REPORT NUMBER: SINCAP-CAL-21-006

NEW CAR ASSESSMENT PROGRAM (NCAP)
MOVING DEFORMABLE BARRIER SIDE IMPACT TEST

General Motors Corporation
2021 Buick Envision Preferred
Five Door SUV

NHTSA No: M20210102

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

June 8, 2021

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
MAIL CODE: NRM-100
1200 NEW JERSEY AVE SE, ROOM W43-410
WASHINGTON, D.C. 20590

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Administration, in response to Contract Number DTNH22-14-D-00352.

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Prepared by: Matthew Pronko Date: June 8, 2021
Matthew Pronko, Test Engineer

Approved by: Vanessa Hansen Date: June 8, 2021
Vanessa Hansen, Operations Manager

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. SINCAP-CAL-21-006	***2. Government Accession No.***	***3. Recipient's Catalog No.***
4. Title and Subtitle Final Report of New Car Assessment Program Side Impact MDB Testing of a 2021 Buick Envision Preferred SUV NHTSA No.: M20210102		***5. Report Date*** June 8, 2021 ***6. Performing Organization Code*** CAL
7. Authors Matthew Pronko, Test Engineer Vanessa Hansen, Operations Program Manager		***8. Performing Organization Report No.*** CAL-DOT-2021-006
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225		***10. Work Unit No.*** ***11. Contract or Grant No.*** DTNH22-14-D-00352
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, Room W43-410 Washington, D.C. 20590		***13. Type of Report and Period Covered:*** Final Test Report March 9, 2021 - June 8, 2021 ***14. Sponsoring Agency Code*** NRM-100
15. *Supplementary Notes*		

16. Abstract

A 55/28, (61.90kph / 38.5 mph), 90^0 Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2021 Buick Envision Preferred SUV in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the generation of consumer information on vehicle side crash protection. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on March 9, 2021.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.84 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21°C. The target vehicle's maximum post-test static crush was 231 mm located at level 3. The test vehicle's occupant performance data is as follows:

Measurement Description	Driver ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC_{36})	N/A	1000	128.015
Maximum Thoracic Rib Deflection	mm	44	17.717
Total Abdominal Force	N	2500	619.354
Pubic Symphysis Force	N	6000	1160.583

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC_{36})	N/A	1000	310.605
Lower Spine Resultant Acceleration	G	82	52.358
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2542.743
Maximum Thoracic Rib Deflection	mm	38*	30.865
Maximum Abdominal Rib Deflection	mm	45*	24.561

* *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 doors did not open during the side impact event.

17. Key Words New Car Assessment Program (NCAP) Side Impact MDB ES-2re SID-IIs	***18. Distribution Statement*** Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, 1200 New Jersey Ave. SE Washington, D.C. 20590

19. Security Class. (of this report)	***20. Security Class. (of this page)***	***21. No. of Pages***	***22. Price***
UNCLASSIFIED	UNCLASSIFIED	195	

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SECTION 1

TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2021 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number DTNH22-14-D-00352. The purpose of this test is to generate comparative side impact performance in a 2021 Buick Envision Preferred SUV. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure dated March 2020.

SECTION 2

SUMMARY OF TEST RESULTS

A 2021 Buick Envision Preferred SUV was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 61.84 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 the Calspan Corporation's Transportation Test Operations Center in Buffalo, New York on March 9, 2021. 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 Side Impact Laboratory Test Procedure, dated March 2020. The side impact event was documented by 9 high-speed and 2 real-time 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 tri-axial 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) tri-axial accelerometers
Public symphysis y-axis load cell

PASSENGER ATD (SID-IIs)
Primary and redundant head CG tri-axial accelerometers
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) tri-axial accelerometers
Acetabulum and iliac wing y-axis load cells

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

DUMMY INJURY VALUES

Measurement Description	Driver ATD (ES-2re)		
	Units	Threshold	Result
Head Injury Criteria (HIC36)		1000	128.015
Maximum Thorax Rib Deflection	mm	44	17.717
Combined Abdominal Force	N	2500	619.354
Pubic Symphysis Force	N	6000	1160.583

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC36)		1000	310.605
Lower Spine (T12) Resultant Acceleration	G	82	52.358
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2542.743
Maximum Thoracic Rib Deflection	mm	38*	30.865
Maximum Abdominal Rib Deflection	mm	45*	24.561

*Proposed IARV

SUPPLEMENTAL RESTRAINT INFORMATION

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Frontal Air bag	Yes	No		
Knee Air bag	Yes	No		
Side Air bag 1 - Curtain	Yes	Yes	Yes	Yes
Side Air bag 2 – Torso/Pelvis Air bag	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 – F033
2. P4 serial number – 300

Data Anomalies:

The following channel was questionable for

- Left Lower B-Pillar Y, Exceeded calibration range at 10.5ms
- Left Mid B-Pillar Y, Exceeded calibration range at 10.5ms, 13.5ms

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 System 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 – Test Vehicle Accelerometer Locations

Data Sheet No. 7 – MDB Accelerometer Locations

Data Sheet No. 8 – Post-Test Observations

Data Sheet No. 9 – MDB Summary of Results

Data Sheet No. 10 – Test Vehicle Profile Measurements

Data Sheet No. 11 – Test Vehicle Exterior Crush Measurements

Data Sheet No. 12 – MDB Exterior Static Crush Measurements

Data Sheet No. 13 – Vehicle and MDB Damage Profile Distances

Data Sheet No. 14 – FMVSS No. 301 Static Rollover Results

Data Sheet No. 15 – Dummy/Vehicle Temperature and Humidity Stabilization Data

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2021 Buick Envision Preferred SUV
NHTSA No.: M20210102
Test Program: NCAP Side MDB Impact Test
Test Date: 3/9/2021

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20210102
Model Year	2021
Make	Buick
Model	Envision
Body Style	SUV
VIN	LRBAZLR4XMD075092
Body Color	Red
Odometer Reading (km/mi)	37 miles
Engine Displacement (L)	2.0
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	9-Speed
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 Air bag	Yes
Driver Curtain Air bag	Yes
Driver Head/Torso Air bag	No
Driver Torso Air bag	No
Driver Torso/Pelvis Air bag	Yes
Driver Pelvis Air bag	No
Driver Knee Air bag	Yes
Rear Pass. Curtain Air bag	Yes
Rear Pass. Head/Torso Air bag	No
Rear Pass. Torso Air bag	No
Rear Pass. Torso/Pelvis Air bag	No
Rear Pass. Pelvis Air bag	No
Driver Seat Belt Pretensioners	Yes
Rear Pass. Seat Belt Pretensioners	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	SAIC General Motors Corporation Limited for General Motors LLC
Date of Manufacture	12/20
Vehicle Type	MPV

GVWR (kg)	2250
GAWR Front (kg)	1200
GAWR Rear (kg)	1150

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3	-	5	
Capacity Weight (VCW) (kg)				561	(A)
DSC X 68.04 kg				340.2	(B)
Cargo Weight (RCLW) (kg)				136	(A-B)

VEHICLE SEAT TYPE

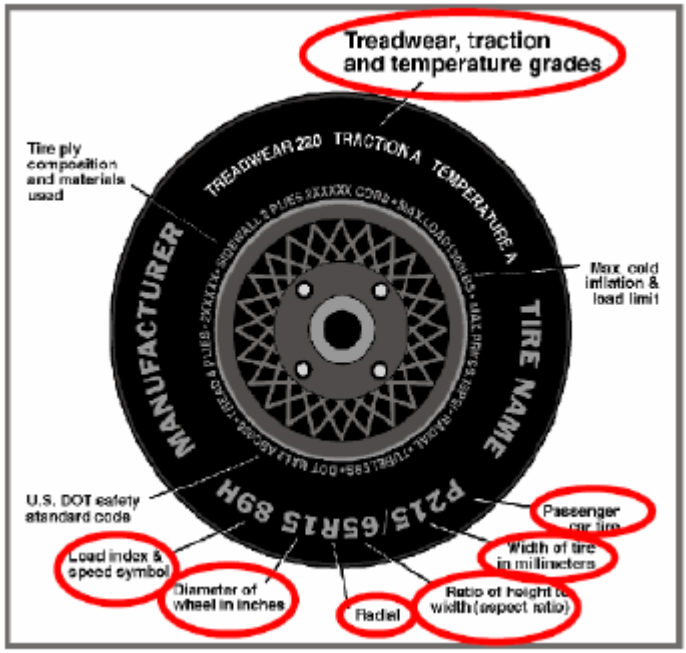
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front Seat	X						X
Rear or Second Row Seat			X		X		
Third Row seat							

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

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021

VEHICLE TIRE INFORMATION

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



TIRE SIDEWALL INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	235/60R18	235/60R18
Tire Size on Vehicle	235/60R18	235/60R18
Tire Manufacturer	Continental	Continental
Tire Model	ProContact	ProContact
Treadwear	500	500
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	103H	103H
Tire Material	Rubber	Rubber
DOT Safety Code Left	ILFOFBBYB4620	ILFOFBBYB4720
DOT Safety Code Right	ILFOFBBYB4620	ILFOFBBYB4820

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

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	257	256	254	258
Tire Placard	kPa	240	240	240	240
Owner's Manual	kPa	240	240	240	240
As Tested	kPa	240	240	240	240

MDB TIRE SPECIFICATIONS

	Units	Requirement	LF	RF	LR	RR
Tire Size		P205/75R15	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	kPa	200 ± 21	207	207	207	207

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	511	334		538	450		551	453	
Right	kg	492	331		513	423		494	427	
Ratio	%	60.1	39.9		55	45		54.3	45.7	
Totals	kg	1003	665	1668	1051	873	1924	1045	880	1925

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1668	(A)
Sum of Actual Weight of 1 ES2re and 1 P572 ATD (SID-IIs)	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	136	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	1931	(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)? [X] **Yes** [ ] **No**

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	Fully Loaded	As Tested	Meets Requirement**
LF	mm	864	863	Yes
RF	mm	868	864	Yes
RR	mm	865	858	Yes
LR	mm	856	854	Yes
Vehicle CG (Aft of Front Axle)	mm	1269	1260	
Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline)	mm	35	22	

**** The "As Tested" vehicle attitude measurements must be equal to or within ± 10mm of the "Fully Loaded" vehicle attitude measurements at each wheel well. Indicate "Yes" or "No" for "Meets Requirements".*

Test height adjustable suspension setting, if applicable: **N/A**

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

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	10
Spare tire	15
Jack	3
Ballast / Equipment Added	98.2

TEST SURFACE MARKINGS

	Distance from 63° Impact Angle Line (mm)
Fore 25 mm target	902
Aft 25 mm target	902
Pre-Impact Angle Line	236

Parallel Track Target	X Location (mm)	Y Location (mm)
A	0	0
B	2955	1555
C	2955	3555
D	0	3000

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

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021

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 passengers' seats should be set to the rear-most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	15.6	7.6	11.6
Front Passenger Seat	Not Adjustable		
Front Center Seat*	N/A	N/A	N/A
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat*	Fixed	Fixed	Fixed

**if applicable*

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	11.6	1	Max	56	55	52
			Mid	28	27	24
			Min	0	1	3
Front Passenger Seat	Not Adjustable		Max	-	-	-
			Mid	-	-	-
			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	-	-	-

**if applicable*

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

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021

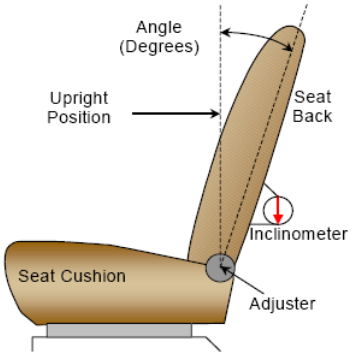
SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forwardmost Position	
	mm	Detents*	mm	Detent*
Driver Seat	240	N/A	120	N/A
Front Passenger Seat	240	25 (0-24)	120	12
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat*	Fixed	Fixed	Fixed	Fixed

**if applicable*

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 Most Upright	
	Degrees	Detents*	Degrees	Detents*
Driver Seat w/ Seated Dummy	61.1	Powered	-10.8	Powered
Front Passenger Seat	57.8	21 (0-20)	-10.9	10
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat w/ Seated Dummy	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat*	Fixed	Fixed	Fixed	Fixed

**if applicable*

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

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. For this test zero is defined as the uppermost position.

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

HEAD RESTRAINT ADJUSTMENT

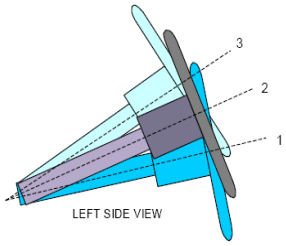
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	9 (0-8)	0 – Uppermost
Rear Seat	2 (0-1)	1 – Lowermost

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	22.0	
Geometric Center – Position 2	24.4	
Uppermost – Position 3	26.6	
Telescoping Steering Wheel Travel		60
Test Position	24.4	30

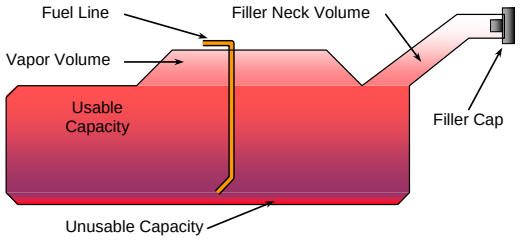


STEERING COLUMN ASSEMBLY

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 fuel pump. The fuel filler neck is on the right side of the vehicle. The pump creates positive pressure in the fuel lines, pushing the gasoline to the engine. See form 1 for more information.



VEHICLE FUEL TANK ASSEMBLY

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

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021

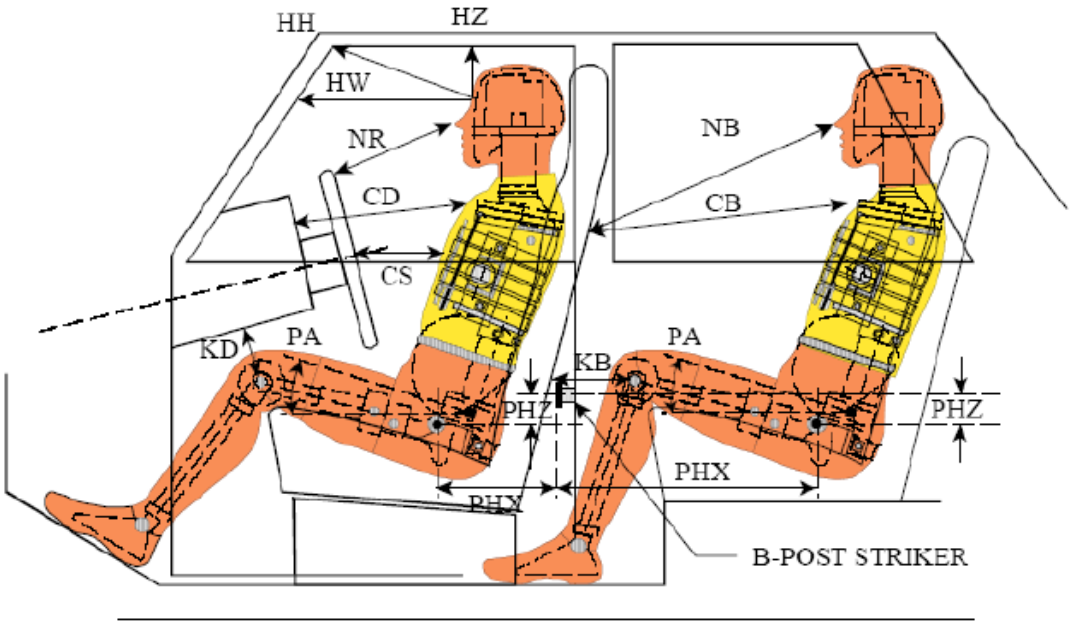
FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	60.2
Usable Capacity of "Optional Tank" (see Form No. 1)	N/A
Usable Capacity of Standard Tank (see Owner's Manual)	60.2
Usable Capacity of Optional Tank (see Owner's Manual)	N/A
93% of Usable Capacity	55.9
Actual Amount of Solvent Used in Test	55.9
1/3 of Usable Capacity	20.1

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

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021



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

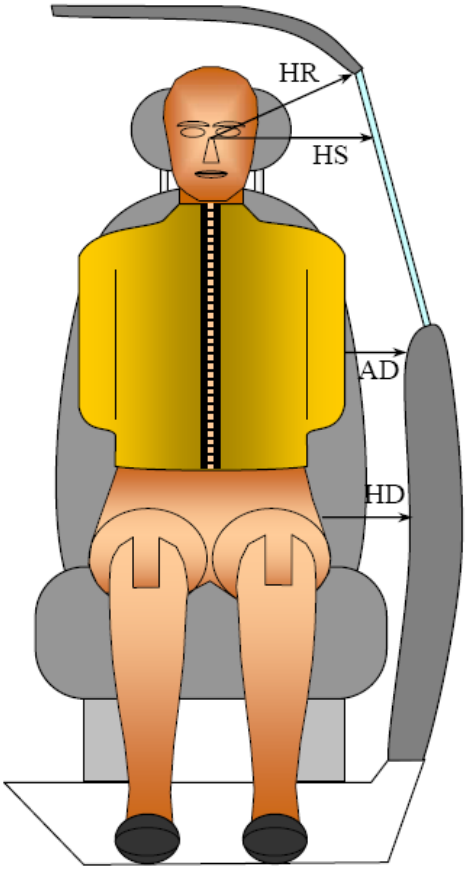
LEFT SIDE VIEW

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Description	Driver (Serial No. F033)		Passenger (Serial No.300)	
			Length (mm)	Angle	Length (mm)	Angle
HH		Header to Header	486			
HW		Header to Windshield	766			
HZ	HZ	Head to Roof Liner	237		314	
NR	NB	Nose to Rim/Seat Back	521		456	
CD	CB	Chest to Dash/Seat Back	616		475	
CS		Chest to Steering Wheel	414			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	244	19.8	232	0.4
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	239	15.3	230	0.2
PAX°	PAX°	Pelvic Tilt Angle X		23.8		19.2
	PAY°	Pelvic Tilt Angle Y				0.3
PHX	PHX	Hip Point to Striker (X-Axis)	113		244	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	150		228	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021



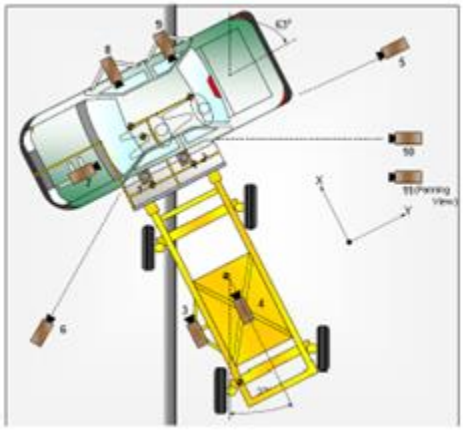
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver (Serial No. F033)	Passenger (Serial No. 300)
HR	Head to Side Header	mm	214	285
HS	Head to Side Window	mm	335	386
AD	Arm to Door	mm	92	85
HD	Hip Point to Door	mm	165	167

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2021 Buick Envision Preferred SUV NHTSA No.: M20210102
Test Program: NCAP Side MDB Impact Test Test Date: 3/9/2021



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	0	0	-8389	12.5	1000
2	Overhead Close-up	0	0	-8389	24	1000
3	Left Impact Point (MDB)				25	1000
4	Side Overall (MDB)				8	1000
5	Rear	0	9066	-1421	28	1000
6	Left Front	-2906	-5385	-1362	24	1000
7	Driver Front (OB)				25	1000
8	Driver Side (OB)				12.5	1000
9	Passenger Side (OB)				12.5	1000
10	Real-time Left Rear				Zoom	60
11	Real-time In run				Zoom	60

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

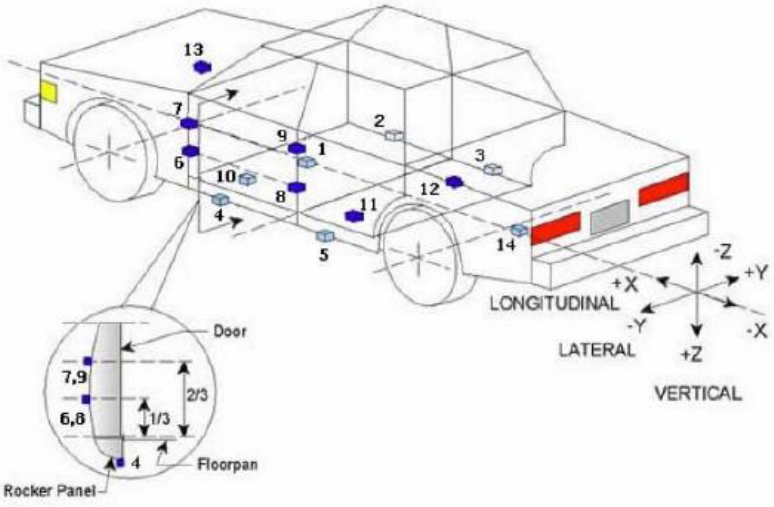
If applicable, explain why camera(s) did not operate as intended: All cameras operated normally

INSTRUMENTATION

Driver Dummy Channels	16
Passenger Dummy Channels	16
Vehicle Structure Accelerometers	23
MDB Accelerometers	7
Total	62

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021



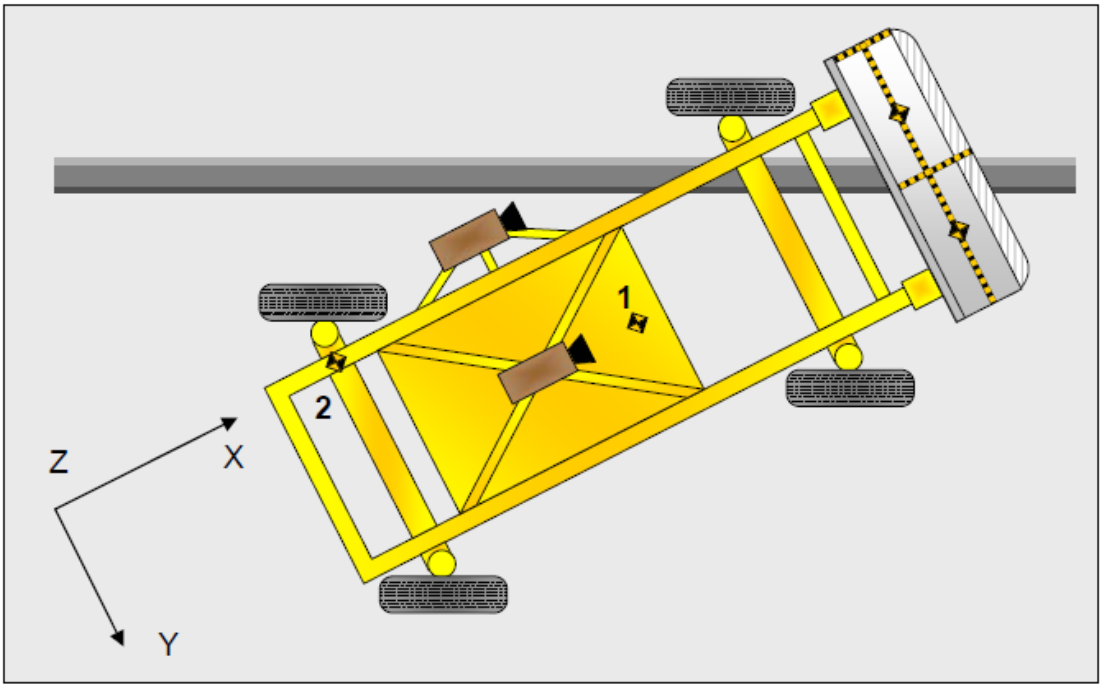
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2432	35	-91
2	Right Sill at Front Seat	2727	691	285
3	Right Sill at Rear Seat	2521	658	271
4	Left Sill at Front Door	2730	-686	285
5	Left Sill at Rear Door	1749	-682	274
6	A-Post Lower	3144	-654	86
7	A-Post Middle	3043	-649	-462
8	B-Post Lower	2124	-696	-27
9	B-Post Middle	2065	-681	-259
10	Front Seat Track	2276	-559	257
11	Rear Seat Structure	1687	-526	242
12	Rt. Rear Occ. Compartment	2689	343	393
13	Engine Block	3850	-55	-165
14	Rear Above Axle	1038	19	75

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:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021



MDB ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	MDB CG	1859	0	-330
2	MDB Rear	386	-660	-660

Reference: X – Face of MDB (+ forward)
Y – MDB centerline (+ to right)
Z – Ground plane (+ down)

Width between left and right contact switches (mm): 1475

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Airbag	Curtain Airbag
Top of Head	Curtain Airbag, Side Header	Curtain Airbag
Left Side of Head	Curtain Airbag	Curtain Airbag
Back of Head	Curtain Airbag, Headrest	Curtain Airbag, Center Seat Headrest
Left Shoulder	Torso/Pelvis Airbag, B-Pillar	Curtain Airbag, Passenger Door
Upper Torso	Seatback, Torso/Pelvis Airbag	Passenger Door
Lower Torso	Seatback	Passenger Door
Left Hip	Seatpan, Torso/Pelvis Airbag	Passenger Door, Seatpan
Left Knee	Driver Door	Passenger 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	Yes	No	No	No
Seat Back Collapse	No	No	No	No

*Seat controller moved seatback rearward trapping passenger

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	B-Pillar and C-Pillar buckled
Sill Separation	None
Windshield Damage	None
Side Window Damage	Minor cracks in driver window, rear passenger windows loose
Other Notable Effects	Driver seatback reclined to pin passenger in vehicle after impact event

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

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2776
Vertical Impact Reference Line (Aft of Front Axle - Intended Impact Point)	mm		448
Actual Impact Point (Aft of Frontal Axle)	mm		454
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	-6
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact Point	0

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2021 Buick Envision Preferred SUV NHTSA No.: M20210102
Test Program: NCAP Side MDB Impact Test Test Date: 3/9/2021

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1,250
Overall Length Including Honeycomb Frame	4,120
Wheelbase of Framework Carriage	2,600
CG Location of Front Axle	1,120

MDB WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg	392.5	297.5	690.0
Right	kg	386.0	291.5	677.5
Ratio	%	57.4%	42.6%	100.0%
Totals	kg	778.5	589.0	1367.5

SPEED AND ANGLE AT IMPACT DATA

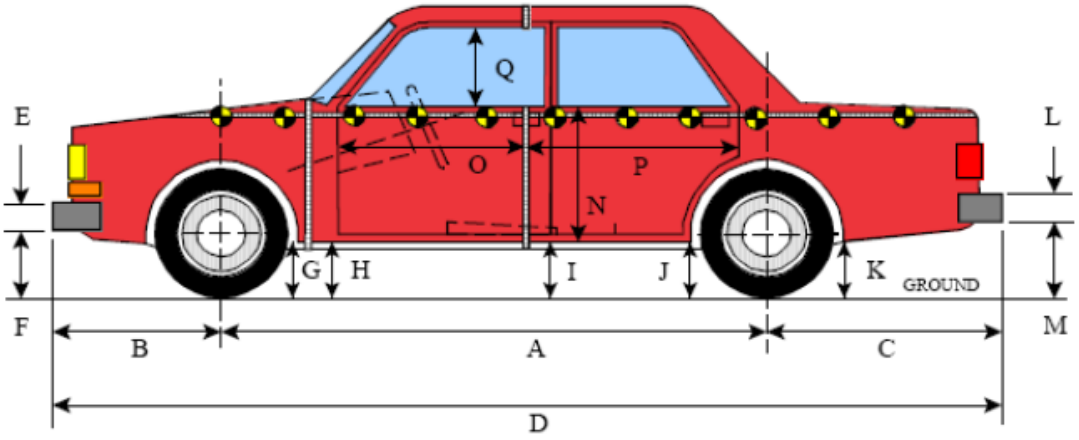
Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.10 to 62.70	61.84
Trap No. 2 Velocity (Redundant)	km/h	61.10 to 62.70	61.85
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.0
MDB Crabbed angle to MDB Forward Line of Motion	degrees	26.0 to 28.0	27.0

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Left	245
B	Top of Bumper	533	800	Left	131
C	Mid-Level	686	800	Left	133
D	Top of Stack	813	800	Left	145

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2021 Buick Envision Preferred SUV
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20210102
Test Date: 3/9/2021



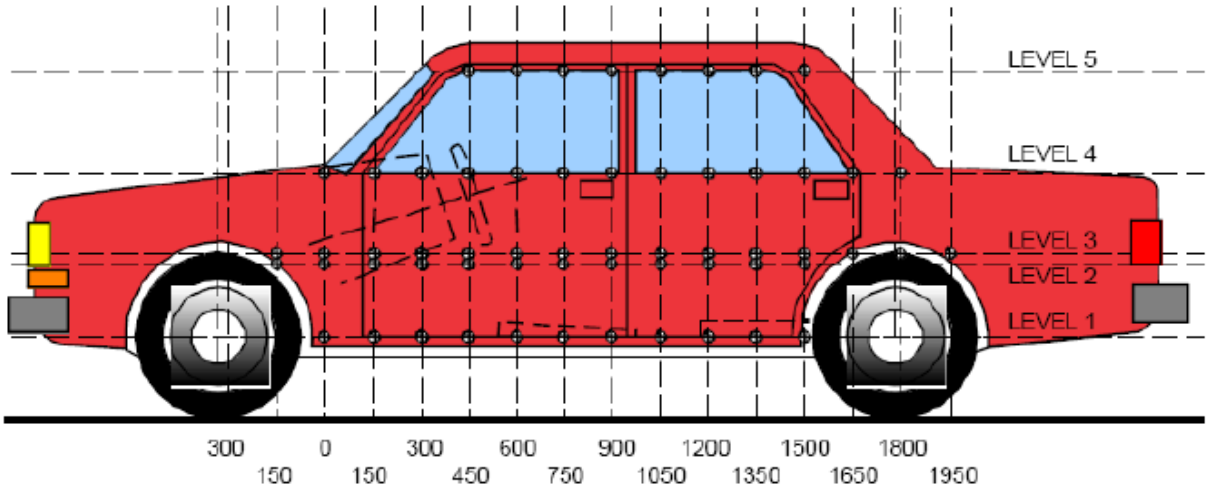
LEFT SIDE VIEW
All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3mm

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2776	2784	8
B	Front Axle to FSOV	977	969	-8
C	Rear Axle to RSOV	885	884	-1
D	Total Length at Centerline	4637	4637	0
E	Front Bumper Thickness	110	110	0
F	Front Bumper Bottom to Ground	344	355	11
G	Sill Height at Front Wheel Well	258	265	7
H	Sill Height at Front Door Leading Edge	259	270	11
I	Sill Height at B Pillar	258	266	8
J1	Sill Height at Rear Wheel Well	262	260	-2
J2	Pinch Weld Height at Rear Wheel Well	230	227	-3
K	Sill Height Aft of Rear Wheel Well	258	255	-3
L	Rear Bumper Thickness	250	250	0
M	Rear Bumper Bottom to Ground	419	415	-4
N	Sill Height to Window Bottom of Front Window Sill	882	828	-54
O	Front Door Leading Edge to Impact CL	766	759	-7
P	Rear Door Trailing Edge to Impact CL	1432	1386	-46
Q	Front Window Opening	450	471	21
R	Right Side Length	4514	4514	0
S	Left Side Length	4514	4515	1
T	Maximum Vehicle Width	1863	1702	-161
U	Front Wheel Track Width	1610	1605	-5
V	Rear Wheel Track Width	1615	1614	-1

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021



LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	309	16	1050
2	Driver Hip Point	mm	644	217	1650
3	Mid-Door	mm	798	231	1650
4	Window Sill	mm	1102	58	1500
5	Window Top	mm	1582	3	1350

*window top level bent outward from original position

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. 11 … (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2021 Buick Envision Preferred SUV NHTSA No.: M20210102
Test Program: NCAP Side MDB Impact Test Test Date: 3/9/2021

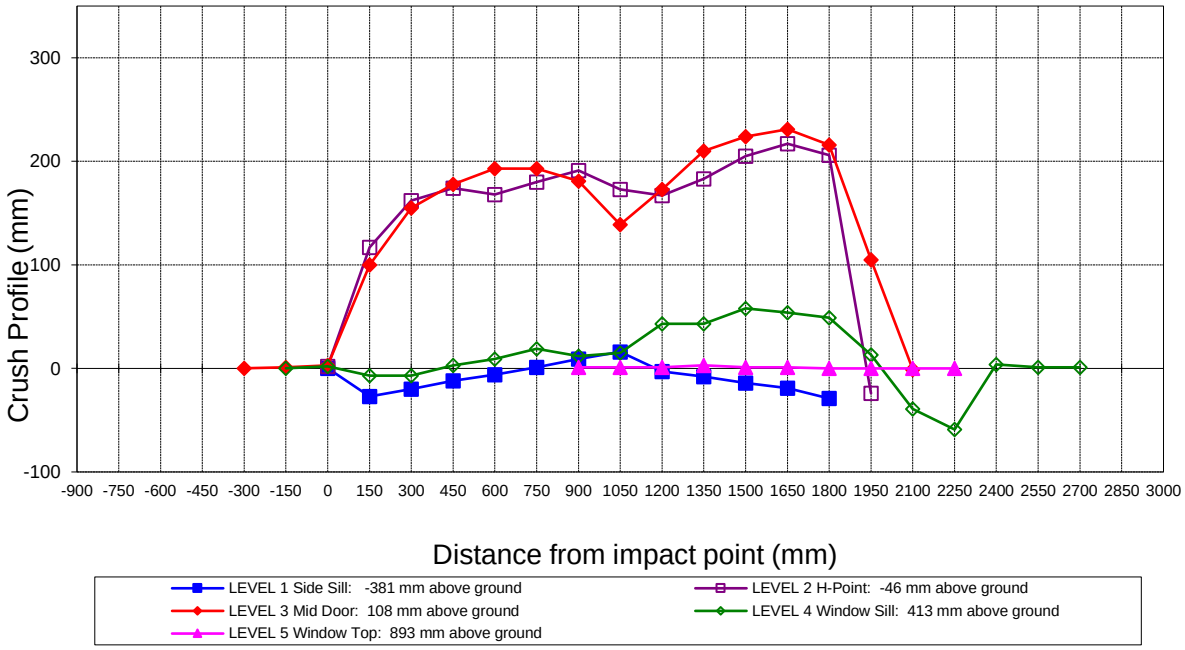
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900															
-750															
-600															
-450															
-300			941					941							
-150			935	809				934	809				1		
0	887	931	931	814		887	929	920	812			2	11	2	
150	886	913	916	818		913	796	816	825		-27	117	100	-7	
300	884	911	916	821		904	749	761	828		-20	162	155	-7	
450	883	916	916	826		895	742	738	823		-12	174	178	3	
600	881	920	916	831		887	752	723	822		-6	168	193	9	
750	880	924	915	836		879	744	722	817		1	180	193	19	
900	879	927	915	841	590	870	736	734	829	589	9	191	181	12	1
1050	878	928	917	844	604	862	755	778	829	603	16	173	139	15	1
1200	878	928	919	847	609	881	761	746	804	608	-3	167	173	43	1
1350	876	927	921	848	610	884	744	711	805	607	-8	183	210	43	3
1500	875	926	923	848	609	889	721	699	790	608	-14	205	224	58	1
1650	875	926	925	848	605	894	709	694	794	604	-19	217	231	54	1
1800	875	927	929	854	596	904	721	713	805	596	-29	206	216	49	
1950		929	934	862	582		953	829	849	582		-24	105	13	
2100			939	867	564			940	906	564			-1	-39	
2250				868	541				927	541				-59	
2400				865					861					4	
2550				854					853					1	
2700				838					837					1	
2850															
3000															

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 test based on an estimated impact point.

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

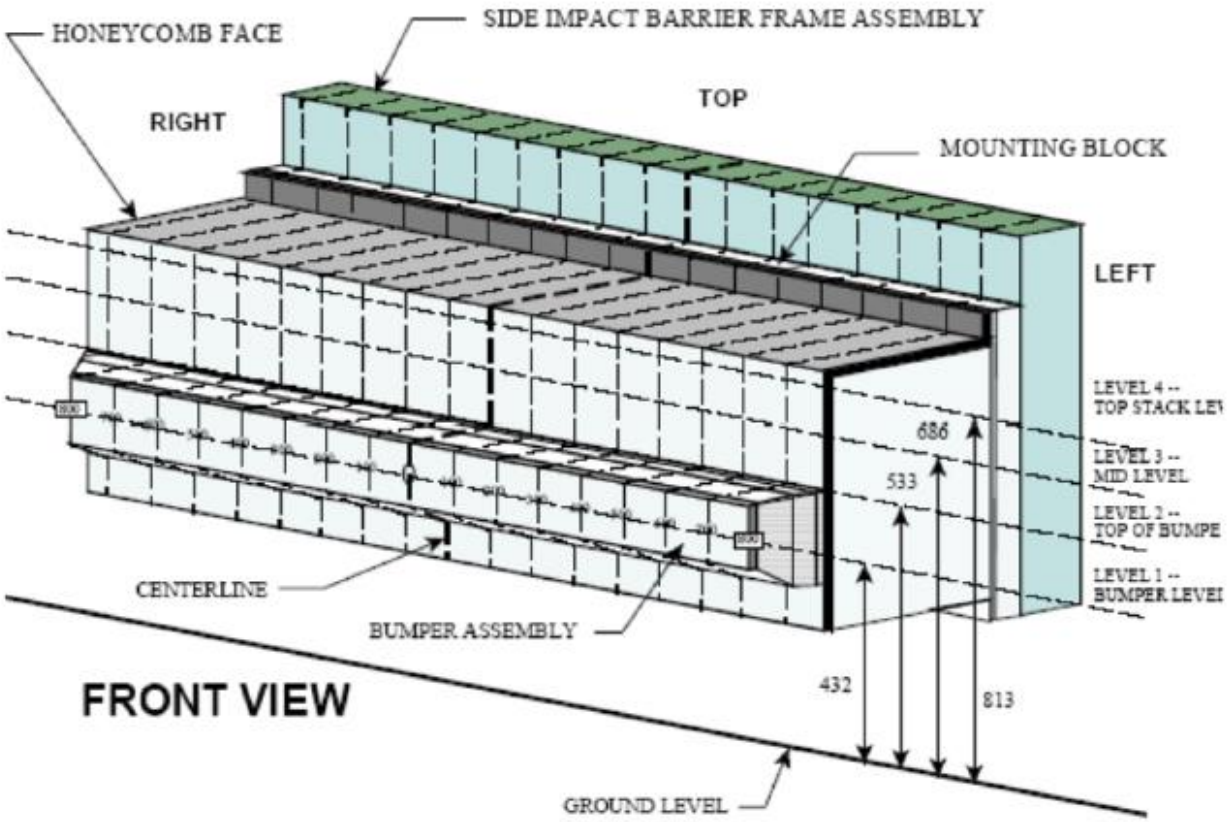
Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021



Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021



NOTE: Dimensions are shown in millimeters, mm

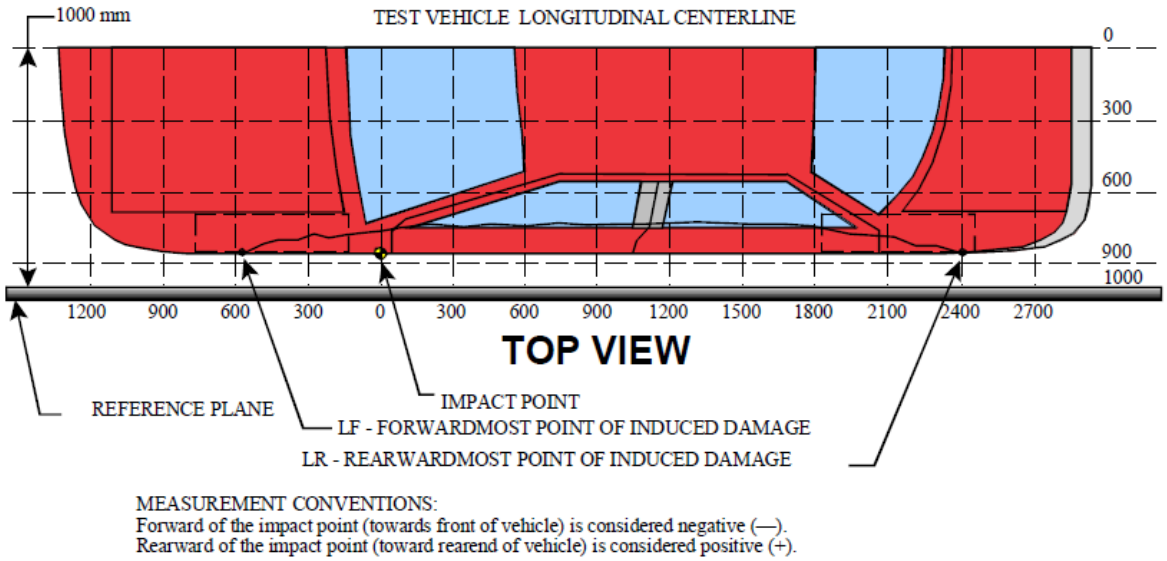
DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center								C/L	Distance Left of Center							
	800	700	600	500	400	300	200	100	0	100	200	300	400	500	600	700	800
1	240	234	231	231	231	231	230	229	229	227	227	226	225	223	223	224	245
2	122	121	121	119	117	116	120	112	111	108	107	108	106	105	106	107	131
3	54	43	40	41	51	63	59	87	74	47	38	36	39	49	64	90	133
4	54	44	40	41	54	75	98	116	93	77	64	66	72	83	99	119	145

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021

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



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)	Crush (mm)
1	-150	3	66	65	1
2	300	3	239	84	155
3	750	3	278	85	193
4	1200	3	254	81	173
5	1650	3	306	75	231
6	2100	3	60	61	-1

MDB DAMAGE PROFILE DISTANCES

DPD	Distance From Center of MDB	Level	Post-Test (mm)*
1	800 mm left of center	1	245
2	480 mm left of center	1	223
3	160 mm left of center	1	227
4	160 mm right of center	1	230
5	480 mm right of center	1	231
6	800 mm right of center	1	240

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

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021
Test Time:	10:08 AM	Temperature:	21˚C

A. From impact until vehicle motion ceases: (Maximum allowable is 1 oz.) — 0 oz.

B. For the 5-minute period after motion ceases: (Maximum allowable is 5 oz.) — 0 oz.

C. For the following 25 minutes: (Maximum allowable is 1 oz./minute) — 0 oz.

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°	72	300	372
180° to 270°	64	300	364
270° to 360°	69	300	369

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

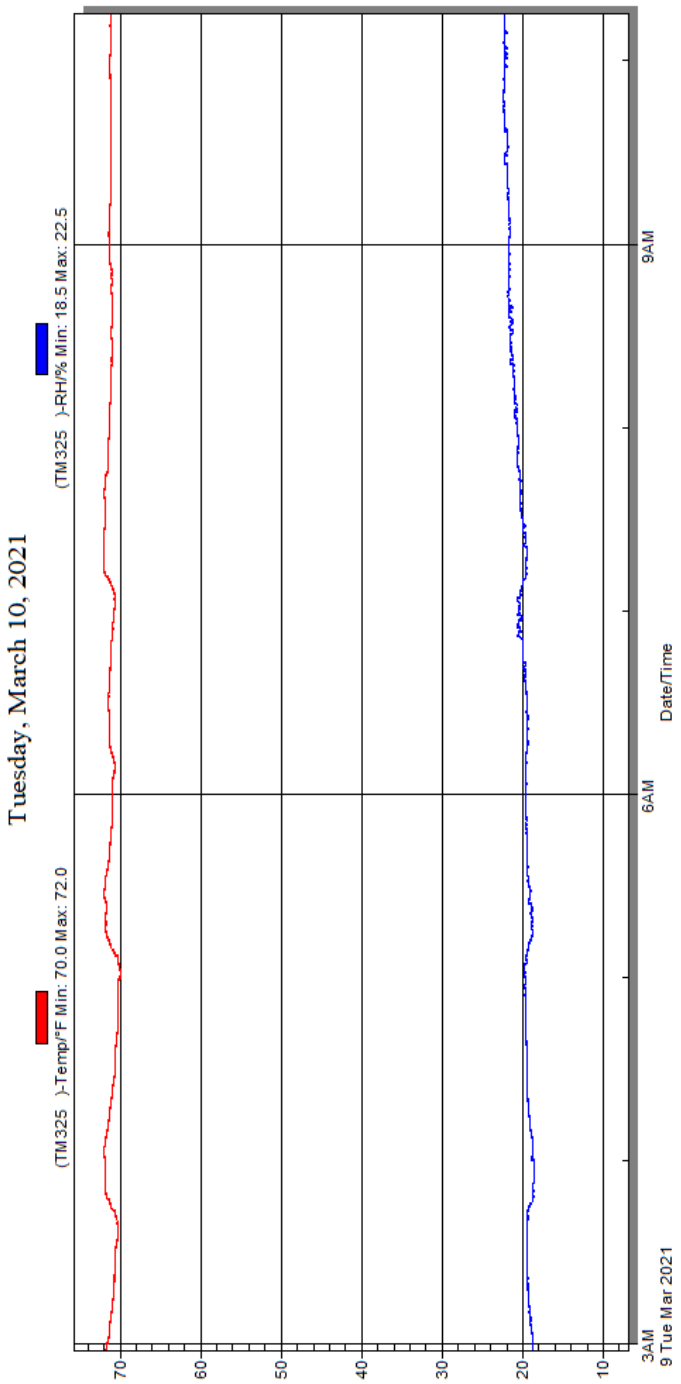
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

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

Test Vehicle:	2021 Buick Envision Preferred SUV	NHTSA No.:	M20210102
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/9/2021



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

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Figure A-1: As-Delivered Right Front 3/4 View of Test Vehicle

Figure A-2: As-Delivered Left Rear 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 ¾ View of Test Vehicle

Figure A-6: Post-Test Left Front ¾ View of Test Vehicle

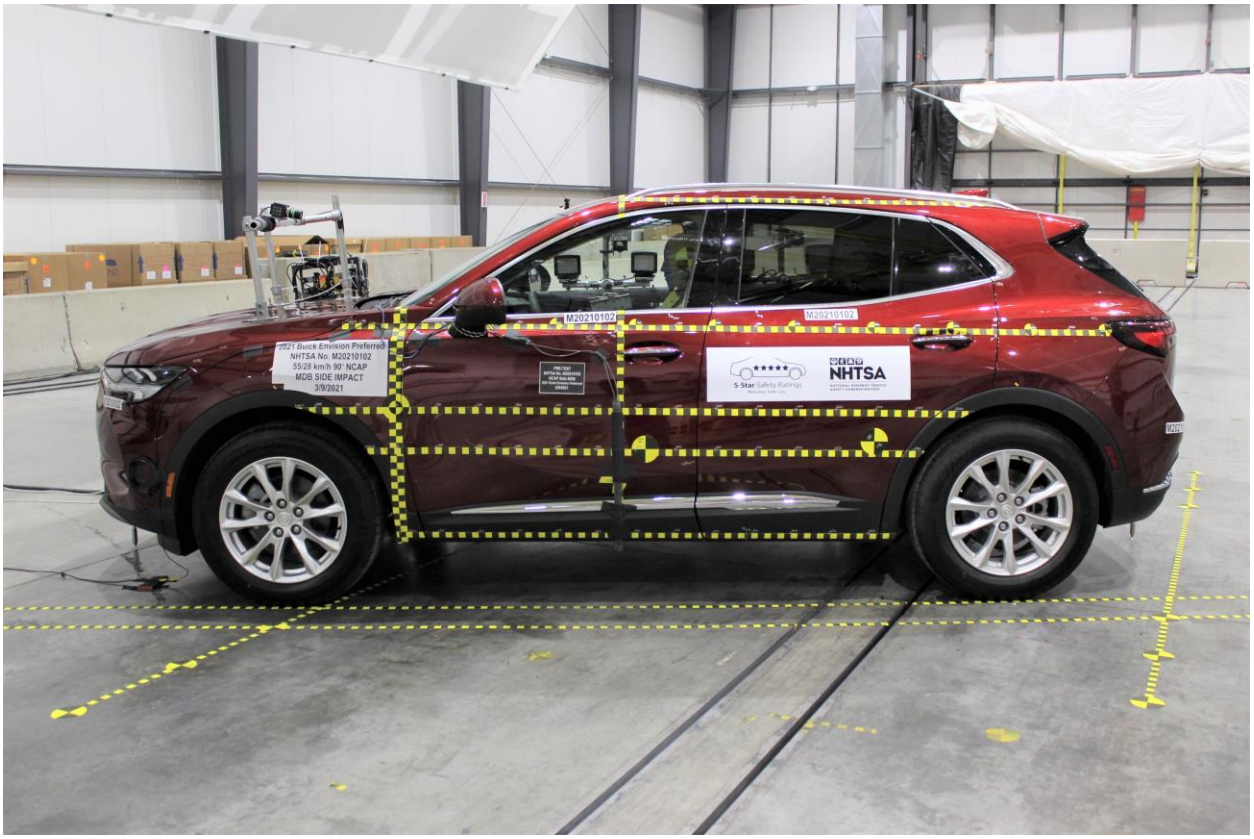


Figure A-7: Pre-Test Left Side View of Test Vehicle

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

Figure A-9: Pre-Test Left Rear ¾ View of Test Vehicle

Figure A-10: Post-Test Left Rear ¾ View of Test Vehicle

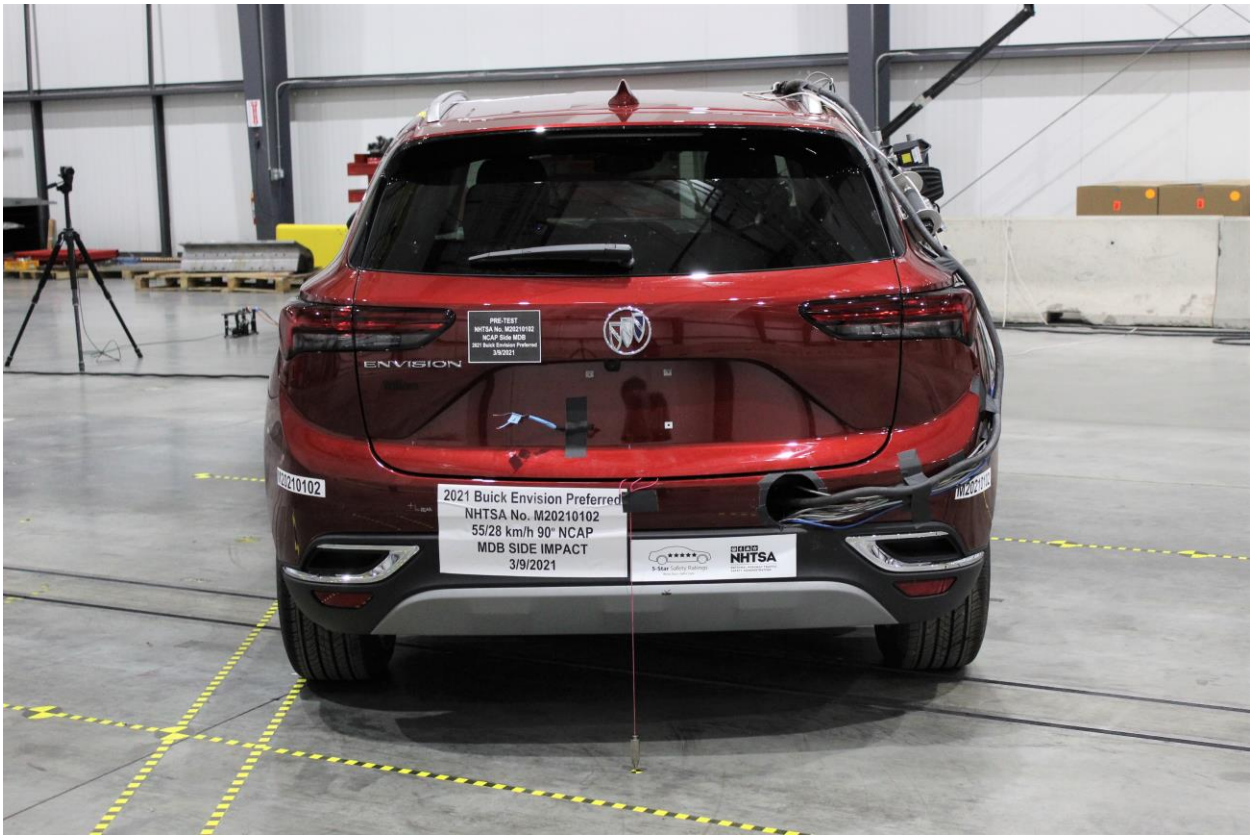


Figure A-11: Pre-Test Rear View of Test Vehicle

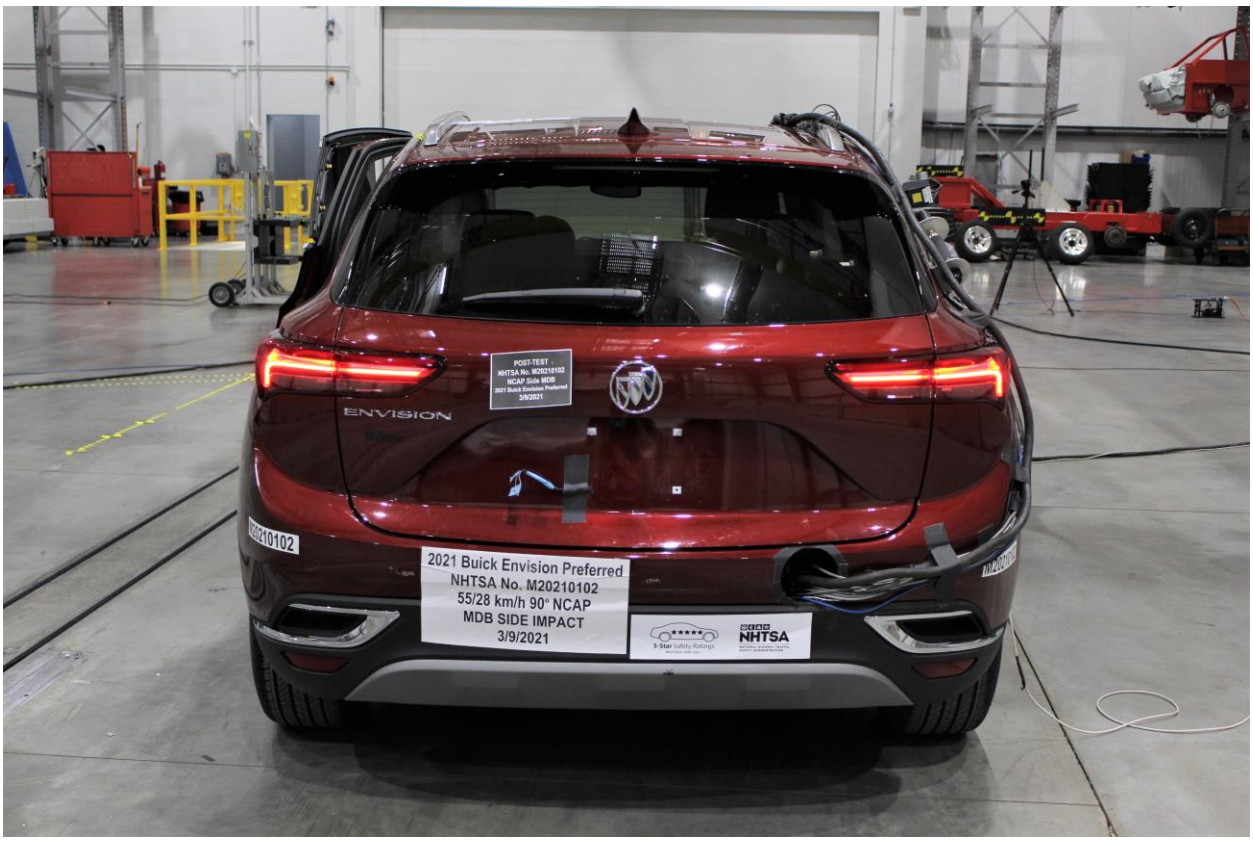


Figure A-12: Post-Test Rear View of Test Vehicle

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

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

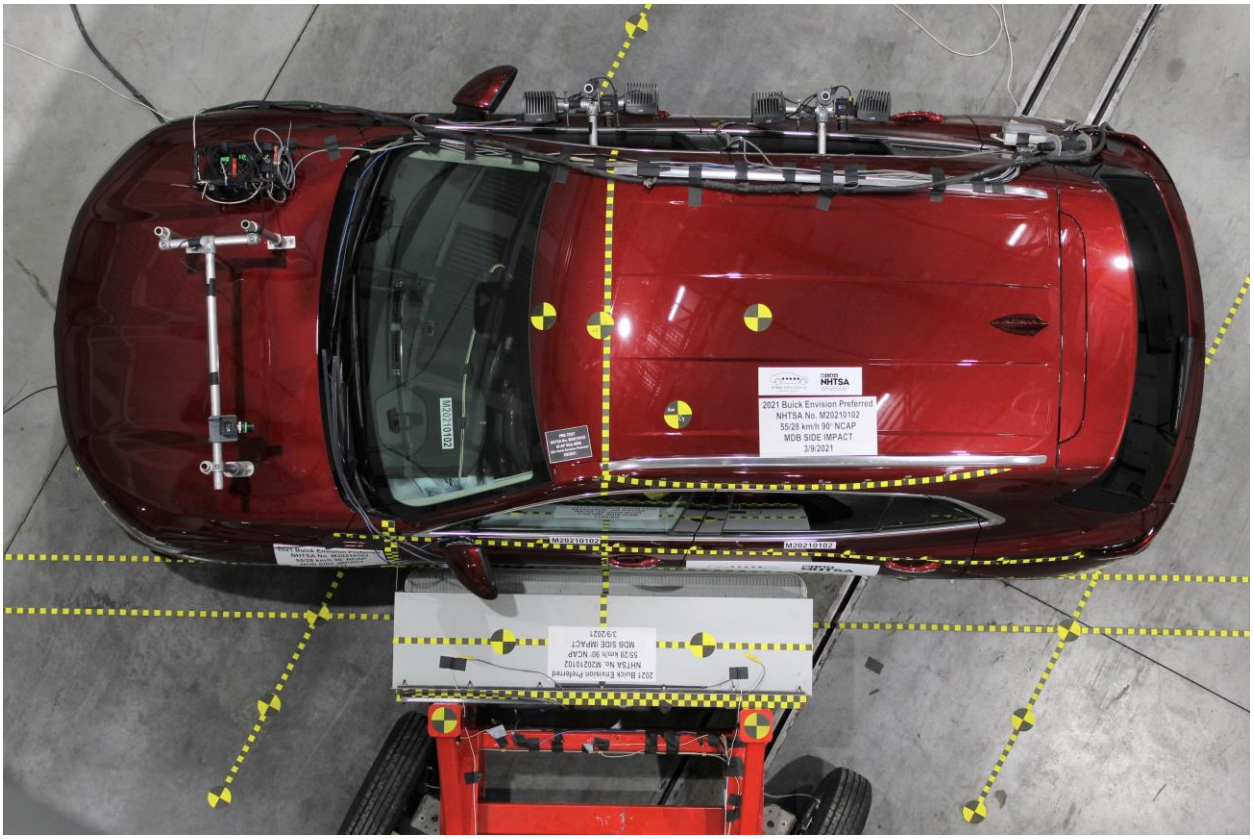


Figure A-15: Pre-Test Overhead View of the Test Area

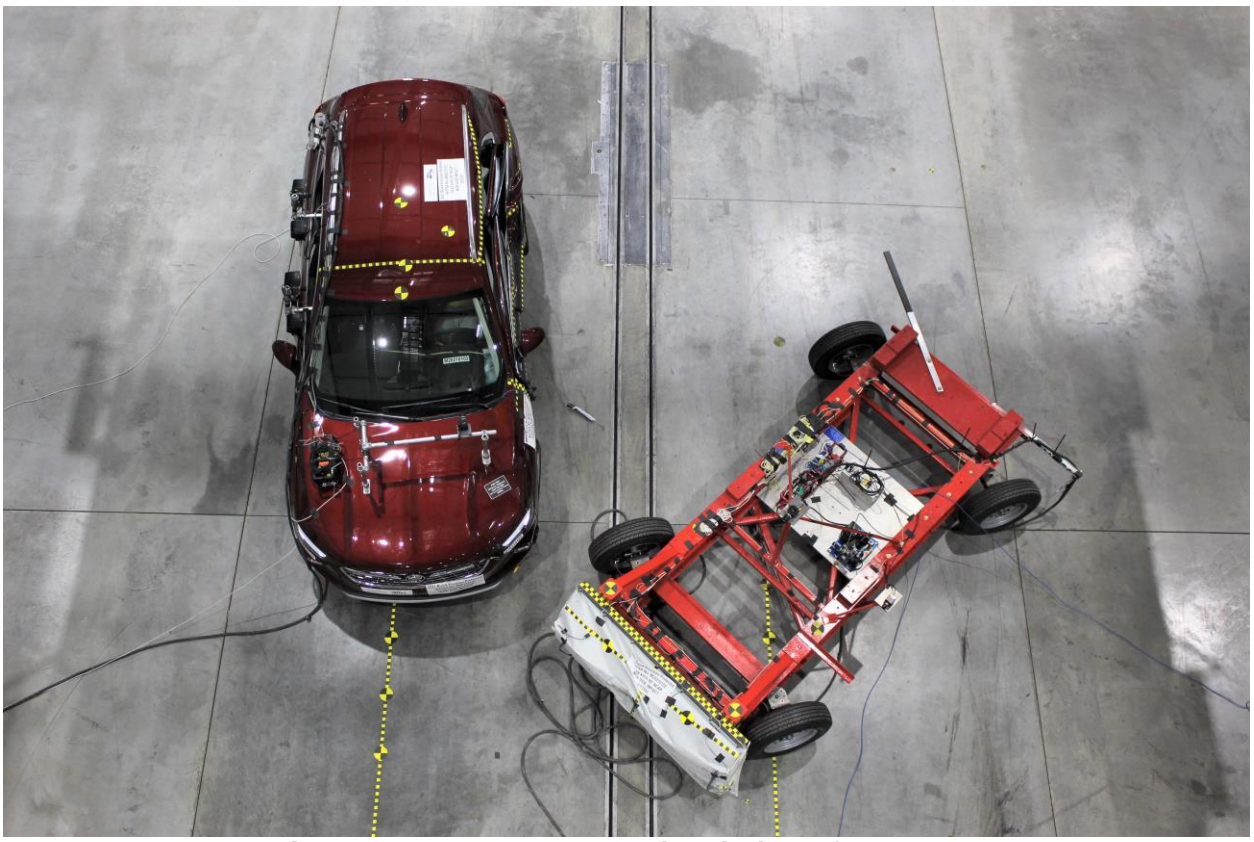


Figure A-16: Post-Test Overhead View of Test Area

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

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

Figure A-21: Pre-Test Left Front Door Latch Close-Up

Figure A-22: Post-Test Left Front Door Latch Close-Up

Figure A-23: Pre-Test Left Rear Door Latch Close-Up

Figure A-24: Post-Test Left Rear Door Latch Close-Up

Figure A-25: Pre-Test Front Close-up View of Driver Dummy

Figure A-26: Post-Test Front Close-up View of Driver Dummy

Figure A-27: Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking

Figure A-28: Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View

Figure A-29: Post-Test Left Side View of Driver Dummy Shoulder and Door Top View

Figure A-30: Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning

Figure A-31: Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint

Figure A-32: Pre-Test Frontal View of Driver Seat Pan Prior to Dummy Positioning

Figure A-33: Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan

Figure A-34: Pre-Test Placement of Driver Dummy's Feet

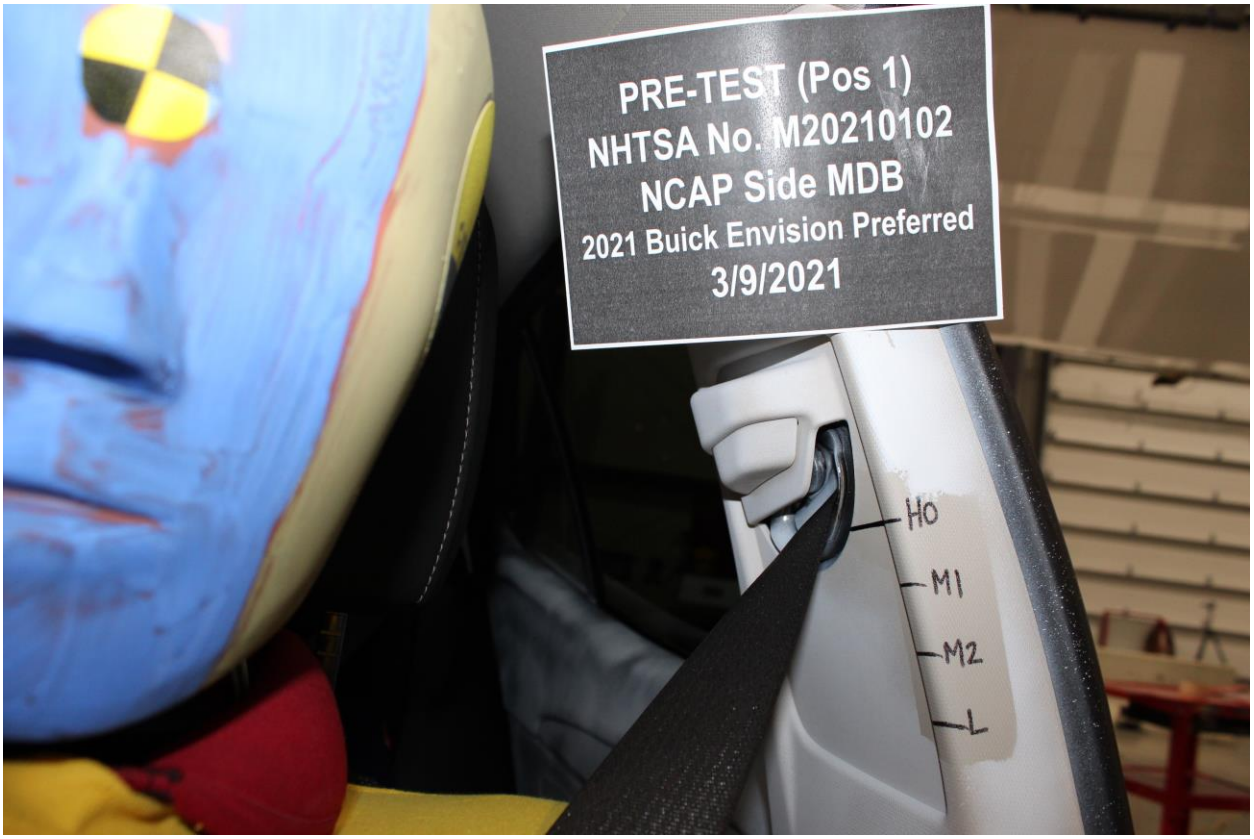


Figure A-35: Pre-Test View of Belt Anchorage for Driver Dummy

Figure A-36: Pre-Test Left Side View of Steering Wheel

Figure A-37: View of Disengaged Parking Brake

Figure A-38: Pre-Test View of Parking Brake

Figure A-39: Pre-test Close-Up Left Side View of Driver Seat Track

Figure A-40: Pre-Test Close-Up Left Side View of Driver Seat Back

Figure A-41: Pre-Test Close-Up View of Driver Seat Back or Head Restraint

Figure A-42: Pre-Test Driver Dummy and Door Clearance View

Figure A-43: Post-Test Driver Dummy and Door Clearance View

Figure A-44: Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment

Figure A-45: Post-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment

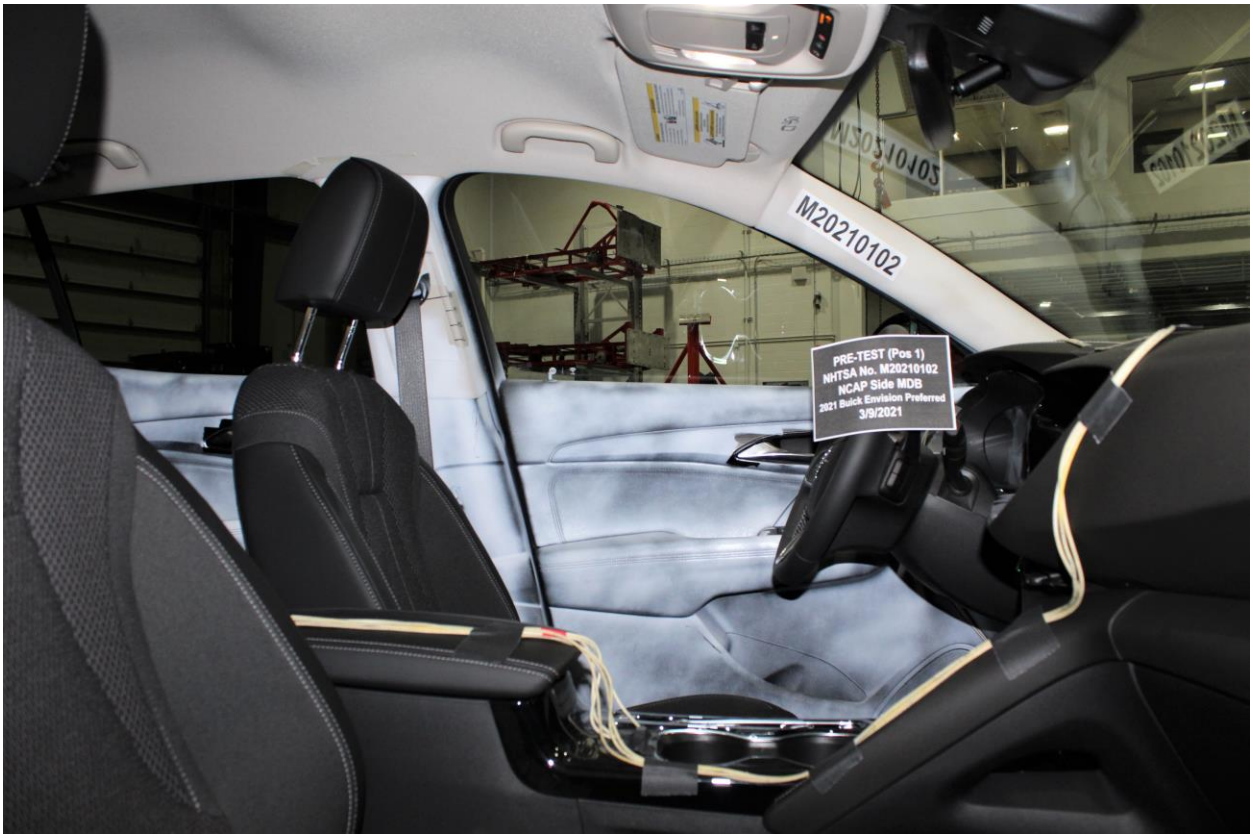


Figure A-46: Pre-Test Driver Inner Door Panel View

Figure A-47: Post-Test Driver Inner Door Panel View Showing Driver Dummy Contact Locations

Figure A-48: Post-Test Driver Dummy Close-Up Head Contact with Vehicle View

Figure A-49: Post-Test Driver Dummy Close-Up Head Contact with Side Air bag View

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

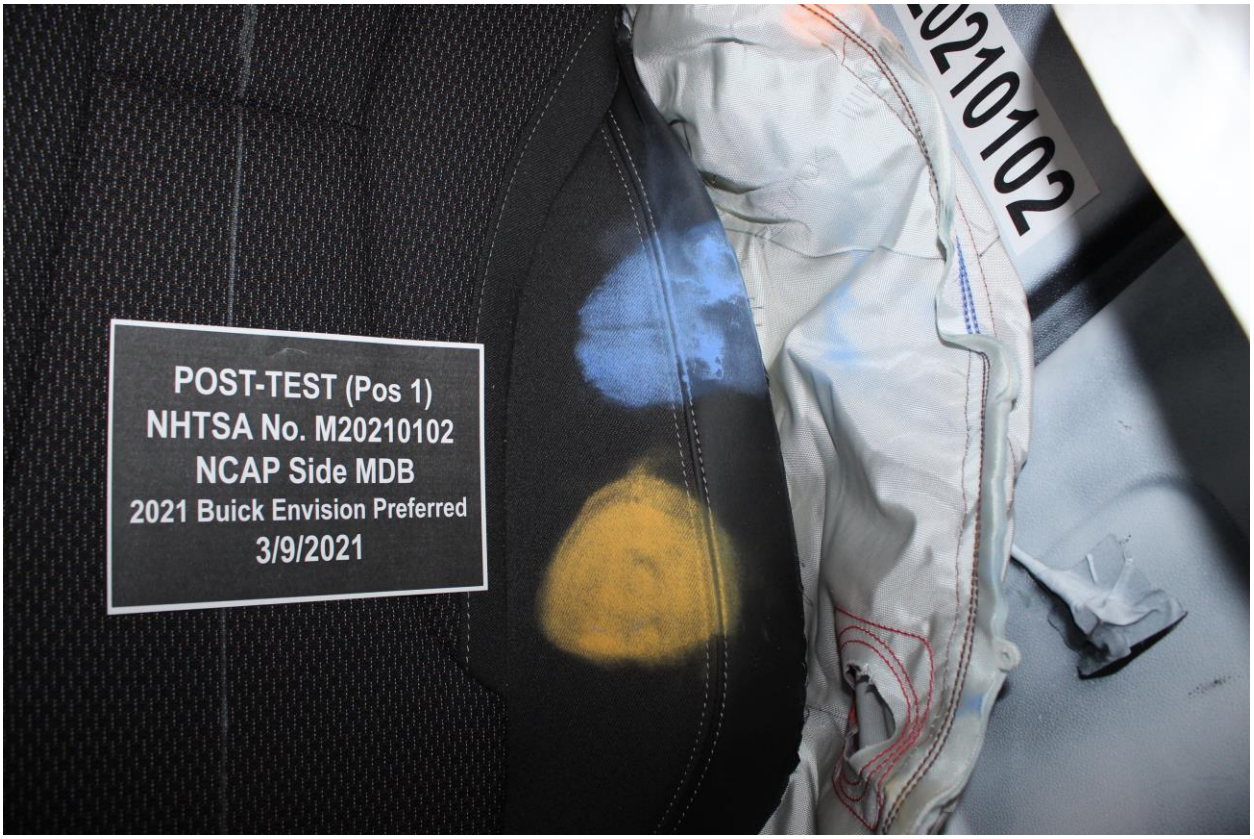


Figure A-51: Post-Test Driver Dummy Close-Up Torso Contact with Side Air bag View

Figure A-52: Post-Test Driver Dummy Close-Up Pelvis Contact View

Figure A-53: Post-Test Driver Dummy Close-Up Pelvis Contact with Side Air bag View

Figure A-54: Post-Test Driver Dummy Close-Up Knee Contact View

Figure A-55: Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking

Figure A-56: Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View

Figure A-57: Post-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View

Figure A-58: Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning

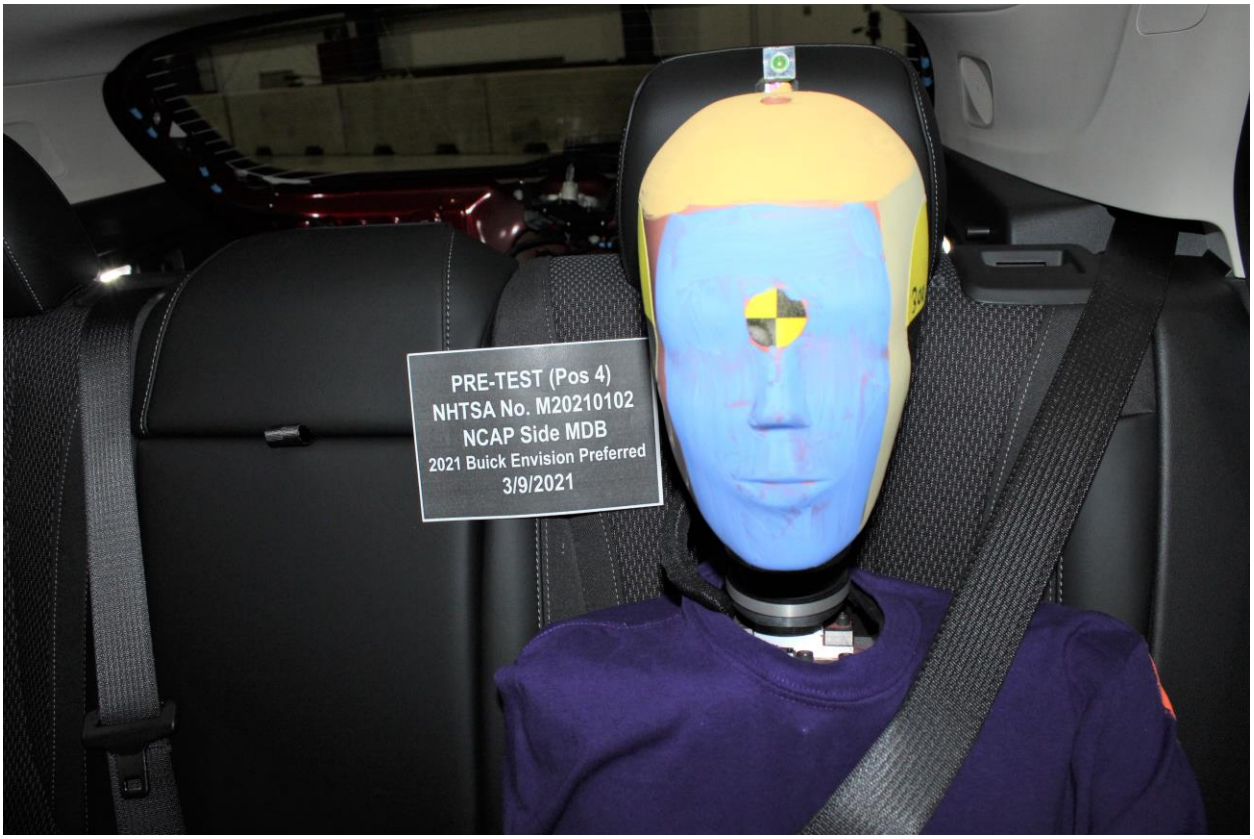


Figure A-59: Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint

Figure A-60: Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning

Figure A-61: Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan

Figure A-62: Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket

Figure A-63: Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level

Figure A-64: Pre-Test Placement of Rear Passenger Dummy's Feet

Figure A-65: Pre-Test View of Belt Anchorage for Rear Passenger Dummy

Figure A-66: Pre-Test Close-Up Left Side View of Rear Passenger Seat Track

Figure A-67: Pre-Test Close-Up Left Side View of Rear Passenger Seat Back

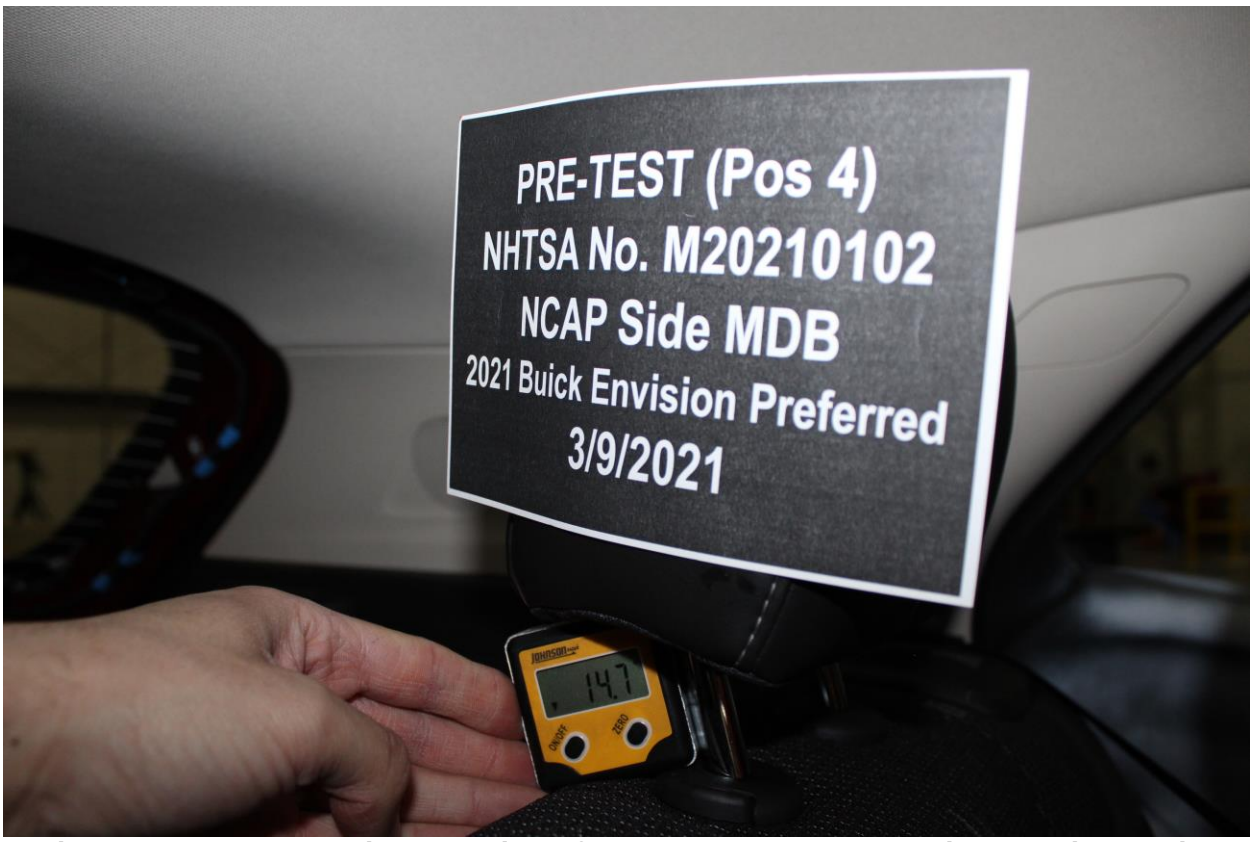


Figure A-68: Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint

Figure A-69: Pre-Test Rear Passenger Dummy and Door Clearance View

Figure A-70: Post-Test Rear Passenger Dummy and Door Clearance View

Figure A-71: Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment

Figure A-72: Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment

Figure A-73: Pre-Test Rear Passenger Inner Door Panel View

Figure A-74: Post-Test Rear Passenger Inner Door Panel View Showing Rear Passenger Dummy Contact Locations

Figure A-75: Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle View

Figure A-76: Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Air bag View

Figure A-77: Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View

Photo Not Applicable

Figure A-78: Post-Test Rear Passenger Dummy Close-Up Torso Contact with Side Air bag View

Figure A-79: Post-Test Rear Passenger Dummy Close-Up Pelvis Contact View

Photo Not Applicable

Figure A-80: Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Air bag View

Figure A-81: Post-Test Rear Passenger Dummy Close-Up Knee Contact View

Figure A-82: Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

Figure A-83: Post-Test View of Fuel Filler Cap or Fuel Filler Neck

Figure A-84: Pre-Test Front View of MDB Impactor Face

Figure A-85: Post-Test Front View of MDB Impactor Face

Figure A-86: Pre-Test Top View of MDB Impactor Face

Figure A-87: Post-Test Top View of MDB Impactor Face

Figure A-88: Pre-Test Left Side View of MDB Impactor Face

Figure A-89: Post-Test Left Side View of MDB Impactor Face

Figure A-90: Pre-Test Right Side View of MDB Impactor Face

Figure A-91: Post-Test Right Side View of MDB Impactor Face

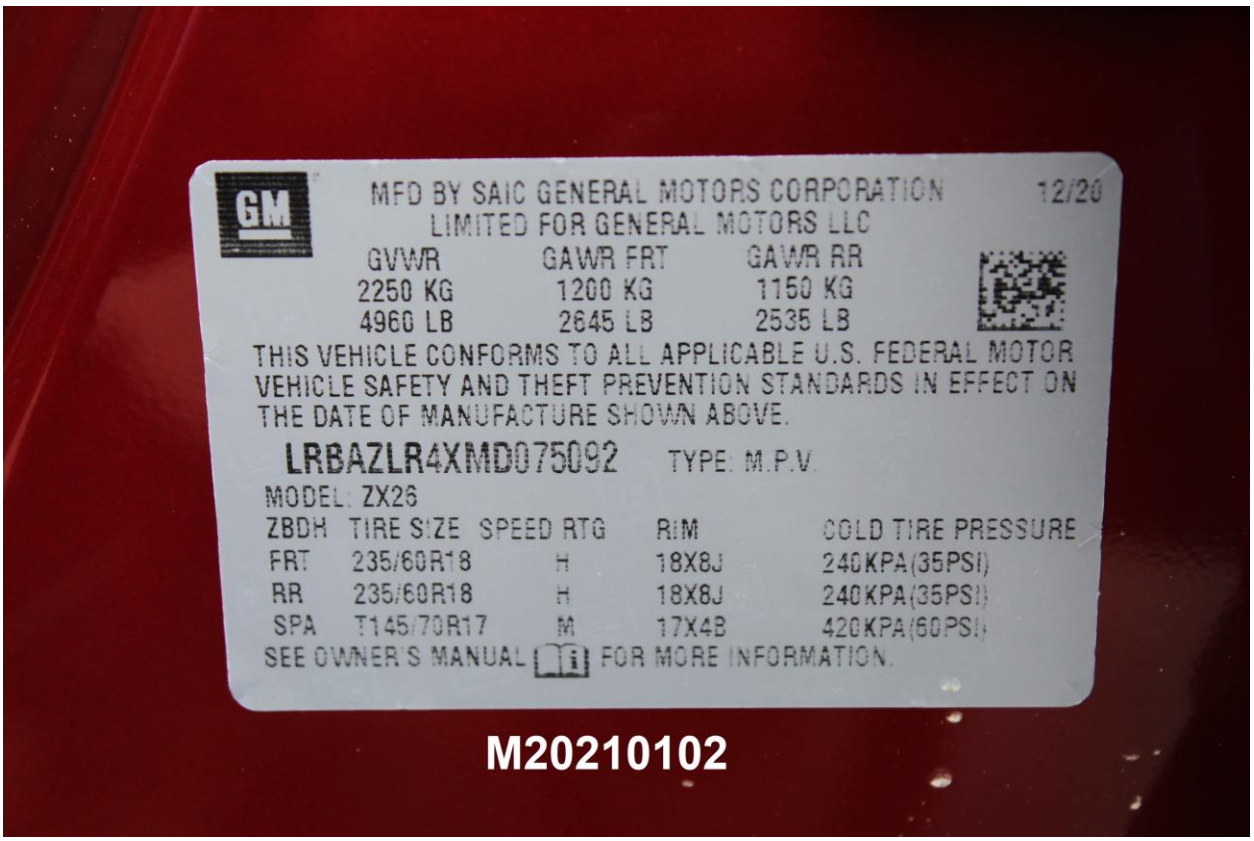


Figure A-92: Close-Up View of Vehicle's Certification Label

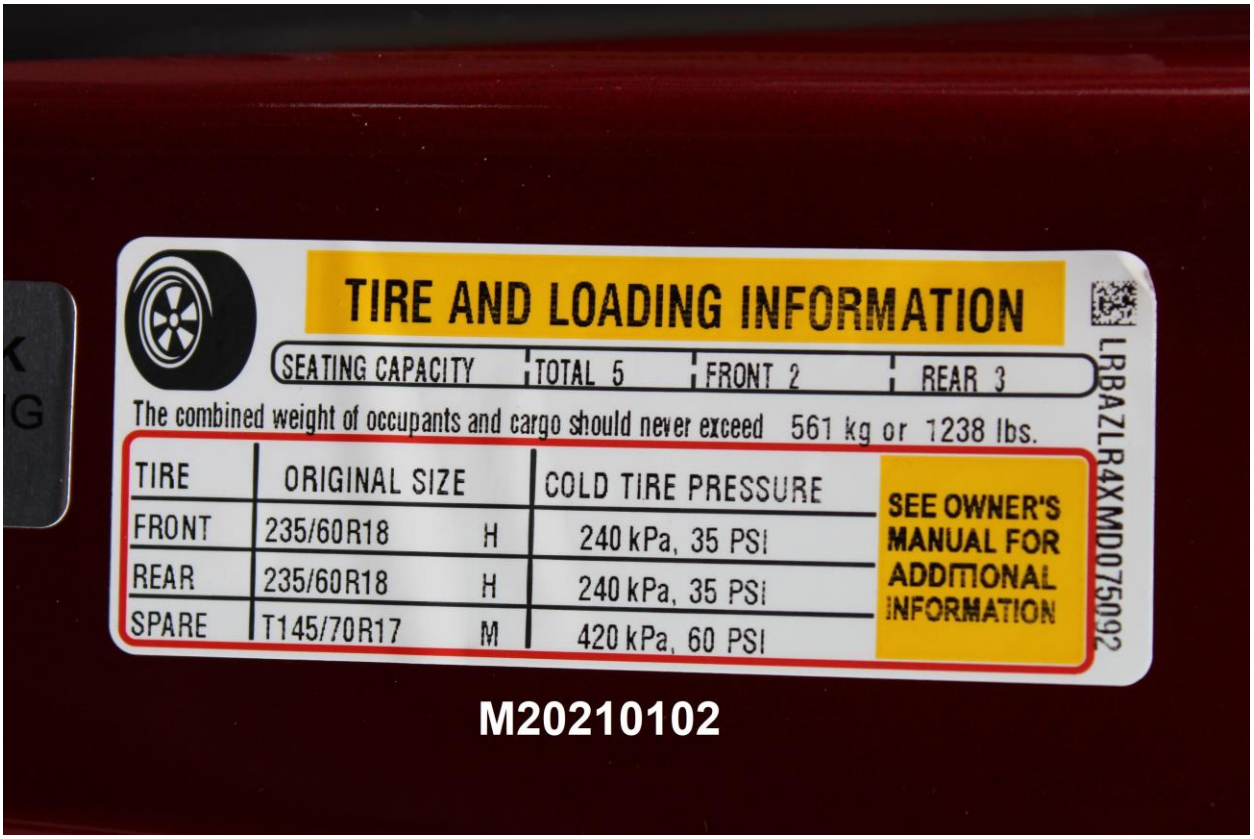


Figure A-93: Close-Up View of Vehicle's Tire Information Placard or Label

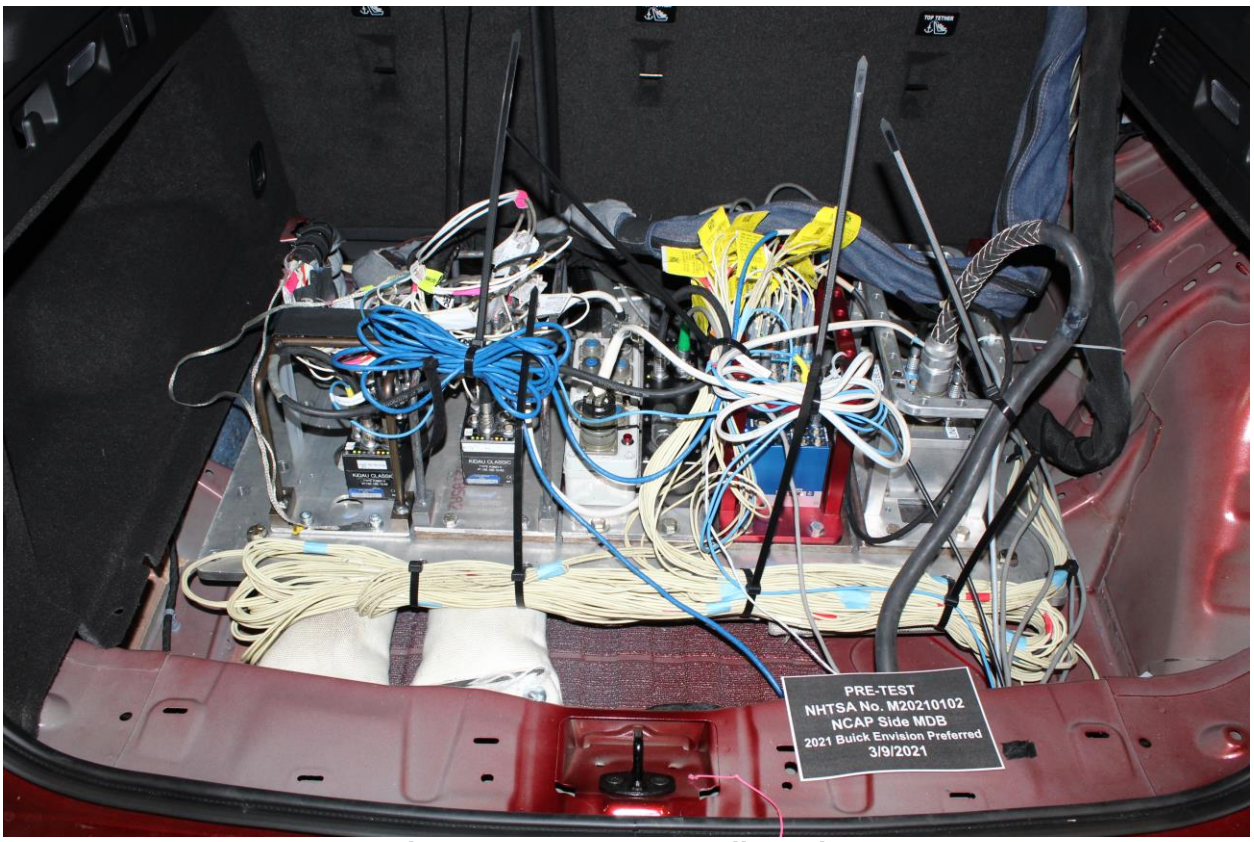


Figure A-94: Pre-Test Ballast View

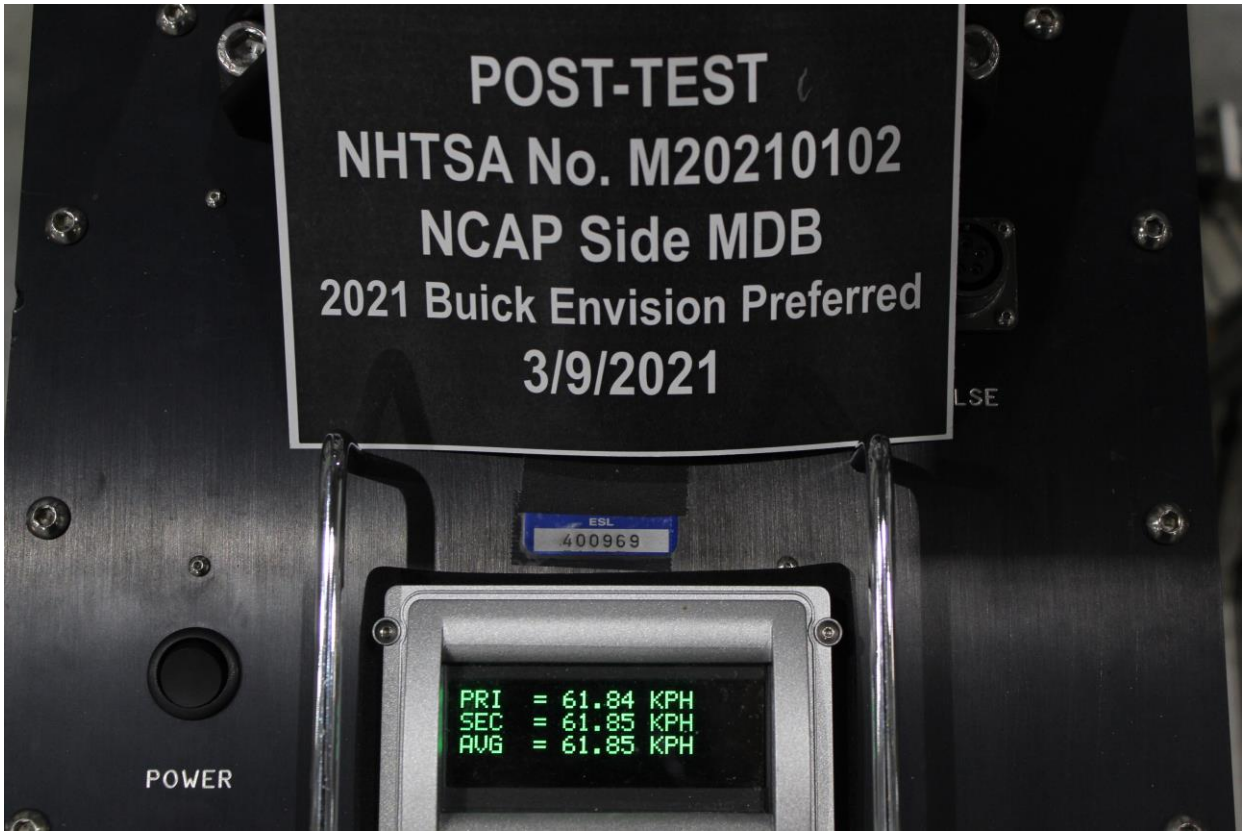


Figure A-95: Post-Test Primary and Redundant Speed Trap Read-Out

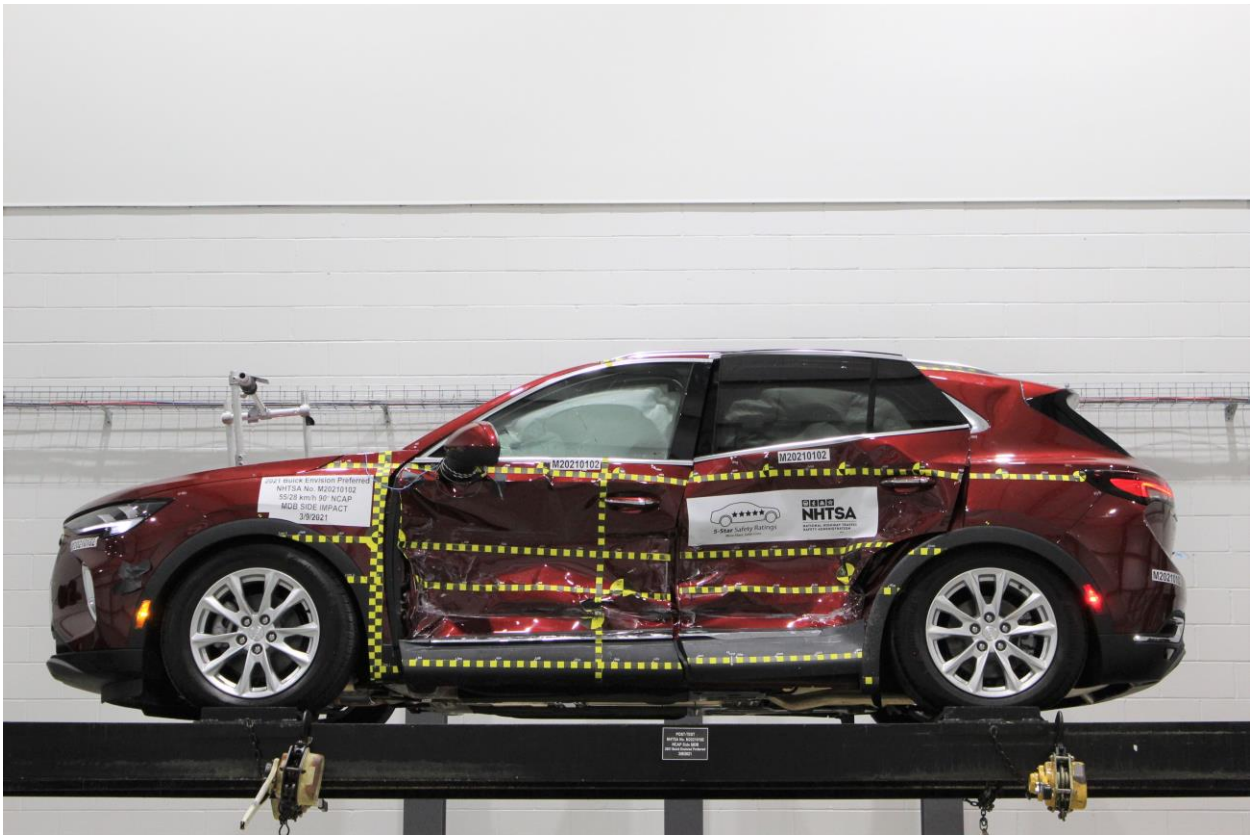


Figure A-96: FMVSS No. 301 Static Rollover 0 Degrees

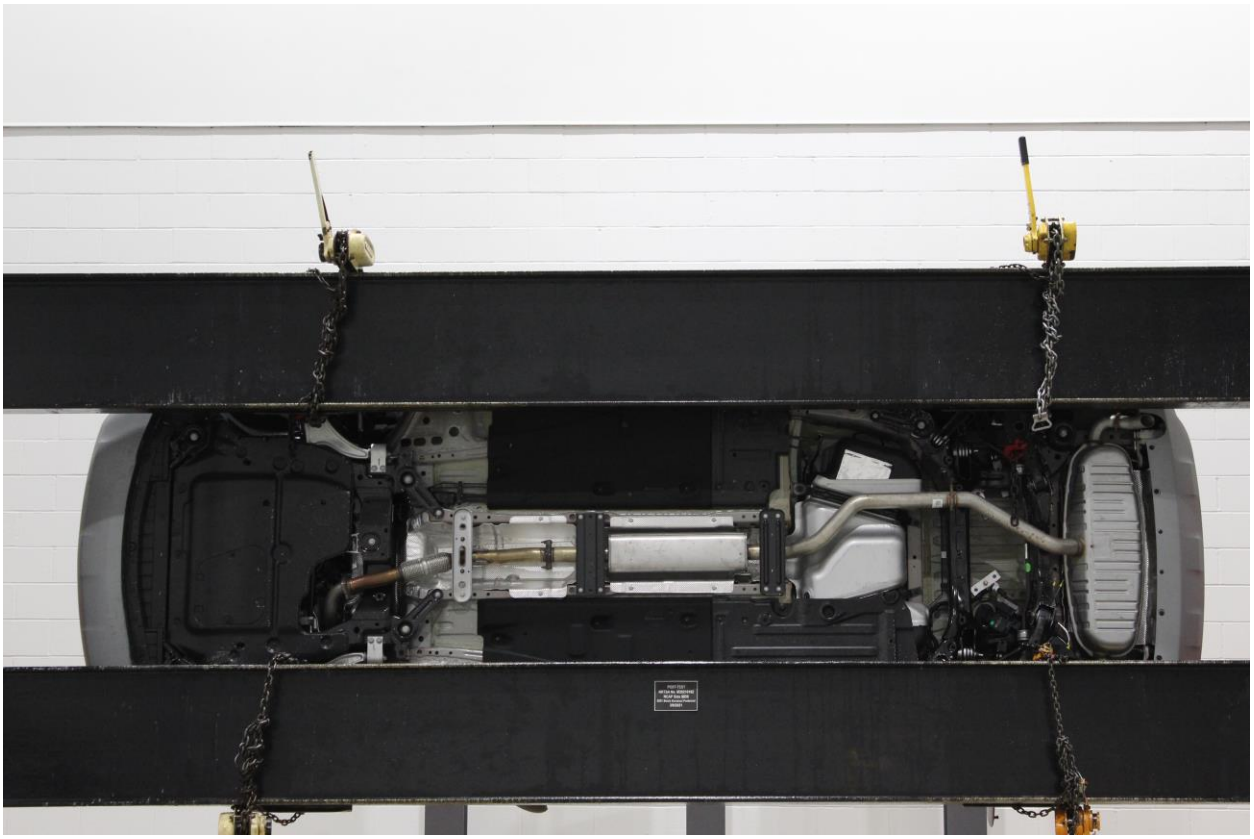


Figure A-97: FMVSS No. 301 Static Rollover 90 Degrees

Figure A-98: FMVSS No. 301 Static Rollover 180 Degrees

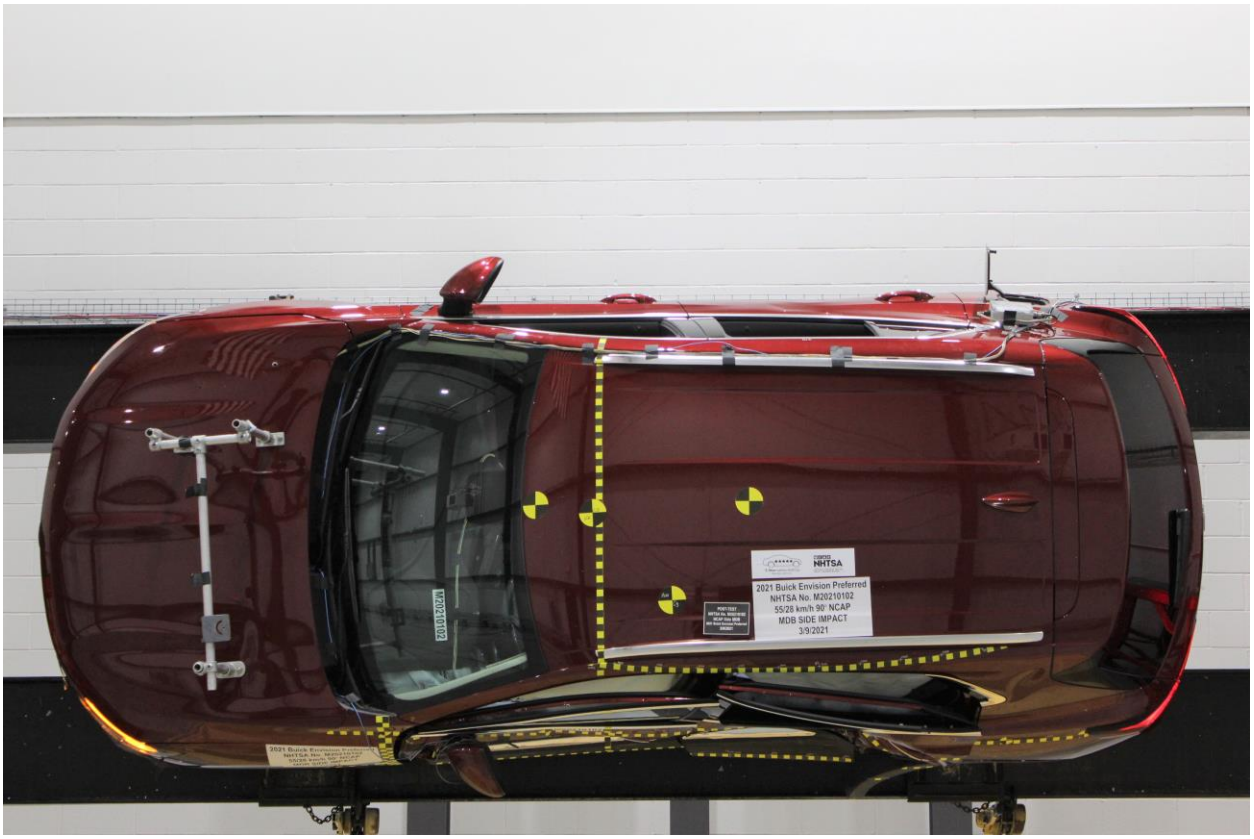


Figure A-99: FMVSS No. 301 Static Rollover 270 Degrees

Figure A-100: FMVSS No. 301 Static Rollover 360 Degrees

Figure A-101: Impact Event

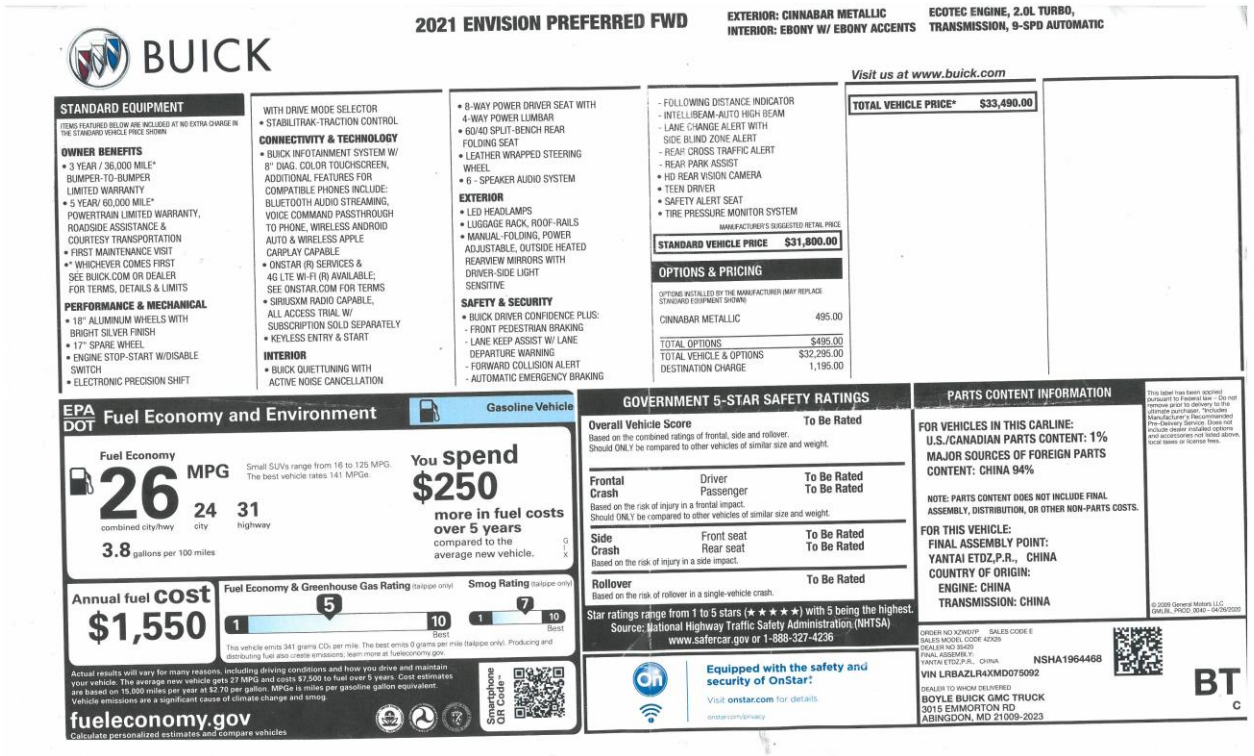
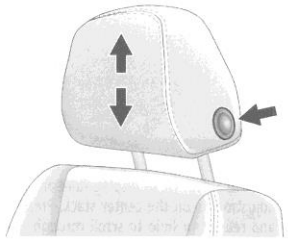


Figure A-102: Monroney Label

Adjust the head restraint so that the top of the restraint is at the same height as the top of the occupant's head. This position reduces the chance of a neck injury in a crash.

The height of the head restraint can be adjusted.



To raise or lower the head restraint, press the button located on the side of the head restraint, and pull up or push the head restraint down, and release the button. Pull and push on the head restraint after the button is released to make sure that it is locked in place.

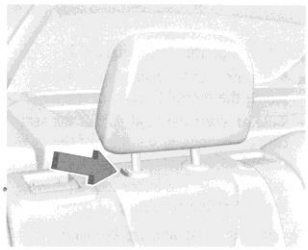
The front seat outboard head restraints are not removable.

Rear Seats

Second Row Seats

The vehicle's rear second row seats have adjustable head restraints in the outboard seating positions.

The height of the head restraint can be adjusted. Pull the head restraint up to raise it. Try to move the head restraint to make sure that it is locked in place.



To lower the head restraint, press the button, located on the top of the seatback, and push the head restraint down.

The second row head restraints are not removable.

Front Seats

Seat Adjustment

⚠ Warning

You can lose control of the vehicle if you try to adjust a driver seat while the vehicle is moving. Adjust the driver seat only when the vehicle is not moving.

To adjust a manual seat:

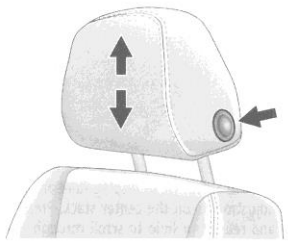
1. Lift the handle under the seat to unlock it.
2. Move the seat forward or rearward to adjust the seat position.

Figure A-103: Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

Seats and Restraints 33

Adjust the head restraint so that the top of the restraint is at the same height as the top of the occupant's head. This position reduces the chance of a neck injury in a crash.

The height of the head restraint can be adjusted.



To raise or lower the head restraint, press the button located on the side of the head restraint, and pull up or push the head restraint down, and release the button. Pull and push on the head restraint after the button is released to make sure that it is locked in place.

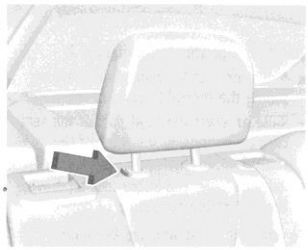
The front seat outboard head restraints are not removable.

Rear Seats

Second Row Seats

The vehicle's rear second row seats have adjustable head restraints in the outboard seating positions.

The height of the head restraint can be adjusted. Pull the head restraint up to raise it. Try to move the head restraint to make sure that it is locked in place.



To lower the head restraint, press the button, located on the top of the seatback, and push the head restraint down.

The second row head restraints are not removable.

Front Seats

Seat Adjustment

⚠ Warning

You can lose control of the vehicle if you try to adjust a driver seat while the vehicle is moving. Adjust the driver seat only when the vehicle is not moving.

To adjust a manual seat:

1. Lift the handle under the seat to unlock it.
2. Move the seat forward or rearward to adjust the seat position.

Figure A-104: Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual-Rear Restraints Not Adjustable

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS

Driver & Passenger 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

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)

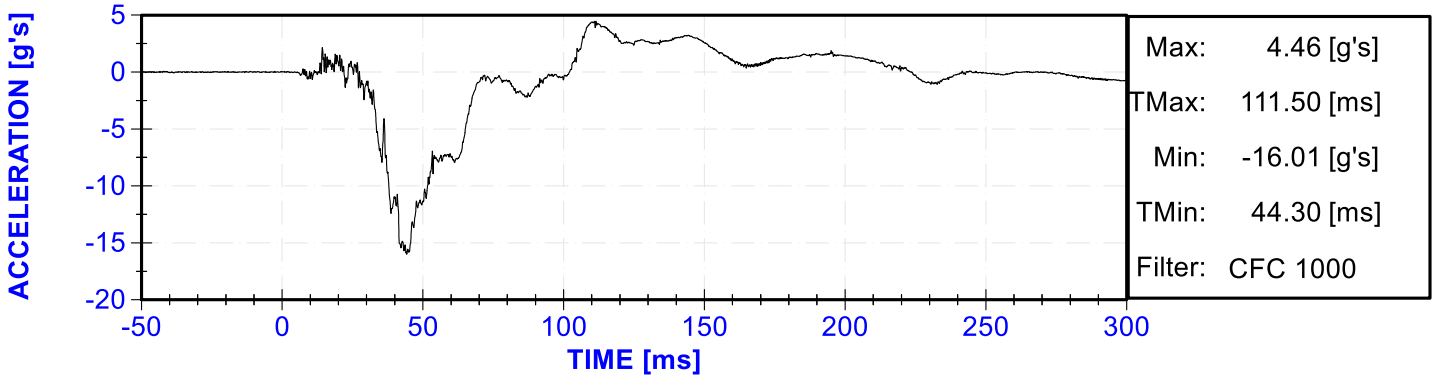
Vehicle Instrumentation Data

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 Structure 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)

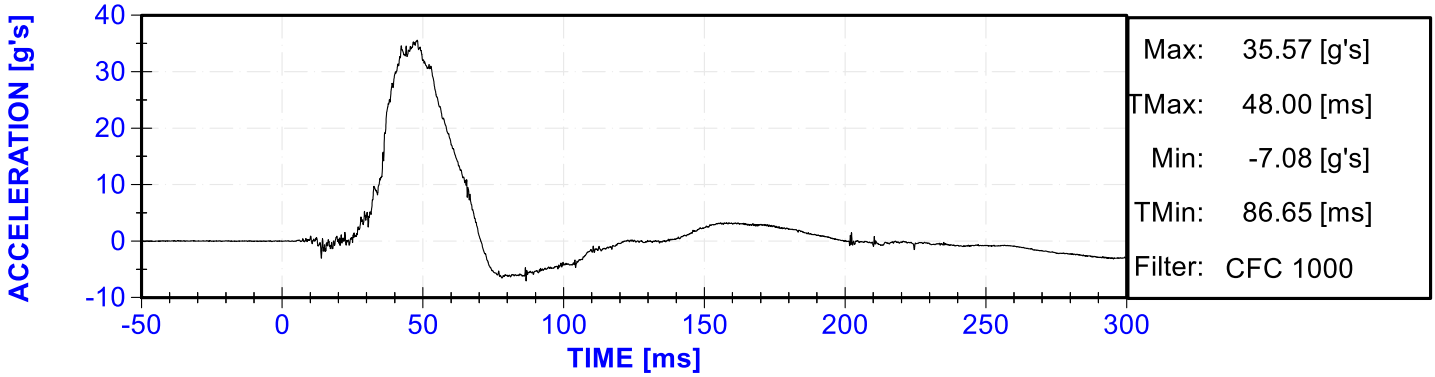
MDB Instrumentation Data

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

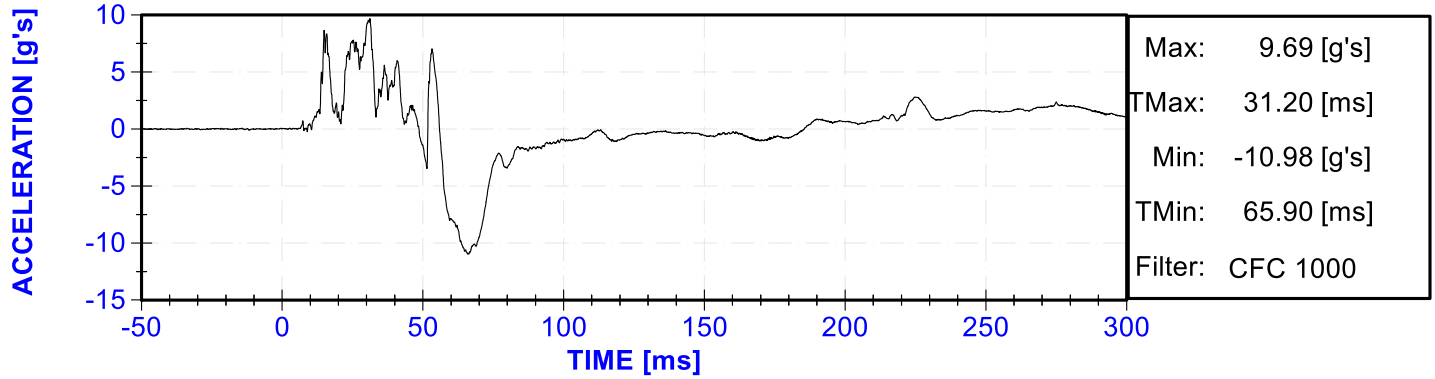
Driver Head Acceleration (X) Primary vs. Time



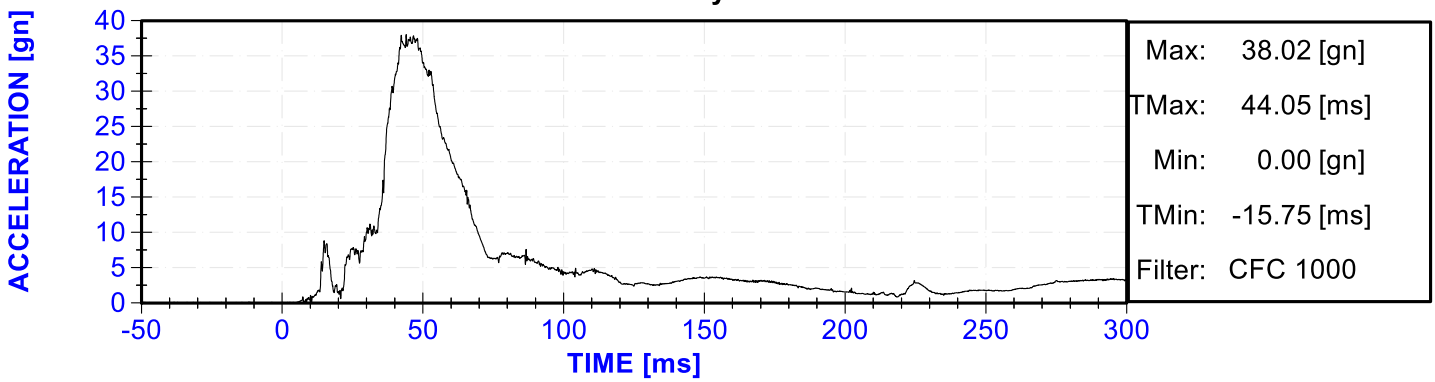
Driver Head Acceleration (Y) Primary vs. Time



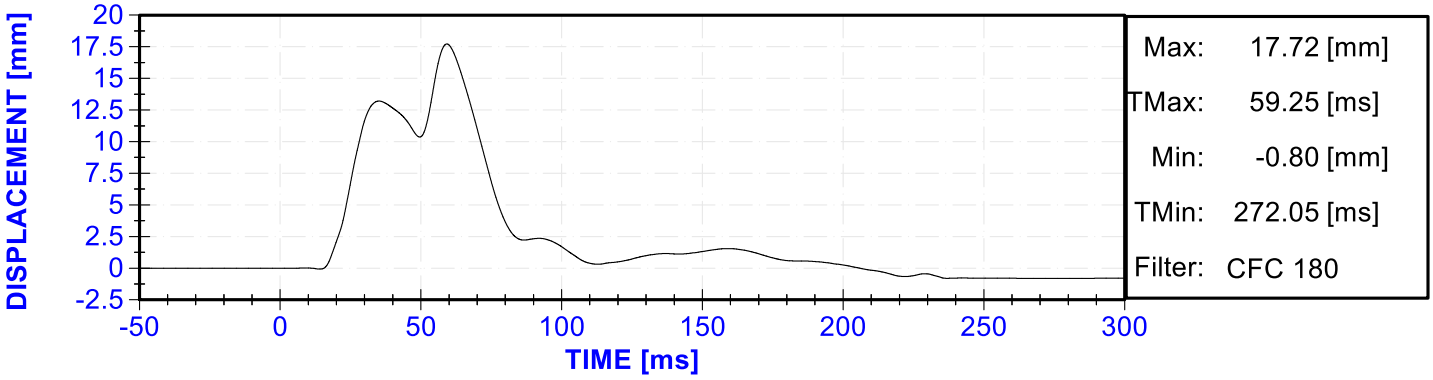
Driver Head Acceleration (Z) Primary vs. Time



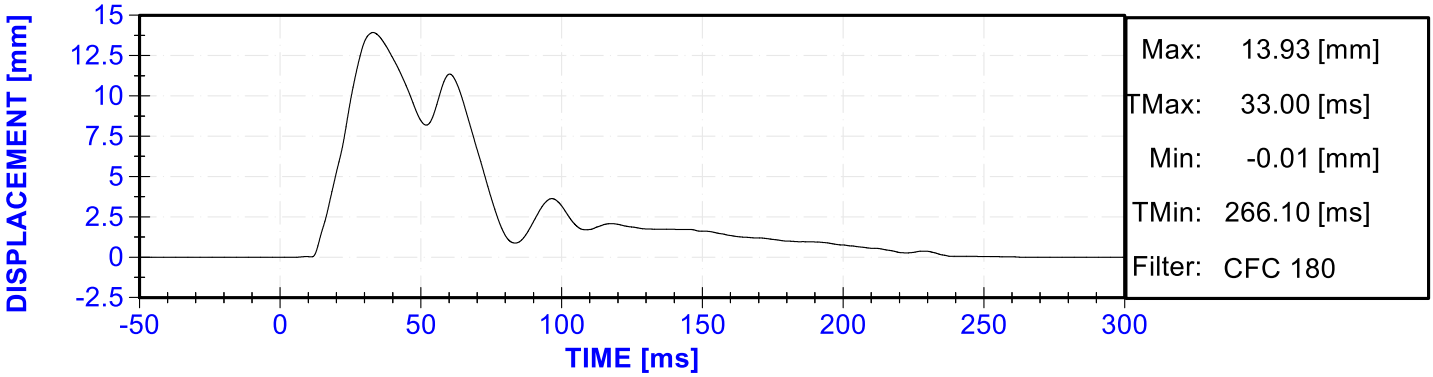
Driver Head Resultant Acceleration Primary vs. Time



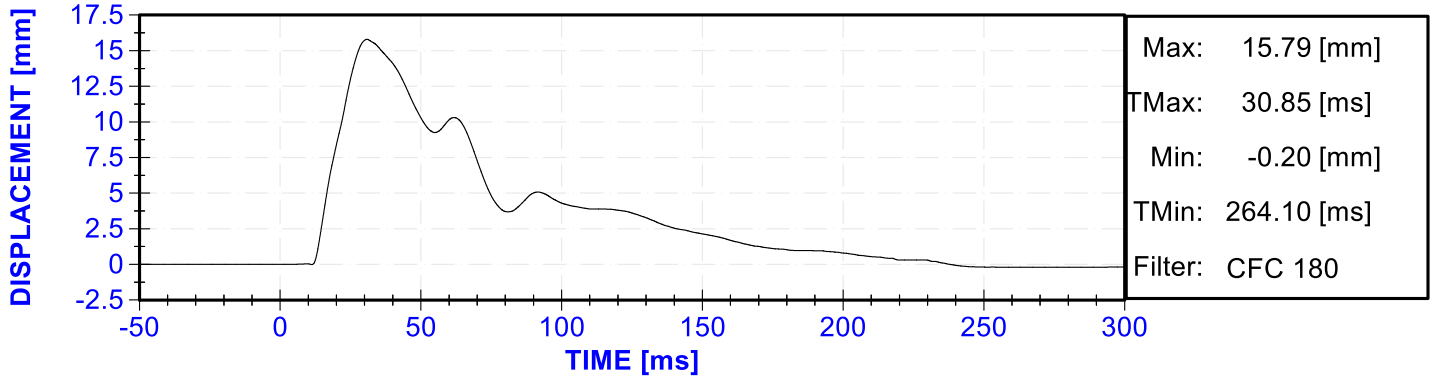
Driver Upper Thorax Rib Deflection (Y) vs. Time



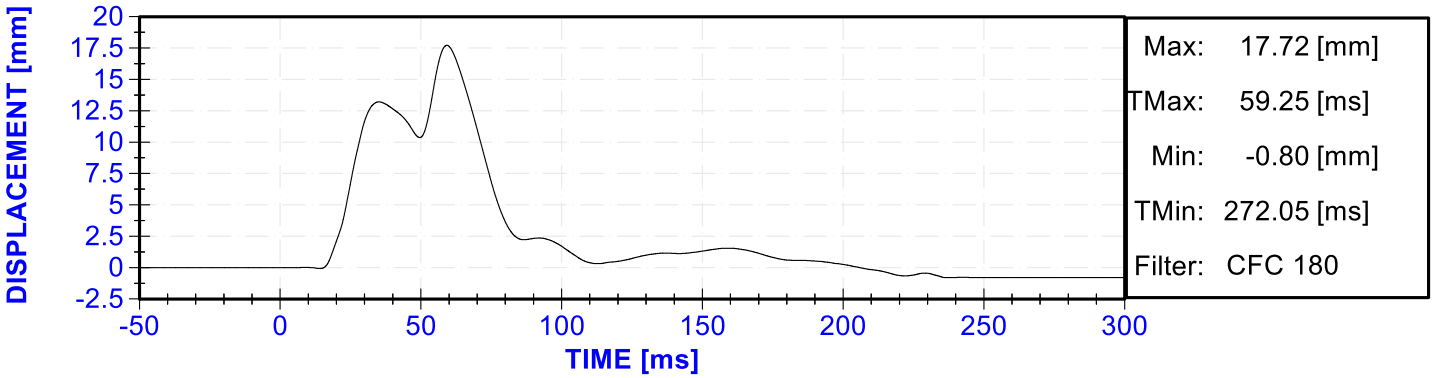
Driver Middle Thorax Rib Deflection (Y) vs. Time



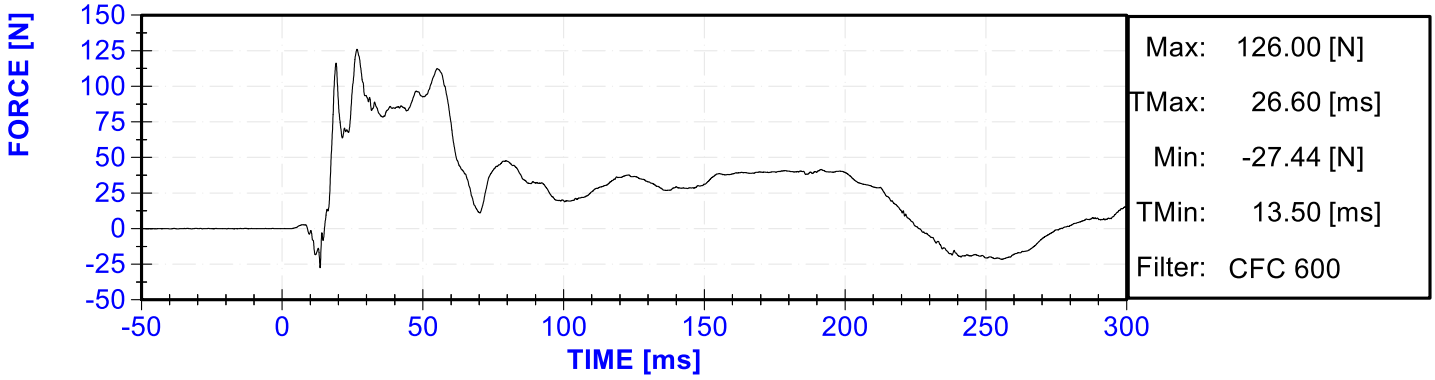
Driver Lower Thorax Rib Deflection (Y) vs. Time



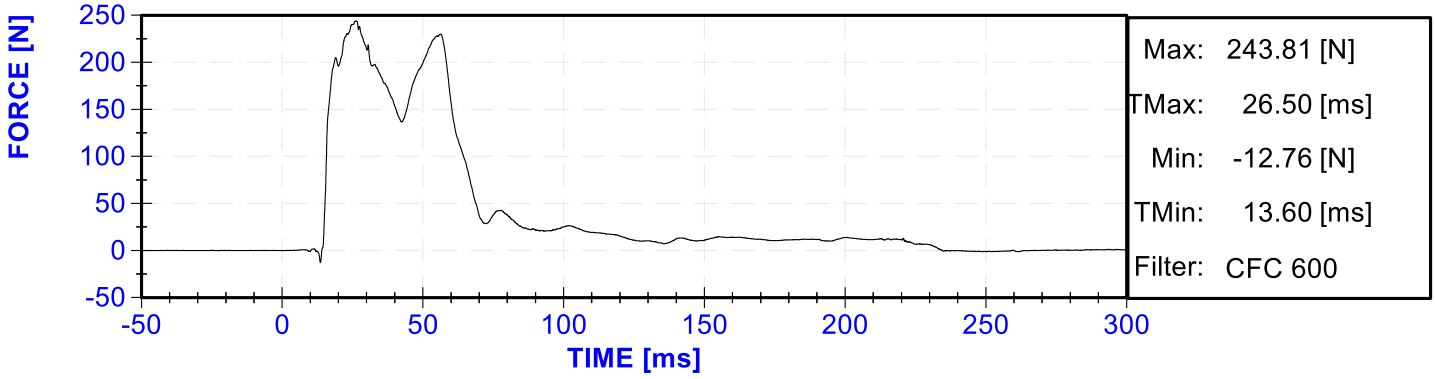
Driver Thorax Rib Deflection Maximum vs. Time



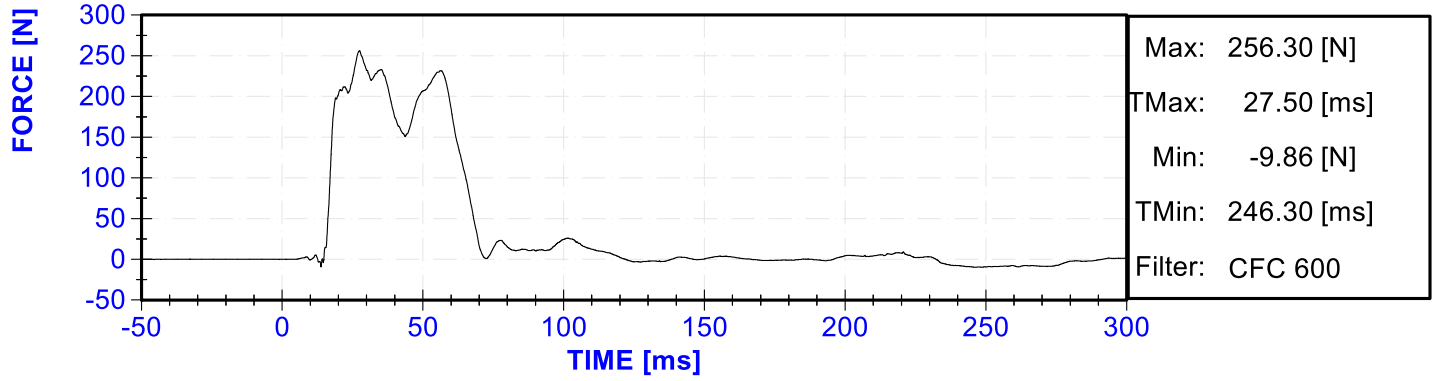
Driver Anterior Abdominal Force (Y) vs. Time



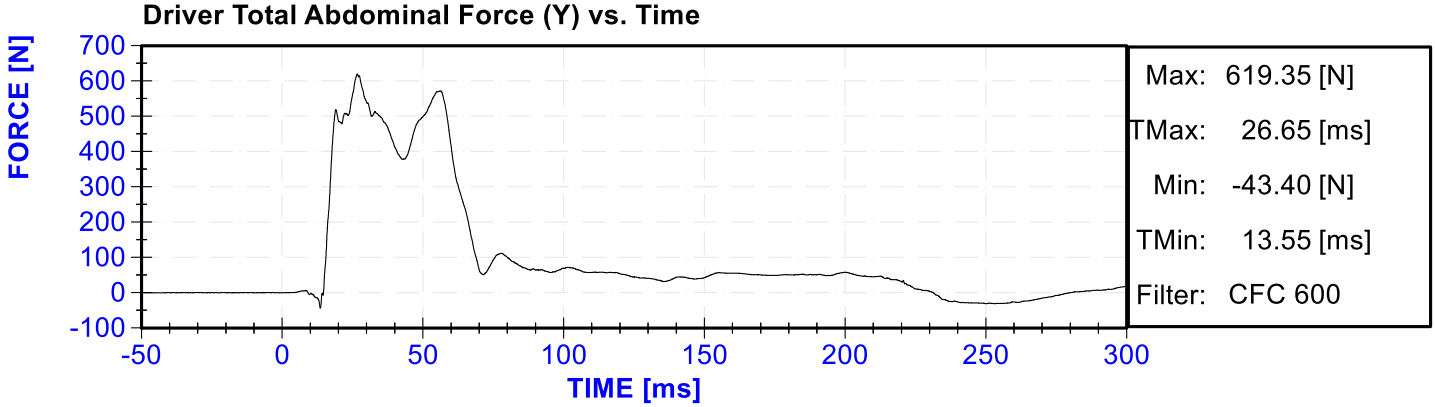
Driver Middle Abdominal Force (Y) vs. Time



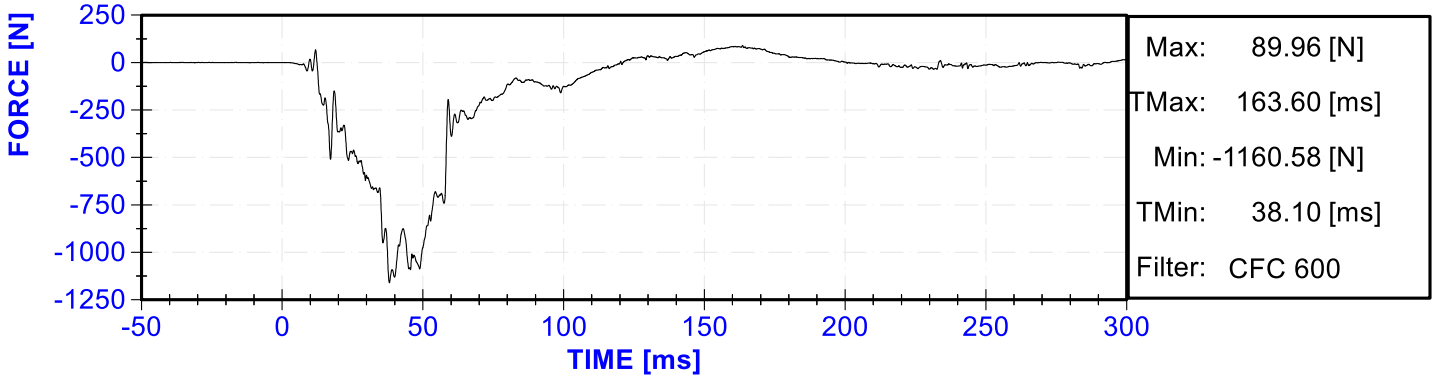
Driver Posterior Abdominal Force (Y) vs. Time



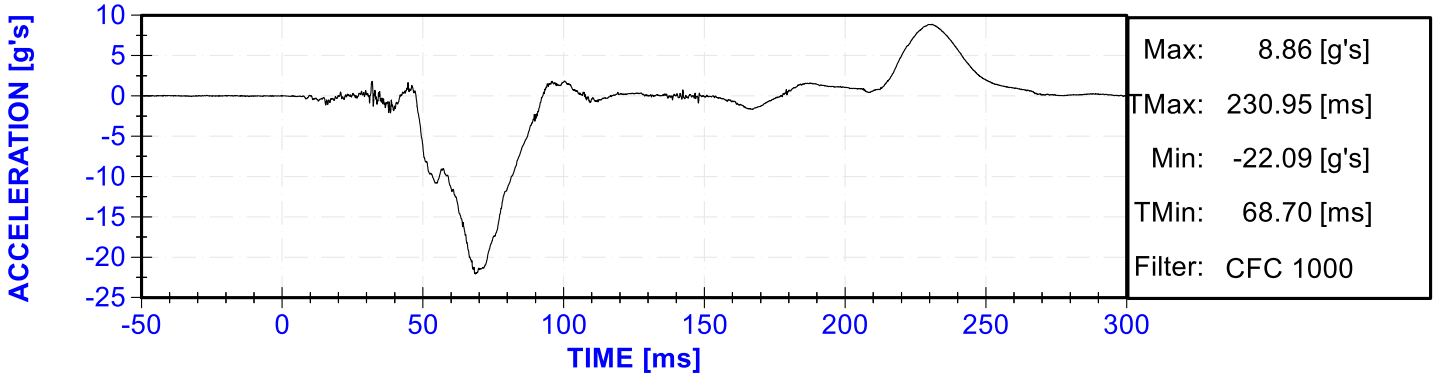
Driver Total Abdominal Force (Y) vs. Time



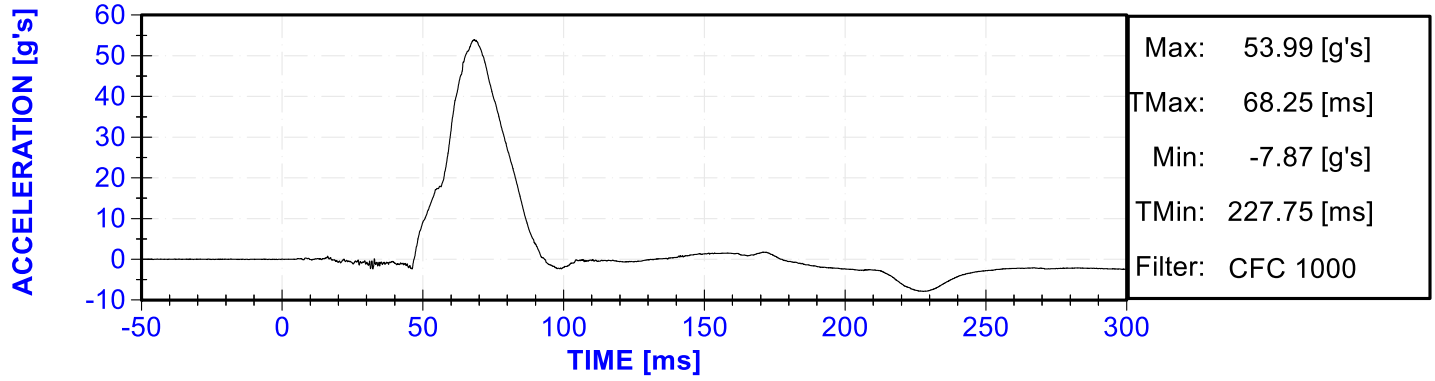
Driver Pubic Symphysis Force (Y) vs. Time



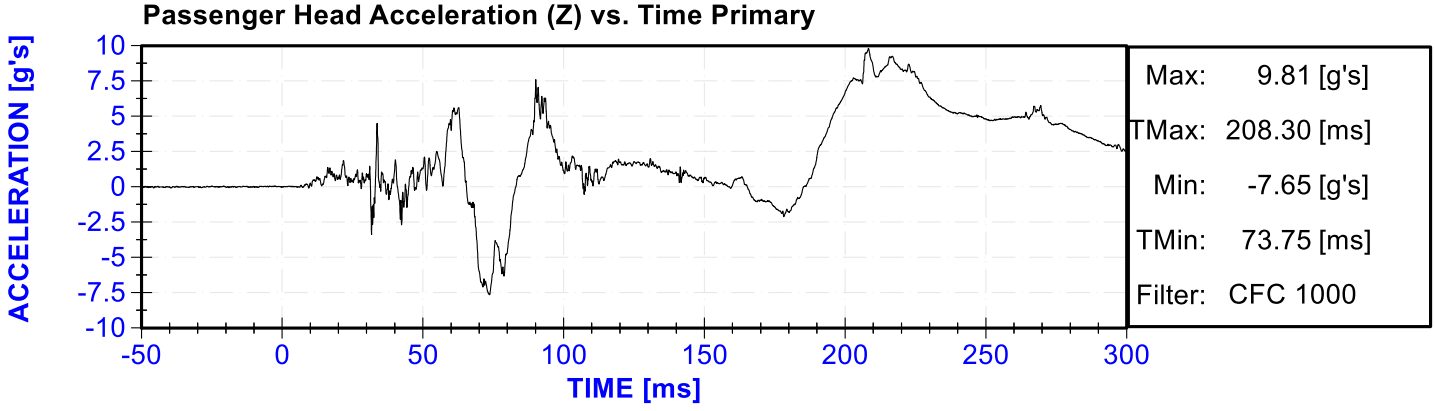
Passenger Head Acceleration (X) vs. Time Primary



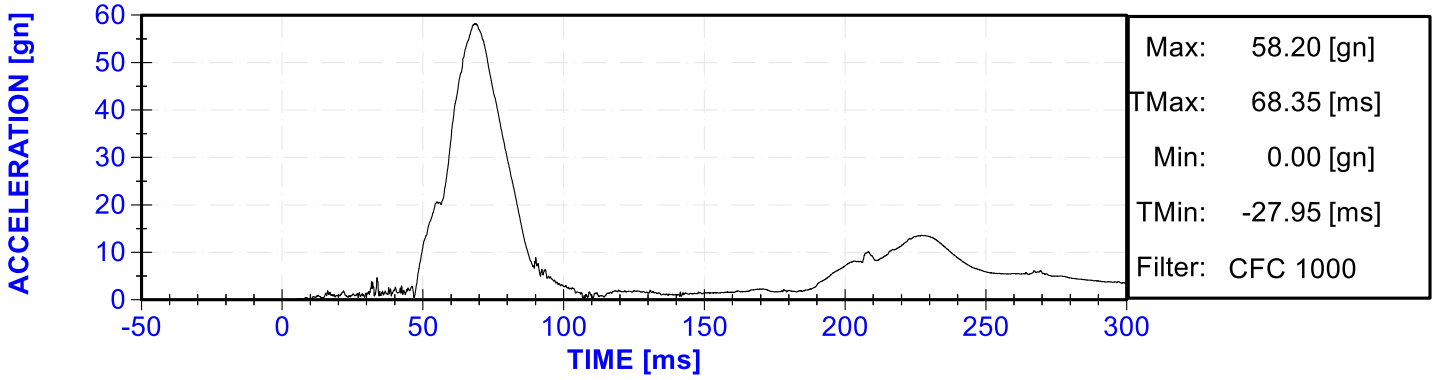
Passenger Head Acceleration (Y) vs. Time Primary



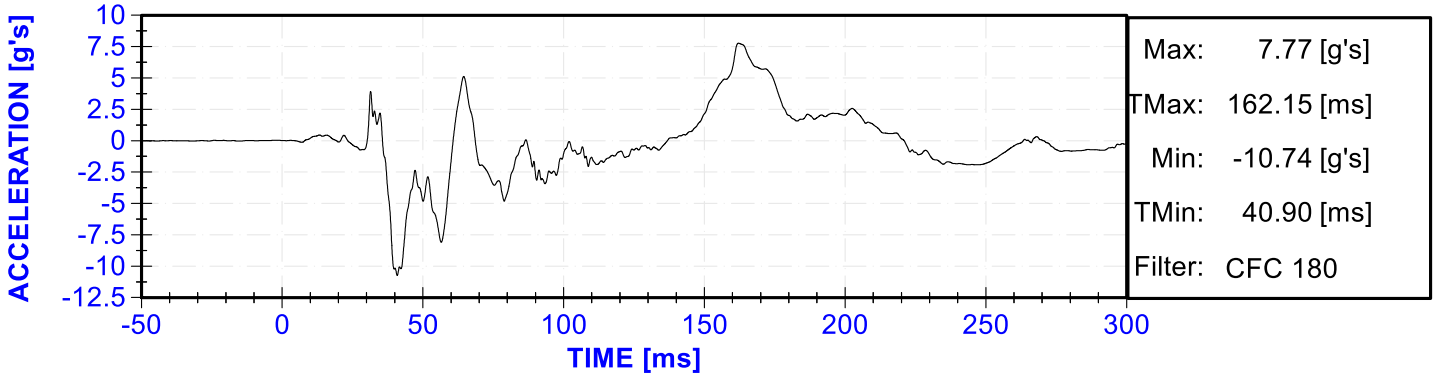
Passenger Head Acceleration (Z) vs. Time Primary



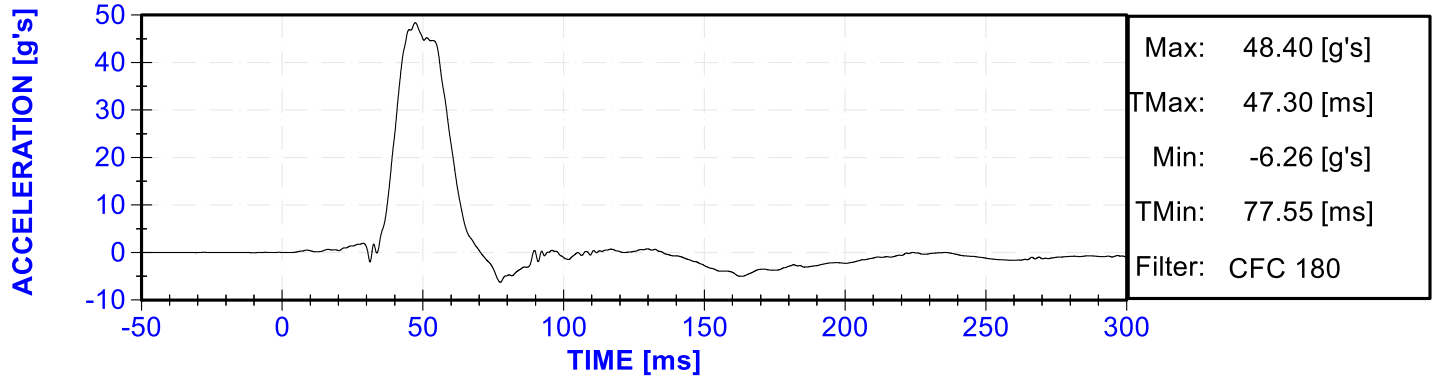
Passenger Head Resultant Acceleration Primary vs. Time



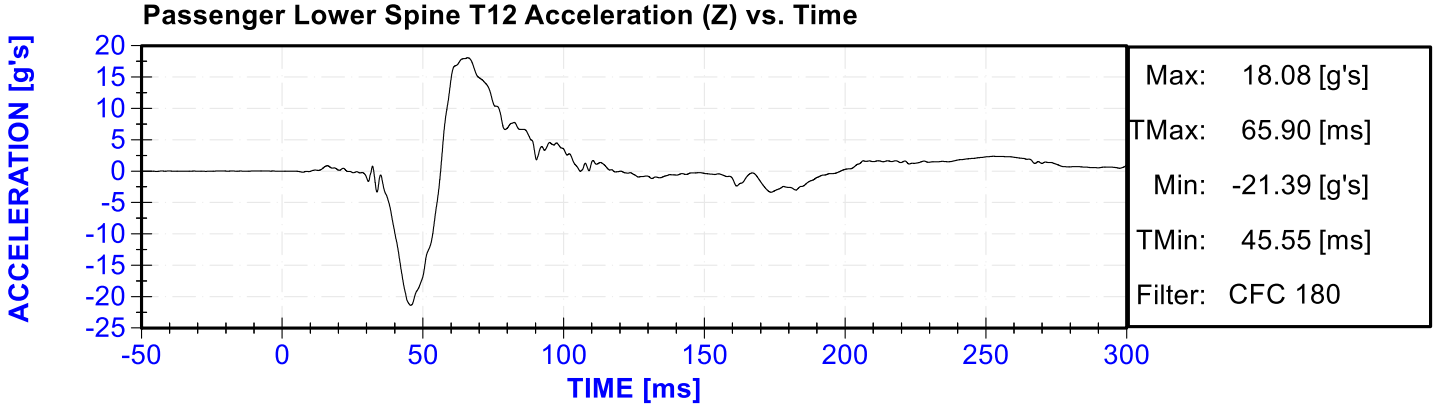
Passenger Lower Spine T12 Acceleration (X) vs. Time



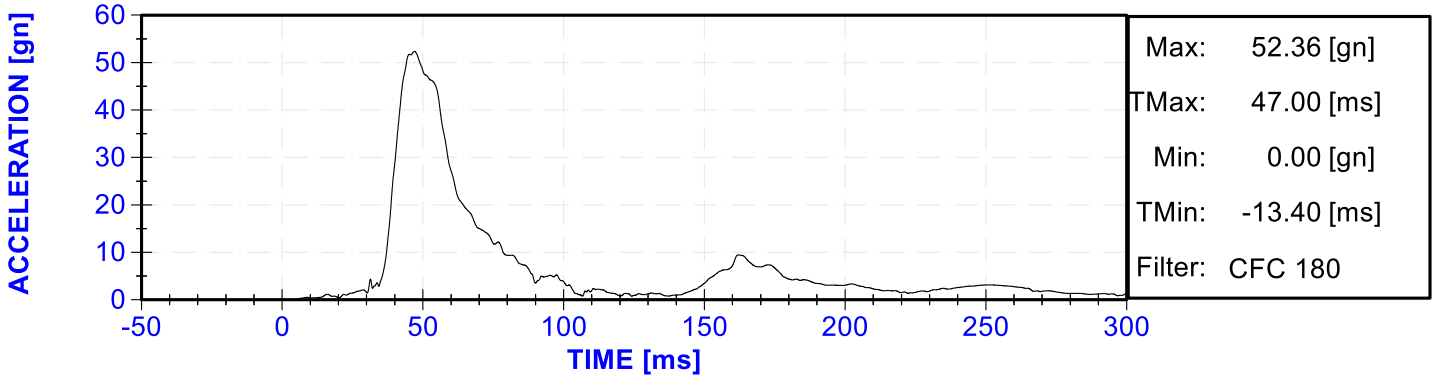
Passenger Lower Spine T12 Acceleration (Y) vs. Time



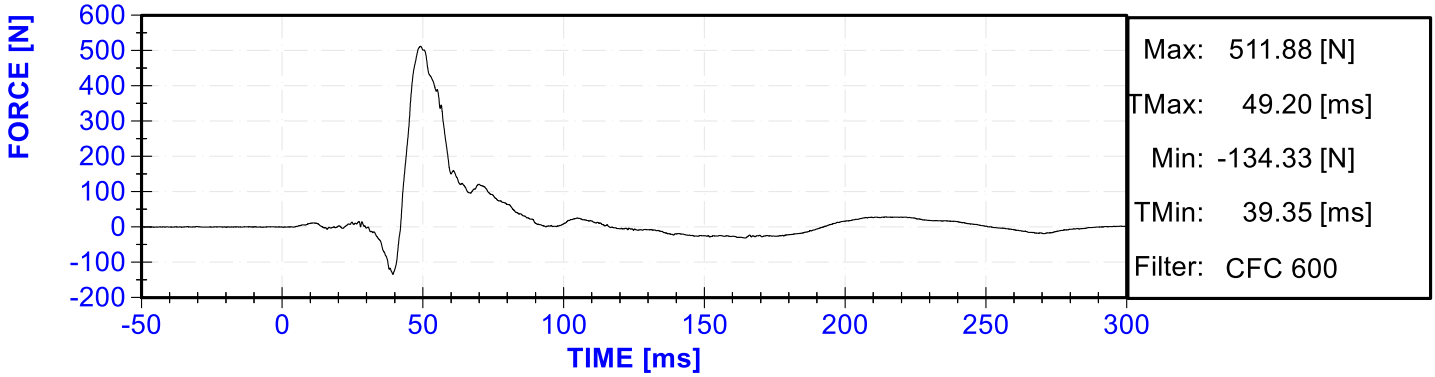
Passenger Lower Spine T12 Acceleration (Z) vs. Time



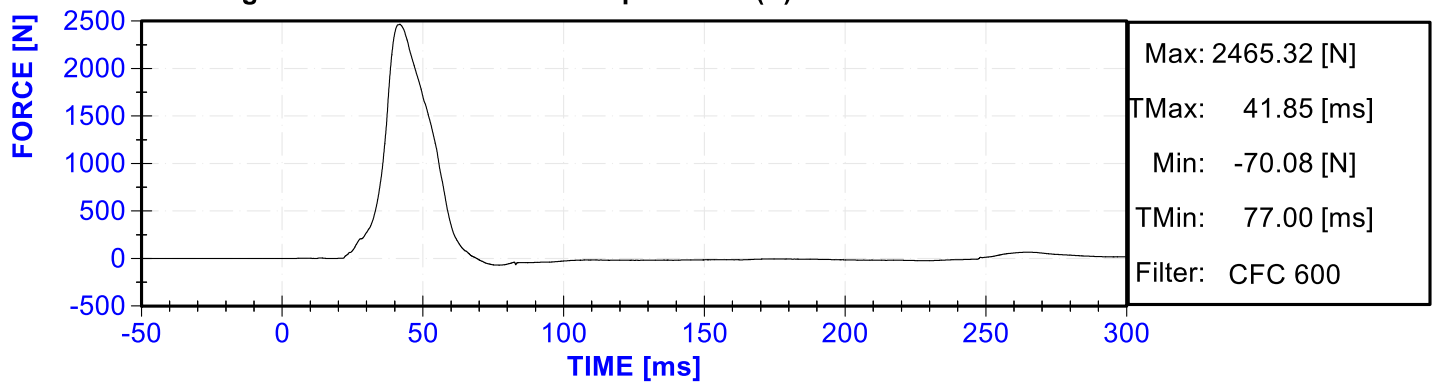
Passenger Lower Spine T12 Resultant Acceleration vs. Time



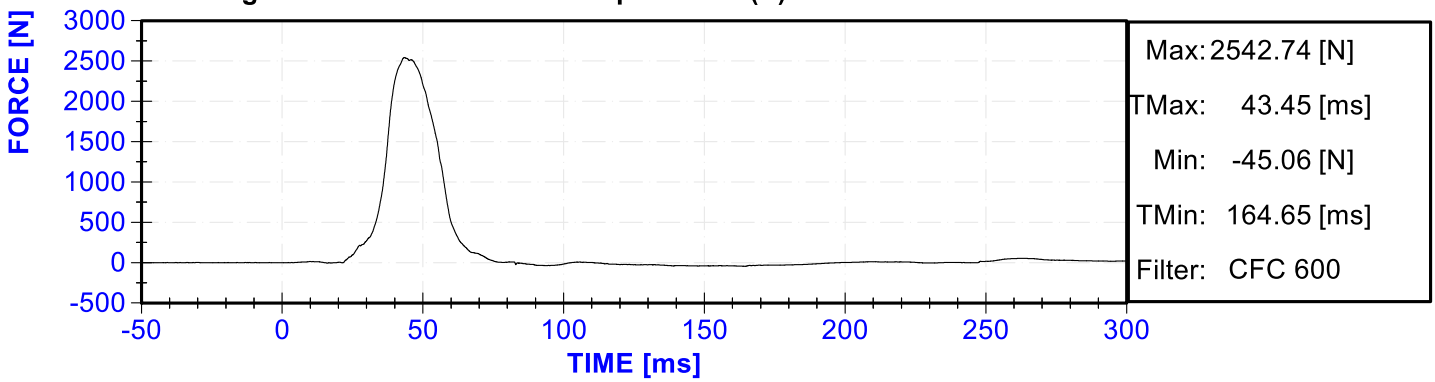
Passenger Iliac Force on Impact Side (Y) vs. Time



Passenger Acetabulum Force on Impact Side (Y) vs. Time



Passenger Total Pelvic Force on Impact Side (Y) vs. Time



APPENDIX C

DUMMY PERFORMANCE CALIBRATION TEST DATA

CALIBRATION TEST RESULTS

PRE-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

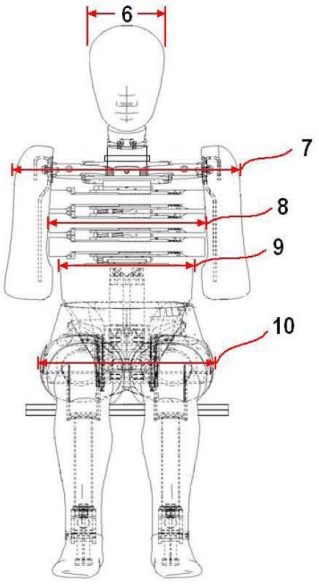
SERIAL NO: F033

(CONFIGURED FOR LEFT SIDE IMPACT)

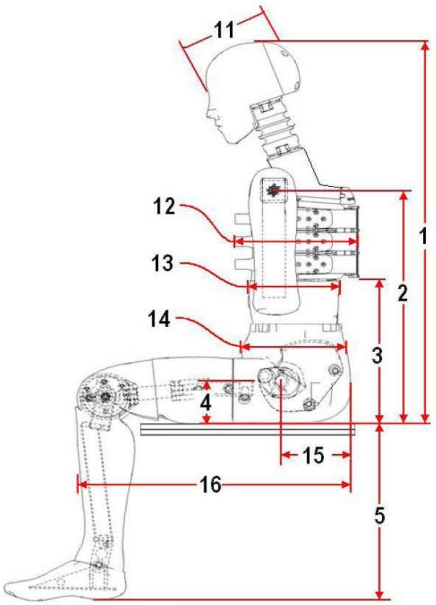
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 1/18/2021

Dummy Serial Number: F033



FRONT VIEW



SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	911	Pass
2	Seat to Shoulder Joint	558	572	569	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	99	Pass
5	Sole to Seat, Sitting	333	451	426	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	329	Pass
9	Abdomen Width	273	287	285	Pass
10	Pelvis Lap Width	359	373	367	Pass
11	Head Depth	196	206	201	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	239	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

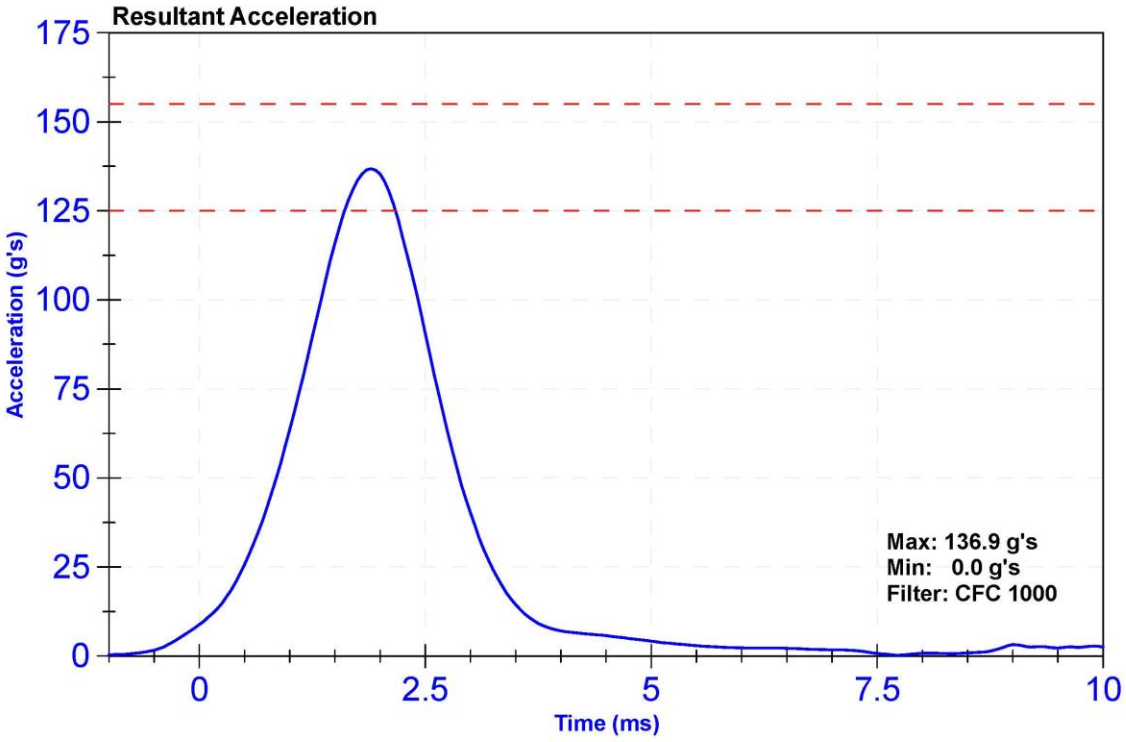
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

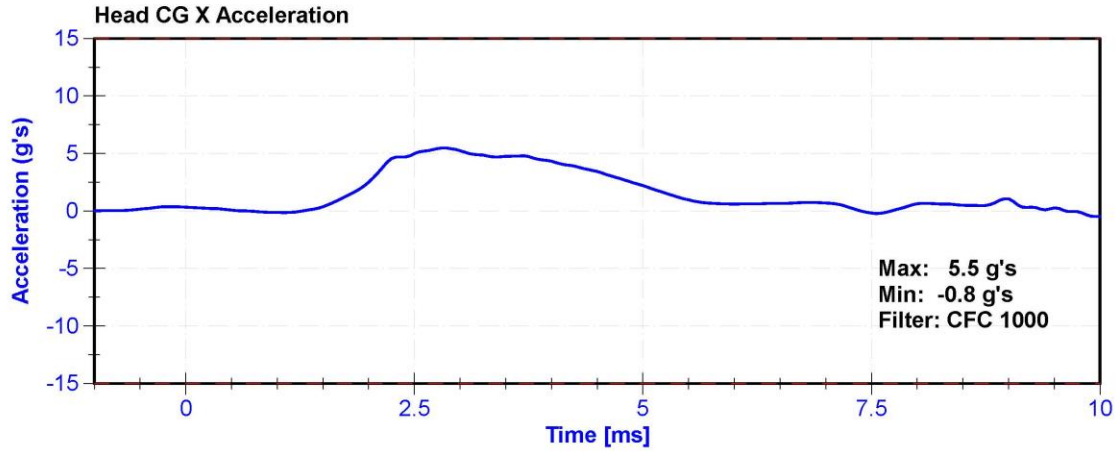
Results

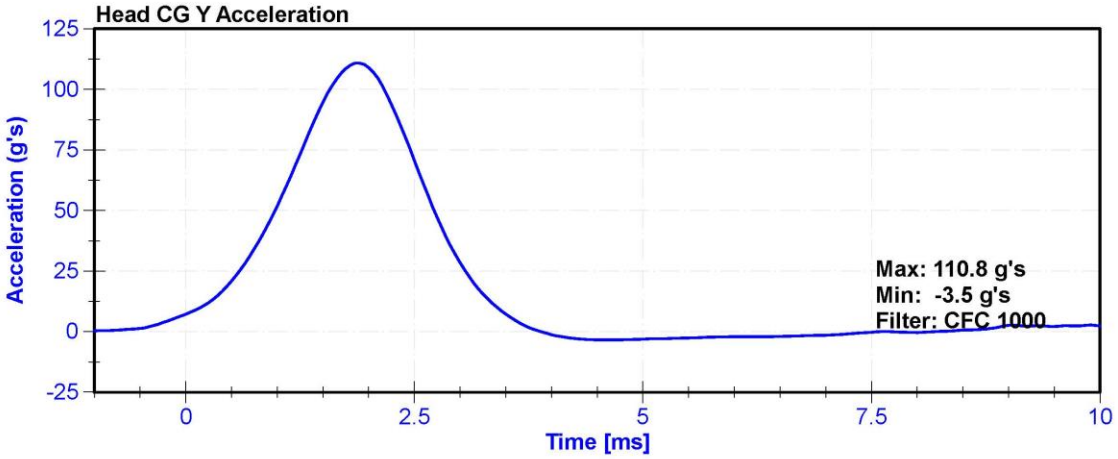
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	27.0	Pass
Resultant Acceleration	125	155	g's	136.9	Pass
Oscillation	0	15	%	2.33	Pass
Fore-Aft Acceleration	-15	15	g's	5.5	Pass

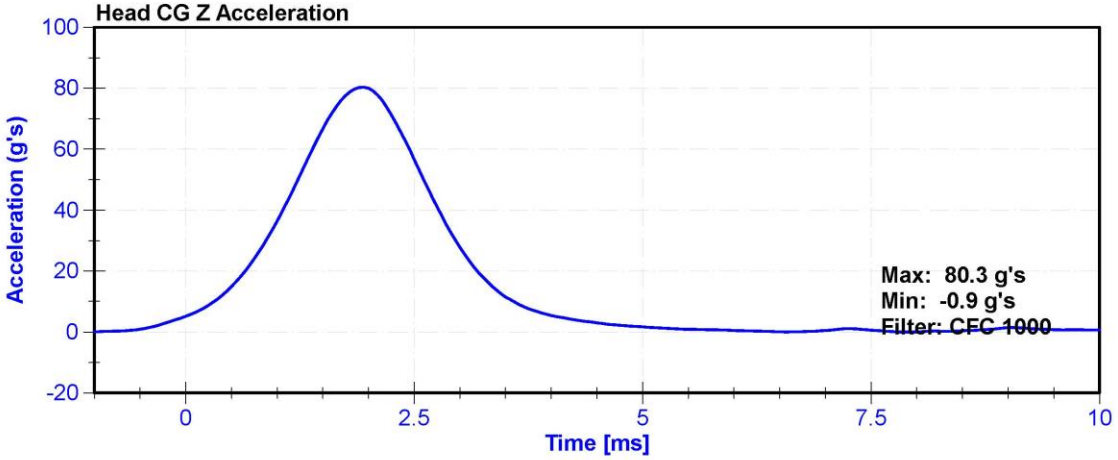
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P63861	11/24/2020	5/25/2021
Y Accelerometer	ENDEVCO 7264CT	AC-P49216	11/24/2020	5/25/2021
Z Accelerometer	ENDEVCO 7264	AC-P51303	11/24/2020	5/25/2021




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 5.5 g's
Min: -0.8 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 110.8 g's
Min: -3.5 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]
Max: 80.3 g's
Min: -0.9 g's
Filter: CFC 1000

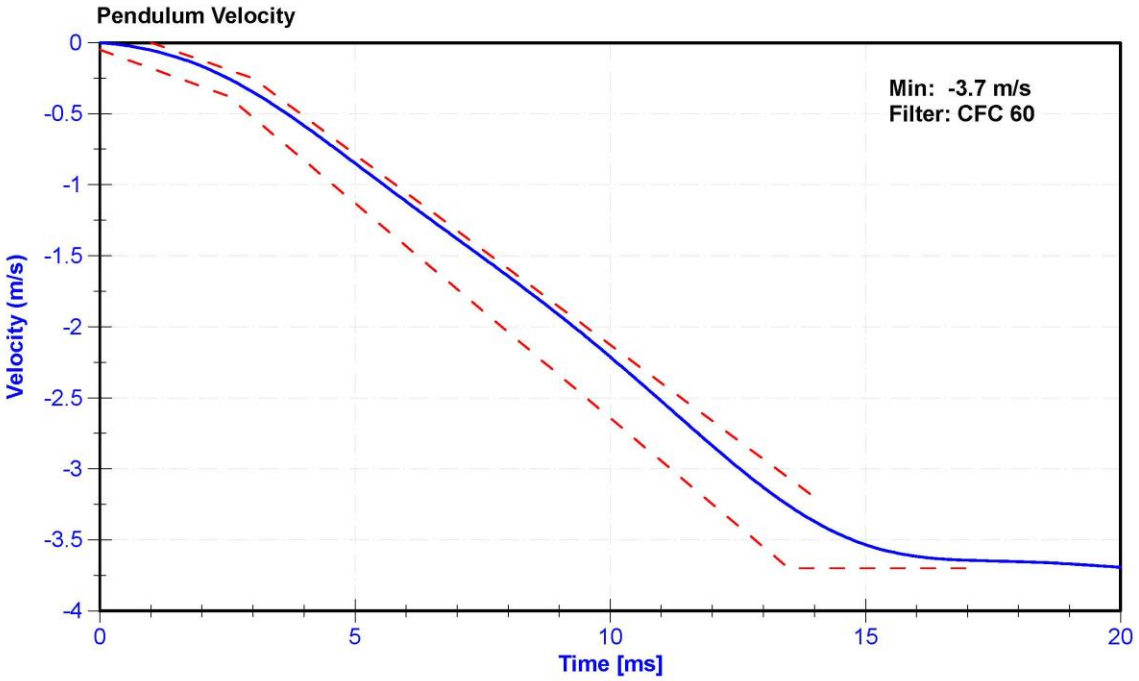
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

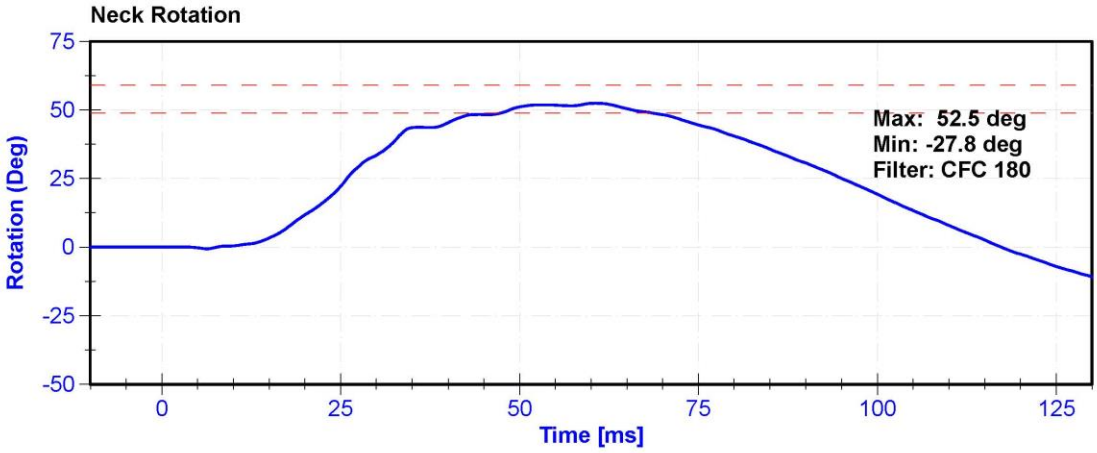
Results

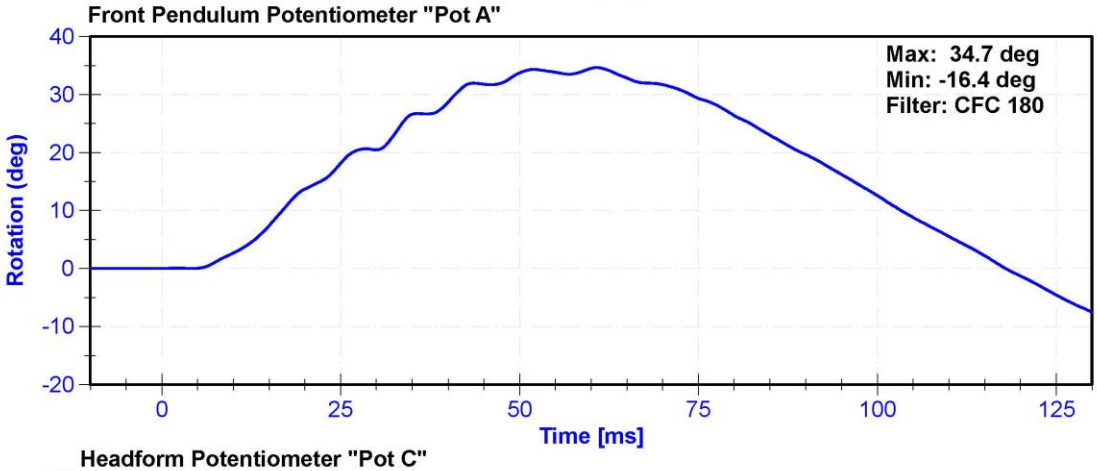
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	28	Pass
Velocity	3.3	3.5	m/s	3.37	Pass
Lateral Neck Rotation	49	59	deg	52.5	Pass
Time at Maximum Rotation	54	66	ms	60.6	Pass
Time of Rotation Decay from Maximum	53	88	ms	56.8	Pass

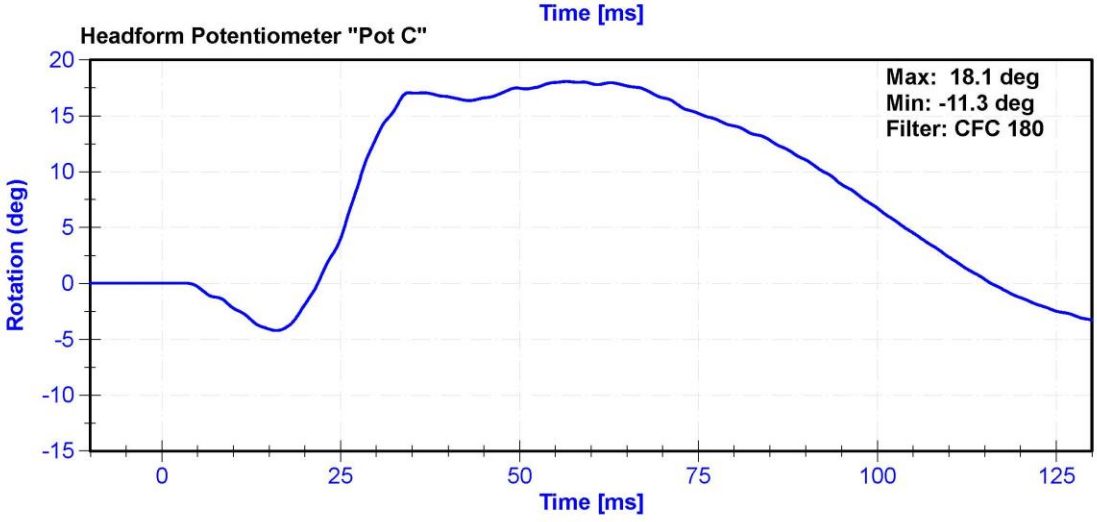
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231C	AC-C16503	2/6/2020	2/5/2021
Front Pendulum Potentiometer	SP22G	DS-094	8/18/2020	8/18/2021
Headform Potentiometer	SP22G	DS-095	8/18/2020	8/18/2021




Neck Rotation
Rotation (Deg)
Time [ms]
Max: 52.5 deg
Min: -27.8 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 34.7 deg
Min: -16.4 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 18.1 deg
Min: -11.3 deg
Filter: CFC 180

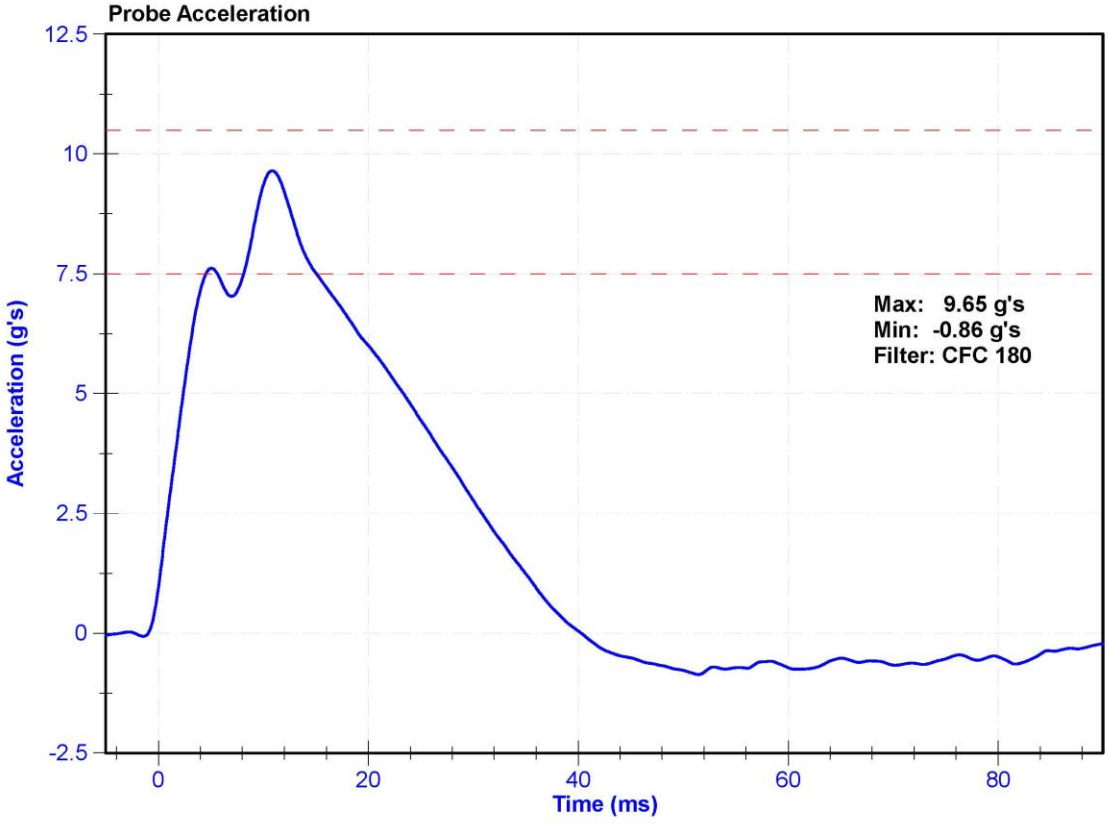
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	27.0	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	7.5	10.5	g's	9.65	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021



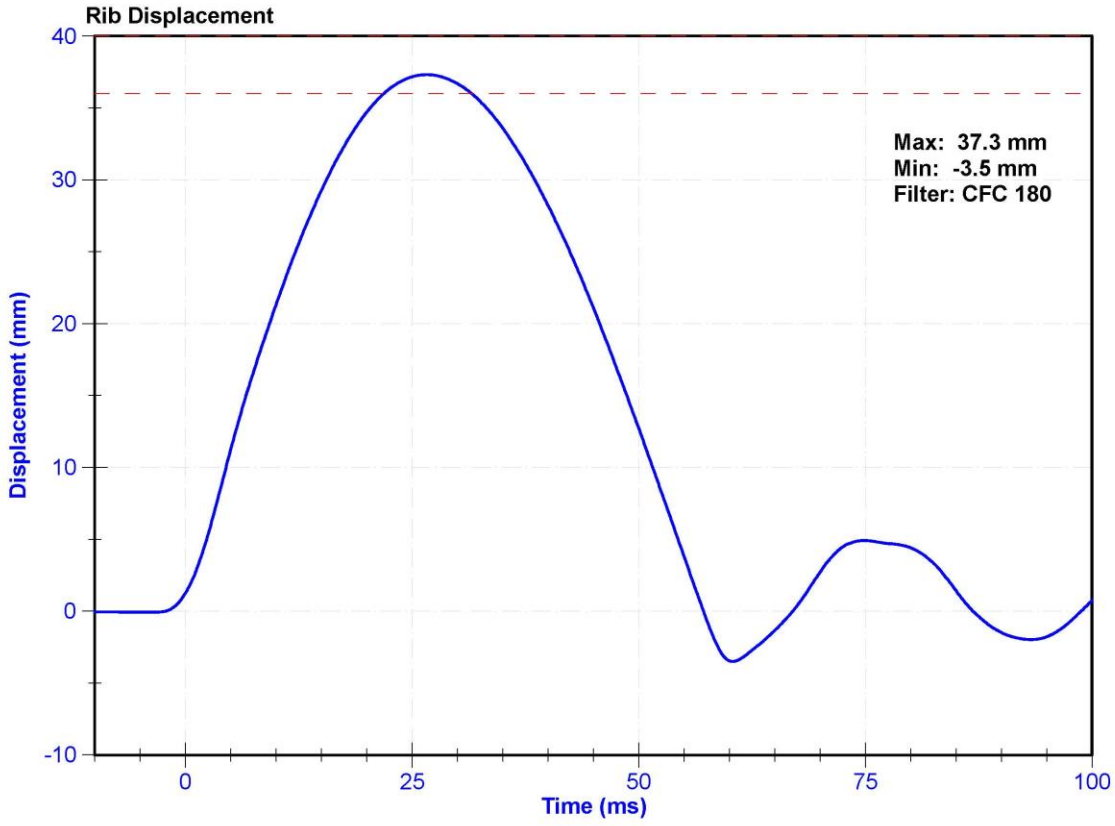
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	26.0	Pass
Rib Displacement	36	40	mm	37.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	11/25/2020	5/26/2021



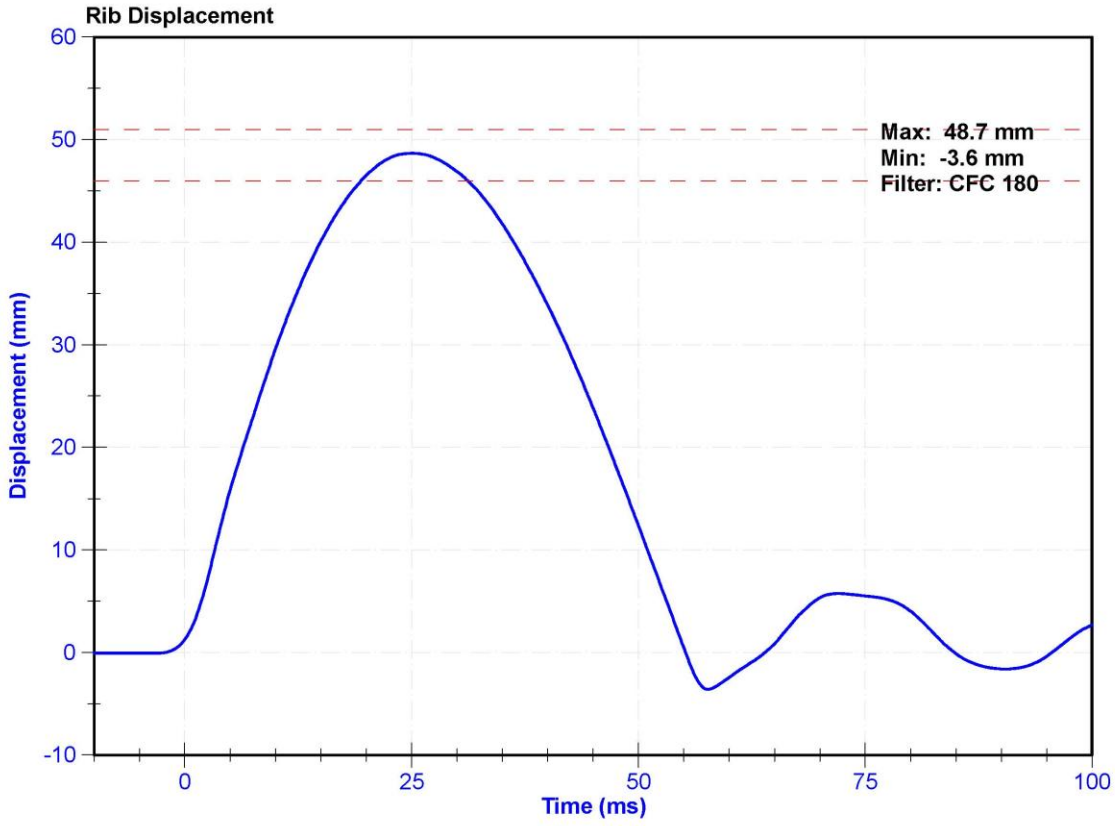
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	26.0	Pass
Rib Displacement	46	51	mm	48.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	11/25/2020	5/26/2021



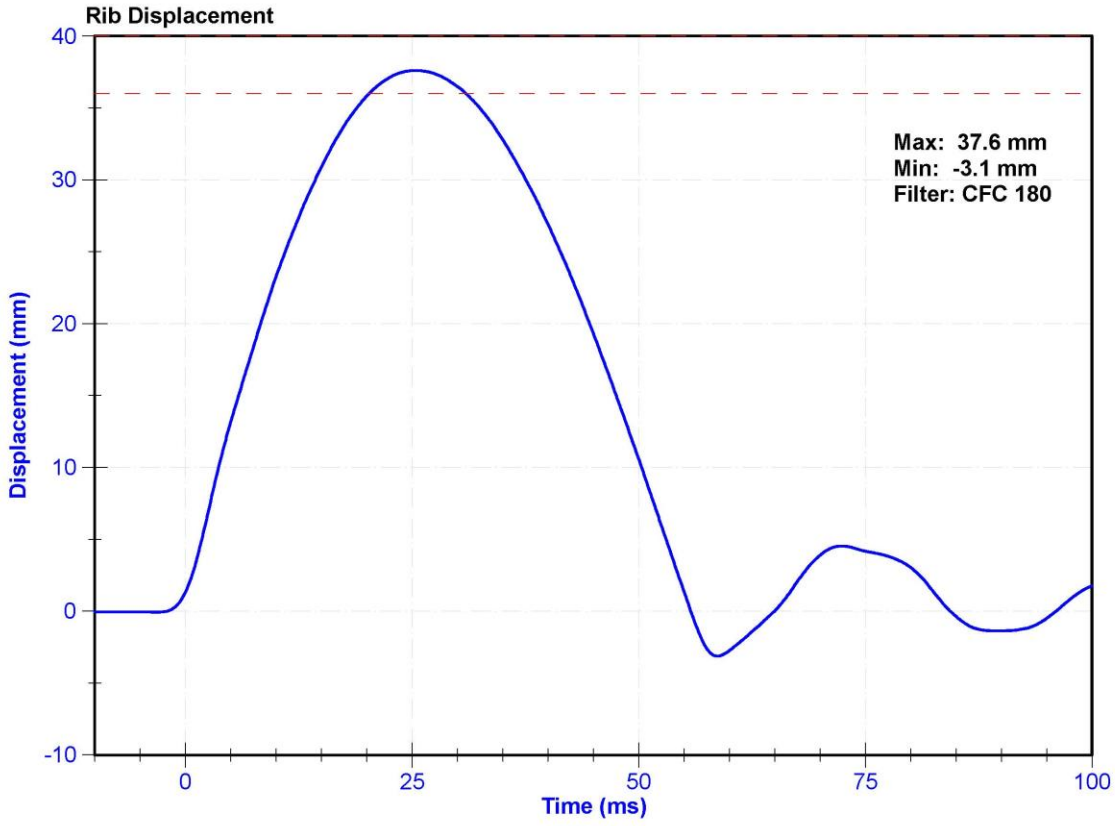
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	26.0	Pass
Rib Displacement	36	40	mm	37.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	11/25/2020	5/26/2021



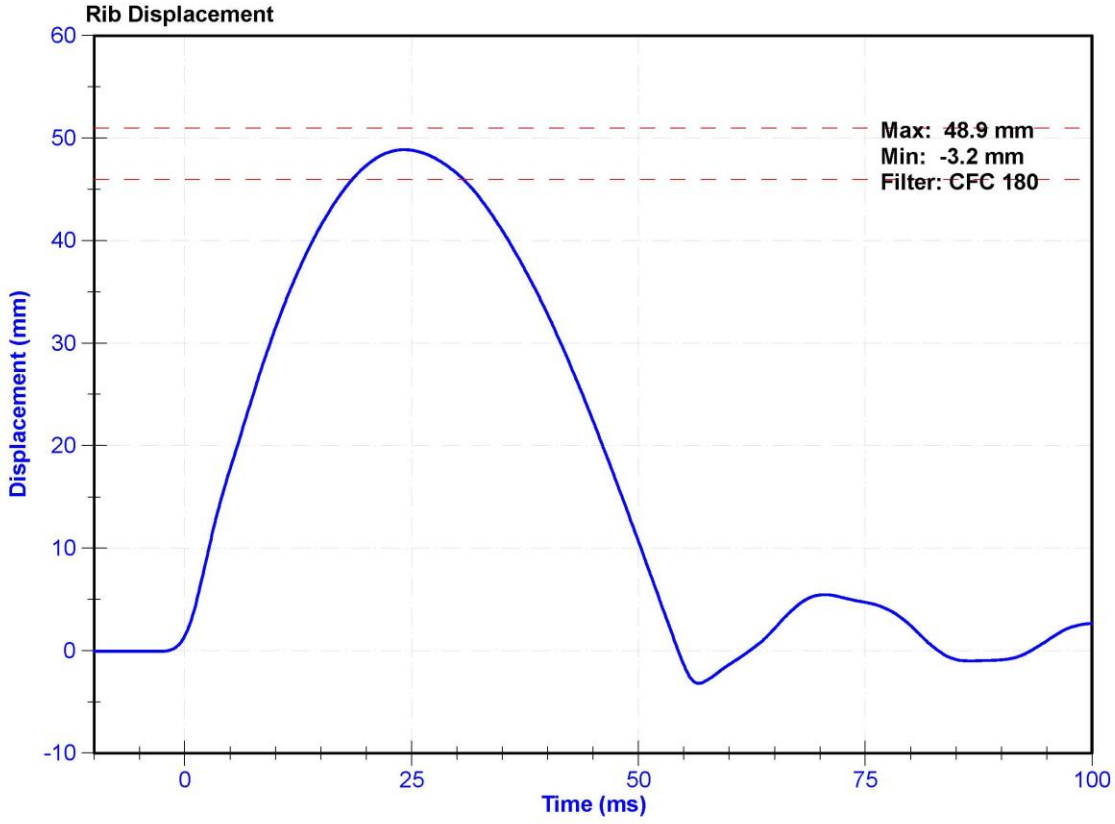
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	26.0	Pass
Rib Displacement	46	51	mm	48.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	11/25/2020	5/26/2021



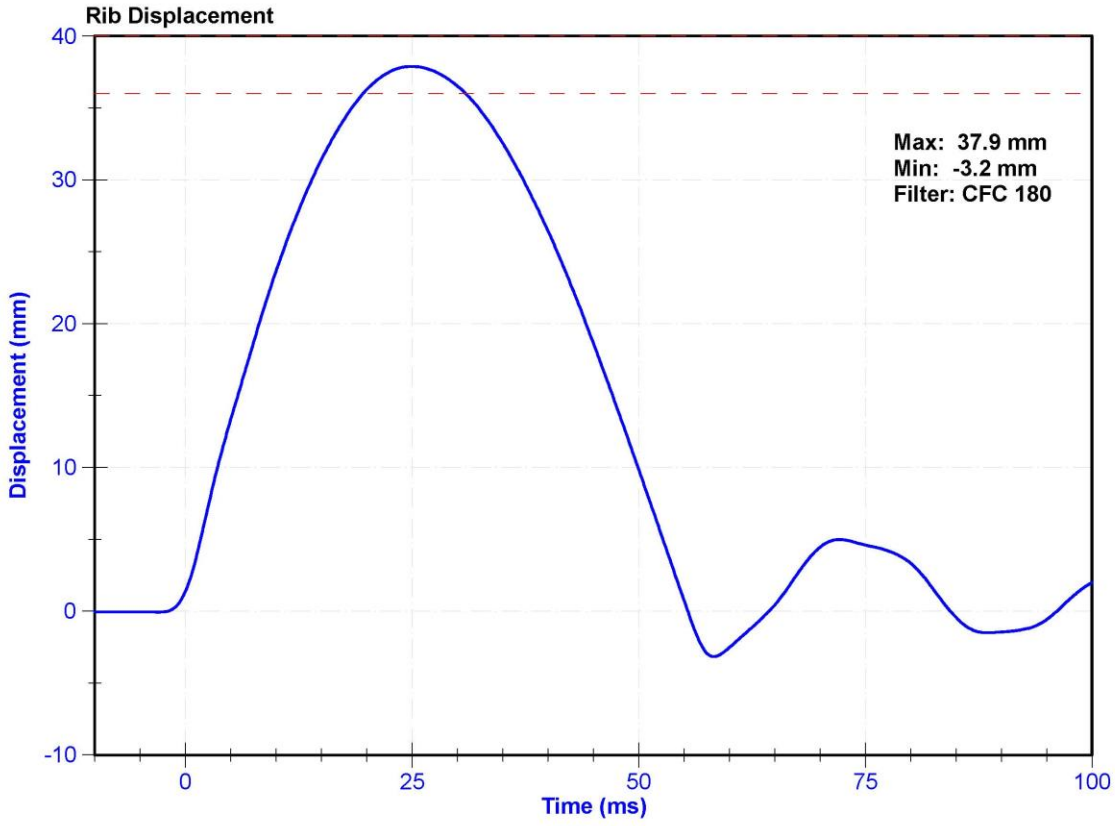
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	27.0	Pass
Rib Displacement	36	40	mm	37.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	11/25/2020	5/26/2021



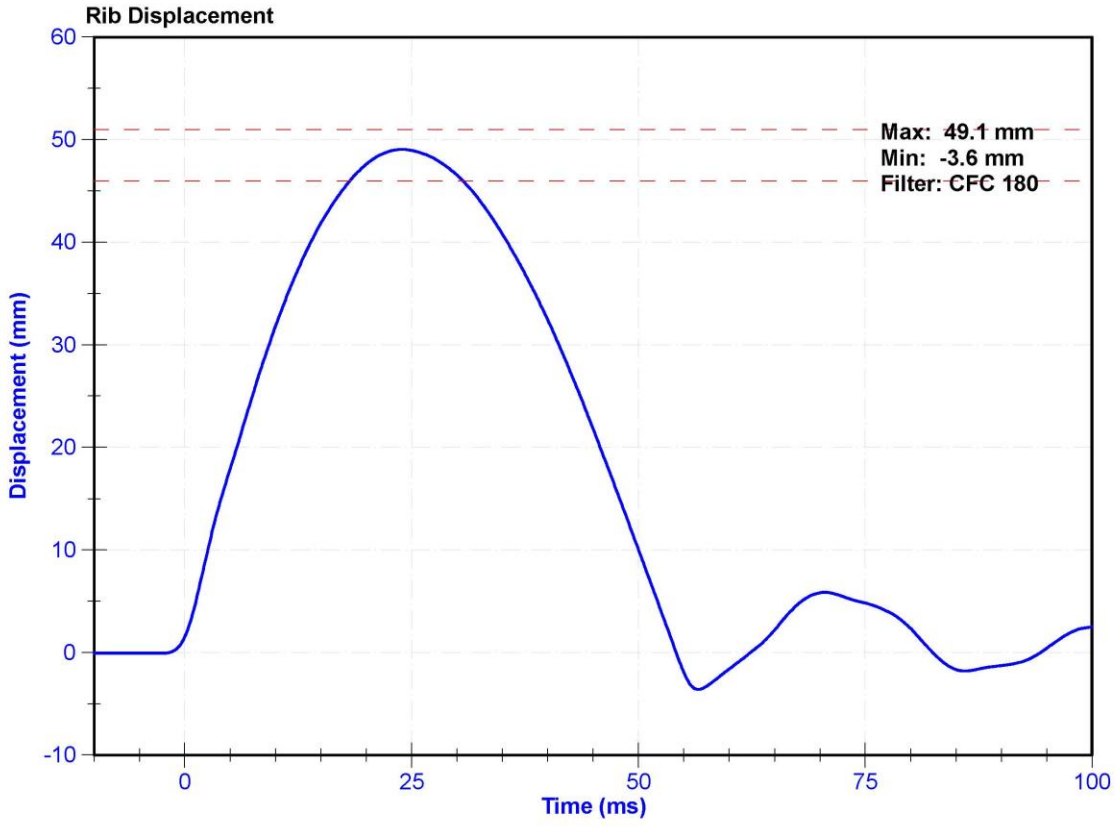
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	26.5	Pass
Rib Displacement	46	51	mm	49.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	11/25/2020	5/26/2021



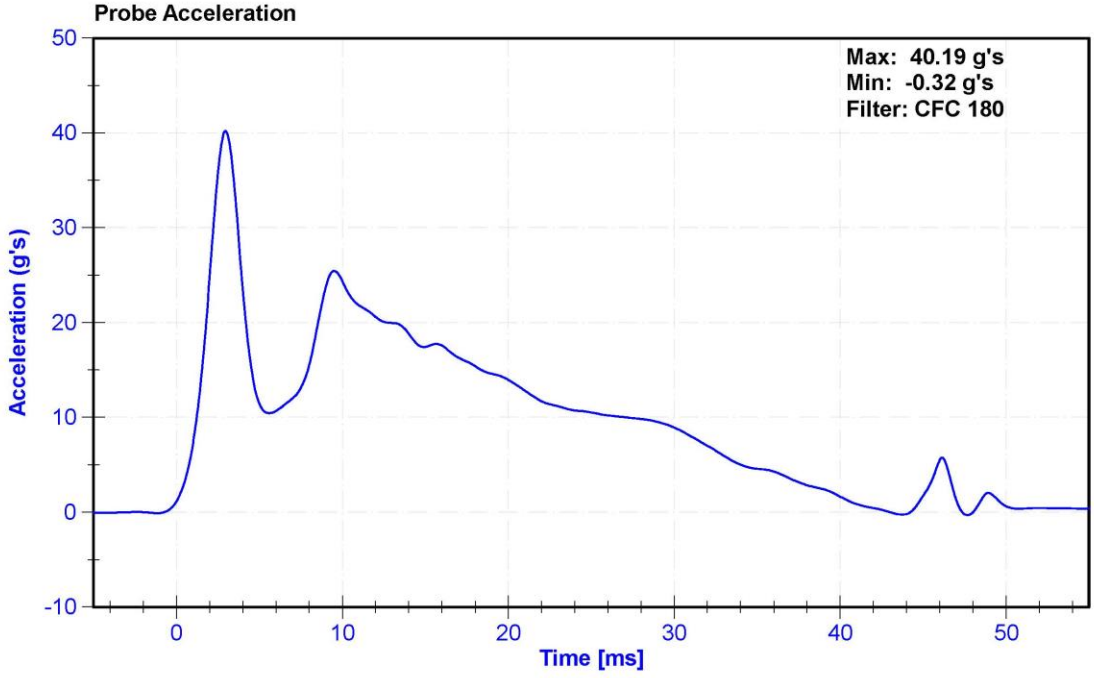
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

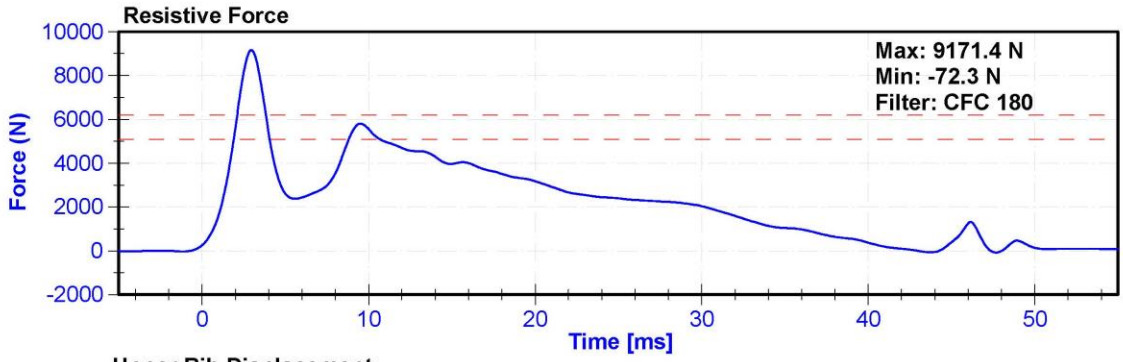
Results

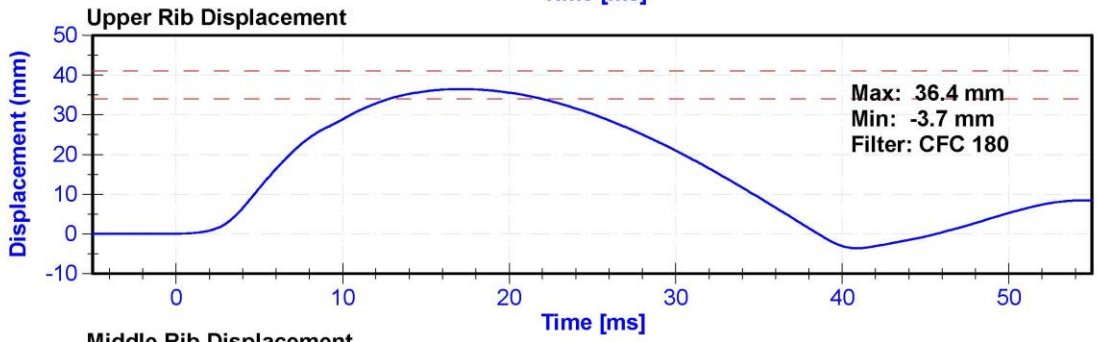
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	26.0	Pass
Velocity	5.4	5.6	m/s	5.46	Pass
Resistive Force after 6ms	5100	6200	N	5805.4	Pass
Upper Thorax Rib Deflection	34	41	mm	36.4	Pass
Mid Thorax Rib Deflection	37	45	mm	40.5	Pass
Lower Thorax Rib Deflection	37	44	mm	39.8	Pass

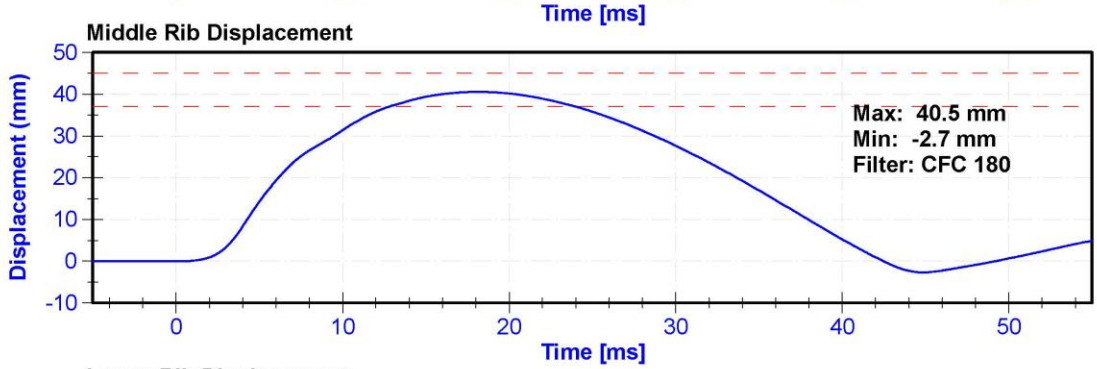
Transducer Calibrations

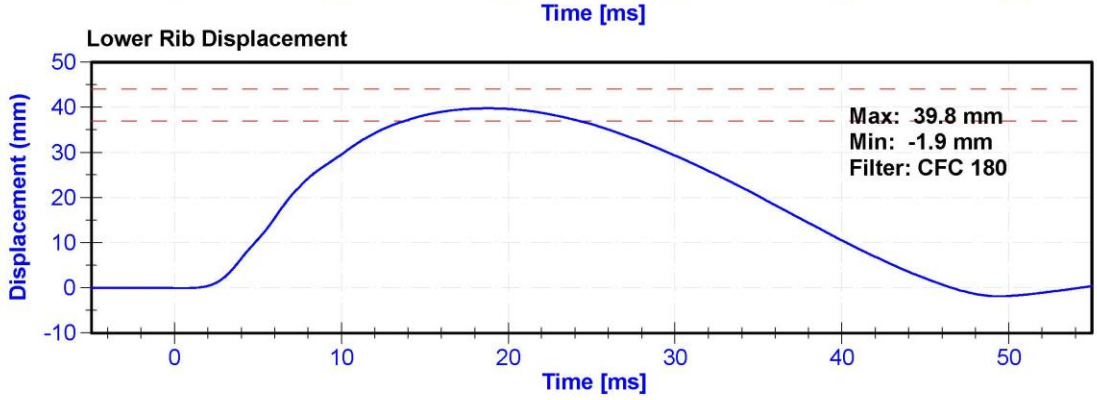
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	11/25/2020	5/26/2021
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	11/25/2020	5/26/2021
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	11/25/2020	5/26/2021




Resistive Force
Max: 9171.4 N
Min: -72.3 N
Filter: CFC 180
Force (N)
Time [ms]


Upper Rib Displacement
Max: 36.4 mm
Min: -3.7 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Middle Rib Displacement
Max: 40.5 mm
Min: -2.7 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Lower Rib Displacement
Max: 39.8 mm
Min: -1.9 mm
Filter: CFC 180
Displacement (mm)
Time [ms]

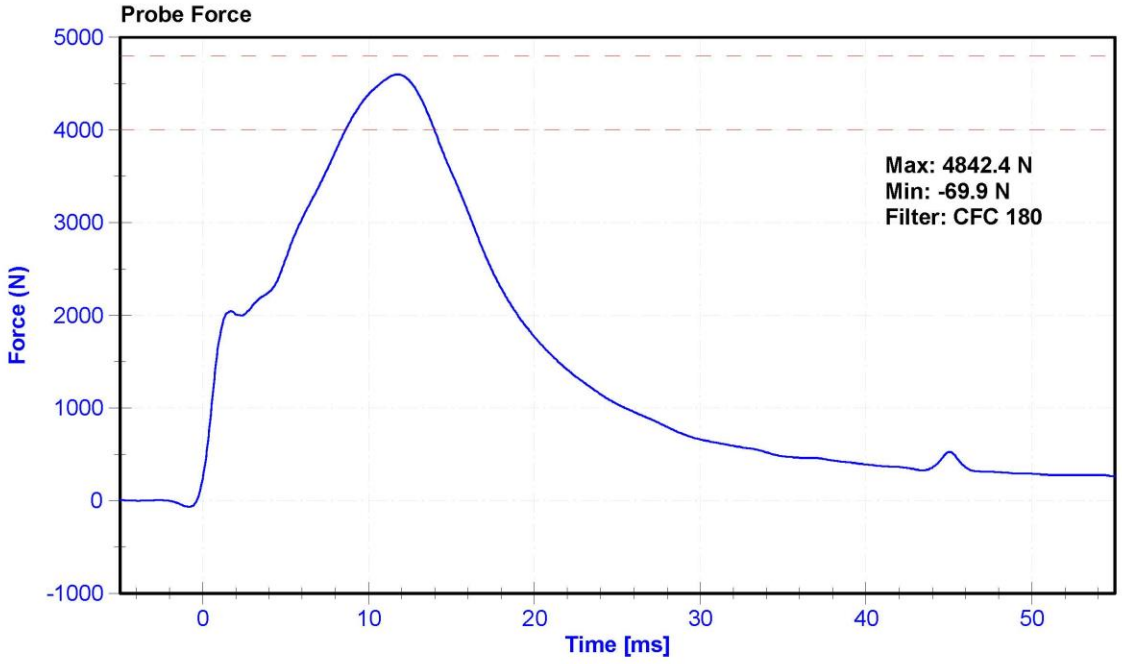
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K.Brogan

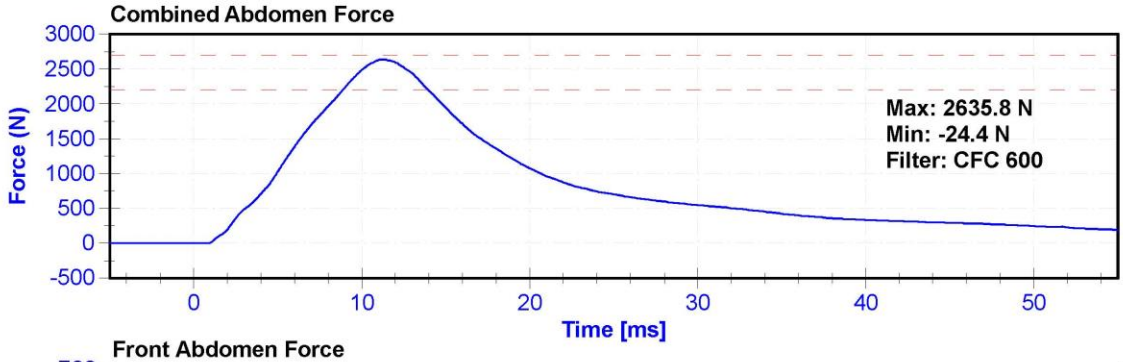
Results

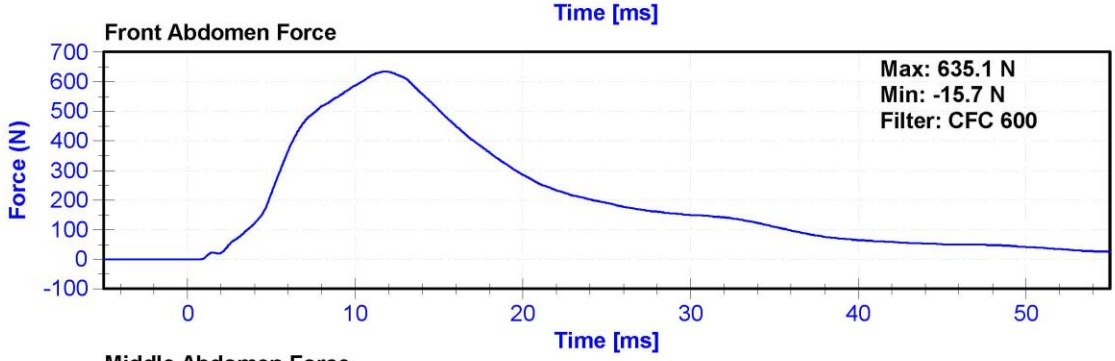
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	28	Pass
Velocity	3.9	4.1	m/s	4.09	Pass
Combined Abdomen Force	2200	2700	N	2635.8	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.25	Pass
Resistive Probe Force	4000	4800	N	4600.3	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.75	Pass

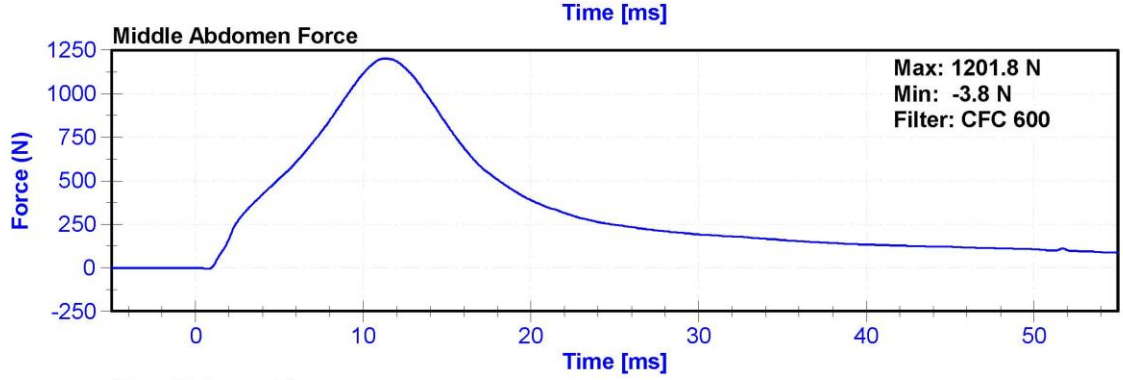
Transducer Calibrations

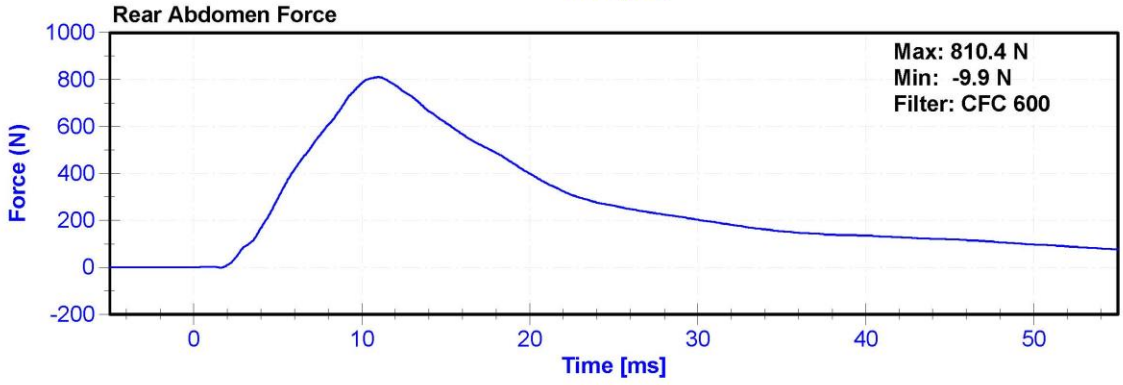
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Front Abdomen Load Cell	FTSS 2631	LC-1509	11/10/2020	11/10/2021
Middle Abdomen Load Cell	DENTON 2631	LC-1508	11/10/2020	11/10/2021
Rear Abdomen Load Cell	FTSS 2631	LC-1507	11/10/2020	11/10/2021




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2635.8 N
Min: -24.4 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 635.1 N
Min: -15.7 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1201.8 N
Min: -3.8 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 810.4 N
Min: -9.9 N
Filter: CFC 600

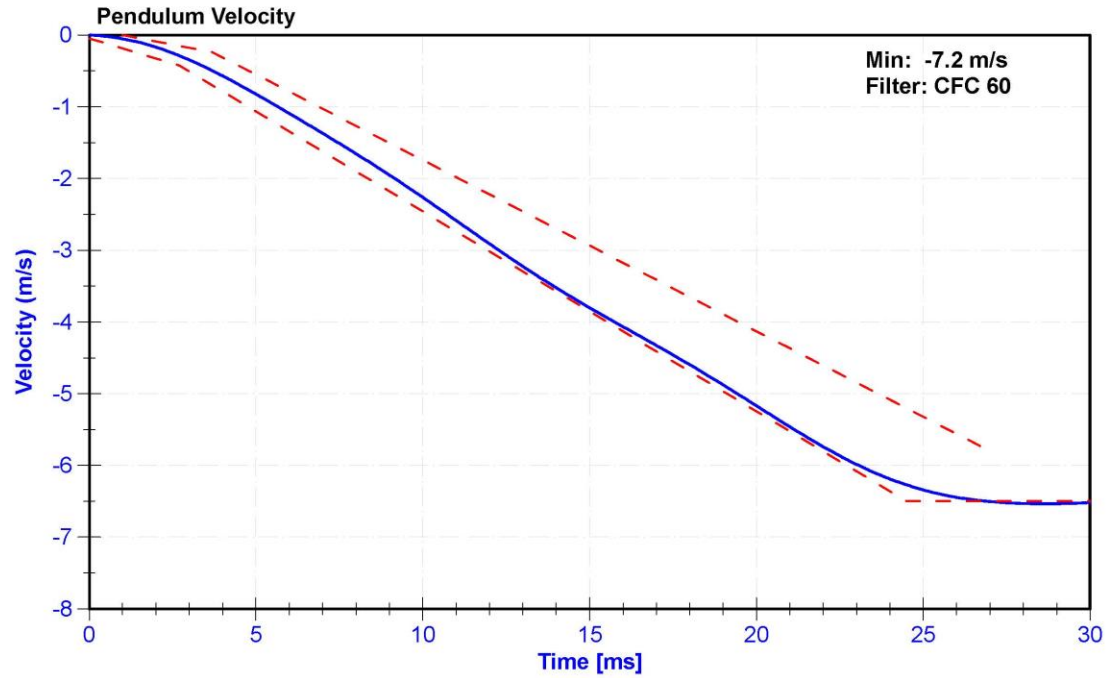
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

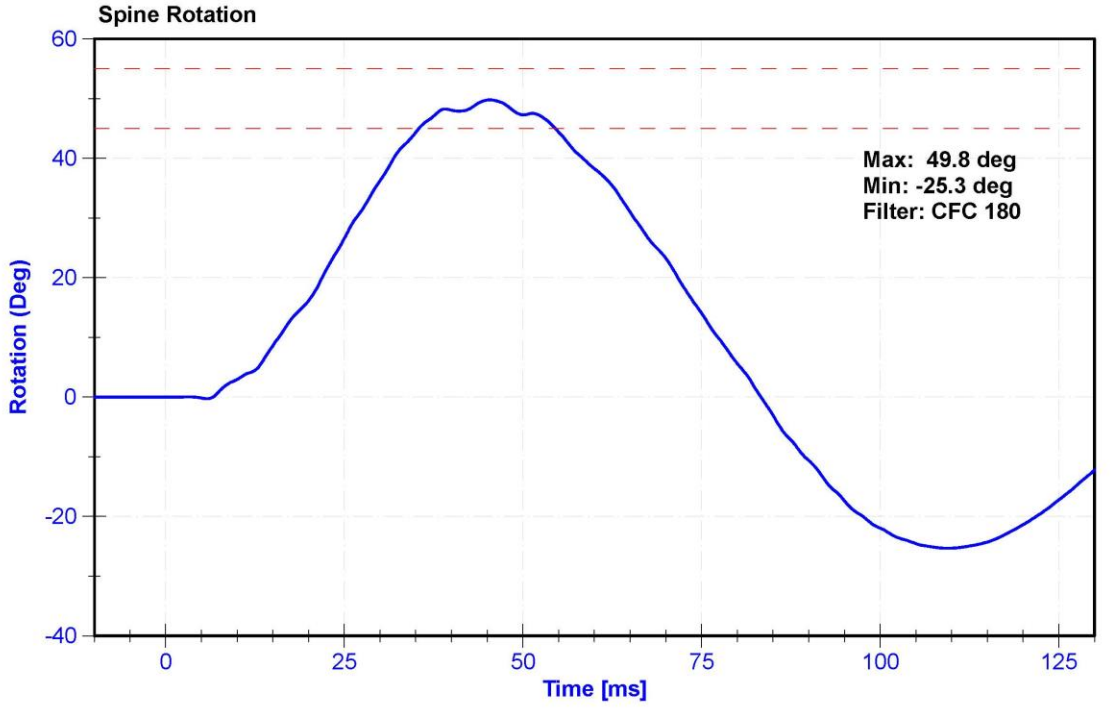
Results

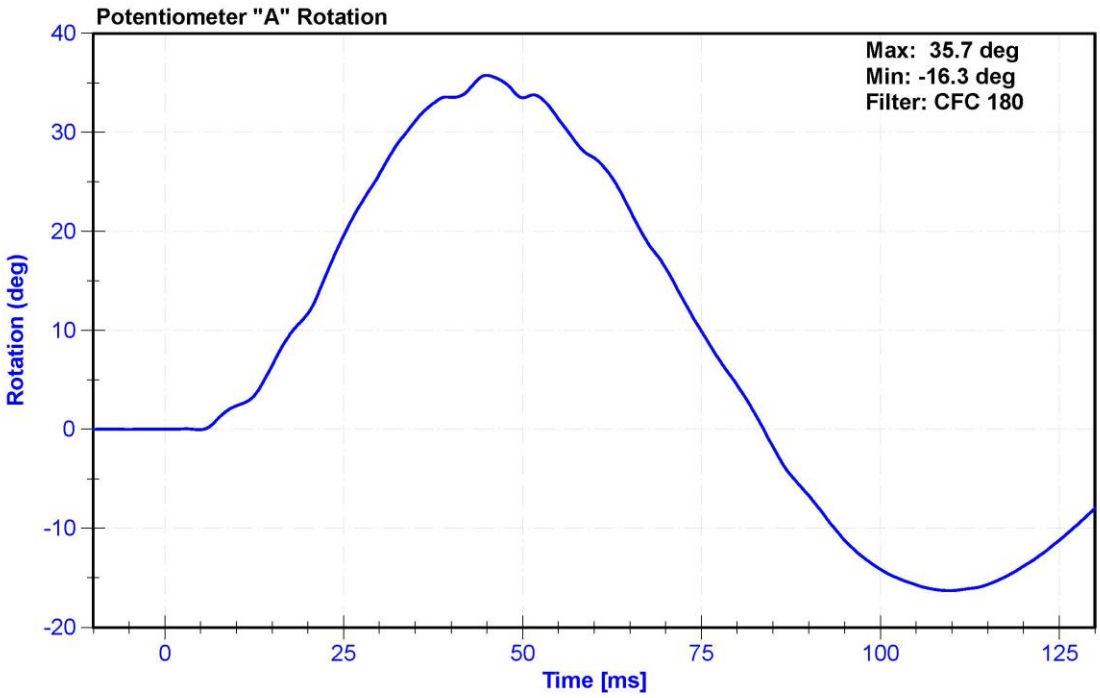
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	28	Pass
Velocity	5.95	6.15	m/s	6.005	Pass
Lateral Spine Rotation	45	55	deg	49.8	Pass
Time at Maximum Rotation	39	53	ms	45.3	Pass
Time of Decay to Zero Degrees	37	57	ms	38.0	Pass
Pulse within Corridor?	-	-	-		

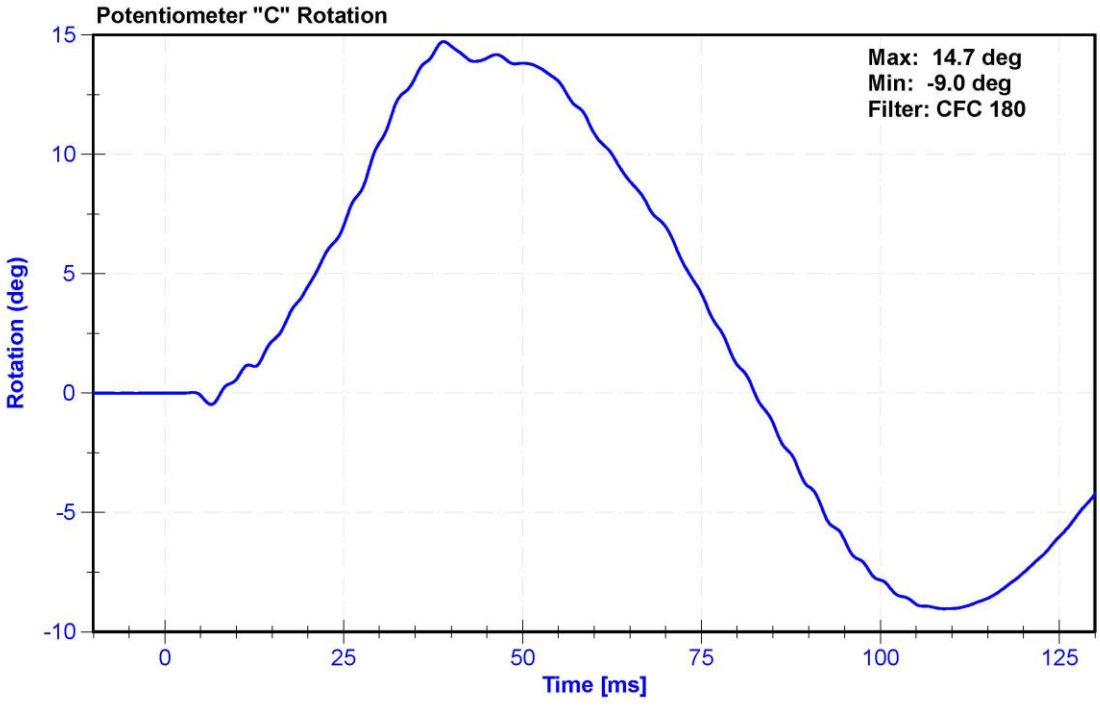
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C16503 Striker	2/6/2020	2/5/2021
Pendulum "A" Potentiometer	SP22G	DS-094	8/18/2020	8/18/2021
Condyle "B" Potentiometer	SP22G	DS-095	8/18/2020	8/18/2021


Pendulum Velocity
Min: -7.2 m/s
Filter: CFC 60
Velocity (m/s)
0
-1
-2
-3
-4
-5
-6
-7
-8
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 49.8 deg
Min: -25.3 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 35.7 deg
Min: -16.3 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
-20
0
25
50
75
100
125
Time [ms]


Potentiometer "C" Rotation
Max: 14.7 deg
Min: -9.0 deg
Filter: CFC 180
Rotation (deg)
15
10
5
0
-5
-10
0
25
50
75
100
125
Time [ms]

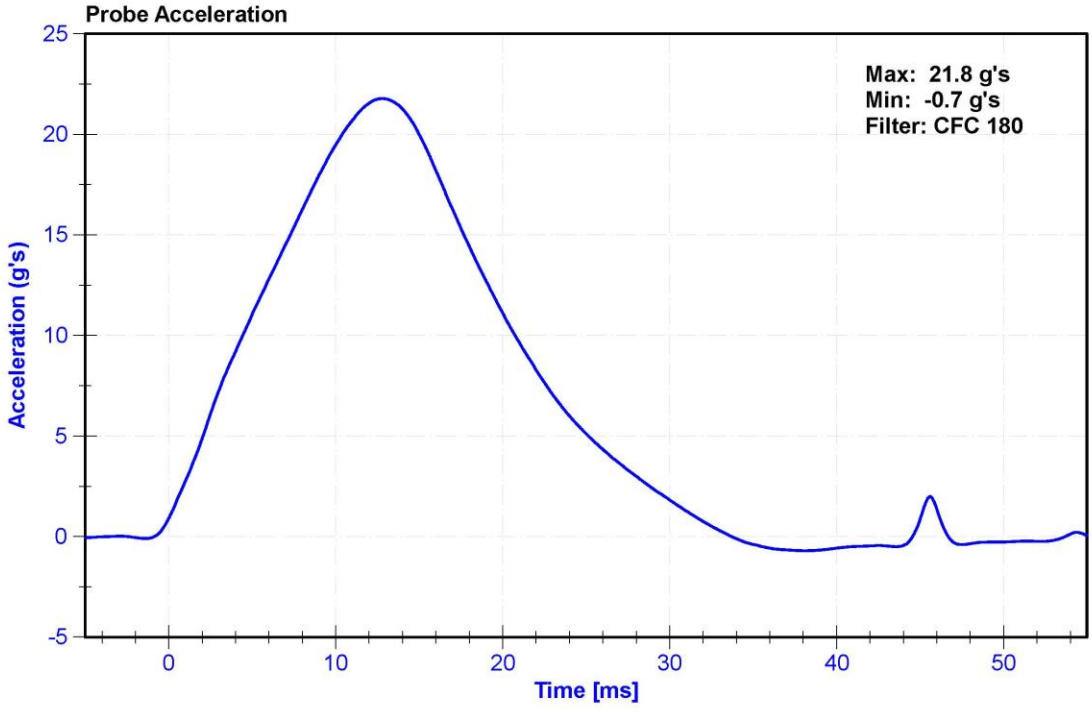
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

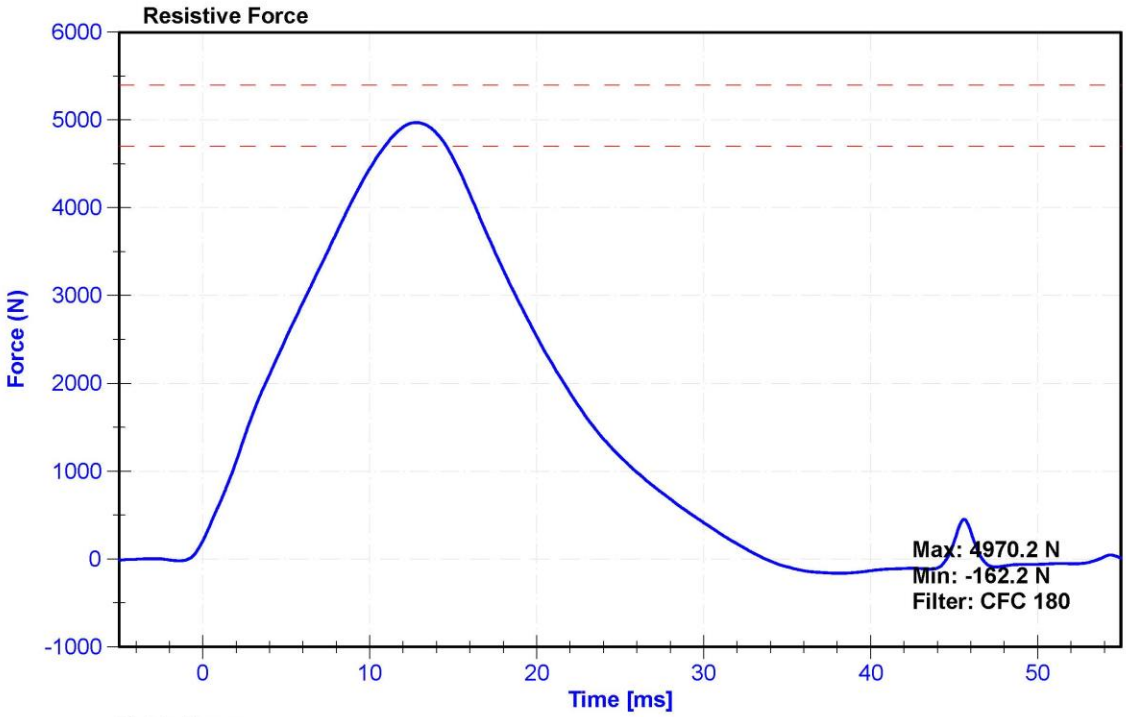
Results

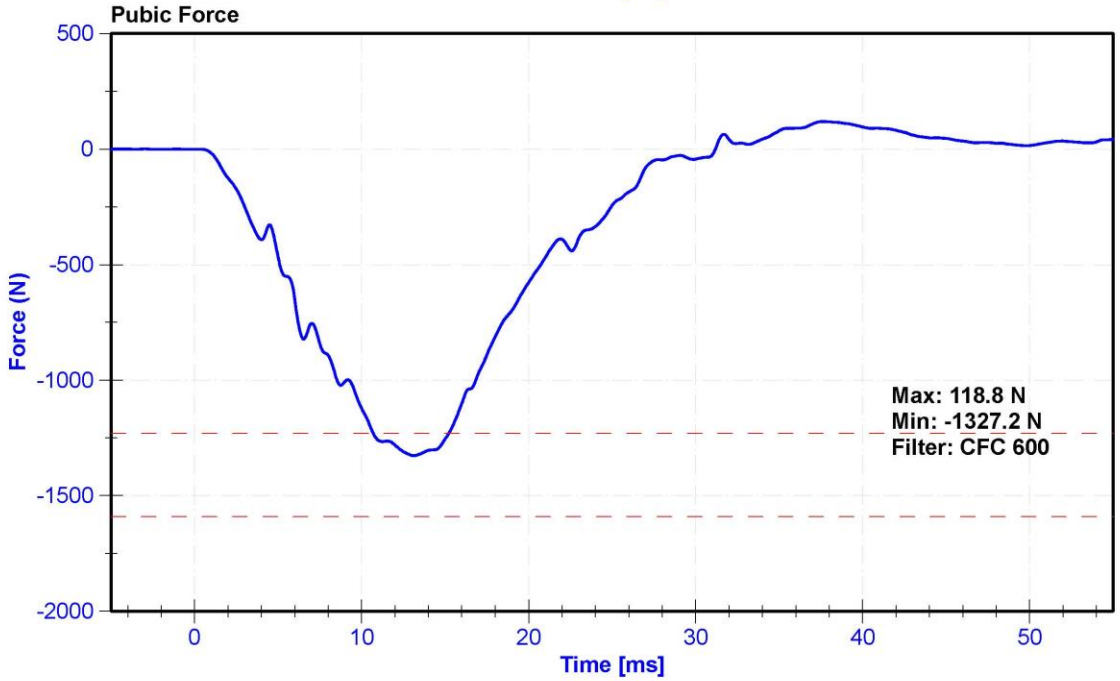
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	27.0	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Resistive Force	4700	5400	N	4970.2	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.80	Pass
Pubic Force	-1590	-1230	N	-1327.2	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.15	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Pubic Load Cell	Denton 3096JFL	LC-464fy	7/23/2020	7/23/2021




Resistive Force
Force (N)
Time [ms]
Max: 4970.2 N
Min: -162.2 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 118.8 N
Min: -1327.2 N
Filter: CFC 600

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

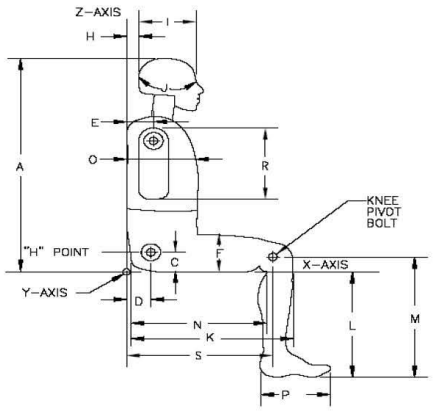
SERIAL No: 300

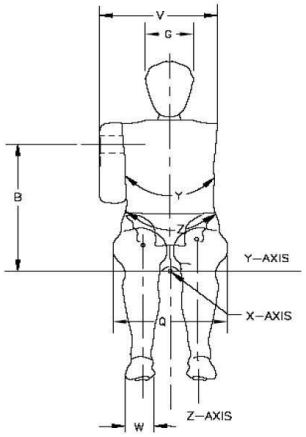
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: K. Brogan Date: 02/11/2021

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	781	Pass
B	Shoulder Pivot Height	437	453	445	Pass
C	H-point Height	79	89	84	Pass
D	H-point from seatback	141	151	145	Pass
E	Shoulder Pivot from Backline	97	107	103	Pass
F	Thigh Clearance	119	135	126	Pass
G	Head Breadth	140	148	145	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	186	Pass
J	Head Circumference	541	551	544	Pass
K	Buttock to Knee Length	514	540	532	Pass
L	Popliteal Height	343	369	361	Pass
M	Knee Pivot to floor height	392	409	398	Pass
N	Buttock Popliteal Length	416	442	430	Pass
O	Chest Depth w/o jacket	195	211	208	Pass
P	Foot Length	216	232	220	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	317	Pass
R	Arm Length	249	259	254	Pass
S	Knee Joint to seatback	477	493	484	Pass
V	Shoulder Width	341	357	352	Pass
W	Foot Width	78	94	83	Pass
Y	Chest Circumference w/jacket	851	881	875	Pass
Z	Waist Circumference	761	791	773	Pass

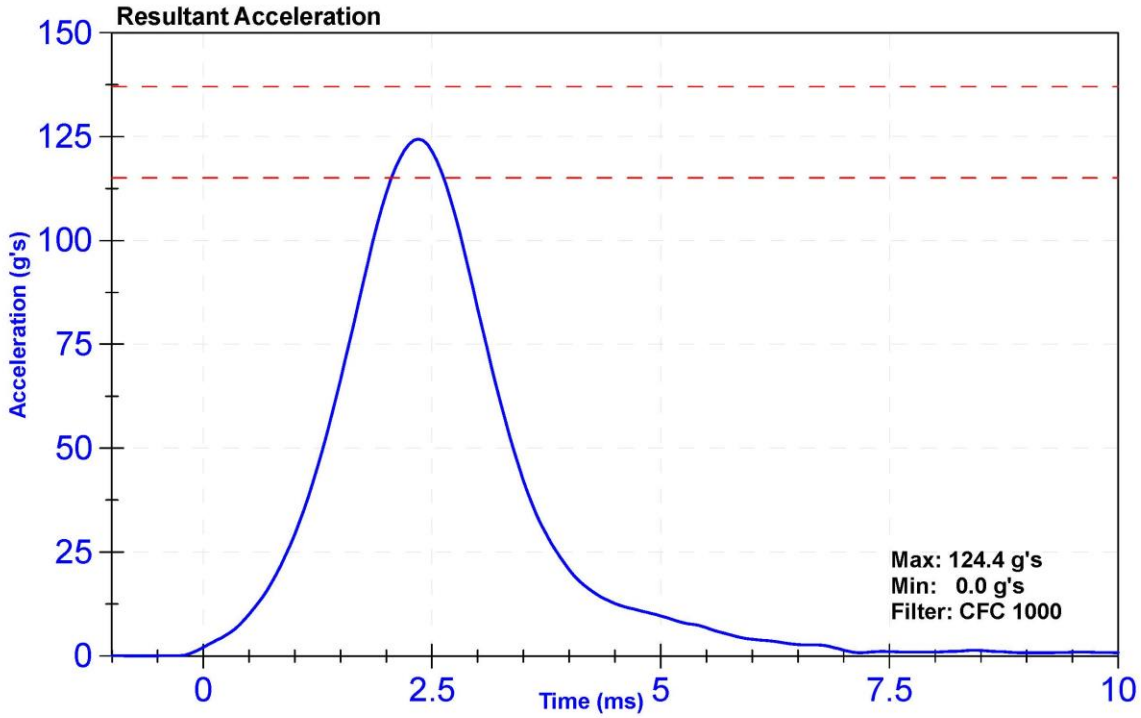
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

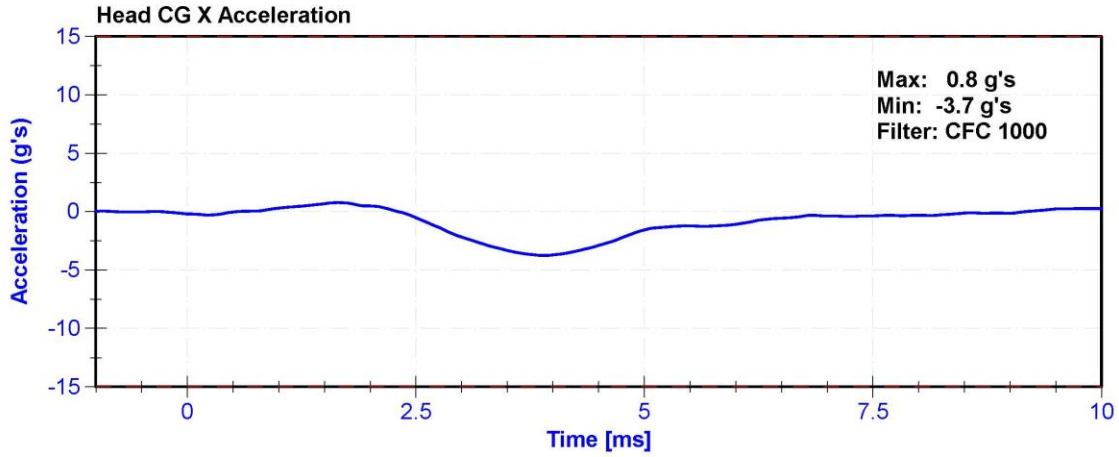
Results

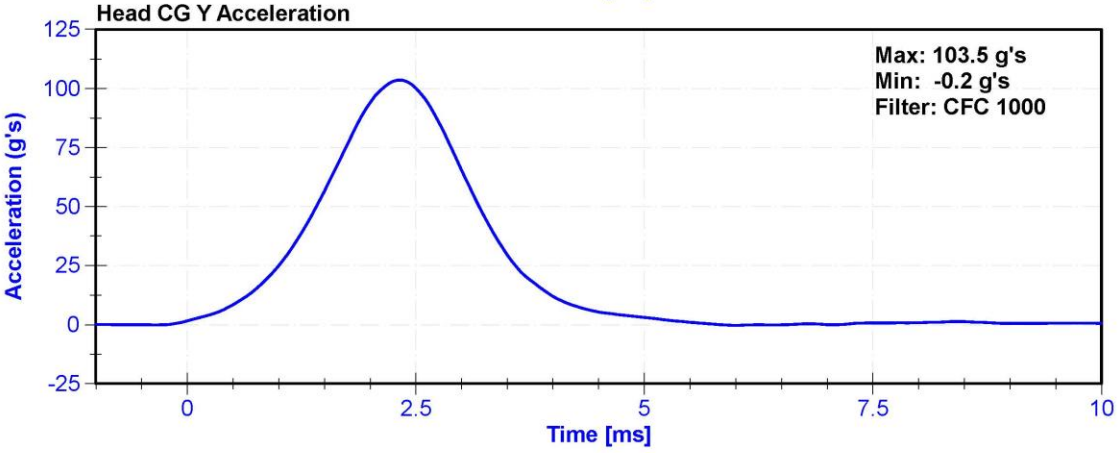
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	23	Pass
Resultant Acceleration	115	137	g's	124.4	Pass
Oscillation	0	15	%	1.0	Pass
Fore-Aft Acceleration	-15	15	g's	-3.7	Pass

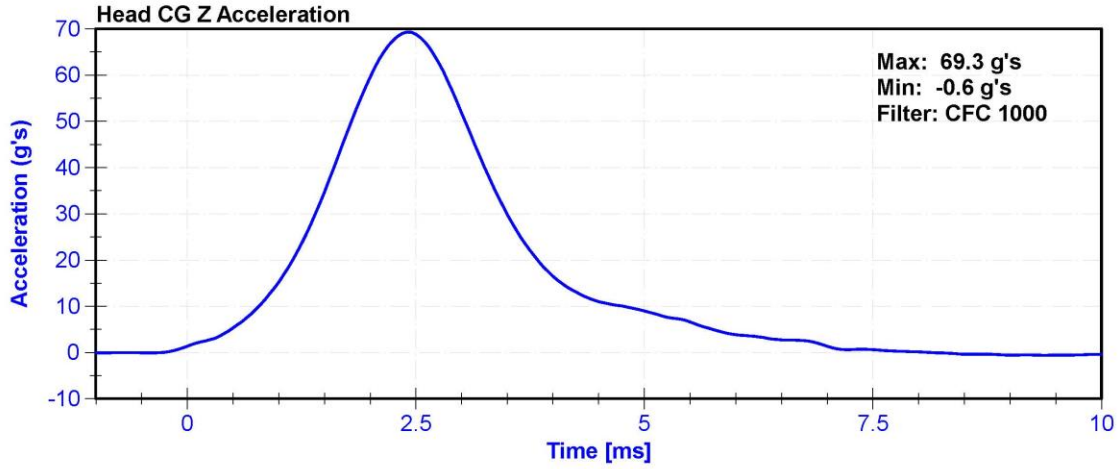
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P59018	11/10/2020	5/11/2021
Y Accelerometer	ENDEVCO 7264	AC-P79189	11/10/2020	5/11/2021
Z Accelerometer	ENDEVCO 7264CT	AC-P58777	11/10/2020	5/11/2021




Head CG X Acceleration
Max: 0.8 g's
Min: -3.7 g's
Filter: CFC 1000
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]


Head CG Y Acceleration
Max: 103.5 g's
Min: -0.2 g's
Filter: CFC 1000
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]


Head CG Z Acceleration
Max: 69.3 g's
Min: -0.6 g's
Filter: CFC 1000
Acceleration (g's)
70
60
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]

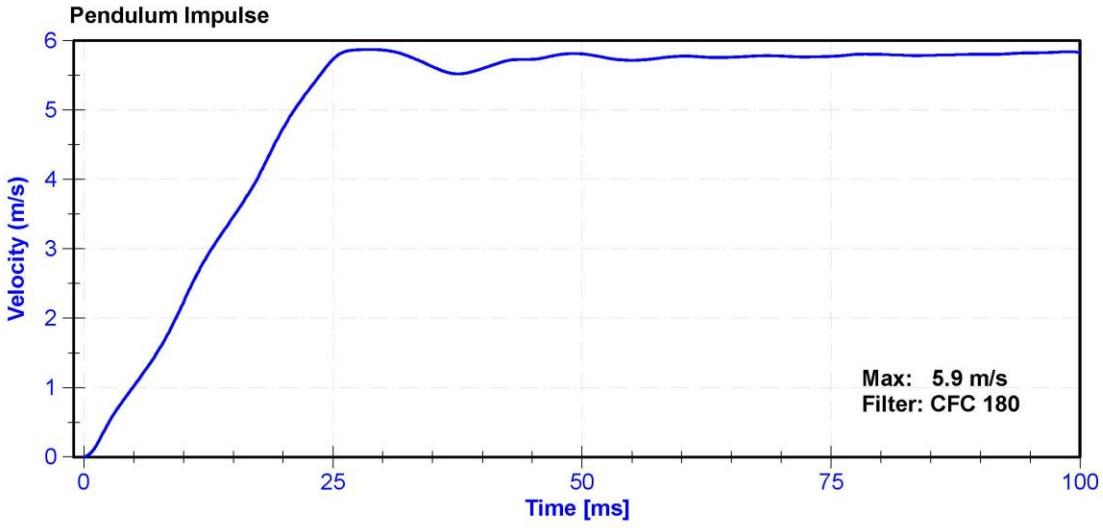
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

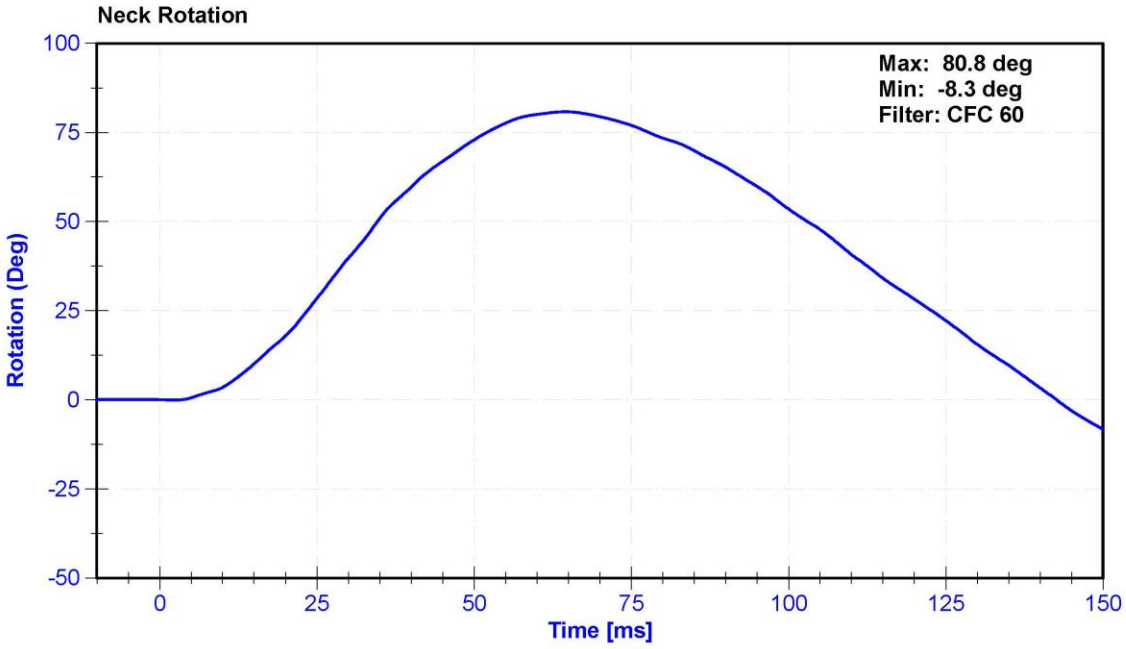
Results

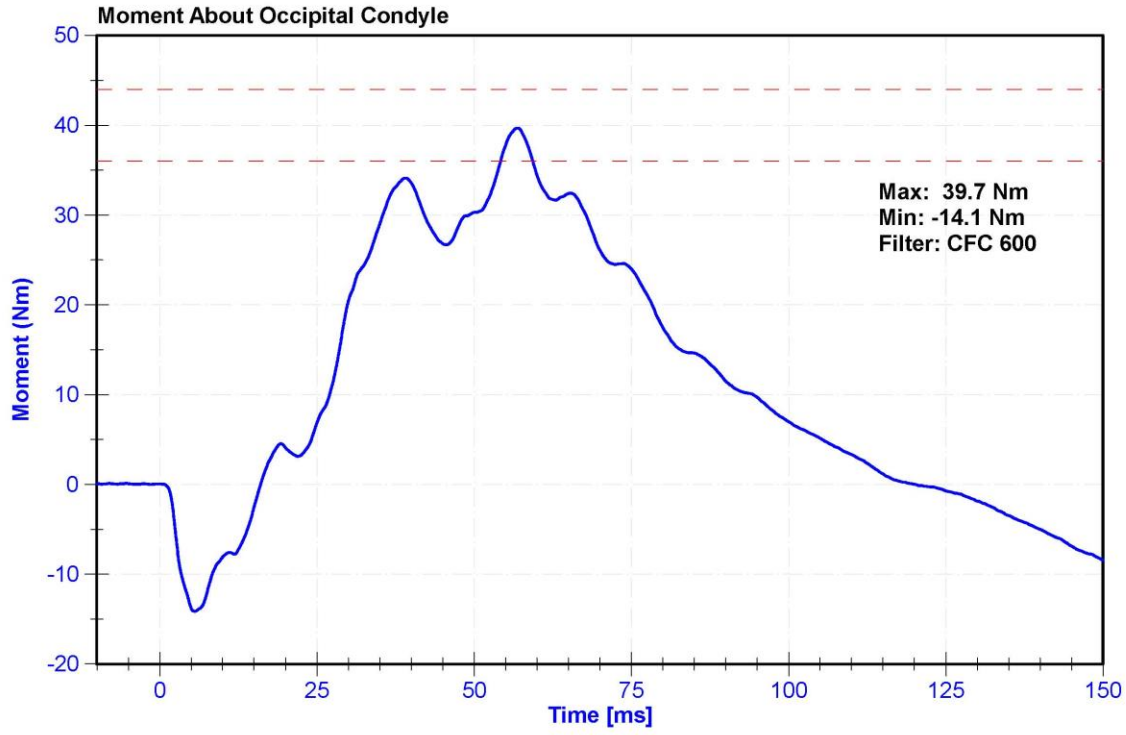
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	22.7	Pass
Velocity	5.51	5.63	m/s	5.584	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.23	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.46	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.73	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.73	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.87	Pass
Neck Rotation	71	81	deg	80.8	Pass
Time at Maximum Rotation	50	70	ms	64.5	Pass
Moment about the OC	36	44	Nm	39.7	Pass
Moment Decay to 0 Nm	102	126	ms	120.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C16503 Striker	2/5/2021	2/5/2022
Pendulum Potentiometer	Denton 78051-342	DS-184Pend	11/6/2020	11/6/2021
Condyle Potentiometer	Denton 78051-342	DS-185Pend	11/6/2020	11/6/2021
Upper Neck Load Cell	Denton 1716	17162019 FY	3/18/2020	3/18/2021




Neck Rotation
Max: 80.8 deg
Min: -8.3 deg
Filter: CFC 60
Rotation (Deg)
Time [ms]
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150


Moment About Occipital Condyle
Max: 39.7 Nm
Min: -14.1 Nm
Filter: CFC 600
Moment (Nm)
Time [ms]
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150

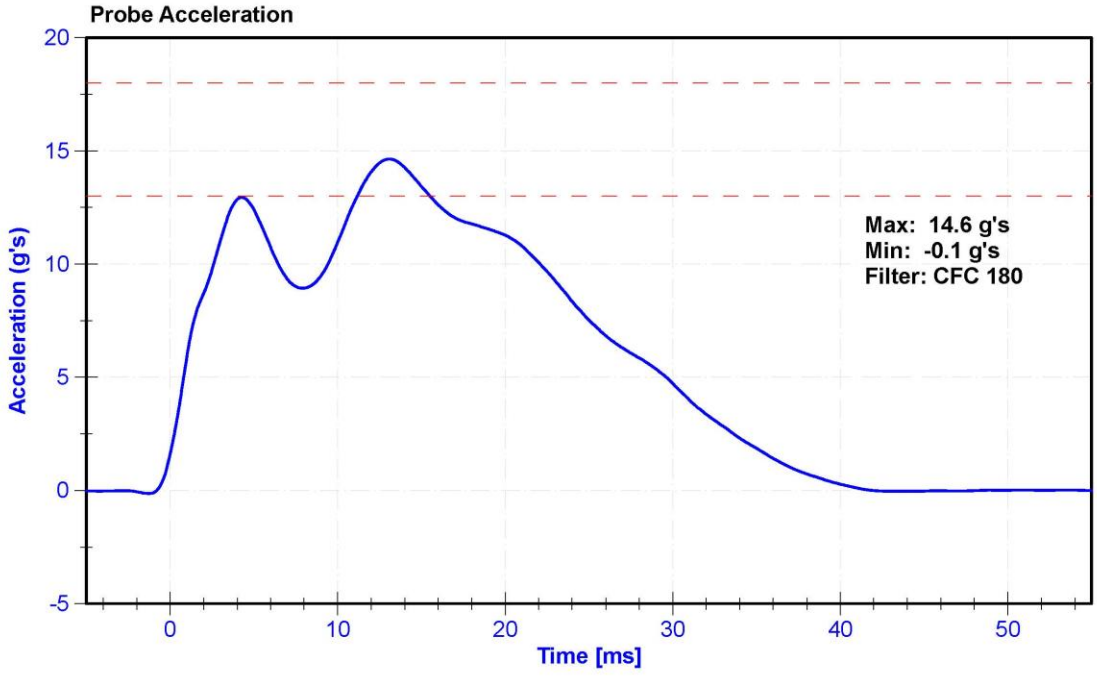
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

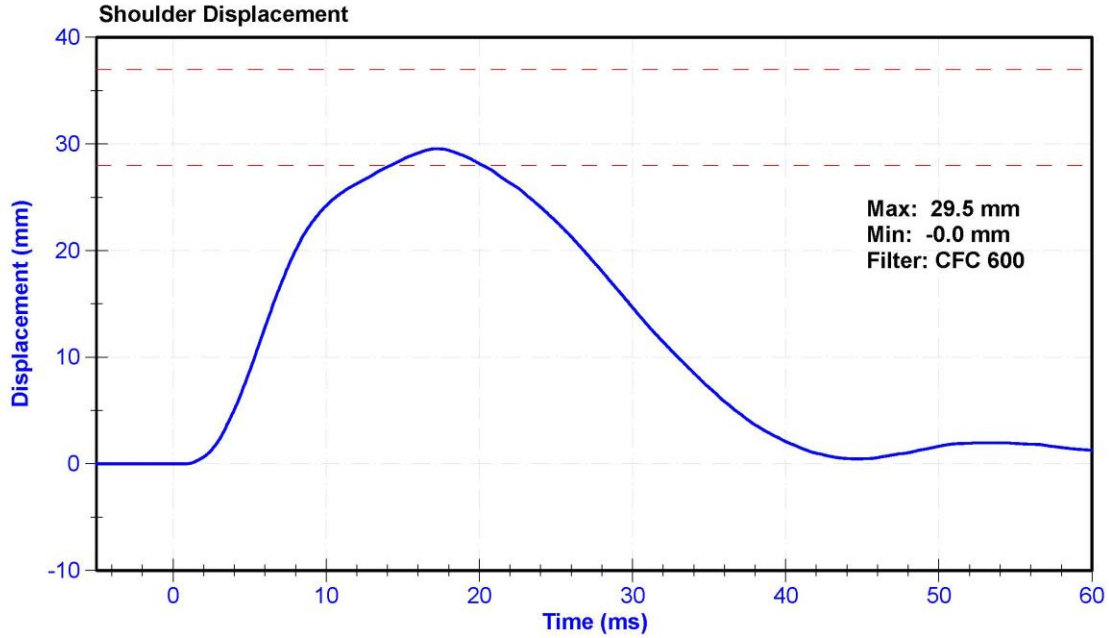
Results

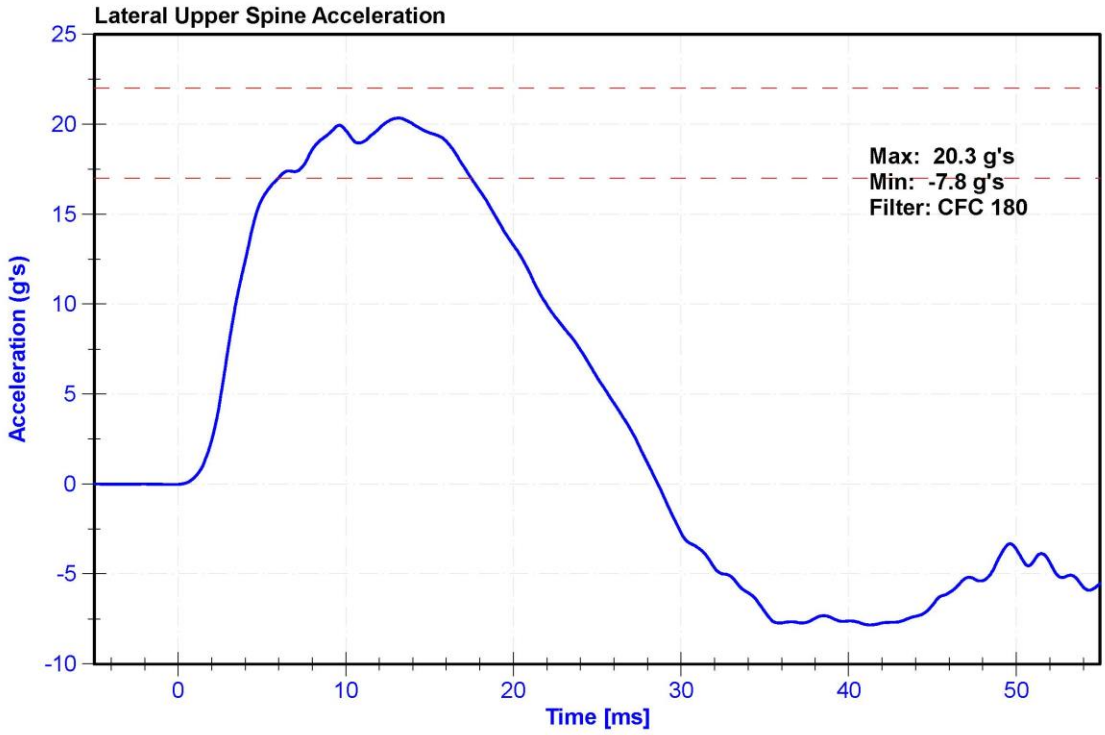
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	23	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	13	18	g's	14.6	Pass
Shoulder Deflection	28	37	mm	29.5	Pass
Lateral Upper Spine Acceleration	17	22	g's	20.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264C	T25885	2/2/2021	2/2/2022
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	11/10/2020	5/11/2021
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P71281	11/9/2020	5/10/2021




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 29.5 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 20.3 g's
Min: -7.8 g's
Filter: CFC 180

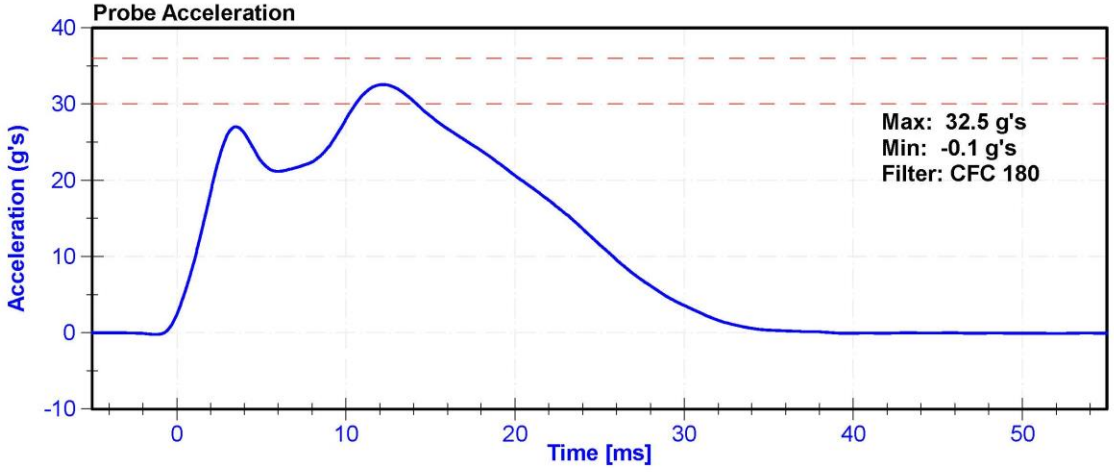
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

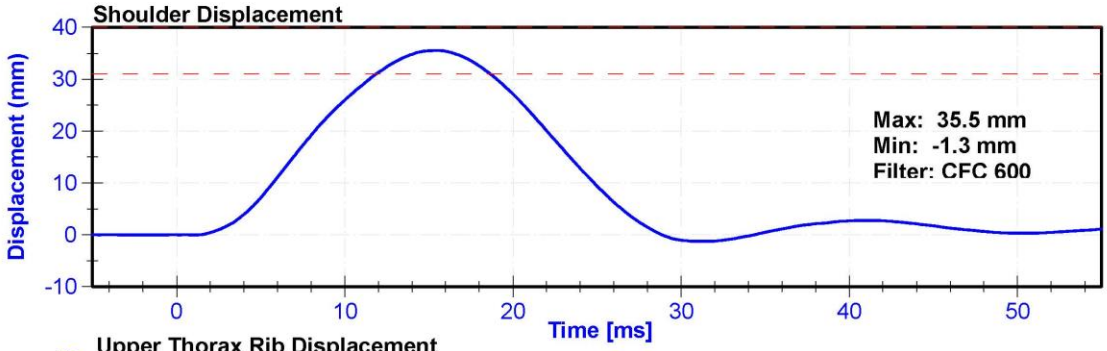
Results

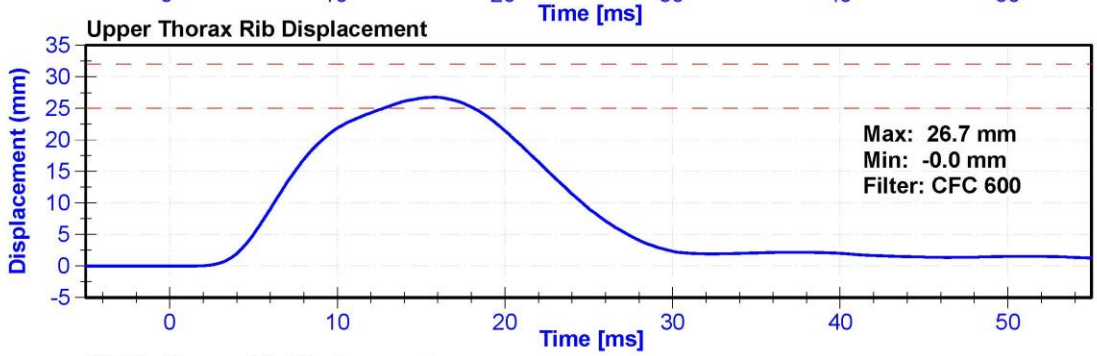
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	23	Pass
Velocity	6.6	6.8	m/s	6.74	Pass
Probe Acceleration after 5 ms	30	36	g's	32.5	Pass
Lateral Upper Spine Acceleration	34	43	g's	40.3	Pass
Lateral Lower Spine Acceleration	29	37	g's	32.8	Pass
Shoulder Deflection	31	40	mm	35.5	Pass
Upper Thorax Rib Deflection	25	32	mm	26.7	Pass
Mid Thorax Rib Deflection	30	36	mm	31.3	Pass
Lower Thorax Rib Deflection	32	38	mm	32.4	Pass

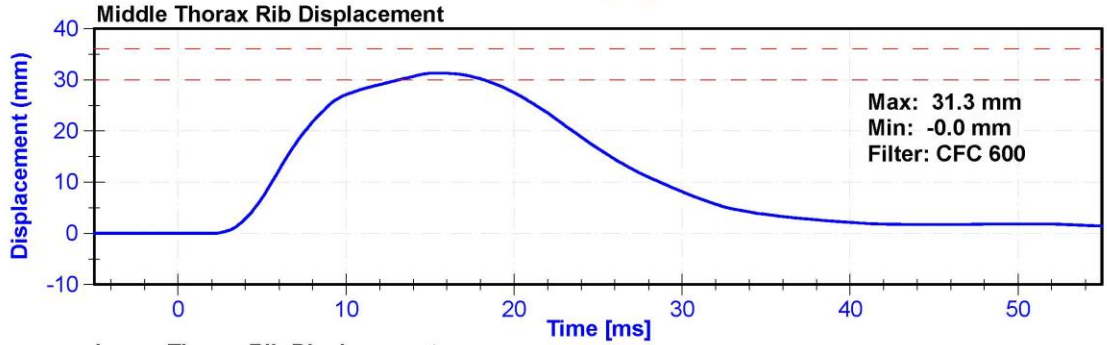
Transducer Calibrations

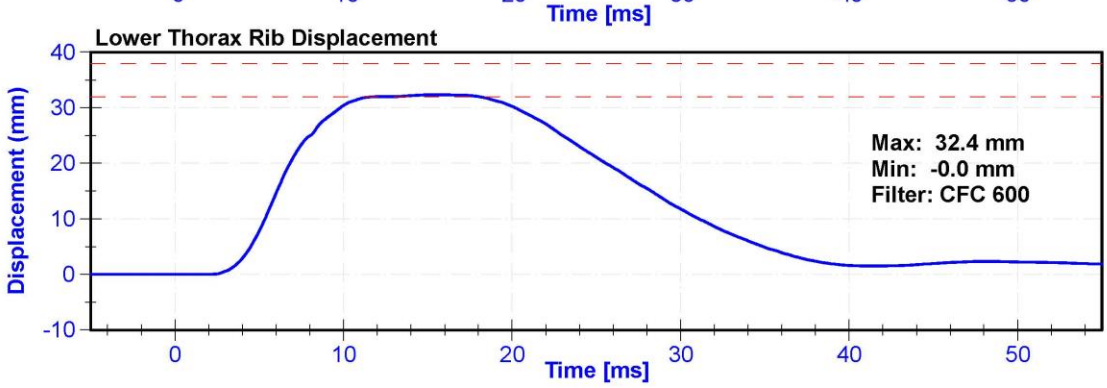
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264C	T25885	2/2/2021	2/2/2022
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P71281	11/9/2020	5/10/2021
Upper Spine T12 Y Accelerometer	ENDEVCO 7264	AC-P64147	11/9/2020	5/10/2021
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	11/10/2020	5/11/2021
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	11/10/2020	5/11/2021
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	11/10/2020	5/11/2021
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	11/9/2020	5/10/2021

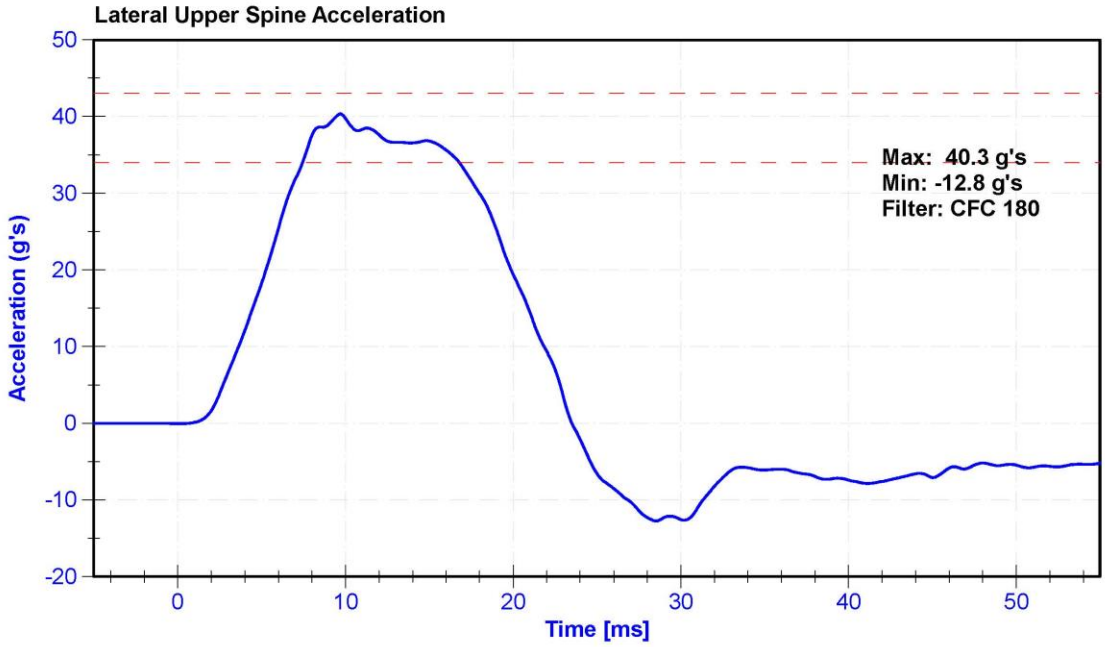


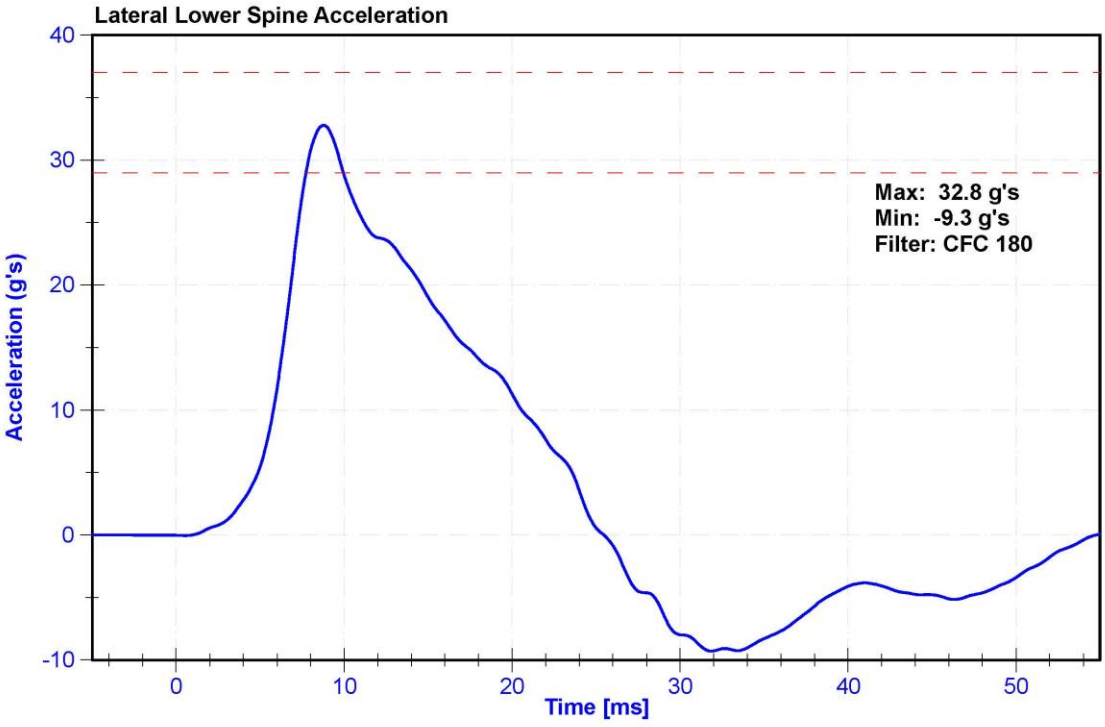

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 35.5 mm
Min: -1.3 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 26.7 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 31.3 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 32.4 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 40.3 g's
Min: -12.8 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 32.8 g's
Min: -9.3 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50

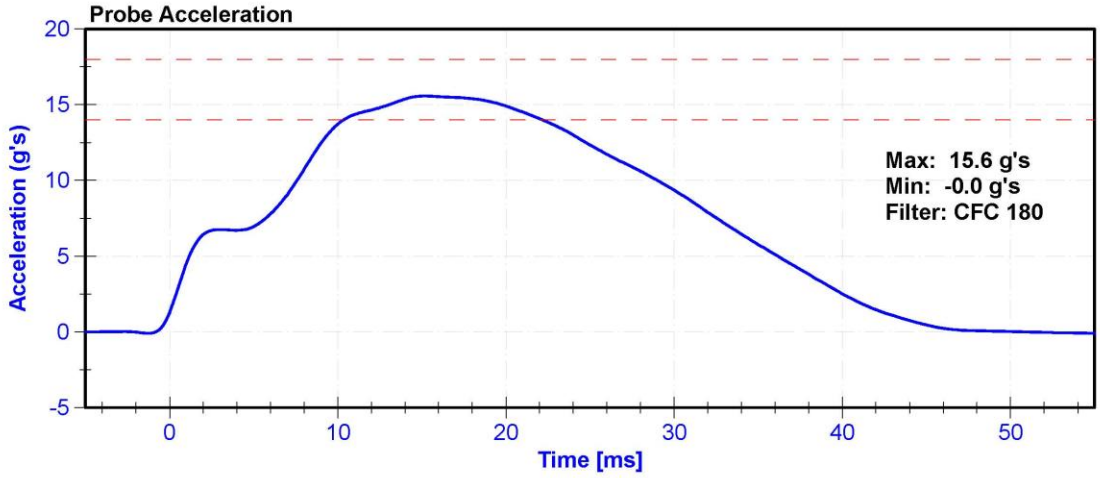
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

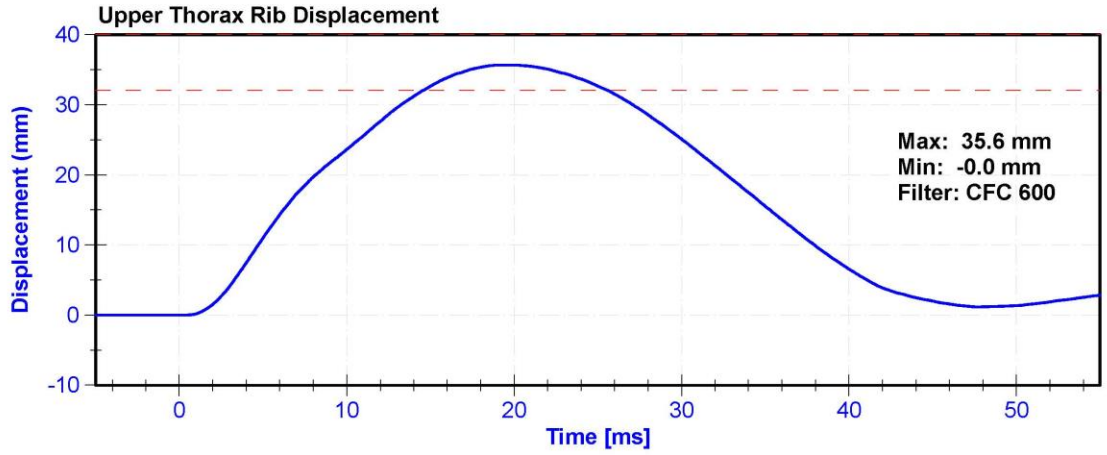
Results

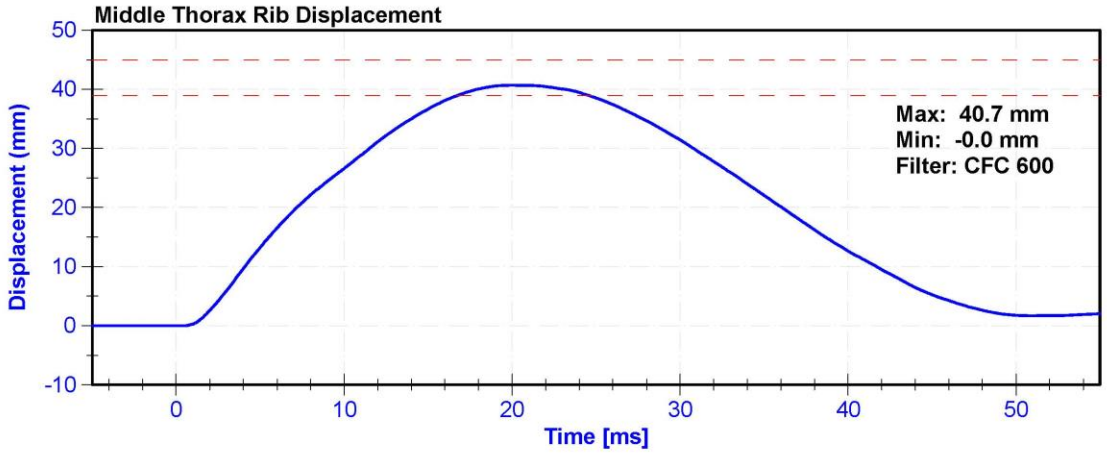
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	23	Pass
Velocity	4.2	4.4	m/s	4.37	Pass
Probe Acceleration	14	18	g's	15.6	Pass
Lateral Upper Spine Acceleration	13	17	g's	16.7	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.6	Pass
Upper Thorax Rib Deflection	32	40	mm	35.6	Pass
Middle Thorax Rib Deflection	39	45	mm	40.7	Pass
Lower Thorax Rib Deflection	35	43	mm	36.3	Pass

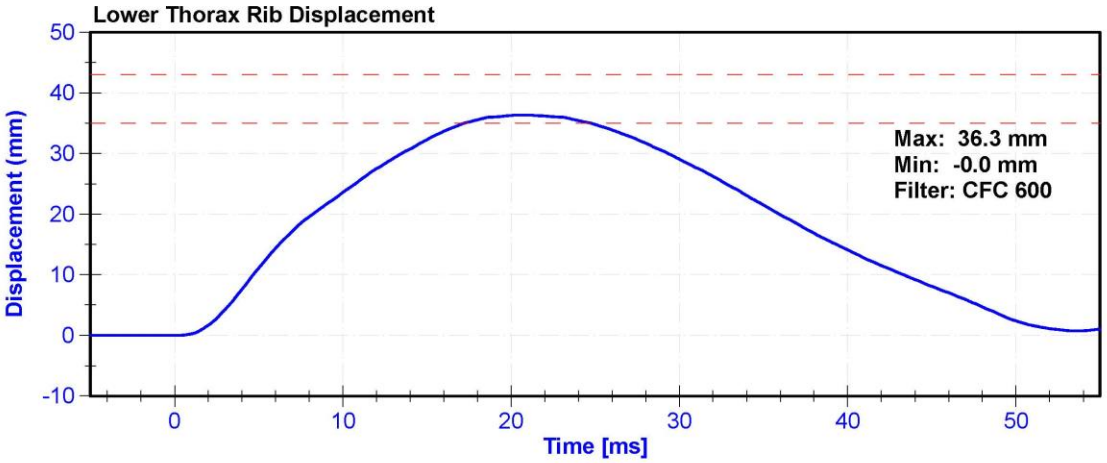
Transducer Calibrations

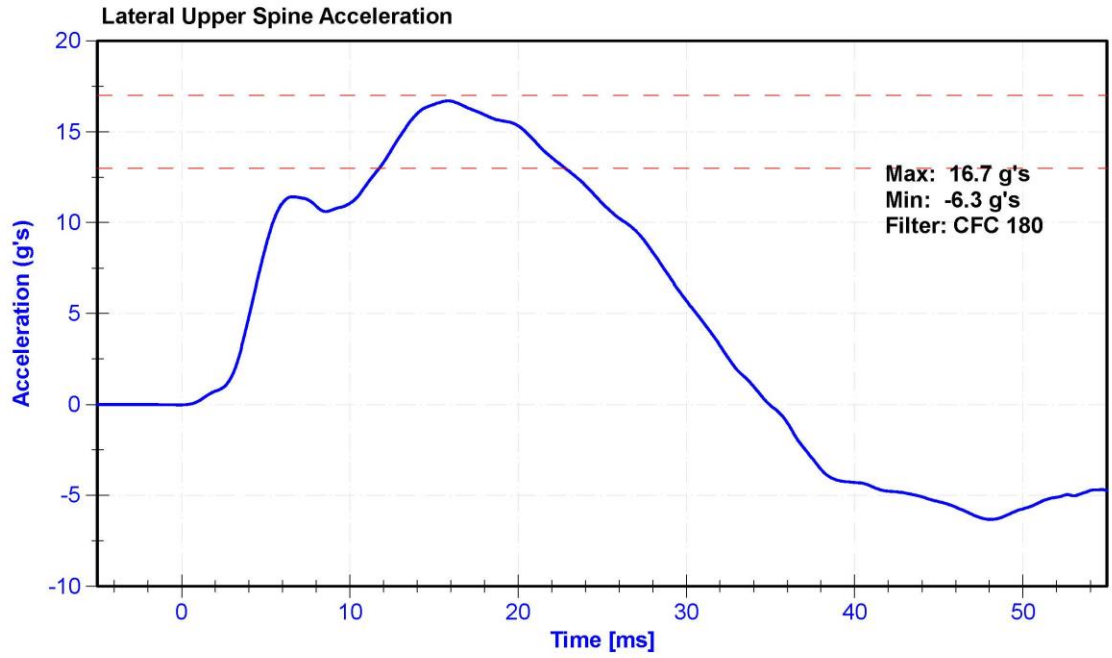
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264C	T25885	2/2/2021	2/2/2022
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P71281	11/9/2020	5/10/2021
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	11/9/2020	5/10/2021
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	11/10/2020	5/11/2021
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	11/10/2020	5/11/2021
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	11/9/2020	5/10/2021

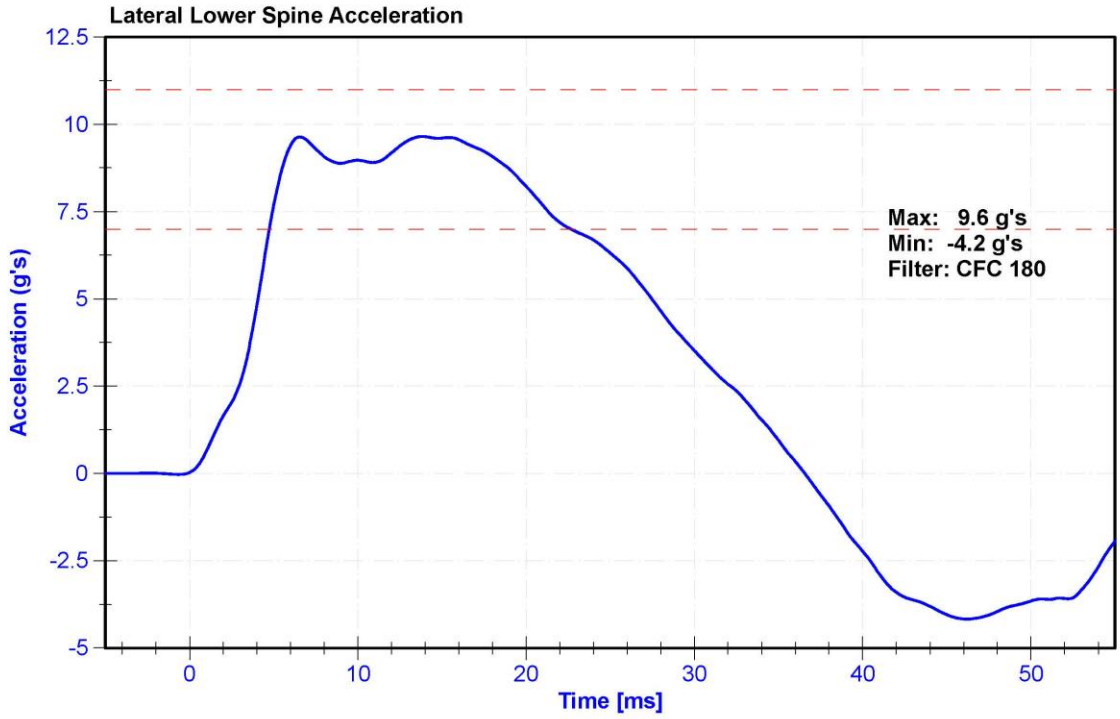



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 35.6 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.7 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 36.3 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 16.7 g's
Min: -6.3 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
20
15
10
5
0
-5
-10
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 9.6 g's
Min: -4.2 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50

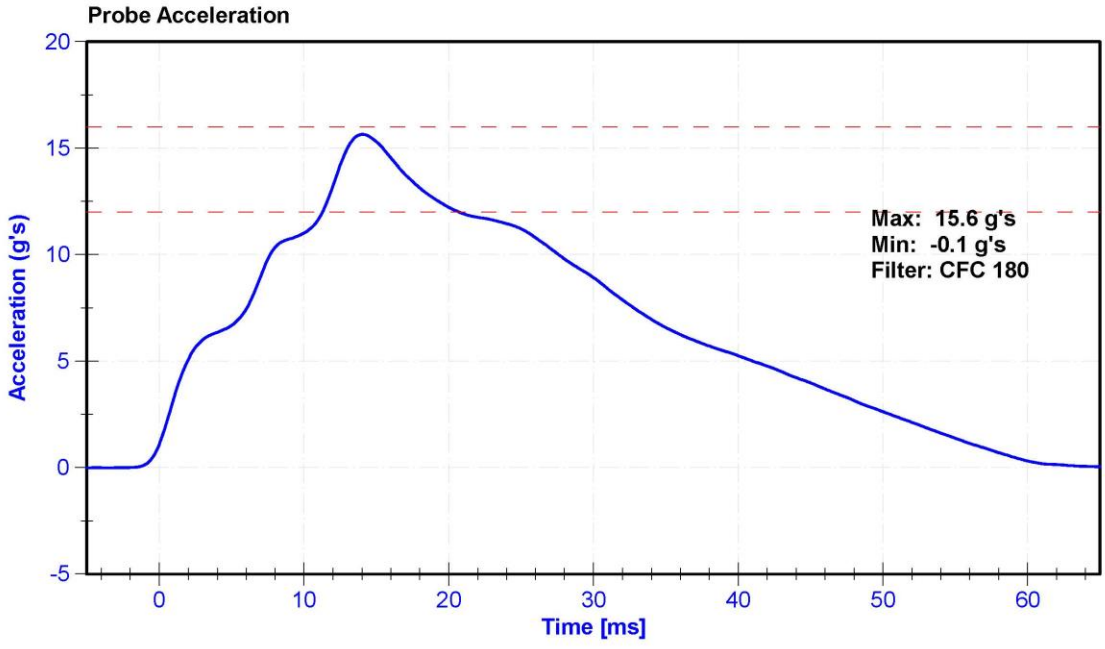
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

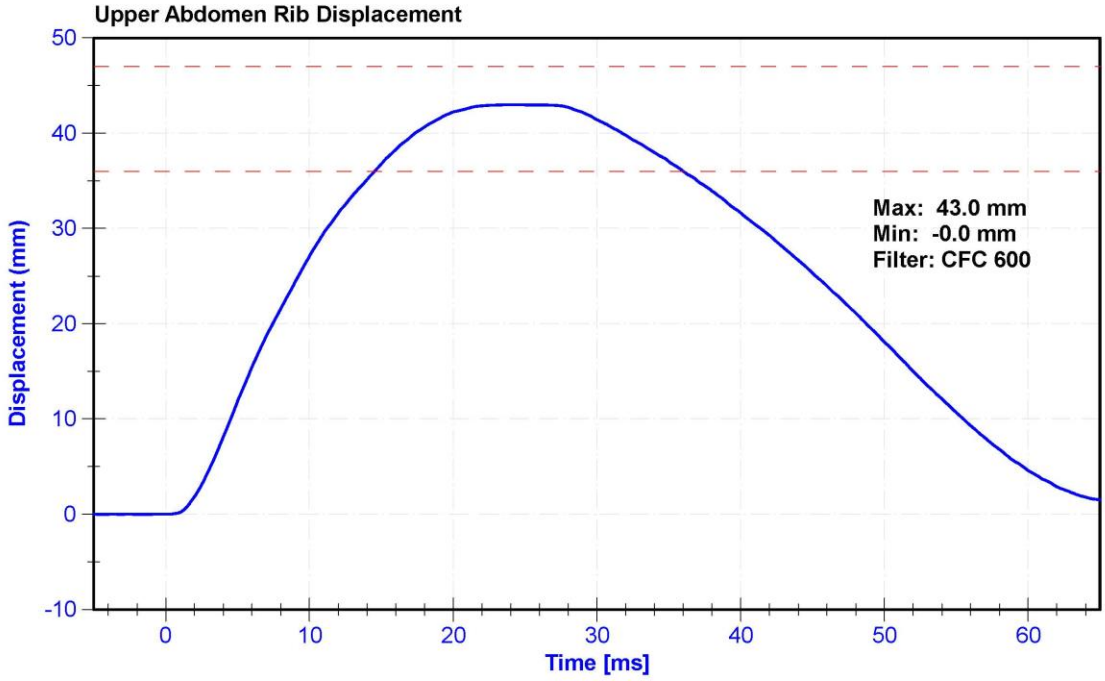
Results

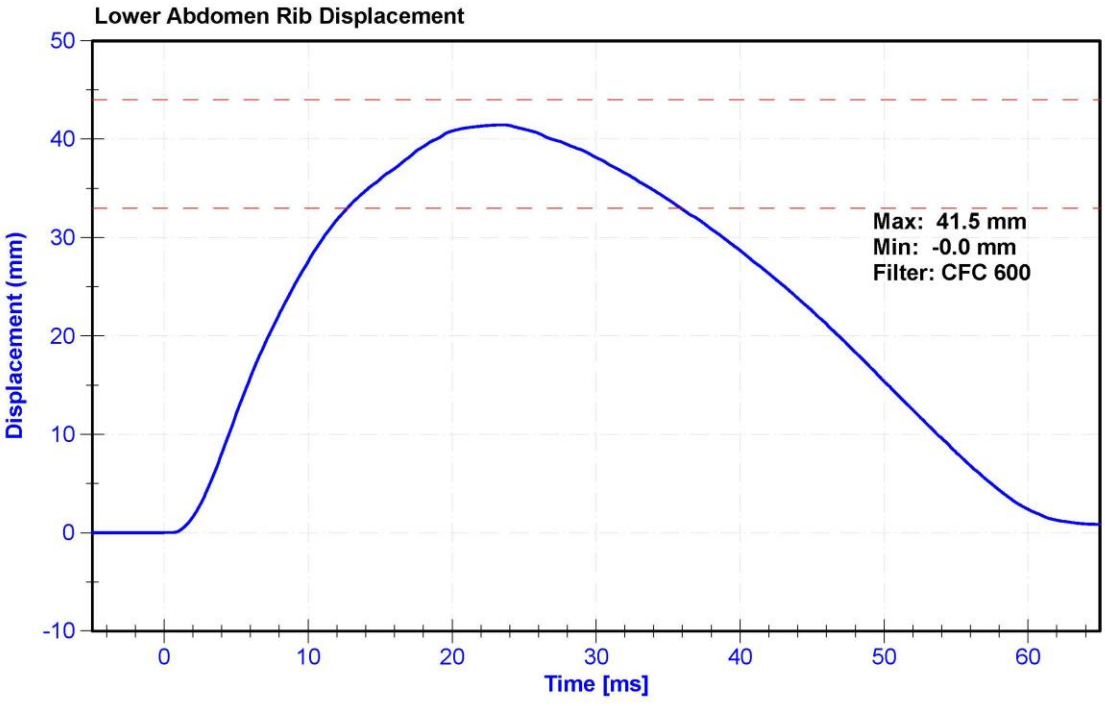
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	23	Pass
Velocity	4.2	4.4	m/s	4.33	Pass
Probe Acceleration	12	16	g's	15.6	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.5	Pass
Upper Abdomen Rib Deflection	36	47	mm	43.0	Pass
Lower Abdomen Rib Deflection	33	44	mm	41.5	Pass

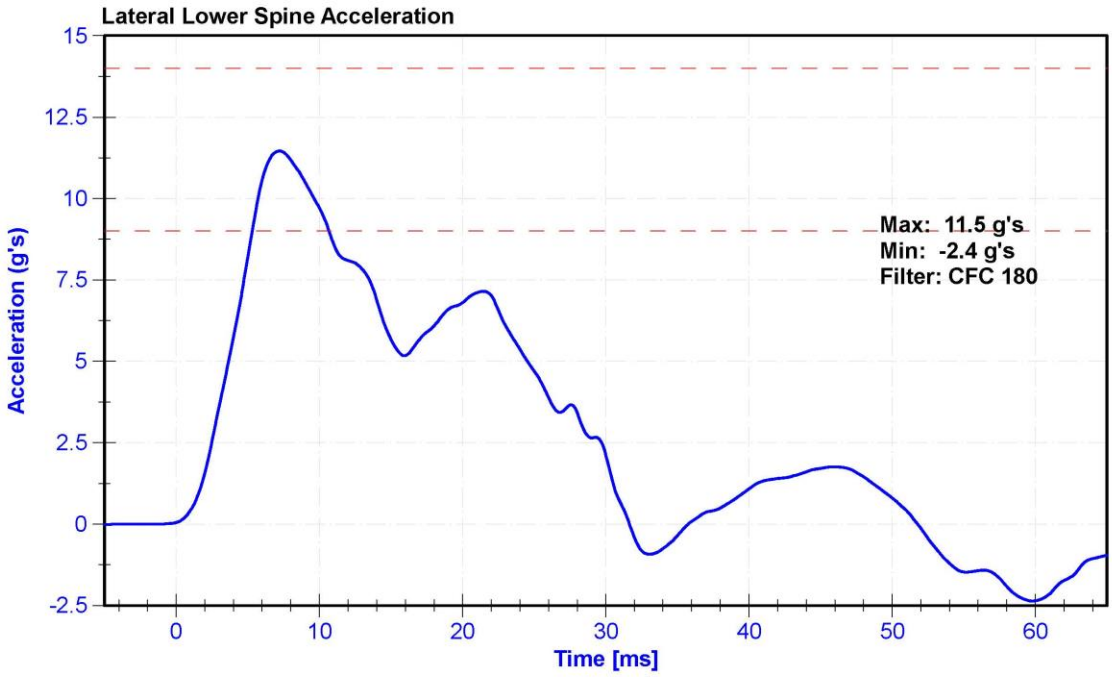
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264C	T25885	2/2/2021	2/2/2022
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	11/9/2020	5/10/2021
Upper Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-308GFE	11/10/2020	5/11/2021
Lower Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-307GFE	11/10/2020	5/11/2021




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 43.0 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.5 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Lower Spine Acceleration
Acceleration (g's)
15
12.5
10
7.5
5
2.5
0
-2.5
0
10
20
30
40
50
60
Time [ms]
Max: 11.5 g's
Min: -2.4 g's
Filter: CFC 180

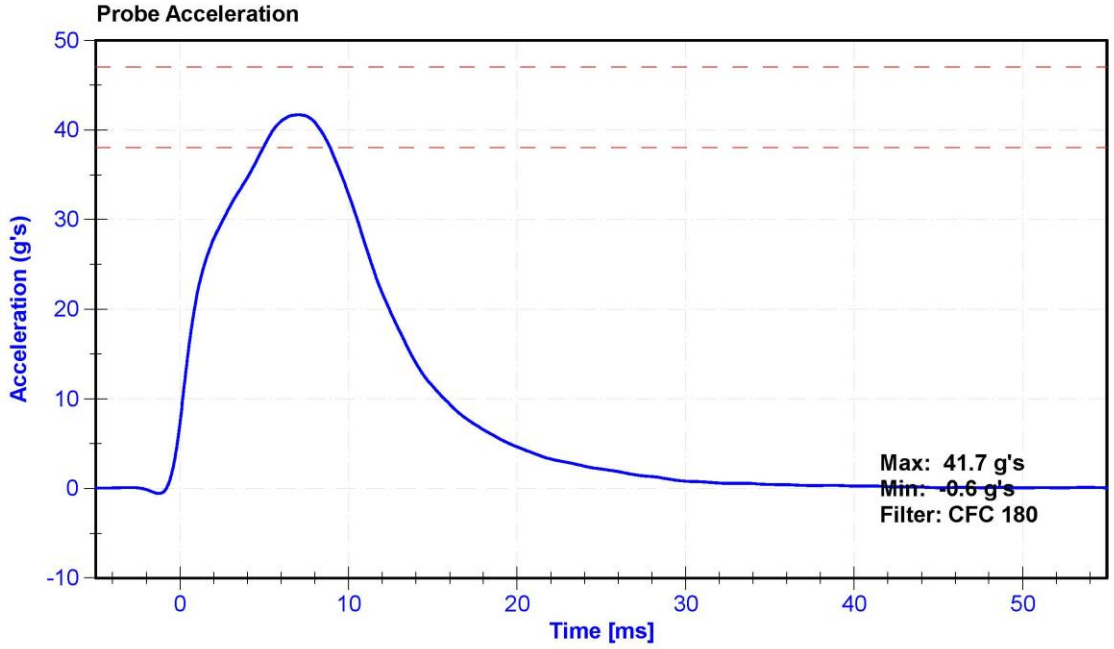
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

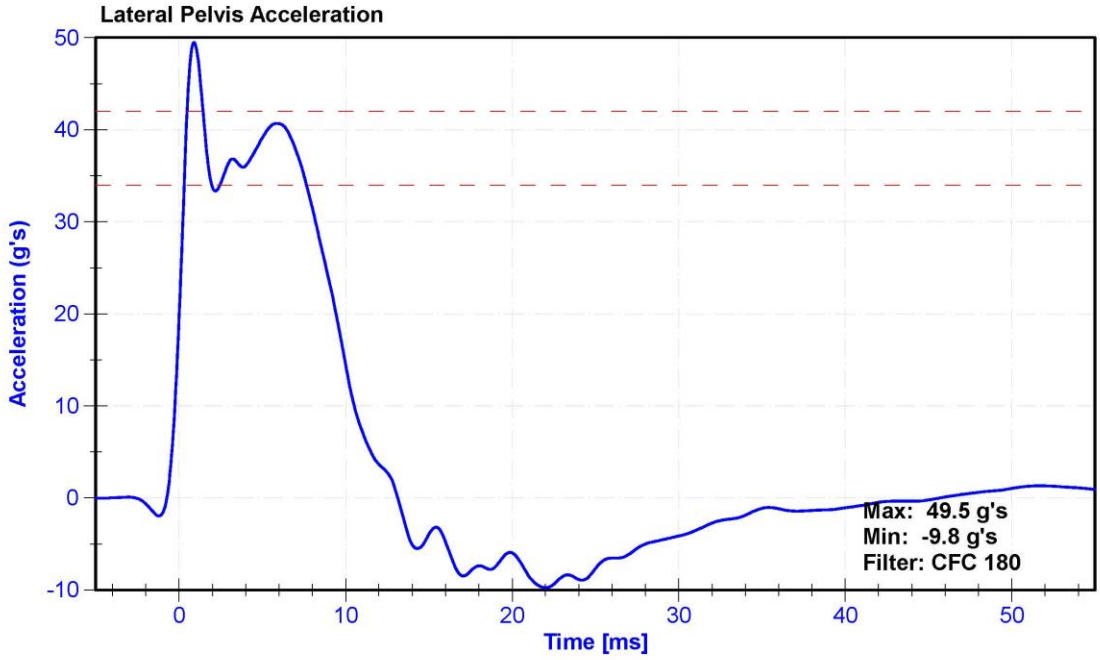
Results

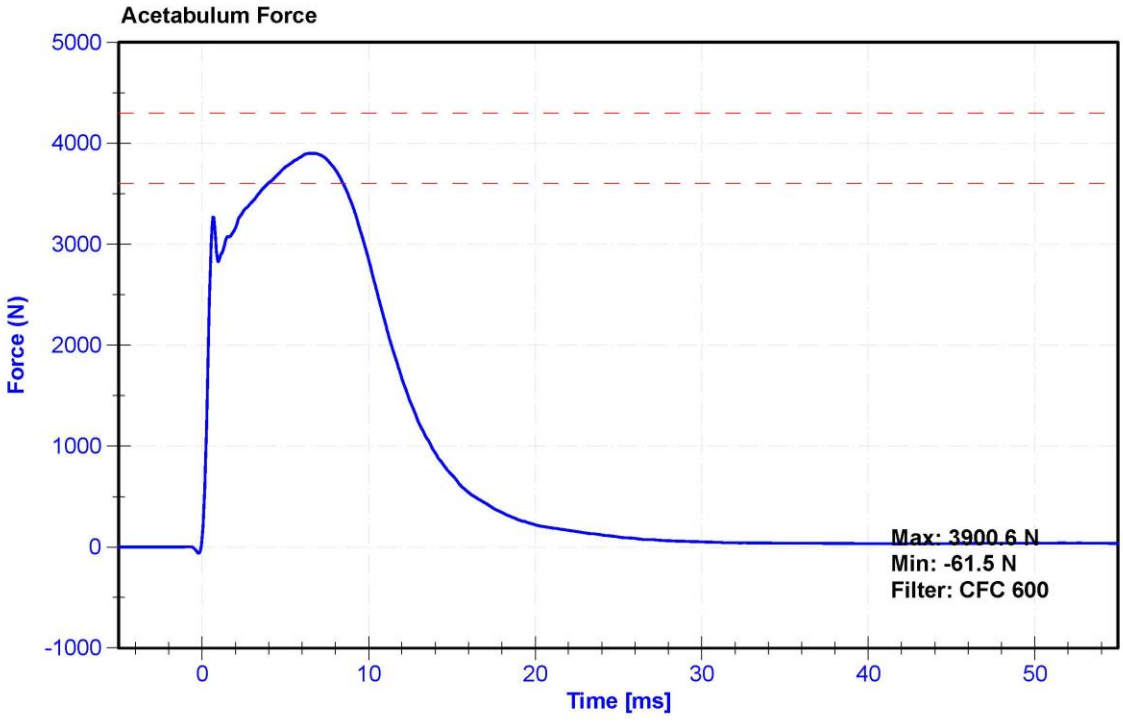
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	23	Pass
Velocity	6.6	6.8	m/s	6.68	Pass
Probe Acceleration	38	47	g's	41.7	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	40.7	Pass
Acetabulum Force	3600	4300	N	3900.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264C	T25885	2/2/2021	2/2/2022
Pelvis Y Accelerometer	ENDEVCO 7264C	AC-P51731	11/9/2020	5/10/2021
Acetabulum Load Cell	Denton IF-520	LC-236Fy	3/18/2020	3/18/2021
Certification Plug	SACO	13858	5/20/2020	N/A
Crash Test Plug	SACO	13701	9/26/2020	N/A




Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 49.5 g's
Min: -9.8 g's
Filter: CFC 180


Acetabulum Force
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 3900.6 N
Min: -61.5 N
Filter: CFC 600

SACO RESEARCH

300 Crash 2/11/21 SV

SID-IIs Pelvis Plug Certification Test

Plug S/N 13701
Test Number 11349
Report Number 11387
Test Date 9/26/2019 1:59:45 PM

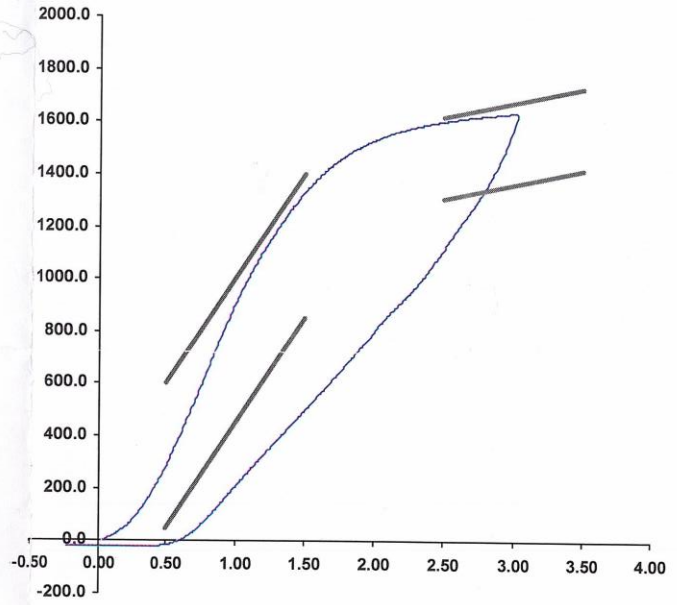
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	304.95	50.00	600.00
Force @ 1.5 mm (N)	1,336.80	850.00	1,400.00
Force @ 2.5 mm (N)	1,603.42	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,635.05	1,361.00	1,673.00

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

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

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 26-Sep-19
SACO Research

By : DC Date : 9/26/2019

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

300
Non-Impact
2/11/21
SV

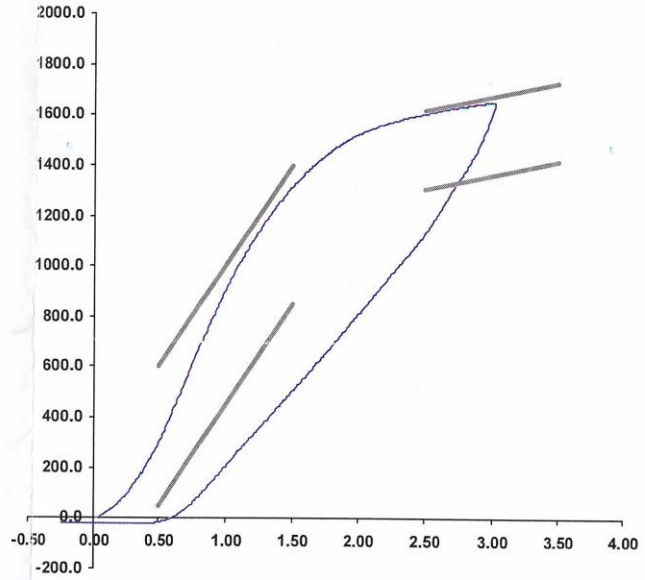
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 13042
Test Number 10362
Report Number 10397
Test Date 7/30/2019 1:17:25 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	314.46	50.00	600.00
Force @ 1.5 mm (N)	1,322.57	850.00	1,400.00
Force @ 2.5 mm (N)	1,607.66	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,654.24	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 30-Jul-19
SACO Research

By : DC Date : 7/30/2019

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

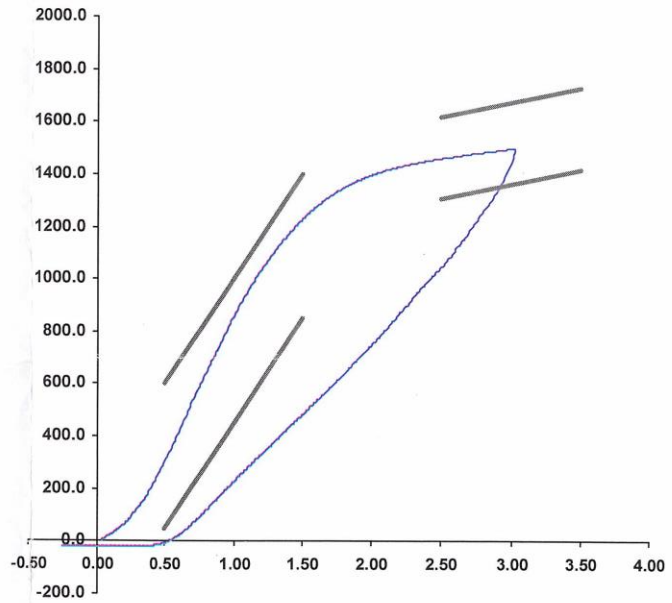
300
CoA 1
2/11/21
SV

SID-IIs Pelvis Plug Certification Test

Plug S/N 13858
Test Number 13332
Report Number 13377
Test Date 5/20/2020 6:34:22 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	311.53	50.00	600.00
Force @ 1.5 mm (N)	1,229.85	850.00	1,400.00
Force @ 2.5 mm (N)	1,460.40	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,496.59	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000
Preload Value (-N) 22.24
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 20-May-20
SACO Research

By : DC Date : 5/20/2020

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

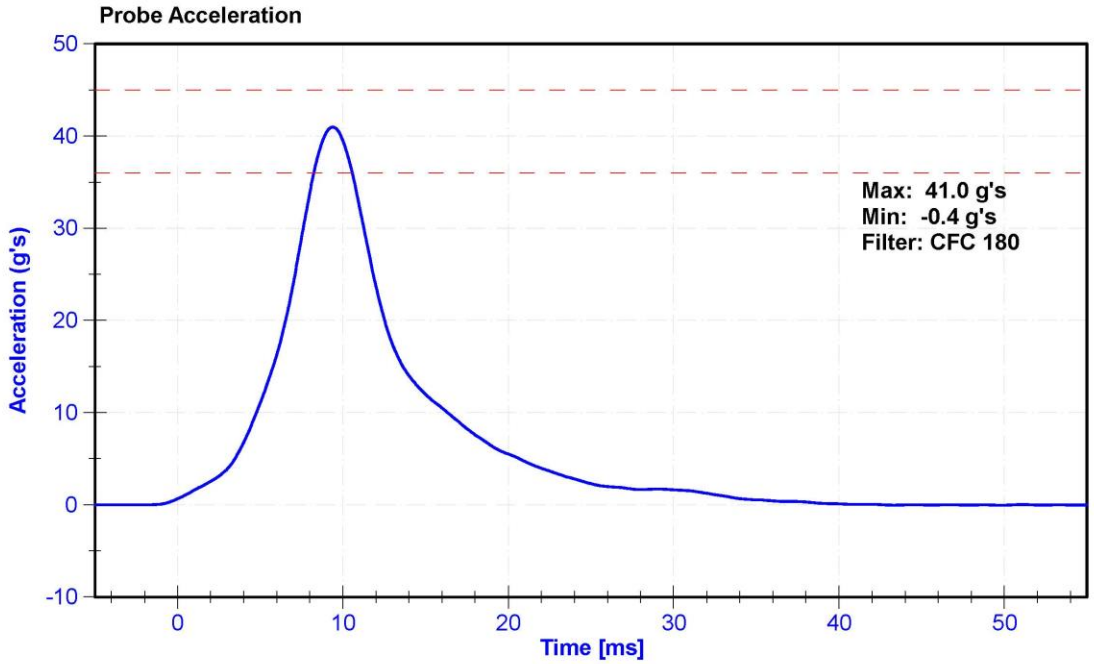
ATD Manufacturer	FTSS	Test Technician	K. Brogan
ATD Serial Number	300	Laboratory Supervisor	S. Vacanti

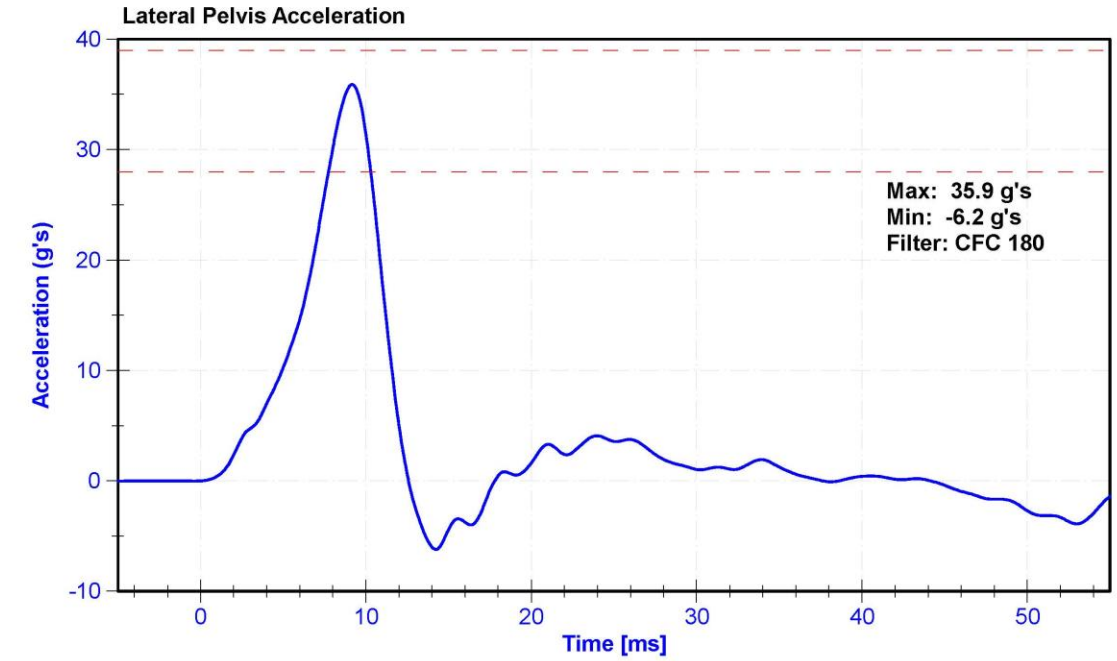
Results

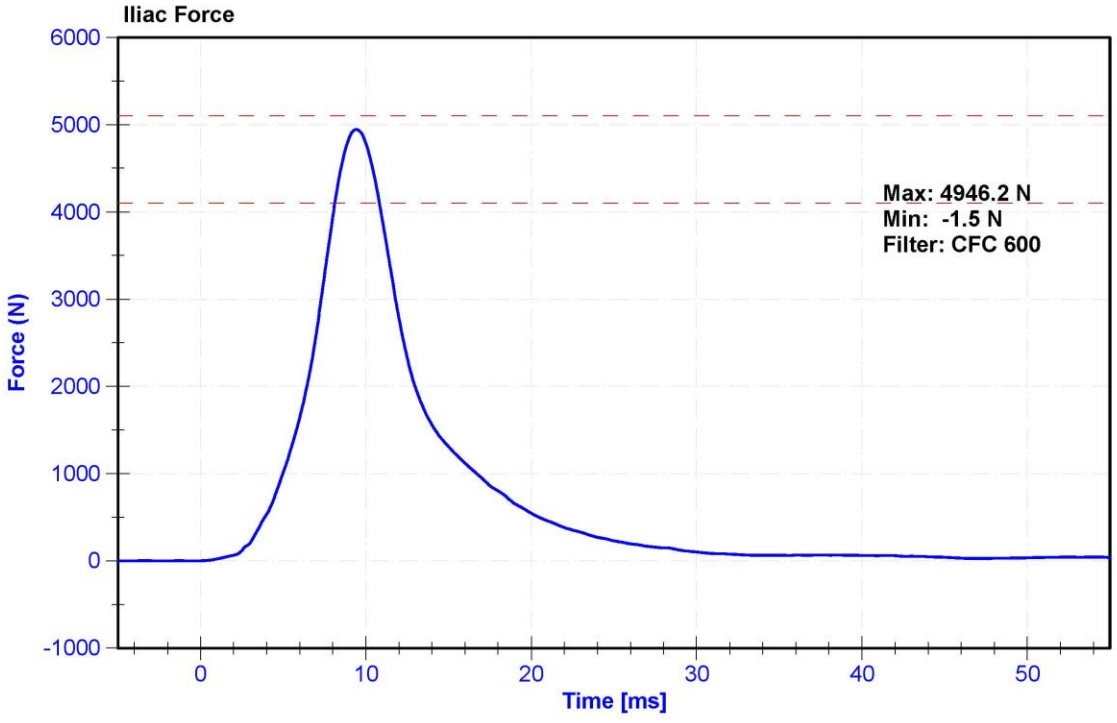
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	23	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	36	45	g's	41.0	Pass
Lateral Pelvis Acceleration	28	39	g's	35.9	Pass
Iliac Force	4100	5100	N	4946.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264C	T25885	2/2/2021	2/2/2022
Pelvis Y Accelerometer	ENDEVCO 7264C	AC-P51731	11/9/2020	5/10/2021
Iliac Load Cell	DENTON 3228J	LC-279Fy	11/23/2020	11/23/2021




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 35.9 g's
Min: -6.2 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4946.2 N
Min: -1.5 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

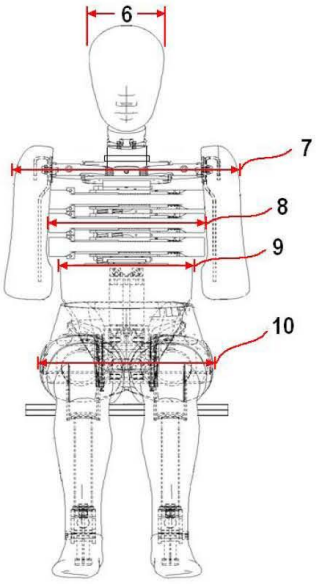
SERIAL NO: F033

(CONFIGURED FOR LEFT SIDE IMPACT)

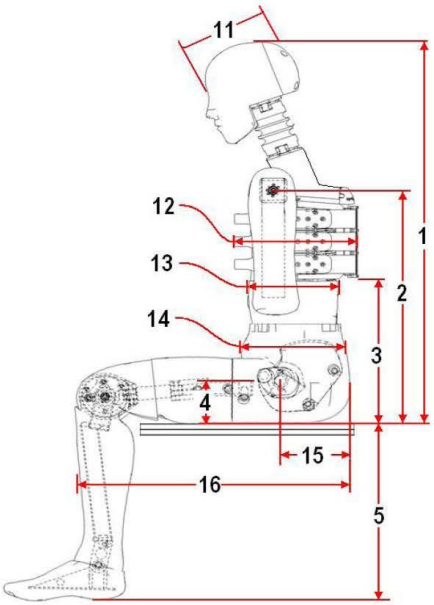
External Measurements - EuroSID-2re

Technician: K. Brogan Date: 3/11/2021

Dummy Serial Number: F033



FRONT VIEW



SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	912	Pass
2	Seat to Shoulder Joint	558	572	569	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	98	Pass
5	Sole to Seat, Sitting	333	451	426	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	329	Pass
9	Abdomen Width	273	287	285	Pass
10	Pelvis Lap Width	359	373	367	Pass
11	Head Depth	196	206	201	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	239	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

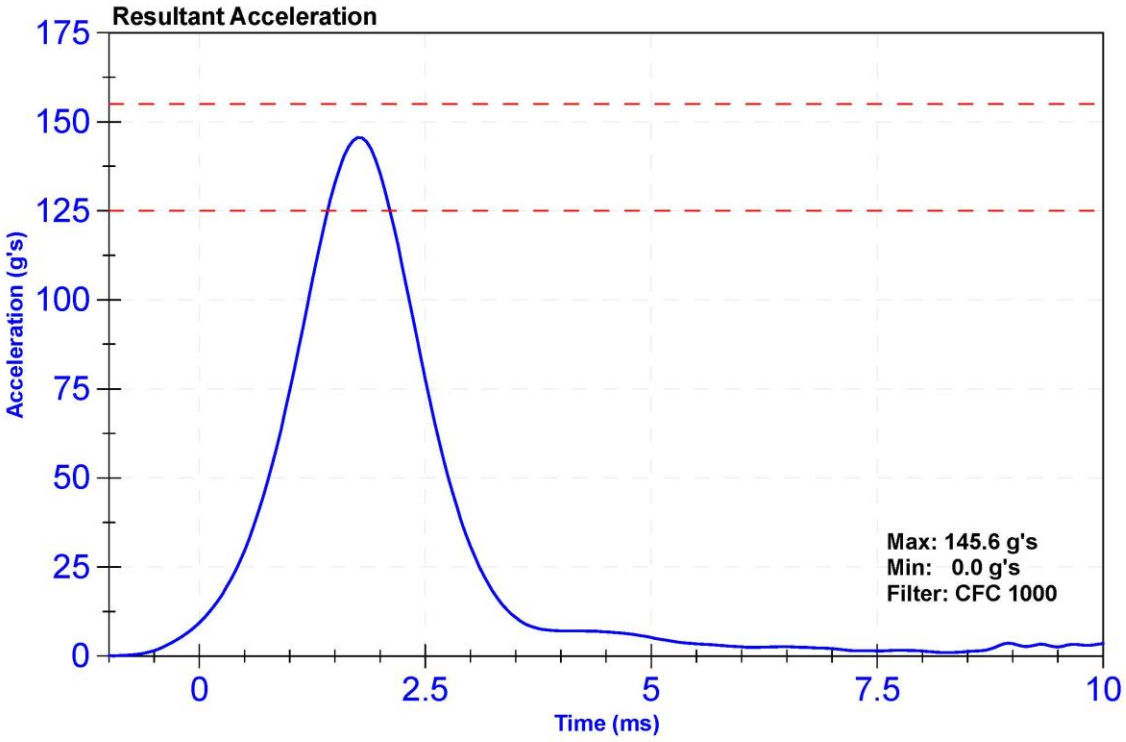
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

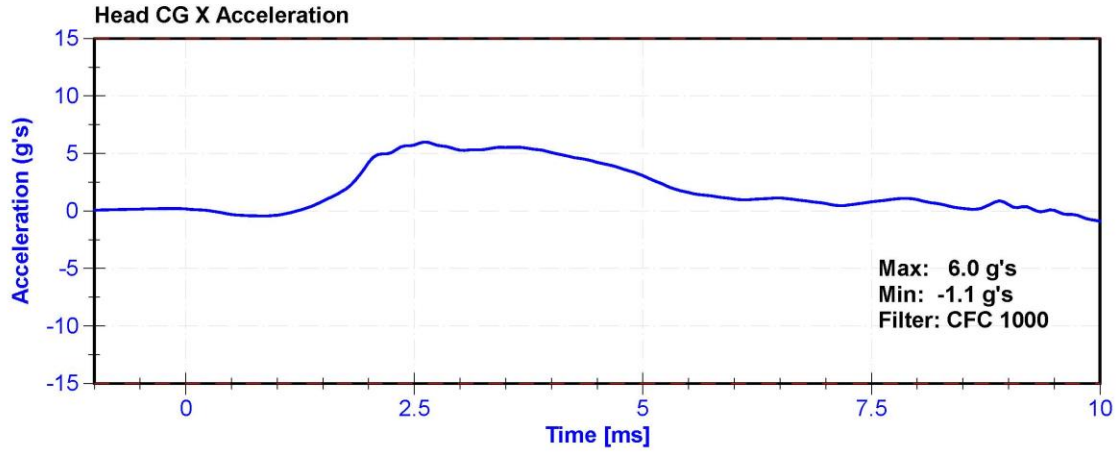
Results

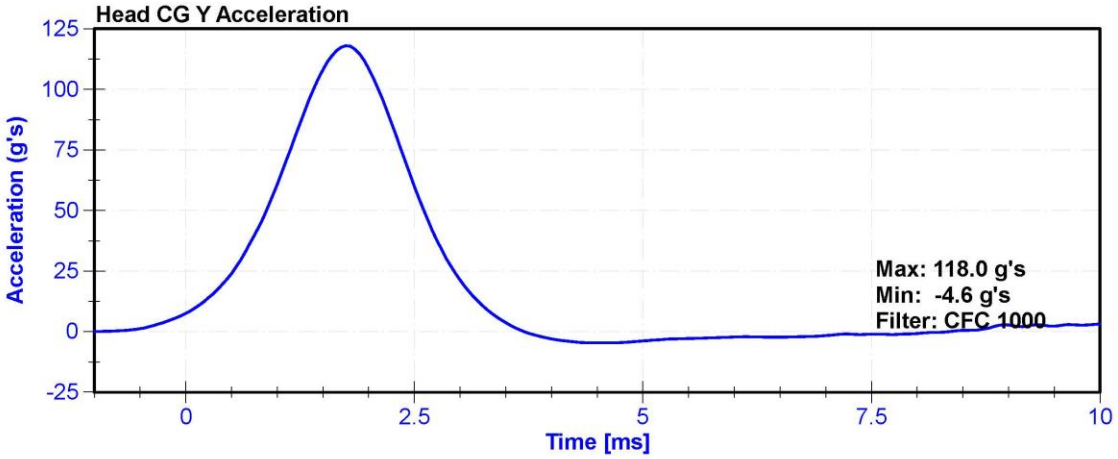
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.0	Pass
Humidity	10	70	%	28.0	Pass
Resultant Acceleration	125	155	g's	145.6	Pass
Oscillation	0	15	%	2.48	Pass
Fore-Aft Acceleration	-15	15	g's	6.0	Pass

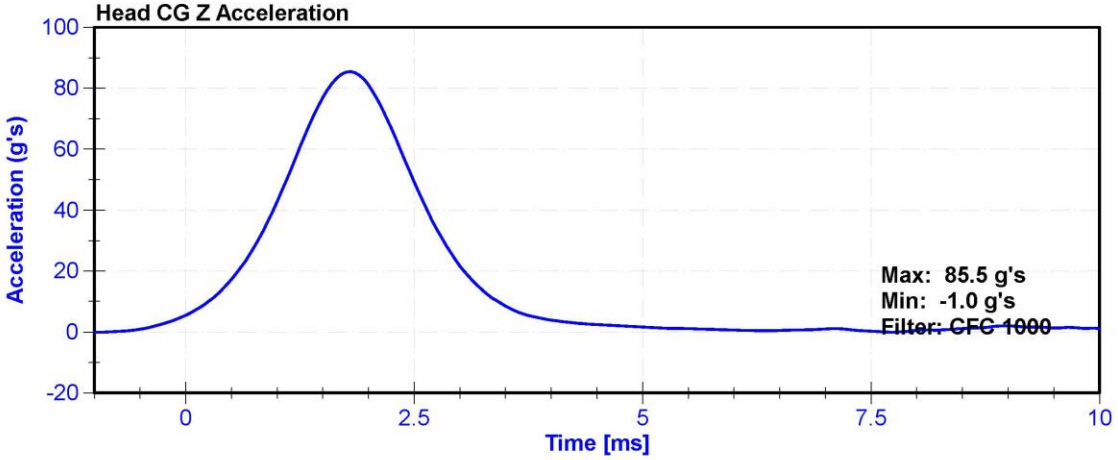
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P63861	11/24/2020	5/25/2021
Y Accelerometer	ENDEVCO 7264CT	AC-P49216	11/24/2020	5/25/2021
Z Accelerometer	ENDEVCO 7264	AC-P51303	11/24/2020	5/25/2021




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 6.0 g's
Min: -1.1 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 118.0 g's
Min: -4.6 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]
Max: 85.5 g's
Min: -1.0 g's
Filter: CFC 1000

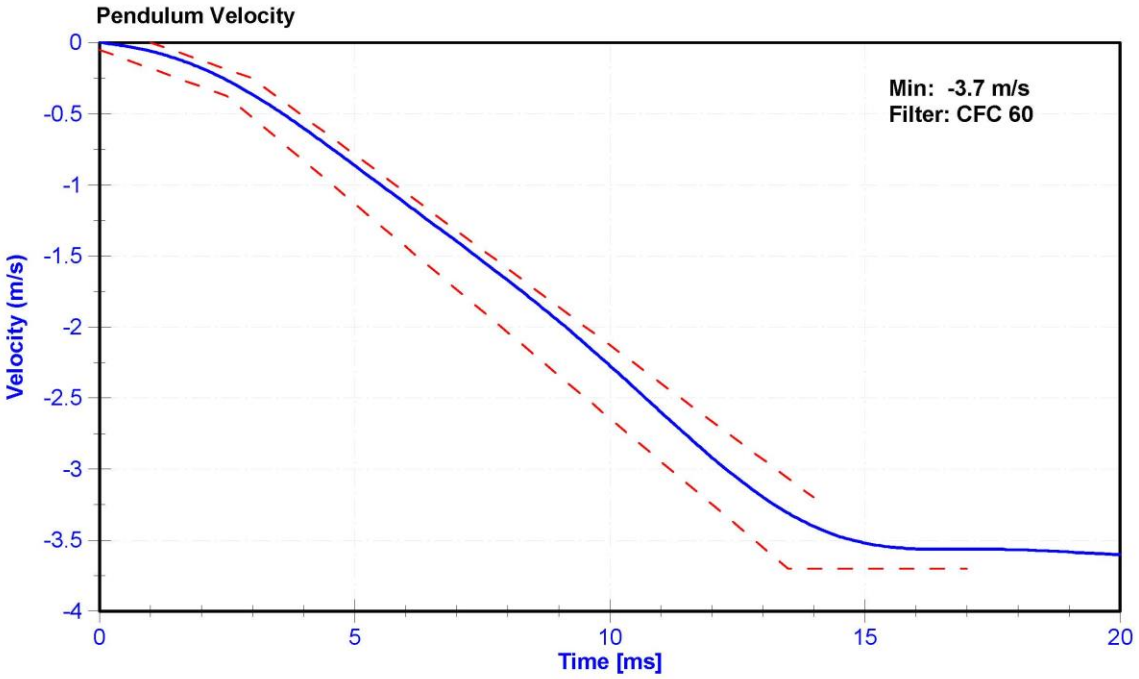
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

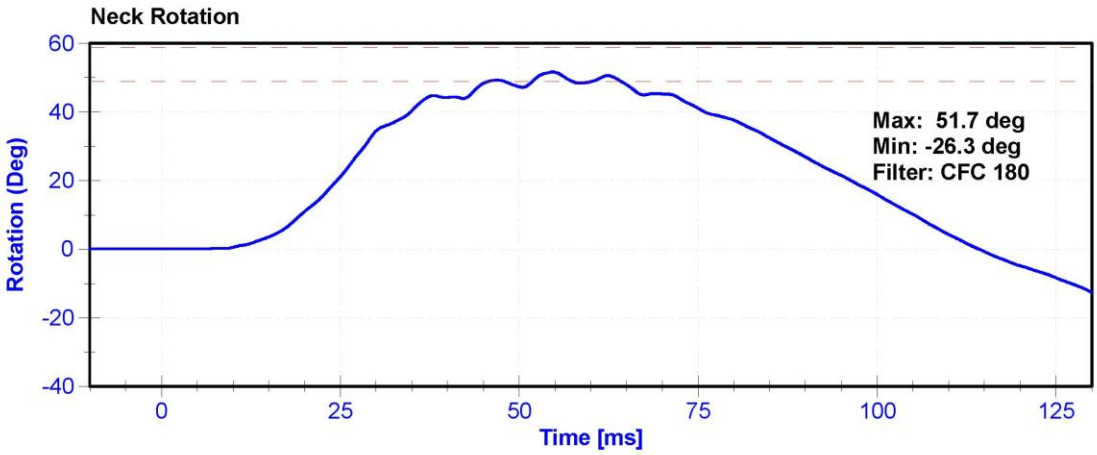
Results

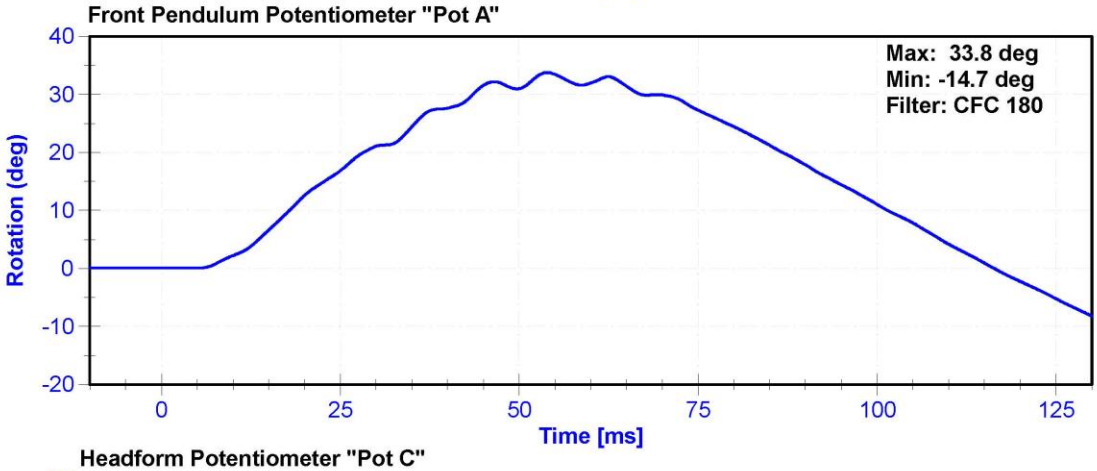
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	28	Pass
Velocity	3.3	3.5	m/s	3.38	Pass
Lateral Neck Rotation	49	59	deg	51.7	Pass
Time at Maximum Rotation	54	66	ms	54.7	Pass
Time of Rotation Decay from Maximum	53	88	ms	59.6	Pass

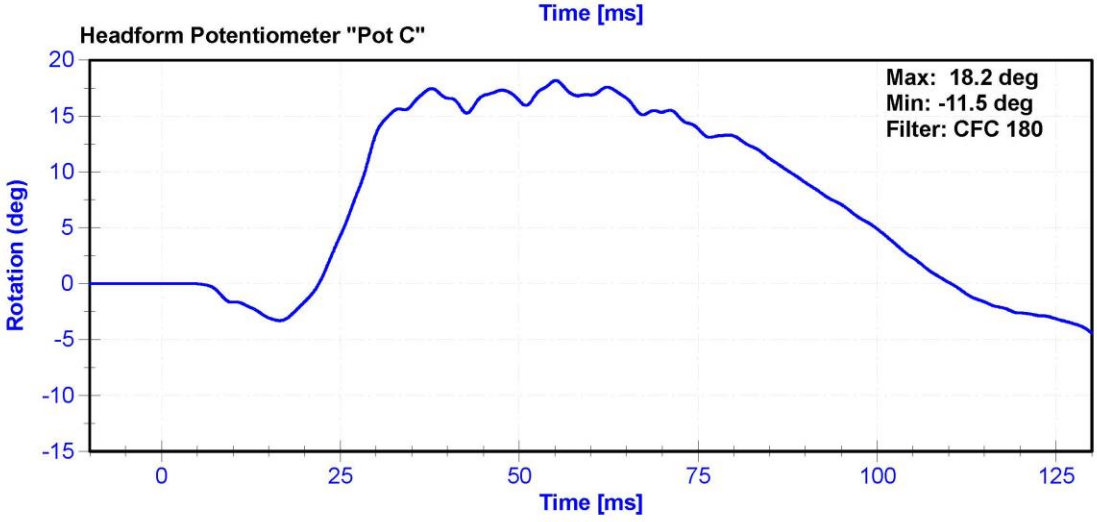
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C16503	2/5/2021	2/5/2022
Front Pendulum Potentiometer	SP22G	DS-094	8/18/2020	8/18/2021
Headform Potentiometer	SP22G	DS-095	8/18/2020	8/18/2021




Neck Rotation
Rotation (Deg)
Time [ms]
Max: 51.7 deg
Min: -26.3 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 33.8 deg
Min: -14.7 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 18.2 deg
Min: -11.5 deg
Filter: CFC 180

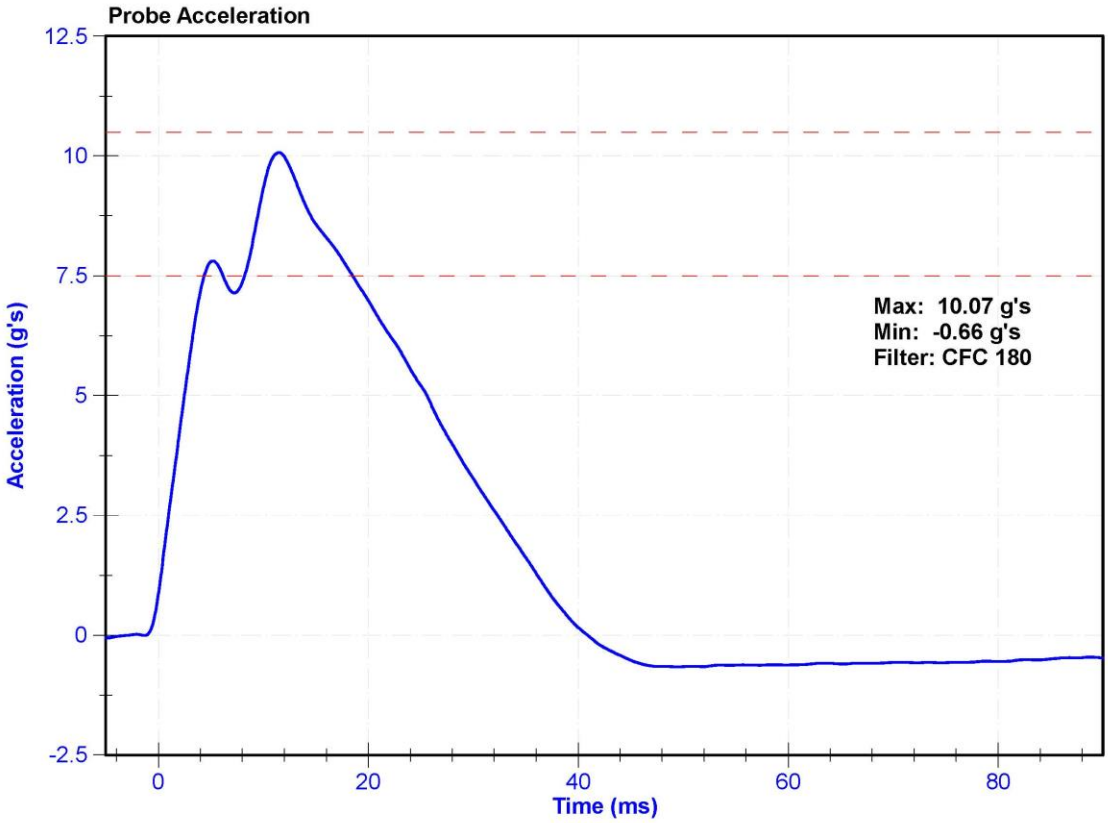
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	28.0	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	7.5	10.5	g's	10.07	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021



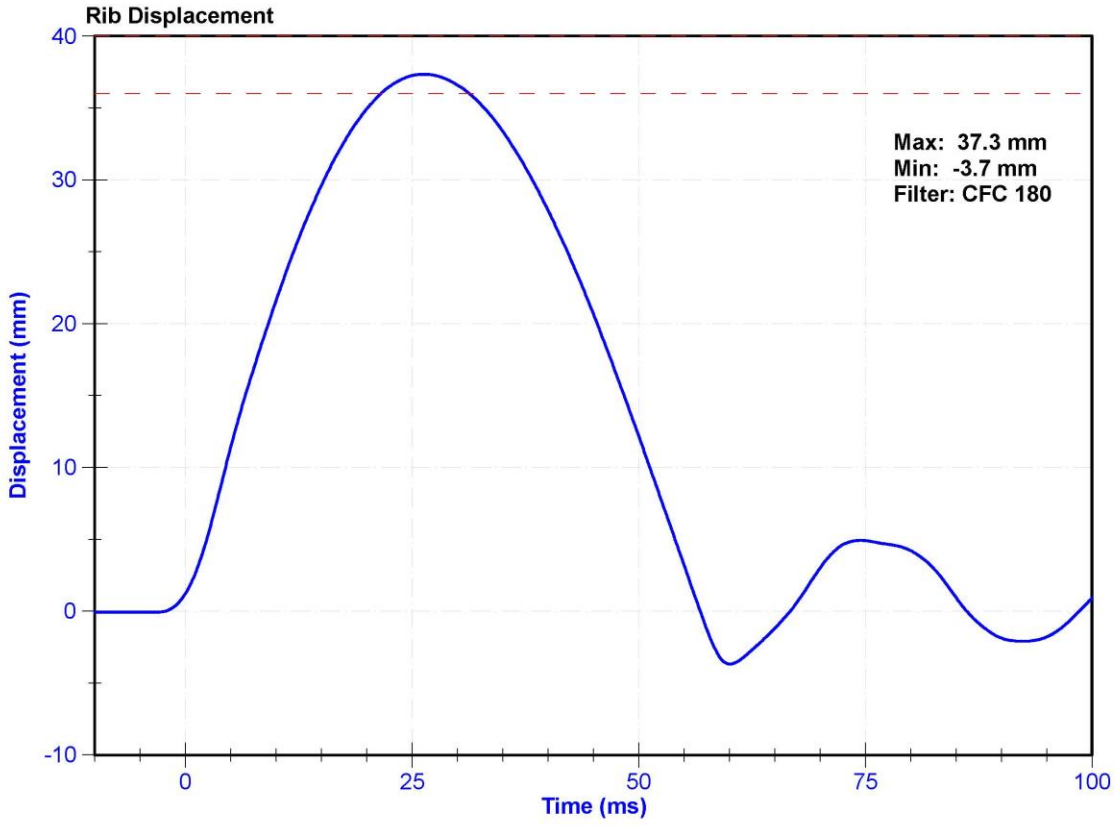
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	29.0	Pass
Rib Displacement	36	40	mm	37.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	11/25/2020	5/26/2021



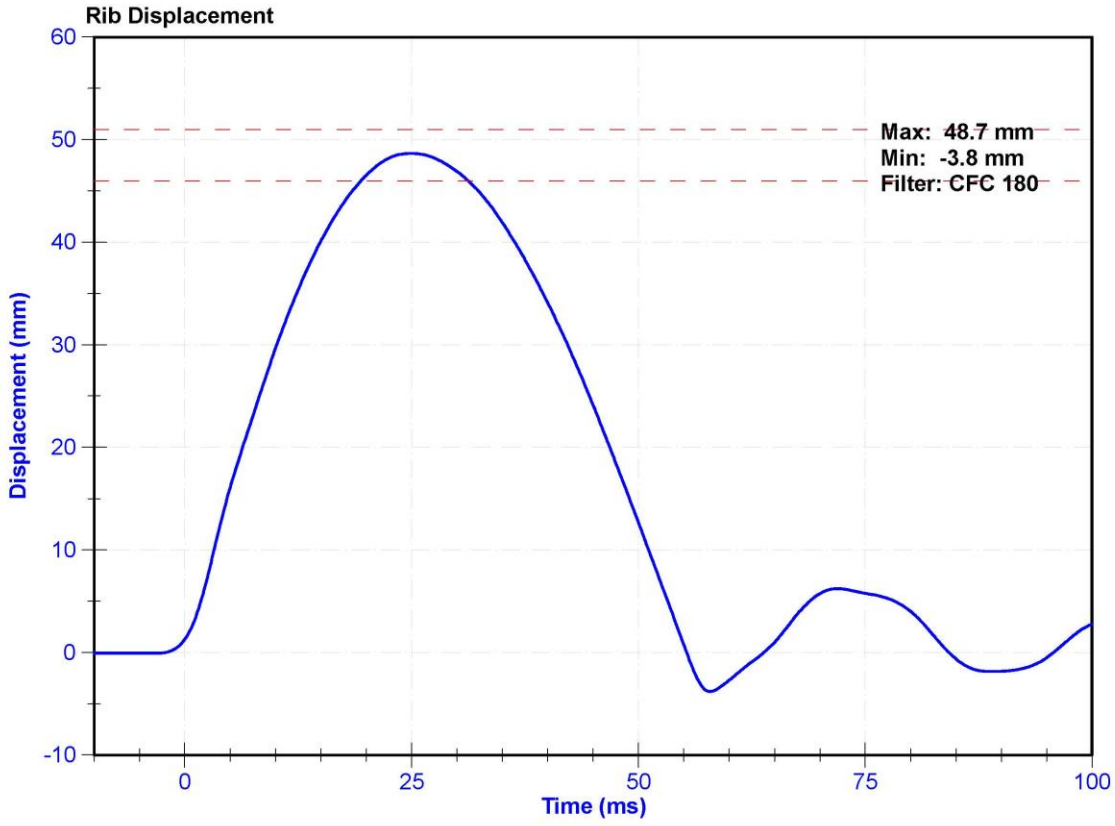
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	29.0	Pass
Rib Displacement	46	51	mm	48.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	11/25/2020	5/26/2021



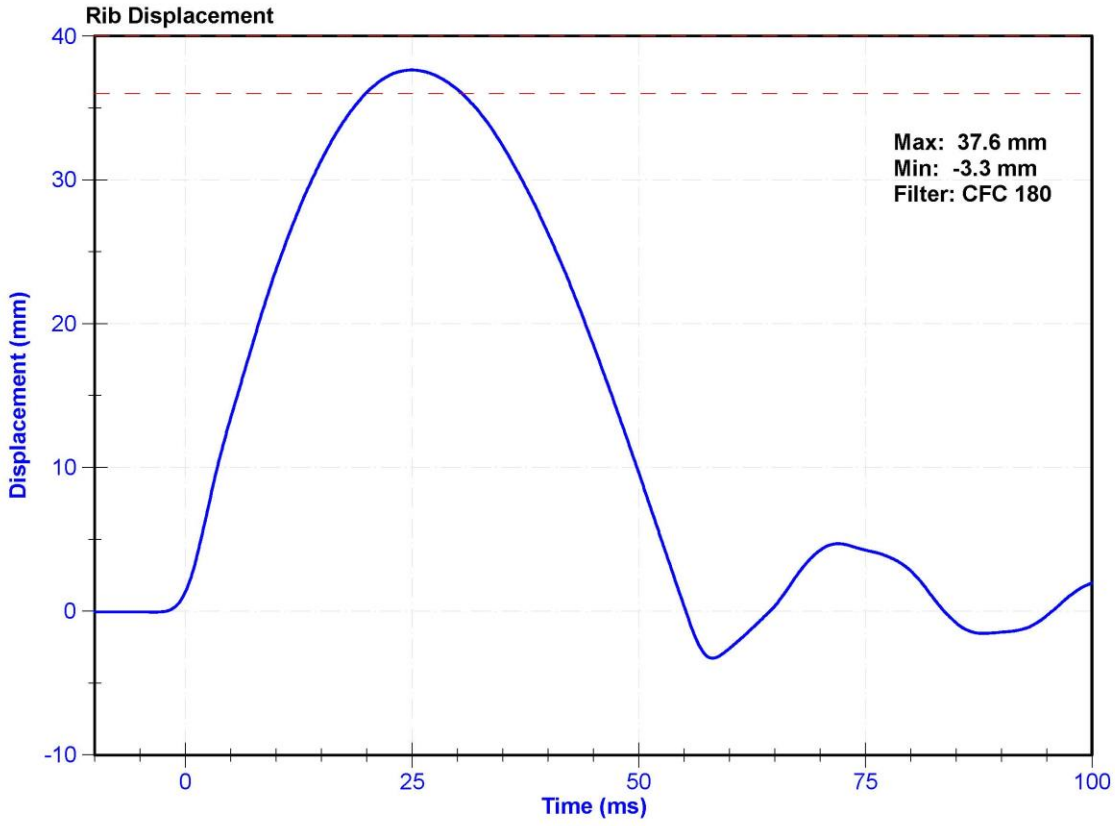
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	27.0	Pass
Rib Displacement	36	40	mm	37.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	11/25/2020	5/26/2021



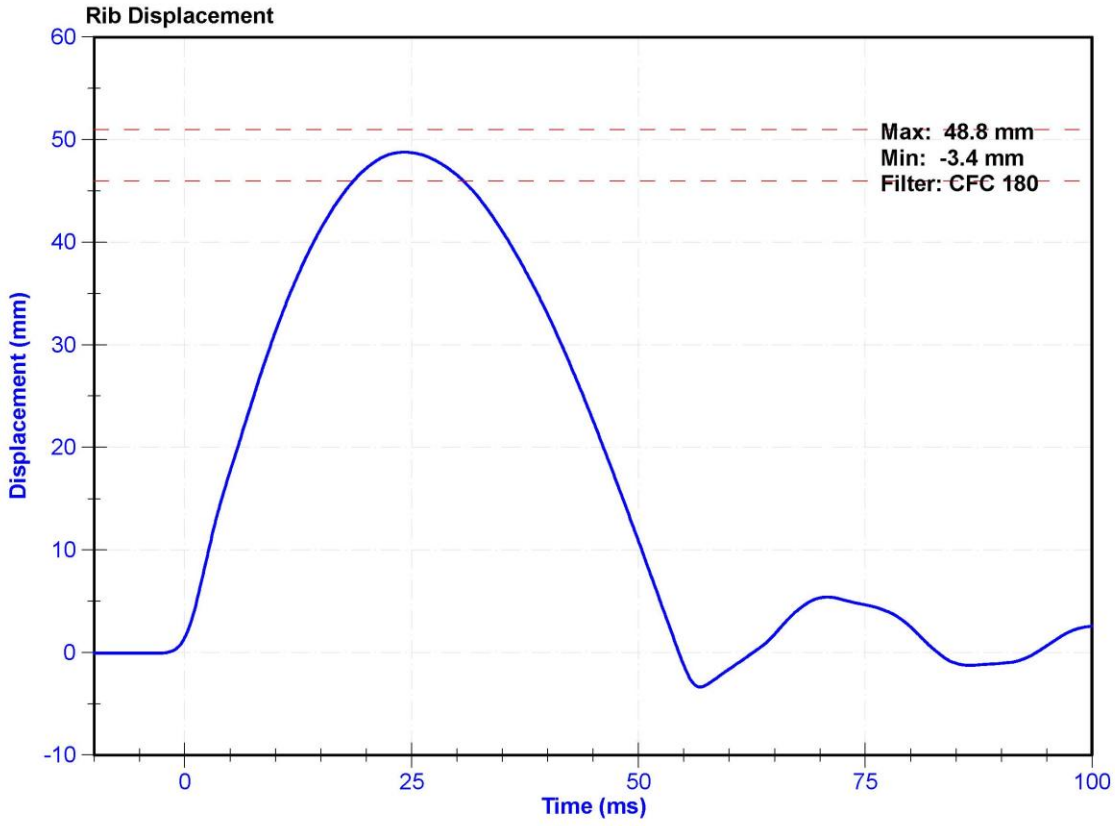
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	29.0	Pass
Rib Displacement	46	51	mm	48.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	11/25/2020	5/26/2021



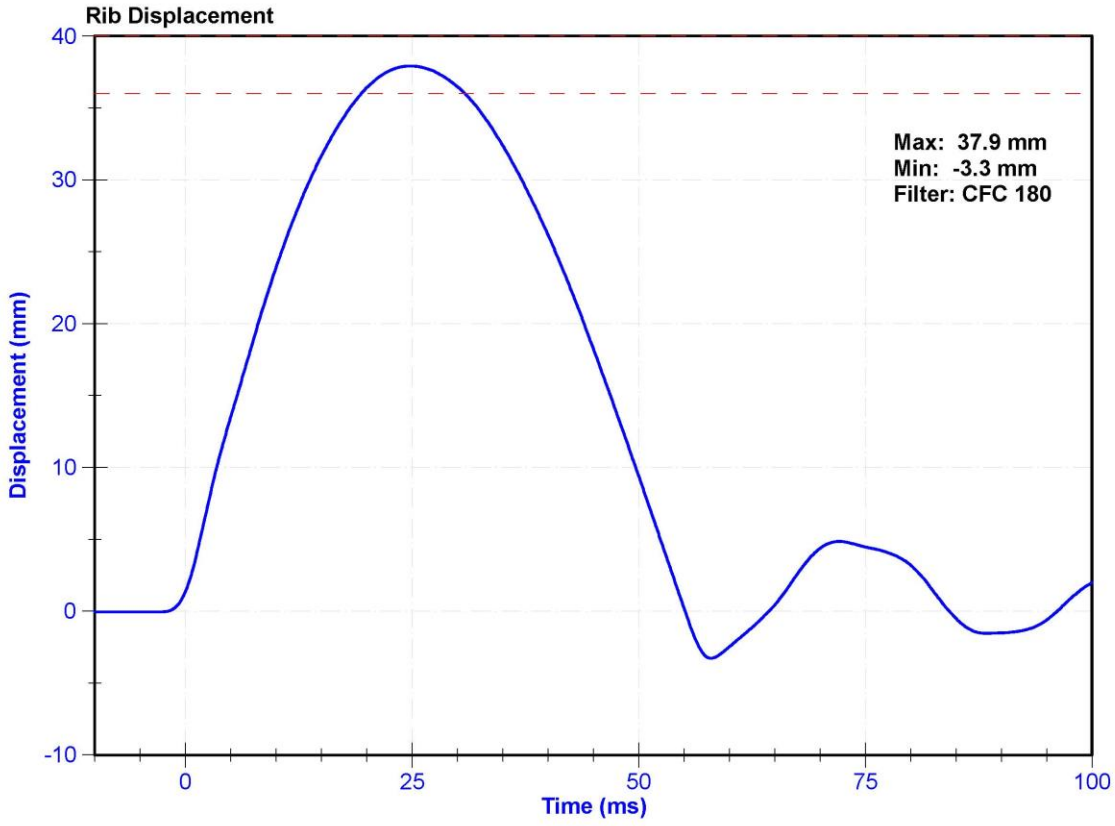
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	29.0	Pass
Rib Displacement	36	40	mm	37.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	11/25/2020	5/26/2021



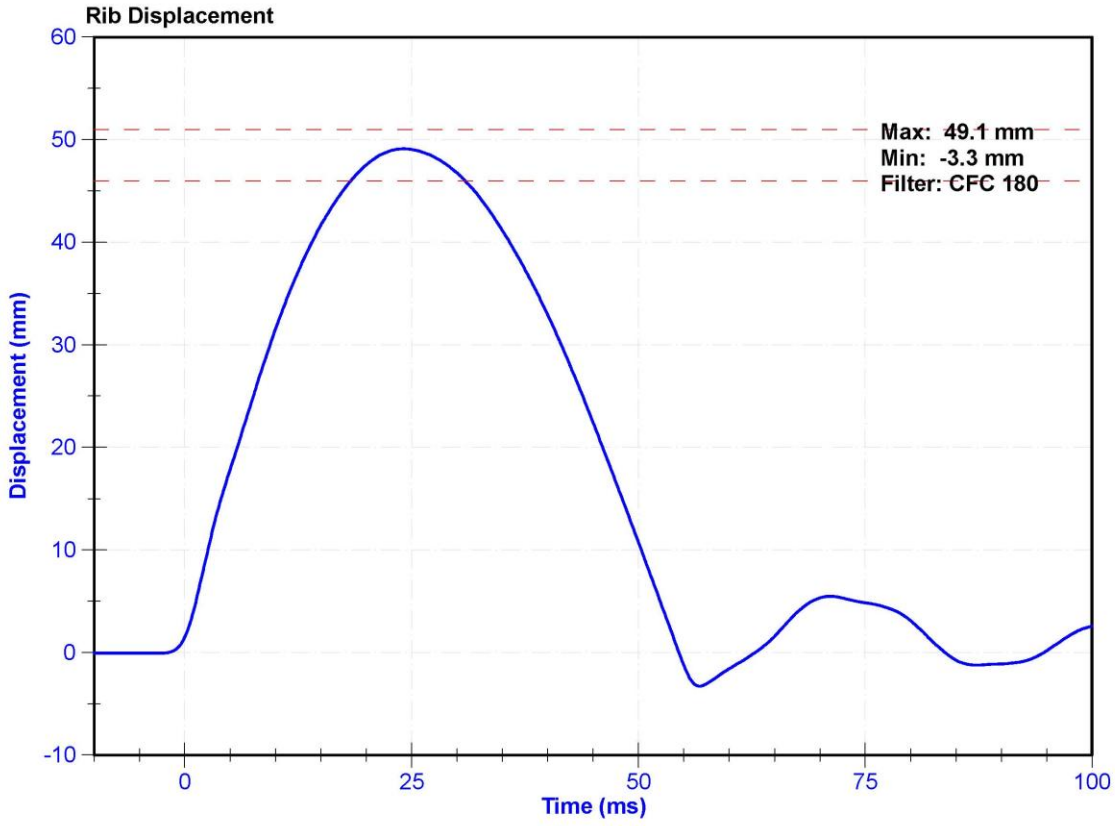
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	29.0	Pass
Rib Displacement	46	51	mm	49.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	11/25/2020	5/26/2021



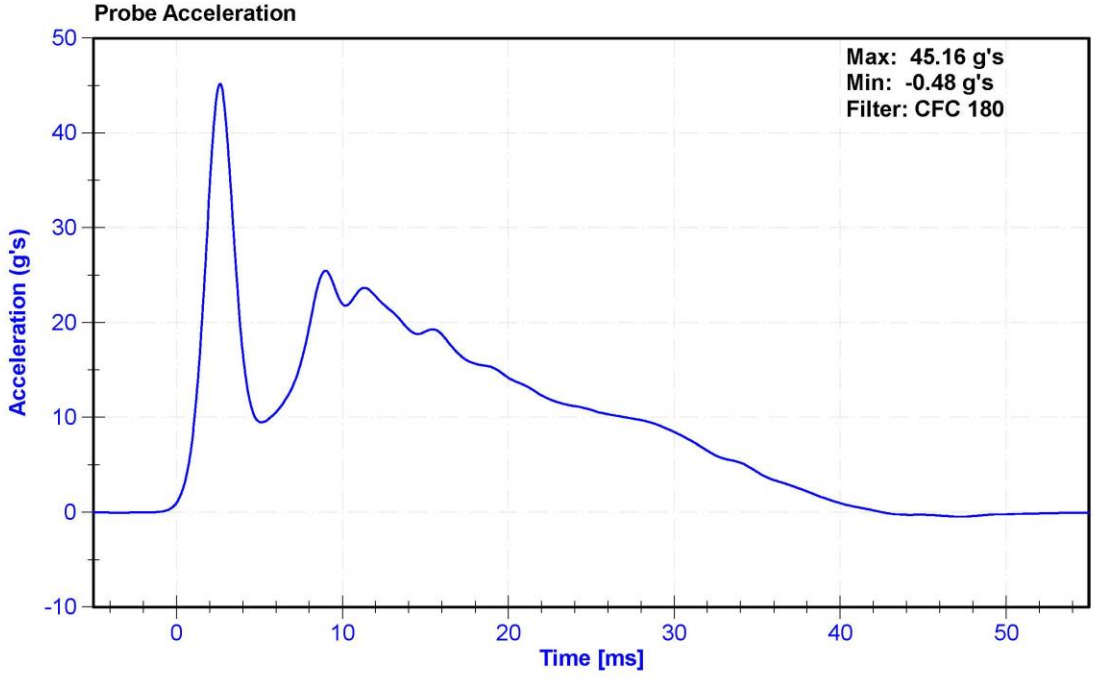
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

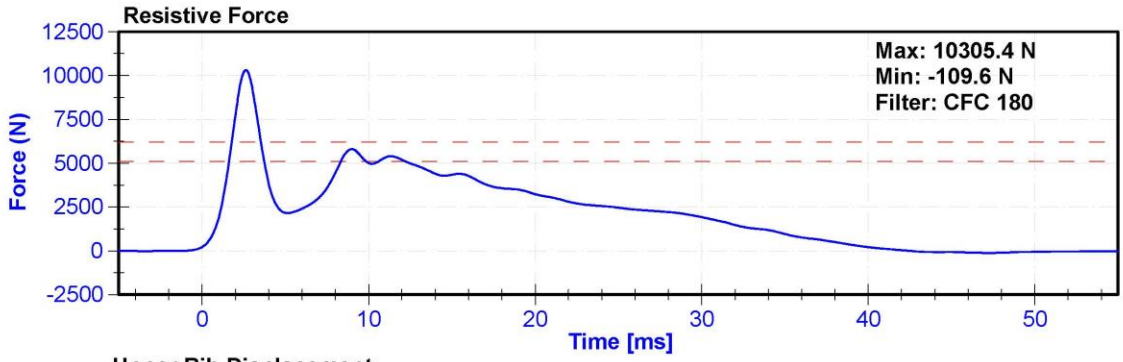
Results

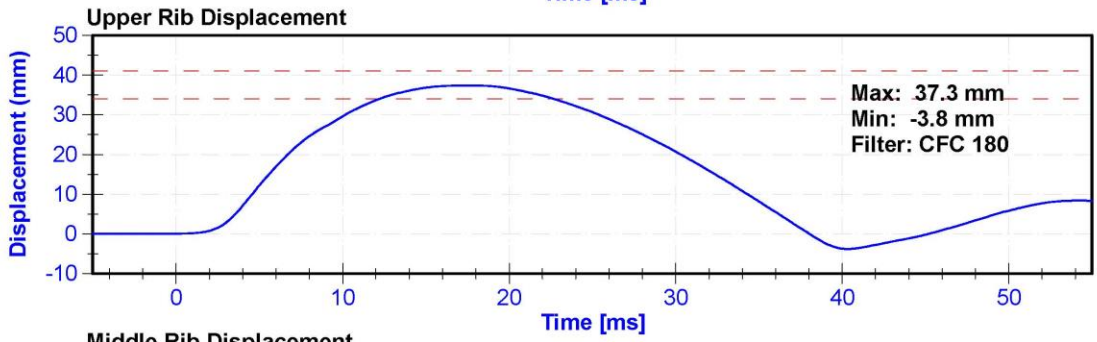
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	24.0	Pass
Velocity	5.4	5.6	m/s	5.47	Pass
Resistive Force after 6ms	5100	6200	N	5809.8	Pass
Upper Thorax Rib Deflection	34	41	mm	37.3	Pass
Mid Thorax Rib Deflection	37	45	mm	41.2	Pass
Lower Thorax Rib Deflection	37	44	mm	41.4	Pass

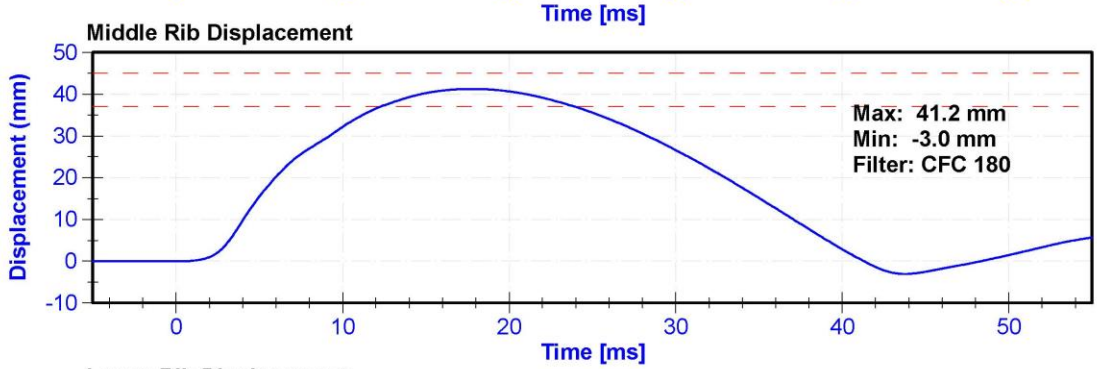
Transducer Calibrations

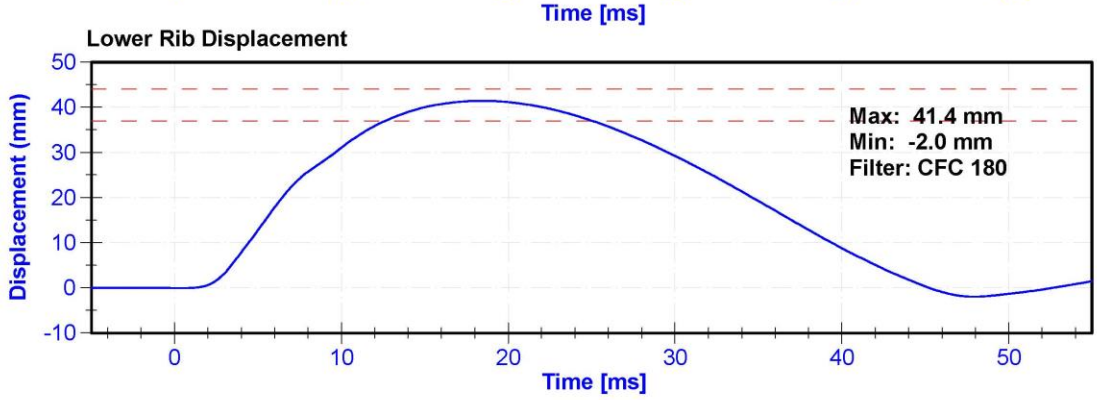
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	11/25/2020	5/26/2021
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	11/25/2020	5/26/2021
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	11/25/2020	5/26/2021




Resistive Force
Max: 10305.4 N
Min: -109.6 N
Filter: CFC 180
Force (N)
12500
10000
7500
5000
2500
0
-2500
0
10
20
30
40
50
Time [ms]


Upper Rib Displacement
Max: 37.3 mm
Min: -3.8 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Middle Rib Displacement
Max: 41.2 mm
Min: -3.0 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Lower Rib Displacement
Max: 41.4 mm
Min: -2.0 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]

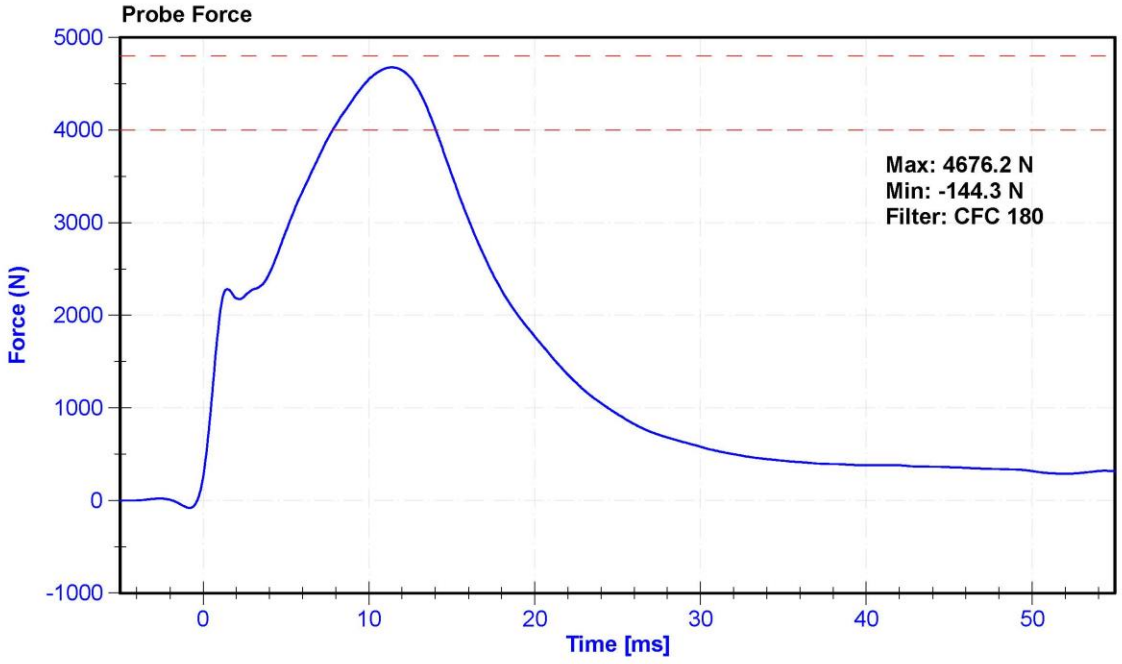
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	F033	Laboratory Supervisor	K.Brogan

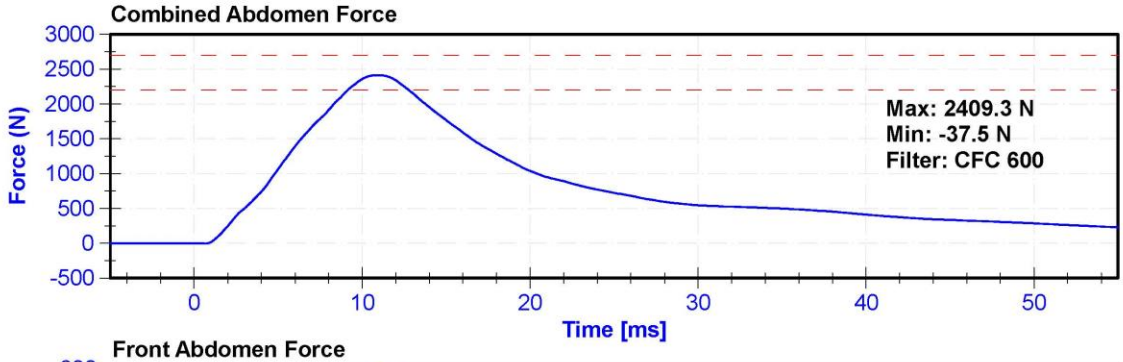
Results

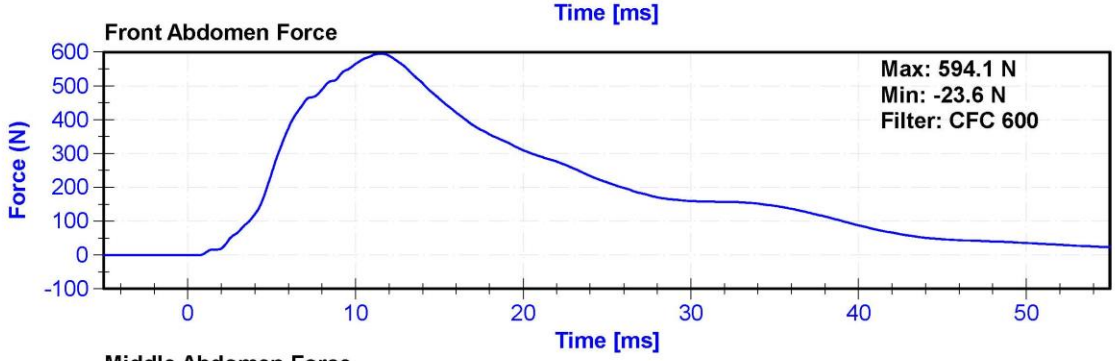
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	24	Pass
Velocity	3.9	4.1	m/s	3.97	Pass
Combined Abdomen Force	2200	2700	N	2409.3	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.00	Pass
Resistive Probe Force	4000	4800	N	4676.2	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.40	Pass

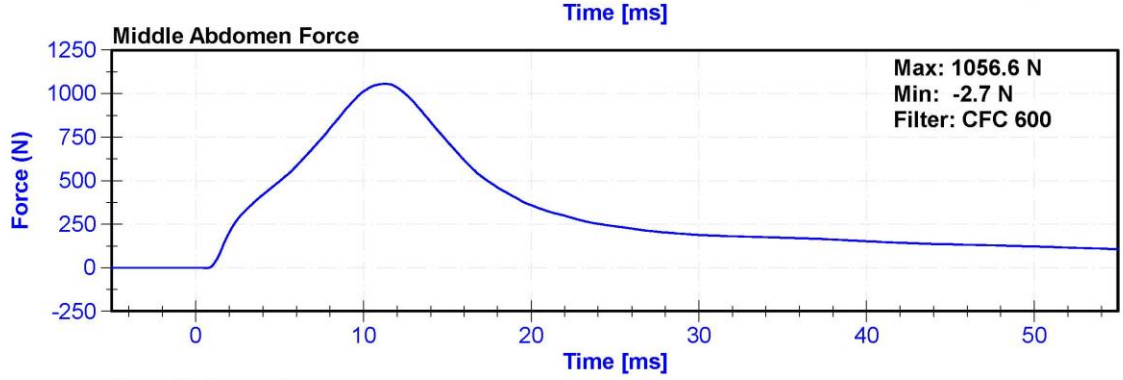
Transducer Calibrations

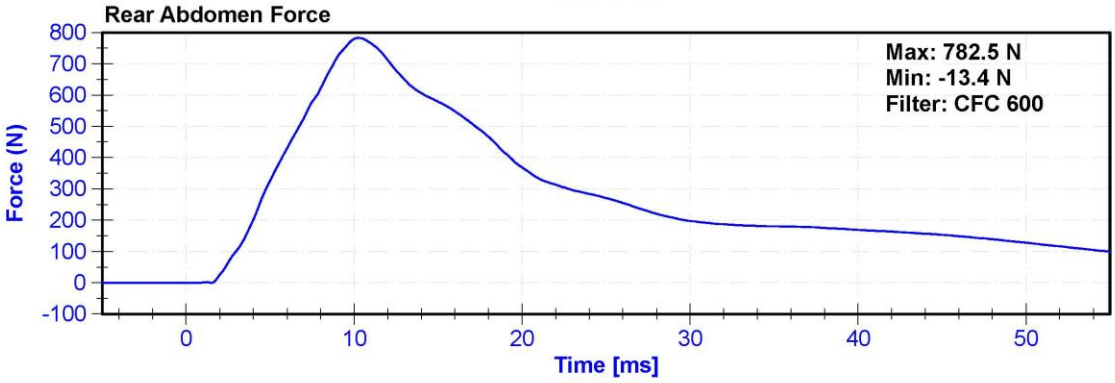
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Front Abdomen Load Cell	FTSS 2631	LC-1509	11/10/2020	11/10/2021
Middle Abdomen Load Cell	DENTON 2631	LC-1508	11/10/2020	11/10/2021
Rear Abdomen Load Cell	FTSS 2631	LC-1507	11/10/2020	11/10/2021




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2409.3 N
Min: -37.5 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 594.1 N
Min: -23.6 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1056.6 N
Min: -2.7 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 782.5 N
Min: -13.4 N
Filter: CFC 600

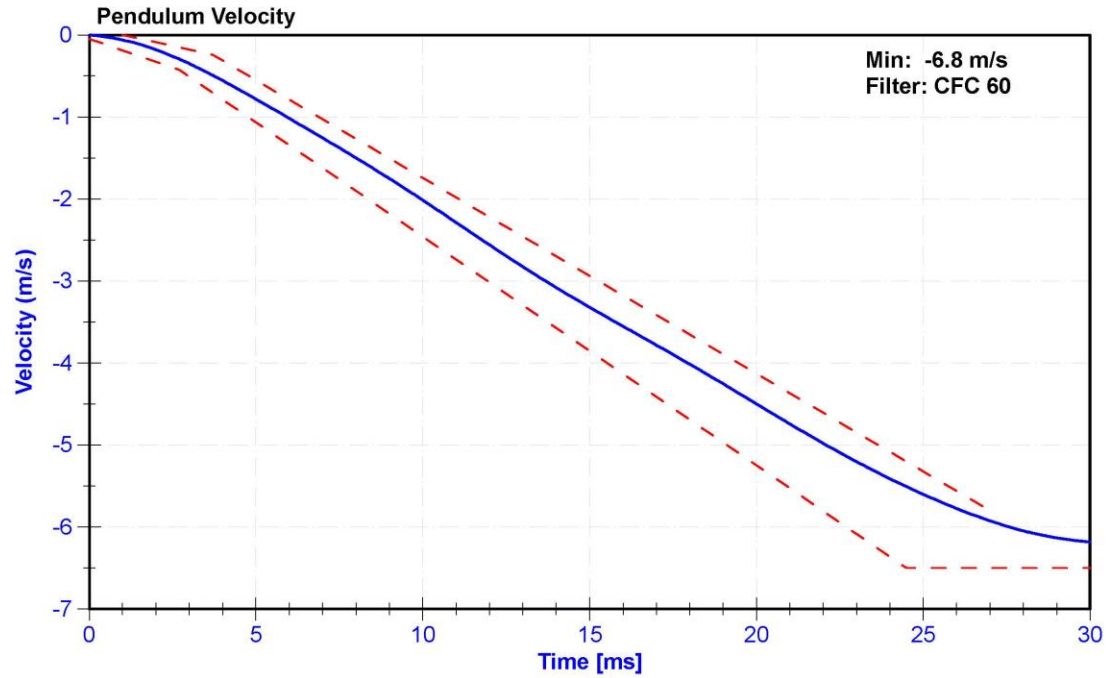
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

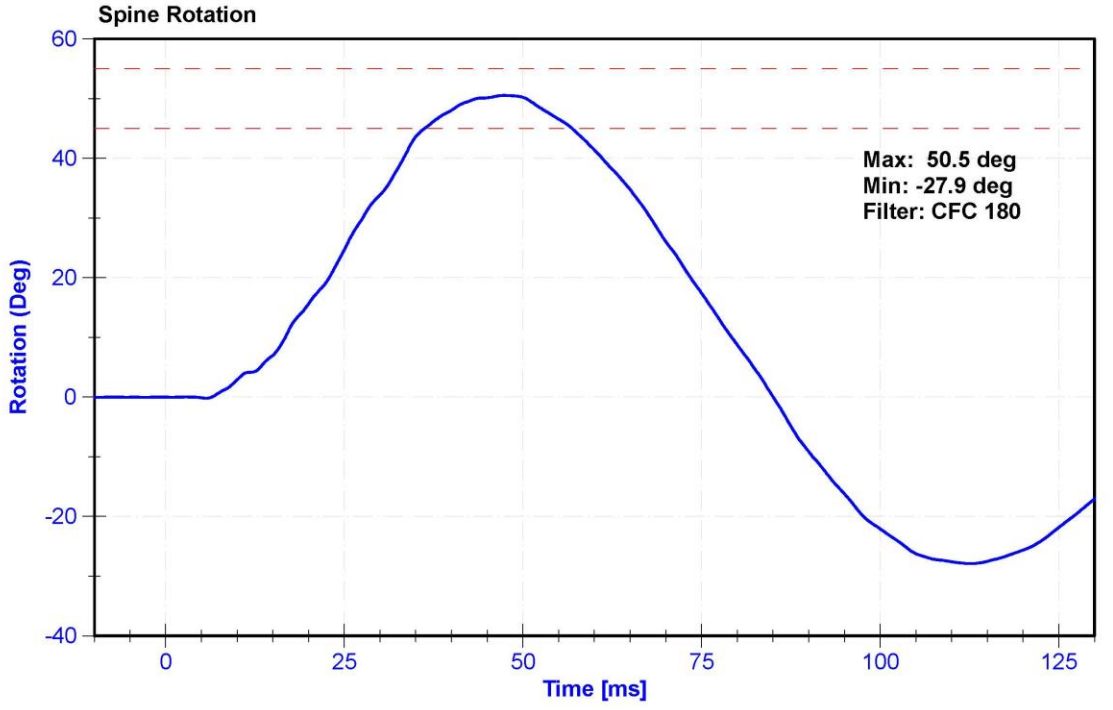
Results

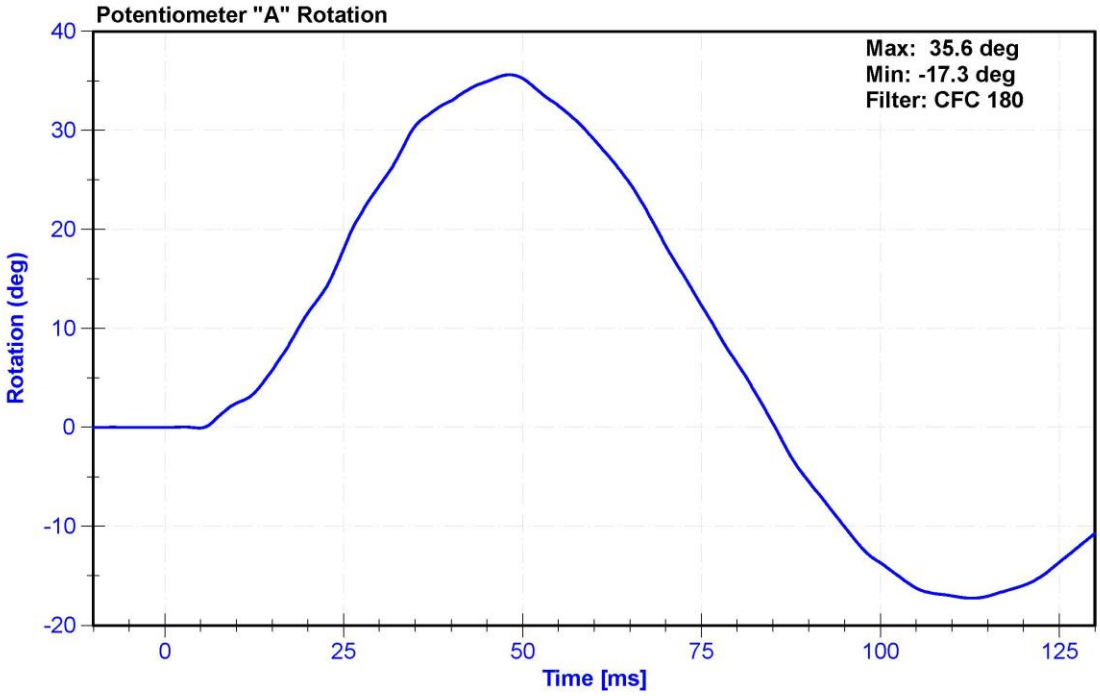
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	31.0	Pass
Velocity	5.95	6.15	m/s	5.964	Pass
Lateral Spine Rotation	45	55	deg	50.5	Pass
Time at Maximum Rotation	39	53	ms	47.4	Pass
Time of Decay to Zero Degrees	37	57	ms	37.6	Pass
Pulse within Corridor?	-	-	-		

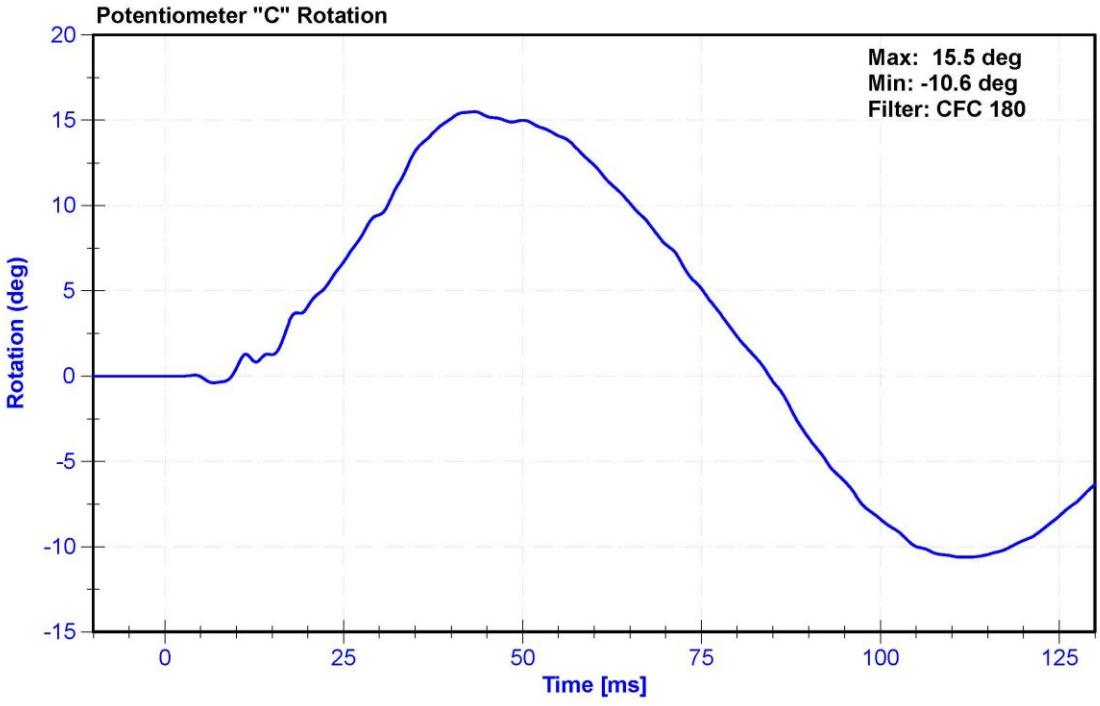
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C16503 Striker	2/5/2021	2/5/2022
Pendulum "A" Potentiometer	SP22G	DS-094	8/18/2020	8/18/2021
Condyle "B" Potentiometer	SP22G	DS-095	8/18/2020	8/18/2021


Pendulum Velocity
Min: -6.8 m/s
Filter: CFC 60
Velocity (m/s)
0
-1
-2
-3
-4
-5
-6
-7
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 50.5 deg
Min: -27.9 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 35.6 deg
Min: -17.3 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
-20
0
25
50
75
100
125
Time [ms]


Potentiometer "C" Rotation
Max: 15.5 deg
Min: -10.6 deg
Filter: CFC 180
Rotation (deg)
20
15
10
5
0
-5
-10
-15
0
25
50
75
100
125
Time [ms]

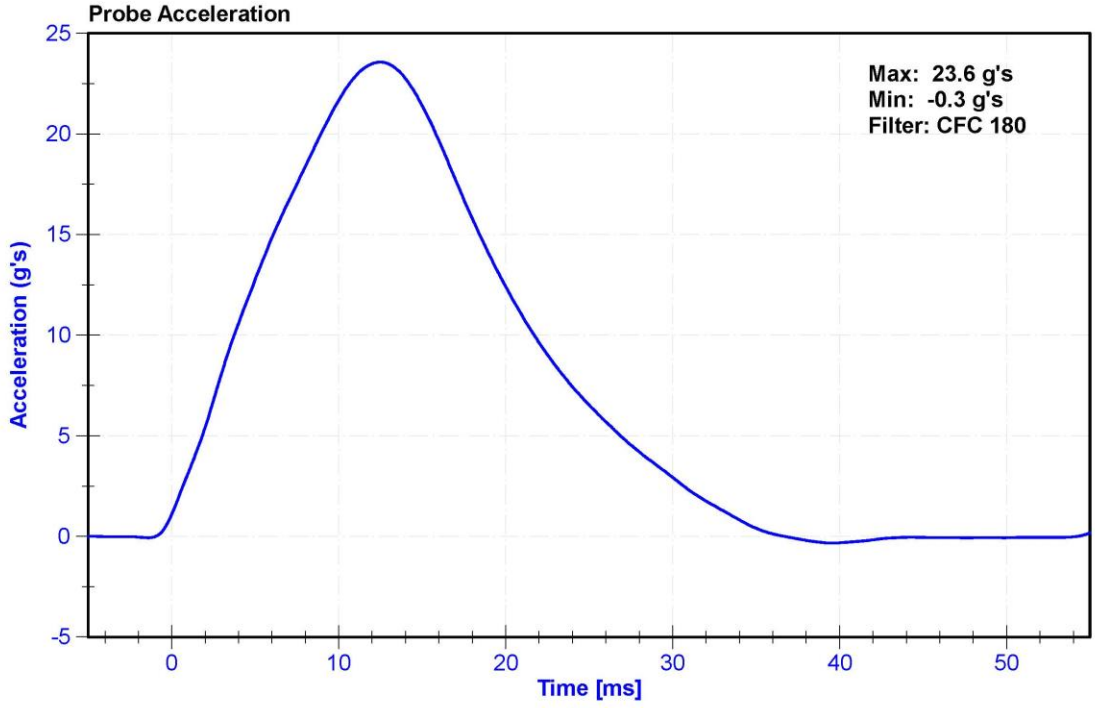
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

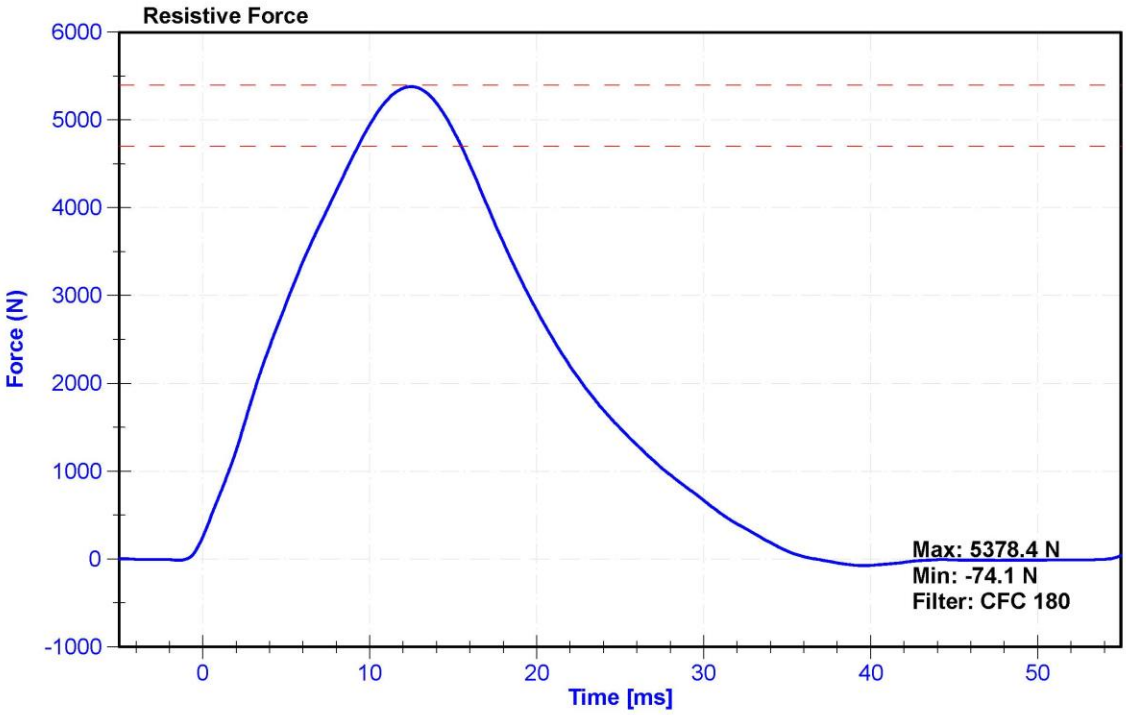
Results

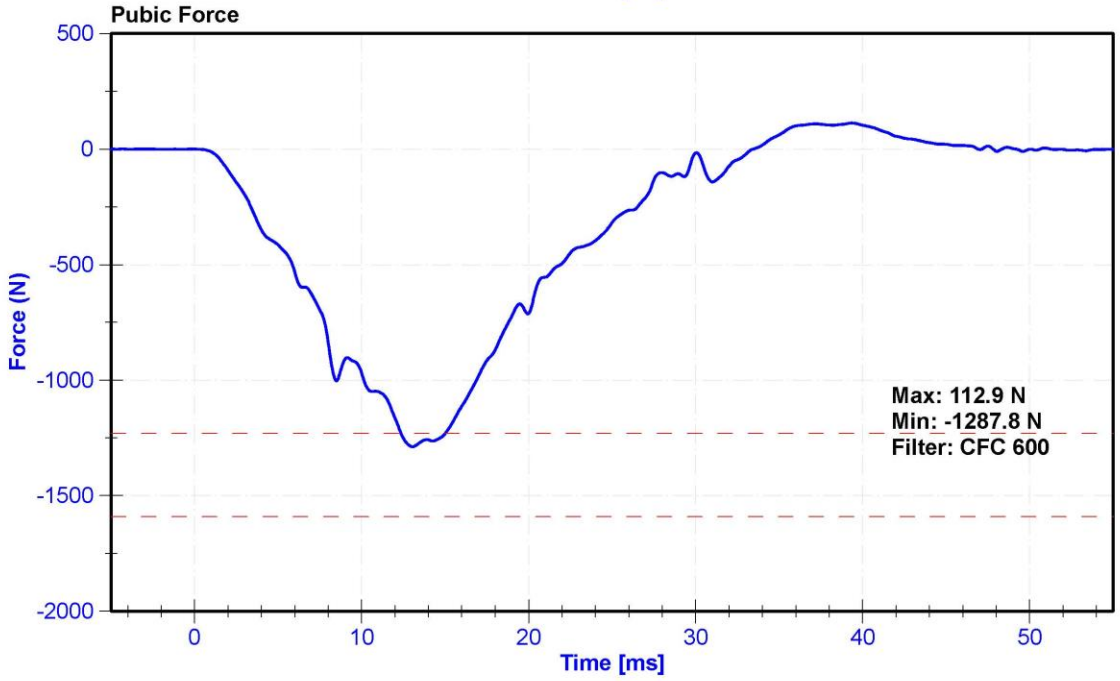
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	24.0	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Resistive Force	4700	5400	N	5378.4	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.50	Pass
Pubic Force	-1590	-1230	N	-1287.8	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.05	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Pubic Load Cell	Denton 3096JFL	LC-464fy	7/23/2020	7/23/2021




Resistive Force
Force (N)
Time [ms]
Max: 5378.4 N
Min: -74.1 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 112.9 N
Min: -1287.8 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

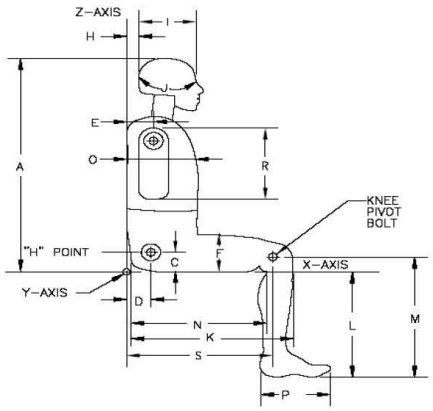
SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

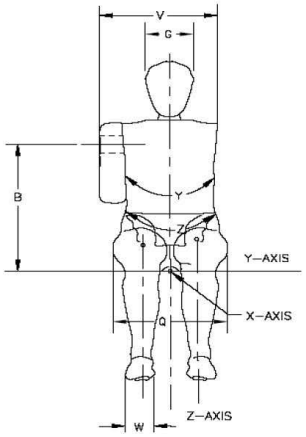
SERIAL No: 300

External Measurements - SID-IIs

Technician: K. Brogan Date: 03/10/2021

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	782	Pass
B	Shoulder Pivot Height	437	453	446	Pass
C	H-point Height	79	89	84	Pass
D	H-point from seatback	141	151	145	Pass
E	Shoulder Pivot from Backline	97	107	104	Pass
F	Thigh Clearance	119	135	126	Pass
G	Head Breadth	140	148	144	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	186	Pass
J	Head Circumference	541	551	544	Pass
K	Buttock to Knee Length	514	540	532	Pass
L	Popliteal Height	343	369	361	Pass
M	Knee Pivot to floor height	392	409	398	Pass
N	Buttock Popliteal Length	416	442	430	Pass
O	Chest Depth w/o jacket	195	211	208	Pass
P	Foot Length	216	232	220	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	317	Pass
R	Arm Length	249	259	254	Pass
S	Knee Joint to seatback	477	493	484	Pass
V	Shoulder Width	341	357	352	Pass
W	Foot Width	78	94	83	Pass
Y	Chest Circumference w/jacket	851	881	875	Pass
Z	Waist Circumference	761	791	773	Pass

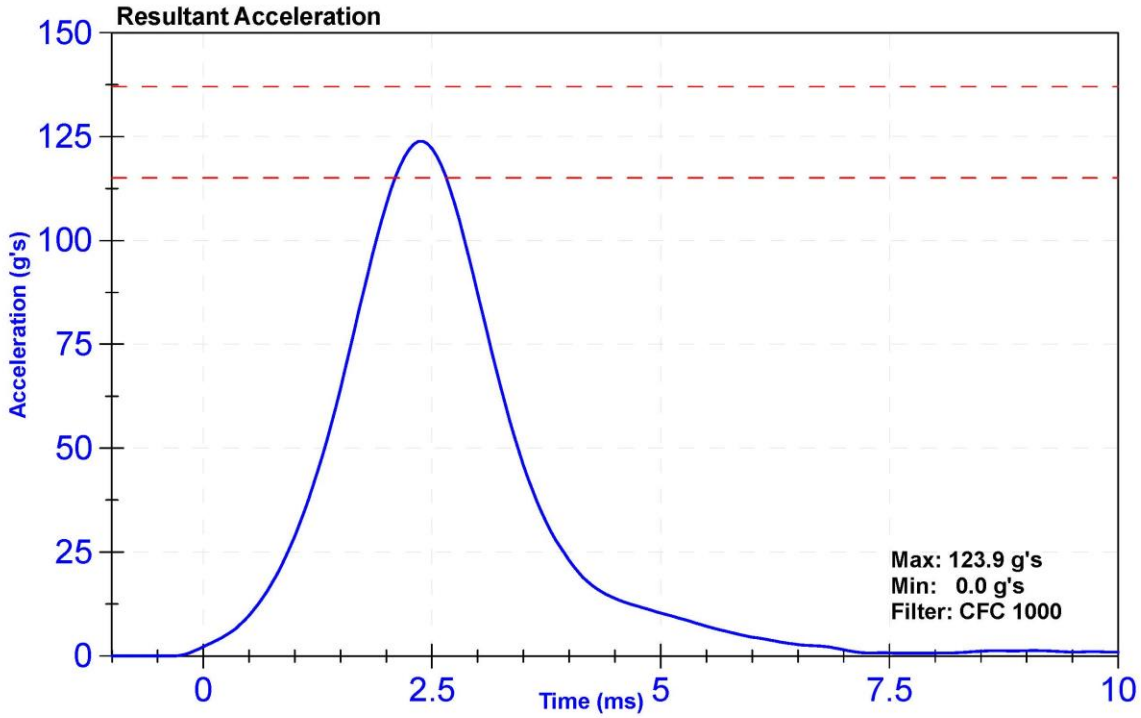
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

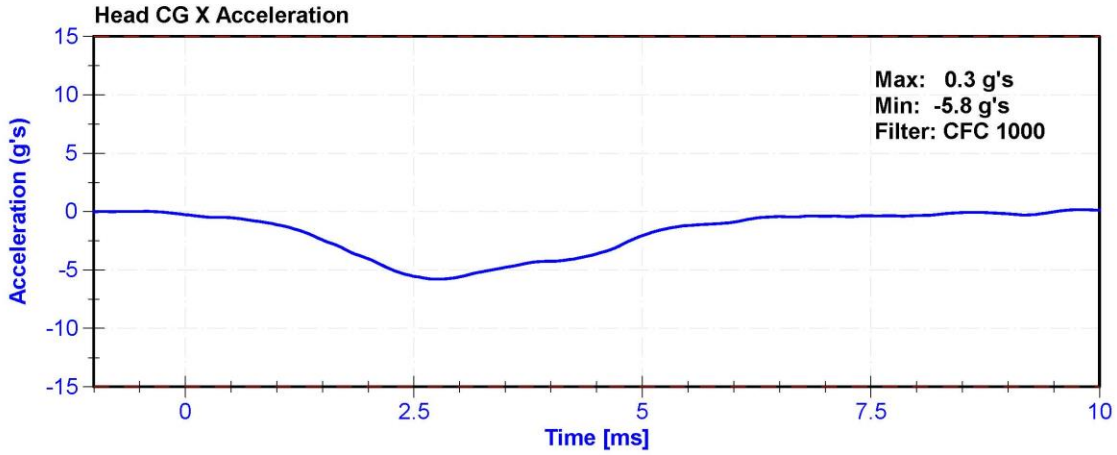
Results

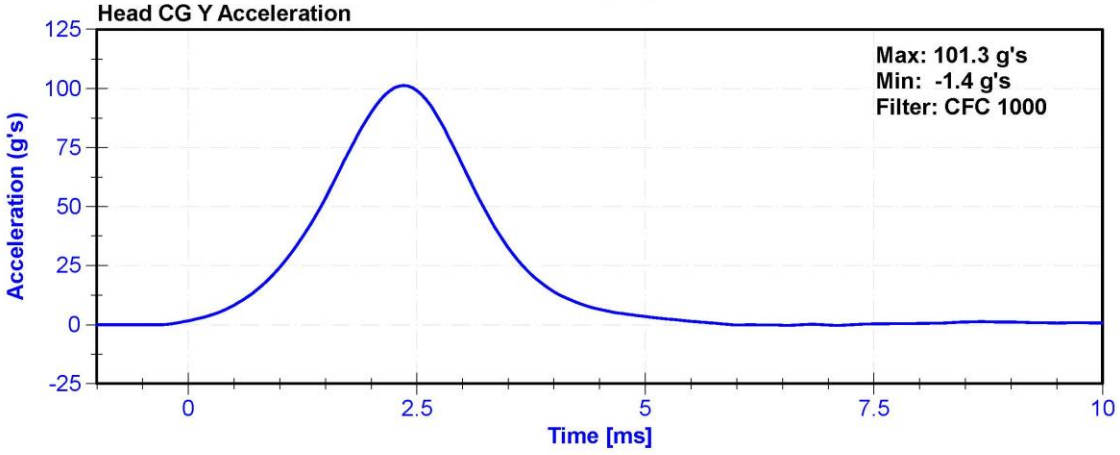
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	29	Pass
Resultant Acceleration	115	137	g's	123.9	Pass
Oscillation	0	15	%	1.2	Pass
Fore-Aft Acceleration	-15	15	g's	-5.8	Pass

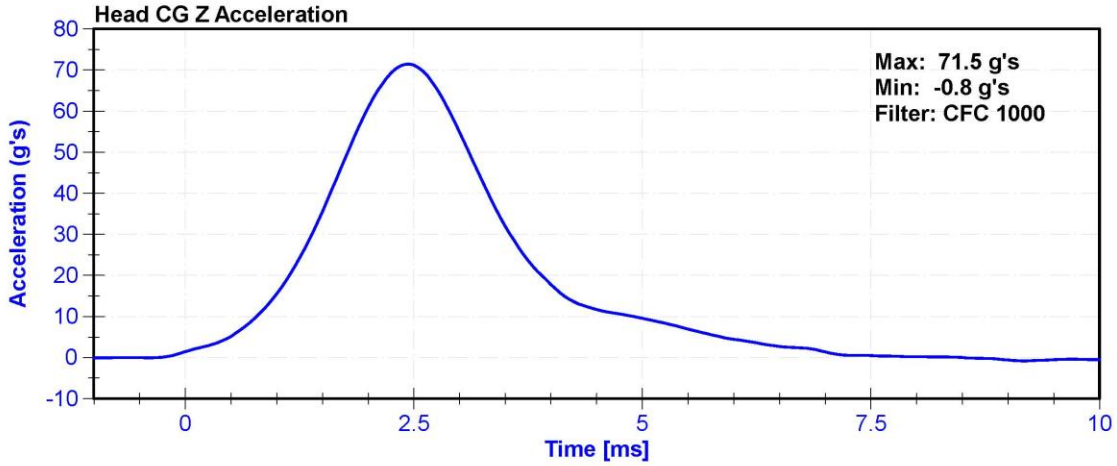
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P59018	11/10/2020	5/11/2021
Y Accelerometer	ENDEVCO 7264	AC-P79189	11/10/2020	5/11/2021
Z Accelerometer	ENDEVCO 7264CT	AC-P58777	11/10/2020	5/11/2021




Head CG X Acceleration
Max: 0.3 g's
Min: -5.8 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Y Acceleration
Max: 101.3 g's
Min: -1.4 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Z Acceleration
Max: 71.5 g's
Min: -0.8 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]

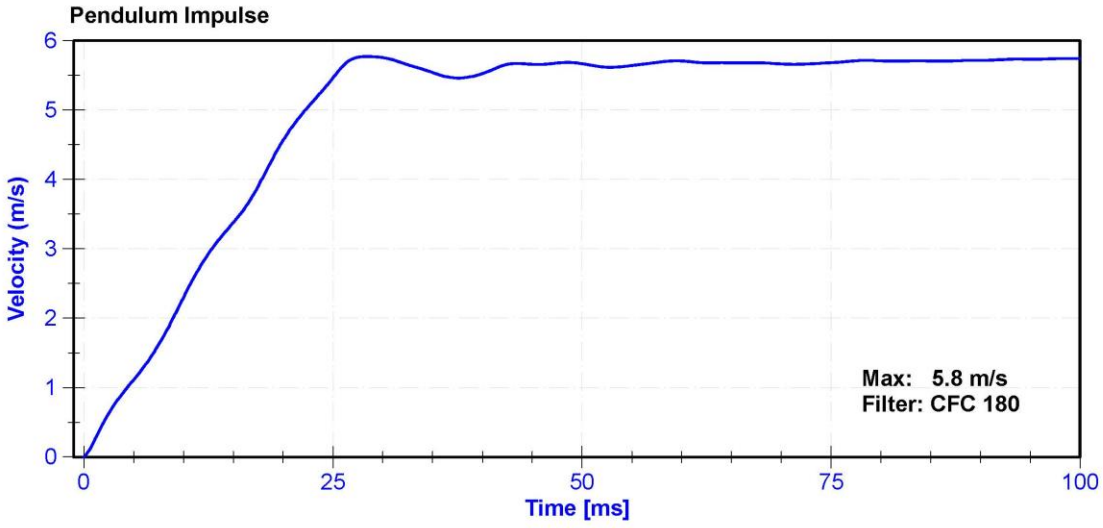
ATD Manufacturer	FTSS	Test Technician	S. Vacanti
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

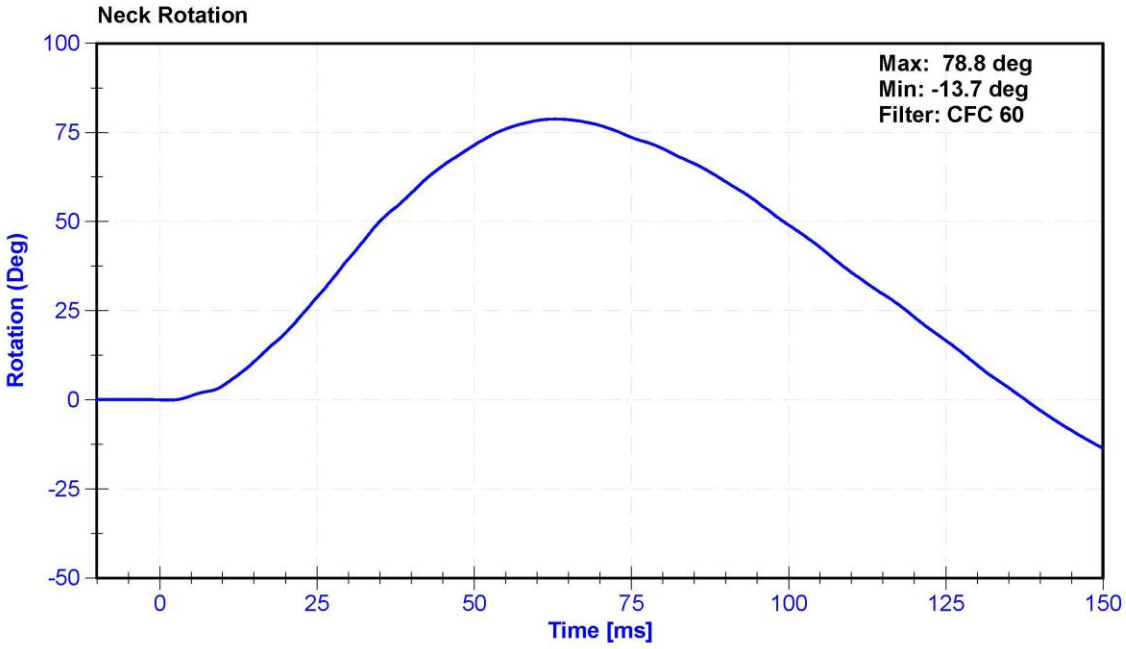
Results

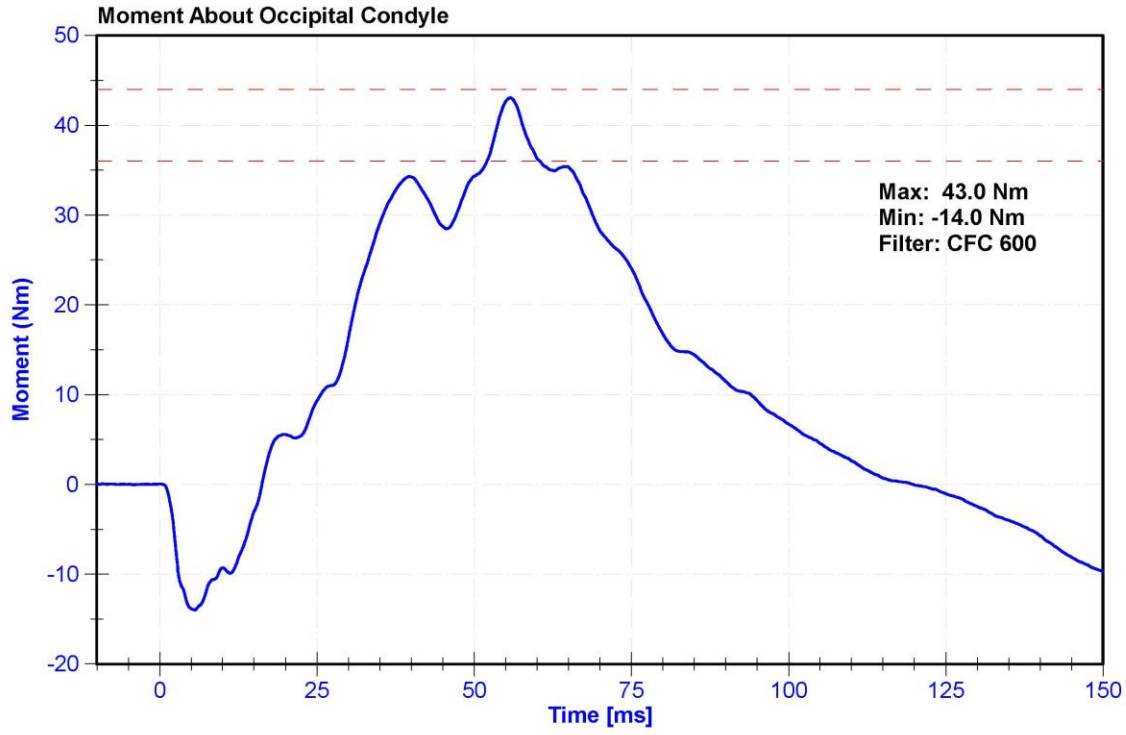
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	24	Pass
Velocity	5.51	5.63	m/s	5.549	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.30	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.38	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.56	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.46	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.77	Pass
Neck Rotation	71	81	deg	78.8	Pass
Time at Maximum Rotation	50	70	ms	62.9	Pass
Moment about the OC	36	44	Nm	43.0	Pass
Moment Decay to 0 Nm	102	126	ms	119.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C16503 Striker	2/5/2021	2/5/2022
Pendulum Potentiometer	Denton 78051-342	DS-184Pend	11/6/2020	11/6/2021
Condyle Potentiometer	Denton 78051-342	DS-185Pend	11/6/2020	11/6/2021
Upper Neck Load Cell	Denton 1716	17162019 FY	3/18/2020	3/18/2021




Neck Rotation
Max: 78.8 deg
Min: -13.7 deg
Filter: CFC 60
Rotation (Deg)
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 43.0 Nm
Min: -14.0 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

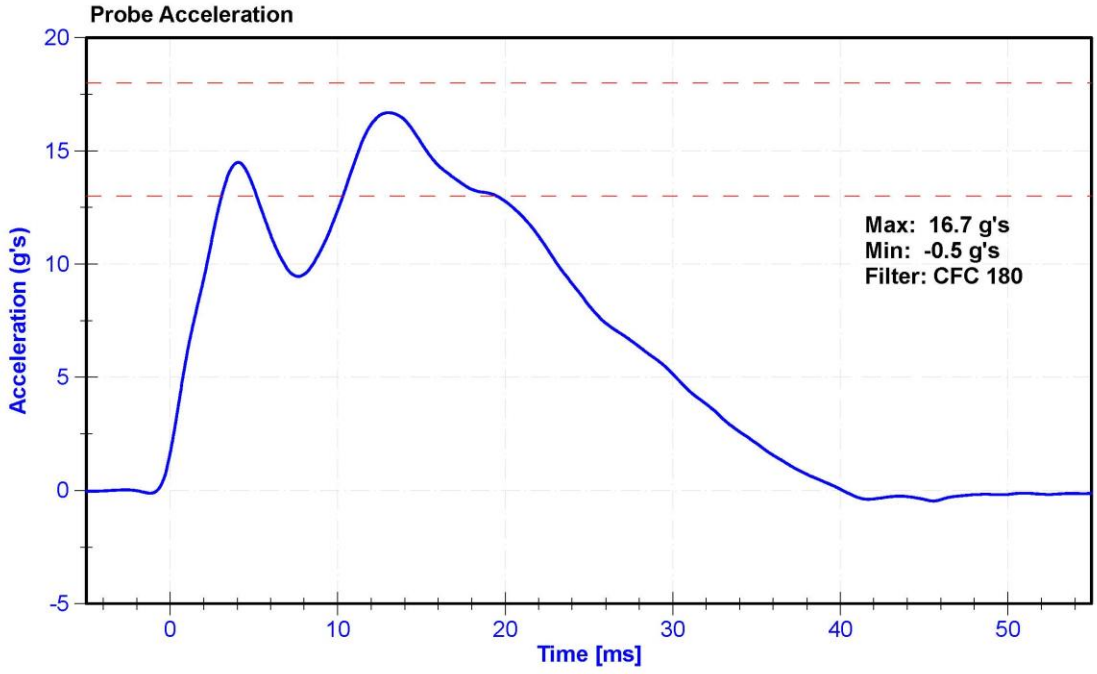
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

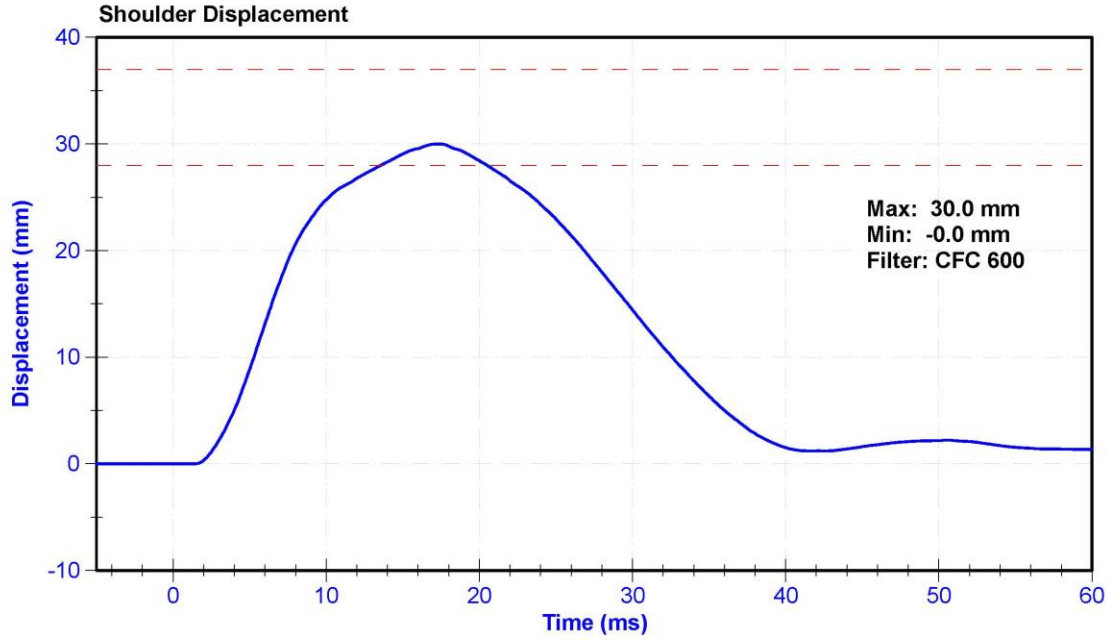
Results

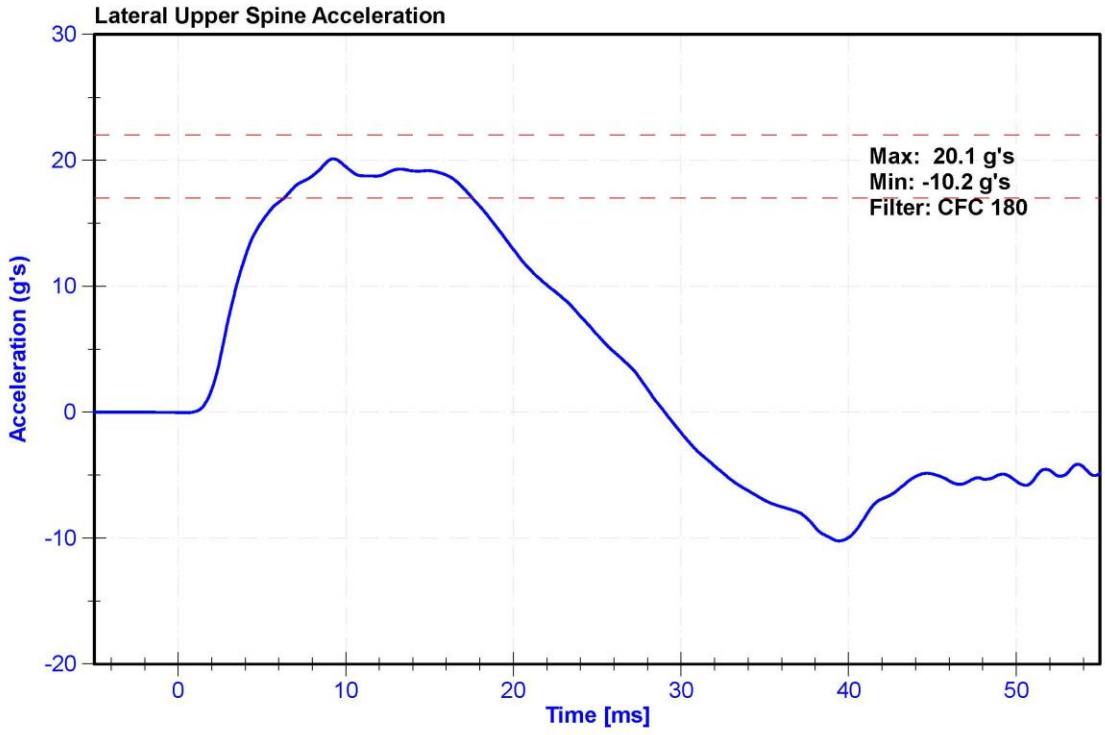
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	22	Pass
Velocity	4.2	4.4	m/s	4.27	Pass
Probe Acceleration	13	18	g's	16.7	Pass
Shoulder Deflection	28	37	mm	30.0	Pass
Lateral Upper Spine Acceleration	17	22	g's	20.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	11/10/2020	5/11/2021
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P71281	11/9/2020	5/10/2021




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 30.0 mm
Min: -0.0 mm
Filter: CFC 600
40
30
20
10
0
-10
0
10
20
30
40
50
60


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 20.1 g's
Min: -10.2 g's
Filter: CFC 180
30
20
10
0
-10
-20
0
10
20
30
40
50

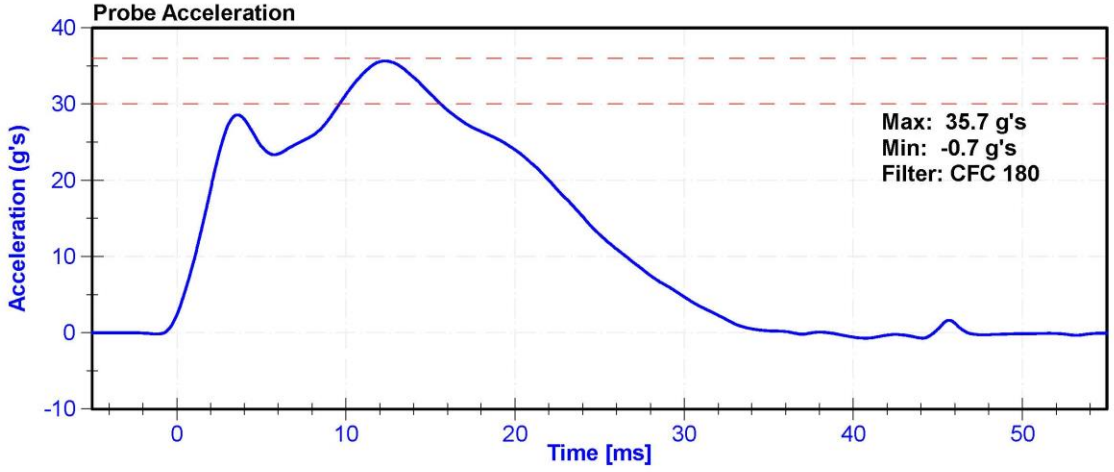
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

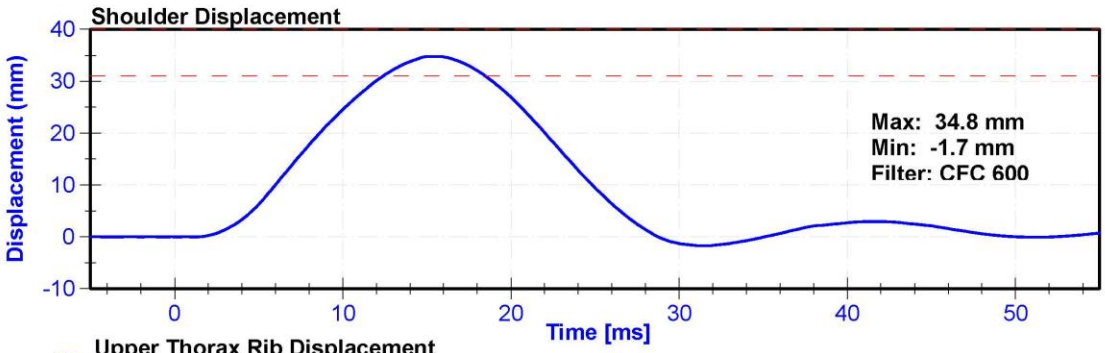
Results

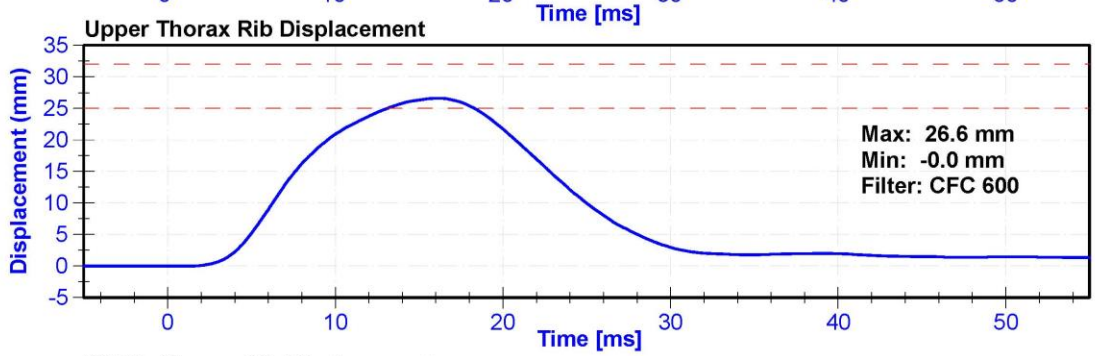
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	24.0	Pass
Velocity	6.6	6.8	m/s	6.66	Pass
Probe Acceleration after 5 ms	30	36	g's	35.7	Pass
Lateral Upper Spine Acceleration	34	43	g's	40.3	Pass
Lateral Lower Spine Acceleration	29	37	g's	33.2	Pass
Shoulder Deflection	31	40	mm	34.8	Pass
Upper Thorax Rib Deflection	25	32	mm	26.6	Pass
Mid Thorax Rib Deflection	30	36	mm	31.2	Pass
Lower Thorax Rib Deflection	32	38	mm	32.9	Pass

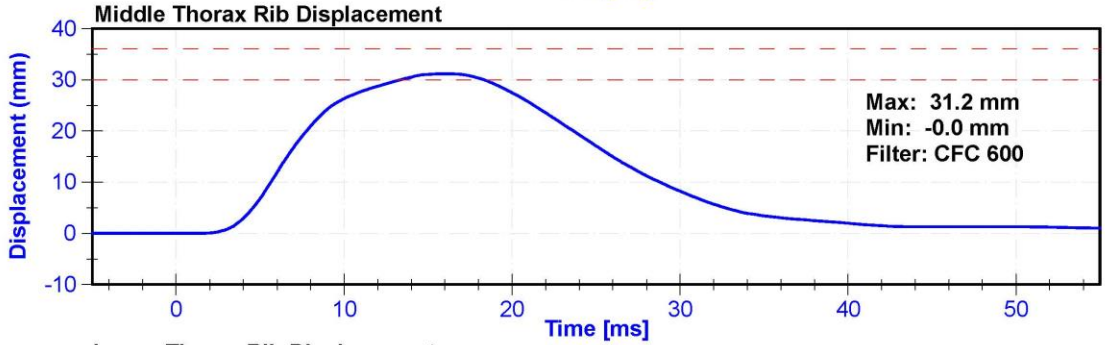
Transducer Calibrations

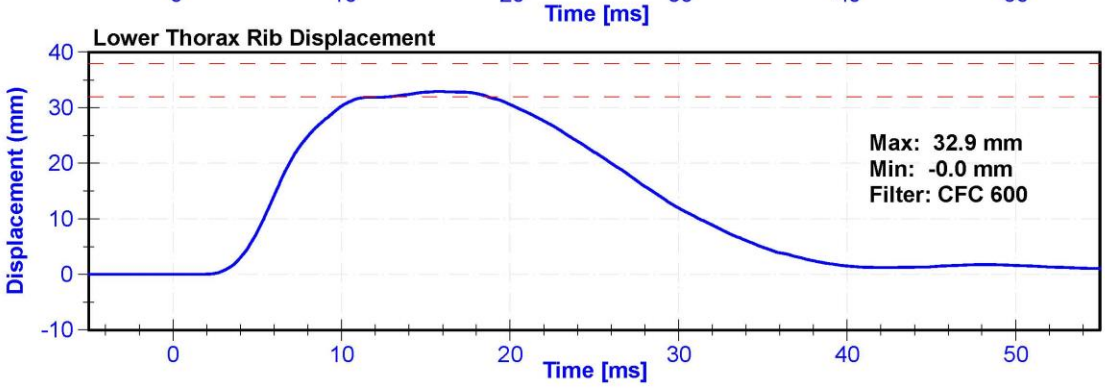
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P71281	11/9/2020	5/10/2021
Upper Spine T12 Y Accelerometer	ENDEVCO 7264	AC-P64147	11/9/2020	5/10/2021
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	11/10/2020	5/11/2021
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	11/10/2020	5/11/2021
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	11/10/2020	5/11/2021
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	11/9/2020	5/10/2021

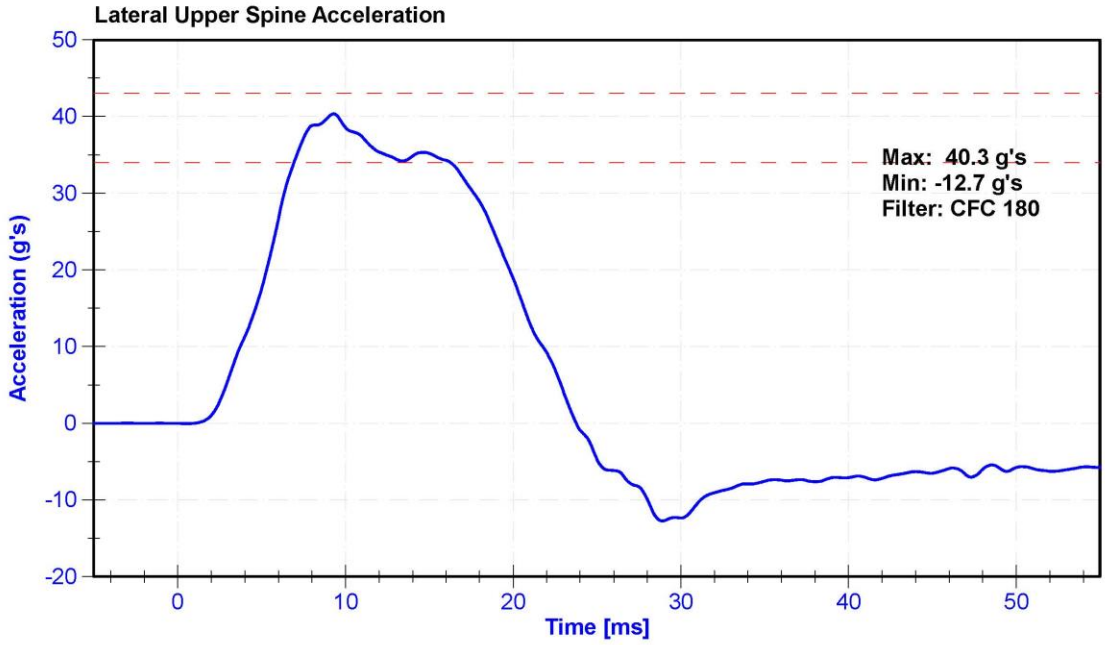


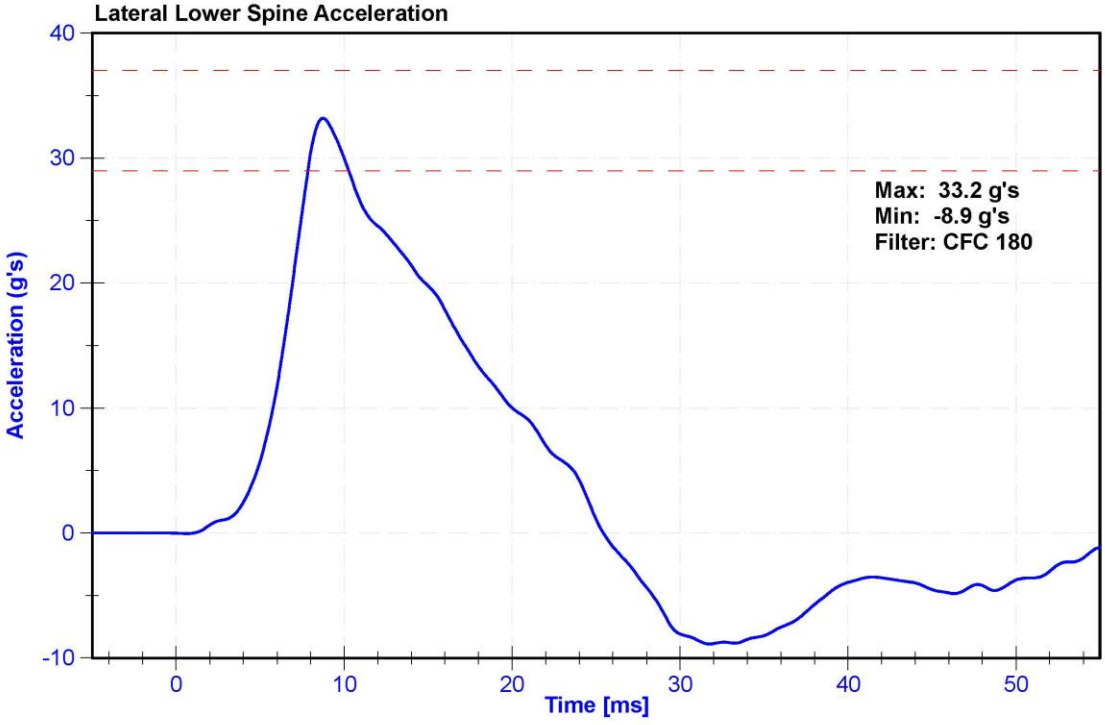

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 34.8 mm
Min: -1.7 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 26.6 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 31.2 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 32.9 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 40.3 g's
Min: -12.7 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]


Lateral Lower Spine Acceleration
Max: 33.2 g's
Min: -8.9 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]

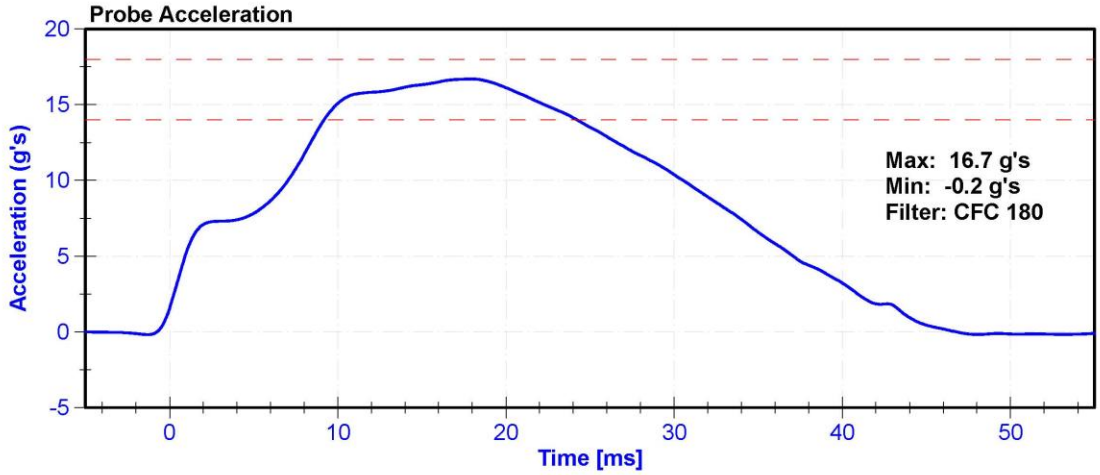
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

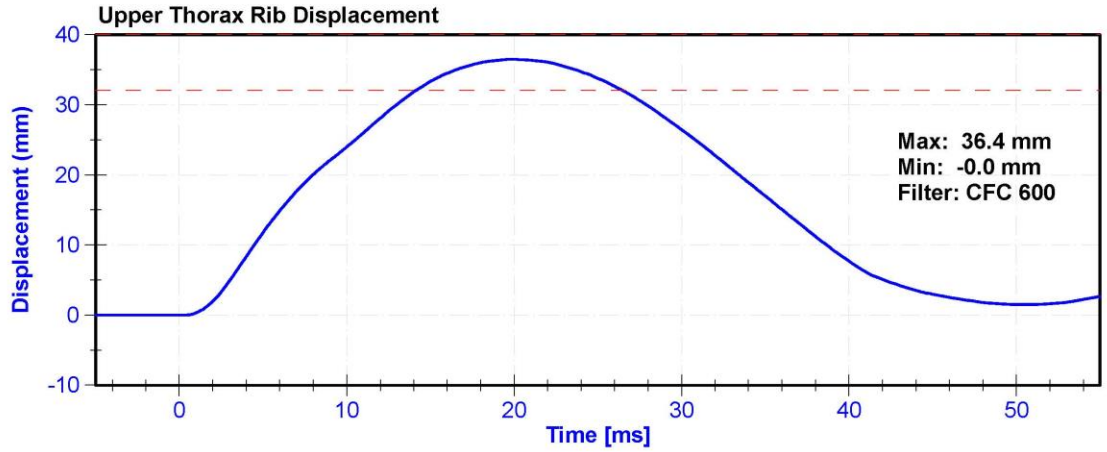
Results

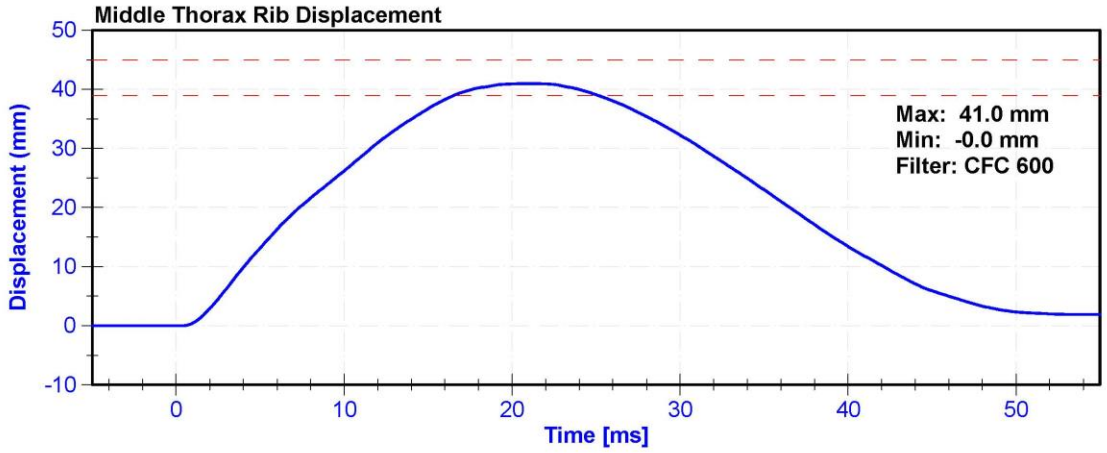
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	29	Pass
Velocity	4.2	4.4	m/s	4.37	Pass
Probe Acceleration	14	18	g's	16.7	Pass
Lateral Upper Spine Acceleration	13	17	g's	16.8	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.8	Pass
Upper Thorax Rib Deflection	32	40	mm	36.4	Pass
Middle Thorax Rib Deflection	39	45	mm	41.0	Pass
Lower Thorax Rib Deflection	35	43	mm	36.3	Pass

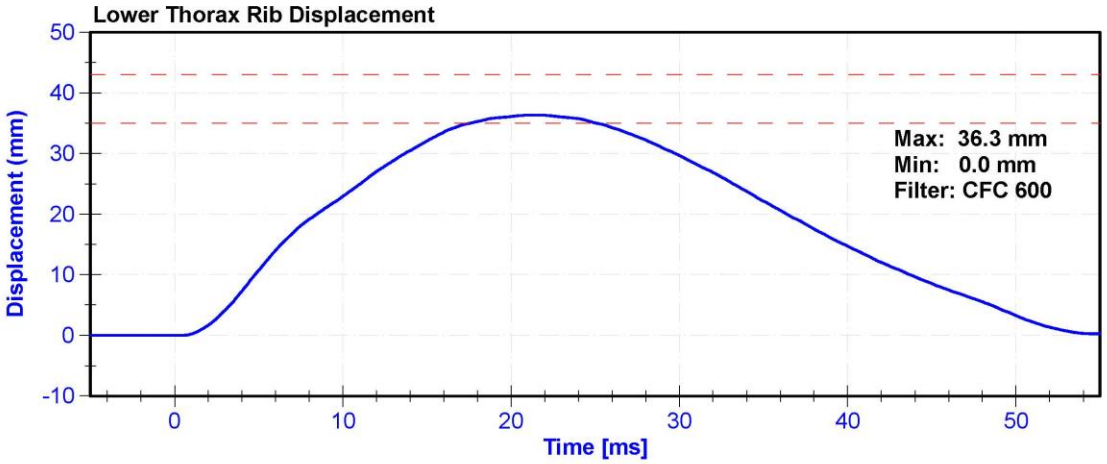
Transducer Calibrations

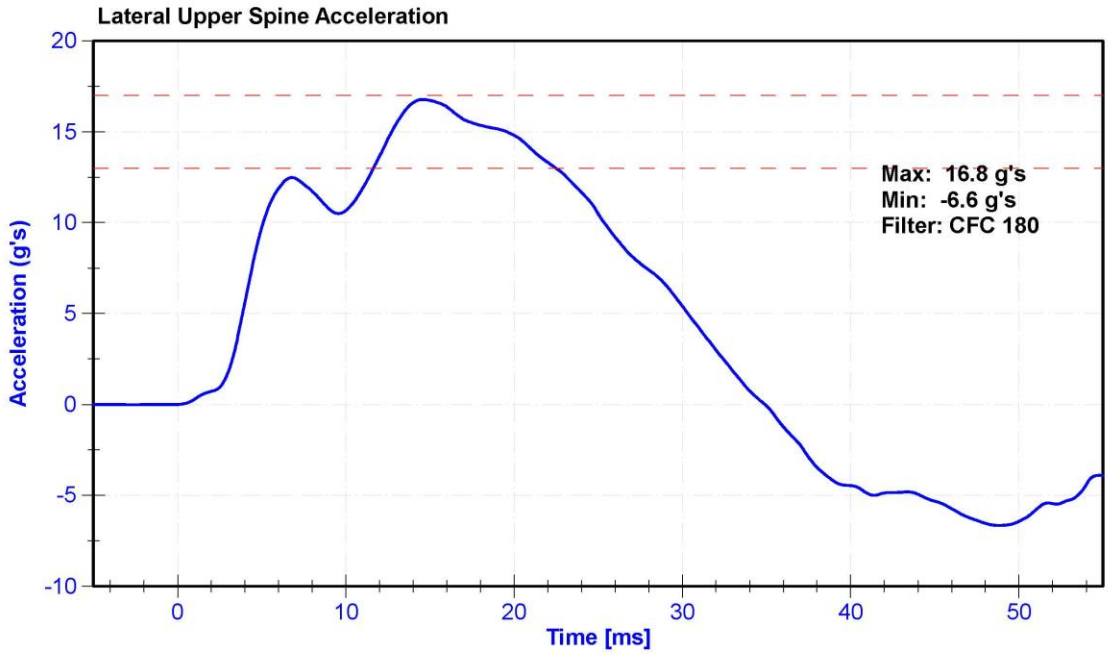
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P71281	11/9/2020	5/10/2021
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	11/9/2020	5/10/2021
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	11/10/2020	5/11/2021
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	11/10/2020	5/11/2021
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	11/9/2020	5/10/2021

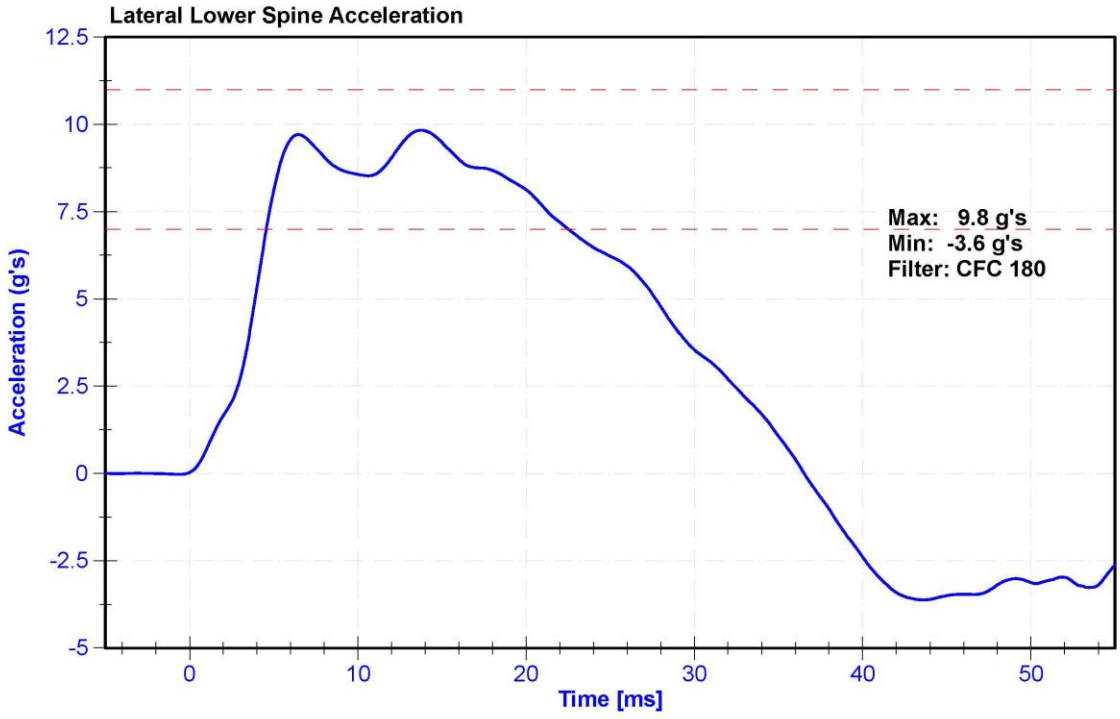



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 36.4 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.0 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 36.3 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 16.8 g's
Min: -6.6 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
20
15
10
5
0
-5
-10
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 9.8 g's
Min: -3.6 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50

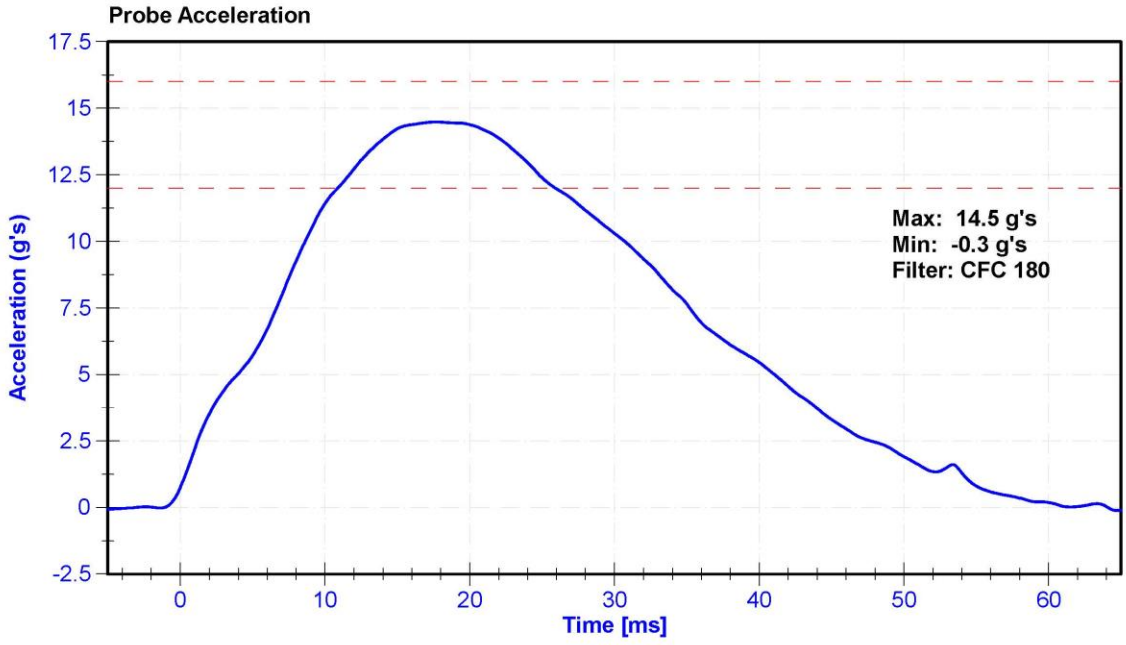
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

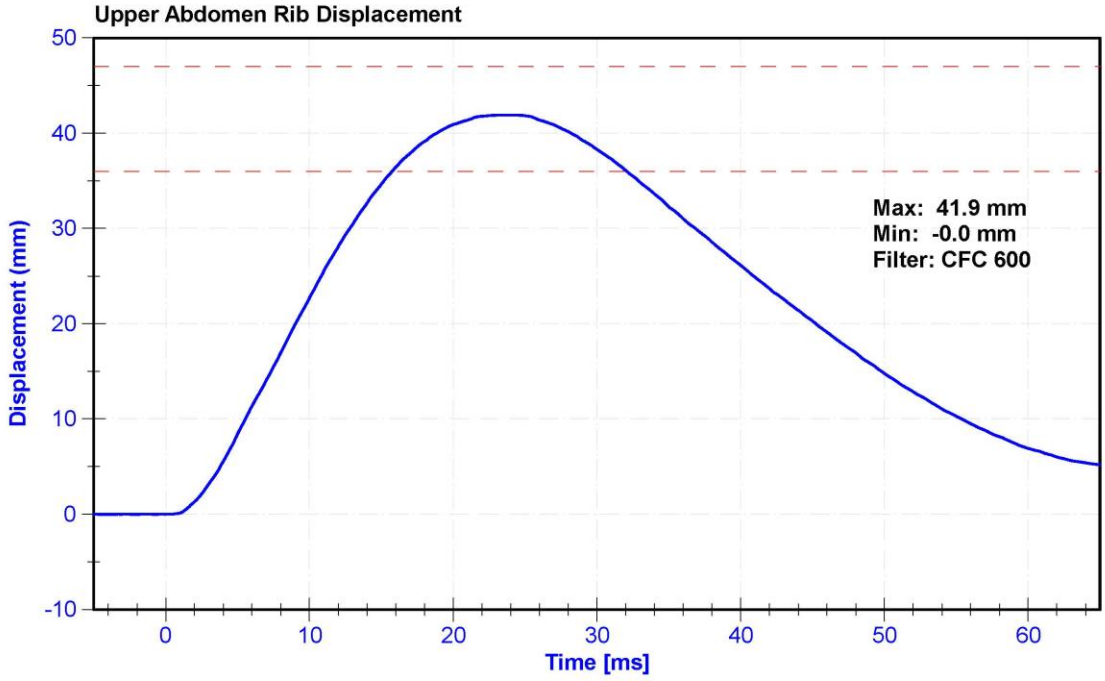
Results

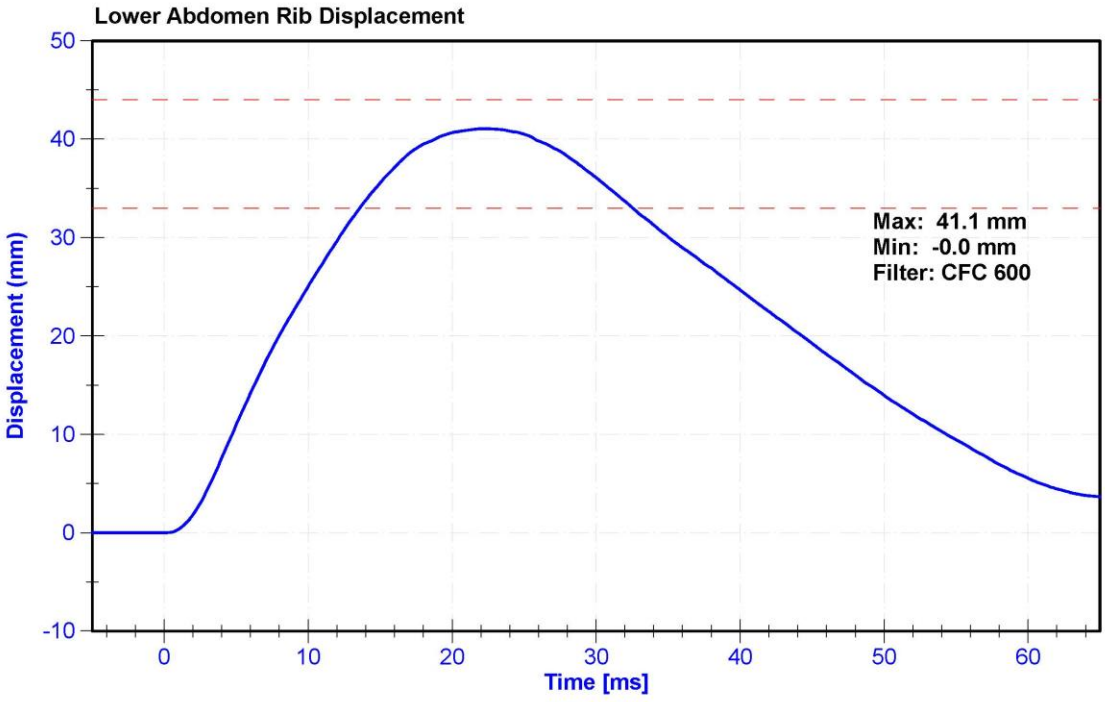
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	29.0	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	12	16	g's	14.5	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.3	Pass
Upper Abdomen Rib Deflection	36	47	mm	41.9	Pass
Lower Abdomen Rib Deflection	33	44	mm	41.1	Pass

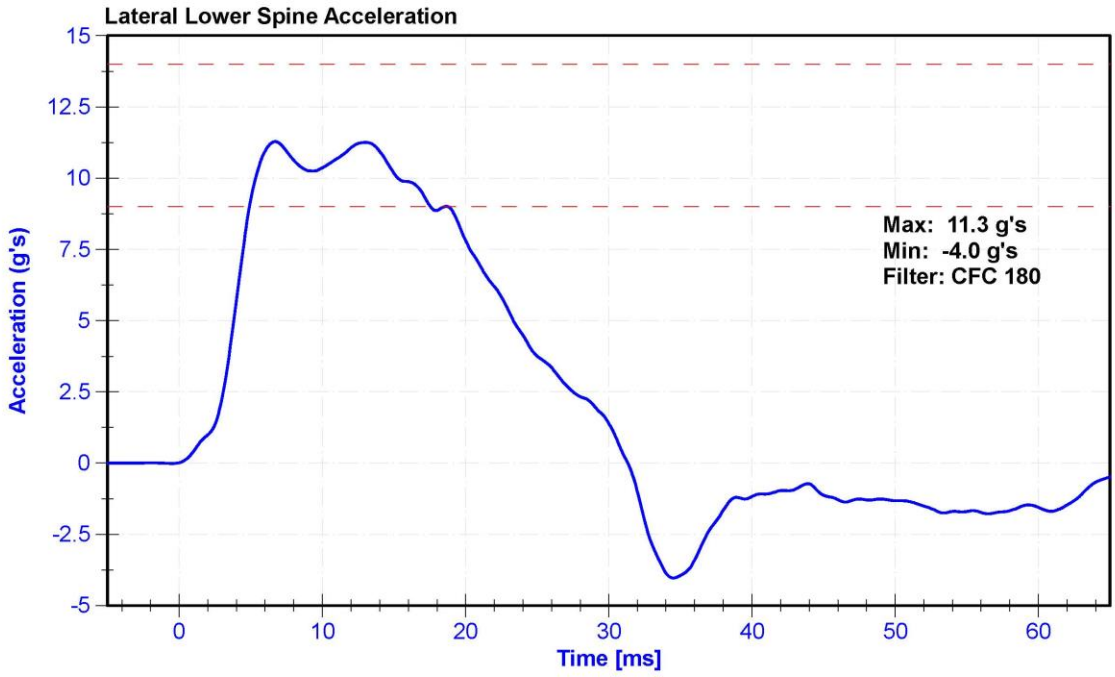
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	11/9/2020	5/10/2021
Upper Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-308GFE	11/10/2020	5/11/2021
Lower Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-307GFE	11/10/2020	5/11/2021




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.9 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.1 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Lower Spine Acceleration
Acceleration (g's)
15
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50
60
Time [ms]
Max: 11.3 g's
Min: -4.0 g's
Filter: CFC 180

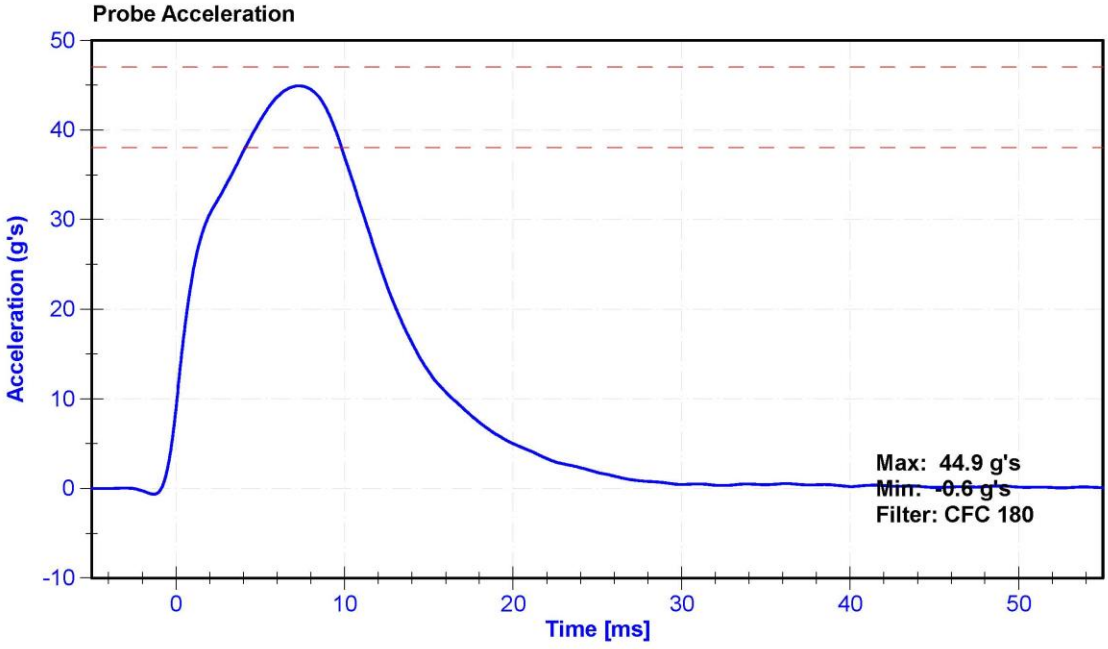
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

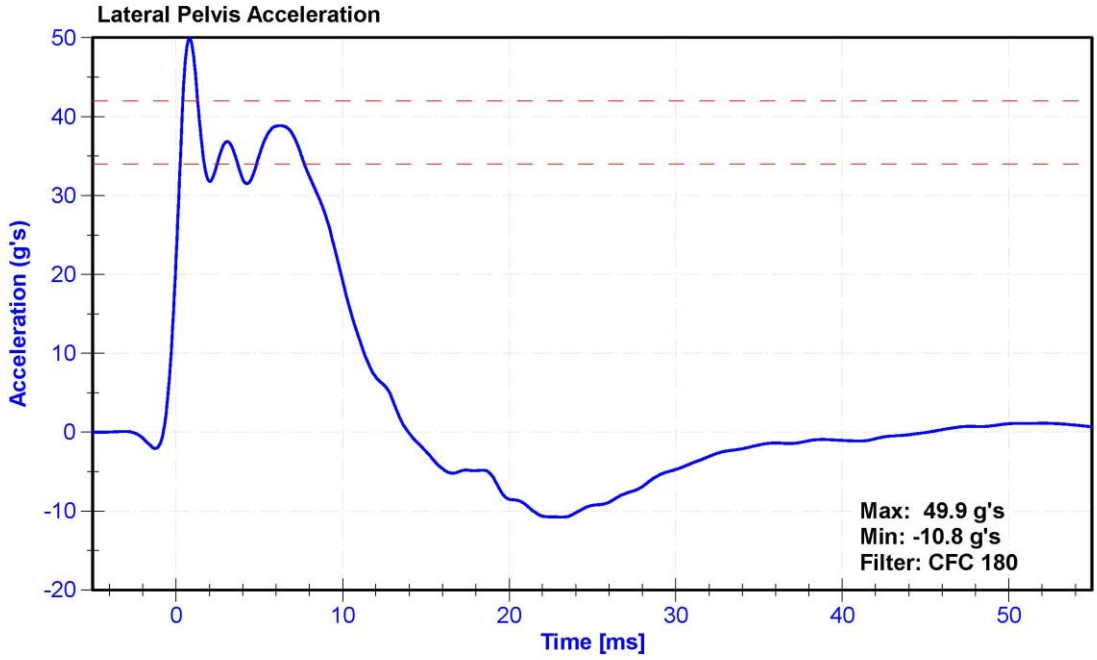
Results

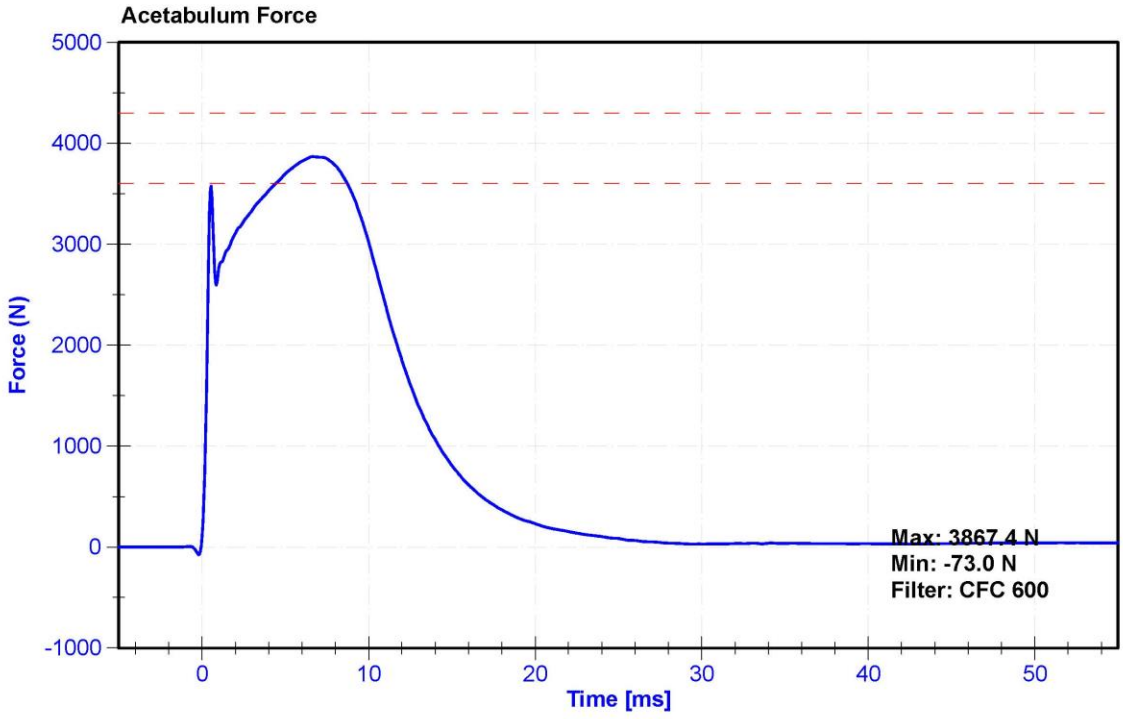
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	29	Pass
Velocity	6.6	6.8	m/s	6.66	Pass
Probe Acceleration	38	47	g's	44.9	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	38.9	Pass
Acetabulum Force	3600	4300	N	3867.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Pelvis Y Accelerometer	ENDEVCO 7264C	AC-P51731	11/9/2020	5/10/2021
Acetabulum Load Cell	Denton IF-520	LC-236Fy	3/18/2020	3/18/2021
Certification Plug	SACO	13919	5/20/2020	N/A
Crash Test Plug	SACO	13941	5/20/2020	N/A




Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 49.9 g's
Min: -10.8 g's
Filter: CFC 180


Acetabulum Force
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 3867.4 N
Min: -73.0 N
Filter: CFC 600

300
Crash
3/10/21

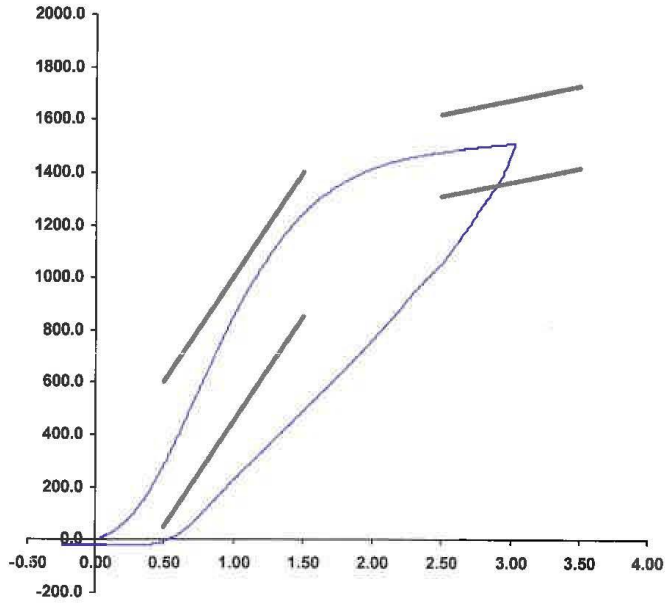
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 13941
Test Number 13415
Report Number 13460
Test Date 5/20/2020 10:18:32 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	299.29	50.00	600.00
Force @ 1.5 mm (N)	1,246.36	850.00	1,400.00
Force @ 2.5 mm (N)	1,476.26	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,508.53	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 20-May-20
SACO Research

By : DC Date : 5/20/2020

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

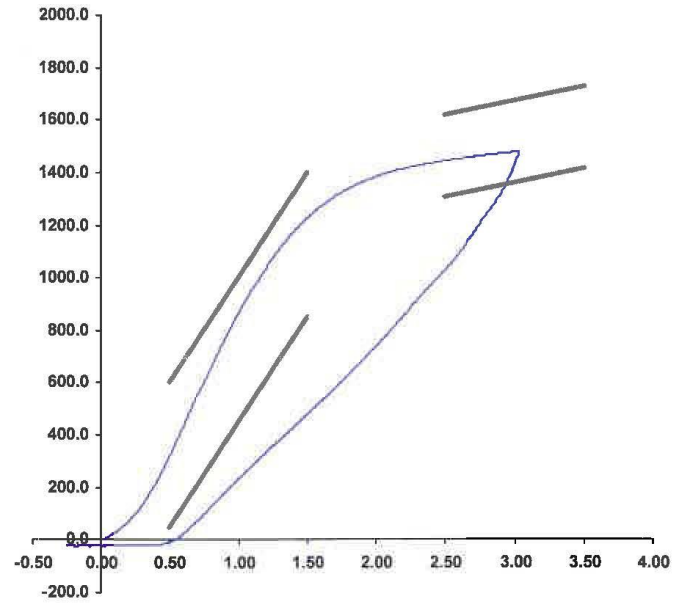
300 Cell
3/10/21

SID-IIs Pelvis Plug Certification Test

Plug S/N 13919
Test Number 13393
Report Number 13438
Test Date 5/20/2020 9:38:18 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	327.80	50.00	600.00
Force @ 1.5 mm (N)	1,229.07	850.00	1,400.00
Force @ 2.5 mm (N)	1,445.24	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,478.91	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000
Preload Value (-N) 22.24
Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator 13916

Part Number 180-4450

Template No 107 20-May-20
SACO Research

By : DC Date : 5/20/2020

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

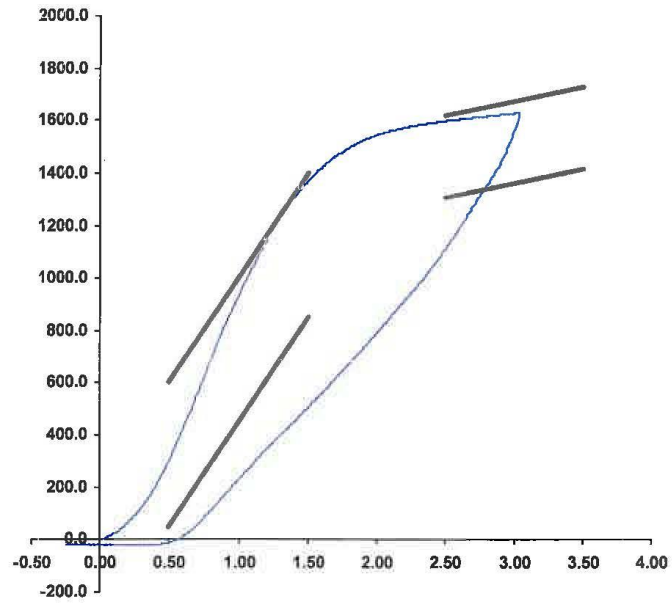
300
310-91
Non-Impact

SID-IIs Pelvis Plug Certification Test

Plug S/N 13782
Test Number 12971
Report Number 13015
Test Date 4/7/2020 7:14:34 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	315.80	50.00	600.00
Force @ 1.5 mm (N)	1,370.19	850.00	1,400.00
Force @ 2.5 mm (N)	1,599.01	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,628.14	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000
Preload Value (-N) 22.24
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 07-Apr-20
SACO Research

By : DC Date : 4/7/2020

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

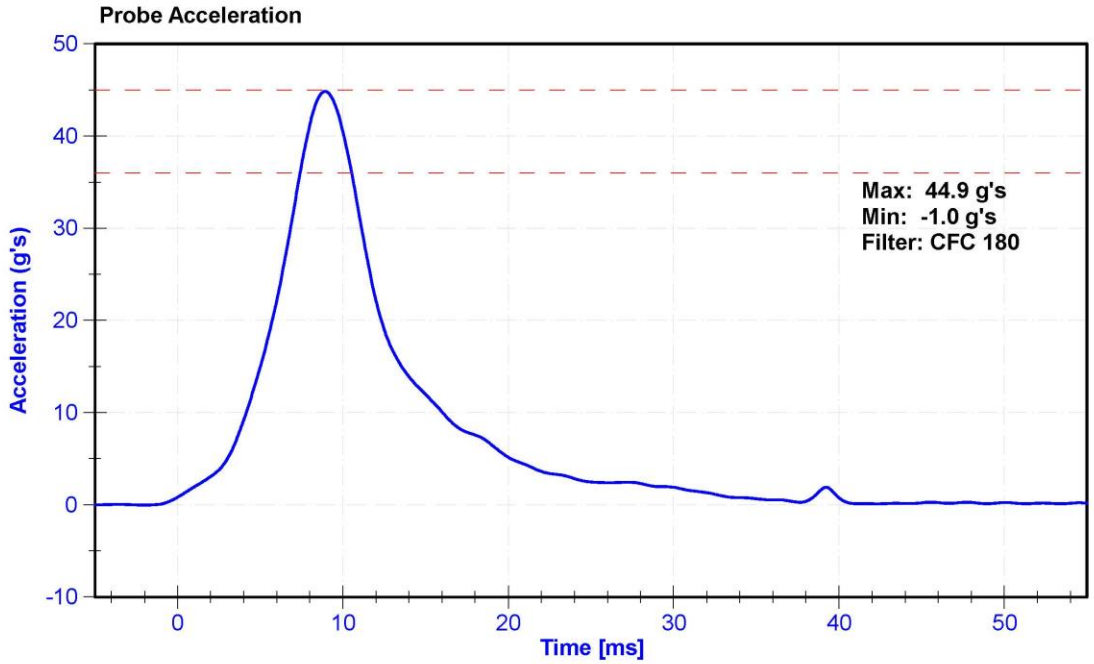
ATD Manufacturer	FTSS	Test Technician	K. Brogan
ATD Serial Number	300	Laboratory Supervisor	D.Reinhard

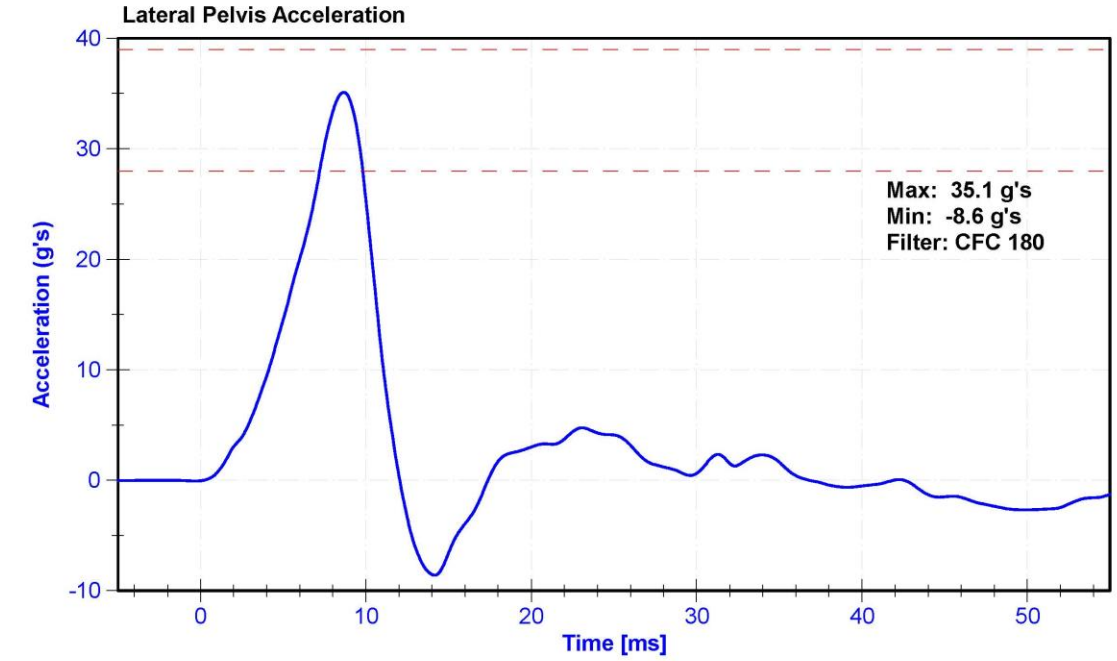
Results

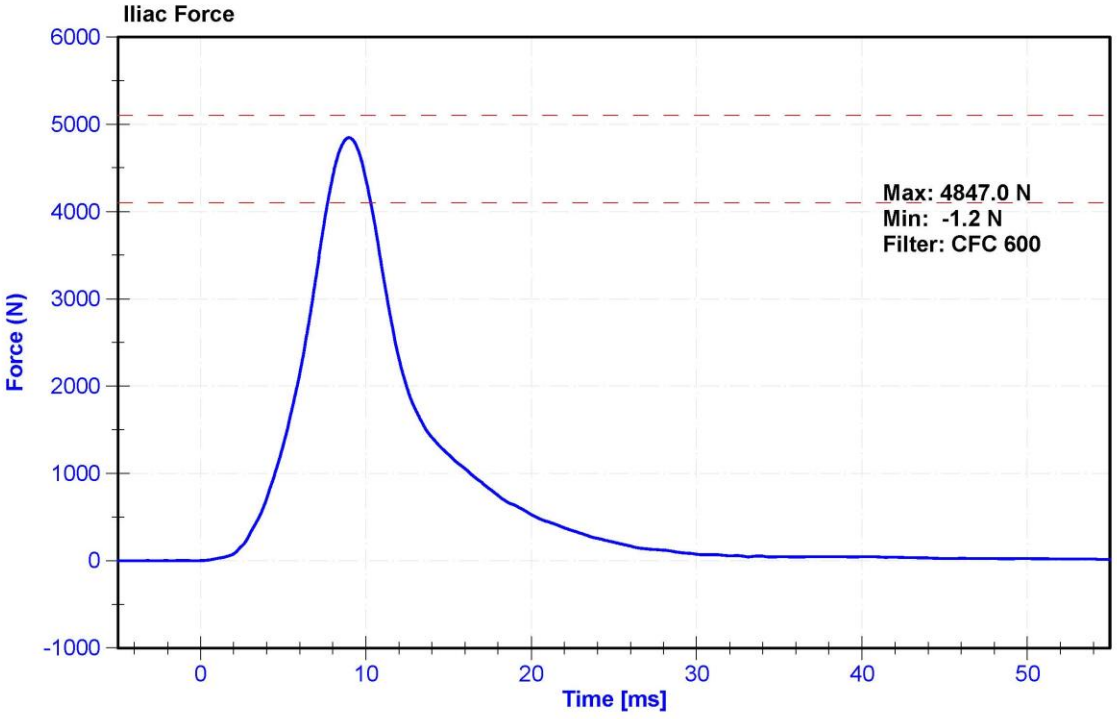
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	29.0	Pass
Velocity	4.2	4.4	m/s	4.23	Pass
Probe Acceleration	36	45	g's	44.9	Pass
Lateral Pelvis Acceleration	28	39	g's	35.1	Pass
Iliac Force	4100	5100	N	4847.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A278994	12/3/2020	12/3/2021
Pelvis Y Accelerometer	ENDEVCO 7264C	AC-P51731	11/9/2020	5/10/2021
Iliac Load Cell	DENTON 3228J	LC-279Fy	11/23/2020	11/23/2021




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 35.1 g's
Min: -8.6 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4847.0 N
Min: -1.2 N
Filter: CFC 600

APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N: F033		
			Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers	Primary	X	AC-P63861	ENDEVCO	11/24/2020
		Y	AC-P49216	ENDEVCO	11/24/2020
		Z	AC-P51303	ENDEVCO	11/24/2020
	Redundant	X	AC-P58868	ENDEVCO	11/24/2020
		Y	AC-P16755	ENDEVCO	11/24/2020
		Z	AC-P52132	ENDEVCO	11/24/2020
Thorax Rib Displacement Potentiometers	Upper	Y	DS-179GFE	Honeywell	11/25/2020
	Middle	Y	DS-185GFE	Honeywell	11/25/2020
	Lower	Y	DS-178GFE	Honeywell	11/25/2020
Abdomen Load Cells	Forward	Y	LC-1509	FTSS	11/10/2020
	Middle	Y	LC-1508	DENTON	11/10/2020
	Rear	Y	LC-1507	DENTON	11/10/2020
Lower Spine Accelerometers (T12)		X	AC-P52009	ENDEVCO	11/24/2020
		Y	AC-P49163	ENDEVCO	11/24/2020
		Z	AC-P52033	ENDEVCO	11/24/2020
Pubic Symphysis Load Cell		Y	LC-464fy	DENTON	7/23/2020

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N: 300		
				Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers		Primary	X	AC-P59018	ENDEVCO	11/10/2020
			Y	AC-P79189	ENDEVCO	11/10/2020
			Z	AC-P58777	ENDEVCO	11/10/2020
		Redundant	X	AC-P68057	ENDEVCO	11/10/2020
			Y	AC-P58986	ENDEVCO	11/10/2020
			Z	AC-P52025	ENDEVCO	11/10/2020
Displacement Potentiometers	Thoracic Rib	Upper	Y	DS-451GFE	Servo	11/10/2020
		Middle	Y	DS-040GFE	Servo	11/10/2020
		Lower	Y	DS-1156GFE	Servo	11/9/2020
	Abdominal Rib	Upper	Y	DS-308GFE	Servo	11/10/2020
		Lower	Y	DS-307GFE	Servo	11/10/2020
Lower Spine Accelerometers (T12)			X	AC-P64003	ENDEVCO	11/9/2020
			Y	AC-P64147	ENDEVCO	11/9/2020
			Z	AC-P58786	ENDEVCO	11/9/2020
Acetabulum Load Cell			Y	LC-236Fy	Denton	3/18/2020
Iliac Wing Load Cell			Y	LC-279Fy	Denton	11/23/2020
Pelvis Plug (struck side)				13701	SACO	9/26/2019
Pelvis Plug (non-struck side)				13042	SACO	7/30/2019

Table 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	1201-1000_A370929	Measurement Specialties	11/18/2020
	Vehicle Center of Gravity	Y	1201-1000_A370935	Measurement Specialties	11/18/2020
	Vehicle Center of Gravity	Z	1201-1000_A370942	Measurement Specialties	11/18/2020
2	Right Sill at Front Seat	X	1201-1000_A370957	Measurement Specialties	11/19/2020
	Right Sill at Front Seat	Y	1201-1000_A374218	Measurement Specialties	11/30/2020
	Right Sill at Front Seat	Z	1201-1000_A370949	Measurement Specialties	11/19/2020
3	Right Sill at Rear Seat	X	1201-1000_A370934	Measurement Specialties	11/18/2020
	Right Sill at Rear Seat	Y	1201-1000_A372833	Measurement Specialties	11/19/2020
	Right Sill at Rear Seat	Z	1201-1000_A374315	Measurement Specialties	11/28/2020
4	Left Sill at Front Door	Y	1201-1000_A283603	Measurement Specialties	1/20/2021
5	Left Sill at Rear Door	Y	1201-1000_A301875	Measurement Specialties	1/21/2021
6	Left A-Post Lower	Y	1201-1000_A280832	Measurement Specialties	7/17/2020
7	Left A-Post Middle	Y	1201-1000_A279997	Measurement Specialties	1/29/2021
8	Left B-Post Lower	Y	1201-1000_A262059	Measurement Specialties	1/25/2021
9	Left B-Post Middle	Y	1201-1000_A315113	Measurement Specialties	1/21/2021
10	Front Seat Track	Y	1201-1000_A280829	Measurement Specialties	1/20/2021
11	Rear Seat Track or Structure	Y	1201-1000_A315917	Measurement Specialties	1/25/2021
12	Right Rear Occ. Compartment	Y	1201-1000_A372824	Measurement Specialties	11/19/2020
13	Engine Block	X	1201-1000_A350954	Measurement Specialties	9/23/2020
	Engine Block	Y	1201-1000_A350984	Measurement Specialties	9/23/2020
14	Rear Floorpan Above Axle	X	1201-1000_A315101	Measurement Specialties	1/21/2021
	Rear Floorpan Above Axle	Y	1201-1000_A315125	Measurement Specialties	1/21/2021
	Rear Floorpan Above Axle	Z	1201-1000_A315998	Measurement Specialties	1/21/2021

TABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	1201-1000_A315181	Measurement Specialties	10/6/2020
MDB Center of Gravity	Y	1201-1000_A315931	Measurement Specialties	10/7/2020
MDB Center of Gravity	Z	1201-1000_A315085	Measurement Specialties	10/6/2020
Left Frame at Rear Axle Centerline	X	1201-1000_A315983	Measurement Specialties	10/5/2020
Left Frame at Rear Axle Centerline	Y	1201-1000_A290947	Measurement Specialties	10/5/2020