

REPORT NUMBER: SPNCAP-CAL-22-002

**NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE IMPACT POLE TEST**

**Kia Corporation
2022 KIA Niro EV EX
SUV**

NHTSA No: M20224210

**PREPARED BY:
CALSPAN CORPORATION
P.O. BOX 400
BUFFALO, NEW YORK 14225**



June 15, 2022

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
MAIL CODE: NRM-110
1200 NEW JERSEY AVE SE, ROOM W43-410
WASHINGTON, D.C. 20590**

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Date: June 15, 2022

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Date: June 15, 2022

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

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16. Abstract A 32.20 km/h (20 mph), 75° oblique impact Side NCAP Test was conducted on the subject 2022 KIA Niro EV EX SUV in accordance with the specifications of the Office of Crashworthiness Standards Side NCAP Pole Laboratory Test Procedure for the generation of consumer information on vehicle side pole crash protection. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on February 9, 2022. The impact velocity of the vehicle was 32.25 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle was 21°C. The target vehicle's maximum post-test static crush was 206 mm located at level 3. The test vehicle's occupant performance data is as follows: <table border="1"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th colspan="3">Driver ATD (SID-IIs) (Serial No. DG8012)</th> </tr> <tr> <th>Units</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₃₆)</td> <td></td> <td>1000</td> <td>188.419</td> </tr> <tr> <td>Resultant Lower Spine Acceleration</td> <td>G</td> <td>82</td> <td>40.506</td> </tr> <tr> <td>Total Pelvic Force (sum of acetabular and iliac forces)</td> <td>N</td> <td>5525</td> <td>2782.929</td> </tr> <tr> <td>Maximum Thoracic Rib Deflection</td> <td>mm</td> <td>38</td> <td>20.353</td> </tr> <tr> <td>Maximum Abdomen Rib Deflection</td> <td>mm</td> <td>45</td> <td>19.352</td> </tr> </tbody> </table> The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.						Measurement Description	Driver ATD (SID-IIs) (Serial No. DG8012)			Units	Threshold	Result	Head Injury Criteria (HIC ₃₆)		1000	188.419	Resultant Lower Spine Acceleration	G	82	40.506	Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2782.929	Maximum Thoracic Rib Deflection	mm	38	20.353	Maximum Abdomen Rib Deflection	mm	45	19.352
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SECTION 1

TEST PURPOSE AND PROCEDURE

This side impact test was conducted as part of the MY 2022 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. 693JJ920D000016. The purpose of this test is to generate comparative side impact performance in a 2022 KIA Niro EV EX SUV. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Pole Laboratory Test Procedure, dated March 2020.

SECTION 2

SUMMARY OF TEST RESULTS

A rigid pole side impact test was conducted on a 2022 KIA Niro EV EX SUV. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 32.25 km/h. The test was conducted by Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on February 9, 2022. Pre-test and post-test photographs of the test vehicle and side impact dummy (SID-IIs) are included in Appendix A of this report.

One Part 572V (SID-IIs) dummy was placed in the driver designated seating position according to instructions specified in the OCWS Side NCAP Pole Laboratory Test Procedure, dated March 2020. The side impact event was documented by 9 cameras. Camera locations and other pertinent camera information are included on page 3-11 in this report.

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

Head CG tri-axial accelerometers

Thorax upper, middle, and lower rib displacement potentiometers

Abdomen upper and lower rib displacement potentiometers

Lower spine tri-axial accelerometers

Iliac load cell

Acetabulum load cell

Appendix B contains the dummy response data. Dummy configuration and performance verification data can be found in Appendix C of this report. Appendix D identifies all serial numbers, manufacturers, and calibration dates for test equipment, dummy sensors, potentiometers, and load cells used to collect data during the test.

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

INJURY READINGS

Measurement Description	Driver ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC ₃₆)		1000	188.419
Resultant Lower Spine Acceleration	g	82	40.506
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2782.929
Maximum Thoracic Rib Deflection	mm	38*	20.353
Maximum Abdominal Rib Deflection	mm	45*	19.352

*Proposed IARV

Supplemental restraint information was recorded as follows:

SUPPLEMENTAL RESTRAINT INFORMATION

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes		
Knee Airbag	Yes	Yes		
Side Airbag 1 - Curtain	Yes	Yes	Yes	Yes
Side Airbag 2 – Torso/Pelvis	Yes	Yes	No	N/A
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Yes	No	N/A
Other				

GENERAL COMMENTS:

1. P1 serial number – DG8012

Data Anomalies:

- Left Front Sill Y, Exceeded calibration range at 18.4 ms

SECTION 3

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

Data Sheet No. 1 – General Test and Vehicle Parameter Data

Data Sheet No. 2 – Seat, Seat Belt, Steering Wheel Adjustment and Fuel Systems Data

Data Sheet No. 3 – Dummy Longitudinal Clearance Dimensions

Data Sheet No. 4 – Dummy Lateral Clearance Dimensions

Data Sheet No. 5 – Camera and instrumentation Data

Data Sheet No. 6 – Vehicle Accelerometer Data

Data Sheet No. 7 – Rigid Pole Load Cell Data

Data Sheet No. 8 – Post-Test Observations

Data Sheet No. 9 – Test Vehicle Profile Measurements

Data Sheet No. 10 – Test Vehicle Exterior Crush Measurements

Data Sheet No. 11 – Vehicle Damage Profile Distances

Data Sheet No. 12 – FMVSS No. 301 Static Rollover Results

Data Sheet No. 13 – Dummy / Vehicle Temperature and Humidity Stabilization Data

Data Sheet No. 305-1 – General Test and Parameter Data for Indicant FMVSS No. 305 Testing

Data Sheet No. 305-2 – Pre-Impact Data for Indicant FMVSS No. 305 Testing

Data Sheet No. 305-3 – Pre-Impact Electrical Isolation Measurements and Calculations for
Indicant FMVSS No. 305 Testing

Data Sheet No. 305-4 – Post-Impact Data for Indicant FMVSS No. 305 Testing

Data Sheet No. 305-5 – Static Rollover Test Data for Indicant FMVSS No. 305 Testing

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2022 KIA Niro EV EX SUV
Test Program: NCAP Side Pole Impact Test

NHTSA No.: M20224210
Test Date: 02/09/2022

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20224210
Model Year	2022
Make	Kia
Model	Niro
Body Style	SUV
VIN	KNDCC3LG9N5138581
Body Color	Red
Odometer Reading (km/mi)	6 mi
Engine Displacement (L)	Electric Vehicle
Type / No. Cylinders	N/A
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	Direct Drive
Overdrive	Yes
Final Drive	Front Wheel Drive
Roof Rack	No
Sunroof / T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
Auto-Leveling System	No
Automatic Door Locks (ADL)	Yes
Power Window Auto-Reverse	No
Other Optional Feature	-
Driver Front Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso / Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	Yes
Rear Pass. Curtain Airbag	Yes
Rear Pass. Head / Torso Airbag	No
Rear Pass. Torso Airbag	No
Rear Pass. Torso / Pelvis Airbag	No
Rear Pass. Pelvis Airbag	No
Driver Seat Belt Pretensioner	Yes
Rear Pass. Seat Belt Pretensioner	No
Driver Load Limiter	Yes
Rear Pass. Load Limiter	No
Other Safety Restraint	-

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

No

DATA FROM CERTIFICATION LABEL

Manufactured By	Kia Corporation
Date of Manufacture	11/21
Vehicle Type	MPV

GVWR (kg)	2230
GAWR Front (kg)	1160
GAWR Rear (kg)	1160

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	3	N/A	5
Capacity Weight (VCW) (kg)				385
DSC X 68.04 kg				340.2
Cargo Weight (RCLW) (kg)				44.8

(A)

(B)

(A-B)

VEHICLE SEAT TYPE

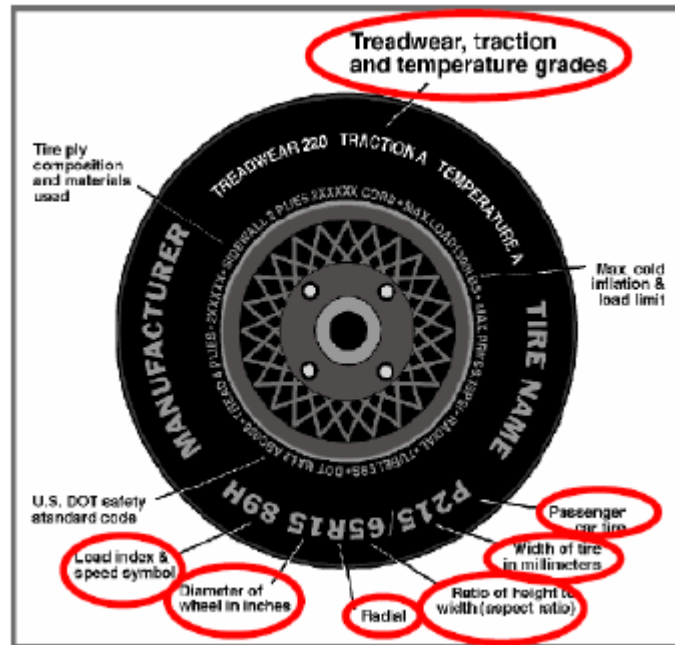
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front Seat	X					X	
Rear or Second Row Seat			X		X		
Third Row seat							

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

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test NCAP Side Pole Impact Test

NHTSA M20224210
 Test Date: 02/09/2022

Collected for year, make, model, & VIN, all items circled in red, tire manufacturer and tire name.



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	250	250
Recommended Tire Size	215/55R17	215/55R17
Tire Size on Vehicle	215/55R17	215/55R17
Tire Manufacturer	Michelin	Michelin
Tire Model	Primacy MXV4	Primacy MXV4
Treadwear	500	500
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 1 Polyamide, 2 Steel	2 Polyester, 1 Polyamide, 2 Steel
Load Index/Speed Symbol	94V	94V
Tire Material	Rubber	Rubber
DOT Safety Code Left	B33F01VX2621	B33F01VX2621
DOT Safety Code Right	B33F01VX2621	B33F01VX2621

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

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test NCAP Side Pole Impact Test

NHTSA M20224210
 Test Date: 02/09/2022

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	238	241	231	242
Tire Placard	kPa	250	250	250	250
Owner's Manual	kPa	250	250	250	250
As Tested	kPa	250	250	250	250

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	458.5	422		490	438		478.5	462	
Right	kg	477.5	377.5		489	407		491.5	398	
Ratio	%	54	46		54	46		53	47	
Totals	kg	936	799.5	1735.5	979	845	1824	970	860	1830

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1735.5	(A)
Actual Weight of 1 P572V (SID-IIs) ATD Used	kg	50	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	44.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1830.3	(A+B+C)

Does the measured As Test Vehicle Weight lie within the required weight range
 (i.e. Calculated Test Vehicle Target Weight – 4.5 kg to – 9 kg)? ☒ Yes ☐ No

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	As Delivered	As Tested	Fully Loaded	Meets Rqmt***
Driver Door Sill Angle (front-to-rear)*	Deg	-0.10	0.0	+0.15	Yes
Front Passenger Sill Angle (front-to-rear)*	Deg	+0.05	-0.1	-0.25	Yes
Front Bumper-Line Angle (left-to-right)**	Deg	-0.30	-0.4	-0.50	Yes
Rear Bumper-Line Angle (left-to-right)**	Deg	-0.25	-0.1	+0.60	Yes
Vehicle CG (Aft of Front Axle)	mm	1243	1250	1268	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	11	14	22	

* ND = Nose Down (-), NU = Nose Up (+)

** LD = Left Down (-), LU = Left Up (+)

*** The "As Tested" vehicle attitude measurements must be equal to or between the "As Delivered" and "Fully Loaded" vehicle attitude measurements. Indicate "Yes" or "No" for Meets Requirement

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

Test Vehicle:	2022 KIA Niro EV EX SUV	NHTSA	M20224210
Test	NCAP Side Pole Impact Test	Test Date:	02/09/2022

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	16
Air pump	3
Tail Light, wiper motor & headlight	7
Headrest & vibration damper	5
Rear valance	4
Side mirror & engine shield	4
Passenger Windows and door parts	6
Ballast / Equipment Added	0

Test Height – Adjustable Suspension Setting, if Applicable	N/A
--	-----

Test Surface Markings

	Distance from 75° Impact Location Line (mm)
Fore 25 mm target	896
Aft 25 mm target	895

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

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test NCAP Side Pole Impact Test

NHTSA M20224210
 Test Date: 02/09/2022

SEAT POSITIONING

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

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	20.1	13.2	16.65
Front Passenger Seat	15.9	13.0	14.45
Front Center Seat			
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid-Fore / Aft	Forward-Most
Driver Seat	16.7	37	Max	48	54	59
			Mid	25	31	37
			Min	2	8	14.5
Front Passenger Seat	14.6	20	Max	-	-	-
			Mid	8	15	20
			Min	-	-	-
Front Center Seat	N/A	N/A	Max			
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max			
			Mid			
			Min			
Non-Struck Side Rear Seat	Fixed	Fixed	Max			
			Mid			
			Min			
Rear Center Seat	Fixed	Fixed	Max			
			Mid			
			Min			

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

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test NCAP Side Pole Impact Test

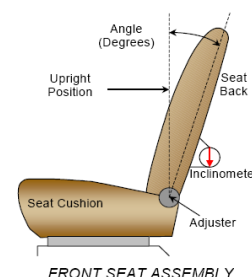
NHTSA M20224210
 Test Date: 02/09/2022

SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forward most Position	
	mm	Detents*	mm	Detents*
Driver Seat	252	Power	0	Power
Front Passenger Seat	252	64 (0-63)	0	0
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed	Fixed

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned such that the dummy's head is level. The front center and front passenger's seat backs are positioned in a similar manner as the driver's seat back. The struck-side rear passenger seat back is positioned in accordance with the information provided by the manufacturer on Form No. 1 for the 5th percentile female dummy in a Side NCAP MDB test. The rear center and non-struck side rear passenger's seat back are set to match the struck-side rear seat back.



Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degrees	Detents*
Driver Seat w/Seated Dummy	62.5	Power	3.8	Power
Front Passenger Seat	59.1	21 (0-20)	3.9	5
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed	Fixed

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. Zero is defined as the uppermost detent

Seat	Total # of Positions	Placed in Position #
Driver Seat	4 (0-3)	0

HEAD RESTRAINT ADJUSTMENT

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

Seat	Total # of Positions	Placed in Position #
Driver Seat	6 (0-5)	Lowest

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

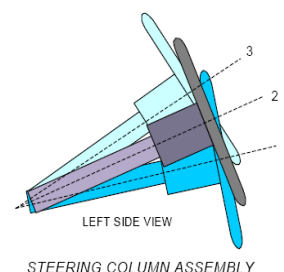
Test Vehicle: 2022 KIA Niro EV EX SUV
 Test NCAP Side Pole Impact Test

NHTSA M20224210
 Test Date: 02/09/2022

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.

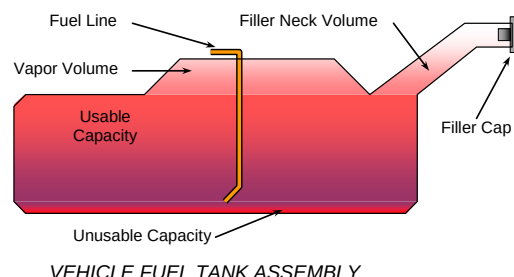
		Degrees	Fore / Aft Position (mm)
Lowermost	– Position 1	21.5	
Geometric Center	– Position 2	24.4	
Uppermost	– Position 3	27.0	
Telescoping Steering Wheel Travel			52
Test Position		24.4	26



FUEL PUMP

Describe the fuel pump type, details about how it operates, and the location of the fuel filler neck.

The vehicle is equipped with an electric charge port.
The charge port is on the left front bumper of the
vehicle.



FUEL TANK CAPACITY DATA

Description	Liters
Usable Capacity of "Standard Tank" - see Form No. 1	N/A
Usable Capacity of "Optional Tank" - see Form No. 1	N/A
Usable Capacity of "Standard Tank" - see Owner's Manual	N/A
Usable Capacity of "Optional Tank" - see Owner's Manual	N/A
93% of Usable Capacity	N/A
Actual Amount of Solvent Used in Test	N/A
1/3 of Usable Capacity	N/A

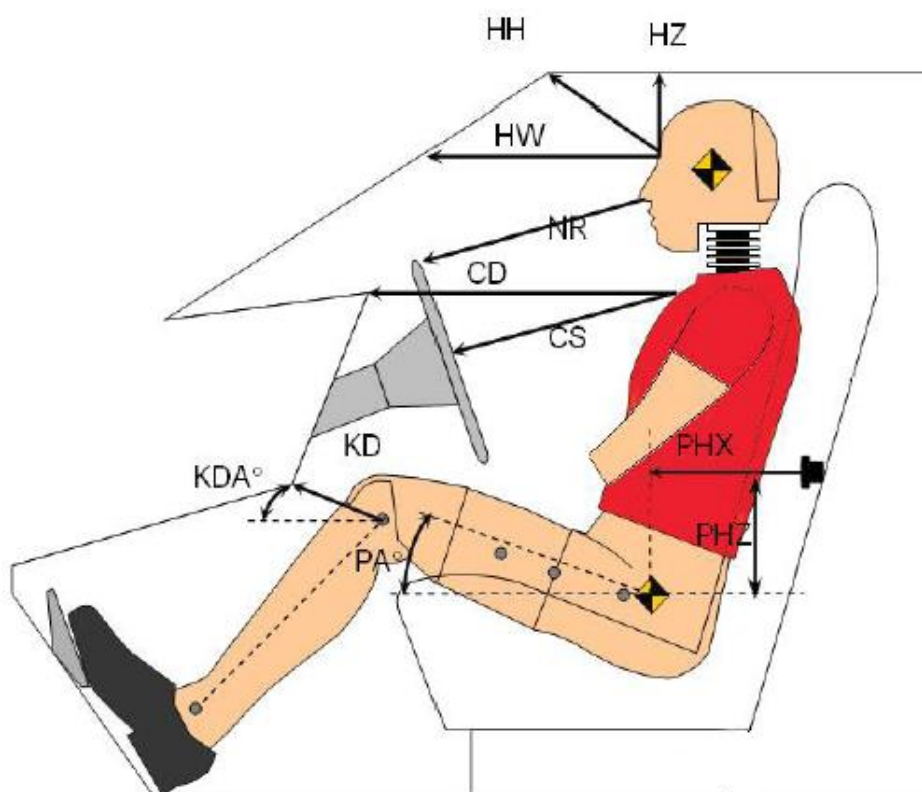
Is the Actual Amount of Solvent Used in the test equal to 93% ±1% of the Usable Capacity stated in Form No. 1?

☒ N/A Yes ☐ No

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test: NCAP Side Pole Impact Test

NHTSA: M20224210
 Test Date: 02/09/2022



Left Side View

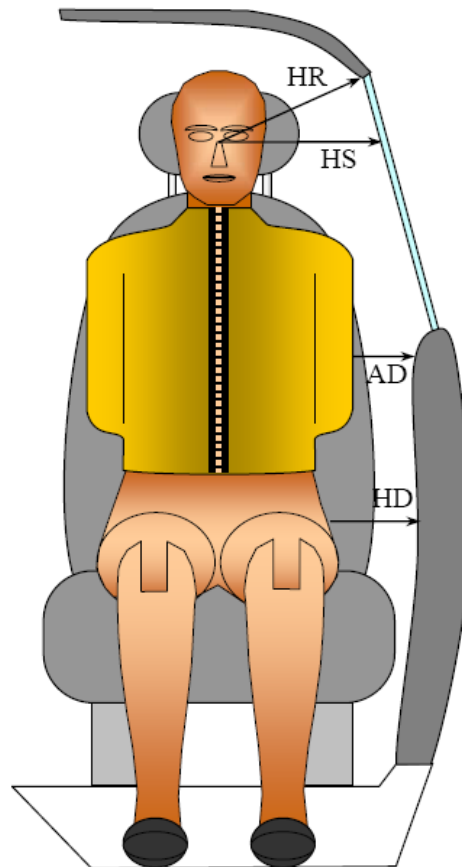
DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Description	Driver (Serial No. DG8012)	
		Length (mm)	Angle (°)
HH	Head to Header	275	
HW	Head to Windshield	622	
HZ	Head to Roof Liner	178	
NR	Nose to Rim	237	
CD	Chest to Dash	412	
CS	Chest to Steering Wheel	165	
KD(L) / KDA(L)°	Left Knee to Dash	117	18.2
KD(R) / KDA(R)°	Right Knee to Dash	90	26.9
PAX°	Pelvic Tilt Angle (X-Axis)		20.5
PAY°	Pelvic Tilt Angle (Y-Axis)		0.3
PHX	Hip Point to Striker (X-Axis)	359	
PHZ	Hip Point to Striker (Z-Axis)	213	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2022 KIA Niro EV EX SUV
Test NCAP Side Pole Impact Test

NHTSA M20224210
Test Date: 02/09/2022



FRONT VIEW OF DUMMY

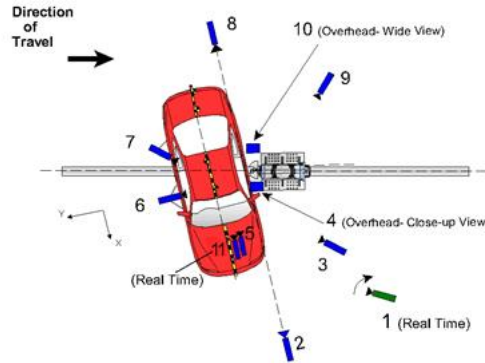
DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver - Length (Serial No. DG8012)
HR	Head To Side Header	mm	249
HS	Head to Side Window	mm	365
AD	Arm to Door	mm	164
HD	Hip Point to Door	mm	176

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2022 KIA Niro EV EX SUV
Test: NCAP Side Pole Impact Test

NHTSA: M20224210
Test Date: 02/09/2022



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Real-time (24 - 30 fps) pan view of impact				Zoom	1000
2	Front ground level - impact view	7845	2104	-1589	28	1000
3	Impact side 45° - forward pole view	5354	2020	-1633	24	1000
4	Overhead Close-up view of impact	0	0	-6998	28	1000
5	Onboard - dummy front view				25	1000
6	Onboard - dummy side view				12.5	1000
7	Onboard - dummy rear oblique view				12.5	1000
8	Rear ground level - impact view	-7798	-1795	-1505	24	1000
9	Impact side 45° - rearward pole view	-5833	2001	-1518	28	1000
10	Overhead wide - view of impact	0	0	-6998	12.5	1000
11	Real-time (24 - 30 fps) - dummy front view				Zoom	60

Notes: Reference - From Point of Impact for X and Y; from Ground for Z
+X = Forward of vehicle, +Y = Right of vehicle, +Z = Down
* All measurements accurate to ± 6 mm. Vehicle is at a 75° angle to the rigid pole.

Comments: All cameras operated as intended.

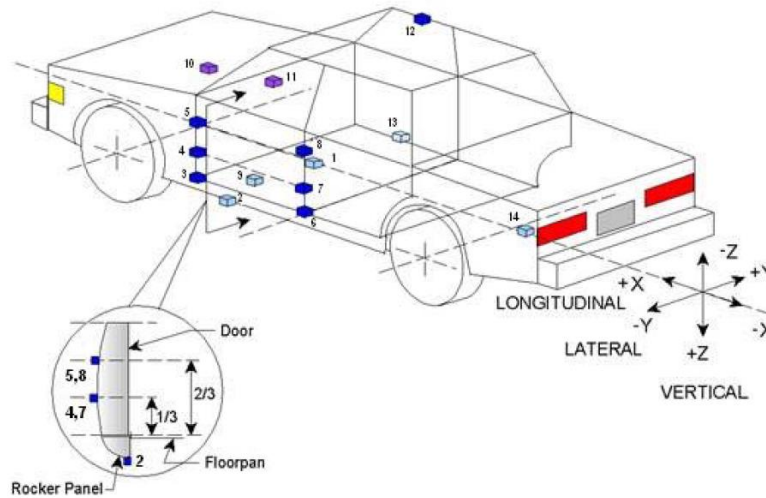
INSTRUMENTATION

Description	Number of Channels
Driver Dummy Channels	16
Vehicle Structure Accelerometers	18
Pole Load Cells	8
Total	42

DATA SHEET NO. 6 **VEHICLE ACCELEROMETER DATA**

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test: NCAP Side Pole Impact Test

NHTSA: M20224210
 Test Date: 02/09/2022



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	1863	-11	183
2	Left Floor Sill	2628	-653	237
3	A-Pillar Sill	2917	-642	237
4	A-Pillar Low	3010	-634	29
5	A-Pillar Mid	2962	-650	-471
6	B-Pillar Sill	1880	-633	221
7	B-Pillar Low	1960	-675	93
8	B-Pillar Mid	1913	-660	-354
9	Driver Seat Track	2128	-558	206
10	Engine Top	3680	138	-131
11	Firewall	3264	13	-89
12	Right Roof	1825	585	-940
13	Right Floor Sill	2618	653	232
14	Rear Floorpan	845	11	183

Reference: X – Rear surface of vehicle (+ forward)
 Y – Vehicle centerline (+ to right)
 Z – Ground plane (+ down)

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA

Test Vehicle: 2022 KIA Niro EV EX SUV
Test NCAP Side Pole Impact Test

NHTSA M20224210
Test Date: 02/09/2022

POLE BARRIER



RIGID POLE LOAD CELL LOCATIONS

ID	Units	Height From Ground
1	mm	200
2	mm	590
3	mm	750
4	mm	1075
5	mm	1260
6	mm	1740
7	mm	1920
8	mm	2300

**DATA SHEET NO. 8
POST-TEST OBSERVATIONS**

Test Vehicle: 2022 KIA Niro EV EX SUV
Test NCAP Side Pole Impact Test

NHTSA M20224210
Test Date: 02/09/2022

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Driver Seat Dummy (SID-IIs)
Face	Curtain & Frontal Airbag
Top of Head	Curtain Airbag & Headrest
Left Side of Head	Curtain Airbag
Back of Head	Curtain Airbag, Headrest & Seatback
Left Shoulder	Seatback & Torso/Pelvis Airbag
Upper Torso	Seatback
Lower Torso	Seatback
Left Hip	Seatback & Torso/Pelvis Airbag
Left Knee	Driver Door

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Rear Hatch/ Other
	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, Width of Opening at Striker (mm)	0	0	0	0	0

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

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

Test Vehicle: 2022 KIA Niro EV EX SUV
Test NCAP Side Pole Impact Test

NHTSA M20224210
Test Date: 02/09/2022

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	A-Pillar buckled
Sill Separation	None
Windshield Damage	Cracks throughout
Side Window Damage	Driver window shattered
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes		
Knee Airbag	Yes	Yes		
Side Airbag 1 - Curtain	Yes	Yes	Yes	Yes
Side Airbag 2 – Torso/Pelvis	Yes	Yes	No	N/A
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Yes	No	N/A
Other				

VEHICLE SPEED, VEHICLE ANGLE AT IMPACT AND IMPACT POINT LOCATION DATA

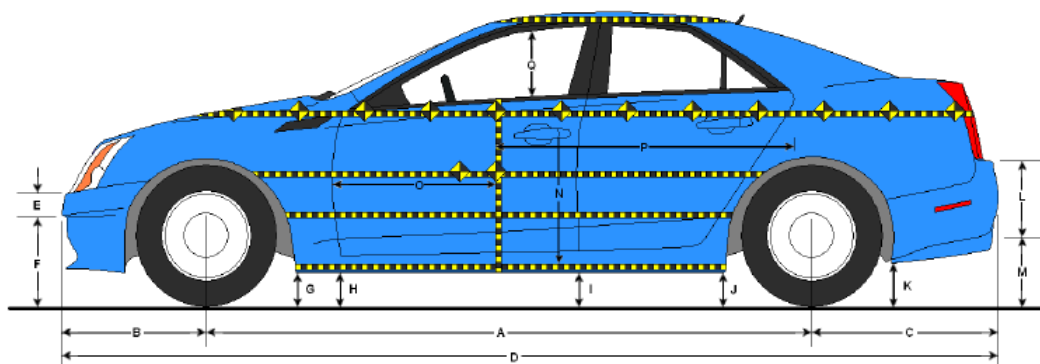
Measured Parameter	Units	Tolerance	Value
Vertical Impact Ref Line - Aft of Front Axle, Intended Impact Pt	mm		1078
Actual Impact Point - Aft of Front Axle	mm		1085
Horizontal Offset (+ forward / - rearward)	mm	+/- 38 *	-7
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	deg	75 +/- 3	75
Trap No. 1 Velocity - Primary	kph	31.4 to 33.0	32.25
Trap No. 2 Velocity - Redundant	kph	31.4 to 33.0	32.25

* Of Intended Impact Point

DATA SHEET NO. 9
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2022 KIA Niro EV EX SUV
Test: NCAP Side Pole Impact Test

NHTSA: M20224210
Test Date: 02/09/2022



LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

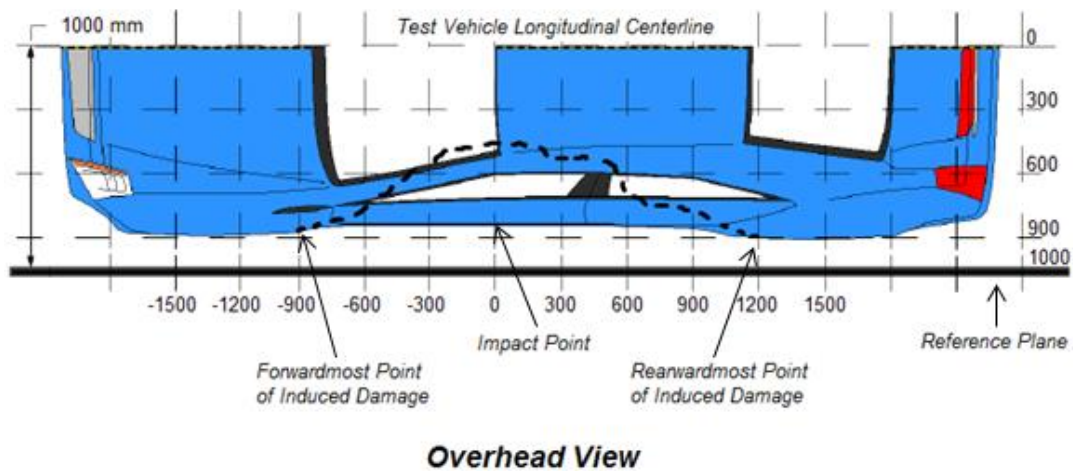
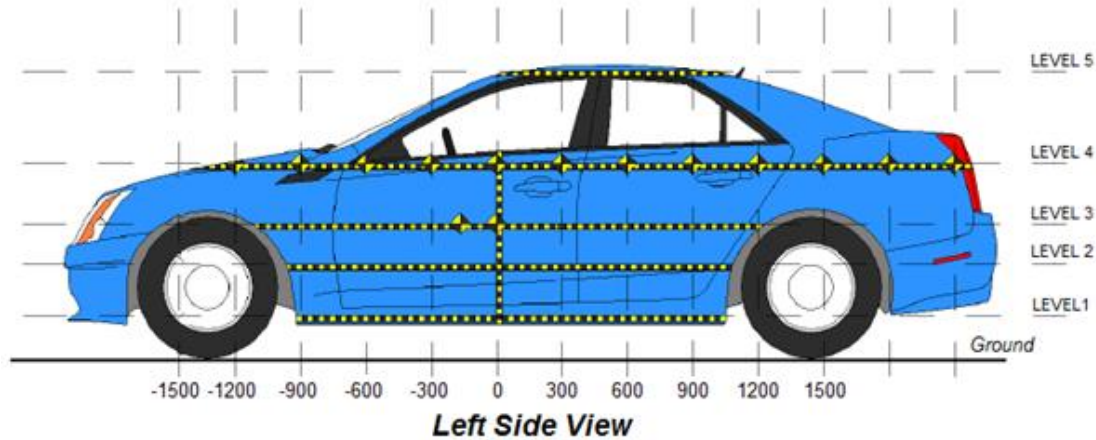
Code	Description	Pre-Test	Post-Test	Difference
A	Vehicle Wheelbase	2698	2678	20
B	Front Axle to FSOV	883	902	-19
C	Rear Axle to RSOV	789	795	-6
D	Total Length at Centerline	4369	4375	-6
E	Front Bumper Thickness	185	185	0
F	Front Bumper Bottom to Ground	235	239	-4
G	Sill Height at Front Wheel Well	224	228	-4
H	Sill Height at Front Door Leading Edge	224	220	4
I	Sill Height at B-Pillar	223	232	-9
J1	Sill Height at Rear Wheel Well	235	231	4
J2	Pinch Weld Height at Rear Wheel Well	227	235	-8
K	Sill Height Aft of Rear Wheel Well	235	231	4
L	Rear Bumper Thickness	225	225	0
M	Rear Bumper Bottom to Ground	262	357	-95
N	Sill Height to Bottom of Front Window Sill	750	750	0
O	Front Door Leading Edge to Impact CL	613	589	24
P	Rear Door Trailing Edge to Impact CL	1515	2078	-563
Q	Front Window Opening	395	373	22
R	Right Side Length	4300	4313	-13
S	Left Side Length	4302	4293	9
T	Vehicle Width at B-Pillars	1797	1753	44
U	Front Wheel Track Width	1557	1557	0
V	Rear Wheel Track Width	1565	1561	-4

* All measurements in mm with tolerance of $\pm 3\text{mm}$

DATA SHEET NO. 10
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test: NCAP Side Pole Impact Test

NHTSA: M20224210
 Test Date: 02/09/2022



MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	373	167	0
2	Occupant Hip Point	mm	642	195	0
3	Mid - Door	mm	717	206	0
4	Window Sill	mm	1014	177	150
5	Window Top	mm	1505	26	150

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

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

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test: NCAP Side Pole Impact Test

NHTSA: M20224210
 Test Date: 02/09/2022

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

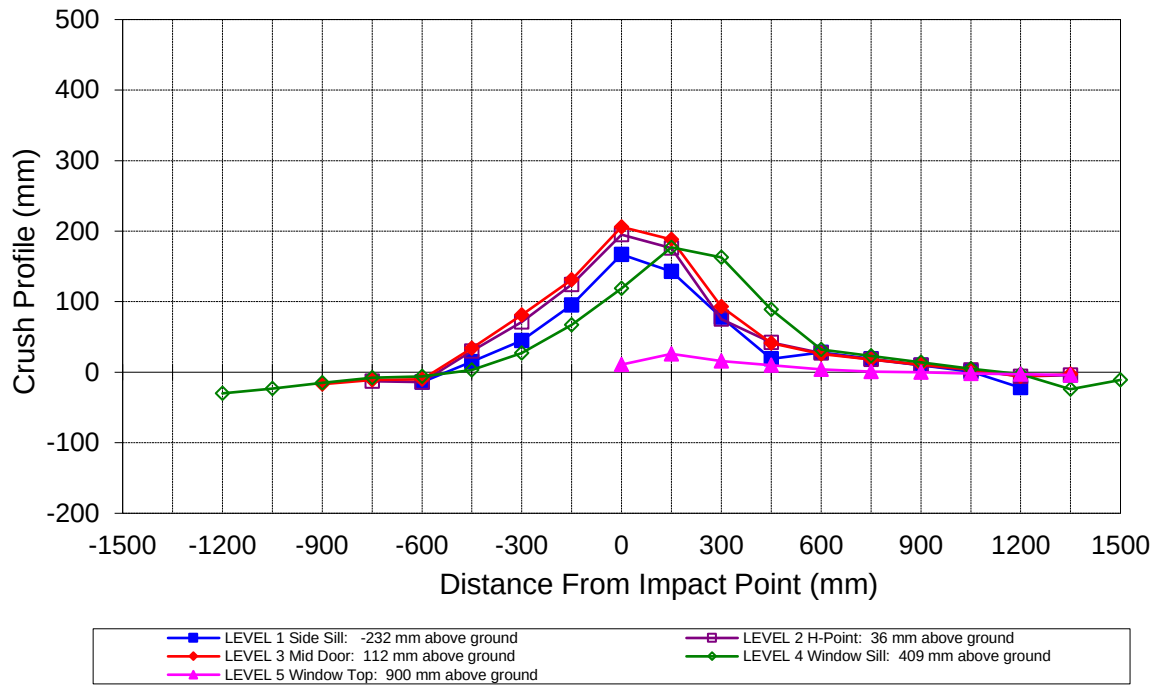
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1500															
-1350															
-1200				763					793					-30	
-1050				783					806					-23	
-900			901	795				918	810				-17	-15	
-750		898	899	798			911	910	806			-13	-11	-8	
-600	880	892	891	795		894	906	901	801		-14	-14	-10	-6	
-450	863	885	887	804		848	855	853	801		15	30	34	3	
-300	860	883	886	813		815	812	805	786		45	71	81	27	
-150	862	883	885	822		767	759	754	755		95	124	131	67	
0	866	882	886	832	551	699	687	680	713	540	167	195	206	119	11
150	868	881	887	839	591	725	705	699	662	565	143	176	188	177	26
300	869	880	888	845	598	791	805	795	682	582	78	75	93	163	16
450	868	880	889	848	600	849	838	848	759	590	19	42	41	89	10
600	867	879	888	851	599	839	852	862	819	595	28	27	26	32	4
750	865	877	885	852	597	846	859	867	829	596	19	18	18	23	1
900	865	877	883	852	594	855	867	872	838	594	10	10	11	14	0
1050	869	882	883	851	588	868	879	879	846	590	1	3	4	5	-2
1200	881	894	890	850	577	903	900	896	853	580	-22	-6	-6	-3	-3
1350		898	895	836	554		902	898	860	558		-4	-3	-24	-4
1500				843					854					-11	

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. The final distance from impact is determined after the final dummy positioning and the pole is aligned with the center of gravity of the dummy’s head.

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

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test: NCAP Side Pole Impact Test

NHTSA: M20224210
 Test Date: 02/09/2022



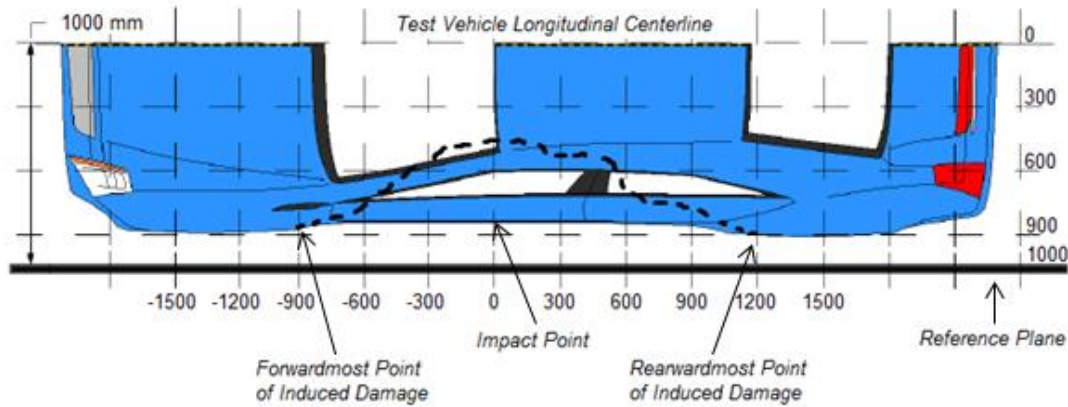
Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO. 11 **VEHICLE DAMAGE PROFILE DISTANCES**

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test: NCAP Side Pole Impact Test

NHTSA: M20224210
 Test Date: 02/09/2022

For guidance regarding damage profile distance measurements, please refer to the latest version of the *NHTSA Test Reference Guide, Volume 1: Vehicle Tests*.



Overhead View

VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance From Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	-900	3	82	99	-17
2	-450	3	147	113	34
3	0	3	320	114	206
4	450	3	152	111	41
5	900	3	128	117	11
6	1350	3	102	105	-3

DATA SHEET NO. 12
FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: <u>2022 KIA Niro EV EX SUV</u>	NHTSA No.: <u>M20224210</u>
Test Program: <u>NCAP Side Pole Impact Test</u>	Test Date: <u>02/09/2022</u>
Test Time: <u>11:03 AM</u>	Temperature: <u>21° C</u>

- A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable is 1 oz.)
- B. For the 5-minute period after motion ceases: 0 oz.
(Maximum allowable is 5 oz.)
- C. For the following 25 minutes: 0 oz.
(Maximum allowable is 1 oz./minute)
- D. Spillage Details: No Spillage Occurred

FMVSS NO. 301 STATIC ROLLOVER DATA



ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	70	300	370
90° to 180°	65	300	365
180° to 270°	61	300	361
270° to 360°	68	300	368

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

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

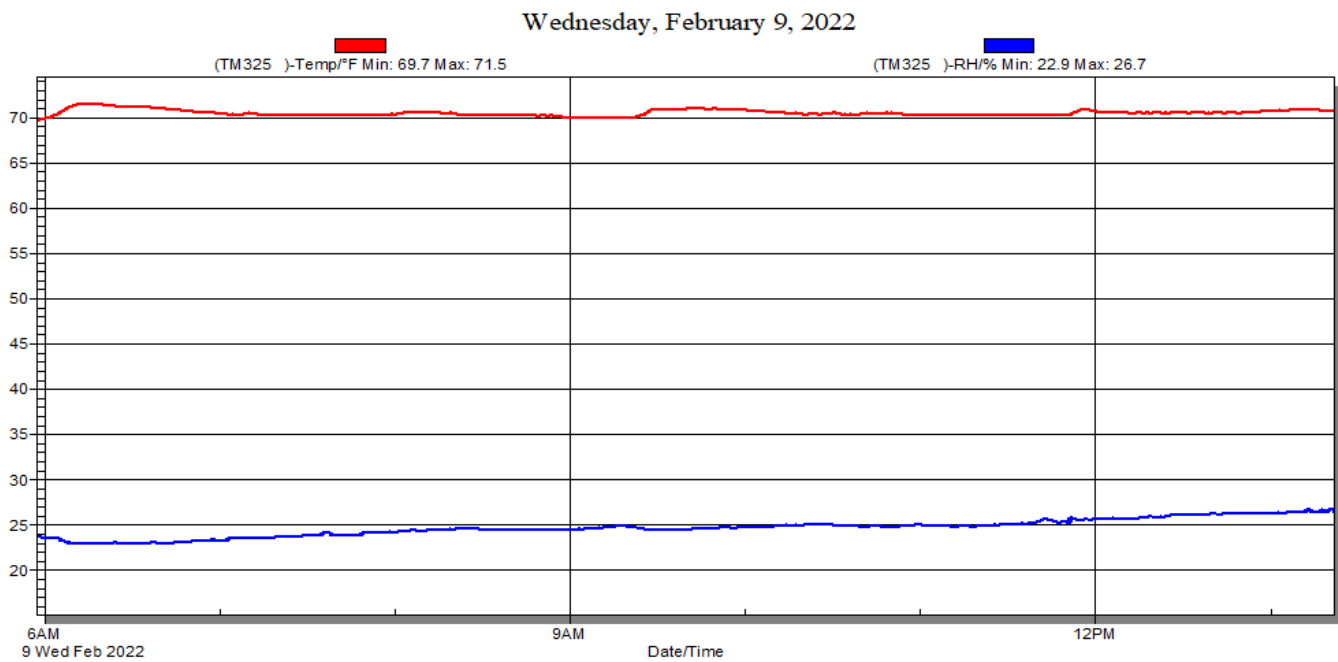
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 13
DUMMY / VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2022 KIA Niro EV EX SUV
Test: NCAP Side Pole Impact Test

NHTSA: M20224210
Test Date: 02/09/2022



Temperature and Humidity Stabilization Chart / Data for Dummies and Test Vehicle

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

Test Vehicle:	2022 KIA Niro EV EX SUV	NHTSA	M20224210
Test	NCAP Side Pole Impact Test	Test Date:	02/09/2022

ELECTRIC VEHICLE PROPULSION SYSTEM

Measured Parameter	Value
Type of Electric Vehicle (Electric/Gas-Electric Hybrid/Fuel Cell-Electric Hybrid)	Electric
Propulsion Battery Type	Lithium-ion Polymer
Nominal Voltage (Volts)	356
Is this Vehicle equipped with an Automatic Propulsion Battery Disconnect?	Yes
Physical Location of Automatic Propulsion Battery Disconnect, if applicable	Under Hood
Auxiliary Battery Type	12V

PROPULSION BATTERY SYSTEM DATA (COTR SUPPLIED)

Measured Parameter	Value
Electrolyte Fluid Type	LiPF6 Salt, Carbonate Solvent
Electrolyte Fluid Specific Gravity	1.23
Electrolyte Fluid Kinematic Viscosity (centistokes)	3cps @ 25°C
Electrolyte Fluid Color	Transparent/Pale Yellow
Propulsion Battery Coolant Type, Color and Specific Gravity (if applicable)	Water, Ethylene glycol, Blue
Location of Battery Modules (Inside or Outside of Passenger Compartment?)	Outside

PROPULSION BATTERY STATE OF CHARGE

Measured Parameter	Units	Value
<i>For all battery types:</i> Voltage Range corresponding to useable energy of the battery:		
Minimum State of Charge	V	245
Maximum State of Charge	V	421.4
95% of Maximum	V	400.3
Test Voltage *	V	405.3
<i>For batteries that are rechargeable ONLY by an energy source on the vehicle:</i> Voltage range corresponding to useable energy of the battery :		
Minimum State of Charge	V	
Maximum State of Charge	V	
95% of Maximum	V	
Test Voltage *	V	

* For all battery types-No less than 95% of Maximum Operating Voltage; for batteries that are rechargeable ONLY by an energy source on the vehicle-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: 2022 KIA Niro EV EX SUV
Test NCAP Side Pole Impact Test

NHTSA M20224210
Test Date: 02/09/2022

VEHICLE CHASSIS GROUND PT(S) LOCATION(S) & PROPULSION BATTERY SYSTEM

Measured Parameter	Value
Details of Vehicle Chassis Ground Points & Locations	Ground wire was attached to the under hood cross brace on the vehicle body.
Details of Propulsion Battery Components	All battery components are internal to the battery located on the underside of the vehicle.

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

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test NCAP Side Pole Impact Test

NHTSA M20224210
 Test Date: 02/09/2022

VOLTMETER INFORMATION

Measured Parameter	Units	Value
Make & Model		Fluke 1587
Serial No.		58100115
Internal Impedance Value	MΩ	10
Resolution	V	0.001
Last Calibration Date		4/28/2021

NOTES:

- The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 MΩ
- An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

**PROPULSION BATTERY VOLTAGE, RESISTANCE &
ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS**

Measured Parameter	Symbol	Units	Value
Normal operating voltage range specified by the manufacturer	V_b	V	421.4
Propulsion Battery Voltage : (ready to drive position)	V_b	V	407.1
Propulsion Battery to Vehicle Chassis	V_1	V	280
Propulsion Battery to Vehicle Chassis	V_2	V	279
Propulsion Battery to Vehicle Chassis Across Known Resistor	R_o	Ω	299,200
Propulsion Battery to Vehicle Chassis with R_o installed	V_1'	V	59.1
Propulsion Battery to Vehicle Chassis with R_o installed	V_2'	V	58.8
$R_{i1} = R_o * (1 + V_2/V_1) * [(V_1 - V_1')/V_1']$	R_{i1}	Ω	2,232,665
$R_{i2} = R_o * (1 + V_1/V_2) * [(V_2 - V_2')/V_2']$	R_{i2}	Ω	2,244,963
Lesser value of R_{i1} and R_{i2}	R_i	Ω	2,232,665
Electrical Isolation Value (Minimum E.I. Value is 500 Ω/V)	R_i/V_b	Ω/V	5,484

Is the Electrical Isolation Value $\geq 500 \Omega/V$ (Yes/No)? X Yes No (Fail)

NOTES:

- The measurement shall be made with the propulsion battery connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion motor(s) activated) position.
- If the voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.
- The known resistance R_o (in Ohms) should be approximately 500 times the nominal operating voltage of the vehicle (in volts) per SAE J1766
- If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant

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

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test NCAP Side Pole Impact Test

NHTSA M20224210
 Test Date: 02/09/2022

VOLTMETER INFORMATION

Measured Parameter	Units	Value
Make & Model		Fluke 1587
Serial No.		58100115
Internal Impedance Value	MΩ	10
Nominal Propulsion Battery Voltage (V _b)	V	0.001

NOTES:

- The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 MΩ
- An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

ELECTRICAL ISOLATION MEASUREMENTS & IMPACT CALCULATIONS

Parameter	Value	Units		Value		Value	
V ₁ =	0.082	V	Time:	3	Minutes	16	Seconds
V ₂ =	0.089	V	Time:	3	Minutes	21	Seconds
R ₀ =	299,200	Ω	Time:		Minutes		Seconds
V ₁ ' =	0.006	V	Time:	3	Minutes	25	Seconds
V ₂ ' =	0.019	V	Time:	3	Minutes	27	Seconds
R _{i1} =	7,903,259	Ω	Time:	3	Minutes	25	Seconds
R _{i2} =	2,117,933	Ω	Time:	3	Minutes	27	Seconds
R _i =	2,117,933	Ω	Time:	3	Minutes	27	Seconds
R _i /V _b =	2,117,932,584	Ω/V	Time:	3	Minutes	27	Seconds

Is the Electrical Isolation Value ≥ 500 Ω/V (Yes/No)? X Yes No (Fail)

NOTES:

- $R_{i1} = R_0 * (1 + V_2/V_1) * [(V_1 - V_1')/V_1]$, $R_{i2} = R_0 * (1 + V_1/V_2) * [(V_2 - V_2')/V_2]$, R_i = Lesser value of R_{i1} and R_{i2}
- If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant
- Minimum Electrical Isolation Value is 500 Ω/V

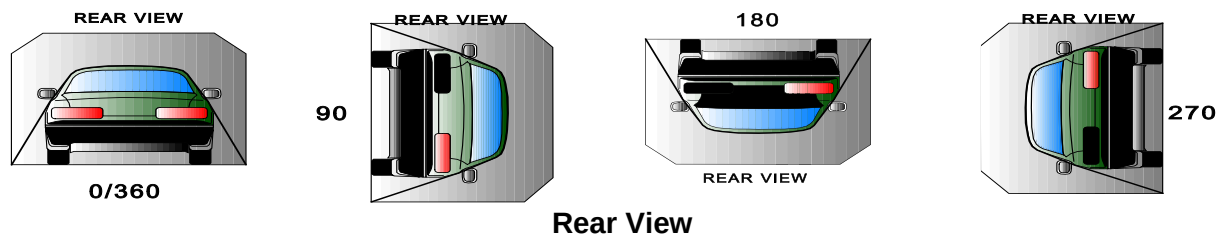
PROPULSION BATTERY SYSTEM COMPONENTS

Measured Parameter	Comments	Passed	Failed
Propulsion Battery Module movement within the passenger compartment	None	X	
Intrusion of an outside Propulsion Battery Component into the passenger compartment	None	X	
Is 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: 2022 KIA Niro EV EX SUV
 Test: NCAP Side Pole Impact Test

NHTSA: M20224210
 Test Date: 02/09/2022



DETERMINATION OF PROPULSION BATTERY ELECTROLYTE COLLECTION TIME PERIOD

Rollover Stage	Rotation Time (spec. 1 -3 min)		FMVSS 301 Hold Time	Total Time		Next Whole Minute Interval
	Minutes	Seconds		Minutes	Seconds	
0° to 90°	1	10	5	6	10	7
90° to 180°	1	5	5	6	5	7
180° to 270°	1	1	5	6	1	7
270° to 360°	1	8	5	6	8	7

ACTUAL TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE

Rollover Stage	Propulsion Battery Electrolyte Spillage	Units	Spillage Location
0° to 90°	0.0	Liters	None
90° to 180°	0.0	Liters	None
180° to 270°	0.0	Liters	None
270° to 360°	0.0	Liters	None
Total Spillage	0.0	Liters	None

* FMVSS 305 Requirements: Maximum allowable propulsion battery electrolyte spillage is **5.0 Liters**

Is the total spillage of propulsion battery electrolyte greater than 5.0 Liters? ☐ Yes (Fail) ☒ No
 Is propulsion battery electrolyte spillage visible in the passenger compartment? ☐ Yes (Fail) ☒ No

VOLTMETER INFORMATION

Measured Parameter	Units	Value
Make & Model		Fluke 1587
Serial No.		58100115
Internal Impedance Value	MΩ	10
Nominal Propulsion Battery Voltage (V _b)	V	0.001

NOTES:

- The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 MΩ
- An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

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

Test Vehicle: 2022 KIA Niro EV EX SUV
 Test NCAP Side Pole Impact Test

NHTSA M20224210
 Test Date: 02/09/2022

ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS

Parameter	Rollover Stage	Value	Units		Minutes	Seconds
$V_1 =$	90°	0.003	V	Time:	1	22
	180°	0.014	V		11	2
	270°	0.024	V		17	16
	360°	0.026	V		24	2
$V_2 =$	90°	0.004	V	Time:	1	25
	180°	0.012	V		11	9
	270°	0.020	V		17	22
	360°	0.024	V		24	10
$V_1' =$	90°	0.001	V	Time:	1	28
	180°	0.001	V		11	15
	270°	0.020	V		17	26
	360°	0.002	V		24	16
$V_2' =$	90°	0.001	V	Time:	1	30
	180°	0.001	V		11	20
	270°	0.001	V		17	28
	360°	0.006	V		24	20
$R_{i1} =$	90°	1,396,267	Ω	Time:	1	28
	180°	7,223,543	Ω		11	15
	270°	109,707	Ω		17	26
	360°	6,904,615	Ω		24	16
$R_{i2} =$	90°	1,570,800	Ω	Time:	1	30
	180°	7,130,933	Ω		11	20
	270°	12,506,560	Ω		17	28
	360°	1,870,000	Ω		24	20
$R_i =$	90°	1,396,267	Ω	Time:	1	28
	180°	7,130,933	Ω		11	20
	270°	109,707	Ω		17	28
	360°	1,870,000	Ω		24	20
$R_i/V_b =$	90°	1,396,266,667	Ω/V	Time:	1	28
	180°	7,130,933,333	Ω/V		11	20
	270°	109,706,667	Ω/V		17	28
	360°	1,870,000,000	Ω/V		24	20

Is the Electrical Isolation Value $\geq 500 \Omega/V$ (Yes/No)? ☒ Yes ☐ No (Fail)

APPENDIX A
PHOTOGRAPHS

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M20224210

Figure A-1: As Delivered Right Front $\frac{3}{4}$ View of Test Vehicle



M20224210

Figure A-2: As Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle



Figure A-3: Pre-Test Frontal View of Test Vehicle

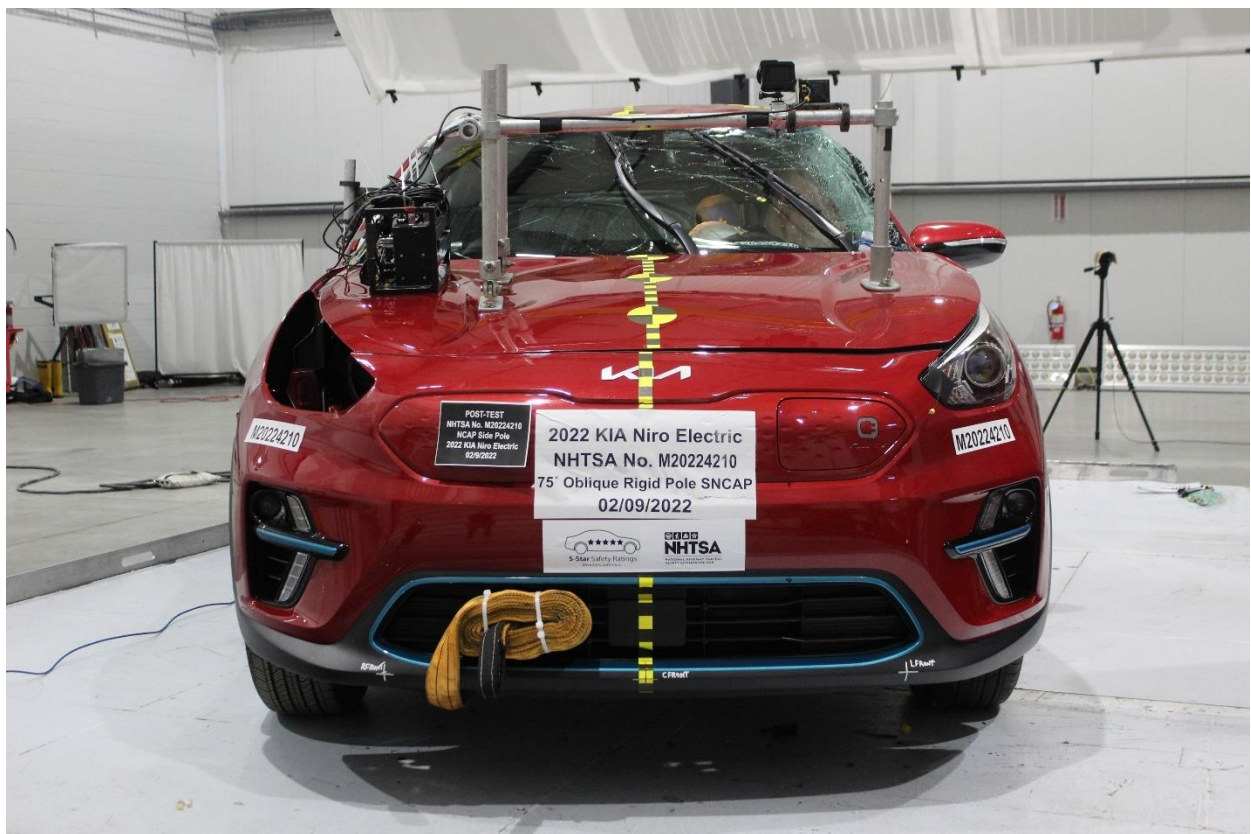


Figure A-4: Post-Test Frontal View of Test Vehicle



Figure A-5: Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



Figure A-6: Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



Figure A-7: Pre-Test Left Side View of Test Vehicle



Figure A-8: Post-Test Left Side View of Test Vehicle



Figure A-9: Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



Figure A-10: Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle

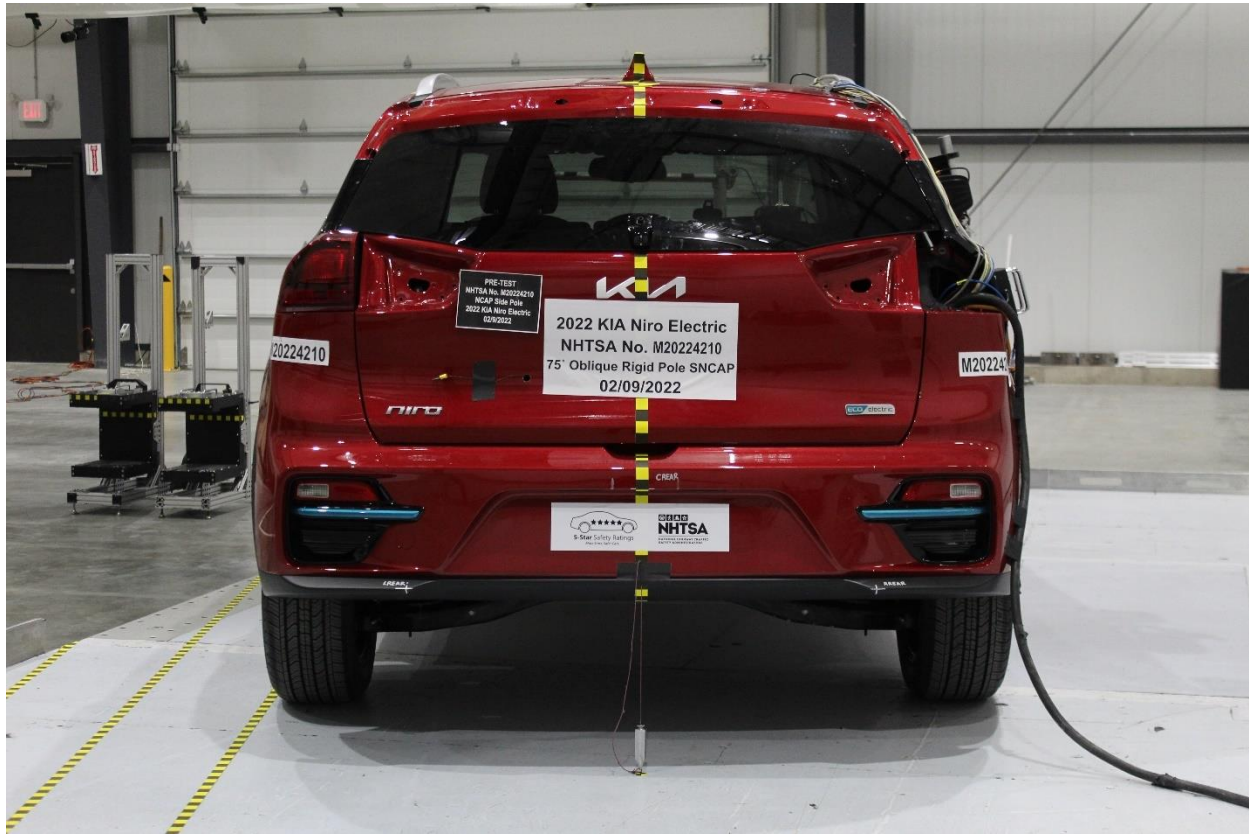


Figure A-11: Pre-Test Rear View of Test Vehicle



Figure A-12: Post-Test Rear View of Test Vehicle



Figure A-13: Pre-Test Right Side View of Test Vehicle



Figure A-14: Post-Test Right Side View of Test Vehicle

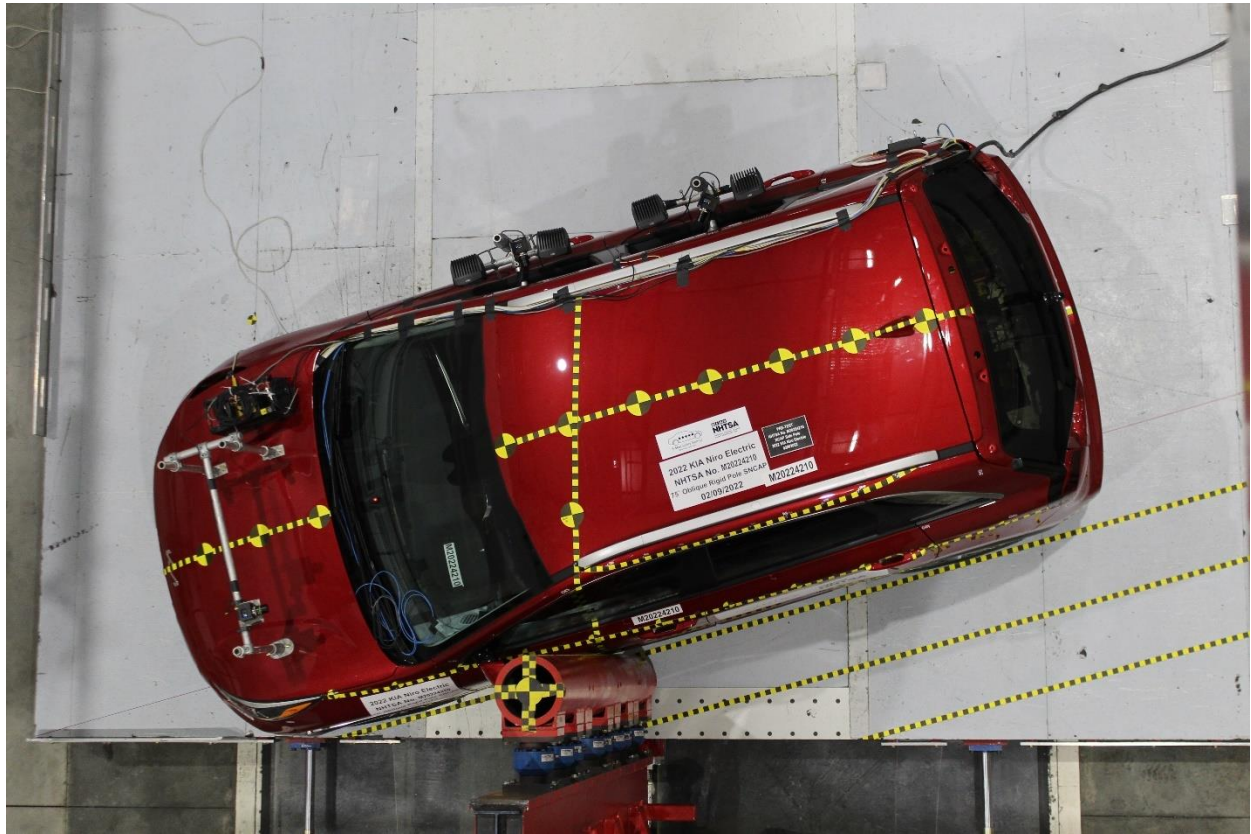


Figure A-15: Pre-Test Overhead View of Test Area

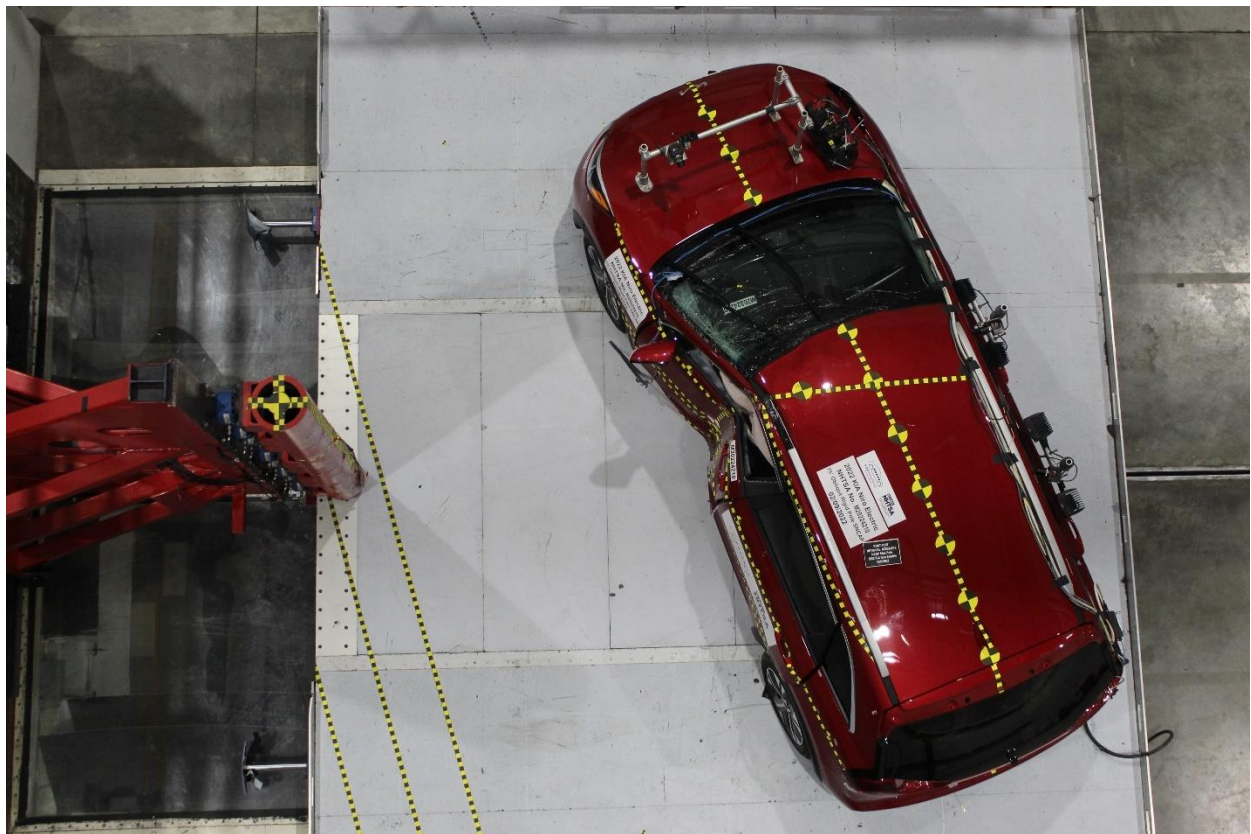


Figure A-16: Post-Test Overhead View of Test Area



Figure A-17: Pre-Test Left Side View of Pole Positioned Against Side of Vehicle



Figure A-18: Pre-Test Right Side View of Pole Positioned Against Side of Vehicle



Figure A-19: Pre-Test Close-Up View of Impact Point Target



Figure A-20: Post-Test Close-Up View of Impact Point Target Showing Impact Location



Figure A-21: Pre-Test Front Close-Up View of Dummy Head and Chest



Figure A-22: Post-Test Front Close-Up View of Dummy



Figure A-23: Pre-Test Left Side View of Dummy Showing Belt and Chalking



Figure A-24: Pre-Test Left Side View of Dummy Shoulder and Door Top View



Figure A-25: Post-Test Left Side View of Dummy Shoulder and Door Top View



Figure A-26: Pre-Test Frontal View of Seat Back Prior to Dummy Positioning



Figure A-27: Pre-Test Frontal Close-Up View of Dummy Head / Shoulders in Relation to Head Restraint



Figure A-28: Pre-Test Frontal View of Seat Pan Prior to Dummy Positioning



Figure A-29: Pre-Test Overhead View of Dummy Thighs on Seat Pan

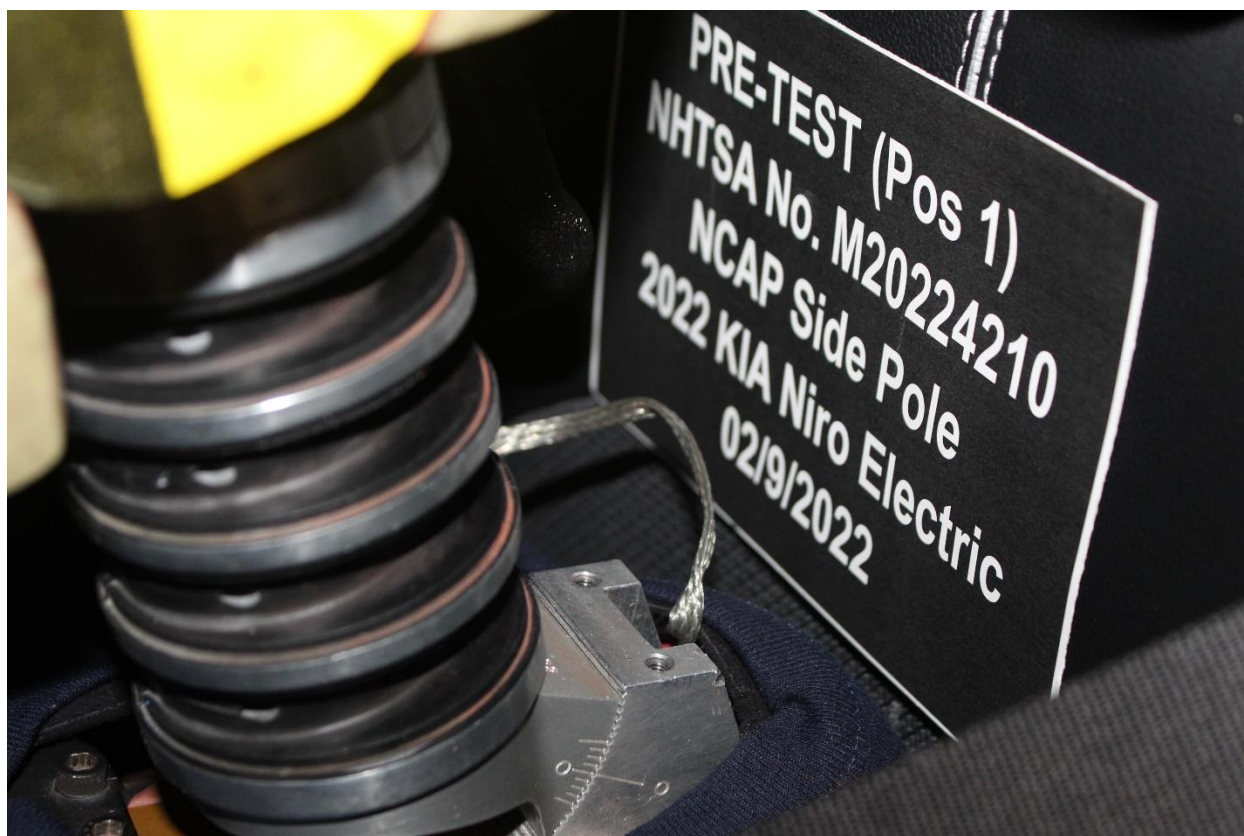


Figure A-30: Pre-Test Left Side View of Dummy's Neck Showing Position of Adjustable Neck Bracket



Figure A-31: Pre-Test Left Side View of Dummy's Head Showing Dummy's Head is Level

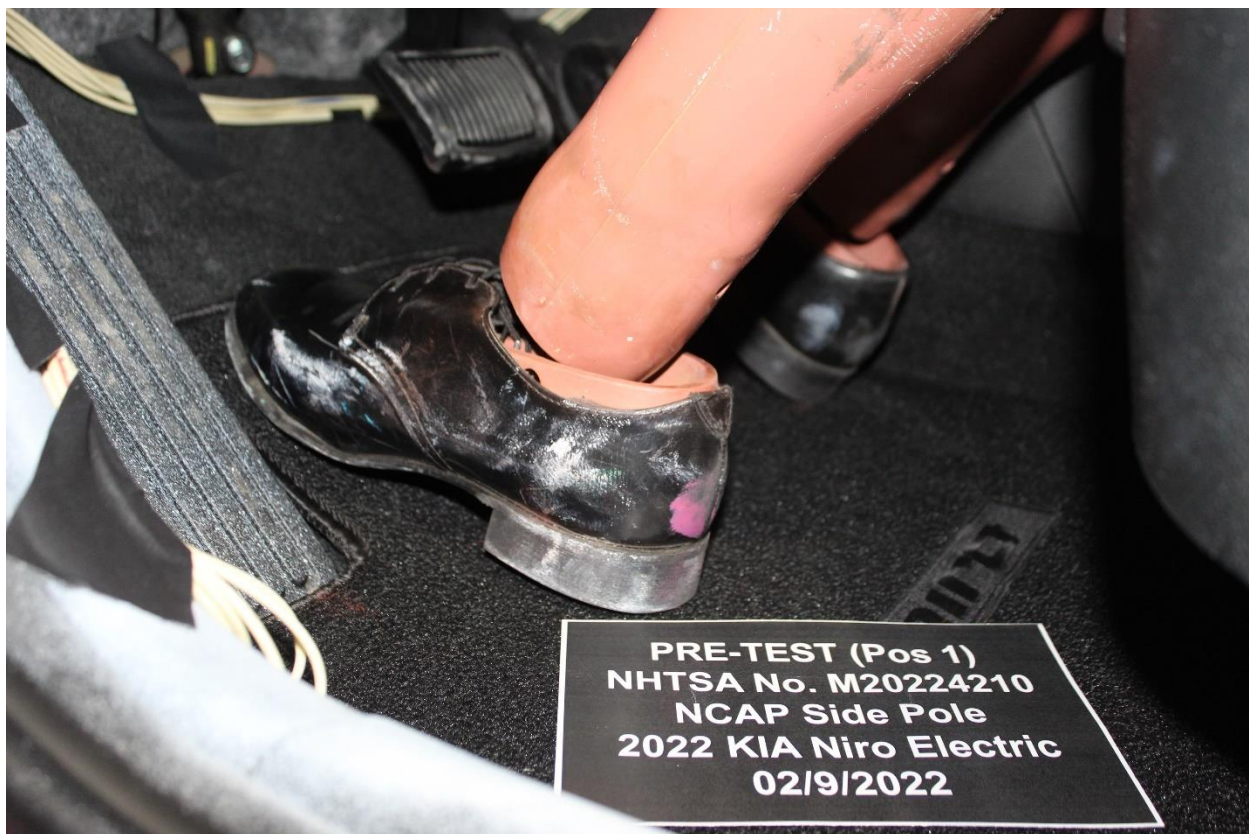


Figure A-32: Pre-Test Placement of Dummy's Feet



Figure A-33: Pre-Test View of Belt Anchorage for Dummy



Figure A-34: Pre-Test Left Side View of Steering Wheel



Figure A-35: Pre-Test View of Disengaged Parking Brake



Figure A-36: Pre-Test View of Parking Brake



Figure A-37: Pre-Test Close-Up Left Side View of Driver Seat Track

Figure A-38: Pre-Test Close-Up Left Side View of Driver Seat Back



Figure A-39: Pre-Test Close-Up View of Driver Seat Back or Head Restraint



Figure A-40: Pre-Test Dummy and Door Clearance View



Figure A-41: Post-Test Dummy and Door Clearance View



Figure A-42: Pre-Test Right Side View of Dummy and Front Seat of Occupant Compartment



Figure A-43: Post-Test Right Side View of Dummy and Front Seat of Occupant Compartment



Figure A-44: Pre-Test Inner Door Panel View



Figure A-45: Post-Test Inner Door Panel View Showing Dummy Contact Location



Figure A-46: Post-Test Dummy Close-Up Head Contact with Vehicle Interior View



Figure A-47: Post-Test Dummy Close-Up Head Contact with Side Airbag View

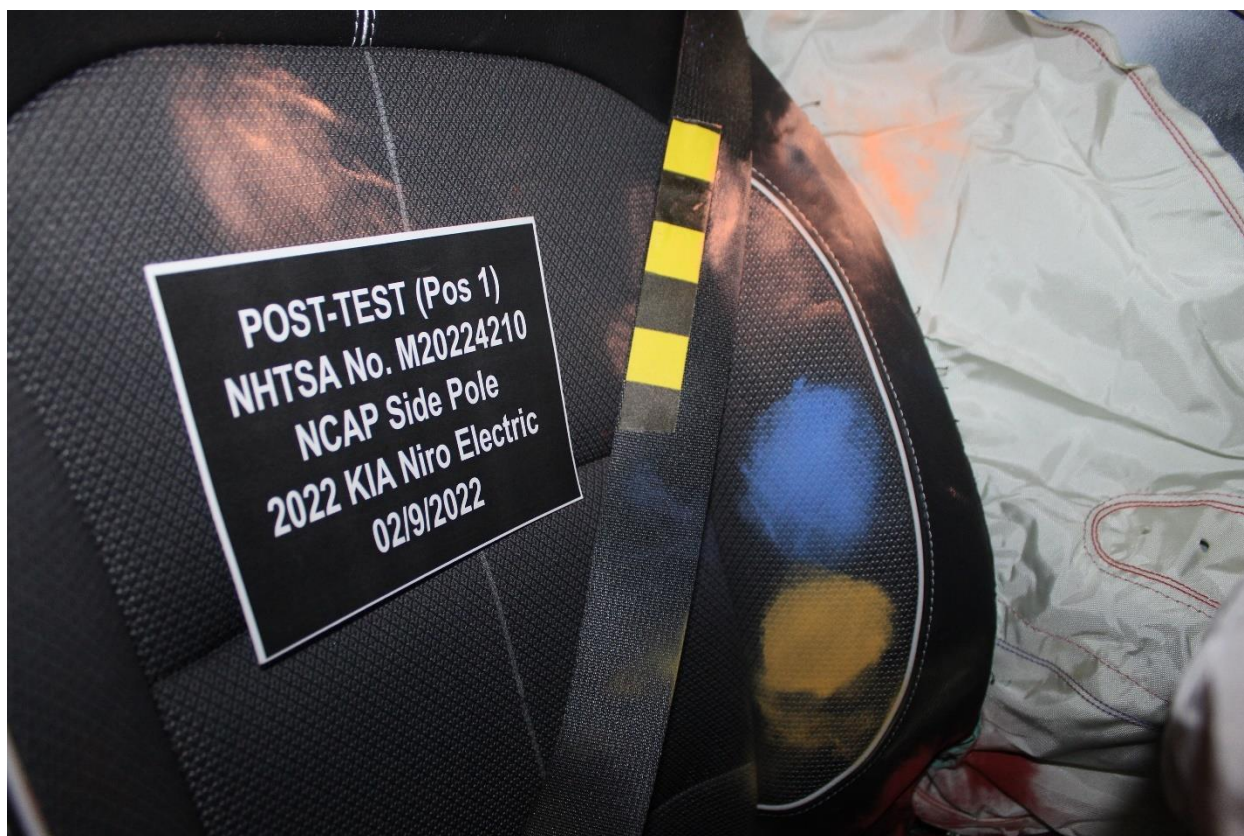


Figure A-48: Post-Test Dummy Close-Up Torso Contact with Vehicle Interior View

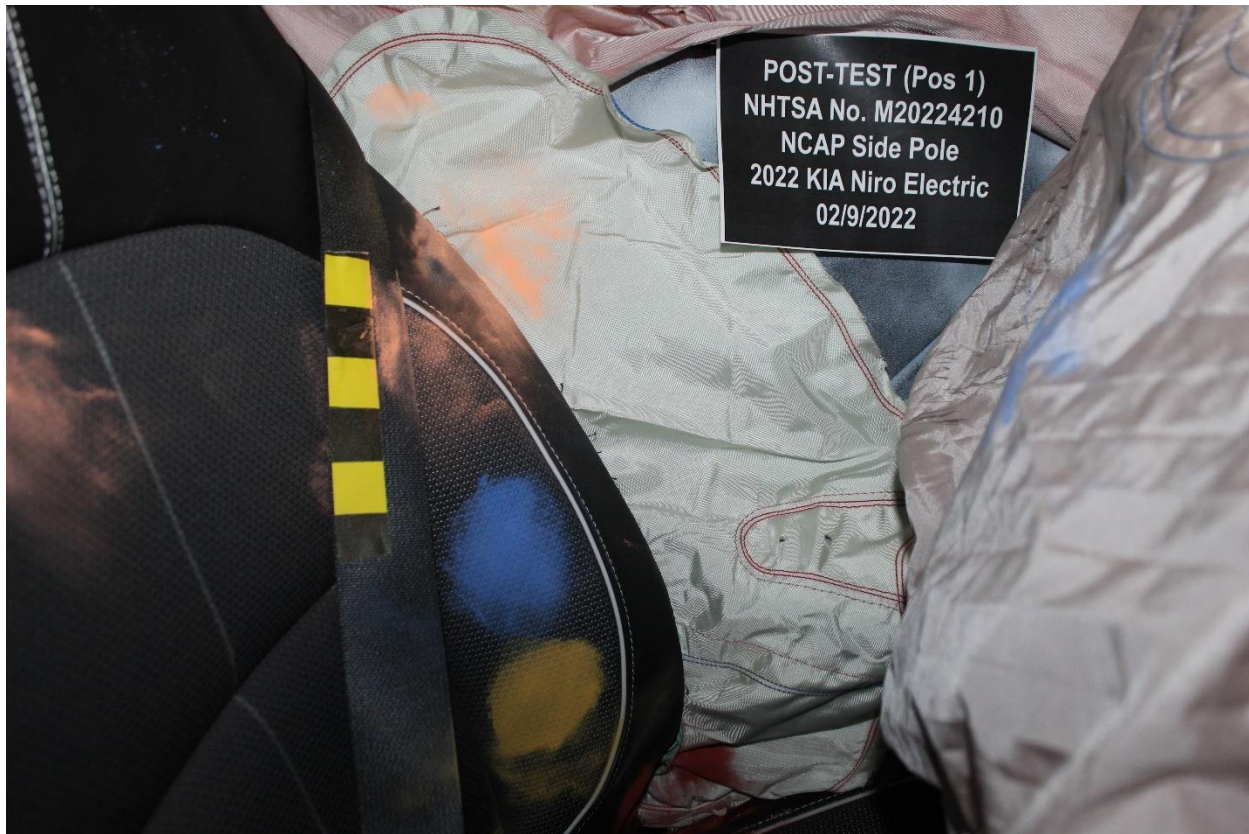


Figure A-49: Post-Test Dummy Close-Up Torso Contact with Side Airbag View



Figure A-50: Post-Test Dummy Close-Up Pelvis Contact with Vehicle Interior View



Figure A-51: Post-Test Dummy Close-Up Pelvis Contact with Side Airbag View



Figure A-52: Post-Test Dummy Close-Up Knee Contact with Vehicle Interior View



Figure A-53: Pre-Test Right Side View of Dummy and Rear Seat of Occupant Compartment

Photo Not Applicable

Figure A-54: Post-Test Inner Rear Passenger Torso Air Bag Deployment View



Figure A-55: Pre-Test View of Charging Port



Figure A-56: Post-Test View of Charging Port



Figure A-57: Close-Up View of Vehicle's Certification Label



Figure A-58: Close-Up View of Vehicle's Tire Information Placard or Label



Figure A-59: Pre-Test Pole Barrier Front View

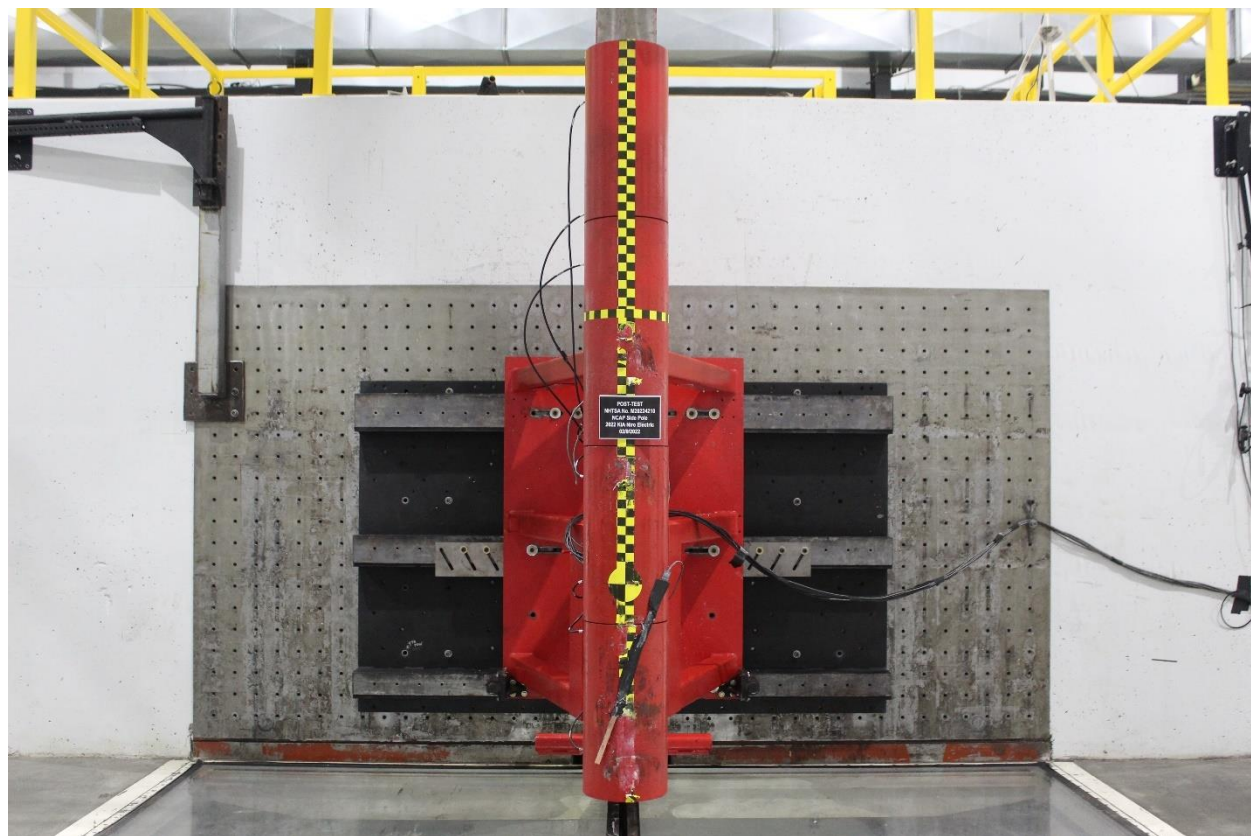


Figure A-60: Post-Test Pole Barrier Front View

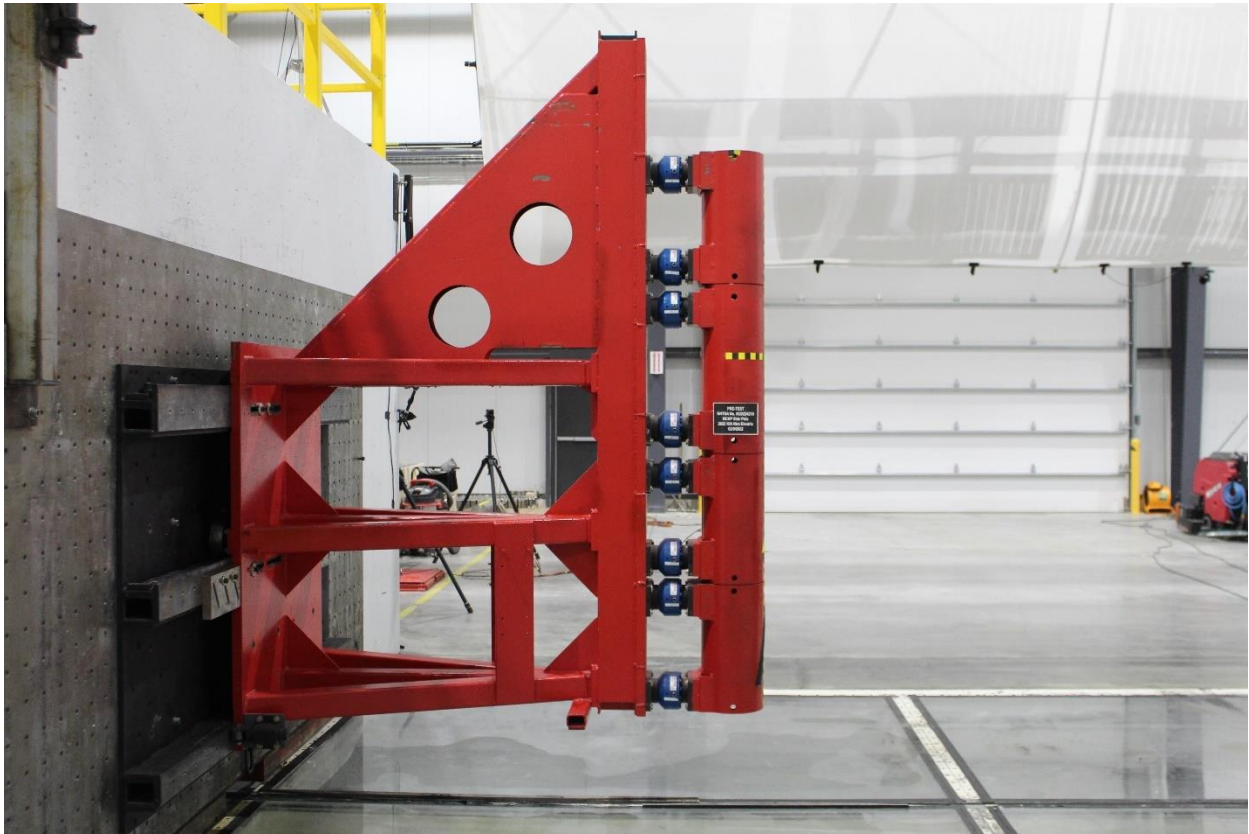


Figure A-61: Pre-Test Pole Barrier Side View

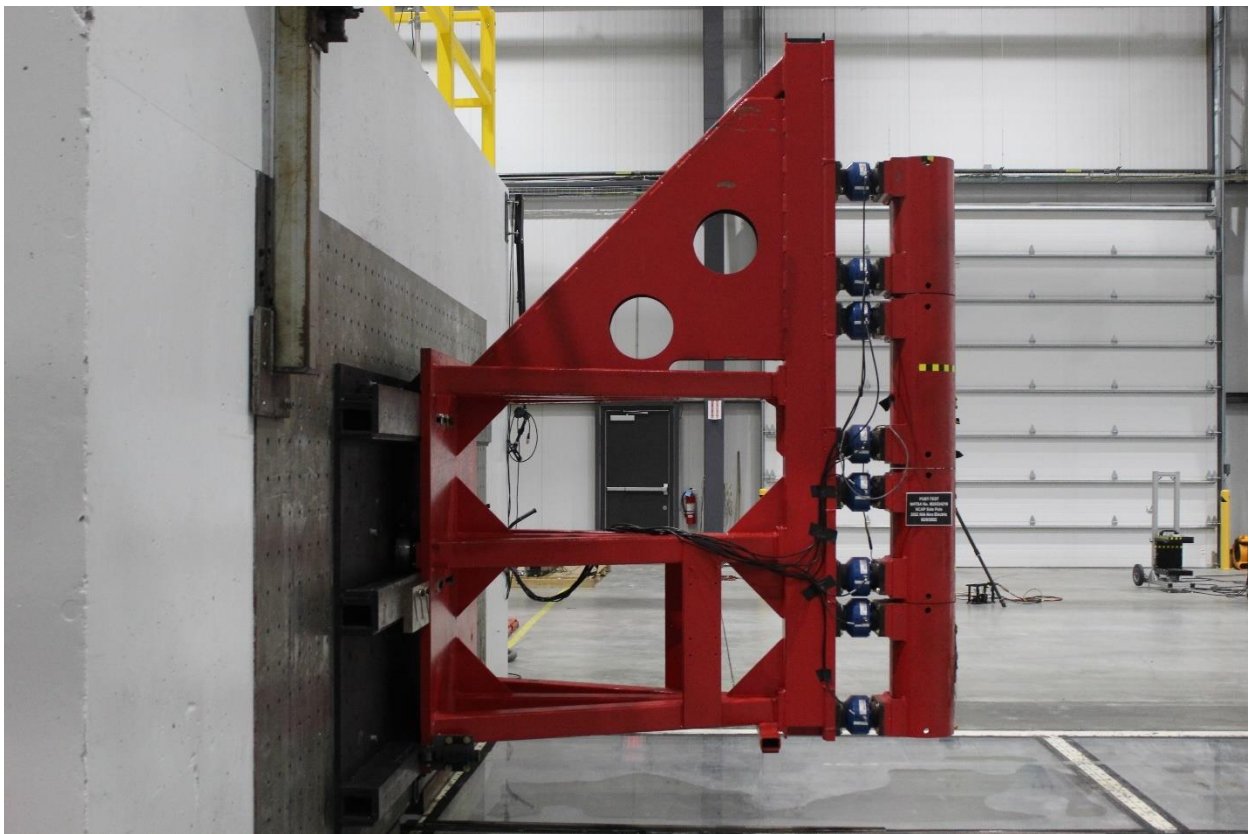


Figure A-62: Post-Test Pole Barrier Side View

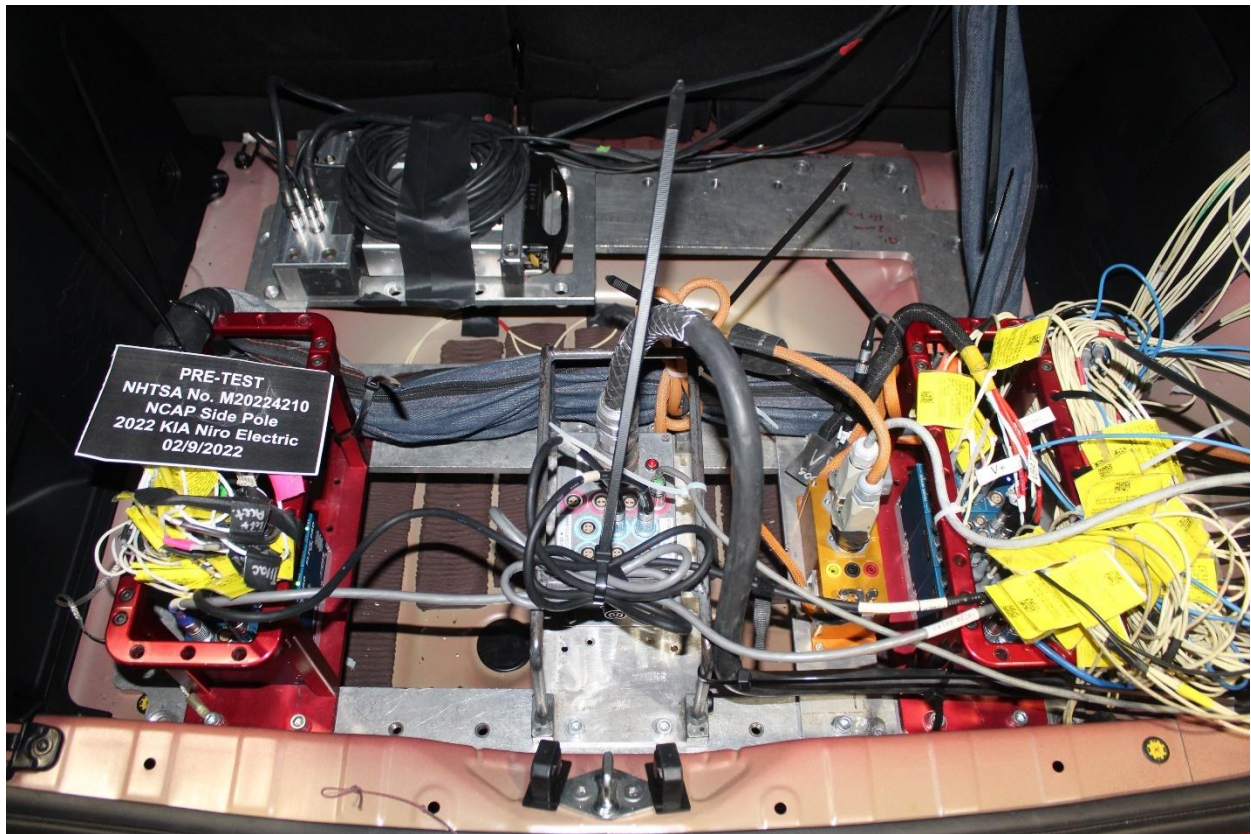


Figure A-63: Pre-Test Ballast View



Figure A-64: Post-Test Primary and Redundant Speed Trap Read-Out



Figure A-65: FMVSS No. 301 Static Rollover 0 Degrees

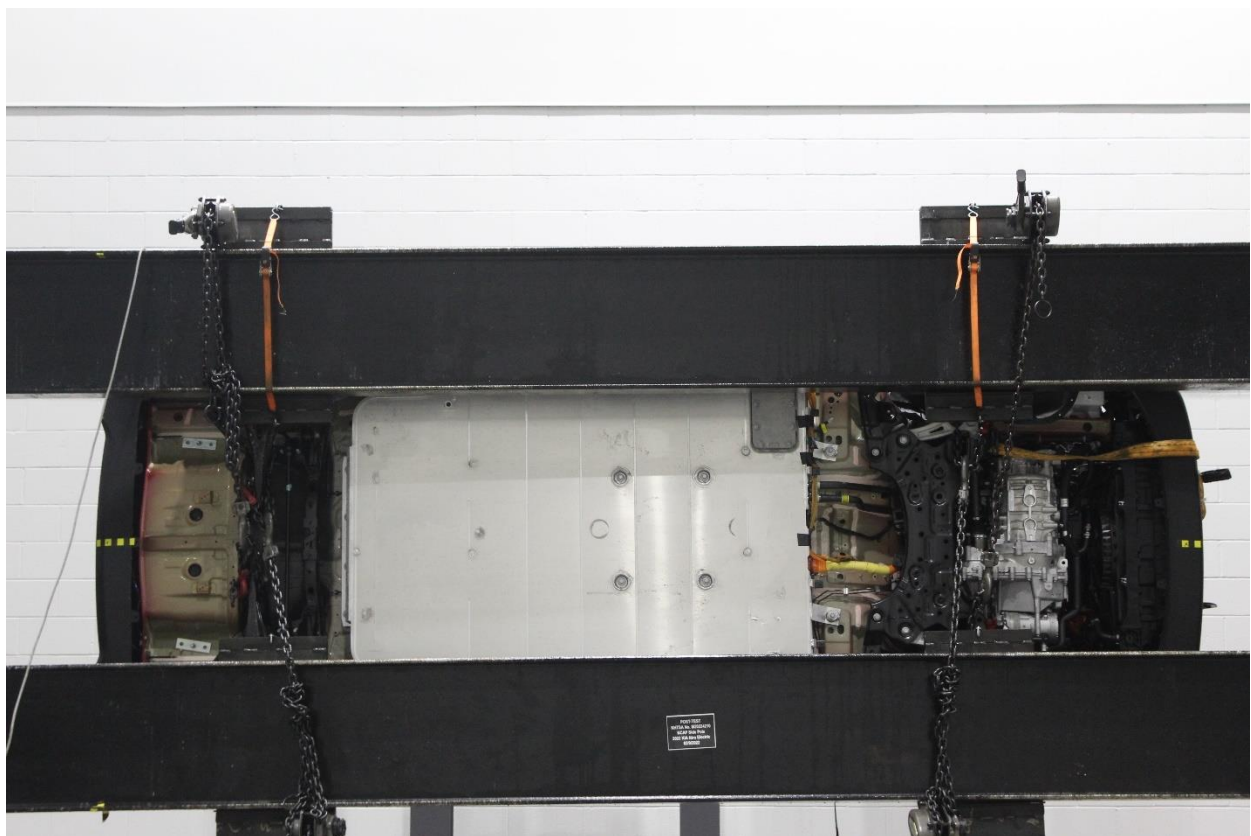


Figure A-66: FMVSS No. 301 Static Rollover 90 Degrees



Figure A-67: FMVSS No. 301 Static Rollover 180 Degrees



Figure A-68: FMVSS No. 301 Static Rollover 270 Degrees



Figure A-69: FMVSS No. 301 Static Rollover 360 Degrees



Figure A-70: Impact Event



Figure A-73: Post-Test View of Shattered Vehicle Inner Door Panel



Figure 305-1: Auxiliary Power Module Warning Label



Figure 305-2: Power Inverter Warning Label



Figure 305-3 First Responder Warning Label



Figure 305-4: First Responder Warning Label Location



Figure 305-5: Other Vehicle Label Related to Electric Propulsion System



Figure 305-6: Manual High Voltage Service Disconnect in Place



Figure 305-7: Manual High Voltage Service Disconnect Removed (Show Plug)



Figure 305-8: Manual High Voltage Service Disconnect Removed Location

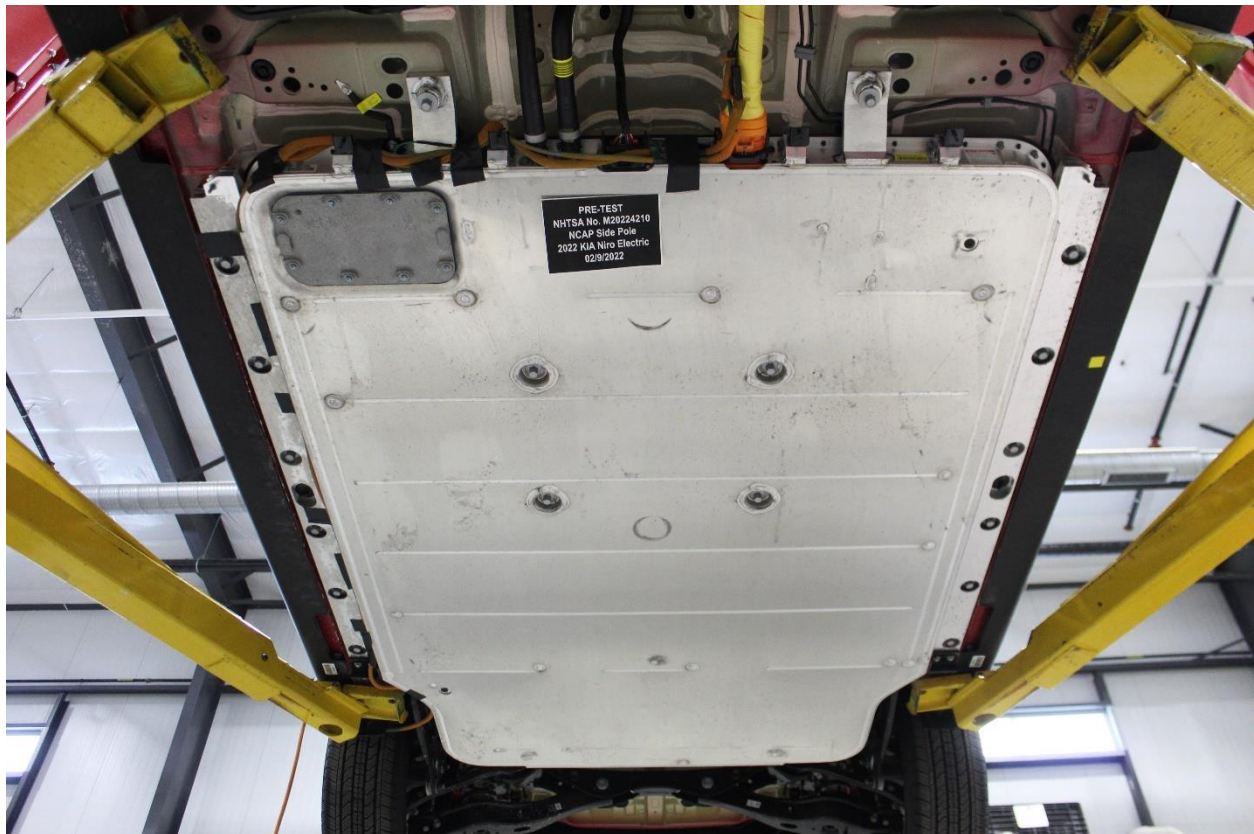


Figure 305-9: Pre-Impact View of Propulsion Battery

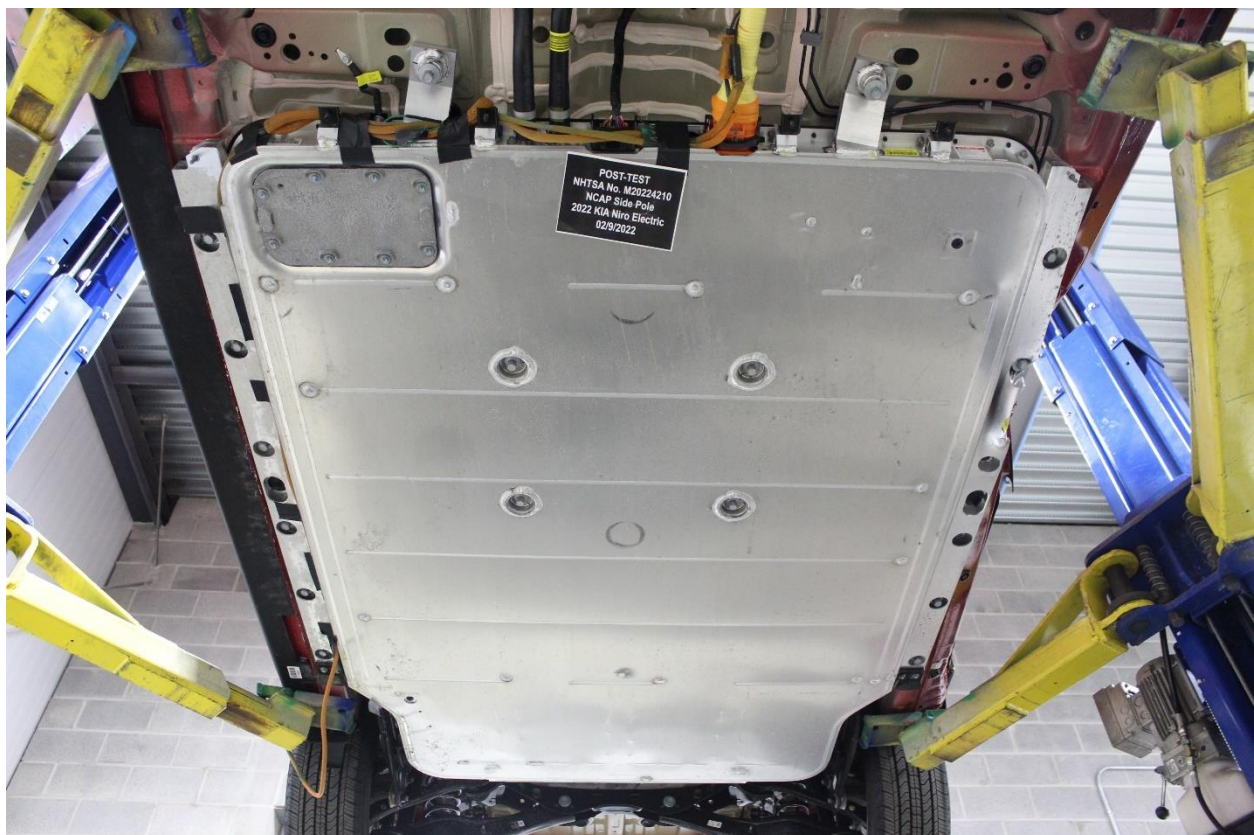


Figure 305-10: Post-Impact Front View of Propulsion Battery



Figure 305-11: Post-Impact Rear View of Propulsion Battery (if any part of it is visible)

Photo Not Applicable

Figure 305-12: Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

Photo Not Applicable

Figure 305-13: Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

Photo Not Applicable

Figure 305-14: Pre-Impact View of Propulsion Battery Module(s)

Photo Not Applicable

Figure 305-15: Post-Impact View of Propulsion Battery Module(s)

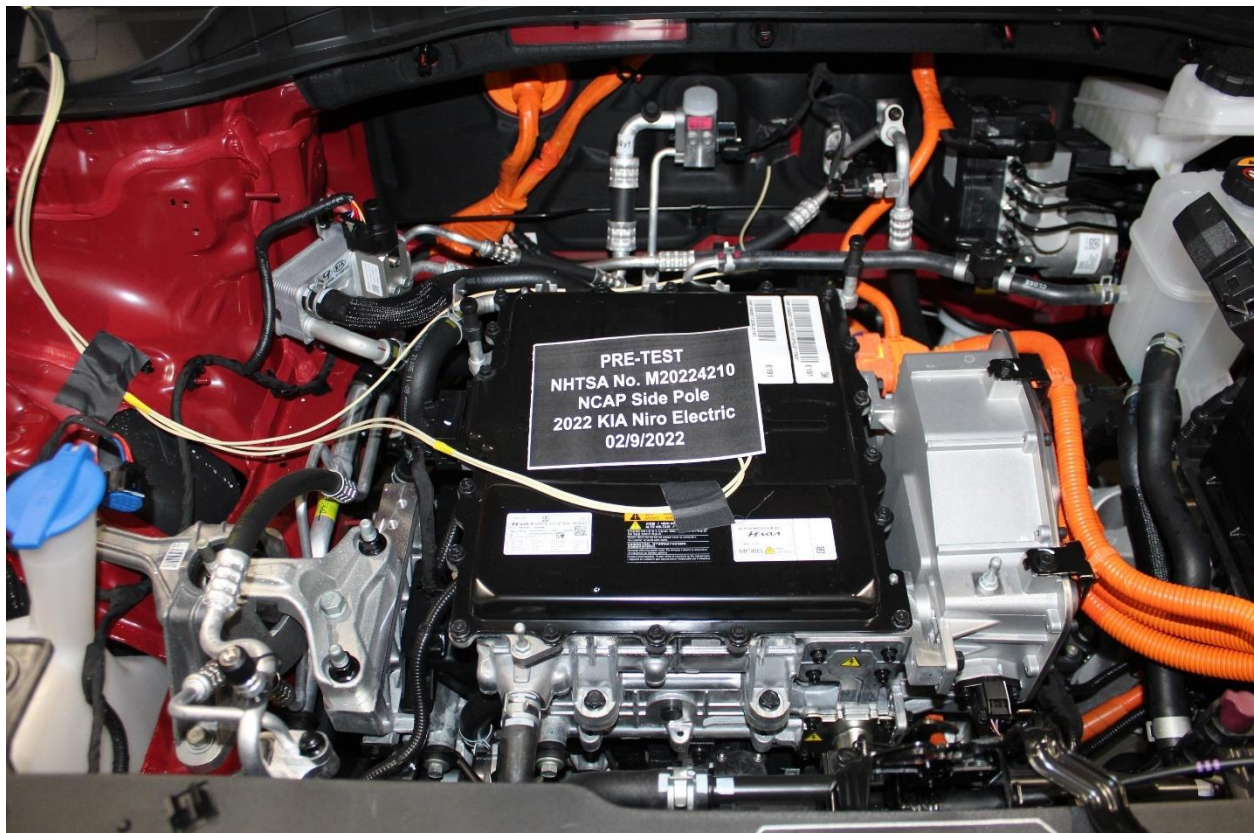


Figure 305-16: Pre-Impact View of Electric Propulsion Drive



Figure 305-17: Post-Impact View of Electric Propulsion Drive

Photo Not Applicable

Figure 305-18: Pre-Impact View of High Voltage Interconnects

Photo Not Applicable

Figure 305-19: Pre-Impact View of Propulsion Battery Venting System



Figure 305-20: Pre-Impact View of Other Visible Electric Propulsion Components



Figure 305-21: Pre-Impact View of Ground Lead Attached



Figure 305-22: Pre-Impact View of High Voltage Leads Attached



Figure 305-23: Pre-Impact Close Up View of High Voltage Leads Attached



Figure 305-24: Pre-Impact View of Installed Test Interface Port



Figure 305-25: Post-Impact View of Installed Test Interface Port

Photo Not Applicable

Figure 305-26: Pre-Impact View of Other Test Devices

Photo Not Applicable

Figure 305-27: Post-Impact View of Other Test Devices

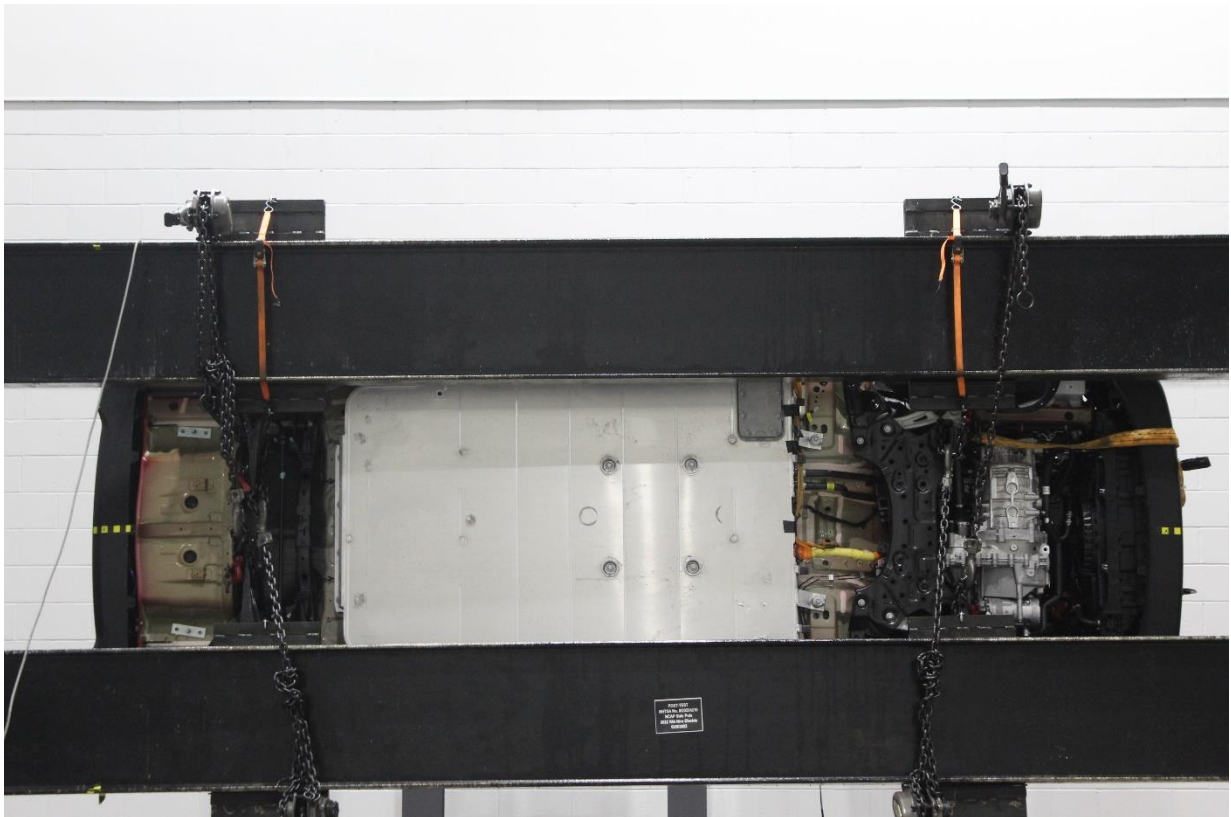


Figure 305-28: FMVSS No. 305 Static Rollover 90 Degrees



Figure 305-29: FMVSS No. 305 Static Rollover 180 Degrees



Figure 305-30: FMVSS No. 305 Static Rollover 270 Degrees



Figure 305-31: FMVSS No. 305 Static Rollover 360 Degrees



Figure 305-32: Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery



Figure 305-33: Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

Photo Not Applicable

Figure 305-34: Post-Impact Propulsion Battery System Mounting and-or Intrusion Failure(s)

Photo Not Applicable

Figure 305-35: Post-Impact View of Battery Component Intrusion (if applicable)

Photo Not Applicable

Figure 305-36: Post-Impact View of Battery Module Movement or Retention Loss (if applicable)

Photo Not Applicable

Figure 305-37: Post-Impact View of Propulsion Battery Electrolyte Spillage Location (if applicable)

Photo Not Applicable

Figure 305-38: Post-Impact View of Propulsion Battery Electrolyte Spillage Location (after rollover)

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA PLOTS

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Driver Dummy Instrumentation Plots

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10	Driver Acetabulum Force on Impact Side (Y) vs. Time	B-6
11	Driver Total Pelvis Force on Impact Side (Y) vs. Time	B-6

The following additional data for this test can be obtained from the Research and Development section of the NHTSA website. The website can be found at www.NHTSA.gov.

Additional Driver Dummy Instrumentation Data

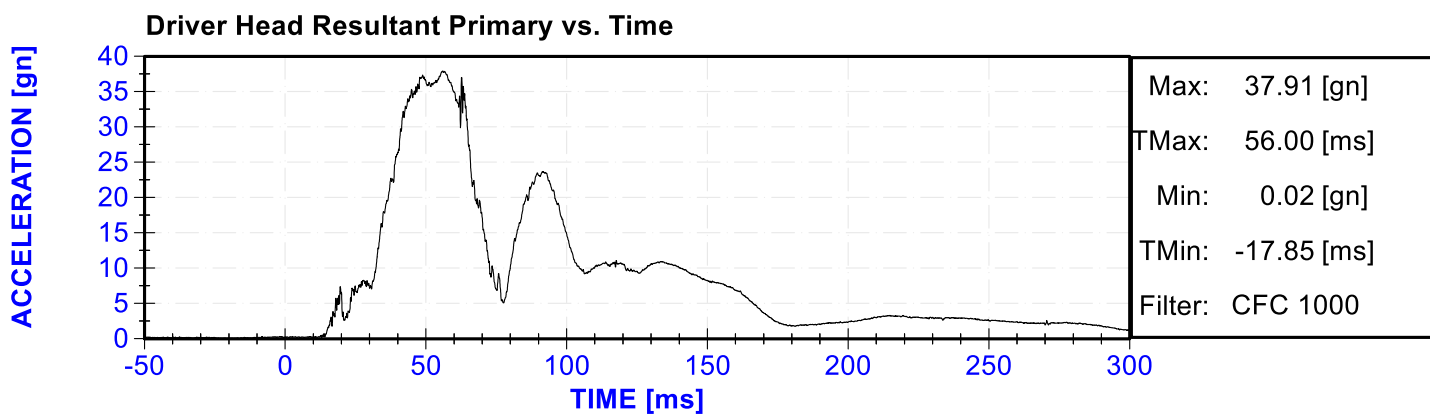
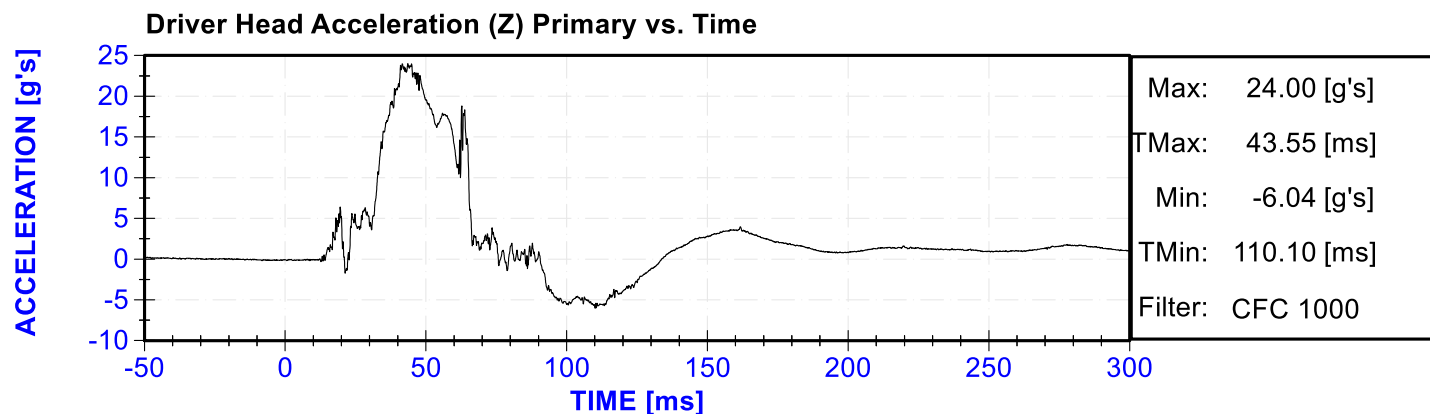
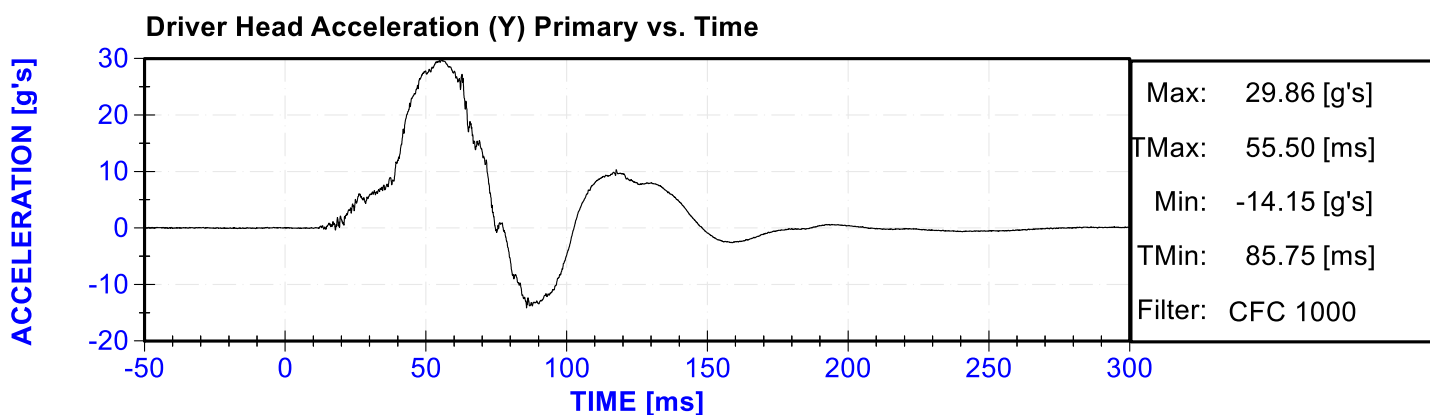
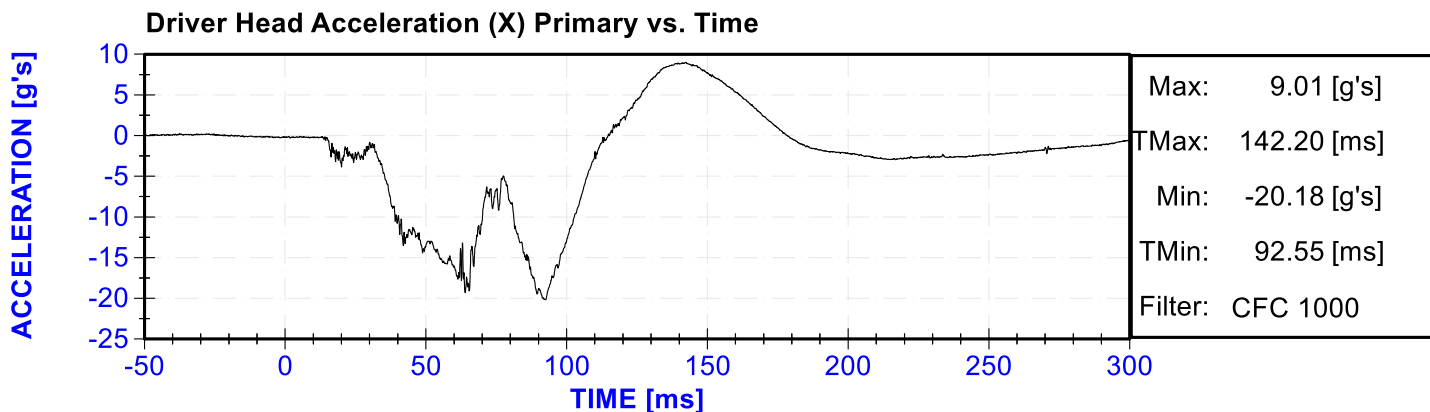
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Driver Head Acceleration Redundant (Y)
Driver Head Acceleration Redundant (Z)
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Driver Middle Thorax Rib Deflection (Y)
Driver Lower Thorax Rib Deflection (Y)
Driver Upper Abdomen Rib Deflection (Y)
Driver Lower Abdomen Rib Deflection (Y)

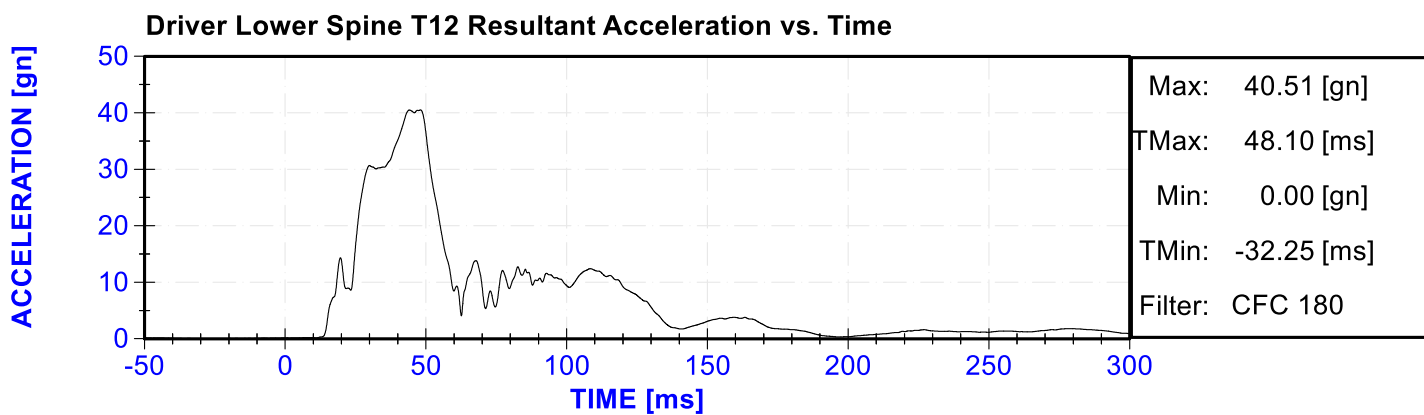
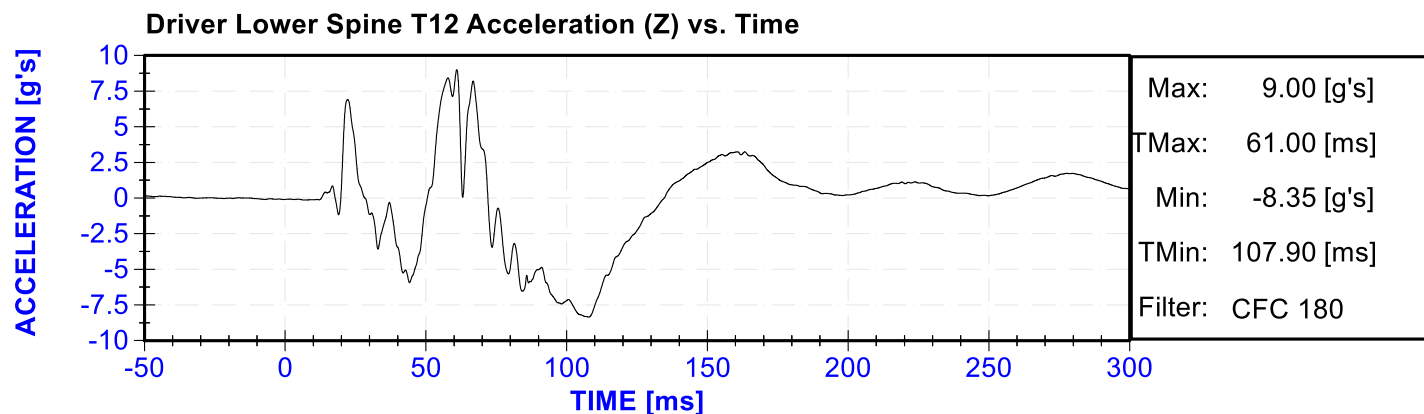
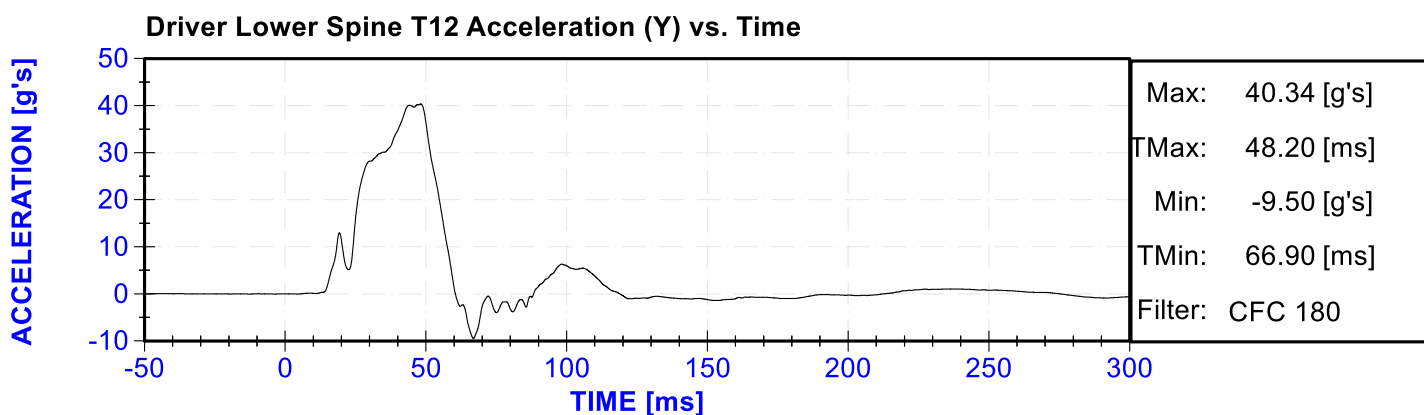
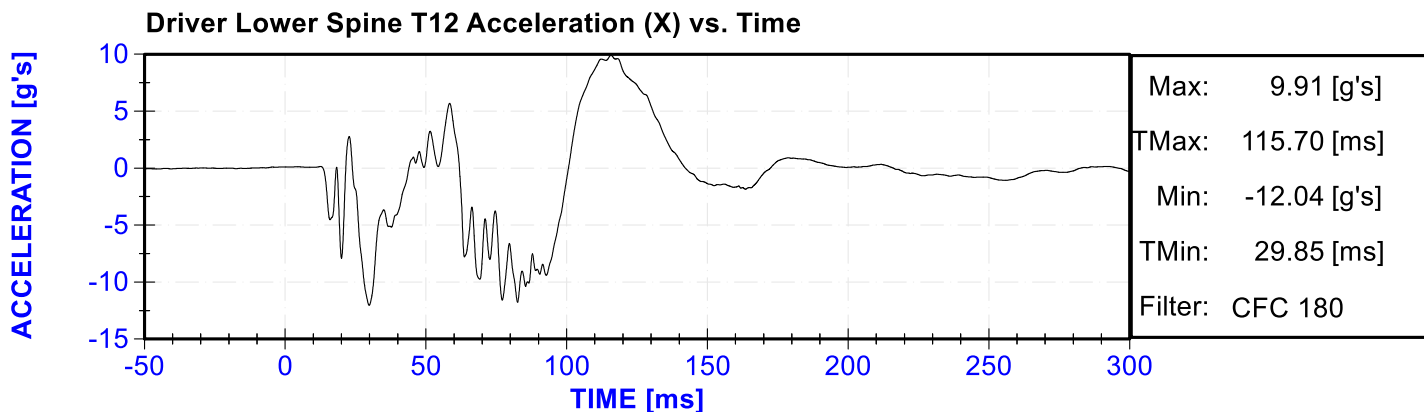
Vehicle Instrumentation Data

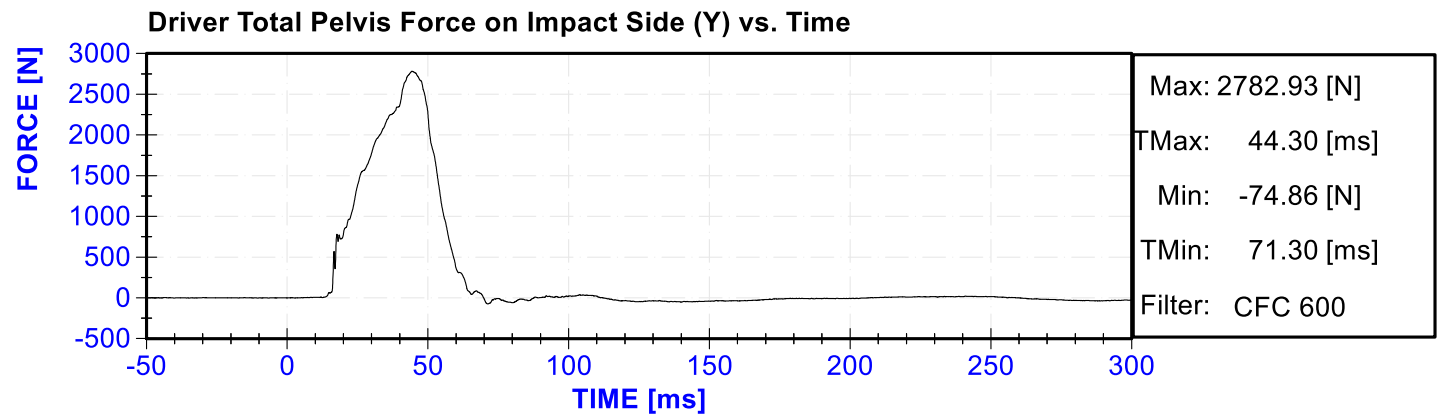
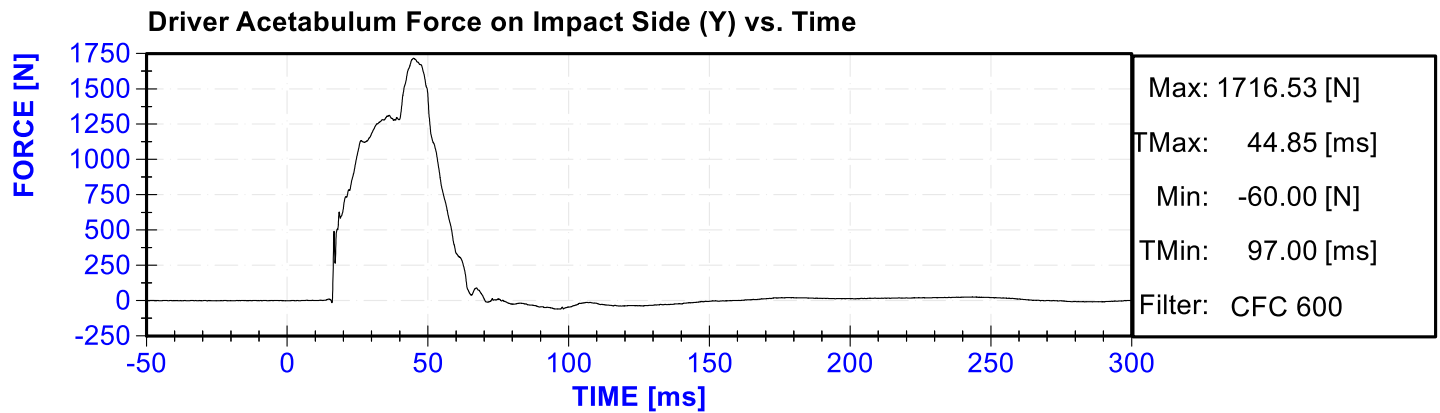
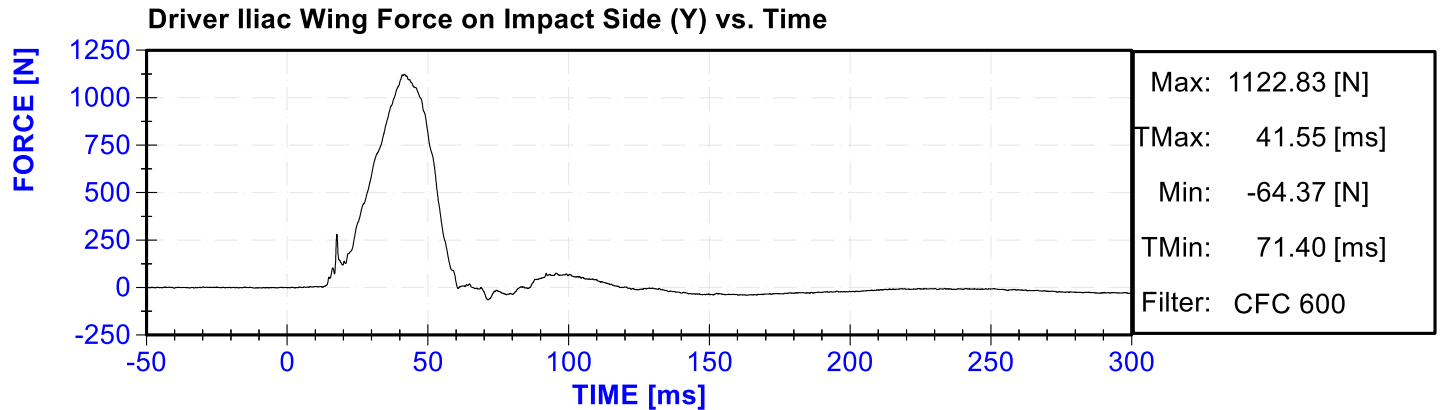
Vehicle Center of Gravity Acceleration (X)
Vehicle Center of Gravity Acceleration (Y)
Vehicle Center of Gravity Acceleration (Z)
Left Floor Sill Acceleration (Y)
Left A-Pillar Sill Acceleration (Y)
Left Lower A-Pillar Acceleration (Y)
Left Mid A-Pillar Acceleration (Y)
Left B-Pillar Sill Acceleration (Y)
Left Lower B-Pillar Acceleration (Y)
Left Mid B-Pillar Acceleration (Y)
Driver Seat Track at Dummy Hip Point Acceleration (Y)
Engine Top Acceleration (X)
Engine Top Acceleration (Y)
Firewall Center Acceleration (Y)
Right Roof at Vertical Impact Reference Line Acceleration (Y)
Right Sill at Vertical Impact Reference Line Acceleration (Y)
Rear Floorpan Behind Rear Axle at Centerline Acceleration (X)
Rear Floorpan Behind Rear Axle at Centerline Acceleration (Y)

Pole Instrumentation Data

Load Cell Pole Barrier #1 Force (Y)
Load Cell Pole Barrier #2 Force (Y)
Load Cell Pole Barrier #3 Force (Y)
Load Cell Pole Barrier #4 Force (Y)
Load Cell Pole Barrier #5 Force (Y)
Load Cell Pole Barrier #6 Force (Y)
Load Cell Pole Barrier #7 Force (Y)
Load Cell Pole Barrier #8 Force (Y)







APPENDIX C

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - DRIVER ATD

SERIAL NO: DG8012

(CONFIGURED FOR LEFT SIDE IMPACT)

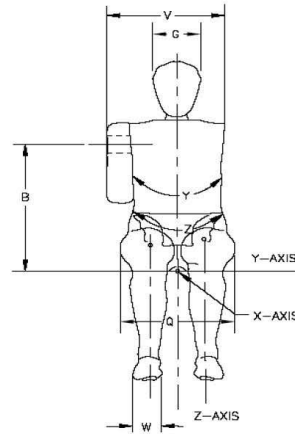
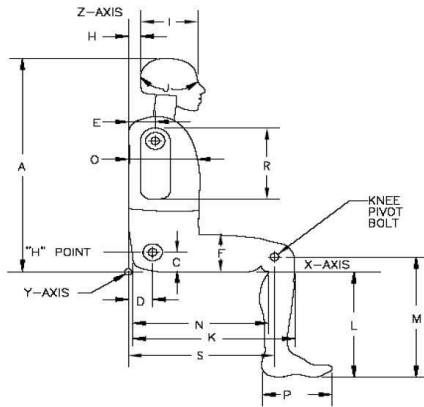


External Measurements - SID-IIs

Technician: J.Pericak

Date: 02/07/2022

Dummy Serial Number: DG8012



Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	780	Pass
B	Shoulder Pivot Height	437	453	446	Pass
C	H-point Height	79	89	85	Pass
D	H-point from seatback	141	151	145	Pass
E	Shoulder Pivot from Backline	97	107	104	Pass
F	Thigh Clearance	119	135	128	Pass
G	Head Breadth	140	148	143	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	185	Pass
J	Head Circumference	541	551	545	Pass
K	Buttock to Knee Length	514	540	536	Pass
L	Popliteal Height	343	369	357	Pass
M	Knee Pivot to floor height	392	409	400	Pass
N	Buttock Popliteal Length	416	442	435	Pass
O	Chest Depth w/o jacket	195	211	209	Pass
P	Foot Length	216	232	225	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	321	Pass
R	Arm Length	249	259	255	Pass
S	Knee Joint to seatback	477	493	485	Pass
V	Shoulder Width	341	357	348	Pass
W	Foot Width	78	94	87	Pass
Y	Chest Circumference w/jacket	851	881	870	Pass
Z	Waist Circumference	761	791	775	Pass

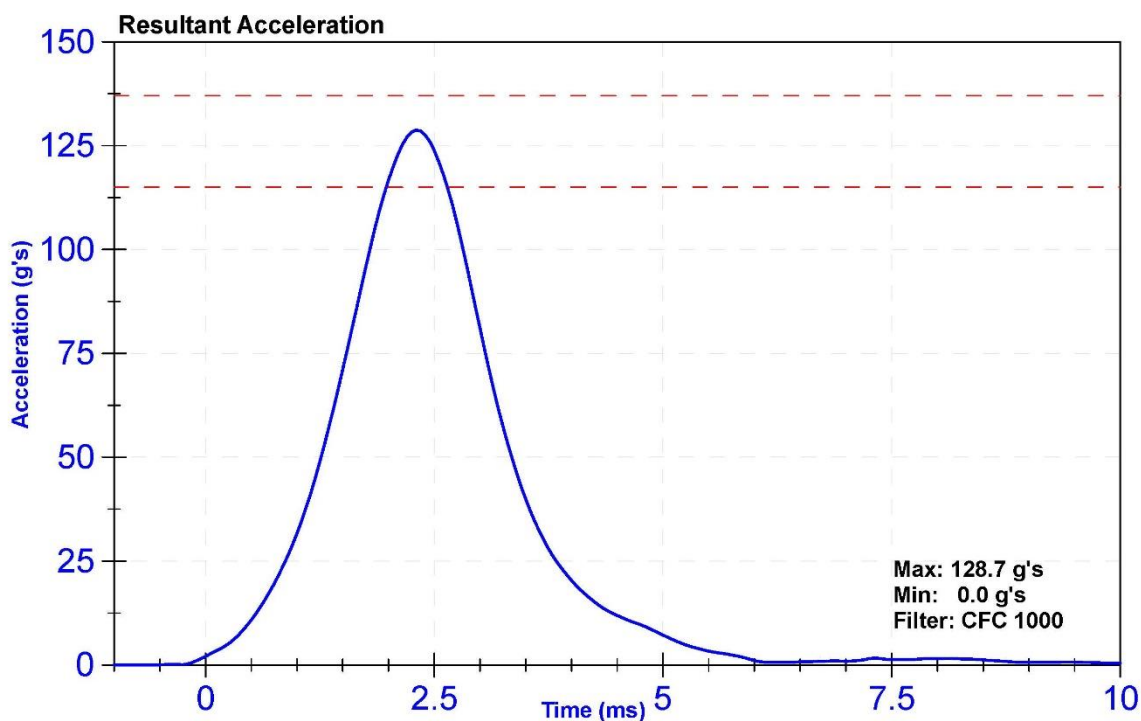
ATD Manufacturer	FTSS	Test Technician	B. Kirchner
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

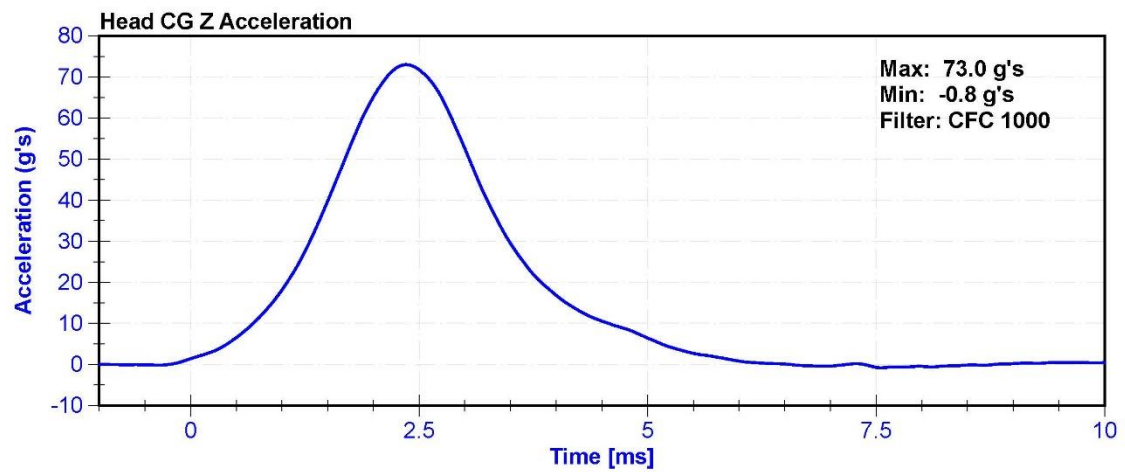
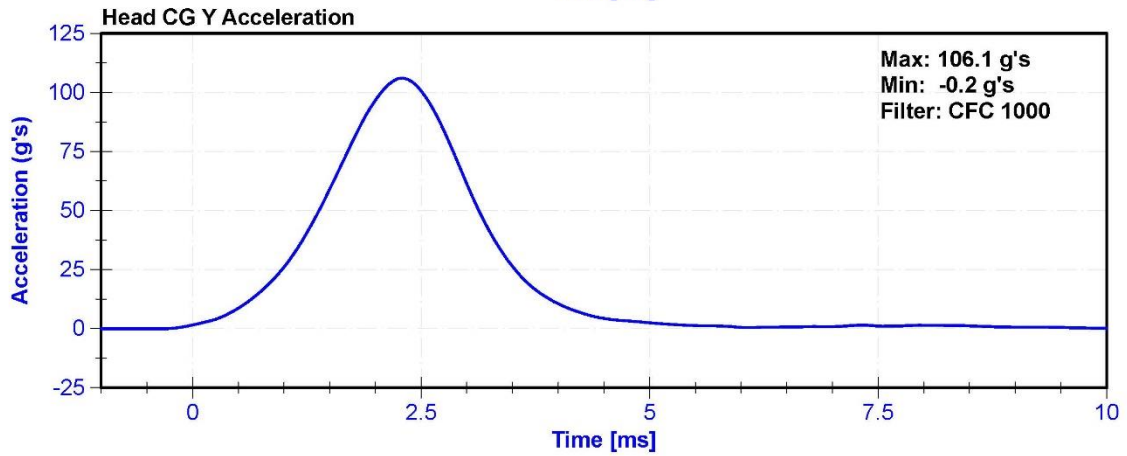
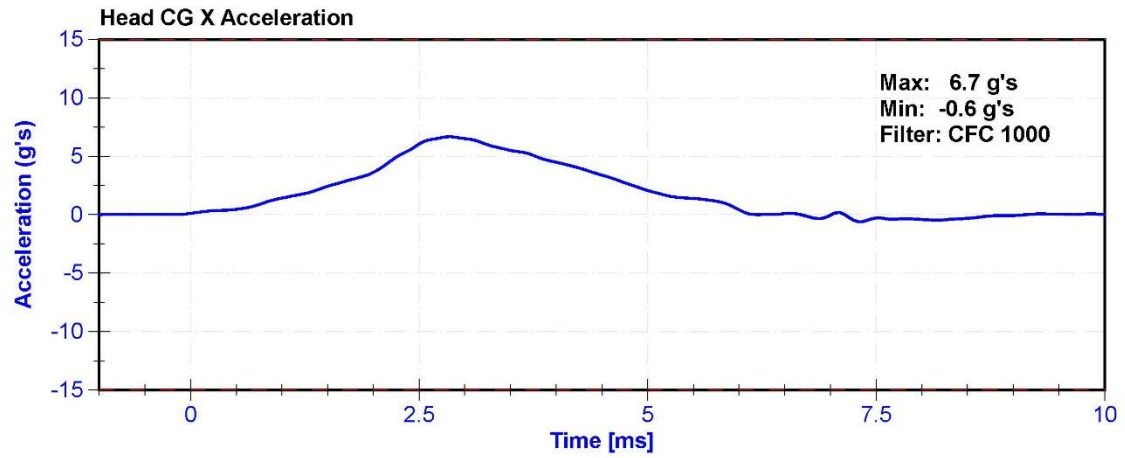
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	20.5	Pass
Resultant Acceleration	115	137	g's	128.7	Pass
Oscillation	0	15	%	1.2	Pass
Fore-Aft Acceleration	-15	15	g's	6.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibratio Date	Calibratio Due Date
X Accelerometer	Endevco	P74788	1/10/2022	7/9/2022
Y Accelerometer	Endevco	P83432	1/10/2022	7/9/2022
Z Accelerometer	Endevco	P83319	1/10/2022	7/9/2022





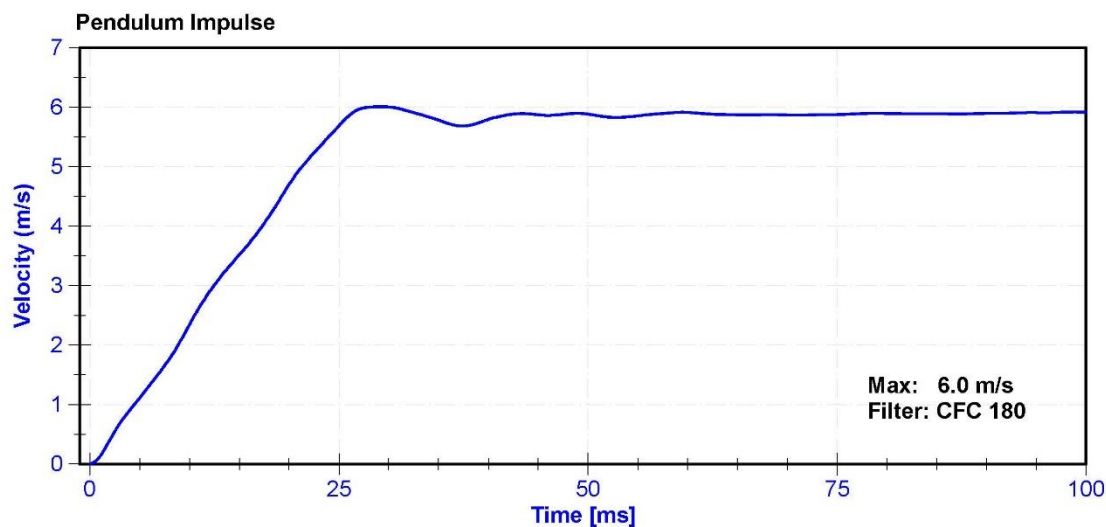
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

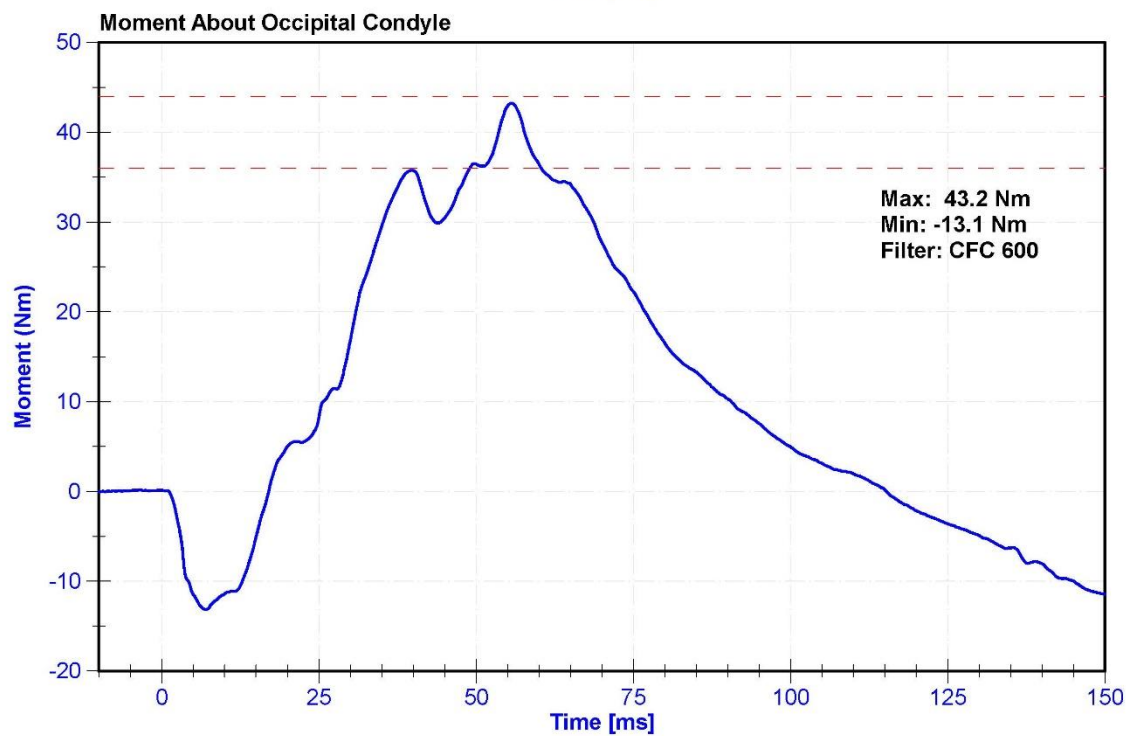
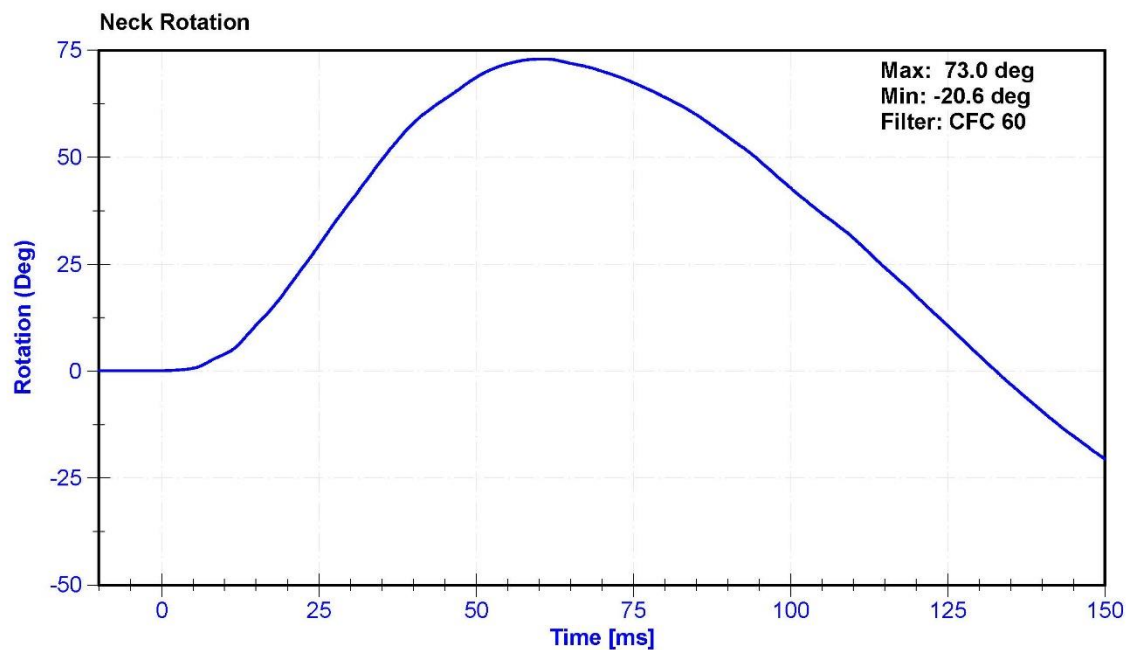
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	22.6	Pass
Velocity	5.51	5.63	m/s	5.586	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.34	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.52	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.70	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.68	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	6.00	Pass
Neck Rotation	71	81	deg	73.0	Pass
Time at Maximum Rotation	50	70	ms	60.6	Pass
Moment about the OC	36	44	Nm	43.2	Pass
Moment Decay to 0 Nm	102	126	ms	115.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	7231CT	10/28/2021	10/28/2022
Pendulum Potentiometer	MCB	WS1800057	11/30/2021	11/30/2022
Condyle Potentiometer	Servo	DS185 Pend H	11/12/2021	11/12/2022
Upper Neck Load Cell	Denton	1037	06/29/2021	06/29/2022





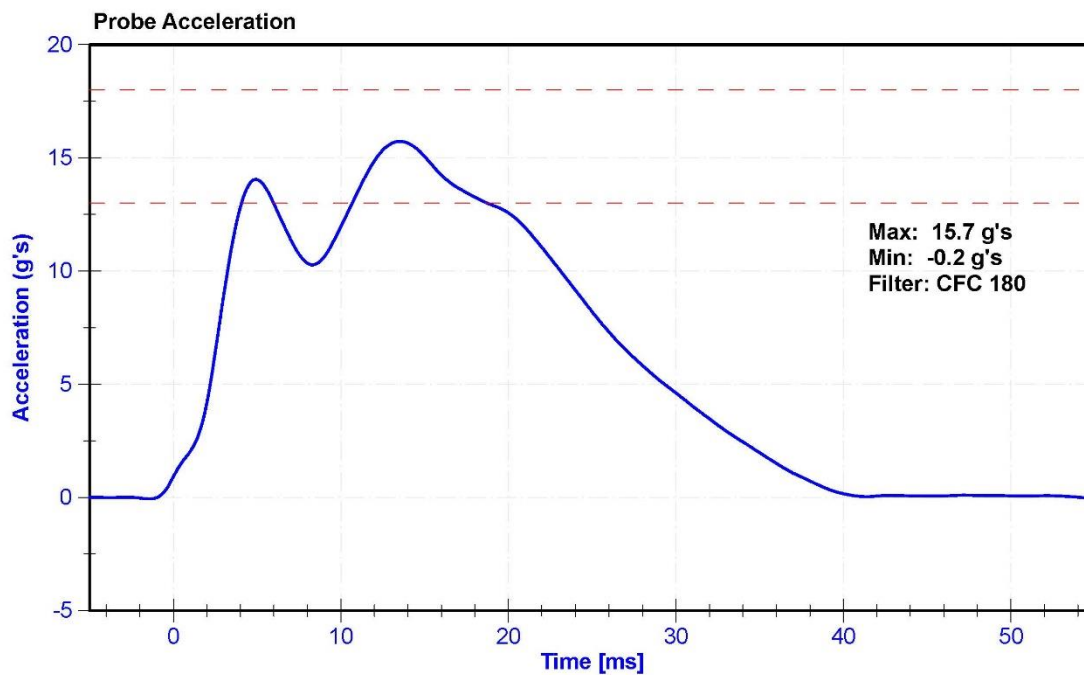
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

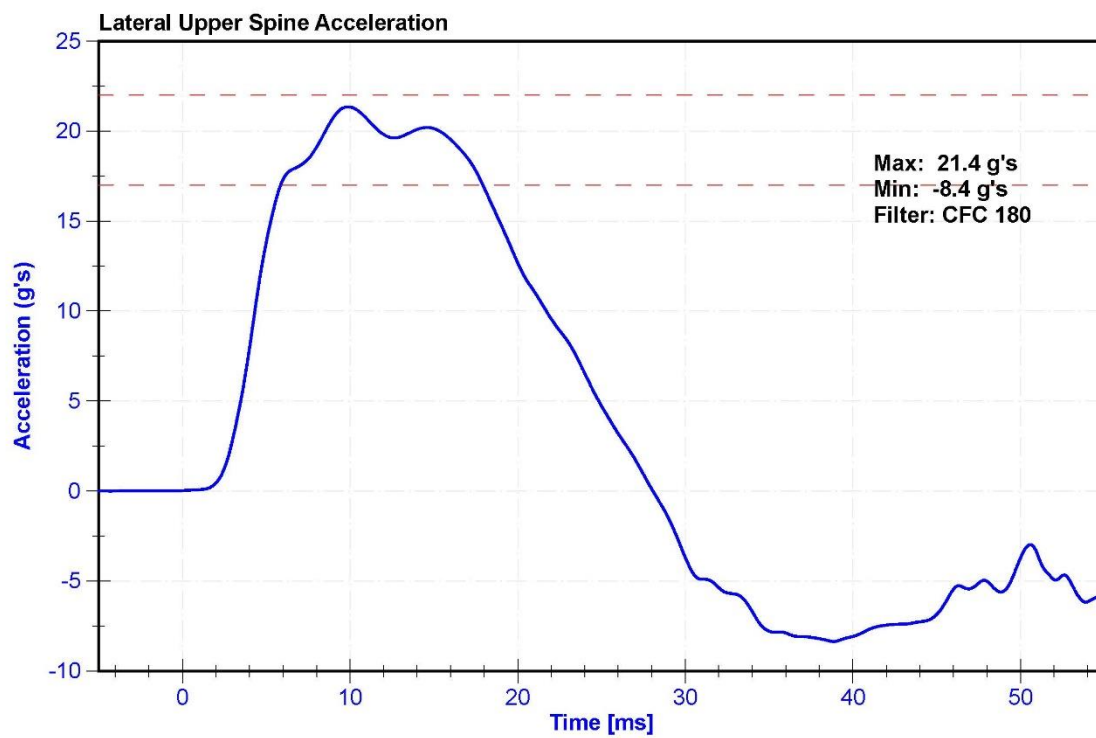
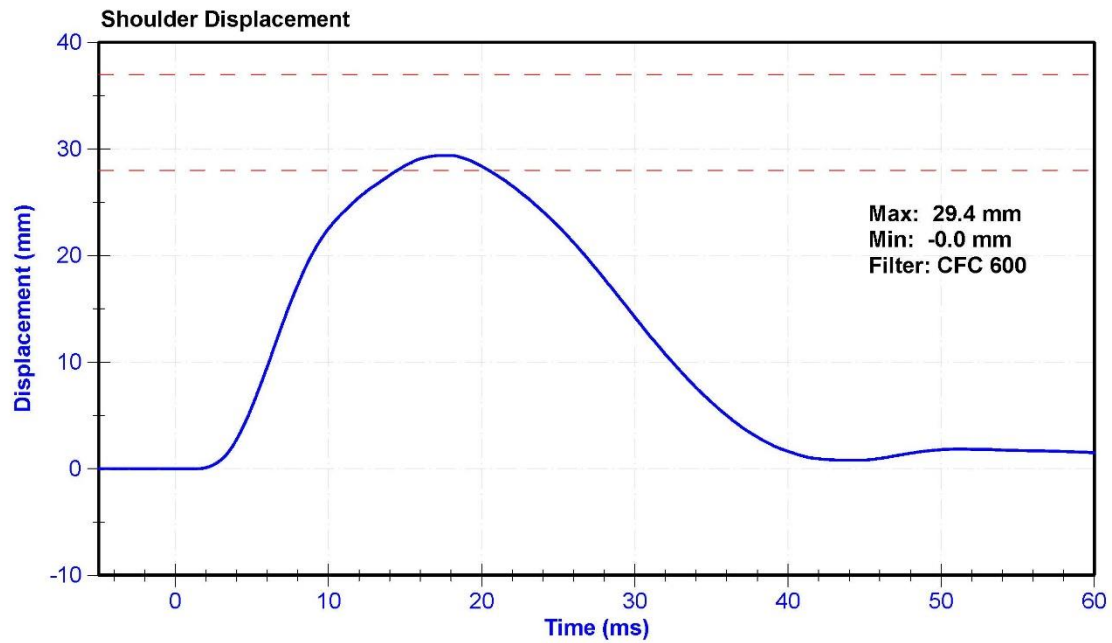
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	17	Pass
Velocity	4.2	4.4	m/s	4.33	Pass
Probe Acceleration	13	18	g's	15.7	Pass
Shoulder Deflection	28	37	mm	29.4	Pass
Lateral Upper Spine Acceleration	17	22	g's	21.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Shoulder Potentiometer	Servo	045GFE	1/12/2022	7/13/2022
Upper Spine Y Accelerometer	Endevco	P64148	1/10/2022	7/9/2022





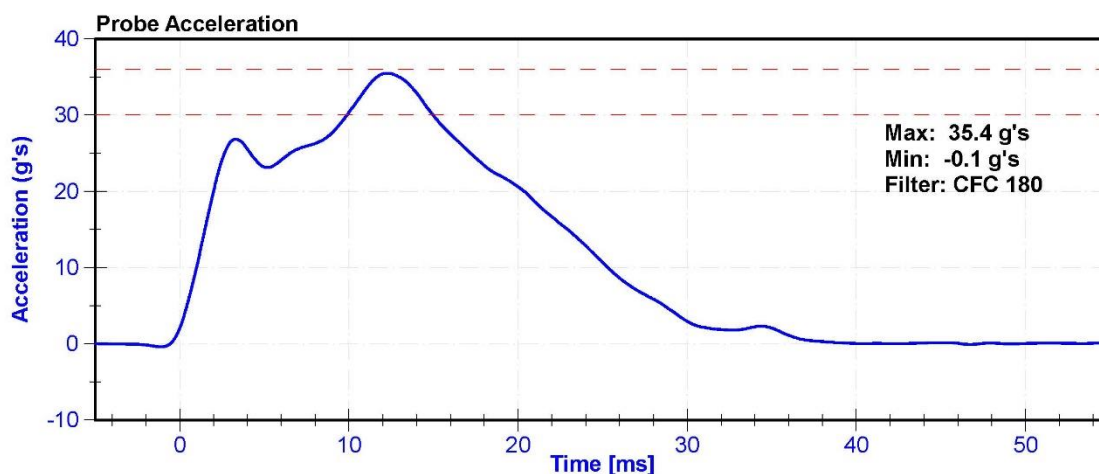
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

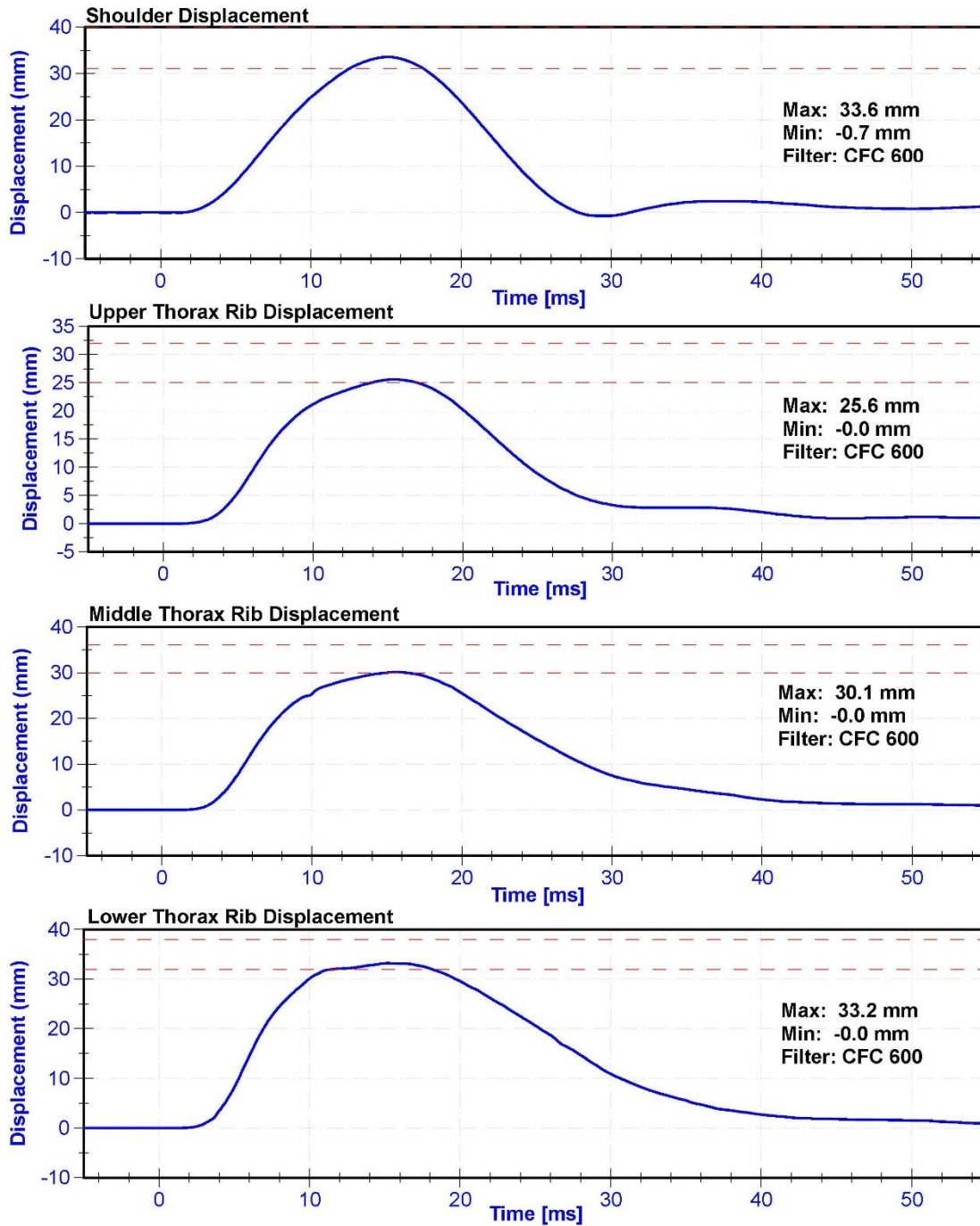
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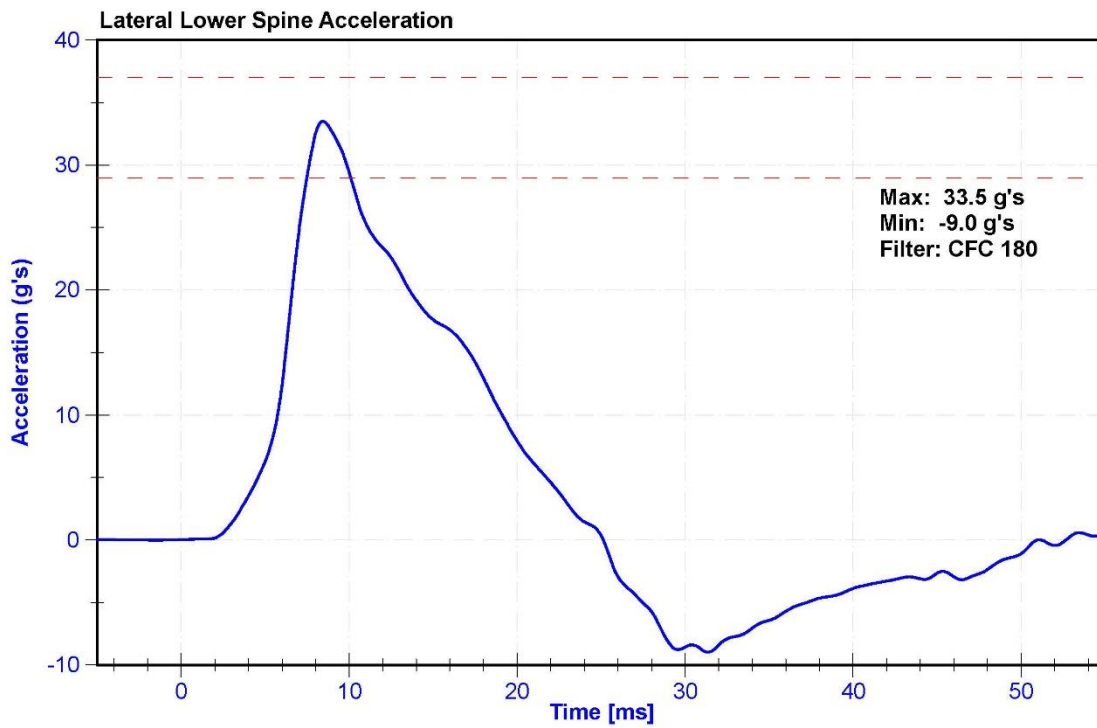
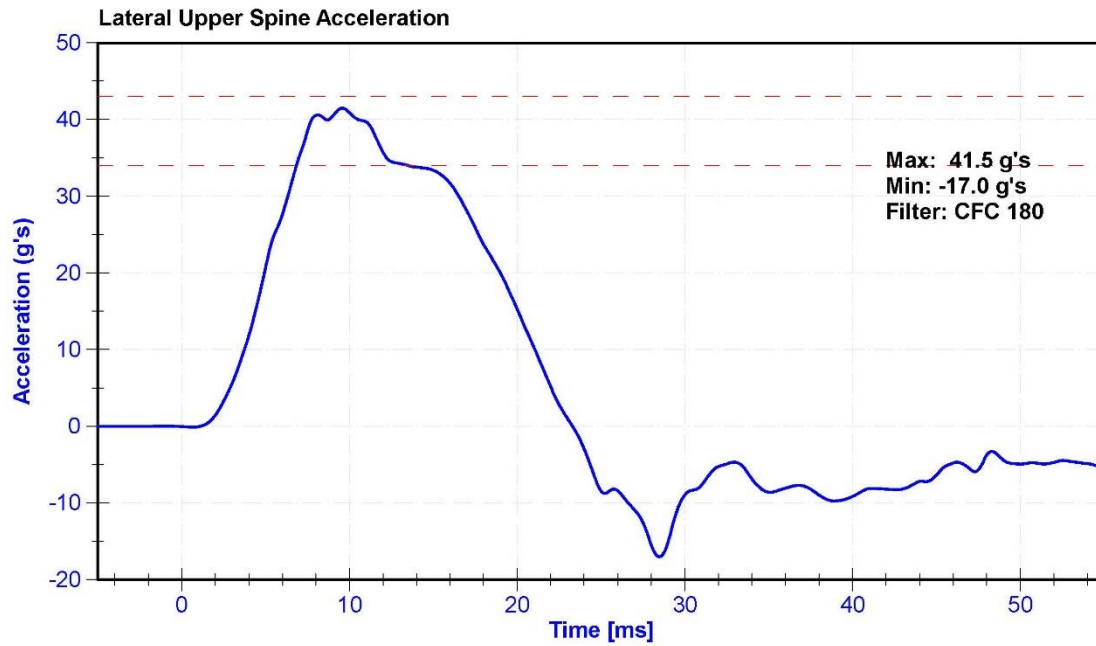
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	17	Pass
Velocity	6.6	6.8	m/s	6.75	Pass
Probe Acceleration after 5 ms	30	36	g's	35.4	Pass
Lateral Upper Spine Acceleration	34	43	g's	41.5	Pass
Lateral Lower Spine Acceleration	29	37	g's	33.5	Pass
Shoulder Deflection	31	40	mm	33.6	Pass
Upper Thorax Rib Deflection	25	32	mm	25.6	Pass
Mid Thorax Rib Deflection	30	36	mm	30.1	Pass
Lower Thorax Rib Deflection	32	38	mm	33.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Upper Spine T1 Y Accelerometer	Endevco	P64148	1/10/2022	7/9/2022
Upper Spine T12 Y Accelerometer	Endevco	P51327	1/10/2022	7/9/2022
Shoulder Potentiometer	Servo	045GFE	1/12/2022	7/13/2022
Upper Thorax Rib Potentiometer	Servo	1199GFE	1/12/2022	7/13/2022
Middle Thorax Rib Potentiometer	Servo	1246GFE	1/13/2022	7/14/2022
Lower Thorax Rib Potentiometer	Servo	011GFE	1/12/2022	7/13/2022







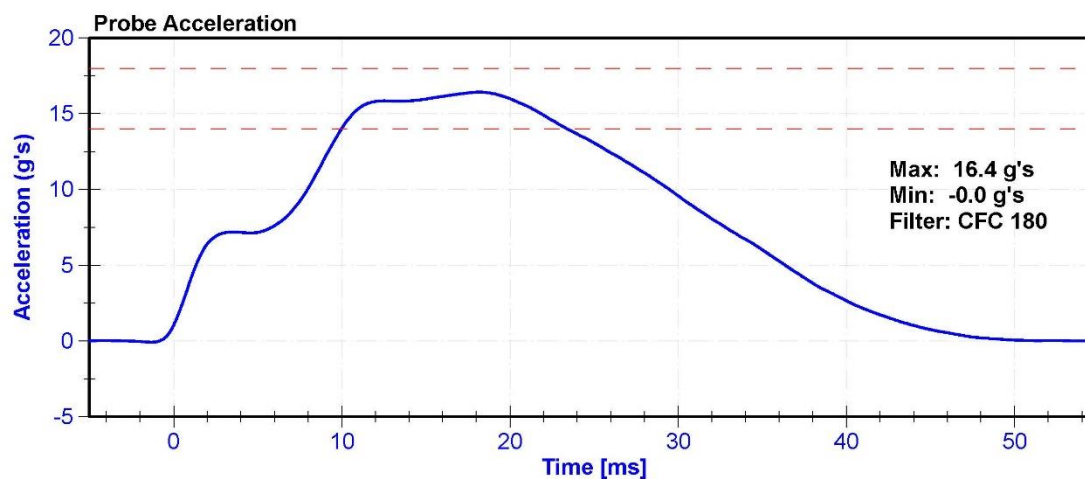
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

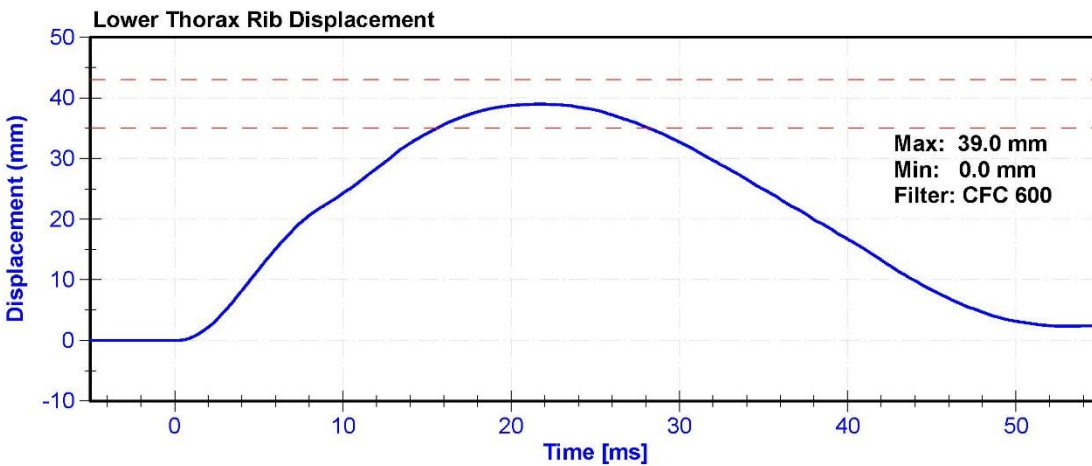
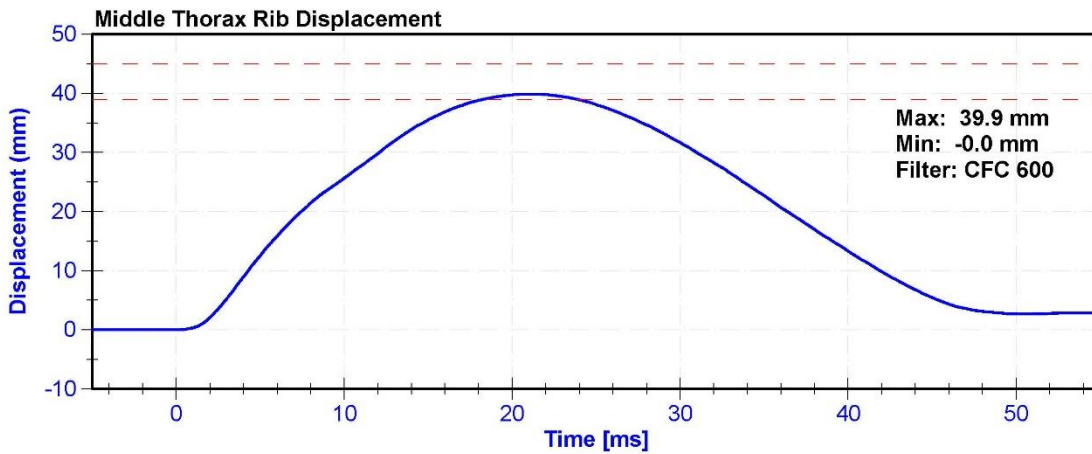
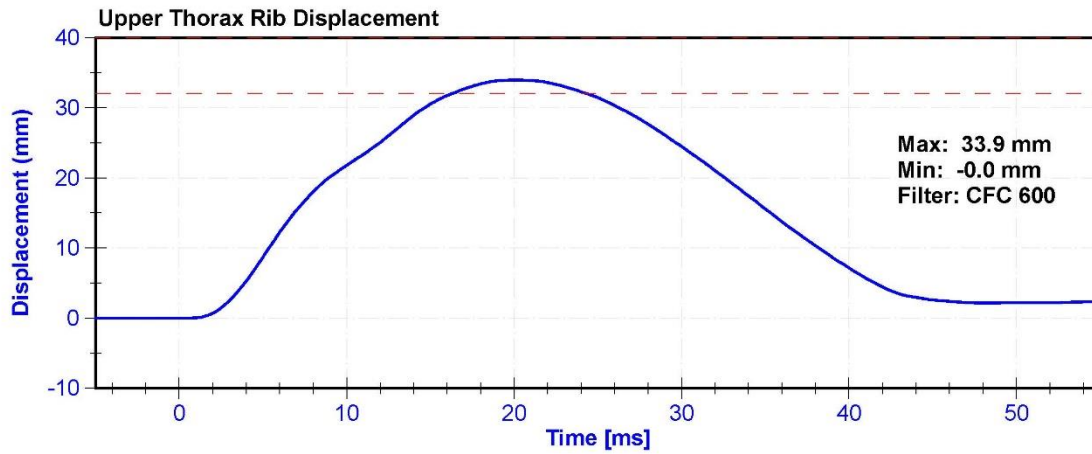
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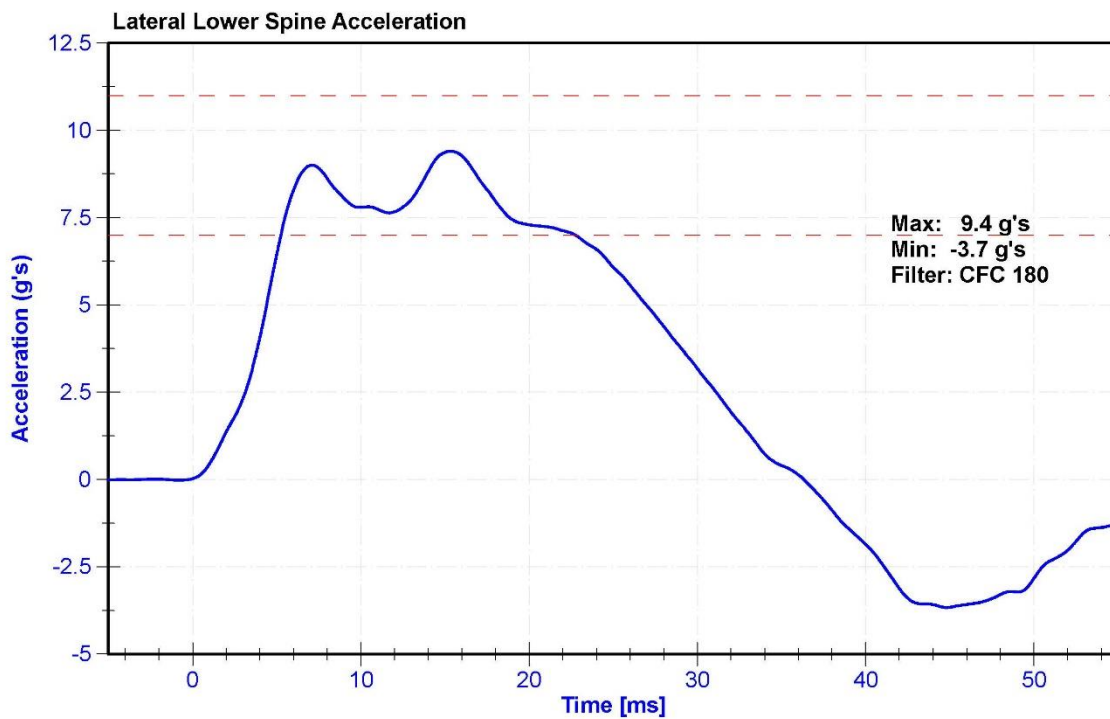
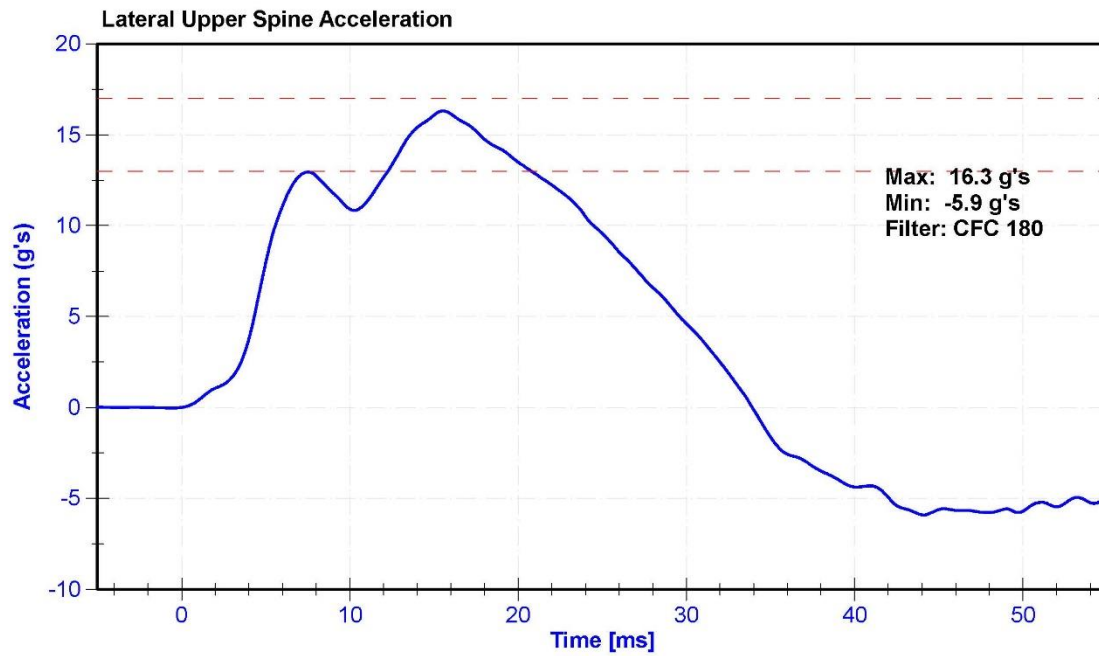
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	17	Pass
Velocity	4.2	4.4	m/s	4.27	Pass
Probe Acceleration	14	18	g's	16.4	Pass
Lateral Upper Spine Acceleration	13	17	g's	16.3	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.4	Pass
Upper Thorax Rib Deflection	32	40	mm	33.9	Pass
Middle Thorax Rib Deflection	39	45	mm	39.9	Pass
Lower Thorax Rib Deflection	35	43	mm	39.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Upper Spine Y Accelerometer	Endevco	P64148	1/10/2022	7/9/2022
Lower Spine Y Accelerometer	Endevco	P51327	1/10/2022	7/9/2022
Upper Thorax Rib Potentiometer	Servo	1199GFE	1/12/2022	7/13/2022
Middle Thorax Rib Potentiometer	Servo	1246GFE	1/13/2022	7/14/2022
Lower Thorax Rib Potentiometer	Servo	011GFE	1/12/2022	7/13/2022







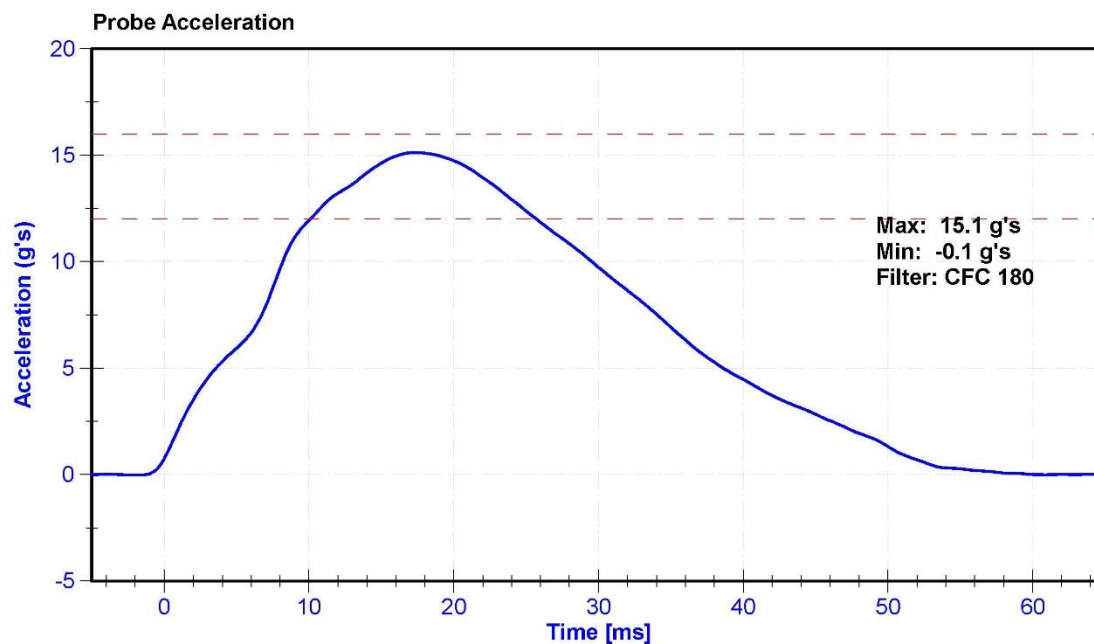
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

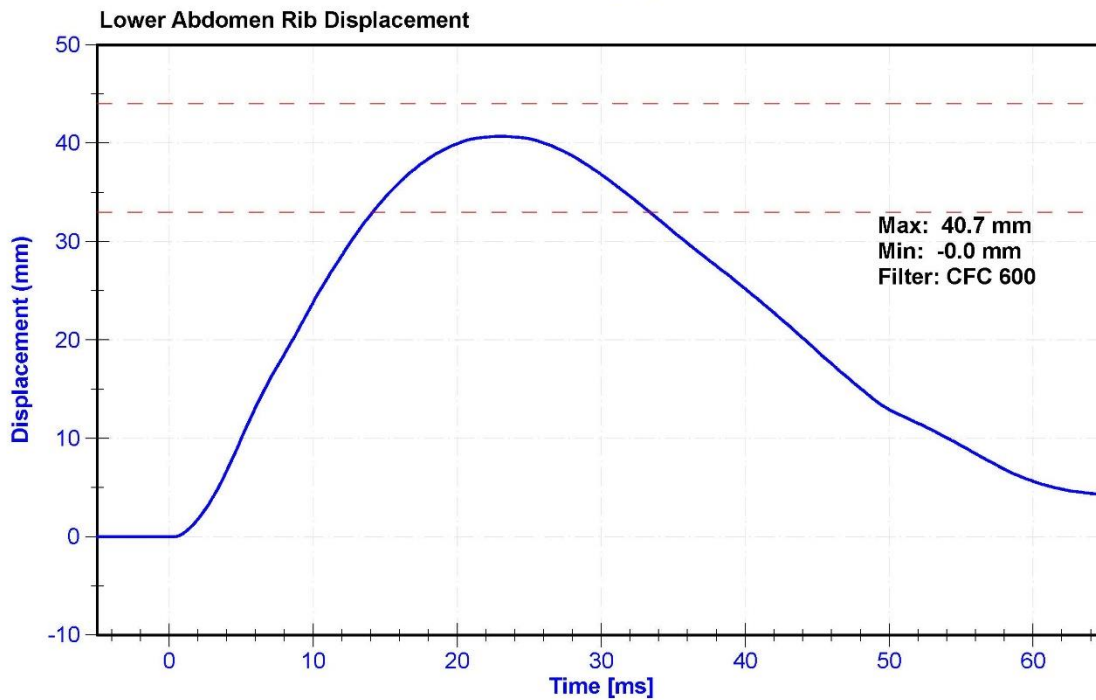
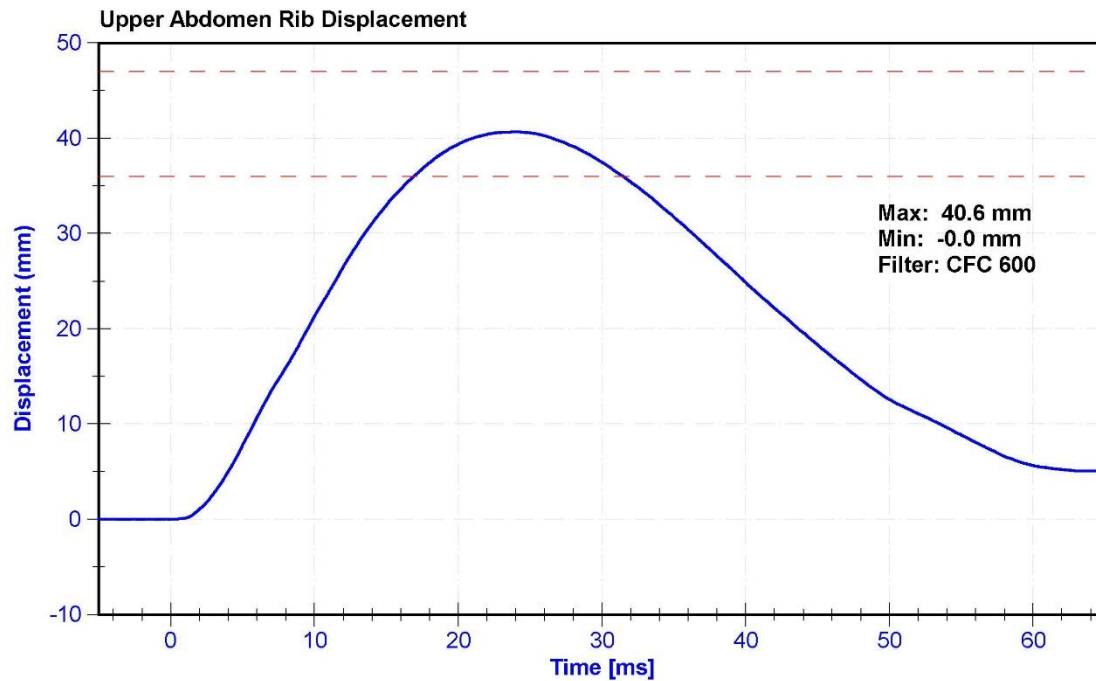
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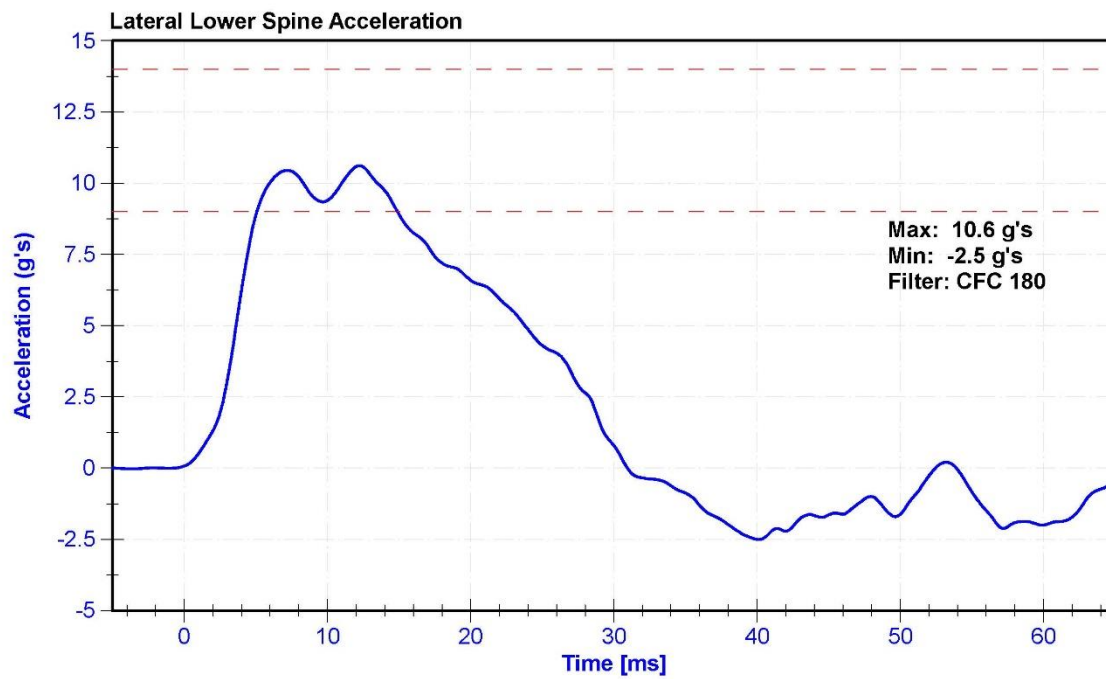
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	17	Pass
Velocity	4.2	4.4	m/s	4.29	Pass
Probe Acceleration	12	16	g's	15.1	Pass
Lateral Lower Spine Acceleration	9	14	g's	10.6	Pass
Upper Abdomen Rib Deflection	36	47	mm	40.6	Pass
Lower Abdomen Rib Deflection	33	44	mm	40.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Lower Spine Y Accelerometer	Endevco	P51327	1/10/2022	7/9/2022
Upper Abdomen Rib Potentiometer	Servo	008GFE	1/12/2022	7/13/2022
Lower Abdomen Rib Potentiometer	Servo	041 GFE	1/12/2022	7/13/2022







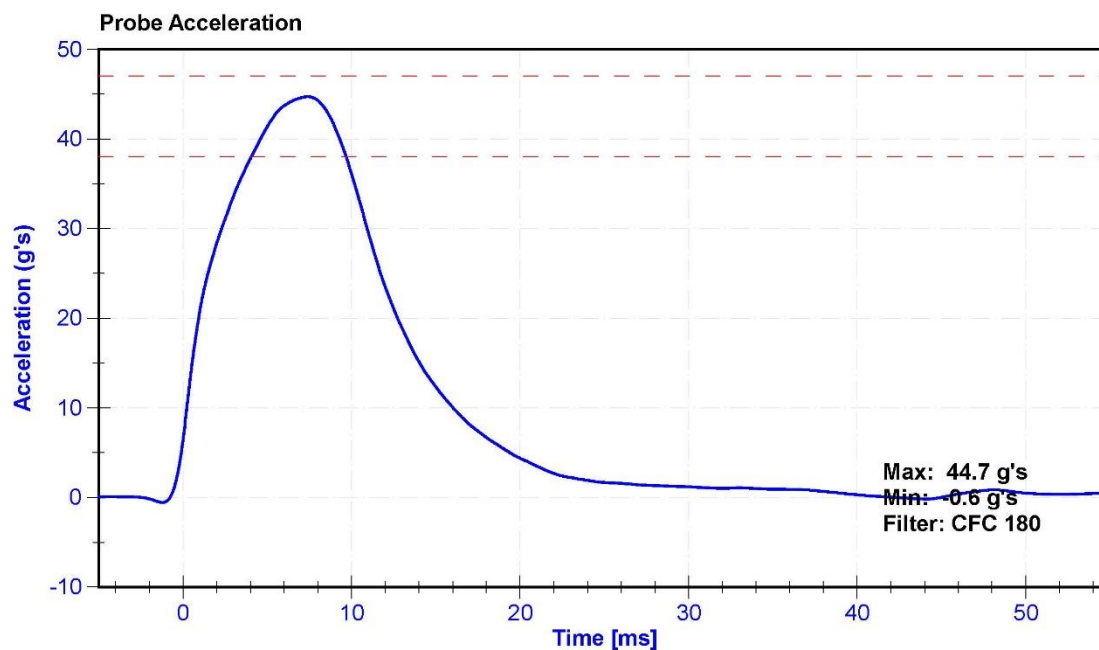
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

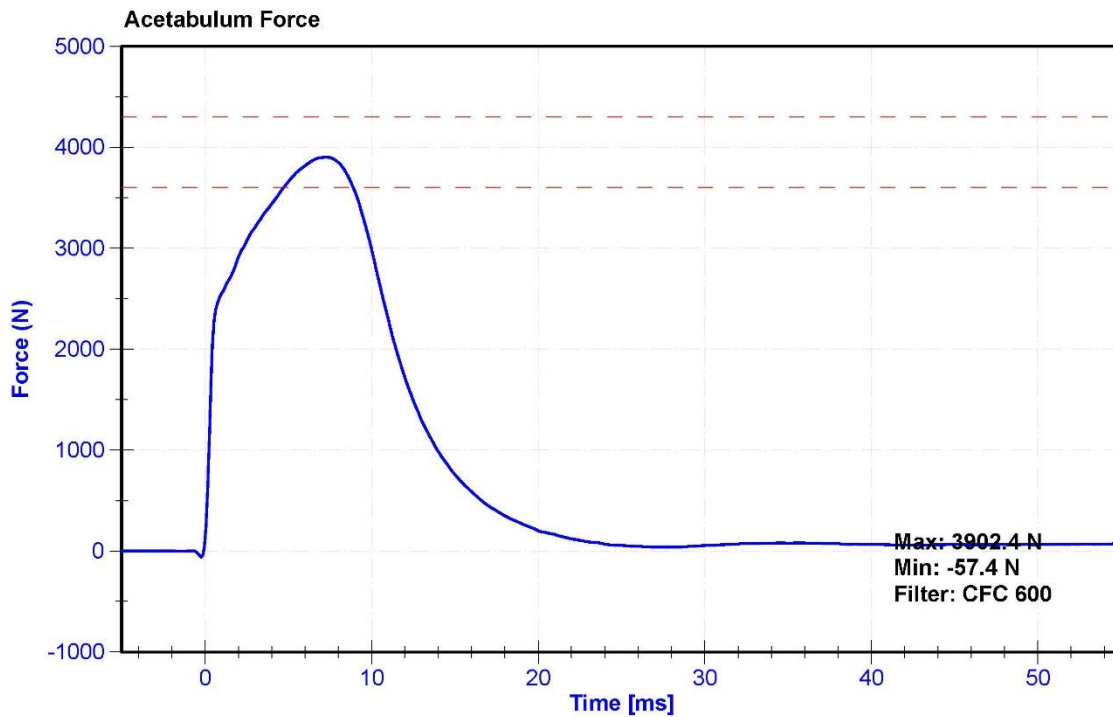
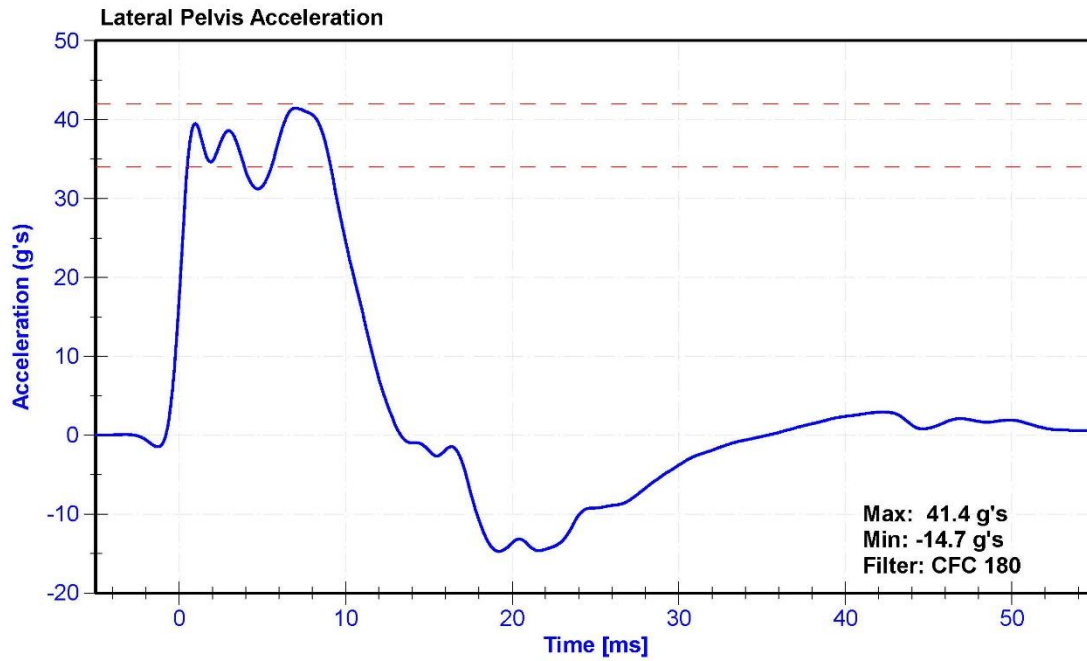
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	17	Pass
Velocity	6.6	6.8	m/s	6.65	Pass
Probe Acceleration	38	47	g's	44.7	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.4	Pass
Acetabulum Force	3600	4300	N	3902.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Pelvis Y Accelerometer	Endevco	P51875	1/10/2022	7/9/2022
Acetabulum Load Cell	Denton	276-FY	9/14/2021	9/14/2022
Certification Plug	SACO			N/A
Crash Test Plug	SACO			N/A







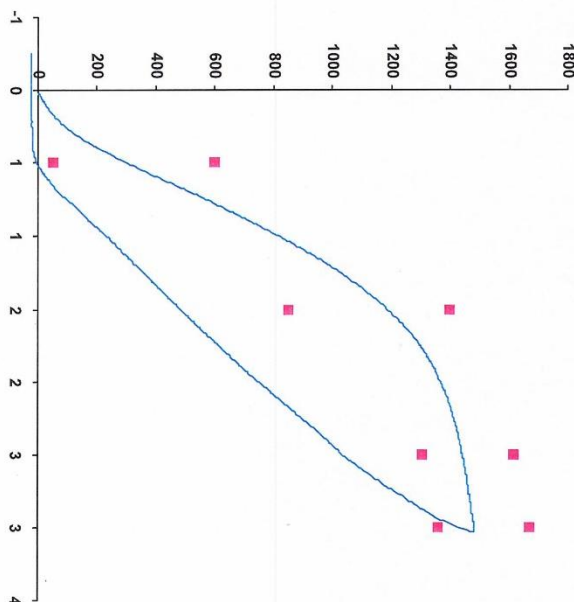
SID-Its Pelvis Plug Certification Test

Plug S/N 14031
Test Number 13505
Report Number 13550
Test Date 5/22/2020 12:56:17 PM

Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	305	500
Force @ 1.5 mm (N)	1,187	1,400
Force @ 2.5 mm (N)	1,443	1,618
Force @ 3.0 mm (N)	1,483	1,673

Testing Machine STM-20 5965542
Load Cell S/N (F1360947), Units (LBS) 1000
Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)
Notes:

Force (-N) vs Extension (-mm)



DG 8012
Crash Plug
2-7-22

Operator _____
Part Number 180-4450
Template No 107 08-Jul-21
SACO Research

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



Desold certd
2-7-22

SID-11s Pelvis Plug Certification Test

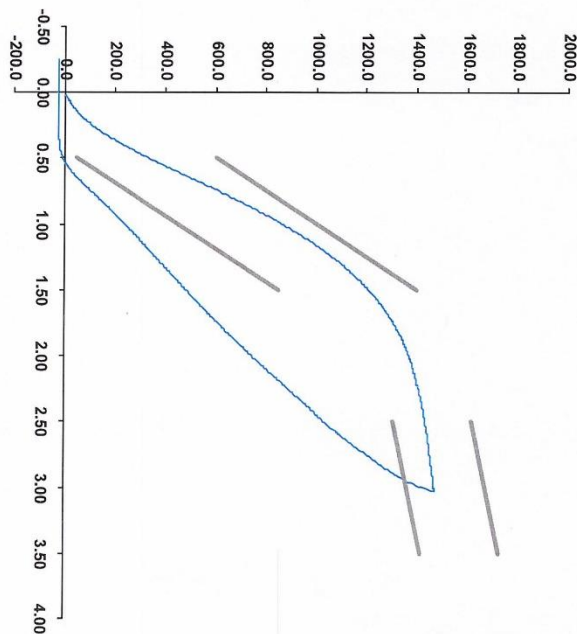
Plug S/N 14060
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Report Number 13579
Test Date 5/25/2020 11:15:56 AM

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

Testing Machine STM-20 5965542
Load Cell S/N (F1360947), Units (LBS) 1000
Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 08-Jul-21
SACO Research

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



SID-11s Pelvis Plug Certification Test

Plug S/N 13045

Test Number 10365

Report Number 10400

Test Date 7/30/2019 2:19:41 PM

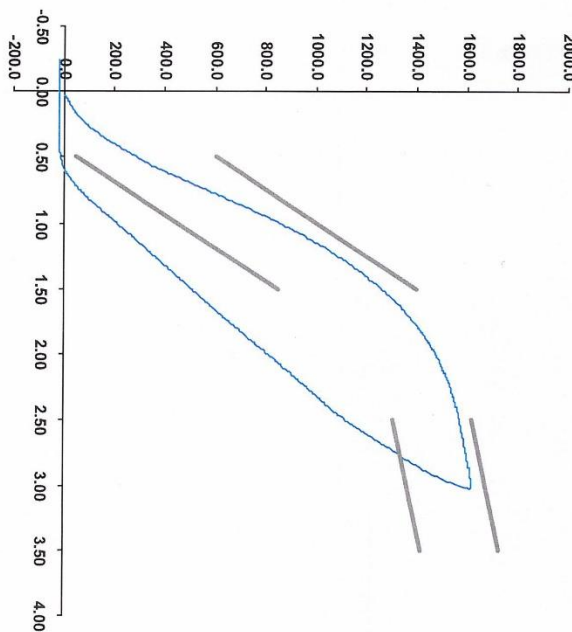
068012
Non-Impact
2/8/22

Force (-N) vs Extension (-mm)

Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	289	50
Force @ 1.5 mm (N)	1,262	850
Force @ 2.5 mm (N)	1,572	1,306
Force @ 3.0 mm (N)	1,620	1,361

Testing Machine STM-20 5965542
Load Cell S/N (F1360947), 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
SACO Research

08-Jul-21

By : _____ Date : _____

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

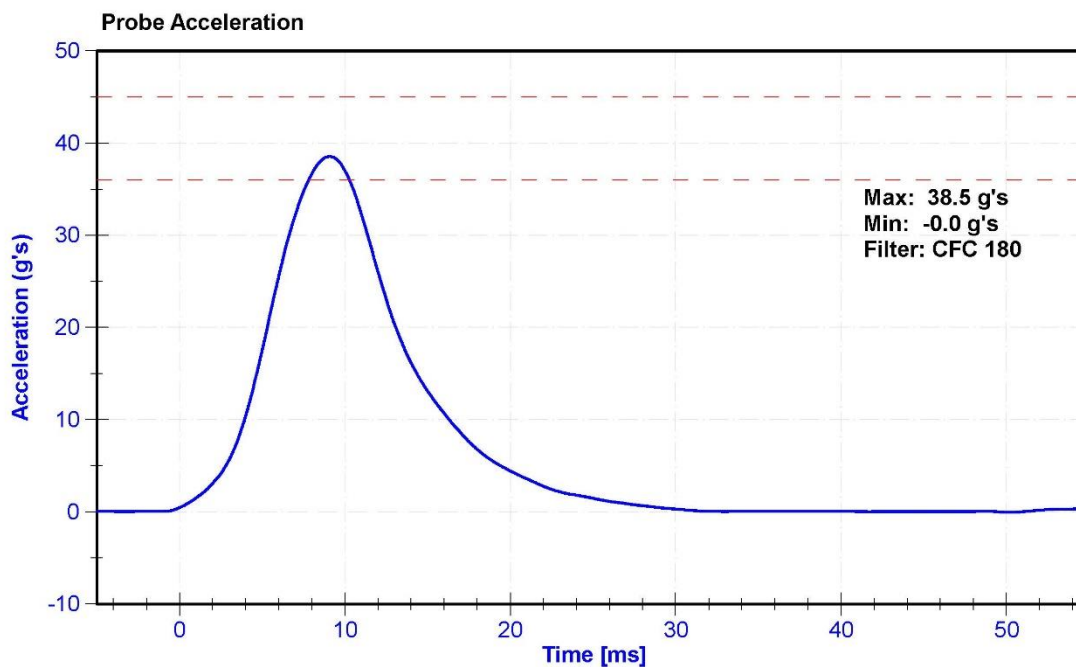
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

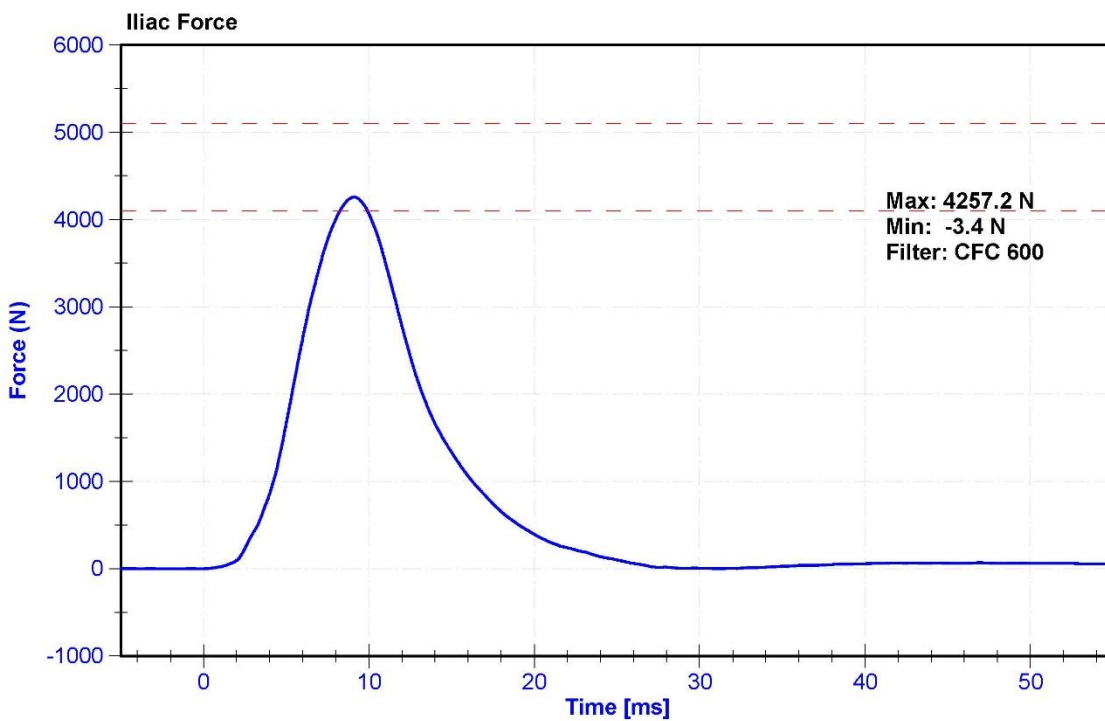
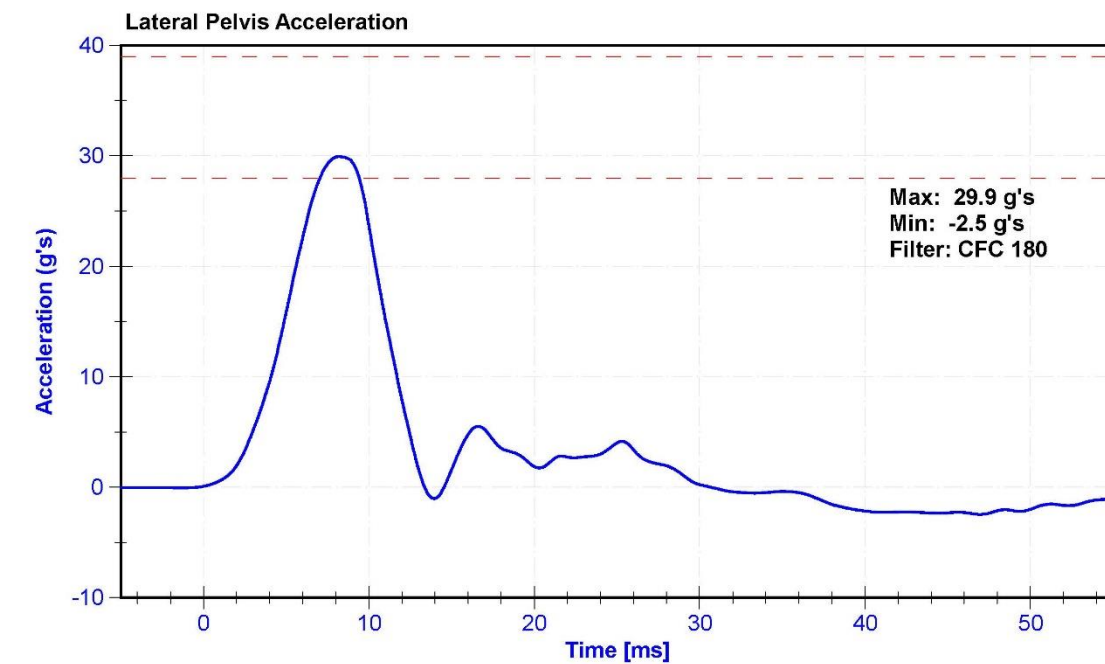
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	17	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	36	45	g's	38.5	Pass
Lateral Pelvis Acceleration	28	39	g's	29.9	Pass
Iliac Force	4100	5100	N	4257.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Pelvis Y Accelerometer	Endevco	P51875	1/10/2022	7/9/2022
Iliac Load Cell	Denton	290-FY	9/14/2021	9/14/2022





CALIBRATION TEST RESULTS

POST-TEST

SID-IIS 5TH PERCENTILE FEMALE - DRIVER ATD

SERIAL NO: DG8012

(CONFIGURED FOR LEFT SIDE IMPACT)

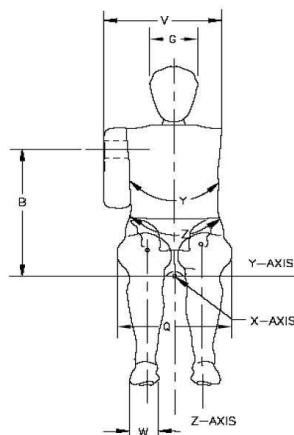
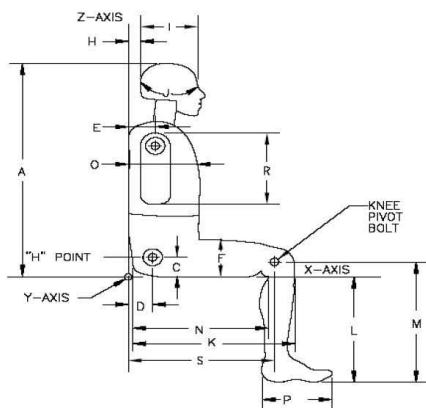


External Measurements - SID-IIs

Technician: J.Pericak

Date: 02/14/2022

Dummy Serial Number: DG8012



Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	780	Pass
B	Shoulder Pivot Height	437	453	446	Pass
C	H-point Height	79	89	85	Pass
D	H-point from seatback	141	151	145	Pass
E	Shoulder Pivot from Backline	97	107	105	Pass
F	Thigh Clearance	119	135	125	Pass
G	Head Breadth	140	148	143	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	184	Pass
J	Head Circumference	541	551	545	Pass
K	Buttock to Knee Length	514	540	536	Pass
L	Popliteal Height	343	369	357	Pass
M	Knee Pivot to floor height	392	409	400	Pass
N	Buttock Popliteal Length	416	442	430	Pass
O	Chest Depth w/o jacket	195	211	209	Pass
P	Foot Length	216	232	225	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	321	Pass
R	Arm Length	249	259	250	Pass
S	Knee Joint to seatback	477	493	485	Pass
V	Shoulder Width	341	357	348	Pass
W	Foot Width	78	94	85	Pass
Y	Chest Circumference w/jacket	851	881	870	Pass
Z	Waist Circumference	761	791	775	Pass

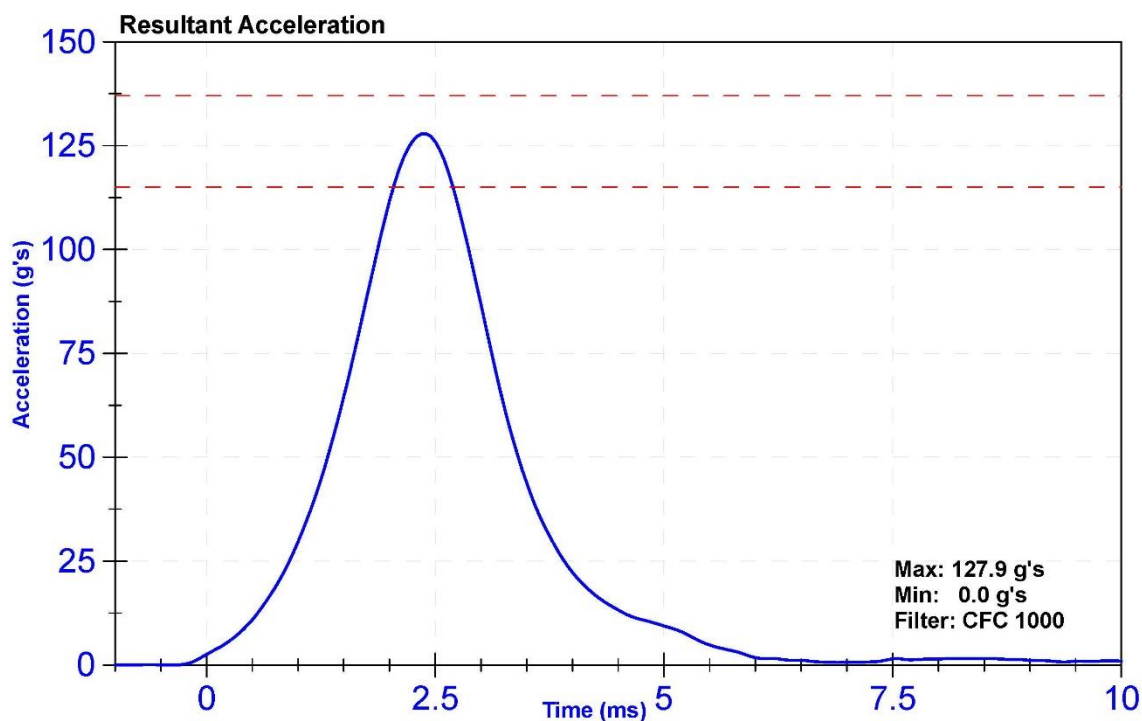
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

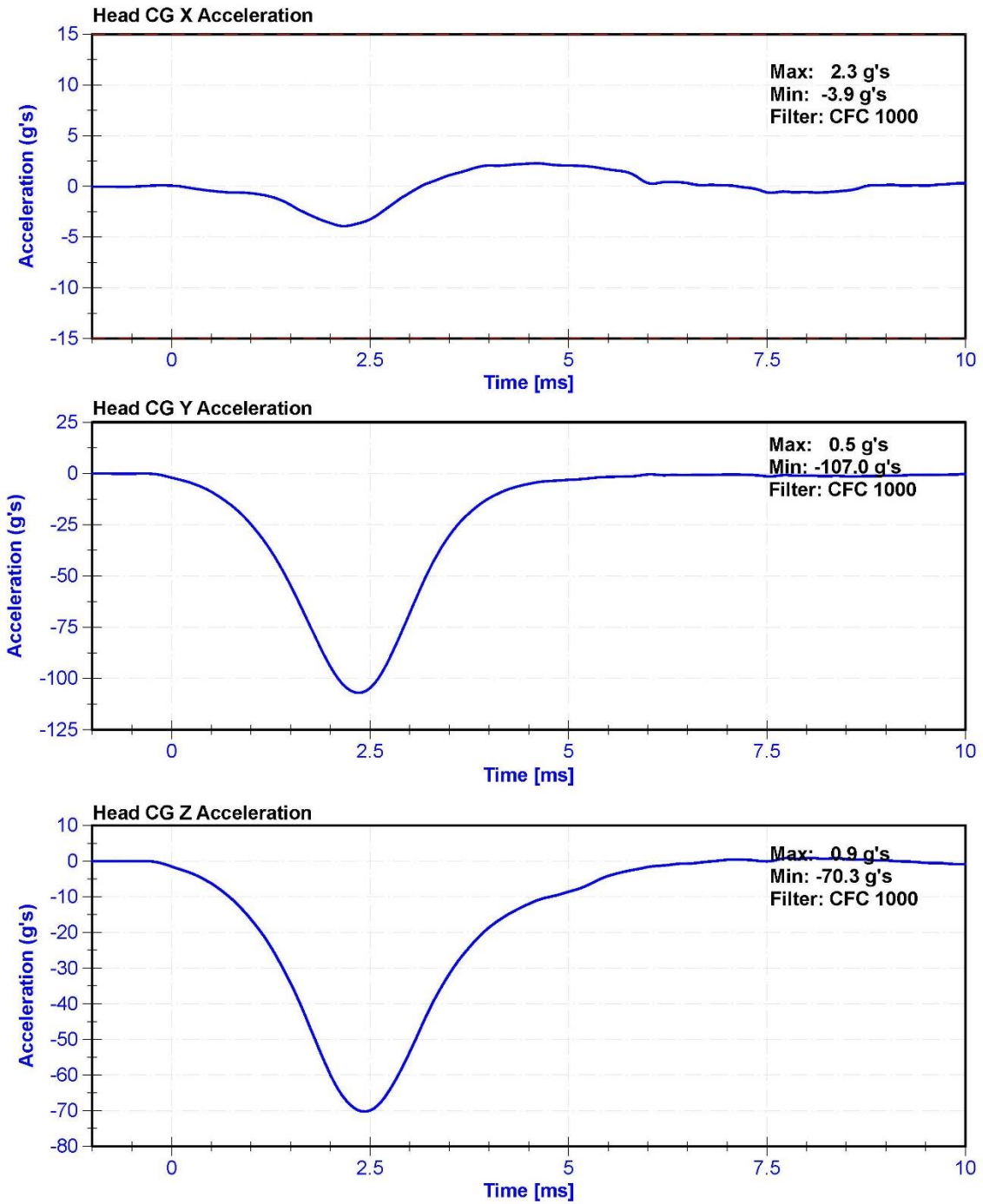
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	13.1	Pass
Resultant Acceleration	115	137	g's	127.9	Pass
Oscillation	0	15	%	1.2	Pass
Fore-Aft Acceleration	-15	15	g's	-3.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibratio Date	Calibratio Due Date
X Accelerometer	Endevco	P74788	1/10/2022	7/9/2022
Y Accelerometer	Endevco	P83432	1/10/2022	7/9/2022
Z Accelerometer	Endevco	P83319	1/10/2022	7/9/2022





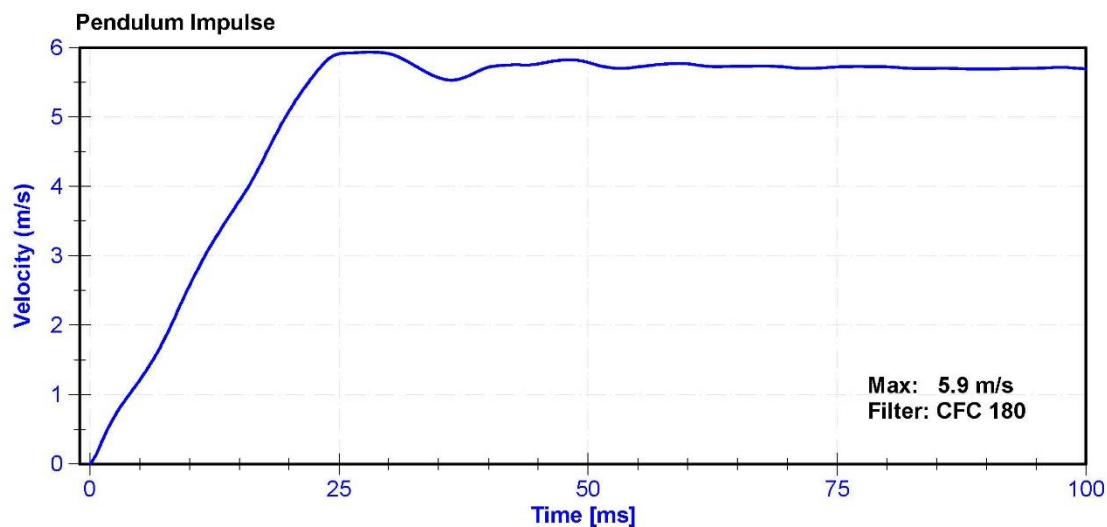
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

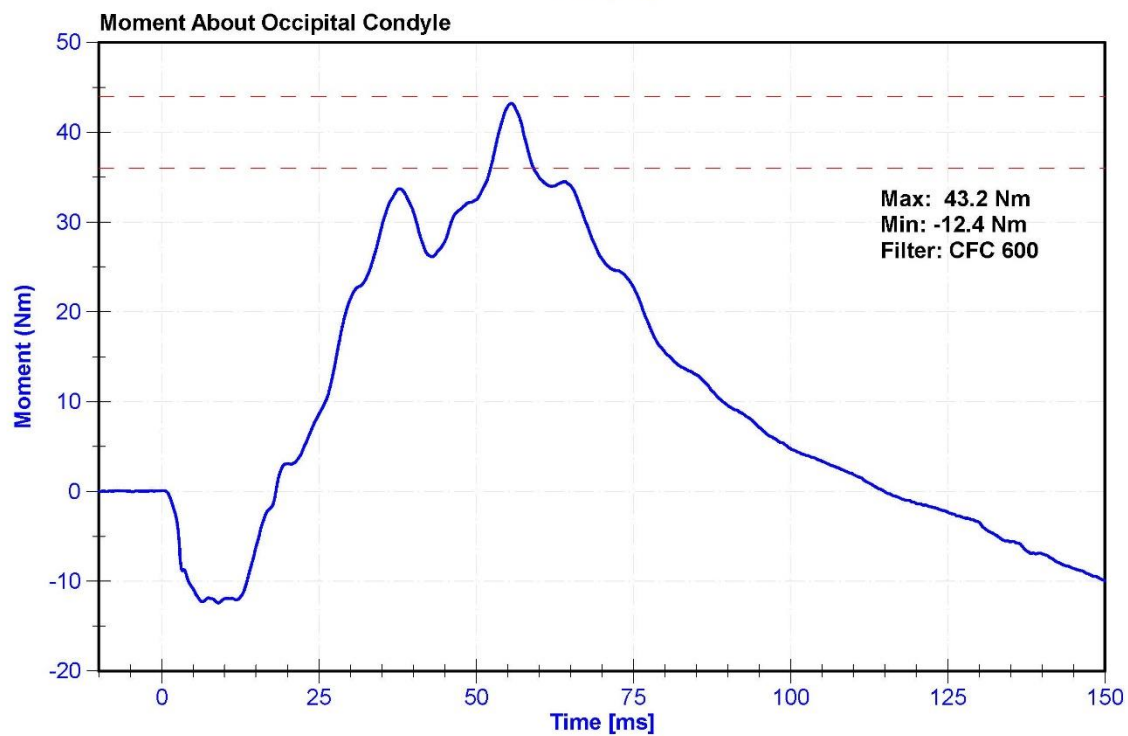
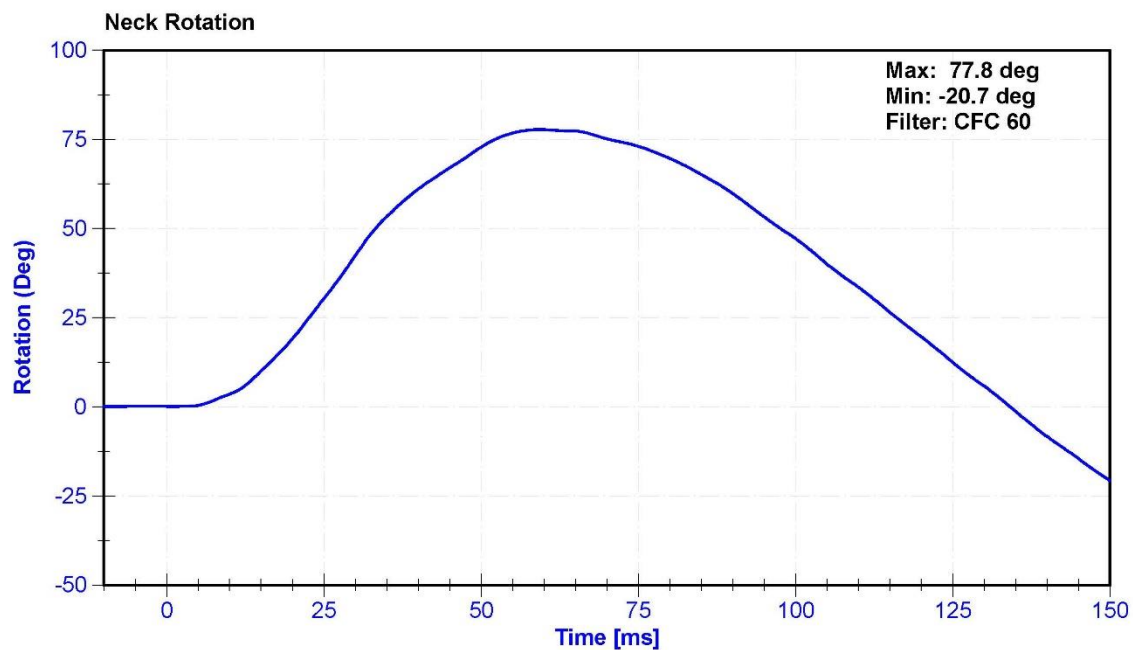
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	13	Pass
Velocity	5.51	5.63	m/s	5.588	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.57	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.79	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	5.08	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.91	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.93	Pass
Neck Rotation	71	81	deg	77.8	Pass
Time at Maximum Rotation	50	70	ms	59.3	Pass
Moment about the OC	36	44	Nm	43.2	Pass
Moment Decay to 0 Nm	102	126	ms	114.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	7231CT	10/28/2021	10/28/2022
Pendulum Potentiometer	MCB	WS1800057	11/30/2021	11/30/2022
Condyle Potentiometer	Servo	DS185 Pend H	11/12/2021	11/12/2022
Upper Neck Load Cell	Denton	1037-FY	06/29/2021	06/29/2022





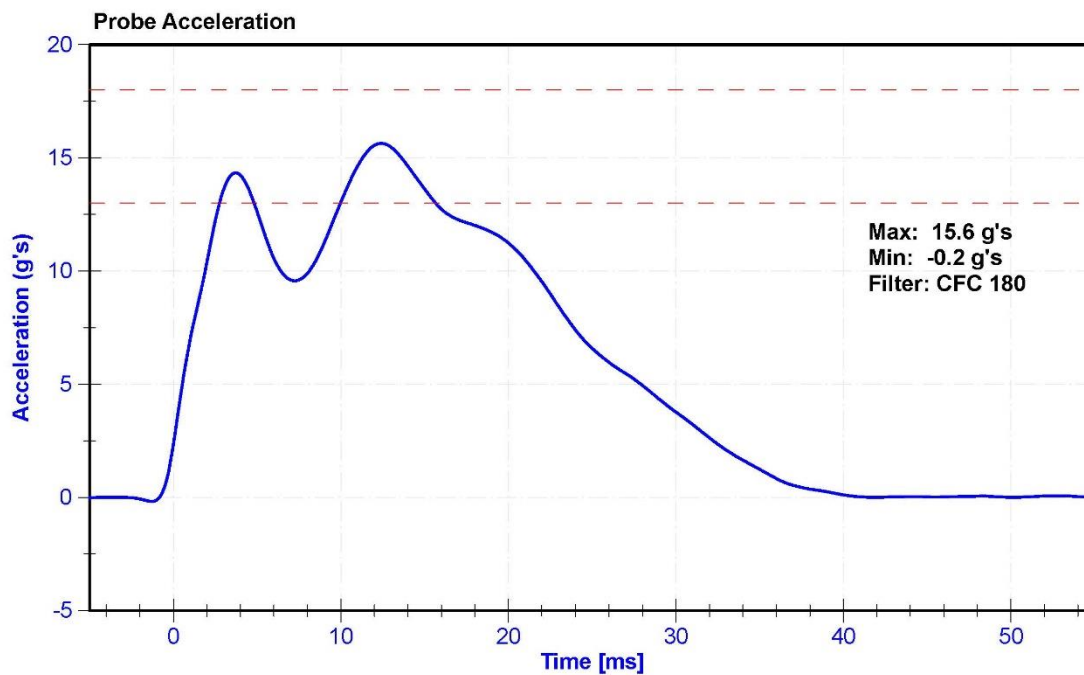
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

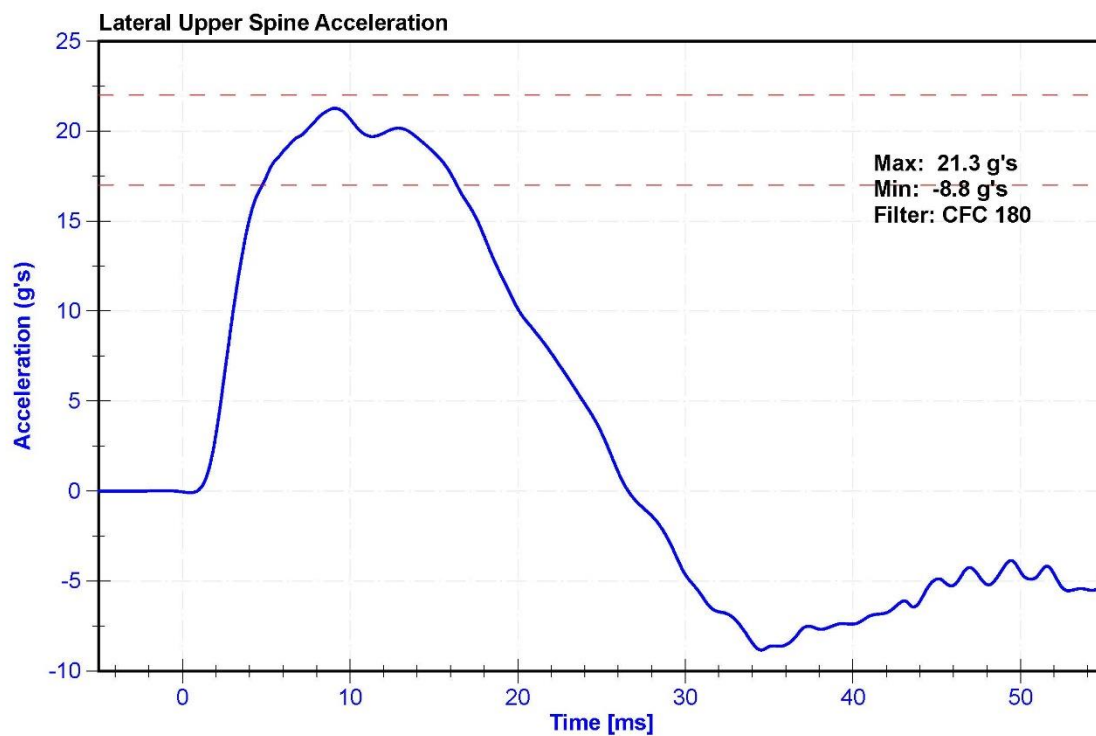
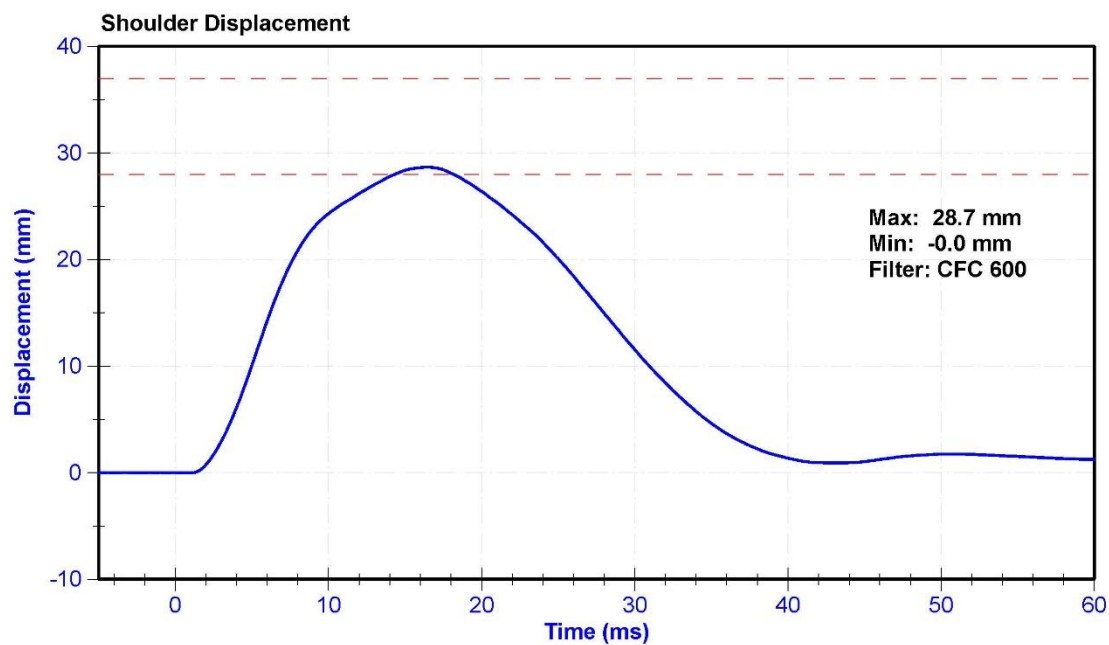
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	27.1	Pass
Velocity	4.2	4.4	m/s	4.33	Pass
Probe Acceleration	13	18	g's	15.6	Pass
Shoulder Deflection	28	37	mm	28.7	Pass
Lateral Upper Spine Acceleration	17	22	g's	21.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Shoulder Potentiometer	Servo	045GFE	1/12/2022	7/13/2022
Upper Spine Y Accelerometer	Endevco	P64148	1/10/2022	7/9/2022





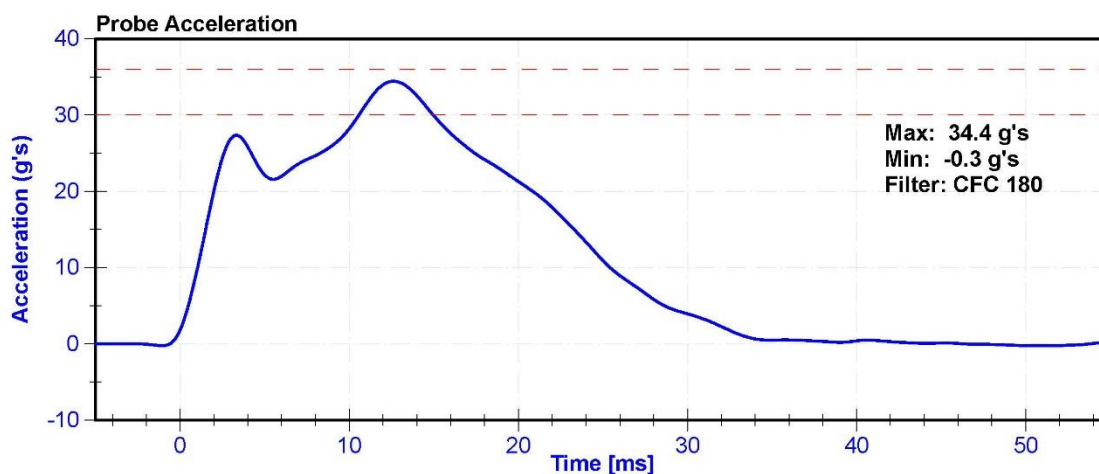
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

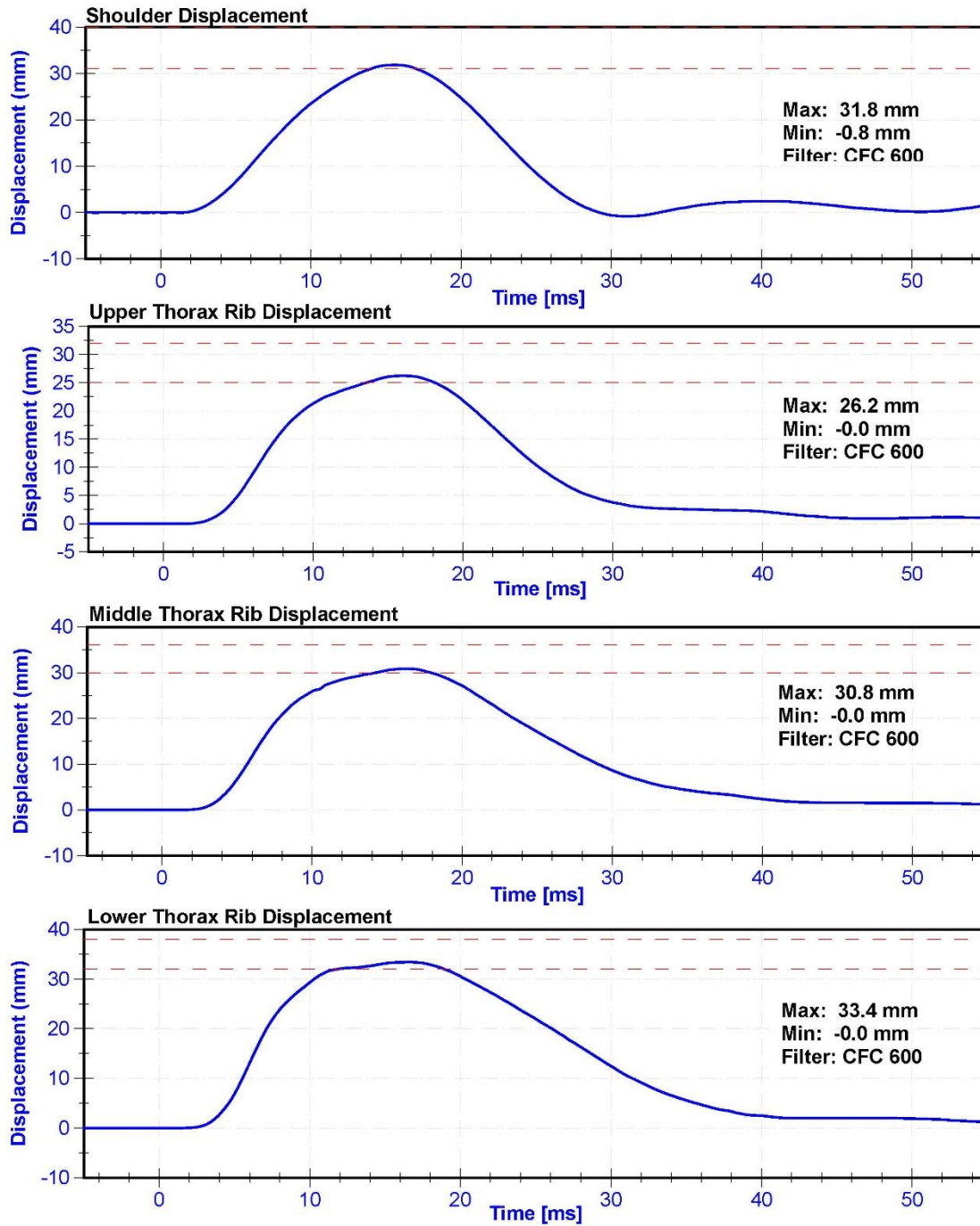
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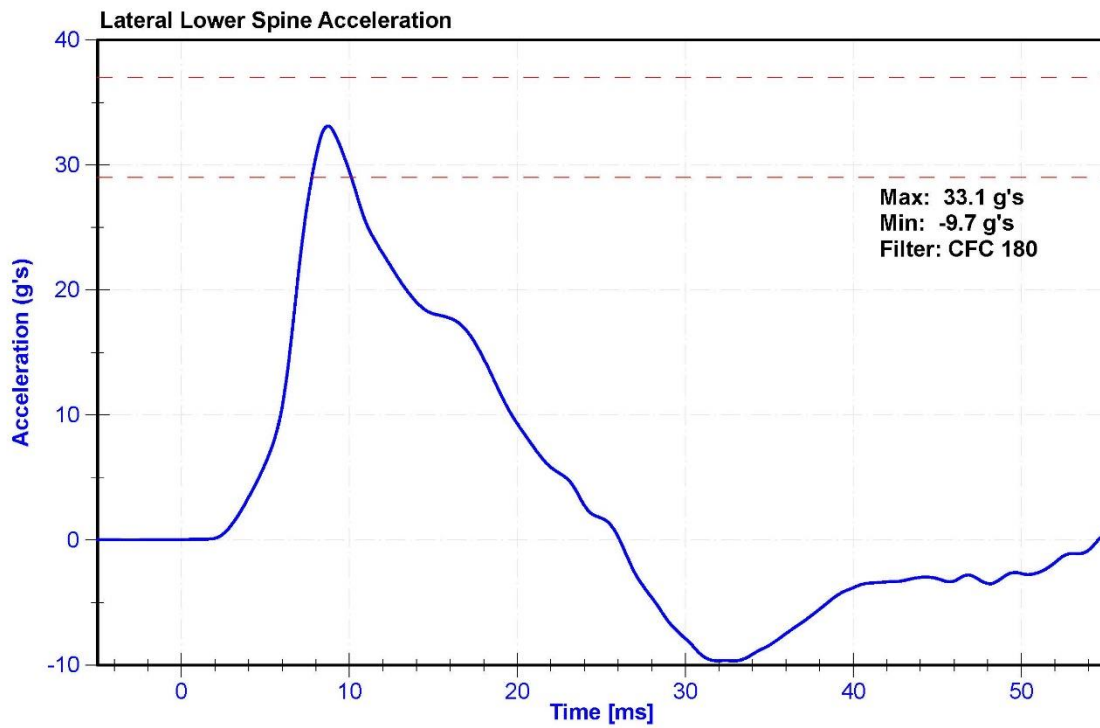
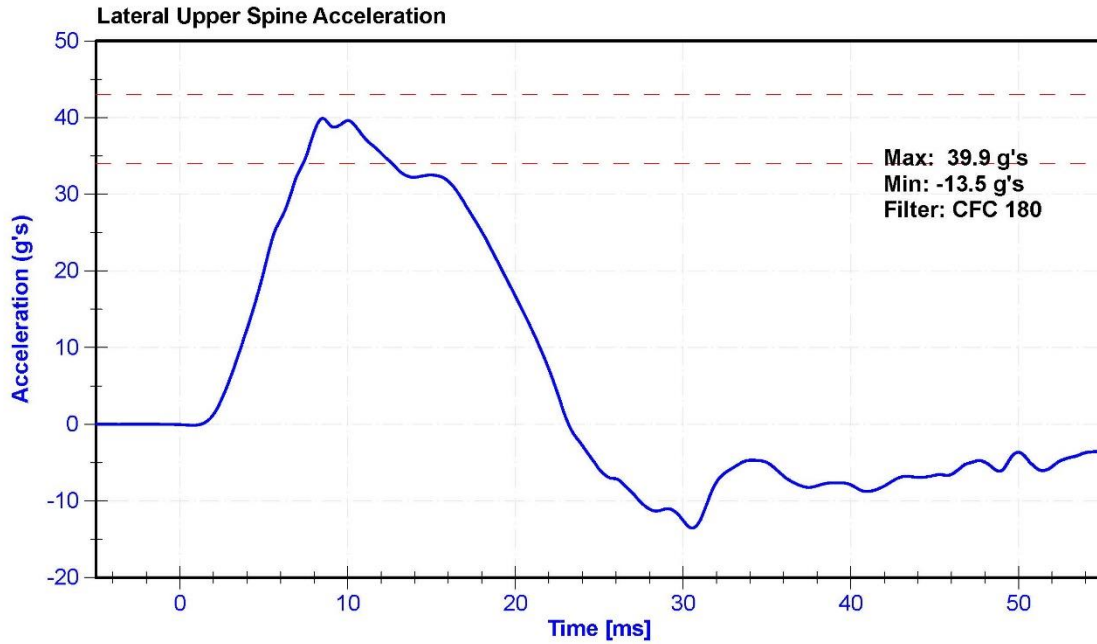
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	27.1	Pass
Velocity	6.6	6.8	m/s	6.71	Pass
Probe Acceleration after 5 ms	30	36	g's	34.4	Pass
Lateral Upper Spine Acceleration	34	43	g's	39.9	Pass
Lateral Lower Spine Acceleration	29	37	g's	33.1	Pass
Shoulder Deflection	31	40	mm	31.8	Pass
Upper Thorax Rib Deflection	25	32	mm	26.2	Pass
Mid Thorax Rib Deflection	30	36	mm	30.8	Pass
Lower Thorax Rib Deflection	32	38	mm	33.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Upper Spine T1 Y Accelerometer	Endevco	P64148	1/10/2022	7/9/2022
Upper Spine T12 Y Accelerometer	Endevco	P51327	1/10/2022	7/9/2022
Shoulder Potentiometer	Servo	045GFE	1/12/2022	7/13/2022
Upper Thorax Rib Potentiometer	Servo	1199GFE	1/12/2022	7/13/2022
Middle Thorax Rib Potentiometer	Servo	1246GFE	1/13/2022	7/14/2022
Lower Thorax Rib Potentiometer	Servo	011GFE	1/12/2022	7/13/2022







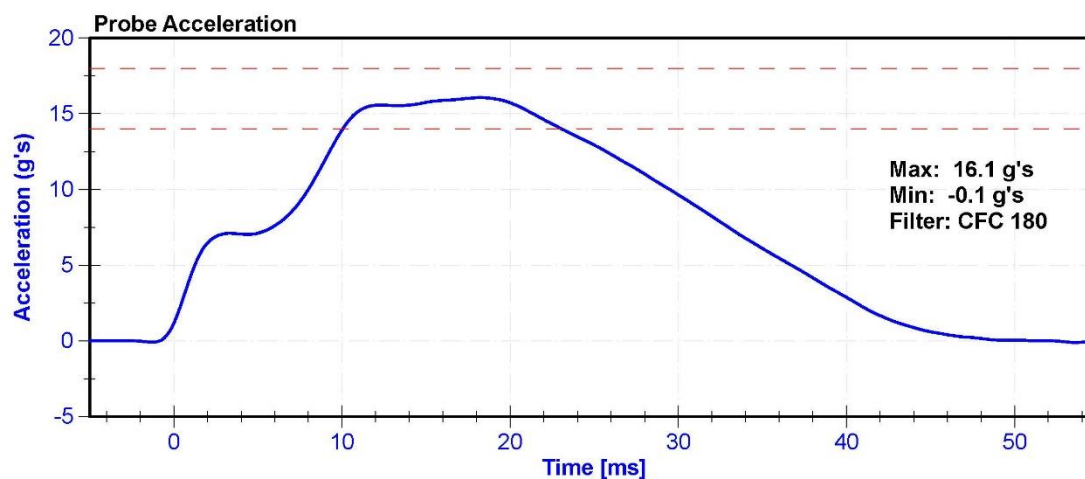
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

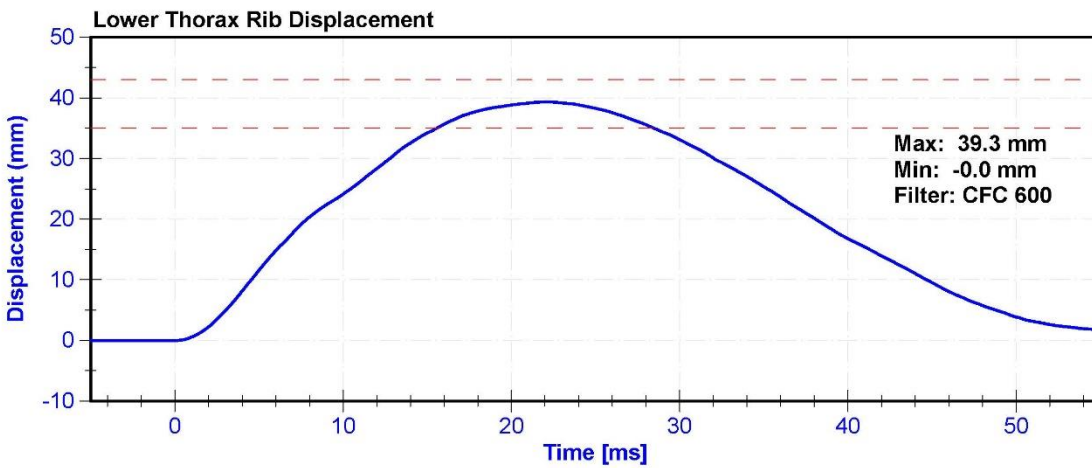
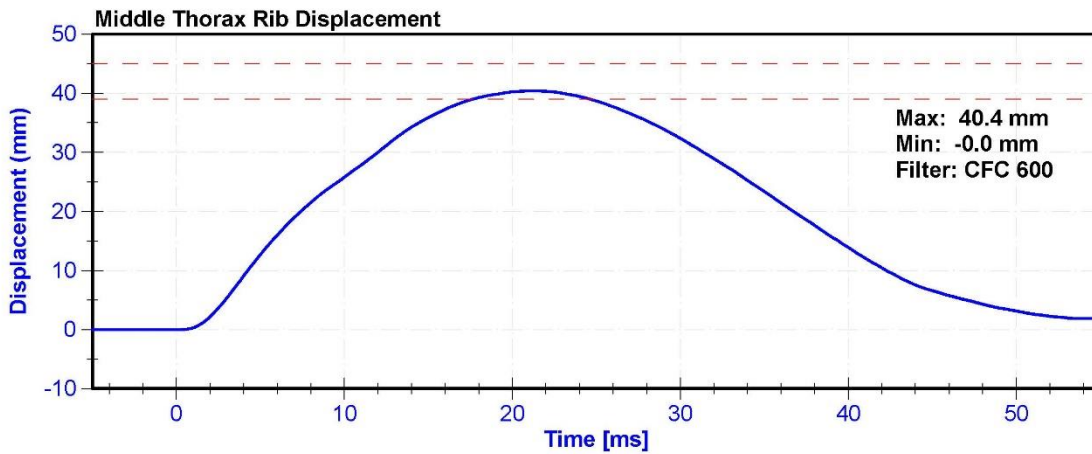
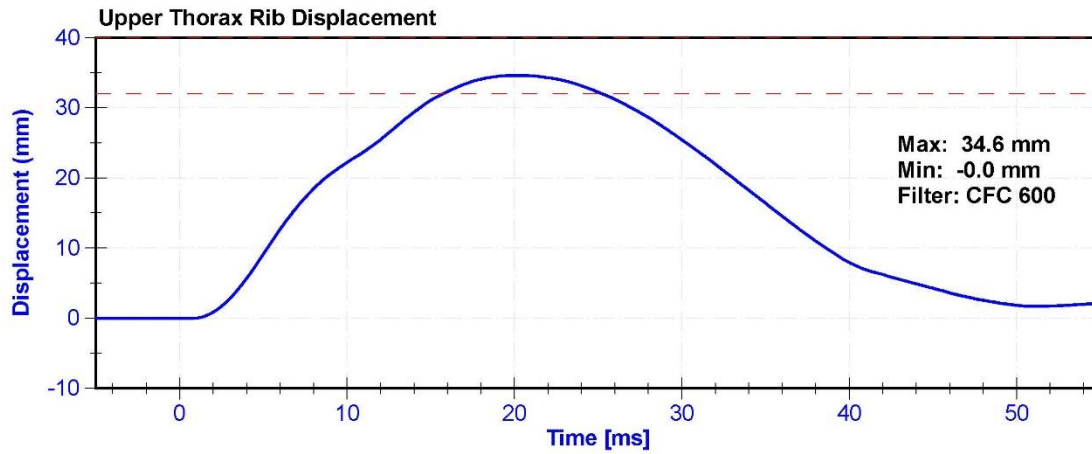
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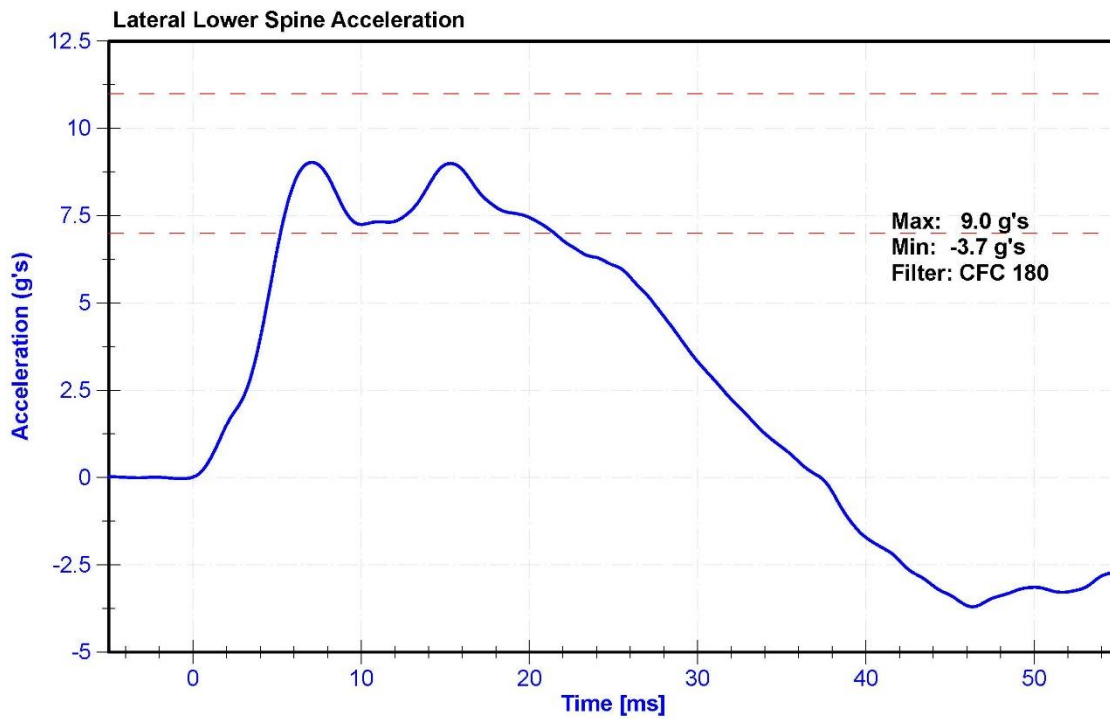
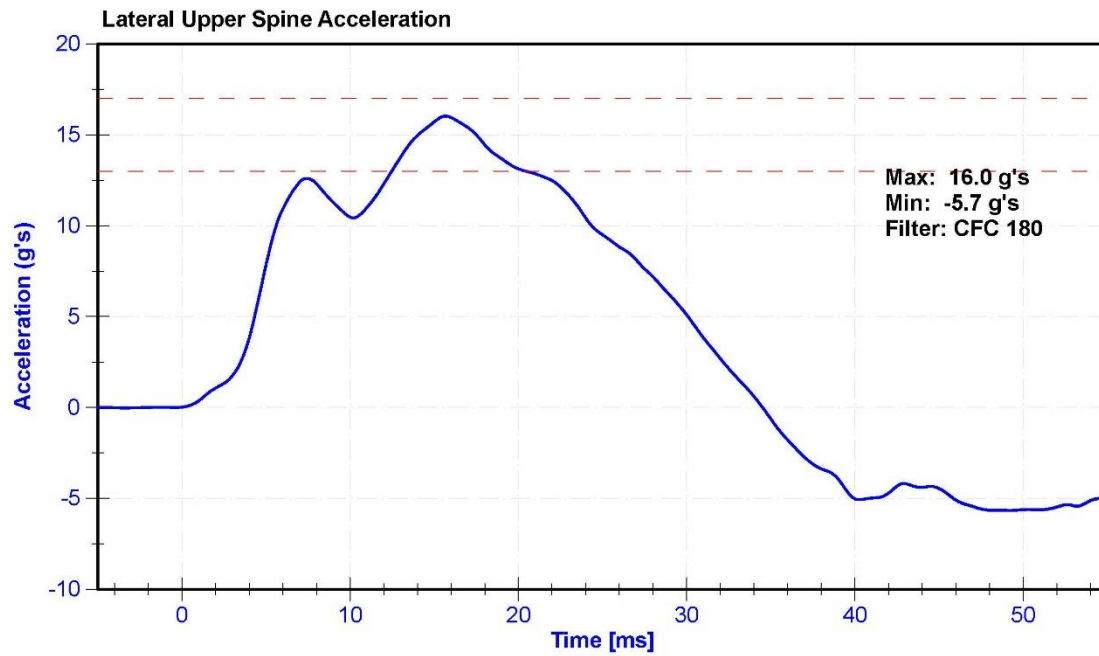
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	27.1	Pass
Velocity	4.2	4.4	m/s	4.27	Pass
Probe Acceleration	14	18	g's	16.1	Pass
Lateral Upper Spine Acceleration	13	17	g's	16.0	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.0	Pass
Upper Thorax Rib Deflection	32	40	mm	34.6	Pass
Middle Thorax Rib Deflection	39	45	mm	40.4	Pass
Lower Thorax Rib Deflection	35	43	mm	39.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Upper Spine Y Accelerometer	Endevco	P64148	1/10/2022	7/9/2022
Lower Spine Y Accelerometer	Endevco	P51327	1/10/2022	7/9/2022
Upper Thorax Rib Potentiometer	Servo	1199GFE	1/12/2022	7/13/2022
Middle Thorax Rib Potentiometer	Servo	1246GFE	1/13/2022	7/14/2022
Lower Thorax Rib Potentiometer	Servo	011GFE	1/12/2022	7/13/2022







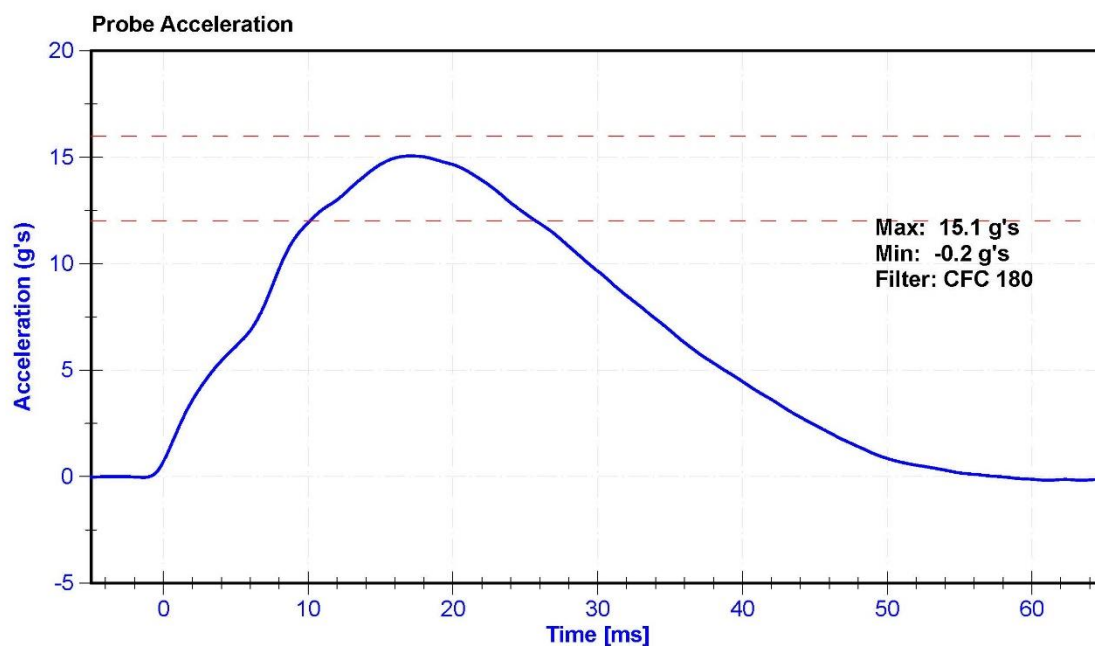
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

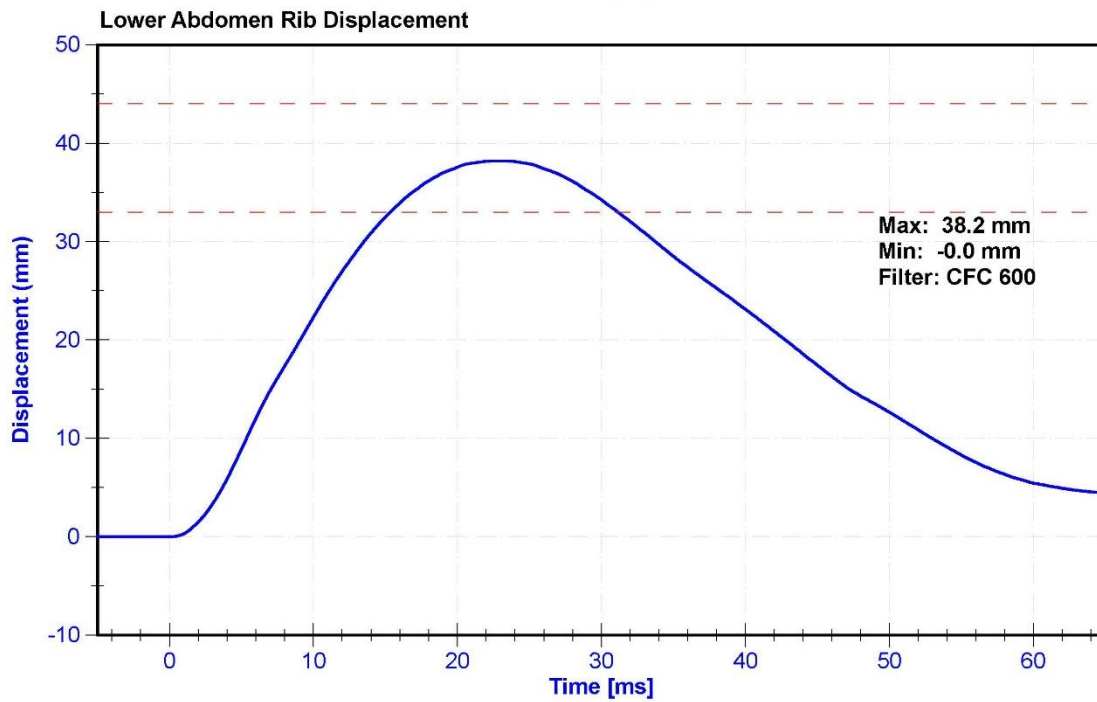
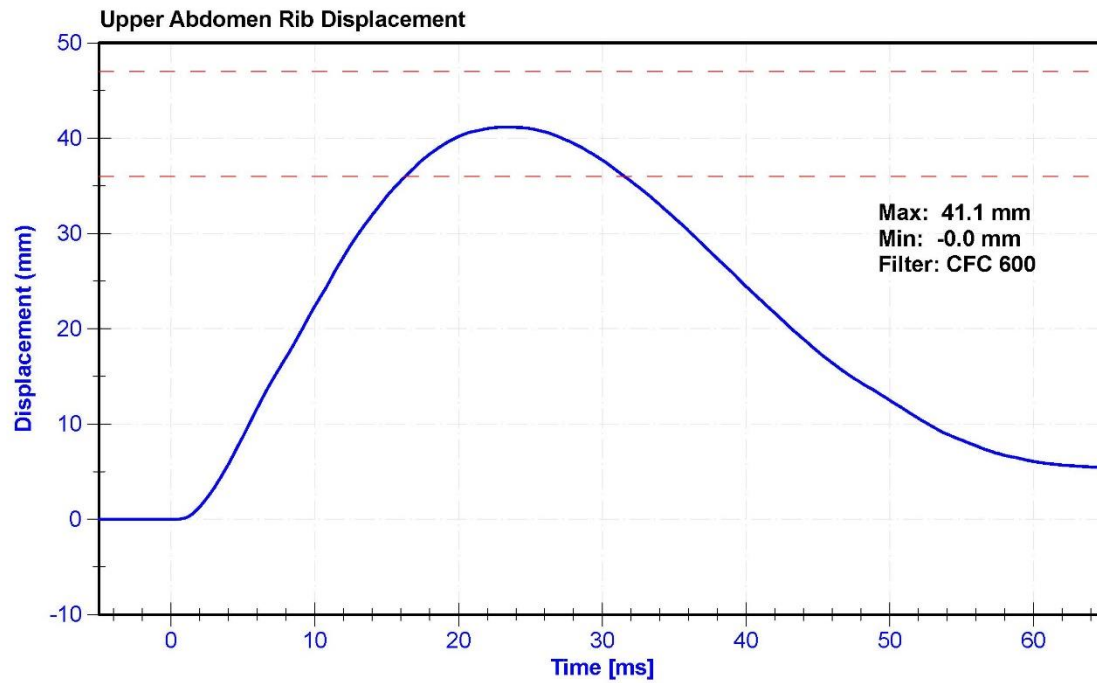
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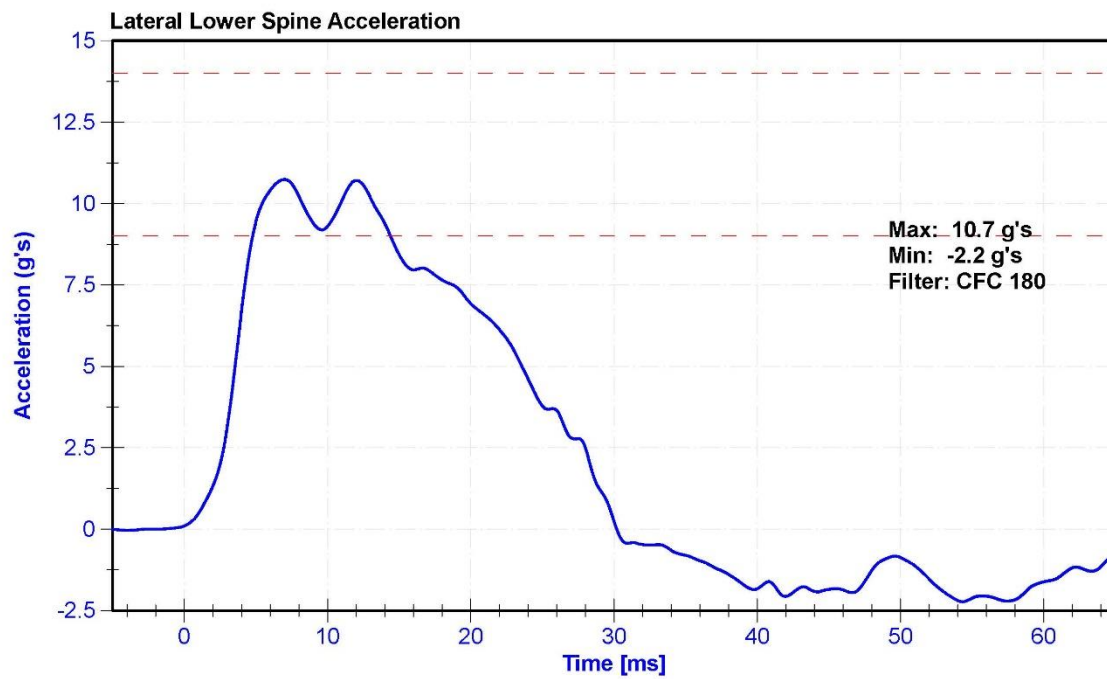
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	27.1	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	12	16	g's	15.1	Pass
Lateral Lower Spine Acceleration	9	14	g's	10.7	Pass
Upper Abdomen Rib Deflection	36	47	mm	41.1	Pass
Lower Abdomen Rib Deflection	33	44	mm	38.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Lower Spine Y Accelerometer	Endevco	P51327	1/10/2022	7/9/2022
Upper Abdomen Rib Potentiometer	Servo	008GFE	1/12/2022	7/13/2022
Lower Abdomen Rib Potentiometer	Servo	041 GFE	1/12/2022	7/13/2022







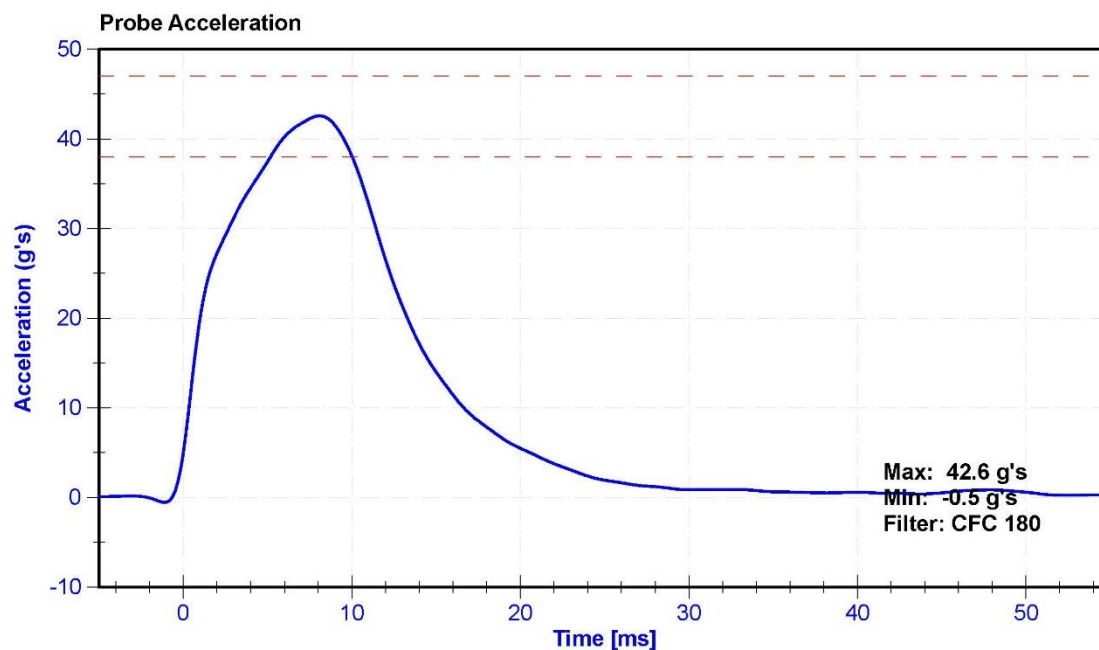
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

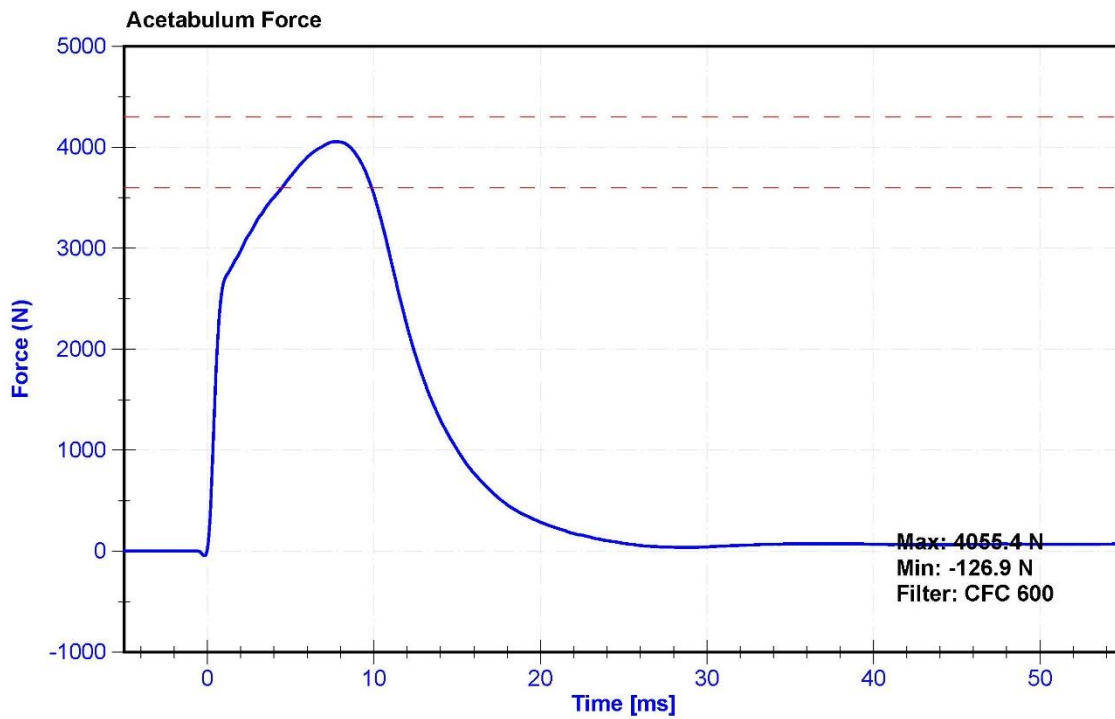
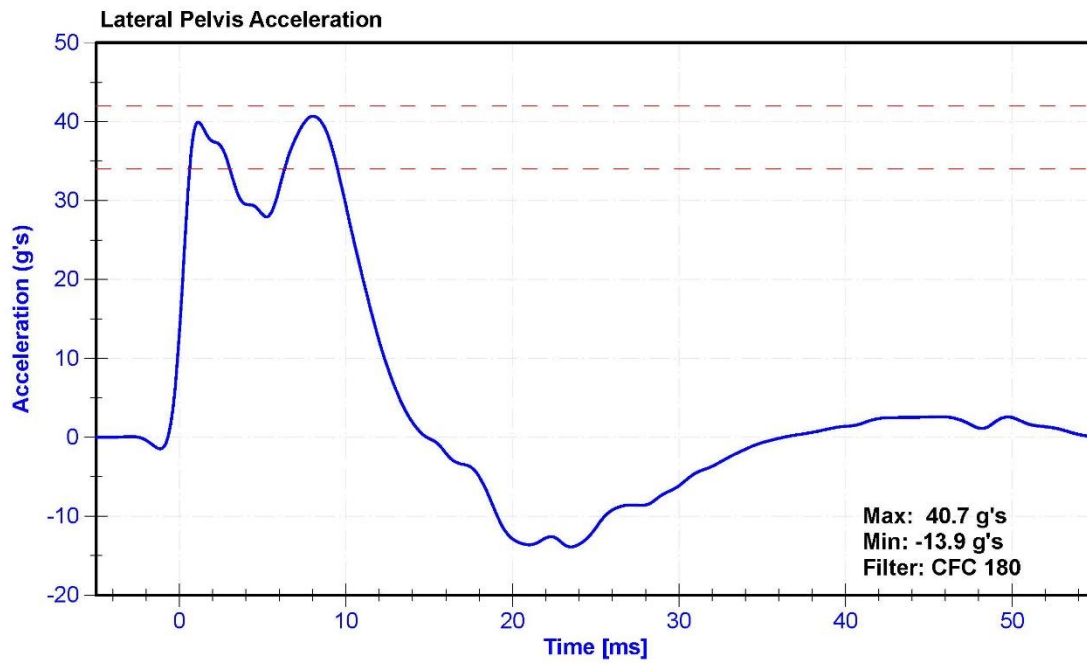
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	27.1	Pass
Velocity	6.6	6.8	m/s	6.68	Pass
Probe Acceleration	38	47	g's	42.6	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	40.7	Pass
Acetabulum Force	3600	4300	N	4055.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Pelvis Y Accelerometer	Endevco	P51875	1/10/2022	7/9/2022
Acetabulum Load Cell	Denton	276-FY	9/14/2021	9/14/2022
Certification Plug	SACO			N/A
Crash Test Plug	SACO			N/A







DC8012
NonImpact

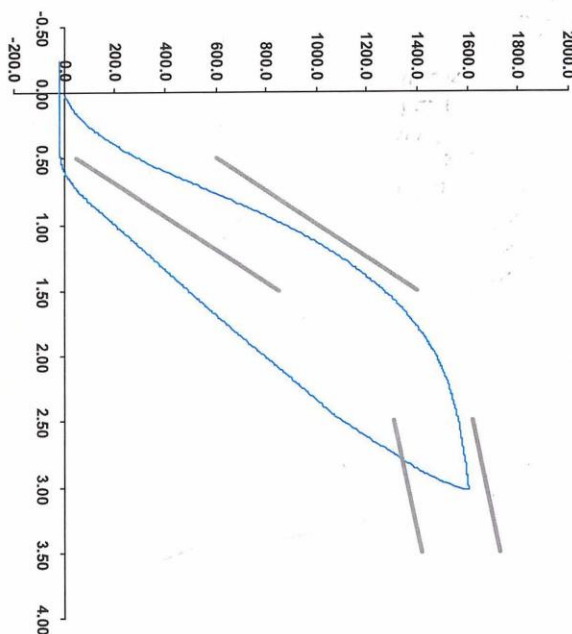
SID-IIs Pelvis Plug Certification Test

Plug S/N 13070
Test Number 10390
Report Number 10425
Test Date 7/30/2019 2:52:18 PM

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

Testing Machine STM-20 5965542
Load Cell S/N (F1360947), Units (LBS) 1000
Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:



Operator

Part Number 180-4450

Template No 107 08-Jul-21
SACO Research

By: _____ Date: _____

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



SID-11s Pelvis Plug Certification Test

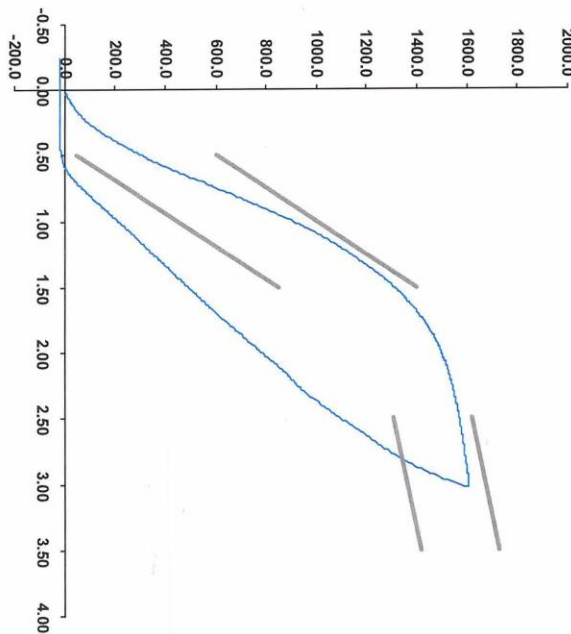
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Test Number 11300
Report Number 11338
Test Date 9/26/2019 12:11:28 PM

Force (-N) vs Extension (-mm)

D68012
CERT
2/11/2022

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

Testing Machine STM-20 596542
Load Cell S/N (F1360947), Units (LBS) 1000
Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured By XHD_100 (XHD100)



Notes:	
Operator	
Part Number 180-4450	
Template No 107	08-Jul-21
SACO Research	

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



SID-11s Pelvis Plug Certification Test

Plug S/N 13128
Test Number 10490
Report Number 10526
Test Date 8/5/2019 10:50:16 AM

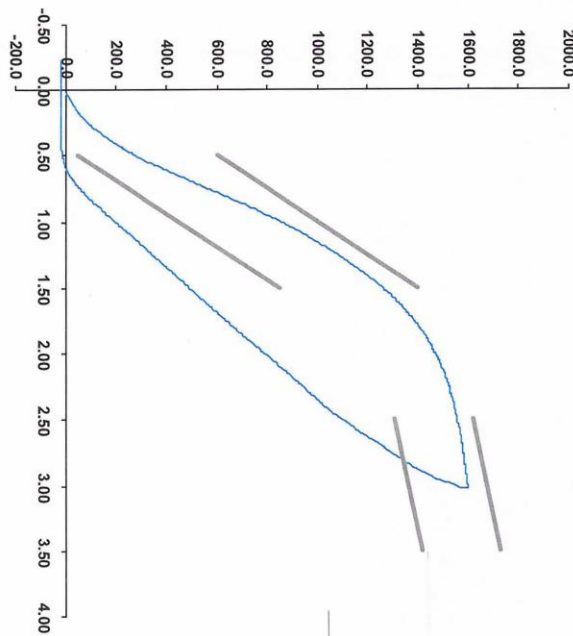
Force (-N) vs Extension (-mm)

DE8012
Crash
2/11/2022

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

Testing Machine STM-20 5965542
Load Cell S/N (F1360947), Units (LBS) 1000
Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured By XHD_100 (XHD100)

Notes:



Operator

Part Number 180-4450

Template No 107 08-Jul-21
SACO Research

By: _____ Date: _____

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

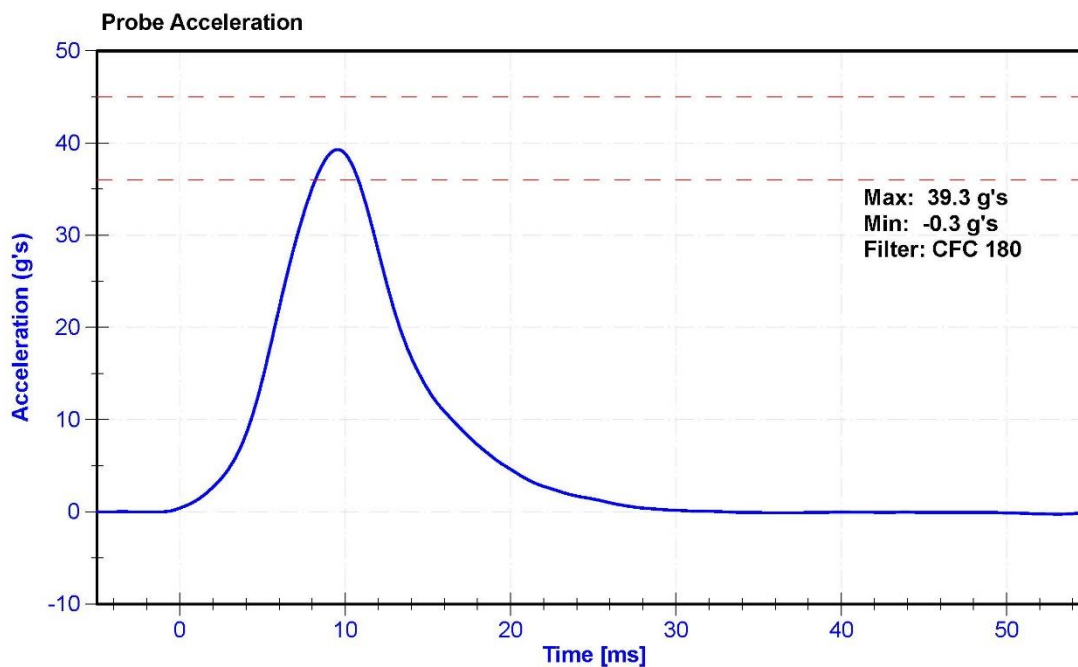
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

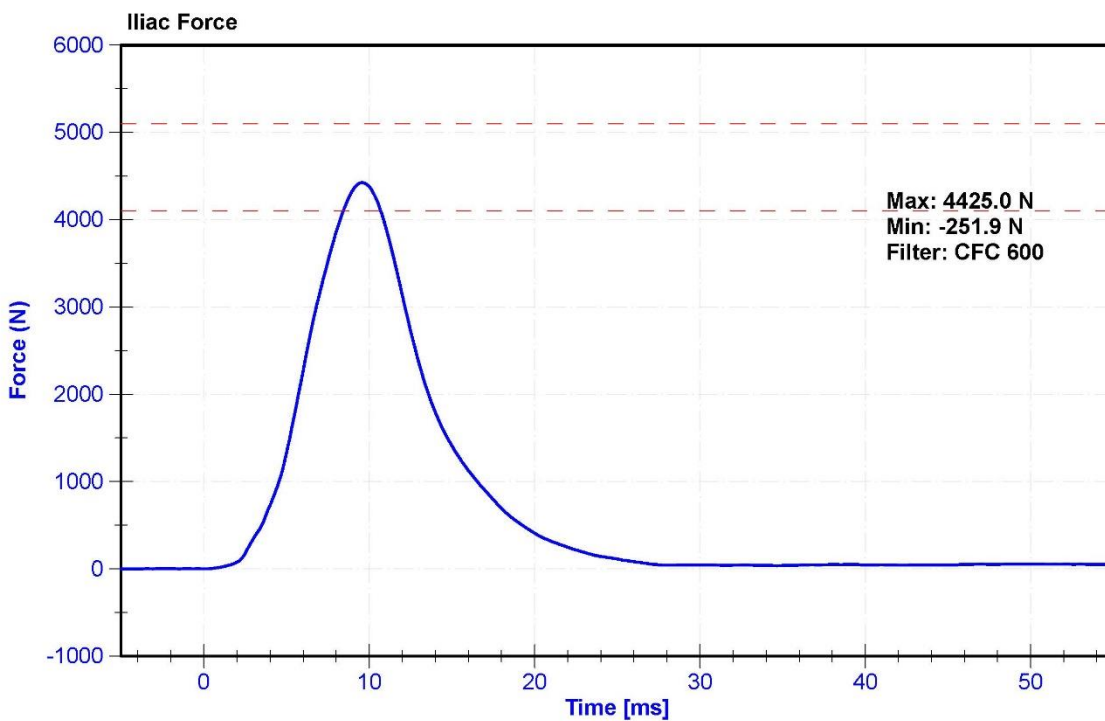
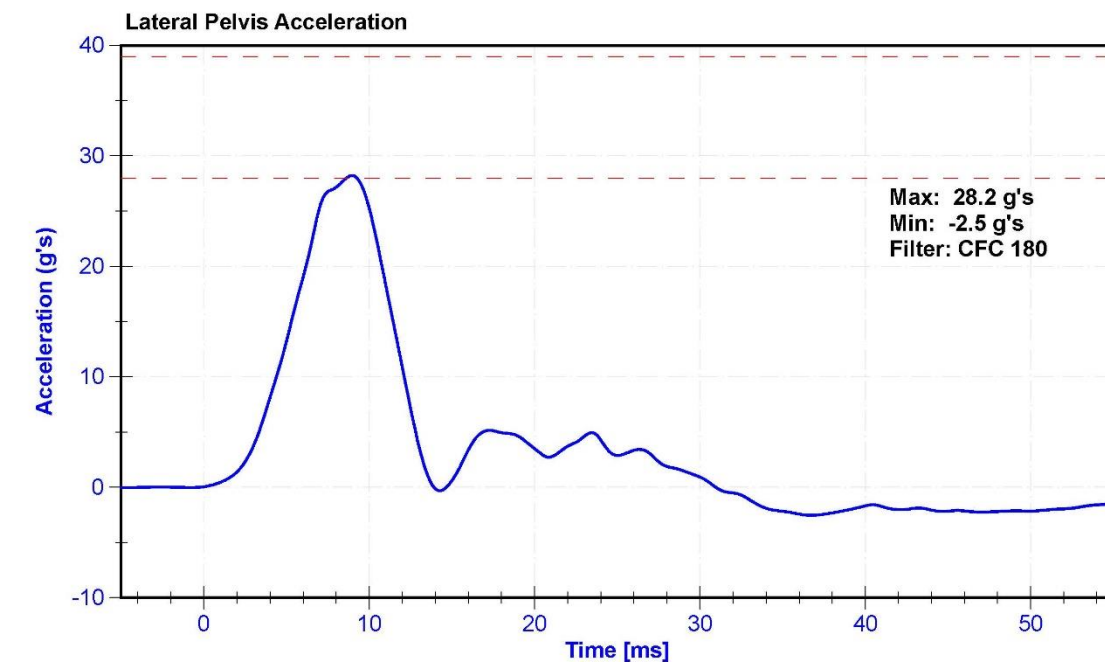
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	27.1	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Probe Acceleration	36	45	g's	39.3	Pass
Lateral Pelvis Acceleration	28	39	g's	28.2	Pass
Iliac Force	4100	5100	N	4425.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	T25885	10/25/2021	4/23/2022
Pelvis Y Accelerometer	Endevco	P51875	1/10/2022	7/9/2022
Iliac Load Cell	Denton	290-FY	9/14/2021	9/14/2022





APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (SID-IIs)

			SID-IIs S/N: DG8012			
			Serial Number	Manufacturer	Calibration Date	
Head Accelerometers		X	7264C-2000-TZ-2_P74788	Endevco	1/10/2022	
		Y	7264C-2000-TZ-2_P83432	Endevco	1/10/2022	
		Z	7264C-2000-TZ-2_P83319	Endevco	1/10/2022	
Head Accelerometers - Redundant		X	7264C-2000-TZ-2_P80334	Endevco	1/10/2022	
		Y	7264C-2000-TZ-2_P52155	Endevco	1/10/2022	
		Z	7264C-2000-TZ-2_P83322	Endevco	1/10/2022	
Displacement Potentiometer	Shoulder		Y			
	Thoracic Rib	Upper	Y	08TC1-3745_1199GFE	Servo	1/12/2022
		Middle	Y	08TC1-3745_1246GFE	Servo	1/13/2022
		Lower	Y	08TC1-3745_011GFE	Servo	1/12/2022
	Abdominal Rib	Upper	Y	08TC1-3745_008GFE	Servo	1/12/2022
		Lower	Y	0BTC1-3745_041 GFE	Servo	1/12/2022
Lower Spine Accelerometers (T12)			X	7264C-2000-TZ-2_P71272	Endevco	1/10/2022
			Y	7264C-2000-TZ-2_P51327	Endevco	1/10/2022
			Z	7264C-2000-TZ-2_P52067	Endevco	1/10/2022
Acetabulum Load Cell			Y	3249J_276-FY	Denton	9/14/2021
Lilac Wing Load Cell			Y	3228J_290-FY	Denton	9/14/2021
Pelvis Plug (Struck Side)				14031	SACO	5/22/2020
Pelvis Plug (Non-Struck Side)				13045	SACO	7/30/2019

Table 2 – Vehicle Instrumentation

Vehicle Instrumentation		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	1201-1000_A315198	Measurement	9/21/2021
Vehicle Center of Gravity	Y	1201-1000_A315855	Measurement	9/21/2021
Vehicle Center of Gravity	Z	1201-1000_A352354	Measurement	9/21/2021
Left Floor Sill	Y	1201-1000_A400759	Measurement	8/16/2021
A-Pillar Sill	Y	1201-1000_A274230	Measurement	9/3/2021
A-Pillar Low	Y	1201-1000_A300210	Measurement	9/8/2021
A-Pillar Mid	Y	1201-1000_A373216	Measurement	11/9/2021
B-Pillar Sill	Y	1201-1000_A405553	Measurement	10/5/2021
B-Pillar Low	Y	1201-1000_A400780	Measurement	8/16/2021
B-Pillar Mid	Y	1201-1000_A400772	Measurement	8/16/2021
Driver Seat	Y	1201-1000_A282636	Measurement	12/28/2021
Engine Top	X	1201-1000_A405597	Measurement	10/5/2021
Engine Top	Y	1201-1000_A405606	Measurement	10/5/2021
Firewall	Y	1201-1000_A280328	Measurement	9/9/2021
Right Roof	Y	1201-1000_A405603	Measurement	10/5/2021
Right Floor Sill	Y	1201-1000_A405568	Measurement	10/5/2021
Rear Floorpan	X	1201-1000_A405532	Measurement	10/5/2021
Rear Floorpan	Y	1201-1000_A405535	Measurement	10/5/2021

Table 3 – Pole Instrumentation

Pole Instrumentation	Serial Number	Manufacturer	Calibration Date
Load Cell 1	1220AF-1117023-F0	Interface	8/5/2021
Load Cell 2	1220AF-1117006-F0	Interface	8/5/2021
Load Cell 3	1220AF-1117025-F0	Interface	7/28/2021
Load Cell 4	1220AF-1117019-F0	Interface	8/2/2021
Load Cell 5	1220AF-1117011-F0	Interface	8/2/2021
Load Cell 6	1220AF-1117017-F0	Interface	8/2/2021
Load Cell 7	1220AF-1117035-F0	Interface	8/2/2021
Load Cell 8	1220AF-1057559-F0	Interface	8/2/2021