REPORT NUMBER: SPNCAP-MGA-20-007

NEW CAR ASSESSMENT PROGRAM (NCAP)
Side Impact Pole Test

VOLVO CAR CORPORATION
2020 Volvo XC40 T4 Inscription 5-Door SUV
NHTSA No.: O20205901

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: November 22, 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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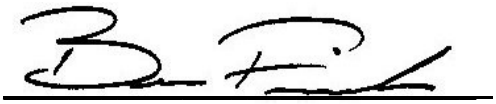
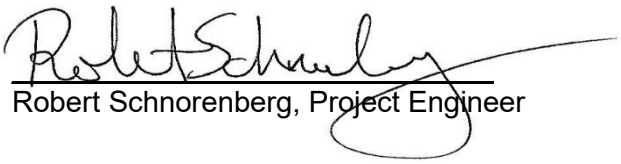
Prepared by: 
Ben Fischer, Project Engineer

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

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

TECHNICAL REPORT DOCUMENTATION PAGE

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SPNCAP-MGA-20-007		

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Final Report of New Car Assessment Program Side Impact Pole Testing of a 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901	February 14, 2020
	6. Performing Organization Code MGA
7. Author(s) Ben Fischer, Project Engineer	**8. Performing Organization Report No.** SPNCAP-MGA-20-007
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105	**10. Work Unit No.**
	11. Contract or Grant No. DTNH22-14-D-00353
12. Sponsoring Agency Name and Address United States Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE, Room W43-410 Washington, DC 20590	**13. Type of Report and Period Covered:** Final Test Report November 22, 2019 to February 14, 2020
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15. Supplementary Notes

16. Abstract

A 32.20 km/h, 75° oblique impact Side NCAP Test was conducted on the subject 2020 Volvo XC40 T4 Inscription 5-Door SUV in accordance with the specifications of the Office of Crashworthiness Standards Side NCAP Pole Laboratory Test Procedure for the generation of consumer information on vehicle side pole crash protection. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on November 22, 2019.

The impact velocity was 32.30 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 22.1°C. The test vehicle post-test maximum crush was 329 mm at level 3. The test vehicle's performance was as follows:

Measurement Description	Units	Driver ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	237
Resultant Lower Spine Acceleration	g	82	33
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	1828
Maximum Thoracic Rib Deflection	mm	38*	25
Maximum Abdomen Rib Deflection	mm	45*	22

*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 Pole Part 572V 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	137	

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SECTION 1
PURPOSE AND SUMMARY OF TEST

PURPOSE

This side pole 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 Inscription 5-Door SUV. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Pole Laboratory Test Procedure, dated April 2018.

SUMMARY

A rigid pole side impact test was conducted on a 2020 Volvo XC40 T4 Inscription 5-Door SUV. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 32.30 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin on November 22, 2019. Pre-test and post-test photographs of the test vehicle and side impact dummy (SID-IIs) are included in Appendix A of this report.

One Part 572V (SID-IIs) dummy was placed in the driver designated seating position according to instructions specified in the OCWS Side NCAP Pole Laboratory Test Procedure dated April 2018. Camera locations and other pertinent camera information are included in this report.

The Part 572V (SID-IIs) dummy was instrumented accordingly:

Primary and Redundant Head CG Triaxial Accelerometers
Head Triaxial Angular Rate Sensors
Thorax Upper, Middle, and Lower Rib Displacement Potentiometers
Abdomen Upper Rib and Lower Rib Displacement Potentiometers
Lower Spine (T12) Triaxial Accelerometers
Iliac Load Cell
Acetabulum Load Cell

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

Injury readings for the SID-IIs dummy were recorded as follows:

Measurement Description	Units	Driver ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	237
Resultant Lower Spine Acceleration	g	82	33
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	1828
Maximum Thoracic Rib Deflection	mm	38*	25
Maximum Abdomen Rib Deflection	mm	45*	22

*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	No
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

Vehicle CG Z recorded no valid data after 17 ms.
Left Lower B-Post Y was not installed.
Left Mid B-Post Y was not installed.
Driver Seat Track Y recorded questionable data.
Load Cell Pole #8 Fy recorded no valid data.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20205901	Traction Control System (TCS)	Yes
Model Year	2020	Auto-Leveling System	No
Make	Volvo	Automatic Door Locks (ADL)	Yes
Model	XC40 T4 Inscription	Power Window Auto-Reverse	Yes
Body Style	5-Door SUV	Other Optional Feature	No
VIN	YV4AC2HL2L2189228	Driver Front Airbag	Yes
Body Color	Denim Blue Metallic	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	13 km / 8 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)

* Rated Cargo and Luggage Weight (RCLW) limited to maximum of 300 lbs (136 kg).

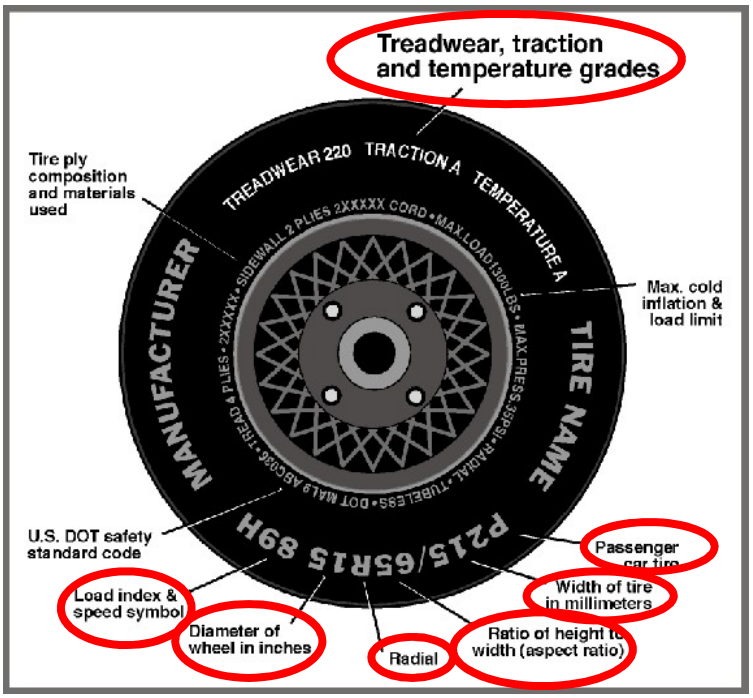
VEHICLE SEAT TYPE

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

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

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20205901
Test Date: 11/22/2019

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	230	230
Recommended Tire Size	235/50R19	235/50R19
Tire Size on Vehicle	235/50R19	235/50R19
Tire Manufacturer	Michelin	Michelin
Tire Model	Primacy MXM4	Primacy MXM4
Treadwear	500	500
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	99H	99H
Tire Material	Rubber	Rubber
DOT Safety Code Left	F3NM 00CX 1719	F3NM 00CX 1719
DOT Safety Code Right	F3NM 00CX 1719	F3NM 00CX 1719

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

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019

TEST PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	260	270	260	270
Tire Placard	kPa	230	230	230	230
Owner's Manual	kPa	230	230	230	230
As Tested	kPa	230	230	230	230

TEST AXLE VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	494.0	357.0		508.0	416.5		511.5	417.5	
Right	kg	498.0	331.5		503.0	377.5		503.0	380.0	
Ratio	%	59.0%	41.0%		56.0%	44.0%		56.0%	44.0%	
Totals	kg	992.0	688.5	1680.5	1011.0	794.0	1805.0	1014.5	797.5	1812.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1680.5	(A)
Actual Weight of 1 P572 ATD (SID-IIs) Used	kg	52	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	80	(C)
Calculated Test Vehicle Target Weight (TVTW)	kg	1812.5	(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	As Delivered	As Tested	Fully Loaded	Meets Requirement
Driver Door Sill Angle (front-to-back)*	deg	0.2	0.4	0.4	Yes
Front Pass. Door Sill Angle (front-to-back)*	deg	-1.8	-1.6	-1.6	Yes
Front Bumper Angle (left-to-right)**	deg	-0.8	-0.8	-0.8	Yes
Rear Bumper Angle (left-to-right)**	deg	0.4	0.3	0.3	Yes
Vehicle CG (Aft of Front Axle)	mm	1110	1192	1193	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	10	20	21	

* ND=Nose Down (-), NU=Nose Up (+) ** LD=Left Down (-), LU=Left Up (+)
*** The "As Tested" vehicle attitude measurements must be equal to or between the "As Delivered" and "Fully Loaded" vehicle attitude measurements.

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Units	Weight
Weight of Ballast Added	kg	49
Components Removed: None	kg	

Test height adjustable suspension setting, if applicable:	Not Applicable

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

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and right front passenger's seat should be set to the forward-most, mid-height, 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	24.9	12.4	18.7
Front Passenger Seat	24.0	10.6	17.3
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	18.7	30	Max	60	60	60
			Mid	30	30	30
			Min	0	0	0
Front Passenger Seat	17.3	31	Max	62	62	62
			Mid	31	31	31
			Min	0	0	0
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

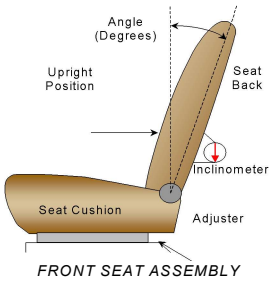
Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019

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	262		0	
Front Passenger Seat	262		0	
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 such that the dummy's head is level. The front center and front passenger's seat backs are positioned in a similar manner as the driver's seat back. All rear passenger seat backs are positioned in accordance with the information provided by the manufacturer on Form No. 1 for the 5th percentile female dummy in a Side NCAP MDB test.



Seat	Total Seat Back Angle Range		Test Position from Vertical	
	Degrees	Detents (1st as 1)	Degrees	Detent (1st as 0)
Driver Seat	71.0		8.4	
Front Passenger Seat	71.6		8.4	
Front Center Seat				
Struck Side Rear Seat	Fixed		Fixed	
Non-Struck Side Rear Seat	Fixed		Fixed	
Rear Center Seat	Fixed		Fixed	

All seat back angles measured on seatback center.

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)

HEAD RESTRAINT ADJUSTMENT

Head restraints are 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

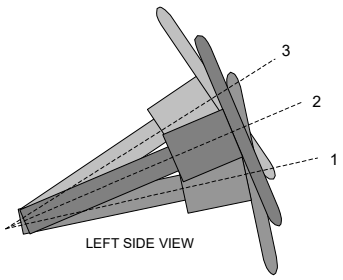
DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019

STEERING COLUMN ADJUSTMENT

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

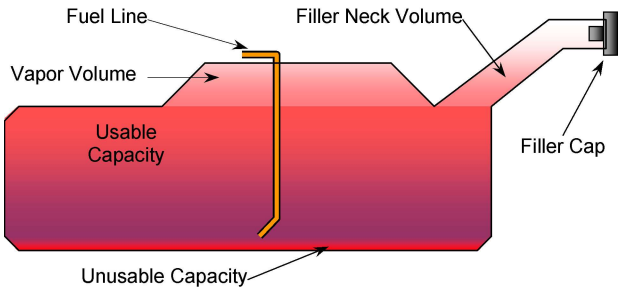
	Wheel Angle (°)	Fore/Aft Position (mm)
Lowermost, Position 1	69.3	
Geometric Center, Position 2	66.0	
Uppermost, Position 3	62.6	
Telescoping Steering Wheel Travel		57
Test Position	66.0	29



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

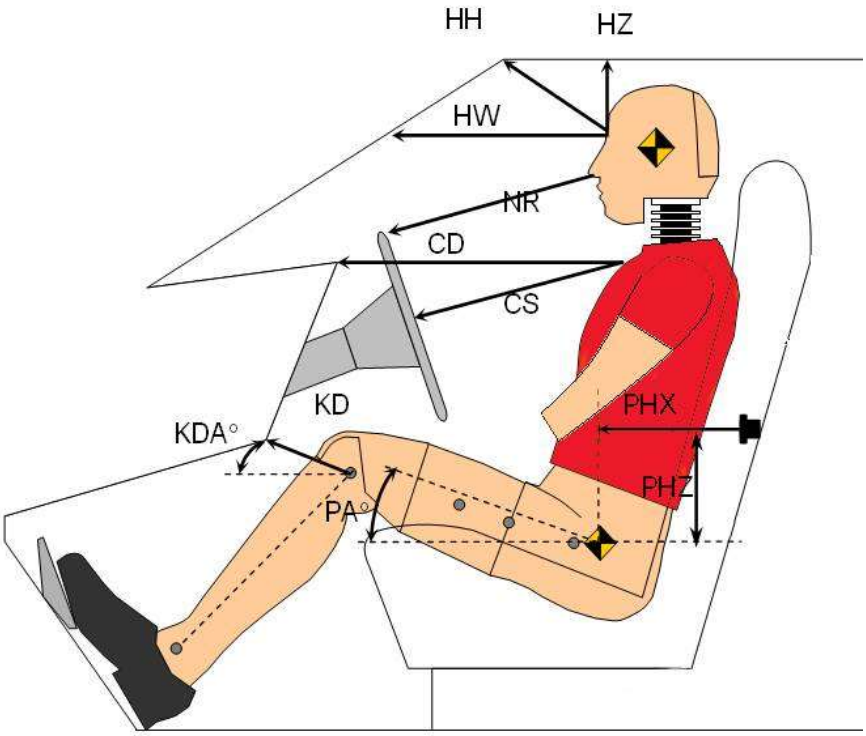
FUEL TANK CAPACITY DATA

	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 Inscription 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20205901
Test Date: 11/22/2019

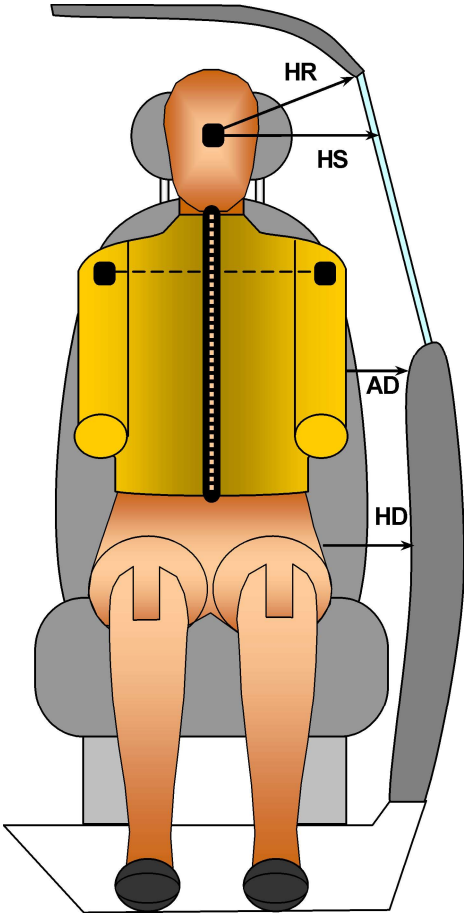


LEFT SIDE VIEW

Code	Measurement Description	Driver	
		Length (mm)	Angle (°)
HH	Head to Header	243	
HW	Head to Windshield	540	
HZ	Head to Roof Liner	171	
NR	Nose to Rim/Seat Back	238	
CD	Chest to Dashboard/Seat Back	403	
CS	Chest to Steering Wheel	179	
KDL / KDAL	Left Knee to Dash/Seat Back	135	46.2
KDR / KDAL	Right Knee to Dash/Seat Back	133	44.3
PAX	Pelvic Tilt Angle X		21.8
PAY	Pelvic Tilt Angle Y		0.8
PHX	Hip Point to Striker (X-Axis)	348	
PHZ	Hip Point to Striker (Z-Axis)	99	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20205901
Test Date: 11/22/2019

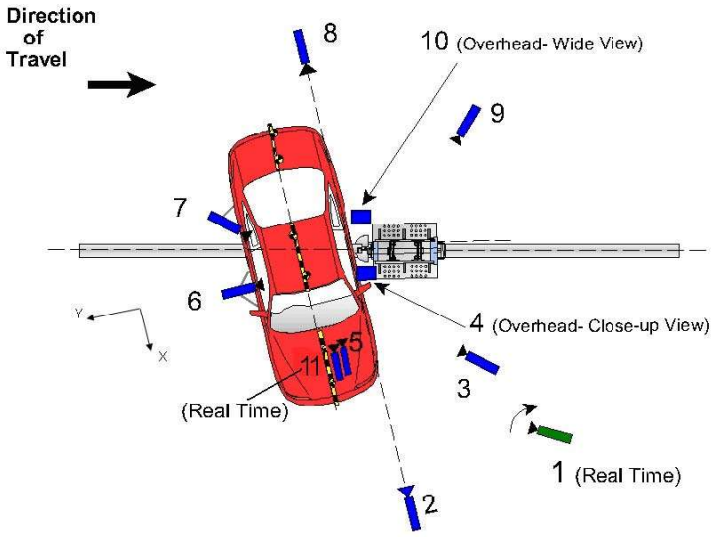


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver
		Length (mm)
HR	Head to Side Header	232
HS	Head to Side Window	376
AD	Arm to Door	165
HD	Hip Point to Door	236

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019



Reference: (from Point of Impact for X and Y; from Ground for Z):
+X = Forward of Impact, + Y = Right of Impact, +Z = Down

No.	Camera View	Coordinates* (mm)			Lens (mm)	Frame Rate (fps)
		X	Y	Z		
1	Real-Time Pan View					30
2	Front Ground Level	6150	210	-1995	25	1000
3	Impact Side 45° Forward	4500	-1600	-1975	20	1000
4	Overhead Closeup	0	0	-6670	70	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	-7200	225	-1995	25	1000
9	Impact Side 45° Rearward	-2985	-3740	-1950	20	1000
10	Overhead Wide View	-310	760	-6640	11	1000
11	Real-Time Dummy Front View					30

*All measurements accurate to ±6 mm
Note: Vehicle was positioned at a 75° angle to the rigid pole.

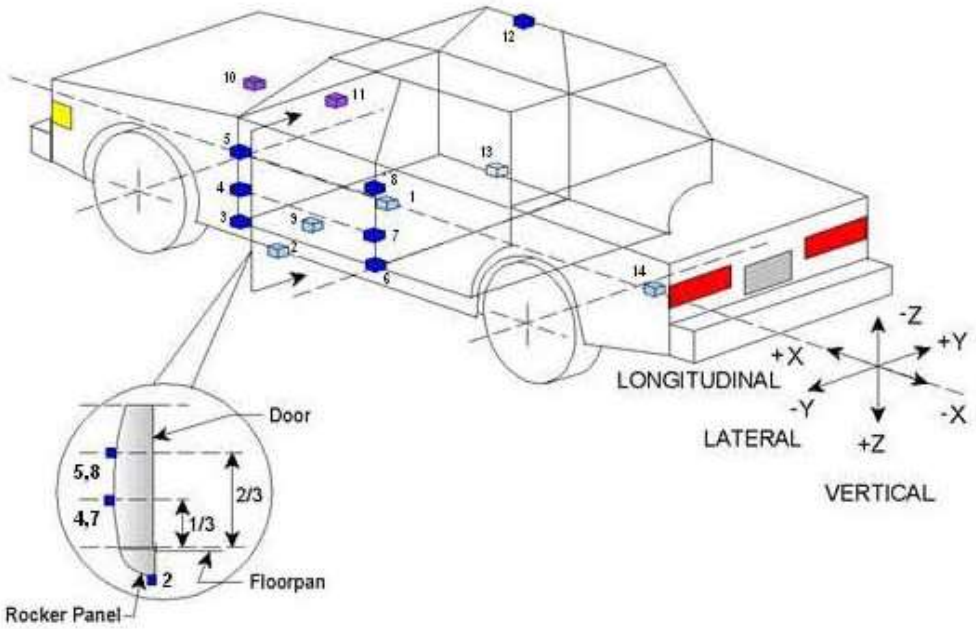
Explain why camera(s) did not operate as intended: None

INSTRUMENTATION

	Number of Channels
Driver Dummy	19
Vehicle Structure	16
Pole Load Cells	8
Total	43

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20205901
Test Date: 11/22/2019



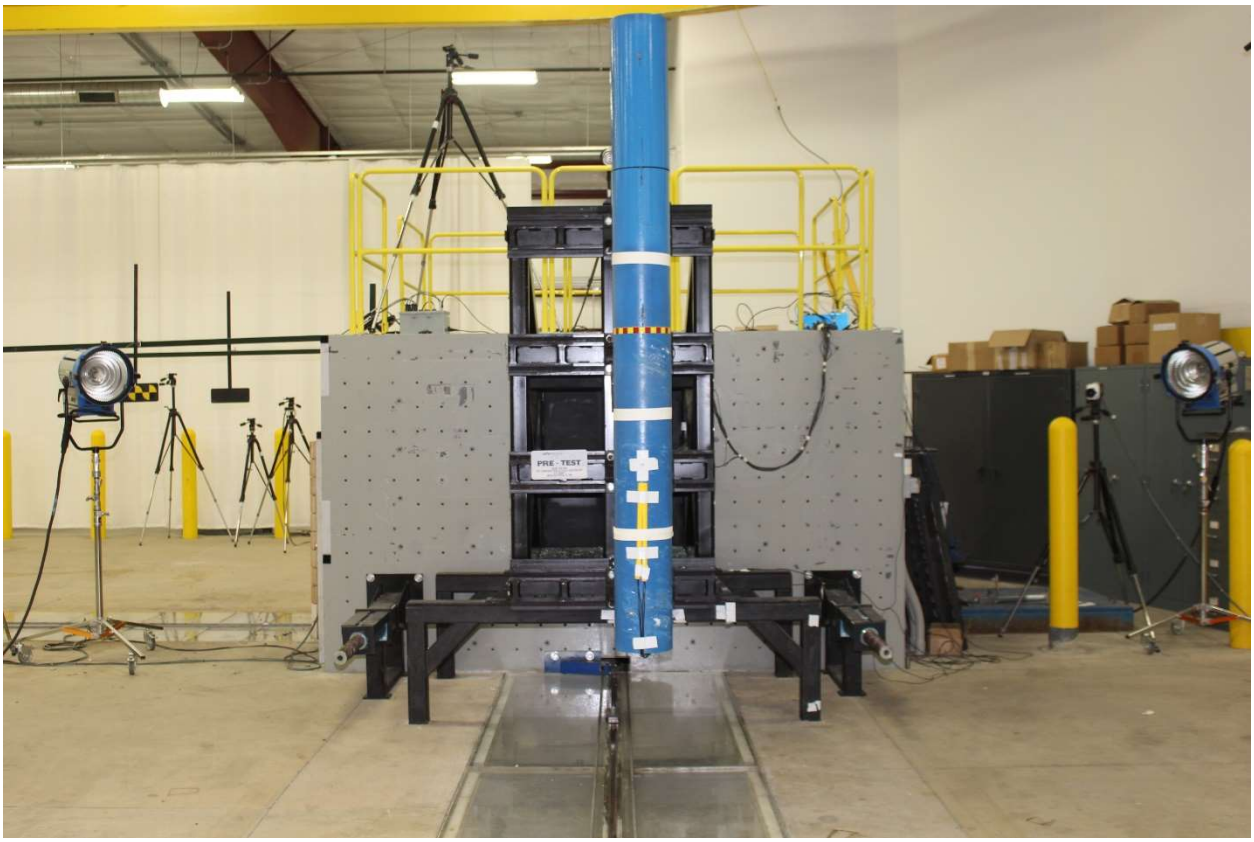
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2383	150	-275
2	Left Floor Sill	2672	-740	-260
3	A Pillar Sill	2980	-740	-260
4	A Pillar Low	3020	-840	-580
5	A Pillar Mid	3020	-840	-850
6	B Pillar Sill	1880	-740	-260
7	B Pillar Low			
8	B Pillar Mid			
9	Driver Seat Track	2058	-370	-350
10	Engine Top	3765	290	-850
11	Firewall	3458	35	-955
12	Right Roof	2025	590	-1600
13	Right Floor Sill	2665	740	-260
14	Rear Floorpan	955	15	-645

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

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20205901
Test Date: 11/22/2019



254 mm Diameter Rigid Pole

Load Cell Locations	
ID	**Height from Impact Surface (mm)**
1	182
2	470
3	698
4	986
5	1212
6	1641
7	1854
8	2053

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Driver Dummy (SID-IIs)
Face	None
Top of Head	Curtain Airbag
Left Side of Head	Curtain Airbag
Back of Head	Curtain Airbag, Headrest, Seatback
Left Shoulder	Side Torso/Pelvis Airbag, Seatback
Upper Torso	Side Torso/Pelvis Airbag, Seatback
Lower Torso	Side Torso/Pelvis Airbag, Seatback
Left Hip	Side Torso/Pelvis Airbag, Seat Cushion
Left Knee	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	Cracked
Side Window Damage	LF window broken
Other Notable Effects	None

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

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

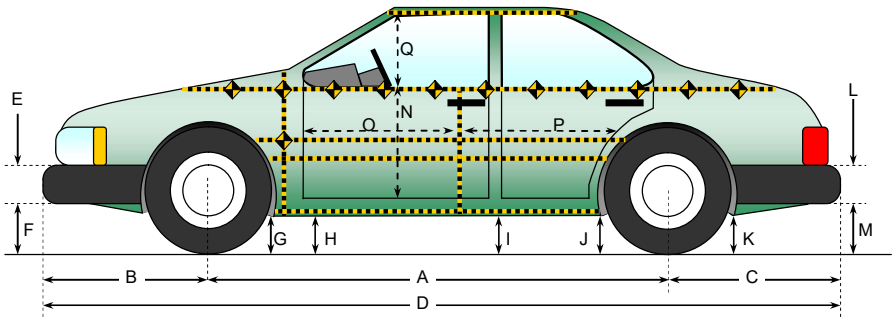
Restraint Type	Struck Side Driver		Struck Side Left Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	
Side Airbag (Other)				
Seat Belt Pretensioner	Yes	Yes	Yes	No
Seat Belt Load Limiter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

SPEED, ANGLE AT IMPACT, AND IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		1087
Actual Impact Point (Aft of Front Axle)	mm		1088
Horizontal Offset (+forward / -rearward)	mm	+/- 38 of Intended Impact Point	-1
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	degrees	75 +/- 3	74.8
Trap No. 1 Velocity (Primary)	km/h	31.4 to 33.0	32.30
Trap No. 2 Velocity (Redundant)	km/h	31.4 to 33.0	32.41

DATA SHEET NO. 9
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20205901
Test Date: 11/22/2019



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

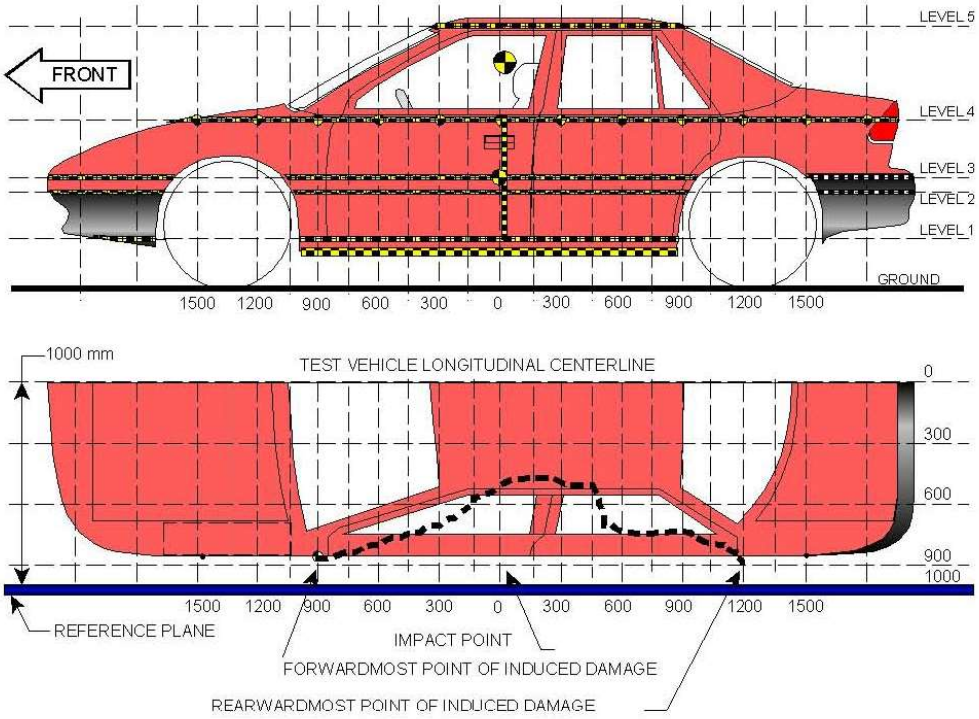
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2710	2635	75
B	Front Axle to FSOV	918	1041	-123
C	Rear Axle to RSOV	820	721	99
D	Total Vehicle Length at Centerline	4448	4397	51
E	Front Bumper Thickness	113	113	0
F	Front Bumper Bottom to Ground	230	235	-5
G	Sill Height at Front Wheel Well	232	237	-5
H	Sill Height at Front Door Leading Edge	232	237	-5
I	Sill Height at B-Pillar	236	223	13
J1	Sill Height at Rear Wheel Well	243	250	-7
J2	Pinch Weld Height at Rear Wheel Well	243	250	-7
K	Sill Height Aft of Rear Wheel Well	292	299	-7
L	Rear Bumper Thickness	98	98	0
M	Rear Bumper Bottom to Ground	333	334	-1
N	Sill Height to Bottom of Front Window Sill	865	853	12
O	Front Door Leading Edge to Impact CL	577	477	100
P	Rear Door Trailing Edge to Impact CL	1267	1171	96
Q	Front Window Opening	360	318	42
R	Right Side Length	3262	3282	-20
S	Left Side Length	3262	3190	72
T	Vehicle Width at B-Pillars	1875	1752	123
U	Front Wheel Track Width	2710	2635	75
V	Rear Wheel Track Width	918	1041	-123

DATA SHEET NO. 10
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019



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

MAXIMUM EXTERIOR CRUSH MEAUREMENTS

Level	Measurement Description	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	565	294	75
2	Mid Door	676	322	75
3	Occupant H-Point	702	327	75
4	Window Sill	1065	301	75
5	Window Top	1530	80	150

DATA SHEET NO. 10 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

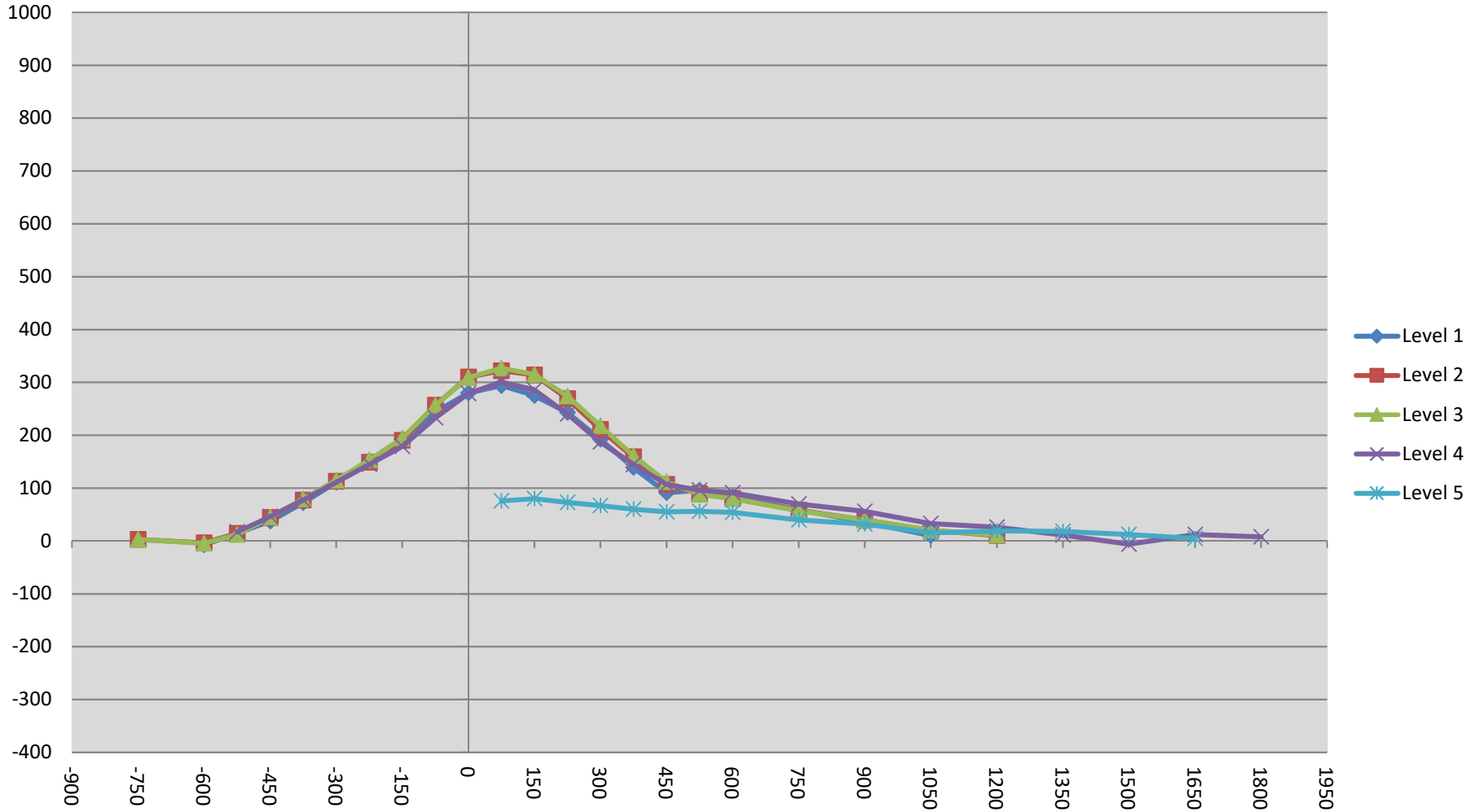
Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019

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.

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-2700															
-2550															
-2400															
-2250															
-2100															
-1950															
-1800															
-1650															
-1500															
-1350															
-1200															
-1050															
-900															
-825															
-750		175	175				178	178				3	3		
-675															
-600	182	182	184			174	178	179			-8	-4	-5		
-525	194	190	191	282		208	204	203	299		14	14	12	17	
-450	201	195	195	275		238	239	240	321		37	44	45	46	
-375	214	197	196	268		286	274	275	345		72	77	79	77	
-300	221	197	195			332	310	310			111	113	115		
-225	221	197	194	252		371	346	347	397		150	149	153	145	
-150	222	196	194	247		414	386	388	426		192	190	194	179	
-75	222	195	193	245		466	452	450	478		244	257	257	233	
0	222	195	193	243		502	505	502	522		280	310	309	279	
75	221	195	193	237	520	515	517	520	538	596	294	322	327	301	76
150	221	195	193	235	505	496	509	508	521	585	275	314	315	286	80
225	221	195	193	233	497	464	464	467	473	570	243	269	274	240	73
300	221	195	193	231	492	413	406	411	418	559	192	211	218	187	67
375	221	196	194	228	487	360	355	355	373	547	139	159	161	145	60
450	221	197	194	226	486	312	304	306	333	541	91	107	112	107	55
525	222	198	196	226	484	318	287	284	322	540	96	89	88	96	56
600	222	199	197	224	481	305	279	277	315	535	83	80	80	91	54
675															
750	223	202	200	225	481	282	260	257	295	521	59	58	57	70	40
825															
900	220	203	202	227	481	256	243	242	283	513	36	40	40	56	32
1050	195	192	192	231	484	205	212	212	264	499	10	20	20	33	15
1200		171	171	231	486		181	182	257	505		10	11	26	19
1350				230	496				241	514				11	18
1500				228	509				222	521				-6	12
1650				227	528				239	533				12	5
1800				230					238					8	
1950															
2100															
2250															
2400															
2550															
2700															

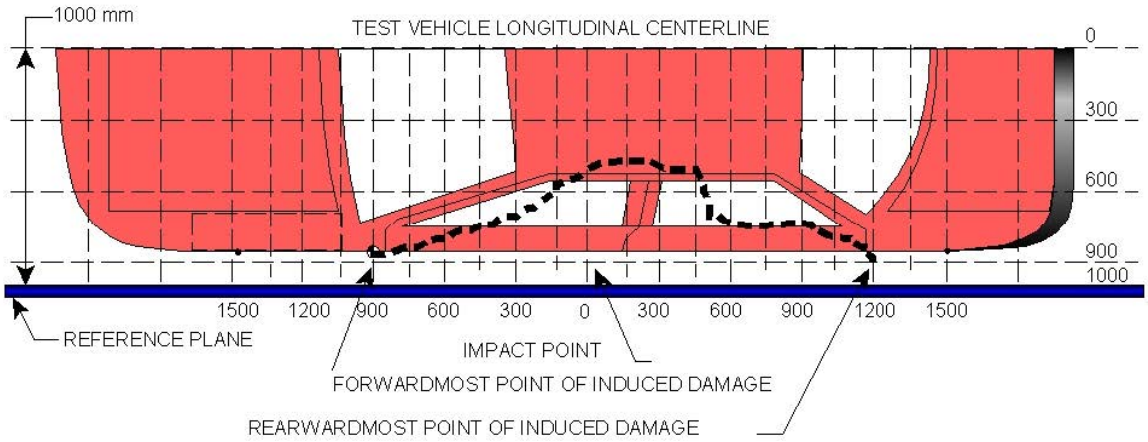
DATA SHEET NO. 10 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20205901
Test Date: 11/22/2019



DATA SHEET NO. 10 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019



VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Pre-Test (mm)	Post-Test (mm)	Max. Static Crush (mm)
1	490	3	195	280	85
2	277	3	193	446	253
3	64	3	193	522	329
4	-149	3	194	390	196
5	-362	3	196	280	84
6	-575	3	186	179	-7

DATA SHEET NO. 11
FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV
NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test
Test Date: 11/22/2019

Test Time: 3:19 pm
Temperature: 22.1°C

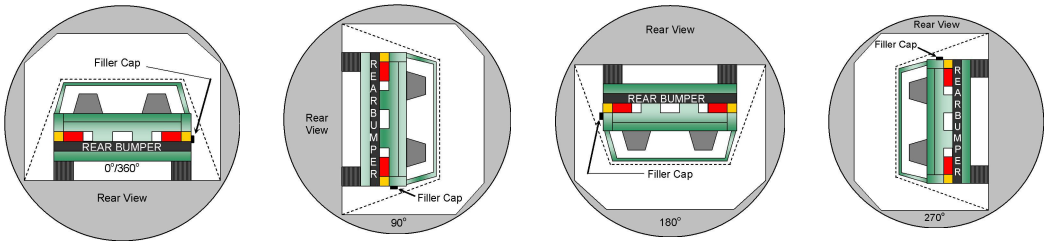
A. From impact until vehicle motion ceases: (Maximum Allowable = 1 ounce) 0.0 oz.

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°	111	300	411
90° to 180°	112	300	412
180° to 270°	107	300	407
270° to 360°	114	300	414

FMVSS 301 ROLLOVER SPILLAGE TABLE (UNITS IN OUNCES)

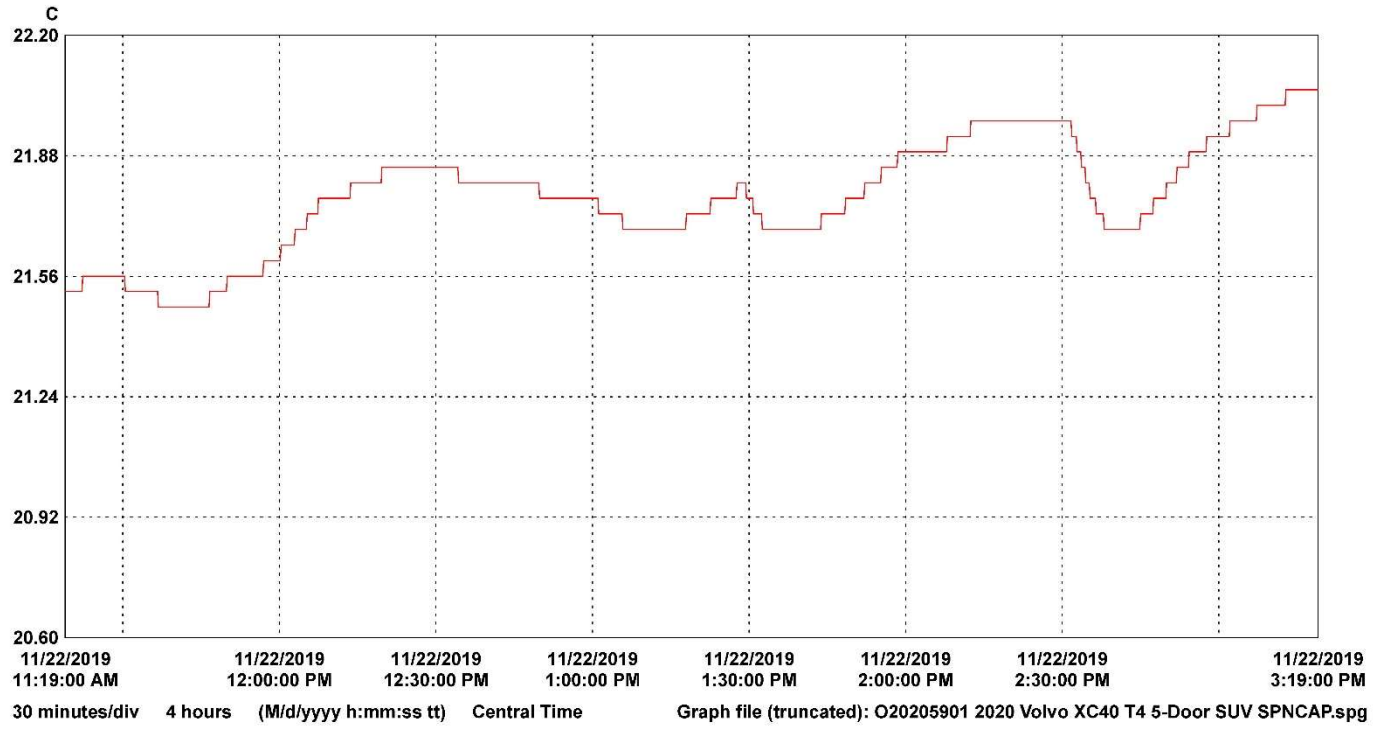
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0.0	0.0	0.0	
90° to 180°	0.0	0.0	0.0	
180° to 270°	0.0	0.0	0.0	
270° to 360°	0.0	0.0	0.0	

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 12
DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2020 Volvo XC40 T4 Inscription 5-Door SUV NHTSA No.: O20205901
Test Program: NCAP Side Pole Impact Test Test Date: 11/22/2019



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	15212045	VSC_South_Hall	1		22.06	21.77	21.48	C	Temperature	15212045_VSC_South_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

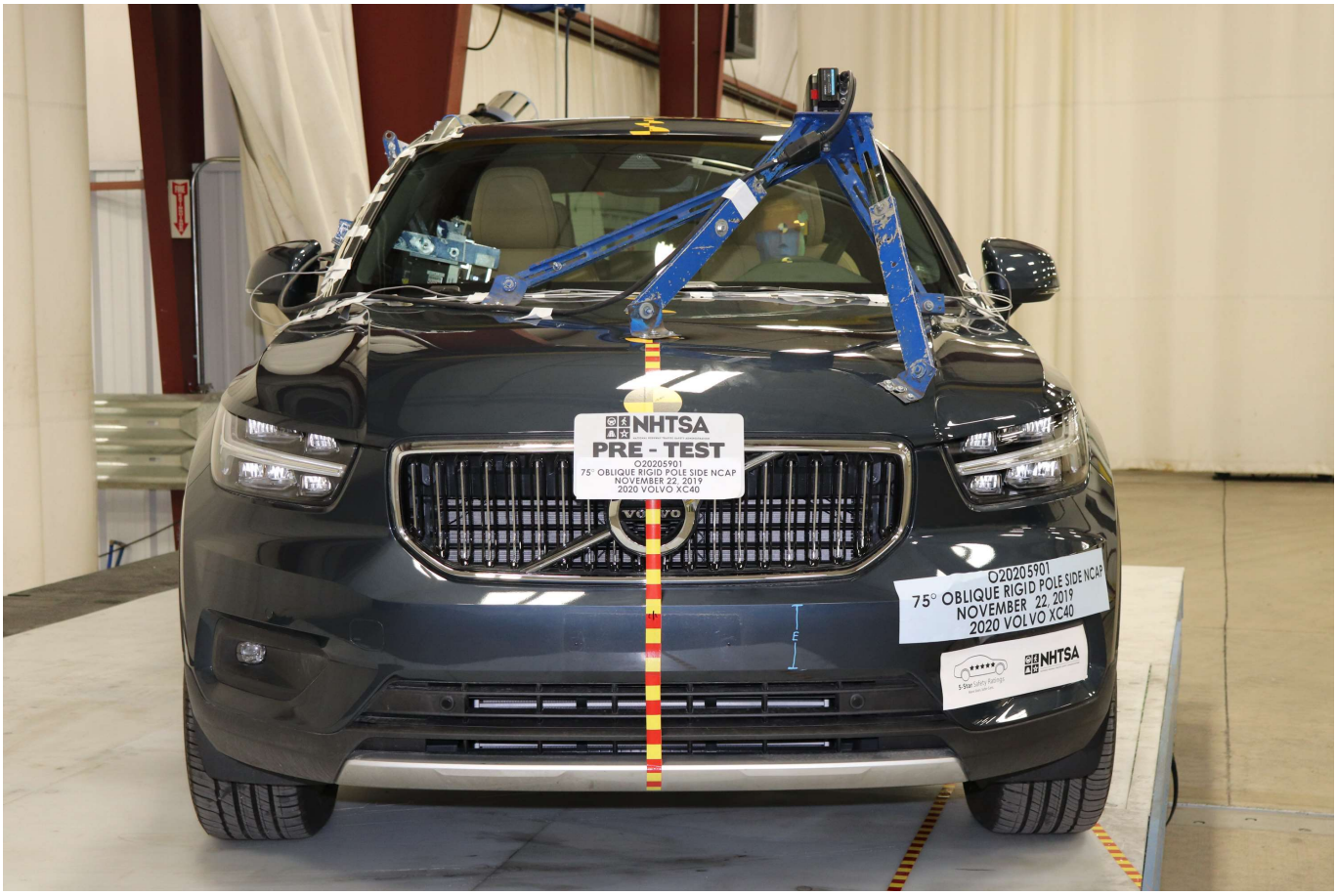


Photo No. 003 - Pre-Test Frontal View of Test Vehicle

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 Rear Three-Quarter View of Test Vehicle

Photo No. 010 - Post-Test Left Rear Three-Quarter 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

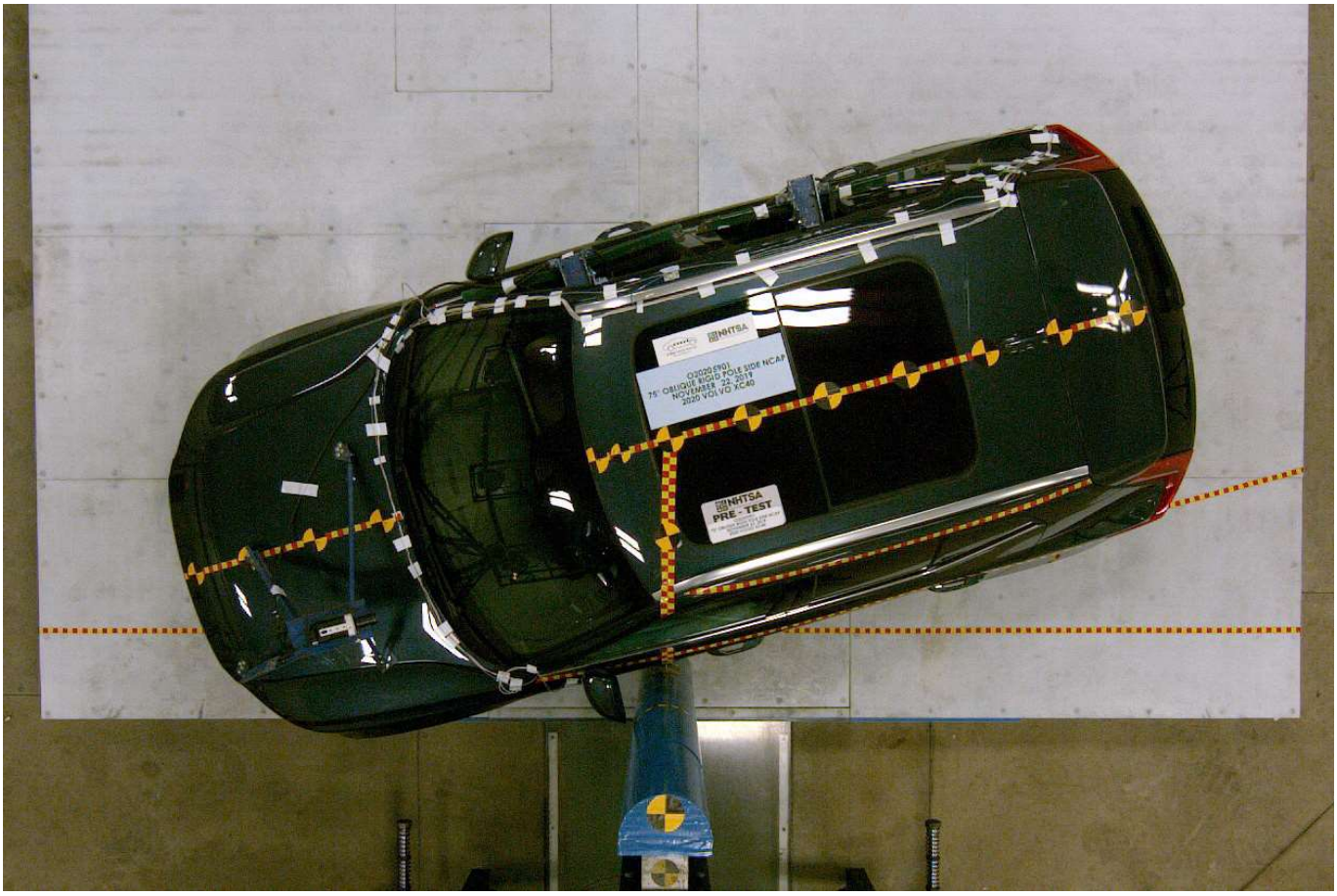


Photo No. 015 - Pre-Test Overhead View of Test Area

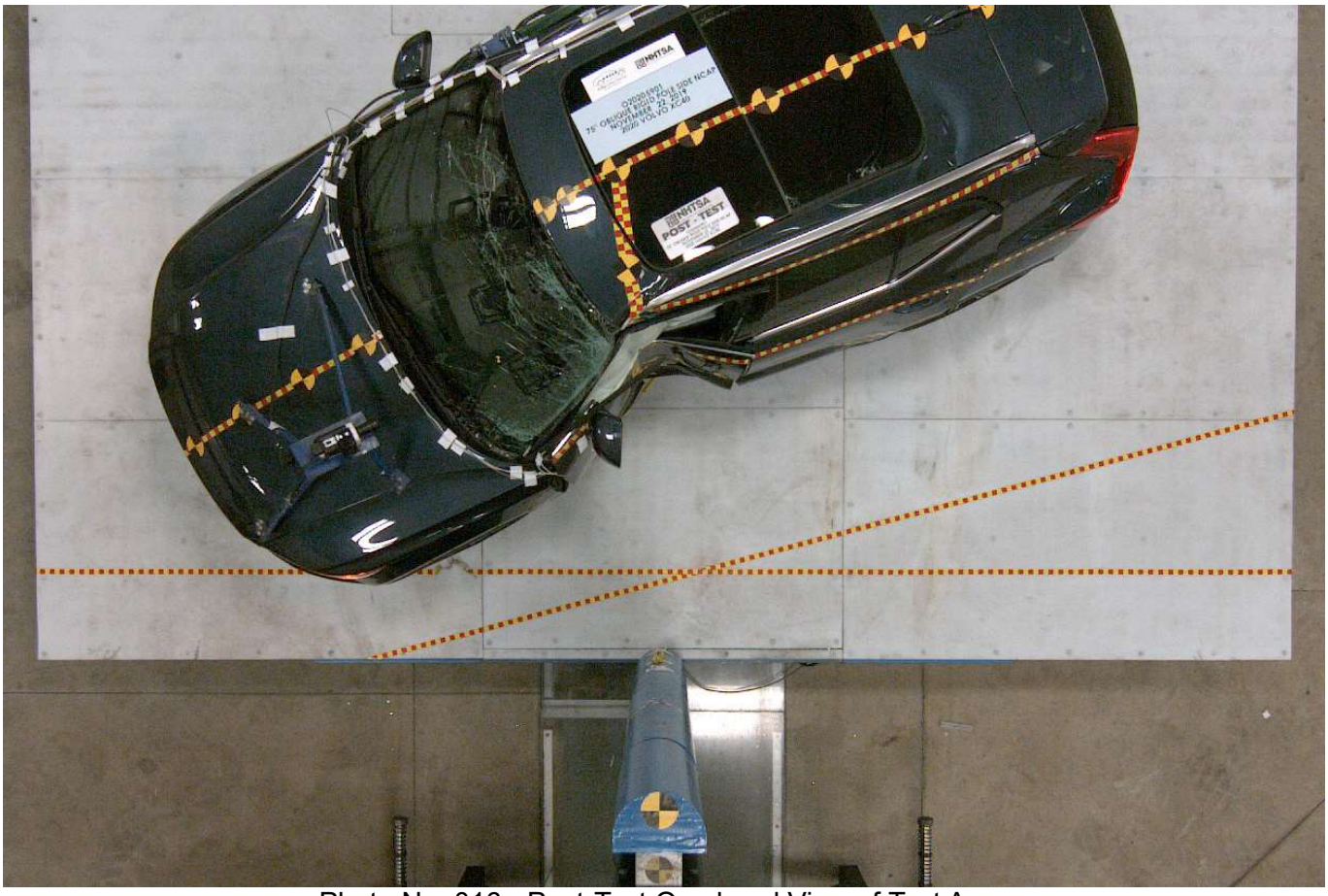


Photo No. 016 - Post-Test Overhead View of Test Area

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

Photo No. 018 - Pre-Test Right Side View of Pole Positioned Against Side of 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 Showing Impact Location

Photo No. 021 - Pre-Test Front Close-Up View of Dummy Head and Chest

Photo No. 022 - Post-Test Front Close-Up View of Dummy

Photo No. 023 - Pre-Test Left Side View of Dummy Showing Belt and Chalking

Photo No. 024 - Pre-Test Left Side View of Dummy Shoulder and Door Top View

Photo No. 025 - Post-Test Left Side View of Dummy Shoulder and Door Top View

Photo No. 026 - Pre-Test Front View of Seat Back Prior to Dummy Positioning

Photo No. 027 - Pre-Test Front Close-Up View of Dummy Head and Shoulders in Relation to Head Restraint

Photo No. 028 - Pre-Test Front View of Seat Pan Prior to Dummy Positioning

Photo No. 029 - Pre-Test Overhead View of Dummy Thighs on Seat Pan

Photo No. 030 - Pre-Test Left Side View of Dummy Neck Showing Position of Adjustable Neck Bracket

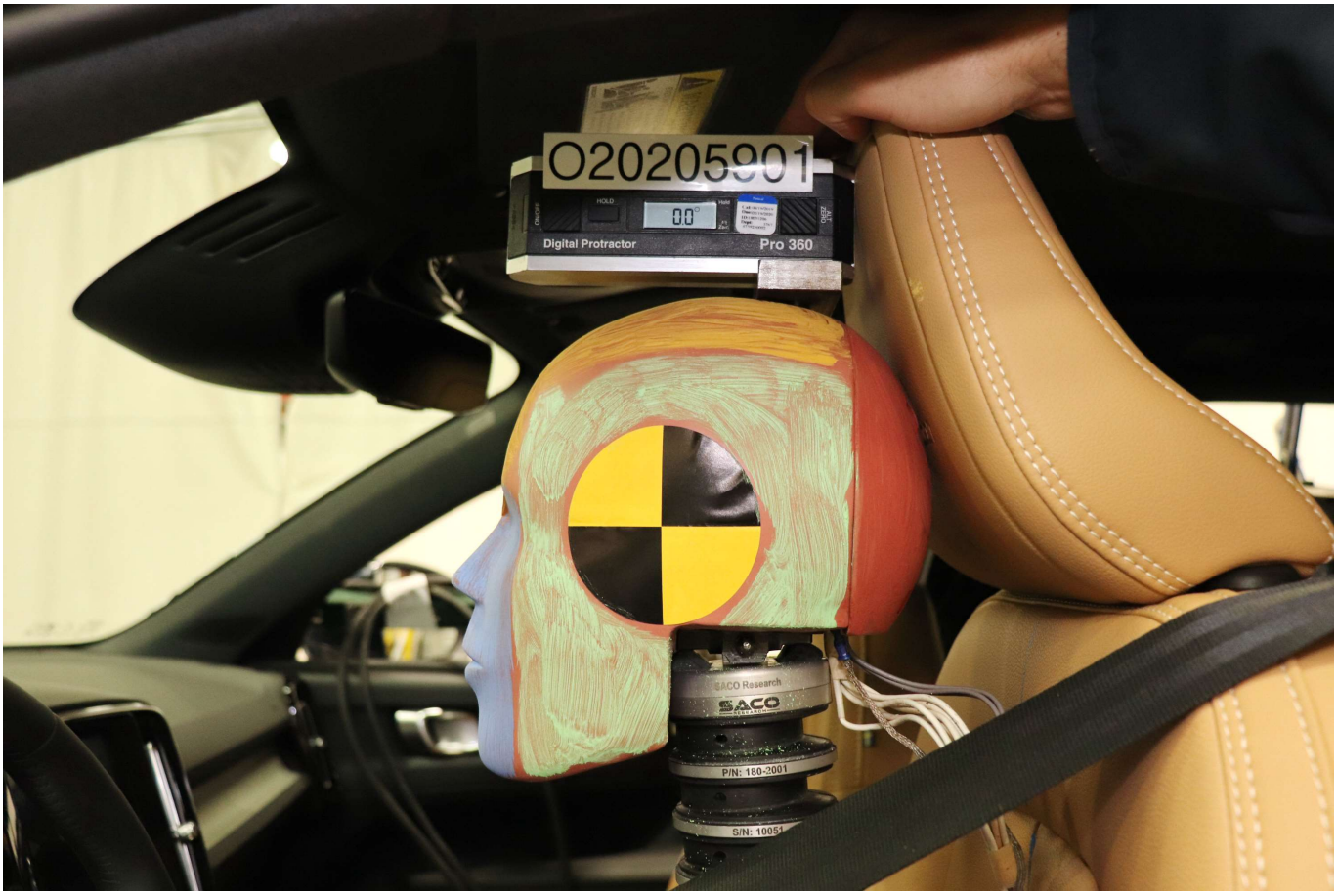


Photo No. 031 - Pre-Test Left Side View of Dummy Head Showing Dummy Head is Level

Photo No. 032 - Pre-Test Placement of Dummy Feet

Photo No. 033 - Pre-Test View of Belt Anchorage for Dummy

Photo No. 034 - Pre-Test Left Side View of Steering Wheel

Photo No. 035 - Pre-Test View of Disengaged Parking Brake

Photo No. 036 - Pre-Test View of Parking Brake

Photo No. 037 - Pre-Test Close-Up Left Side View of Driver Seat Track

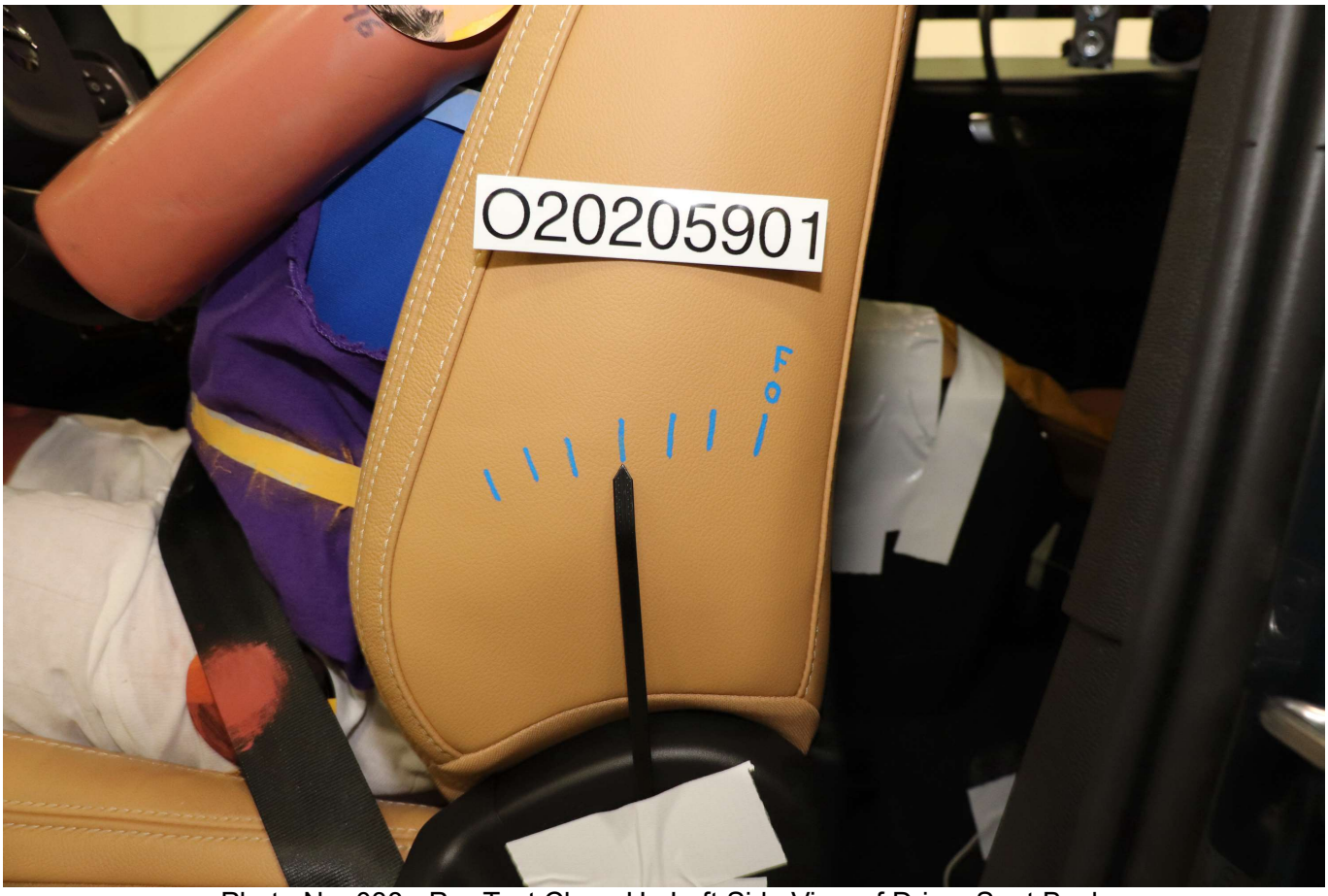


Photo No. 038 - Pre-Test Close-Up Left Side View of Driver Seat Back

Photo No. 039 - Pre-Test Close-Up View of Driver Seat Back or Head Restraint

Photo No. 040 - Pre-Test Dummy and Door Clearance View

Photo No. 041 - Post-Test Dummy and Door Clearance View

Photo No. 042 - Pre-Test Right Side View of Dummy and Front Seat of Occupant Compartment

Photo No. 043 - Post-Test Right Side View of Dummy and Front Seat of Occupant Compartment

Photo No. 044 - Pre-Test Inner Door Panel View

Photo No. 045 - Post-Test Inner Door Panel View Showing Dummy Contact Location

Photo No. 046 - Post-Test Dummy Close-Up Head Contact with Vehicle Interior View

Photo No. 047 - Post-Test Dummy Close-Up Head Contact with Side Air Bag View

Photo No. 048 - Post-Test Dummy Close-Up Torso Contact with Vehicle Interior View

Photo No. 049 - Post-Test Dummy Close-Up Torso Contact with Side Air Bag View

Photo No. 050 - Post-Test Dummy Close-Up Pelvis Contact with Vehicle Interior View

Photo No. 051 - Post-Test Dummy Close-Up Pelvis Contact with Side Air Bag View

Photo No. 052 - Post-Test Dummy Close-Up Knee Contact with Vehicle Interior View

Photo No. 053 - Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

Photo No. 054 - Post-Test View of Fuel Filler Cap or Fuel Filler Neck

Photo No. 055 - Close-Up View of Vehicle Certification Label

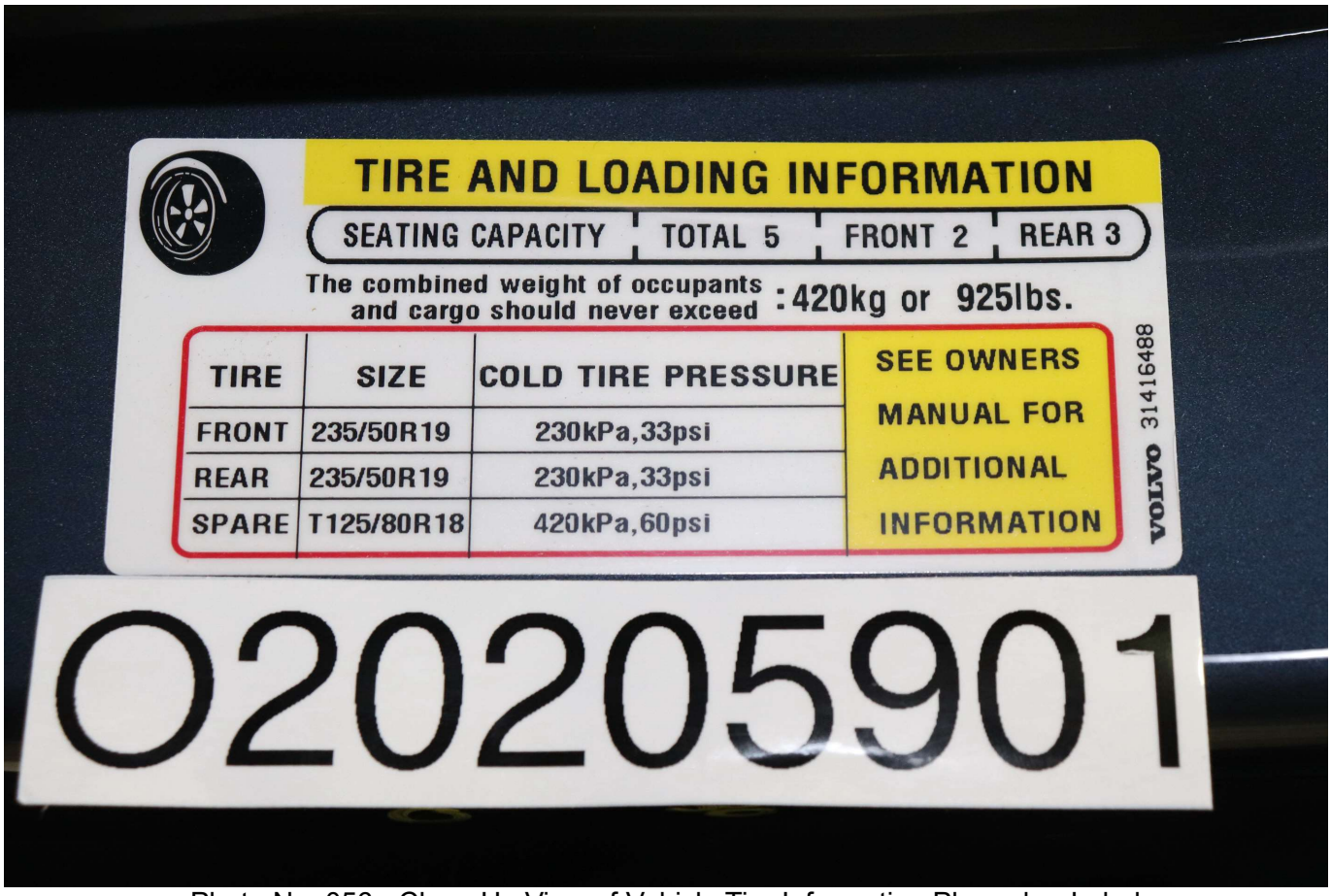


Photo No. 056 - Close-Up View of Vehicle Tire Information Placard or Label

Photo No. 057 - Pre-Test Pole Barrier Front View

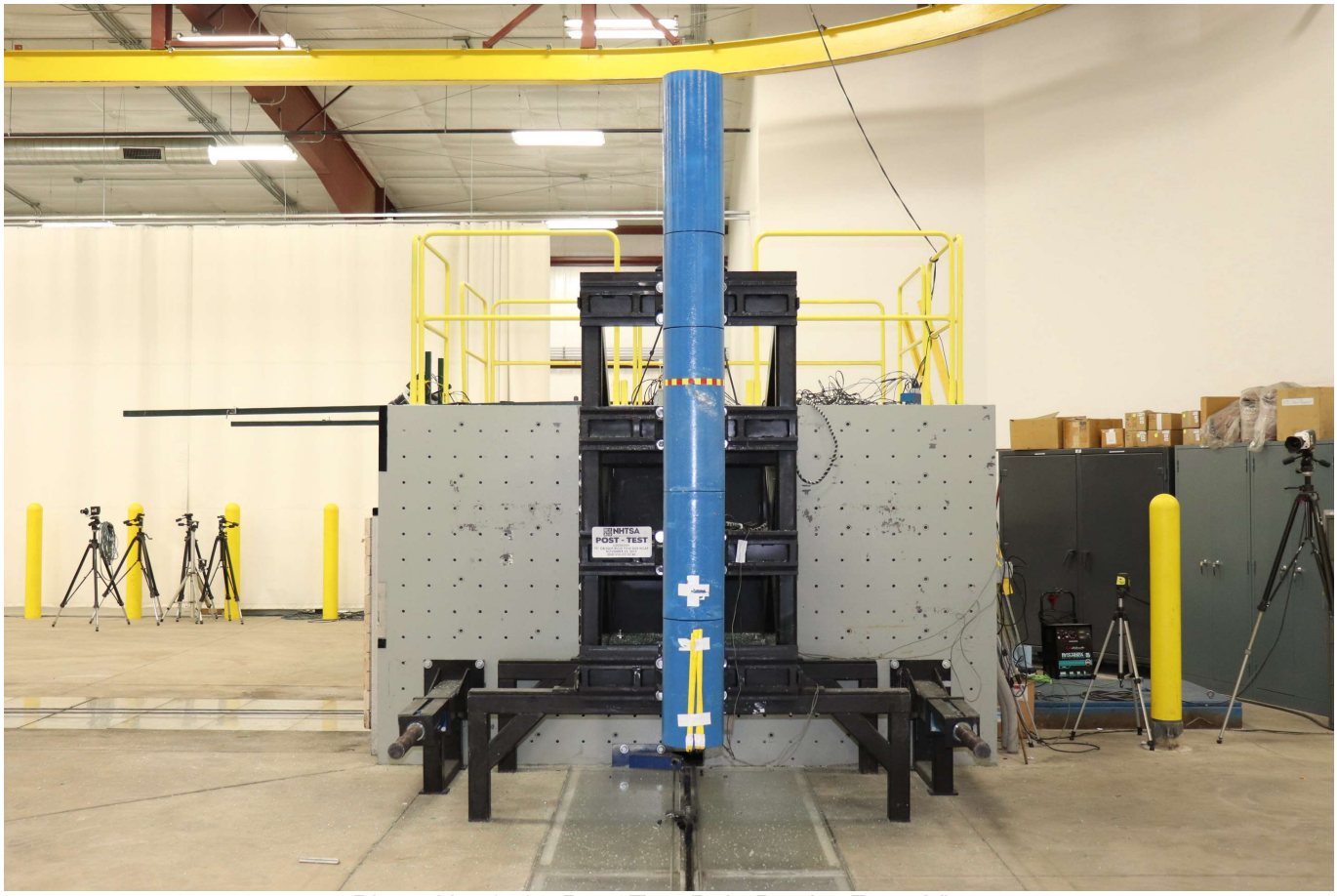


Photo No. 058 - Post-Test Pole Barrier Front View

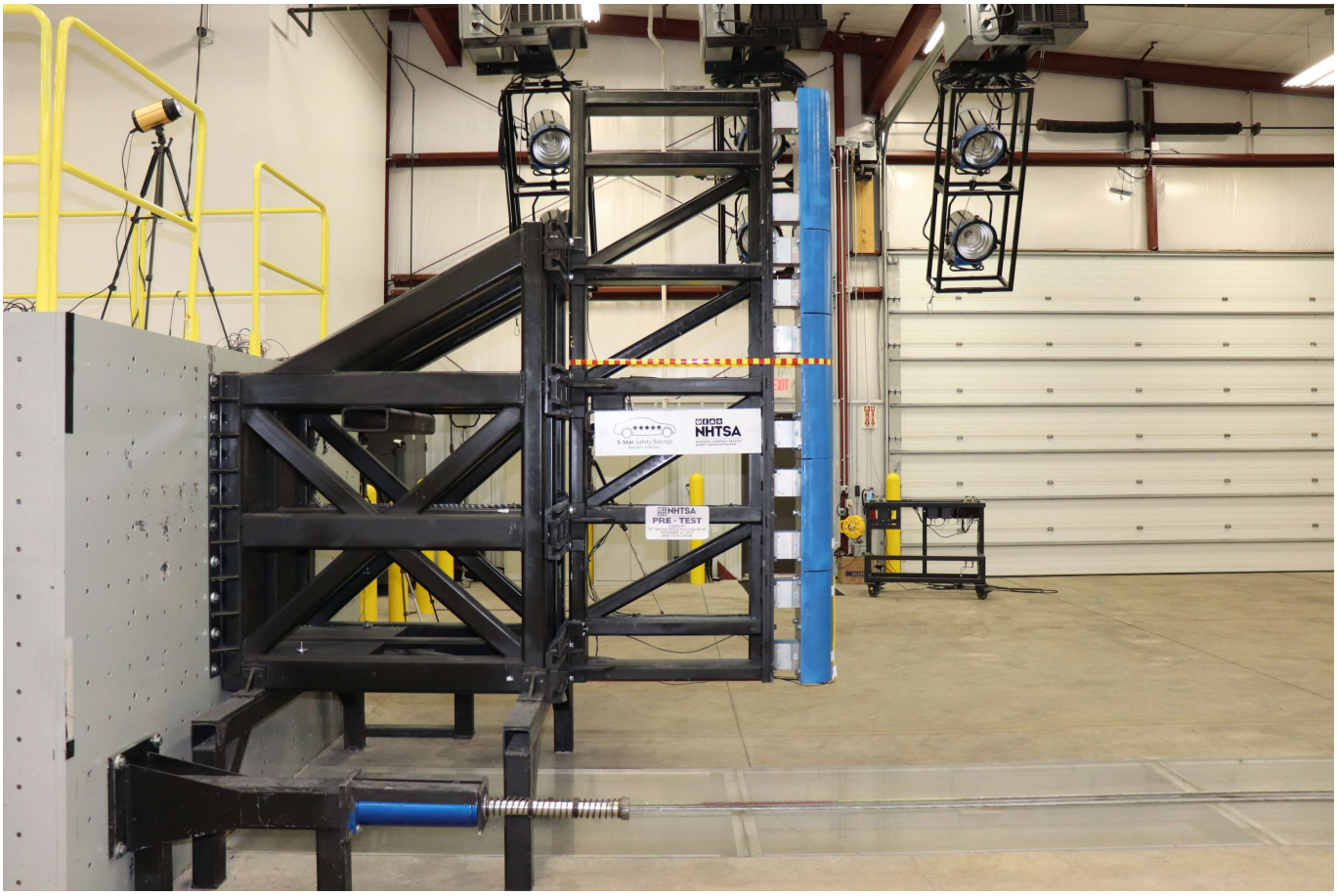


Photo No. 059 - Pre-Test Pole Barrier Side View

Photo No. 060 - Post-Test Pole Barrier Side View

Photo No. 061 - Pre-Test Ballast View

Photo No. 062 - Post-Test Primary and Redundant Speed Trap Read-Out

Photo No. 063 - FMVSS Photo No. 301 Static Rollover 0 Degrees

Photo No. 064 - FMVSS Photo No. 301 Static Rollover 90 Degrees

Photo No. 065 - FMVSS Photo No. 301 Static Rollover 180 Degrees

Photo No. 066 - FMVSS Photo No. 301 Static Rollover 270 Degrees

Photo No. 067 - FMVSS Photo No. 301 Static Rollover 360 Degrees

Photo No. 068 - Impact Event

2020VOLVO

XC40 T4 FWD INSCRIPTION

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
Sport 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" Inscription Alloy Wheels with All-Season Tires
Adjustable Drive Mode Settings

AUDIO & TECHNOLOGY

12.3" Digital Driver Display
9" Integrated Sensus Connect Touchscreen feat.
Sensus Navigation Pro
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
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

Blind Spot Information System (BLIS) with
Steer Assist & Cross Traffic Alert with Autobrake
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
Power Child Safety Locks in Rear Doors
Hill Descent Control
Electronic Stability Control
LED Headlights w/Thor's Hammer DRL & Auto Highbeam
LED Front Fog Lights

LUXURY & CONVENIENCE

Laminated Panoramic Moonroof w/ Power Sunshade
Leather Upholstery w/Mechanical Seat Extensions
Leather Wrapped Tilt & Telescopic Steering Wheel
Driftwood Inlays
Orrefors Crystal Gear Shift Knob
Dual Integrated Tailpipes
Stainless Steel Cargo Scuff Plate
Metallic Exterior Paint
Interior High Level Illumination
Keyless Entry & Drive w/ Hands-Free Power Tailgate
8-Way Power Front Seats & Driver Seat Memory
Split Folding Backrest with Load Through Hatch
2-Zone Automatic Climate Control + CleanZone
Rear Park Assist Camera
Heated Wiper Blades with Integrated Washers

AUTHORIZED RETAILER

KEYSTONE - BERWYN 7308
529 LANCASTER AVE
BERWYN, PA 19312

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 -
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or visit https://accessories.volvocars.com/en-us

JOIN THE CONVERSATION

See what our fans are saying about Volvo and join in!

Have a question?
Feel free to ask us on Twitter! @VolvoCarUSA
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Instagram: @VolvoCarUSA
Facebook: Volvo Car USA
YouTube: Volvo Car USA

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.

PRICING

IMPORTER'S SUGGESTED LIST PRICE P.O.E.:	$ 33,700.00
Inscription Features	6,750.00
18" Inscription Alloy Wheels	
2-Zone Automatic Climate Control + CleanZone	
4-Way Power Lumbar, Front Seats	
8-Way Power Front Seats & Driver Seat Memory	
Auto Dimming Interior & Exterior Mirrors	
Blind Spot Information System (BLIS) with	
Steer Assist & Cross Traffic Alert w/Autobrake	
Bright Integrated Roof Rails	
Driftwood Inlays	
Dual Integrated Tailpipes	
Front and Rear Park Assist	
Hidden Storage Compartment Under Driver's Seat	
Homelink & Compass Integrated in Rearview Mirror	
Inscription Design Front Grill	
Inscription Embossing on C-Pillar	
Interior High Level Illumination	
Keyless Entry with Hands-Free Power Tailgate	
Laminated Panoramic Moonroof w/ Power Sunshade	
LED Front Fog Lights	
Mechanical Driver & Passenger Seat Extensions	
Metal Front Tread Plates	
Metallic Exterior Paint	
Orrefors Crystal Gear Shift Knob	
Power Folding Headrests	
Power Retractable Rearview Mirrors	
Removable / Folding Load Floor	
with Grocery Bag Holders	
Sensus Navigation Pro	
Stainless Steel Cargo Scuff Plate	
Wireless Charging Pad	
Heated Front Seats & Heated Steering Wheel	750.00
Protection Package Premier*	460.00
19" 5-Double Spoke Black Alloy Wheels	800.00
Destination Charge	995.00
Total Suggested Retail Price:	$ 43,455.00

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

Fuel Economy

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

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): 6 (1 – 10, Best)

Smog Rating (tailpipe only): 5 (1 – 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 189228
Model Year: 2020
Color: Denim Blue Metallic
VIN: YV4AC2HL2L2189228

Port of Importation: Baltimore, MD
Delivered by: Truck
DELIVERY ADDRESS
KEYSTONE - BERWYN 7308
529 LANCASTER AVE
BERWYN, PA 19312

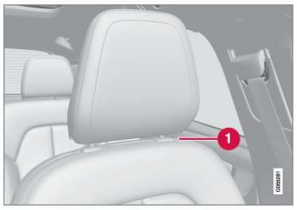
YV4AC2HL2L2189228

Photo No. 069 - 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.

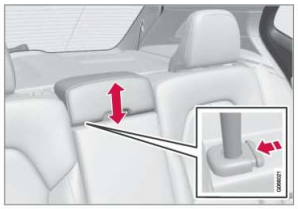
1 Only applies to the driver's seat.

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. 070 - Head Restraint Use and Adjustment Information from Vehicle Owners Manual

Photo No. 071 - Post-Test View of Shattered Vehicle Inner Door Panel

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 Dummy Instrumentation Data

Driver Head CG Redundant Acceleration (X) vs. Time

Driver Head CG Redundant Acceleration (Y) vs. Time

Driver Head CG Redundant Acceleration (Z) vs. Time

Driver Head Angular Velocity X (Deg/Sec) vs. Time

Driver Head Angular Velocity Y (Deg/Sec) vs. Time

Driver Head Angular Velocity Z (Deg/Sec) vs. Time

Driver Upper Thorax Rib Deflection (Y)

Driver Middle Thorax Rib Deflection (Y)

Driver Lower Thorax Rib Deflection (Y)

Driver Upper Abdomen Rib Deflection (Y)

Driver Lower Abdomen Rib Deflection (Y)

Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)

Vehicle Center of Gravity Acceleration (Y)

Vehicle Center of Gravity Acceleration (Z)

Left Floor Sill Acceleration (Y)

Left A-Pillar Sill Acceleration (Y)

Left Lower A-Pillar Acceleration (Y)

Left Mid A-Pillar Acceleration (Y)

Left B-Pillar Sill Acceleration (Y)

Left Lower B-Pillar Acceleration (Y)

Left Mid B-Pillar Acceleration (Y)

Driver Seat Track at Dummy Hip Point Acceleration (Y)

Engine Top Acceleration (X)

Engine Top Acceleration (Y)

Firewall Center Acceleration (Y)

Right Roof at Vertical Impact Reference Line Acceleration (Y)

Right Sill at Vertical Impact Reference Line Acceleration (Y)

Rear Floorpan Behind Rear Axle at Centerline Acceleration (X)

Rear Floorpan Behind Rear Axle at Centerline Acceleration (Y)

Pole Instrumentation Data

Load Cell Pole Barrier #1 Force (Y)

Load Cell Pole Barrier #2 Force (Y)

Load Cell Pole Barrier #3 Force (Y)

Load Cell Pole Barrier #4 Force (Y)

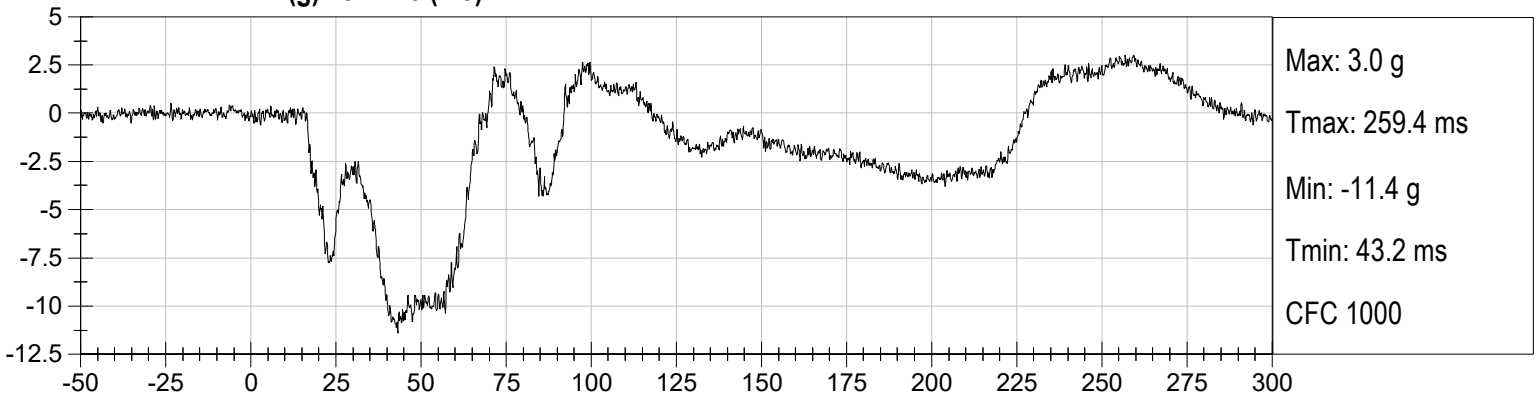
Load Cell Pole Barrier #5 Force (Y)

Load Cell Pole Barrier #6 Force (Y)

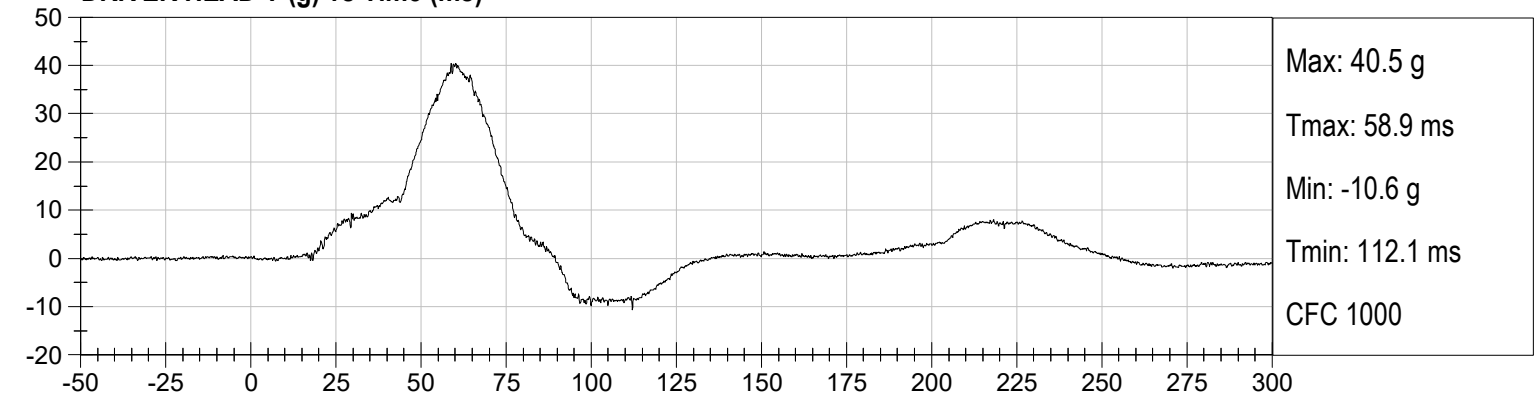
Load Cell Pole Barrier #7 Force (Y)

Load Cell Pole Barrier #8 Force (Y)

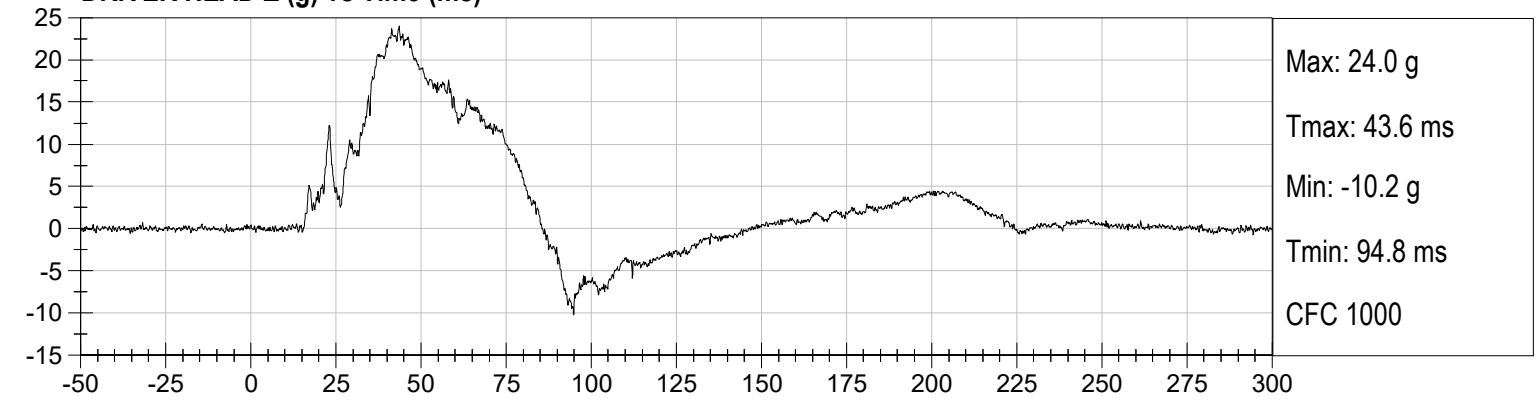
DRIVER HEAD X (g) vs Time (ms)



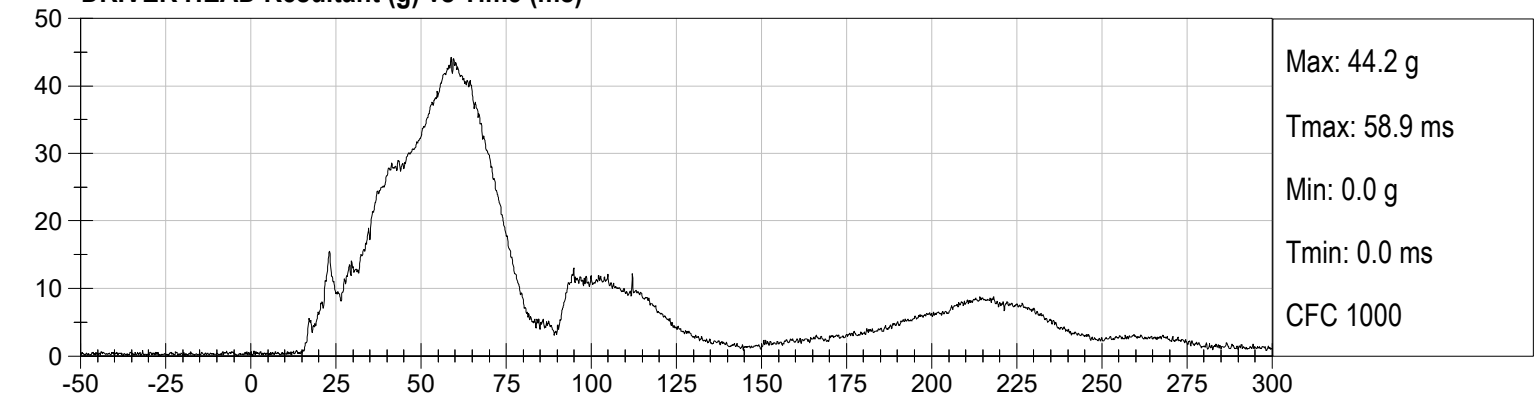
DRIVER HEAD Y (g) vs Time (ms)



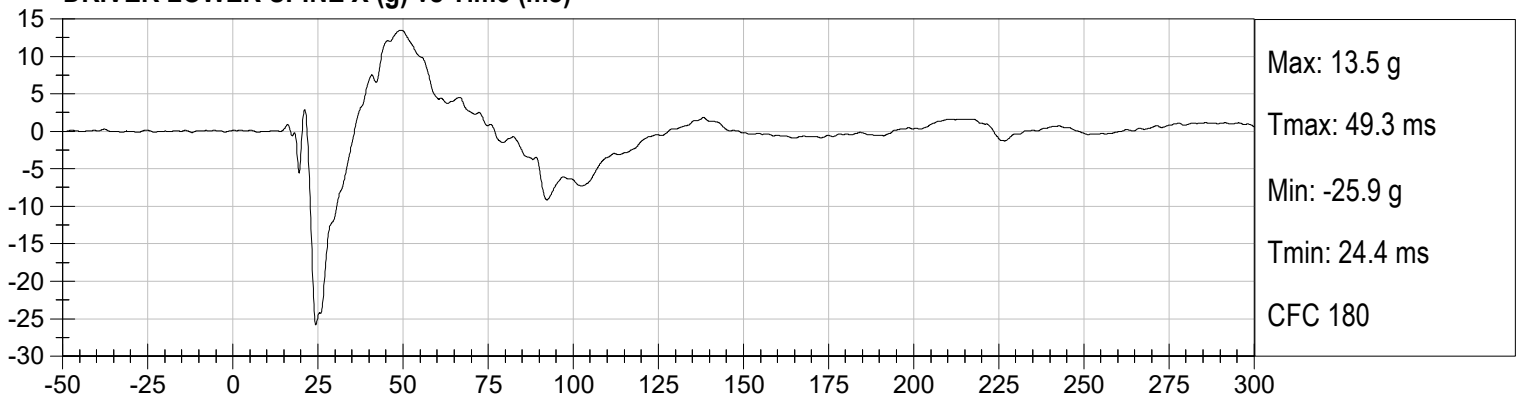
DRIVER HEAD Z (g) vs Time (ms)



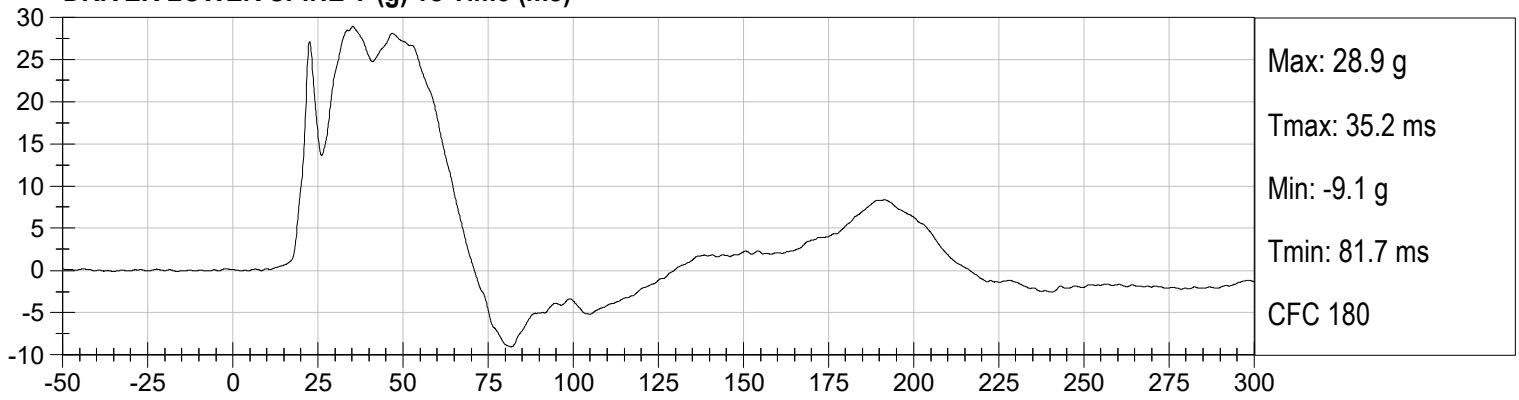
DRIVER HEAD Resultant (g) vs Time (ms)



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

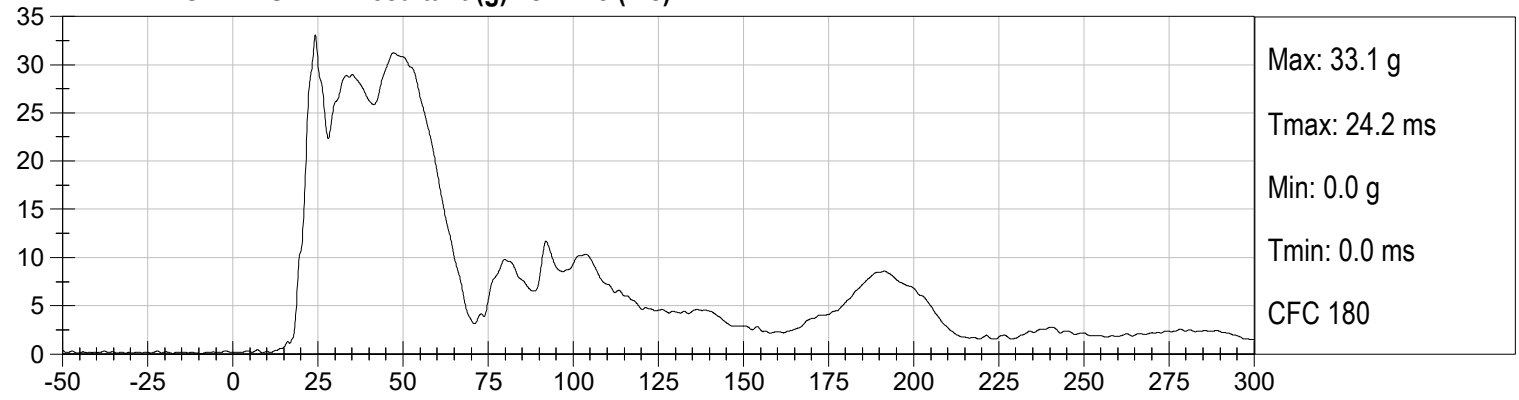


DRIVER LOWER SPINE Y (g) vs Time (ms)

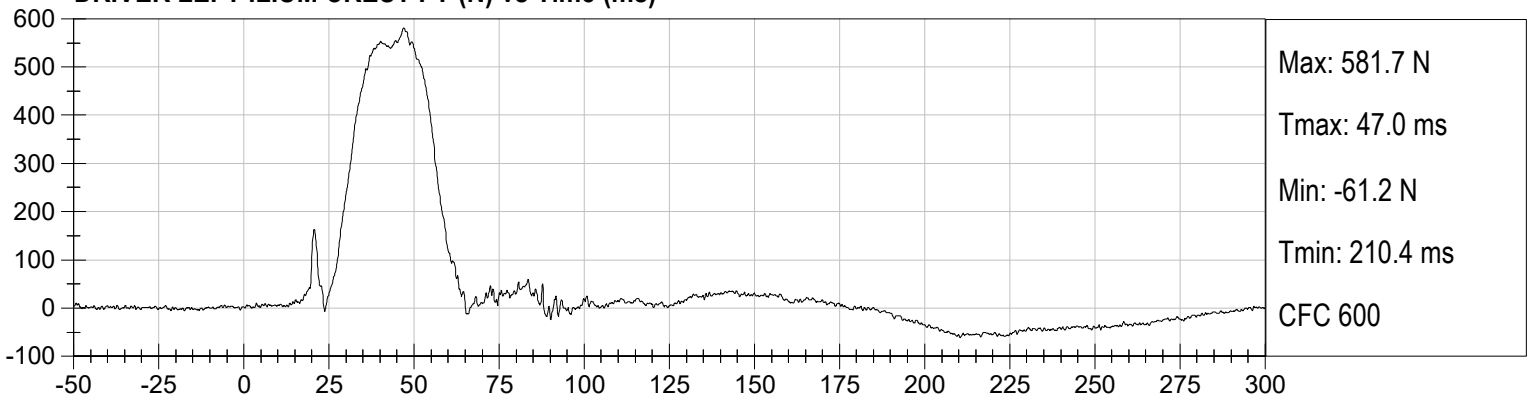


DRIVER LOWER SPINE Z (g) vs Time (ms)

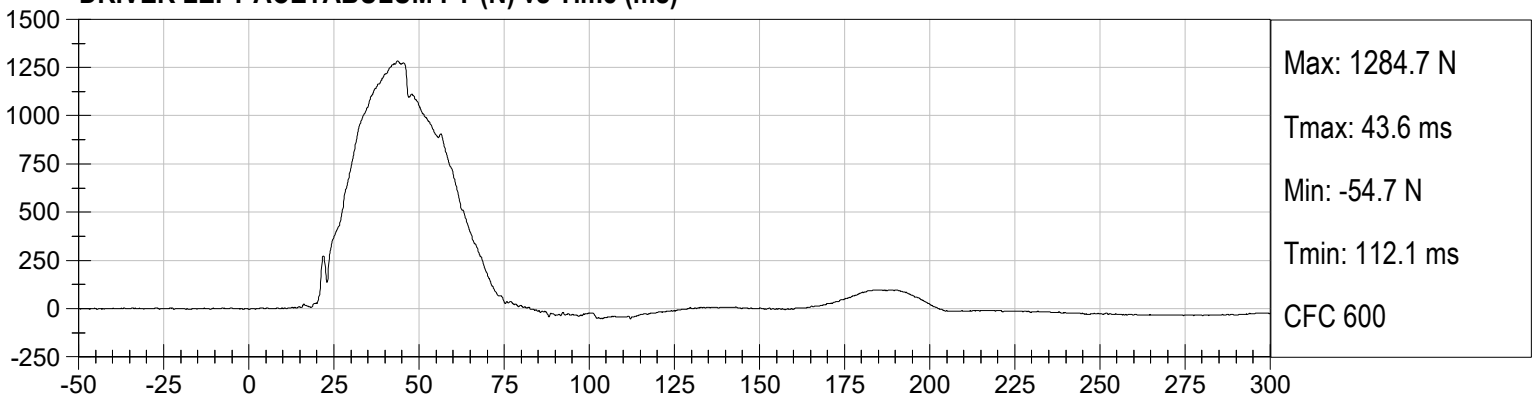
DRIVER LOWER SPINE Resultant (g) vs Time (ms)



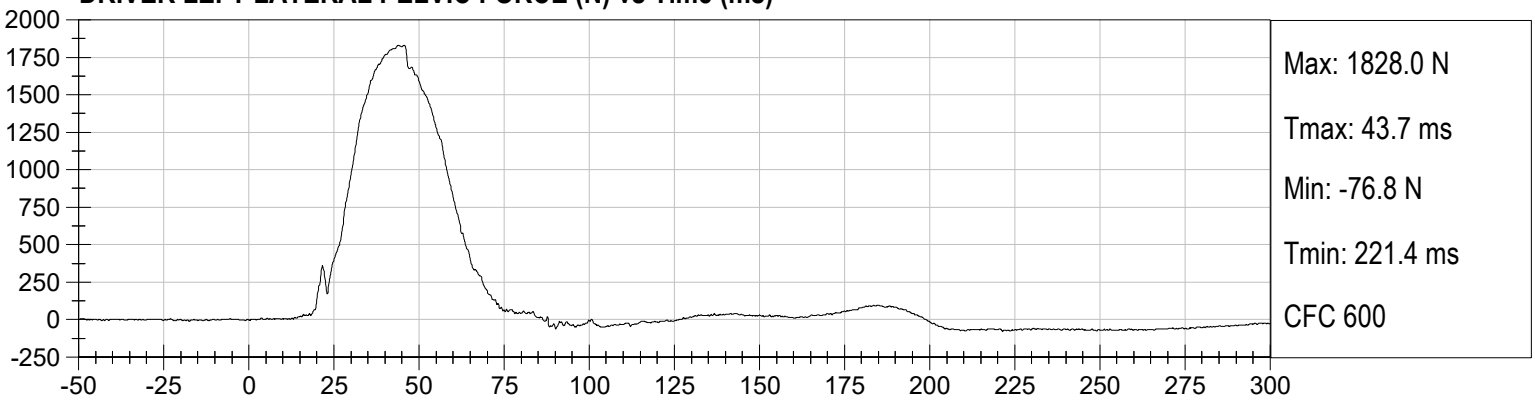
DRIVER LEFT ILIUM CREST FY (N) vs Time (ms)



DRIVER LEFT ACETABULUM FY (N) vs Time (ms)



DRIVER LEFT LATERAL PELVIC FORCE (N) vs Time (ms)



APPENDIX C
DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - DRIVER ATD

SID-IIsD External Measurements
SN: 296

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

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D193531

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Peak Resultant Acceleration	G's	115 to 137	126	Pass
Peak Longitudinal Acceleration	G's	+/- 15	5.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

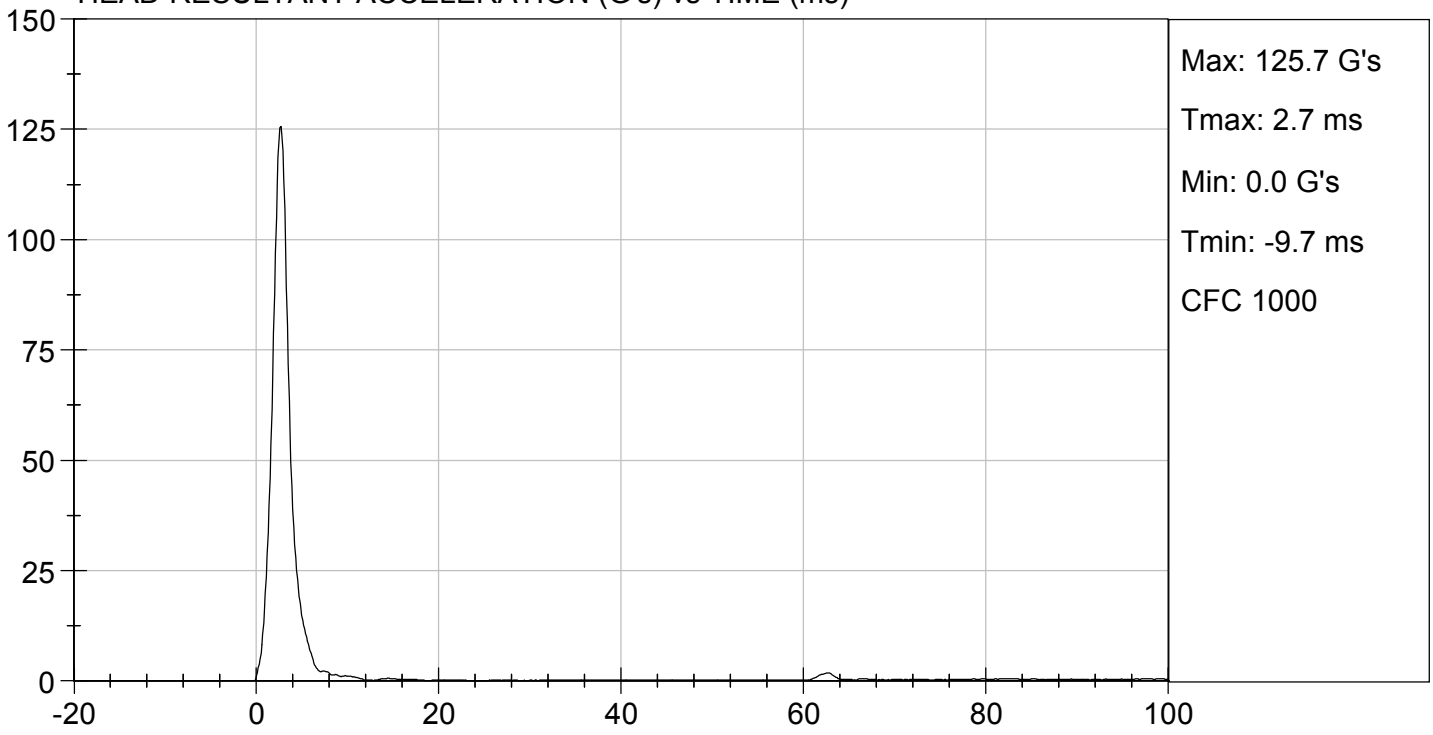
11/11/2019
Test Date

Approved By

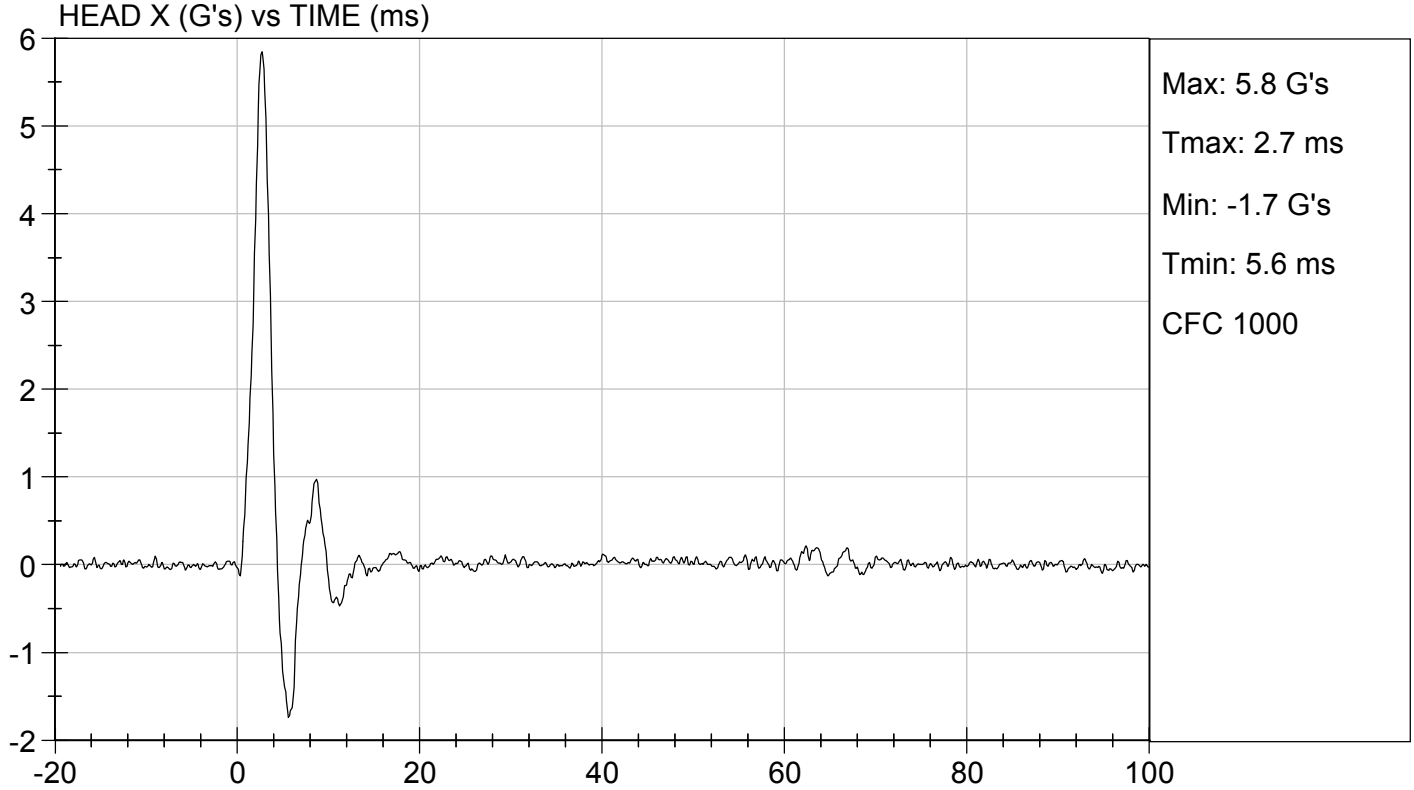
TEST DESC: HEAD DROP

TEST DATE: 11/11/2019
TEST #: D193531

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

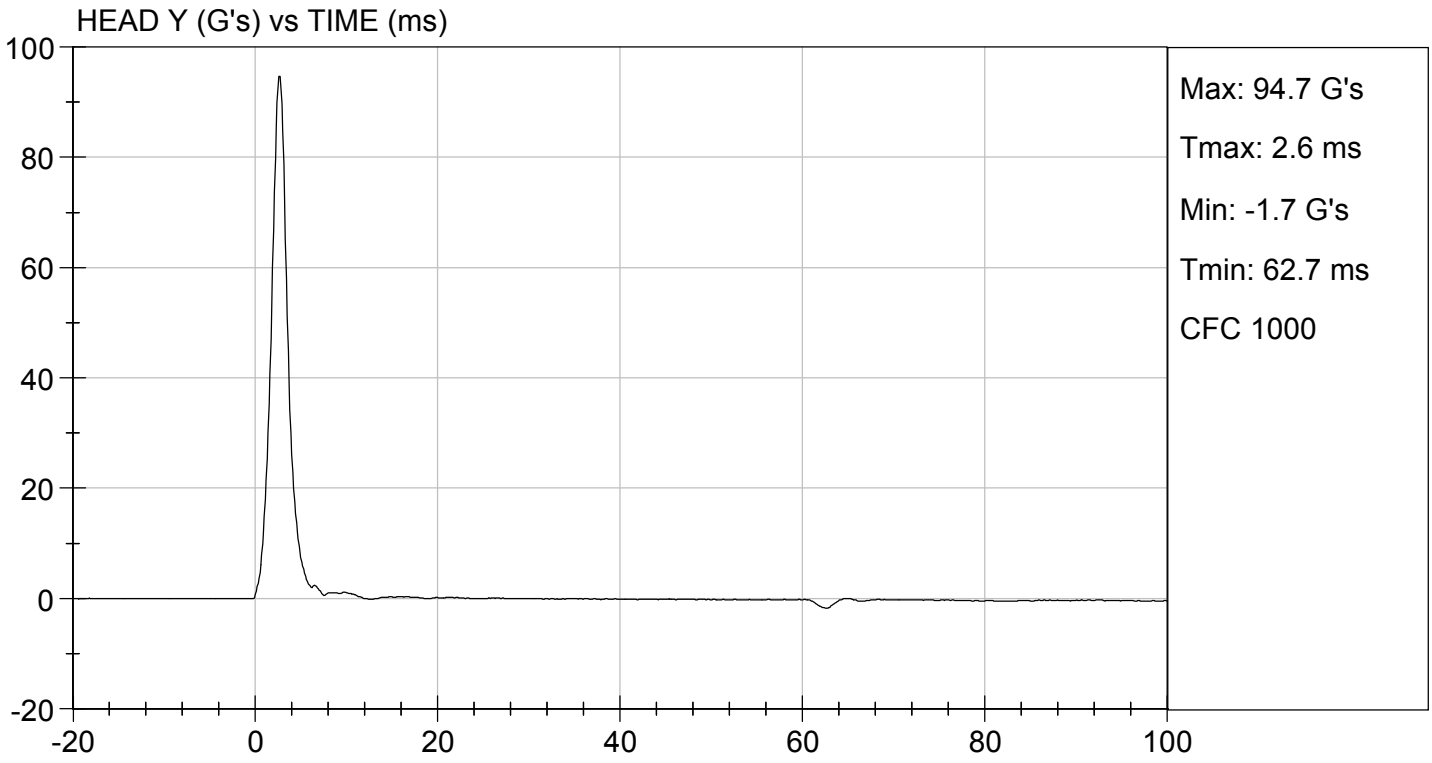


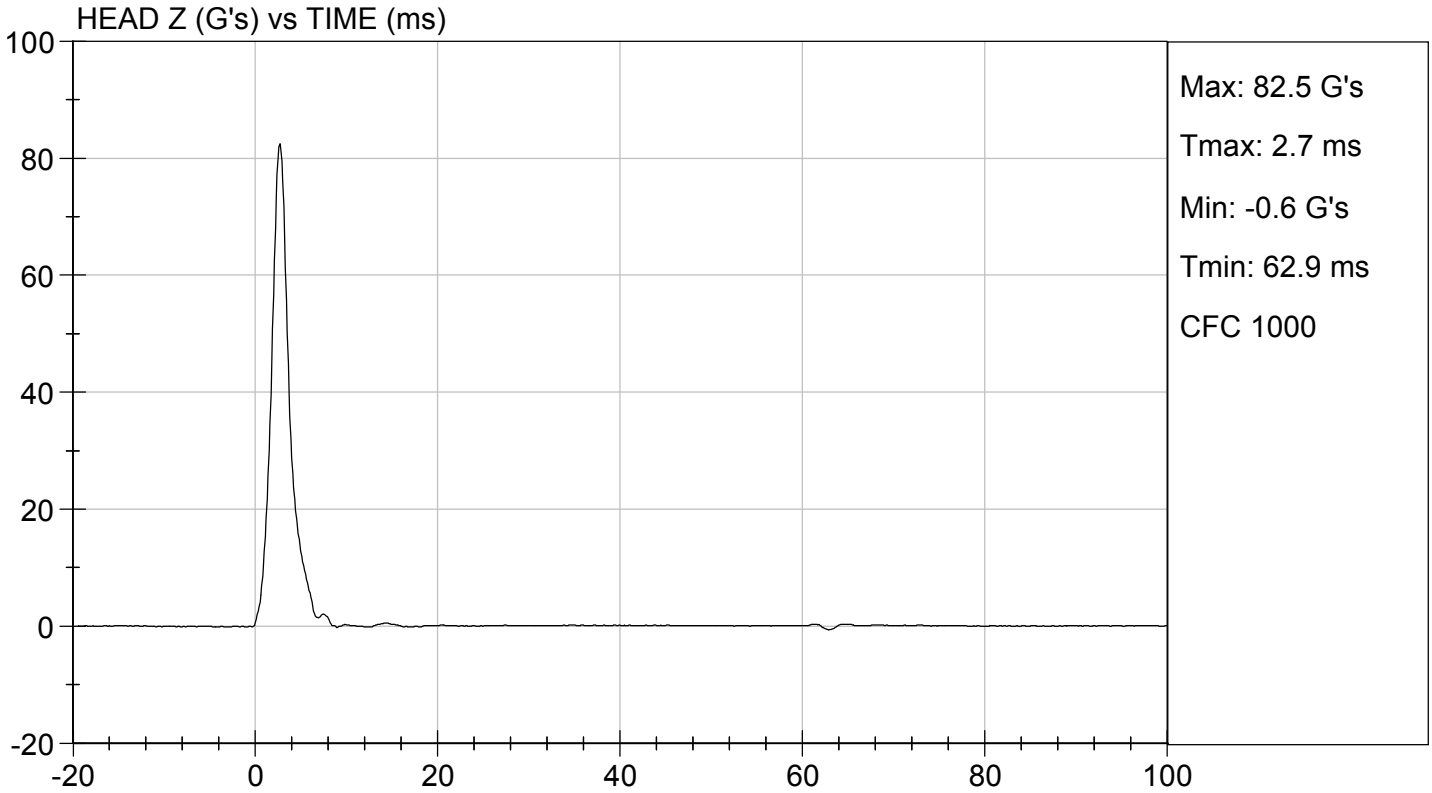
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 11/11/2019
TEST #: D193531





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193532

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	20.7	Pass
Humidity		%	10 to 70	22	Pass
Impact Velocity		m/s	5.51 to 5.63	5.62	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.65	Pass
	15 ms	m/s	3.30 to 4.10	3.87	Pass
	20 ms	m/s	4.40 to 5.40	5.37	Pass
	25 ms	m/s	5.40 to 6.10	5.67	Pass
	25-100 ms	m/s	5.50 to 6.20	5.68	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	61	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-38	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	113	Pass
			Overall Test Results		Pass

Laboratory Technician

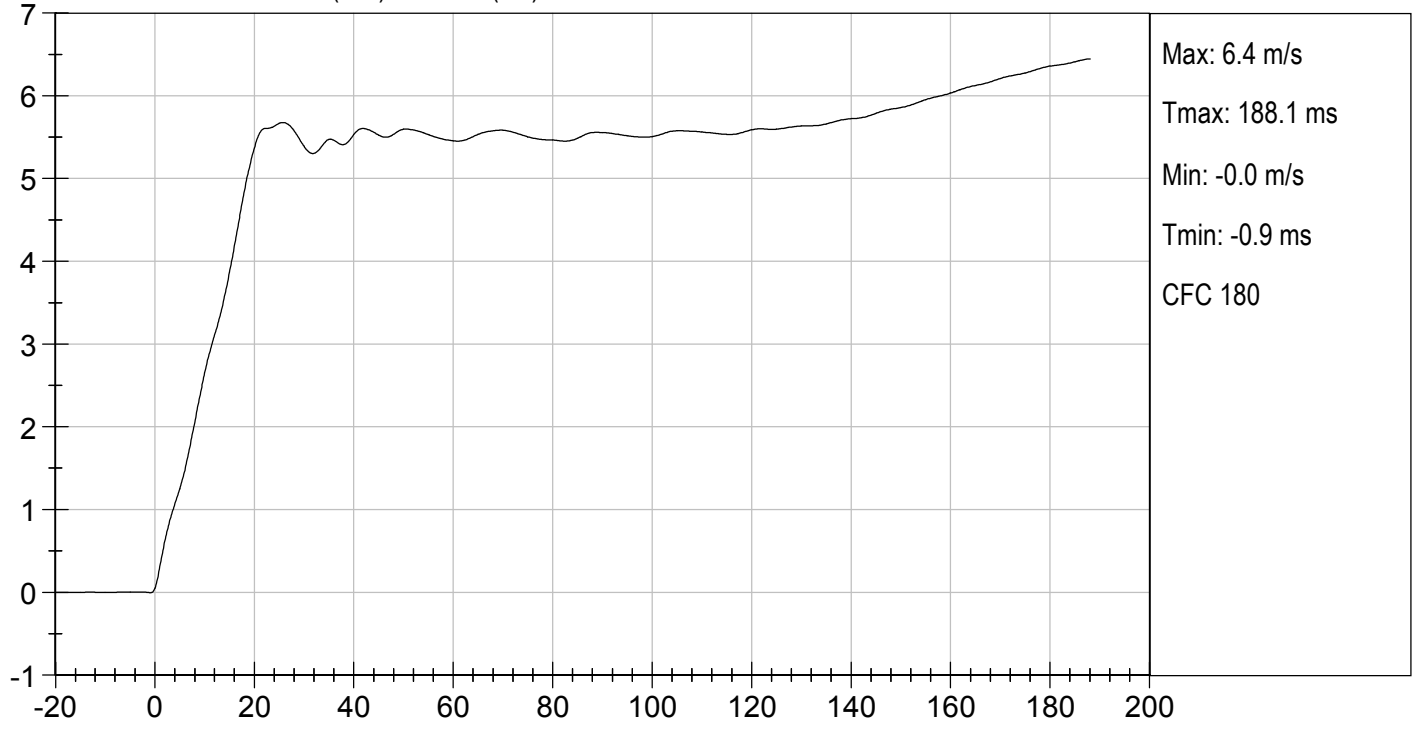
11/11/2019
Test Date

Approved By

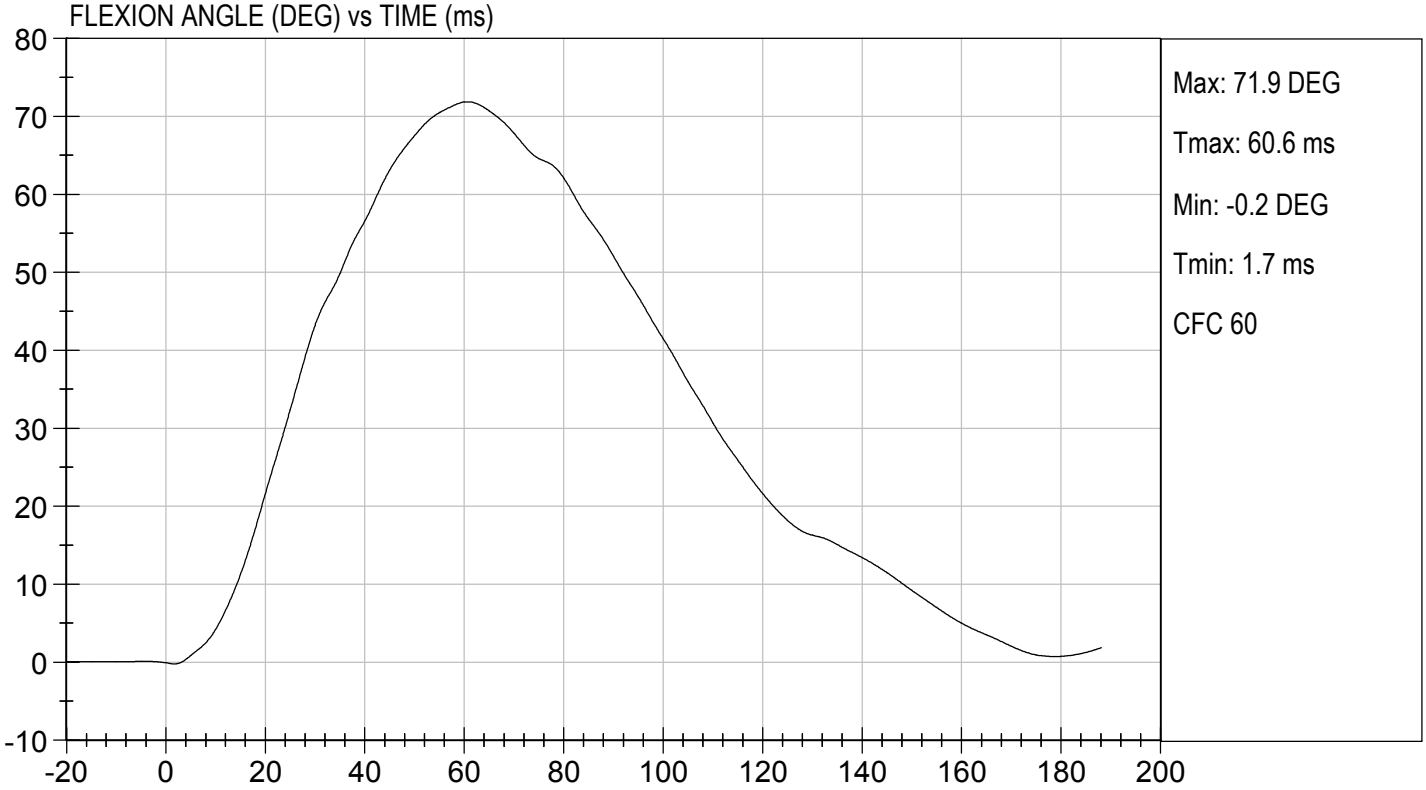
TEST DESC: NECK BENDING
VELOCITY: 18.45 ft/s, 5.62 m/s

TEST DATE: 11/11/2019
TEST #: D193532

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

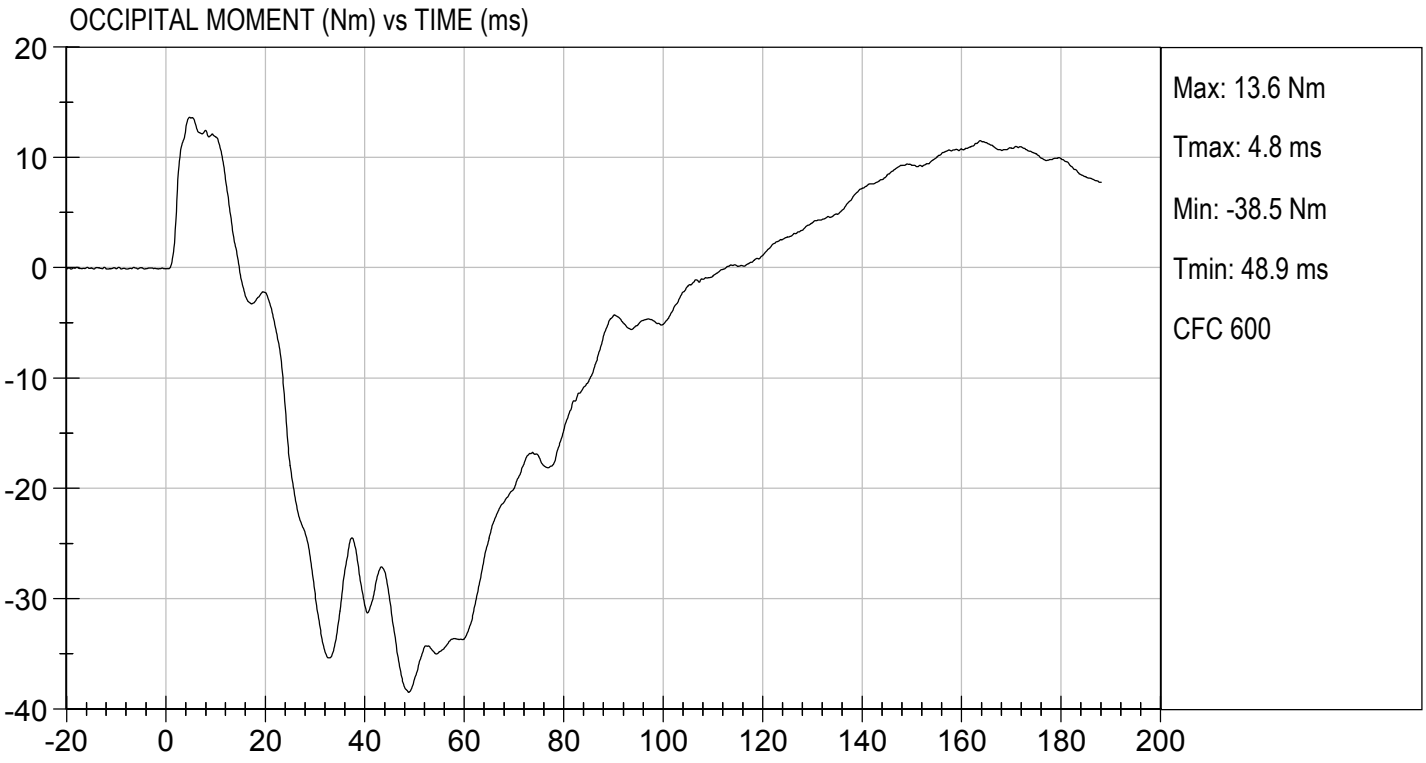


FLEXION ANGLE (DEG) vs TIME (ms)



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

TEST DATE: 11/11/2019
TEST #: D193532



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D193533

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	18	Pass
Shoulder Displacement	mm	28 to 37	28	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	21	Pass
		Overall Test Results		Pass

Laboratory Technician

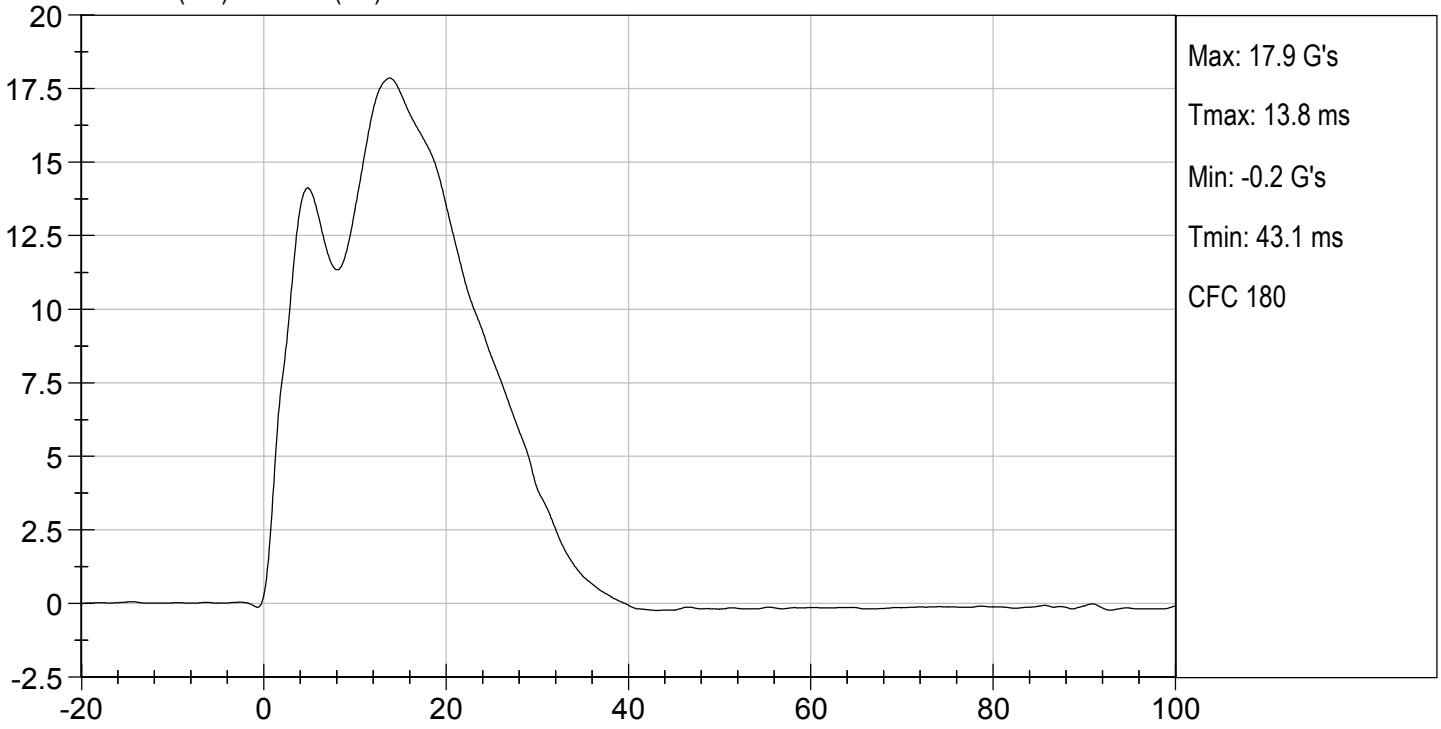
11/12/2019
Test Date

Approved By

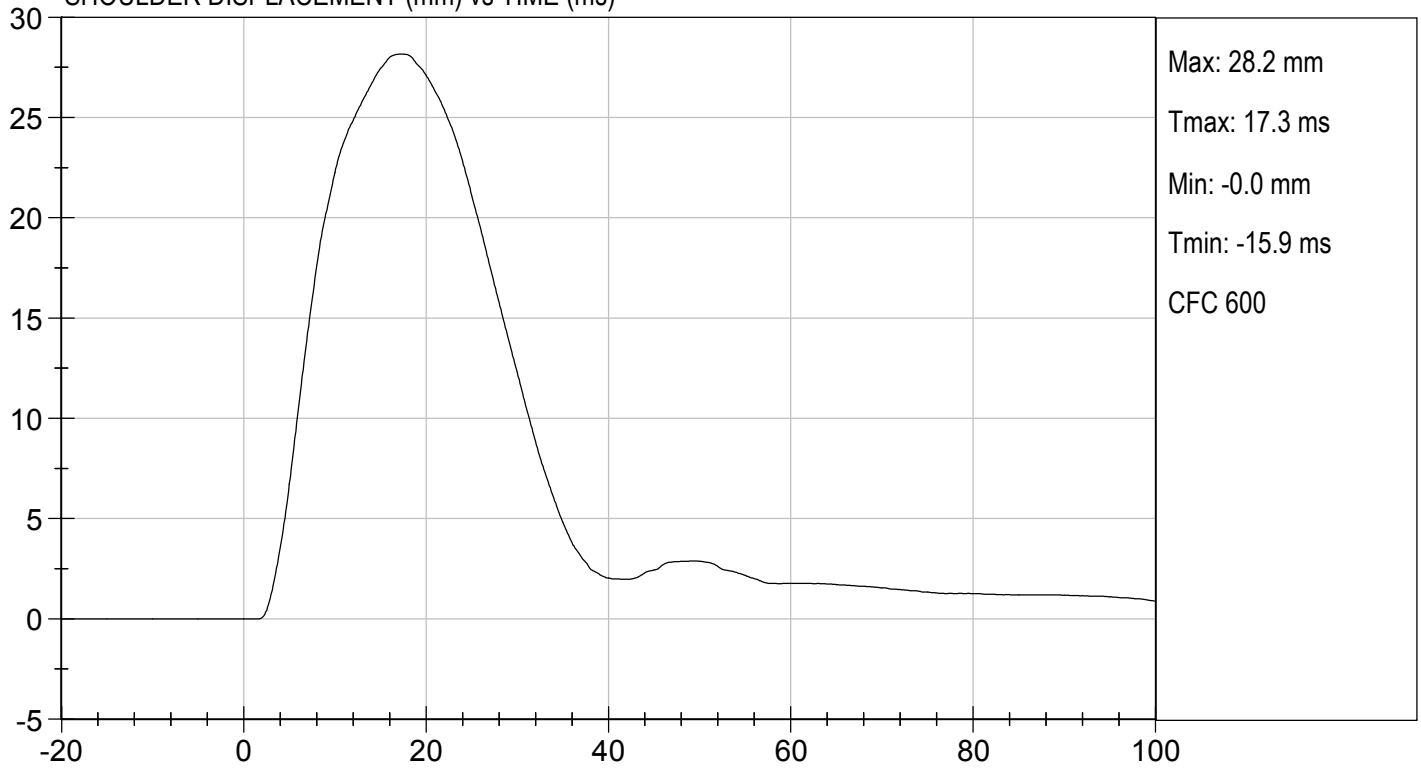
TEST DESC: SHOULDER IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 11/12/2019
TEST #: D193533

PROBE (G's) vs TIME (ms)

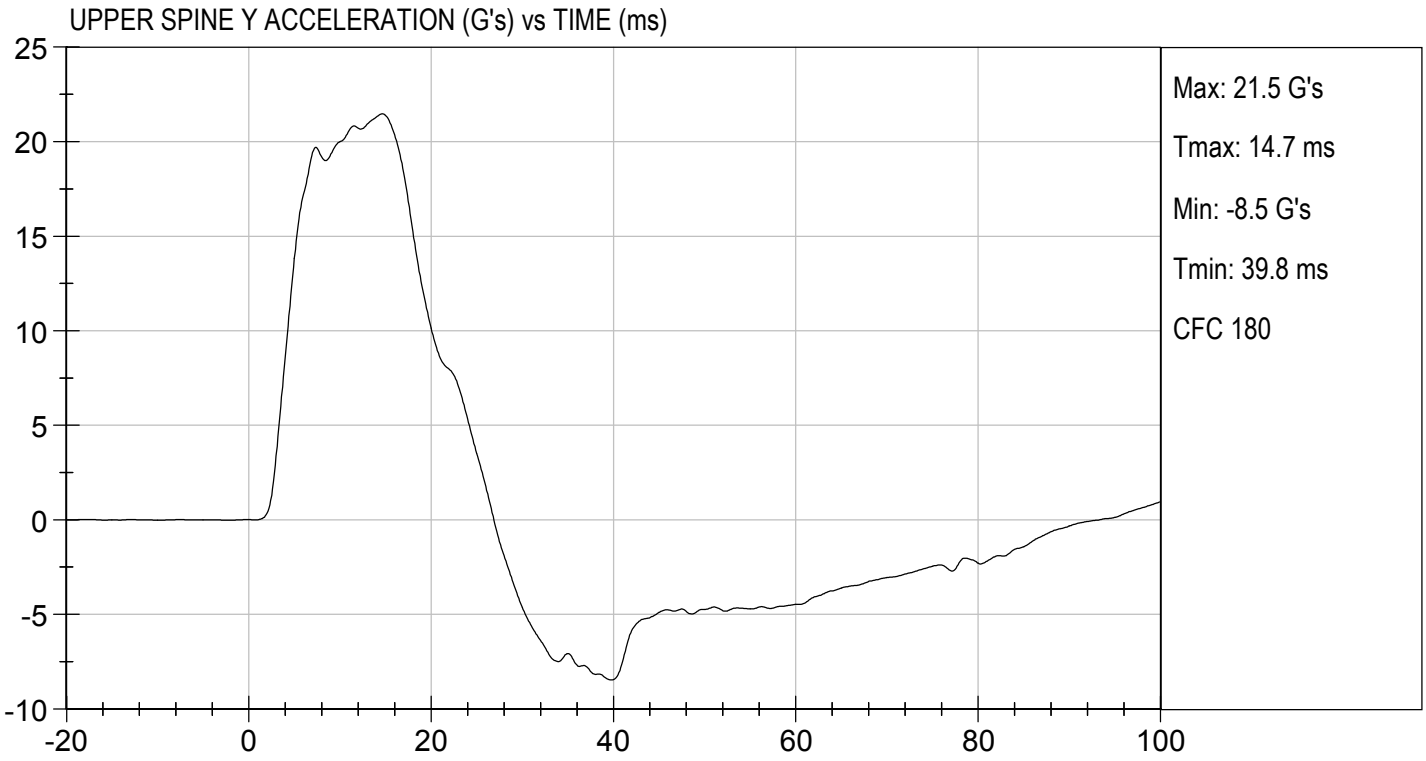


SHOULDER DISPLACEMENT (mm) vs TIME (ms)



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

TEST DATE: 11/12/2019
TEST #: D193533



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193534

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	6.68	Pass
Maximum Probe Acceleration	G's	30 to 36	33	Pass
Shoulder Displacement	mm	31 to 40	35	Pass
Upper Rib Displacement	mm	25 to 32	26	Pass
Middle Rib Displacement	mm	30 to 36	30	Pass
Lower Rib Displacement	mm	32 to 38	33	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	40	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	36	Pass
		Overall Test Results		Pass

Laboratory Technician

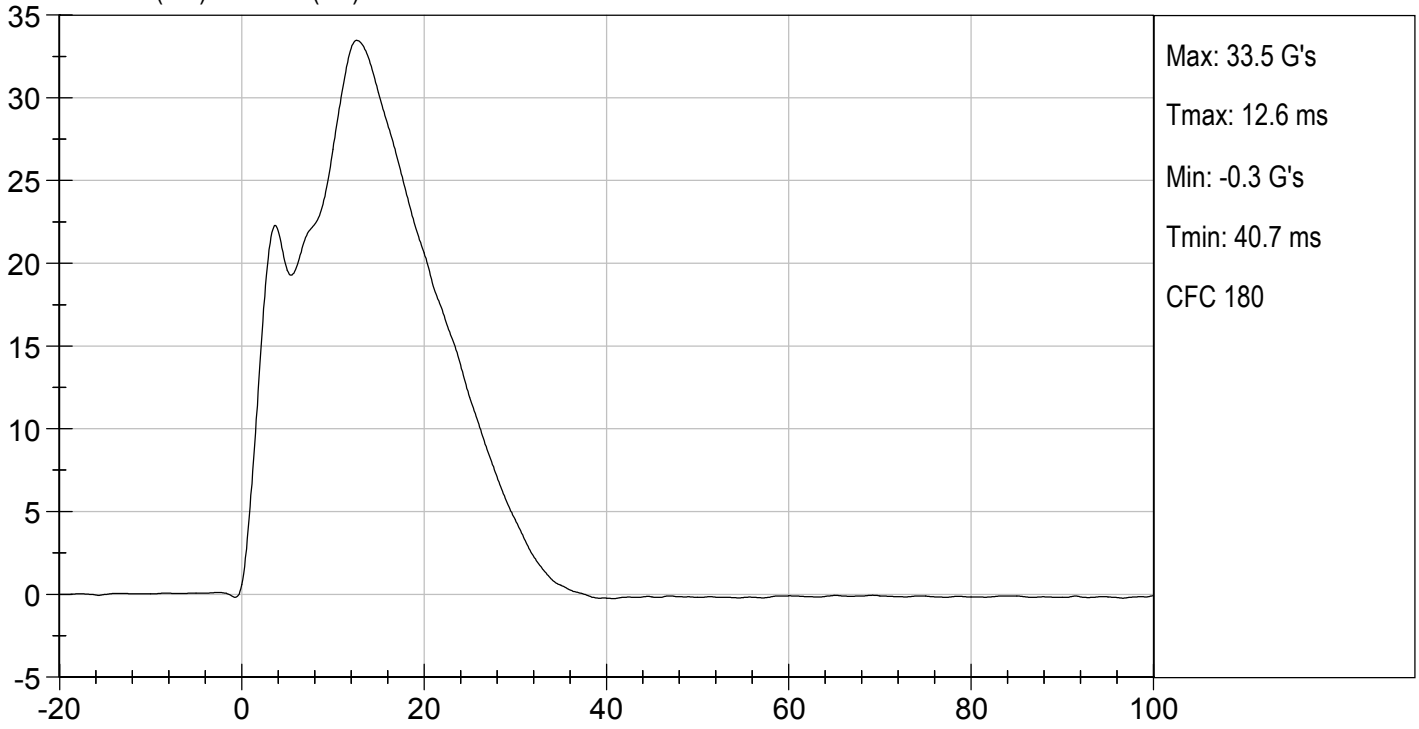
11/12/2019
Test Date

Approved By

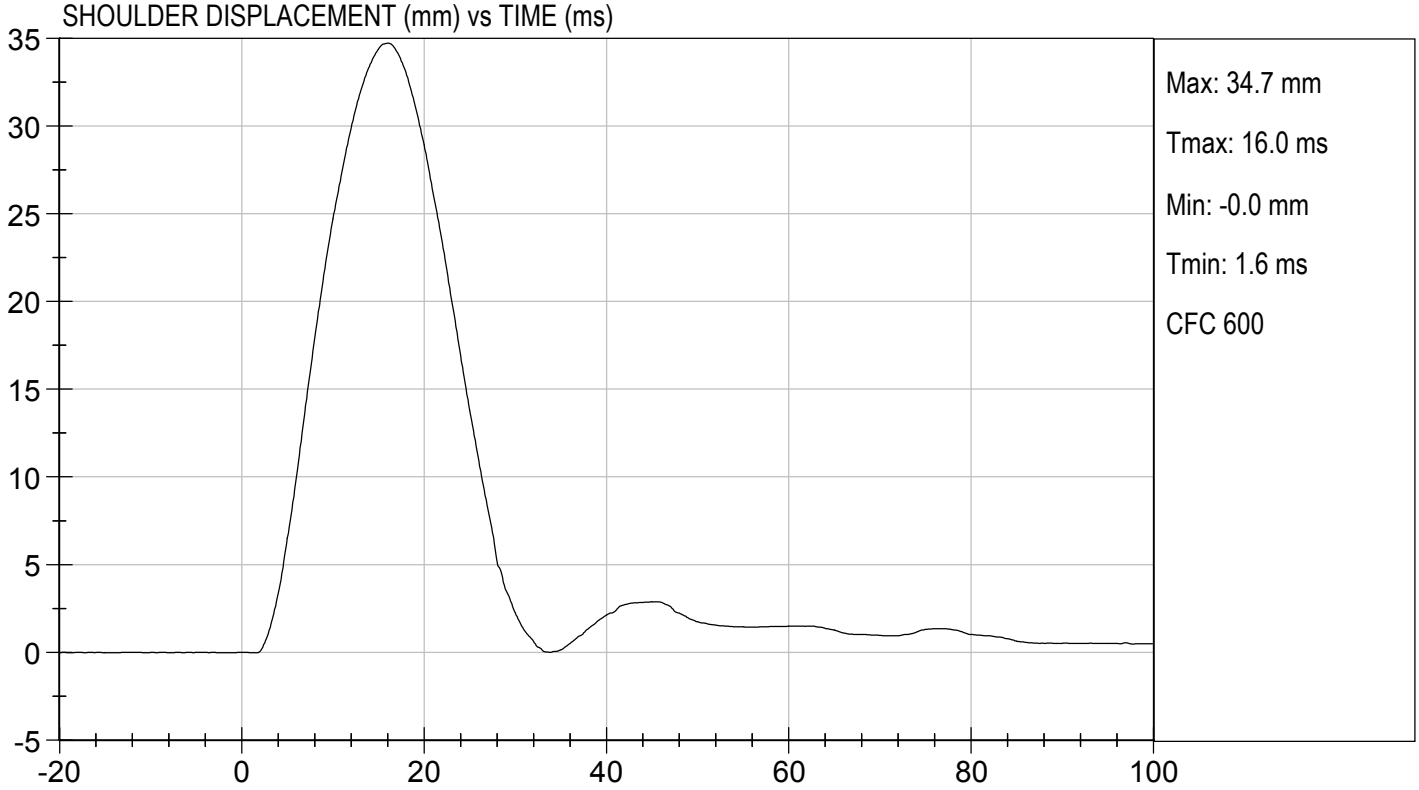
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 11/12/2019
TEST #: D193534

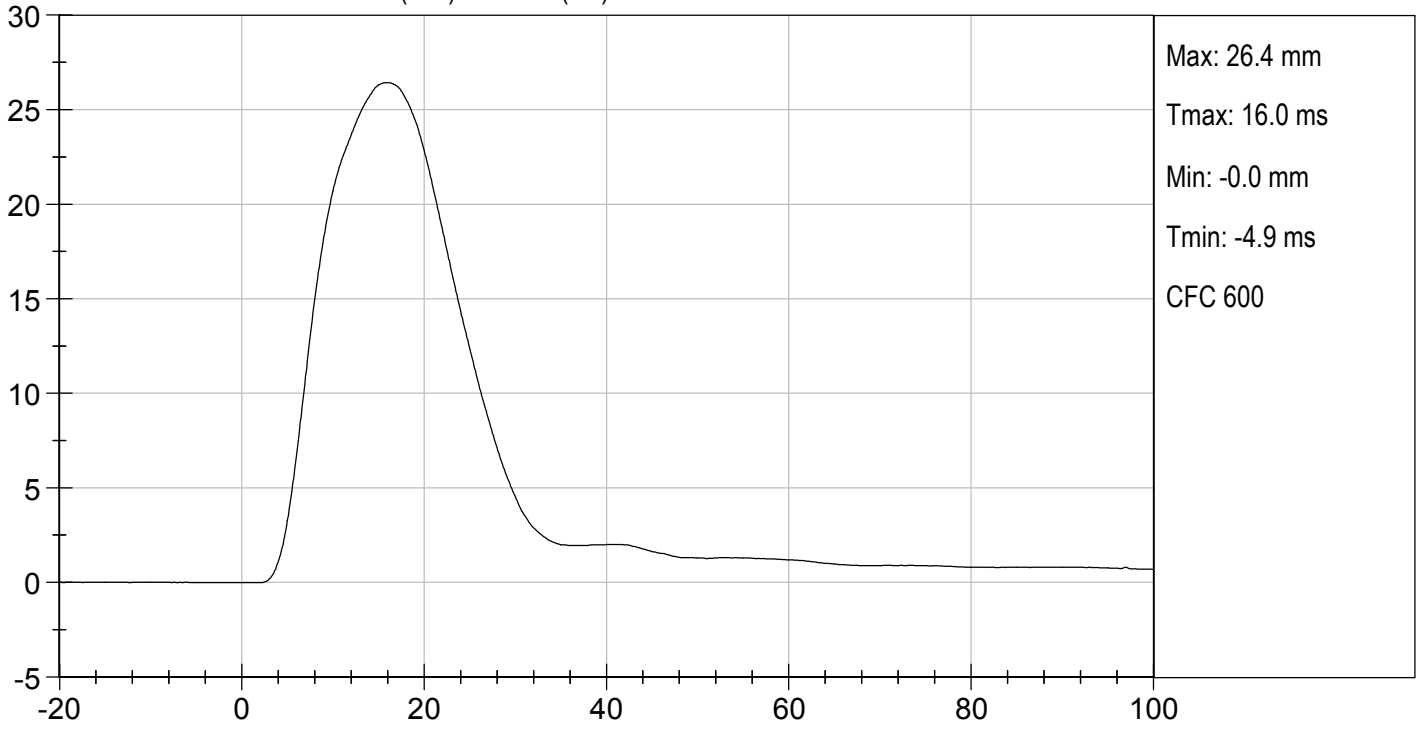
PROBE (G's) vs TIME (ms)



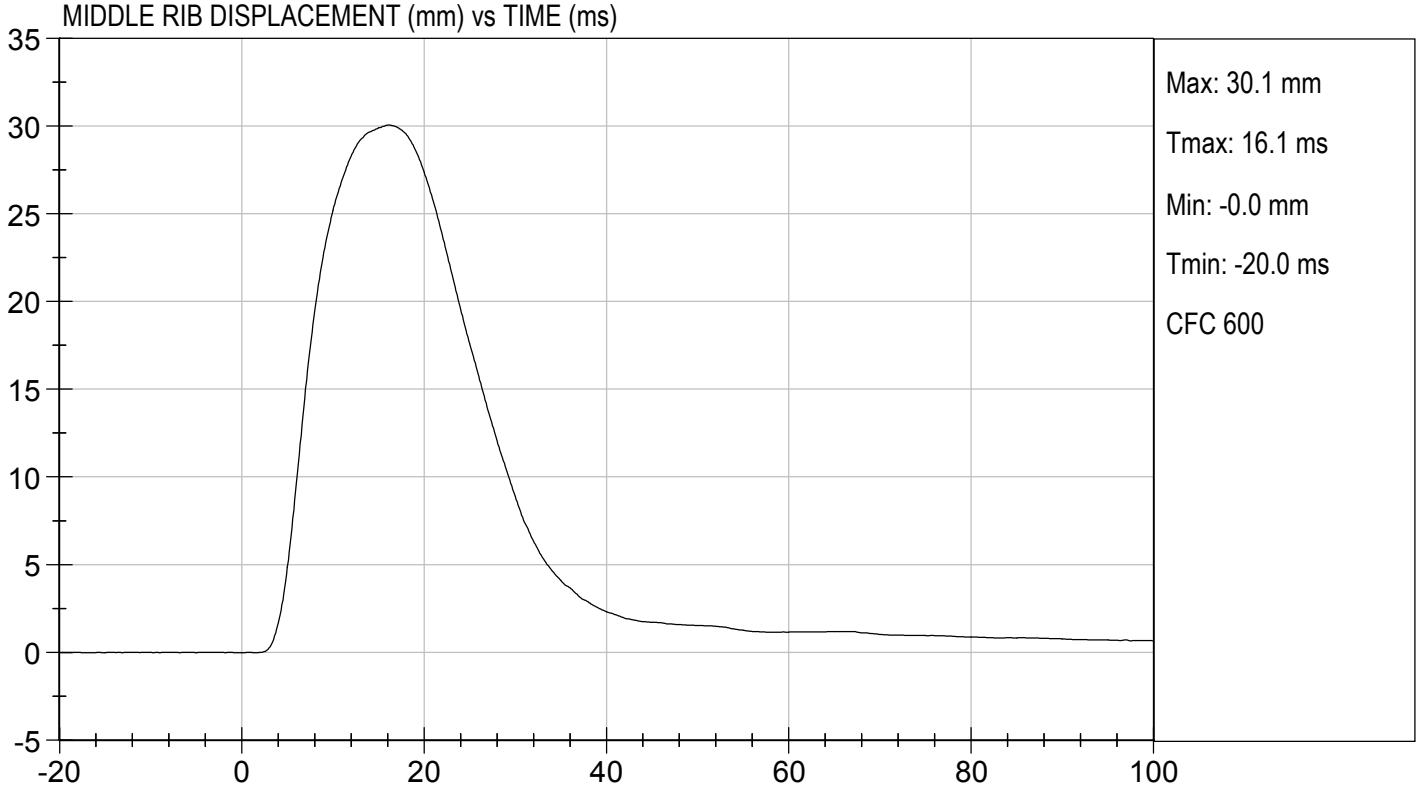
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



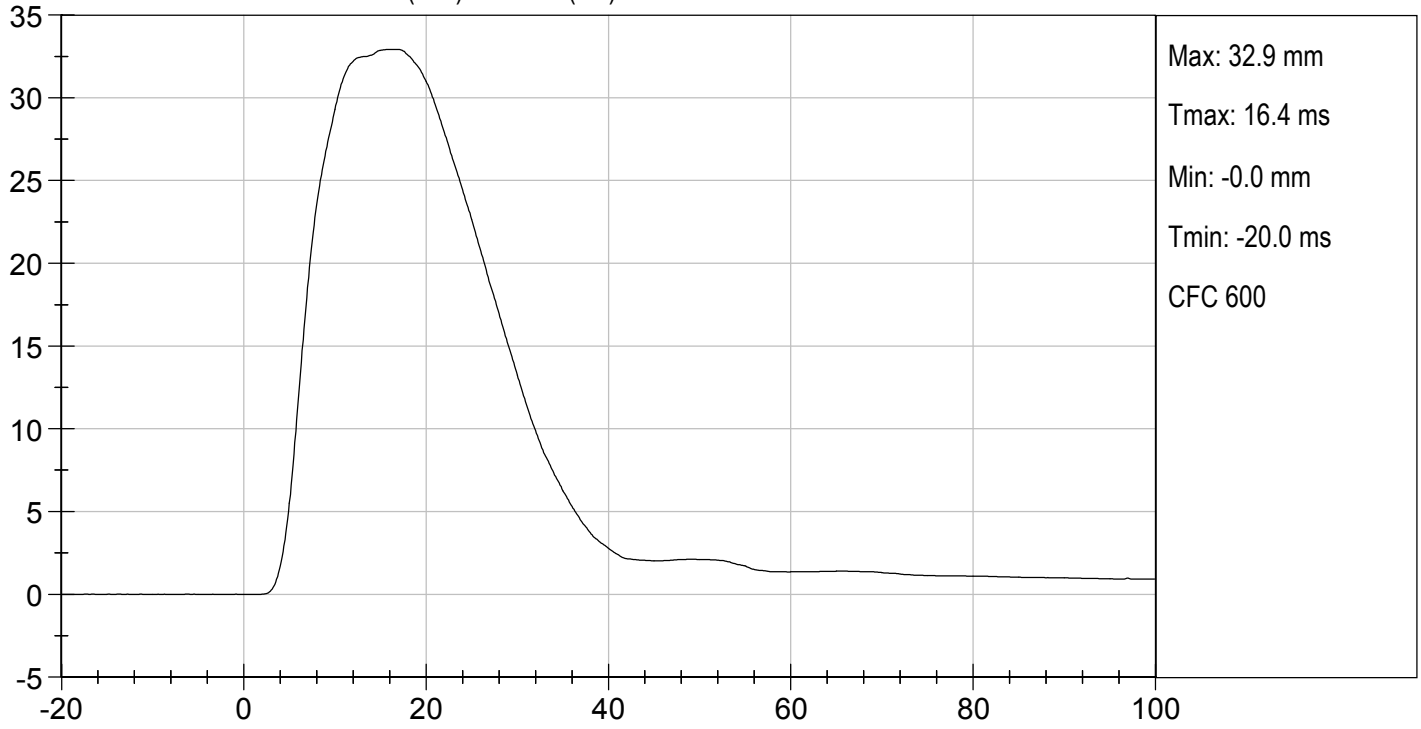
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



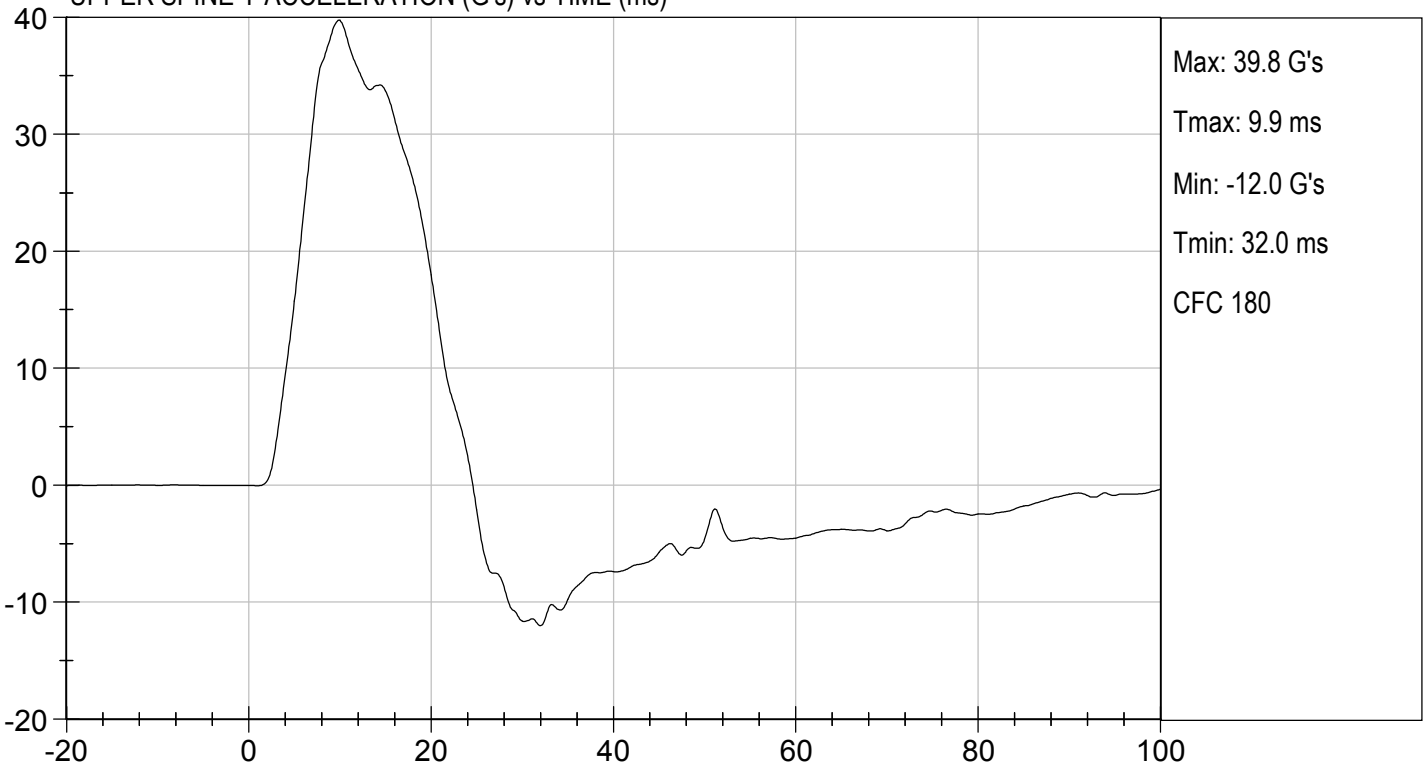
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 11/12/2019
TEST #: D193534

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

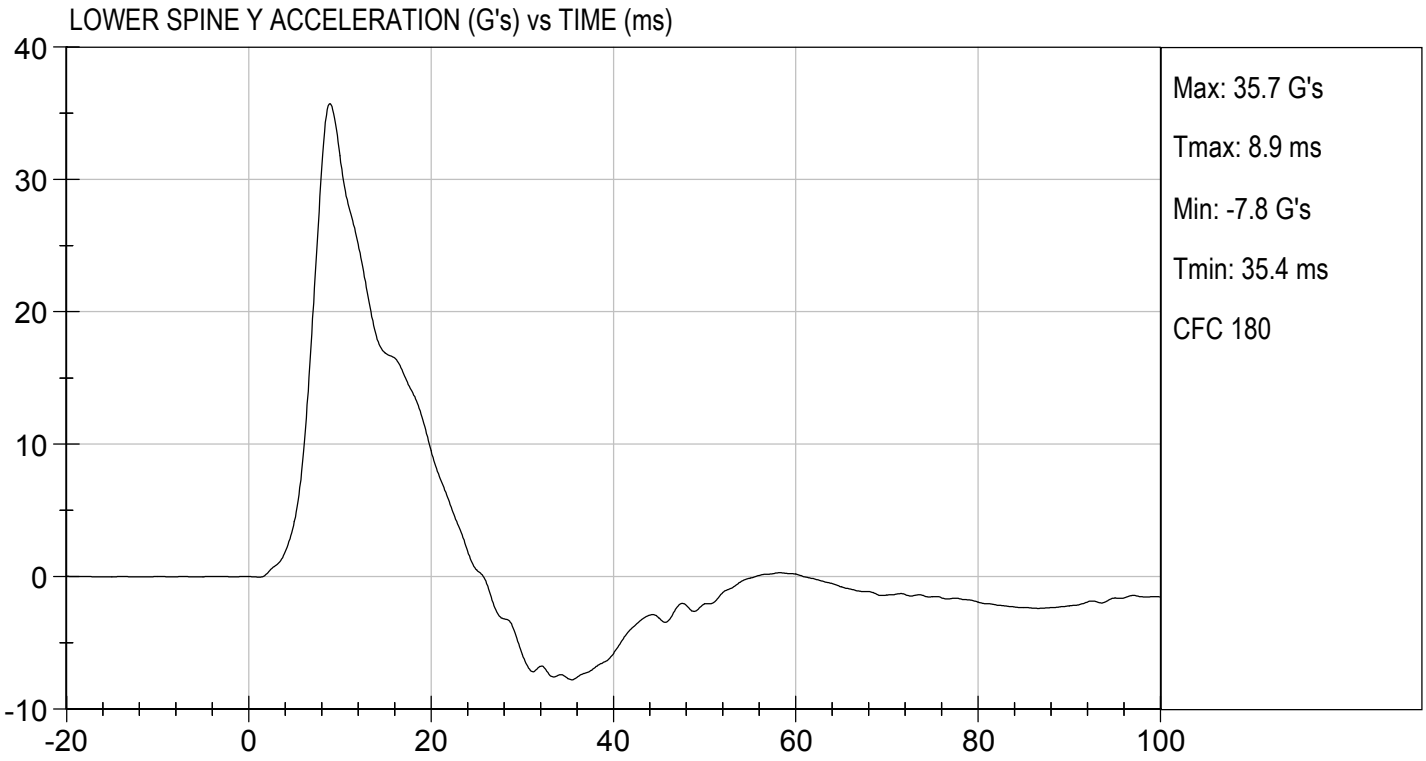


UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 11/12/2019
TEST #: D193534



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193535

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	4.27	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	37	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	9	Pass
		Overall Test Results		Pass

Laboratory Technician

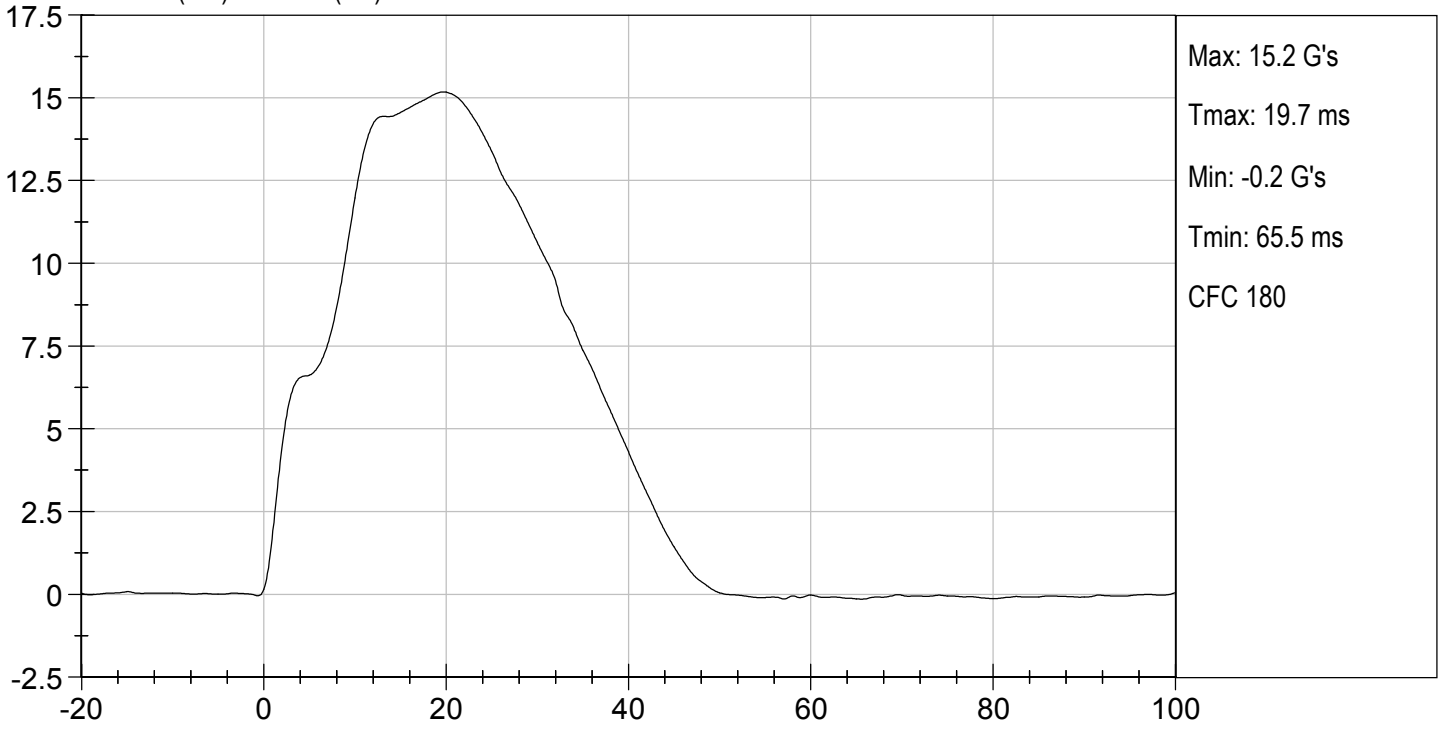
11/12/2019
Test Date

Approved By

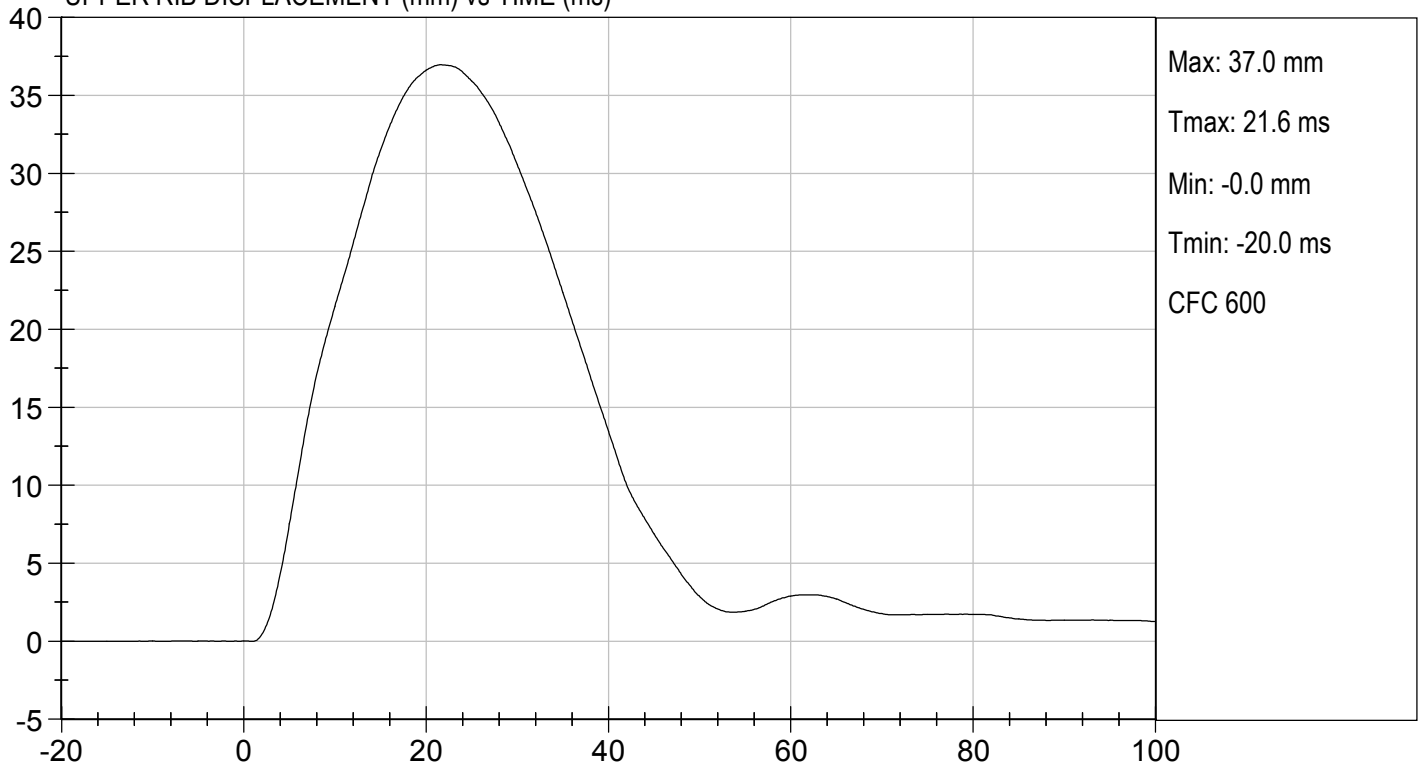
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 11/12/2019
TEST #: D193535

PROBE (G's) vs TIME (ms)



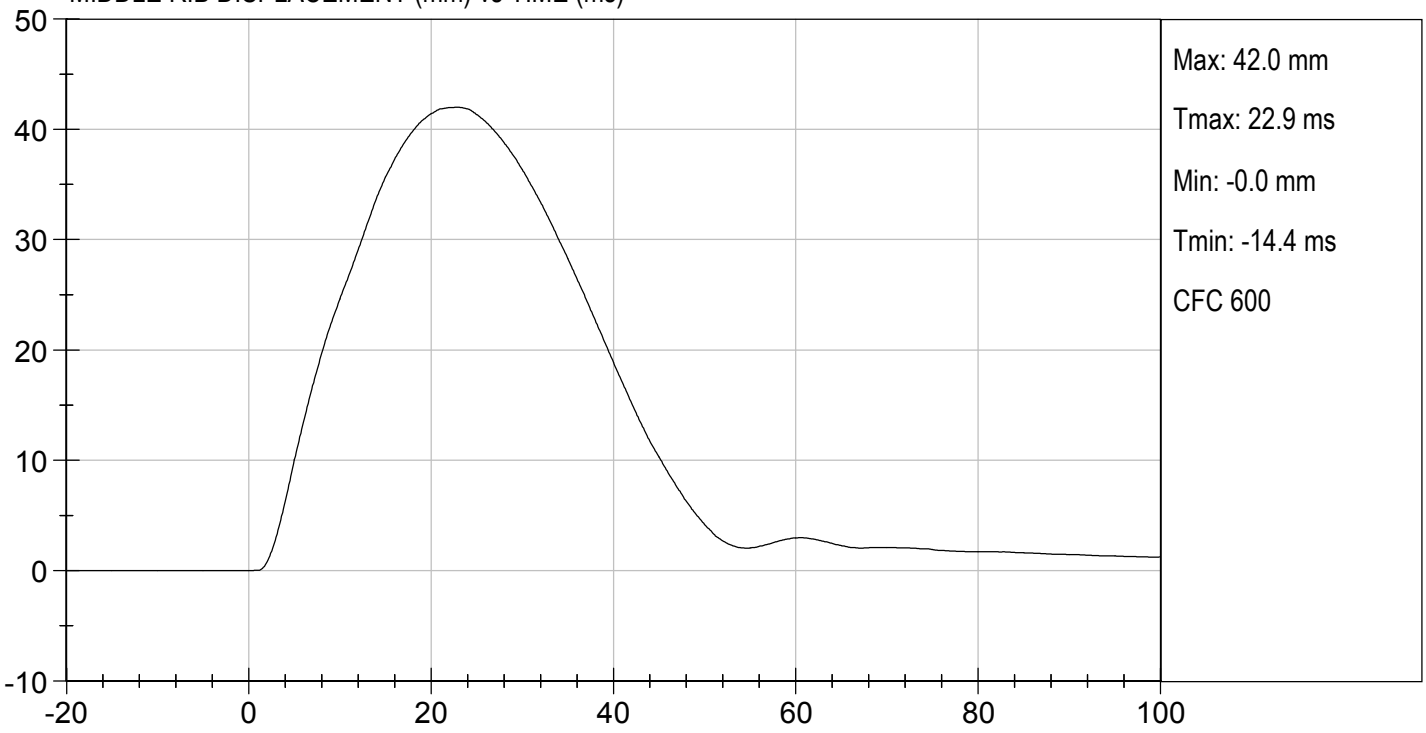
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



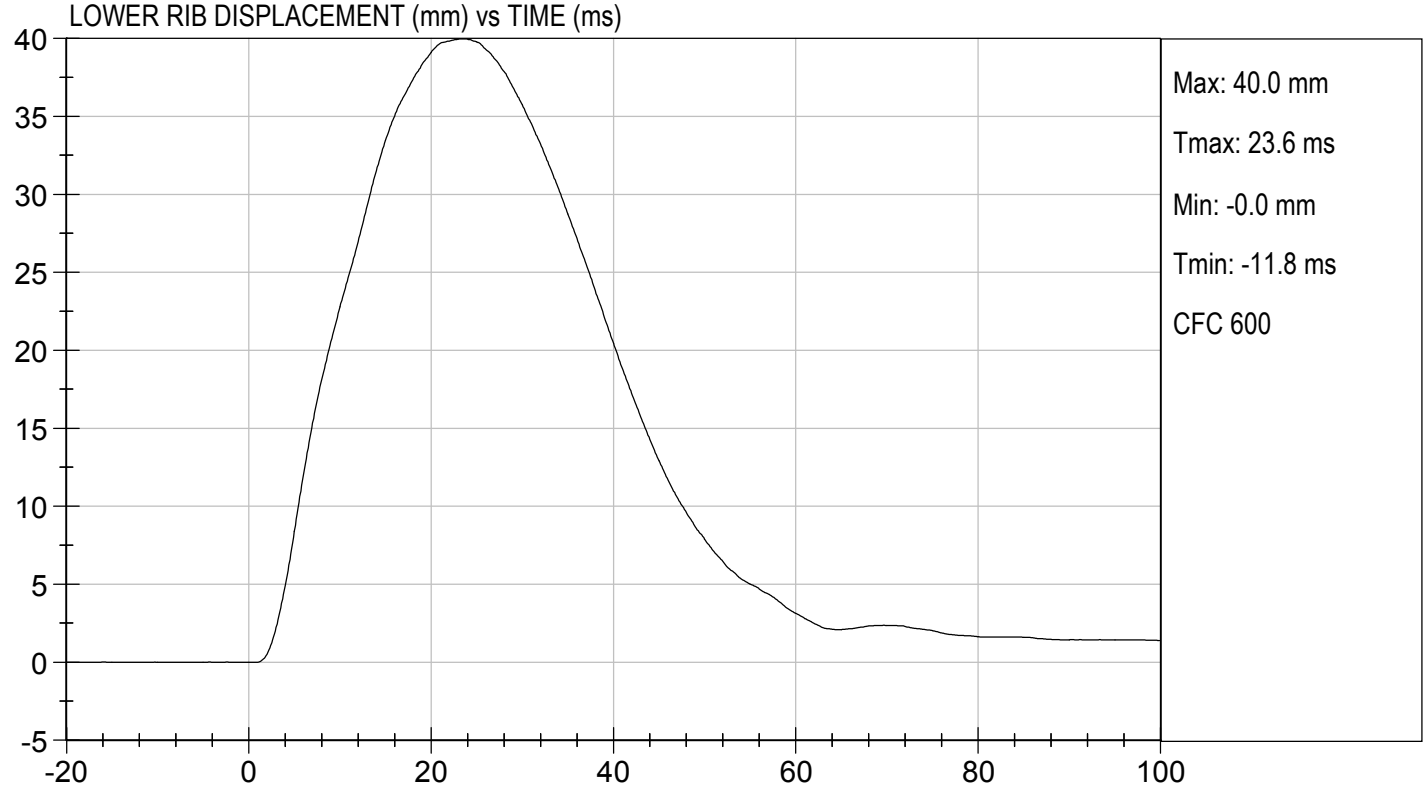
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 11/12/2019
TEST #: D193535

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



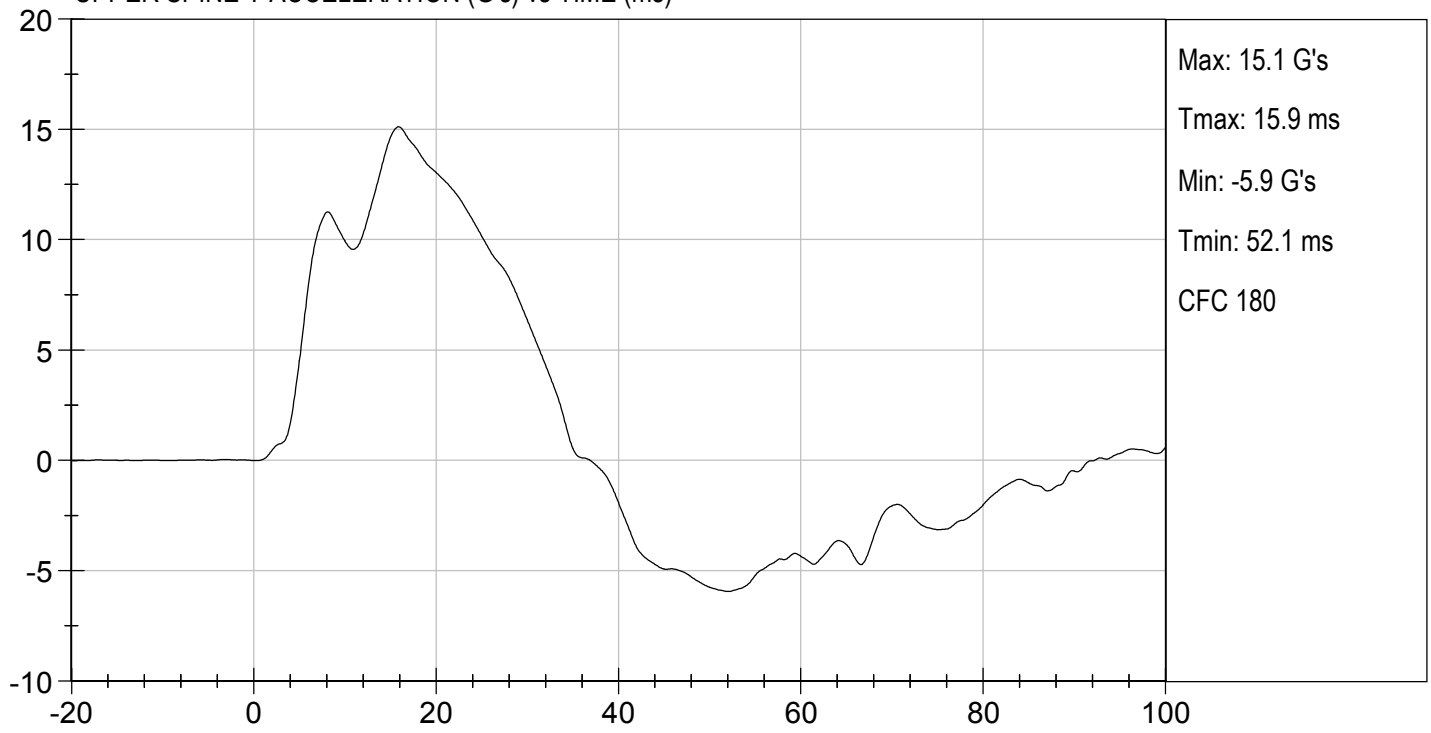
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



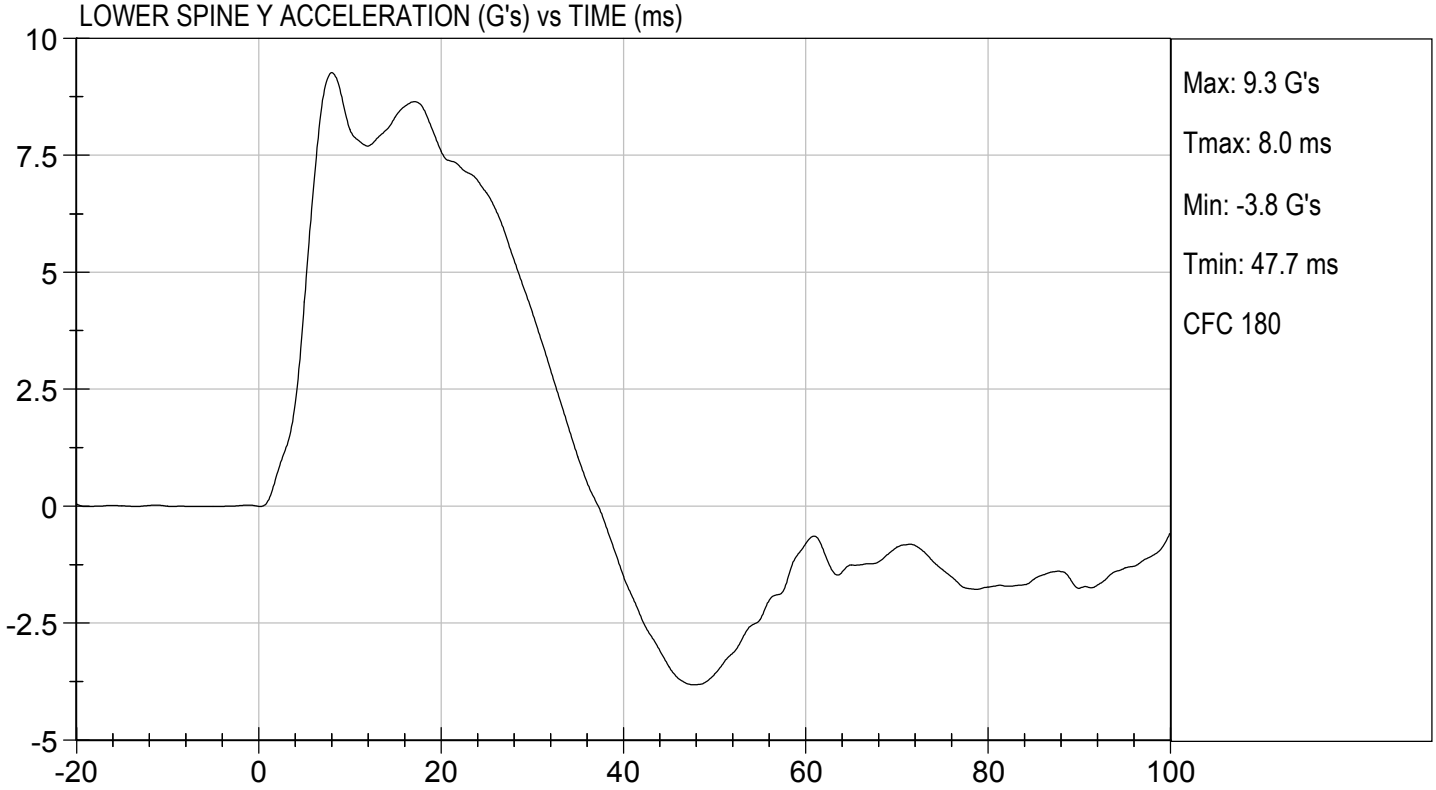
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 11/12/2019
TEST #: D193535

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



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



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193536

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	15	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

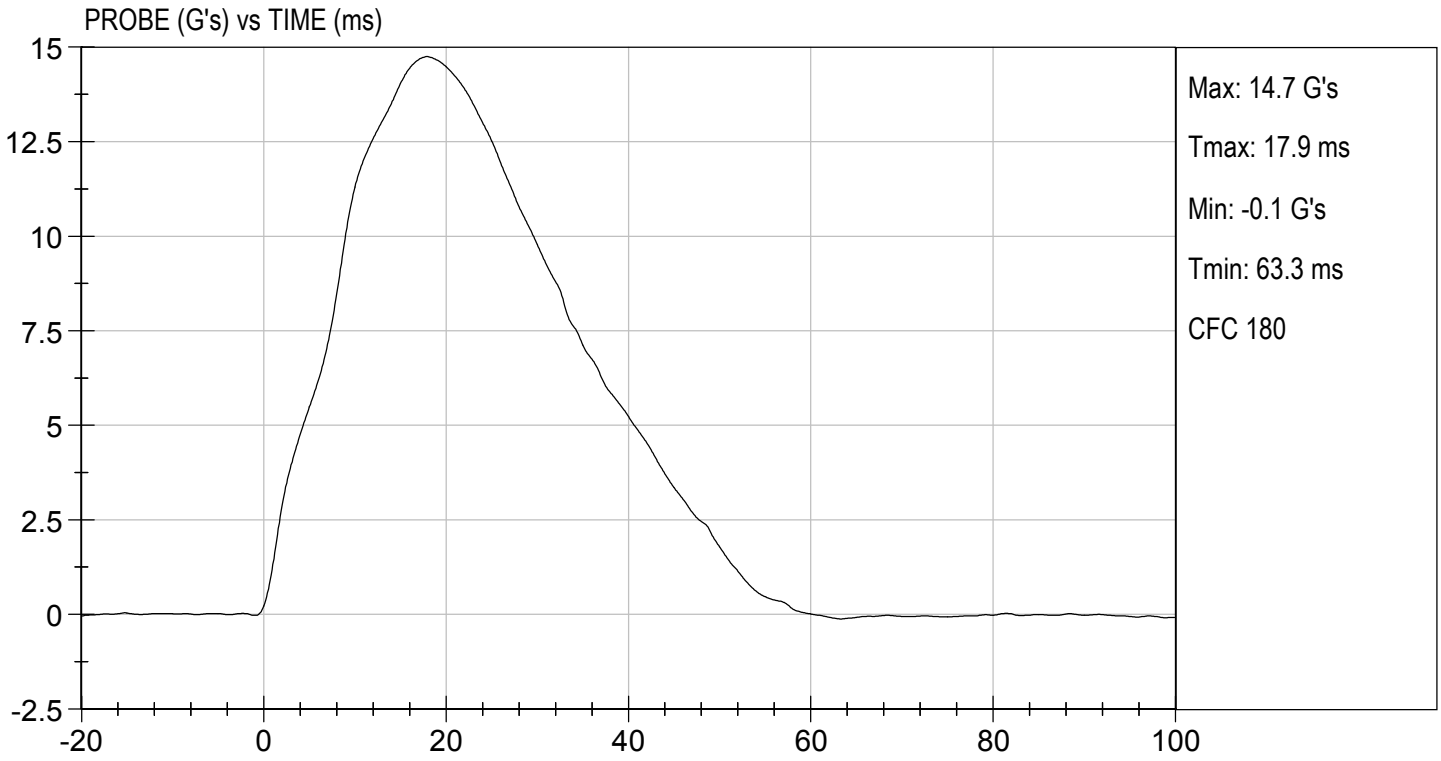
Alex Thomas
Laboratory Technician

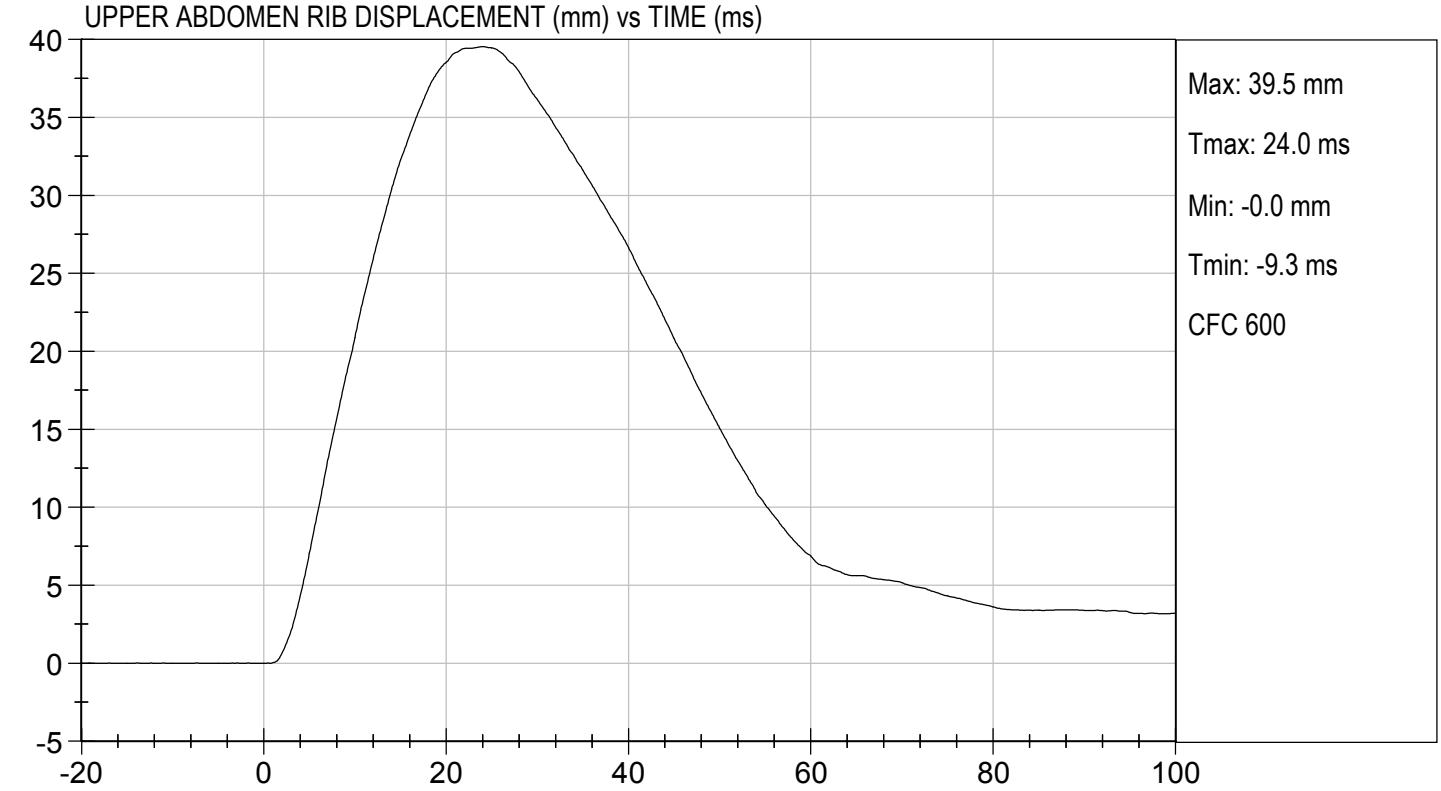
11/12/2019
Test Date

Approved By

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

TEST DATE: 11/12/2019
TEST #: D193536

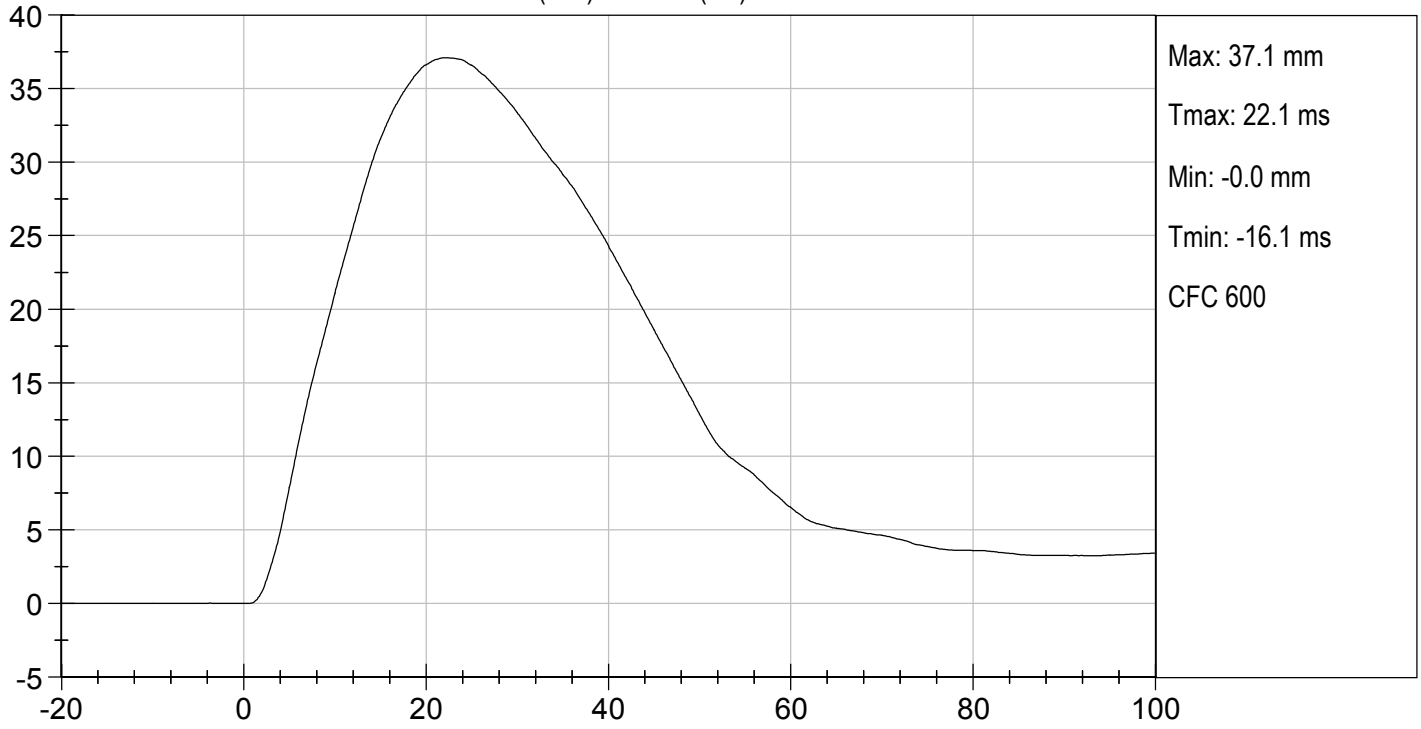




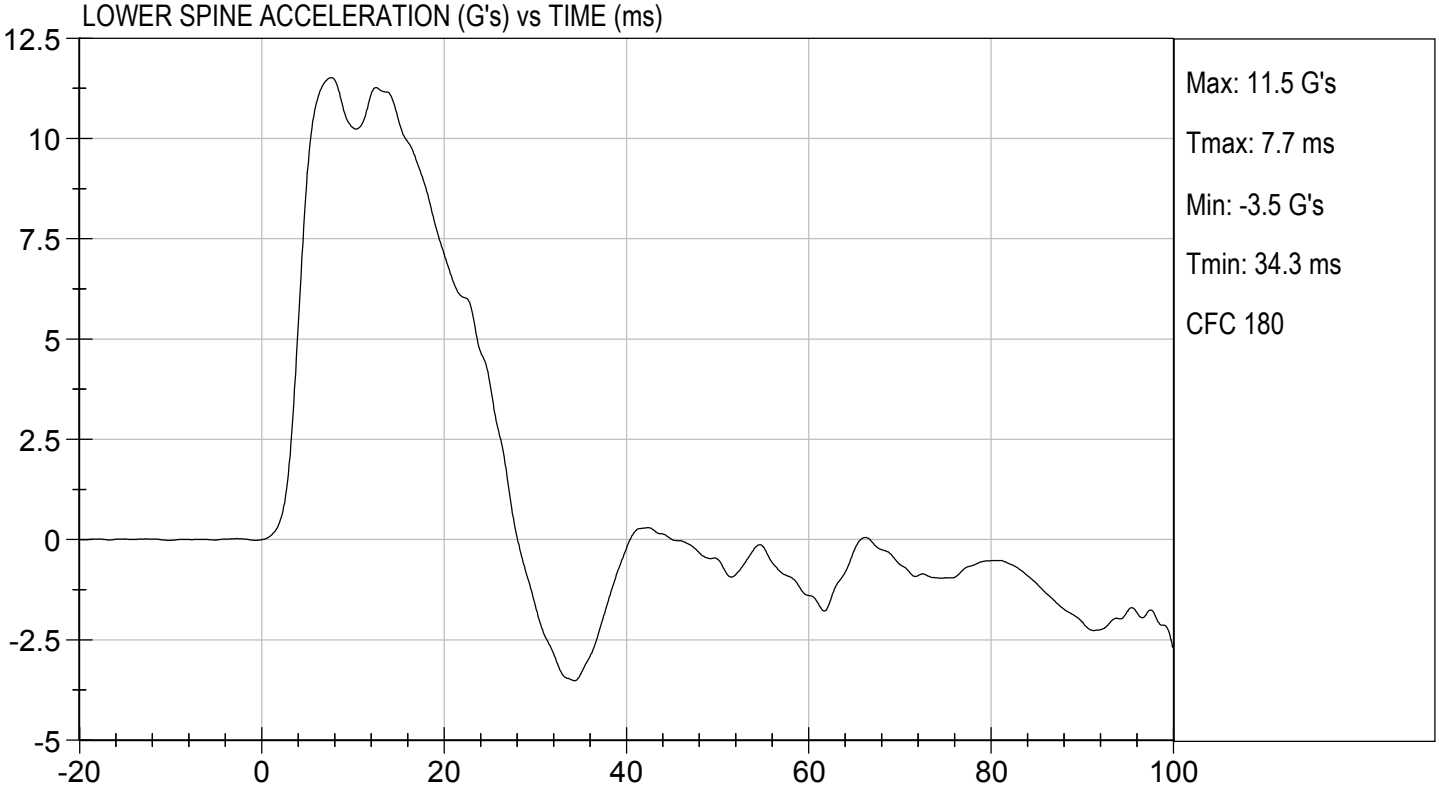
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 11/12/2019
TEST #: D193536

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



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



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193537

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	47	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	40	Pass
Peak Acetabulum Force	N	3600 to 4300	4,245	Pass
		Overall Test Results		Pass

Alex Thomas

Laboratory Technician

11/12/2019

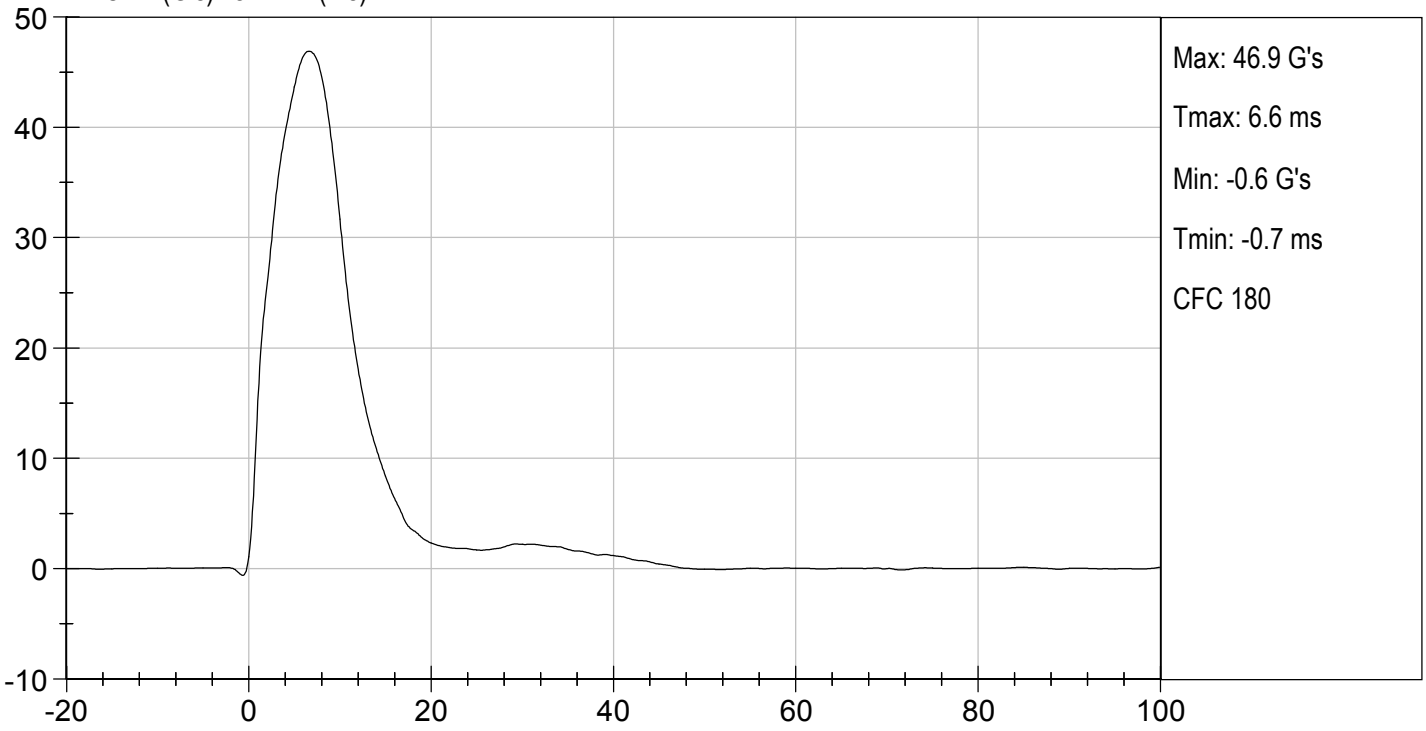
Test Date

Approved By

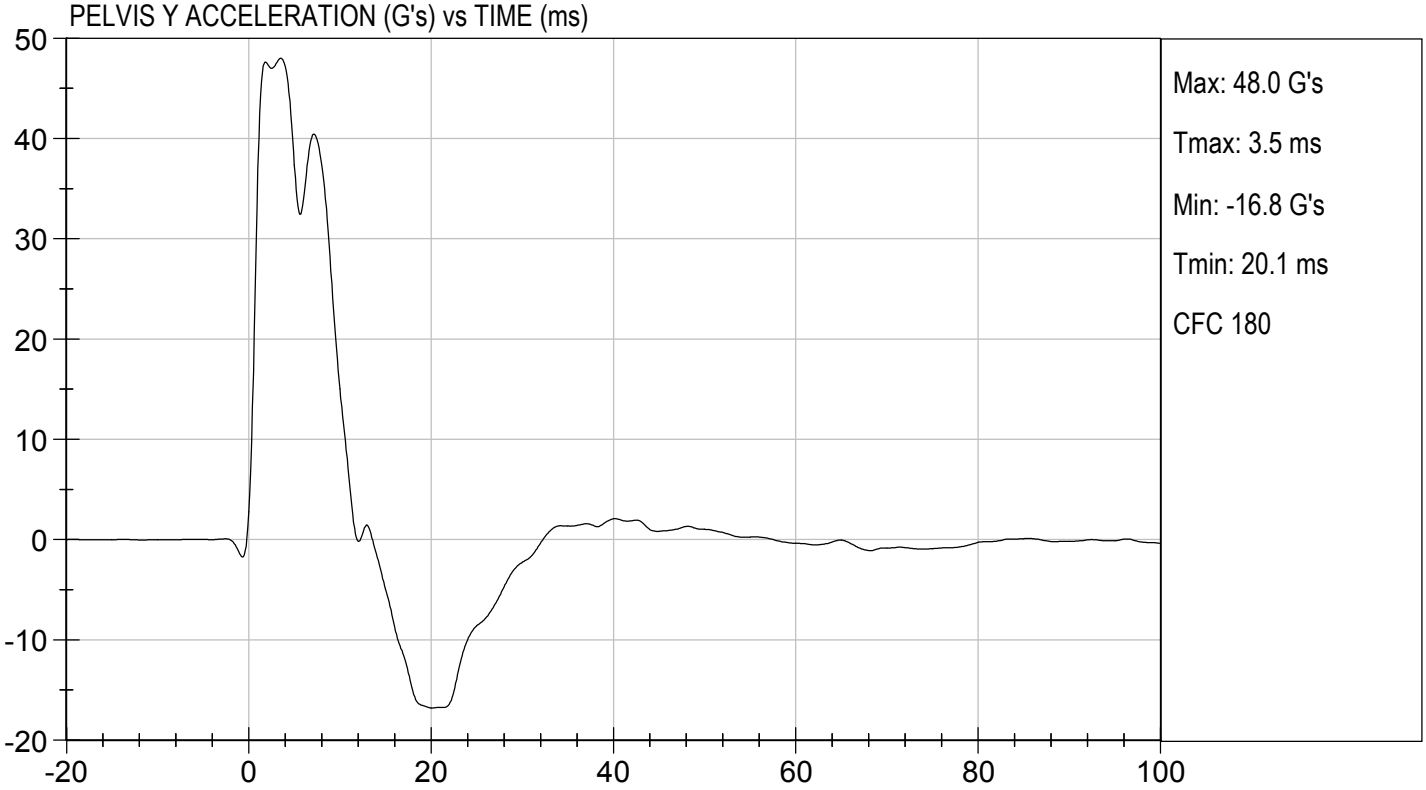
TEST DESC: PELVIS IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 11/12/2019
TEST #: D193537

PROBE (G's) vs TIME (ms)

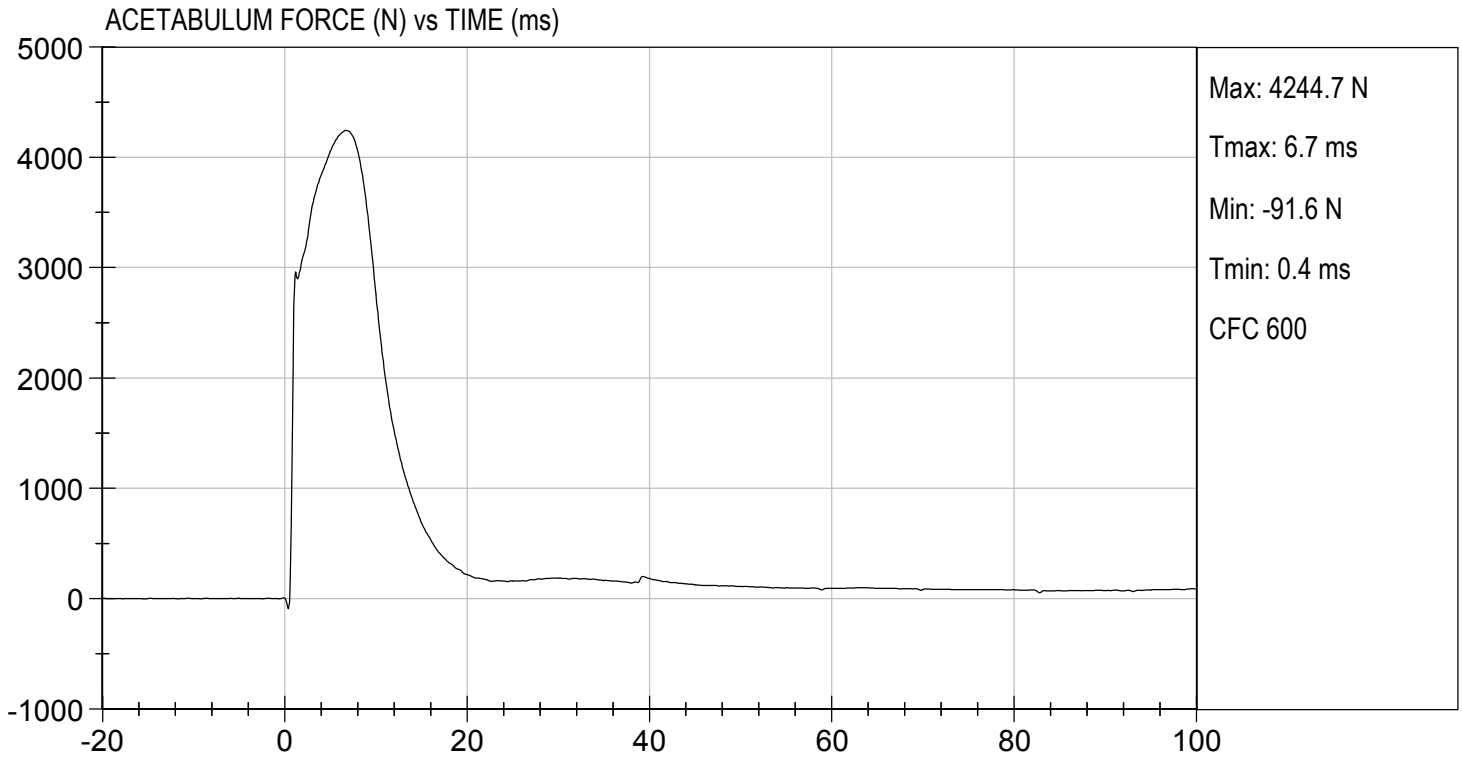


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 11/12/2019
TEST #: D193537



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193538

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	4.34	Pass
Maximum Probe Acceleration	G's	36 to 45	36	Pass
Pelvis Y Acceleration	G's	28 to 39	29	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,109	Pass
		Overall Test Results		Pass

Laboratory Technician

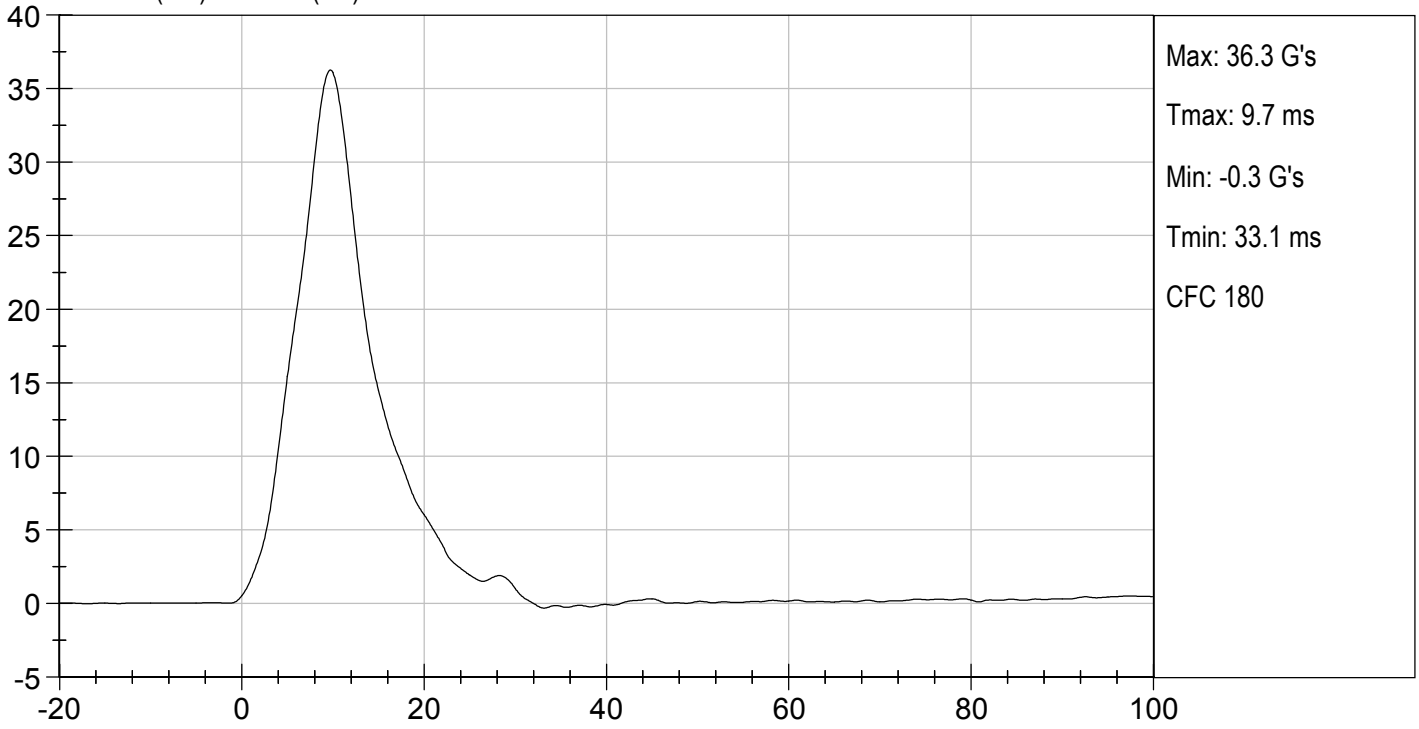
11/12/2019
Test Date

Approved By

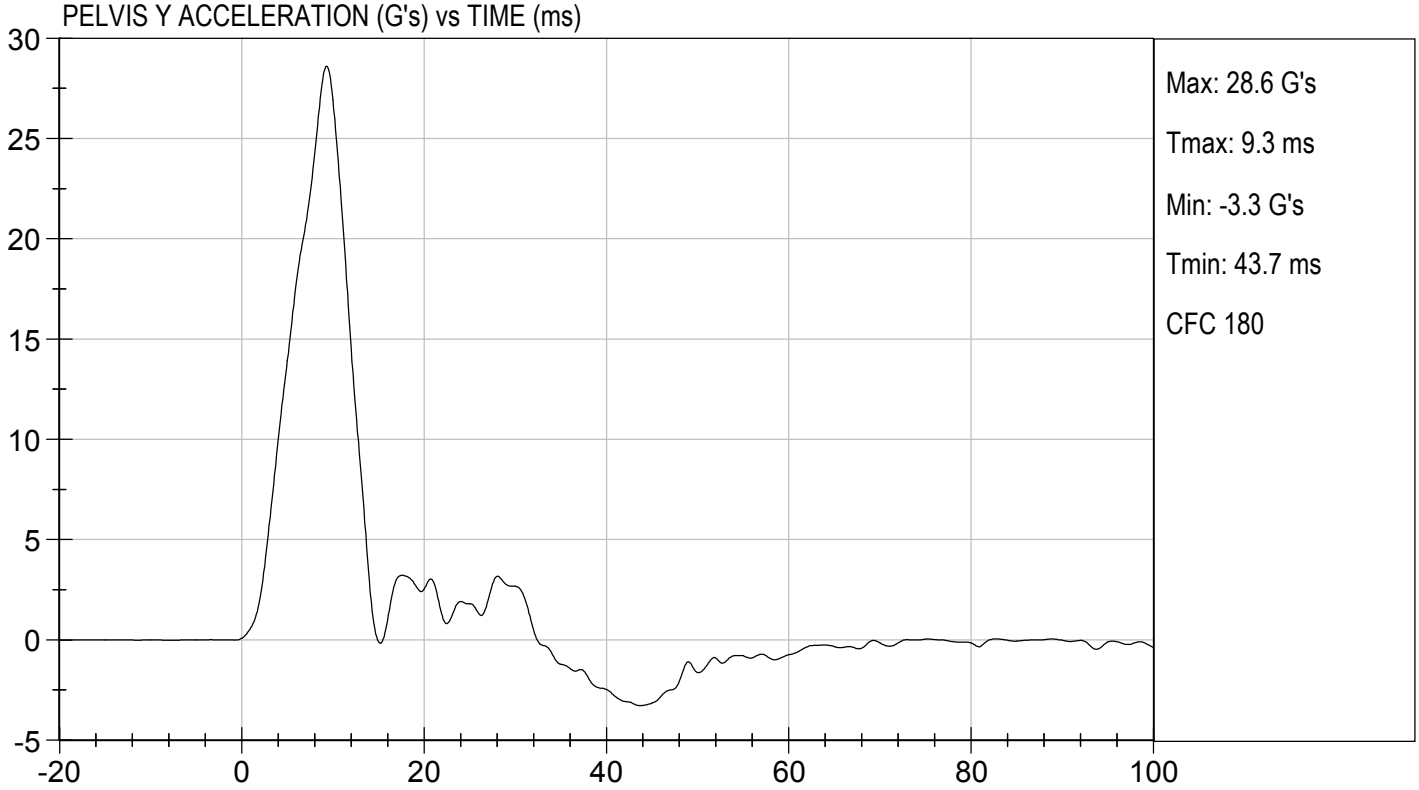
TEST DESC: ILLIAC
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 11/12/2019
TEST #: D193538

PROBE (G's) vs TIME (ms)

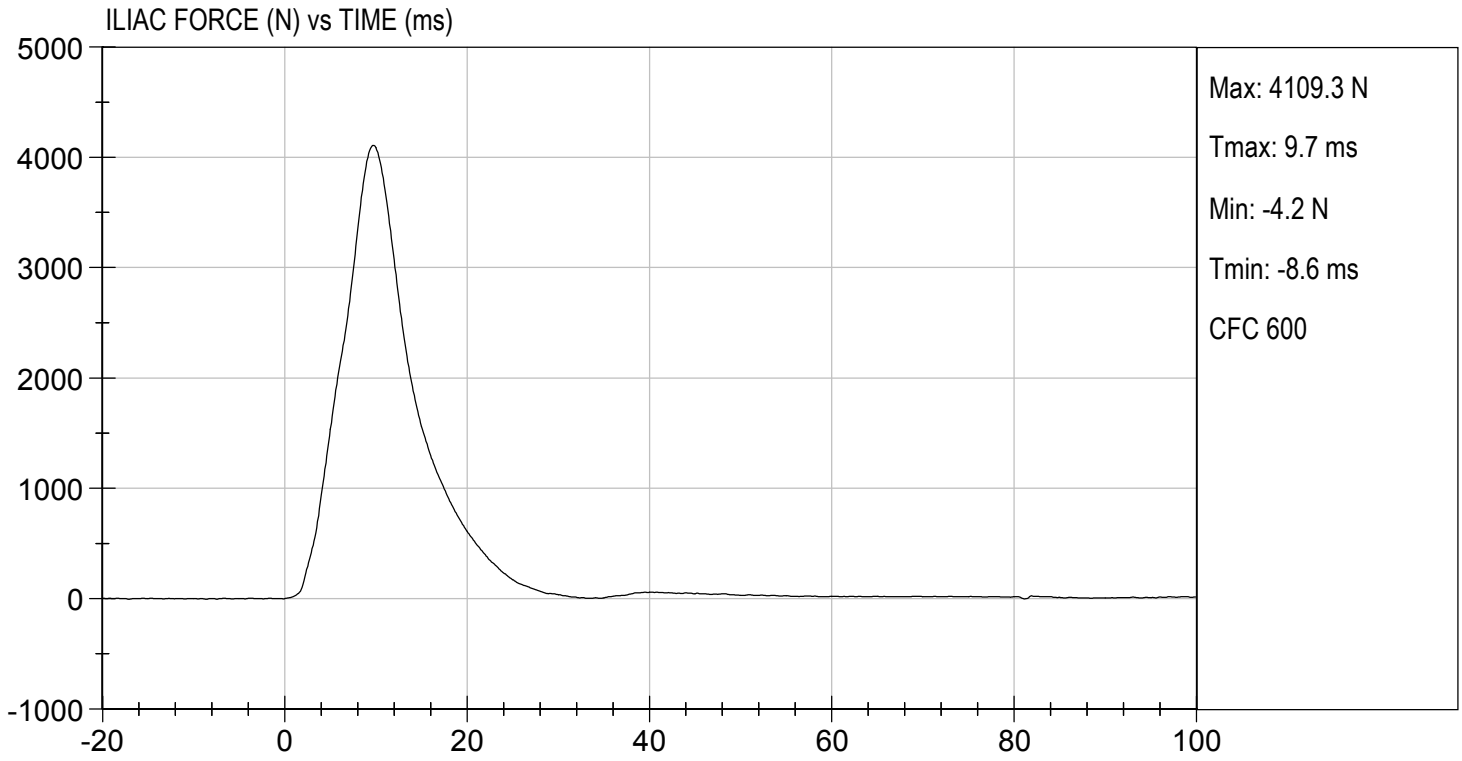


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: ILLIAC
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 11/12/2019
TEST #: D193538



CALIBRATION TEST RESULTS

POST-TEST

SID-IIS 5TH PERCENTILE FEMALE - DRIVER ATD

SID-IIsD External Measurements
SN: 296

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

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D193691

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	128	Pass
Peak Longitudinal Acceleration	G's	+/- 15	5.6	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

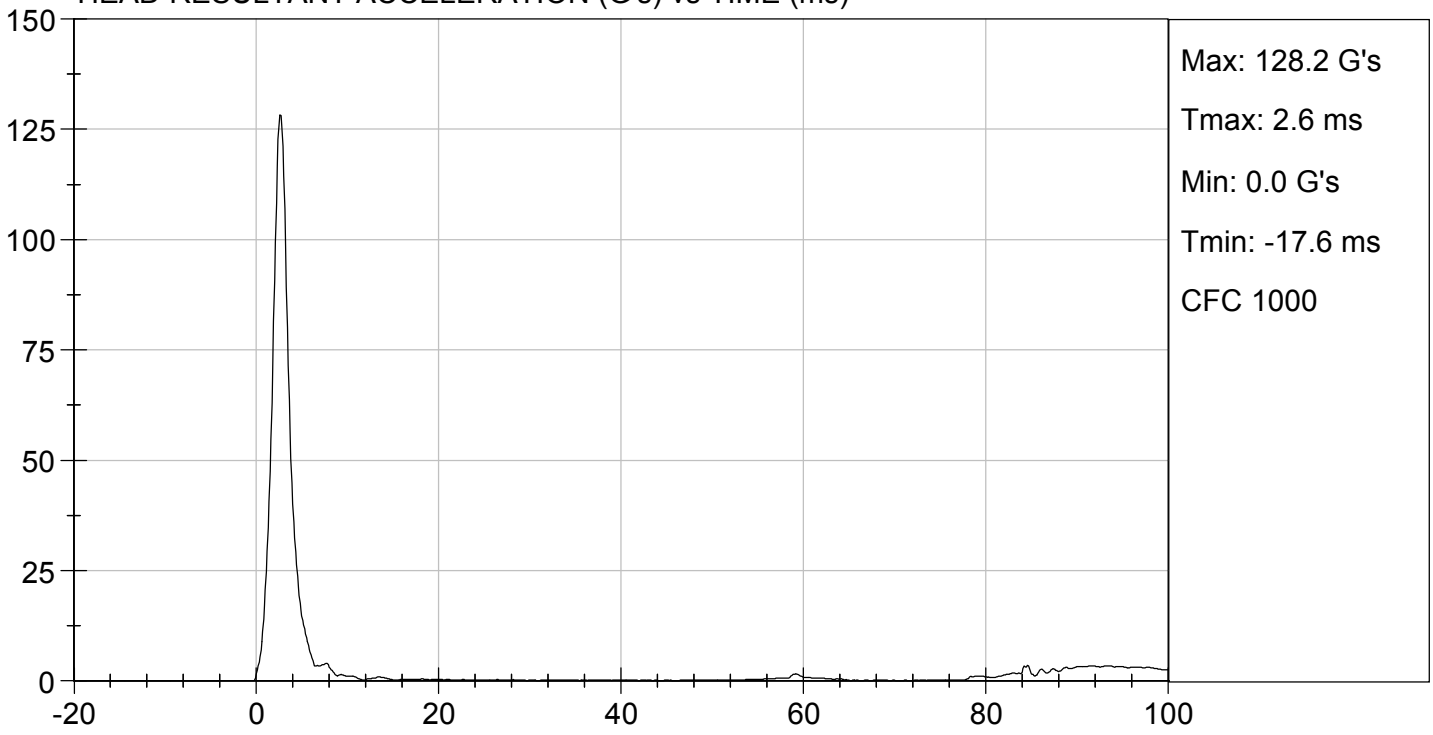
Test Date

Approved By

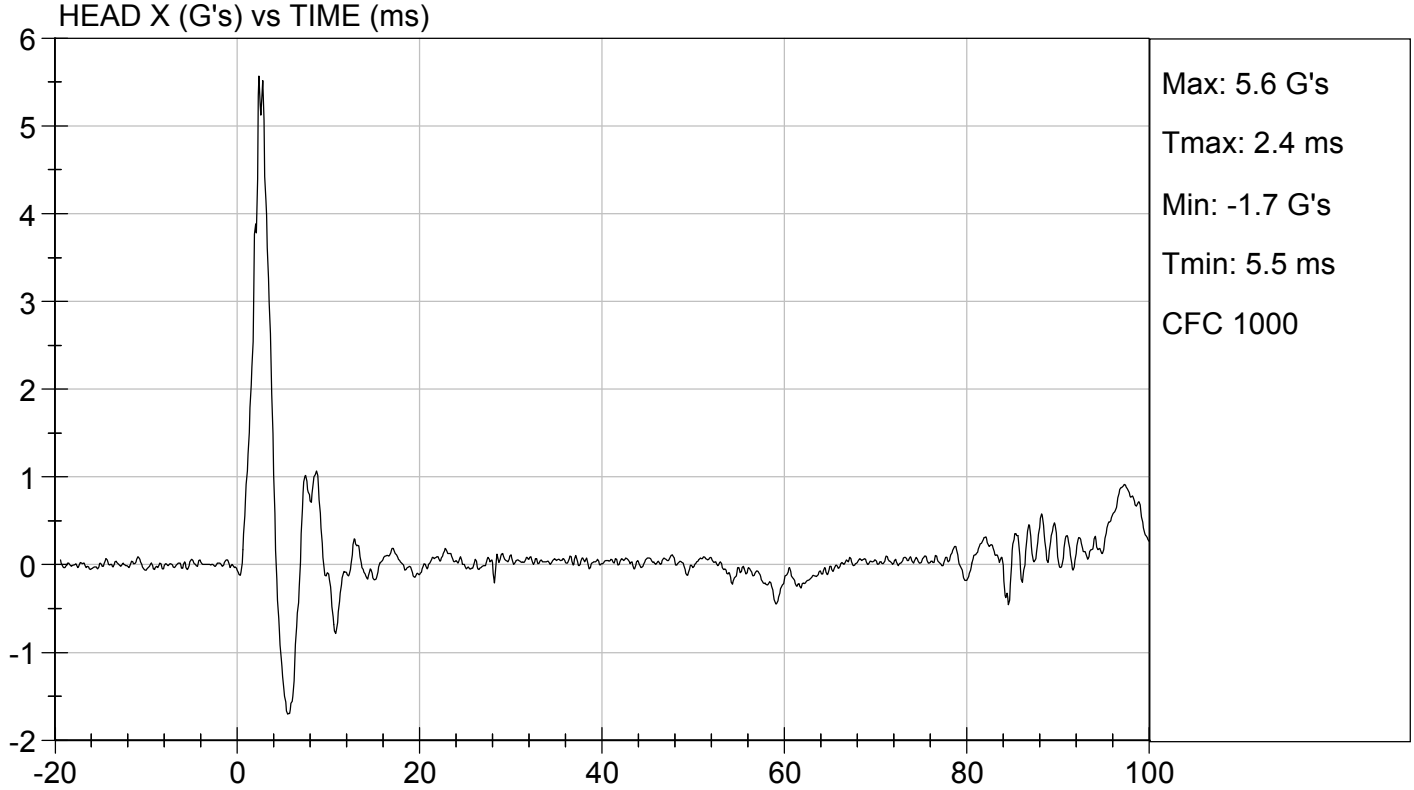
TEST DESC: HEAD DROP

TEST DATE: 11/25/2019
TEST #: D193691

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

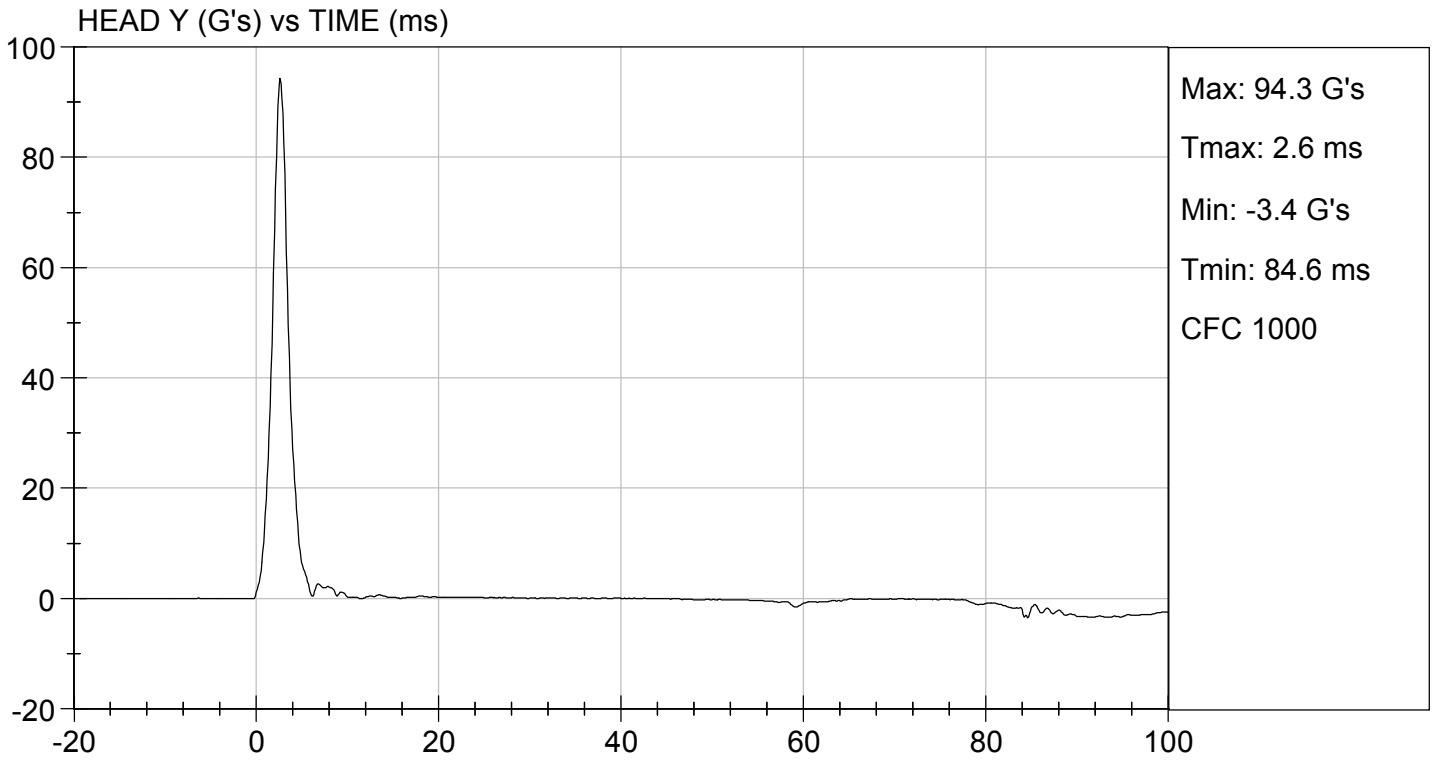


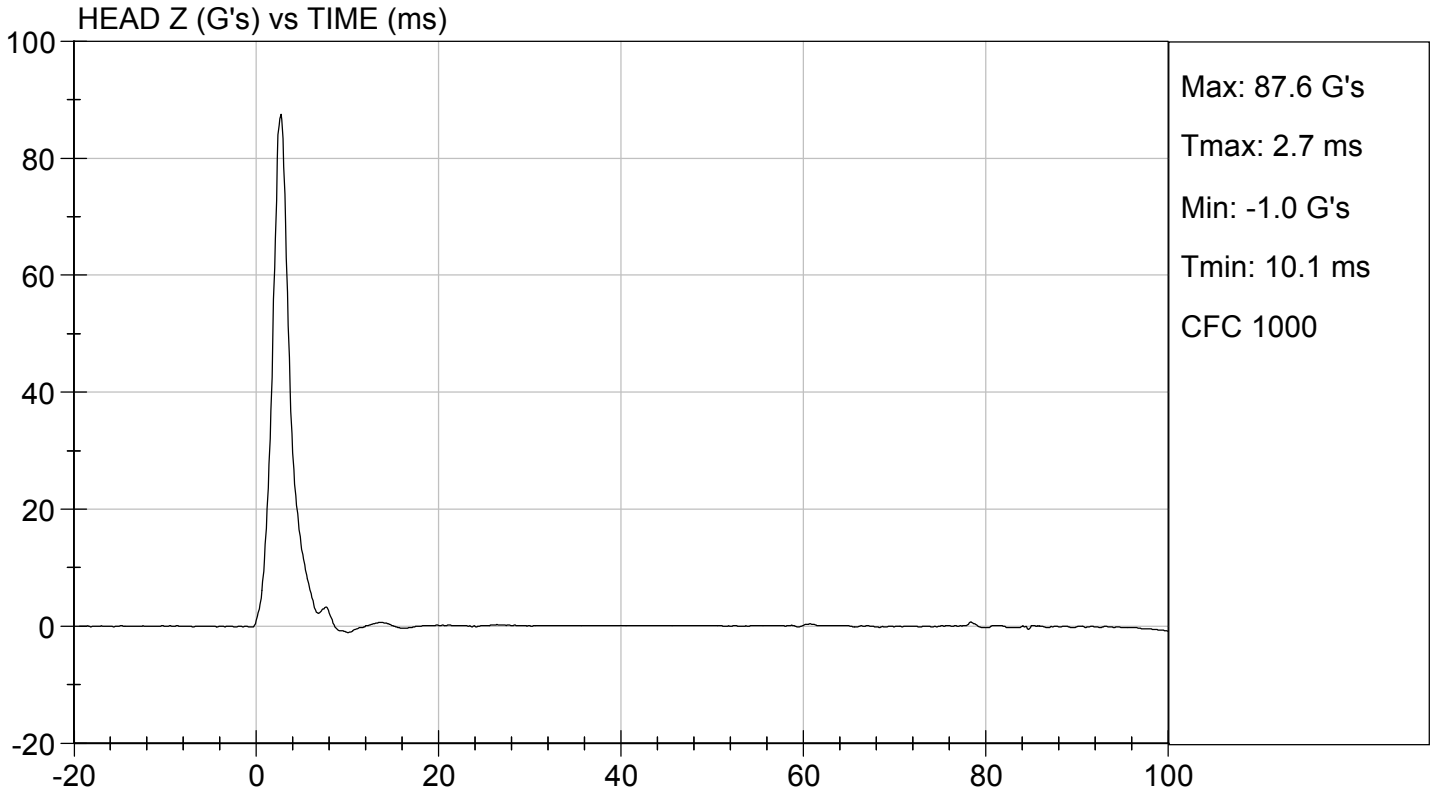
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 11/25/2019
TEST #: D193691





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193692

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	2.61	Pass
	15 ms	m/s	3.30 to 4.10	3.82	Pass
	20 ms	m/s	4.40 to 5.40	5.29	Pass
	25 ms	m/s	5.40 to 6.10	5.66	Pass
	25-100 ms	m/s	5.50 to 6.20	5.67	Pass
Maximum D-Plane Rotation		deg	71 to 81	73	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	61	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-37	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	118	Pass
			Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

11/26/2019

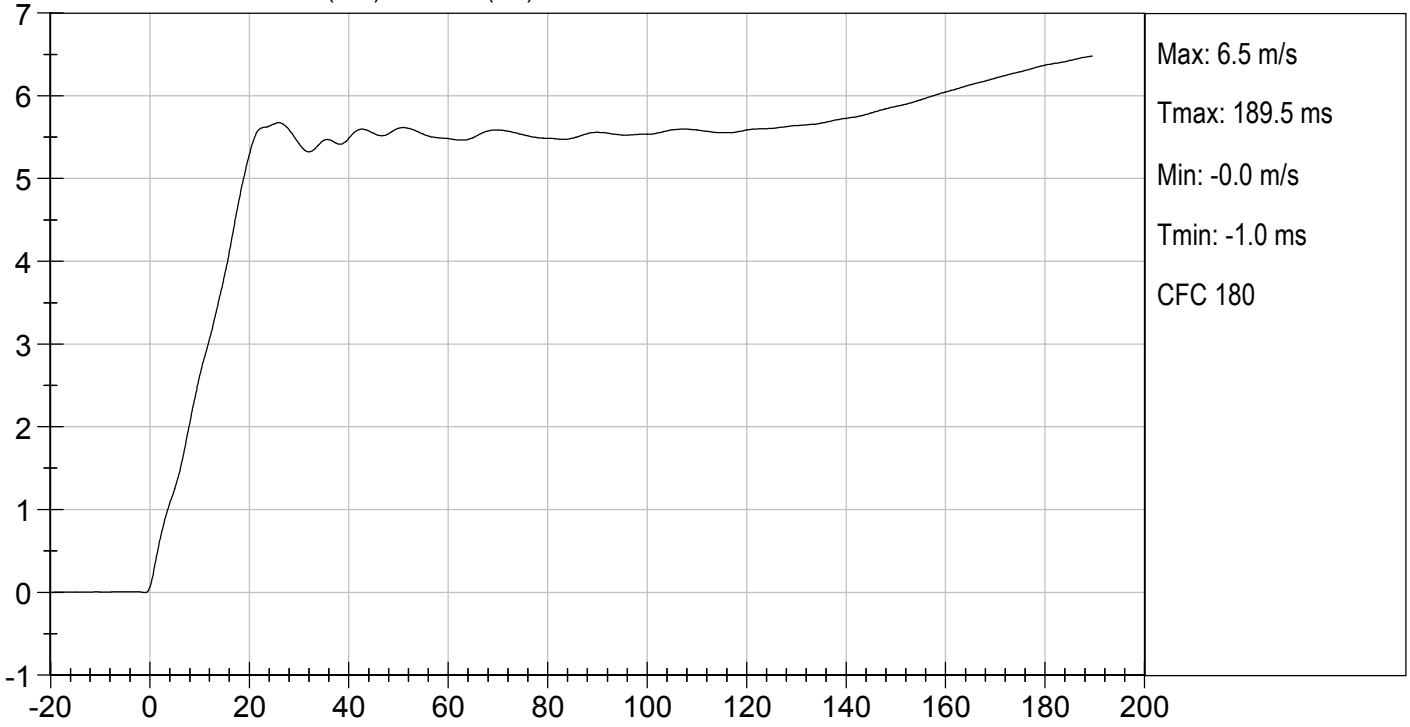
Test Date

Approved By

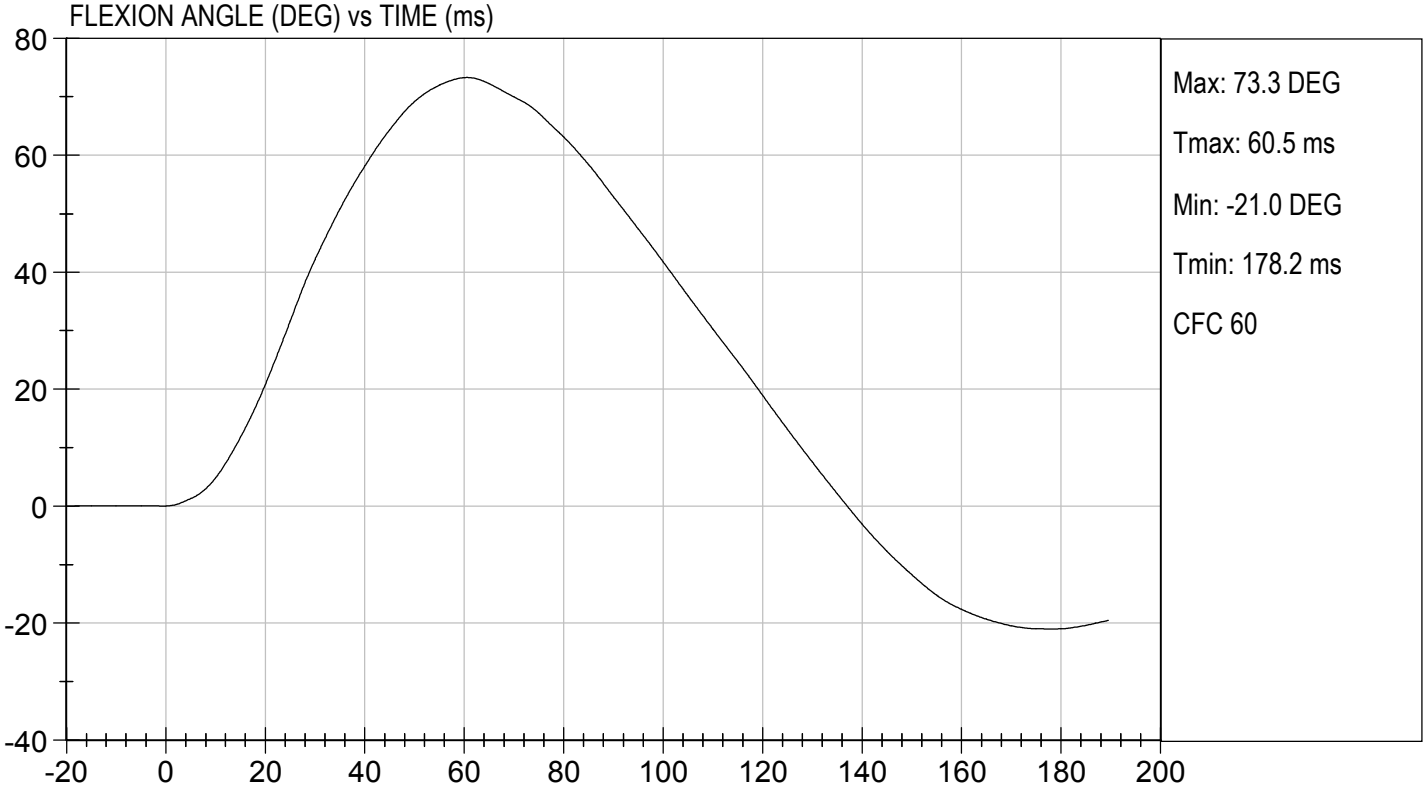
TEST DESC: NECK BENDING
VELOCITY: 18.45 ft/s, 5.62 m/s

TEST DATE: 11/26/2019
TEST #: D193692

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

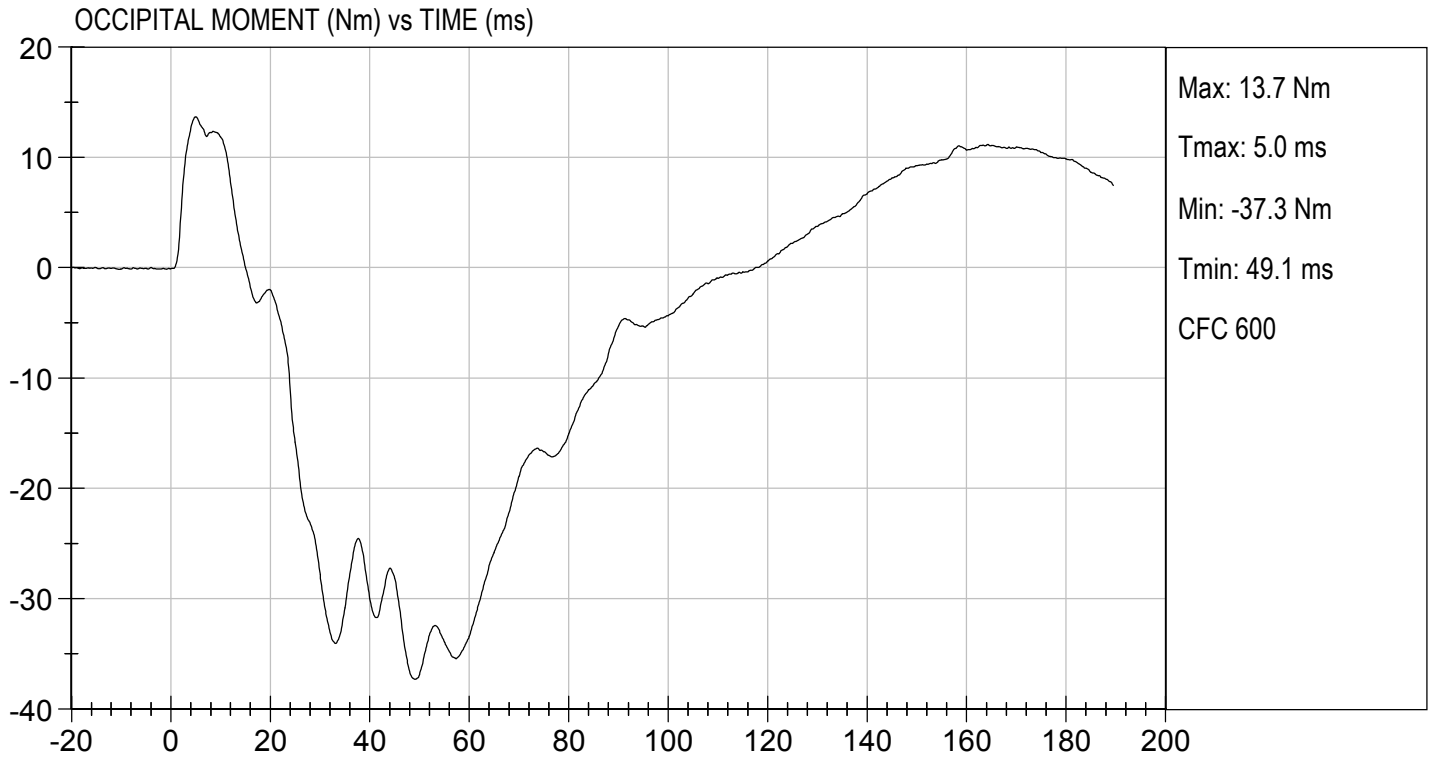


FLEXION ANGLE (DEG) vs TIME (ms)



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

TEST DATE: 11/26/2019
TEST #: D193692



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D193693

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	4.27	Pass
Maximum Probe Acceleration	G's	13 to 18	14	Pass
Shoulder Displacement	mm	28 to 37	31	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	19	Pass
		Overall Test Results		Pass

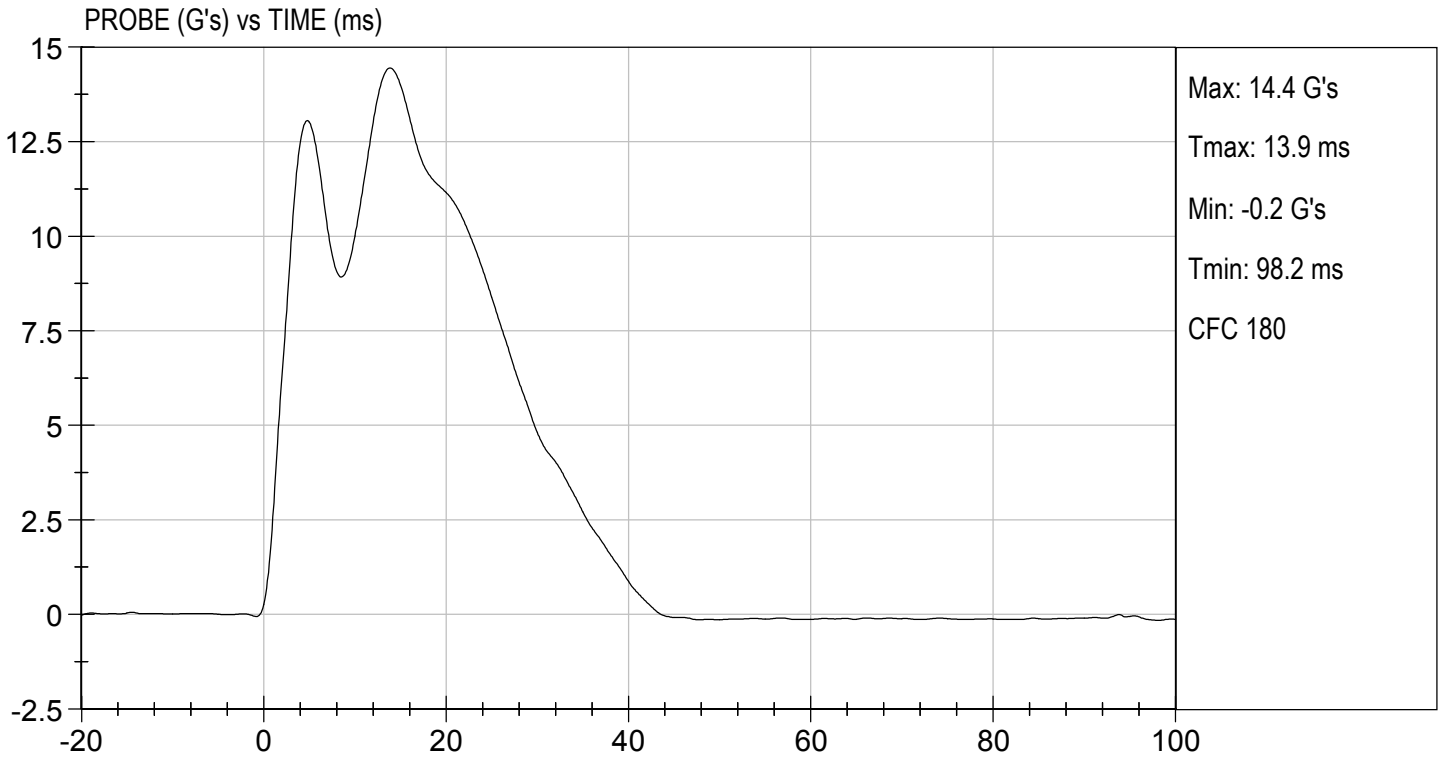
Jacob D Taylor
Laboratory Technician

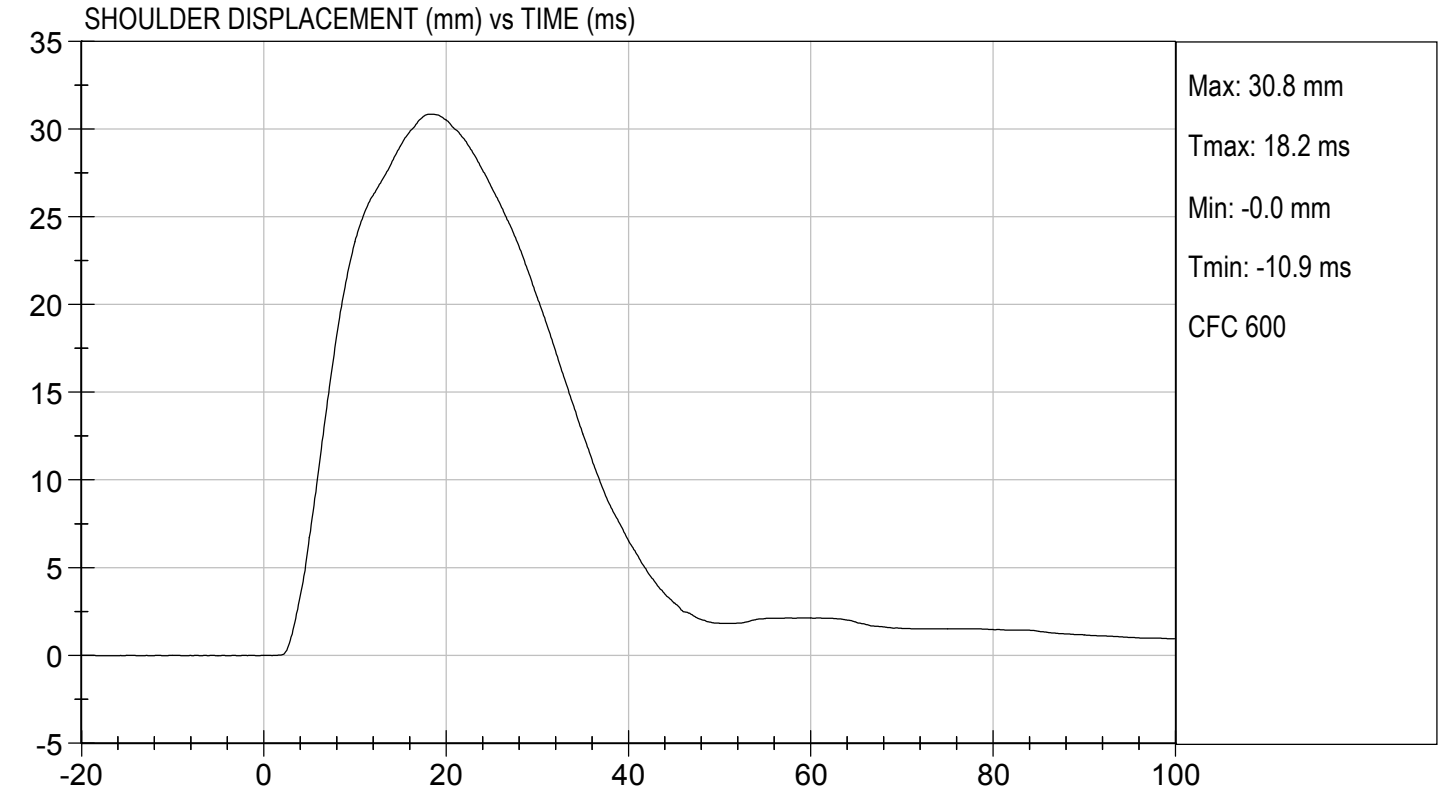
11/25/2019
Test Date

Approved By

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

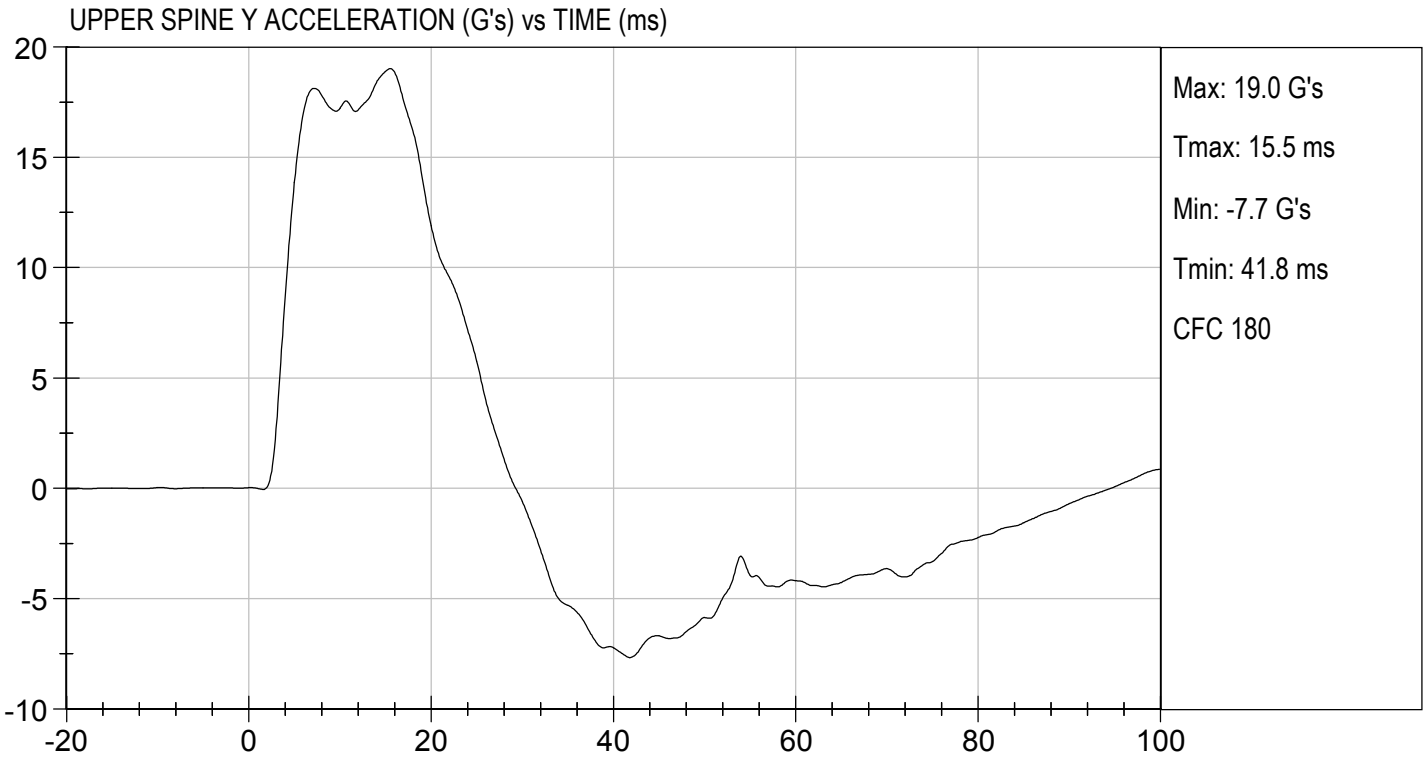
TEST DATE: 11/25/2019
TEST #: D193693





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

TEST DATE: 11/25/2019
TEST #: D193693



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193694

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	33	Pass
Shoulder Displacement	mm	31 to 40	35	Pass
Upper Rib Displacement	mm	25 to 32	27	Pass
Middle Rib Displacement	mm	30 to 36	31	Pass
Lower Rib Displacement	mm	32 to 38	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	39	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	33	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

11/25/2019

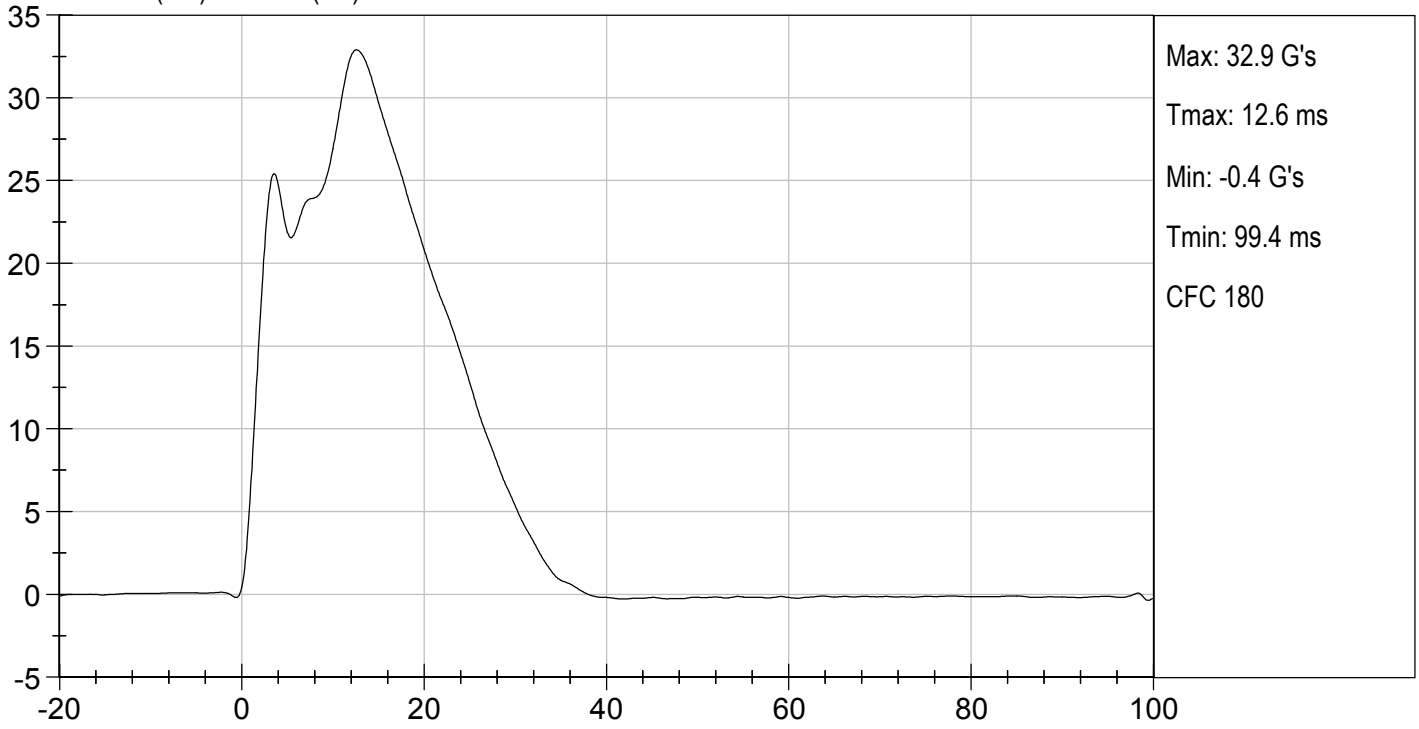
Test Date

Approved By

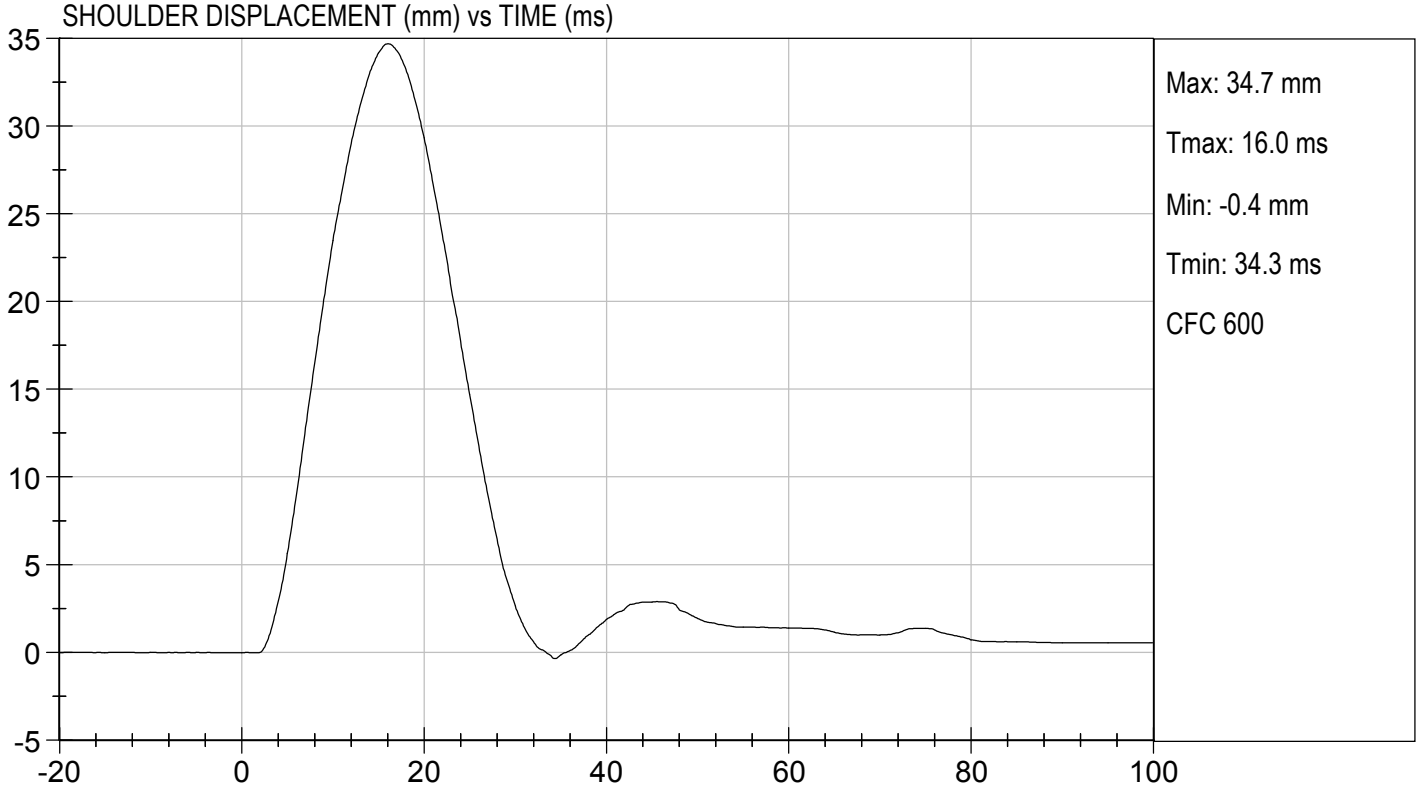
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 11/25/2019
TEST #: D193694

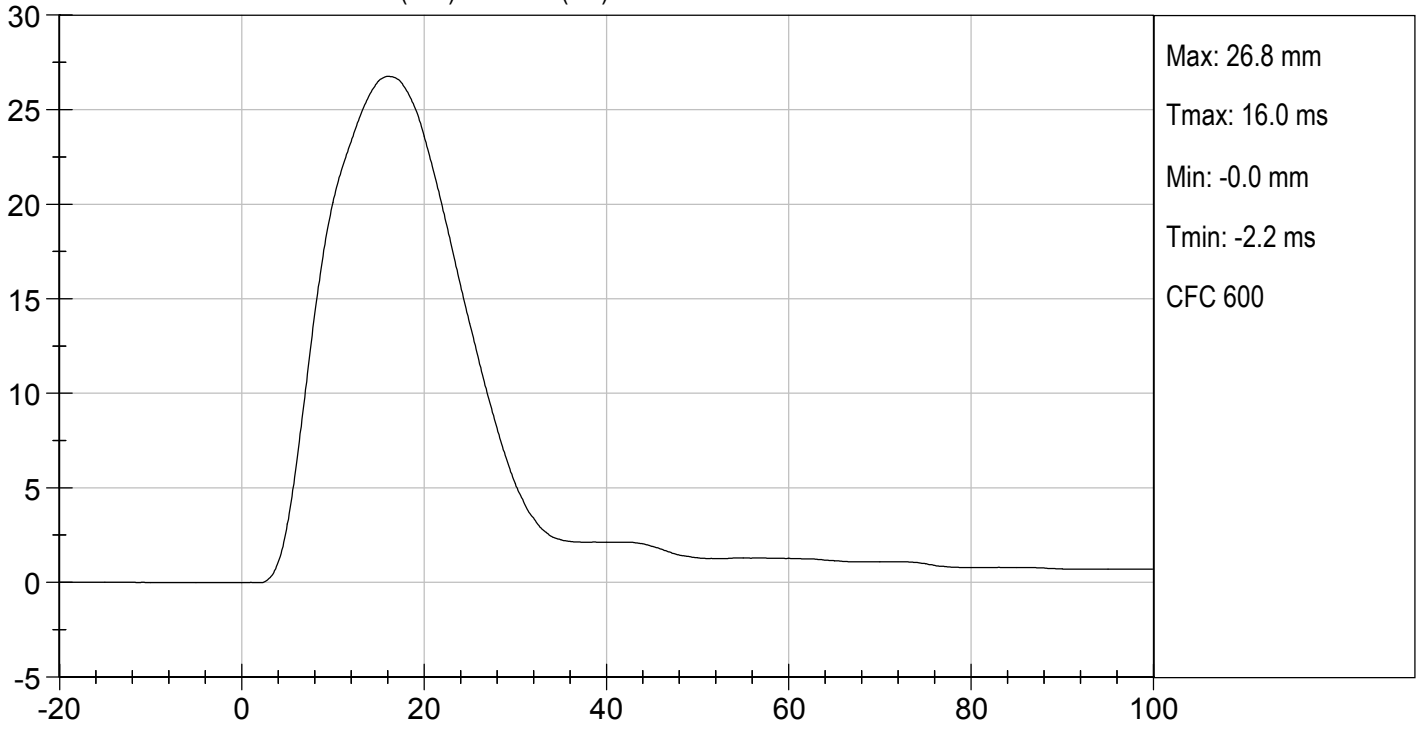
PROBE (G's) vs TIME (ms)



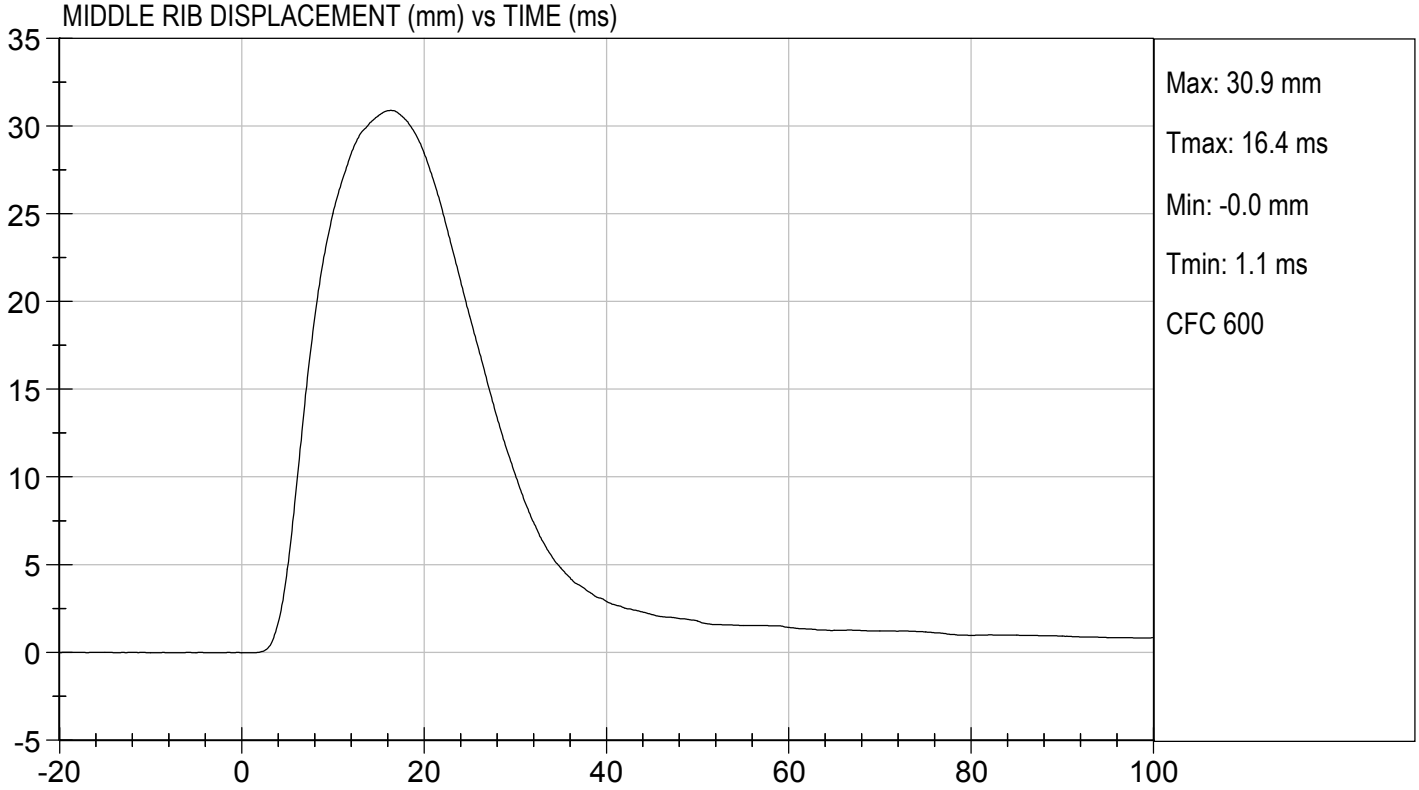
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



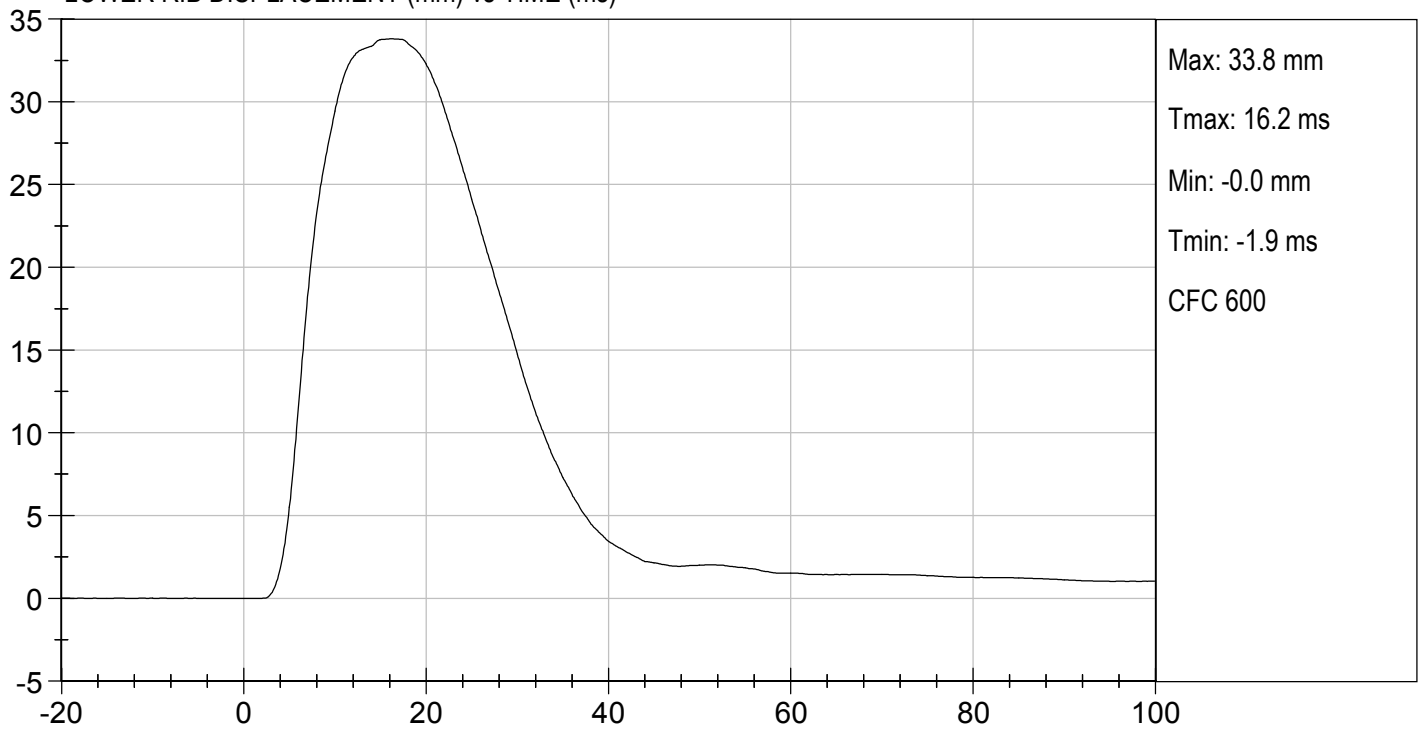
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



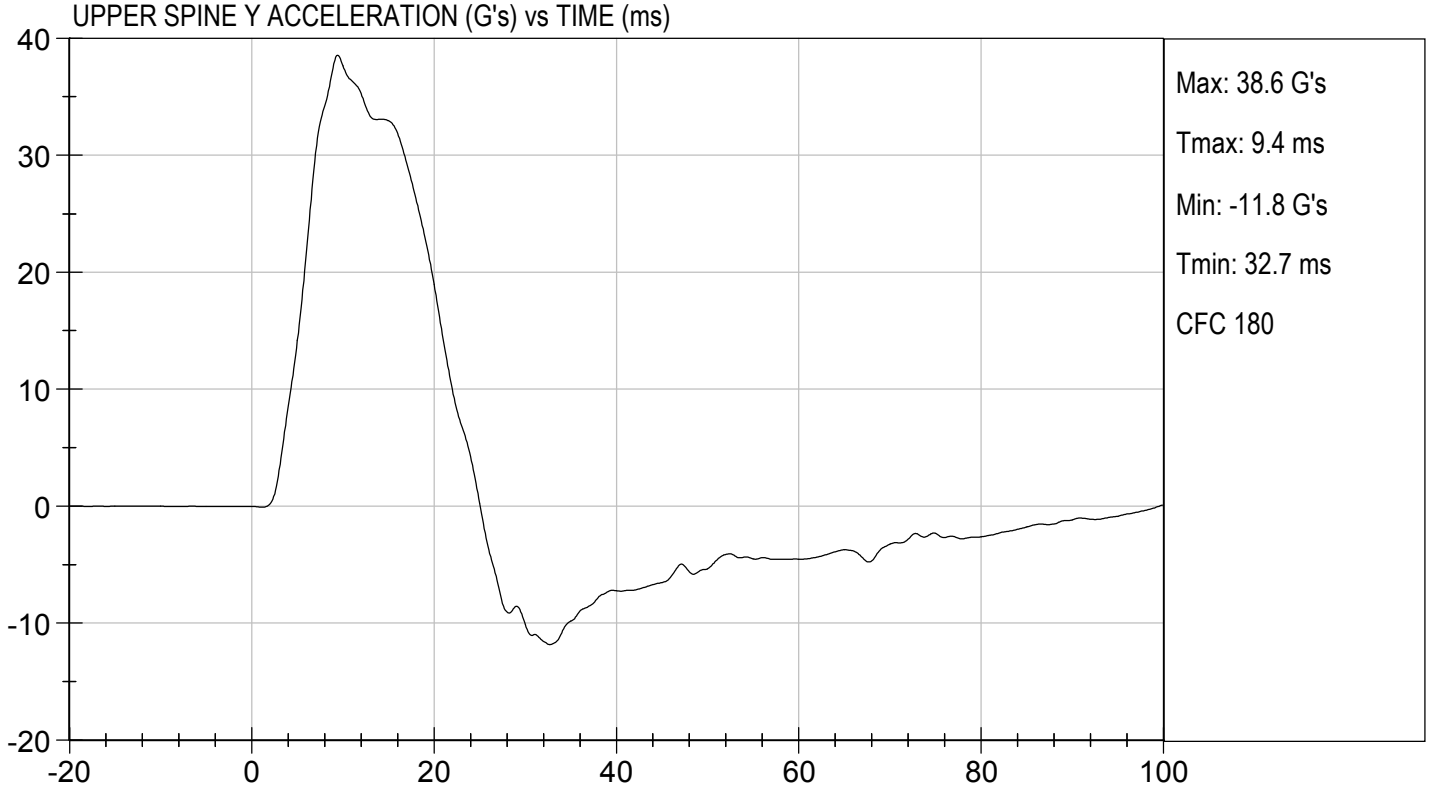
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 11/25/2019
TEST #: D193694

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



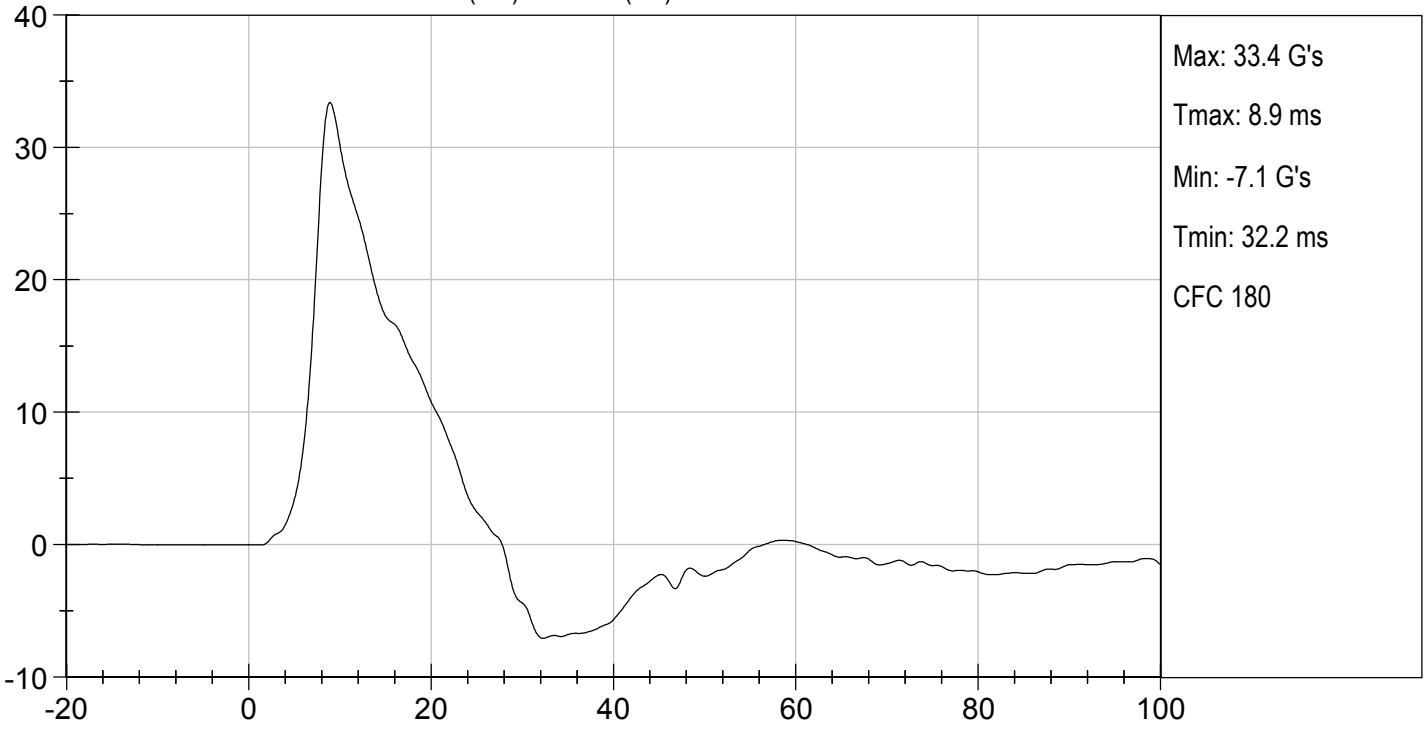
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 11/25/2019
TEST #: D193694

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



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193695

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	42	Pass
Lower Rib Displacement	mm	35 to 43	39	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

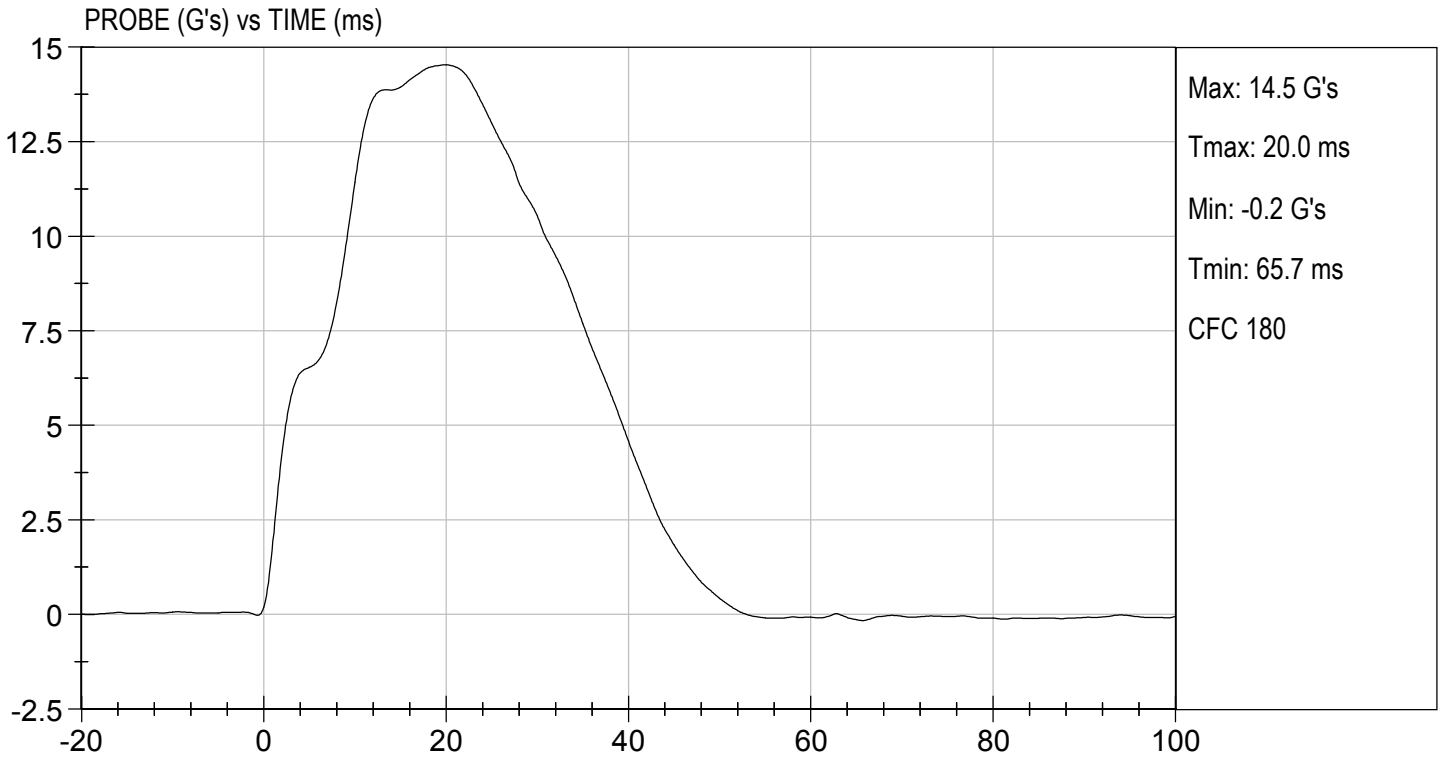
Jacob D Taylor
Laboratory Technician

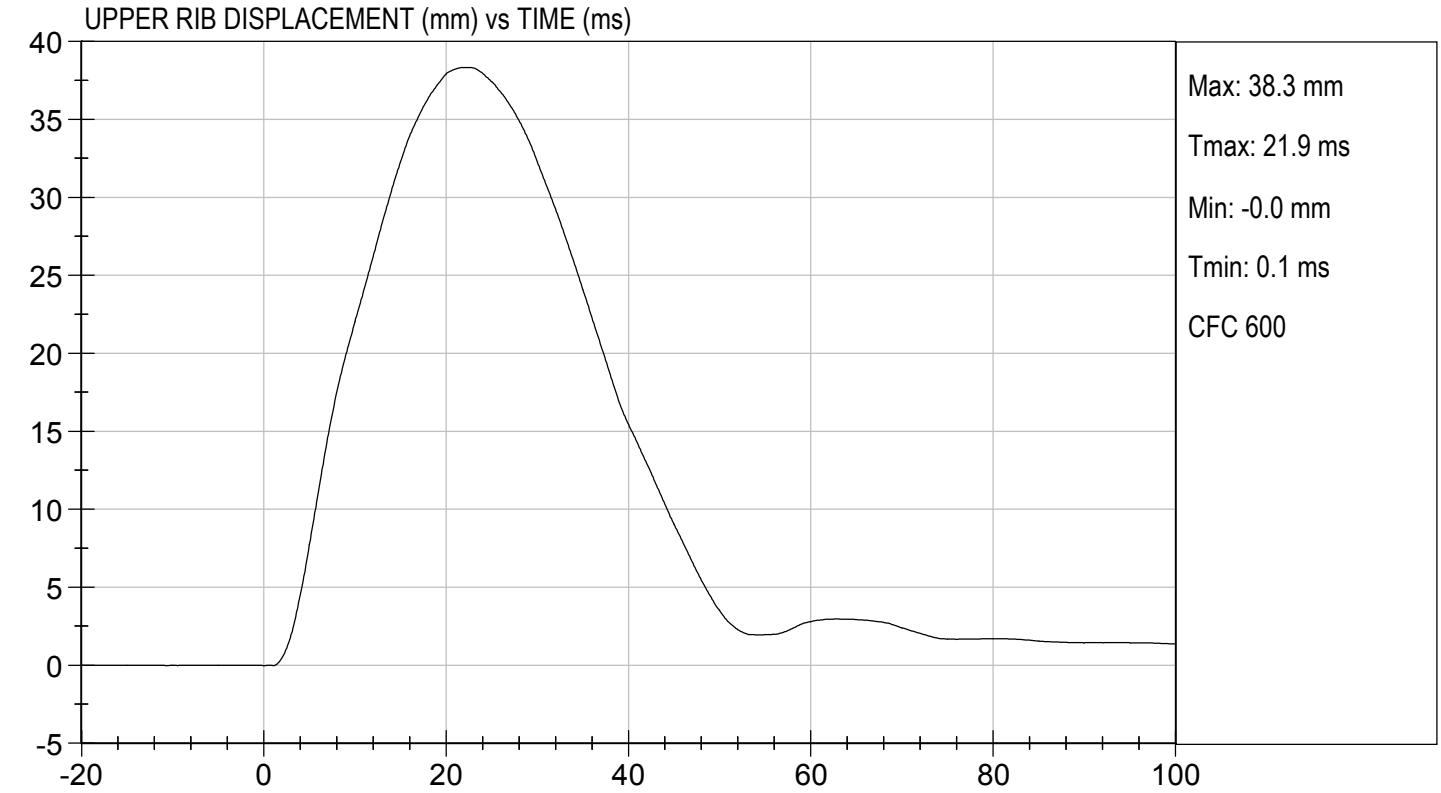
11/25/2019
Test Date

Approved By

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

TEST DATE: 11/25/2019
TEST #: D193695

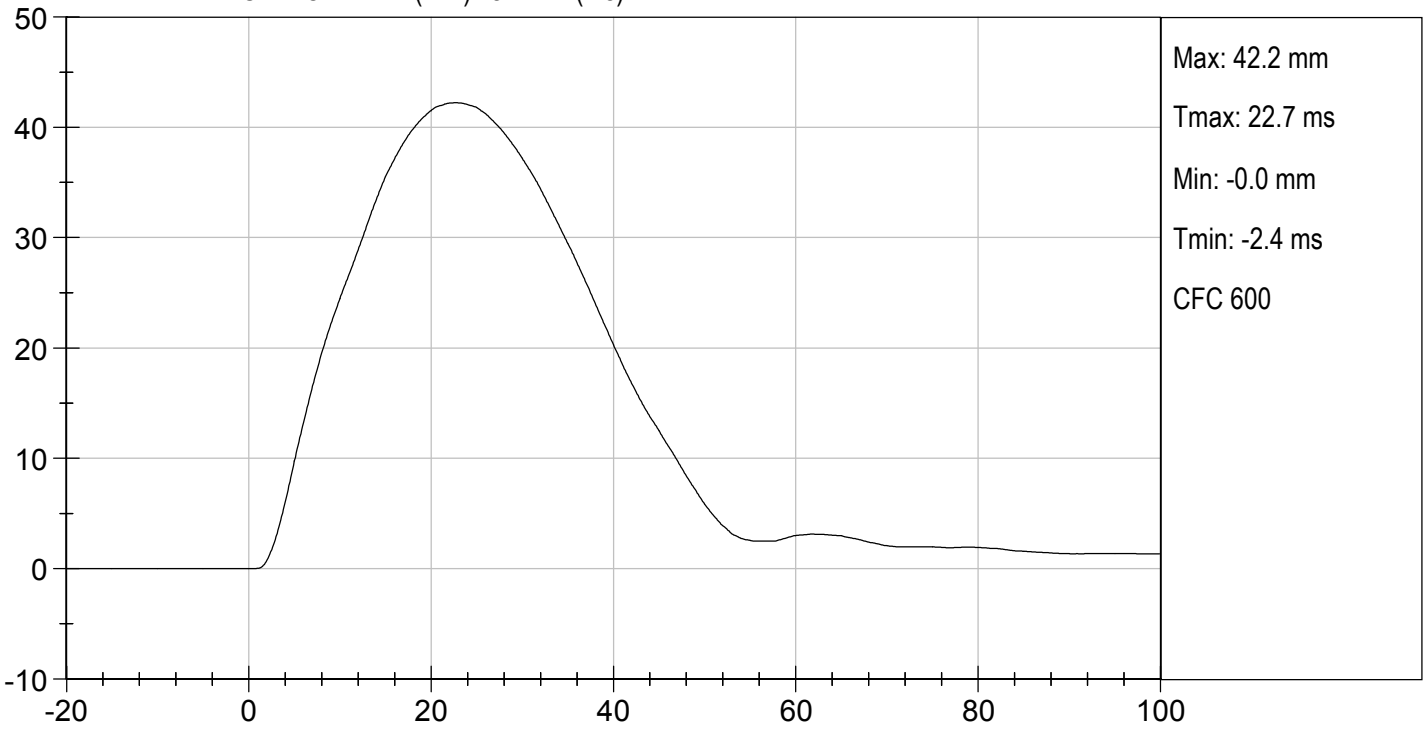




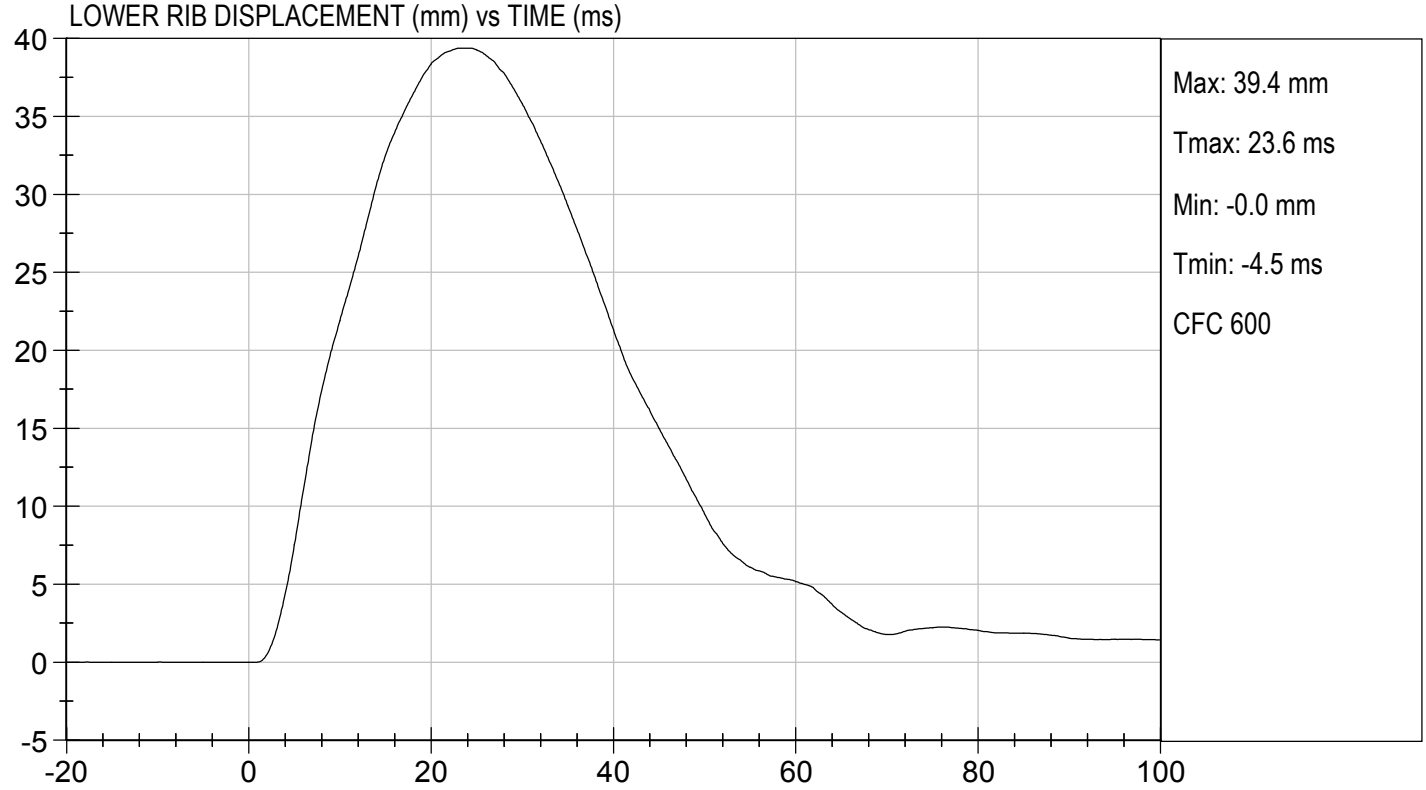
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 11/25/2019
TEST #: D193695

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



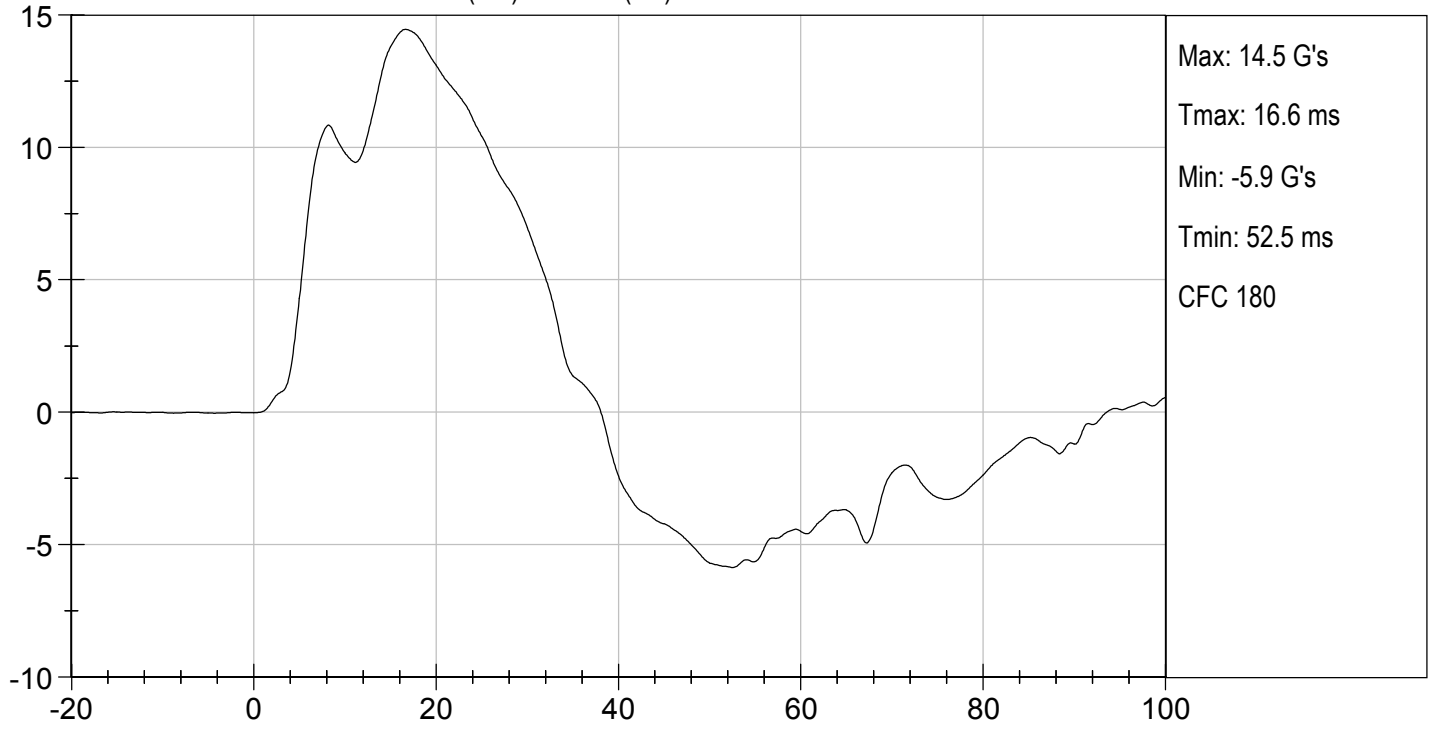
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



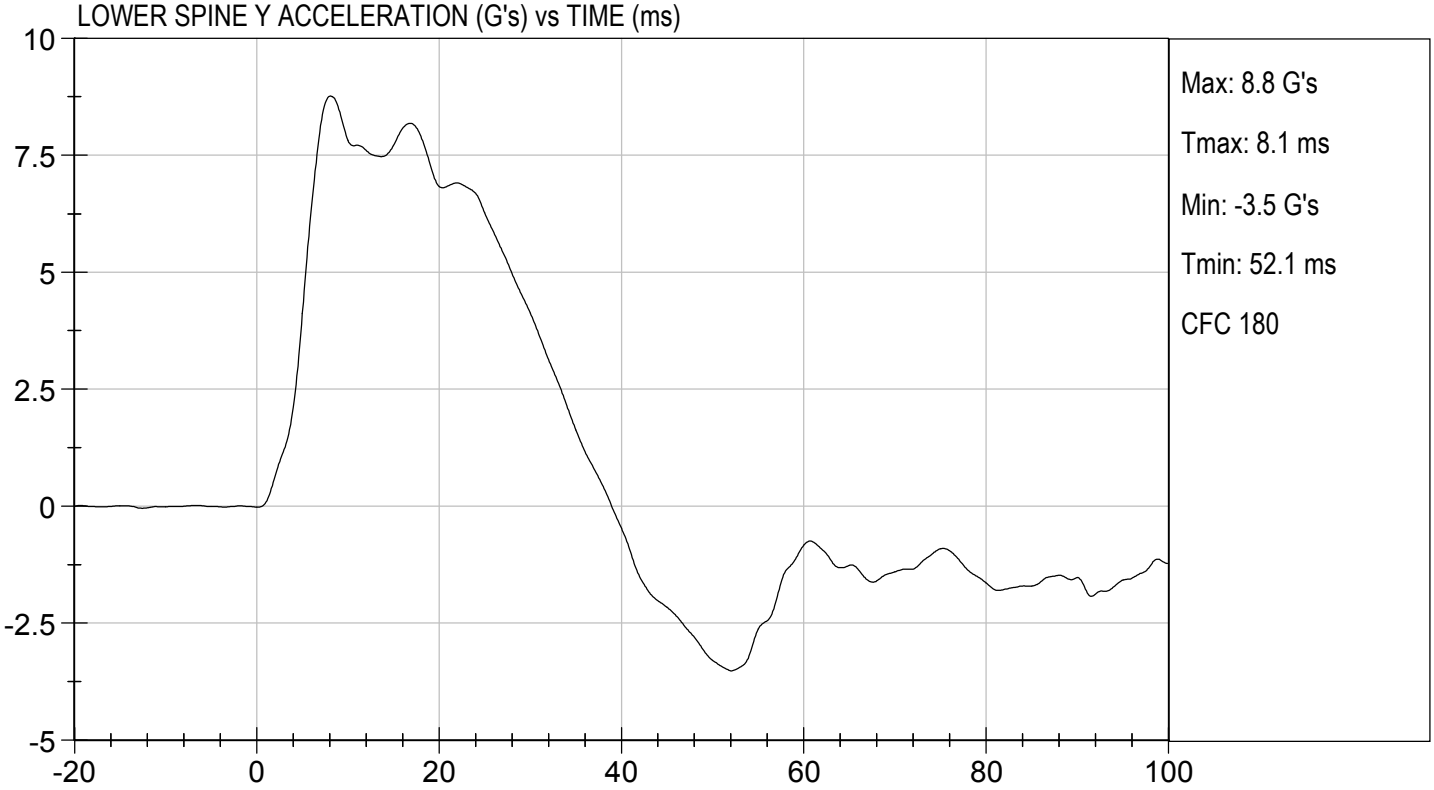
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 11/25/2019
TEST #: D193695

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



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



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193696

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	4.23	Pass
Maximum Probe Acceleration	G's	12 to 16	14	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	39	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	39	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

11/25/2019

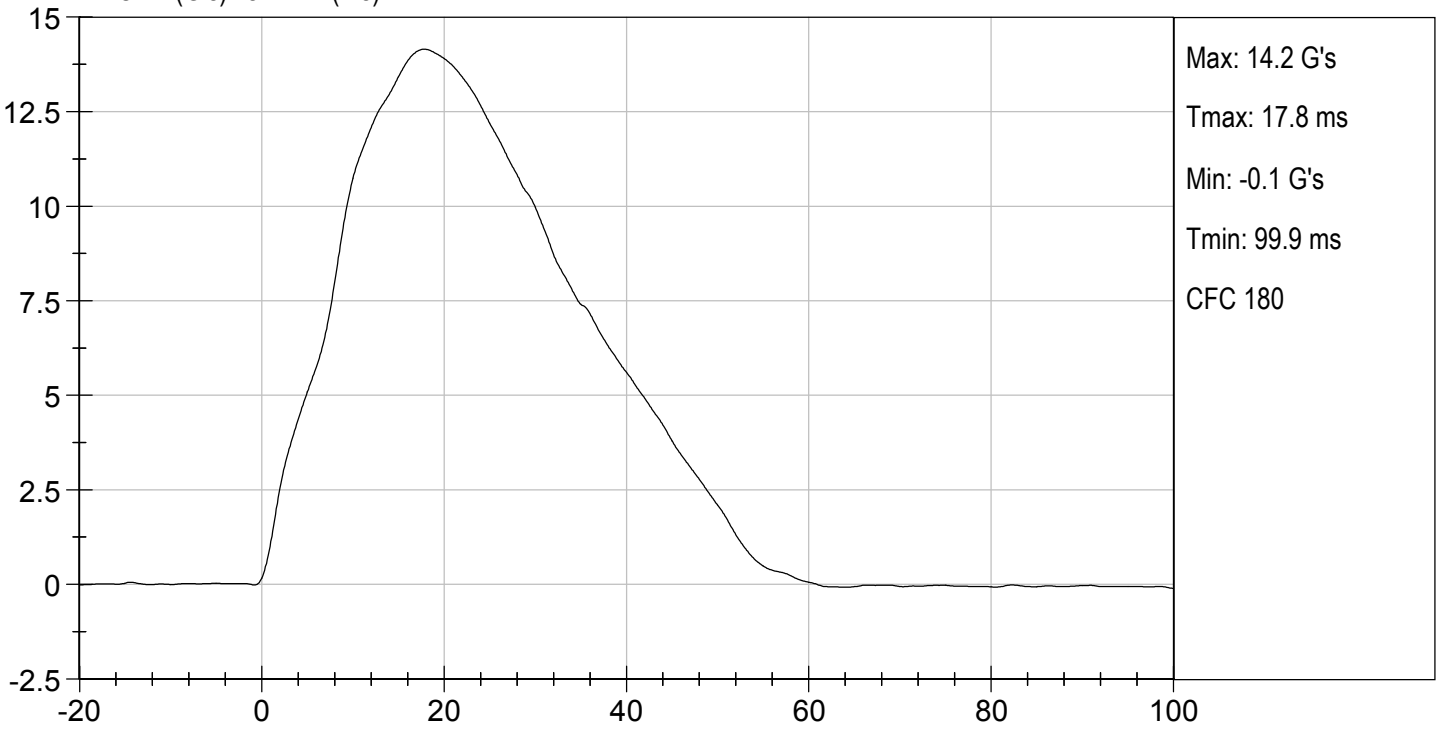
Test Date

Approved By

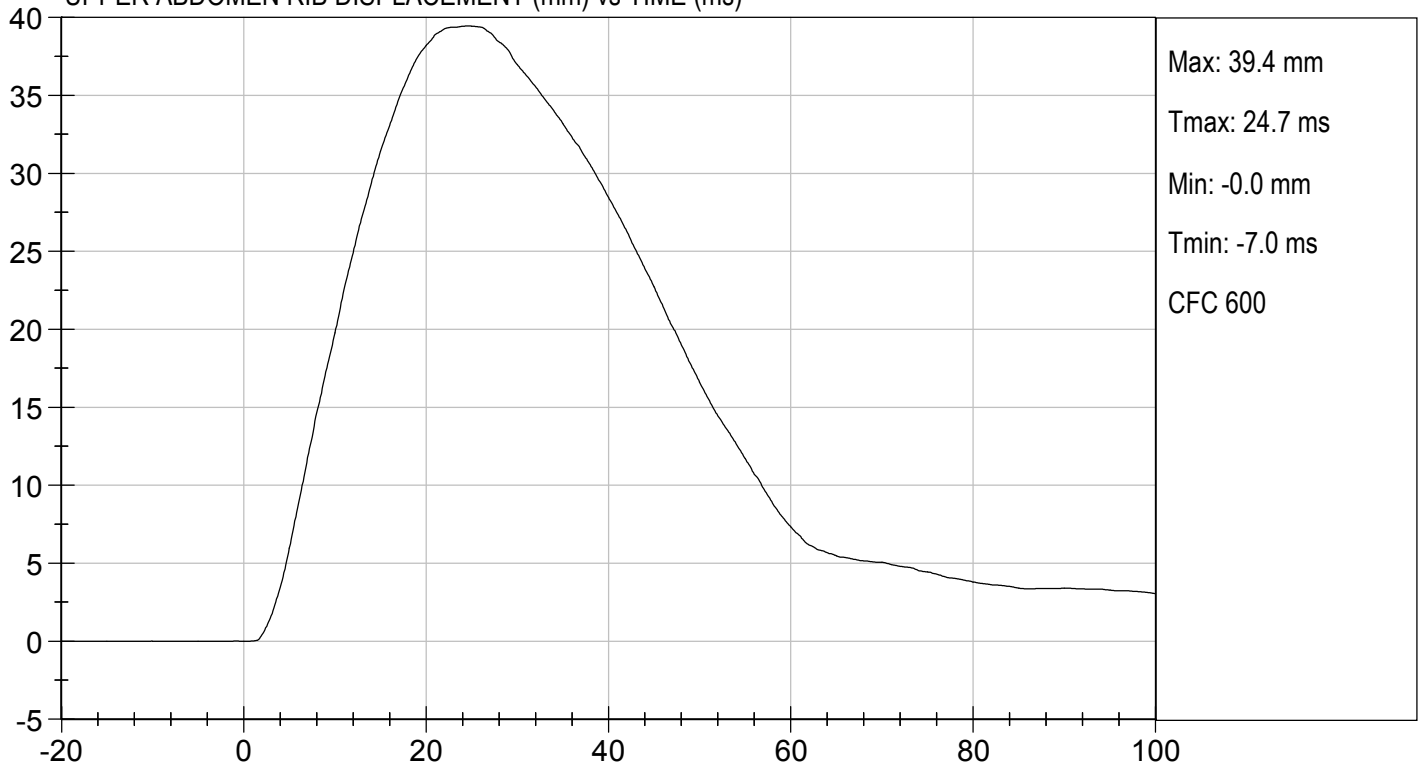
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 11/25/2019
TEST #: D193696

PROBE (G's) vs TIME (ms)



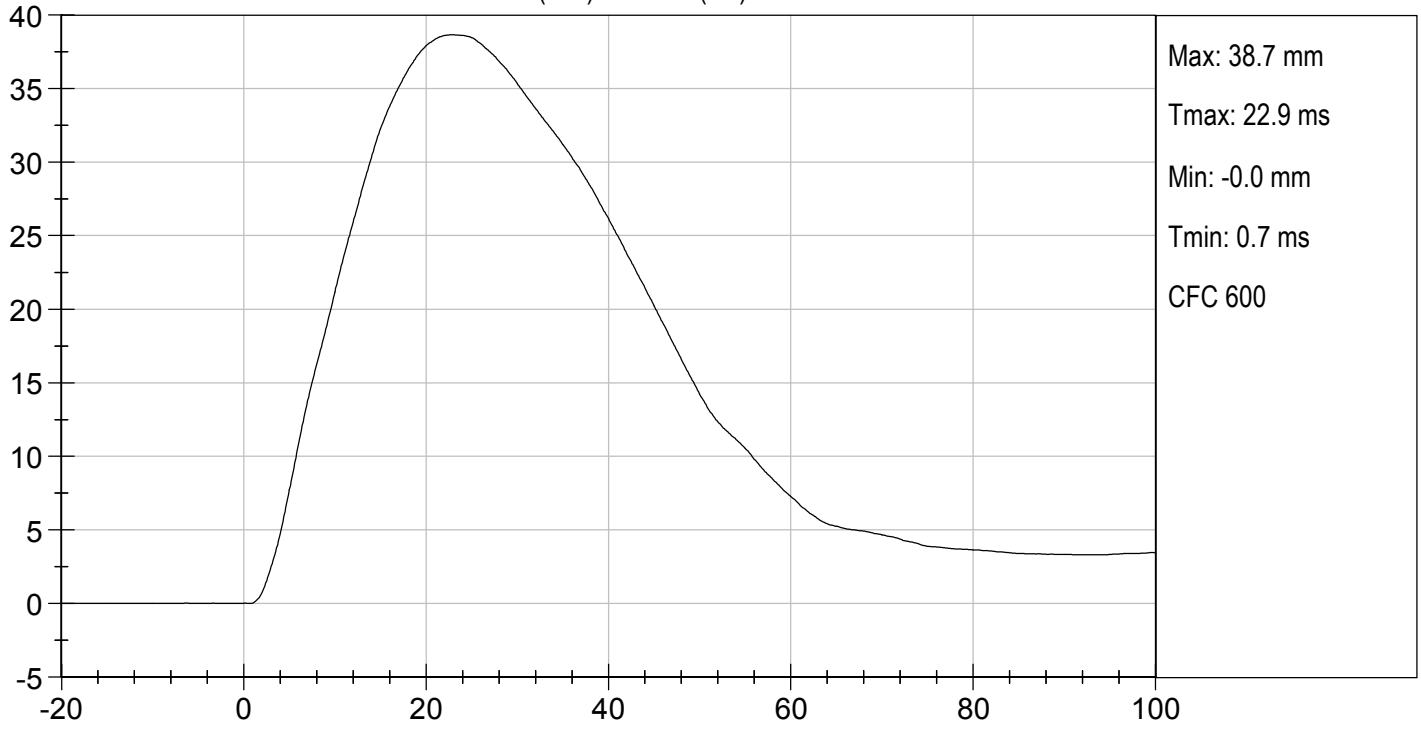
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



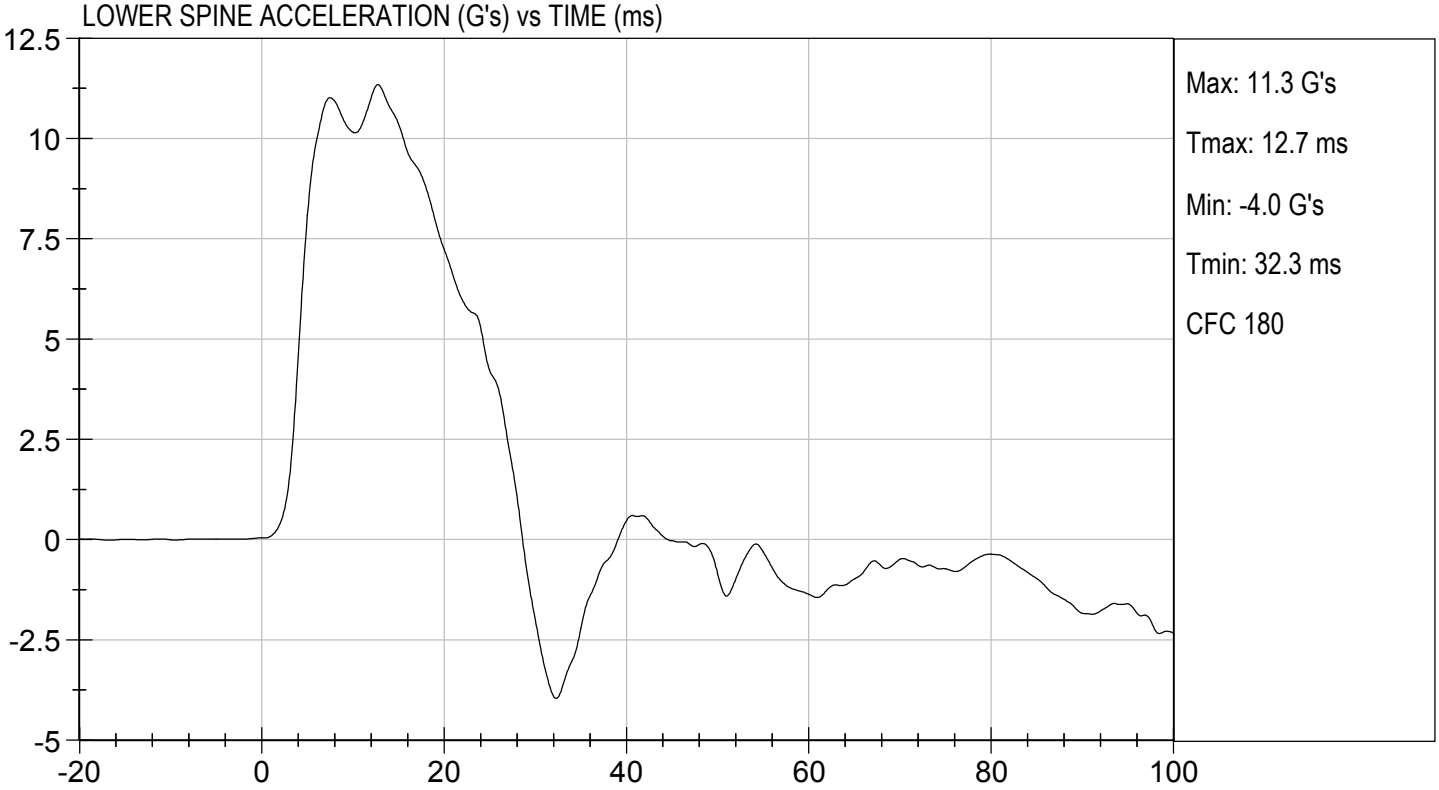
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 11/25/2019
TEST #: D193696

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



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



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193697

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	6.68	Pass
Maximum Probe Acceleration	G's	38 to 47	46	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	41	Pass
Peak Acetabulum Force	N	3600 to 4300	4,289	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

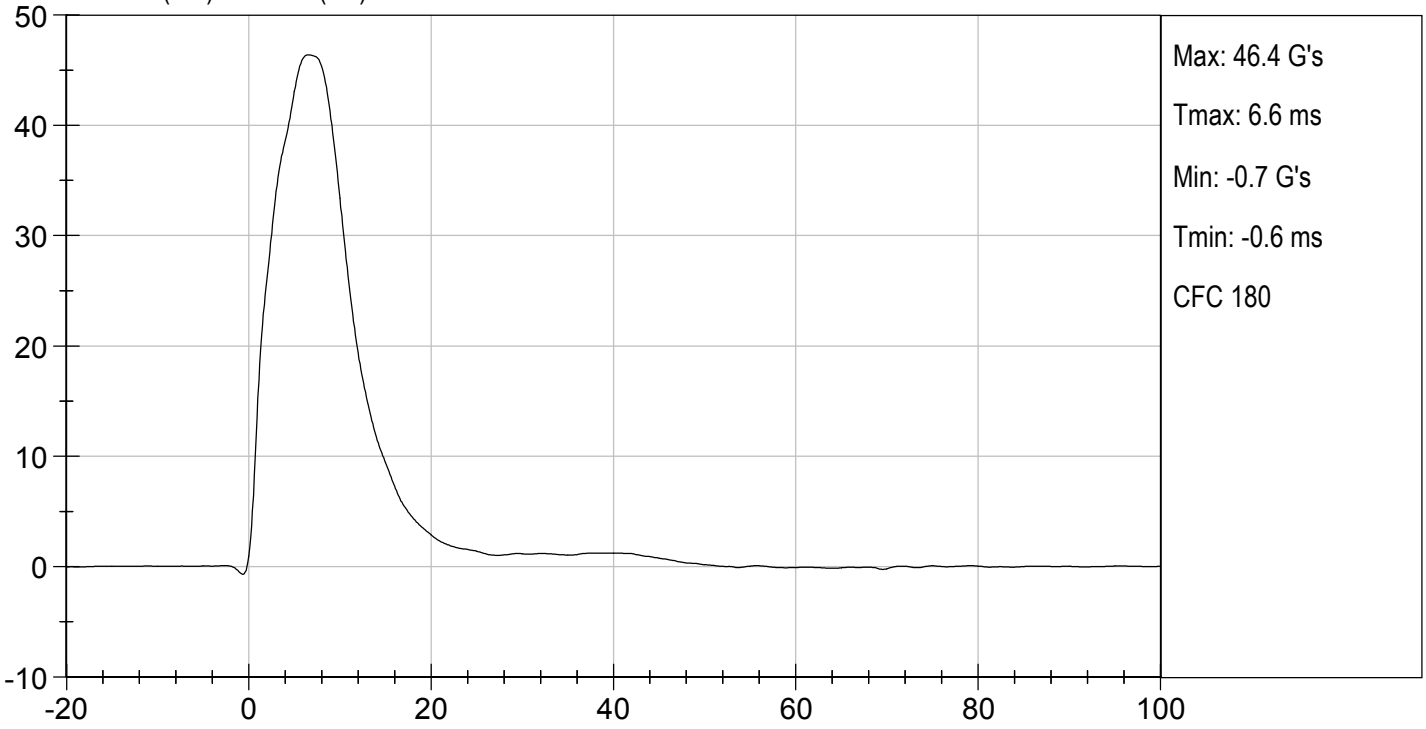
11/25/2019
Test Date

Approved By

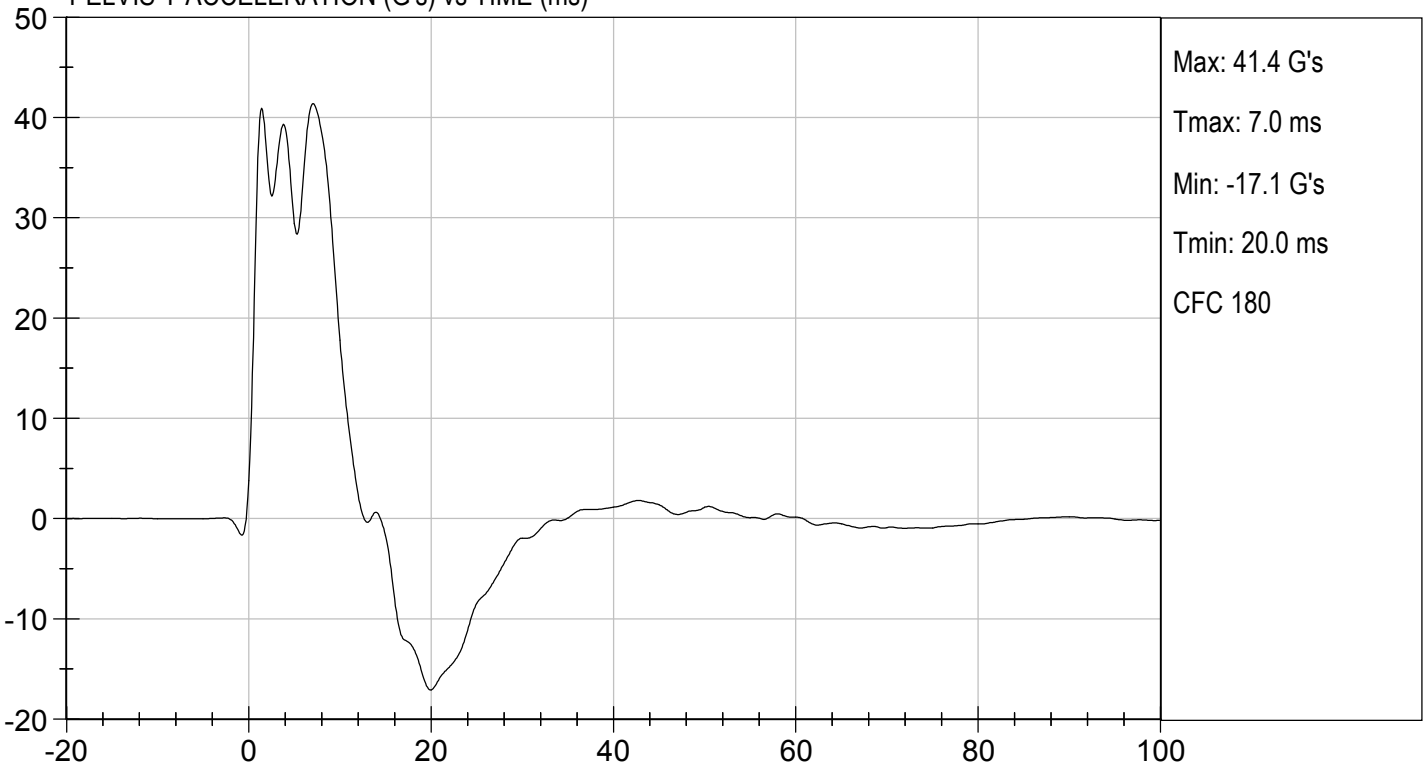
TEST DESC: PELVIS IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 11/25/2019
TEST #: D193697

PROBE (G's) vs TIME (ms)

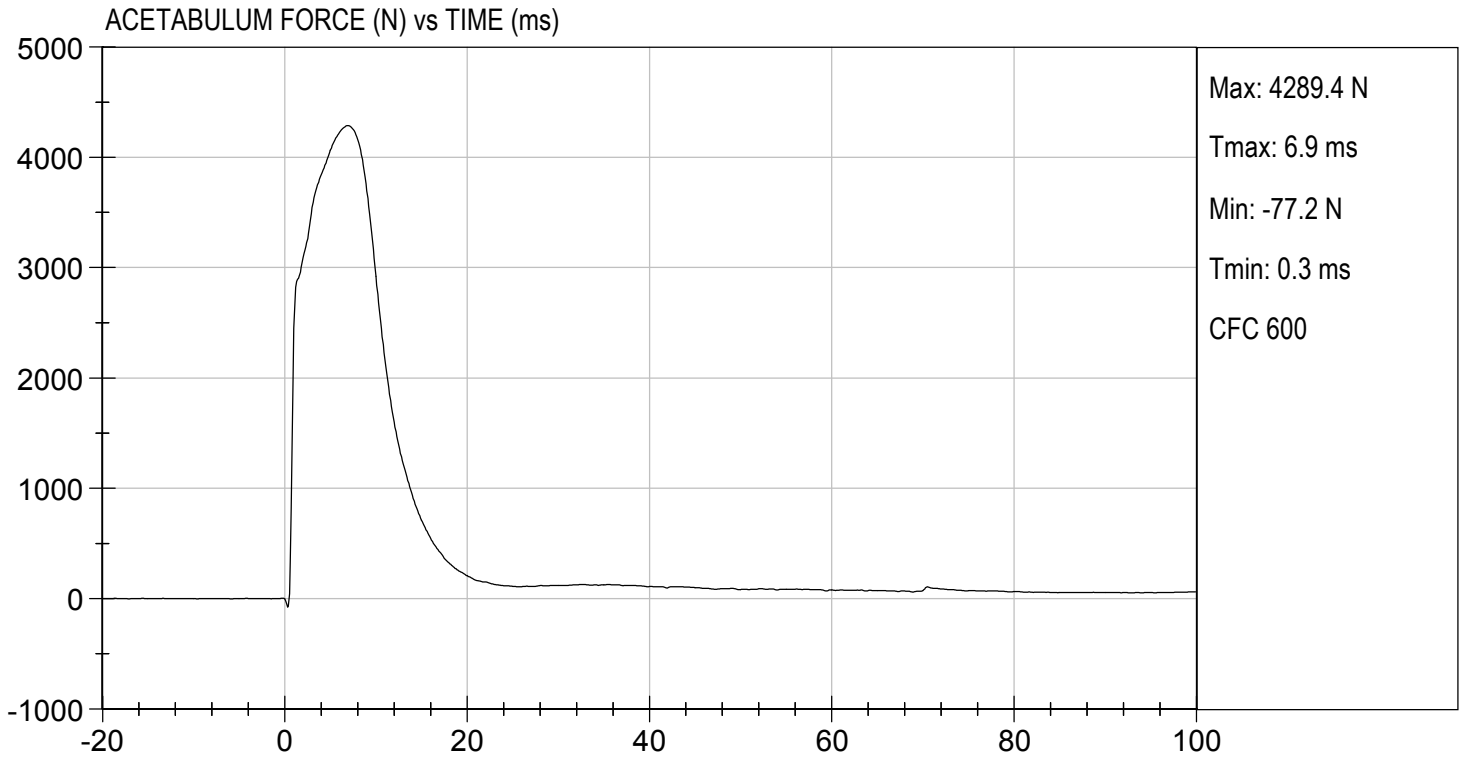


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 11/25/2019
TEST #: D193697



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D193698

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	4.39	Pass
Maximum Probe Acceleration	G's	36 to 45	36	Pass
Pelvis Y Acceleration	G's	28 to 39	29	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,176	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

11/25/2019

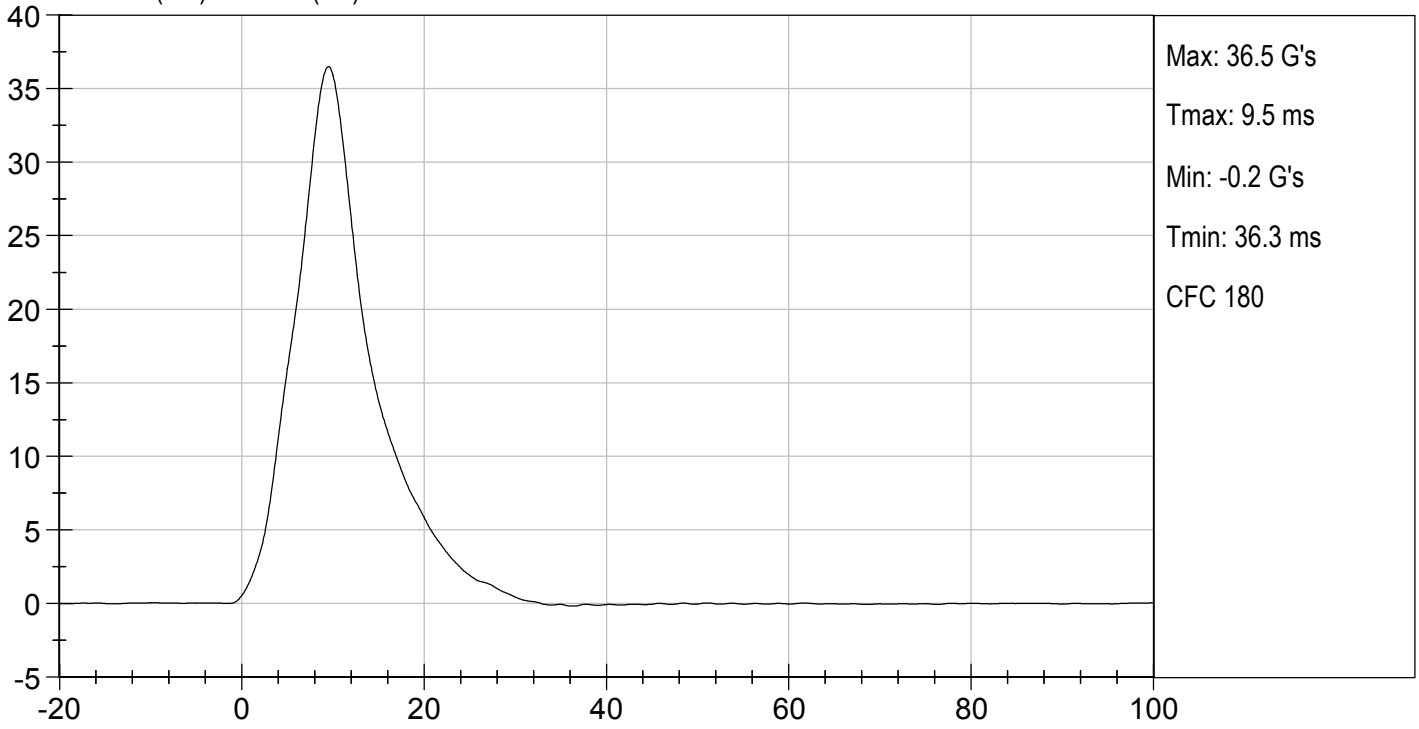
Test Date

Approved By

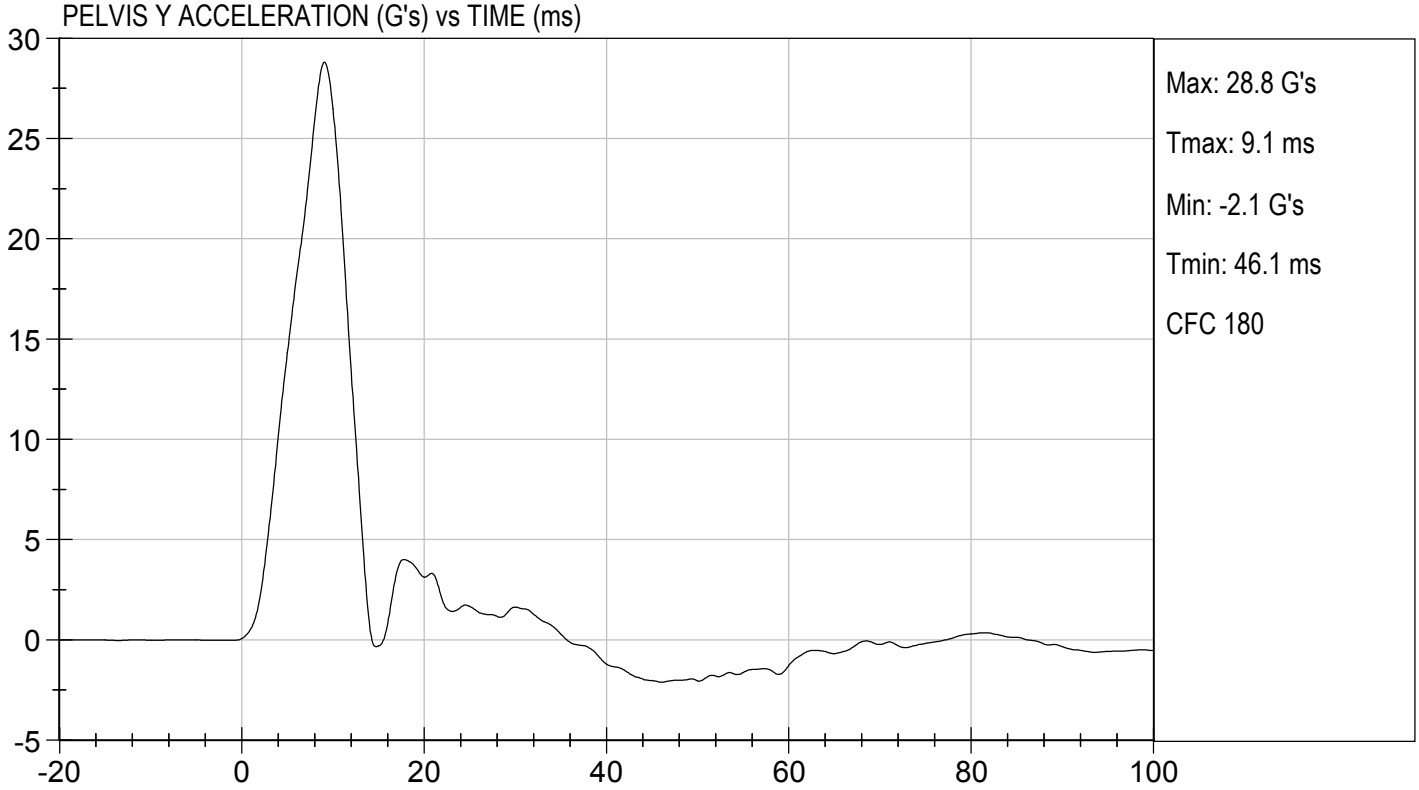
TEST DESC: ILLIAC
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 11/25/2019
TEST #: D193698

PROBE (G's) vs TIME (ms)

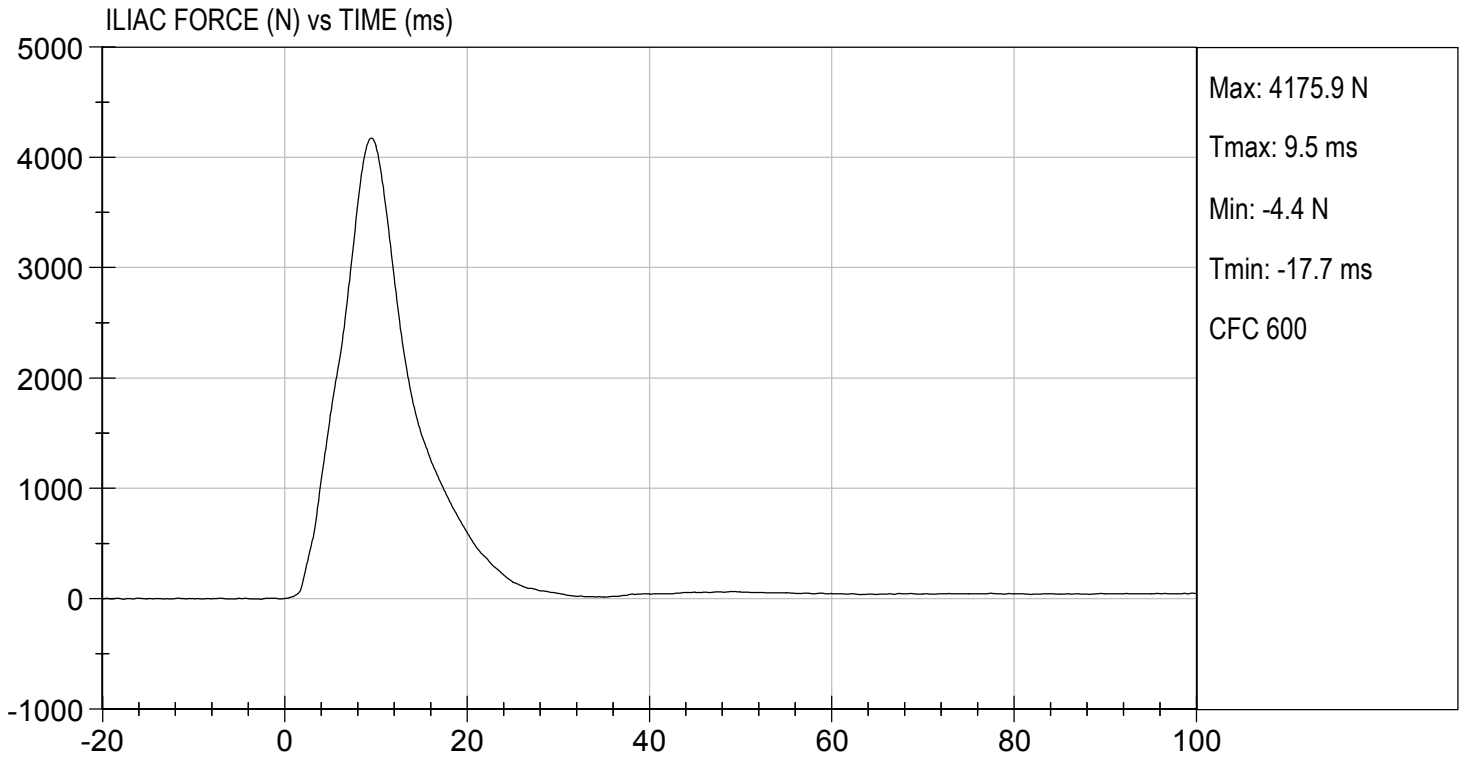


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: ILLIAC
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 11/25/2019
TEST #: D193698



SID-IIs Pelvis Plug Certification Test

Plug S/N 12321
Test Number 6706
Report Number 6721
Test Date 3/21/2018 12:32:07 PM

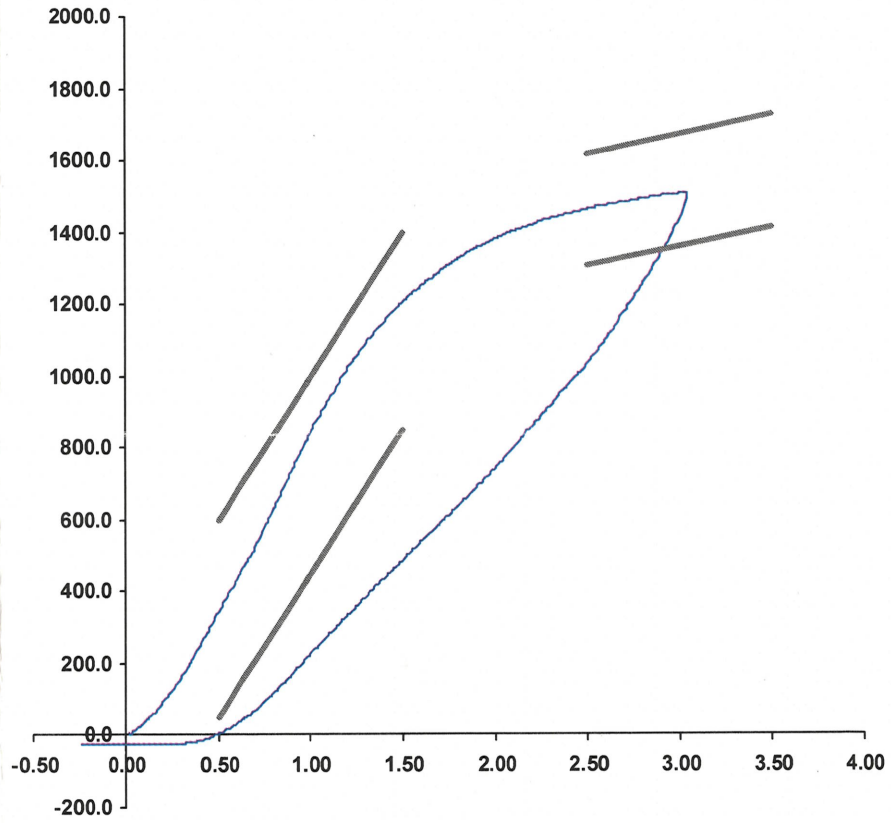
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	343.79	50.00	600.00
Force @ 1.5 mm (N)	1,209.22	850.00	1,400.00
Force @ 2.5 mm (N)	1,464.74	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,509.85	1,361.00	1,673.00

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

Part Number 180-4450

Template No 107 **22-Mar-18**
SACO Research

By : DC Date : 3/21/18

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

Test # 019353

ATD # 296

11/12/19

AF

SID-IIs Pelvis Plug Certification Test

Plug S/N 12857

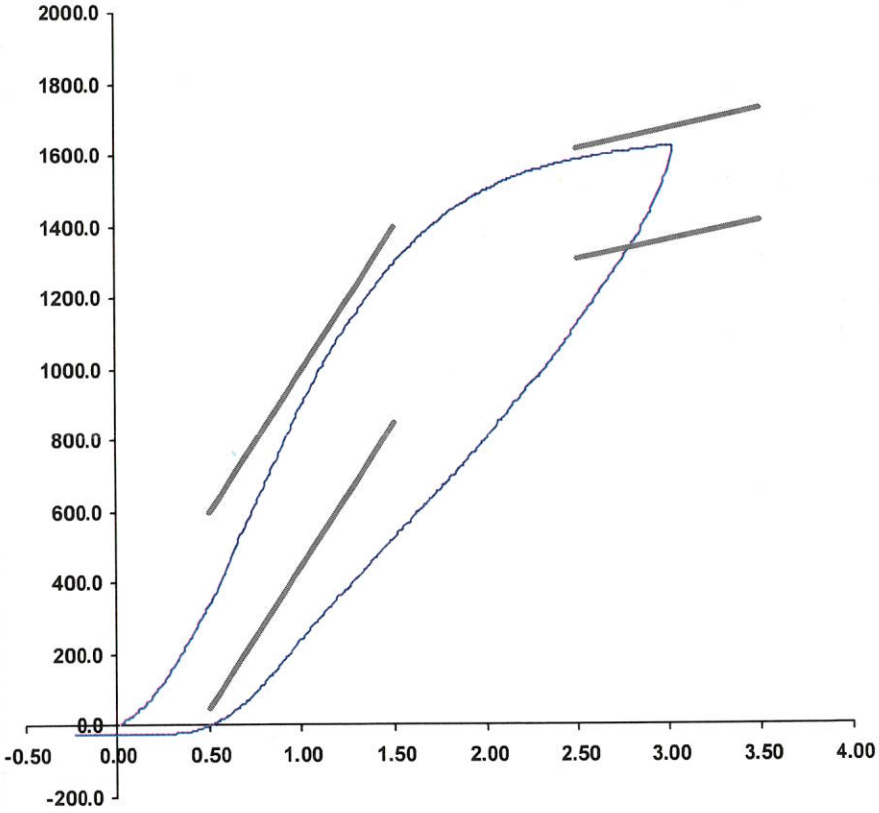
Test Number 8189

Report Number 8219

Test Date 1/18/2019 10:40:27 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	341.38	50.00	600.00
Force @ 1.5 mm (N)	1,298.30	850.00	1,400.00
Force @ 2.5 mm (N)	1,584.91	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,622.76	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

				SID-IIs S/N 296		
				Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers			X	P85003	Endevco	7/12/2019
			Y	P94783	Endevco	7/12/2019
			Z	P94786	Endevco	7/12/2019
			Xr	P94938	Endevco	7/12/2019
			Yr	P96854	Endevco	7/12/2019
			Zr	P97386	Endevco	7/12/2019
Head Angular Rate Sensors			X	ARS7421	DTS	7/8/2019
			Y	ARS7413	DTS	7/8/2019
			Z	ARS7423	DTS	7/8/2019
Displacement Potentiometers	Thoracic Rib	Upper	Y	G012	Servo	7/12/2019
		Middle	Y	G1163	FTSS	7/12/2019
		Lower	Y	G1158	FTSS	7/12/2019
	Abdominal Rib	Upper	Y	G1146	FTSS	7/12/2019
		Lower	Y	G1126	FTSS	7/12/2019
Lower Spine Accelerometers (T12)			X	P79418	Endevco	7/12/2019
			Y	P79439	Endevco	7/12/2019
			Z	P79614	Endevco	7/12/2019
Acetabulum Load Cell			Y	ACG269	Denton	3/15/2019
Iliac Wing Load Cell			Y	IWG282	Denton	3/15/2019
Pelvis Plug (struck side)				12321	SACO	3/21/2018
Pelvis Plug (non-struck side)				12857	SACO	1/18/2019

Table 2 – Vehicle Instrumentation

		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	T20036	Endevco	9/26/2019
Vehicle Center of Gravity	Y	T20388	Endevco	9/26/2019
Vehicle Center of Gravity	Z	T20385	Endevco	9/26/2019
Left Floor Sill	Y	T18990	Endevco	9/27/2019
A-Pillar Sill	Y	T20026	Endevco	11/6/2019
A-Pillar Low	Y	T21426	Endevco	7/25/2019
A-Pillar Mid	Y	T18996	Endevco	8/28/2019
B-Pillar Sill	Y	T19311	Endevco	10/24/2019
B-Pillar Low	Y			
B-Pillar Mid	Y			
Driver Seat	Y	T19995	Endevco	11/15/2019
Engine Top	X	T21419	Endevco	7/29/2019
Engine Top	Y	T21432	Endevco	7/25/2019
Firewall	Y	T19527	Endevco	11/15/2019
Right Roof	Y	PCB1138	PCB	11/18/2019
Right Floor Sill	Y	PCB1146	PCB	11/18/2019
Rear Floorpan	X	T19958	Endevco	6/13/2019
Rear Floorpan	Y	T17825	Endevco	6/12/2019

Table 3 – Pole Instrumentation

	Serial Number	Manufacturer	Calibration Date
Load Cell 1	DG6277	FTSS	7/30/2018
Load Cell 2	DG6278	FTSS	7/30/2018
Load Cell 3	DG6279	FTSS	7/30/2018
Load Cell 4	DG6280	FTSS	7/30/2018
Load Cell 5	DG6281	FTSS	7/30/2018
Load Cell 6	DG6283	FTSS	7/30/2018
Load Cell 7	DG6284	FTSS	7/30/2018
Load Cell 8	DG6582	FTSS	7/30/2018