REPORT NUMBER: SINCAP-MGA-20-005

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

VOLVO CAR CORPORATION
2020 Volvo XC40 T4 Momentum 5-Door SUV
NHTSA No.: O20205902

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: November 21, 2019

Final Report Date: February 14, 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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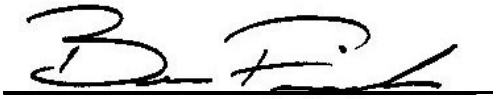
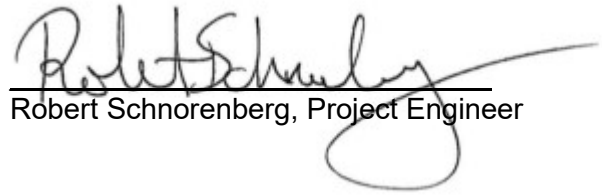
Prepared by: 
Ben Fischer, Project Engineer

Approved by: 
Robert Schnorenberg, Project Engineer

Approval Date: February 14, 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-20-005		

4. Title and Subtitle	5. Report Date
Final Report of New Car Assessment Program Side Impact MDB Testing of 2020 Volvo XC40 T4 Momentum 5-Door SUV, NHTSA No.: O20205902	February 14, 2020
	6. Performing Organization Code MGA
7. Author(s) Ben Fischer, Project Engineer	**8. Performing Organization Report No.** SINCAP-MGA-20-005
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105	**10. Work Unit No.**
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	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 Volvo XC40 T4 Momentum 5-Door SUV 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 November 21, 2019.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.80 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21.7°C. The target vehicle post-test maximum crush was 223 mm at level 3. The test vehicle's performance was as follows:

Measurement Description	Units	Driver ATD (ES-2re)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	78
Maximum Thorax Rib Deflection	mm	44	22
Total Abdominal Force	N	2500	694
Pubic Symphysis Force	N	6000	1422
Resultant Lower Spine Acceleration	g	82*	24

Measurement Description	Units	Passenger ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	119
Resultant Lower Spine Acceleration	g	82	48
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3357
Maximum Thoracic Rib Deflection	mm	38*	27
Maximum Abdomen Rib Deflection	mm	45*	21

*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, NPO-411 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	226	

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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 Volvo XC40 T4 Momentum 5-Door SUV. 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 Volvo XC40 T4 Momentum 5-Door SUV 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 61.80 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 November 21, 2019. 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	78
Maximum Thorax Rib Deflection	mm	44	22
Total Abdominal Force	N	2500	694
Pubic Symphysis Force	N	6000	1422
Resultant Lower Spine Acceleration	g	82*	24

Measurement Description	Units	Passenger ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	119
Resultant Lower Spine Acceleration	g	82	48
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3357
Maximum Thoracic Rib Deflection	mm	38*	27
Maximum Abdomen Rib Deflection	mm	45*	21

*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	Yes	No		
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	
Side Airbag (Other)				
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	
Other:	No		No	

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

GENERAL COMMENTS

Left Lower B-Post Y was not installed.

Left Mid B-Post Y was not installed.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20205902	Traction Control System (TCS)	Yes
Model Year	2020	Auto-Leveling System	No
Make	Volvo	Automatic Door Locks (ADL)	Yes
Model	XC40 T4 Momentum	Power Window Auto-Reverse	Yes
Body Style	5-Door SUV	Other Optional Feature	No
VIN	YV4AC2HK7L2179723	Driver Front Airbag	Yes
Body Color	Glacier Silver Metallic	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	51 km / 32 mi	Driver Head/Torso Airbag	No
Engine Displacement (L)	2.0 L	Driver Torso Airbag	No
Type/No. Cylinders	Inline 4	Driver Torso/Pelvis Airbag	Yes
Engine Placement	Lateral	Driver Pelvis Airbag	No
Transmission Type	Automatic	Driver Knee Airbag	Yes
Transmission Speeds	8	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	Yes	Rear Pass. Pelvis Airbag	No
Running Boards	No	Driver Seat Belt Pretensioner	Yes
Tilt Steering Wheel	Yes	Rear Pass. Seat Belt Pretensioner	Yes
Power Seats	Yes	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Rear Pass. Load Limiter	Yes
		Other Safety Restraint	N/A

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

DATA FROM CERTIFICATION LABEL

Manufactured By	VOLVO CAR CORPORATION
Date of Manufacture	05/19
Vehicle Type	MPV

GVWR (kg)	2160
GAWR Front (kg)	1130
GAWR Rear (kg)	1070

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3		5	
Capacity Weight (VCW) (kg)				420	(A)
DSC x 68.04 kg				340	(B)
Rated Cargo and Luggage Weight (RCLW) (kg)				80	(A-B)

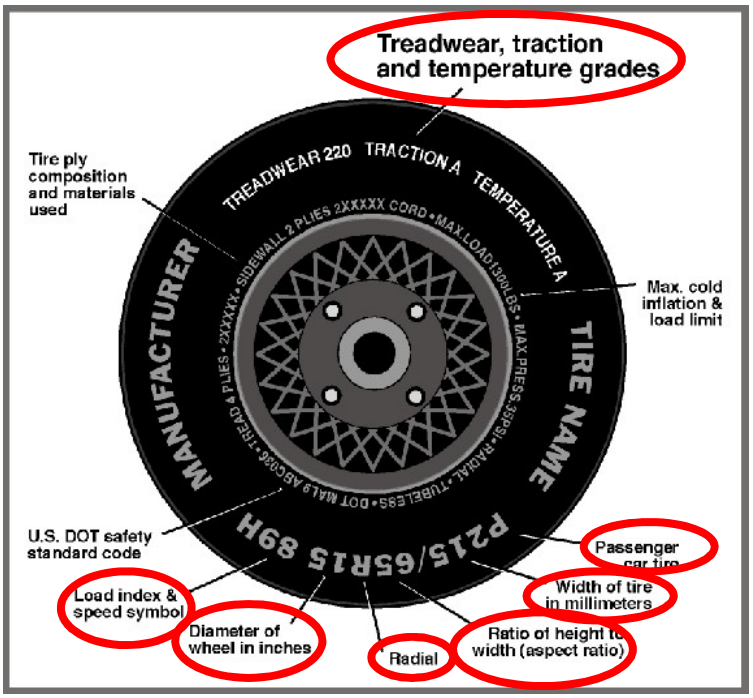
VEHICLE SEAT TYPE

Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						w/ Lever	w/ Knob
Front Seat	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 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	230	230
Recommended Tire Size	235/55R18	235/55R18
Tire Size on Vehicle	Michelin	Michelin
Tire Manufacturer	Primacy MXM4	Primacy MXM4
Tire Model	Passenger Vehicle	Passenger Vehicle
Treadwear	2 Polyester	2 Polyester
Traction	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Temperature Grade	F33J 029X 1419	F33J 029X 1419
Tire Plies Sidewall	F33J 029X 1419	F33J 029X 1419
Tire Plies Body	100H	100H
Load Index/Speed Symbol	500	500
Tire Material	A	A
DOT Safety Code Left	A	A
DOT Safety Code Right	Rubber	Rubber

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

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

TEST VEHICLE TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	220	220	215	220
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	499.0	343.5		542.5	423.0		535.0	436.5	
Right	kg	490.0	340.0		506.0	403.5		498.5	411.5	
Ratio	%	59.1%	40.9%		55.9%	44.1%		54.9%	45.1%	
Totals	kg	989.0	683.5	1672.5	1048.5	826.5	1875.0	1033.5	848.0	1881.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1672.5	(A)
Sum of Actual Weight of 2 P572 ATDs Used	kg	129	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	80	(C)
Calculated Test Vehicle Target Weight (TVTW)	kg	1881.5	(A+B+C)

Does the measured As Tested Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight – 4.5 kg to 9 kg)? **YES**

TEST VEHICLE ATTITUDES AND CG

	Units	Fully Loaded	As Tested	Meets Requirement*
Left Front	mm	760	763	Yes
Right Front	mm	766	758	Yes
Right Rear	mm	775	783	Yes
Left Rear	mm	769	768	Yes
Vehicle CG (Aft of Front Axle)	mm	1219	1192	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	27	24	

* 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 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Units	Weight
Weight of Ballast Added	kg	67
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 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

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	24.5	11.2	17.9
Front Passenger Seat	18.3	12.0	15.2
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	17.9	0	Max	62	62	62
			Mid	31	31	31
			Min	0	0	0
Front Passenger Seat	15.2	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

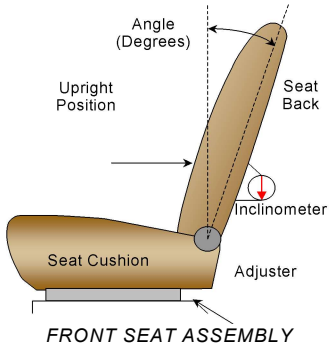
Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

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	260		130	
Front Passenger Seat	260	39	130	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	70.8		18.3	
Front Passenger Seat	71.2	0	22.1	0
Front Center Seat				
Struck Side Rear Seat	Fixed		22.8	
Non-Struck Side Rear Seat	Fixed		22.8	
Rear Center Seat	Fixed		22.8	

Seatback angles measured on rear surface of seatback.

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

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

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	4	0 (Uppermost as 0)
Rear Seat	Fixed	

HEAD RESTRAINT ADJUSTMENT

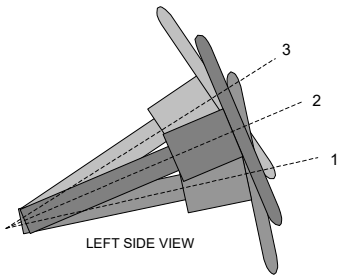
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	3	0 (Lowest as 0) / Fixed Fore-Aft
Rear Seat	Fixed	

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.

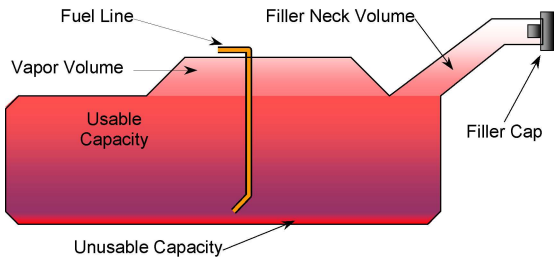
	Wheel Angle (°)	Fore/Aft Position (mm)
Lowermost, Position 1	69.0	
Geometric Center, Position 2	65.8	
Uppermost, Position 3	62.5	
Telescoping Steering Wheel Travel		57
Test Position	65.8	29



STEERING COLUMN ASSEMBLY

FUEL PUMP

The vehicle is equipped with an electronic fuel pump. The fuel pump will run under normal engine running conditions. The filler neck is located on the passenger's side.



VEHICLE FUEL TANK ASSEMBLY

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

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

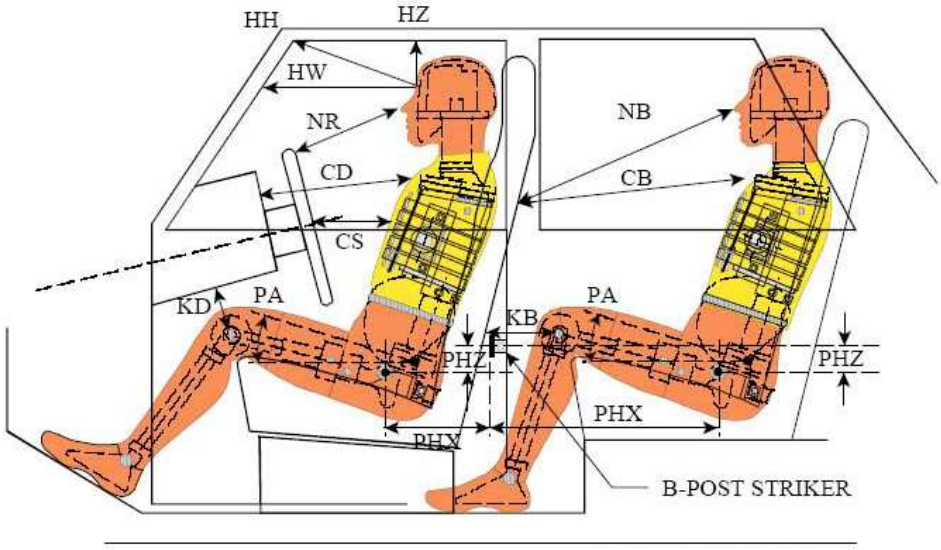
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of Standard Tank (see Form No. 1)	53.8
Usable Capacity of Optional Tank (see Form No. 1)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	53.8
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	50.0
Actual Amount of Solvent Used	50.0
1/3 of Usable Capacity	17.9

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 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019



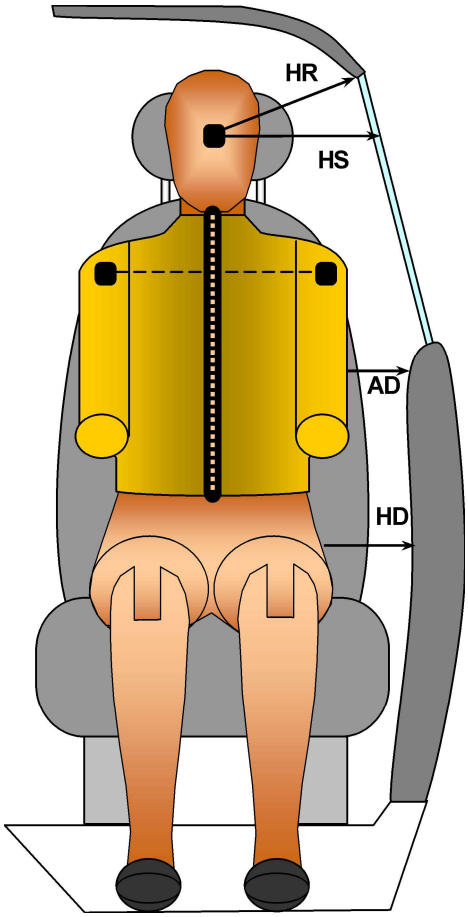
LEFT SIDE VIEW

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	380	25.0		
HW		Head to Windshield	609	0		
HZ	HZ	Head to Roof Liner	145	90	278	90
NR	NB	Nose to Rim/Seat Back	479	16.9	523	6.1
CD	CB	Chest to Dashboard/Seat Back	568	4.2	527	5.0
CS		Chest to Steering Wheel	377	2.9		
KDL	KBL	Left Knee to Dash/Seat Back	208	32.6	255	21.2
KDR	KBR	Right Knee to Dash/Seat Back	198	33.5	258	21.2
PAX	PAX	Pelvic Tilt Angle X		21.4		22.0
PAY	PAY	Pelvic Tilt Angle Y		1.1		0.8
PHX	PHX	Hip Point to Striker (X-Axis)	178		201	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	135		246	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV
NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test
Test Date: 11/21/2019

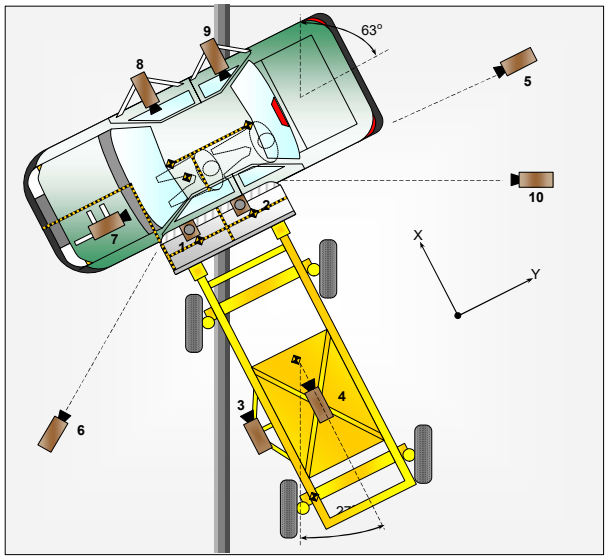


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
HR	Head to Side Header	192	272
HS	Head to Side Window	338	377
AD	Arm to Door	93	109
HD	Hip Point to Door	226	205

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates* (mm)			Lens (mm)	Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	960	410	-4995	8.5	1000
2	Overhead Close-Up	200	0	-4895	20	1000
3	Left Impact Point (MDB)				50	1000
4	Side Overall (MDB)				16	1000
5	Rear	10	6940	-1570	24	1000
6	Left Front	-1830	-6830	-1660	24	1000
7	Driver Front (OB)				16	1000
8	Driver Side (OB)				8	1000
9	Passenger Side (OB)				8	1000
10	Real Time Left Rear					30
11	Real Time Inrun					30

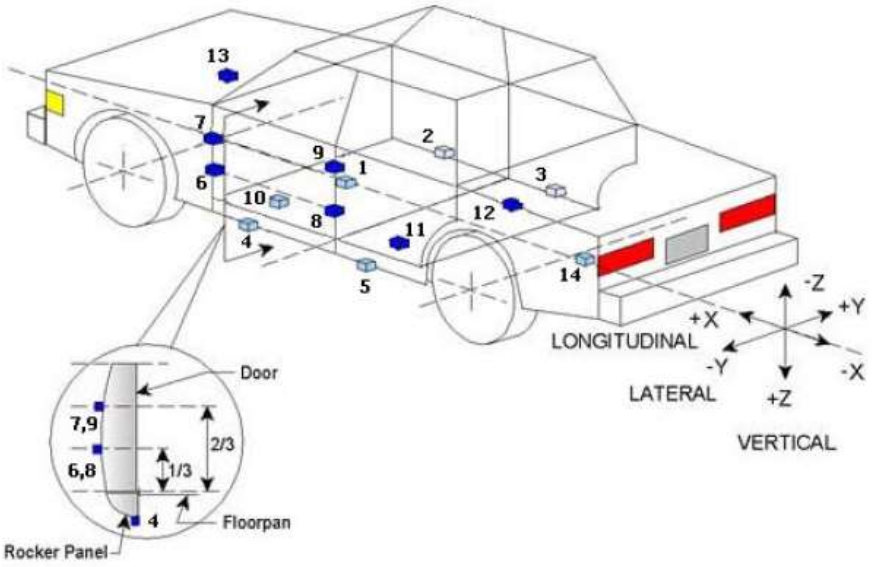
Reference: Impact Point projected to Ground; +X = To Front of MDB, + Y = To Right of MDB, +Z = Down
*All measurements accurate to ±6 mm

INSTRUMENTATION

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

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019



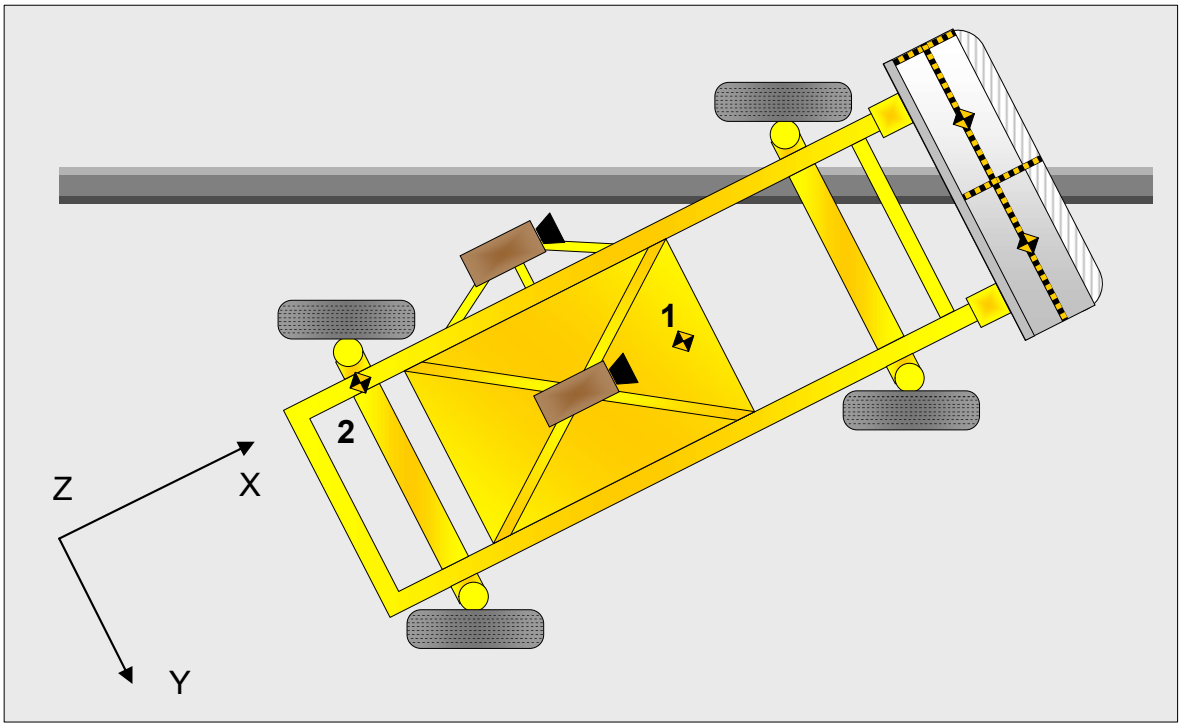
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2613	160	-265
2	Right Sill at Front Seat	2308	740	-250
3	Right Sill at Rear Seat	1385	740	-265
4	Left Sill at Front Door	2474	-740	-250
5	Left Sill at Rear Door	1414	-740	-265
6	Left Lower A-Post	3005	-845	-580
7	Left Middle A-Post	3005	-845	-835
8	Left Lower B-Post			
9	Left Middle B-Post			
10	Front Seat Track	2062	-390	-355
11	Rear Seat Structure	1685	-360	-370
12	Rt. Rear Occ. Compartment	1720	340	-275
13	Engine Block	3715	270	-860
14	Rear Above Axle	820	15	-630

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 Volvo XC40 T4 Momentum 5-Door SUV
Test Program: NCAP Side MDB Impact Test
NHTSA No.: O20205902
Test Date: 11/21/2019



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	1405

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	None	None
Top of Head	Headliner	Curtain Airbag, Door Panel
Left Side of Head	Curtain Airbag, Headliner	Curtain Airbag
Back of Head	Curtain Airbag, Headrest	Curtain Airbag, Headrest, C-Pillar Trim, Seatback
Left Shoulder	Curtain Airbag, Door Panel	Door Panel
Upper Torso	Side Torso/Pelvis Airbag, Seatback	C-Pillar Trim
Lower Torso	Side Torso/Pelvis Airbag, Seatback	C-Pillar Trim
Left Hip	Side Torso/Pelvis Airbag	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	Yes
Total Separation from Vehicle at Hinges or Latches	No	No	No	No	No
Latch or Hinge Systems Pulled Out of Their Anchorages	No	No	No	No	No
Disengaged from Latched Position	No	No	No	No	No
Latch Separated from Striker	No	No	No	No	No
Jammed Shut	Yes	Yes	No	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	None
Other Notable Effects	None

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

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2705
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		413
Actual Impact Point (Aft of Front Axle)	mm		412
Horizontal Offset (+forward / -rearward)	mm	+/- 50 of intended impact point	1
Vertical Offset (+down / -up)	mm	+/- 20 of intended impact point	-7

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

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

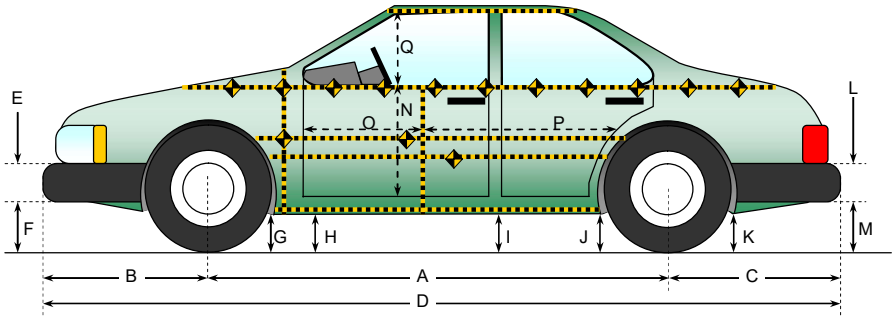
	Units	Front Axle	Rear Axle	Total
Left	kg	368.2	320.6	
Right	kg	400.7	271.4	
Ratio	%	56.5	43.5	
Totals	kg	768.9	592.0	1360.9

SPEED AND ANGLE AT IMPACT DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	61.80
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	61.93
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.3
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	62.8
MDB Crabbed Angle to MDB Forward Line of Motion	degrees	26 to 28	27.0

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019



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

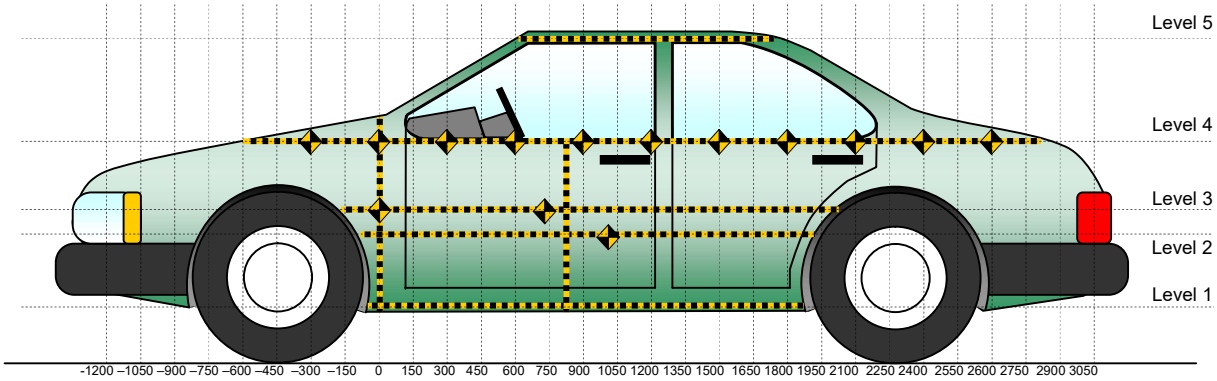
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2705	2677	28
B	Front Axle to FSOV	933	1067	-134
C	Rear Axle to RSOV	810	701	109
D	Total Length at Centerline	4448	4445	3
E	Front Bumper Thickness	113	113	0
F	Front Bumper Bottom to Ground	202	225	-23
G	Sill Height at Front Wheel Well	211	226	-15
H	Sill Height at Front Door Leading Edge	211	226	-15
I	Sill Height at B Pillar	225	210	15
J1	Sill Height at Rear Wheel Well	232	232	0
J2	Pinch Weld Height at Rear Wheel Well	232	232	0
K	Sill Height Aft of Rear Wheel Well	280	274	6
L	Rear Bumper Thickness	98	98	0
M	Rear Bumper Bottom to Ground	319	319	0
N	Sill Height to Window Bottom Sill	707	655	52
O	Front Door Leading Edge to Impact CL	734	687	47
P	Rear Door Trailing Edge to Impact CL	1103	1015	88
Q	Front Window Opening	402	408	-6
R	Right Side Length	3262	3266	-4
S	Left Side Length	3262	3251	11
T	Vehicle Width at B Post	1875	1843	32
U	Front Wheel Track Width	2705	2677	28
V	Rear Wheel Track Width	933	1067	-134

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019



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	568	194	1650
2	Occupant H-Point	642	219	1650
3	Mid Door	692	223	1650
4	Window Sill	1059	65	1350
5	Window Top	1553	12	1050

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

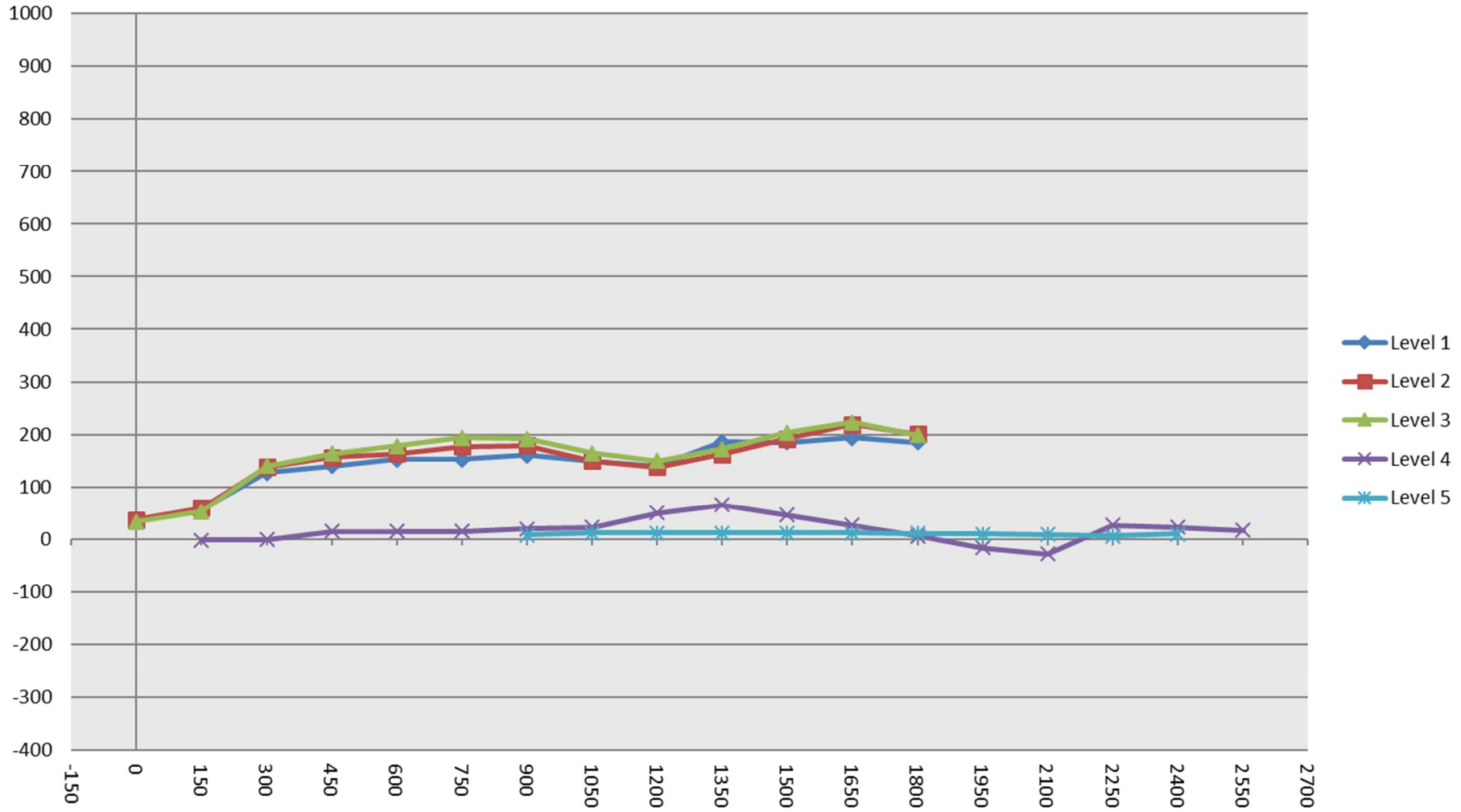
Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019

	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															
0		173	173				210	206				37	33		
150	191	189	190	285		248	249	243	283		57	60	53	-2	
300	213	198	195	274		340	336	335	273		127	138	140	-1	
450	221	198	194	258		361	355	357	273		140	157	163	15	
600	222	197	194	248		375	360	372	263		153	163	178	15	
750	222	198	194	242		375	375	388	257		153	177	194	15	
900	221	201	194	235	519	381	380	386	254	527	160	179	192	19	8
1050	222	204	195	233	497	372	354	359	255	509	150	150	164	22	12
1200	222	208	197	228	489	362	346	347	278	501	140	138	150	50	12
1350	223	213	200	228	487	409	375	372	293	499	186	162	172	65	12
1500	225	213	203	229	486	410	405	407	275	498	185	192	204	46	12
1650	208	202	199	234	486	402	421	422	260	498	194	219	223	26	12
1800	182	181	183	237	489	367	382	382	243	500	185	201	199	6	11
1950				237	493				220	503				-17	10
2100				234	501				205	510				-29	9
2250				233	517				259	523				26	6
2400				233	536				255	546				22	10
2550				239					255					16	
2700															
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.

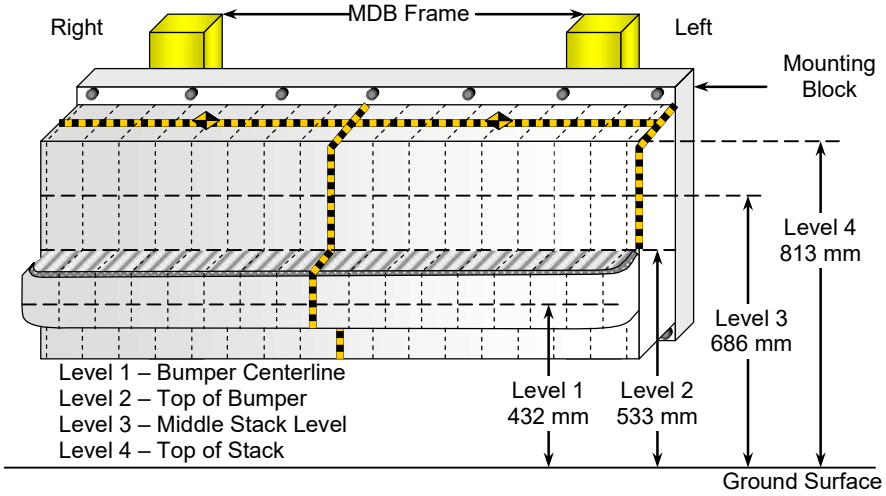
DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019



DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV
NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test
Test Date: 11/21/2019



FRONT **VIEW**

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

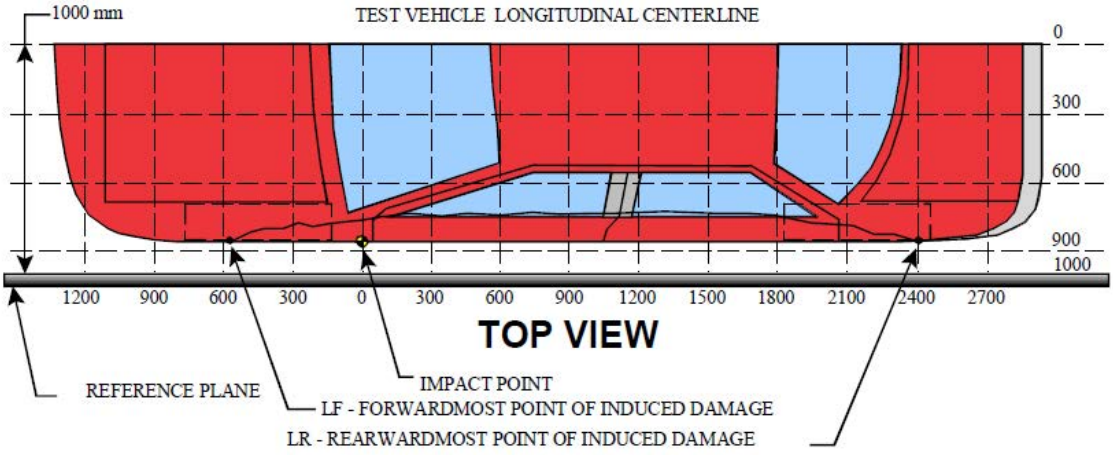
Vertical Location			From Centerline		Maximum Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Left	231
B	Top of Bumper	533	800	Left	183
C	Mid-Level	686	800	Left	186
D	Top of Stack	813	800	Left	190

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	88	77	70	66	95	138	140	129	102	91	87	93	104	113	110	138	190
3	55	63	55	53	78	87	105	107	70	55	50	55	65	75	85	120	186
2	120	120	111	102	98	95	98	95	97	106	115	115	115	115	120	129	183
1	208	209	205	206	209	221	211	207	212	199	202	200	202	202	205	215	231

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019



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	1920	3	276	199	77
2	1556	3	409	202	207
3	1192	3	348	197	151
4	828	3	390	194	196
5	464	3	358	194	164
6	100	3	250	184	66

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	684	476	208
2	480 mm right of center	1	674	463	211
3	160 mm right of center	1	673	463	210
4	160 mm left of center	1	658	463	195
5	480 mm left of center	1	673	463	210
6	800 mm left of center	1	707	476	231

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

Test Vehicle: 2020 Volvo XC40 T4 Momentum 5-Door SUV
NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test
Test Date: 11/21/2019

Test Time: 12:29 am
Temperature: 21.7°C

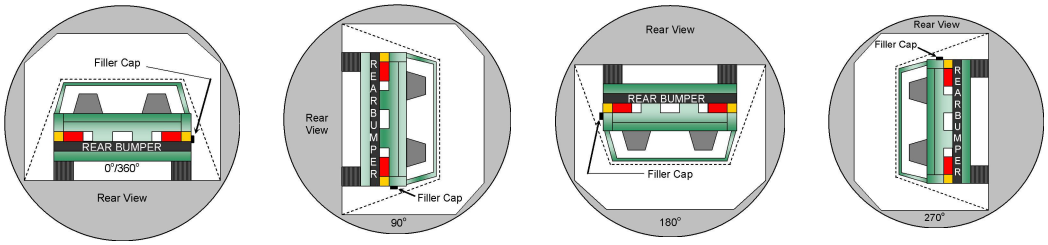
A. From impact until vehicle motion ceases: (Maximum Allowable = 1 ounce) 0.0 oz.

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°	113	300	413
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)

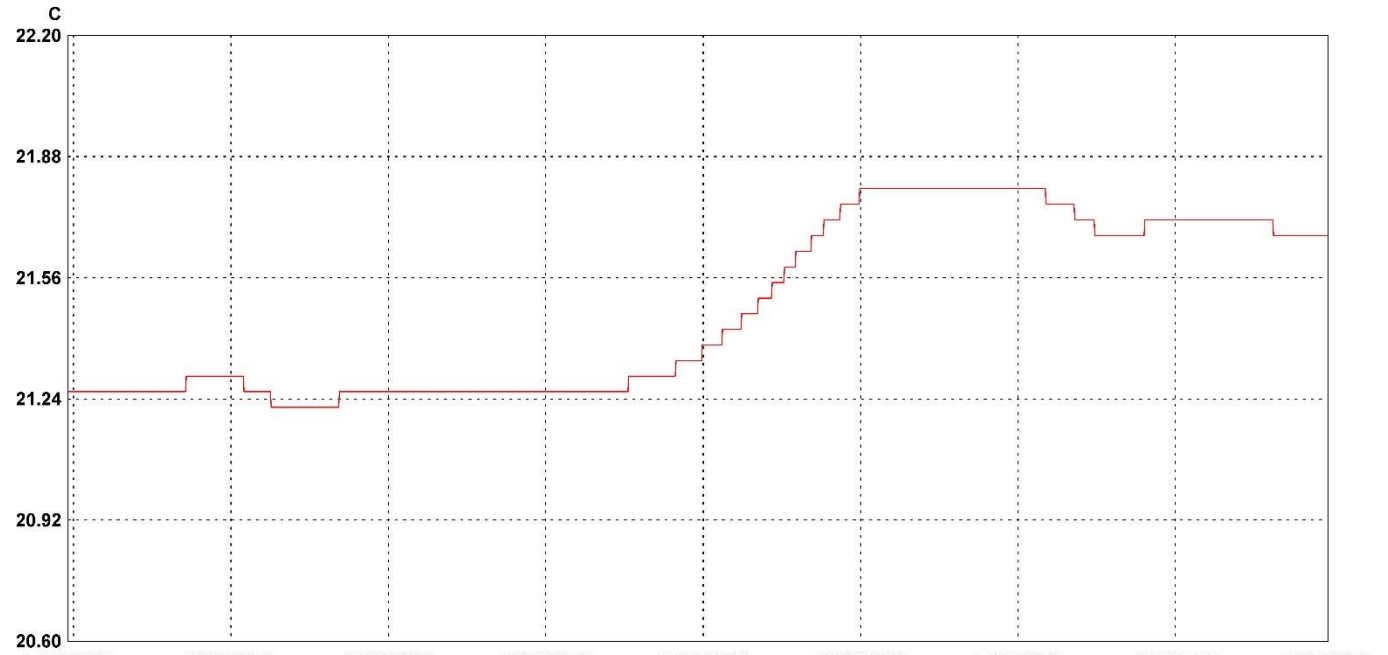
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0.0	0.0	0.0	
90° to 180°	0.0	0.0	0.0	
180° to 270°	0.0	0.0	0.0	
270° to 360°	0.0	0.0	0.0	

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 Volvo XC40 T4 Momentum 5-Door SUV NHTSA No.: O20205902
Test Program: NCAP Side MDB Impact Test Test Date: 11/21/2019



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	18352040	VSC_North_Hall	1		21.79	21.48	21.22	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

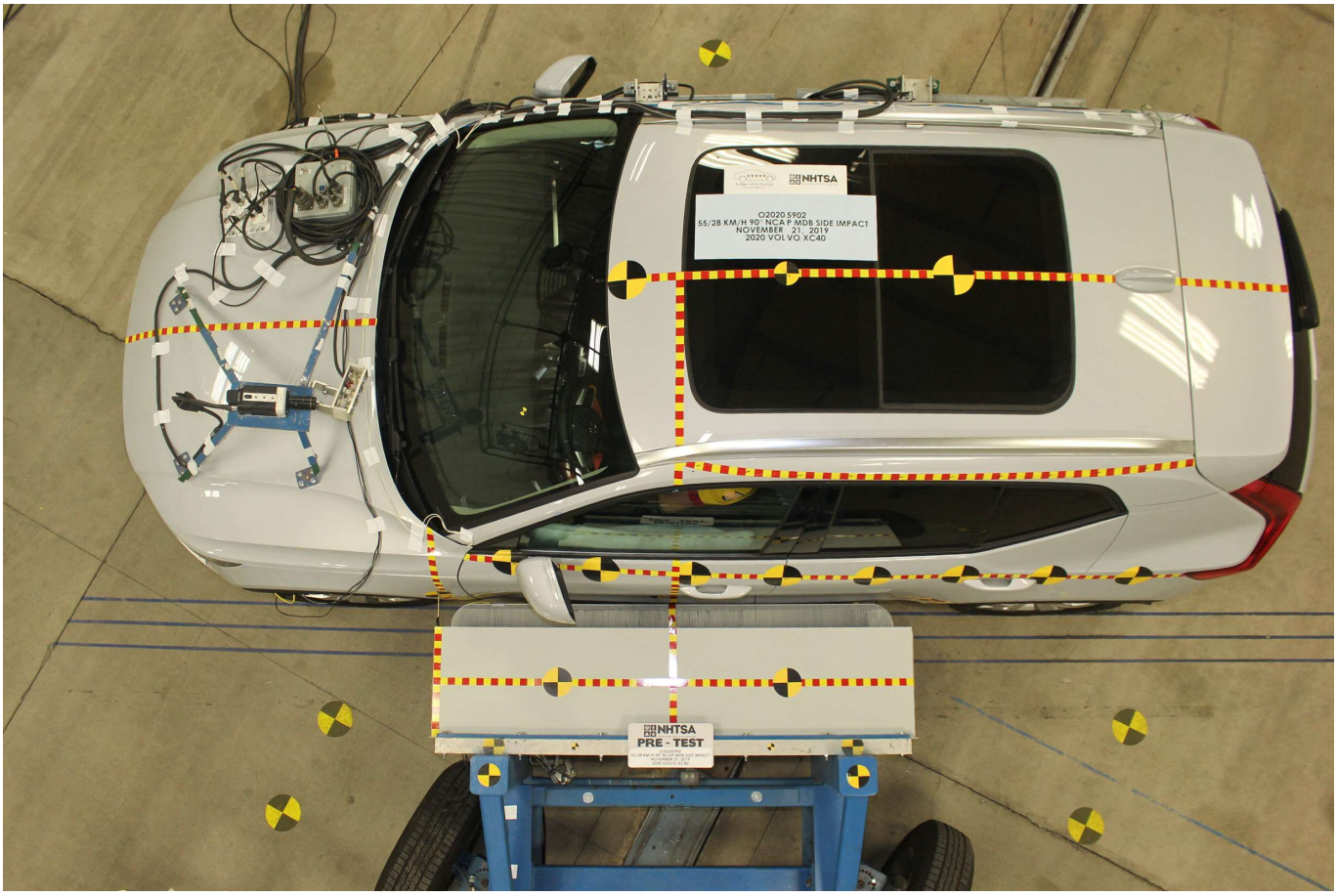


Photo No. 015 - Pre-Test Overhead View of Test Area

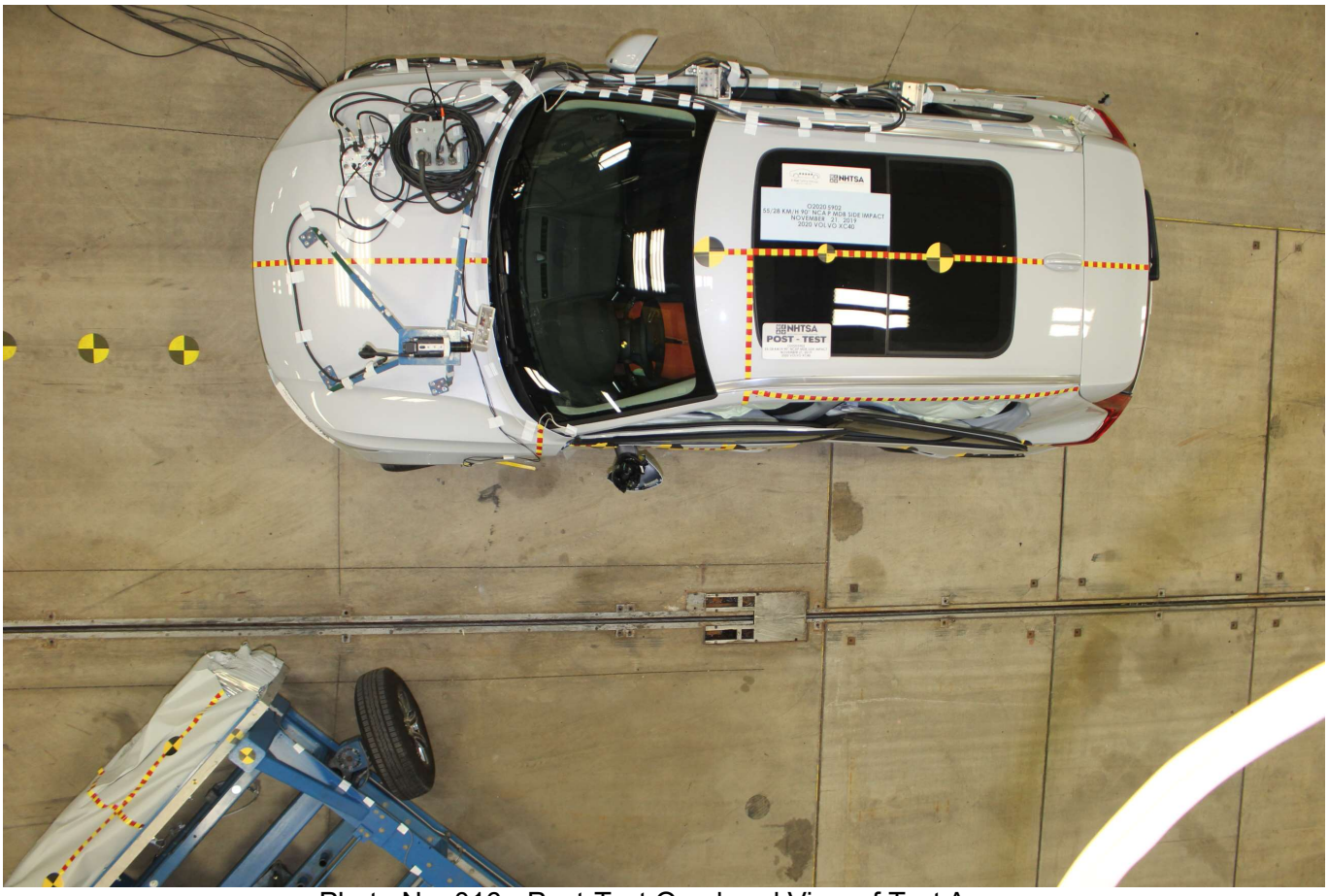


Photo No. 016 - Post-Test Overhead View of Test Area

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

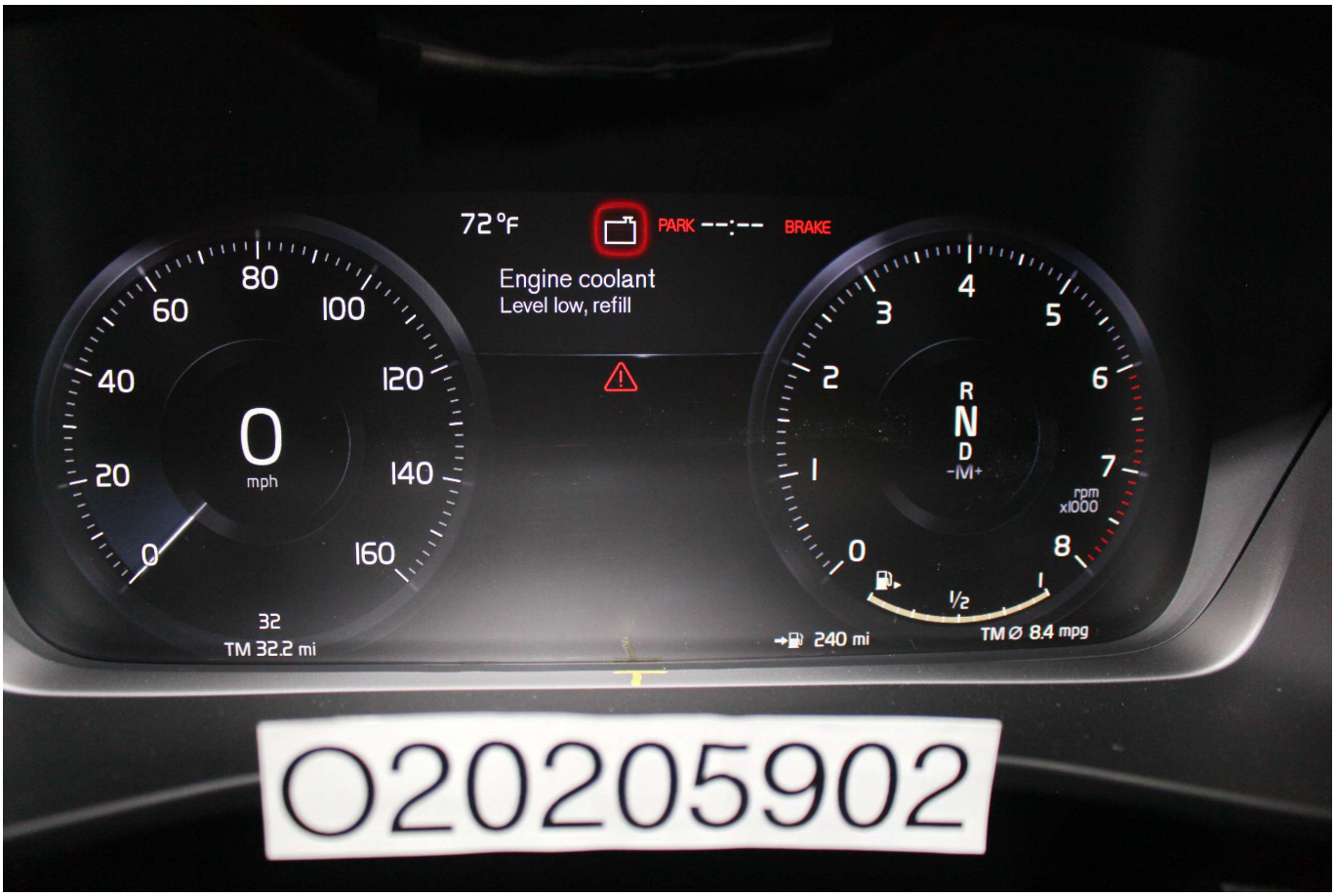


Photo No. 038 - Pre-Test View of Parking Brake

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

PHOTOGRAPH NOT APPLICABLE

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

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

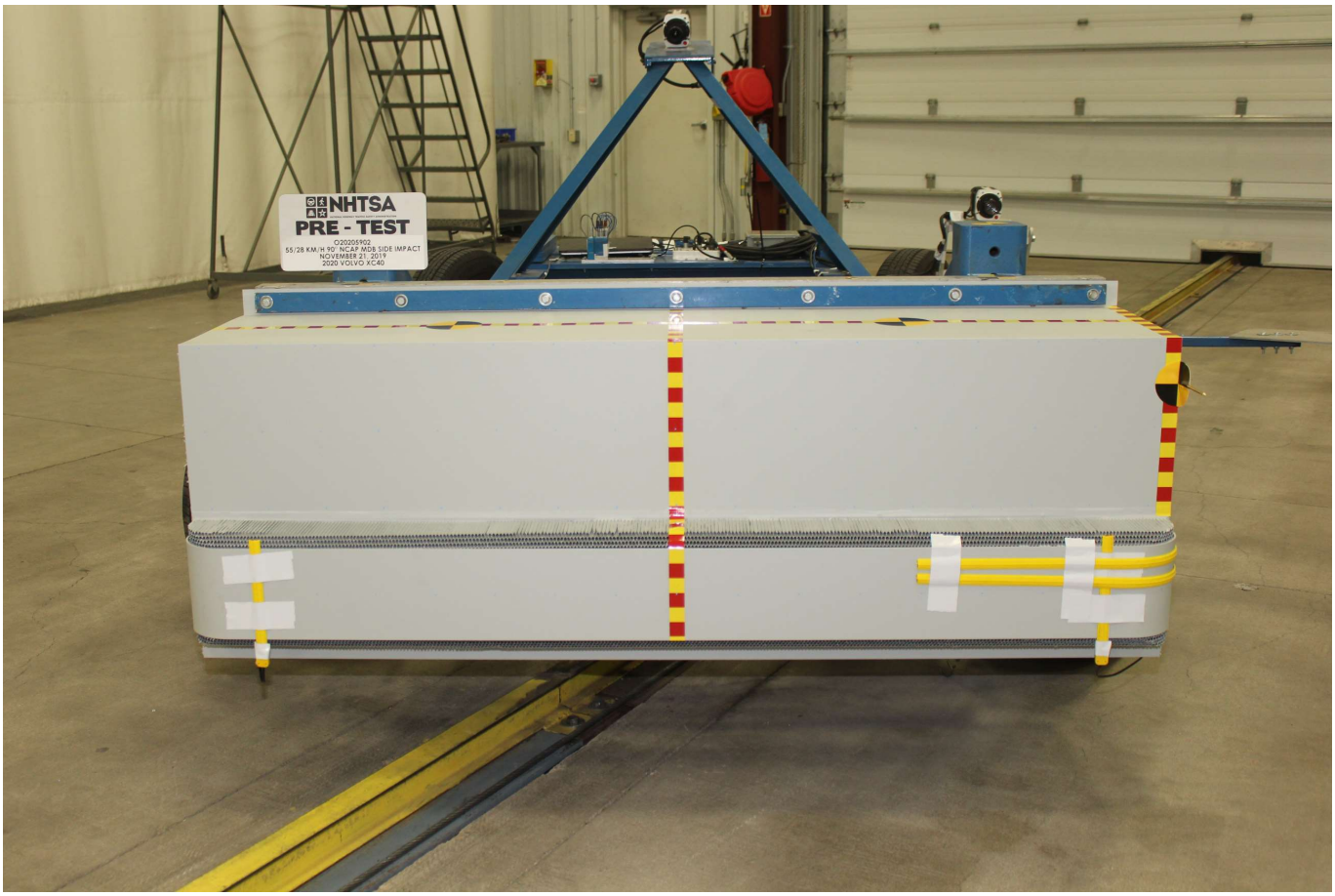


Photo No. 084 - Pre-Test Front View of MDB Impactor Face

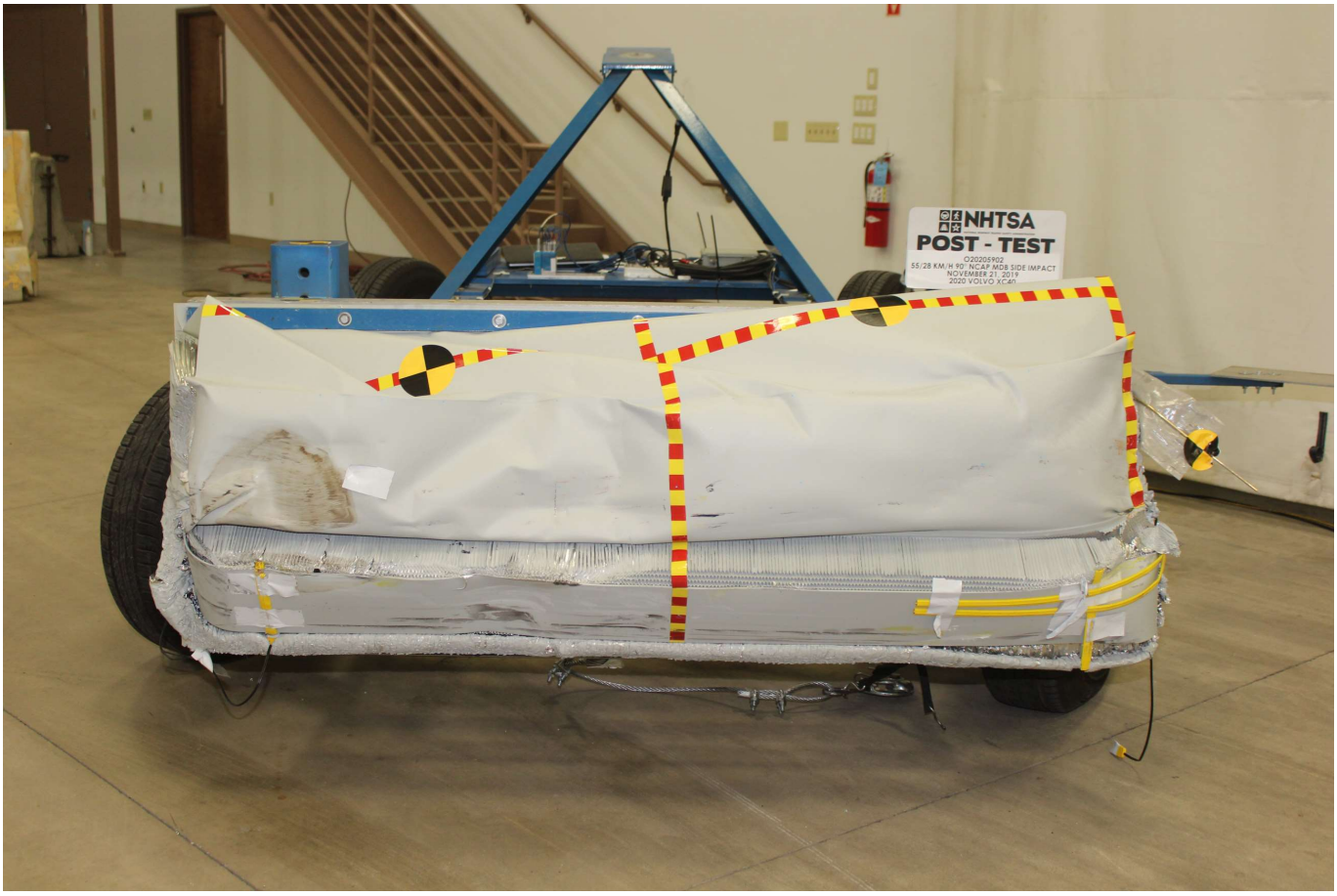


Photo No. 085 - Post-Test Front View of MDB Impactor Face

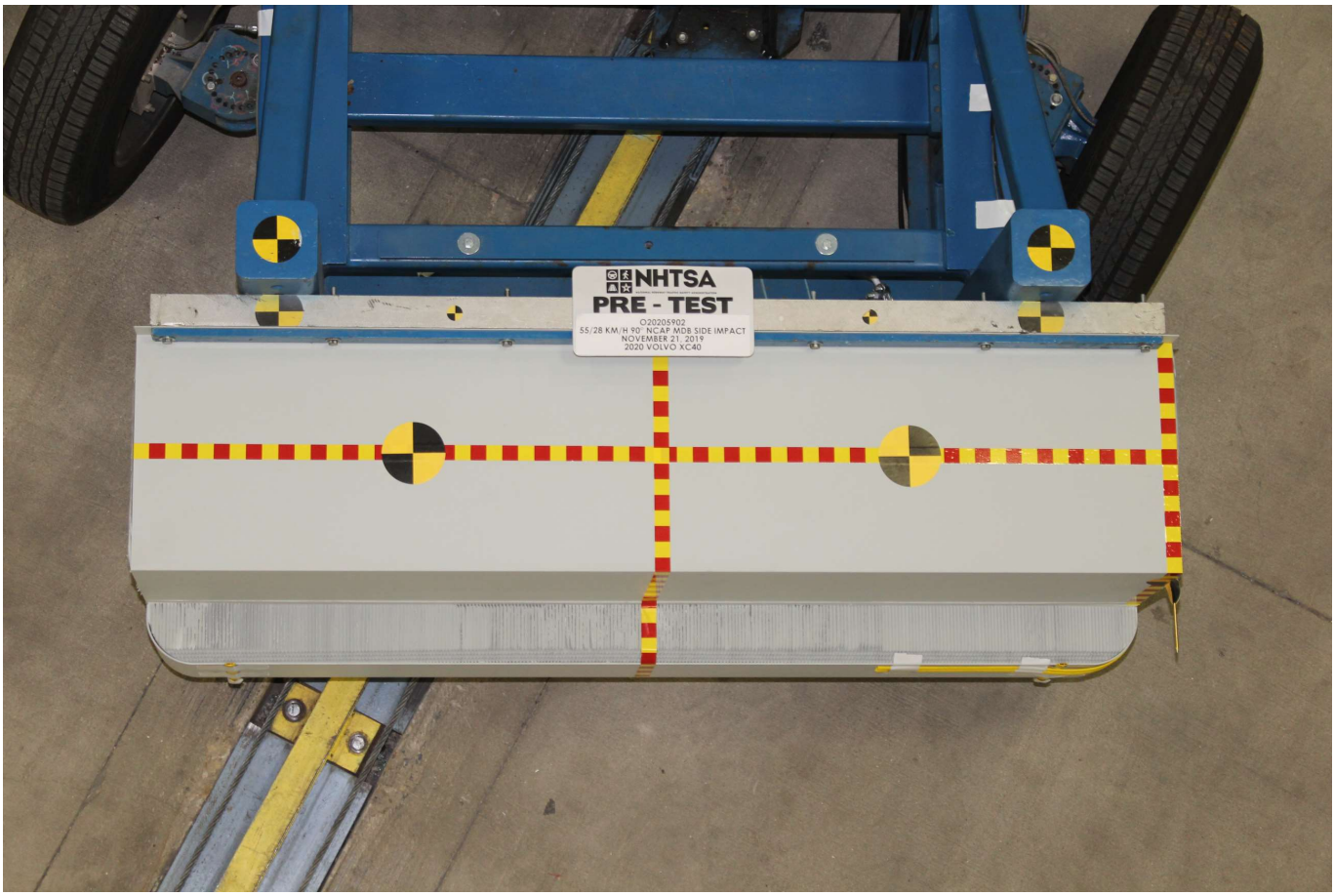


Photo No. 086 - Pre-Test Top View of MDB Impactor Face

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

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

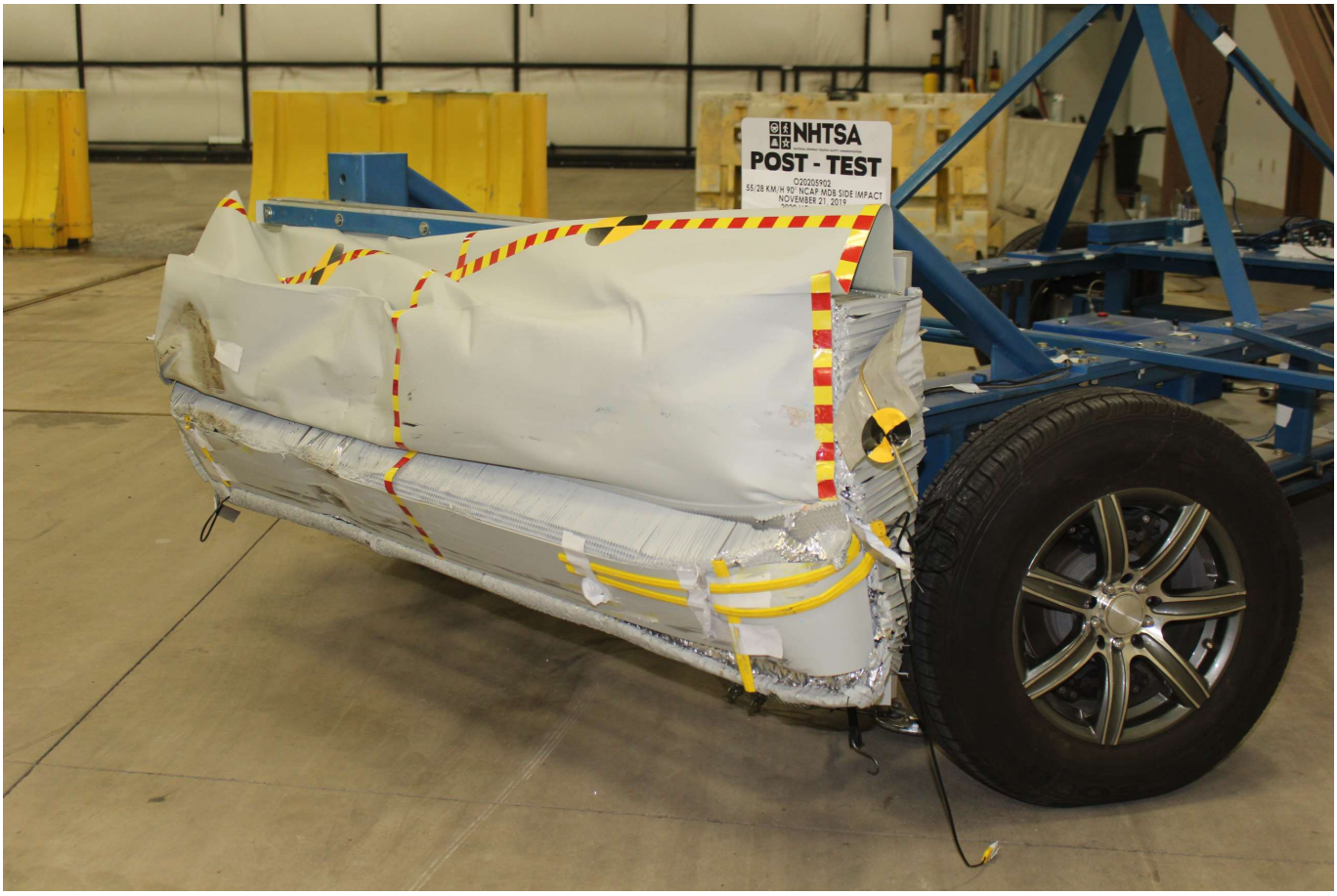


Photo No. 089 - Post-Test Left Side View of MDB Impactor Face

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

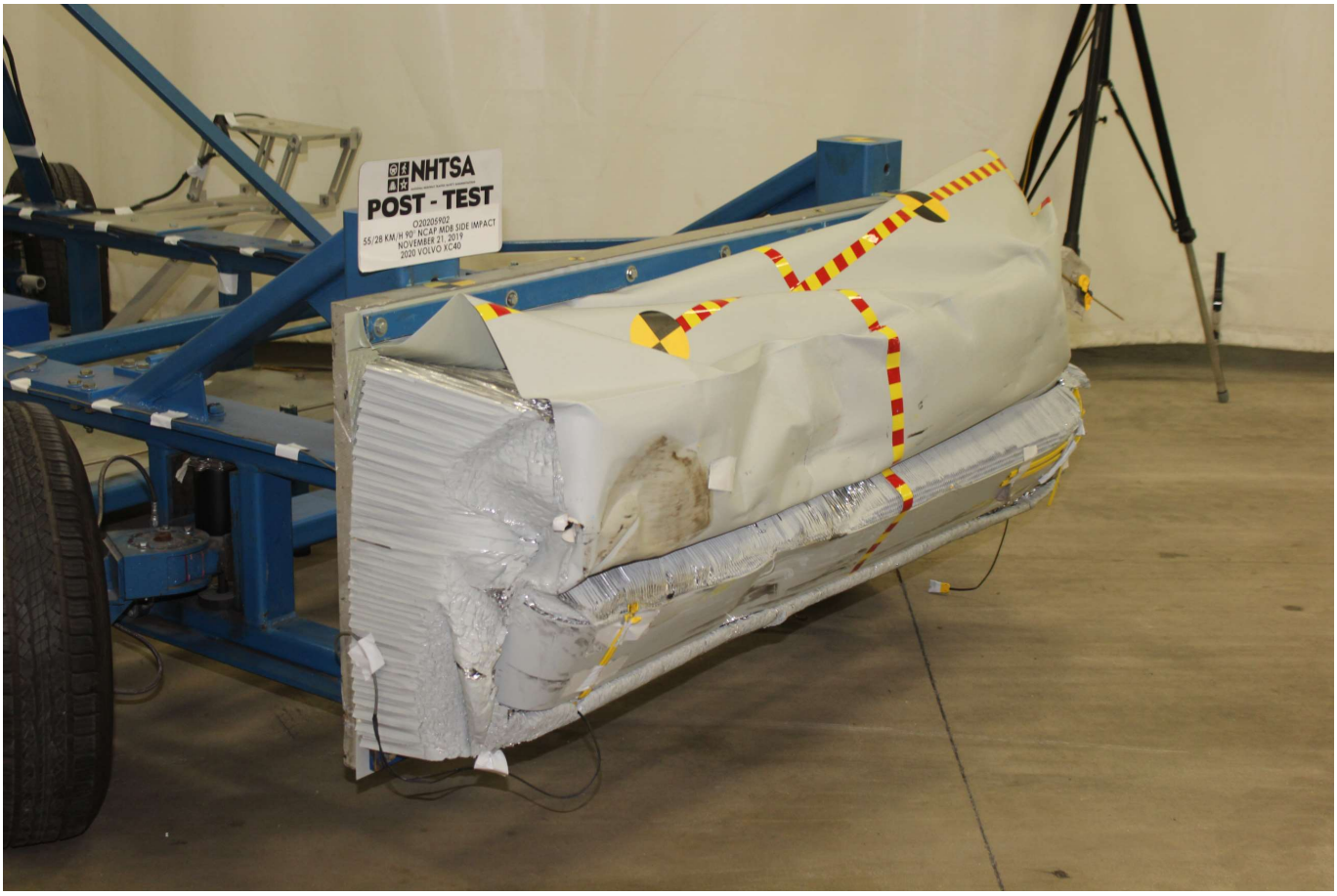


Photo No. 091 - Post-Test Right Side View of MDB Impactor Face

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

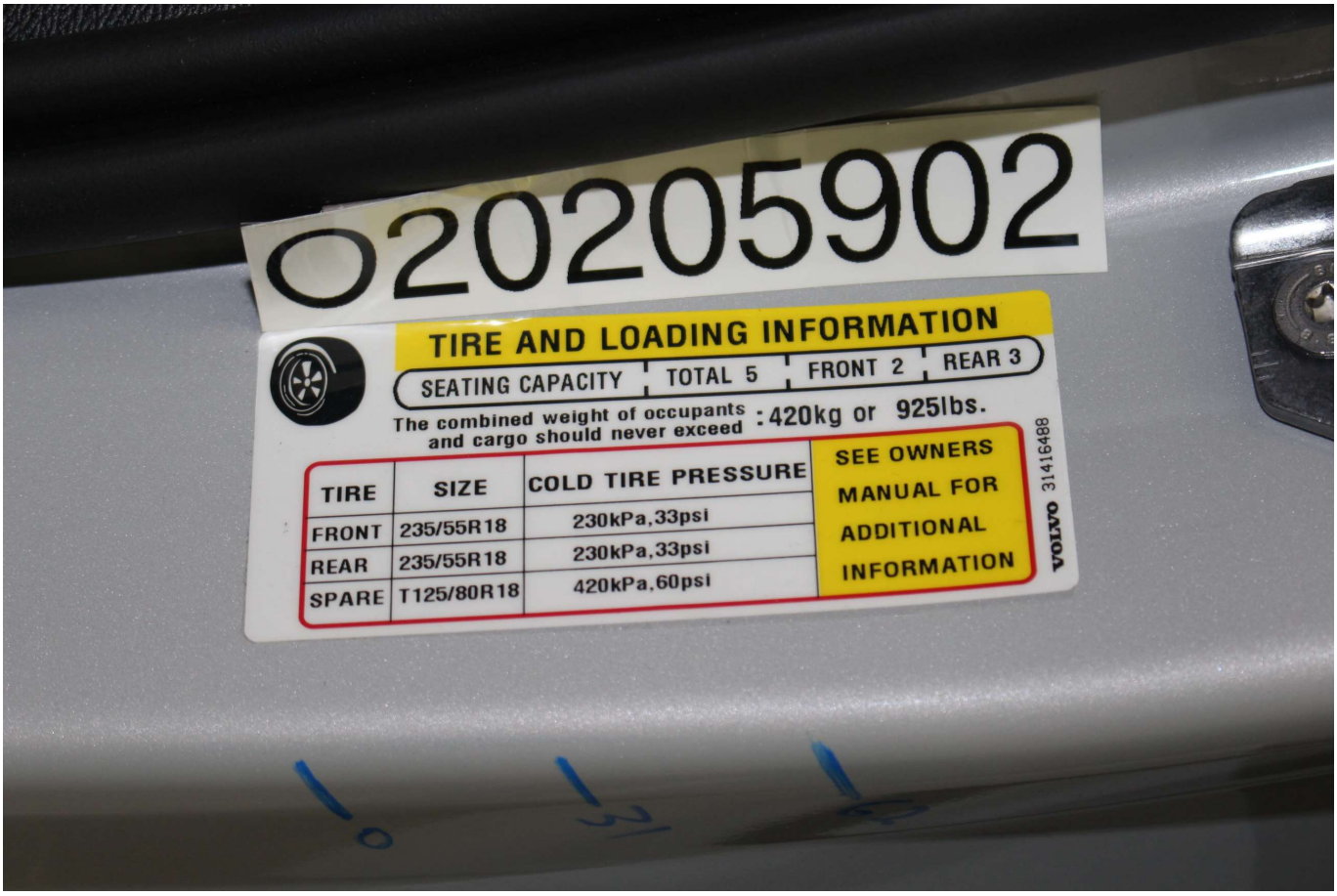


Photo No. 093 - Close-Up View of Vehicle Tire Information Placard or Label

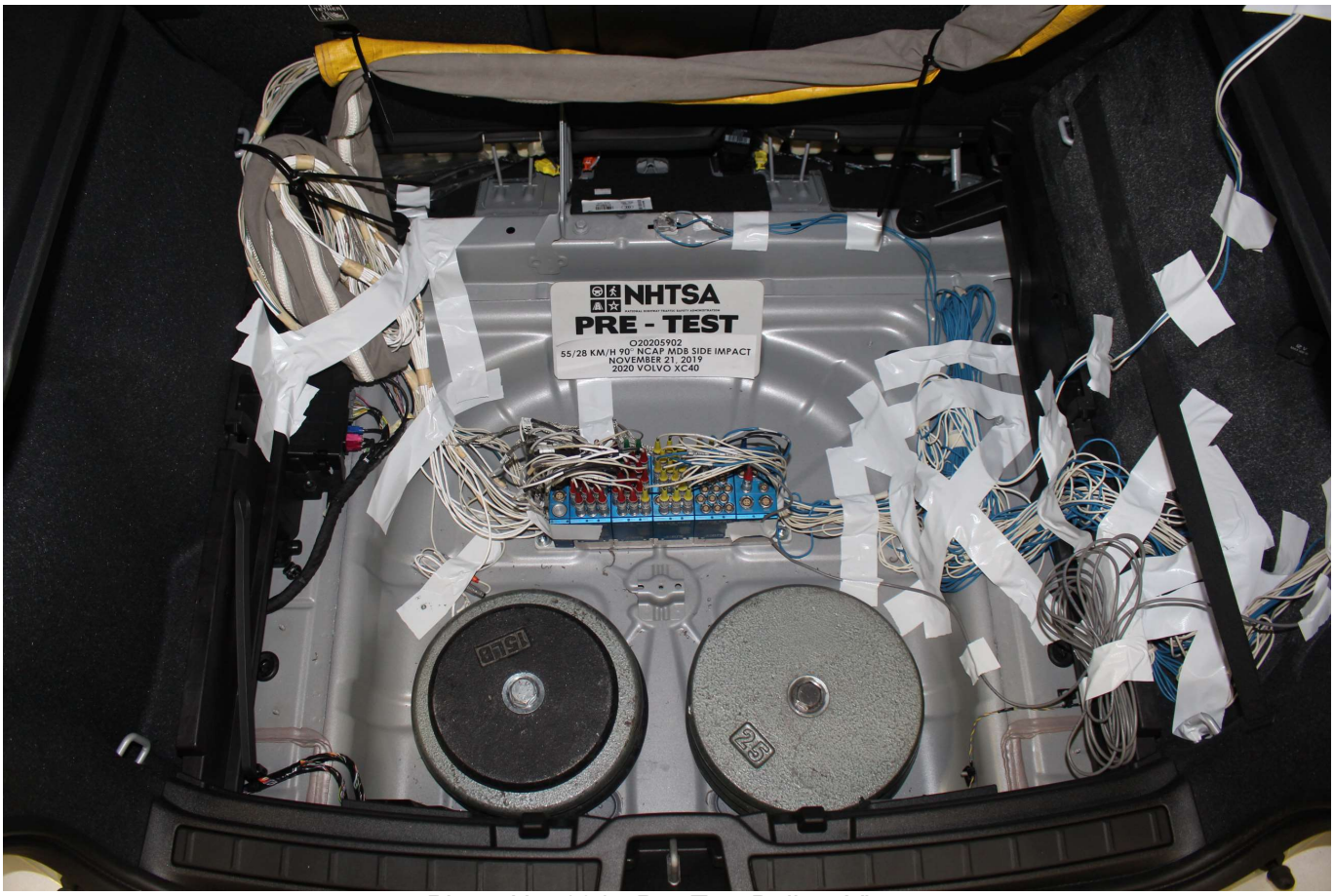


Photo No. 094 - Pre-Test Ballast View

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

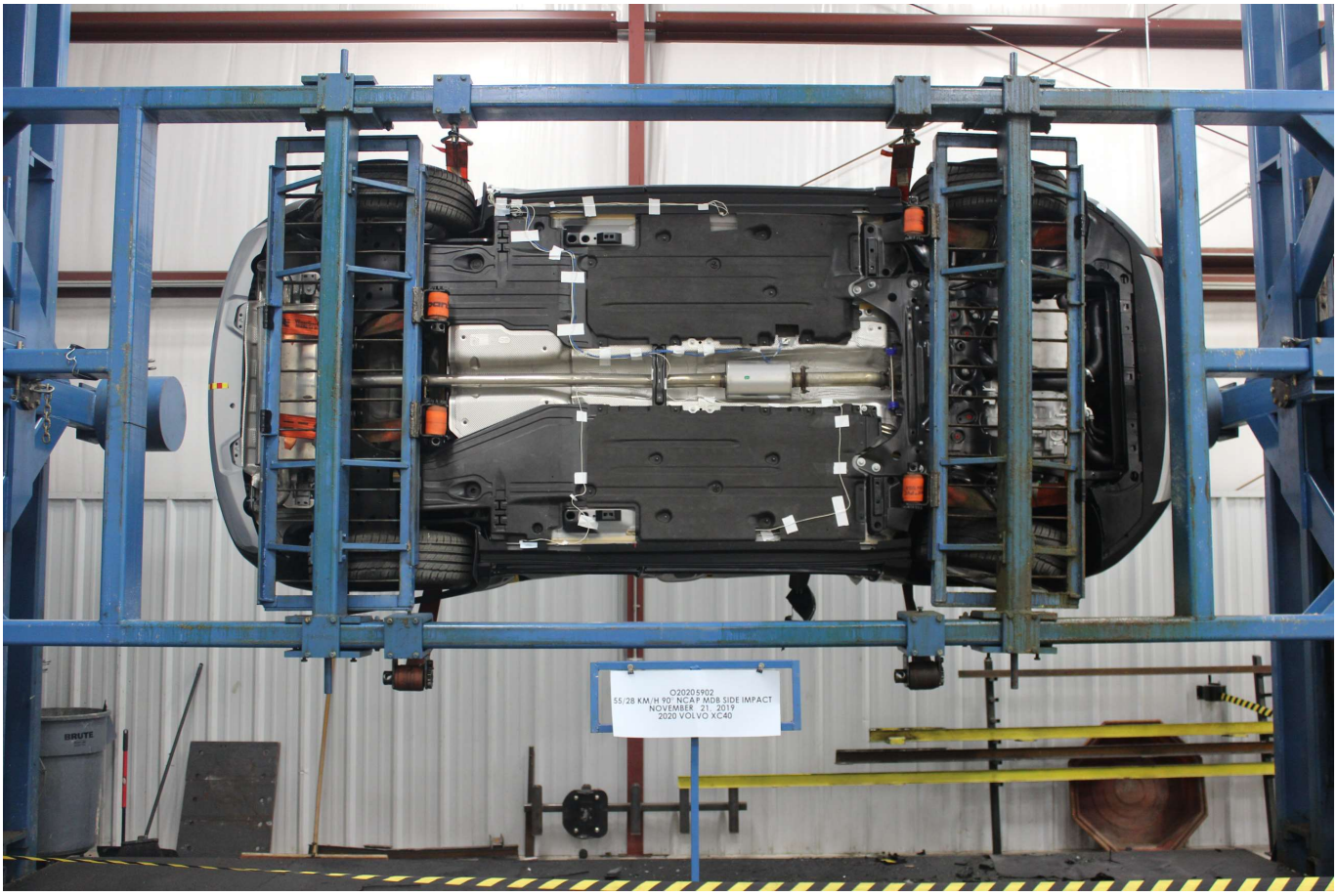


Photo No. 099 - FMVSS Photo No. 301 Static Rollover 270 Degrees

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

Photo No. 101 - Impact Event

2020VOLVO

XC40 T4 FWD MOMENTUM

Volvo Car USA LLC
www.volvocars.com/us

PERFORMANCE

2.0L Turbo-Charged, Direct Injected Engine
187 HP @ 4700 RPM and 221 lb-ft Torque @ 1400 RPM
8-Speed Geartronic Automatic Trans w/ Start-Stop
Dynamic Chassis with Front-Wheel-Drive
Front MacPherson Strut & Rear Multi-Link Suspension
Anti-Lock Braking Sys (ABS) w/ Hill Start Assist
Advanced Electronic Stability Control (ESC)
Electric Power Assisted Steering
18" Alloy Wheels with All-Season Tires
Adjustable Drive Mode Settings

AUDIO & TECHNOLOGY

12.3" Digital Driver Display
9" Integrated Sensus Connect Touchscreen feat.
WiFi Hotspot and Complimentary Trial Subscription
Smartphone Integ (Apple CarPlay/Android Auto)
Volvo On Call with 4-Yr Complimentary Subscription
Incl Mobile App w/ Remote Start
250W High Performance Audio System w/ 8 Speakers
AM / FM / HD Radio
USB Ports, 2 Front + 1 Rear (USB-C)
Bluetooth Hands-free w/ Audio Streaming
SiriusXM Radio w/ 3-month Trial Subscription

SAFETY & SECURITY

Collision Avoidance by City Safety
Detects Vehicle/Pedestrian/Cyclist/Large Animal
Run-off Road Protection & Run-off Road Mitigation
Lane Keeping Aid & Oncoming Lane Mitigation
Road Sign Information
Supplemental Restraint System (Airbags):
Driver Adaptive & Frnt Pass Dual Stage, Driver
Knee, Driver/Frnt Pass Dual Chamber Side-Impact,
Inflatable Curtain Head Side-Impact (Incl. Rear)
Side Impact Protection System (SIPS)
Whiplash Protection System (WHIPS) in Front Seats
Unibody High Strength Steel Safety Cage
Five, 3-Point Safety Belts w/ outer pretensioners
Lower Anchors and Tethers for Child Seats (LATCH)
Power Child Safety Locks in Rear Doors
Hill Descent Control
Electronic Stability Control
LED Headlights w/Thor's Hammer DRL & Auto Highbeam
Rear Park Assist Camera

LUXURY & CONVENIENCE

Textile / T-Tec Upholstery
Leather Wrapped Tilt & Telescopic Steering Wheel
Integrated Roof Rails in Bright Aluminum
Urban Grid Aluminum Deco Inlays
Hidden Tailpipes
Front Door Sill Plates
Cargo Scuff Plate
Power Tailgate with Programmable Height
Automatically Dimming Interior Rearview Mirror
Keyless Engine Start/Turn-Off
8-way, Power Driver Seat & Driver Seat Memory
Heated Wiper Blades with Integrated Washers
Split Folding Backrest with Load Through Hatch
Automatic Climate Control + CleanZone

AUTHORIZED RETAILER

DON BEYER - DULLES 7669
21830 PACIFIC BLVD.
DULLES, VA 20166

WARRANTY

48 Month/50,000 Mile Limited Warranty Coverage
144 Month Corrosion Protection "Unlimited Mileage"
Refer to Warranty Info Book for Specific Limitations.

VOLVO On-Call Roadside Assistance

Volvo Increased Protection: Ask Your Volvo Retailer
About an Extended Service Contract

MAINTENANCE

Complimentary Factory Scheduled Maintenance for the
First 3 Years or 36,000 Miles

ACCESSORIES

Enhance the driving pleasure with Volvo accessories.
Enrich the styling, integrate technology, boost
performance, or simply carry more cargo - from
function to fun, there's something for everyone.

To view full accessory product line -
Scan this Smartphone QR code
or visit https://accessories.volvocars.com/en-us

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Facebook: Volvo Car USA
YouTube: Volvo Car USA

PRICING

IMPORTER'S SUGGESTED LIST PRICE P.O.E.:	$ 33,700.00
Premium Package Power Retractable Rearview Mirrors Automatically Dimming Exterior Mirrors Homelink & Compass Integrated in Rearview Mirror Blind Spot Information System (BLIS) with Steer Assist & Cross Traffic Alert w/ Autobrake Front and Rear Park Assist Keyless Entry with Hands-Free Power Tailgate Wireless Charging Pad	1,900.00
Heated Front Seats & Heated Steering Wheel	750.00
Metallic Paint	645.00
Navigation System*	1,200.00
Protection Package Premier*	460.00
Laminated Panoramic Moonroof	1,475.00
Destination Charge	995.00
Total Suggested Retail Price:	$ 41,125.00

The price shown does not include Gasoline, License and Title Fees, State and Local Taxes and Dealer Installed Options and Accessories. The factory reserves the right to modify price, designs and equipment without previous notice.

EPA DOT **Fuel Economy and Environment** — Gasoline Vehicle

Fuel Economy

27 MPG — Combined city/hwy: 23 city, 33 highway

Small SUV-2WD range from 18 to 120 MPG. The best vehicle rates 136 MPGe.

3.7 gallons per 100 miles

You save **$ 0** in fuel costs over 5 years compared to the average new vehicle.

Annual Fuel cost **$ 1,500**

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 1 — 6 — 10 Best

Smog Rating (tailpipe only): 1 — 5 — 10 Best

This vehicle emits 331 grams CO2 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

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE: VOLVO SERIES

U.S./CANADIAN PARTS CONTENT: 1%

MAJOR SOURCES OF FOREIGN PARTS CONTENT:
BELGIUM: 20%
SWEDEN: 20%

FOR THIS VEHICLE:
FINAL ASSEMBLY POINT: GHENT, BELGIUM

COUNTRY OF ORIGIN:
ENGINE PARTS: SWEDEN

TRANSMISSION PARTS: JAPAN

Note: Parts contents does not include final assembly, distribution, or other non-parts costs.

GOVERNMENT 5-STAR SAFETY RATINGS

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

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.
Source: National Highway Traffic Safety Administration (NHTSA)
www.safercar.gov or 1-888-327-4236

VEHICLE IDENTIFICATION
Type & Chassis: 536 179723
Model Year: 2020
Color: Glacier Silver Meta
VIN: YV4AC2HK7L2179723

Port of Importation: Baltimore, MD
Delivered by: Truck
DELIVERY ADDRESS
DON BEYER - DULLES 7669
21830 PACIFIC BLVD.
DULLES, VA 20166

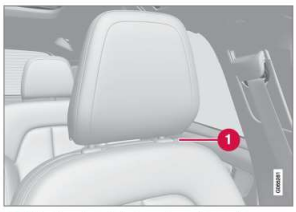
YV4AC2HK7L2179723

Photo No. 102 - Monroney Label

Manual front seats

The front seats can be adjusted in a number of different ways to help enhance your seating comfort.

1. Move the seat forward/backing by lifting the handle and moving the seat to a suitable distance from the steering wheel and pedals. Check to make sure the seat is securely locked into place after its setting has been changed.
2. Change the length of the seat cushion* by pulling up the lever and moving the cushion forward/backward.
3. Raise/lower the front edge of the seat cushion* by pumping up/down[1].
4. Adjust lumbar support* by pressing the button up/down/forward/rearward.
5. Raise/lower the seat by moving the lever up/down.
6. Change the backrest tilt by turning the knob on the backrest.



1. The head restraint can be adjusted up or down by pressing the button and manually moving the head restraint to the desired position.

WARNING

- Do not adjust the seat while driving. The seat should be adjusted so that the brake pedal can be depressed fully. In addition, position the seat as far rearward as comfort and control allow.
- Check that the seat is securely locked into position after adjusting.

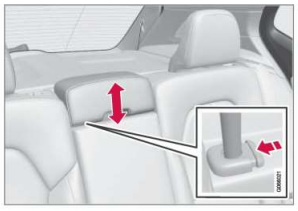
1 Only applies to the driver's seat.

Adjusting the rear seat head restraints

Adjust the center head restraint in the rear seat to the seat occupant's height. Fold down the outboard head restraints* to improve rear visibility.

Adjusting the center seat head restraint

The center head restraint should be adjusted to suit the passenger's height. The entire back of the head should be covered if possible. Manually move the restraint up or down as needed.



To lower the restraint, push and hold the button (see illustration) while carefully lowering the head restraint.

WARNING

The center seat head restraint must be in its lowest position when the seat is not occupied. When the center seat is occupied, the head restraint must be correctly adjusted to the passenger's height, covering the entire back of the head if possible.

Folding the rear seat outboard head restraints using the center display*

The outer head restraints can be folded via the center display's function view. The head restraint can be folded down when the vehicle is in ignition mode **0**.

Tap the **Headrest Fold** button to activate/deactivate folding.

Manually push the head restraint until it clicks into position.

WARNING

Do not lower the head restraint if there are passengers in any of the rear seats.

WARNING

The head restraint must be locked in the upright position after it has been folded up.

* Option/accessory.

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)

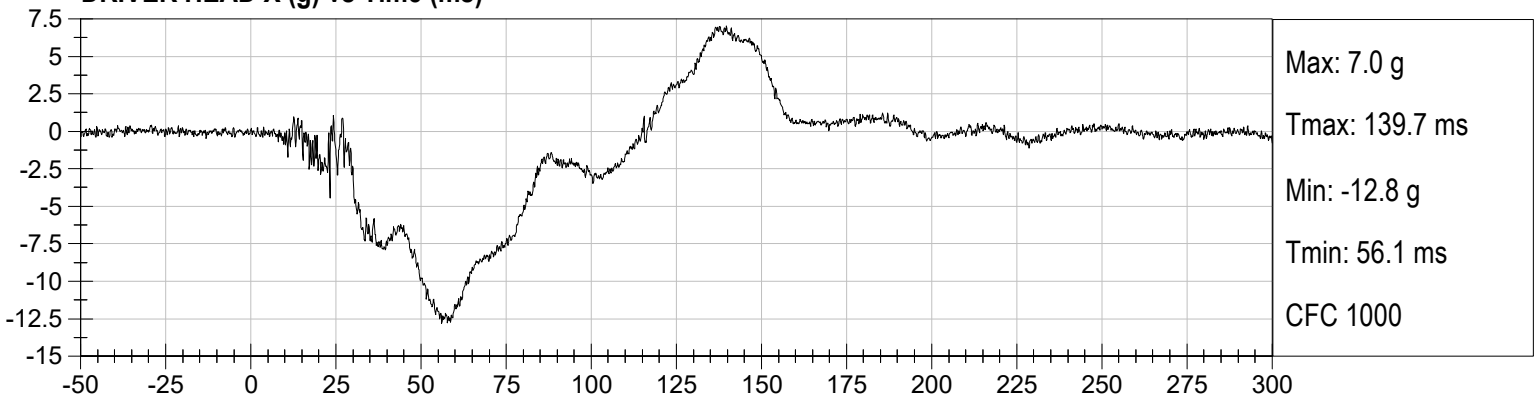
MDB Rear Acceleration (X)

MDB Rear Acceleration (Y)

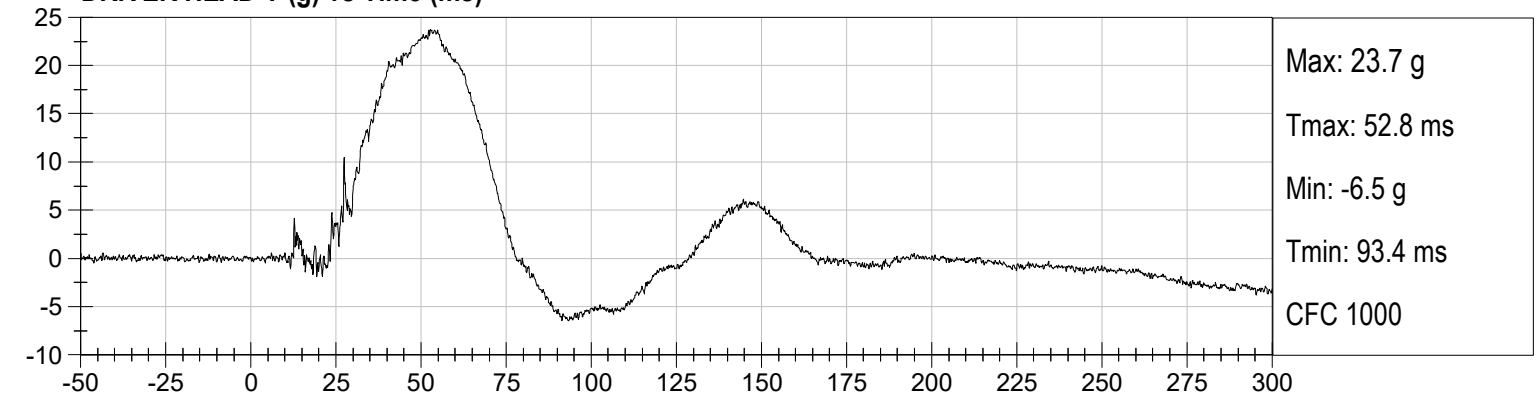
Left MDB Contact Switch

Right MDB Contact Switch

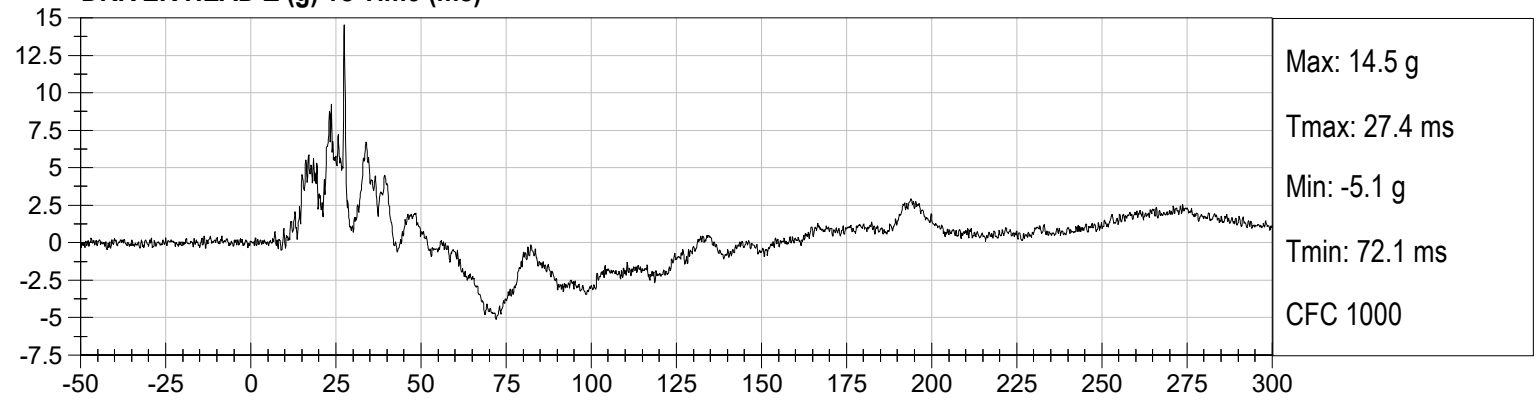
DRIVER HEAD X (g) vs Time (ms)



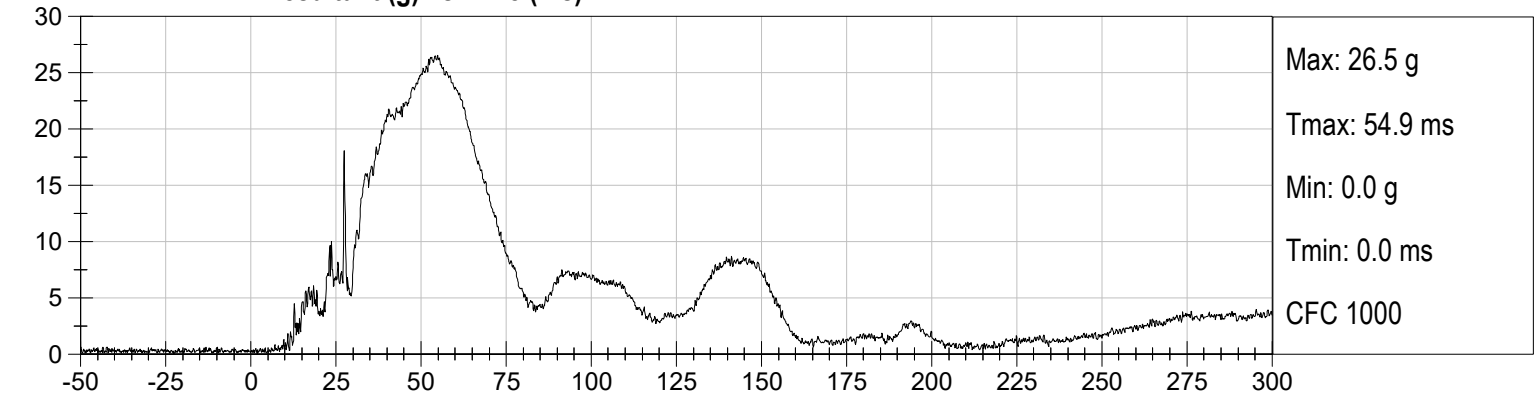
DRIVER HEAD Y (g) vs Time (ms)



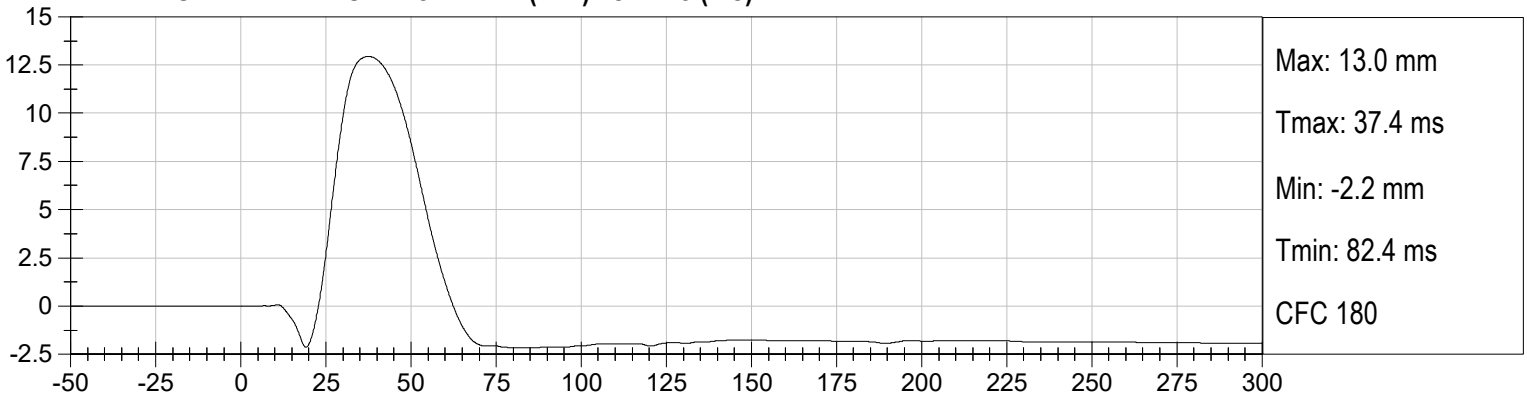
DRIVER HEAD Z (g) vs Time (ms)



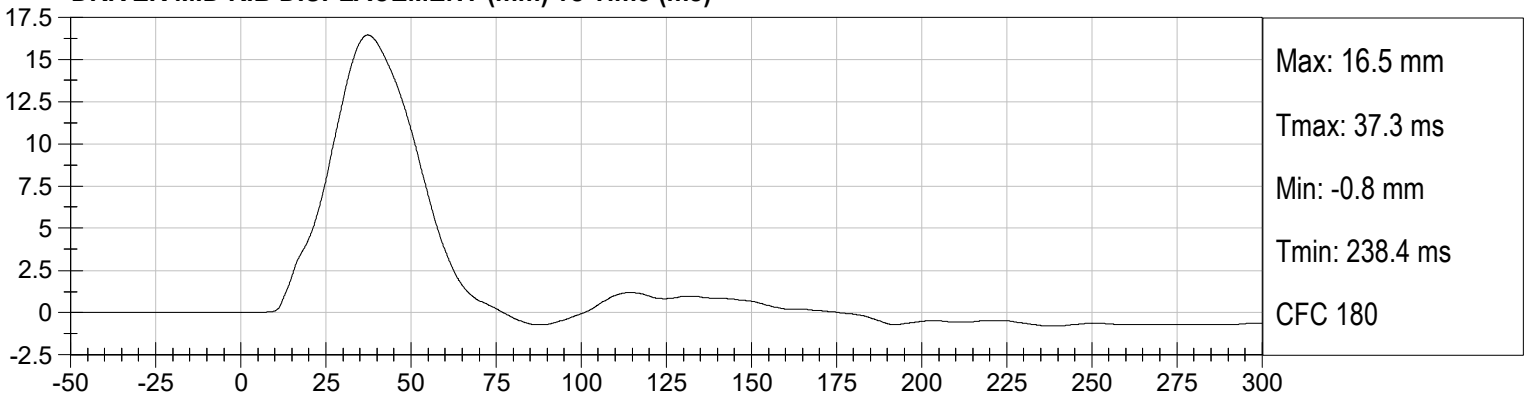
DRIVER HEAD Resultant (g) vs Time (ms)



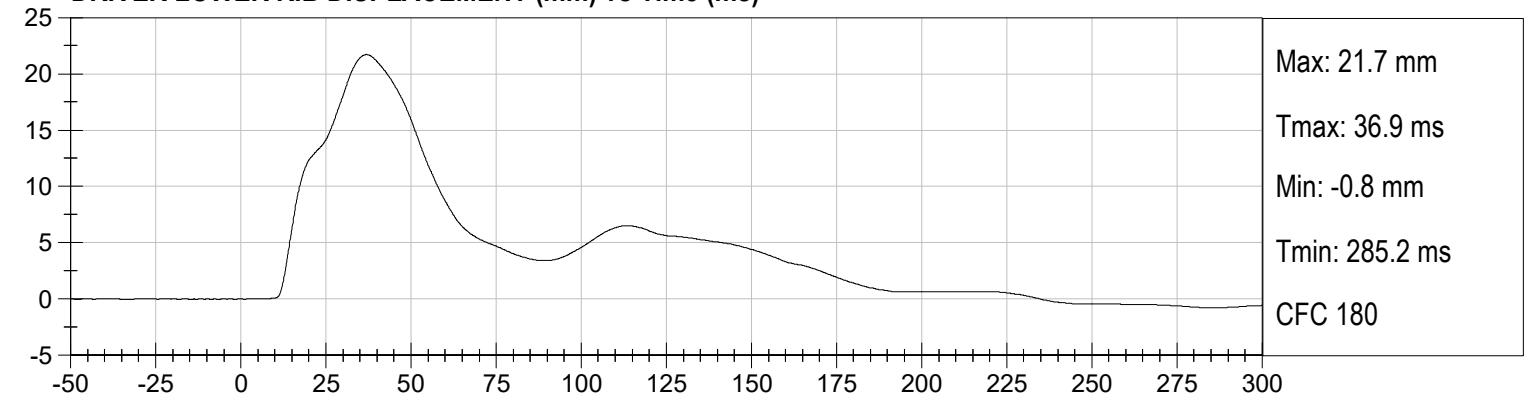
DRIVER UPPER RIB DISPLACEMENT (mm) vs Time (ms)



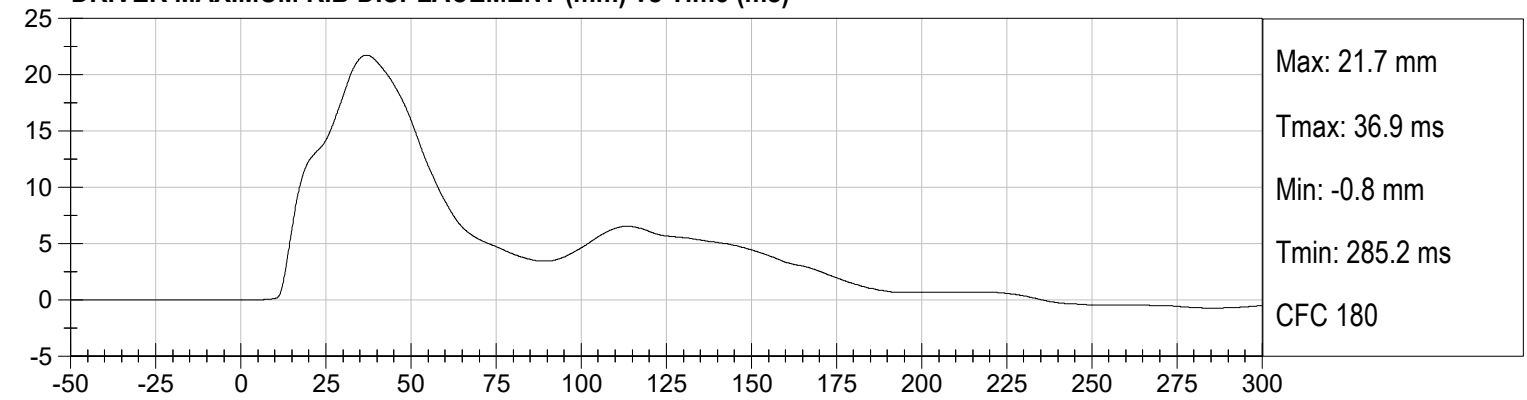
DRIVER MID RIB DISPLACEMENT (mm) vs Time (ms)



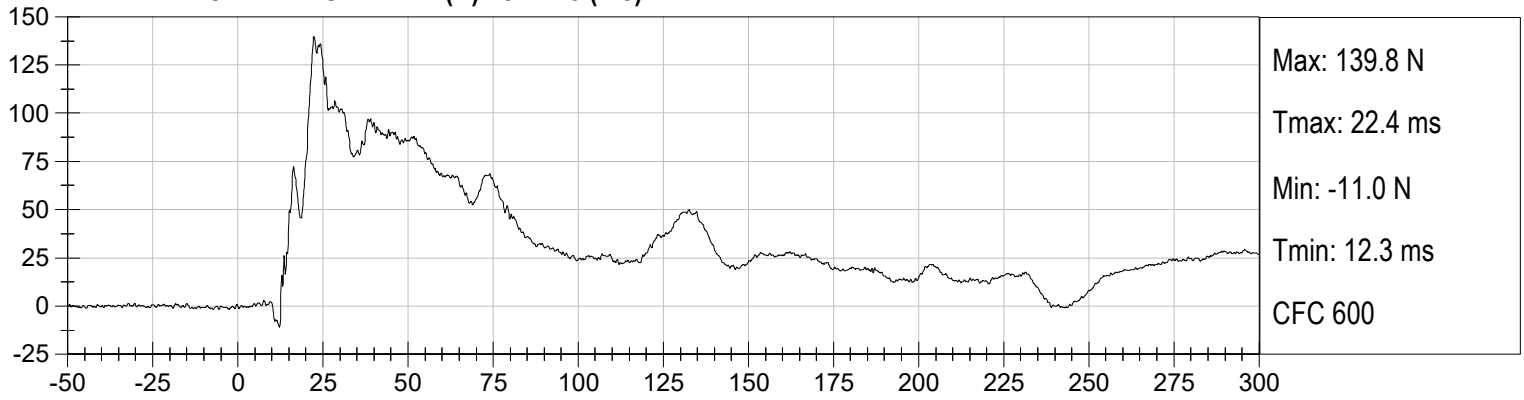
DRIVER LOWER RIB DISPLACEMENT (mm) vs Time (ms)



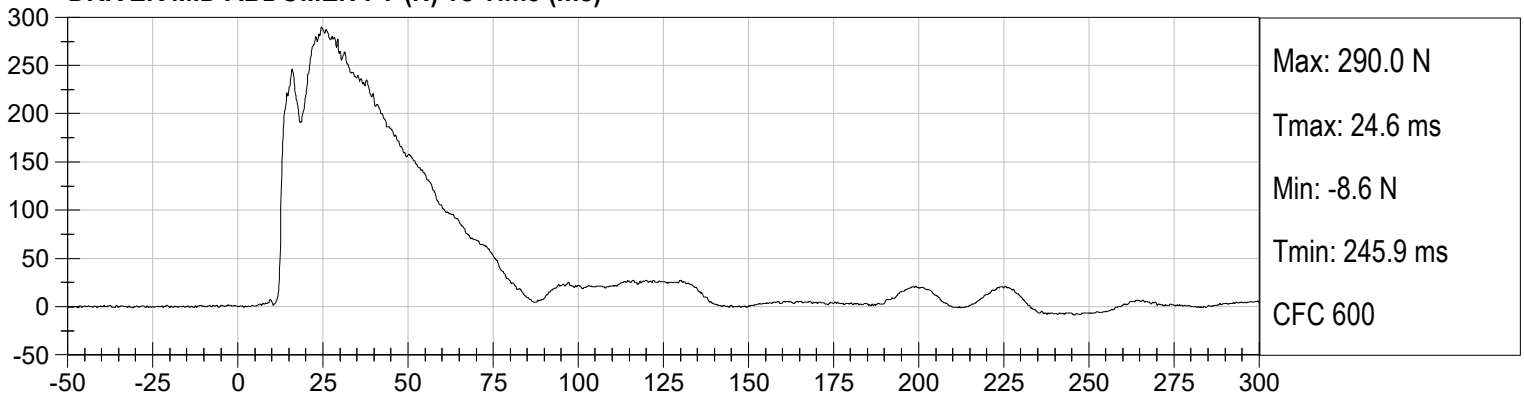
DRIVER MAXIMUM RIB DISPLACEMENT (mm) vs Time (ms)



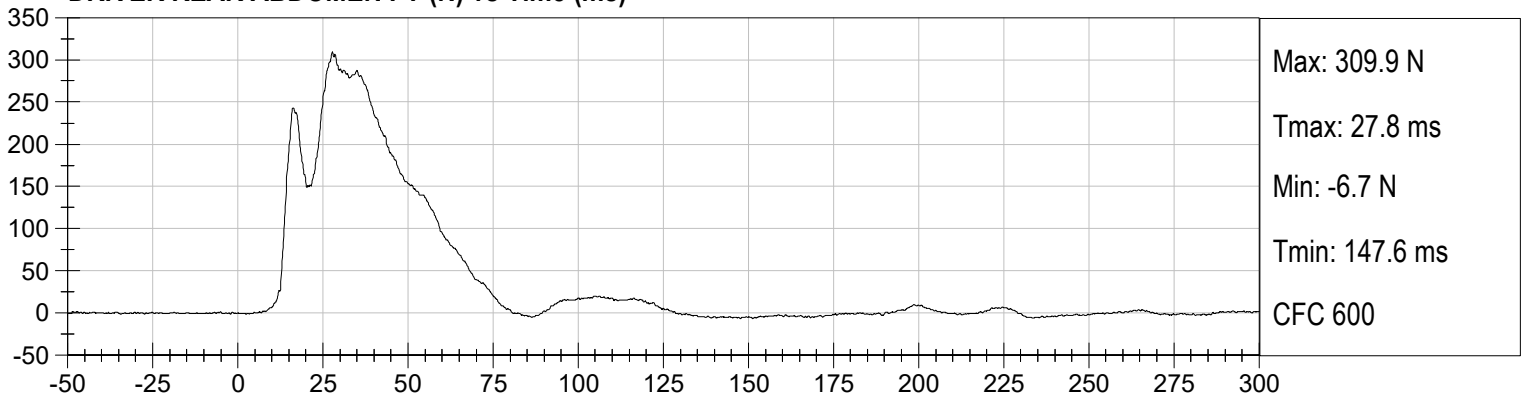
DRIVER FRONT ABDOMEN FY (N) vs Time (ms)



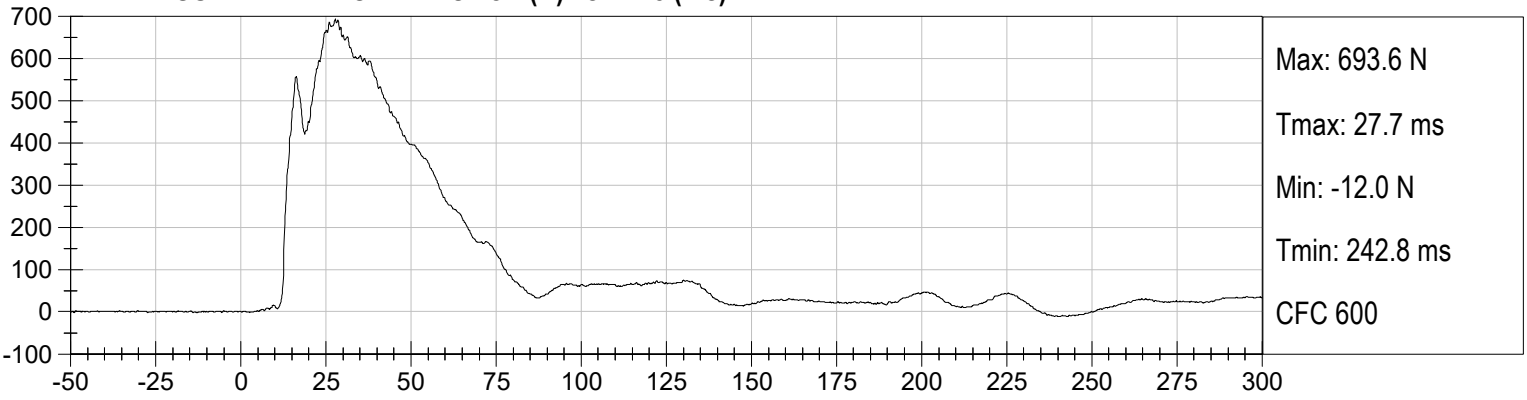
DRIVER MID ABDOMEN FY (N) vs Time (ms)



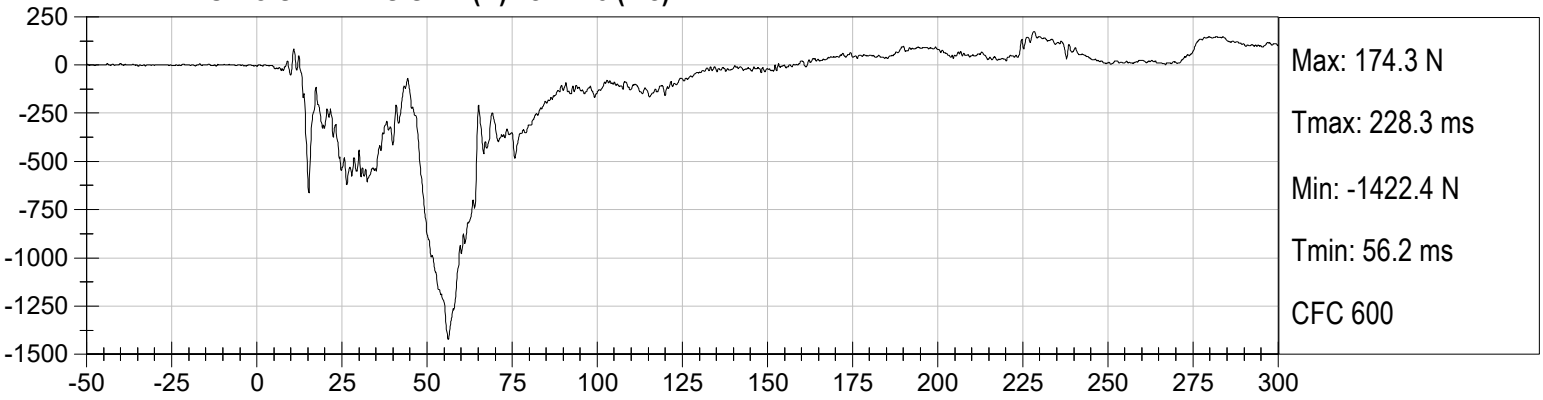
DRIVER REAR ABDOMEN FY (N) vs Time (ms)



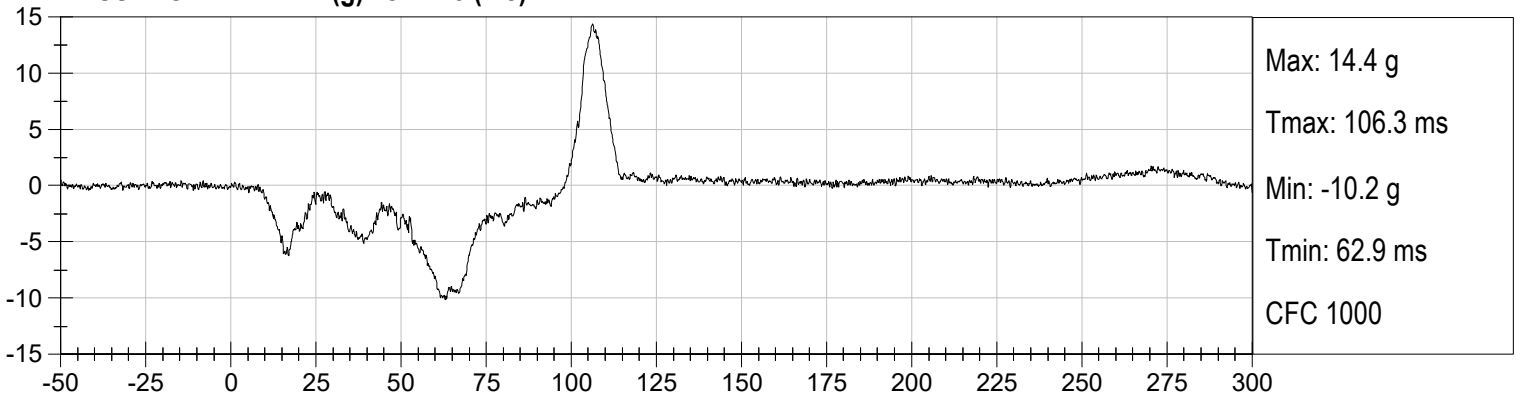
DRIVER SUMMED ABDOMEN FORCE (N) vs Time (ms)



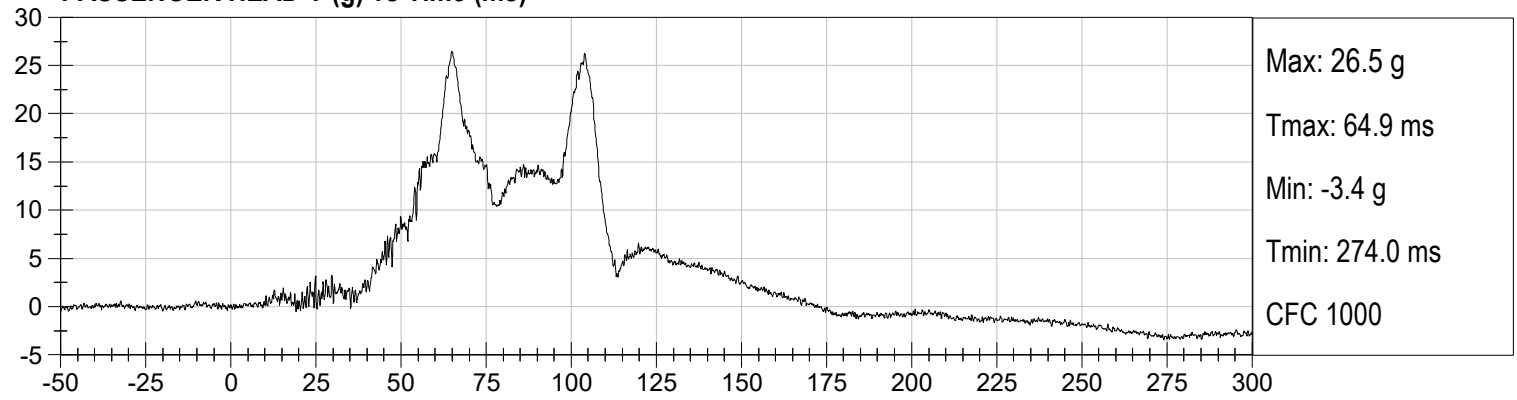
DRIVER PUBIC SYMPHYSIS FY (N) vs Time (ms)



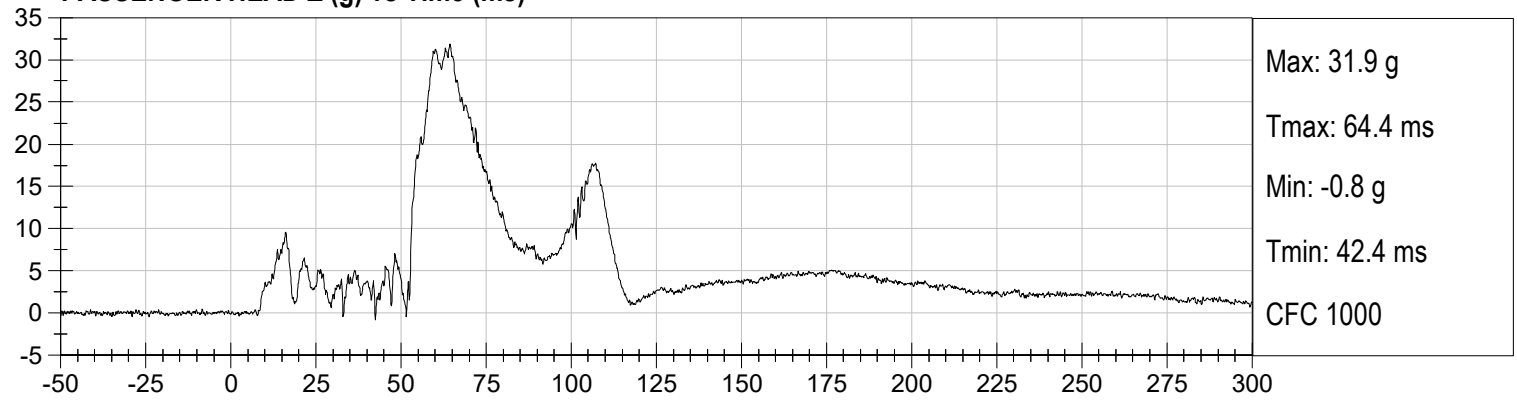
PASSENGER HEAD X (g) vs Time (ms)



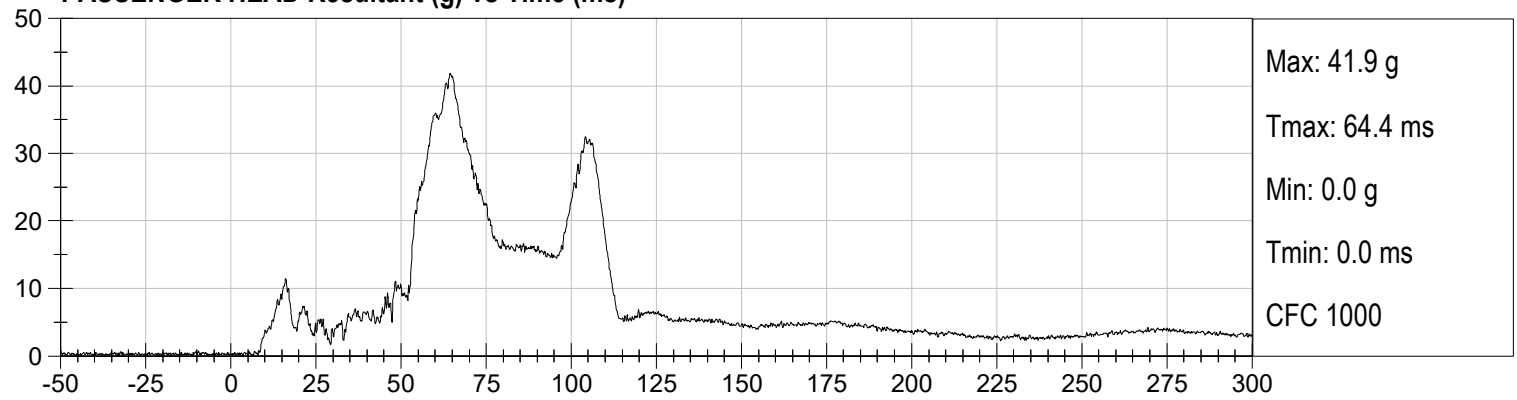
PASSENGER HEAD Y (g) vs Time (ms)



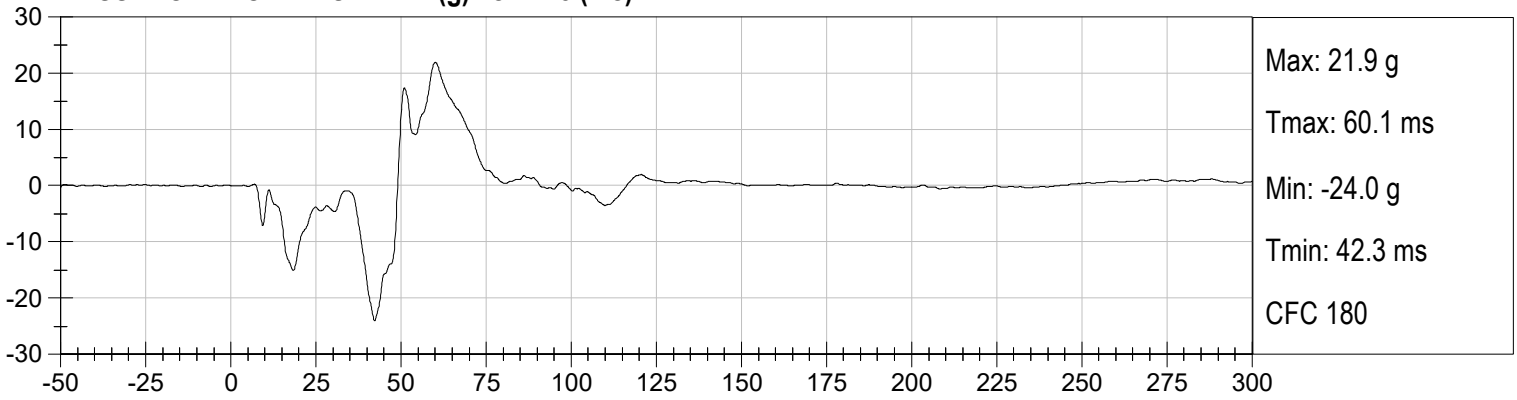
PASSENGER HEAD Z (g) vs Time (ms)



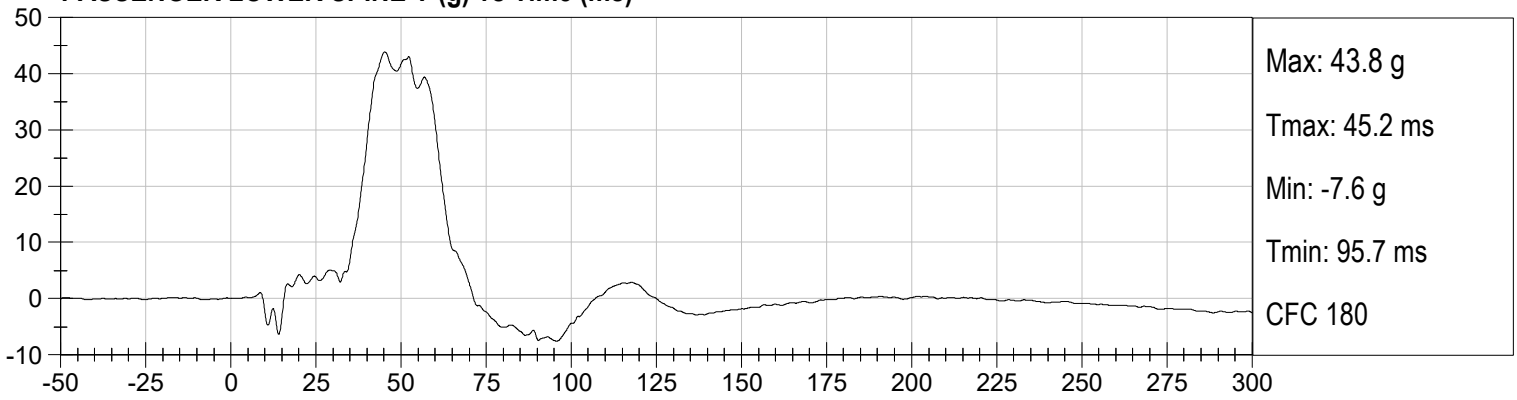
PASSENGER HEAD Resultant (g) vs Time (ms)



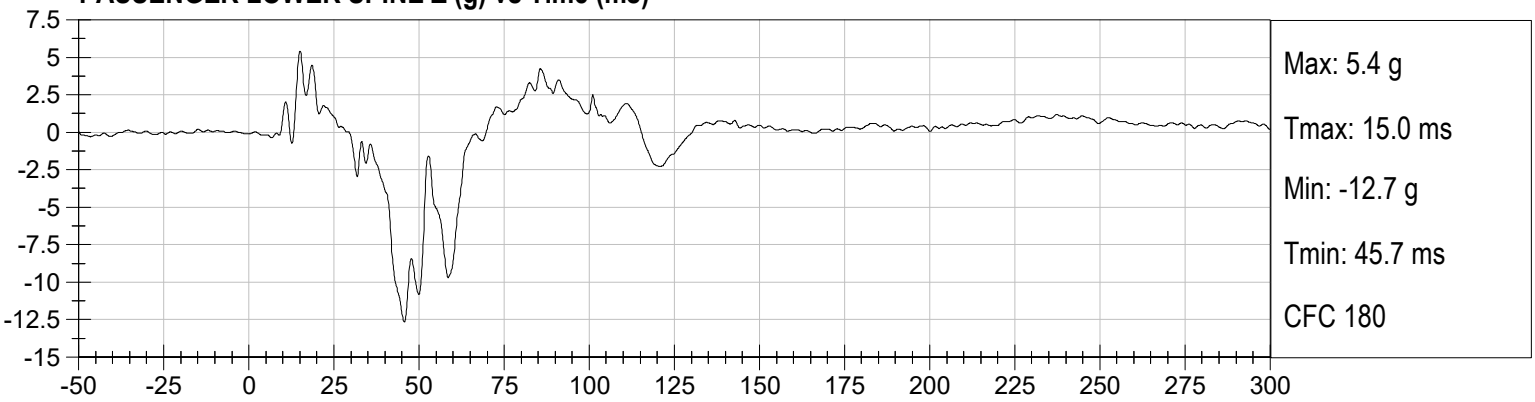
PASSENGER LOWER SPINE X (g) vs Time (ms)



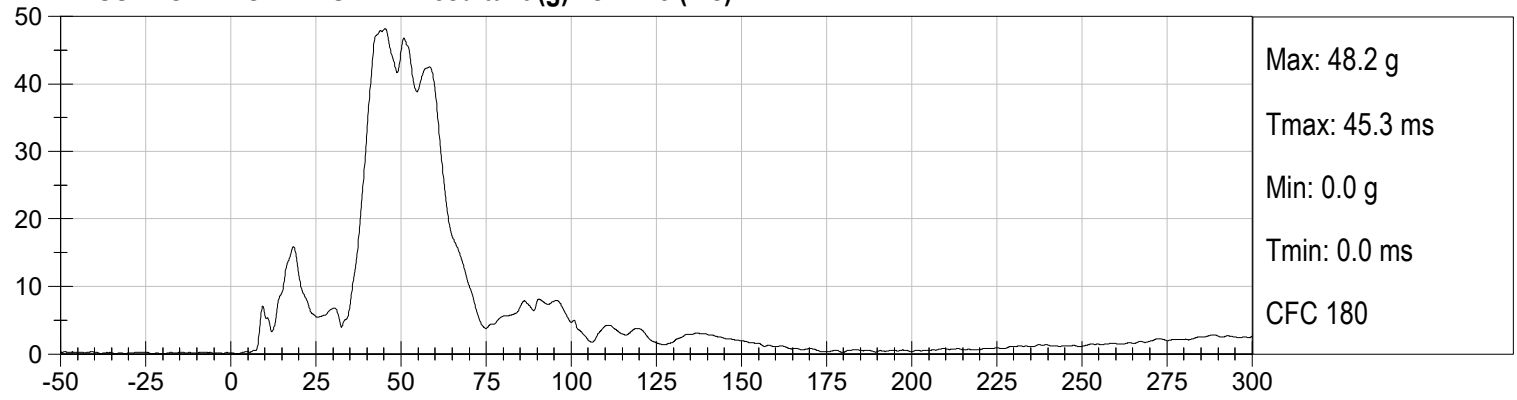
PASSENGER LOWER SPINE Y (g) vs Time (ms)



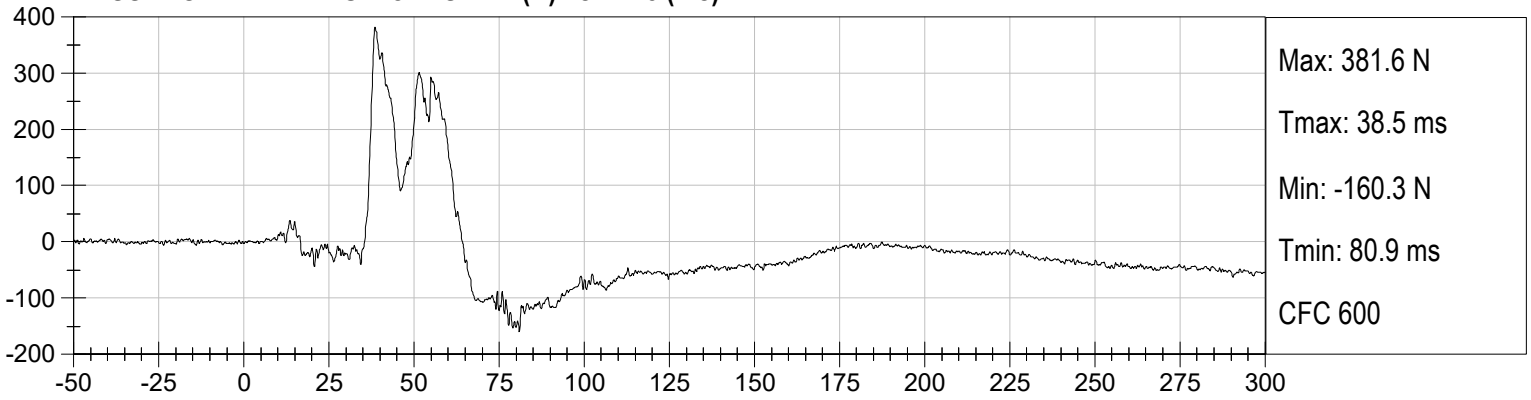
PASSENGER LOWER SPINE Z (g) vs Time (ms)



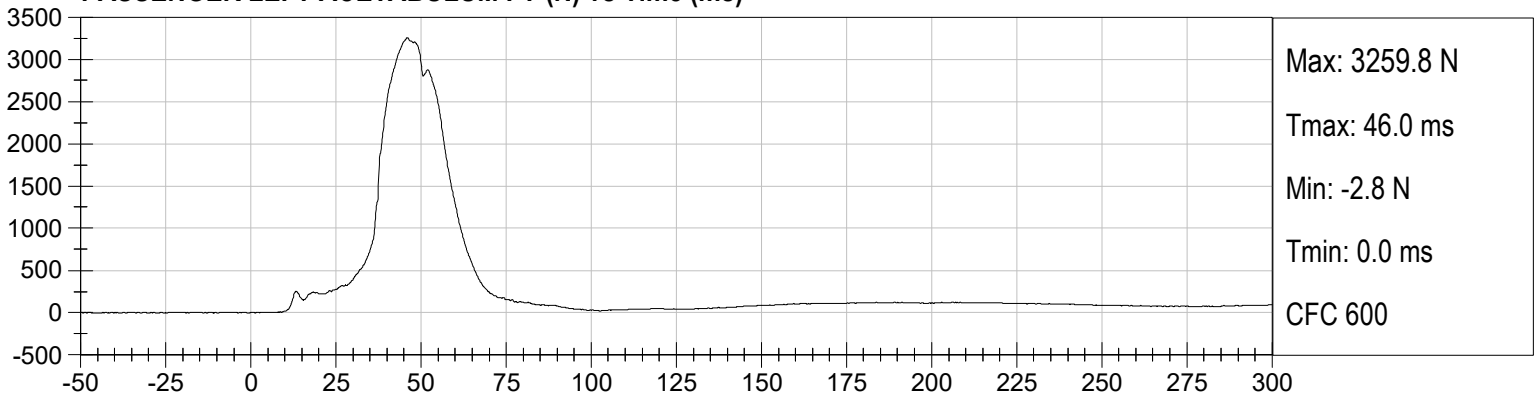
PASSENGER LOWER SPINE Resultant (g) vs Time (ms)



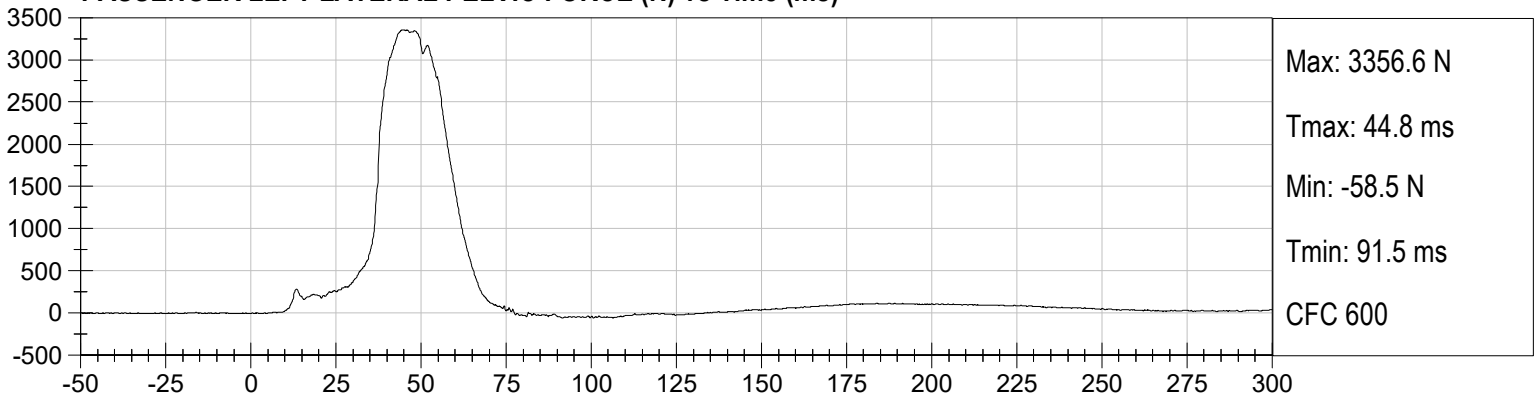
PASSENGER LEFT ILIUM CREST FY (N) vs Time (ms)



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:** D193571

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	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	9.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

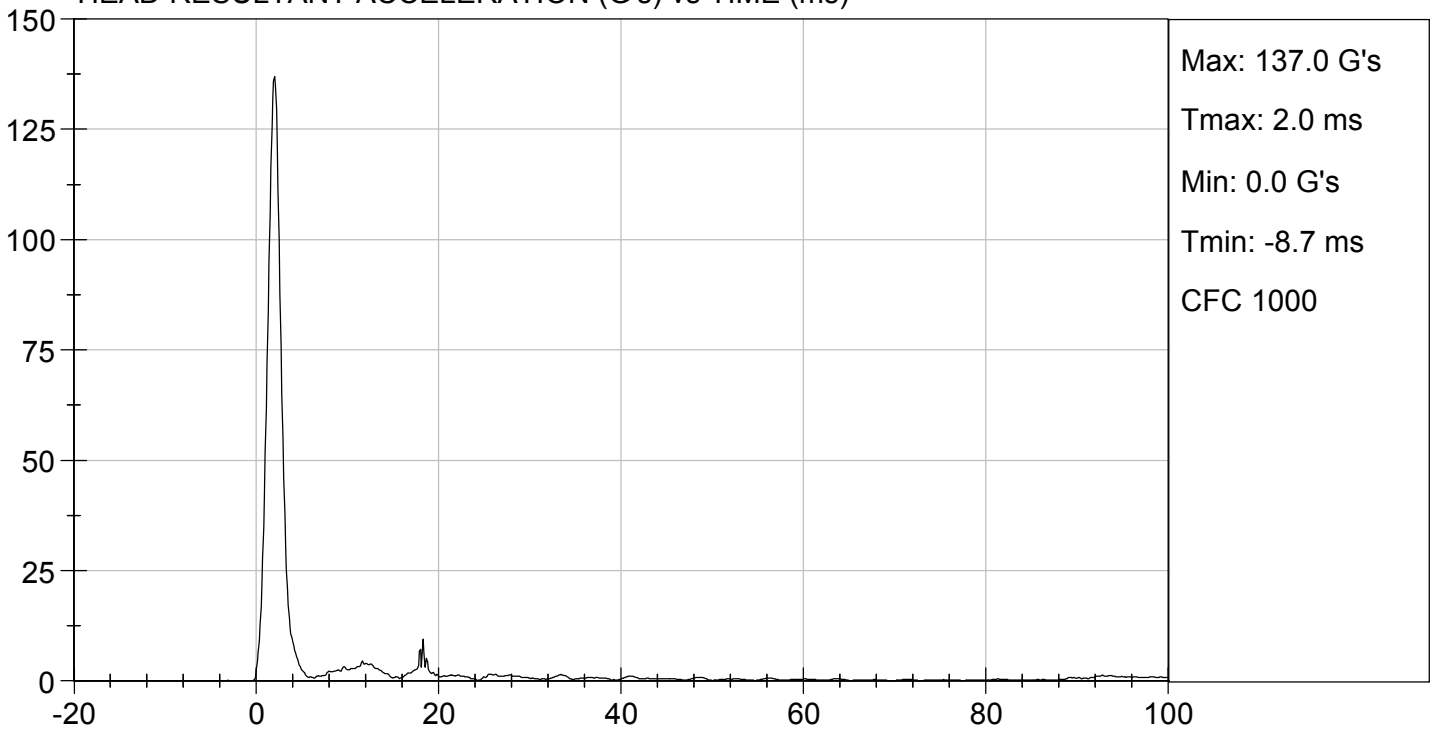
11/13/2019
Test Date

Approved By

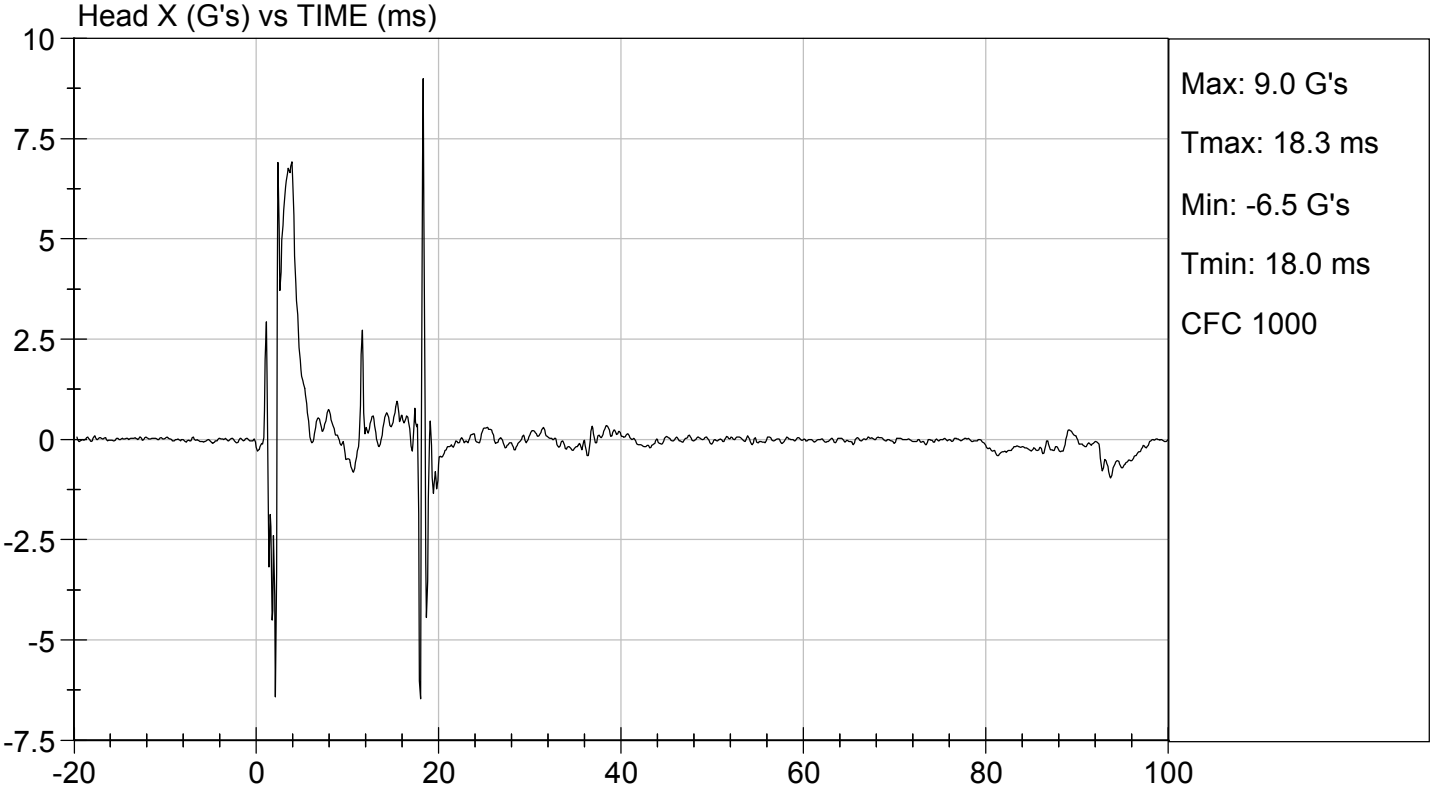
TEST DESC: HEAD DROP

TEST DATE: 11/13/2019
TEST #: D193571

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



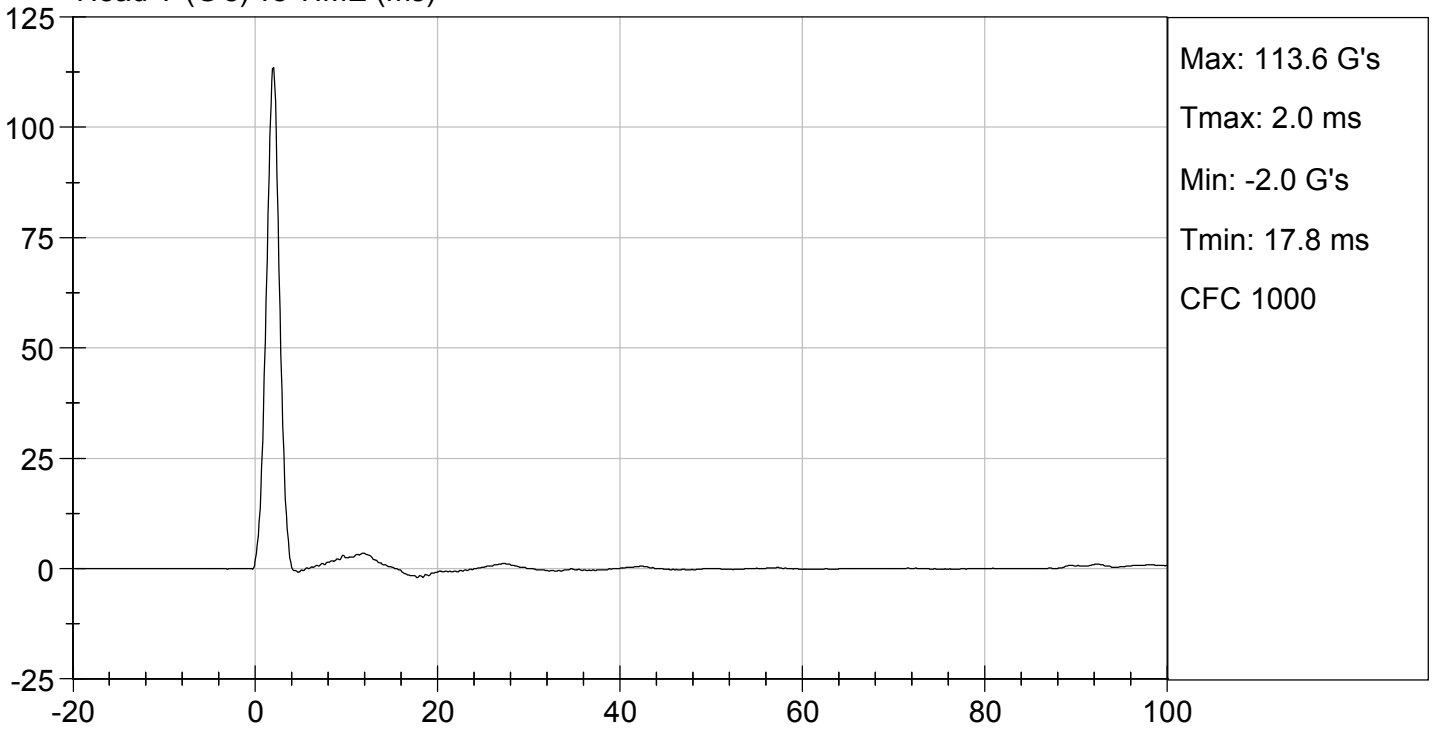
Head X (G's) vs TIME (ms)



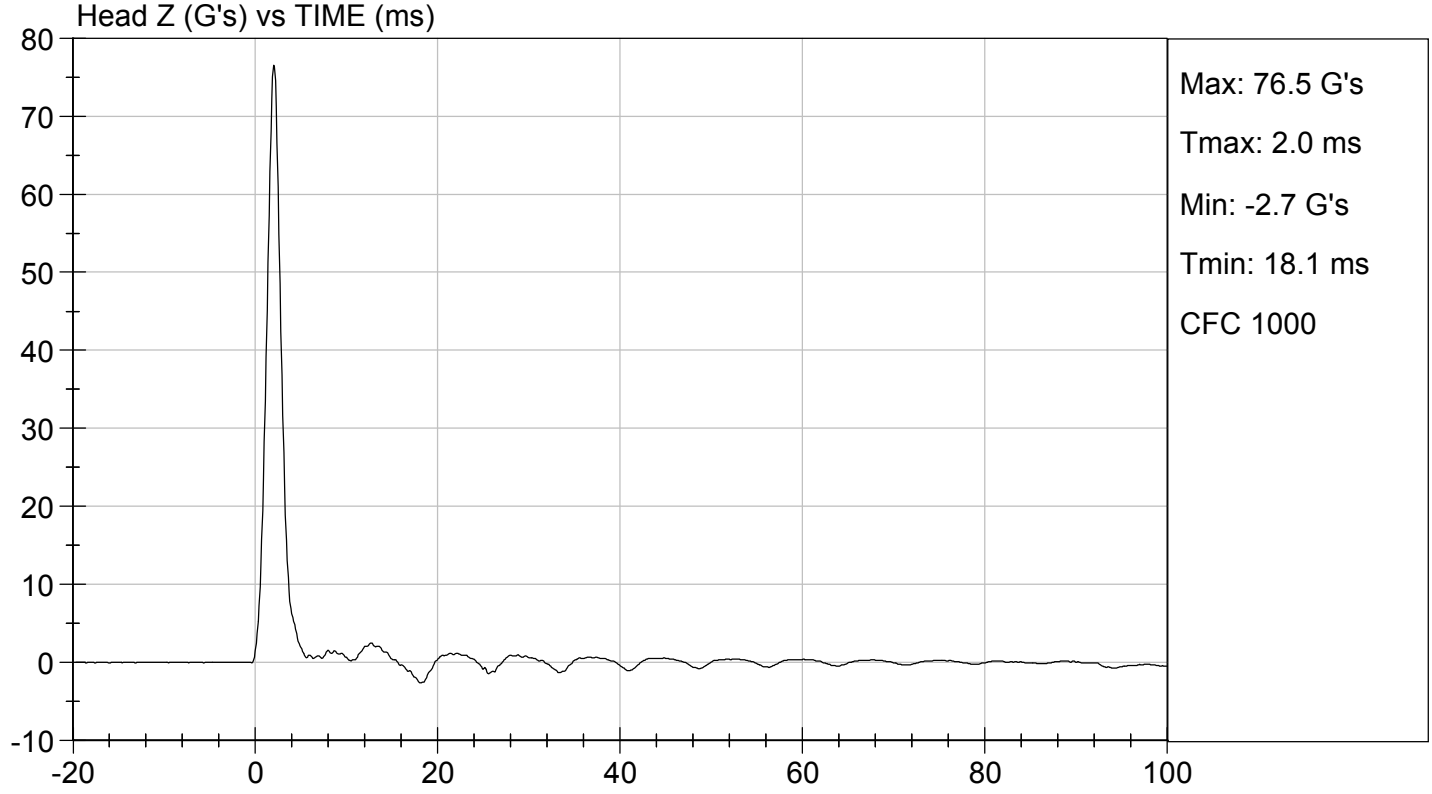
TEST DESC: HEAD DROP

TEST DATE: 11/13/2019
TEST #: D193571

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:** D193572

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	18	Pass
Pendulum Speed		m/s	3.30 to 3.50	3.50	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.00	Pass
	3 ms	m/s	-0.25 to -0.375	-0.36	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	51.2	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	56.1	Pass
Head Rotation Decay Time to 0 Degree		ms	53.0 to 88.0	61.3	Pass
			Overall Results		Pass

Laboratory Technician

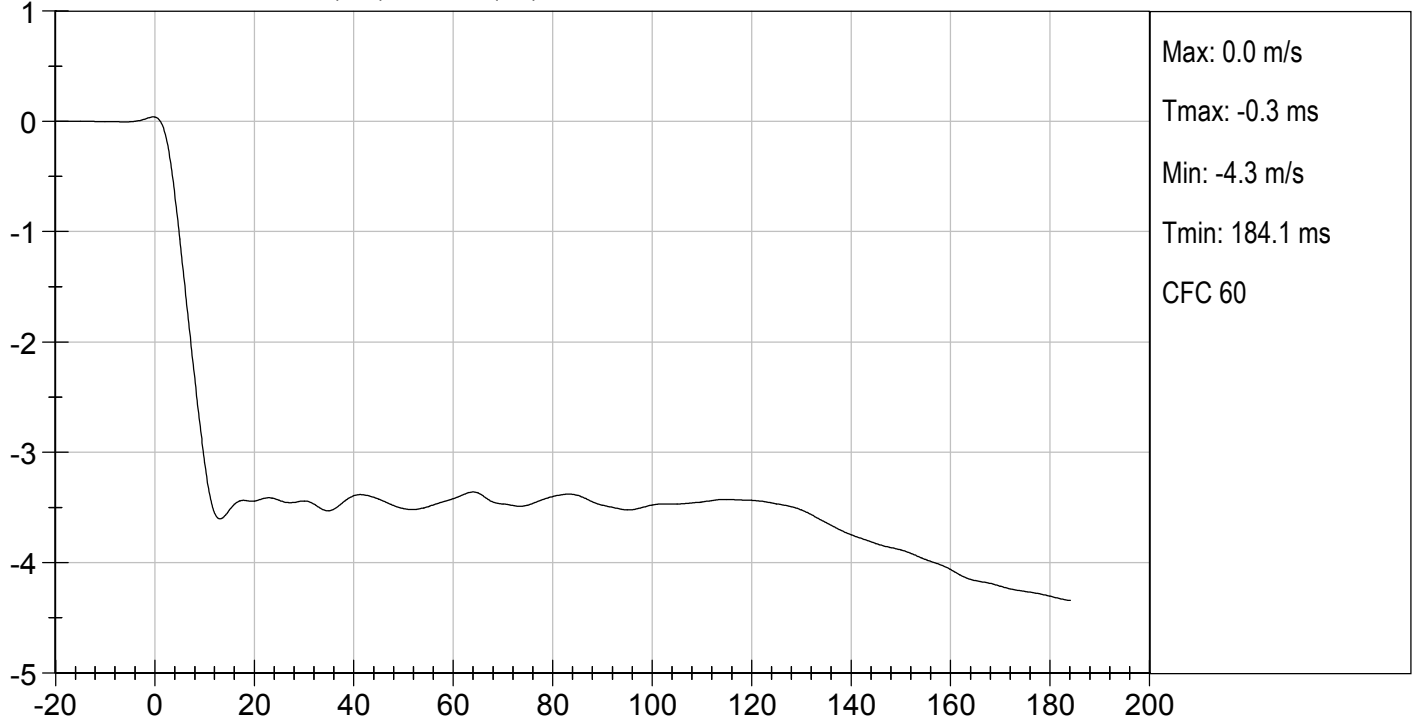
11/13/2019
Test Date

Approved By

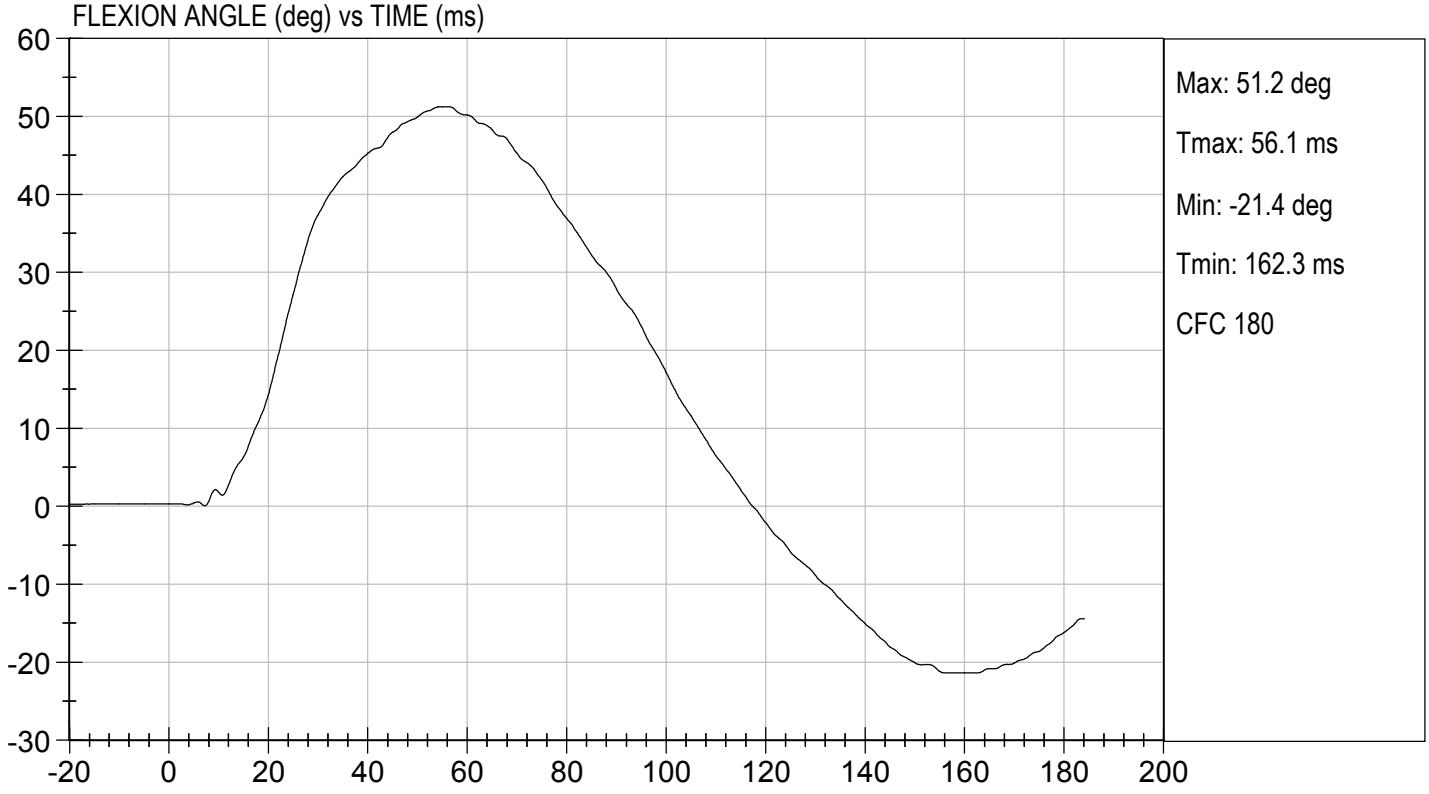
TEST DESC: NECK BENDING
VELOCITY: 11.49 ft/s, 3.50 m/s

TEST DATE: 11/13/2019
TEST #: D193572

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



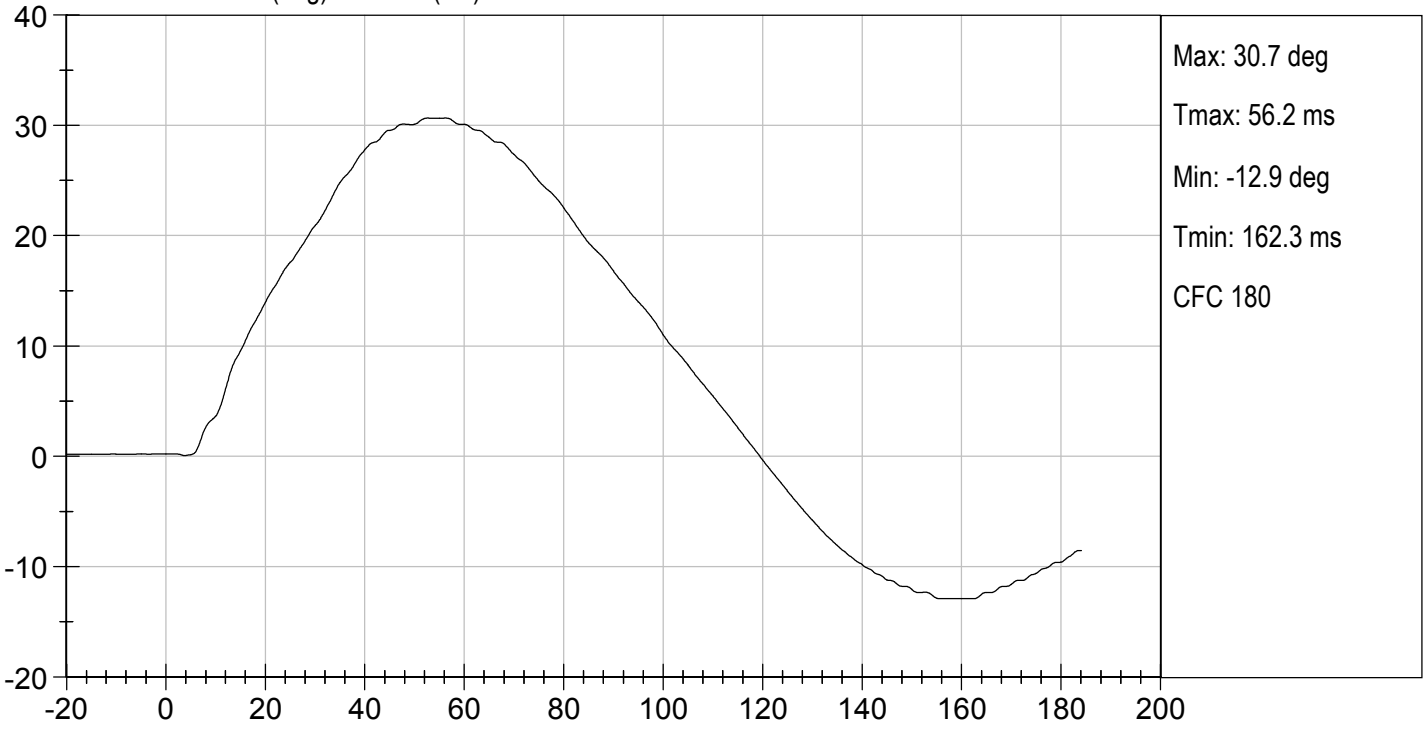
FLEXION ANGLE (deg) vs TIME (ms)



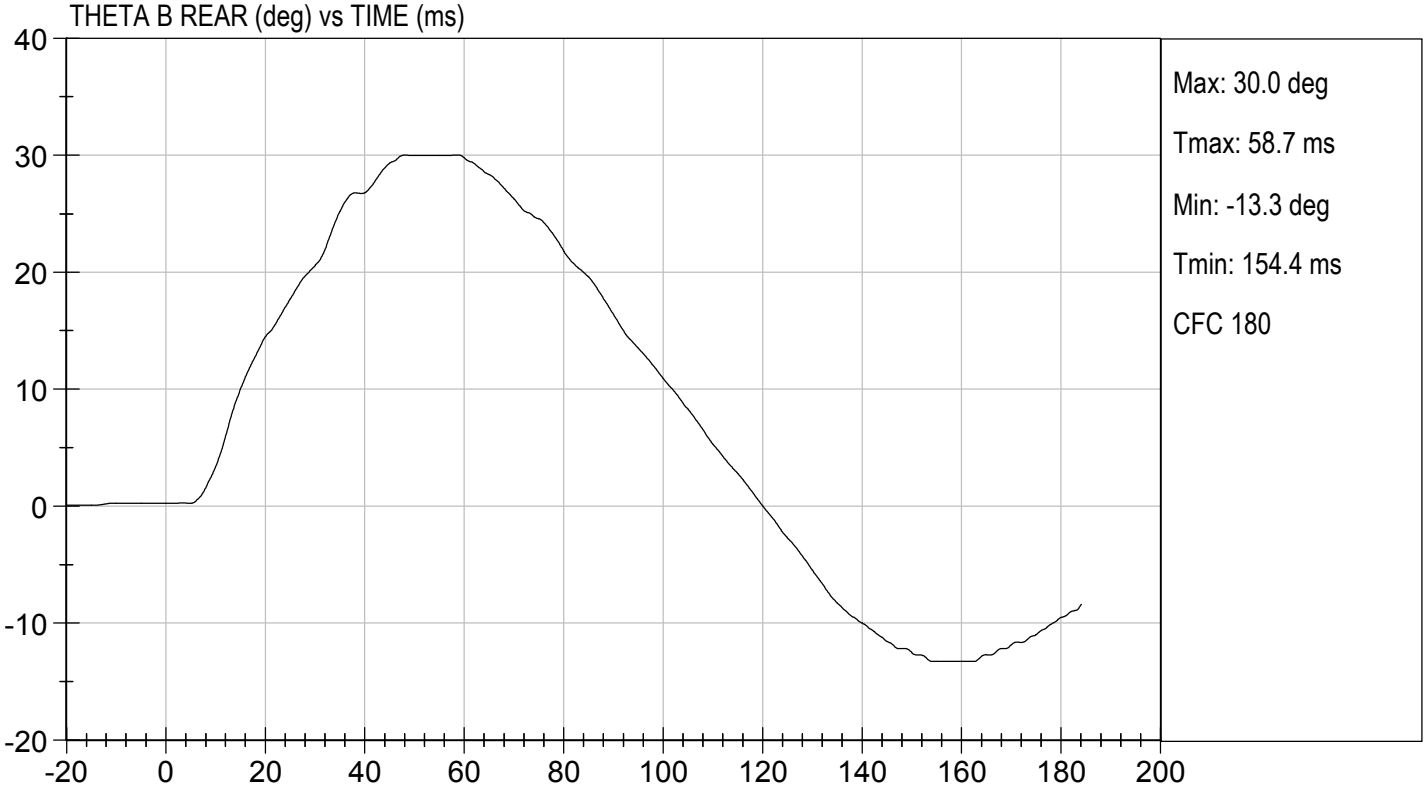
TEST DESC: NECK BENDING
VELOCITY: 11.49 ft/s, 3.50 m/s

TEST DATE: 11/13/2019
TEST #: D193572

THETA A FRONT (deg) vs TIME (ms)

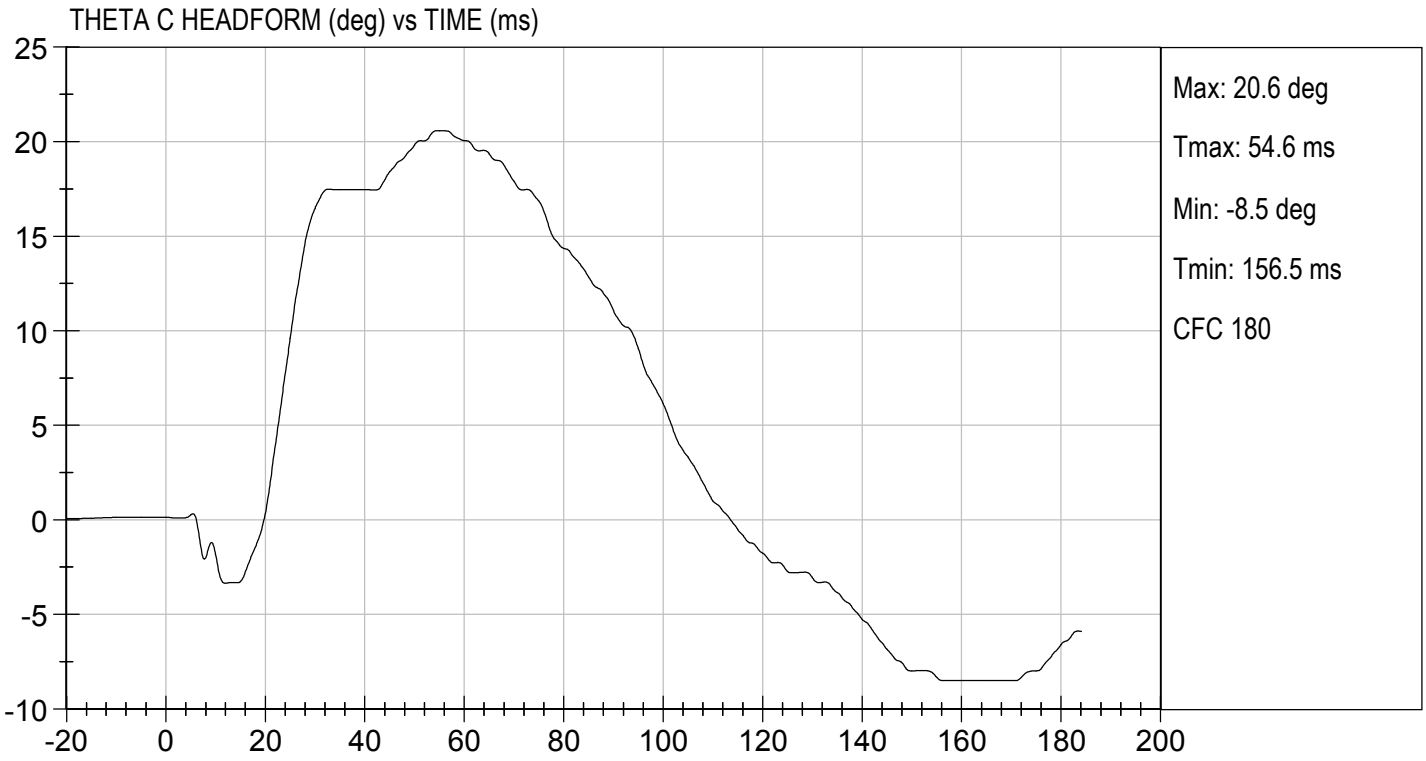


THETA B REAR (deg) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 11.49 ft/s, 3.50 m/s

TEST DATE: 11/13/2019
TEST #: D193572



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193573

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Pendulum Speed	m/s	4.20 to 4.40	4.2	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	8.8	Pass
		Overall Test Results		Pass

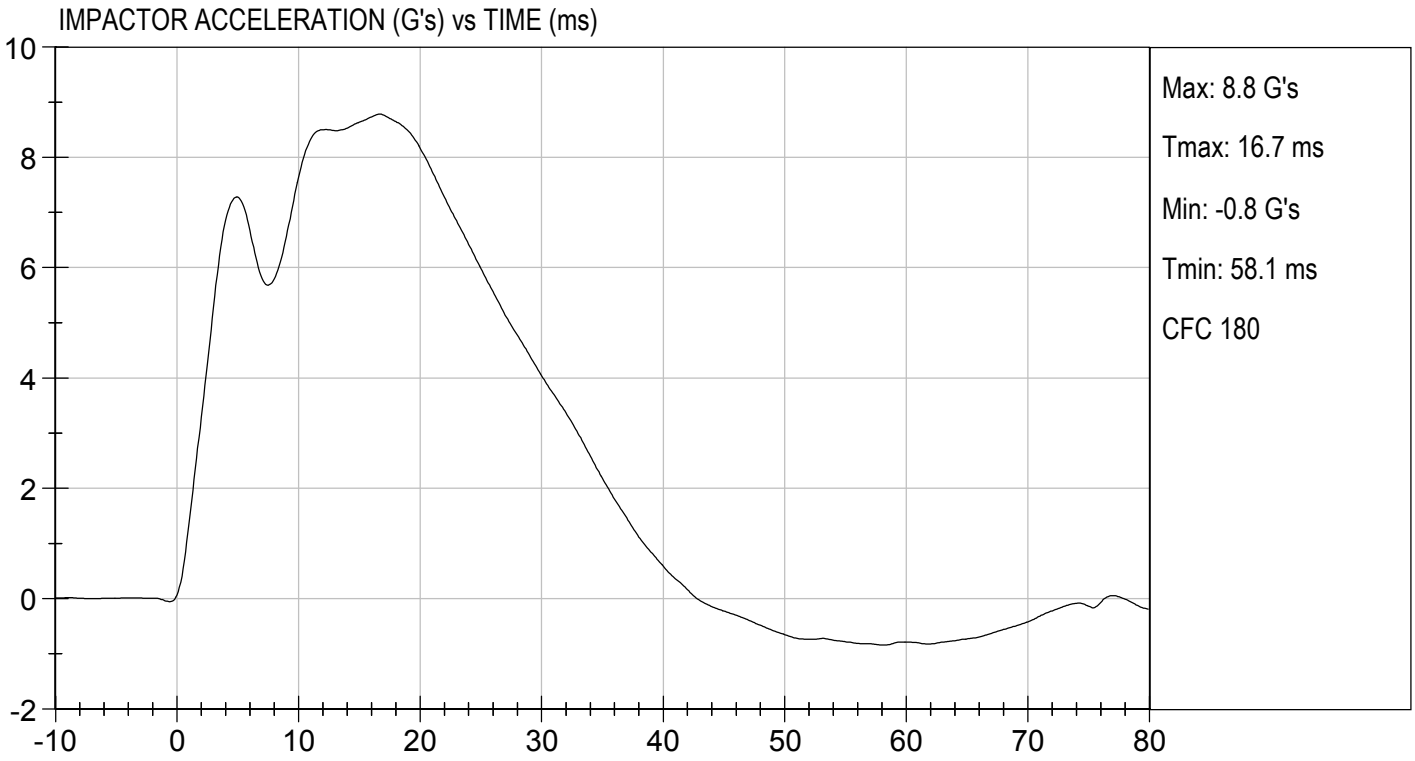
Laboratory Technician

11/14/2019
Test Date

Approved By

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

TEST DATE: 11/14/2019
TEST #: D193573



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193574

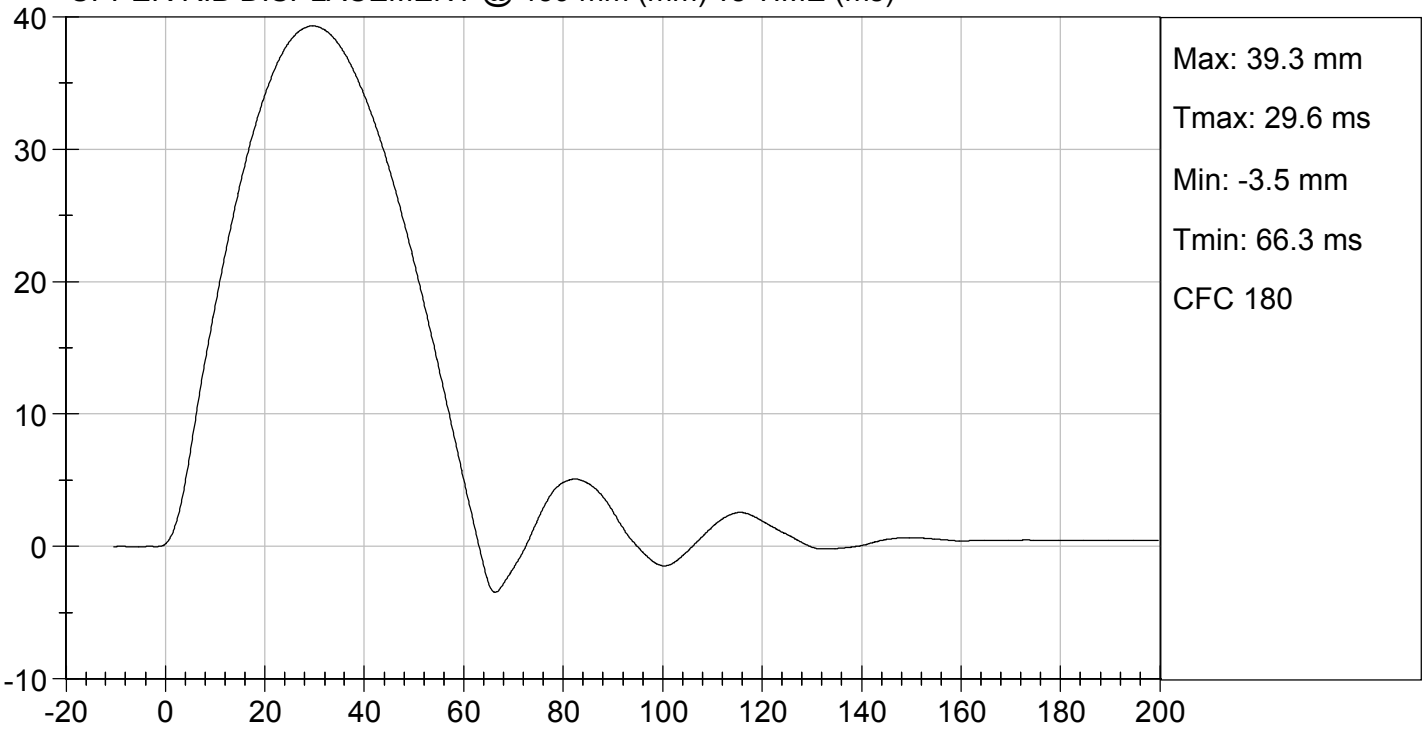
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Displacement at 459 mm	mm	36.0 to 40.0	39.3	Pass
Displacement at 815 mm	mm	46.0 to 51.0	49.9	Pass
		Overall Test Results		Pass

Laboratory Technician

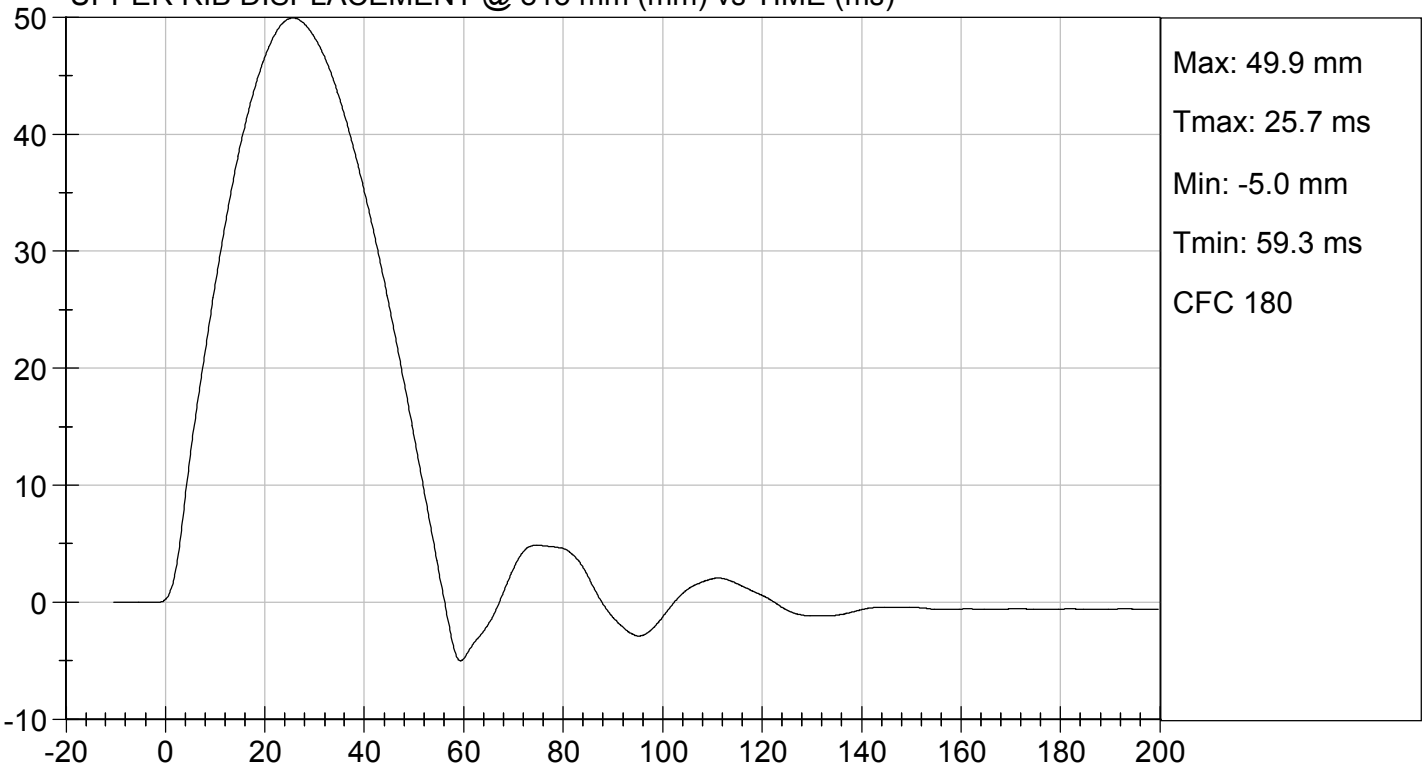
11/13/2019
Test Date

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:** D193575

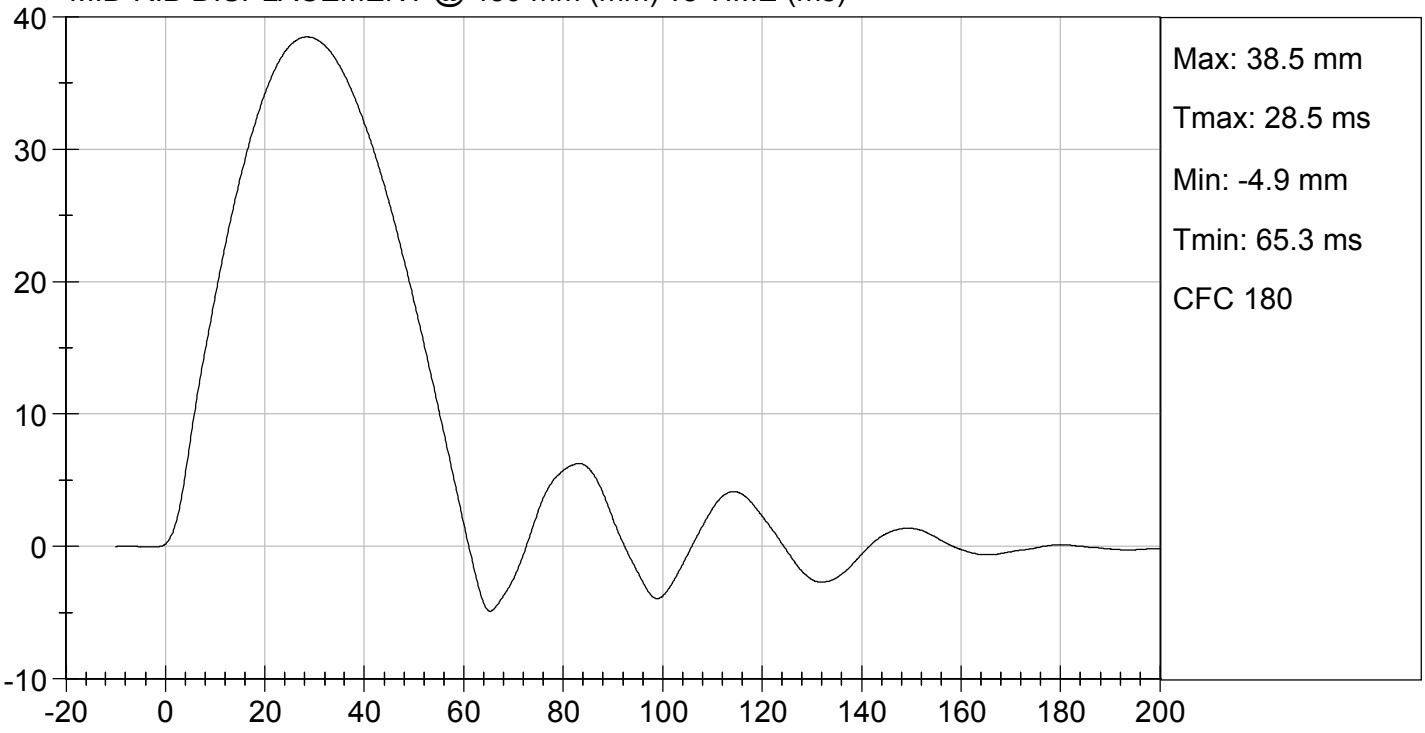
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Displacement at 459 mm	mm	36.0 to 40.0	38.5	Pass
Displacement at 815 mm	mm	46.0 to 51.0	47.8	Pass
		Overall Test Results		Pass

Laboratory Technician

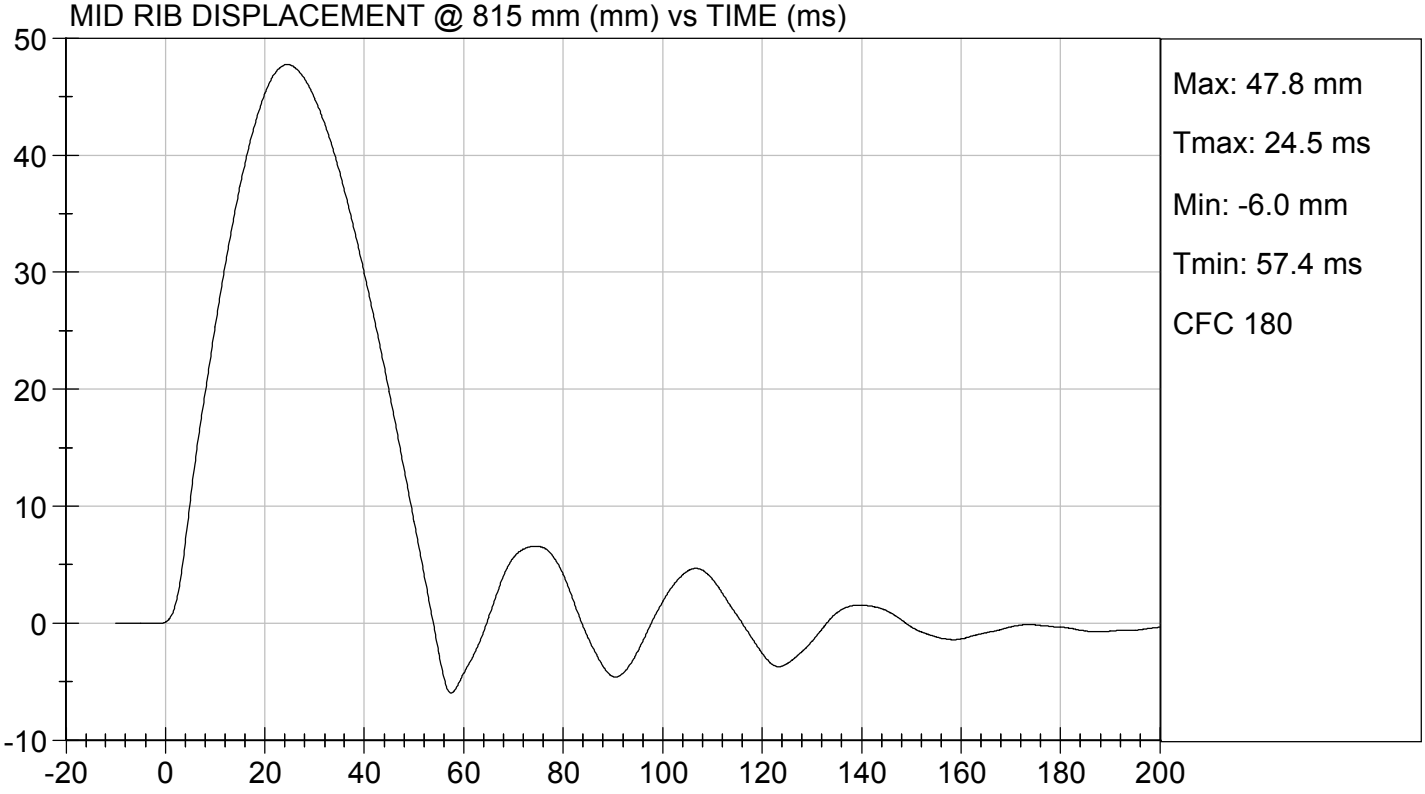
11/13/2019
Test Date

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:** D193576

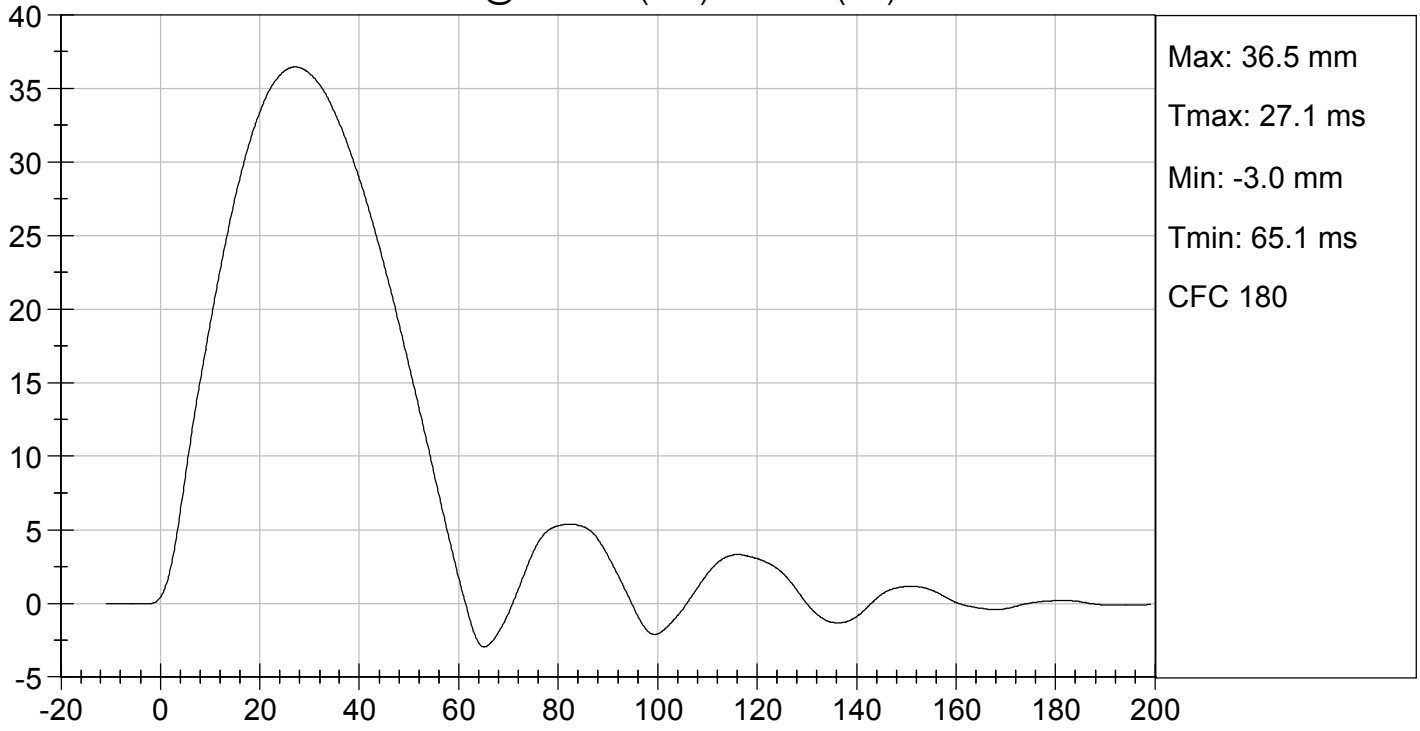
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Displacement at 459 mm	mm	36.0 to 40.0	36.5	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.0	Pass
		Overall Test Results		Pass

Laboratory Technician

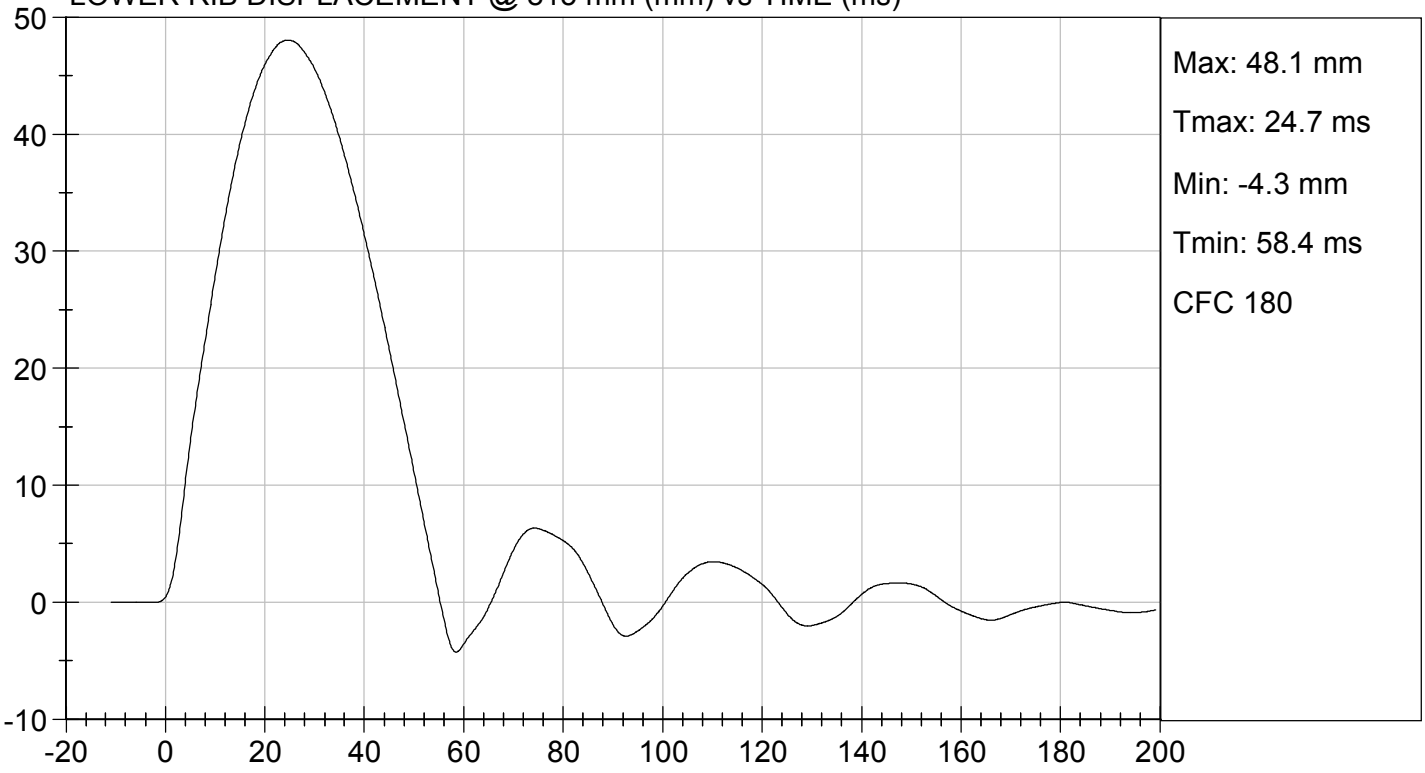
11/13/2019
Test Date

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:** D193577

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Probe Speed	m/s	3.90 to 4.10	4.10	Pass
Maximum Impactor Force	N	4000 to 4800	4391	Pass
Time of Maximum Impactor Force	ms	10.6 to 13.0	10.6	Pass
Maximum Total Abdomen Force	N	2200 to 2700	2395	Pass
Time of Maximum Abdomen Force	ms	10.0 to 12.3	11.1	Pass
		Overall Test Results		Pass

Laboratory Technician

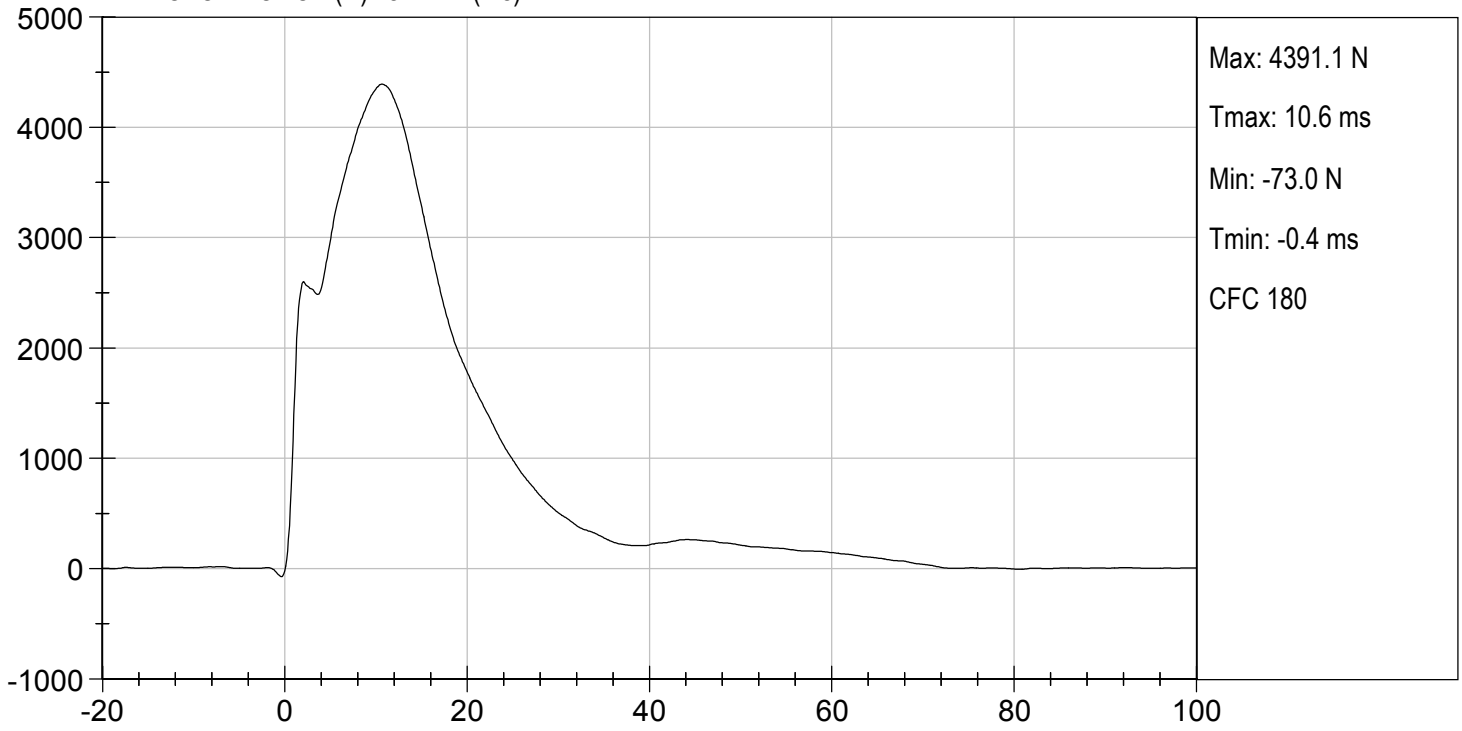
11/14/2019
Test Date

Approved By

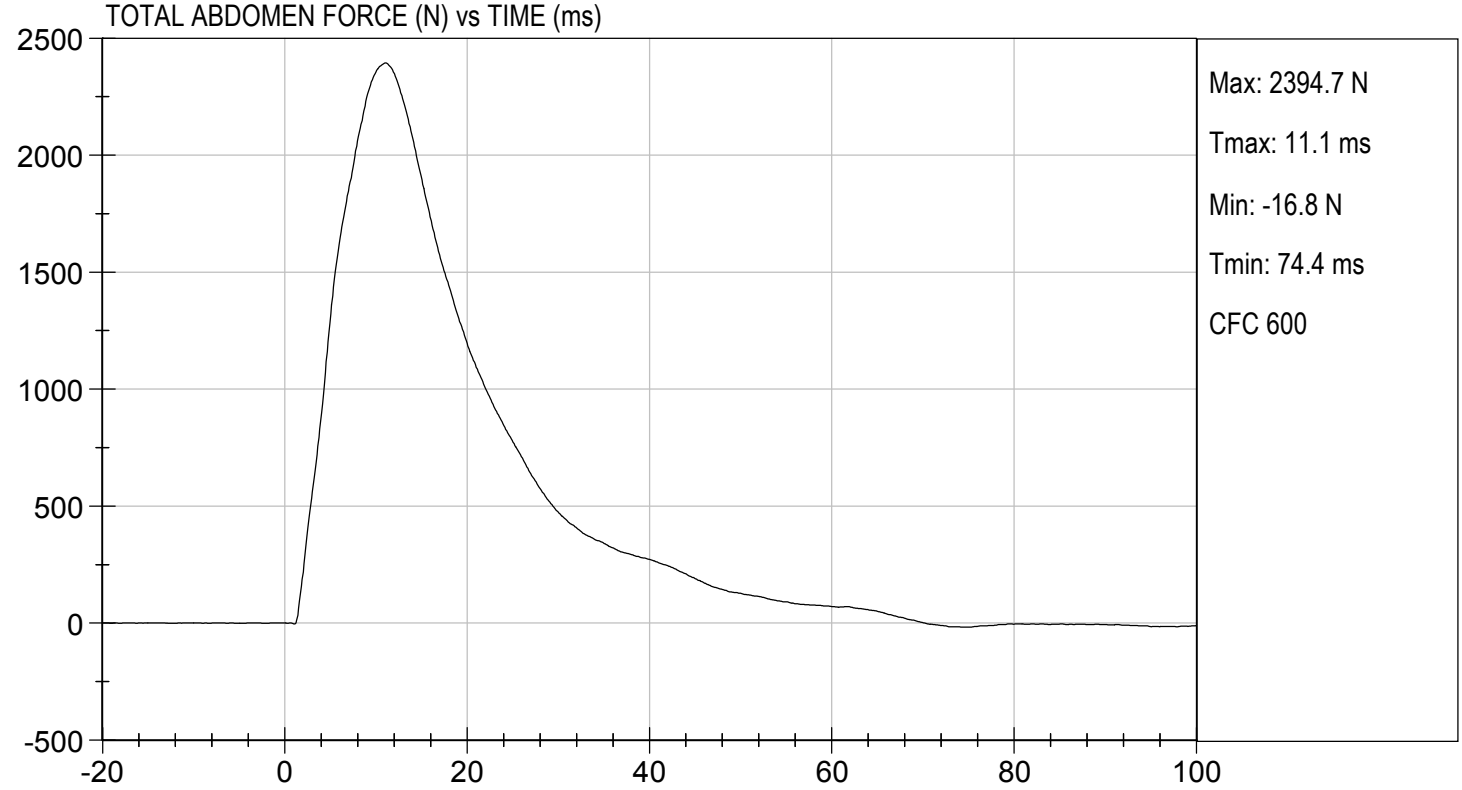
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 11/14/2019
TEST #: D193577

IMPACTOR FORCE (N) vs TIME (ms)



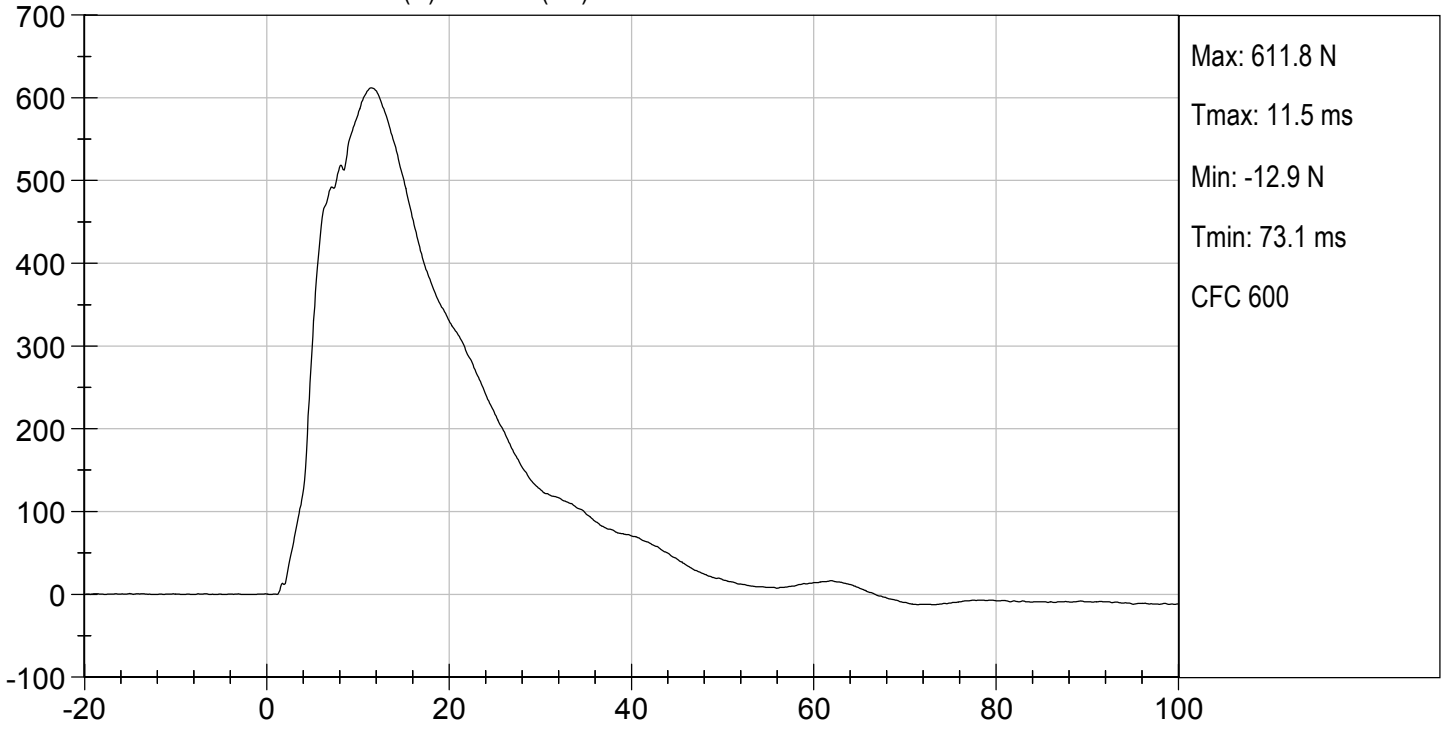
TOTAL ABDOMEN FORCE (N) vs TIME (ms)



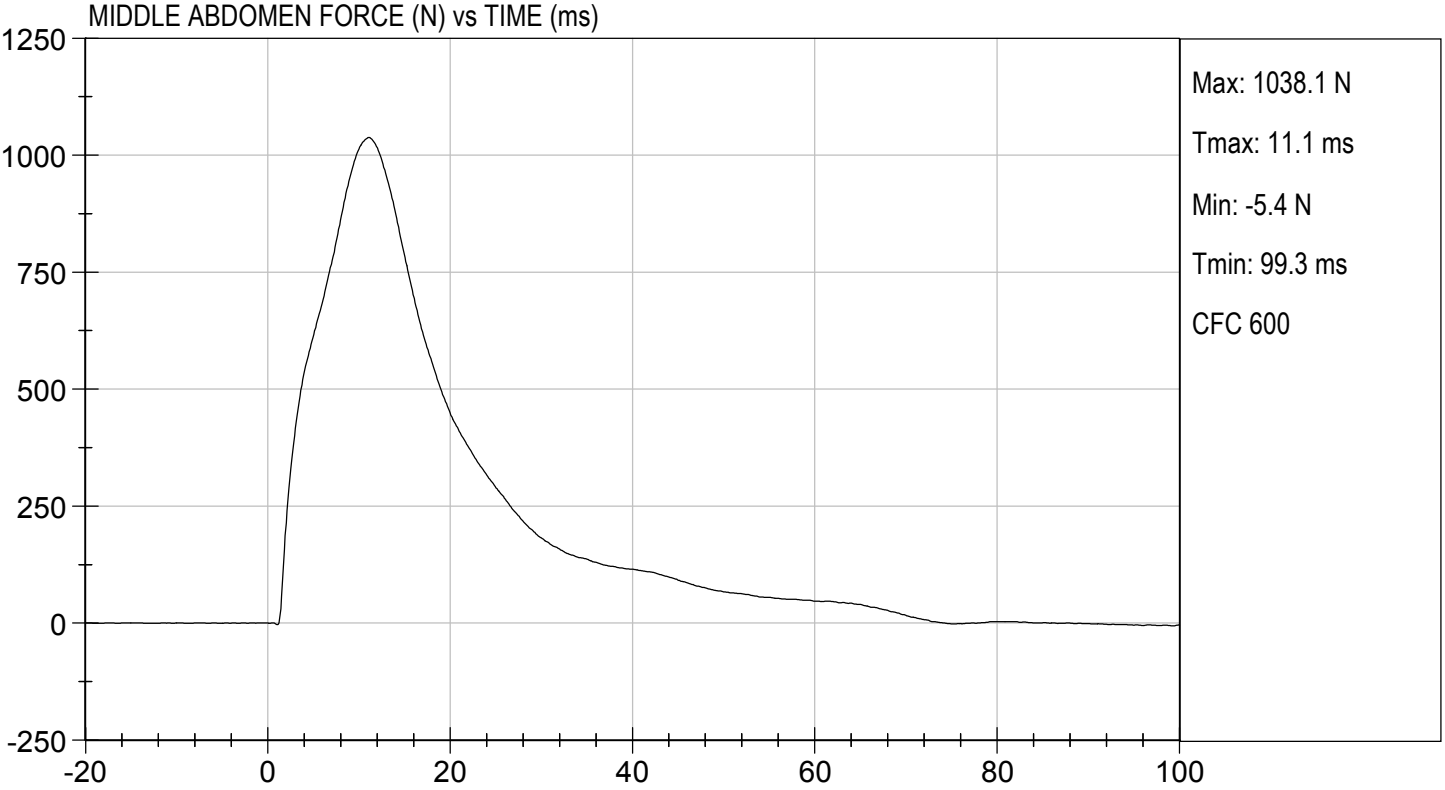
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 11/14/2019
TEST #: D193577

FRONT ABDOMEN FORCE (N) vs TIME (ms)



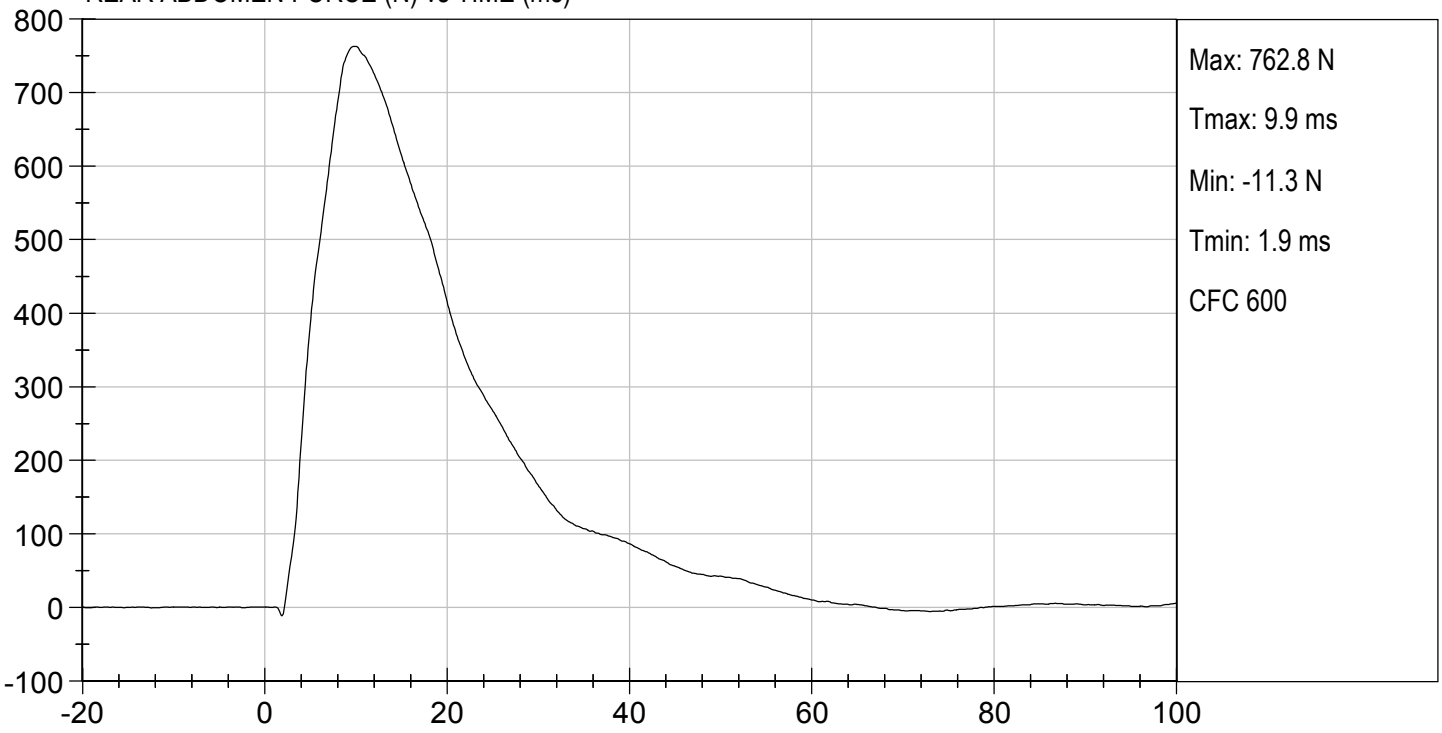
MIDDLE ABDOMEN FORCE (N) vs TIME (ms)



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

TEST DATE: 11/14/2019
TEST #: D193577

REAR ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193578

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	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	-0.00	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.413	Pass
	27 ms	m/s	-6.50 to -5.80	-5.97	Pass
	30 ms	m/s	>= -6.50	-5.82	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.4	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	42.4	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	39	Pass
			Overall Results		Pass

Laboratory Technician

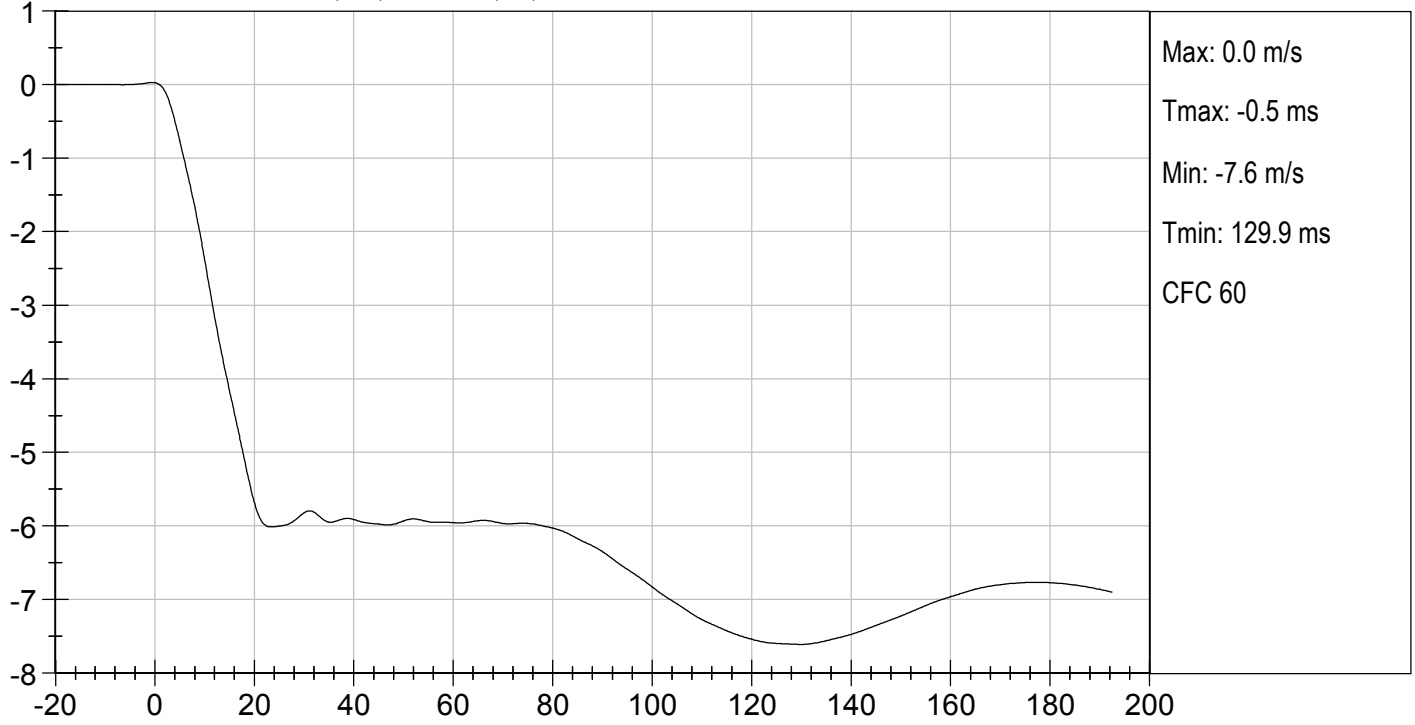
11/13/2019
Test Date

Approved By

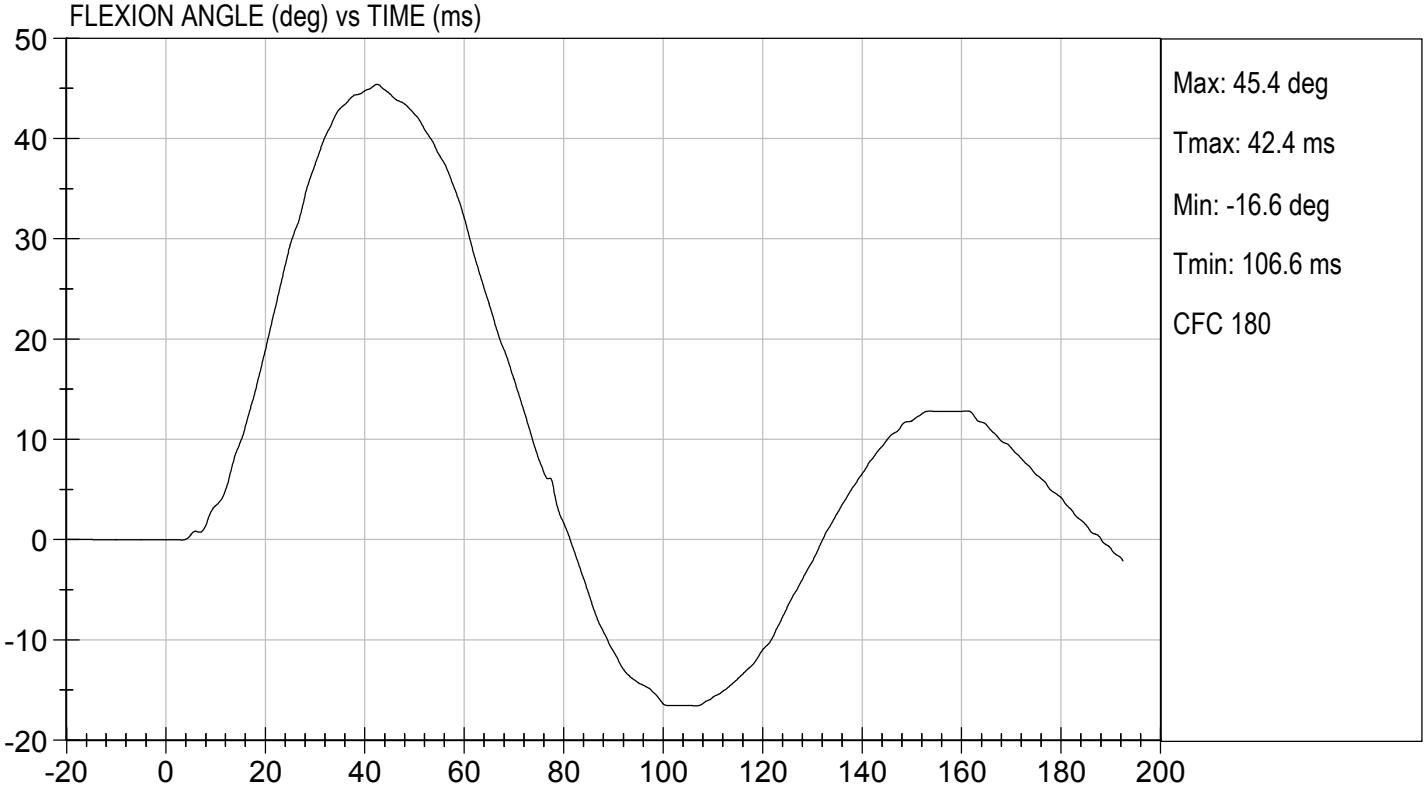
TEST DESC: LUMBAR BENDING
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 11/13/2019
TEST #: D193578

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

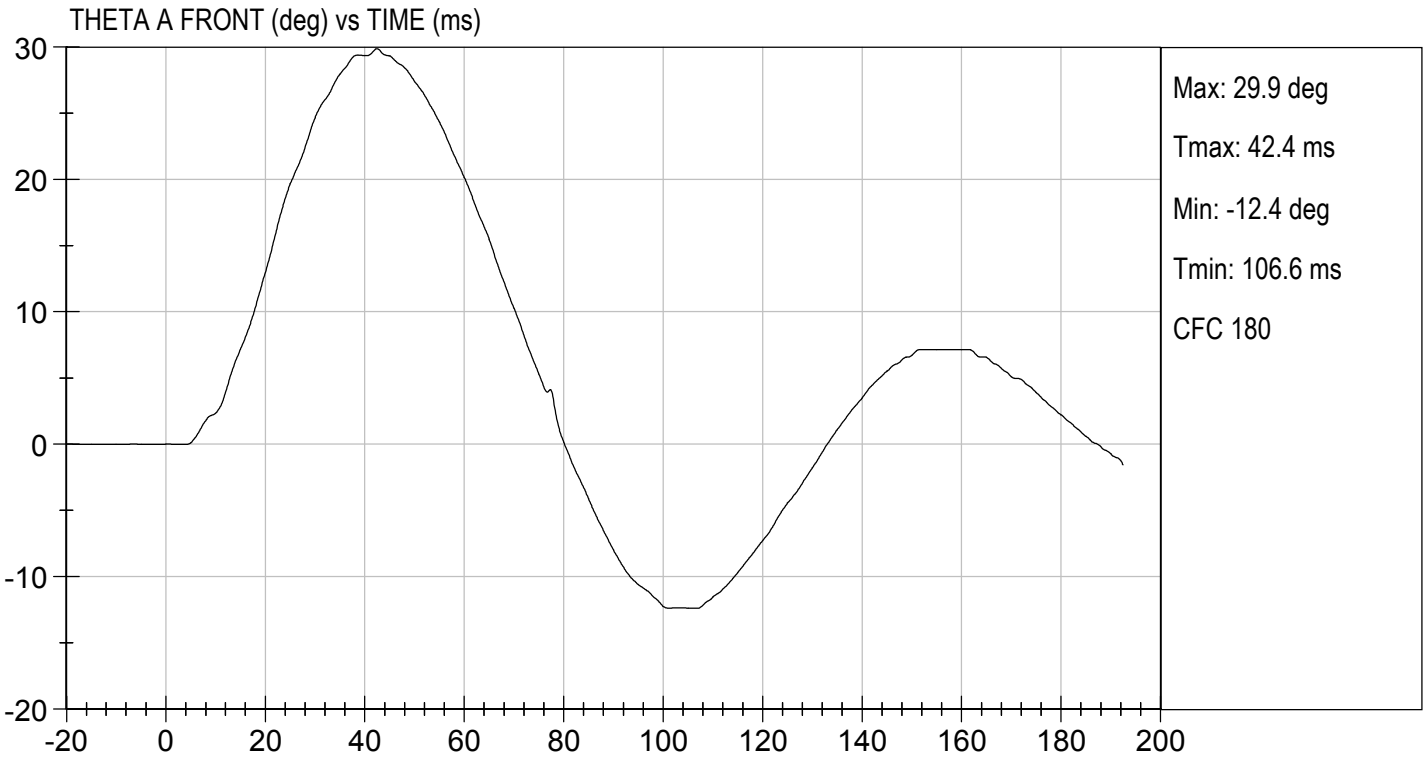


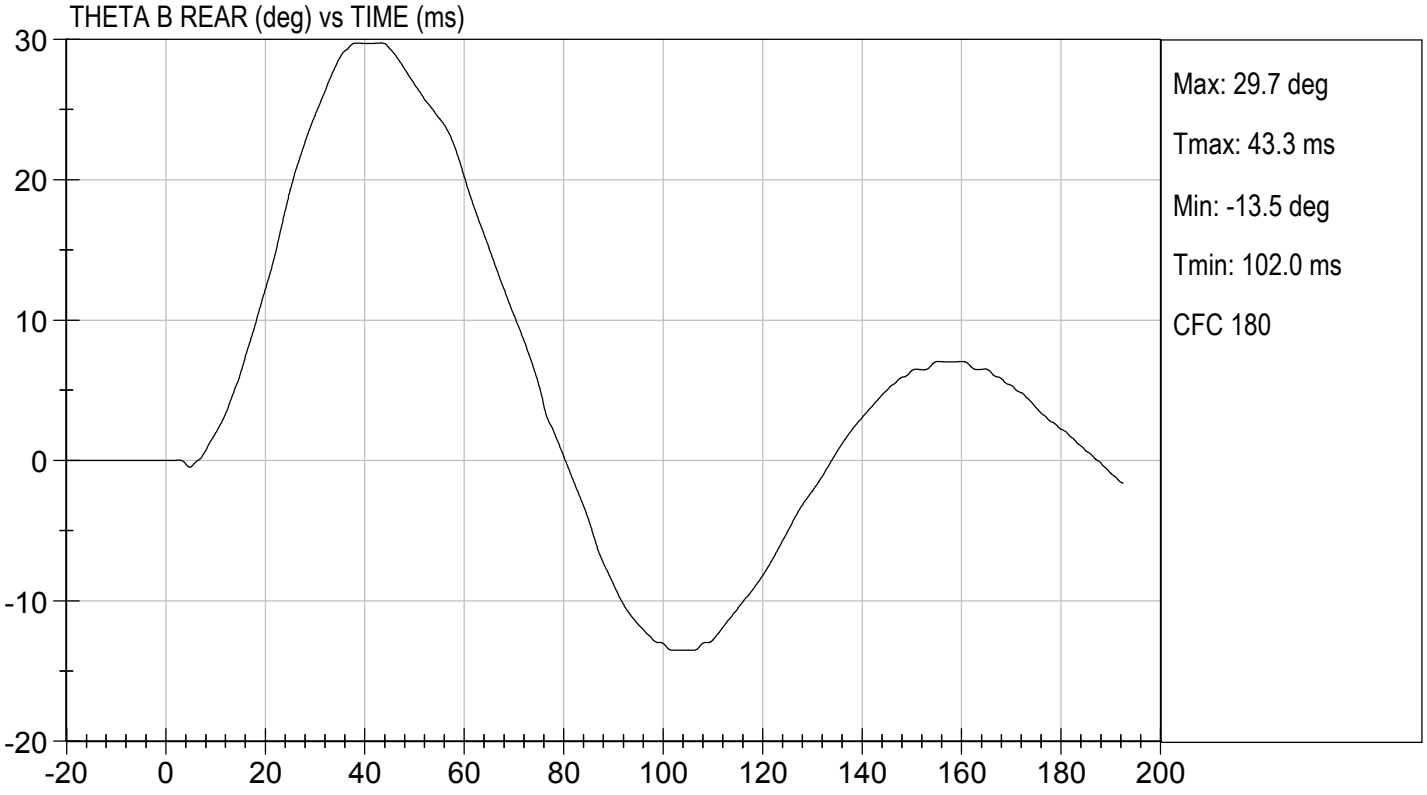
FLEXION ANGLE (deg) vs TIME (ms)



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

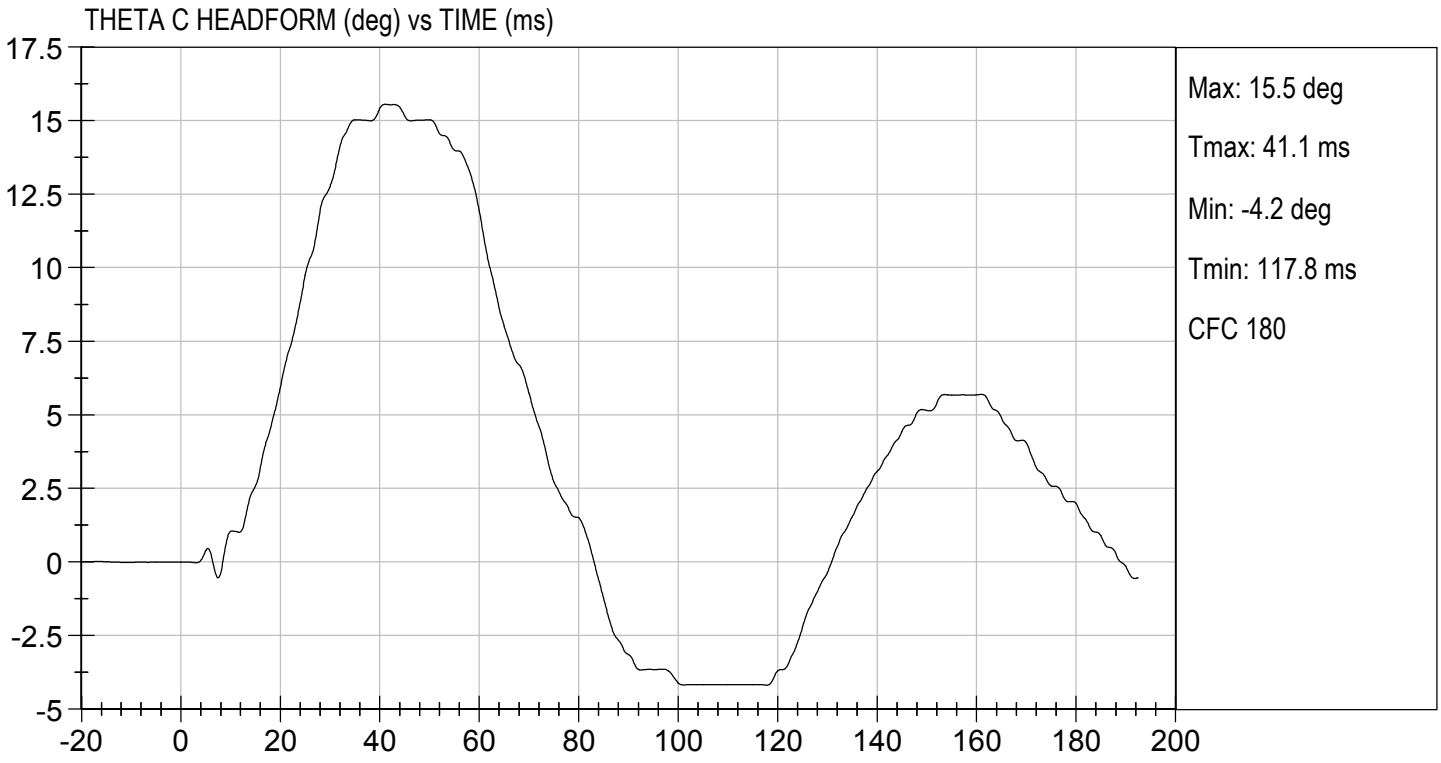
TEST DATE: 11/13/2019
TEST #: D193578





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

TEST DATE: 11/13/2019
TEST #: D193578



MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193579

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	N	4700 to 5400	5054	Pass
Time of Maximum Impactor Force	ms	11.8 to 16.1	12.8	Pass
Maximum Pubic Force	N	1230 to 1590	1396	Pass
Time of Maximum Pubic Force	ms	12.2 to 17.0	12.5	Pass
		Overall Test Results		Pass

Laboratory Technician

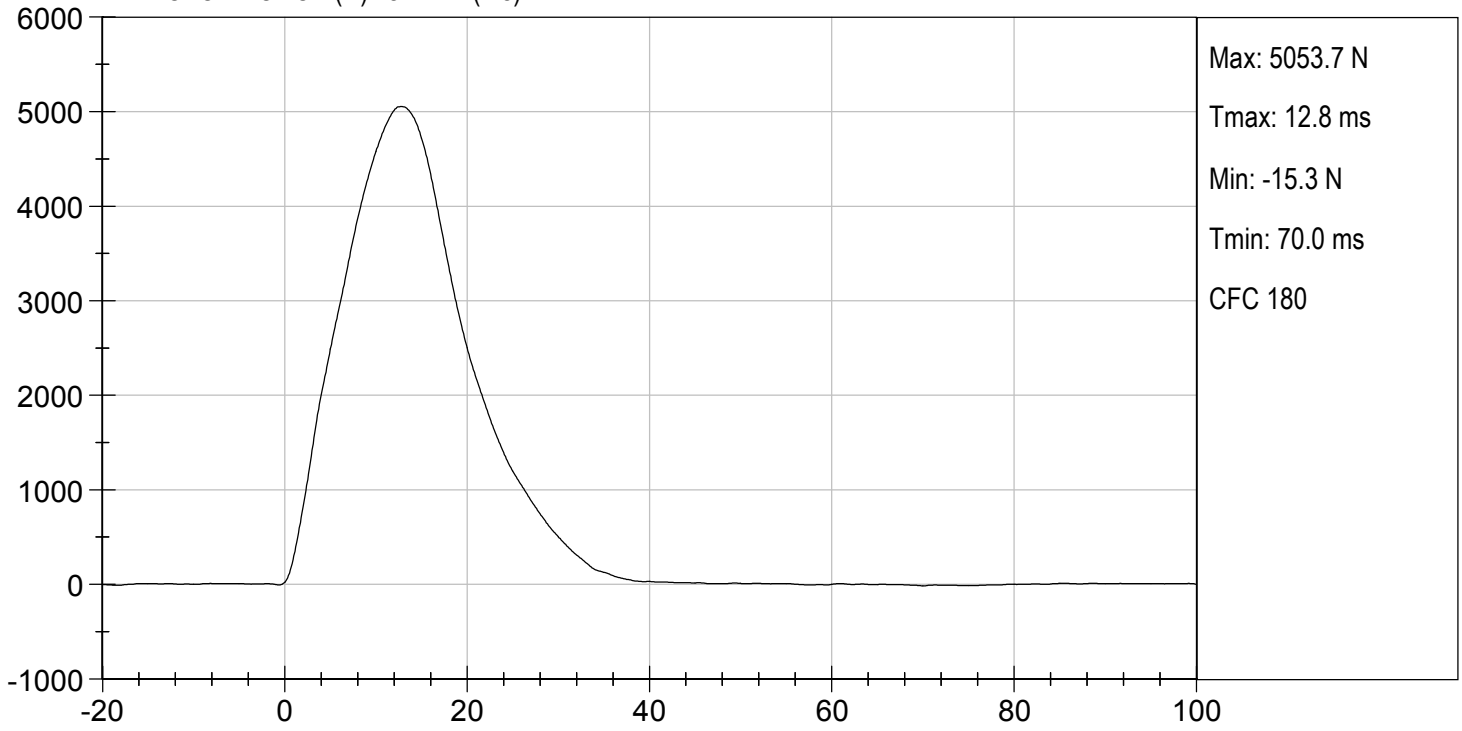
11/14/2019
Test Date

Approved By

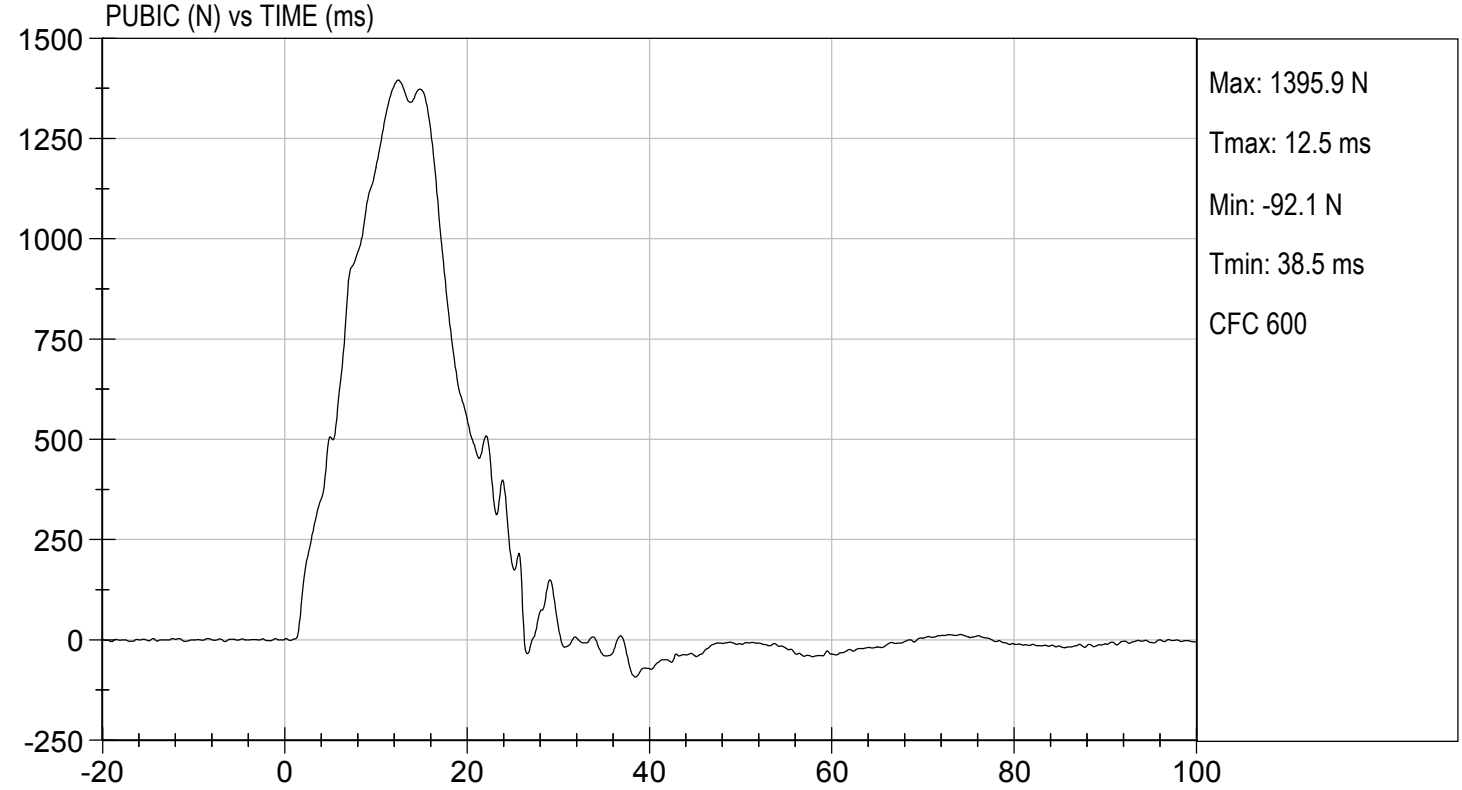
TEST DESC: PELVIS IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 11/14/2019
TEST #: D193579

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:** D193570

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.1	Pass
Humidity	%	10 to 70	25	Pass
Probe Speed	m/s	5.40 to 5.60	5.52	Pass
Maximum Impactor Force (after 6 ms)	N	5100 to 6200	5564	Pass
Upper Rib Displacement	mm	34.0 to 41.0	39.2	Pass
Middle Rib Displacement	mm	37.0 to 45.0	40.6	Pass
Lower Rib Displacement	mm	37.0 to 44.0	41.5	Pass
		Overall Test Results		Pass

Laboratory Technician

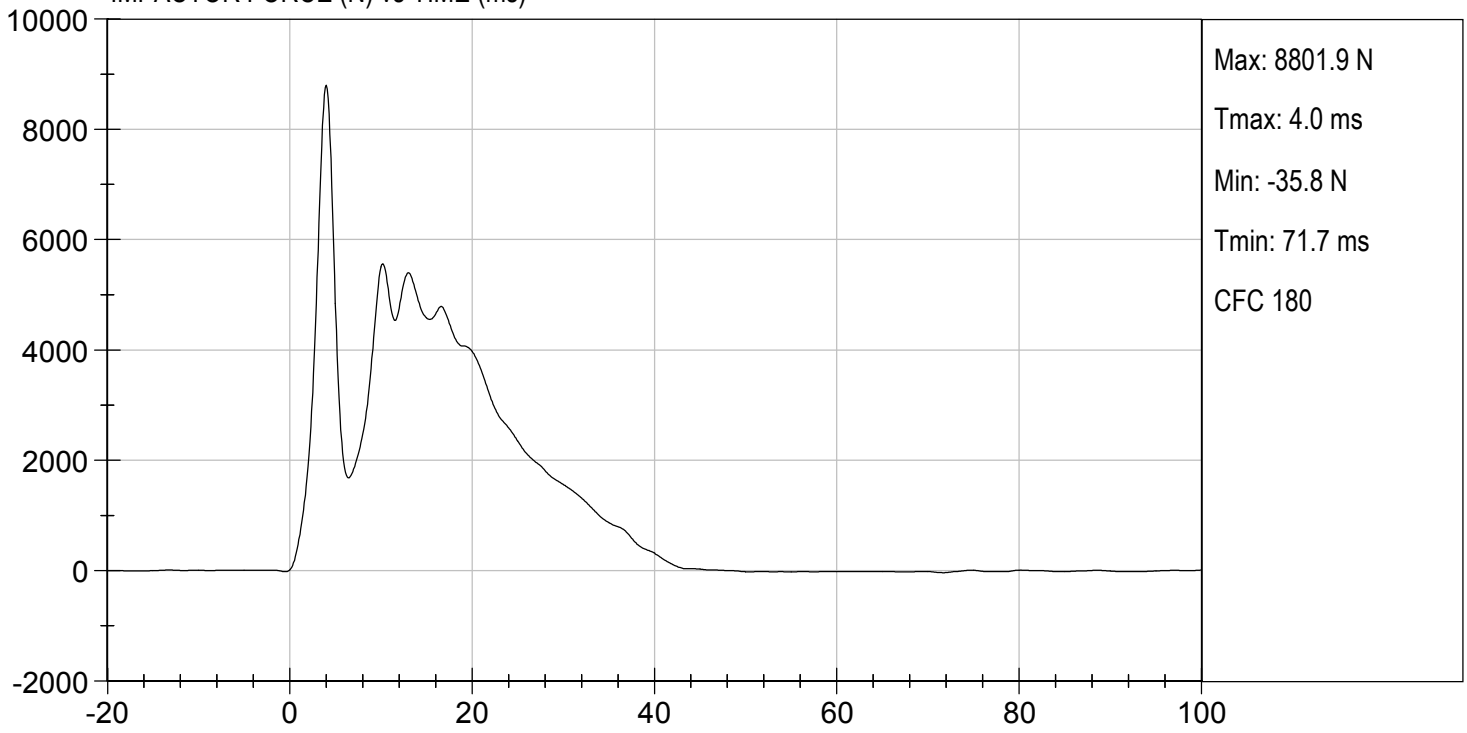
11/14/2019
Test Date

Approved By

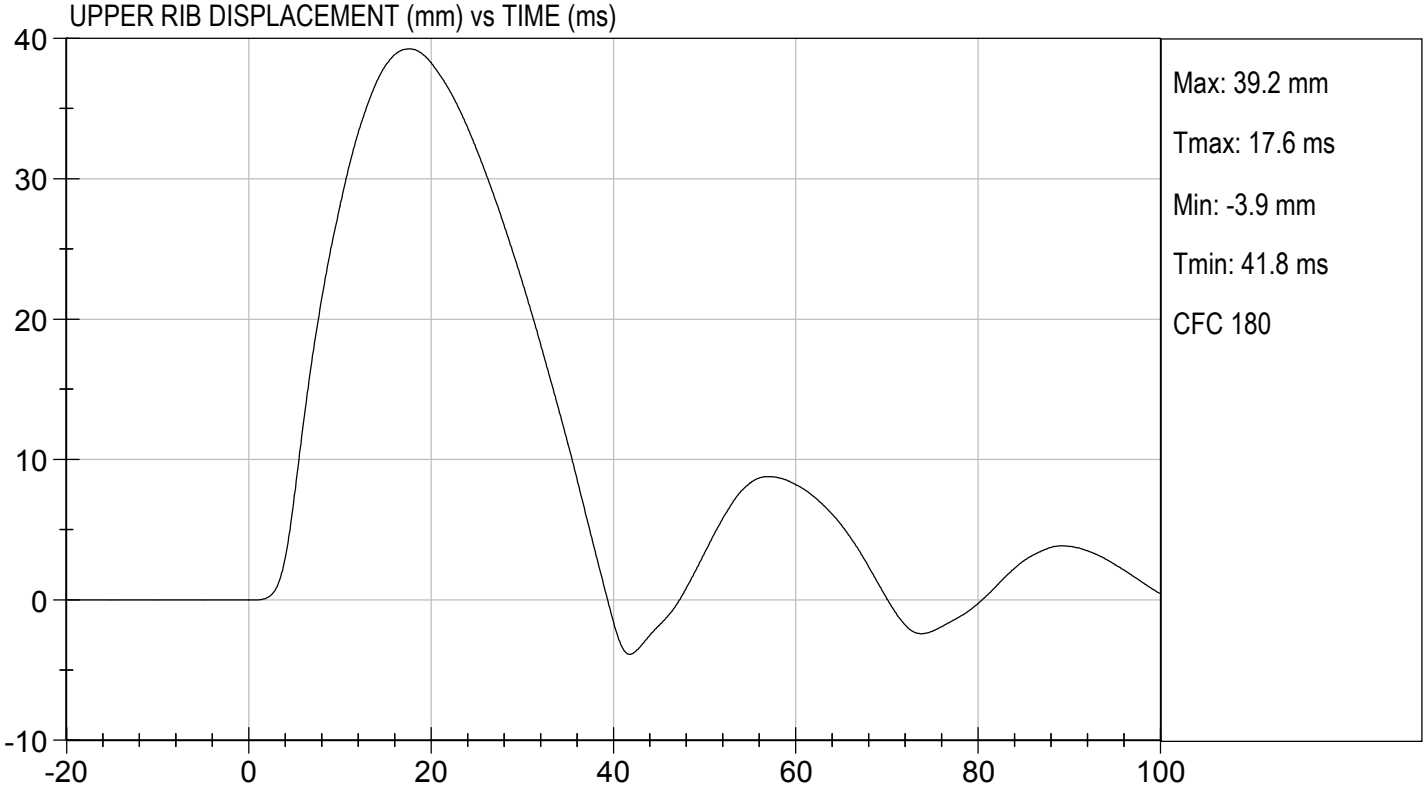
TEST DESC: THORAX IMPACT
VELOCITY: 18.12 ft/s, 5.52 m/s

TEST DATE: 11/14/2019
TEST #: D193570

IMPACTOR FORCE (N) vs TIME (ms)



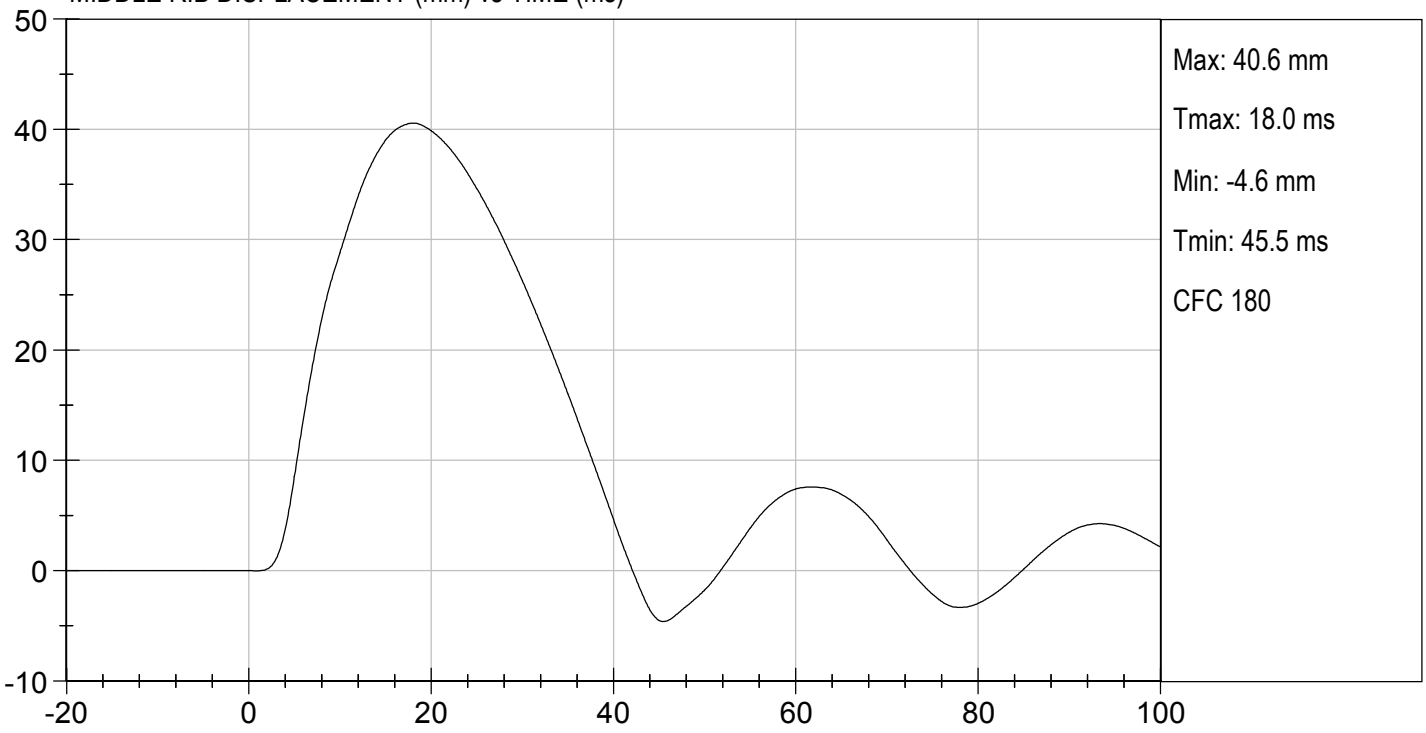
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



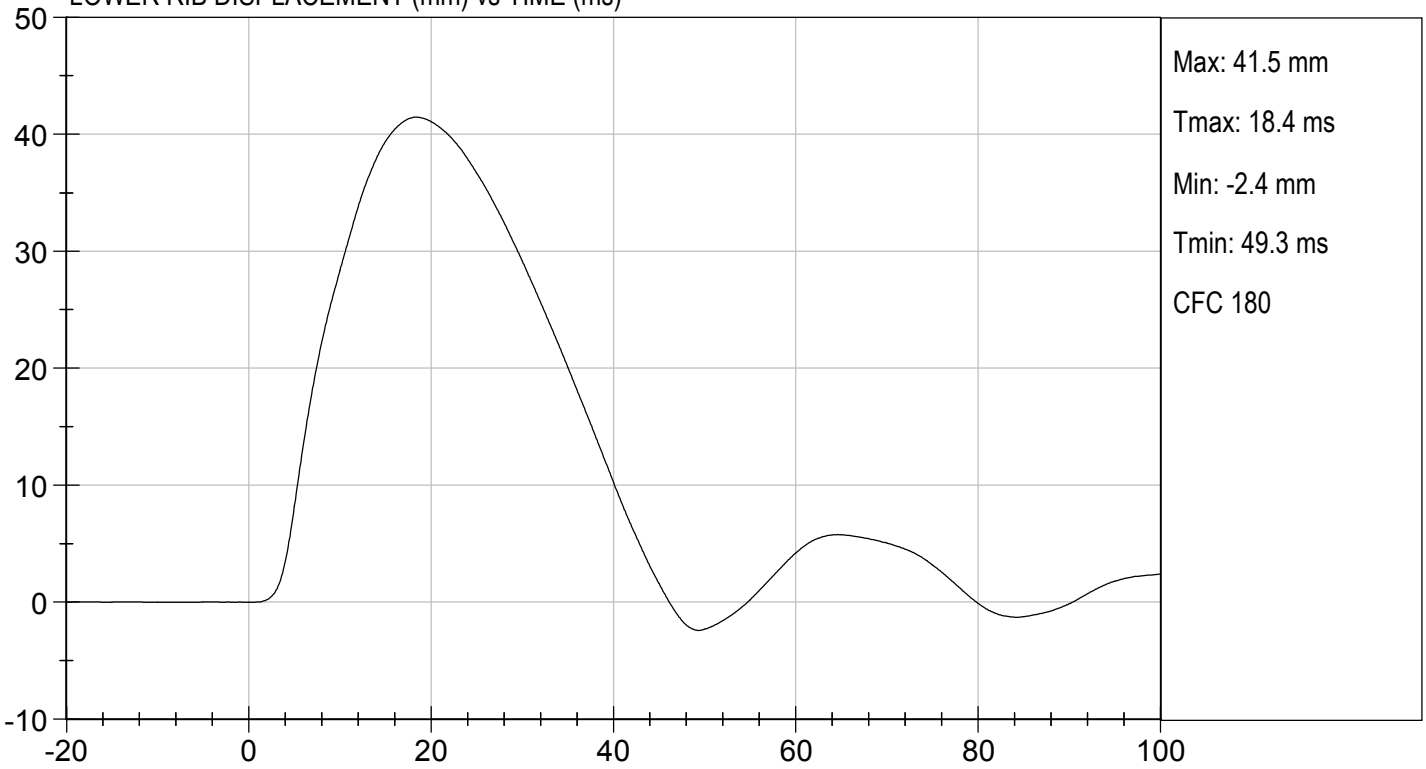
TEST DESC: THORAX IMPACT
VELOCITY: 18.12 ft/s, 5.52 m/s

TEST DATE: 11/14/2019
TEST #: D193570

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:** D193641

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	125 to 155	136	Pass
Peak Longitudinal Acceleration	G's	<= +/- 15.0	7.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

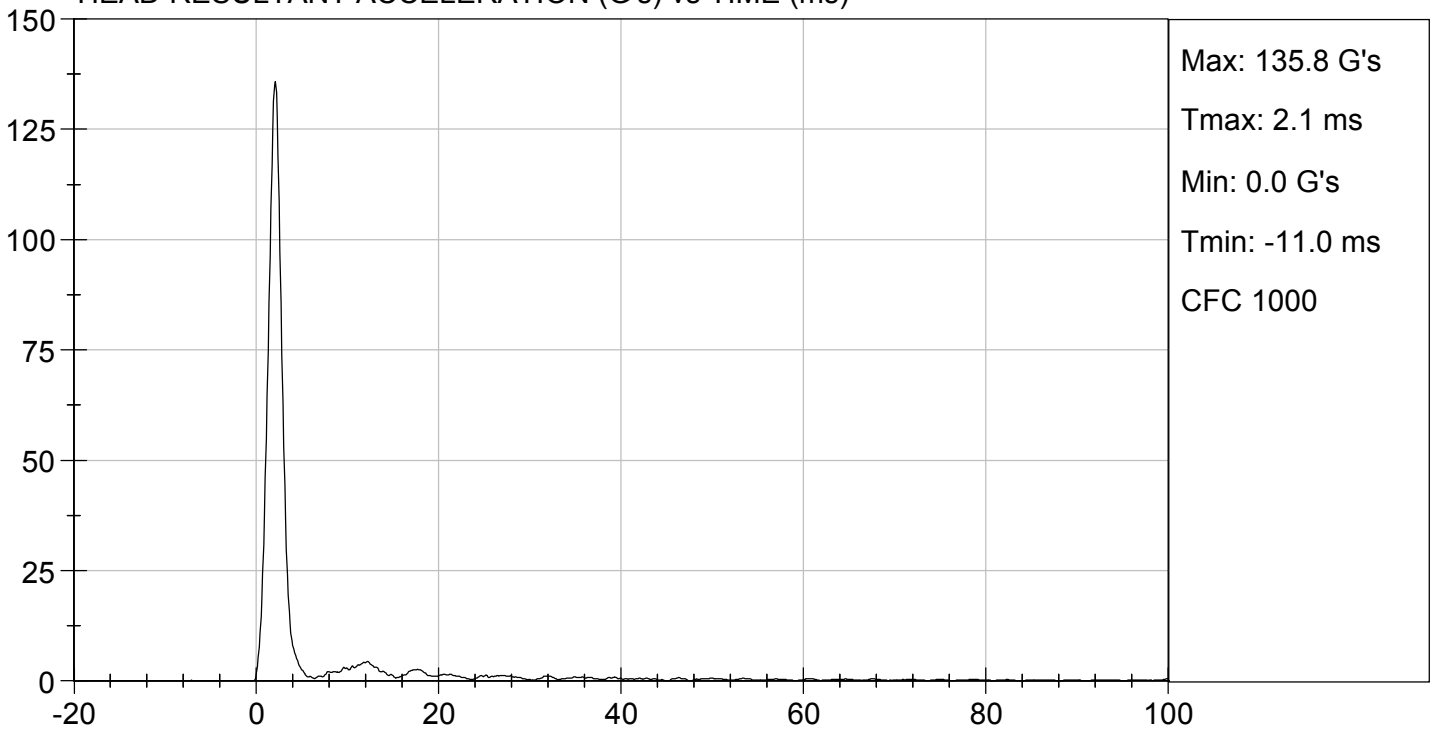
11/25/2019
Test Date

Approved By

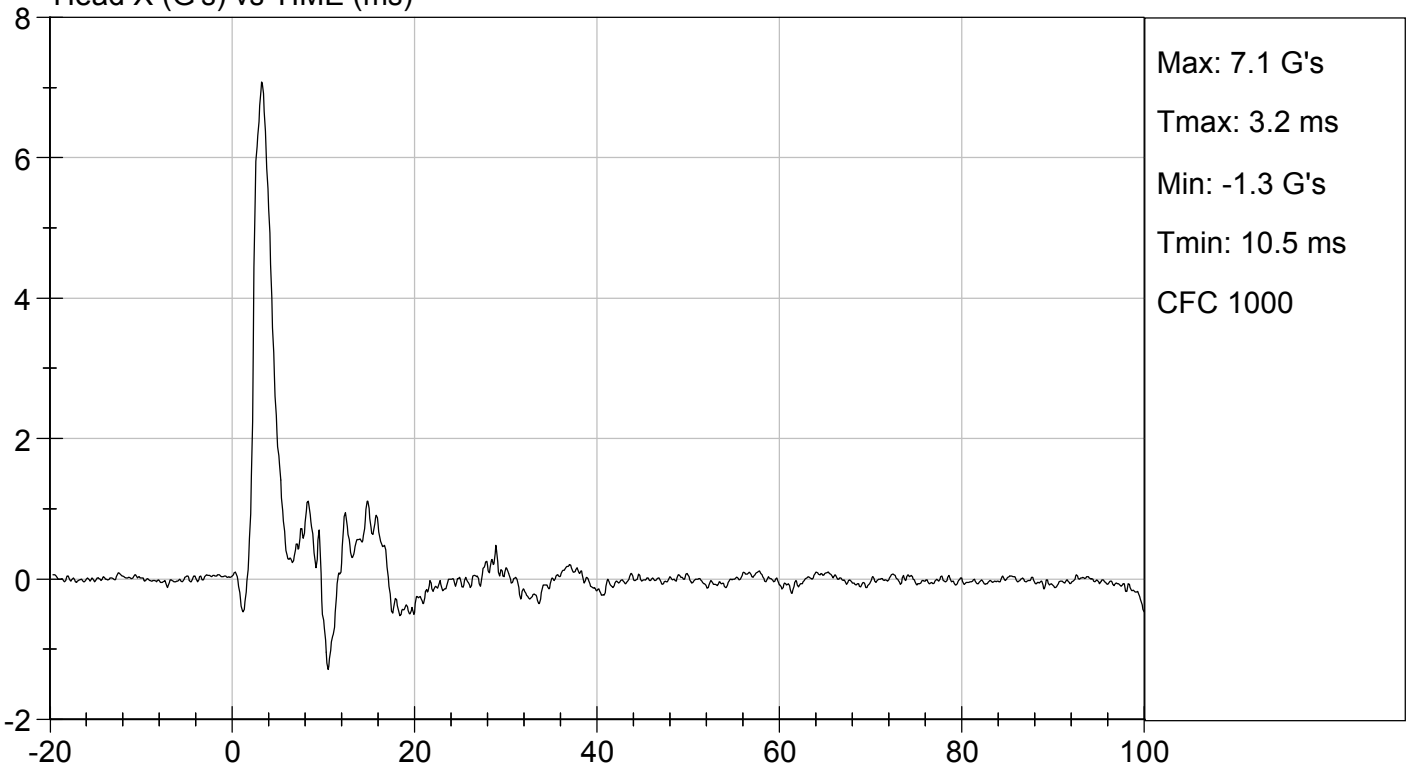
TEST DESC: HEAD DROP

TEST DATE: 11/25/2019
TEST #: D193641

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

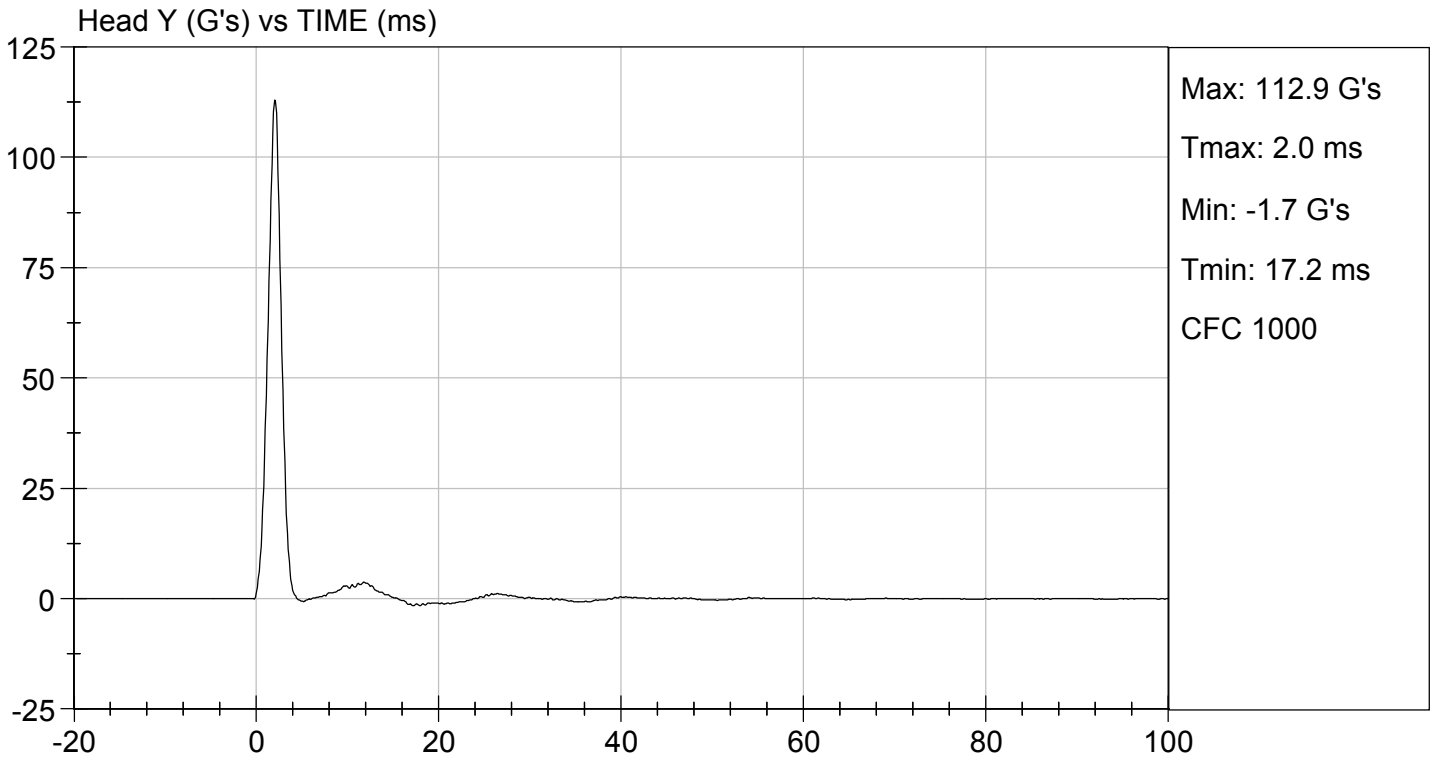


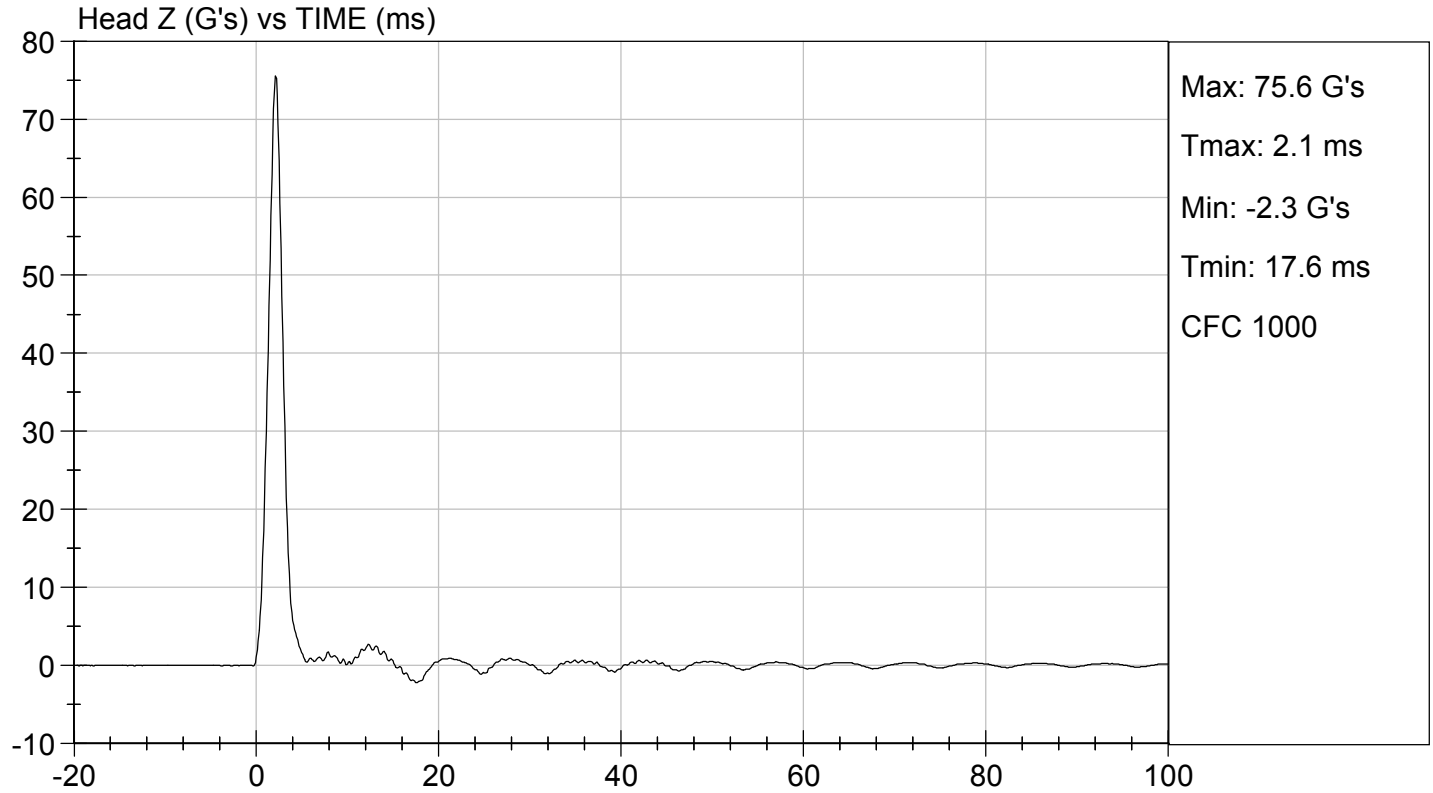
Head X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 11/25/2019
TEST #: D193641





MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193642

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	26	Pass
Pendulum Speed		m/s	3.30 to 3.50	3.50	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.00	Pass
	3 ms	m/s	-0.25 to -0.375	-0.35	Pass
	14 ms	m/s	-3.20 to -3.70	-3.58	Pass
	17 ms	m/s	>= -3.70	-3.41	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	49.4	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	55.1	Pass
Head Rotation Decay Time to 0 Degree		ms	53.0 to 88.0	65.6	Pass
			Overall Results		Pass

Laboratory Technician

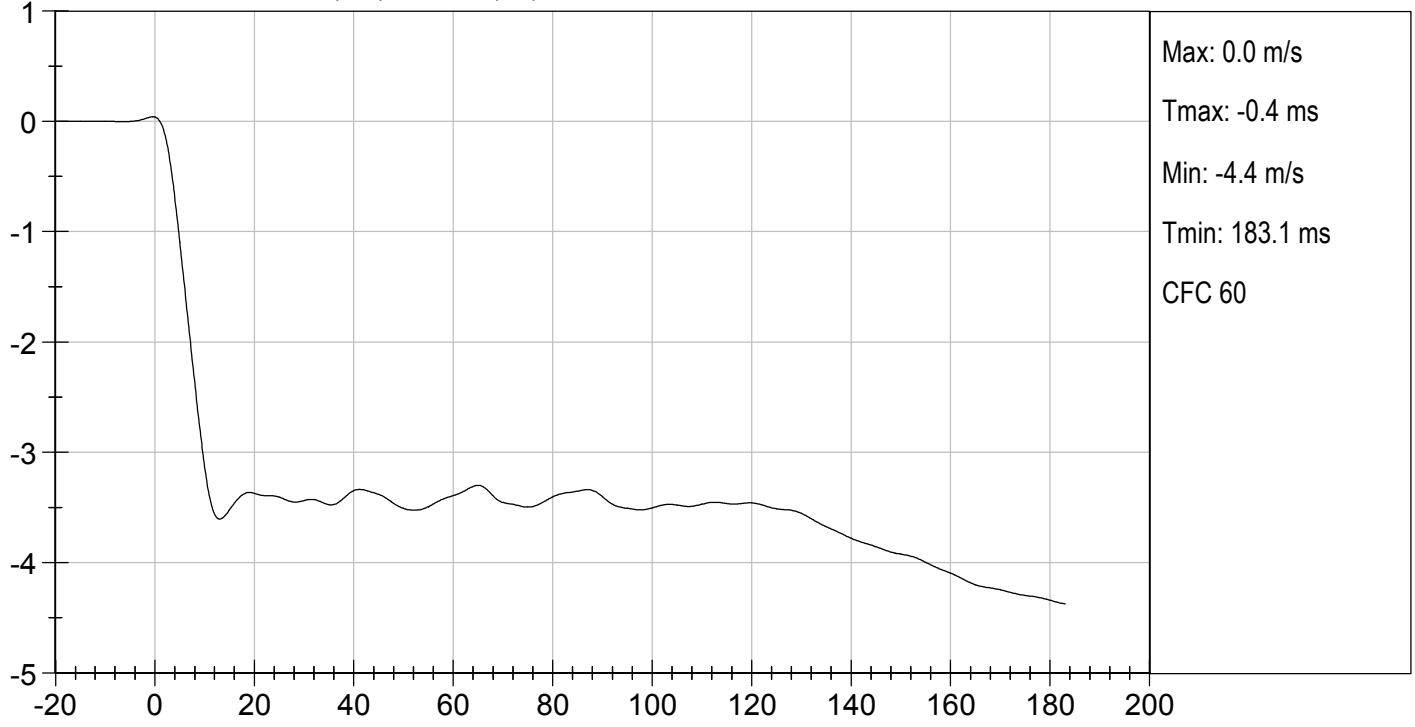
11/25/2019
Test Date

Approved By

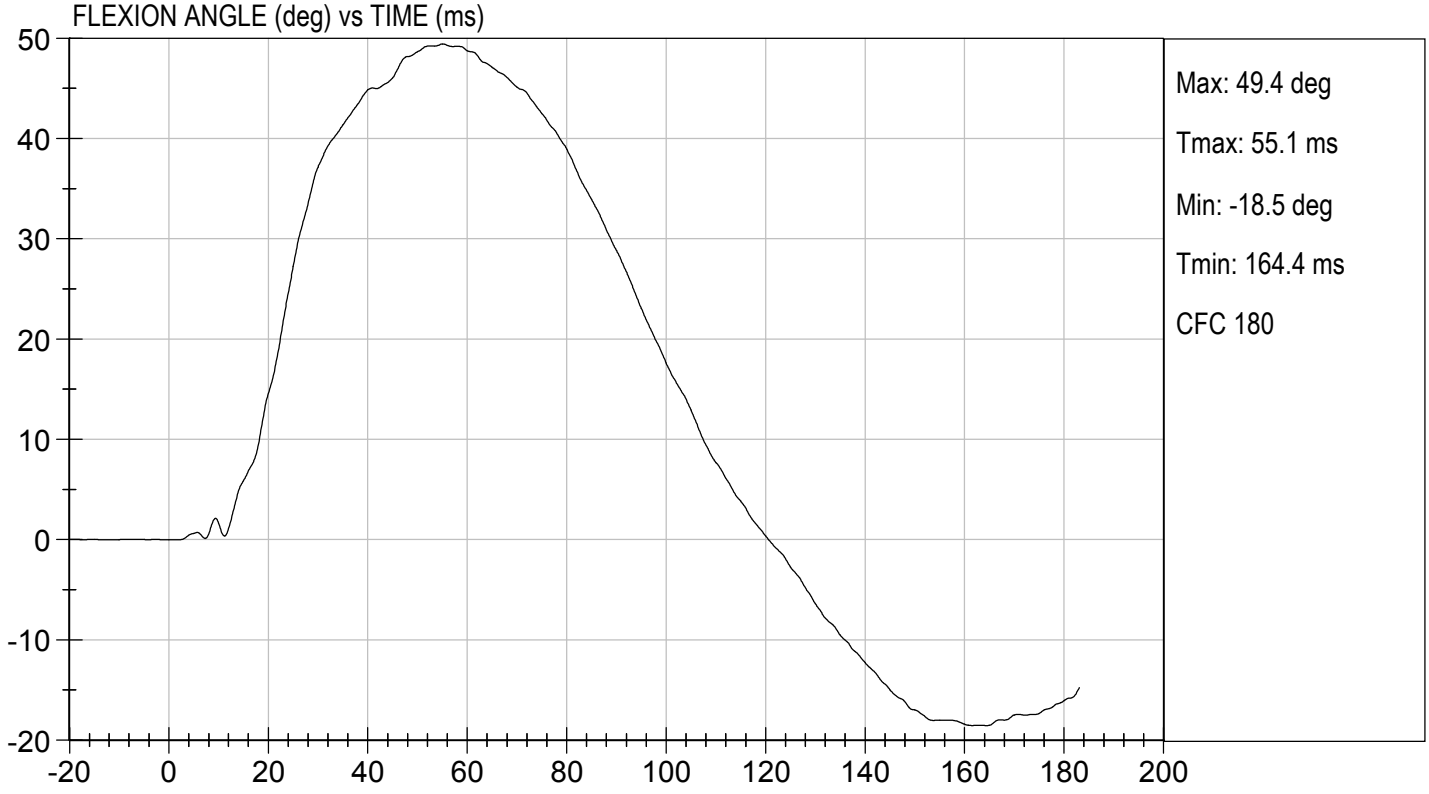
TEST DESC: NECK BENDING
VELOCITY: 11.48 ft/s, 3.50 m/s

TEST DATE: 11/25/2019
TEST #: D193642

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



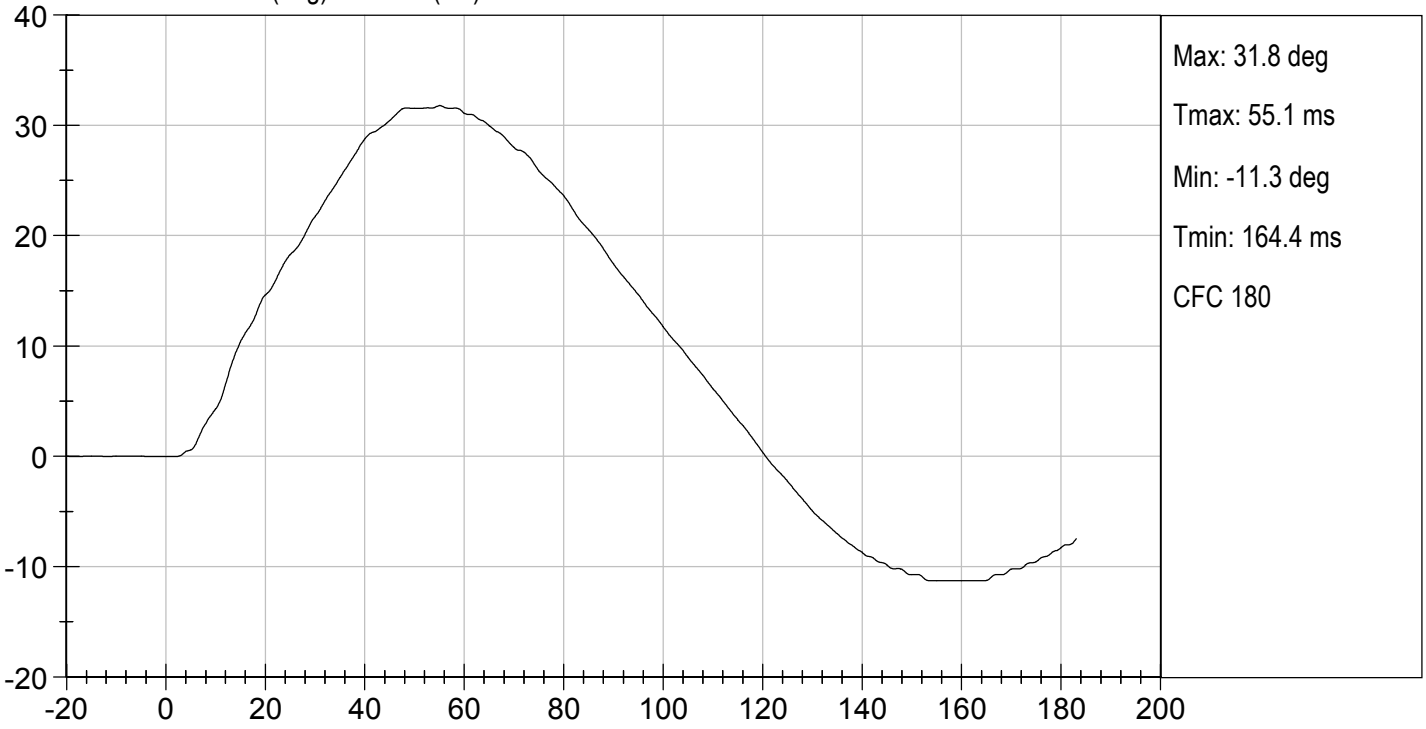
FLEXION ANGLE (deg) vs TIME (ms)



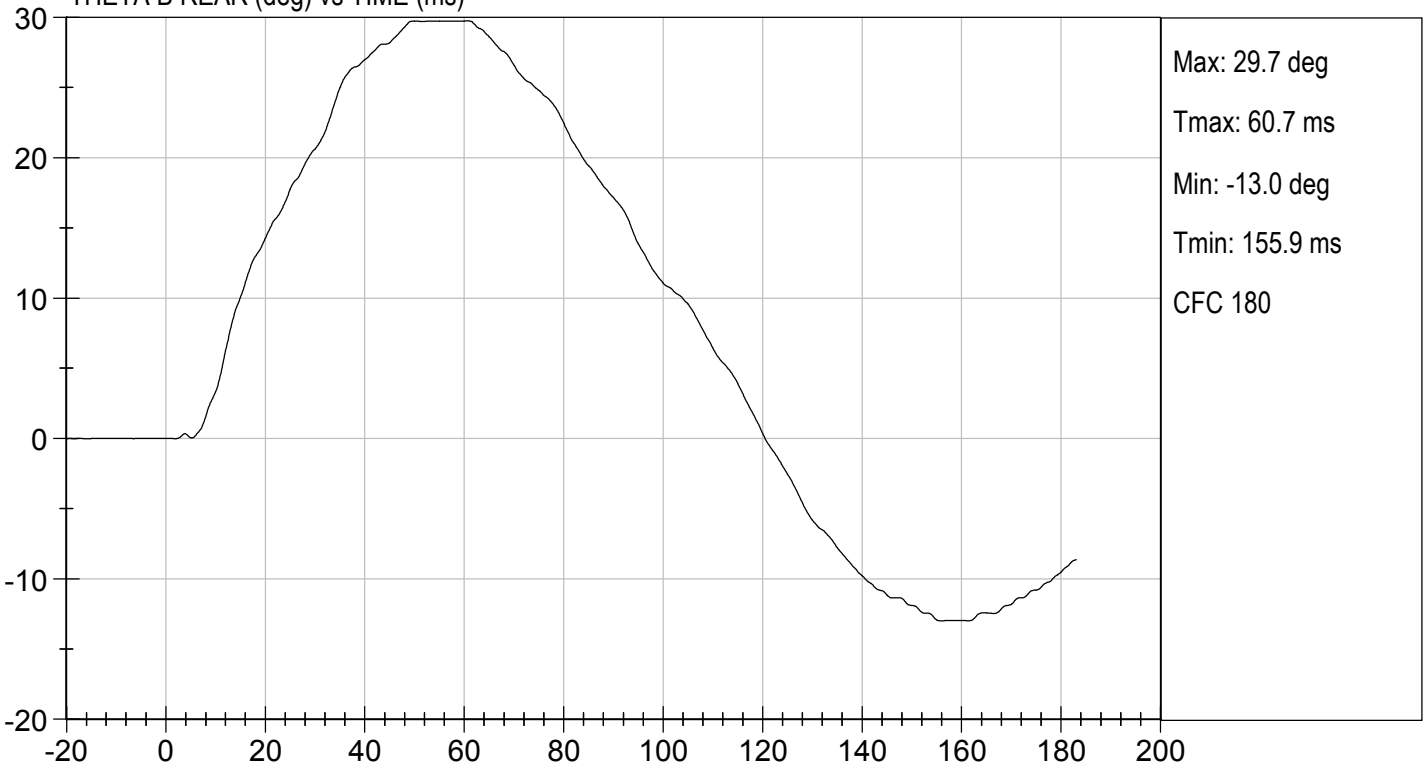
TEST DESC: NECK BENDING
VELOCITY: 11.48 ft/s, 3.50 m/s

TEST DATE: 11/25/2019
TEST #: D193642

THETA A FRONT (deg) vs TIME (ms)

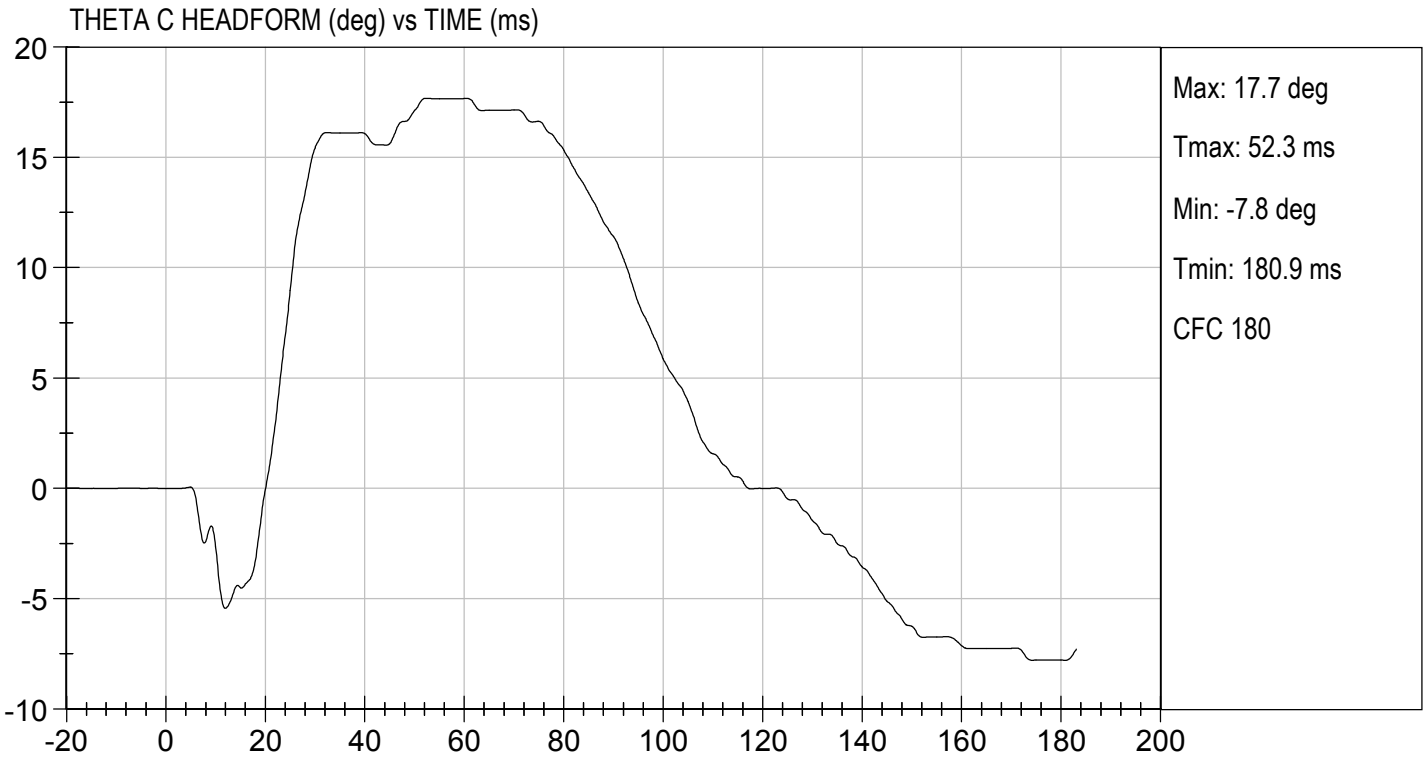


THETA B REAR (deg) vs TIME (ms)



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

TEST DATE: 11/25/2019
TEST #: D193642



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193643

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Pendulum Speed	m/s	4.20 to 4.40	4.23	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	8.6	Pass
		Overall Test Results		Pass

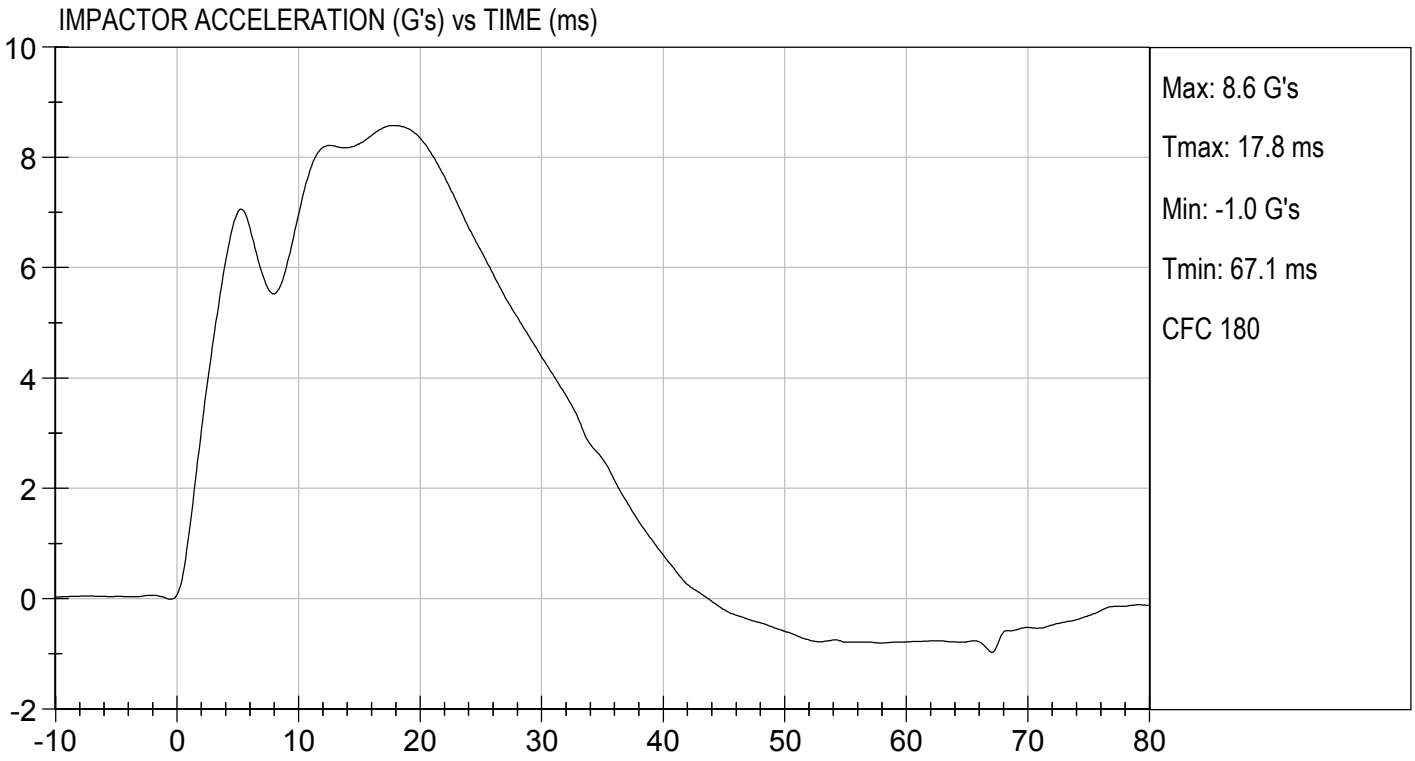
Laboratory Technician

11/21/2019
Test Date

Approved By

TEST DESC: SHOULDER IMPACT
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 11/21/2019
TEST #: D193643



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193644

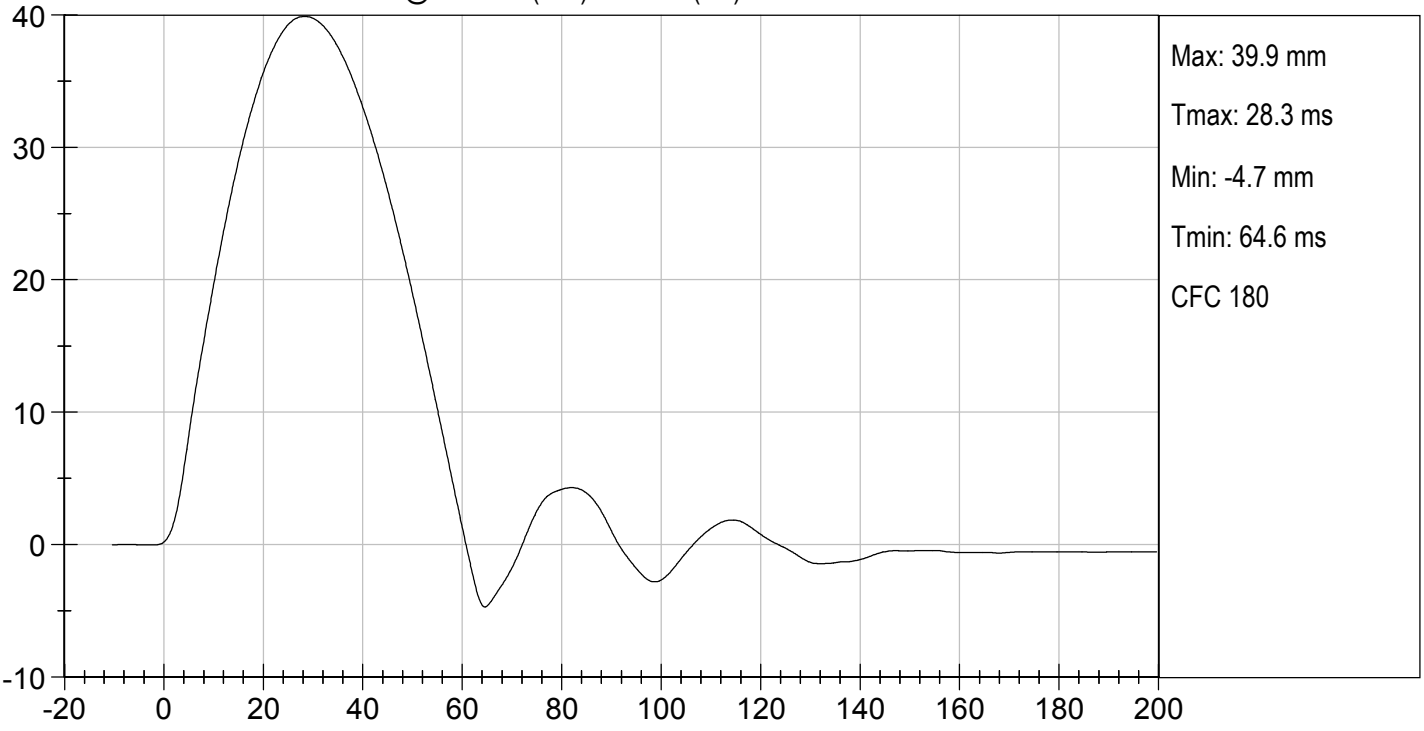
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Displacement at 459 mm	mm	36.0 to 40.0	39.9	Pass
Displacement at 815 mm	mm	46.0 to 51.0	50.5	Pass
		Overall Test Results		Pass

Laboratory Technician

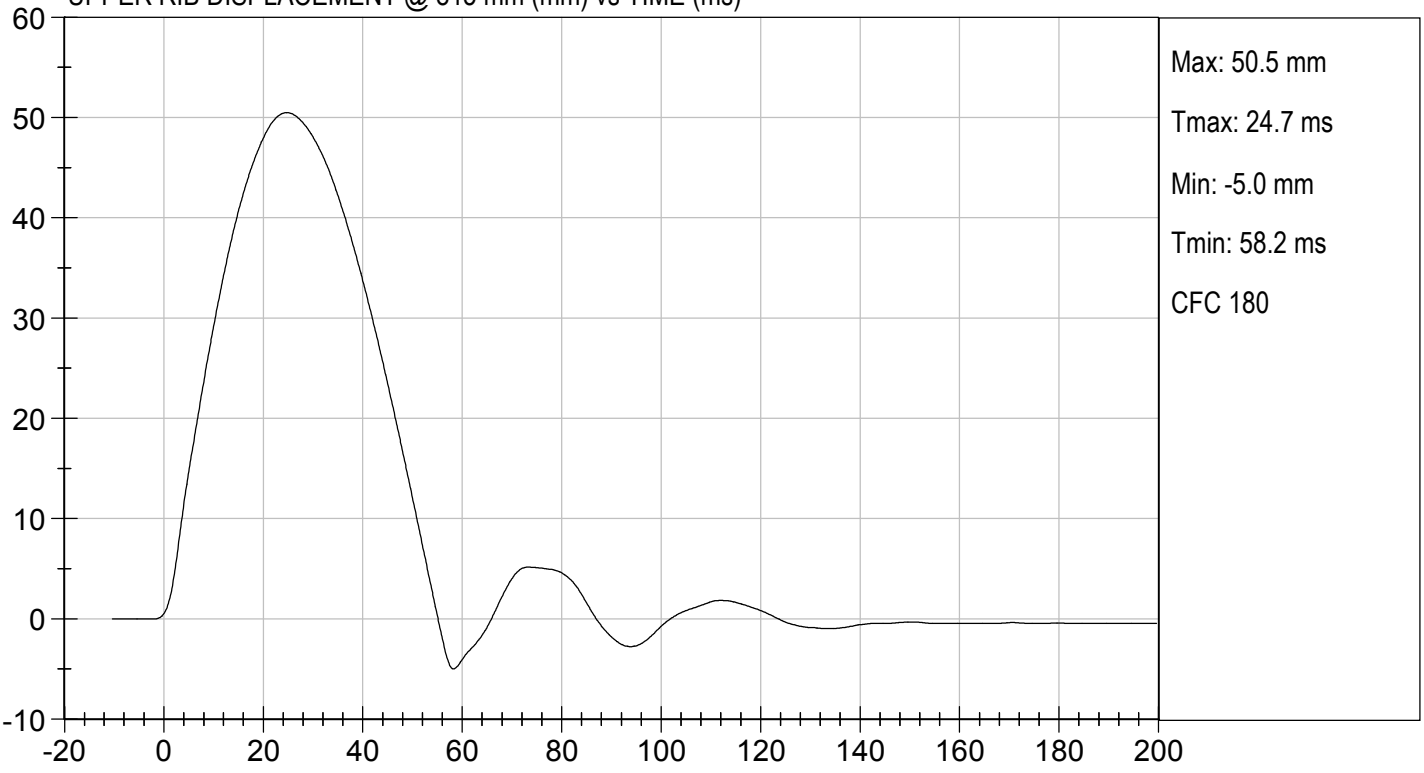
11/25/2019
Test Date

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:** D193645

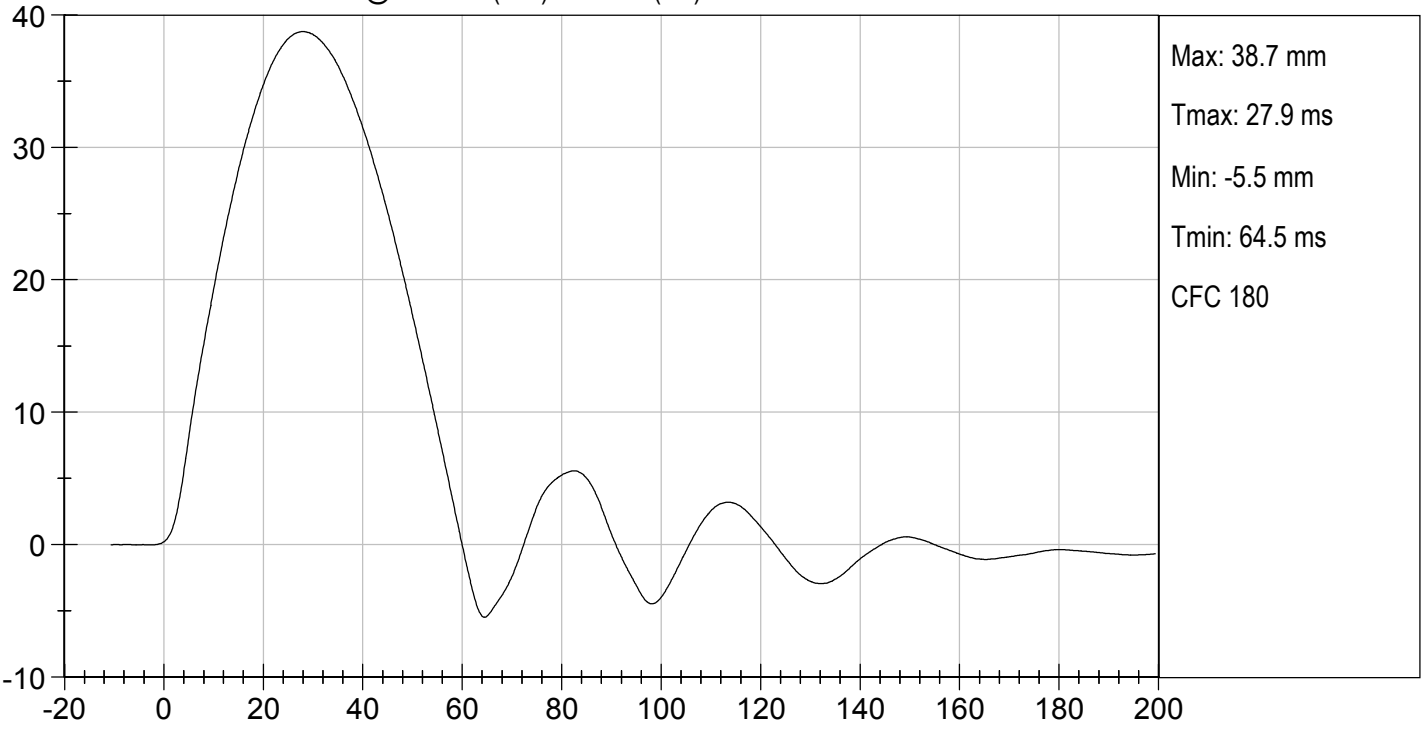
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Displacement at 459 mm	mm	36.0 to 40.0	38.7	Pass
Displacement at 815 mm	mm	46.0 to 51.0	47.8	Pass
		Overall Test Results		Pass

Laboratory Technician

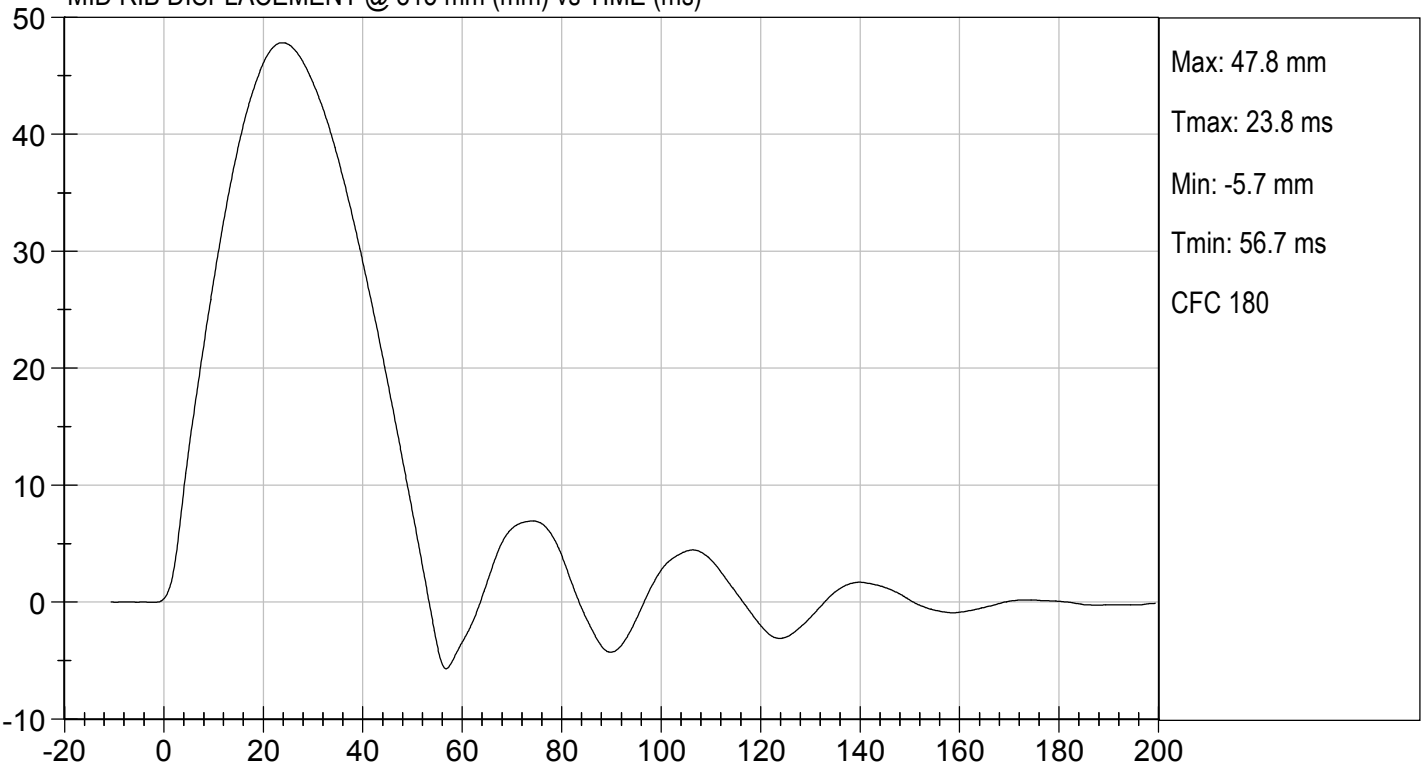
11/25/2019
Test Date

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:** D193646

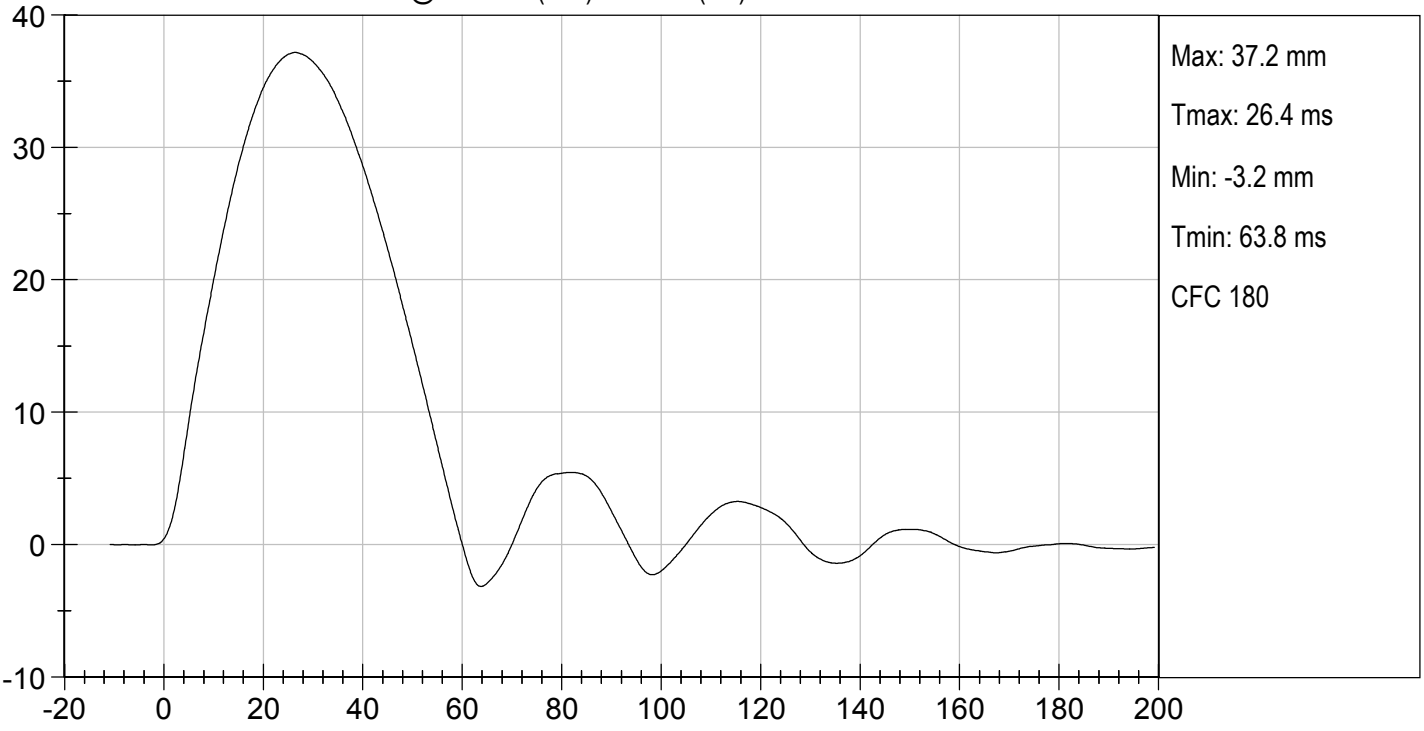
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Displacement at 459 mm	mm	36.0 to 40.0	37.2	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.2	Pass
		Overall Test Results		Pass

Laboratory Technician

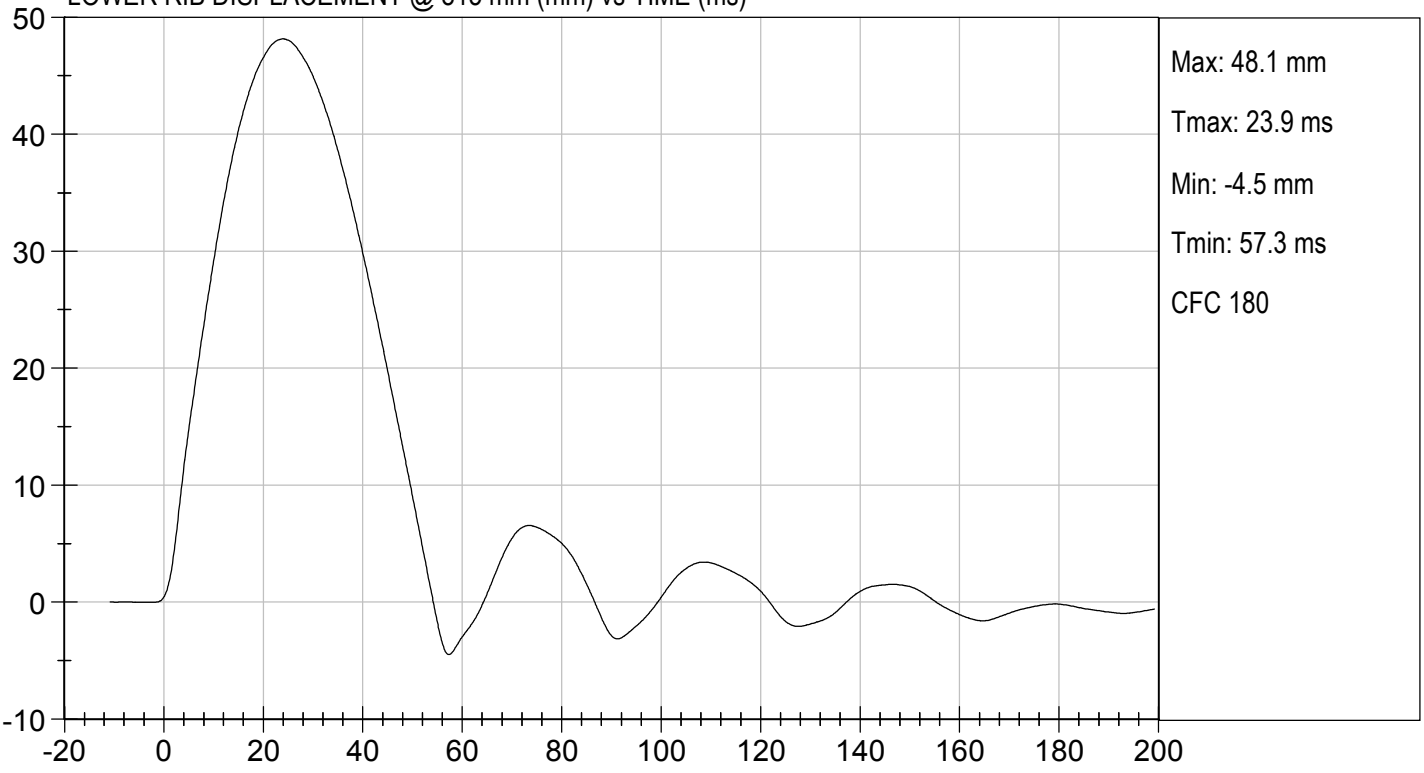
11/25/2019
Test Date

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:** D193647

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	24	Pass
Probe Speed	m/s	3.90 to 4.10	4.10	Pass
Maximum Impactor Force	N	4000 to 4800	4389	Pass
Time of Maximum Impactor Force	ms	10.6 to 13.0	10.8	Pass
Maximum Total Abdomen Force	N	2200 to 2700	2411	Pass
Time of Maximum Abdomen Force	ms	10.0 to 12.3	11.0	Pass
		Overall Test Results		Pass

Laboratory Technician

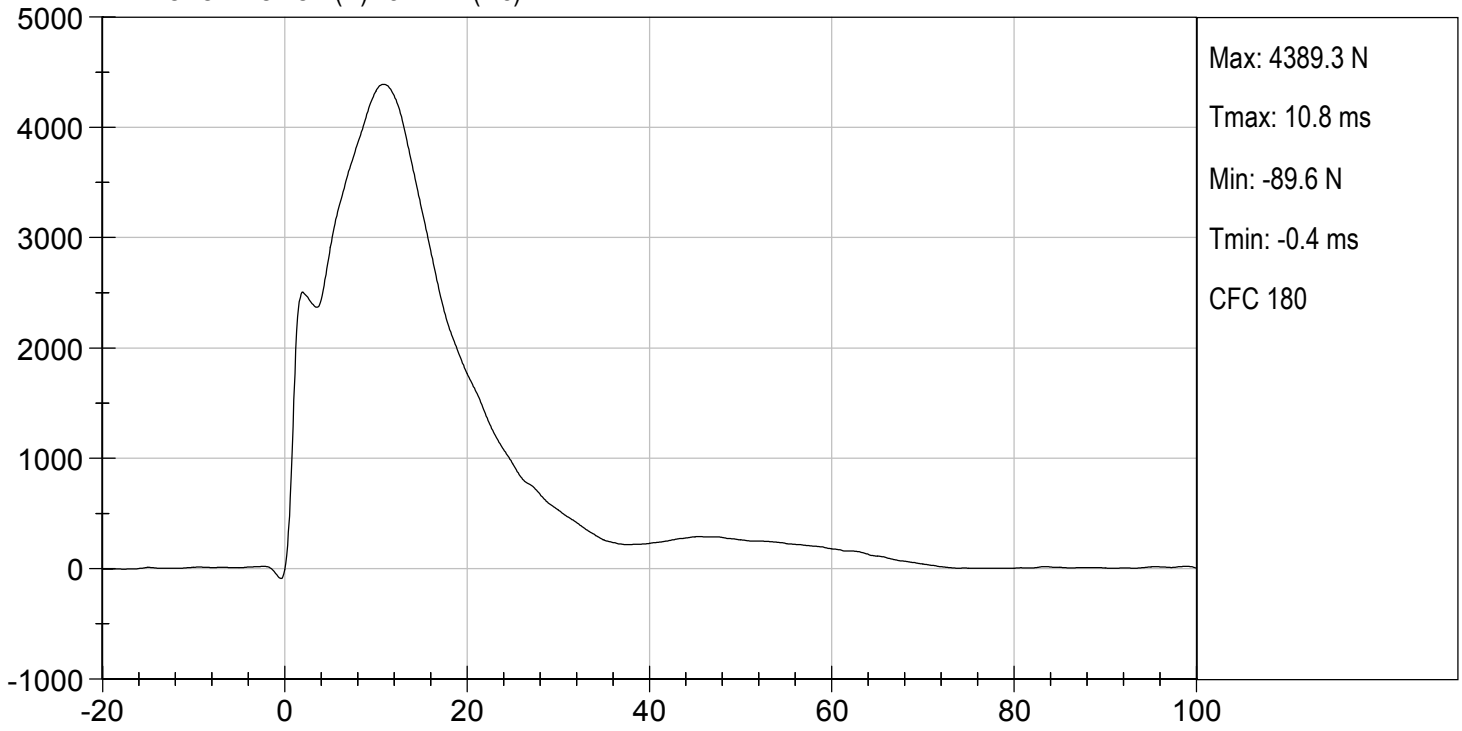
11/22/2019
Test Date

Approved By

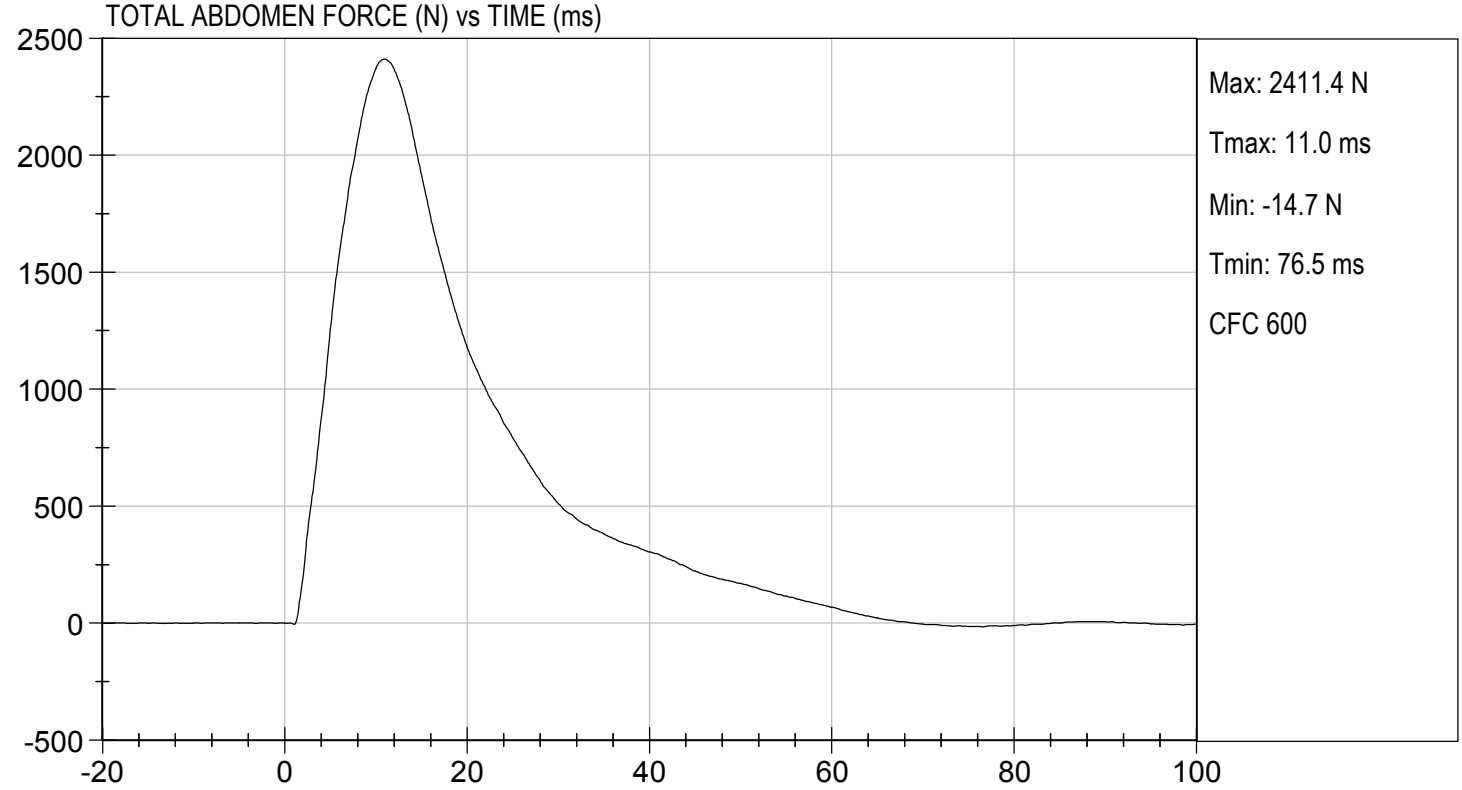
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 11/22/2019
TEST #: D193647

IMPACTOR FORCE (N) vs TIME (ms)



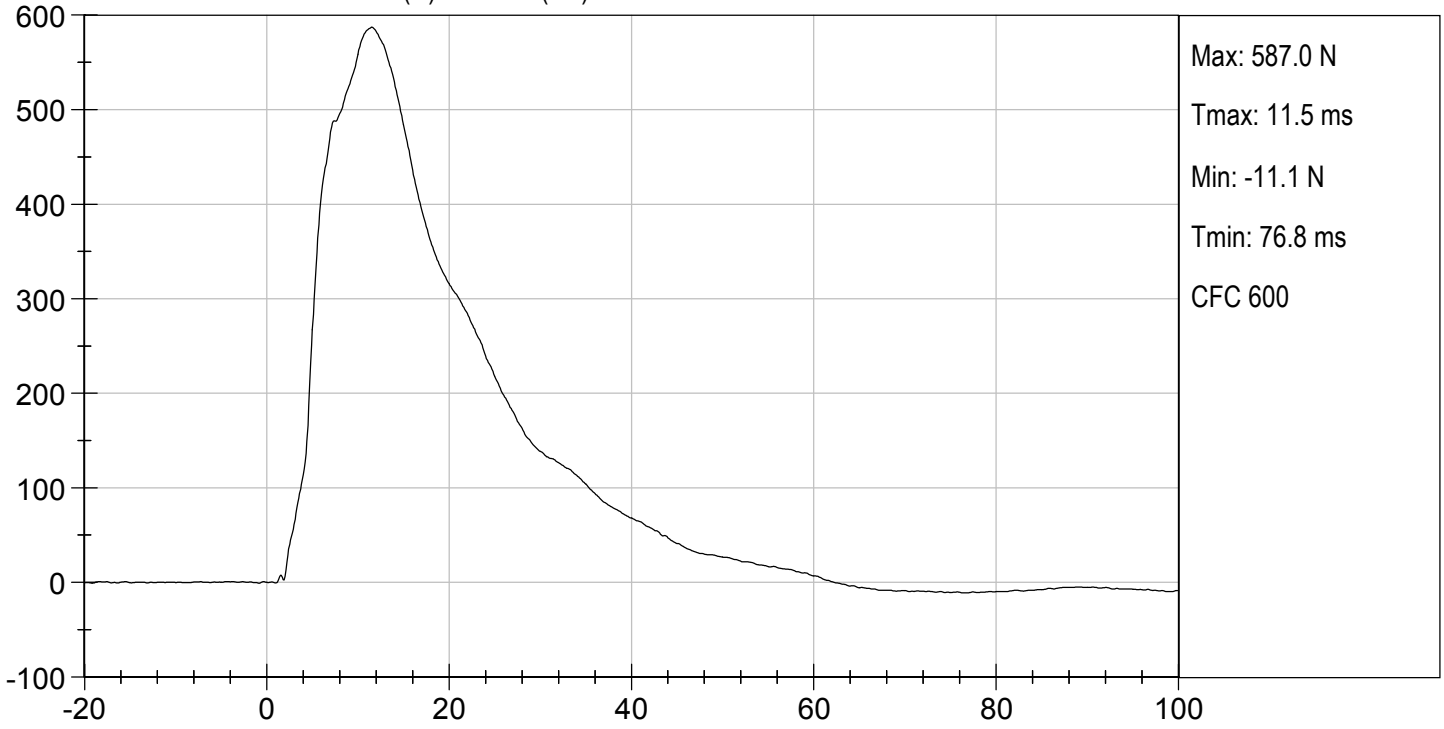
TOTAL ABDOMEN FORCE (N) vs TIME (ms)



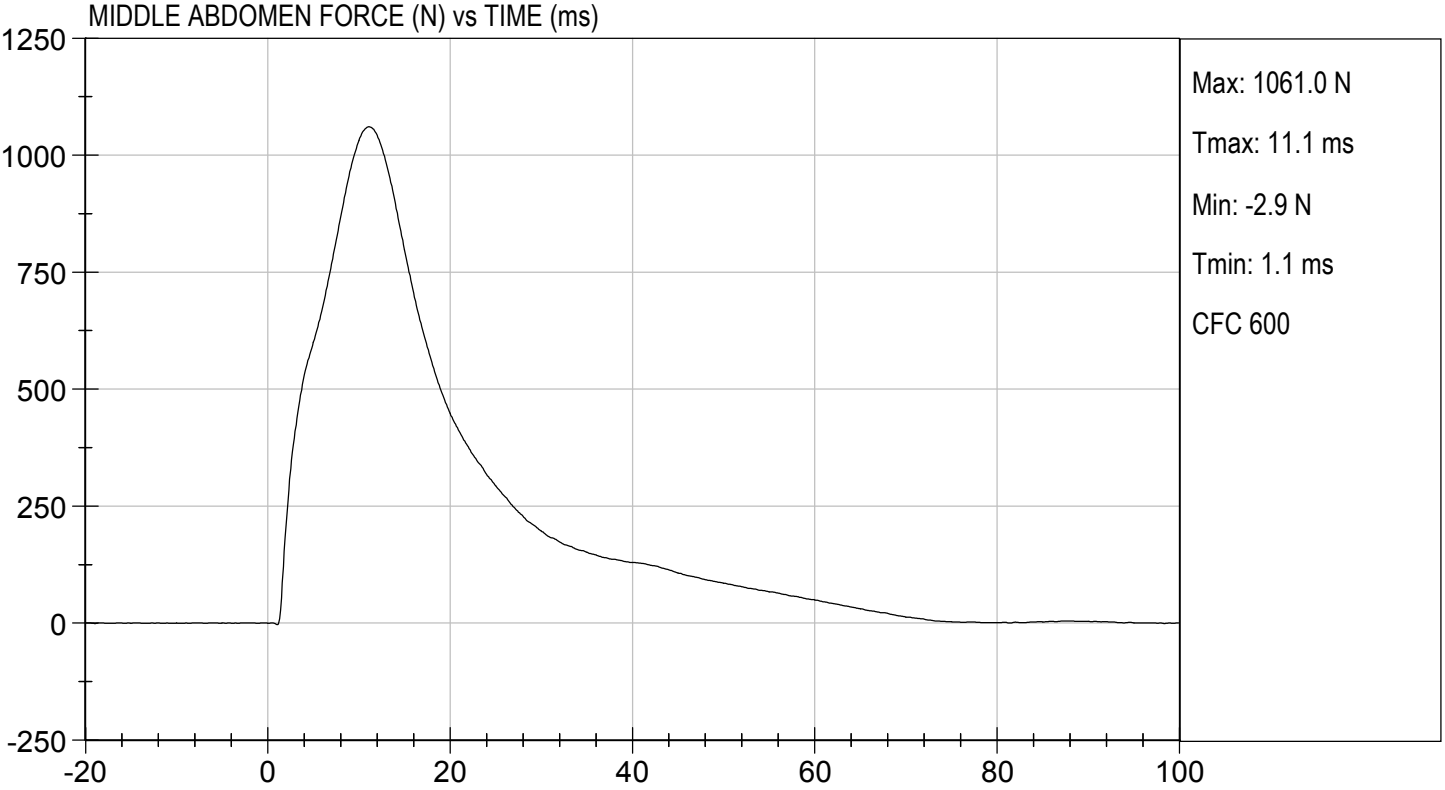
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 11/22/2019
TEST #: D193647

FRONT ABDOMEN FORCE (N) vs TIME (ms)



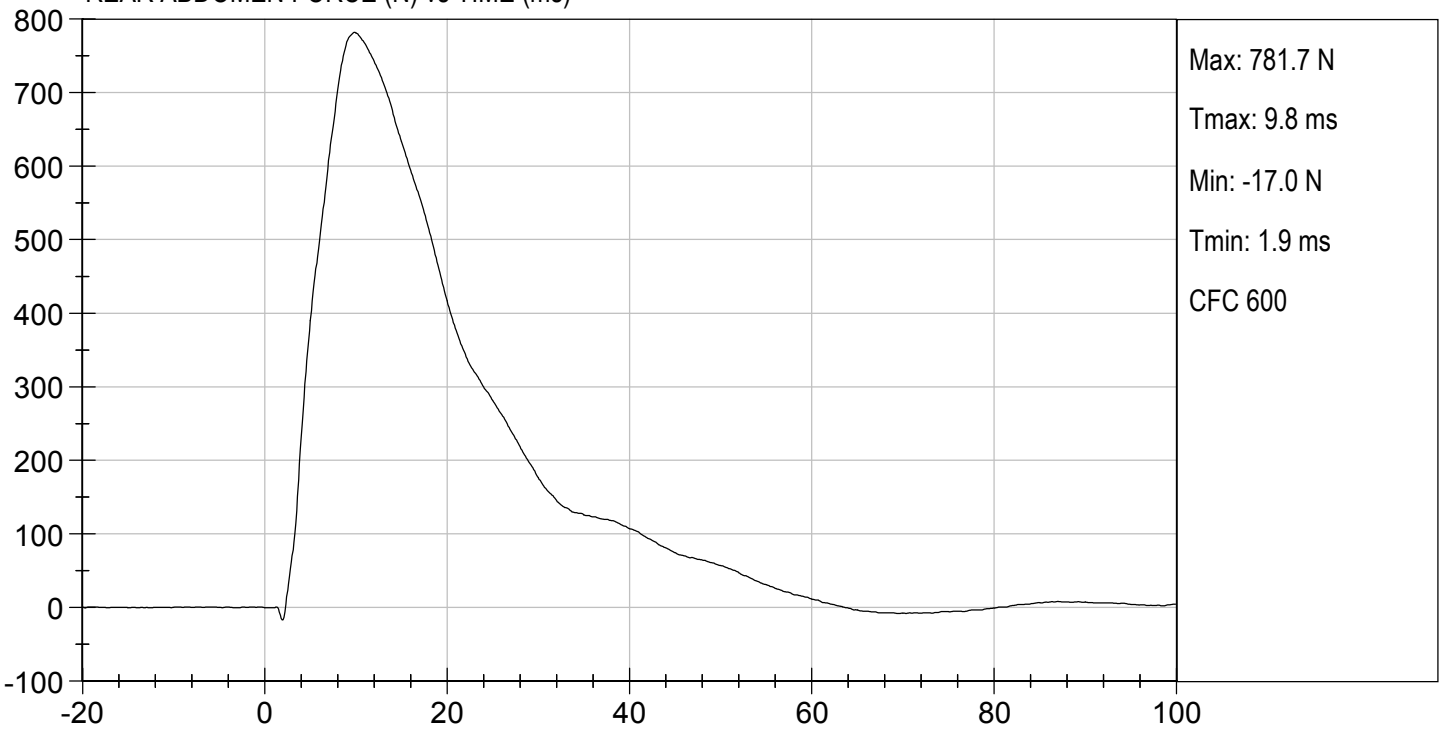
MIDDLE ABDOMEN FORCE (N) vs TIME (ms)



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

TEST DATE: 11/22/2019
TEST #: D193647

REAR ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193648

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	26	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	-0.422	Pass
	27 ms	m/s	-6.50 to -5.80	-5.99	Pass
	30 ms	m/s	>= -6.50	-5.82	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.0	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	44.3	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	40	Pass
			Overall Results		Pass

Laboratory Technician

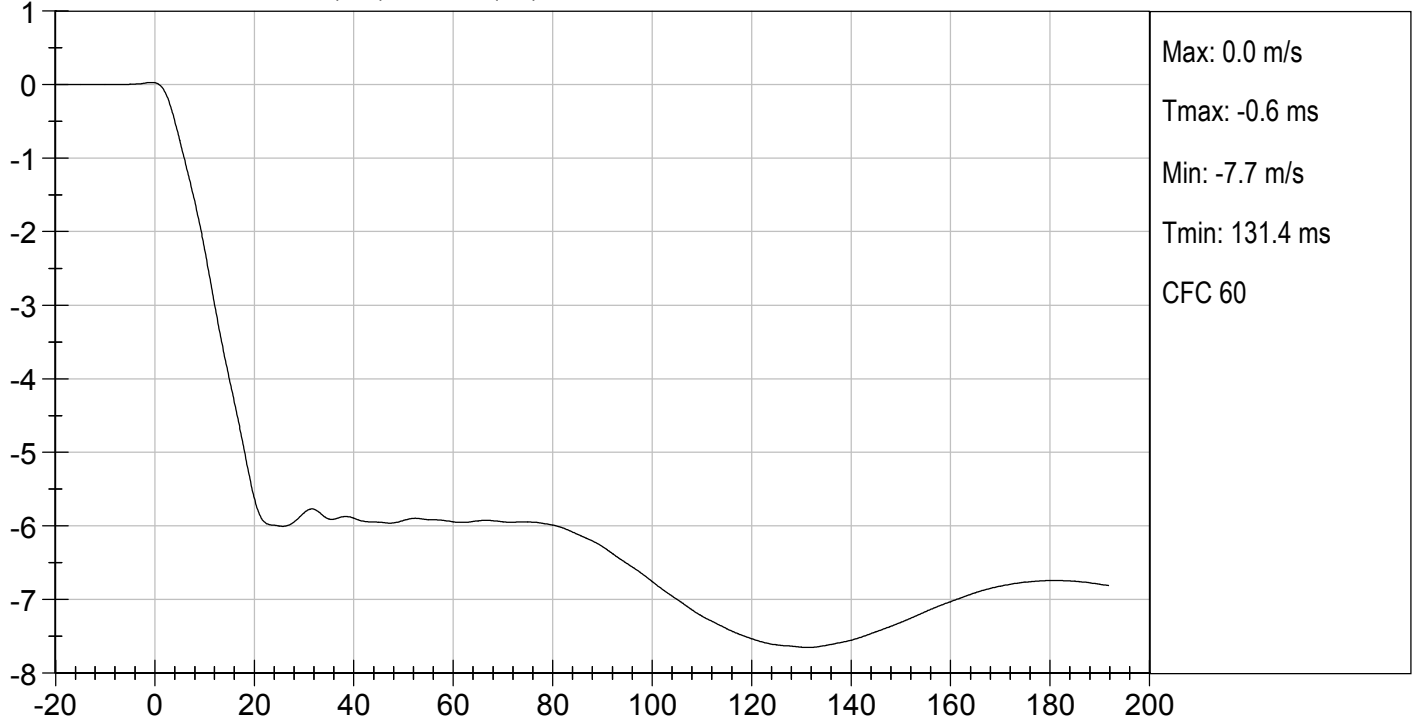
11/25/2019
Test Date

Approved By

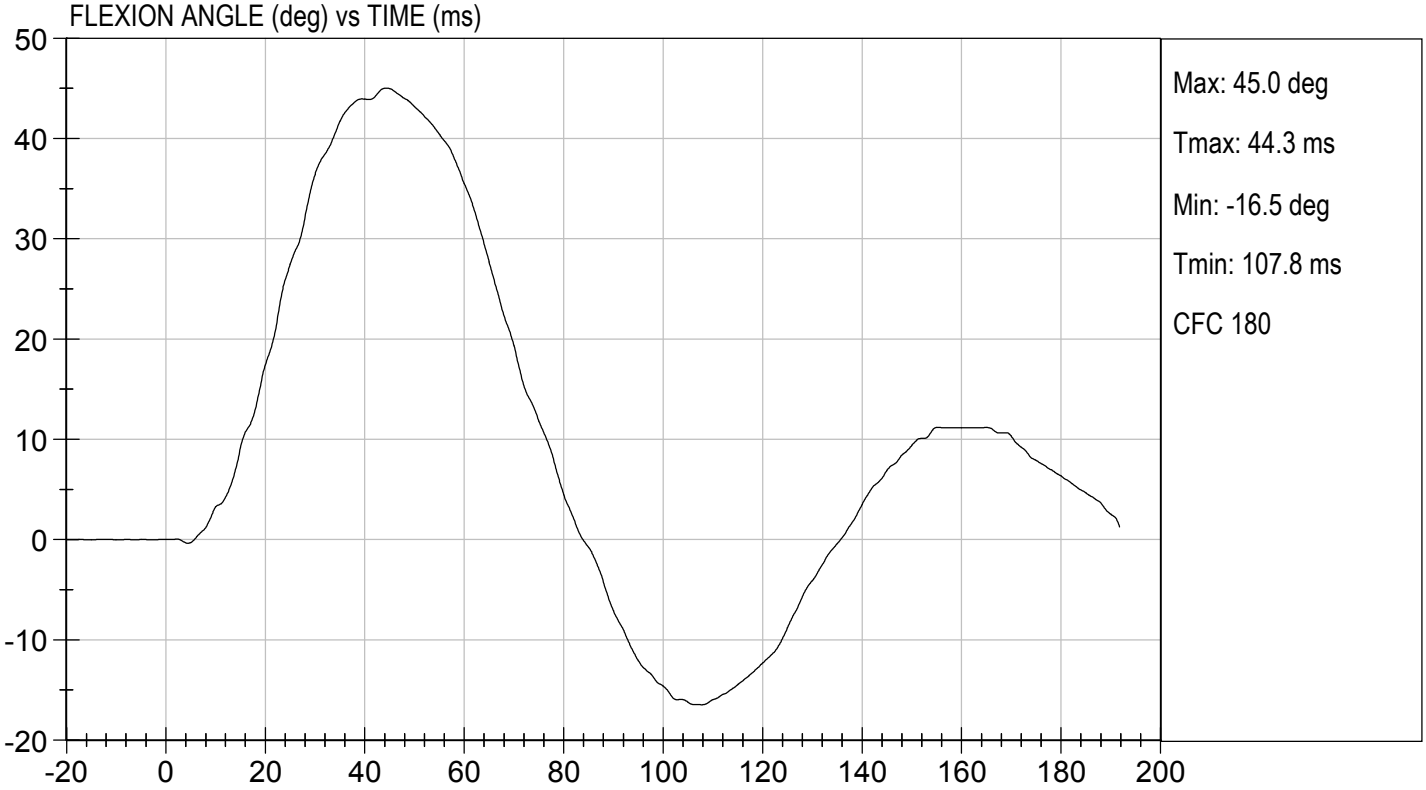
TEST DESC: LUMBAR BENDING
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 11/25/2019
TEST #: D193648

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



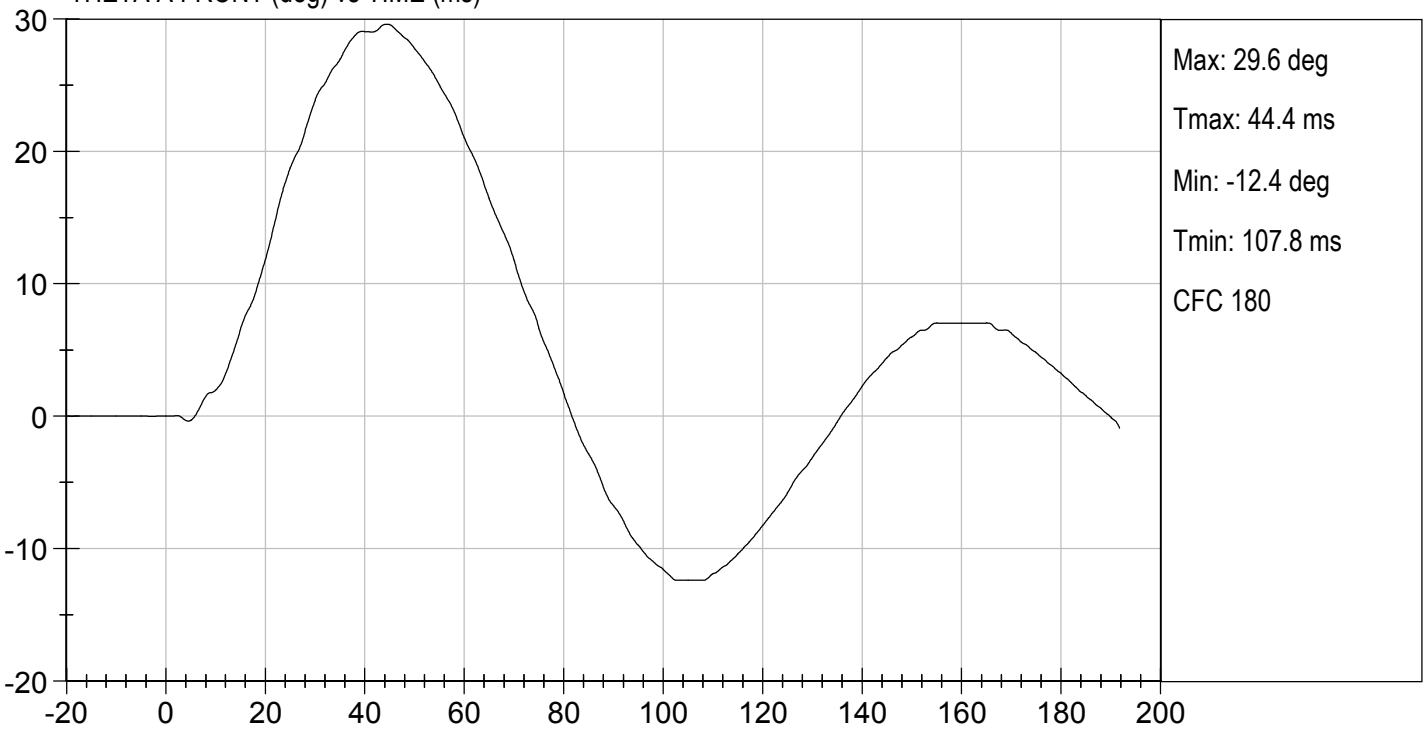
FLEXION ANGLE (deg) vs TIME (ms)



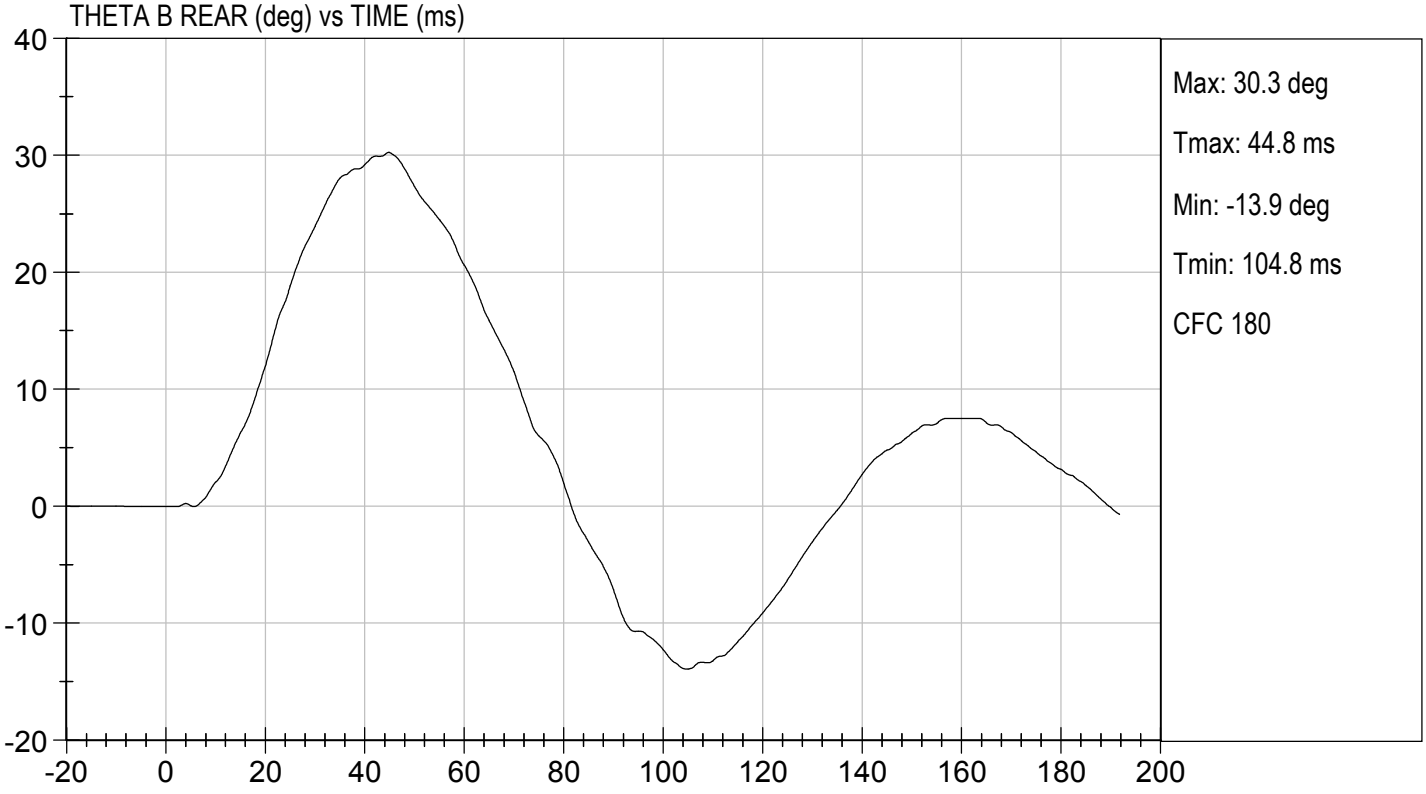
TEST DESC: LUMBAR BENDING
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 11/25/2019
TEST #: D193648

THETA A FRONT (deg) vs TIME (ms)

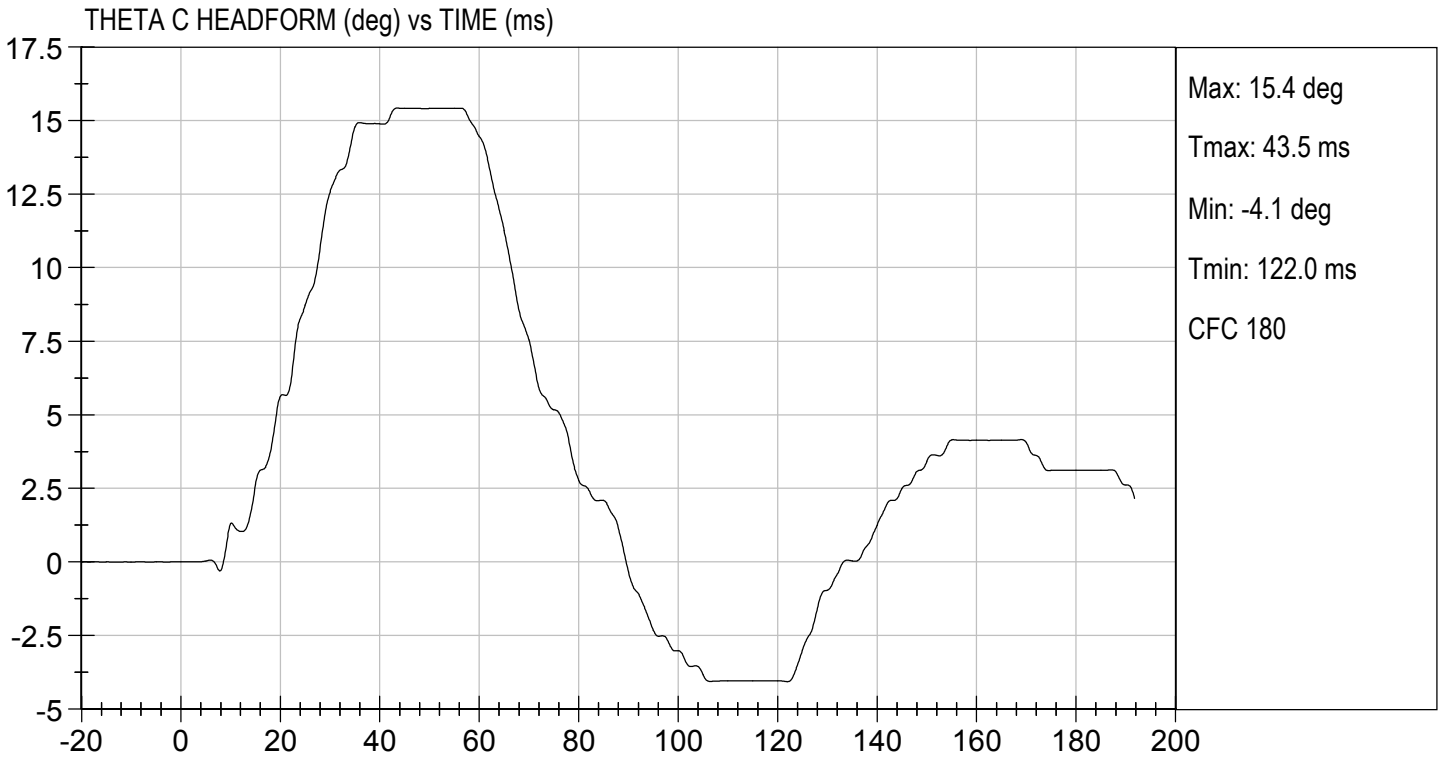


THETA B REAR (deg) vs TIME (ms)



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

TEST DATE: 11/25/2019
TEST #: D193648



MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D193649

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	24	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	N	4700 to 5400	5168	Pass
Time of Maximum Impactor Force	ms	11.8 to 16.1	12.5	Pass
Maximum Pubic Force	N	1230 to 1590	1376	Pass
Time of Maximum Pubic Force	ms	12.2 to 17.0	12.2	Pass
		Overall Test Results		Pass

Laboratory Technician

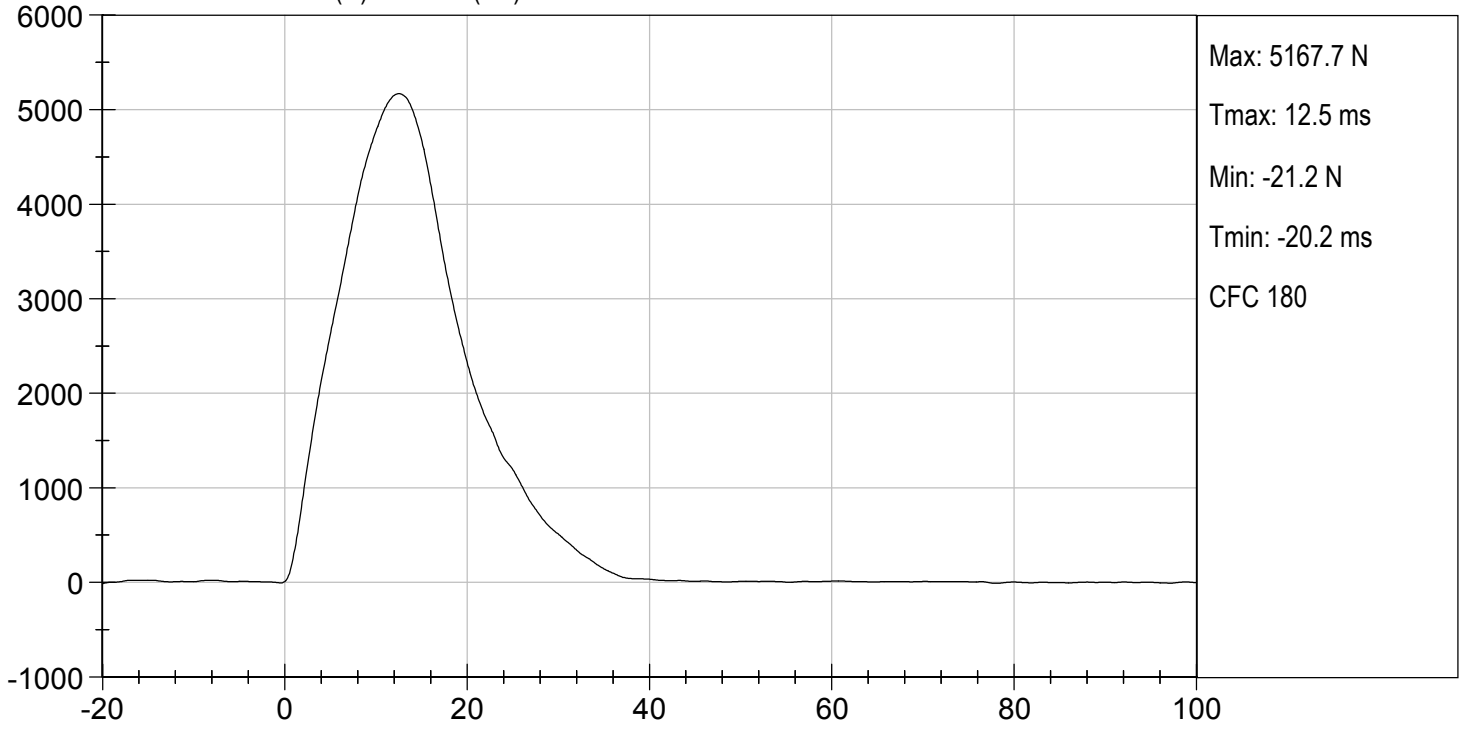
11/22/2019
Test Date

Approved By

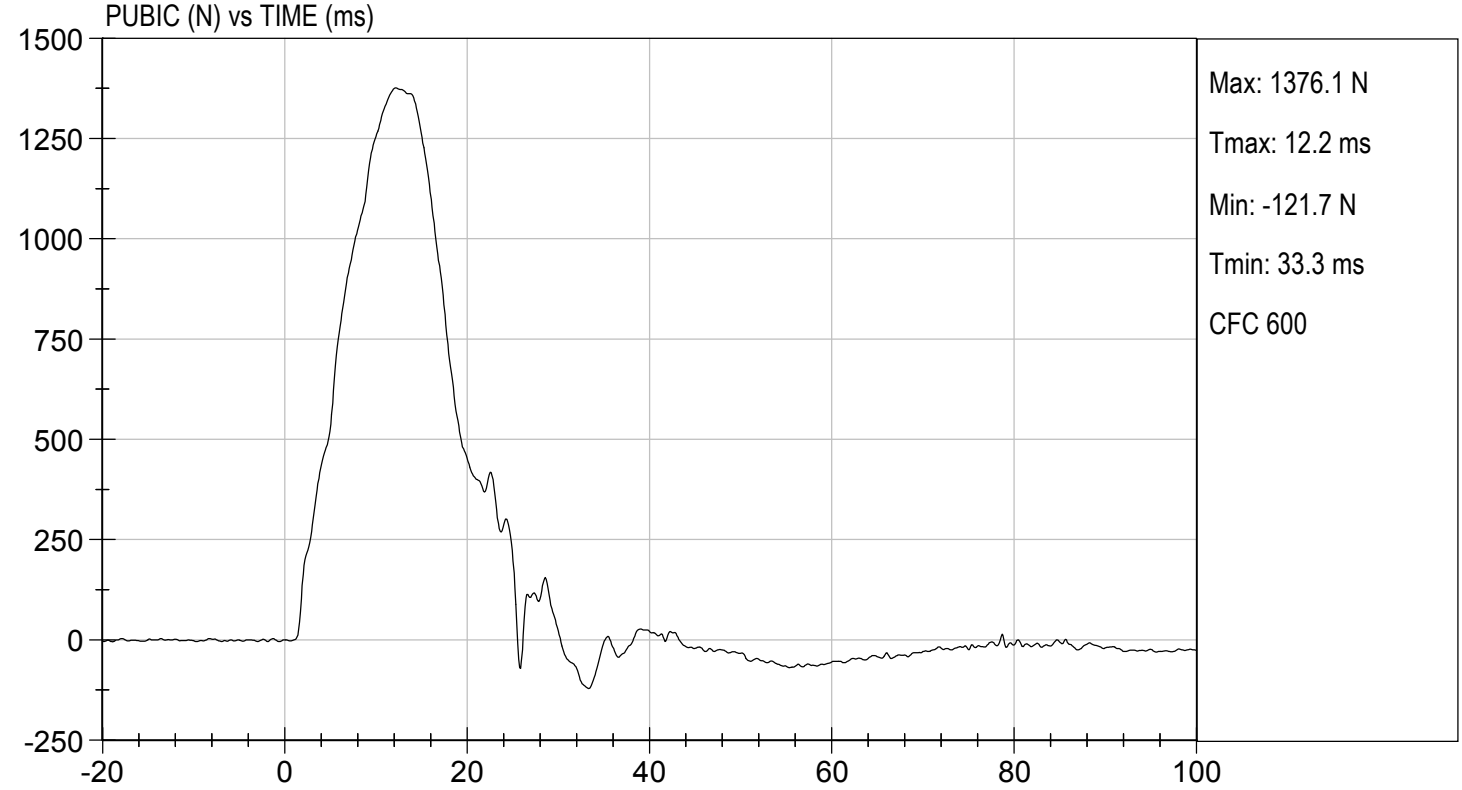
TEST DESC: PELVIS IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 11/22/2019
TEST #: D193649

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:** D193640

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	24	Pass
Probe Speed	m/s	5.40 to 5.60	5.46	Pass
Maximum Impactor Force (after 6 ms)	N	5100 to 6200	5792	Pass
Upper Rib Displacement	mm	34.0 to 41.0	38.3	Pass
Middle Rib Displacement	mm	37.0 to 45.0	40.2	Pass
Lower Rib Displacement	mm	37.0 to 44.0	41.2	Pass
		Overall Test Results		Pass

Laboratory Technician

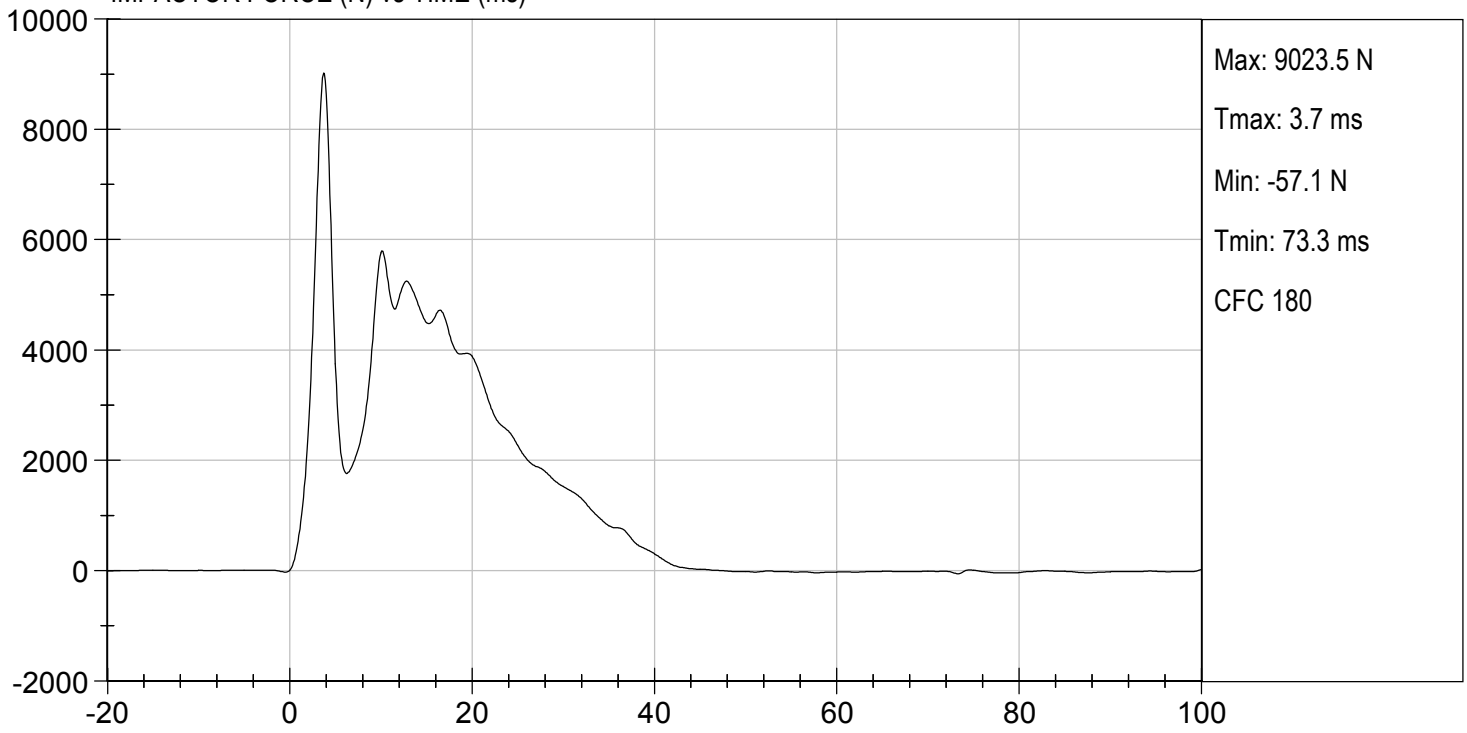
11/22/2019
Test Date

Approved By

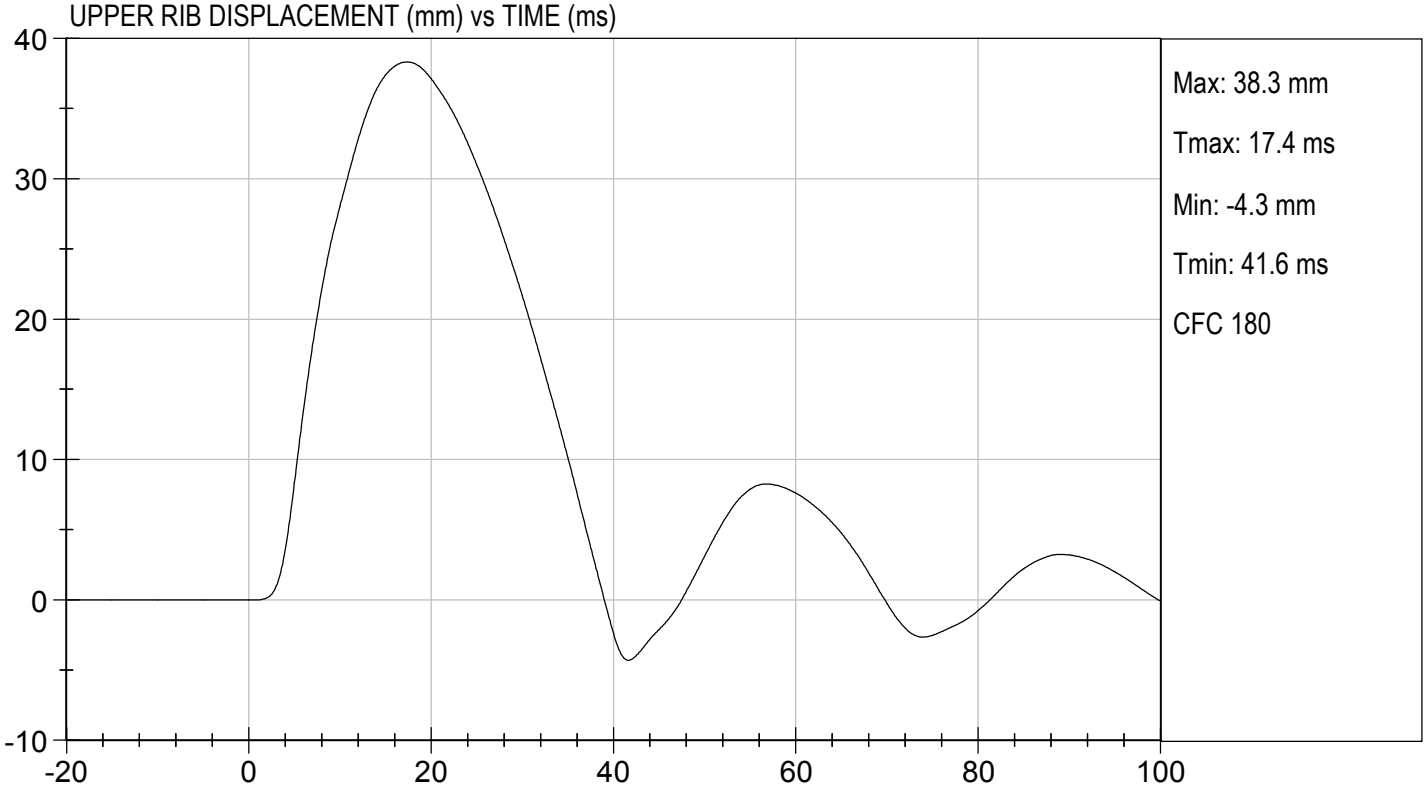
TEST DESC: THORAX IMPACT
VELOCITY: 17.92 ft/s, 5.46 m/s

TEST DATE: 11/22/2019
TEST #: D193640

IMPACTOR FORCE (N) vs TIME (ms)



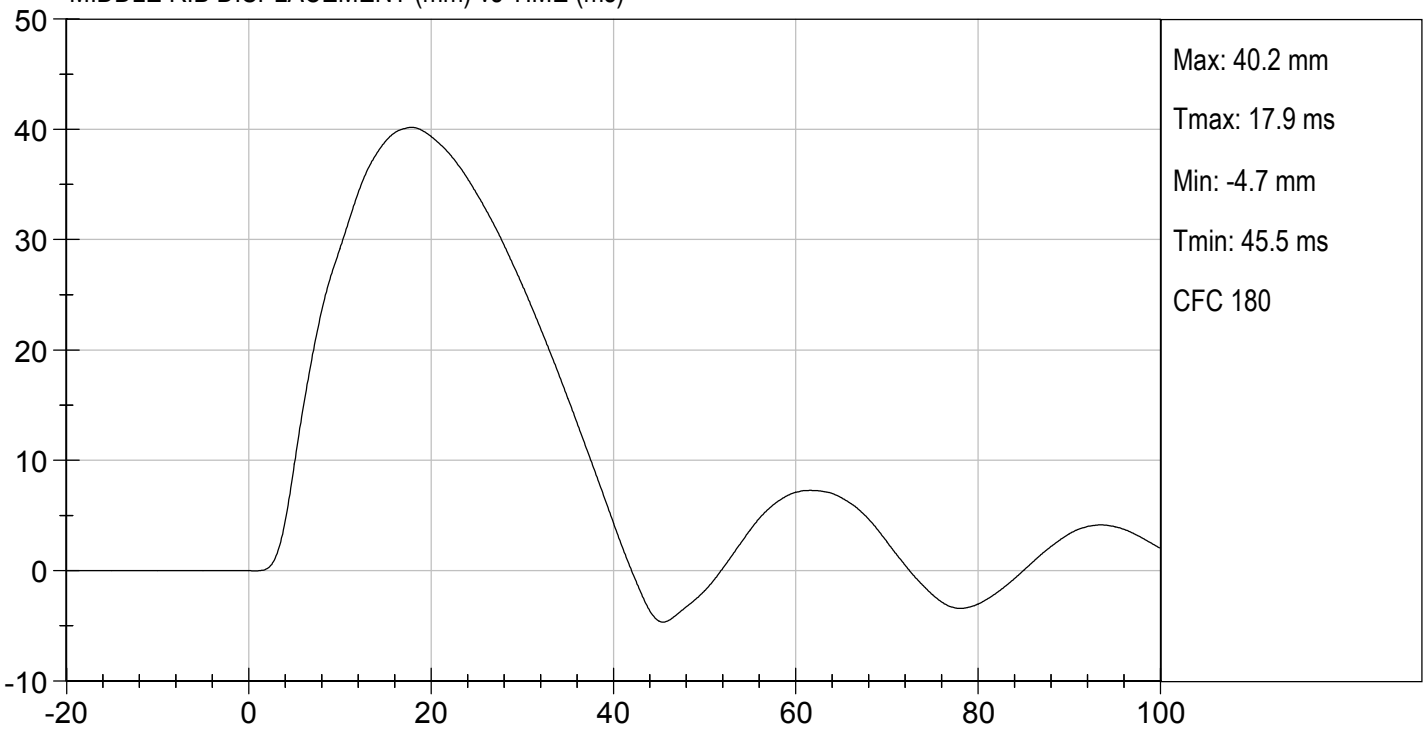
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



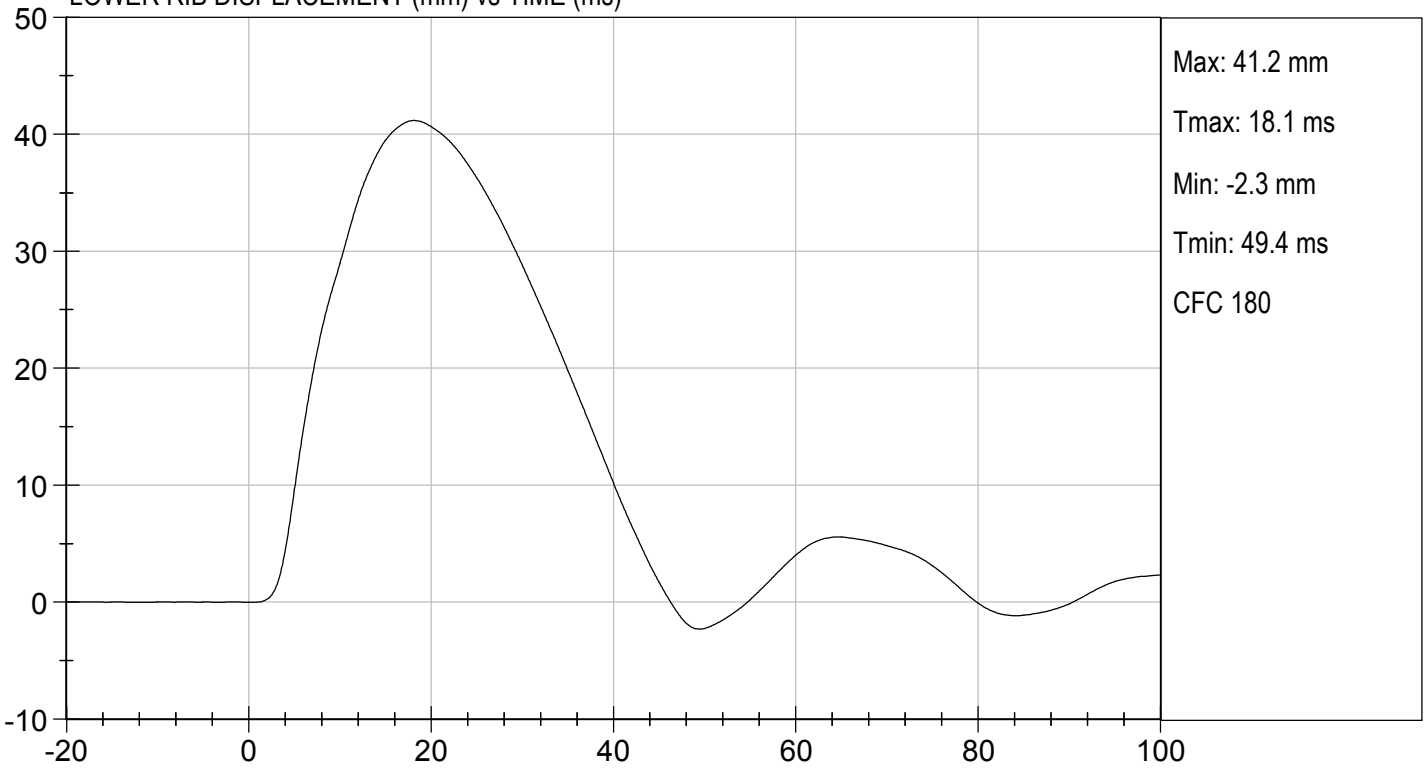
TEST DESC: THORAX IMPACT
VELOCITY: 17.92 ft/s, 5.46 m/s

TEST DATE: 11/22/2019
TEST #: D193640

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: 306

No.	Name	Spec. (mm)	Result	Pass/Fail
A	Sitting Height	772 - 788	785	Pass
B	Shoulder Pivot Height	437 - 453	449	Pass
C	H-point Height	79 - 89	86	Pass
D	H-point from Seatback	141 - 151	147	Pass
E	Shoulder Pivot from Backline	97 - 107	99	Pass
F	Thigh Clearance	119 -135	120	Pass
G	Head Breadth	140 - 148	141	Pass
H	Head Back from Backline	40 - 46	45	Pass
I	Head Depth	178 - 188	182	Pass
J	Head Circumference	541 - 551	550	Pass
K	Buttock to Knee Length	514 - 540	538	Pass
L	Popliteal Height	343 - 369	349	Pass
M	Knee Pivot to Floor Height	392 - 409	394	Pass
N	Buttock Popliteal Length	416 - 442	435	Pass
O	Chest Depth w/o Jacket	195 - 211	198	Pass
P	Foot Length	216 - 232	222	Pass
Q	Hip Breadth (w/ pelvic plugs)	313 - 323	317	Pass
R	Arm Length	249 - 259	250	Pass
S	Knee Joint to Seatback	477 - 493	483	Pass
V	Shoulder Width	341 - 357	351	Pass
W	Foot Width	78 - 94	82	Pass
Y	Chest Circumference w/ jacket	851 - 881	863	Pass
Z	Waist Circumference	761 - 791	782	Pass

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D193561

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Peak Resultant Acceleration	G's	115 to 137	127	Pass
Peak Longitudinal Acceleration	G's	+/- 15	7.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

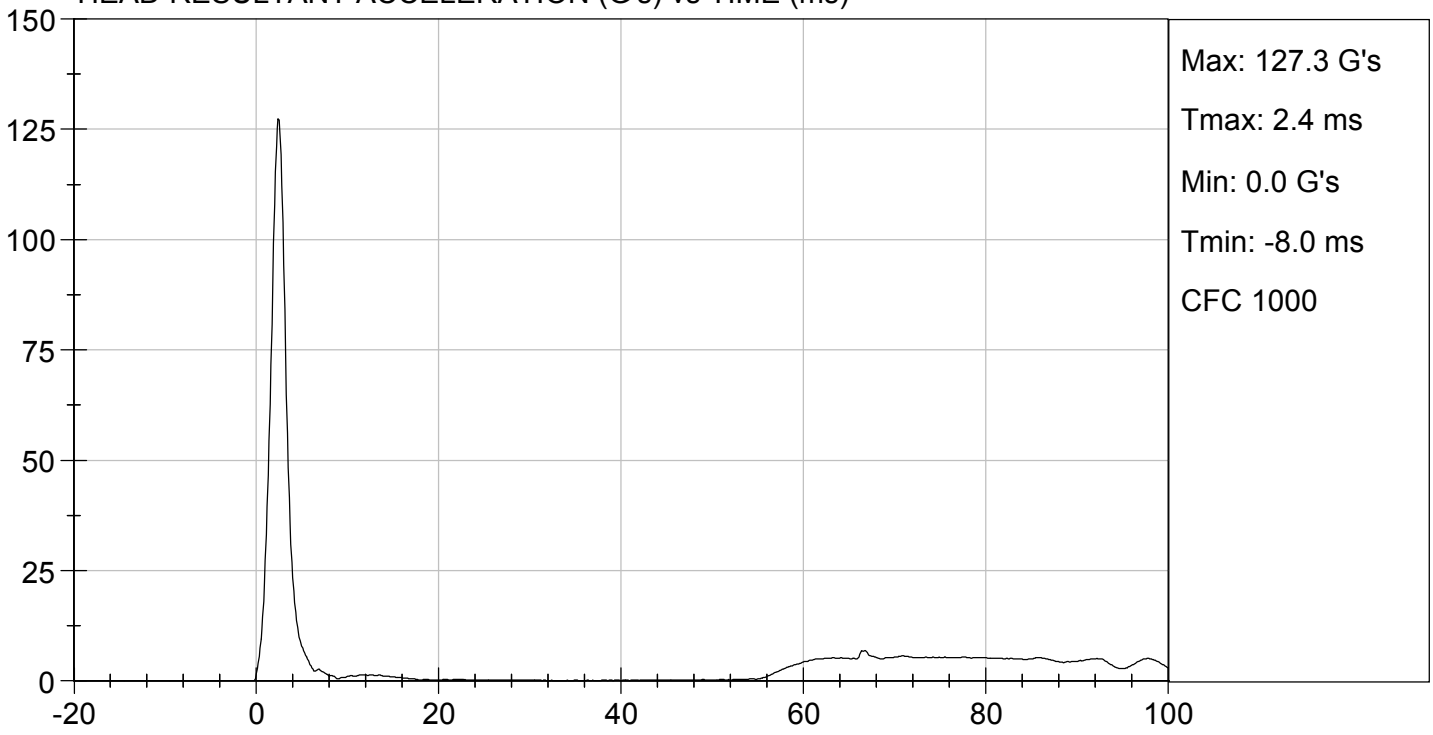
11/12/2019
Test Date

Approved By

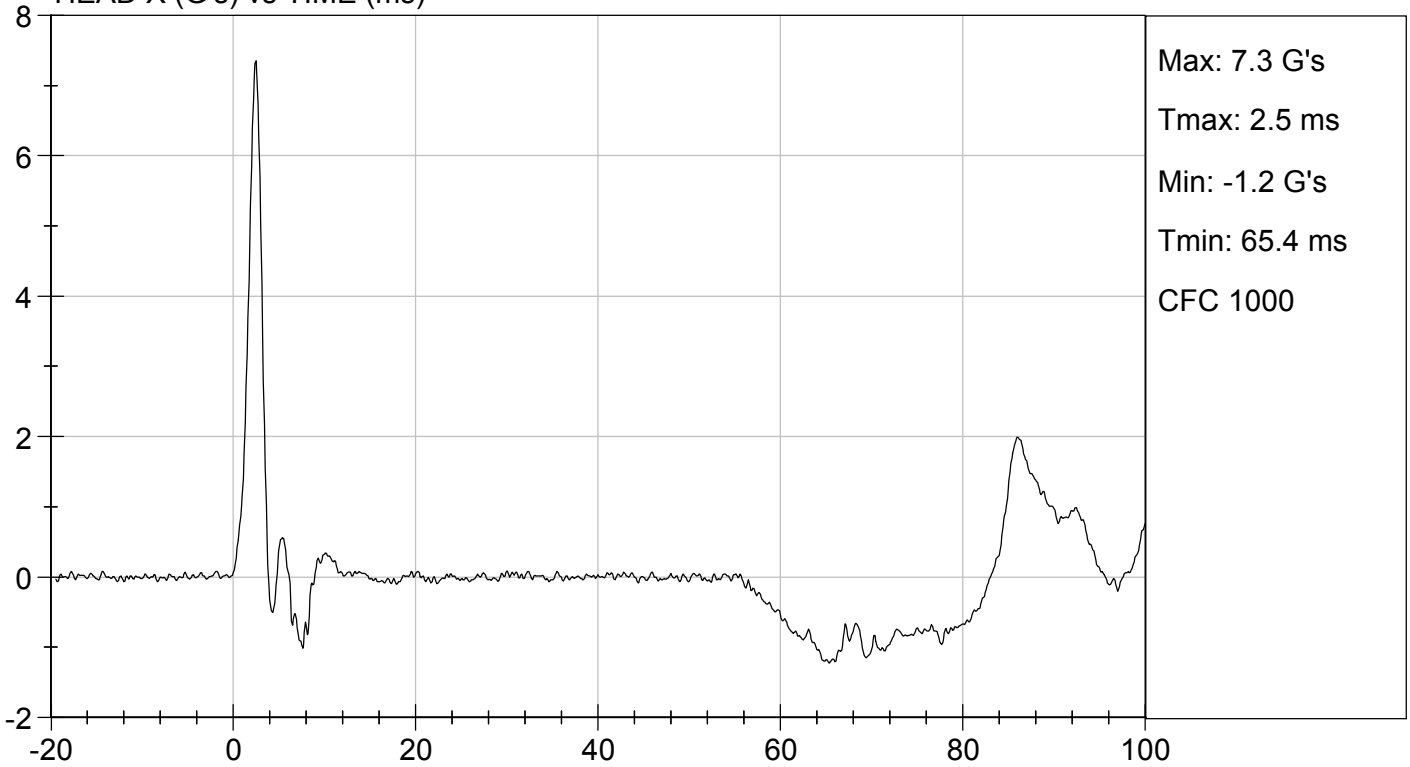
TEST DESC: HEAD DROP

TEST DATE: 11/12/2019
TEST #: D193561

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

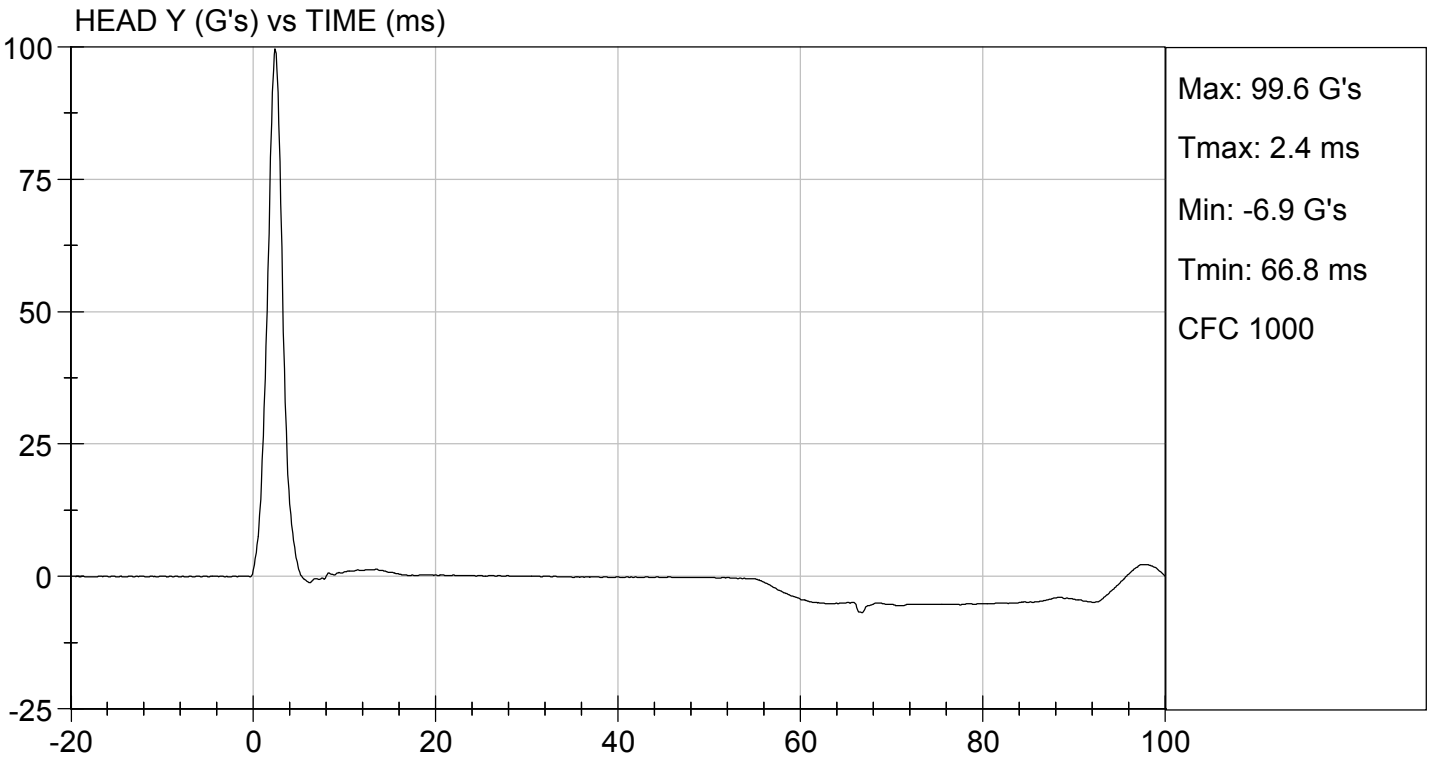


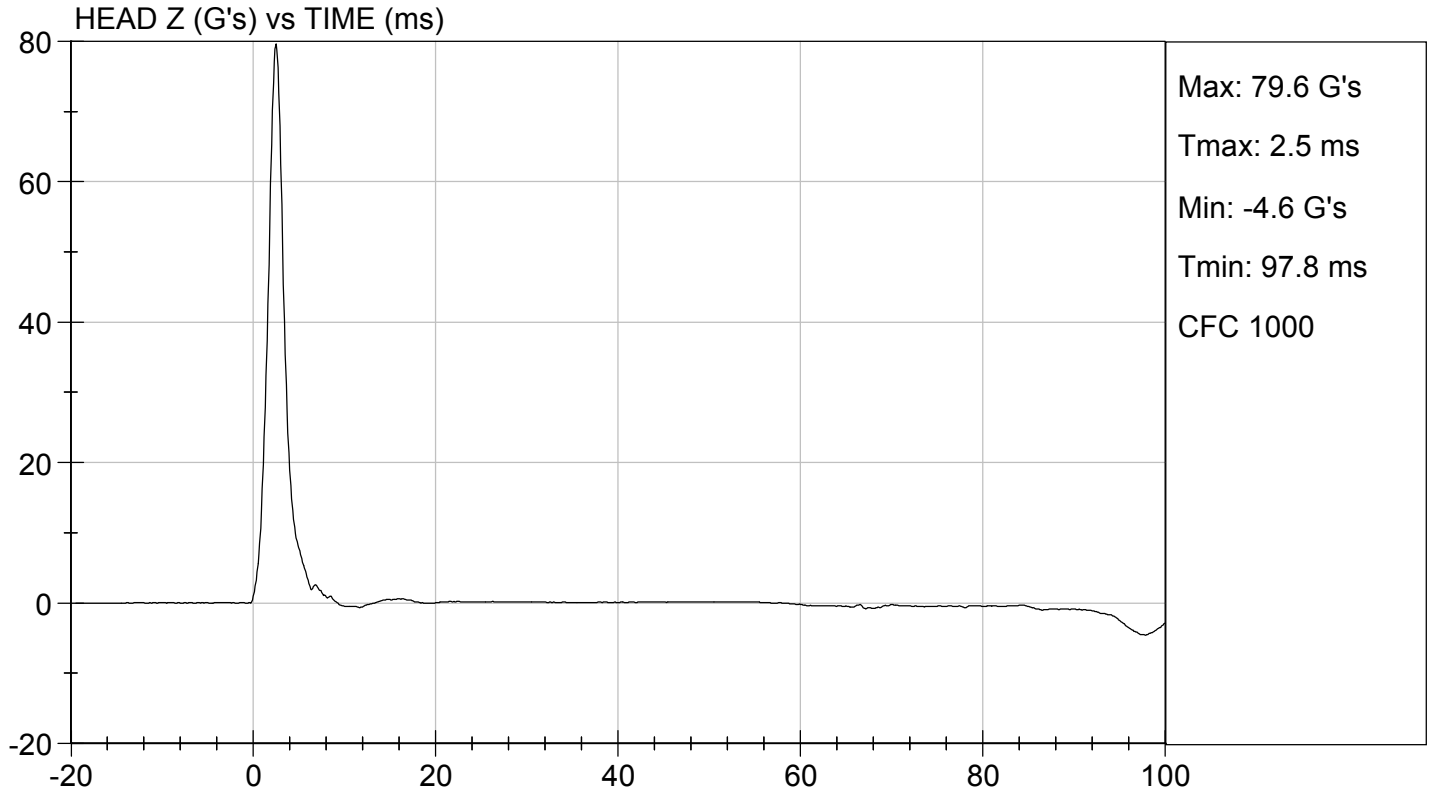
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 11/12/2019
TEST #: D193561





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D193562

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.1	Pass
Humidity		%	10 to 70	18	Pass
Impact Velocity		m/s	5.51 to 5.63	5.63	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.31	Pass
	15 ms	m/s	3.30 to 4.10	3.38	Pass
	20 ms	m/s	4.40 to 5.40	4.81	Pass
	25 ms	m/s	5.40 to 6.10	5.70	Pass
	25-100 ms	m/s	5.50 to 6.20	5.70	Pass
Maximum D-Plane Rotation		deg	71 to 81	76	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	63	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-37	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	119	Pass
			Overall Test Results		Pass

Laboratory Technician

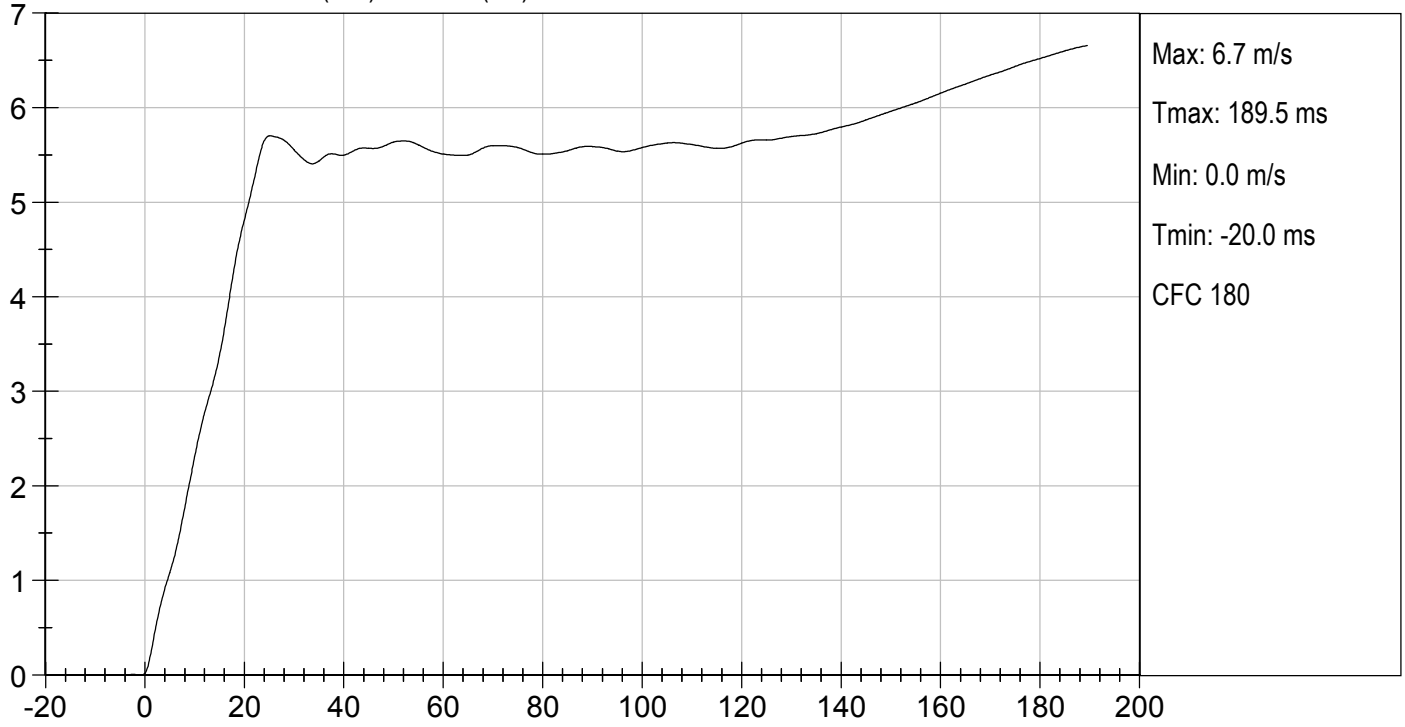
11/13/2019
Test Date

Approved By

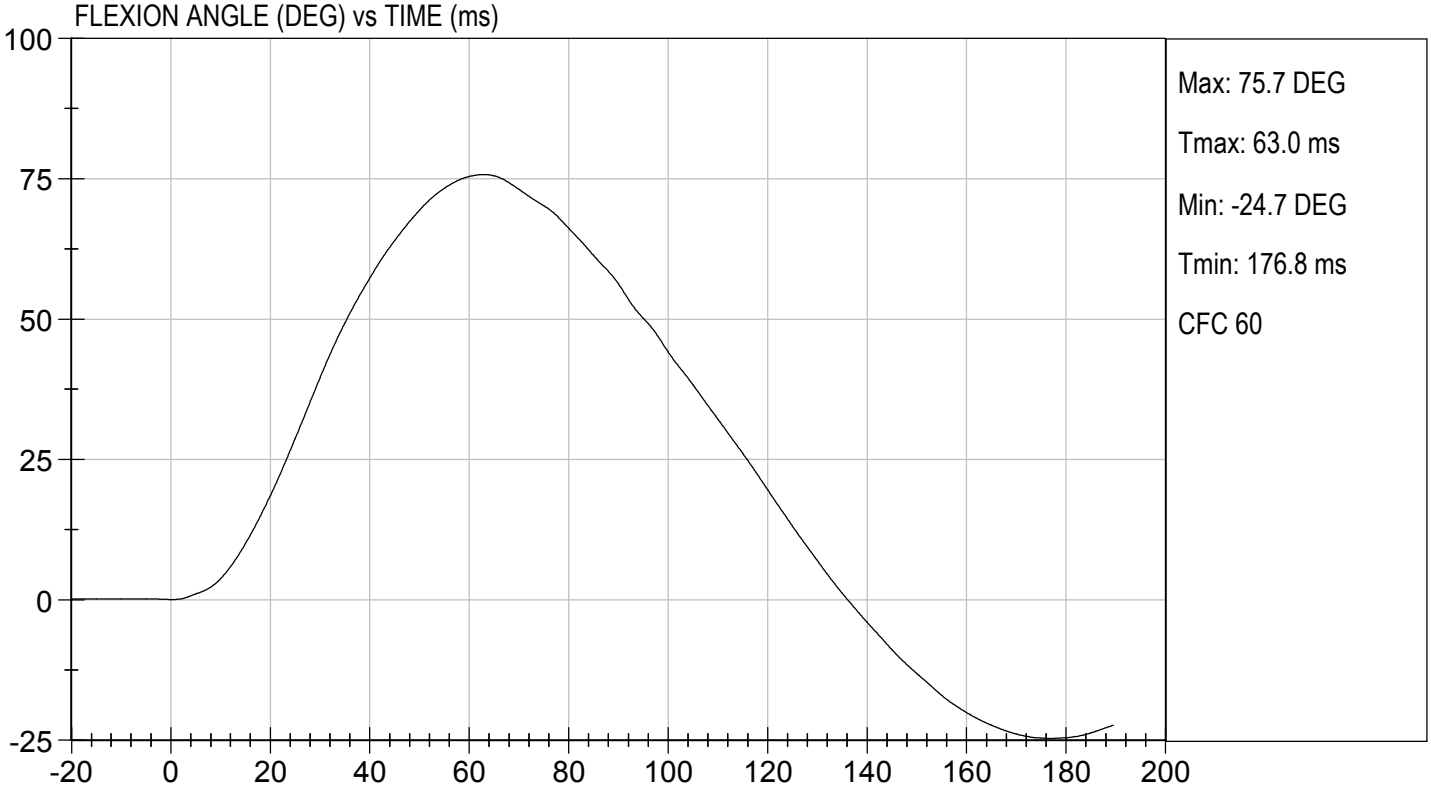
TEST DESC: NECK BENDING
VELOCITY: 18.48 ft/s, 5.63 m/s

TEST DATE: 11/13/2019
TEST #: D193562

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

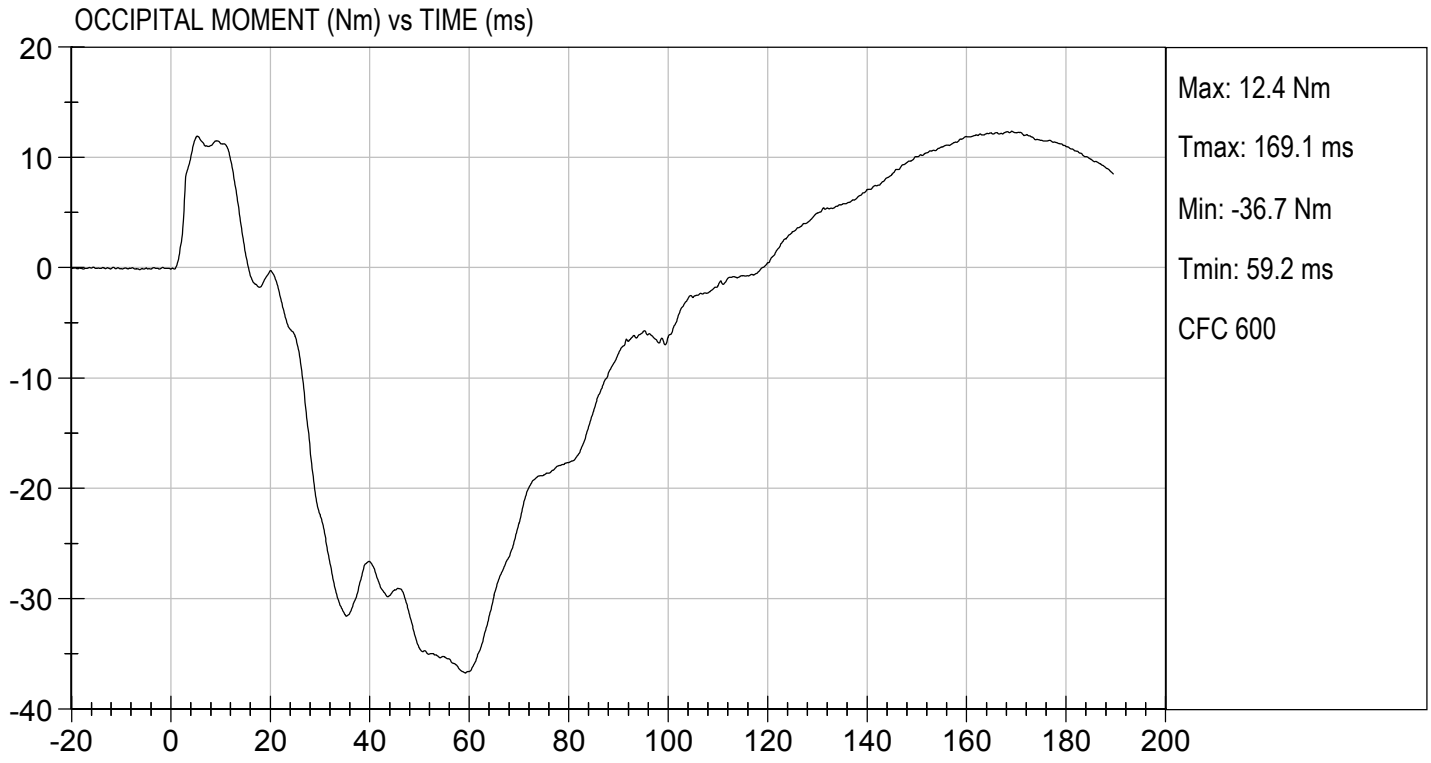


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.48 ft/s, 5.63 m/s

TEST DATE: 11/13/2019
TEST #: D193562



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D193563

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	18	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	28	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	19	Pass
		Overall Test Results		Pass

Laboratory Technician

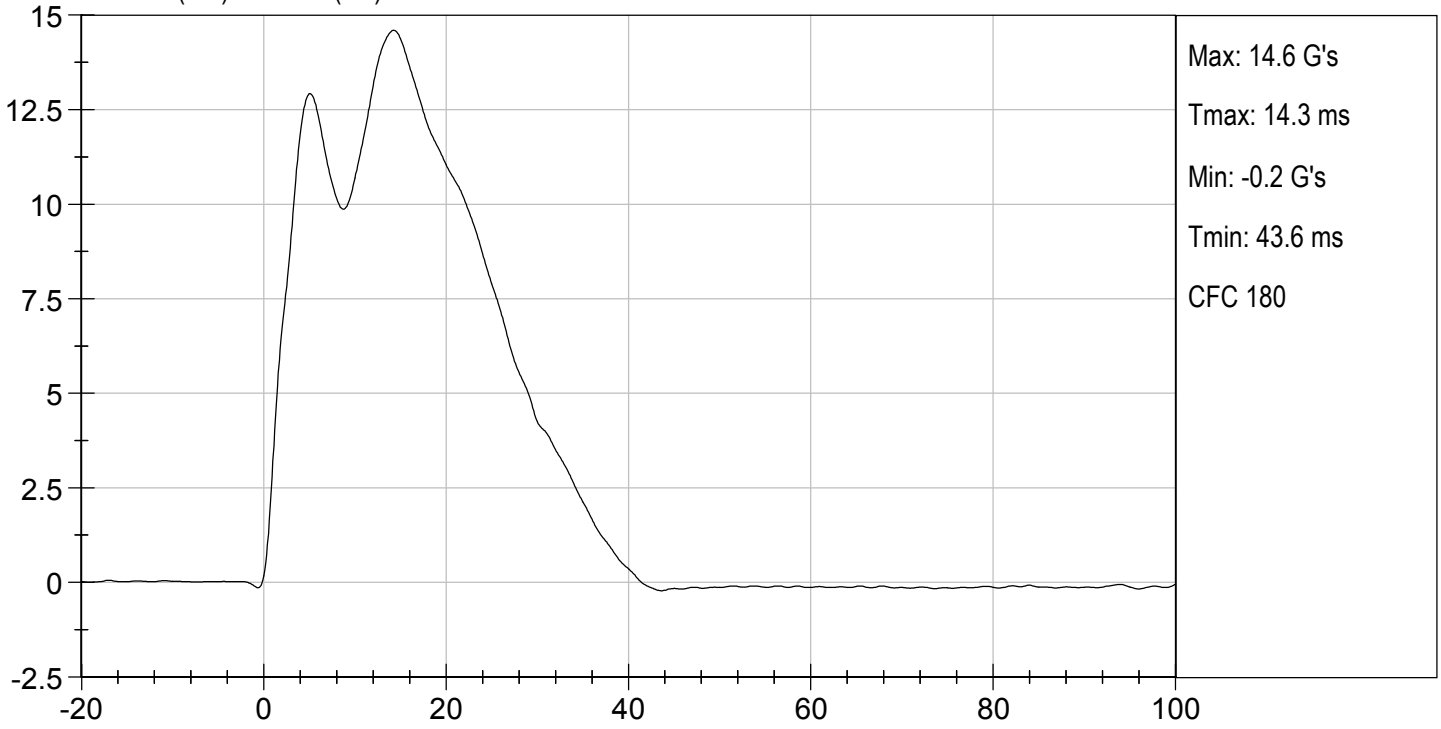
11/12/2019
Test Date

Approved By

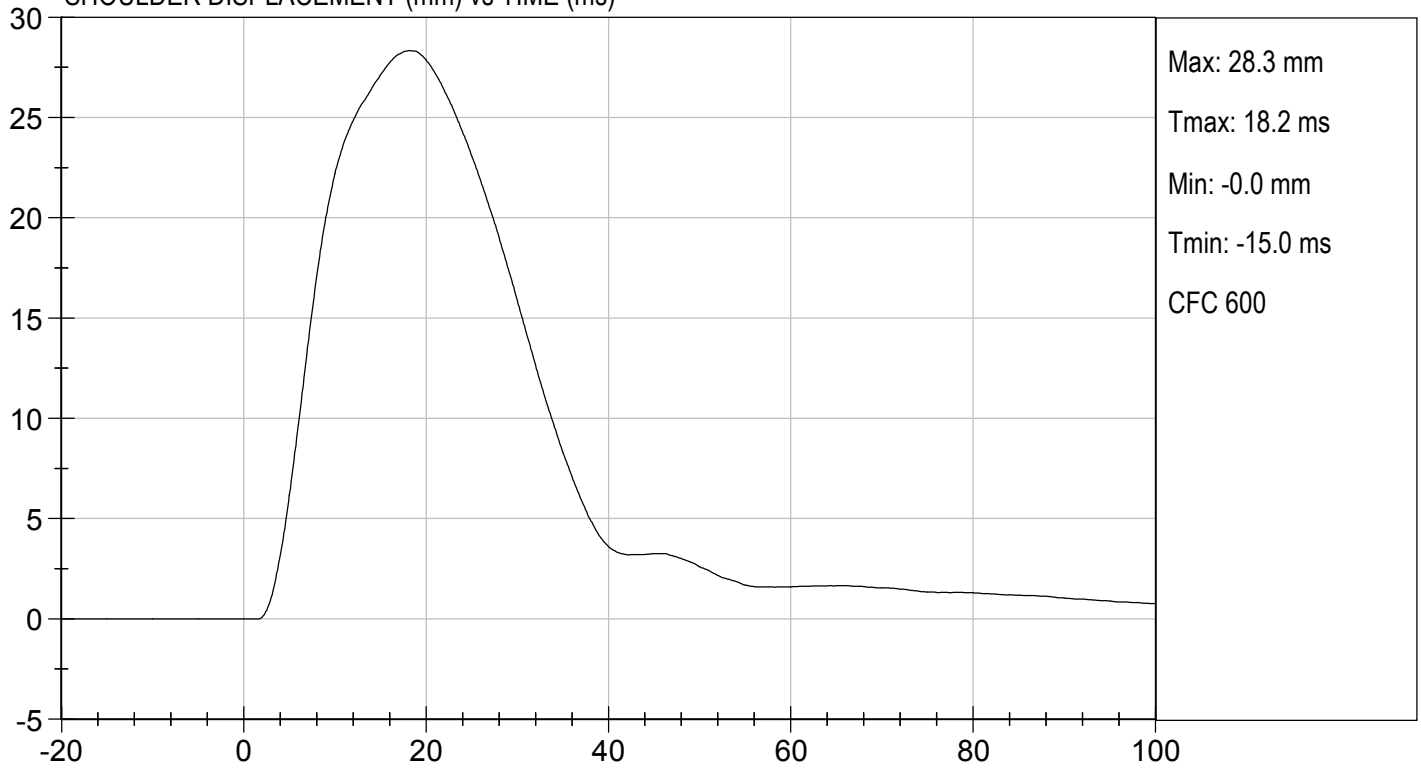
TEST DESC: SHOULDER IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 11/12/2019
TEST #: D193563

PROBE (G's) vs TIME (ms)

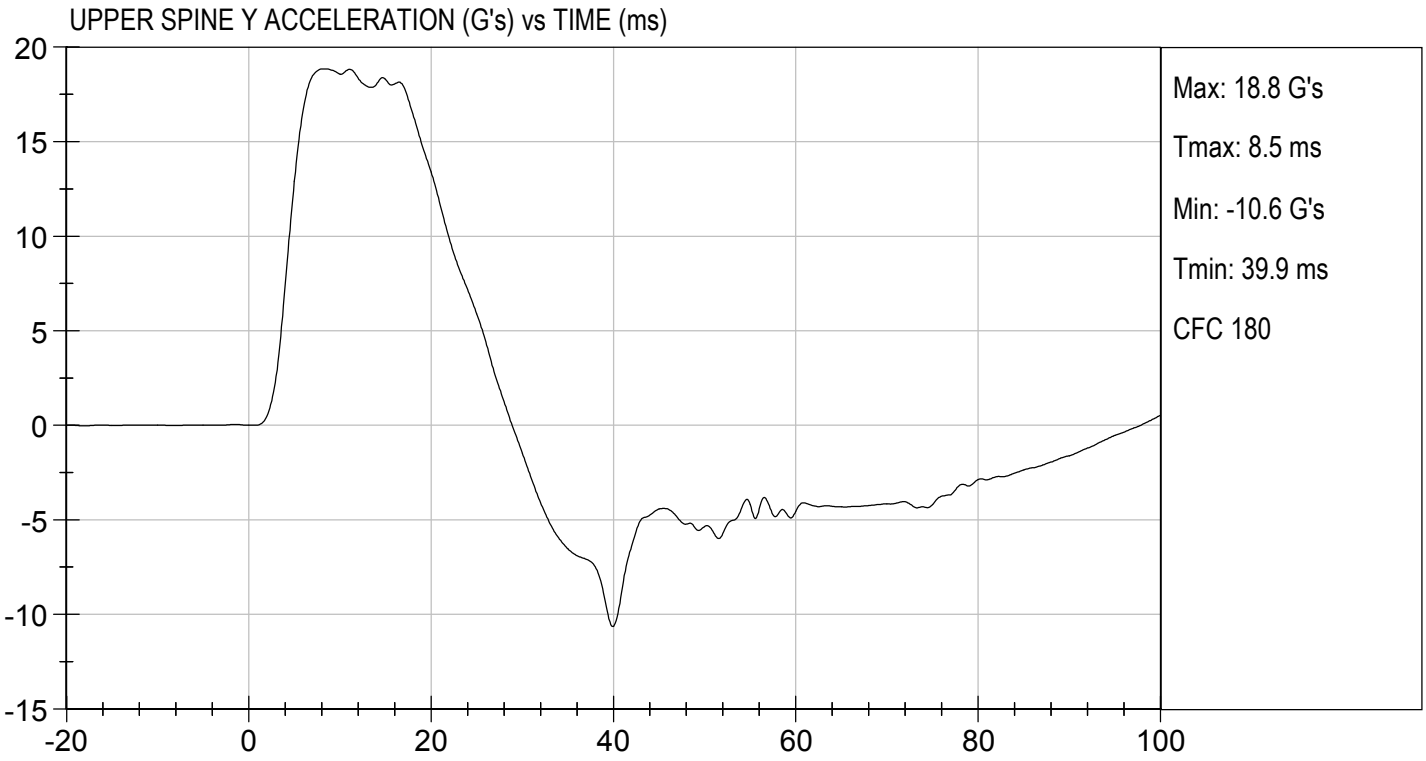


SHOULDER DISPLACEMENT (mm) vs TIME (ms)



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

TEST DATE: 11/12/2019
TEST #: D193563



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D193564

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	18	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	32	Pass
Shoulder Displacement	mm	31 to 40	33	Pass
Upper Rib Displacement	mm	25 to 32	27	Pass
Middle Rib Displacement	mm	30 to 36	31	Pass
Lower Rib Displacement	mm	32 to 38	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	40	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	32	Pass
		Overall Test Results		Pass

Laboratory Technician

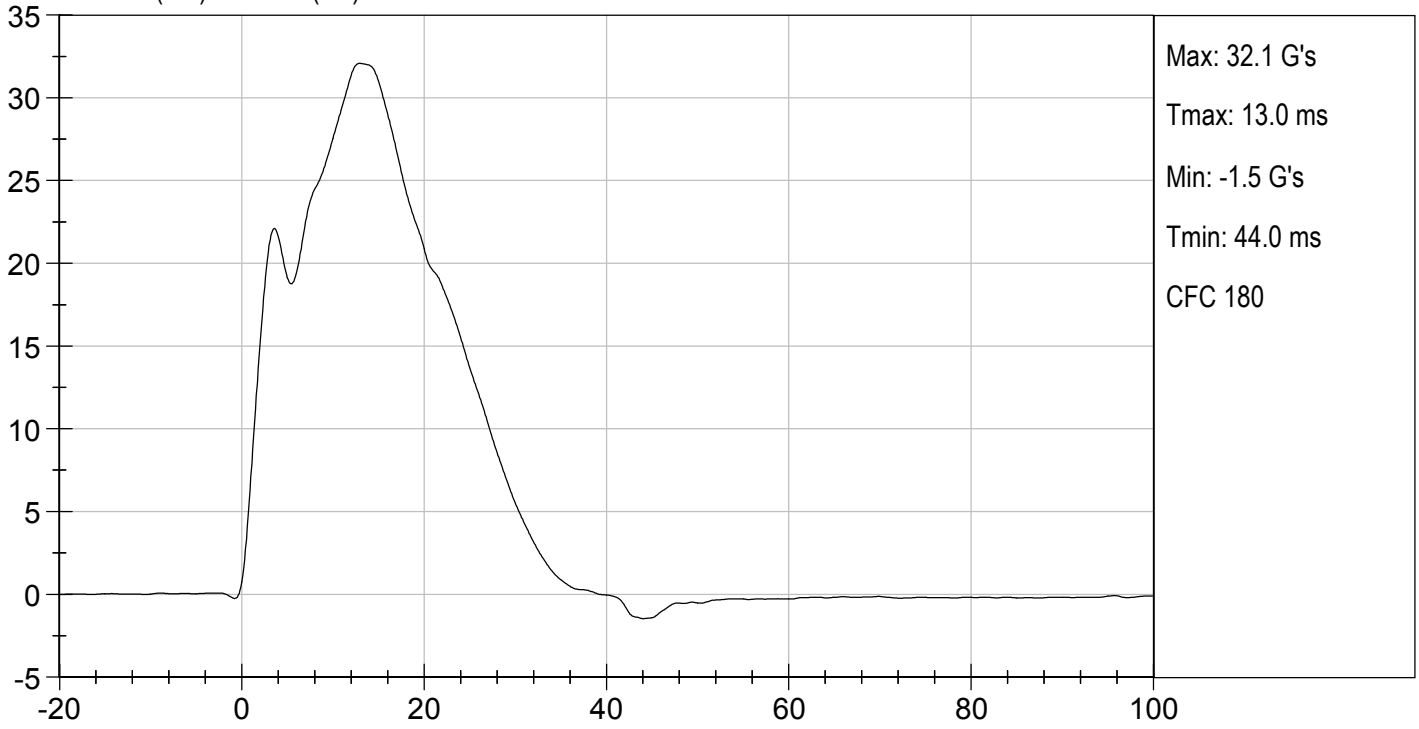
11/12/2019
Test Date

Approved By

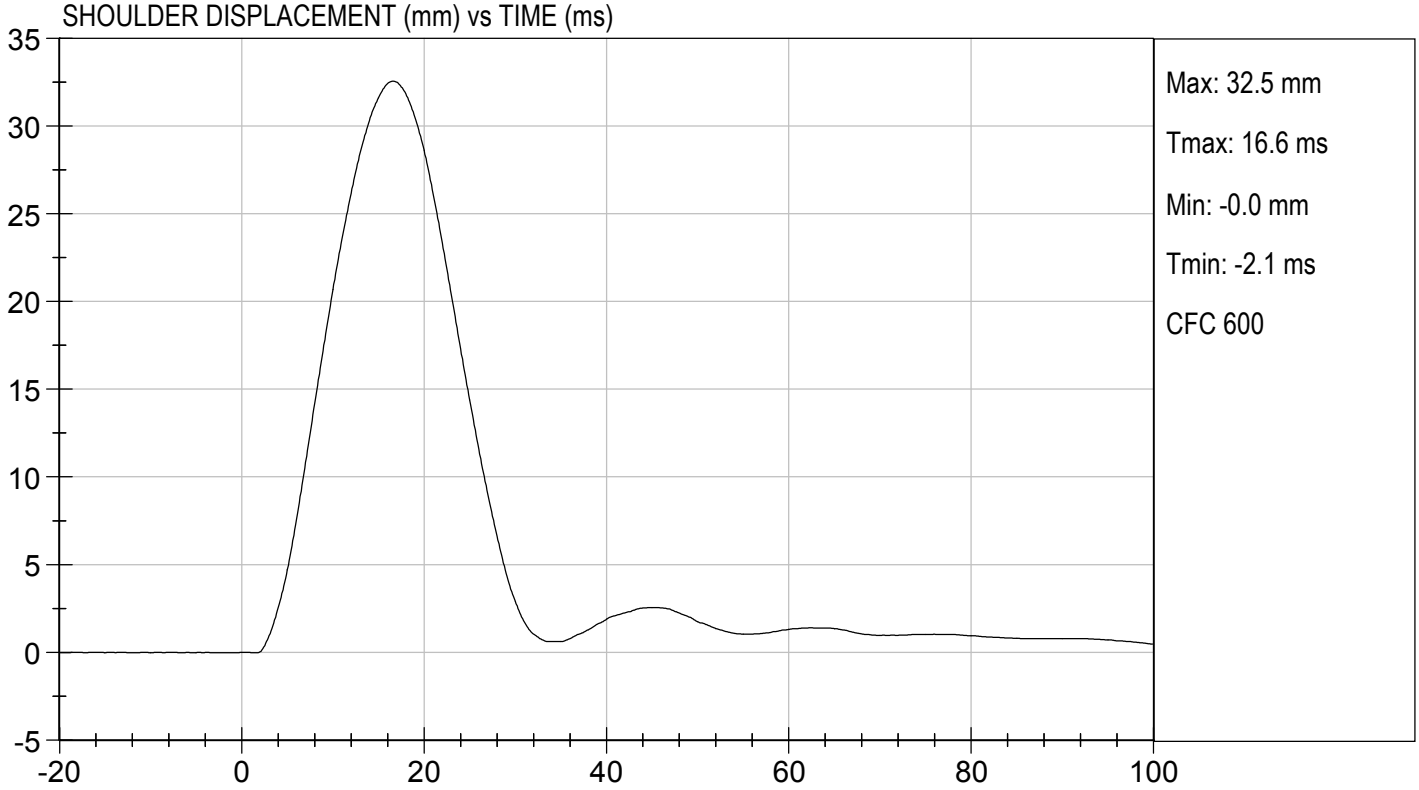
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 11/12/2019
TEST #: D193564

PROBE (G's) vs TIME (ms)



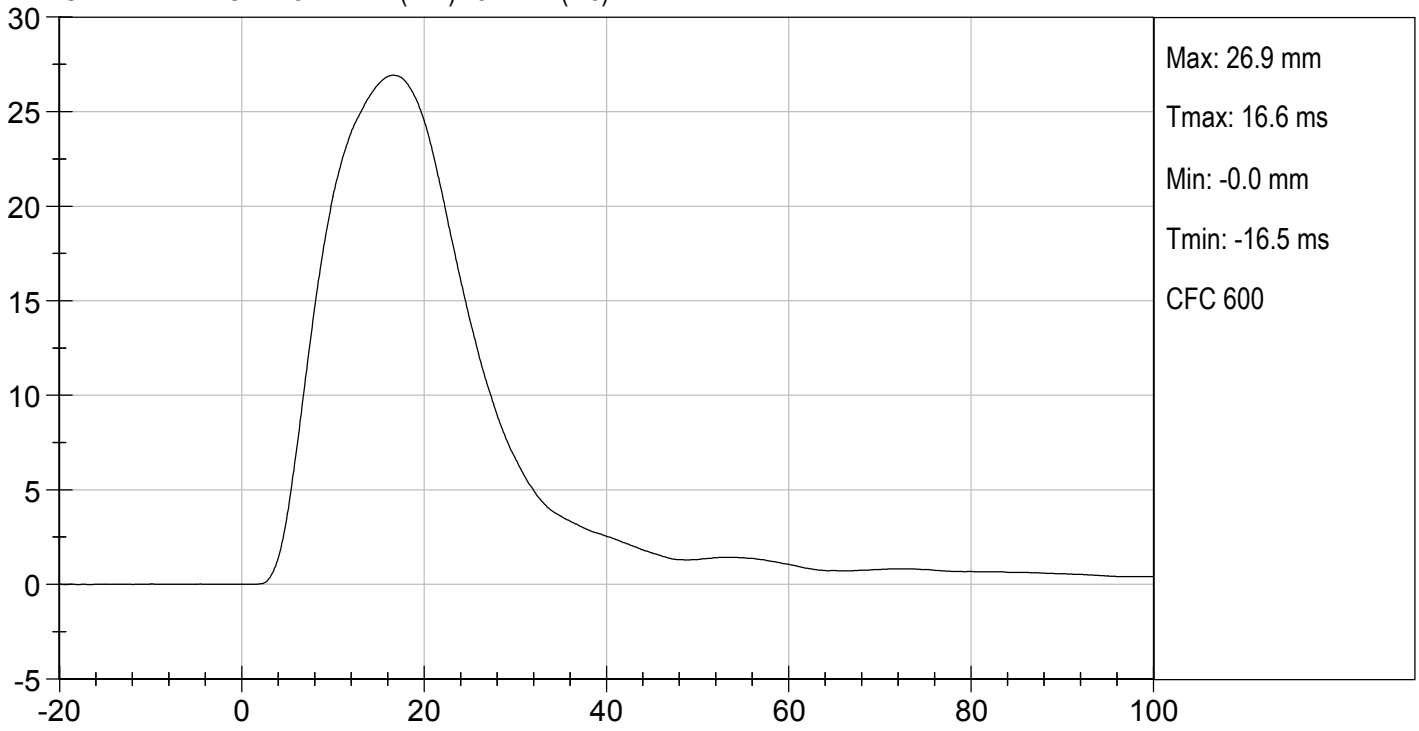
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



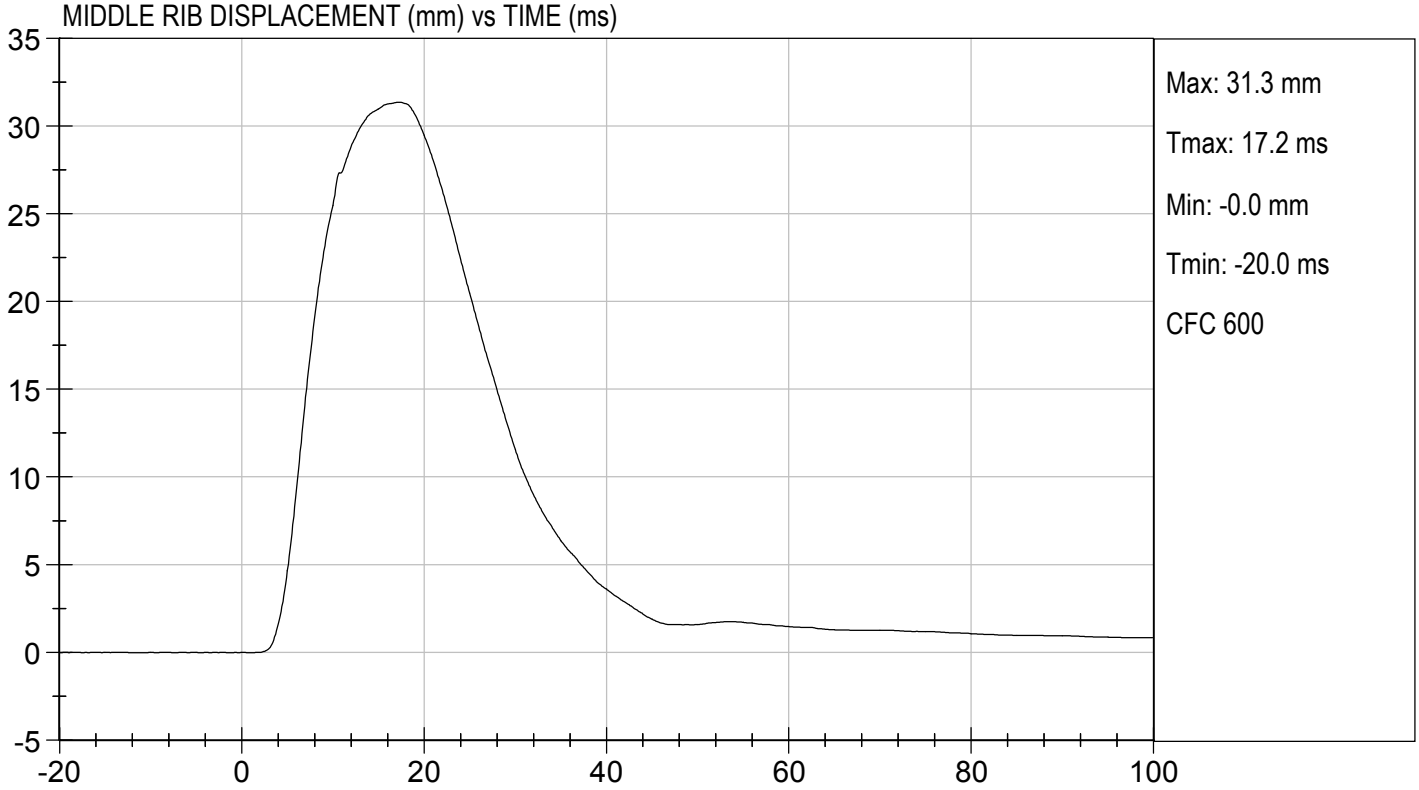
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 11/12/2019
TEST #: D193564

UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



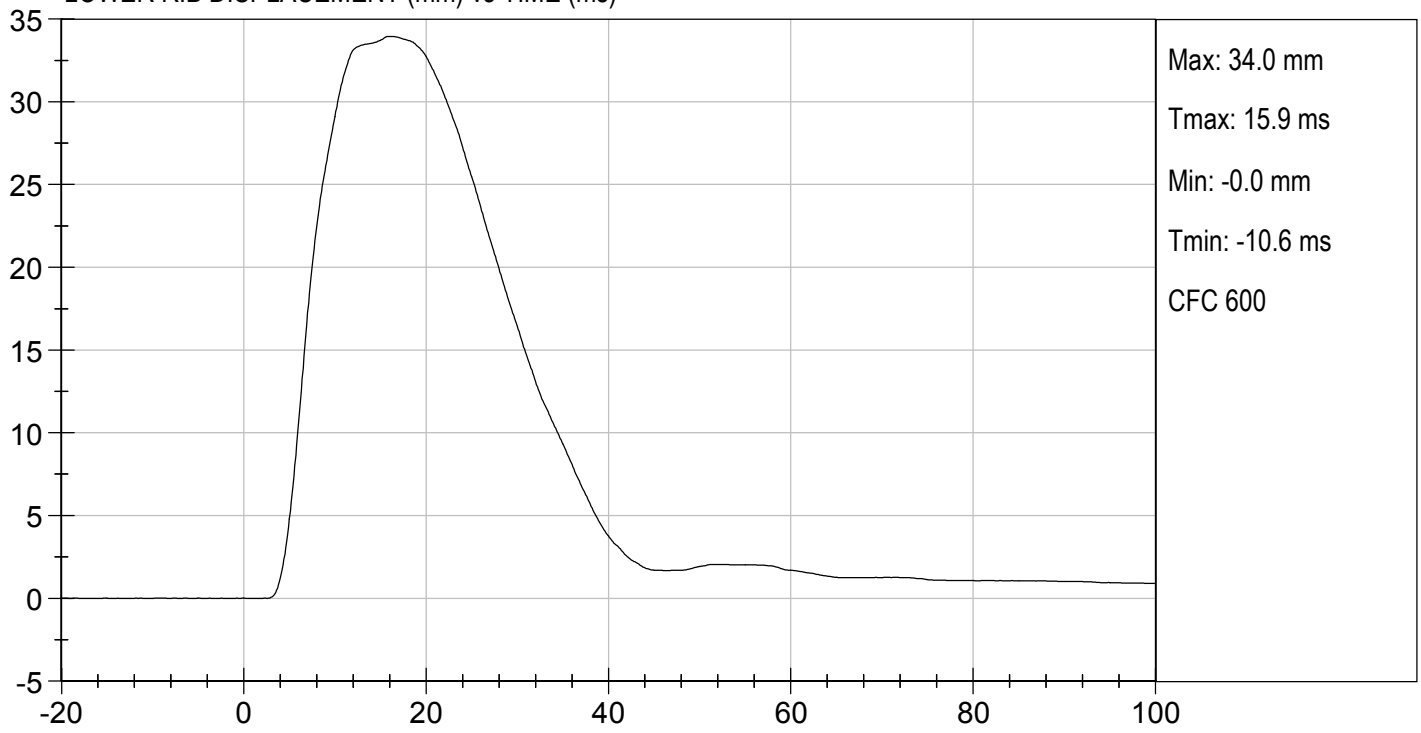
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



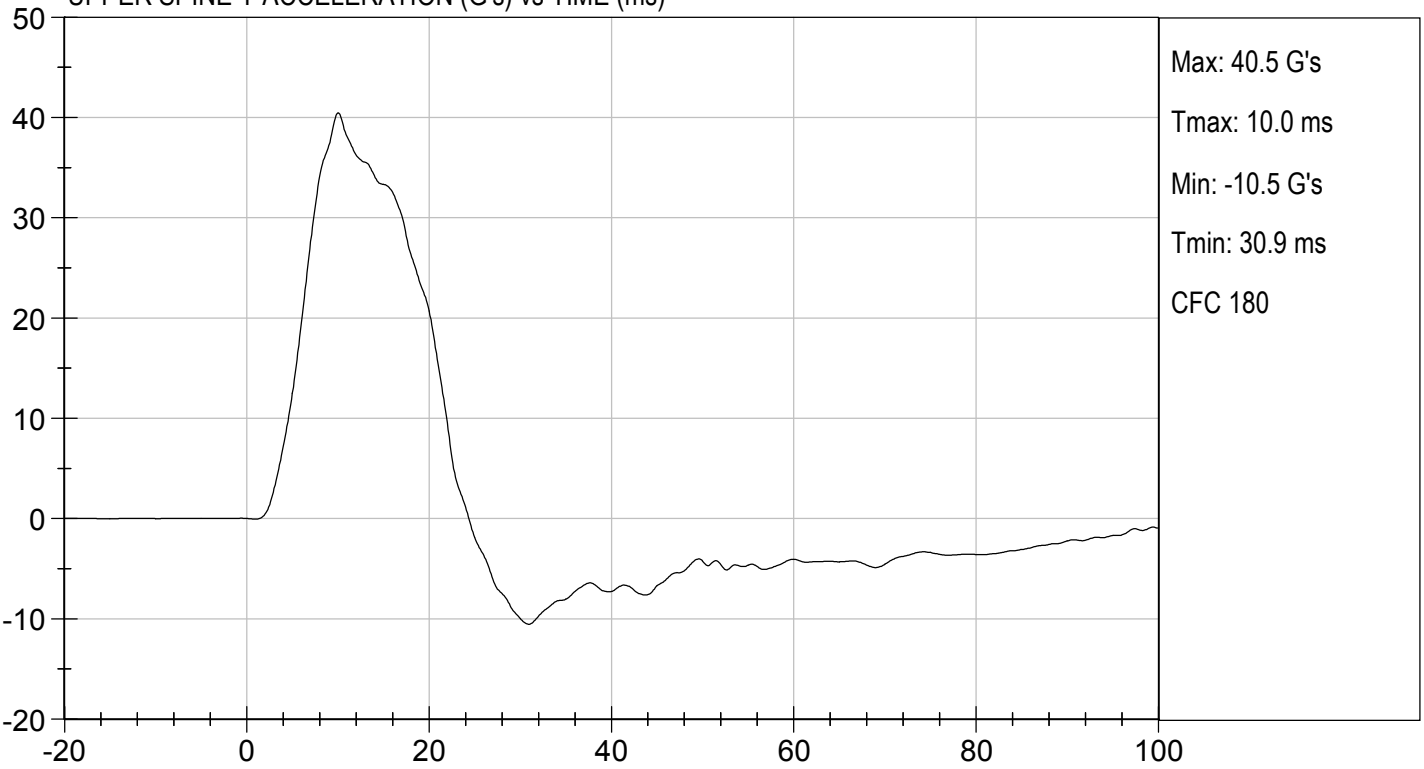
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 11/12/2019
TEST #: D193564

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



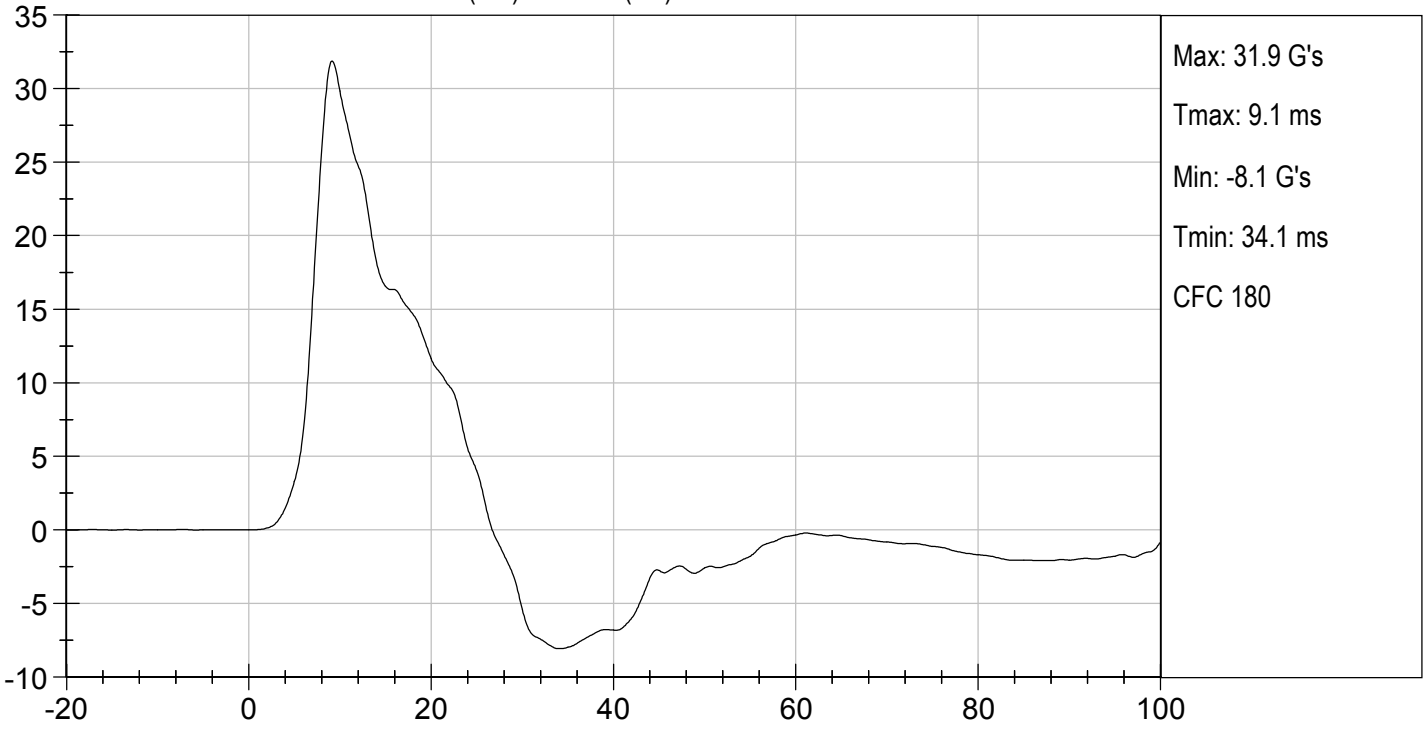
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 11/12/2019
TEST #: D193564

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: 306 **Test I.D:** D193565

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	18	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	14 to 18	16	Pass
Upper Rib Displacement	mm	32 to 40	35	Pass
Middle Rib Displacement	mm	39 to 45	42	Pass
Lower Rib Displacement	mm	35 to 43	40	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	15	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	10	Pass
		Overall Test Results		Pass

Laboratory Technician

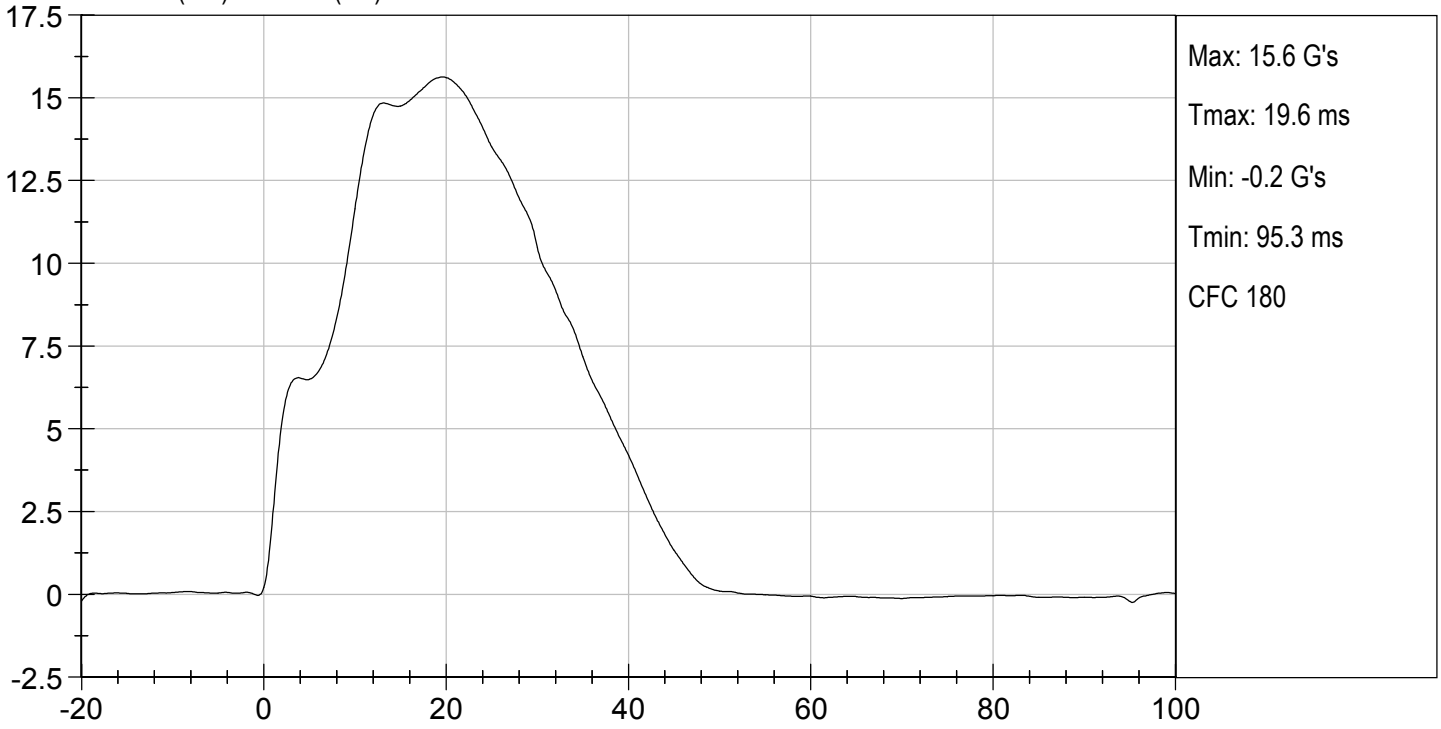
11/12/2019
Test Date

Approved By

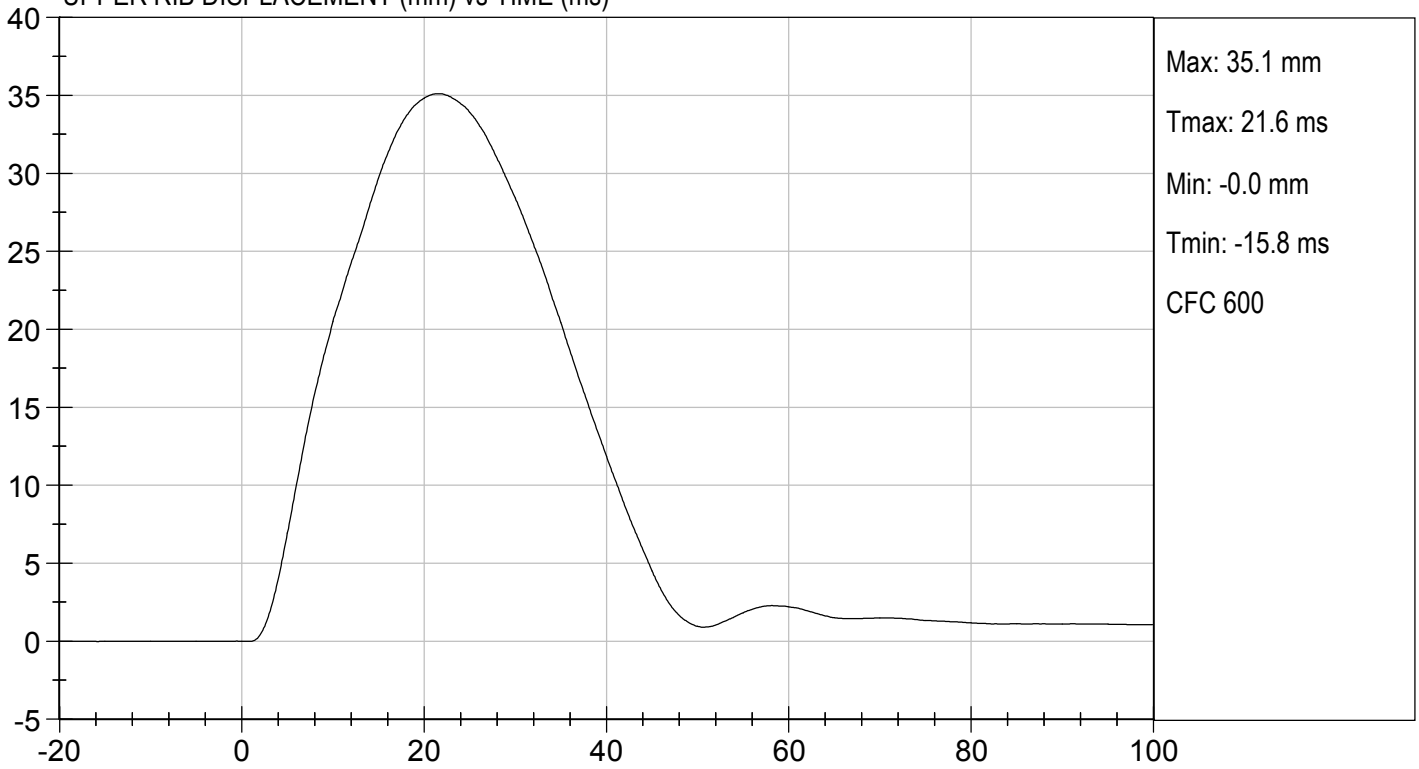
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 11/12/2019
TEST #: D193565

PROBE (G's) vs TIME (ms)



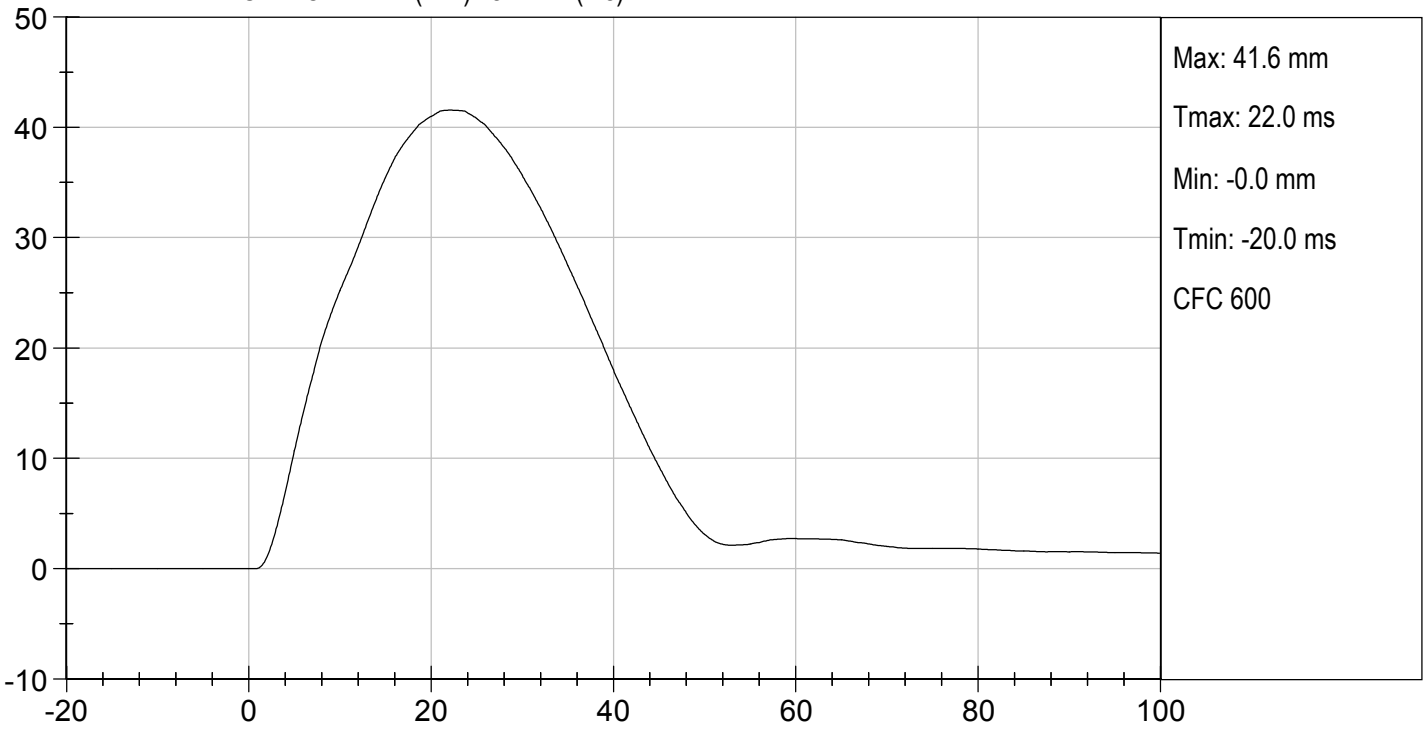
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



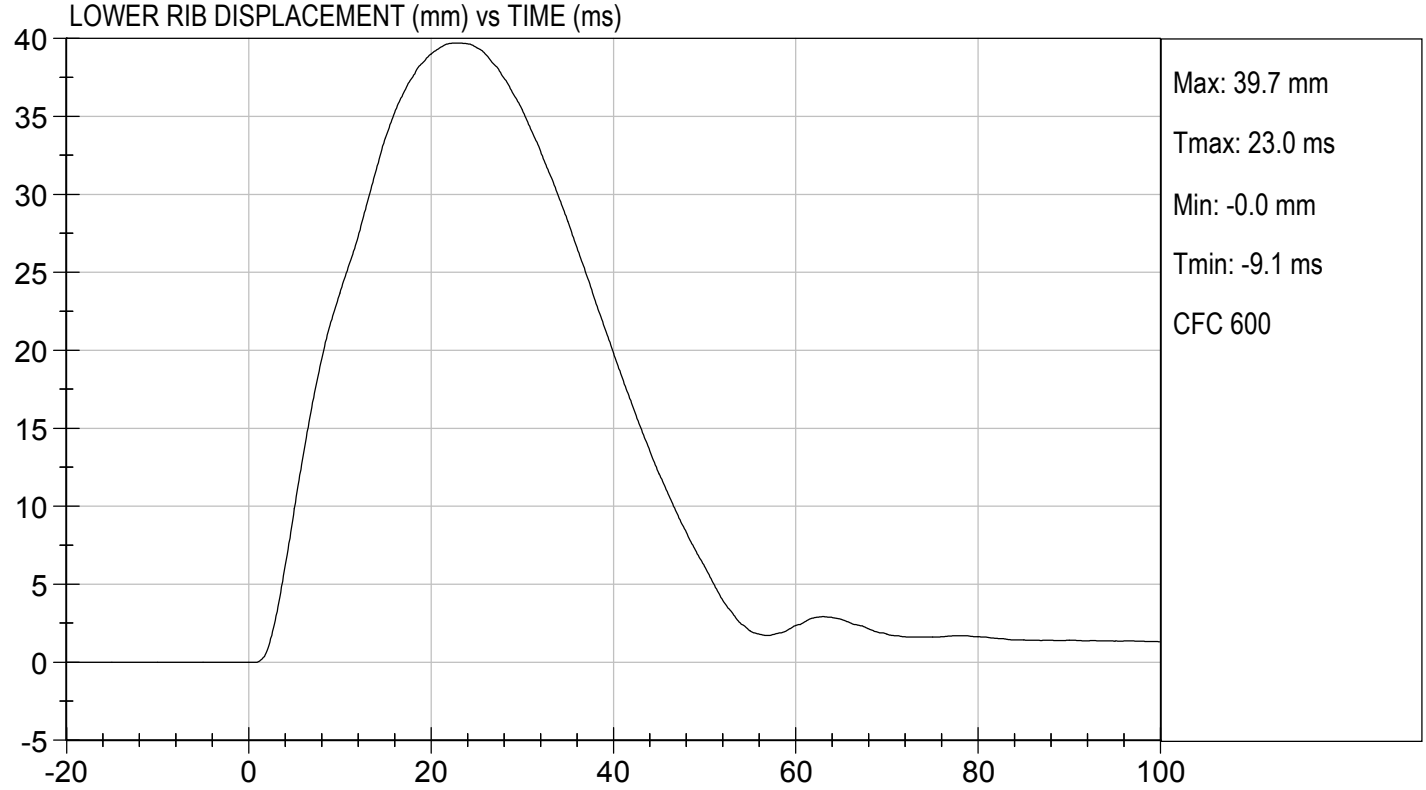
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 11/12/2019
TEST #: D193565

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



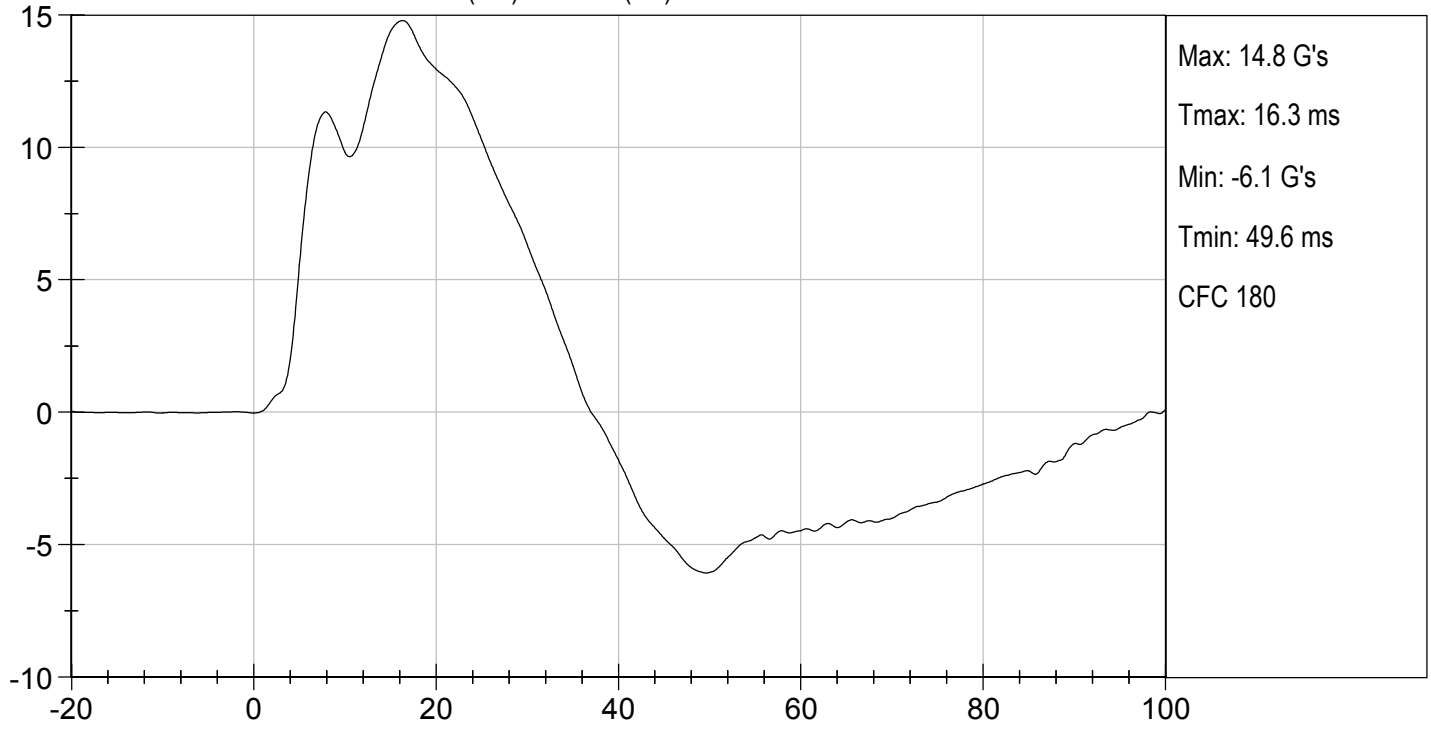
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



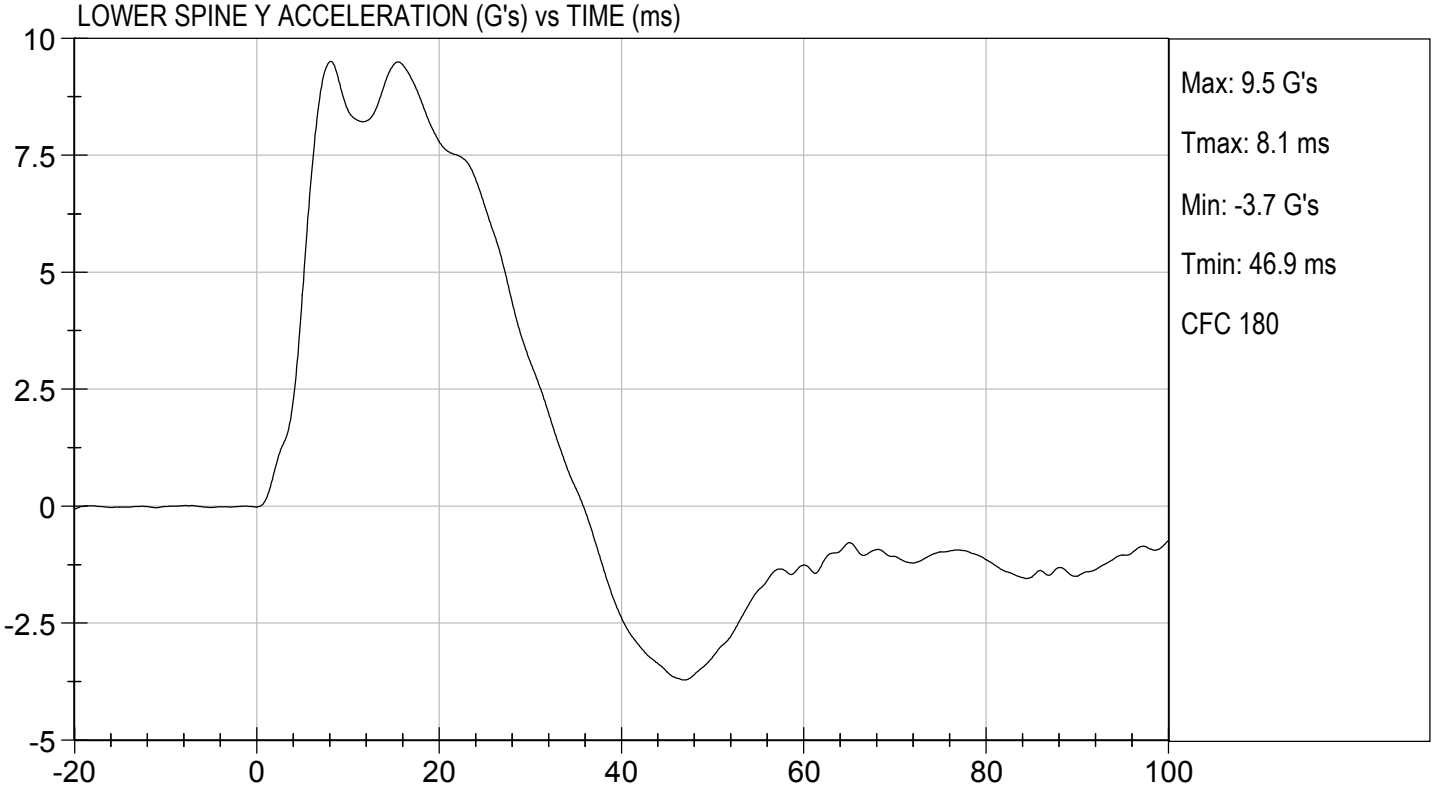
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 11/12/2019
TEST #: D193565

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: 306 **Test I.D:** D193566

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	18	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	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	37	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	12	Pass
		Overall Test Results		Pass

Laboratory Technician

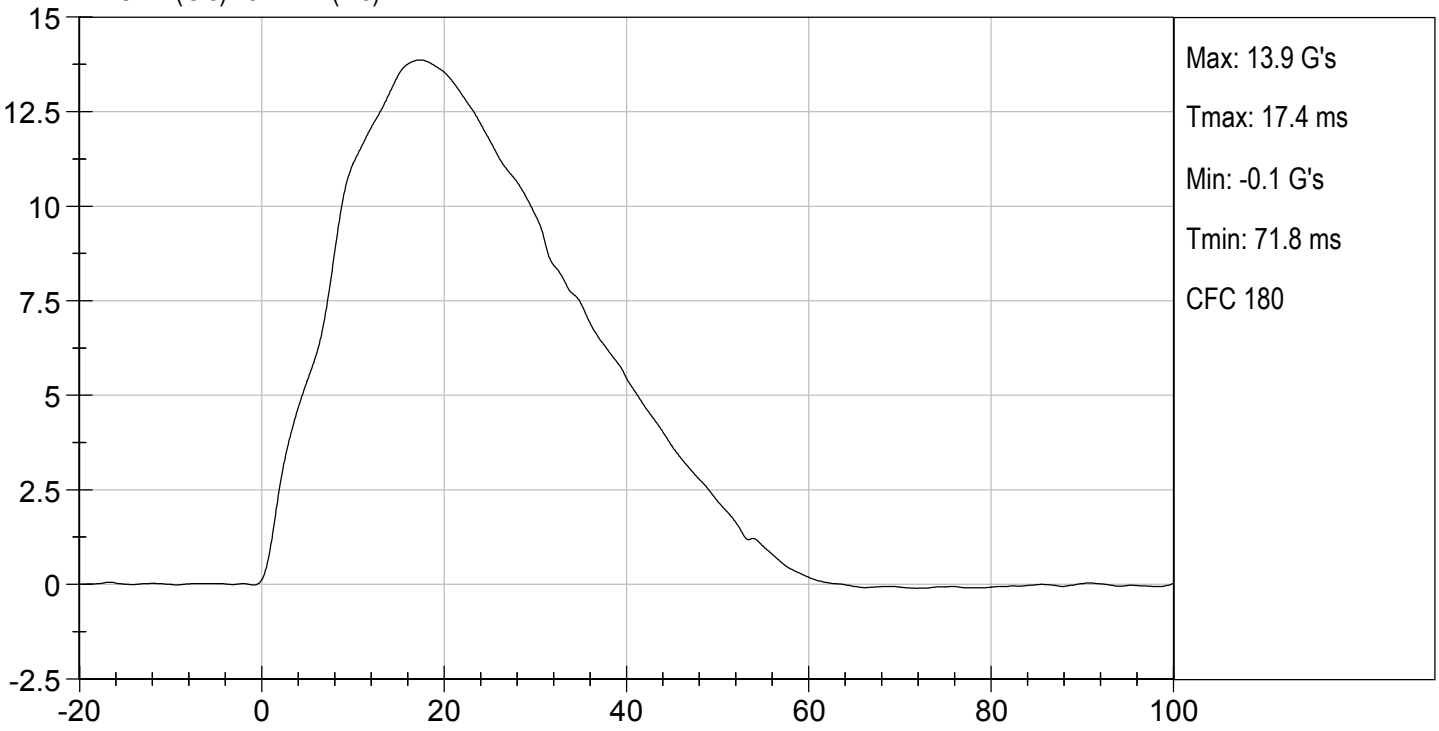
11/12/2019
Test Date

Approved By

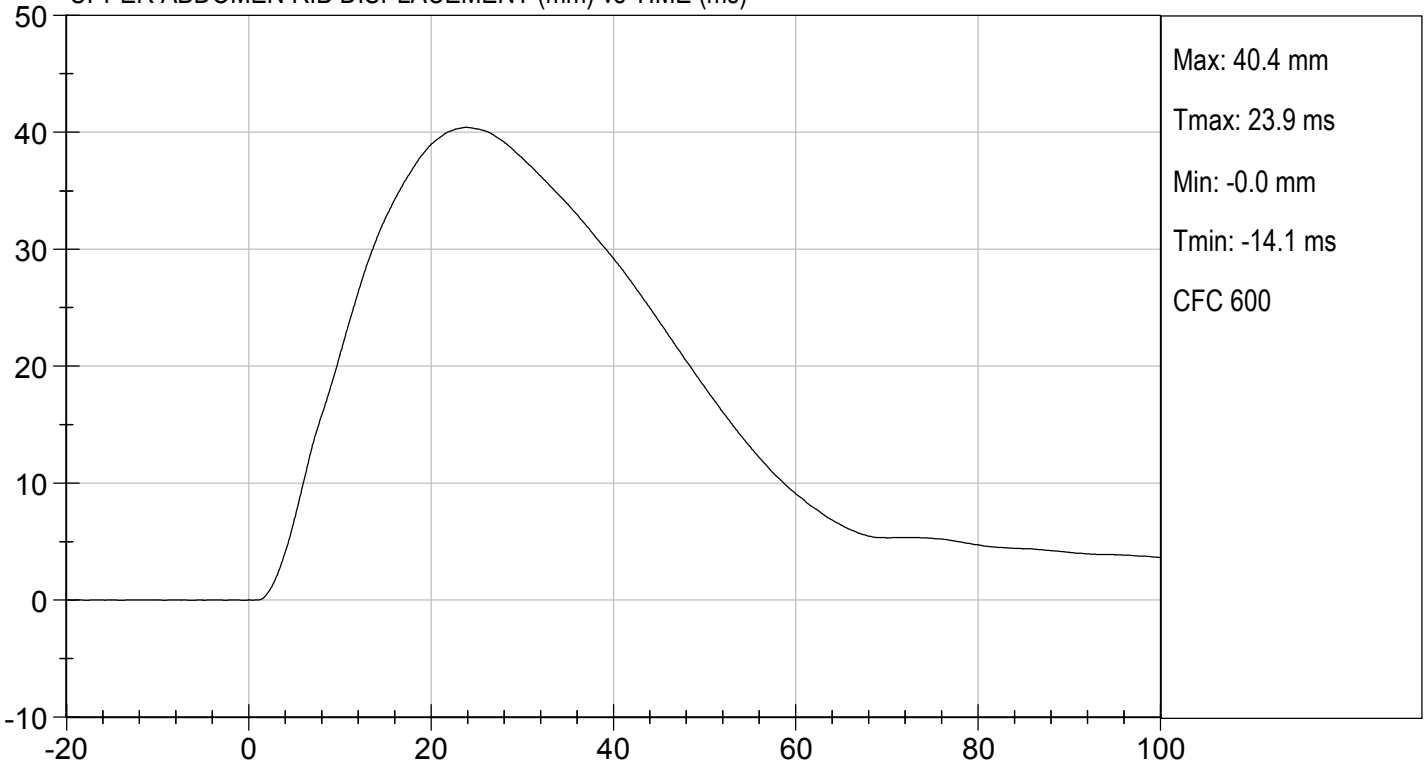
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 11/12/2019
TEST #: D193566

PROBE (G's) vs TIME (ms)



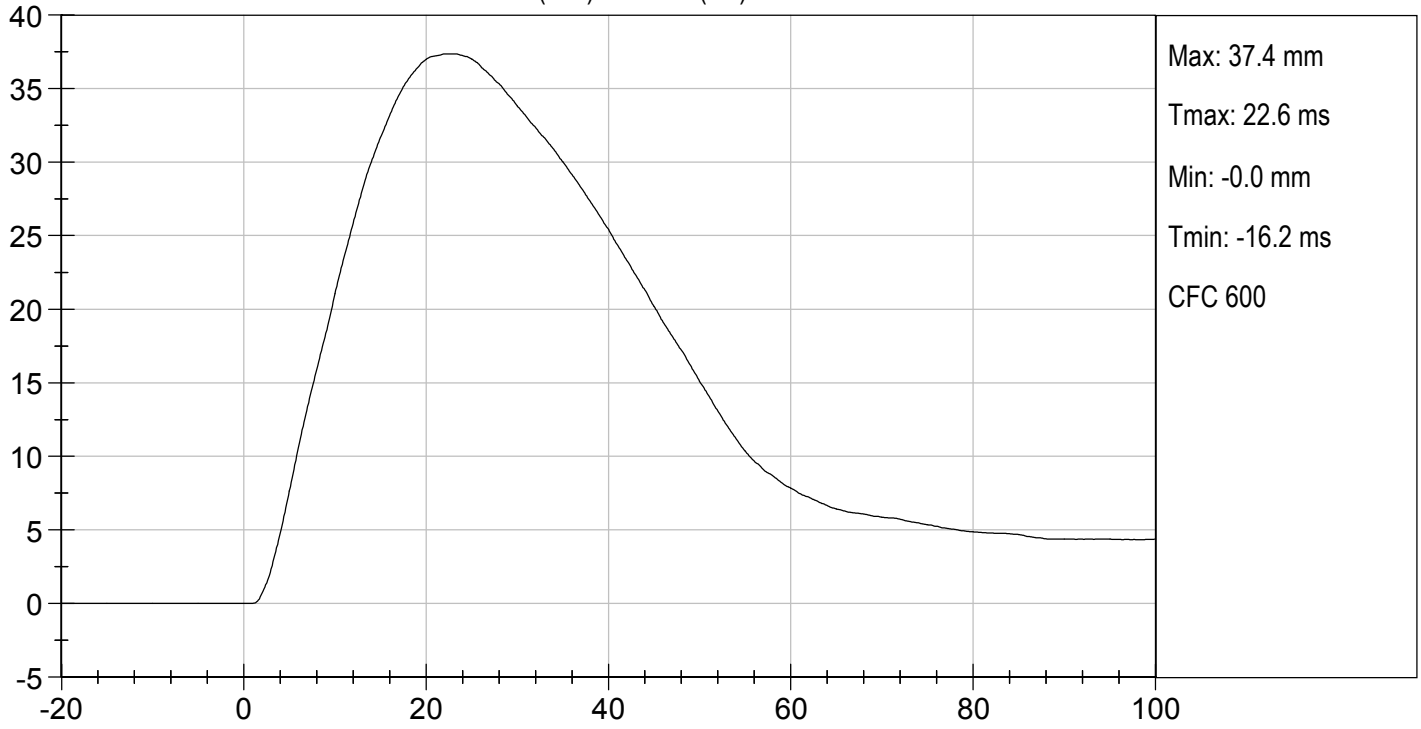
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



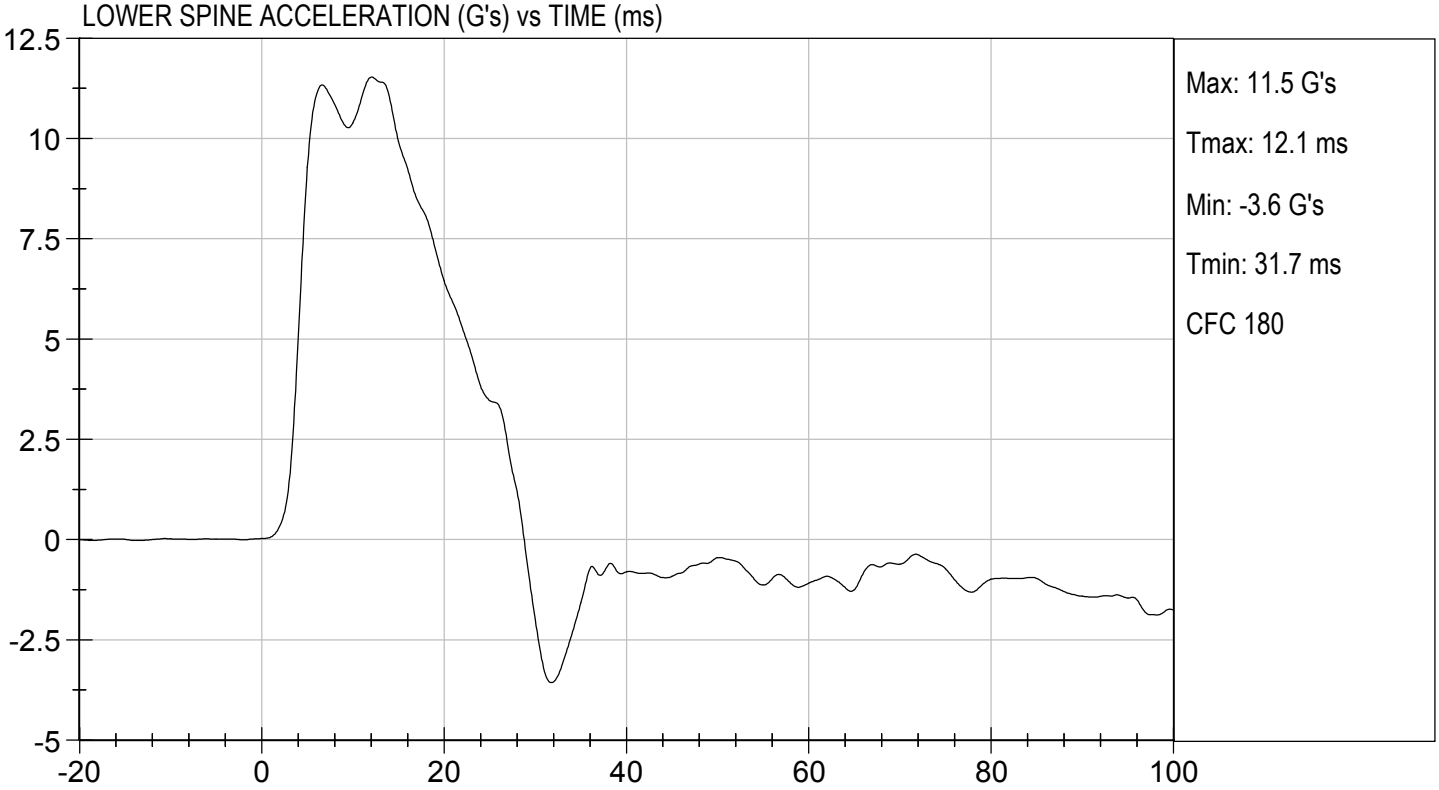
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 11/12/2019
TEST #: D193566

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: 306 **Test I.D:** D193567

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	18	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	38 to 47	44	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	36	Pass
Peak Acetabulum Force	N	3600 to 4300	4,229	Pass
		Overall Test Results		Pass

Laboratory Technician

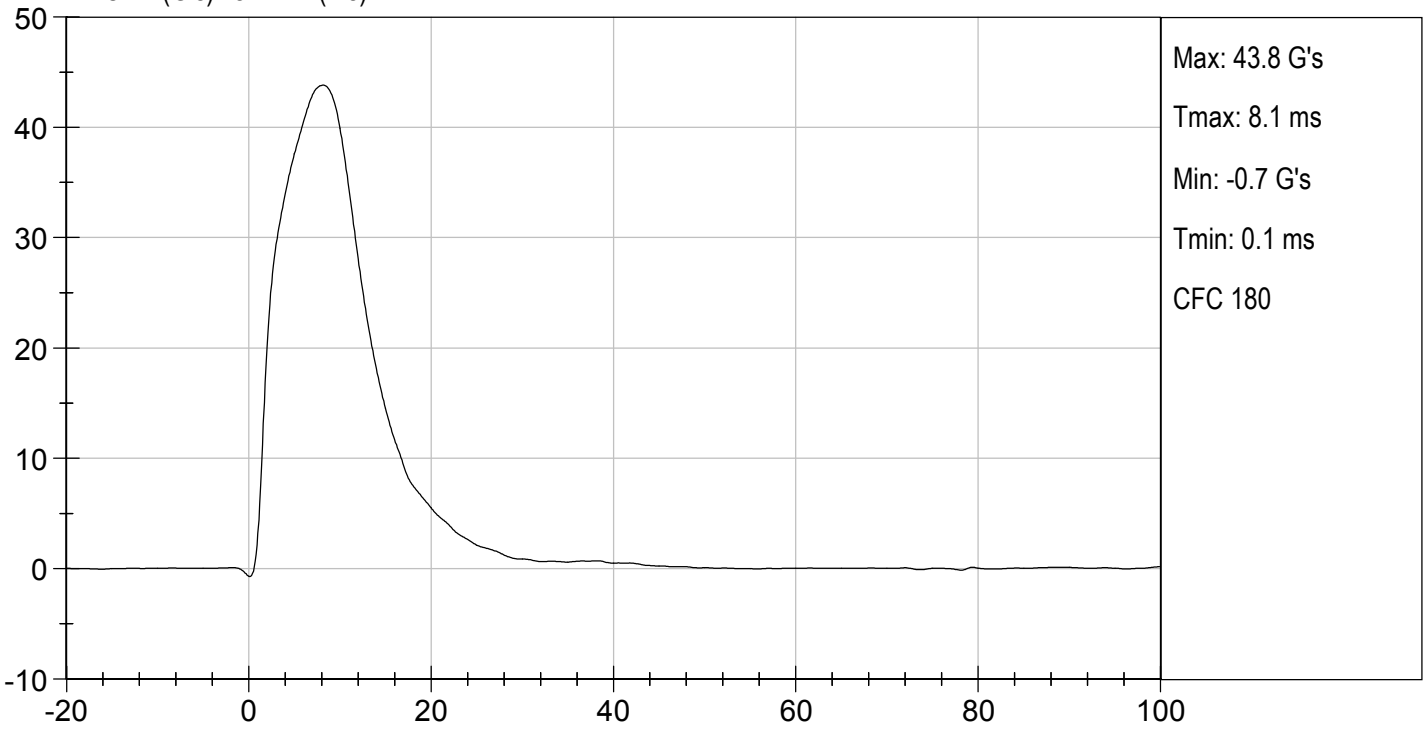
11/12/2019
Test Date

Approved By

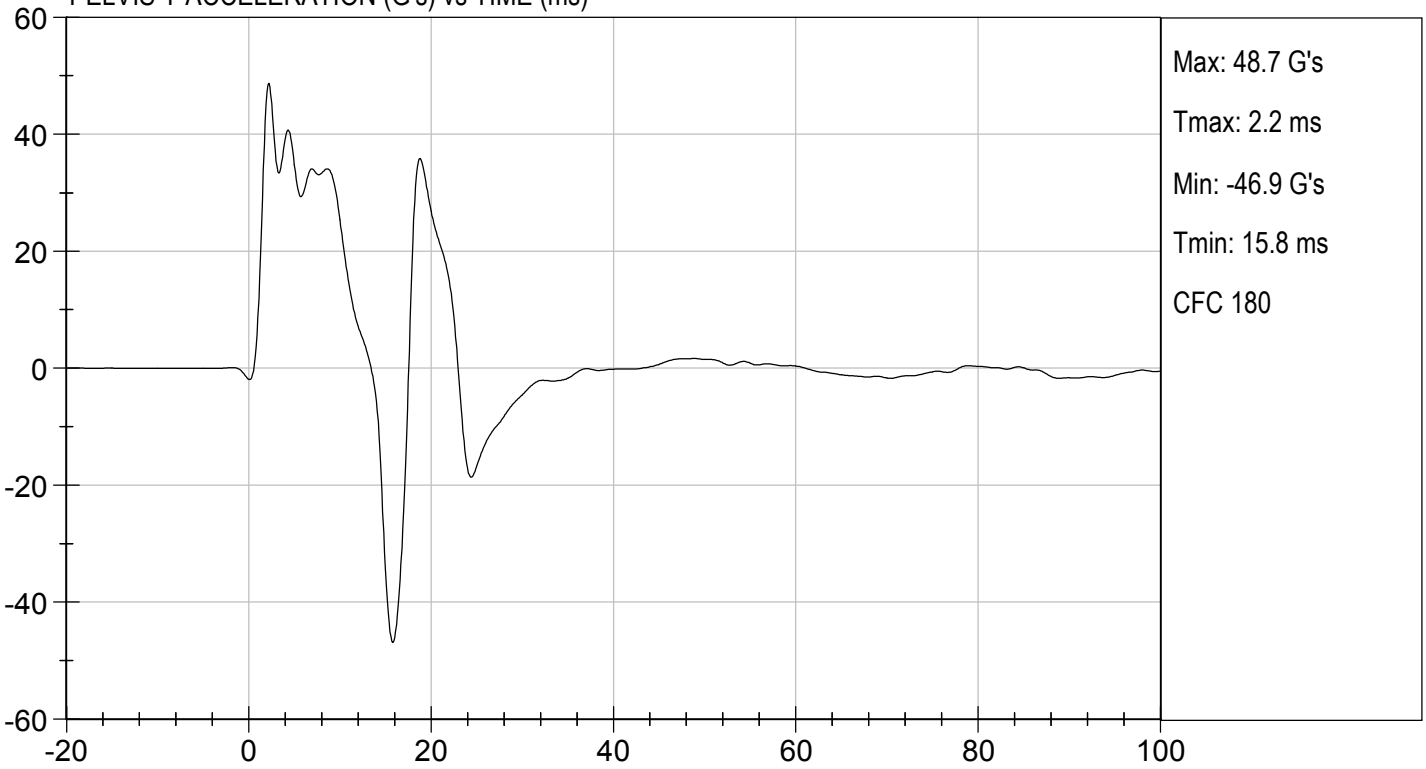
TEST DESC: PELVIS IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 11/12/2019
TEST #: D193567

PROBE (G's) vs TIME (ms)



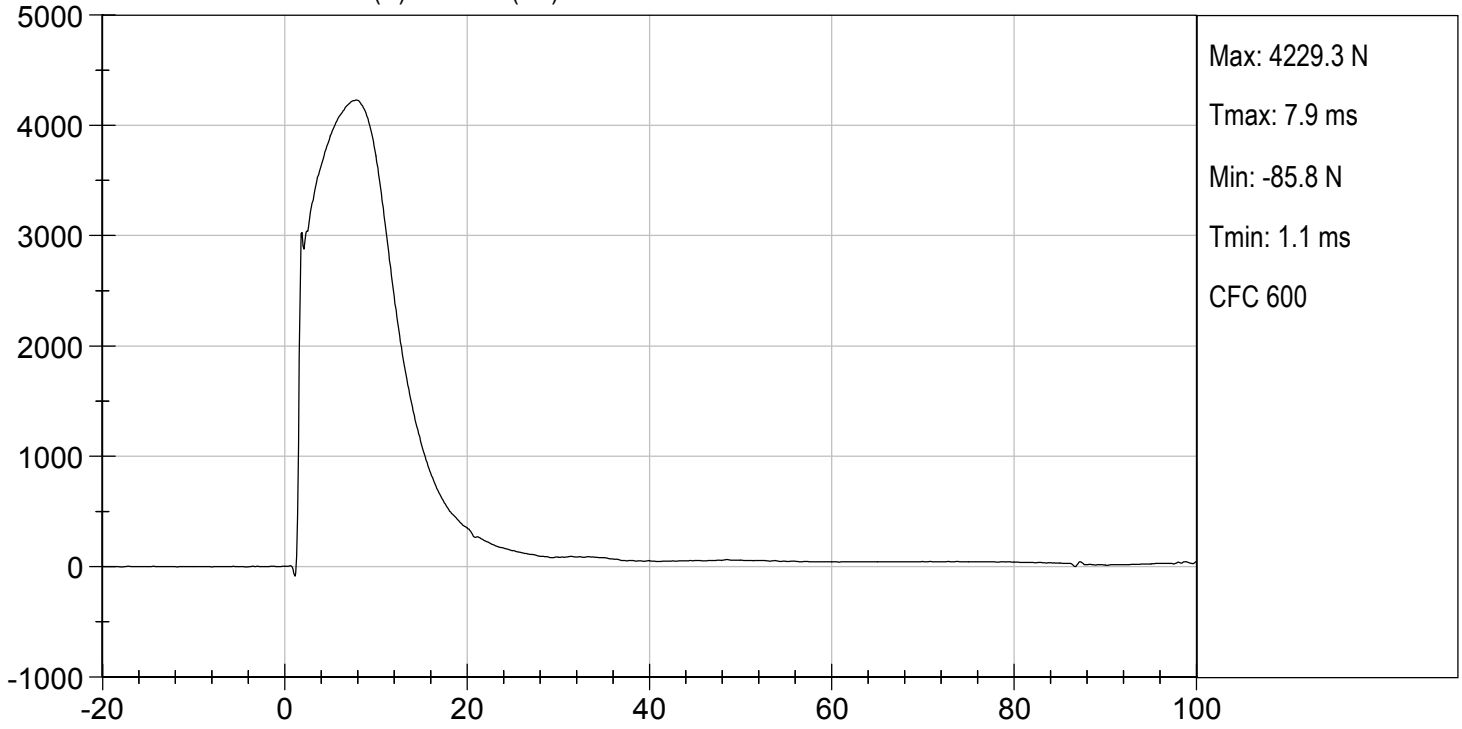
PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 11/12/2019
TEST #: D193567

ACETABULUM FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D193568

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Humidity	%	10 to 70	18	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	36 to 45	43	Pass
Pelvis Y Acceleration	G's	28 to 39	37	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,919	Pass
		Overall Test Results		Pass

Laboratory Technician

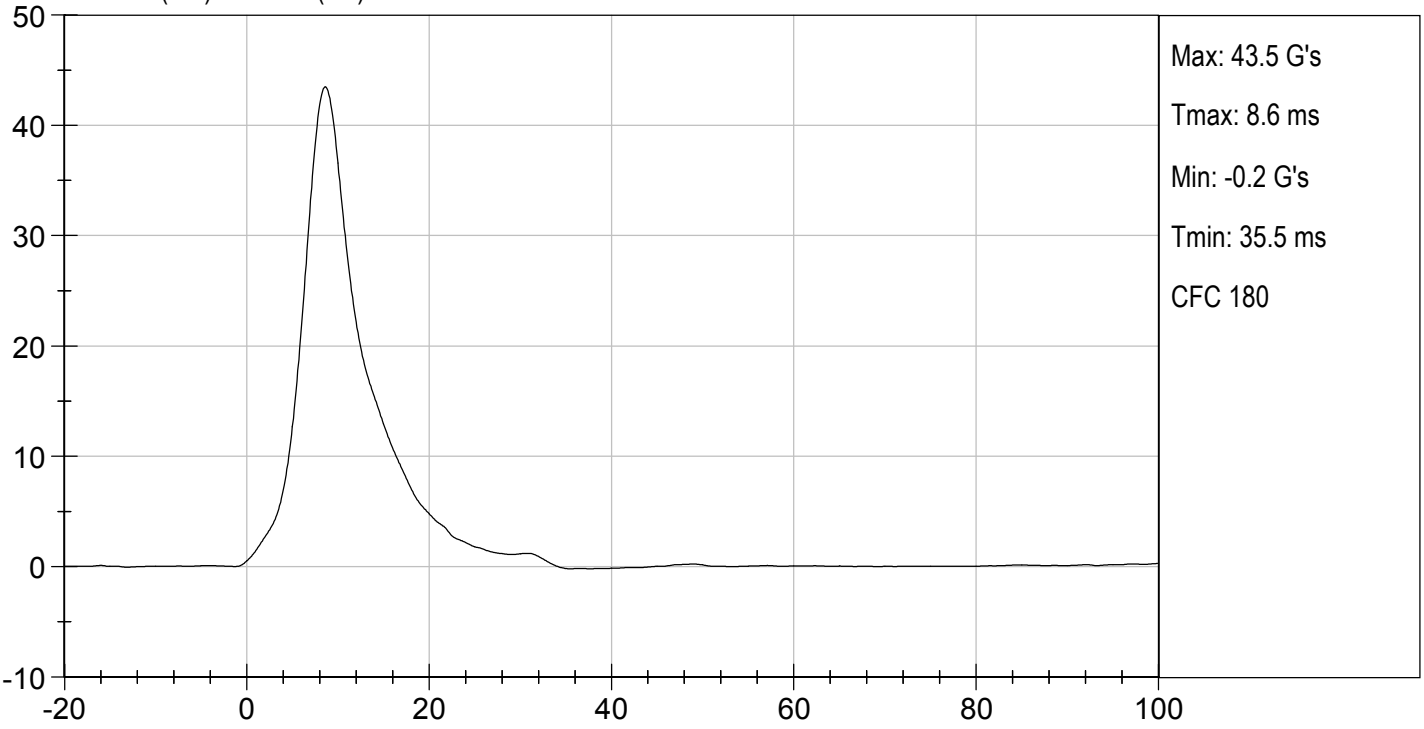
11/12/2019
Test Date

Approved By

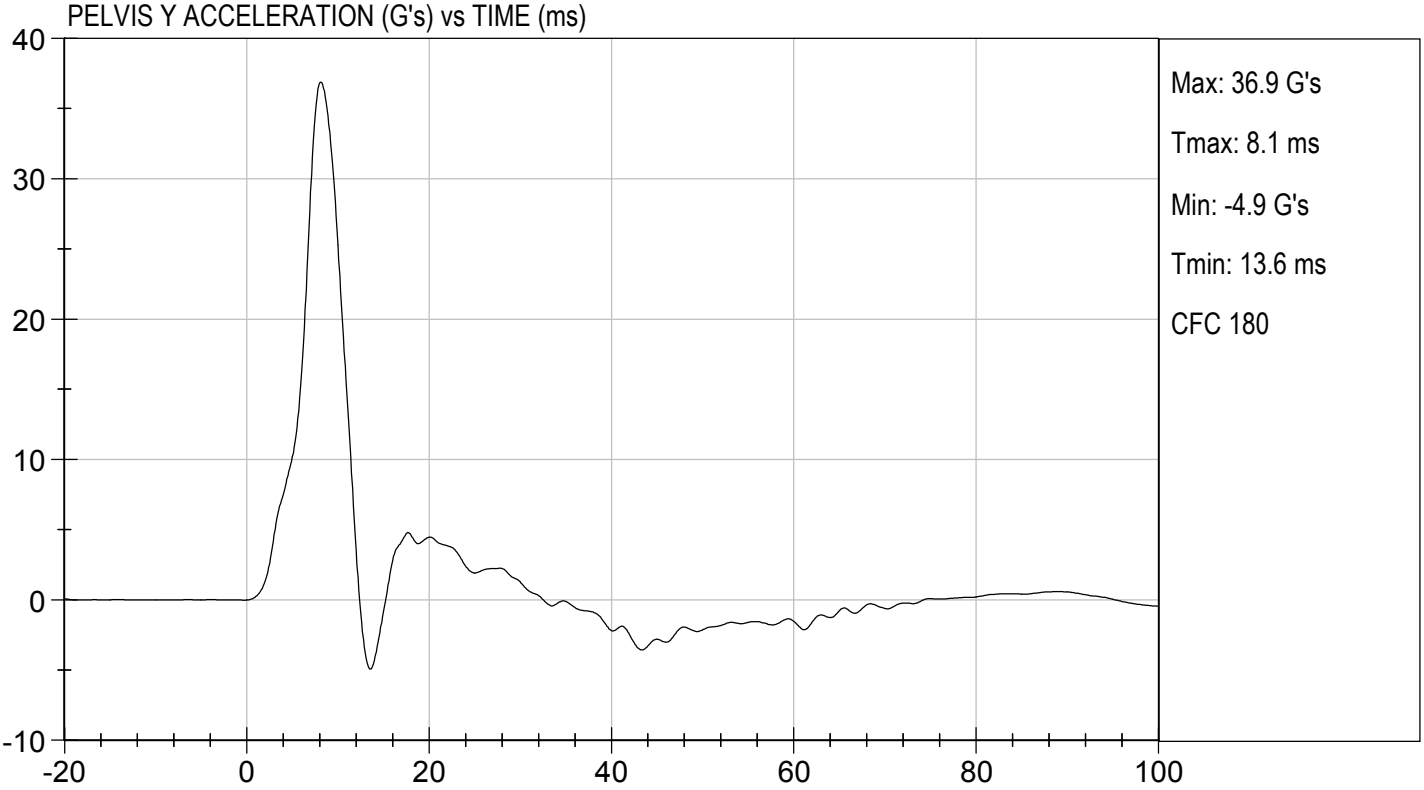
TEST DESC: ILLIAC
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 11/12/2019
TEST #: D193568

PROBE (G's) vs TIME (ms)

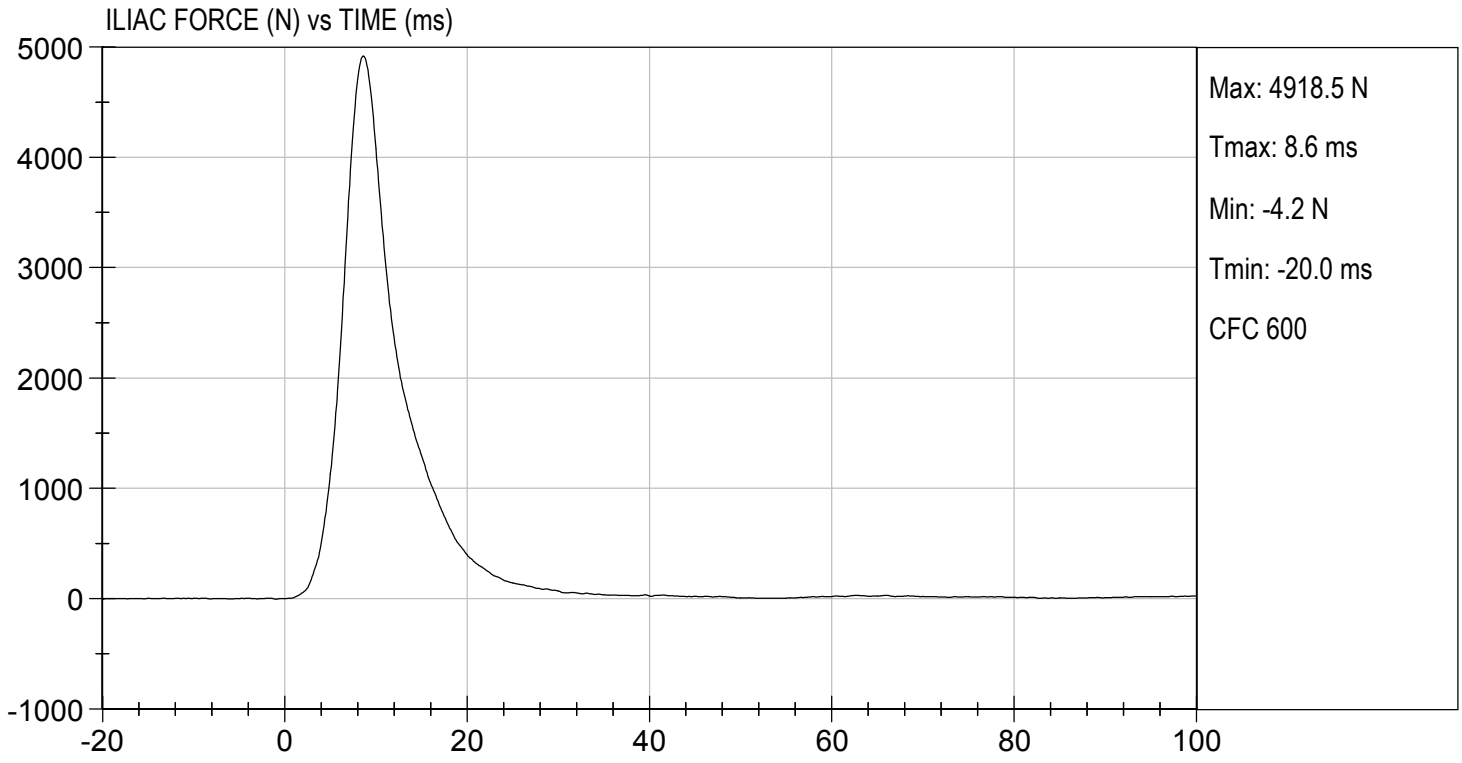


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 11/12/2019
TEST #: D193568



CALIBRATION TEST RESULTS

POST-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

SID-IIsD External Measurements
SN: 306

No.	Name	Spec. (mm)	Result	Pass/Fail
A	Sitting Height	772 - 788	785	Pass
B	Shoulder Pivot Height	437 - 453	449	Pass
C	H-point Height	79 - 89	86	Pass
D	H-point from Seatback	141 - 151	147	Pass
E	Shoulder Pivot from Backline	97 - 107	99	Pass
F	Thigh Clearance	119 -135	120	Pass
G	Head Breadth	140 - 148	141	Pass
H	Head Back from Backline	40 - 46	45	Pass
I	Head Depth	178 - 188	182	Pass
J	Head Circumference	541 - 551	550	Pass
K	Buttock to Knee Length	514 - 540	538	Pass
L	Popliteal Height	343 - 369	349	Pass
M	Knee Pivot to Floor Height	392 - 409	394	Pass
N	Buttock Popliteal Length	416 - 442	435	Pass
O	Chest Depth w/o Jacket	195 - 211	198	Pass
P	Foot Length	216 - 232	222	Pass
Q	Hip Breadth (w/ pelvic plugs)	313 - 323	317	Pass
R	Arm Length	249 - 259	250	Pass
S	Knee Joint to Seatback	477 - 493	483	Pass
V	Shoulder Width	341 - 357	351	Pass
W	Foot Width	78 - 94	82	Pass
Y	Chest Circumference w/ jacket	851 - 881	863	Pass
Z	Waist Circumference	761 - 791	782	Pass

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D193651

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	115 to 137	135	Pass
Peak Longitudinal Acceleration	G's	+/- 15	8.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

11/25/2019

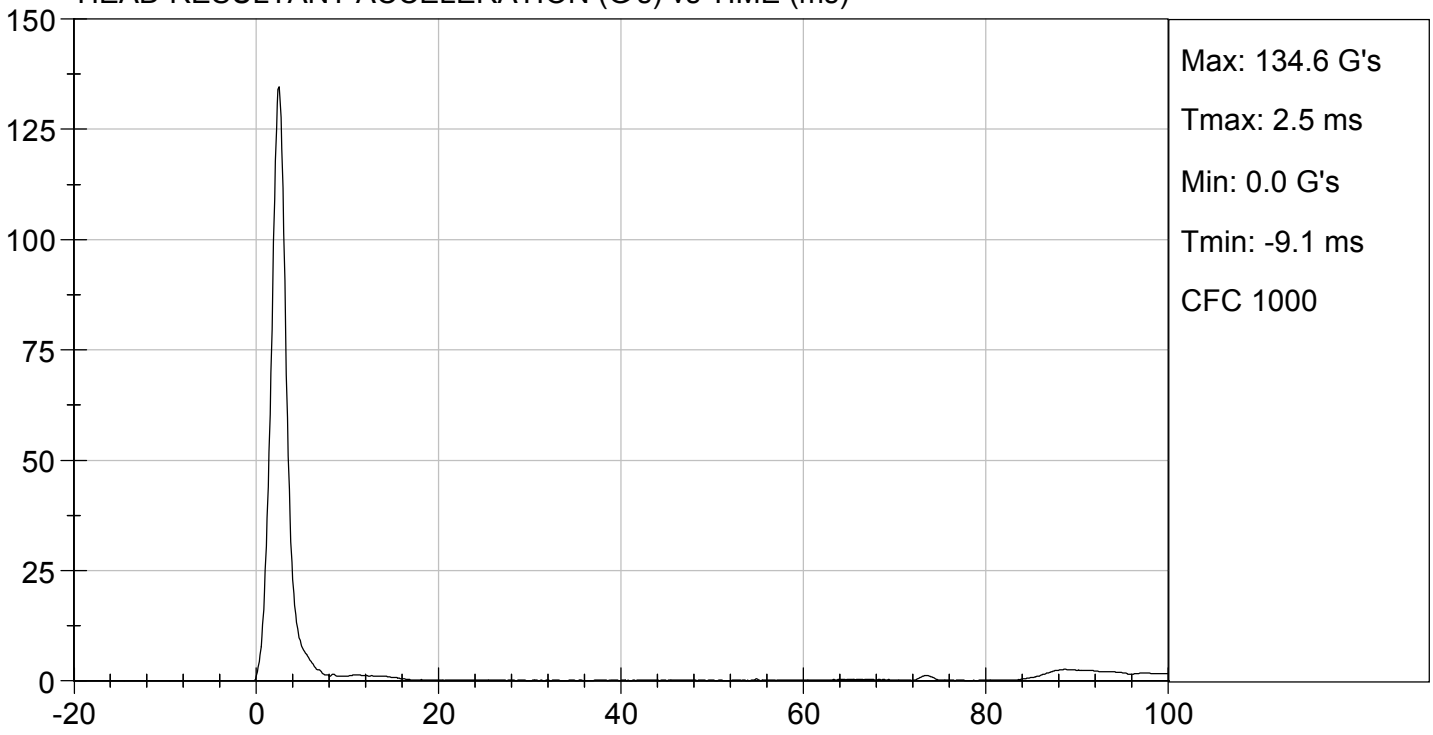
Test Date

Approved By

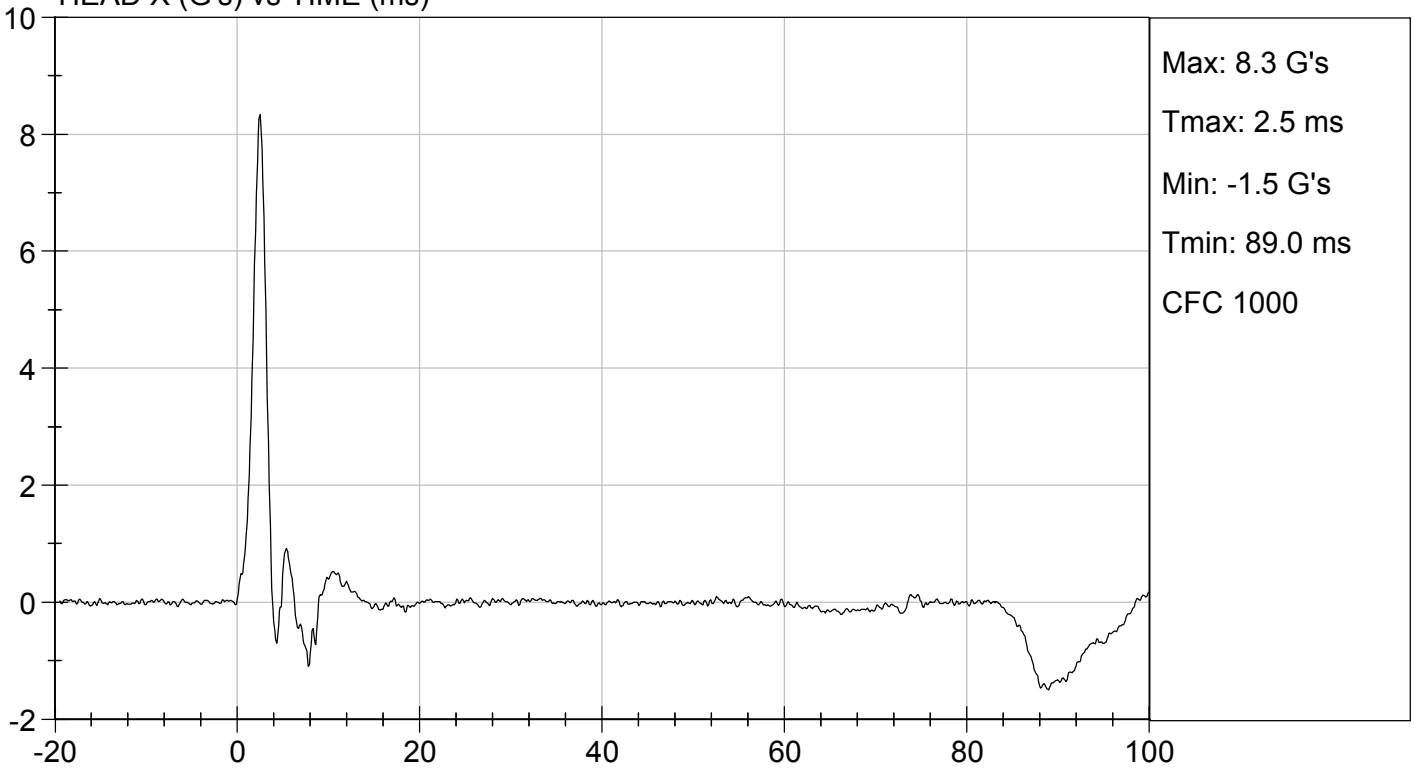
TEST DESC: HEAD DROP

TEST DATE: 11/25/2019
TEST #: D193651

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

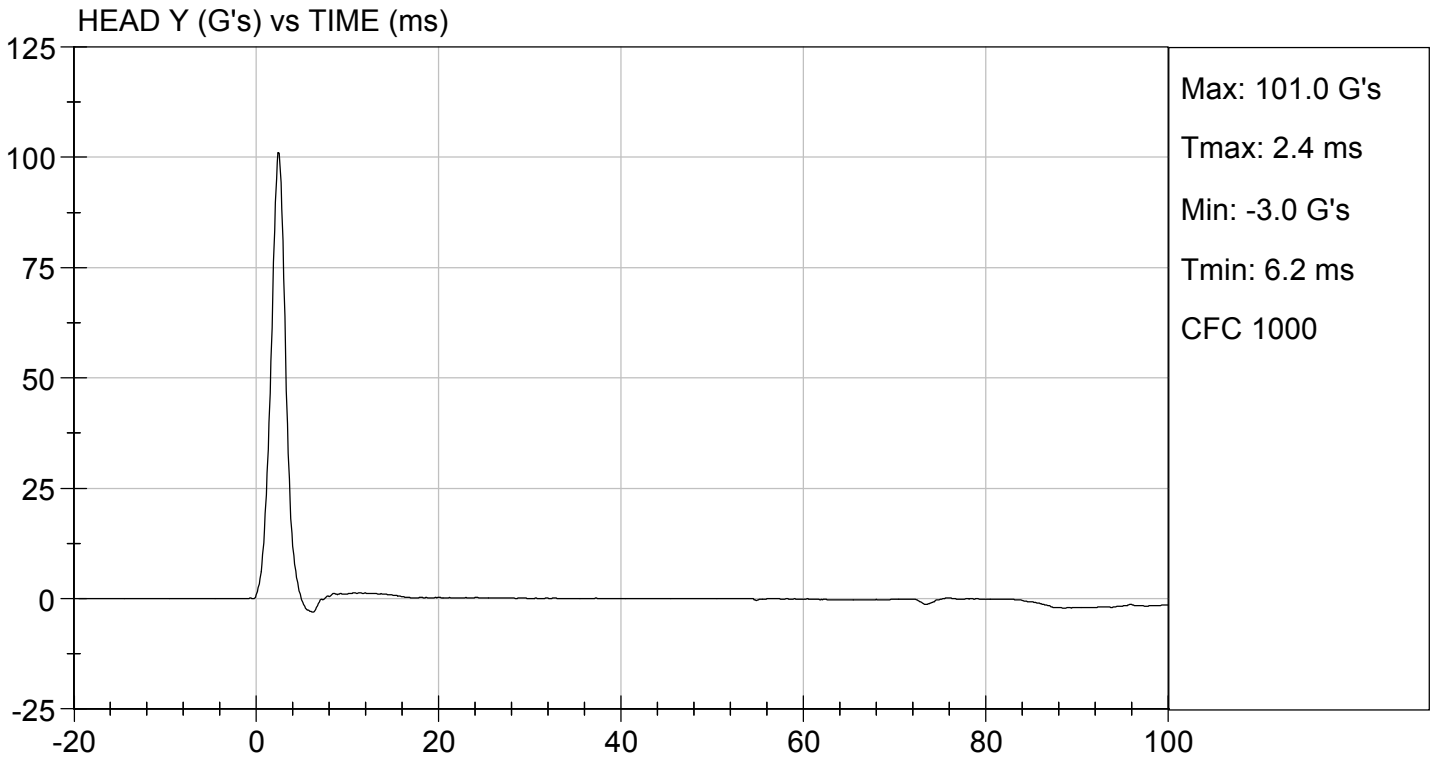


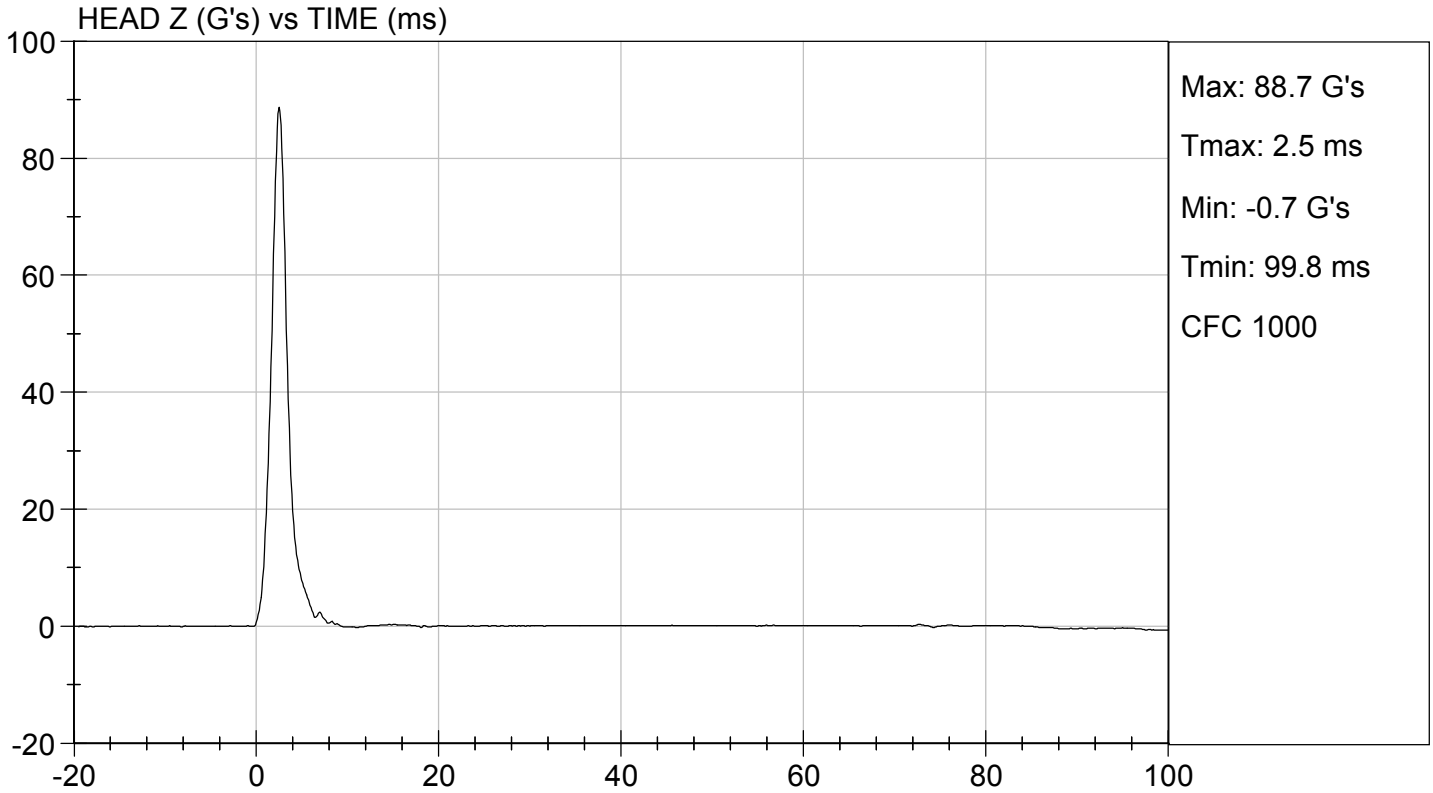
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 11/25/2019
TEST #: D193651





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D193652

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.1	Pass
Humidity		%	10 to 70	26	Pass
Impact Velocity		m/s	5.51 to 5.63	5.62	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.48	Pass
	15 ms	m/s	3.30 to 4.10	3.67	Pass
	20 ms	m/s	4.40 to 5.40	4.97	Pass
	25 ms	m/s	5.40 to 6.10	5.70	Pass
	25-100 ms	m/s	5.50 to 6.20	5.71	Pass
Maximum D-Plane Rotation		deg	71 to 81	73	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	60	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-37	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	117	Pass
			Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

11/26/2019

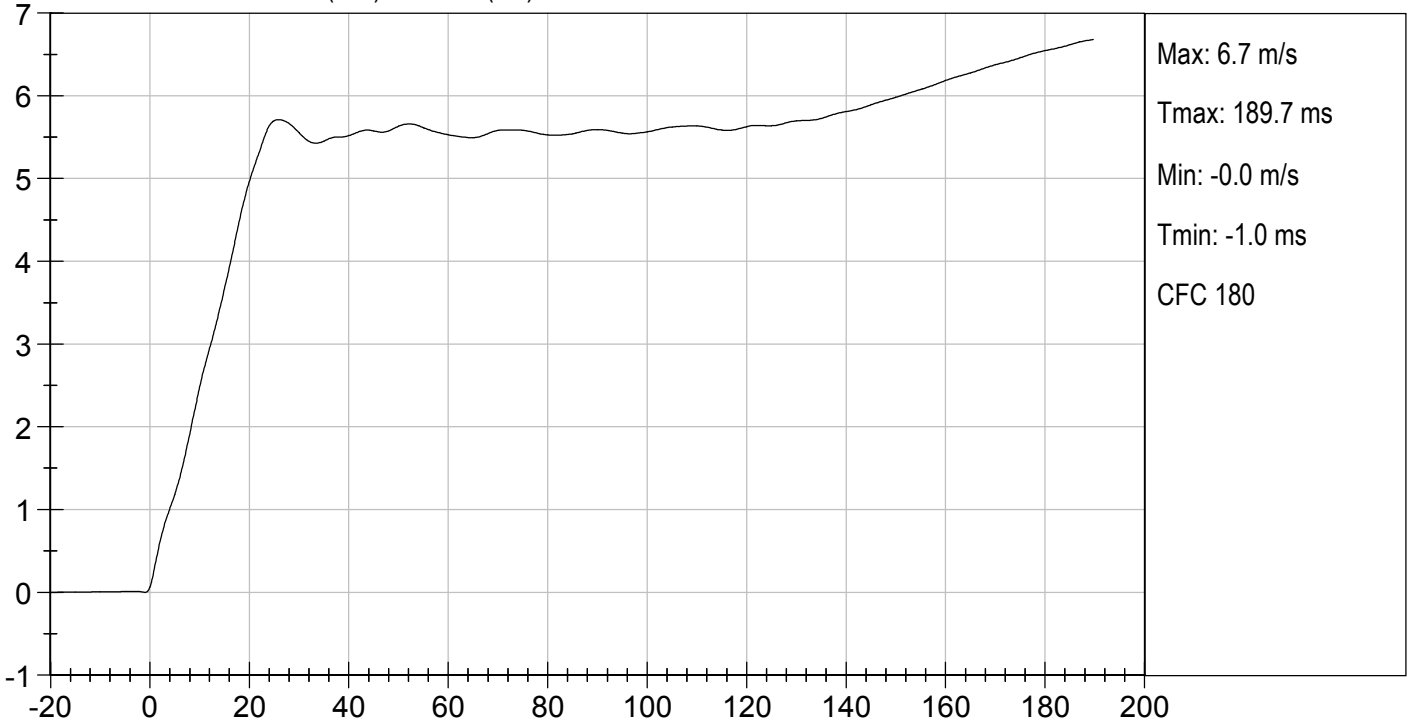
Test Date

Approved By

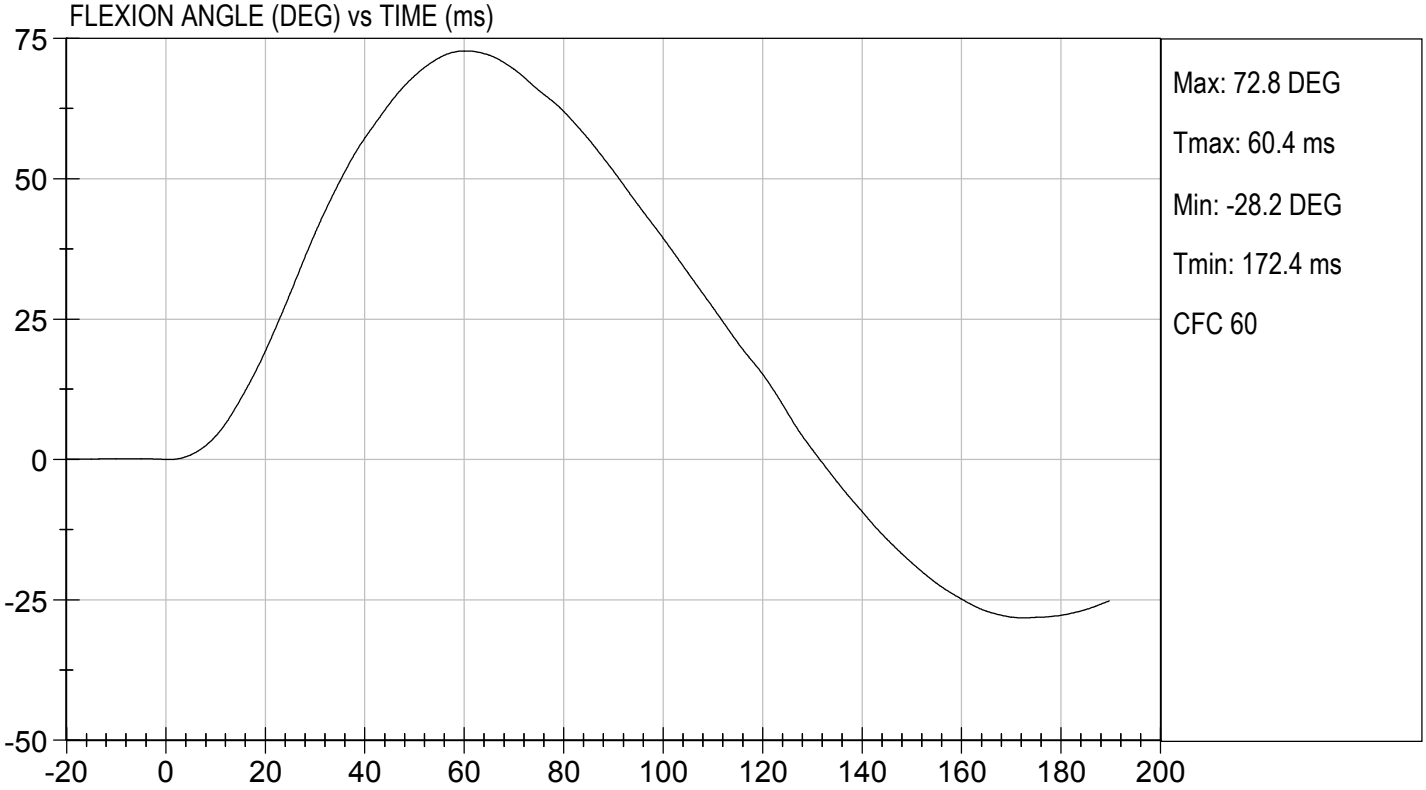
TEST DESC: NECK BENDING
VELOCITY: 18.45 ft/s, 5.62 m/s

TEST DATE: 11/26/2019
TEST #: D193652

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

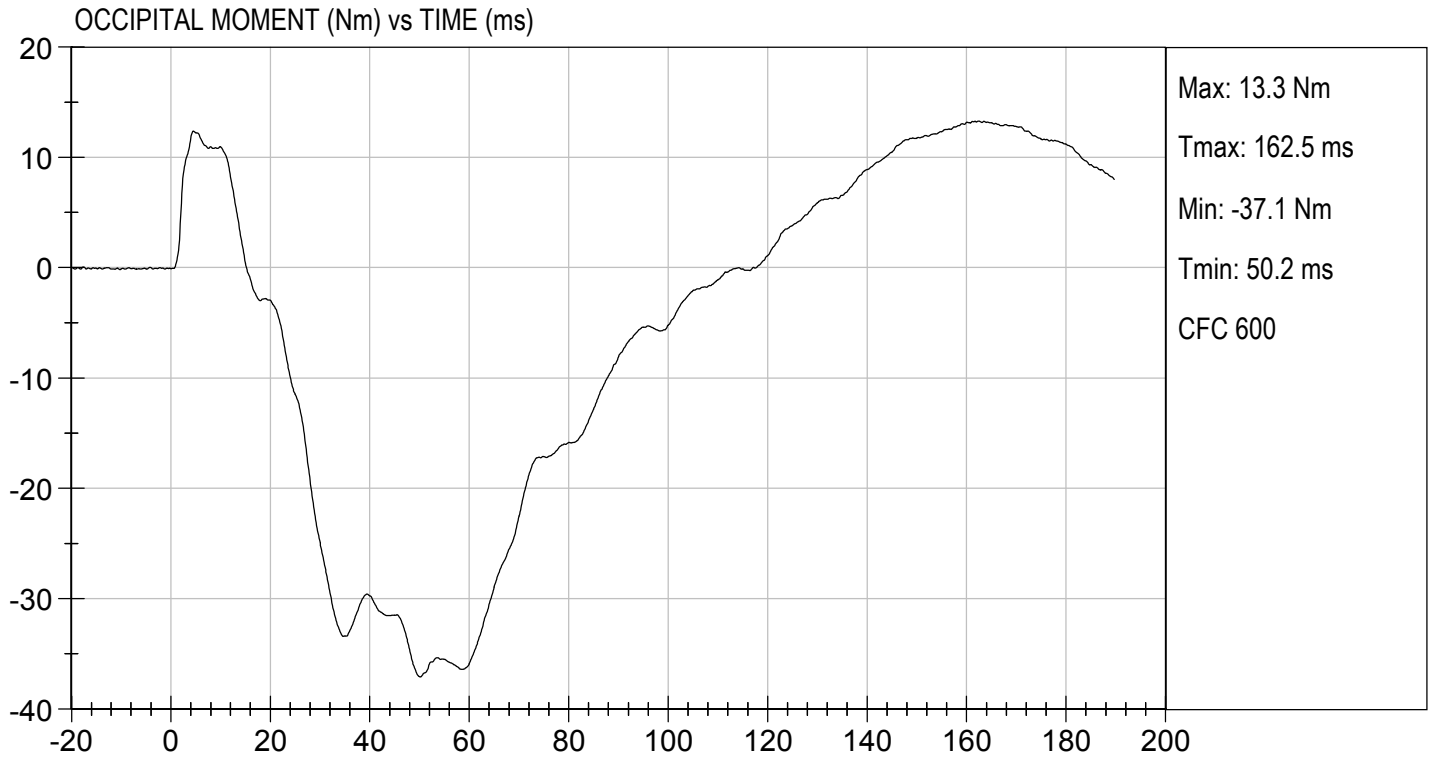


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.45 ft/s, 5.62 m/s

TEST DATE: 11/26/2019
TEST #: D193652



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D193653

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	26	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	29	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	20	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

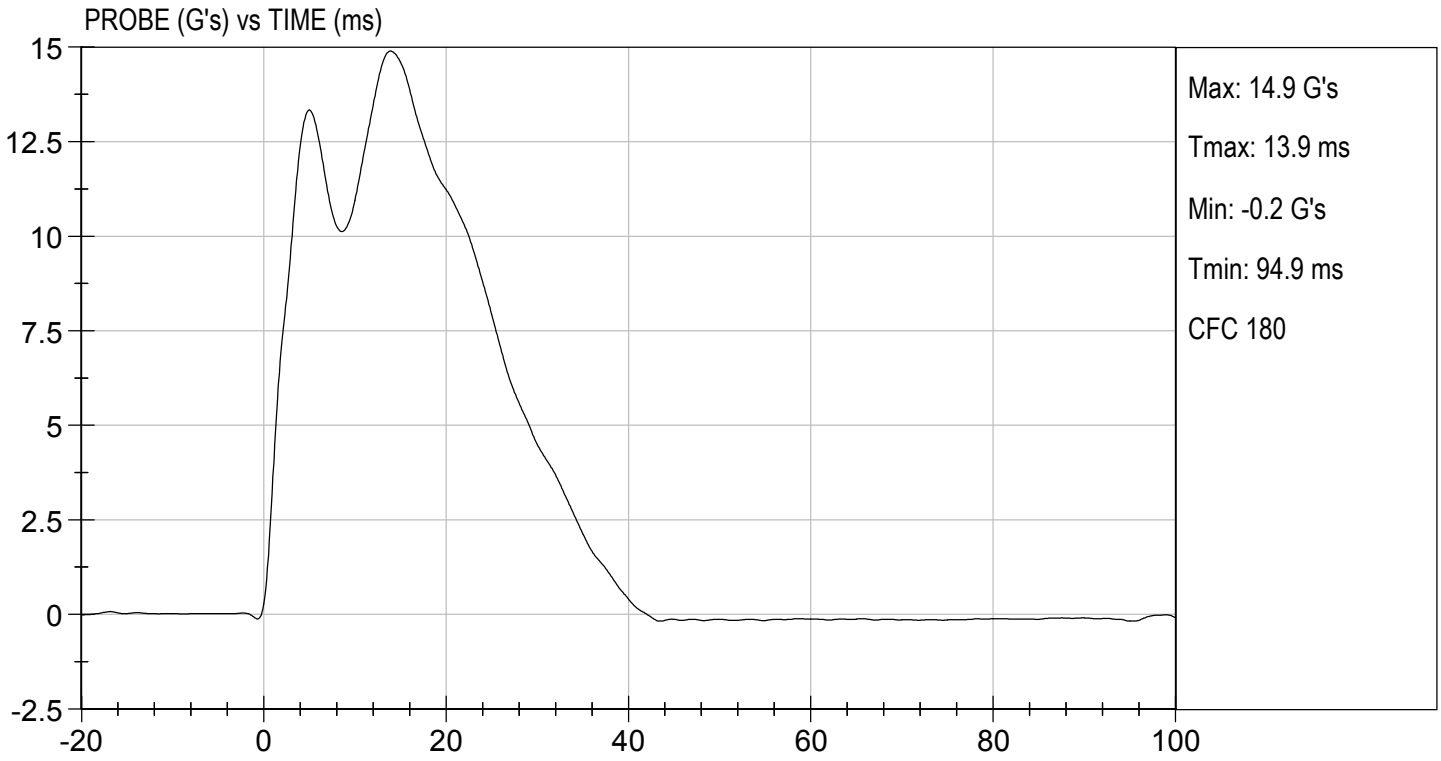
11/25/2019

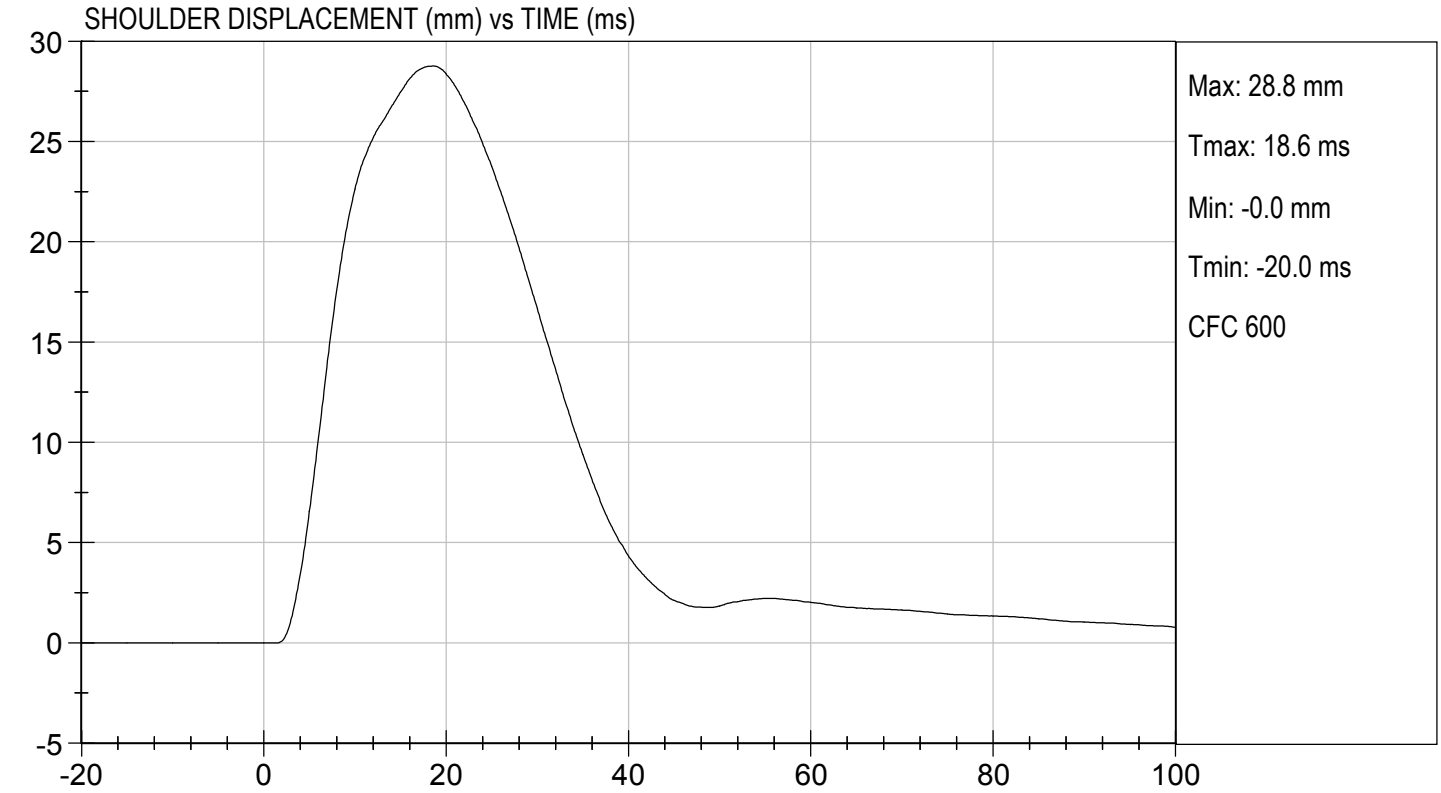
Test Date

Approved By

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

TEST DATE: 11/25/2019
TEST #: D193653

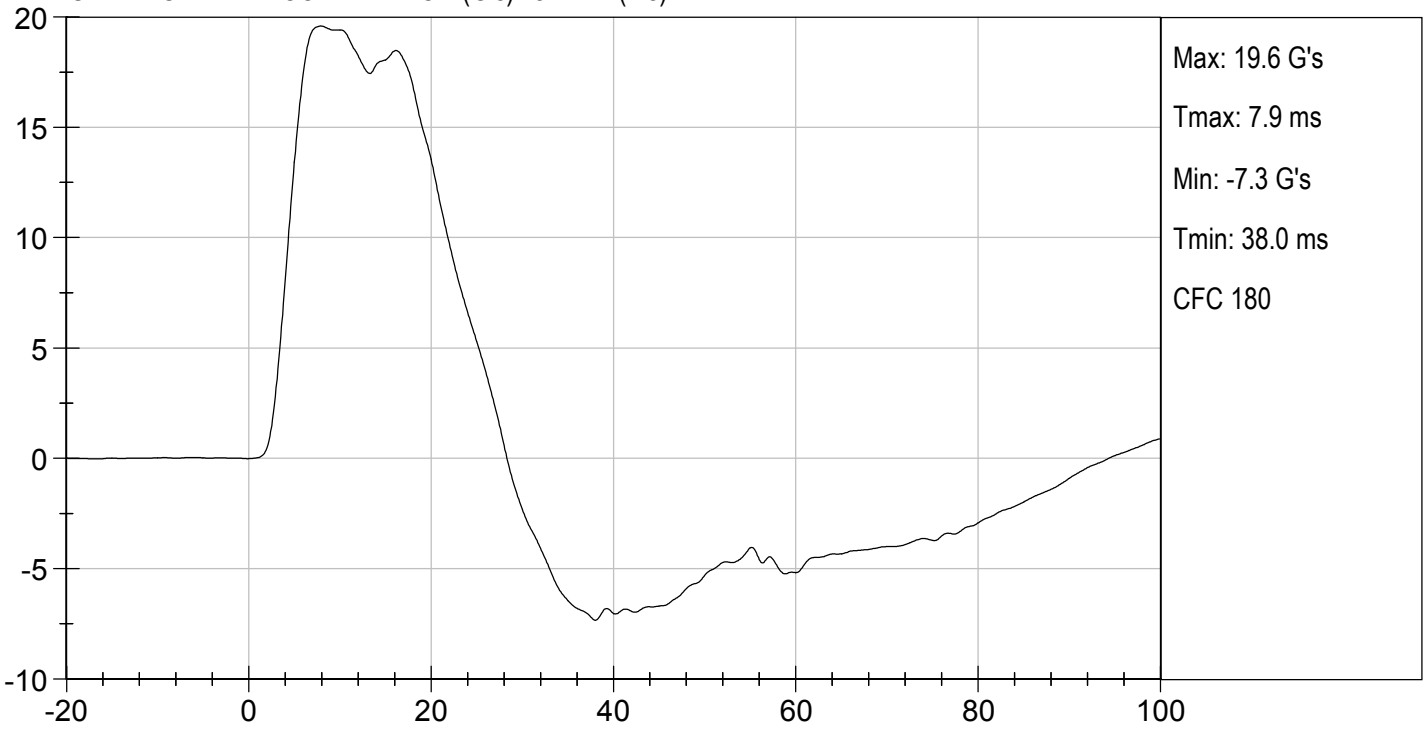




TEST DESC: SHOULDER IMPACT
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 11/25/2019
TEST #: D193653

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: 306 **Test I.D:** D193654

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	26	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	32	Pass
Shoulder Displacement	mm	31 to 40	32	Pass
Upper Rib Displacement	mm	25 to 32	27	Pass
Middle Rib Displacement	mm	30 to 36	32	Pass
Lower Rib Displacement	mm	32 to 38	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	41	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	32	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

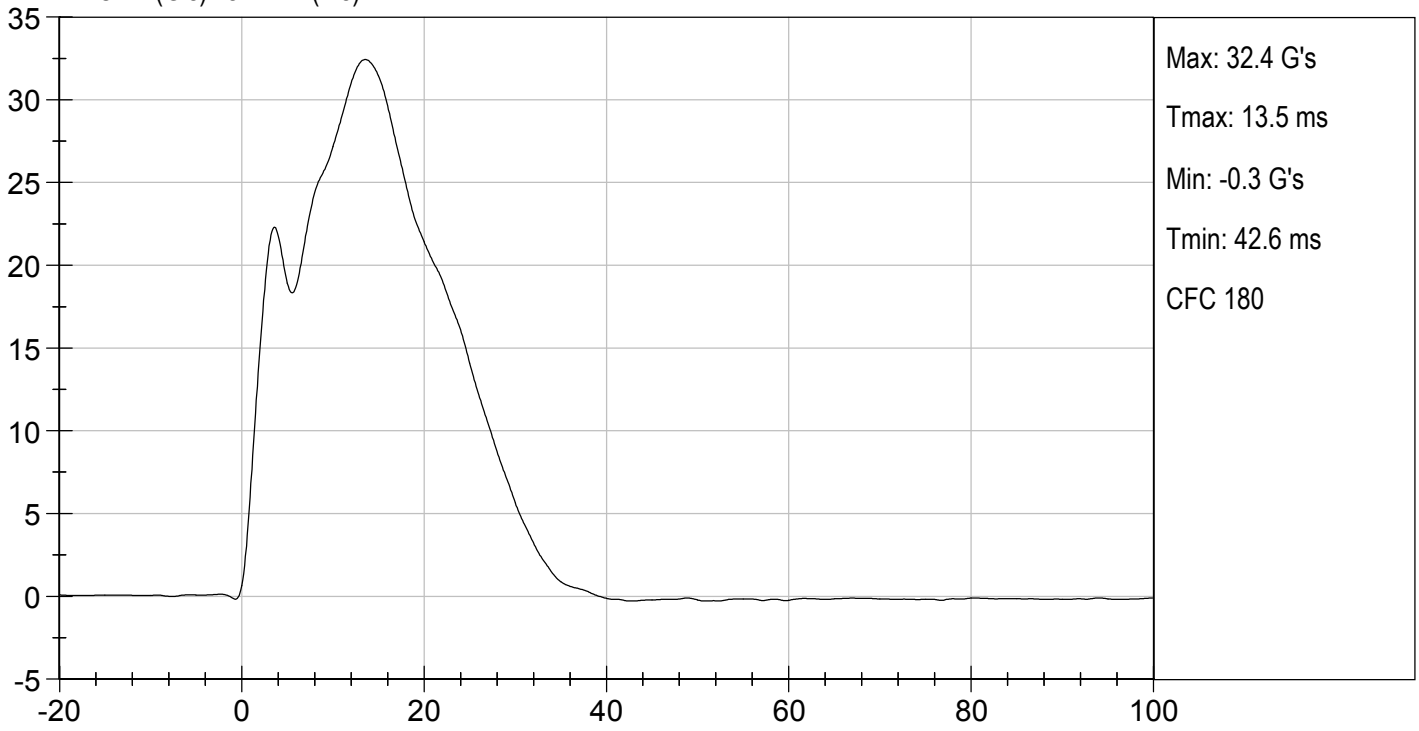
11/25/2019
Test Date

Approved By

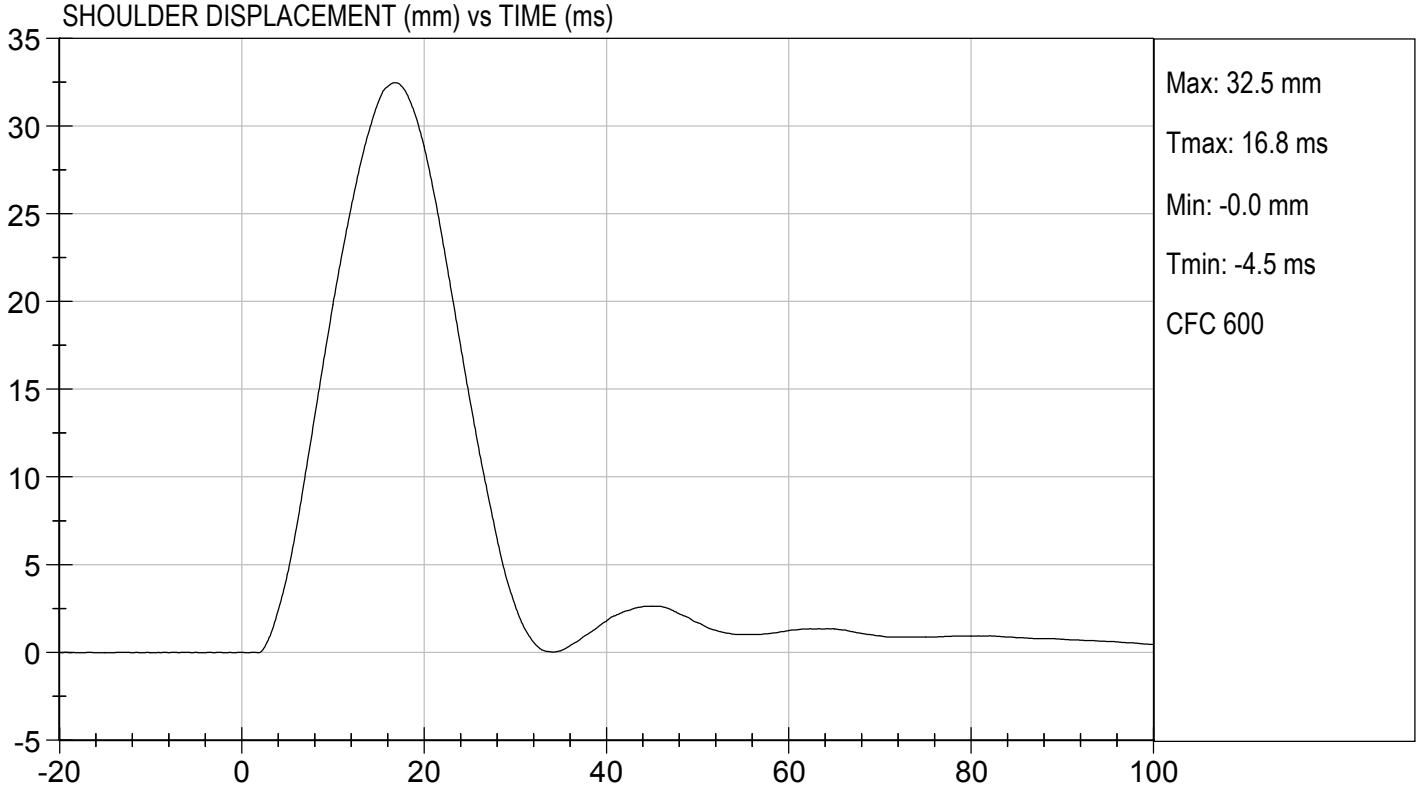
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 11/25/2019
TEST #: D193654

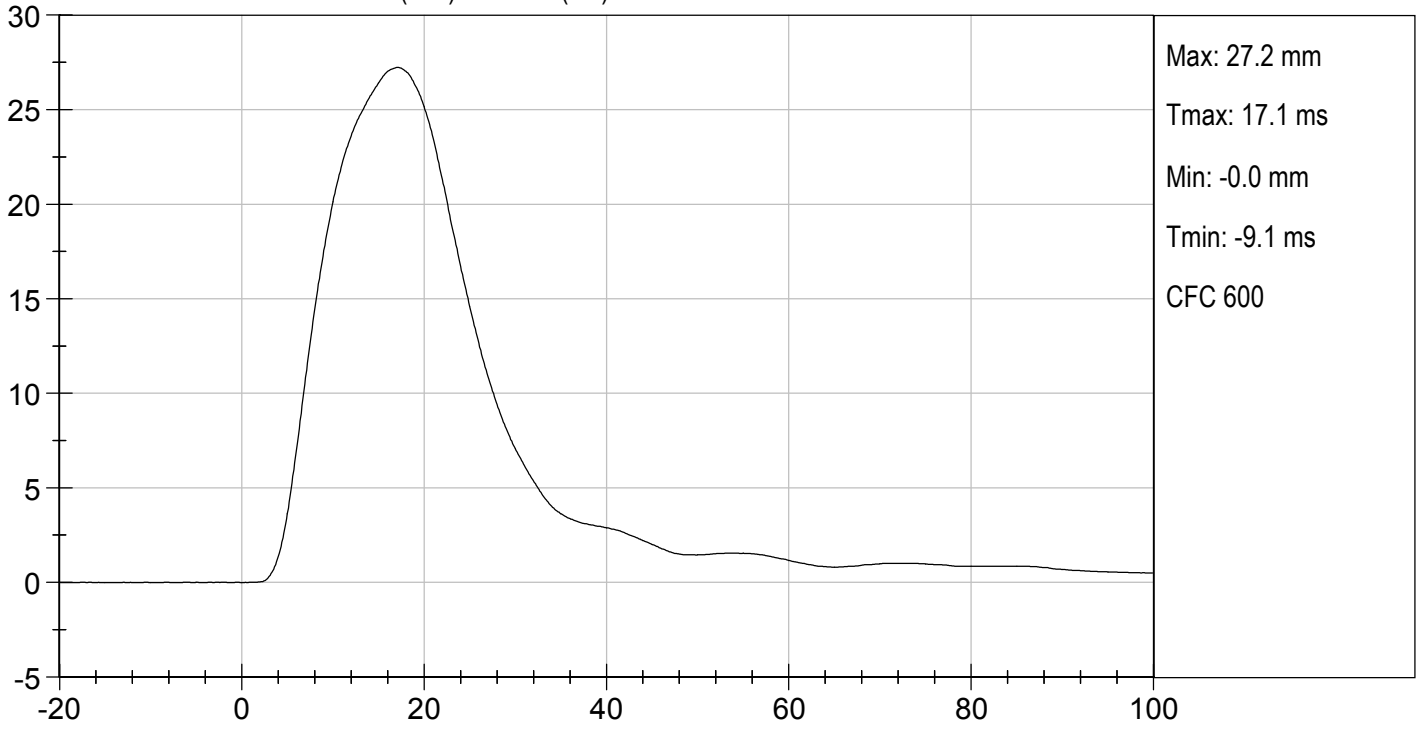
PROBE (G's) vs TIME (ms)



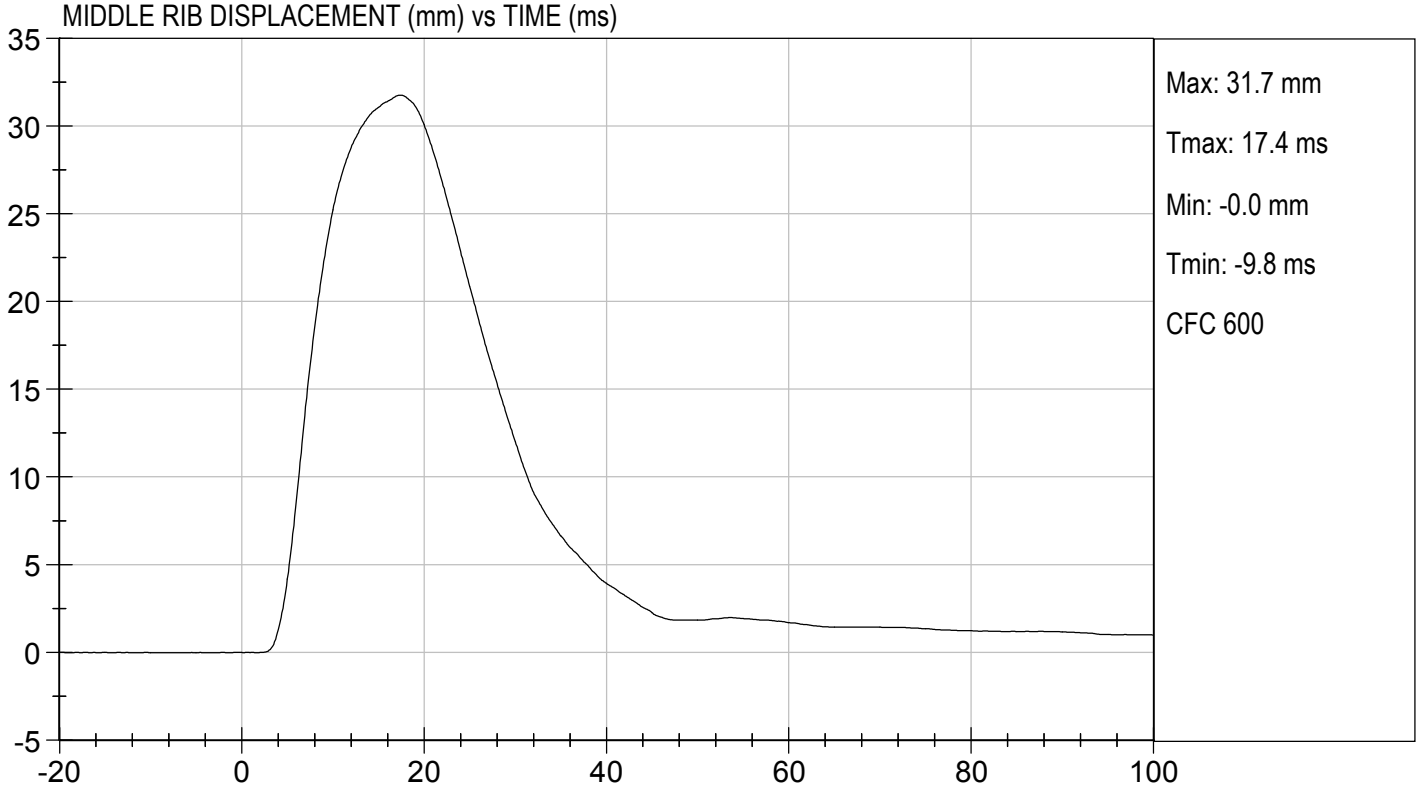
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



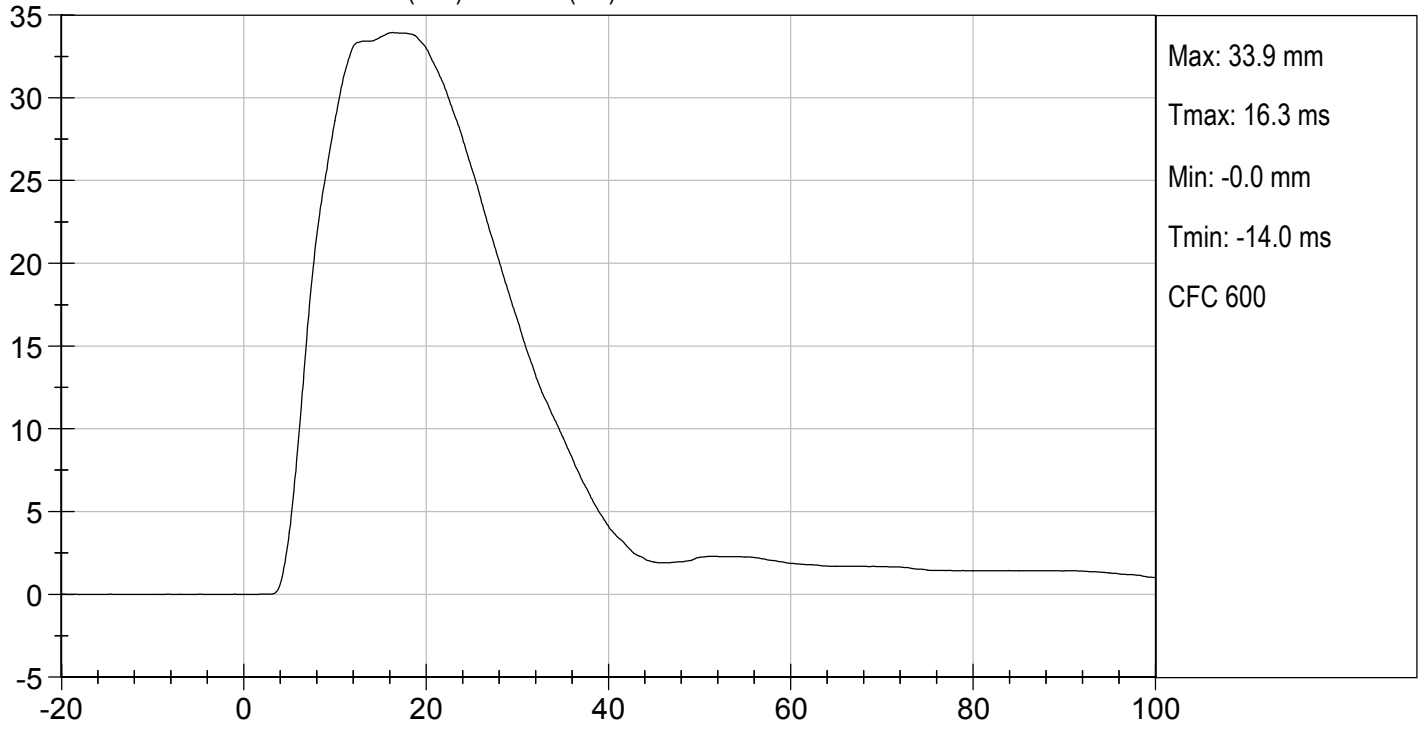
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



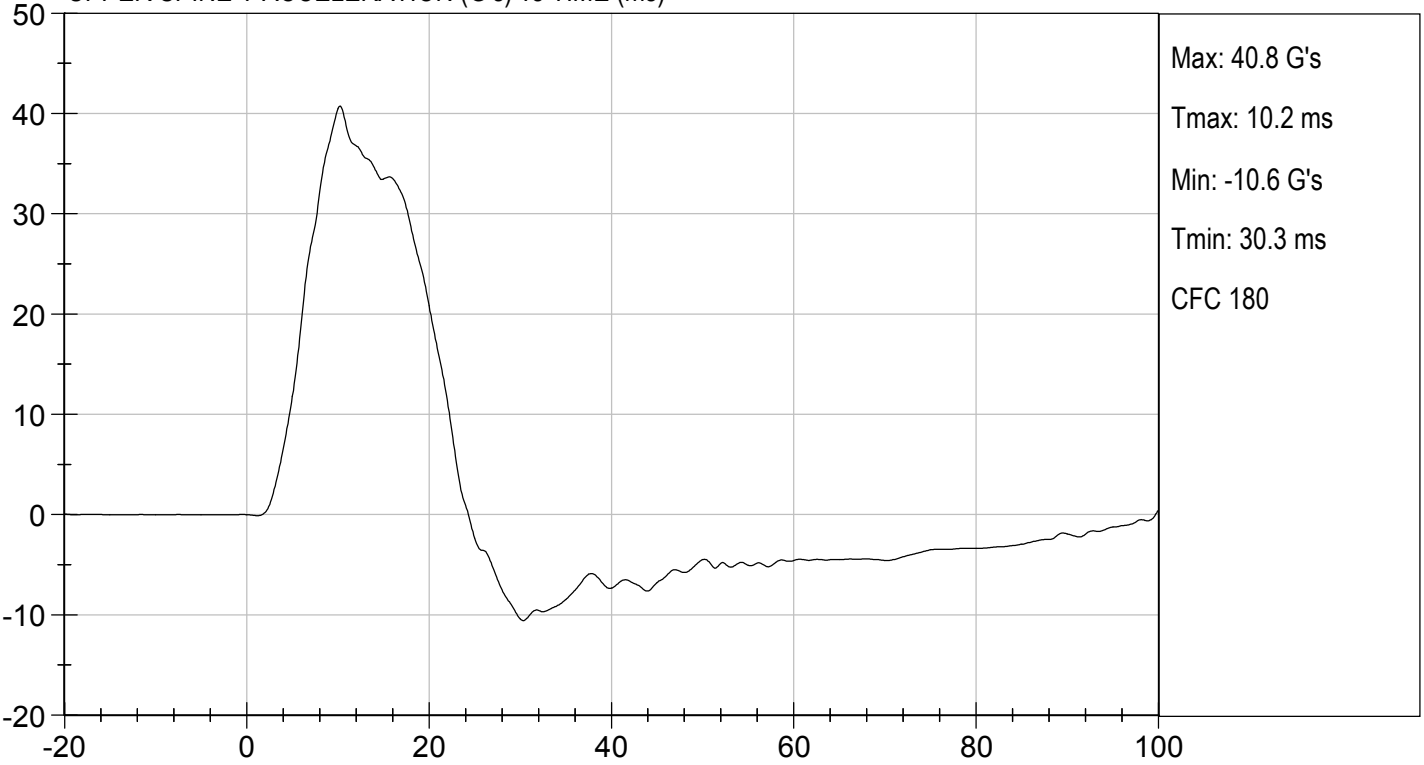
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 11/25/2019
TEST #: D193654

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



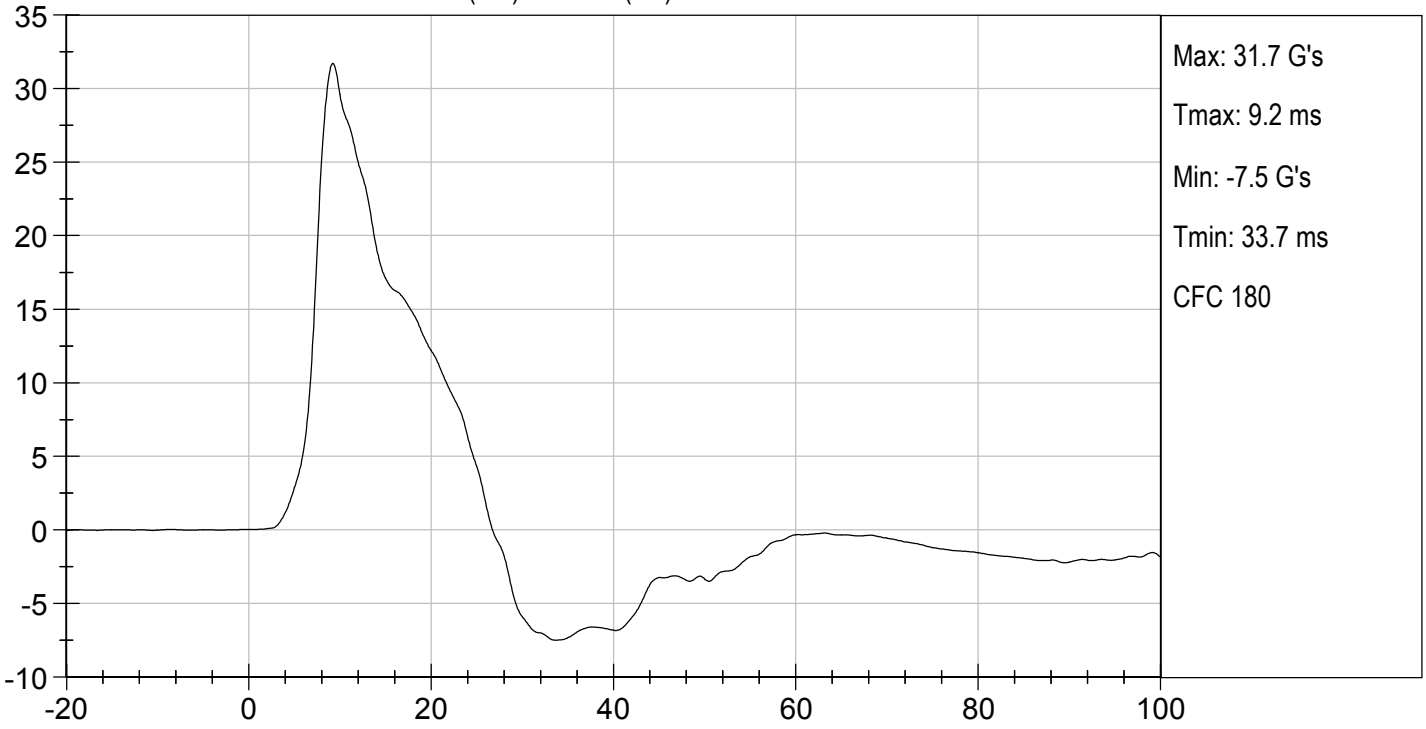
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 11/25/2019
TEST #: D193654

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: 306 **Test I.D:** D193655

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	26	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	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	41	Pass
Lower Rib Displacement	mm	35 to 43	37	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	16	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

11/25/2019

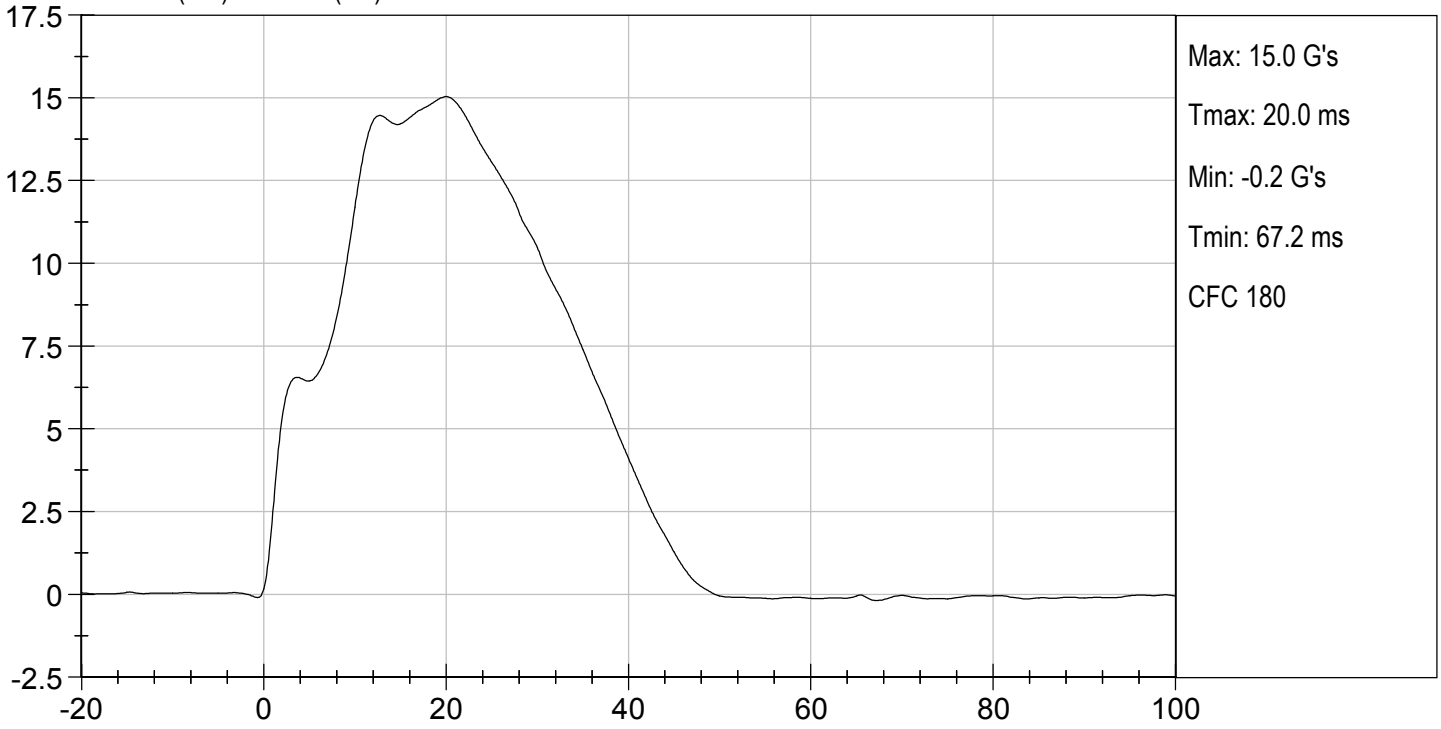
Test Date

Approved By

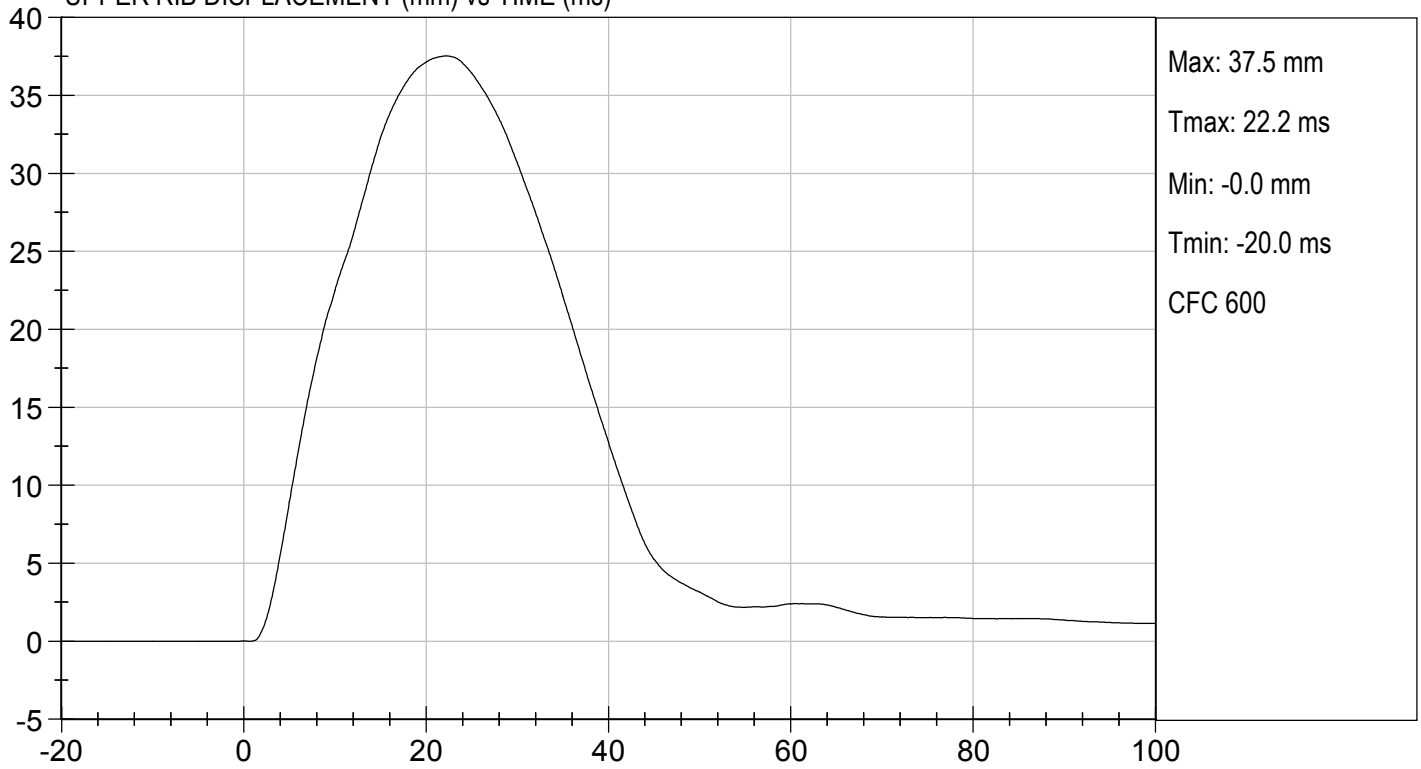
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 11/25/2019
TEST #: D193655

PROBE (G's) vs TIME (ms)



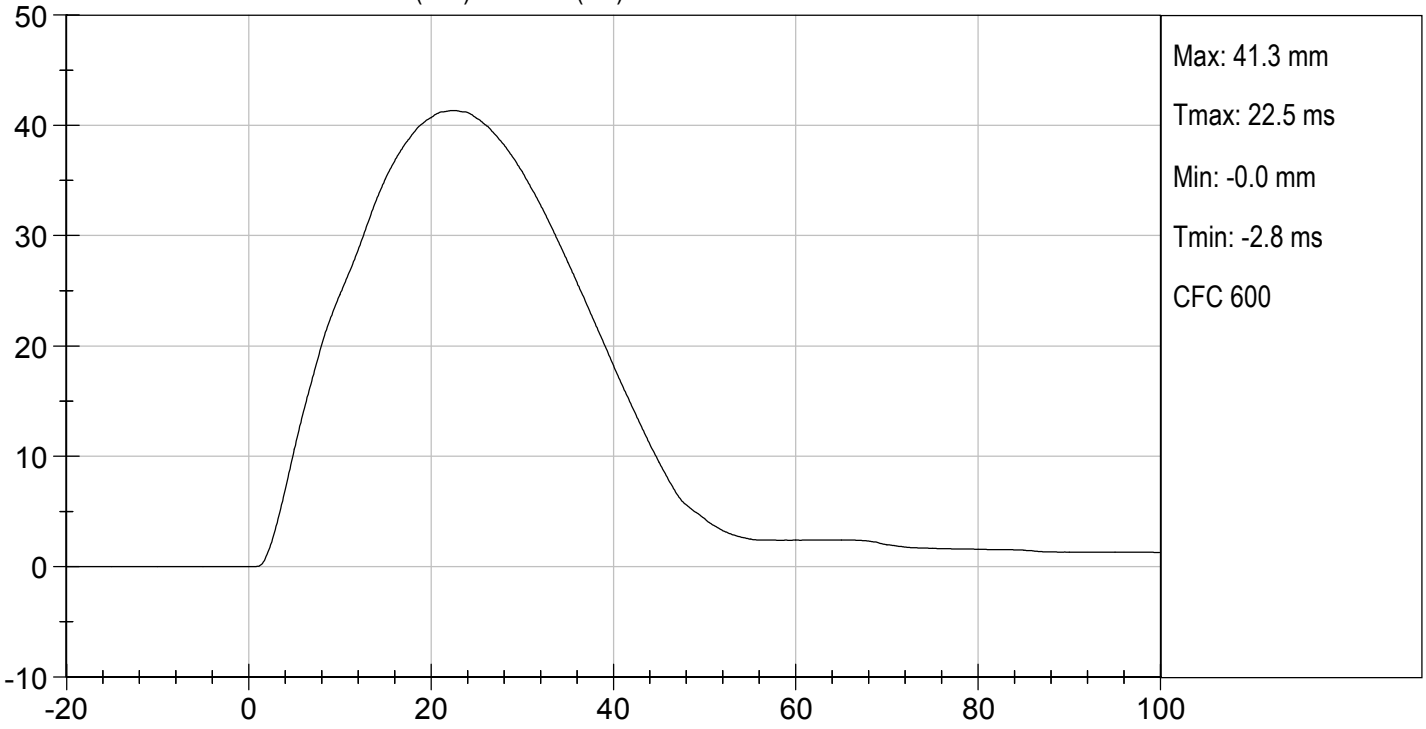
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



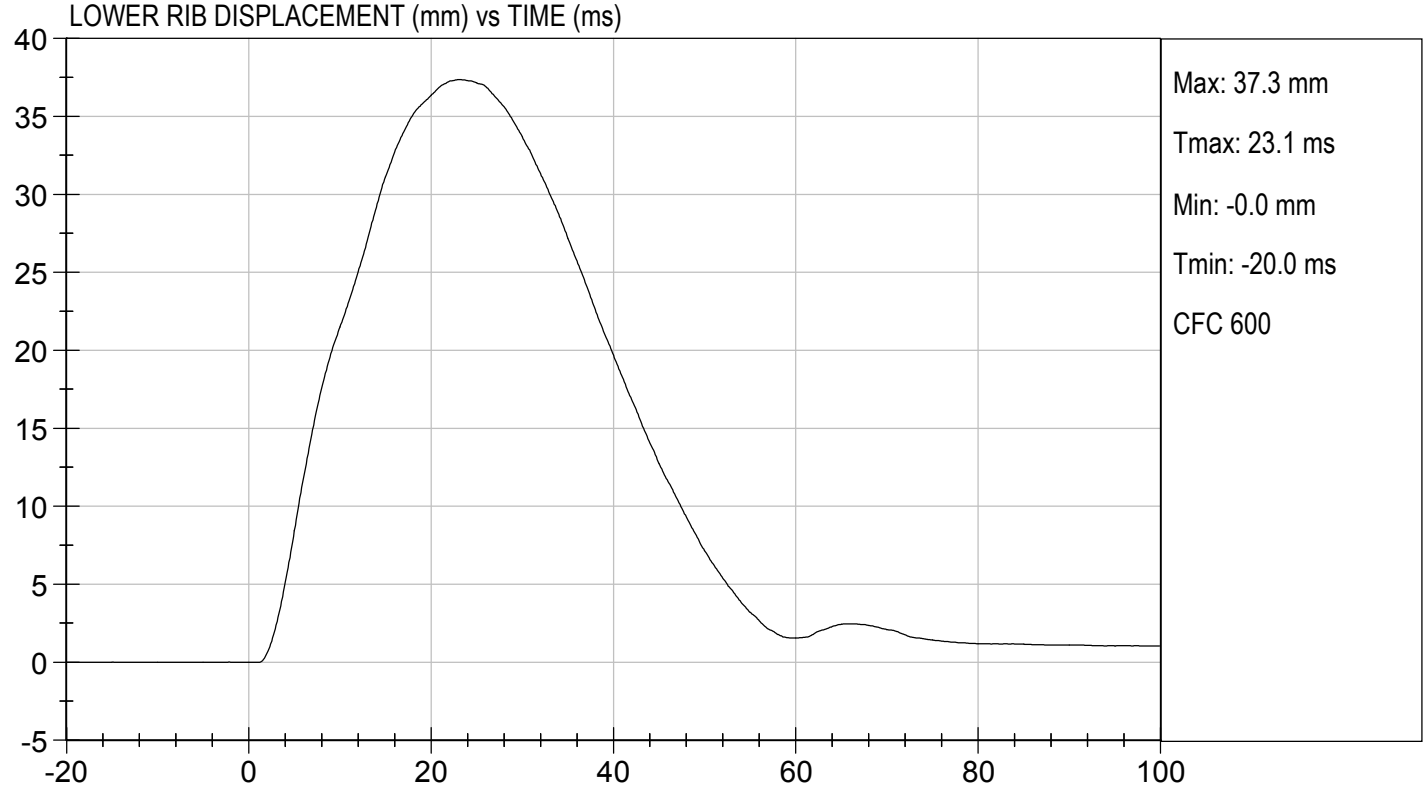
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 11/25/2019
TEST #: D193655

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



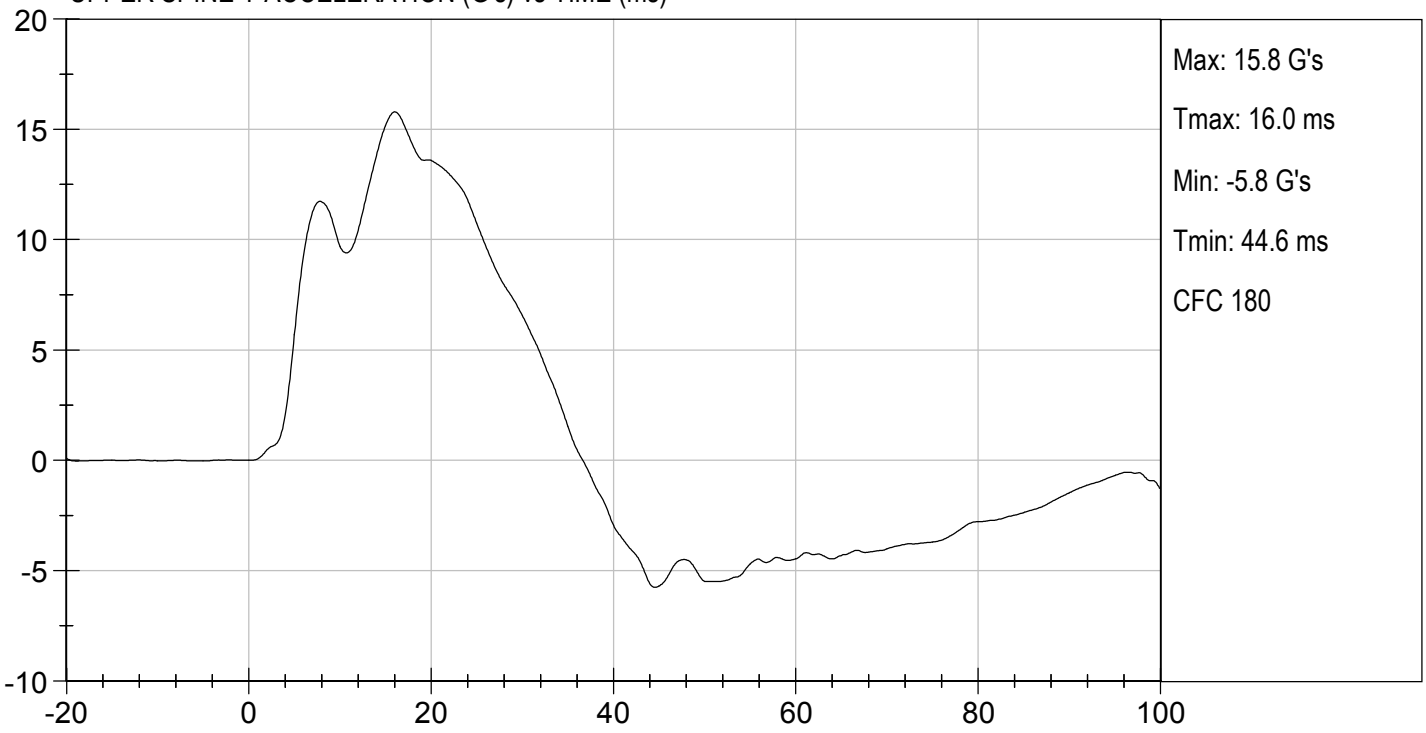
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



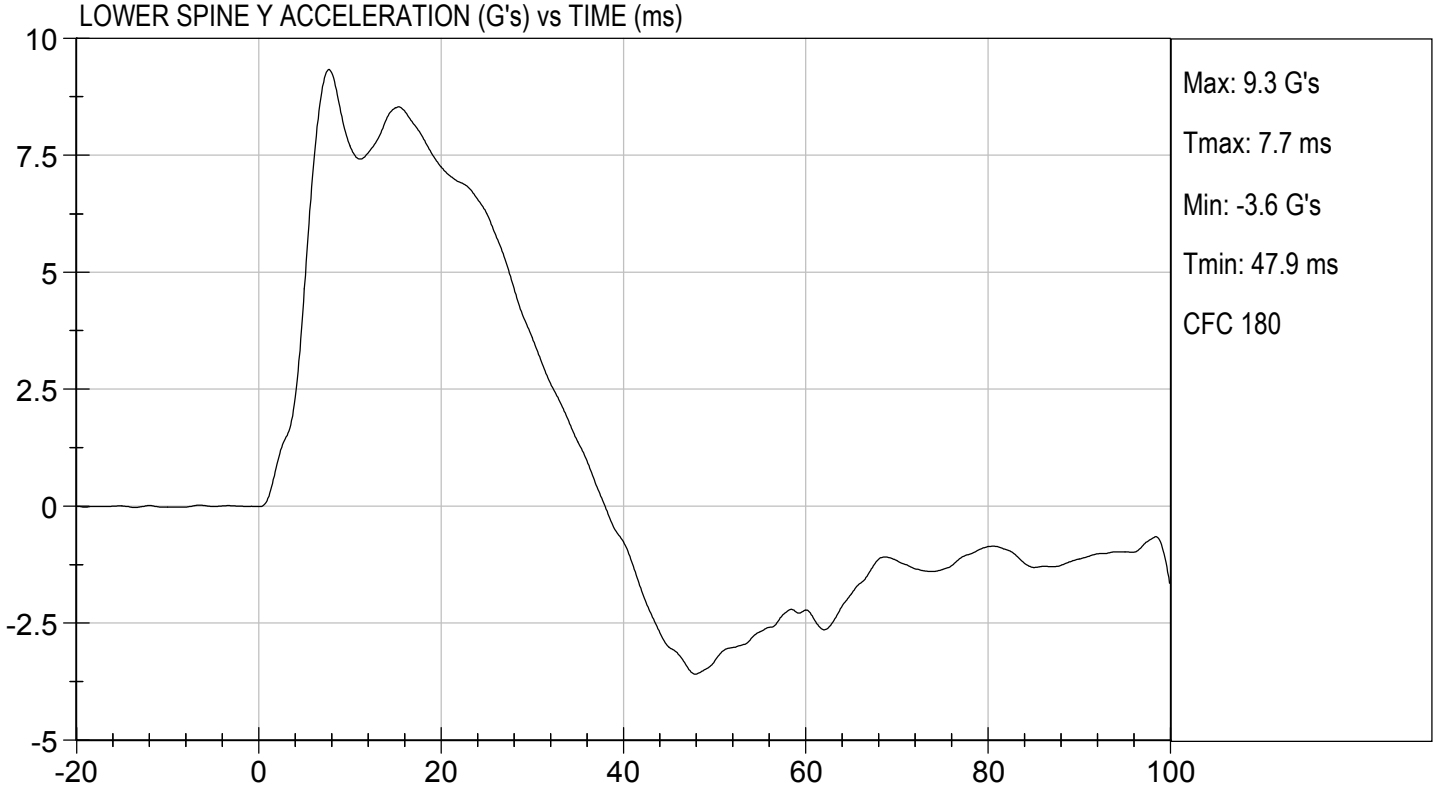
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 11/25/2019
TEST #: D193655

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: 306 **Test I.D:** D193656

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	26	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	38	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	12	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

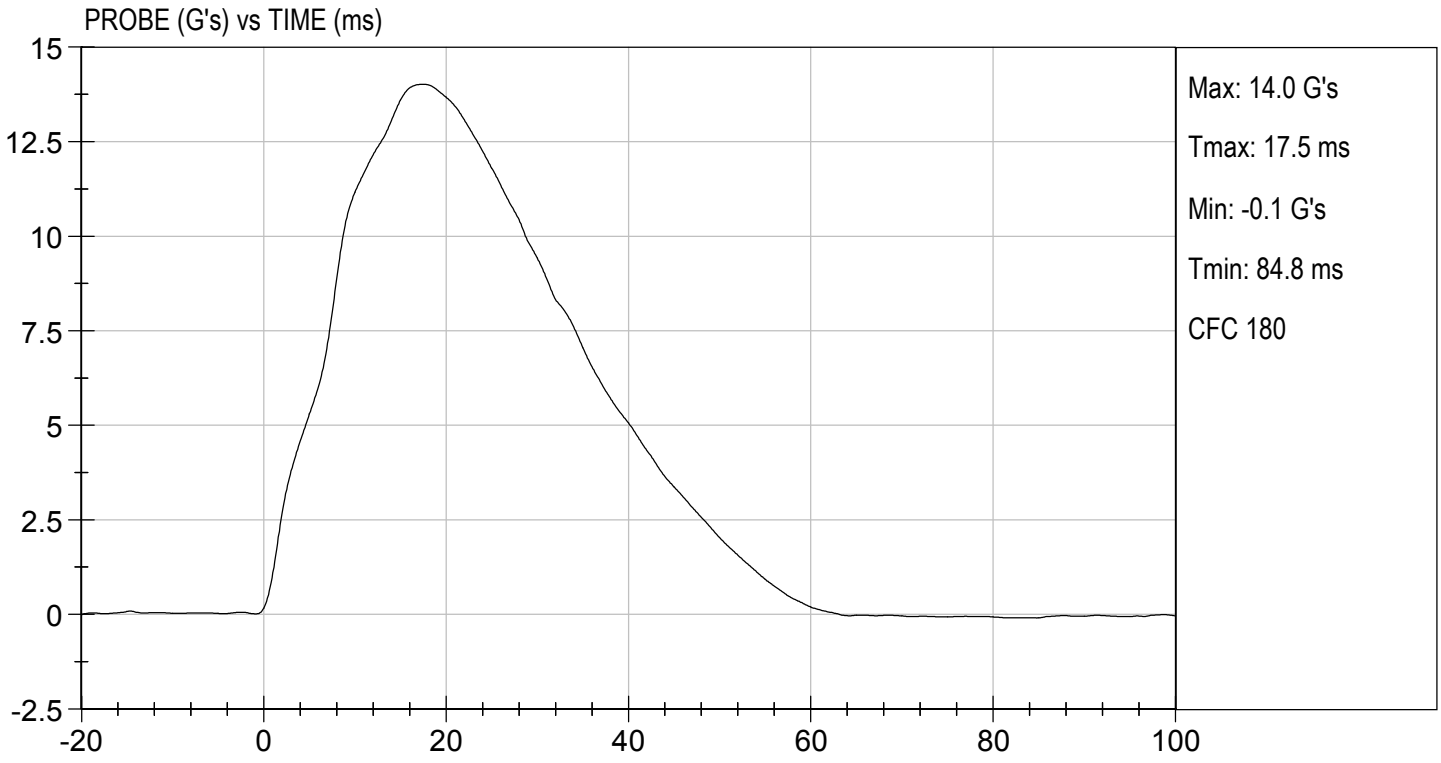
11/25/2019

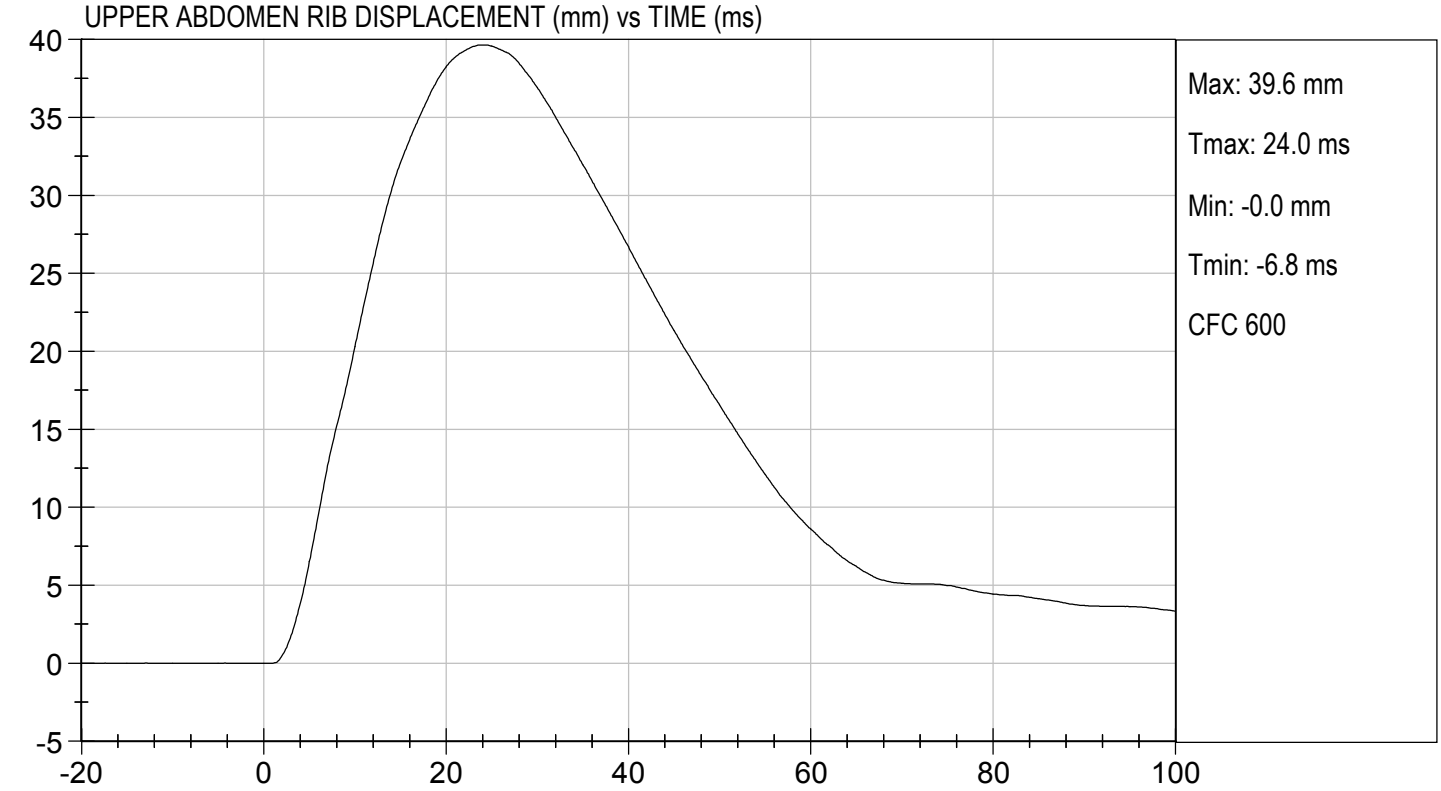
Test Date

Approved By

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

TEST DATE: 11/25/2019
TEST #: D193656

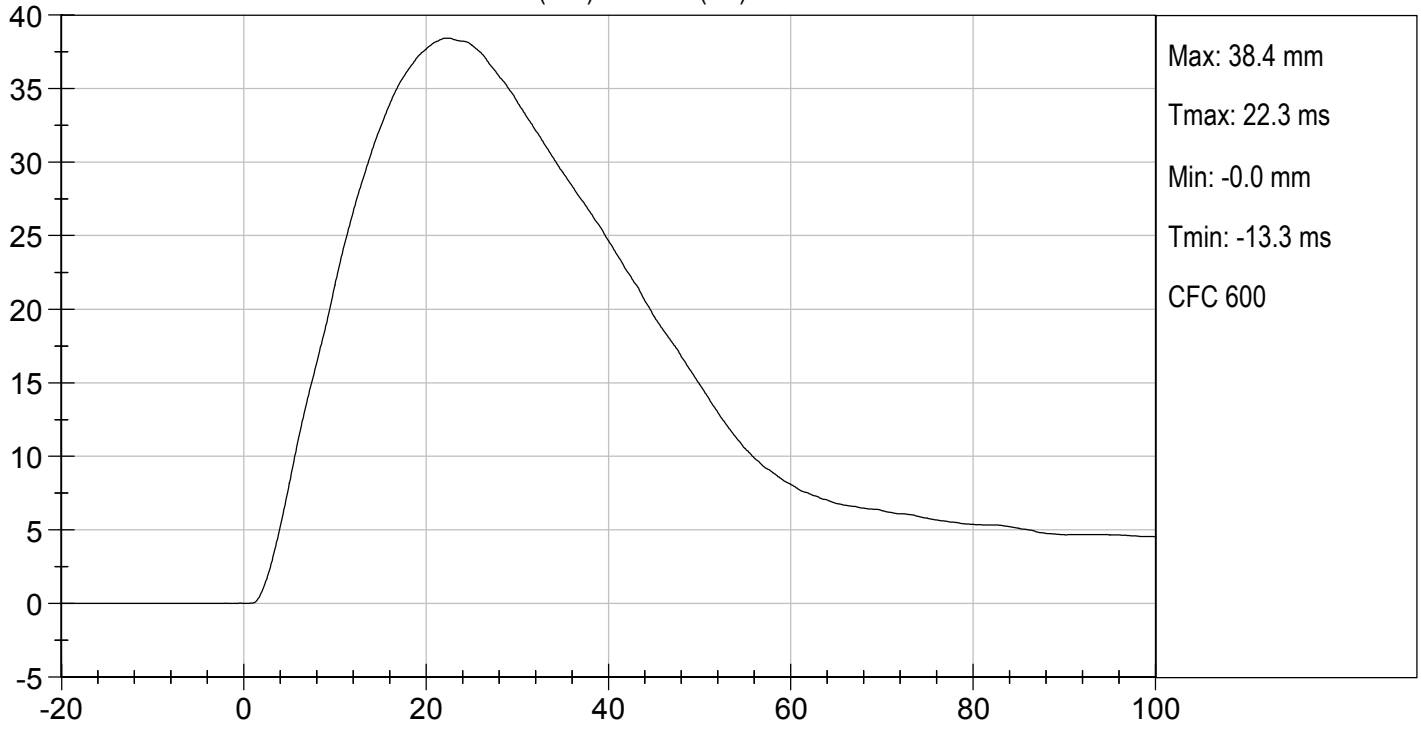




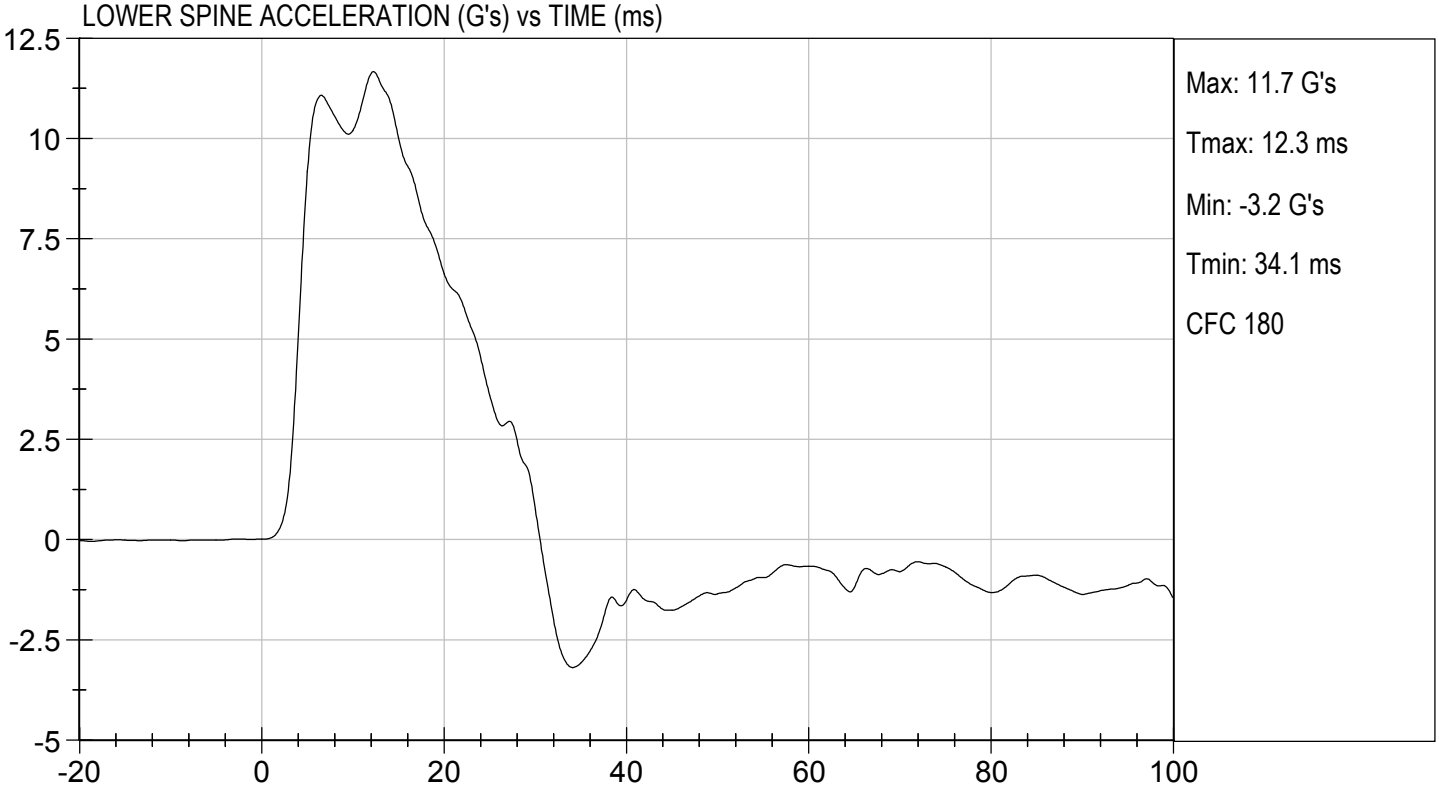
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 11/25/2019
TEST #: D193656

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: 306 **Test I.D:** D193657

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	26	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	38 to 47	44	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	40	Pass
Peak Acetabulum Force	N	3600 to 4300	4,176	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

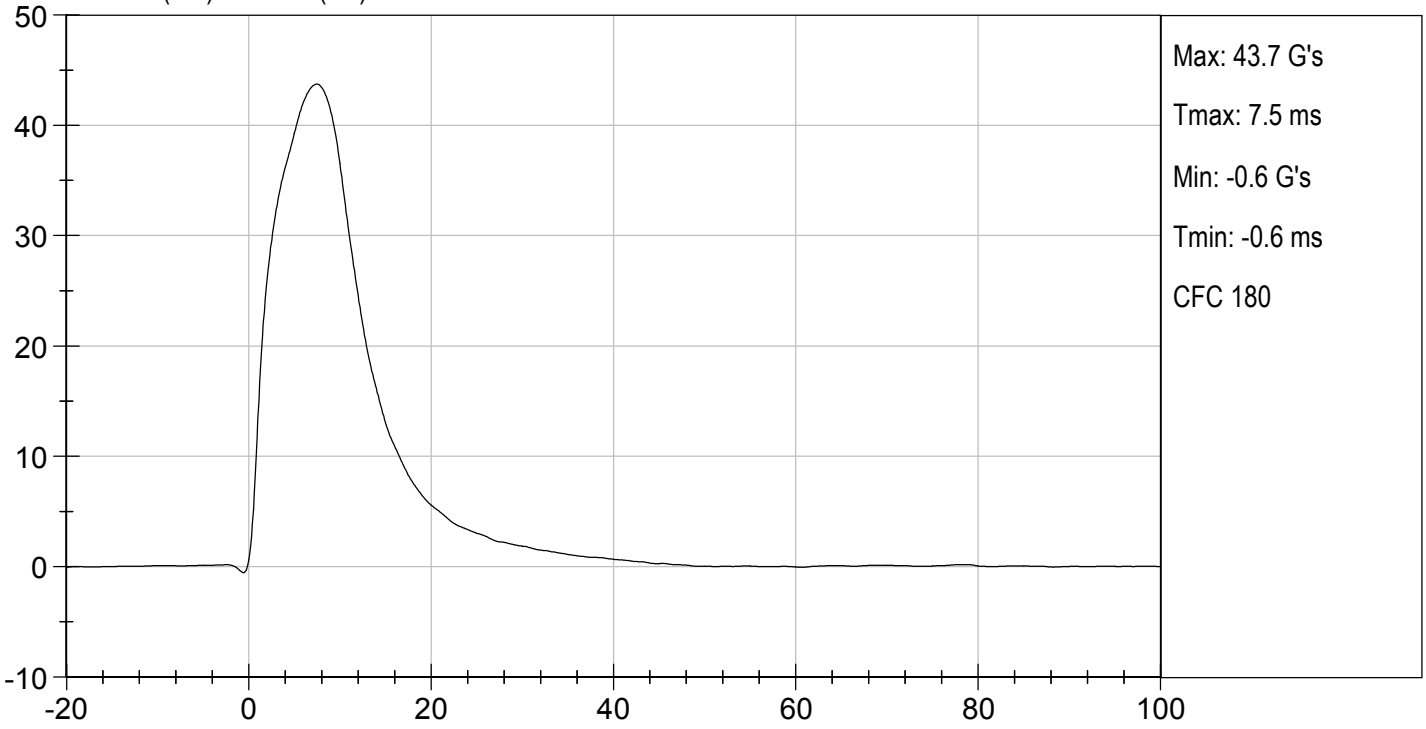
11/25/2019
Test Date

Approved By

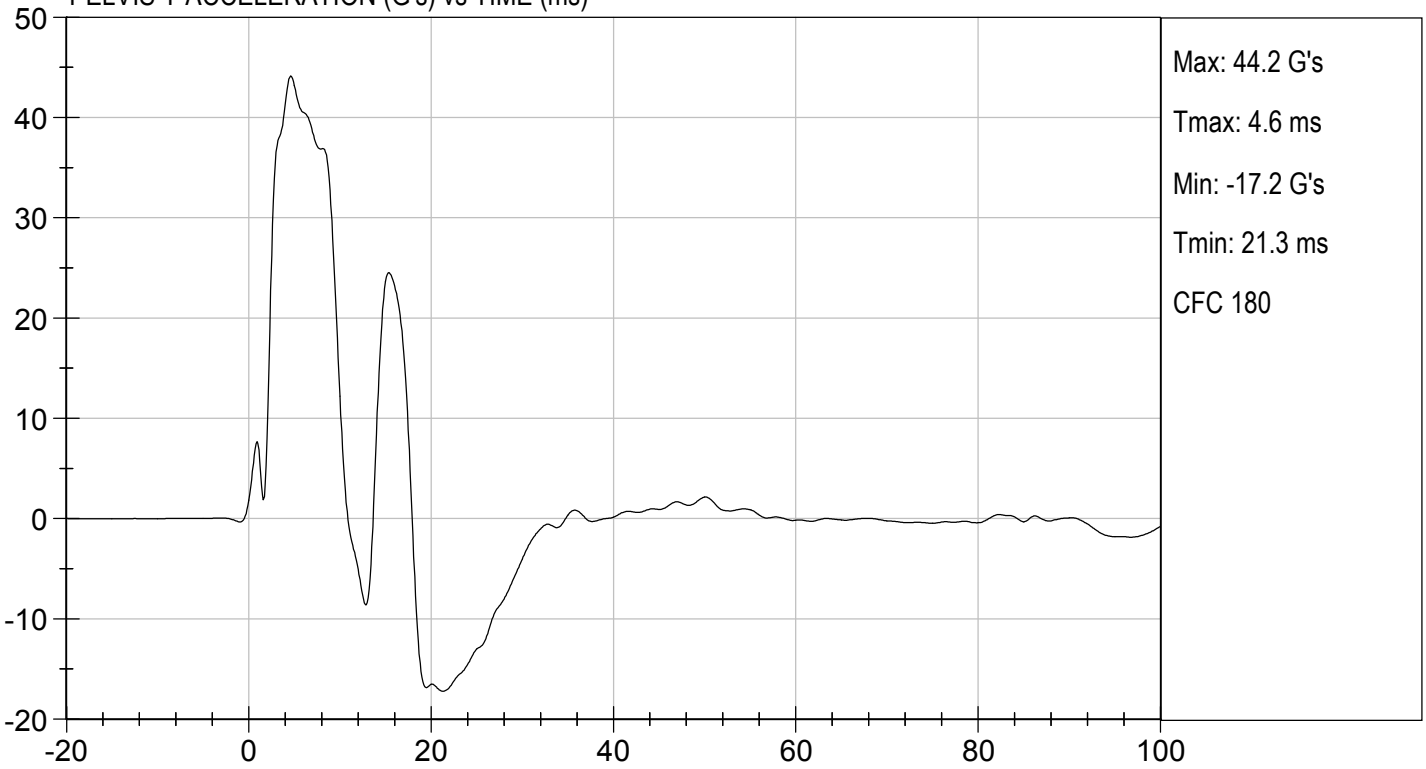
TEST DESC: PELVIS IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 11/25/2019
TEST #: D193657

PROBE (G's) vs TIME (ms)

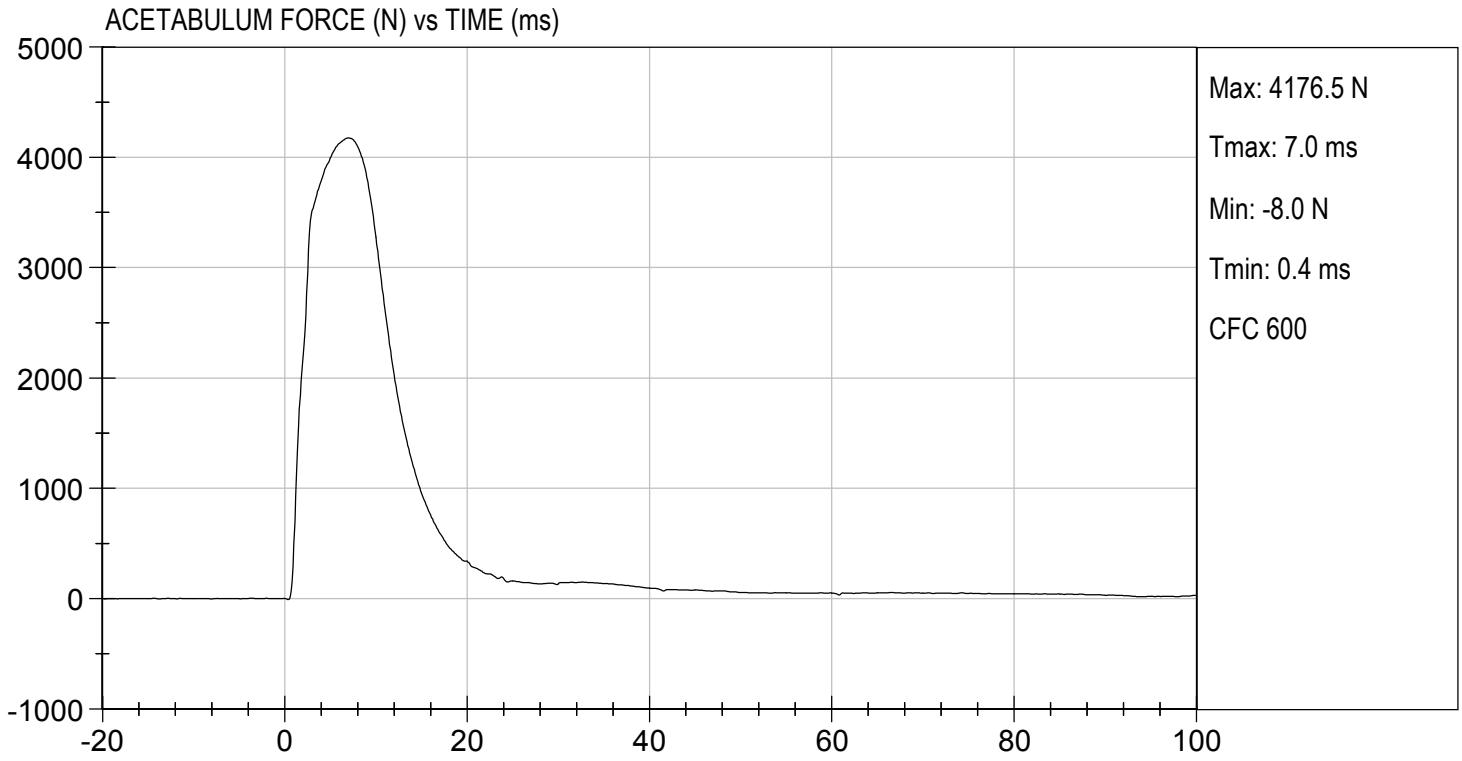


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 11/25/2019
TEST #: D193657



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D193658

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	26	Pass
Impact Velocity	m/s	4.20 to 4.40	4.21	Pass
Maximum Probe Acceleration	G's	36 to 45	43	Pass
Pelvis Y Acceleration	G's	28 to 39	38	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,888	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

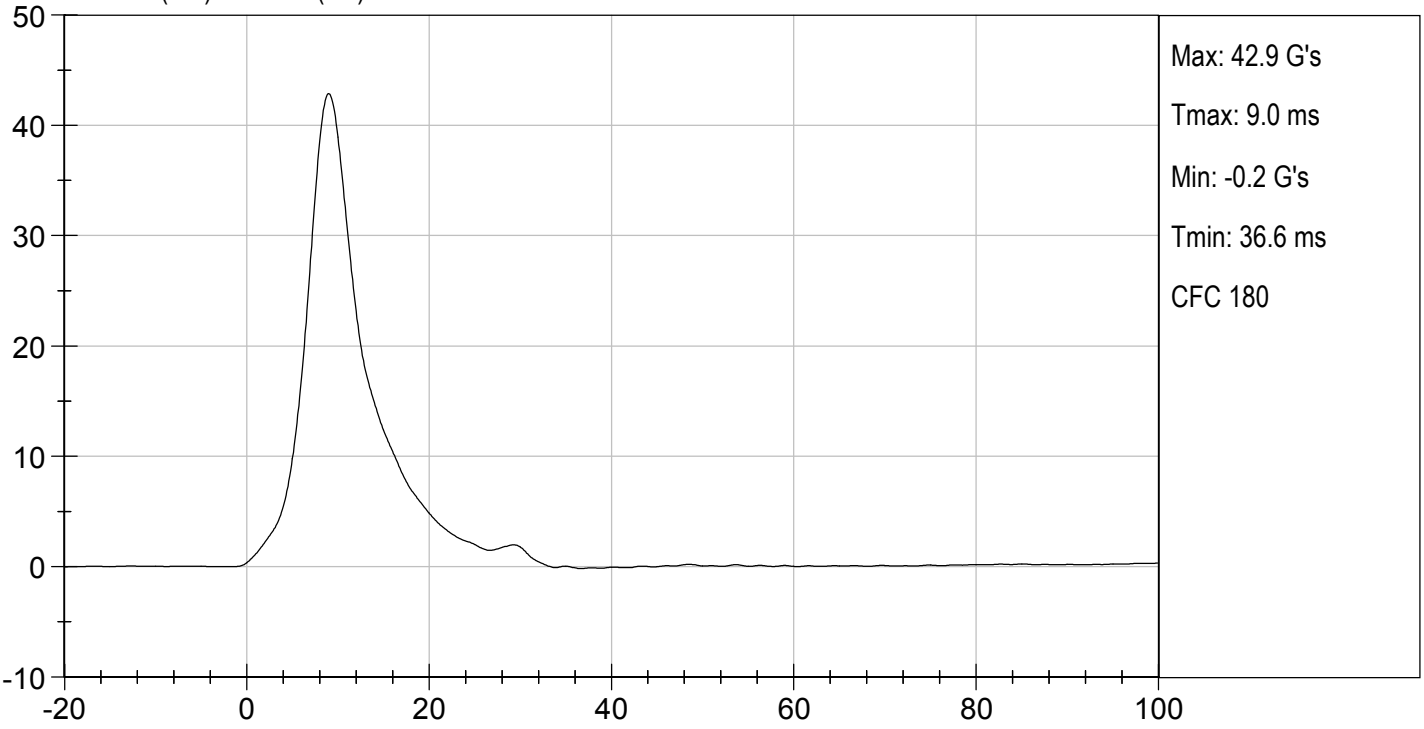
11/25/2019
Test Date

Approved By

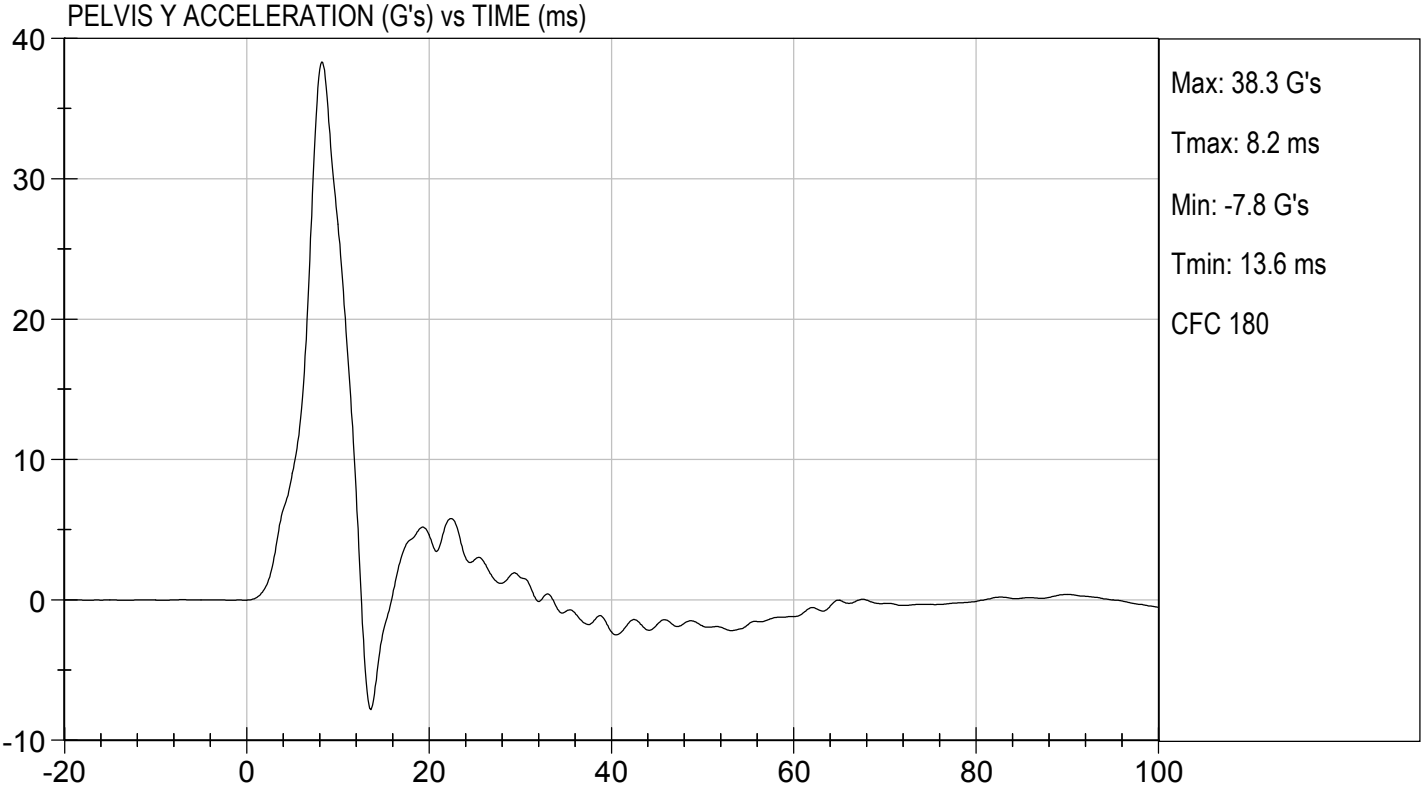
TEST DESC: ILLIAC
VELOCITY: 13.80 ft/s, 4.21 m/s

TEST DATE: 11/25/2019
TEST #: D193658

PROBE (G's) vs TIME (ms)

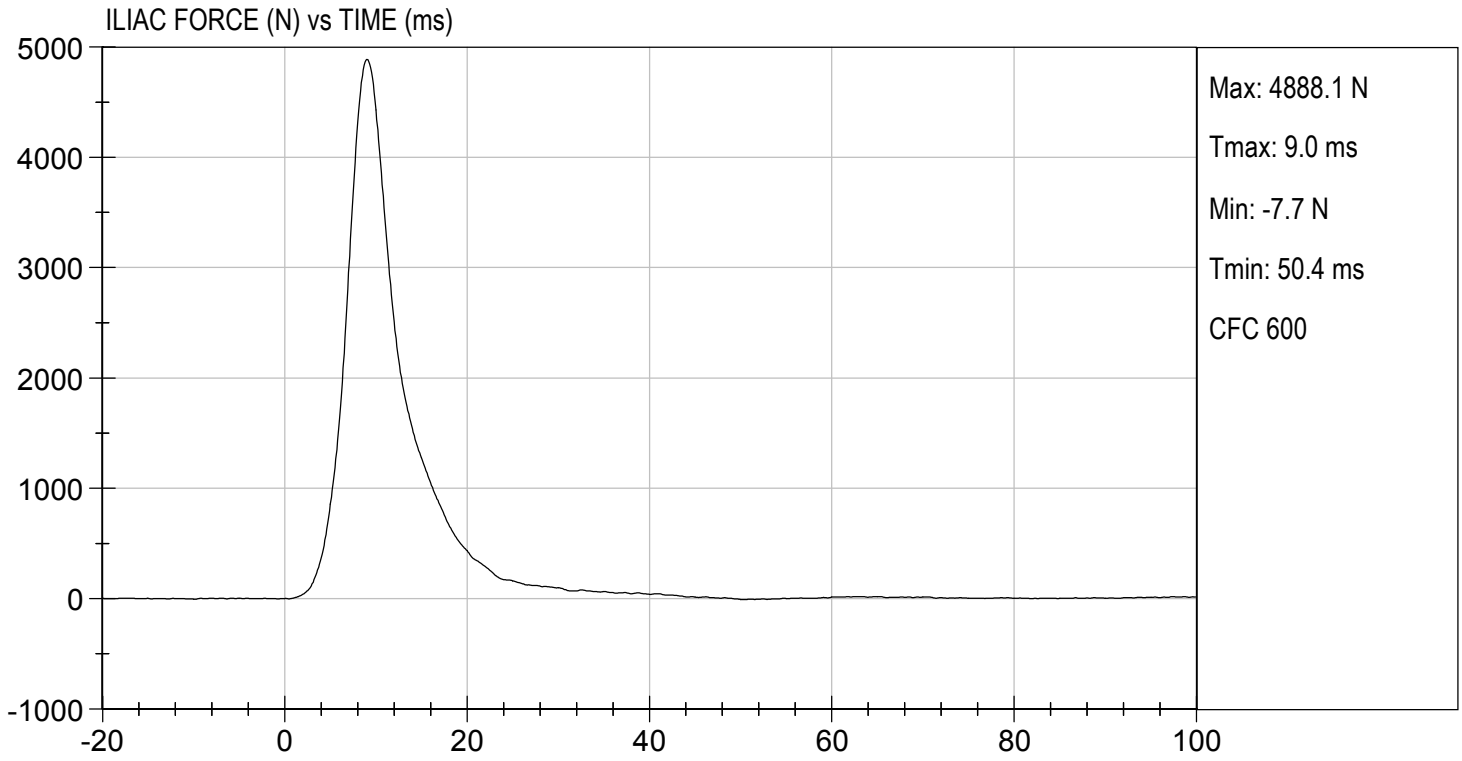


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: ILLIAC
VELOCITY: 13.80 ft/s, 4.21 m/s

TEST DATE: 11/25/2019
TEST #: D193658



SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12514
Test Number 7441
Report Number 7455
Test Date 10/2/2018 8:20:06 AM

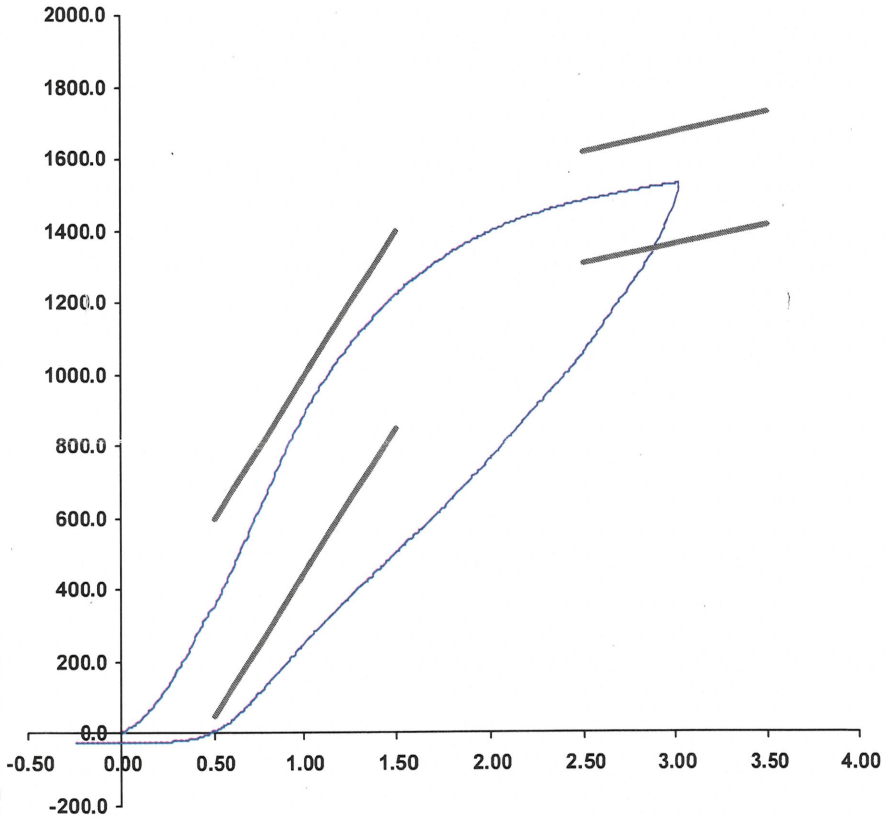
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	356.49	50.00	600.00
Force @ 1.5 mm (N)	1,228.57	850.00	1,400.00
Force @ 2.5 mm (N)	1,482.39	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,528.24	1,361.00	1,673.00

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 **02-Oct-18**
SACO Research

By : DC Date : 10/2/18

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

Test # D19356

ATD # 306

11/12/19 AT

SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12823

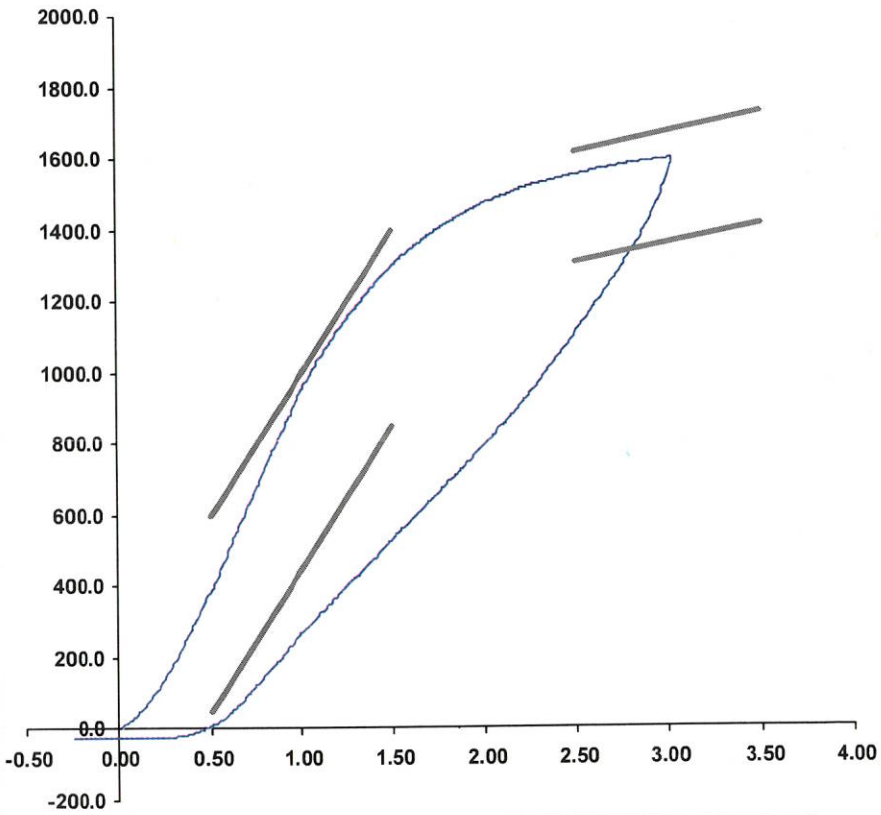
Test Number 8155

Report Number 8185

Test Date 1/18/2019 8:11:00 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	382.07	50.00	600.00
Force @ 1.5 mm (N)	1,299.84	850.00	1,400.00
Force @ 2.5 mm (N)	1,554.16	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,599.58	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 **18-Jan-19**

SACO Research

By : DC Date : 1/18/2019

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	7/19/2019
		Y	P79712	Endevco	7/19/2019
		Z	P79750	Endevco	7/19/2019
		Xr	P79751	Endevco	7/19/2019
		Yr	P79753	Endevco	7/19/2019
		Zr	P88170	Endevco	7/19/2019
Thorax Rib Displacement Potentiometers	Upper	Y	G176	Honeywell	7/19/2019
	Middle	Y	G169	Honeywell	7/19/2019
	Lower	Y	G164	Honeywell	7/19/2019
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	7/19/2019
		Y	P82097	Endevco	7/19/2019
		Z	P82603	Endevco	7/19/2019
Public Symphysis Load Cell		Y	PG461	Denton	8/13/2019

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N 306		
				Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers			X	P79445	Endevco	7/12/2019
			Y	P79721	Endevco	7/12/2019
			Z	P79724	Endevco	7/12/2019
			Xr	P84999	Endevco	7/12/2019
			Yr	P85000	Endevco	7/12/2019
			Zr	P85001	Endevco	7/12/2019
Head Angular Rate Sensors			X	ARS7416	DTS	7/8/2019
			Y	ARS7442	DTS	7/8/2019
			Z	ARS7475	DTS	7/8/2019
Displacement Potentiometers	Thoracic Rib	Upper	Y	G033	FTSS	7/12/2019
		Middle	Y	G1261	FTSS	7/12/2019
		Lower	Y	G1270	FTSS	7/12/2019
	Abdominal Rib	Upper	Y	G032	FTSS	7/12/2019
		Lower	Y	G1304	FTSS	7/12/2019
Lower Spine Accelerometers (T12)			X	P96332	Endevco	7/12/2019
			Y	P96335	Endevco	7/12/2019
			Z	P96341	Endevco	7/12/2019
Acetabulum Load Cell			Y	ACG268	Denton	12/4/2018
Iliac Wing Load Cell			Y	IWG273	Denton	12/4/2018
Pelvis Plug (struck side)				12514	SACO	10/2/2018
Pelvis Plug (non-struck side)				12823	SACO	1/18/2019

Table 3 – Vehicle Instrumentation

			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	PCB1371	PCB	7/17/2019
	Vehicle Center of Gravity	Y	PCB1165	PCB	9/18/2019
	Vehicle Center of Gravity	Z	PCB1377	PCB	9/18/2019
2	Right Sill at Front Seat	X	T18351	Endevco	7/19/2019
	Right Sill at Front Seat	Y	T20041	Endevco	9/26/2019
	Right Sill at Front Seat	Z	T20361	Endevco	9/26/2019
3	Right Sill at Rear Seat	X	T18975	Endevco	8/28/2019
	Right Sill at Rear Seat	Y	T21398	Endevco	7/26/2019
	Right Sill at Rear Seat	Z	T18984	Endevco	8/28/2019
4	Left Sill at Front Door	Y	T19018	Endevco	8/28/2019
5	Left Sill at Rear Door	Y	T21456	Endevco	7/26/2019
6	Left A-Post Lower	Y	T21417	Endevco	7/26/2019
7	Left A-Post Middle	Y	T19552	Endevco	11/15/2019
8	Left B-Post Lower	Y			
9	Left B-Post Middle	Y			
10	Front Seat Track	Y	PCB1172	PCB	7/12/2019
11	Rear Seat Track or Structure	Y	T19556	Endevco	6/13/2019
12	Right Rear Occ. Compartment	Y	T20348	Endevco	9/13/2019
13	Engine Block	X	PCB1220	PCB	11/7/2019
	Engine Block	Y	PCB399	PCB	11/7/2019
14	Rear Floorpan Above Axle	X	PCB1145	PCB	7/22/2019
	Rear Floorpan Above Axle	Y	PCB1125	PCB	7/17/2019
	Rear Floorpan Above Axle	Z	PCB1329	PCB	7/12/2019

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