REPORT NUMBER: SideNCAPPole-MGA-23-038

NEW CAR ASSESSMENT PROGRAM (NCAP)
Side Impact Pole Test

TOYOTA MOTOR CORPORATION
2023 RAV4 Prime SE AWD 5-Door SUV
NHTSA No.: M20235101

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: September 1, 2023

Final Report Date: February 9, 2024

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NRM-100
1200 New Jersey Ave, SE
Washington, DC 20590

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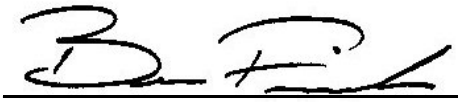
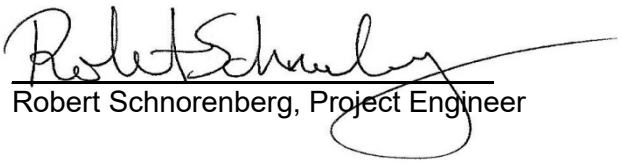
Prepared by: 
Ben Fischer, Program Manager

Approved by: 
Robert Schnorenberg, Project Engineer

Approval Date: February 9, 2024

FINAL REPORT ACCEPTANCE BY OCWS:

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

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

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
SideNCAPPole-MGA-23-038		

4. Title and Subtitle Final Report of New Car Assessment Program Side Impact Pole Testing and FMVSS No. 305 Indicant Testing of a 2023 RAV4 Prime SE AWD 5-Door SUV, NHTSA No.: M20235101	**5. Report Date** February 9, 2024
	6. Performing Organization Code MGA
7. Author(s) Ben Fischer, Program Manager	**8. Performing Organization Report No.** SideNCAPPole-MGA-23-038
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105	**10. Work Unit No.**
	11. Contract or Grant No. 693JJ920D000017
12. Sponsoring Agency Name and Address United States Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards Mail Code: NRM-100 1200 New Jersey Ave, SE Washington, DC 20590	**13. Type of Report and Period Covered:** Final Test Report September 1, 2023 to February 9, 2024
	14. Sponsoring Agency Code NRM-100

15. Supplementary Notes

16. Abstract

A 32.20 km/h, 75° oblique impact Side NCAP Test was conducted on the subject 2023 RAV4 Prime SE AWD 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 the MGA Research Corporation facility in Burlington, Wisconsin on September 1, 2023.

The impact velocity was 32.13 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21.3°C. The test vehicle post-test maximum crush was 362 mm at level 2. The test vehicle's performance was as follows:

Measurement Description	Units	Driver ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	359.533
Resultant Lower Spine Acceleration	g	82	45.432
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	4313.377
Maximum Thoracic Rib Deflection	mm	38*	16.978
Maximum Abdomen Rib Deflection	mm	45*	25.881

*Proposed IARV

The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite door(s) 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 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	174	

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SECTION 1
PURPOSE AND SUMMARY OF TEST

PURPOSE

This side pole impact test is part of the MY 2023 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. 693JJ920D000017. The purpose of this test is to generate comparative side impact performance in a 2023 RAV4 Prime SE AWD 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 March 2020.

SUMMARY

A rigid pole side impact test was conducted on a 2023 RAV4 Prime SE AWD 5-Door SUV. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 32.13 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin on September 1, 2023. Pre-test and post-test photographs of the test vehicle and side impact dummy (SID-IIs) are included in 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 March 2020. 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	359.533
Resultant Lower Spine Acceleration	g	82	45.432
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	4313.377
Maximum Thoracic Rib Deflection	mm	38*	16.978
Maximum Abdomen Rib Deflection	mm	45*	25.881

*Proposed IARV

Supplemental restraint information is given below:

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

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

GENERAL COMMENTS

Left A-Post @ Sill Y recorded questionable data.
Left Lower A-Post Y recorded questionable data.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20235101	Traction Control System (TCS)	Yes
Model Year	2023	Auto-Leveling System	No
Make	Toyota	Automatic Door Locks (ADL)	Yes
Model	RAV4 Prime SE AWD	Power Window Auto-Reverse	Yes
Body Style	5-Door SUV	Other Optional Feature	No
VIN	JTMAB3FV4PD131986	Driver Front Airbag	Yes
Body Color	Silver Sky Metallic	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	14 km / 9 mi	Driver Head/Torso Airbag	No
Engine Displacement (L)	2.5 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	ECVT	Rear Pass. Curtain Airbag	Yes
Overdrive	Yes	Rear Pass. Head/Torso Airbag	No
Final Drive	AWD	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	No

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

DATA FROM CERTIFICATION LABEL

Manufactured By	TOYOTA MOTOR CORPORATION
Date of Manufacture	03/23
Vehicle Type	MPV

GVWR (kg)	2510
GAWR Front (kg)	1265
GAWR Rear (kg)	1315

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3		5	
Capacity Weight (VCW) (kg)				440	(A)
DSC x 68 kg				340	(B)
Rated Cargo and Luggage Weight (RCLW) (kg)				91	(A-B)

* Rated Cargo and Luggage Weight (RCLW) reduced by 9 kg to account for Load Carrying Capacity Reduction Label.

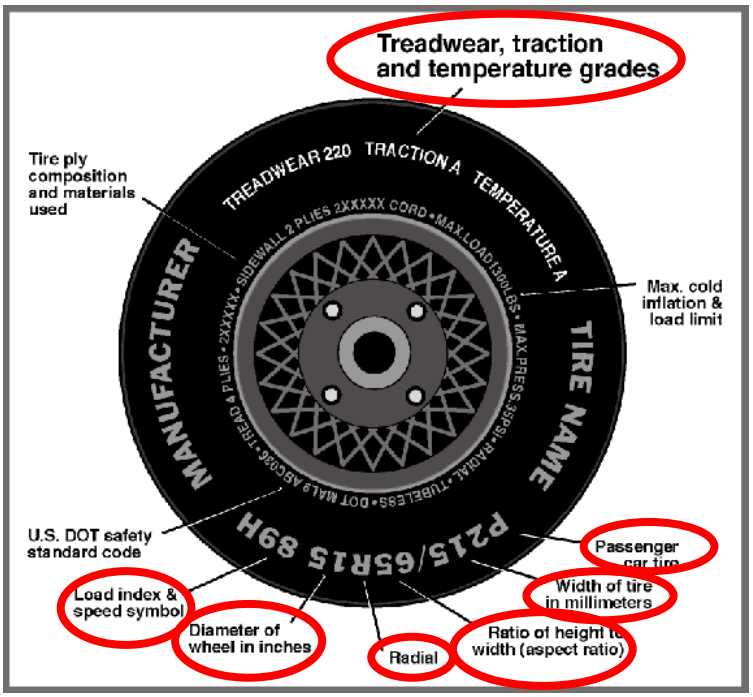
VEHICLE SEAT TYPE

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: 2023 RAV4 Prime SE AWD 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: M20235101
Test Date: 9/1/2023

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	230	230
Recommended Tire Size	225/60R18	225/60R18
Tire Size on Vehicle	225/60R18	225/60R18
Tire Manufacturer	Dunlop	Dunlop
Tire Model	Grand Trek	Grand Trek
Treadwear	360	360
Traction	B	B
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	100H	100H
Tire Material	Rubber	Rubber
DOT Safety Code Left	U2HD 3M9R 1223	U2HD 3M9R 1223
DOT Safety Code Right	U2HD 3M9R 1223	U2HD 3M9R 1223

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

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

TEST PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	270	270	270	280
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	547.5	440.0		548.0	514.5		556.5	518.5	
Right	kg	539.0	420.0		548.0	471.0		539.5	474.5	
Ratio	%	55.8%	44.2%		52.7%	47.3%		52.5%	47.5%	
Totals	kg	1086.5	860.0	1946.5	1096.0	985.5	2081.5	1096.0	993.0	2089.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1946.5	(A)
Actual Weight of 1 P572 ATD (SID-IIs) Used	kg	52	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	91	(C)
Calculated Test Vehicle Target Weight (TVTW)	kg	2089.5	(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	-0.7	0.1	0.2	Yes
Front Pass. Door Sill Angle (front-to-back)*	deg	-0.5	0.1	0.2	Yes
Front Bumper Angle (left-to-right)**	deg	0.0	0.5	0.6	Yes
Rear Bumper Angle (left-to-right)**	deg	0.3	0.0	0.0	Yes
Vehicle CG (Aft of Front Axle)	mm	1186	1271	1276	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	12	17	23	

* 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	64
Components Removed: none	kg	

Test height adjustable suspension setting, if applicable:	Not Applicable

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

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

TEST SURFACE MARKINGS

	Distance from 75° Impact Location Line (mm)
Fore 25 mm Target	927
Aft 25 mm Target	930

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

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

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	20.2	9.2	14.7
Front Passenger Seat	Fixed	Fixed	Fixed
Front Center Seat			
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed

SEAT HEIGHT AND ANGLE

Seat	As-Tested SCRL Angle (Mid) (°)	As-Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rear-Most	Mid	Forward-Most
Driver Seat	14.7	26	Max	52	52	52
			Mid	26	26	26
			Min	0	0	0
Front Passenger Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Front Center Seat			Max			
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed

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

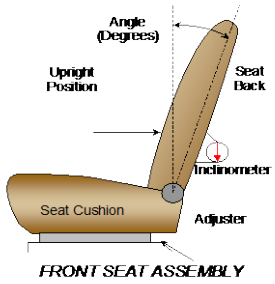
Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

SEAT FORE/AFT POSITIONS

Seat	Total Fore/Aft Travel		Test Position from Forward-Most Position	
	mm	Detents (1st as 1)	mm	Detent (1st as 0)
Driver Seat	240		0	
Front Passenger Seat	240	25	0	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. The struck-side rear passenger seat back is positioned in accordance with the information provided by the manufacturer on S1 – Vehicle Setup Information for the 5th percentile female dummy in a Side NCAP MDB test. The rear center and non-struck side rear passenger's seat back is set to match the struck-side rear seat back.



Seat	Total Seat Back Angle Range		Test Position from Vertical	
	Degrees	Detents (1st as 1)	Degrees	Detent (1st as 0)
Driver Seat	51.0		-4.5	
Front Passenger Seat	51.8	28	-4.6	3
Front Center Seat				
Struck Side Rear Seat	3.8	2	15.7	0
Non-Struck Side Rear Seat	3.8	2	15.7	0
Rear Center Seat	3.8	2	15.7	0

All seat back angles measured on outboard headrest post.

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on S1 – Vehicle Setup Information.

	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

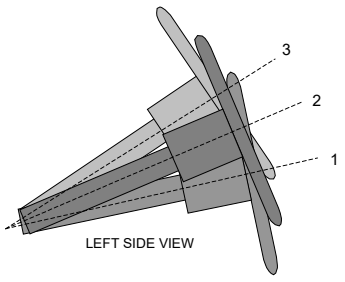
DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

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.

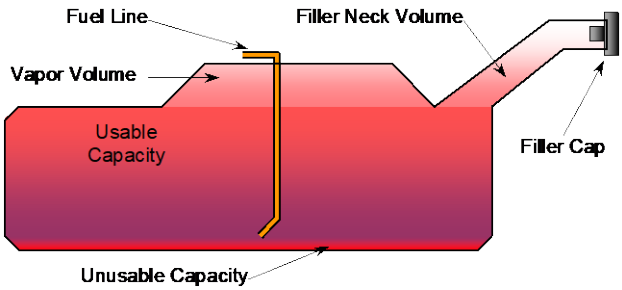
	Wheel Angle (°)	Fore/Aft Position (mm)
Lowermost, Position 1	68.5	
Geometric Center, Position 2	66.5	
Uppermost, Position 3	64.4	
Telescoping Steering Wheel Travel		58
Test Position	66.5	29



STEERING COLUMN ASSEMBLY

FUEL PUMP

The vehicle is equipped with an electronic fuel pump. The fuel pump is activated when the ignition is turned on. The filler neck is located on the driver's side.



VEHICLE FUEL TANK ASSEMBLY

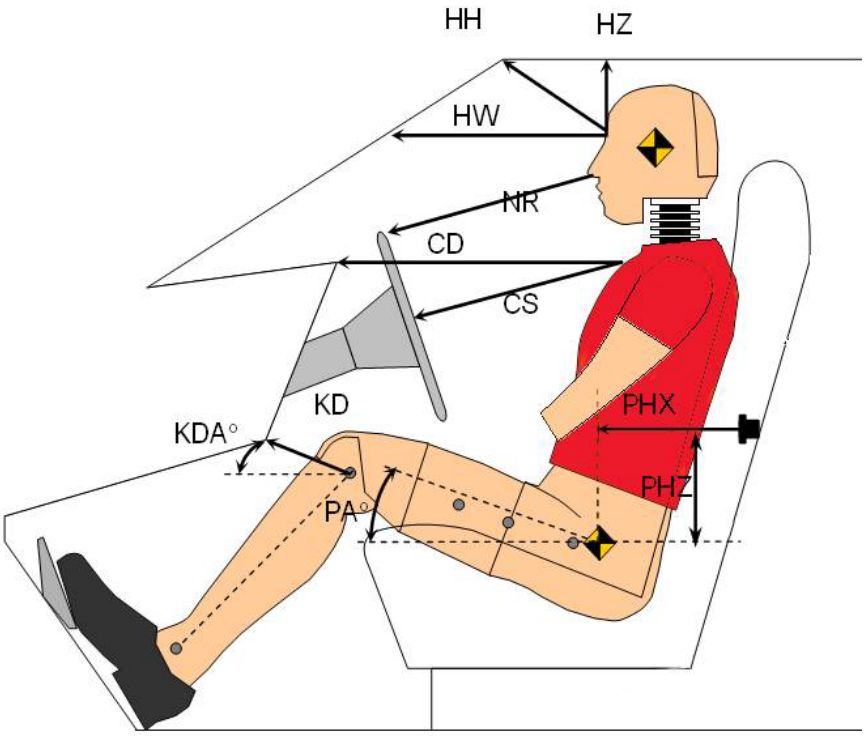
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of Standard Tank (see S1 – Vehicle Setup Information)	54.1
Usable Capacity of Optional Tank (see S1 – Vehicle Setup Information)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	54.9
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	50.3
Actual Amount of Solvent Used	50.3
1/3 of Usable Capacity	18.0

Is the actual amount of solvent used in the test equal to 93% ± 1% of the Usable Capacity stated in S1 – Vehicle Setup Information? **YES**

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: M20235101
Test Date: 9/1/2023

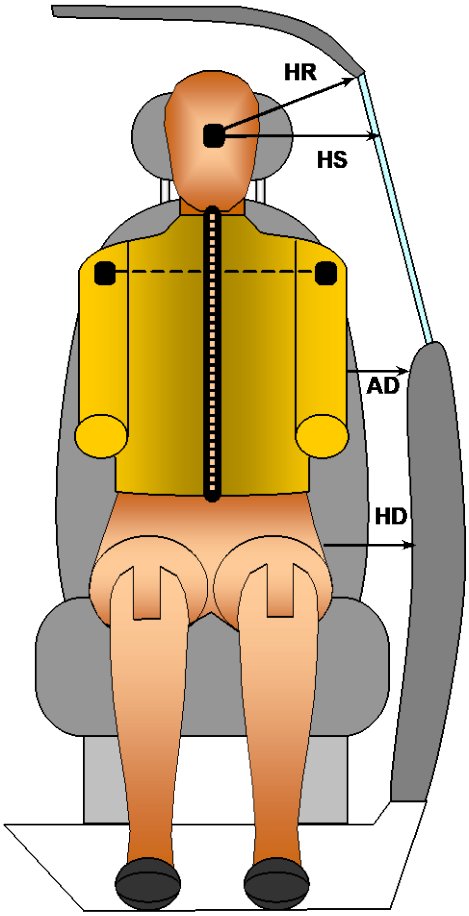


LEFT SIDE VIEW

Code	Measurement Description	Driver	
		Length (mm)	Angle (°)
HH	Head to Header	250	
HW	Head to Windshield	536	
HZ	Head to Roof Liner	180	
NR	Nose to Rim/Seat Back	234	
CD	Chest to Dashboard/Seat Back	400	
CS	Chest to Steering Wheel	169	
KDL / KDAL	Left Knee to Dash/Seat Back	100	34.1
KDR / KDAL	Right Knee to Dash/Seat Back	103	34.0
PAX	Pelvic Tilt Angle X		21.1
PAY	Pelvic Tilt Angle Y		-0.8
PHX	Hip Point to Striker (X-Axis)	336	
PHZ	Hip Point to Striker (Z-Axis)	173	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: M20235101
Test Date: 9/1/2023

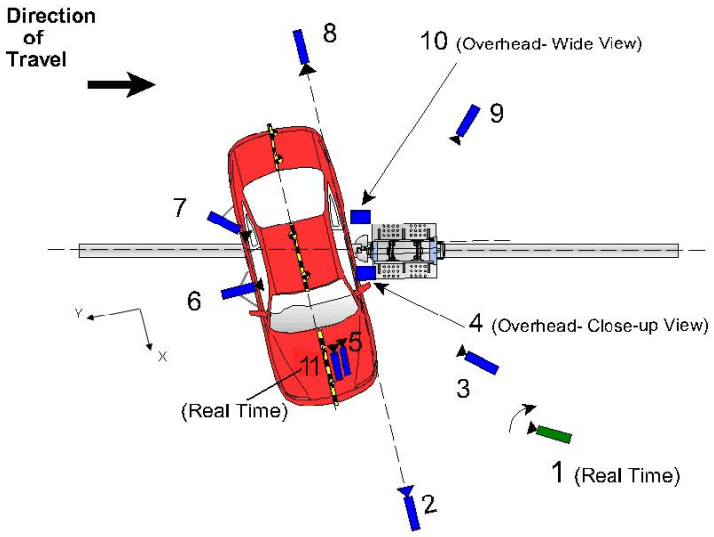


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver
		Length (mm)
HR	Head to Side Header	246
HS	Head to Side Window	375
AD	Arm to Door	180
HD	Hip Point to Door	180

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023



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	6090	-30	-1460	24	1000
3	Impact Side 45° Forward	4095	-1890	-1505	12	1000
4	Overhead Closeup	0	0	-6670	85	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	-7300	-35	-1500	24	1000
9	Impact Side 45° Rearward	-3005	-3490	-1505	12	1000
10	Overhead Wide View	40	680	-6650	12	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.

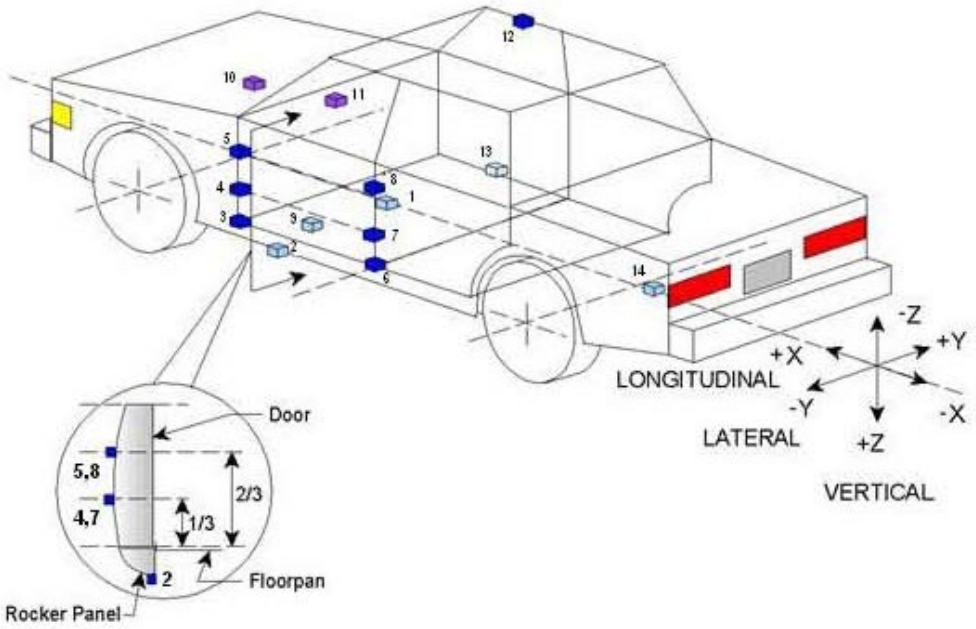
Explain why camera(s) did not operate as intended: None

INSTRUMENTATION

	Number of Channels
Driver Dummy	21
Vehicle Structure	18
Pole Load Cells	8
Total	47

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: M20235101
Test Date: 9/1/2023



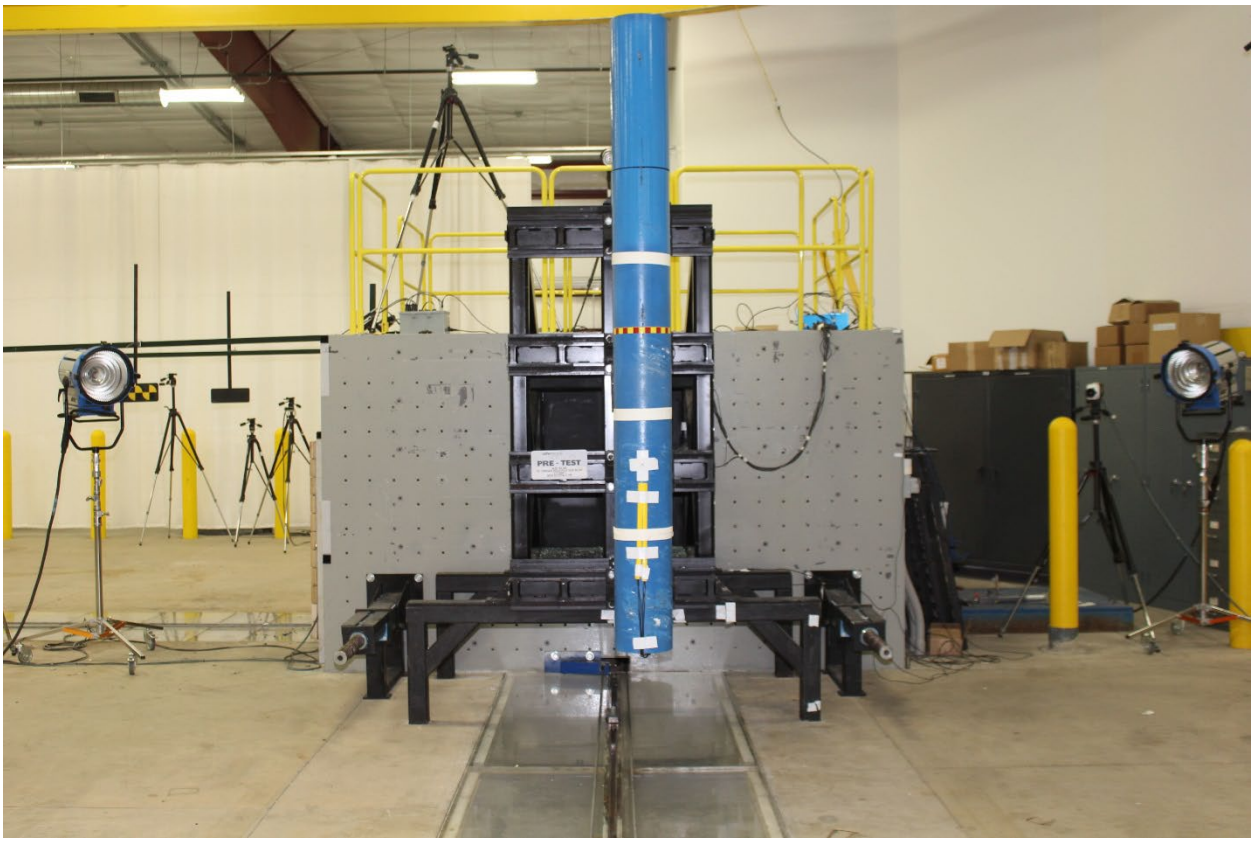
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2394	0	-209
2	Left Floor Sill	2998	-762	-295
3	A Pillar Sill	3197	-762	-295
4	A Pillar Low	3103	-820	-517
5	A Pillar Mid	3103	-820	-754
6	B Pillar Sill	2060	-762	-300
7	B Pillar Low	1988	-727	-691
8	B Pillar Mid	1988	-727	-883
9	Driver Seat Track	2173	-383	-382
10	Engine Top	3879	193	-879
11	Firewall	3522	12	-974
12	Right Roof	2289	459	-1619
13	Right Floor Sill	2998	762	-295
14	Rear Floorpan	978	0	-631

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: 2023 RAV4 Prime SE AWD 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: M20235101
Test Date: 9/1/2023



254 mm Diameter Rigid Pole

Load Cell Locations	
ID	**Height from Test 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: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Driver Dummy (SID-IIs)
Face	Curtain Airbag
Top of Head	Curtain Airbag
Left Side of Head	Curtain Airbag
Back of Head	Curtain Airbag, Headrest
Left Shoulder	Side Torso/Pelvis Airbag, Seatback
Upper Torso	Seatback
Lower Torso	Side Torso/Pelvis Airbag, Seatback
Left Hip	Side Torso/Pelvis Airbag, Seat Cushion
Left Knee	None

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	No Separation
Windshield Damage	Broken
Side Window Damage	LF window cracked
Other Notable Effects	Windshield separated at driver A-pillar

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

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

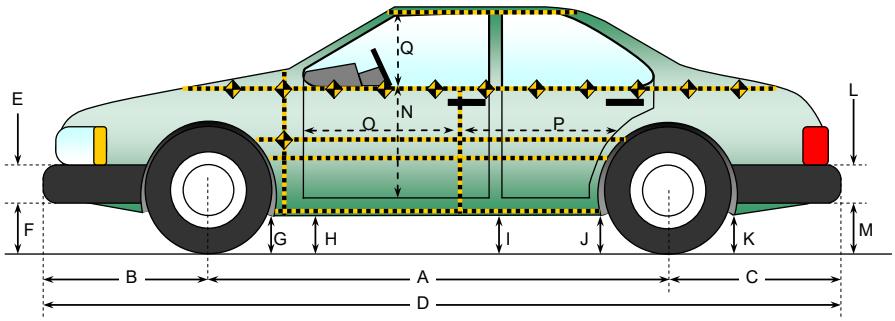
Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	
Side Airbag (Other)				
Seat Belt Pretensioner	Yes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

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		1095
Actual Impact Point (Aft of Front Axle)	mm		1097
Horizontal Offset (+forward / -rearward)	mm	+/- 38 of Intended Impact Point	-2
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	degrees	75 +/- 3	
Trap No. 1 Velocity (Primary)	km/h	31.4 to 33.0	32.13
Trap No. 2 Velocity (Redundant)	km/h	31.4 to 33.0	32.19

DATA SHEET NO. 9
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: M20235101
Test Date: 9/1/2023



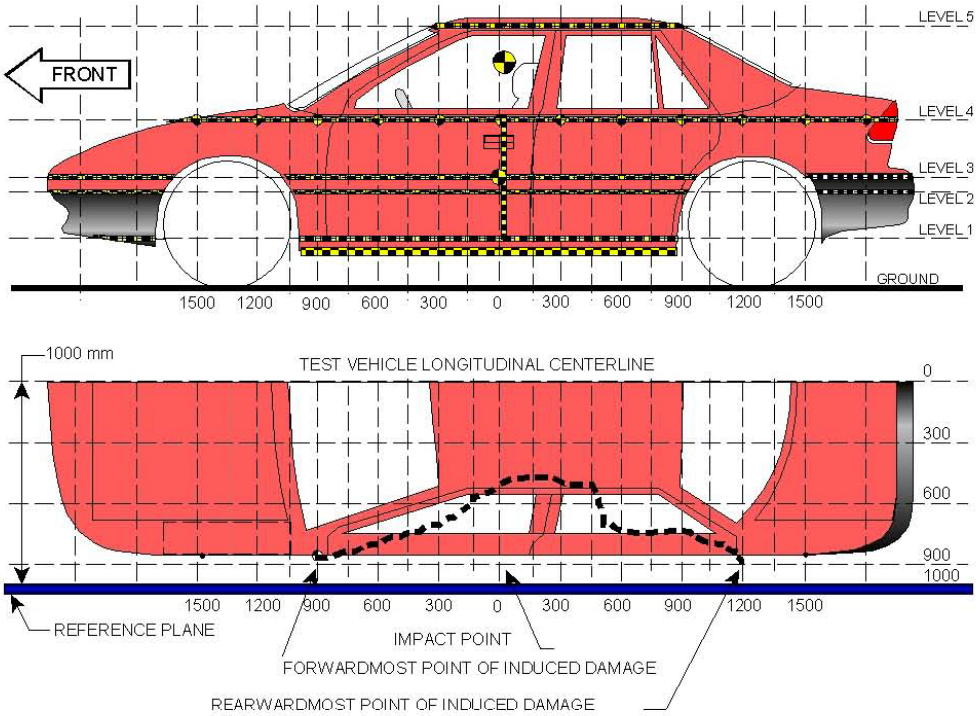
All measurements in (mm) with tolerance of ± 3 mm
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Change
A	Wheelbase	2685	2625	-60
B	Front Axle to FSOV	933	880	-53
C	Rear Axle to RSOV	978	965	-13
D	Total Vehicle Length at Centerline	4596	4470	-126
E	Front Bumper Thickness	136	136	0
F	Front Bumper Bottom to Ground	246	270	24
G	Sill Height at Front Wheel Well	274	267	-7
H	Sill Height at Front Door Leading Edge	275	267	-8
I	Sill Height at B-Pillar	283	291	8
J1	Sill Height at Rear Wheel Well	281	293	12
J2	Pinch Weld Height at Rear Wheel Well	283	295	12
K	Sill Height Aft of Rear Wheel Well	236	234	-2
L	Rear Bumper Thickness	118	118	0
M	Rear Bumper Bottom to Ground	316	308	-8
N	Sill Height to Bottom of Front Window Sill	680	678	-2
O	Front Door Leading Edge to Impact CL	630	600	-30
P	Rear Door Trailing Edge to Impact CL	1161	1069	-92
Q	Front Window Opening	418	388	-30
R	Right Side Length	3534	3539	5
S	Left Side Length	3534	3522	-12
T	Vehicle Width at B-Pillars	1877	1878	1
U	Front Wheel Track Width	1603		
V	Rear Wheel Track Width	1616		

DATA SHEET NO. 10
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: M20235101
Test Date: 9/1/2023



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	491	345	0
2	Mid Door	692	362	0
3	Occupant H-Point	716	360	0
4	Window Sill	1083	305	0
5	Window Top	1590	99	300

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

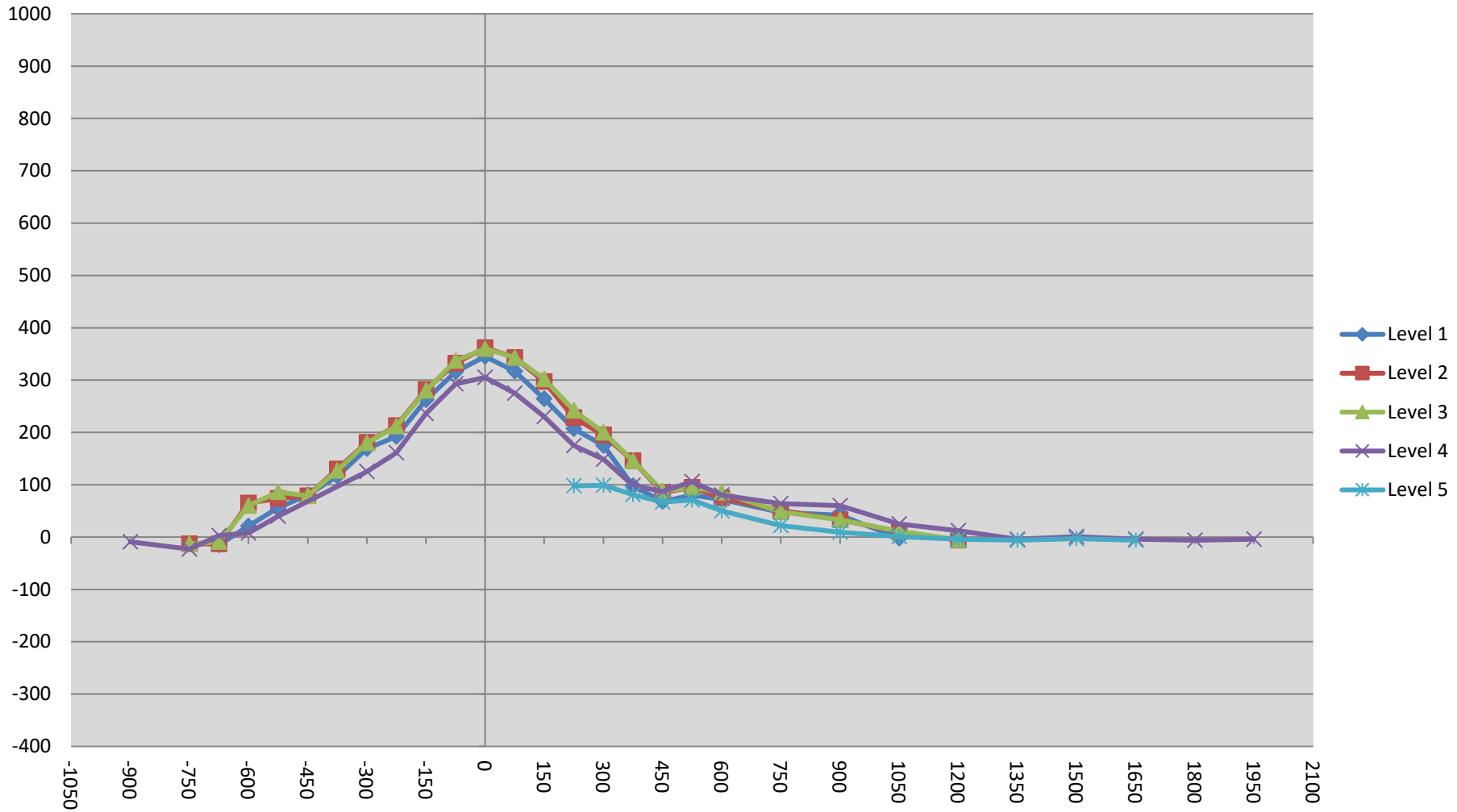
Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

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					Exterior Crush				
	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				284					275					-9	
-825															
-750		169	169	289			156	156	266			-13	-13	-23	
-675	189	172	172	263		174	159	163	266		-15	-13	-9	3	
-600	191	177	177	264		212	242	237	272		21	65	60	8	
-525	199	179	179	265		255	253	265	305		56	74	86	40	
-450	203	179	179			283	258	258			80	79	79		
-375	205	179	179			321	309	306			116	130	127		
-300	204	179	179	265		373	360	359	390		169	181	180	125	
-225	202	179	179	262		394	392	391	423		192	213	212	161	
-150	200	180	180	256		462	462	460	492		262	282	280	236	
-75	200	181	181	253		516	513	518	546		316	332	337	293	
0	198	181	181	249		543	543	541	554		345	362	360	305	
75	198	182	182	245		515	525	525	520		317	343	343	275	
150	197	184	184	241		461	481	486	471		264	297	302	230	
225	196	185	185	238	510	403	413	427	413	608	207	228	242	175	98
300	196	186	186	236	492	371	381	386	385	591	175	195	200	149	99
375	196	188	188	235	478	294	334	334	334	559	98	146	146	99	81
450	196	190	190	231	472	264	275	278	318	539	68	85	88	87	67
525	196	191	191	230	470	276	286	286	336	541	80	95	95	106	71
600	195	193	193	228	468	267	268	278	308	518	72	75	85	80	50
675															
750	196	190	190	229	471	243	241	238	293	493	47	51	48	64	22
825															
900	191	185	185	228	474	233	218	218	288	483	42	33	33	60	9
1050	187	178	178	229	478	185	188	189	254	479	-2	10	11	25	1
1200		172	172	240	482		166	167	252	478		-6	-5	12	-4
1350				244	493				240	487				-4	-6
1500				241	495				242	492				1	-3
1650				242	520				238	514				-4	-6
1800				240					234					-6	
1950				249					245					-4	
2100															
2250															
2400															
2550															
2700															

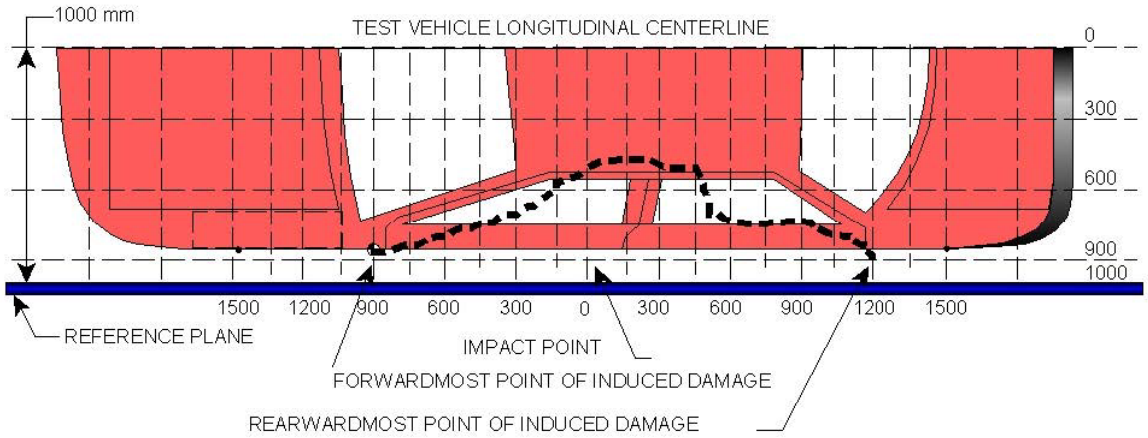
DATA SHEET NO. 10 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: M20235101
Test Date: 9/1/2023



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

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: M20235101
Test Date: 9/1/2023



VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Pre-Test (mm)	Post-Test (mm)	Max. Static Crush (mm)
1	450	3	190	278	88
2	225	3	185	427	242
3	0	3	181	541	360
4	-225	3	179	391	212
5	-450	3	179	258	79
6	-675	3	172	162	-10

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

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No.: M20235101
Test Date: 9/1/2023

Test Time: 12:27 pm
Temperature: 21.3°C

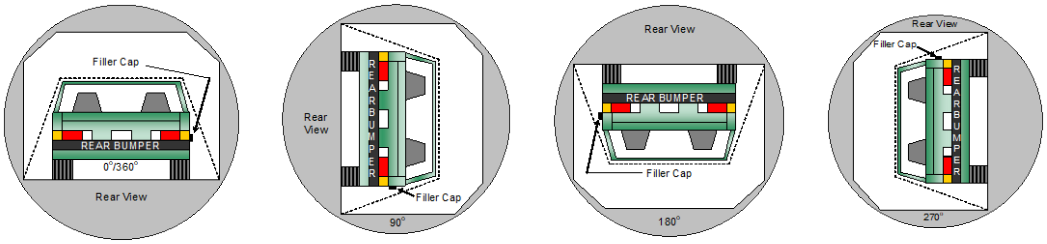
A. From impact until vehicle motion ceases: (Maximum Allowable = 1 ounce) 0.0 oz.

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

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

D. Spillage Details: None

FMVSS 301 STATIC ROLLOVER DATA



0°/360° 90° 180° 270°

ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	112	300	412
90° to 180°	111	300	411
180° to 270°	108	300	408
270° to 360°	113	300	413

FMVSS 301 ROLLOVER SPILLAGE TABLE (UNITS IN OUNCES)

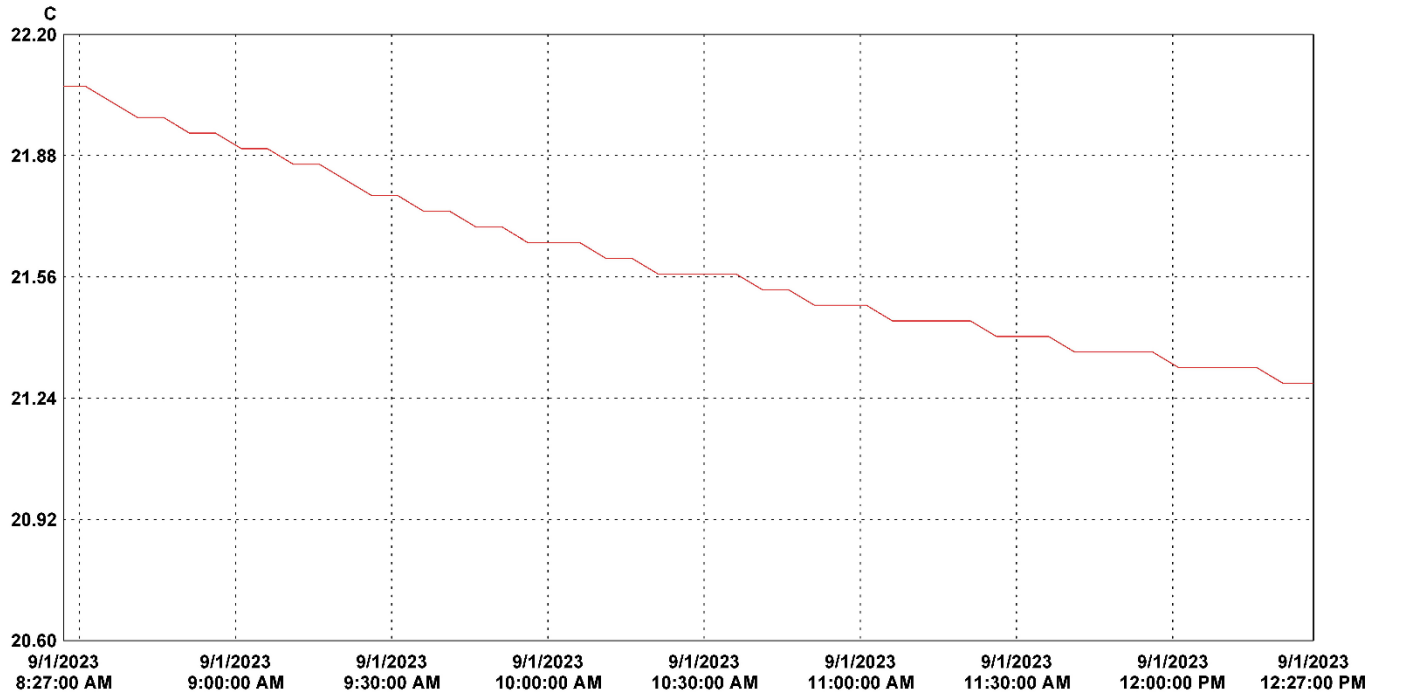
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0.0	0.0	0.0	
90° to 180°	0.0	0.0	0.0	
180° to 270°	0.0	0.0	0.0	
270° to 360°	0.0	0.0	0.0	

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: 2023 RAV4 Prime SE AWD 5-Door SUV
NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test
Test Date: 9/1/2023



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	18352041	VSC_South_Hall	1		22.06	21.60	21.28	C	Temperature	18352041_VSC_South_Hall (11-1-2023).spl

DATA SHEET NO. 305-1
GENERAL TEST AND VEHICLE PARAMETER DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

ELECTRIC VEHICLE PROPULSION SYSTEM

	Units	Observations and Conclusions
Type of Electric Vehicle		Gasoline-Electric Hybrid
Propulsion Battery Type		Li-ion battery
Nominal Voltage	V	355.2
Physical Location of Automatic Propulsion Battery Disconnect		Inside of the traction battery
Auxiliary Battery Type		LN2

PROPULSION BATTERY SYSTEM DATA

	Units		Observations and Conclusions
Electrolyte Fluid Type			Organic electrolyte
Electrolyte Fluid Specific Gravity	g/L		1255
Electrolyte Fluid Kinematic Viscosity	cSt		4.0
Electrolyte Fluid Color			Clear
Propulsion Battery Coolant Type, Color, Specific Gravity (if applicable)			N/A
Location of Battery Modules			Inside Passenger Compartment
		X	Outside Passenger Compartment
			The high-voltage battery is located below the occupant compartment

PROPULSION BATTERY STATE OF CHARGE

For all battery types:	
Voltage range corresponding to **useable energy** of the battery:	
Minimum State of Charge	
Maximum State of Charge	403.2
95% of Maximum State of Charge	383.0
Test Voltage - No less than 95% of maximum State of Charge	389.6
For batteries that are rechargeable ONLY by an energy source on the vehicle:	
Voltage range corresponding to **useable energy** of the battery:	
Minimum State of Charge	
Maximum State of Charge	
Test Voltage – Maximum practicable State of Charge within Normal Operating Range	

DATA SHEET NO. 305-2
PRE-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2023 RAV4 Prime SE AWD 5-Door SUV	NHTSA No.:	M20235101
Test Program:	NCAP Side Pole Impact Test	Test Date:	9/1/2023

VEHICLE CHASSIS GROUND POINT(S) LOCATION(S)

Details of Vehicle Chassis Ground Point(s) & Location(s)	Cargo area grounding plate shared with 12V auxiliary battery ground

PROPULSION BATTERY SYSTEM

Details of Electric Energy Storage/Conversion System Test Points	Connected at + and – terminal ends of propulsion system
Additional Comments	None

DATA SHEET NO. 305-3
PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		Fluke
Model		177
Serial Number		57580164
Internal Impedance Value	MΩ	> 10 MΩ < 100 pF
Resolution	V	0.001
Last Calibration Date		9/1/2023

PROPULSION BATTERY VOLTAGE

Measurement shall be made with Energy Storage/Conversion System connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion system energized) position.

NOTE: If voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.

Vb	V	389.6

ELECTRIC ISOLATION MEASUREMENTS
PROPULSION BATTERY TO VEHICLE CHASSIS

Vehicle chassis point(s) determined and supplied to contractor by COR.

V1	V	
V2	V	

PROPULSION BATTERY TO VEHICLE CHASSIS ACROSS RESISTOR

The known resistance Ro (in ohms) should be approximately 500 times the normal operating voltage of the vehicle (in volts) per SAE J1766.

Ro	Ω	

V1' Pre-Impact	V	
V2' Pre-Impact	V	

DATA SHEET NO. 305-3 (CONTINUED)
PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2023 RAV4 Prime SE AWD 5-Door SUV	NHTSA No.:	M20235101
Test Program:	NCAP Side Pole Impact Test	Test Date:	9/1/2023

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record “Zero Volts”.
This “zero voltage” condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1’)/V1’]		
Ri1 Pre-Impact	Ω	
Ri2 = Ro (1 + V1/V2) [(V2-V2’)/V2’]		
Ri2 Pre-Impact	Ω	
Ri = The lesser of Ri1 and Ri2		
Ri Pre-Impact	Ω	
Ri / Vb = Electrical Isolation Value / Nominal Battery Voltage		
Ri / Vb Pre-Impact	Ω	

NOTE: The minimum Electrical Isolation Value is 500 Ω/V.

	Yes	No (Fail)
Is the measured Electrical Isolation Value ≥ 500 Ω/V?		
Additional Comments	Not Applicable, vehicle was certified to FMVSS No. 305 S5.3(c).	

DATA SHEET NO. 305-4
POST-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		Fluke
Model		177
Serial Number		57580164
Internal Impedance Value	MΩ	> 10 MΩ < 100 pF
Resolution	V	0.001
Last Calibration Date		9/1/2023

ELECTRICAL ISOLATION MEASUREMENTS

Vb Post-Impact	V	

V1 Post-Impact	V		Impact Time		Minutes		Seconds
V2 Post-Impact	V				Minutes		Seconds
V1' Post-Impact	V				Minutes		Seconds
V2' Post-Impact	V				Minutes		Seconds

DATA SHEET NO. 305-4 (CONTINUED)
POST-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2023 RAV4 Prime SE AWD 5-Door SUV	NHTSA No.:	M20235101
Test Program:	NCAP Side Pole Impact Test	Test Date:	9/1/2023

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']							
Ri1 Post-Impact	Ω		Impact Time		Minutes		Seconds
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']							
Ri2 Post-Impact	Ω		Impact Time		Minutes		Seconds
Ri = The lesser of Ri1 and Ri2							
Ri Post-Impact	Ω		Impact Time		Minutes		Seconds
Ri / Vb = Electrical Isolation Value / Nominal Battery Voltage							
Ri / Vb Post-Impact	Ω		Impact Time		Minutes		Seconds

NOTE: The minimum Electrical Isolation Value is 500 Ω/V.

	Yes	No (Fail)
Is the measured Electrical Isolation Value ≥ 500 Ω/V?		
Additional Comments	Not Applicable, vehicle was certified to FMVSS No. 305 S5.3(c).	

DATA SHEET NO. 305-4 (CONTINUED)
POST-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2023 RAV4 Prime SE AWD 5-Door SUV	NHTSA No.:	M20235101
Test Program:	NCAP Side Pole Impact Test	Test Date:	9/1/2023

PROPULSION BATTERY SYSTEM COMPONENTS

Describe any Propulsion Battery Module movement within the passenger compartment [Supply photographs as appropriate]:
Not Applicable

	Yes (Fail)	No
Has the Propulsion Battery Module moved within the passenger compartment?		X

Describe intrusion of an outside Propulsion Battery Component into the passenger compartment [Supply photographs as appropriate]:
No Intrusion

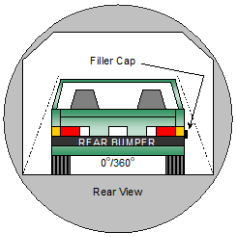
	Yes (Fail)	No
Has an outside Propulsion Battery Component intruded into the passenger compartment?		X

	Yes (Fail)	No
Is the Propulsion Battery Electrolyte Spillage visible in the passenger compartment?		X

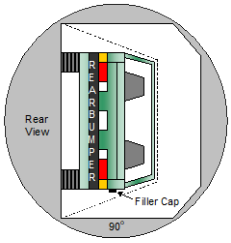
DATA SHEET NO. 305-5
STATIC ROLLOVER TEST DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

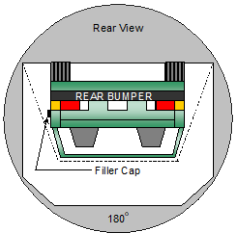
PROPULSION BATTERY SYSTEM COMPONENTS



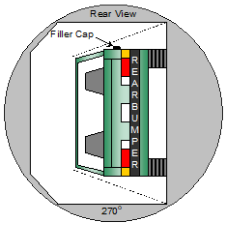
0°/360°



90°



180°



270°

PROPULSION BATTERY ELECTROLYTE COLLECTION TIME PERIOD

Test Phase	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	1	min	52	sec	5	min	6	min	52	sec	7	min
90° - 180°	1	min	51	sec	5	min	6	min	51	sec	7	min
180° - 270°	1	min	48	sec	5	min	6	min	48	sec	7	min
270° - 360°	1	min	53	sec	5	min	6	min	53	sec	7	min

TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE

NOTE: The maximum allowable Propulsion Battery Electrolyte Spillage is 5.0 Liters.

Test Phase	Propulsion Battery Electrolyte Spillage (L)	Spillage Location
0° to 90°	0	Not Applicable
90° to 180°	0	Not Applicable
180° to 270°	0	Not Applicable
270° to 360°	0	Not Applicable
Total Spillage	0	

	Yes (Fail)	No
Is the total Propulsion Battery Electrolyte Spillage greater than 5.0 Liters?		X
Is the Propulsion Battery Electrolyte Spillage visible in the passenger compartment?		X

DATA SHEET NO. 305-5 (CONTINUED)
STATIC ROLLOVER TEST DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		Fluke
Model		177
Serial Number		57580164
Internal Impedance Value	MΩ	> 10 MΩ < 100 pF
Resolution	V	0.001
Last Calibration Date		9/1/2023

ELECTRICAL ISOLATION MEASUREMENTS

Vb Post-Impact	V	

Record V1, V2, V1', V2' voltage measurements at the start of each successive increment of 90°, 180°, 270°, and 360° of the static rollover test.

	Voltage	Units	Test Phase	Time			
V1		V	0°		min		sec
			90°				
			180°				
			270°				
			360°				
V2		V	0°		min		sec
			90°				
			180°				
			270°				
			360°				
V1'		V	0°		min		sec
			90°				
			180°				
			270°				
			360°				
V2'		V	0°		min		sec
			90°				
			180°				
			270°				
			360°				

DATA SHEET NO. 305-5 (CONTINUED)
STATIC ROLLOVER TEST DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

	Voltage	Units	Test Phase	Time			
Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']							
Ri1		Ω	0°		min		sec
			90°				
			180°				
			270°				
			360°				
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']							
Ri2		Ω	0°		min		sec
			90°				
			180°				
			270°				
			360°				
Ri = The lesser of Ri1 and Ri2							
Ri		Ω	0°		min		sec
			90°				
			180°				
			270°				
			360°				
Ri / Vb = Electrical Isolation Value / Nominal Battery Voltage							
Ri / Vb		Ω/V	0°		min		sec
			90°				
			180°				
			270°				
			360°				

NOTE: The minimum Electrical Isolation Value is 500 Ω/V.

	Yes	No (Fail)
Is the measured Electrical Isolation Value ≥ 500 Ω/V?		
Additional Comments	Not Applicable, vehicle was certified to FMVSS No. 305 S5.3(c).	

DATA SHEET NO. 305A-1
EVALUATE PROTECTION FROM DIRECT CONTACT WITH HIGH VOLTAGES SOURCES FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

For each data point where the IPXXB probe is used to evaluate electrical protection from direct contact with high voltage sources, provide a thumbnail photo and be as descriptive of the locations as possible. If an apparent failure is detected, include a photograph showing the direct contact between probe and the high voltage source and/or the probe lamp being illuminated.

POST-CRASH / PRE-ROLLOVER

Description of Evaluated Location	Probe Contact with High Voltage Source		Probe Lamp Illuminated	
	Yes, Fail	No, Pass	Yes, Fail	No, Pass
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground		X		X
High-Voltage Battery Case to Electrical Ground		X		X
Rear Drive Unit to Electrical Ground		X		X
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground		X		X
Rear Drive Unit to High-Voltage Battery Case		X		X

STATIC ROLLOVER

Description of Evaluated Location	Probe Contact with High Voltage Source		Probe Lamp Illuminated	
	Yes, Fail	No, Pass	Yes, Fail	No, Pass
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground		X		X
High-Voltage Battery Case to Electrical Ground		X		X
Rear Drive Unit to Electrical Ground		X		X
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground		X		X
Rear Drive Unit to High-Voltage Battery Case		X		X

POST-ROLLOVER

Description of Evaluated Location	Probe Contact with High Voltage Source		Probe Lamp Illuminated	
	Yes, Fail	No, Pass	Yes, Fail	No, Pass
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground		X		X
High-Voltage Battery Case to Electrical Ground		X		X
Rear Drive Unit to Electrical Ground		X		X
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground		X		X
Rear Drive Unit to High-Voltage Battery Case		X		X

DATA SHEET NO. 305A-2
EVALUATE PROTECTION AGAINST INDIRECT CONTACT WITH HIGH VOLTAGE SOURCES USING A RESISTANCE TESTER OR DC POWER SUPPLY, VOLTMETER AND AMMETER FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

For any measuring points where protection against indirect contact with high voltage sources is evaluated, provide a thumbnail photo and be as descriptive of the locations as possible. If an apparent failure is detected, include a photograph showing the locations in question and the related measured values. If the resistance is calculated using separately measured resistances, describe each measurement and the final calculation as separate entries in the table below.

Measuring Path	Pass	Fail
BC: *Between exposed conductive parts of the electrical protection barrier of the high voltage source and the electrical chassis.*	< 0.1 Ω	≥ 0.1 Ω
BB: *Between exposed conductive parts of the electrical protection barrier of the high voltage source and any other simultaneously reachable exposed conductive parts of the electrical protection barriers withing 2.5 meters.*	< 0.2 Ω	≥ 0.2 Ω

POST-CRASH / PRE-ROLLOVER

Description of Evaluated Location	Measuring Path	Method 2 ONLY		Methods 1 & 2	Pass *or* Fail
	BC *or* **BB**	**Voltage** (V) Volts	**Current** (I) Amps	**Resistance** (R=V/I) Ω	
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground	BC			0.02	Pass
High-Voltage Battery Case to Electrical Ground	BC			0.02	Pass
Rear Drive Unit to Electrical Ground	BC			0.01	Pass
Front Drive Unit / Inverter /Transmission Assembly to High-Voltage Battery Case	BB			0.00	Pass
Rear Drive Unit to High-Voltage Battery Case	BB			0.01	Pass
Front Drive Unit / Inverter /Transmission Assembly to Rear Drive Unit	BB			0.00	Pass

STATIC ROLLOVER

Description of Evaluated Location	Measuring Path	Method 2 ONLY		Methods 1 & 2	Pass *or* Fail
	BC *or* **BB**	**Voltage** (V) Volts	**Current** (I) Amps	**Resistance** (R=V/I) Ω	
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground	BC			0.00	Pass
High-Voltage Battery Case to Electrical Ground	BC			0.00	Pass
Rear Drive Unit to Electrical Ground	BC			0.01	Pass
Front Drive Unit / Inverter /Transmission Assembly to High-Voltage Battery Case	BB			0.01	Pass
Rear Drive Unit to High-Voltage Battery Case	BB			0.01	Pass
Front Drive Unit / Inverter /Transmission Assembly to Rear Drive Unit	BB			0.02	Pass

* Final resistance values reported after subtracting the resistance of the measurement device extensions.

DATA SHEET NO. 305A-2 (CONTINUED)
EVALUATE PROTECTION AGAINST INDIRECT CONTACT WITH HIGH VOLTAGE SOURCES USING A RESISTANCE TESTER OR DC POWER SUPPLY, VOLTMETER AND AMMETER FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

For any measuring points where protection against indirect contact with high voltage sources is evaluated, provide a thumbnail photo and be as descriptive of the locations as possible. If an apparent failure is detected, include a photograph showing the locations in question and the related measured values. If the resistance is calculated using separately measured resistances, describe each measurement and the final calculation as separate entries in the table below.

Measuring Path	Pass	Fail
BC: *Between exposed conductive parts of the electrical protection barrier of the high voltage source and the electrical chassis.*	< 0.1 Ω	≥ 0.1 Ω
BB: *Between exposed conductive parts of the electrical protection barrier of the high voltage source and any other simultaneously reachable exposed conductive parts of the electrical protection barriers withing 2.5 meters.*	< 0.2 Ω	≥ 0.2 Ω

POST-ROLLOVER

Description of Evaluated Location	Measuring Path	Method 2 ONLY		Methods 1 & 2	Pass *or* Fail
	BC *or* **BB**	**Voltage** (V) Volts	**Current** (I) Amps	**Resistance** (R=V/I) Ω	
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground	BC			0.00	Pass
High-Voltage Battery Case to Electrical Ground	BC			0.00	Pass
Rear Drive Unit to Electrical Ground	BC			0.01	Pass
Front Drive Unit / Inverter /Transmission Assembly to High-Voltage Battery Case	BB			0.01	Pass
Rear Drive Unit to High-Voltage Battery Case	BB			0.01	Pass
Front Drive Unit / Inverter /Transmission Assembly to Rear Drive Unit	BB			0.00	Pass

* Final resistance values reported after subtracting the resistance of the measurement device extensions.

DATA SHEET NO. 305A-3
DETERMINE VOLTAGE BETWEEN EXPOSED CONDUCTIVE PARTS OF ELECTRICAL PROTECTION BARRIERS AND THE ELECTRICAL CHASSIS AND BETWEEN EXPOSED PARTS OF ELECTRICAL PROTECTION BARRIERS

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

For each data point where the voltage between exposed conductive parts of electrical protection barriers and the electrical chassis and between exposed conductive parts of electrical protection barriers is determined, provide a thumbnail photo and be as descriptive of the locations as possible. If an apparent failure is detected, include a photograph showing the locations in question and the related measured values.

Measuring Path	Pass	Fail
BC: *Between exposed conductive parts of the electrical protection barrier of the high voltage source and the electrical chassis.*	≤ 30 VAC ≤ 60 VDC	> 30 VAC > 60 VDC
BB: *Between exposed conductive parts of the electrical protection barrier of the high voltage source and any other simultaneously reachable exposed conductive parts of the electrical protection barriers withing 2.5 meters.*	≤ 30 VAC ≤ 60 VDC	> 30 VAC > 60 VDC

POST-CRASH / PRE-ROLLOVER

Description of Evaluated Location	Measuring Path	Measured Voltage		Pass *or* Fail
	BC *or* **BB**	**VAC** (V) Volts	**VDC** (V) Volts	
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground	BC	0.0	0.0	Pass
High-Voltage Battery Case to Electrical Ground	BC	0.0	0.0	Pass
Rear Drive Unit to Electrical Ground	BC	0.0	0.0	Pass
Front Drive Unit / Inverter /Transmission Assembly to High-Voltage Battery Case	BB	0.0	0.0	Pass
Rear Drive Unit to High-Voltage Battery Case	BB	0.0	0.0	Pass
Front Drive Unit / Inverter /Transmission Assembly to Rear Drive Unit	BB	0.0	0.0	Pass

STATIC ROLLOVER

Description of Evaluated Location	Measuring Path	Measured Voltage		Pass *or* Fail
	BC *or* **BB**	**VAC** (V) Volts	**VDC** (V) Volts	
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground	BC	0.0	0.0	Pass
High-Voltage Battery Case to Electrical Ground	BC	0.0	0.0	Pass
Rear Drive Unit to Electrical Ground	BC	0.0	0.0	Pass
Front Drive Unit / Inverter /Transmission Assembly to High-Voltage Battery Case	BB	0.0	0.0	Pass
Rear Drive Unit to High-Voltage Battery Case	BB	0.0	0.0	Pass
Front Drive Unit / Inverter /Transmission Assembly to Rear Drive Unit	BB	0.0	0.0	Pass

DATA SHEET NO. 305A-3 (CONTINUED)
DETERMINE VOLTAGE BETWEEN EXPOSED CONDUCTIVE PARTS OF ELECTRICAL PROTECTION BARRIERS AND THE ELECTRICAL CHASSIS AND BETWEEN EXPOSED PARTS OF ELECTRICAL PROTECTION BARRIERS

Test Vehicle: 2023 RAV4 Prime SE AWD 5-Door SUV NHTSA No.: M20235101
Test Program: NCAP Side Pole Impact Test Test Date: 9/1/2023

POST-ROLLOVER

Description of Evaluated Location	**Measuring Path**	**Measured Voltage**		**Pass** *or* **Fail**
	BC *or* **BB**	**VAC** (V) Volts	**VDC** (V) Volts	
Front Drive Unit / Inverter /Transmission Assembly to Electrical Ground	BC	0.0	0.0	Pass
High-Voltage Battery Case to Electrical Ground	BC	0.0	0.0	Pass
Rear Drive Unit to Electrical Ground	BC	0.0	0.0	Pass
Front Drive Unit / Inverter /Transmission Assembly to High-Voltage Battery Case	BB	0.0	0.0	Pass
Rear Drive Unit to High-Voltage Battery Case	BB	0.0	0.0	Pass
Front Drive Unit / Inverter /Transmission Assembly to Rear Drive Unit	BB	0.0	0.0	Pass

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

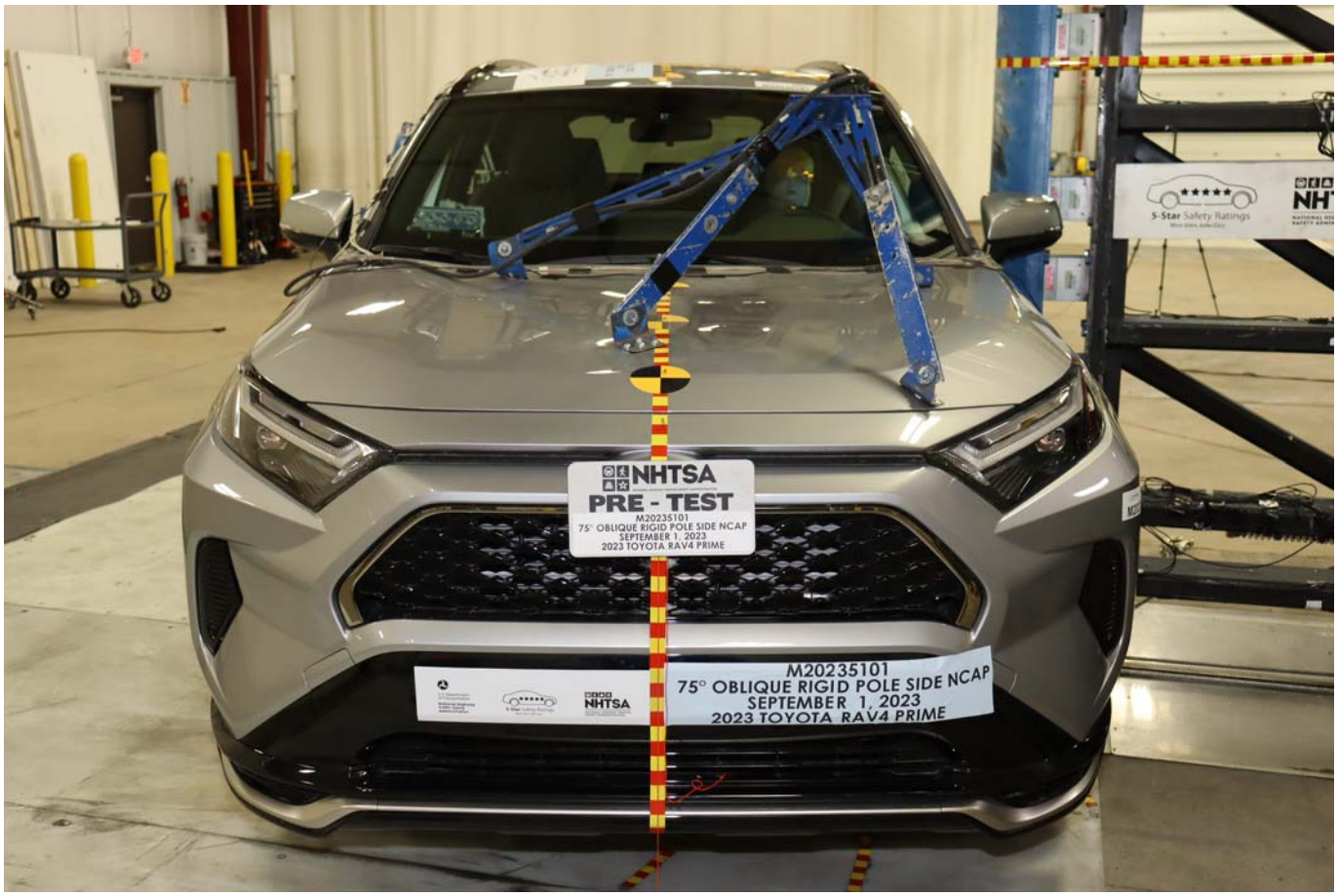


Photo No. 003 - Pre-Test Frontal View of Test Vehicle

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

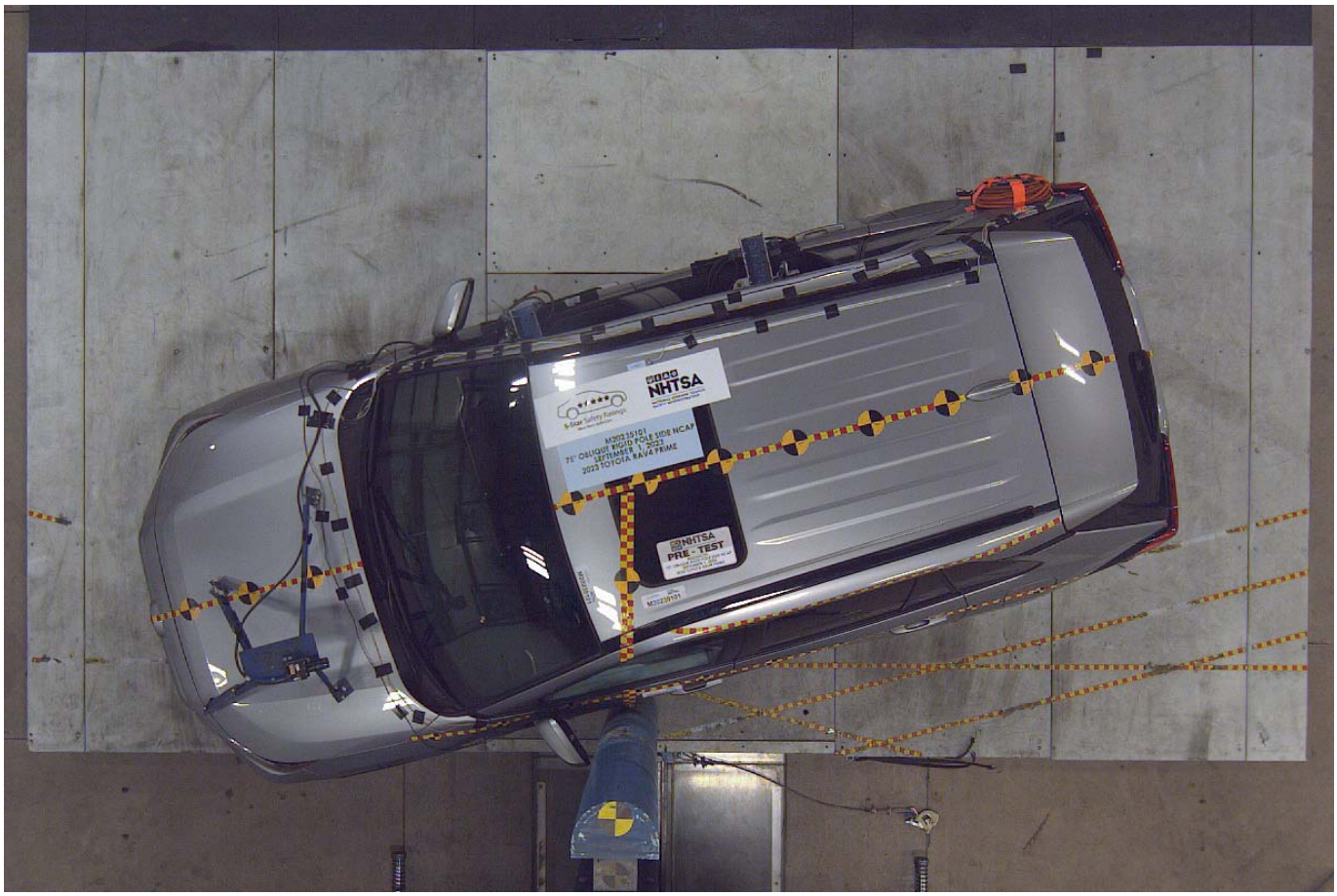


Photo No. 015 - Pre-Test Overhead View of Test Area

PHOTOGRAPH NOT AVAILABLE

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

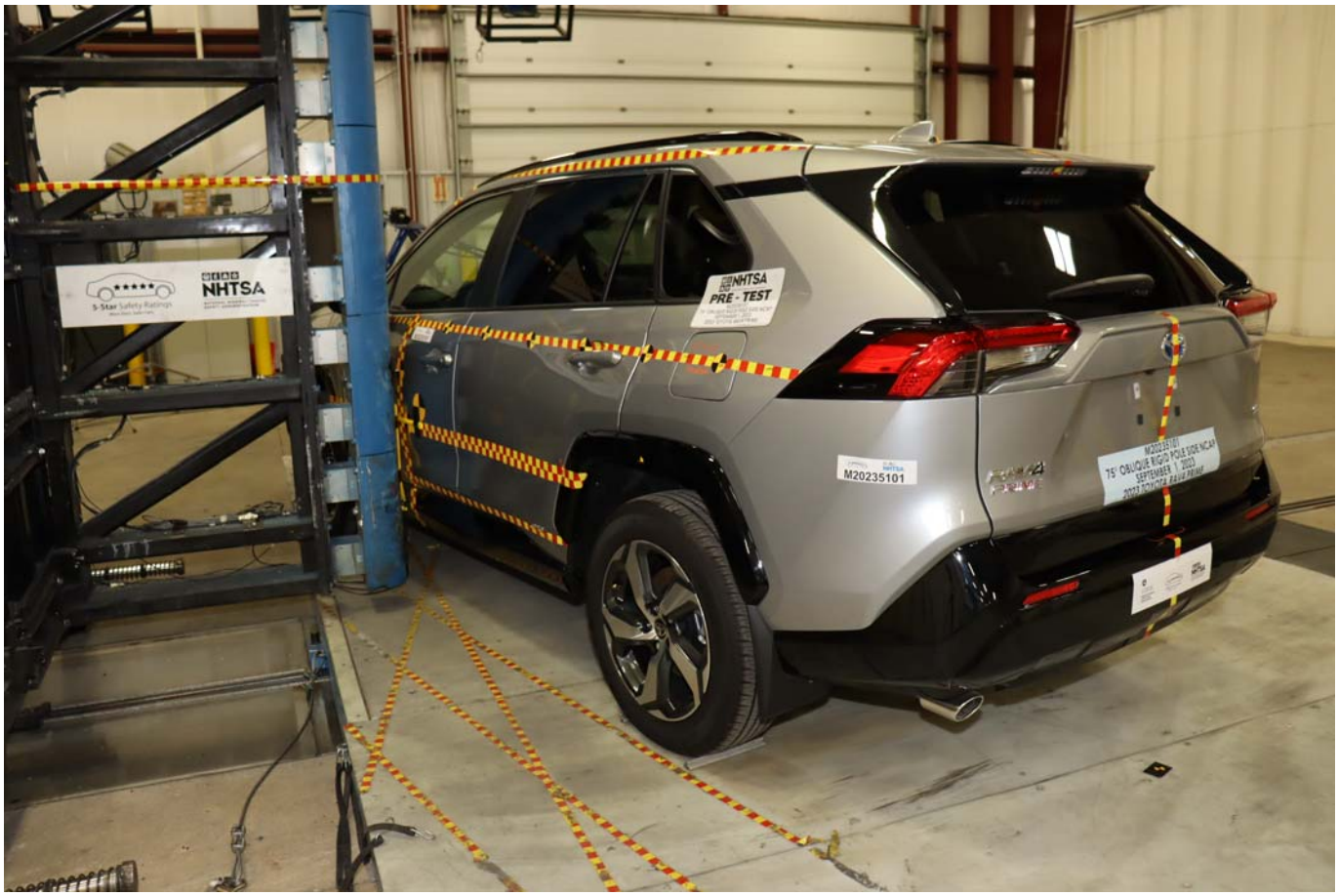


Photo No. 018 - Pre-Test Right Side View of Pole Positioned Against Side of Vehicle

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's Neck Showing Position of Adjustable Neck Bracket

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

Photo No. 032 - Pre-Test Placement of Dummy's 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

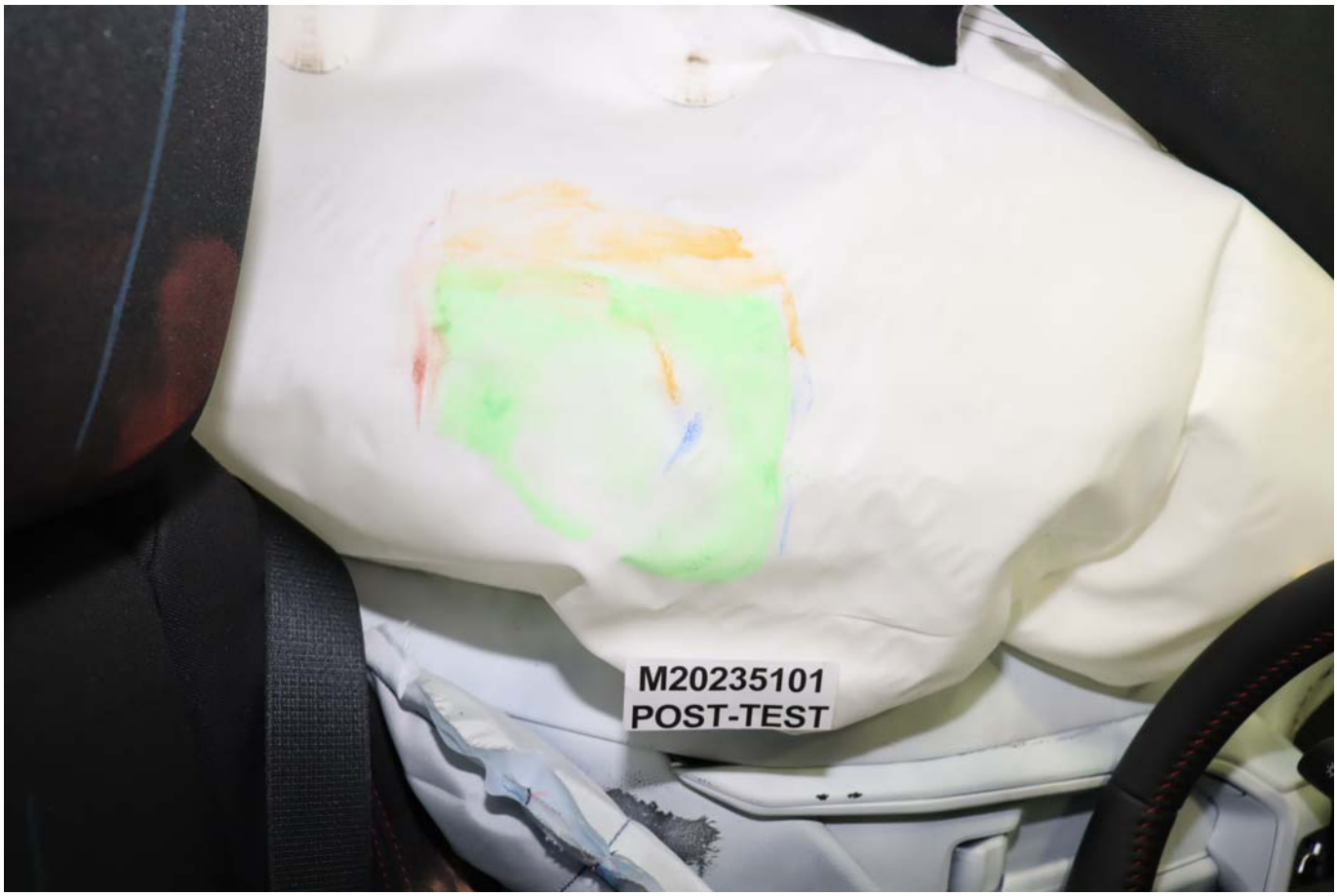


Photo No. 047 - Post-Test Dummy Close-Up Head Contact with Side Air Bag View

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

PHOTOGRAPH NOT APPLICABLE

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

Photo No. 053 - Post-Test Right Side View of Dummy and Rear Seat of Occupant Compartment

PHOTOGRAPH NOT APPLICABLE

Photo No. 054 - Post-Test Inner Rear Passenger Torso Air Bag Deployment View

Photo No. 055 - Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

PHOTOGRAPH NOT AVAILABLE

Photo No. 056 - Post-Test View of Fuel Filler Cap or Fuel Filler Neck

Photo No. 057 - Close-Up View of Vehicle's Certification Label

Photo No. 058 - Close-Up View of Vehicle's Tire Information Placard or Label

Photo No. 058a - Close-Up View of Vehicle Load Carrying Capacity Reduction Label

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

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

Photo No. 061 - Pre-Test Pole Barrier Side View

Photo No. 062 - Post-Test Pole Barrier Side View

Photo No. 063 - Pre-Test Ballast View

Photo No. 064 - Post-Test Primary and Redundant Speed Trap Read-Out

Photo No. 065 - FMVSS Photo No. 301 Static Rollover 0 Degrees

Photo No. 066 - FMVSS Photo No. 301 Static Rollover 90 Degrees

Photo No. 067 - FMVSS Photo No. 301 Static Rollover 180 Degrees

Photo No. 068 - FMVSS Photo No. 301 Static Rollover 270 Degrees

Photo No. 069 - FMVSS Photo No. 301 Static Rollover 360 Degrees

Photo No. 070 - Impact Event

Photo No. 071 - Monroney Label

door is unlocked with smart key system, the driving position cannot be recalled. In this case, press the driving position button which has been set.

■ **Customization**

Settings (e.g. the unlock door settings of the memory recall function) can be customized. (Customizable features: →P.608)

Head restraints

Head restraints are provided for all seats.

WARNING

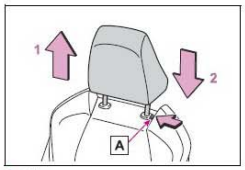
■ **Head restraint precautions**

Observe the following precautions regarding the head restraints. Failure to do so may result in death or serious injury.

- Use the head restraints designed for each respective seat.
- Adjust the head restraints to the correct position at all times.
- After adjusting the head restraints, push down on them and make sure they are locked in position.
- Do not drive with the head restraints removed.

Vertical adjustment

■ **Front seats**



1 Up

Pull the head restraints up.

2 Down

Push the head restraint down while pressing the lock release button A.

Photo No. 072 - Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

PHOTOGRAPH NOT AVAILABLE

Photo No. 073 - Post-Test View of Shattered Vehicle Inner Door Panel

Photo No. 305-01 - Auxiliary Power Module Warning Label

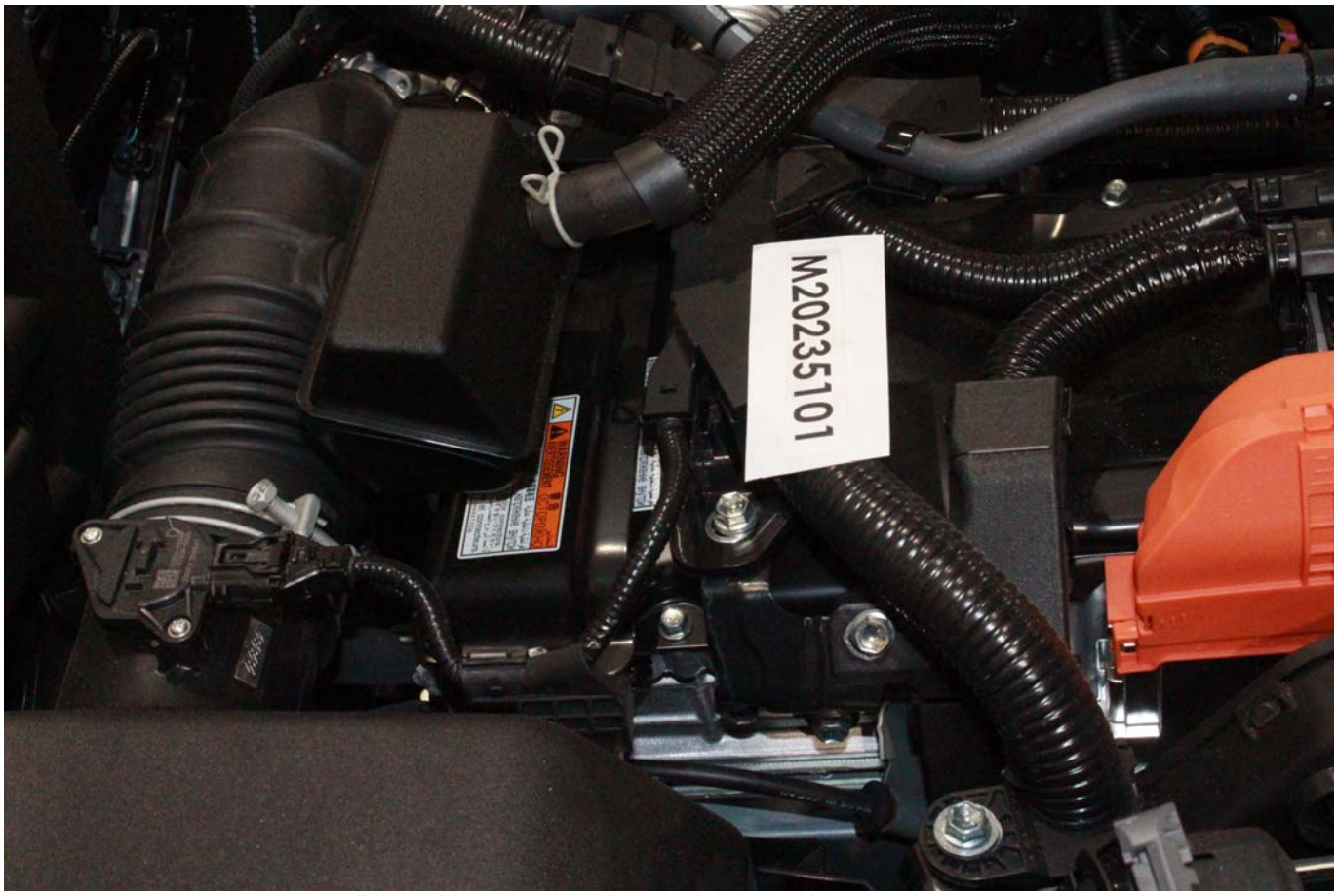


Photo No. 305-02 - Power Inverter Warning Label

Photo No. 305-03 - First Responder Warning Label

Photo No. 305-04 - First Responder Warning Location

Photo No. 305-05 - Other Vehicle Label(s) Related to Electrical Propulsion System

Photo No. 305-06 - Manual High Voltage Service Disconnect in Place

Photo No. 305-07 - Manual High Voltage Service Disconnect Removed

Photo No. 305-08 - Manual High Voltage Service Disconnect Removed

Photo No. 305-09 - Pre-Impact View of Propulsion Battery

Photo No. 305-10 - Post-Impact Front View of Propulsion Battery

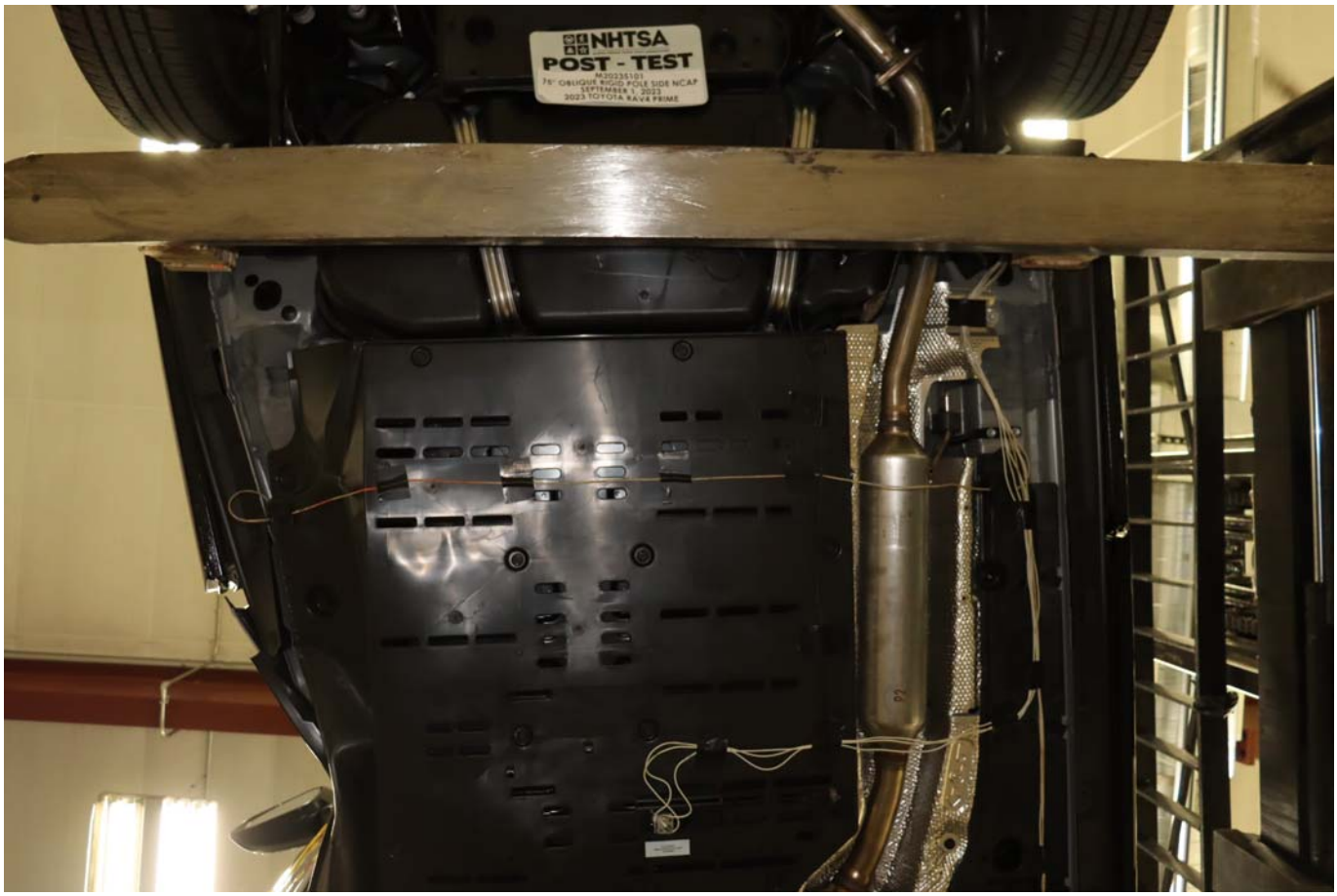


Photo No. 305-11 - Post-Impact Rear View of Propulsion Battery

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-12 - Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

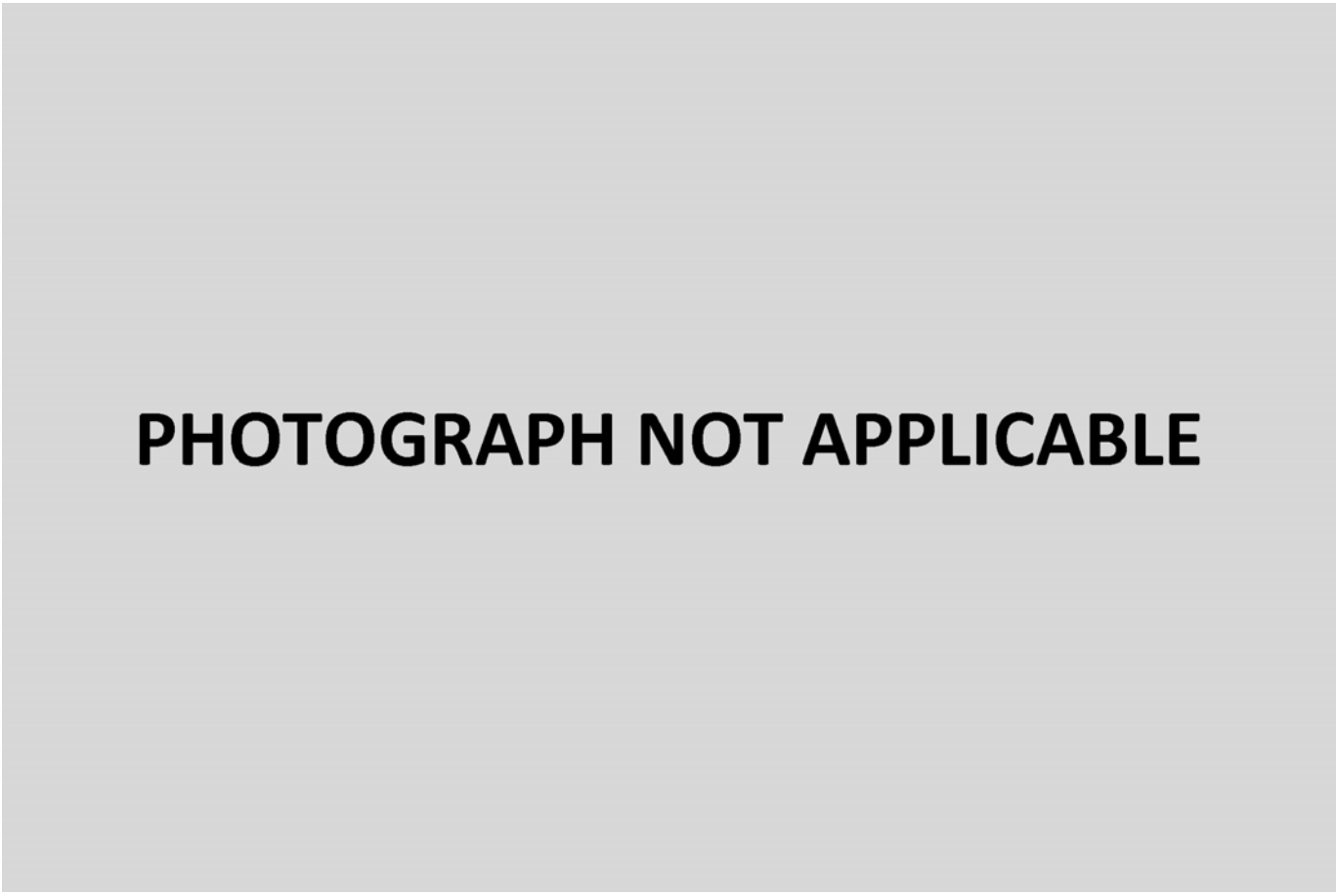


Photo No. 305-13 - Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

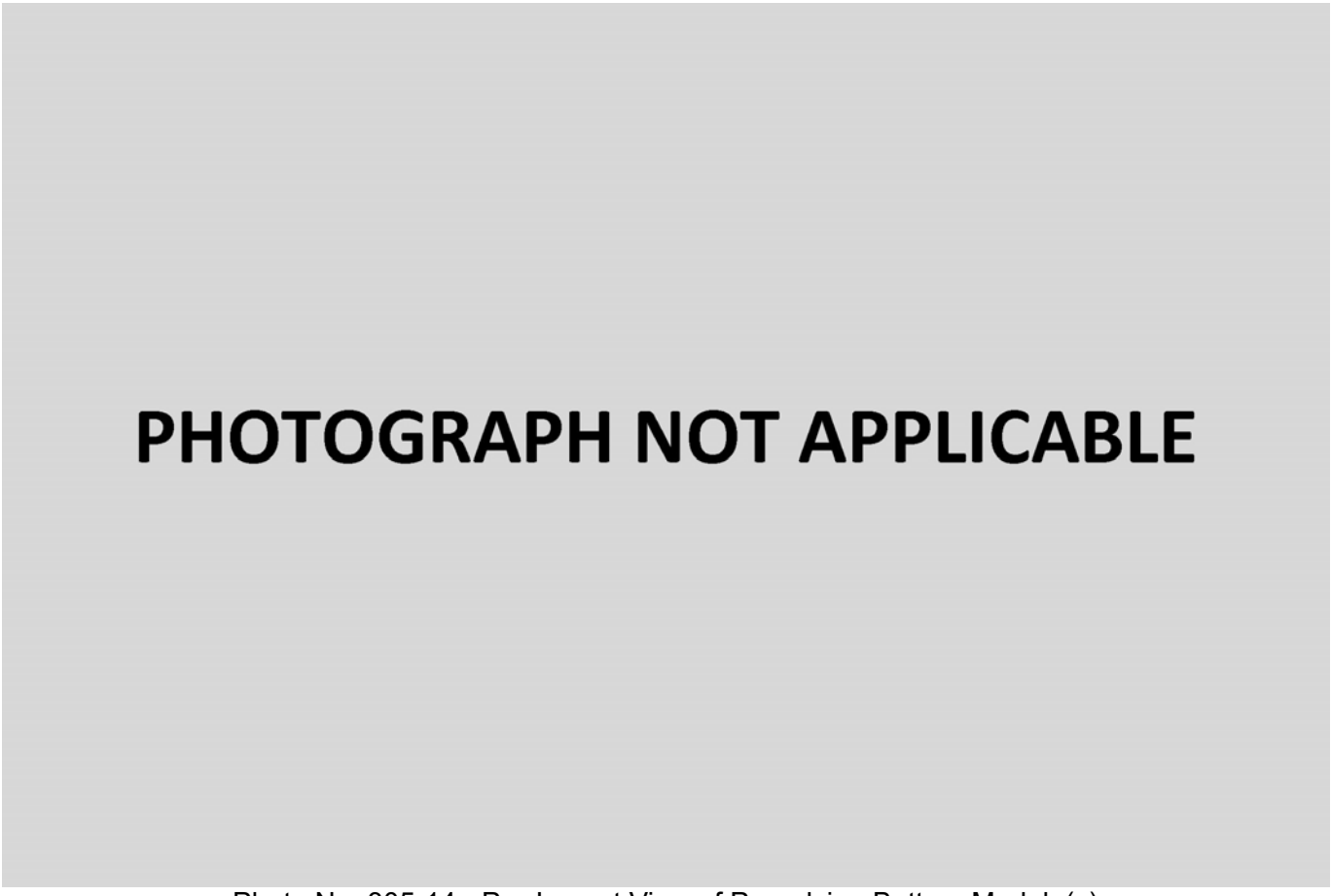


Photo No. 305-14 - Pre-Impact View of Propulsion Battery Module(s)

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-15 - Post-Impact View of Propulsion Battery Module(s)

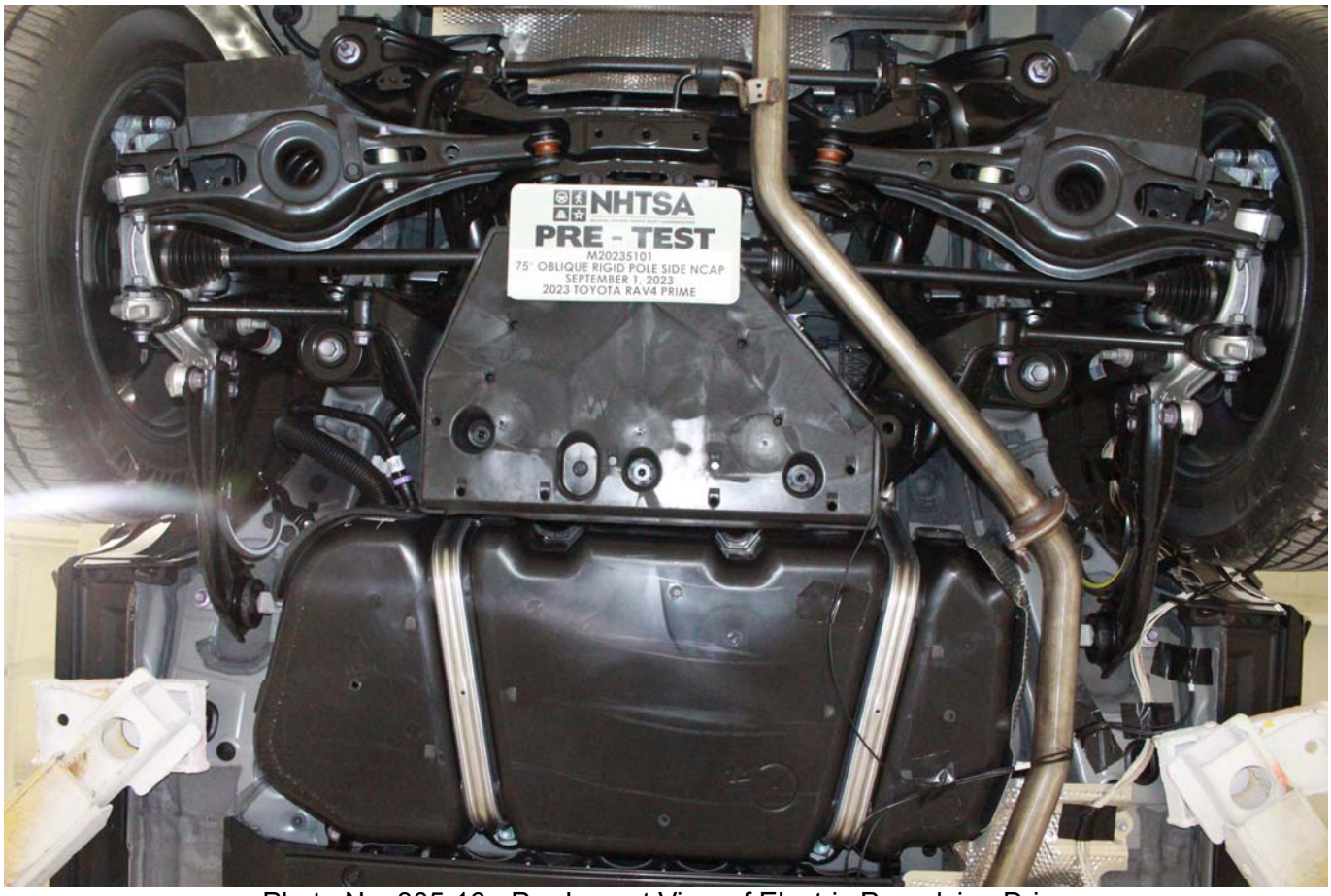


Photo No. 305-16 - Pre-Impact View of Electric Propulsion Drive

Photo No. 305-17 - Post-Impact View of Electric Propulsion Drive

Photo No. 305-18 - Pre-Impact View of High Voltage Interconnect(s)

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-19 - Pre-Impact View Propulsion Battery Venting System(s)

Photo No. 305-20 - Pre-Impact View of Other Visible Electric Propulsion Components

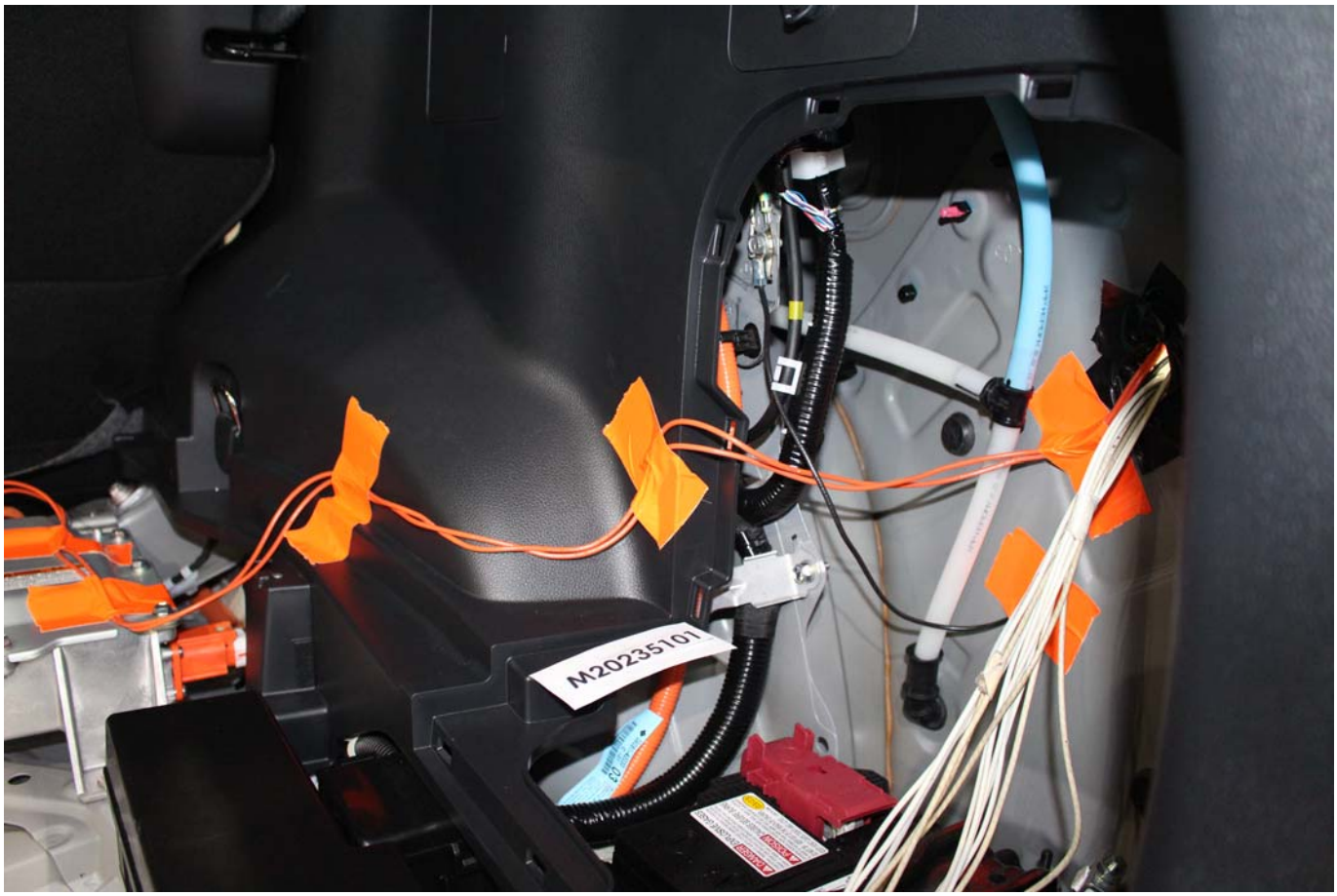


Photo No. 305-21 - Pre-Impact View of Ground Lead Attached

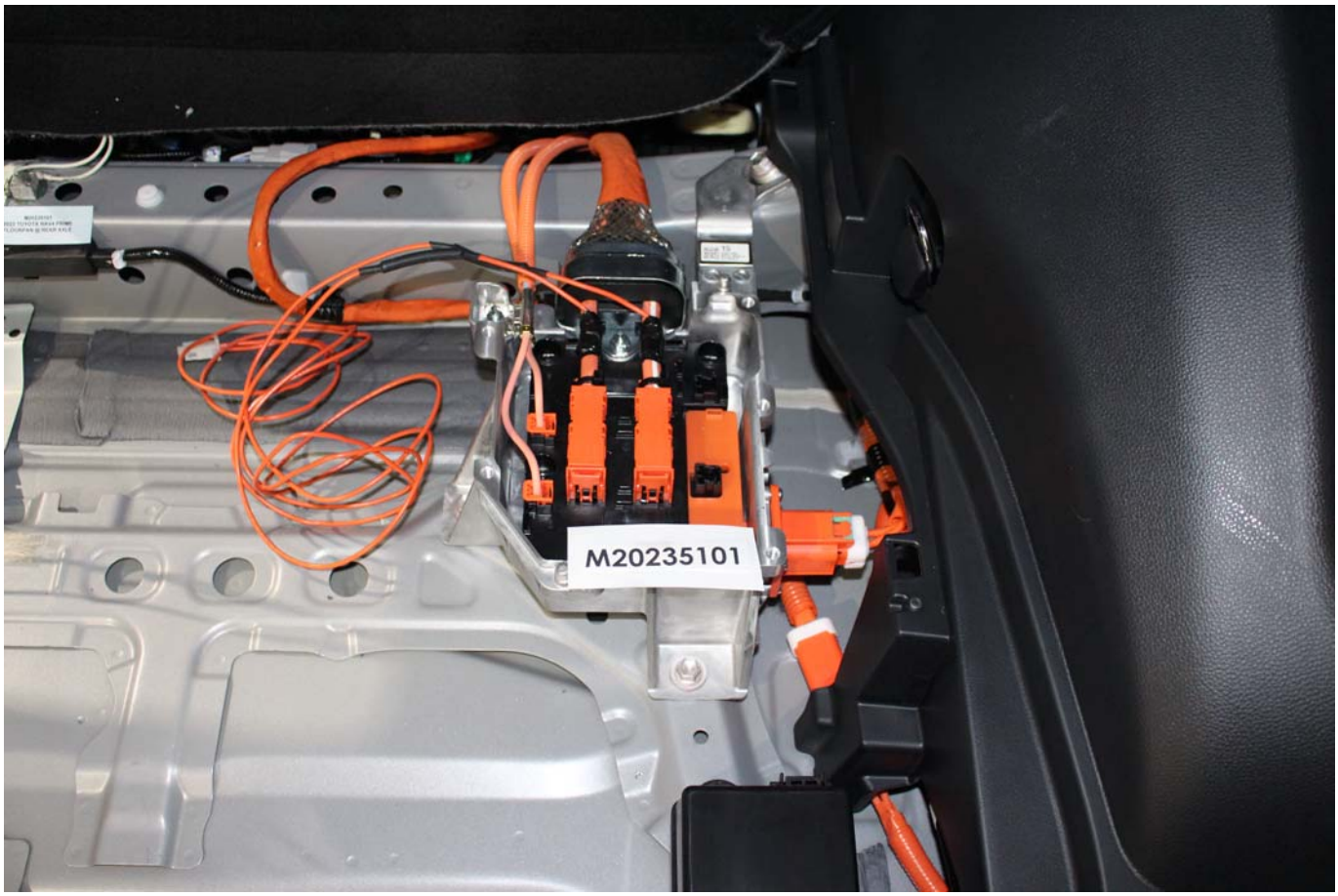


Photo No. 305-22 - Pre-Impact View of High Voltage Leads Attached

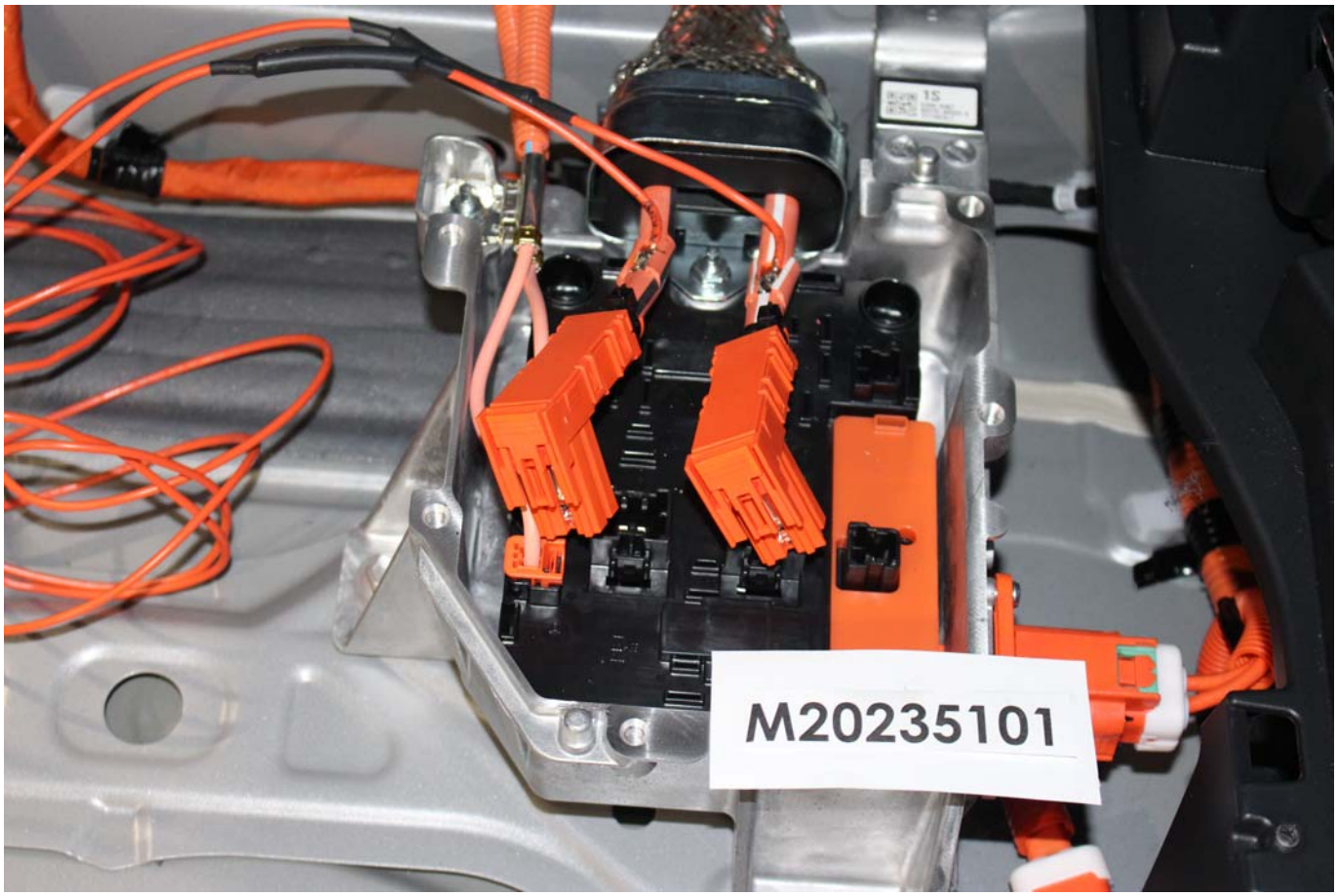


Photo No. 305-23 - Pre-Impact Close-Up View of High Voltage Leads Attached

Photo No. 305-24 - Pre-Impact View of Installed Test Interface Port

Photo No. 305-25 - Post-Impact View of Installed Test Interface Port

Photo No. 305-26 - Pre-Impact View of Other Test Devices

Photo No. 305-27 - Post-Impact View of Other Test Devices

Photo No. 305-28 - FMVSS No. 305 Static Rollover at 90 Degrees

Photo No. 305-29 - FMVSS No. 305 Static Rollover at 180 Degrees

Photo No. 305-30 - FMVSS No. 305 Static Rollover at 270 Degrees

Photo No. 305-31 - FMVSS No. 305 Static Rollover at 360 Degrees

Photo No. 305-32 - Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

Photo No. 305-33 - Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-34 - Post-Impact Propulsion Battery System Mounting and-or Intrusion Failure(s)

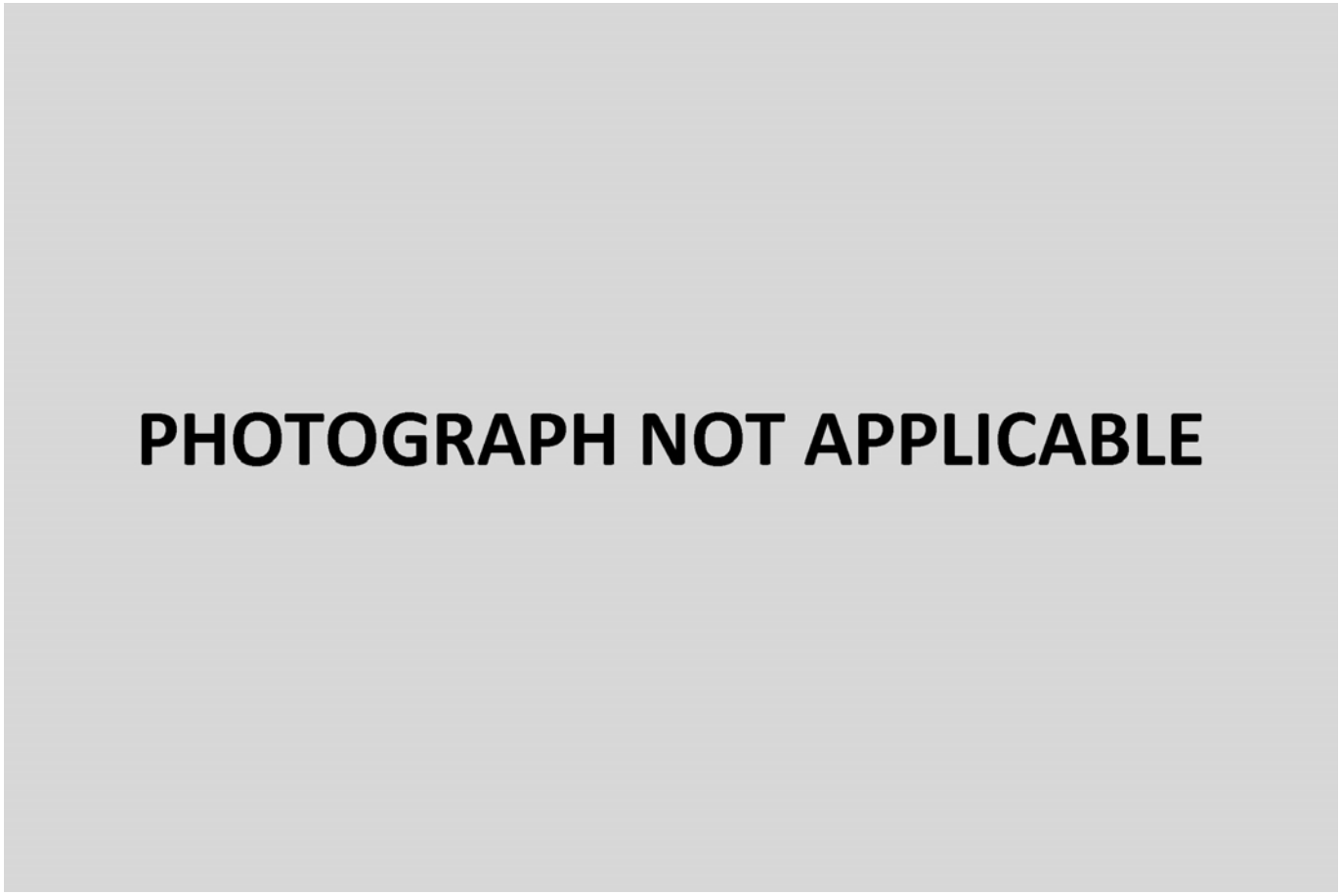


Photo No. 305-35 - Post-Impact View of Battery Component Intrusion

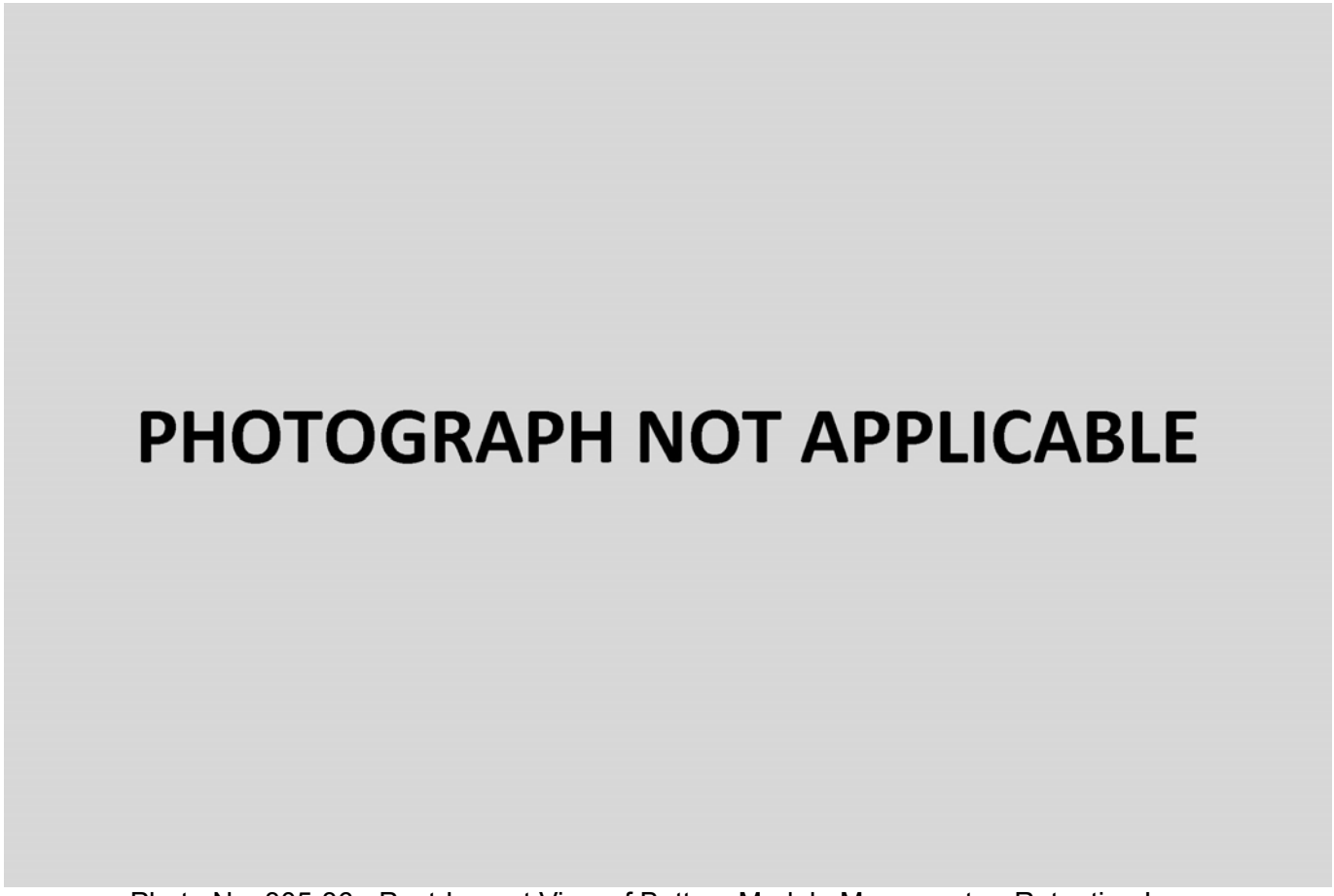


Photo No. 305-36 - Post-Impact View of Battery Module Movement or Retention Loss

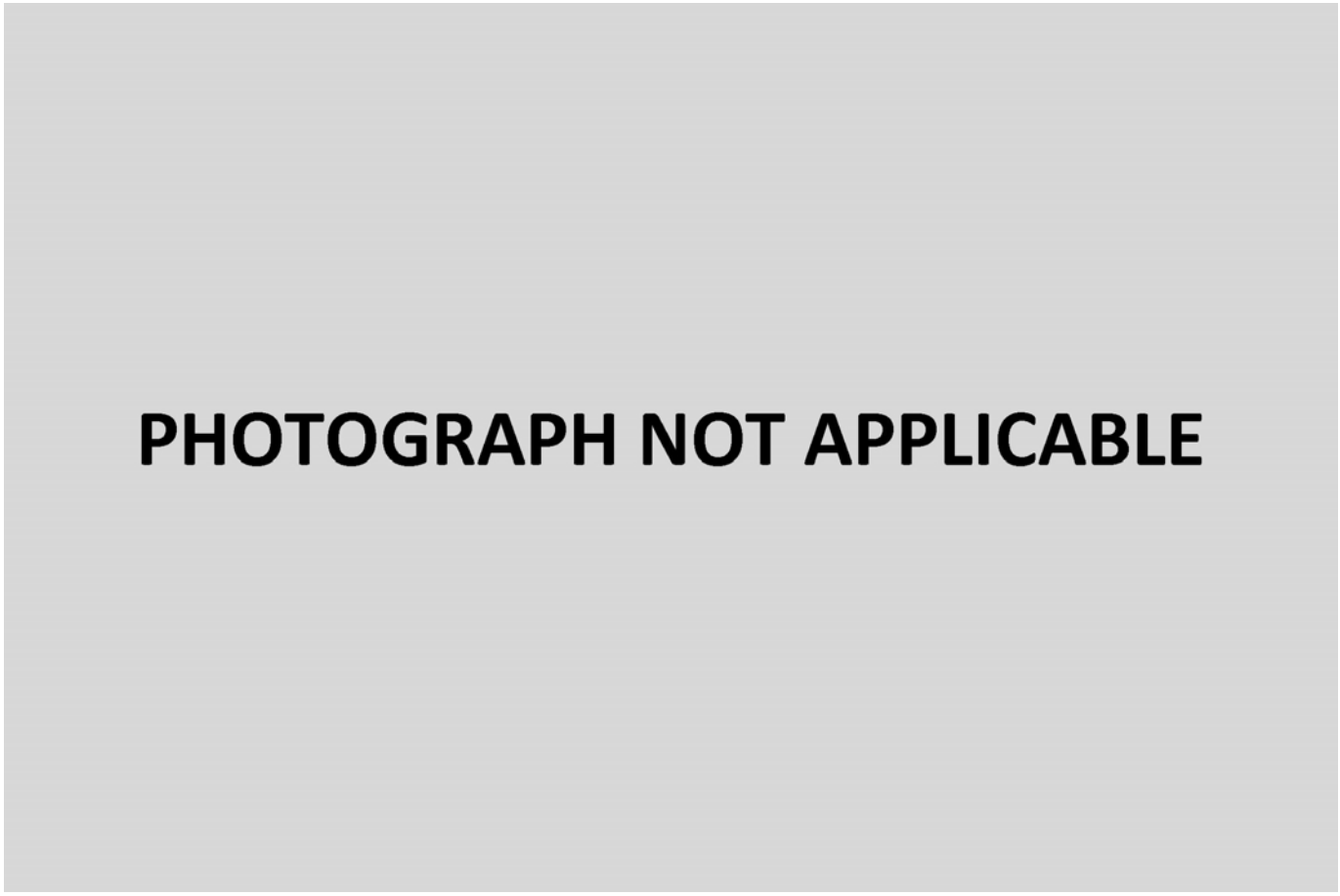


Photo No. 305-37 - Post-Impact View of Propulsion Battery Electrolyte Spillage Location

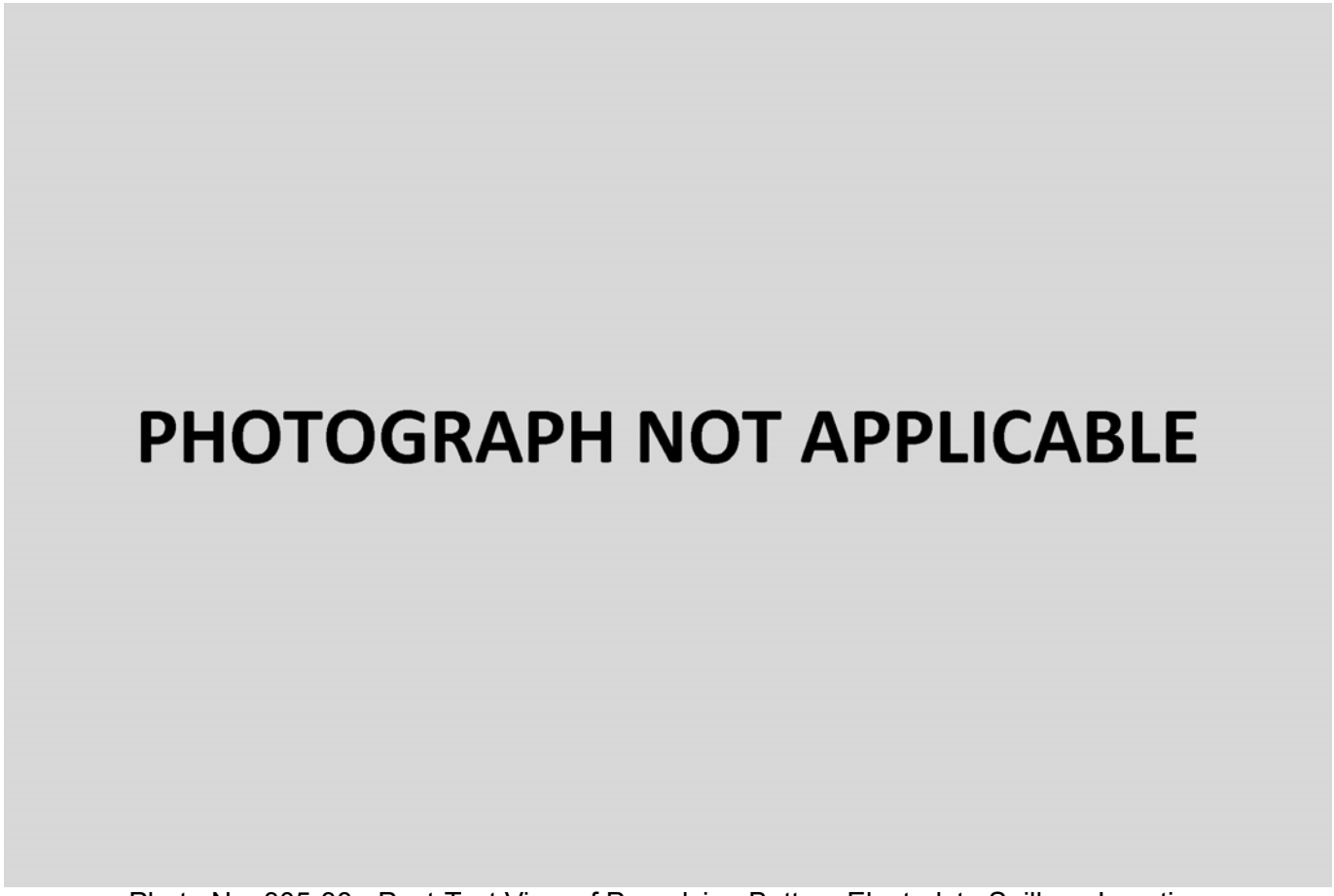


Photo No. 305-38 - Post-Test View of Propulsion Battery Electrolyte Spillage Location

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)

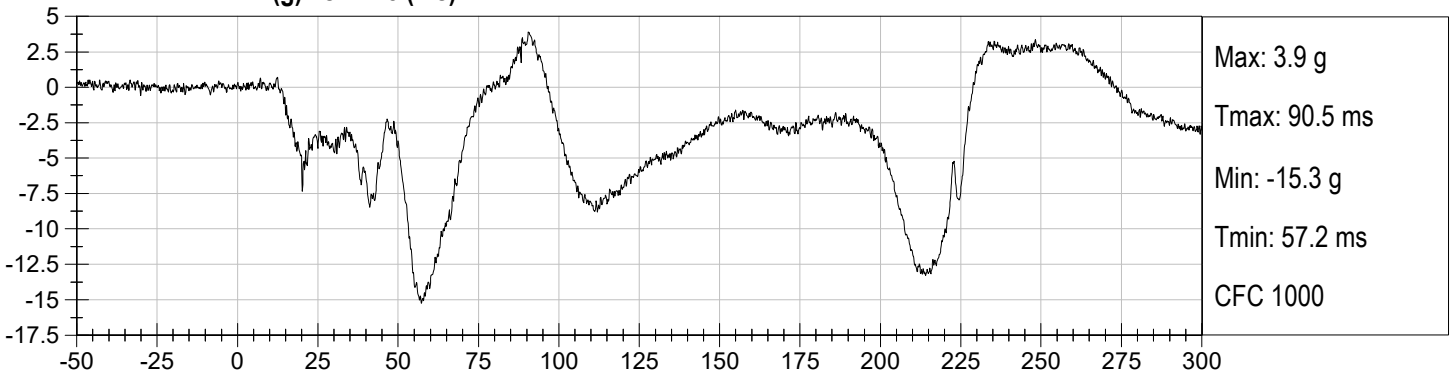
Load Cell Pole Barrier #5 Force (Y)

Load Cell Pole Barrier #6 Force (Y)

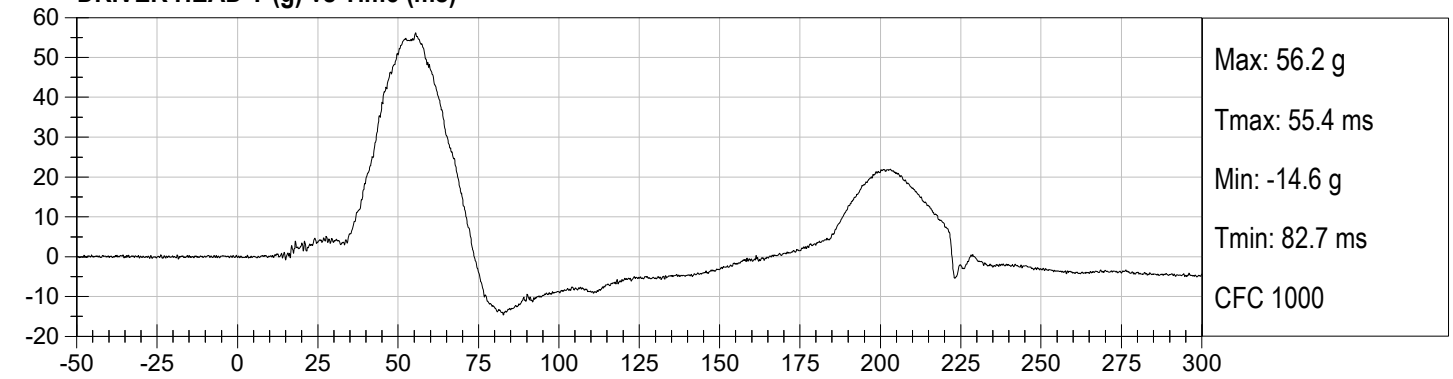
Load Cell Pole Barrier #7 Force (Y)

Load Cell Pole Barrier #8 Force (Y)

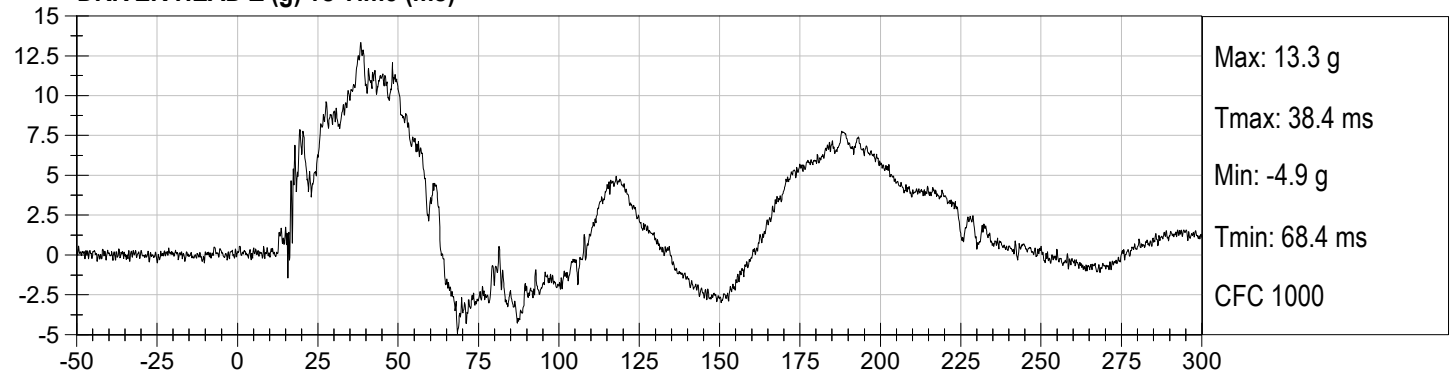
DRIVER HEAD X (g) vs Time (ms)



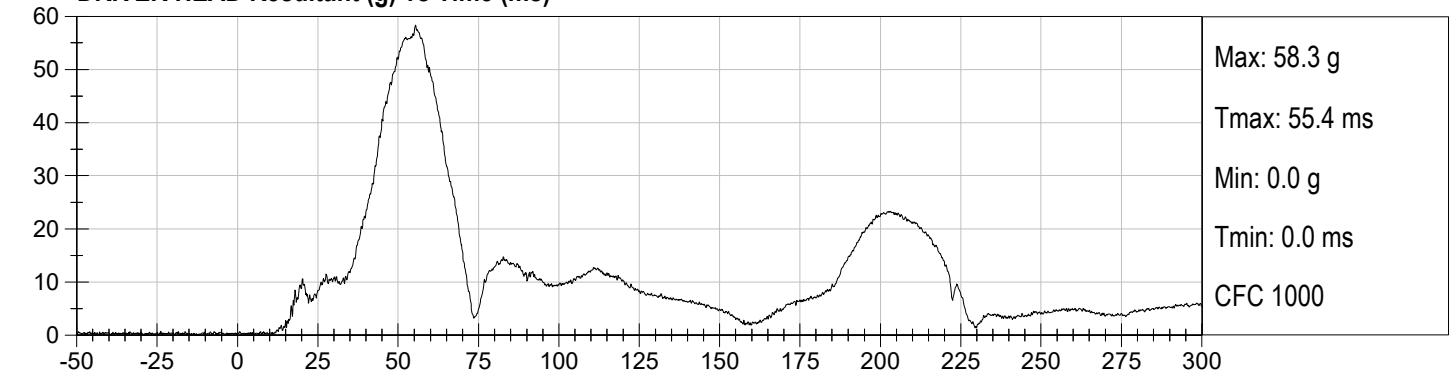
DRIVER HEAD Y (g) vs Time (ms)



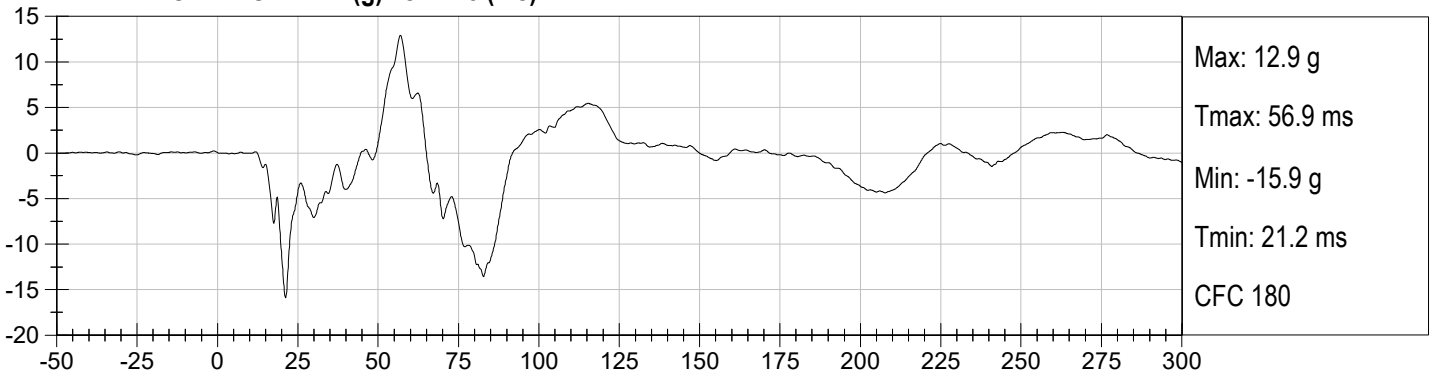
DRIVER HEAD Z (g) vs Time (ms)



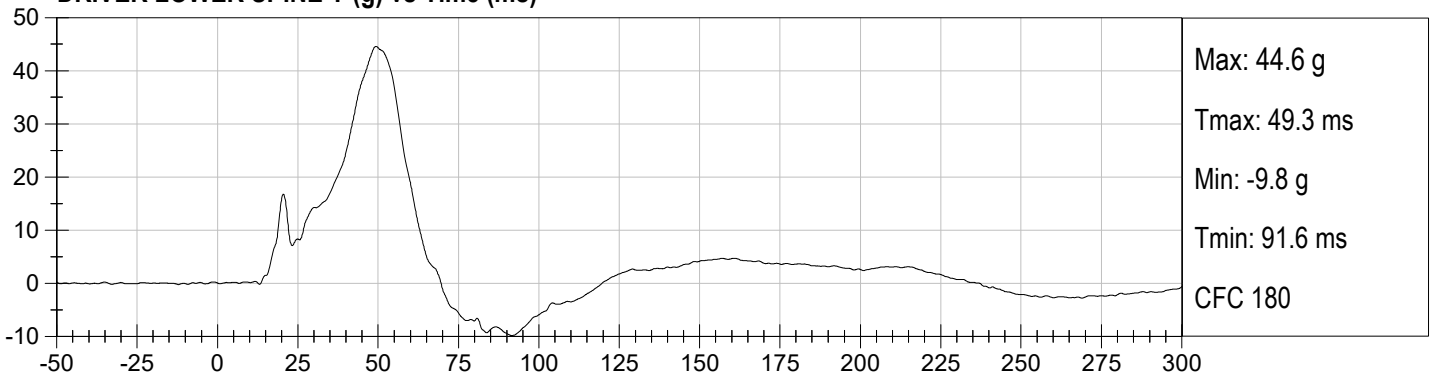
DRIVER HEAD Resultant (g) vs Time (ms)



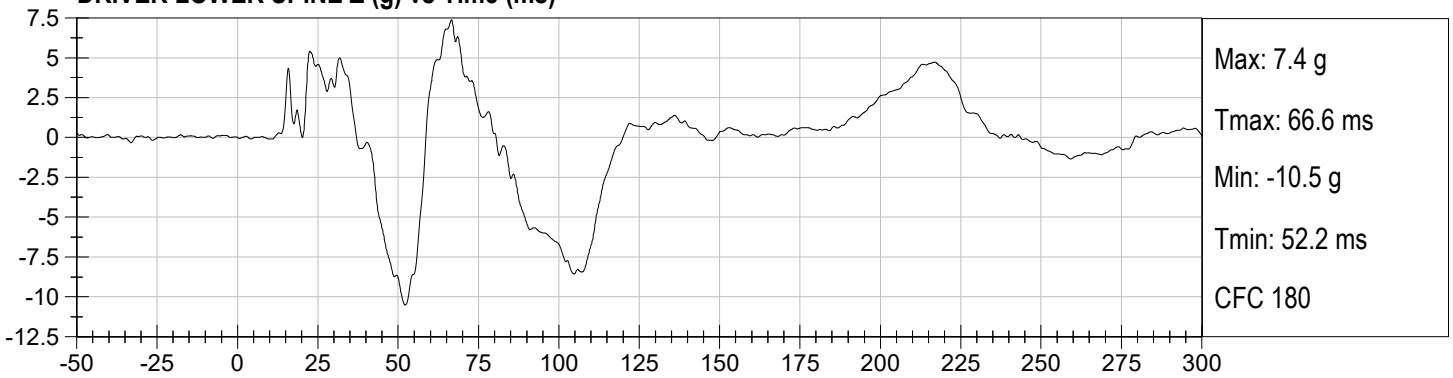
DRIVER LOWER SPINE X (g) vs Time (ms)



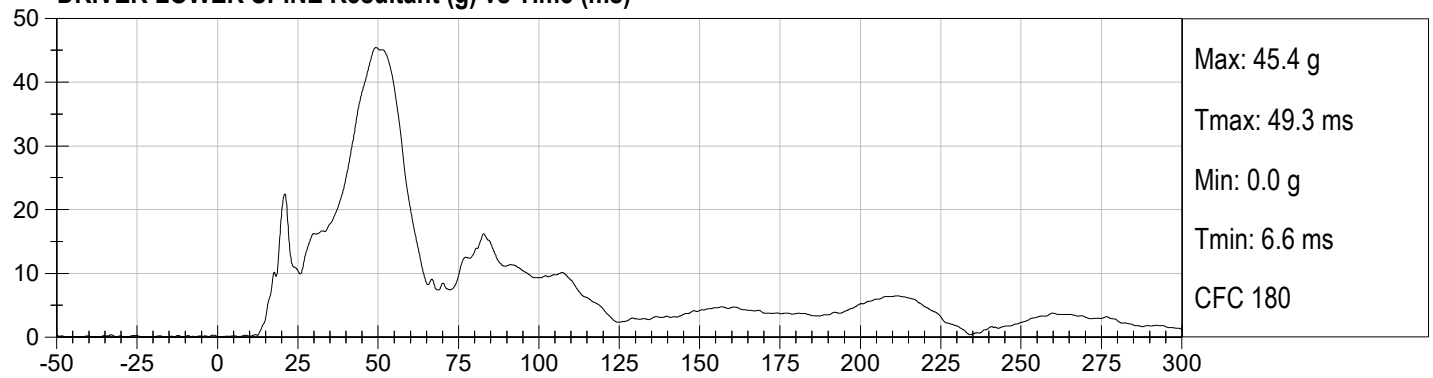
DRIVER LOWER SPINE Y (g) vs Time (ms)



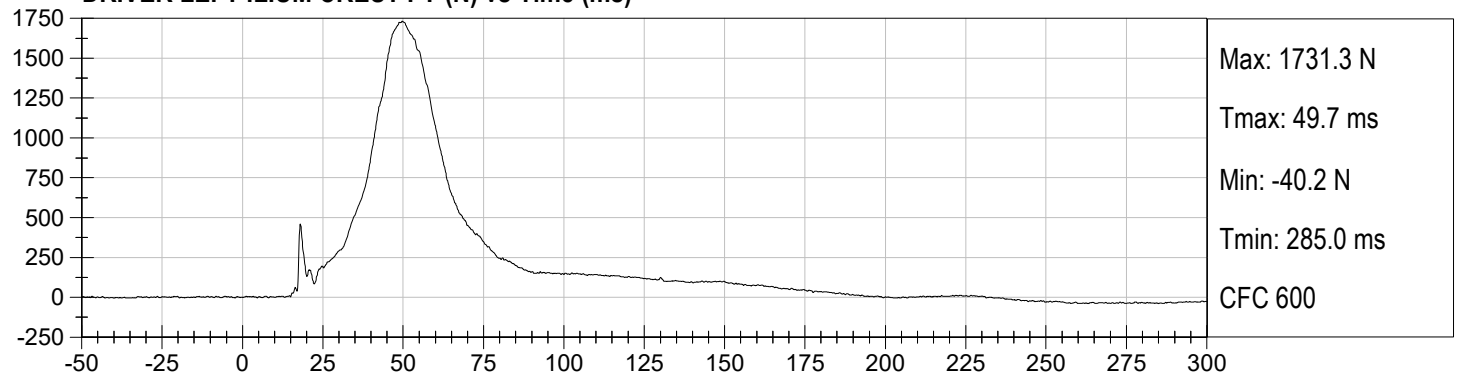
DRIVER LOWER SPINE Z (g) vs Time (ms)



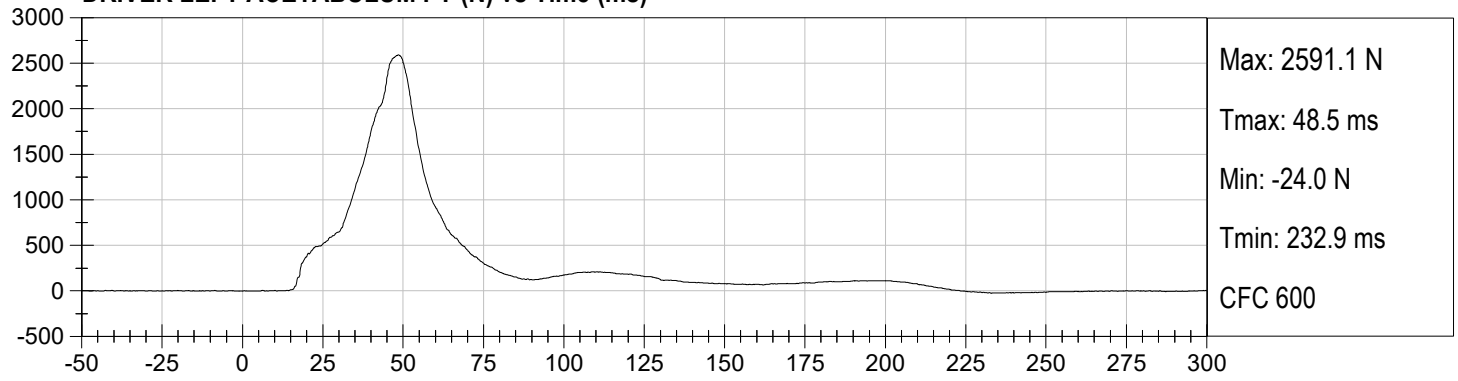
DRIVER LOWER SPINE Resultant (g) vs Time (ms)



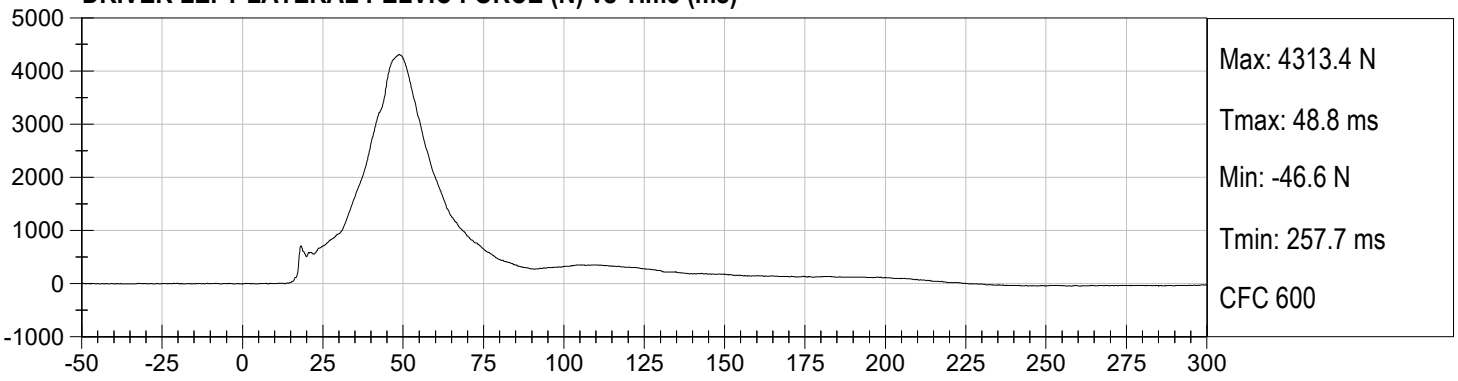
DRIVER LEFT ILIUM CREST FY (N) vs Time (ms)



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



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



APPENDIX C
DUMMY QUALIFICATION AND PERFORMANCE VERIFICATION

QUALIFICATION 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:** D232191

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	115 to 137	125	Pass
Peak Longitudinal Acceleration	G's	+/- 15	4.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

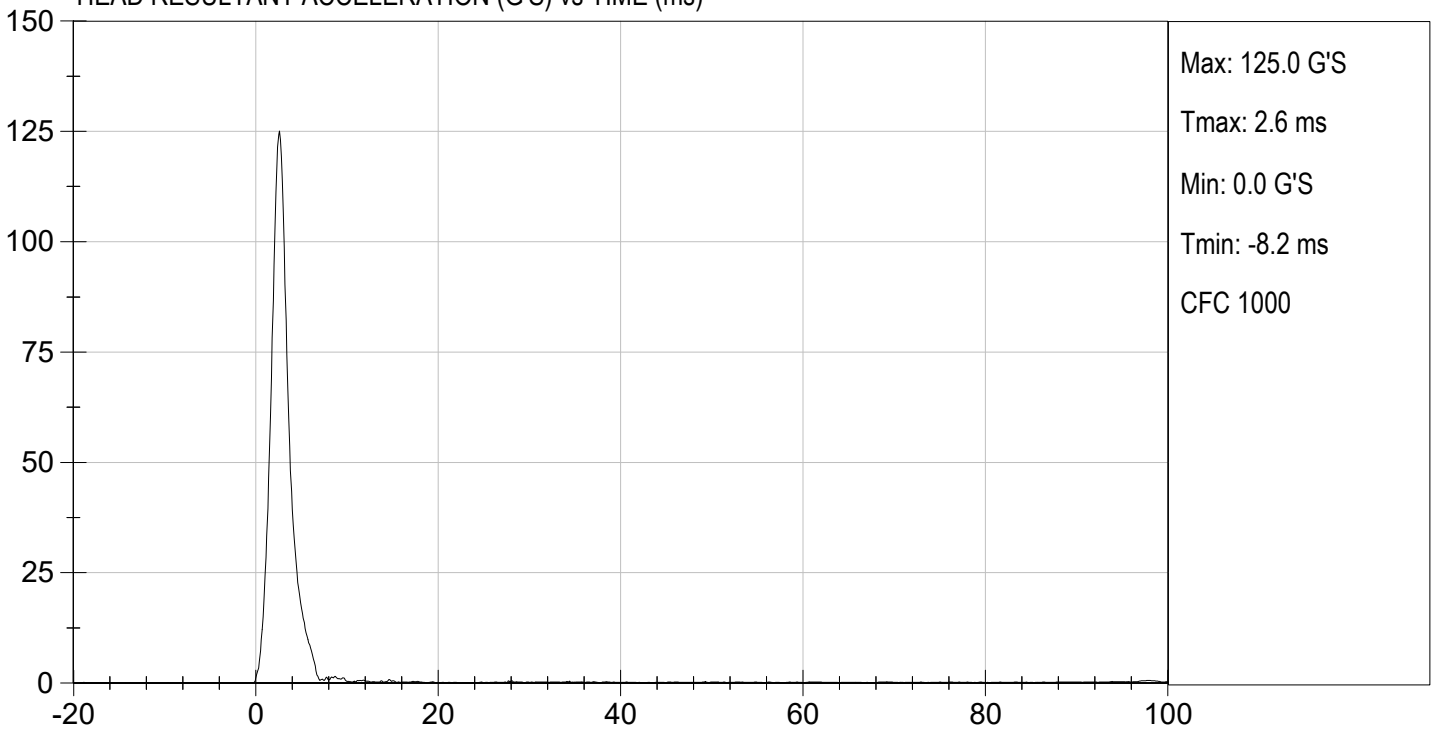
08/11/2023
Test Date

Approved By

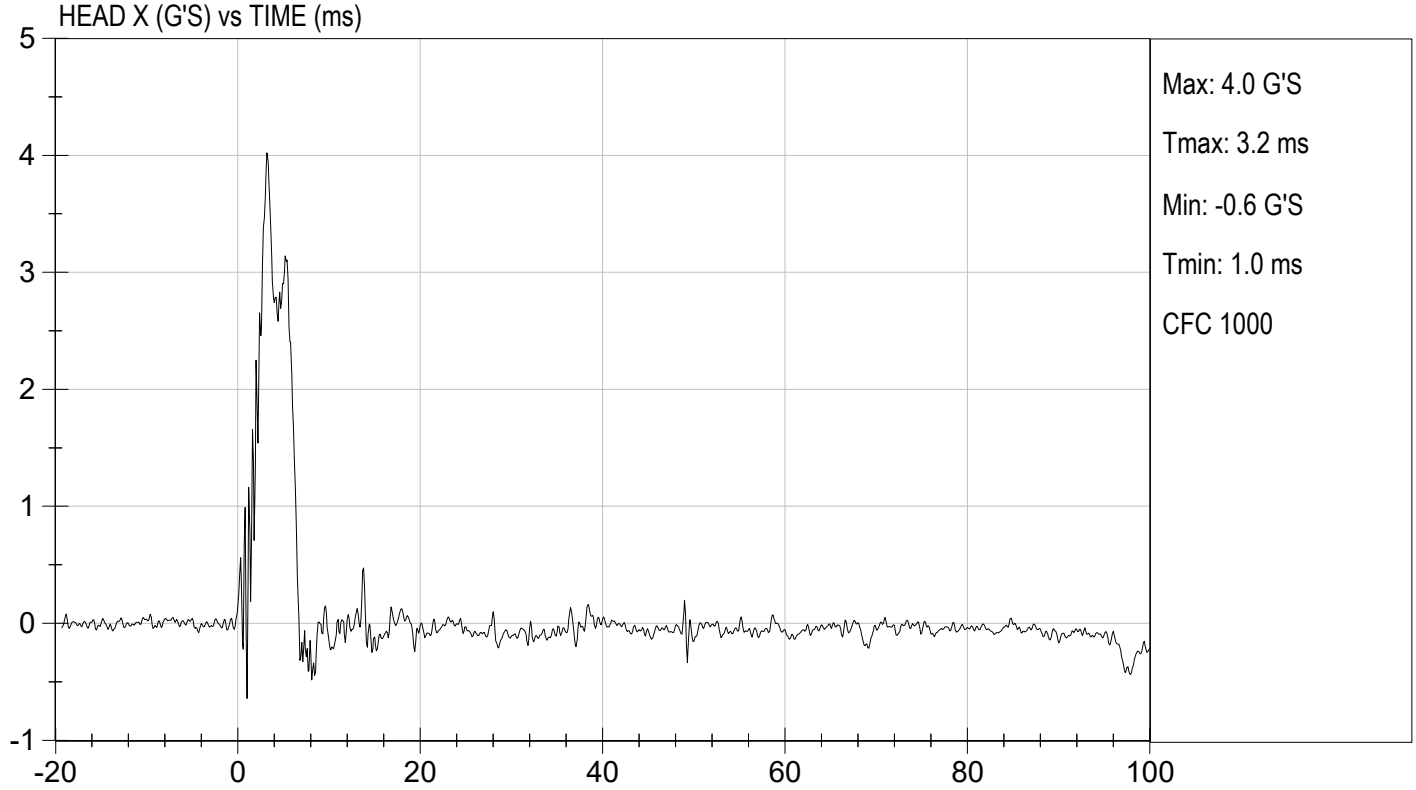
TEST DESC: HEAD DROP

TEST DATE: 08/11/2023
TEST #: D232191

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



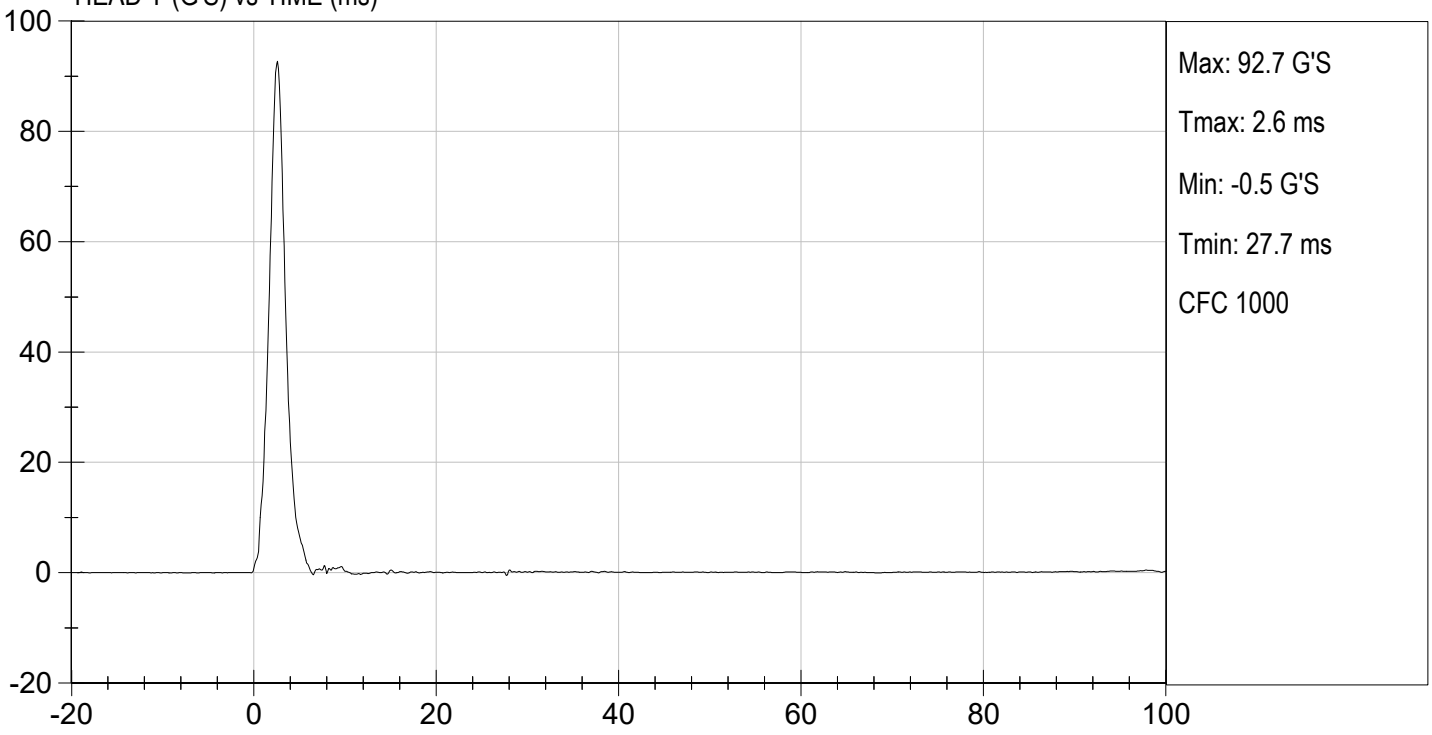
HEAD X (G'S) vs TIME (ms)



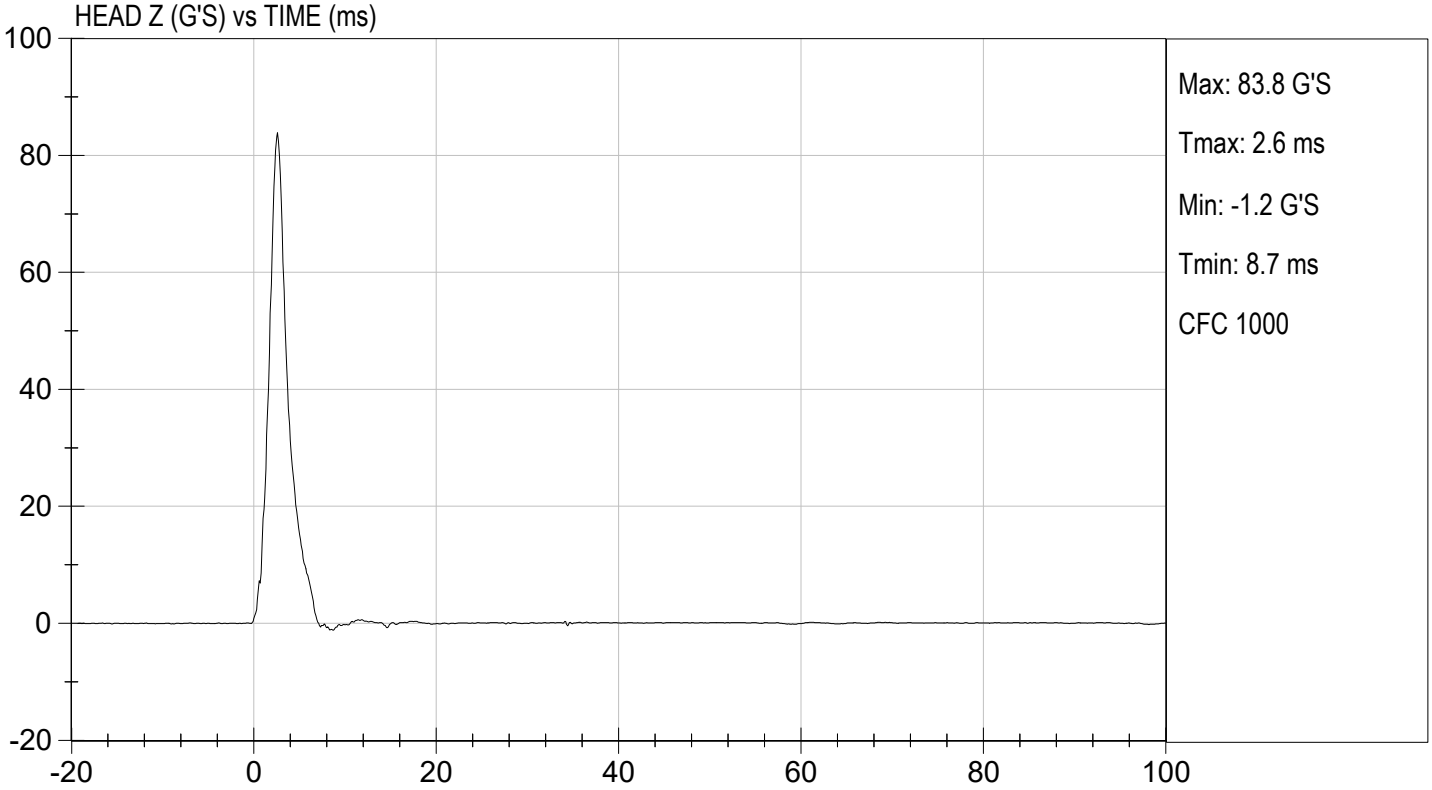
TEST DESC: HEAD DROP

TEST DATE: 08/11/2023
TEST #: D232191

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



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



MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D232192

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.3	Pass
Humidity		%	10 to 70	44	Pass
Impact Velocity		m/s	5.51 to 5.63	5.62	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.52	Pass
	15 ms	m/s	3.30 to 4.10	3.86	Pass
	20 ms	m/s	4.40 to 5.40	5.36	Pass
	25 ms	m/s	5.40 to 6.10	5.83	Pass
	25-100 ms	m/s	5.50 to 6.20	5.89	Pass
Maximum D-Plane Rotation		deg	71 to 81	74	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	62	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-38	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	112	Pass
			Overall Test Results		Pass

Laboratory Technician

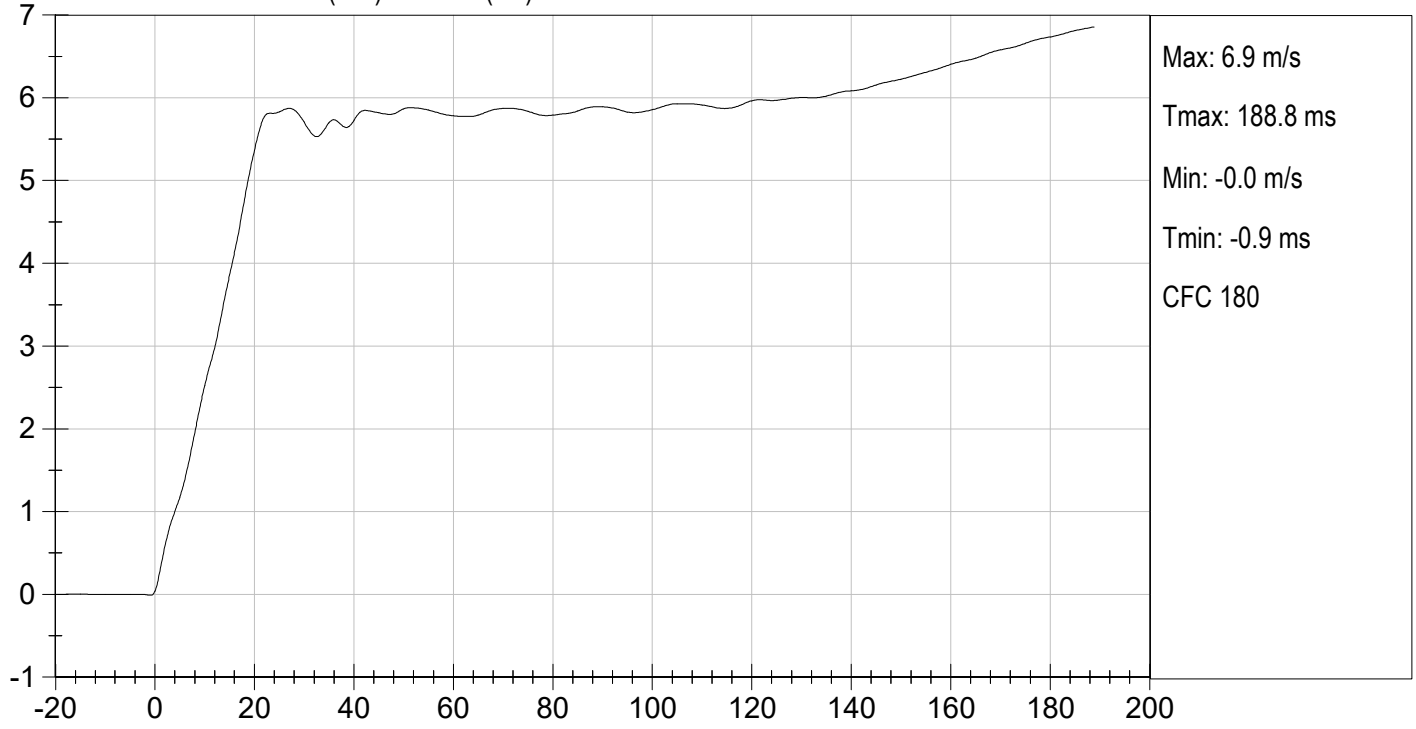
08/11/2023
Test Date

Approved By

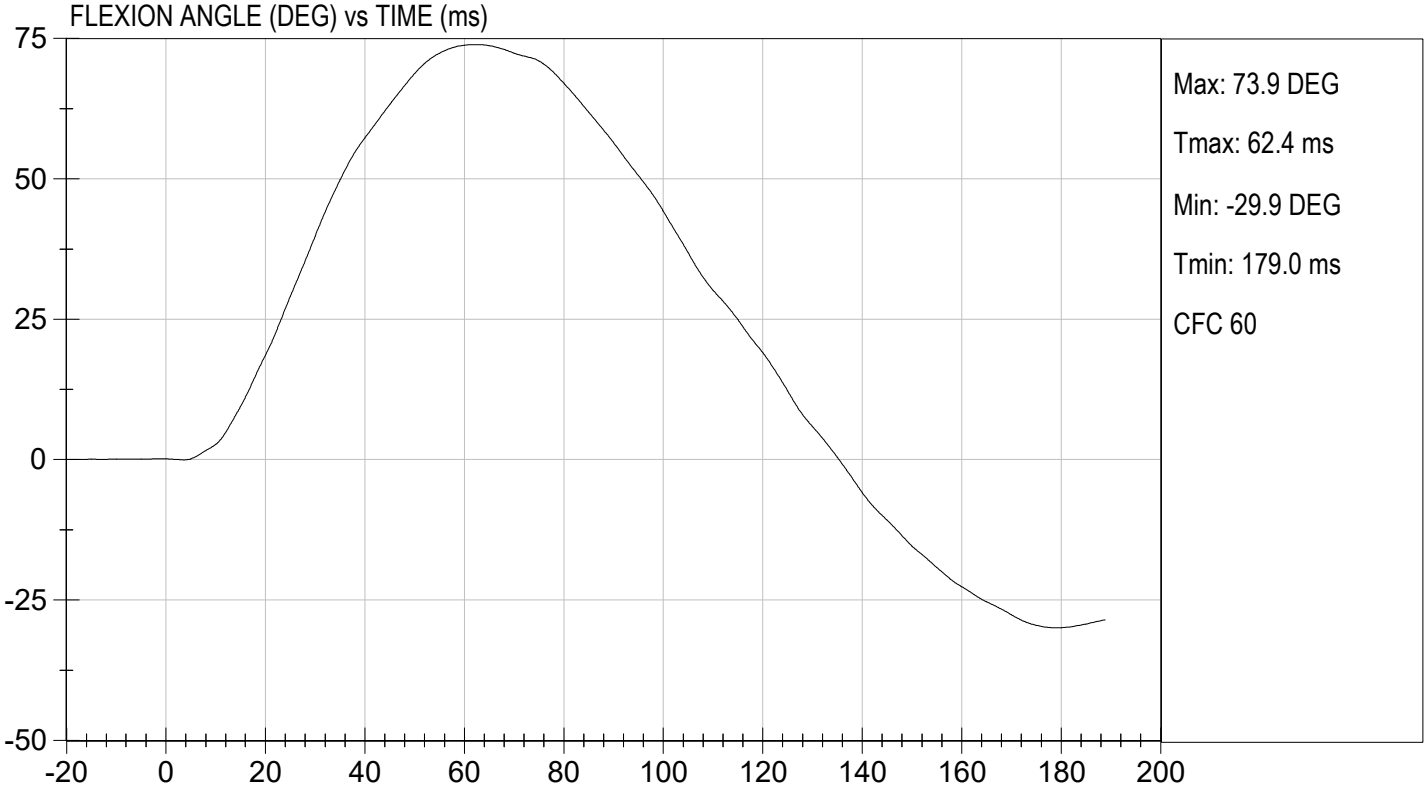
TEST DESC: NECK BENDING
VELOCITY: 18.45 ft/s, 5.62 m/s

TEST DATE: 08/11/2023
TEST #: D232192

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

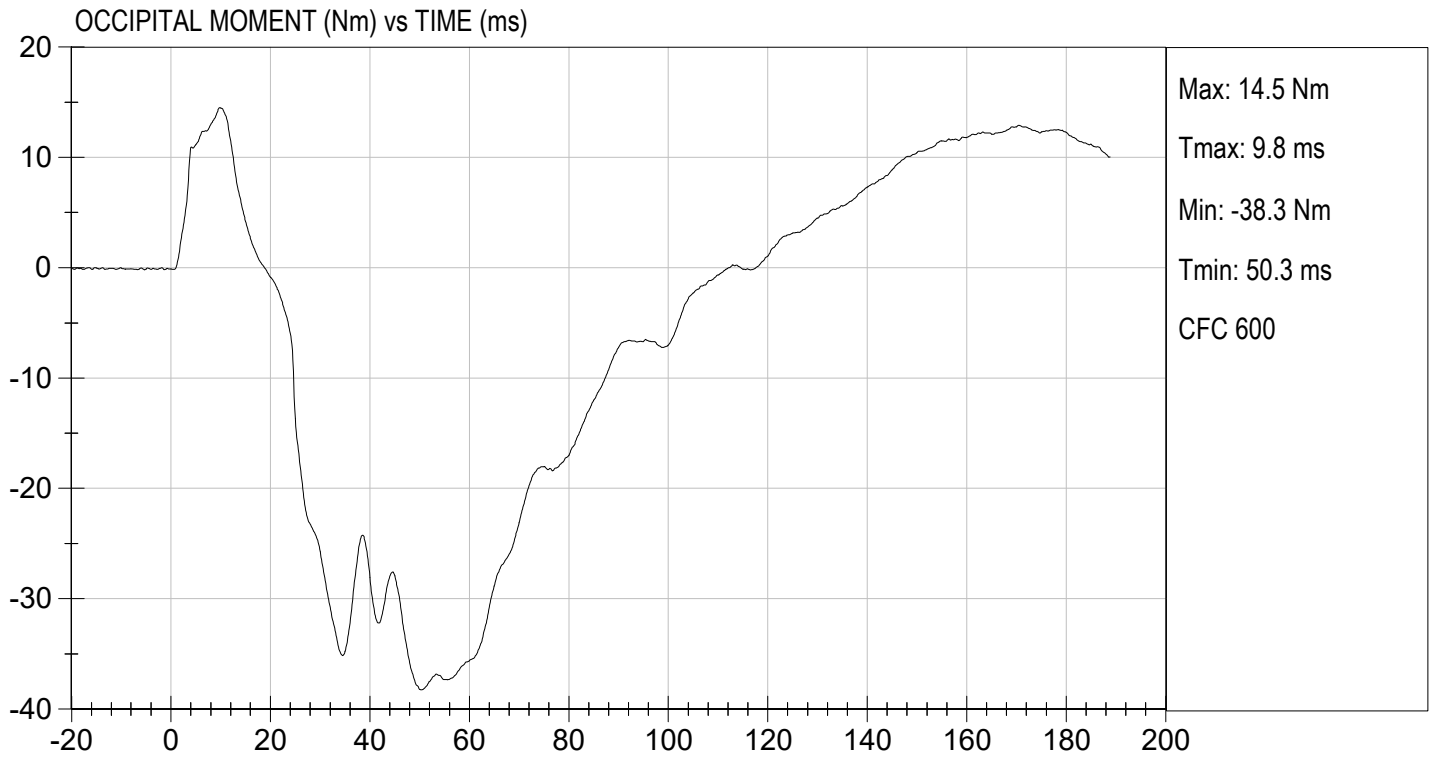


FLEXION ANGLE (DEG) vs TIME (ms)



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

TEST DATE: 08/11/2023
TEST #: D232192



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D232193

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	13 to 18	16	Pass
Shoulder Displacement	mm	28 to 37	31	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	20	Pass
		Overall Test Results		Pass

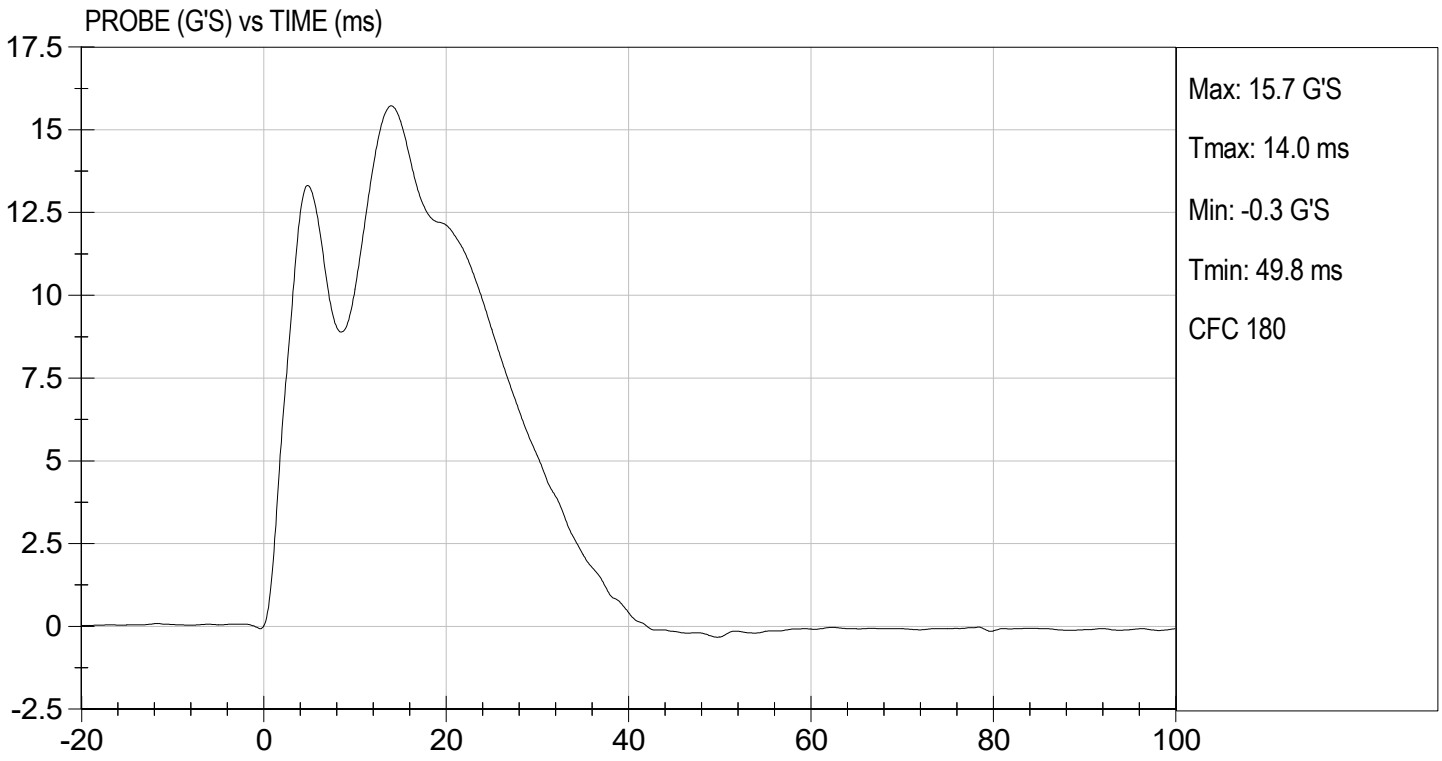
Laboratory Technician

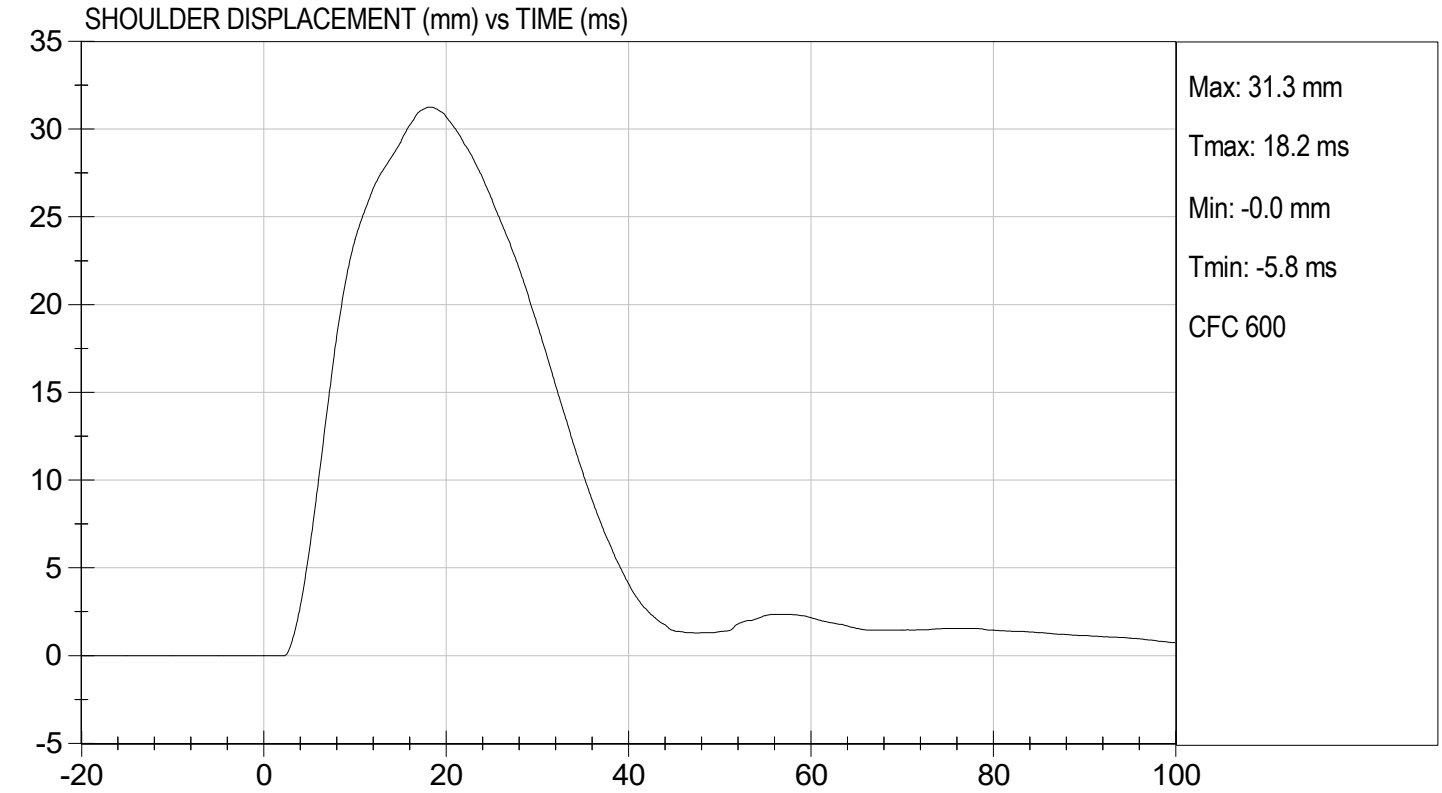
08/11/2023
Test Date

Approved By

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

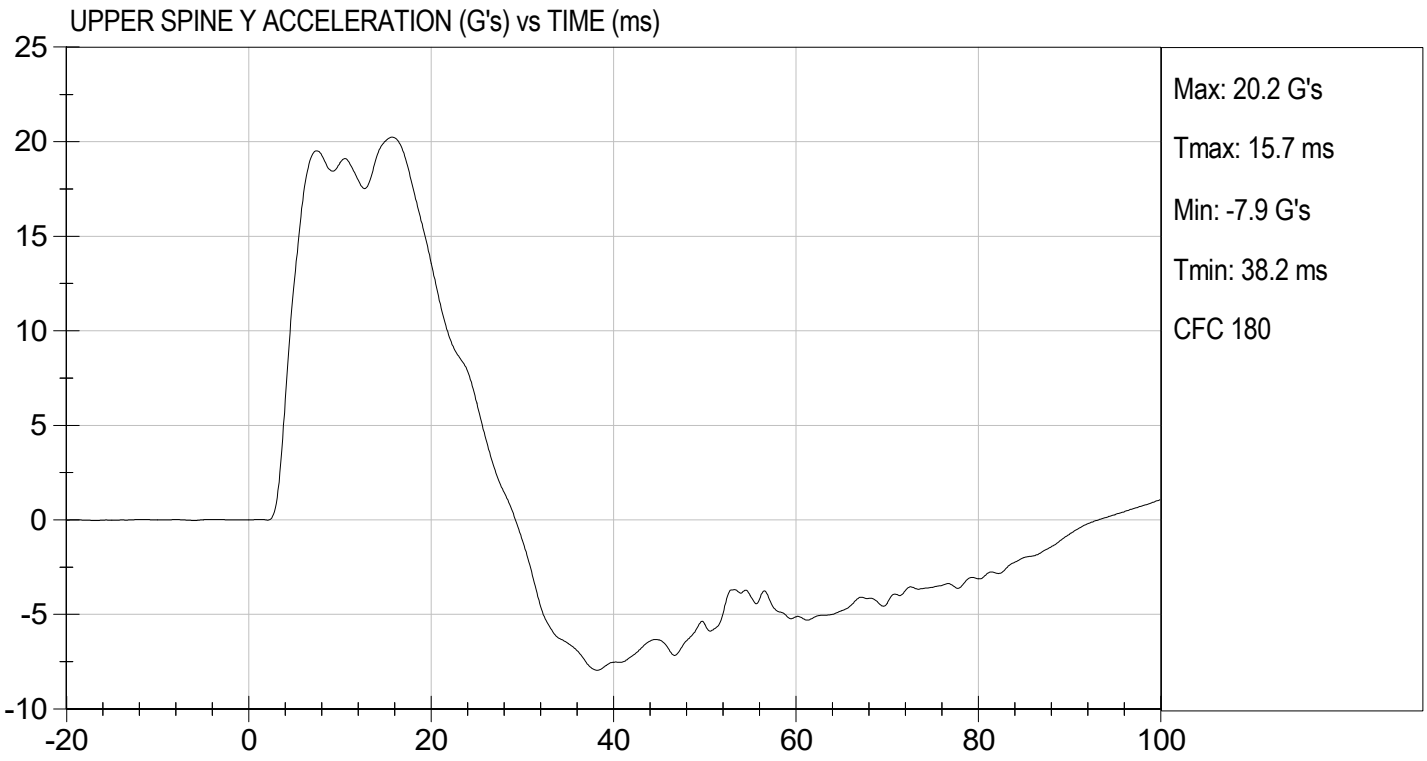
TEST DATE: 08/11/2023
TEST #: D232193





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

TEST DATE: 08/11/2023
TEST #: D232193



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D232194

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	34	Pass
Shoulder Displacement	mm	31 to 40	38	Pass
Upper Rib Displacement	mm	25 to 32	29	Pass
Middle Rib Displacement	mm	30 to 36	32	Pass
Lower Rib Displacement	mm	32 to 38	33	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	38	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	35	Pass
		Overall Test Results		Pass

Laboratory Technician

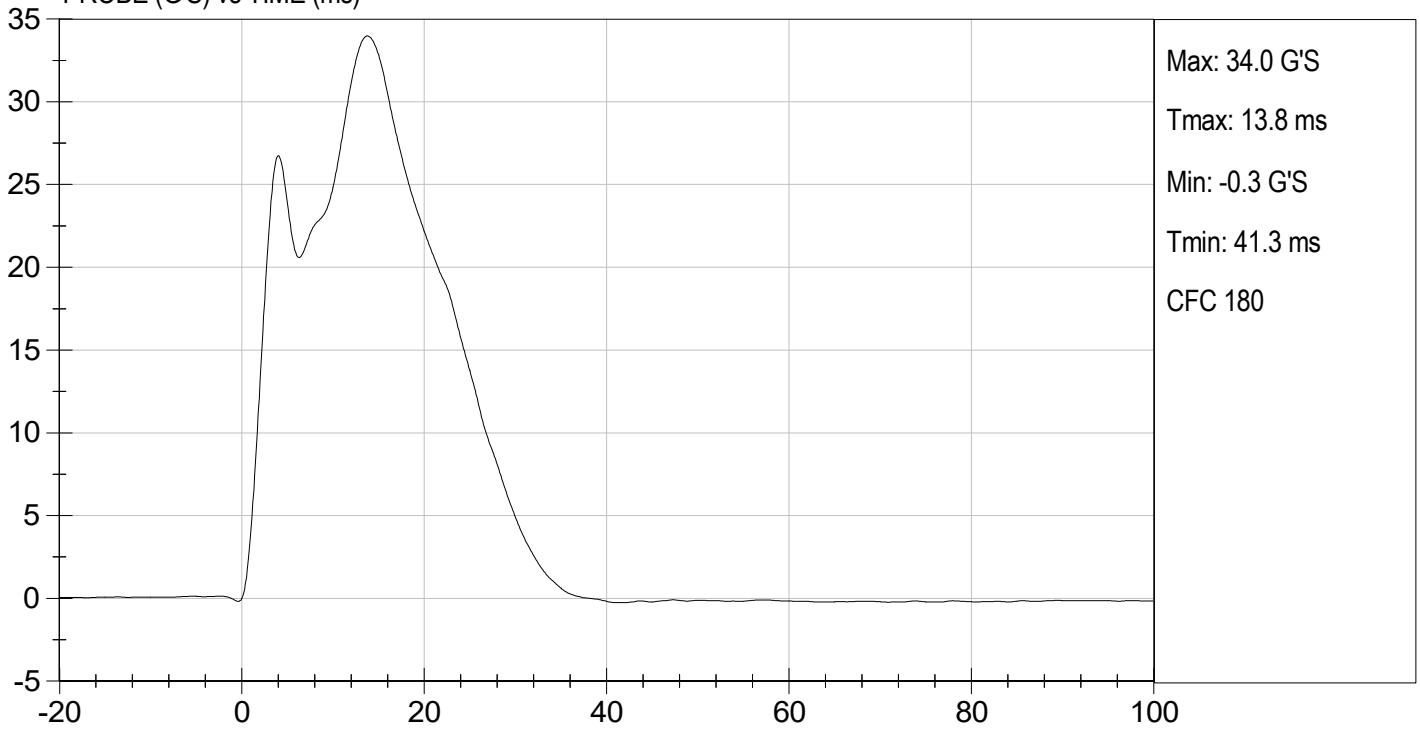
08/11/2023
Test Date

Approved By

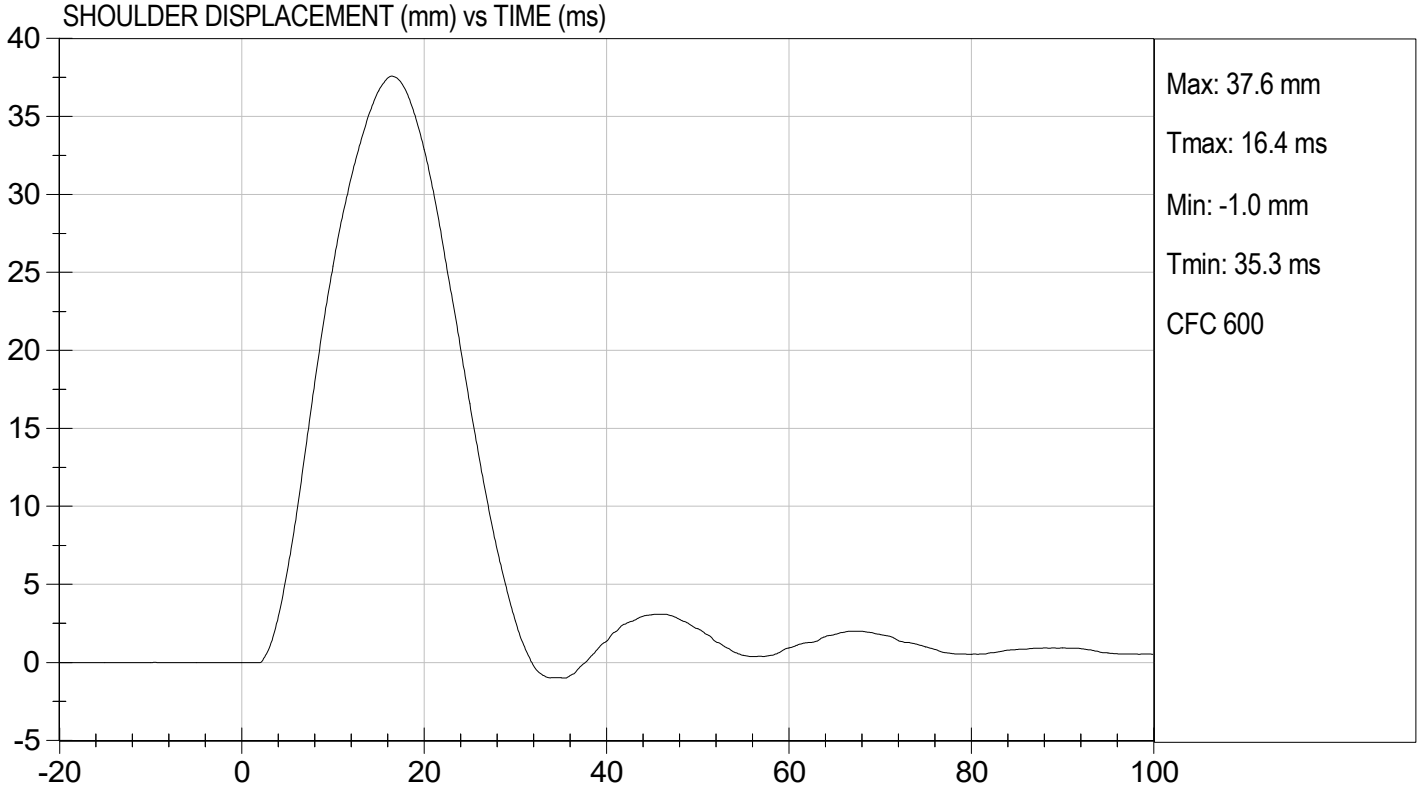
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

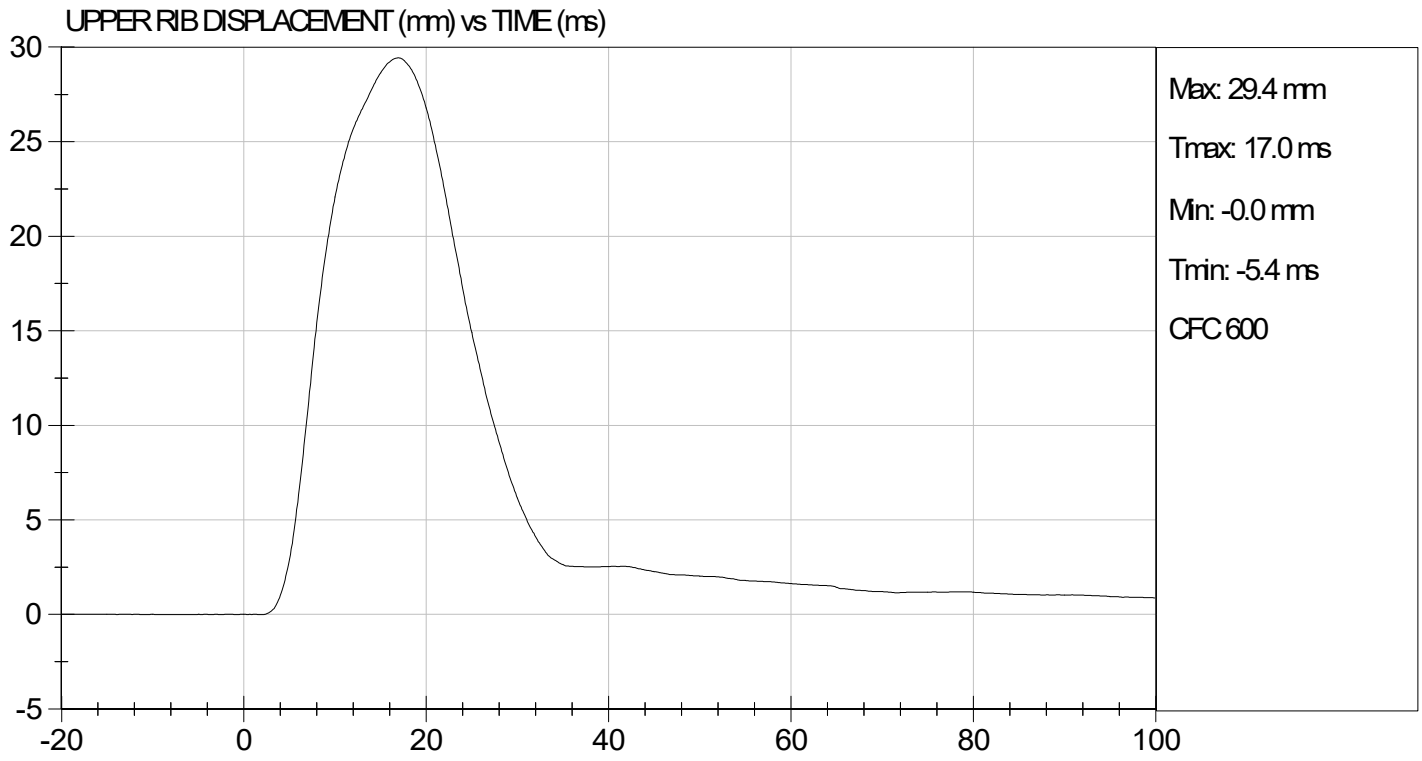
TEST DATE: 08/11/2023
TEST #: D232194

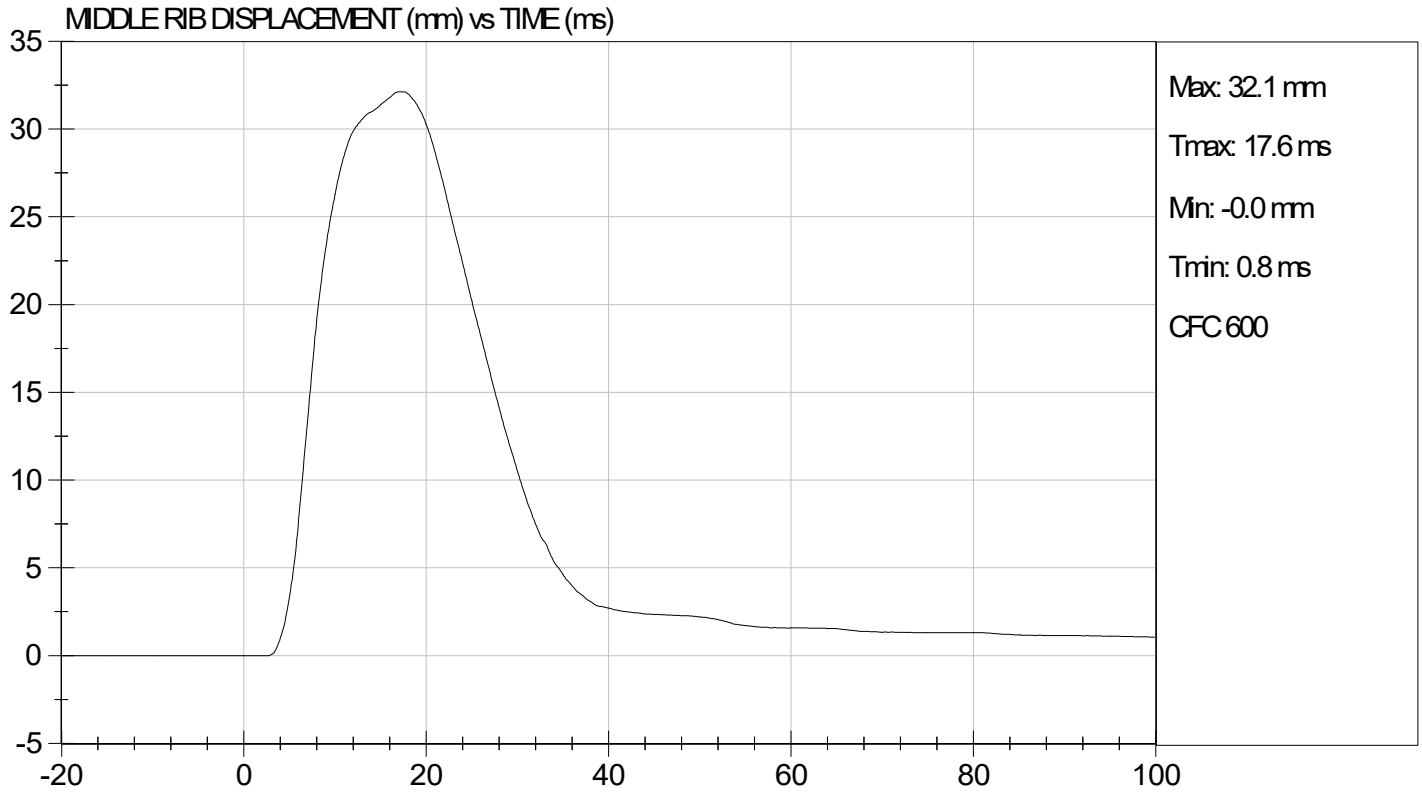
PROBE (G'S) vs TIME (ms)



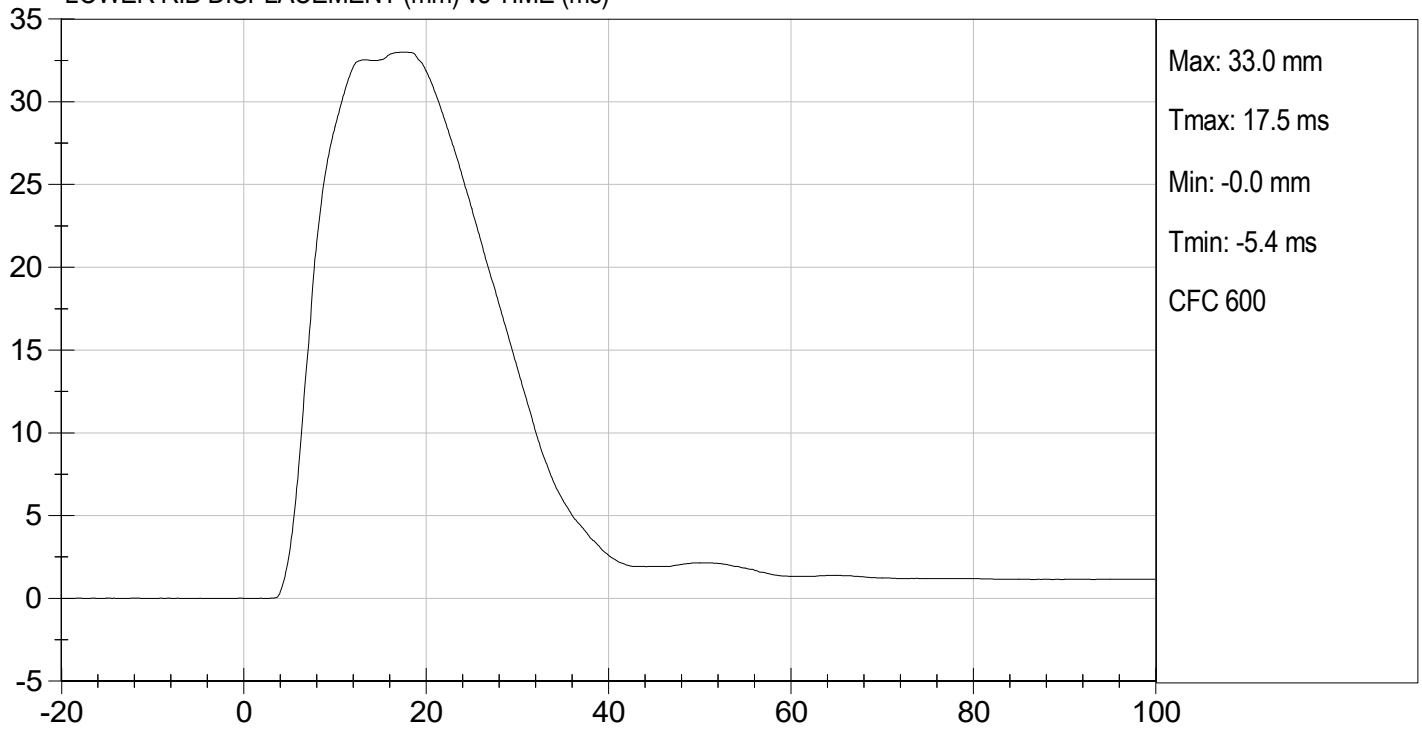
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



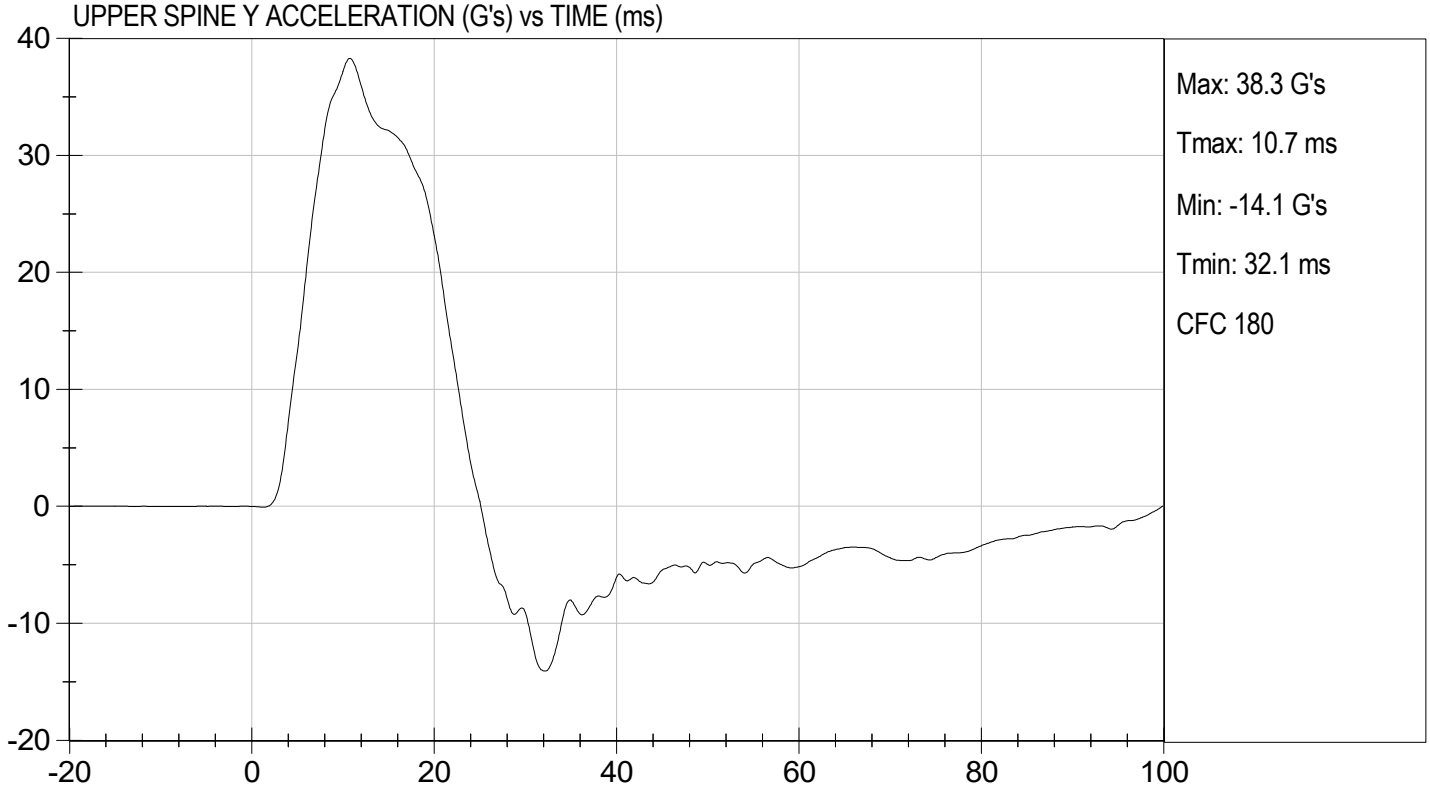

UPPER RIB DISPLACEMENT (mm) vs TIME (ms)
30
25
20
15
10
5
0
-5
-20
0
20
40
60
80
100
Max: 29.4 mm
Tmax: 17.0 ms
Min: -0.0 mm
Tmin: -5.4 ms
CFC 600


MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-20
0
20
40
60
80
100
Max: 32.1 mm
Tmax: 17.6 ms
Min: -0.0 mm
Tmin: 0.8 ms
CFC 600

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

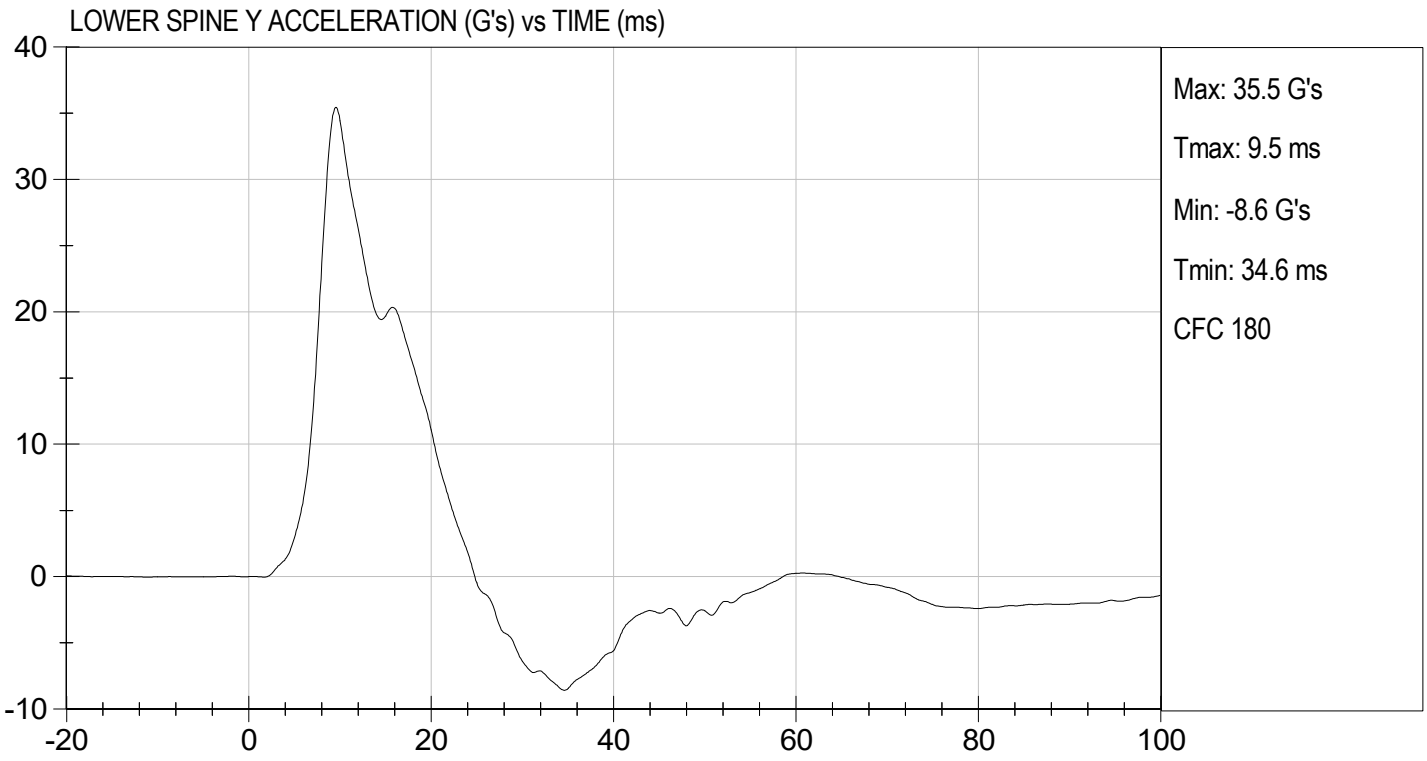


UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 08/11/2023
TEST #: D232194



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D232195

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	14 to 18	16	Pass
Upper Rib Displacement	mm	32 to 40	38	Pass
Middle Rib Displacement	mm	39 to 45	43	Pass
Lower Rib Displacement	mm	35 to 43	41	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	16	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	10	Pass
		Overall Test Results		Pass

Laboratory Technician

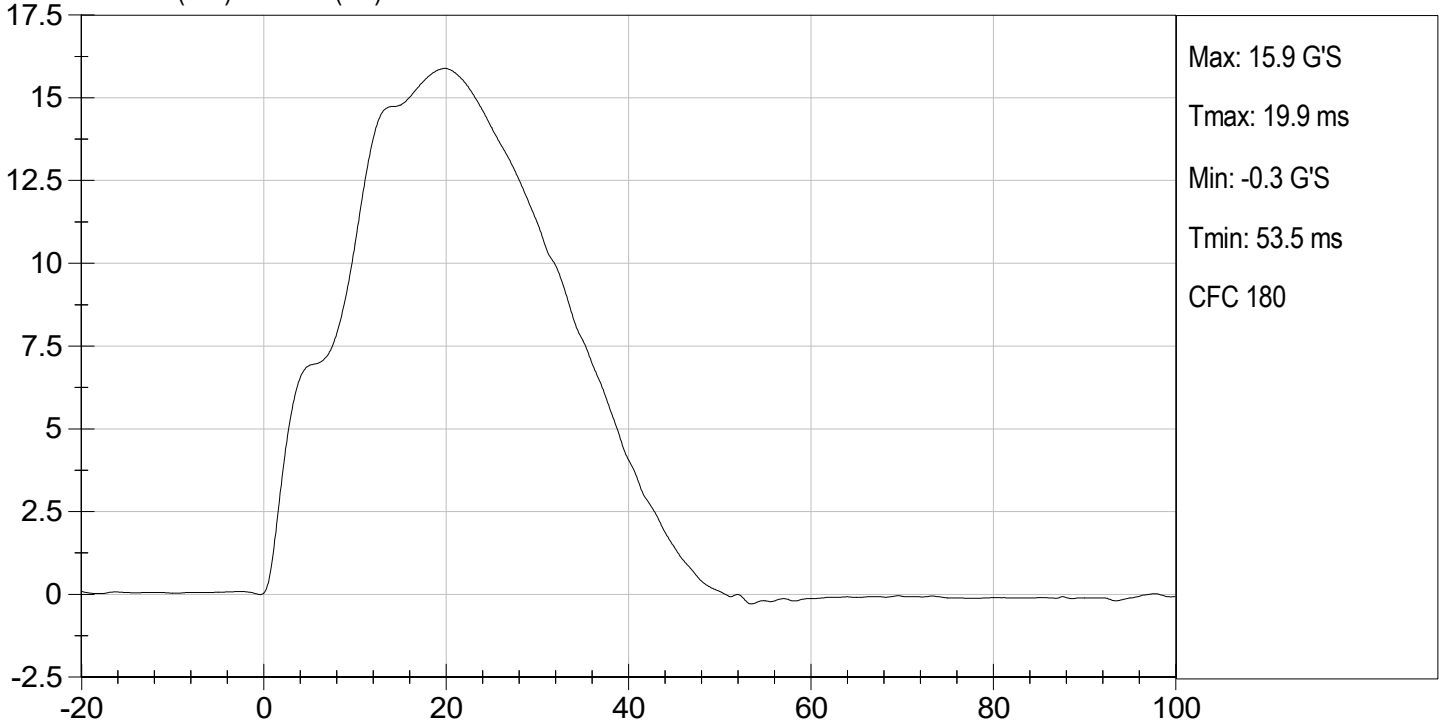
08/11/2023
Test Date

Approved By

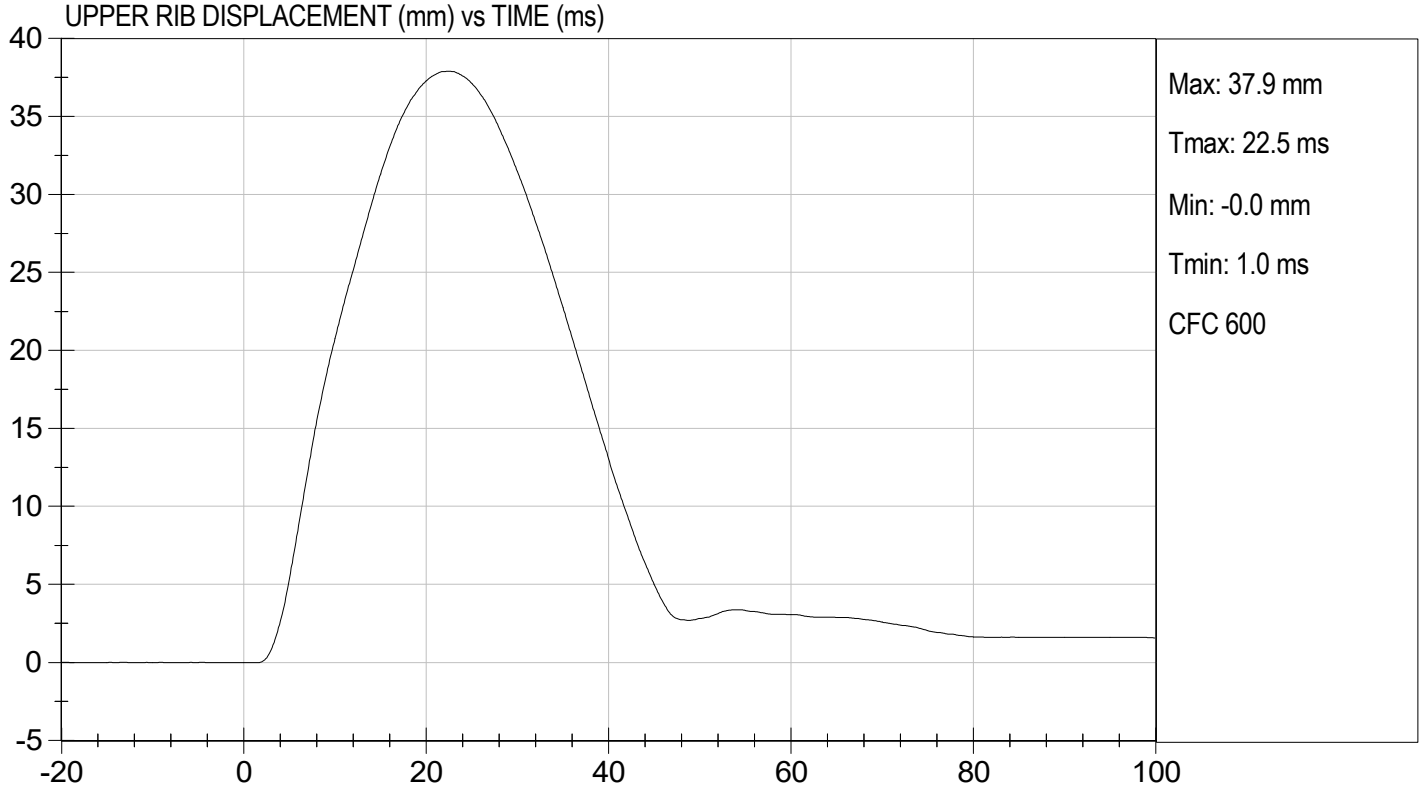
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/11/2023
TEST #: D232195

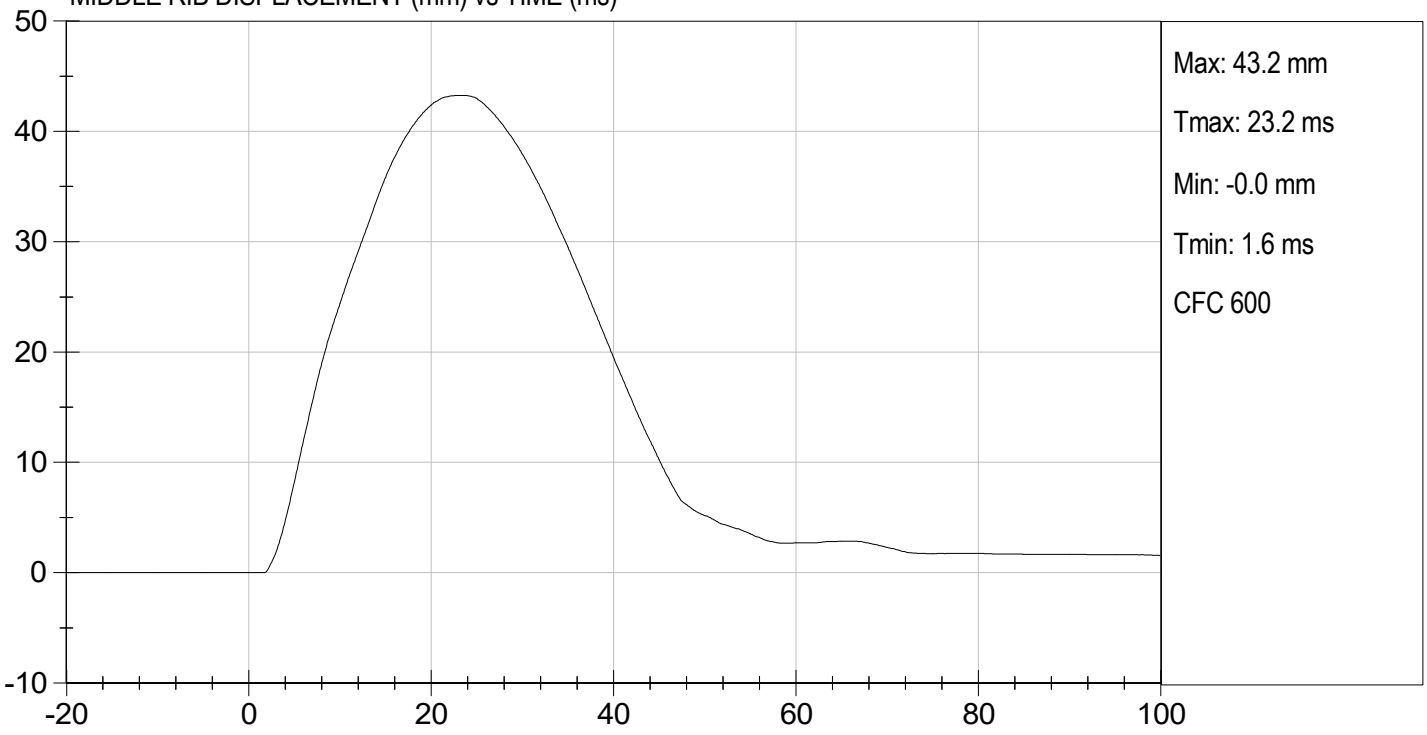
PROBE (G'S) vs TIME (ms)



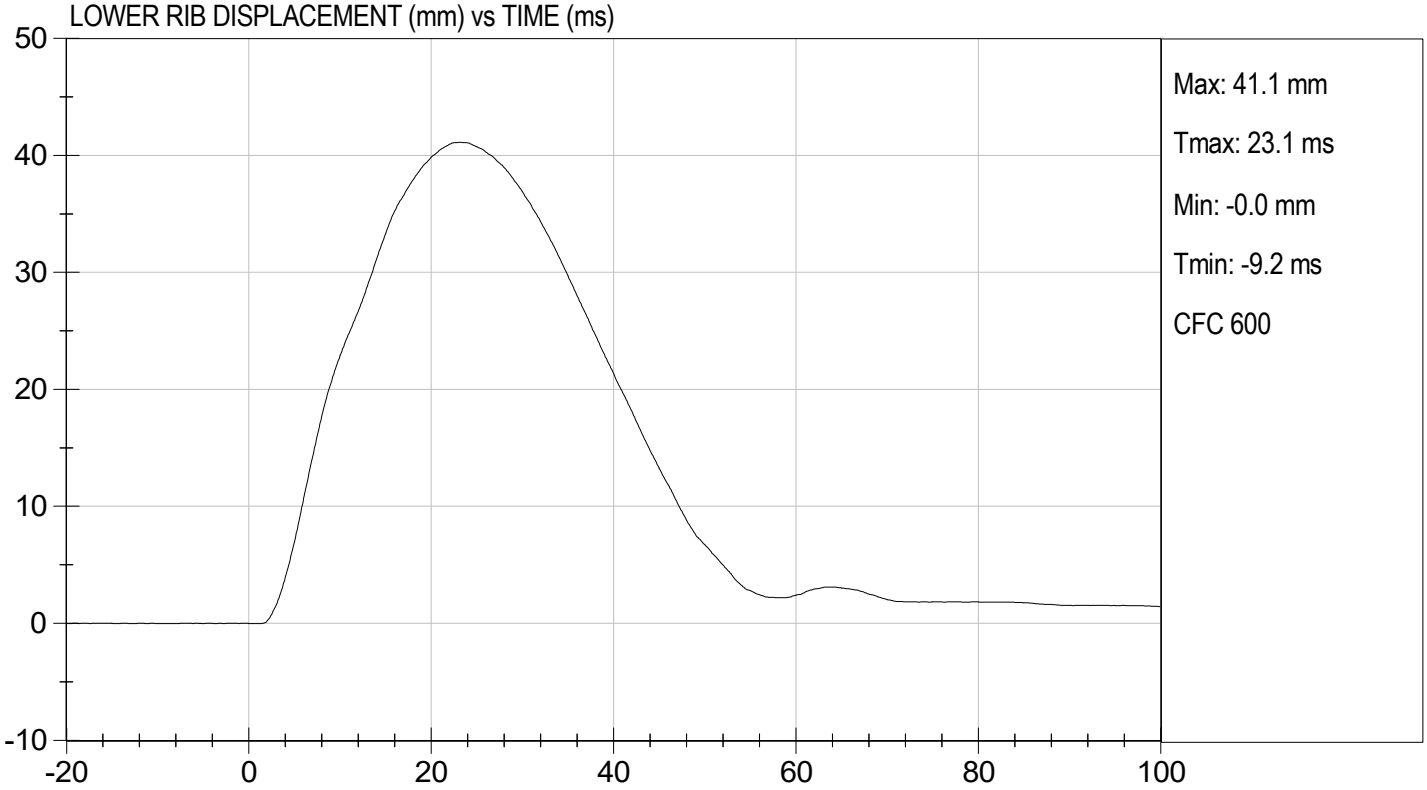
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)

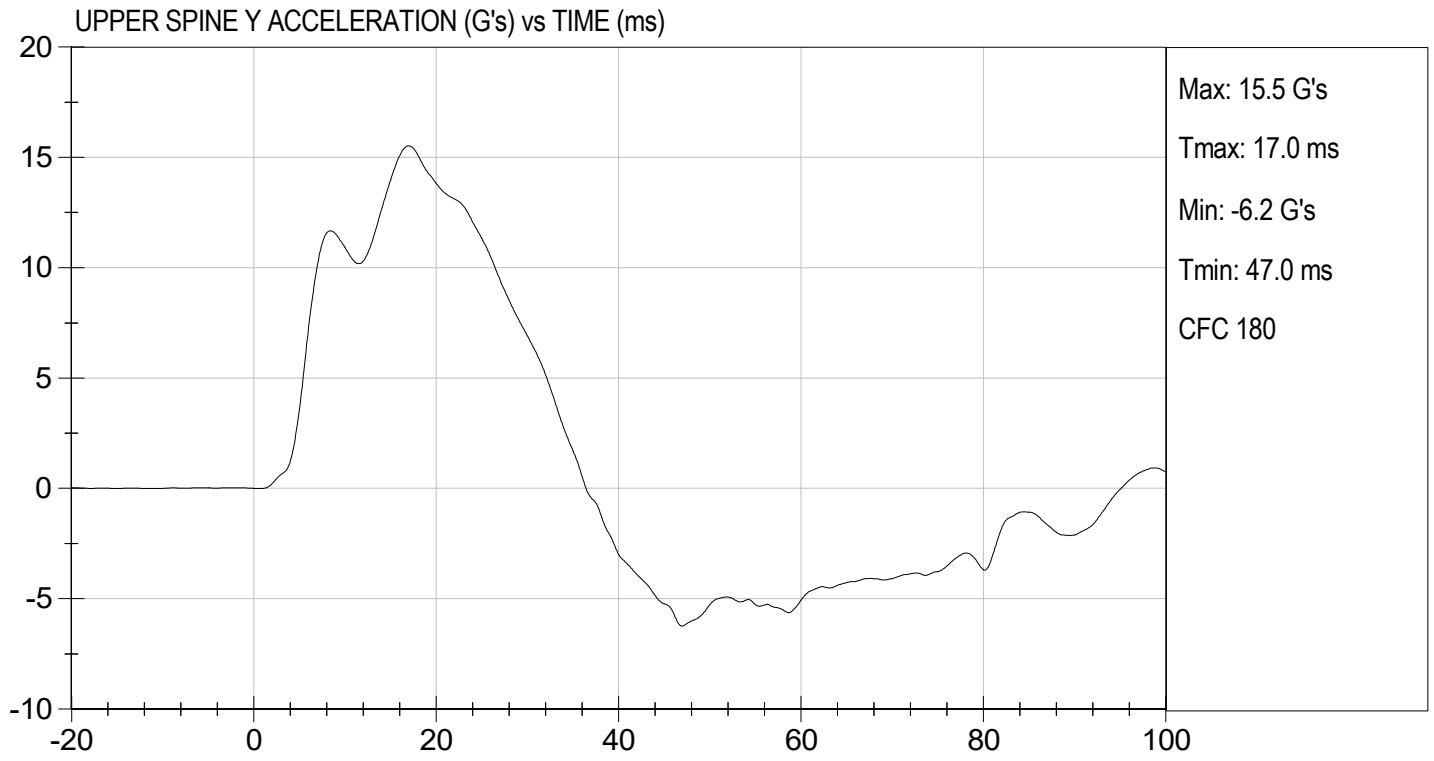


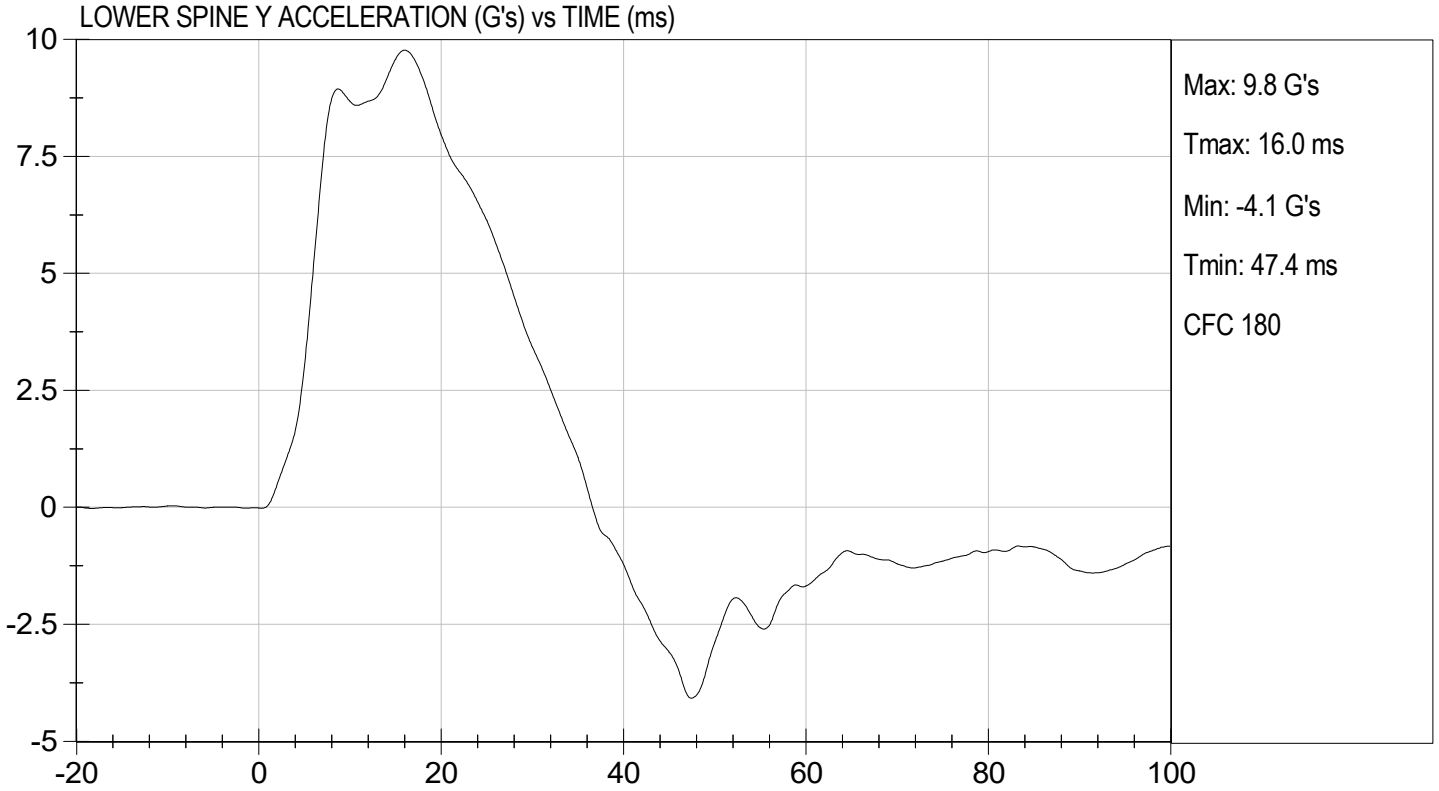
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/11/2023
TEST #: D232195





MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D232196

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	12 to 16	14	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	41	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	36	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	12	Pass
		Overall Test Results		Pass

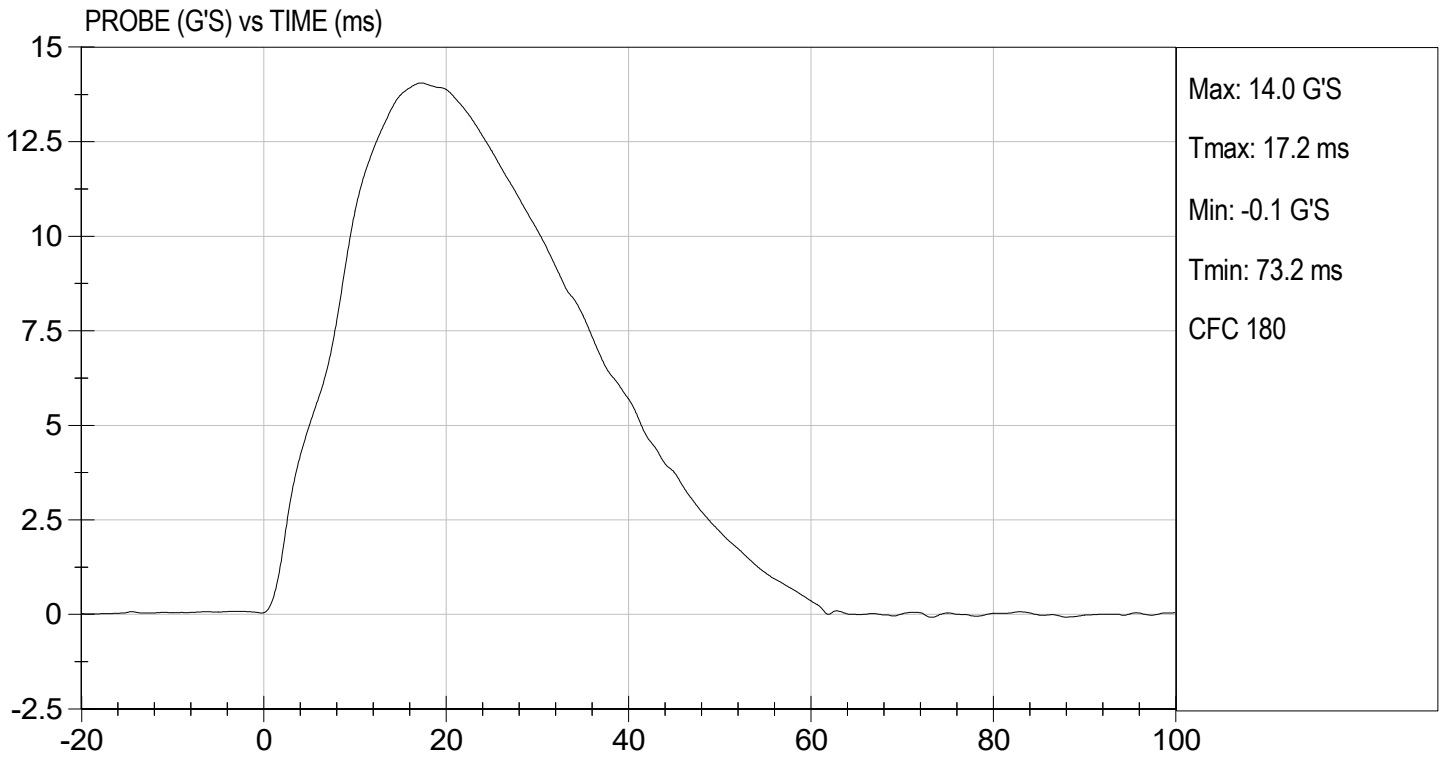
Laboratory Technician

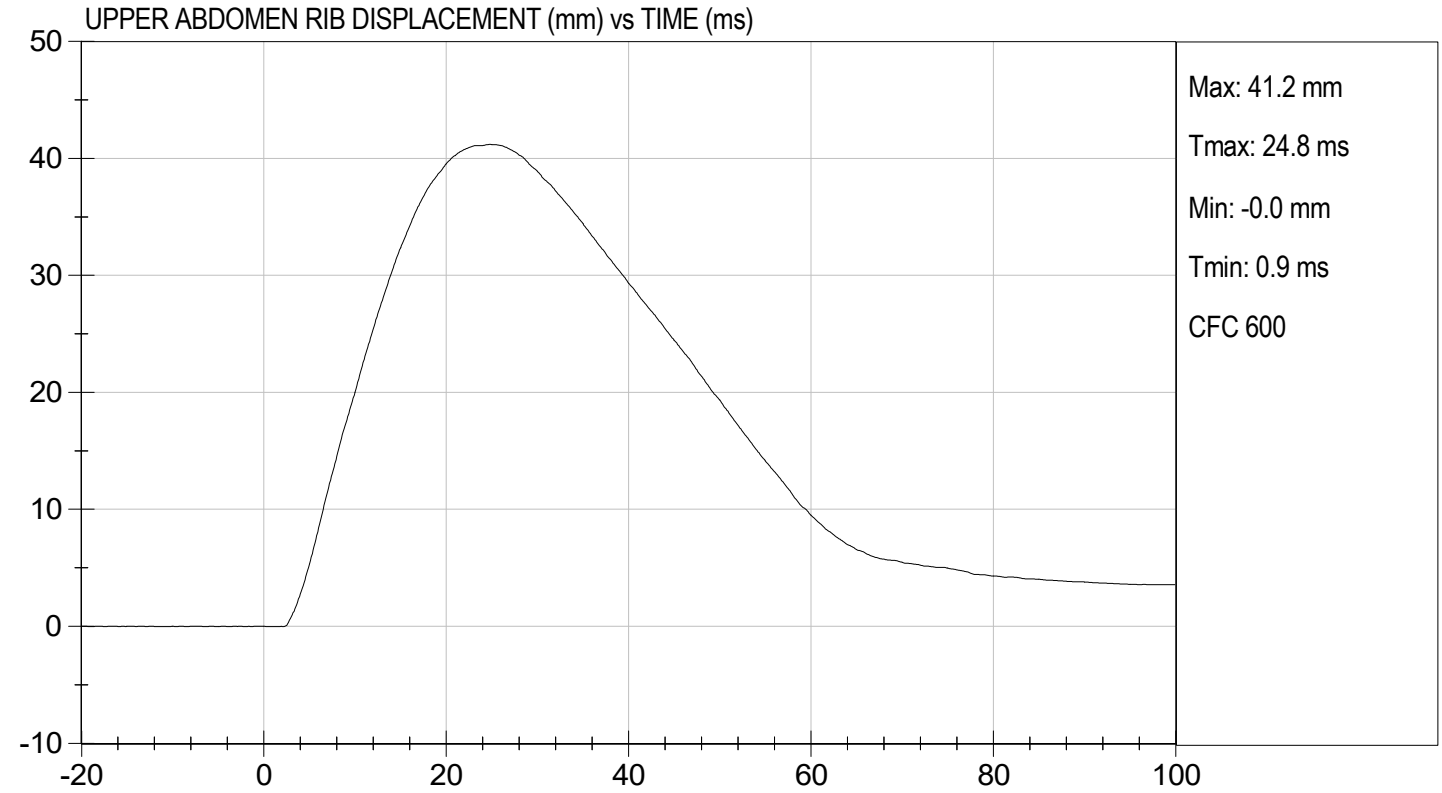
08/11/2023
Test Date

Approved By

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

TEST DATE: 08/11/2023
TEST #: D232196

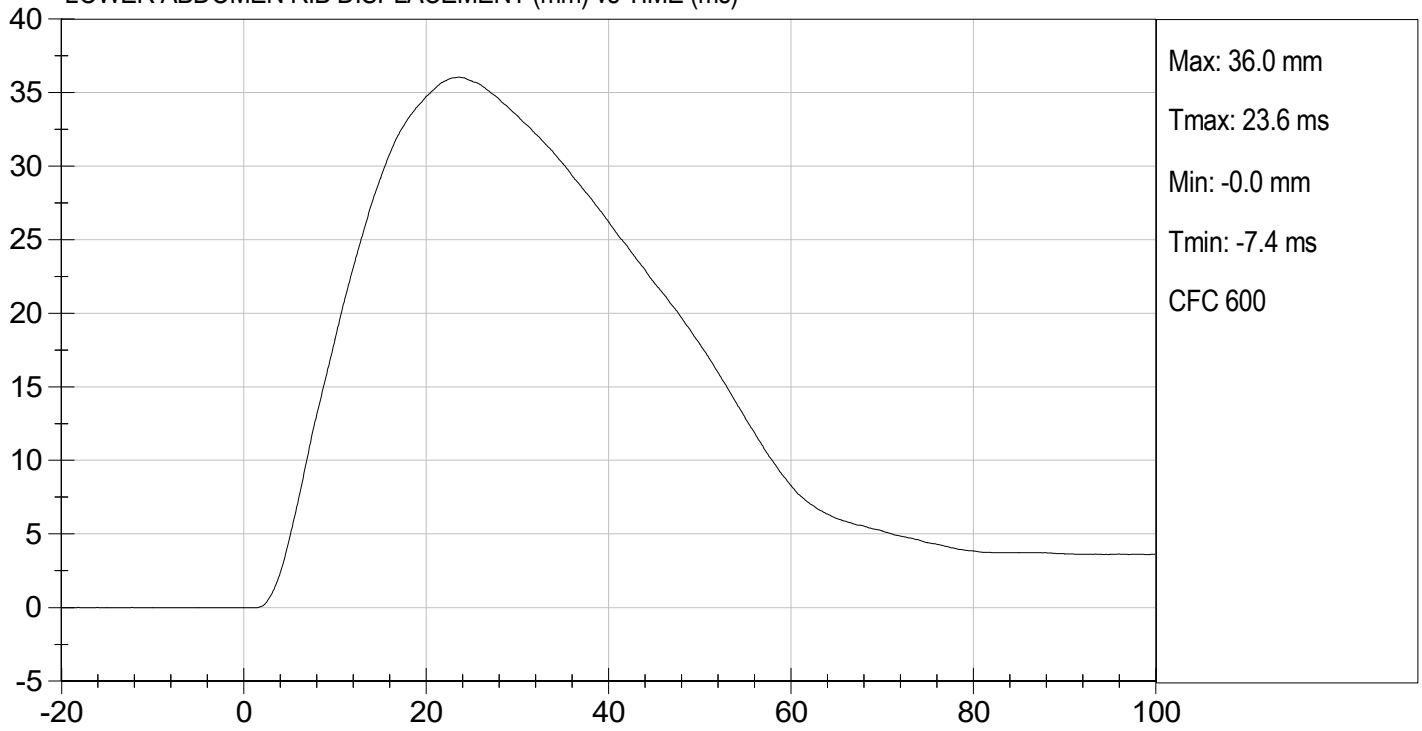




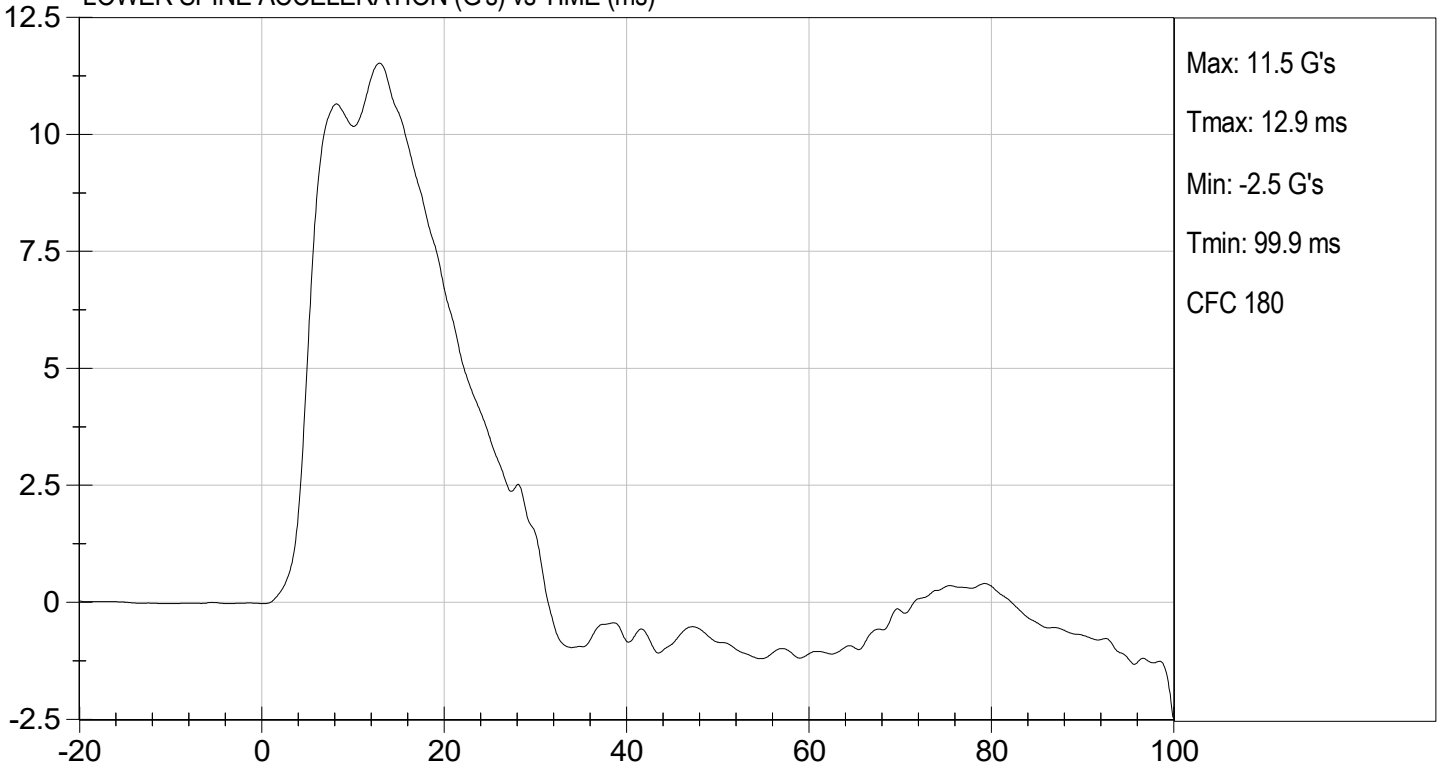
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/11/2023
TEST #: D232196

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:** D232197

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	38 to 47	40	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	36.4	Pass
Peak Acetabulum Force	N	3600 to 4300	3,807	Pass
		Overall Test Results		Pass

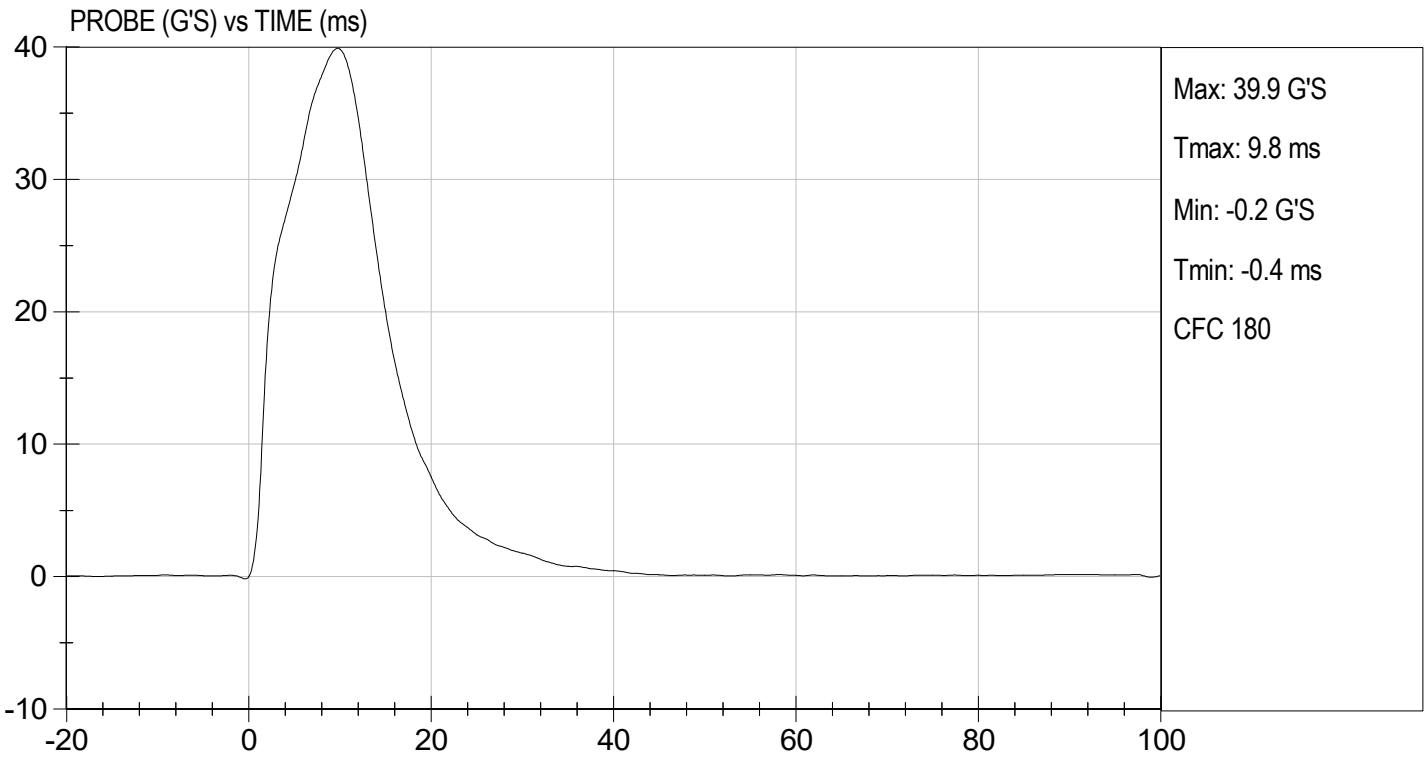
Laboratory Technician

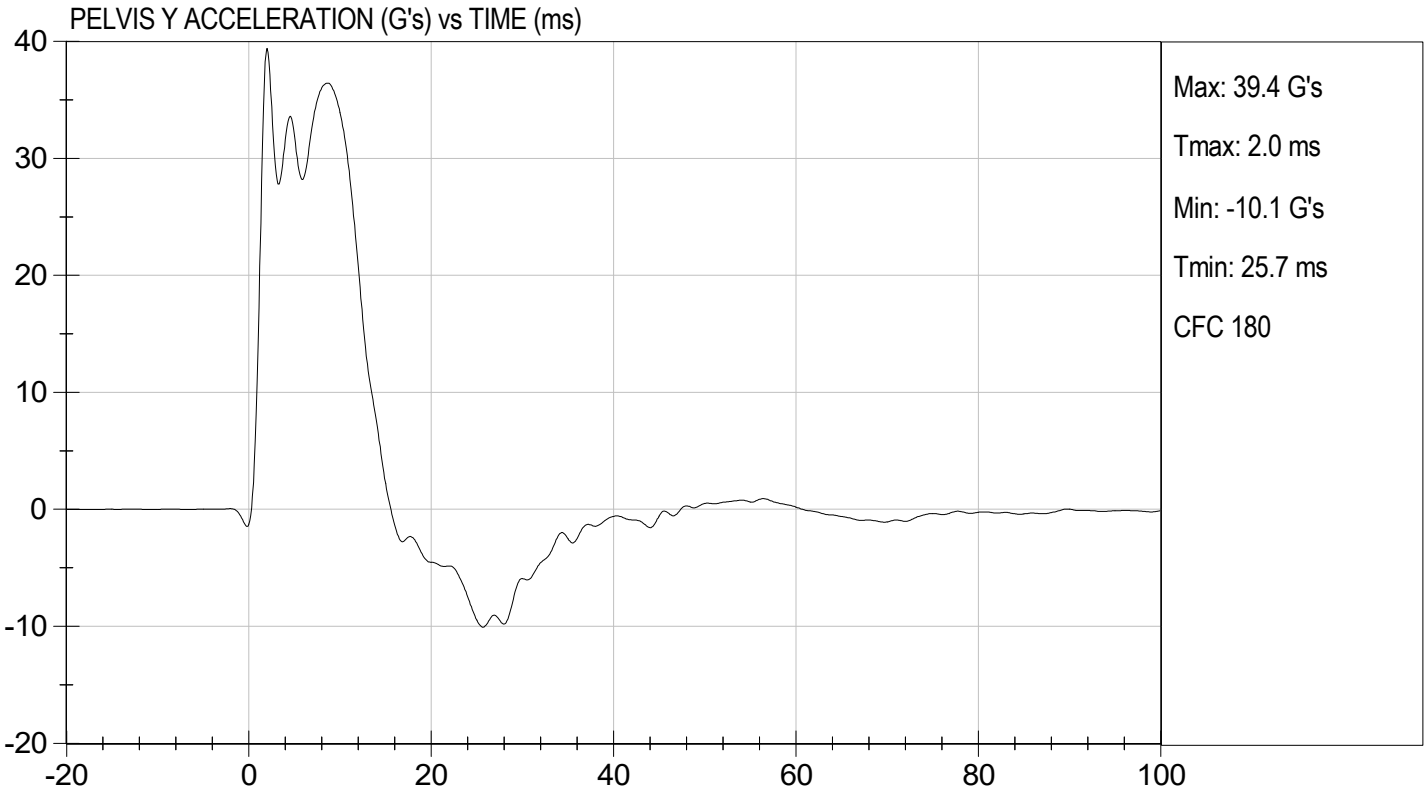
08/11/2023
Test Date

Approved By

TEST DESC: PELVIS IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

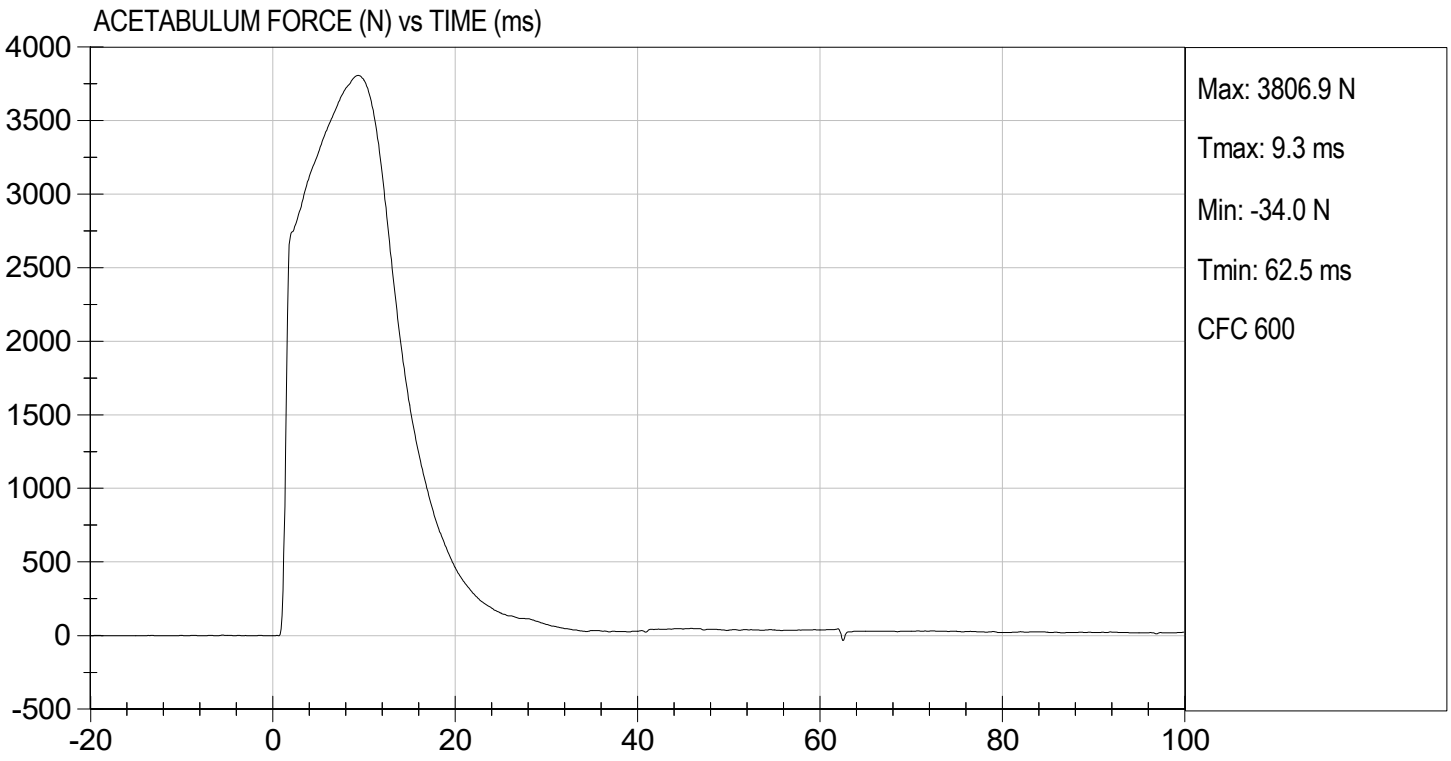
TEST DATE: 08/11/2023
TEST #: D232197





TEST DESC: PELVIS IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 08/11/2023
TEST #: D232197



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D232198

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	45	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	36 to 45	40	Pass
Pelvis Y Acceleration	G's	28 to 39	31	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,732	Pass
		Overall Test Results		Pass

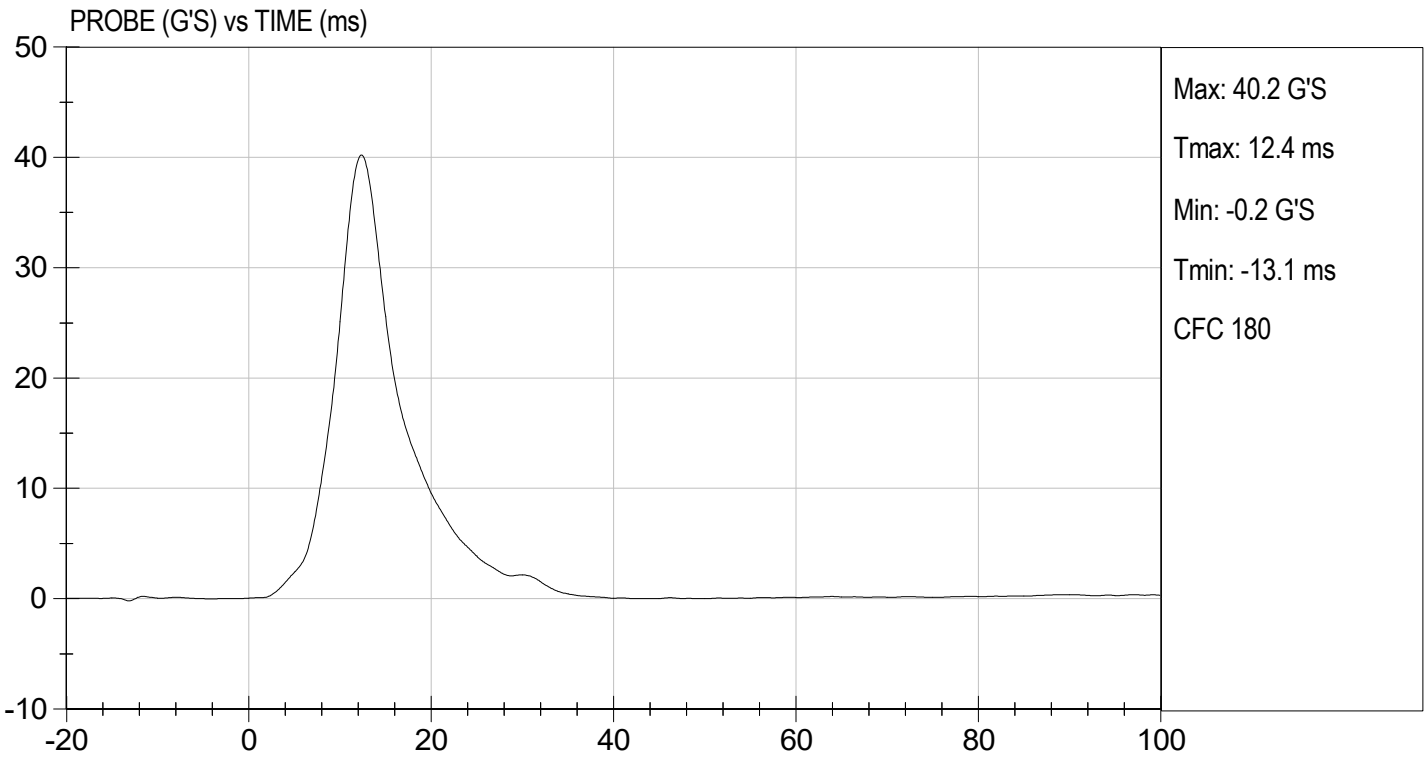
Laboratory Technician

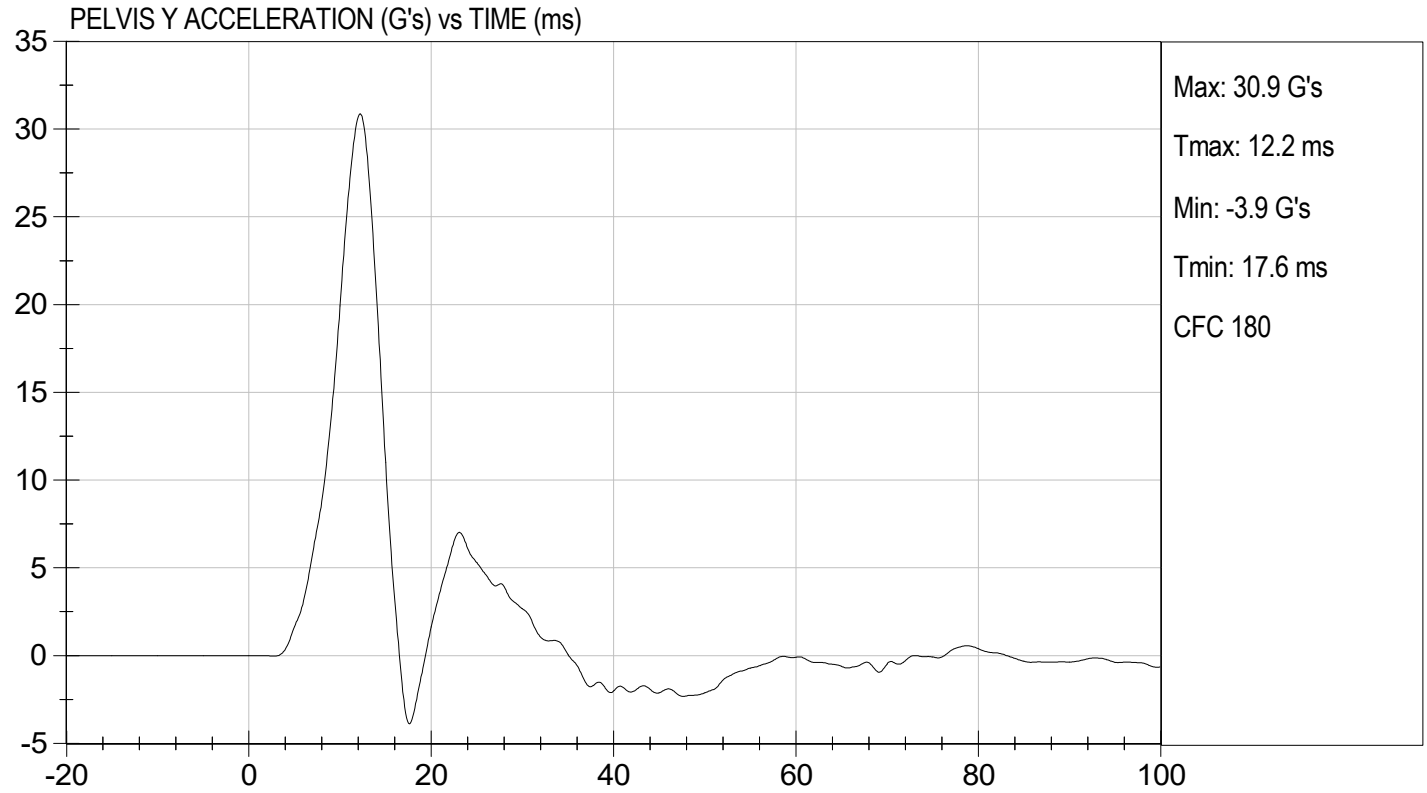
08/11/2023
Test Date

Approved By

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

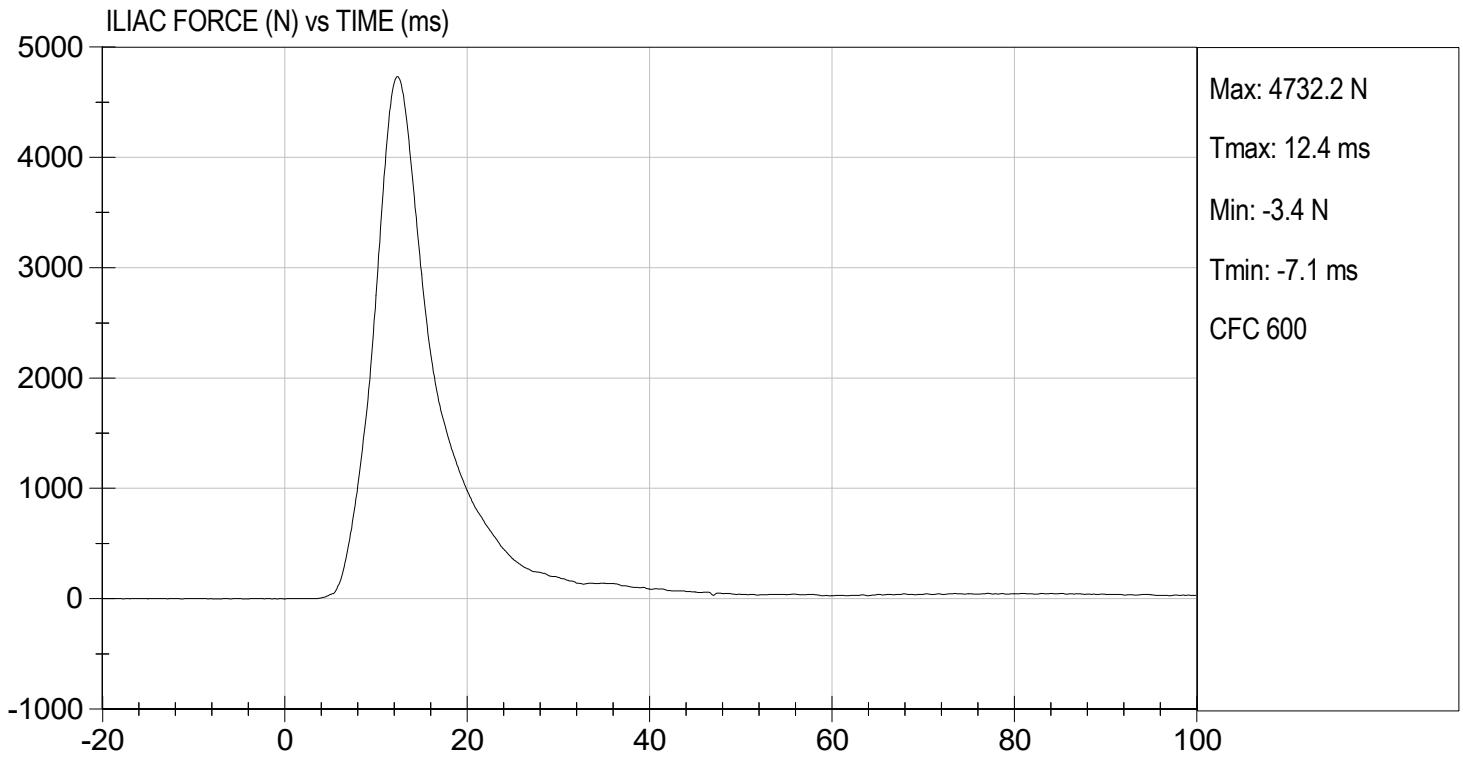
TEST DATE: 08/11/2023
TEST #: D232198





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

TEST DATE: 08/11/2023
TEST #: D232198



QUALIFICATION 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:** D232381

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Peak Resultant Acceleration	G's	115 to 137	133	Pass
Peak Longitudinal Acceleration	G's	+/- 15	2.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

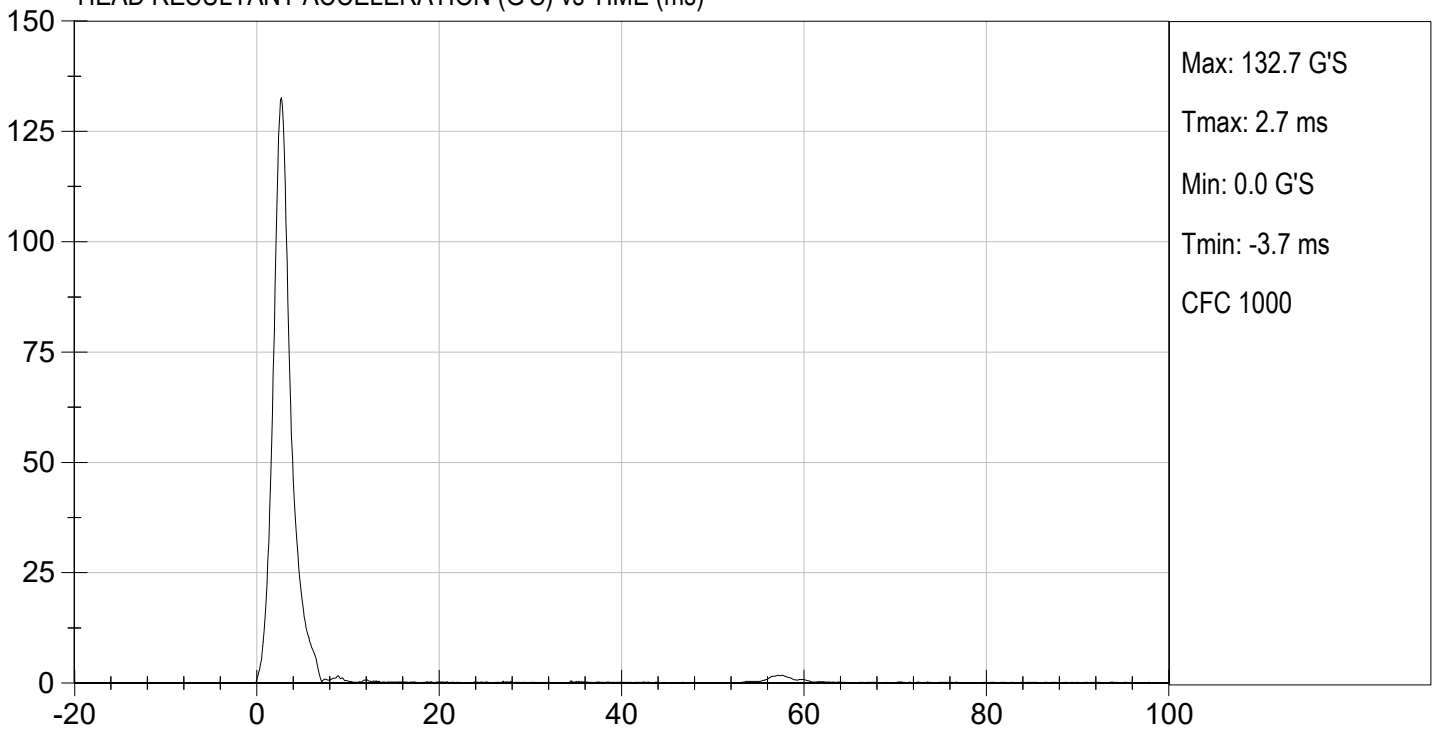
09/05/2023
Test Date

Approved By

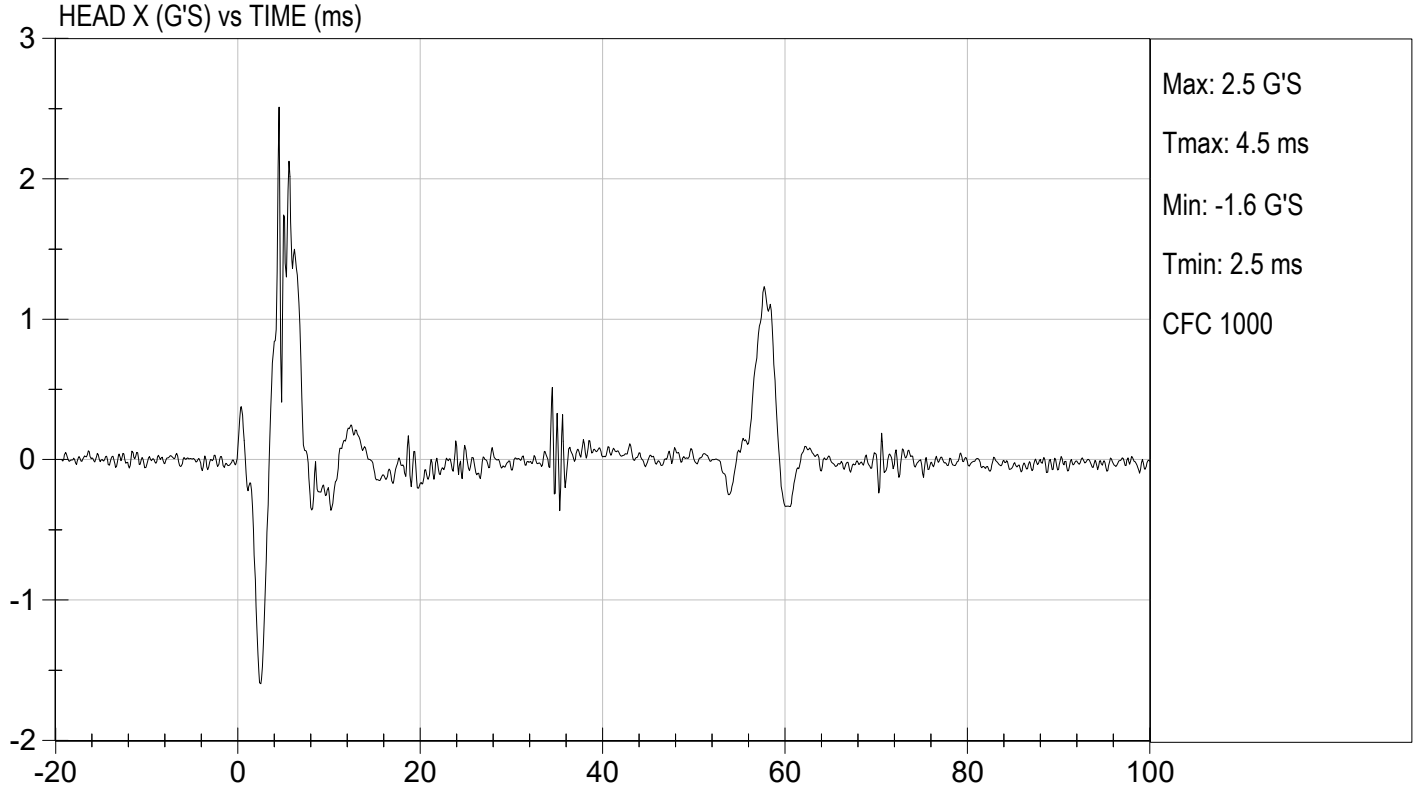
TEST DESC: HEAD DROP

TEST DATE: 09/05/2023
TEST #: D232381

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

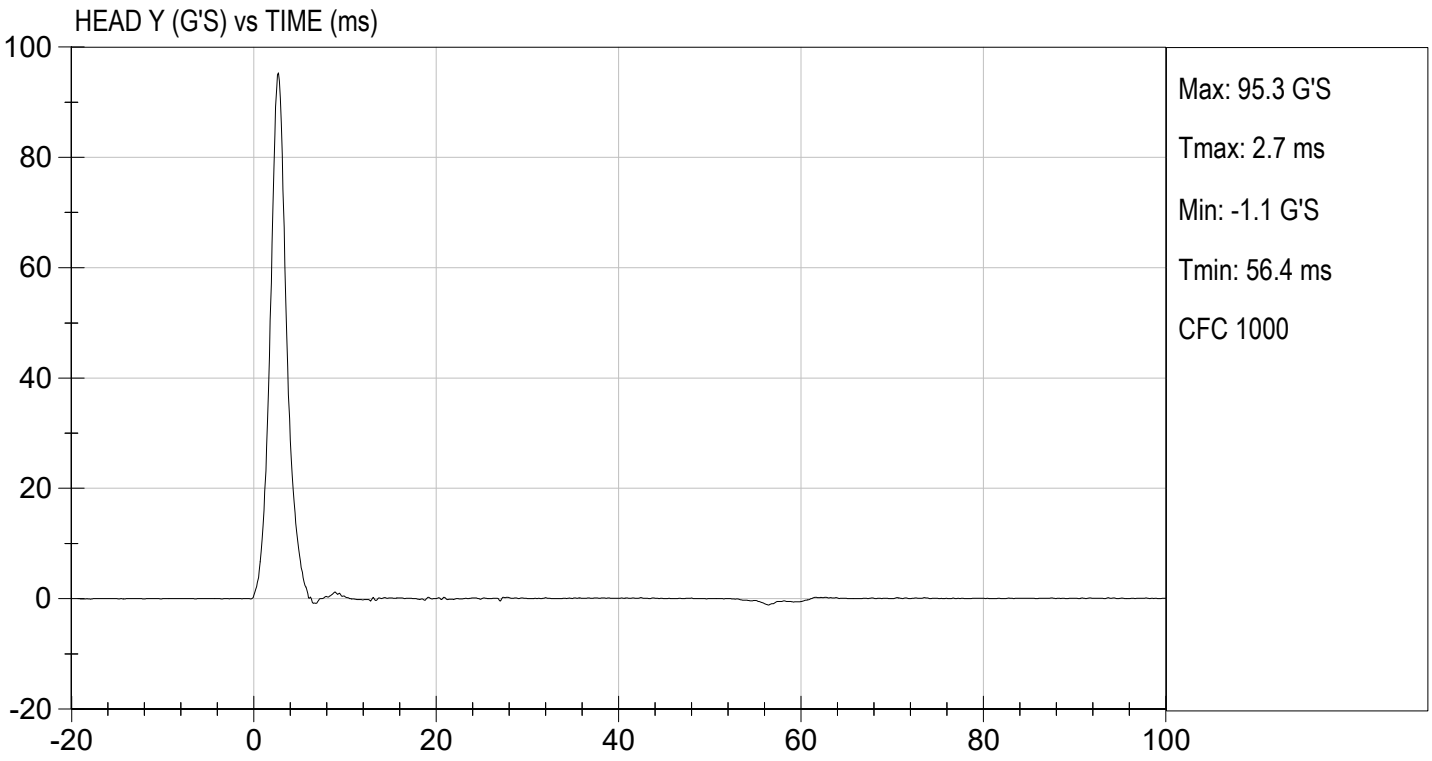


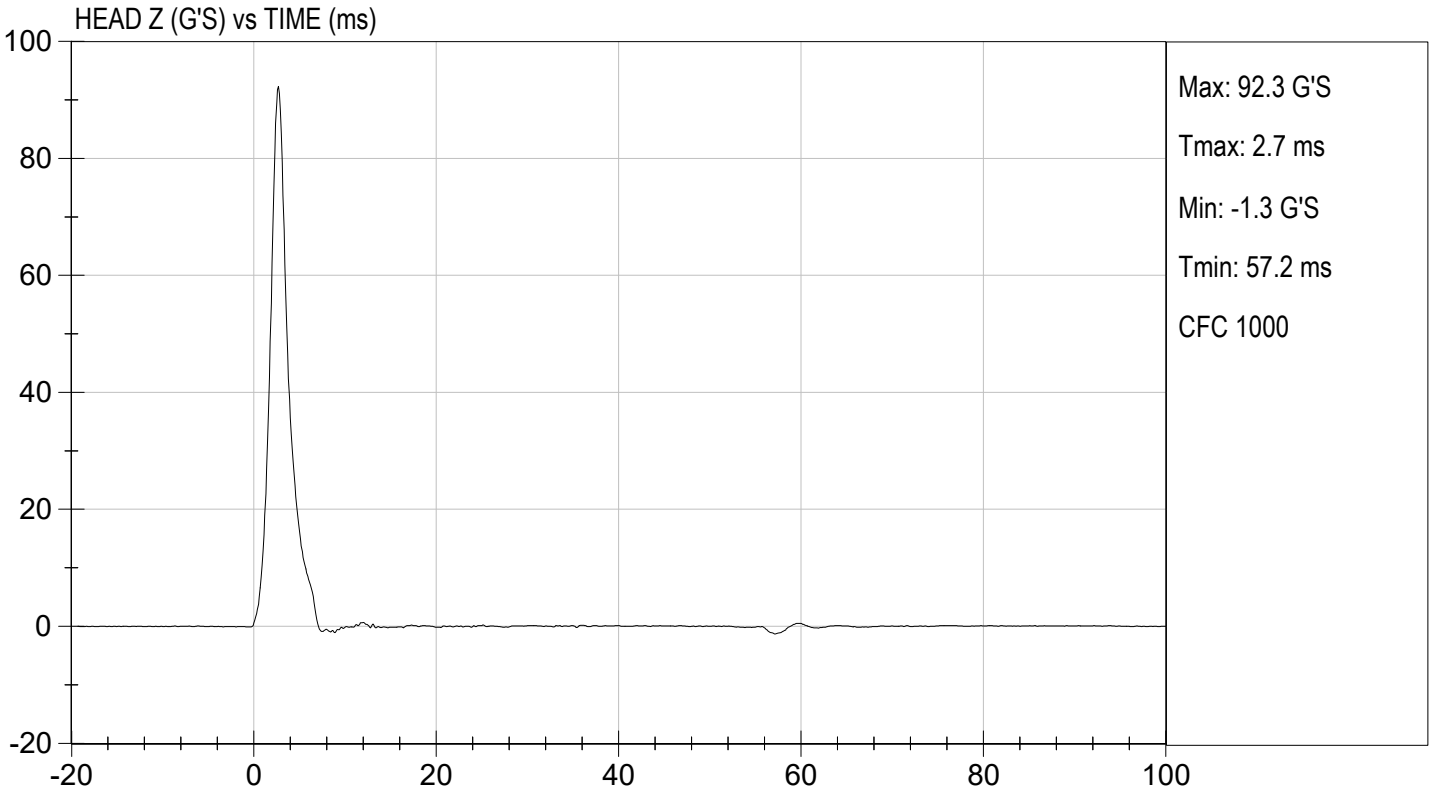
HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 09/05/2023
TEST #: D232381





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D232382

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.2	Pass
Humidity		%	10 to 70	48	Pass
Impact Velocity		m/s	5.51 to 5.63	5.63	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.38	Pass
	15 ms	m/s	3.30 to 4.10	3.60	Pass
	20 ms	m/s	4.40 to 5.40	5.19	Pass
	25 ms	m/s	5.40 to 6.10	5.81	Pass
	25-100 ms	m/s	5.50 to 6.20	5.85	Pass
Maximum D-Plane Rotation		deg	71 to 81	75	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	62	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-39	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	120	Pass
			Overall Test Results		Pass

Laboratory Technician

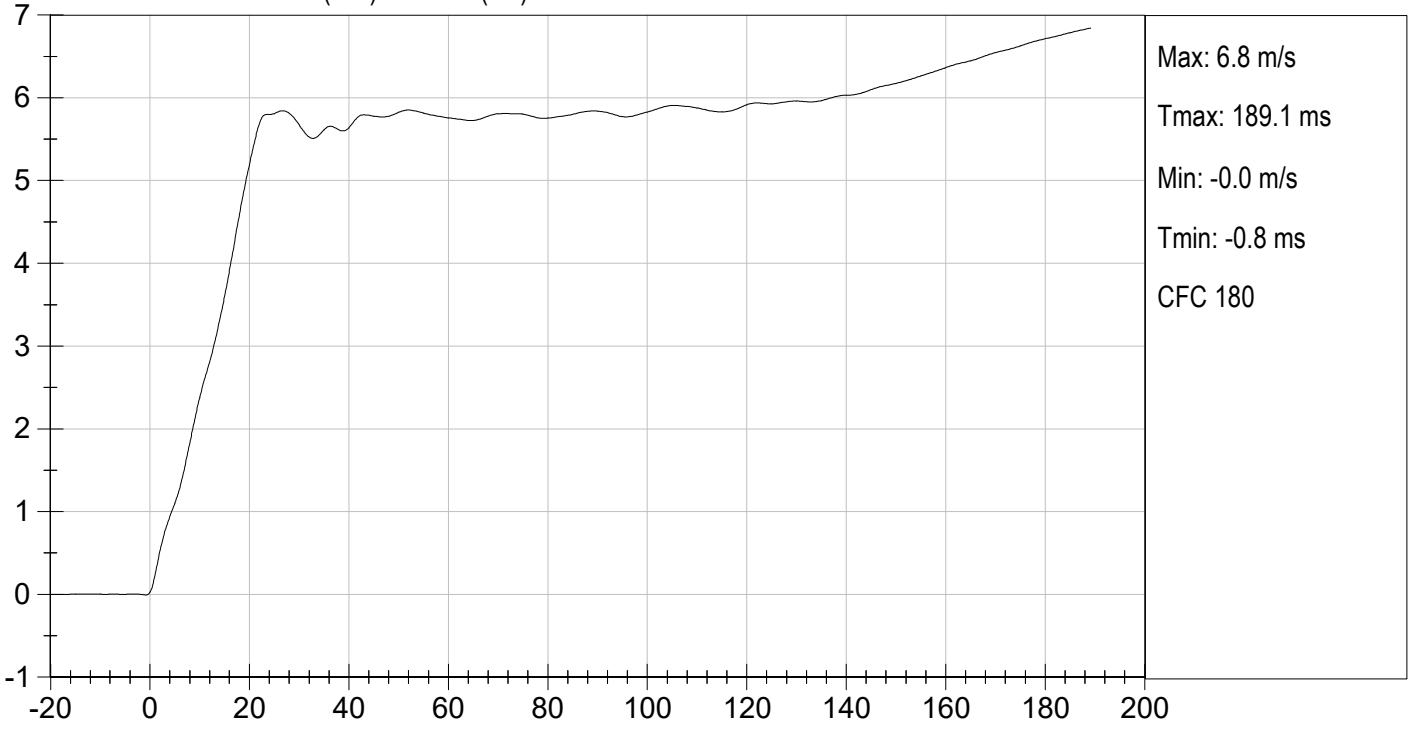
09/05/2023
Test Date

Approved By

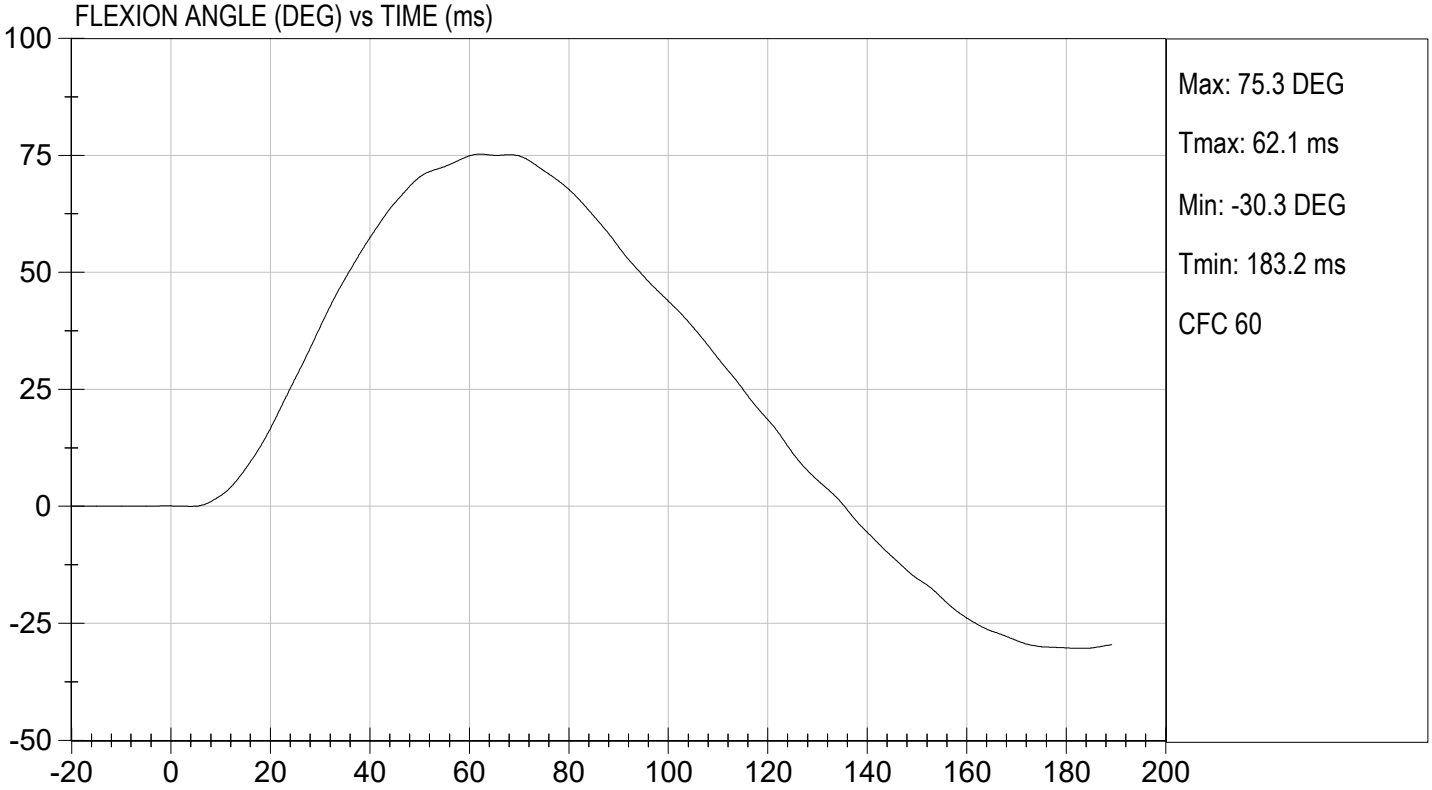
TEST DESC: NECK BENDING
VELOCITY: 18.48 ft/s, 5.63 m/s

TEST DATE: 09/05/2023
TEST #: D232382

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

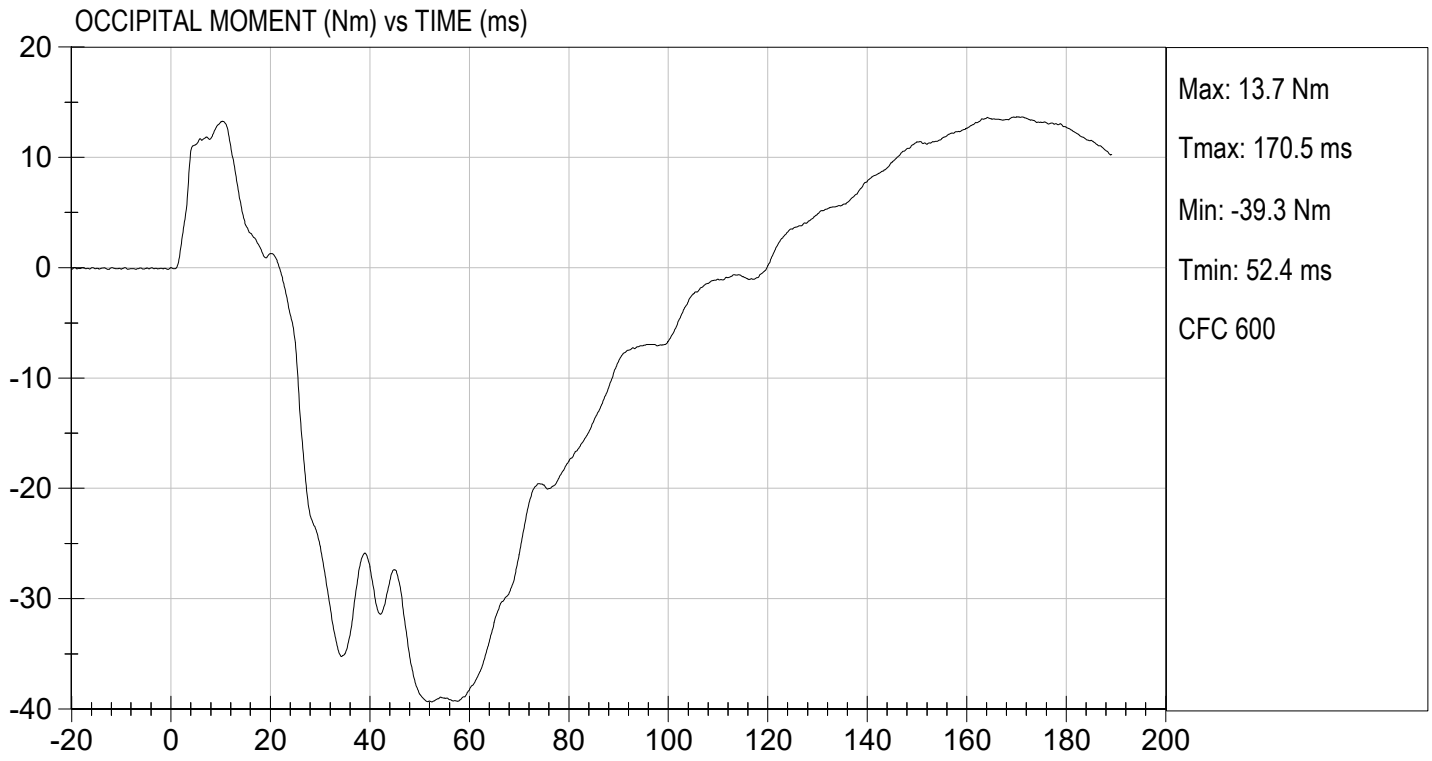


FLEXION ANGLE (DEG) vs TIME (ms)



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

TEST DATE: 09/05/2023
TEST #: D232382



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D232383

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	13 to 18	16	Pass
Shoulder Displacement	mm	28 to 37	30	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	20	Pass
		Overall Test Results		Pass

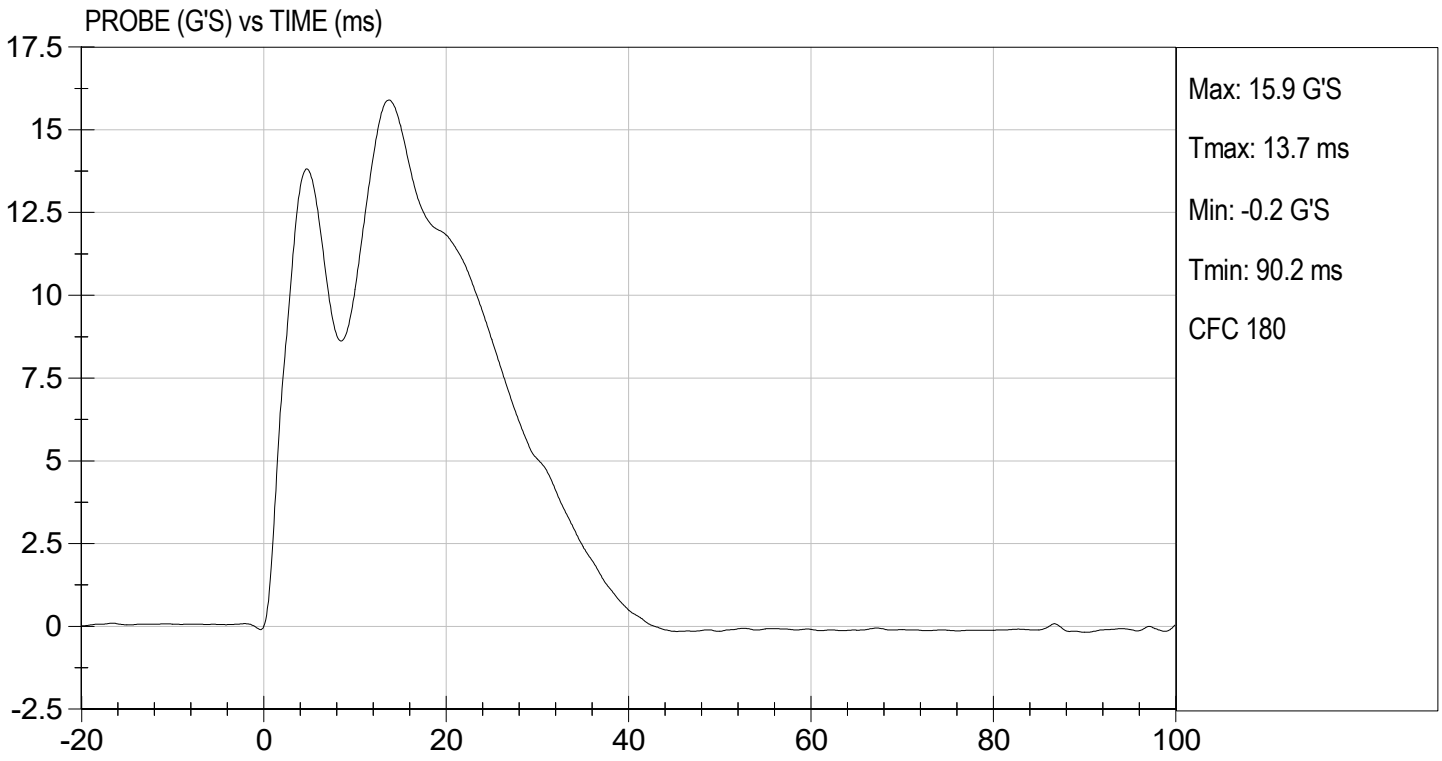
Laboratory Technician

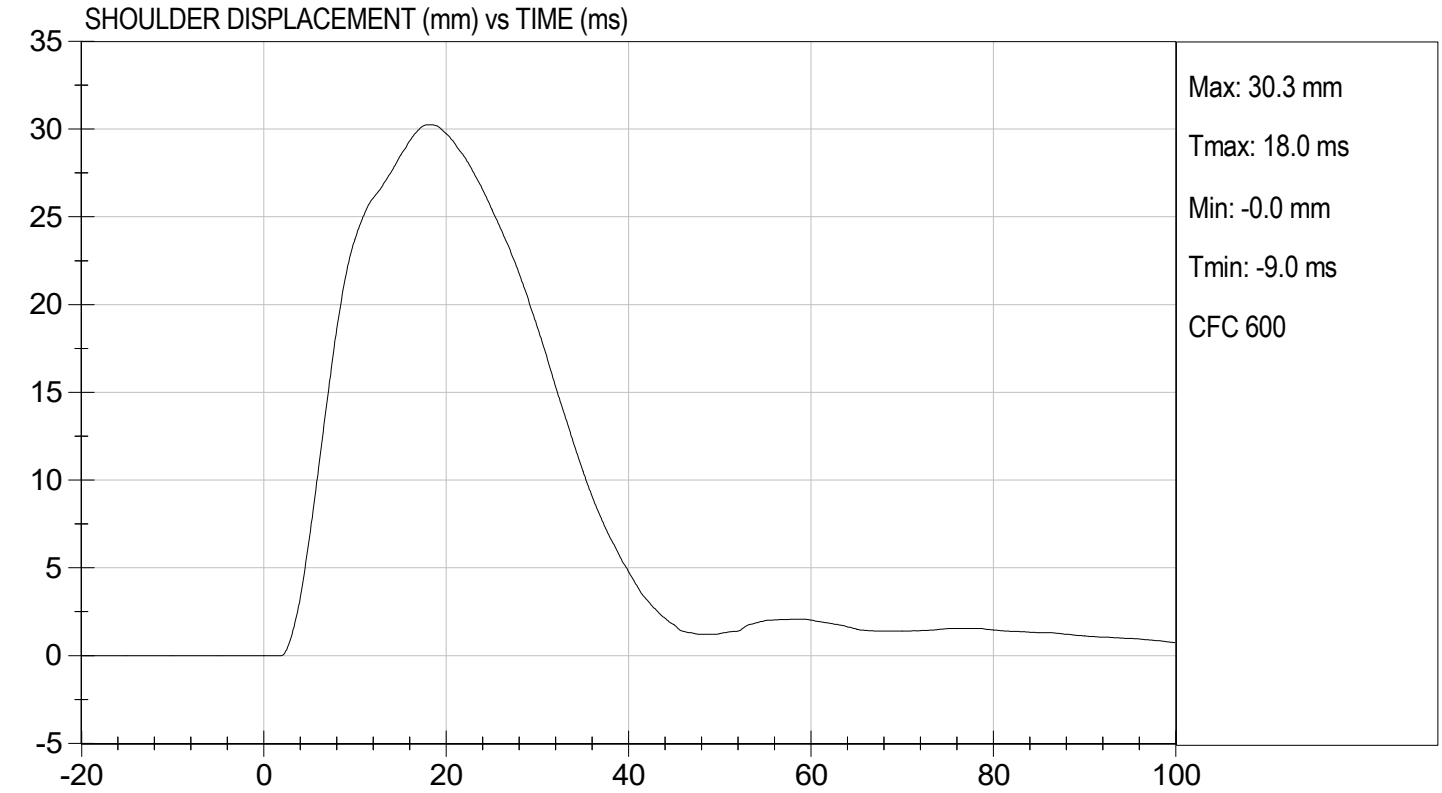
09/05/2023
Test Date

Approved By

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

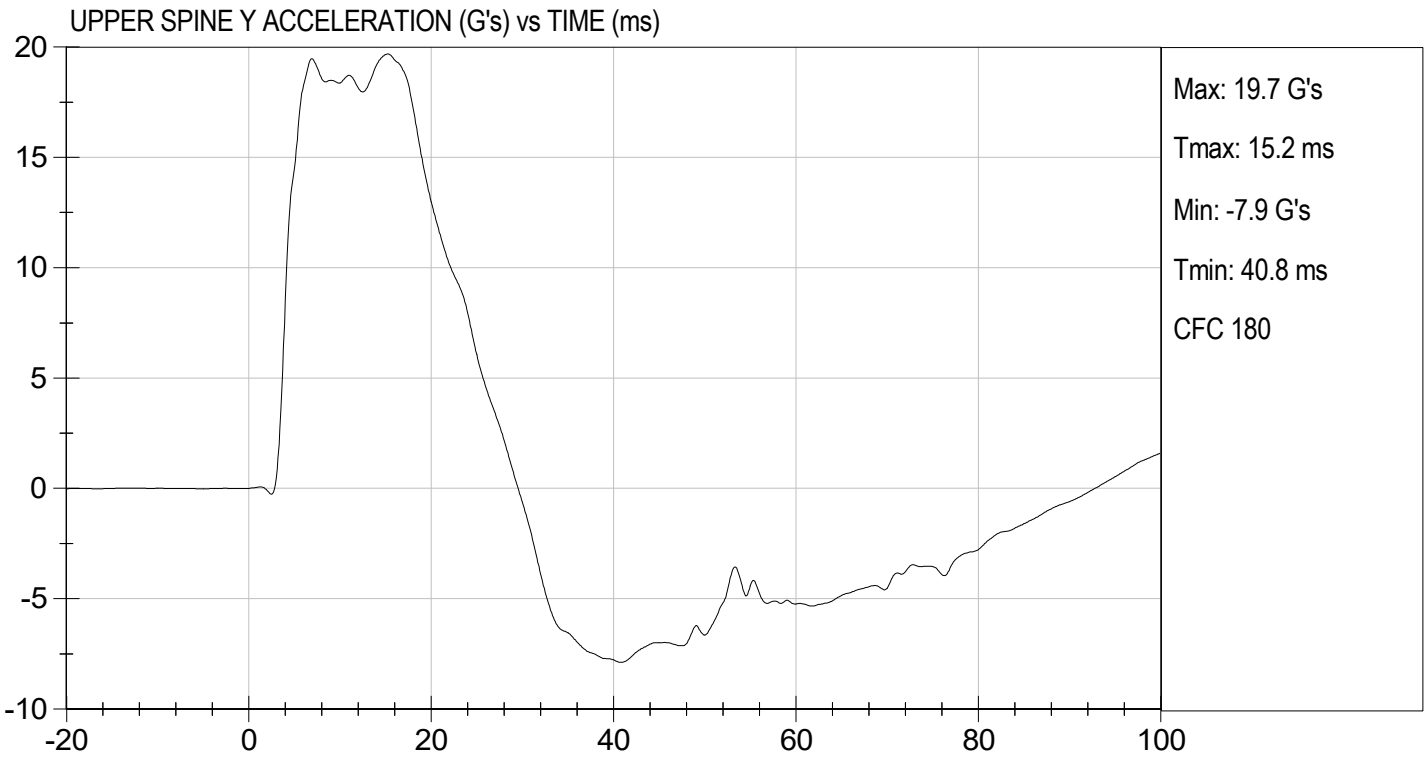
TEST DATE: 09/05/2023
TEST #: D232383





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

TEST DATE: 09/05/2023
TEST #: D232383



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D232384

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	47	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	34	Pass
Upper Rib Displacement	mm	25 to 32	28	Pass
Middle Rib Displacement	mm	30 to 36	32	Pass
Lower Rib Displacement	mm	32 to 38	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	38	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	32	Pass
		Overall Test Results		Pass

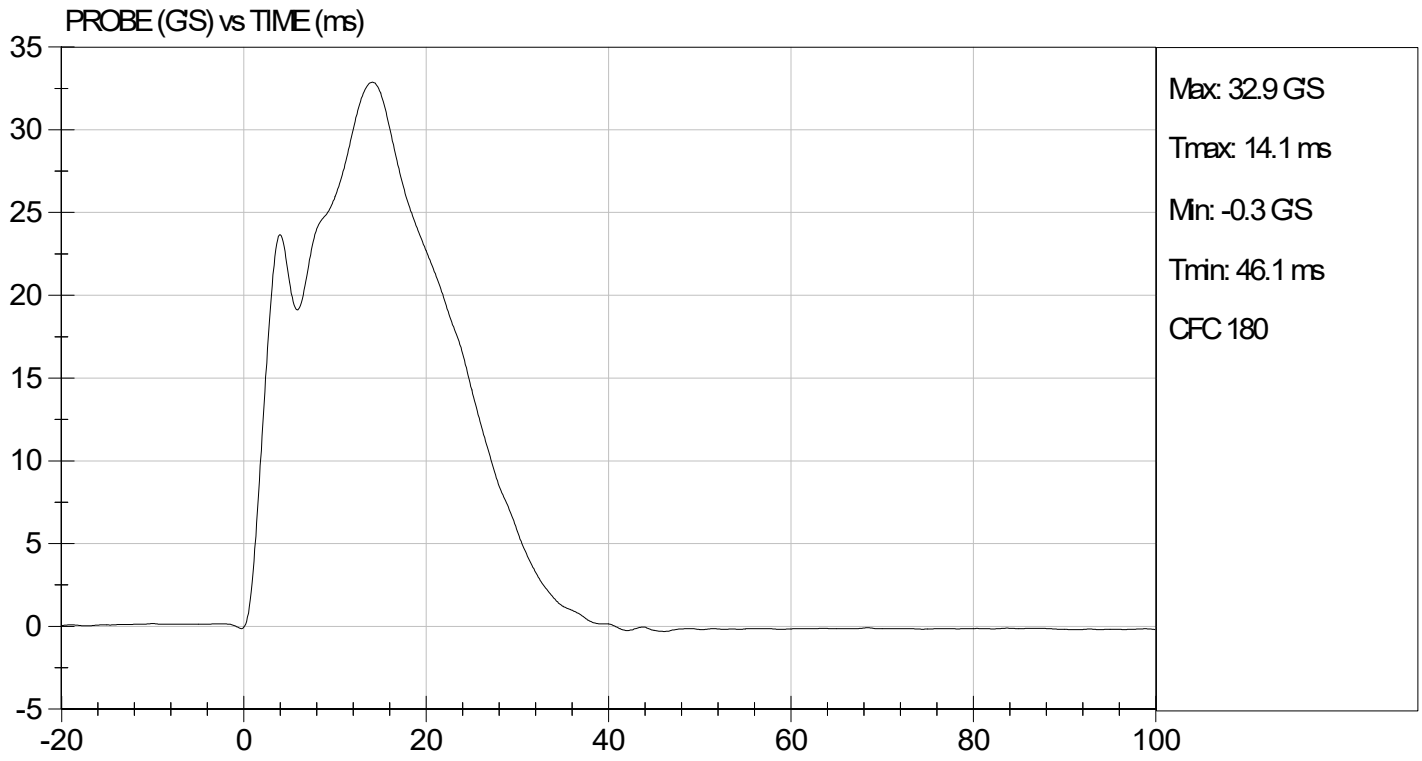
Laboratory Technician

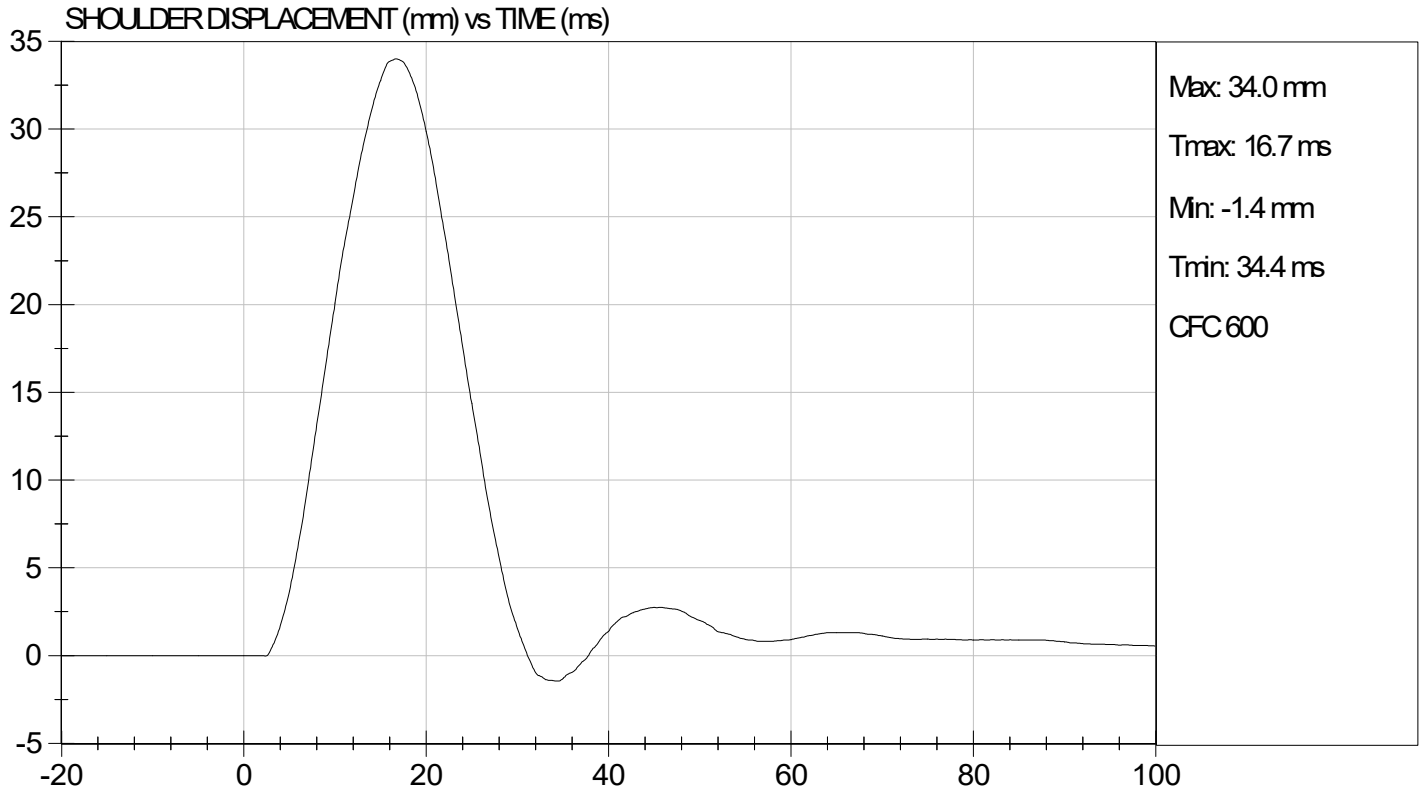
09/05/2023
Test Date

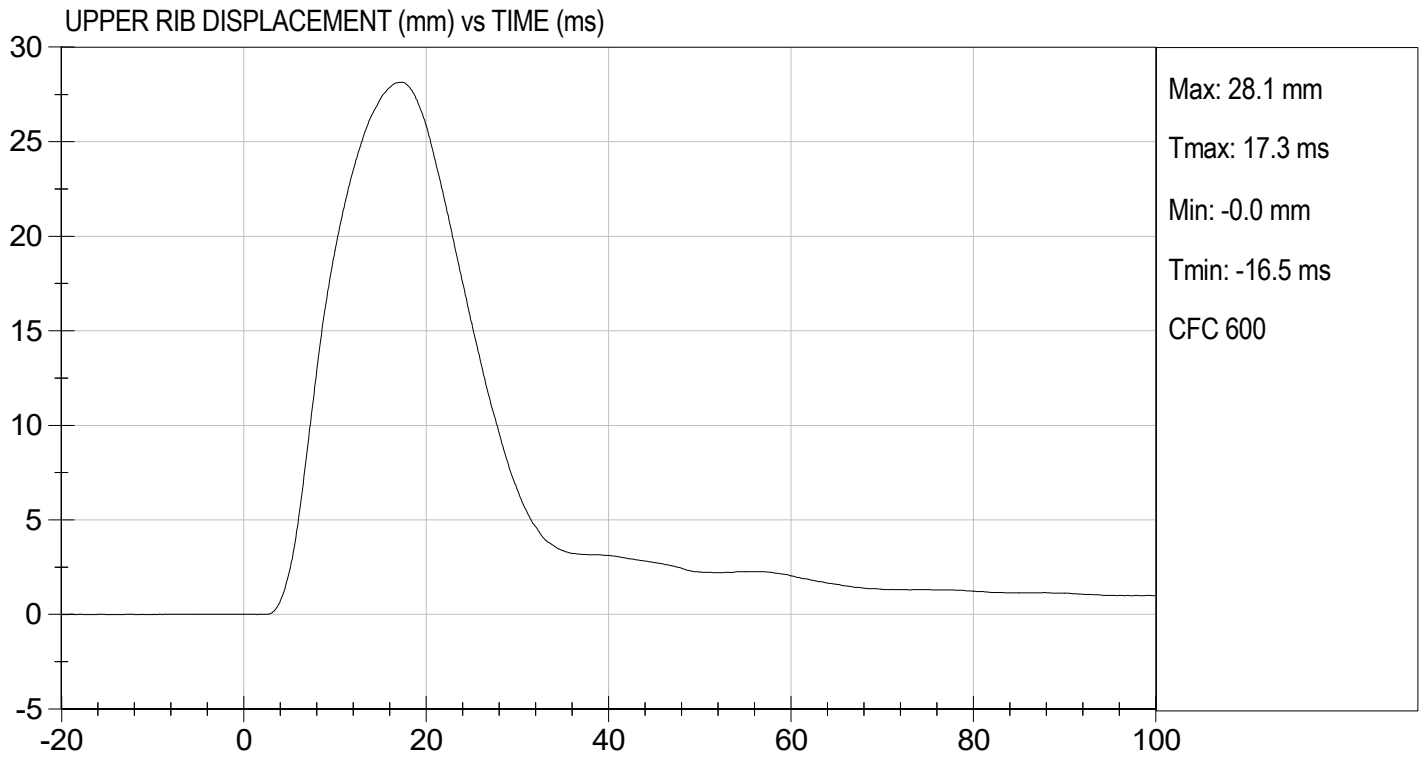
Approved By

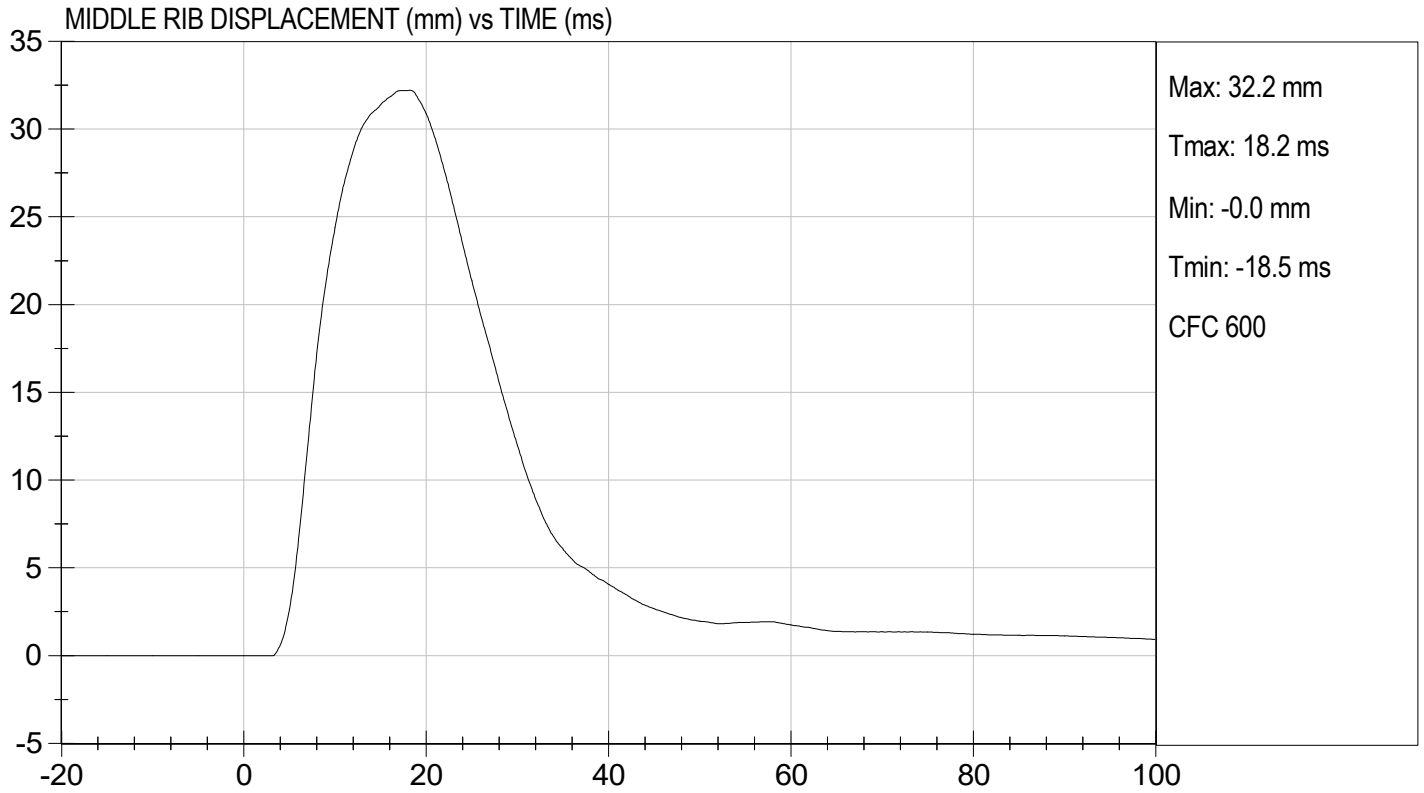
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 09/05/2023
TEST #: D232384

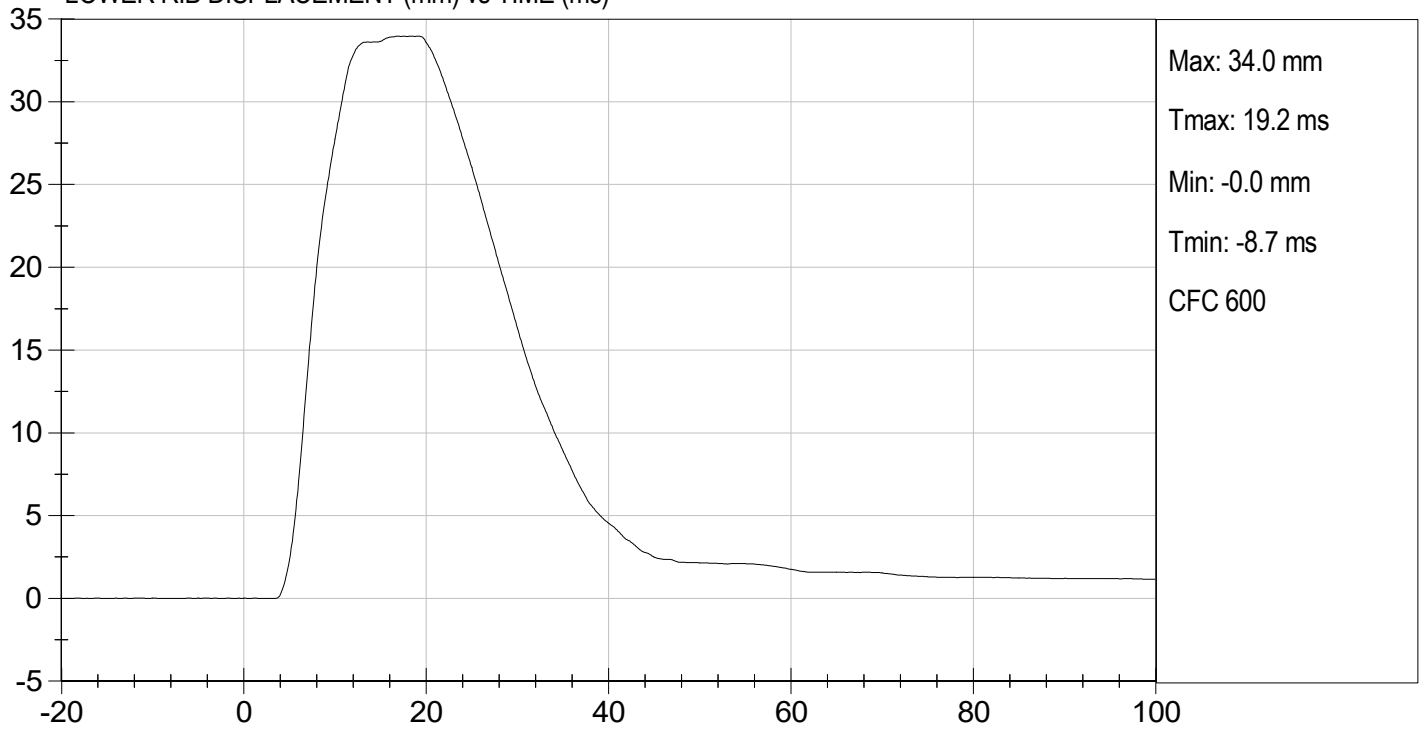




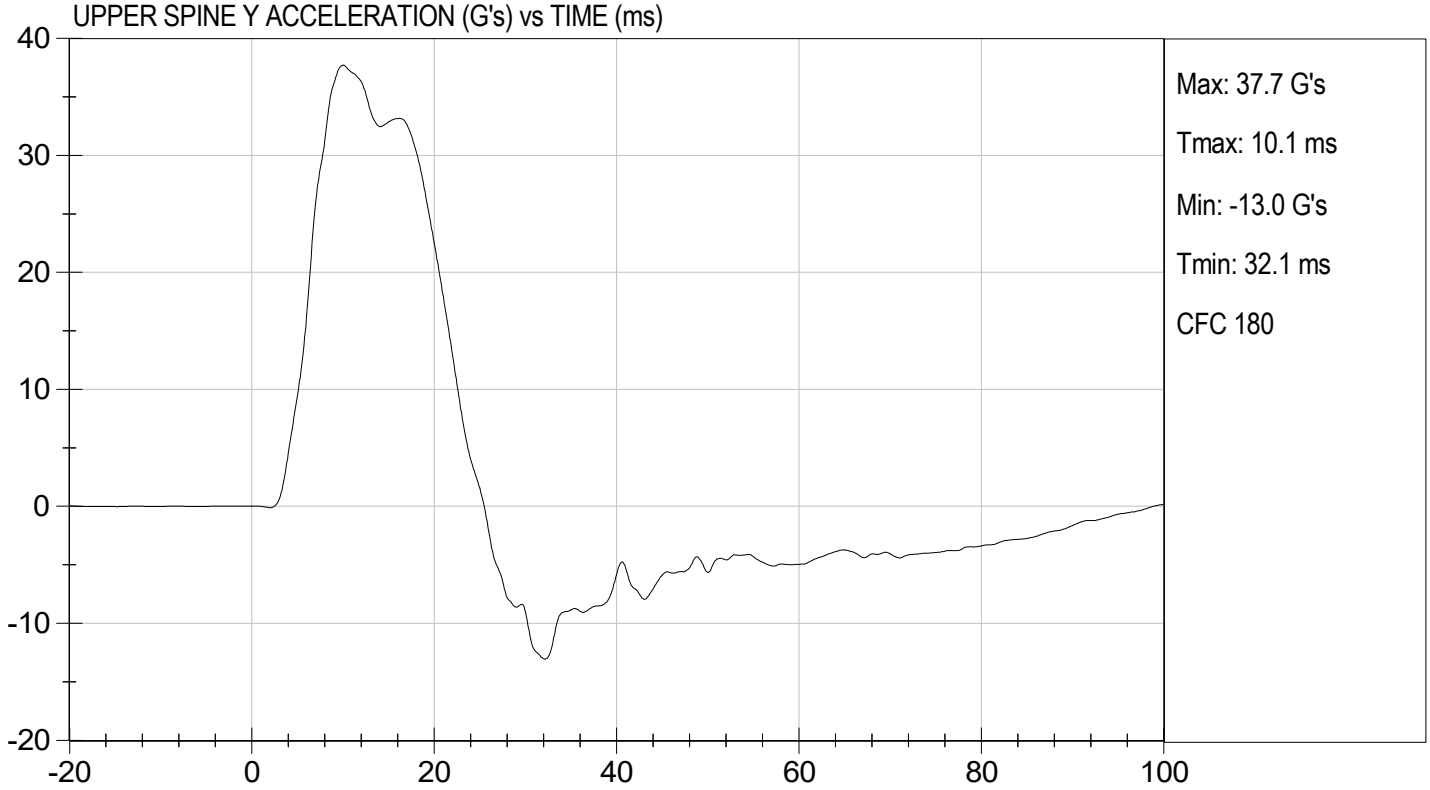

UPPER RIB DISPLACEMENT (mm) vs TIME (ms)
30
25
20
15
10
5
0
-5
-20
0
20
40
60
80
100
Max: 28.1 mm
Tmax: 17.3 ms
Min: -0.0 mm
Tmin: -16.5 ms
CFC 600


MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-20
0
20
40
60
80
100
Max: 32.2 mm
Tmax: 18.2 ms
Min: -0.0 mm
Tmin: -18.5 ms
CFC 600

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

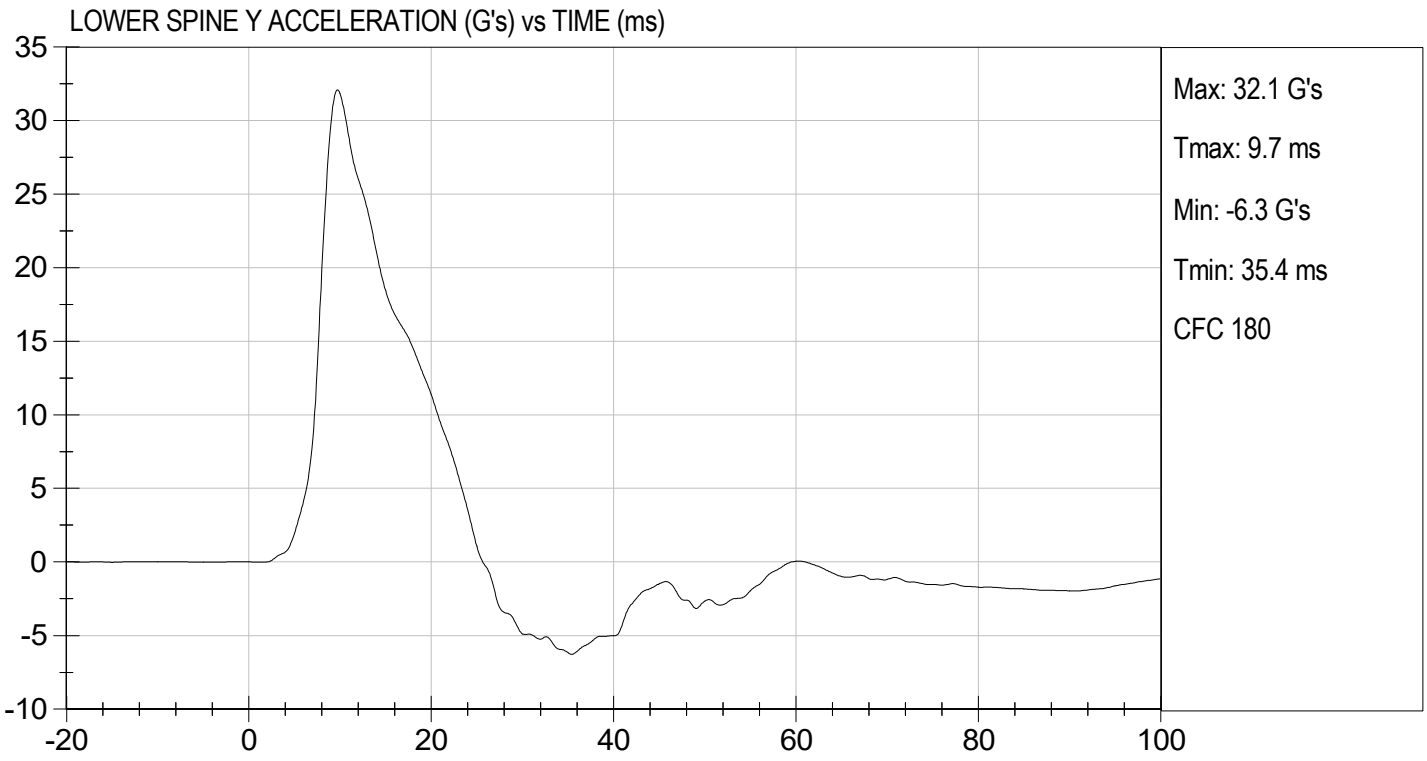


UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 09/05/2023
TEST #: D232384



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D232385

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	14 to 18	16	Pass
Upper Rib Displacement	mm	32 to 40	38	Pass
Middle Rib Displacement	mm	39 to 45	43	Pass
Lower Rib Displacement	mm	35 to 43	40	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	15	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	10	Pass
		Overall Test Results		Pass

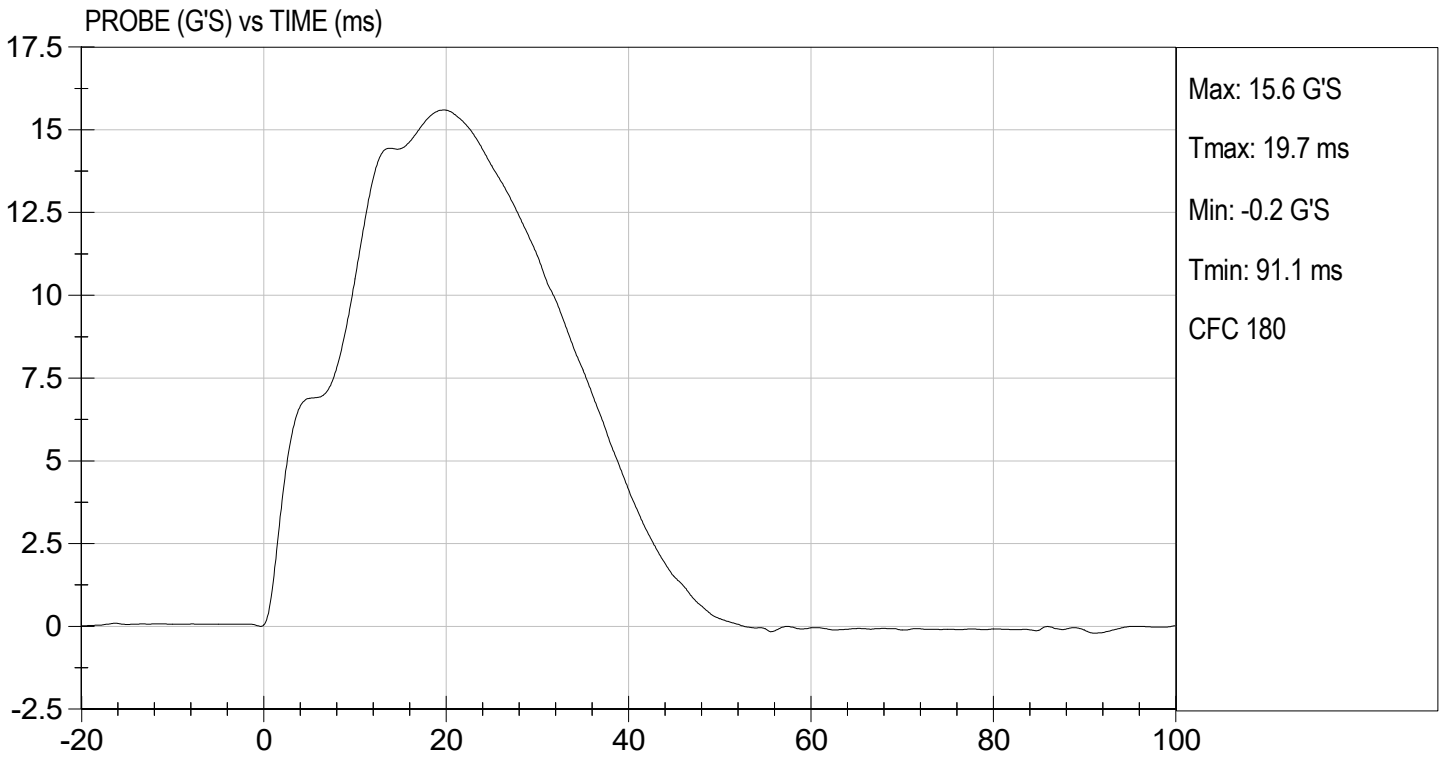
Laboratory Technician

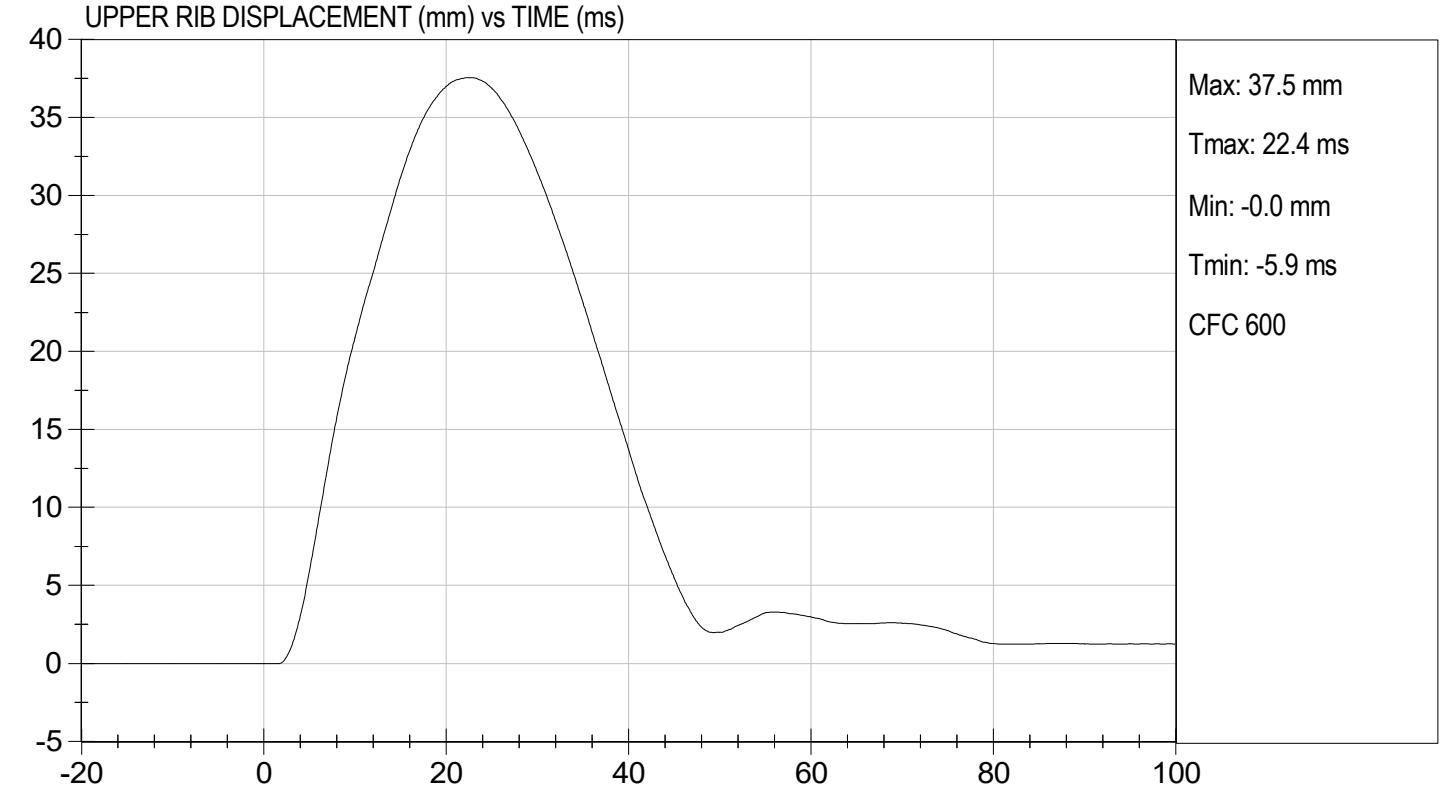
09/05/2023
Test Date

Approved By

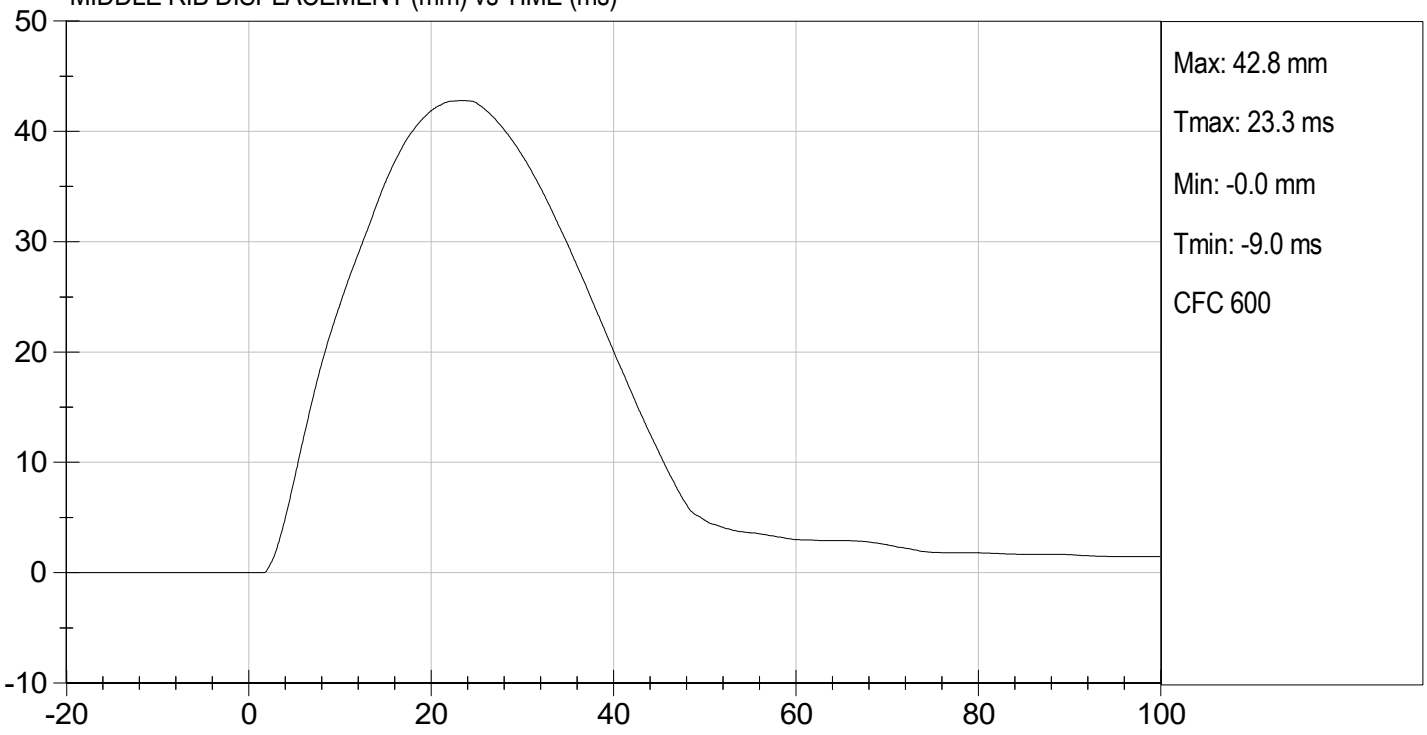
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 09/05/2023
TEST #: D232385

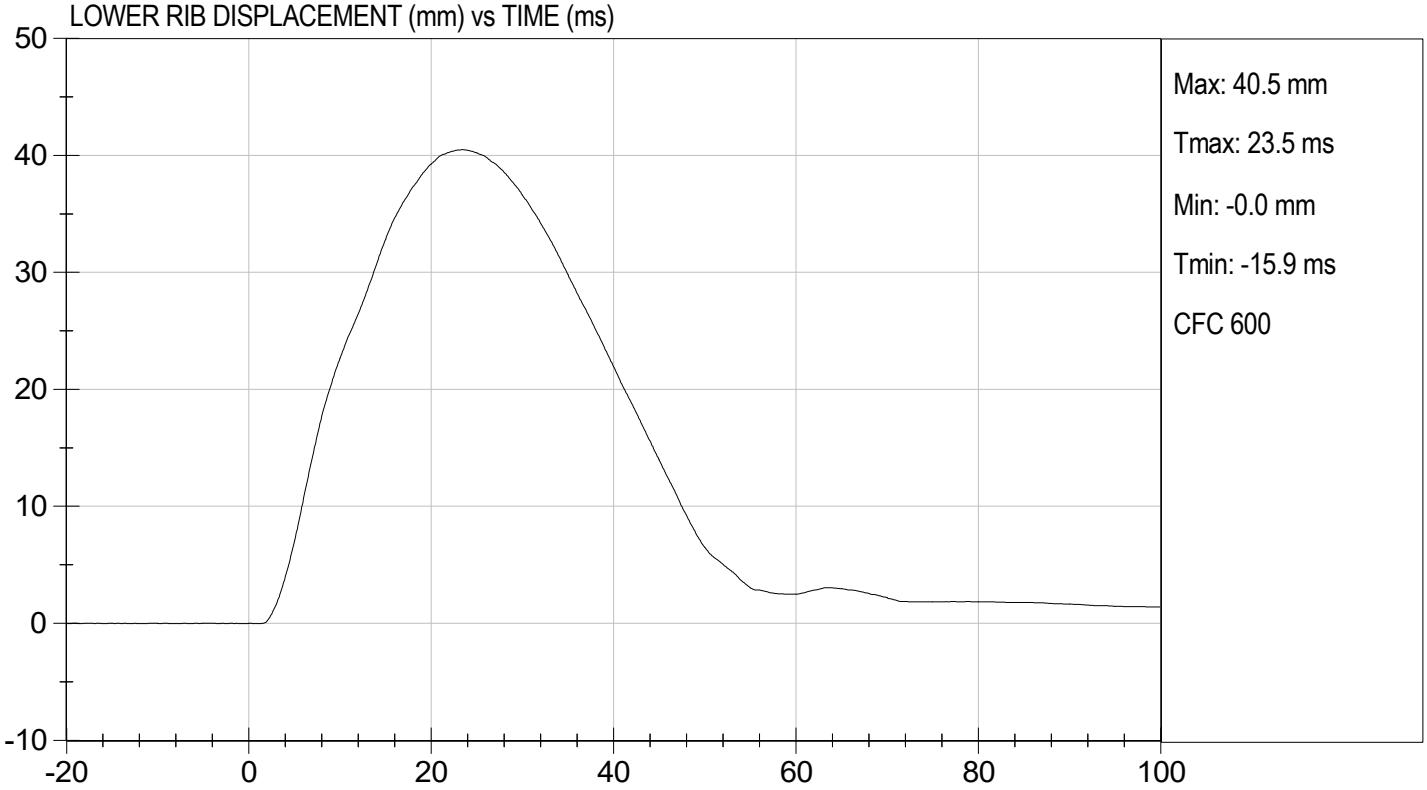




MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)

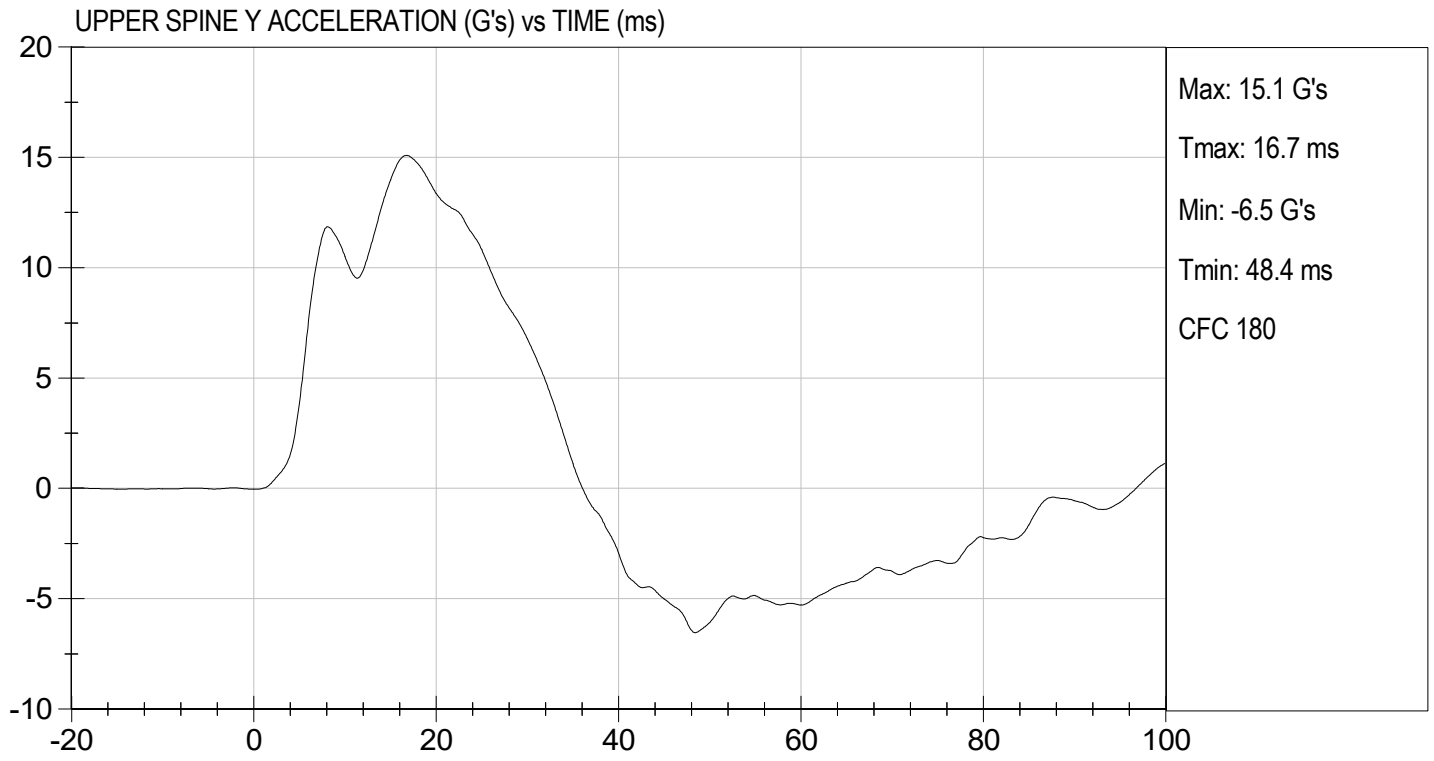


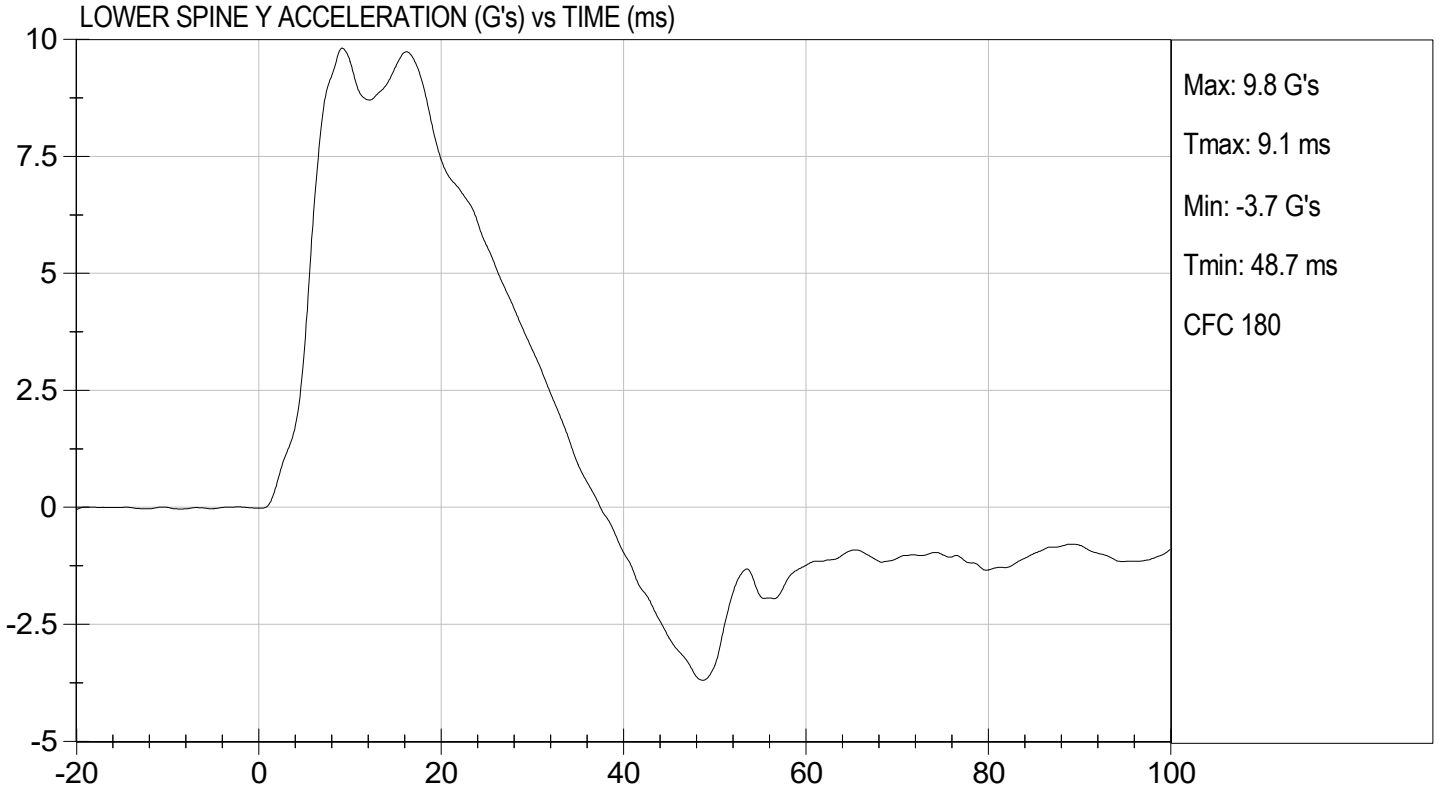
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



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

TEST DATE: 09/05/2023
TEST #: D232385





MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D232386

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.1	Pass
Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	12 to 16	14	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	43	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	36	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

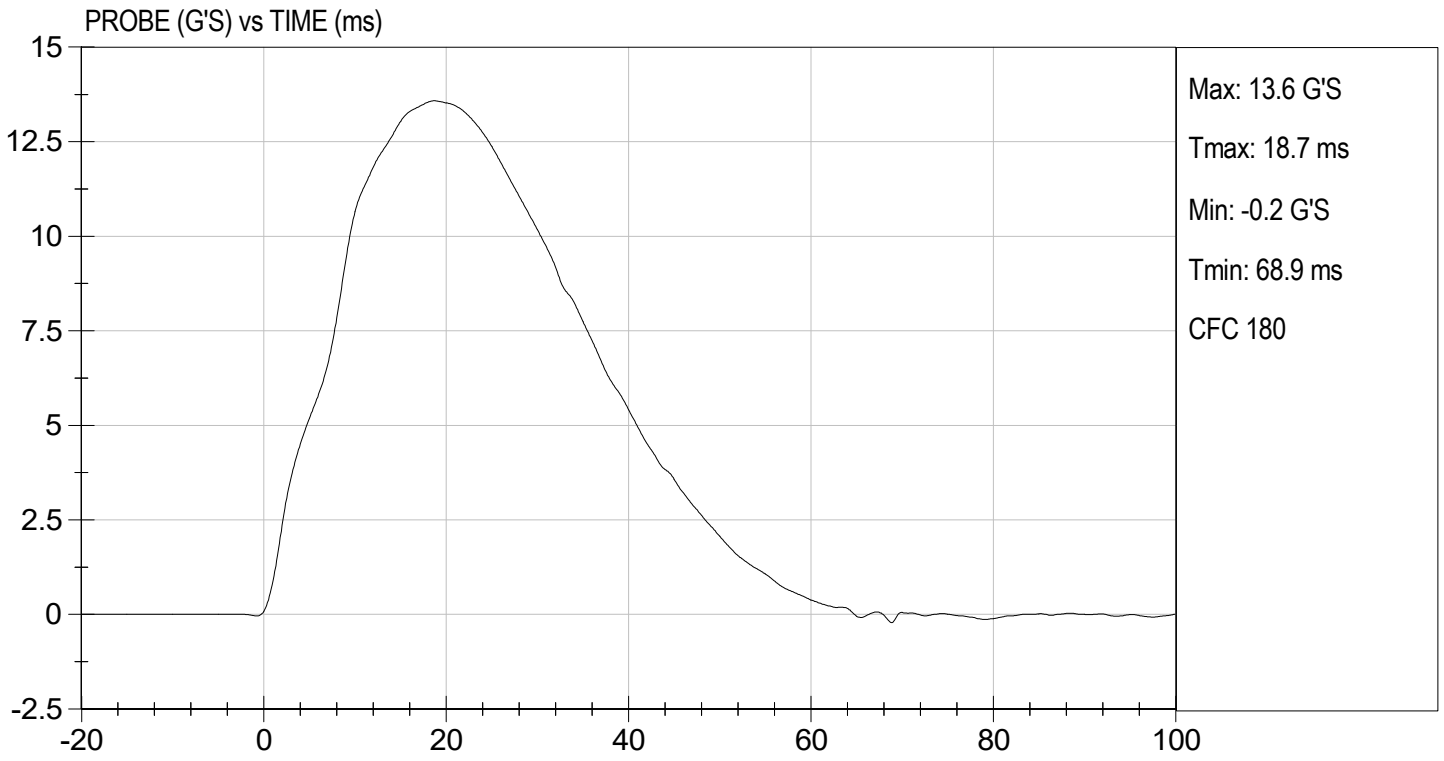
Laboratory Technician

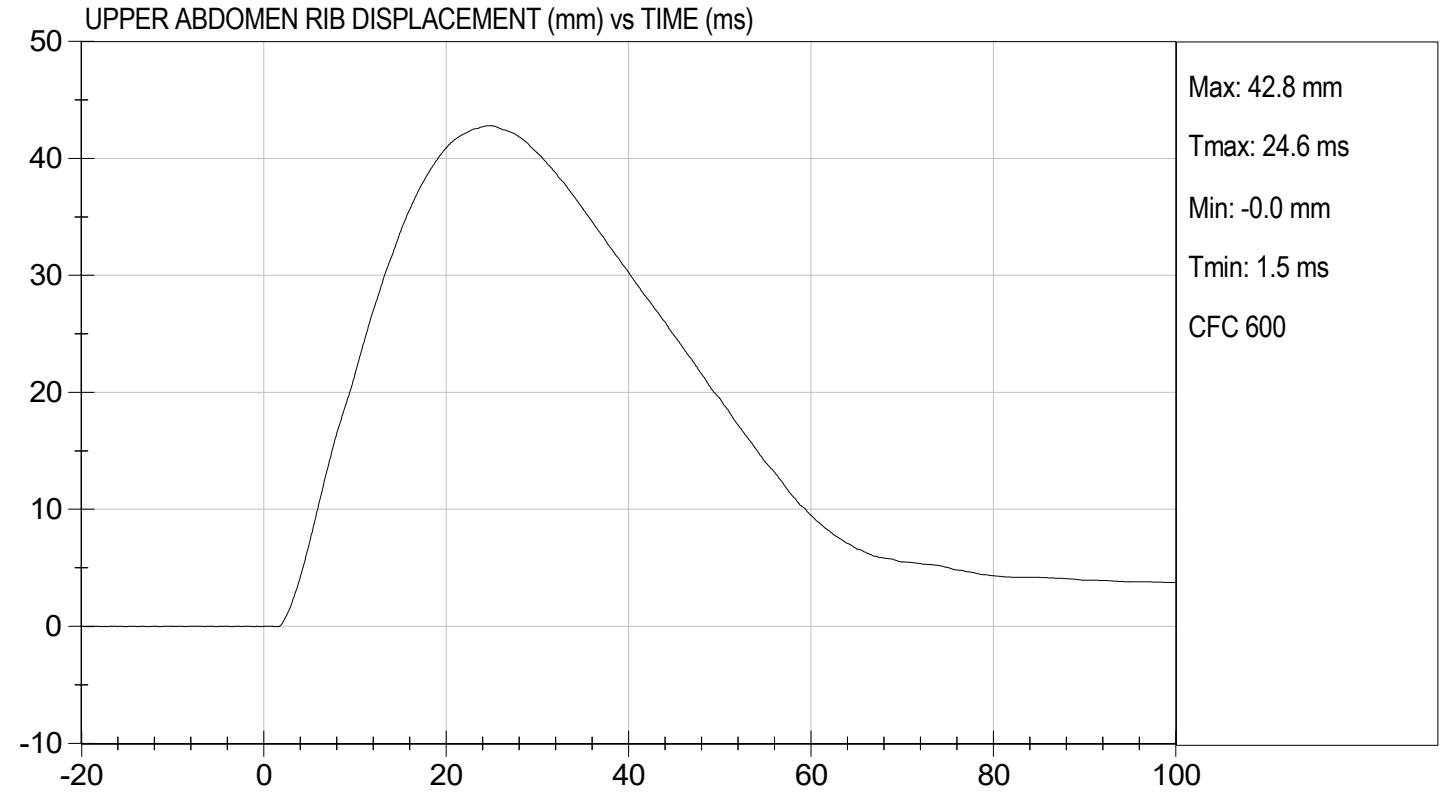
09/05/2023
Test Date

Approved By

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

TEST DATE: 09/05/2023
TEST #: D232386

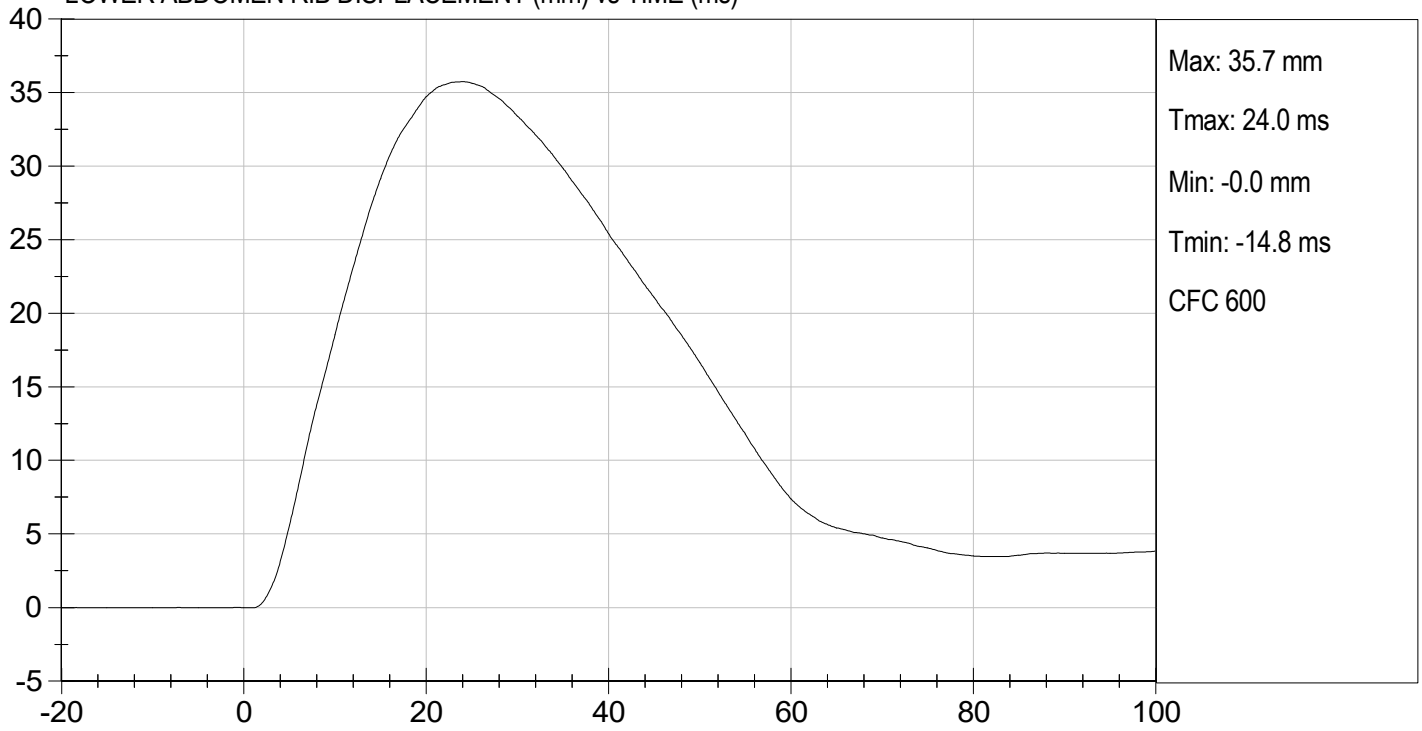




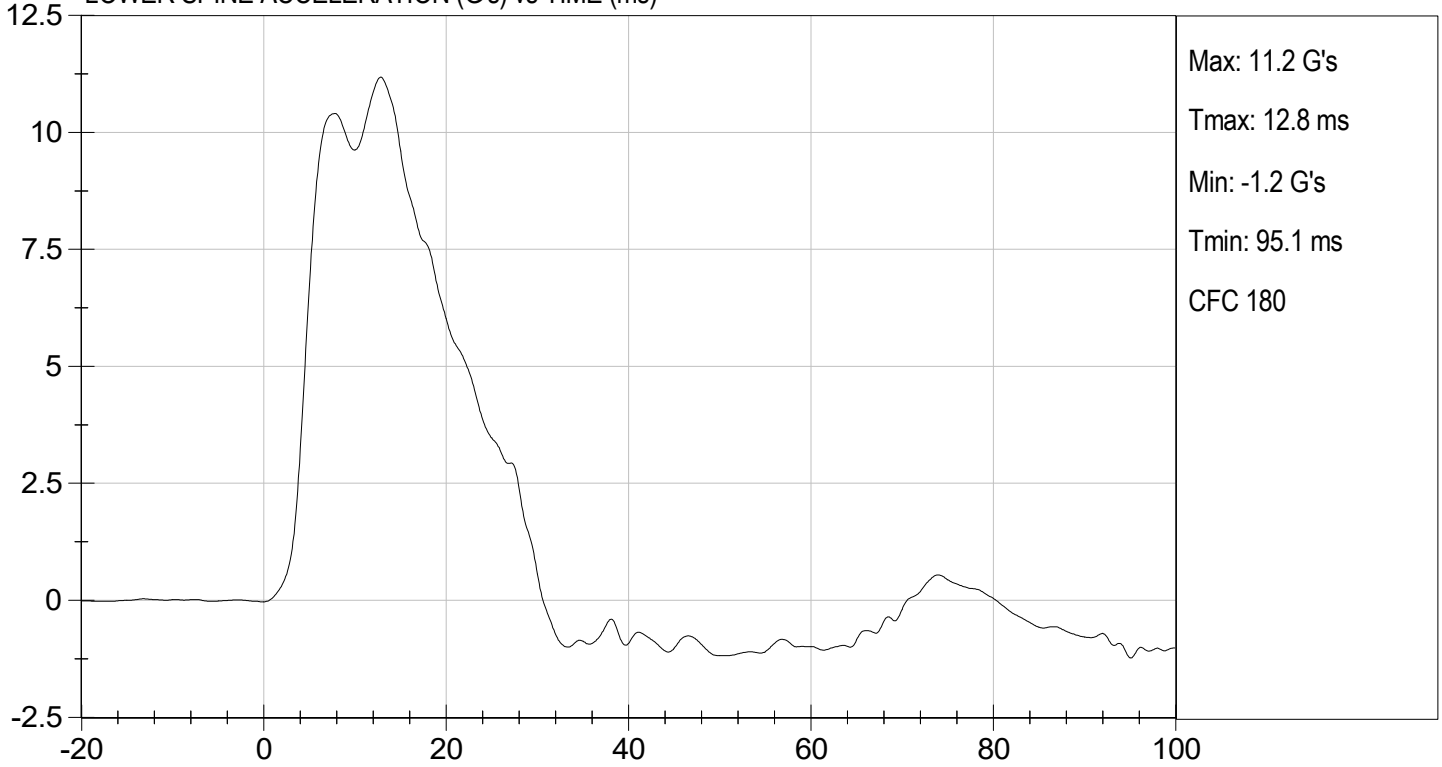
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 09/05/2023
TEST #: D232386

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:** D232387

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	46	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	38 to 47	41	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	38.1	Pass
Peak Acetabulum Force	N	3600 to 4300	3,934	Pass
		Overall Test Results		Pass

Laboratory Technician

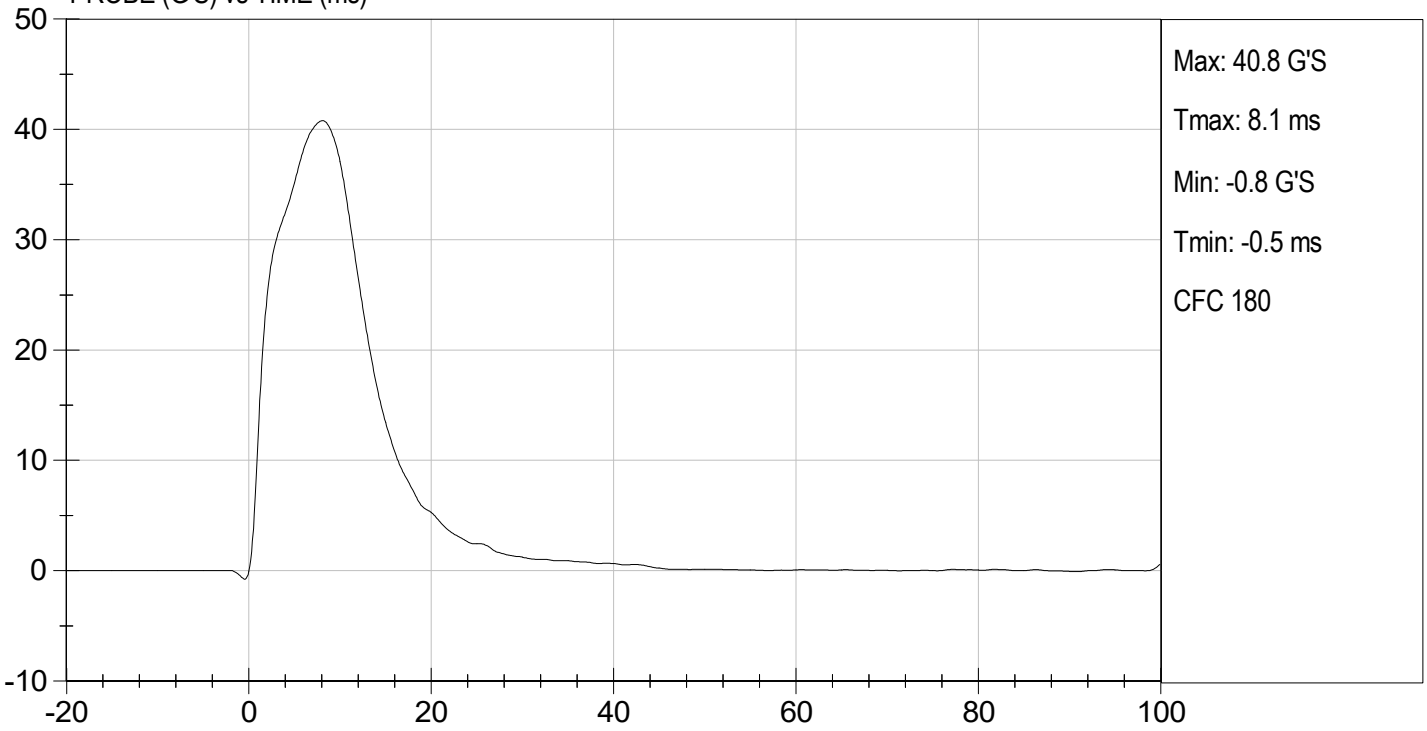
09/05/2023
Test Date

Approved By

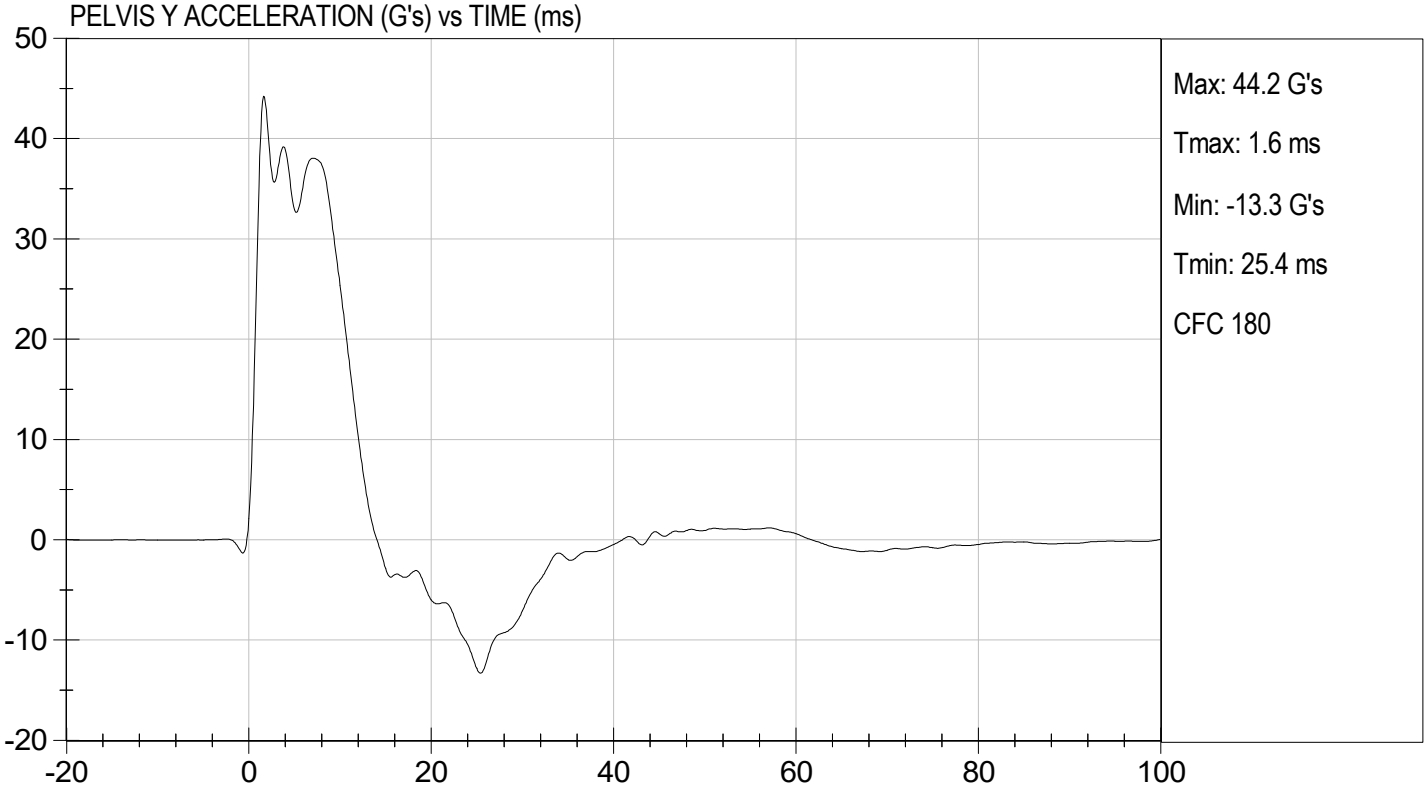
TEST DESC: PELVIS IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 09/05/2023
TEST #: D232387

PROBE (G'S) vs TIME (ms)

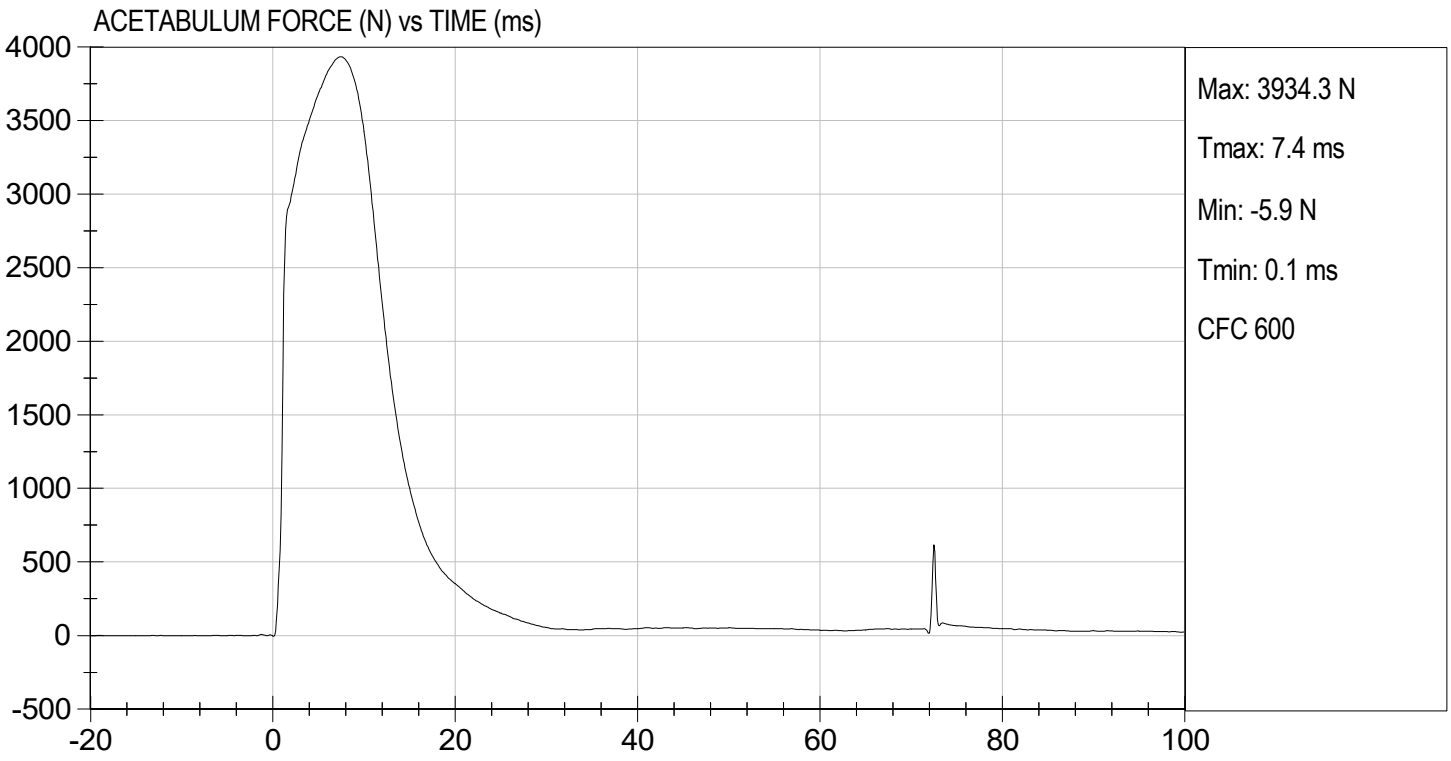


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: PELVIS IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 09/05/2023
TEST #: D232387



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D232388

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	36 to 45	38	Pass
Pelvis Y Acceleration	G's	28 to 39	29	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,493	Pass
		Overall Test Results		Pass

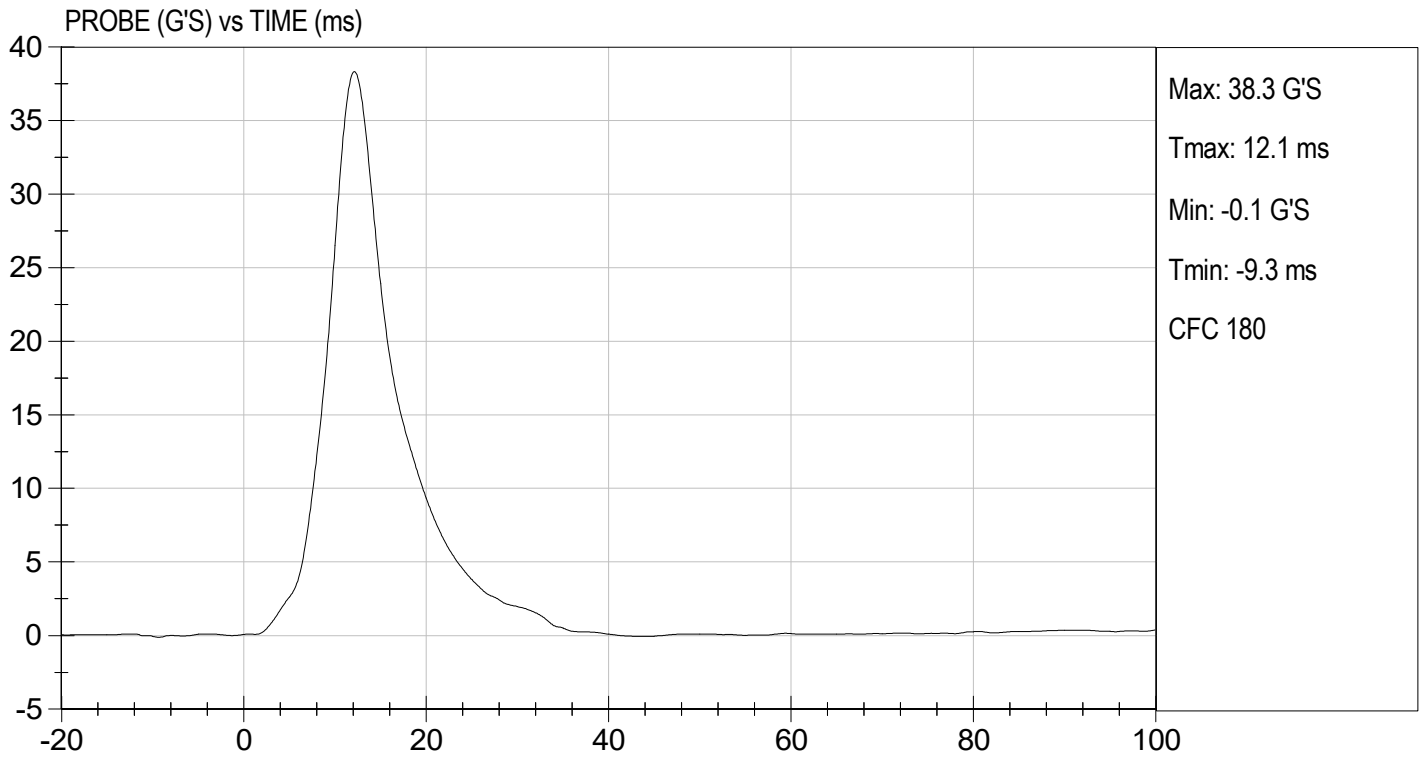
Laboratory Technician

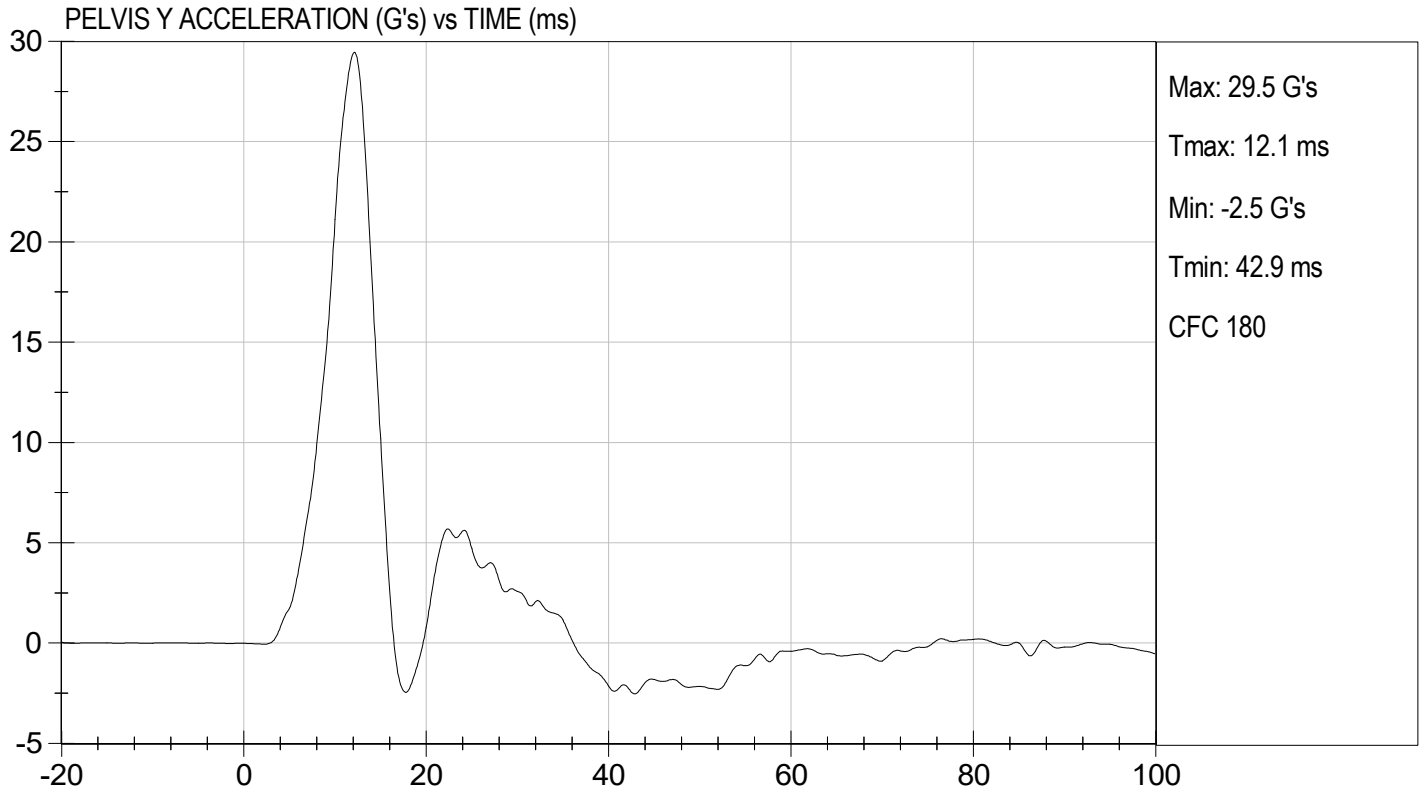
09/05/2023
Test Date

Approved By

TEST DESC: ILLIAC
VELOCITY: 13.89 ft/s, 4.23 m/s

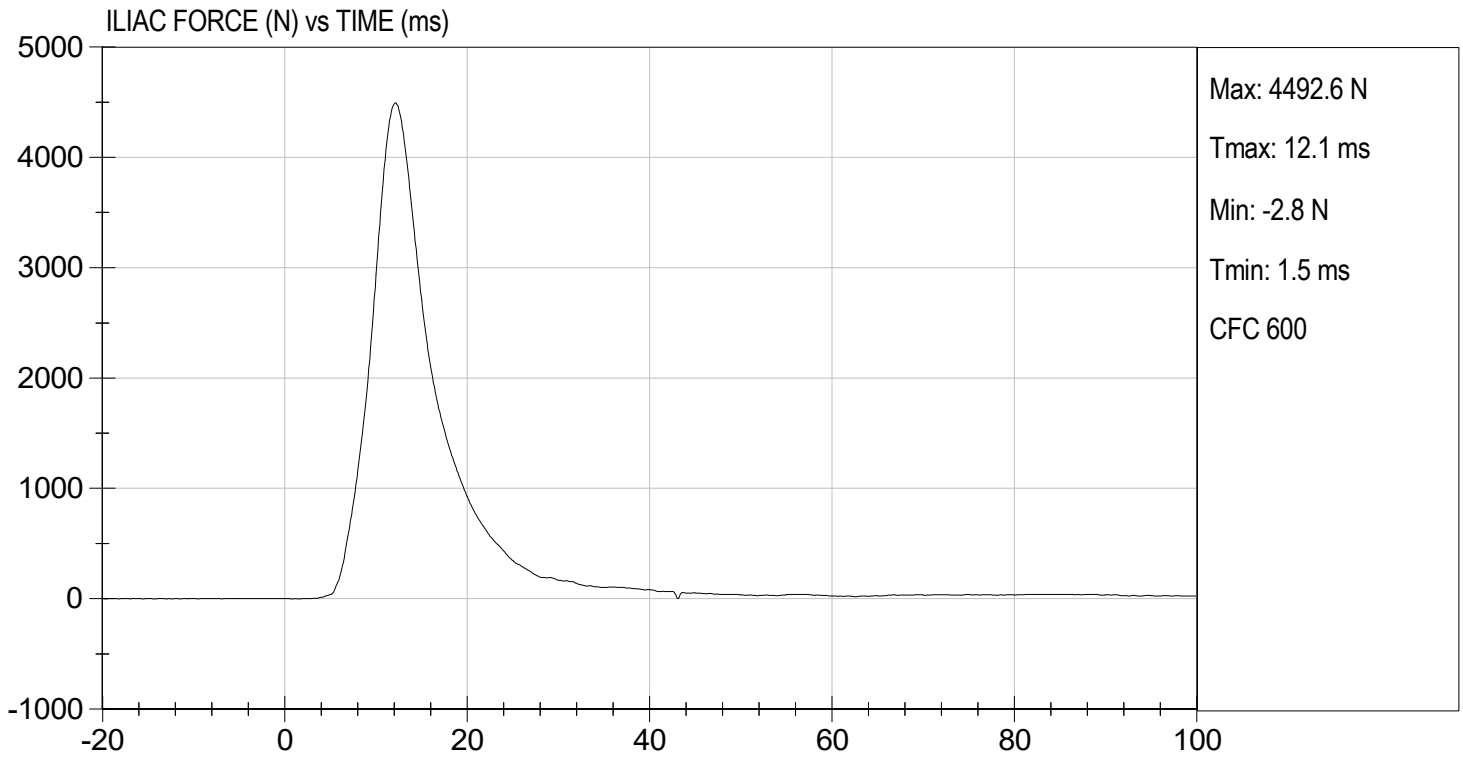
TEST DATE: 09/05/2023
TEST #: D232388





TEST DESC: ILLIAC
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 09/05/2023
TEST #: D232388

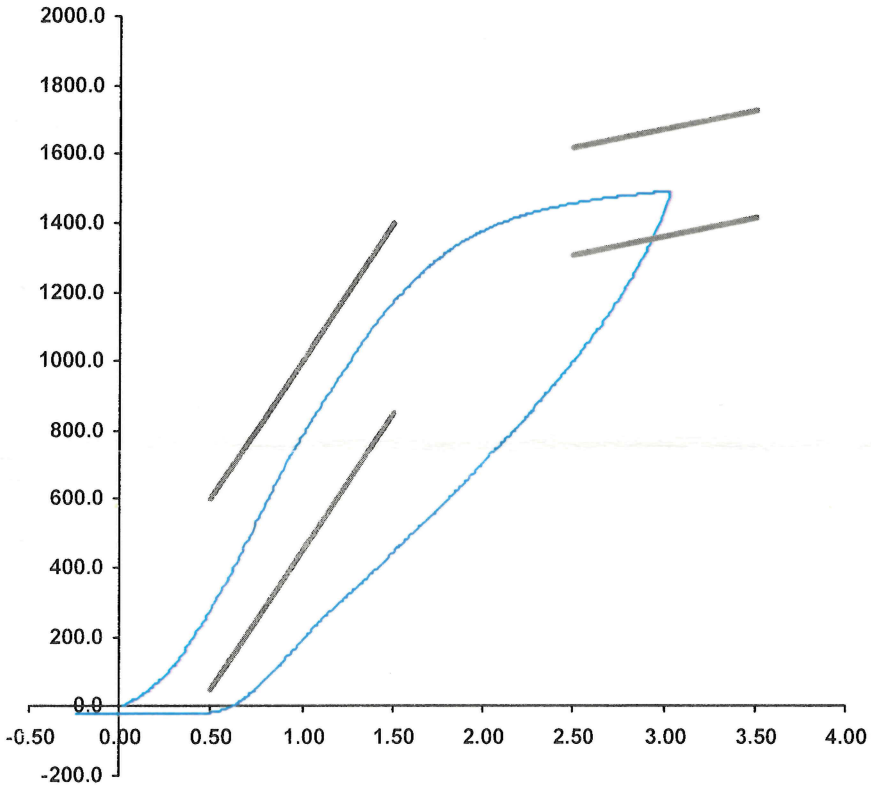


SID-IIs Pelvis Plug Certification Test

Plug S/N 16999
Test Number 23896
Report Number 23953
Test Date 8/18/2022 12:41:43 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	282	50	600
Force @ 1.5 mm (N)	1,172	850	1,400
Force @ 2.5 mm (N)	1,459	1,306	1,618
Force @ 3.0 mm (N)	1,494	1,361	1,673

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-Aug-22
SACO Research

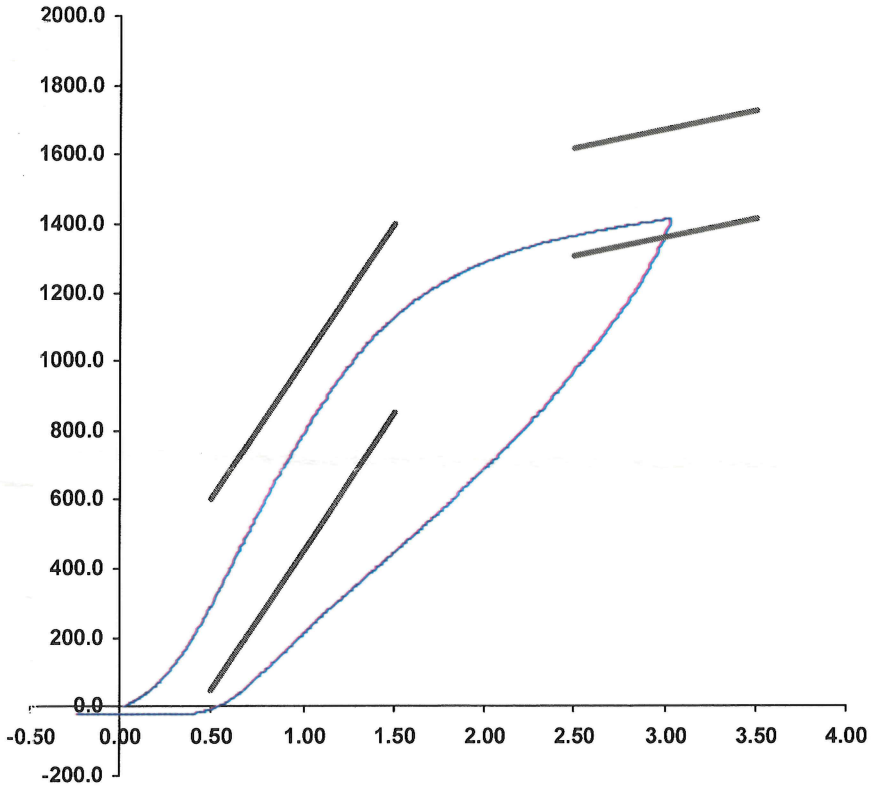
By : DC Date : 8/18/22

SID-IIs Pelvis Plug Certification Test

Plug S/N 14967
Test Number 17547
Report Number 17594
Test Date 2/4/2021 12:25:29 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	305	50	600
Force @ 1.5 mm (N)	1,128	850	1,400
Force @ 2.5 mm (N)	1,366	1,306	1,618
Force @ 3.0 mm (N)	1,415	1,361	1,673

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 **04-Feb-21**
SACO Research

By : DC Date : 2/4/2021

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

APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

Table 1 – Dummy Instrumentation

				SID-IIs S/N 296		
				Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers			X	P82109	Endevco	07/06/2023
			Y	P94783	Endevco	07/06/2023
			Z	P94786	Endevco	07/06/2023
			Xr	P94938	Endevco	07/06/2023
			Yr	P96854	Endevco	07/06/2023
			Zr	P97386	Endevco	07/06/2023
Head Angular Rate Sensors			X	ARS15213	DTS	04/07/2023
			Y	ARS15229	DTS	04/07/2023
			Z	ARS15231	DTS	04/07/2023
Displacement Potentiometers	Thoracic Rib	Upper	Y	G012	Servo	07/06/2023
		Middle	Y	G1163	FTSS	07/06/2023
		Lower	Y	G1158	FTSS	07/06/2023
	Abdominal Rib	Upper	Y	G1146	FTSS	07/06/2023
		Lower	Y	G1126	FTSS	07/06/2023
Lower Spine Accelerometers (T12)			X	P79614	Endevco	07/06/2023
			Y	P79439	Endevco	07/06/2023
			Z	P79418	Endevco	07/06/2023
Acetabulum Load Cell			Y	ACG269	Denton	04/20/2023
Iliac Wing Load Cell			Y	IWG282	Denton	04/20/2023
Pelvis Plug (struck side)				16999	SACO	08/18/2022
Pelvis Plug (non-struck side)				14967	SACO	02/04/2021

Table 2 – Vehicle Instrumentation

		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	T32356	Endevco	04/14/2023
Vehicle Center of Gravity	Y	T33158	Endevco	04/20/2023
Vehicle Center of Gravity	Z	T33151	Endevco	04/17/2023
Left Floor Sill	Y	A390895	MSI	05/09/2023
A-Pillar Sill	Y	T30613	Endevco	06/08/2023
A-Pillar Low	Y	A360944	MSI	07/28/2023
A-Pillar Mid	Y	A360987	MSI	07/28/2023
B-Pillar Sill	Y	A390880	MSI	07/28/2023
B-Pillar Low	Y	A405058	MSI	06/07/2023
B-Pillar Mid	Y	A393884	MSI	06/07/2023
Driver Seat	Y	T34075	Endevco	04/13/2023
Engine Top	X	T33417	Endevco	04/05/2023
Engine Top	Y	T32351	Endevco	04/14/2023
Firewall	Y	A340624	MSI	04/27/2023
Right Roof	Y	T22760	Endevco	04/27/2023
Right Floor Sill	Y	A424075	MSI	06/08/2023
Rear Floorpan	X	T32319	Endevco	06/07/2023
Rear Floorpan	Y	T33473	Endevco	04/05/2023

Table 3 – Pole Instrumentation

	Serial Number	Manufacturer	Calibration Date
Load Cell 1	DG6277	FTSS	07/30/2018
Load Cell 2	DG6278	FTSS	07/30/2018
Load Cell 3	DG6279	FTSS	07/30/2018
Load Cell 4	DG6280	FTSS	07/30/2018
Load Cell 5	DG6281	FTSS	07/30/2018
Load Cell 6	DG6283	FTSS	07/30/2018
Load Cell 7	DG6284	FTSS	07/30/2018
Load Cell 8	DG6582	FTSS	07/30/2018