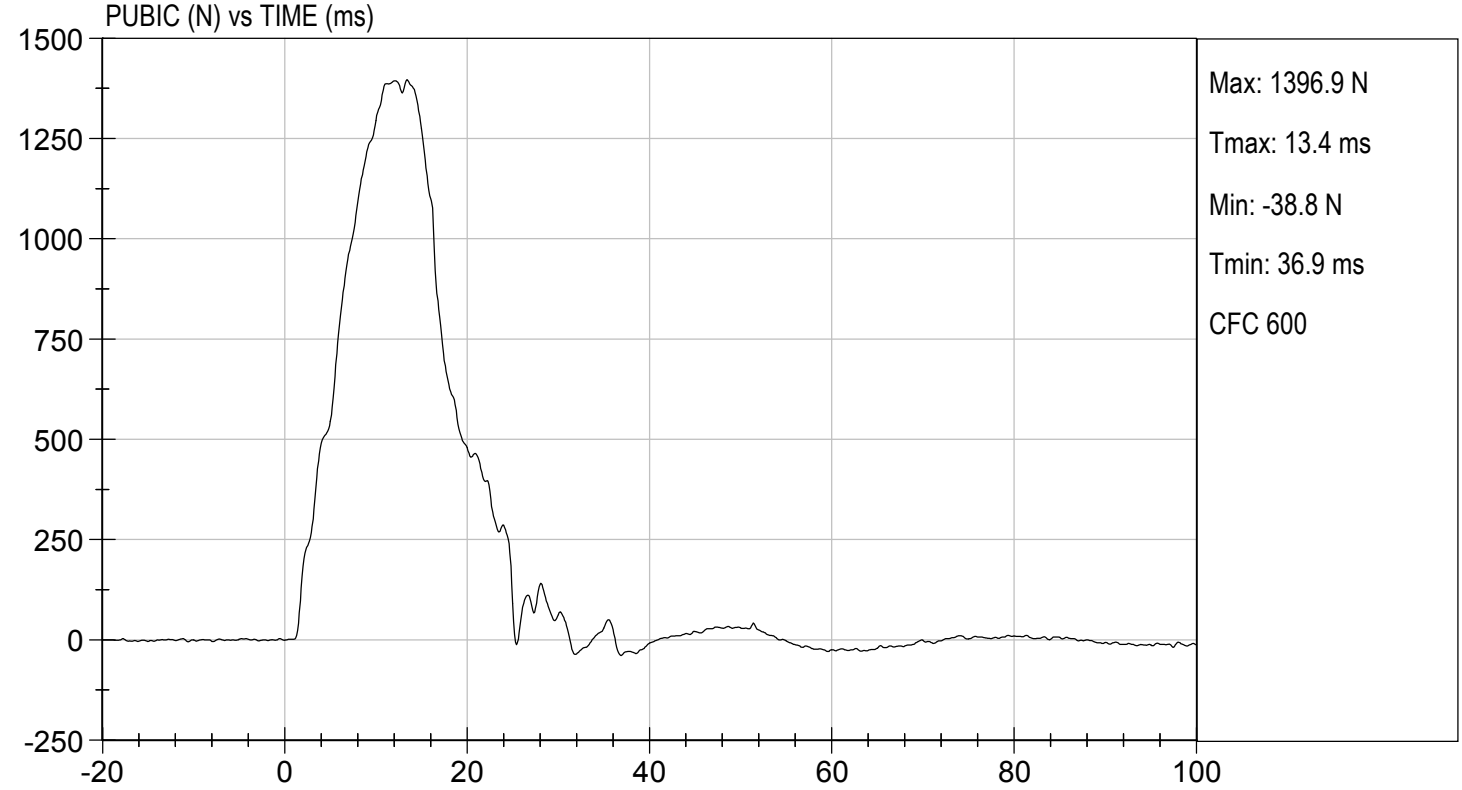
TEST DESC: PELVIS IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 12/17/2019
TEST #: D193939

IMPACTOR FORCE (N) vs TIME (ms)



PUBIC (N) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193930

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	17	Pass
Probe Speed	m/s	5.40 to 5.60	5.52	Pass
Maximum Impactor Force (after 6 ms)	N	5100 to 6200	5567	Pass
Upper Rib Displacement	mm	34.0 to 41.0	39.3	Pass
Middle Rib Displacement	mm	37.0 to 45.0	40.2	Pass
Lower Rib Displacement	mm	37.0 to 44.0	41.8	Pass
		Overall Test Results		Pass

Laboratory Technician

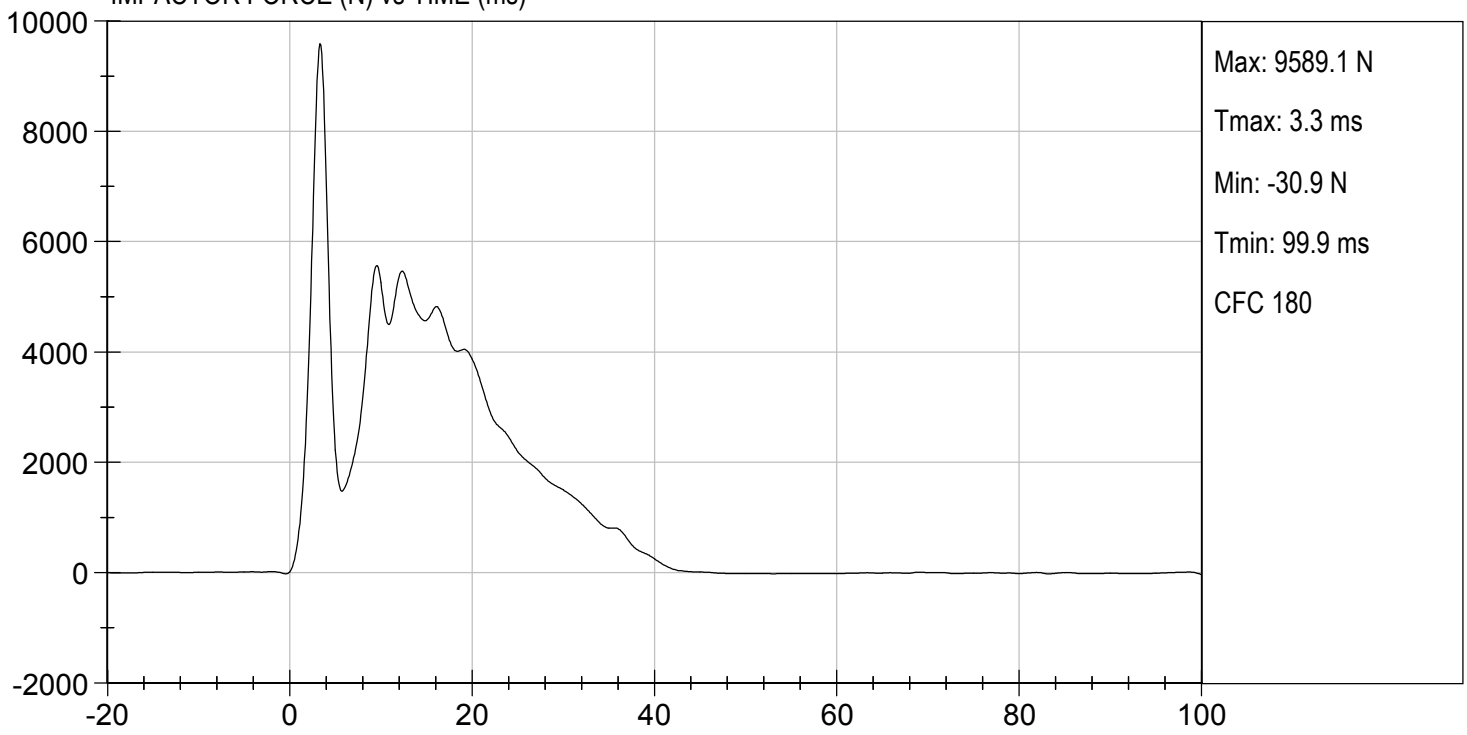
12/17/2019
Test Date

Approved By

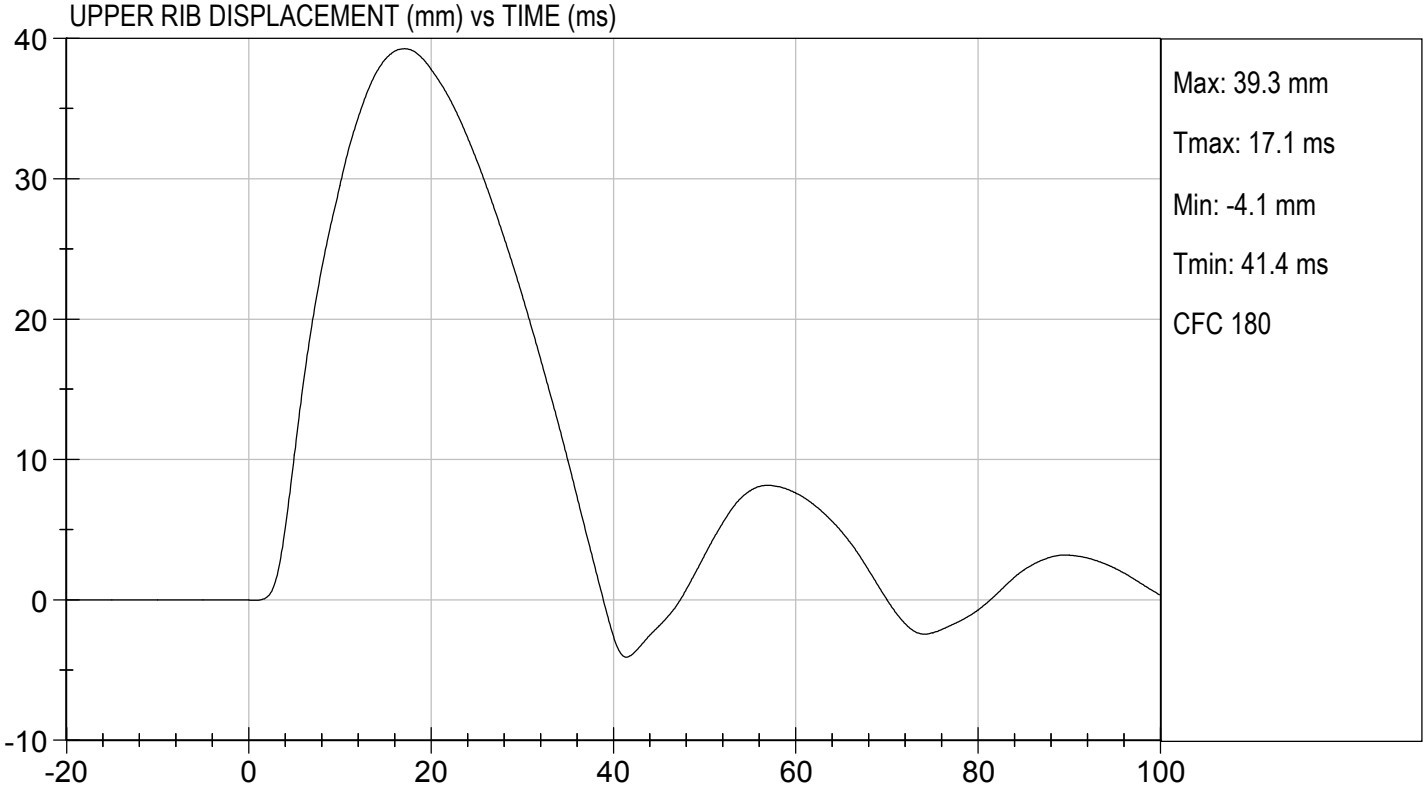
TEST DESC: THORAX IMPACT
VELOCITY: 18.12 ft/s, 5.52 m/s

TEST DATE: 12/17/2019
TEST #: D193930

IMPACTOR FORCE (N) vs TIME (ms)



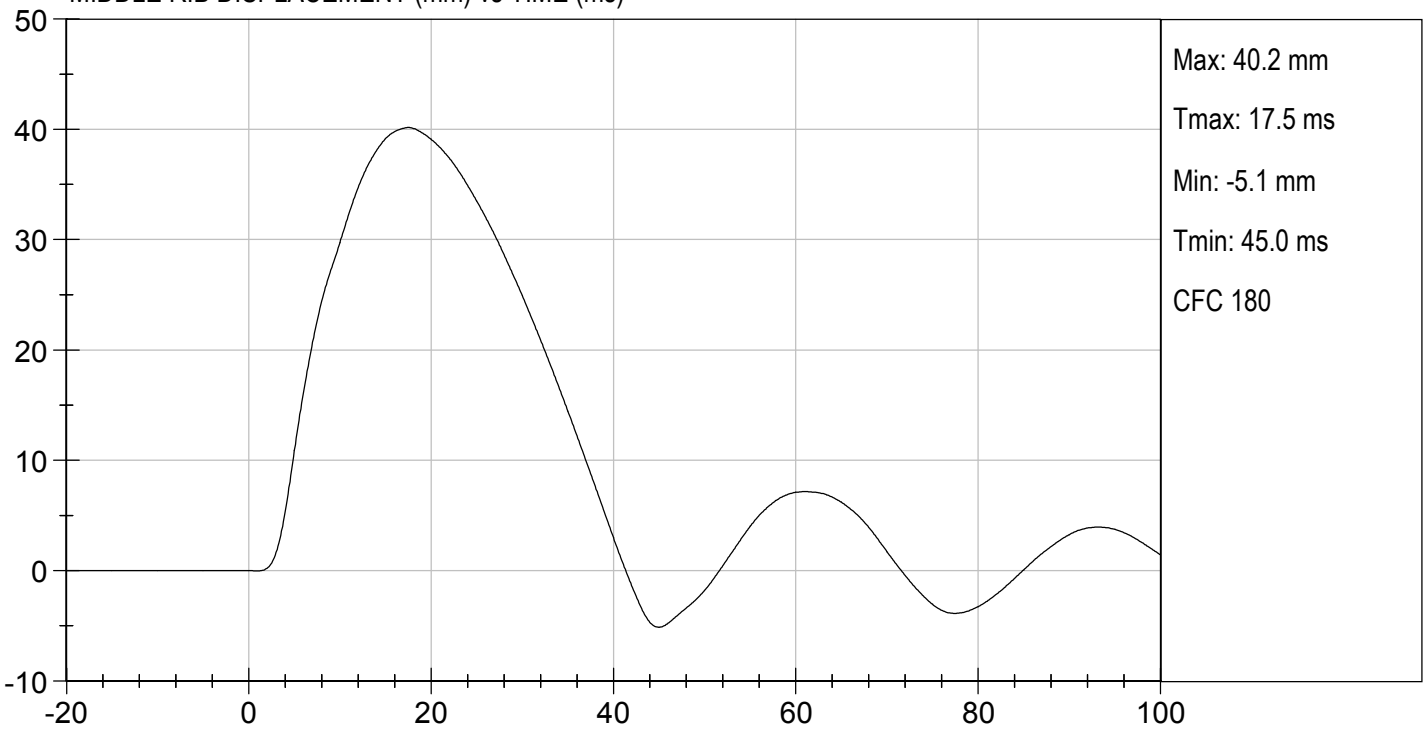
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



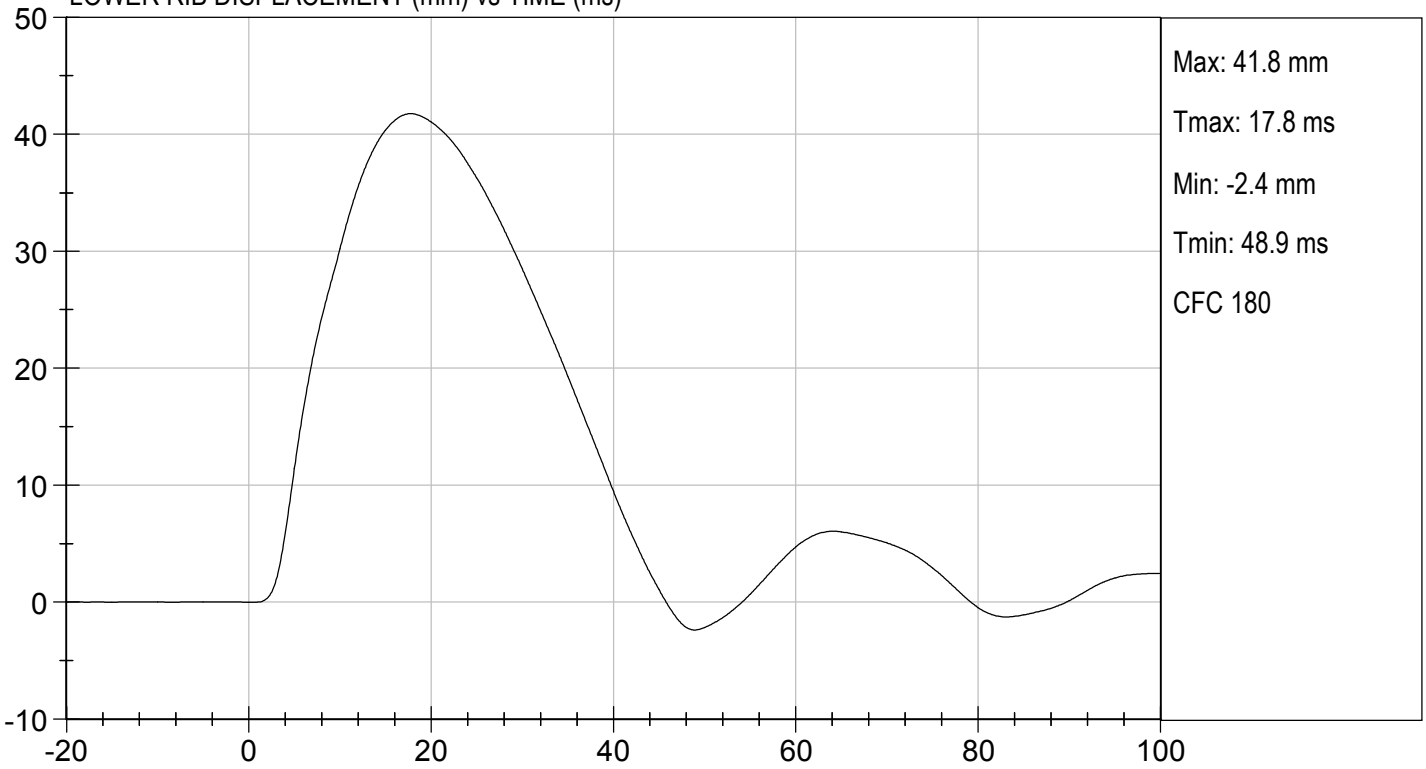
TEST DESC: THORAX IMPACT
VELOCITY: 18.12 ft/s, 5.52 m/s

TEST DATE: 12/17/2019
TEST #: D193930

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



CALIBRATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

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: F032 **Test ID:** D200091

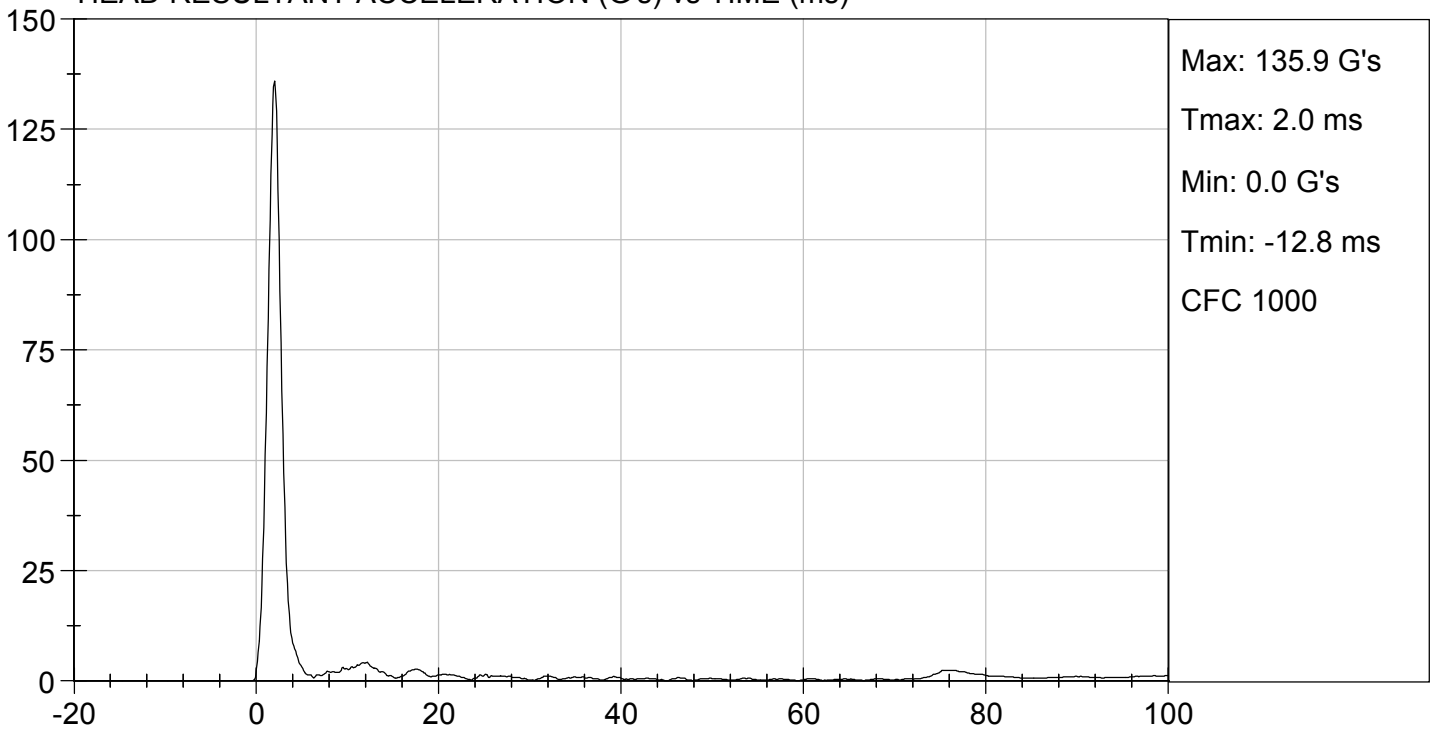
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	125 to 155	136	Pass
Peak Longitudinal Acceleration	G's	<= +/- 15.0	7.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

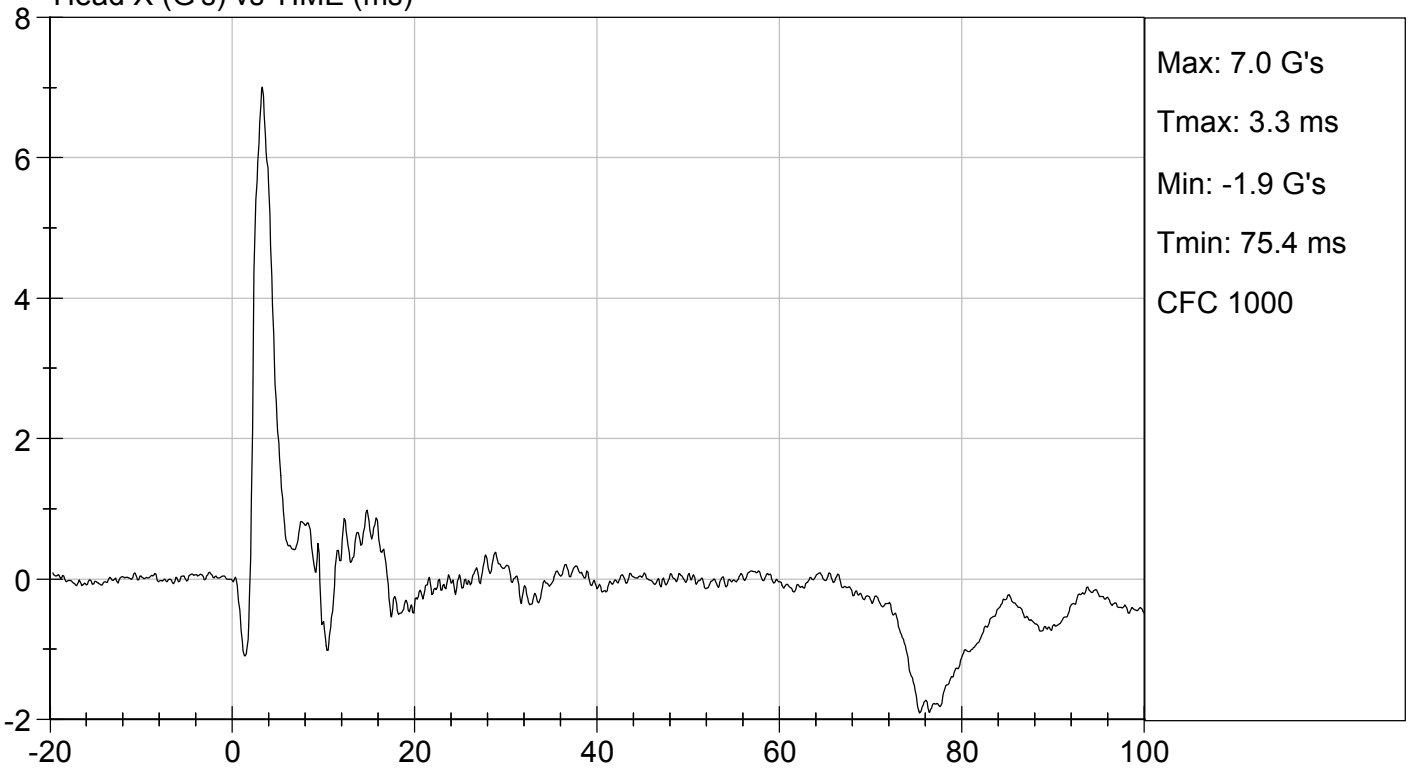
01/10/2020
Test Date

Approved By

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

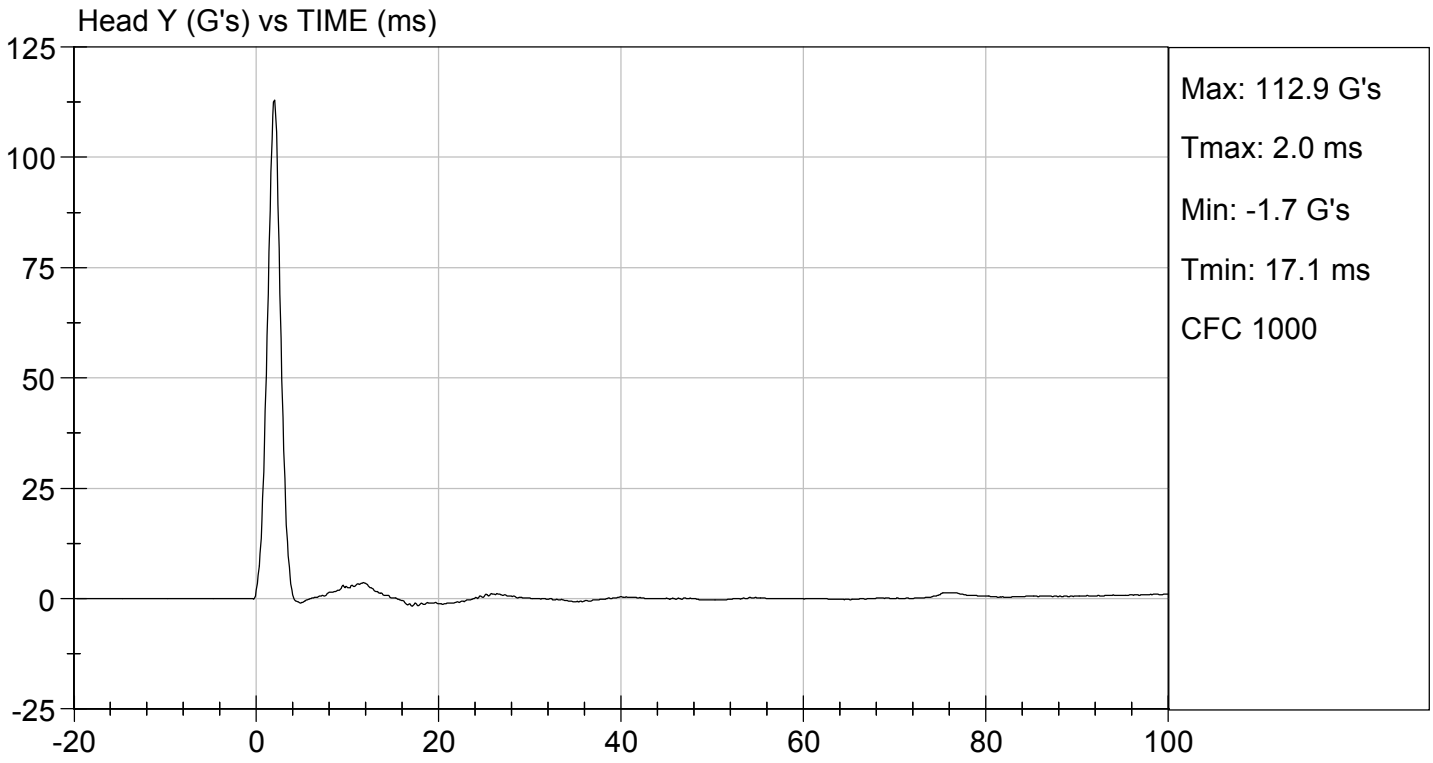


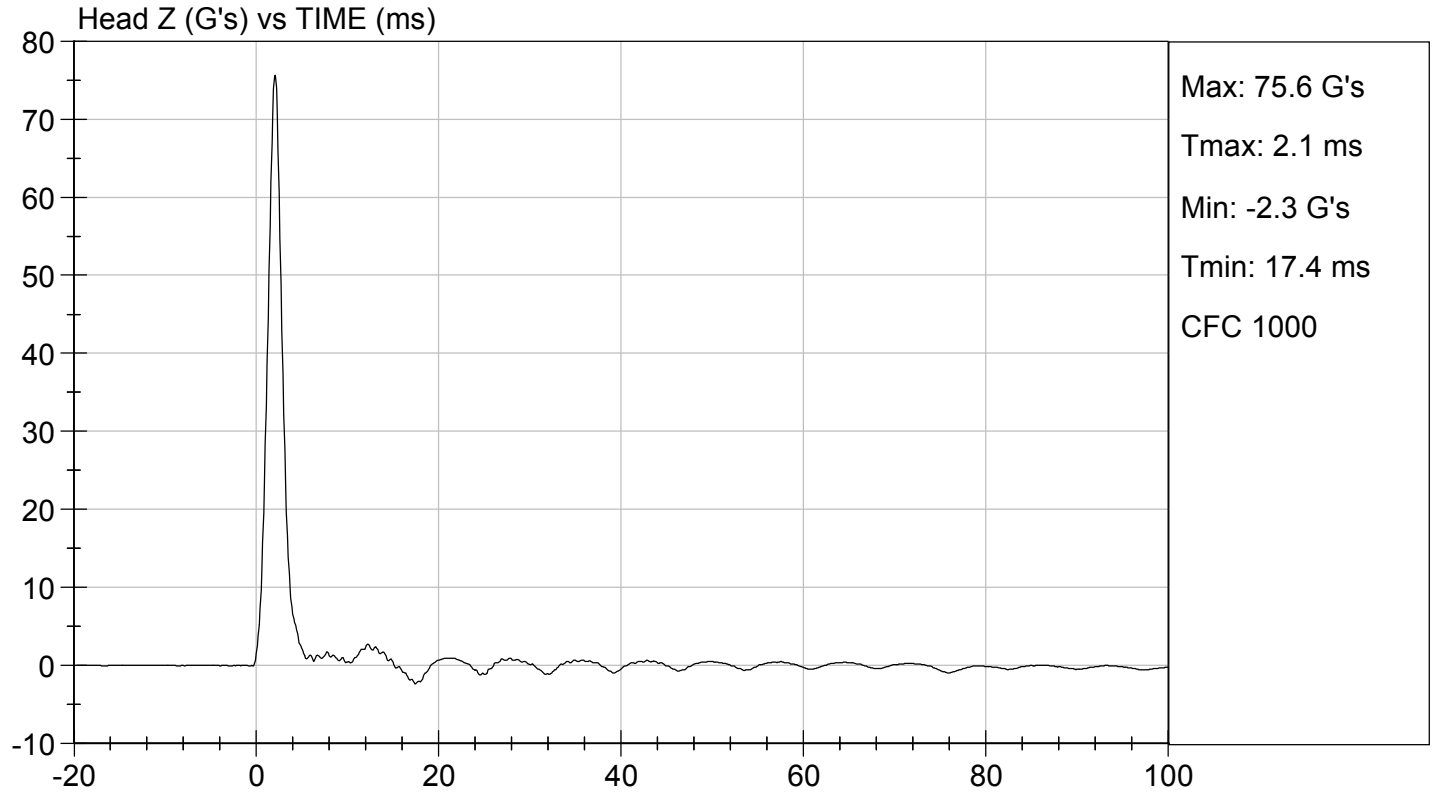
Head X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 01/10/2020
TEST #: D200091





MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D200092

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity		%	10 to 70	22	Pass
Pendulum Speed		m/s	3.30 to 3.50	3.50	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3 ms	m/s	-0.25 to -0.375	-0.34	Pass
	14 ms	m/s	-3.20 to -3.70	-3.56	Pass
	17 ms	m/s	>= -3.70	-3.52	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	50.1	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	58.4	Pass
Head Rotation Decay Time to 0 Degree		ms	53.0 to 88.0	61.7	Pass
			Overall Results		Pass

Jacob D Taylor
Laboratory Technician

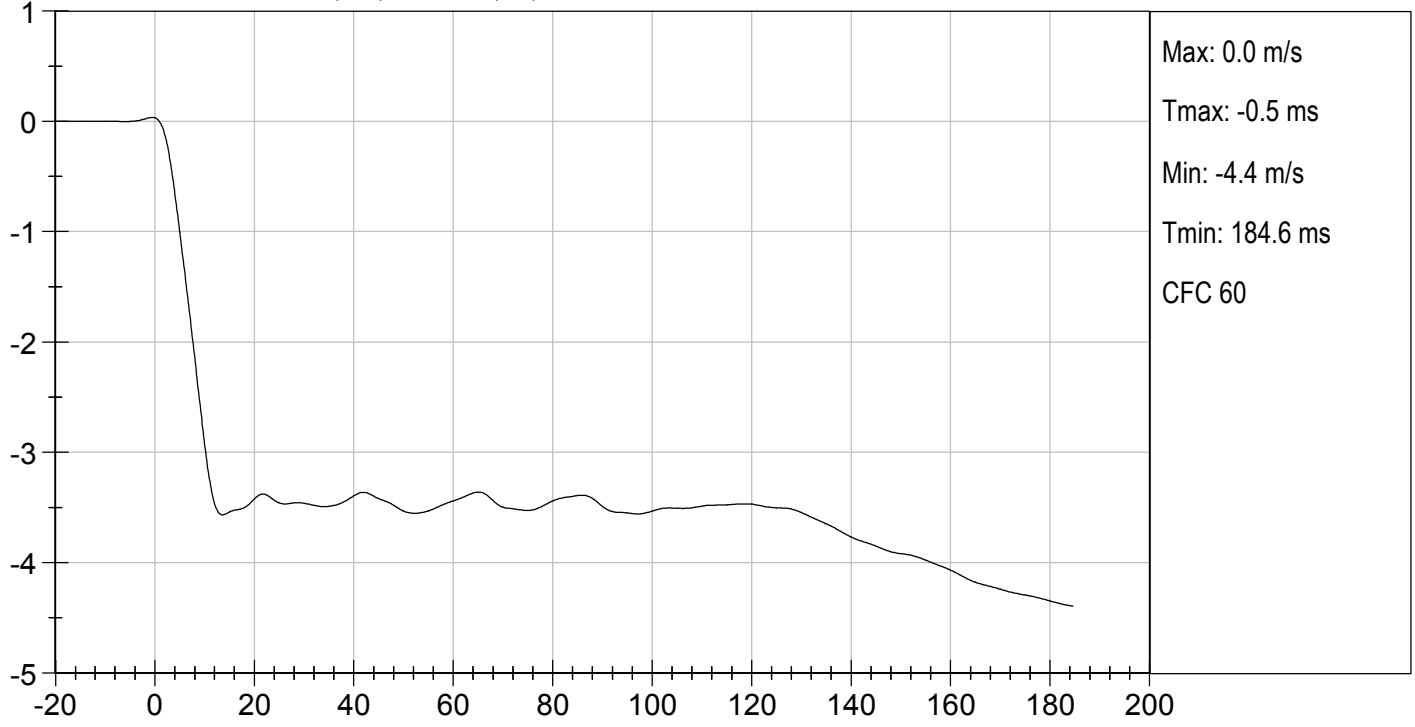
01/09/2020
Test Date

Approved By

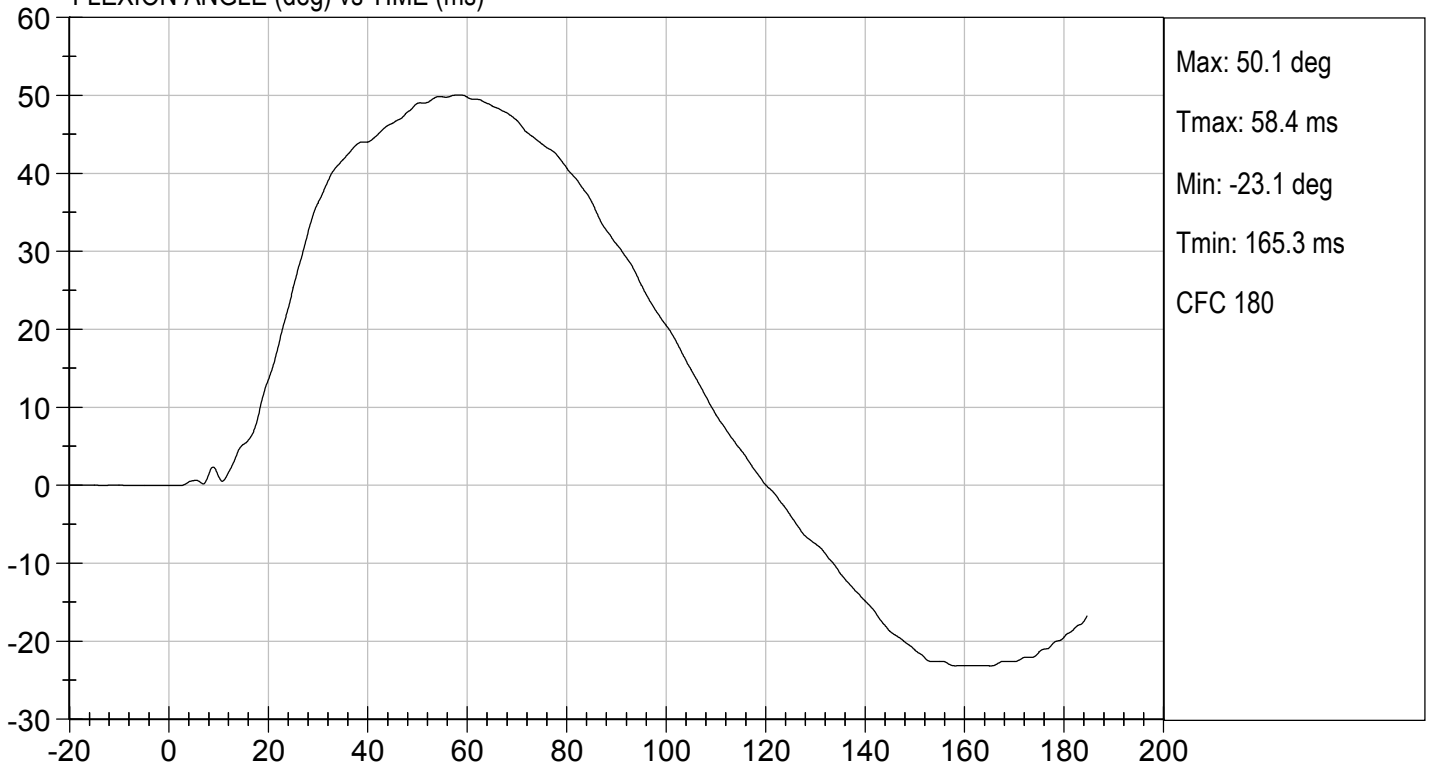
TEST DESC: NECK BENDING
VELOCITY: 11.48 ft/s, 3.50 m/s

TEST DATE: 01/09/2020
TEST #: D200092

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



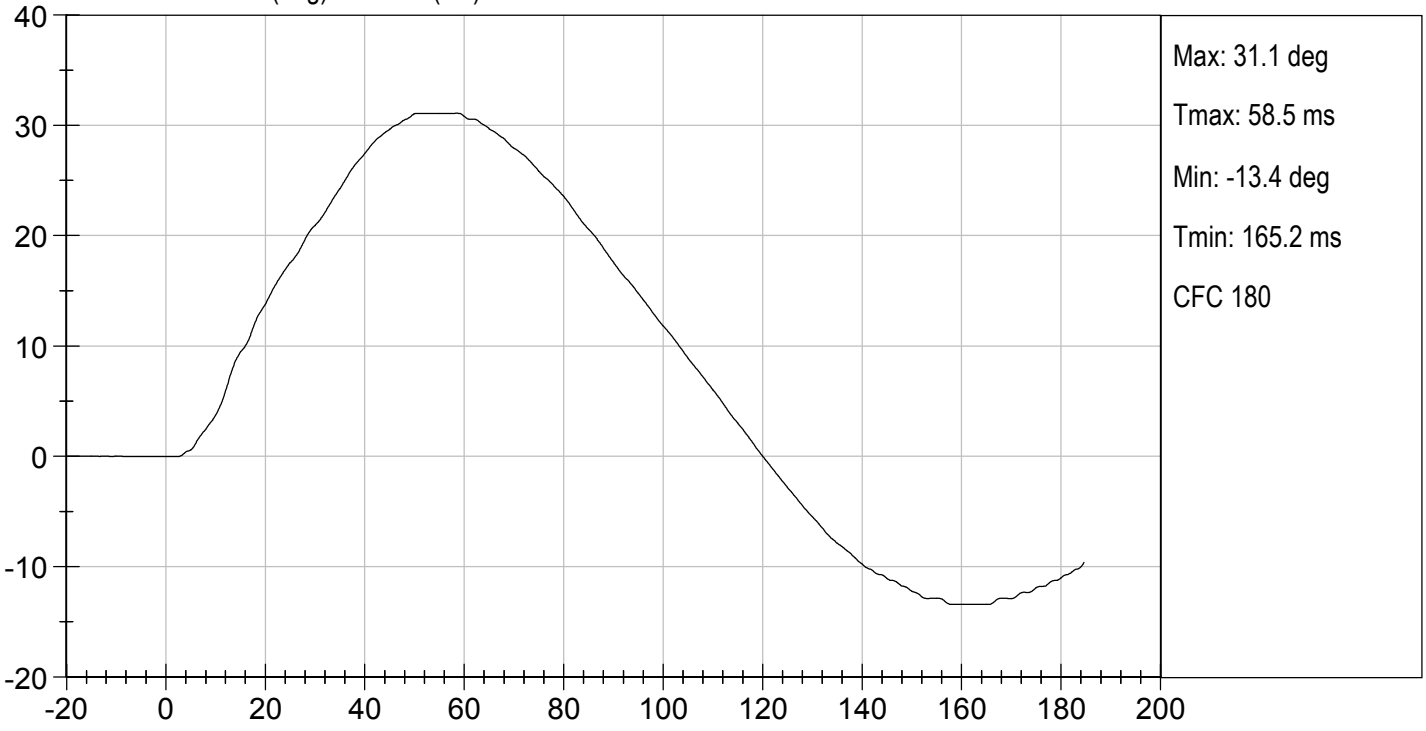
FLEXION ANGLE (deg) vs TIME (ms)



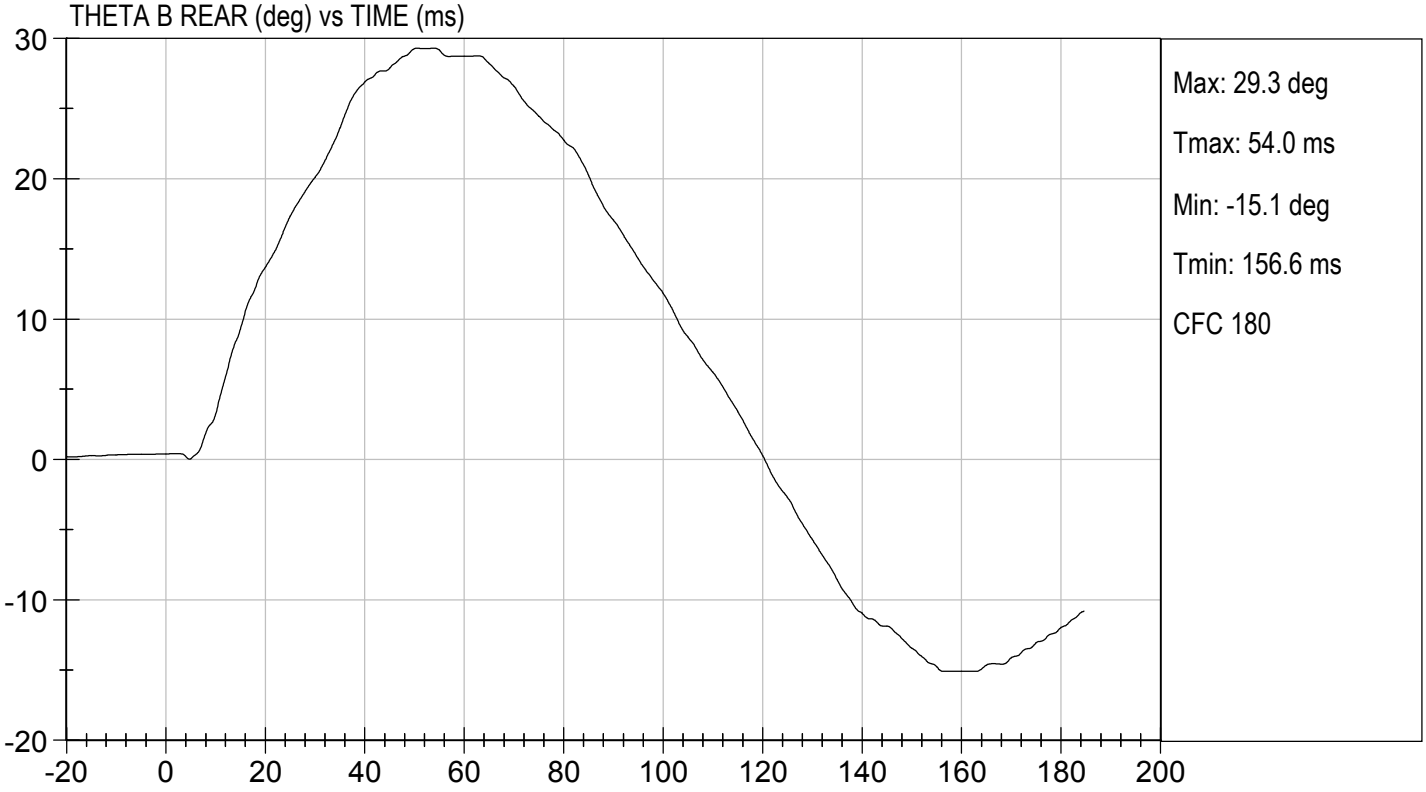
TEST DESC: NECK BENDING
VELOCITY: 11.48 ft/s, 3.50 m/s

TEST DATE: 01/09/2020
TEST #: D200092

THETA A FRONT (deg) vs TIME (ms)

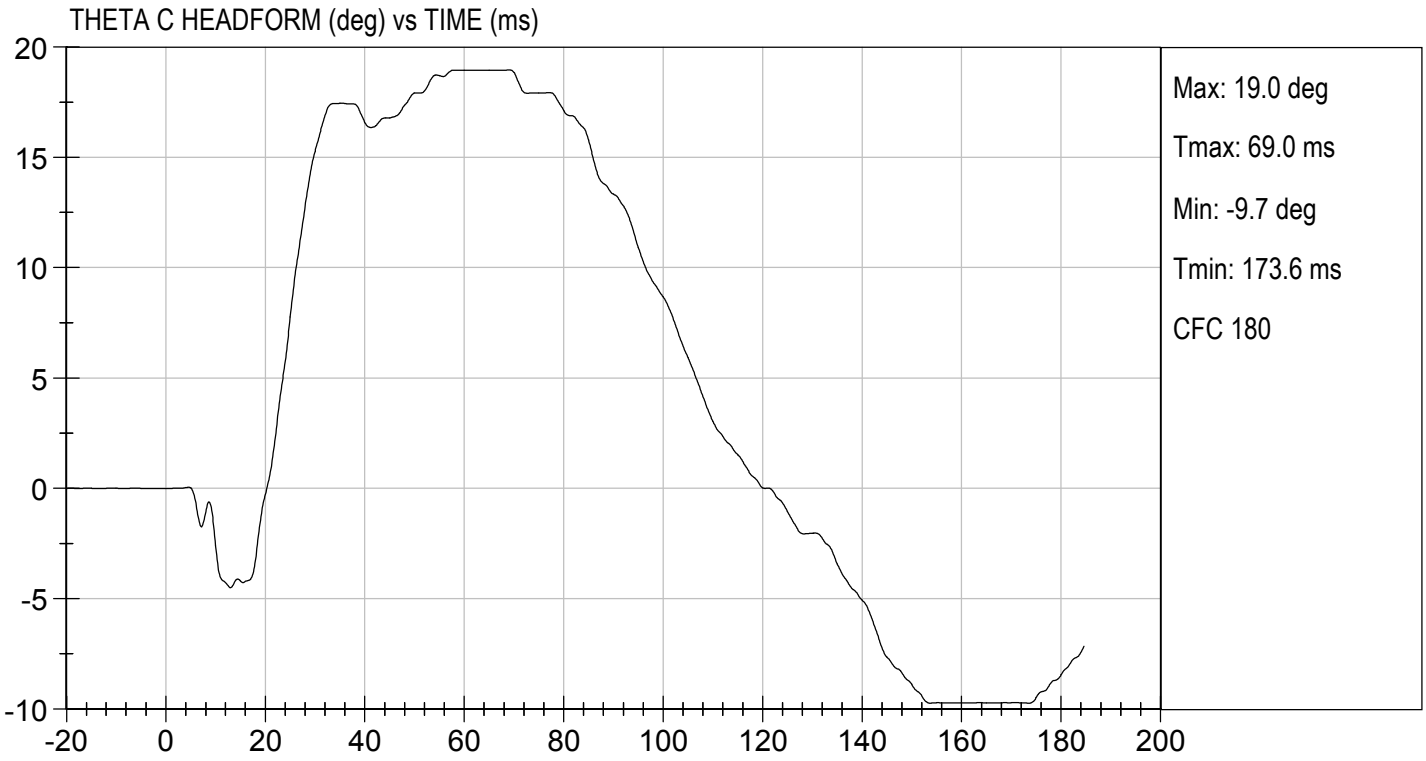


THETA B REAR (deg) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 11.48 ft/s, 3.50 m/s

TEST DATE: 01/09/2020
TEST #: D200092



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D200093

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	14	Pass
Pendulum Speed	m/s	4.20 to 4.40	4.2	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	9.0	Pass
		Overall Test Results		Pass

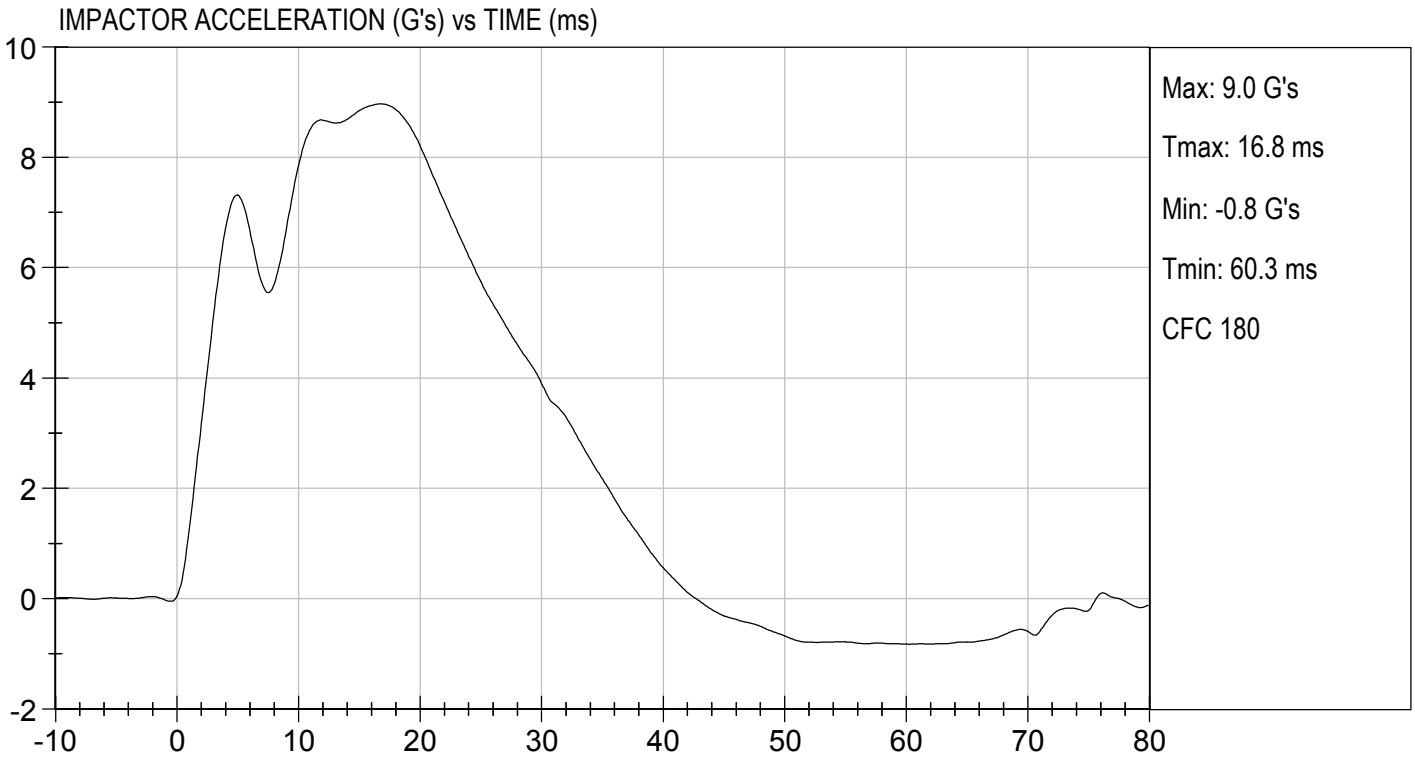
Jacob D Taylor
Laboratory Technician

01/08/2020
Test Date

Approved By

TEST DESC: SHOULDER IMPACT
VELOCITY: 13.77 ft/s, 4.2 m/s

TEST DATE: 01/08/2020
TEST #: D200093



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

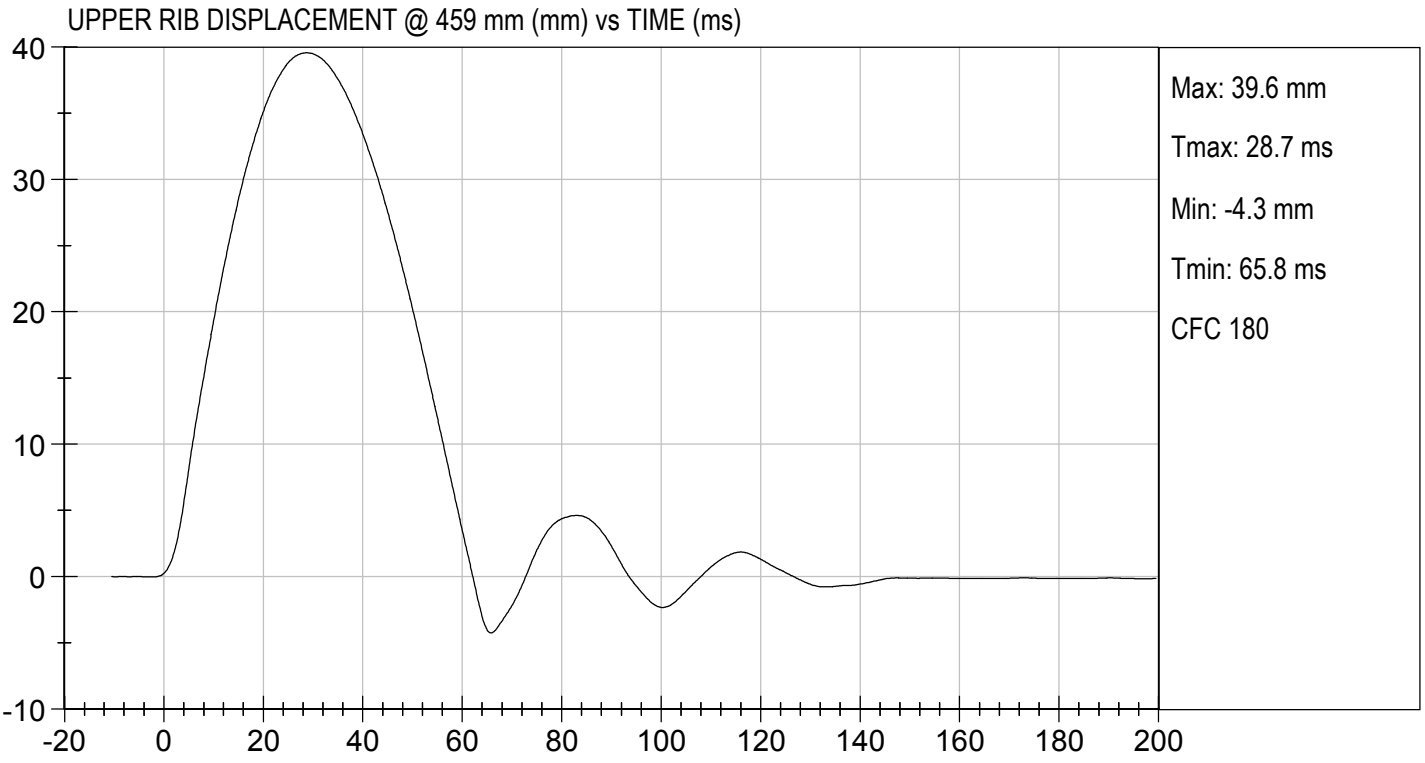
ATD Serial No: F032 **Test I.D:** D200094

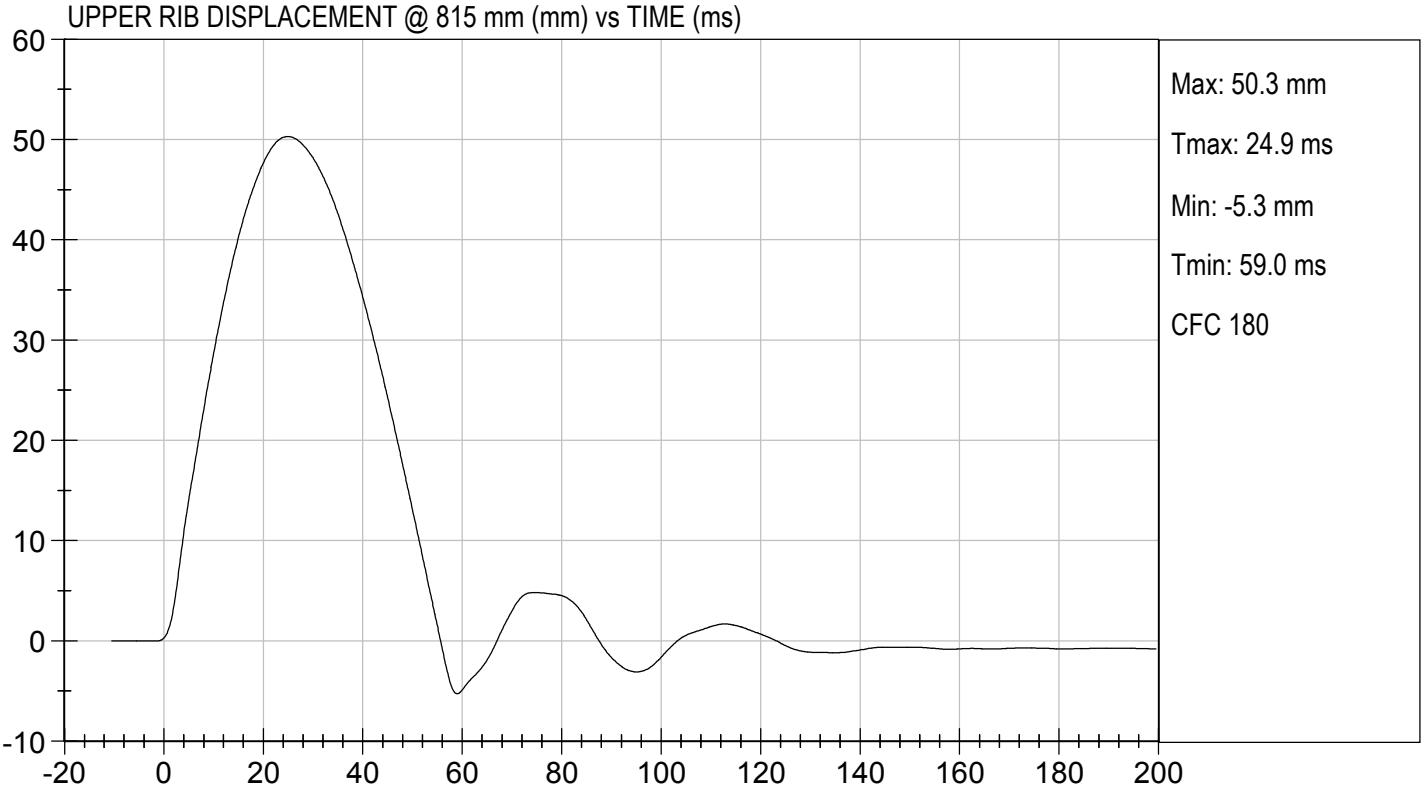
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Displacement at 459 mm	mm	36.0 to 40.0	39.6	Pass
Displacement at 815 mm	mm	46.0 to 51.0	50.3	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

01/08/2020
Test Date

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: 39.6 mm
Tmax: 28.7 ms
Min: -4.3 mm
Tmin: 65.8 ms
CFC 180


UPPER RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 50.3 mm
Tmax: 24.9 ms
Min: -5.3 mm
Tmin: 59.0 ms
CFC 180

MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D200095

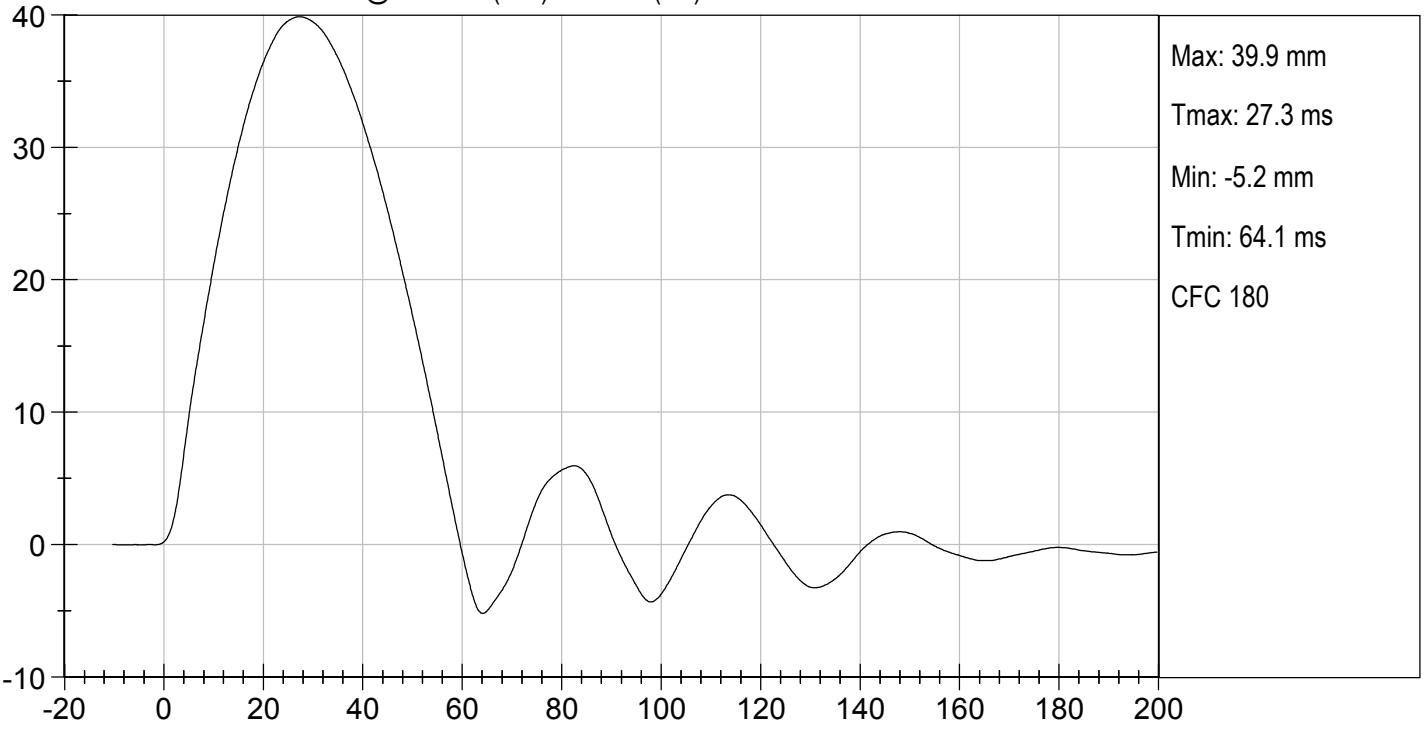
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Displacement at 459 mm	mm	36.0 to 40.0	39.9	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.2	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

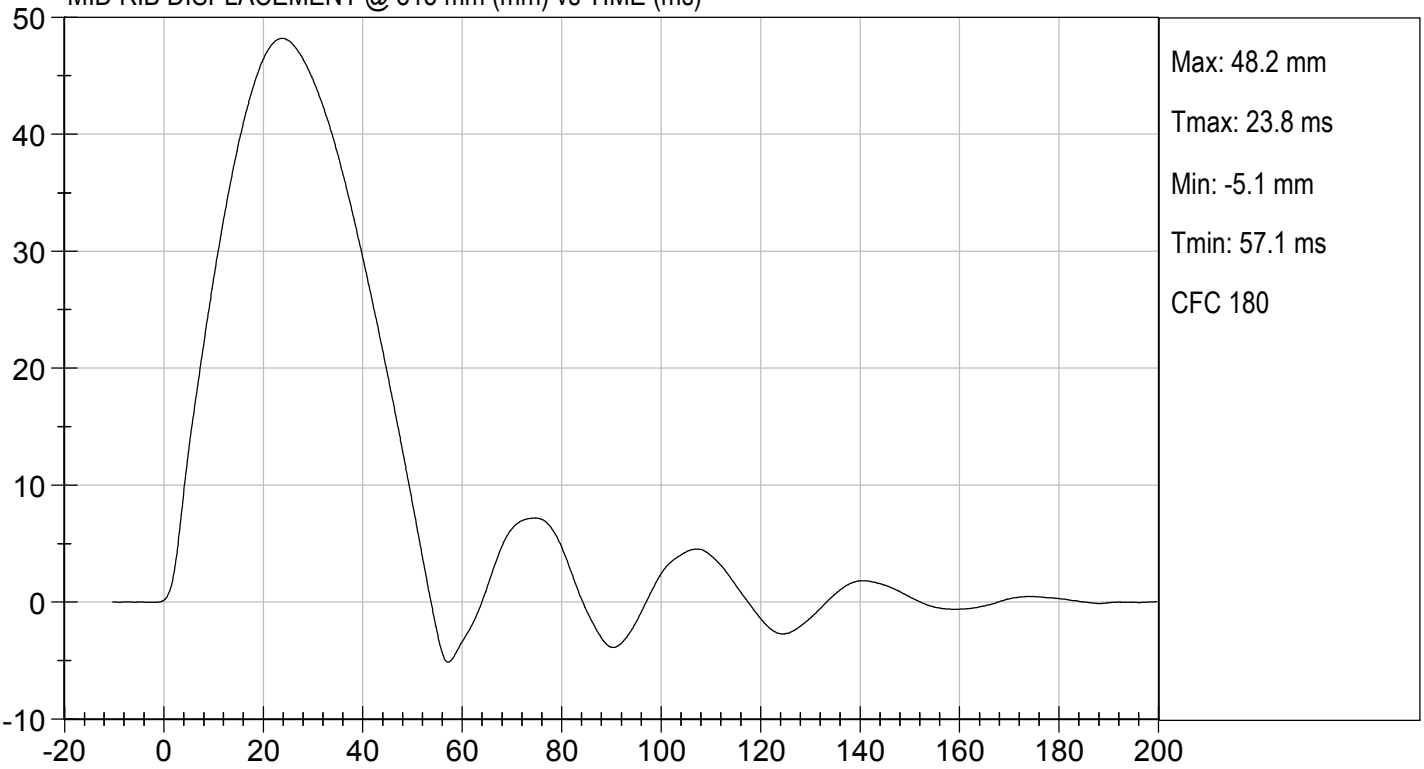
01/08/2020
Test Date

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: F032 **Test I.D:** D200096

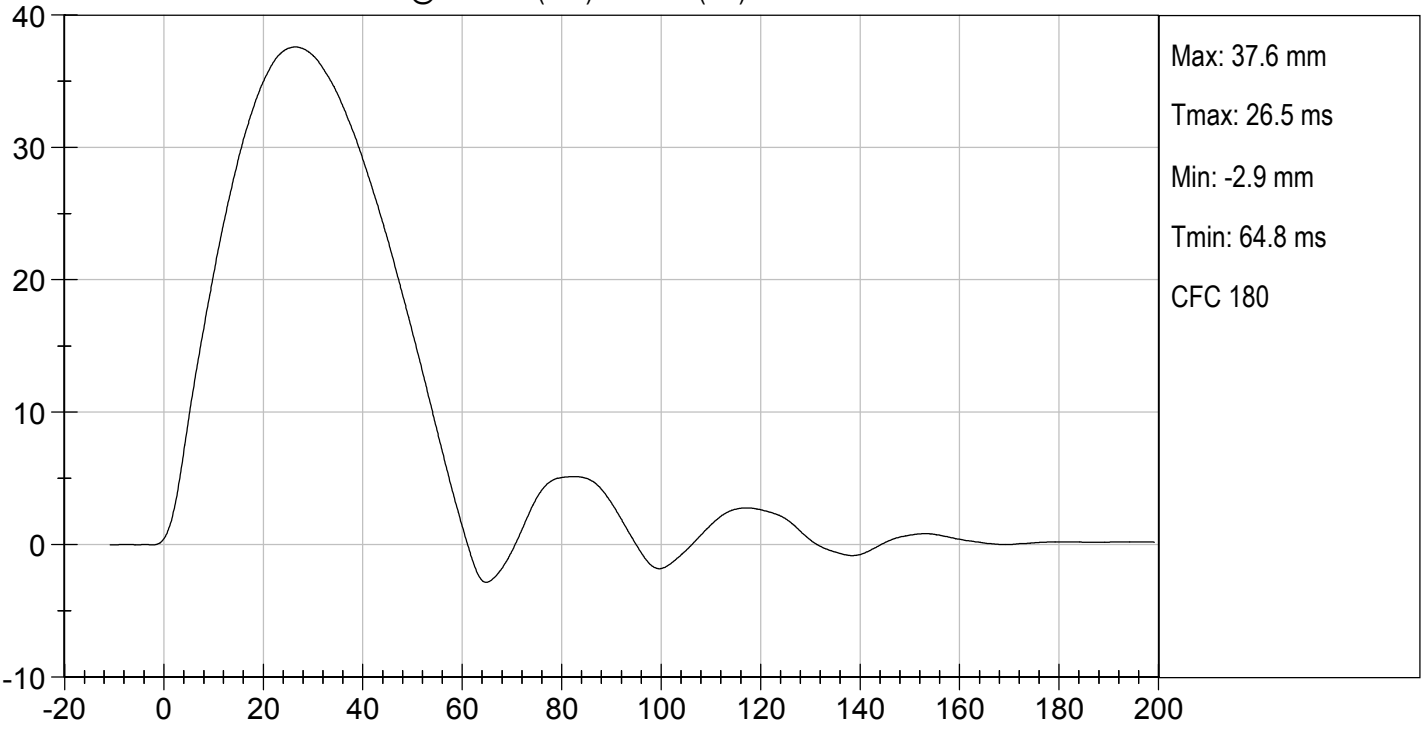
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Displacement at 459 mm	mm	36.0 to 40.0	37.6	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.2	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

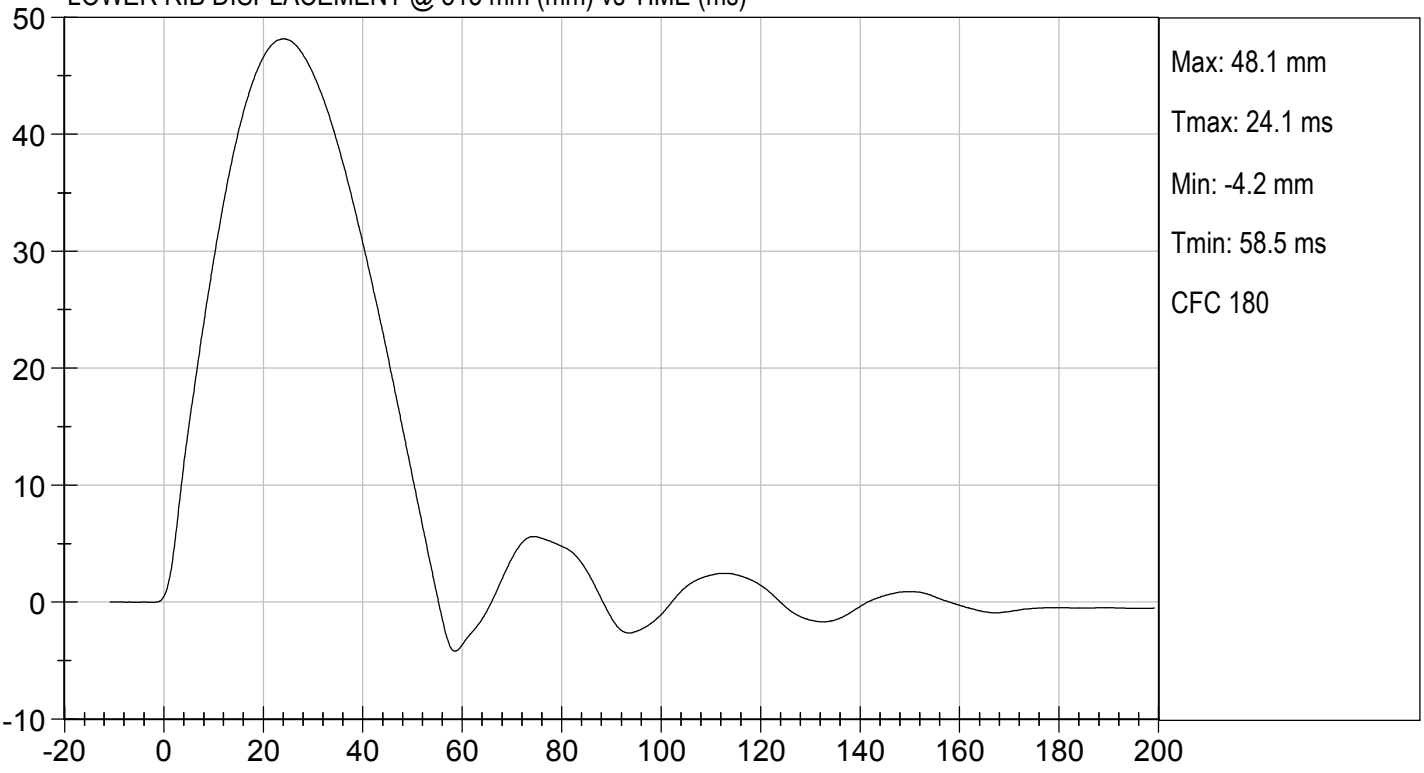
01/08/2020
Test Date

Approved By

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



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



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D200097

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	14	Pass
Probe Speed	m/s	3.90 to 4.10	4.10	Pass
Maximum Impactor Force	N	4000 to 4800	4336	Pass
Time of Maximum Impactor Force	ms	10.6 to 13.0	11.2	Pass
Maximum Total Abdomen Force	N	2200 to 2700	2399	Pass
Time of Maximum Abdomen Force	ms	10.0 to 12.3	10.7	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

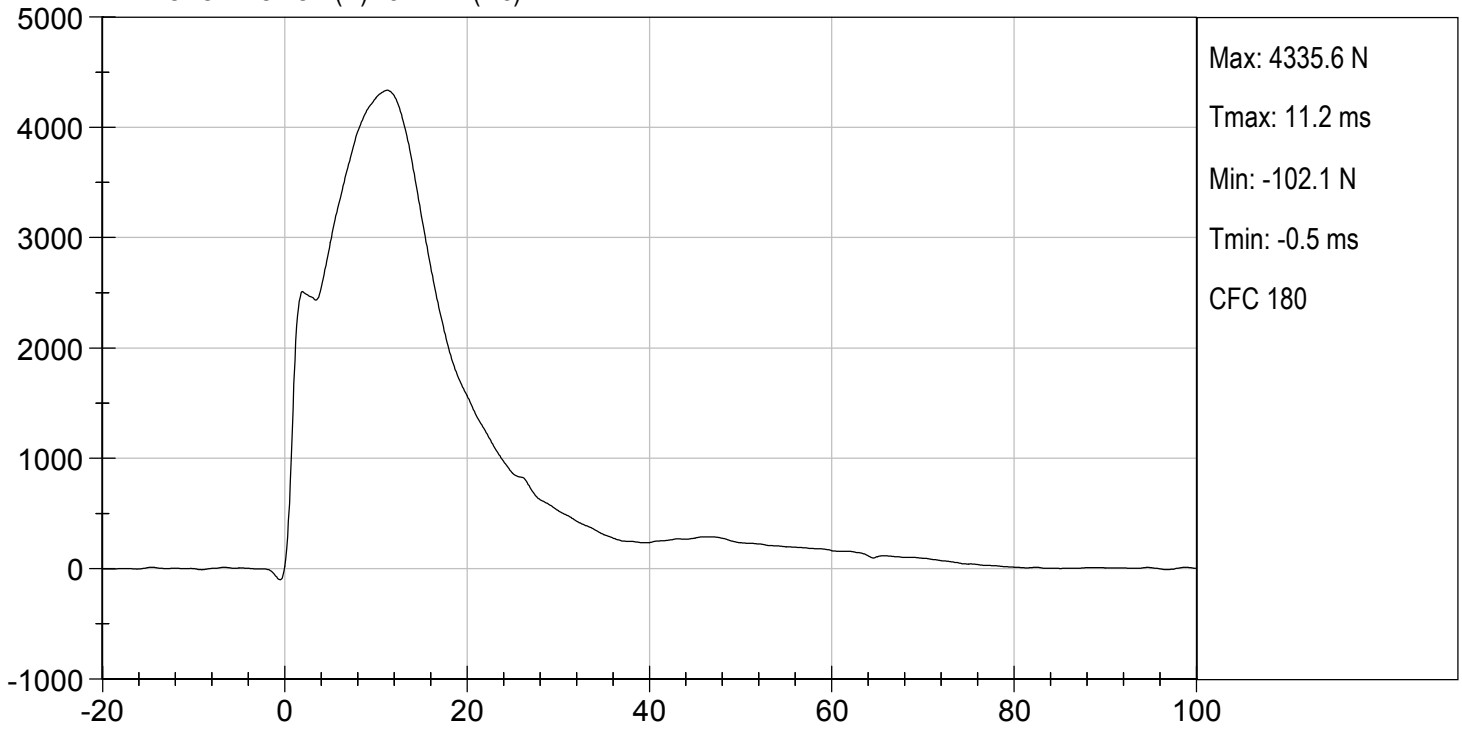
01/08/2020
Test Date

Approved By

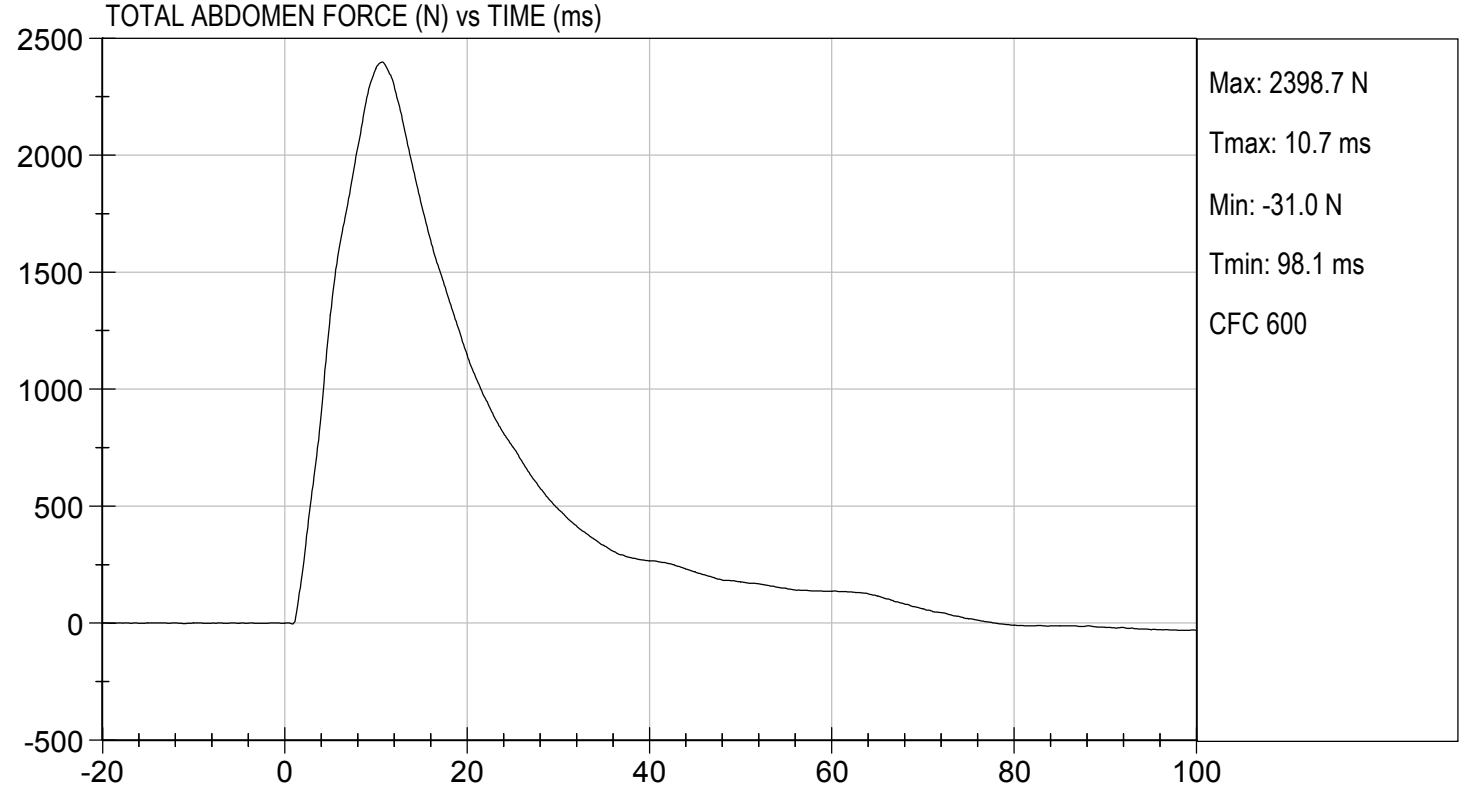
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.45 ft/s, 4.10 m/s

TEST DATE: 01/08/2020
TEST #: D200097

IMPACTOR FORCE (N) vs TIME (ms)



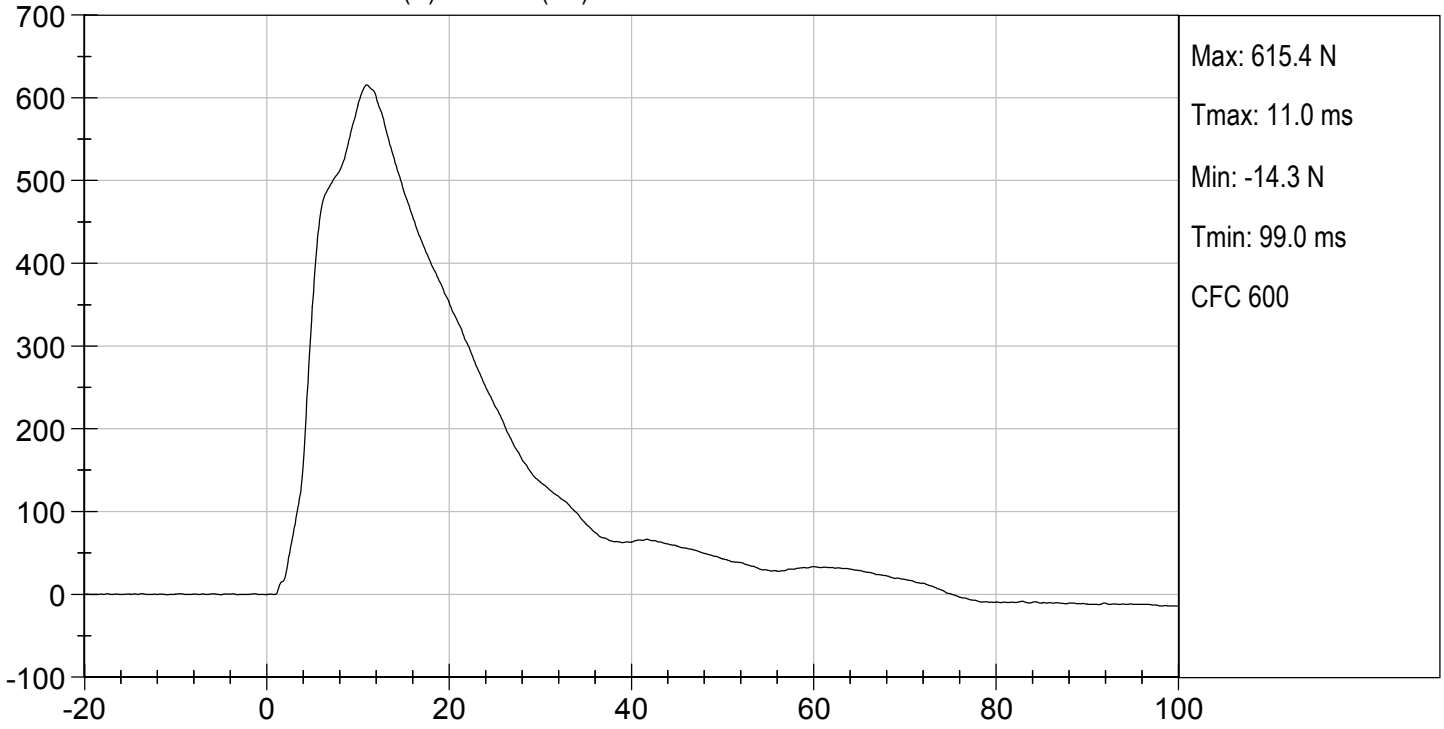
TOTAL ABDOMEN FORCE (N) vs TIME (ms)



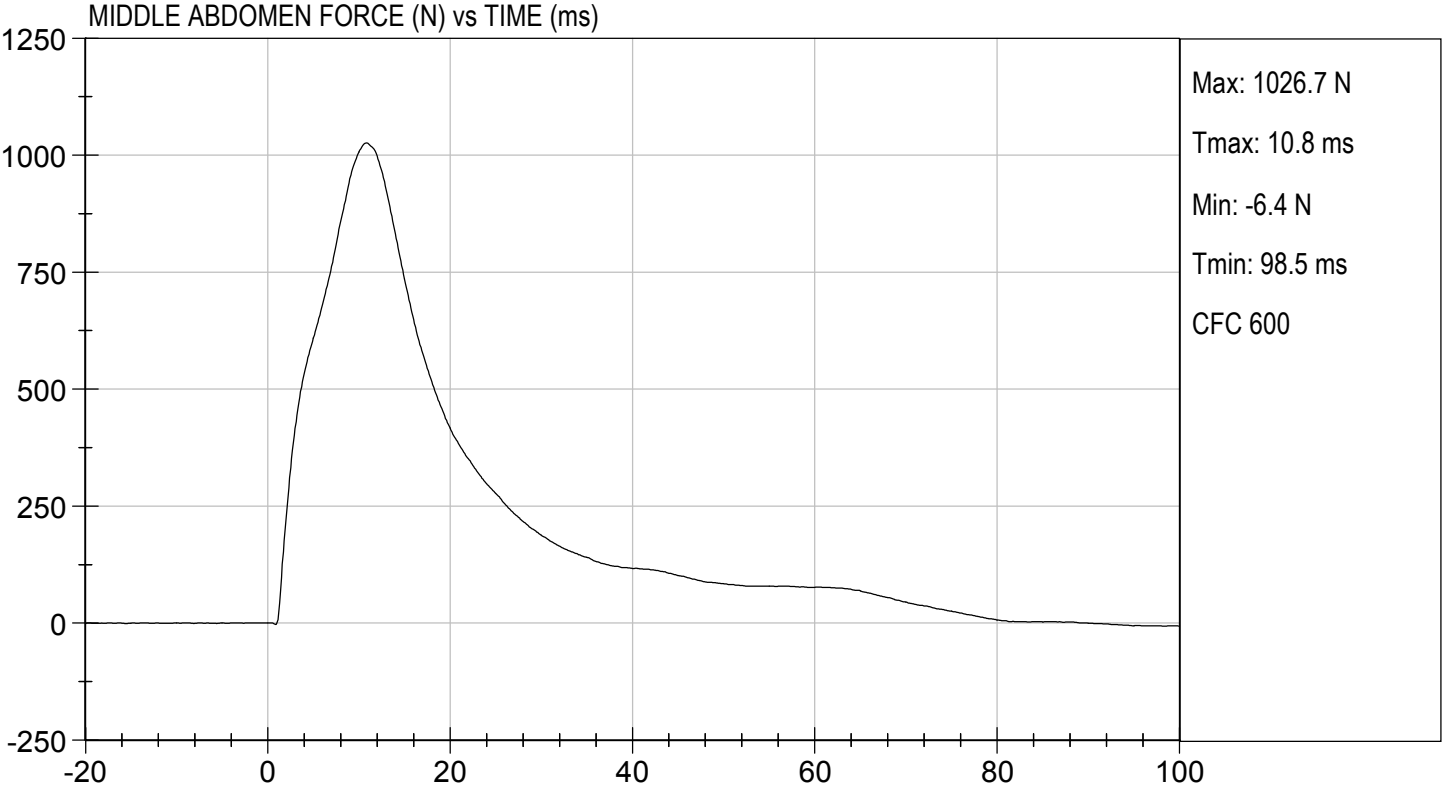
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.45 ft/s, 4.10 m/s

TEST DATE: 01/08/2020
TEST #: D200097

FRONT ABDOMEN FORCE (N) vs TIME (ms)



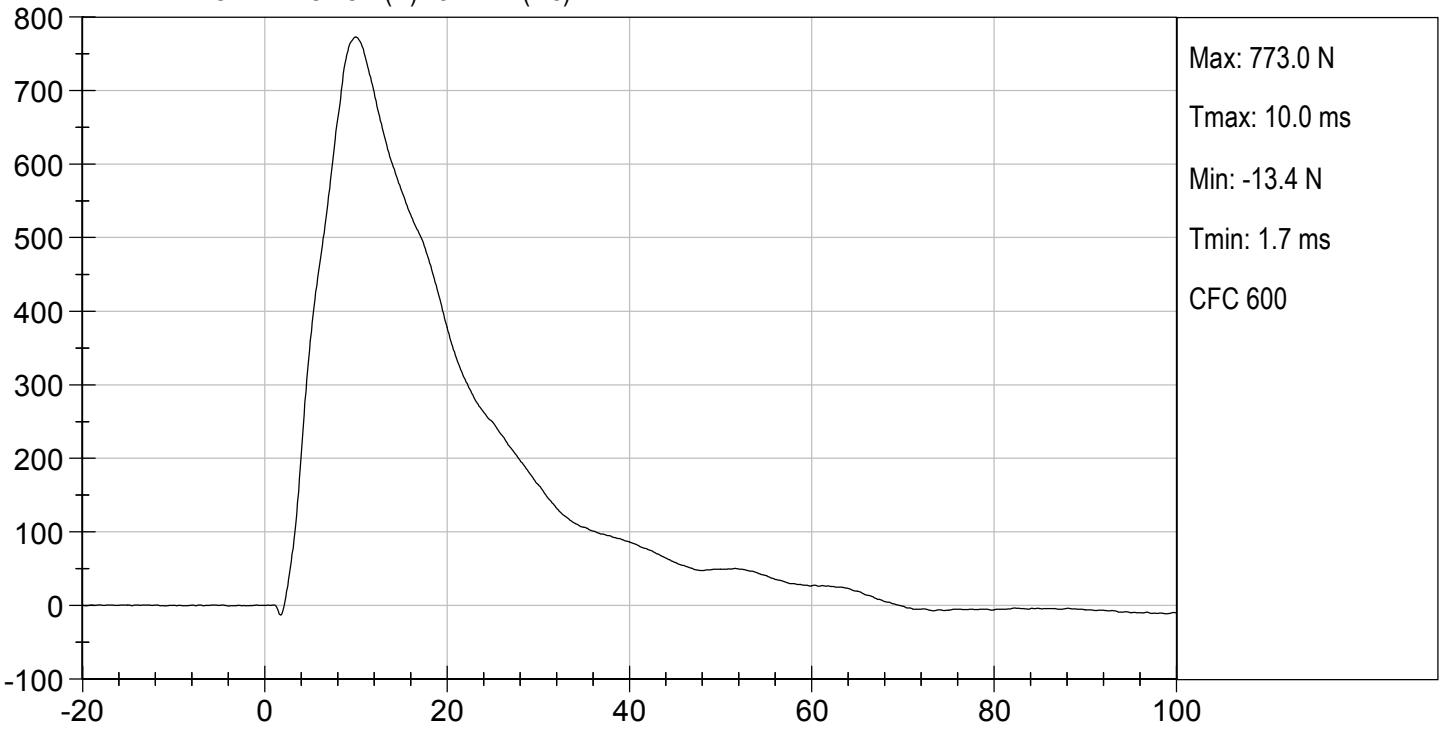
MIDDLE ABDOMEN FORCE (N) vs TIME (ms)



TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.45 ft/s, 4.10 m/s

TEST DATE: 01/08/2020
TEST #: D200097

REAR ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D200098

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity		%	10 to 70	22	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.14	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	-0.408	Pass
	27 ms	m/s	-6.50 to -5.80	-6.18	Pass
	30 ms	m/s	>= -6.50	-6.04	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.4	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	46.0	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	44	Pass
			Overall Results		Pass

Jacob D Taylor
Laboratory Technician

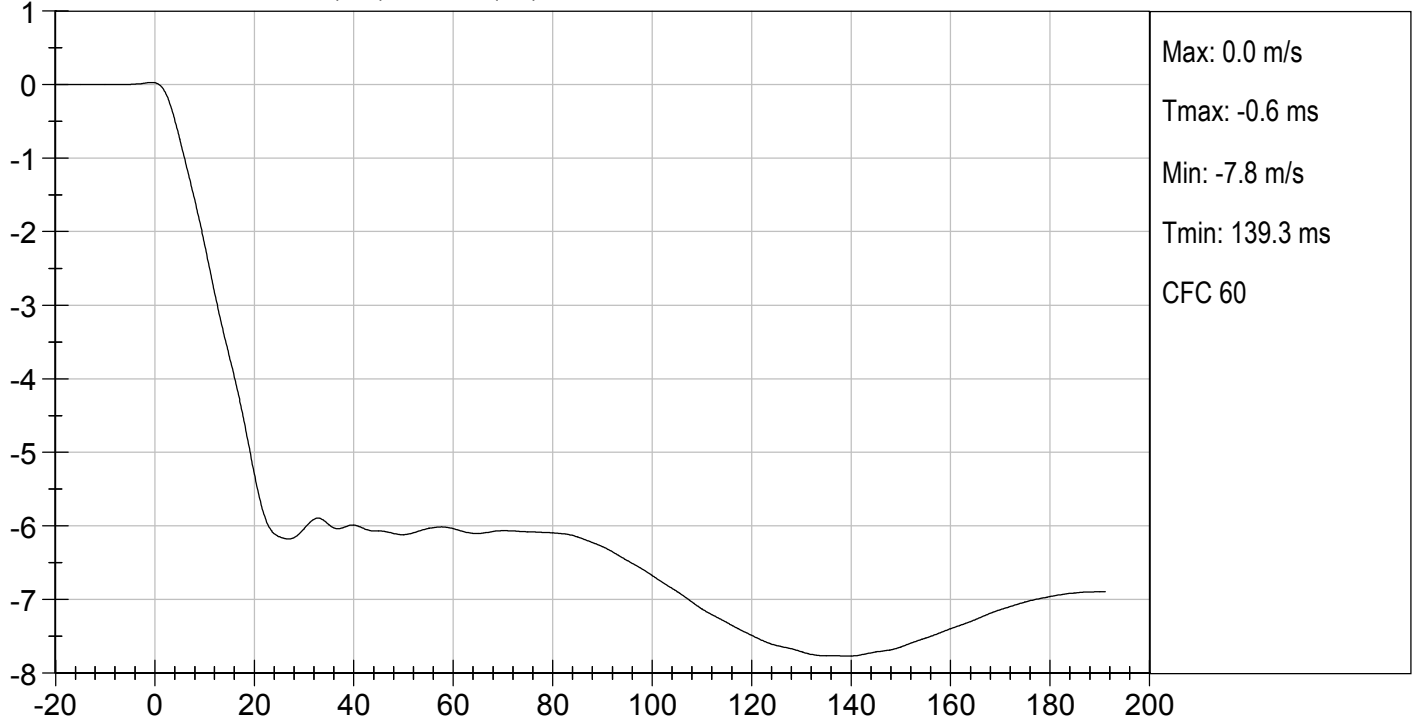
01/09/2020
Test Date

Approved By

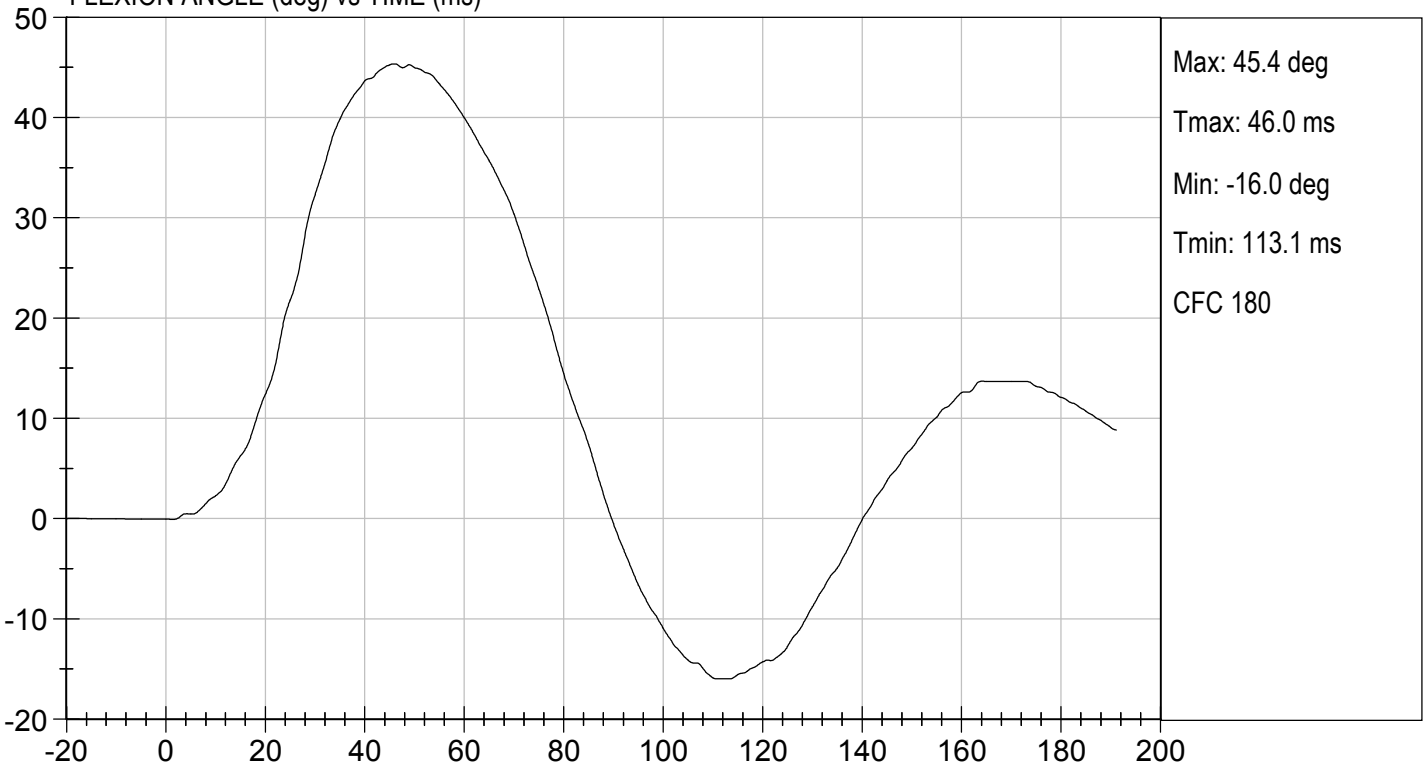
TEST DESC: LUMBAR BENDING
VELOCITY: 20.15 ft/s, 6.14 m/s

TEST DATE: 01/09/2020
TEST #: D200098

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



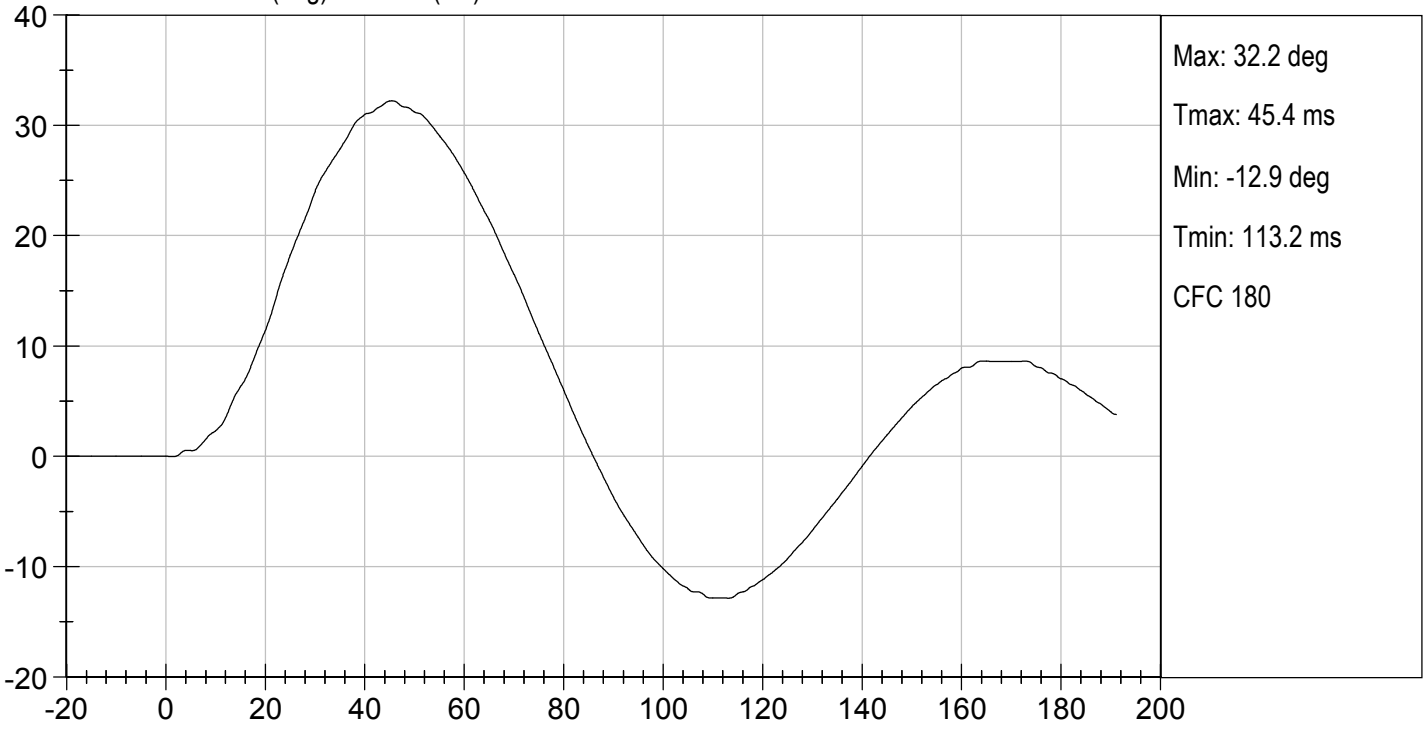
FLEXION ANGLE (deg) vs TIME (ms)



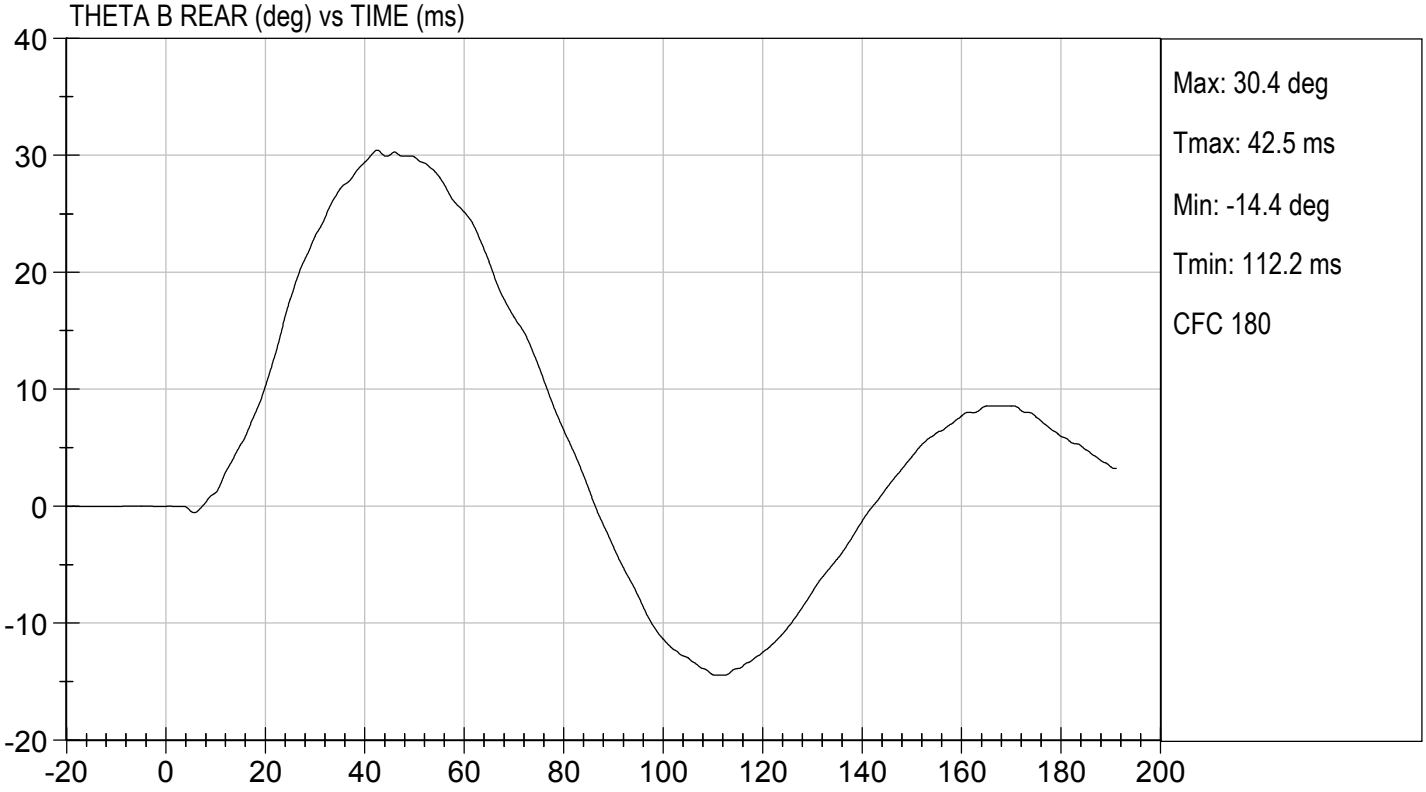
TEST DESC: LUMBAR BENDING
VELOCITY: 20.15 ft/s, 6.14 m/s

TEST DATE: 01/09/2020
TEST #: D200098

THETA A FRONT (deg) vs TIME (ms)

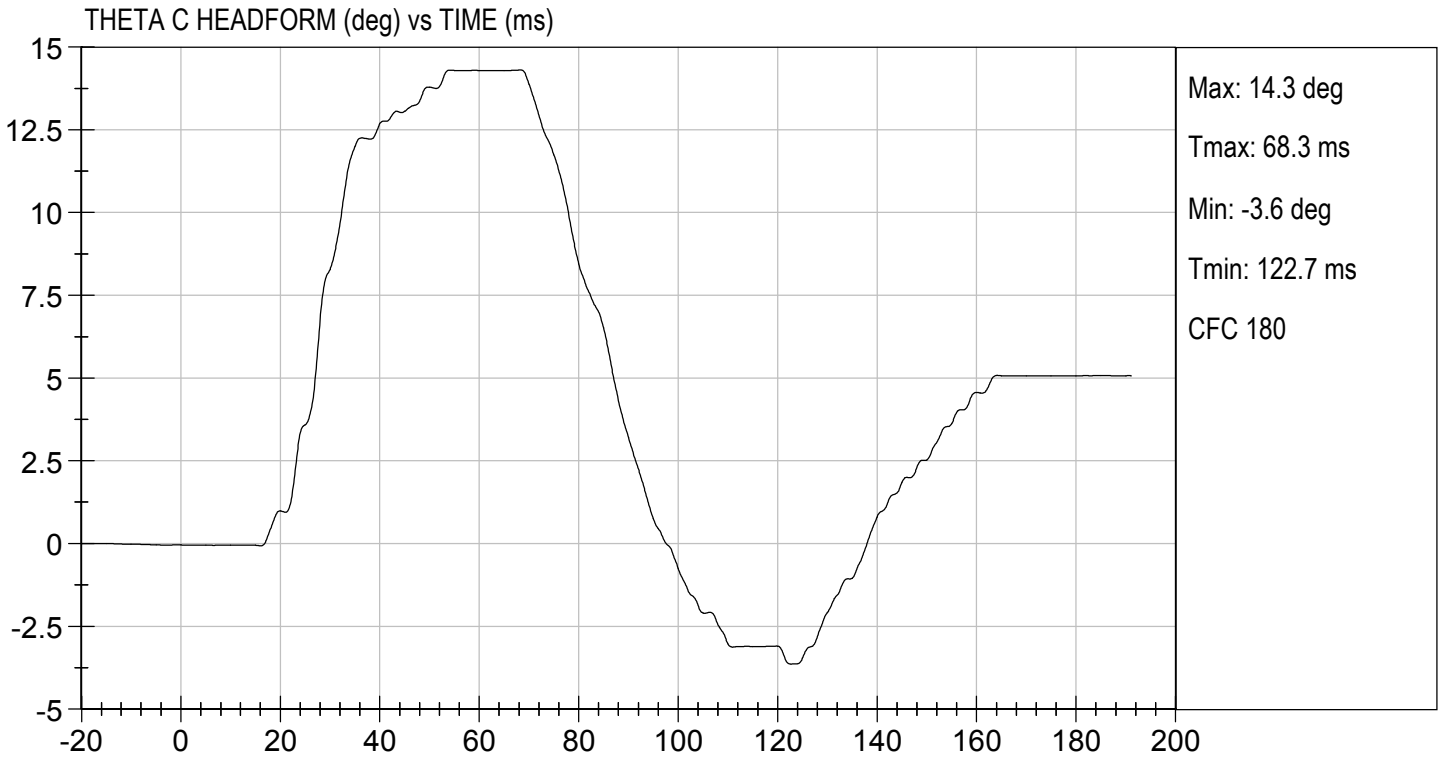


THETA B REAR (deg) vs TIME (ms)



TEST DESC: LUMBAR BENDING
VELOCITY: 20.15 ft/s, 6.14 m/s

TEST DATE: 01/09/2020
TEST #: D200098



MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D200099

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	14	Pass
Probe Speed	m/s	4.20 to 4.40	4.27	Pass
Maximum Impactor Force	N	4700 to 5400	5116	Pass
Time of Maximum Impactor Force	ms	11.8 to 16.1	12.7	Pass
Maximum Pubic Force	N	1230 to 1590	1512	Pass
Time of Maximum Pubic Force	ms	12.2 to 17.0	12.4	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

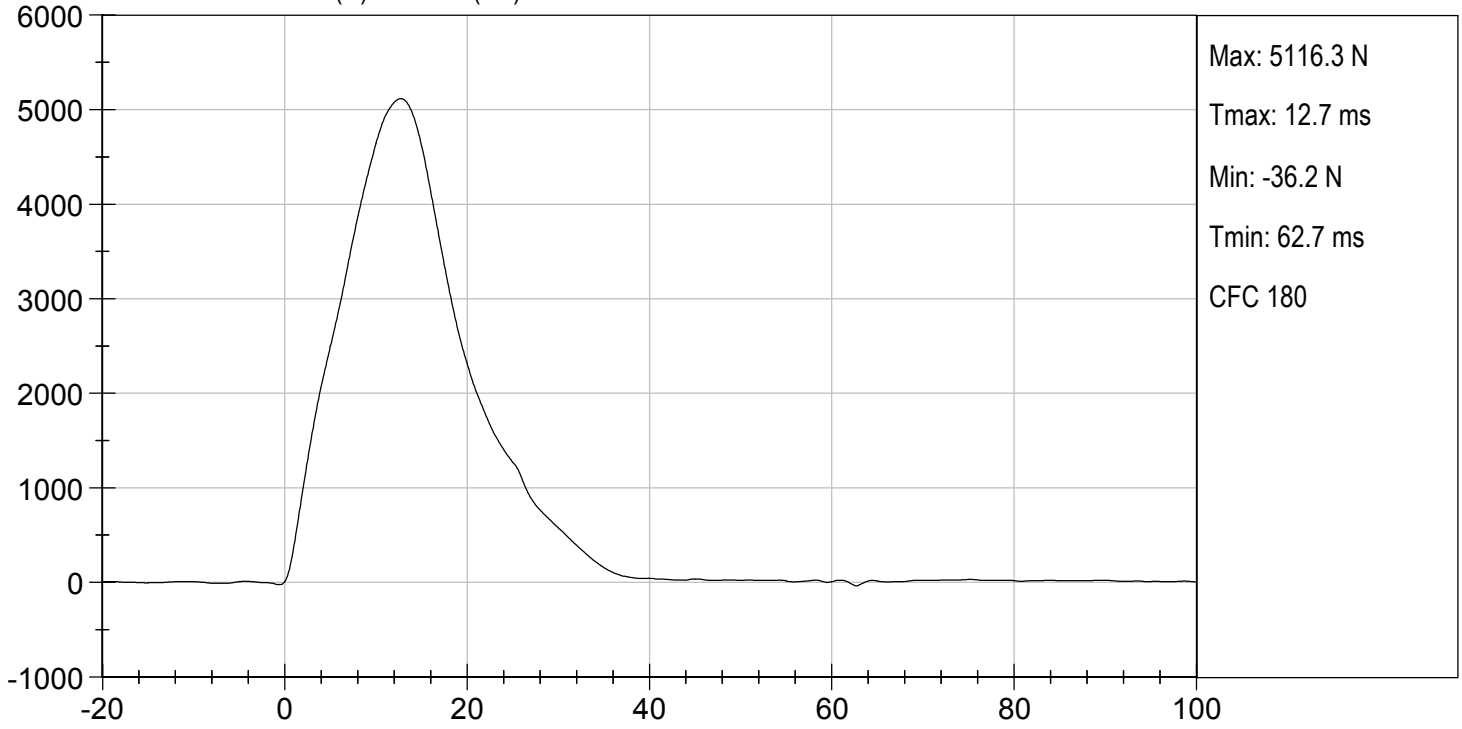
01/08/2020
Test Date

Approved By

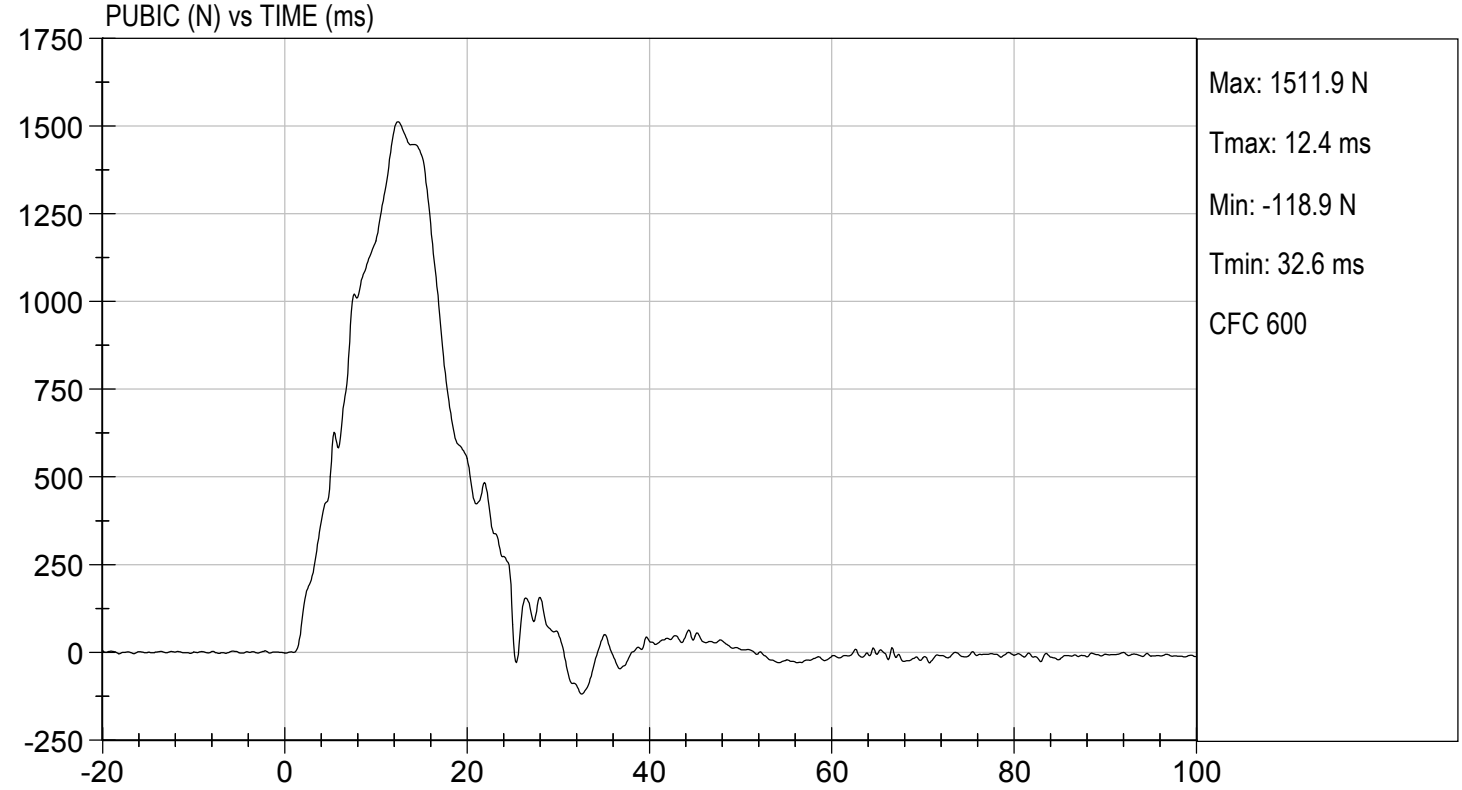
TEST DESC: PELVIS IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 01/08/2020
TEST #: D200099

IMPACTOR FORCE (N) vs TIME (ms)



PUBIC (N) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D200090

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	14	Pass
Probe Speed	m/s	5.40 to 5.60	5.46	Pass
Maximum Impactor Force (after 6 ms)	N	5100 to 6200	5449	Pass
Upper Rib Displacement	mm	34.0 to 41.0	39.5	Pass
Middle Rib Displacement	mm	37.0 to 45.0	40.7	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.8	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

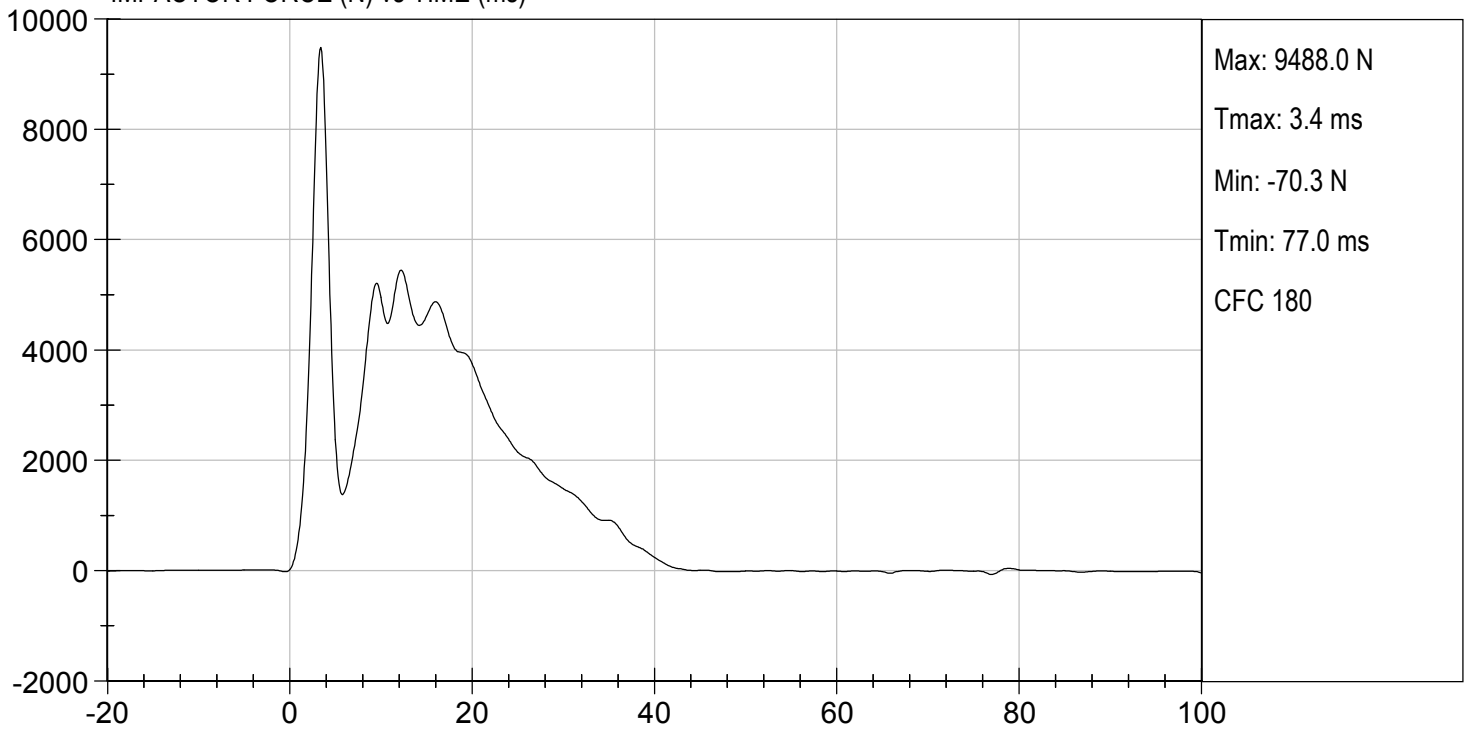
01/08/2020
Test Date

Approved By

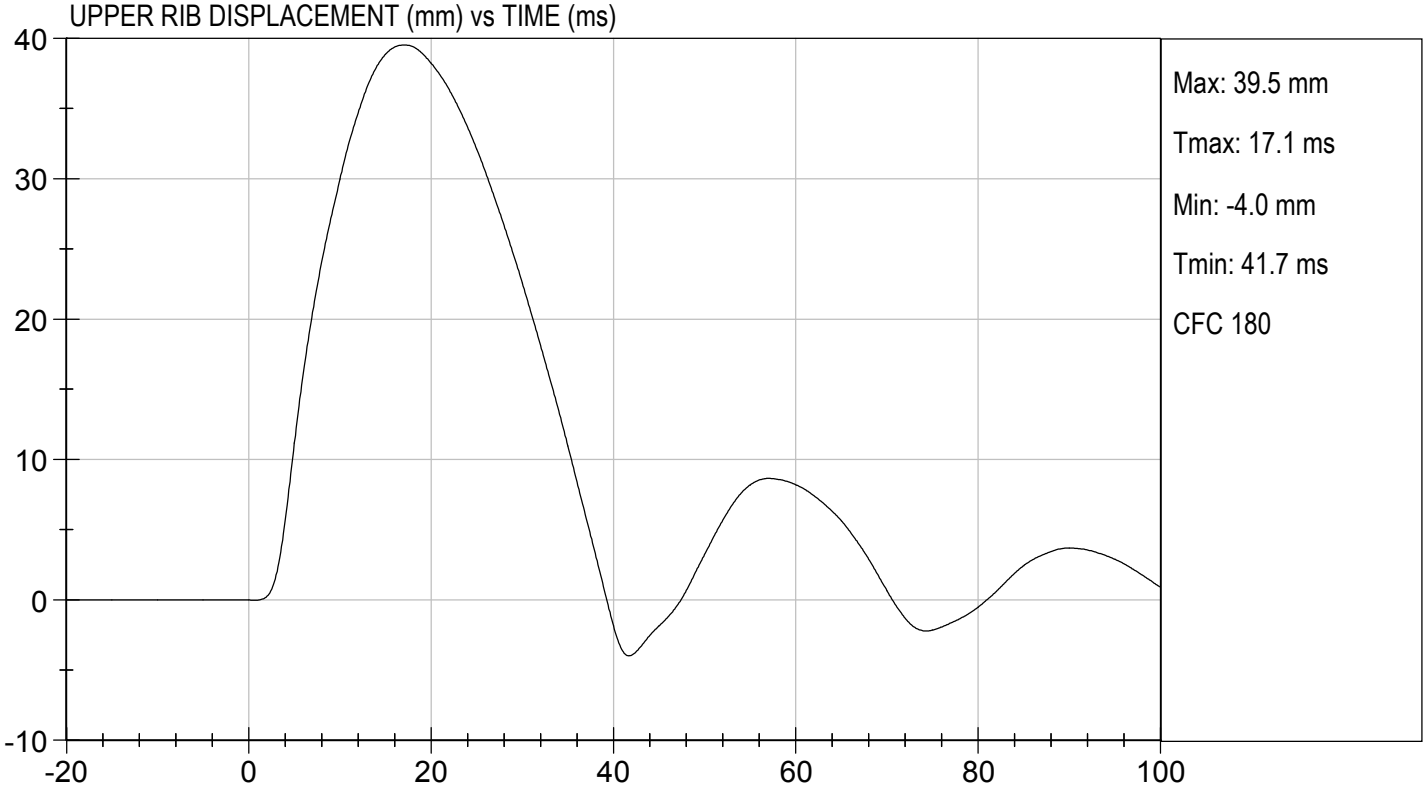
TEST DESC: THORAX IMPACT
VELOCITY: 17.92 ft/s, 5.46 m/s

TEST DATE: 01/08/2020
TEST #: D200090

IMPACTOR FORCE (N) vs TIME (ms)



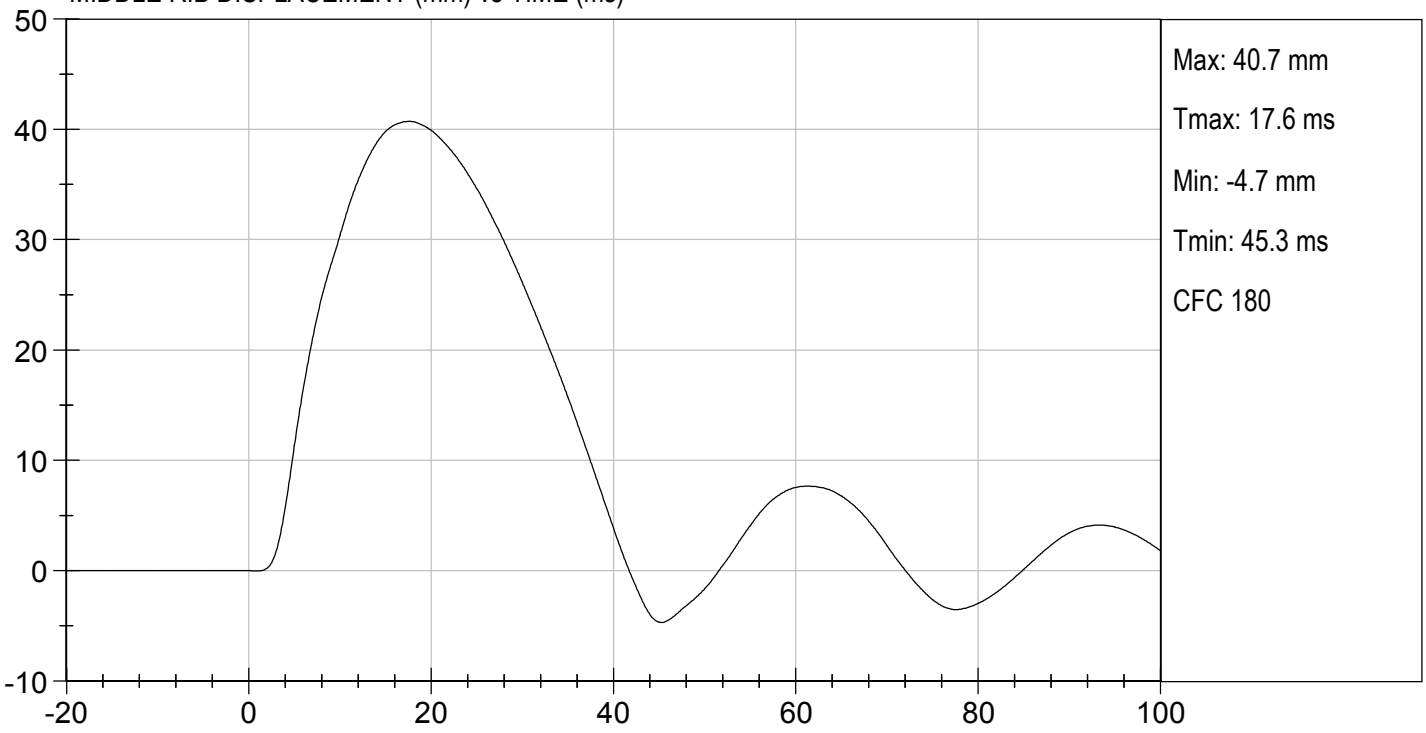
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



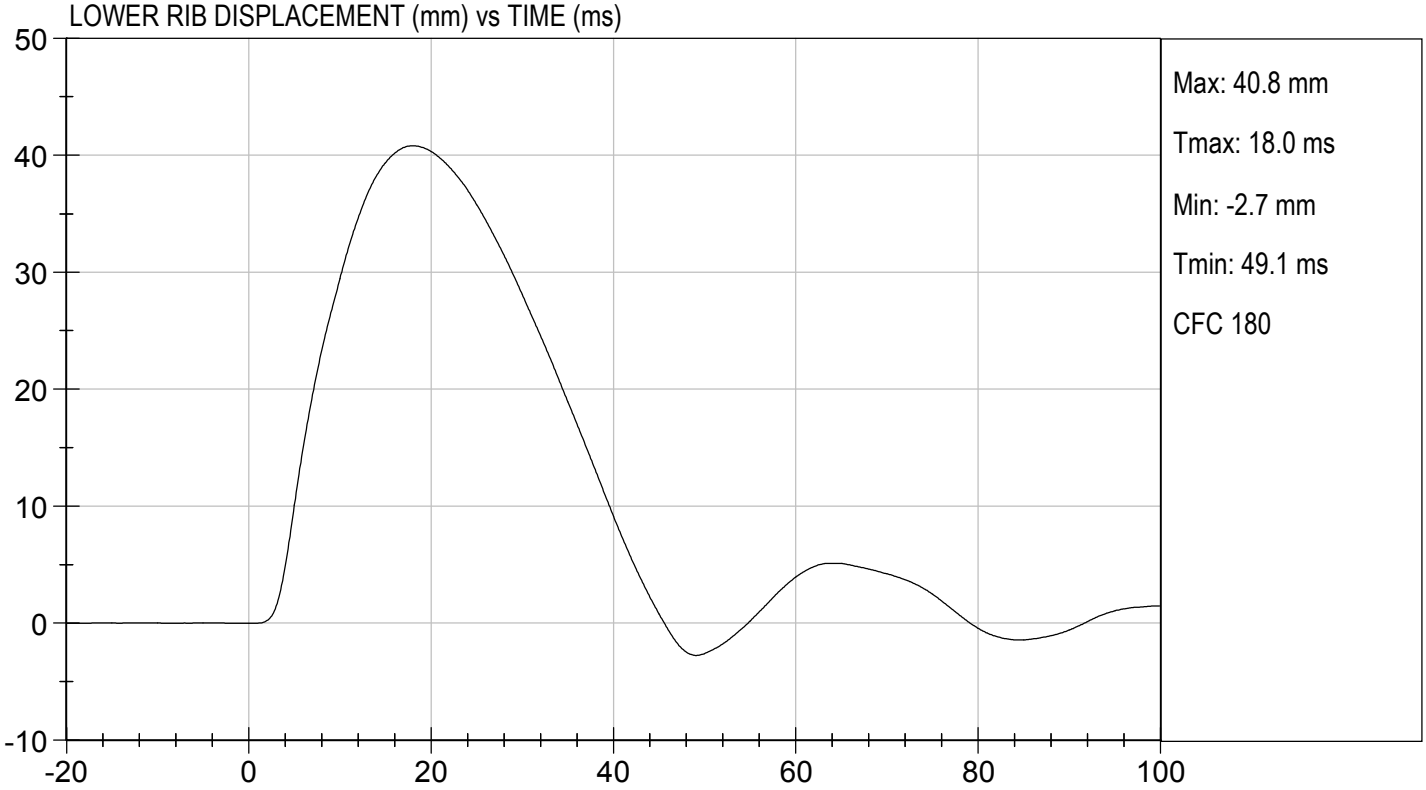
TEST DESC: THORAX IMPACT
VELOCITY: 17.92 ft/s, 5.46 m/s

TEST DATE: 01/08/2020
TEST #: D200090

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

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:** D193841

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Peak Resultant Acceleration	G's	115 to 137	126	Pass
Peak Longitudinal Acceleration	G's	+/- 15	4.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

12/12/2019

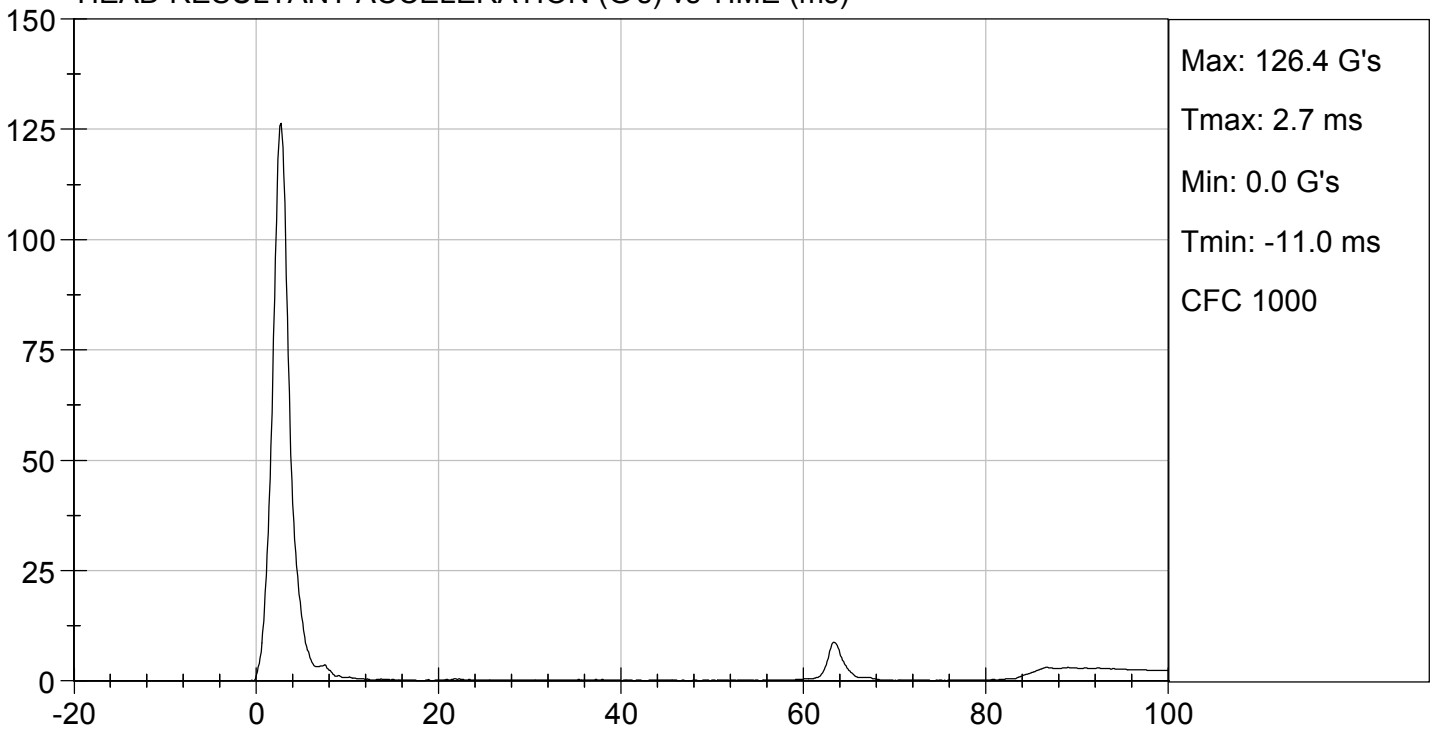
Test Date

Approved By

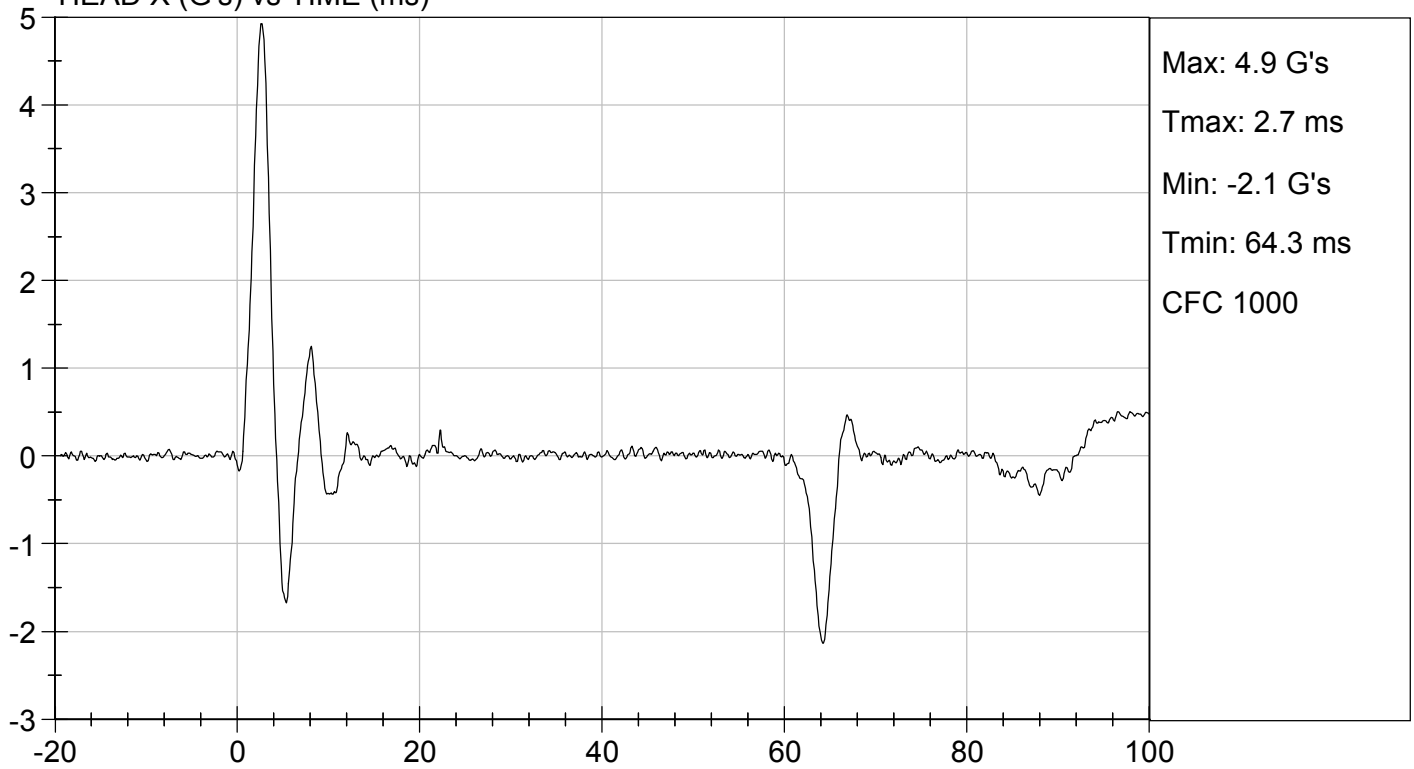
TEST DESC: HEAD DROP

TEST DATE: 12/12/2019
TEST #: D193841

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

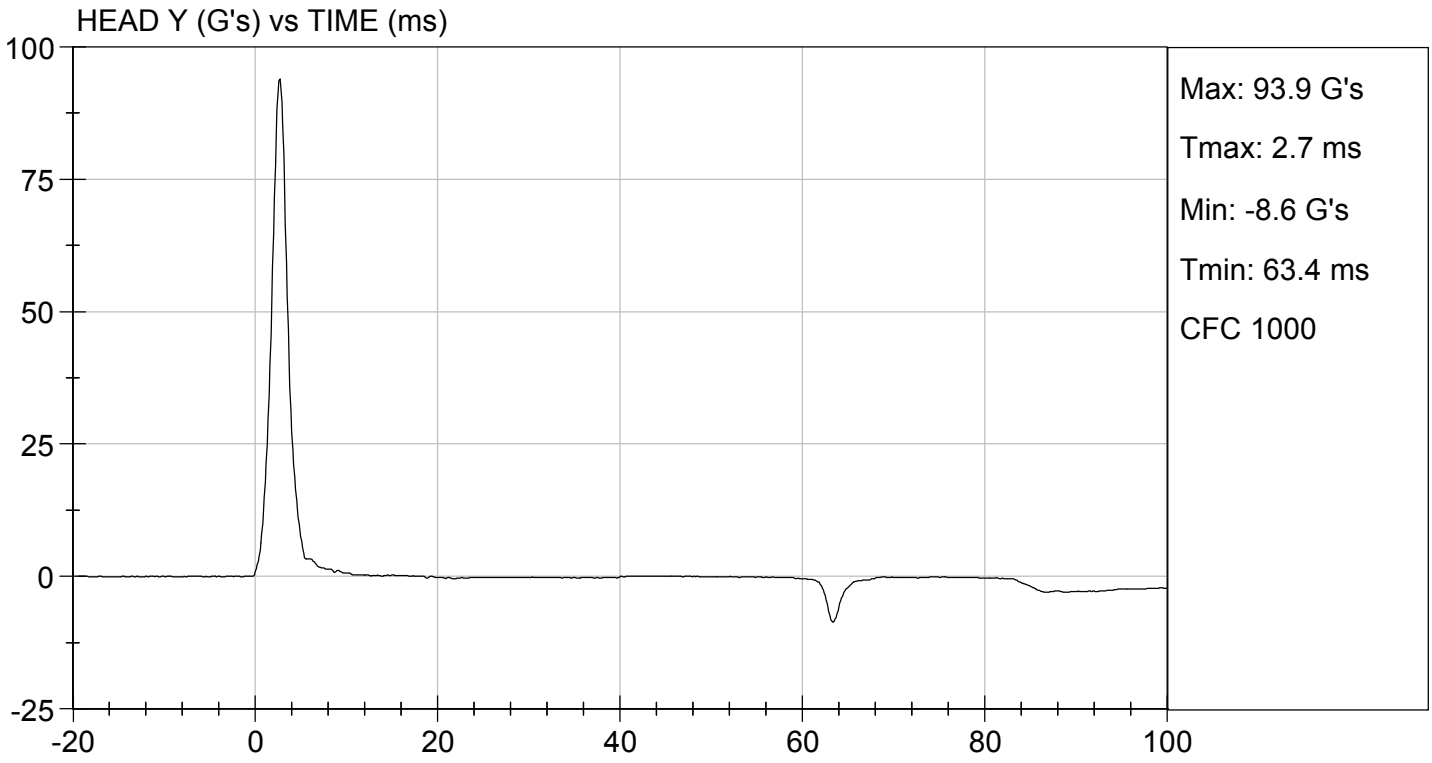


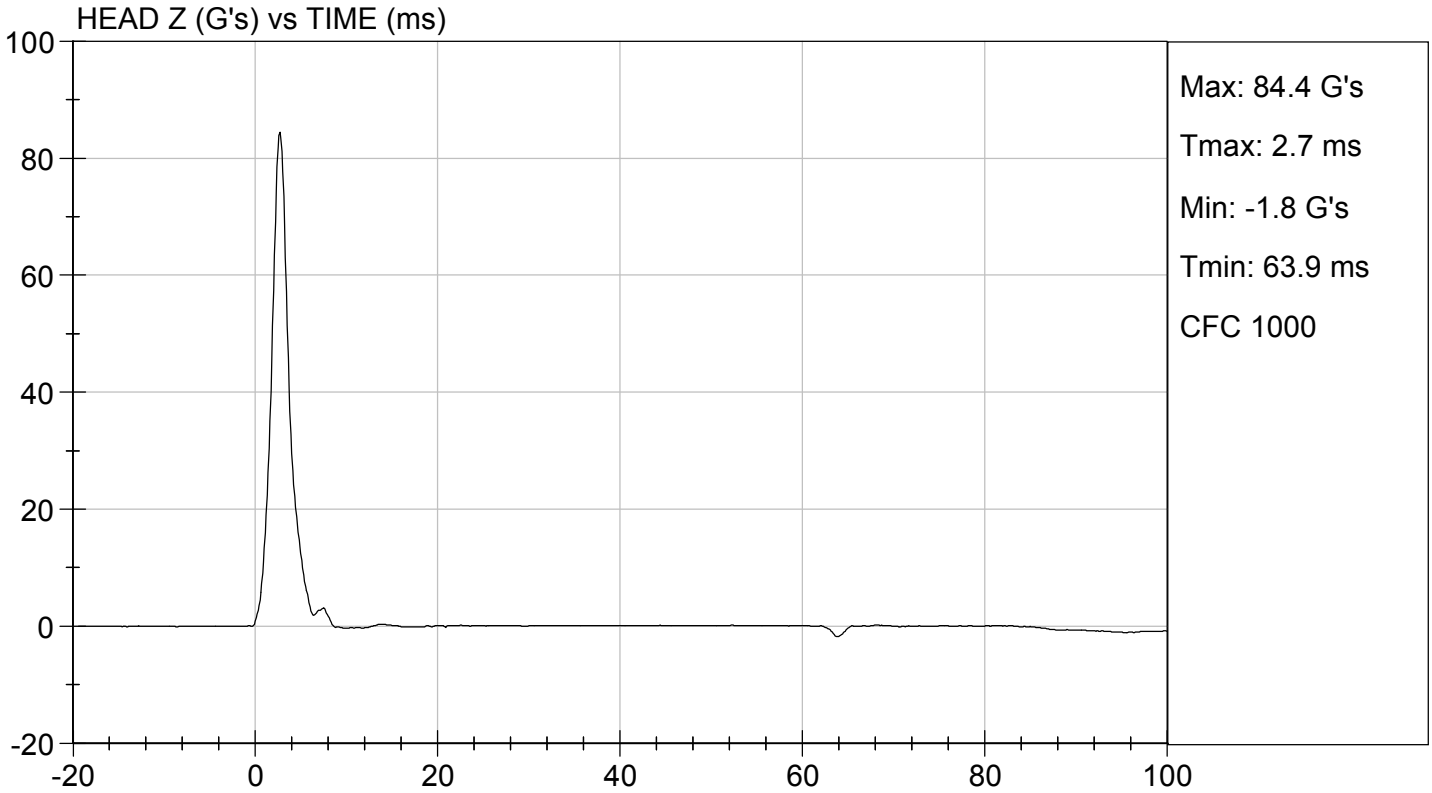
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 12/12/2019
TEST #: D193841





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193842

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	20.7	Pass
Humidity		%	10 to 70	20	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.62	Pass
	15 ms	m/s	3.30 to 4.10	3.77	Pass
	20 ms	m/s	4.40 to 5.40	5.22	Pass
	25 ms	m/s	5.40 to 6.10	5.60	Pass
	25-100 ms	m/s	5.50 to 6.20	5.63	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	63	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-38	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	112	Pass
			Overall Test Results		Pass

Laboratory Technician

12/12/2019

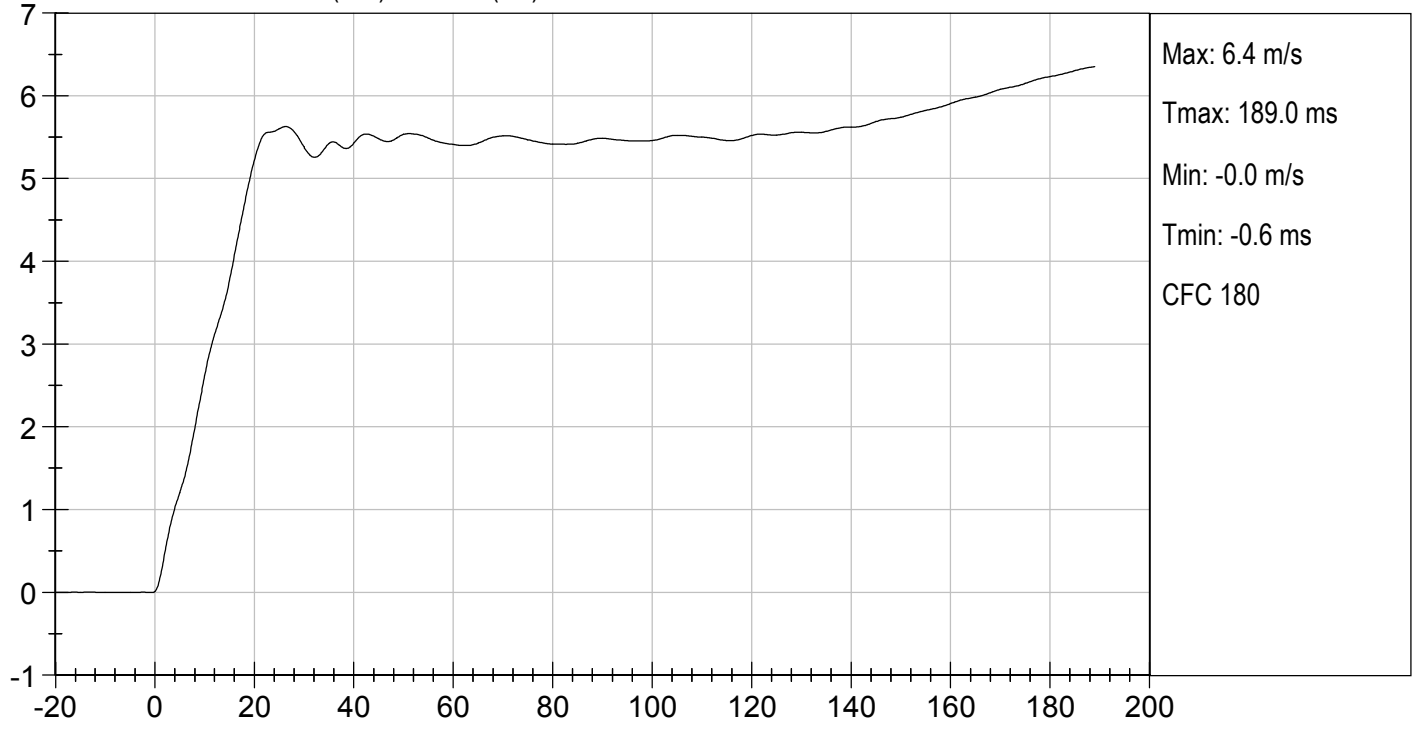
Test Date

Approved By

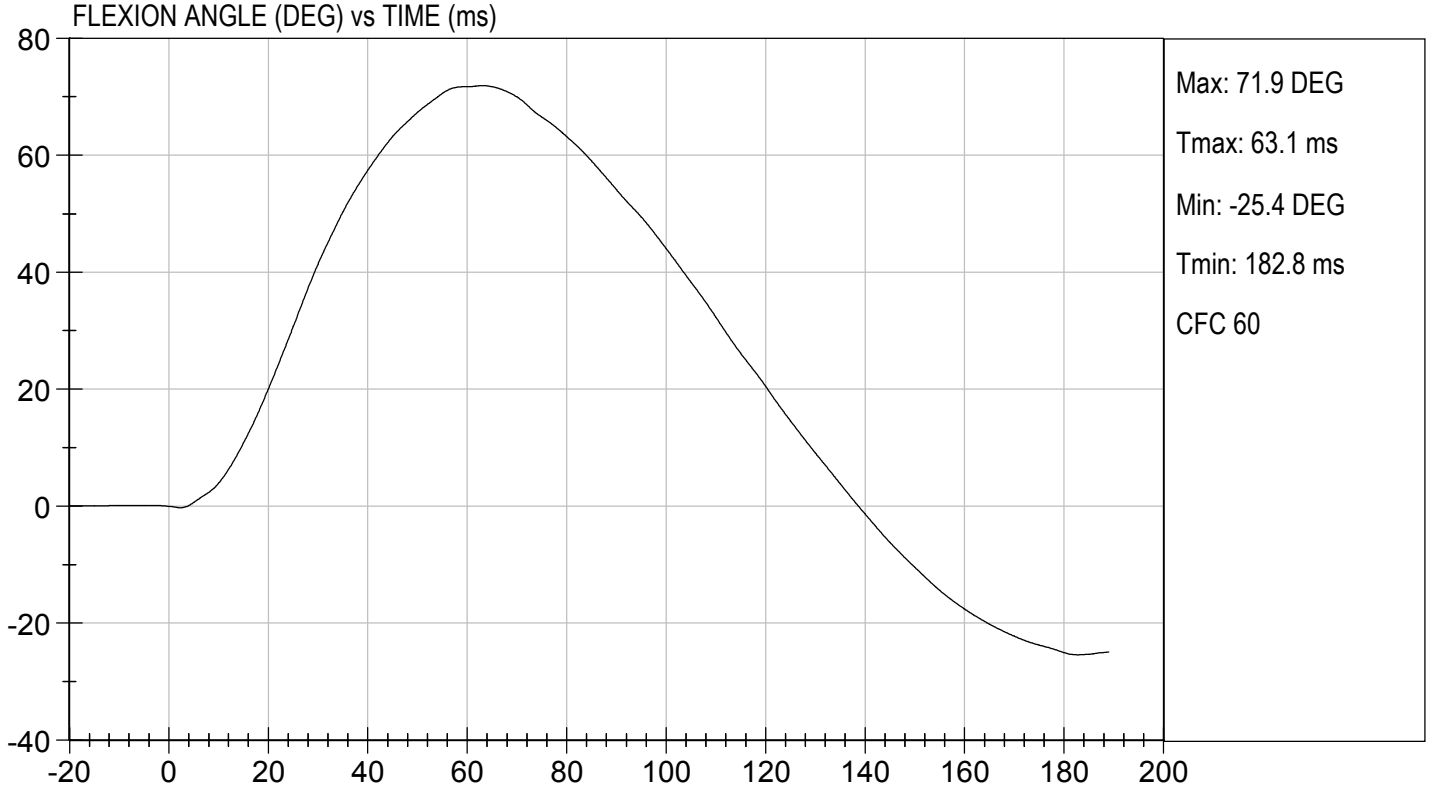
TEST DESC: NECK BENDING
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 12/12/2019
TEST #: D193842

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

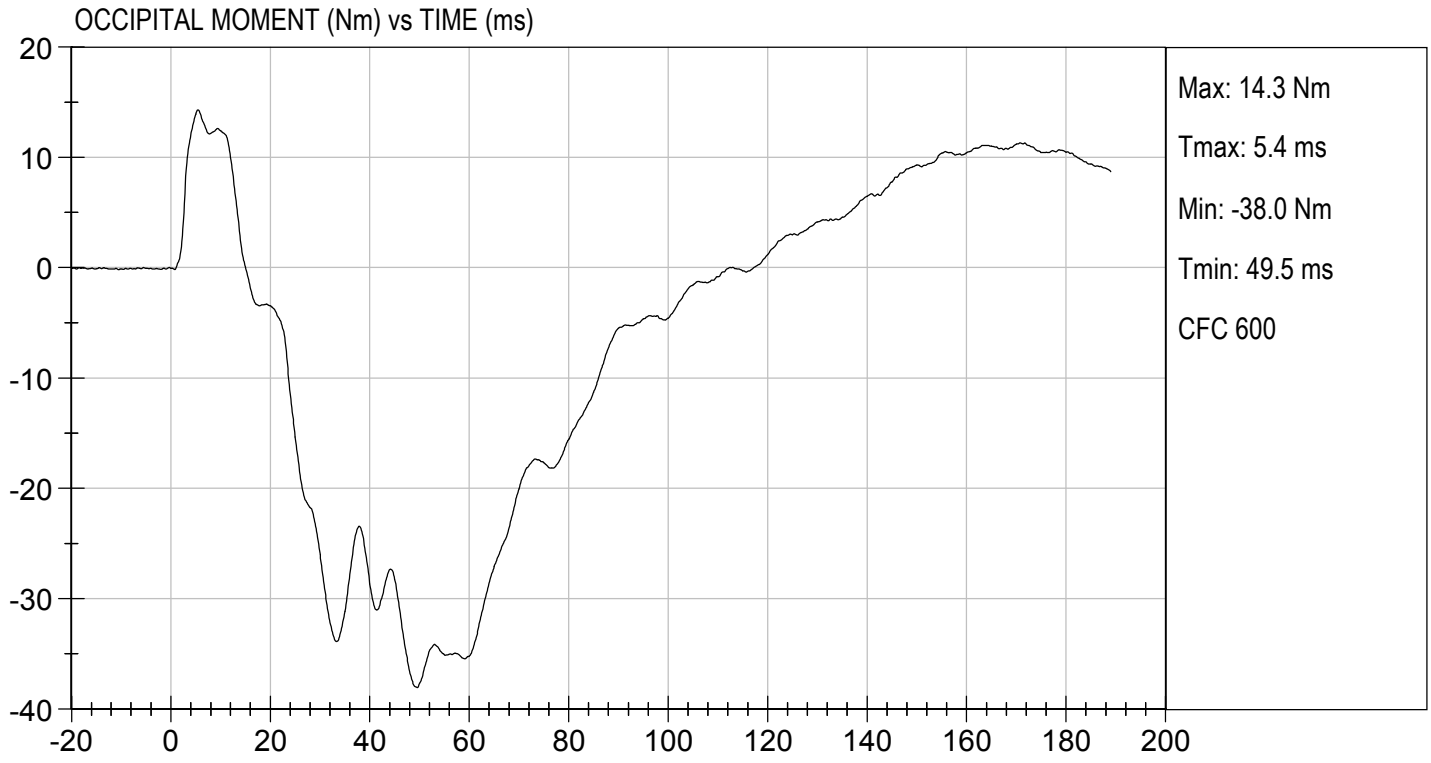


FLEXION ANGLE (DEG) vs TIME (ms)



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

TEST DATE: 12/12/2019
TEST #: D193842



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D193843

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	13 to 18	14	Pass
Shoulder Displacement	mm	28 to 37	30	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
		Overall Test Results		Pass

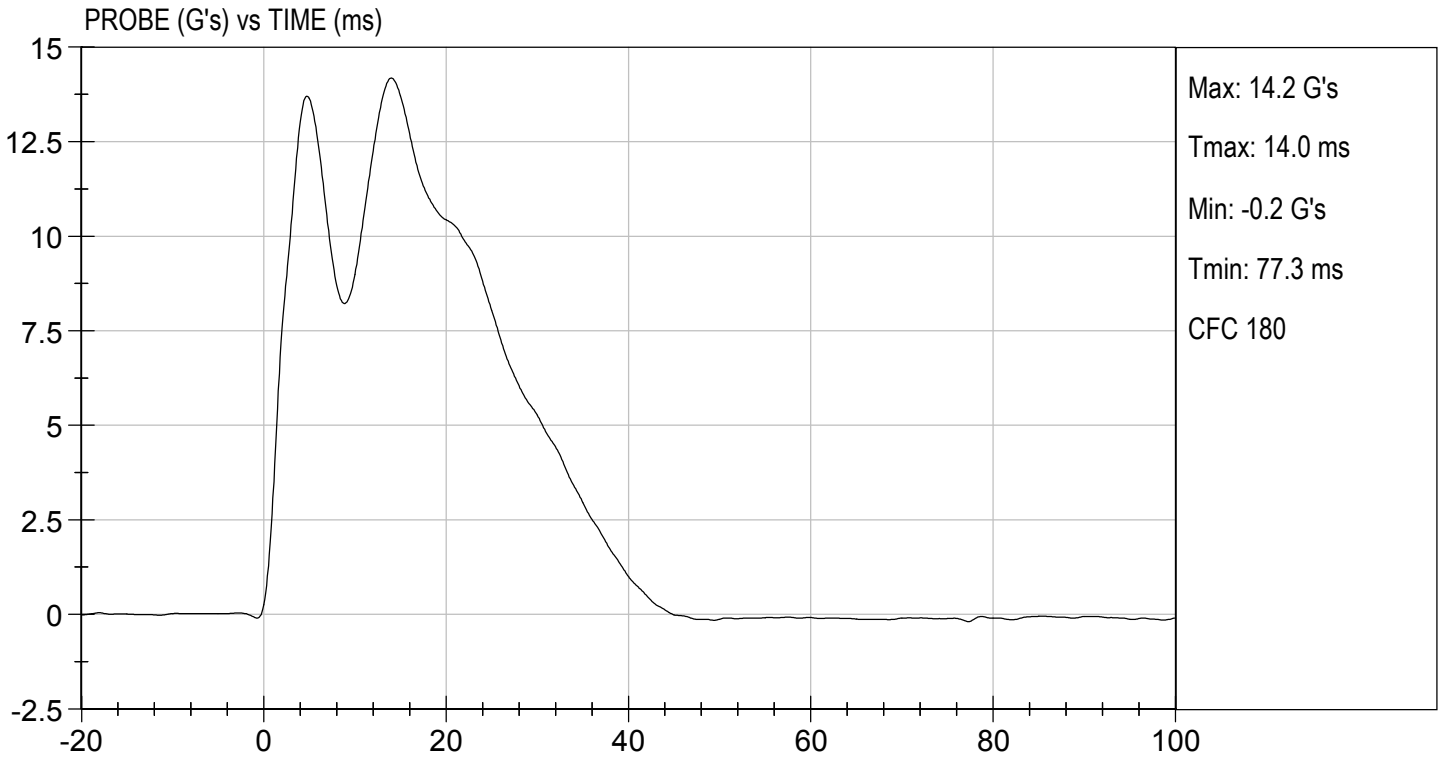
Jacob D Taylor
Laboratory Technician

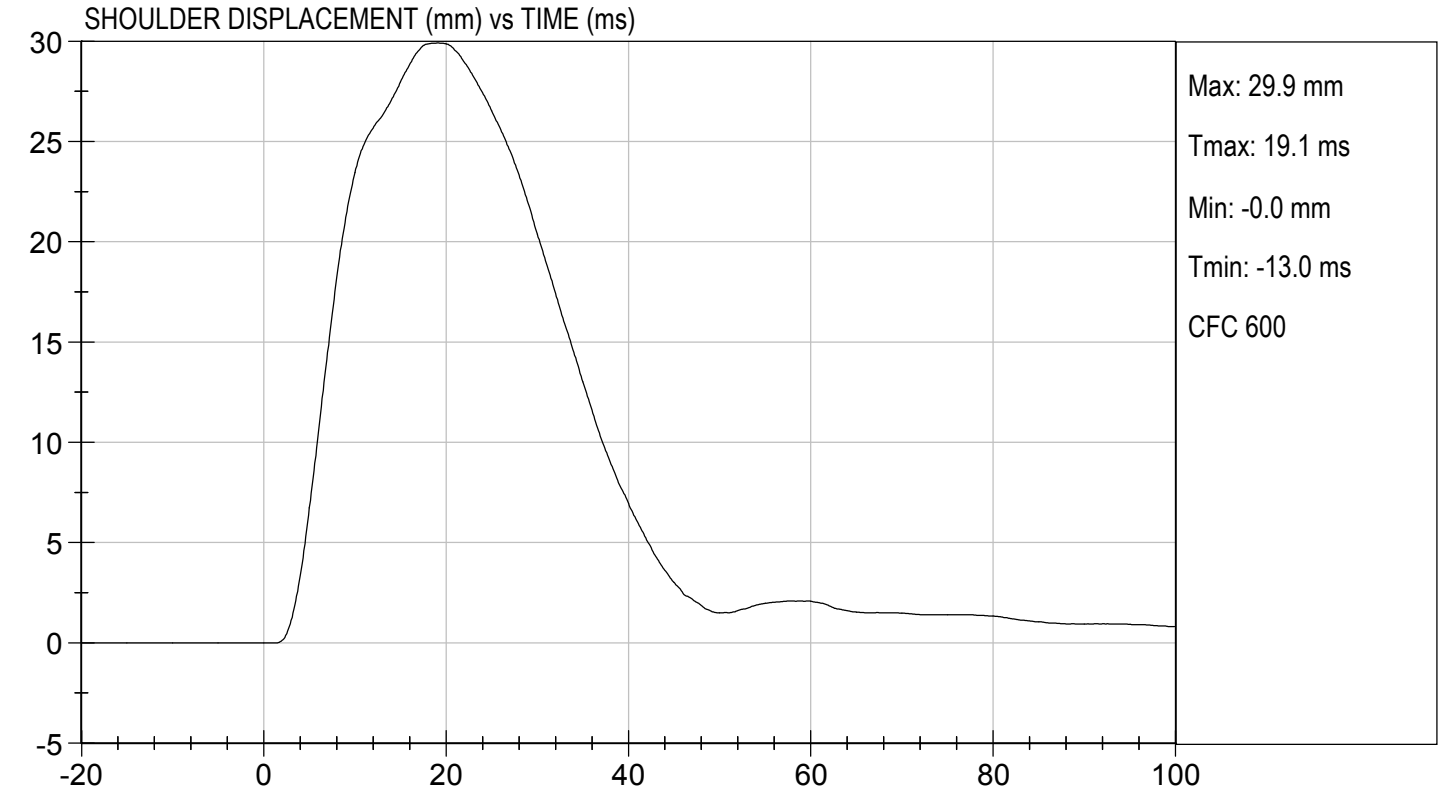
12/11/2019
Test Date

Approved By

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

TEST DATE: 12/11/2019
TEST #: D193843

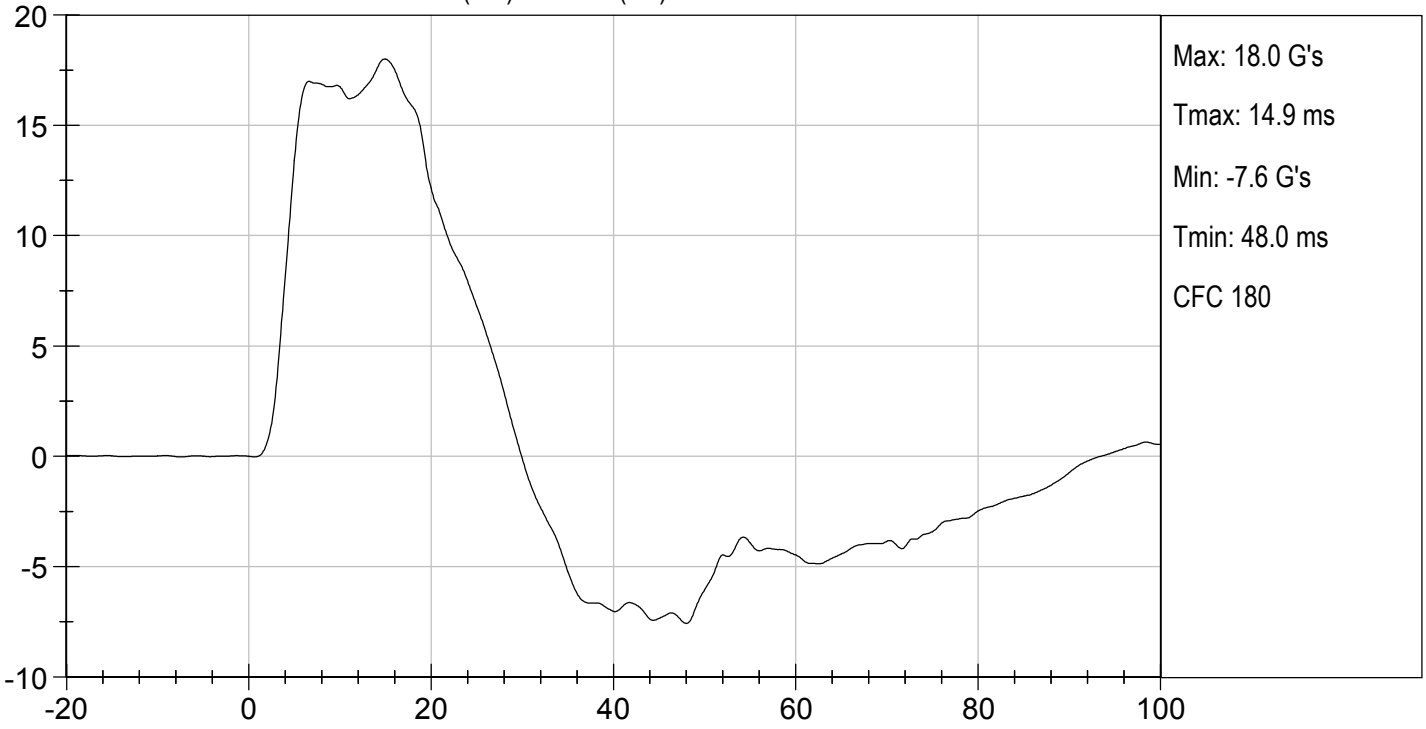




TEST DESC: SHOULDER IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 12/11/2019
TEST #: D193843

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



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193844

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21	Pass
Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	33	Pass
Shoulder Displacement	mm	31 to 40	36	Pass
Upper Rib Displacement	mm	25 to 32	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	37	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	34	Pass
		Overall Test Results		Pass

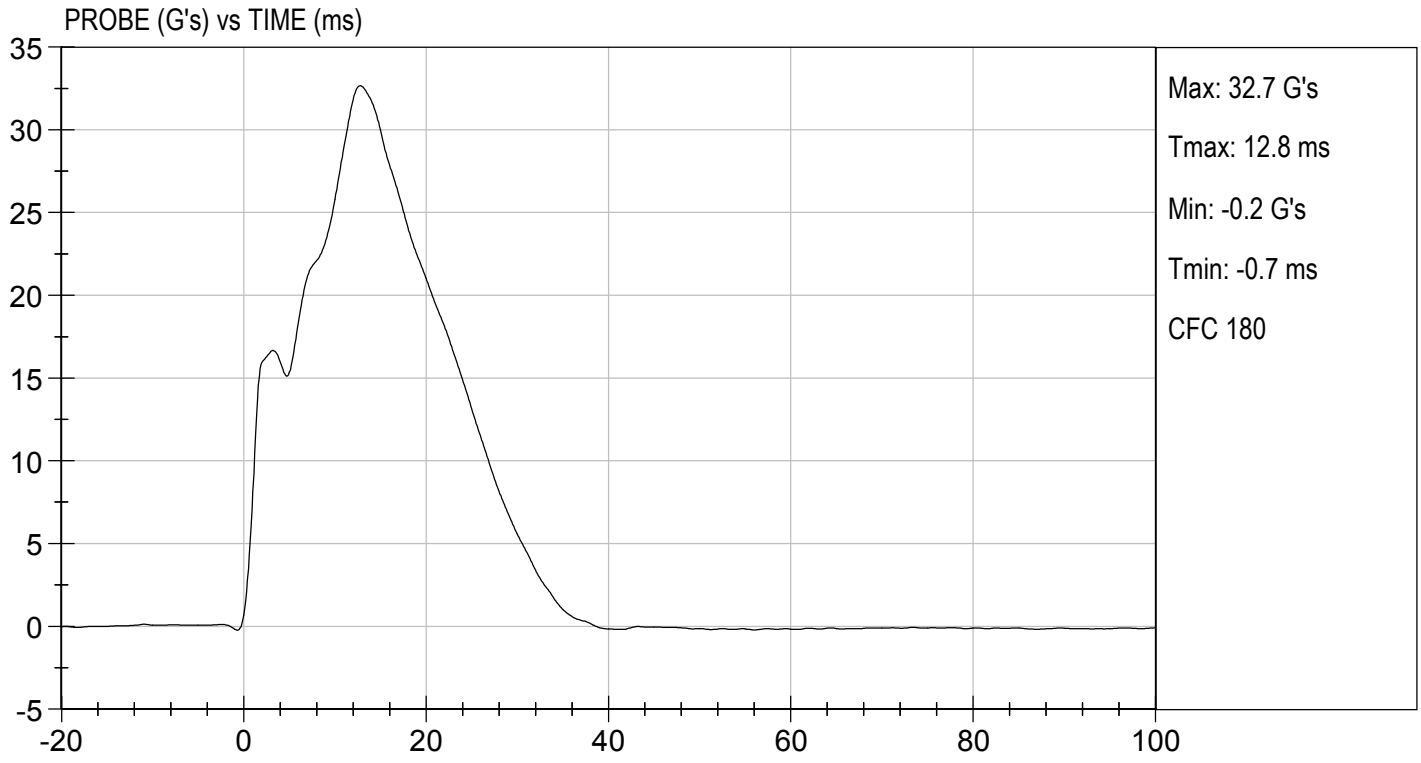
Jacob D Taylor
Laboratory Technician

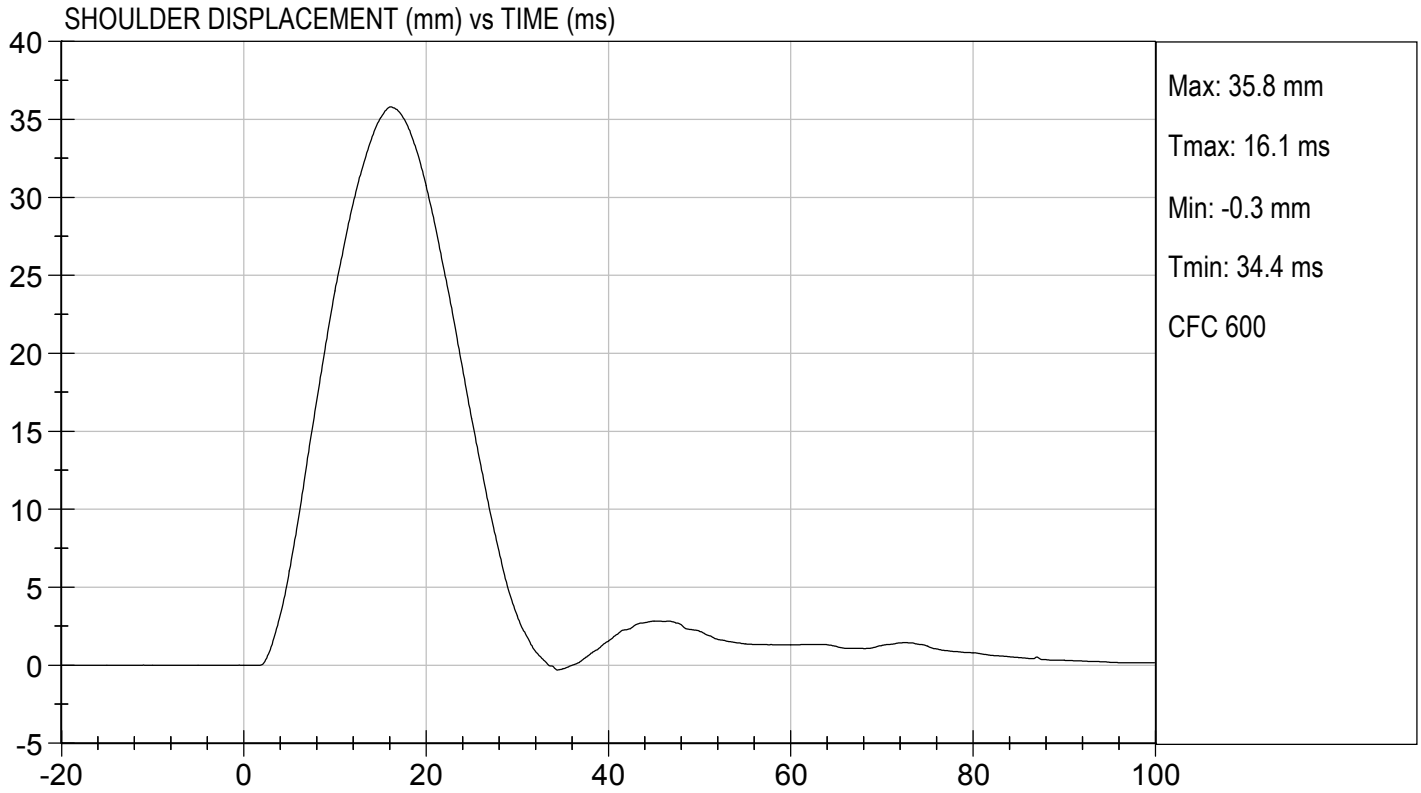
12/11/2019
Test Date

Approved By

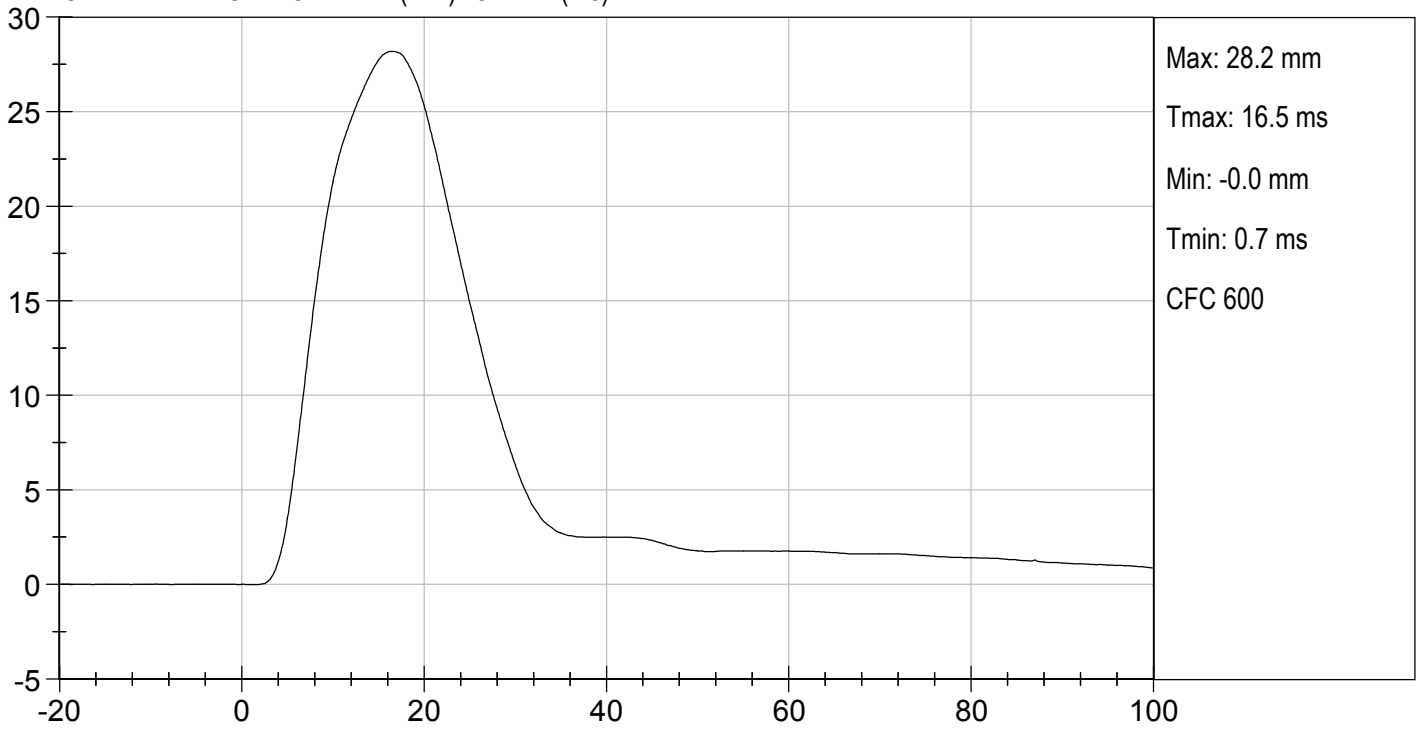
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 12/11/2019
TEST #: D193844

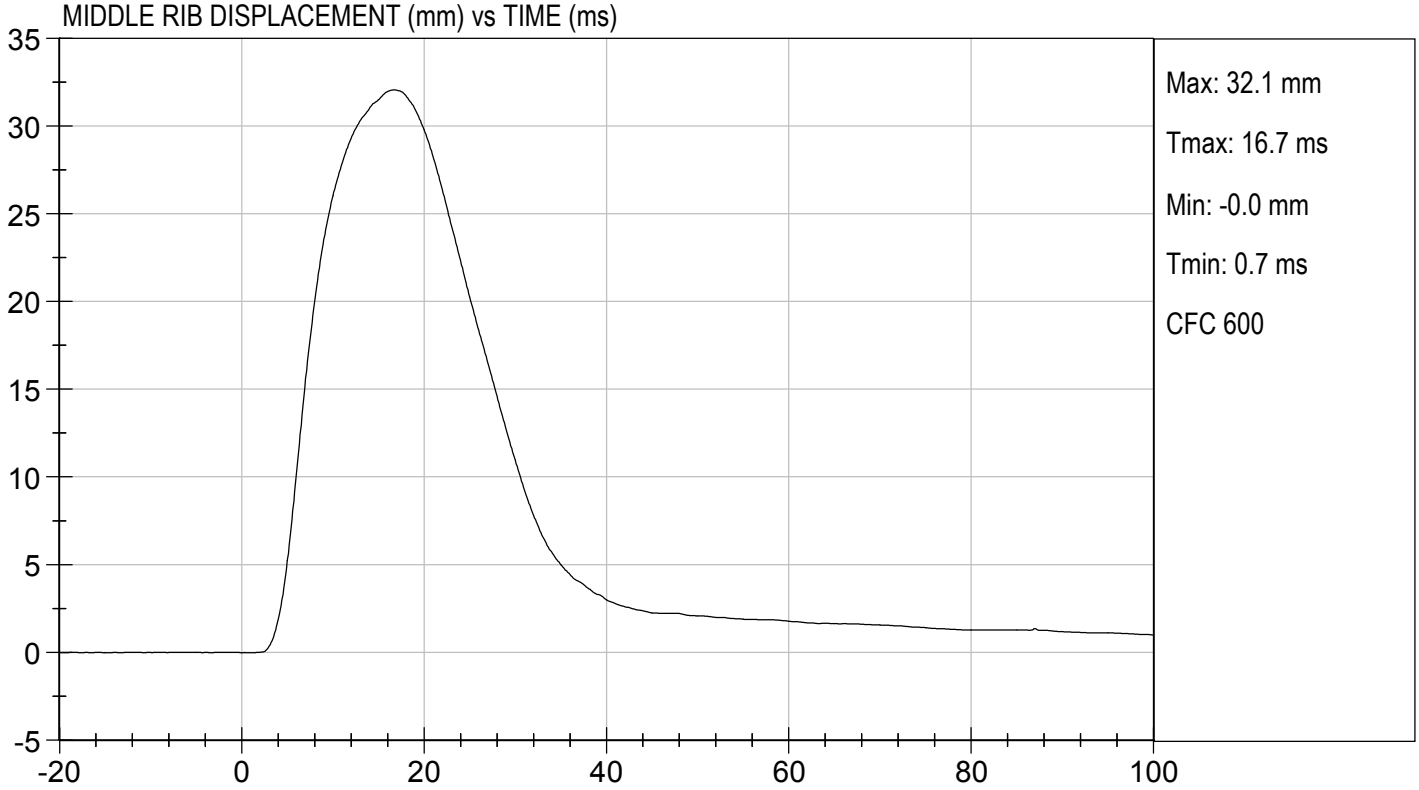




UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



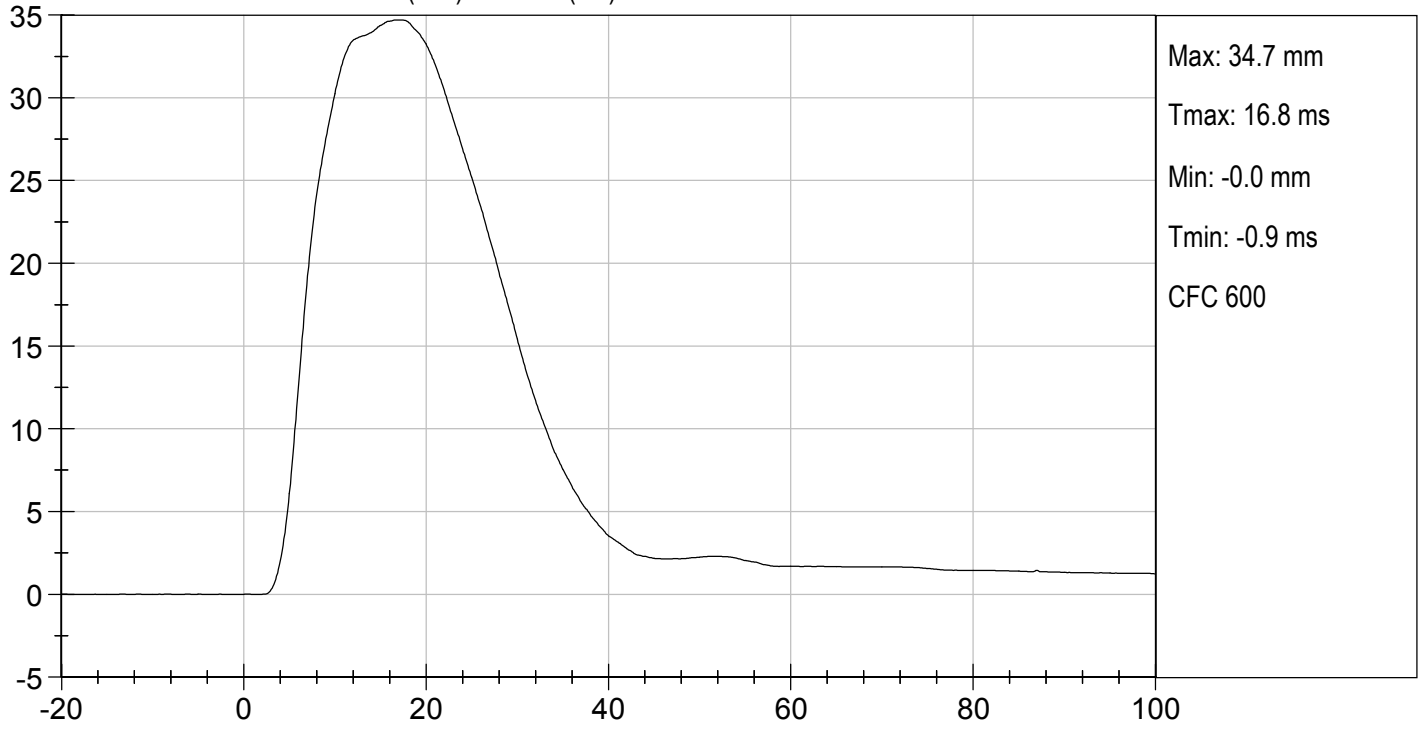
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



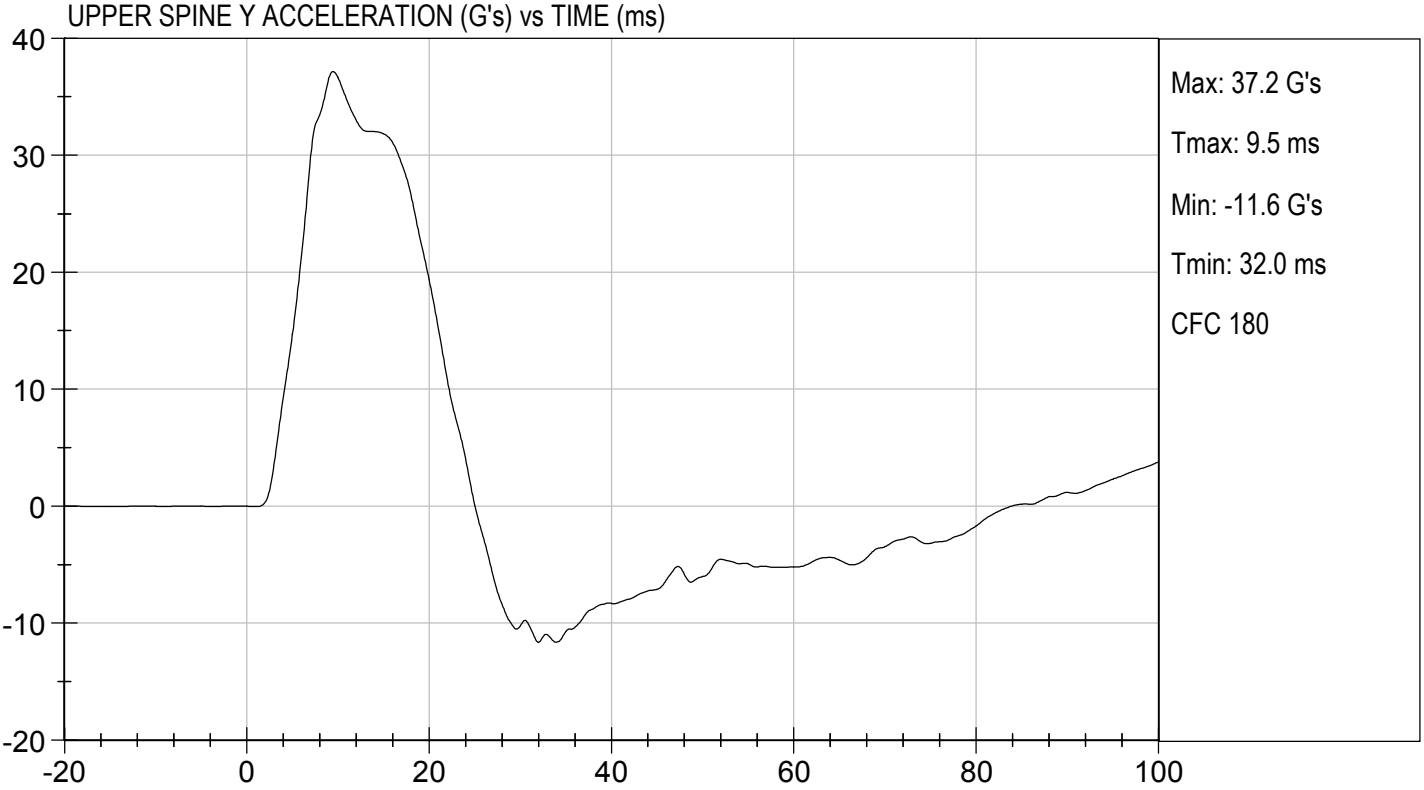
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 12/11/2019
TEST #: D193844

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



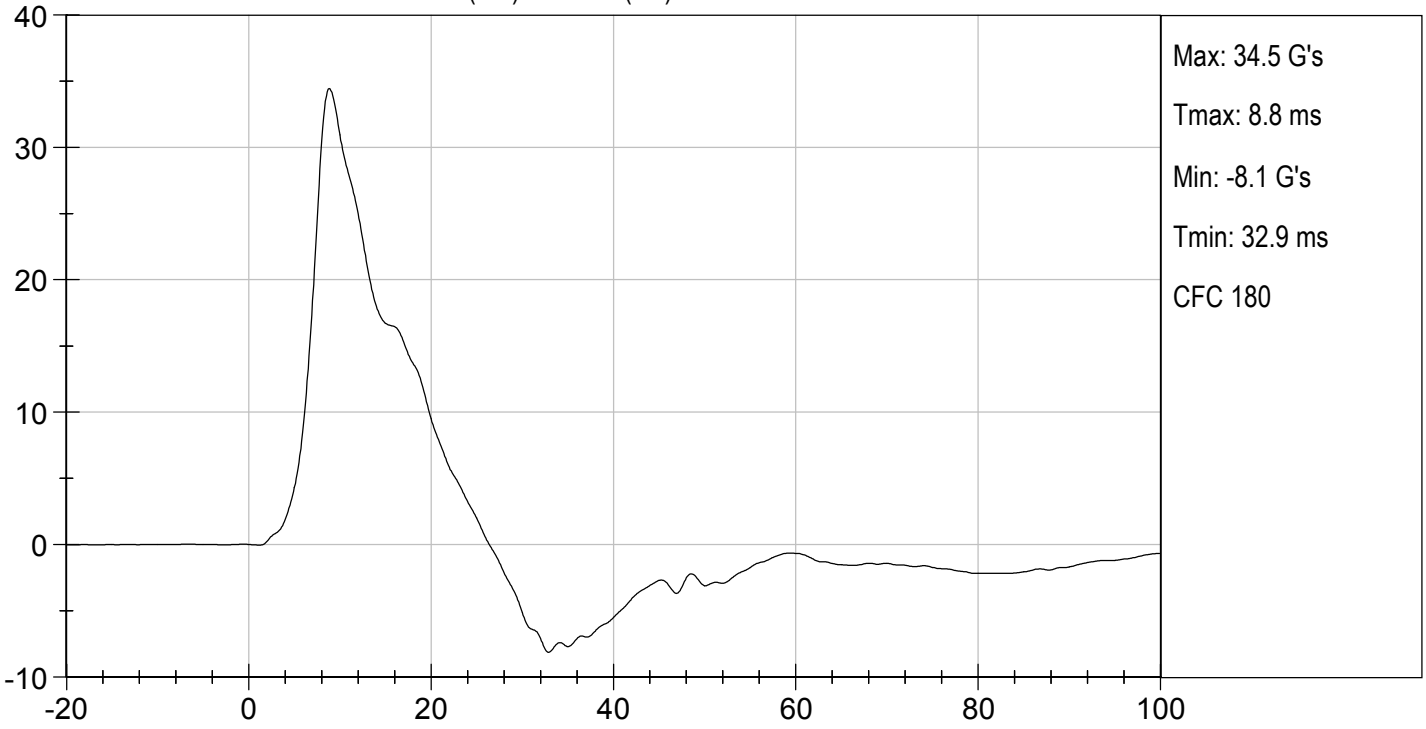
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 12/11/2019
TEST #: D193844

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:** D193845

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21	Pass
Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	14 to 18	14	Pass
Upper Rib Displacement	mm	32 to 40	39	Pass
Middle Rib Displacement	mm	39 to 45	42	Pass
Lower Rib Displacement	mm	35 to 43	39	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

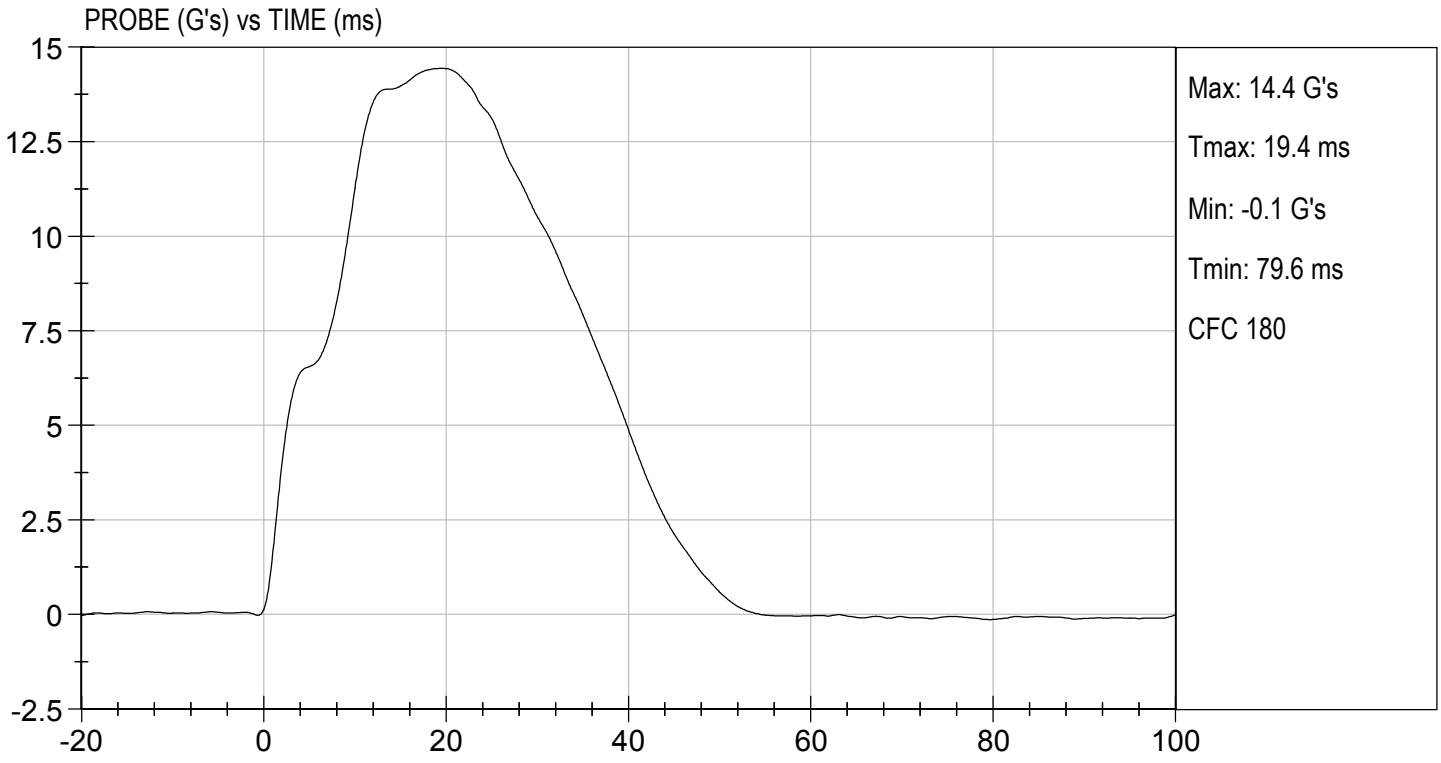
12/11/2019

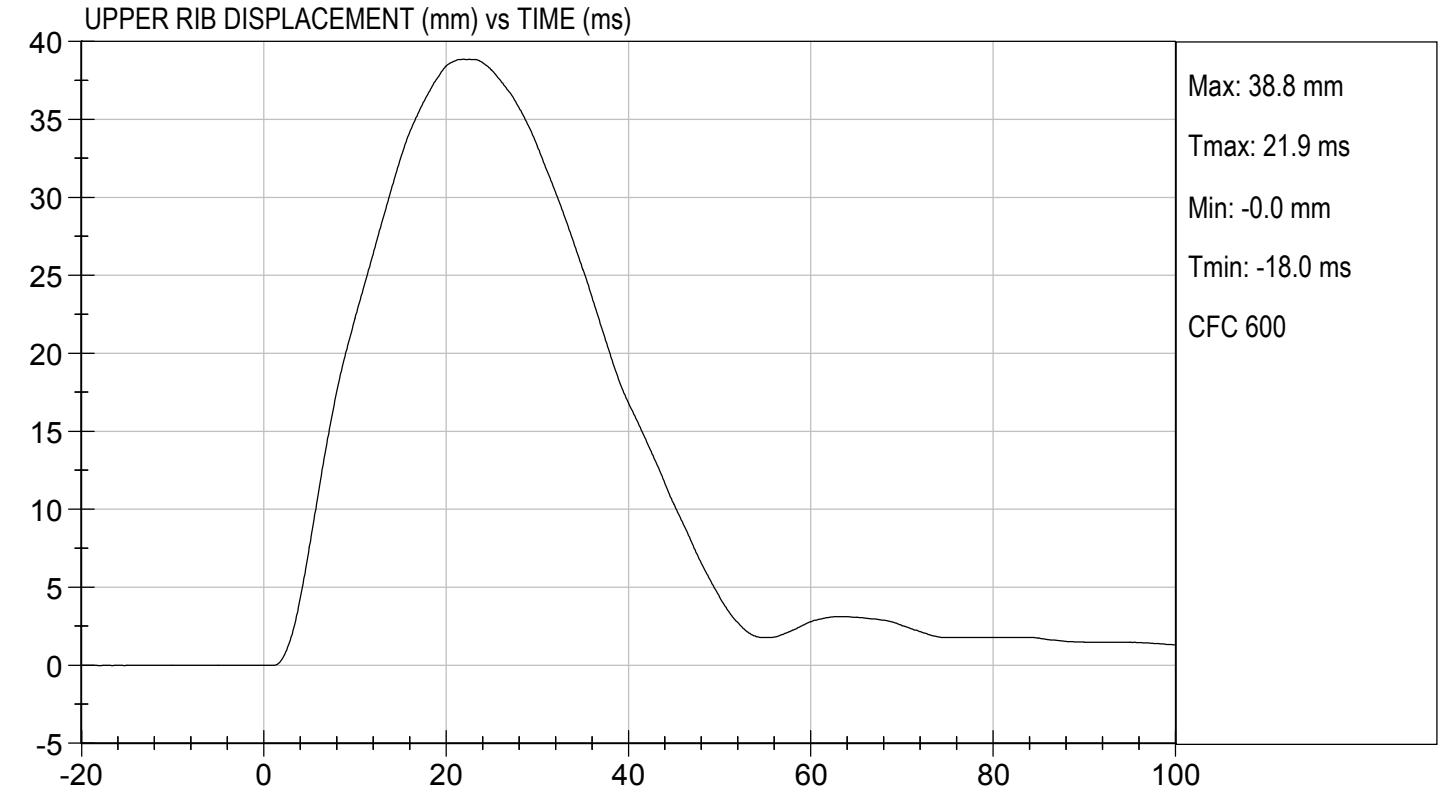
Test Date

Approved By

TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 12/11/2019
TEST #: D193845

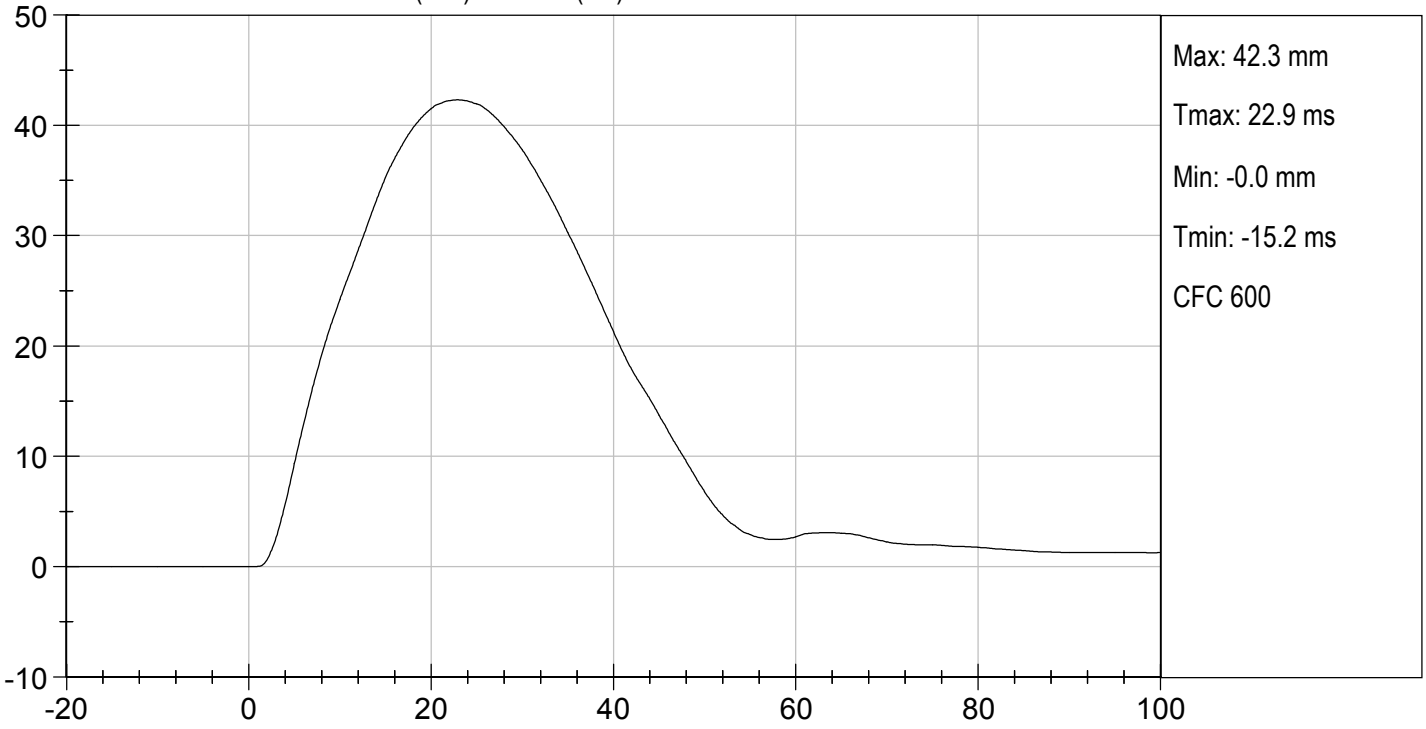




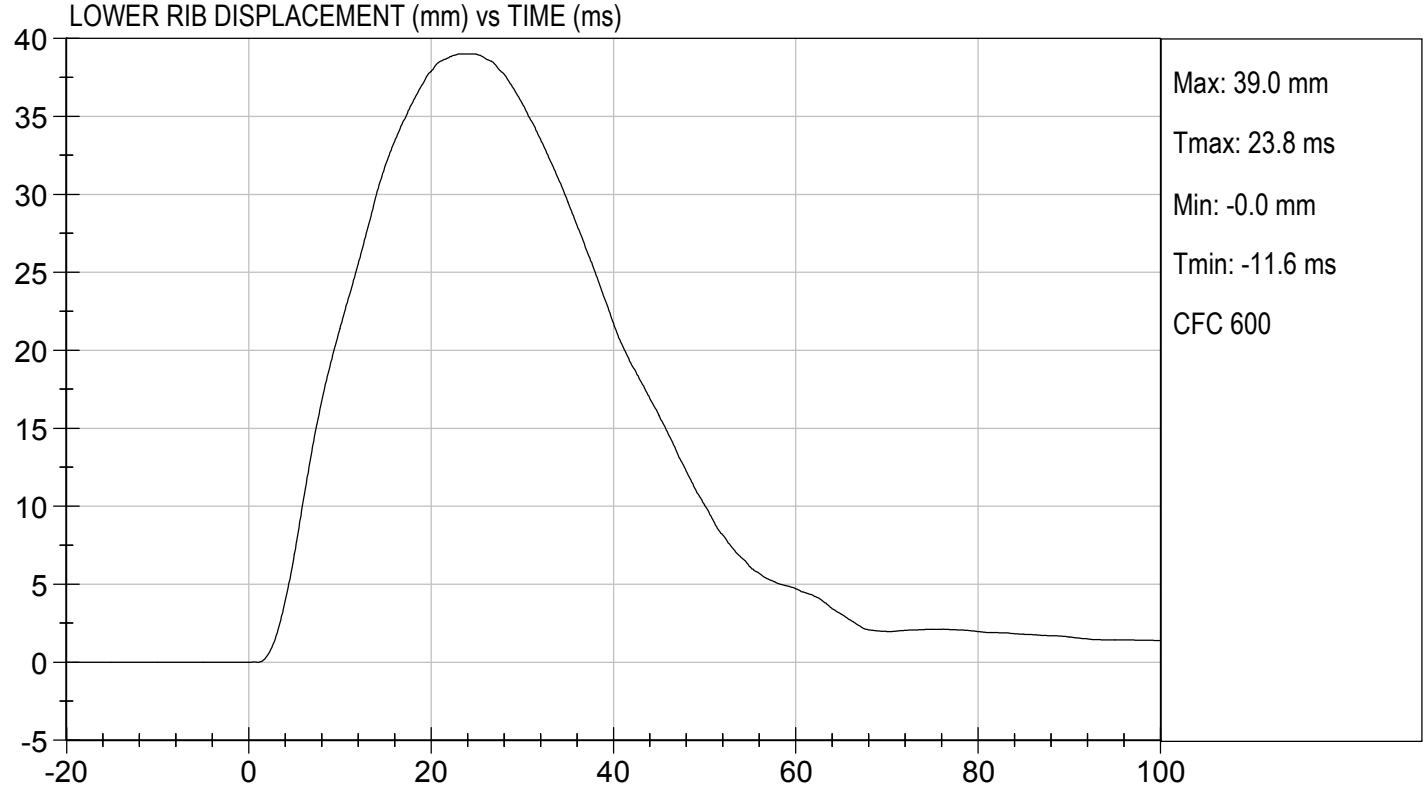
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 12/11/2019
TEST #: D193845

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



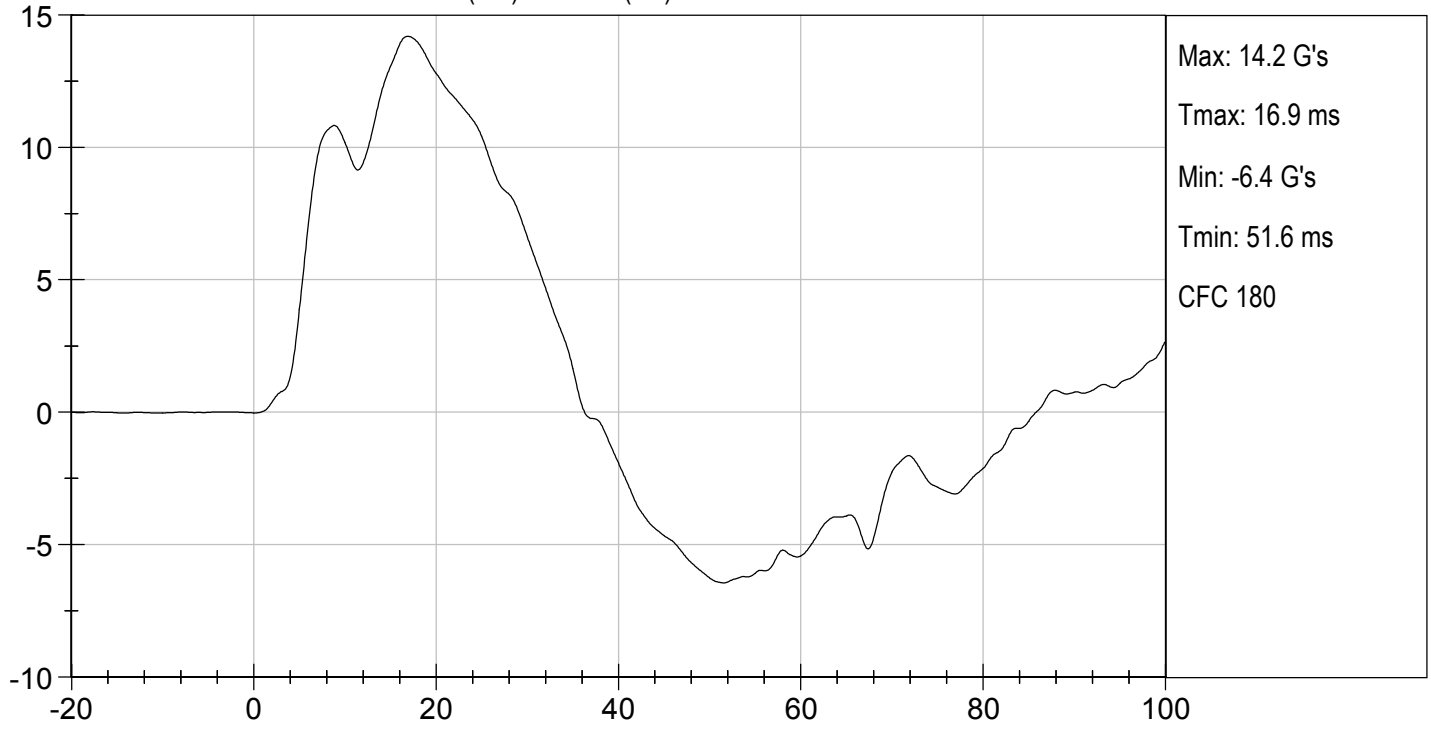
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



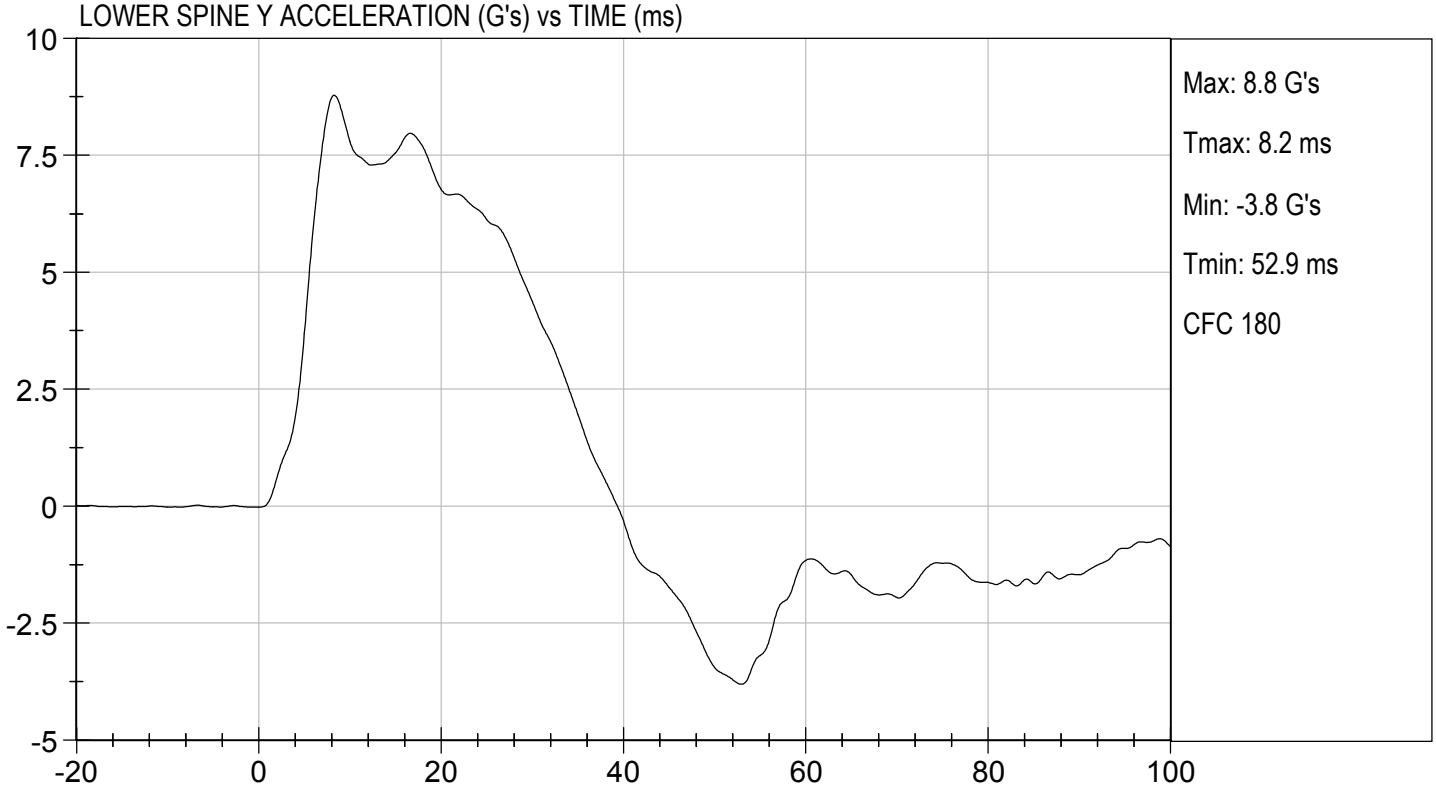
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 12/11/2019
TEST #: D193845

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:** D193846

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21	Pass
Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	12 to 16	14	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	40	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	40	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

12/11/2019

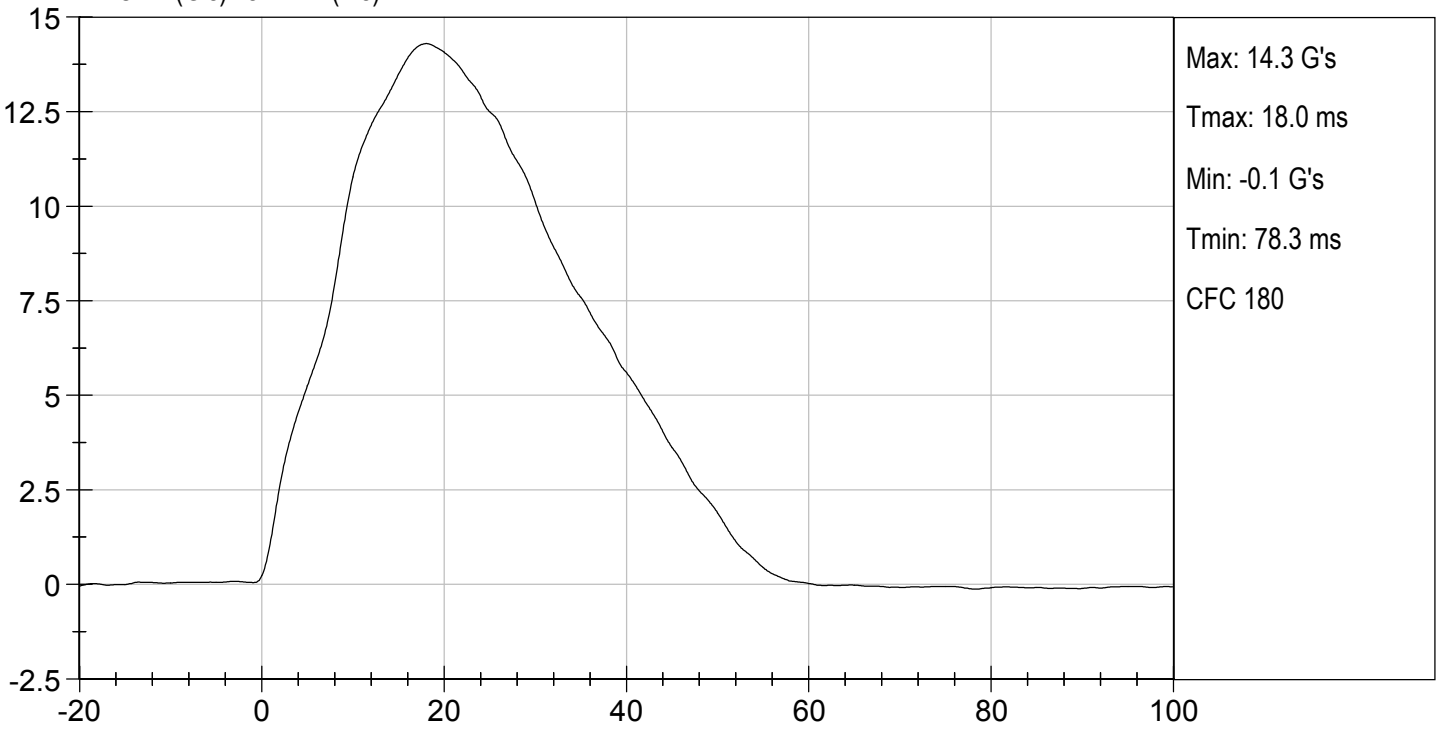
Test Date

Approved By

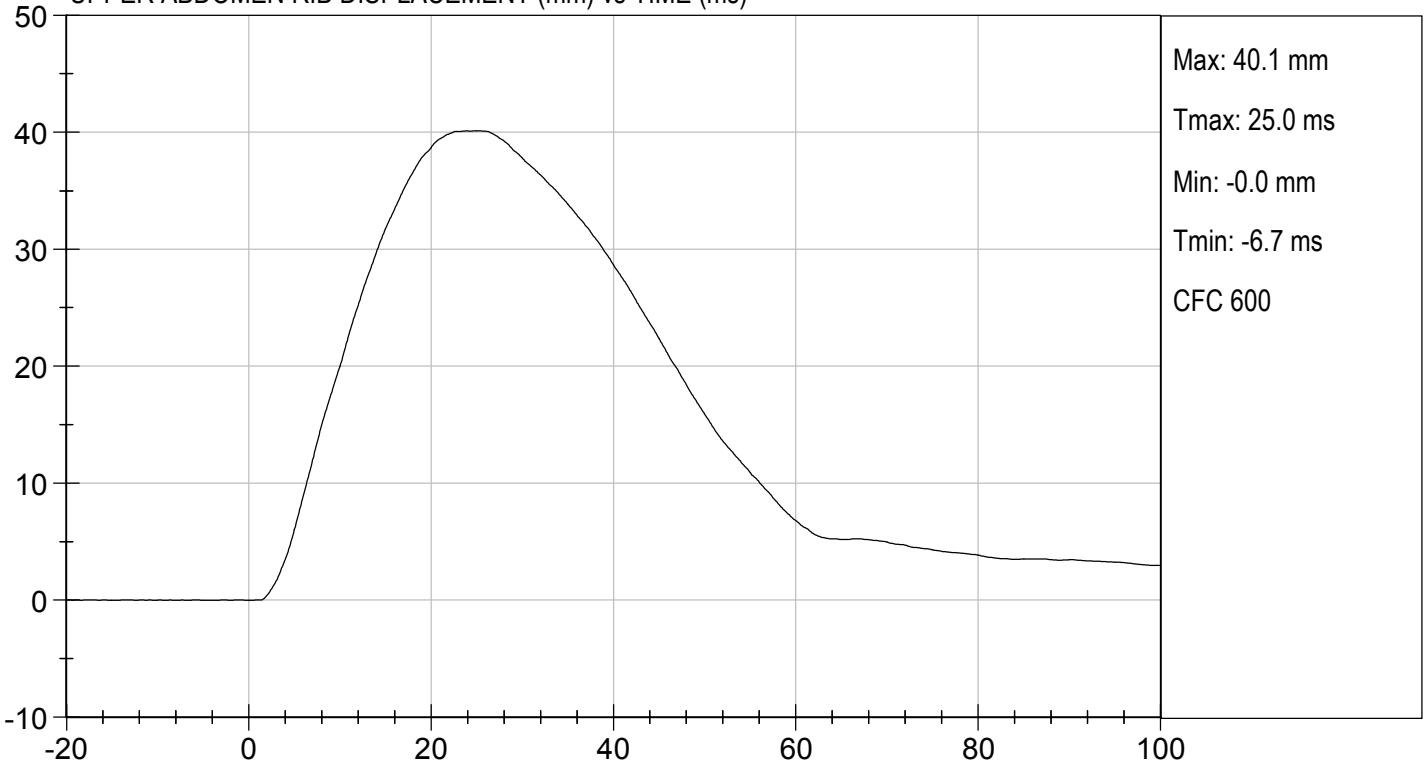
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.02 ft/s, 4.27 m/s

TEST DATE: 12/11/2019
TEST #: D193846

PROBE (G's) vs TIME (ms)



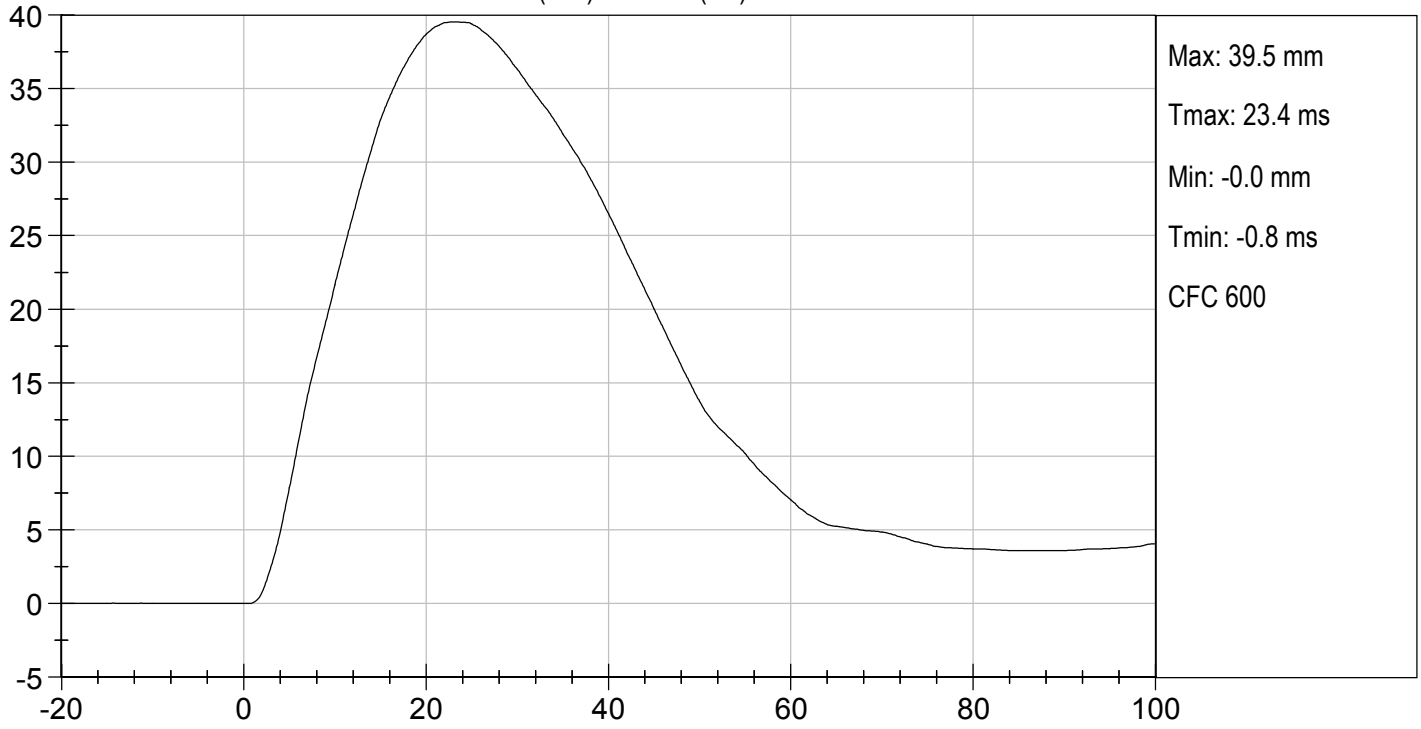
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



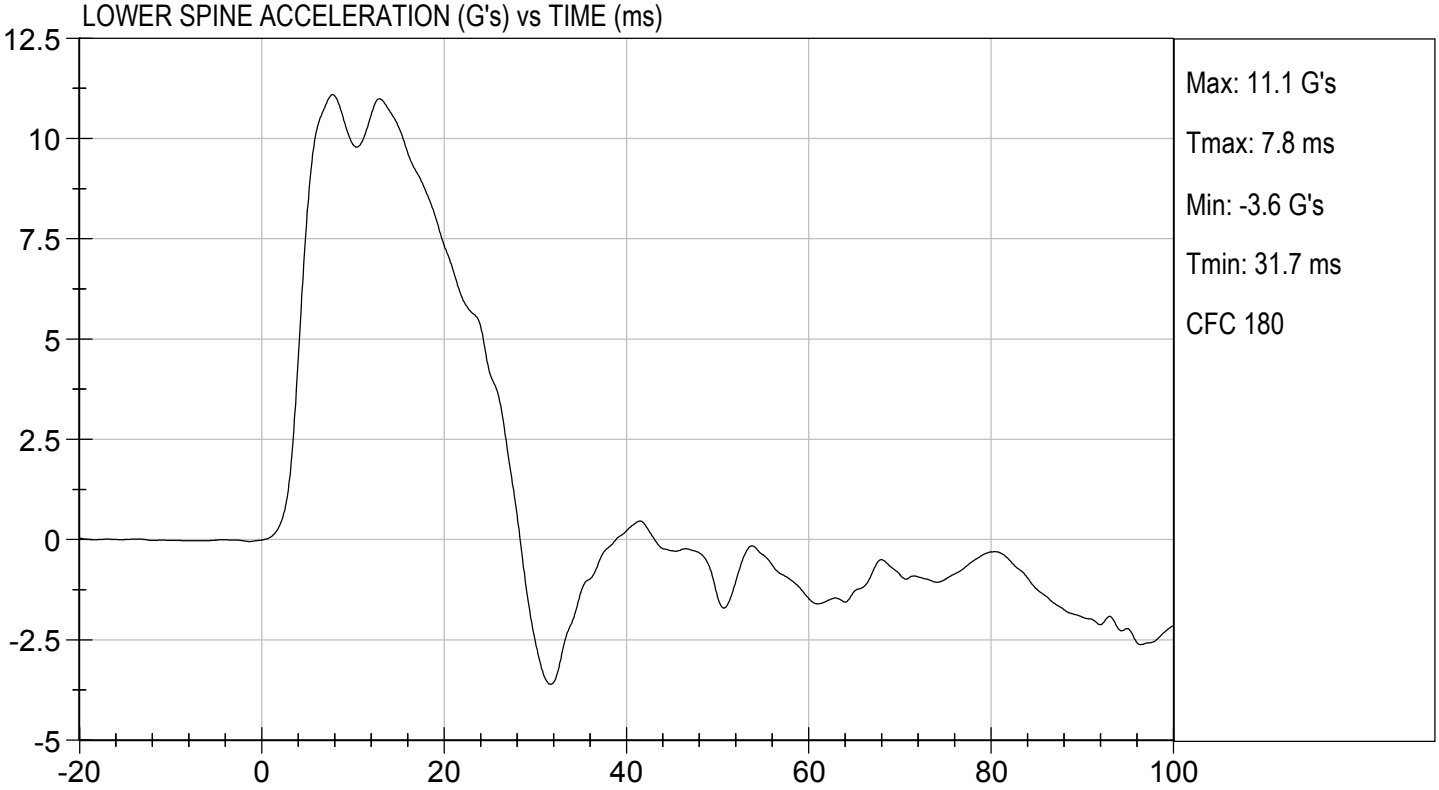
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.02 ft/s, 4.27 m/s

TEST DATE: 12/11/2019
TEST #: D193846

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:** D193847

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21	Pass
Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	38 to 47	47	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	37	Pass
Peak Acetabulum Force	N	3600 to 4300	4,151	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

12/11/2019

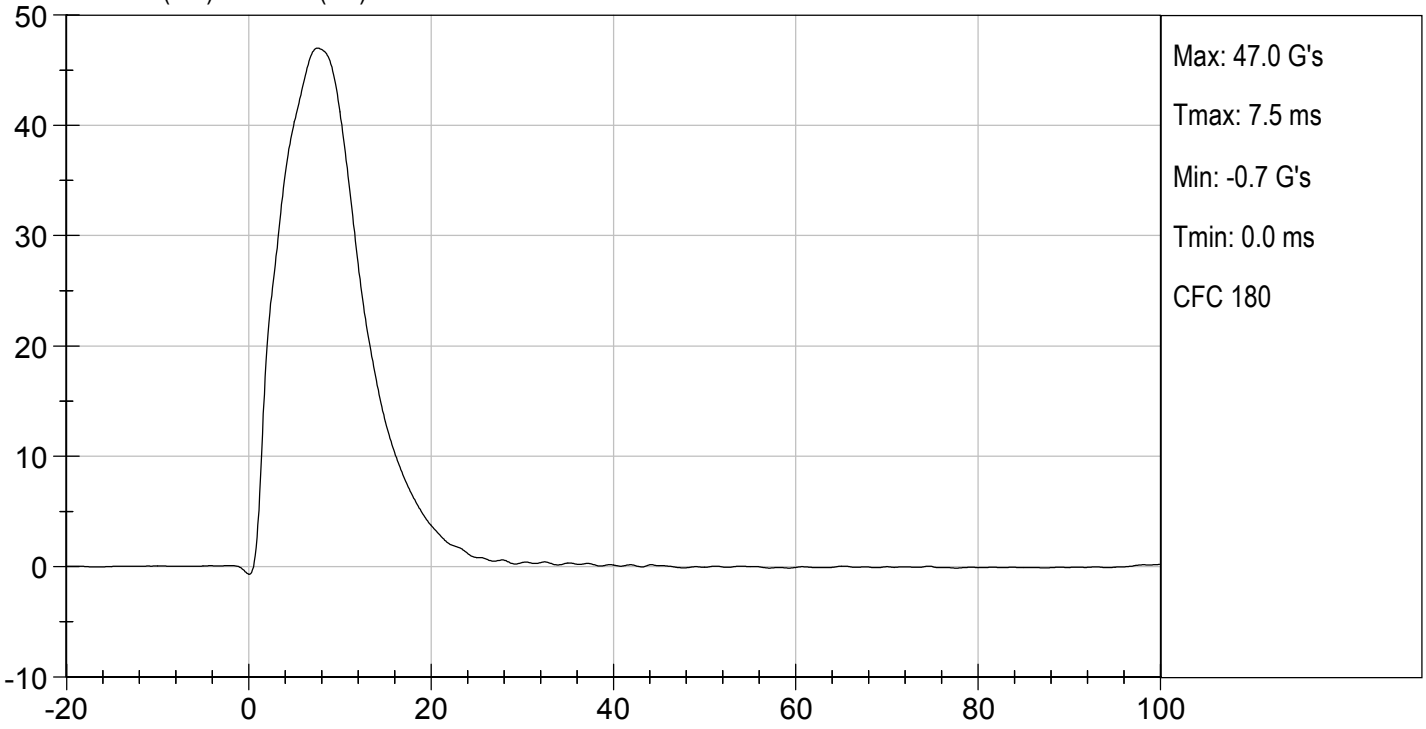
Test Date

Approved By

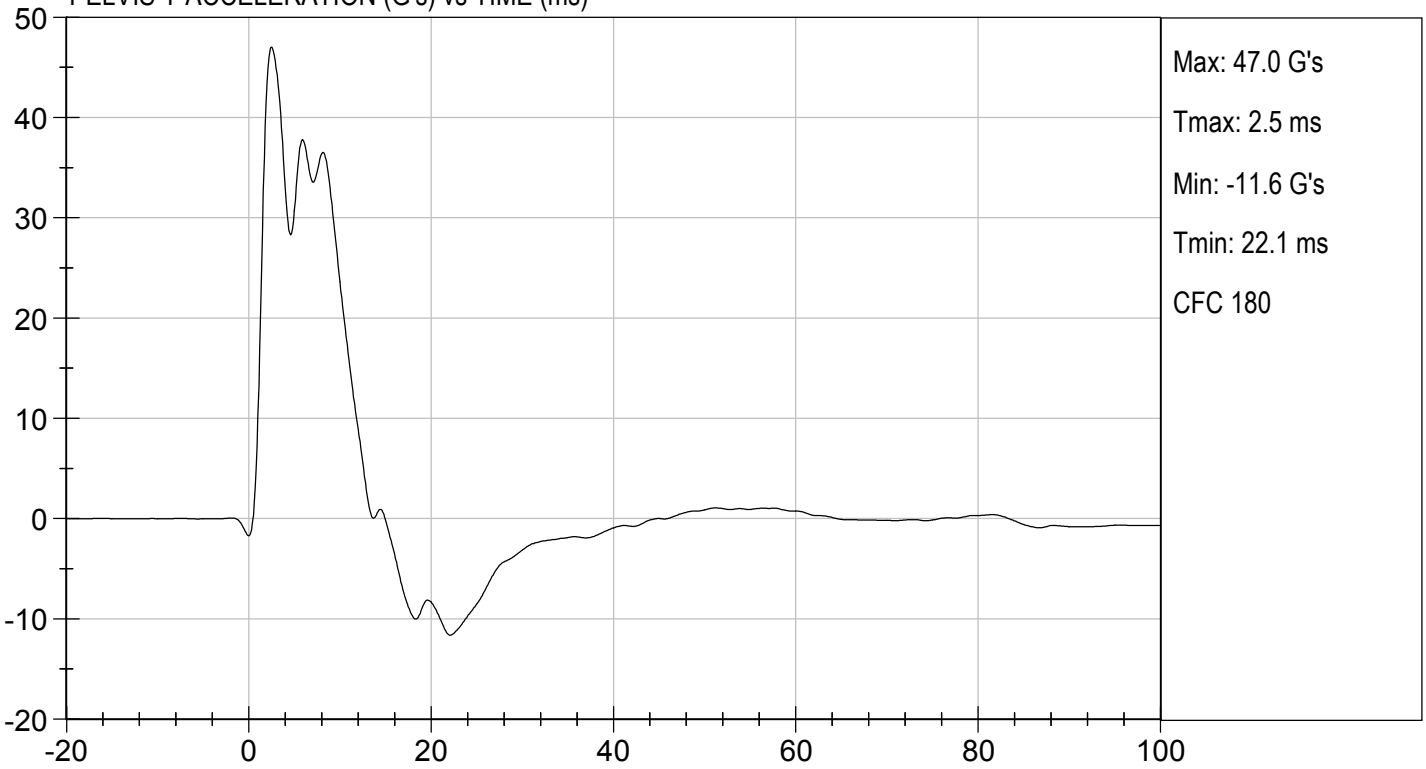
TEST DESC: PELVIS IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 12/11/2019
TEST #: D193847

PROBE (G's) vs TIME (ms)

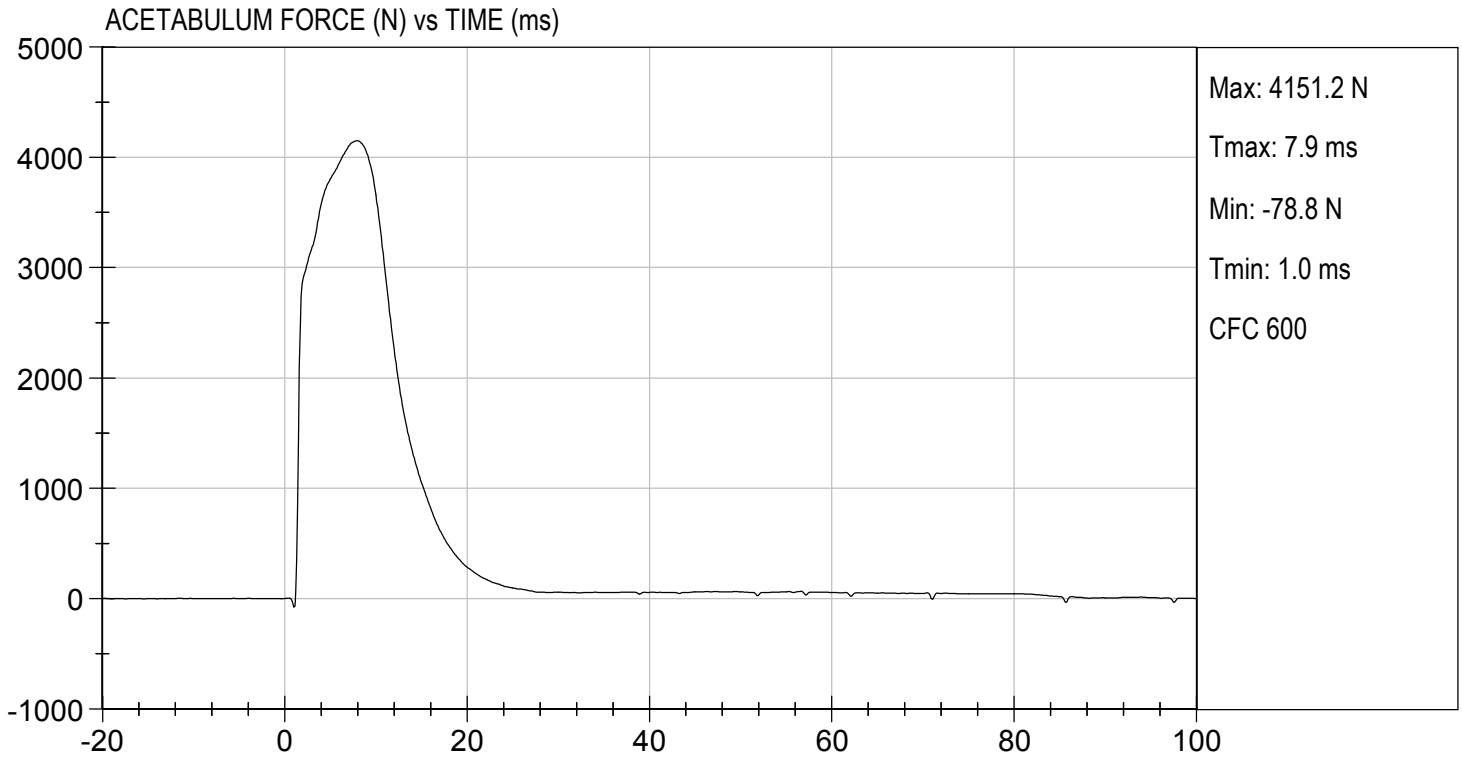


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: PELVIS IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 12/11/2019
TEST #: D193847



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193848

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	Pass
Humidity	%	10 to 70	20	Pass
Impact Velocity	m/s	4.20 to 4.40	4.40	Pass
Maximum Probe Acceleration	G's	36 to 45	38	Pass
Pelvis Y Acceleration	G's	28 to 39	30	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,238	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

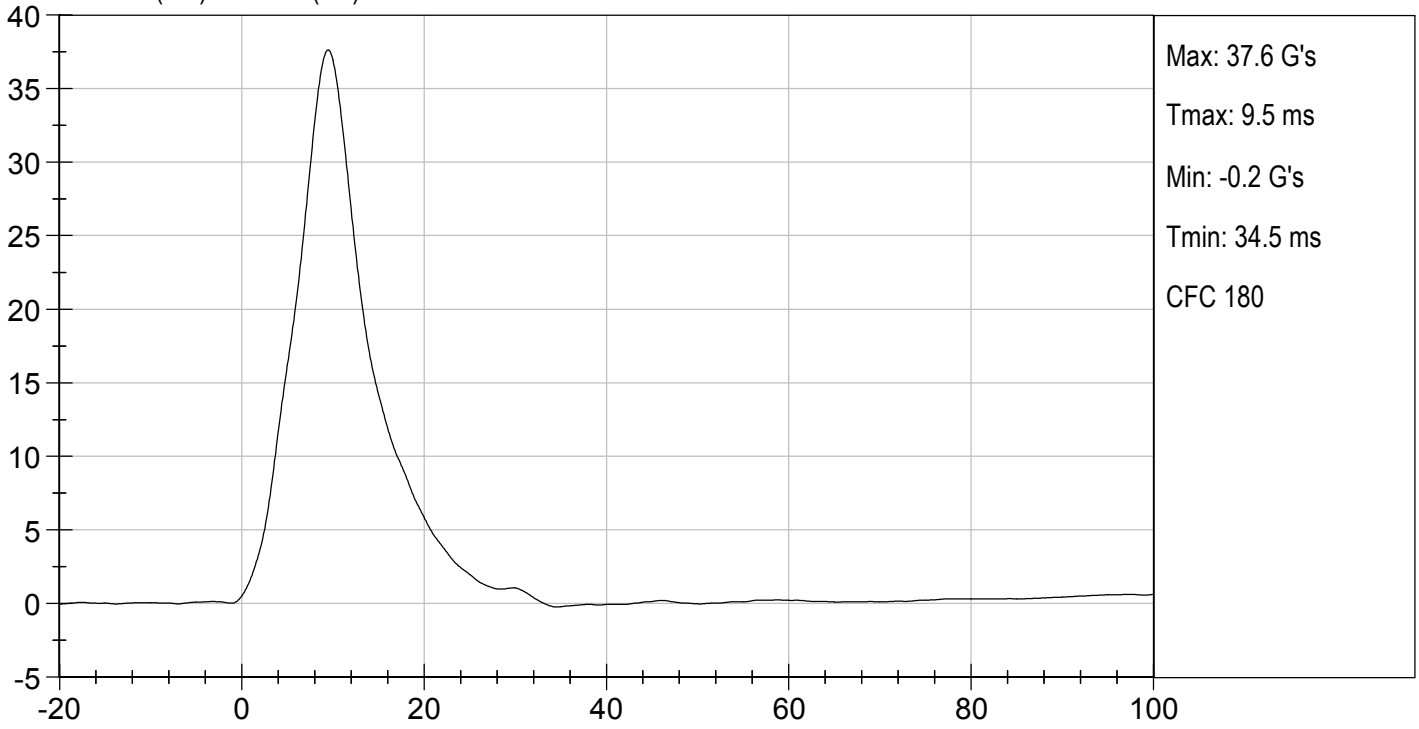
12/12/2019
Test Date

Approved By

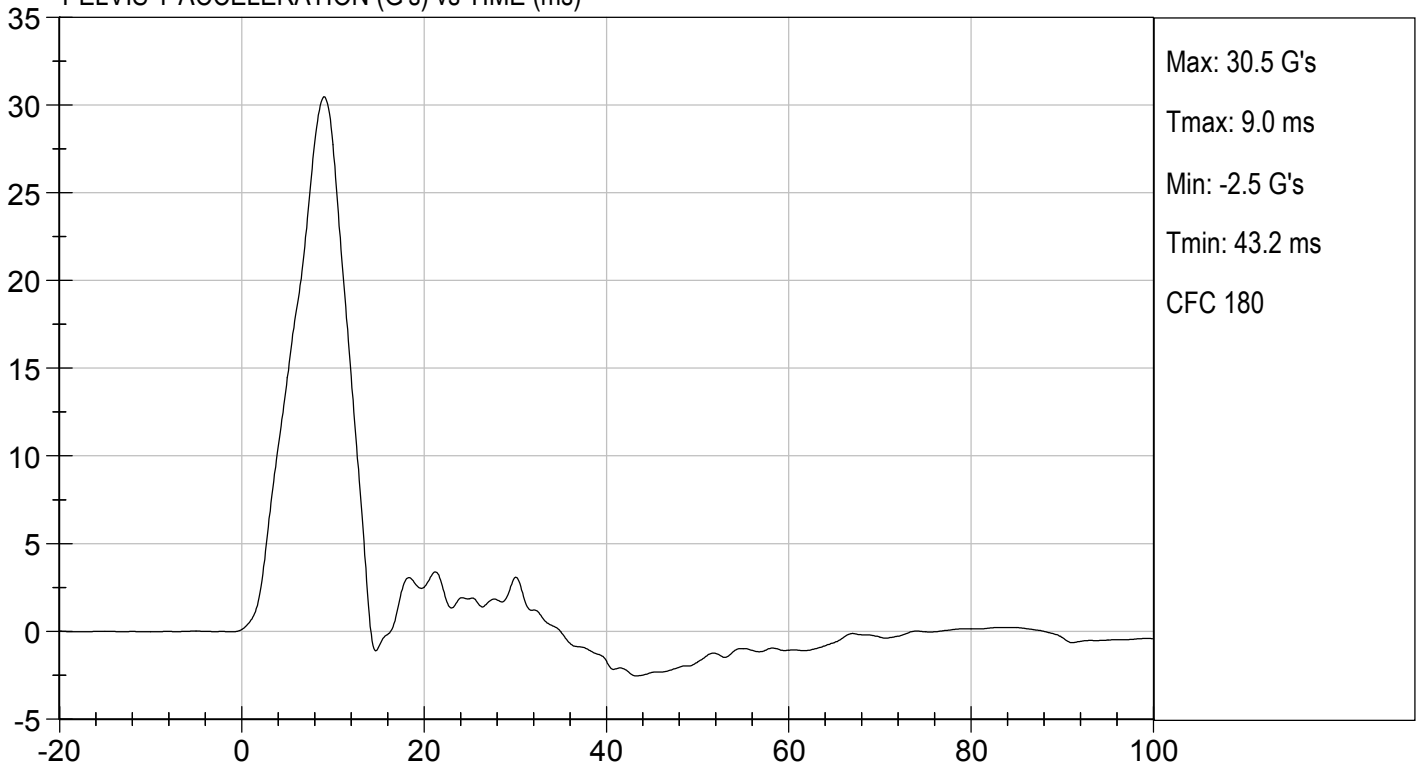
TEST DESC: ILLIAC
VELOCITY: 14.45 ft/s, 4.40 m/s

TEST DATE: 12/12/2019
TEST #: D193848

PROBE (G's) vs TIME (ms)

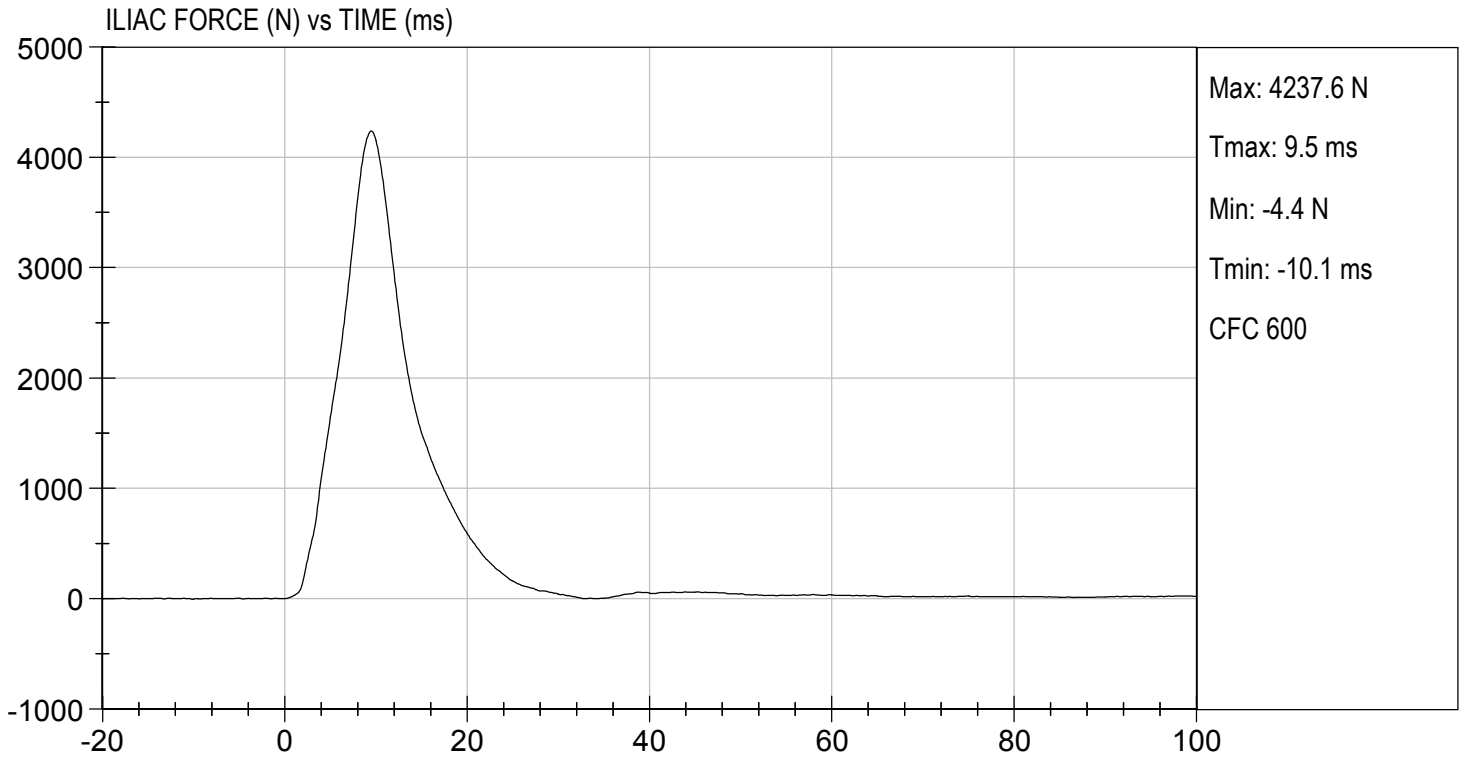


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: ILLIAC
VELOCITY: 14.45 ft/s, 4.40 m/s

TEST DATE: 12/12/2019
TEST #: D193848



CALIBRATION TEST RESULTS

POST-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

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:** D200101

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	115 to 137	127	Pass
Peak Longitudinal Acceleration	G's	+/- 15	5.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

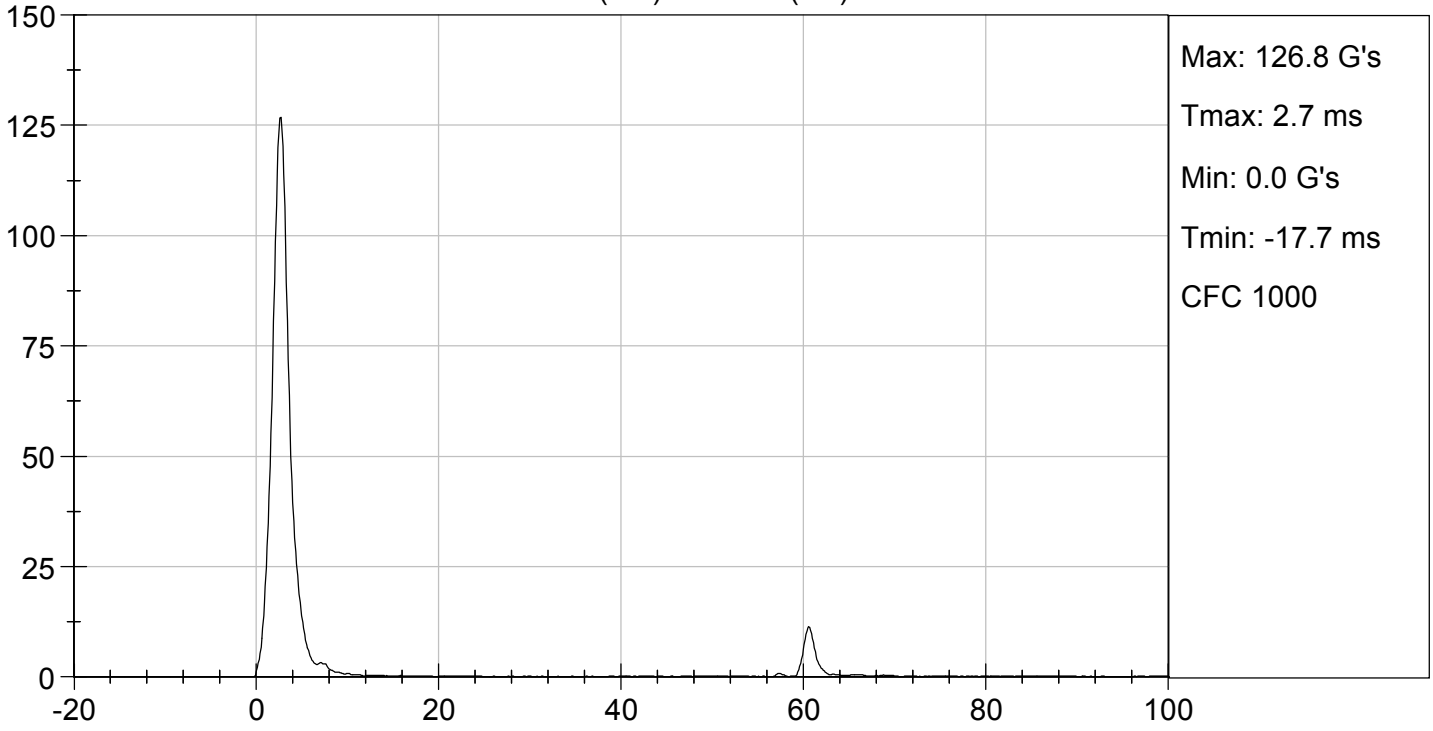
01/09/2020
Test Date

Approved By

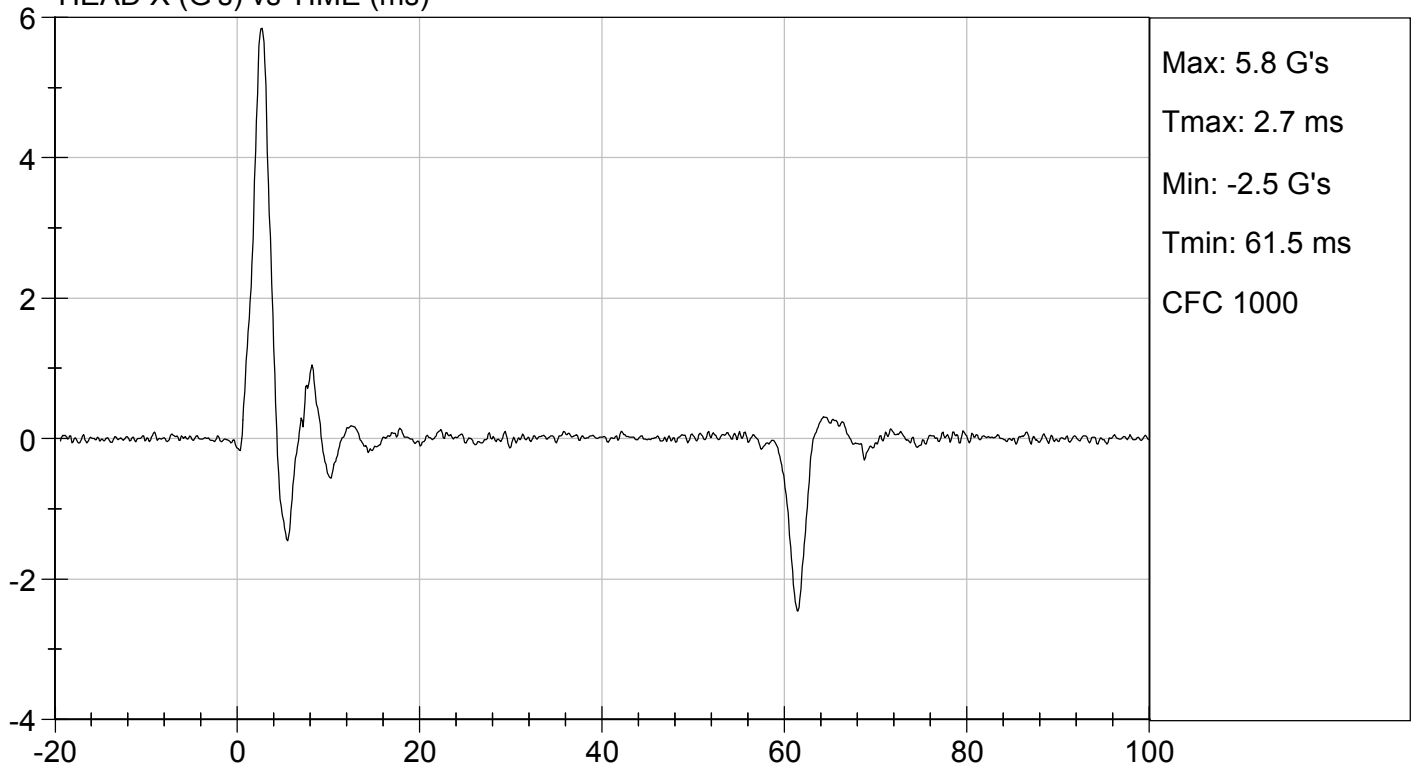
TEST DESC: HEAD DROP

TEST DATE: 01/09/2020
TEST #: D200101

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

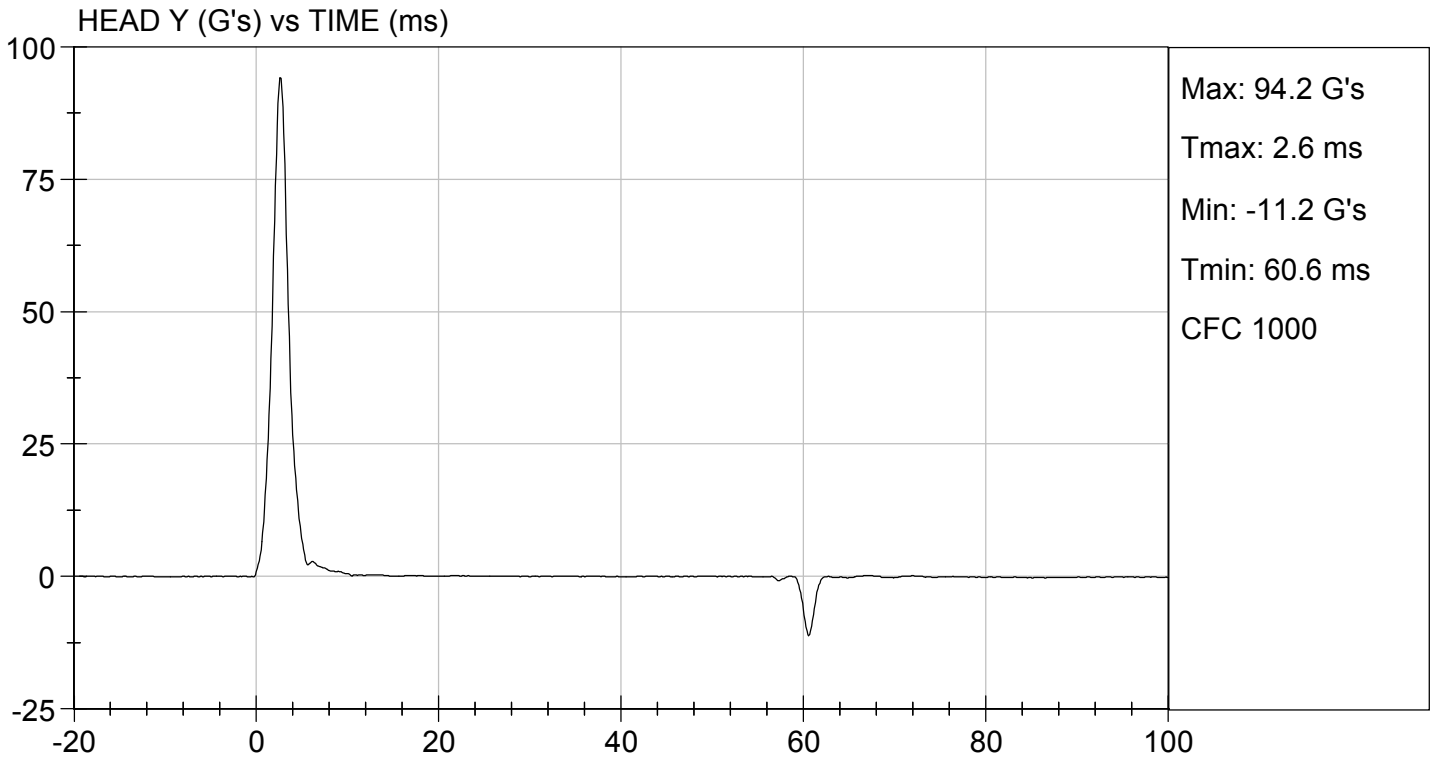


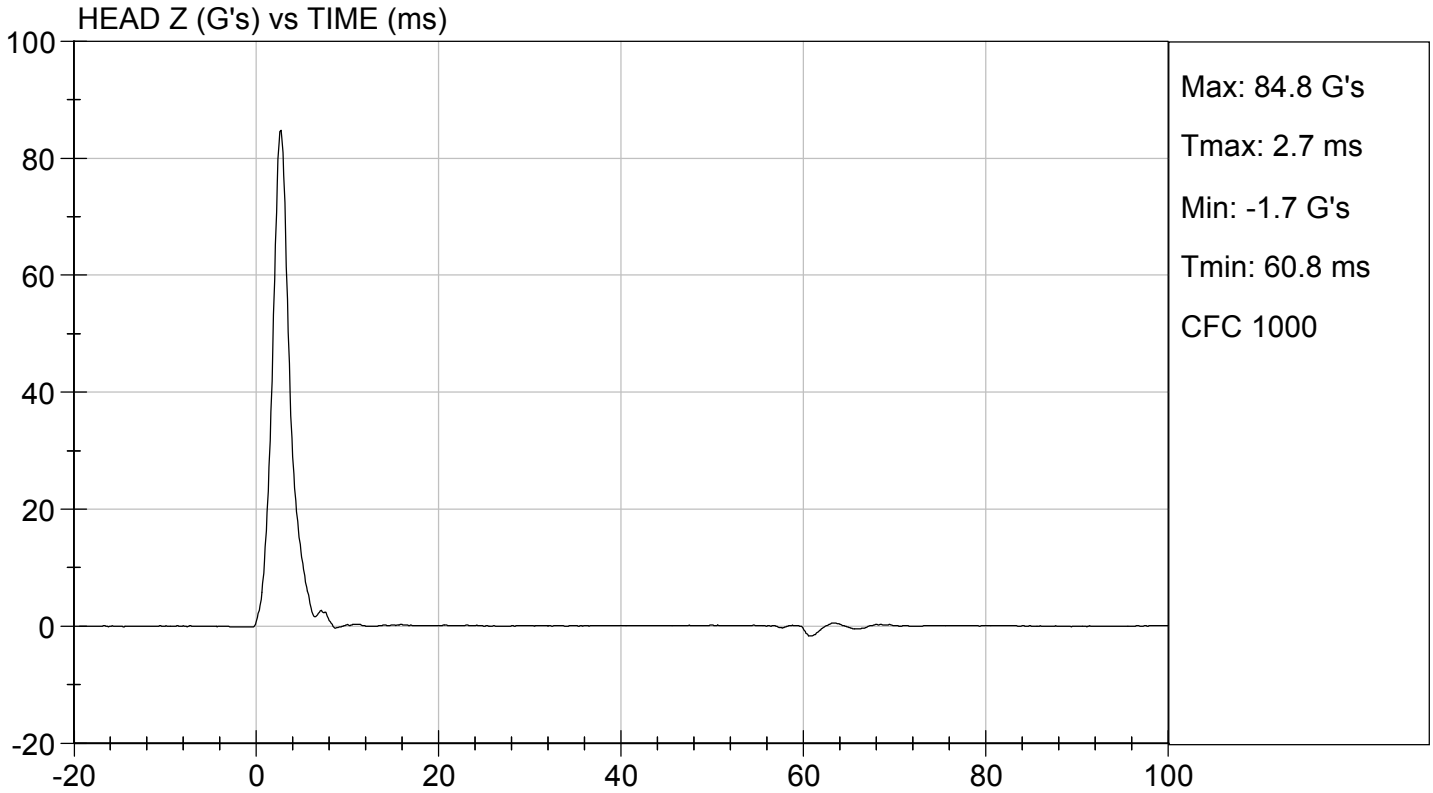
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 01/09/2020
TEST #: D200101





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D200102

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21	Pass
Humidity		%	10 to 70	30	Pass
Impact Velocity		m/s	5.51 to 5.63	5.63	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.52	Pass
	15 ms	m/s	3.30 to 4.10	3.66	Pass
	20 ms	m/s	4.40 to 5.40	5.20	Pass
	25 ms	m/s	5.40 to 6.10	5.65	Pass
	25-100 ms	m/s	5.50 to 6.20	5.70	Pass
Maximum D-Plane Rotation		deg	71 to 81	71	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	61	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-38	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	113	Pass
			Overall Test Results		Pass

Alex Thomas

Laboratory Technician

01/10/2020

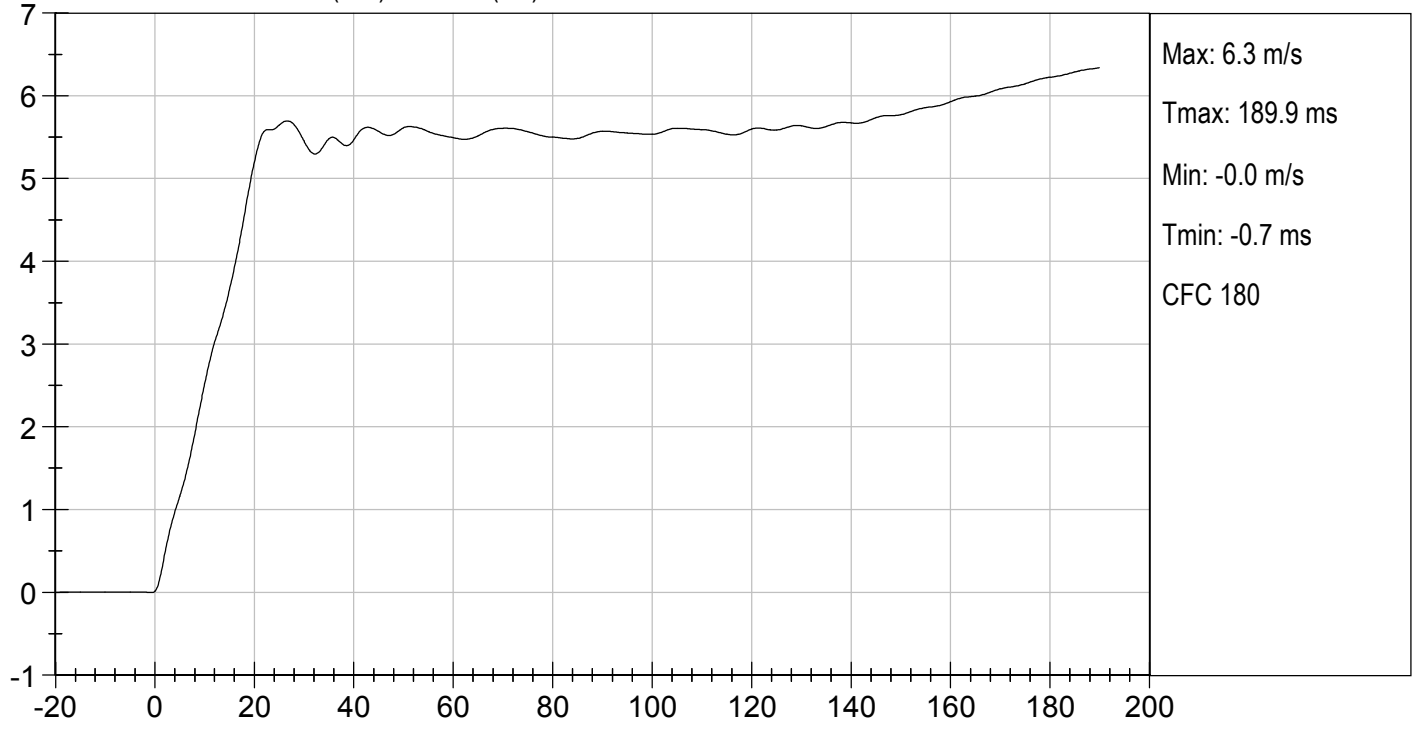
Test Date

Approved By

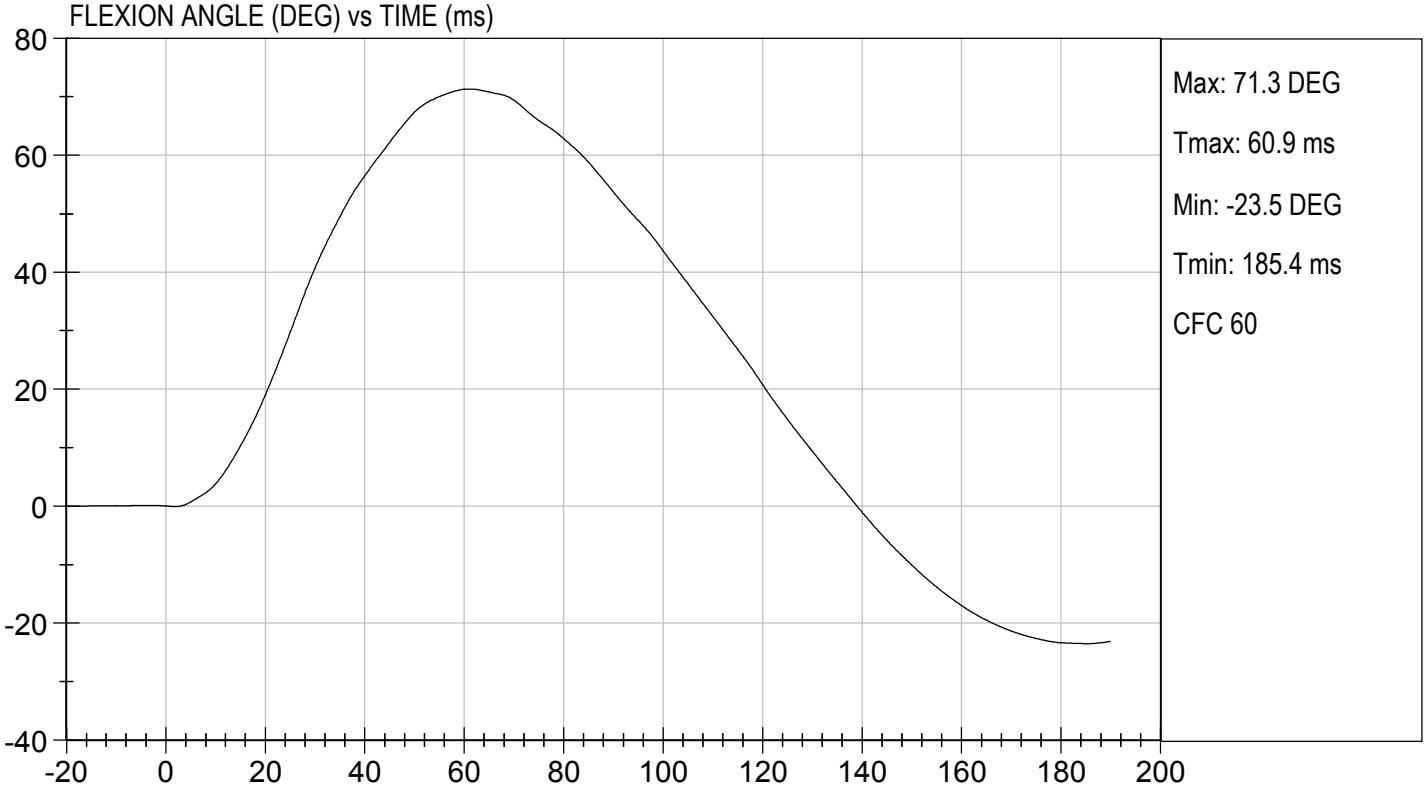
TEST DESC: NECK BENDING
VELOCITY: 18.46 ft/s, 5.63 m/s

TEST DATE: 01/10/2020
TEST #: D200102

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

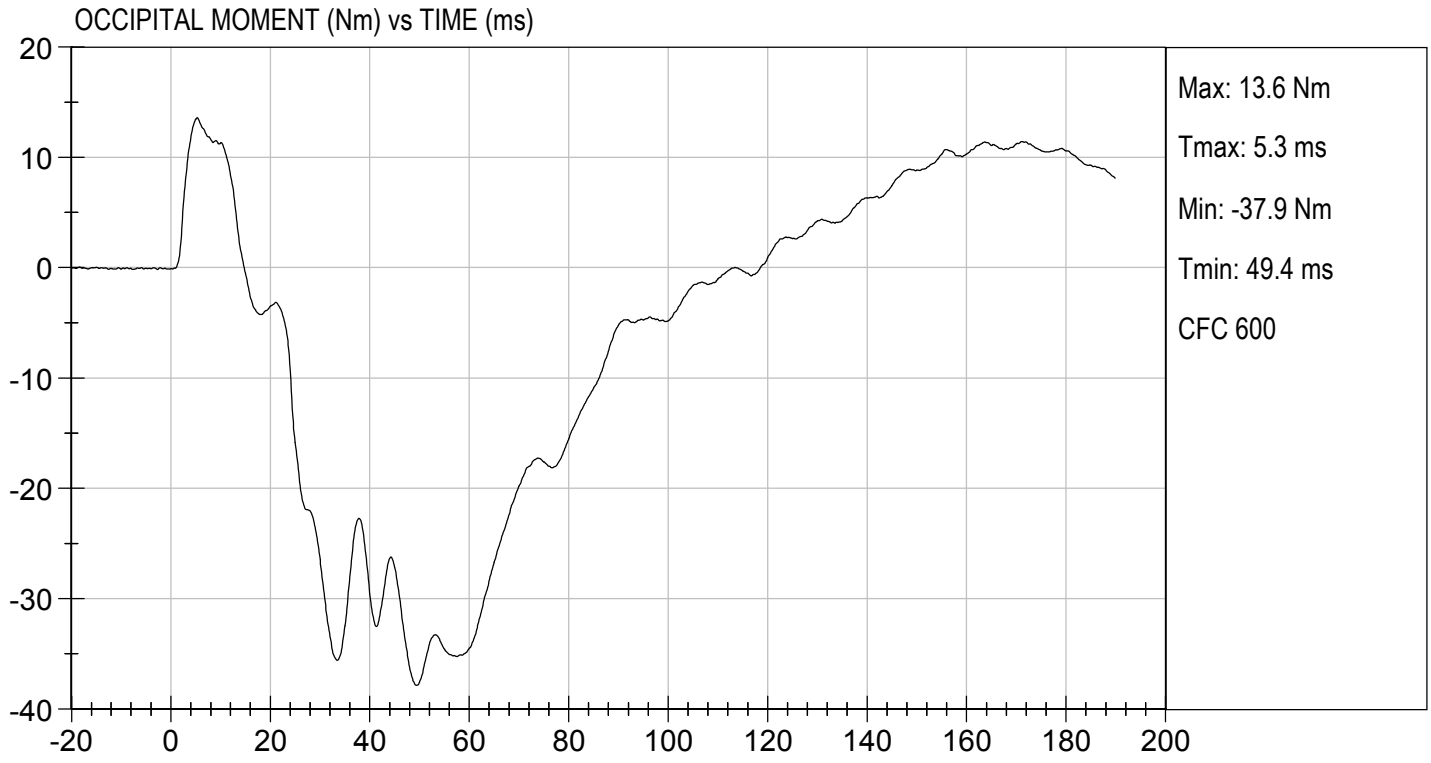


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.46 ft/s, 5.63 m/s

TEST DATE: 01/10/2020
TEST #: D200102



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D200103

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	13 to 18	18	Pass
Shoulder Displacement	mm	28 to 37	28	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	22	Pass
		Overall Test Results		Pass

Laboratory Technician

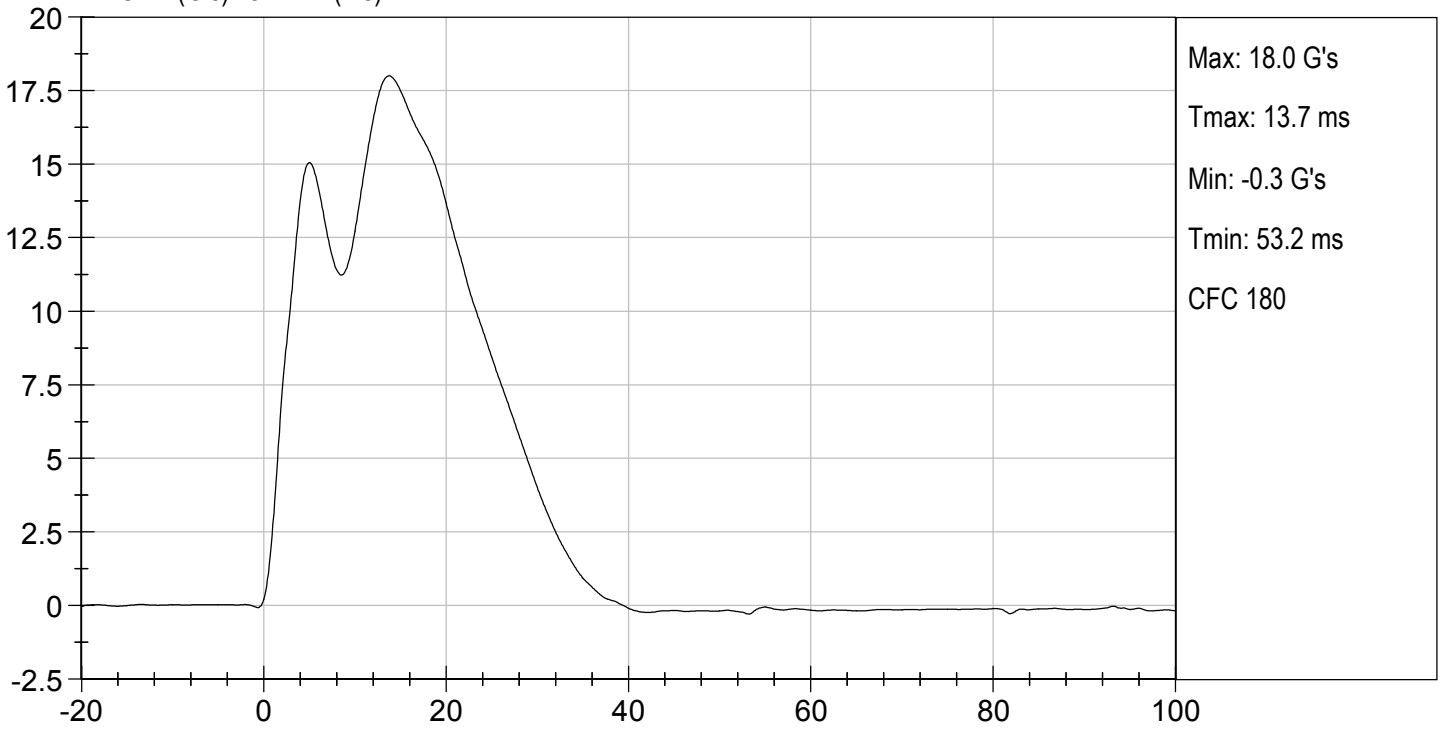
01/09/2020
Test Date

Approved By

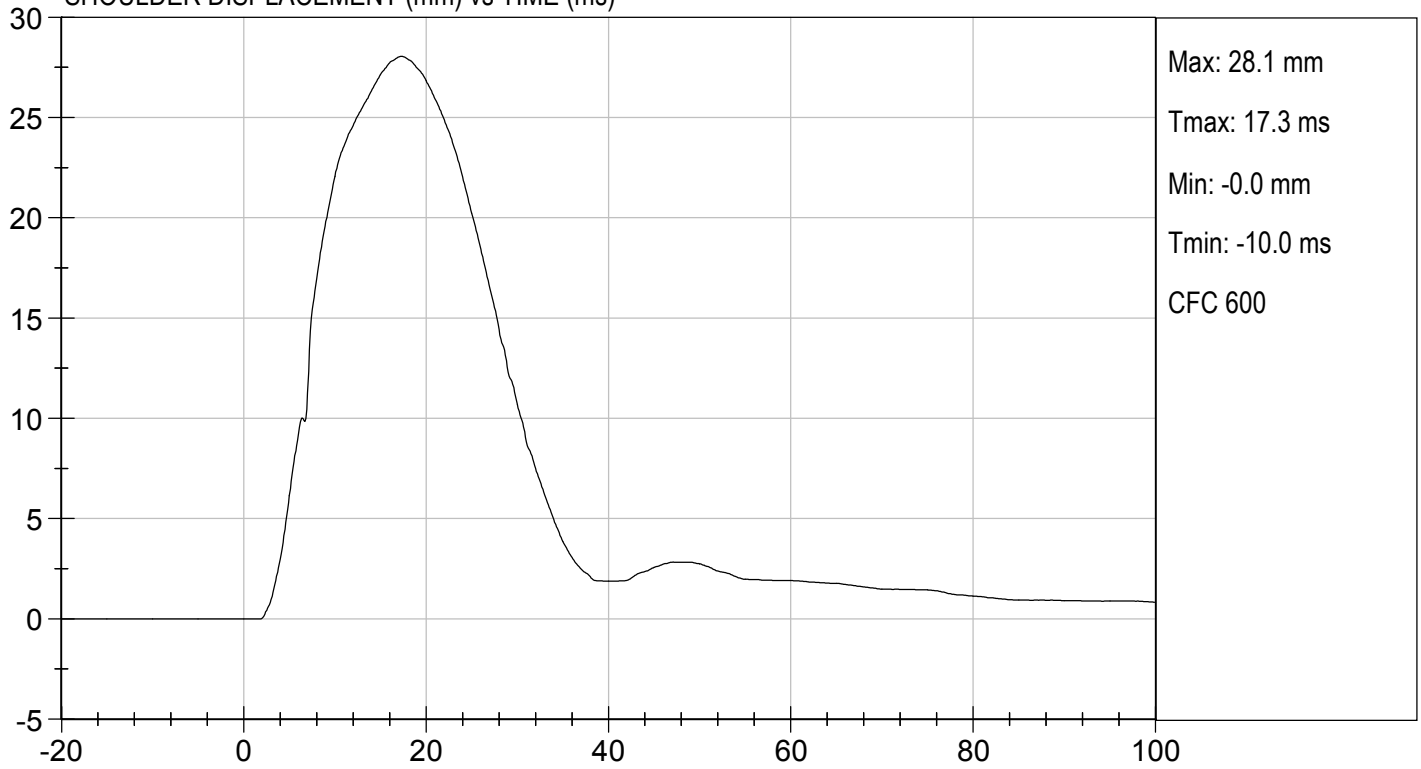
TEST DESC: SHOULDER IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 01/09/2020
TEST #: D200103

PROBE (G's) vs TIME (ms)

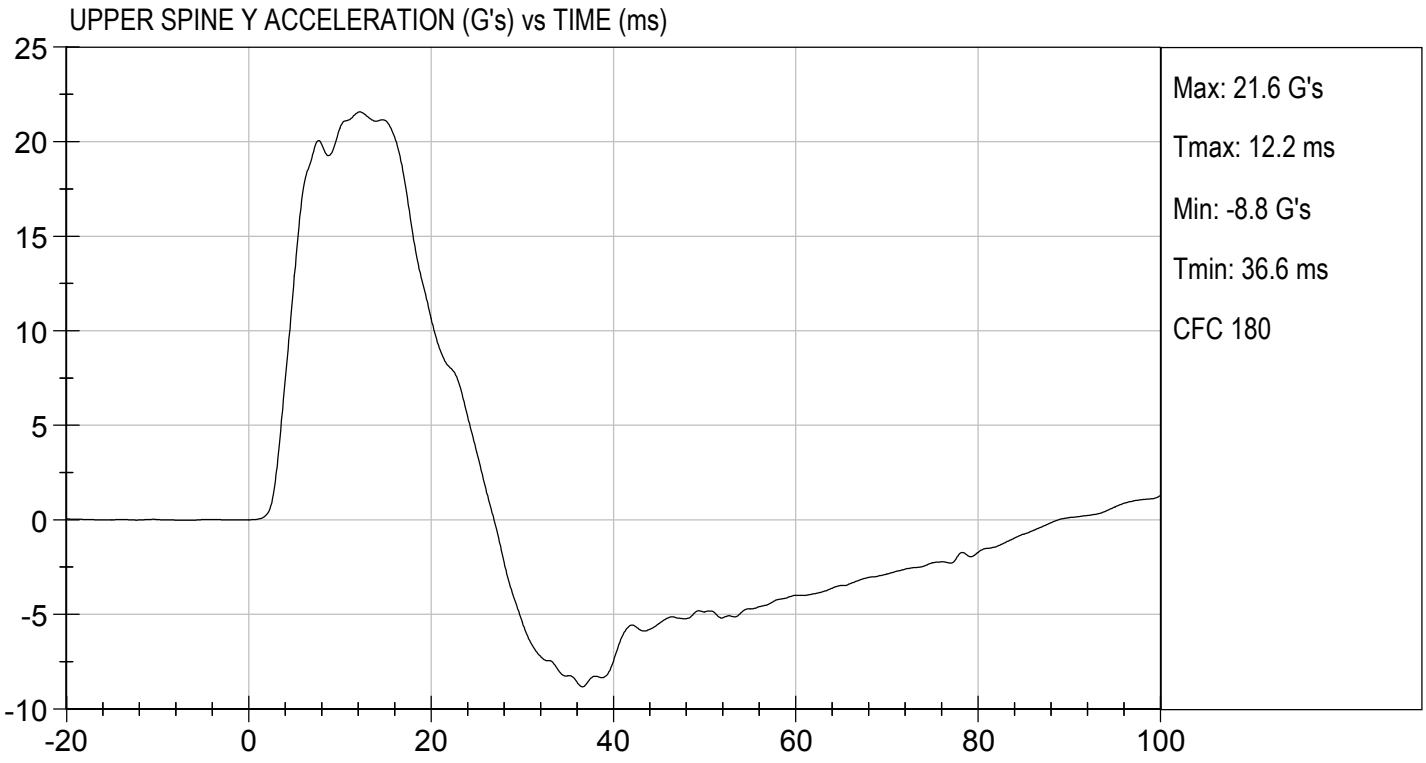


SHOULDER DISPLACEMENT (mm) vs TIME (ms)



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

TEST DATE: 01/09/2020
TEST #: D200103



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D200104

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	21	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	33	Pass
Shoulder Displacement	mm	31 to 40	35	Pass
Upper Rib Displacement	mm	25 to 32	27	Pass
Middle Rib Displacement	mm	30 to 36	30	Pass
Lower Rib Displacement	mm	32 to 38	33	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	38	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	35	Pass
		Overall Test Results		Pass

Laboratory Technician

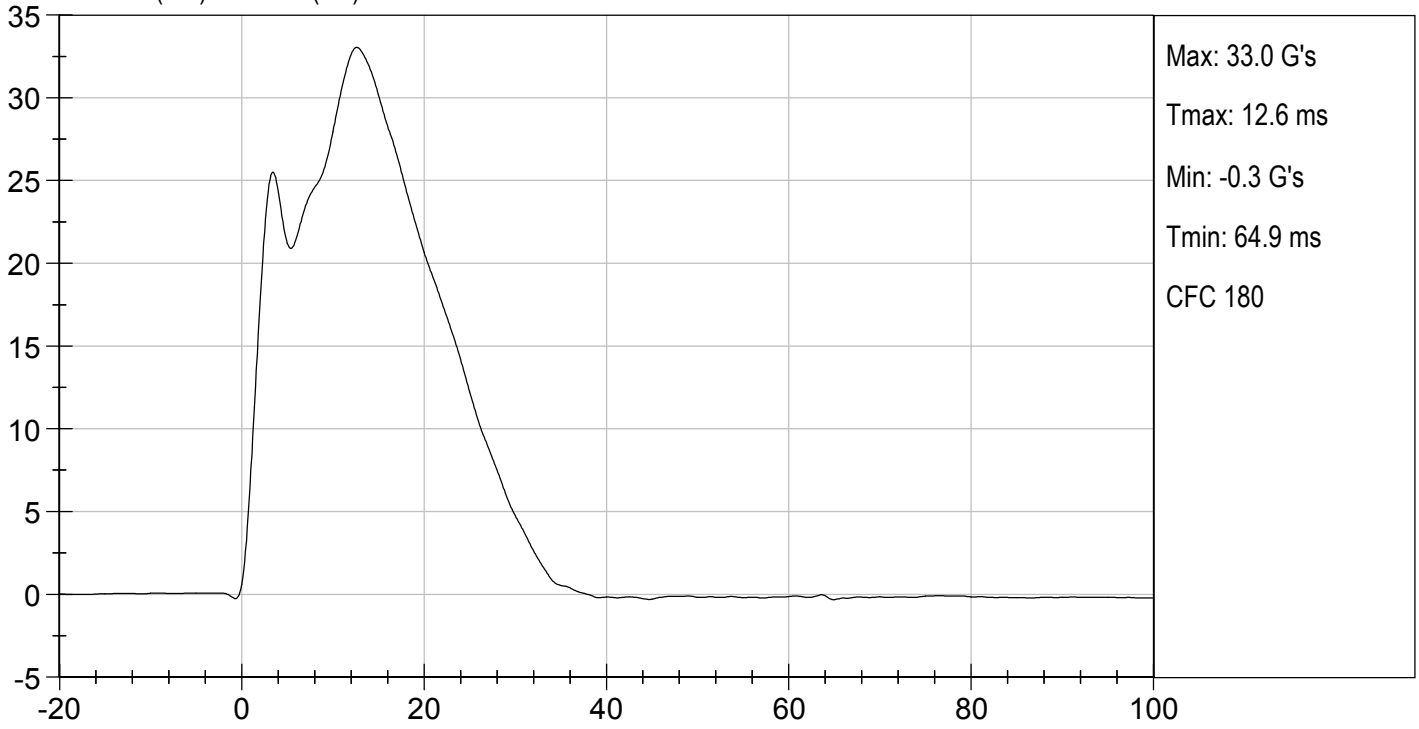
01/09/2020
Test Date

Approved By

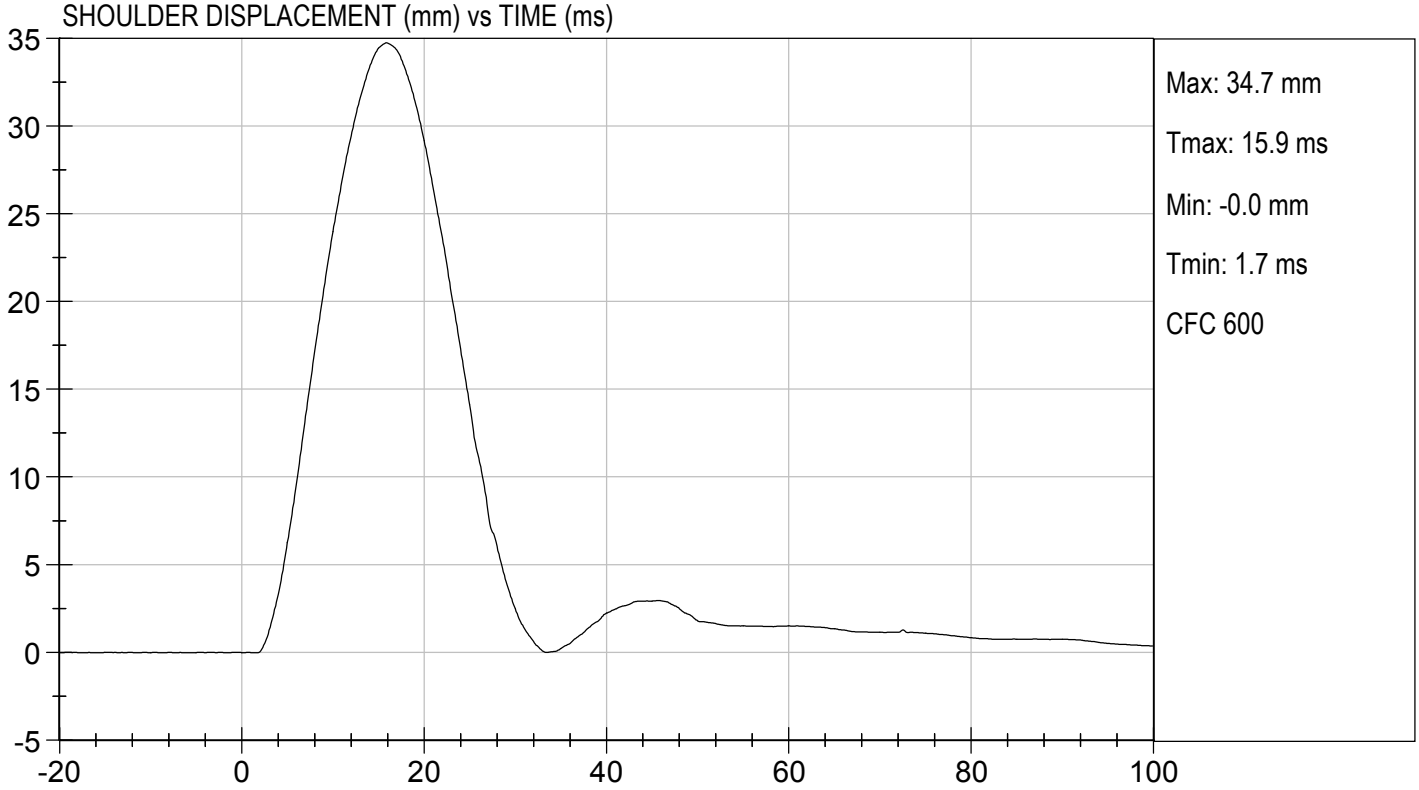
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 01/09/2020
TEST #: D200104

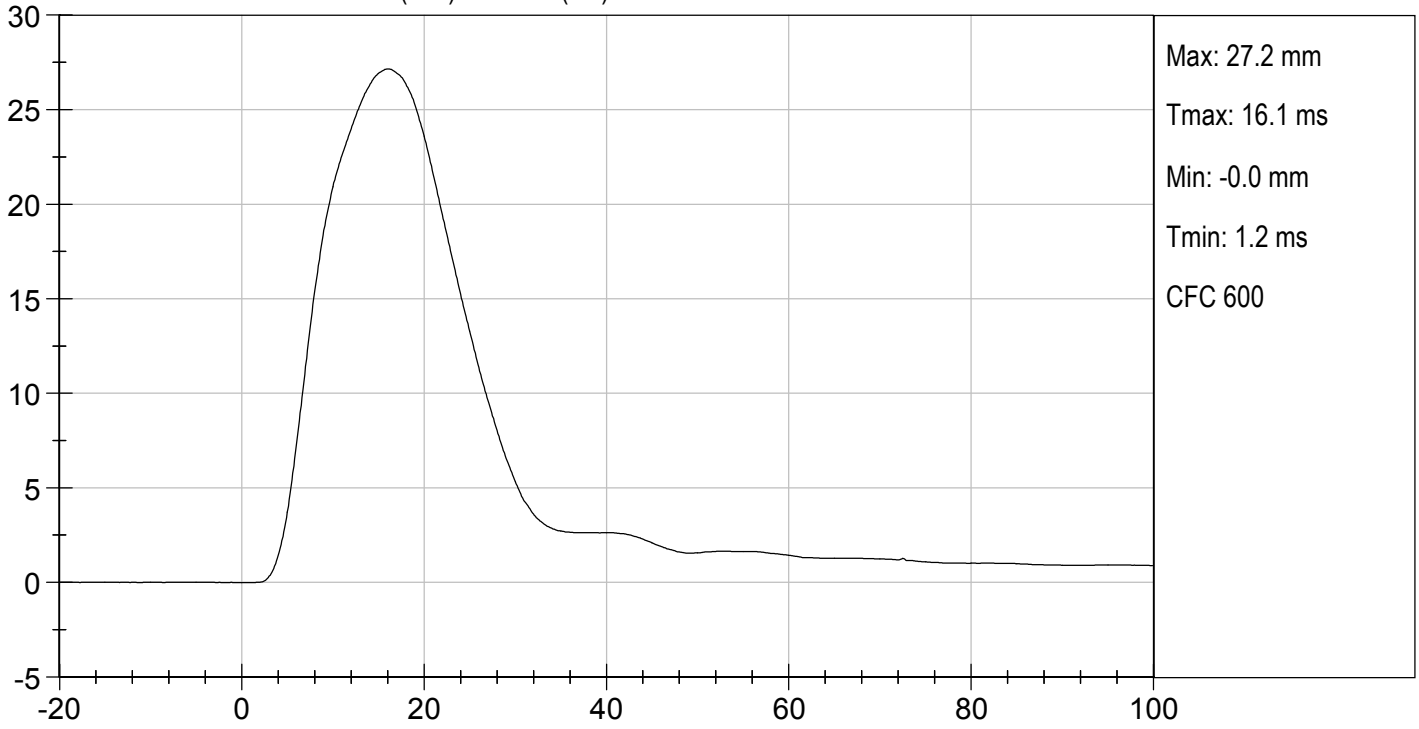
PROBE (G's) vs TIME (ms)



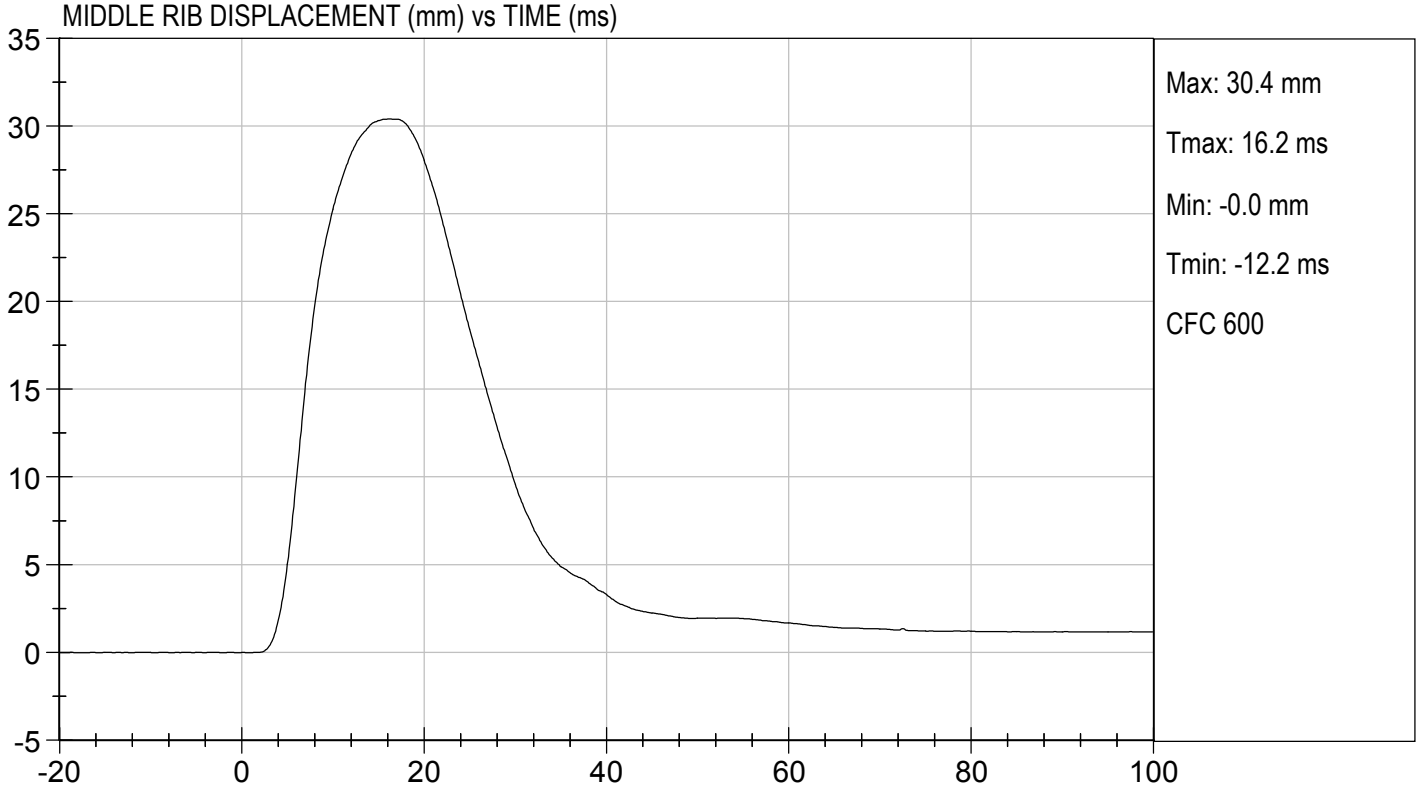
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



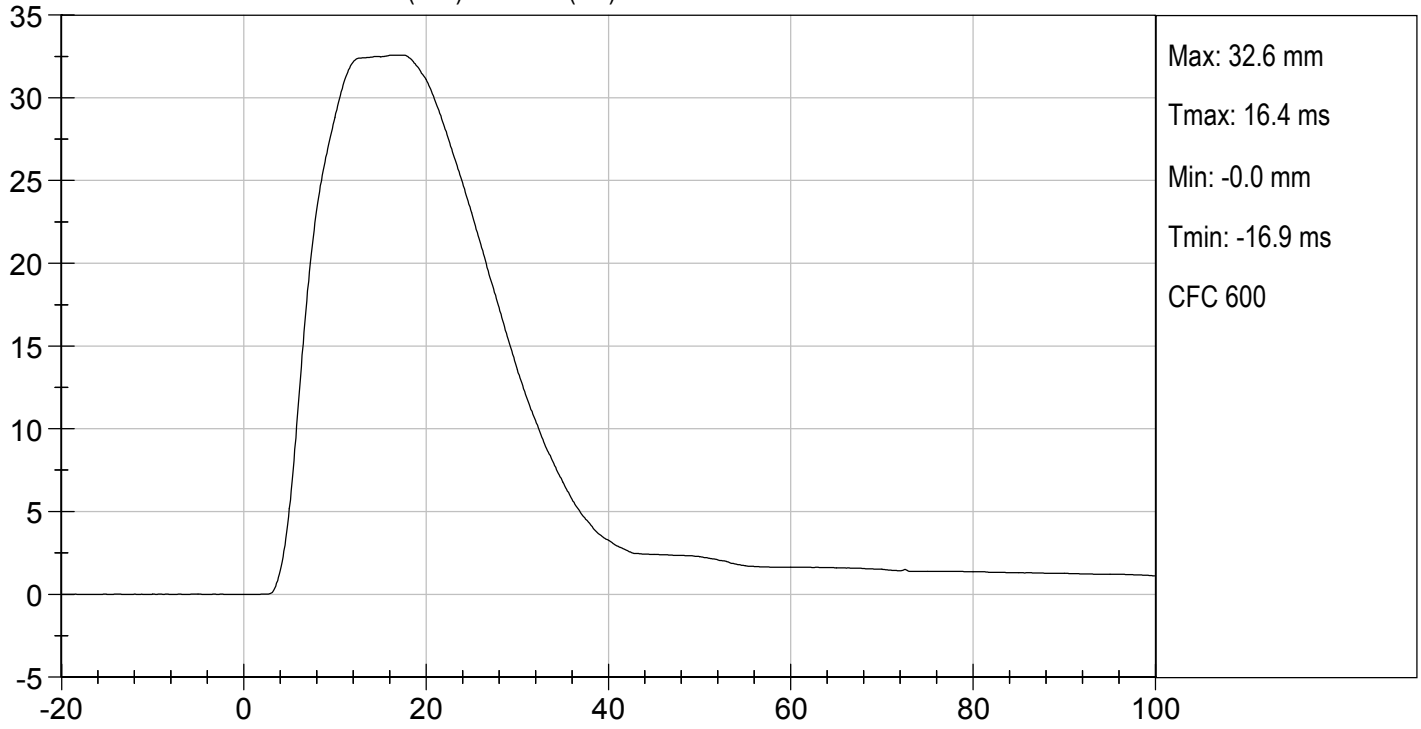
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



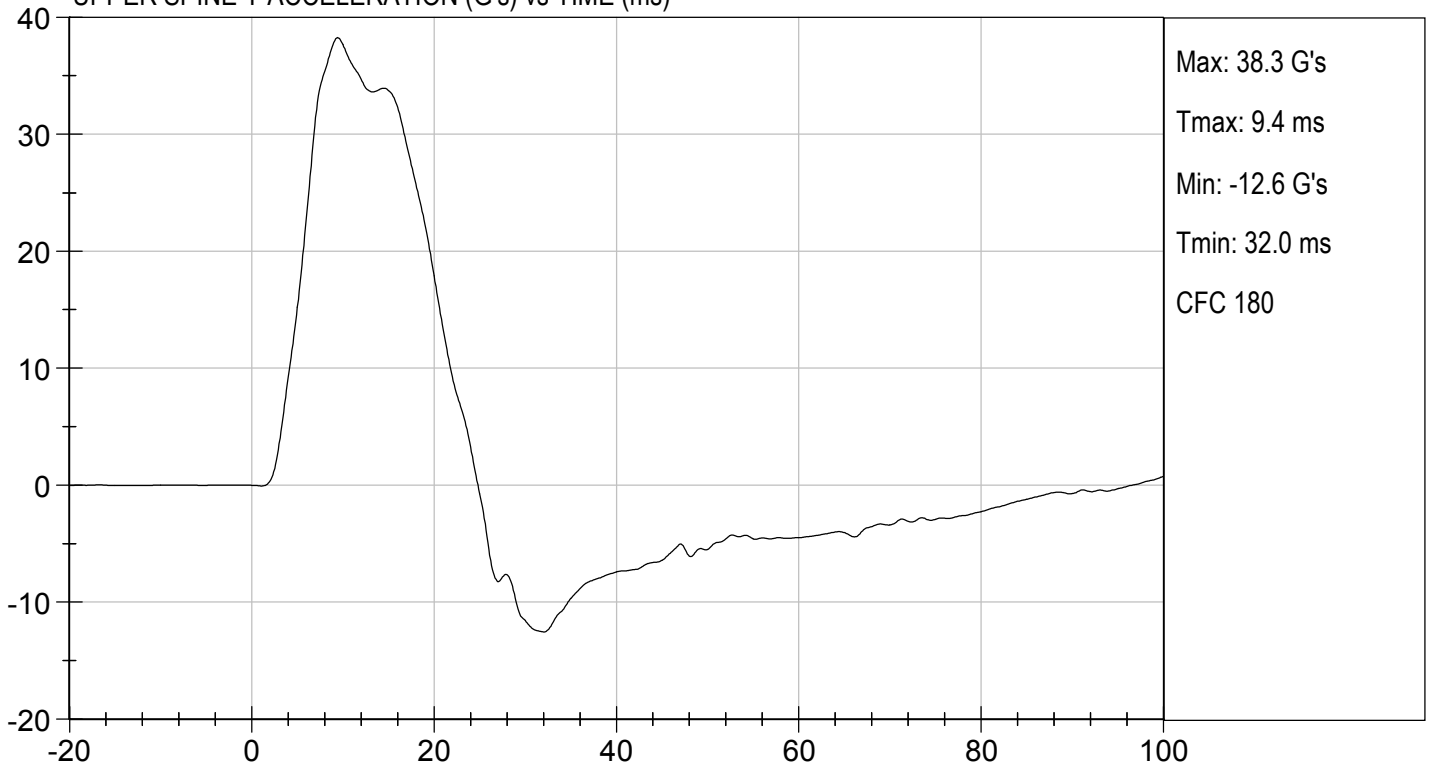
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 01/09/2020
TEST #: D200104

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



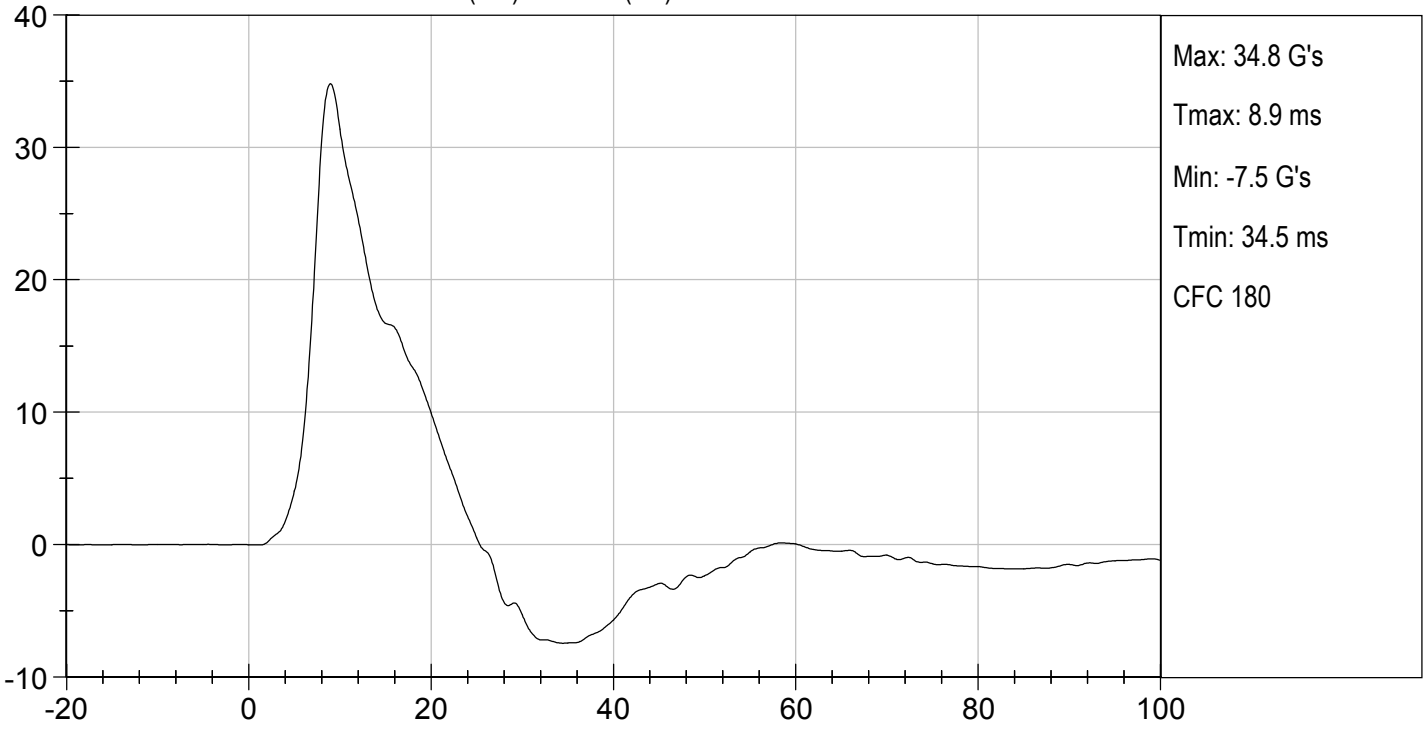
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 01/09/2020
TEST #: D200104

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:** D200105

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	21	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	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	42	Pass
Lower Rib Displacement	mm	35 to 43	39	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	15	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

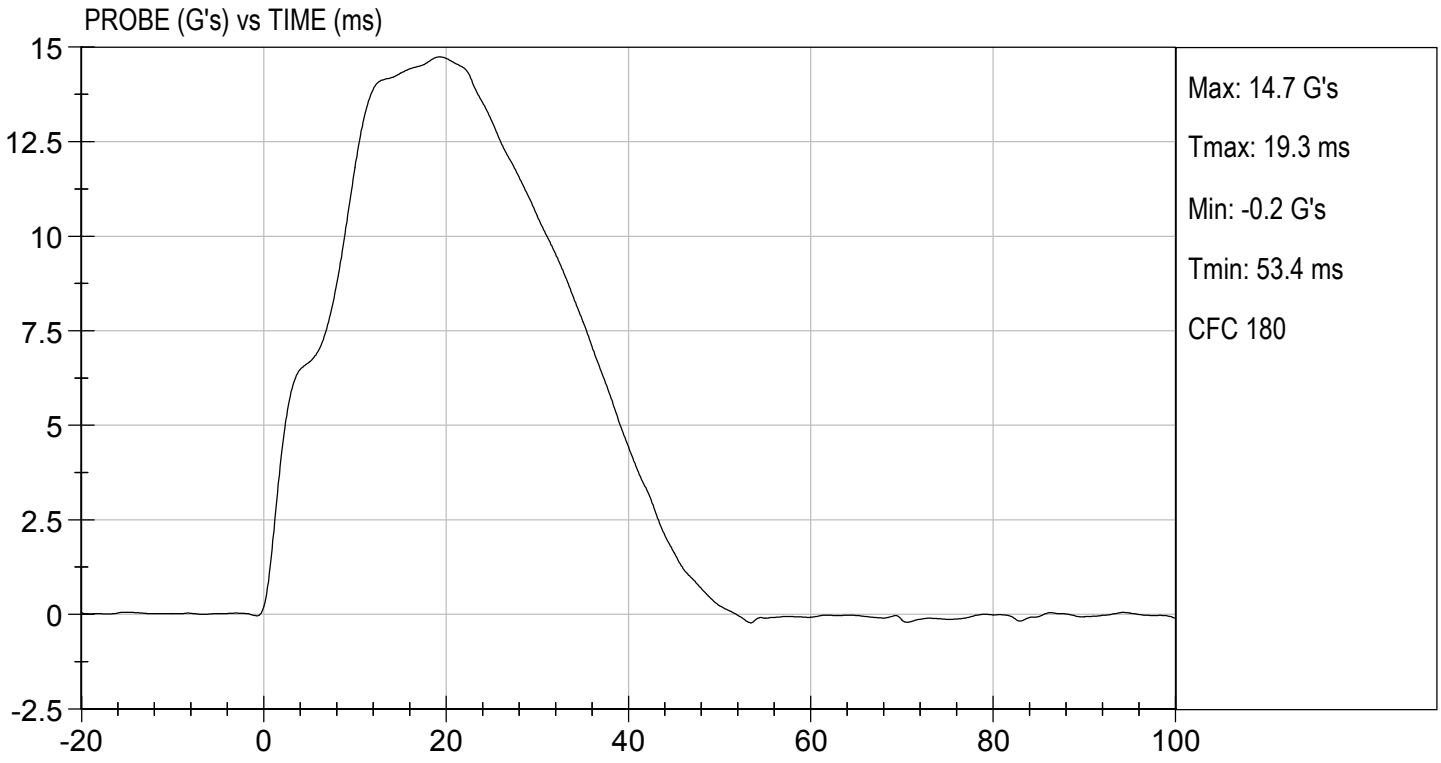
Alex Thomas
Laboratory Technician

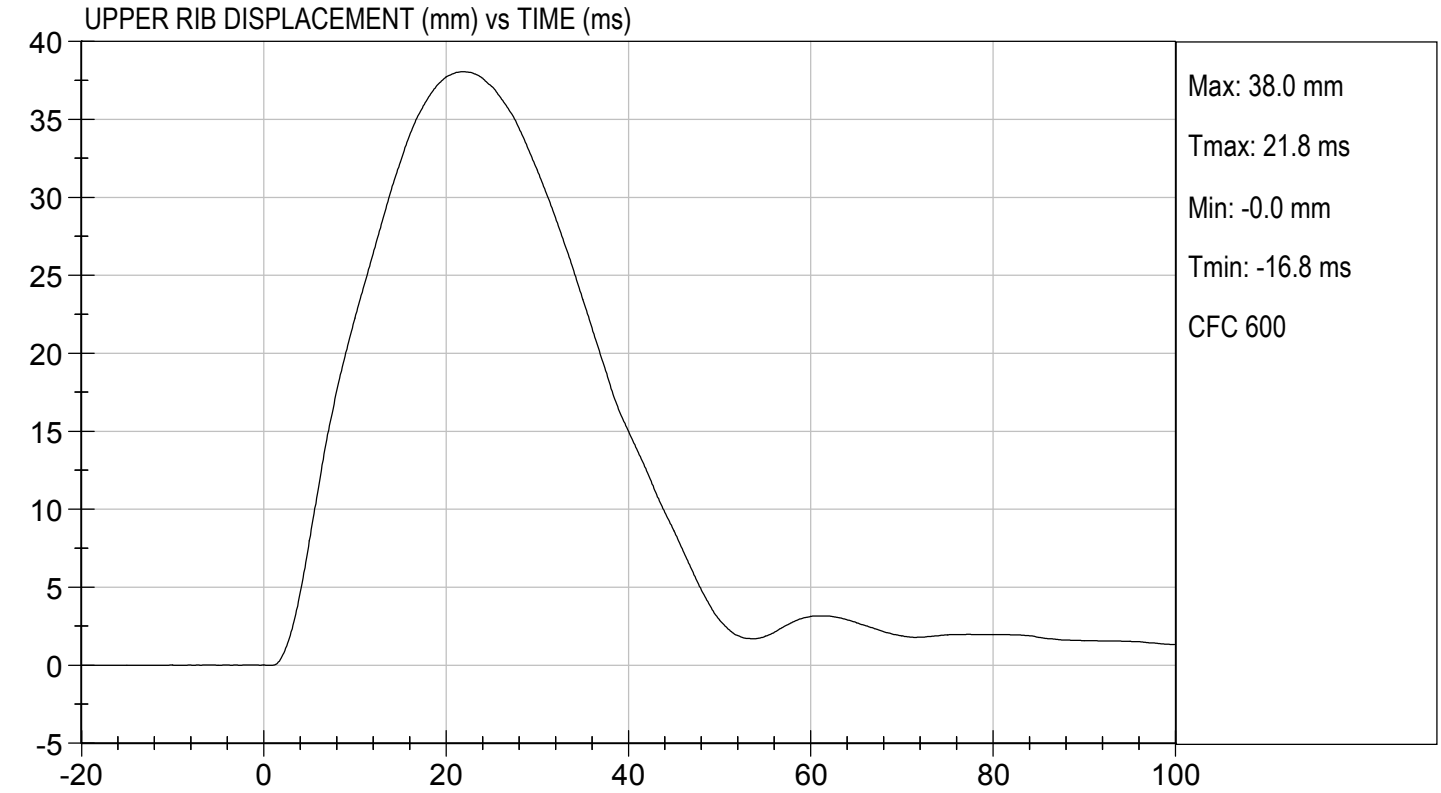
01/09/2020
Test Date

Approved By

TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 01/09/2020
TEST #: D200105

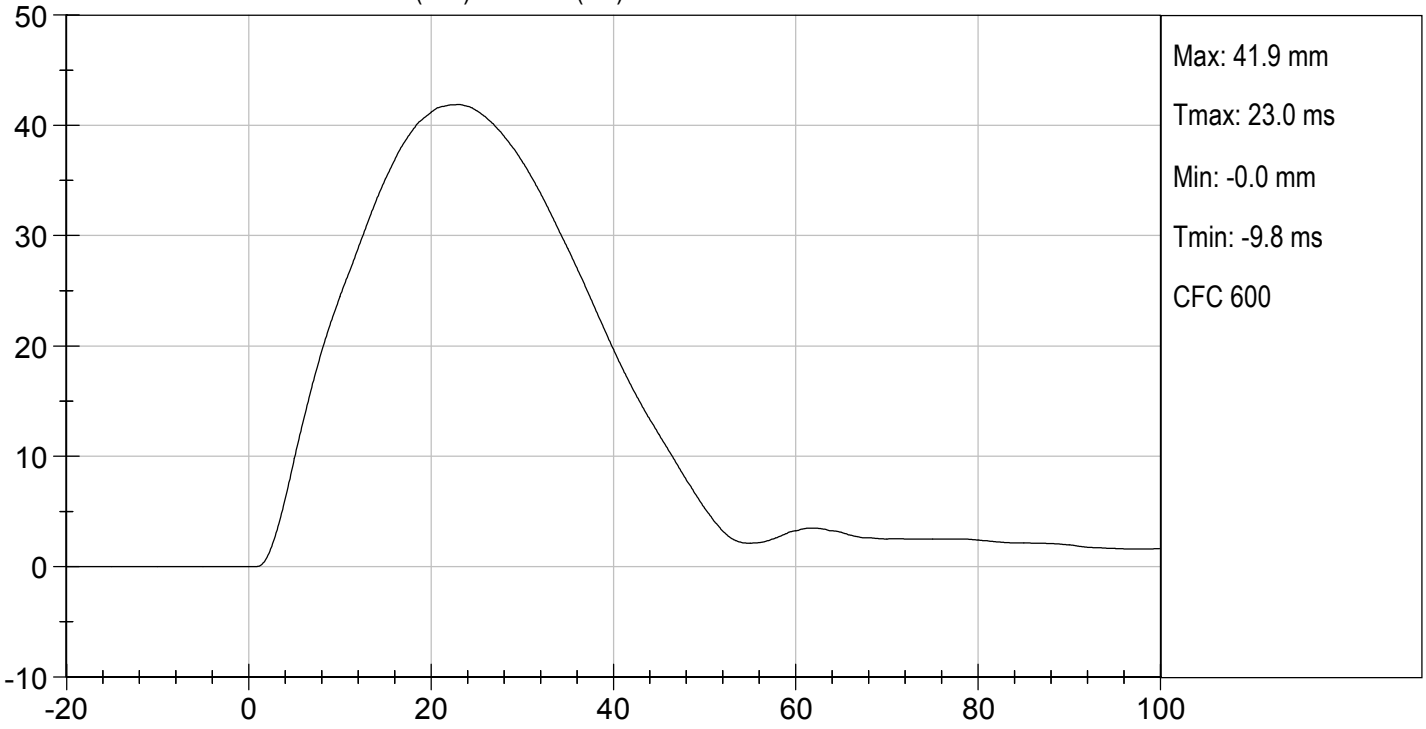




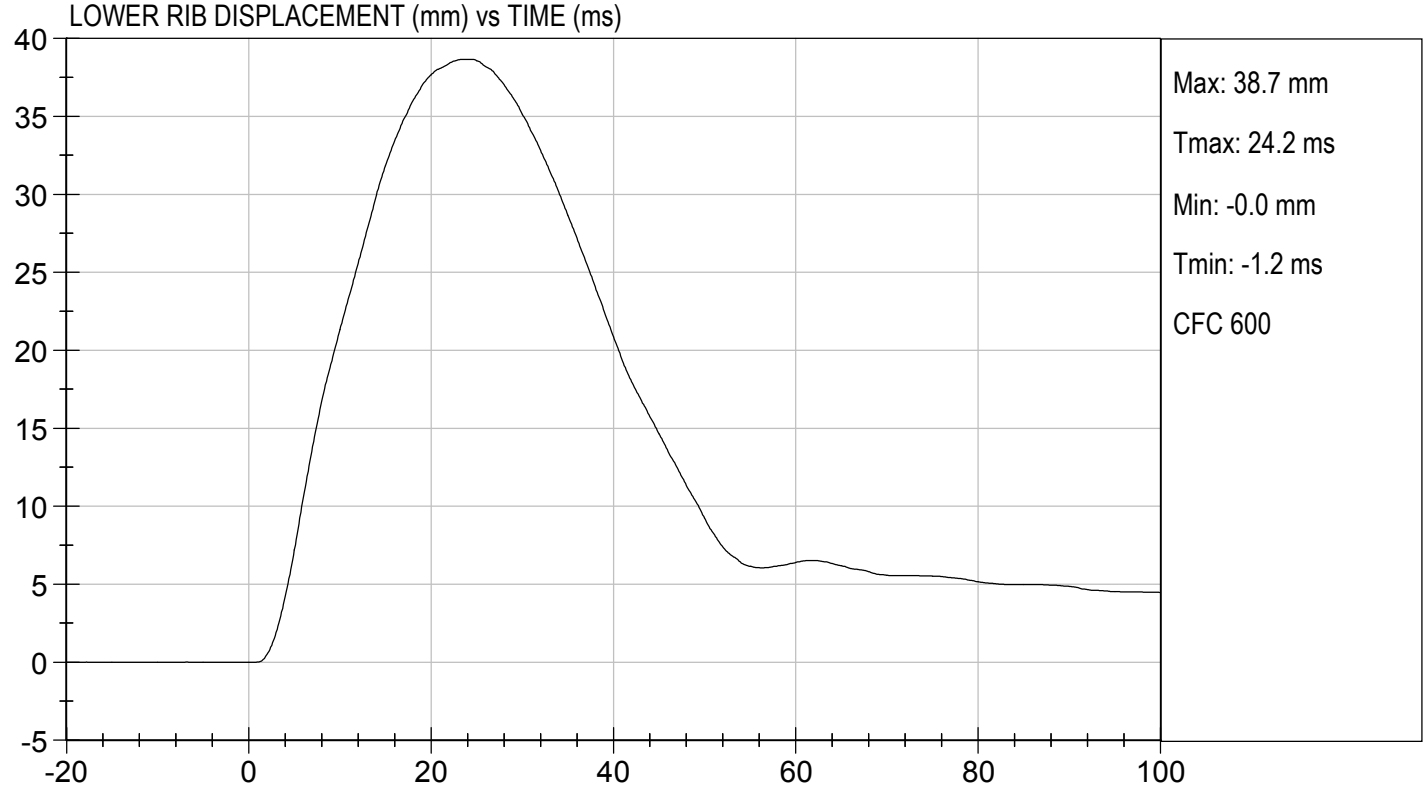
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 01/09/2020
TEST #: D200105

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



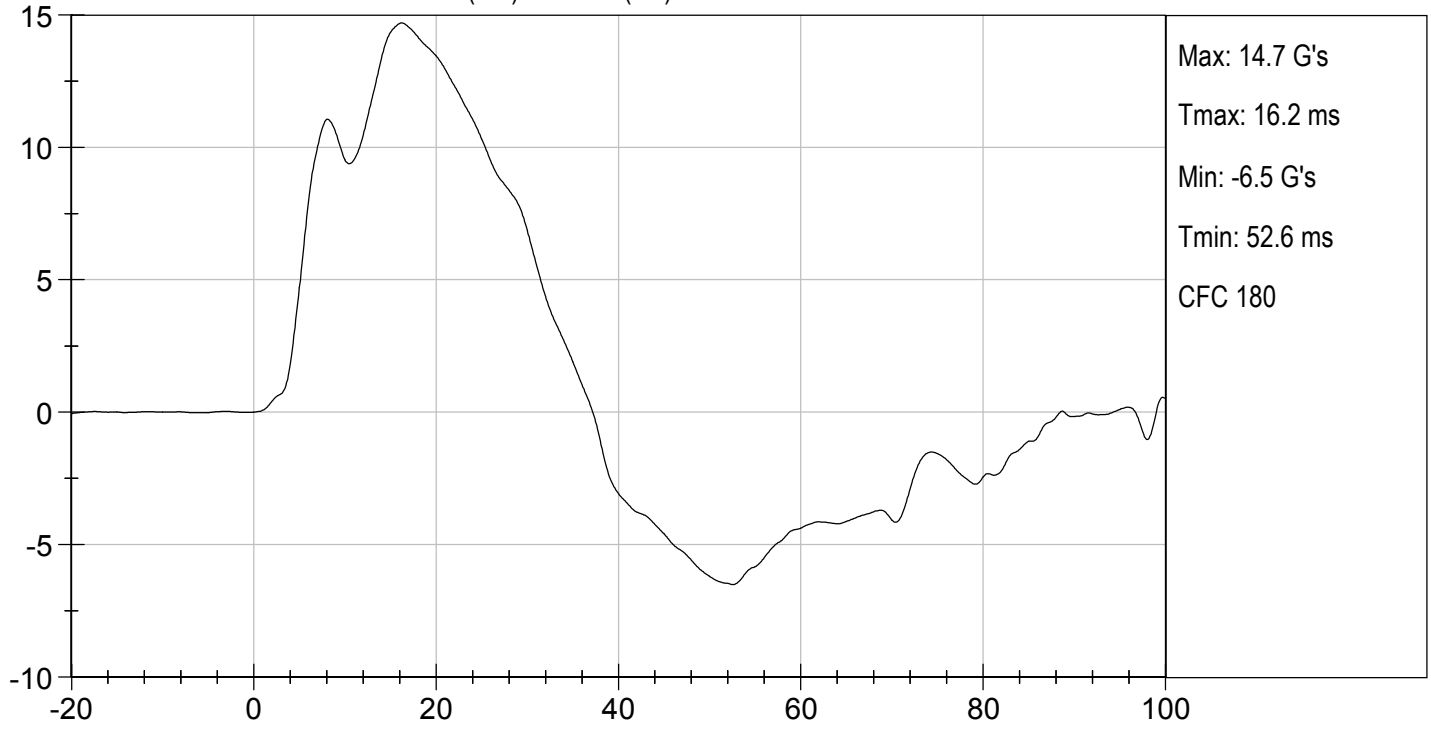
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



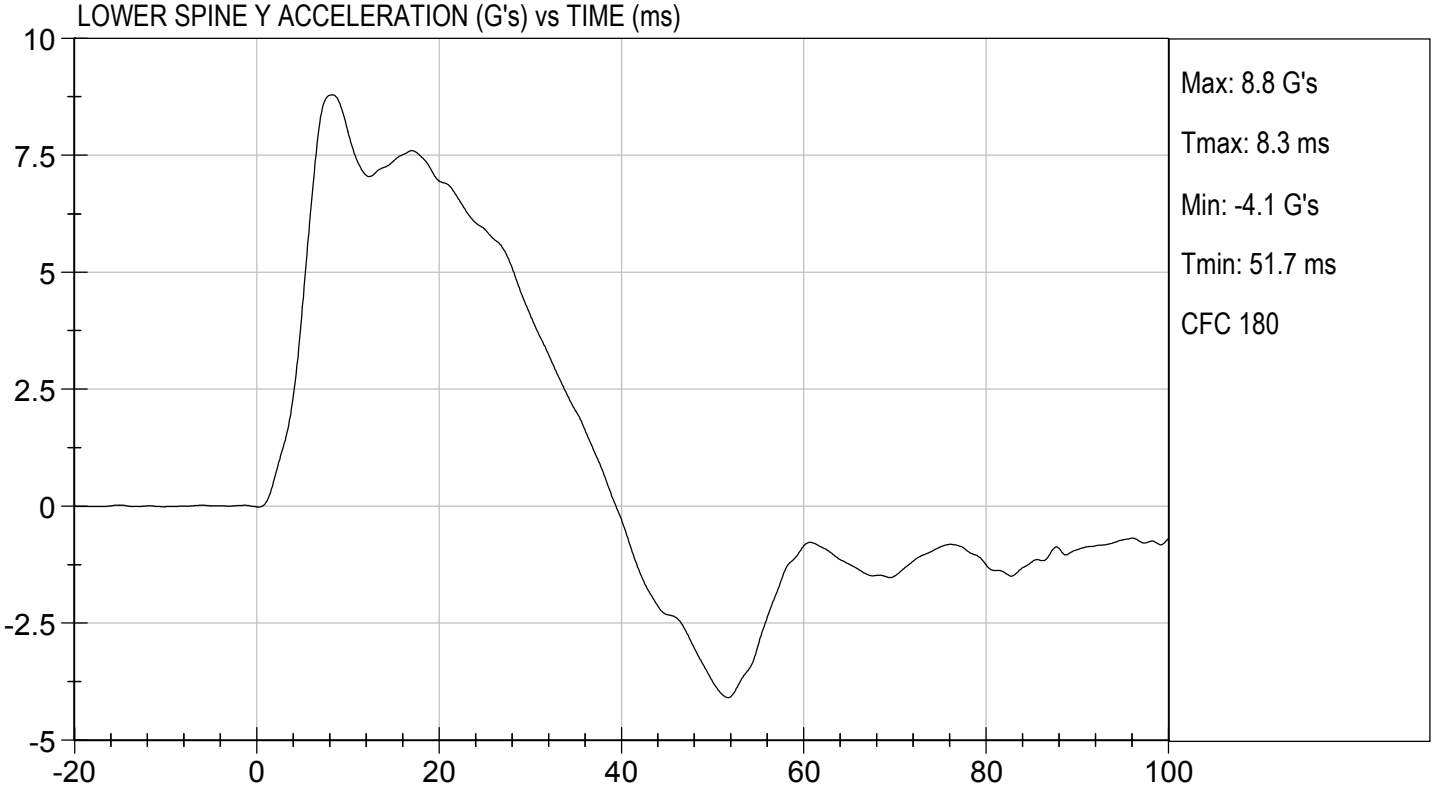
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 01/09/2020
TEST #: D200105

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:** D200106

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	21	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	12 to 16	14	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	38	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	39	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

Laboratory Technician

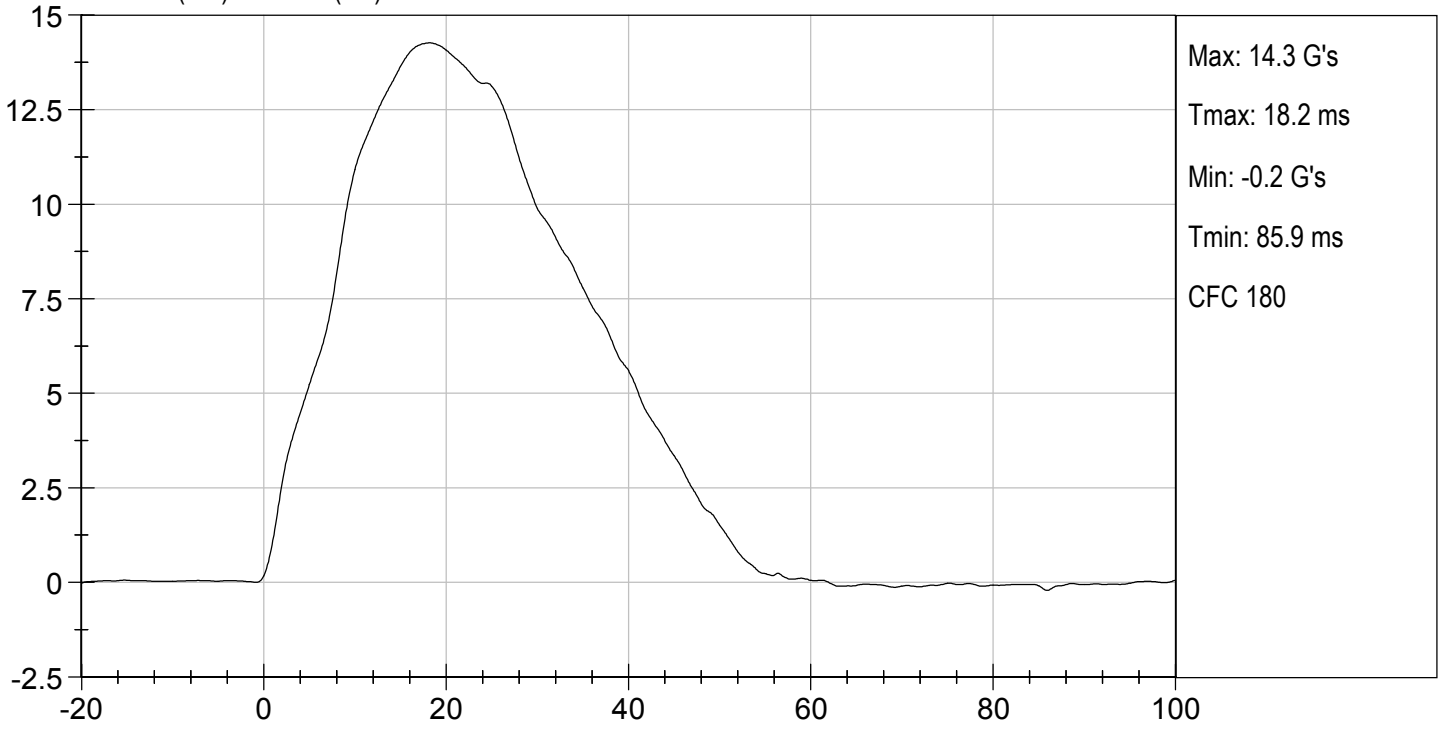
01/09/2020
Test Date

Approved By

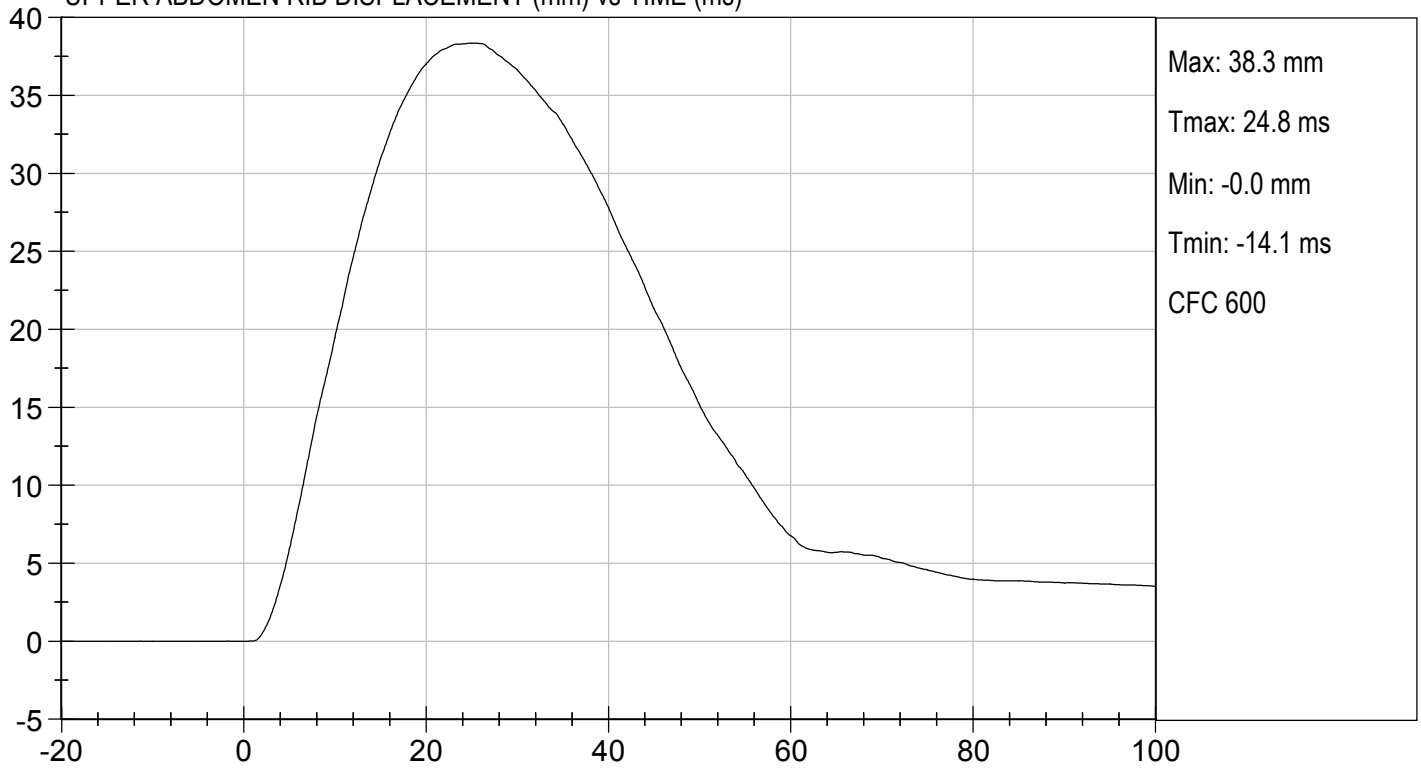
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 01/09/2020
TEST #: D200106

PROBE (G's) vs TIME (ms)



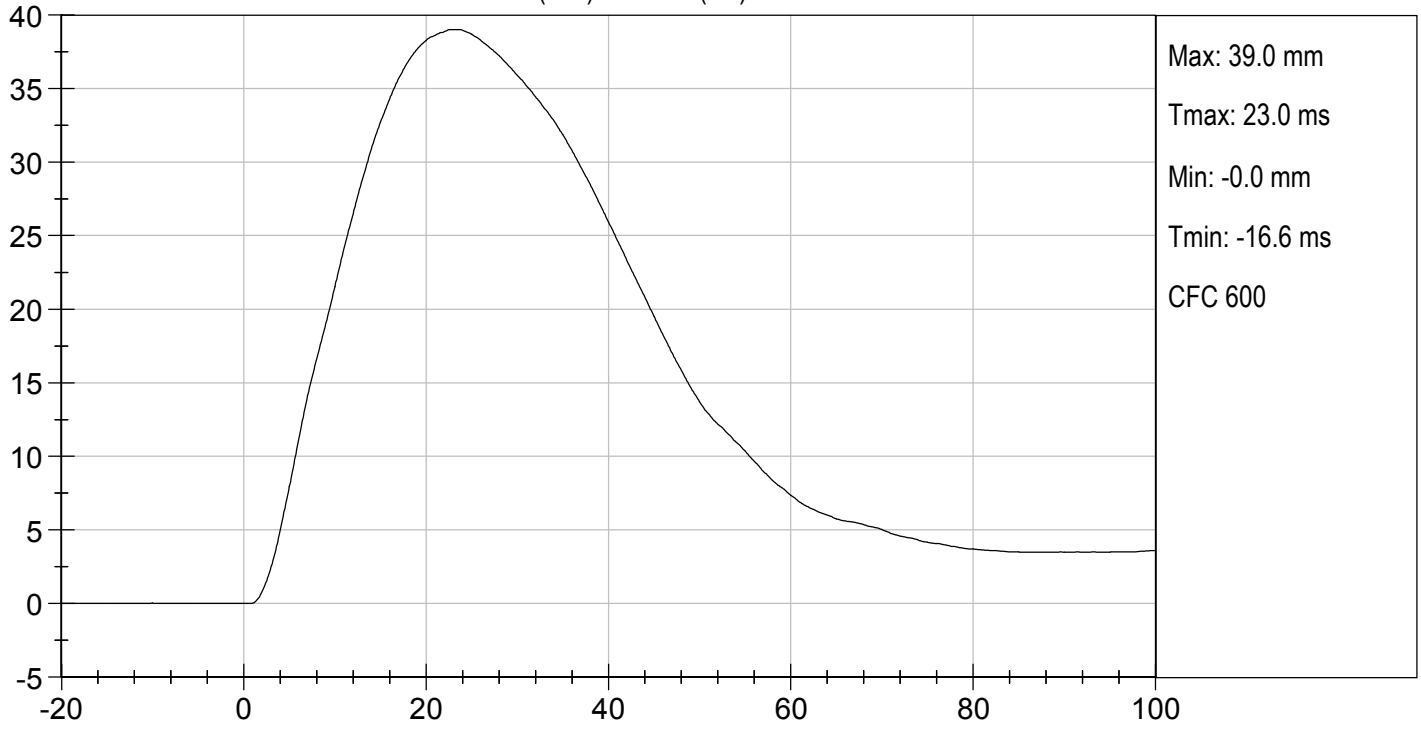
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



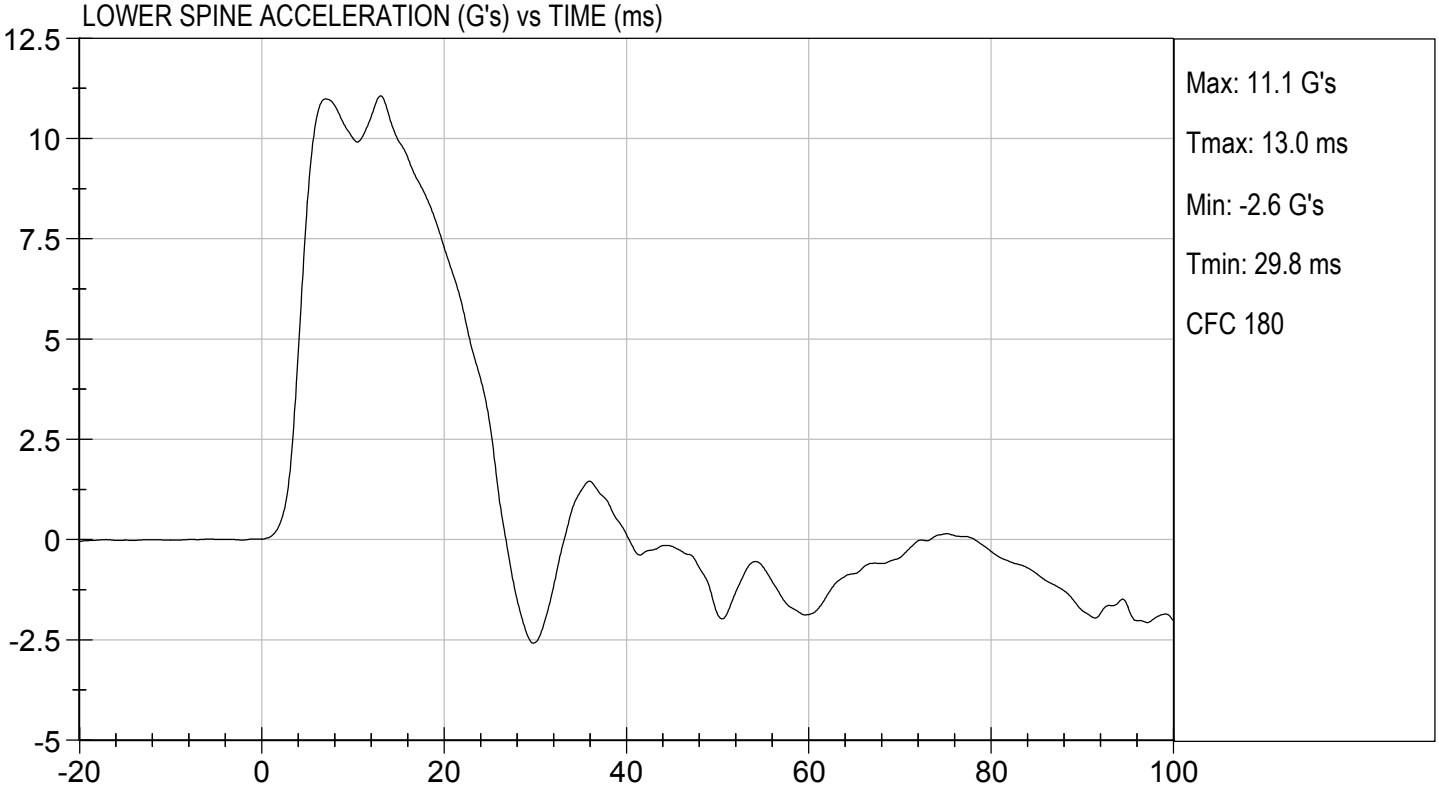
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 01/09/2020
TEST #: D200106

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:** D200107

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	21	Pass
Impact Velocity	m/s	6.60 to 6.80	6.61	Pass
Maximum Probe Acceleration	G's	38 to 47	47	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	41	Pass
Peak Acetabulum Force	N	3600 to 4300	4,173	Pass
		Overall Test Results		Pass

Laboratory Technician

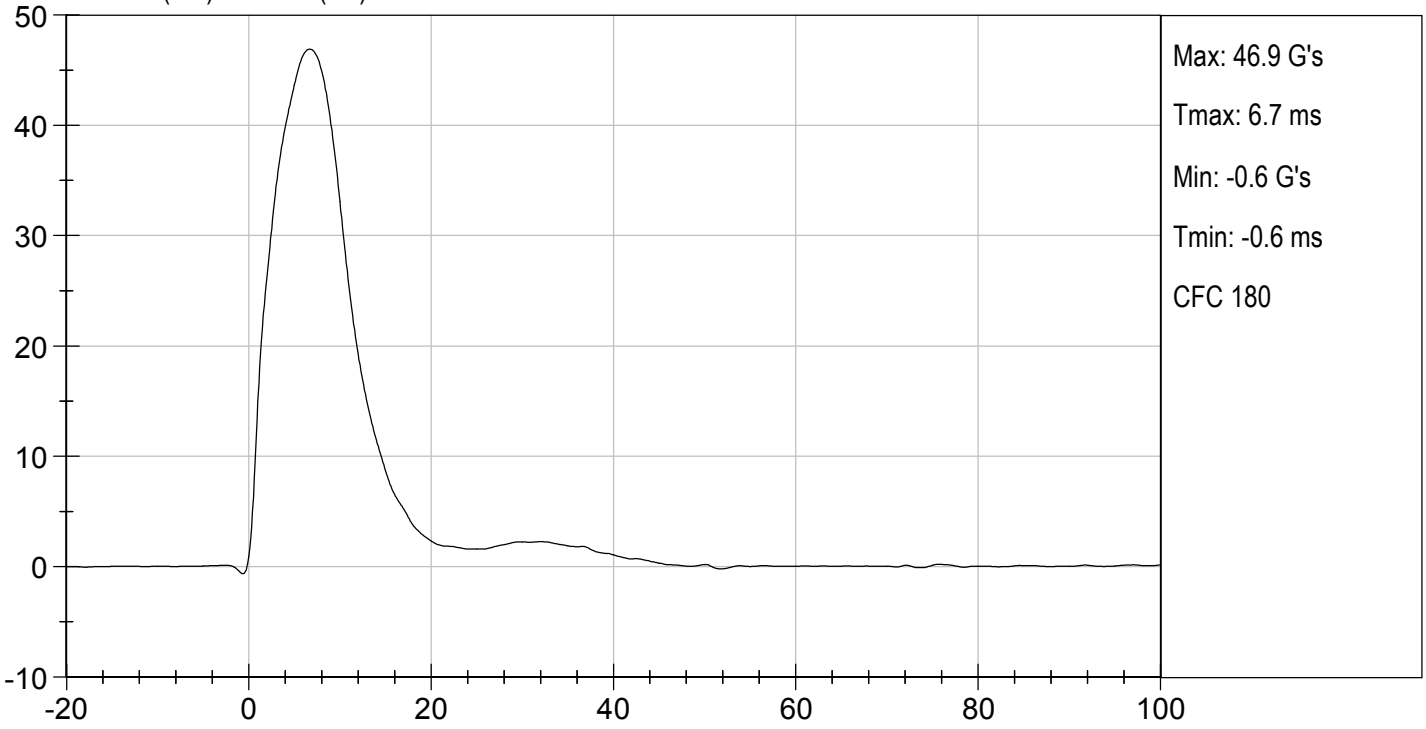
01/09/2020
Test Date

Approved By

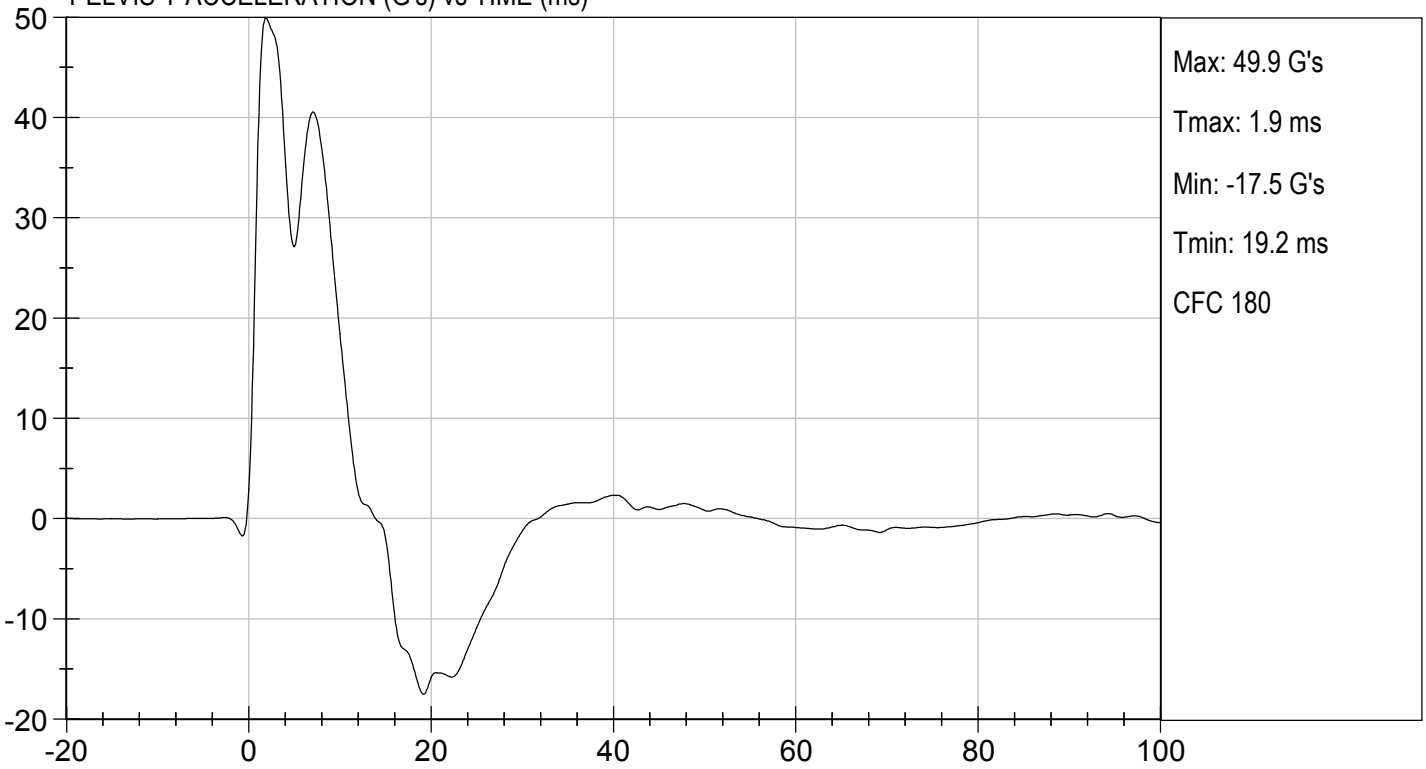
TEST DESC: PELVIS IMPACT
VELOCITY: 21.70 ft/s, 6.61 m/s

TEST DATE: 01/09/2020
TEST #: D200107

PROBE (G's) vs TIME (ms)

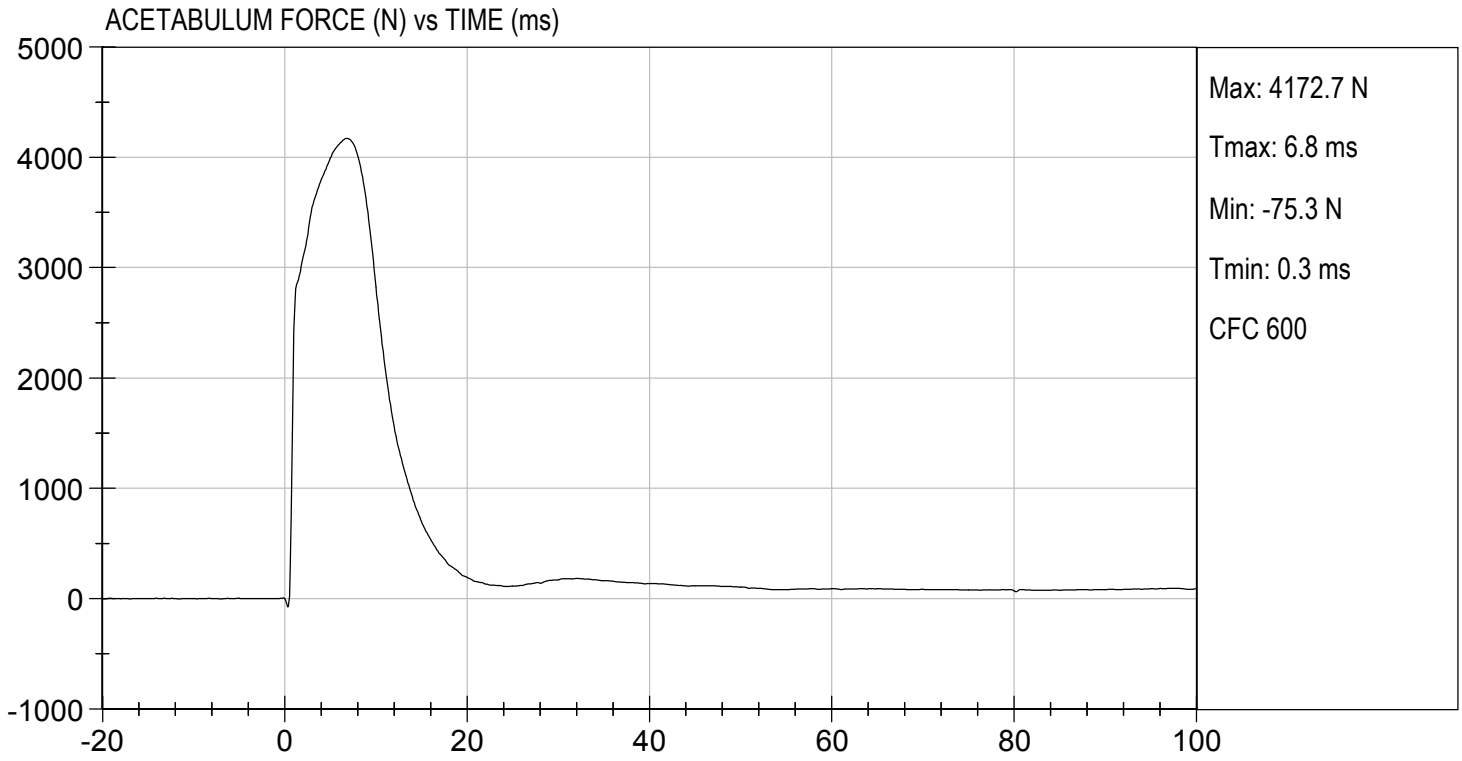


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: PELVIS IMPACT
VELOCITY: 21.70 ft/s, 6.61 m/s

TEST DATE: 01/09/2020
TEST #: D200107



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D200108

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	21	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	36 to 45	36	Pass
Pelvis Y Acceleration	G's	28 to 39	29	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,110	Pass
		Overall Test Results		Pass

Laboratory Technician

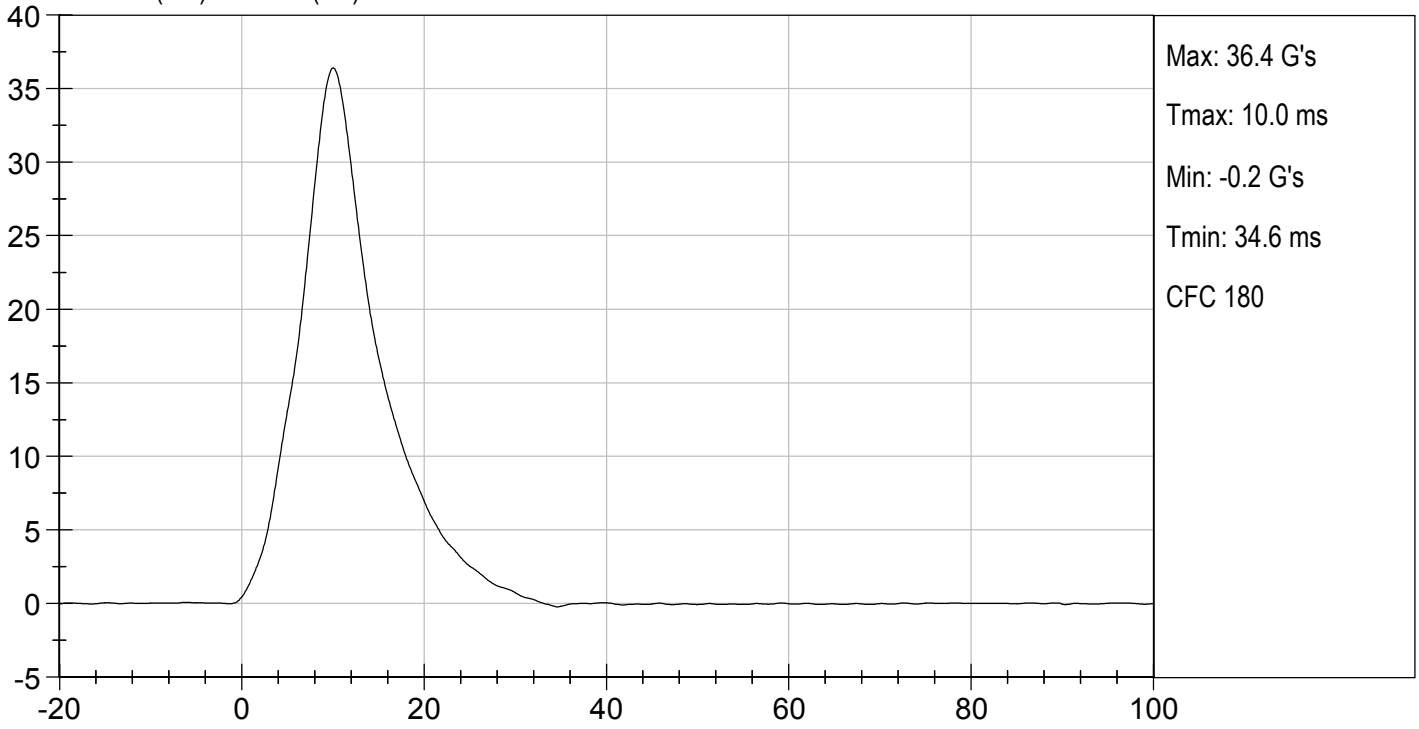
01/10/2020
Test Date

Approved By

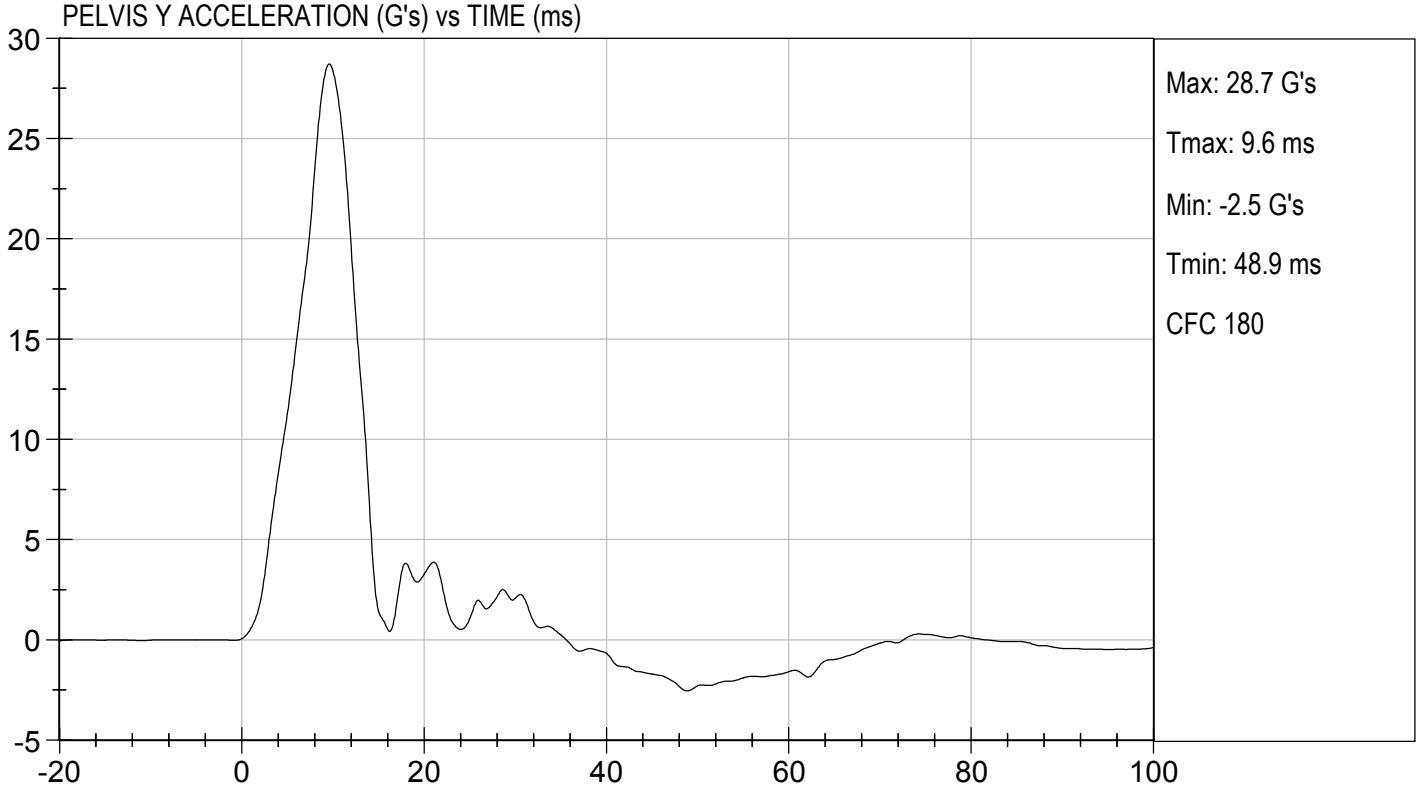
TEST DESC: ILLIAC
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 01/10/2020
TEST #: D200108

PROBE (G's) vs TIME (ms)

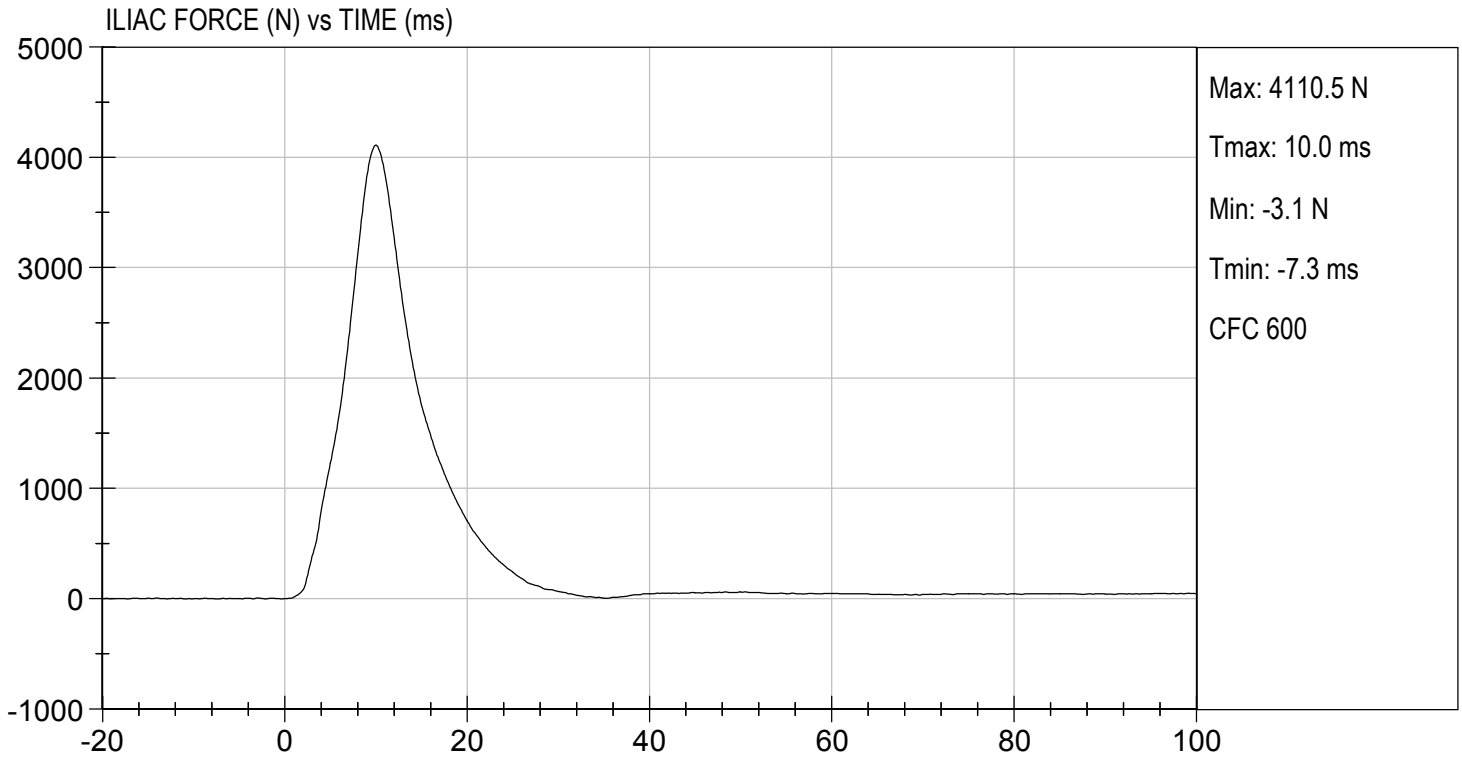


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: ILLIAC
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 01/10/2020
TEST #: D200108



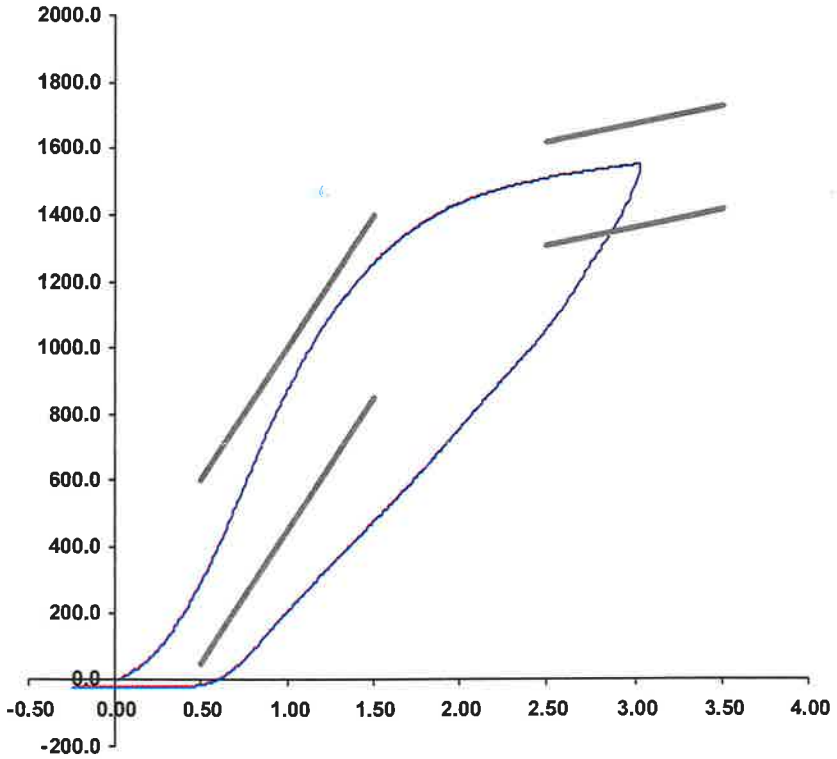
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 13216
Test Number 10611
Report Number 10646
Test Date 8/8/2019 1:28:52 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	296.84	50.00	600.00
Force @ 1.5 mm (N)	1,259.72	850.00	1,400.00
Force @ 2.5 mm (N)	1,512.15	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,553.04	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 **08-Aug-19**
SACO Research

By : DC Date : 8/8/2019

SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 11824
Test Number 5934
Report Number 5950
Test Date 1/23/2018 7:57:56 AM

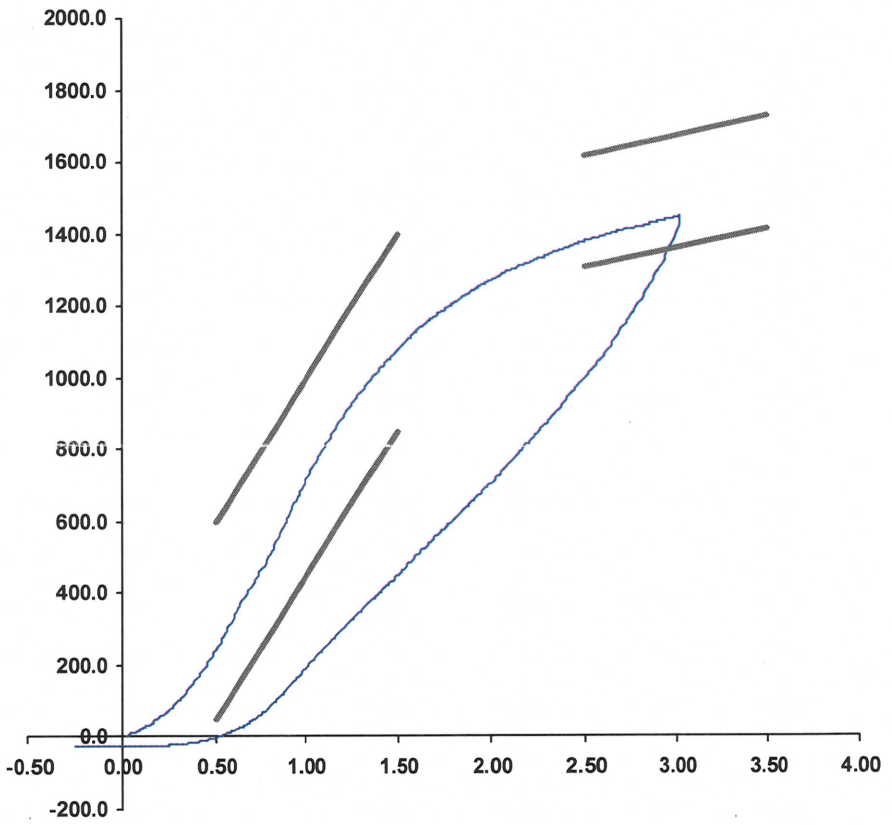
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	243.45	50.00	600.00
Force @ 1.5 mm (N)	1,080.54	850.00	1,400.00
Force @ 2.5 mm (N)	1,379.92	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,446.51	1,361.00	1,673.00

Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator DC

Part Number 180-4450

Template No 107 **23-Jan-18**
SACO Research

By : DC Date : 1/23/18

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

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	P79711	Endevco	12/23/2019
		Y	P79712	Endevco	12/23/2019
		Z	P79750	Endevco	12/23/2019
		Xr	P79751	Endevco	12/23/2019
		Yr	P79753	Endevco	12/23/2019
		Zr	P88170	Endevco	12/23/2019
Thorax Rib Displacement Potentiometers	Upper	Y	G176	Honeywell	12/23/2019
	Middle	Y	G169	Honeywell	12/23/2019
	Lower	Y	G164	Honeywell	12/23/2019
Abdomen Load Cells	Forward	Y	ABG1532	Denton	8/13/2019
	Middle	Y	ABG1534	Denton	8/13/2019
	Rear	Y	ABG1535	Denton	8/13/2019
Lower Spine Accelerometers (T12)		X	P79574	Endevco	12/23/2019
		Y	P82097	Endevco	12/23/2019
		Z	P82603	Endevco	12/23/2019
Public Symphysis Load Cell		Y	PG461	Denton	8/13/2019

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N 296		
				Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers			X	P85003	Endevco	12/31/2019
			Y	P94783	Endevco	12/31/2019
			Z	P94786	Endevco	12/31/2019
			Xr	P94938	Endevco	12/31/2019
			Yr	P96854	Endevco	12/31/2019
			Zr	P97386	Endevco	12/31/2019
Head Angular Rate Sensors			X	ARS7421	DTS	7/8/2019
			Y	ARS7413	DTS	7/8/2019
			Z	ARS7423	DTS	7/8/2019
Displacement Potentiometers	Thoracic Rib	Upper	Y	G012	Servo	12/31/2019
		Middle	Y	G1163	FTSS	12/31/2019
		Lower	Y	G1158	FTSS	1/2/2020
	Abdominal Rib	Upper	Y	G1146	FTSS	1/2/2020
		Lower	Y	G1126	FTSS	1/2/2020
Lower Spine Accelerometers (T12)			X	P79418	Endevco	12/31/2019
			Y	P79439	Endevco	12/31/2019
			Z	P79614	Endevco	12/31/2019
Acetabulum Load Cell			Y	ACG269	Denton	3/15/2019
Iliac Wing Load Cell			Y	IWG282	Denton	3/15/2019
Pelvis Plug (struck side)				13216	SACO	8/8/2019
Pelvis Plug (non-struck side)				11824	SACO	1/23/2018

Table 3 – Vehicle Instrumentation

			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	PCB1012	PCB	11/13/2019
	Vehicle Center of Gravity	Y	PCB1019	PCB	11/13/2019
	Vehicle Center of Gravity	Z	PCB1015	PCB	12/17/2019
2	Right Sill at Front Seat	X	T20783	Endevco	12/2/2019
	Right Sill at Front Seat	Y	T20359	Endevco	9/26/2019
	Right Sill at Front Seat	Z	T19355	Endevco	11/15/2019
3	Right Sill at Rear Seat	X	PCB1129	PCB	12/17/2019
	Right Sill at Rear Seat	Y	PCB1163	PCB	11/18/2019
	Right Sill at Rear Seat	Z	PCB1226	PCB	11/8/2019
4	Left Sill at Front Door	Y	T19995	Endevco	11/15/2019
5	Left Sill at Rear Door	Y	PCB1083	PCB	11/7/2019
6	Left A-Post Lower	Y	P82139	Endevco	11/15/2019
7	Left A-Post Middle	Y	P95336	Endevco	11/15/2019
8	Left B-Post Lower	Y	PCB1036	PCB	12/3/2019
9	Left B-Post Middle	Y	PCB1052	PCB	12/3/2019
10	Front Seat Track	Y	PCB1146	PCB	11/18/2019
11	Rear Seat Track or Structure	Y	PCB1240	PCB	11/18/2019
12	Right Rear Occ. Compartment	Y	PCB1137	PCB	11/13/2019
13	Engine Block	X	T20023	Endevco	12/3/2019
	Engine Block	Y	T20020	Endevco	12/3/2019
14	Rear Floorpan Above Axle	X	T19553	Endevco	11/15/2019
	Rear Floorpan Above Axle	Y	T19311	Endevco	10/24/2019
	Rear Floorpan Above Axle	Z	P94396	Endevco	11/15/2019

Table 4 – MDB Instrumentation

		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	PCB660D	PCB	9/23/2019
MDB Center of Gravity	Y	PCB659D	PCB	9/23/2019
MDB Center of Gravity	Z	PCB661D	PCB	9/23/2019
Left Frame at Rear Axle Centerline	X	PCB557D	PCB	9/23/2019
Left Frame at Rear Axle Centerline	Y	PCB753D	PCB	9/23/2019