REPORT NUMBER: SideNCAPMDB-MGA-24-006

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

MAZDA MOTOR CORPORATION
2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV
NHTSA No.: O20245405

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: December 15, 2023

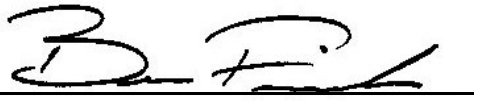
Final Report Date: October 28, 2024

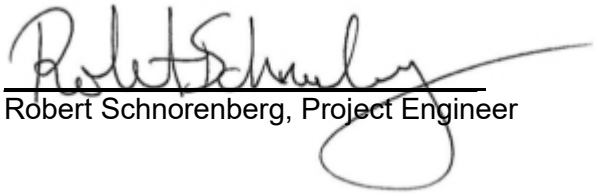
FINAL REPORT

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

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof.

If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement.

Prepared by: 
Ben Fischer, Program Manager

Approved by: 
Robert Schnorenberg, Project Engineer

Approval Date: October 28, 2024

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
SideNCAPMDB-MGA-24-006		

4. Title and Subtitle	5. Report Date
Final Report of New Car Assessment Program Side Impact MDB Testing and FMVSS No. 305 Indicant Testing of 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV, NHTSA No.: O20245405	October 28, 2024
	6. Performing Organization Code MGA
7. Author(s) Ben Fischer, Program Manager	**8. Performing Organization Report No.** SideNCAPMDB-MGA-24-006
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 U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-100) 1200 New Jersey Ave, SE Washington, D.C. 20590	**13. Type of Report and Period Covered:** Final Test Report December 15, 2023 to October 28, 2024
	14. Sponsoring Agency Code NRM-100
15. Supplementary Notes	

16. Abstract

A 55/28 km/h 90° Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV in accordance with the specifications of the Office of Crashworthiness Standards Side NCAP MDB Test Procedure for the generation of consumer information on vehicle side crash protection. The test was conducted at the MGA Research Corporation facility in Burlington, Wisconsin on December 15, 2023.

The impact velocity of the Moving Deformable Barrier (MDB) was 62.03 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21.0°C. The target vehicle post-test maximum crush was 126 mm at level 2. The test vehicle's performance was as follows:

Measurement Description	Units	Driver ATD (ES-2re)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	54.545
Maximum Thorax Rib Deflection	mm	44	14.168
Total Abdominal Force	N	2500	631.363
Pubic Symphysis Force	N	6000	1176.813
Resultant Lower Spine Acceleration	g	82*	14.678

Measurement Description	Units	Passenger ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	24.013
Resultant Lower Spine Acceleration	g	82	24.979
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	1167.805
Maximum Thoracic Rib Deflection	mm	38*	10.388
Maximum Abdomen Rib Deflection	mm	45*	3.807

*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 MDB ES-2re SID-IIs	Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division 1200 New Jersey Ave, SE Washington, DC 20590

19. Security Classification of Report	20. Security Classification of Page	21. No. of Pages	22. Price
Unclassified	Unclassified	262	

TABLE OF CONTENTS

SECTION 1
PURPOSE AND SUMMARY OF TEST

PURPOSE

This moving deformable barrier side impact test is part of the MY 2024 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 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Laboratory Test Procedure dated March 2020.

SUMMARY

A 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 62.03 km/h. The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by MGA Research Corporation in Burlington, Wisconsin on December 15, 2023. Pre-test and post-test photographs of the test vehicle, the MDB, and the dummies (ES-2re and SID-IIs) are included in this report.

Dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OCWS NCAP Side Laboratory Test Procedure dated March 2020. The side impact event was documented by eleven (11) cameras. Camera locations are included in this report.

The dummies were instrumented in the following manner:

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

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

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

Dummy Injury readings were recorded as follows:

DUMMY INJURY VALUES

Measurement Description	Units	Driver ATD (ES-2re)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	54.545
Maximum Thorax Rib Deflection	mm	44	14.168
Total Abdominal Force	N	2500	631.363
Pubic Symphysis Force	N	6000	1176.813
Resultant Lower Spine Acceleration	g	82*	14.678

Measurement Description	Units	Passenger ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	24.013
Resultant Lower Spine Acceleration	g	82	24.979
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	1167.805
Maximum Thoracic Rib Deflection	mm	38*	10.388
Maximum Abdomen Rib Deflection	mm	45*	3.807

*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	Yes	Yes
Side Airbag (Other)				
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	
Other:	No		No	

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

GENERAL COMMENTS

None.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20245405	Traction Control System (TCS)	Yes
Model Year	2024	Auto-Leveling System	No
Make	Mazda	Automatic Door Locks (ADL)	Yes
Model	CX-90 PHEV Premium Plus	Power Window Auto-Reverse	Yes
Body Style	5-Door SUV	Other Optional Feature	No
VIN	JM3KKEHA7R1116601	Driver Front Airbag	Yes
Body Color	Jet Black Mica	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	61 km / 38 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	Longitudinal	Driver Pelvis Airbag	No
Transmission Type	Automatic	Driver Knee Airbag	Yes
Transmission Speeds	8	Rear Pass. Curtain Airbag	Yes
Overdrive	Yes	Rear Pass. Head/Torso Airbag	No
Final Drive	AWD	Rear Pass. Torso Airbag	No
Roof Rack	No	Rear Pass. Torso/Pelvis Airbag	Yes
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	Driver Only	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Rear Pass. Load Limiter	Yes
		Other Safety Restraint	N/A

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

DATA FROM CERTIFICATION LABEL

Manufactured By	MAZDA MOTOR CORPORATION
Date of Manufacture	06/23
Vehicle Type	MPV

GVWR (kg)	3109
GAWR Front (kg)	1313
GAWR Rear (kg)	1797

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	2	3	7	
Capacity Weight (VCW) (kg)				539	(A)
DSC x 68 kg				476	(B)
Rated Cargo and Luggage Weight (RCLW) (kg)				63	(A-B)

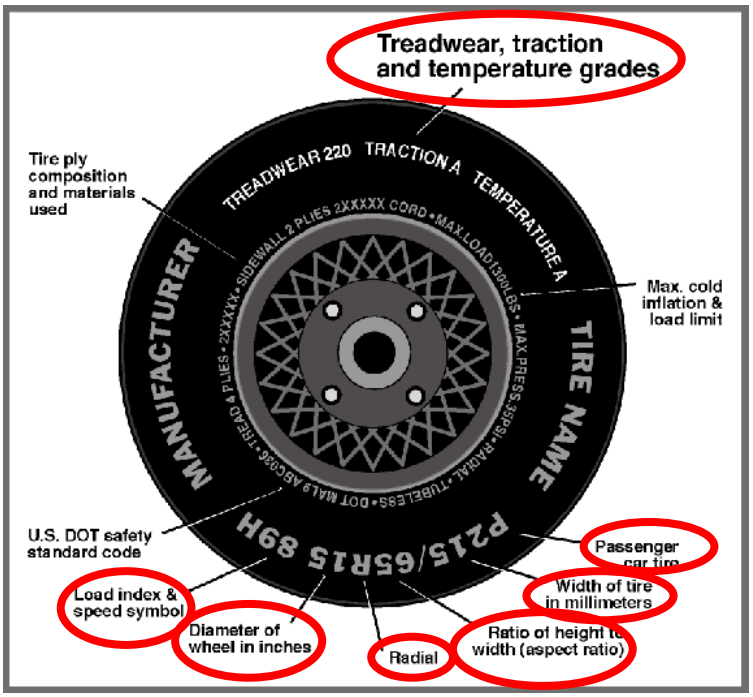
VEHICLE SEAT TYPE

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

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

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	340	340
Cold Pressure (kPa)	250	270
Recommended Tire Size	275/45R21	275/45R21
Tire Size on Vehicle	275/45R21	275/45R21
Tire Manufacturer	Falken	Falken
Tire Model	Ziex	Ziex
Treadwear	300	300
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Tire Plies Body	2 Polyester	2 Polyester
Load Index/Speed Symbol	110W	110W
Tire Material	Rubber	Rubber
DOT Safety Code Left	1V4V6 AMAR 2123	1V4V6 AMAR 2123
DOT Safety Code Right	1V4V6 AMAR 2123	1V4V6 AMAR 0423

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

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

TEST VEHICLE TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	250	250	270	270
Tire Placard	kPa	250	250	270	270
Owner's Manual	kPa	250	250	270	270
As Tested	kPa	250	250	270	270

MDB TIRE SPECIFICATIONS

	Requirement	Units	LF	RF	LR	RR
Tire Size	P205/75R15	N/A	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	200 ± 21	kPa	200	200	200	200

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	590.0	600.0		627.0	650.0		620.0	675.0	
Right	kg	565.0	617.5		606.5	673.5		587.5	682.5	
Ratio	%	48.7%	51.3%		48.2%	51.8%		47.1%	52.9%	
Totals	kg	1155.0	1217.5	2372.5	1233.5	1323.5	2557.0	1207.5	1357.5	2565.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	2372.5	(A)
Sum of Actual Weight of 2 P572 ATDs Used	kg	129	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	63	(C)
Calculated Test Vehicle Target Weight (TVTW)	kg	2564.5	(A+B+C)

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

TEST VEHICLE ATTITUDES AND CG

	Units	Fully Loaded	As Tested	Meets Requirement*
Left Front	mm	850	848	Yes
Right Front	mm	848	845	Yes
Right Rear	mm	850	854	Yes
Left Rear	mm	847	840	Yes
Vehicle CG (Aft of Front Axle)	mm	1649	1613	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	8	-1	

* ND=Nose Down (-), NU=Nose Up (+) ** LD=Left Down (-), LU=Left Up (+)
*** The "As Tested" vehicle attitude measurements must be equal to or within ± 10 mm of the "Fully Loaded" vehicle attitude measurements at each wheel well.

Test height adjustable suspension setting, if applicable:	Not Applicable

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

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Units	Weight
Weight of Ballast Added	kg	25
Components Removed: none	kg	

TEST SURFACE MARKINGS

	Units	Distance from 63° Impact Angle Line
Fore 25 mm Target	mm	986
Aft 25 mm Target	mm	993
Pre-Impact Angle Line	mm	100

Parallel Track Target	Units	X Location	Y Location
A	mm	0	0
B	mm	1520	3085
C	mm		
D	mm	3500	0

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

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and right front passenger's seat should be set to the mid-track, lowest, mid-angle position. The struck-side rear passenger's seat, rear center seat, and non-struck side rear passenger's seats should be set to the rear-most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	20.4	12.5	16.5
Front Passenger Seat	20.0	12.6	16.3
Front Center Seat			
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat			

SEAT HEIGHT AND ANGLE

Seat	As-Tested SCRL Angle (Mid) (°)	As-Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rear-Most	Mid	Forward-Most
Driver Seat	16.5	0	Max	48	48	48
			Mid	24	24	24
			Min	0	0	0
Front Passenger Seat	16.3	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Front Center Seat			Max			
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Rear Center Seat			Max			
			Mid			
			Min			

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

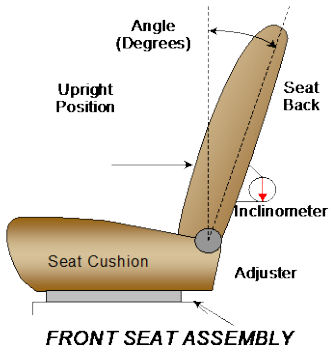
Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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	255		128	
Front Passenger Seat	216		108	
Front Center Seat				
Struck Side Rear Seat	120	13	120	12
Non-Struck Side Rear Seat	120	13	120	12
Rear Center Seat				

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned to the manufacturer's designated design angle. 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 seat back is positioned such that the dummy's head is level. The rear center and non-struck side rear outboard seat backs are positioned in a similar manner as the struck-side rear seat back.



FRONT SEAT ASSEMBLY

Seat	Total Seat Back Angle Range		Test Position from Vertical	
	Degrees	Detents (1st as 1)	Degrees	Detent (1st as 0)
Driver Seat	75.8		5.9	
Front Passenger Seat	74.5		5.5	
Front Center Seat				
Struck Side Rear Seat	17.9	10	2.1	0
Non-Struck Side Rear Seat	18.1	13	2.9	0
Rear Center Seat				

Seat back angles measured on outboard headrest post.

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

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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	0	4 (Uppermost as 0)
Rear Seat	Fixed	

HEAD RESTRAINT ADJUSTMENT

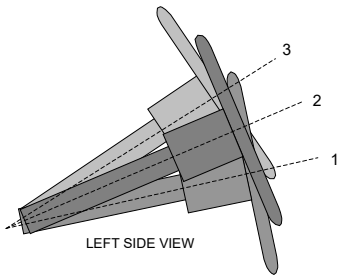
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	4	3 (Lowest as 0) / Fixed Fore-Aft
Rear Seat	4	0 (Lowest as 0) / Fixed Fore-Aft

STEERING COLUMN ADJUSTMENT

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

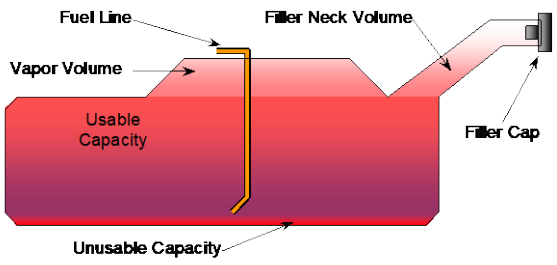
	Wheel Angle (°)	Fore/Aft Position (mm)
Lowermost, Position 1	67.3	
Geometric Center, Position 2	65.1	
Uppermost, Position 3	62.8	
Telescoping Steering Wheel Travel		70
Test Position	65.1	35



STEERING COLUMN ASSEMBLY

FUEL PUMP

The vehicle is equipped with an electronic fuel pump. The fuel pump operates during engine running and cranking. The filler neck is located on the driver's side.



VEHICLE FUEL TANK ASSEMBLY

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

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

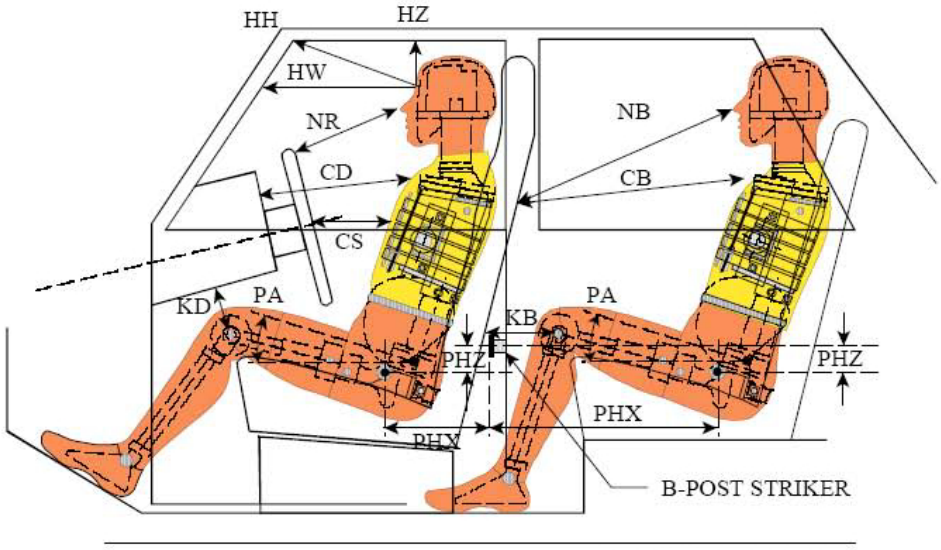
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of Standard Tank (see S1 - Vehicle Setup Information)	70.0
Usable Capacity of Optional Tank (see S1 - Vehicle Setup Information)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	70.0
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	65.1
Actual Amount of Solvent Used	65.1
1/3 of Usable Capacity	23.3

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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



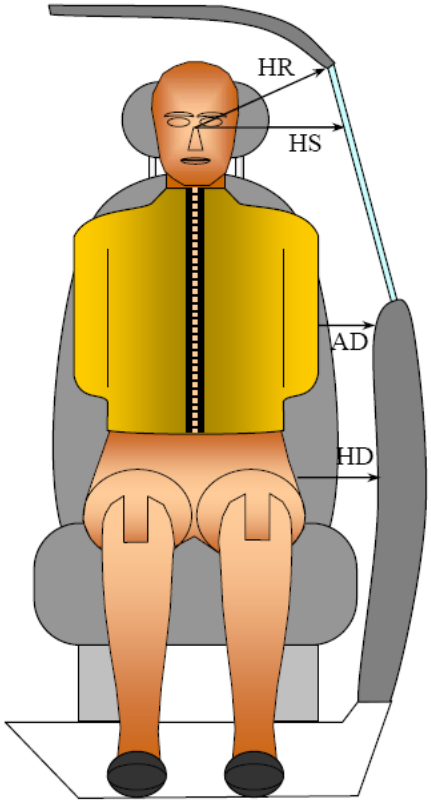
NOTE: 2-DOOR VEHICLE SHOWN. REAR DUMMY PHX & PHZ MEASUREMENTS FOR A 4-DOOR VEHICLE WOULD USE THE C-POST STRIKER AS A REFERENCE POINT

LEFT SIDE VIEW

Driver Code	Pass. Code	Measurement Description	Driver		Passenger	
			Length (mm)	Angle (°)	Length (mm)	Angle (°)
HH		Head to Header	325	17.4		
HW		Head to Windshield	569	0		
HZ	HZ	Head to Roof Liner	149	90	299	90
NR	NB	Nose to Rim/Seat Back	430	22.5	535	8.0
CD	CB	Chest to Dashboard/Seat Back	565	2.9	547	12.2
CS		Chest to Steering Wheel	351	12.8		
KDL	KBL	Left Knee to Dash/Seat Back	170	29.3	315	15.2
KDR	KBR	Right Knee to Dash/Seat Back	166	30.4	302	15.3
PAX	PAX	Pelvic Tilt Angle X		24.3		22.4
PAY	PAY	Pelvic Tilt Angle Y		-1.2		-1.0
PHX	PHX	Hip Point to Striker (X-Axis)	191		395	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	145		250	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

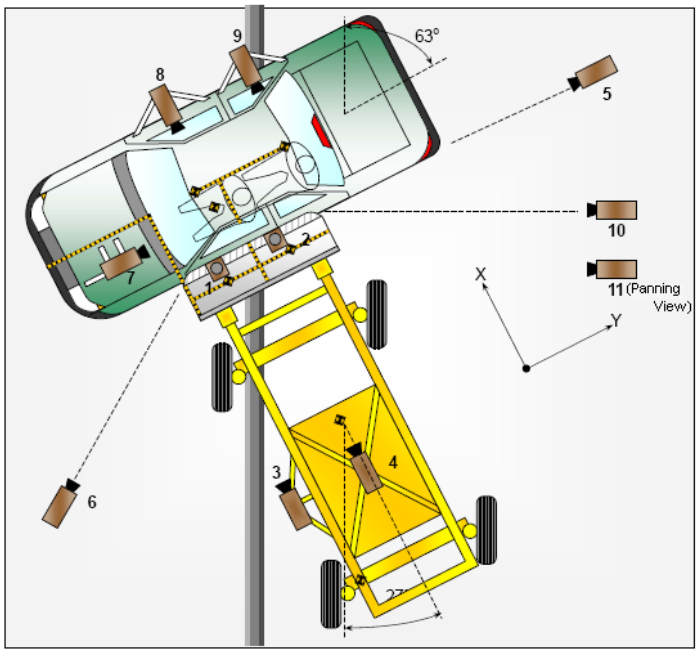
Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



Code	Measurement Description	Driver	Passenger
		Length (mm)	
HR	Head to Side Header	211	296
HS	Head to Side Window	340	378
AD	Arm to Door	90	159
HD	Hip Point to Door	158	199

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates* (mm)			Lens (mm)	Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	880	1150	-4995	8.5	1000
2	Overhead Close-Up	325	825	-4895	20	1000
3	Left Impact Point (MDB)				50	1000
4	Side Overall (MDB)				16	1000
5	Rear	40	6810	-1500	24	1000
6	Left Front	-1800	-6695	-1580	24	1000
7	Driver Front (OB)				16	1000
8	Driver Side (OB)				8	1000
9	Passenger Side (OB)				8	1000
10	Real Time Left Rear					30
11	Real Time Inrun					30

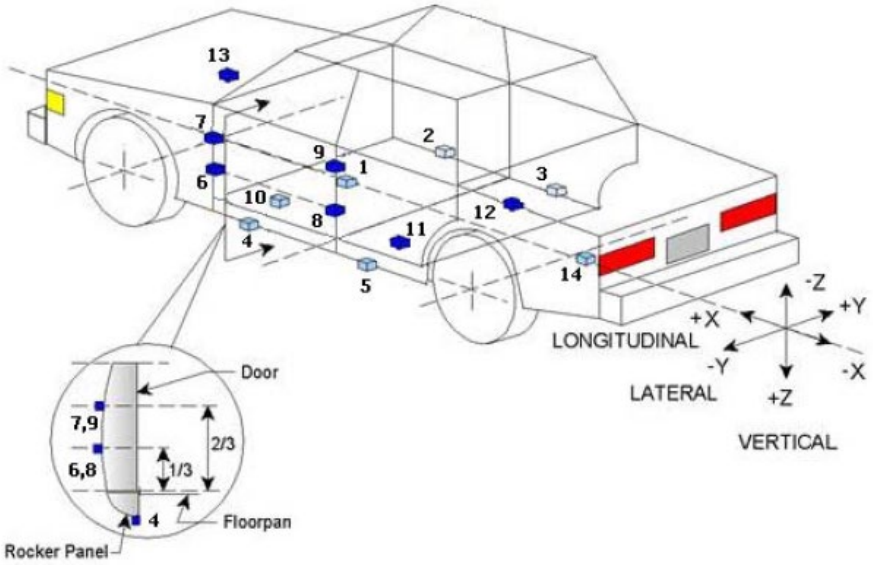
Reference: Impact Point projected to Ground; +X = To Front of MDB, + Y = To Right of MDB, +Z = Down
*All measurements accurate to ±6 mm

INSTRUMENTATION

	Number of Channels
Driver Dummy	16
Passenger Dummy	19
Vehicle Structure	23
MDB Accelerometers	5
Total	63

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



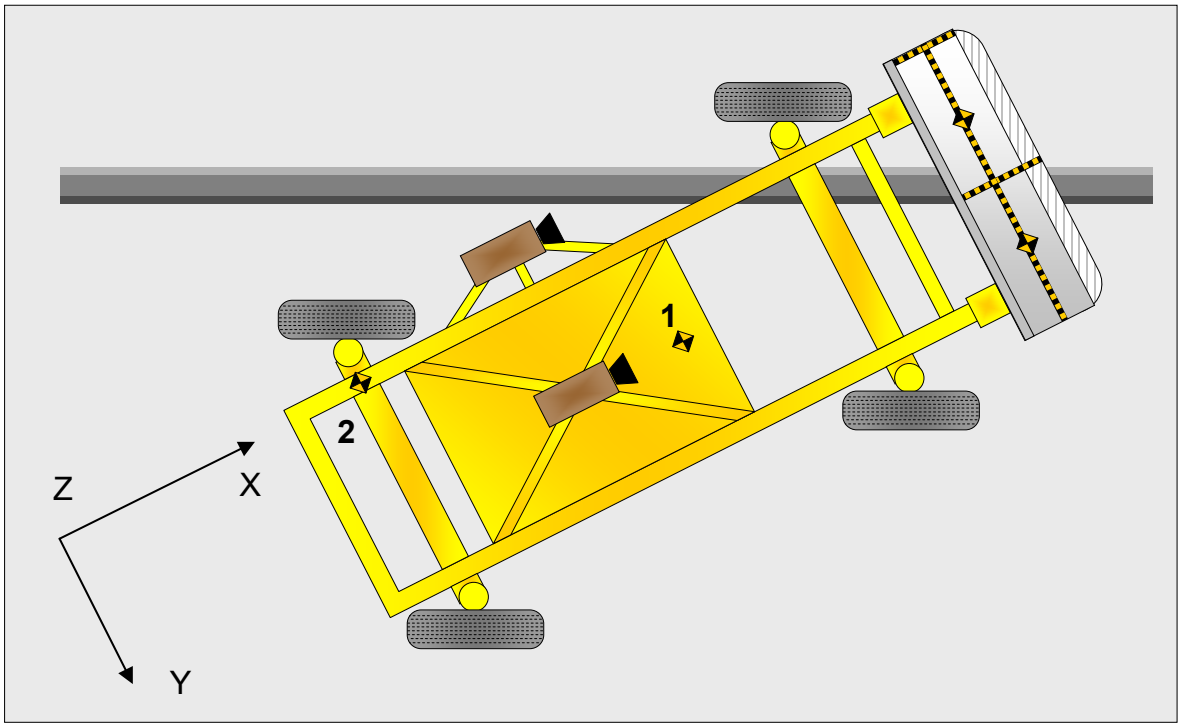
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	1591	-75	-320
2	Right Sill at Front Seat	3097	800	-300
3	Right Sill at Rear Seat	1919	800	-300
4	Left Sill at Front Door	3097	-800	-300
5	Left Sill at Rear Door	1919	-800	-300
6	Left Lower A-Post	3461	-852	-675
7	Left Middle A-Post	3469	-852	-920
8	Left Lower B-Post			
9	Left Middle B-Post			
10	Front Seat Track	2478	-400	-416
11	Rear Seat Structure	2051	-360	-446
12	Rt. Rear Occ. Compartment	2051	360	-446
13	Engine Block	4110	60	-955
14	Rear Above Axle	1020	0	-498

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

DATA SHEET NO. 7
MDB ACCELEROMETER LOCATIONS

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



MDB ACCELEROMETER LOCATIONS

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

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

Width between left and right MDB contact switches	mm	1406

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Airbag	Curtain Airbag
Top of Head	Curtain Airbag, Headliner	Curtain Airbag
Left Side of Head	Curtain Airbag, Headliner	Curtain Airbag
Back of Head	Curtain Airbag, Headrest	Headrest
Left Shoulder	None	Side Torso/Pelvis Airbag, Seatback
Upper Torso	Seatback	Seatback
Lower Torso	Side Torso/Pelvis Airbag, Seatback	Side Torso/Pelvis Airbag, Seatback
Left Hip	Side Torso/Pelvis Airbag, Seat Cushion	Side Torso/Pelvis Airbag, Seat Cushion
Left Knee	Door Panel	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	None
Windshield Damage	None
Side Window Damage	LF window cracked
Other Notable Effects	None

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

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheelbase	mm		3116
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		508
Actual Impact Point (Aft of Front Axle)	mm		508
Horizontal Offset (+forward / -rearward)	mm	+/- 50 of intended impact point	0
Vertical Offset (+down / -up)	mm	+/- 20 of intended impact point	1

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

MDB SPECIFICATIONS

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

MDB WEIGHTS

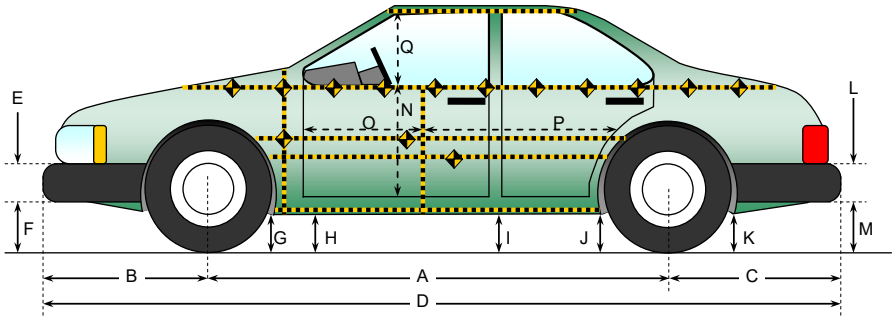
	Units	Front Axle	Rear Axle	Total
Left	kg	368.2	320.6	
Right	kg	400.7	271.4	
Ratio	%	56.5	43.5	
Totals	kg	768.9	592.0	1360.9

SPEED AND ANGLE AT IMPACT DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	62.03
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	62.24
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	89.7
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	62.9
MDB Crabbed Angle to MDB Forward Line of Motion	degrees	26 to 28	26.3

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



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

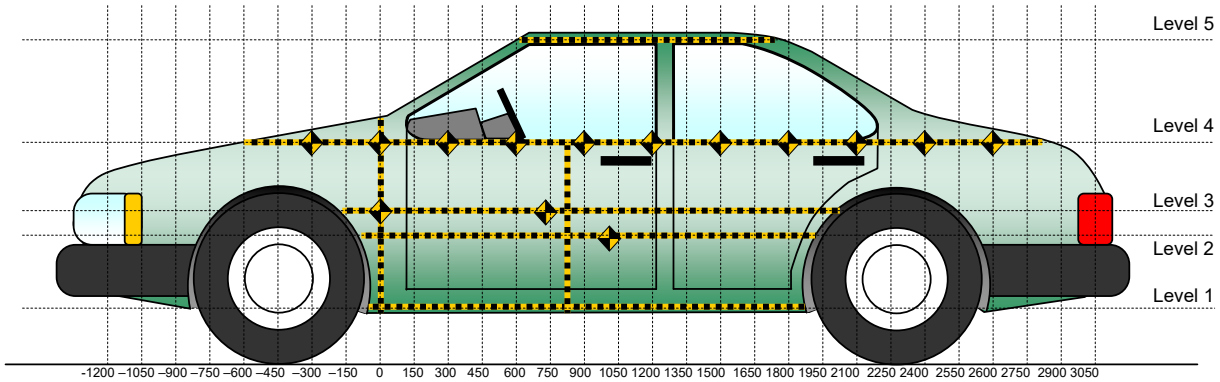
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Change
A	Wheelbase	3116	3111	-5
B	Front Axle to FSOV	851	857	6
C	Rear Axle to RSOV	1125	1129	4
D	Total Length at Centerline	5092	5097	5
E	Front Bumper Thickness	135	135	0
F	Front Bumper Bottom to Ground	500	508	8
G	Sill Height at Front Wheel Well	273	277	4
H	Sill Height at Front Door Leading Edge	273	277	4
I	Sill Height at B Pillar	263	273	10
J1	Sill Height at Rear Wheel Well	265	272	7
J2	Pinch Weld Height at Rear Wheel Well	265	272	7
K	Sill Height Aft of Rear Wheel Well	267	274	7
L	Rear Bumper Thickness	93	93	0
M	Rear Bumper Bottom to Ground	470	477	7
N	Sill Height to Window Bottom Sill	774	746	-28
O	Front Door Leading Edge to Impact CL	600	587	-13
P	Rear Door Trailing Edge to Impact CL	1416	1384	-32
Q	Front Window Opening	382	379	-3
R	Right Side Length	4380	4382	2
S	Left Side Length	4380	4380	0
T	Vehicle Width at B Post	2008	1986	-22
U	Front Wheel Track Width	1703		
V	Rear Wheel Track Width	1705		

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



All Measurements Shown in mm

LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEAUREMENTS

Level	Measurement Description	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	450	118	1050
2	Occupant H-Point	769	126	1650
3	Mid Door	794	123	1500
4	Window Sill	1134	22	1350
5	Window Top	1675	-3	1800

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

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

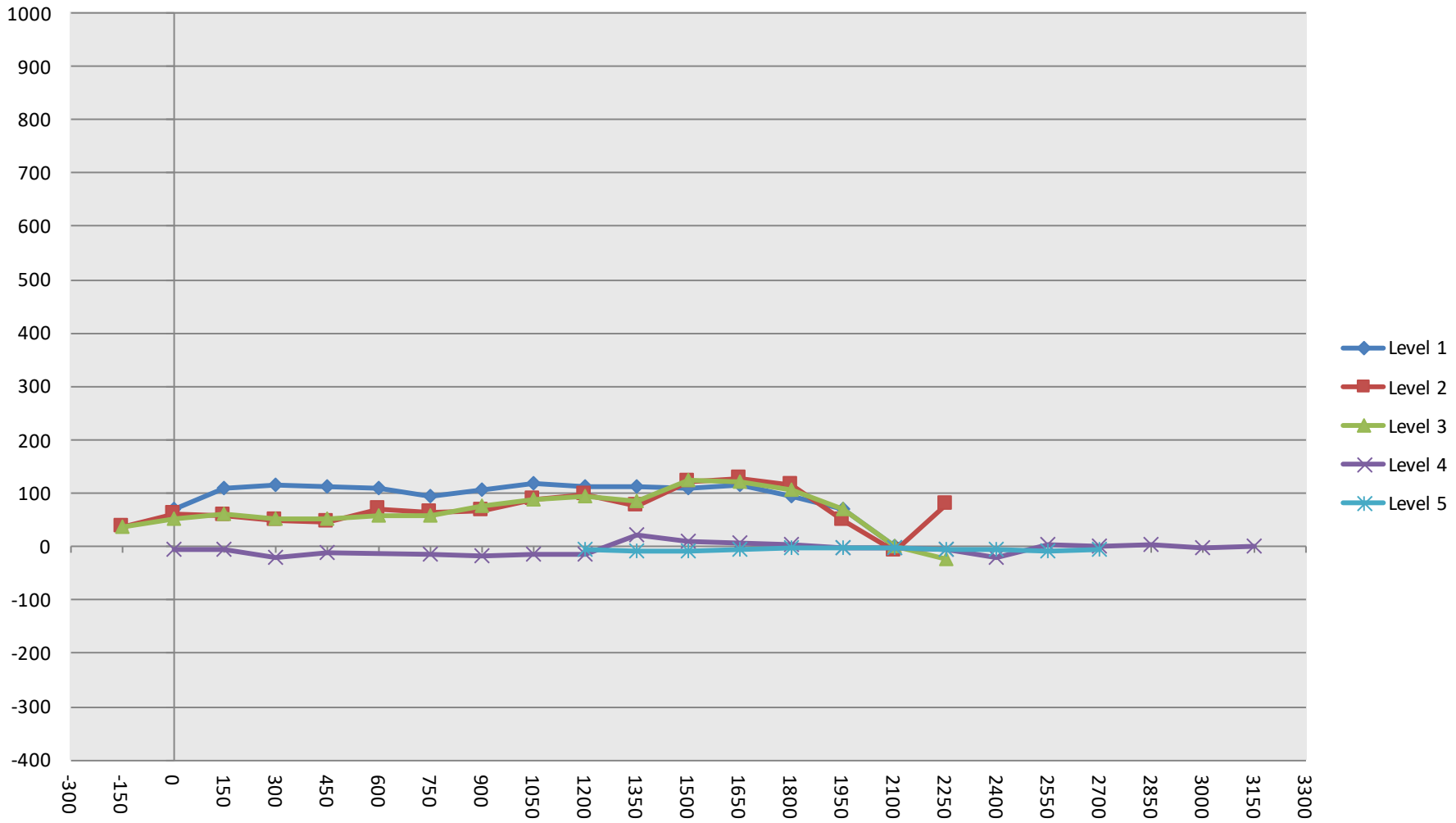
Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

	Pre-Test					Post-Test					Exterior Crush				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-2100															
-1950															
-1800															
-1650															
-1500															
-1350															
-1200															
-1050															
-900															
-750															
-600															
-450															
-300															
-150		123	126				159	162				36	36		
0	122	142	145	270		192	204	198	264		70	62	53	-6	
150	132	160	162	262		240	217	223	256		108	57	61	-6	
300	134	170	169	250		248	220	221	229		114	50	52	-21	
450	142	172	172	240		255	219	225	227		113	47	53	-13	
600	145	174	172			253	245	230			108	71	58		
750	146	174	172	222		240	239	229	206		94	65	57	-16	
900	147	174	172	217		254	240	248	199		107	66	76	-18	
1050	150	174	172	212		268	262	260	196		118	88	88	-16	
1200	152	172	172	208	460	265	269	267	192	453	113	97	95	-16	-7
1350	152	172	172	206	458	263	247	256	228	448	111	75	84	22	-10
1500	157	172	171	205	460	265	294	294	215	450	108	122	123	10	-10
1650	150	169	170	204	458	266	295	290	210	452	116	126	120	6	-6
1800	146	166	168	204	458	239	280	273	206	455	93	114	105	2	-3
1950	137	159	159	205	458	206	208	228	203	454	69	49	69	-2	-4
2100	122	139	142	207	460	121	131	143	203	456	-1	-8	1	-4	-4
2250		118	118	210	464		196	95	204	458		78	-23	-6	-6
2400				212	470				191	465				-21	-5
2550				214	485				216	477				2	-8
2700				220	505				220	500				0	-5
2850				226					228					2	
3000				232					228					-4	
3150				240					239					-1	
3300															
3450															
3600															
3750															
3900															

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

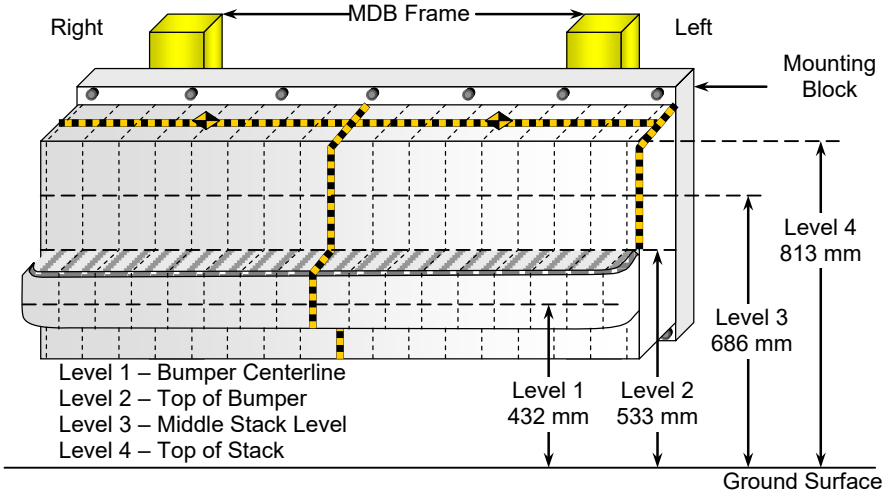
DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



FRONT VIEW

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

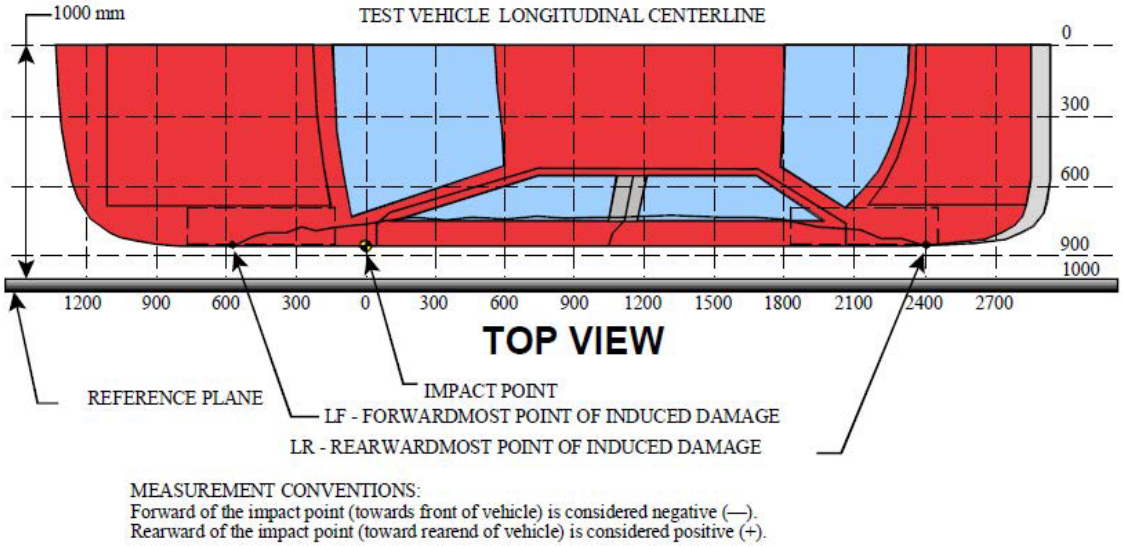
Vertical Location			From Centerline		Maximum Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Right	272
B	Top of Bumper	533	800	Left	219
C	Mid-Level	686	700	Left	183
D	Top of Stack	813	800	Left	218

DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center (mm)								C_L	Distance Left of Center (mm)							
	800	700	600	500	400	300	200	100	0	100	200	300	400	500	600	700	800
4	137	122	116	130	162	135	120	123	129	147	163	174	176	188	205	213	218
3	139	131	133	143	168	160	150	143	125	115	115	122	150	168	174	183	175
2	216	208	199	193	180	188	198	197	197	199	200	198	198	198	201	204	219
1	272	269	265	263	262	257	257	256	253	254	259	252	248	245	247	250	247

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



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

VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Max. Static Crush (mm)
1	2250	3	196	158	38
2	1820	3	267	167	100
3	1390	3	281	172	109
4	960	3	252	172	80
5	530	3	235	172	63
6	100	3	227	156	71

MDB DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Max. Static Crush (mm)
1	800 mm right of center	1	748	476	272
2	480 mm right of center	1	728	463	265
3	160 mm right of center	1	717	463	254
4	160 mm left of center	1	716	463	253
5	480 mm left of center	1	715	463	252
6	800 mm left of center	1	723	476	247

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

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

Test Time: 12:33 pm Temperature: 21.0°C

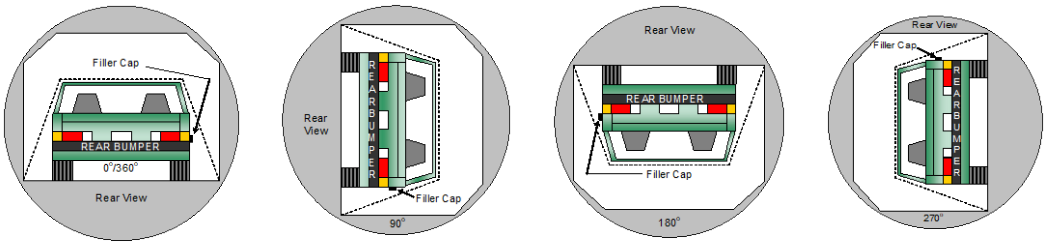
A. From impact until vehicle motion ceases: (Maximum Allowable = 1 ounce) 0.0 oz.

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°	96	300	396
90° to 180°	91	300	391
180° to 270°	82	300	382
270° to 360°	86	300	386

FMVSS 301 ROLLOVER SPILLAGE TABLE (UNITS IN OUNCES)

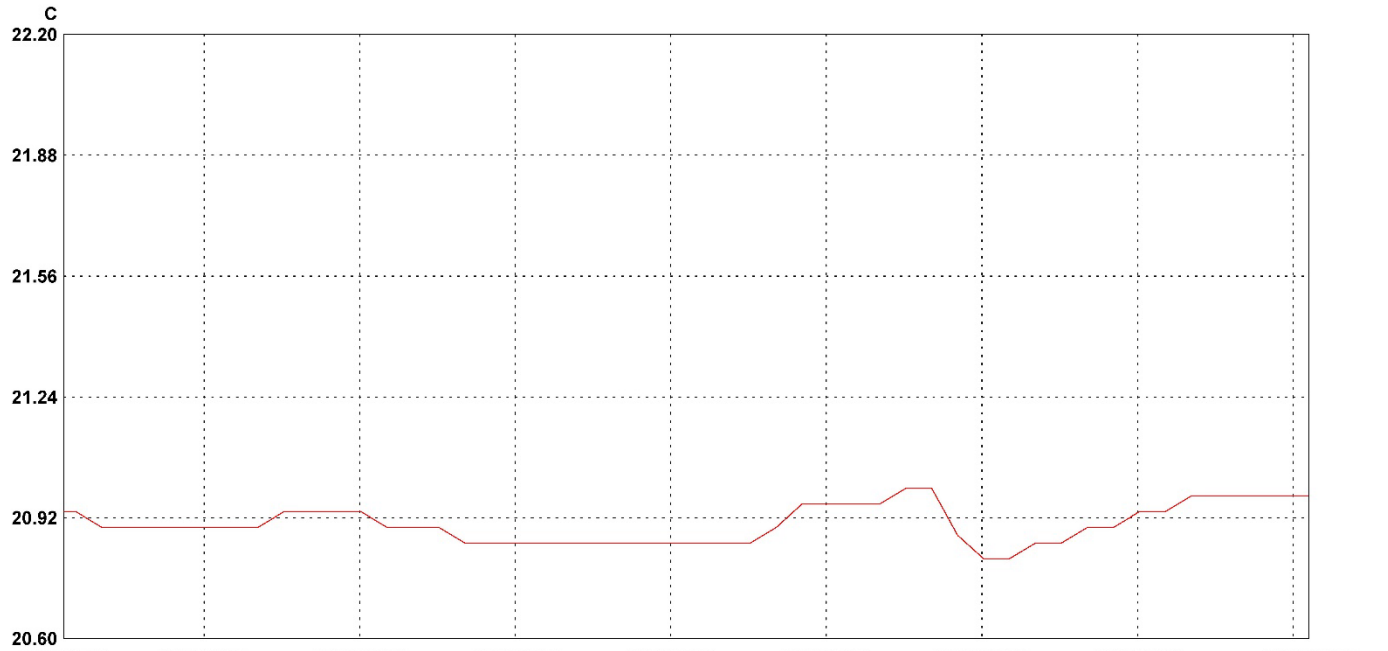
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0.0	0.0	0.0	
90° to 180°	0.0	0.0	0.0	
180° to 270°	0.0	0.0	0.0	
270° to 360°	0.0	0.0	0.0	

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 15
DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	17162078	VSC_North_Hall	1		21.00	20.90	20.81	C	Temperature	17162078_VSC_North_Hall (Mar 2024).spl

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

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

ELECTRIC VEHICLE PROPULSION SYSTEM

	Units	Observations and Conclusions
Type of Electric Vehicle		Gas-Electric Hybrid
Propulsion Battery Type		Lithium-ion Battery
Nominal Voltage	V	355
Physical Location of Automatic Propulsion Battery Disconnect		Automatic Propulsion Battery Disconnect is in Lithium-ion Battery.
Auxiliary Battery Type		Lead Battery

PROPULSION BATTERY SYSTEM DATA

	Units		Observations and Conclusions
Electrolyte Fluid Type			Class 4 Second petroleum
Electrolyte Fluid Specific Gravity	g/cm3		1.25
Electrolyte Fluid Kinematic Viscosity			No Data
Electrolyte Fluid Color			Colorless
Propulsion Battery Coolant Type, Color, Specific Gravity (if applicable)			Refrigerant (Green)
Location of Battery Modules			Inside Passenger Compartment
		X	Outside Passenger Compartment
			The high-voltage battery is located on the underside of the vehicle.

PROPULSION BATTERY STATE OF CHARGE

For all battery types:	
Voltage range corresponding to **useable energy** of the battery:	
Minimum State of Charge	332.3
Maximum State of Charge	397.4
95% of Maximum State of Charge	377.5
Test Voltage - No less than 95% of maximum State of Charge	N/A
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:	2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV	NHTSA No.:	O20245405
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/15/2023

VEHICLE CHASSIS GROUND POINT(S) LOCATION(S)

Details of Vehicle Chassis Ground Point(s) & Location(s)	Body structure

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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		
Model		
Serial Number		
Internal Impedance Value	MΩ	
Resolution	V	
Last Calibration Date		

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	

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:	2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV	NHTSA No.:	O20245405
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/15/2023

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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		
Model		
Serial Number		
Internal Impedance Value	MΩ	
Resolution	V	
Last Calibration Date		

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:	2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV	NHTSA No.:	O20245405
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/15/2023

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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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

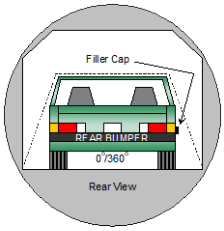
	Yes (Fail)	No
Has an outside Propulsion Battery Component intruded into the passenger compartment?		X

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

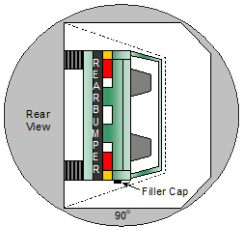
DATA SHEET NO. 305-5
STATIC ROLLOVER TEST DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

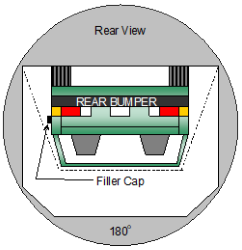
PROPULSION BATTERY SYSTEM COMPONENTS



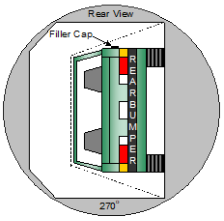
0°/360°



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	36	sec	5	min	6	min	36	sec	7	min
90° - 180°	1	min	31	sec	5	min	6	min	31	sec	7	min
180° - 270°	1	min	22	sec	5	min	6	min	22	sec	7	min
270° - 360°	1	min	26	sec	5	min	6	min	26	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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		
Model		
Serial Number		
Internal Impedance Value	MΩ	
Resolution	V	
Last Calibration Date		

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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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
High-Voltage Battery Case to Electrical Ground		X		X
Inverter to Electrical Ground		X		X
DC Converter to Electrical Ground		X		X
Electric Propulsion Drive Motor to Electrical Ground		X		X
Electric Propulsion Drive Motor to High-Voltage Battery Case		X		X
Electric Propulsion Drive Motor to Inverter		X		X
Electric Propulsion Drive Motor to DC Converter		X		X
DC Converter to High-Voltage Battery Case		X		X
DC Converter to Inverter		X		X
Inverter 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
High-Voltage Battery Case to Electrical Ground		X		X
Inverter to Electrical Ground		X		X
DC Converter to Electrical Ground		X		X
Electric Propulsion Drive Motor to Electrical Ground		X		X
Electric Propulsion Drive Motor to High-Voltage Battery Case		X		X
Electric Propulsion Drive Motor to Inverter		X		X
Electric Propulsion Drive Motor to DC Converter		X		X
DC Converter to High-Voltage Battery Case		X		X
DC Converter to Inverter		X		X
Inverter to High-Voltage Battery Case		X		X

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

Test Vehicle: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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-ROLLOVER

Description of Evaluated Location	Probe Contact with High Voltage Source		Probe Lamp Illuminated	
	Yes, Fail	No, Pass	Yes, Fail	No, Pass
High-Voltage Battery Case to Electrical Ground		X		X
Inverter to Electrical Ground		X		X
DC Converter to Electrical Ground		X		X
Electric Propulsion Drive Motor to Electrical Ground		X		X
Electric Propulsion Drive Motor to High-Voltage Battery Case		X		X
Electric Propulsion Drive Motor to Inverter		X		X
Electric Propulsion Drive Motor to DC Converter		X		X
DC Converter to High-Voltage Battery Case		X		X
DC Converter to Inverter		X		X
Inverter 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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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 within 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	
High-Voltage Battery Case to Electrical Ground	BC			0.028	Pass
Inverter to Electrical Ground	BC			0.055	Pass
DC Converter to Electrical Ground	BC			0.055	Pass
Electric Propulsion Drive Motor to Electrical Ground	BC			0.027	Pass
Electric Propulsion Drive Motor to High-Voltage Battery Case	BB			0.008	Pass
Electric Propulsion Drive Motor to Inverter	BB			0.040	Pass
Electric Propulsion Drive Motor to DC Converter	BB			0.039	Pass
DC Converter to High-Voltage Battery Case	BB			0.067	Pass
DC Converter to Inverter	BB			0.031	Pass
Inverter to High-Voltage Battery Case	BB			0.031	Pass

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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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 within 2.5 meters.*	< 0.2 Ω	≥ 0.2 Ω

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	
High-Voltage Battery Case to Electrical Ground	BC			0.010	Pass
Inverter to Electrical Ground	BC			0.033	Pass
DC Converter to Electrical Ground	BC			0.033	Pass
Electric Propulsion Drive Motor to Electrical Ground	BC			0.004	Pass
Electric Propulsion Drive Motor to High-Voltage Battery Case	BB			0.005	Pass
Electric Propulsion Drive Motor to Inverter	BB			0.028	Pass
Electric Propulsion Drive Motor to DC Converter	BB			0.027	Pass
DC Converter to High-Voltage Battery Case	BB			0.024	Pass
DC Converter to Inverter	BB			0.057	Pass
Inverter to High-Voltage Battery Case	BB			0.024	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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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 within 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	
High-Voltage Battery Case to Electrical Ground	BC			0.009	Pass
Inverter to Electrical Ground	BC			0.032	Pass
DC Converter to Electrical Ground	BC			0.032	Pass
Electric Propulsion Drive Motor to Electrical Ground	BC			0.003	Pass
Electric Propulsion Drive Motor to High-Voltage Battery Case	BB			0.004	Pass
Electric Propulsion Drive Motor to Inverter	BB			0.027	Pass
Electric Propulsion Drive Motor to DC Converter	BB			0.026	Pass
DC Converter to High-Voltage Battery Case	BB			0.023	Pass
DC Converter to Inverter	BB			0.056	Pass
Inverter to High-Voltage Battery Case	BB			0.023	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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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 within 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	
High-Voltage Battery Case to Electrical Ground	BC	0.0	0.0	Pass
Inverter to Electrical Ground	BC	0.0	0.0	Pass
DC Converter to Electrical Ground	BC	0.0	0.0	Pass
Electric Propulsion Drive Motor to Electrical Ground	BC	0.0	0.0	Pass
Electric Propulsion Drive Motor to High-Voltage Battery Case	BB	0.0	0.0	Pass
Electric Propulsion Drive Motor to Inverter	BB	0.0	0.0	Pass
Electric Propulsion Drive Motor to DC Converter	BB	0.0	0.0	Pass
DC Converter to High-Voltage Battery Case	BB	0.0	0.0	Pass
DC Converter to Inverter	BB	0.0	0.0	Pass
Inverter to High-Voltage Battery Case	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	
High-Voltage Battery Case to Electrical Ground	BC	0.0	0.0	Pass
Inverter to Electrical Ground	BC	0.0	0.0	Pass
DC Converter to Electrical Ground	BC	0.0	0.0	Pass
Electric Propulsion Drive Motor to Electrical Ground	BC	0.0	0.0	Pass
Electric Propulsion Drive Motor to High-Voltage Battery Case	BB	0.0	0.0	Pass
Electric Propulsion Drive Motor to Inverter	BB	0.0	0.0	Pass
Electric Propulsion Drive Motor to DC Converter	BB	0.0	0.0	Pass
DC Converter to High-Voltage Battery Case	BB	0.0	0.0	Pass
DC Converter to Inverter	BB	0.0	0.0	Pass
Inverter to High-Voltage Battery Case	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: 2024 Mazda CX-90 PHEV Premium Plus 5-Door SUV NHTSA No.: O20245405
Test Program: NCAP Side MDB Impact Test Test Date: 12/15/2023

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 within 2.5 meters.*	≤ 30 VAC ≤ 60 VDC	> 30 VAC > 60 VDC

POST-ROLLOVER

Description of Evaluated Location	Measuring Path	Measured Voltage		Pass *or* Fail
	BC *or* **BB**	**VAC** (V) Volts	**VDC** (V) Volts	
High-Voltage Battery Case to Electrical Ground	BC	0.0	0.0	Pass
Inverter to Electrical Ground	BC	0.0	0.0	Pass
DC Converter to Electrical Ground	BC	0.0	0.0	Pass
Electric Propulsion Drive Motor to Electrical Ground	BC	0.0	0.0	Pass
Electric Propulsion Drive Motor to High-Voltage Battery Case	BB	0.0	0.0	Pass
Electric Propulsion Drive Motor to Inverter	BB	0.0	0.0	Pass
Electric Propulsion Drive Motor to DC Converter	BB	0.0	0.0	Pass
DC Converter to High-Voltage Battery Case	BB	0.0	0.0	Pass
DC Converter to Inverter	BB	0.0	0.0	Pass
Inverter to High-Voltage Battery Case	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

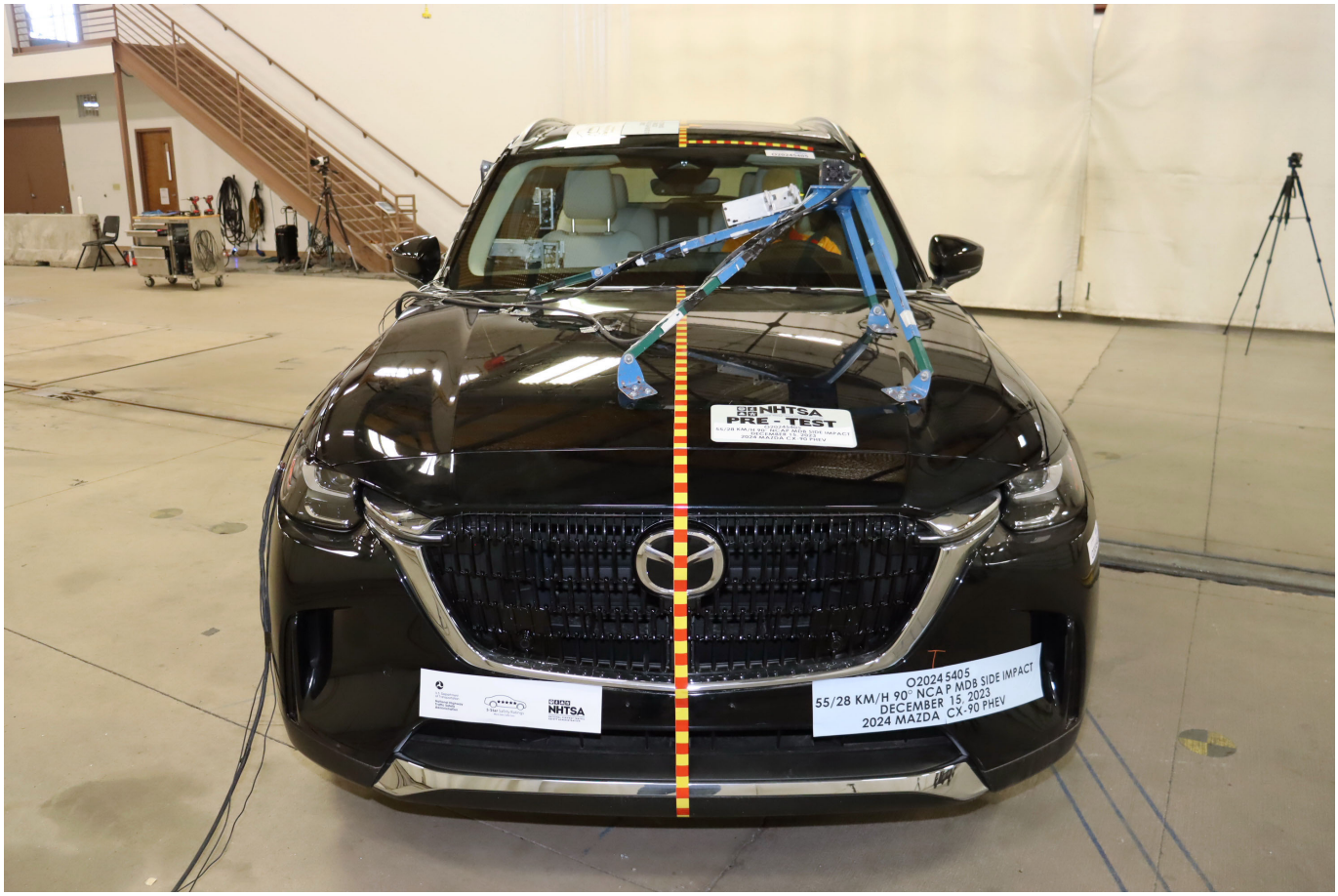


Photo No. 003 - Pre-Test Frontal View of Test Vehicle

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

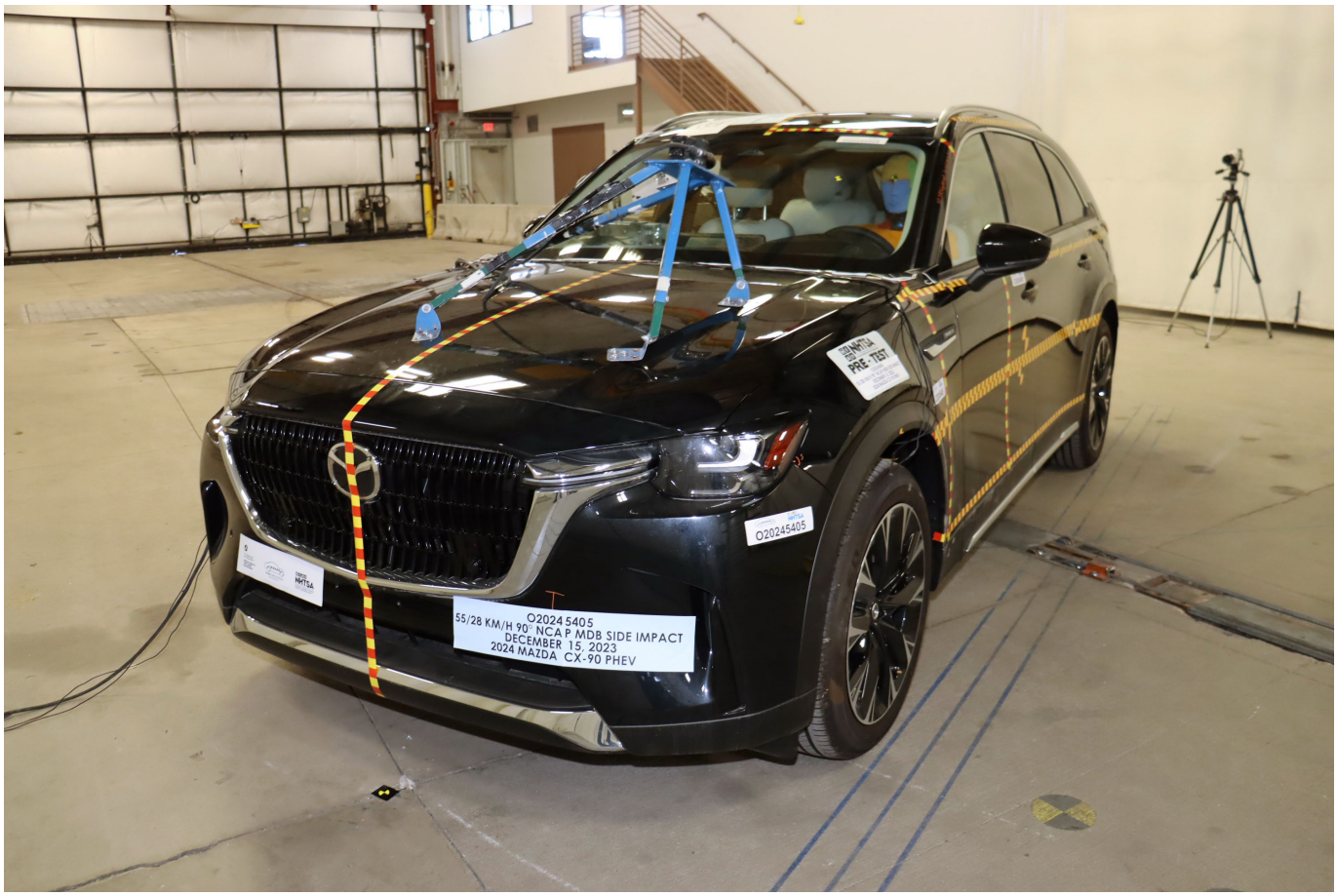


Photo No. 005 - Pre-Test Left Front Three-Quarter View of Test Vehicle

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 Three-Quarter Rear View of Test Vehicle

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

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

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

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

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

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

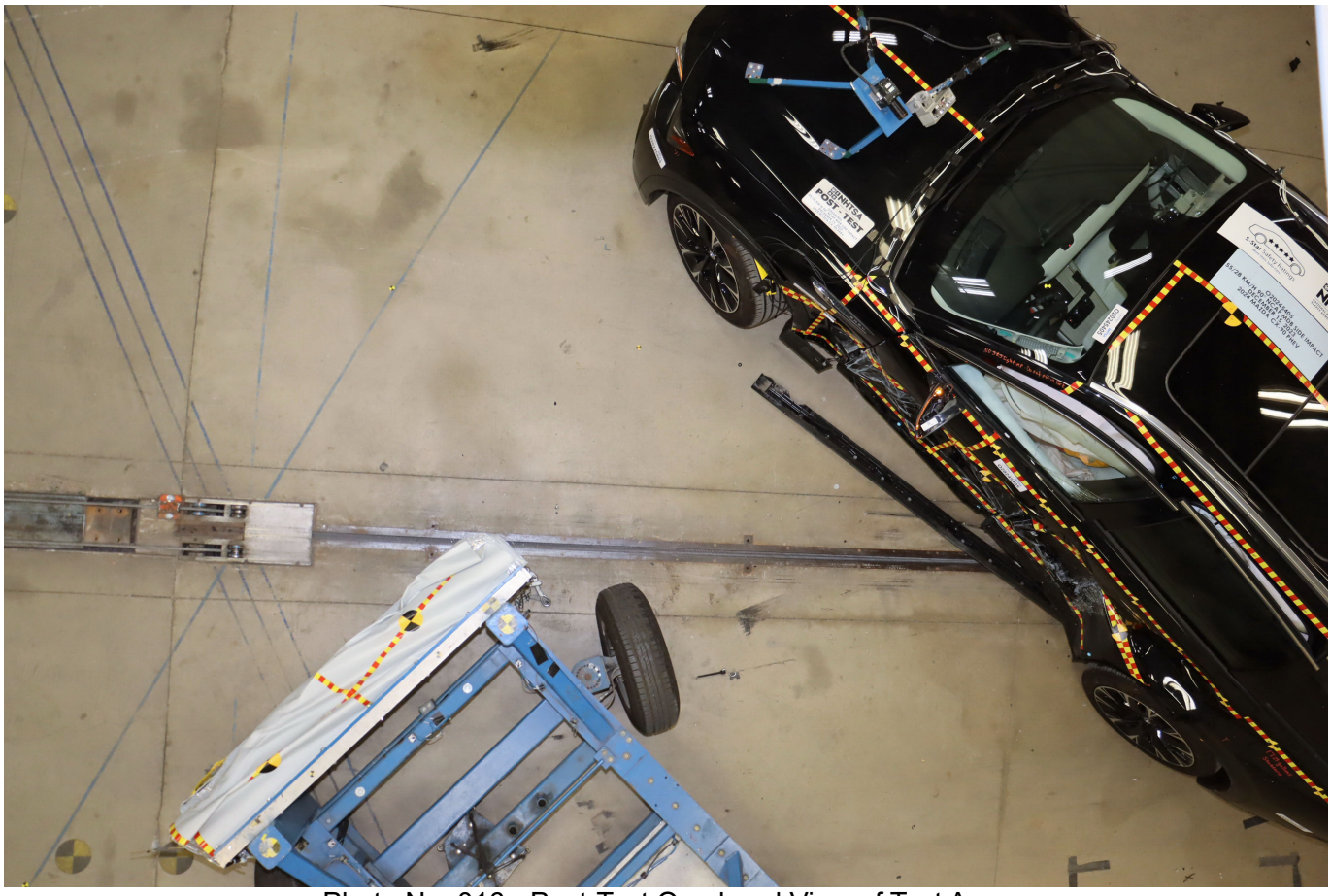


Photo No. 016 - Post-Test Overhead View of Test Area

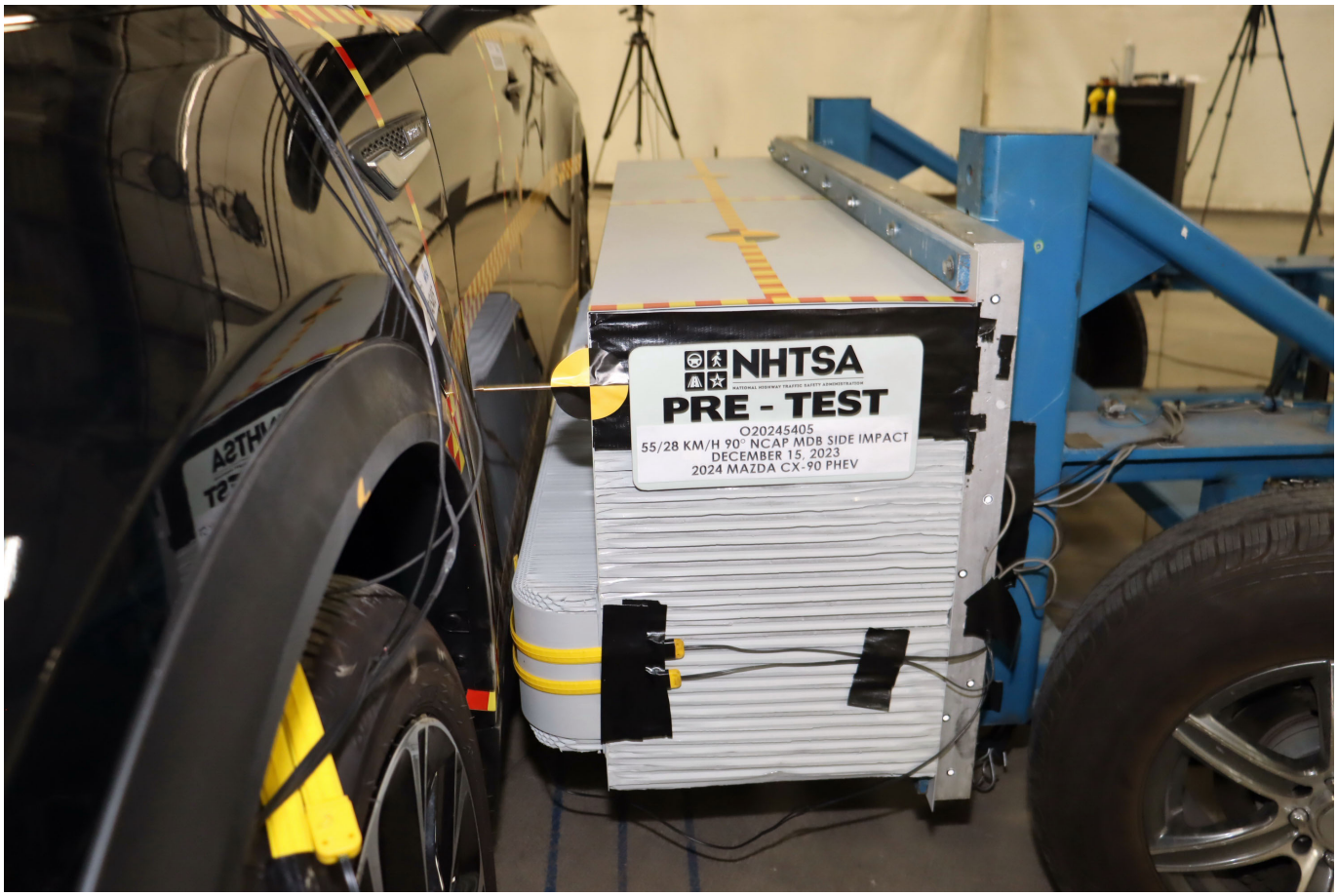


Photo No. 017 - Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Photo No. 034 - Pre-Test Placement of Driver Dummy's Feet

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Photo No. 062 - Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket

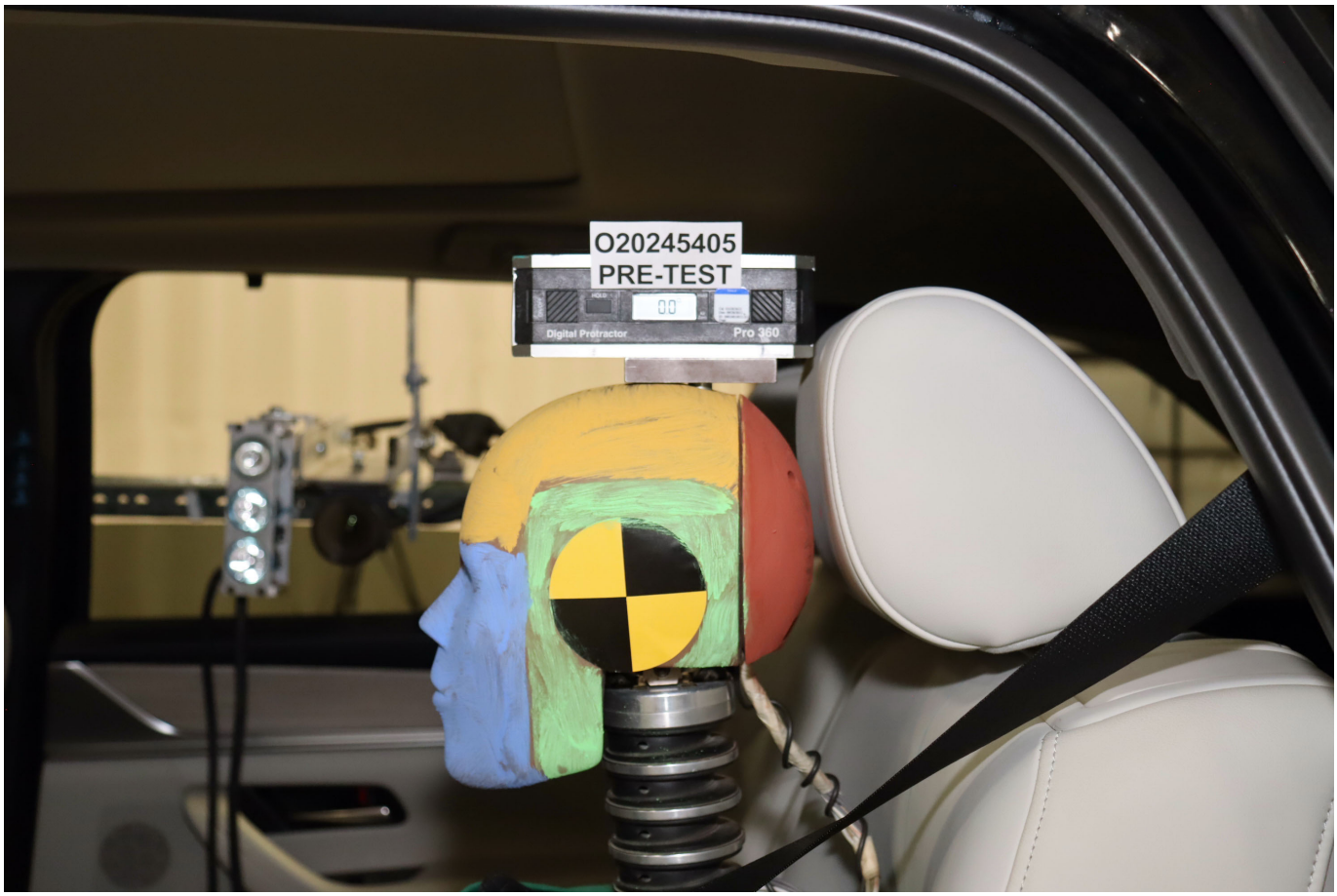


Photo No. 063 - Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level

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

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

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

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

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

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

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

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

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

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

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

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

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

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

PHOTOGRAPH NOT AVAILABLE

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

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

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

PHOTOGRAPH NOT APPLICABLE

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

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

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

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

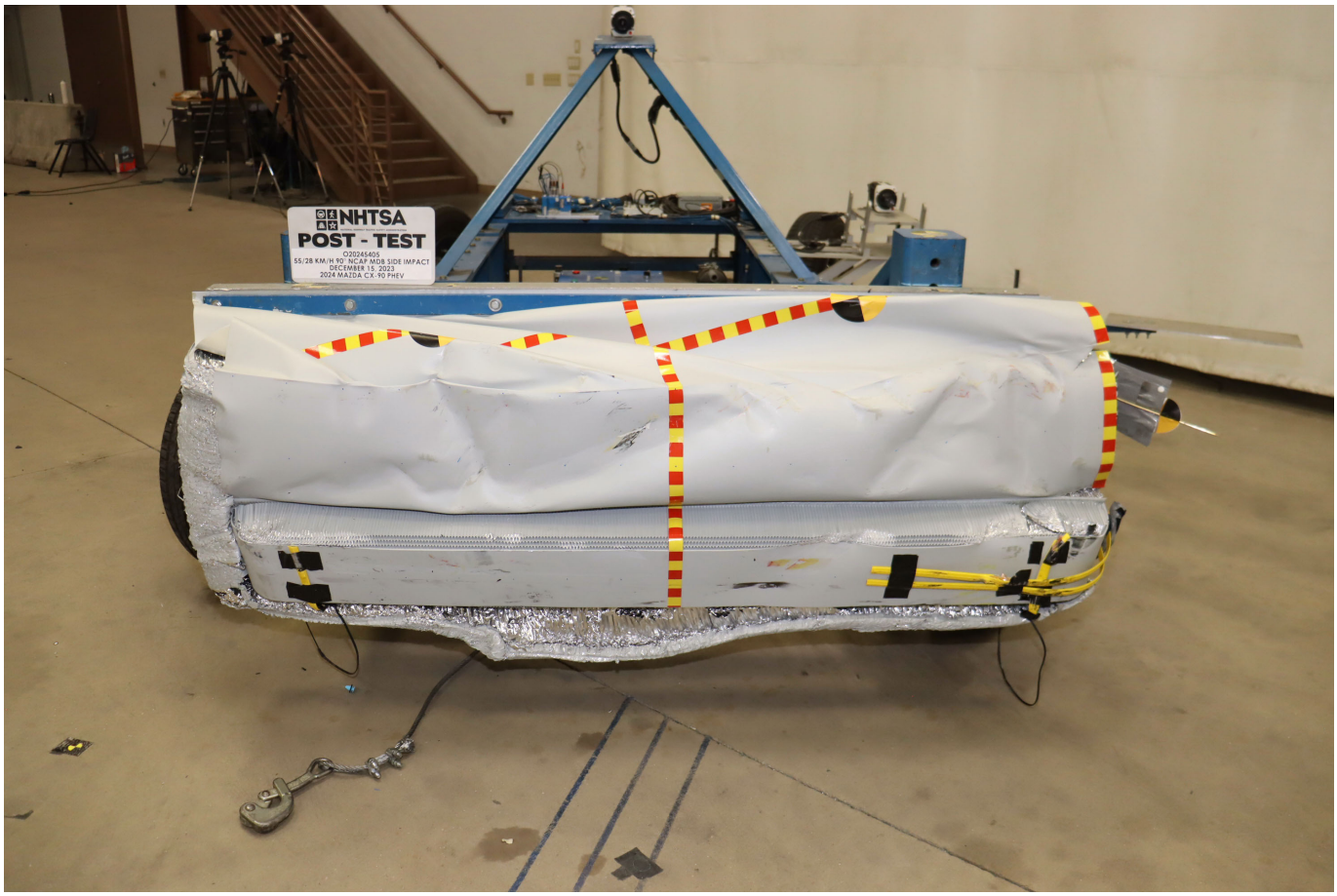


Photo No. 085 - Post-Test Front View of MDB Impactor Face

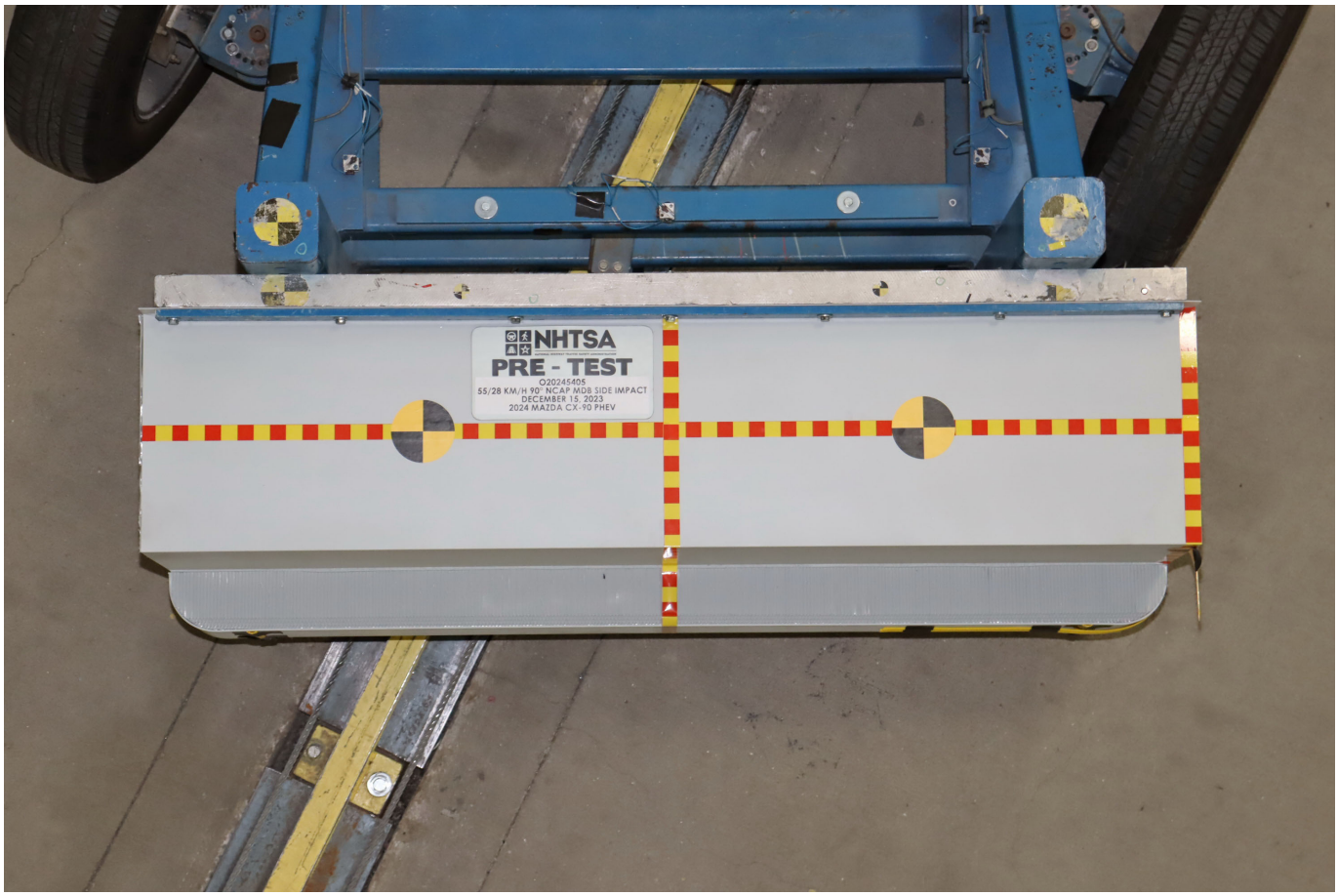


Photo No. 086 - Pre-Test Top View of MDB Impactor Face

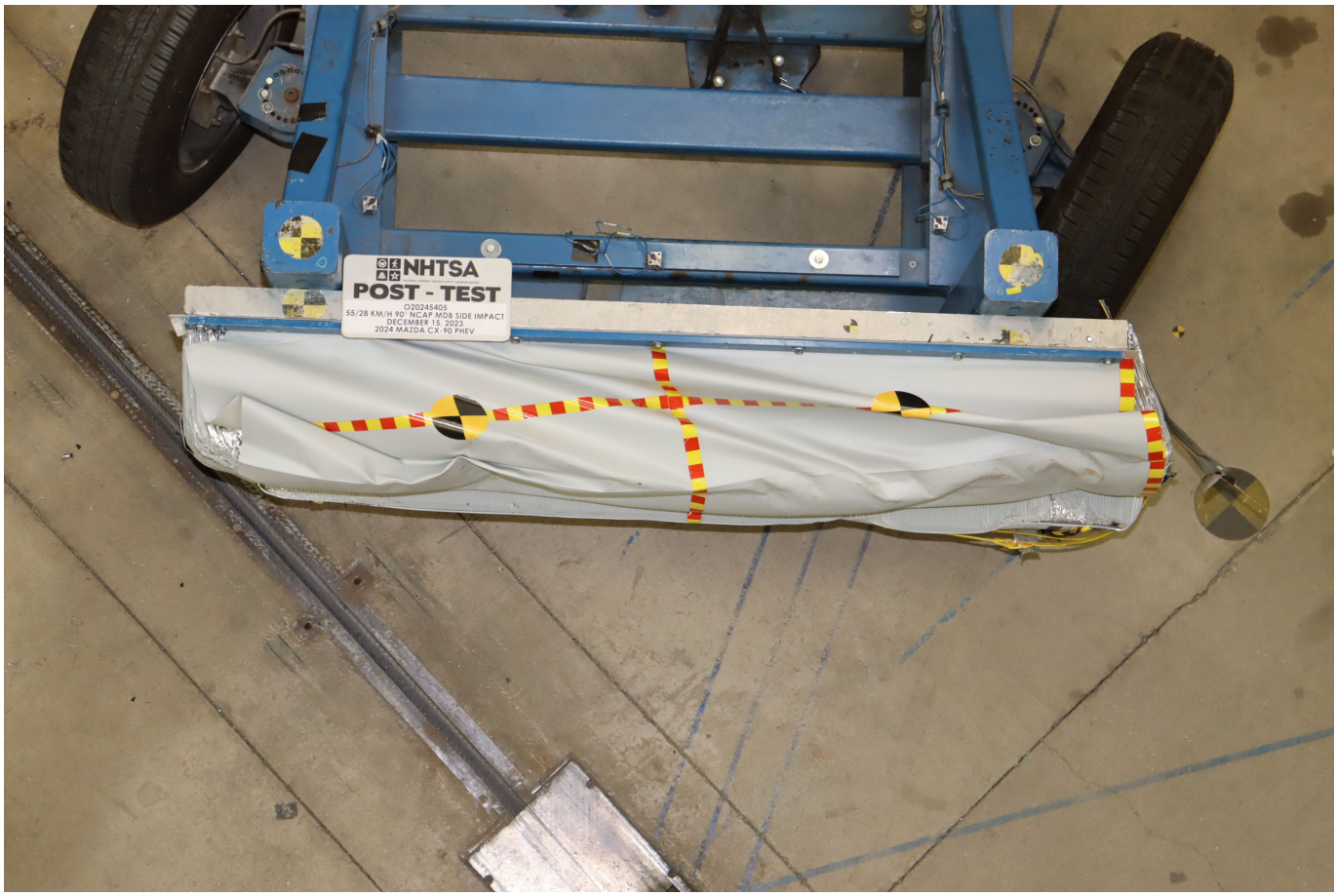


Photo No. 087 - Post-Test Top View of MDB Impactor Face

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

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

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

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

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

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

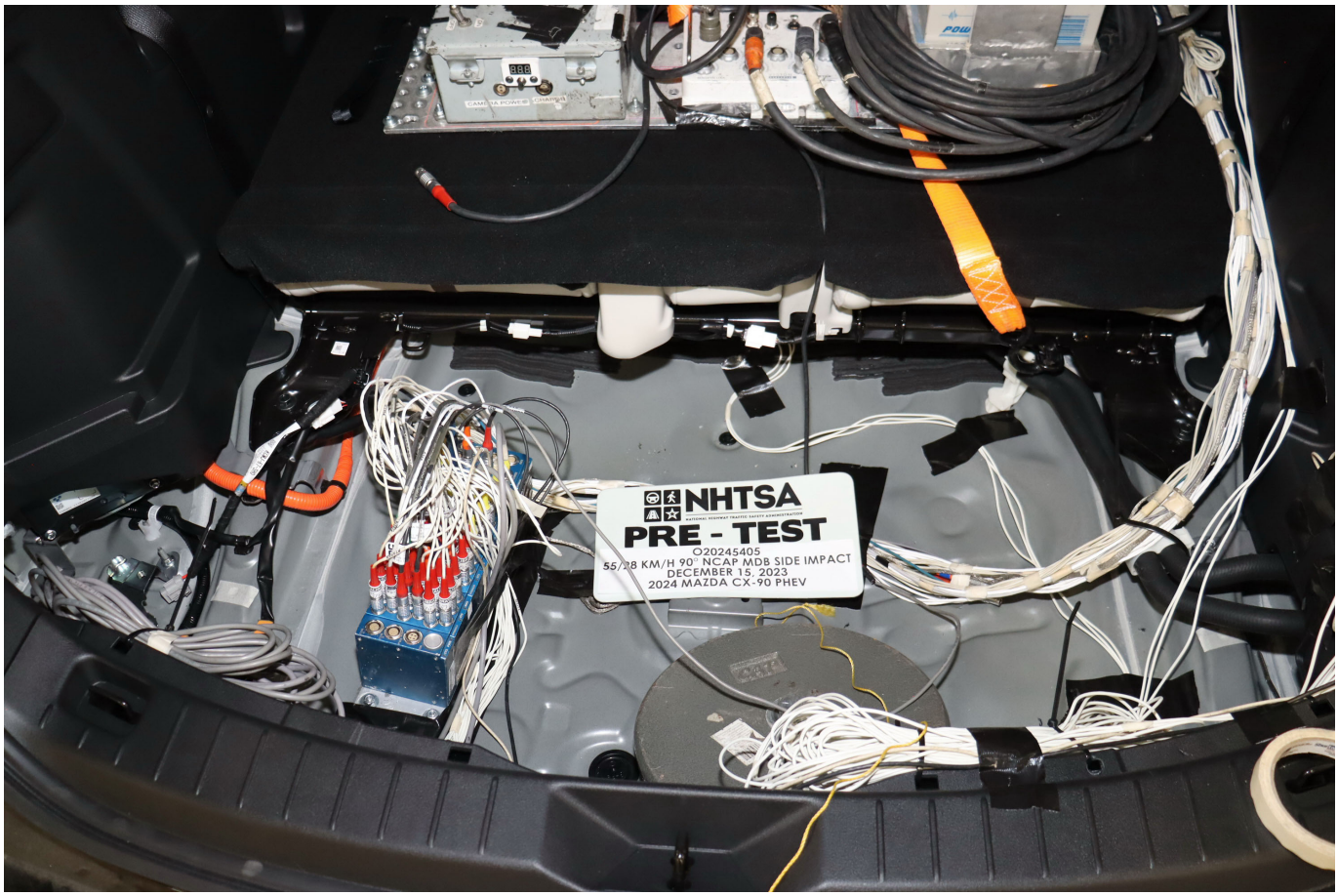


Photo No. 094 - Pre-Test Ballast View

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


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

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

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

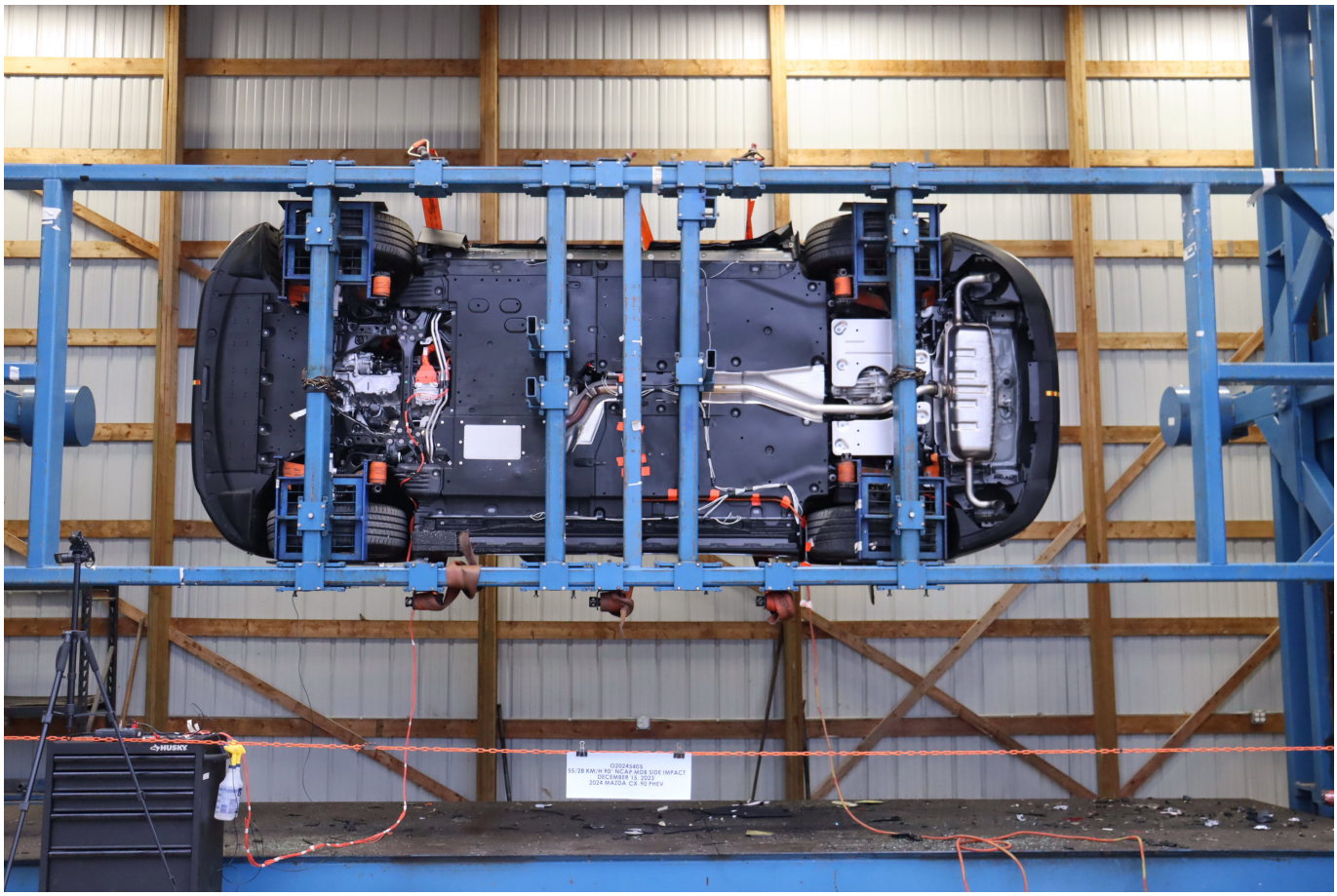


Photo No. 099 - FMVSS Photo No. 301 Static Rollover 270 Degrees

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

Photo No. 101 - Impact Event

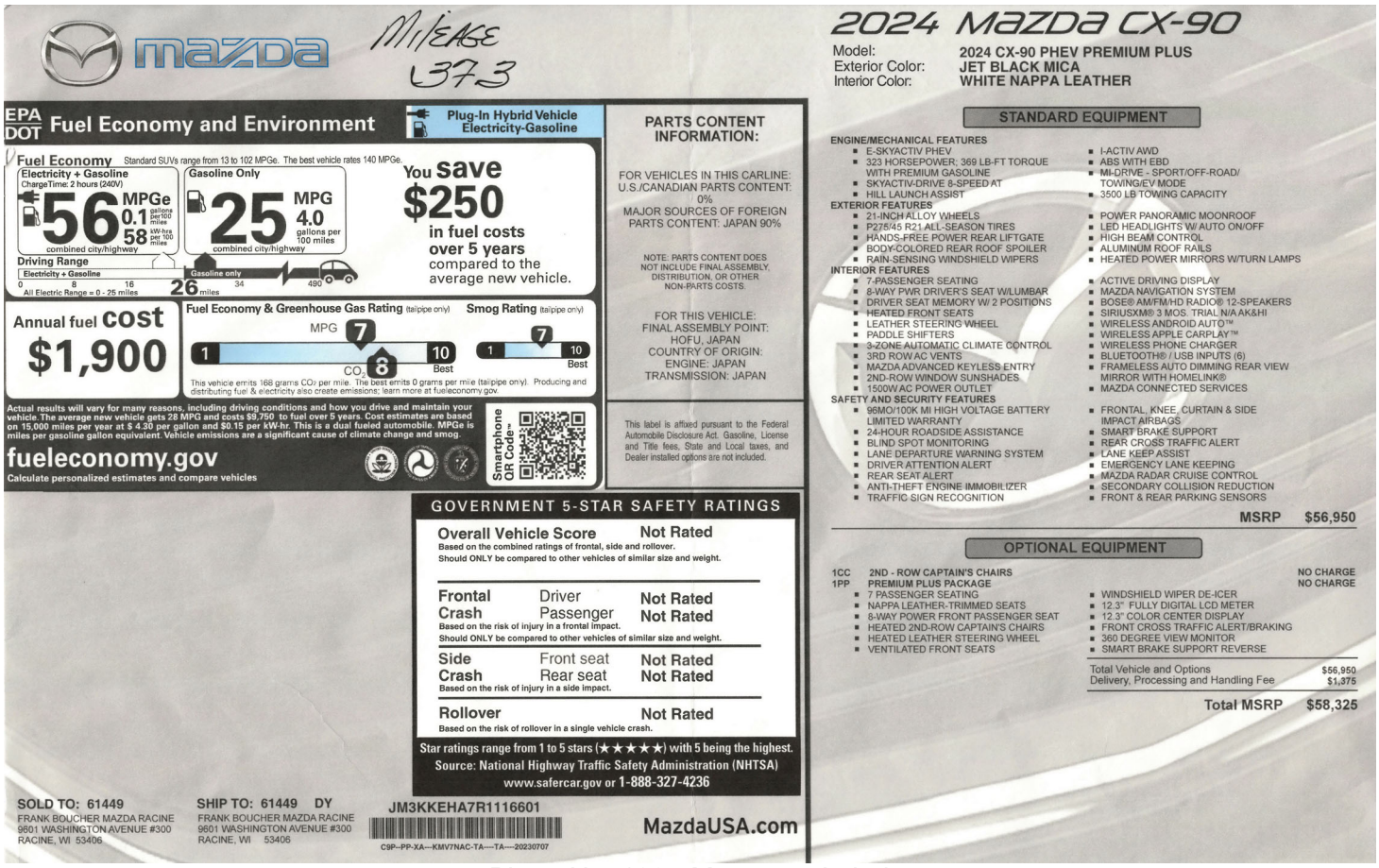


Photo No. 102 - Monroney Label

Head Restraints

Your vehicle is equipped with head restraints on all outboard seats and the second-row/third-row center seat*. The head restraints are intended to help protect you and the passengers from neck injury.

Warnings and Cautions for Using the Head Restraints

⚠ WARNING

Always drive with the head restraints installed when seats are being used and make sure they are properly adjusted.
Driving with the head restraints adjusted too low or removed is dangerous. With no support behind your head, your neck could be seriously injured in a collision.

After installing a head restraint, try lifting it to make sure that it does not pull out.
Driving with an unsecured head restraint is dangerous as the effectiveness of the head restraint will be compromised which could cause it to unexpectedly detach from the seat.
(Third-row seat)

Always drive with the head restraints in their upright positions when the third-row seats are occupied, and make sure they are securely locked in place.
Driving with the head restraints folded down is dangerous. With no support behind your head, your neck could be seriously injured in a collision.

*Some models.

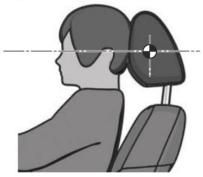
⚠ CAUTION

- When installing a head restraint, make sure that it is installed correctly with the front of the head restraint facing forward. If the head restraint is installed incorrectly, it could detach from the seat during a collision and result in injury.
- The head restraints on each of the front and second-row/third-row seats are specialized to each seat. Do not switch around the head restraint positions. If a head restraint is not installed to its correct seat position, the effectiveness of the head restraint during a collision will be compromised which could cause injury.

How to Use the Head Restraints

Adjusting the Head Restraints

Adjust the head restraint so that the center is even with the top of the passenger's ears.



To Raise a Head Restraint

Pull up a head restraint.

To Lower a Head Restraint

Lower a head restraint while pressing the lock knob.
Front seats

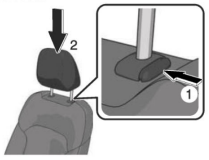


Photo No. 103 - Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

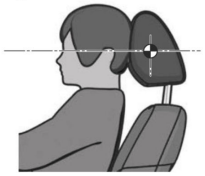
⚠ CAUTION

- When installing a head restraint, make sure that it is installed correctly with the front of the head restraint facing forward. If the head restraint is installed incorrectly, it could detach from the seat during a collision and result in injury.
- The head restraints on each of the front and second-row/third-row seats are specialized to each seat. Do not switch around the head restraint positions. If a head restraint is not installed to its correct seat position, the effectiveness of the head restraint during a collision will be compromised which could cause injury.

How to Use the Head Restraints

Adjusting the Head Restraints

Adjust the head restraint so that the center is even with the top of the passenger's ears.

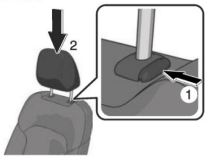


To Raise a Head Restraint

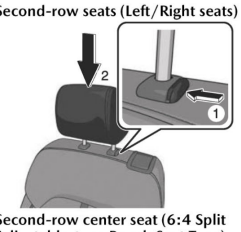
Pull up a head restraint.

To Lower a Head Restraint

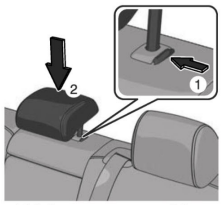
Lower a head restraint while pressing the lock knob.
Front seats



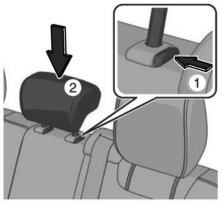
Second-row seats (Left/Right seats)



Second-row center seat (6:4 Split Adjustable-type Bench Seat Type)



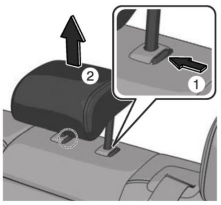
Third-row center seat (Three-seater type)



Removing or Installing a Head Restraint

To Remove a Head Restraint

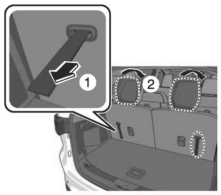
Pull up a head restraint while pressing the lock knob.
(Second-row center seat (6:4 Split Adjustable-type Bench Seat Type))
Pull up the center seat head restraint while pressing both lock knobs.



To Install a Head Restraint

Insert a head restraint while pressing the lock knob.

Foldable Head Restraints (Third-row Seat)



NOTE
The foldable head restraints cannot be adjusted or removed.

Photo No. 104 - Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

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

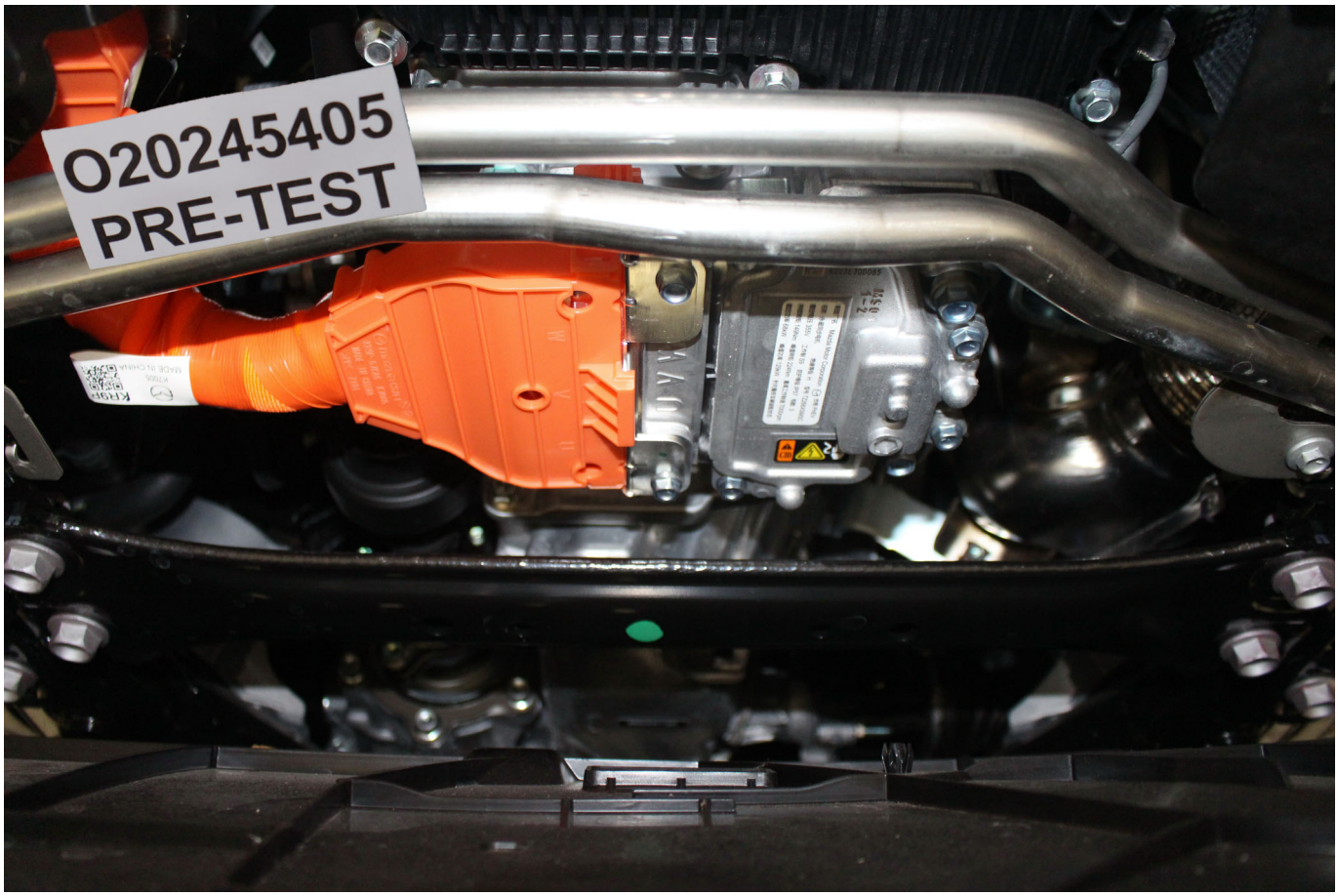


Photo No. 305-02 - Power Inverter Warning Label

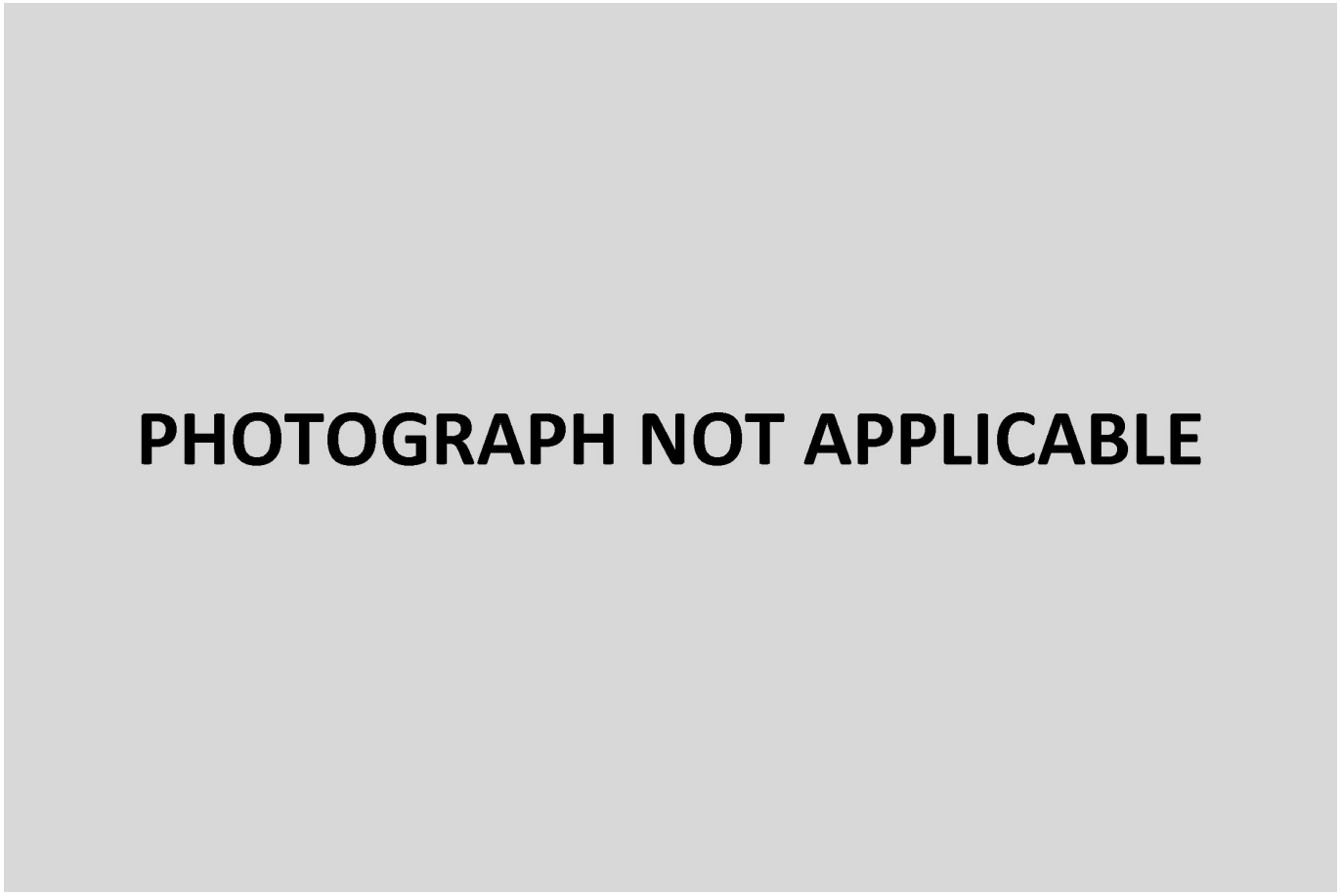


Photo No. 305-03 - First Responder Warning Label

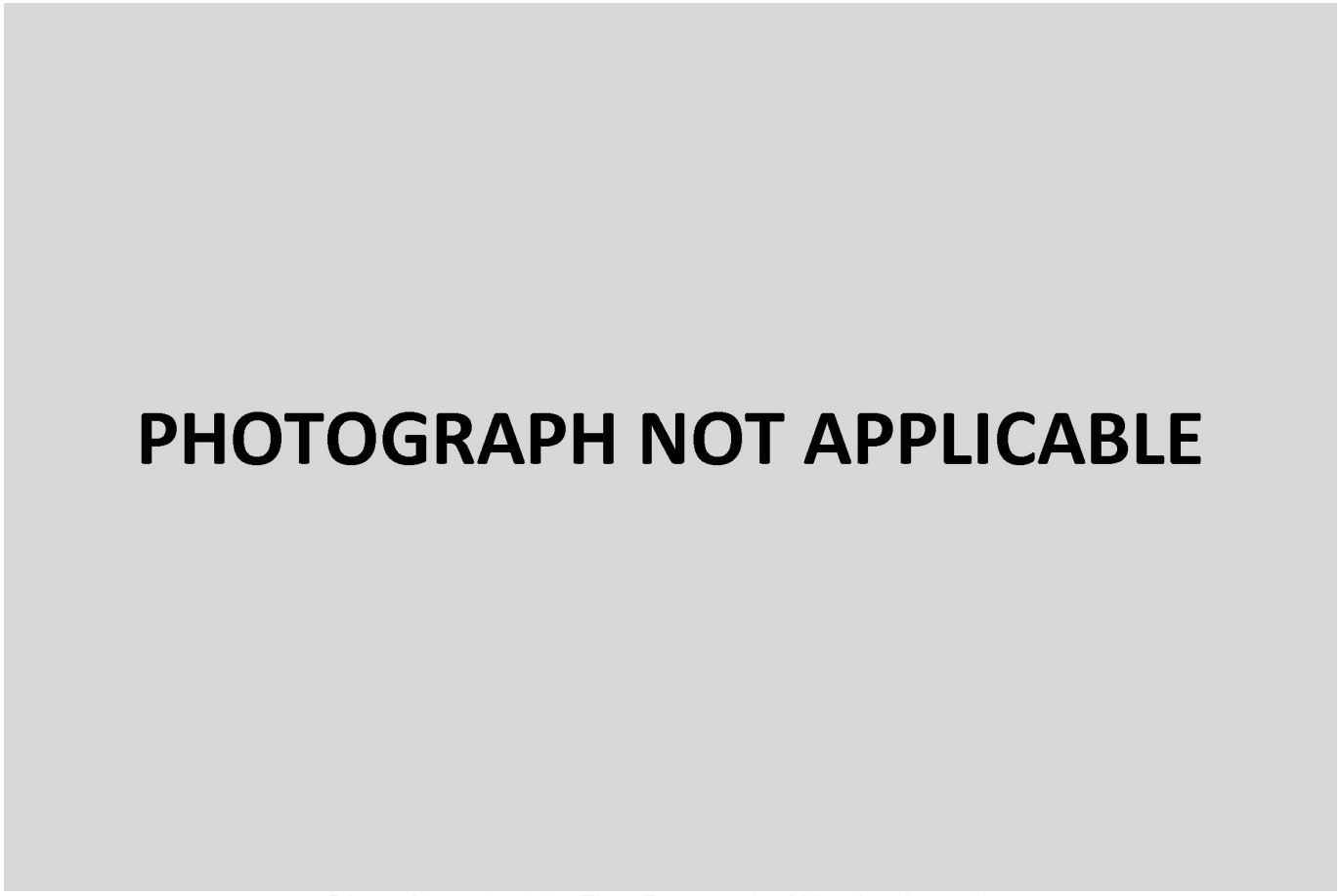


Photo No. 305-04 - First Responder Warning Location

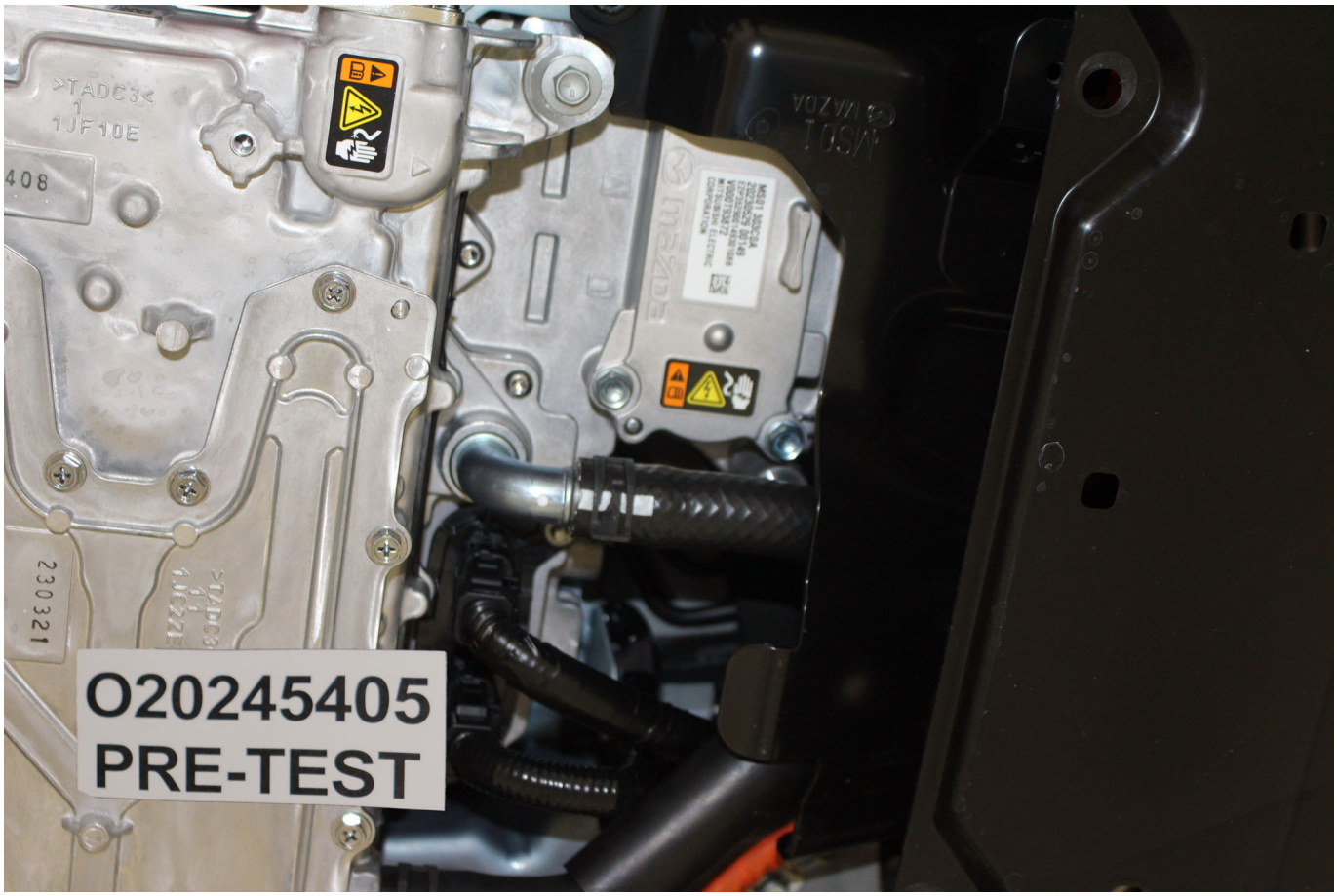


Photo No. 305-05 - Other Vehicle Label(s) Related to Electrical Propulsion System

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

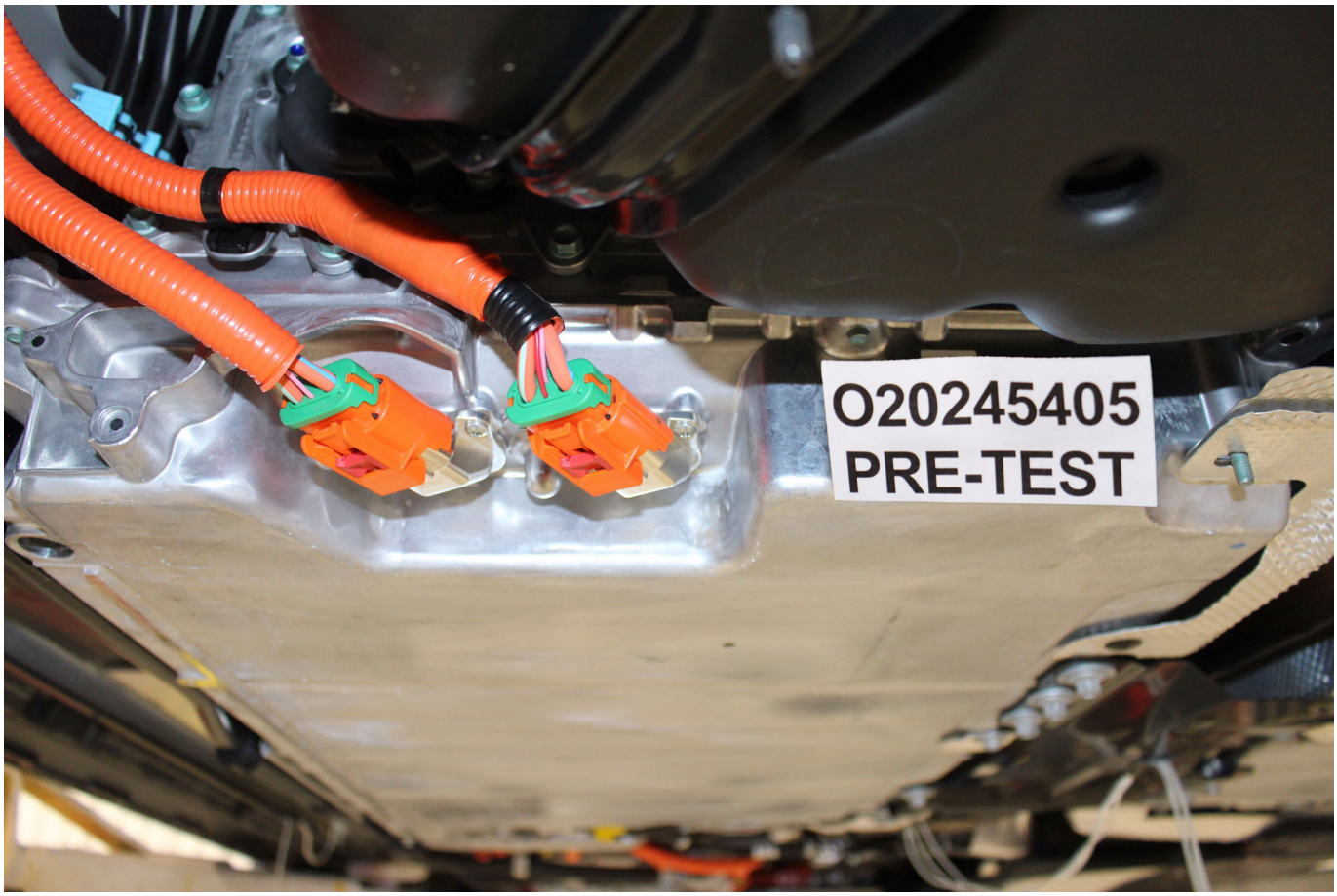


Photo No. 305-09 - Pre-Impact View of Propulsion Battery

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

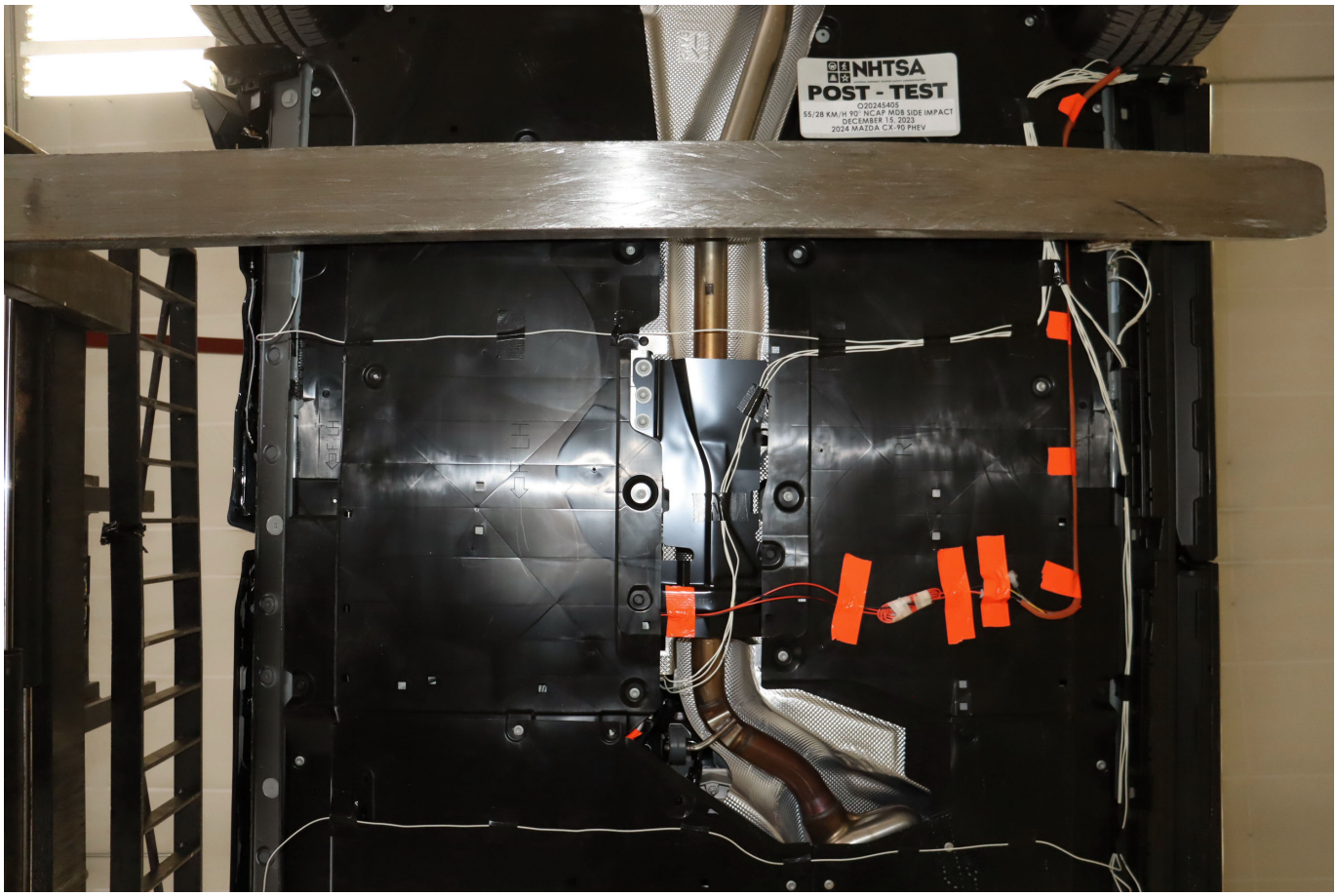


Photo No. 305-11 - Post-Impact Rear View of Propulsion Battery

PHOTOGRAPH NOT APPLICABLE

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

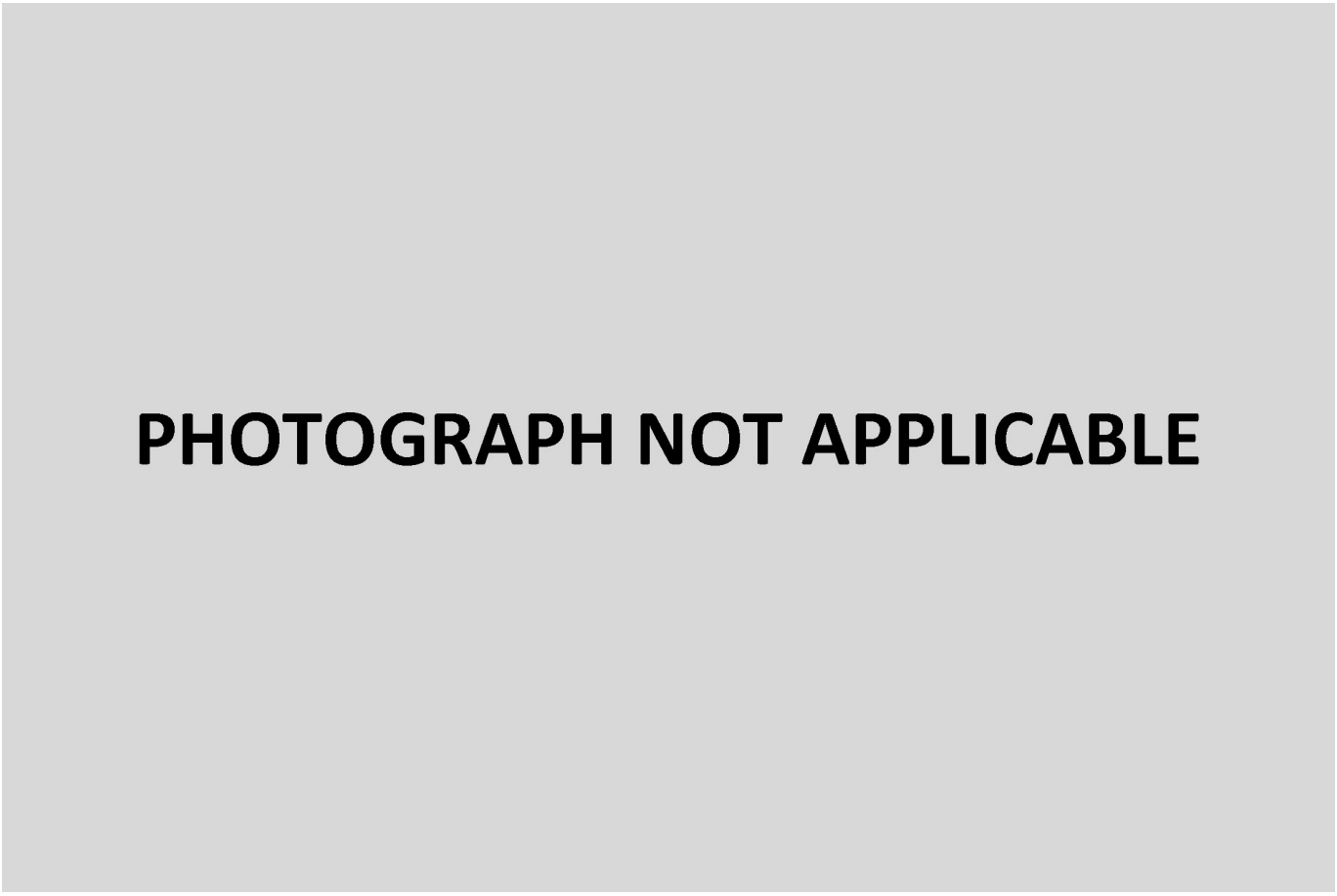


Photo No. 305-13 - Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

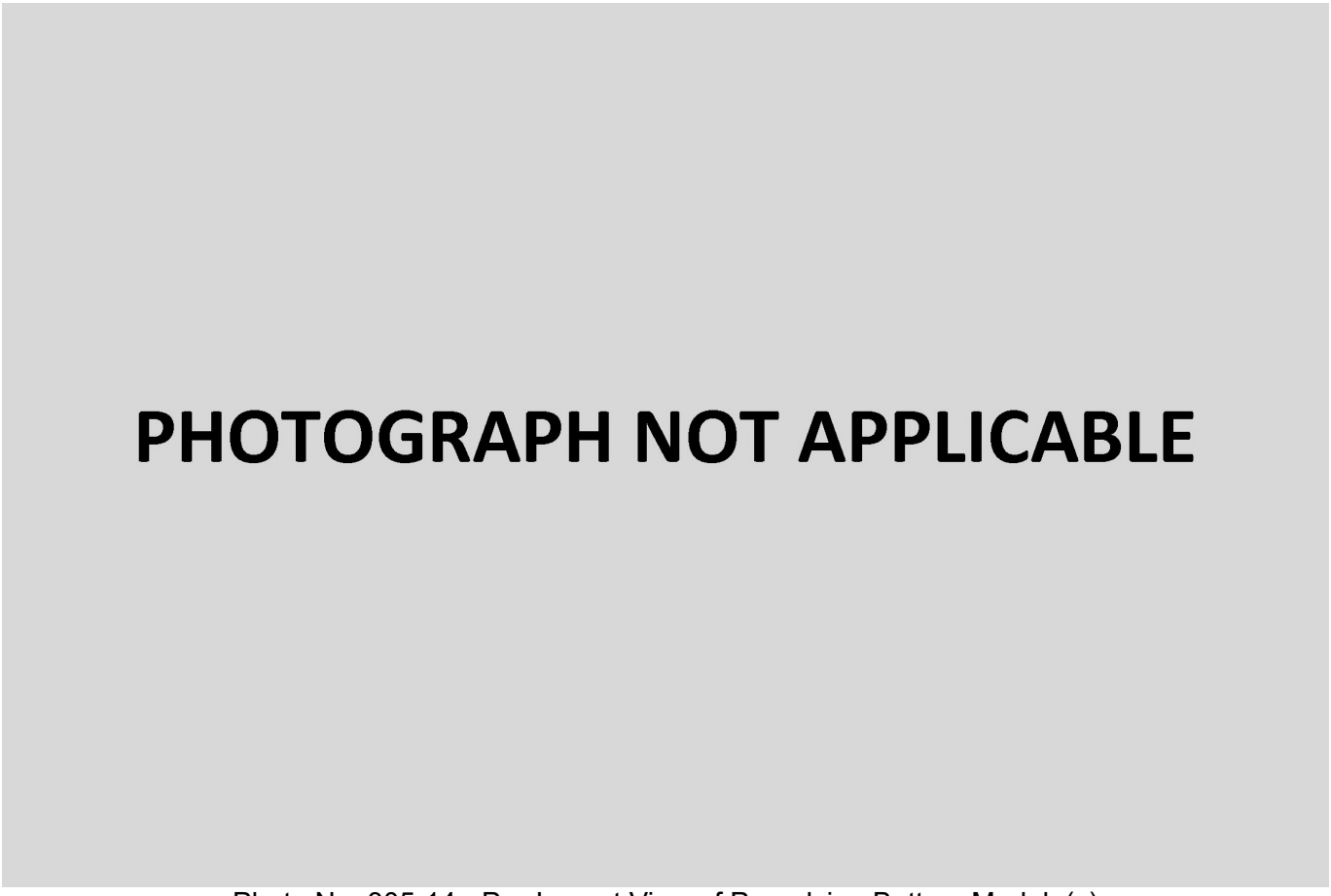


Photo No. 305-14 - Pre-Impact View of Propulsion Battery Module(s)

PHOTOGRAPH NOT APPLICABLE

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

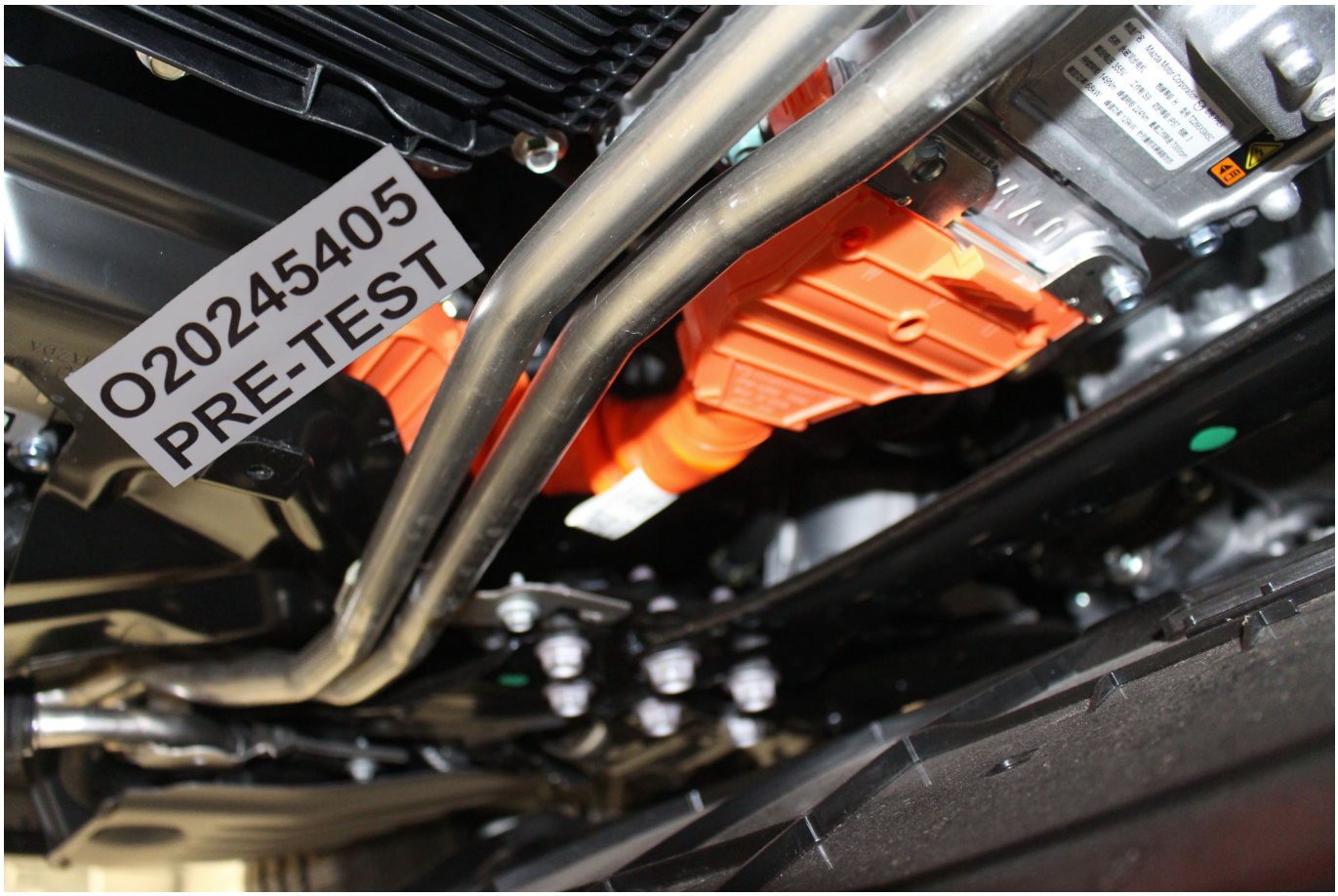


Photo No. 305-16 - Pre-Impact View of Electric Propulsion Drive

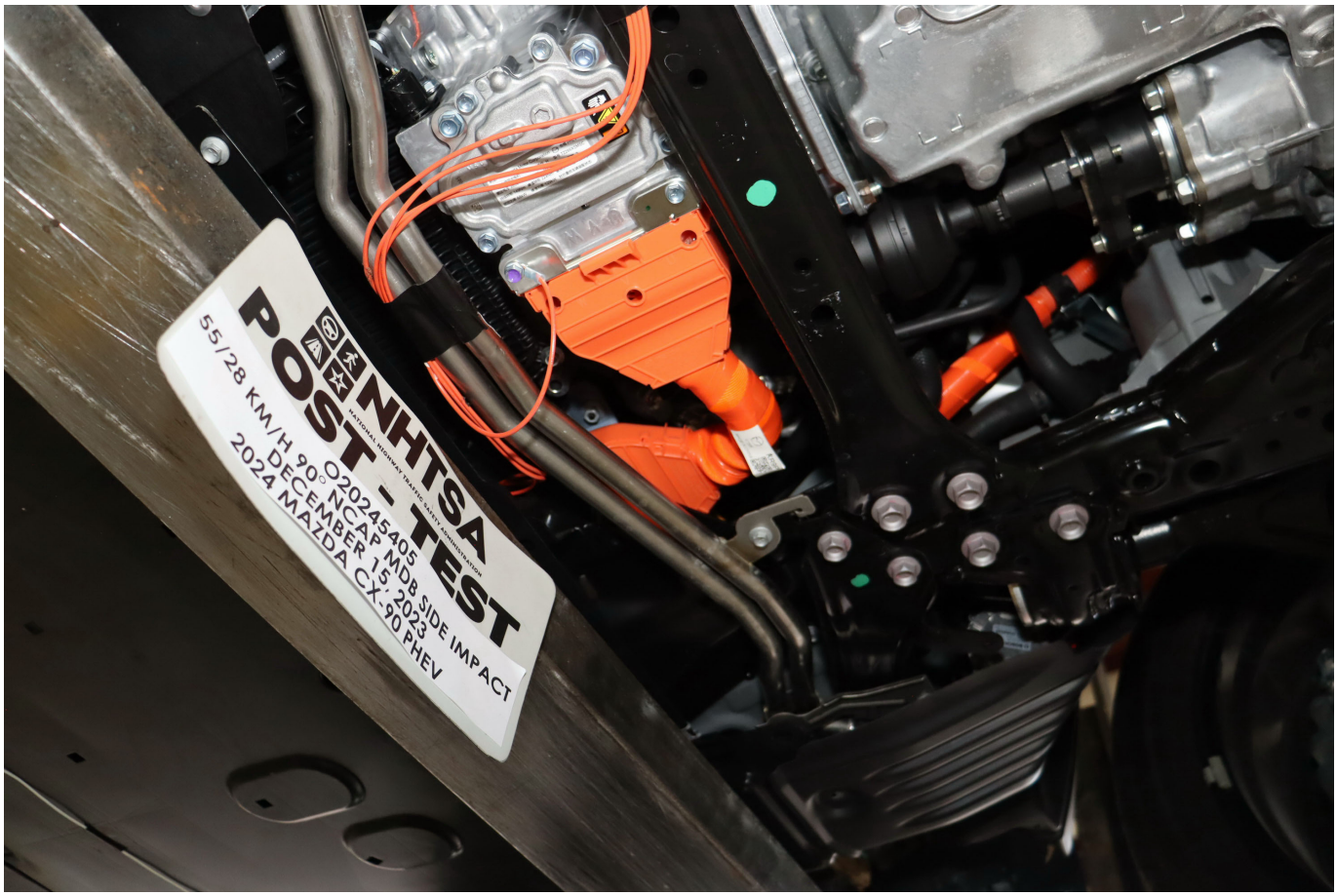


Photo No. 305-17 - Post-Impact View of Electric Propulsion Drive

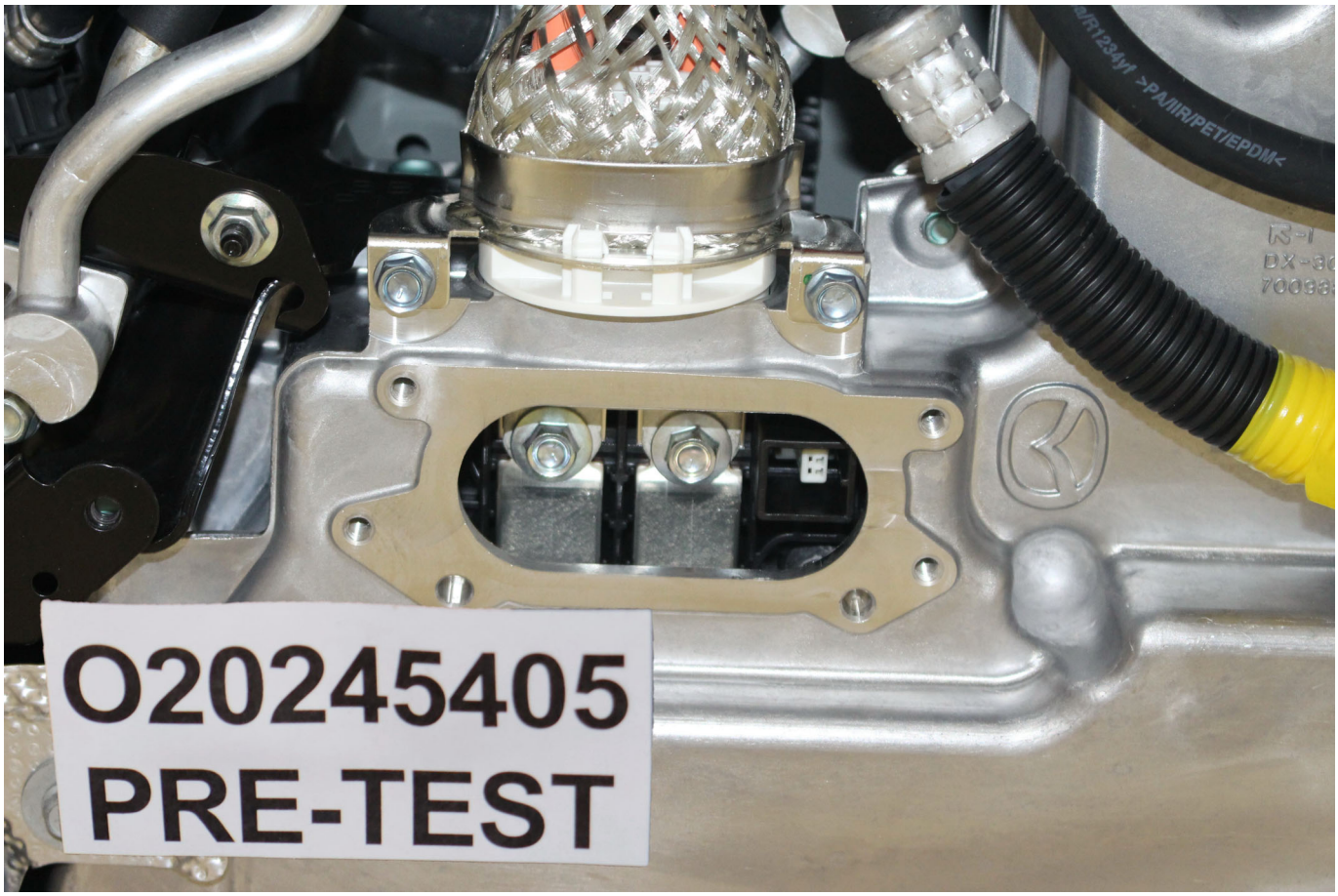


Photo No. 305-18 - Pre-Impact View of High Voltage Interconnect(s)

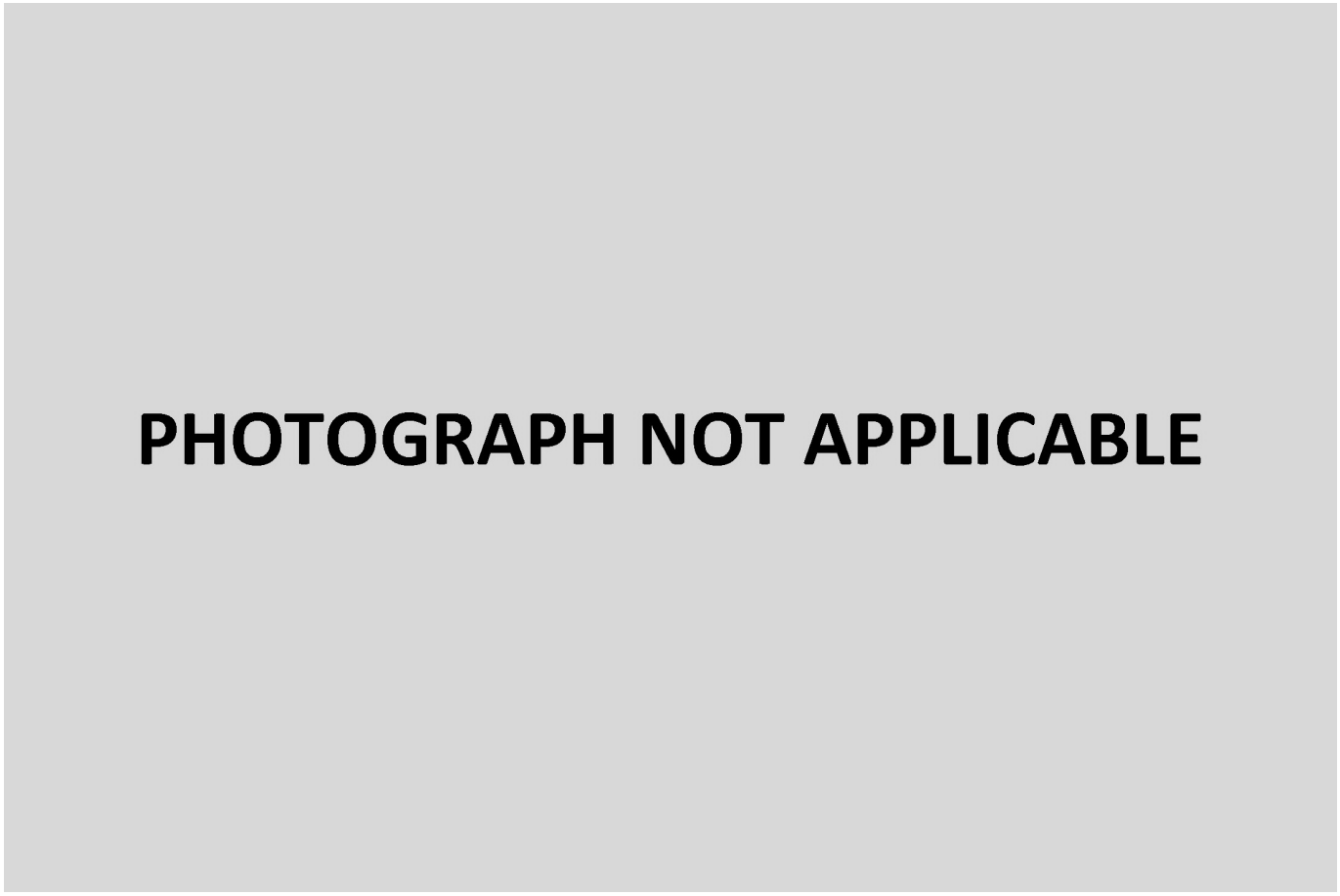


Photo No. 305-19 - Pre-Impact View Propulsion Battery Venting System(s)

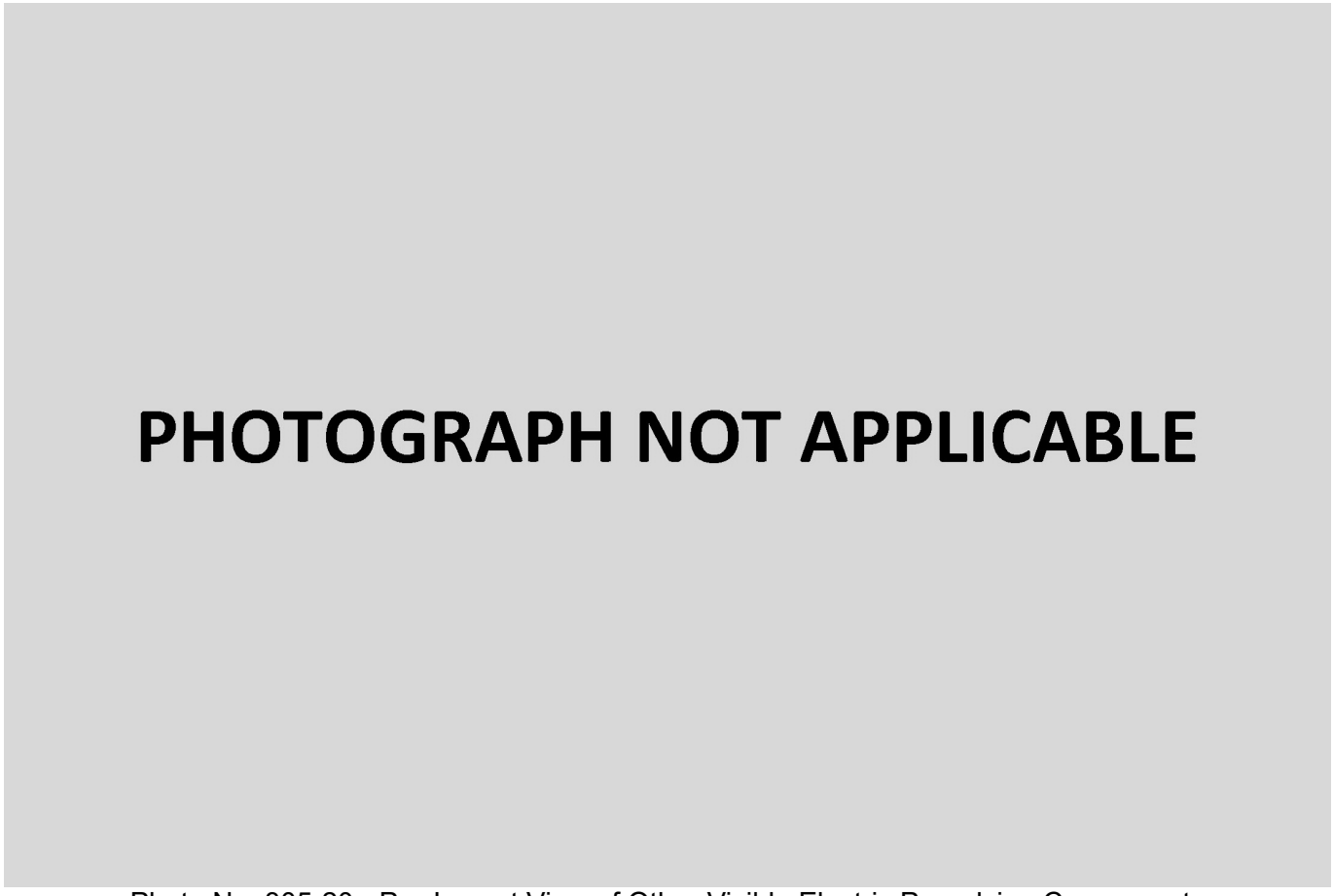


Photo No. 305-20 - Pre-Impact View of Other Visible Electric Propulsion Components

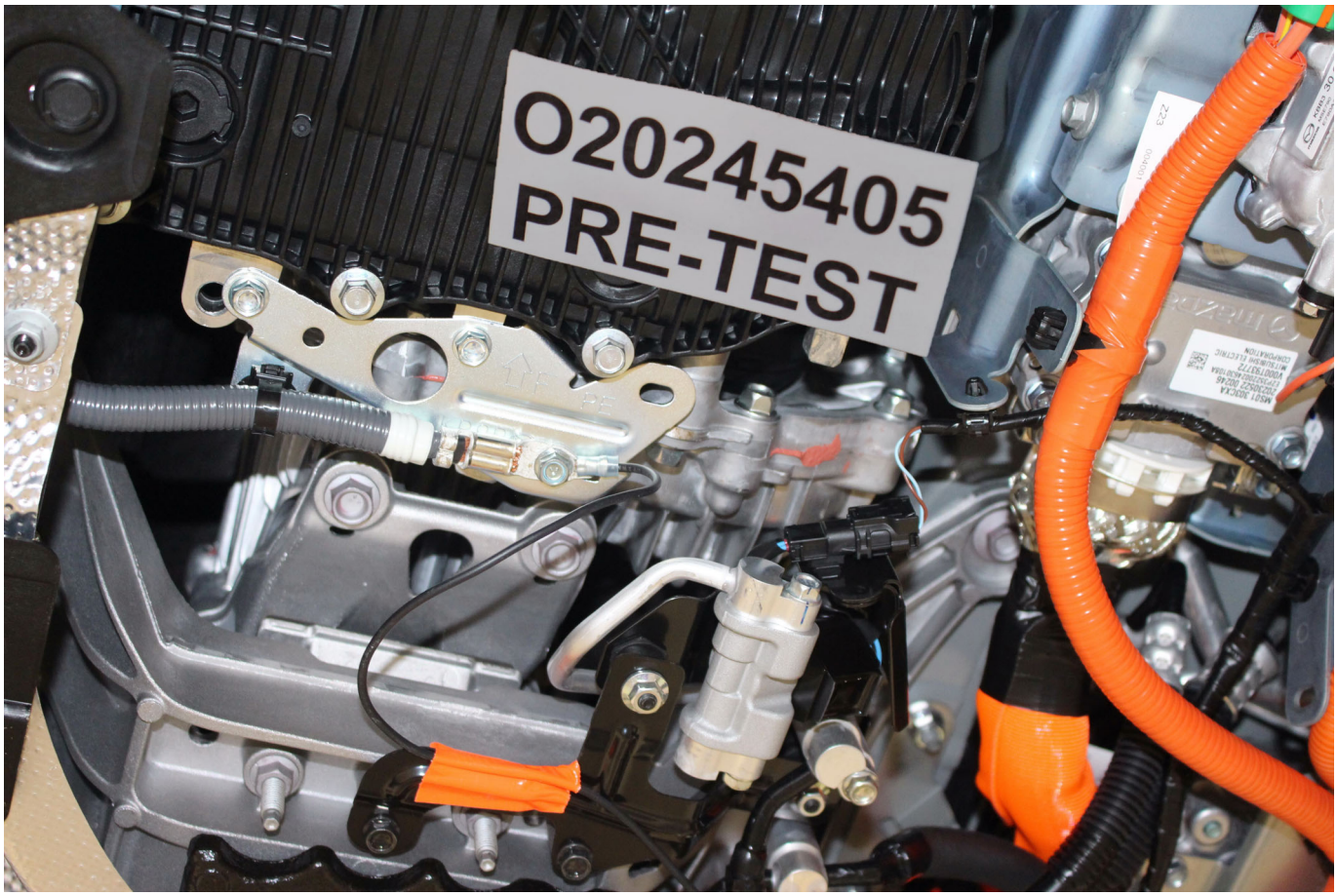


Photo No. 305-21 - Pre-Impact View of Ground Lead Attached

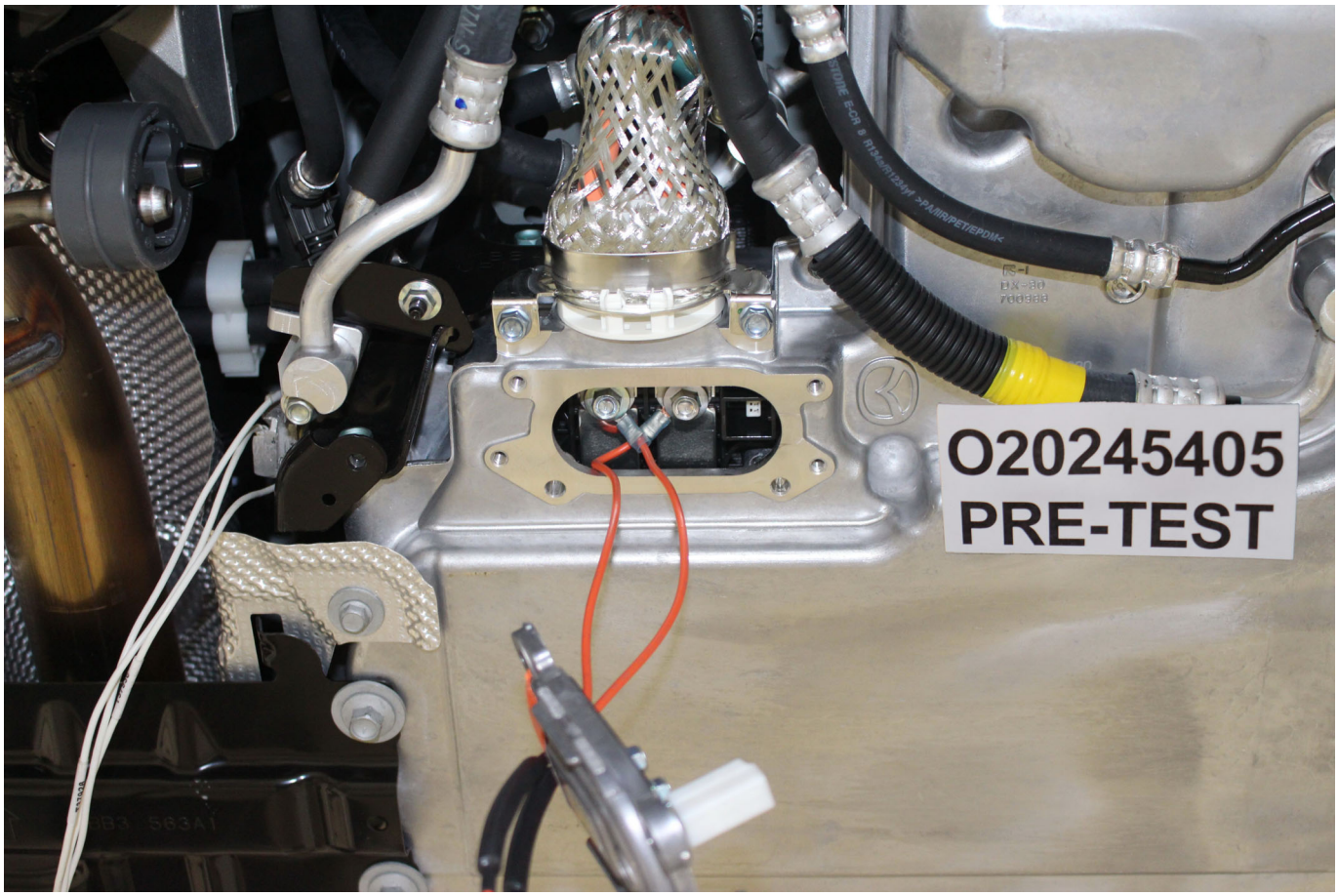


Photo No. 305-22 - Pre-Impact View of High Voltage Leads Attached

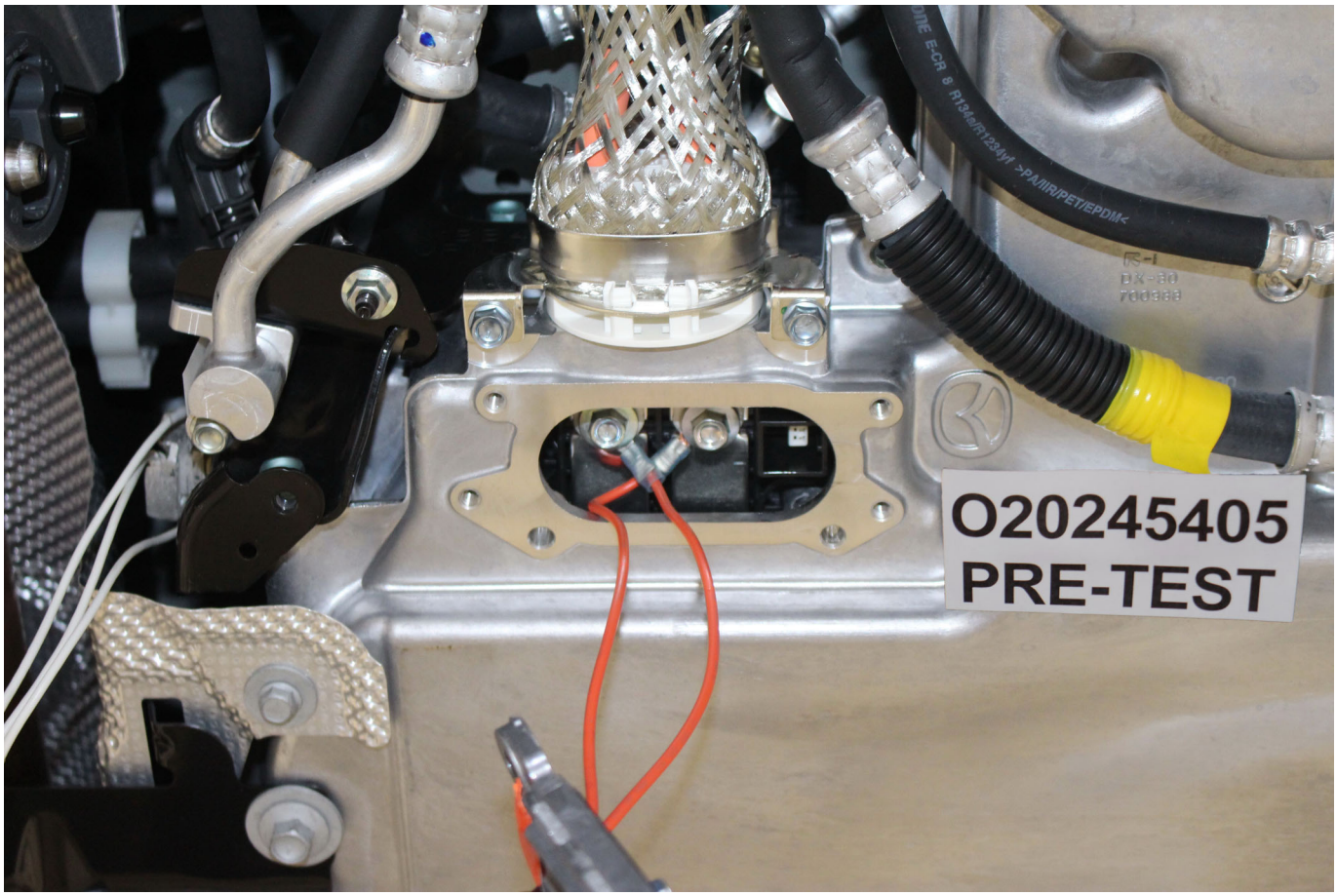


Photo No. 305-23 - Pre-Impact Close-Up View of High Voltage Leads Attached

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

PHOTOGRAPH NOT AVAILABLE

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

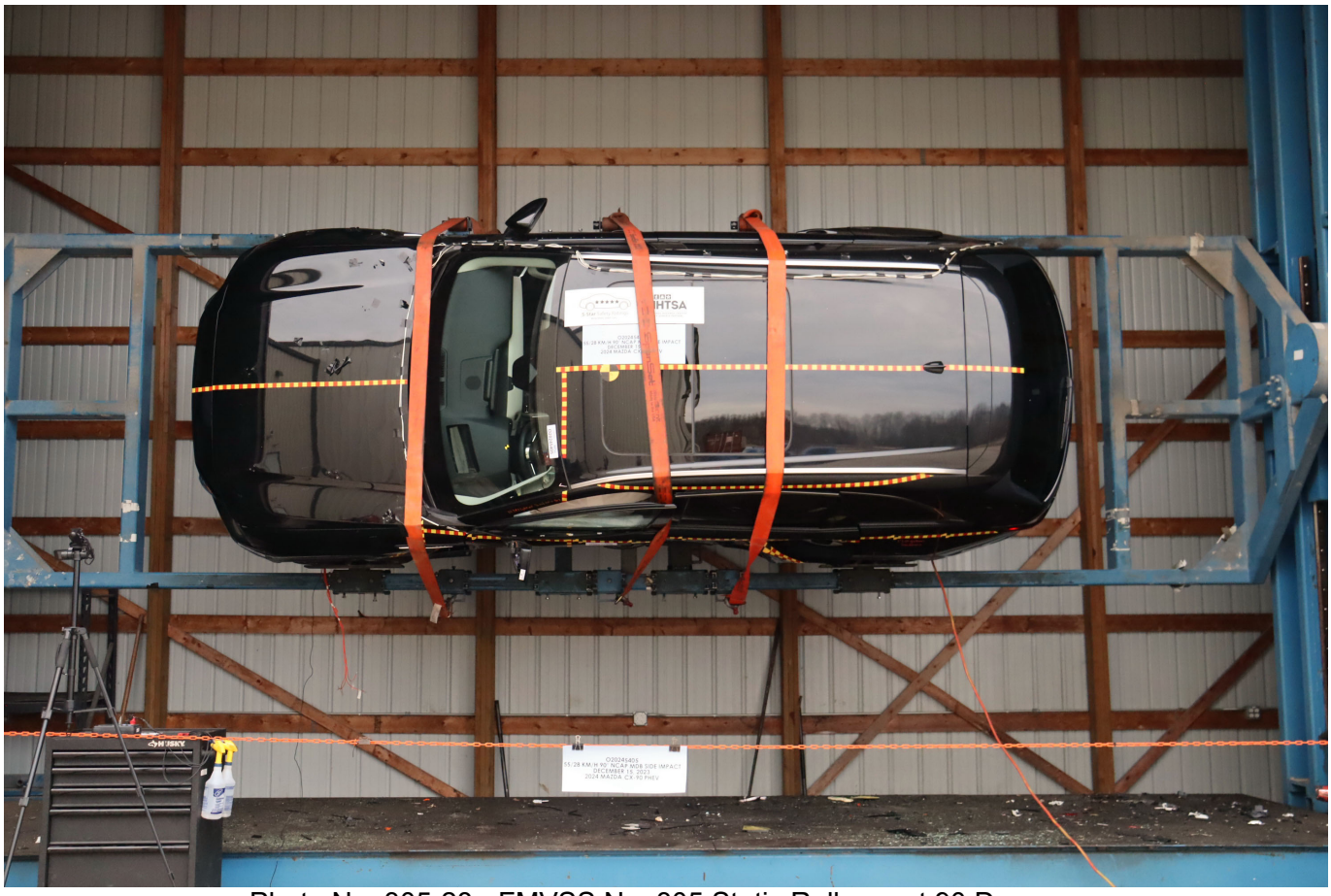


Photo No. 305-28 - FMVSS No. 305 Static Rollover at 90 Degrees

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

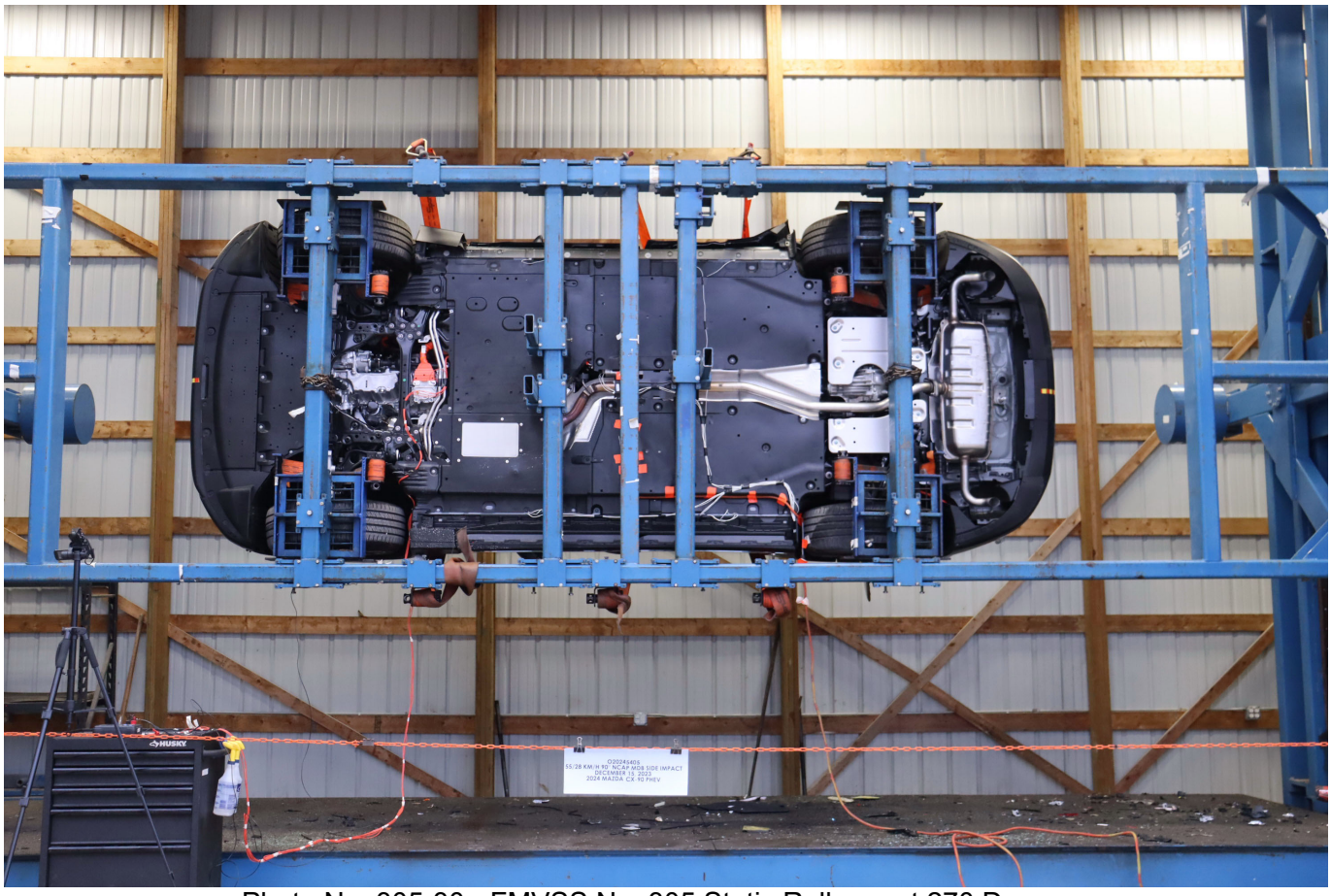


Photo No. 305-30 - FMVSS No. 305 Static Rollover at 270 Degrees

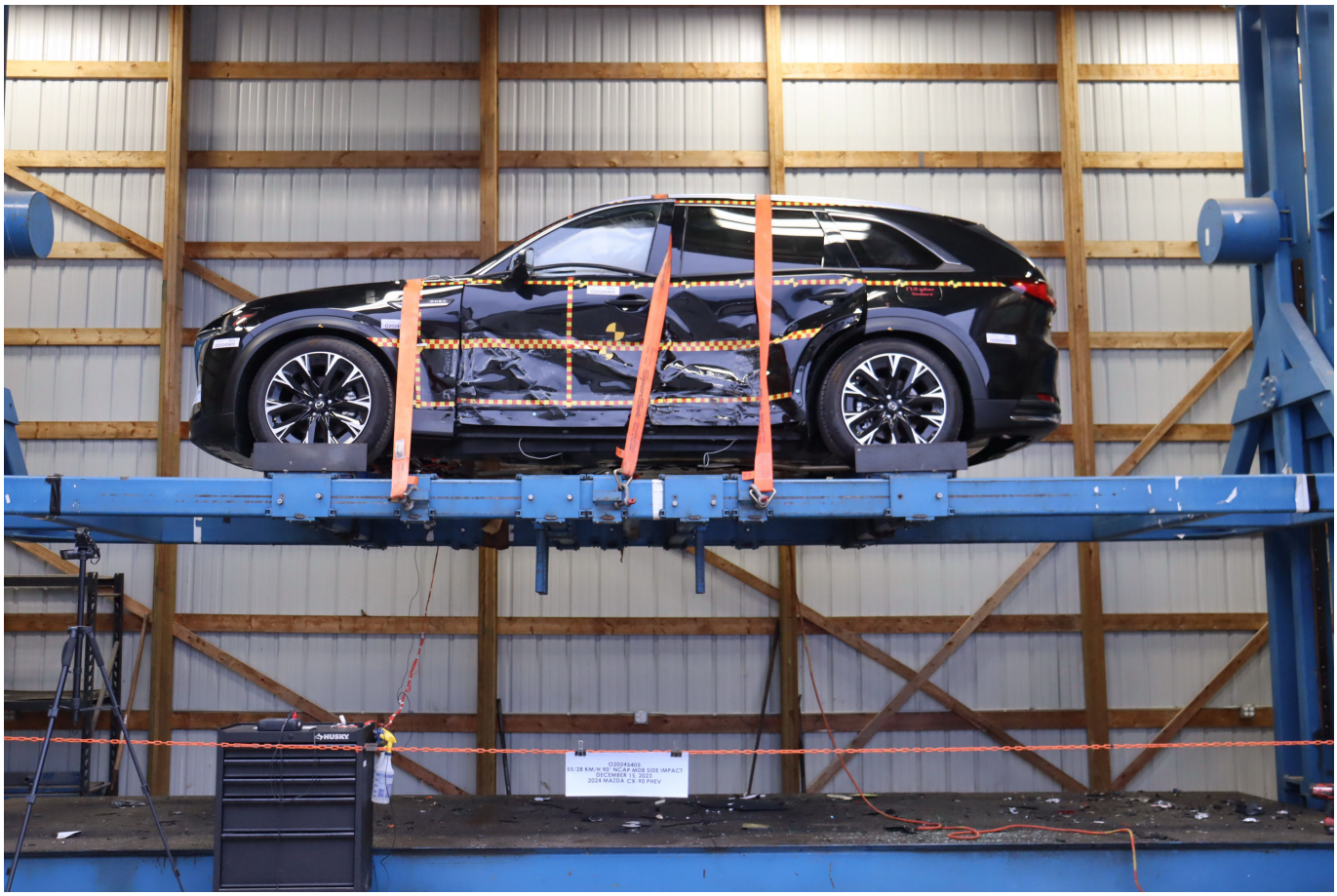


Photo No. 305-31 - FMVSS No. 305 Static Rollover at 360 Degrees

PHOTOGRAPH NOT APPLICABLE

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

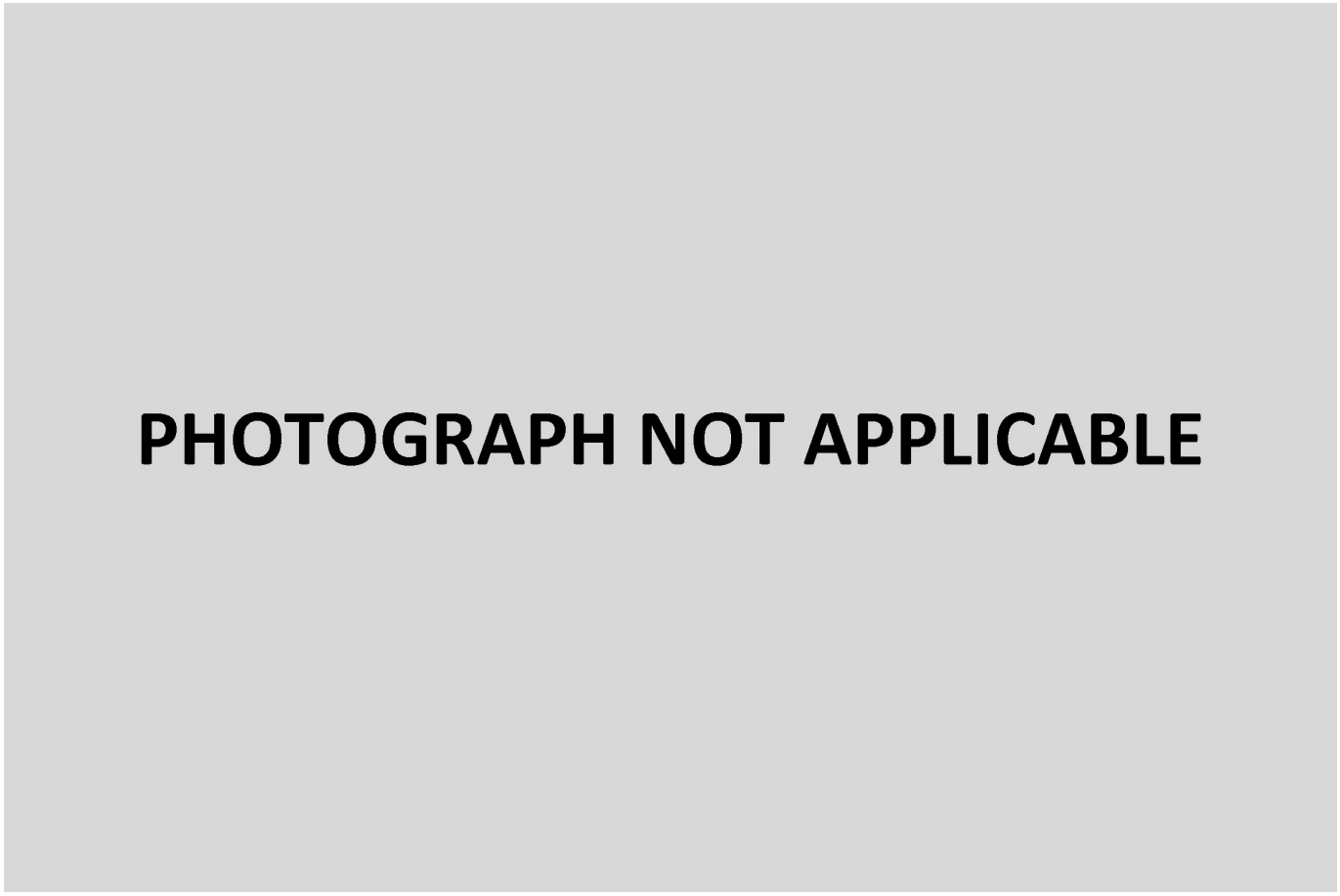


Photo No. 305-33 - Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

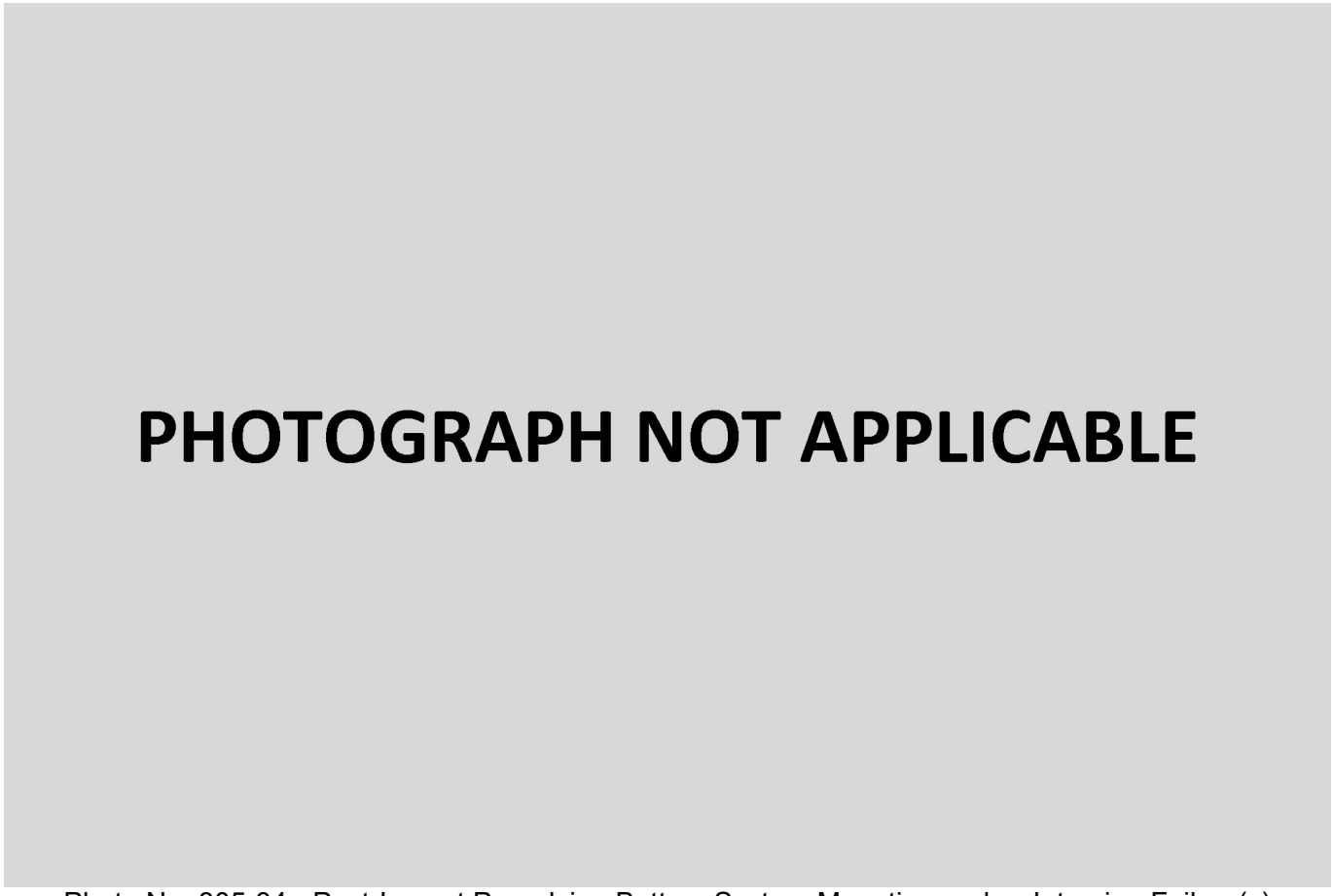


Photo No. 305-34 - Post-Impact Propulsion Battery System Mounting and-or Intrusion Failure(s)

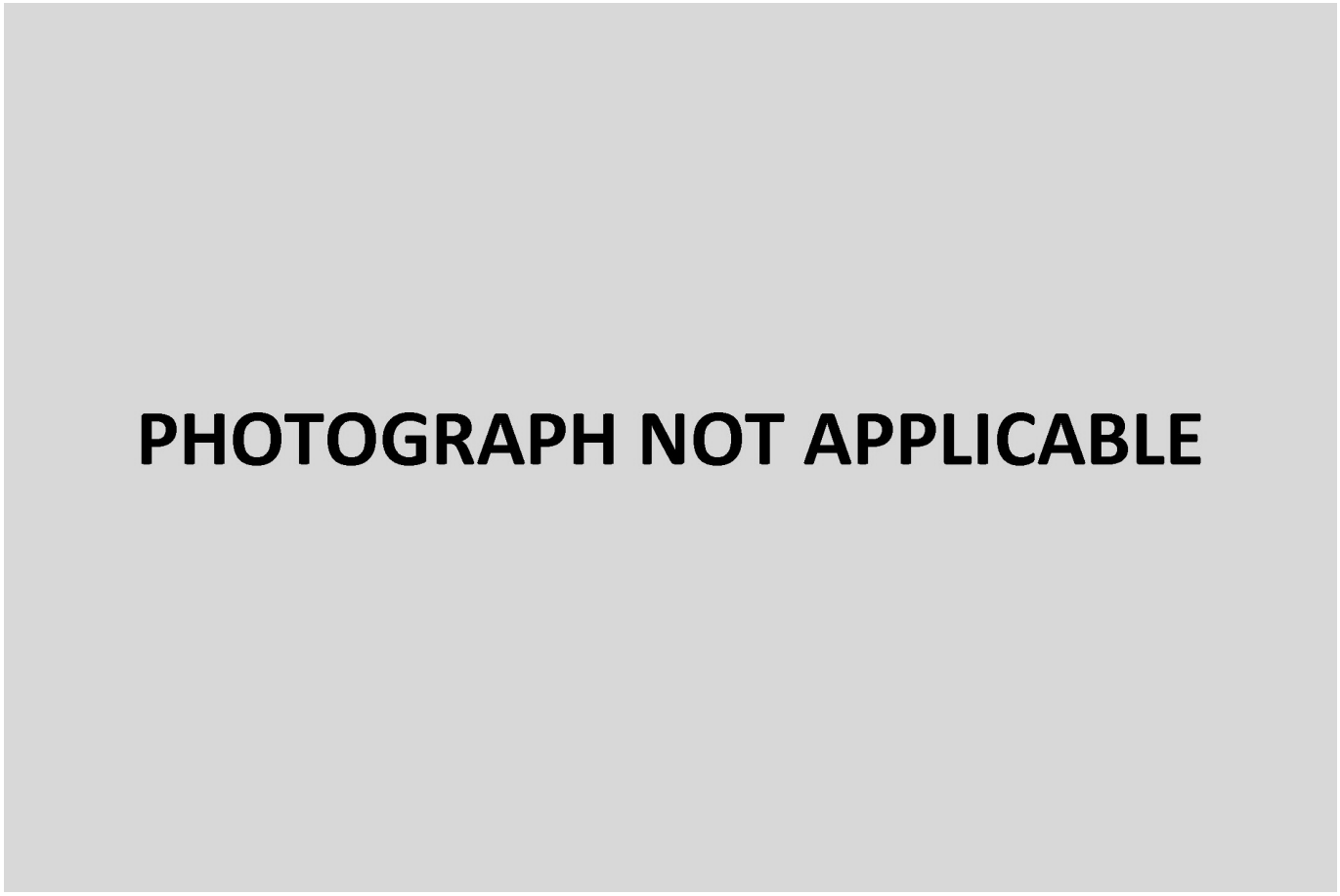


Photo No. 305-35 - Post-Impact View of Battery Component Intrusion

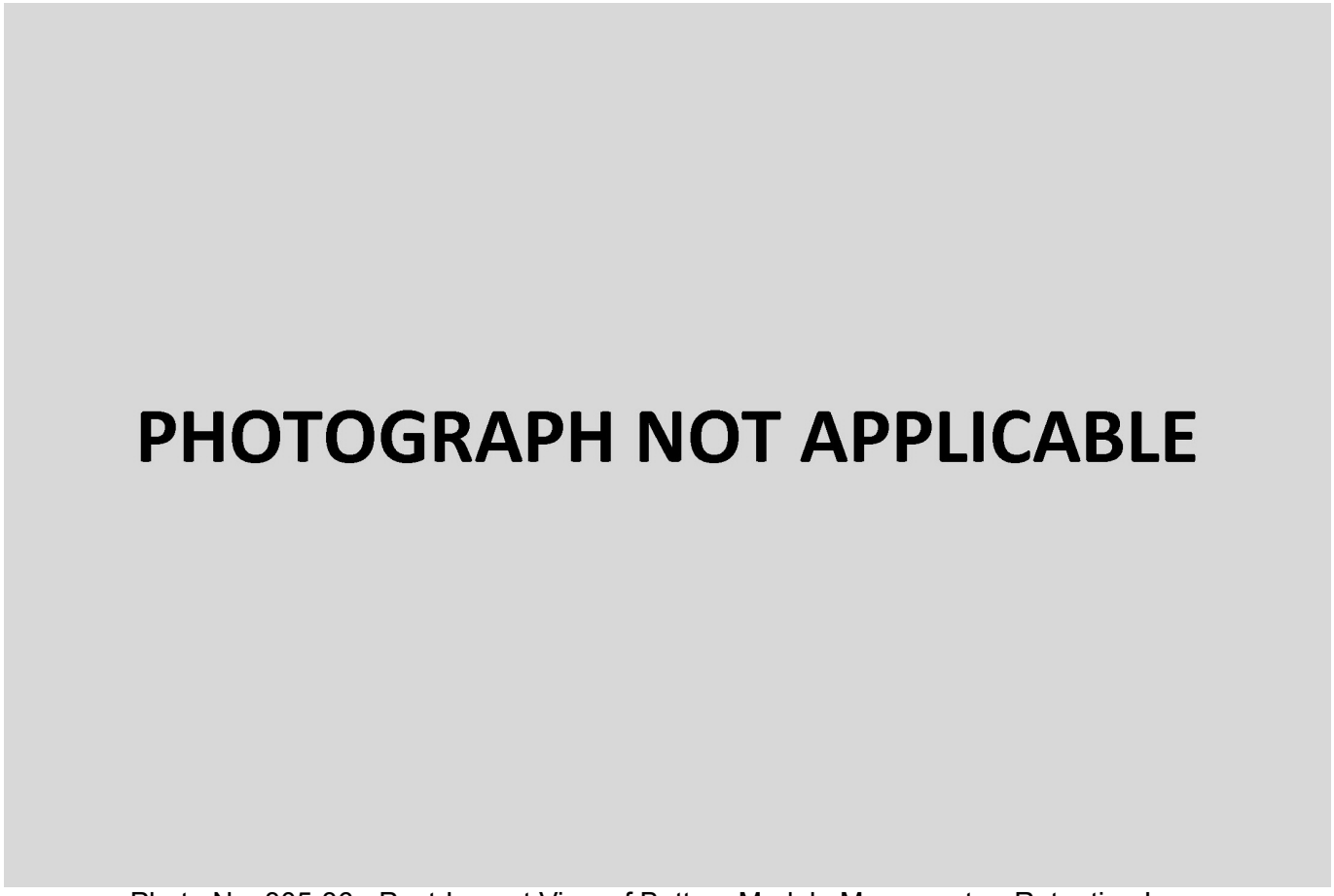


Photo No. 305-36 - Post-Impact View of Battery Module Movement or Retention Loss

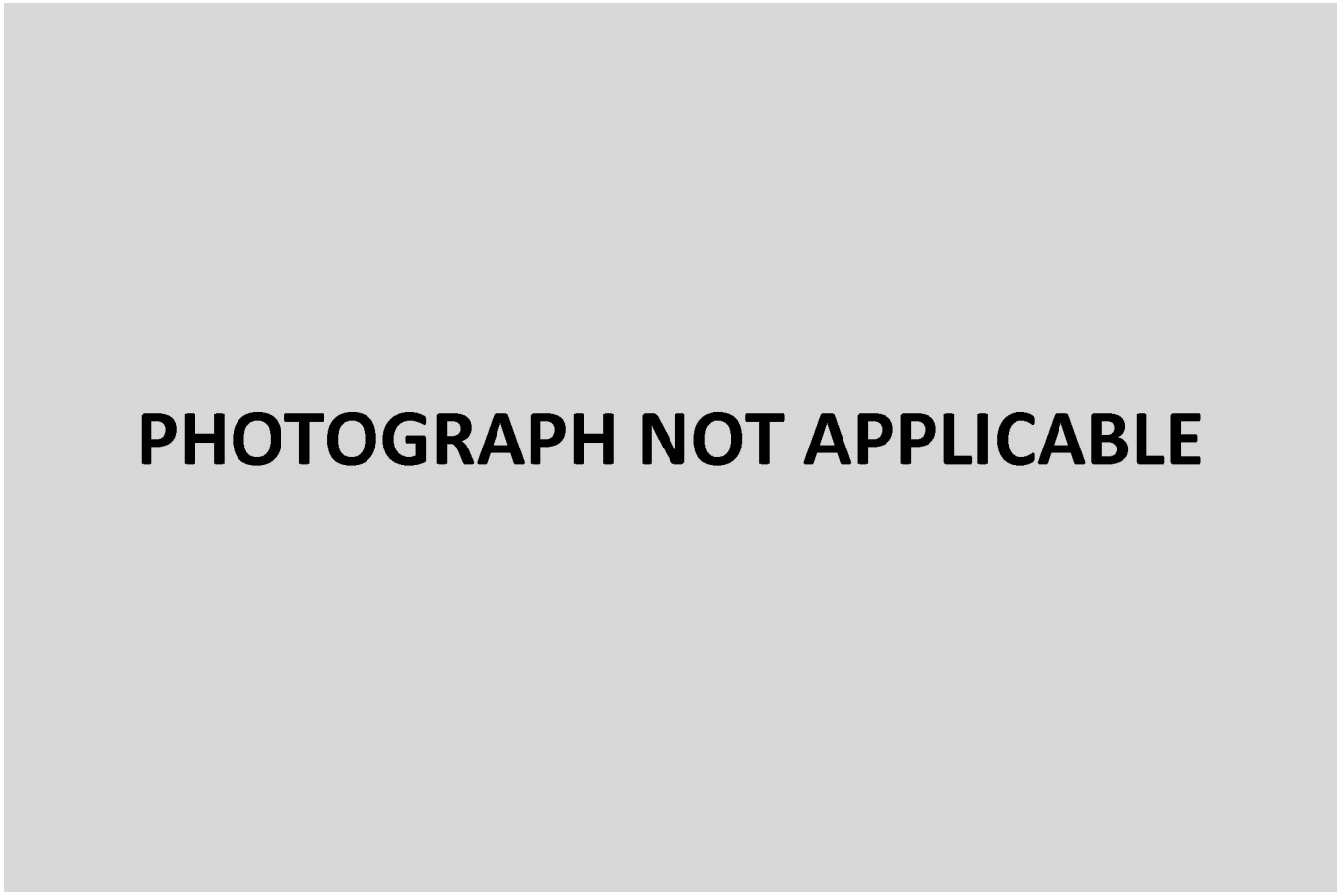


Photo No. 305-37 - Post-Impact View of Propulsion Battery Electrolyte Spillage Location

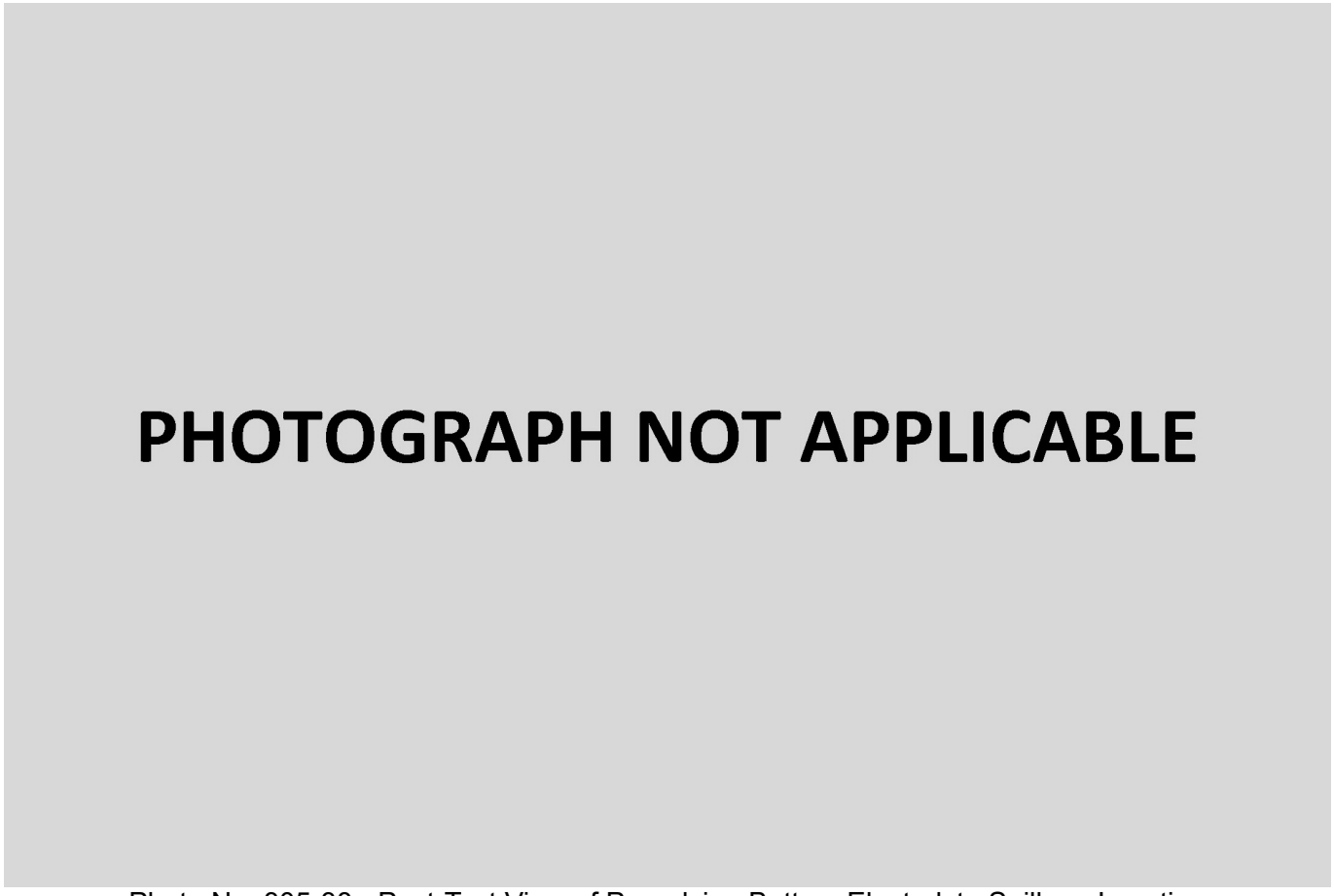


Photo No. 305-38 - Post-Test View of Propulsion Battery Electrolyte Spillage Location

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 & Passenger Dummy Instrumentation Data

Passenger Head Angular Velocity (X)

Passenger Head Angular Velocity (Y)

Passenger Head Angular Velocity (Z)

Driver Lower Spine T12 Acceleration (X)

Driver Lower Spine T12 Acceleration (Y)

Driver Lower Spine T12 Acceleration (Z)

Passenger Upper Thorax Rib Deflection (Y)

Passenger Middle Thorax Rib Deflection (Y)

Passenger Lower Thorax Rib Deflection (Y)

Passenger Upper Abdomen Rib Deflection (Y)

Passenger Lower Abdomen Rib Deflection (Y)

Driver Head Acceleration Redundant (X)

Driver Head Acceleration Redundant (Y)

Driver Head Acceleration Redundant (Z)

Passenger Head Acceleration Redundant (X)

Passenger Head Acceleration Redundant (Y)

Passenger Head Acceleration Redundant (Z)

Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)

Vehicle Center of Gravity Acceleration (Y)

Vehicle Center of Gravity Acceleration (Z)

Right Side Sill at Front Seat Acceleration (X)

Right Side Sill at Front Seat Acceleration (Y)

Right Side Sill at Front Seat Acceleration (Z)

Right Side Sill at Rear Seat Acceleration (X)

Right Side Sill at Rear Seat Acceleration (Y)

Right Side Sill at Rear Seat Acceleration (Z)

Left Side Sill at Front Seat Acceleration (Y)

Left Side Sill at Rear Seat Acceleration (Y)

Lower A-Post Acceleration (Y)

Middle A-Post Acceleration (Y)

Lower B-Post Acceleration (Y)

Middle B-Post Acceleration (Y)

Front Seat Track Acceleration (Y)

Rear Seat Track Acceleration (Y)

Right Rear Occupant Compartment Acceleration (Y)

Engine Block (X)

Engine Block (Y)

Rear Floorpan Above Axle Acceleration (X)

Rear Floorpan Above Axle Acceleration (Y)

Rear Floorpan Above Axle Acceleration (Z)

MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)

MDB Center of Gravity Acceleration (Y)

MDB Center of Gravity Acceleration (Z)

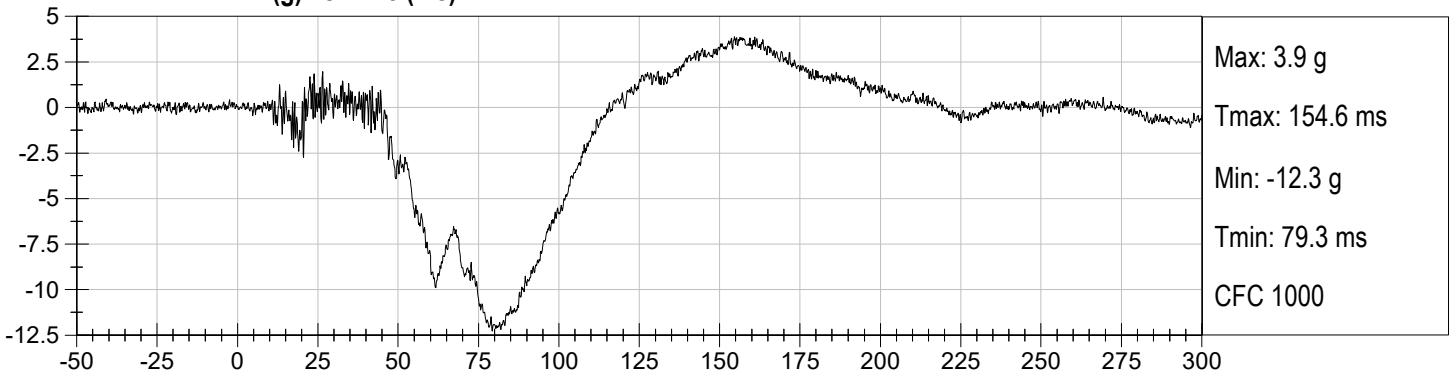
MDB Rear Acceleration (X)

MDB Rear Acceleration (Y)

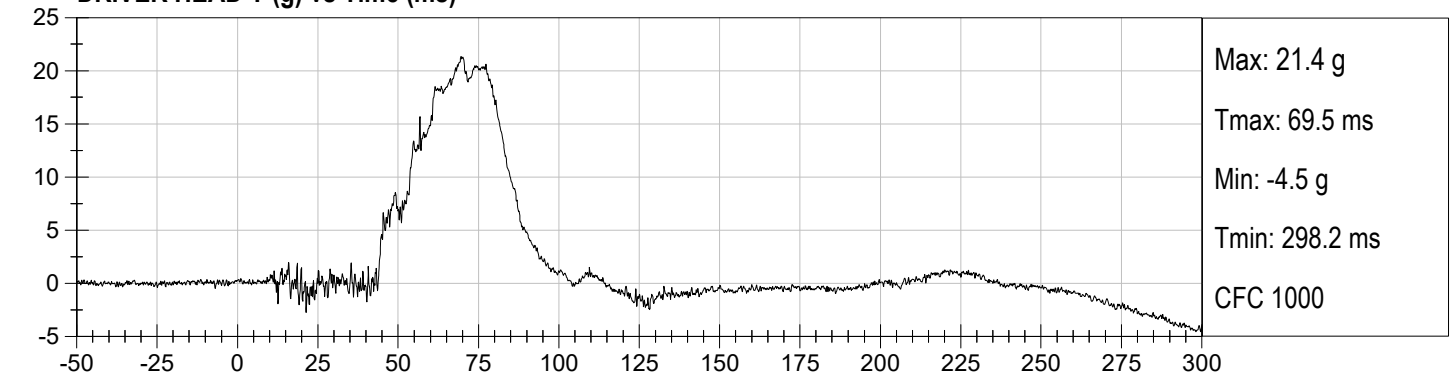
Left MDB Contact Switch

Right MDB Contact Switch

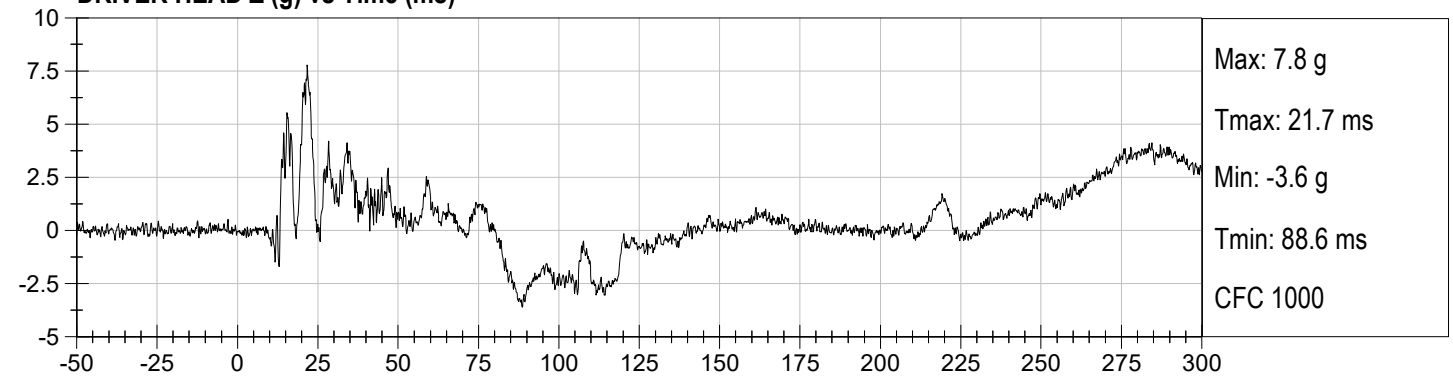
DRIVER HEAD X (g) vs Time (ms)



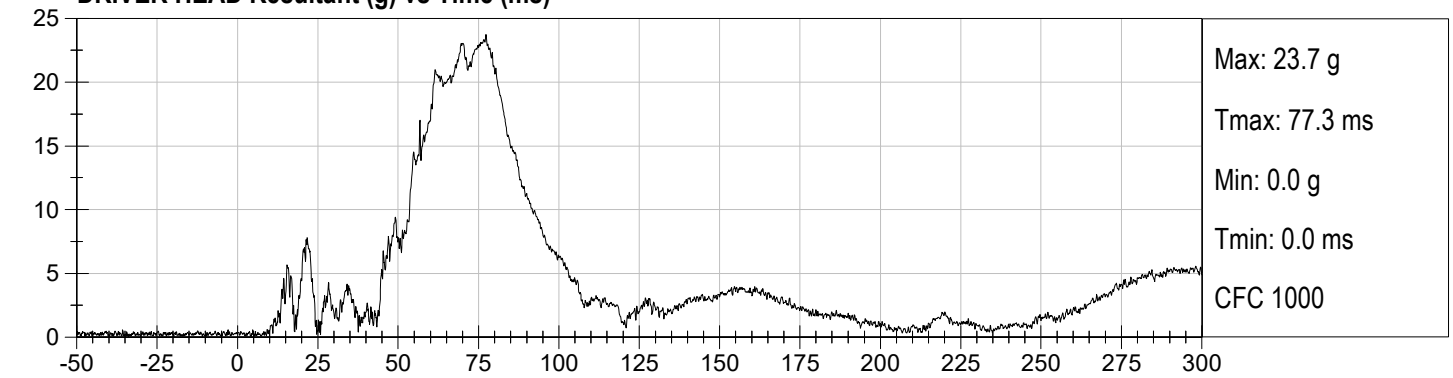
DRIVER HEAD Y (g) vs Time (ms)



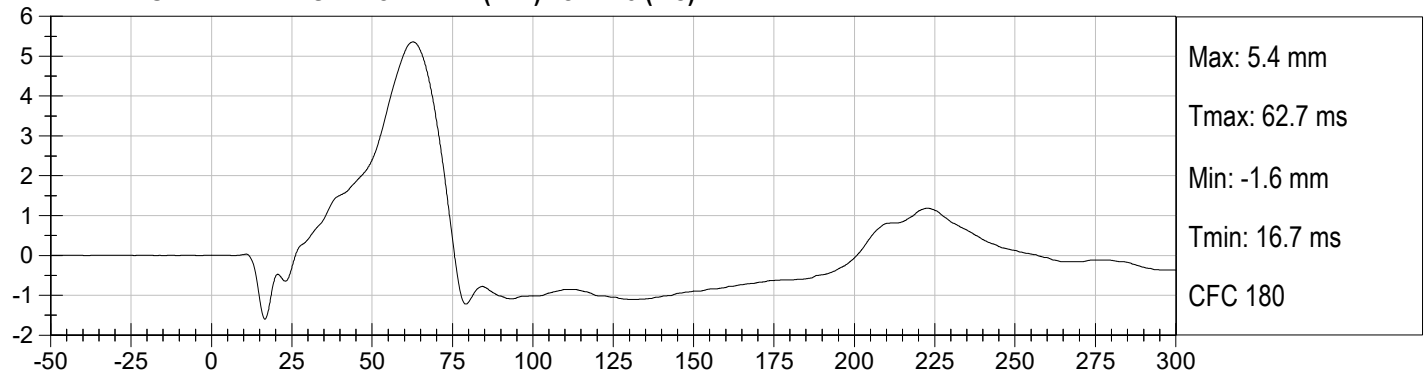
DRIVER HEAD Z (g) vs Time (ms)



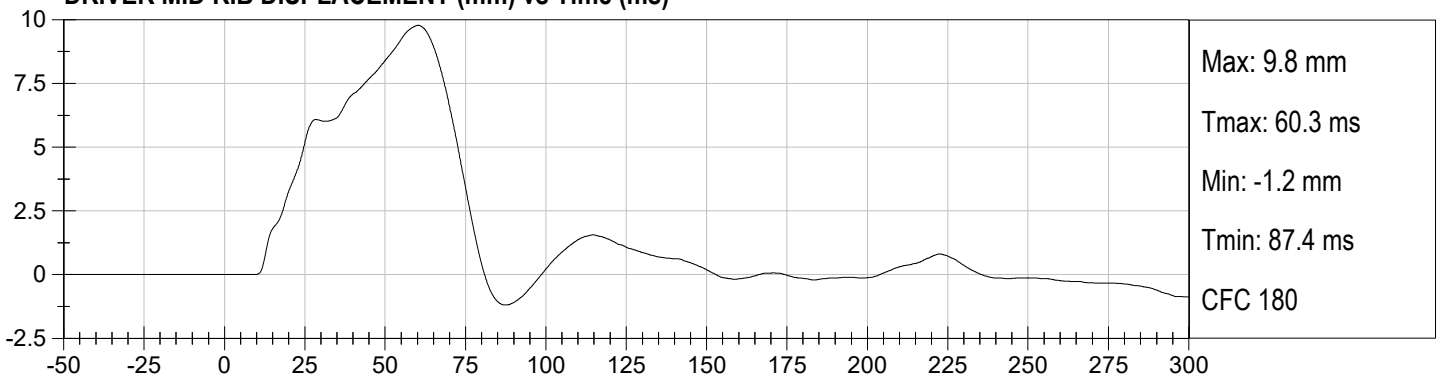
DRIVER HEAD Resultant (g) vs Time (ms)



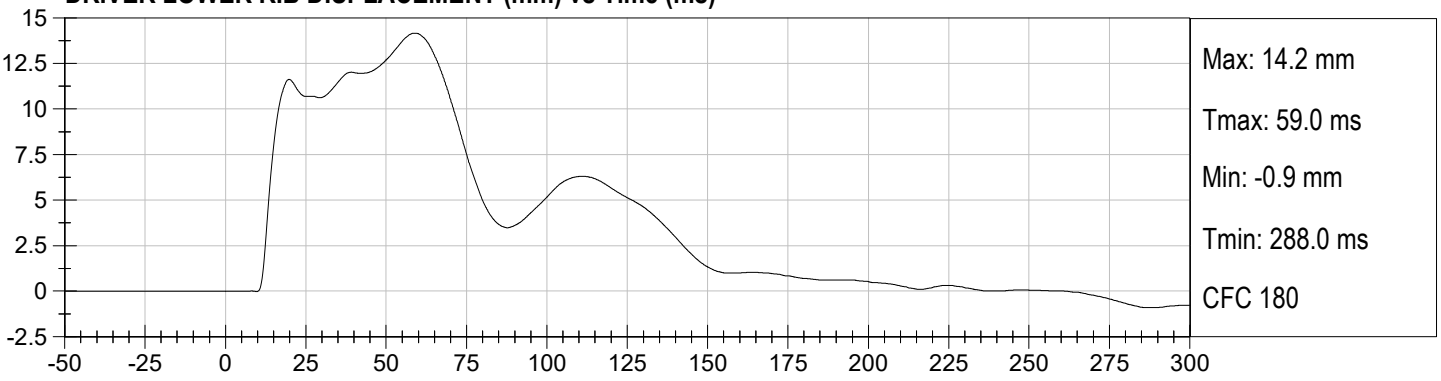
DRIVER UPPER RIB DISPLACEMENT (mm) vs Time (ms)



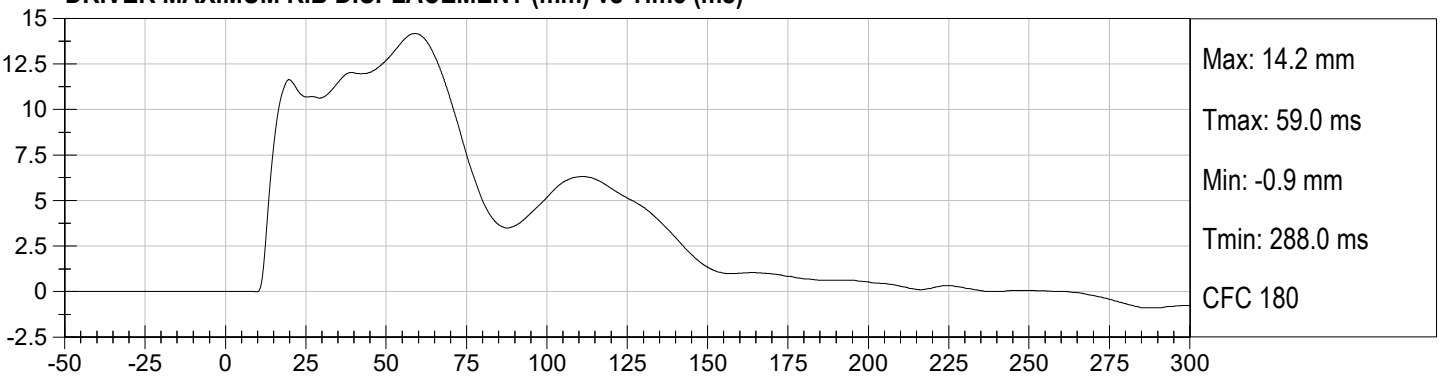
DRIVER MID RIB DISPLACEMENT (mm) vs Time (ms)



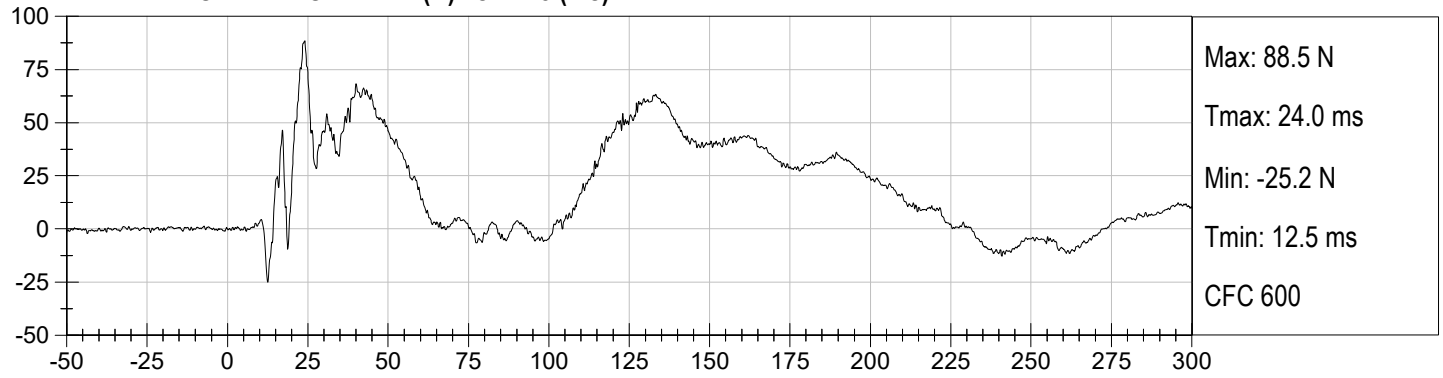
DRIVER LOWER RIB DISPLACEMENT (mm) vs Time (ms)



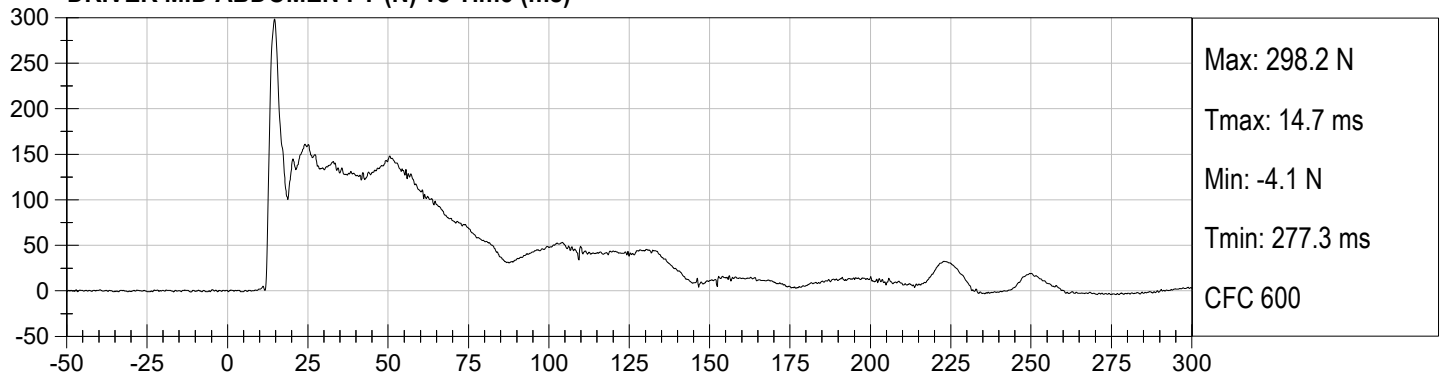
DRIVER MAXIMUM RIB DISPLACEMENT (mm) vs Time (ms)



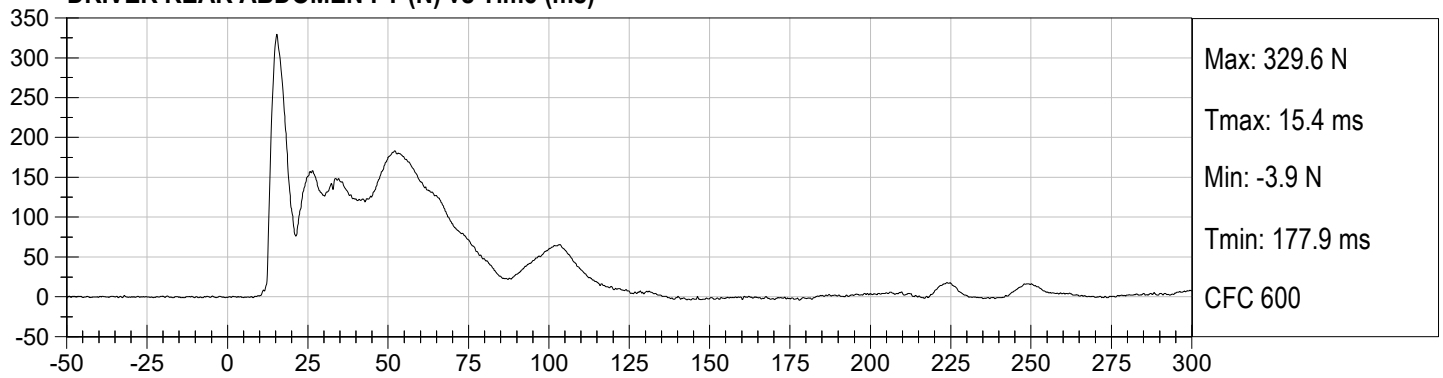
DRIVER FRONT ABDOMEN FY (N) vs Time (ms)



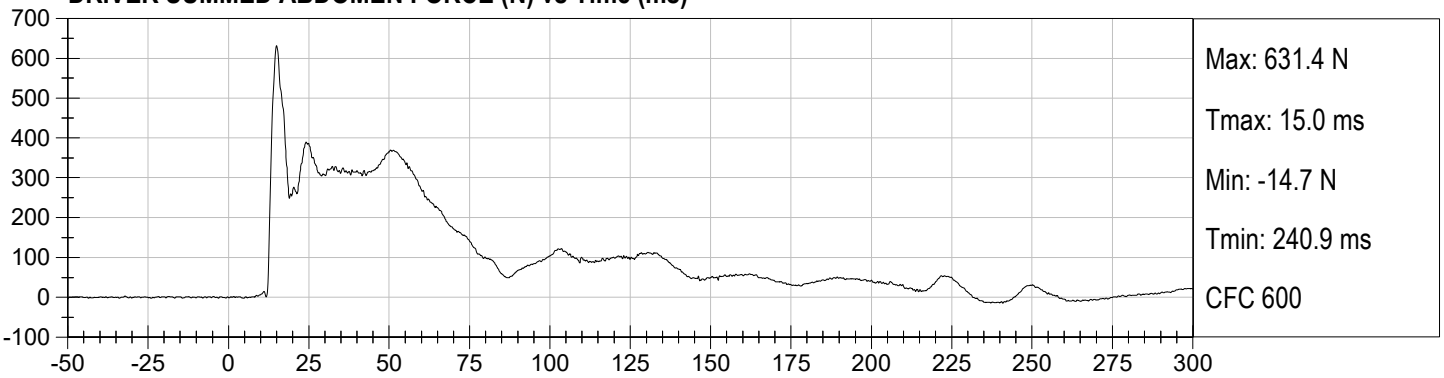
DRIVER MID ABDOMEN FY (N) vs Time (ms)



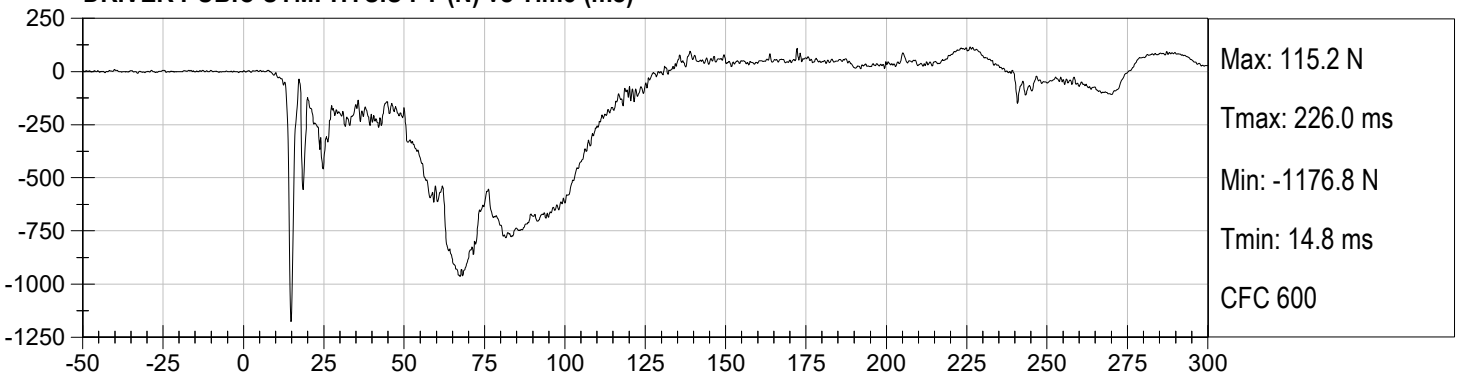
DRIVER REAR ABDOMEN FY (N) vs Time (ms)



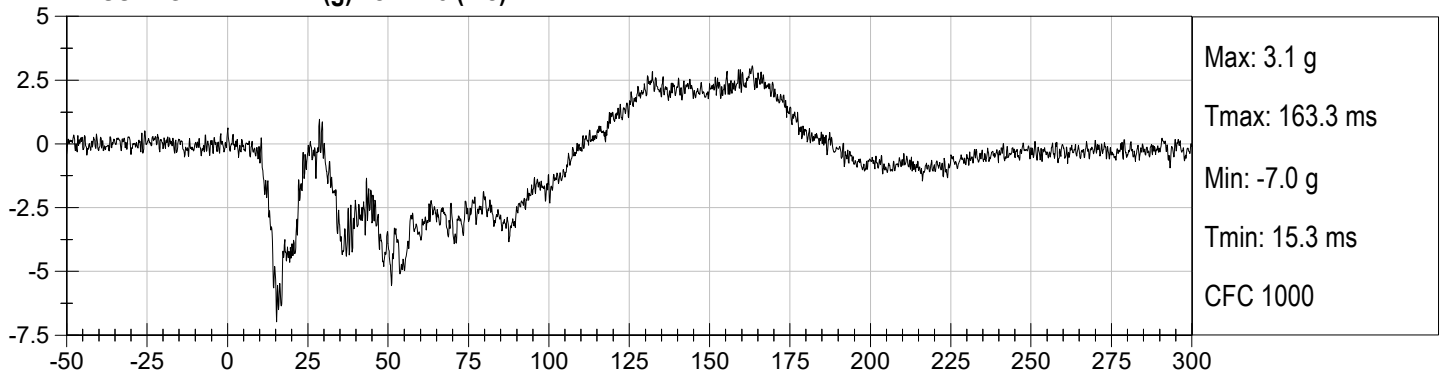
DRIVER SUMMED ABDOMEN FORCE (N) vs Time (ms)



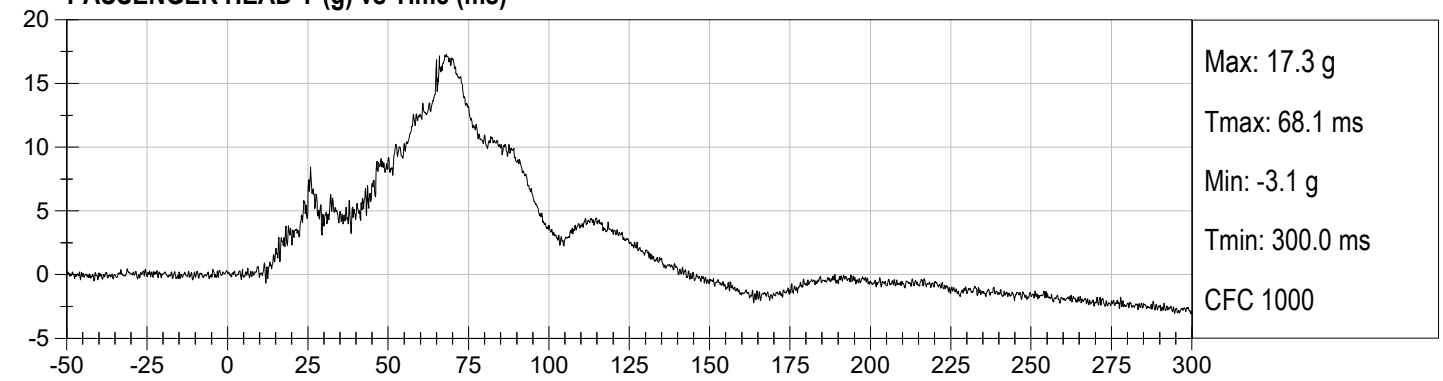
DRIVER PUBIC SYMPHYSIS FY (N) vs Time (ms)



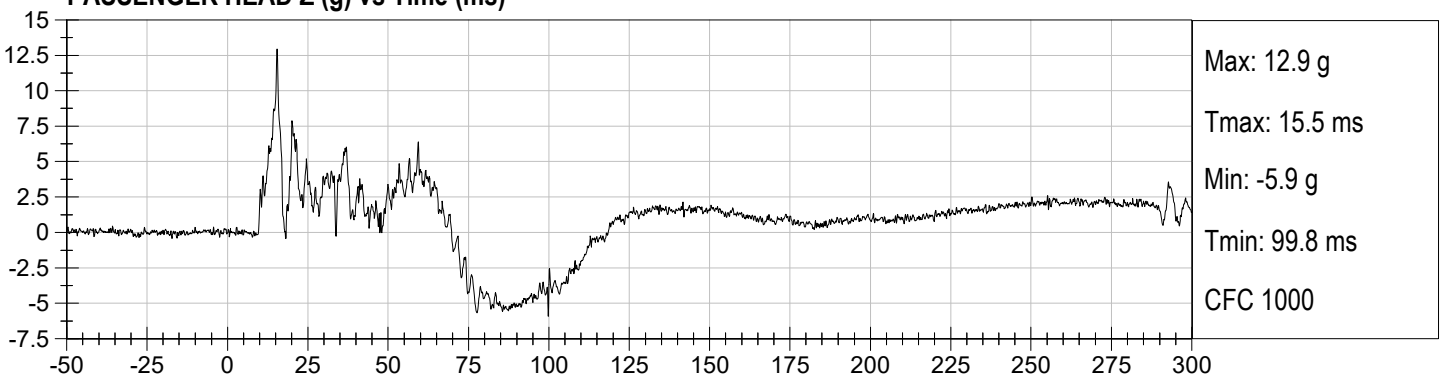
PASSENGER HEAD X (g) vs Time (ms)



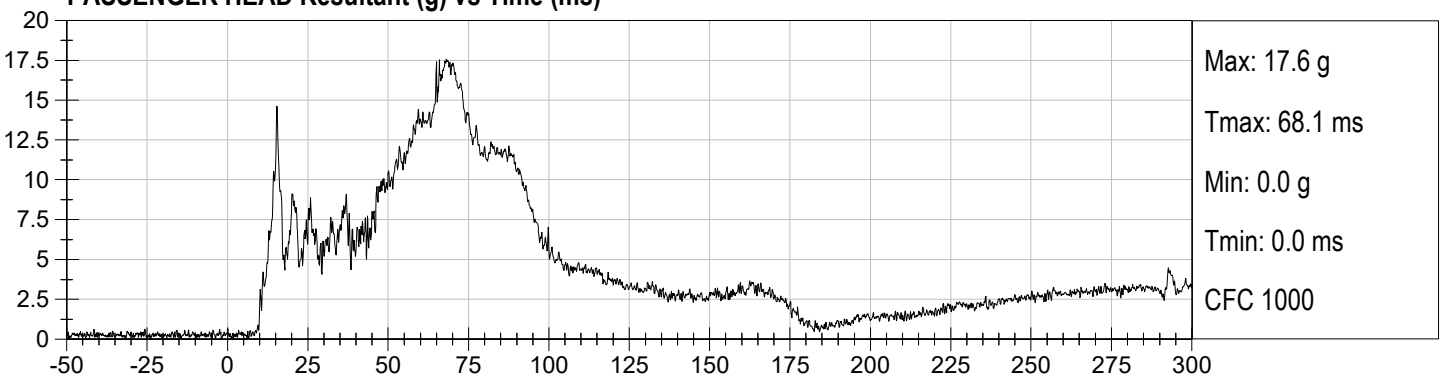
PASSENGER HEAD Y (g) vs Time (ms)



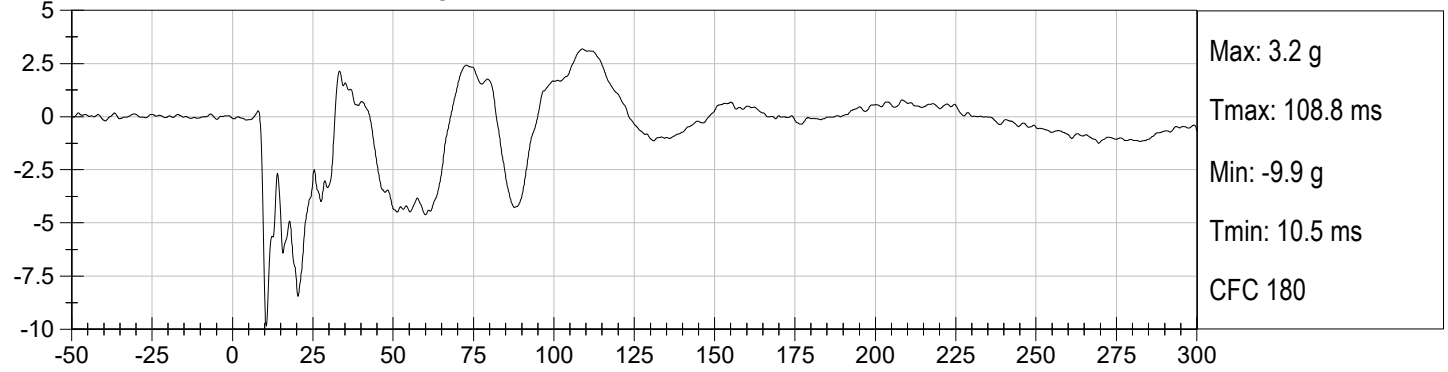
PASSENGER HEAD Z (g) vs Time (ms)



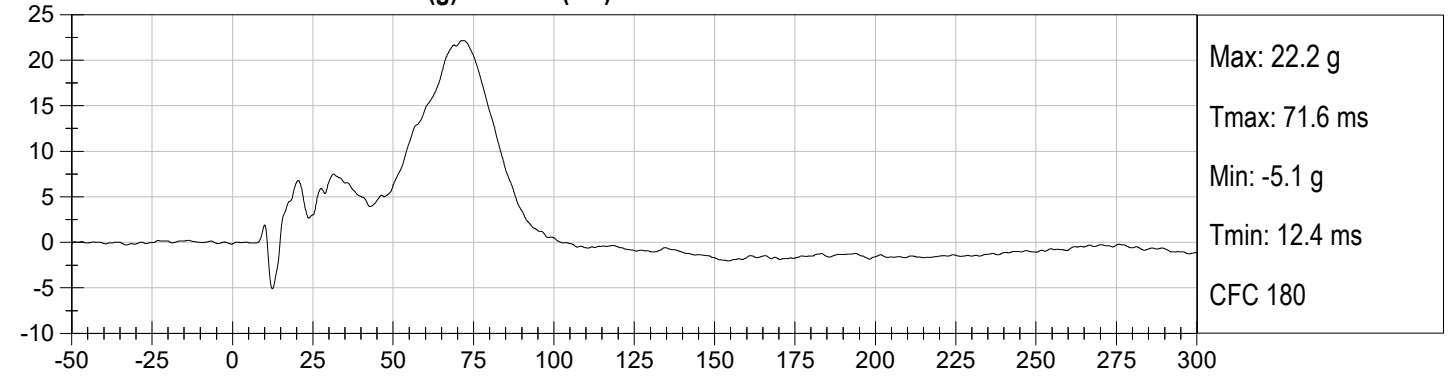
PASSENGER HEAD Resultant (g) vs Time (ms)



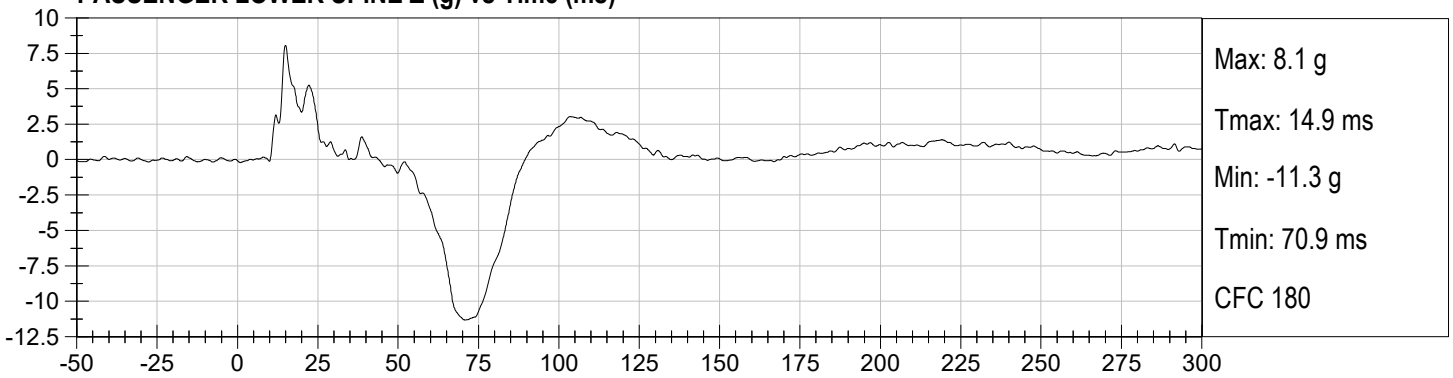
PASSENGER LOWER SPINE X (g) vs Time (ms)



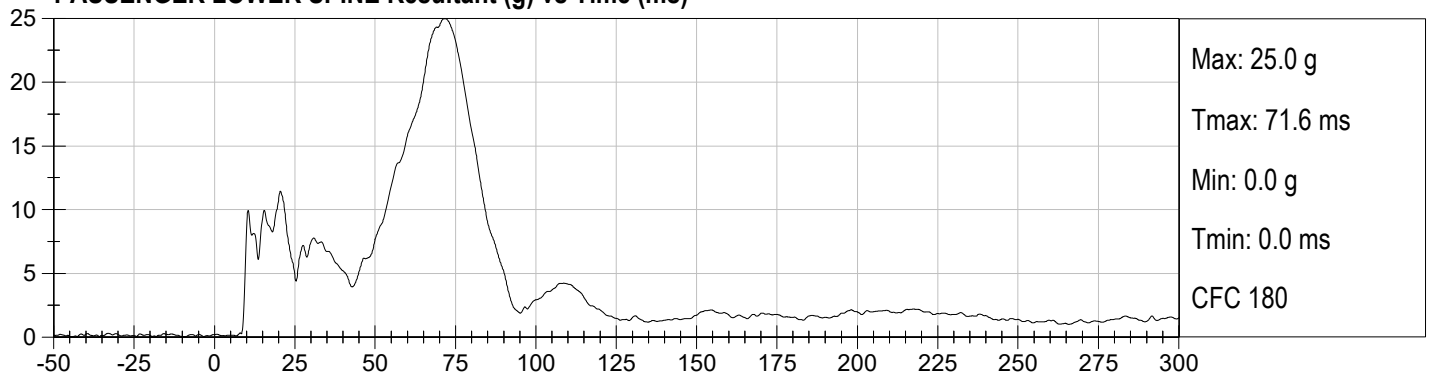
PASSENGER LOWER SPINE Y (g) vs Time (ms)



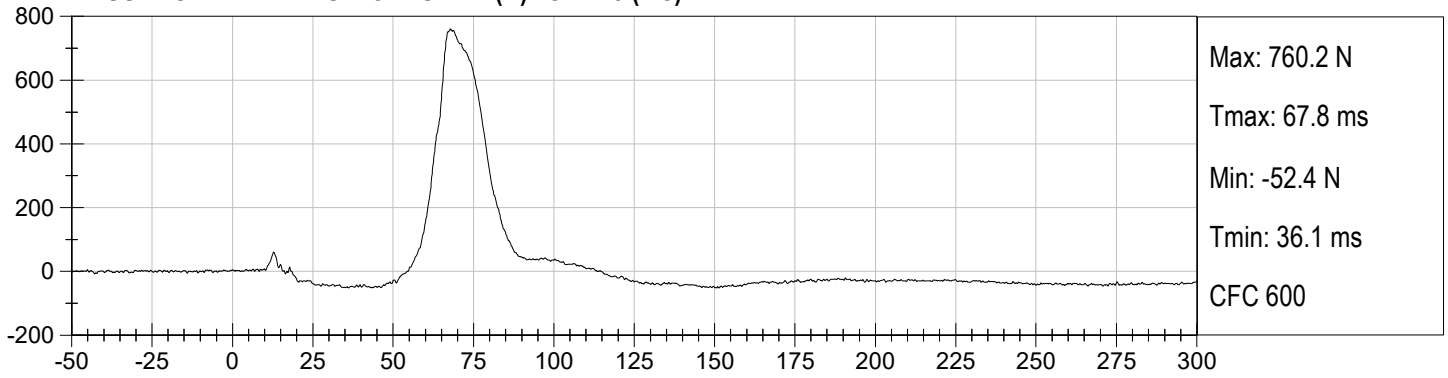
PASSENGER LOWER SPINE Z (g) vs Time (ms)



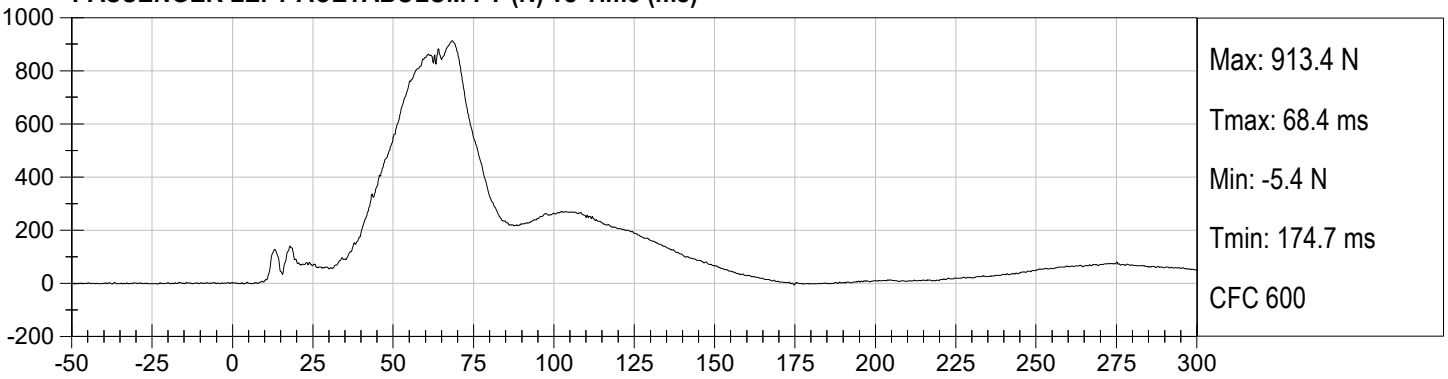
PASSENGER LOWER SPINE Resultant (g) vs Time (ms)



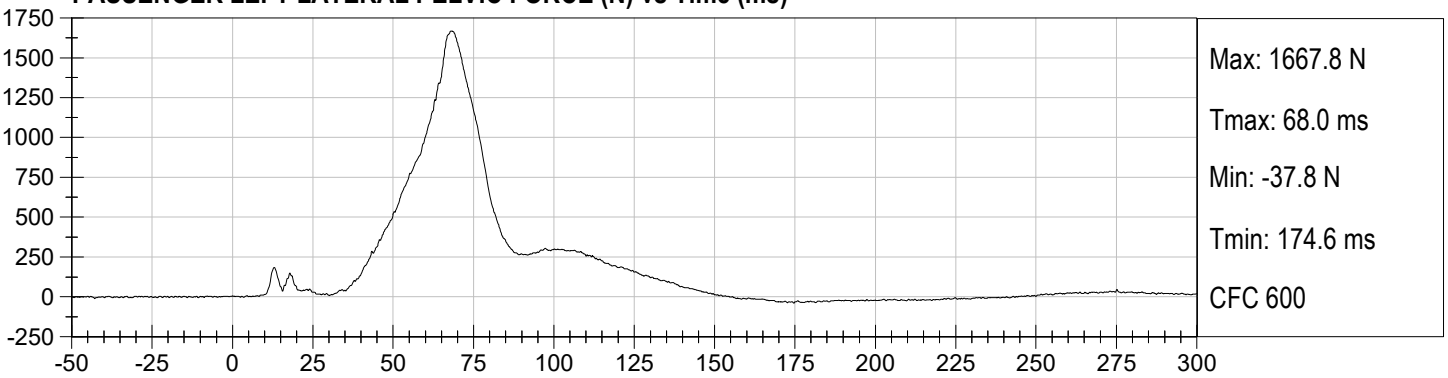
PASSENGER LEFT ILIUM CREST FY (N) vs Time (ms)



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



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



APPENDIX C
DUMMY QUALIFICATION AND PERFORMANCE VERIFICATION

QUALIFICATION TEST RESULTS

PRE-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

ES-2re External Measurements
SN: F032

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

MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: F032 **Test ID:** D233241

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Peak Resultant Acceleration	G's	125 to 155	139	Pass
Peak Longitudinal Acceleration	G's	<= +/- 15.0	7.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

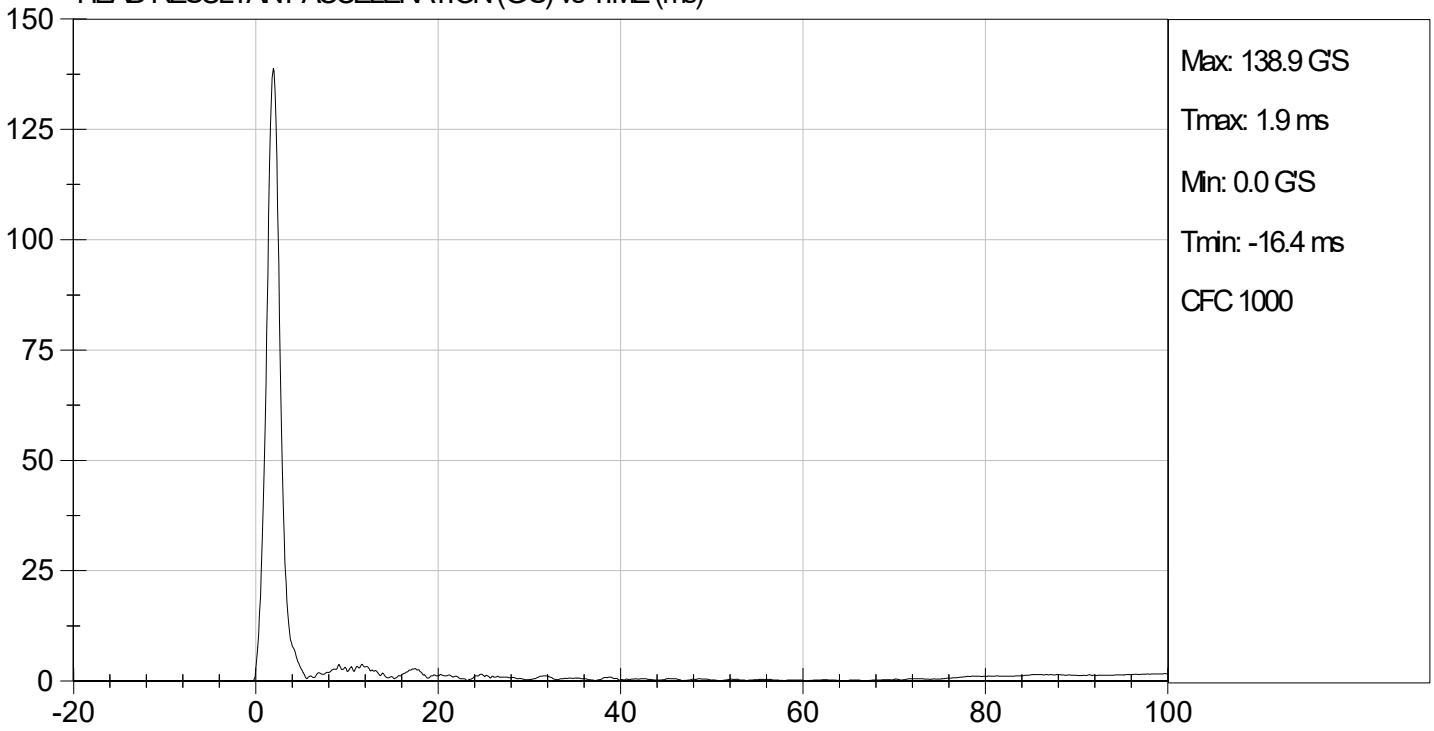
12/08/2023
Test Date

Approved By

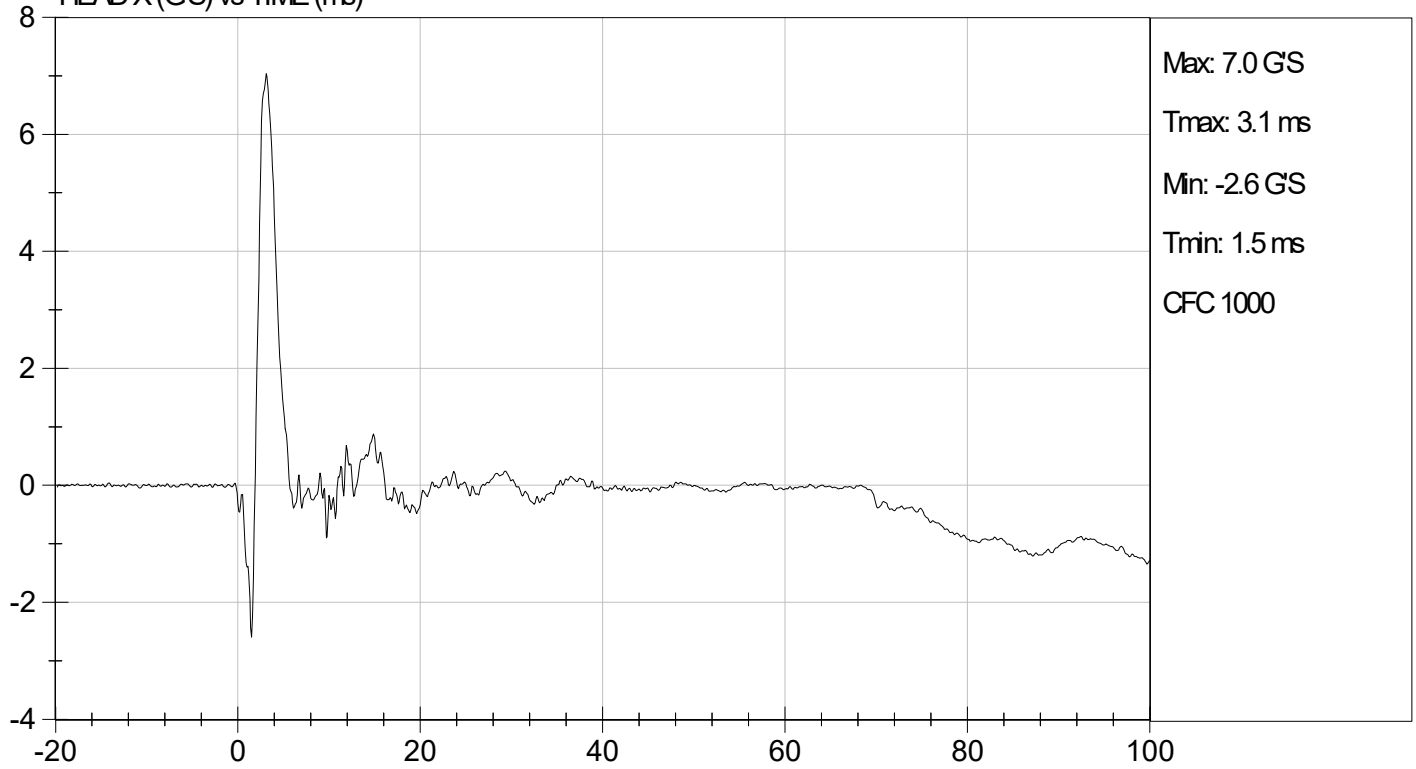
TEST DESC: HEAD DROP

TEST DATE: 12/08/2023
TEST #: D233241

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

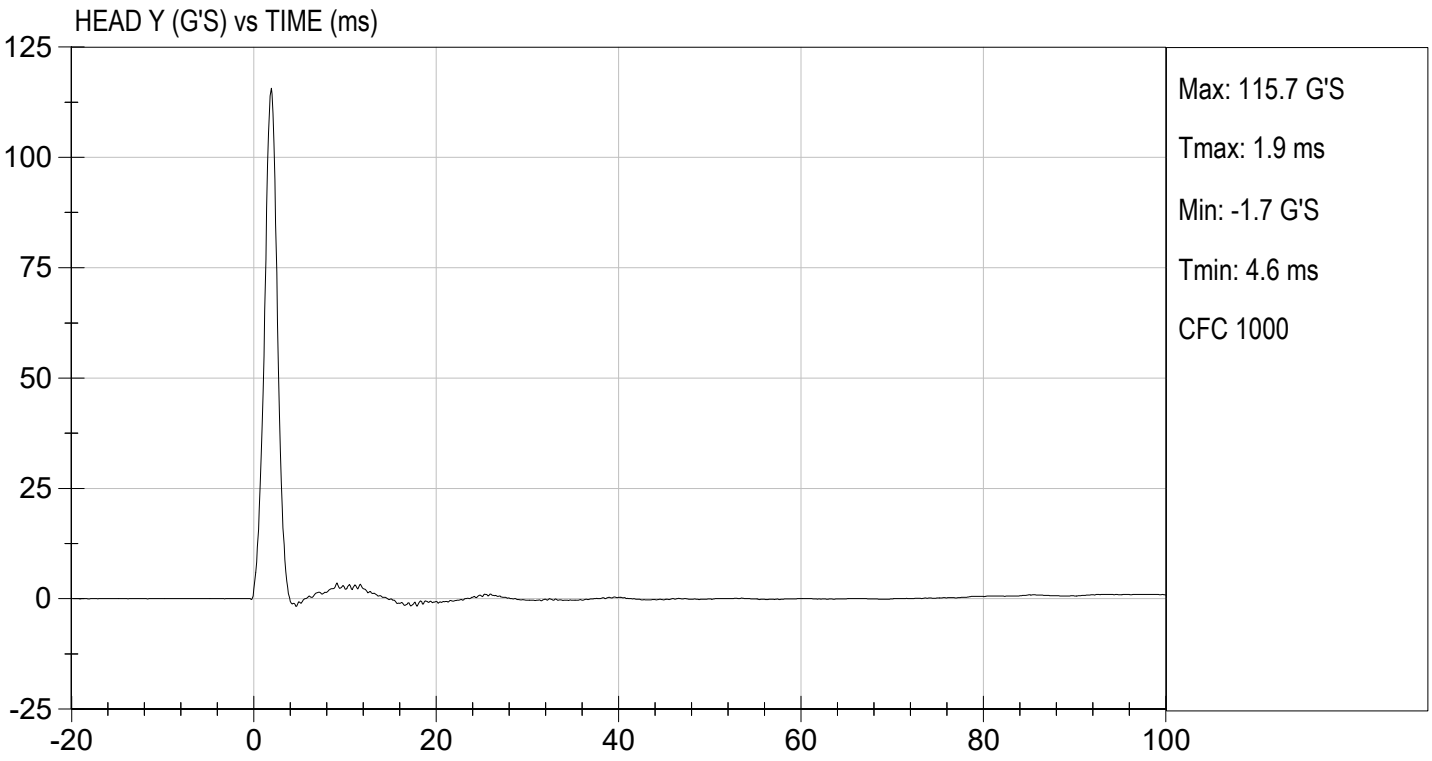


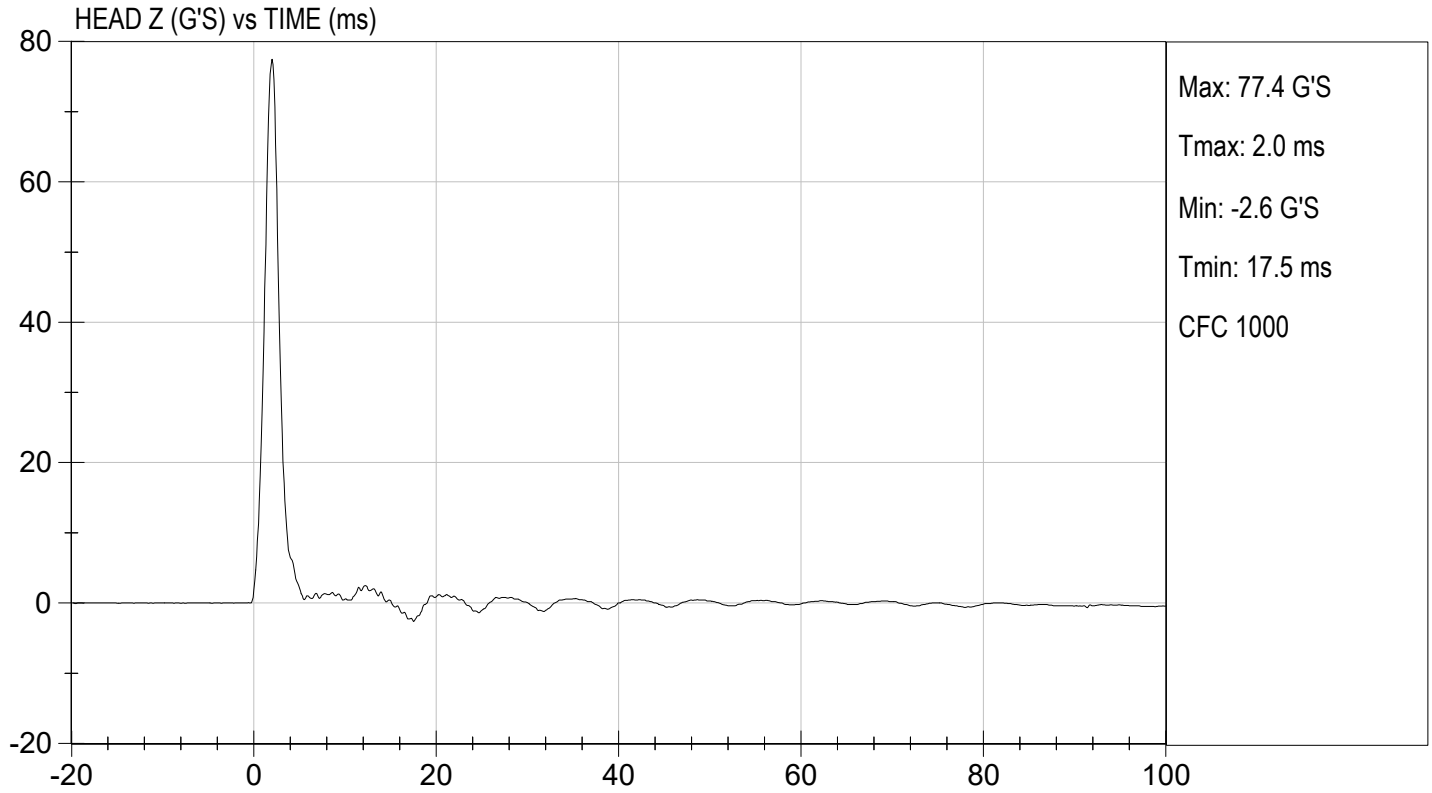
HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 12/08/2023
TEST #: D233241





MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233242

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	31	Pass
Pendulum Speed		m/s	3.30 to 3.50	3.46	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.02	Pass
	3 ms	m/s	-0.25 to -0.375	-0.33	Pass
	14 ms	m/s	-3.20 to -3.70	-3.50	Pass
	17 ms	m/s	>= -3.70	-3.59	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	50.0	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	57.4	Pass
Head Rotation Decay Time to 0 Degree		ms	53.0 to 88.0	58.8	Pass
			Overall Results		Pass

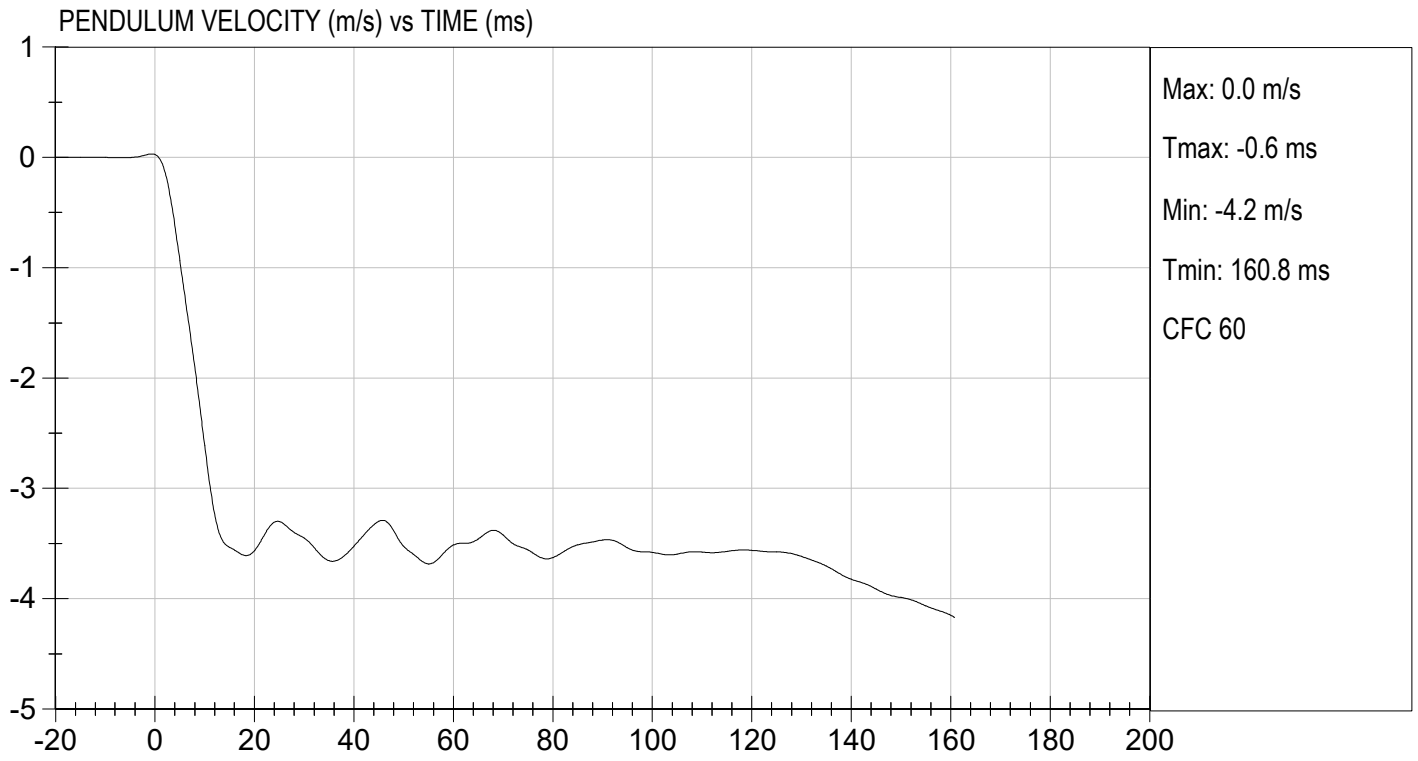
Laboratory Technician

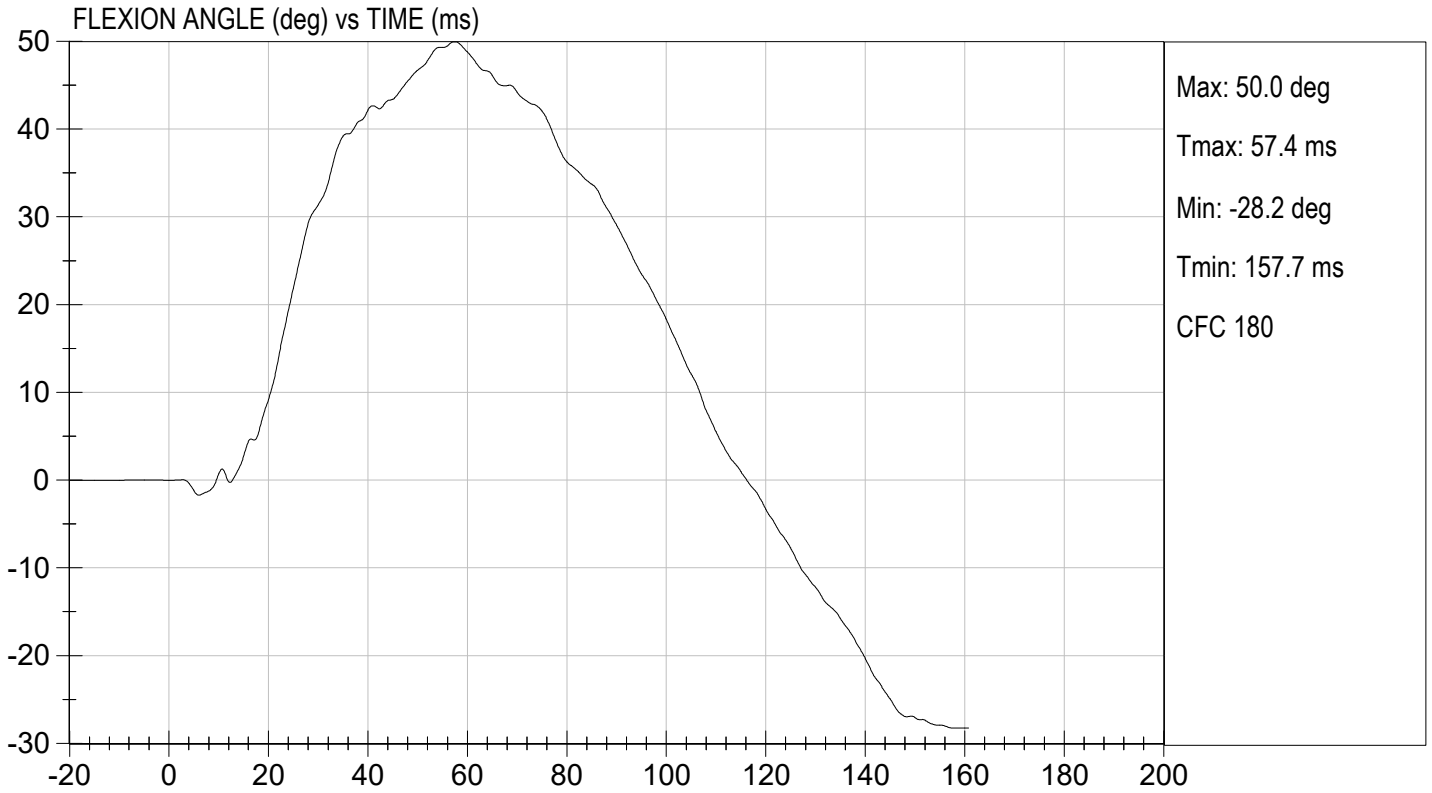
12/08/2023
Test Date

Approved By

TEST DESC: NECK BENDING
VELOCITY: 11.34 ft/s, 3.46 m/s

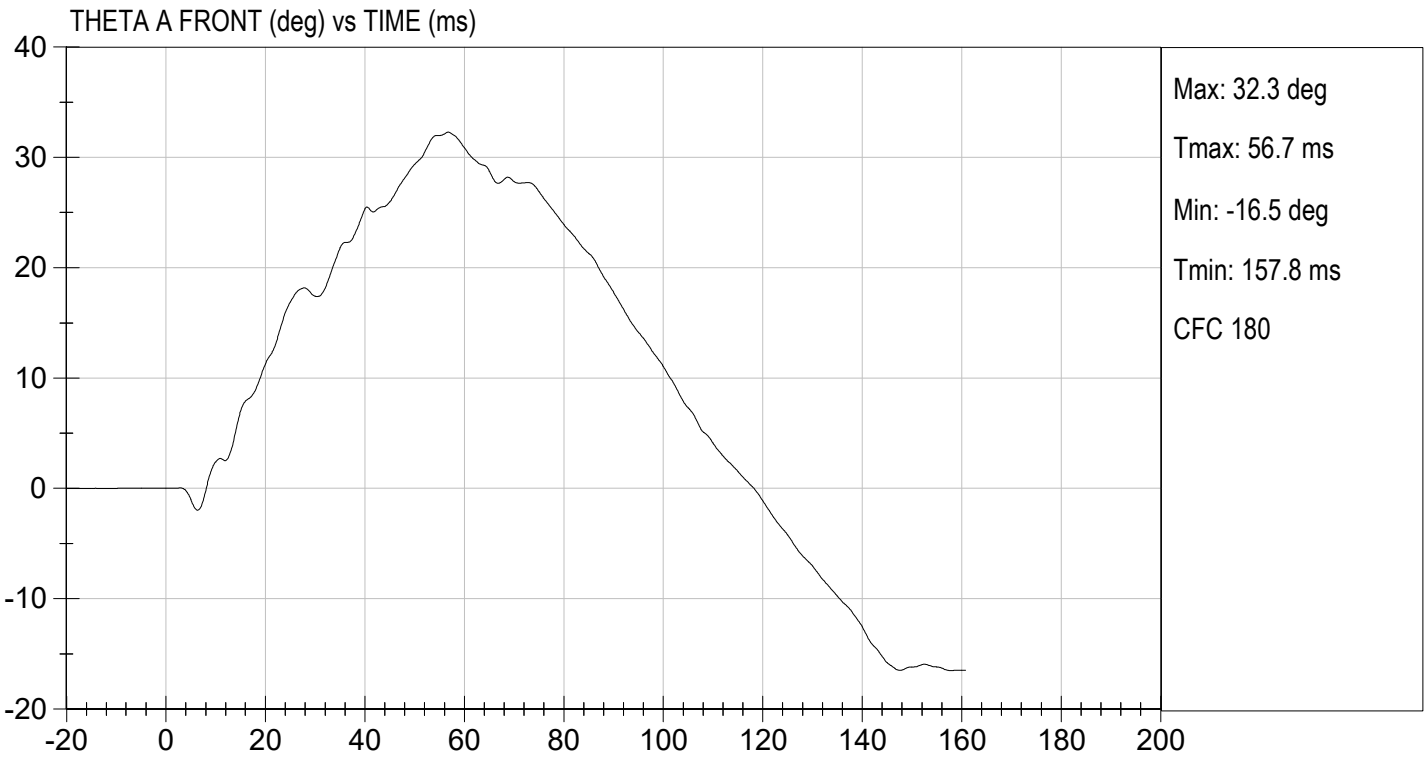
TEST DATE: 12/08/2023
TEST #: D233242

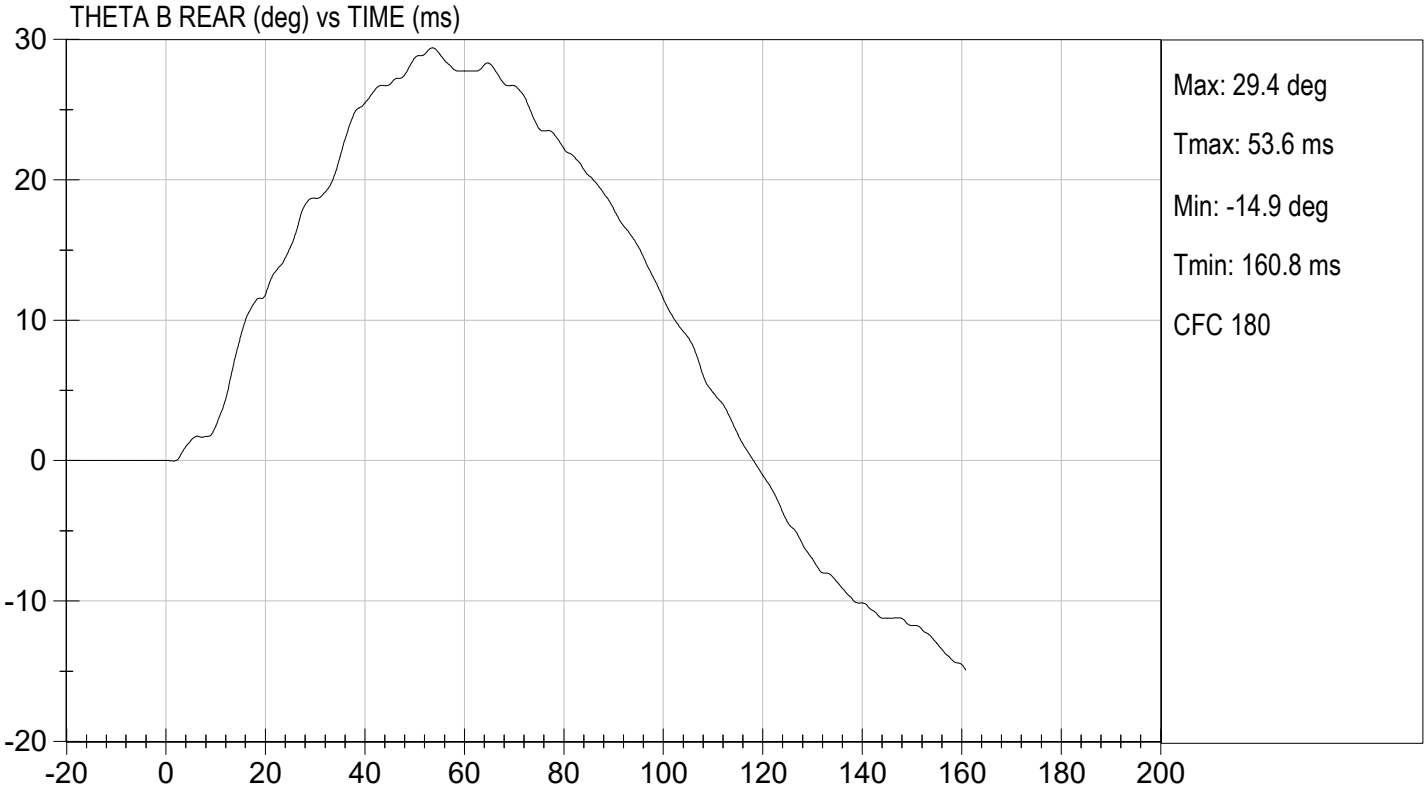




TEST DESC: NECK BENDING
VELOCITY: 11.34 ft/s, 3.46 m/s

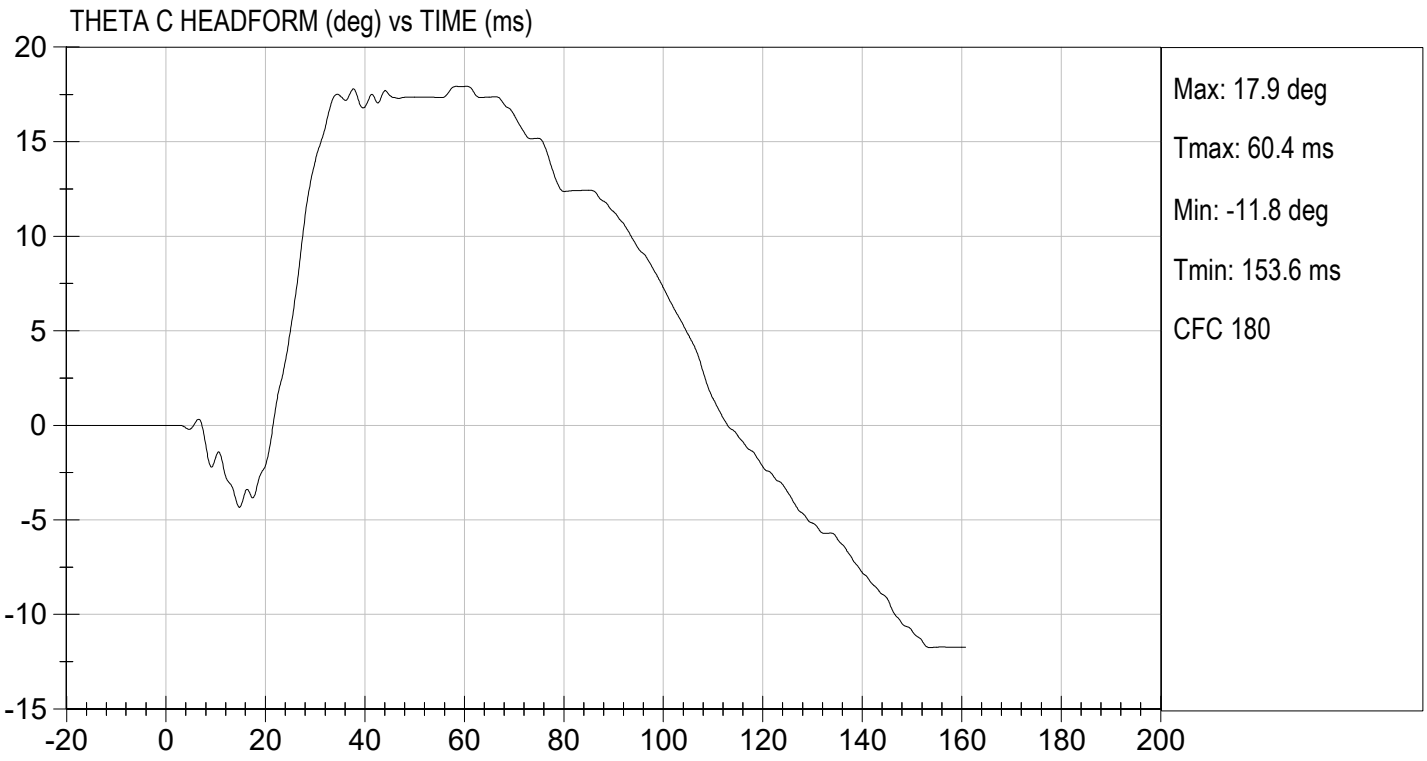
TEST DATE: 12/08/2023
TEST #: D233242





TEST DESC: NECK BENDING
VELOCITY: 11.34 ft/s, 3.46 m/s

TEST DATE: 12/08/2023
TEST #: D233242



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233243

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	36	Pass
Pendulum Speed	m/s	4.20 to 4.40	4.2	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	8.7	Pass
		Overall Test Results		Pass

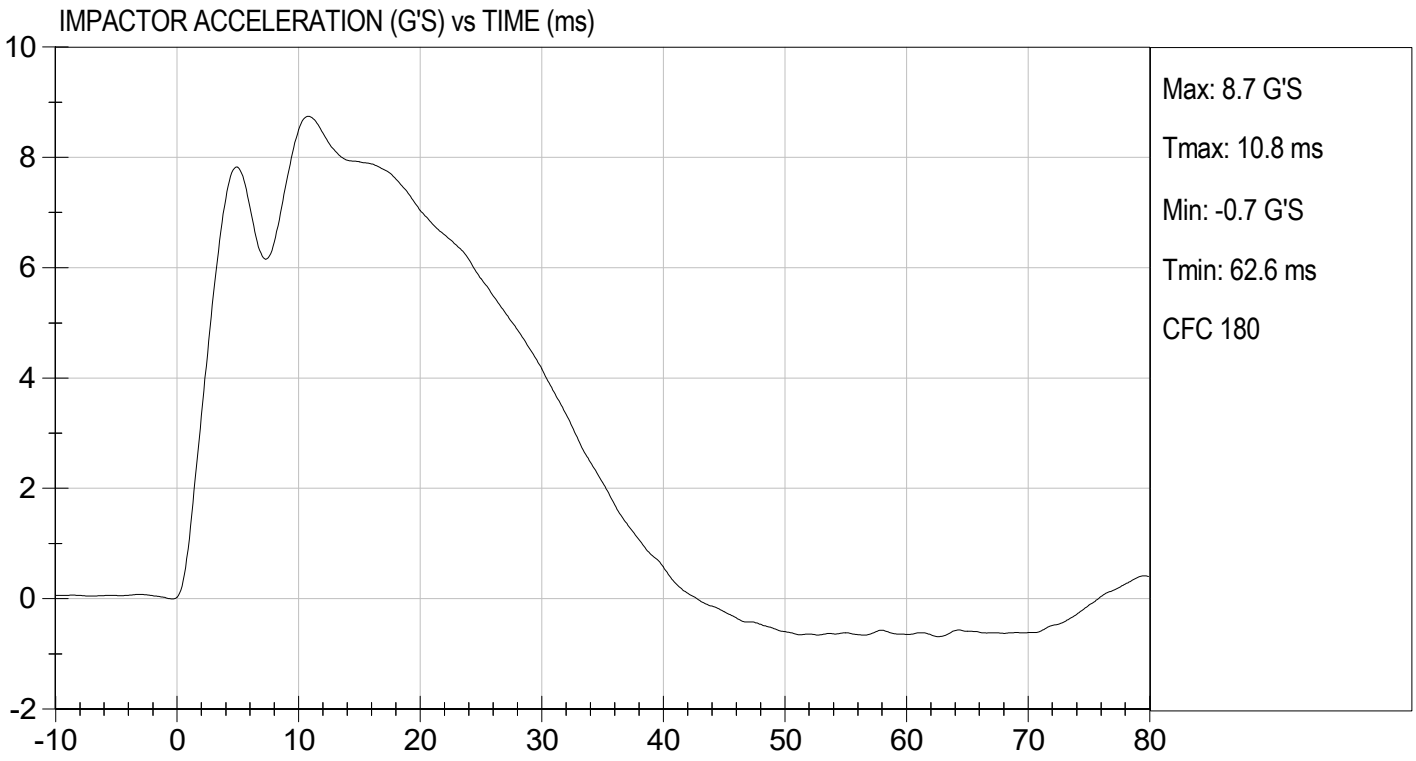
Laboratory Technician

12/08/2023
Test Date

Approved By

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

TEST DATE: 12/08/2023
TEST #: D233243



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

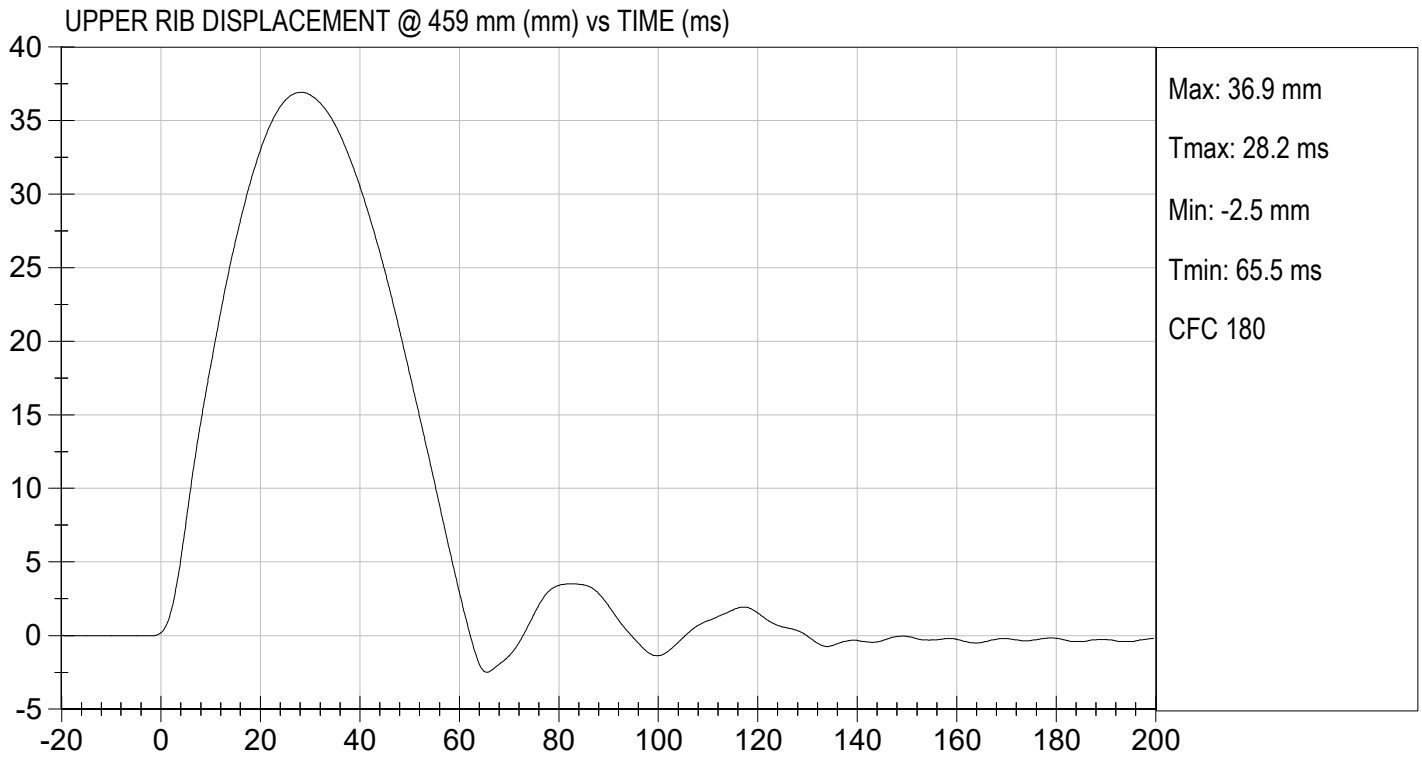
ATD Serial No: F032 **Test I.D:** D233244

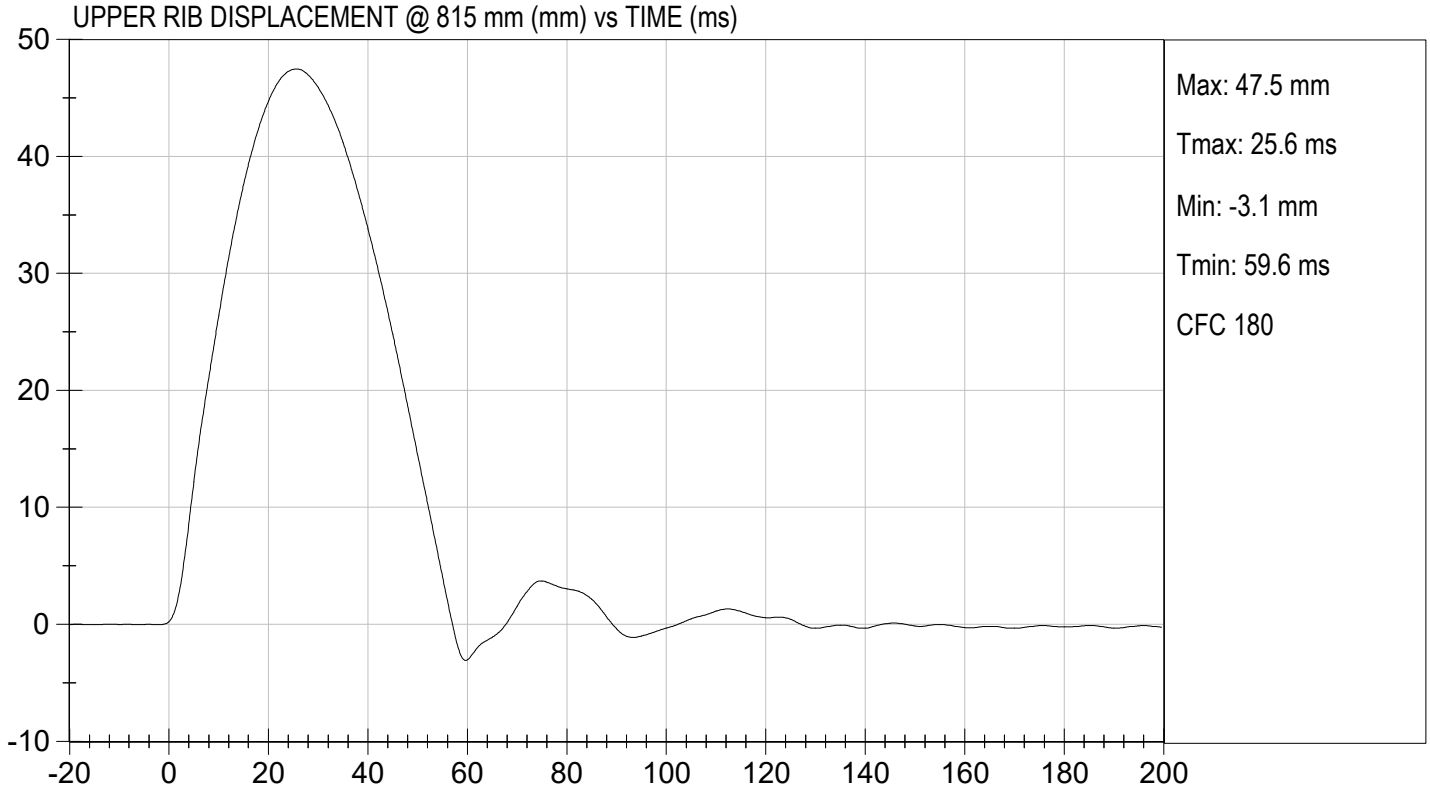
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Displacement at 459 mm	mm	36.0 to 40.0	36.9	Pass
Displacement at 815 mm	mm	46.0 to 51.0	47.5	Pass
		Overall Test Results		Pass

Laboratory Technician

12/08/2023
Test Date

Approved By


UPPER RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)
Max: 36.9 mm
Tmax: 28.2 ms
Min: -2.5 mm
Tmin: 65.5 ms
CFC 180
40
35
30
25
20
15
10
5
0
-5
-20
0
20
40
60
80
100
120
140
160
180
200


UPPER RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)
Max: 47.5 mm
Tmax: 25.6 ms
Min: -3.1 mm
Tmin: 59.6 ms
CFC 180
50
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200

MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

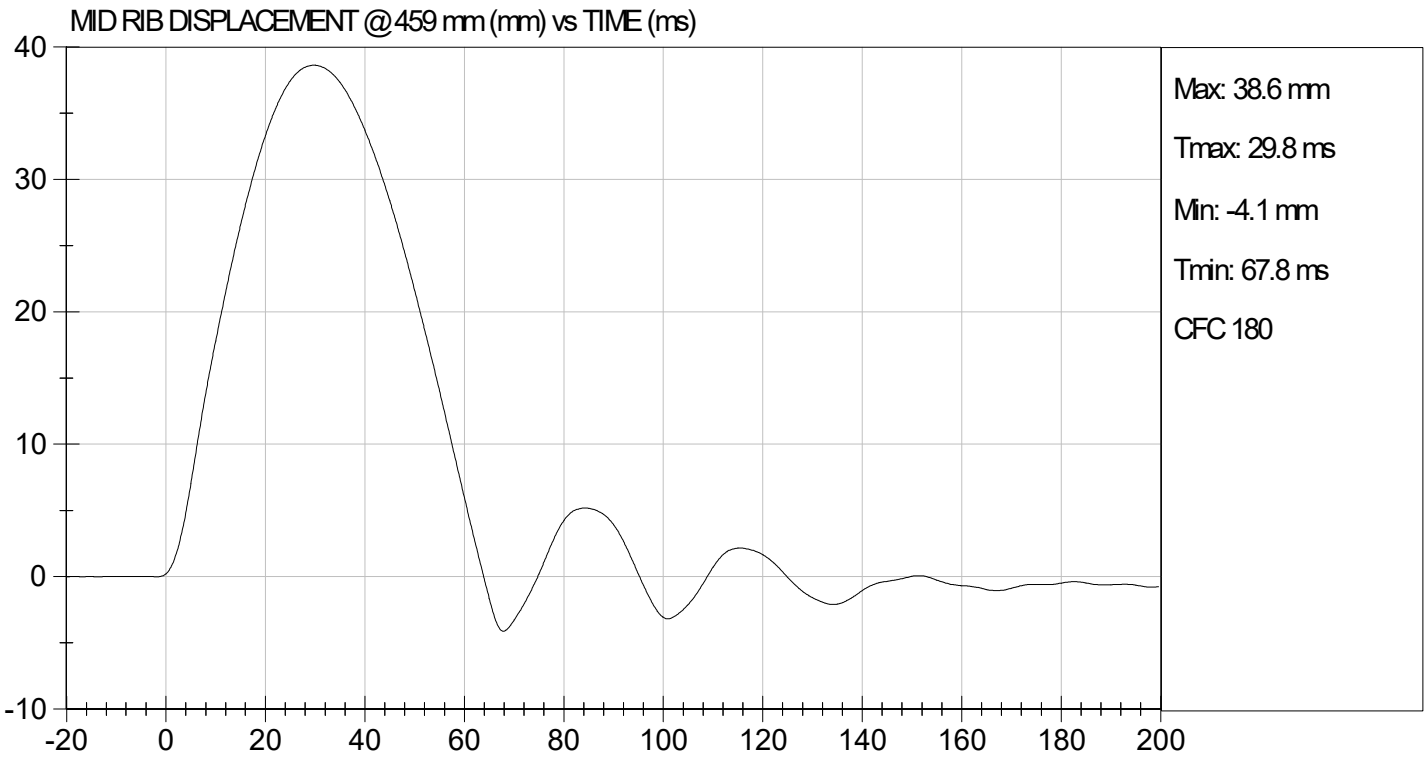
ATD Serial No: F032 **Test I.D:** D233245

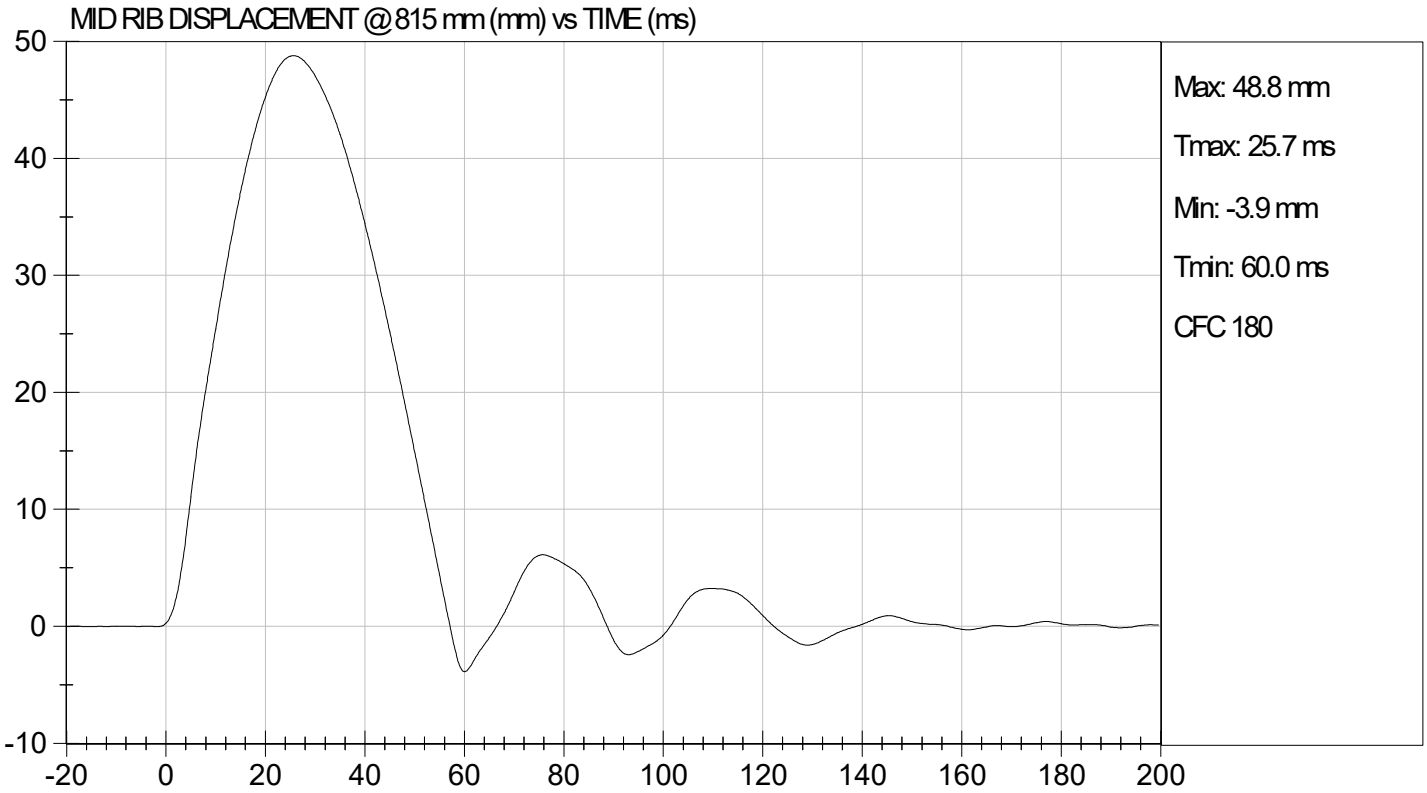
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Displacement at 459 mm	mm	36.0 to 40.0	38.6	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.8	Pass
		Overall Test Results		Pass

Laboratory Technician

12/08/2023
Test Date

Approved By


MID RIB DISPLACEMENT @459 mm (mm) vs TIME (ms)
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 38.6 mm
Tmax: 29.8 ms
Min: -4.1 mm
Tmin: 67.8 ms
CFC 180


MID RIB DISPLACEMENT @815 mm (mm) vs TIME (ms)
50
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 48.8 mm
Tmax: 25.7 ms
Min: -3.9 mm
Tmin: 60.0 ms
CFC 180

MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233246

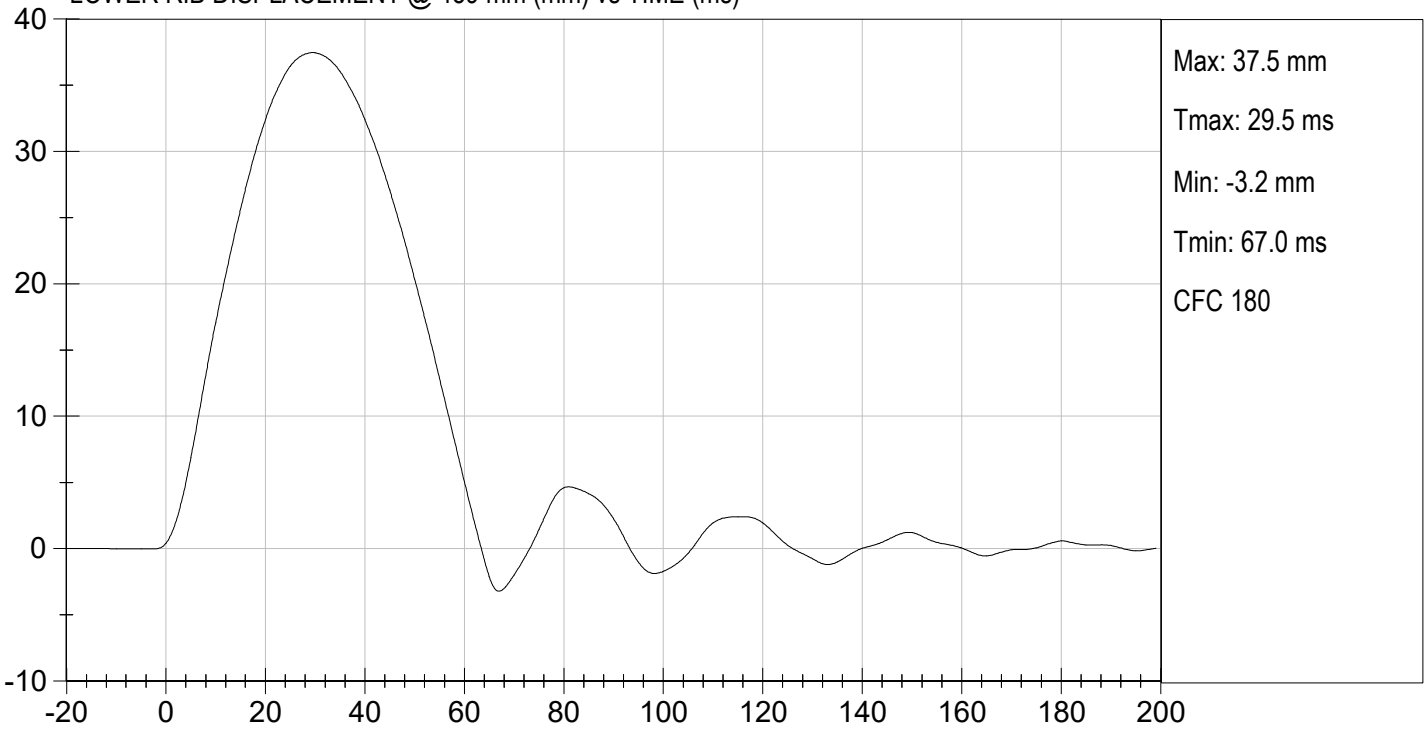
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Displacement at 459 mm	mm	36.0 to 40.0	37.5	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.5	Pass
		Overall Test Results		Pass

Laboratory Technician

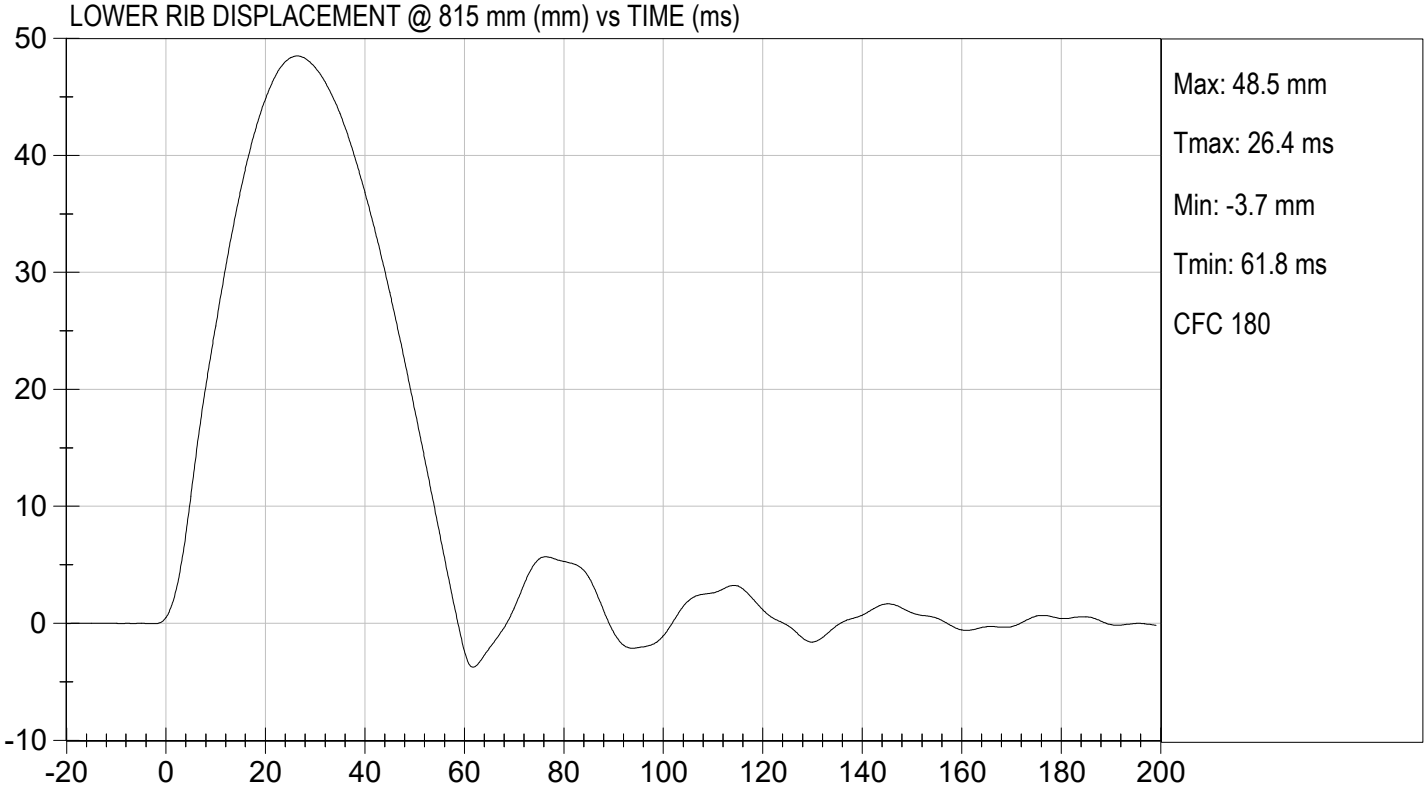
12/08/2023
Test Date

Approved By

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



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



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233247

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	36	Pass
Probe Speed	m/s	3.90 to 4.10	4.10	Pass
Maximum Impactor Force	N	4000 to 4800	4085	Pass
Time of Maximum Impactor Force	ms	10.6 to 13.0	11.4	Pass
Maximum Total Abdomen Force	N	2200 to 2700	2420	Pass
Time of Maximum Abdomen Force	ms	10.0 to 12.3	11.4	Pass
		Overall Test Results		Pass

Laboratory Technician

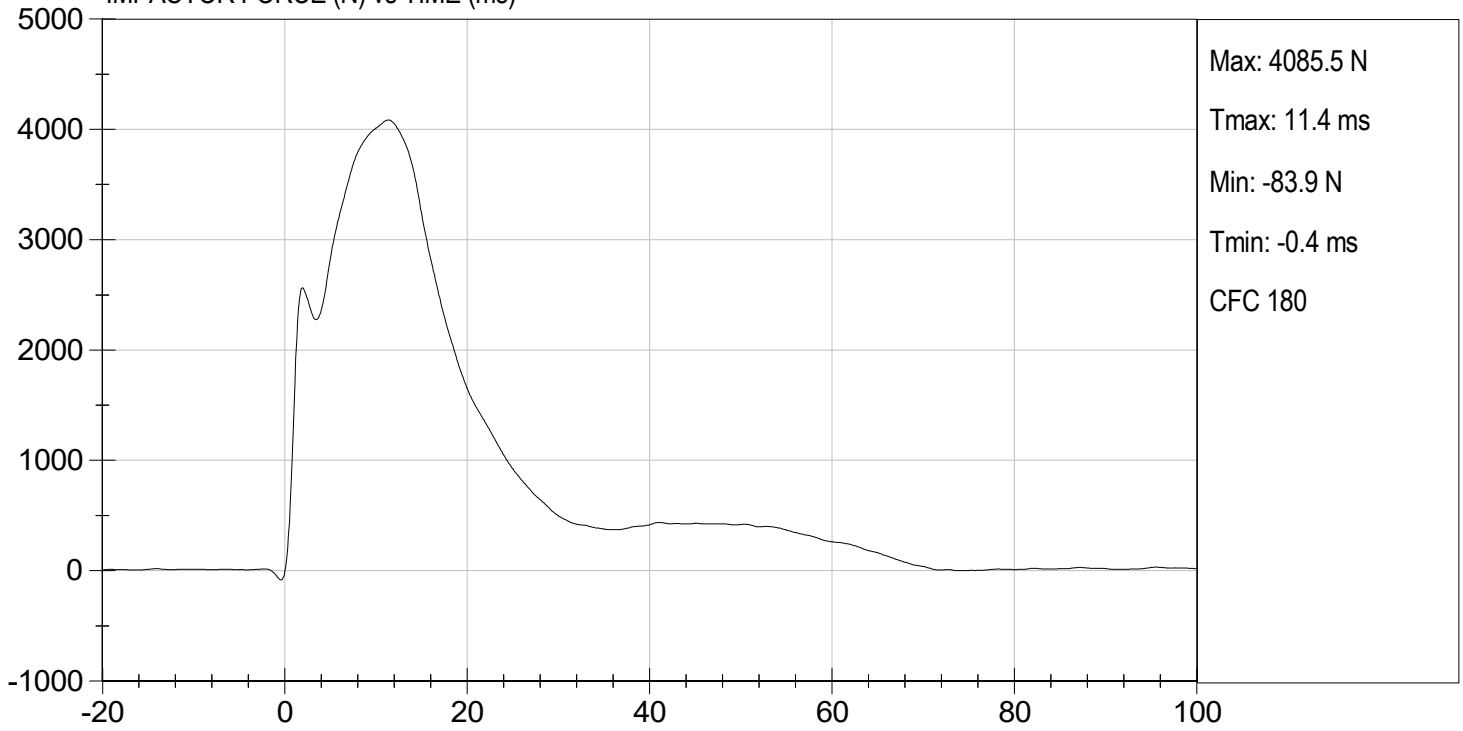
12/08/2023
Test Date

Approved By

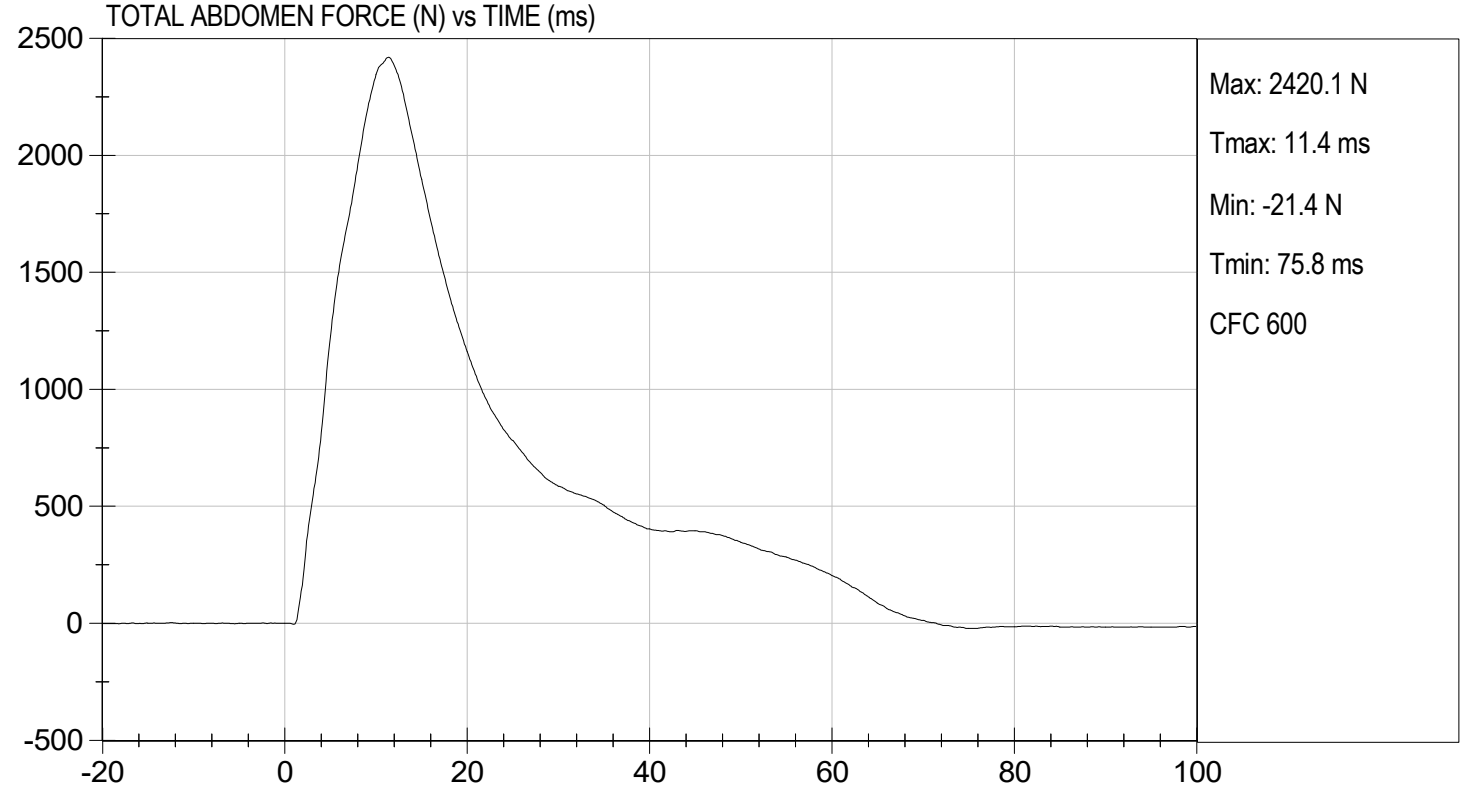
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 12/08/2023
TEST #: D233247

IMPACTOR FORCE (N) vs TIME (ms)



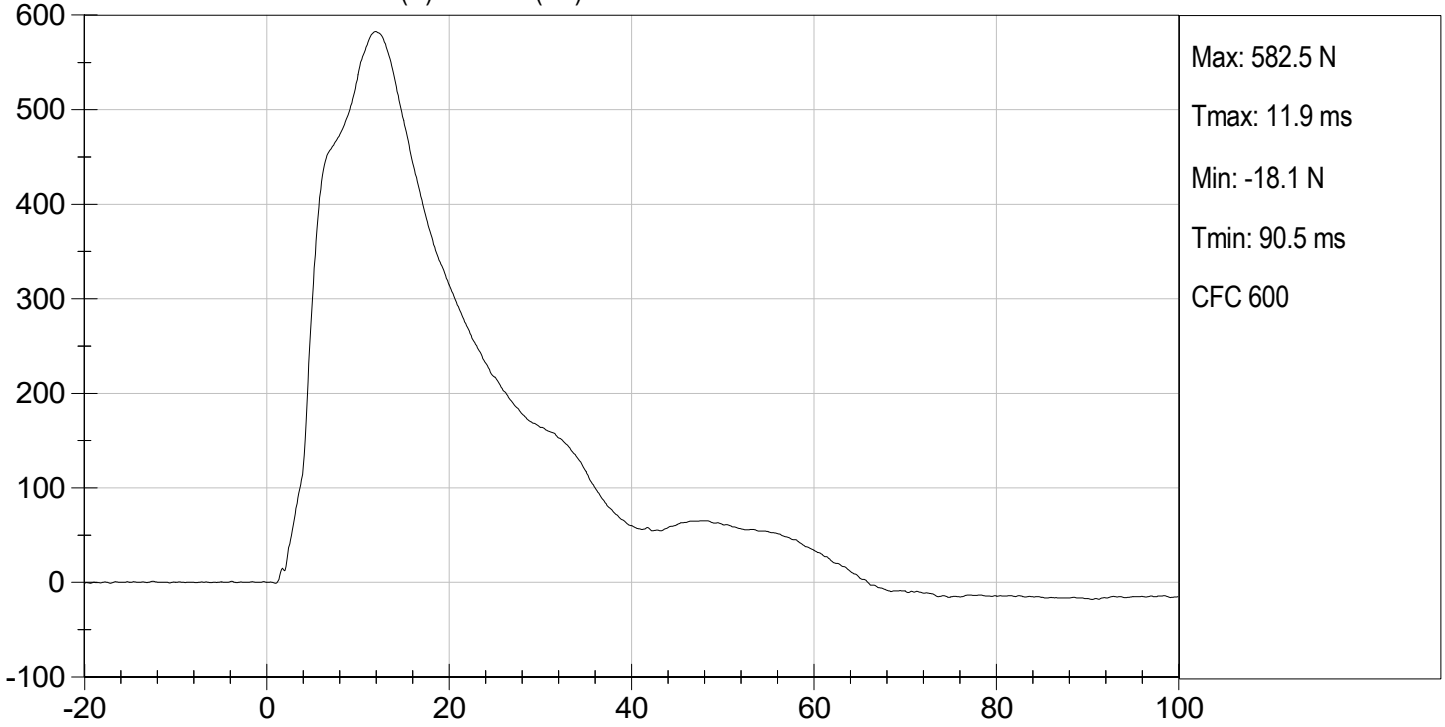
TOTAL ABDOMEN FORCE (N) vs TIME (ms)



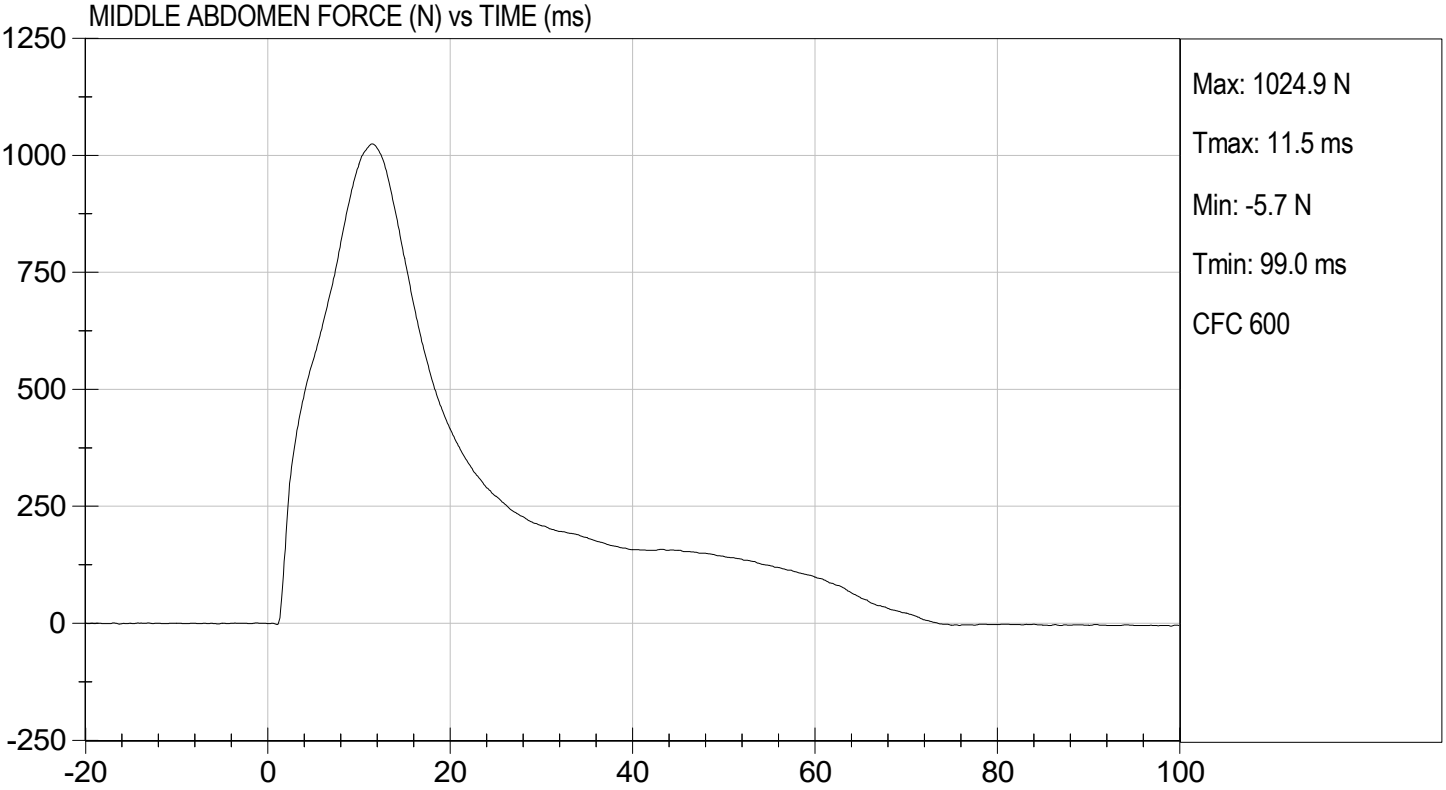
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.44 ft/s, 4.10 m/s

TEST DATE: 12/08/2023
TEST #: D233247

FRONT ABDOMEN FORCE (N) vs TIME (ms)

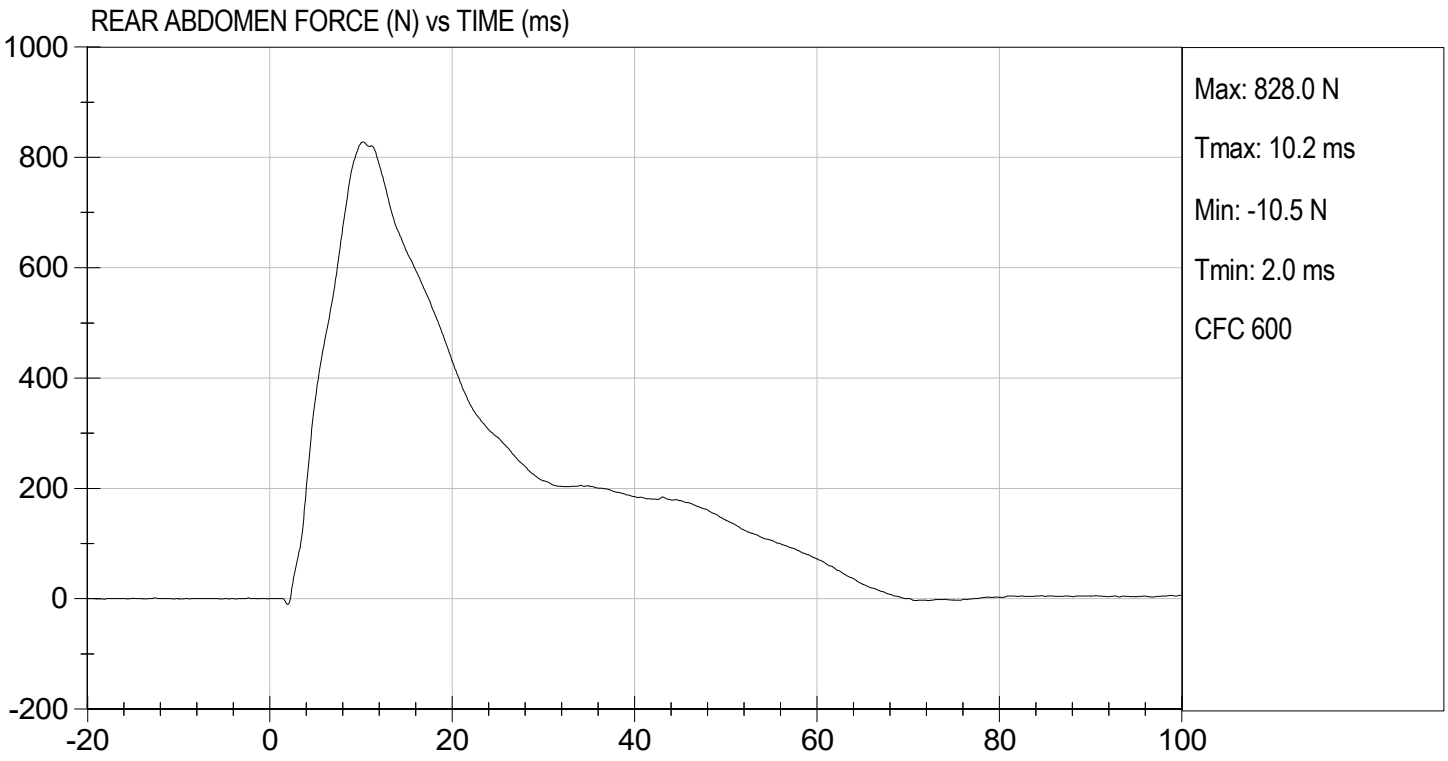


MIDDLE ABDOMEN FORCE (N) vs TIME (ms)



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

TEST DATE: 12/08/2023
TEST #: D233247



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233248

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	31	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.02	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.410	Pass
	27 ms	m/s	-6.50 to -5.80	-5.99	Pass
	30 ms	m/s	>= -6.50	-6.25	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	48.5	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	48.2	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	39	Pass
			Overall Results		Pass

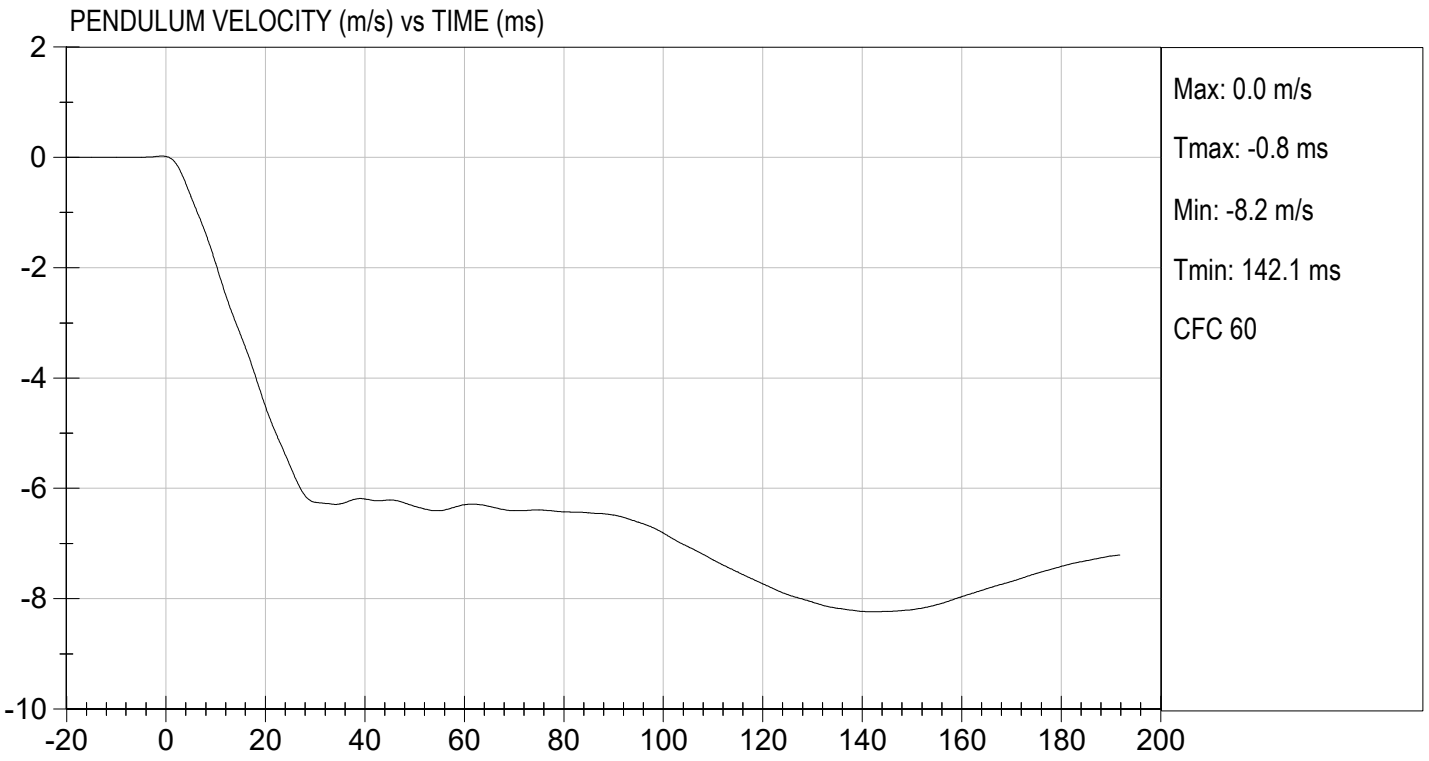
Laboratory Technician

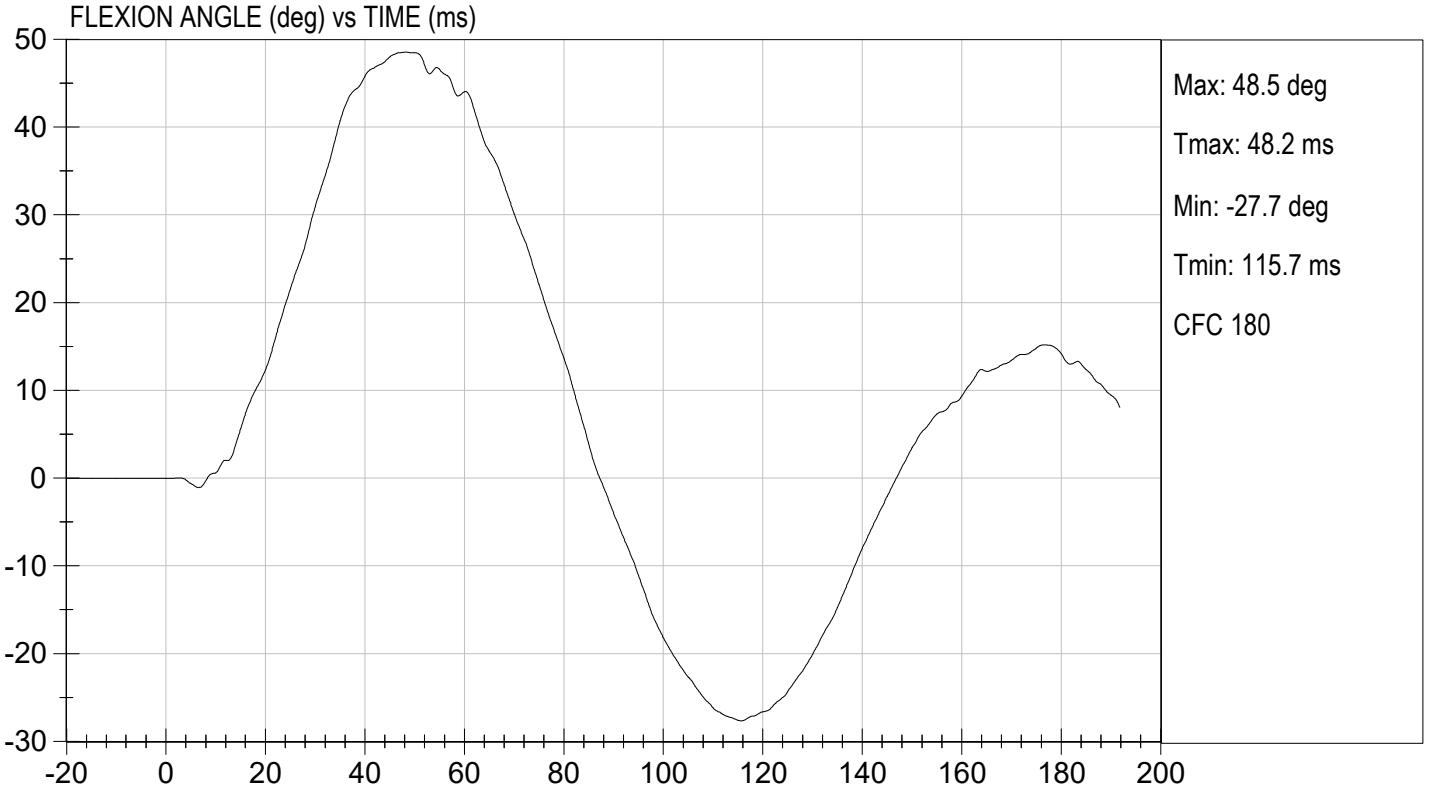
12/08/2023
Test Date

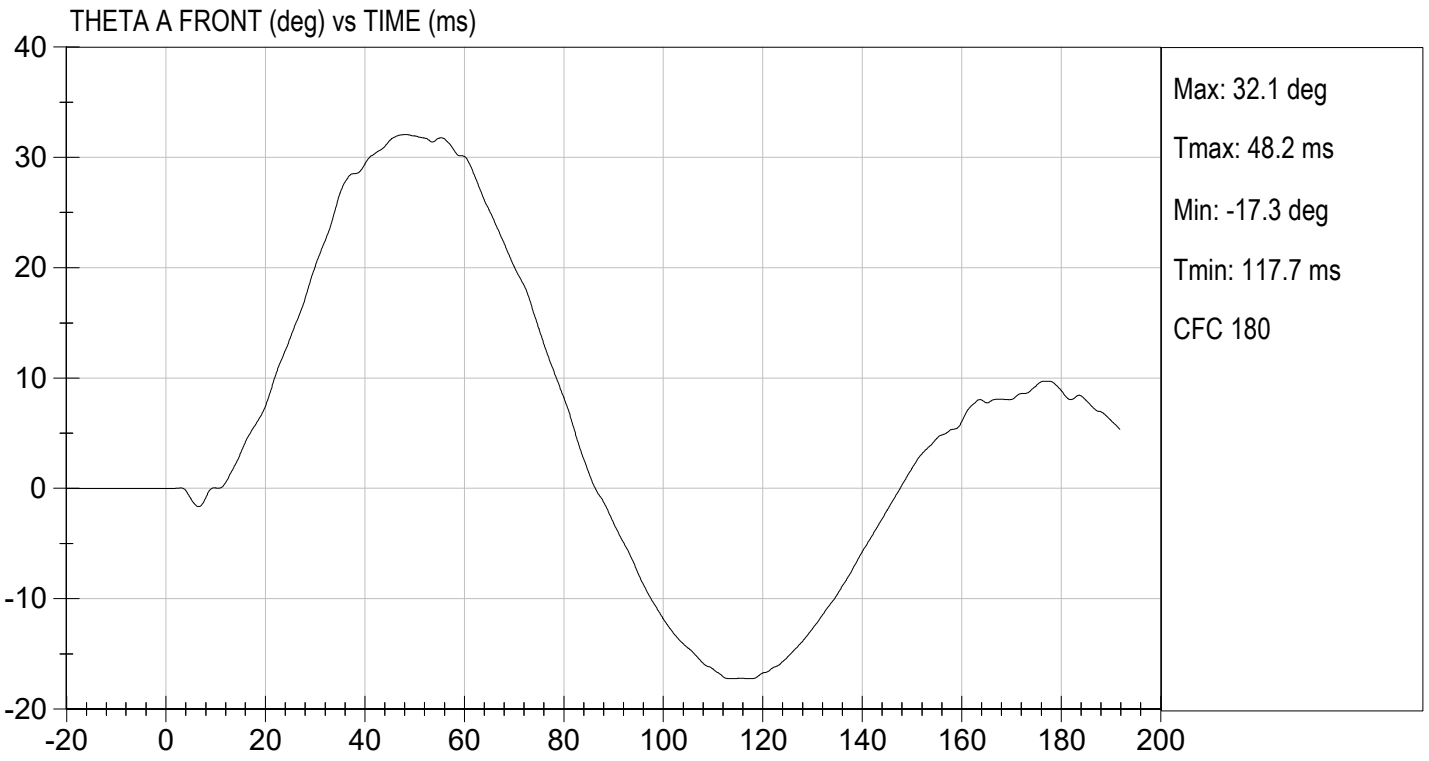
Approved By

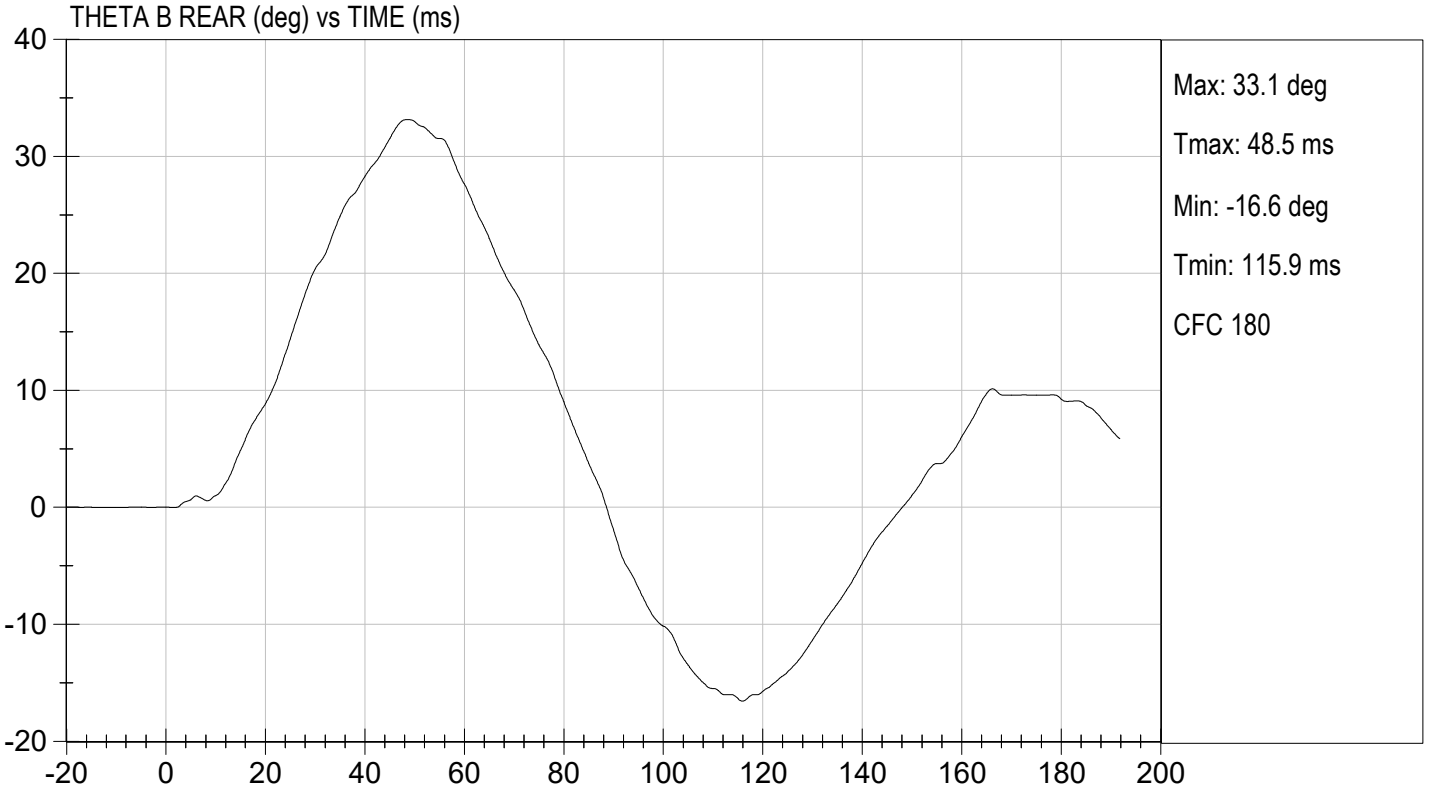
TEST DESC: LUMBAR BENDING
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 12/08/2023
TEST #: D233248



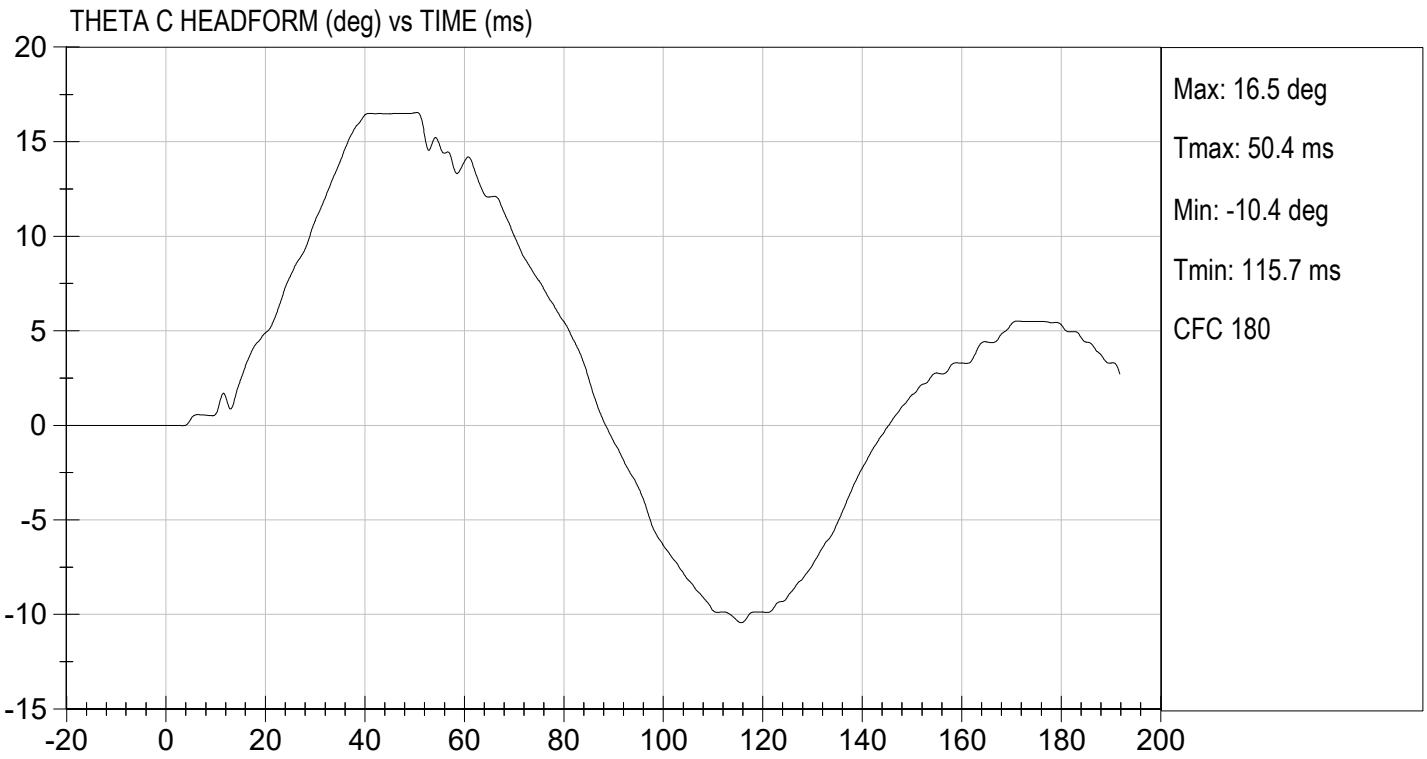



THETA A FRONT (deg) vs TIME (ms)
40
30
20
10
0
-10
-20
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 32.1 deg
Tmax: 48.2 ms
Min: -17.3 deg
Tmin: 117.7 ms
CFC 180


THETA B REAR (deg) vs TIME (ms)
40
30
20
10
0
-10
-20
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 33.1 deg
Tmax: 48.5 ms
Min: -16.6 deg
Tmin: 115.9 ms
CFC 180

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

TEST DATE: 12/08/2023
TEST #: D233248



MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233249

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	36	Pass
Probe Speed	m/s	4.20 to 4.40	4.27	Pass
Maximum Impactor Force	N	4700 to 5400	5113	Pass
Time of Maximum Impactor Force	ms	11.8 to 16.1	13.3	Pass
Maximum Pubic Force	N	1230 to 1590	1354	Pass
Time of Maximum Pubic Force	ms	12.2 to 17.0	15.2	Pass
		Overall Test Results		Pass

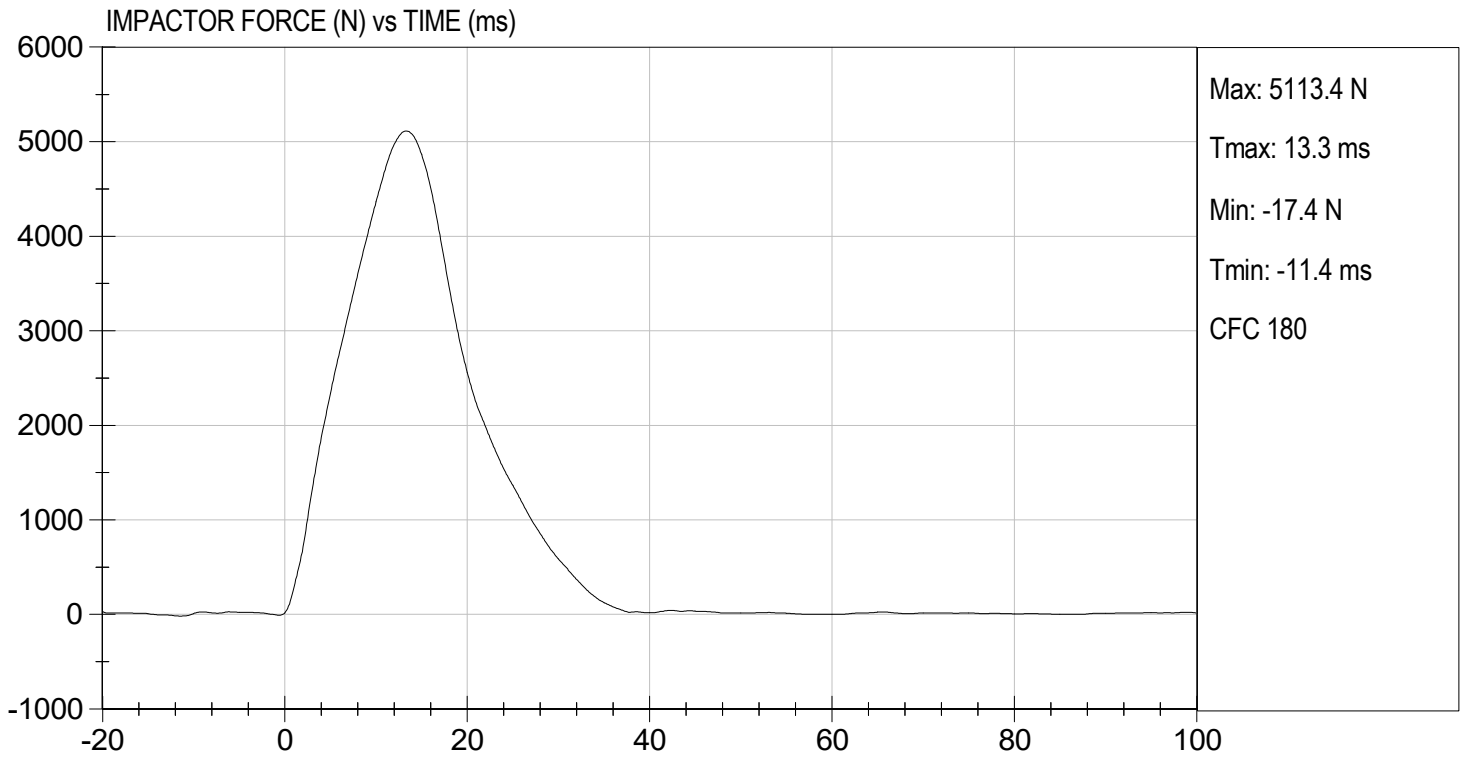
Laboratory Technician

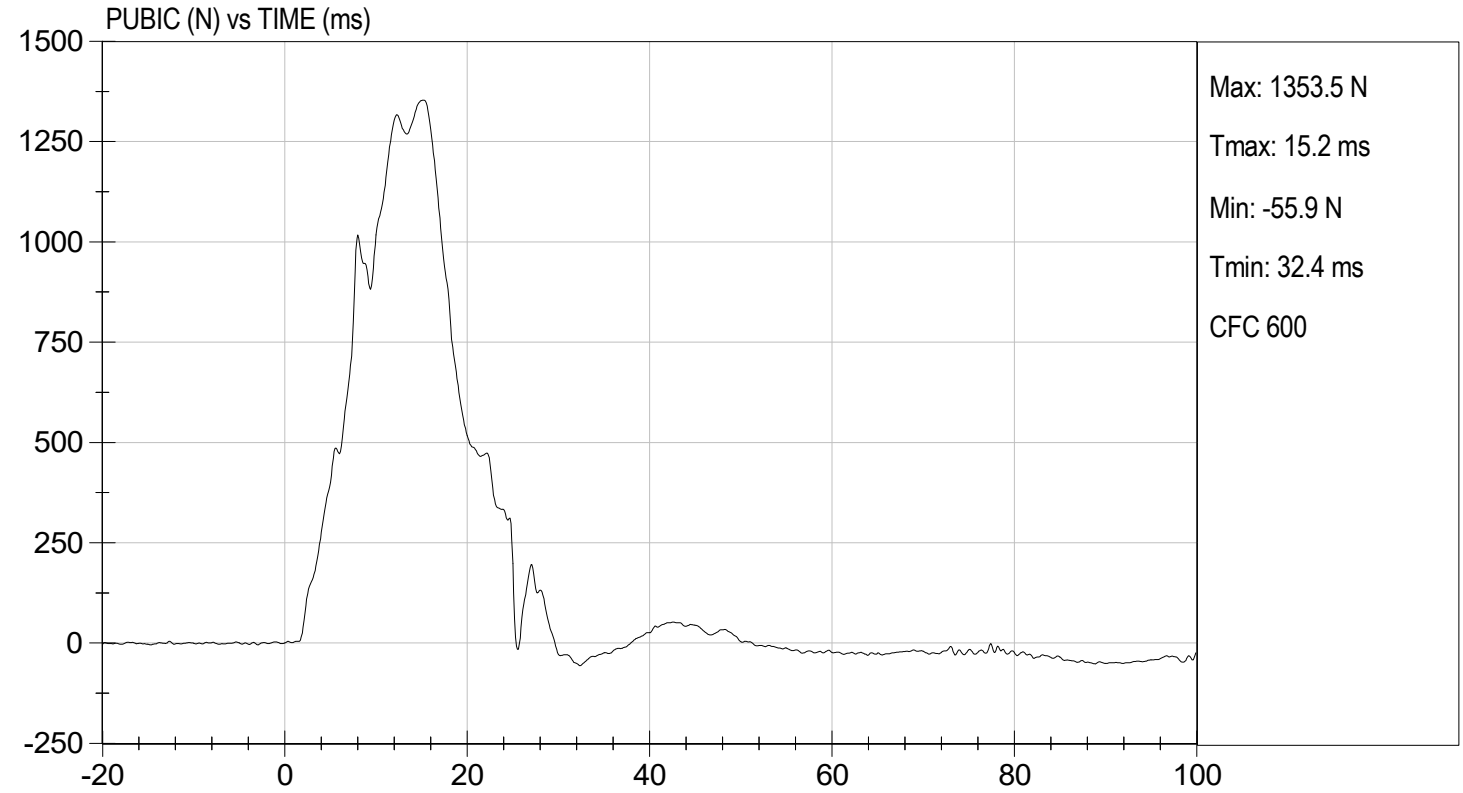
12/08/2023
Test Date

Approved By

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

TEST DATE: 12/08/2023
TEST #: D233249





MGA RESEARCH CORPORATION

THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233240

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Humidity	%	10 to 70	36	Pass
Probe Speed	m/s	5.40 to 5.60	5.40	Pass
Maximum Impactor Force (after 6 ms)	N	5100 to 6200	5156	Pass
Upper Rib Displacement	mm	34.0 to 41.0	38.9	Pass
Middle Rib Displacement	mm	37.0 to 45.0	40.7	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.6	Pass
		Overall Test Results		Pass

Laboratory Technician

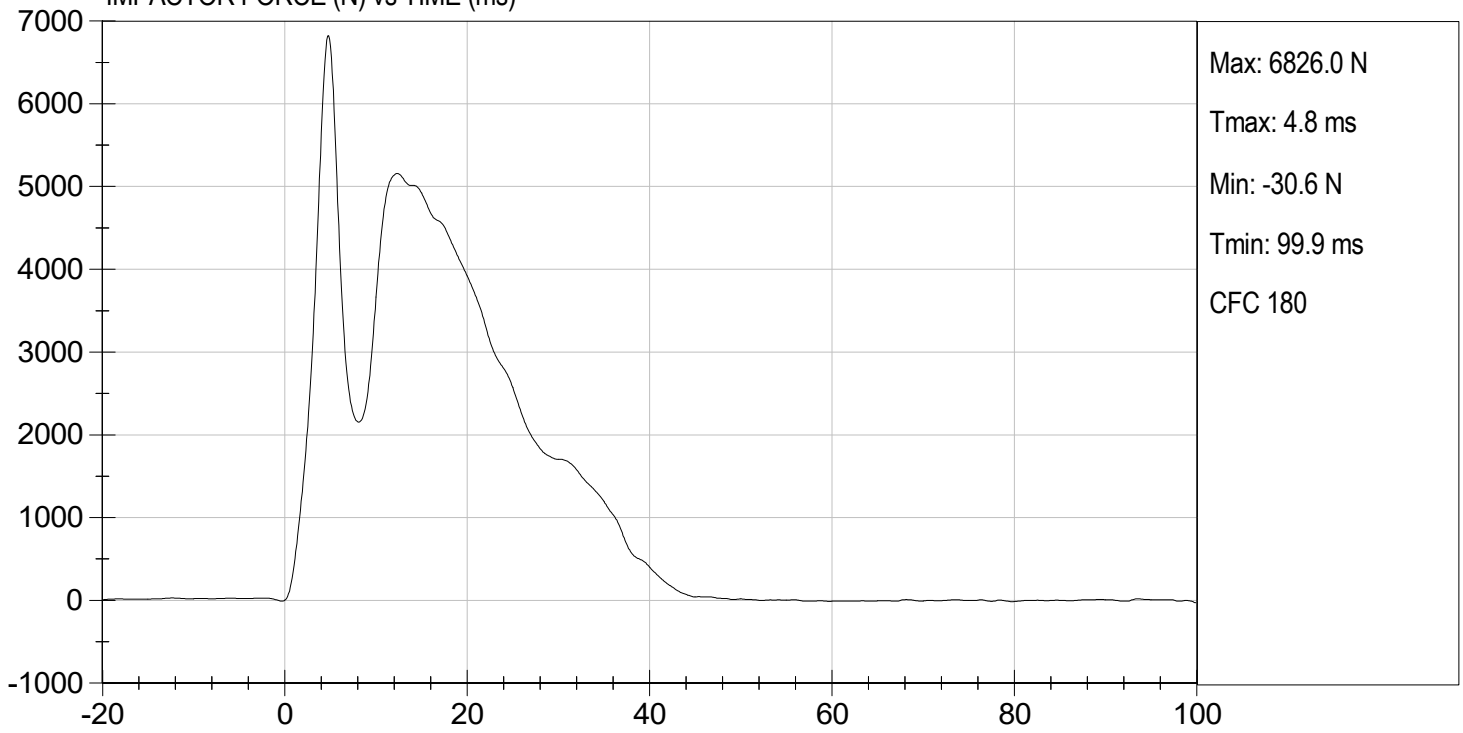
12/08/2023
Test Date

Approved By

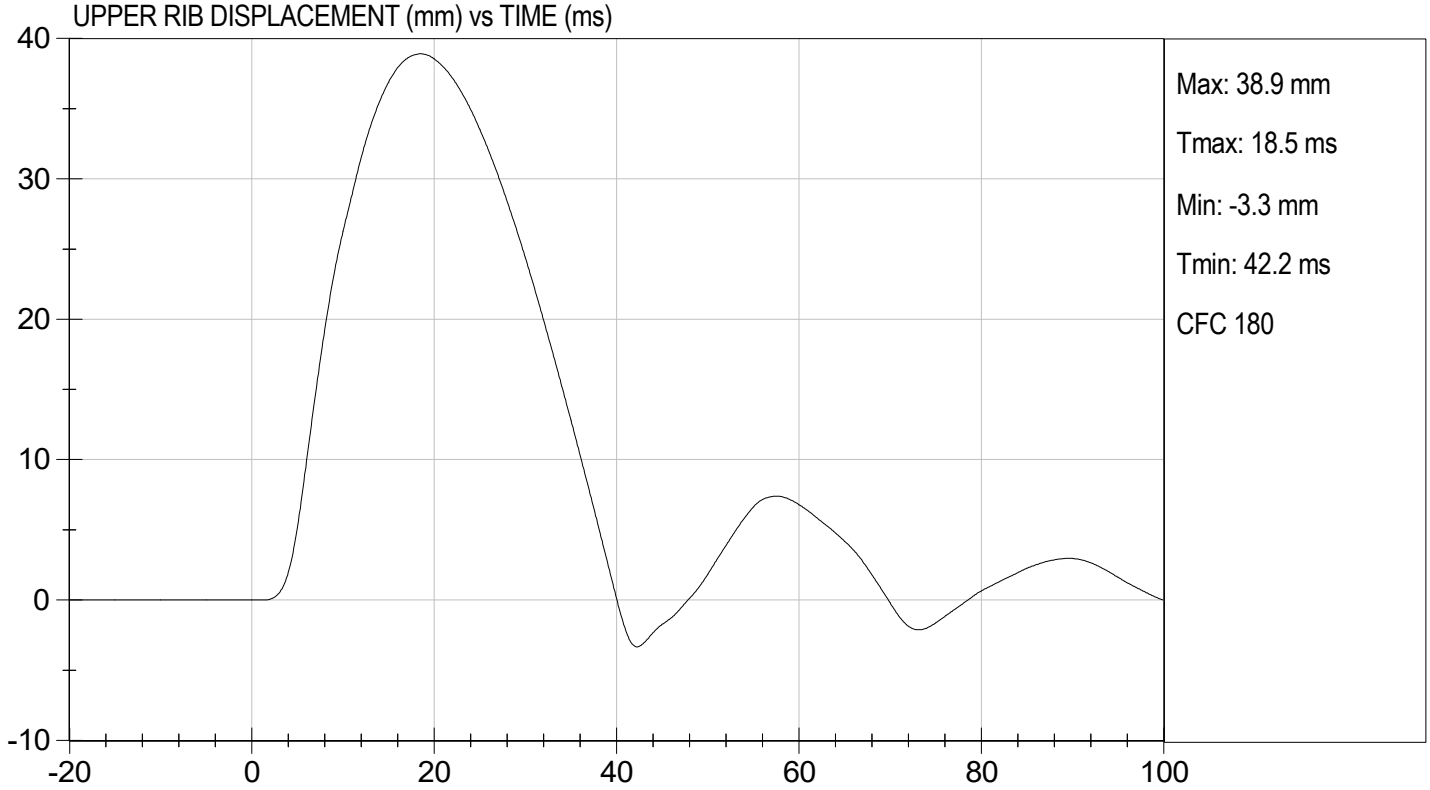
TEST DESC: THORAX IMPACT
VELOCITY: 17.73 ft/s, 5.40 m/s

TEST DATE: 12/08/2023
TEST #: D233240

IMPACTOR FORCE (N) vs TIME (ms)



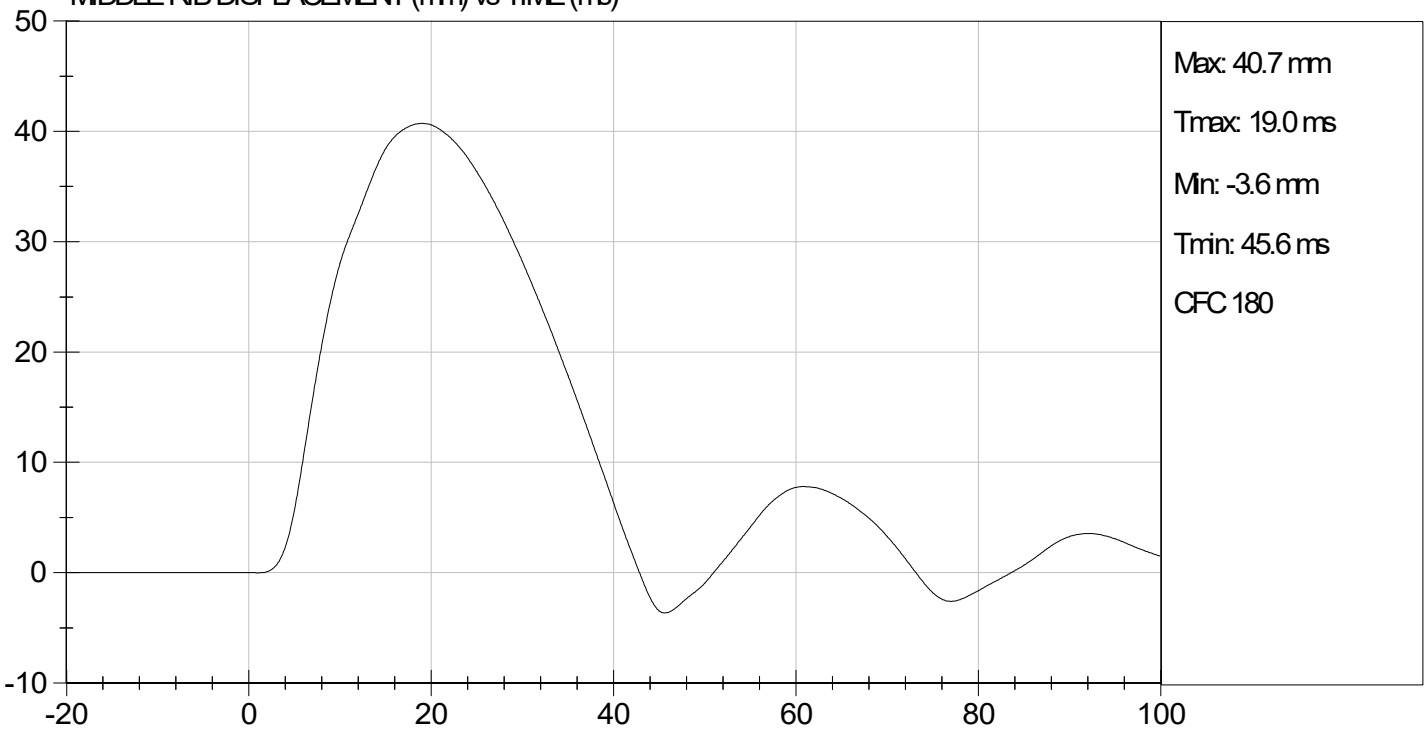
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



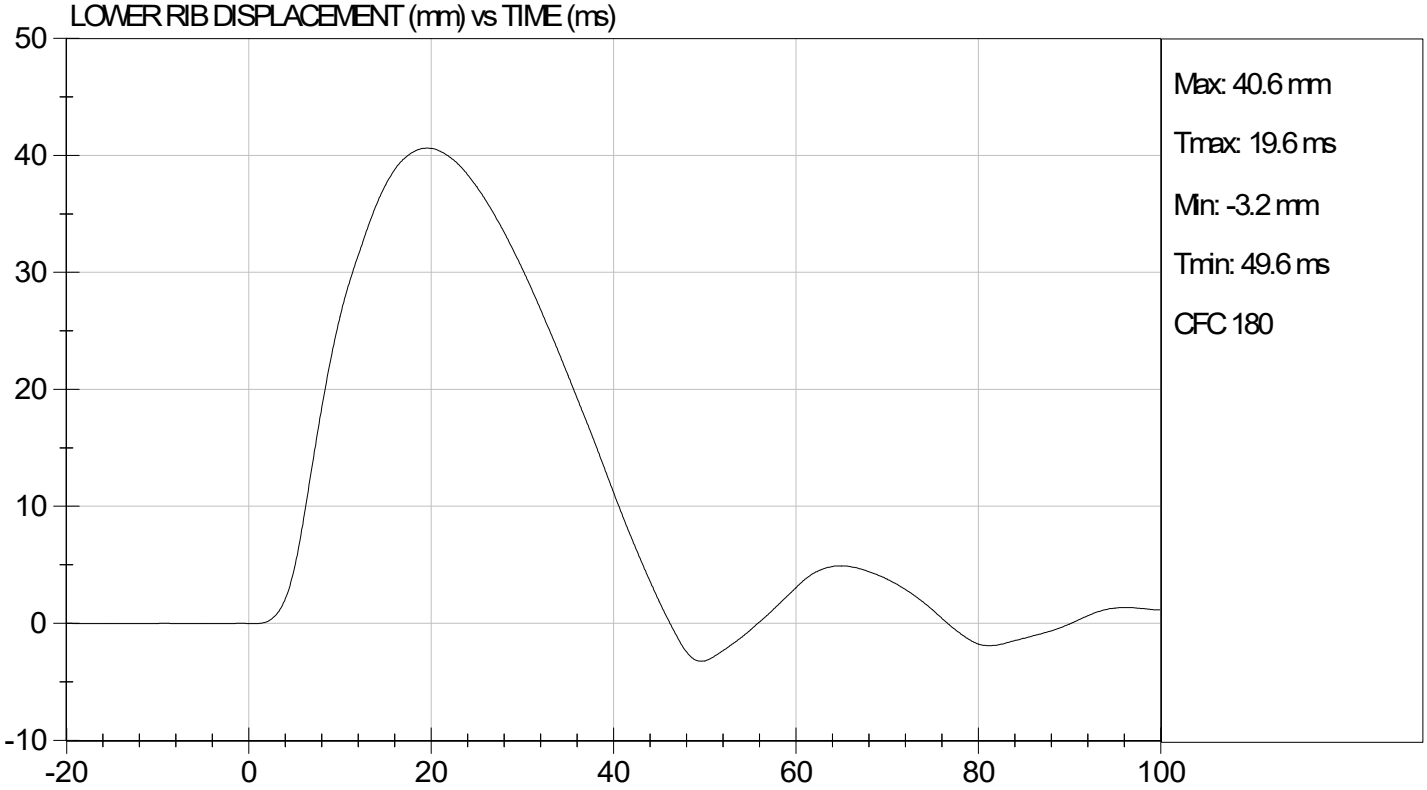
TEST DESC: THORAX IMPACT
VELOCITY: 17.73 ft/s, 5.40 m/s

TEST DATE: 12/08/2023
TEST #: D233240

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



QUALIFICATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

ES-2re External Measurements
SN: F032

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

MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: F032 **Test ID:** D233361

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	27	Pass
Peak Resultant Acceleration	G's	125 to 155	135	Pass
Peak Longitudinal Acceleration	G's	<= +/- 15.0	7.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

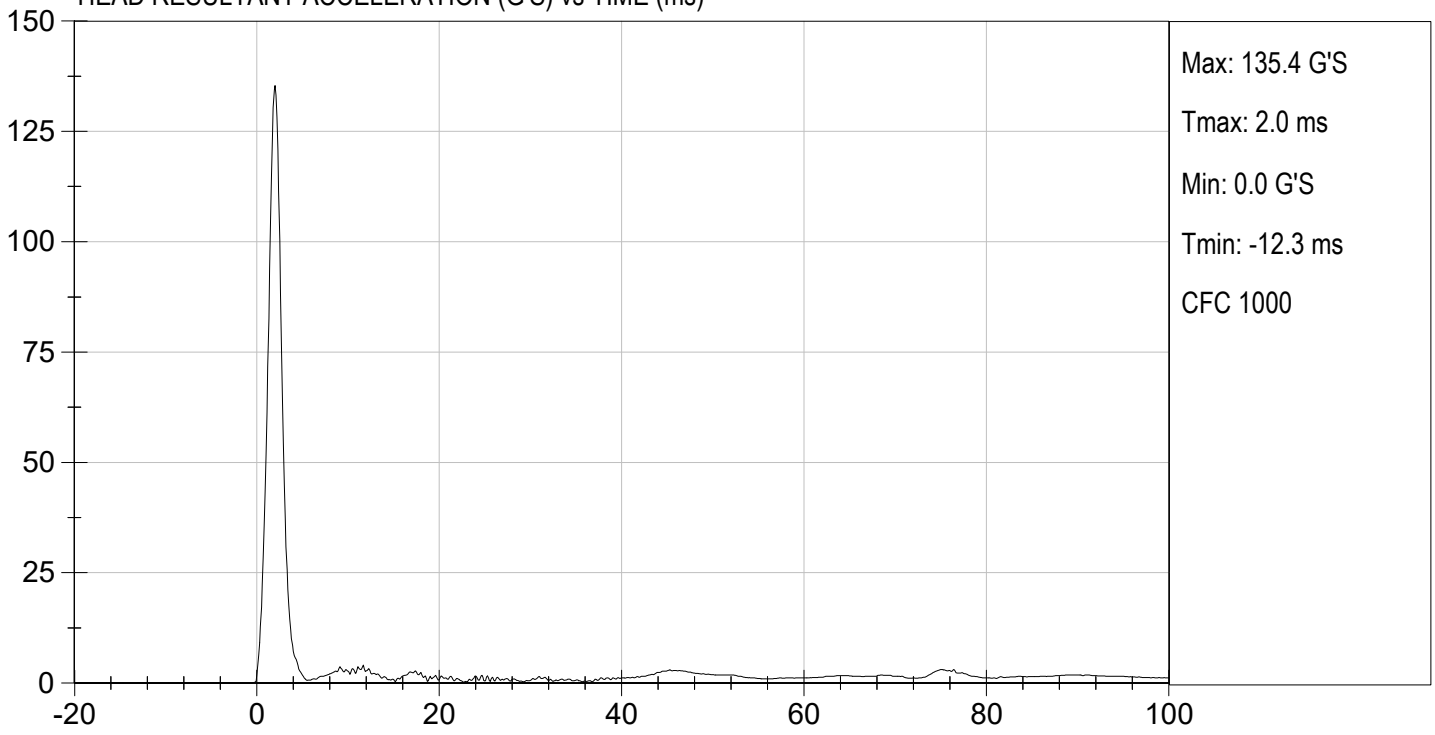
12/18/2023
Test Date

Approved By

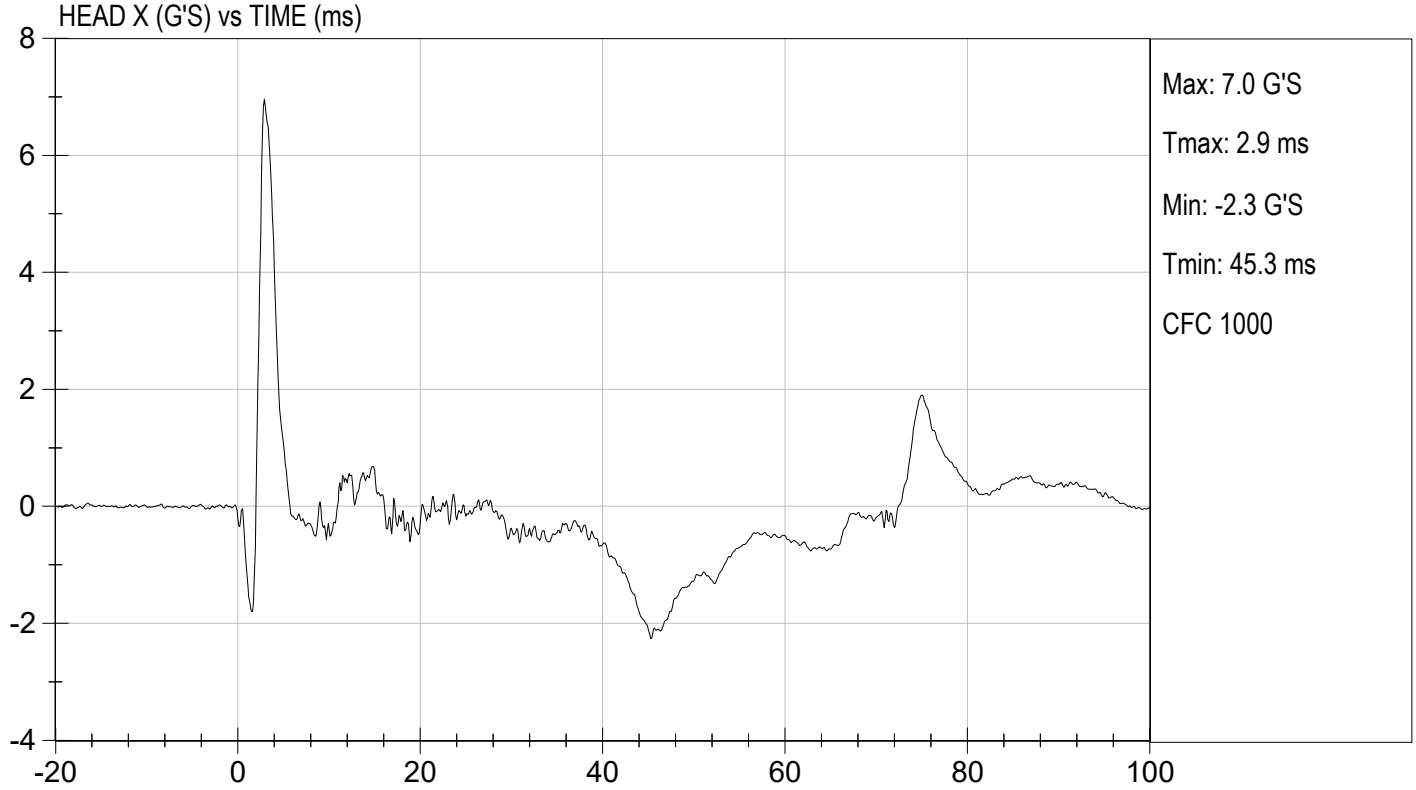
TEST DESC: HEAD DROP

TEST DATE: 12/18/2023
TEST #: D233361

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

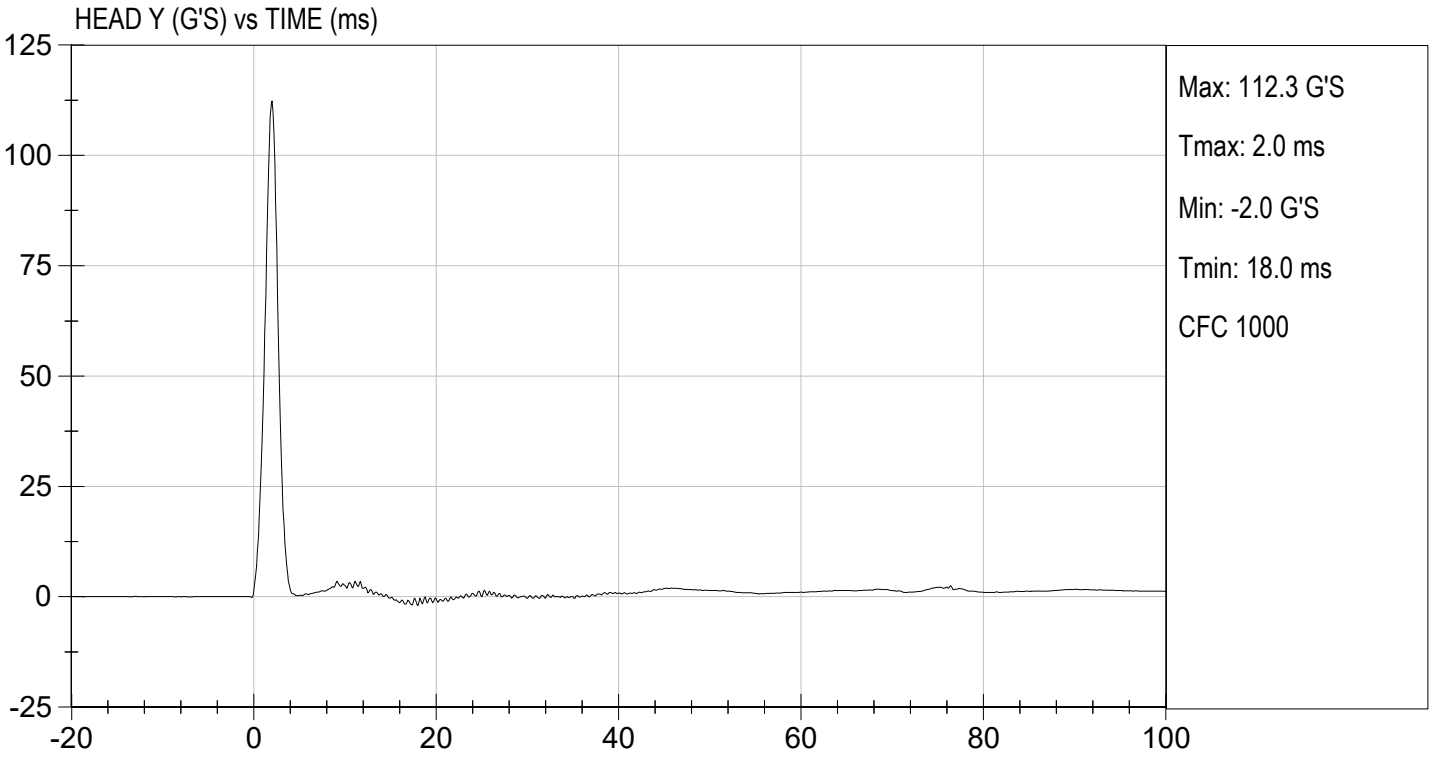


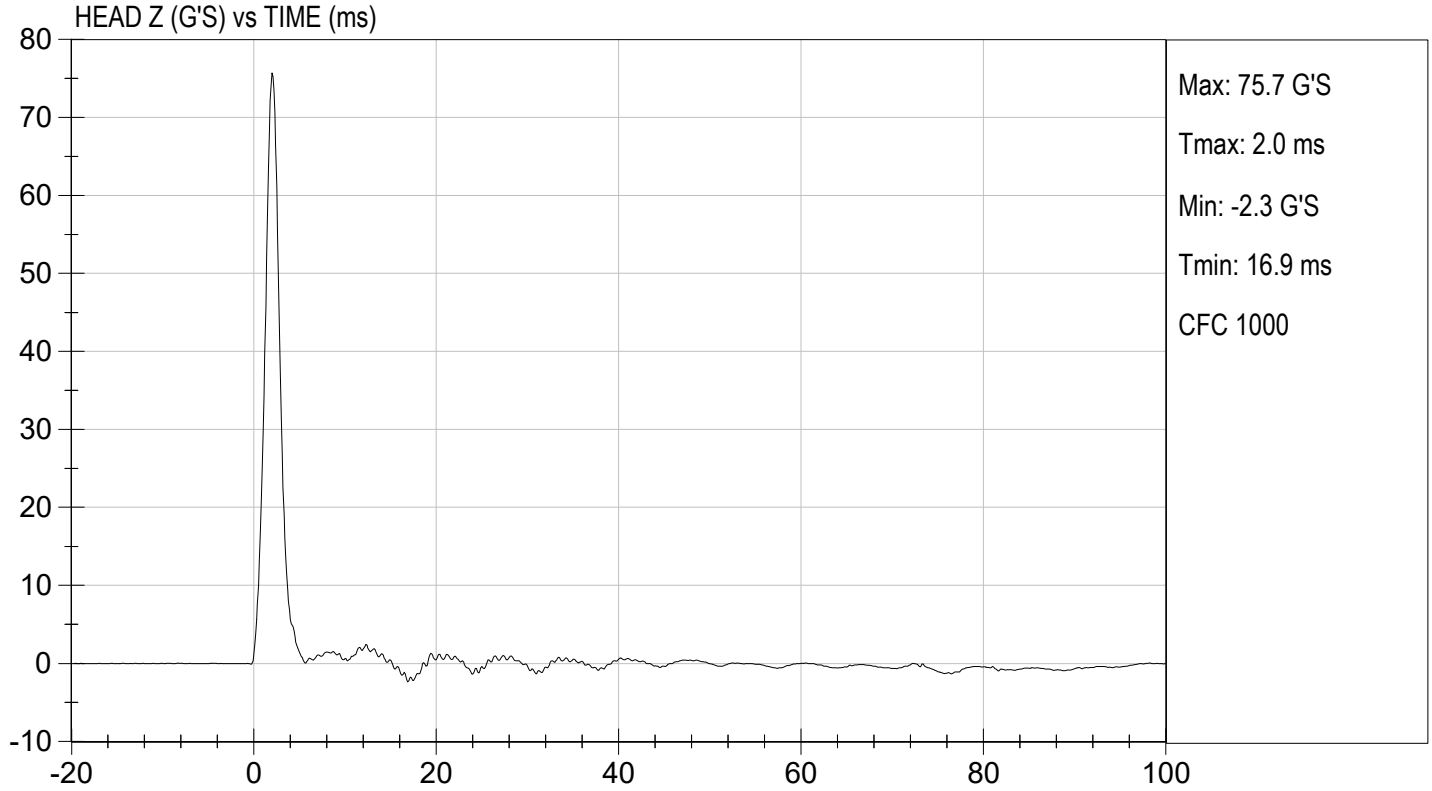
HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 12/18/2023
TEST #: D233361





MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233362

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	26	Pass
Pendulum Speed		m/s	3.30 to 3.50	3.41	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3 ms	m/s	-0.25 to -0.375	-0.33	Pass
	14 ms	m/s	-3.20 to -3.70	-3.52	Pass
	17 ms	m/s	>= -3.70	-3.57	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	49.8	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	61.1	Pass
Head Rotation Decay Time to 0 Degree		ms	53.0 to 88.0	55.4	Pass
			Overall Results		Pass

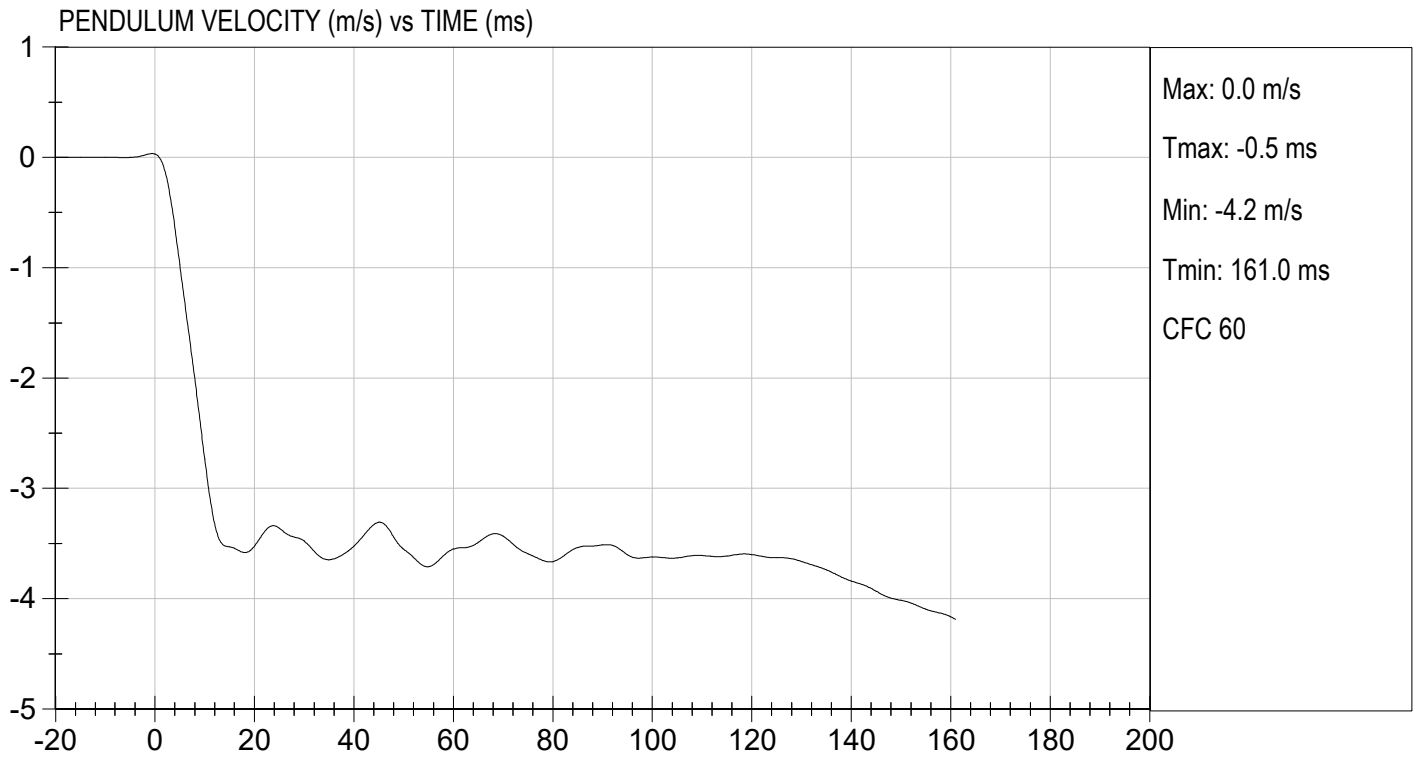
Laboratory Technician

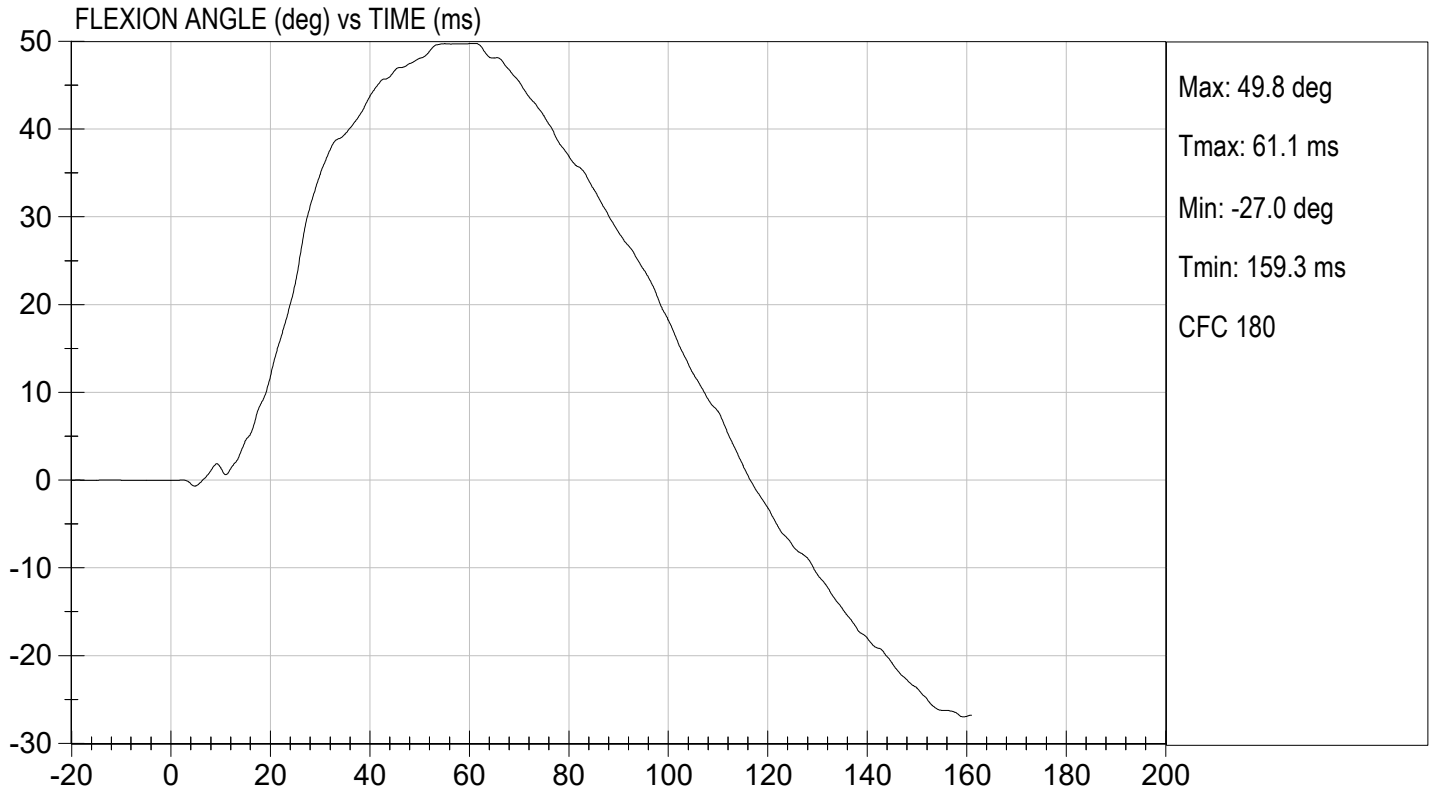
12/18/2023
Test Date

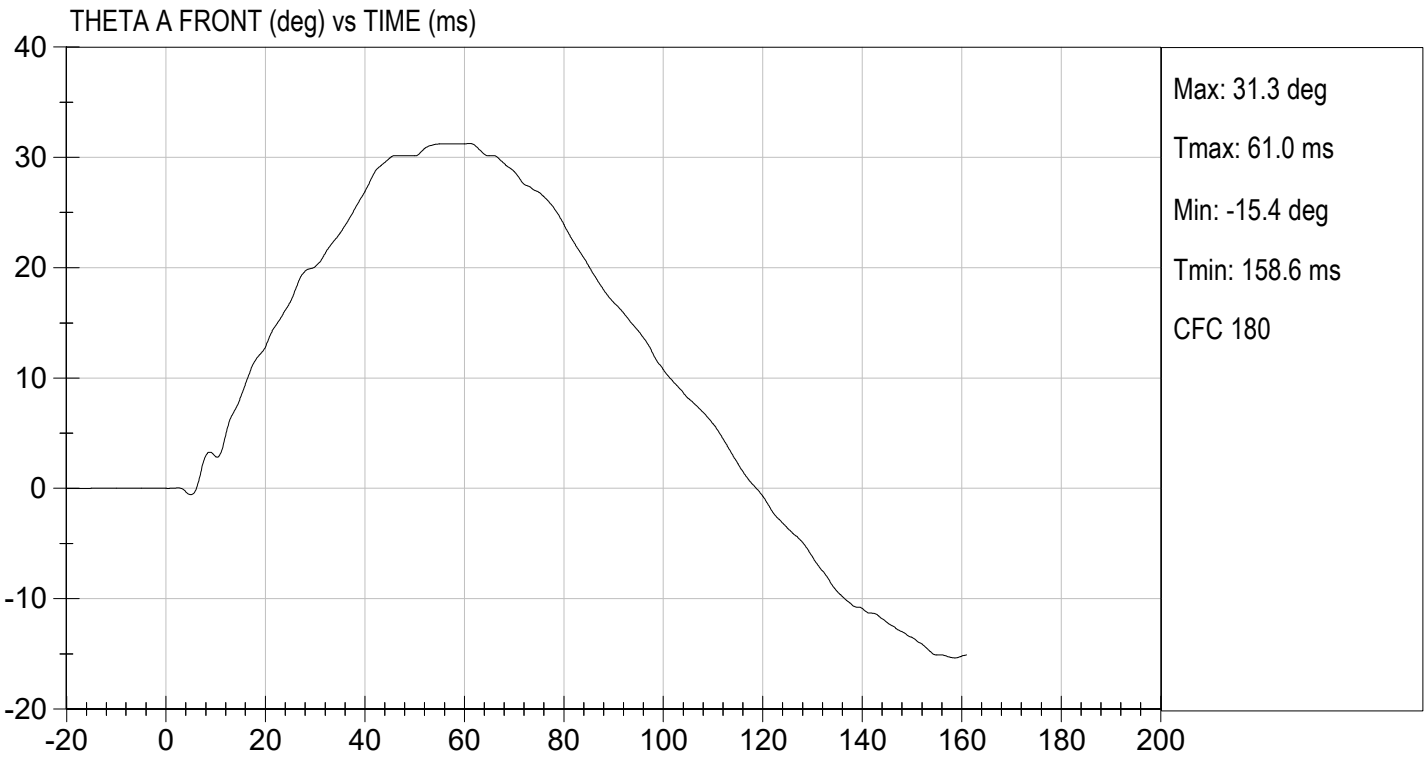
Approved By

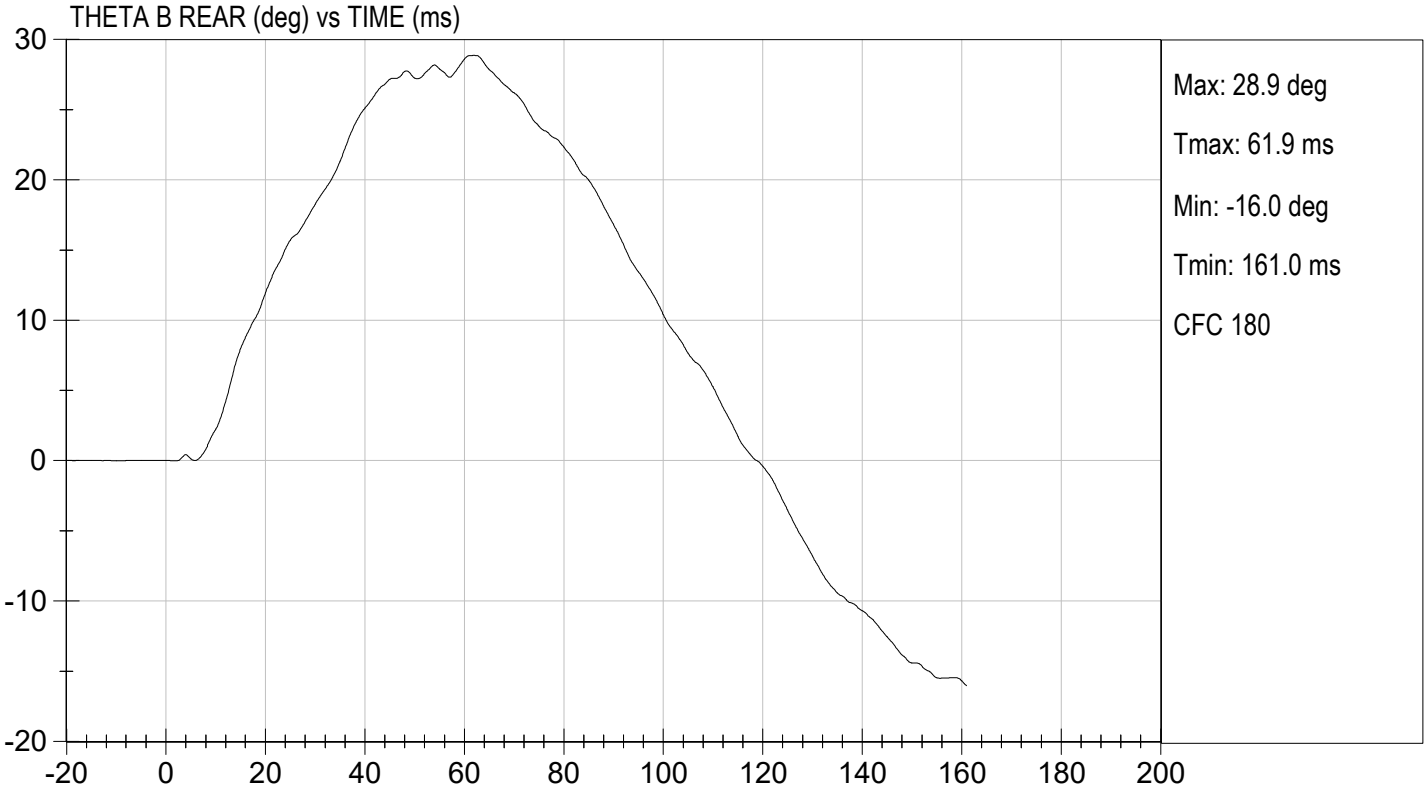
TEST DESC: NECK BENDING
VELOCITY: 11.19 ft/s, 3.41 m/s

TEST DATE: 12/18/2023
TEST #: D233362



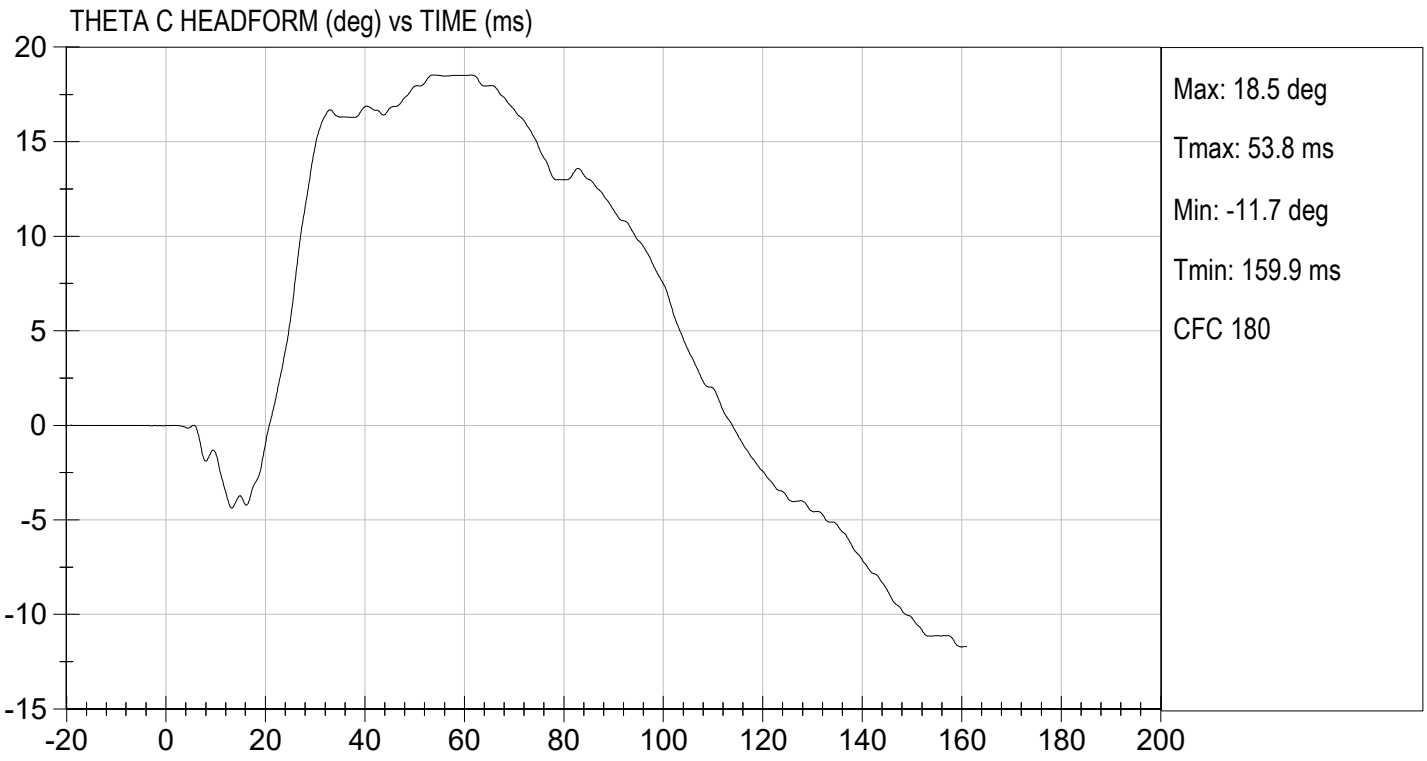



THETA A FRONT (deg) vs TIME (ms)
40
30
20
10
0
-10
-20
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 31.3 deg
Tmax: 61.0 ms
Min: -15.4 deg
Tmin: 158.6 ms
CFC 180


THETA B REAR (deg) vs TIME (ms)
30
20
10
0
-10
-20
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 28.9 deg
Tmax: 61.9 ms
Min: -16.0 deg
Tmin: 161.0 ms
CFC 180

TEST DESC: NECK BENDING
VELOCITY: 11.19 ft/s, 3.41 m/s

TEST DATE: 12/18/2023
TEST #: D233362



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233363

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Pendulum Speed	m/s	4.20 to 4.40	4.2	Pass
Peak Impactor Acceleration	G's	7.5 to 10.5	10.0	Pass
		Overall Test Results		Pass

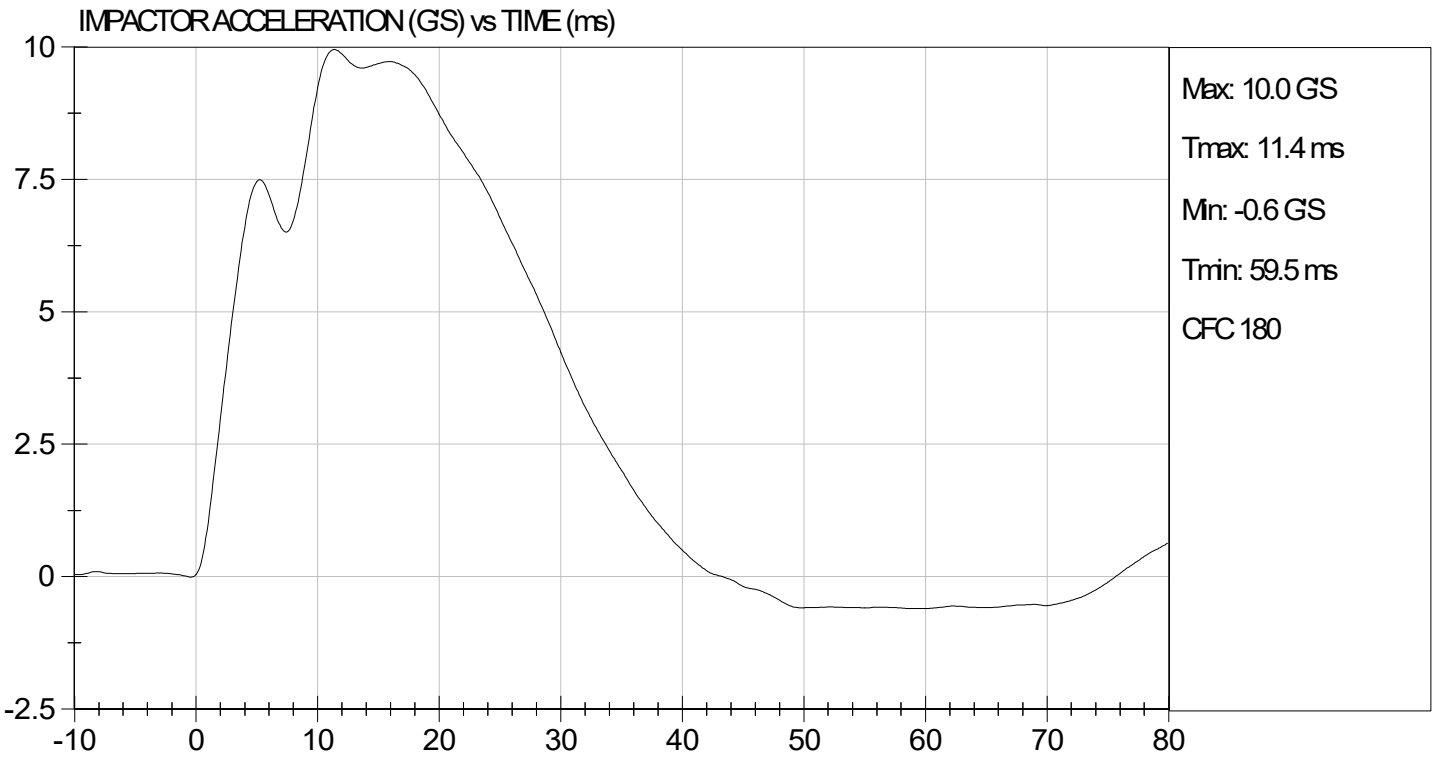
Laboratory Technician

12/18/2023
Test Date

Approved By

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

TEST DATE: 12/18/2023
TEST #: D233363



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

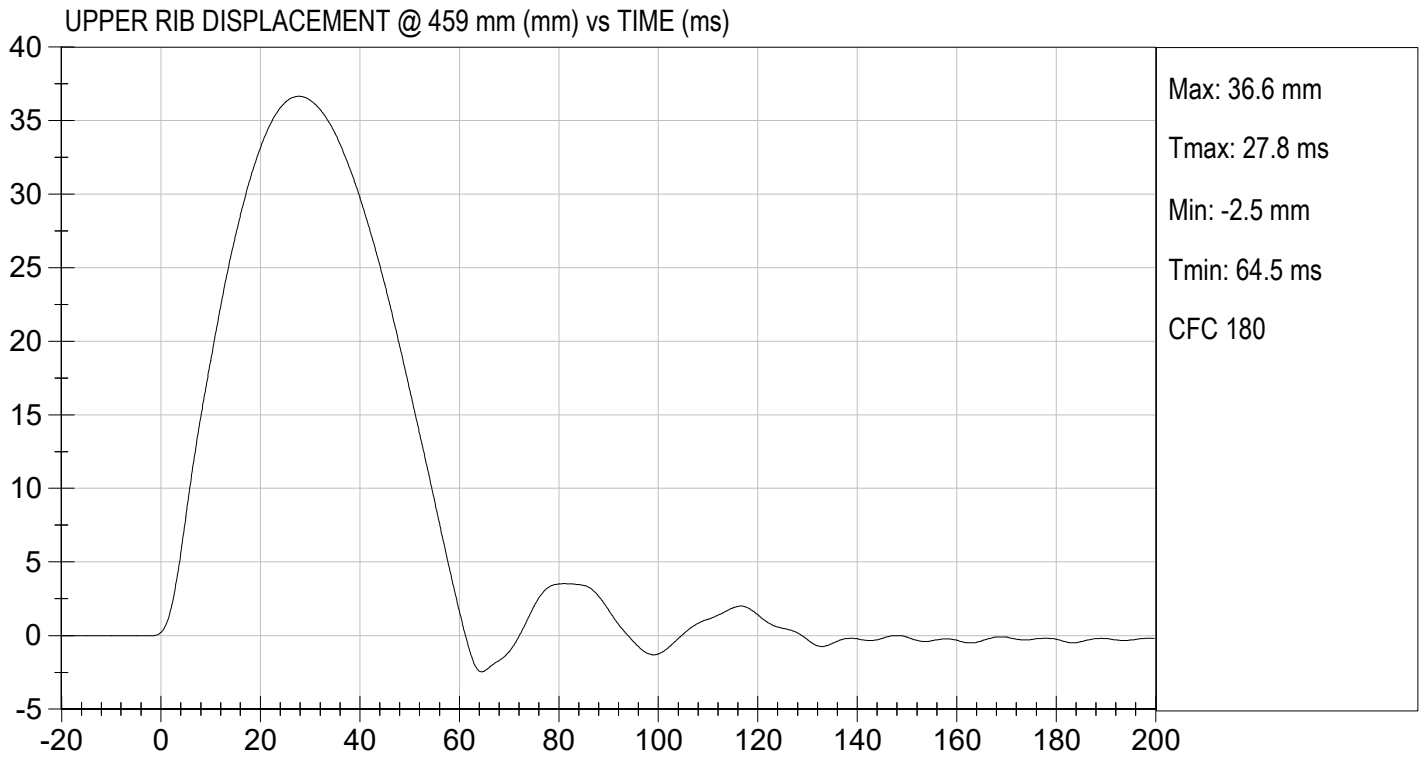
ATD Serial No: F032 **Test I.D:** D233364

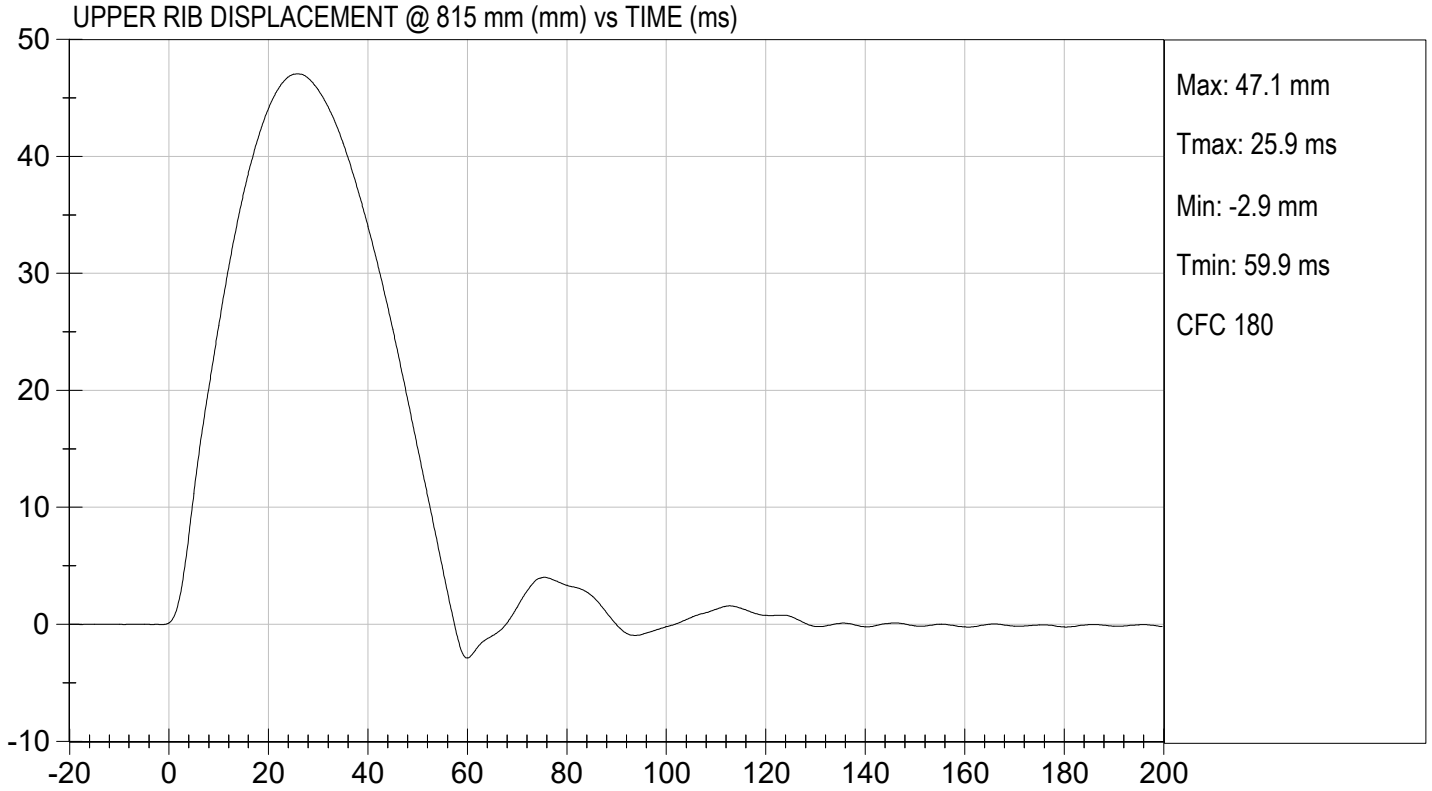
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	27	Pass
Displacement at 459 mm	mm	36.0 to 40.0	36.6	Pass
Displacement at 815 mm	mm	46.0 to 51.0	47.1	Pass
		Overall Test Results		Pass

Laboratory Technician

12/18/2023
Test Date

Approved By


UPPER RIB DISPLACEMENT @ 459 mm (mm) vs TIME (ms)
Max: 36.6 mm
Tmax: 27.8 ms
Min: -2.5 mm
Tmin: 64.5 ms
CFC 180
40
35
30
25
20
15
10
5
0
-5
-20
0
20
40
60
80
100
120
140
160
180
200


UPPER RIB DISPLACEMENT @ 815 mm (mm) vs TIME (ms)
Max: 47.1 mm
Tmax: 25.9 ms
Min: -2.9 mm
Tmin: 59.9 ms
CFC 180
50
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200

MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233365

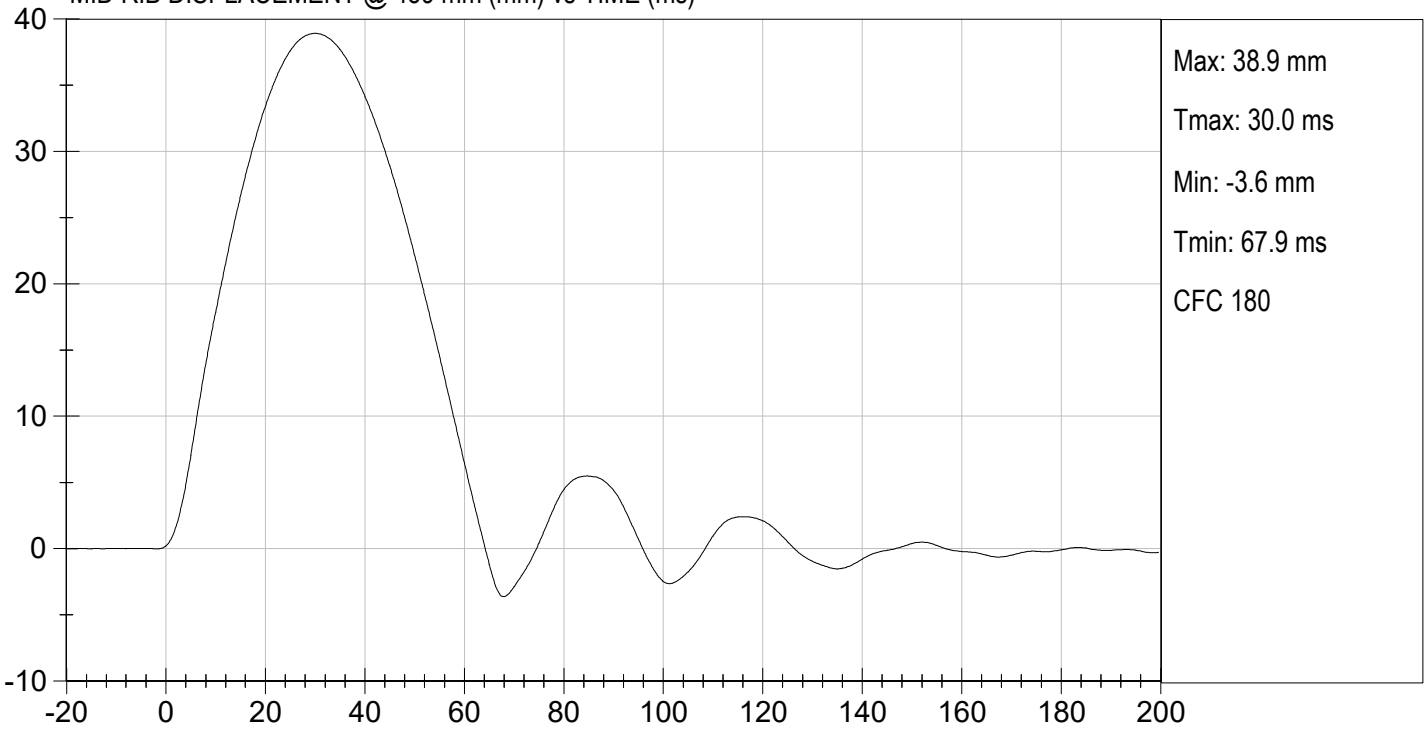
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	27	Pass
Displacement at 459 mm	mm	36.0 to 40.0	38.9	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.4	Pass
		Overall Test Results		Pass

Laboratory Technician

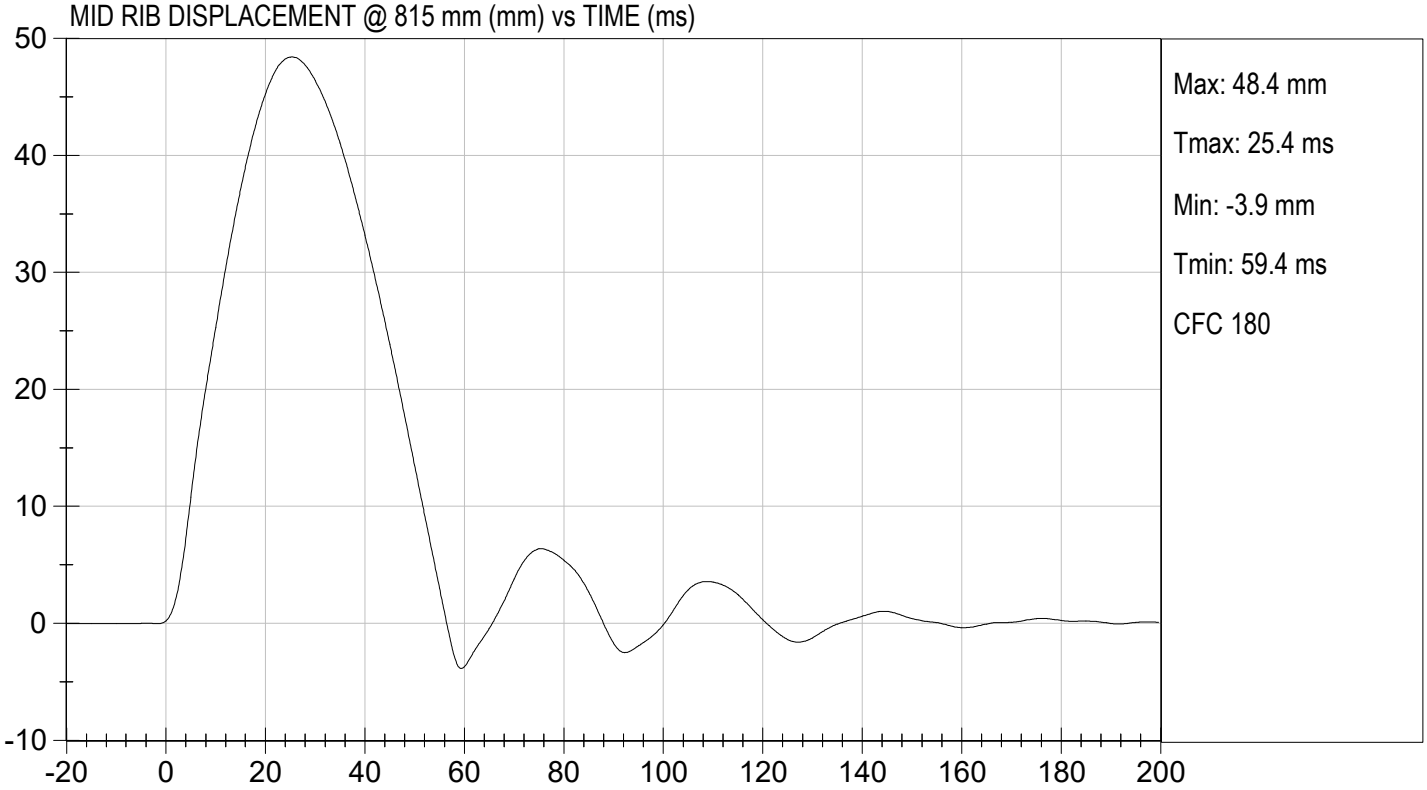
12/18/2023
Test Date

Approved By

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



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



MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

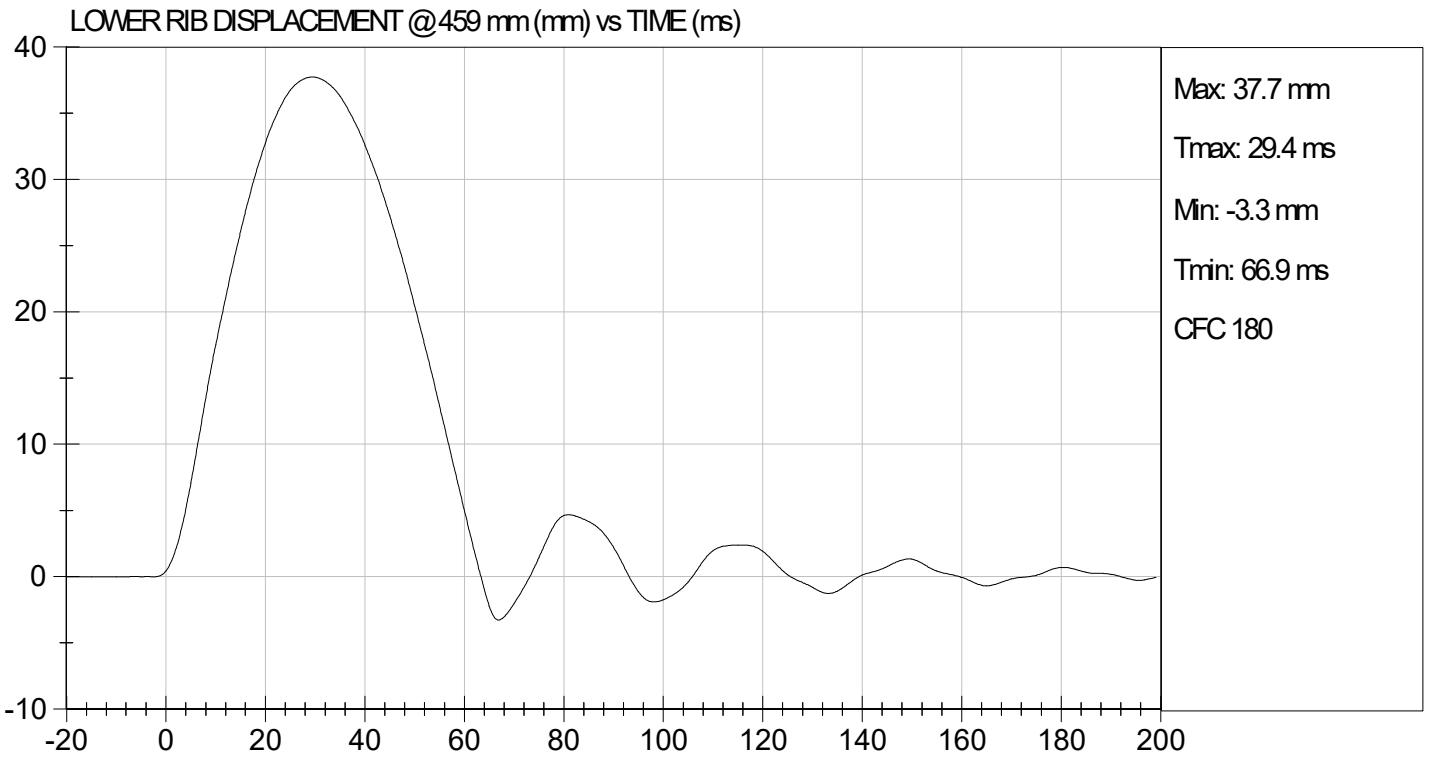
ATD Serial No: F032 **Test I.D:** D233366

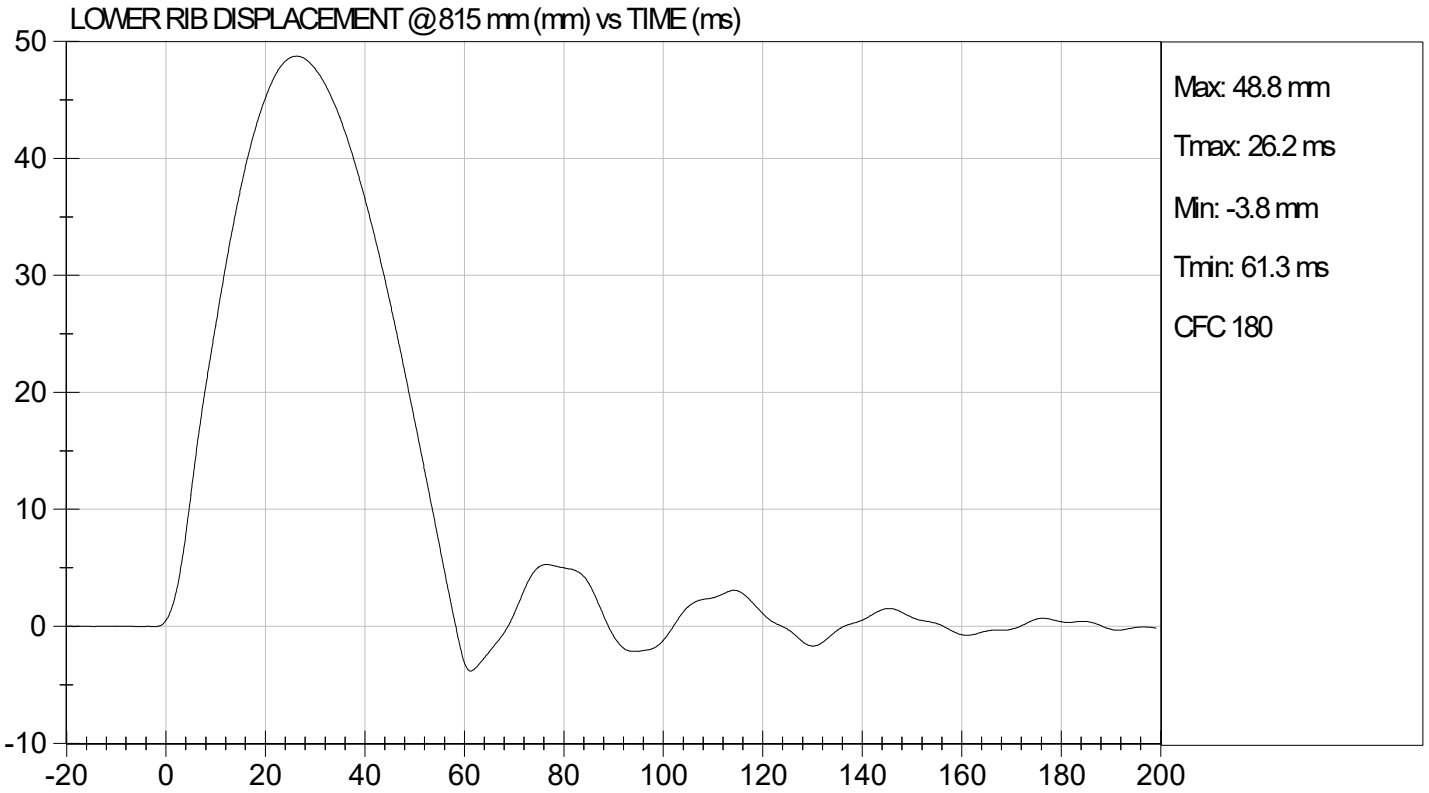
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	27	Pass
Displacement at 459 mm	mm	36.0 to 40.0	37.7	Pass
Displacement at 815 mm	mm	46.0 to 51.0	48.8	Pass
		Overall Test Results		Pass

Laboratory Technician

12/18/2023
Test Date

Approved By


LOWER RIB DISPLACEMENT @459 mm (mm) vs TIME (ms)
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 37.7 mm
Tmax: 29.4 ms
Min: -3.3 mm
Tmin: 66.9 ms
CFC 180


LOWER RIB DISPLACEMENT @815 mm (mm) vs TIME (ms)
50
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 48.8 mm
Tmax: 26.2 ms
Min: -3.8 mm
Tmin: 61.3 ms
CFC 180

MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233367

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Speed	m/s	3.90 to 4.10	4.01	Pass
Maximum Impactor Force	N	4000 to 4800	4102	Pass
Time of Maximum Impactor Force	ms	10.6 to 13.0	11.5	Pass
Maximum Total Abdomen Force	N	2200 to 2700	2464	Pass
Time of Maximum Abdomen Force	ms	10.0 to 12.3	11.7	Pass
		Overall Test Results		Pass

Laboratory Technician

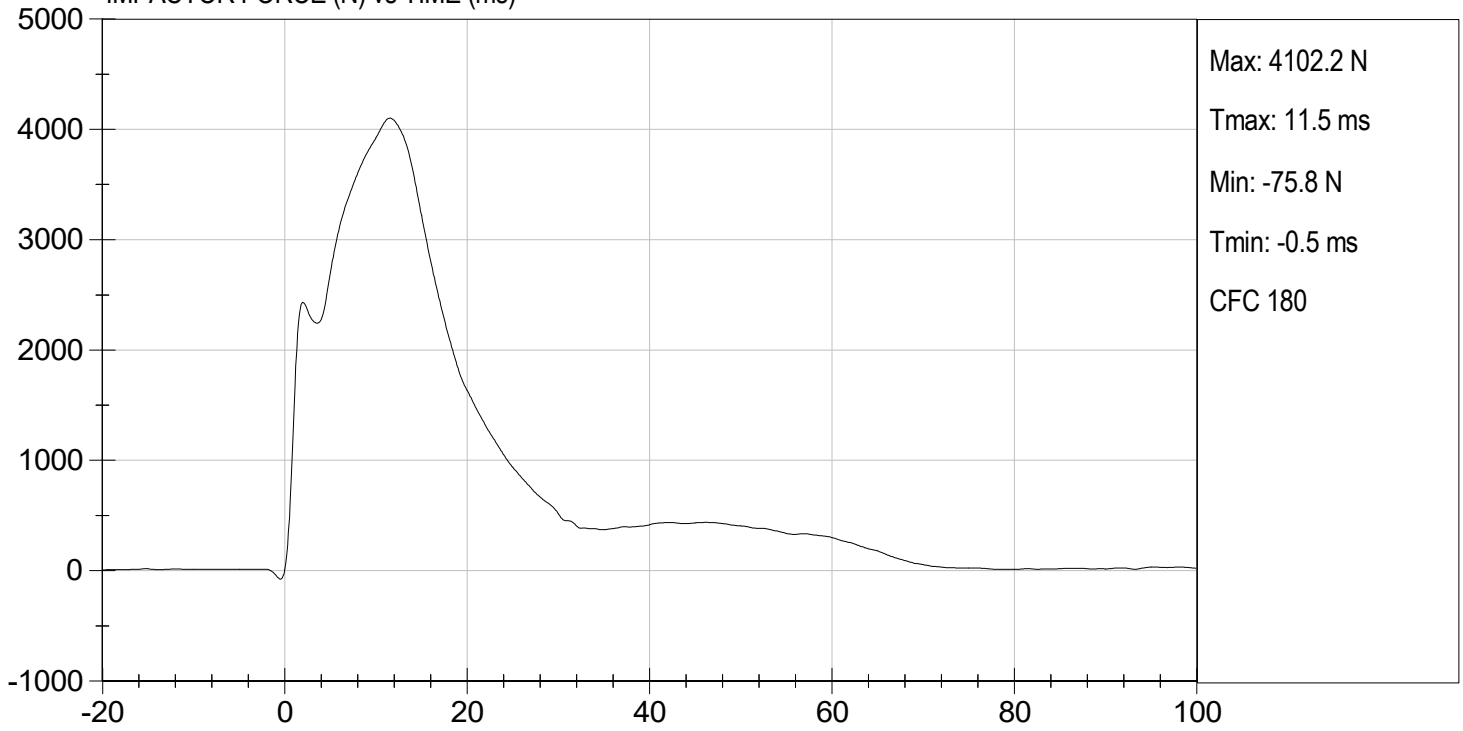
12/18/2023
Test Date

Approved By

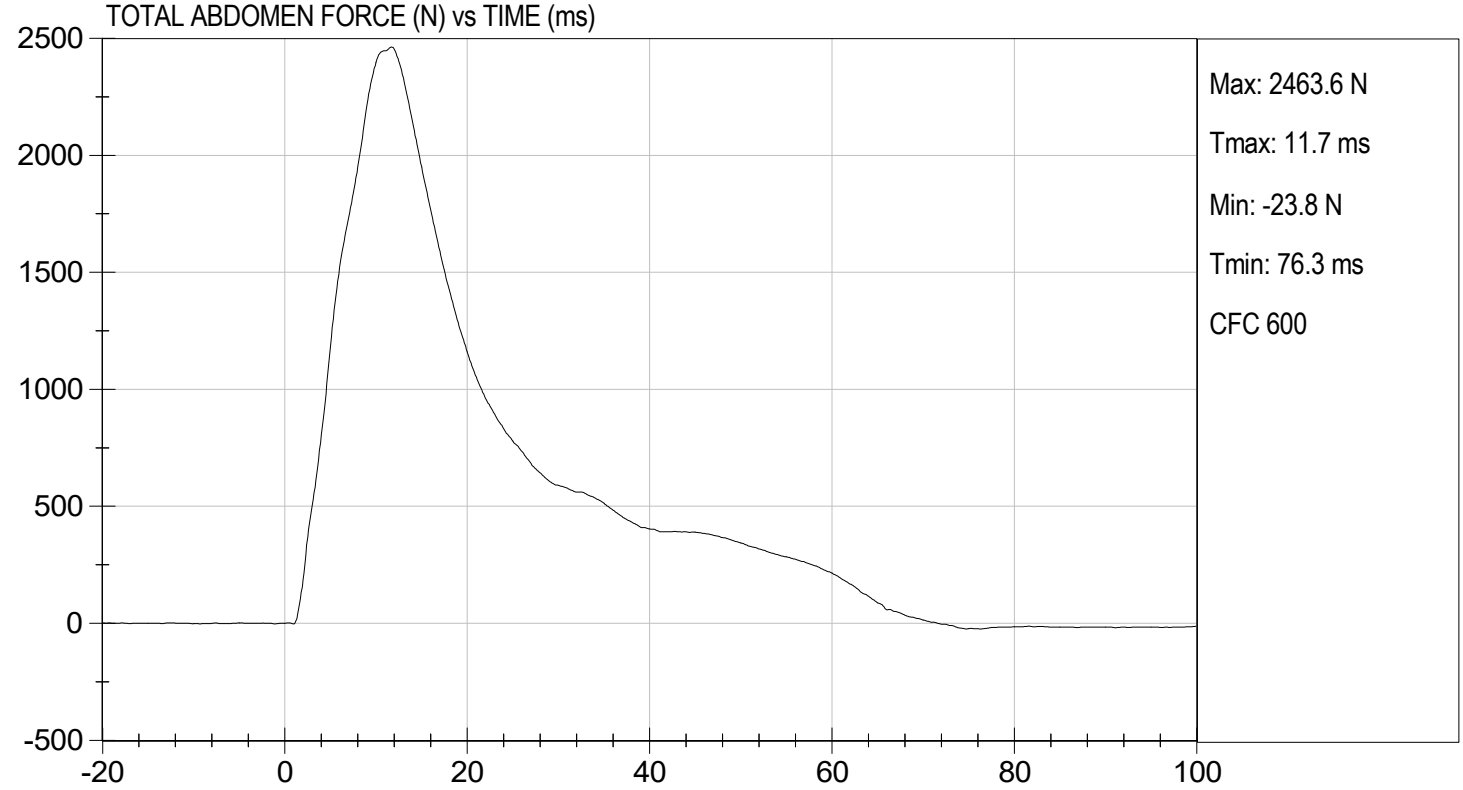
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.15 ft/s, 4.01 m/s

TEST DATE: 12/18/2023
TEST #: D233367

IMPACTOR FORCE (N) vs TIME (ms)



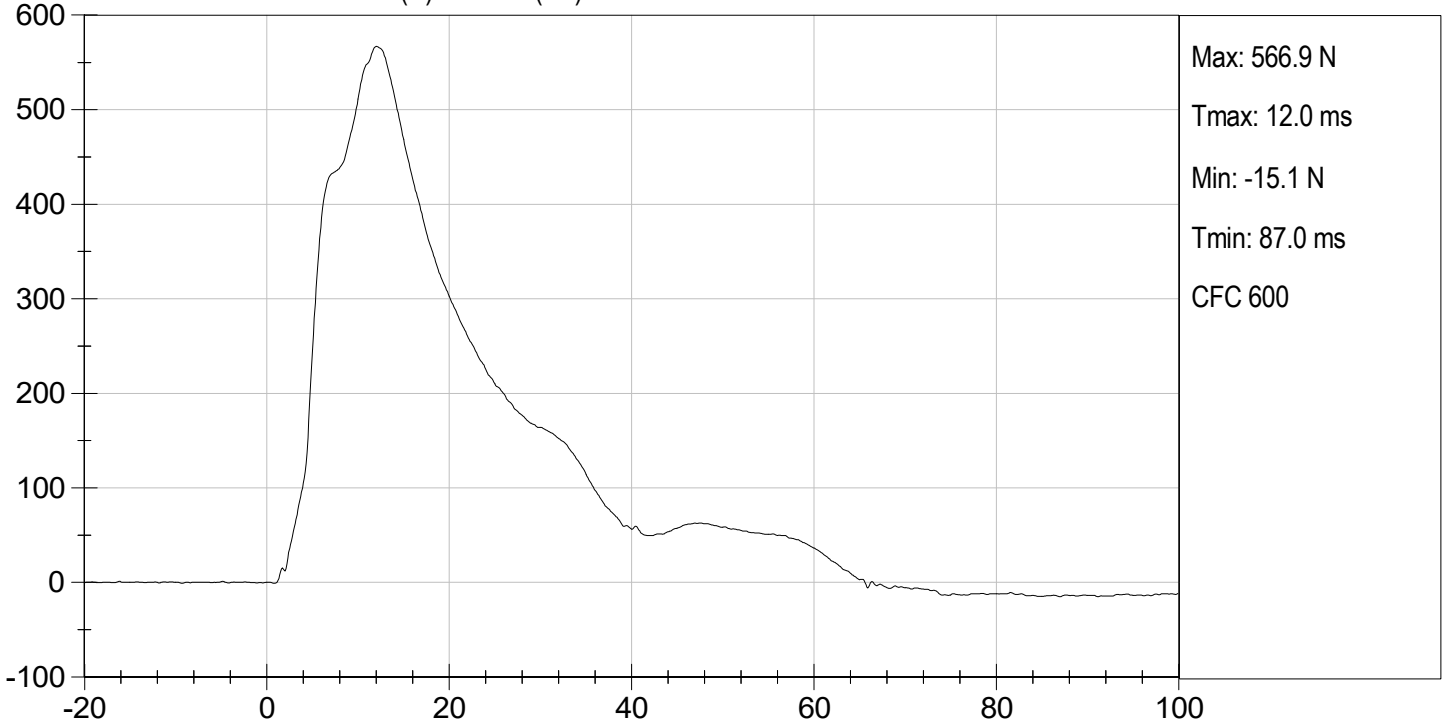
TOTAL ABDOMEN FORCE (N) vs TIME (ms)



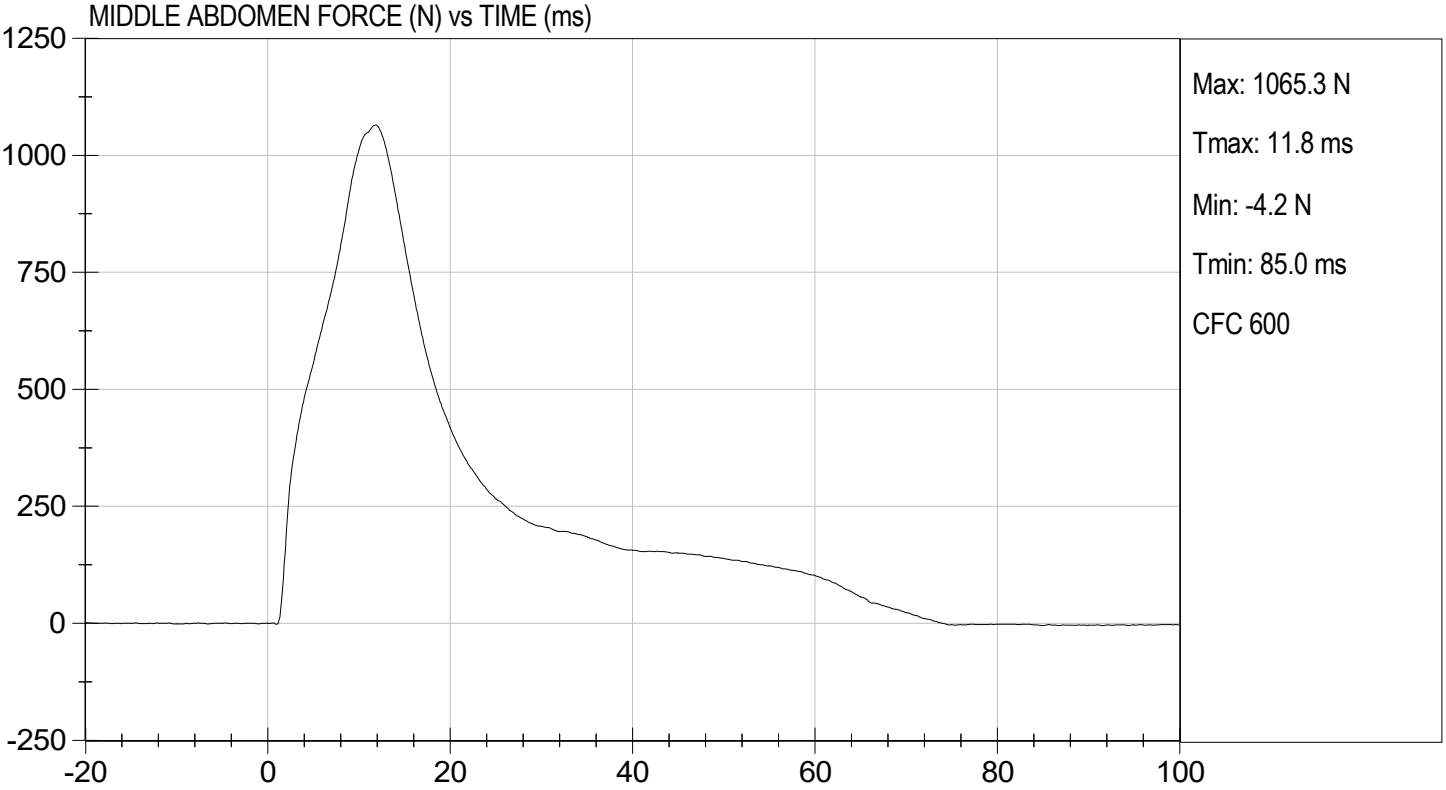
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.15 ft/s, 4.01 m/s

TEST DATE: 12/18/2023
TEST #: D233367

FRONT ABDOMEN FORCE (N) vs TIME (ms)

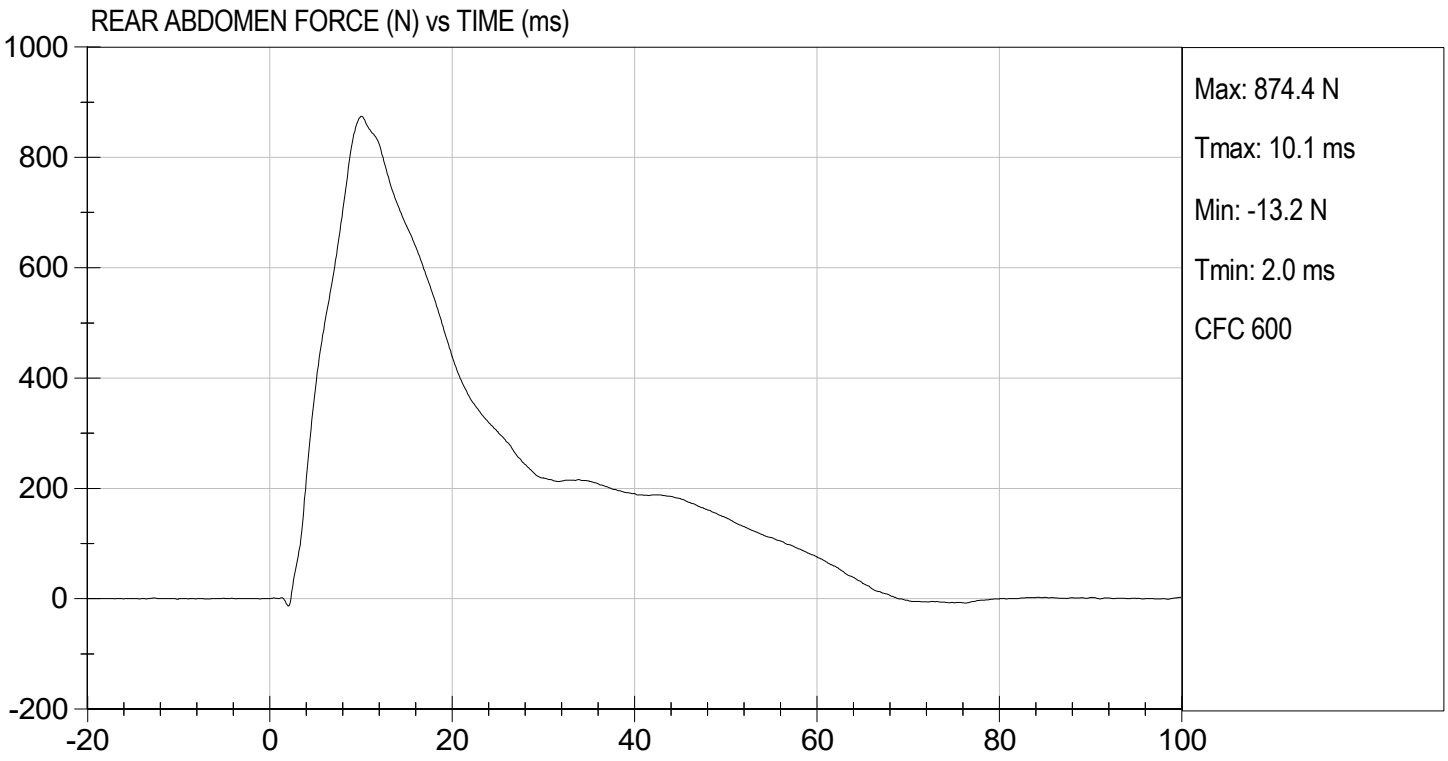


MIDDLE ABDOMEN FORCE (N) vs TIME (ms)



TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.15 ft/s, 4.01 m/s

TEST DATE: 12/18/2023
TEST #: D233367



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233368

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	26	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.05	Pass
Pendulum Velocity	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.417	Pass
	27 ms	m/s	-6.50 to -5.80	-5.97	Pass
	30 ms	m/s	>= -6.50	-6.29	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	49.5	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	47.0	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	40	Pass
			Overall Results		Pass

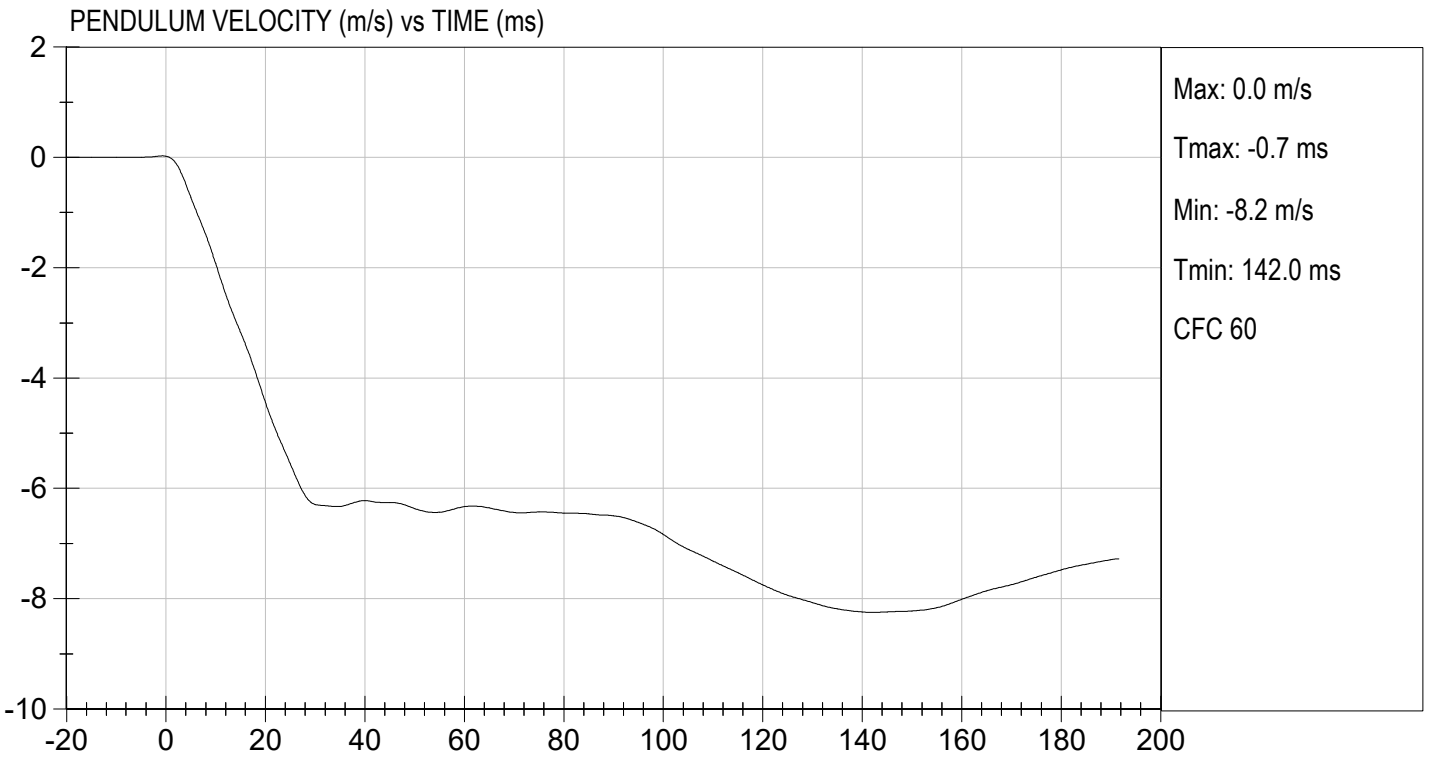
Laboratory Technician

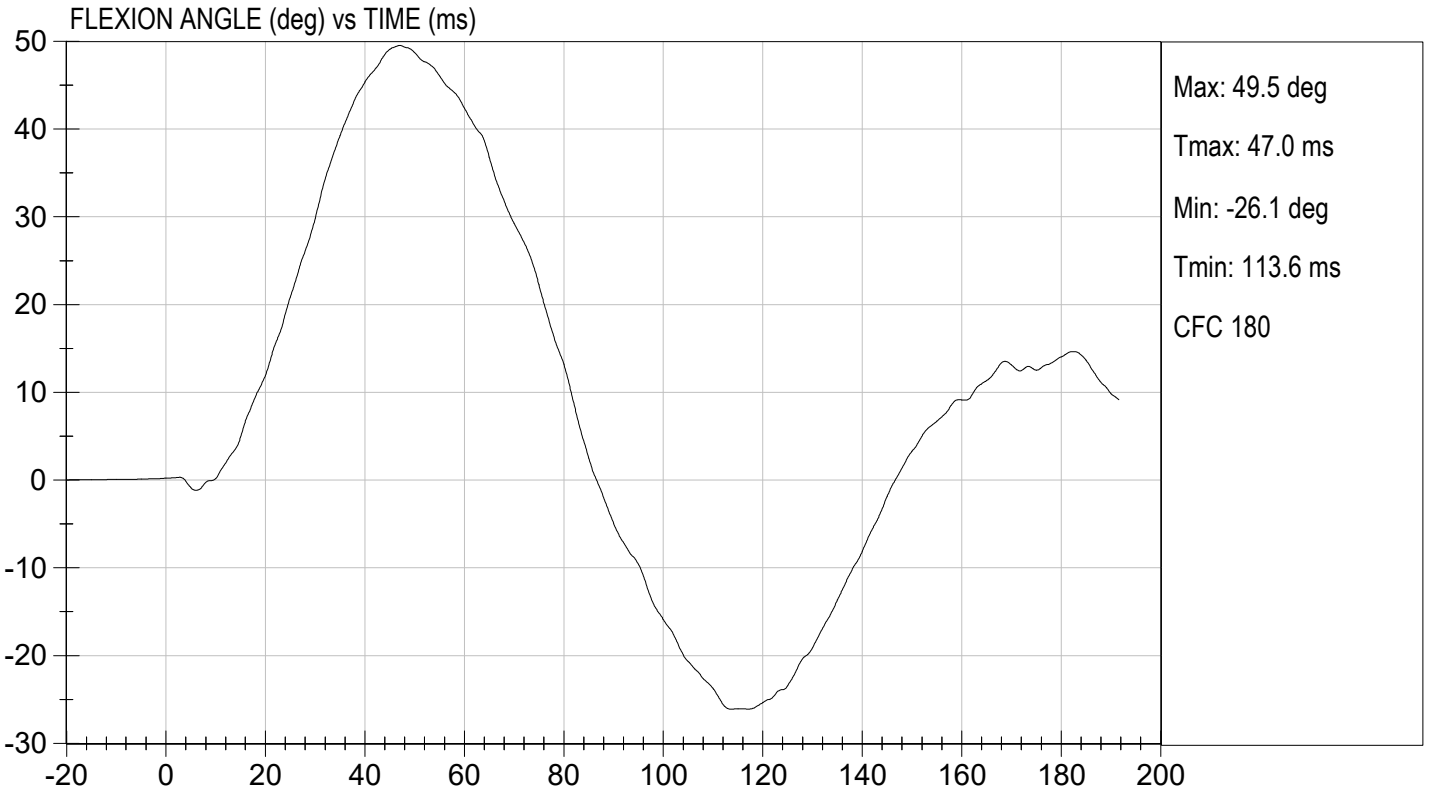
12/18/2023
Test Date

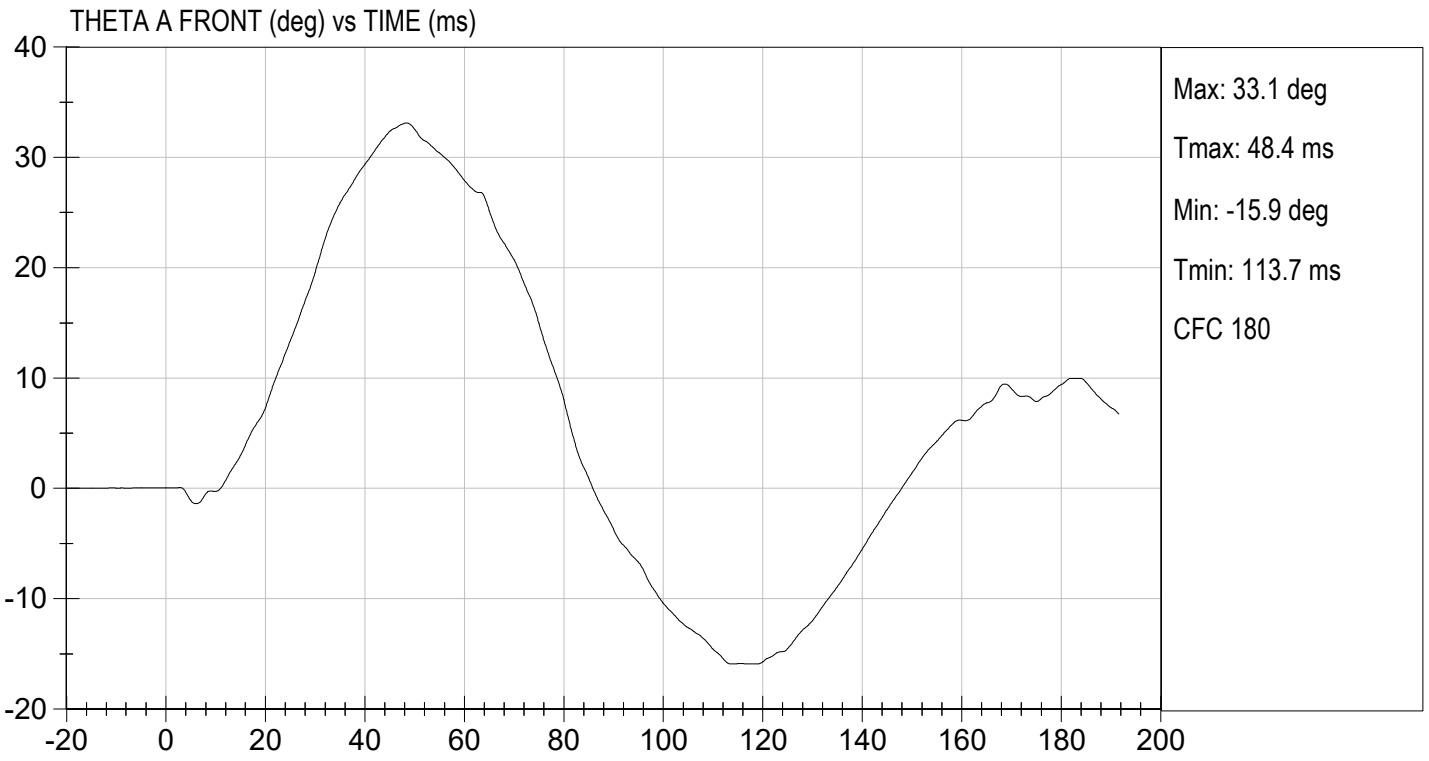
Approved By

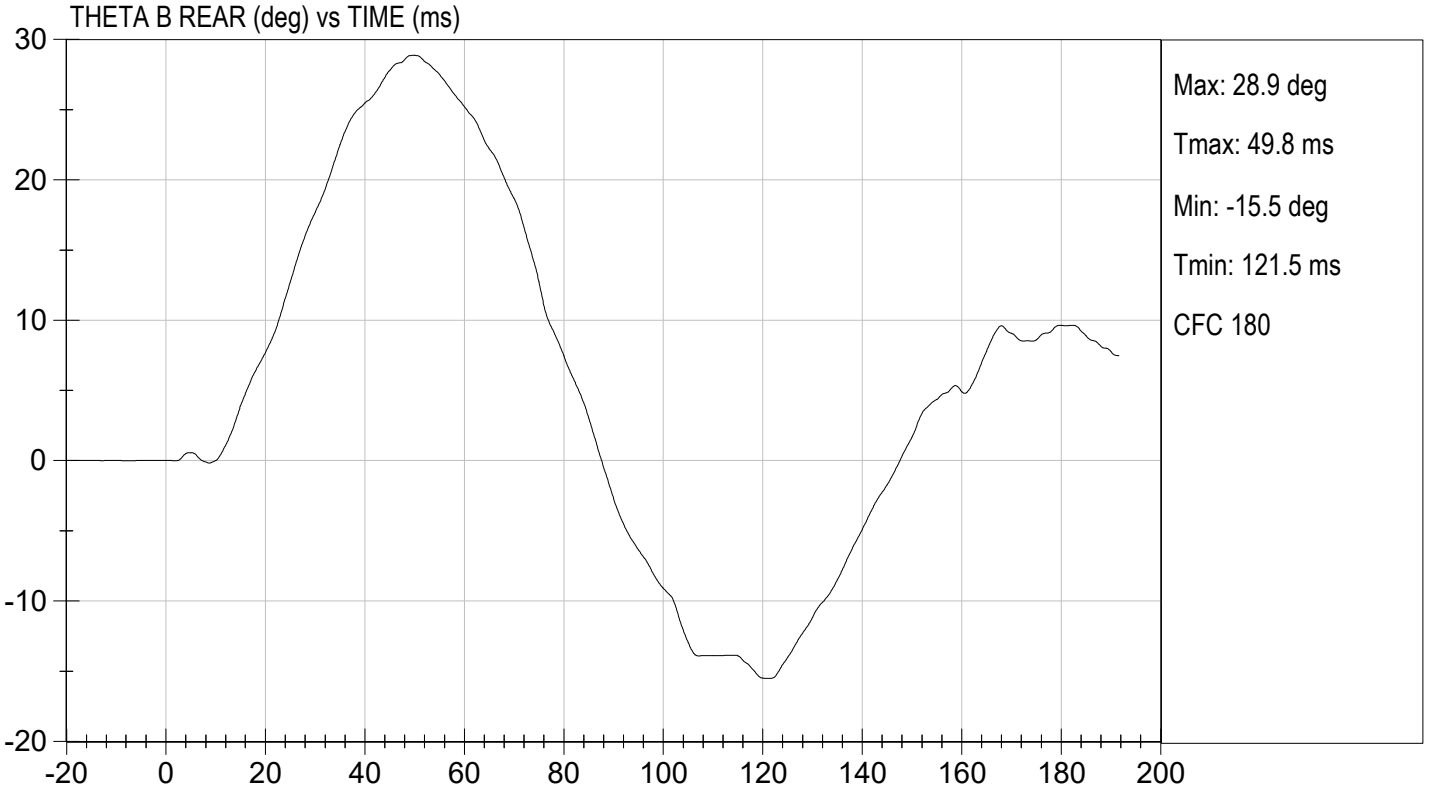
TEST DESC: LUMBAR BENDING
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 12/18/2023
TEST #: D233368



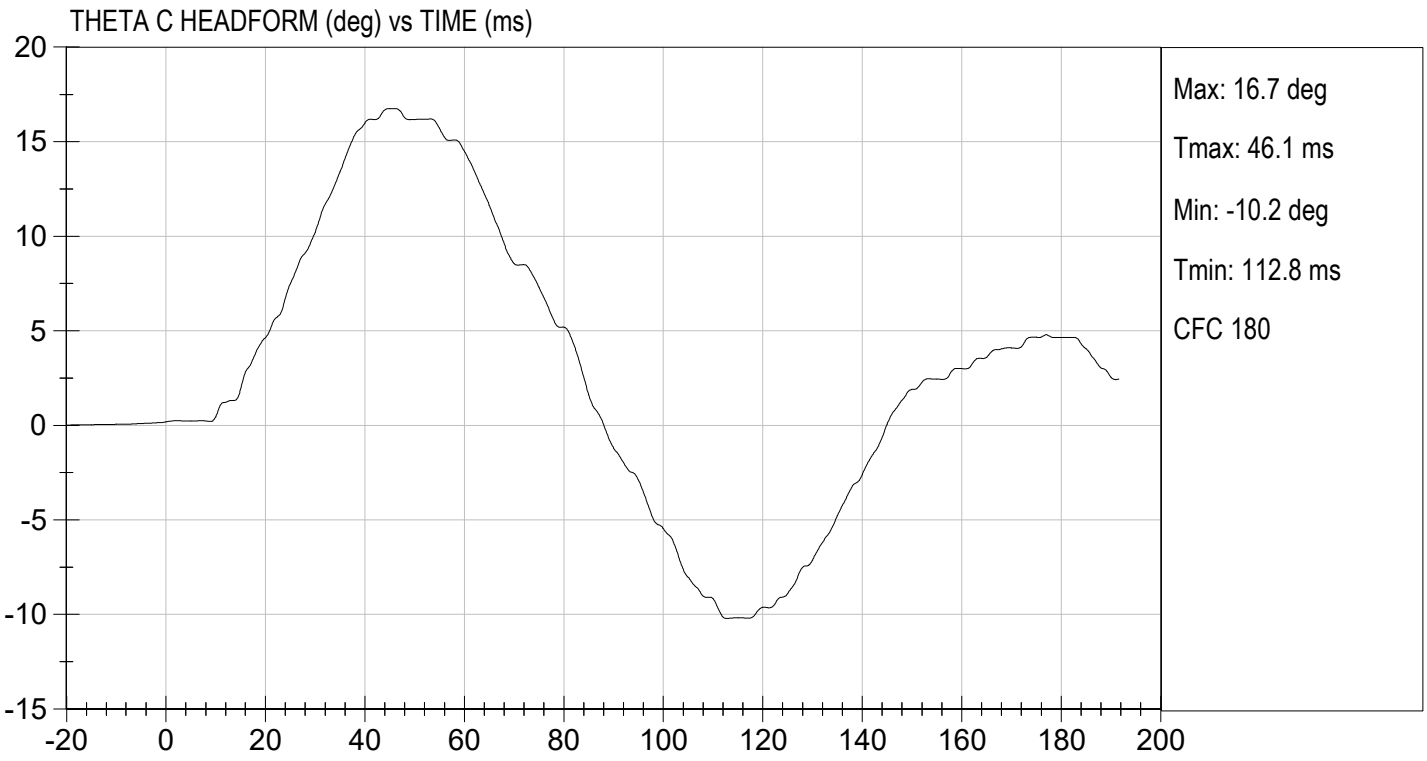



THETA A FRONT (deg) vs TIME (ms)
40
30
20
10
0
-10
-20
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 33.1 deg
Tmax: 48.4 ms
Min: -15.9 deg
Tmin: 113.7 ms
CFC 180


THETA B REAR (deg) vs TIME (ms)
30
20
10
0
-10
-20
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 28.9 deg
Tmax: 49.8 ms
Min: -15.5 deg
Tmin: 121.5 ms
CFC 180

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

TEST DATE: 12/18/2023
TEST #: D233368



MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233369

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	26	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	N	4700 to 5400	5127	Pass
Time of Maximum Impactor Force	ms	11.8 to 16.1	12.7	Pass
Maximum Pubic Force	N	1230 to 1590	1348	Pass
Time of Maximum Pubic Force	ms	12.2 to 17.0	14.3	Pass
		Overall Test Results		Pass

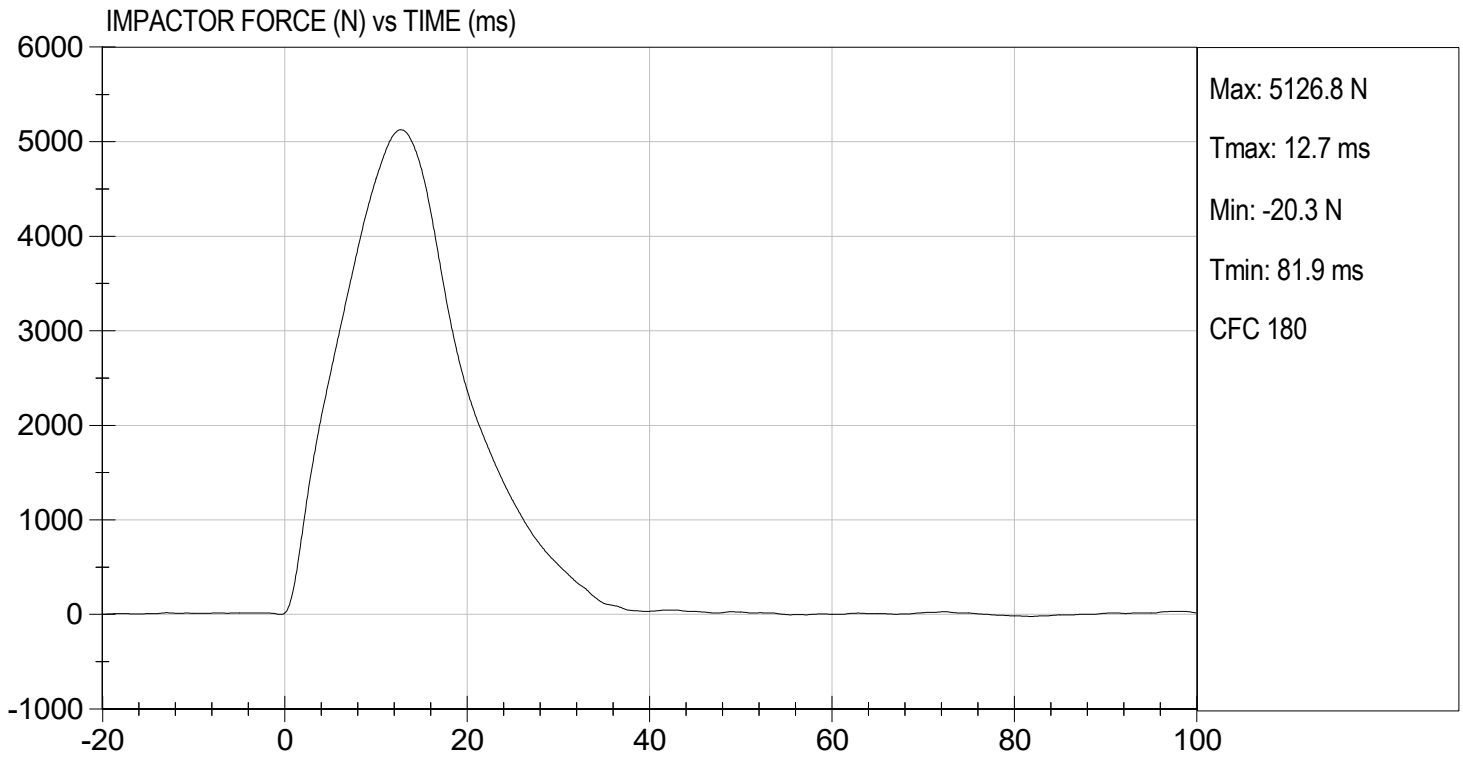
Laboratory Technician

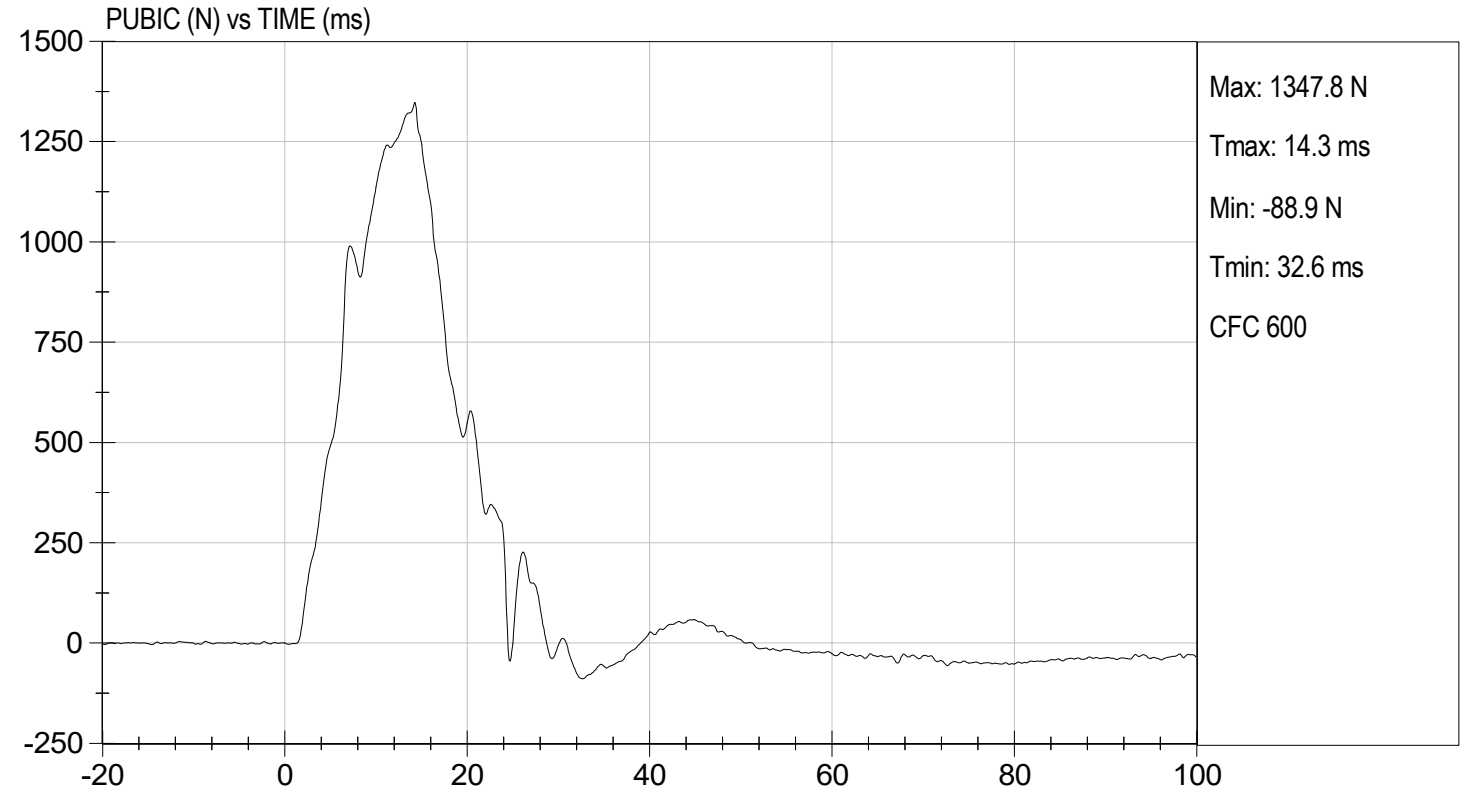
12/18/2023
Test Date

Approved By

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

TEST DATE: 12/18/2023
TEST #: D233369





MGA RESEARCH CORPORATION

THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: F032 **Test I.D:** D233360

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	26	Pass
Probe Speed	m/s	5.40 to 5.60	5.40	Pass
Maximum Impactor Force (after 6 ms)	N	5100 to 6200	5689	Pass
Upper Rib Displacement	mm	34.0 to 41.0	37.1	Pass
Middle Rib Displacement	mm	37.0 to 45.0	39.1	Pass
Lower Rib Displacement	mm	37.0 to 44.0	38.9	Pass
		Overall Test Results		Pass

Laboratory Technician

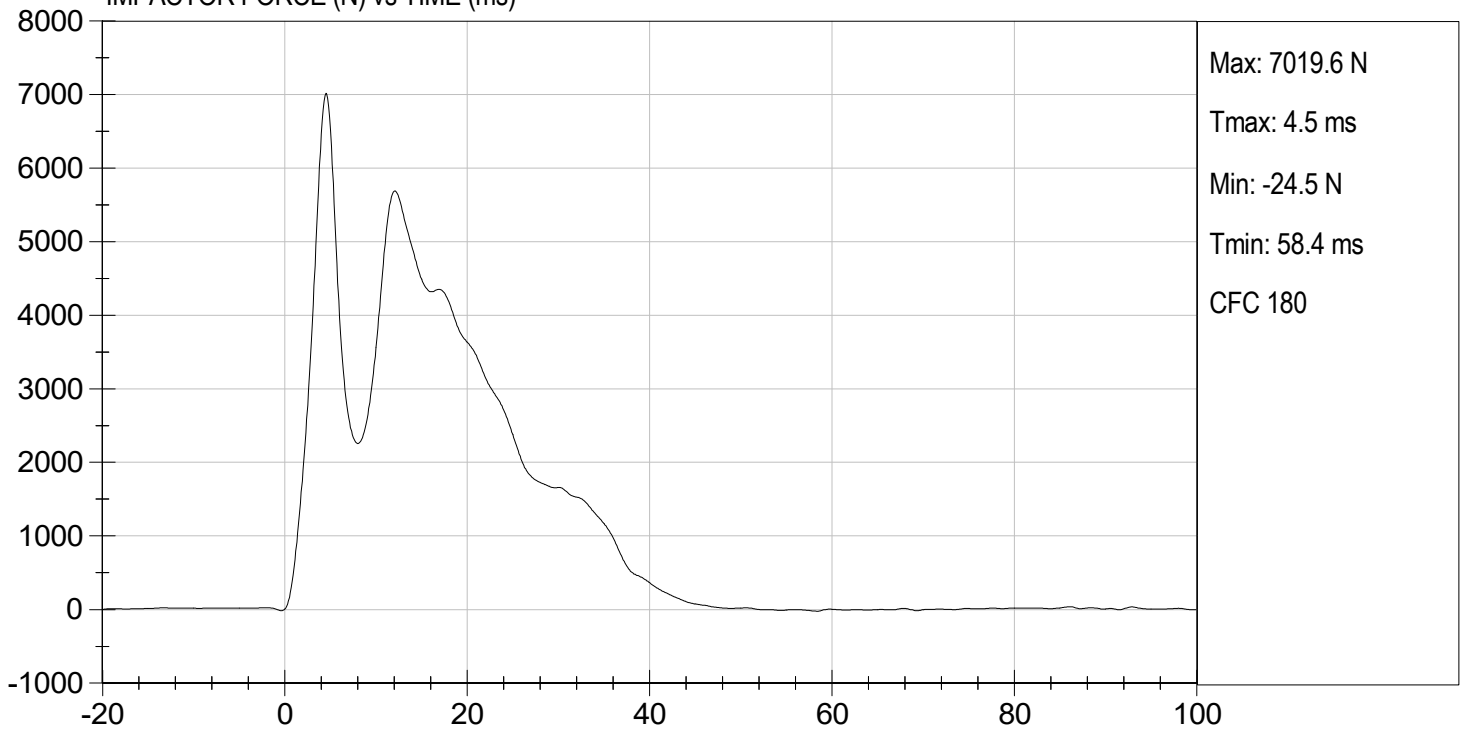
12/18/2023
Test Date

Approved By

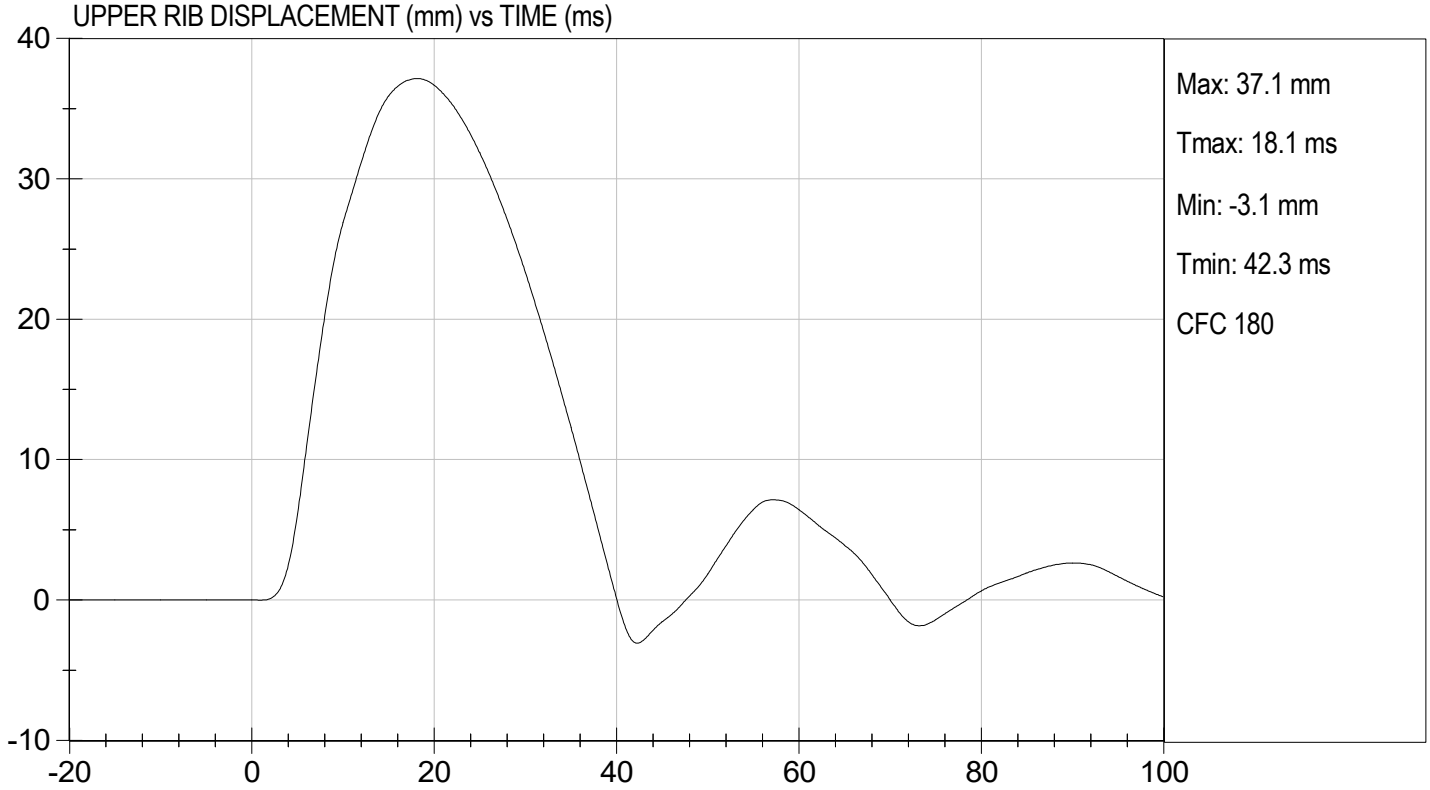
TEST DESC: THORAX IMPACT
VELOCITY: 17.73 ft/s, 5.40 m/s

TEST DATE: 12/18/2023
TEST #: D233360

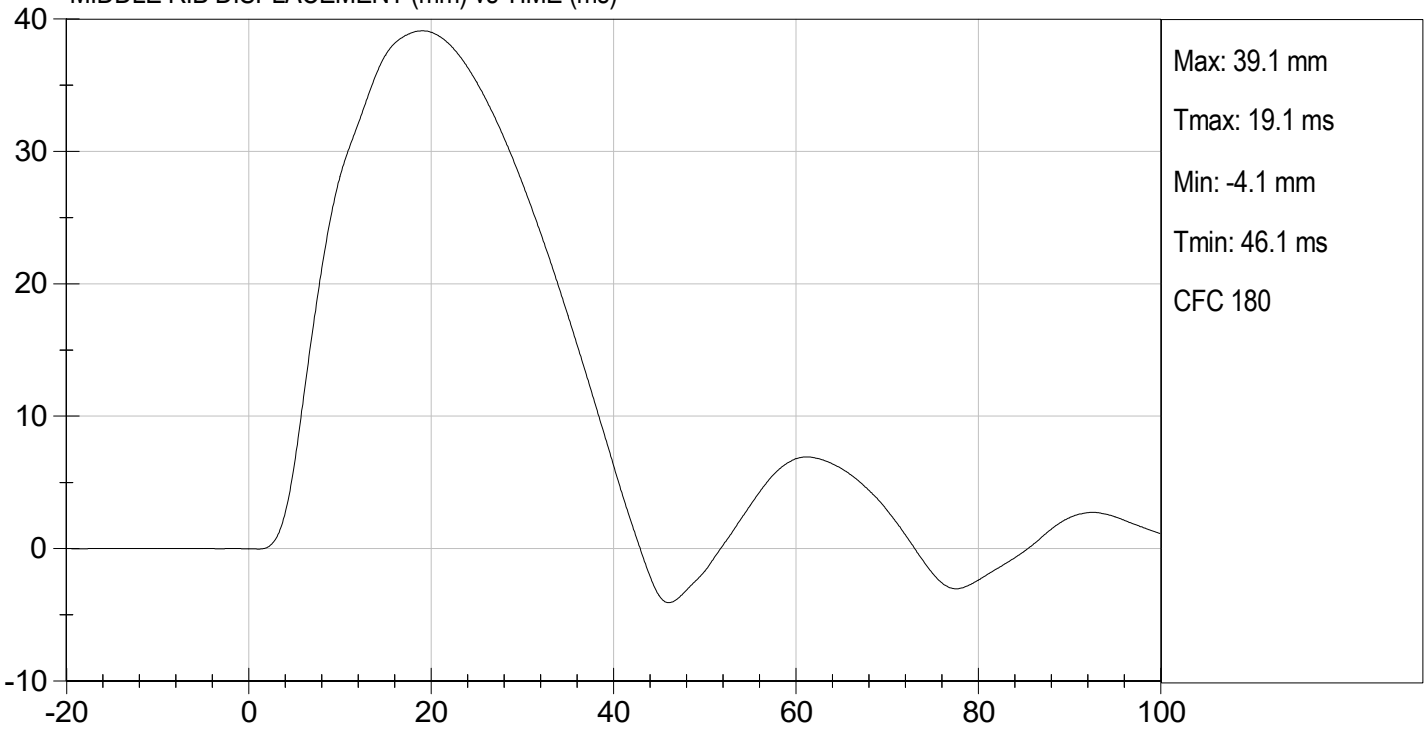
IMPACTOR FORCE (N) vs TIME (ms)



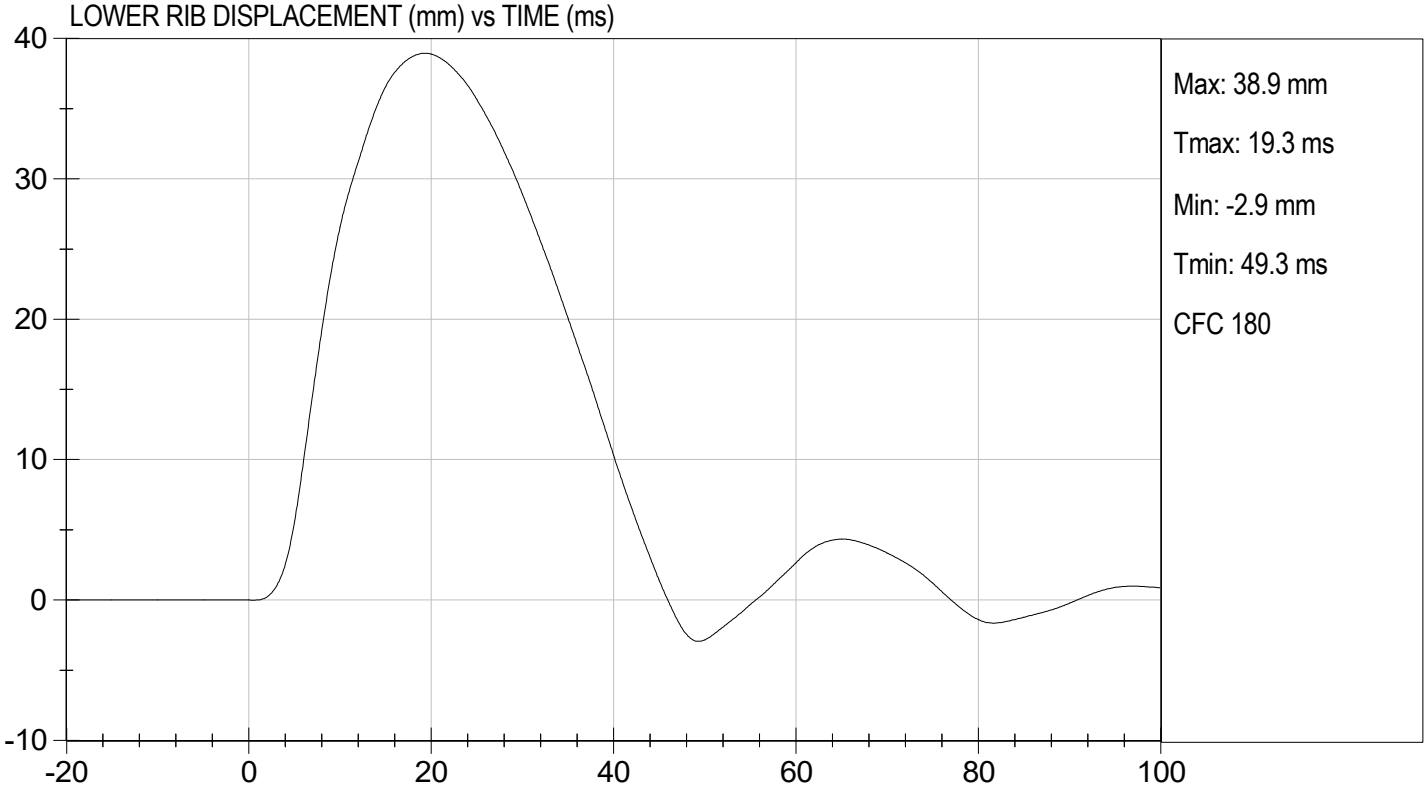
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



QUALIFICATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

SID-IIsD External Measurements
SN: 306

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

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D233251

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	36	Pass
Peak Resultant Acceleration	G's	115 to 137	134	Pass
Peak Longitudinal Acceleration	G's	+/- 15	-3.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

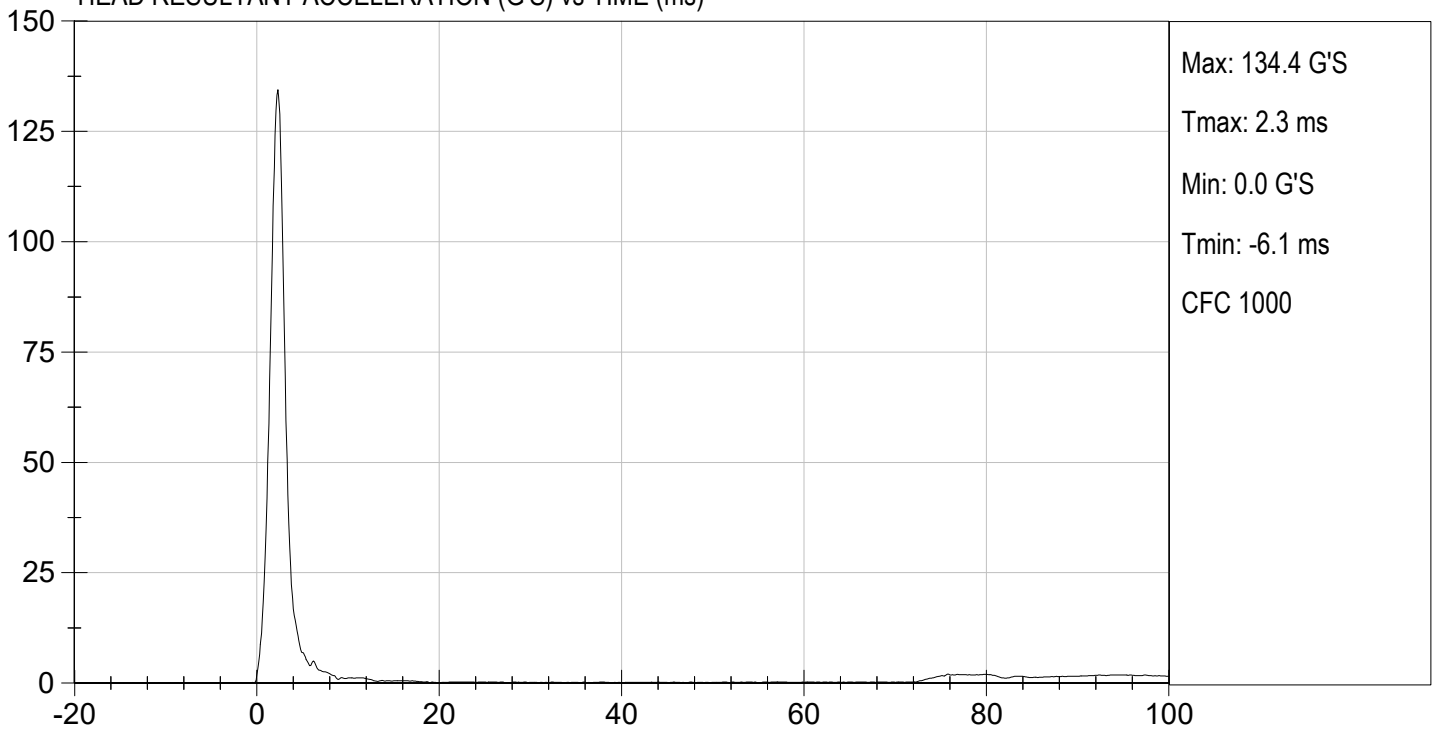
12/08/2023
Test Date

Approved By

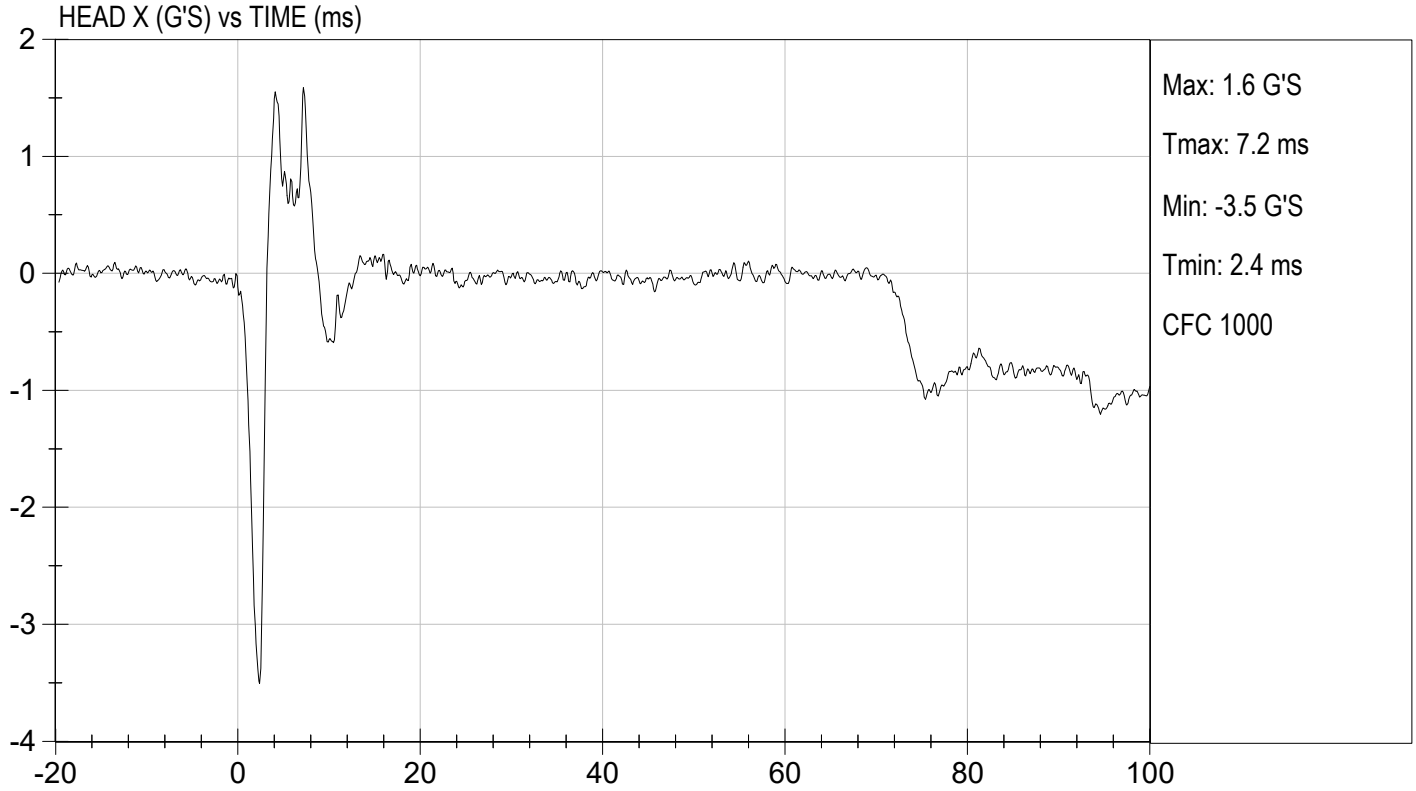
TEST DESC: HEAD DROP

TEST DATE: 12/08/2023
TEST #: D233251

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

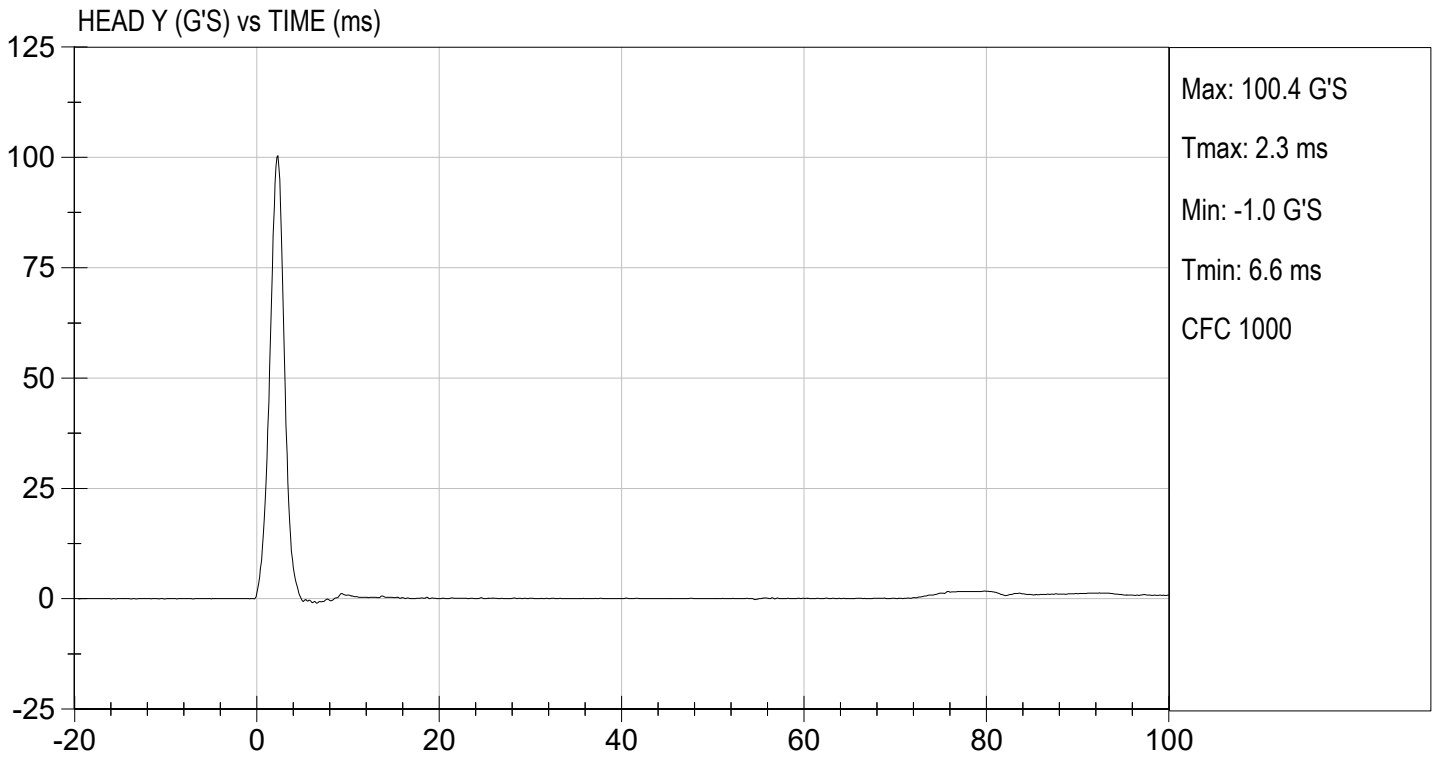


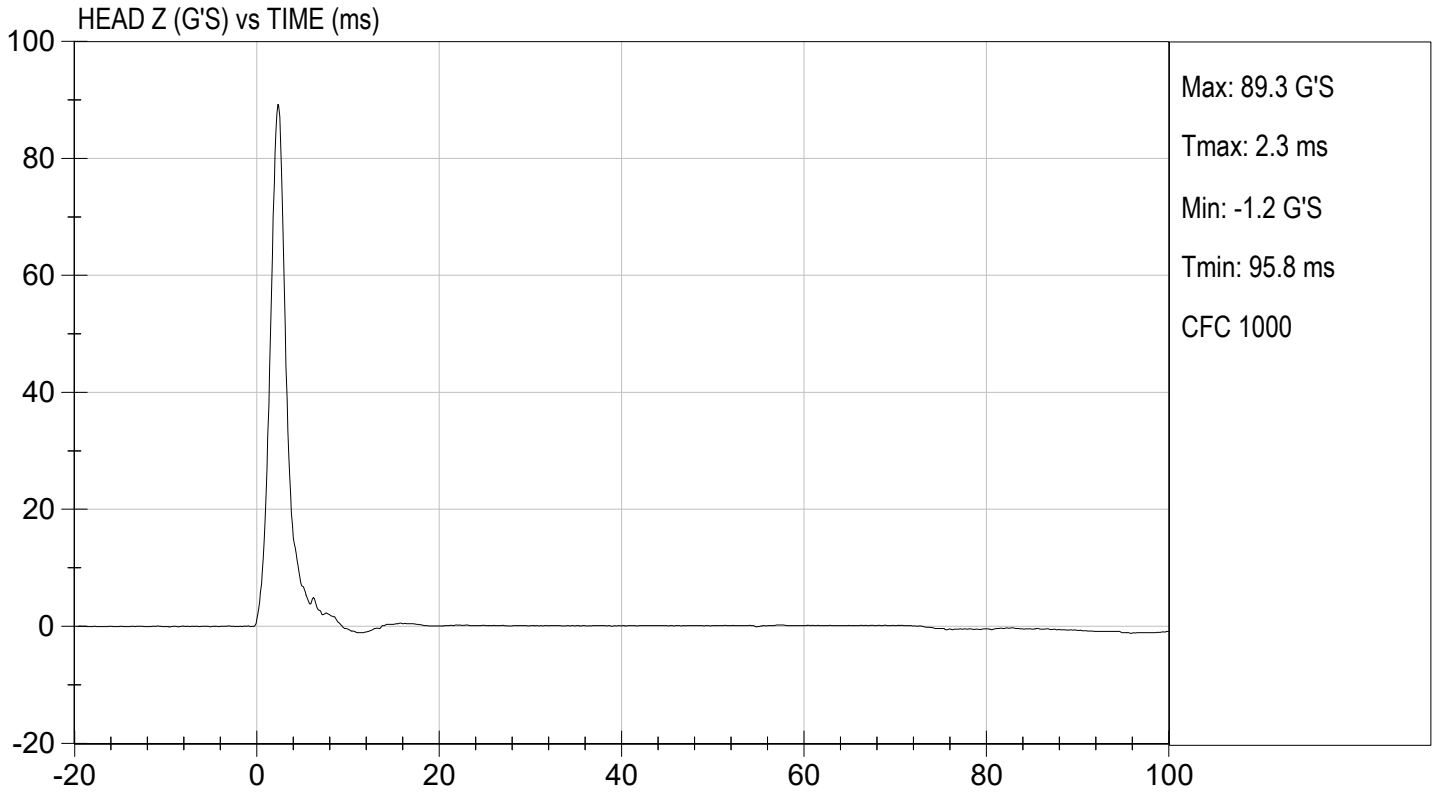
HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 12/08/2023
TEST #: D233251





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233252

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.4	Pass
Humidity		%	10 to 70	36	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.29	Pass
	15 ms	m/s	3.30 to 4.10	3.58	Pass
	20 ms	m/s	4.40 to 5.40	5.22	Pass
	25 ms	m/s	5.40 to 6.10	5.81	Pass
	25-100 ms	m/s	5.50 to 6.20	5.86	Pass
Maximum D-Plane Rotation		deg	71 to 81	75	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	63	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-42	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	119	Pass
			Overall Test Results		Pass

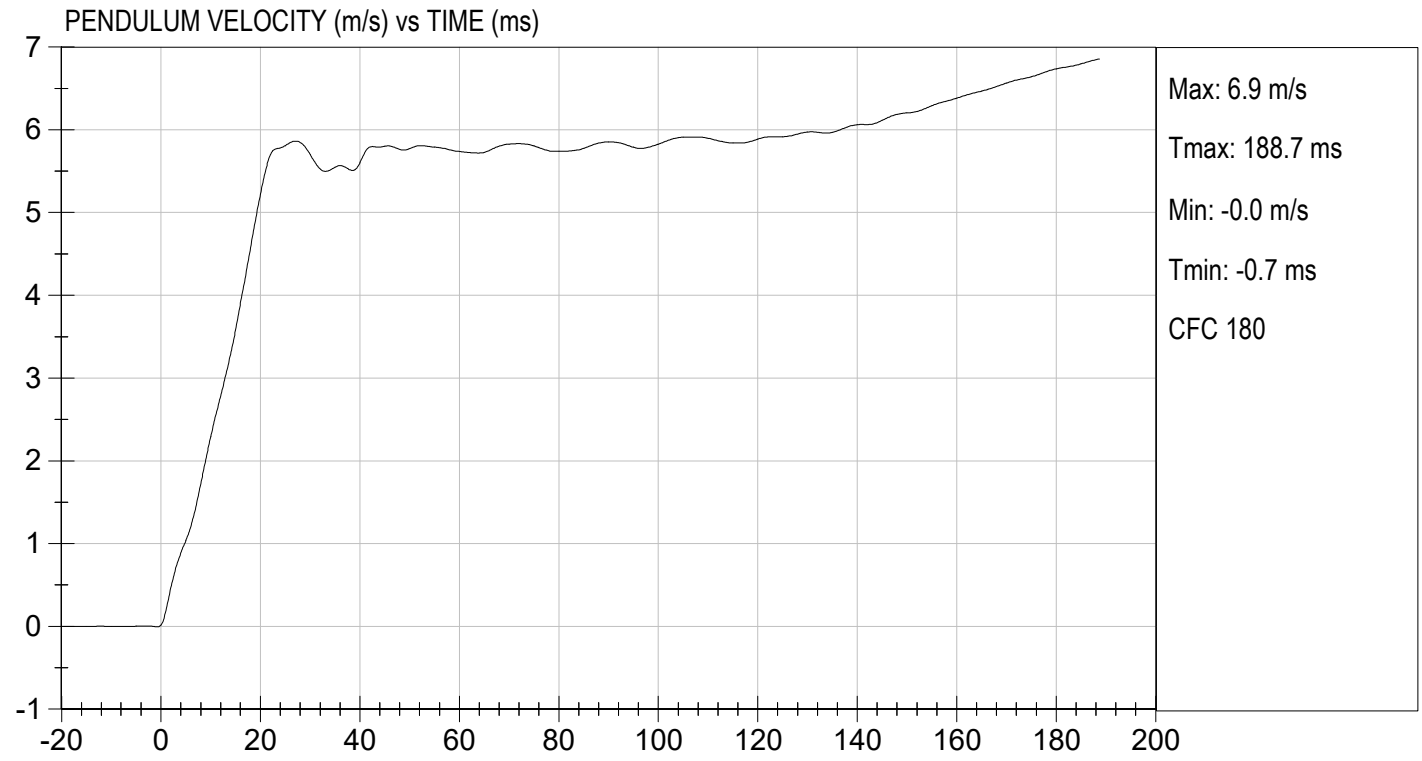
Laboratory Technician

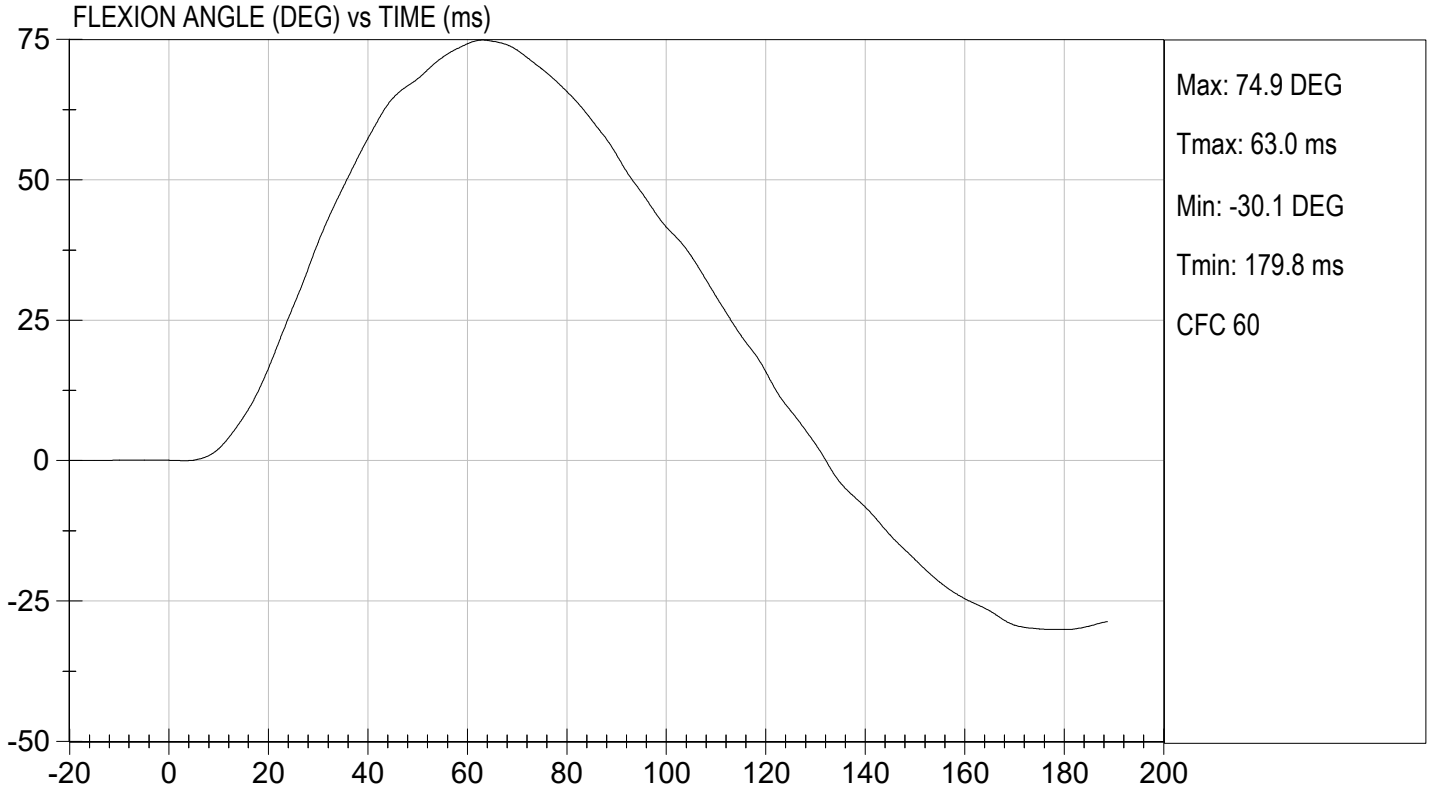
12/08/2023
Test Date

Approved By

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

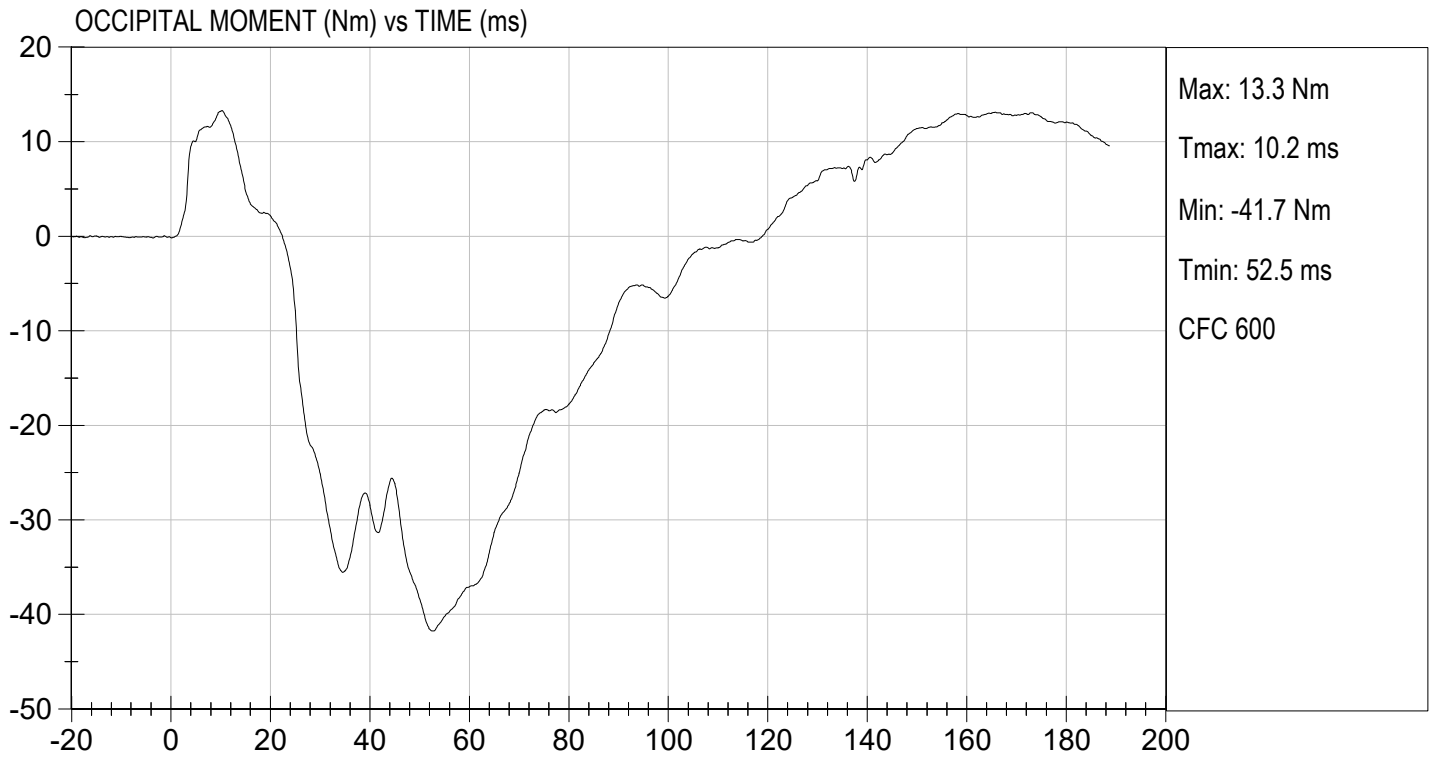
TEST DATE: 12/08/2023
TEST #: D233252





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

TEST DATE: 12/08/2023
TEST #: D233252



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D233253

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	13 to 18	14	Pass
Shoulder Displacement	mm	28 to 37	32	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	17	Pass
		Overall Test Results		Pass

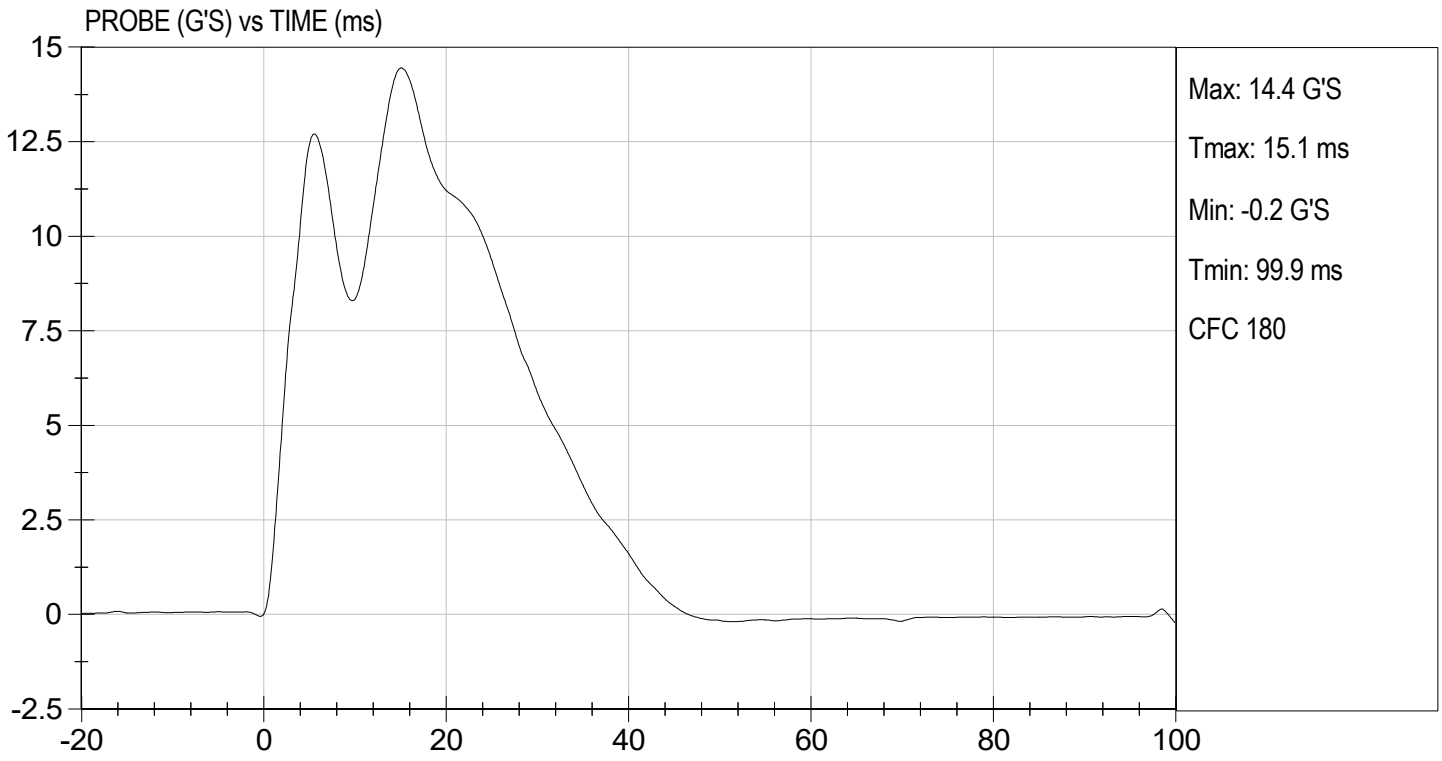
Laboratory Technician

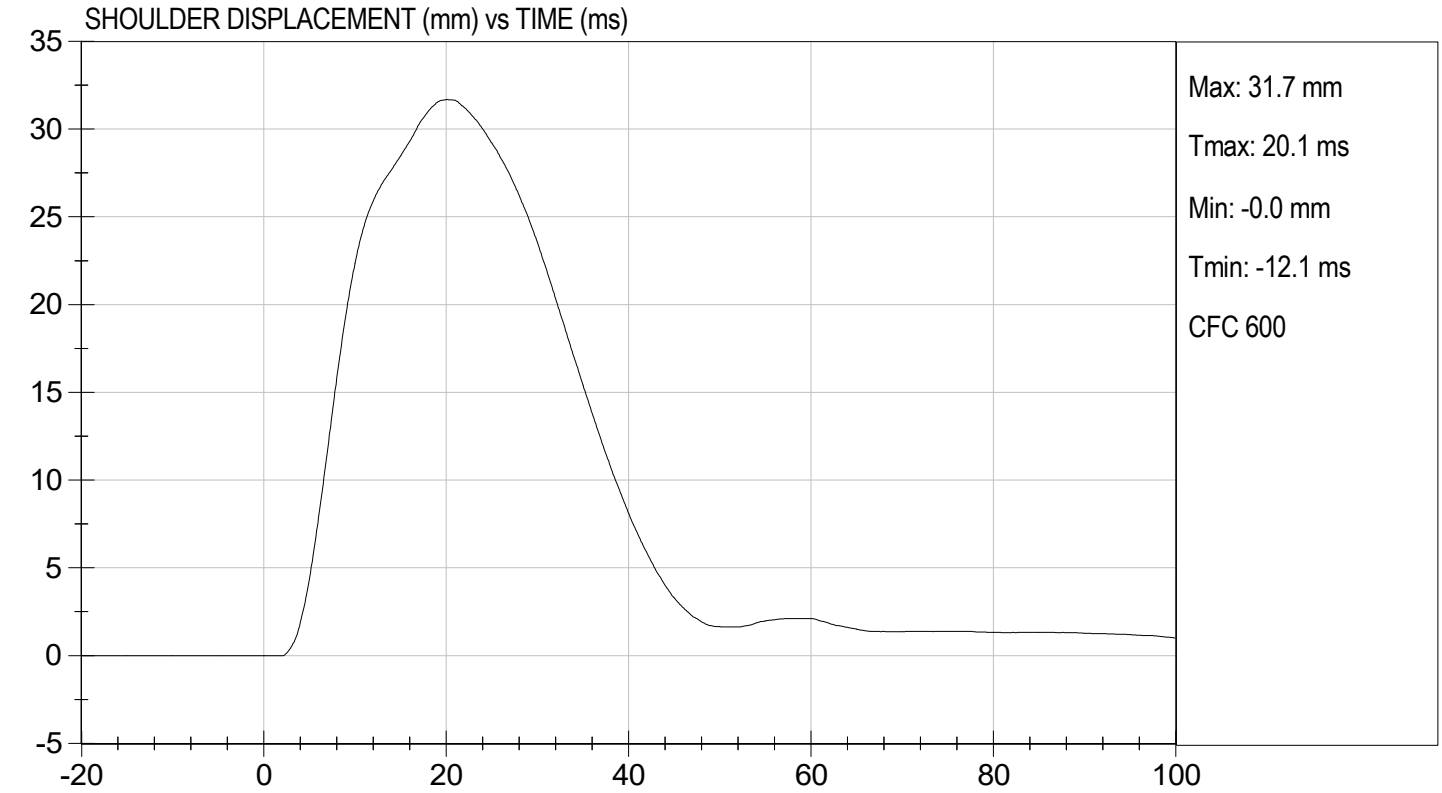
12/08/2023
Test Date

Approved By

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

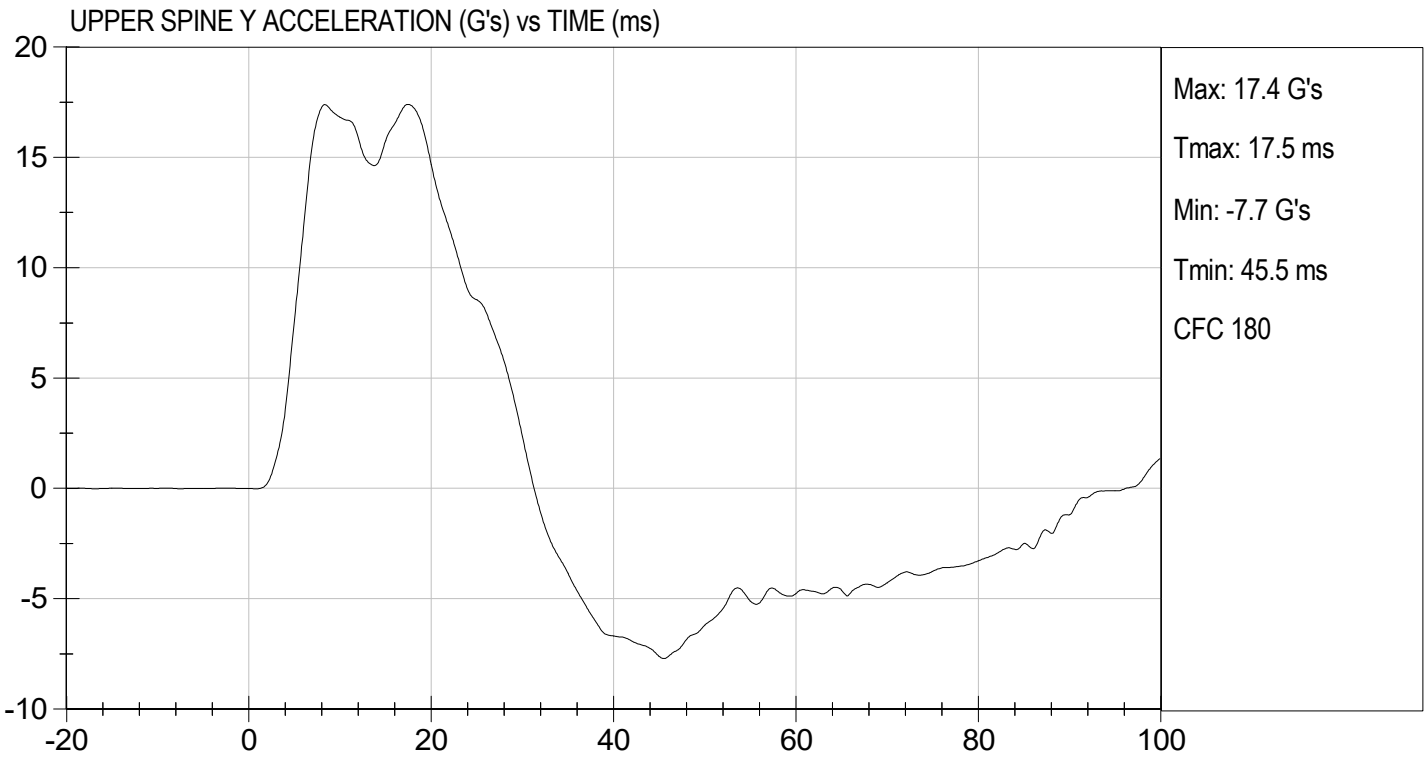
TEST DATE: 12/08/2023
TEST #: D233253





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

TEST DATE: 12/08/2023
TEST #: D233253



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233254

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	33	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	31	Pass
Shoulder Displacement	mm	31 to 40	36	Pass
Upper Rib Displacement	mm	25 to 32	28	Pass
Middle Rib Displacement	mm	30 to 36	32	Pass
Lower Rib Displacement	mm	32 to 38	35	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	34	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	31	Pass
		Overall Test Results		Pass

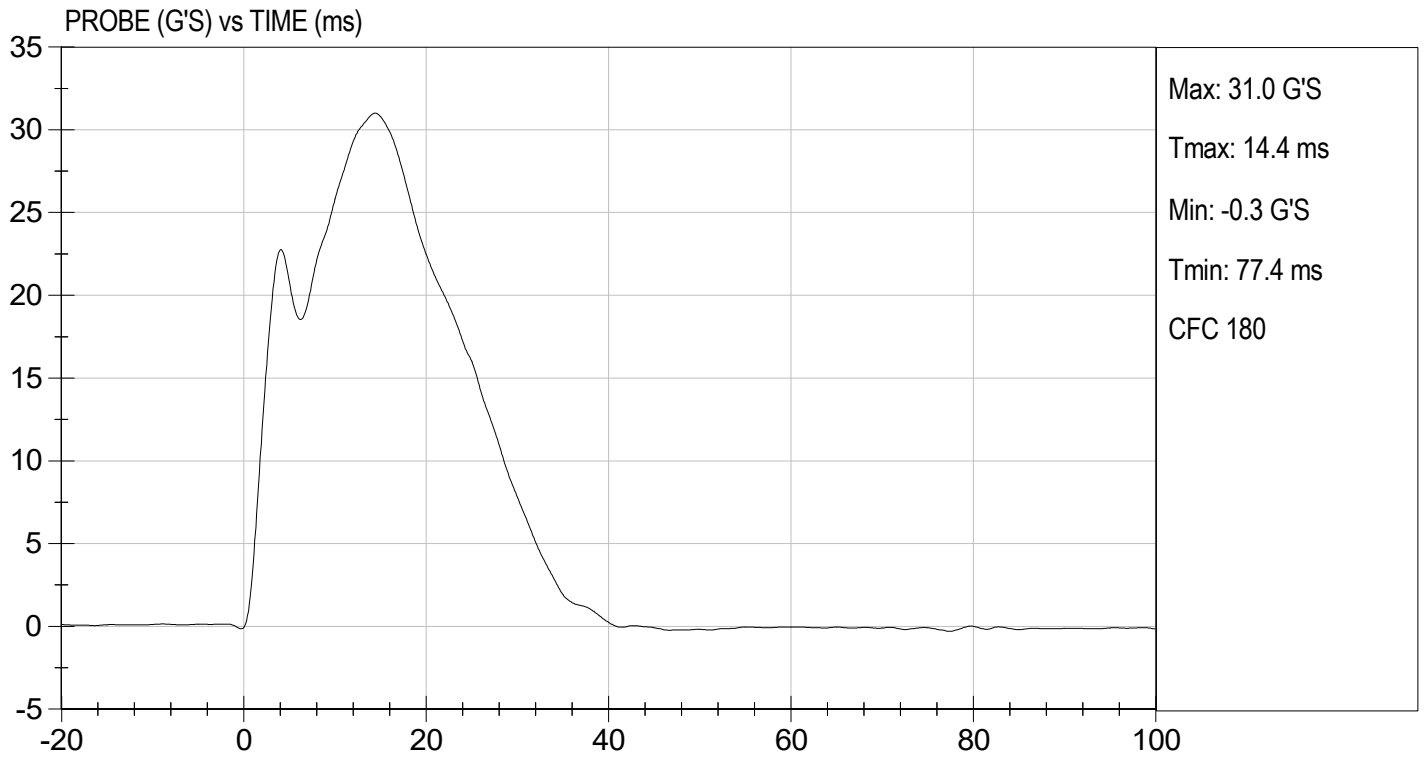
Laboratory Technician

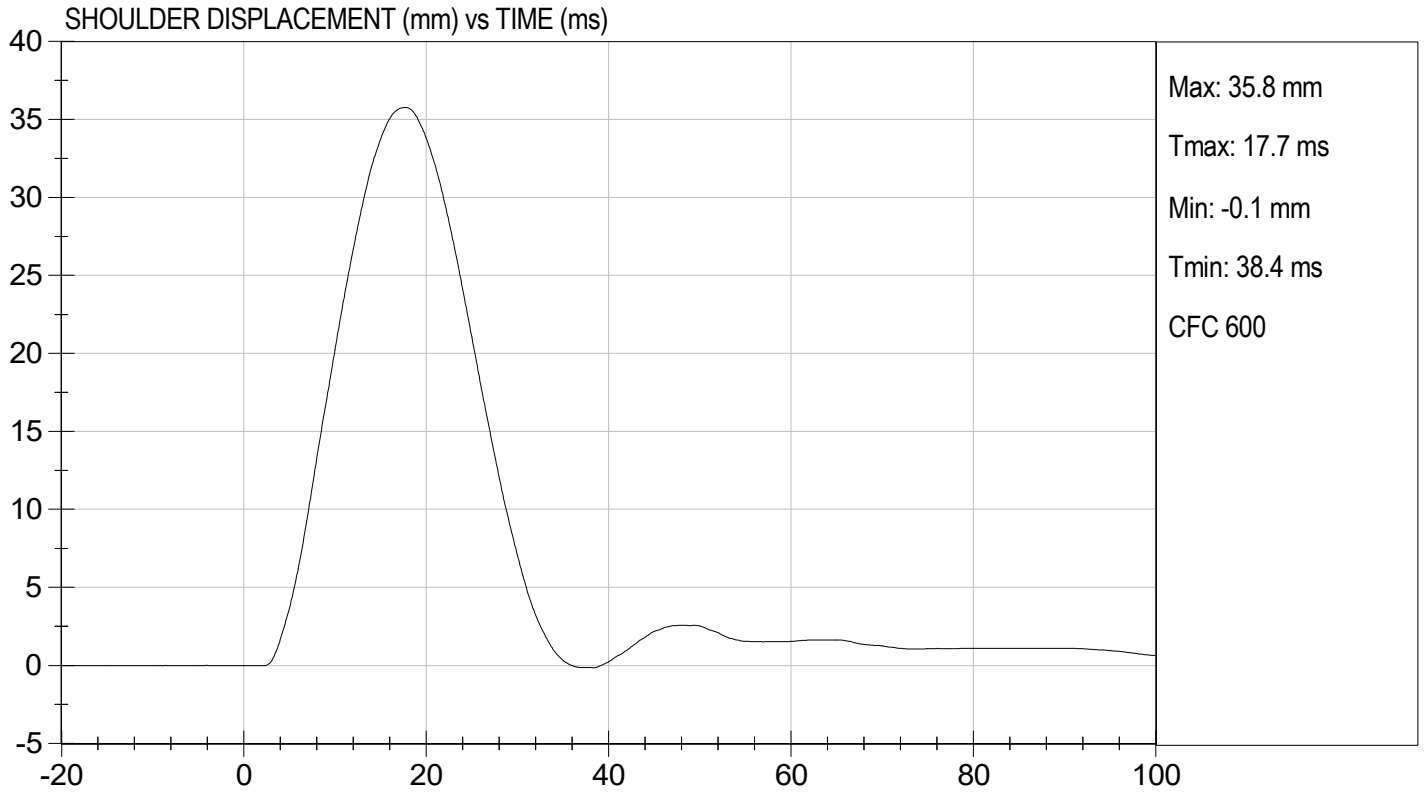
12/08/2023
Test Date

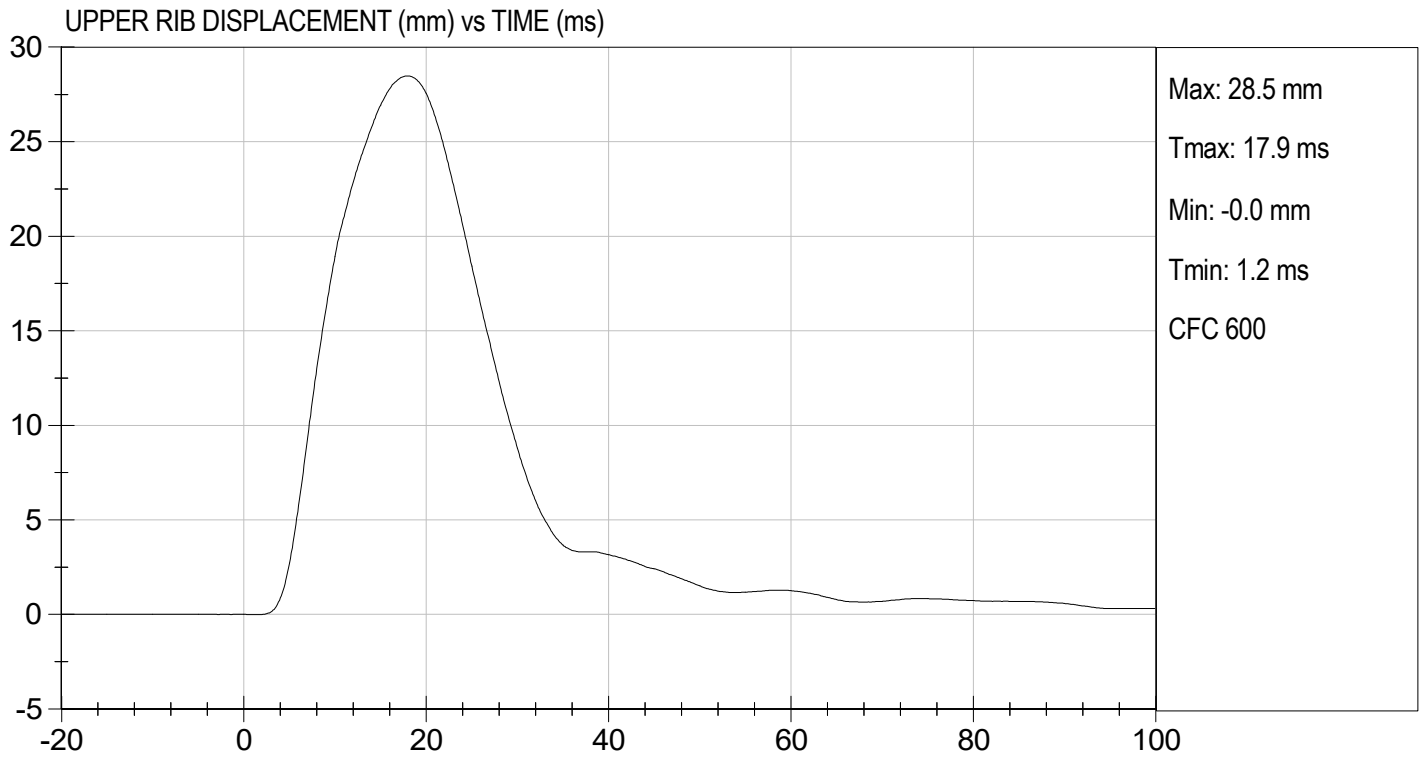
Approved By

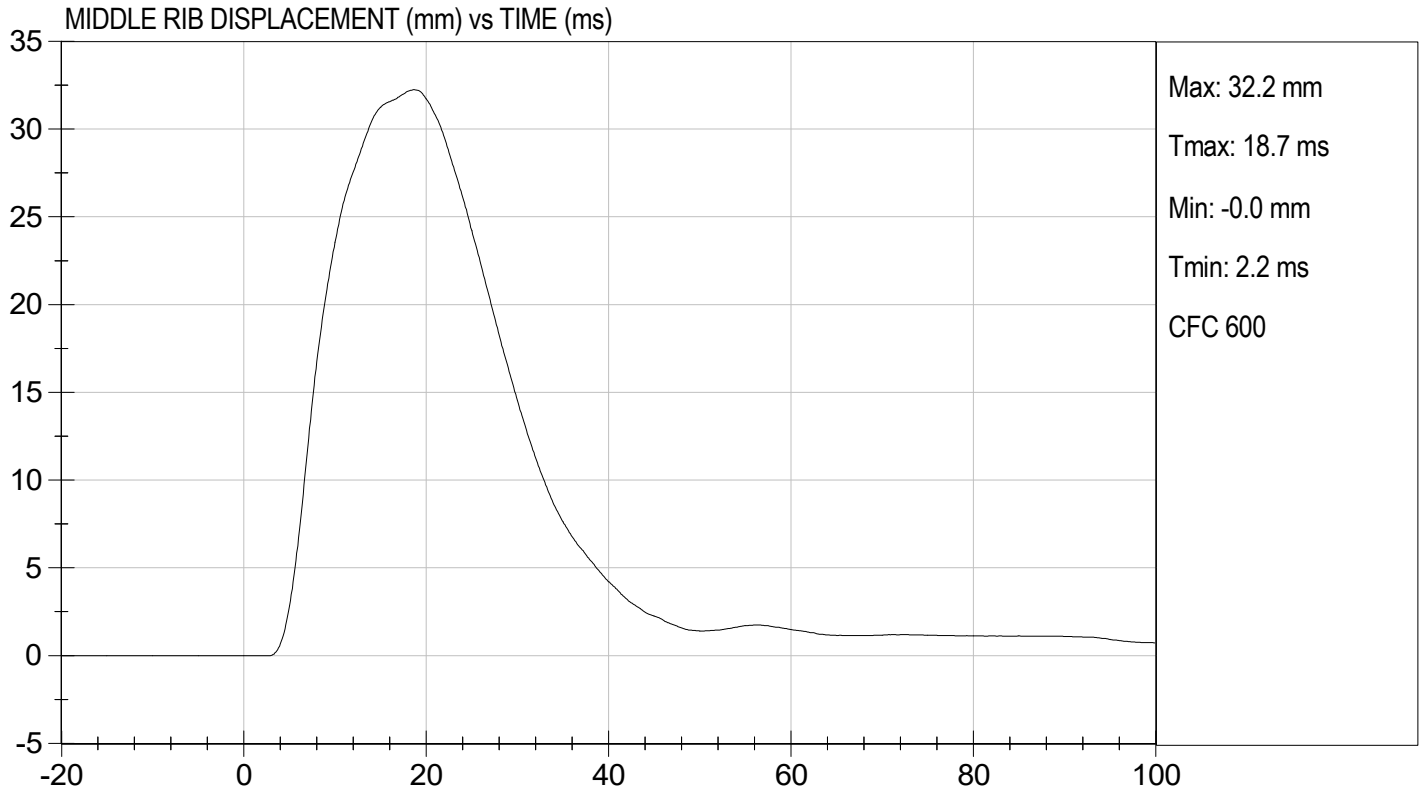
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 12/08/2023
TEST #: D233254





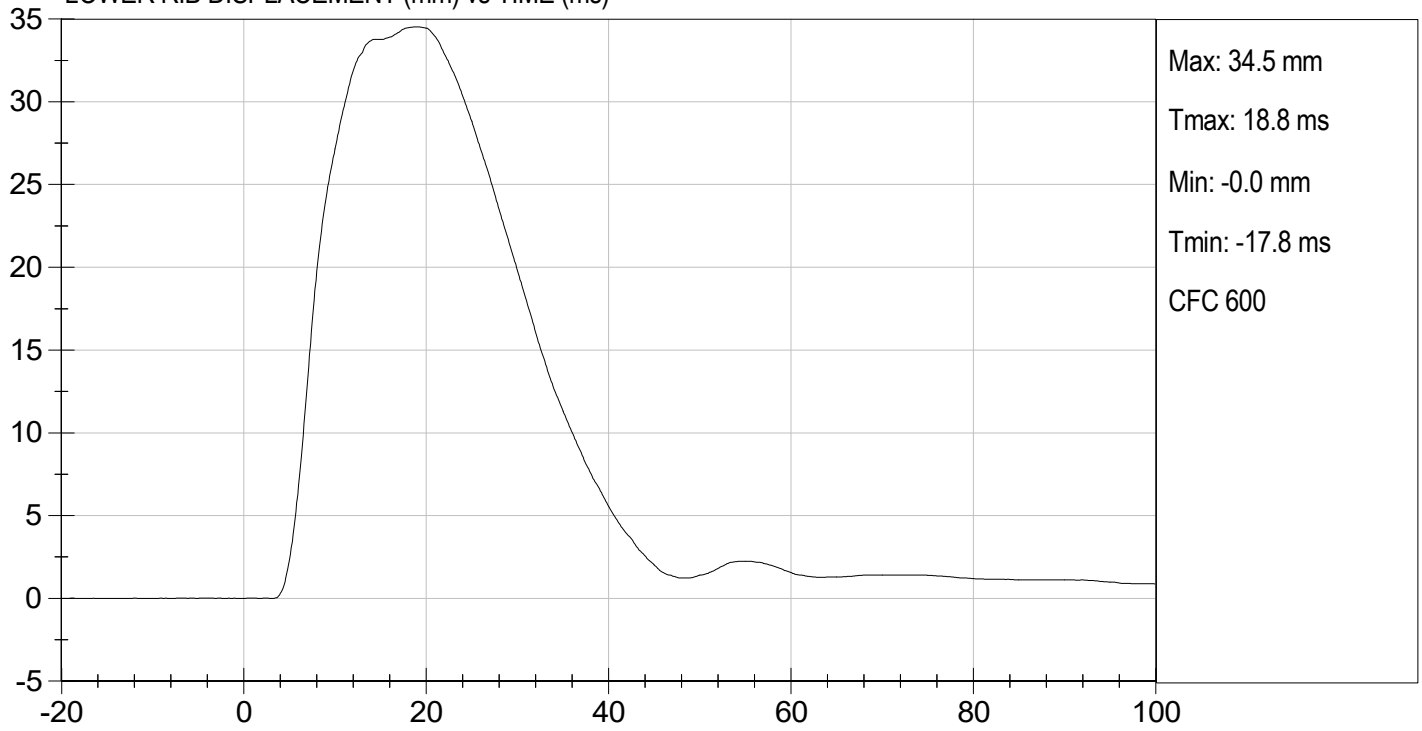

UPPER RIB DISPLACEMENT (mm) vs TIME (ms)
30
25
20
15
10
5
0
-5
-20
0
20
40
60
80
100
Max: 28.5 mm
Tmax: 17.9 ms
Min: -0.0 mm
Tmin: 1.2 ms
CFC 600


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: 18.7 ms
Min: -0.0 mm
Tmin: 2.2 ms
CFC 600

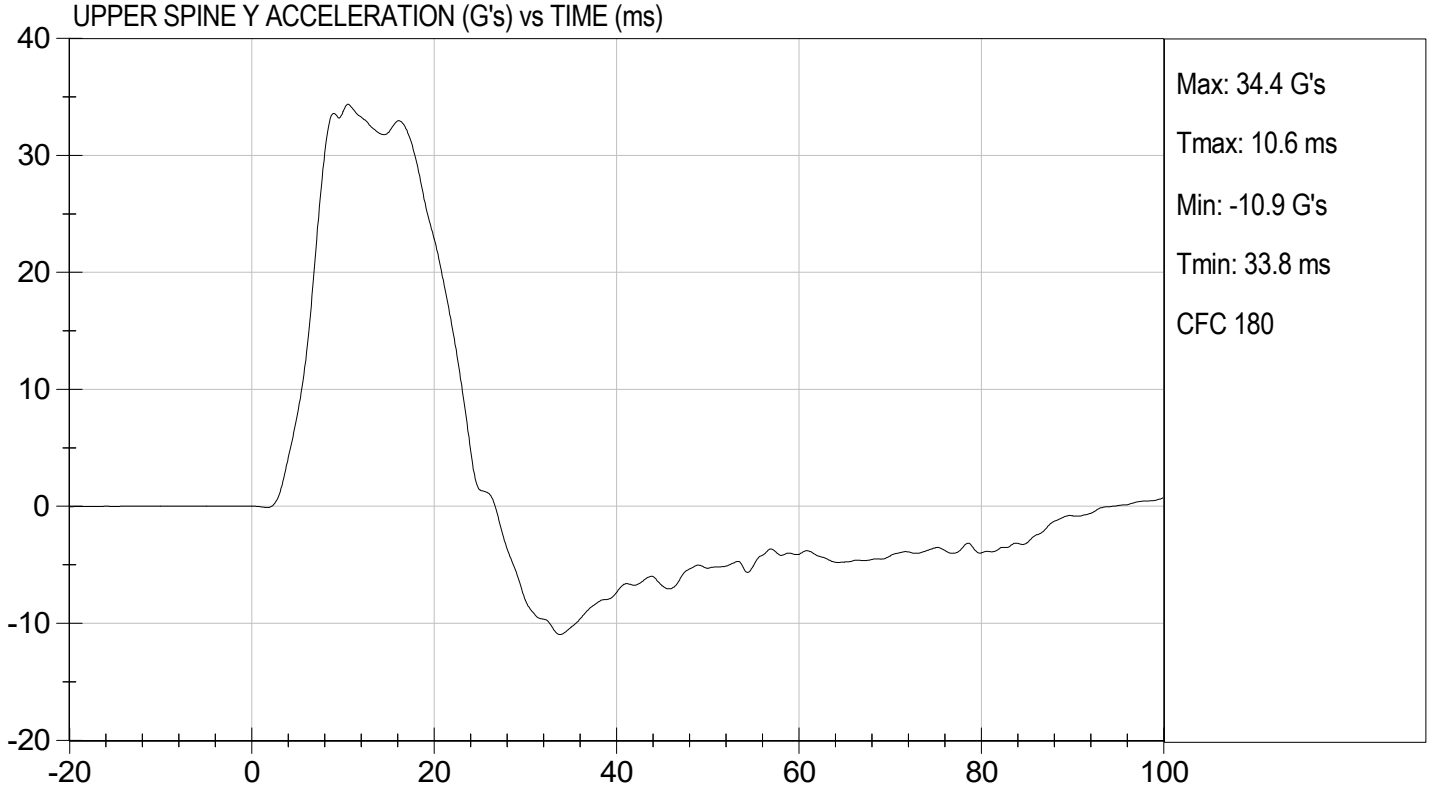
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 12/08/2023
TEST #: D233254

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

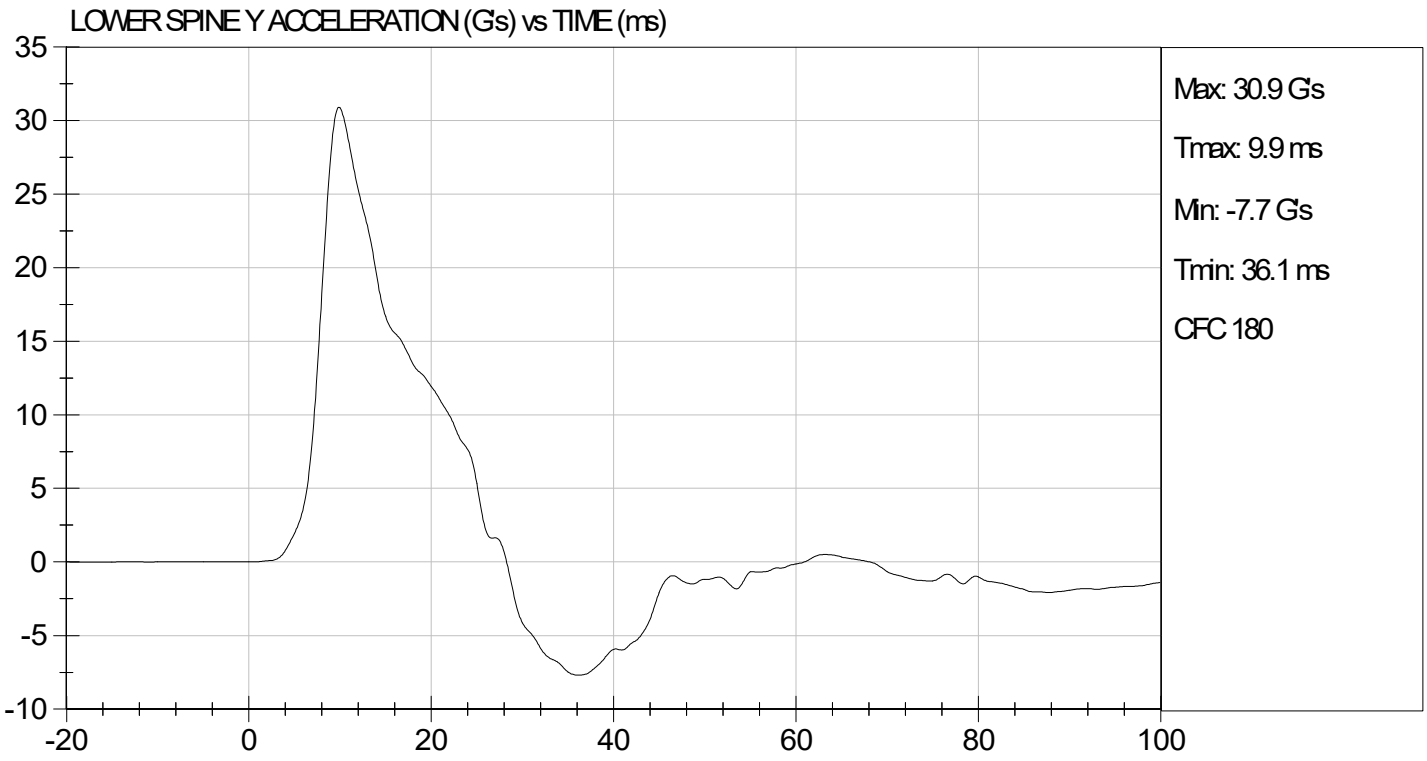


UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 12/08/2023
TEST #: D233254



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233255

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	32	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	36	Pass
Middle Rib Displacement	mm	39 to 45	41	Pass
Lower Rib Displacement	mm	35 to 43	38	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

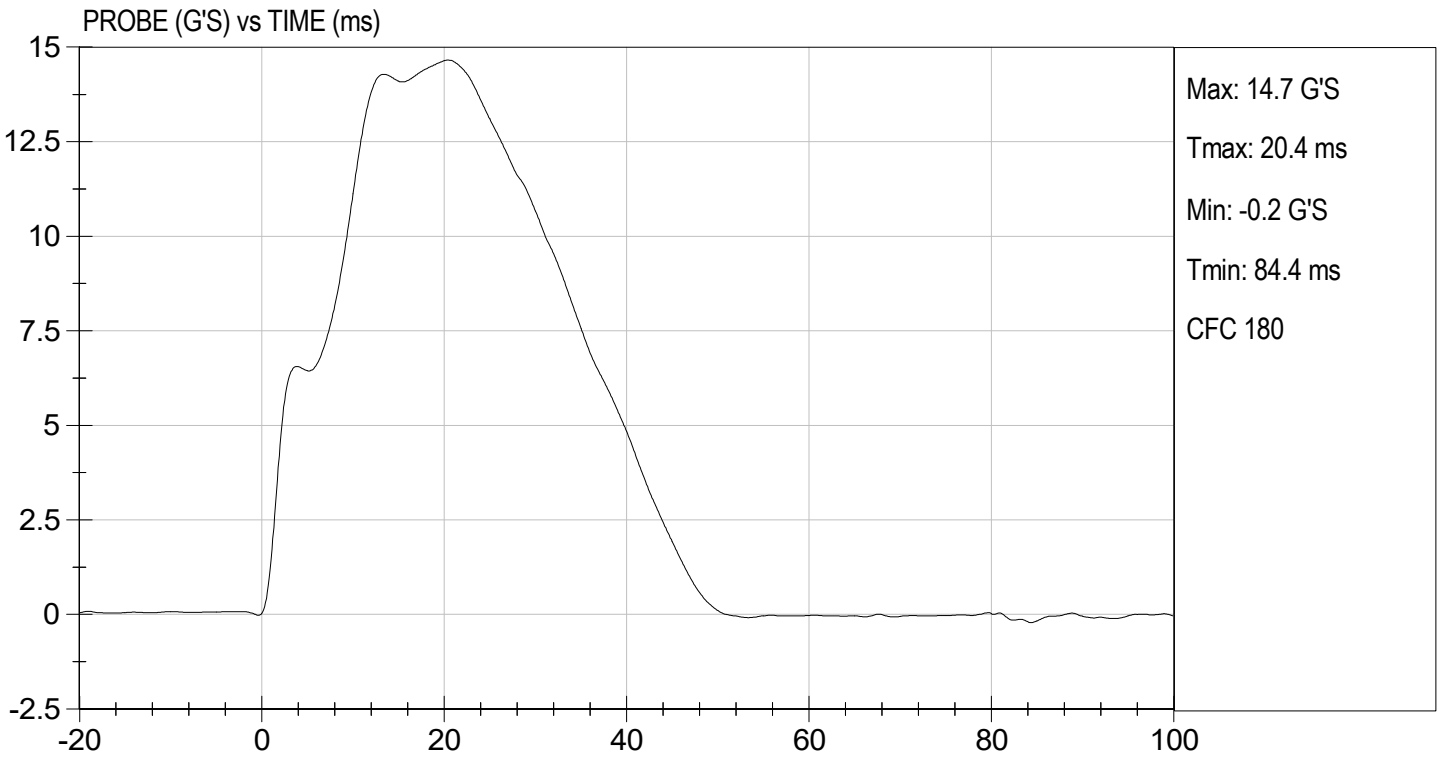
Laboratory Technician

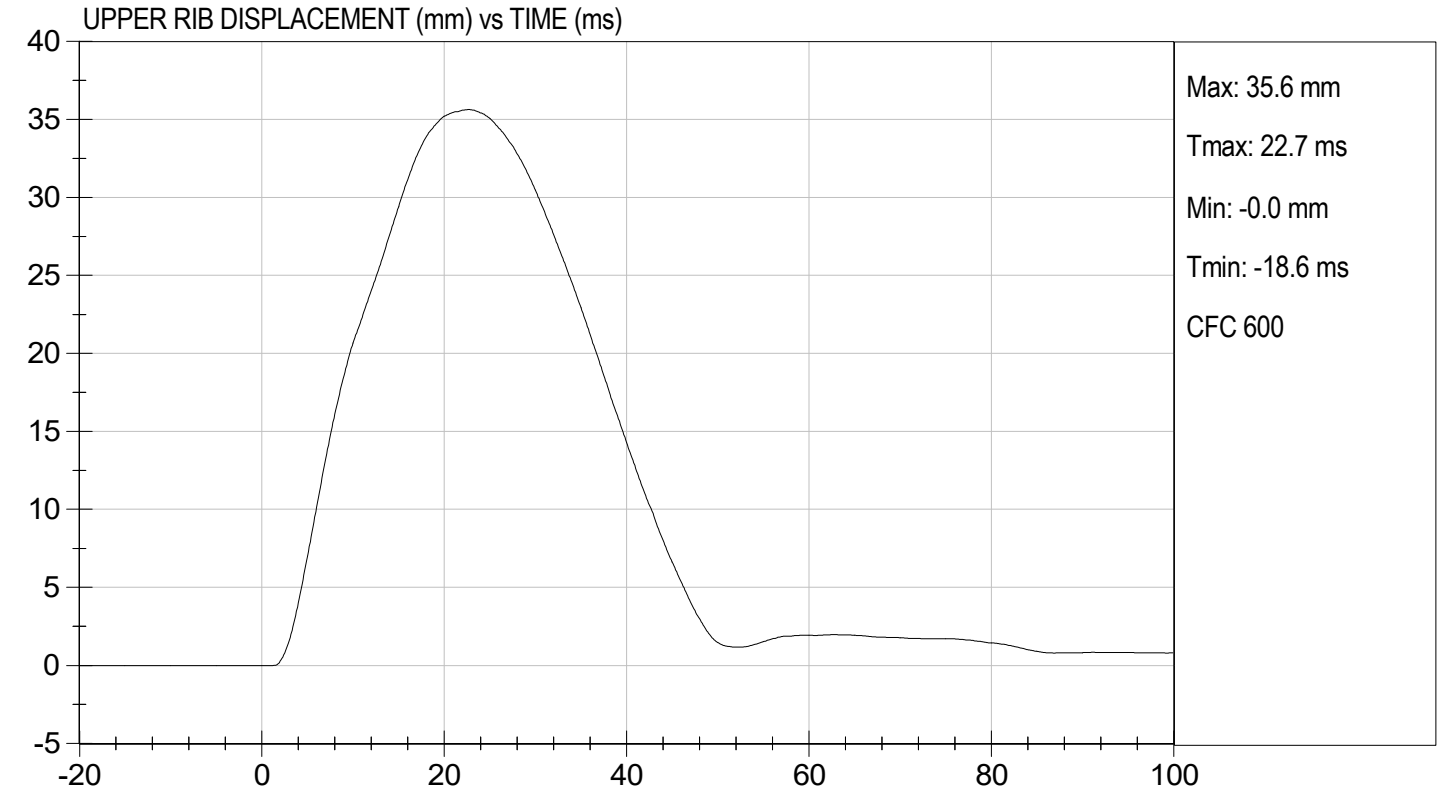
12/08/2023
Test Date

Approved By

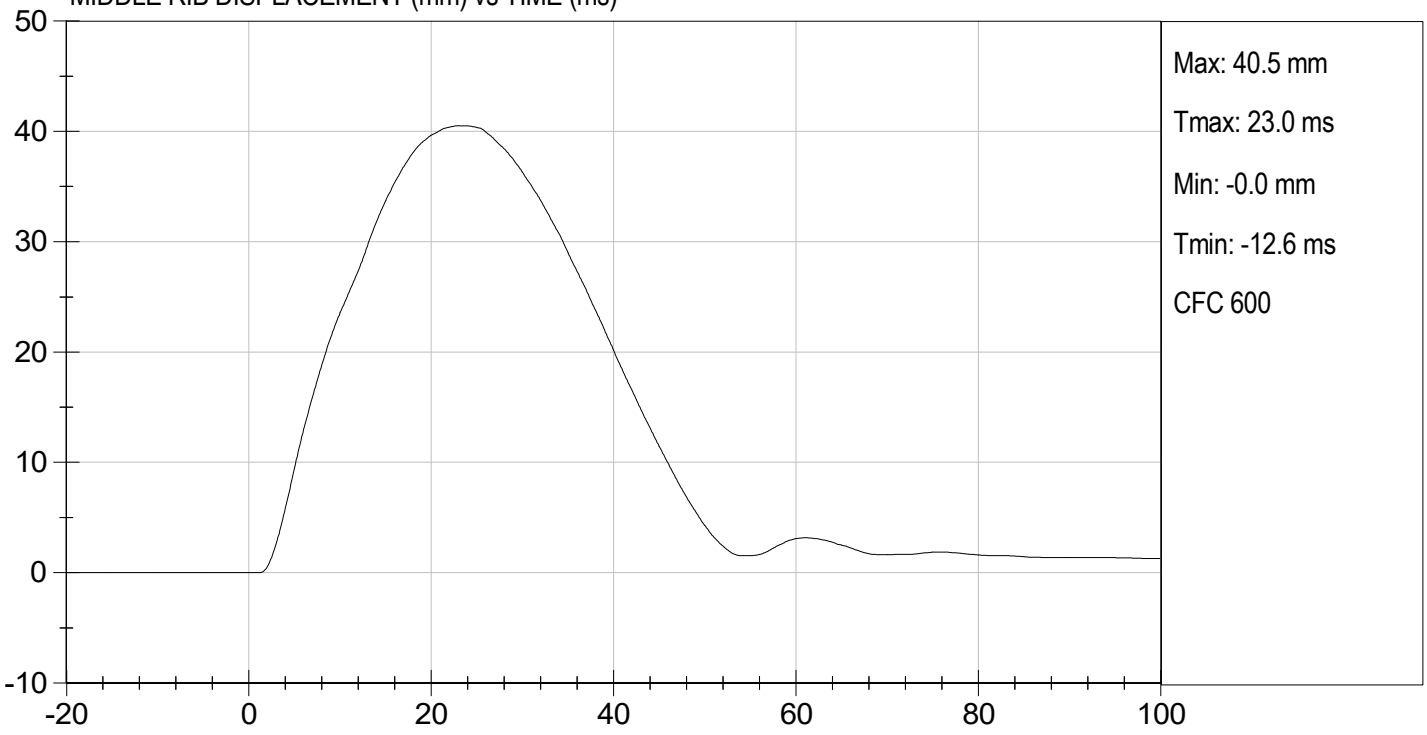
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 12/08/2023
TEST #: D233255

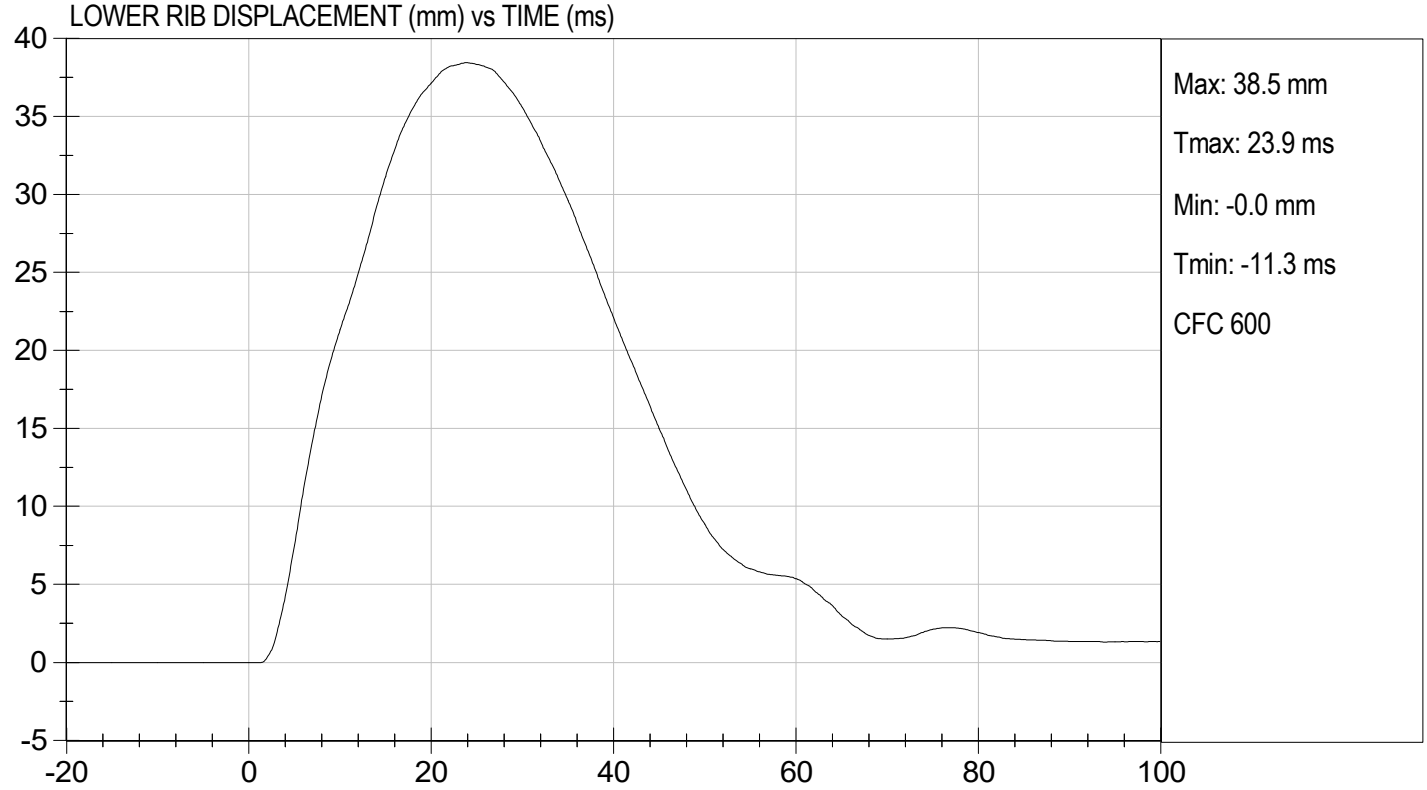




MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



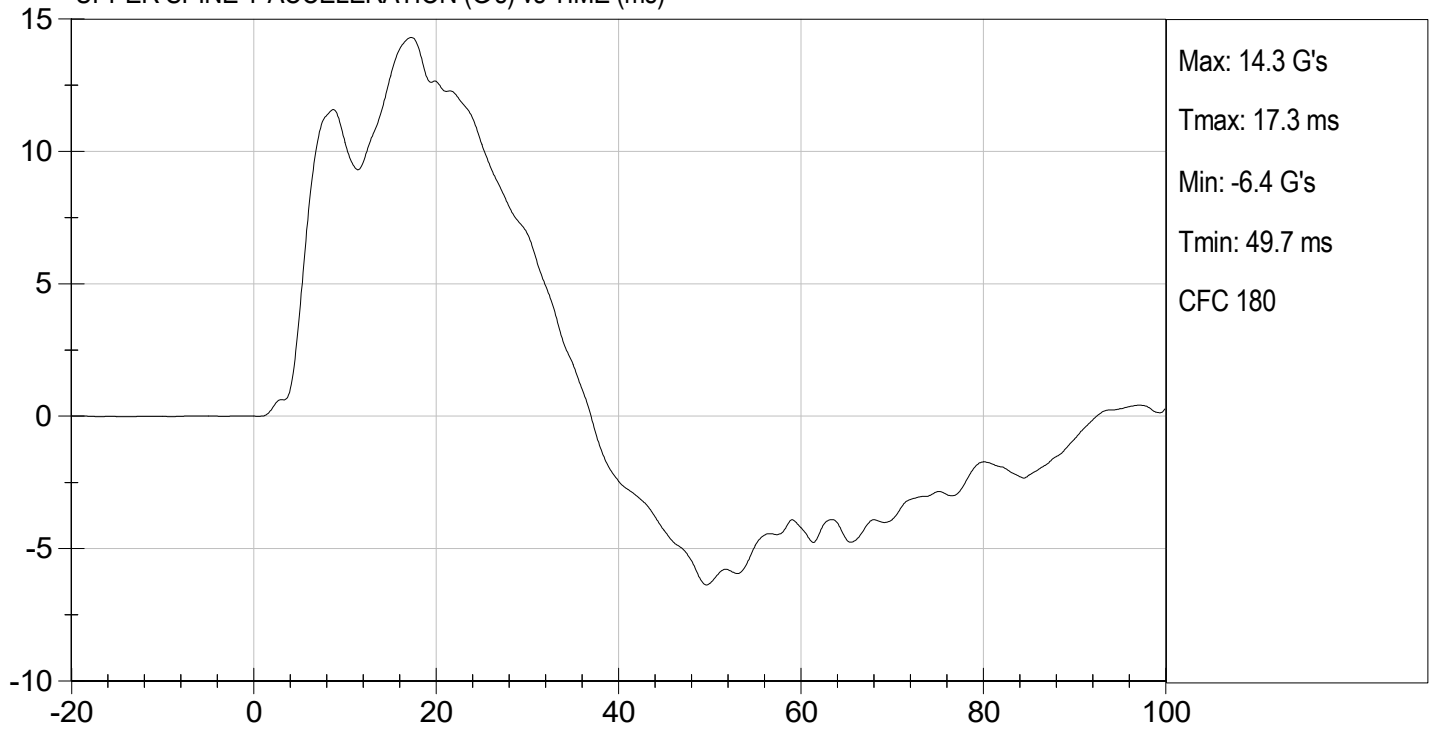
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



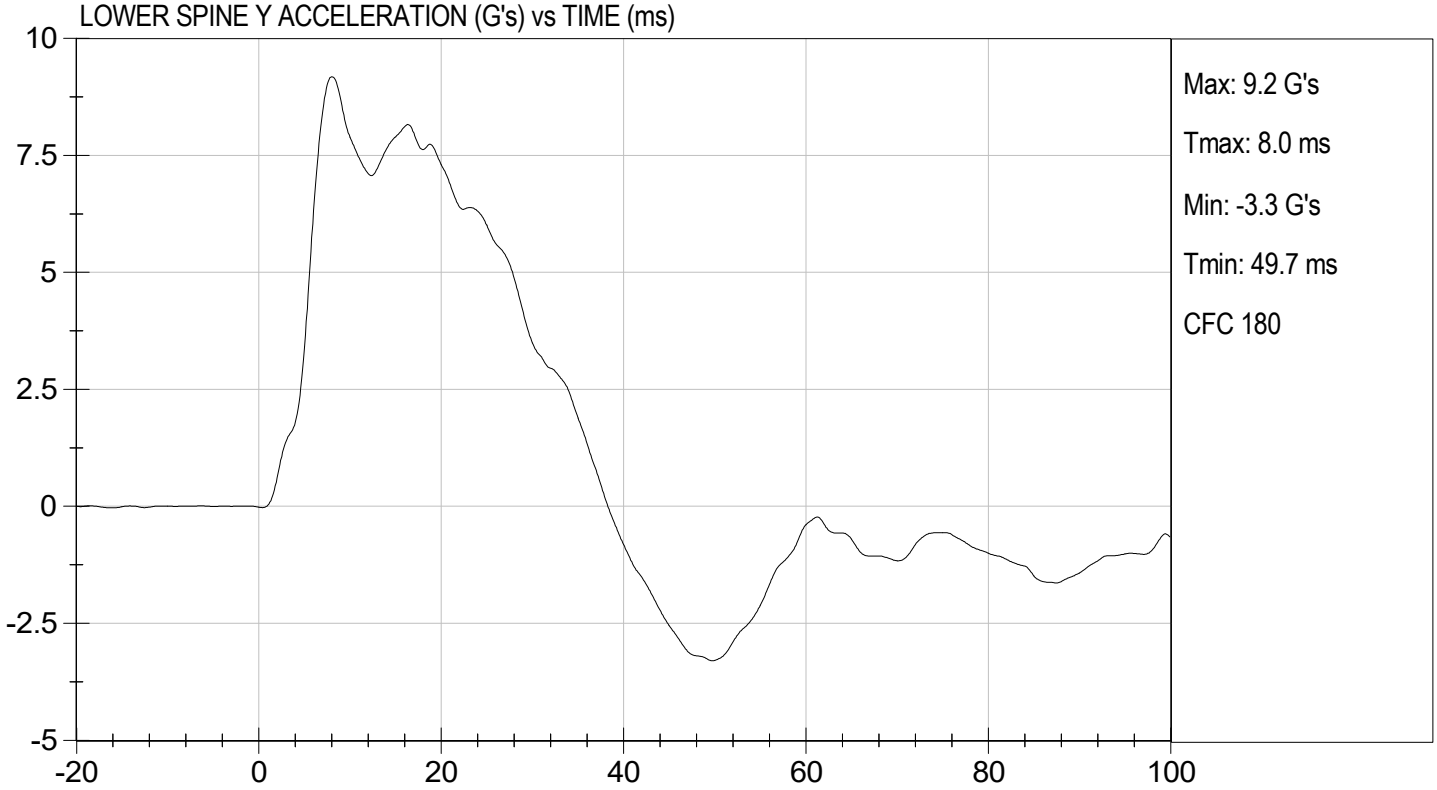
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 12/08/2023
TEST #: D233255

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



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



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233256

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	32	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	42	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	38	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

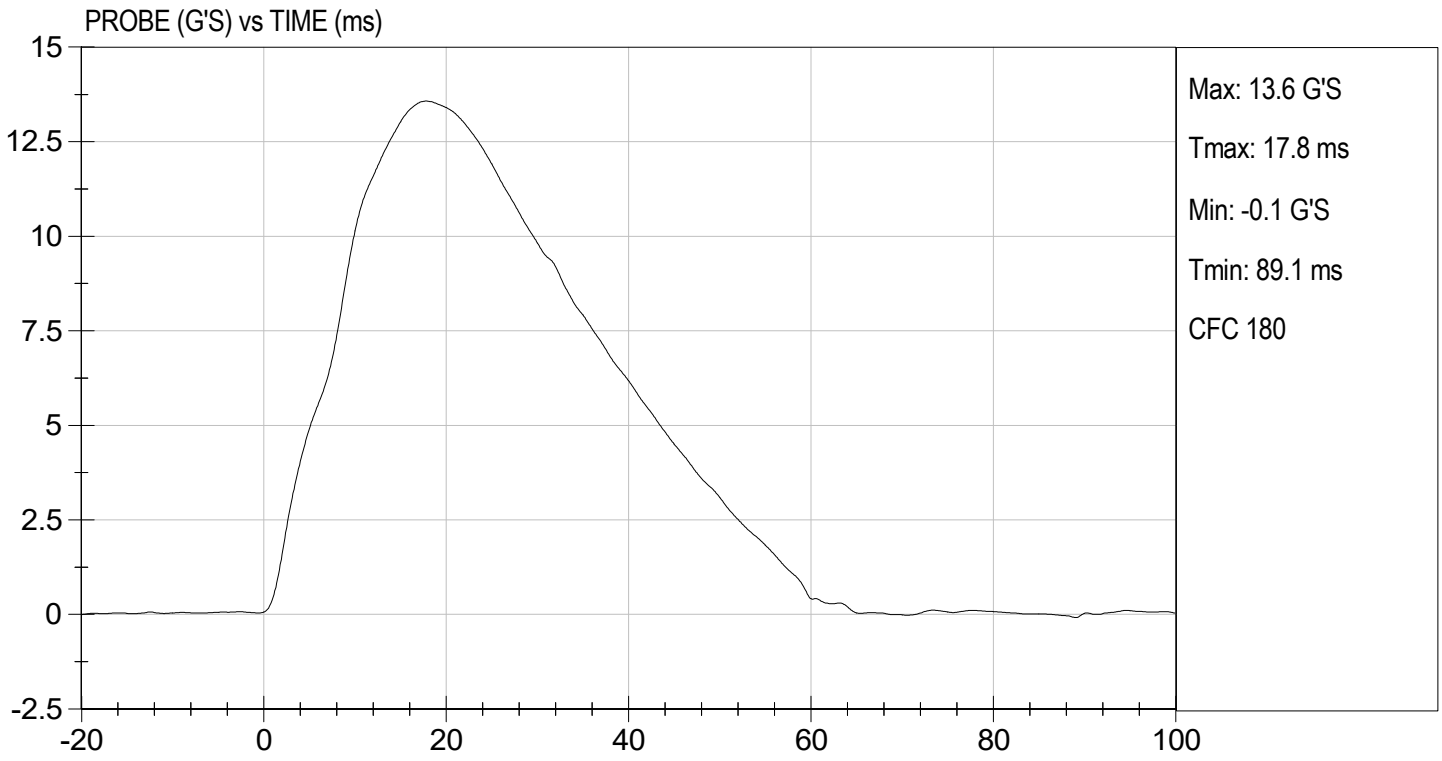
Laboratory Technician

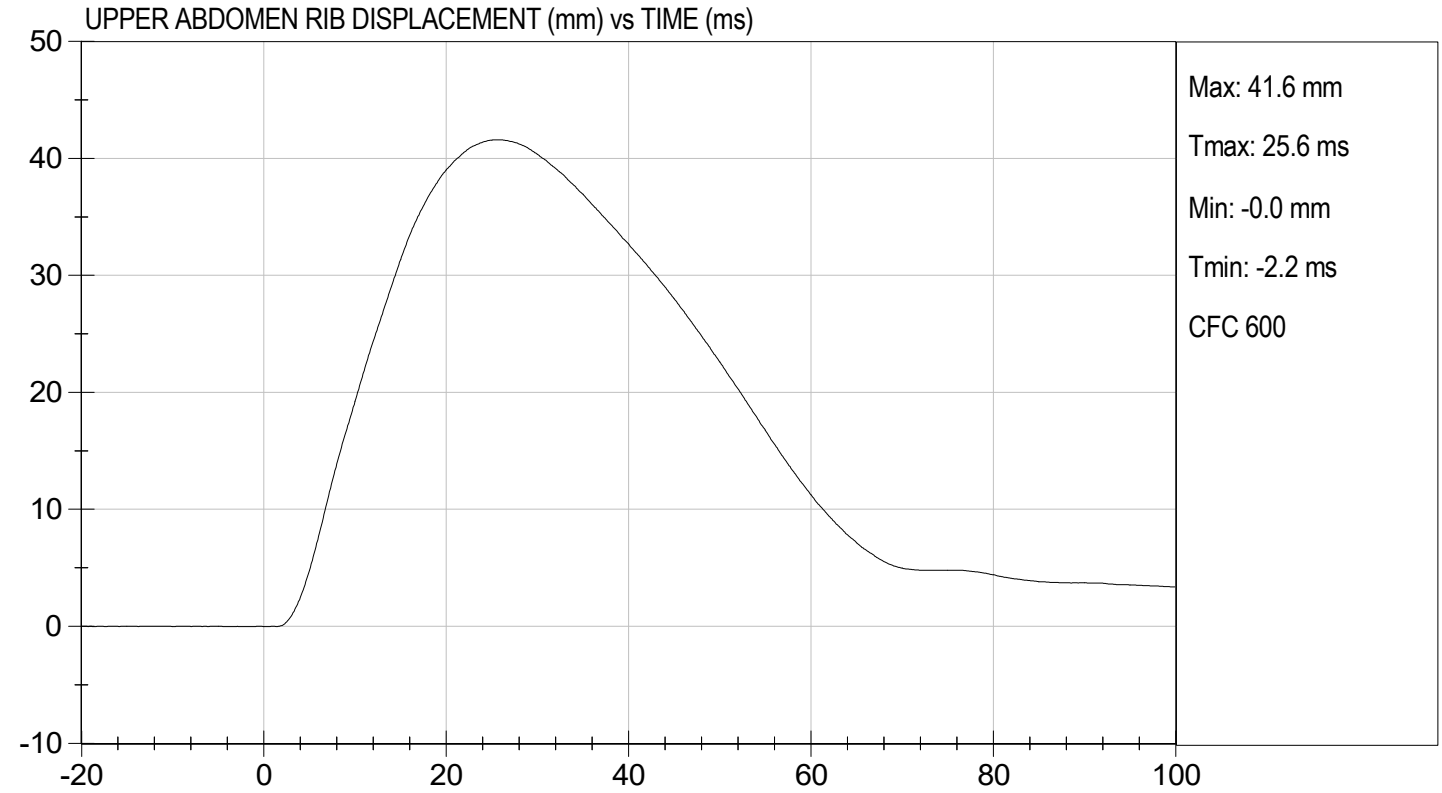
12/08/2023
Test Date

Approved By

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

TEST DATE: 12/08/2023
TEST #: D233256

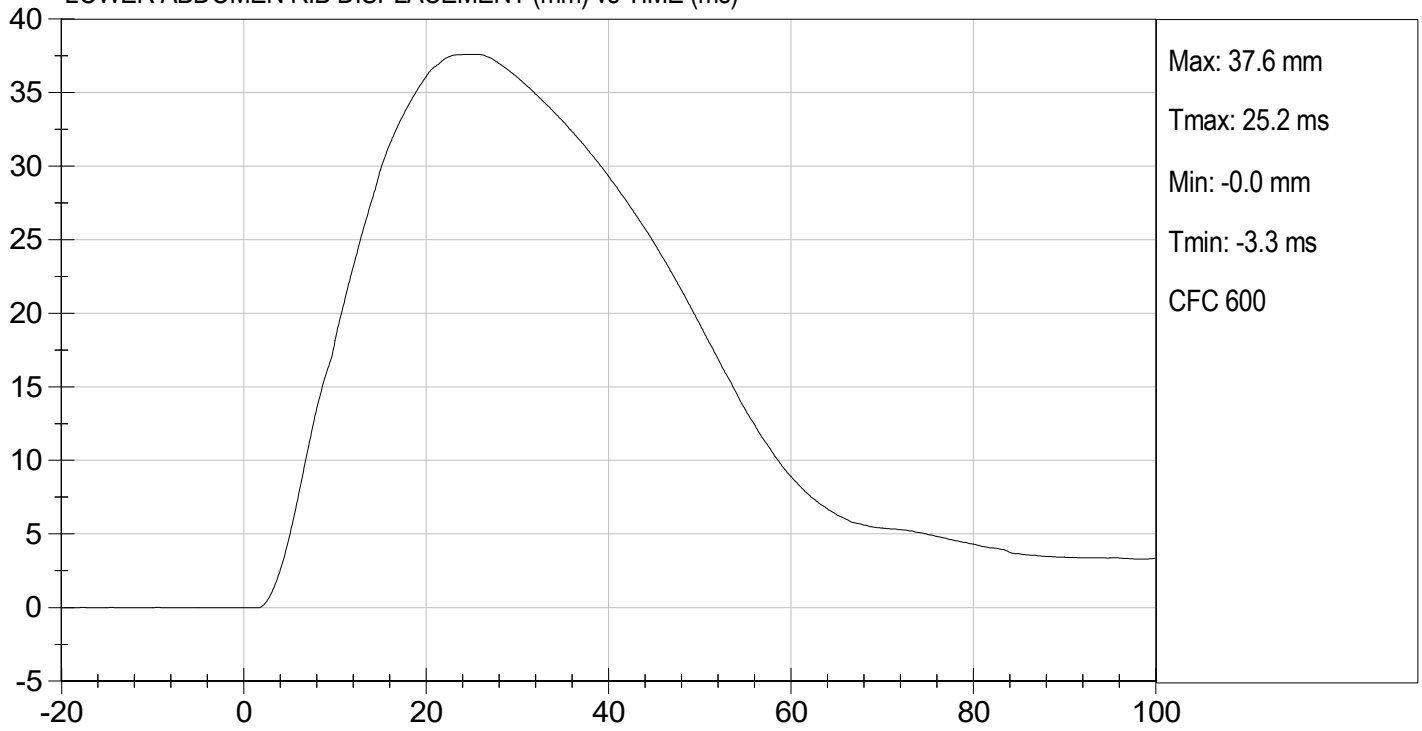




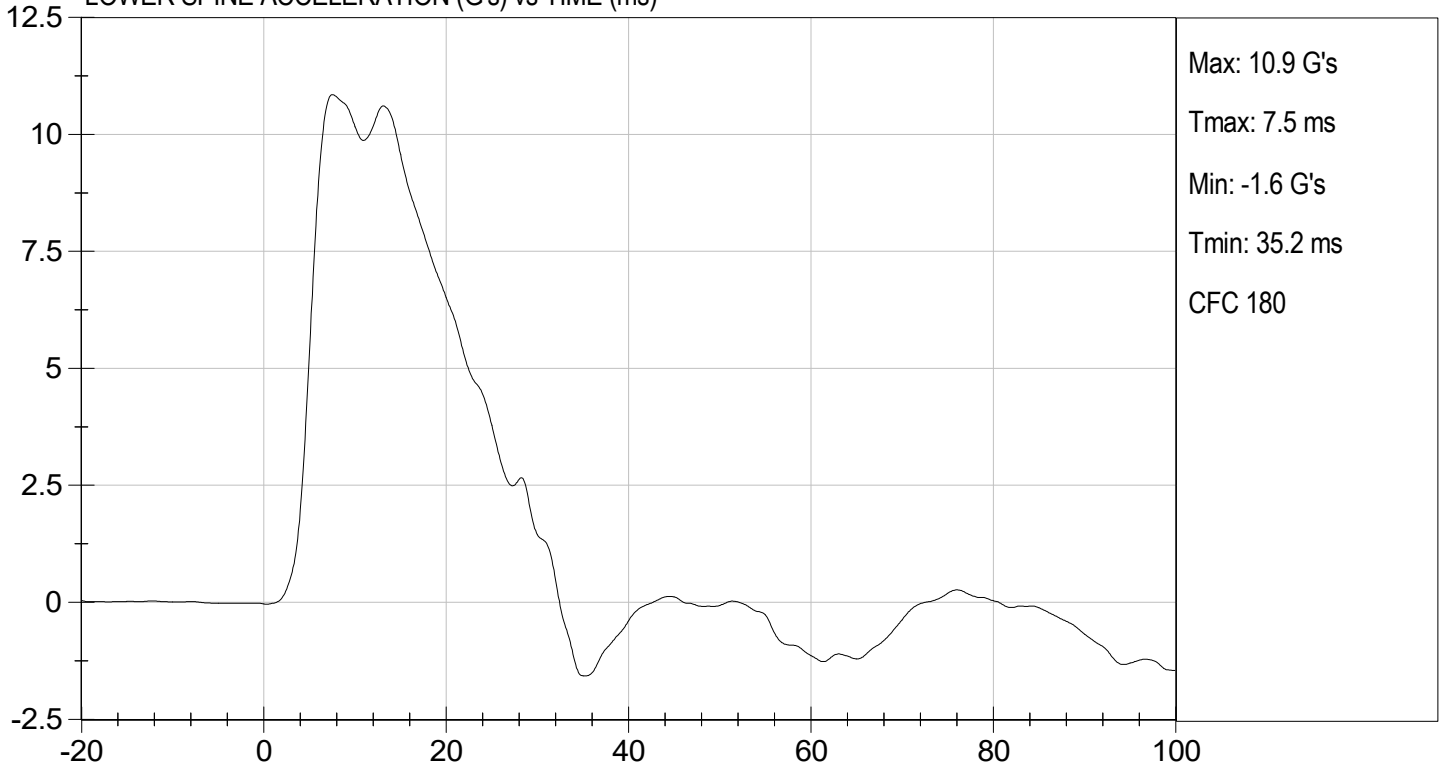
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 12/08/2023
TEST #: D233256

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



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



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233257

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	32	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	38 to 47	42	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	40.4	Pass
Peak Acetabulum Force	N	3600 to 4300	3,925	Pass
		Overall Test Results		Pass

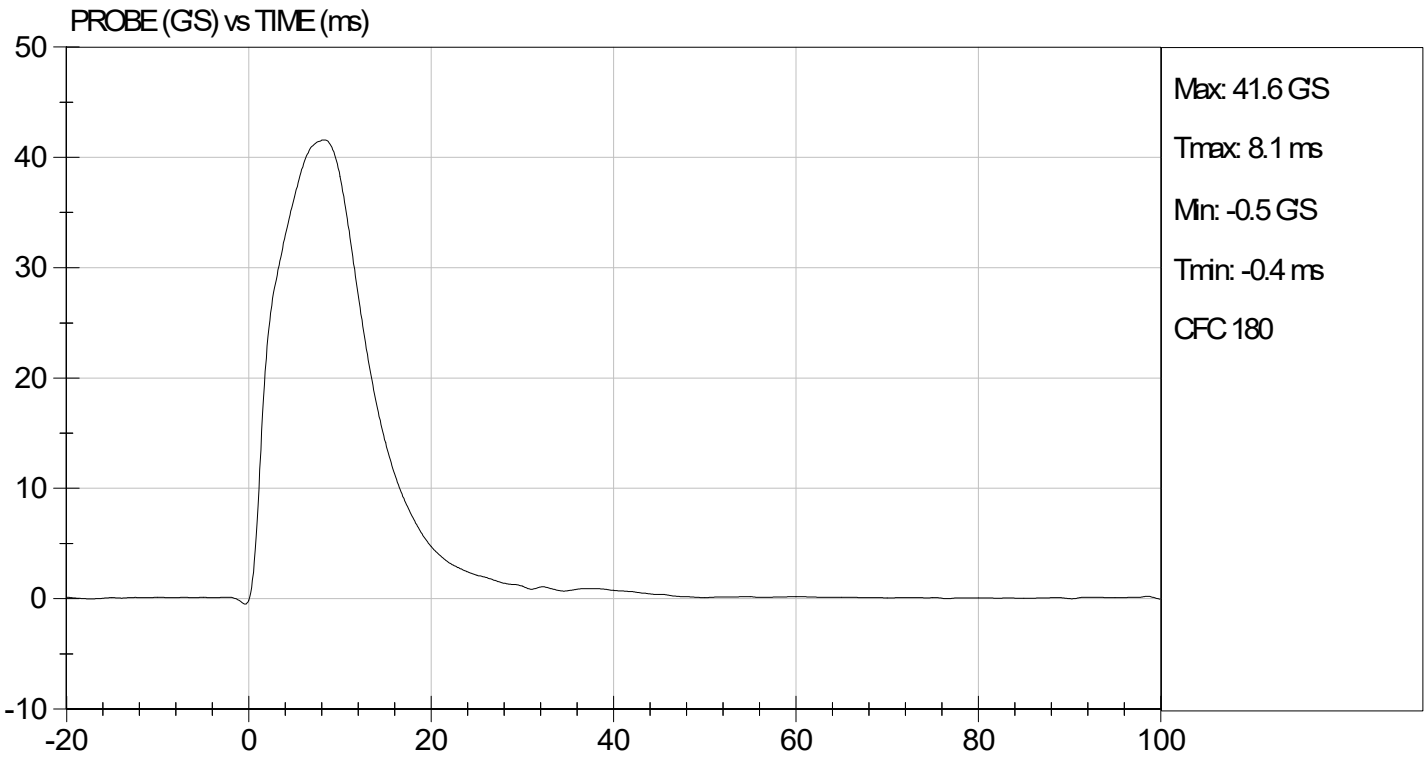
Laboratory Technician

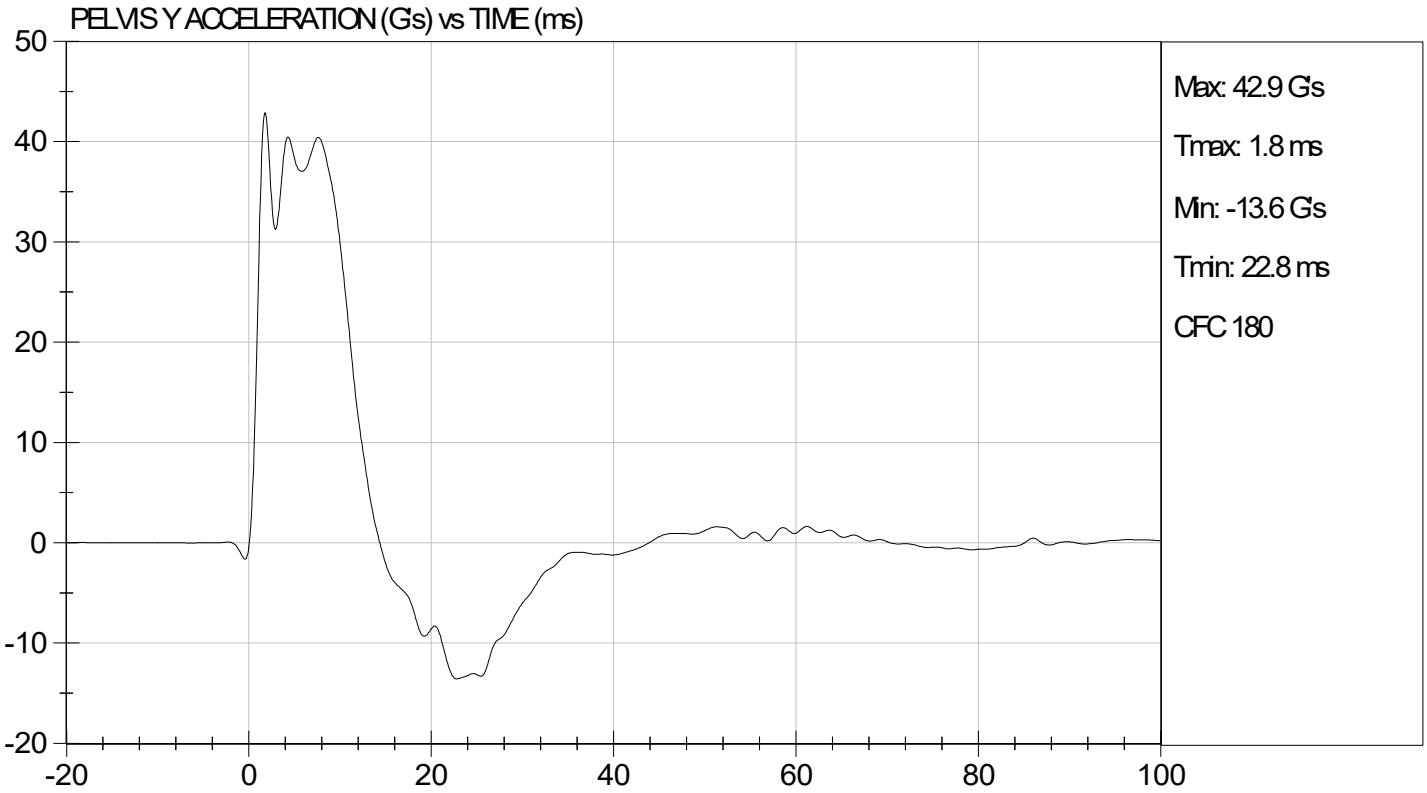
12/08/2023
Test Date

Approved By

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

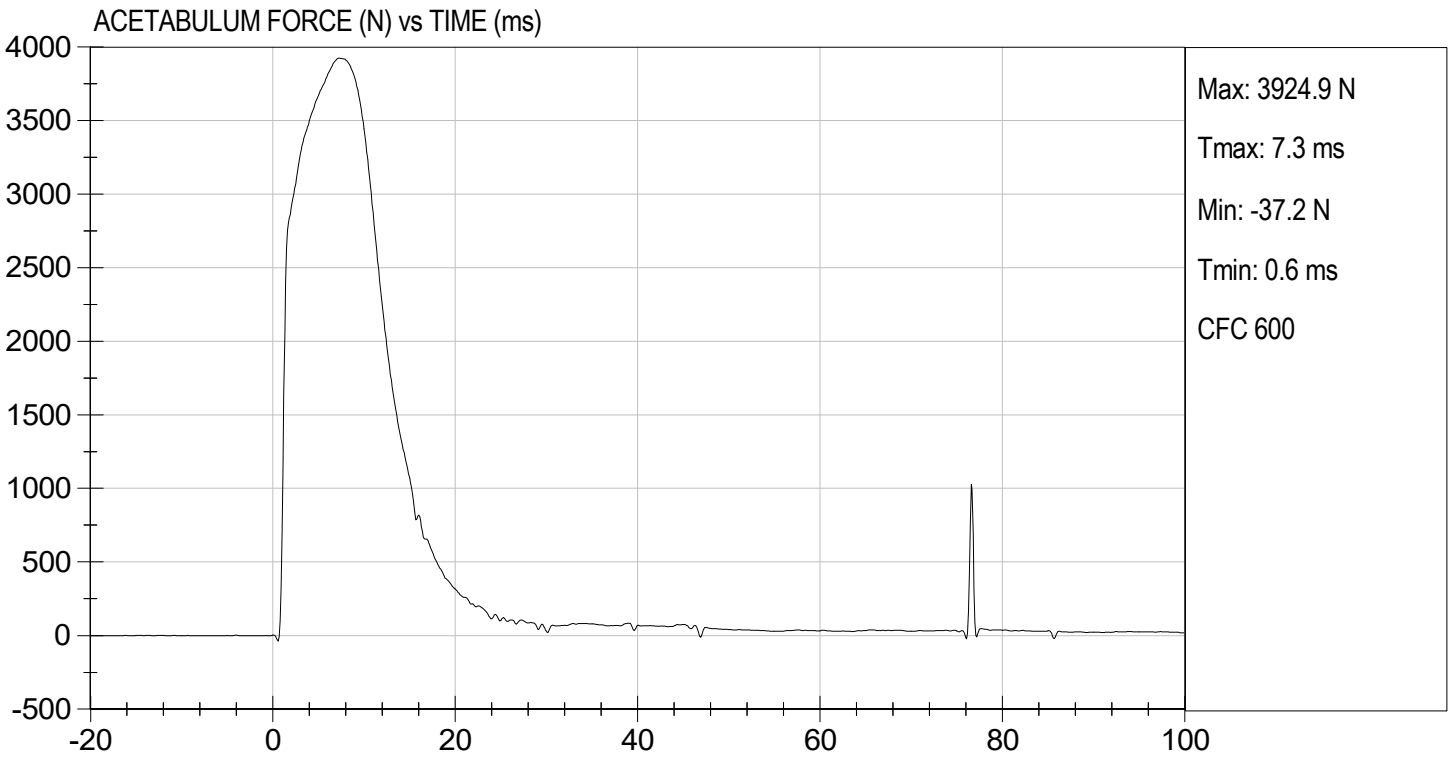
TEST DATE: 12/08/2023
TEST #: D233257





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

TEST DATE: 12/08/2023
TEST #: D233257



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233258

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Humidity	%	10 to 70	34	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	36 to 45	39	Pass
Pelvis Y Acceleration	G's	28 to 39	31	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,444	Pass
		Overall Test Results		Pass

Laboratory Technician

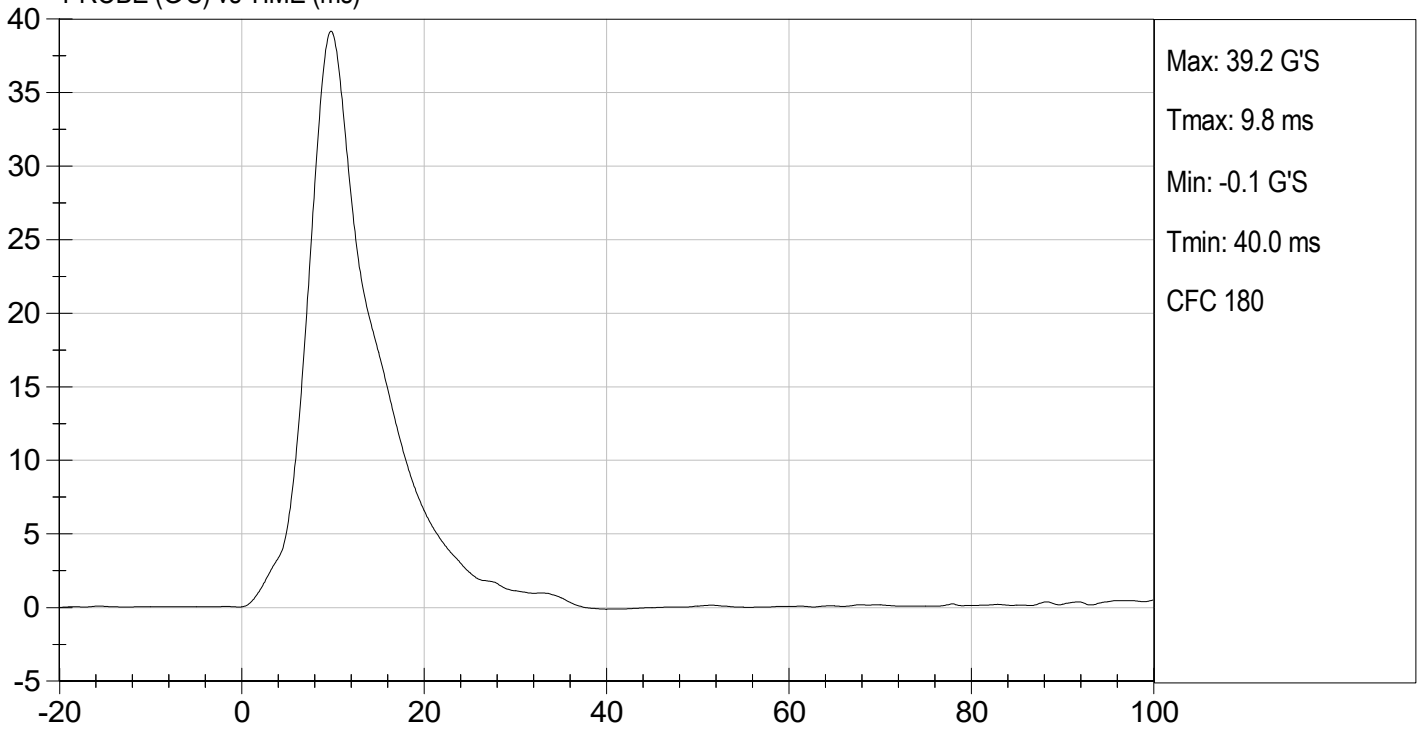
12/08/2023
Test Date

Approved By

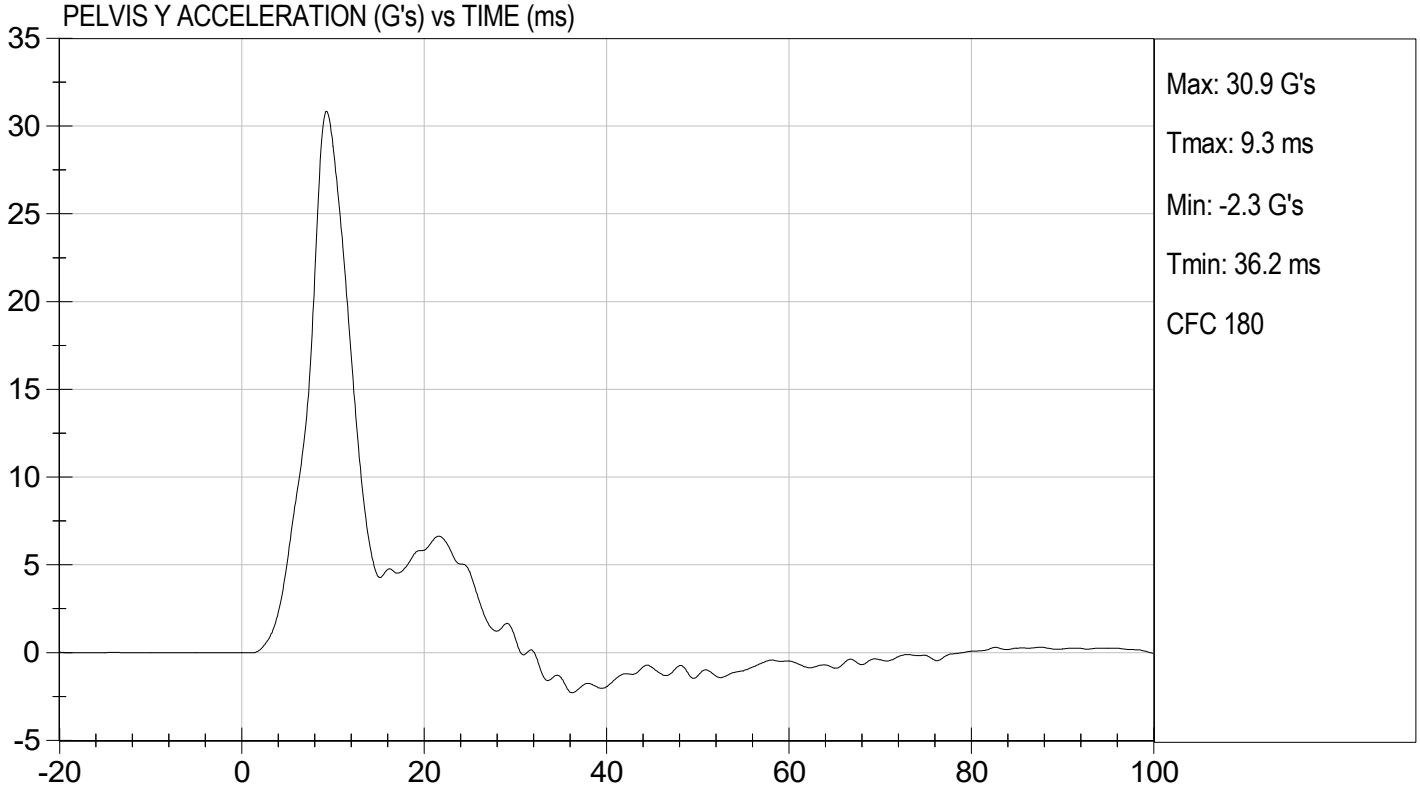
TEST DESC: ILLIAC
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 12/08/2023
TEST #: D233258

PROBE (G'S) vs TIME (ms)

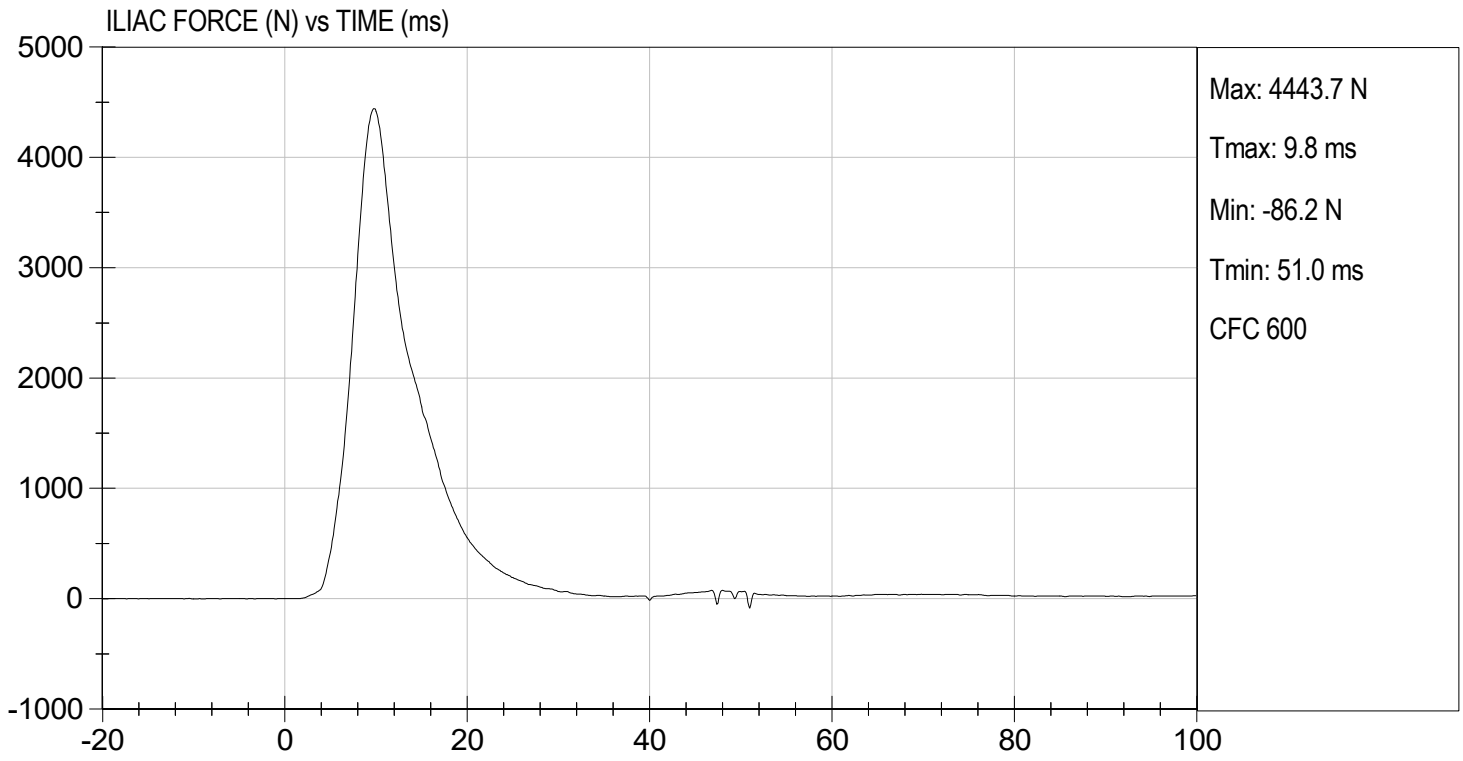


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 12/08/2023
TEST #: D233258



QUALIFICATION TEST RESULTS

POST-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

SID-IIsD External Measurements
SN: 306

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

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D233371

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	27	Pass
Peak Resultant Acceleration	G's	115 to 137	131	Pass
Peak Longitudinal Acceleration	G's	+/- 15	-2.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

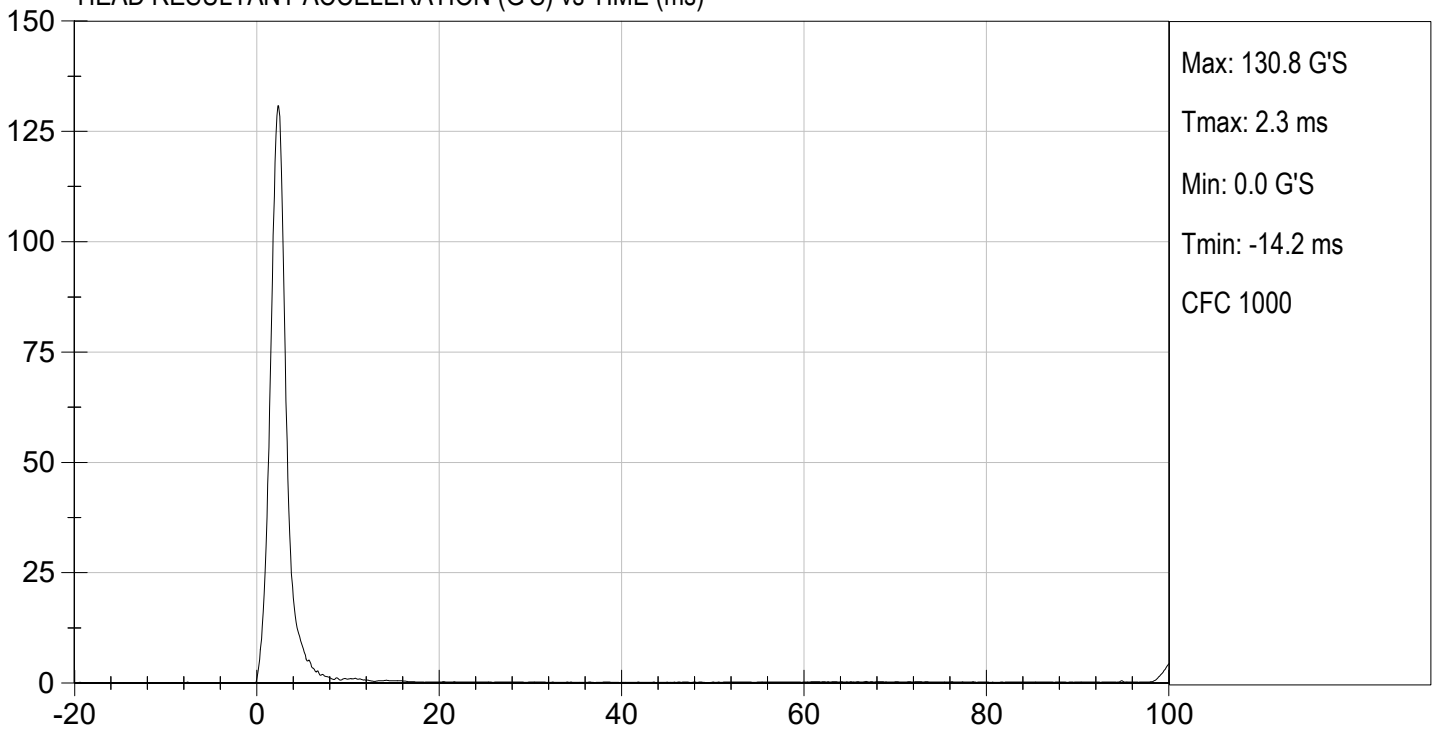
12/18/2023
Test Date

Approved By

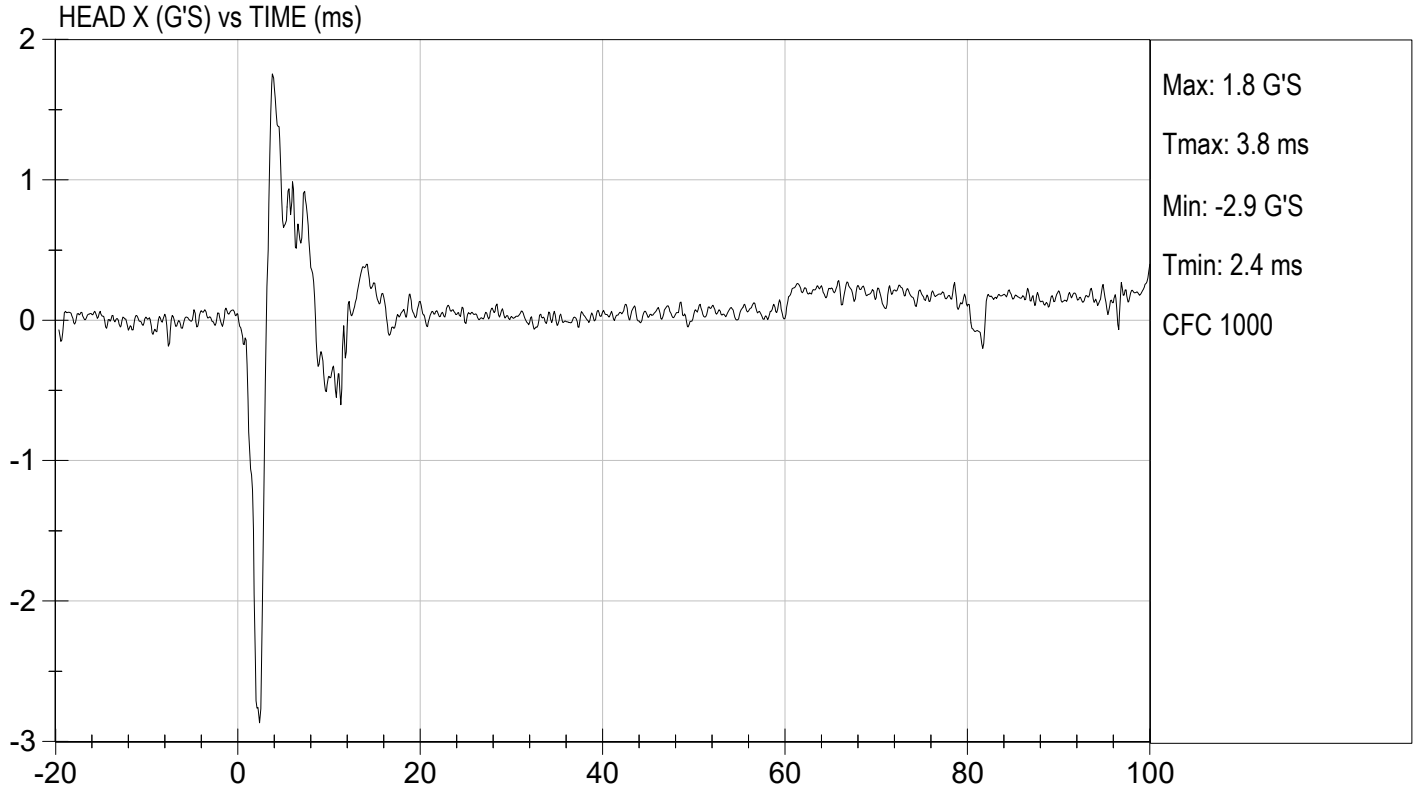
TEST DESC: HEAD DROP

TEST DATE: 12/18/2023
TEST #: D233371

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

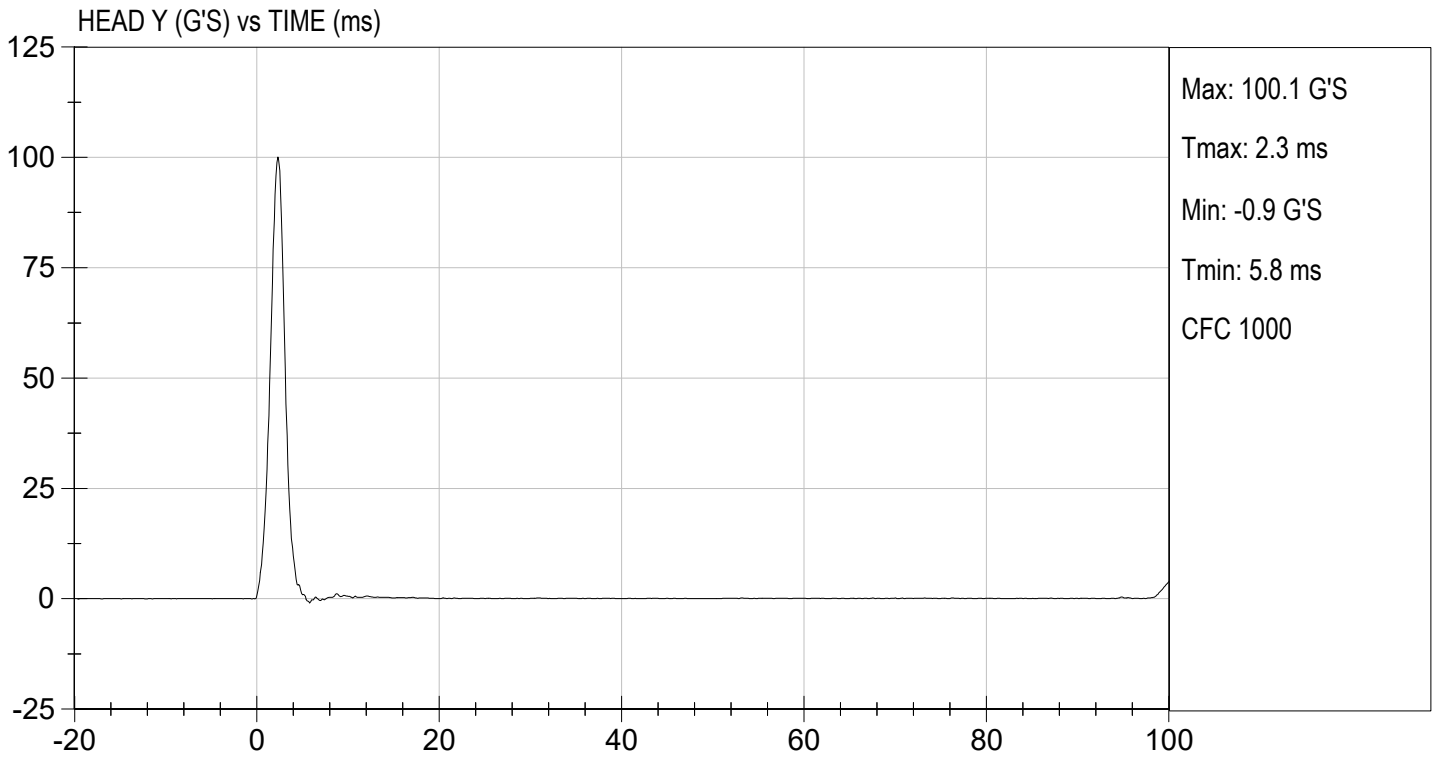


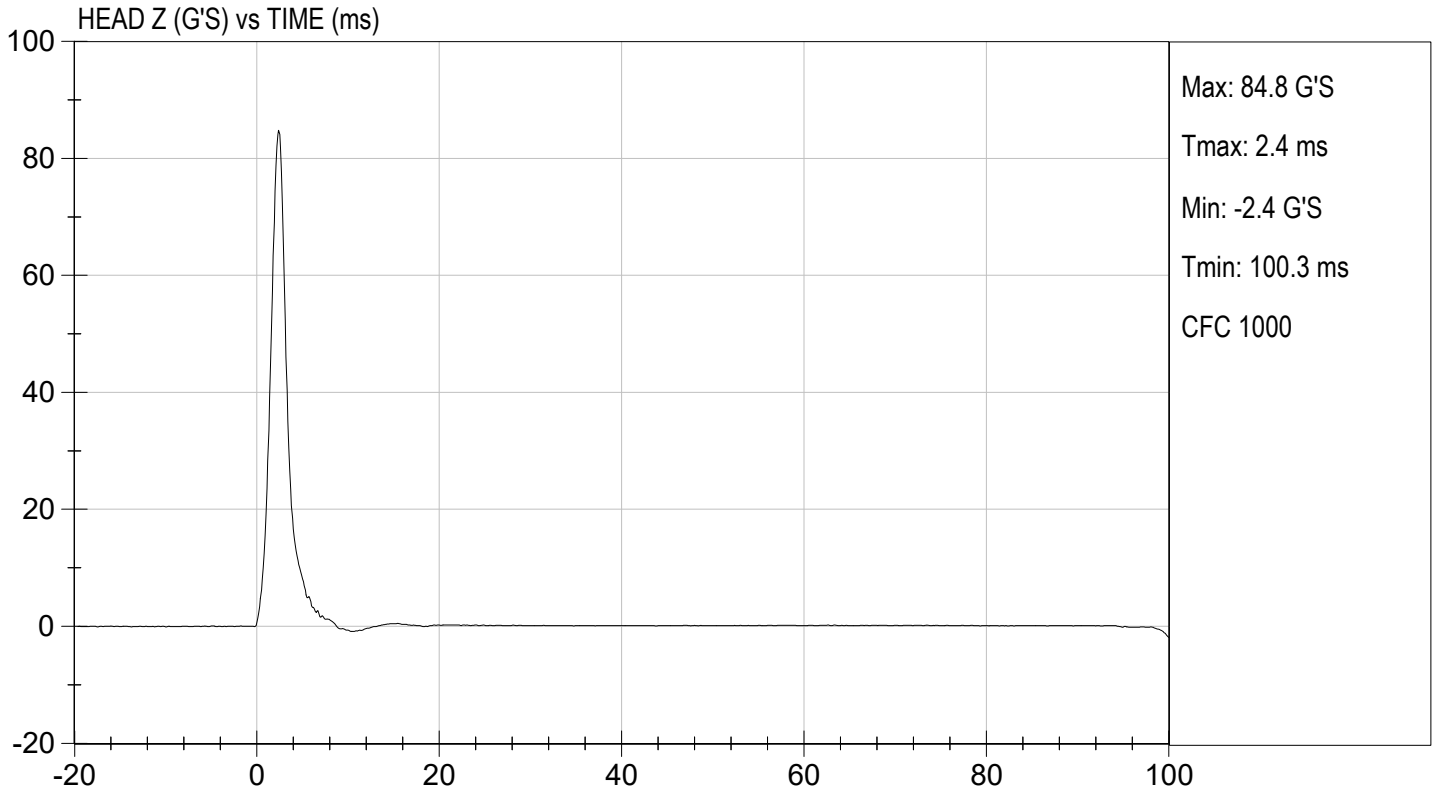
HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 12/18/2023
TEST #: D233371





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233372

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.4	Pass
Humidity		%	10 to 70	26	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.32	Pass
	15 ms	m/s	3.30 to 4.10	3.56	Pass
	20 ms	m/s	4.40 to 5.40	5.07	Pass
	25 ms	m/s	5.40 to 6.10	5.77	Pass
	25-100 ms	m/s	5.50 to 6.20	5.78	Pass
Maximum D-Plane Rotation		deg	71 to 81	75	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	66	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-40	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	118	Pass
			Overall Test Results		Pass

Laboratory Technician

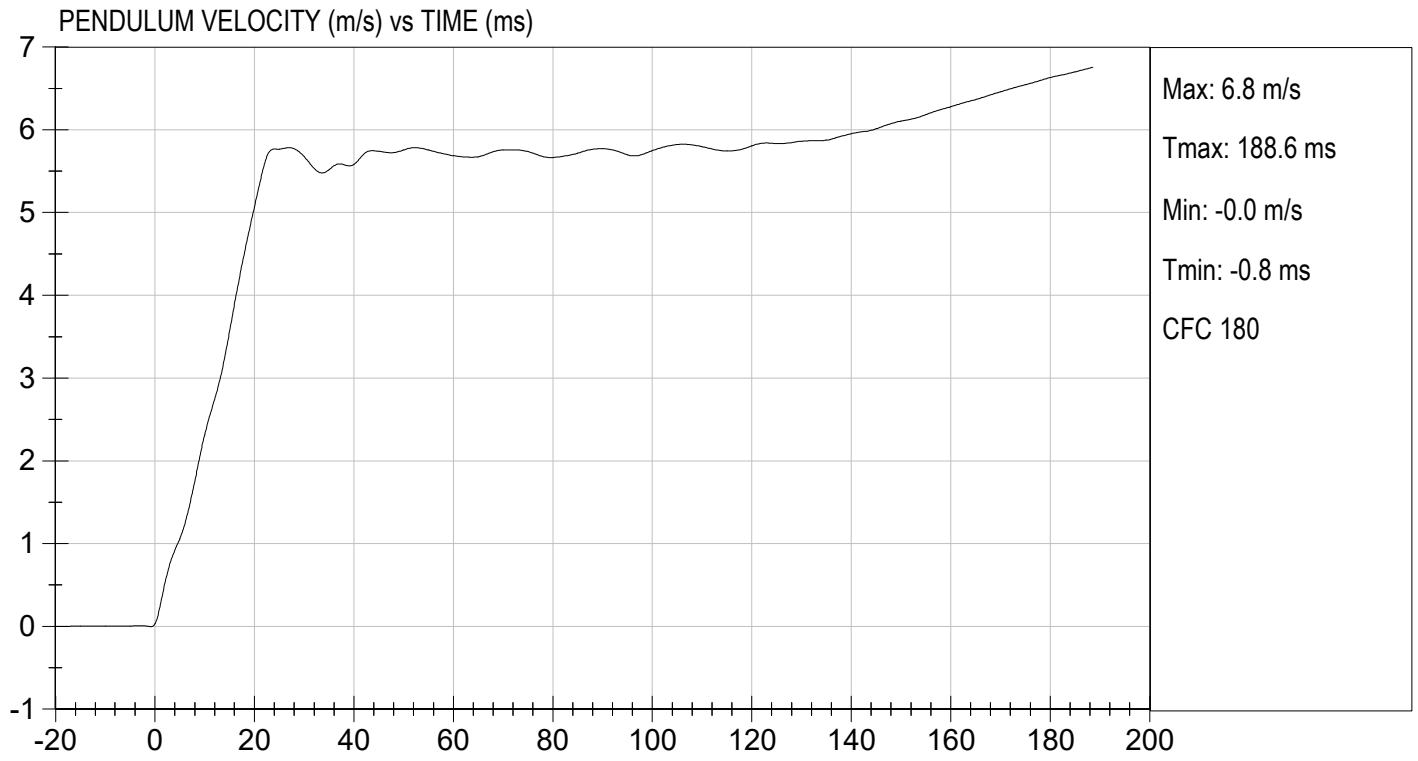
12/18/2023

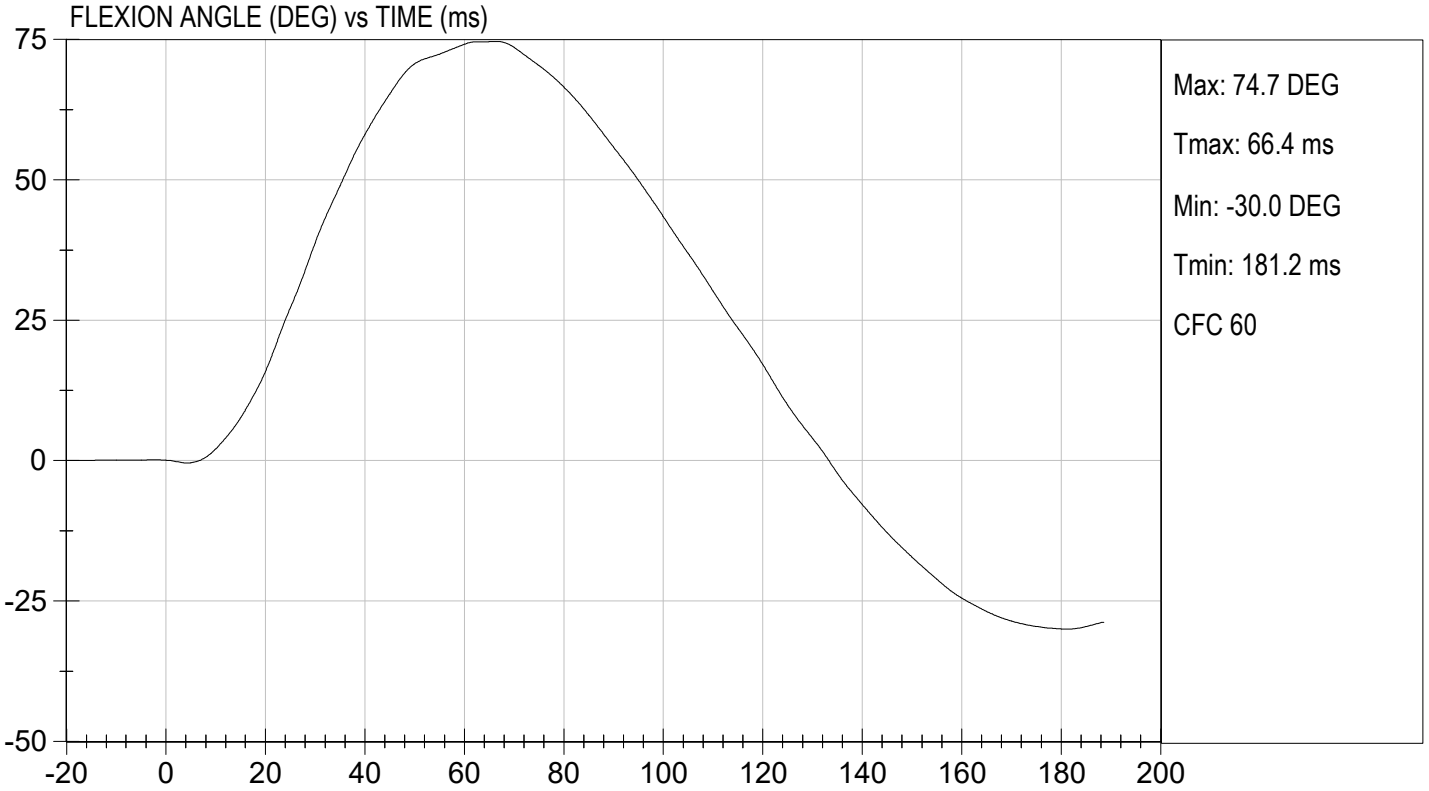
Test Date

Approved By

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

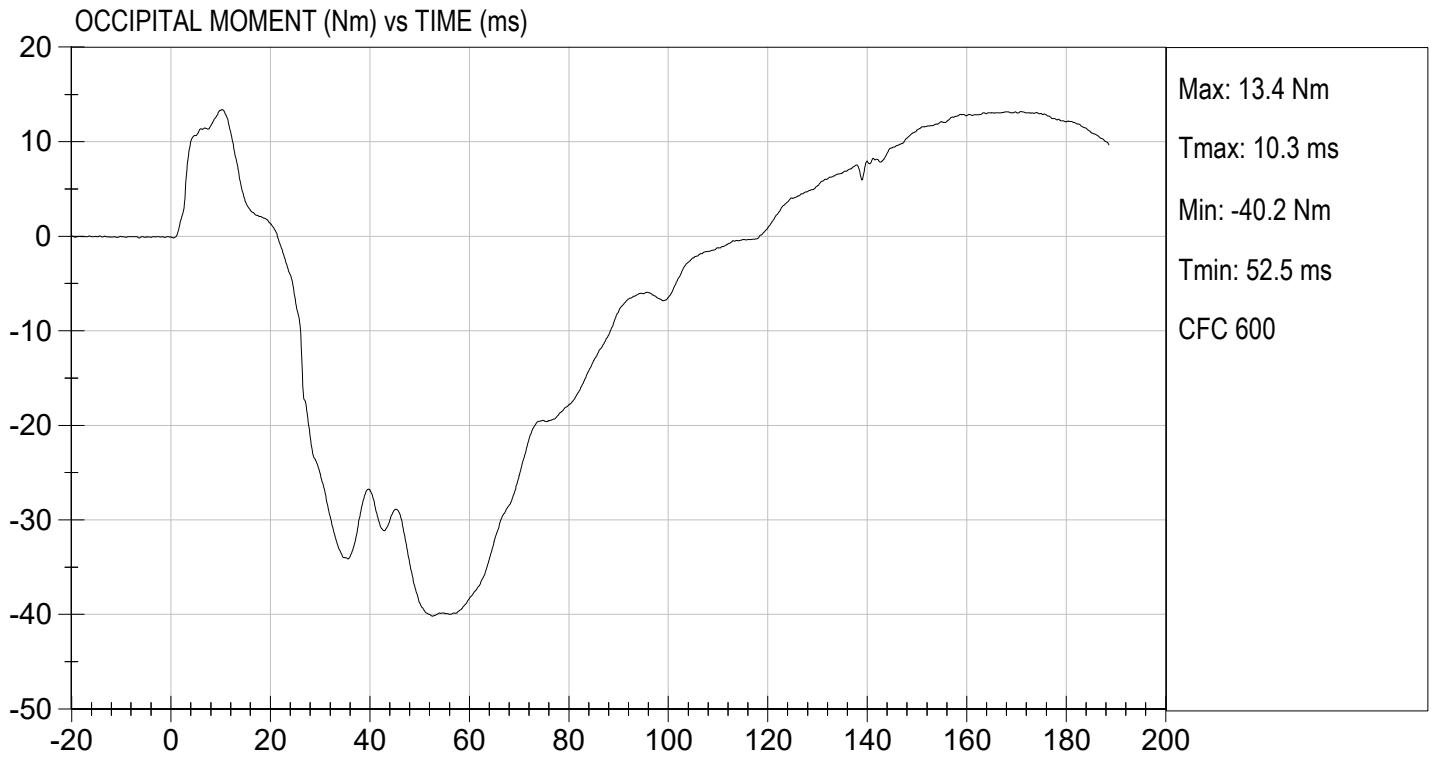
TEST DATE: 12/18/2023
TEST #: D233372





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

TEST DATE: 12/18/2023
TEST #: D233372



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test ID:** D233373

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	27	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	32	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	19	Pass
		Overall Test Results		Pass

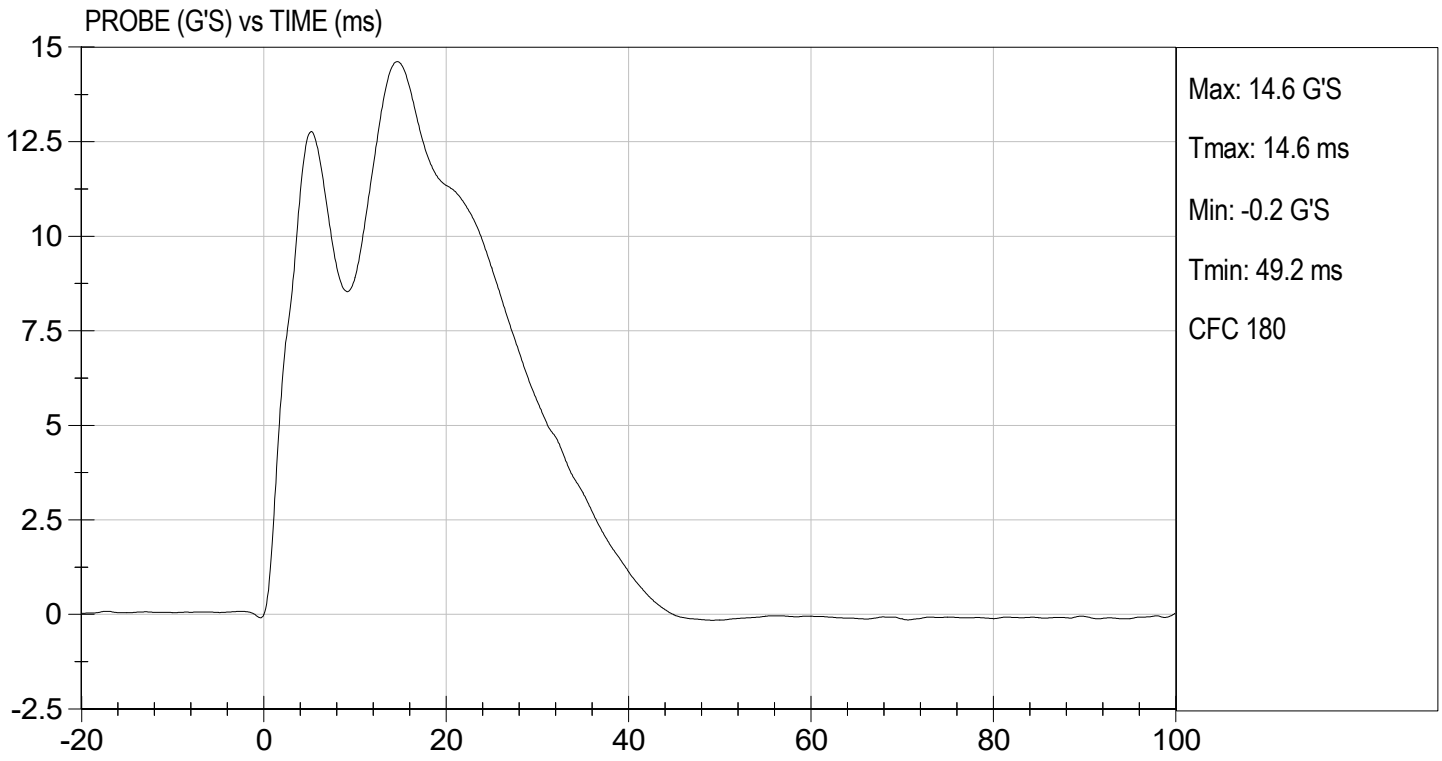
Laboratory Technician

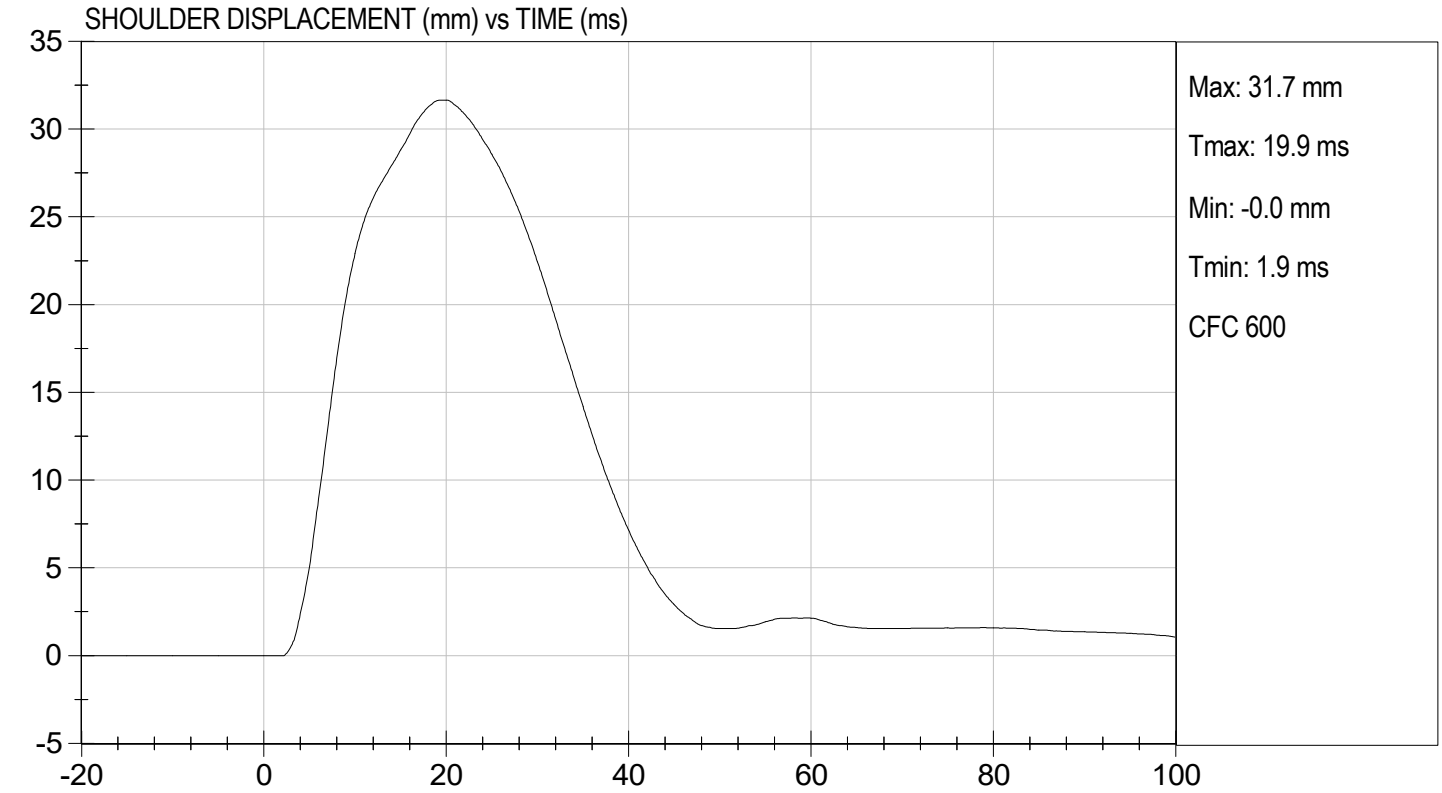
12/18/2023
Test Date

Approved By

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

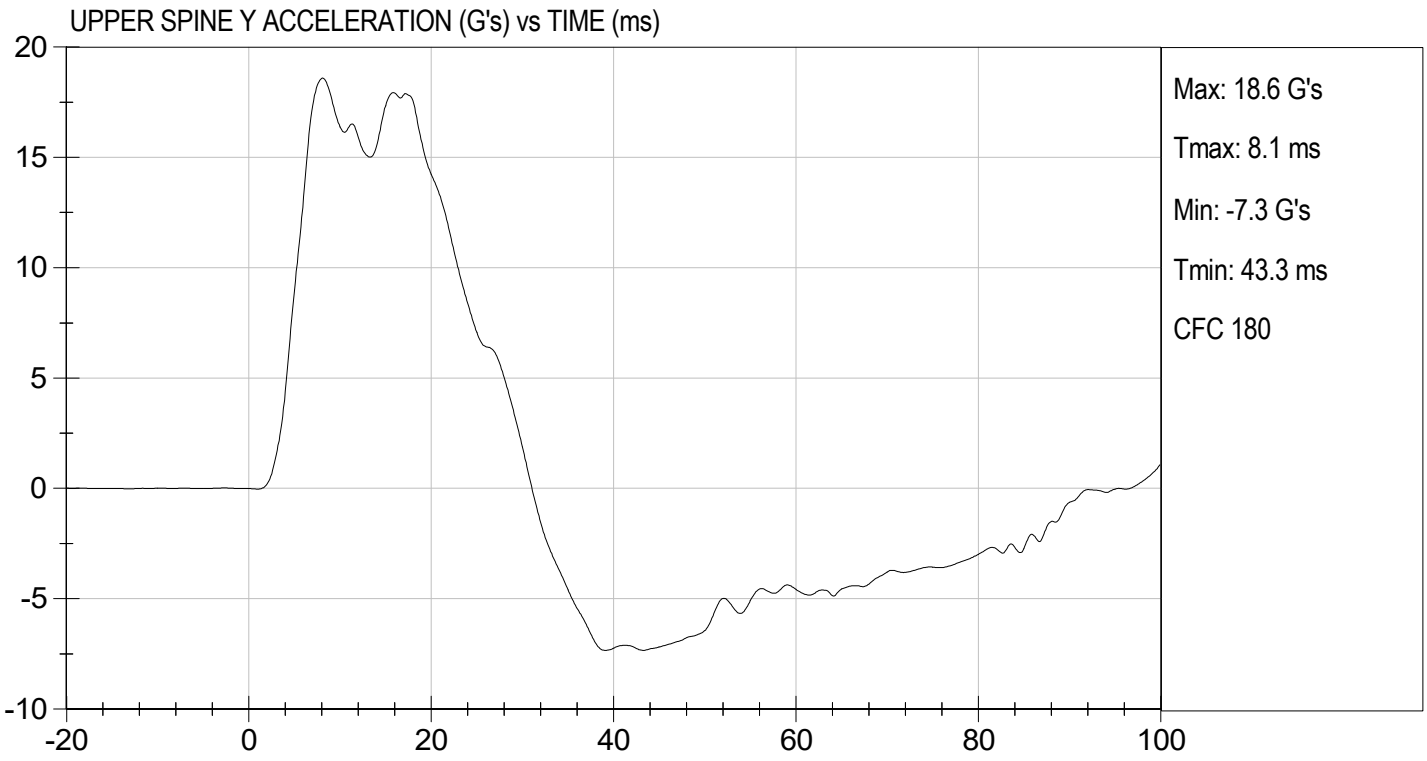
TEST DATE: 12/18/2023
TEST #: D233373





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

TEST DATE: 12/18/2023
TEST #: D233373



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233374

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Humidity	%	10 to 70	27	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Maximum Probe Acceleration	G's	30 to 36	31	Pass
Shoulder Displacement	mm	31 to 40	35	Pass
Upper Rib Displacement	mm	25 to 32	29	Pass
Middle Rib Displacement	mm	30 to 36	33	Pass
Lower Rib Displacement	mm	32 to 38	35	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	34	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	31	Pass
		Overall Test Results		Pass

Laboratory Technician

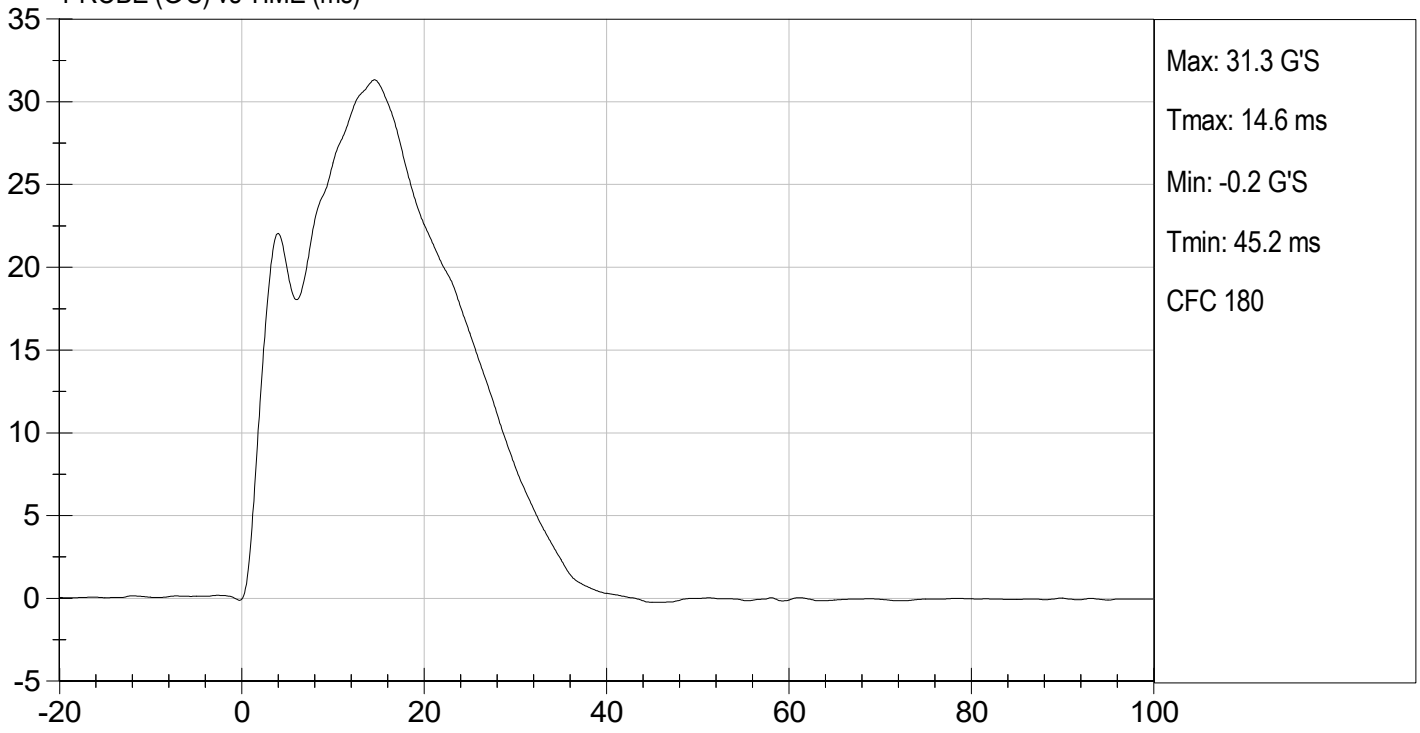
12/18/2023
Test Date

Approved By

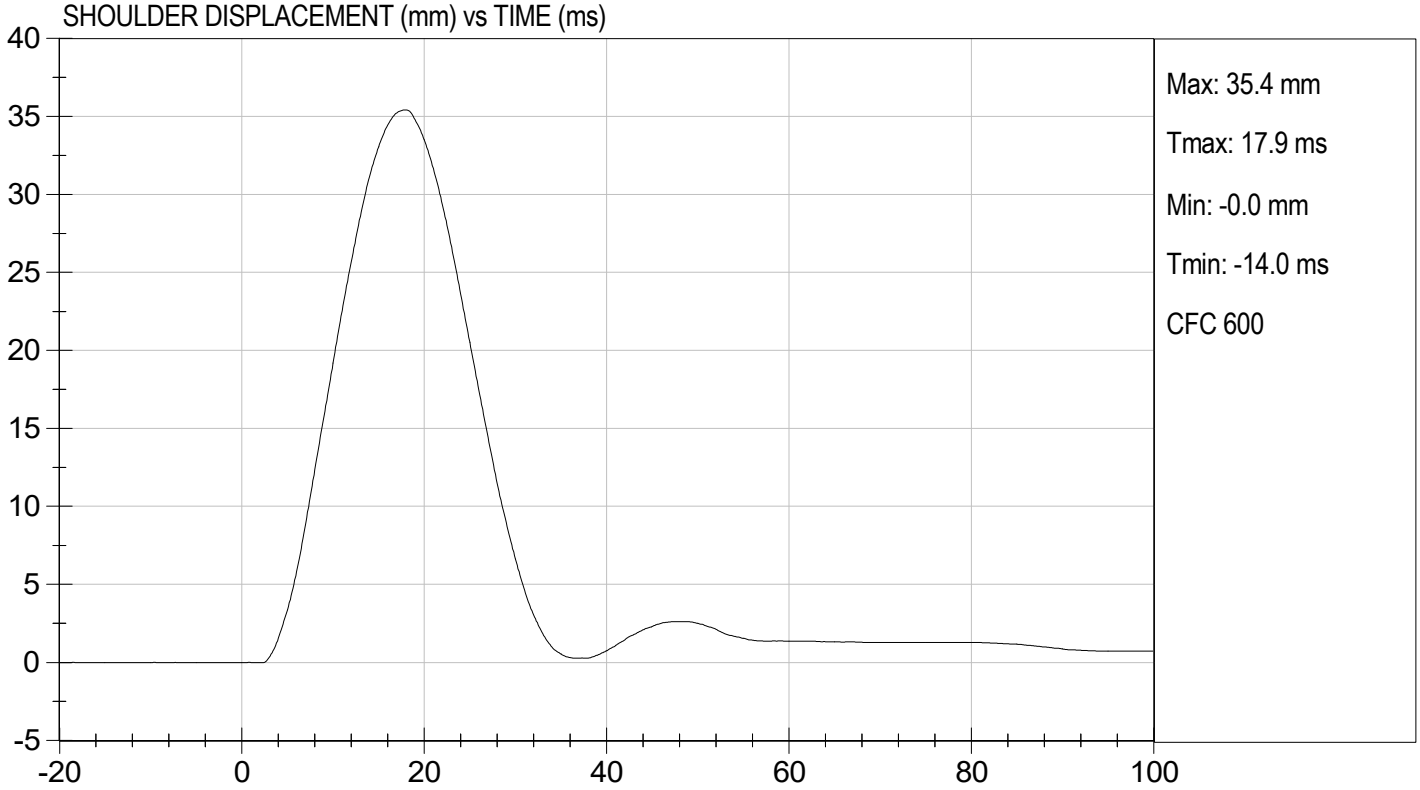
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 12/18/2023
TEST #: D233374

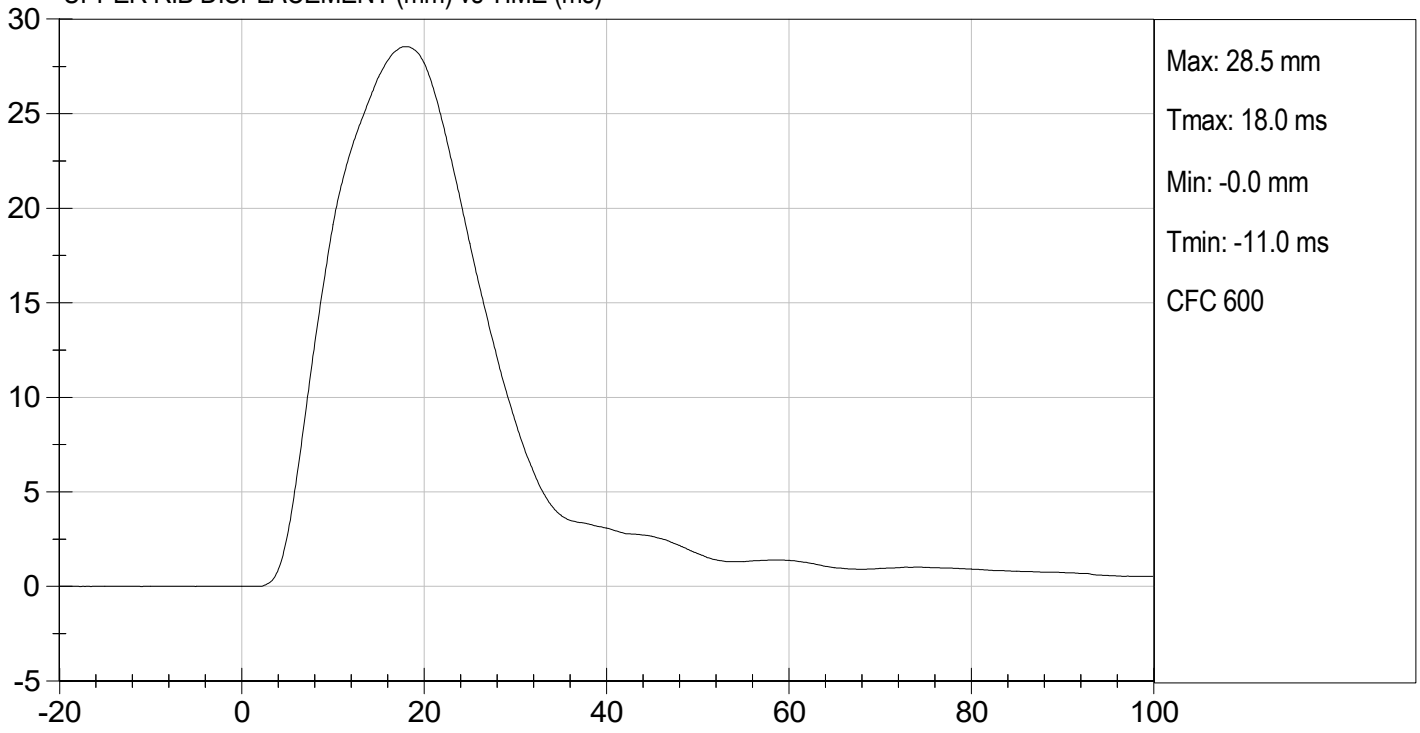
PROBE (G'S) vs TIME (ms)



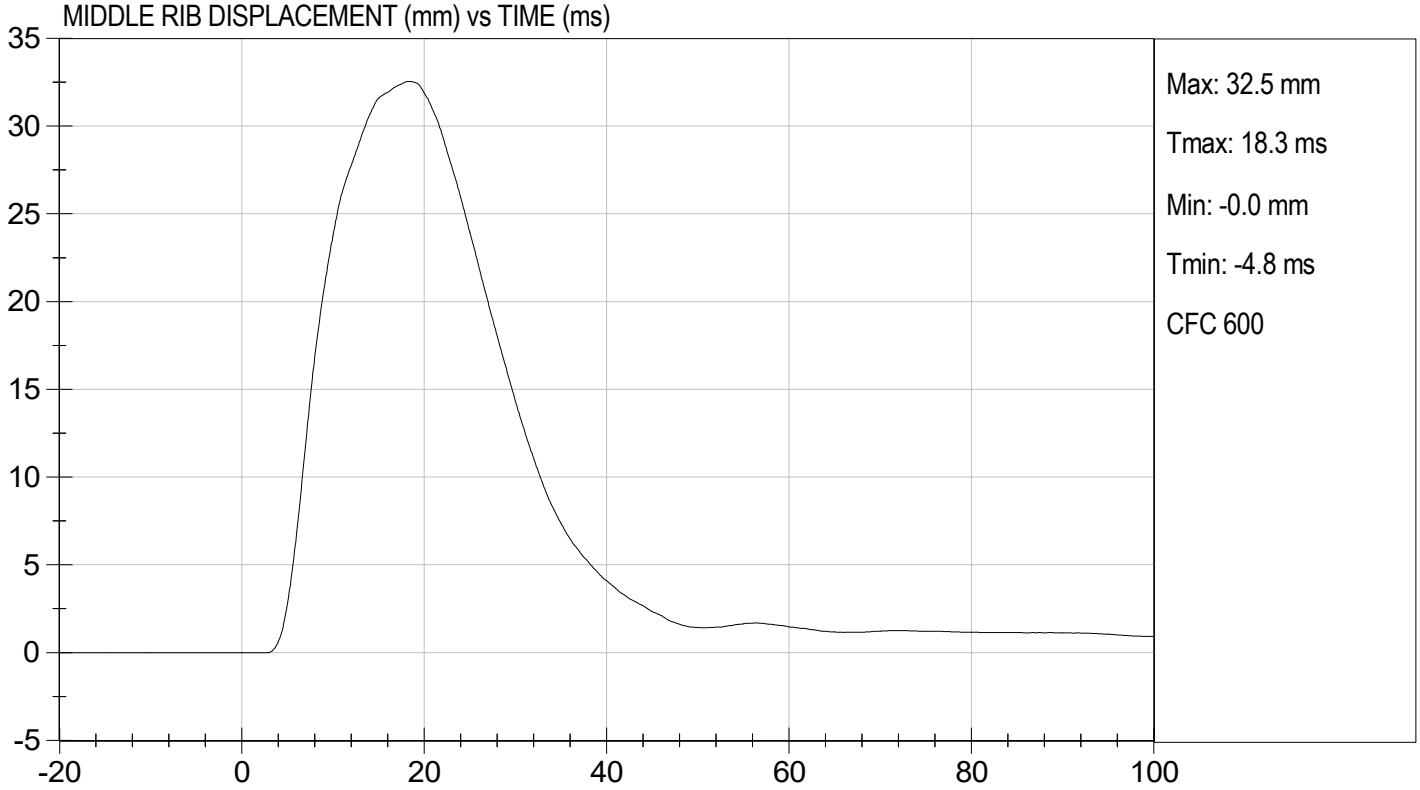
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



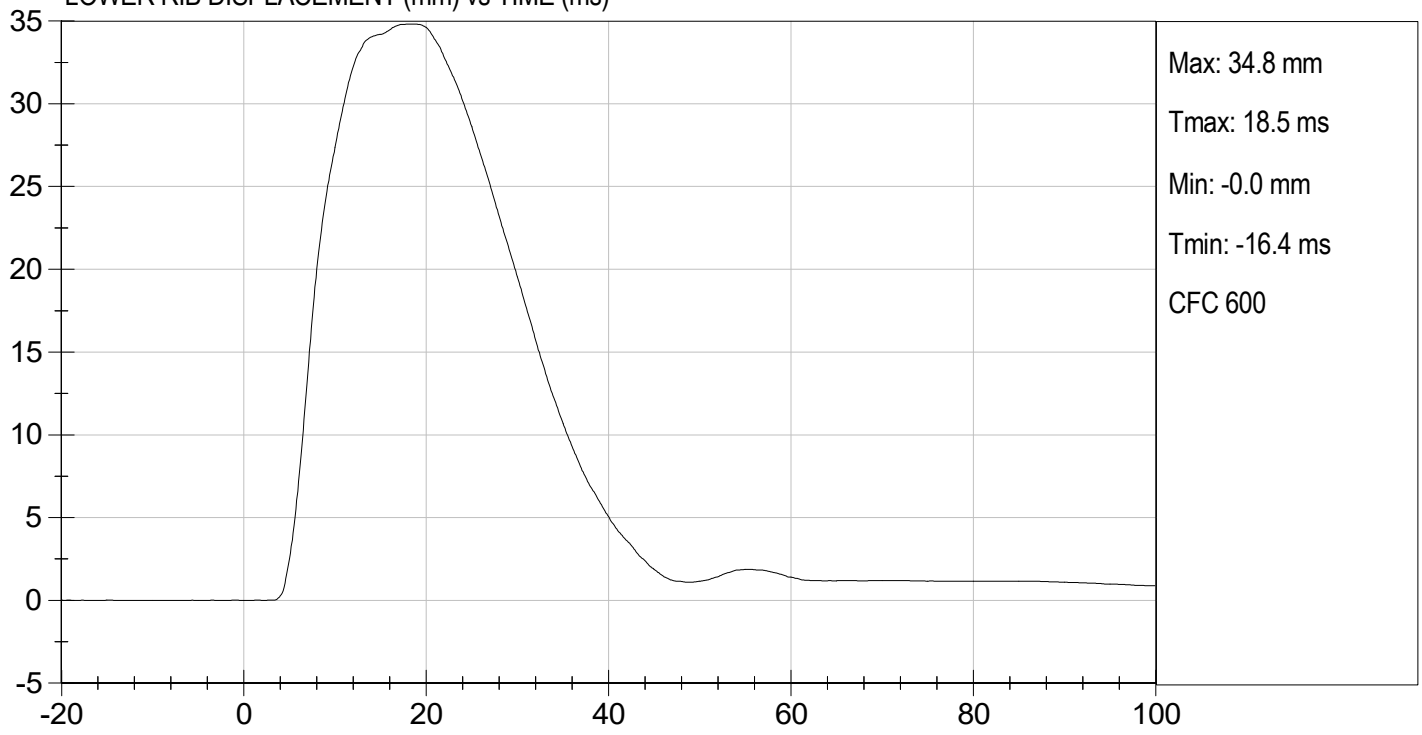
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



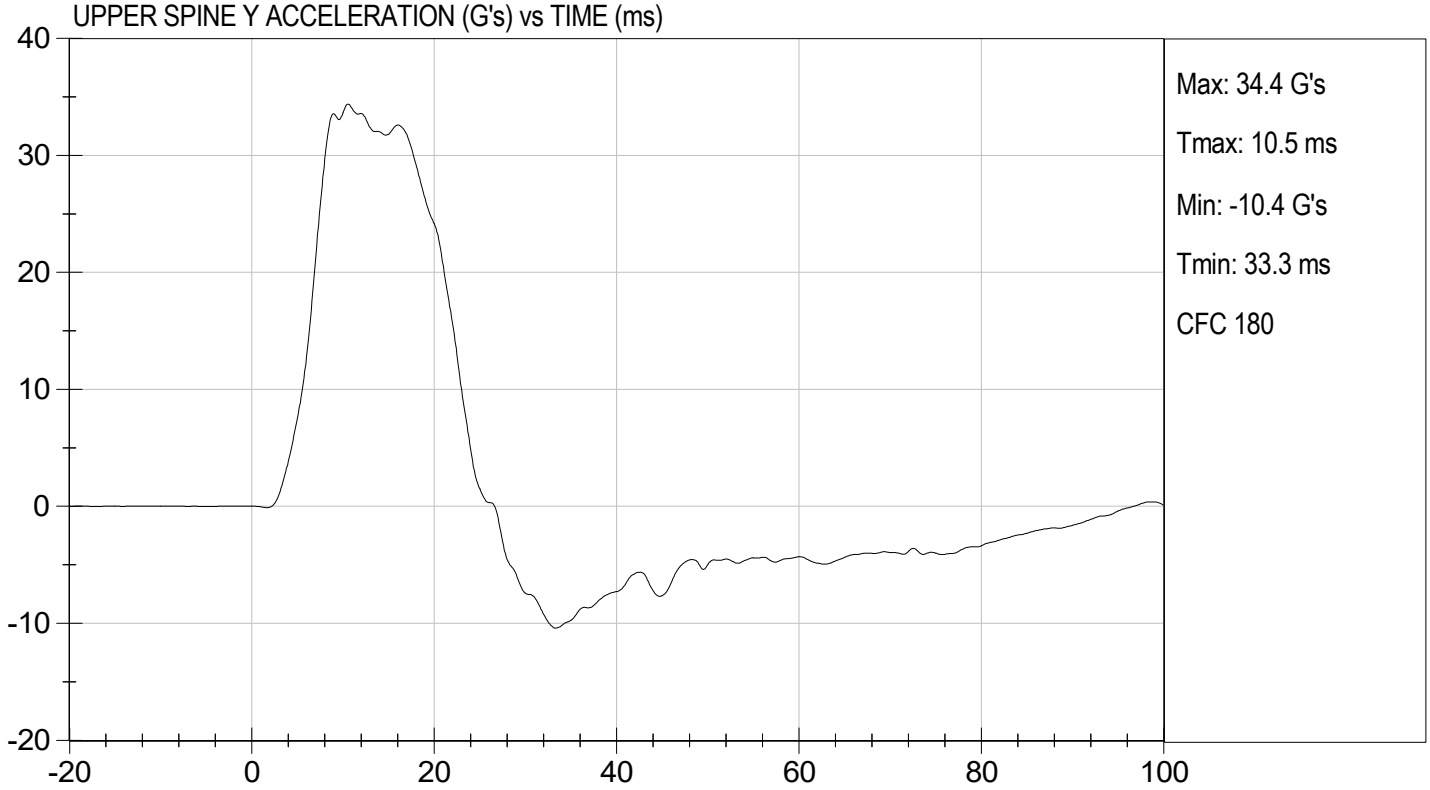
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 12/18/2023
TEST #: D233374

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

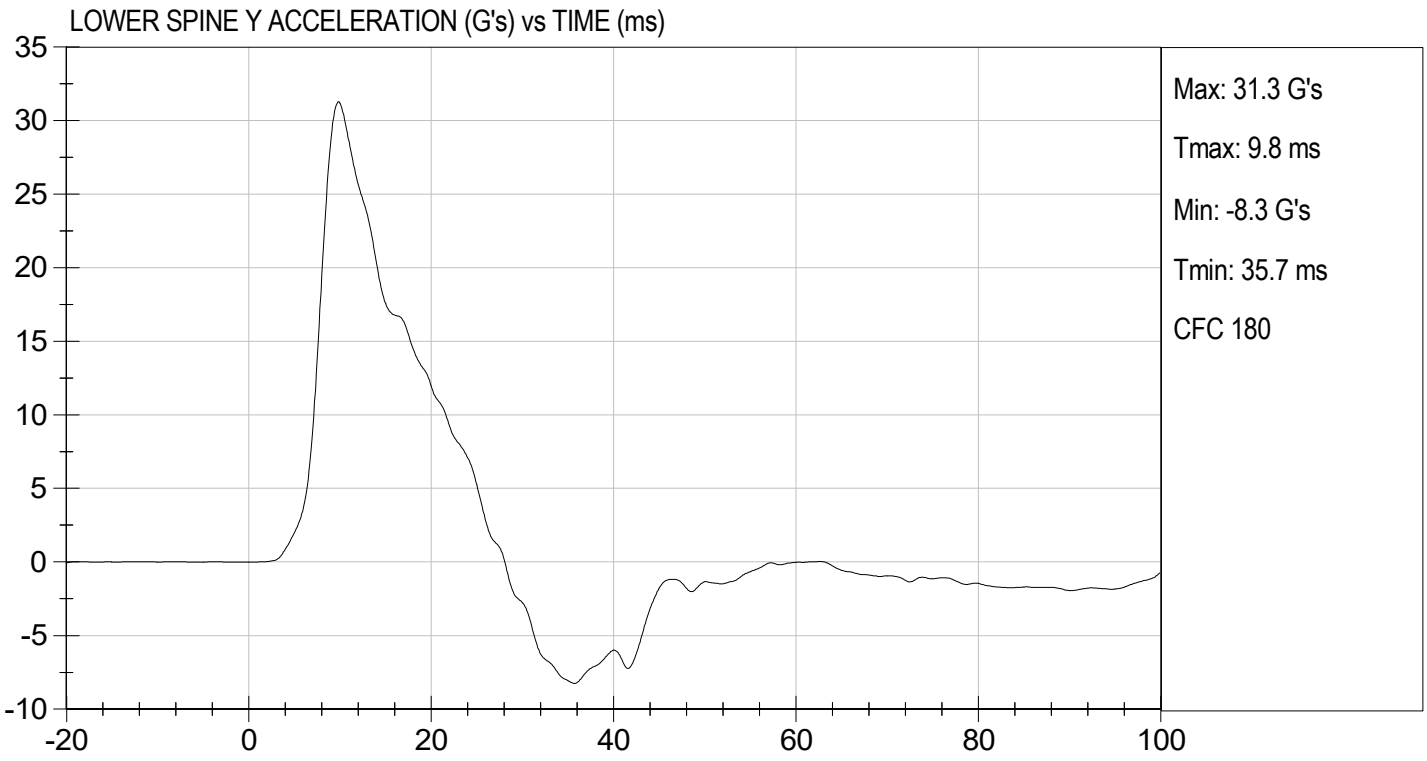


UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 12/18/2023
TEST #: D233374



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233375

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Humidity	%	10 to 70	27	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	36	Pass
Middle Rib Displacement	mm	39 to 45	41	Pass
Lower Rib Displacement	mm	35 to 43	39	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

Laboratory Technician

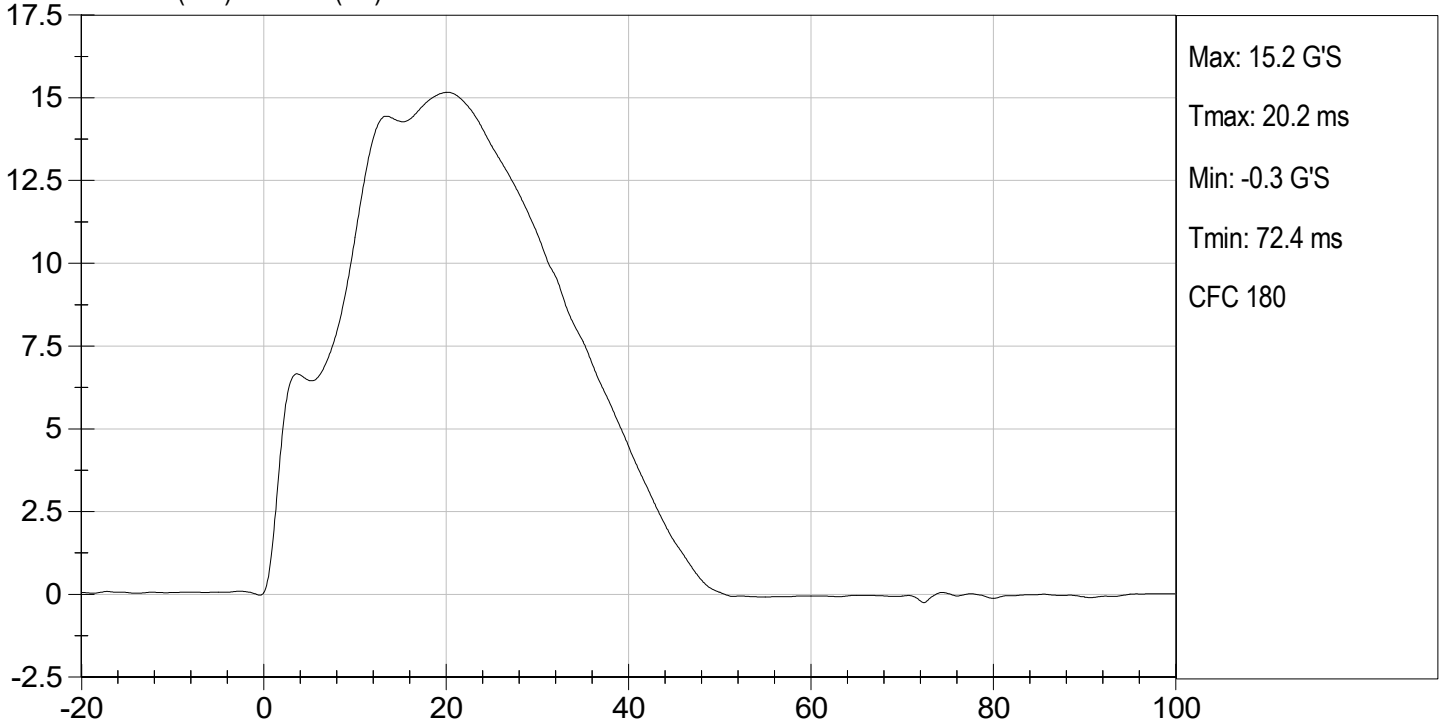
12/18/2023
Test Date

Approved By

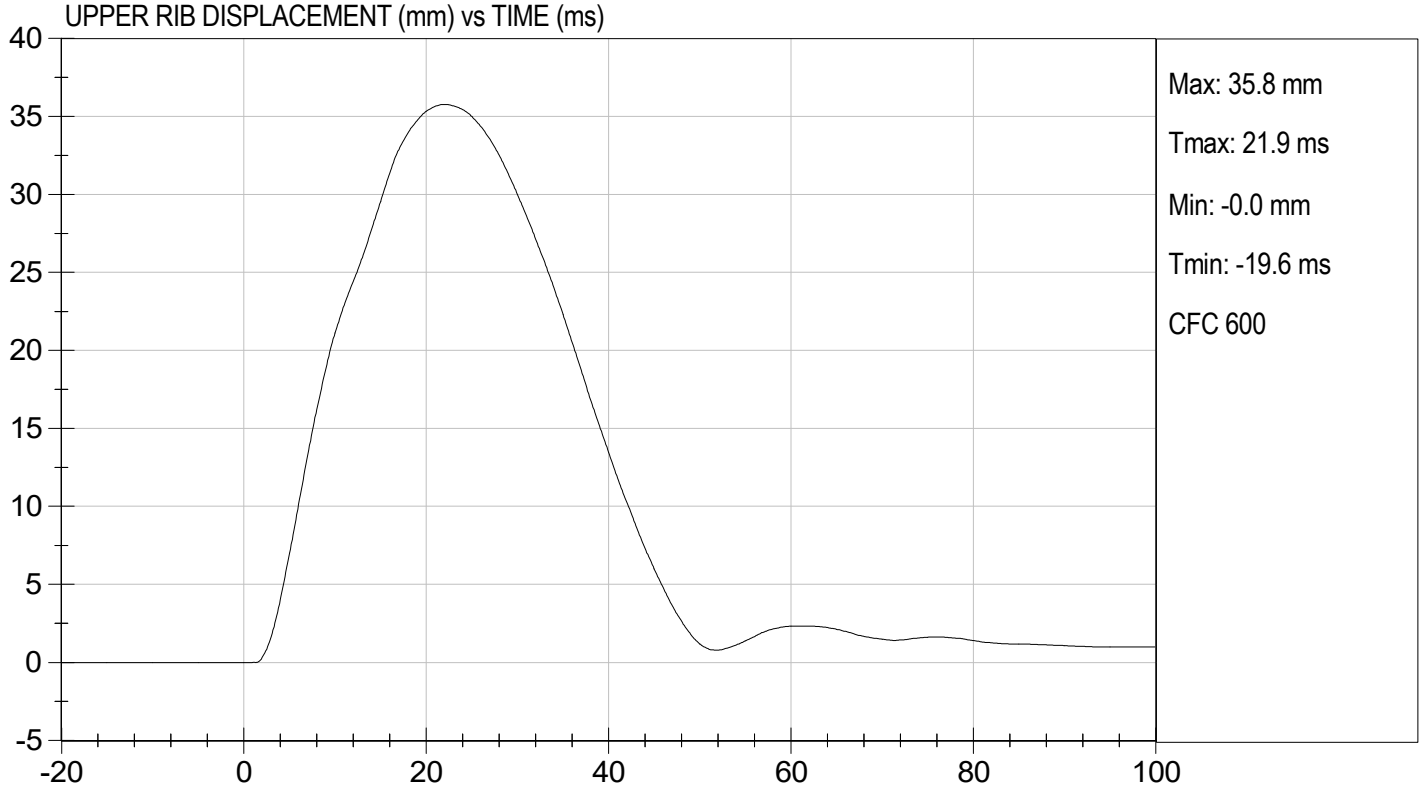
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 12/18/2023
TEST #: D233375

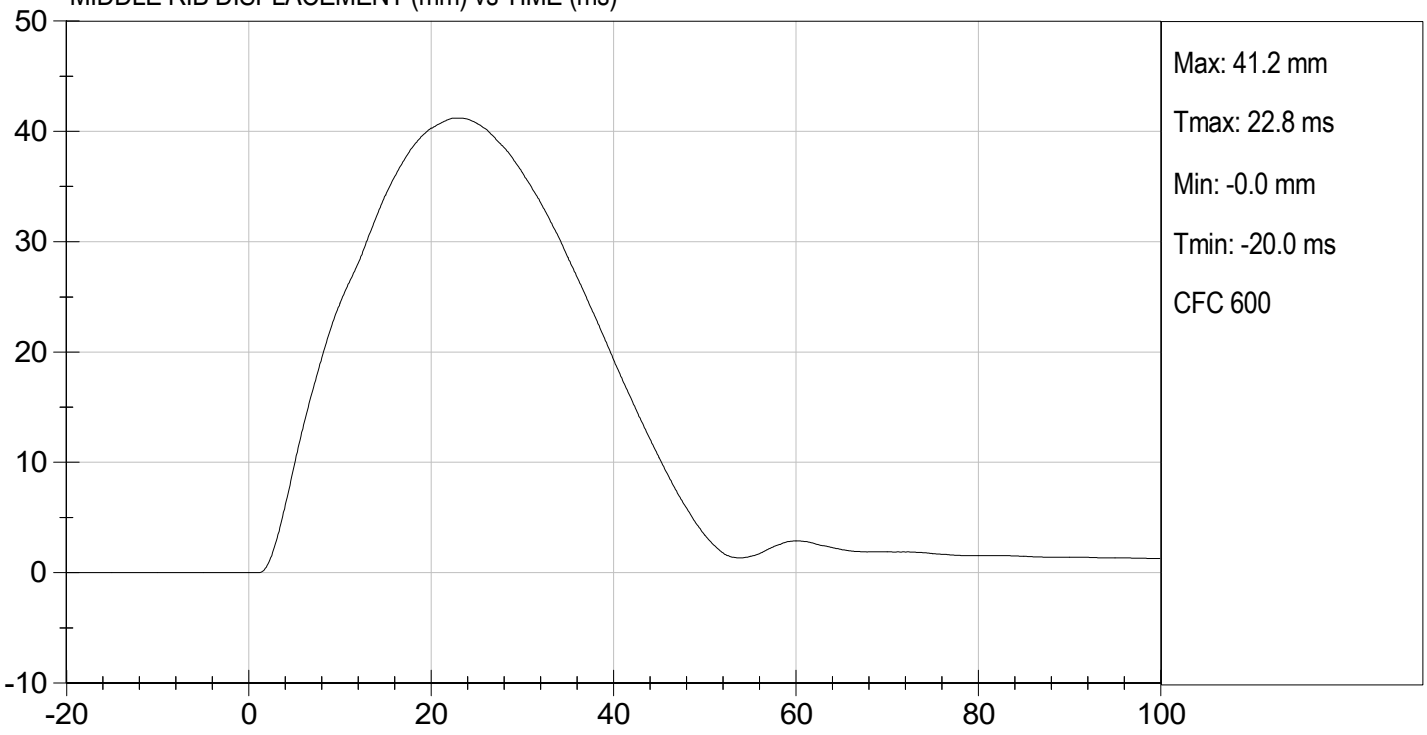
PROBE (G'S) vs TIME (ms)



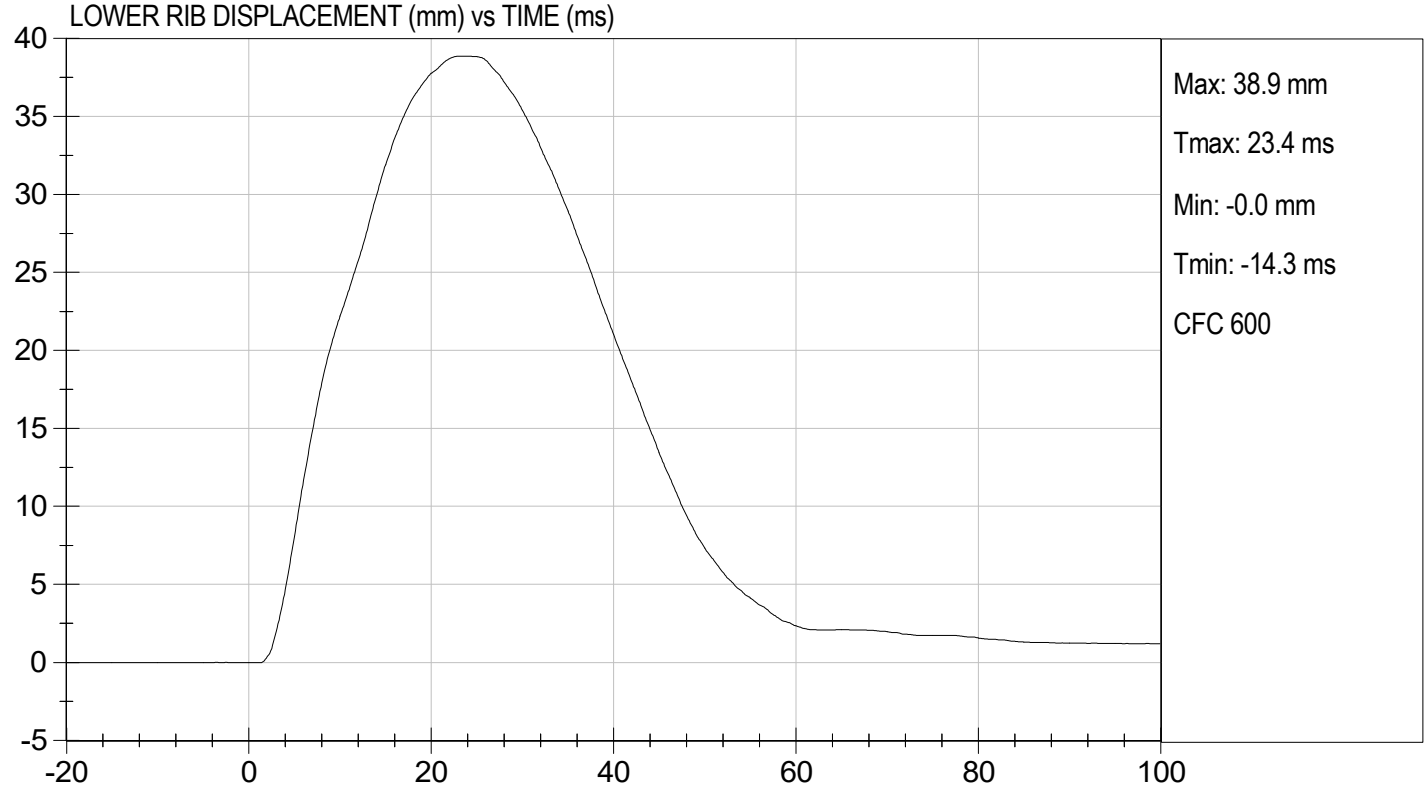
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)

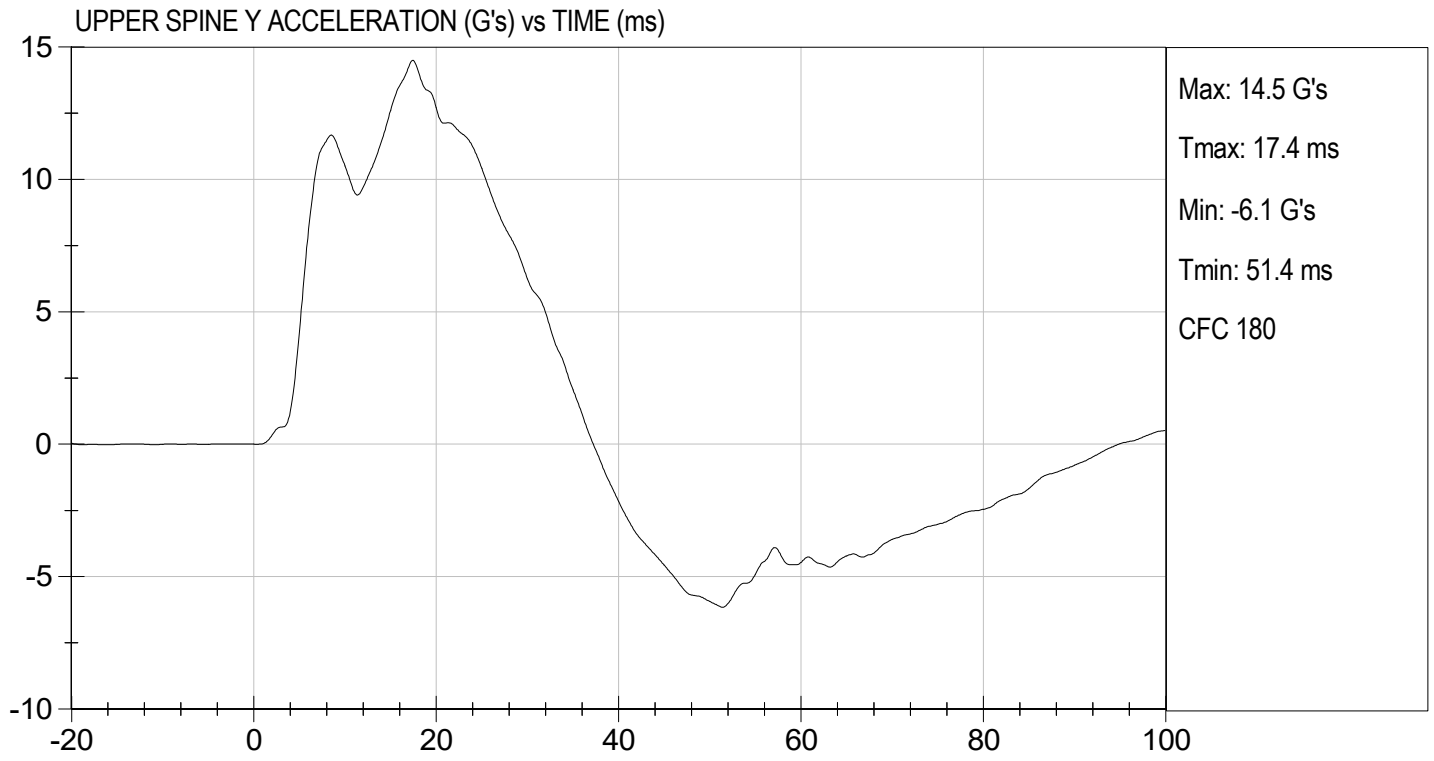


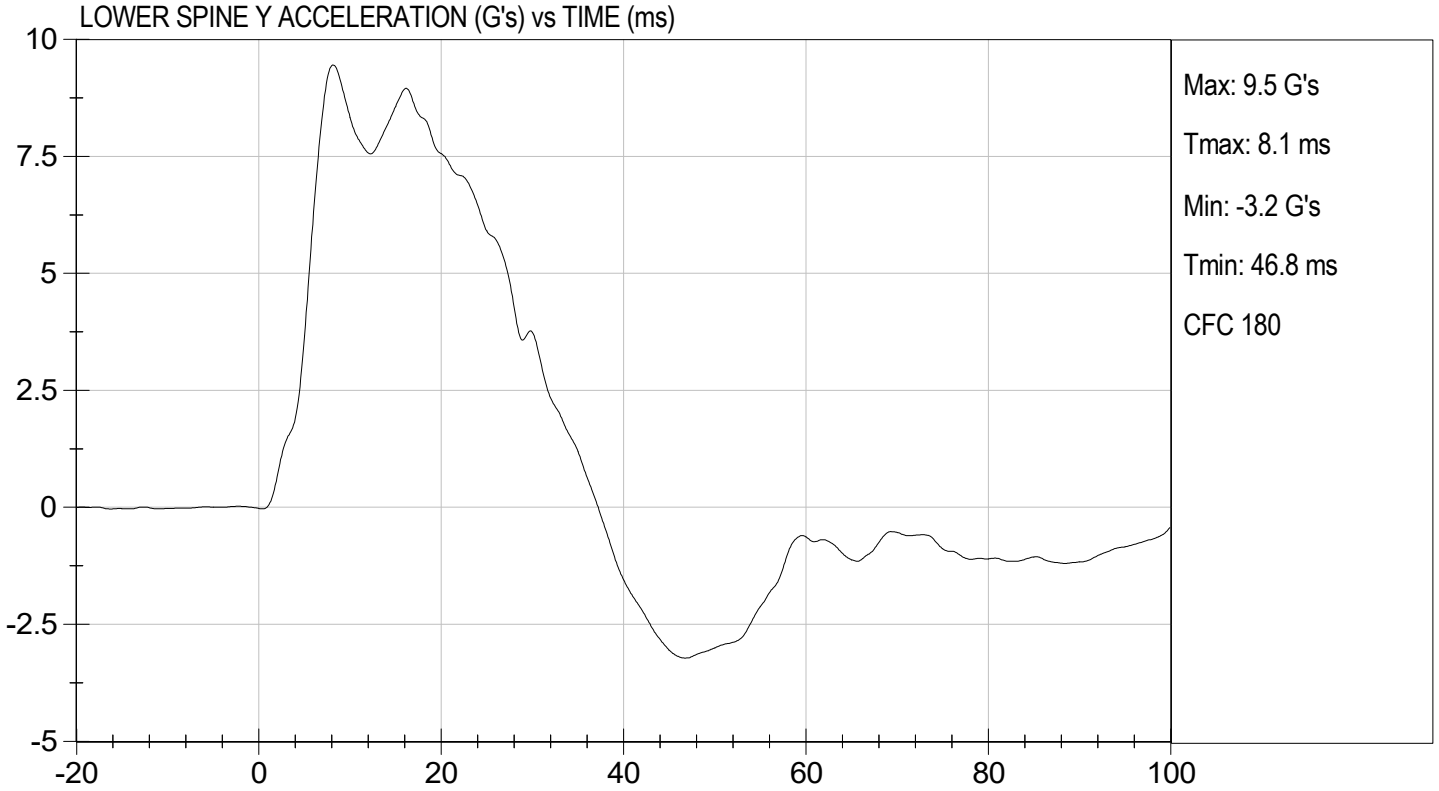
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



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

TEST DATE: 12/18/2023
TEST #: D233375





MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233376

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	27	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	42	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	37	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

Laboratory Technician

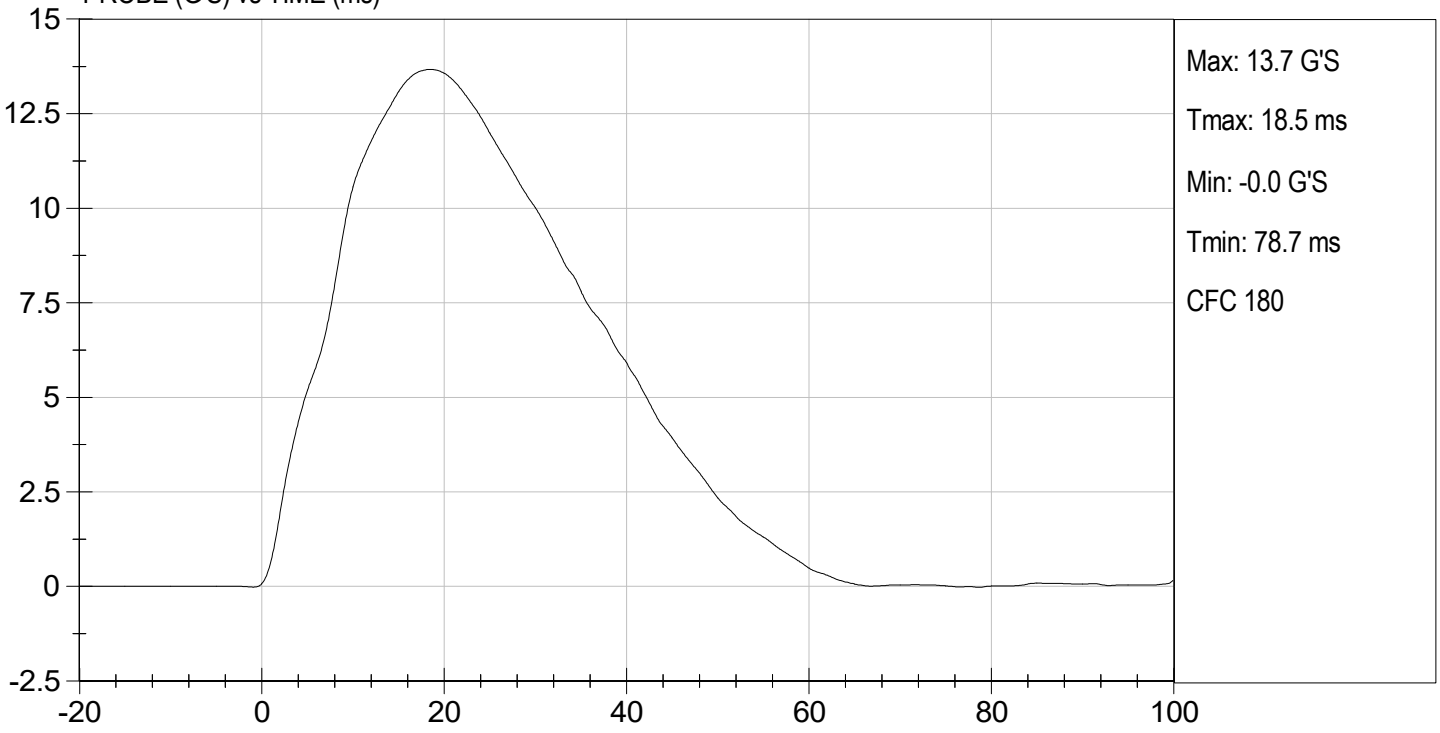
12/18/2023
Test Date

Approved By

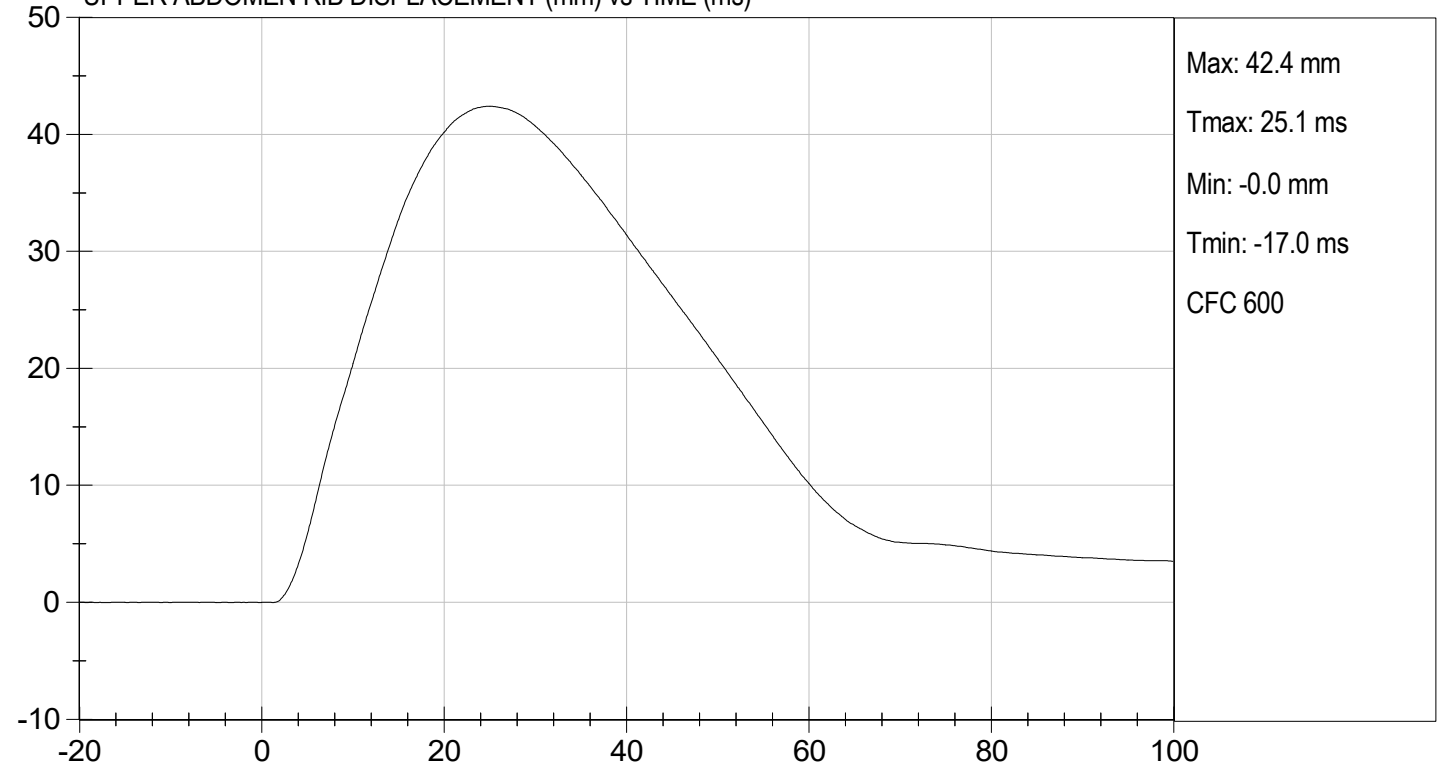
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.24 ft/s, 4.34 m/s

TEST DATE: 12/18/2023
TEST #: D233376

PROBE (G'S) vs TIME (ms)



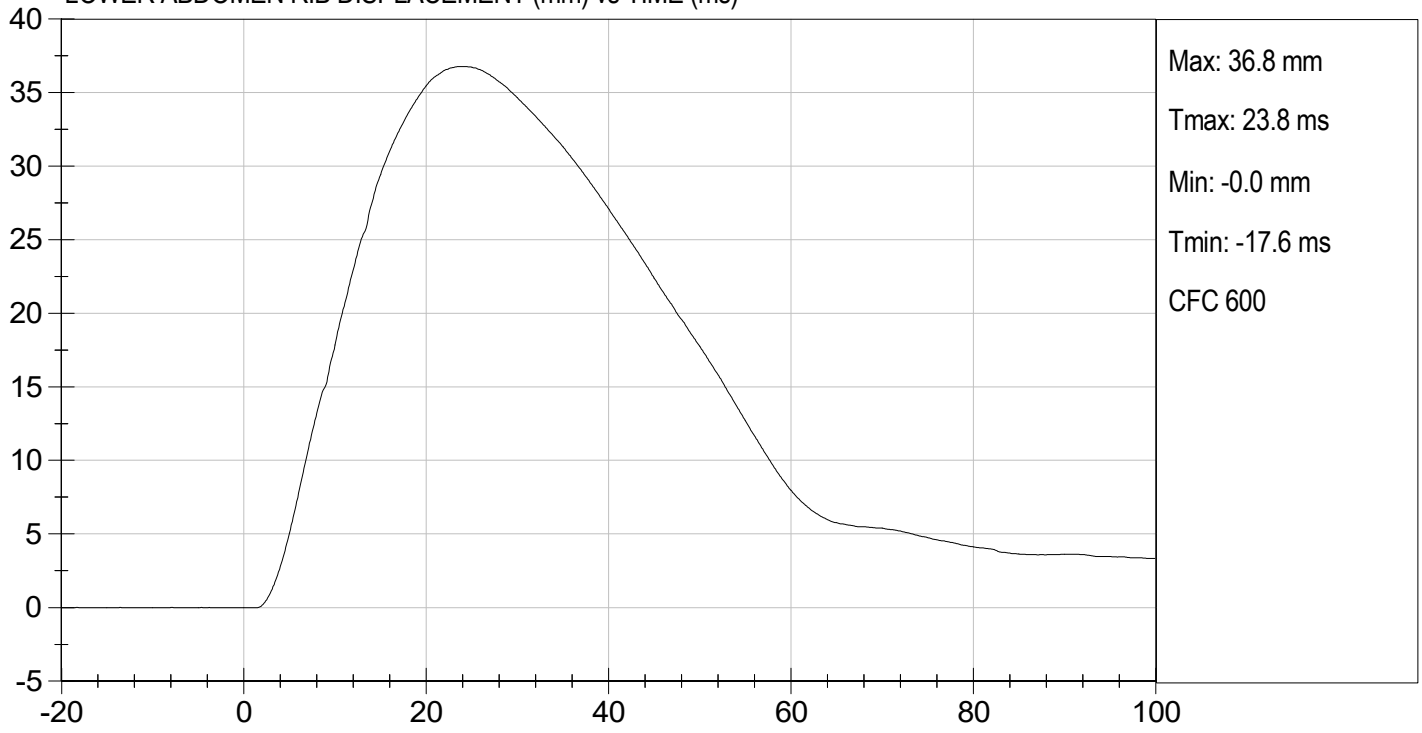
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



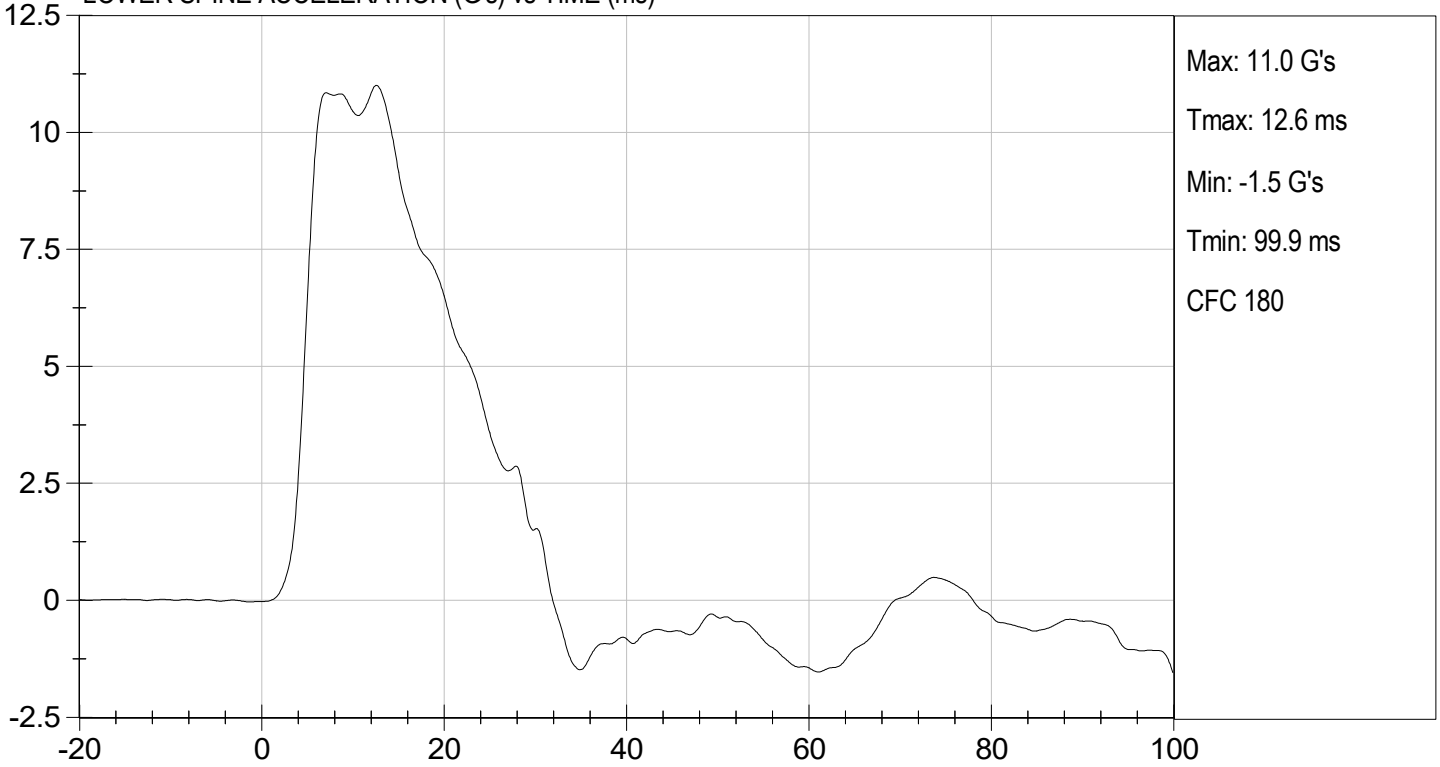
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.24 ft/s, 4.34 m/s

TEST DATE: 12/18/2023
TEST #: D233376

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



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



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233377

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Humidity	%	10 to 70	27	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	38 to 47	43	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	41.9	Pass
Peak Acetabulum Force	N	3600 to 4300	3,904	Pass
		Overall Test Results		Pass

Laboratory Technician

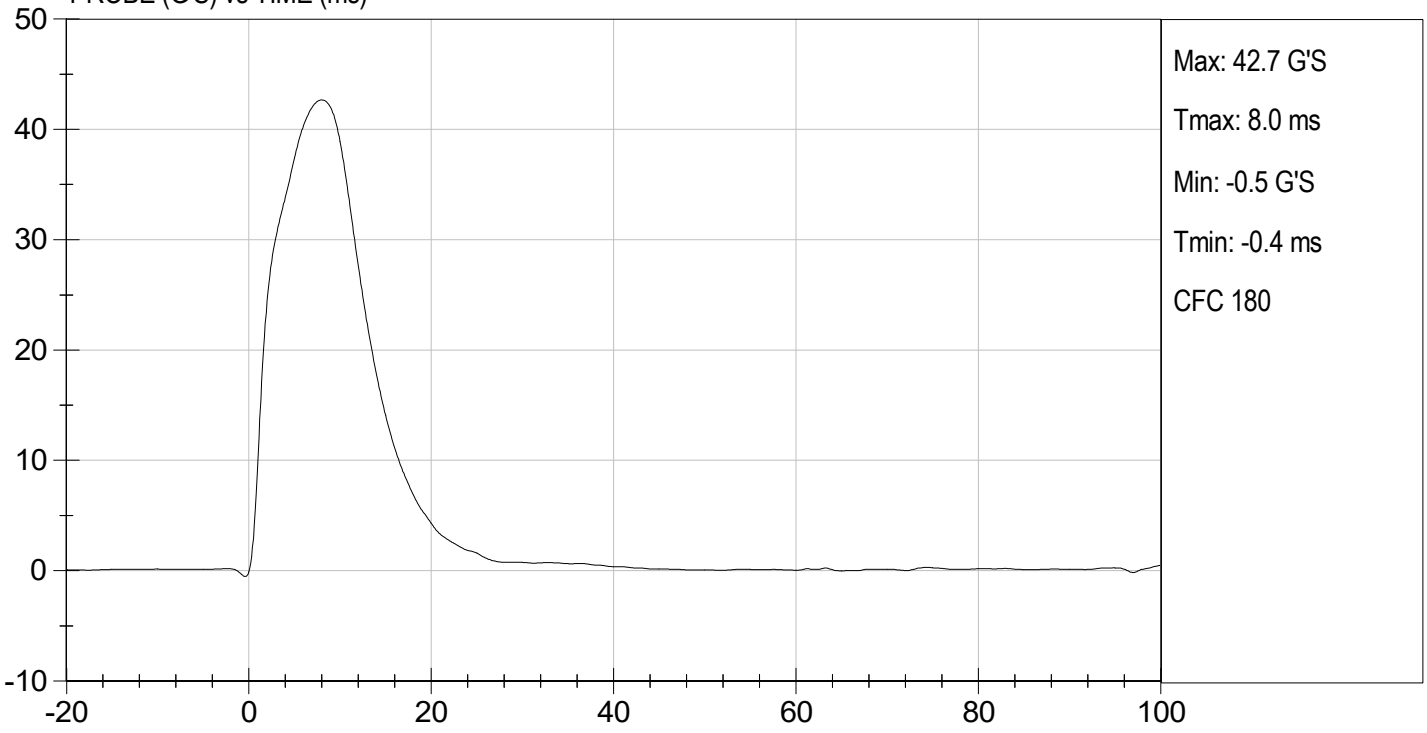
12/18/2023
Test Date

Approved By

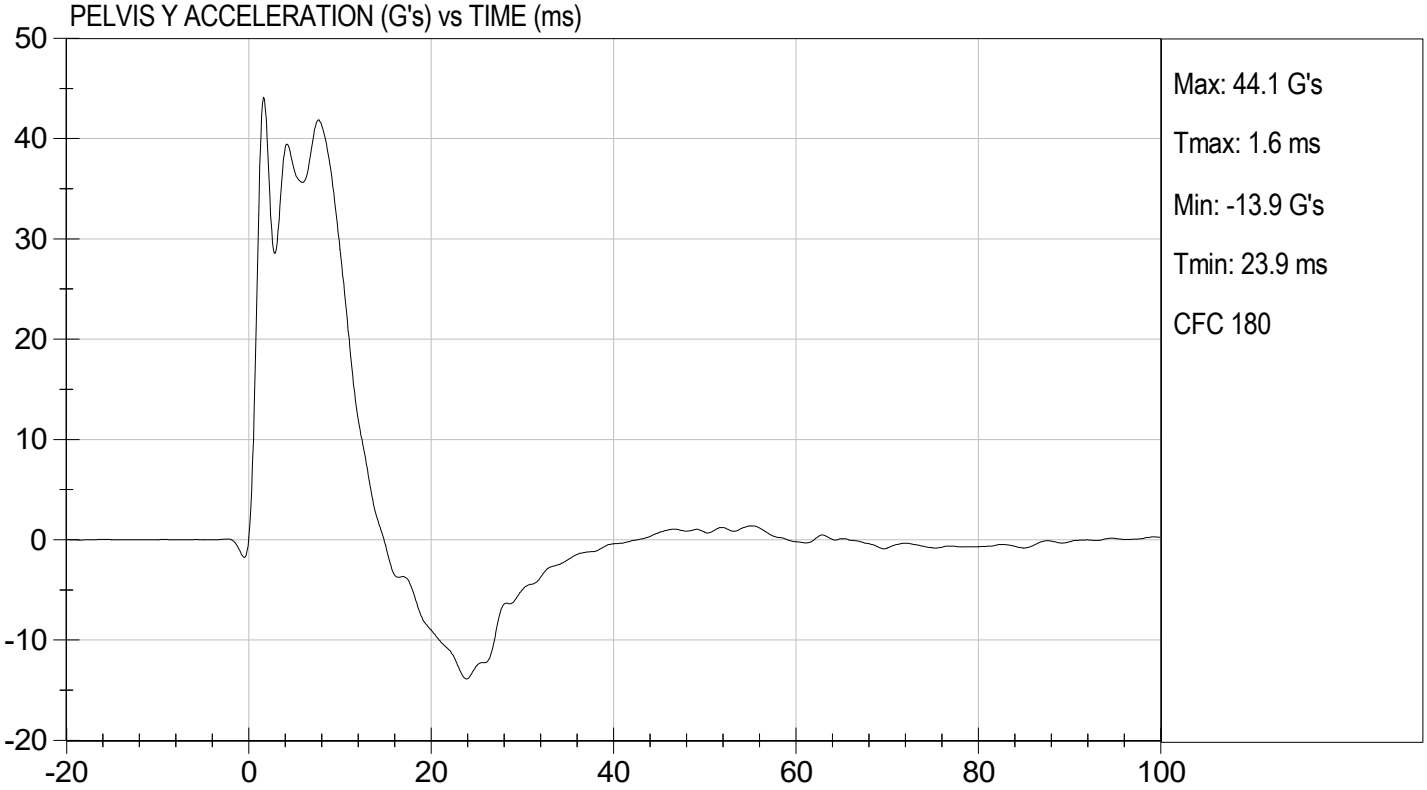
TEST DESC: PELVIS IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 12/18/2023
TEST #: D233377

PROBE (G'S) vs TIME (ms)

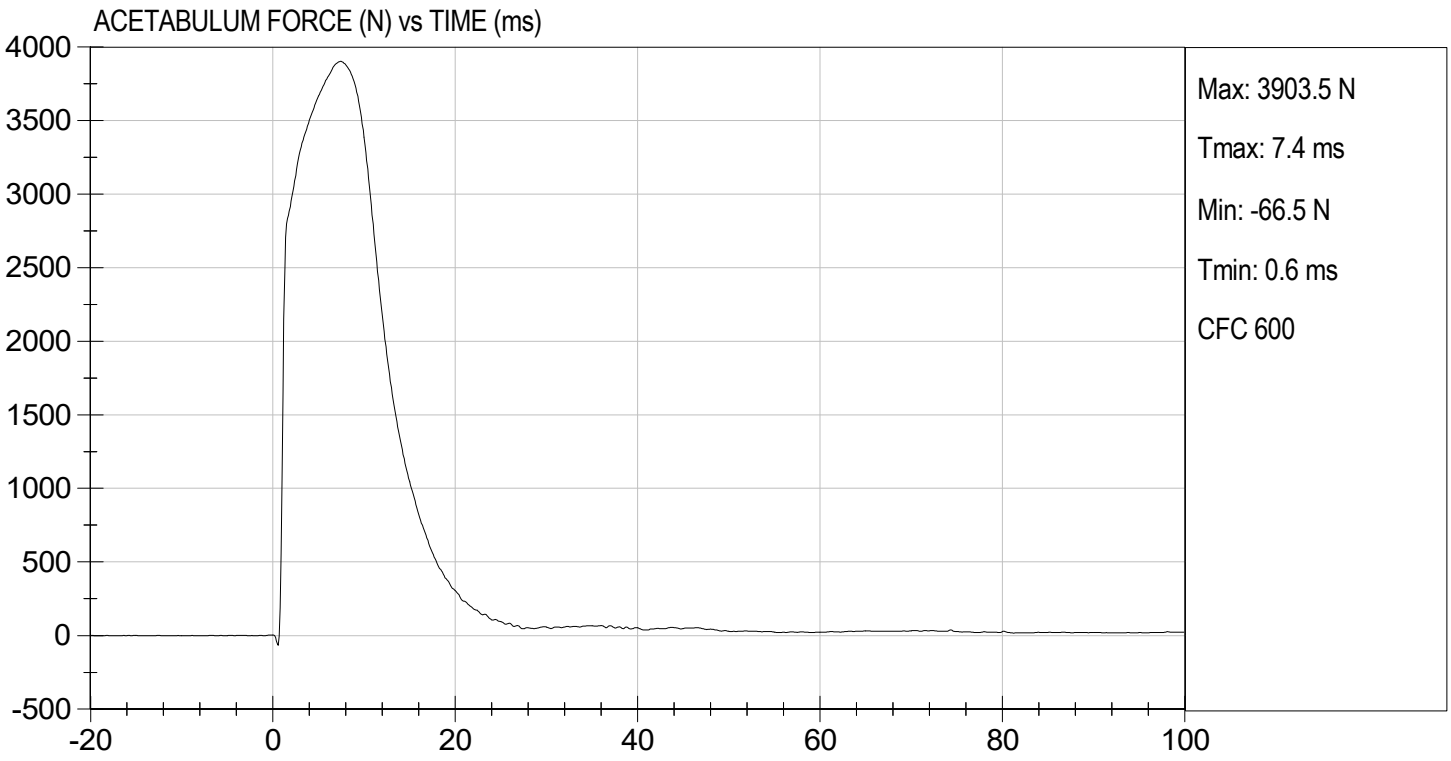


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 12/18/2023
TEST #: D233377



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 306 **Test I.D:** D233378

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	24	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	36 to 45	40	Pass
Pelvis Y Acceleration	G's	28 to 39	32	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,604	Pass
		Overall Test Results		Pass

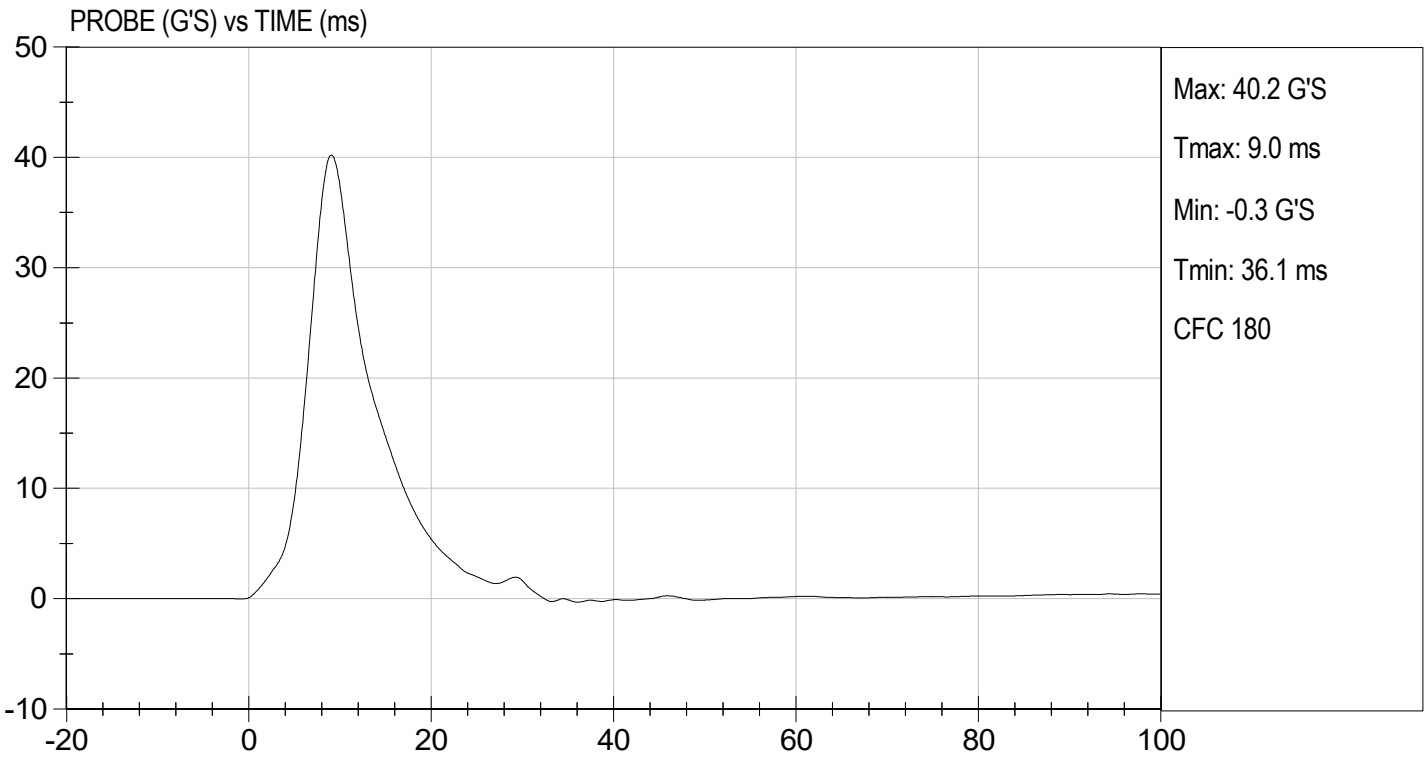
Laboratory Technician

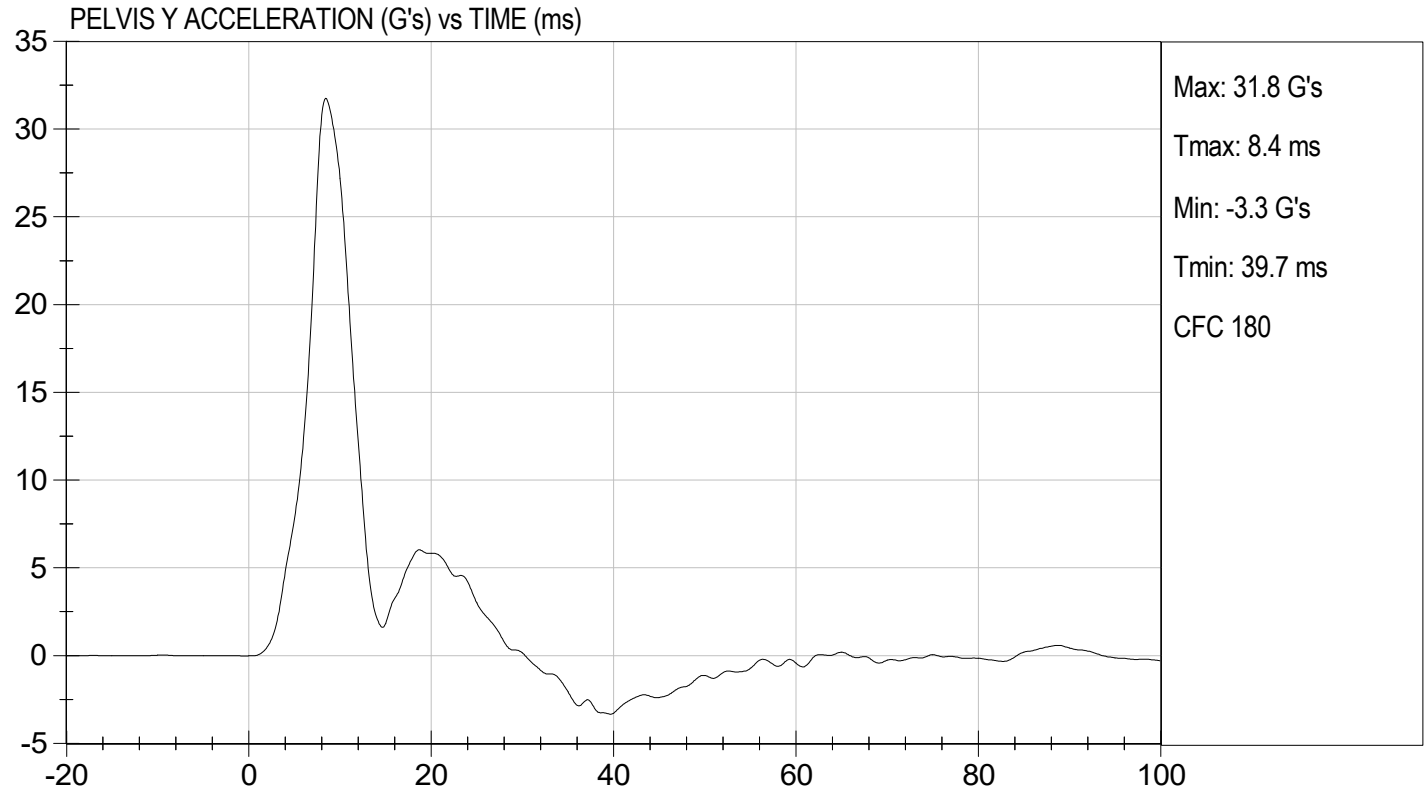
12/18/2023
Test Date

Approved By

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

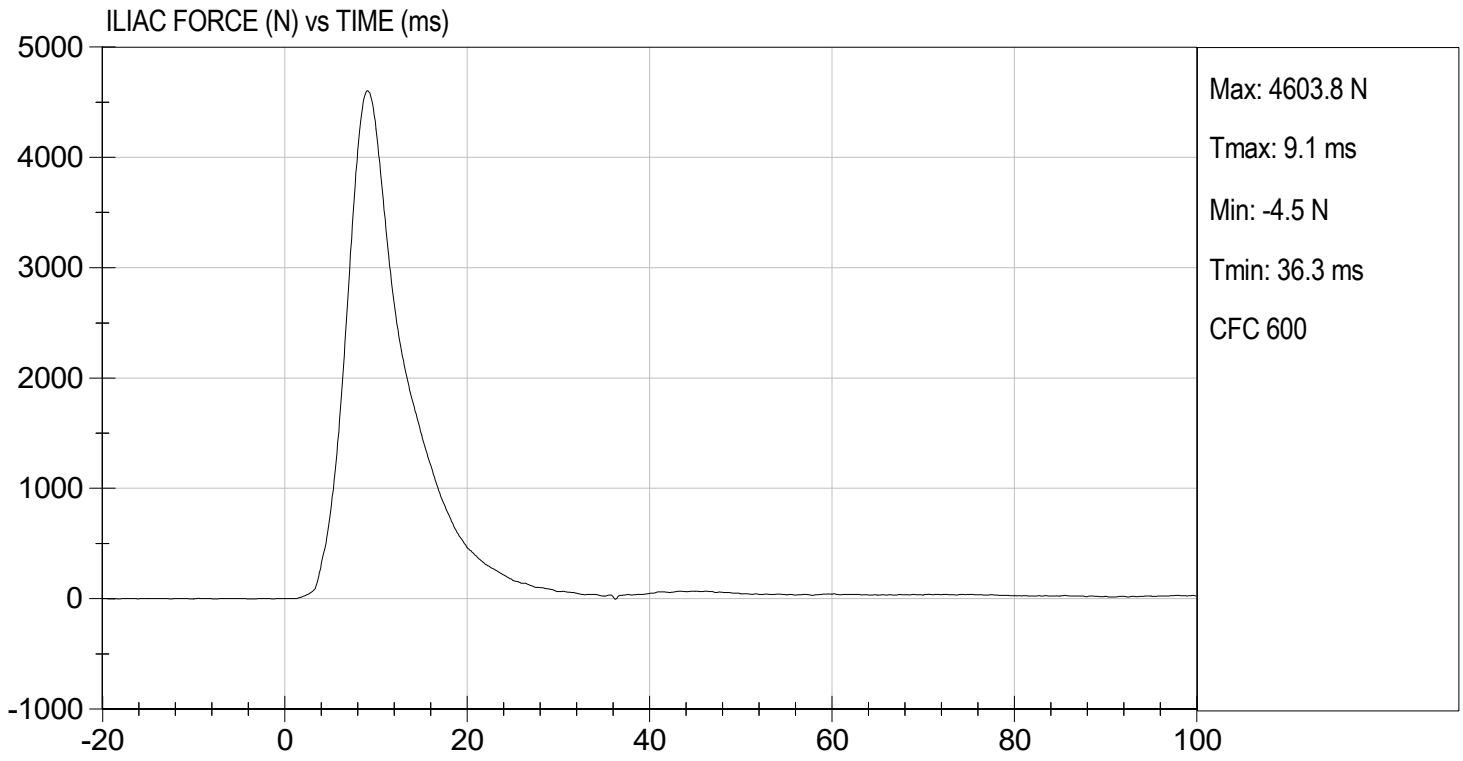
TEST DATE: 12/18/2023
TEST #: D233378





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

TEST DATE: 12/18/2023
TEST #: D233378



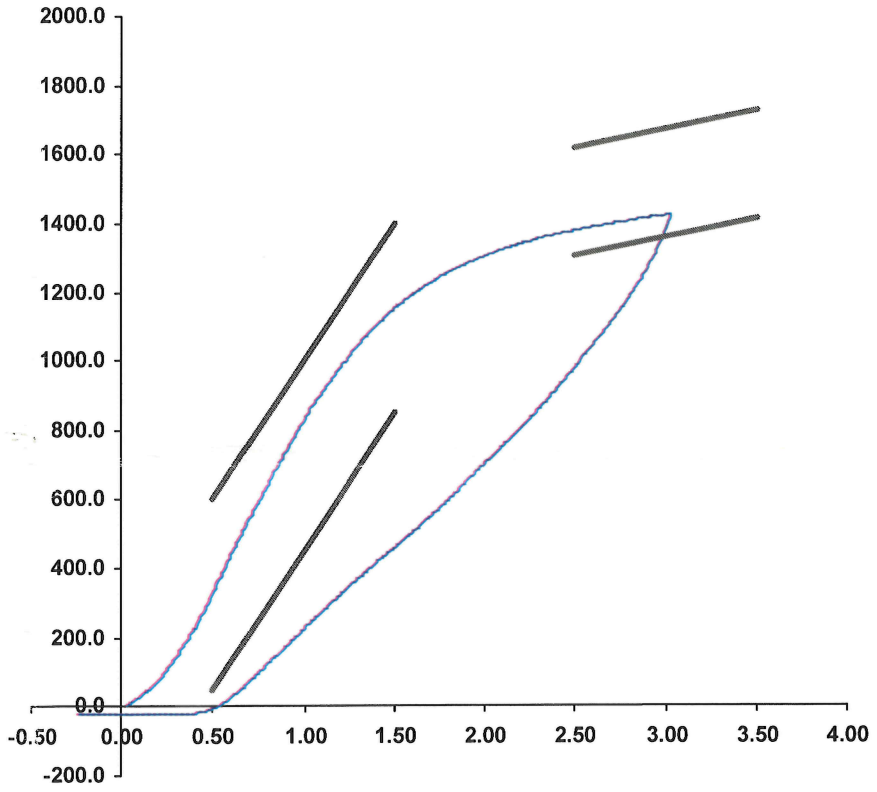
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 14983
Test Number 17563
Report Number 17610
Test Date 2/4/2021 12:59:13 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	335	50	600
Force @ 1.5 mm (N)	1,154	850	1,400
Force @ 2.5 mm (N)	1,382	1,306	1,618
Force @ 3.0 mm (N)	1,426	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

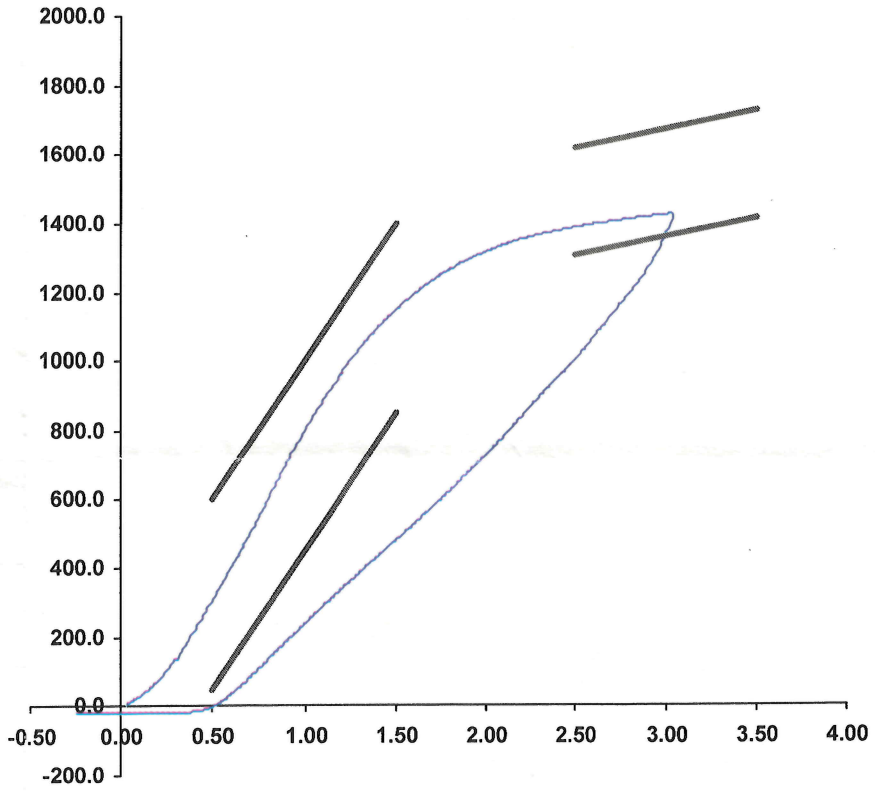
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 14177
Test Number 14215
Report Number 14260
Test Date 6/28/2020 12:59:25 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	316.38	50.00	600.00
Force @ 1.5 mm (N)	1,145.45	850.00	1,400.00
Force @ 2.5 mm (N)	1,387.93	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,424.96	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



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

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

Notes:

Operator

Part Number 180-4450

Template No 107 28-Jun-20
SACO Research

By : _____ Date : 6-28-2020

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 (ES-2re)

			ES-2re S/N F032		
			Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers		X	P79568	Endevco	11/20/2023
		Y	P79569	Endevco	11/20/2023
		Z	P79570	Endevco	11/20/2023
		Xr	P86797	Endevco	11/20/2023
		Yr	P94957	Endevco	11/20/2023
		Zr	P97381	Endevco	11/20/2023
Thorax Rib Displacement Potentiometers	Upper	Y	G236	Honeywell	11/20/2023
	Middle	Y	G368	Honeywell	11/20/2023
	Lower	Y	G164	Honeywell	11/20/2023
Abdomen Load Cells	Forward	Y	ABG1532	Denton	04/20/2023
	Middle	Y	ABG1534	Denton	04/20/2023
	Rear	Y	ABG1535	Denton	04/20/2023
Lower Spine Accelerometers (T12)		X	P79574	Endevco	11/20/2023
		Y	T14094	Endevco	11/20/2023
		Z	P82603	Endevco	11/20/2023
Public Symphysis Load Cell		Y	PG461	Denton	04/20/2023

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N 306		
				Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers			X	P79003	Endevco	06/22/2023
			Y	P79445	Endevco	06/22/2023
			Z	P79724	Endevco	06/22/2023
			Xr	P84999	Endevco	06/22/2023
			Yr	P85000	Endevco	06/22/2023
			Zr	P85001	Endevco	06/22/2023
Head Angular Rate Sensors			X	ARS7566	DTS	04/07/2023
			Y	ARS7586	DTS	04/07/2023
			Z	ARS7602	DTS	04/07/2023
Displacement Potentiometers	Thoracic Rib	Upper	Y	G033	FTSS	06/22/2023
		Middle	Y	G2403	Servo	06/22/2023
		Lower	Y	G1270	FTSS	06/22/2023
	Abdominal Rib	Upper	Y	G032	FTSS	06/22/2023
		Lower	Y	MJ5171	Medius	06/22/2023
Lower Spine Accelerometers (T12)			X	P96332	Endevco	06/22/2023
			Y	P96335	Endevco	06/22/2023
			Z	P96341	Endevco	06/22/2023
Acetabulum Load Cell			Y	ACG259	Denton	08/17/2023
Iliac Wing Load Cell			Y	IWG286	Denton	08/17/2023
Pelvis Plug (struck side)				14983	SACO	02/04/2021
Pelvis Plug (non-struck side)				14177	SACO	06/28/2020

Table 3 – Vehicle Instrumentation

			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	T37936	Endevco	10/26/2023
	Vehicle Center of Gravity	Y	T37928	Endevco	10/25/2023
	Vehicle Center of Gravity	Z	T38377	Endevco	10/24/2023
2	Right Sill at Front Seat	X	T38793	Endevco	10/25/2023
	Right Sill at Front Seat	Y	T39129	Endevco	10/28/2023
	Right Sill at Front Seat	Z	T39070	Endevco	10/30/2023
3	Right Sill at Rear Seat	X	T39069	Endevco	10/30/2023
	Right Sill at Rear Seat	Y	T39105	Endevco	10/30/2023
	Right Sill at Rear Seat	Z	T39125	Endevco	10/30/2023
4	Left Sill at Front Door	Y	T38285	Endevco	10/26/2023
5	Left Sill at Rear Door	Y	T39128	Endevco	10/30/2023
6	Left A-Post Lower	Y	T38987	Endevco	11/06/2023
7	Left A-Post Middle	Y	T39077	Endevco	10/30/2023
8	Left B-Post Lower	Y			
9	Left B-Post Middle	Y			
10	Front Seat Track	Y	T39119	Endevco	10/30/2023
11	Rear Seat Track or Structure	Y	T39144	Endevco	11/01/2023
12	Right Rear Occ. Compartment	Y	T37973	Endevco	10/26/2023
13	Engine Block	X	A395084	MSI	10/20/2023
	Engine Block	Y	T39088	Endevco	10/30/2023
14	Rear Floorpan Above Axle	X	T39145	Endevco	11/01/2023
	Rear Floorpan Above Axle	Y	T38480	Endevco	10/17/2023
	Rear Floorpan Above Axle	Z	T39089	Endevco	10/30/2023

Table 4 – MDB Instrumentation

		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	PCB1183D	PCB	01/10/2023
MDB Center of Gravity	Y	PCB1822D	PCB	01/10/2023
MDB Center of Gravity	Z	PCB1753D	PCB	01/10/2023
Left Frame at Rear Axle Centerline	X	PCB1438D	PCB	01/10/2023
Left Frame at Rear Axle Centerline	Y	PCB1653D	PCB	01/10/2023