REPORT NUMBER: SINCAP-CAL-19-003

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

Volkswagen de Mexico S.A. de C.V.
2019 Volkswagen Jetta
Four Door Sedan

NHTSA No: M20195802

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

April 24, 2019

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
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Prepared by: Zachary Granby, Test Engineer Date: April 24, 2019

Approved by: Vanessa Hansen, Operations Manager Date: April 24, 2019

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

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Zachary Granby, Test Engineer Vanessa Hansen , Operations Manager	***8. Performing Organization Report No.*** CAL-DOT-2019-003
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225	***10. Work Unit No.***
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12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave., SE, Room W43-410 Washington, D.C. 20590	***13. Type of Report and Period Covered:*** Final Test Report February 1, 2019 - April 24, 2019
	14. Sponsoring Agency Code NRM-110
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 2019 Volkswagen Jetta four door sedan 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 February 1, 2019.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.86 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 192mm 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	100.573
Maximum Thoracic Rib Deflection	mm	44	23.730
Total Abdominal Force	N	2500	838.152
Pubic Symphysis Force	N	6000	1410.225

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC_{36})	N/A	1000	306.172
Lower Spine Resultant Acceleration	G	82	55.666
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2462.358
Maximum Thoracic Rib Deflection	mm	38*	31.501
Maximum Abdominal Rib Deflection	mm	45*	31.453

* *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, NPO-411 1200 New Jersey Ave. SE Washington, D.C. 20590 e-mail: tis@nhtsa.dot.gov FAX: 202-493-2833

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UNCLASSIFIED	UNCLASSIFIED	192	

TABLE OF CONTENTS

SECTION 1

TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2019 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 2019 Volkswagen Jetta four door sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure dated October 2015.

SECTION 2

SUMMARY OF TEST RESULTS

A 2019 Volkswagen Jetta four door sedan 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 61.86 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 February 1, 2019. 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 October 2015. 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	100.573
Maximum Thorax Rib Deflection	mm	44	23.730
Combined Abdominal Force	N	2500	838.152
Pubic Symphysis Force	N	6000	1410.225

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC36)		1000	306.172
Lower Spine (T12) Resultant Acceleration	G	82	55.666
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2462.358
Maximum Thoracic Rib Deflection	mm	38*	31.501
Maximum Abdominal Rib Deflection	mm	45*	31.453

*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	No	N/A		
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 – F034
2. P4 serial number – DG8012

Data Anomalies:

The following channel was questionable for

- Vehicle CG Y, Questionable

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: 2019 Volkswagen Jetta four door sedan NHTSA No.: M20195802
Test Program: NCAP Side MDB Impact Test Test Date: 2/1/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20195802
Model Year	2019
Make	Volkswagen
Model	Jetta
Body Style	Four Door Sedan
VIN	3VWC57BU5KM091030
Body Color	Blue
Odometer Reading (km/mi)	192 miles
Engine Displacement (L)	1.4
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	8-speed
Overdrive	Yes
Final Drive	Front Wheel Drive
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
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	No
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	Volkswagen de Mexico S.A. de C.V.
Date of Manufacture	08/18
Vehicle Type	Passenger Car

GVWR (kg)	1870
GAWR Front (kg)	980
GAWR Rear (kg)	940

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3	-	5	
Capacity Weight (VCW) (kg)				440	(A)
DSC X 68.04 kg				340.2	(B)
Cargo Weight (RCLW) (kg)				99.8	(A-B)

VEHICLE SEAT TYPE

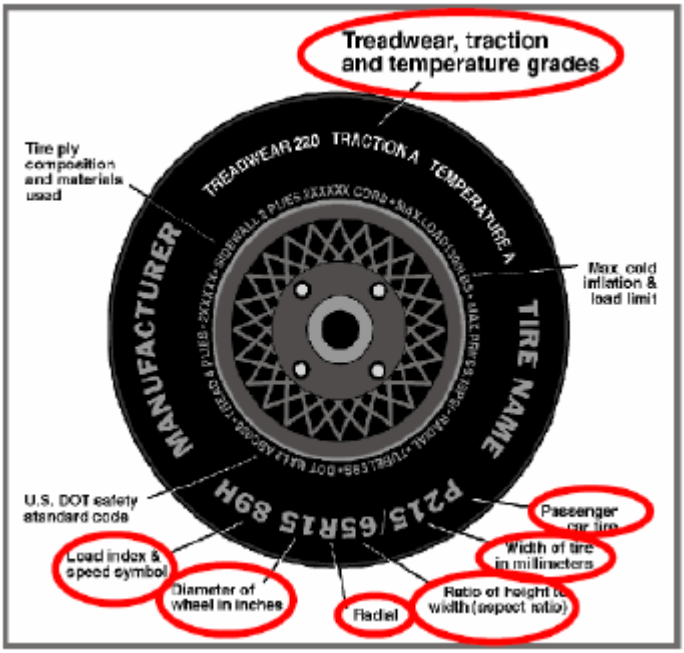
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front Seat	X					X	
Rear or Second Row Seat			X		X		
Third Row seat							

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

Test Vehicle:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019

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)	250	250
Recommended Tire Size	205/60R16	205/60R16
Tire Size on Vehicle	205/60R16	205/60R16
Tire Manufacturer	Hankook	Hankook
Tire Model	Kinergy GT	Kinergy GT
Treadwear	500	500
Traction	B	B
Temperature Grade	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	2 Steel, 1 Polyester, 1 Nylon	2 Steel, 1 Polyester, 1 Nylon
Load Index/Speed Symbol	92H	92H
Tire Material	Rubber	Rubber
*DOT Safety Code Left	15M9X 1B H0	15M9X 1B H0
DOT Safety Code Right	15M9X 1B H0 1818	15M9X 1B H0 1818

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

Test Vehicle: 2019 Volkswagen Jetta four door sedan NHTSA No.: M20195802
Test Program: NCAP Side MDB Impact Test Test Date: 2/1/2019

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	255	255	255	255
Tire Placard	kPa	250	250	250	250
Owner's Manual	kPa	250	250	250	250
As Tested	kPa	250	250	250	250

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	411	271		445	371		448	378	
Right	kg	396	266		401	346		396	348	
Ratio	%	60	40		54	46		54	46	
Totals	kg	807	537	1344	846	717	1563	844	726	1570

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1344	(A)
Sum of Actual Weight of 1 ES2re and 1 P572 ATD (SID-IIs)	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	99.8	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	1570.8	(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	701	702	Yes
RF	mm	715	712	Yes
RR	mm	688	688	Yes
LR	mm	680	675	Yes
Vehicle CG (Aft of Front Axle)	mm	1242	1232	
Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline)	mm	39.5	33.5	

**** 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:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	8
Air Pump	3
Tail Light	1
Ballast / Equipment Added	45

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

Test Vehicle:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019

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	21.3	16.9	19.1
Front Passenger Seat	Not Adjustable		
Front Center Seat*			
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	19.1	10	Max	-	-	-
			Mid	0	10	20
			Min	-	-	-
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: 2019 Volkswagen Jetta four door sedan NHTSA No.: M20195802
Test Program: NCAP Side MDB Impact Test Test Date: 2/1/2019

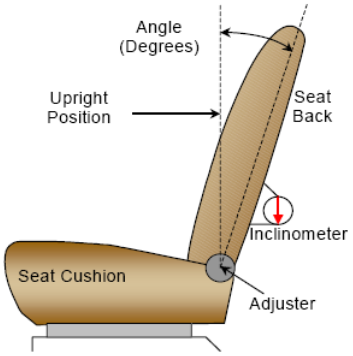
SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forwardmost Position	
	mm	Detents*	mm	Detent*
Driver Seat	246	38 (0-37)	125	19
Front Passenger Seat	254	39 (0-38)	130	19
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	63.9	23	17.6	6
Front Passenger Seat	63.3	21	18.1	6
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: 2019 Volkswagen Jetta four door sedan NHTSA No.: M20195802
Test Program: NCAP Side MDB Impact Test Test Date: 2/1/2019

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
Rear Seat	Fixed	Fixed

HEAD RESTRAINT ADJUSTMENT

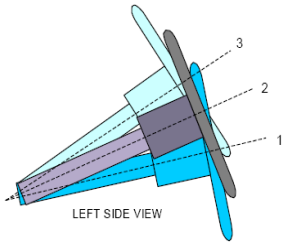
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	4	Uppermost
Rear Seat	Fixed	Fixed

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	19.0	
Geometric Center – Position 2	21.5	
Uppermost – Position 3	24.3	
Telescoping Steering Wheel Travel		56
Test Position	21.5	28

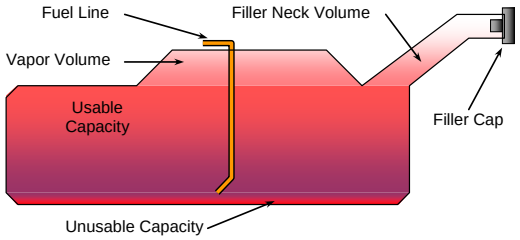


STEERING COLUMN ASSEMBLY

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: 2019 Volkswagen Jetta four door sedan NHTSA No.: M20195802
Test Program: NCAP Side MDB Impact Test Test Date: 2/1/2019

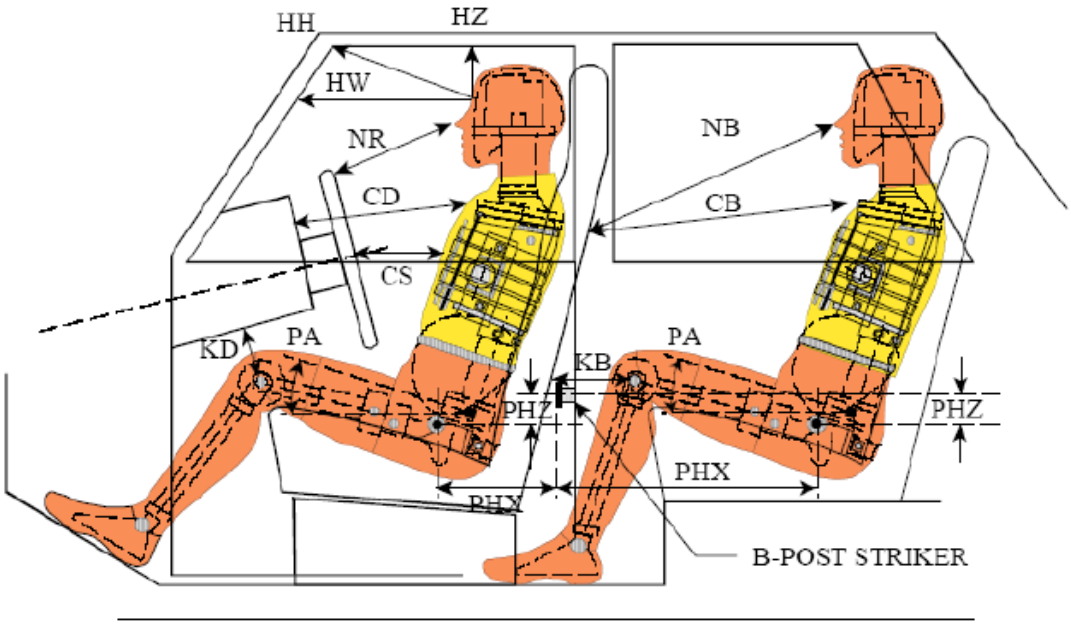
FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	50
Usable Capacity of "Optional Tank" (see Form No. 1)	-
Usable Capacity of Standard Tank (see Owner's Manual)	50
Usable Capacity of Optional Tank (see Owner's Manual)	-
93% of Usable Capacity	46.5
Actual Amount of Solvent Used in Test	46.5
1/3 of Usable Capacity	16.6

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: 2019 Volkswagen Jetta four door sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20195802
Test Date: 2/1/2019



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

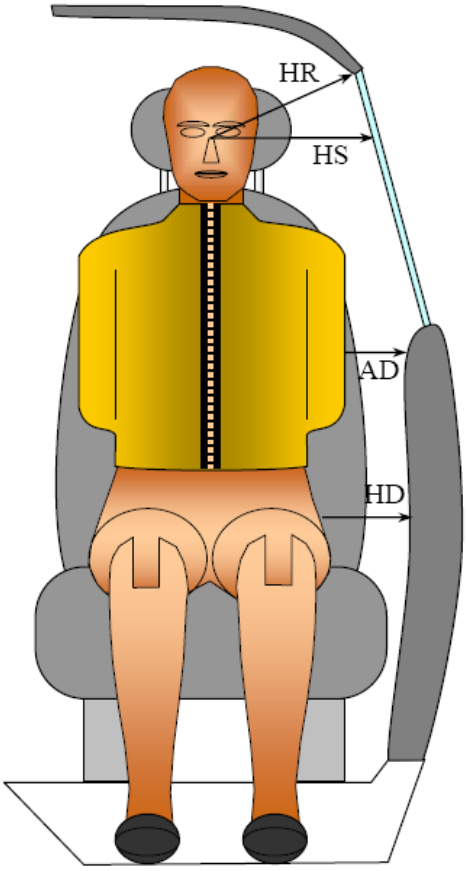
LEFT SIDE VIEW

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Description	Driver (Serial No. F034)		Passenger (Serial No.DG8012)	
			Length (mm)	Angle	Length (mm)	Angle
HH		Header to Header	382			
HW		Header to Windshield	602			
HZ	HZ	Head to Roof Liner	168		268	
NR	NB	Nose to Rim/Seat Back	426		573	
CD	CB	Chest to Dash/Seat Back	535		578	
CS		Chest to Steering Wheel	348			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	231	23.4	276	18.8
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	221	26.2	275	17.2
PAX°	PAX°	Pelvic Tilt Angle X		20.4		24.9
	PAY°	Pelvic Tilt Angle Y				0.3
PHX	PHX	Hip Point to Striker (X-Axis)	157		168	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	242		243	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019



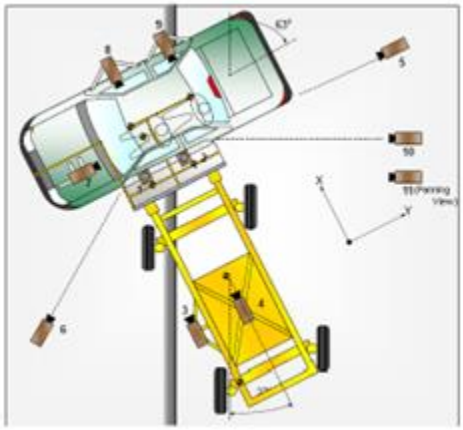
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver (Serial No. F034)	Passenger (Serial No. DG8012)
HR	Head to Side Header	mm	184	252
HS	Head to Side Window	mm	315	358
AD	Arm to Door	mm	132	132
HD	Hip Point to Door	mm	141	156

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2019 Volkswagen Jetta four door sedan NHTSA No.: M20195802
Test Program: NCAP Side MDB Impact Test Test Date: 2/1/2019



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	254	1421	-9500	12.5	1000
2	Overhead Close-up	0	854	-9500	24	1000
3	Left Impact Point (MDB)	-1470	0	-847	25	1000
4	Side Overall (MDB)	-1140	878	-1587	8	1000
5	Rear	0	8258	-1180	28	1000
6	Left Front	-3525	-4613	-1190	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.*

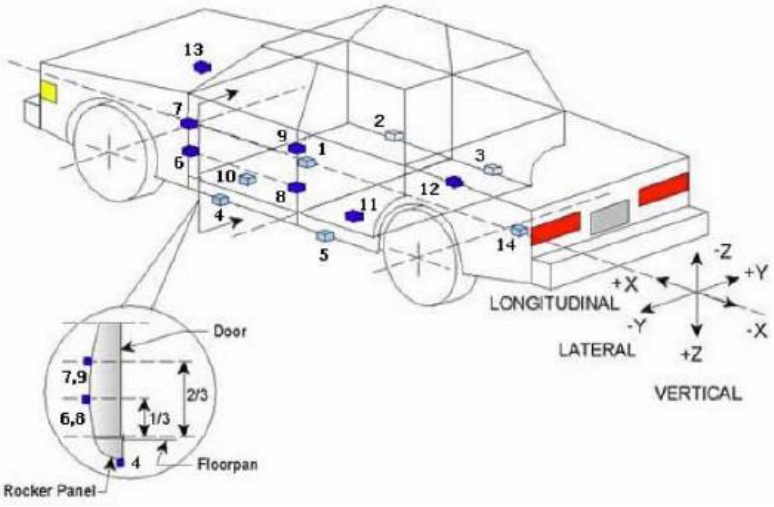
If applicable, explain why camera(s) did not operate as intended: All cameras operated normally

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: 2019 Volkswagen Jetta four door sedan NHTSA No.: M20195802
Test Program: NCAP Side MDB Impact Test Test Date: 2/1/2019



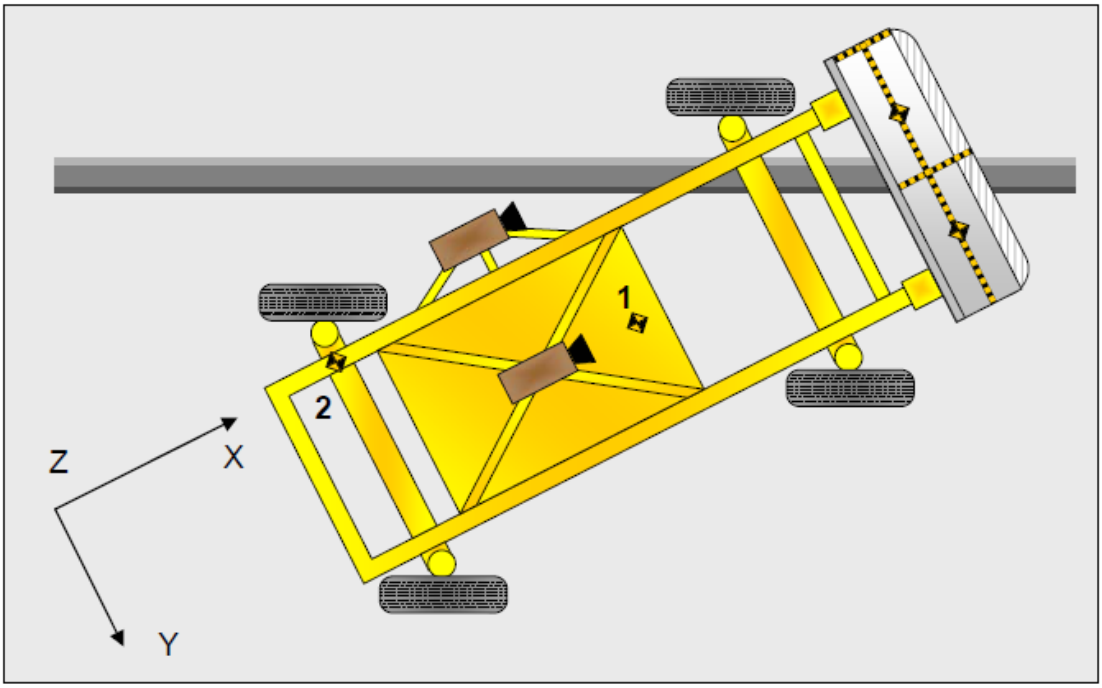
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2648	24	120
2	Right Sill at Front Seat	2922	691	321
3	Right Sill at Rear Seat	2061	691	303
4	Left Sill at Front Door	2910	-685	321
5	Left Sill at Rear Door	2180	-686	309
6	A-Post Lower	3267	-647	20
7	A-Post Middle	3222	-640	-402
8	B-Post Lower	2229	-670	-122
9	B-Post Middle	2186	-631	-360
10	Front Seat Track	2317	-580	301
11	Rear Seat Structure	1816	-446	149
12	Rt. Rear Occ. Compartment	2119	364	385
13	Engine Block	4043	276	-155
14	Rear Above Axle	1111	11	116

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:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019



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)

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2019 Volkswagen Jetta four door sedan NHTSA No.: M20195802
Test Program: NCAP Side MDB Impact Test Test Date: 2/1/2019

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	None	None
Top of Head	Side Header & Grab Handle	Curtain Air bag
Left Side of Head	Side Header & Curtain Air bag	Curtain Air bag
Back of Head	Headrest & Side Header	Center Headrest
Left Shoulder	Curtain Air bag	C-Pillar Trim
Upper Torso	Torso/Pelvis Air bag	C-Pillar Trim
Lower Torso	Seat Bolster	C-Pillar Trim & Passenger Door
Left Hip	Driver Door	C-Pillar Trim & Passenger Door
Left Knee	Driver Door	Rear 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

*Tailgate opened during impact but is still operational.

POST-TEST SEAT PERFORMANCE

Description	Struck Side		Non-Struck Side	
	Front	Rear	Front	Rear
Seat Movement Along Seat Track	No	No	No	No
Seat Disengagement from Floor Pan	No	No	No	No
Seat Back Movement from Initial Position	No	No	No	No
Seat Back Collapse	No	No	No	No

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	B-Pillar Buckled
Sill Separation	None
Windshield Damage	None
Side Window Damage	Both windows on struck side shattered
Other Notable Effects	None

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

Test Vehicle: 2019 Volkswagen Jetta four door sedan NHTSA No.: M20195802
Test Program: NCAP Side MDB Impact Test Test Date: 2/1/2019

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	No	N/A		
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		2685
Vertical Impact Reference Line (Aft of Front Axle - Intended Impact Point)	mm		403
Actual Impact Point (Aft of Frontal Axle)	mm		398
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	+5
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact Point	-1

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019

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

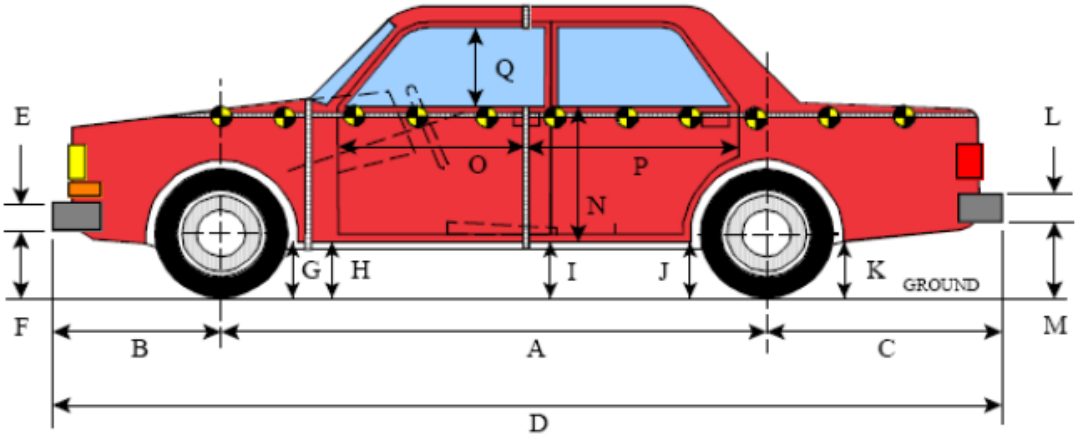
Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.10 to 62.70	61.86
Trap No. 2 Velocity (Redundant)	km/h	61.10 to 62.70	61.92
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.0
MDB Crabbed angle 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	217
B	Top of Bumper	533	800	Left	155
C	Mid-Level	686	800	Left	167
D	Top of Stack	813	800	Left	145

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019



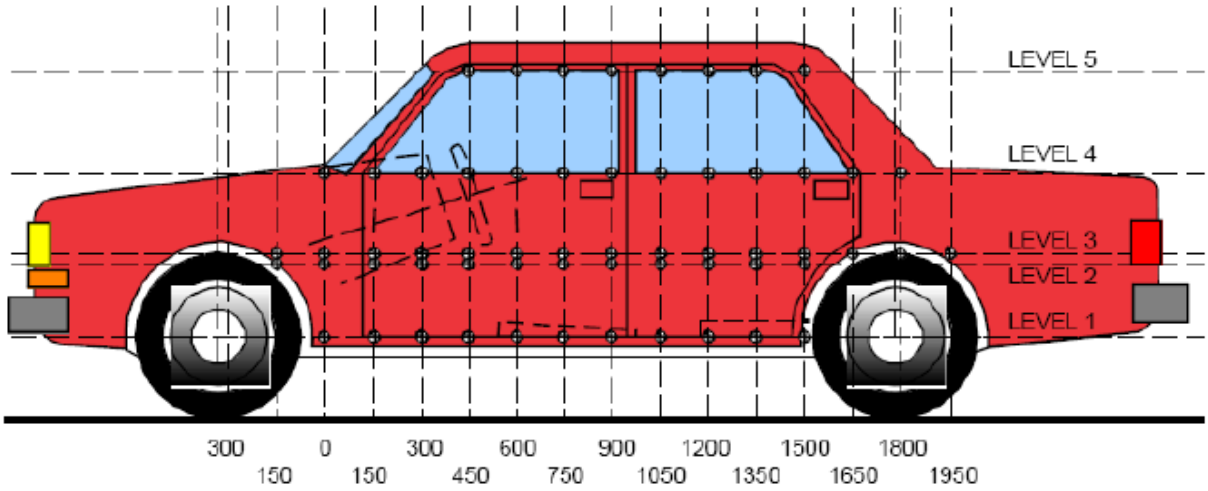
LEFT SIDE VIEW
All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3mm

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2685	2683	-2
B	Front Axle to FSOV	902	902	0
C	Rear Axle to RSOV	1118	1116	-2
D	Total Length at Centerline	4702	4701	-1
E	Front Bumper Thickness	110	110	0
F	Front Bumper Bottom to Ground	385	380	-5
G	Sill Height at Front Wheel Well	178	195	17
H	Sill Height at Front Door Leading Edge	180	190	10
I	Sill Height at B Pillar	192	198	6
J1	Sill Height at Rear Wheel Well	190	180	-10
J2	Pinch Weld Height at Rear Wheel Well	204	200	-4
K	Sill Height Aft of Rear Wheel Well	212	211	-1
L	Rear Bumper Thickness	172	172	0
M	Rear Bumper Bottom to Ground	422	425	3
N	Sill Height to Window Bottom of Front Window Sill	782	770	-12
O	Front Door Leading Edge to Impact CL	770	769	-1
P	Rear Door Trailing Edge to Impact CL	1306	1260	-46
Q	Front Window Opening	420	422	2
R	Right Side Length	4595	4597	2
S	Left Side Length	4594	4587	-7
T	Maximum Vehicle Width	1793	1682	-111

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2019 Volkswagen Jetta four door sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20195802
Test Date: 2/1/2019



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	256	42	900
2	Driver Hip Point	mm	523	179	900
3	Mid-Door	mm	632	192	1650
4	Window Sill	mm	930	116	1650
5	Window Top	mm	1395	3	1650

*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: 2019 Volkswagen Jetta four door sedan NHTSA No.: M20195802
Test Program: NCAP Side MDB Impact Test Test Date: 2/1/2019

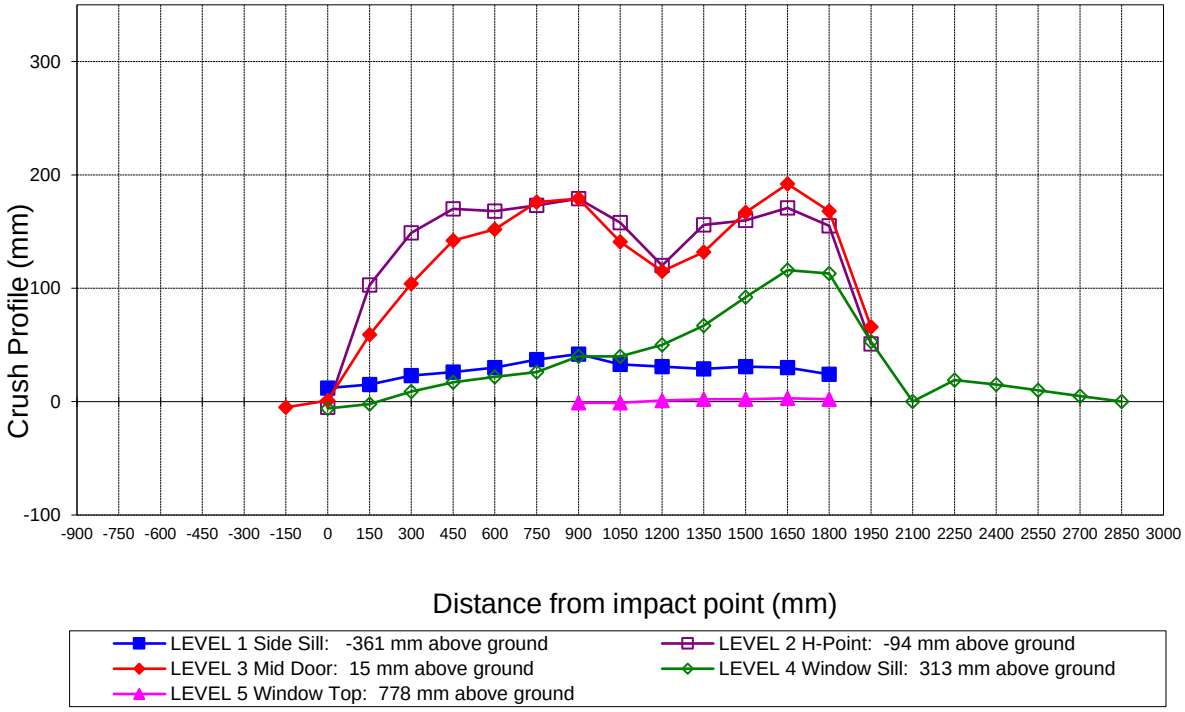
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	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															
-150			888					893					-5		
0	858	889	889	798		846	894	889	804		12	-5	0	-6	
150	858	886	892	811		843	783	833	813		15	103	59	-2	
300	859	886	894	820		836	737	790	811		23	149	104	9	
450	859	887	896	820		833	717	754	803		26	170	142	17	
600	858	888	897	821		828	720	745	799		30	168	152	22	
750	857	888	898	824		820	715	722	798		37	173	176	26	
900	855	887	897	830	591	813	708	718	790	592	42	179	179	40	-1
1050	852	885	896	835	601	819	727	755	795	602	33	158	141	40	-1
1200	849	884	895	842	605	818	764	780	792	604	31	120	115	50	1
1350	845	881	893	848	604	816	725	761	781	602	29	156	132	67	2
1500	843	878	890	856	602	812	718	723	764	600	31	160	167	92	2
1650	839	873	886	859	599	809	702	694	743	596	30	171	192	116	3
1800	838	875	883	863	586	814	720	715	750	584	24	155	168	113	2
1950		879	884	874			828	818	821			51	66	53	
2100				849					849					0	
2250				840					821					19	
2400				829					814					15	
2550				818					808					10	
2700				805					800					5	
2850				787					787					0	
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

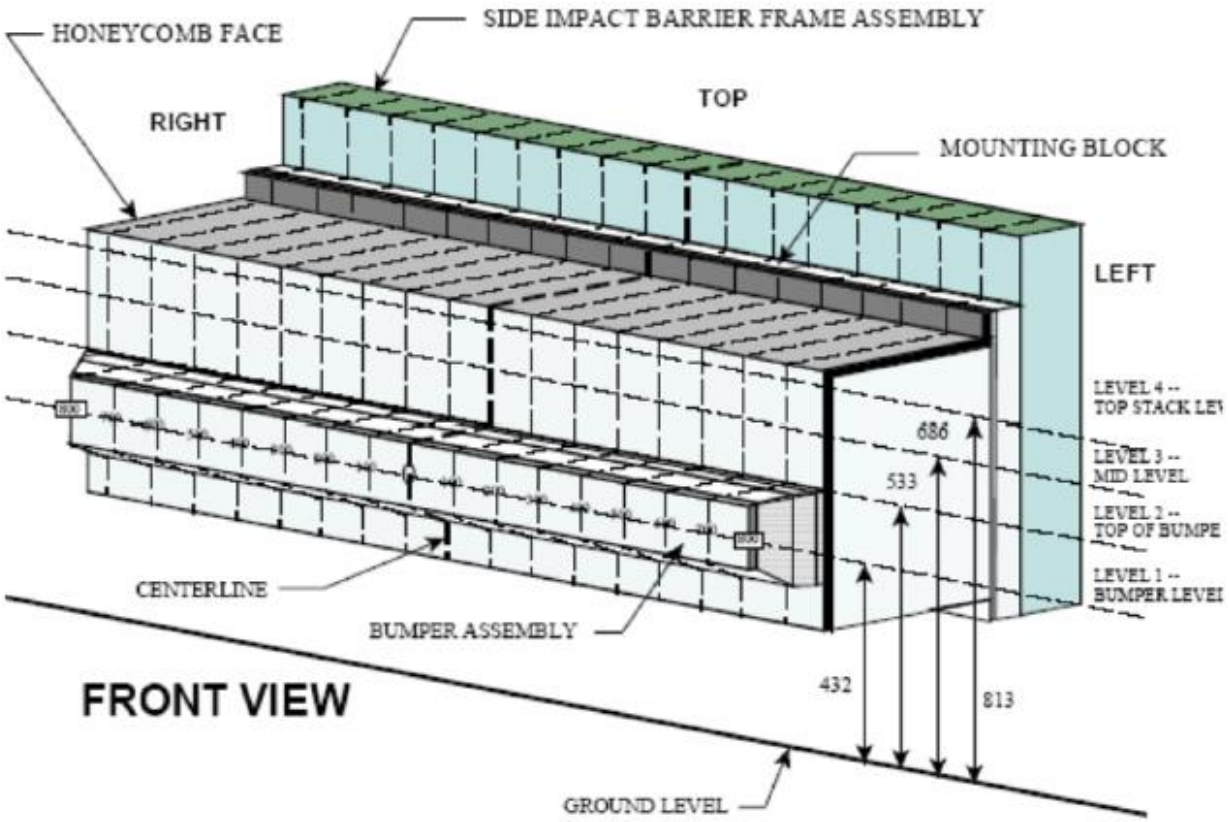
Test Vehicle:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019



Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019



NOTE: Dimensions are shown in millimeters, mm

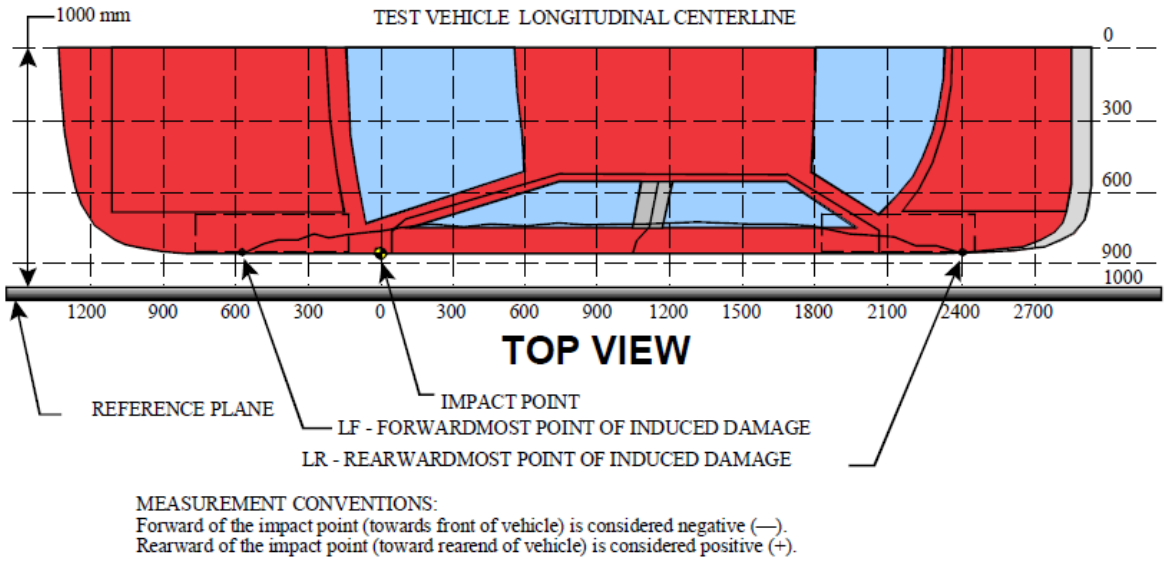
DEFORMABLE BARRIER STATIC CRUSH

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	157	153	150	151	153	161	159	153	142	137	138	138	139	140	151	178	217
2	115	118	122	122	120	114	103	103	102	102	111	112	110	111	114	128	155
3	41	31	36	49	73	101	114	94	66	44	34	34	41	55	77	109	167
4	35	22	31	44	57	91	108	100	71	83	81	71	82	94	108	124	145

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019

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	107	112	-5
2	270	3	201	106	95
3	690	3	269	102	167
4	1110	3	235	104	131
5	1530	3	283	111	172
6	1950	3	182	116	66

MDB DAMAGE PROFILE DISTANCES

DPD	Distance From Center of MDB	Level	Post-Test (mm)*
1	800 mm left of center	1	217
2	480 mm left of center	1	140
3	160 mm left of center	1	138
4	160 mm right of center	1	157
5	480 mm right of center	1	151
6	800 mm right of center	1	157

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

Test Vehicle:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019
Test Time:	10:23 AM	Temperature:	21˚C

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

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

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

D. Spillage Details: No Spillage Occurred

FMVSS NO. 301 STATIC ROLLOVER DATA

ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	74	300	374
90° to 180°	63	300	363
180° to 270°	62	300	362
270° to 360°	66	300	366

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

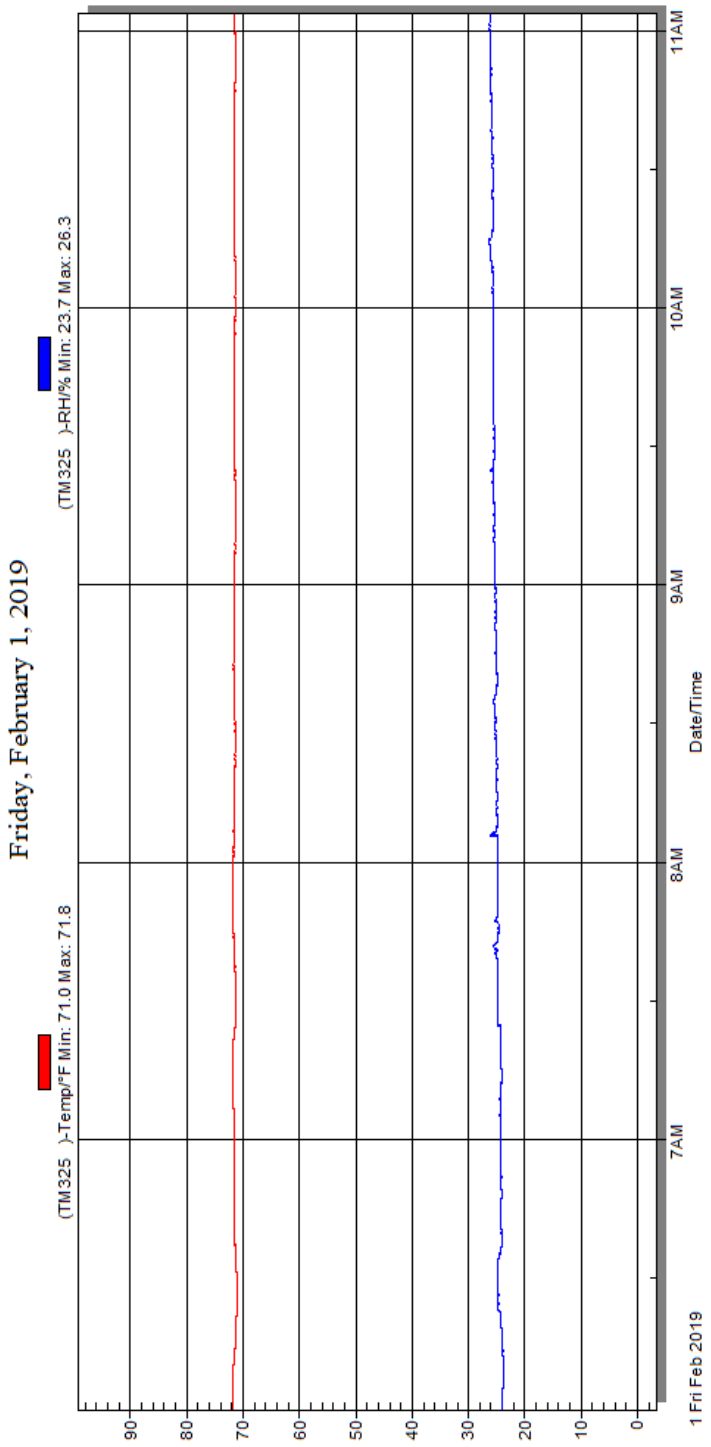
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

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:	2019 Volkswagen Jetta four door sedan	NHTSA No.:	M20195802
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/1/2019



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

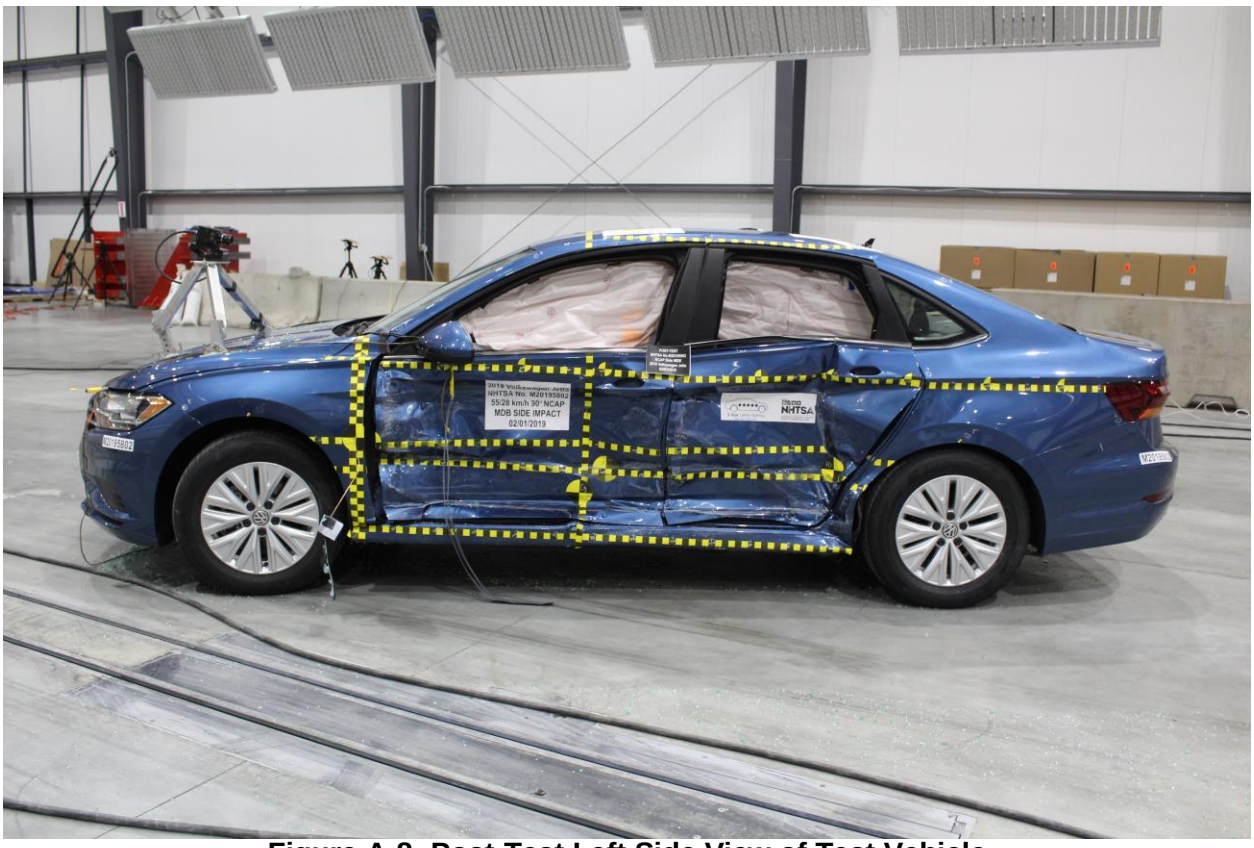


Figure A-8: Post-Test Left Side View of Test Vehicle

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 Side 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

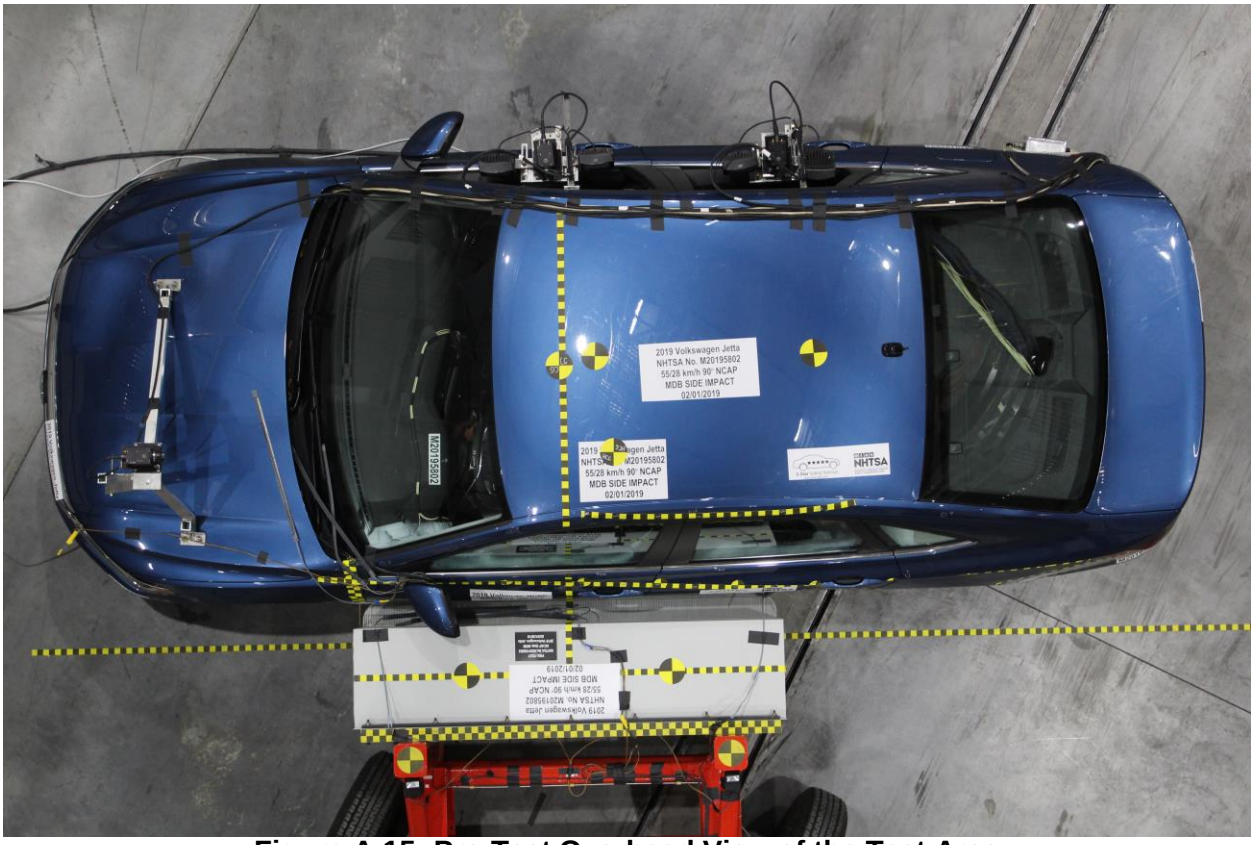


Figure A-15: Pre-Test Overhead View of the Test Area

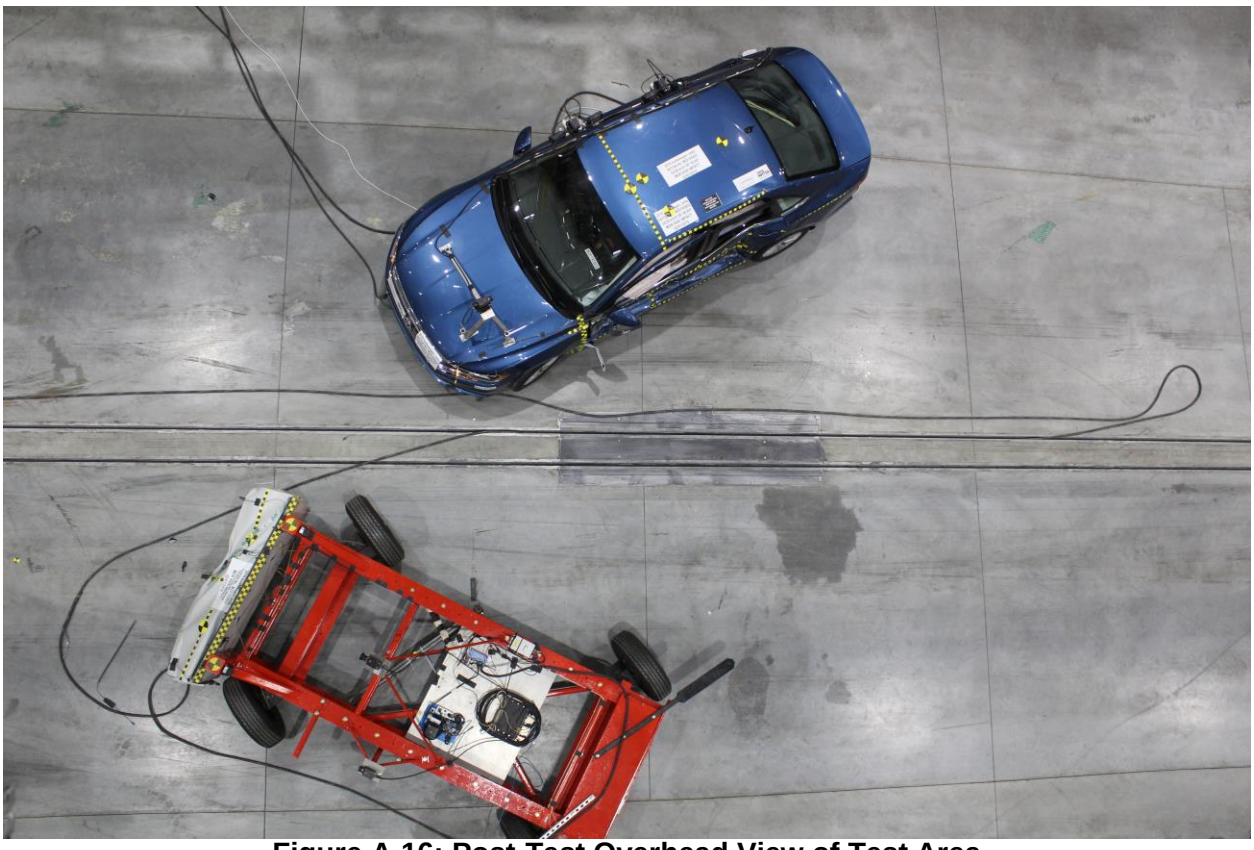


Figure A-16: Post-Test Overhead View of Test Area

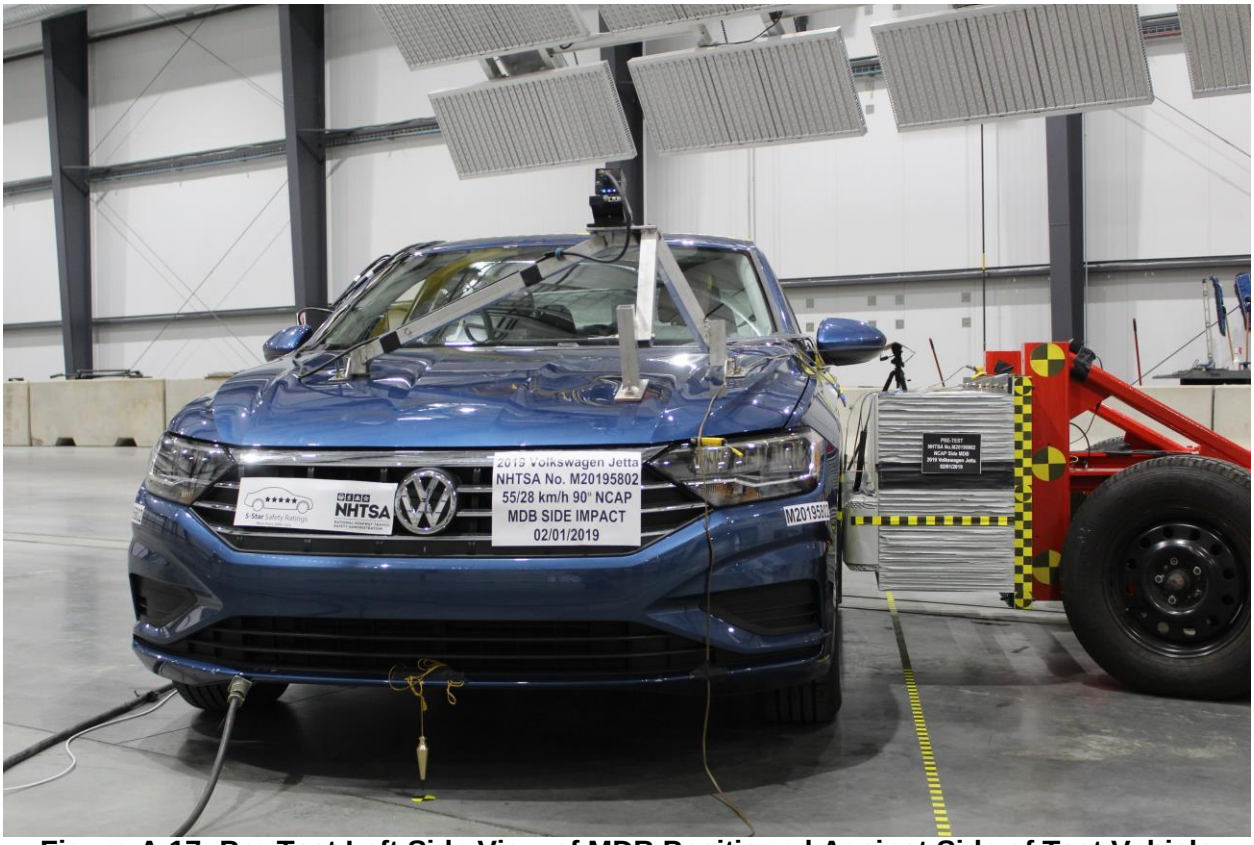


Figure A-17: Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle

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

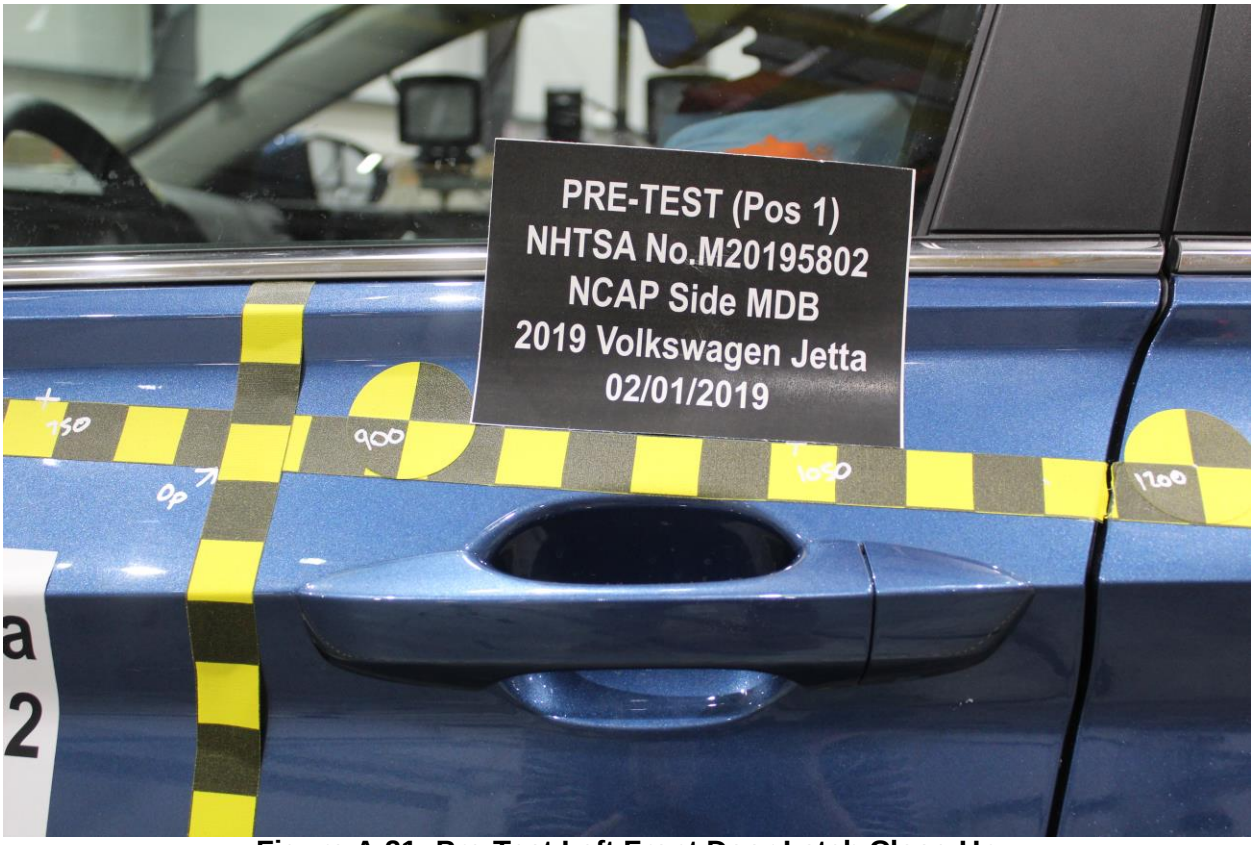


Figure A-21: Pre-Test Left Front Door Latch Close-Up

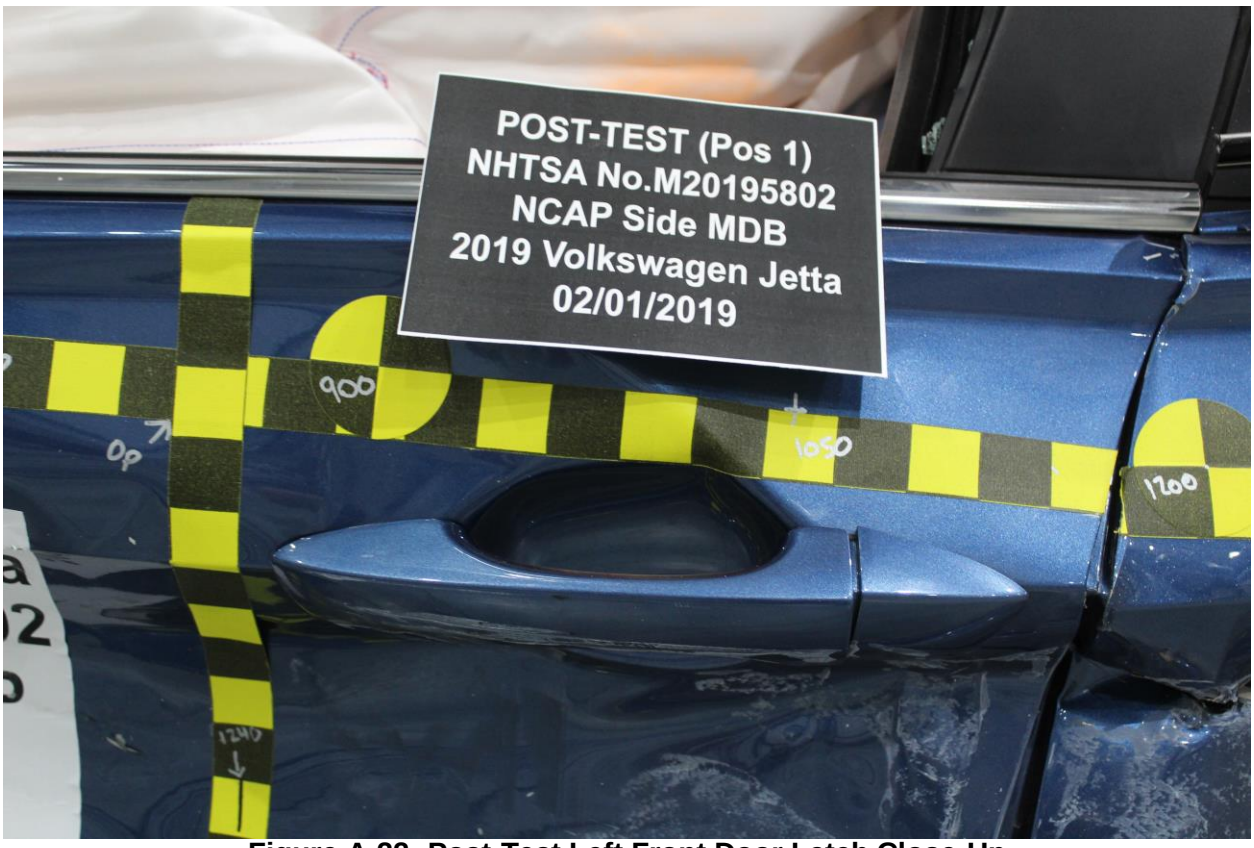


Figure A-22: Post-Test Left Front Door Latch Close-Up

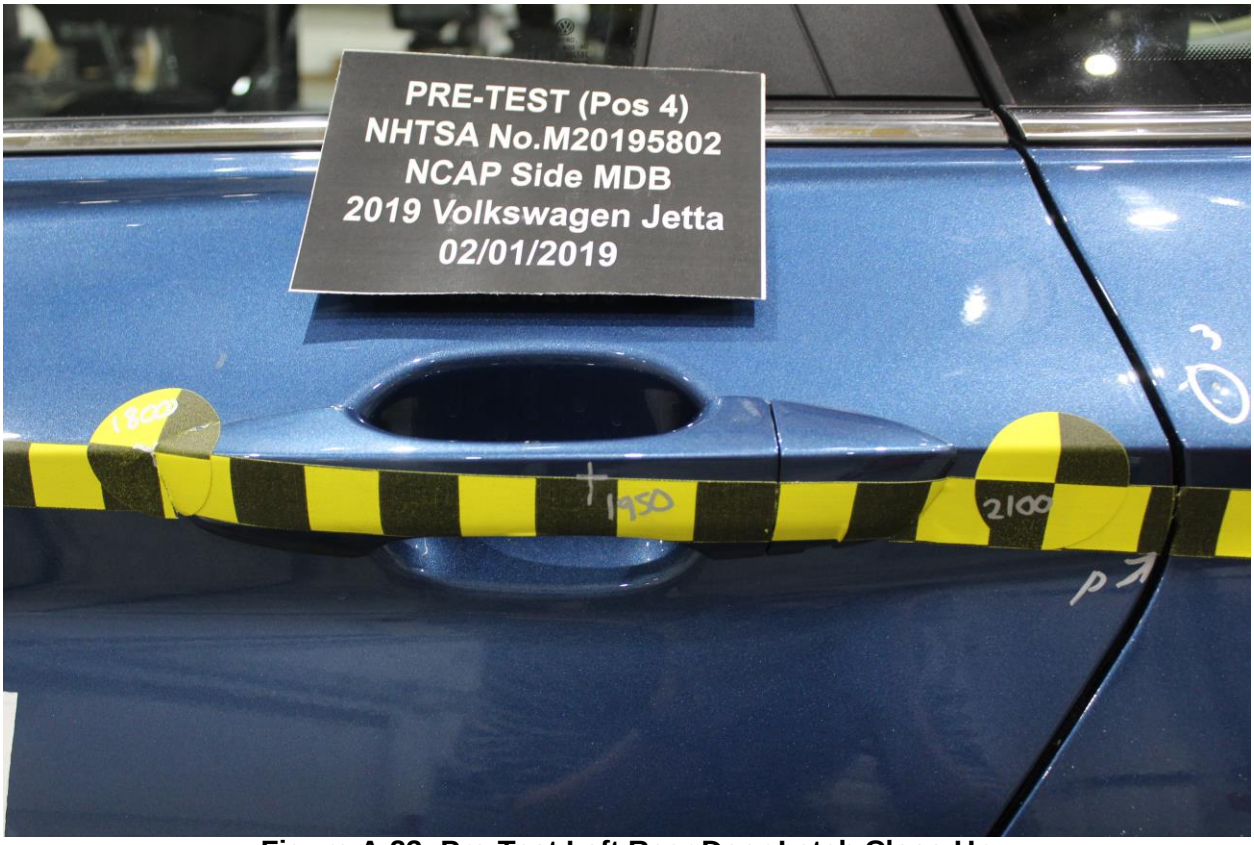


Figure A-23: Pre-Test Left Rear Door Latch Close-Up

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

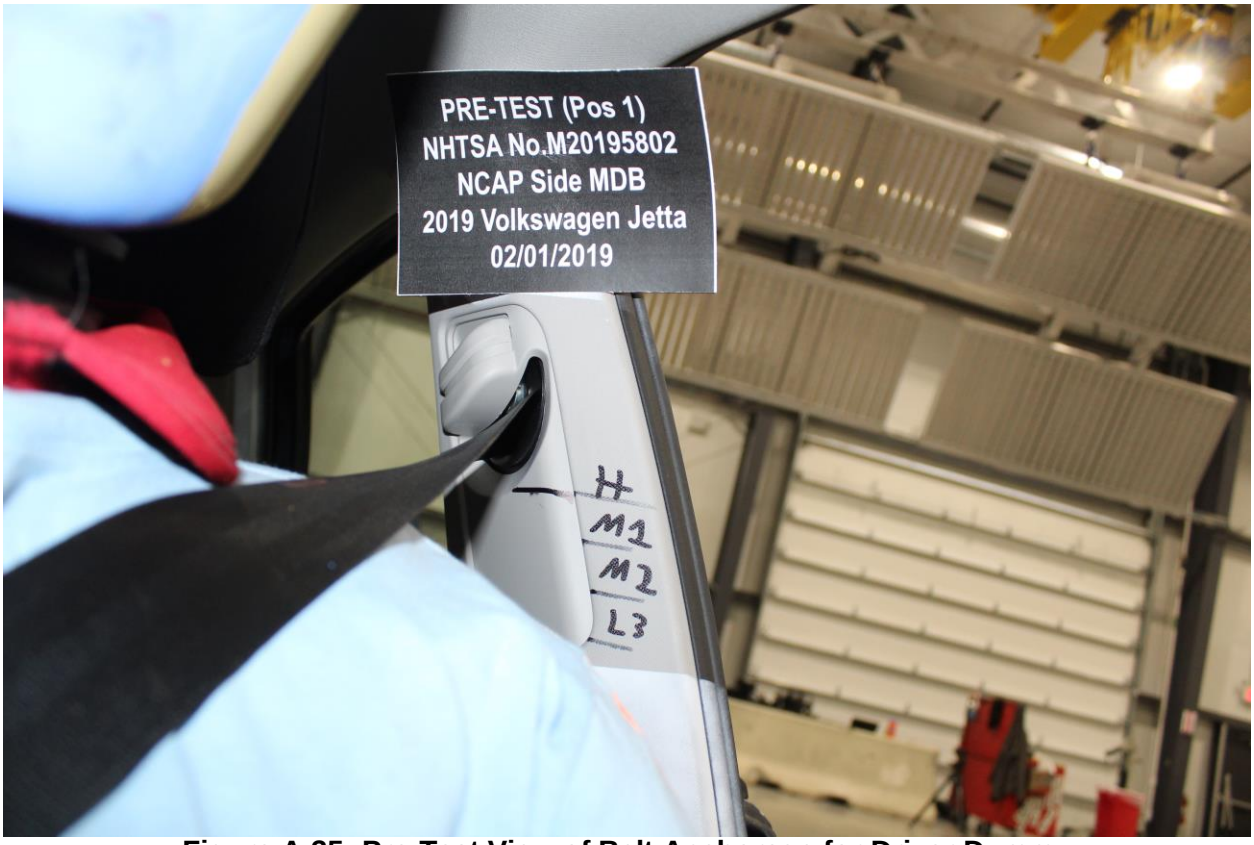


Figure A-35: Pre-Test View of Belt Anchorage for Driver Dummy

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

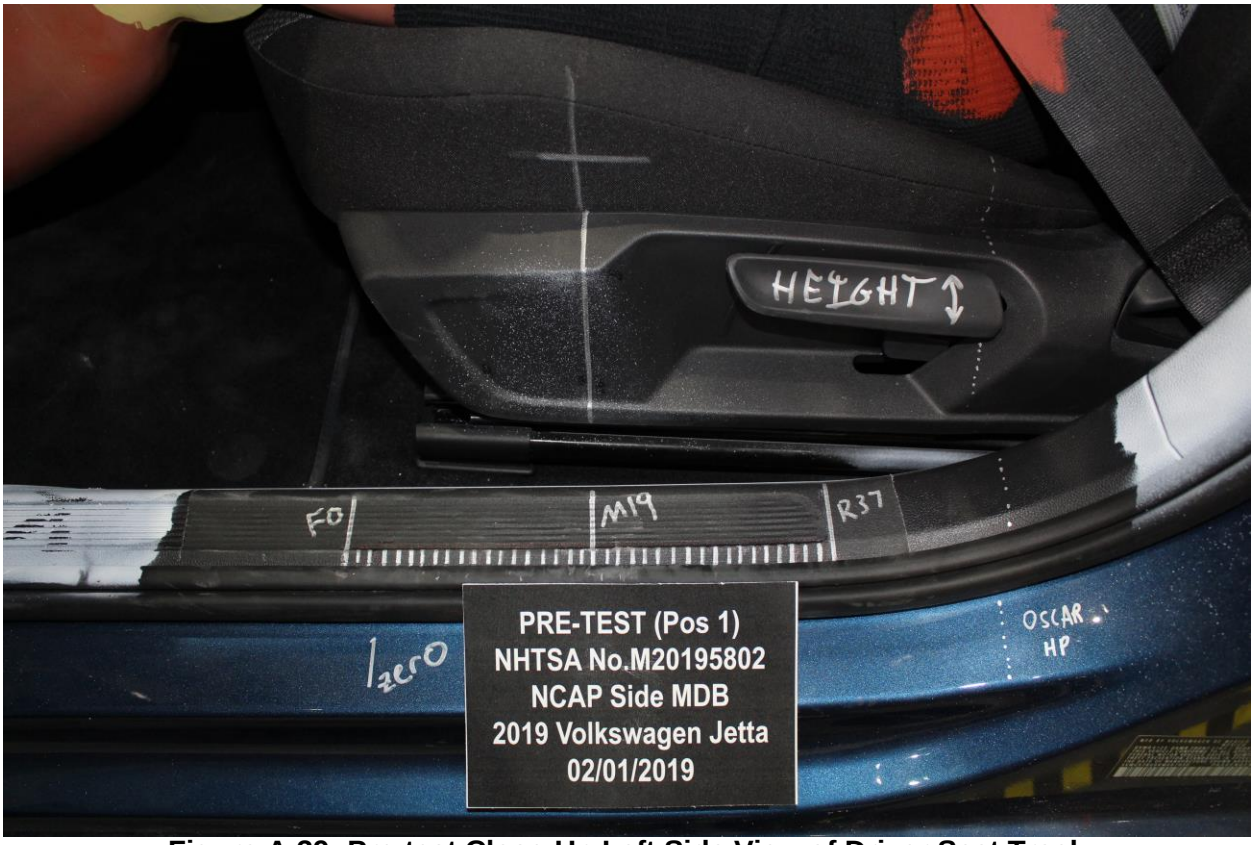


Figure A-39: Pre-test Close-Up Left Side View of Driver Seat Track

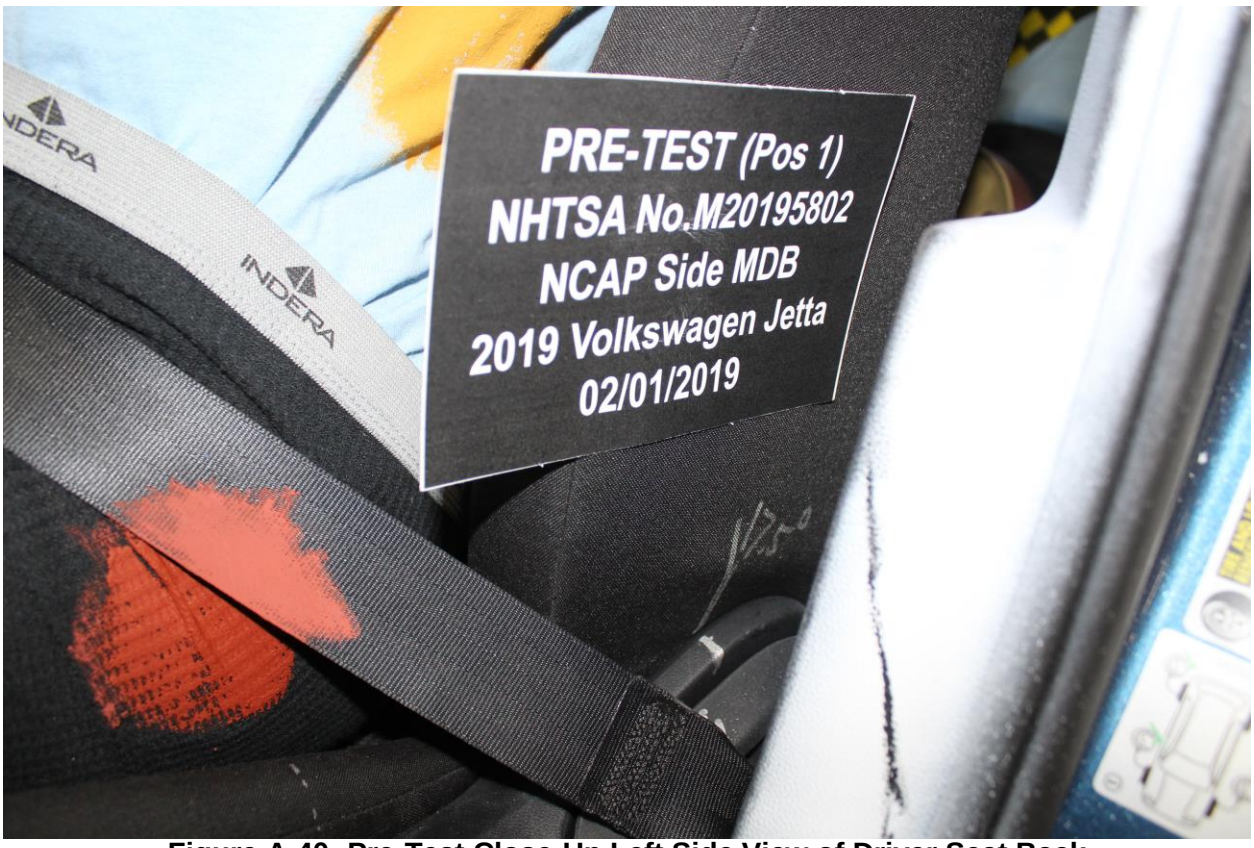


Figure A-40: Pre-Test Close-Up Left Side View of Driver Seat Back

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

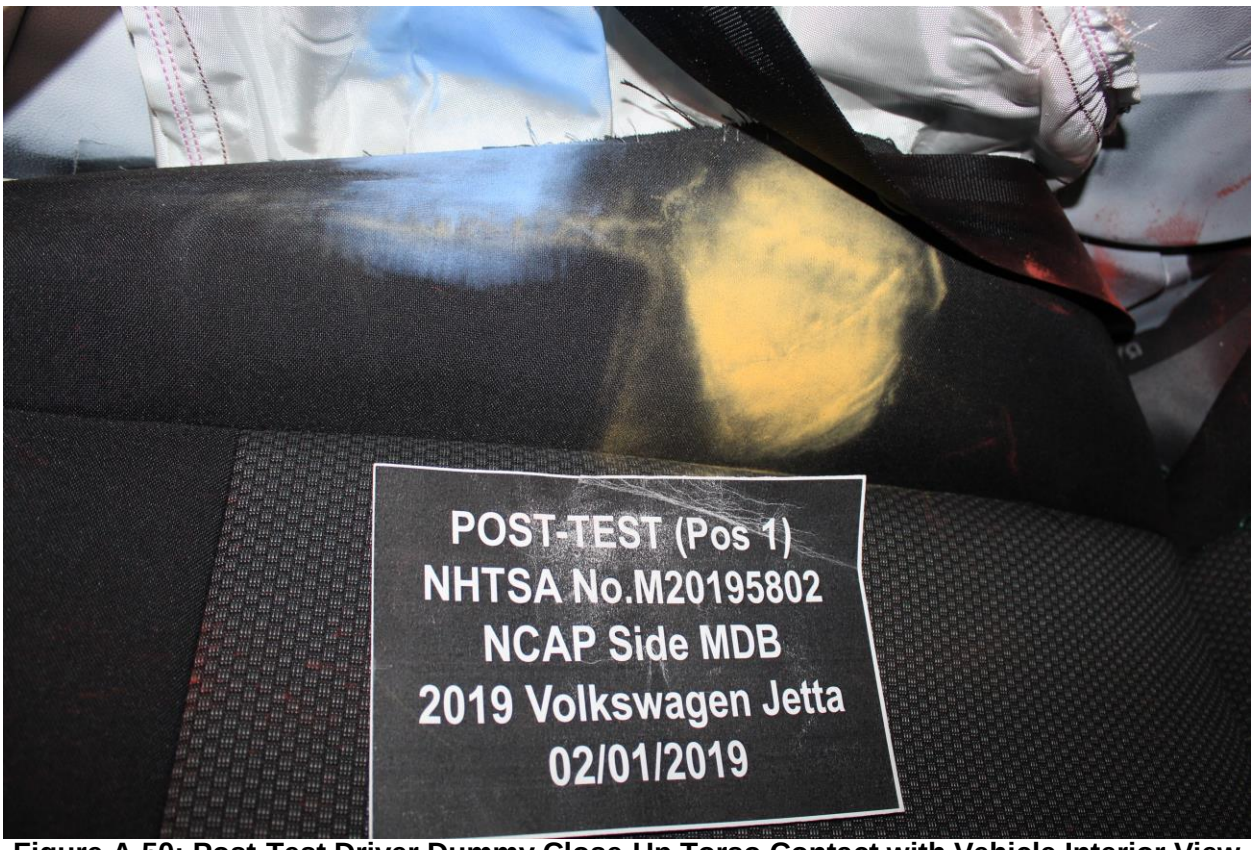


Figure A-50: Post-Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View

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

Photo Not Applicable

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

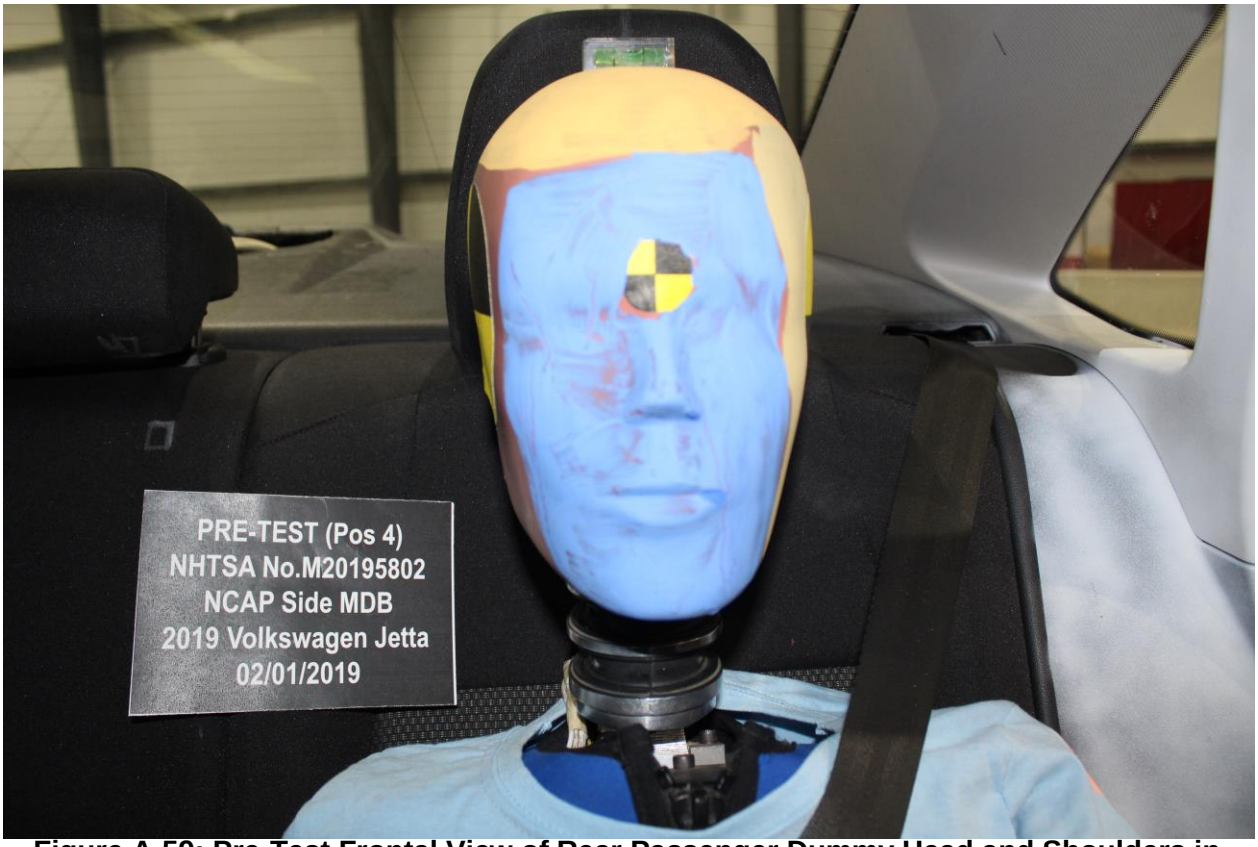


Figure A-59: Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint

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

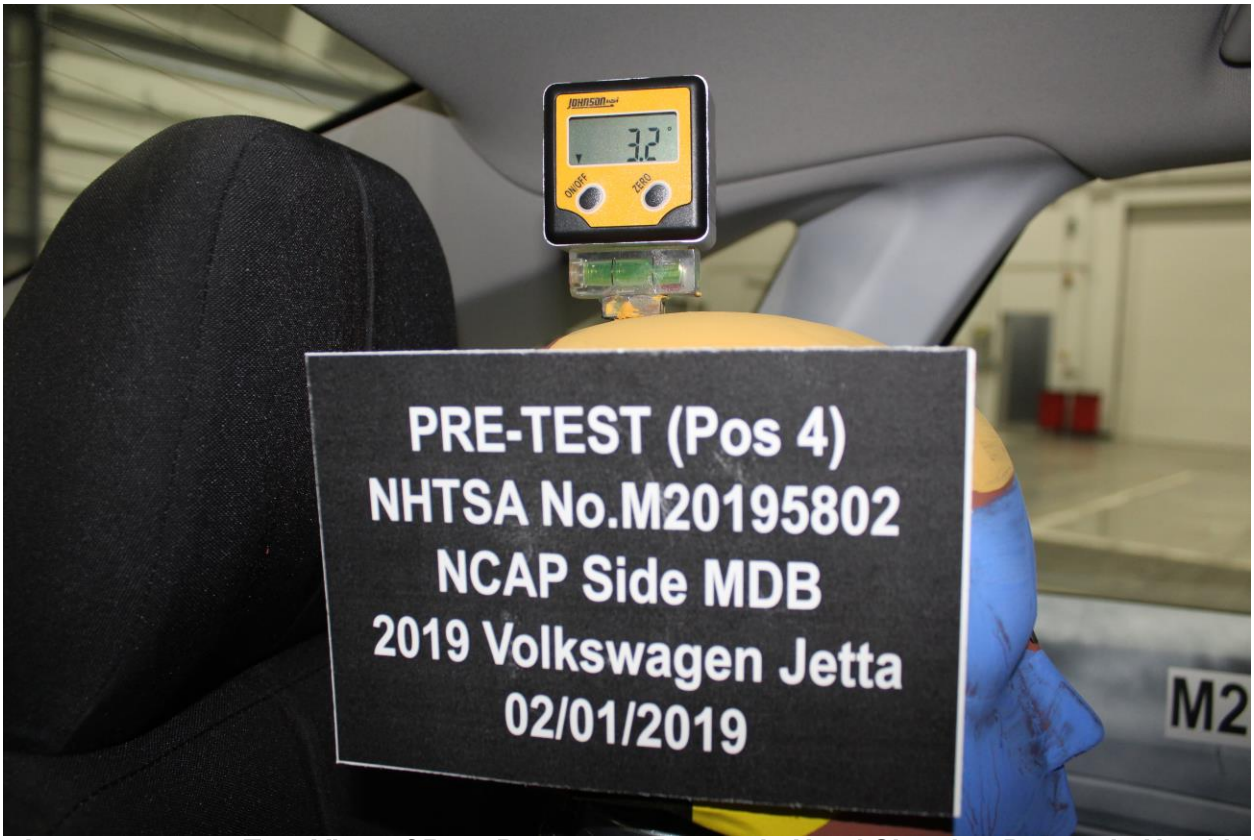


Figure A-63: Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level

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

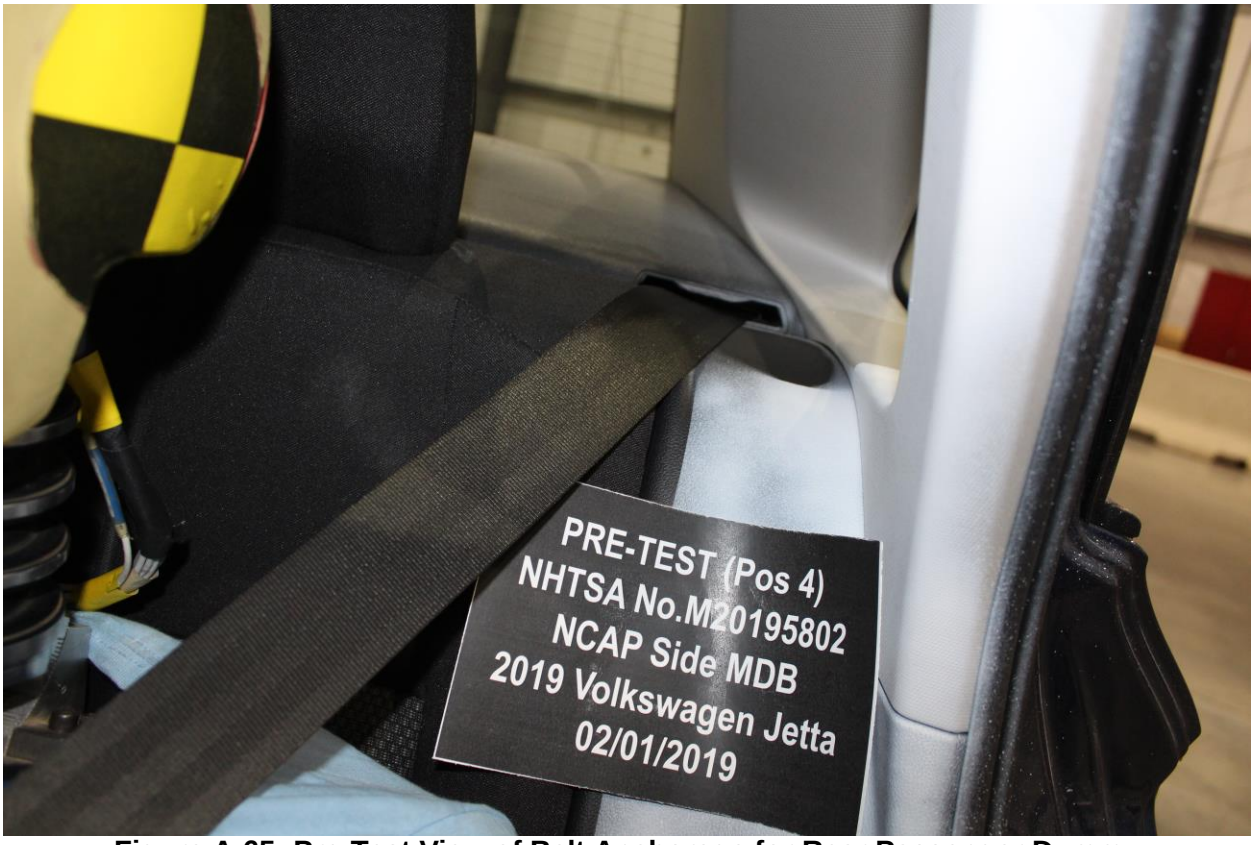


Figure A-65: Pre-Test View of Belt Anchorage for Rear Passenger Dummy

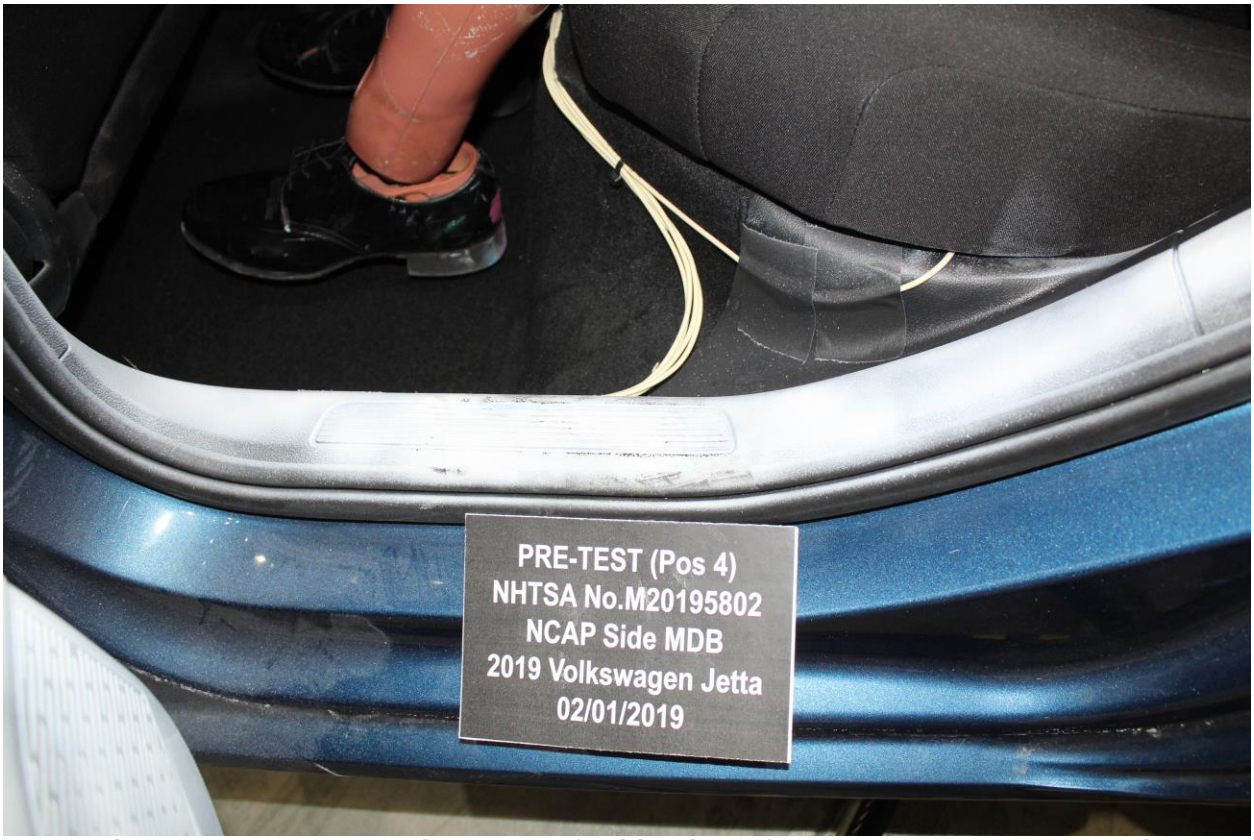


Figure A-66: Pre-Test Close-Up Left Side View of Rear Passenger Seat Track

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

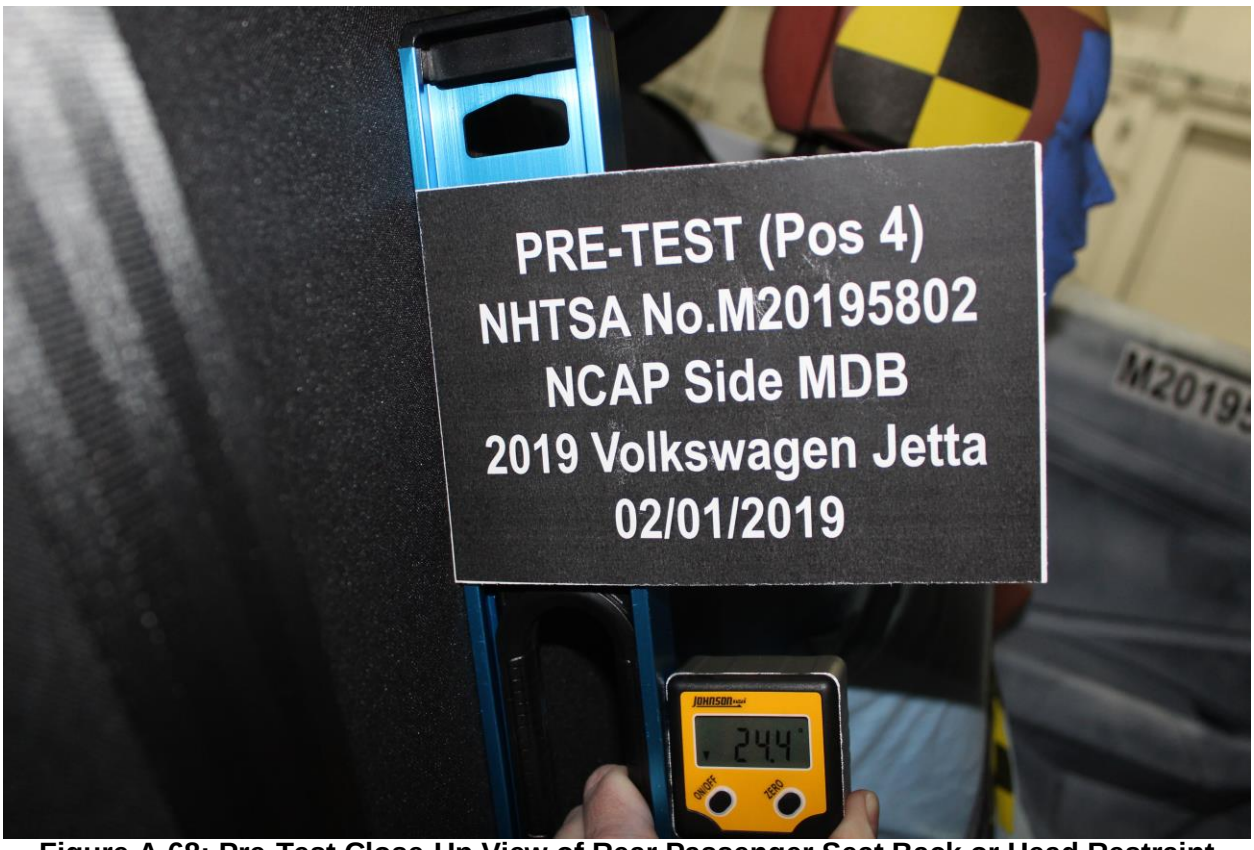


Figure A-68: Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint

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

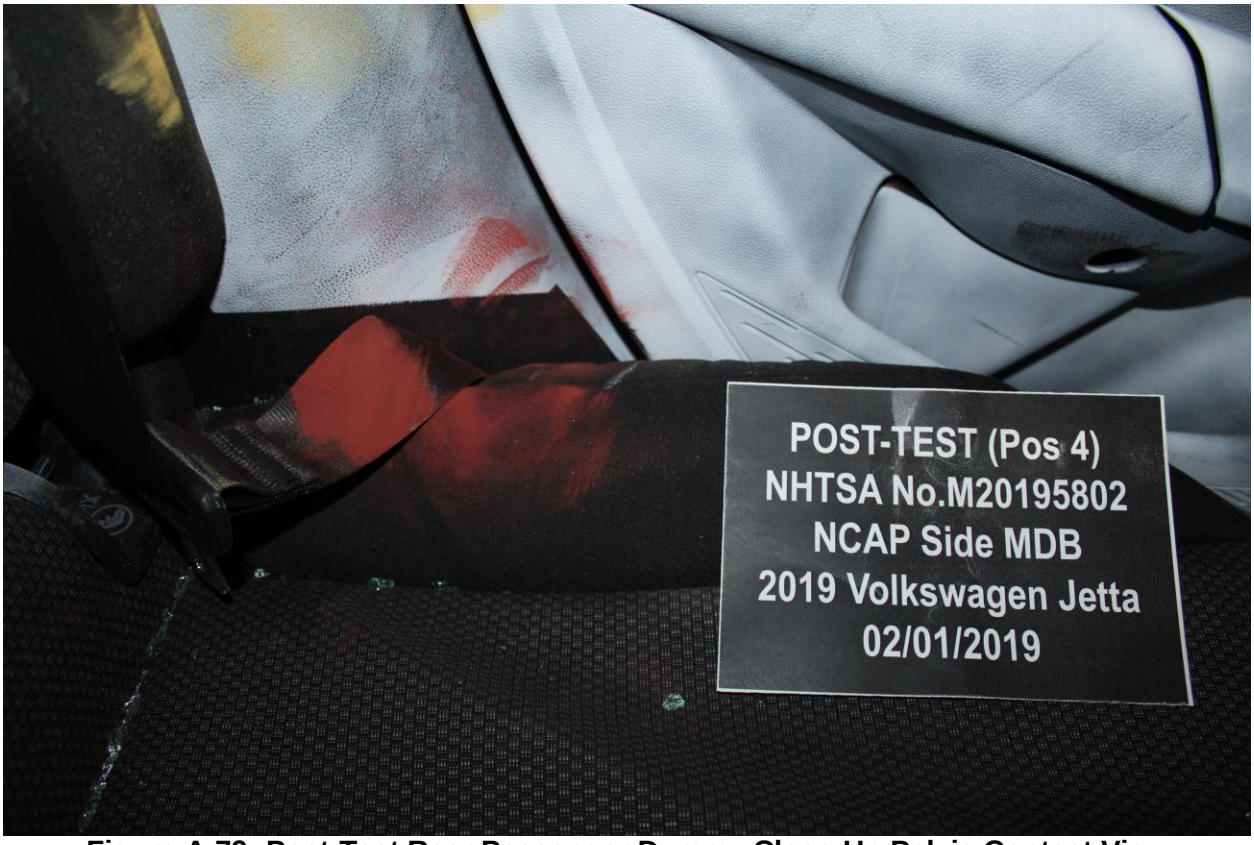


Figure A-79: Post-Test Rear Passenger Dummy Close-Up Pelvis Contact View

Photo Not Applicable

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

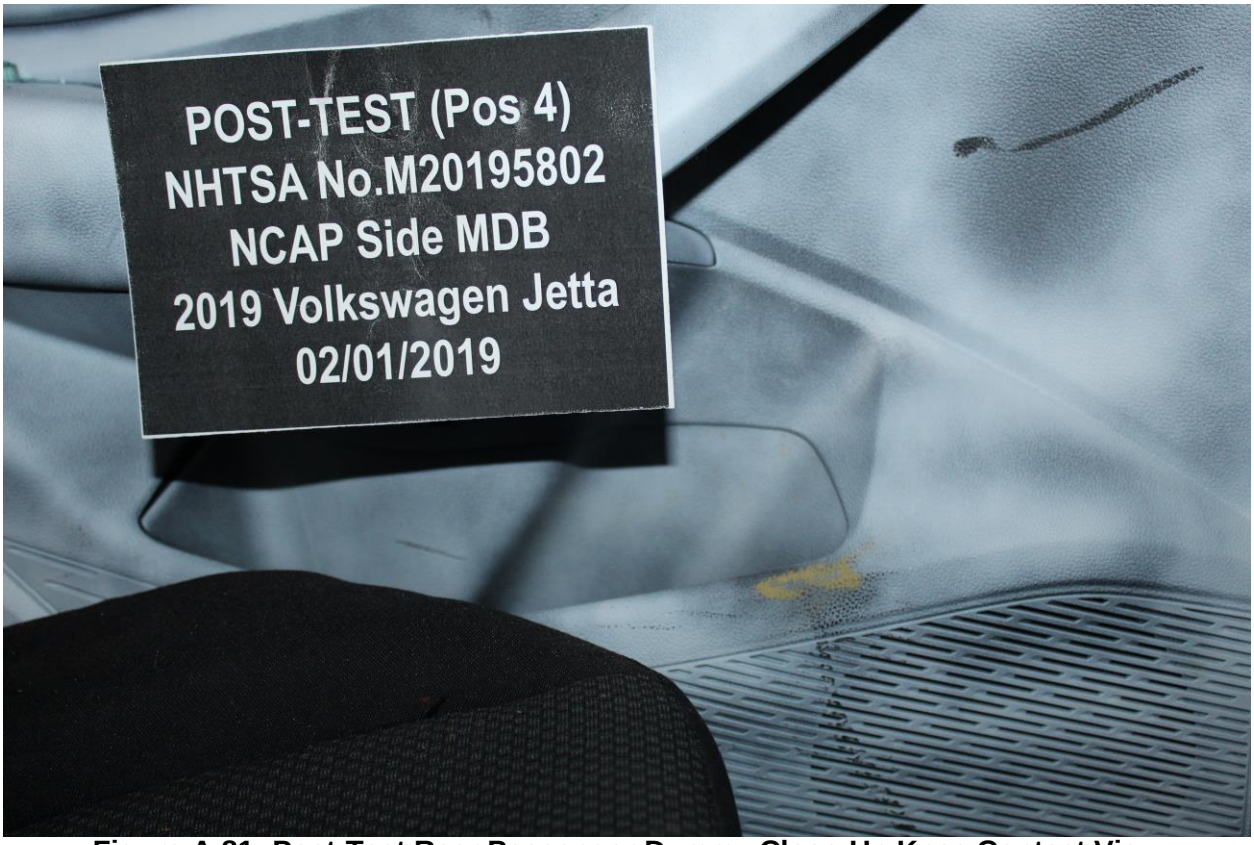


Figure A-81: Post-Test Rear Passenger Dummy Close-Up Knee Contact View

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

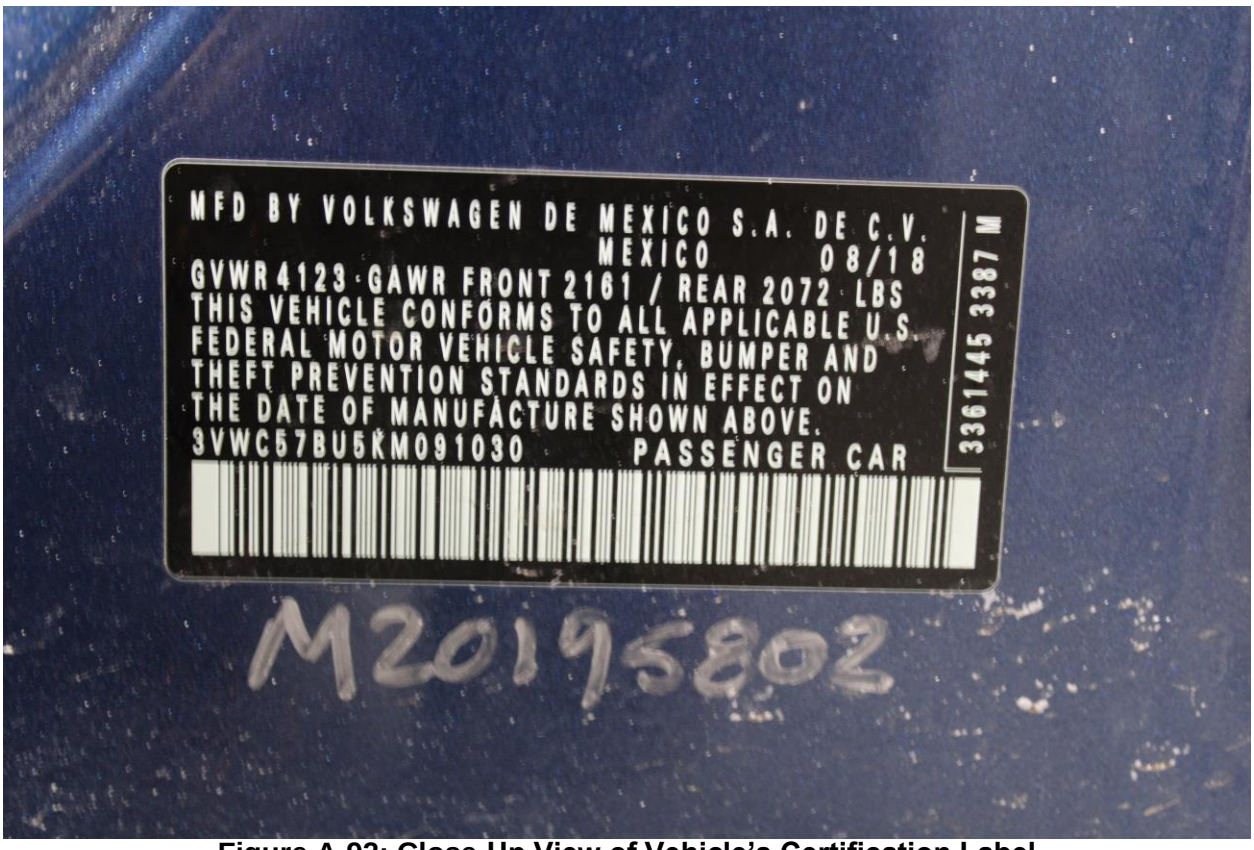


Figure A-92: Close-Up View of Vehicle's Certification Label

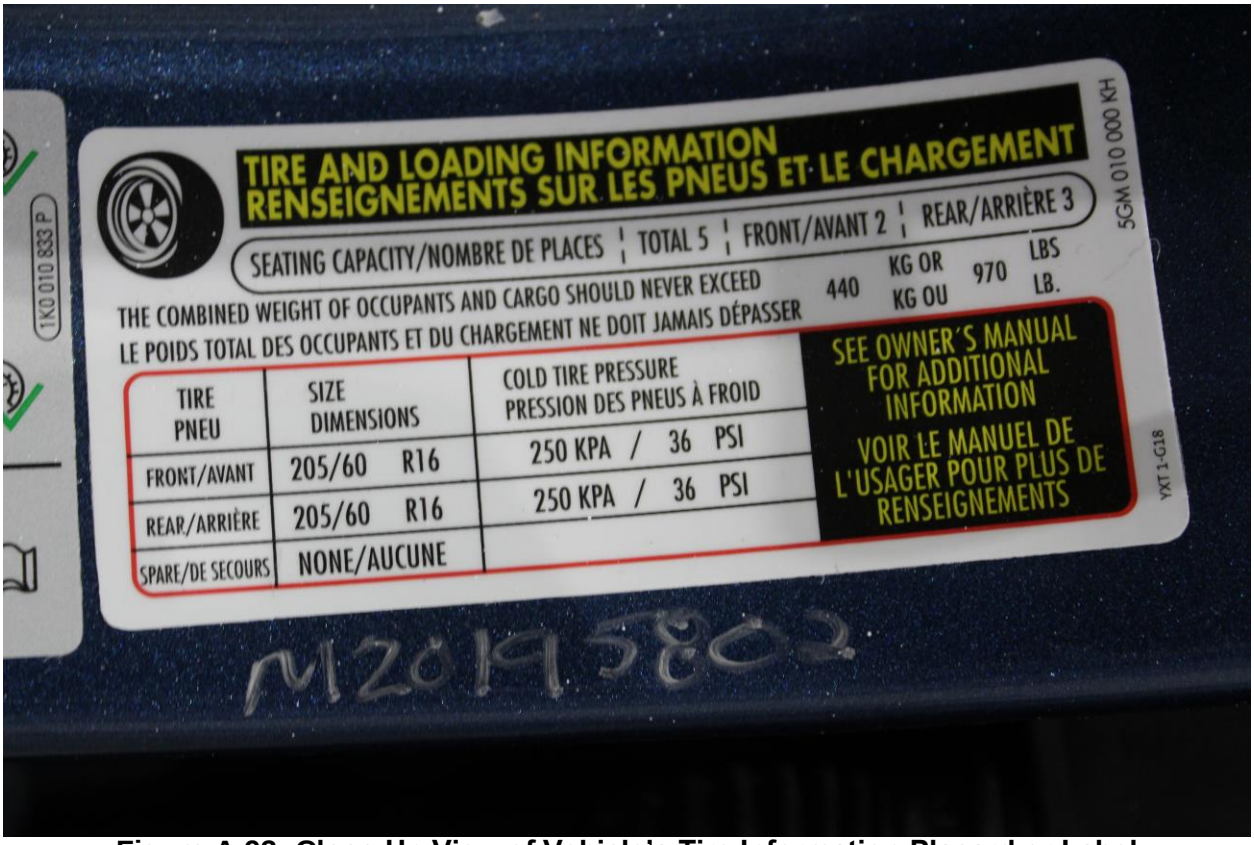


Figure A-93: Close-Up View of Vehicle's Tire Information Placard or Label

Figure A-94: Pre-Test Ballast View

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

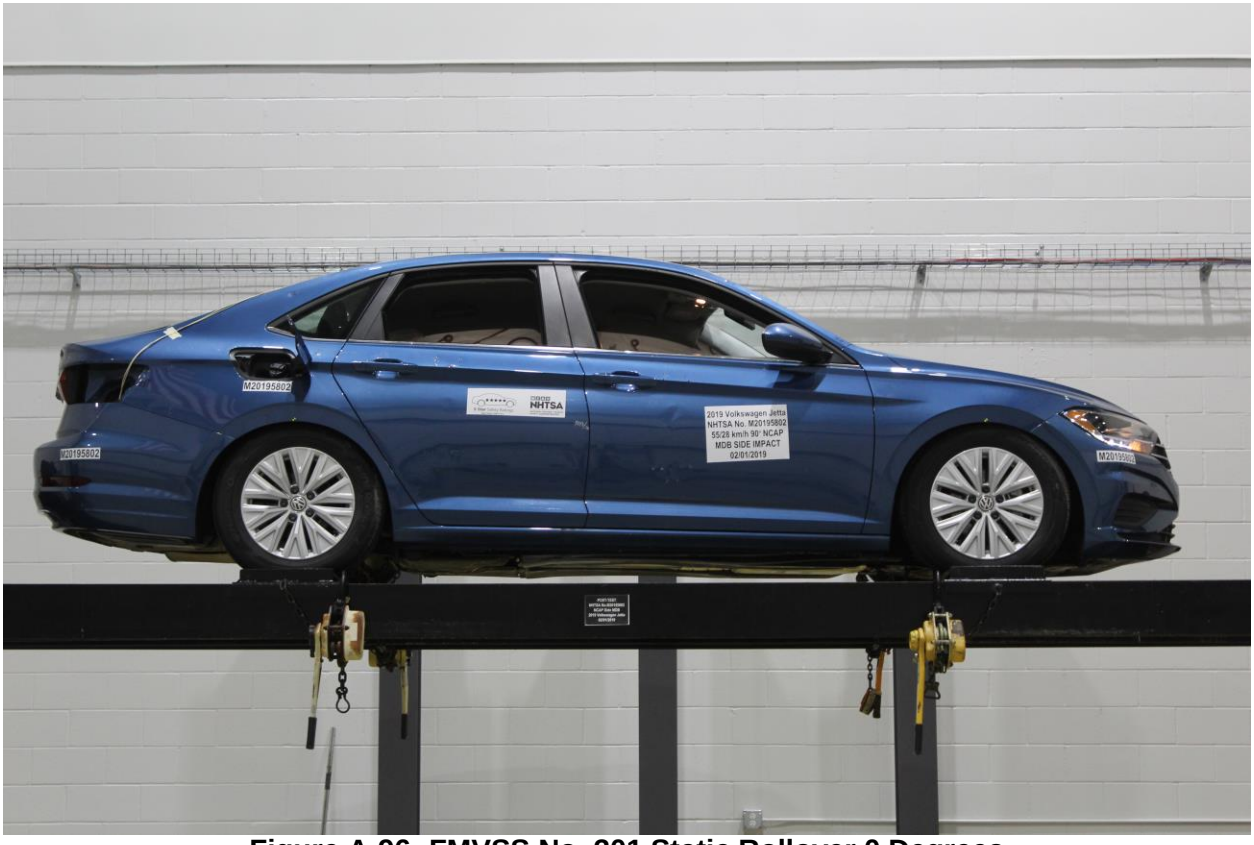


Figure A-96: FMVSS No. 301 Static Rollover 0 Degrees

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

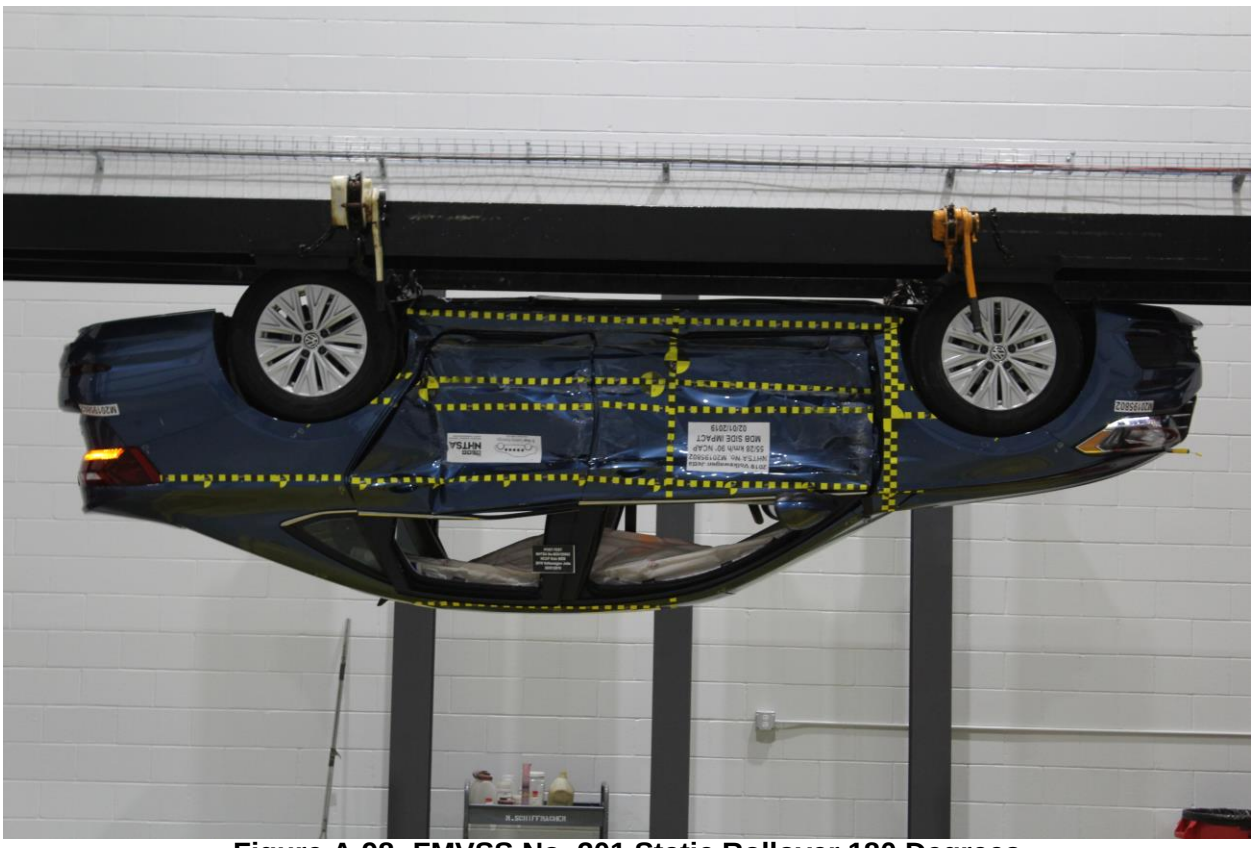


Figure A-98: FMVSS No. 301 Static Rollover 180 Degrees

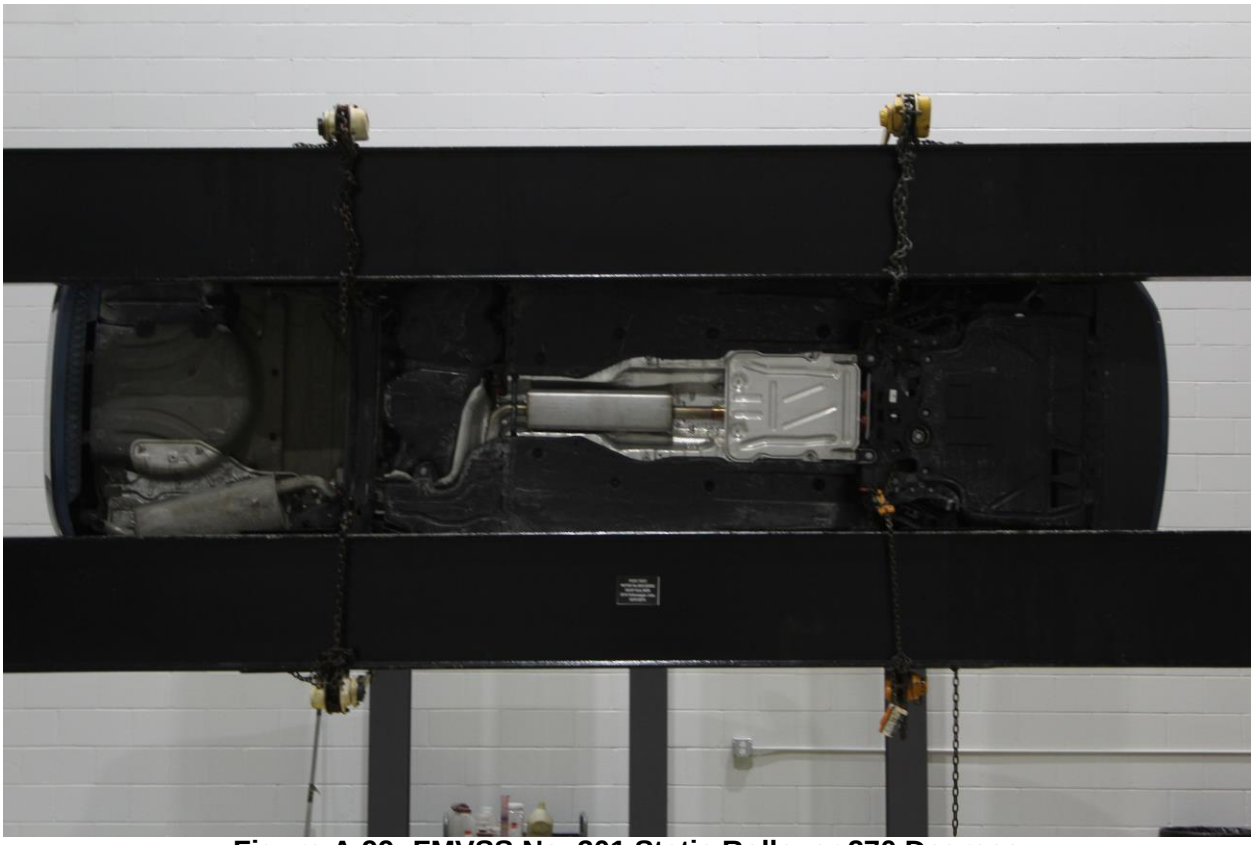


Figure A-99: FMVSS No. 301 Static Rollover 270 Degrees

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

Figure A-101: Impact Event

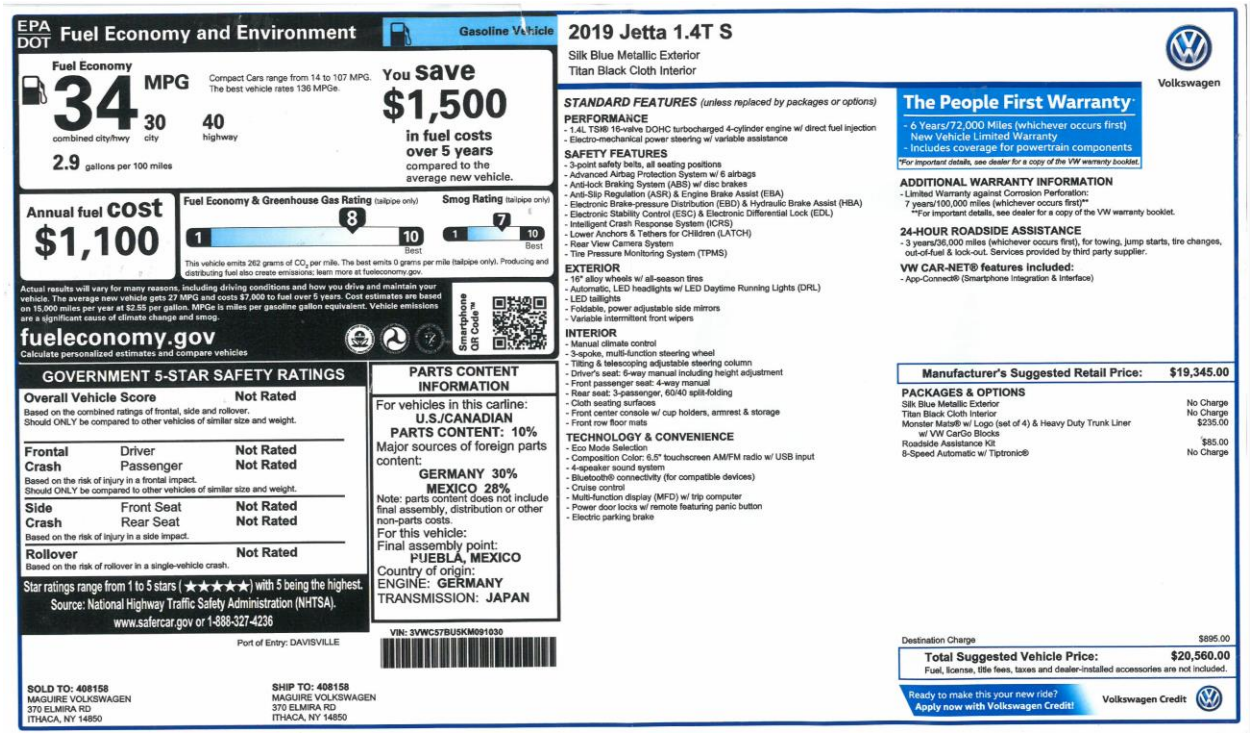
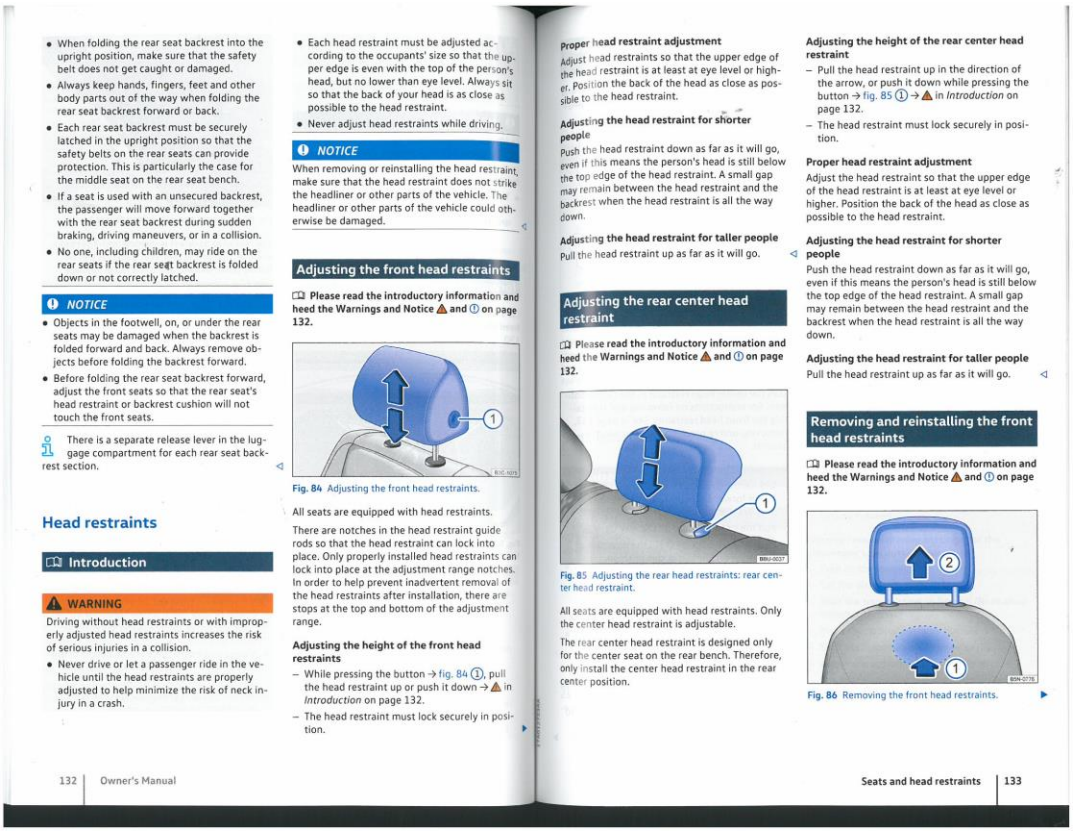


Figure A-102: Monroney Label



- When folding the rear seat backrest into the upright position, make sure that the safety belt does not get caught or damaged.
- Always keep hands, fingers, feet and other body parts out of the way when folding the rear seat backrest forward or back.
- Each rear seat backrest must be securely latched in the upright position so that the safety belts on the rear seats can provide protection. This is particularly the case for the middle seat on the rear seat bench.
- If a seat is used with an unsecured backrest, the passenger will move forward together with the rear seat backrest during sudden braking, driving maneuvers, or in a collision.
- No one, including children, may ride on the rear seats if the rear seat backrest is folded down or not correctly latched.

NOTICE

- Objects in the footwell, on, or under the rear seats may be damaged when the backrest is folded forward and back. Always remove objects before folding the backrest forward.
- Before folding the rear seat backrest forward, adjust the front seats so that the rear seat's head restraint or backrest cushion will not touch the front seats.

There is a separate release lever in the luggage compartment for each rear seat backrest section.

Head restraints

Introduction

WARNING

Driving without head restraints or with improperly adjusted head restraints increases the risk of serious injuries in a collision.

- Never drive or let a passenger ride in the vehicle until the head restraints are properly adjusted to help minimize the risk of neck injury in a crash.

- Each head restraint must be adjusted according to the occupants' size so that the upper edge is even with the top of the person's head, but no lower than eye level. Always sit so that the back of your head is as close as possible to the head restraint.
- Never adjust head restraints while driving.

NOTICE

When removing or reinstalling the head restraint, make sure that the head restraint does not strike the headliner or other parts of the vehicle. The headliner or other parts of the vehicle could otherwise be damaged.

Adjusting the front head restraints

Please read the introductory information and heed the Warnings and Notice ⚠ and ⓘ on page 132.

Fig. 84 Adjusting the front head restraints.

All seats are equipped with head restraints.

There are notches in the head restraint guide rods so that the head restraint can lock into place. Only properly installed head restraints can lock into place at the adjustment range notches. In order to help prevent inadvertent removal of the head restraints after installation, there are stops at the top and bottom of the adjustment range.

Adjusting the height of the front head restraints

– While pressing the button → fig. 84 ①, pull the head restraint up or push it down → ⚠ in *Introduction* on page 132.
– The head restraint must lock securely in position.

Proper head restraint adjustment

Adjust head restraints so that the upper edge of the head restraint is at least at eye level or higher. Position the back of the head as close as possible to the head restraint.

Adjusting the head restraint for shorter people

Push the head restraint down as far as it will go, even if this means the person's head is still below the top edge of the head restraint. A small gap may remain between the head restraint and the backrest when the head restraint is all the way down.

Adjusting the head restraint for taller people

Pull the head restraint up as far as it will go.

Adjusting the rear center head restraint

Please read the introductory information and heed the Warnings and Notice ⚠ and ⓘ on page 132.

Fig. 85 Adjusting the rear head restraints: rear center head restraint.

All seats are equipped with head restraints. Only the center head restraint is adjustable.

The rear center head restraint is designed only for the center seat on the rear bench. Therefore, only install the center head restraint in the rear center position.

Adjusting the height of the rear center head restraint

– Pull the head restraint up in the direction of the arrow, or push it down while pressing the button → fig. 85 ① → ⚠ in *Introduction* on page 132.
– The head restraint must lock securely in position.

Proper head restraint adjustment

Adjust the head restraint so that the upper edge of the head restraint is at least at eye level or higher. Position the back of the head as close as possible to the head restraint.

Adjusting the head restraint for shorter people

Push the head restraint down as far as it will go, even if this means the person's head is still below the top edge of the head restraint. A small gap may remain between the head restraint and the backrest when the head restraint is all the way down.

Adjusting the head restraint for taller people

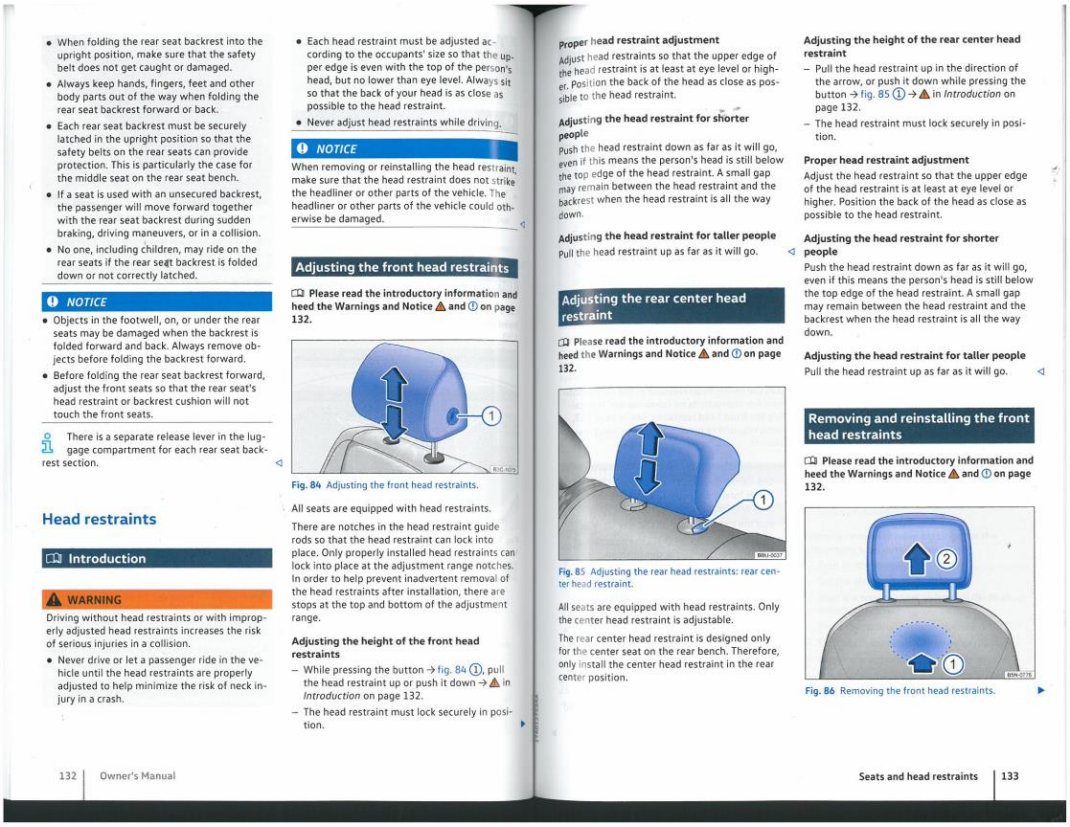
Pull the head restraint up as far as it will go.

Removing and reinstalling the front head restraints

Please read the introductory information and heed the Warnings and Notice ⚠ and ⓘ on page 132.

Fig. 86 Removing the front head restraints.

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



- When folding the rear seat backrest into the upright position, make sure that the safety belt does not get caught or damaged.
- Always keep hands, fingers, feet and other body parts out of the way when folding the rear seat backrest forward or back.
- Each rear seat backrest must be securely latched in the upright position so that the safety belts on the rear seats can provide protection. This is particularly the case for the middle seat on the rear seat bench.
- If a seat is used with an unsecured backrest, the passenger will move forward together with the rear seat backrest during sudden braking, driving maneuvers, or in a collision.
- No one, including children, may ride on the rear seats if the rear seat backrest is folded down or not correctly latched.

NOTICE

- Objects in the footwell, on, or under the rear seats may be damaged when the backrest is folded forward and back. Always remove objects before folding the backrest forward.
- Before folding the rear seat backrest forward, adjust the front seats so that the rear seat's head restraint or backrest cushion will not touch the front seats.

There is a separate release lever in the luggage compartment for each rear seat backrest section.

Head restraints

Introduction

WARNING

Driving without head restraints or with improperly adjusted head restraints increases the risk of serious injuries in a collision.

- Never drive or let a passenger ride in the vehicle until the head restraints are properly adjusted to help minimize the risk of neck injury in a crash.

- Each head restraint must be adjusted according to the occupants' size so that the upper edge is even with the top of the person's head, but no lower than eye level. Always sit so that the back of your head is as close as possible to the head restraint.
- Never adjust head restraints while driving.

NOTICE

When removing or reinstalling the head restraint, make sure that the head restraint does not strike the headliner or other parts of the vehicle. The headliner or other parts of the vehicle could otherwise be damaged.

Adjusting the front head restraints

Please read the introductory information and heed the Warnings and Notice ⚠ and ⓘ on page 132.

Fig. 84 Adjusting the front head restraints.

All seats are equipped with head restraints.

There are notches in the head restraint guide rods so that the head restraint can lock into place. Only properly installed head restraints can lock into place at the adjustment range notches. In order to help prevent inadvertent removal of the head restraints after installation, there are stops at the top and bottom of the adjustment range.

Adjusting the height of the front head restraints

– While pressing the button → fig. 84 ①, pull the head restraint up or push it down → ⚠ in *Introduction* on page 132.
– The head restraint must lock securely in position.

Proper head restraint adjustment

Adjust head restraints so that the upper edge of the head restraint is at least at eye level or higher. Position the back of the head as close as possible to the head restraint.

Adjusting the head restraint for shorter people

Push the head restraint down as far as it will go, even if this means the person's head is still below the top edge of the head restraint. A small gap may remain between the head restraint and the backrest when the head restraint is all the way down.

Adjusting the head restraint for taller people

Pull the head restraint up as far as it will go.

Adjusting the rear center head restraint

Please read the introductory information and heed the Warnings and Notice ⚠ and ⓘ on page 132.

Fig. 85 Adjusting the rear head restraints: rear center head restraint.

All seats are equipped with head restraints. Only the center head restraint is adjustable.

The rear center head restraint is designed only for the center seat on the rear bench. Therefore, only install the center head restraint in the rear center position.

Adjusting the height of the rear center head restraint

– Pull the head restraint up in the direction of the arrow, or push it down while pressing the button → fig. 85 ① → ⚠ in *Introduction* on page 132.
– The head restraint must lock securely in position.

Proper head restraint adjustment

Adjust the head restraint so that the upper edge of the head restraint is at least at eye level or higher. Position the back of the head as close as possible to the head restraint.

Adjusting the head restraint for shorter people

Push the head restraint down as far as it will go, even if this means the person's head is still below the top edge of the head restraint. A small gap may remain between the head restraint and the backrest when the head restraint is all the way down.

Adjusting the head restraint for taller people

Pull the head restraint up as far as it will go.

Removing and reinstalling the front head restraints

Please read the introductory information and heed the Warnings and Notice ⚠ and ⓘ on page 132.

Fig. 86 Removing the front head restraints.

132 | Owner's Manual

Seats and head restraints | 133

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)

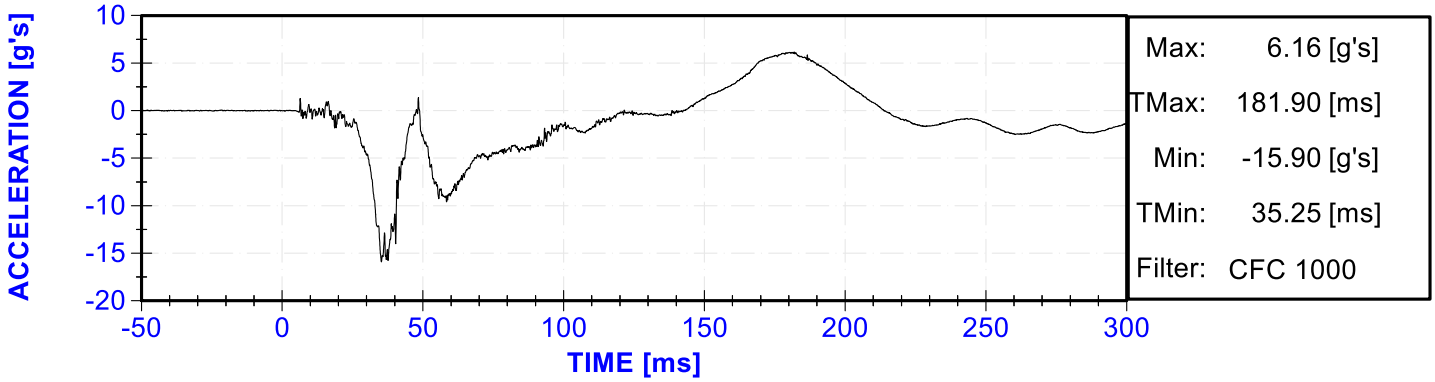
Vehicle Instrumentation Data

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)

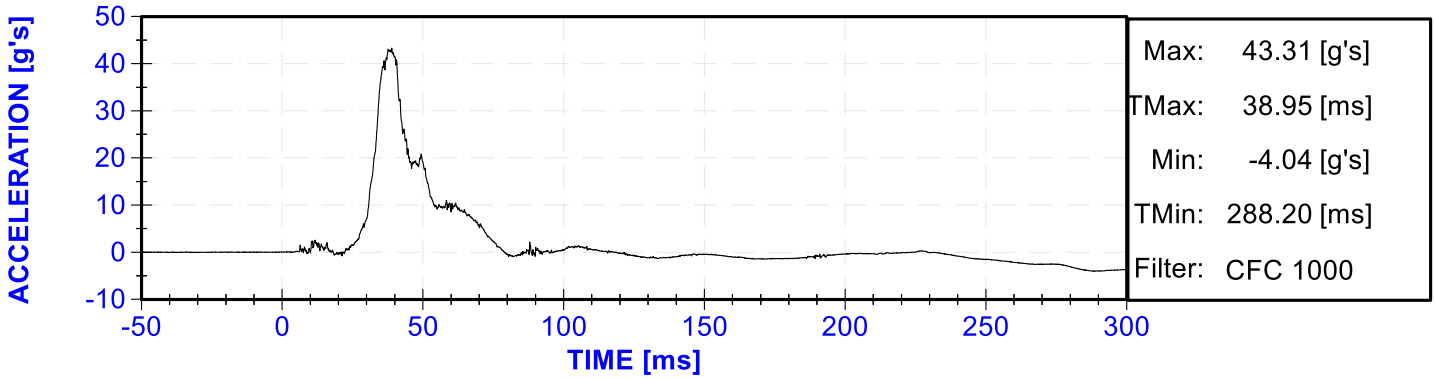
MDB Instrumentation Data

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

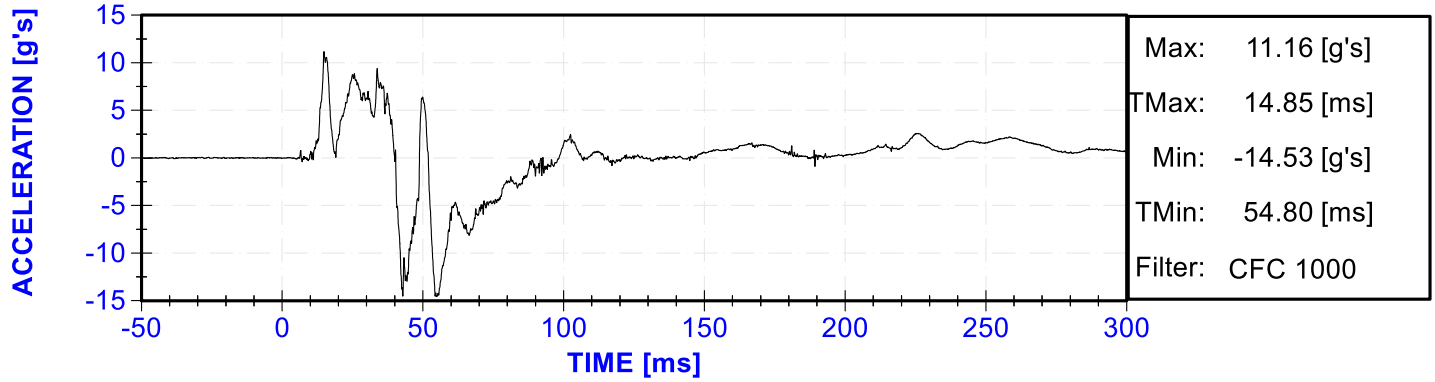
Driver Head Acceleration (X) Primary vs. Time



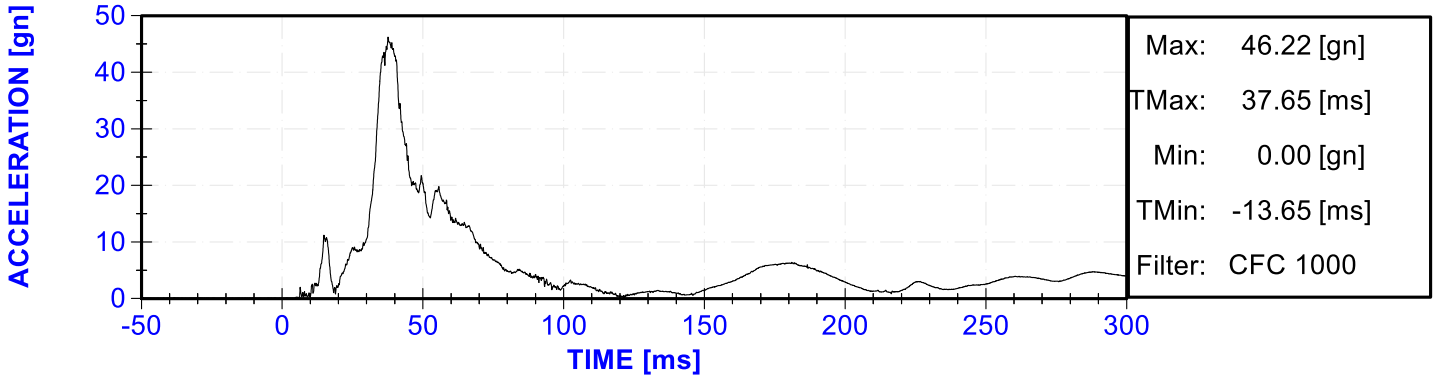
Driver Head Acceleration (Y) Primary vs. Time



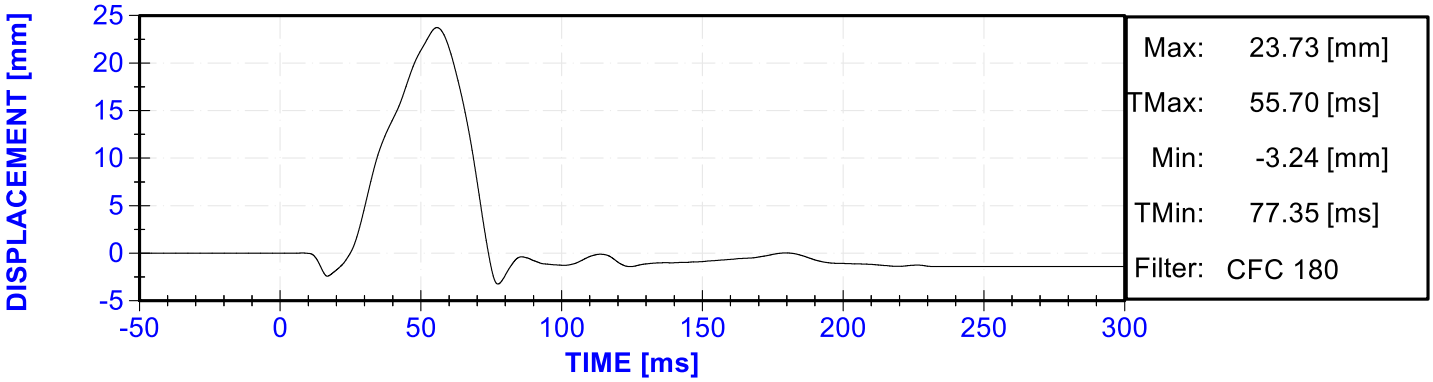
Driver Head Acceleration (Z) Primary vs. Time



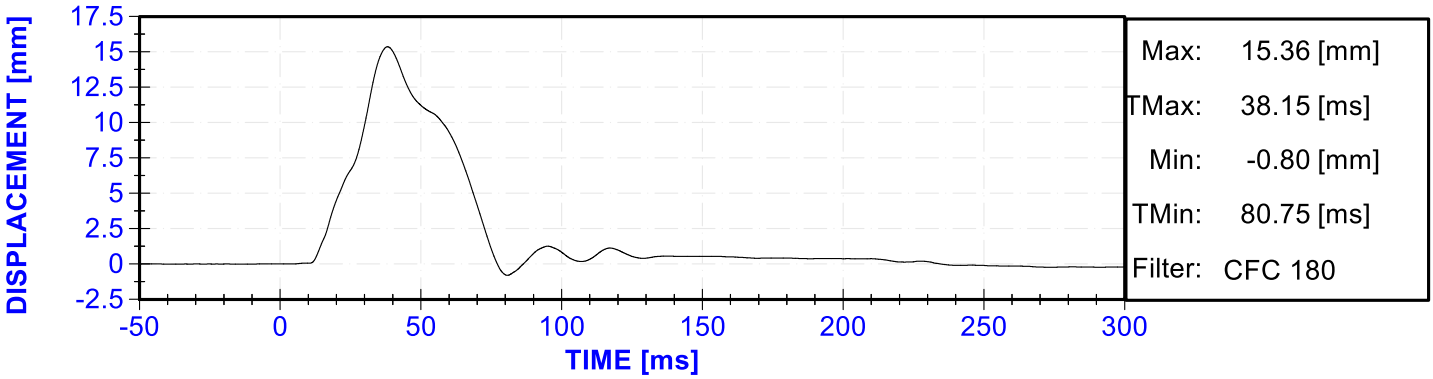
Driver Head Resultant Acceleration Primary vs. Time



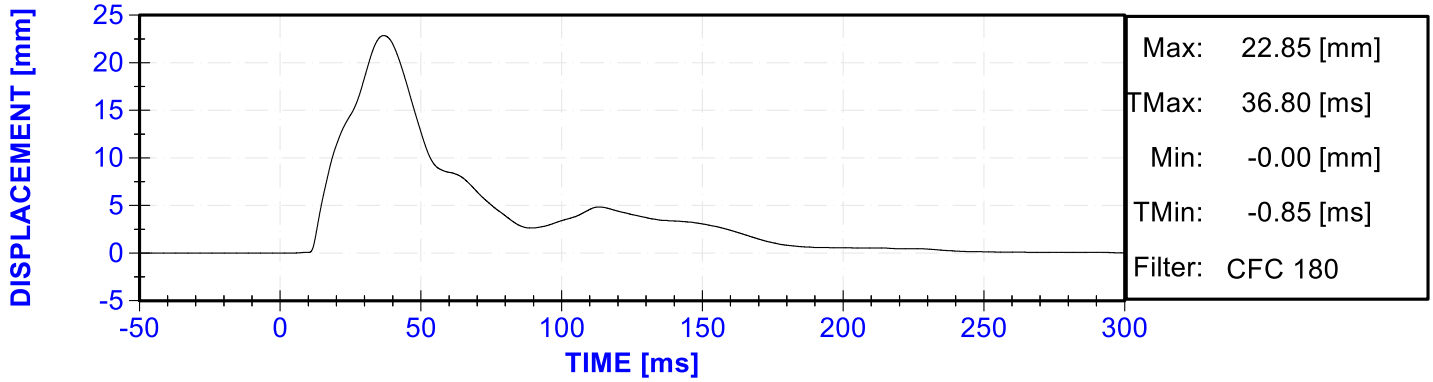
Driver Upper Thorax Rib Deflection (Y) vs. Time



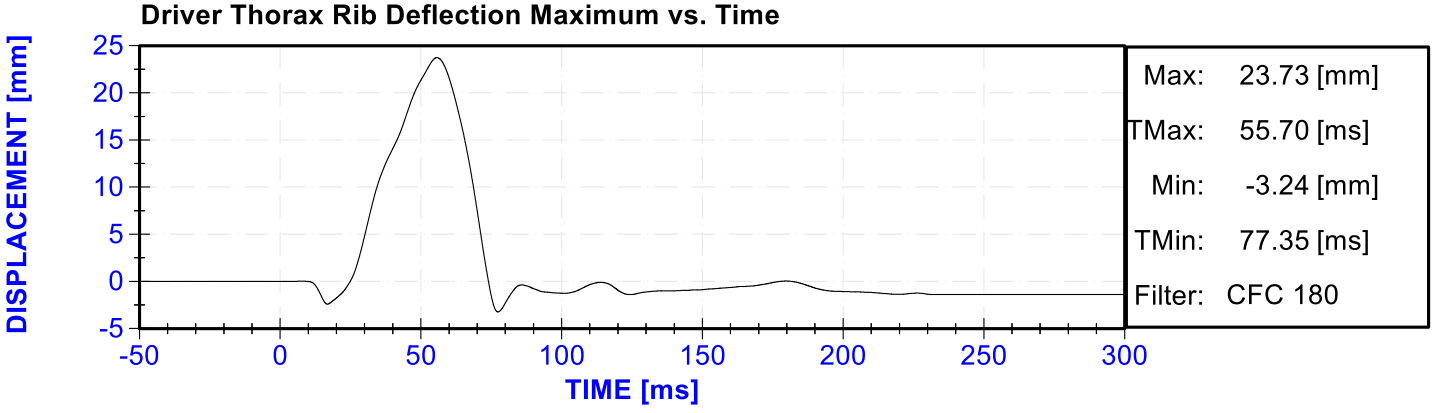
Driver Middle Thorax Rib Deflection (Y) vs. Time



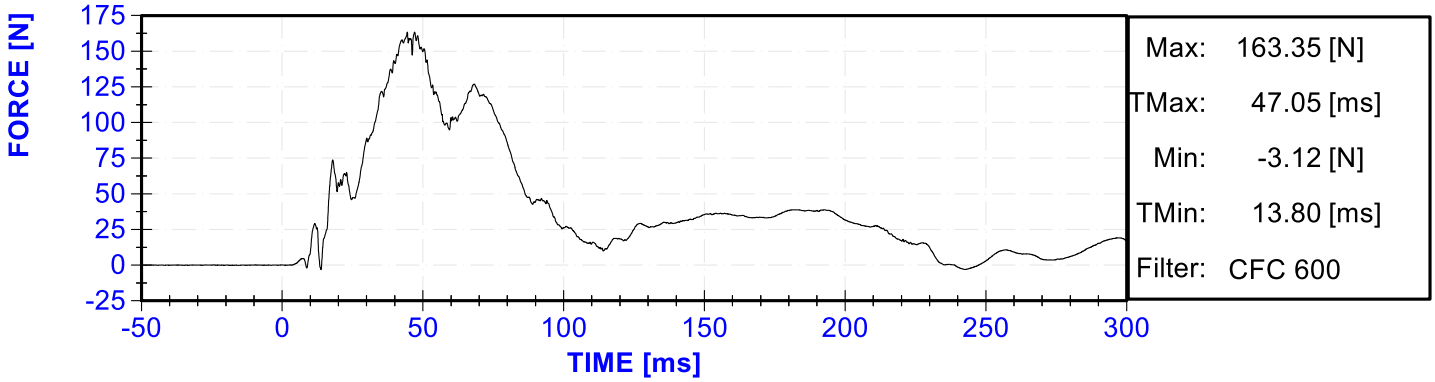
Driver Lower Thorax Rib Deflection (Y) vs. Time



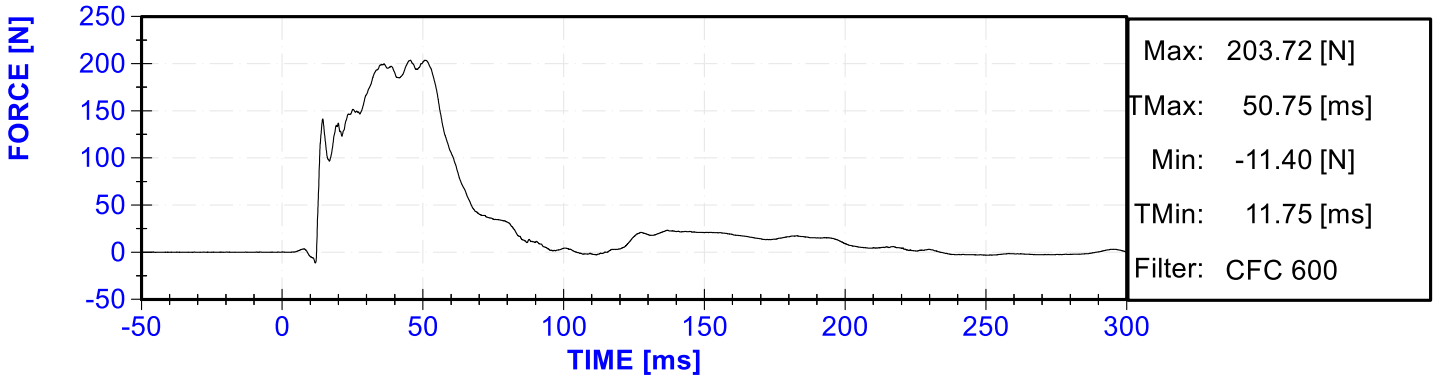
Driver Thorax Rib Deflection Maximum vs. Time



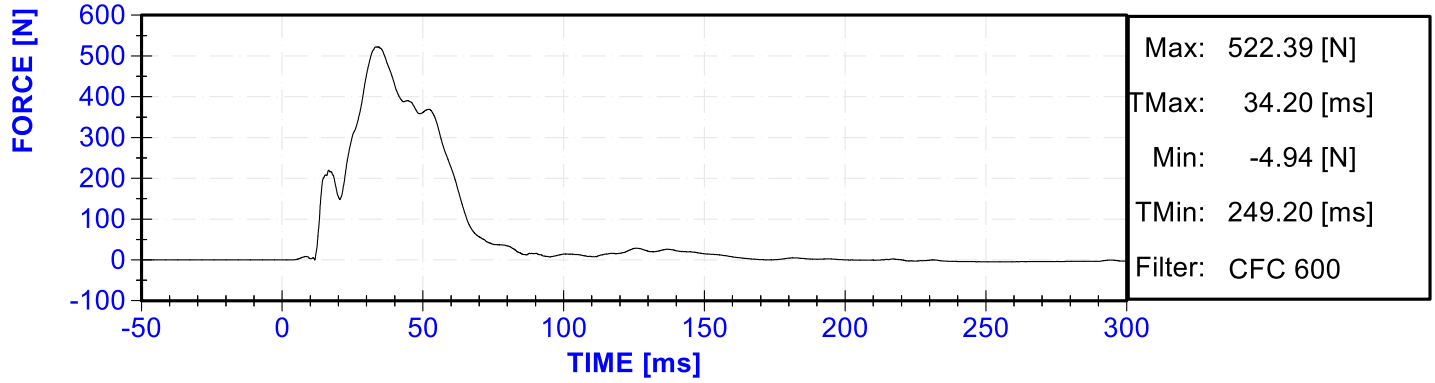
Driver Anterior Abdominal Force (Y) vs. Time



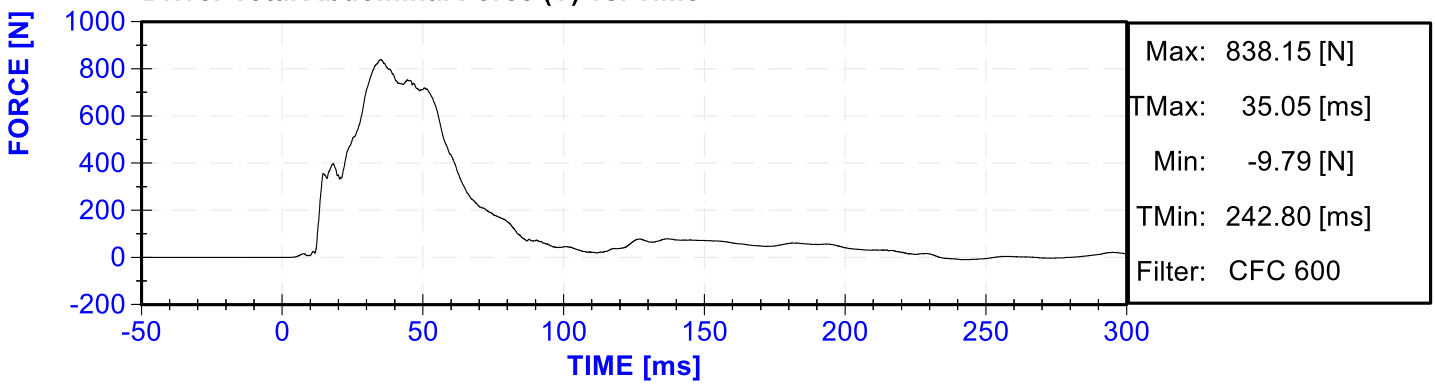
Driver Middle Abdominal Force (Y) vs. Time



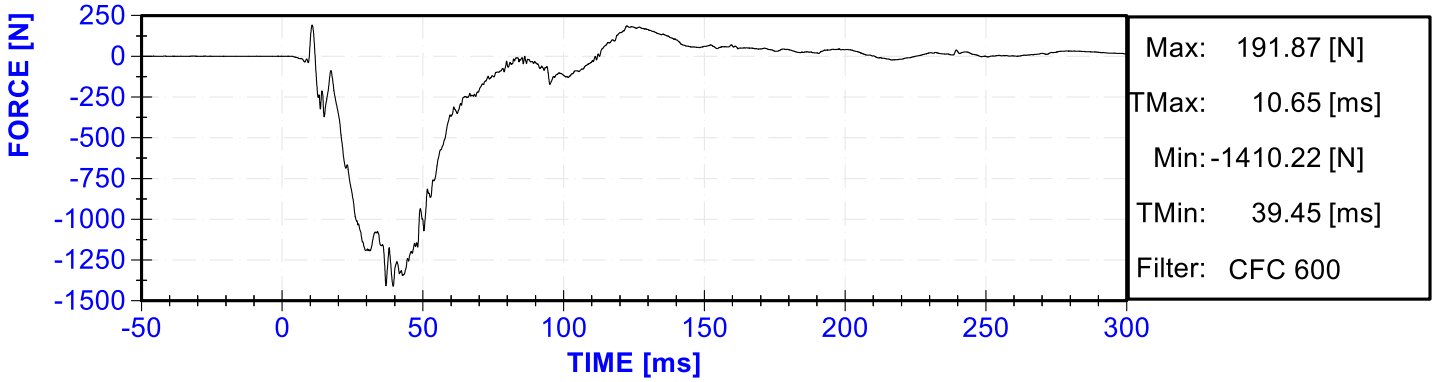
Driver Posterior Abdominal Force (Y) vs. Time



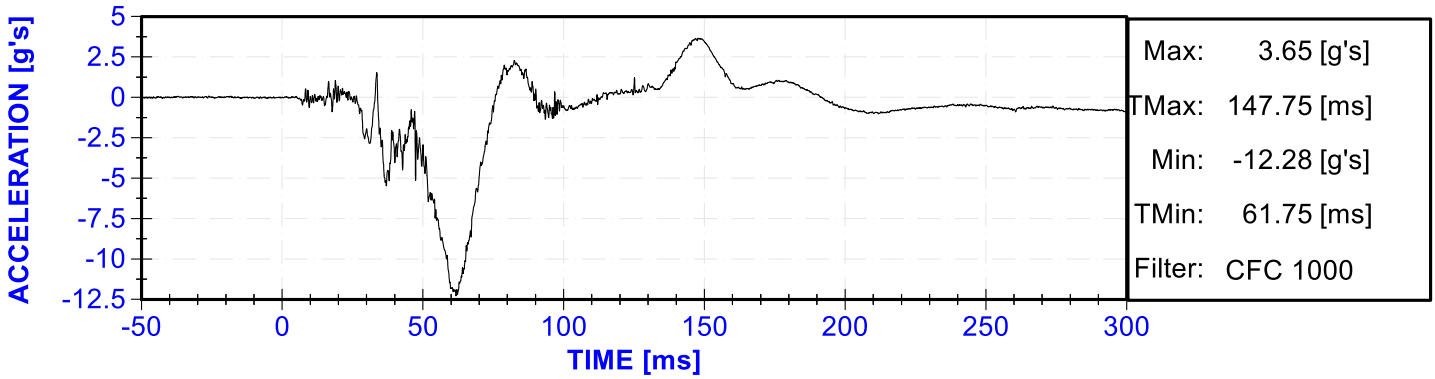
Driver Total Abdominal Force (Y) vs. Time



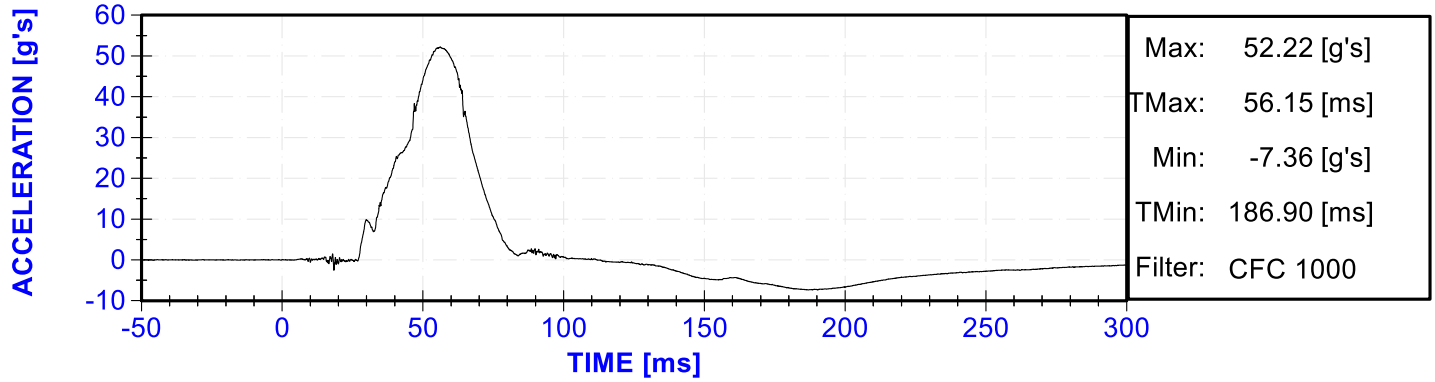
Driver Pubic Symphysis Force (Y) vs. Time



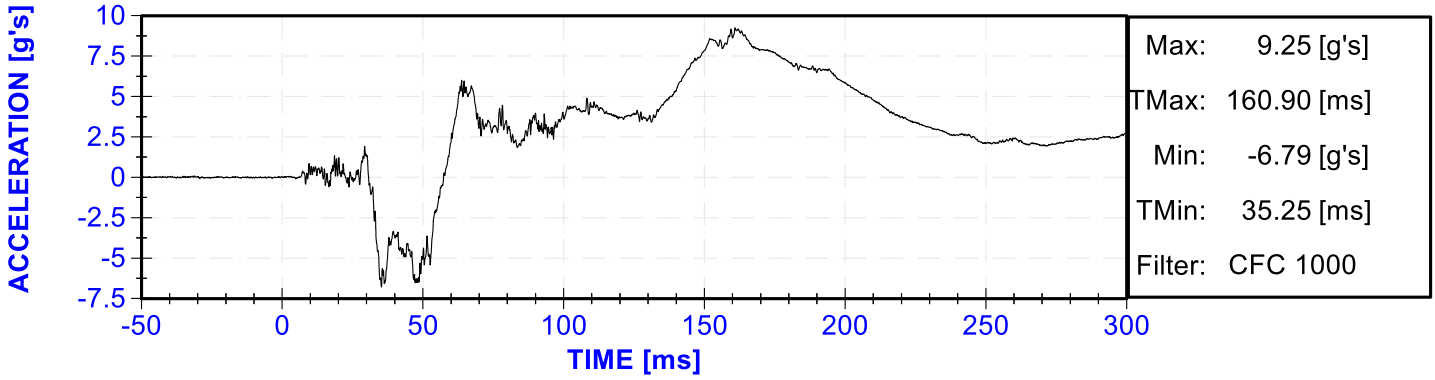
Passenger Head Acceleration (X) vs. Time Primary



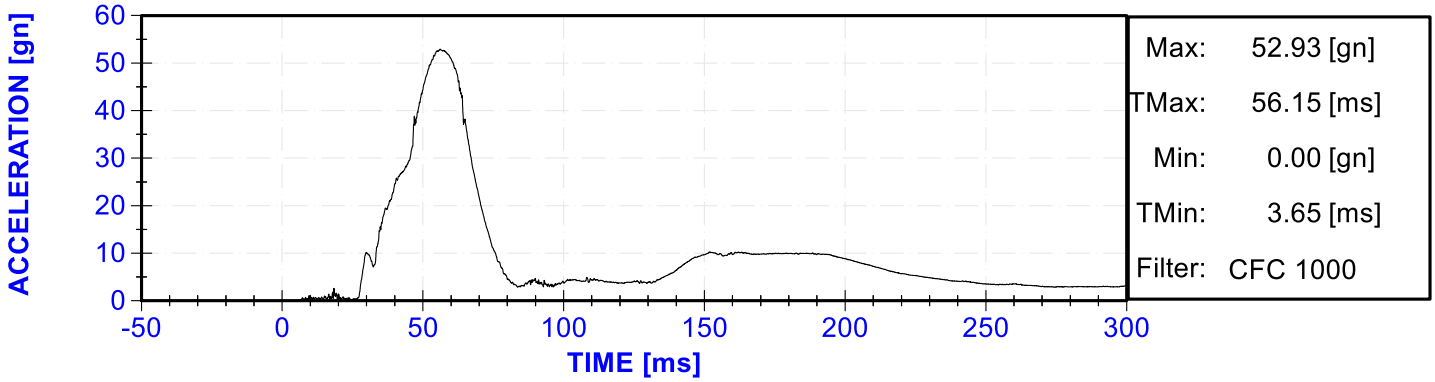
Passenger Head Acceleration (Y) vs. Time Primary



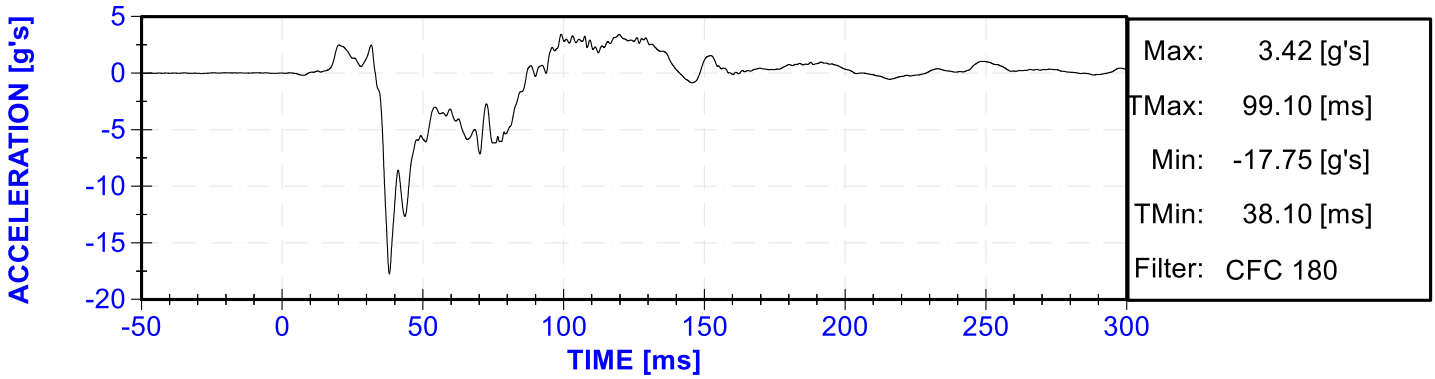
Passenger Head Acceleration (Z) vs. Time Primary



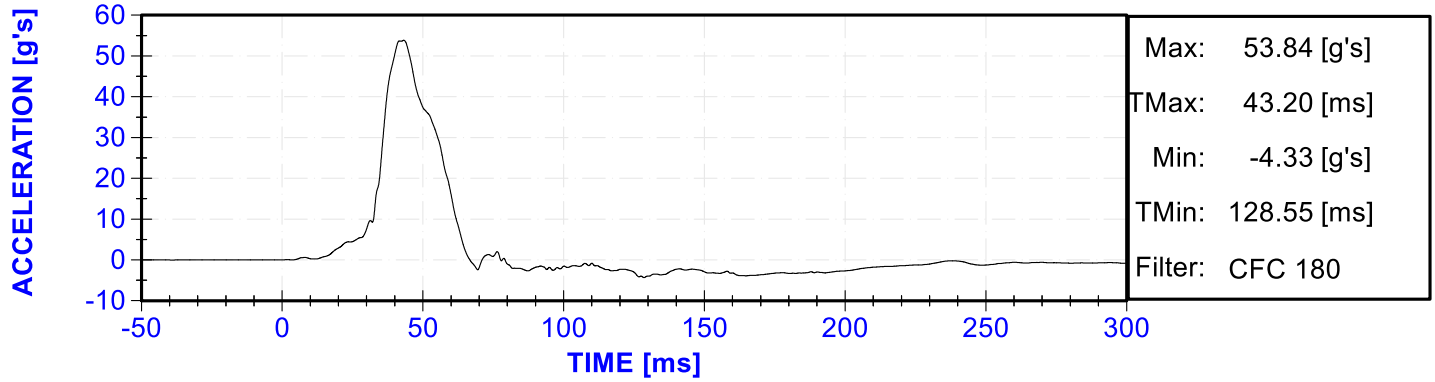
Passenger Head Resultant Acceleration Primary vs. Time



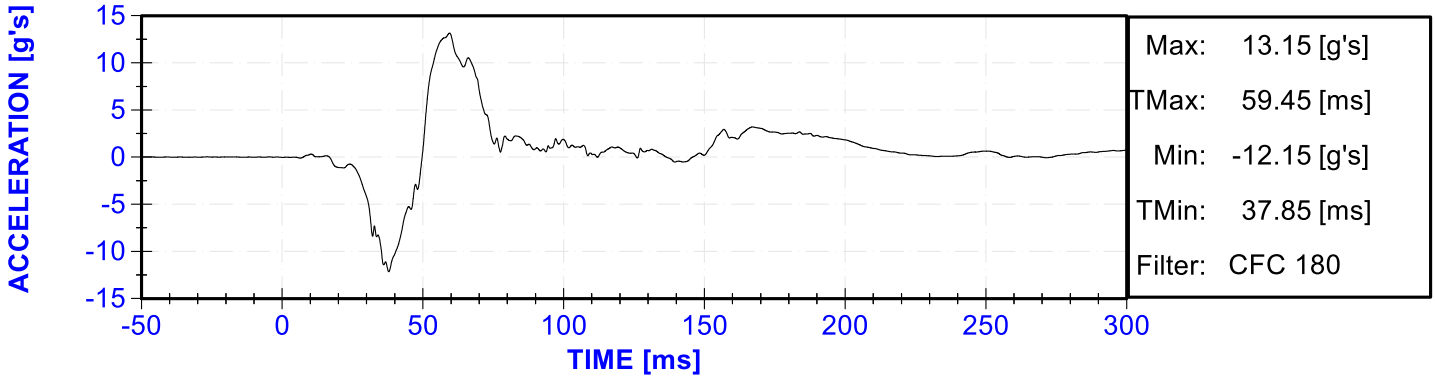
Passenger Lower Spine T12 Acceleration (X) vs. Time



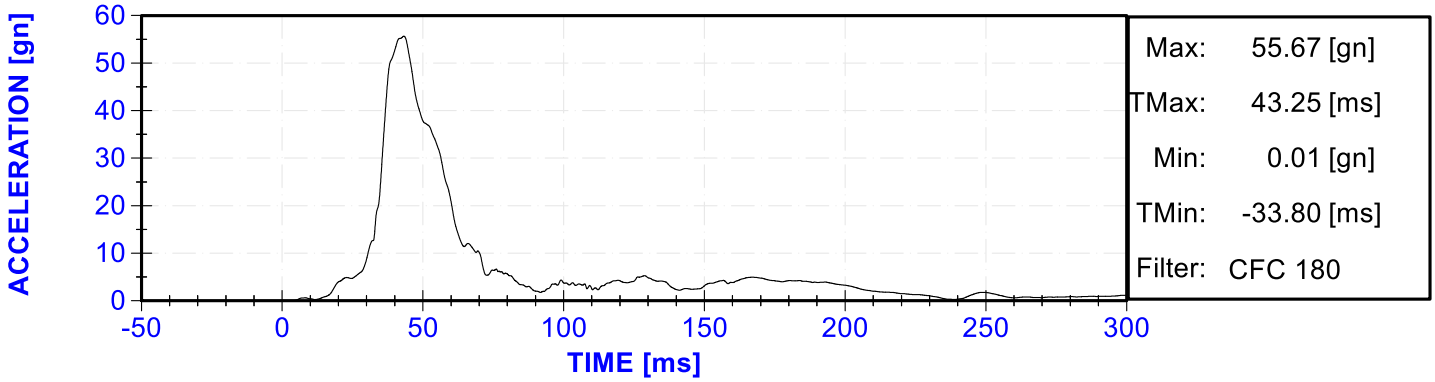
Passenger Lower Spine T12 Acceleration (Y) vs. Time



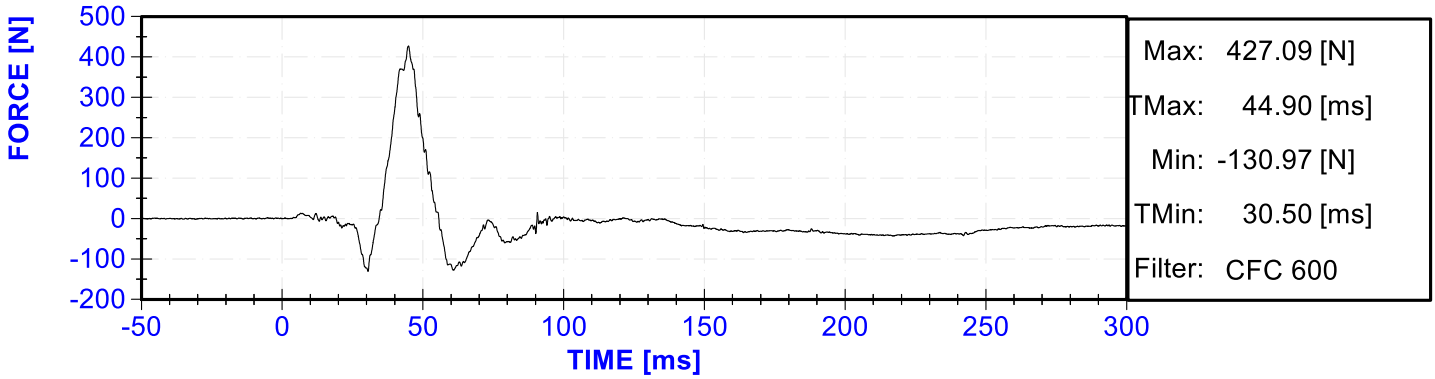
Passenger Lower Spine T12 Acceleration (Z) vs. Time



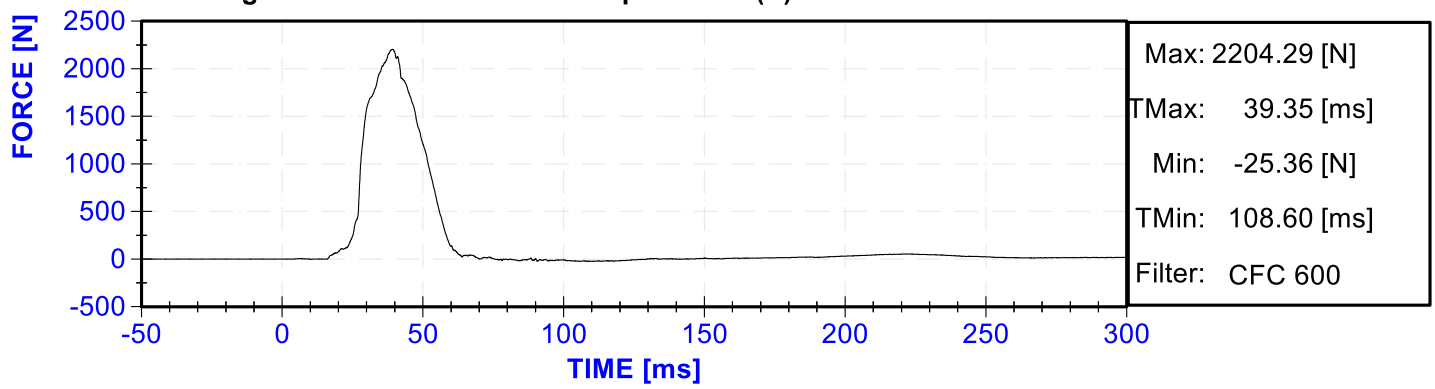
Passenger Lower Spine T12 Resultant Acceleration vs. Time



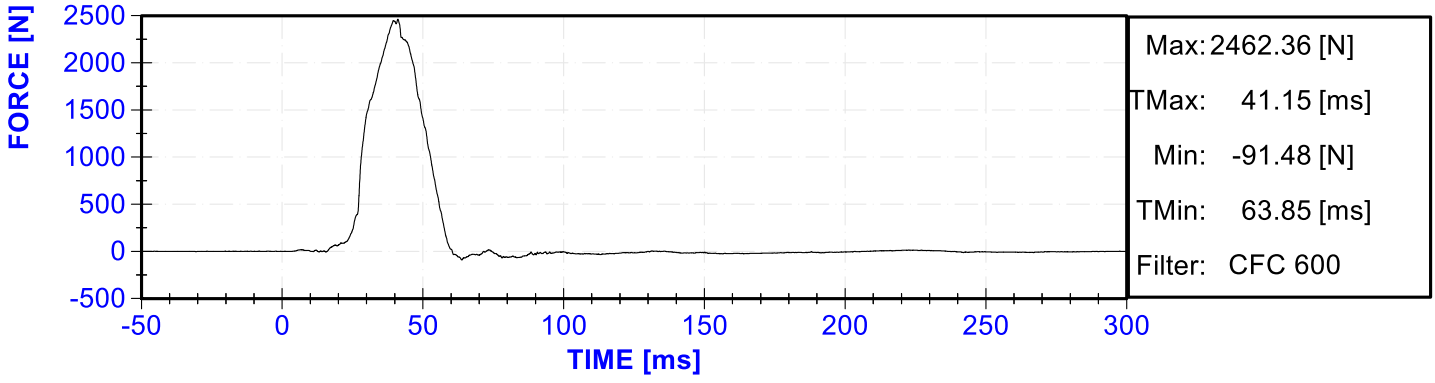
Passenger Iliac Force on Impact Side (Y) vs. Time



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

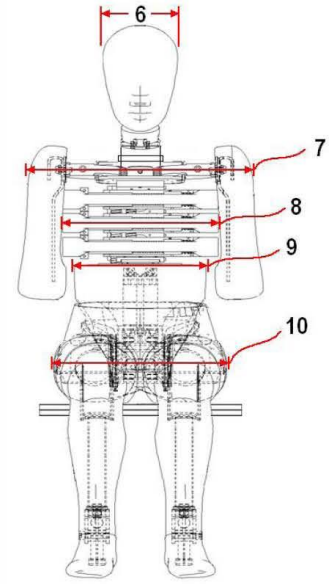
SERIAL NO: F034

(CONFIGURED FOR LEFT SIDE IMPACT)

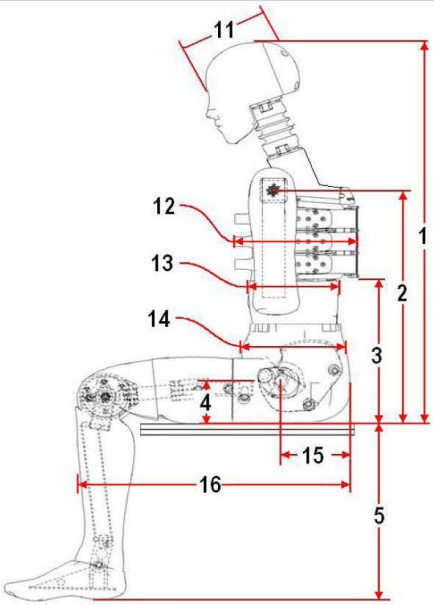
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 01/19/2019

Dummy Serial Number: F034



FRONT VIEW



SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	913	Pass
2	Seat to Shoulder Joint	558	572	567	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	349	Pass
4	Seat to Hip Joint (center of bolt)	97	103	100	Pass
5	Sole to Seat, Sitting	333	451	420	Pass
6	Head Width	152	158	152	Pass
7	Shoulder/Arm Width	461	479	469	Pass
8	Thorax Width	322	332	326	Pass
9	Abdomen Width	273	287	281	Pass
10	Pelvis Lap Width	359	373	366	Pass
11	Head Depth	196	206	201	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	200	Pass
14	Pelvis Depth	235	245	239	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	156	Pass
16	Back of Buttocks to Front Knee	597	615	606	Pass

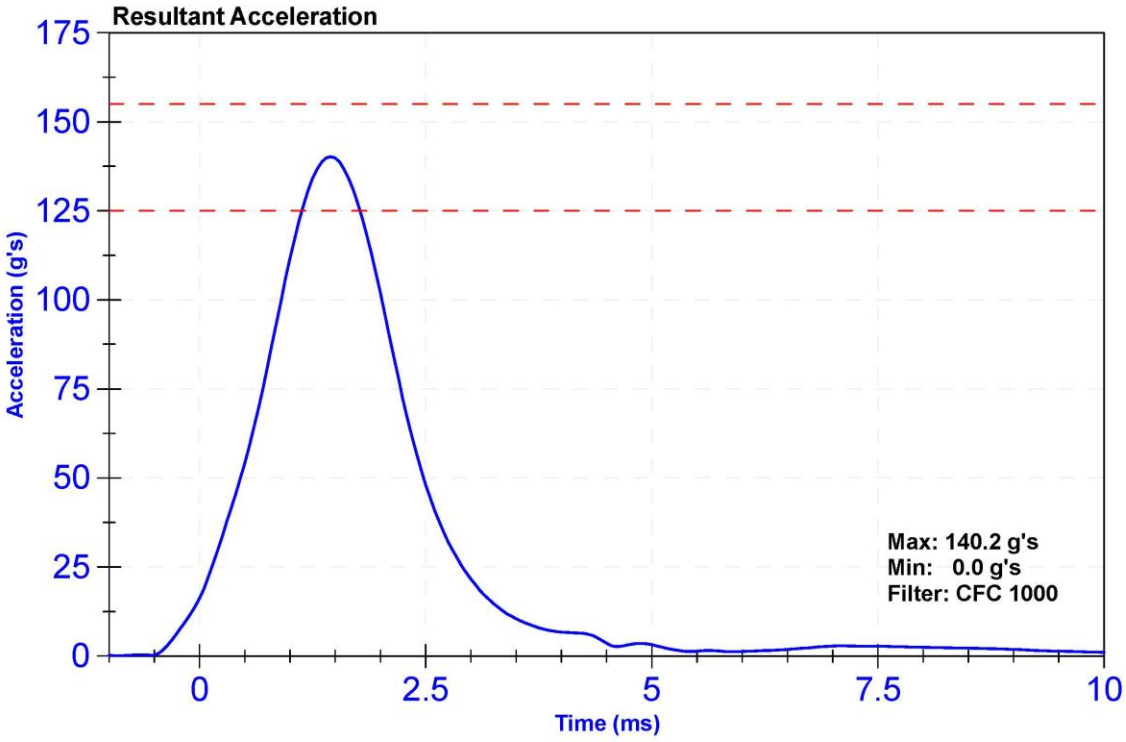
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

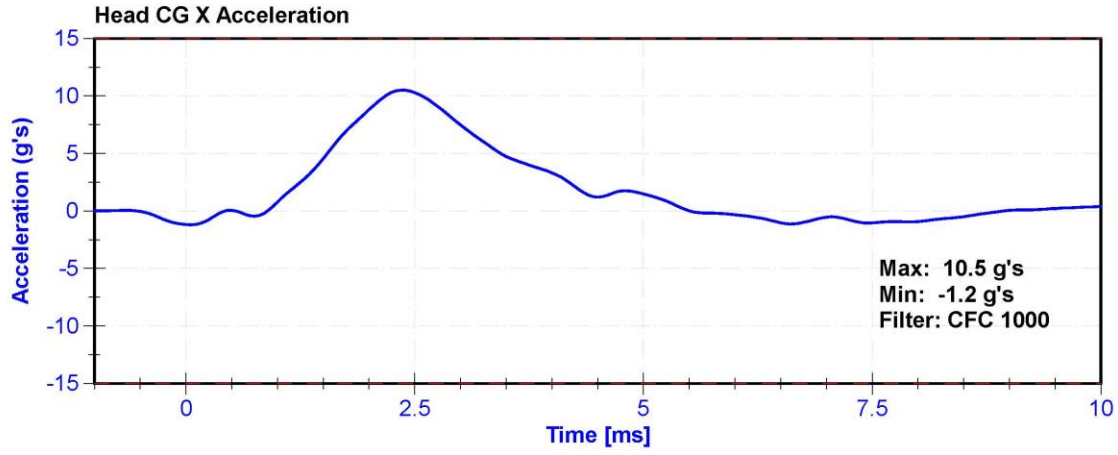
Results

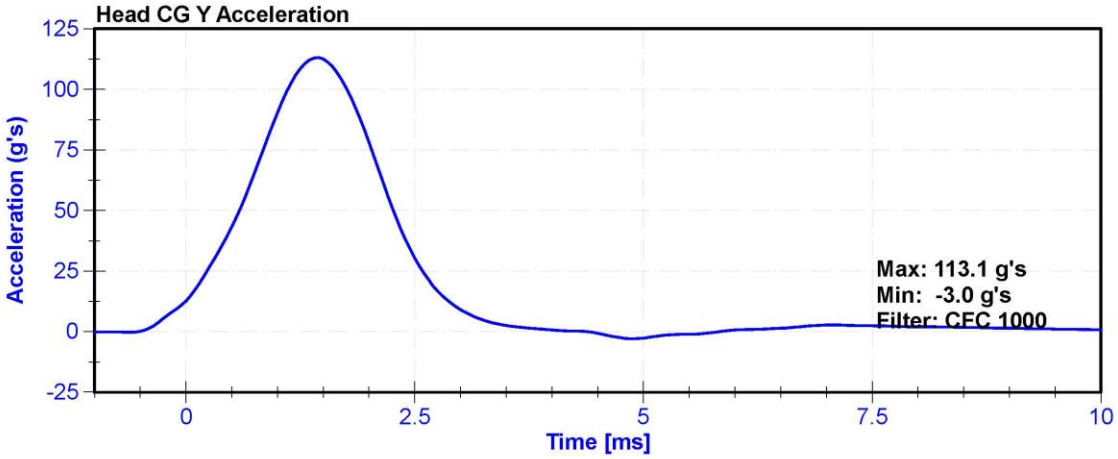
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	20.6	Pass
Resultant Acceleration	125	155	g's	140.2	Pass
Oscillation	0	15	%	2.53	Pass
Fore-Aft Acceleration	-15	15	g's	10.5	Pass

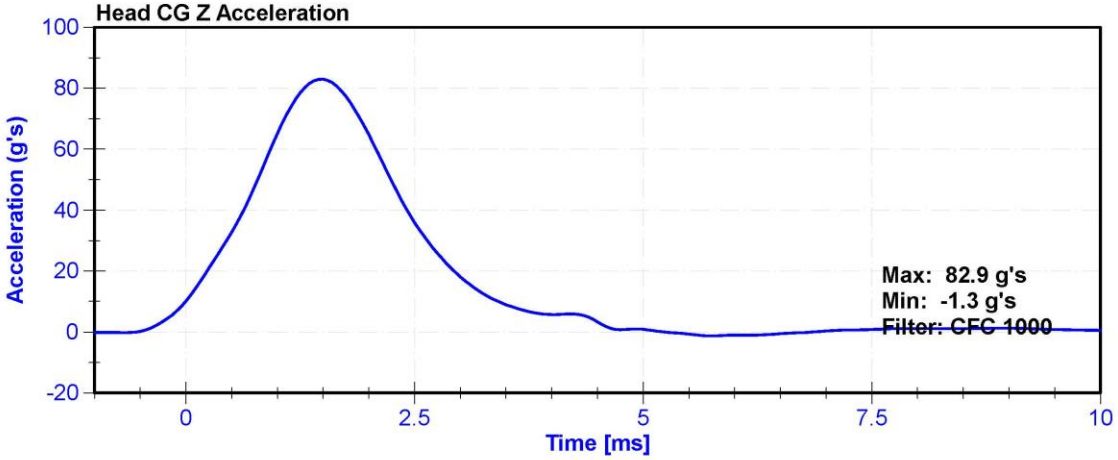
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P58904	10/5/2018	4/5/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P58911	10/5/2018	4/5/2019
Z Accelerometer	ENDEVCO 7264CT	AC-P58776	10/5/2018	4/5/2019




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 10.5 g's
Min: -1.2 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: 113.1 g's
Min: -3.0 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: 82.9 g's
Min: -1.3 g's
Filter: CFC 1000

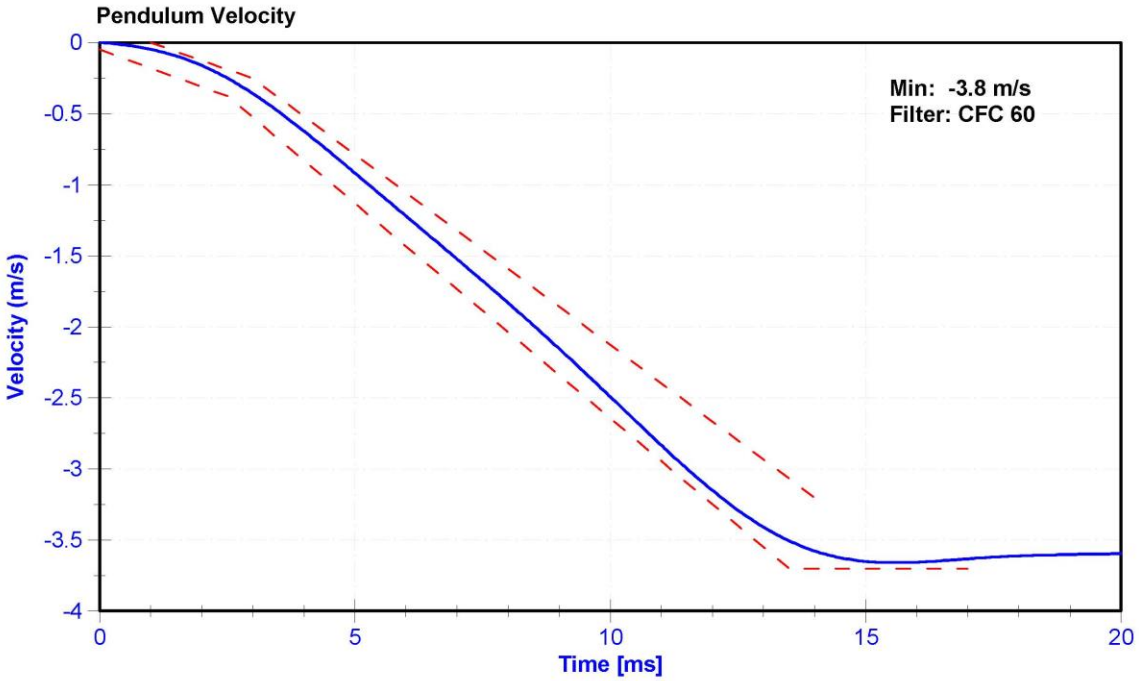
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

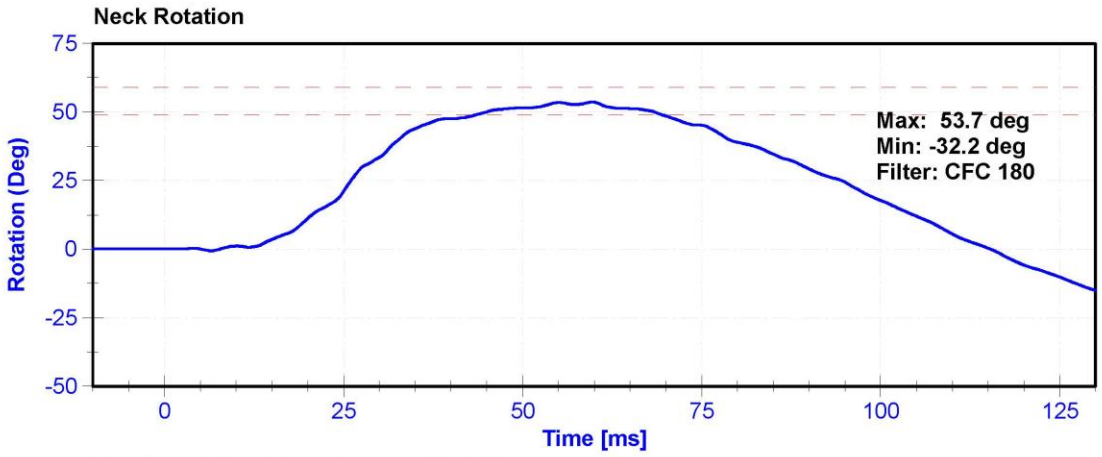
Results

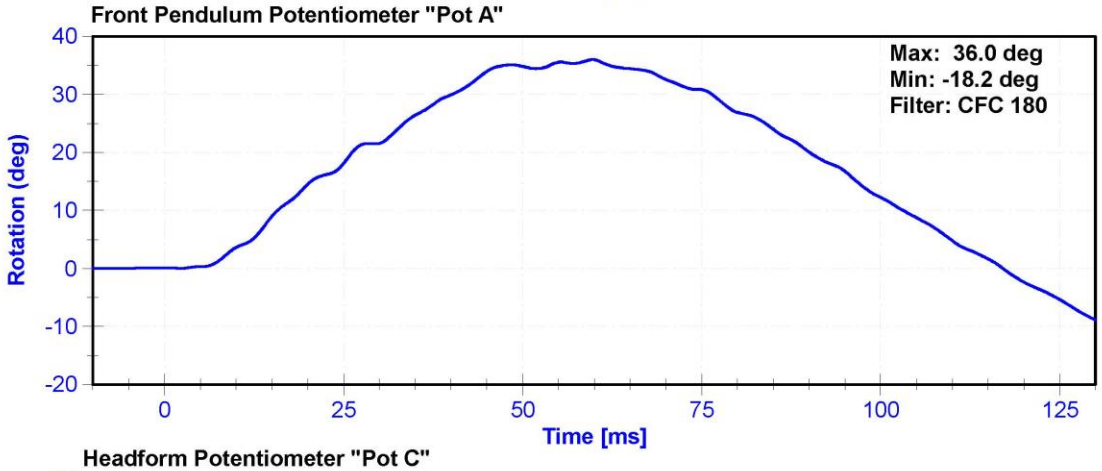
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	24.6	Pass
Velocity	3.3	3.5	m/s	3.42	Pass
Lateral Neck Rotation	49	59	deg	53.7	Pass
Time at Maximum Rotation	54	66	ms	59.8	Pass
Time of Rotation Decay from Maximum	53	88	ms	55.5	Pass

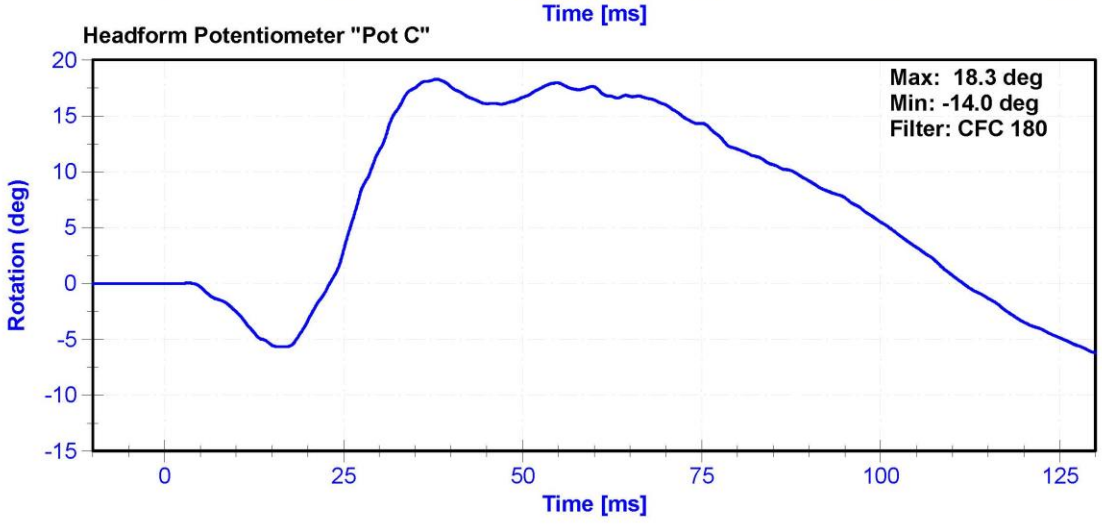
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5F3	5/11/2018	5/11/2019
Front Pendulum Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Headform Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019




Neck Rotation
Rotation (Deg)
Time [ms]
Max: 53.7 deg
Min: -32.2 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 36.0 deg
Min: -18.2 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 18.3 deg
Min: -14.0 deg
Filter: CFC 180

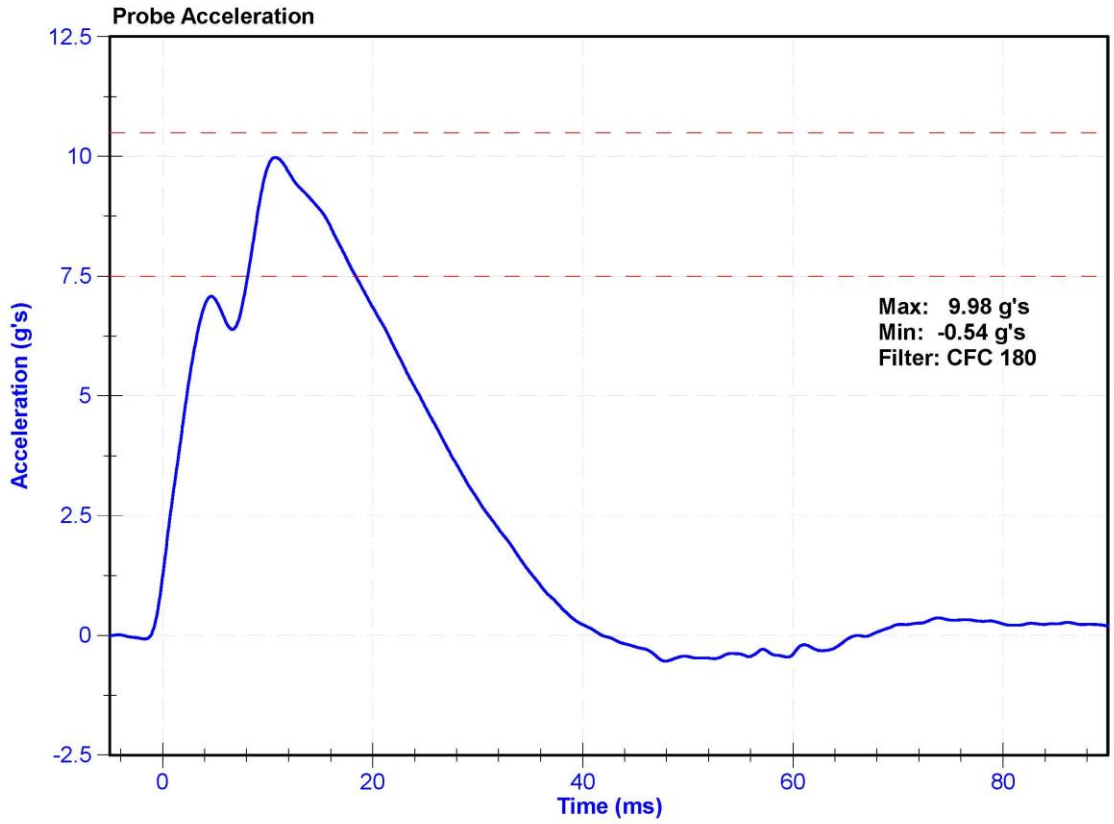
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	22.0	Pass
Velocity	4.2	4.4	m/s	4.20	Pass
Probe Acceleration	7.5	10.5	g's	9.98	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019



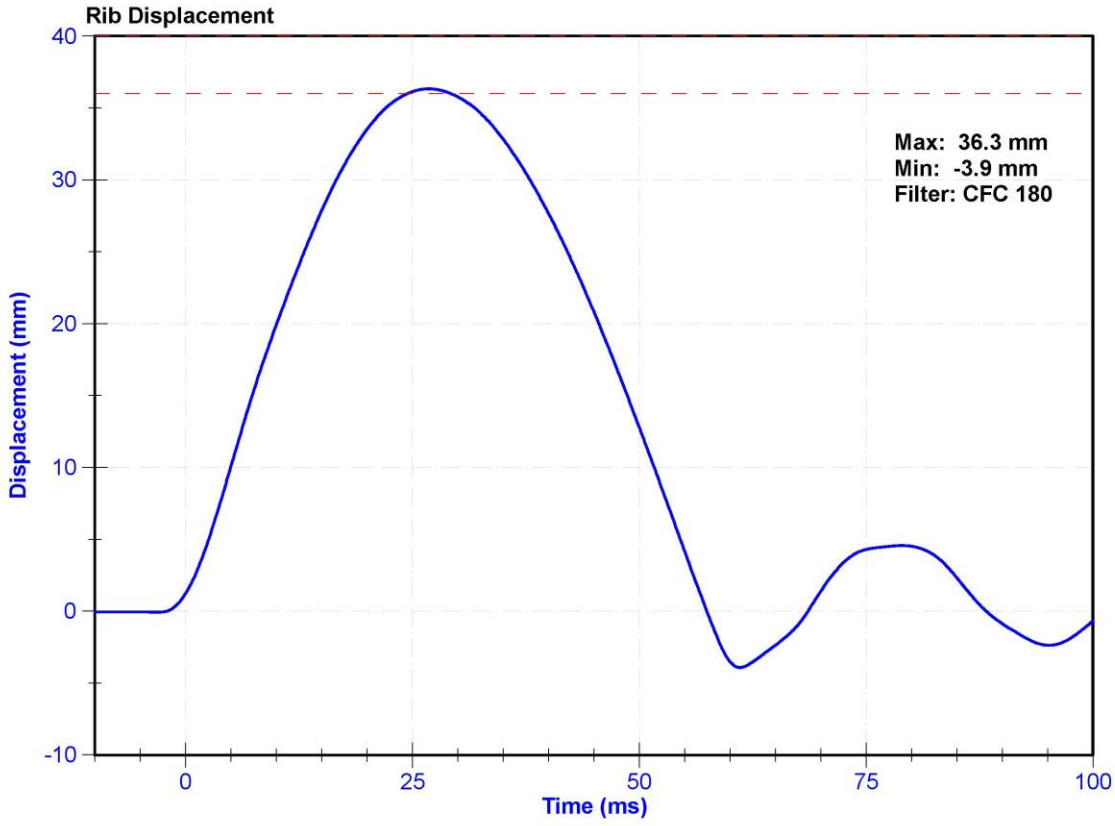
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	20.6	Pass
Rib Displacement	36	40	mm	36.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019



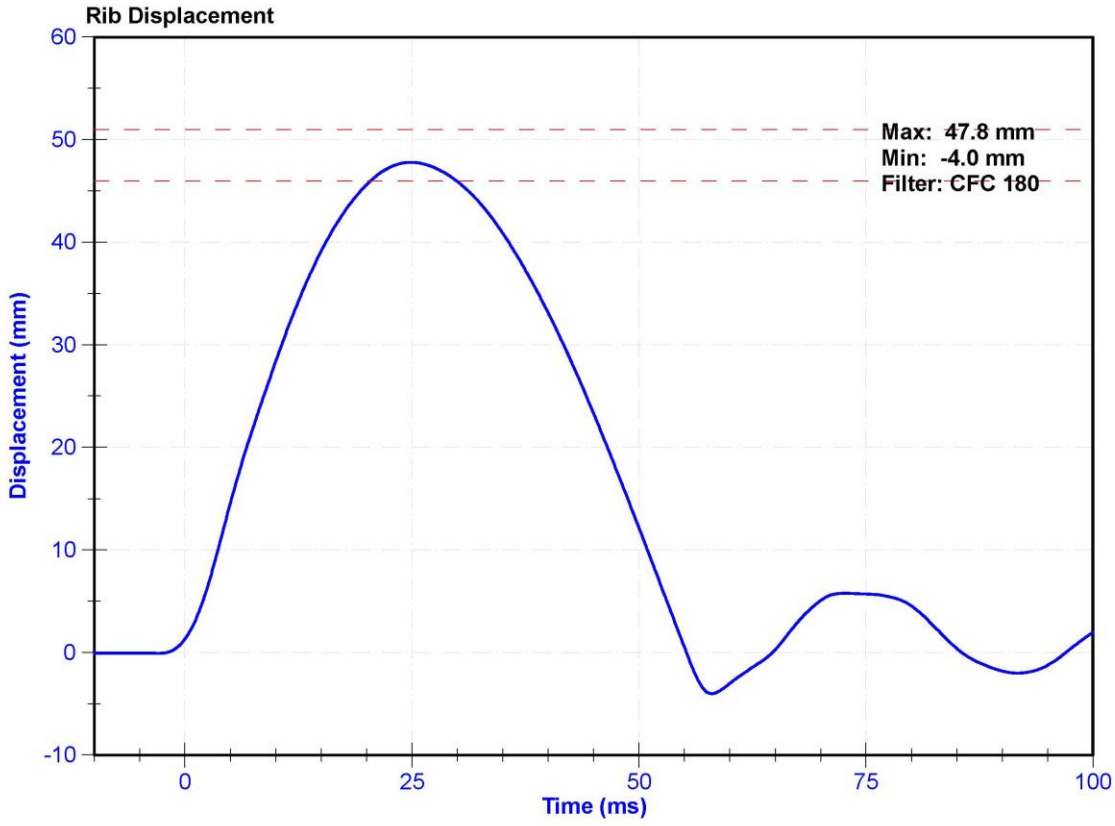
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	23.3	Pass
Rib Displacement	46	51	mm	47.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019



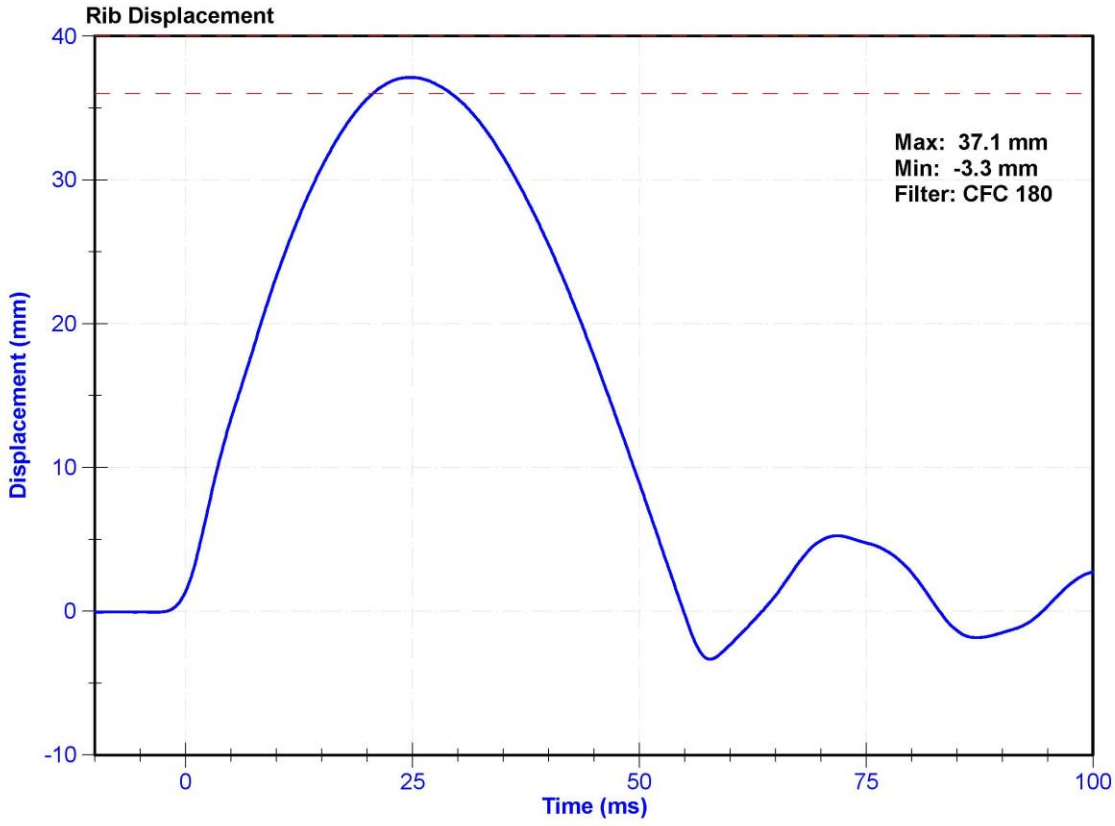
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	20.6	Pass
Rib Displacement	36	40	mm	37.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019



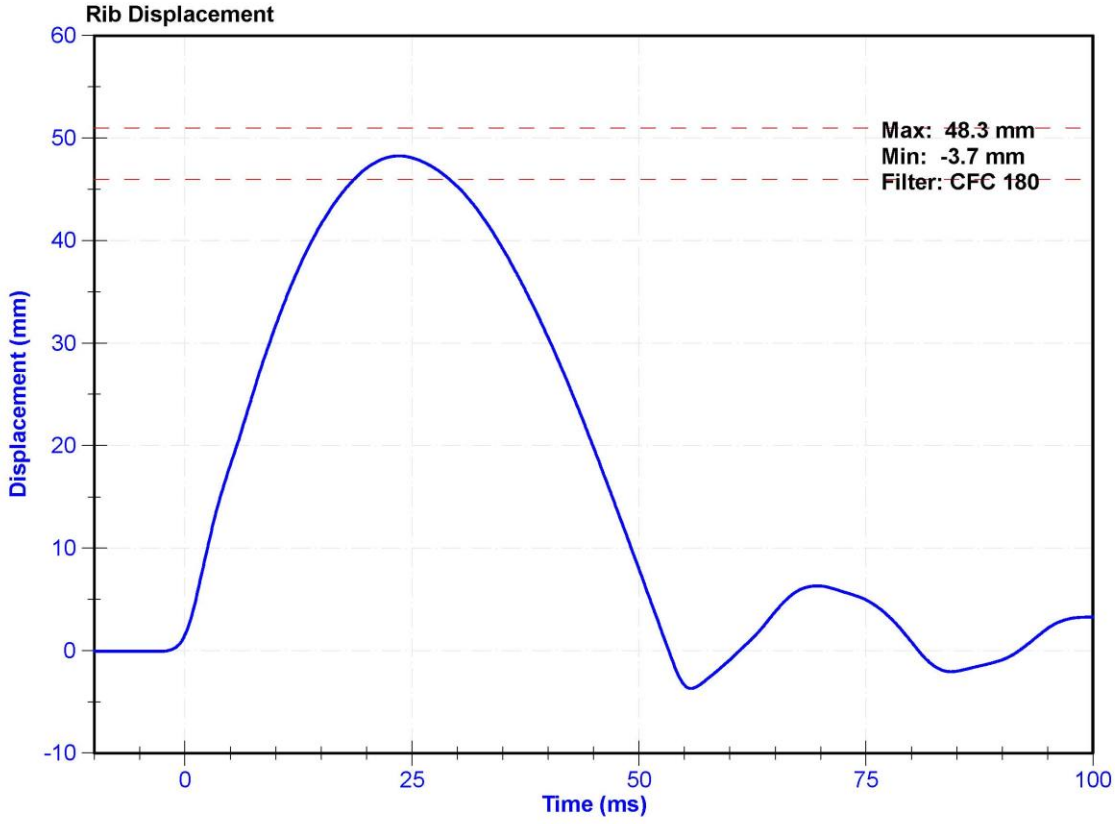
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	26.1	Pass
Rib Displacement	46	51	mm	48.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019



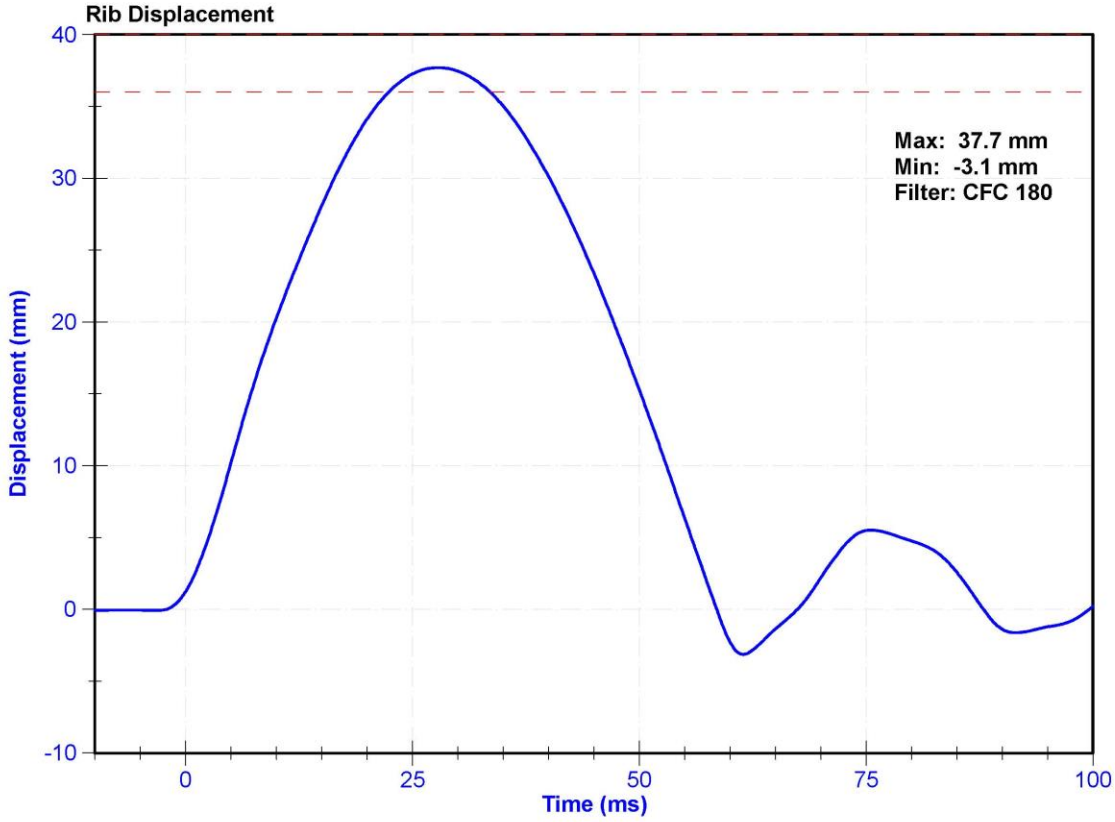
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	23.3	Pass
Rib Displacement	36	40	mm	37.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019



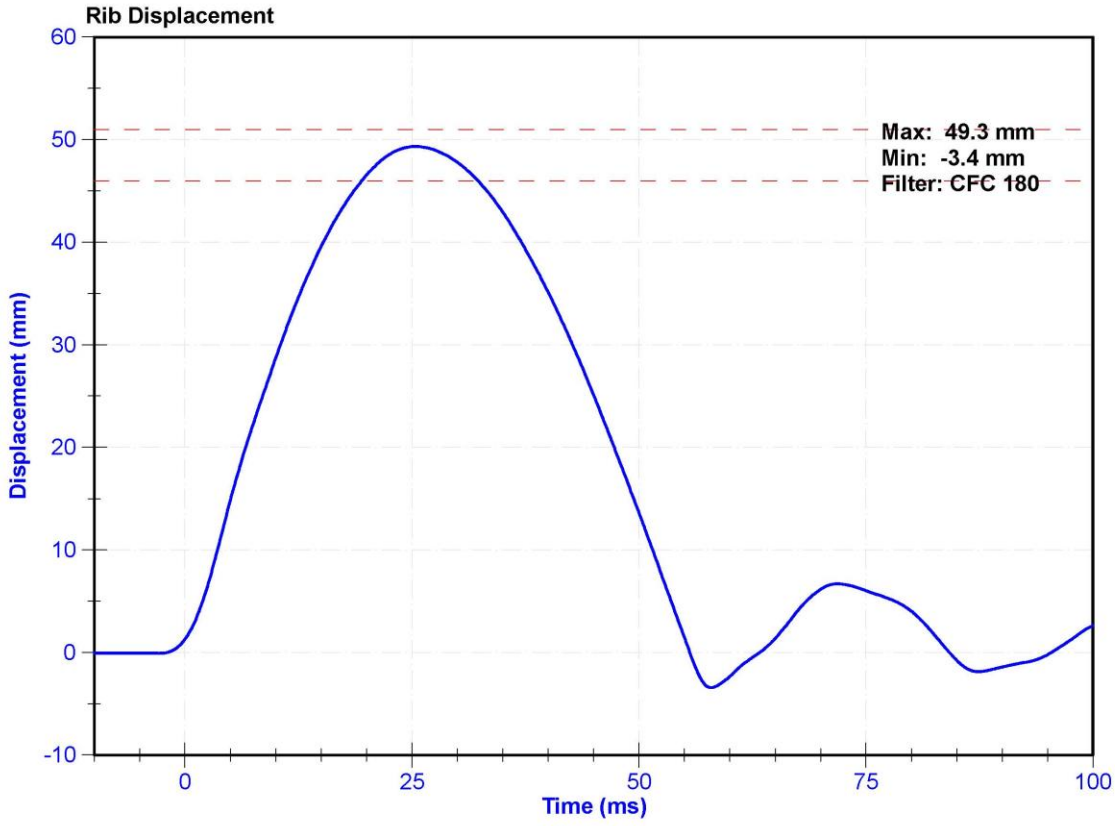
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	23.2	Pass
Rib Displacement	46	51	mm	49.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019



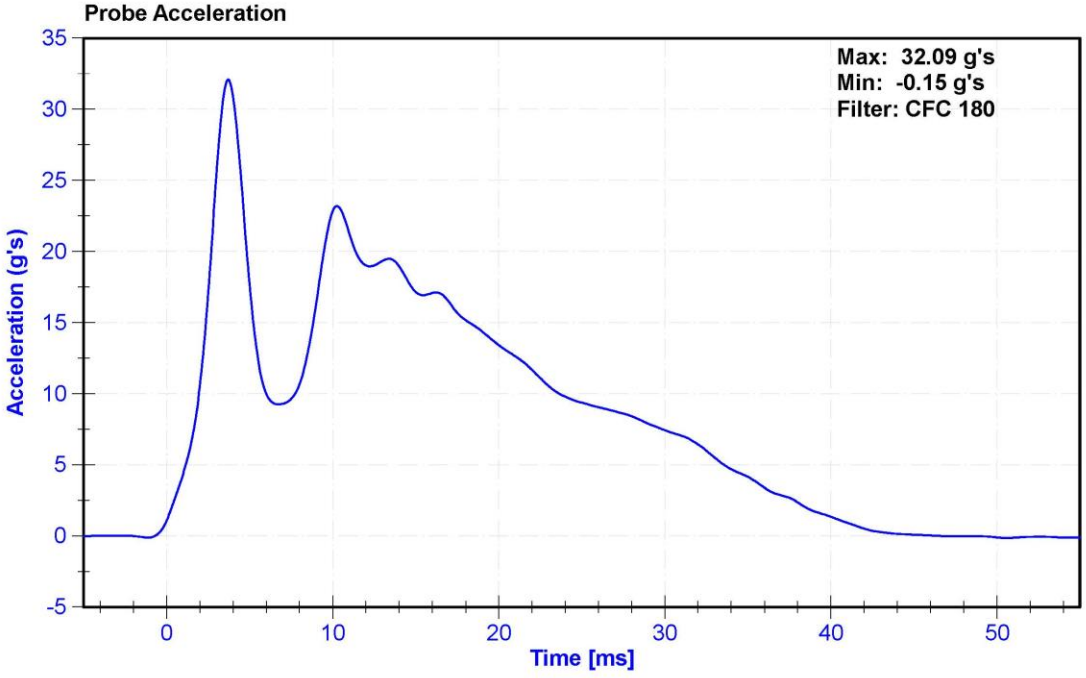
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

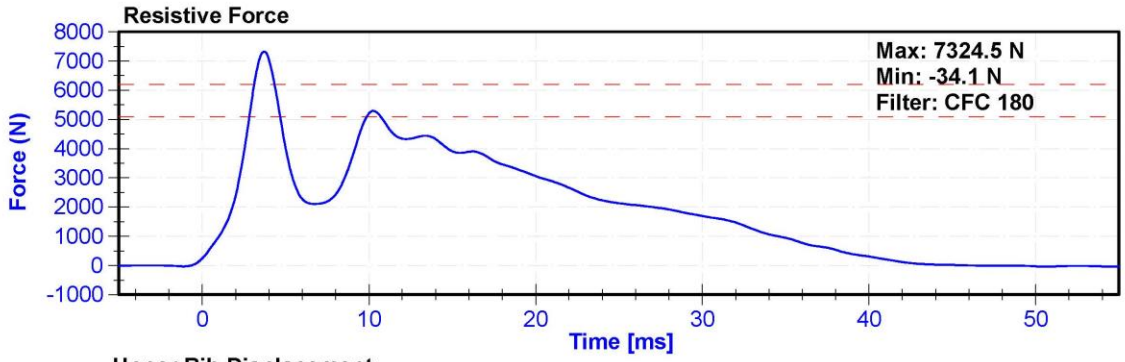
Results

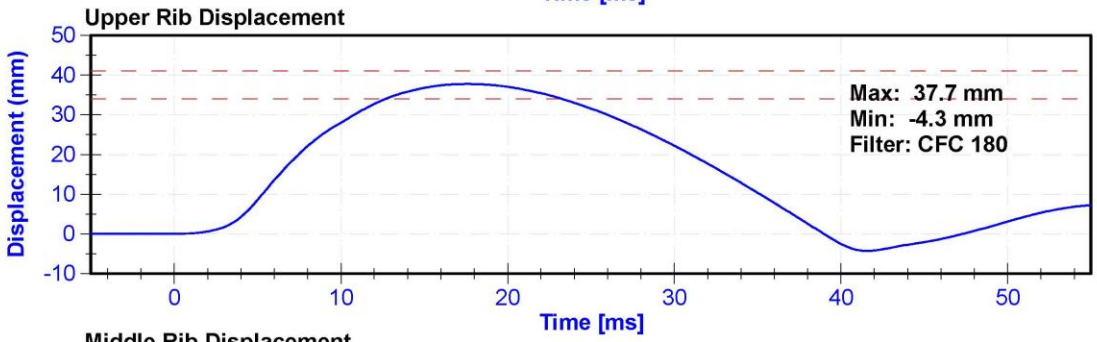
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	26.2	Pass
Velocity	5.4	5.6	m/s	5.47	Pass
Resistive Force after 6ms	5100	6200	N	5292.5	Pass
Upper Thorax Rib Deflection	34	41	mm	37.7	Pass
Mid Thorax Rib Deflection	37	45	mm	40.9	Pass
Lower Thorax Rib Deflection	37	44	mm	40.6	Pass

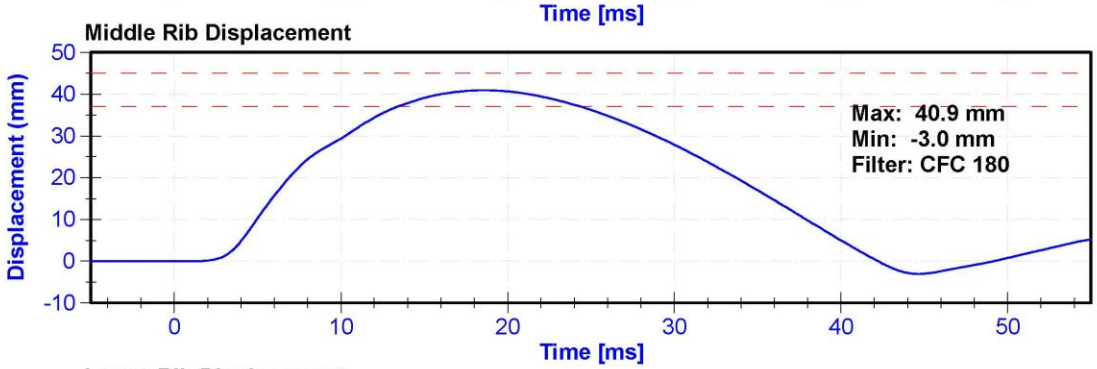
Transducer Calibrations

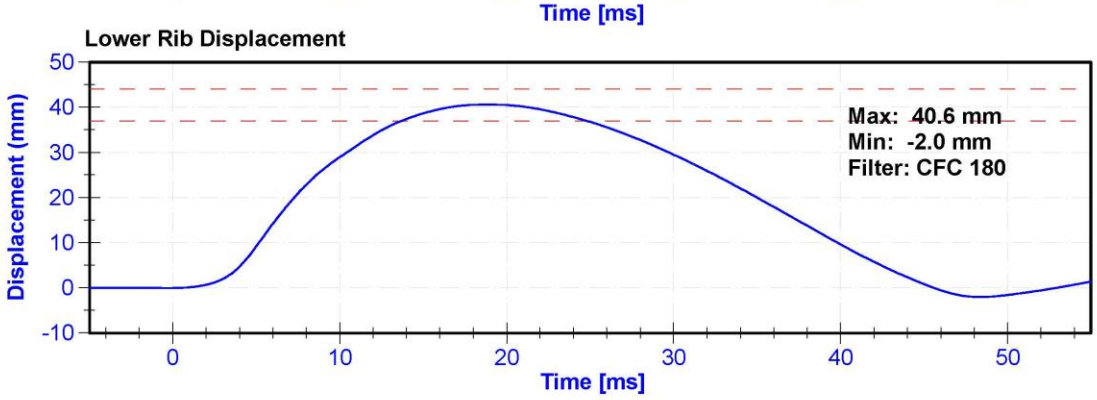
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019




Resistive Force
Force (N)
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 7324.5 N
Min: -34.1 N
Filter: CFC 180


Upper Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 37.7 mm
Min: -4.3 mm
Filter: CFC 180


Middle Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 40.9 mm
Min: -3.0 mm
Filter: CFC 180


Lower Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 40.6 mm
Min: -2.0 mm
Filter: CFC 180

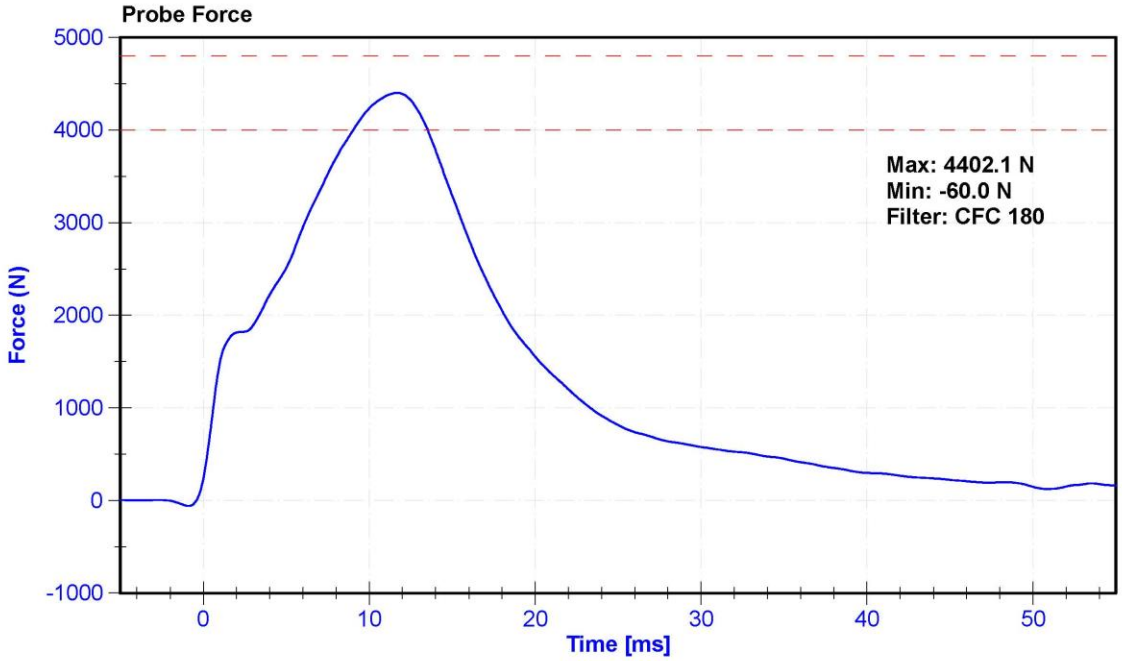
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

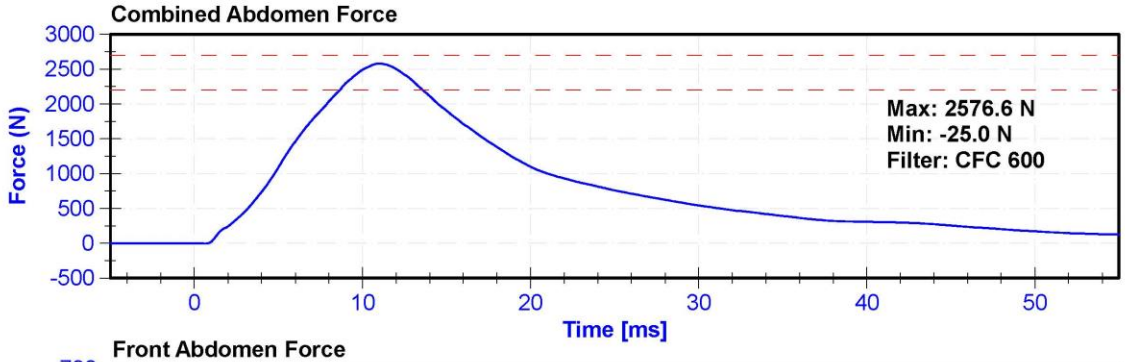
Results

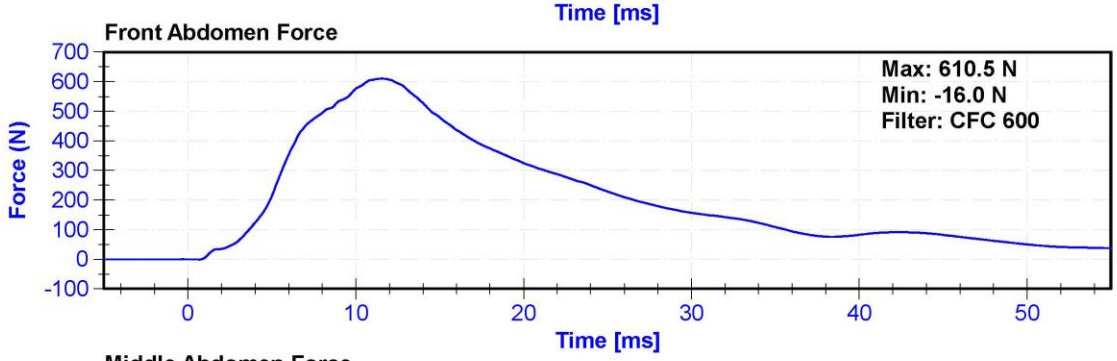
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	23.6	Pass
Velocity	3.9	4.1	m/s	4.02	Pass
Combined Abdomen Force	2200	2700	N	2576.6	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.00	Pass
Resistive Probe Force	4000	4800	N	4402.1	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.65	Pass

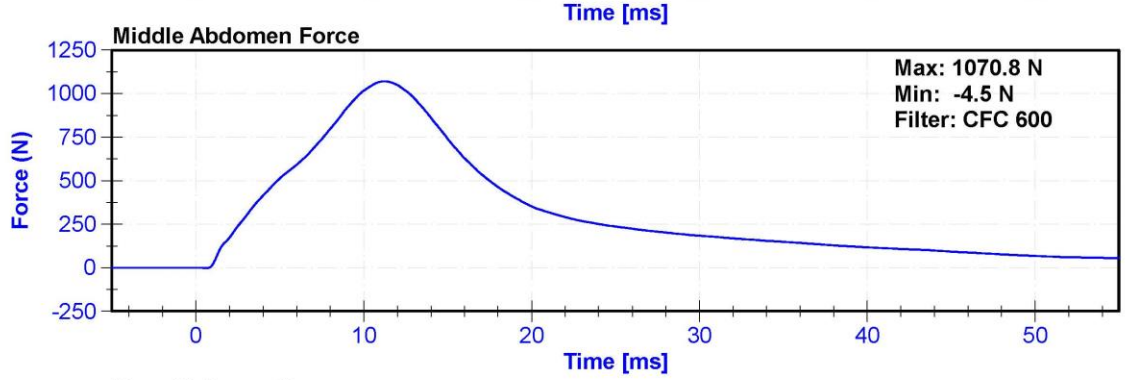
Transducer Calibrations

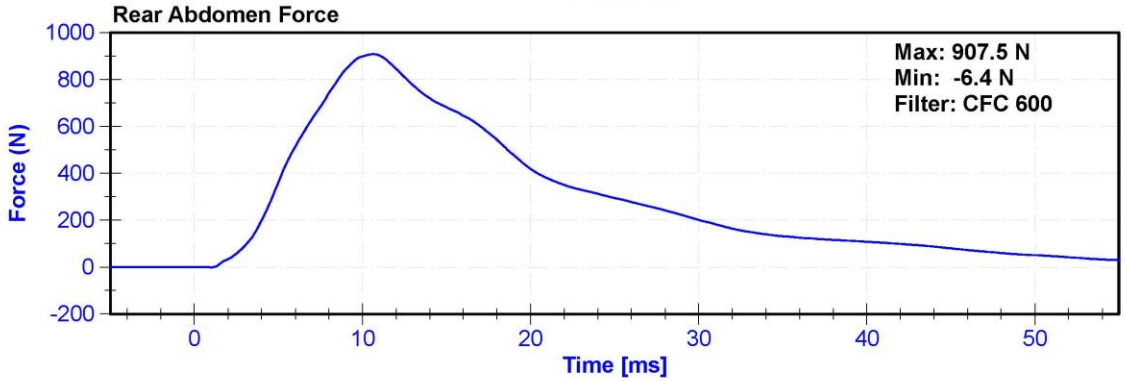
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Front Abdomen Load Cell	DENTON 2631	LC-1440	6/4/2018	6/4/2019
Middle Abdomen Load Cell	DENTON 2631	LC-1525	6/4/2018	6/4/2019
Rear Abdomen Load Cell	DENTON 2631	LC-1528	6/4/2018	6/4/2019




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2576.6 N
Min: -25.0 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 610.5 N
Min: -16.0 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1070.8 N
Min: -4.5 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 907.5 N
Min: -6.4 N
Filter: CFC 600

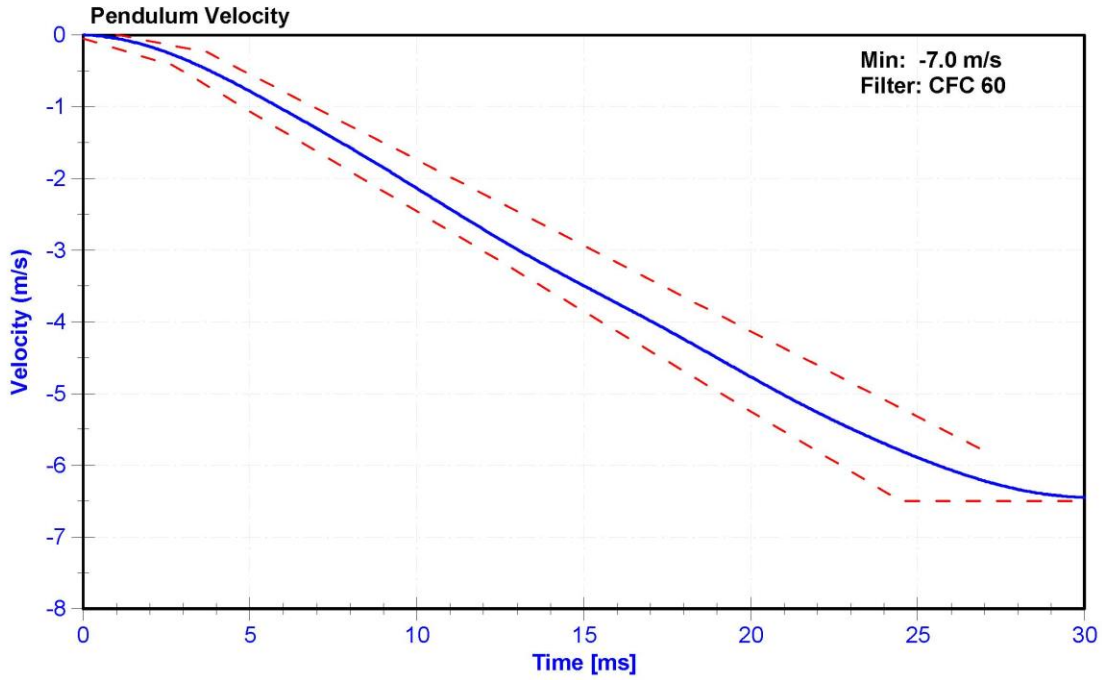
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

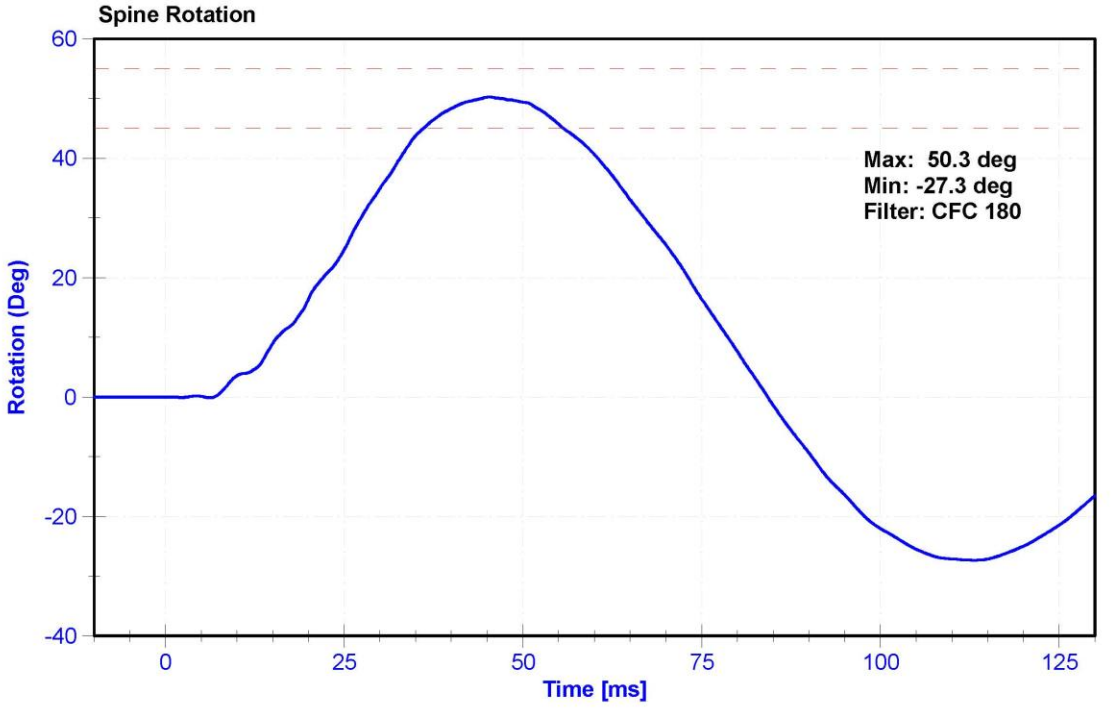
Results

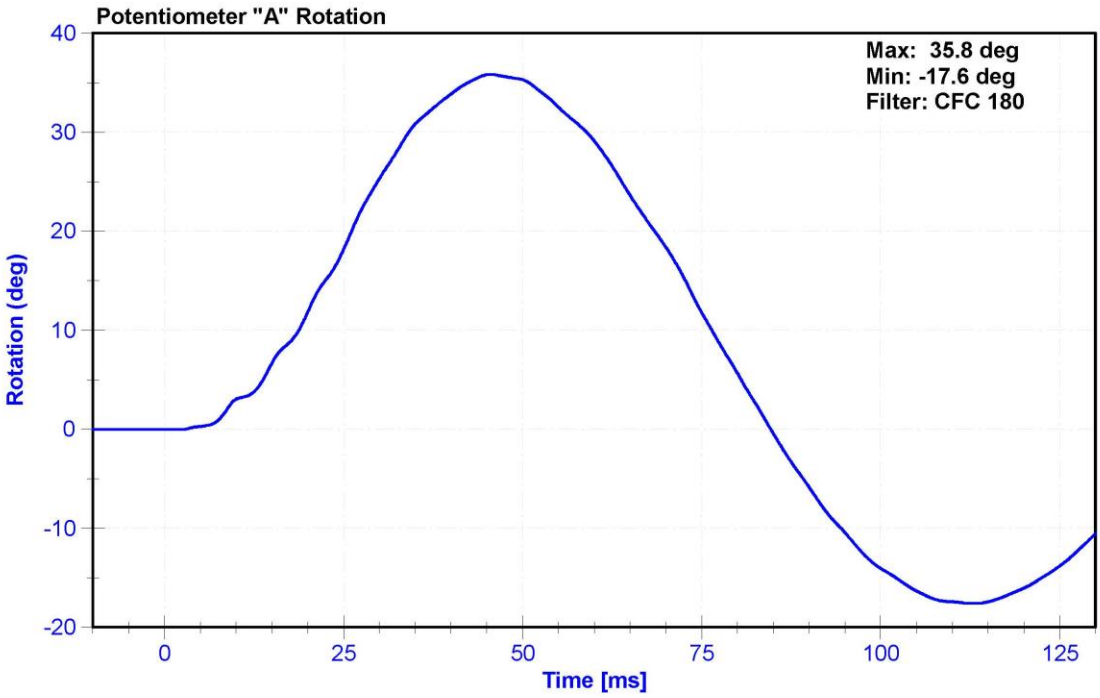
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	24.4	Pass
Velocity	5.95	6.15	m/s	6.113	Pass
Lateral Spine Rotation	45	55	deg	50.3	Pass
Time at Maximum Rotation	39	53	ms	45.2	Pass
Time of Decay to Zero Degrees	37	57	ms	39.1	Pass
Pulse within Corridor?	-	-	-		

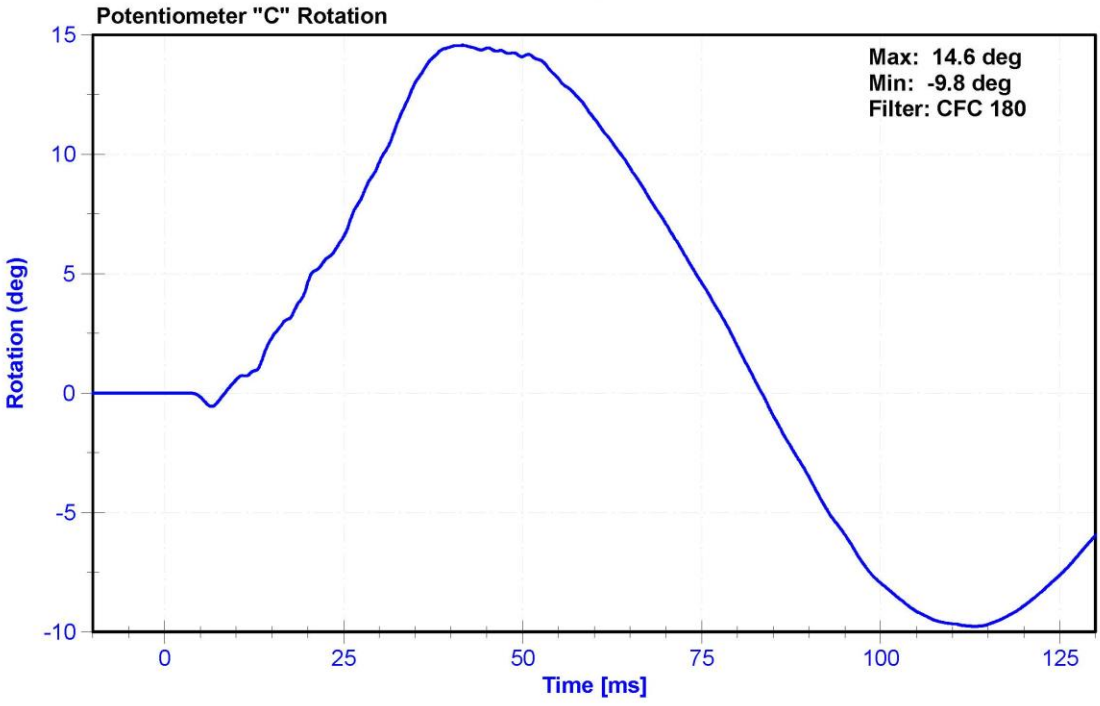
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5F3	5/11/2018	5/11/2019
Pendulum "A" Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Condyle "B" Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019


Pendulum Velocity
Min: -7.0 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: 50.3 deg
Min: -27.3 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 35.8 deg
Min: -17.6 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: 14.6 deg
Min: -9.8 deg
Filter: CFC 180
Rotation (deg)
15
10
5
0
-5
-10
0
25
50
75
100
125
Time [ms]

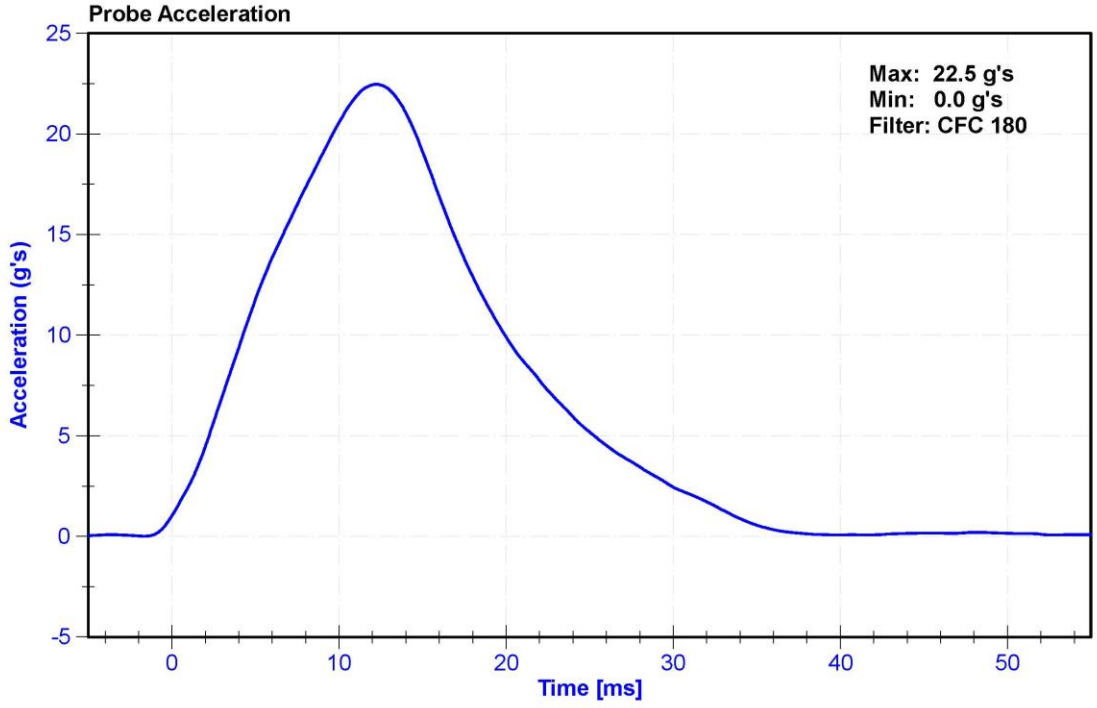
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

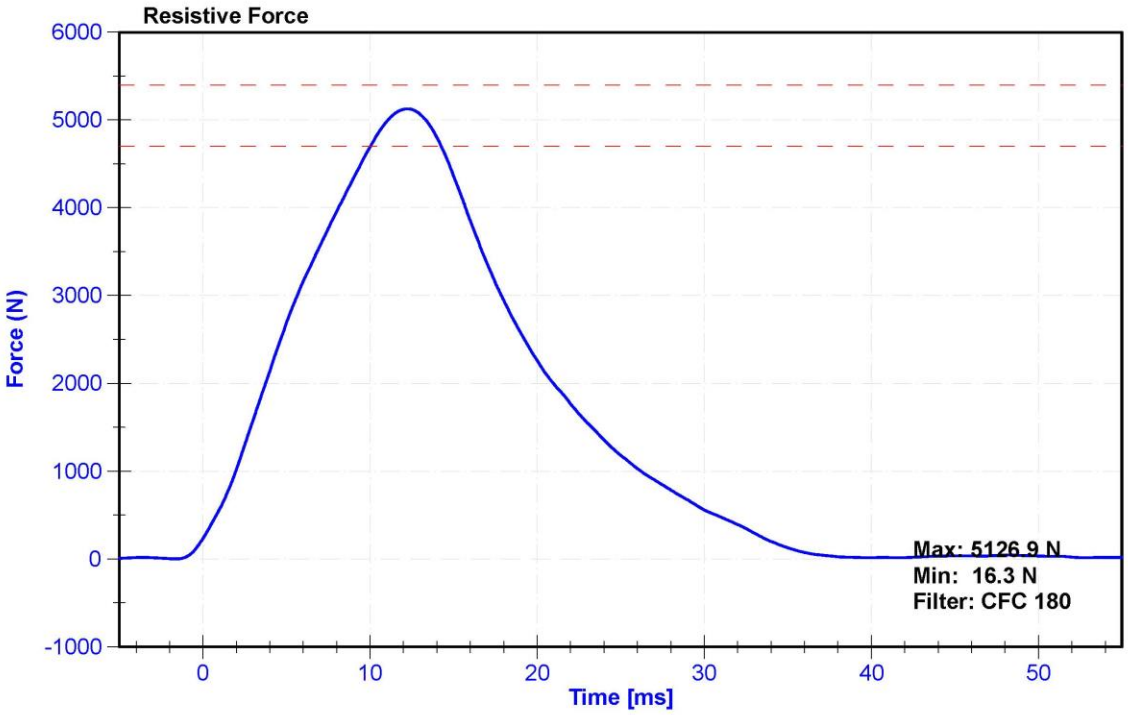
Results

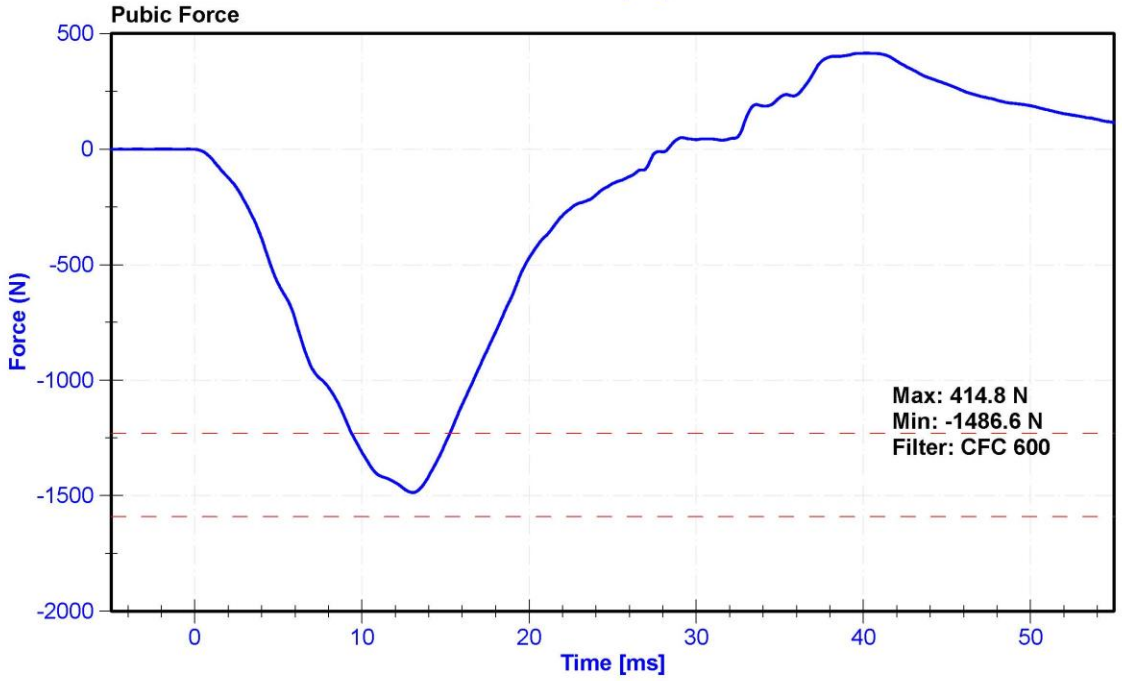
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	26.0	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Resistive Force	4700	5400	N	5126.9	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.25	Pass
Pubic Force	-1590	-1230	N	-1486.6	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	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Pubic Load Cell	Denton 3096JFL	LC-464fy	6/4/2018	6/4/2019




Resistive Force
Force (N)
Time [ms]
Max: 5126.9 N
Min: 16.3 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 414.8 N
Min: -1486.6 N
Filter: CFC 600

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

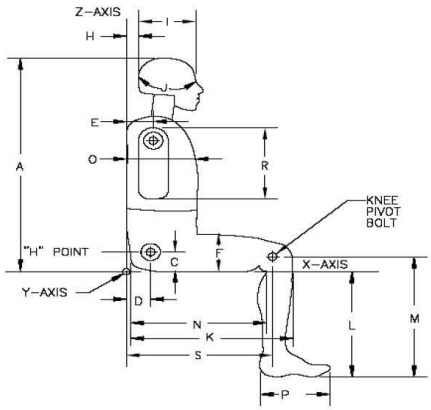
SERIAL No: DG8012

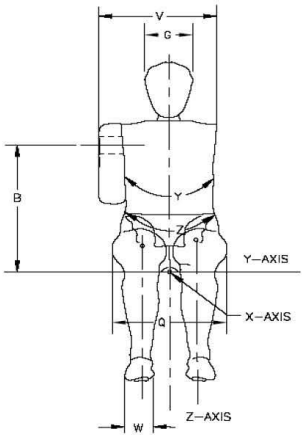
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: K. Dutton Date: 01/11/2019

Dummy Serial Number: DG8012





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	781	Pass
B	Shoulder Pivot Height	437	453	448	Pass
C	H-point Height	79	89	86	Pass
D	H-point from seatback	141	151	146	Pass
E	Shoulder Pivot from Backline	97	107	104	Pass
F	Thigh Clearance	119	135	128	Pass
G	Head Breadth	140	148	143	Pass
H	Head Back from Backline	40	46	44	Pass
I	Head Depth	178	188	185	Pass
J	Head Circumference	541	551	547	Pass
K	Buttock to Knee Length	514	540	531	Pass
L	Popliteal Height	343	369	356	Pass
M	Knee Pivot to floor height	392	409	401	Pass
N	Buttock Popliteal Length	416	442	433	Pass
O	Chest Depth w/o jacket	195	211	206	Pass
P	Foot Length	216	232	221	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	319	Pass
R	Arm Length	249	259	254	Pass
S	Knee Joint to seatback	477	493	485	Pass
V	Shoulder Width	341	357	344	Pass
W	Foot Width	78	94	83	Pass
Y	Chest Circumference w/jacket	851	881	867	Pass
Z	Waist Circumference	761	791	778	Pass

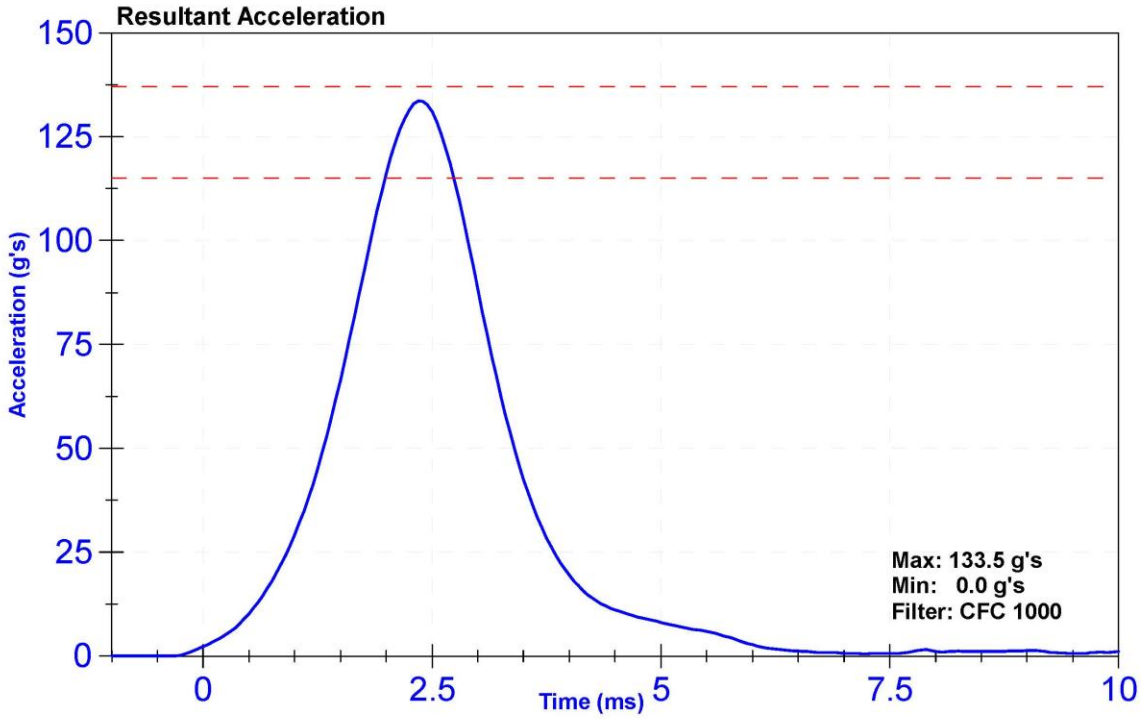
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

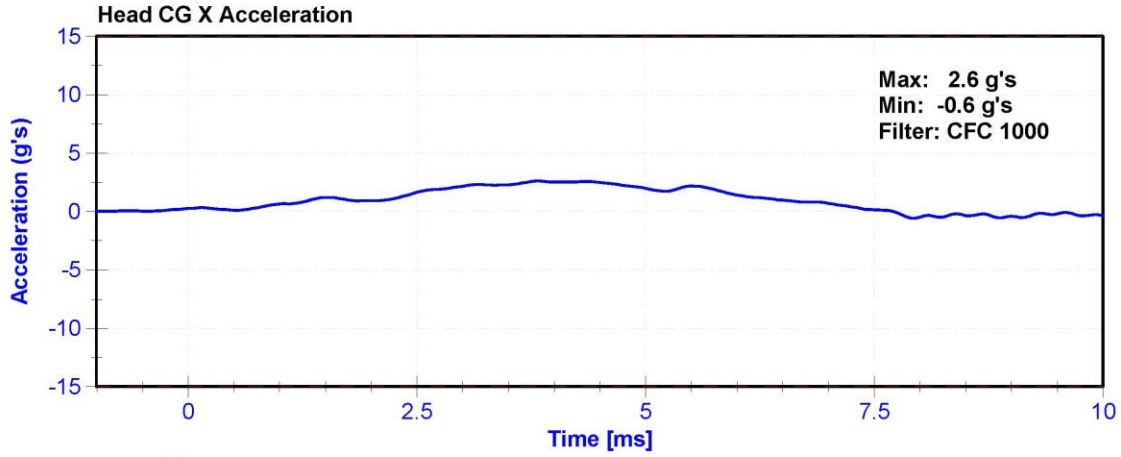
Results

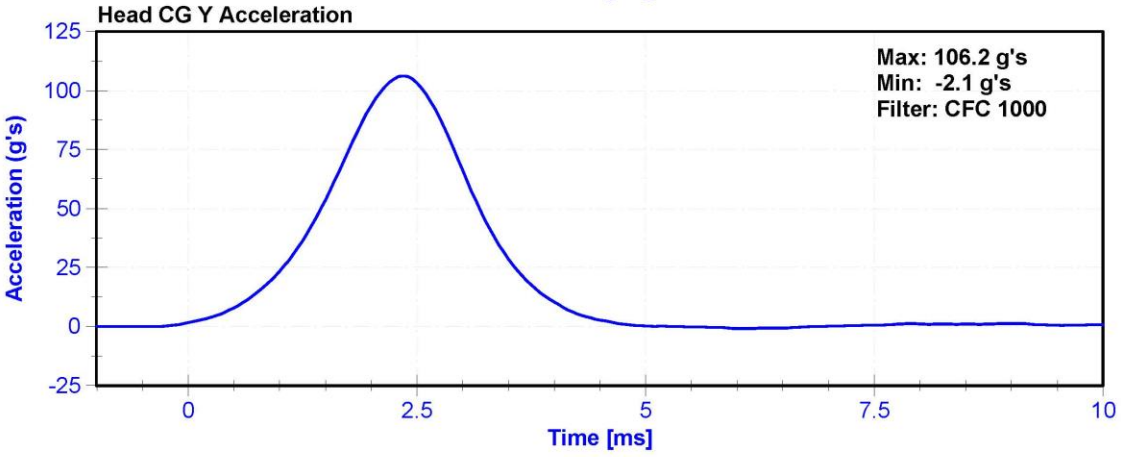
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	21.6	Pass
Resultant Acceleration	115	137	g's	133.5	Pass
Oscillation	0	15	%	2.0	Pass
Fore-Aft Acceleration	-15	15	g's	2.6	Pass

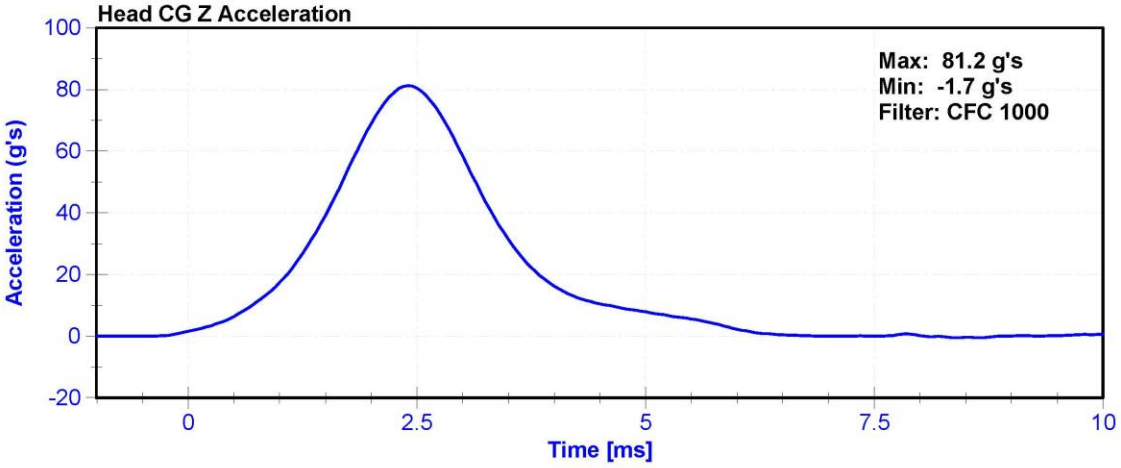
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264	AC-P74788	10/18/2018	4/18/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P83432	10/18/2018	4/18/2019
Z Accelerometer	ENDEVCO 7264	AC-P83319	10/18/2018	4/18/2019




Head CG X Acceleration
Max: 2.6 g's
Min: -0.6 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: 106.2 g's
Min: -2.1 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: 81.2 g's
Min: -1.7 g's
Filter: CFC 1000
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]

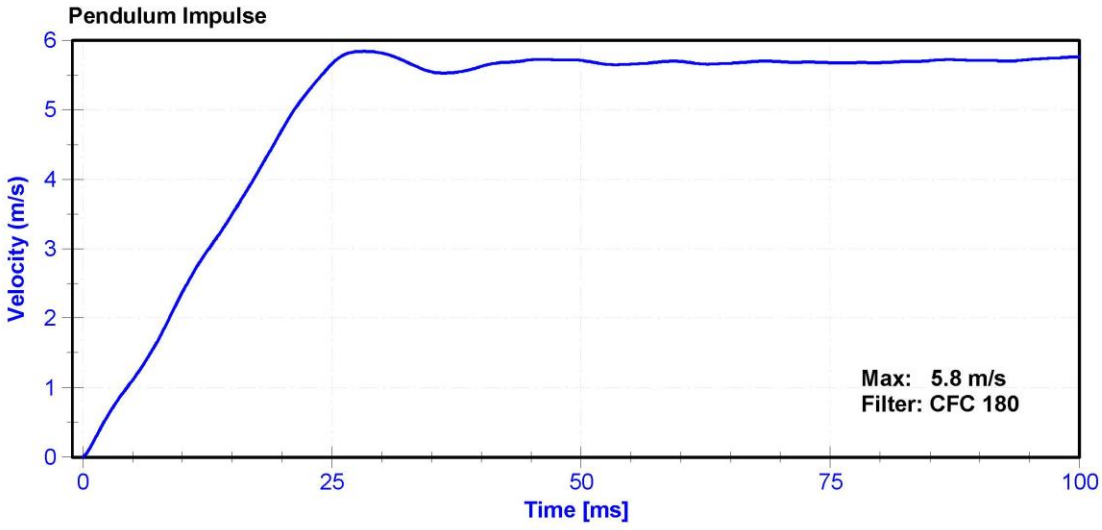
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

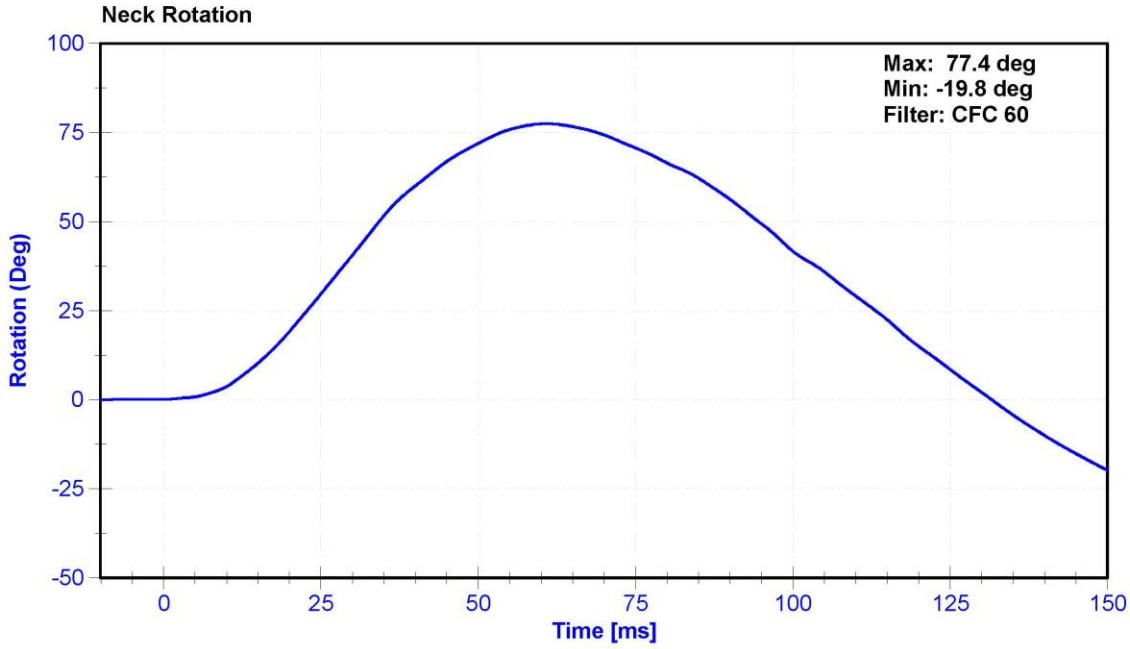
Results

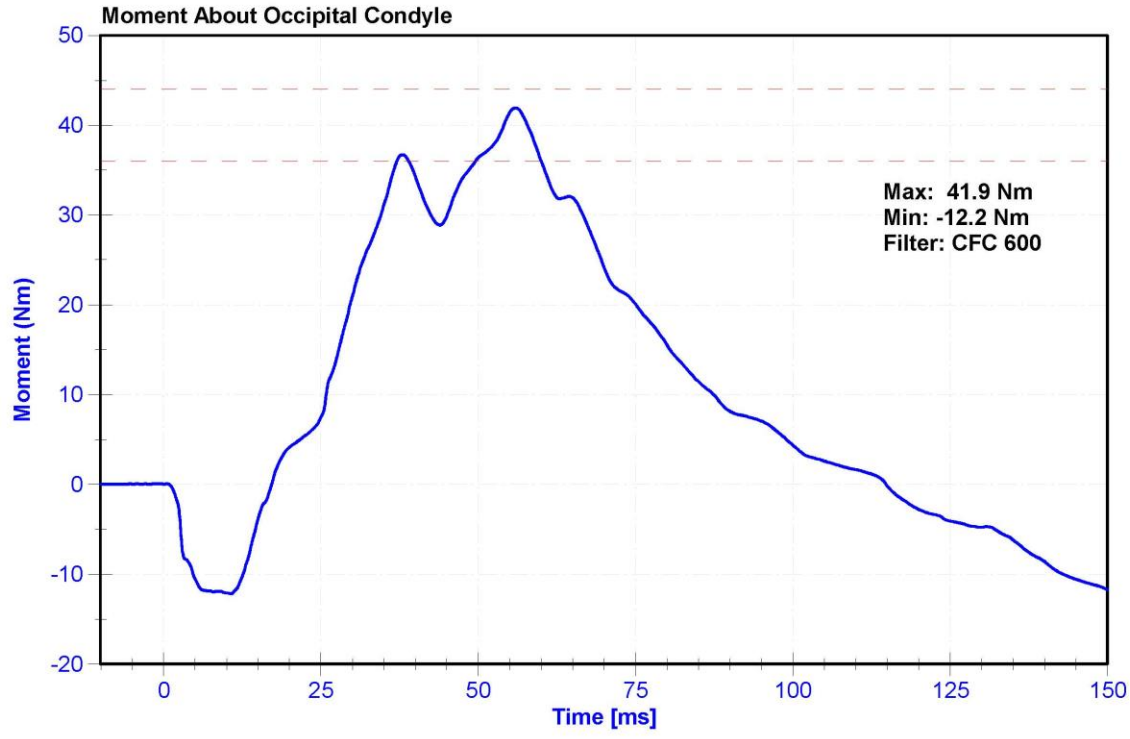
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	20.6	Pass
Velocity	5.51	5.63	m/s	5.546	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.37	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.50	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.71	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.66	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.84	Pass
Neck Rotation	71	81	deg	77.4	Pass
Time at Maximum Rotation	50	70	ms	60.8	Pass
Moment about the OC	36	44	Nm	41.9	Pass
Moment Decay to 0 Nm	102	126	ms	114.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5F3	5/11/2018	5/11/2019
Pendulum Potentiometer	Denton 78051-342	DS-184Pend	11/1/2018	11/1/2019
Condyle Potentiometer	Denton 78051-342	DS-185Pend	11/1/2018	11/1/2019
Upper Neck Load Cell	Denton 1716	LC-2018 FY	9/28/2018	9/28/2019




Neck Rotation
Max: 77.4 deg
Min: -19.8 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: 41.9 Nm
Min: -12.2 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

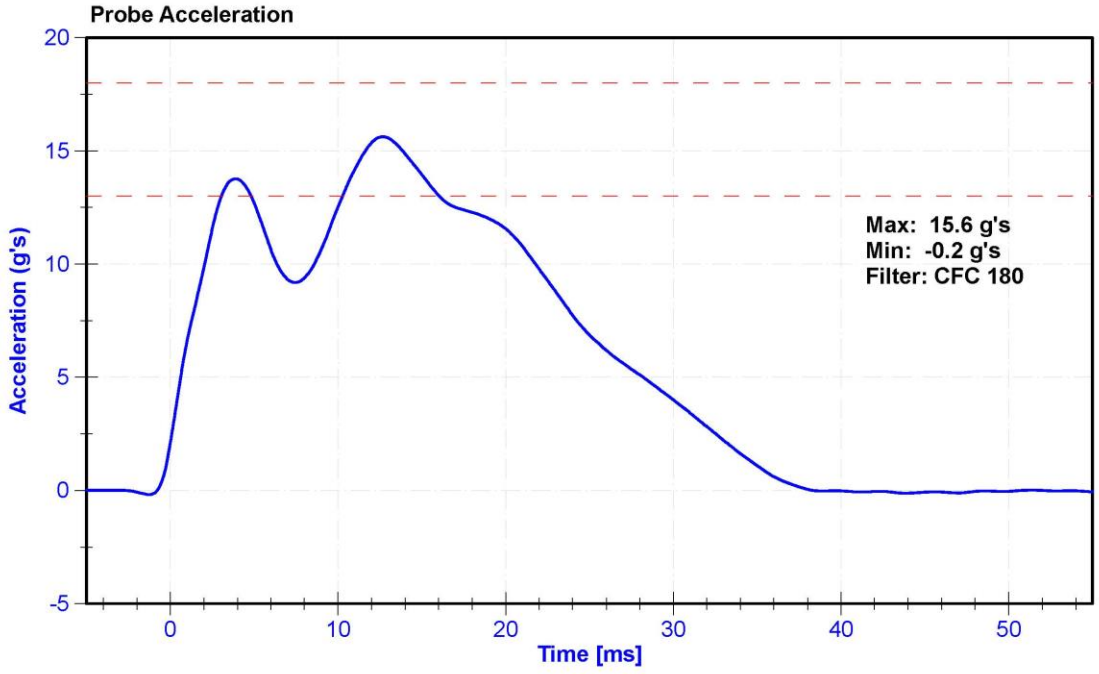
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

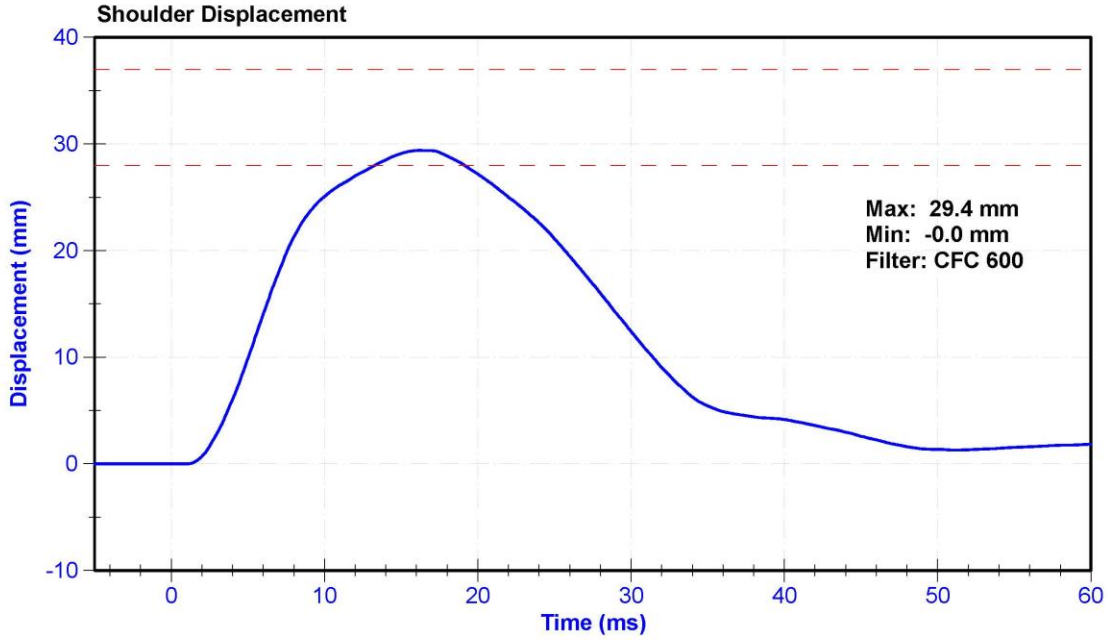
Results

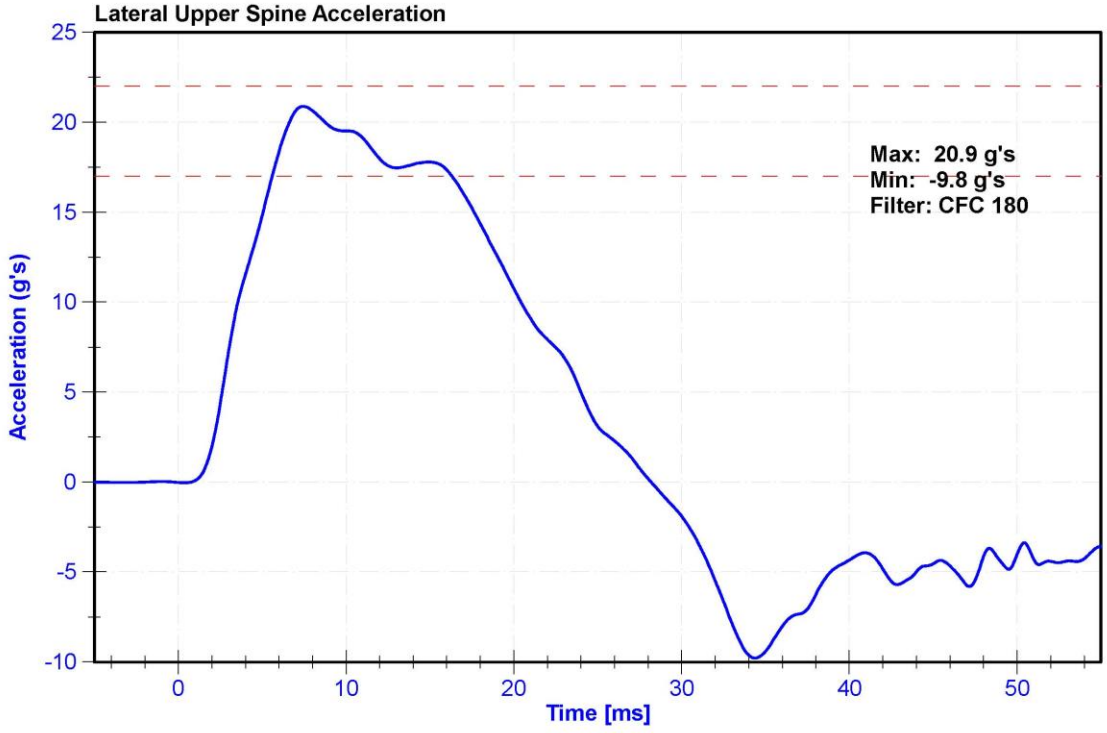
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	19.9	Pass
Velocity	4.2	4.4	m/s	4.36	Pass
Probe Acceleration	13	18	g's	15.6	Pass
Shoulder Deflection	28	37	mm	29.4	Pass
Lateral Upper Spine Acceleration	17	22	g's	20.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360MAC7	AC-P94667	11/1/2018	11/1/2019
Shoulder Potentiometer	Servo 08TC1-3745	DS-1845GFE	10/11/2018	10/11/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/23/2018	4/23/2019




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 29.4 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 20.9 g's
Min: -9.8 g's
Filter: CFC 180

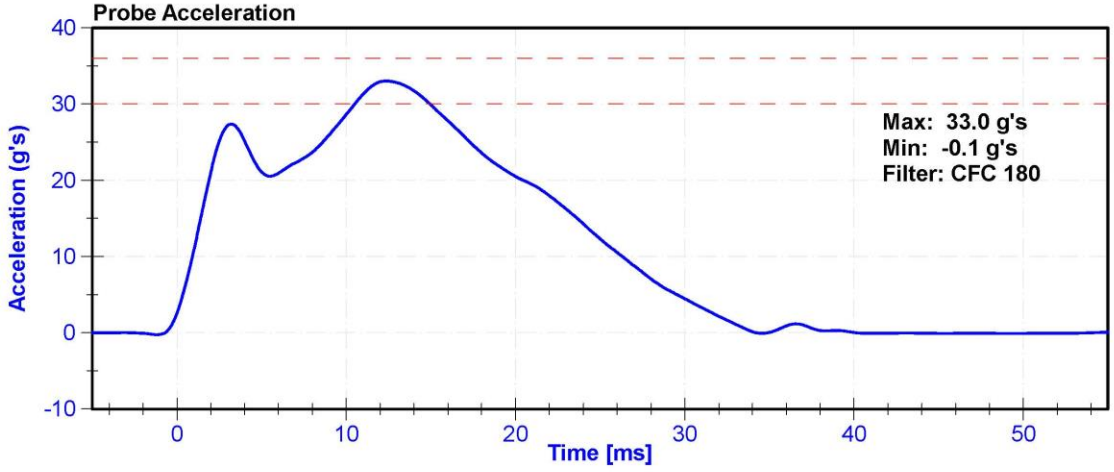
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

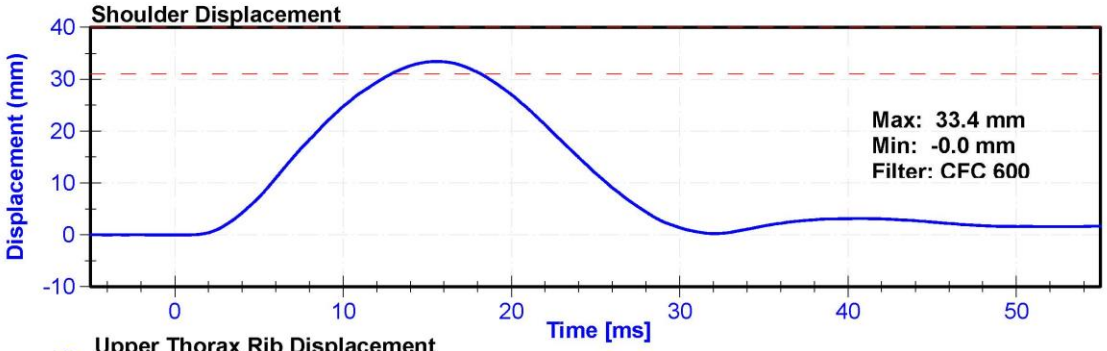
Results

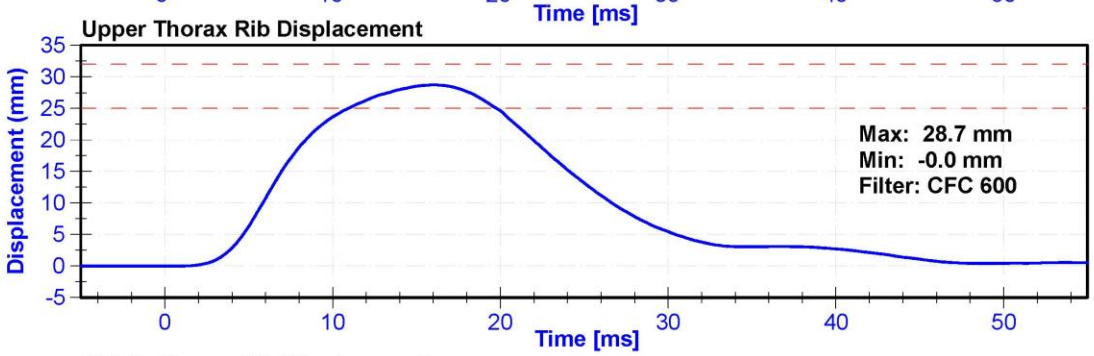
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	17.9	Pass
Velocity	6.6	6.8	m/s	6.77	Pass
Probe Acceleration after 5 ms	30	36	g's	33.0	Pass
Lateral Upper Spine Acceleration	34	43	g's	40.1	Pass
Lateral Lower Spine Acceleration	29	37	g's	32.6	Pass
Shoulder Deflection	31	40	mm	33.4	Pass
Upper Thorax Rib Deflection	25	32	mm	28.7	Pass
Mid Thorax Rib Deflection	30	36	mm	33.0	Pass
Lower Thorax Rib Deflection	32	38	mm	34.7	Pass

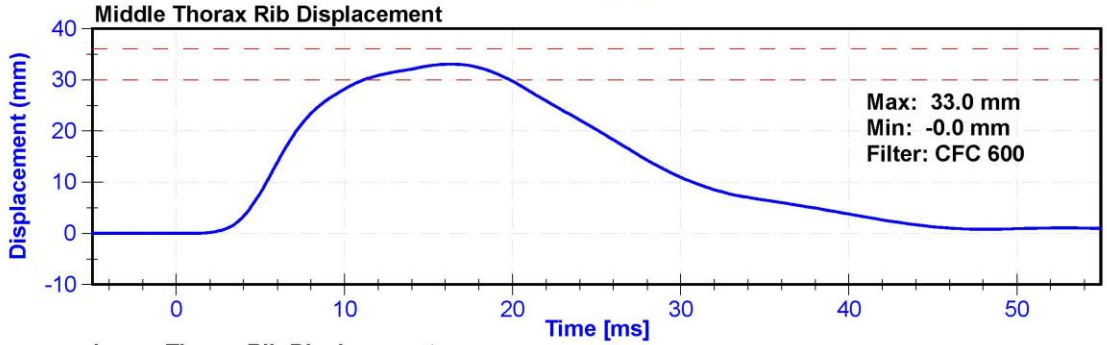
Transducer Calibrations

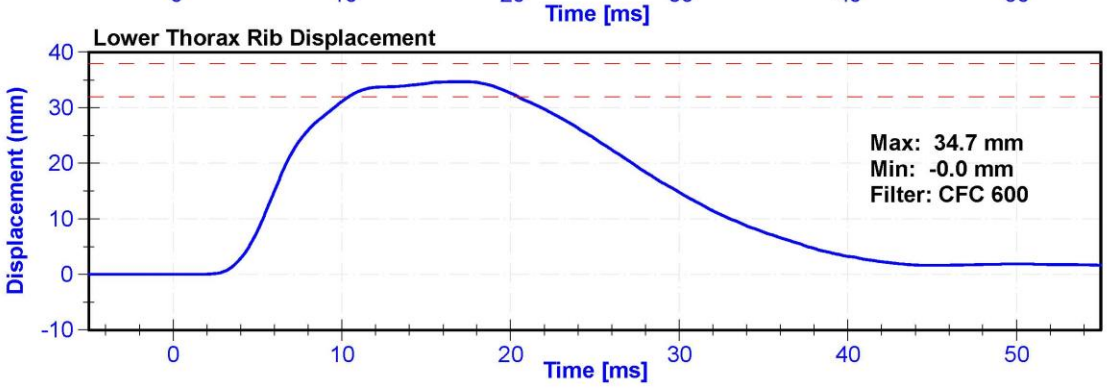
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/23/2018	4/23/2019
Upper Spine T12 Y Accelerometer	ENDEVCO 7264CT	AC-P51699	10/16/2018	4/16/2019
Shoulder Potentiometer	Servo 08TC1-3745	DS-1845GFE	10/11/2018	10/11/2019
Upper Thorax Rib Potentiometer	Servo 1246	DS-2165GFE	5/15/2018	5/15/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3621	DS-45 GFE	10/12/2018	10/12/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3787	DS-011GFE	10/12/2018	10/12/2019

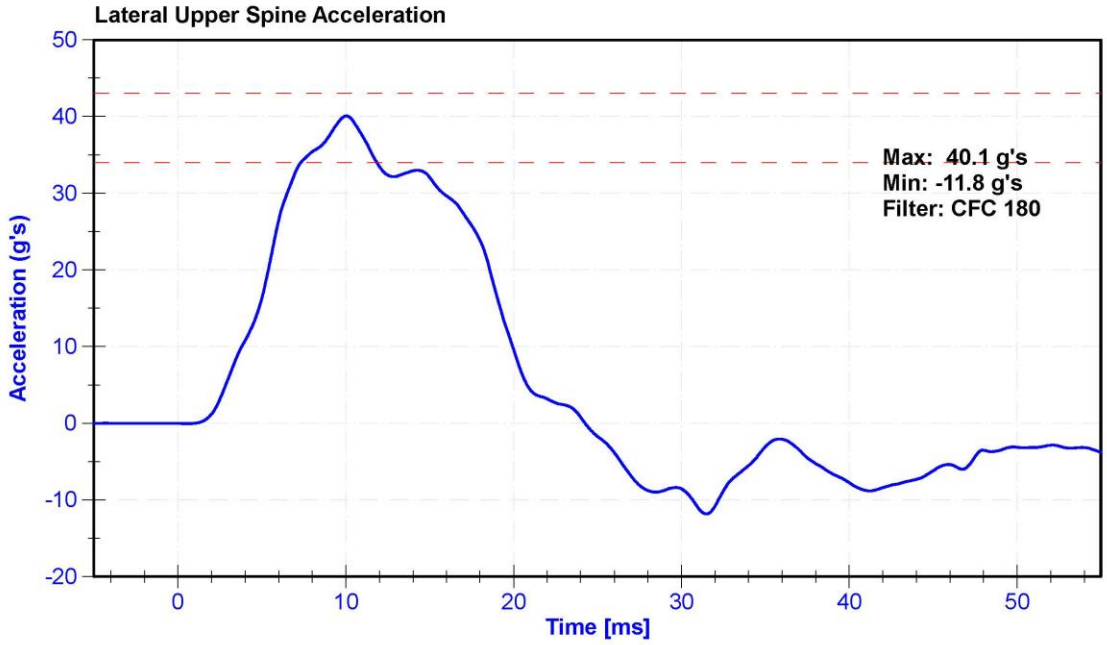


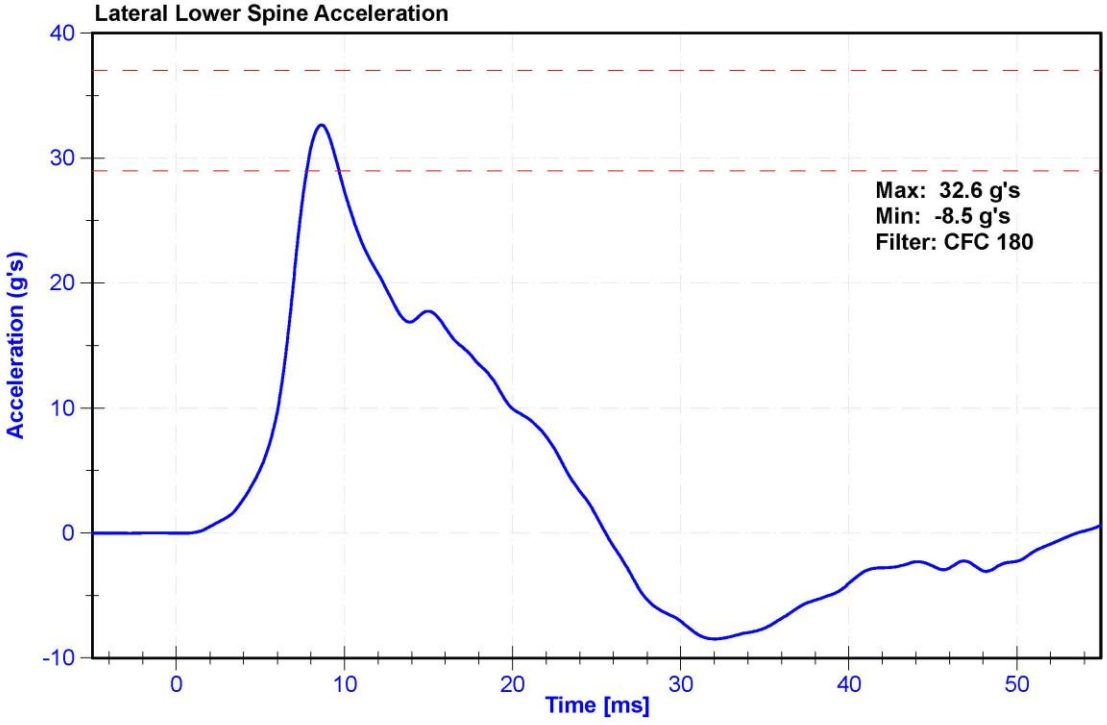

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 33.4 mm
Min: -0.0 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 28.7 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 33.0 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 34.7 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 40.1 g's
Min: -11.8 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]


Lateral Lower Spine Acceleration
Max: 32.6 g's
Min: -8.5 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]

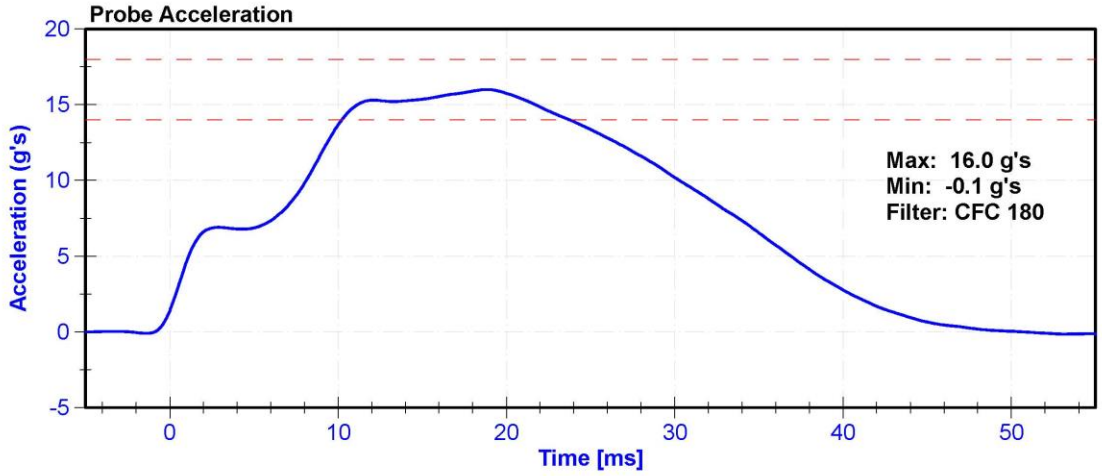
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

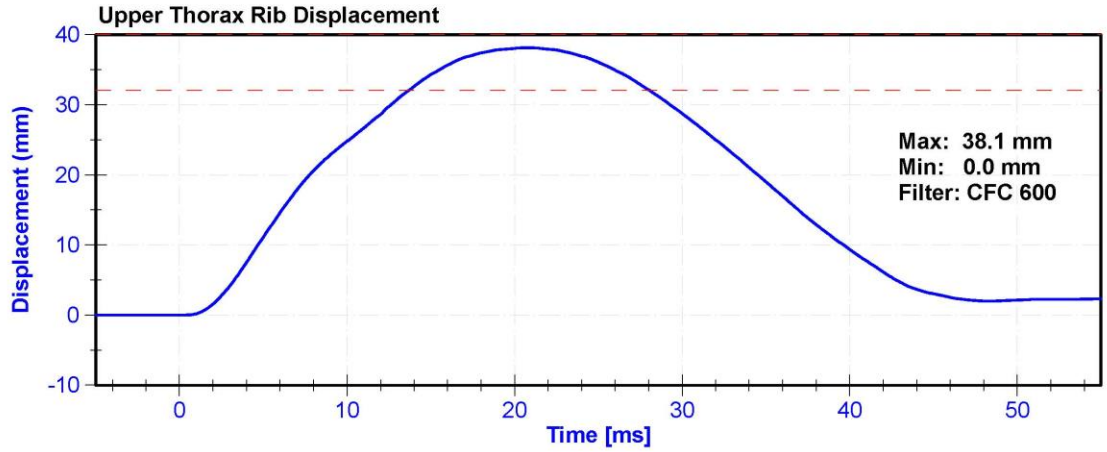
Results

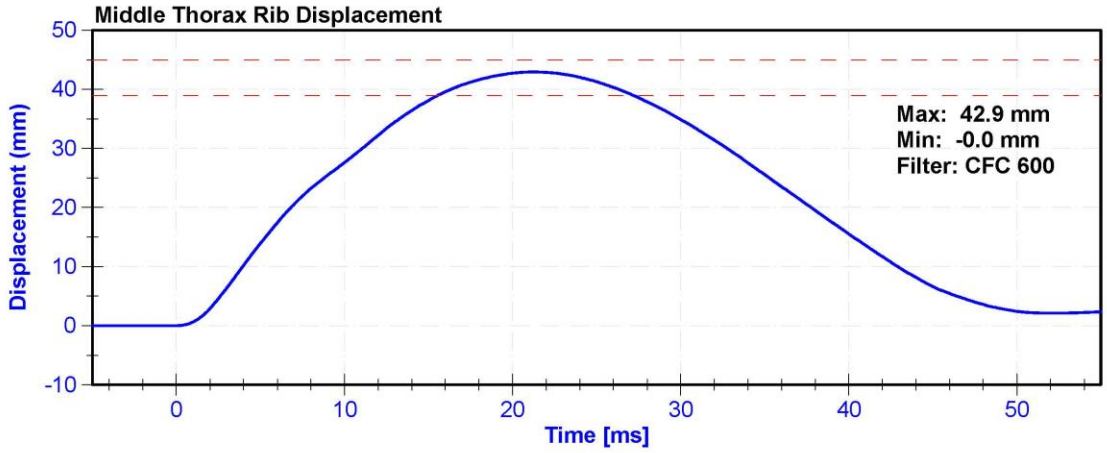
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.2	Pass
Humidity	10	70	%	19.5	Pass
Velocity	4.2	4.4	m/s	4.35	Pass
Probe Acceleration	14	18	g's	16.0	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.3	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.7	Pass
Upper Thorax Rib Deflection	32	40	mm	38.1	Pass
Middle Thorax Rib Deflection	39	45	mm	42.9	Pass
Lower Thorax Rib Deflection	35	43	mm	39.0	Pass

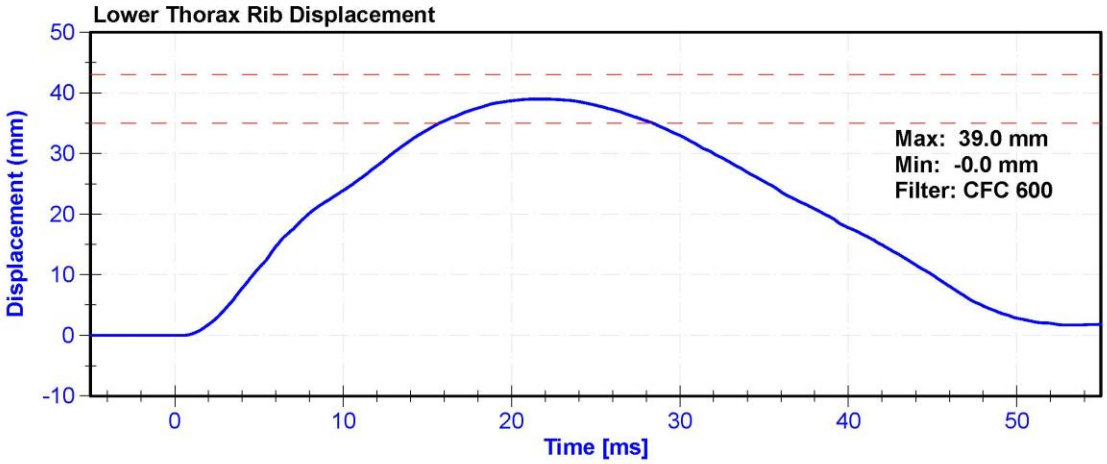
Transducer Calibrations

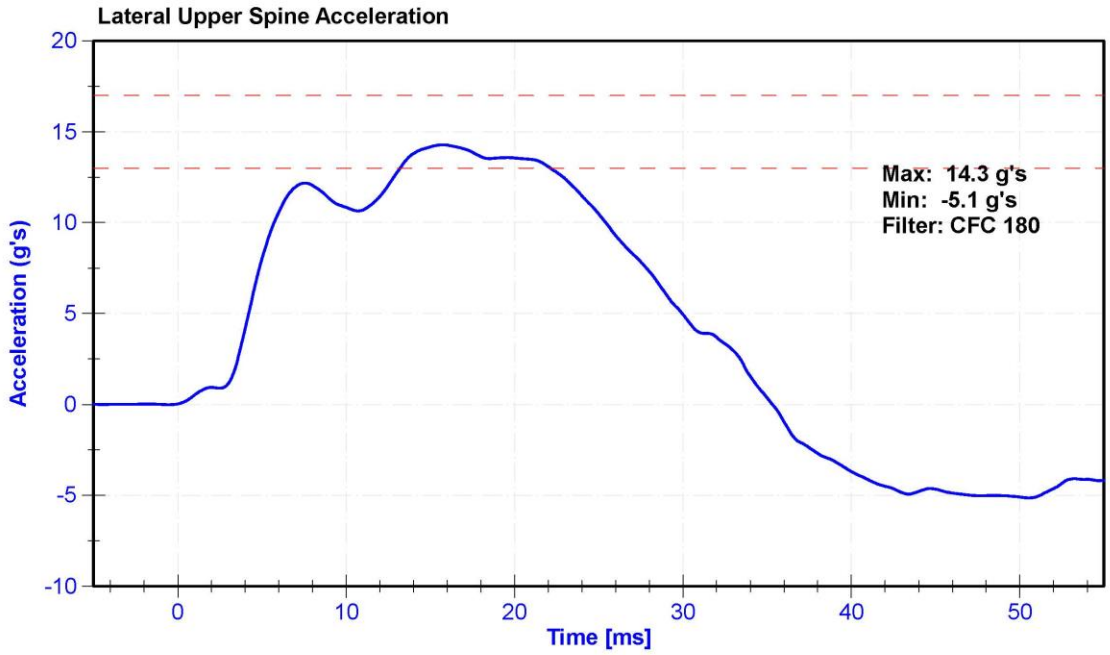
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/23/2018	4/23/2019
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51699	10/16/2018	4/16/2019
Upper Thorax Rib Potentiometer	Servo 1246	DS-2165GFE	5/15/2018	5/15/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3621	DS-45 GFE	10/12/2018	10/12/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3787	DS-011GFE	10/12/2018	10/12/2019

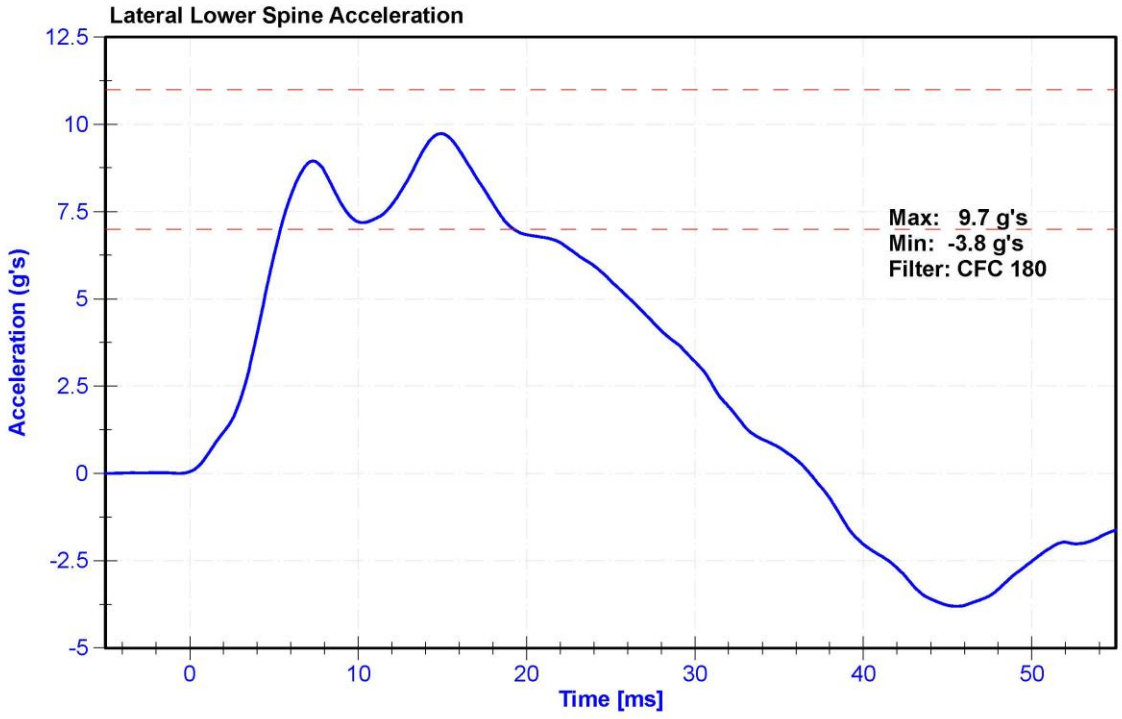



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 38.1 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 42.9 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 39.0 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 14.3 g's
Min: -5.1 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: 9.7 g's
Min: -3.8 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

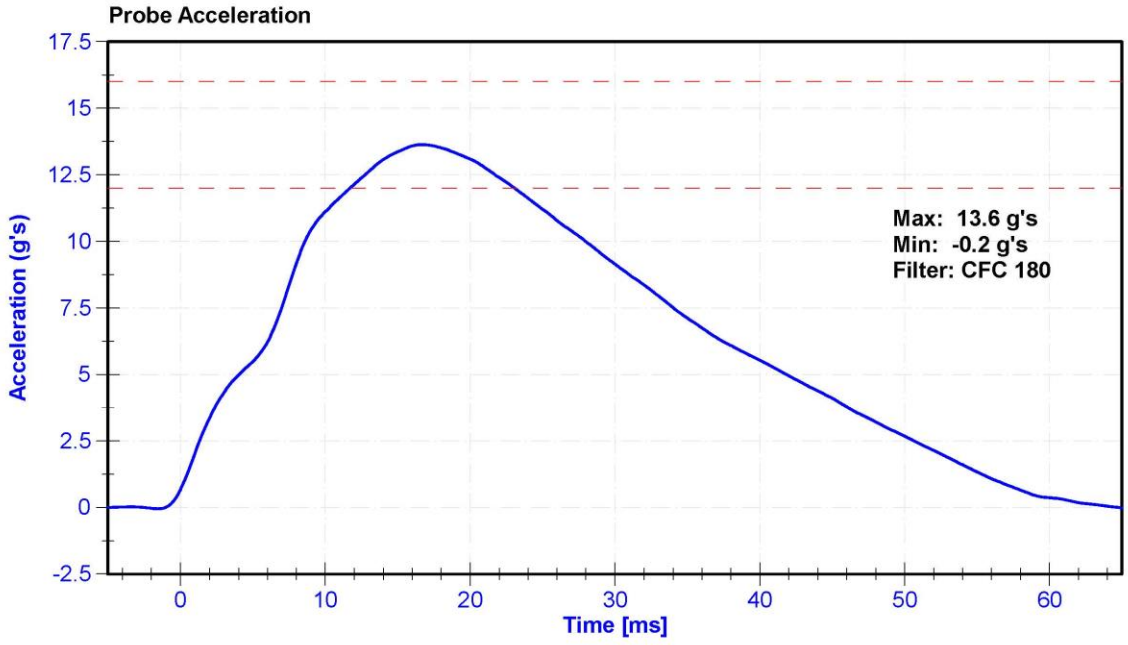
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

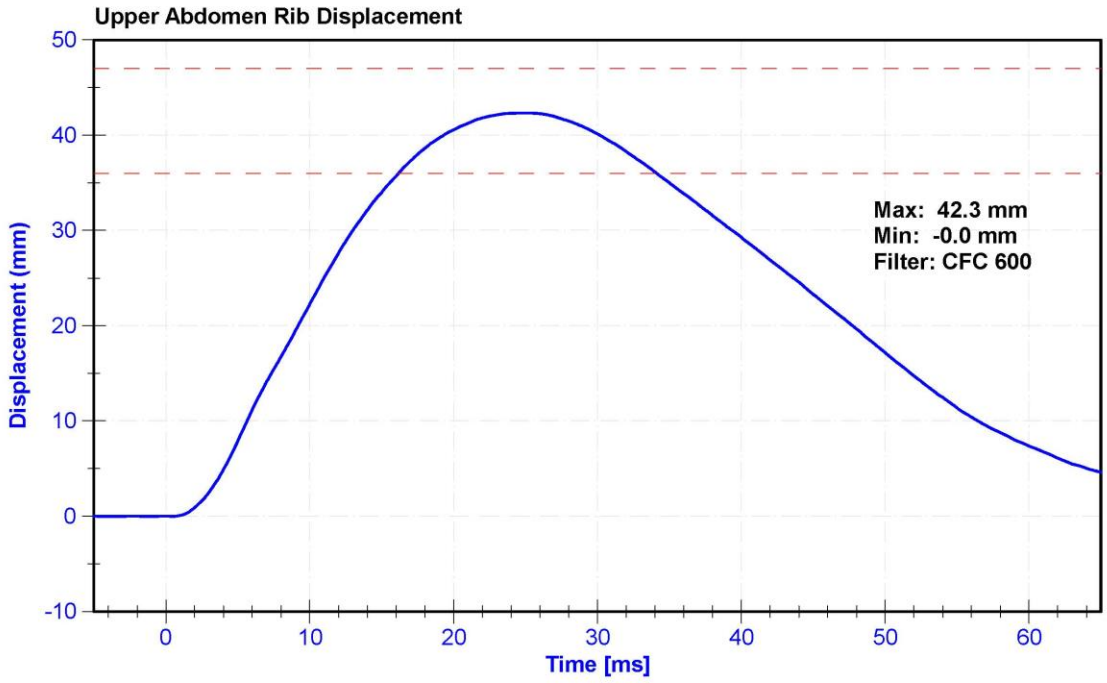
Results

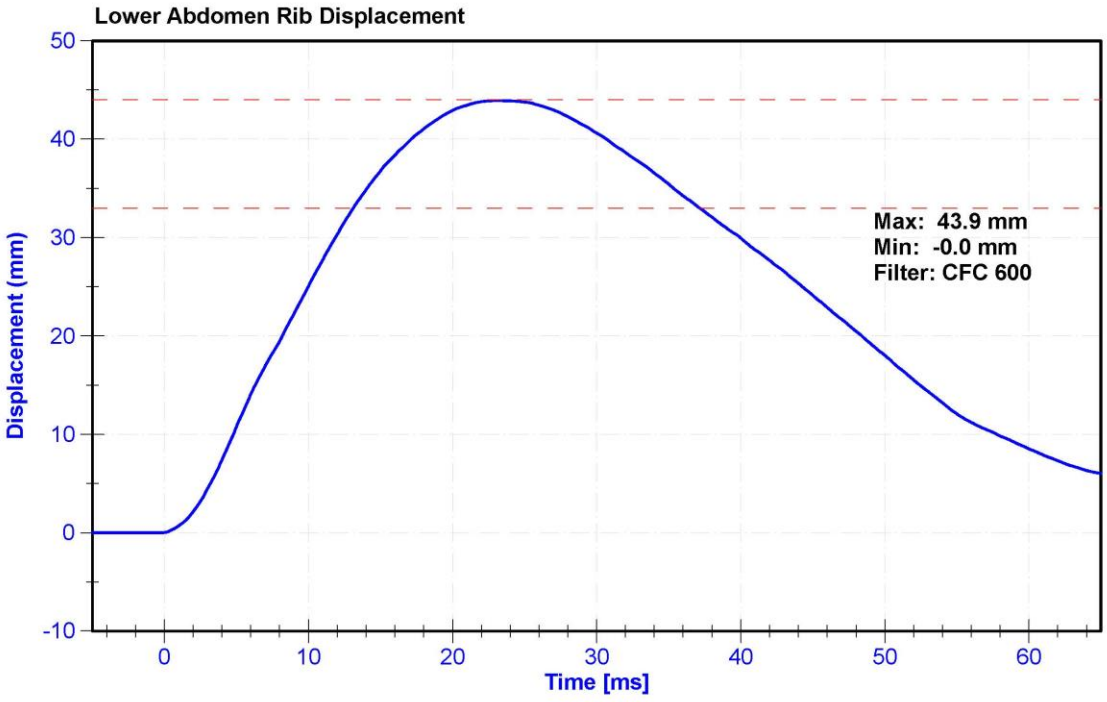
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	25.1	Pass
Velocity	4.2	4.4	m/s	4.36	Pass
Probe Acceleration	12	16	g's	13.6	Pass
Lateral Lower Spine Acceleration	9	14	g's	9.7	Pass
Upper Abdomen Rib Deflection	36	47	mm	42.3	Pass
Lower Abdomen Rib Deflection	33	44	mm	43.9	Pass

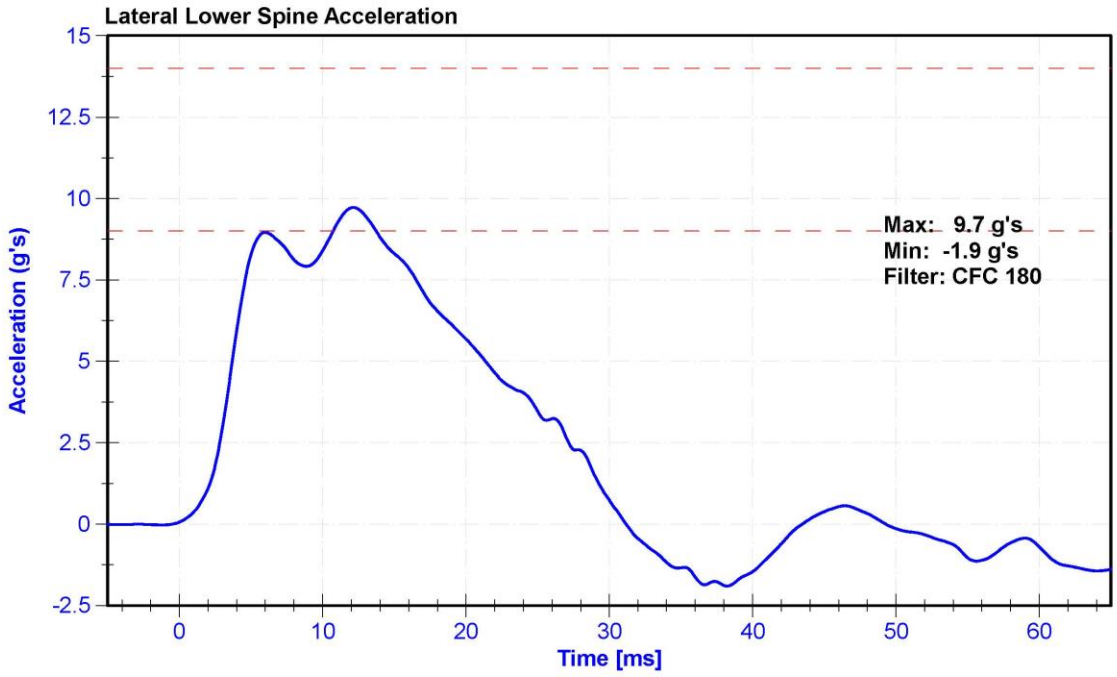
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco 7264C-2KTZ-2-360MAC	AC-P94667	11/1/2018	11/1/2019
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51699	10/16/2018	4/16/2019
Upper Abdomen Rib Potentiometer	Servo 08TC1-3725	DS-008GFE	10/11/2018	10/11/2019
Lower Abdomen Rib Potentiometer	Servo 08TC1-3745	DS-1774GFE	10/12/2018	10/12/2019




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 42.3 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 43.9 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: 9.7 g's
Min: -1.9 g's
Filter: CFC 180

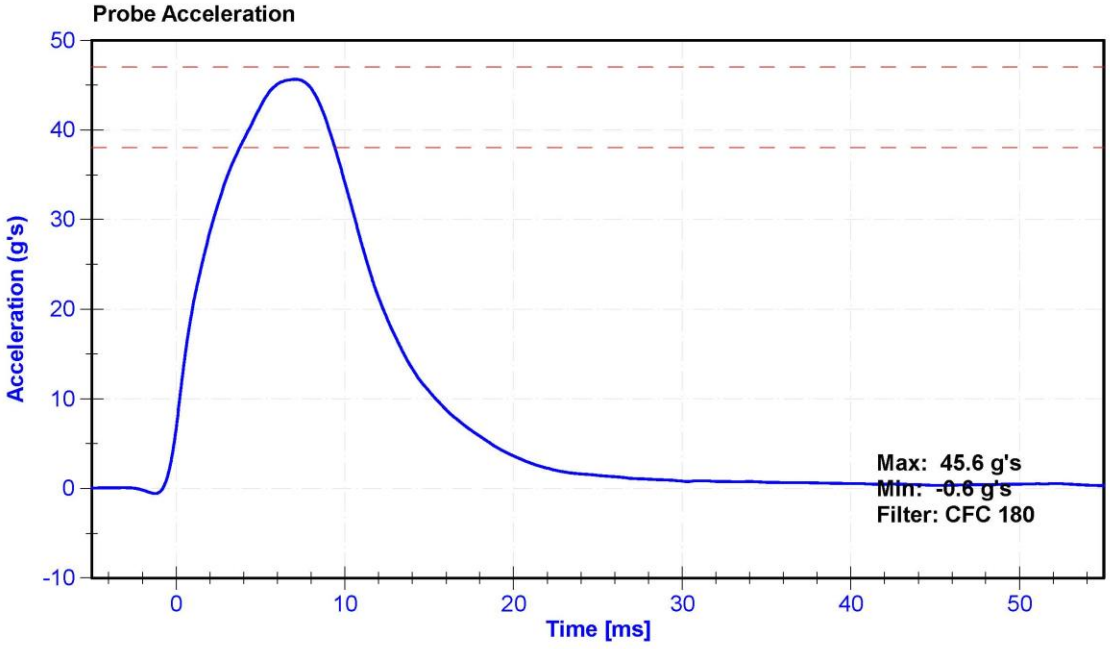
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

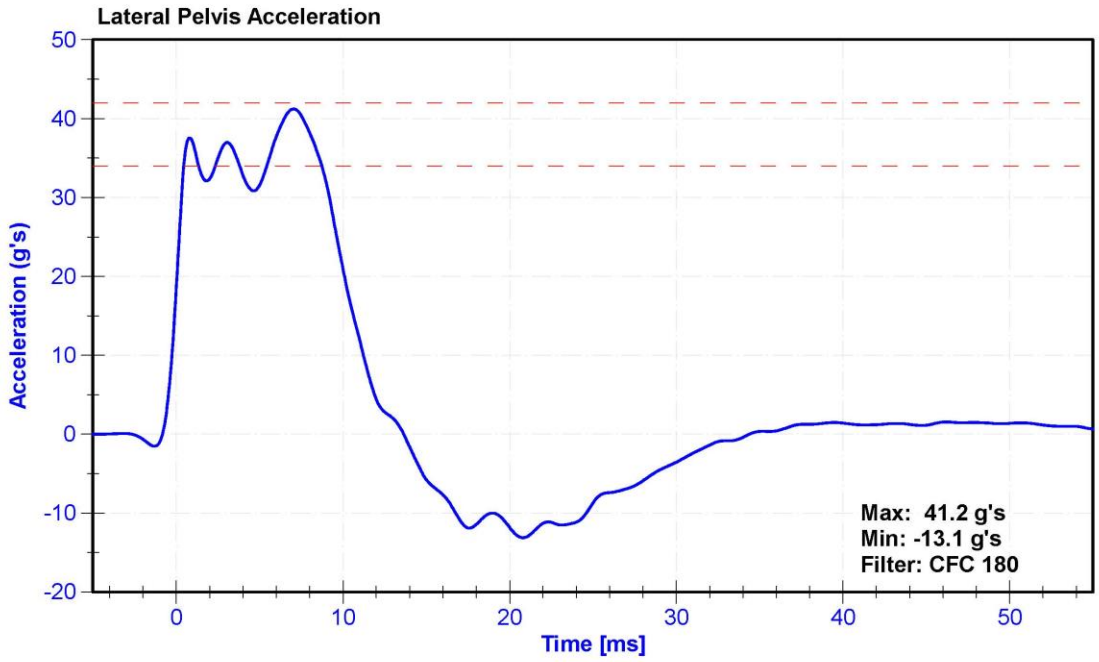
Results

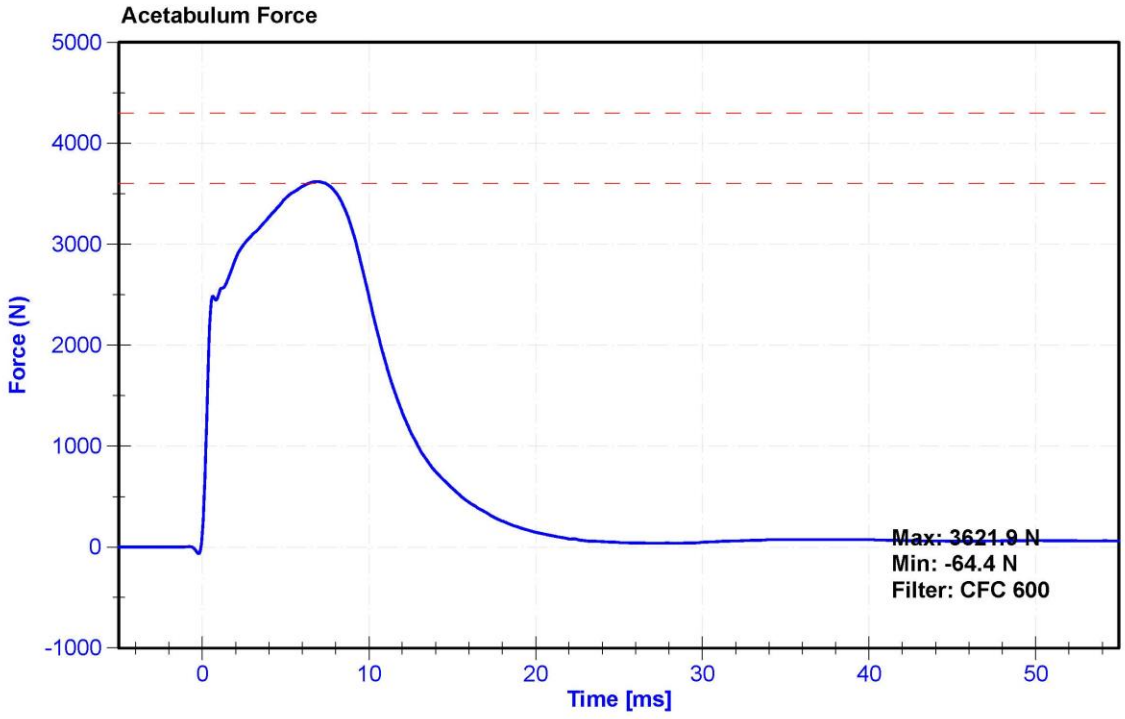
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	25	Pass
Velocity	6.6	6.8	m/s	6.67	Pass
Probe Acceleration	38	47	g's	45.6	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.2	Pass
Acetabulum Force	3600	4300	N	3621.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51875	10/17/2018	4/17/2019
Acetabulum Load Cell	Denton 3249J	LC-4986Fy	6/4/2018	6/4/2019
Certification Plug	Humanetics	11558	9/29/2016	N/A
Crash Test Plug	Humanetics	11587	10/4/2016	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: 41.2 g's
Min: -13.1 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: 3621.9 N
Min: -64.4 N
Filter: CFC 600

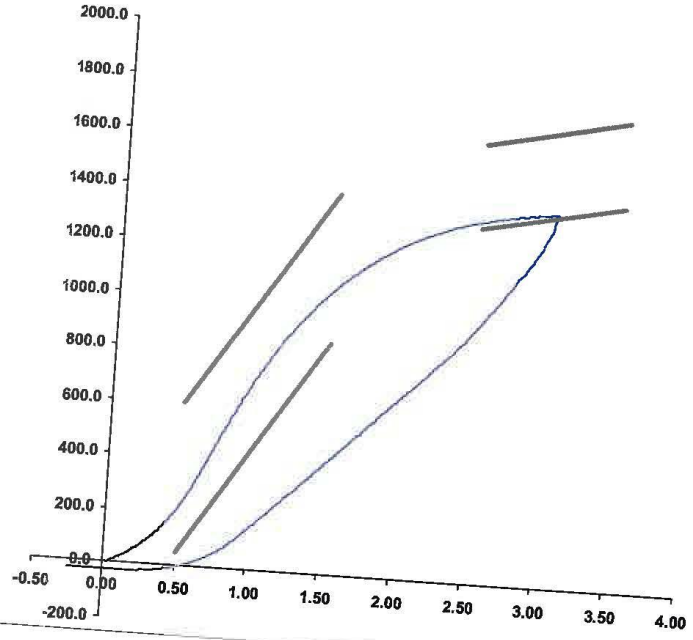
Post Crash 4/14/2019

SID-IIs Pelvis Plug Certification Test

Plug S/N 11587
Test Number 3130
Report Number 3123
Test Date 10/4/2016 12:33:20 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	218.78	50.00	600.00
Force @ 1.5 mm (N)	1,049.43	850.00	1,400.00
Force @ 2.5 mm (N)	1,332.20	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,376.56	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (TI240813), Units (LBS) 1000

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

Notes:

Operator DC

Template No 107 04-Oct-16
SACO Research

Part Number 180-4450

By : DC Date : 10/4/16

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

Cert 3 Post 1/14/2019

SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 11558
Test Number 3099
Report Number 3092
Test Date 9/29/2016 9:24:52 AM

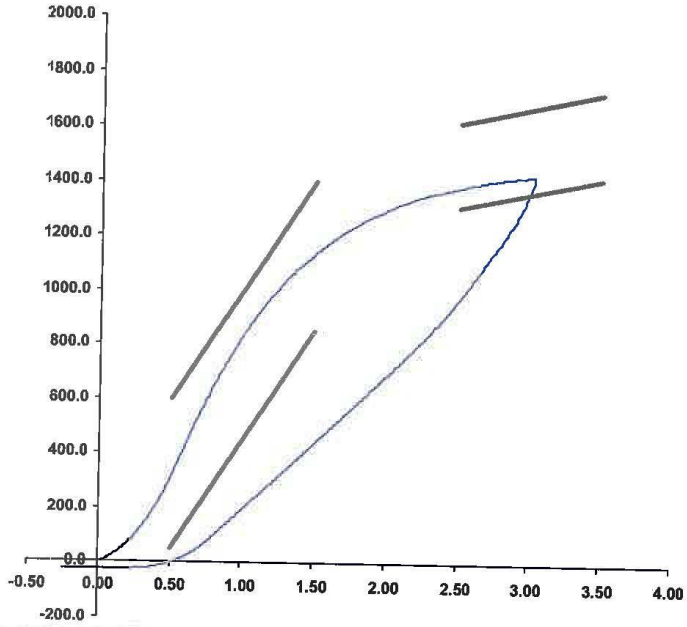
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	317.13	50.00	600.00
Force @ 1.5 mm (N)	1,140.39	850.00	1,400.00
Force @ 2.5 mm (N)	1,380.42	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,424.56	1,361.00	1,673.00

Testing Machine STM-20 5965542
Load Cell S/N (TI240813), Units (LBS) 1000

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

Notes:

Force (-N) vs Extension (-mm)



Operator DC

Part Number 180-4450

Template No 107 29-Sep-16
SACO Research

By : DC Date : 9/29/16

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

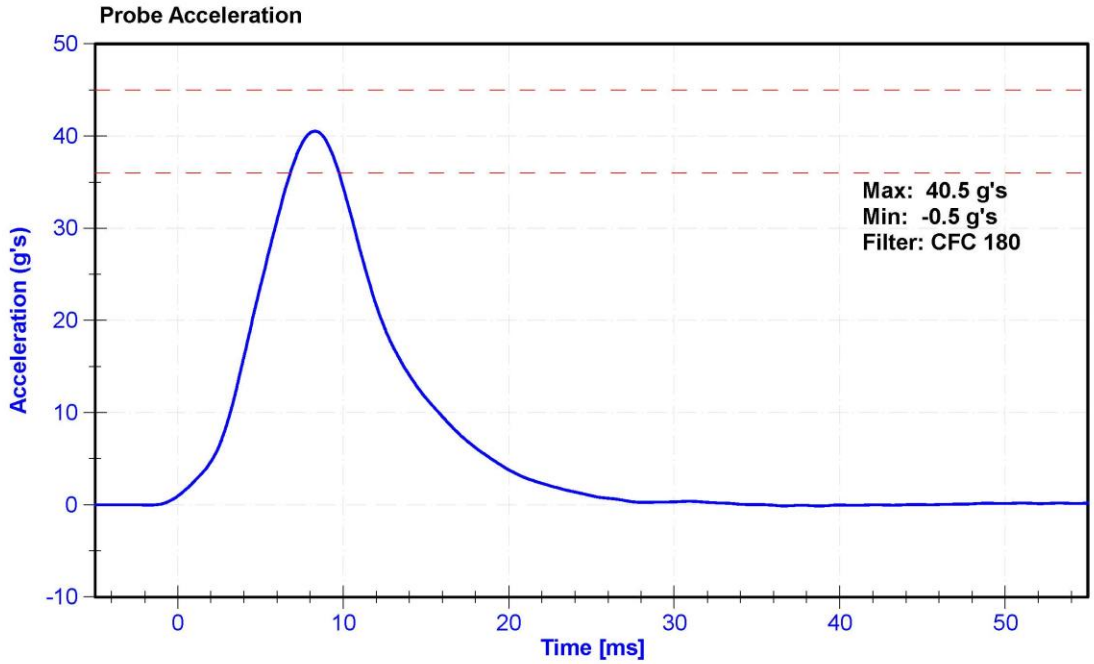
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	DG8012	Laboratory Supervisor	K.Brogan

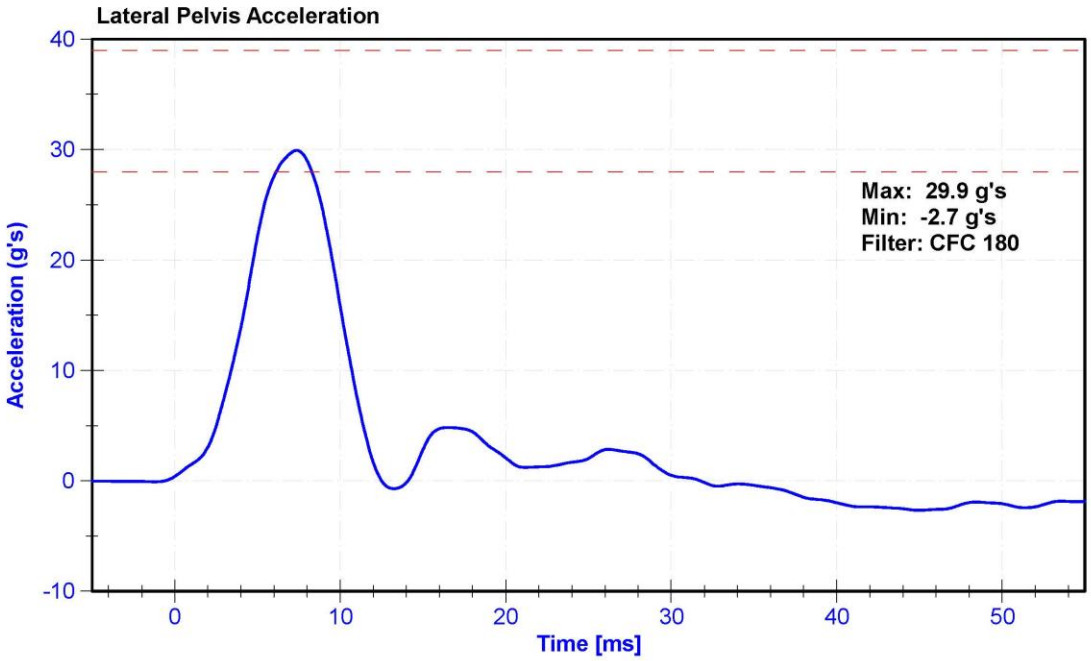
Results

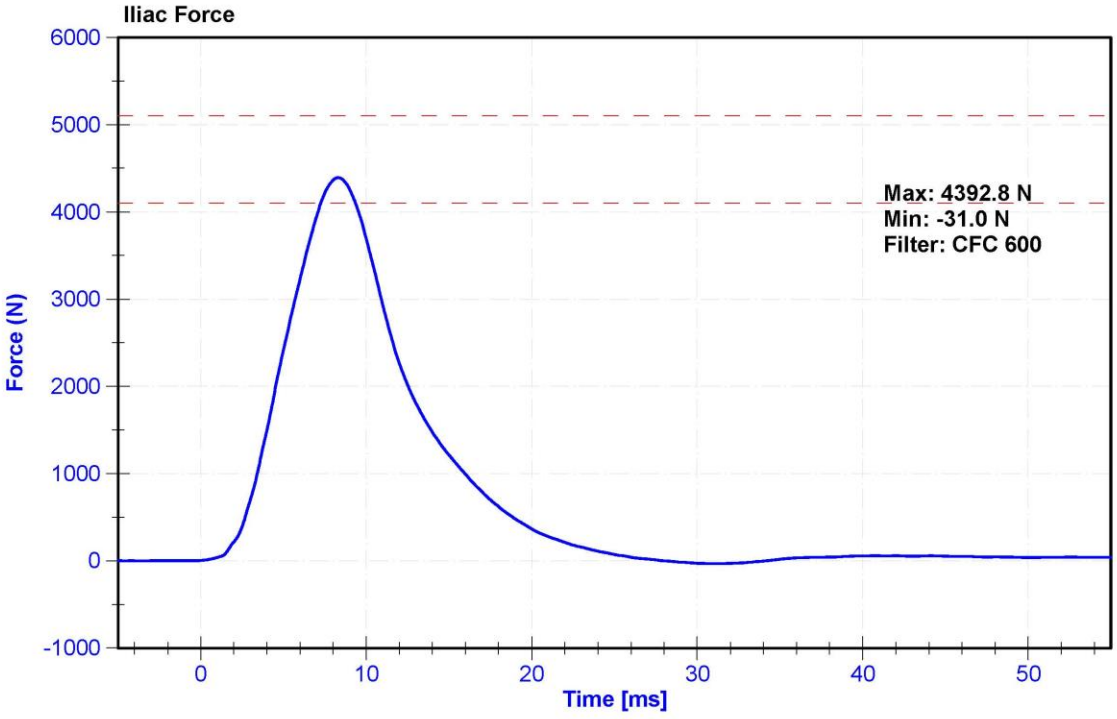
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	16.7	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	36	45	g's	40.5	Pass
Lateral Pelvis Acceleration	28	39	g's	29.9	Pass
Iliac Force	4100	5100	N	4392.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51875	10/17/2018	4/17/2019
Iliac Load Cell	DENTON 3228J	LC-279Fy	10/4/2018	10/4/2019




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 29.9 g's
Min: -2.7 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4392.8 N
Min: -31.0 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

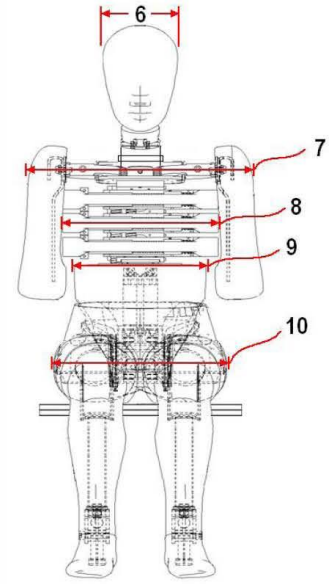
SERIAL NO: F034

(CONFIGURED FOR LEFT SIDE IMPACT)

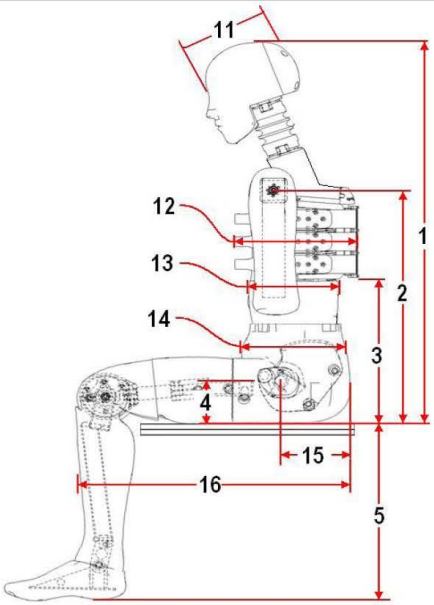
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 02/05/2019

Dummy Serial Number: F034



FRONT VIEW



SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	910	Pass
2	Seat to Shoulder Joint	558	572	566	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	350	Pass
4	Seat to Hip Joint (center of bolt)	97	103	100	Pass
5	Sole to Seat, Sitting	333	451	421	Pass
6	Head Width	152	158	152	Pass
7	Shoulder/Arm Width	461	479	470	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	281	Pass
10	Pelvis Lap Width	359	373	366	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	240	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	156	Pass
16	Back of Buttocks to Front Knee	597	615	606	Pass

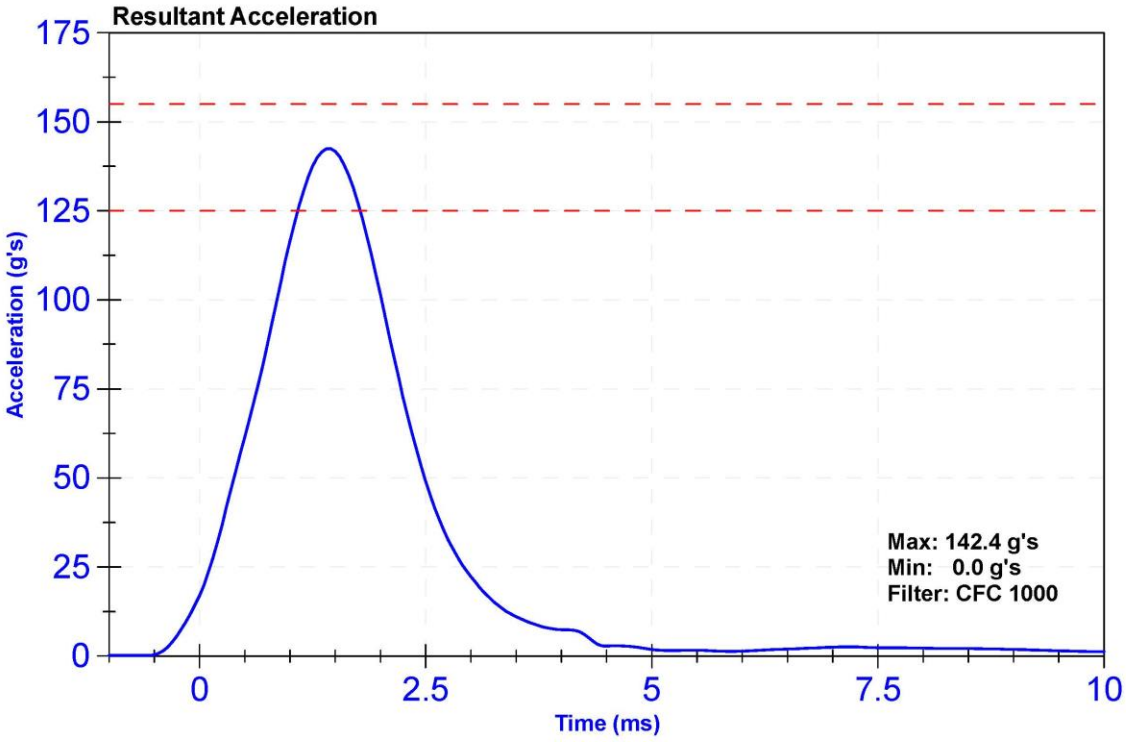
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

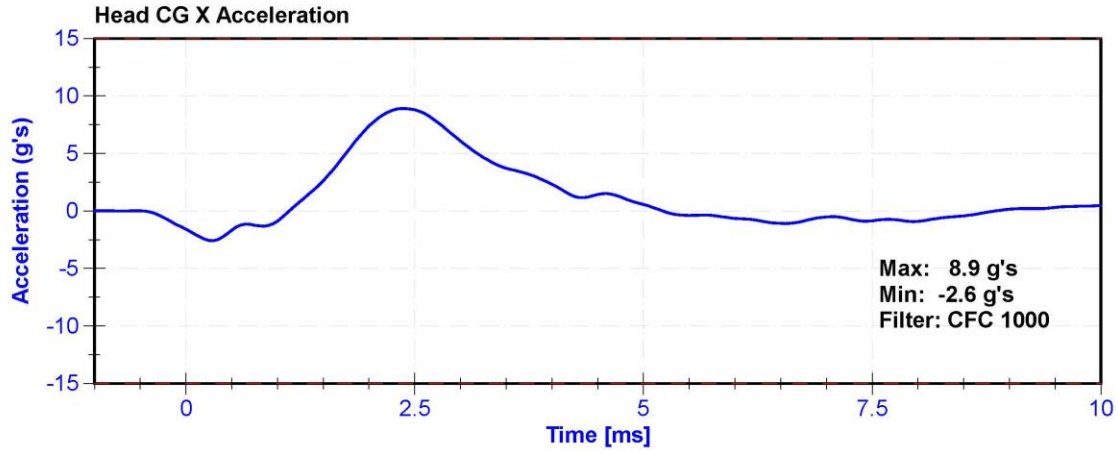
Results

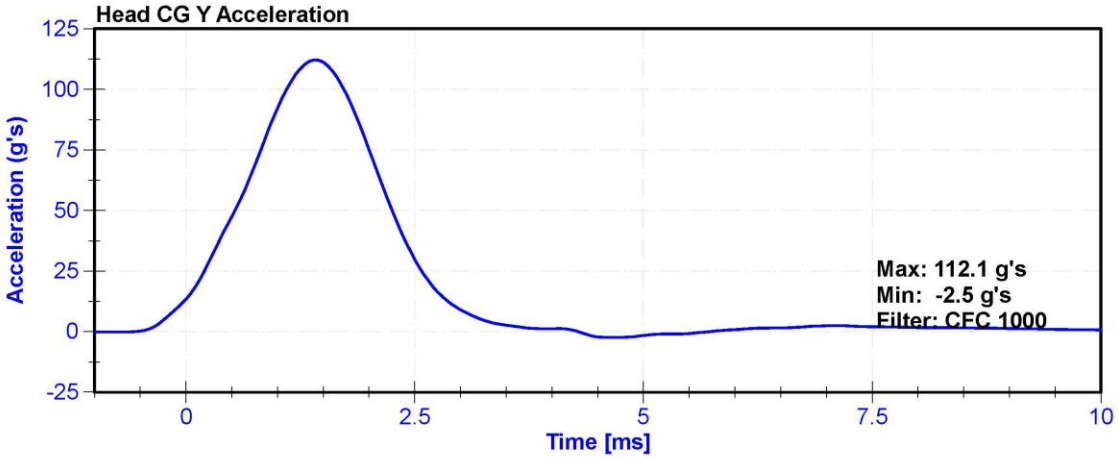
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	20.6	Pass
Resultant Acceleration	125	155	g's	142.4	Pass
Oscillation	0	15	%	2.03	Pass
Fore-Aft Acceleration	-15	15	g's	8.9	Pass

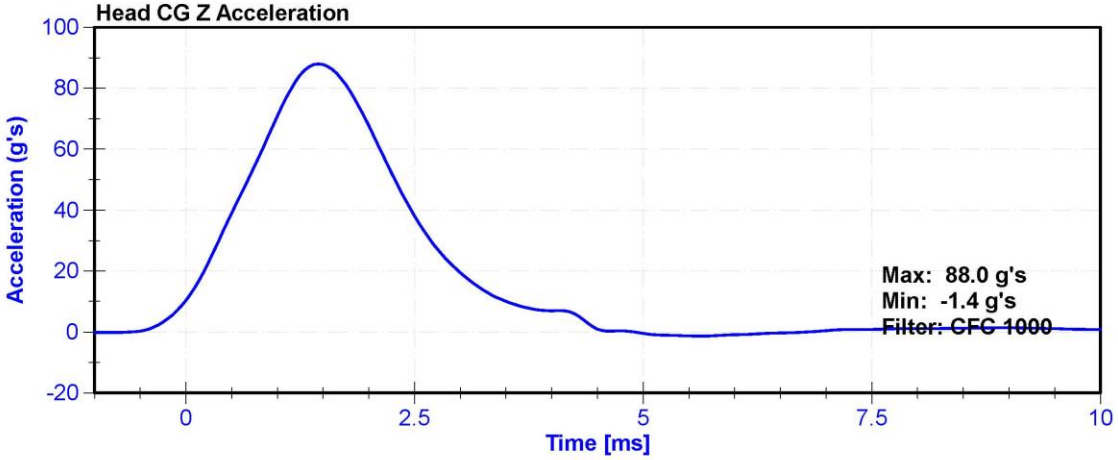
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P58904	10/5/2018	4/5/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P58911	10/5/2018	4/5/2019
Z Accelerometer	ENDEVCO 7264CT	AC-P58776	10/5/2018	4/5/2019




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 8.9 g's
Min: -2.6 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: 112.1 g's
Min: -2.5 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: 88.0 g's
Min: -1.4 g's
Filter: CFC 1000

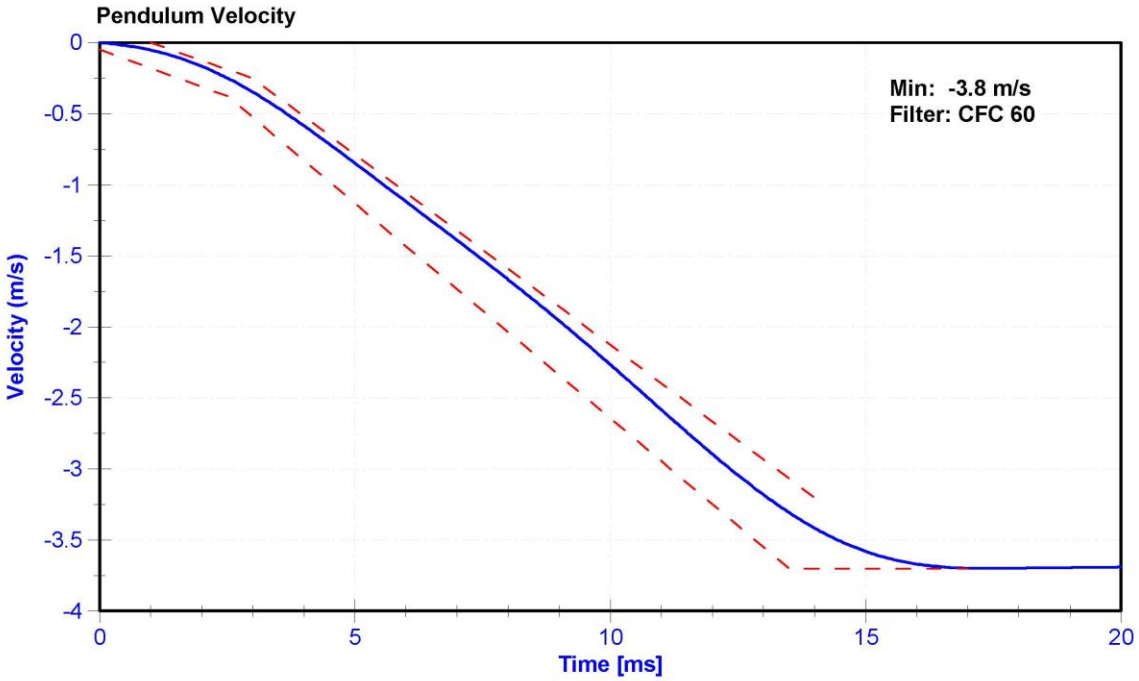
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

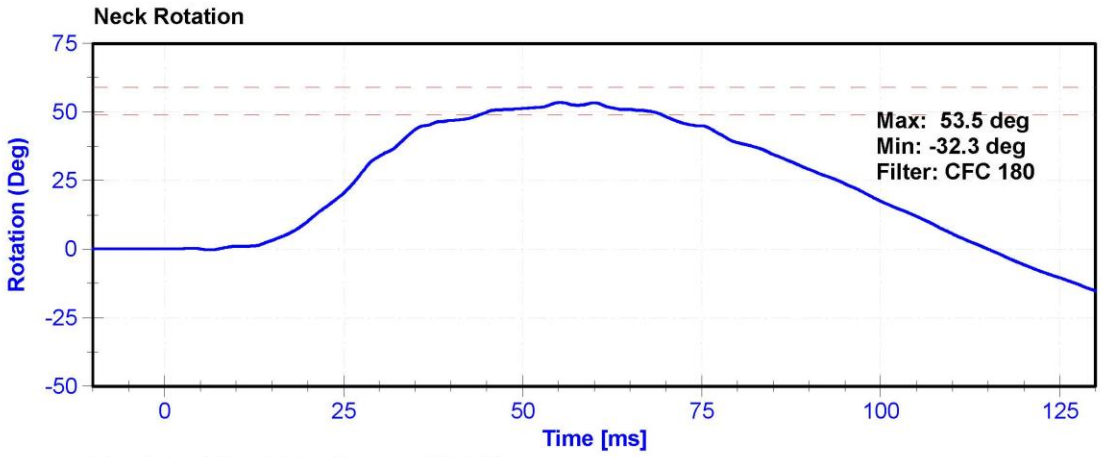
Results

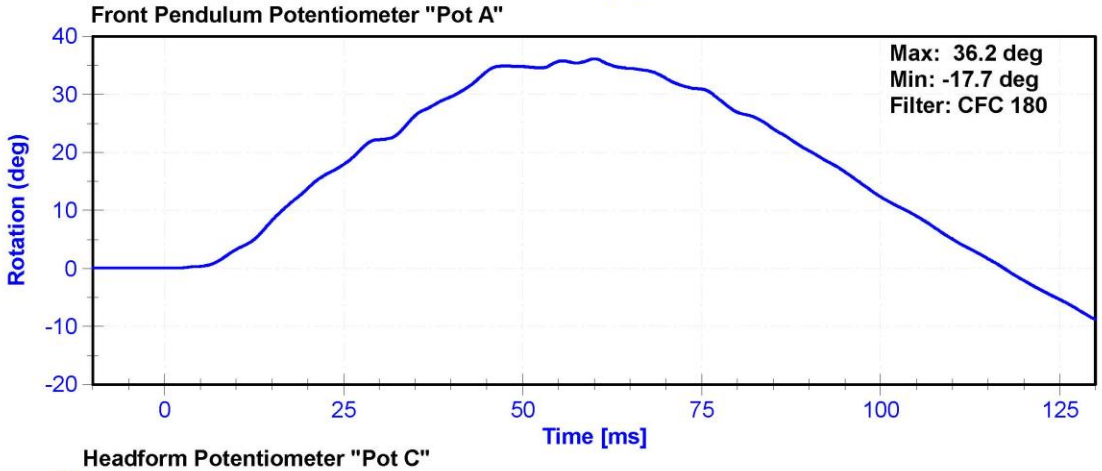
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	40	Pass
Velocity	3.3	3.5	m/s	3.46	Pass
Lateral Neck Rotation	49	59	deg	53.5	Pass
Time at Maximum Rotation	54	66	ms	55.3	Pass
Time of Rotation Decay from Maximum	53	88	ms	59.7	Pass

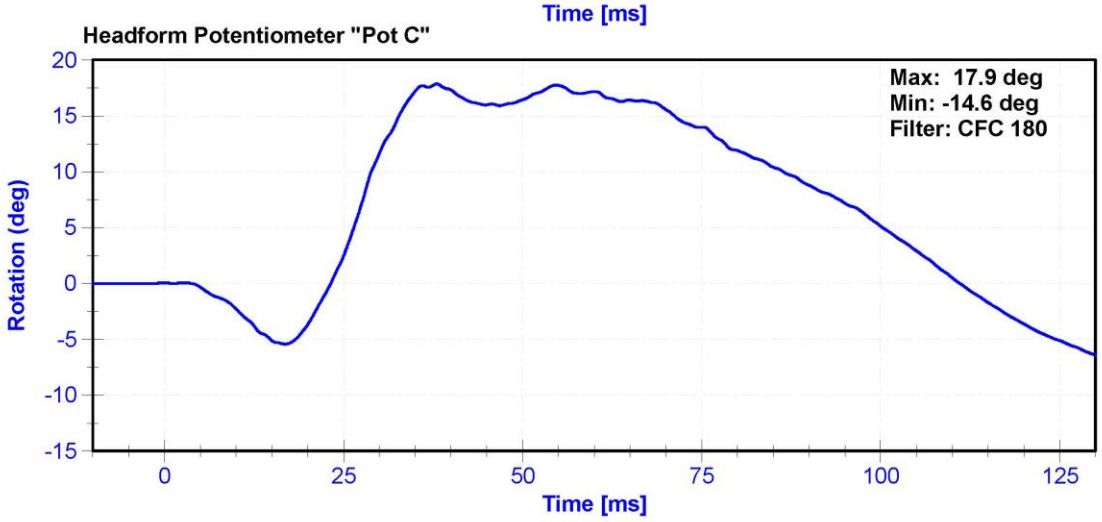
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5F3	5/11/2018	5/11/2019
Front Pendulum Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Headform Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019




Neck Rotation
Rotation (Deg)
Time [ms]
Max: 53.5 deg
Min: -32.3 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 36.2 deg
Min: -17.7 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 17.9 deg
Min: -14.6 deg
Filter: CFC 180

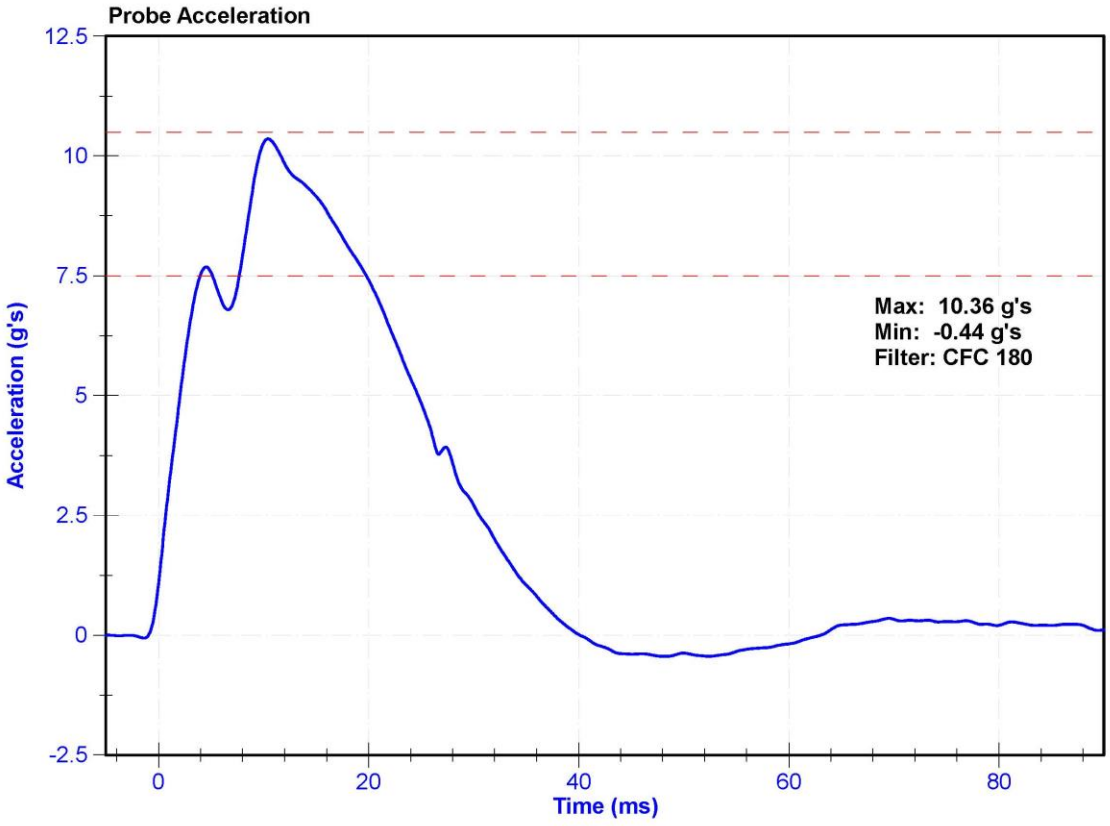
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	31.4	Pass
Velocity	4.2	4.4	m/s	4.20	Pass
Probe Acceleration	7.5	10.5	g's	10.36	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019



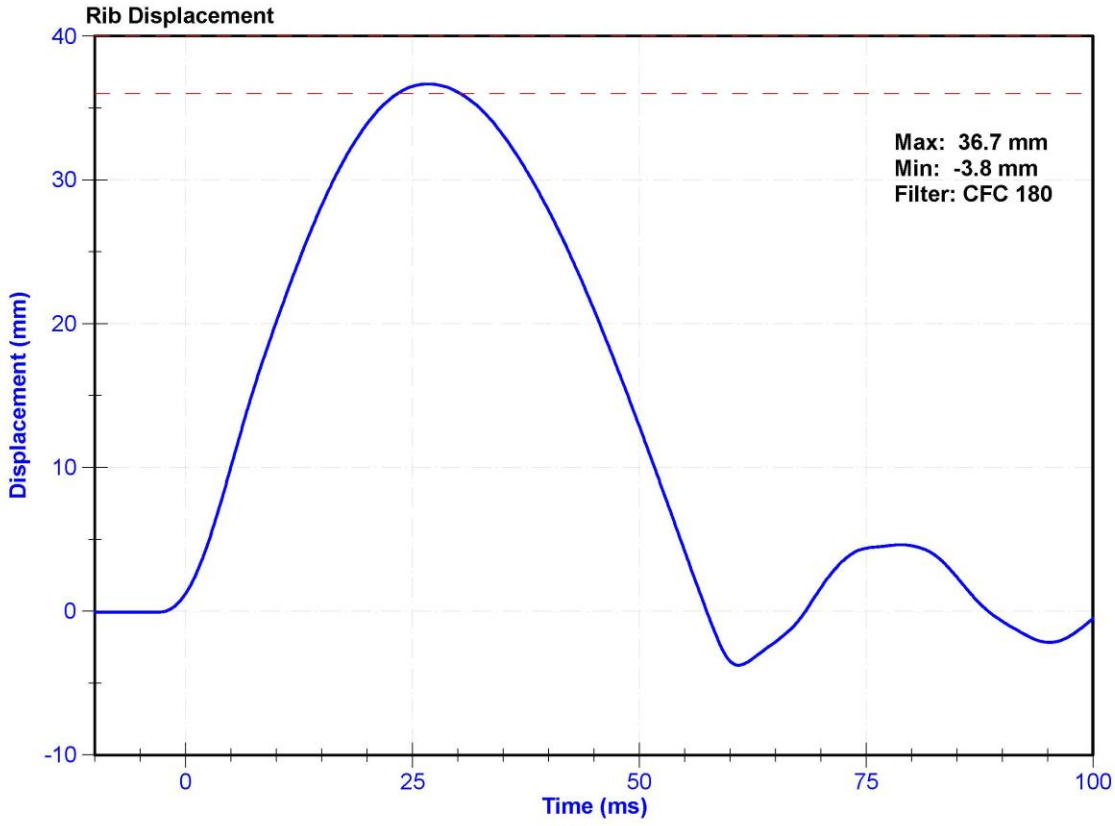
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	36.5	Pass
Rib Displacement	36	40	mm	36.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019



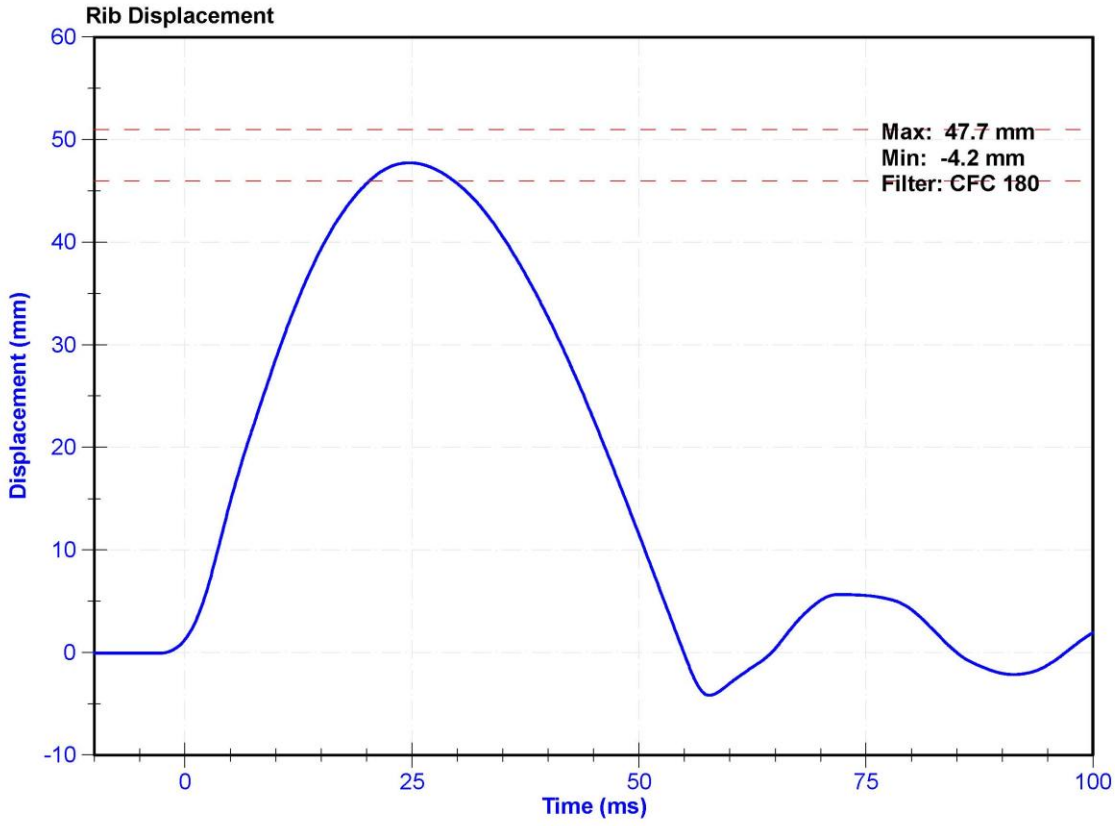
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	36.5	Pass
Rib Displacement	46	51	mm	47.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019



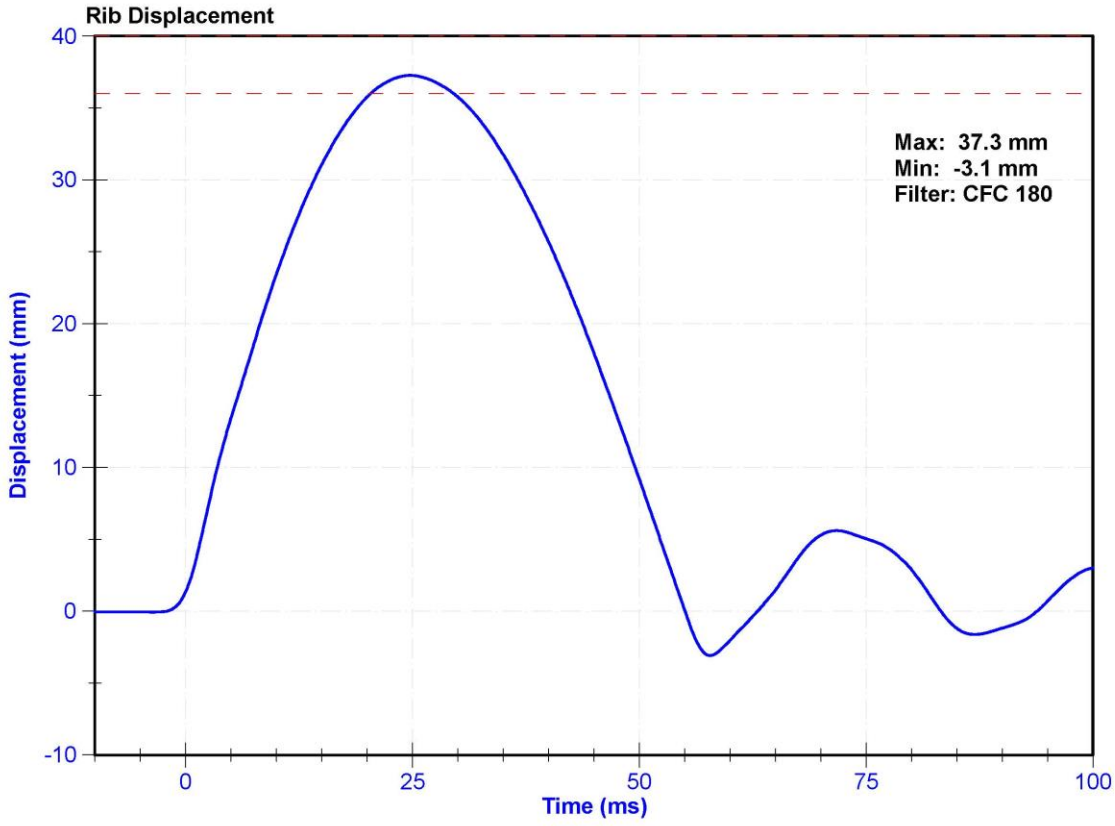
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	36.5	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-184GFE	10/11/2018	10/11/2019



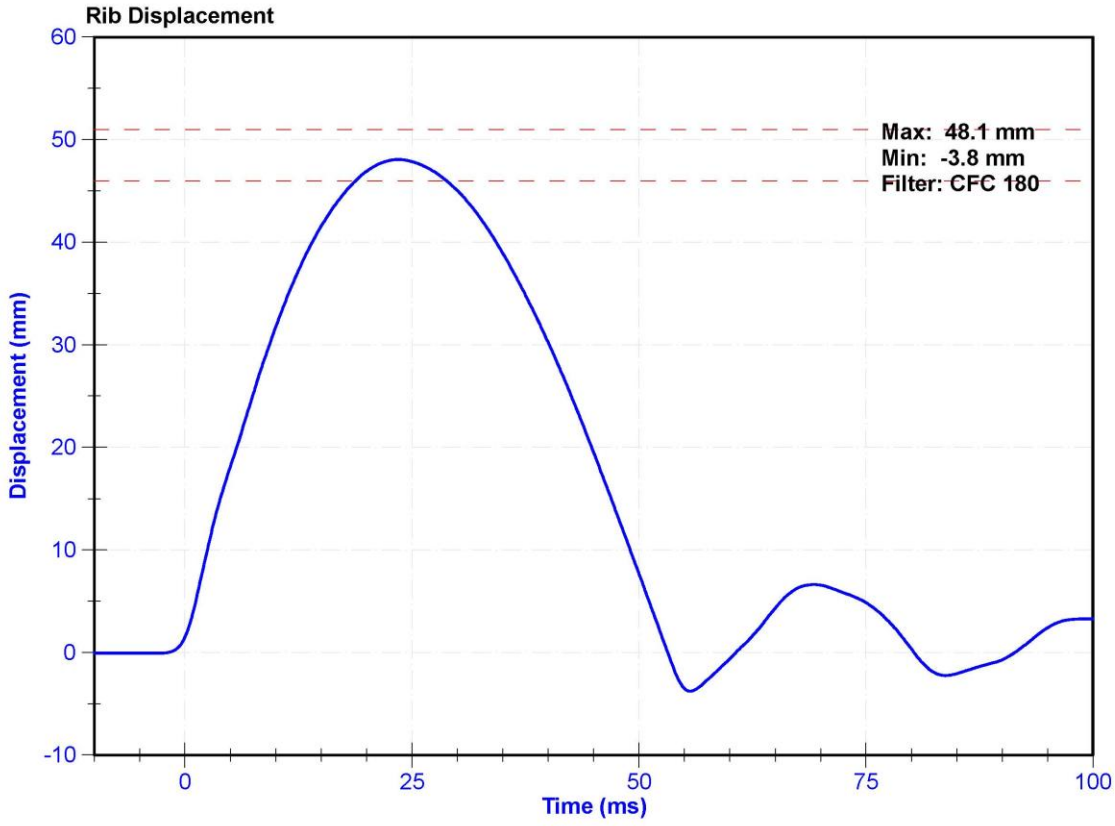
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	36.5	Pass
Rib Displacement	46	51	mm	48.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019



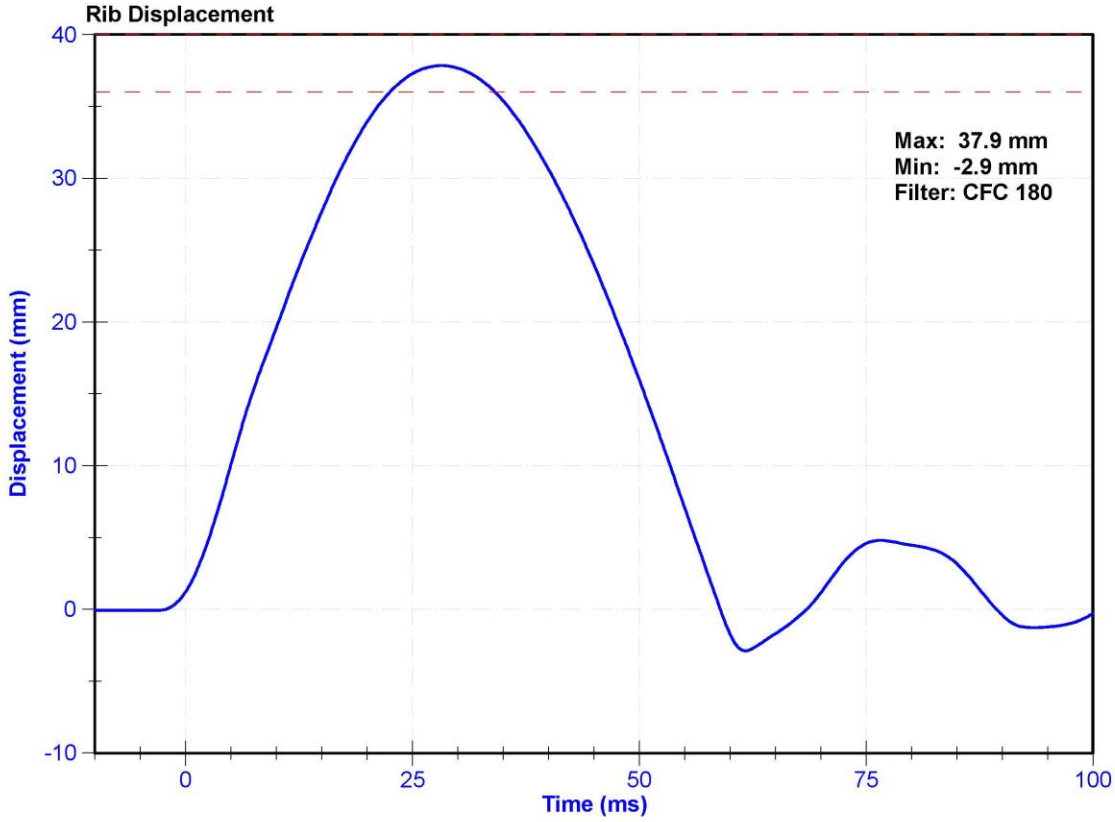
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	36.7	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-182GFE	10/10/2018	10/10/2019



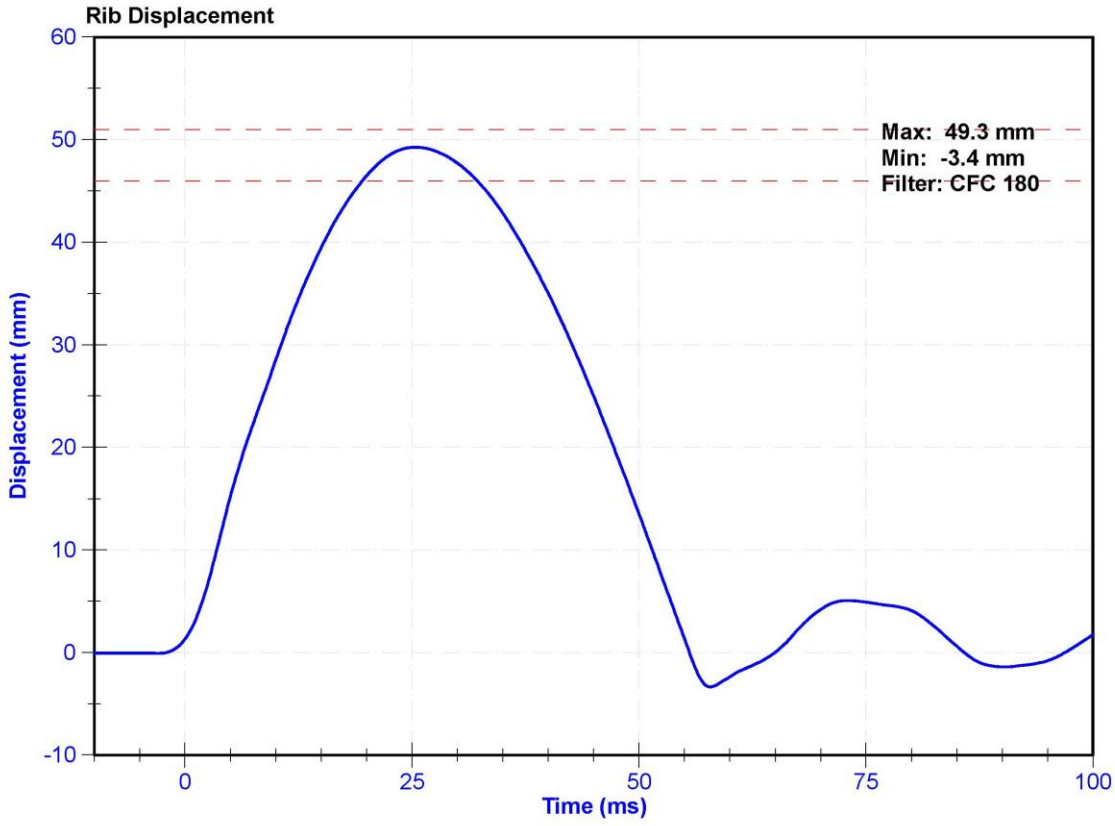
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	36.7	Pass
Rib Displacement	46	51	mm	49.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019



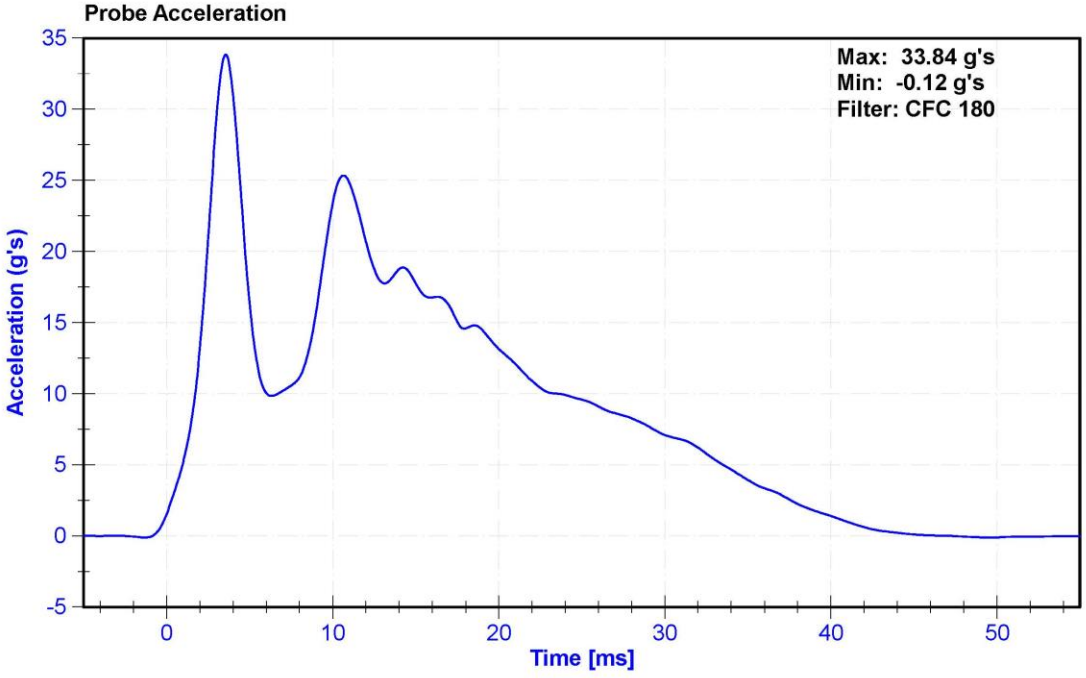
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

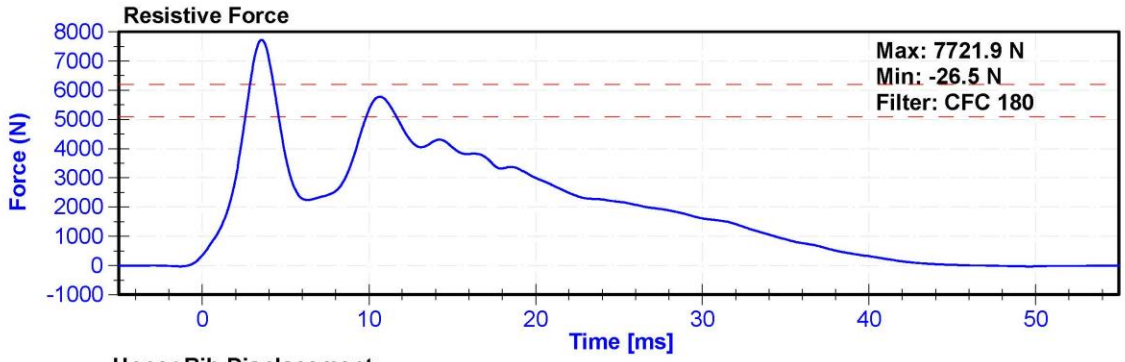
Results

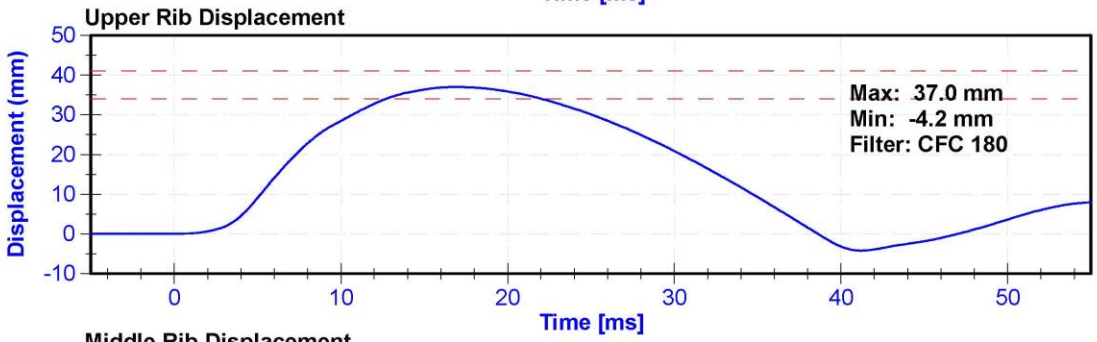
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	25.6	Pass
Velocity	5.4	5.6	m/s	5.55	Pass
Resistive Force after 6ms	5100	6200	N	5780.6	Pass
Upper Thorax Rib Deflection	34	41	mm	37.0	Pass
Mid Thorax Rib Deflection	37	45	mm	40.2	Pass
Lower Thorax Rib Deflection	37	44	mm	41.0	Pass

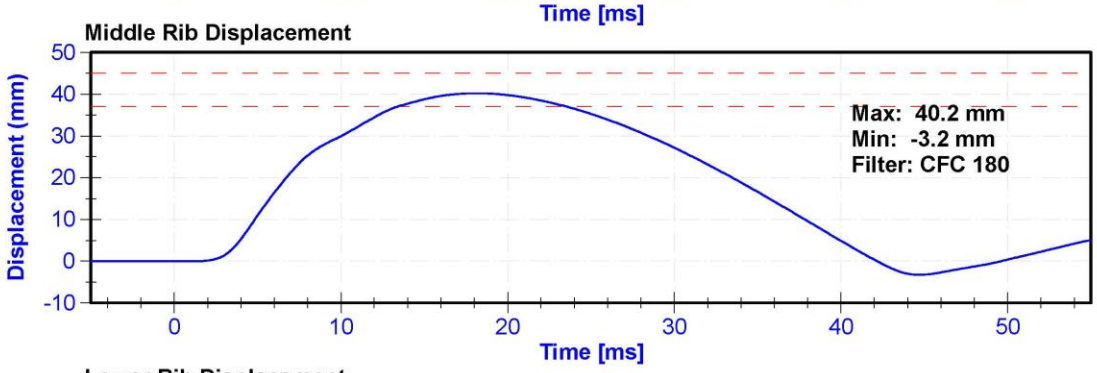
Transducer Calibrations

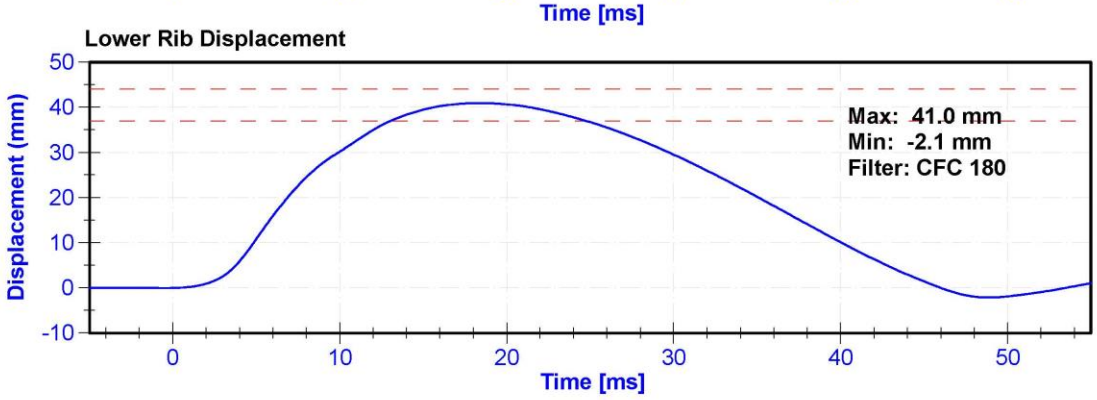
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019




Resistive Force
Force (N)
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
Max: 7721.9 N
Min: -26.5 N
Filter: CFC 180
0
10
20
30
40
50
Time [ms]


Upper Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
Max: 37.0 mm
Min: -4.2 mm
Filter: CFC 180
0
10
20
30
40
50
Time [ms]


Middle Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
Max: 40.2 mm
Min: -3.2 mm
Filter: CFC 180
0
10
20
30
40
50
Time [ms]


Lower Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
Max: 41.0 mm
Min: -2.1 mm
Filter: CFC 180
0
10
20
30
40
50
Time [ms]

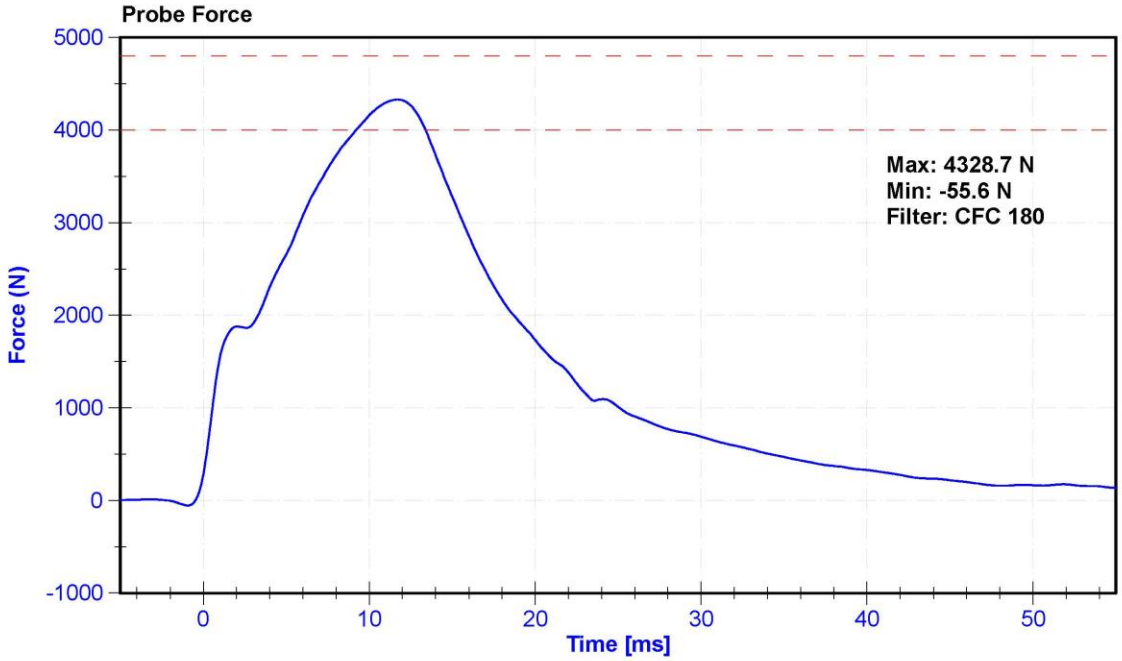
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

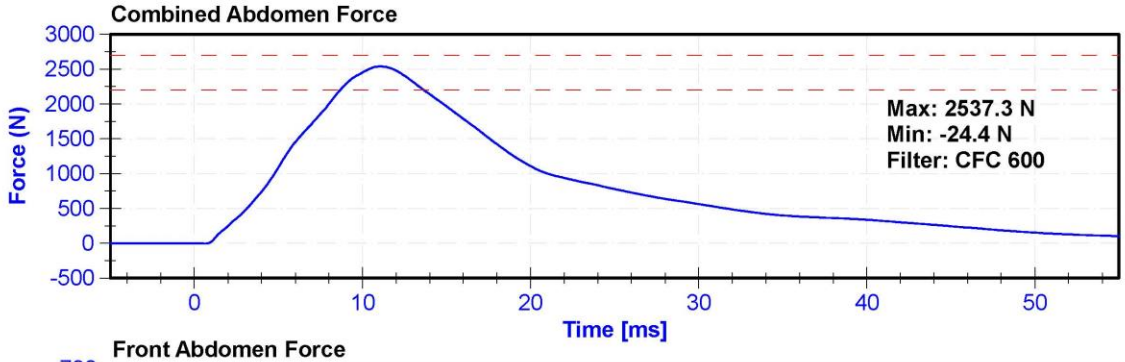
Results

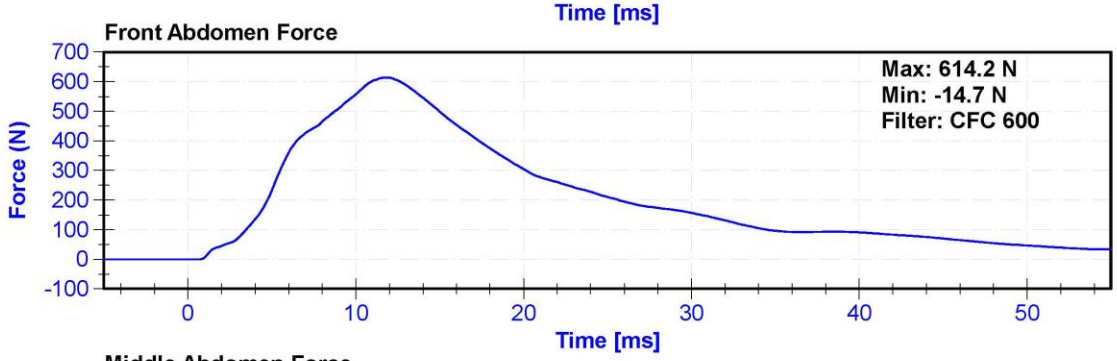
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	23.6	Pass
Velocity	3.9	4.1	m/s	4.09	Pass
Combined Abdomen Force	2200	2700	N	2537.3	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.05	Pass
Resistive Probe Force	4000	4800	N	4328.7	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.70	Pass

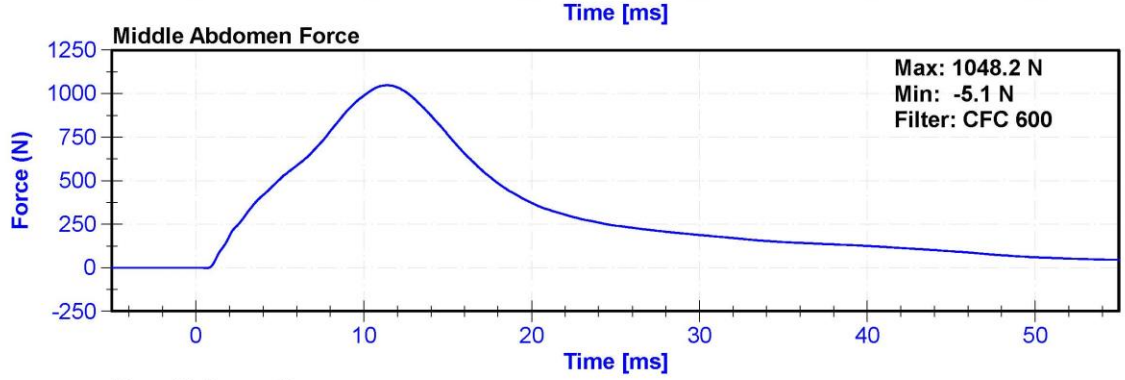
Transducer Calibrations

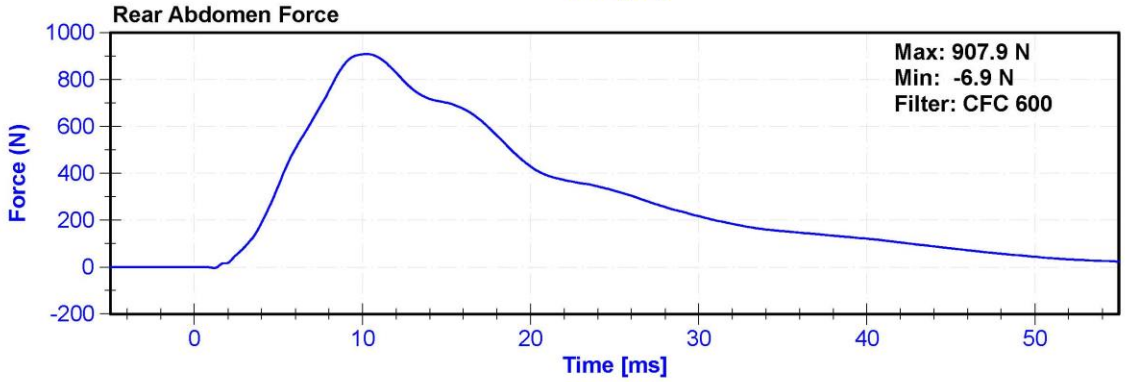
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Front Abdomen Load Cell	DENTON 2631	LC-1440	6/4/2018	6/4/2019
Middle Abdomen Load Cell	DENTON 2631	LC-1525	6/4/2018	6/4/2019
Rear Abdomen Load Cell	DENTON 2631	LC-1528	6/4/2018	6/4/2019




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2537.3 N
Min: -24.4 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 614.2 N
Min: -14.7 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1048.2 N
Min: -5.1 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 907.9 N
Min: -6.9 N
Filter: CFC 600

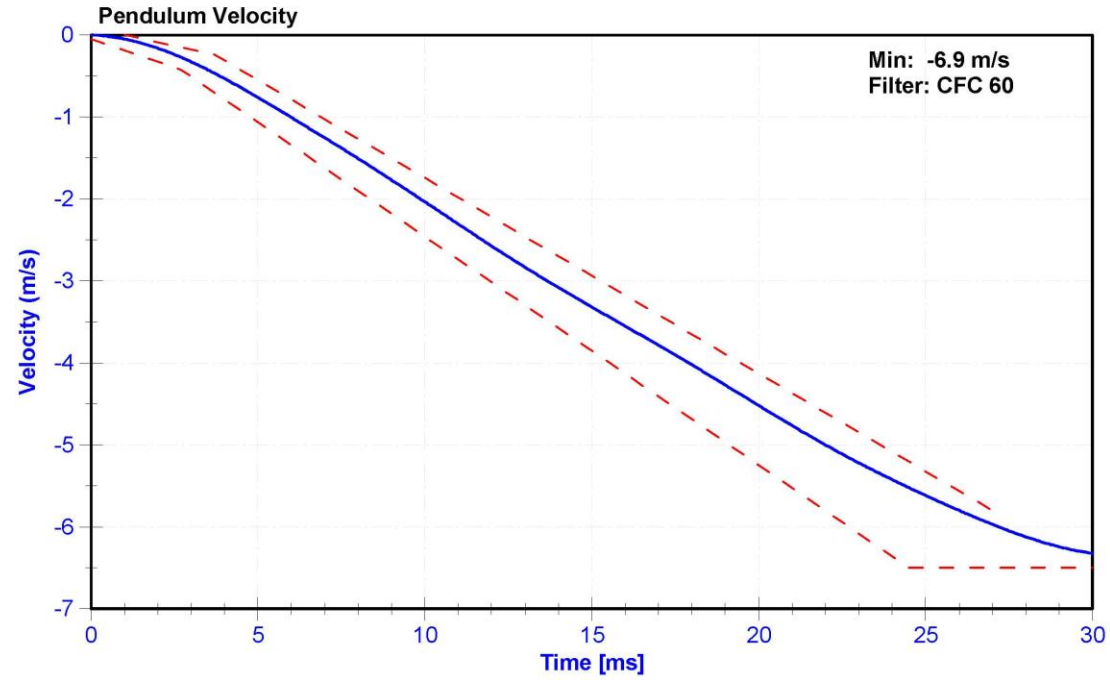
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

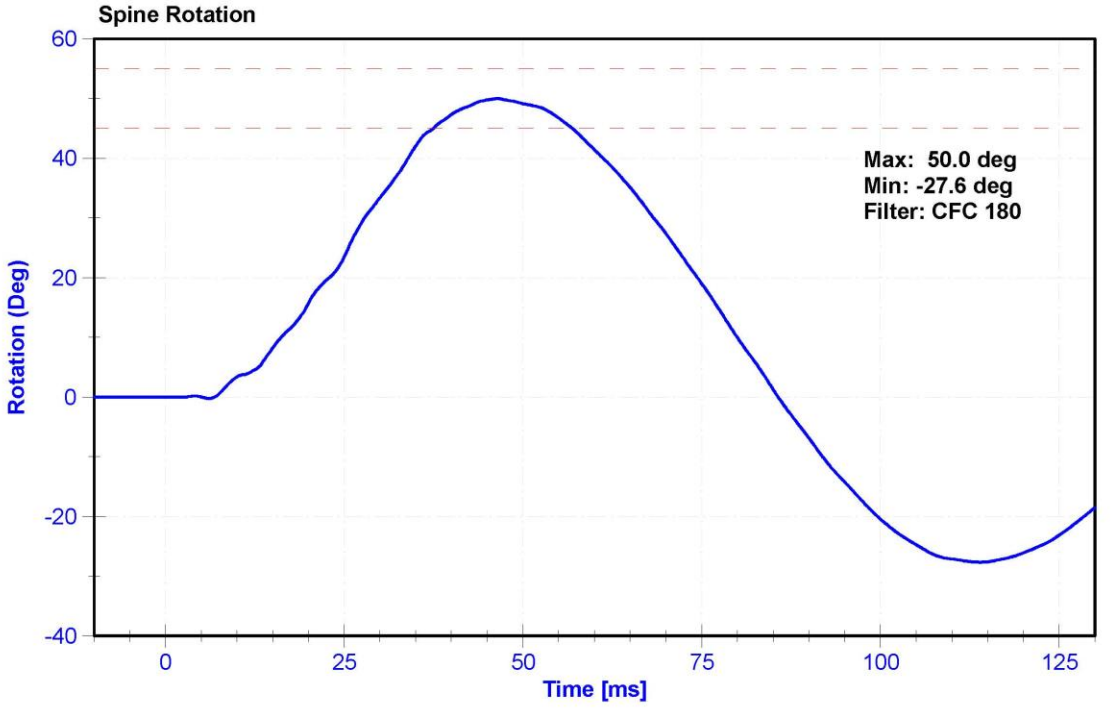
Results

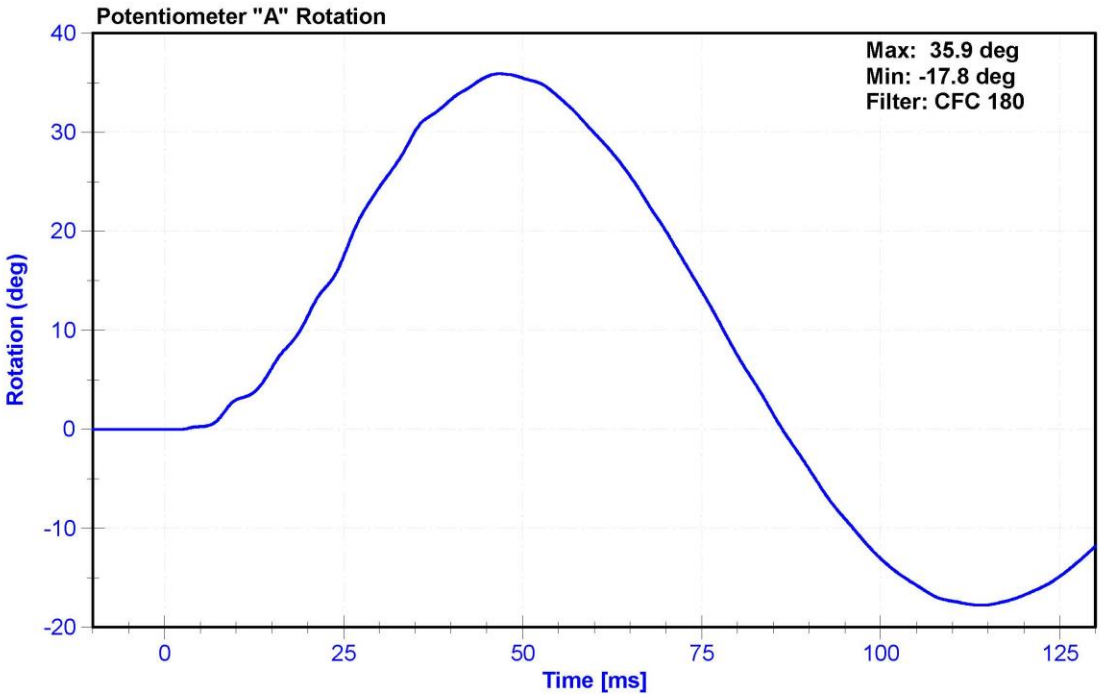
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	37.5	Pass
Velocity	5.95	6.15	m/s	6.025	Pass
Lateral Spine Rotation	45	55	deg	50.0	Pass
Time at Maximum Rotation	39	53	ms	46.4	Pass
Time of Decay to Zero Degrees	37	57	ms	39.3	Pass
Pulse within Corridor?	-	-	-		

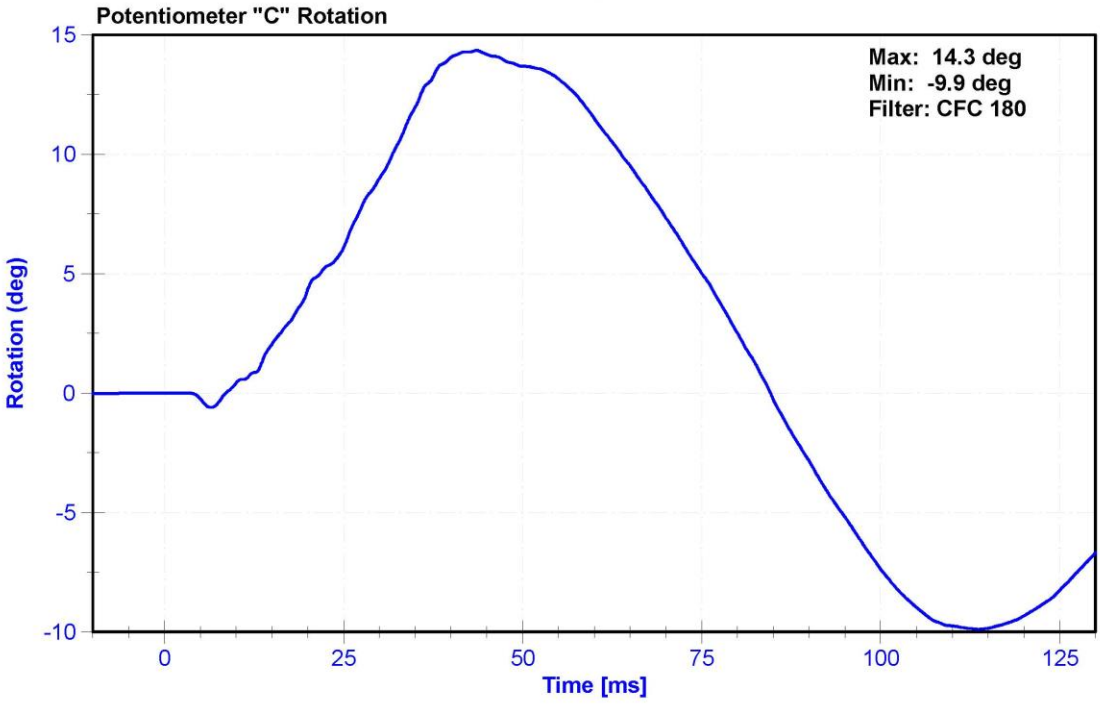
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5F3	5/11/2018	5/11/2019
Pendulum "A" Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Condyle "B" Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019


Pendulum Velocity
Min: -6.9 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: 50.0 deg
Min: -27.6 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 35.9 deg
Min: -17.8 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: 14.3 deg
Min: -9.9 deg
Filter: CFC 180
Rotation (deg)
15
10
5
0
-5
-10
0
25
50
75
100
125
Time [ms]

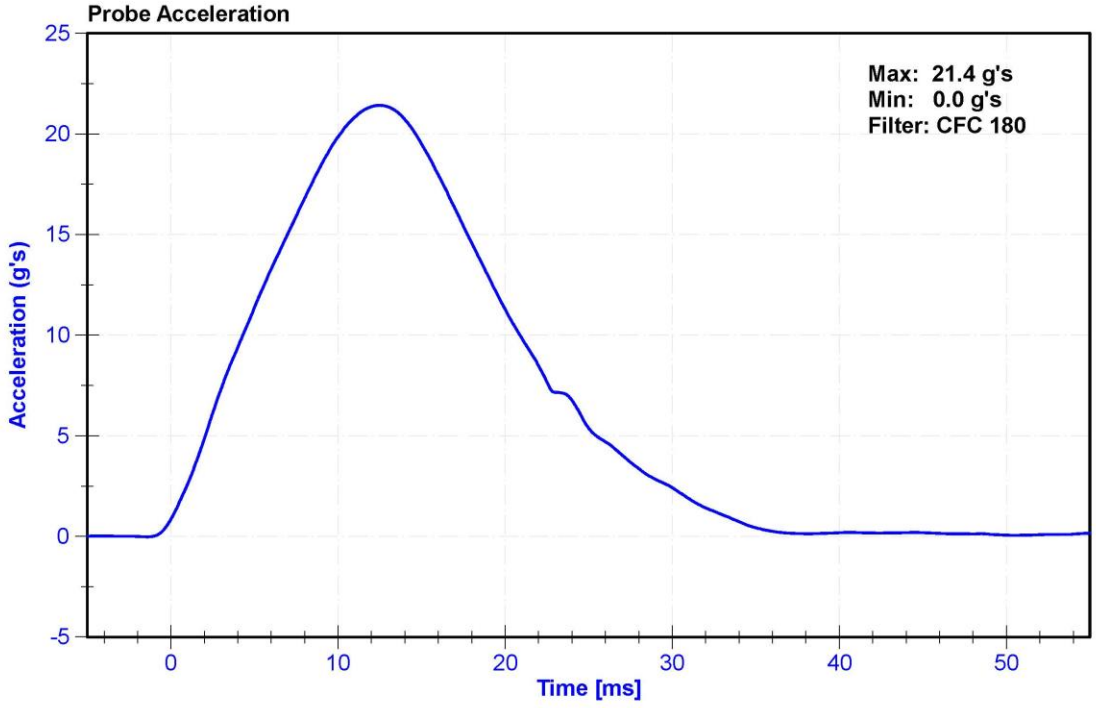
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

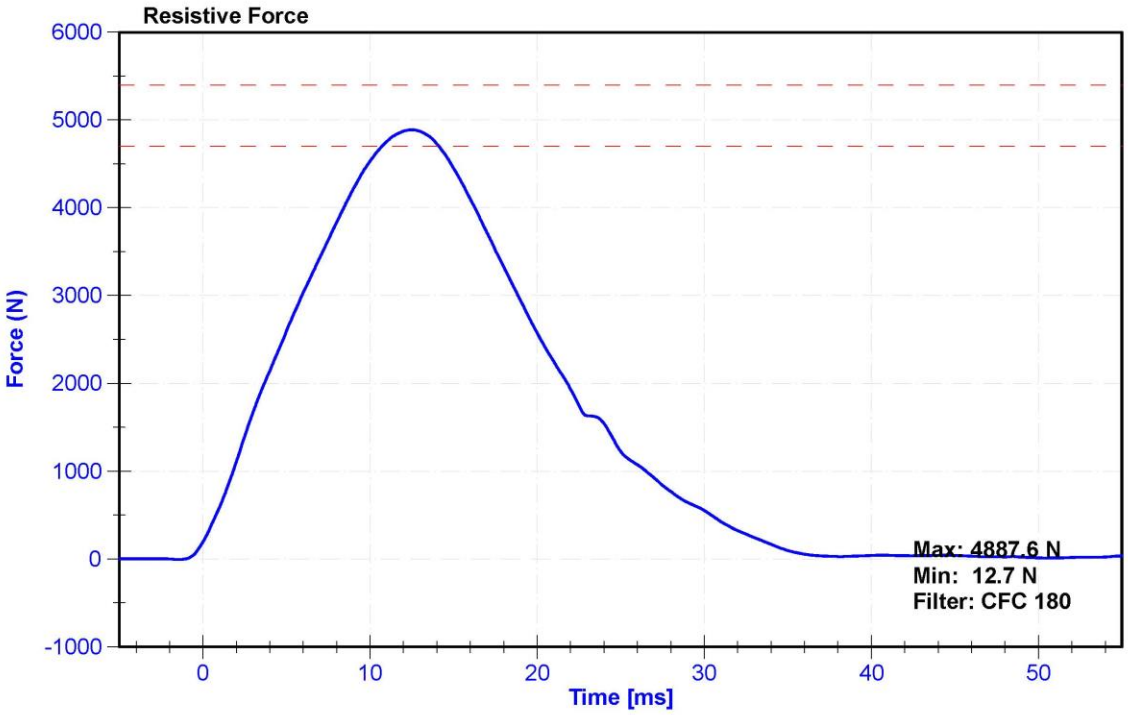
Results

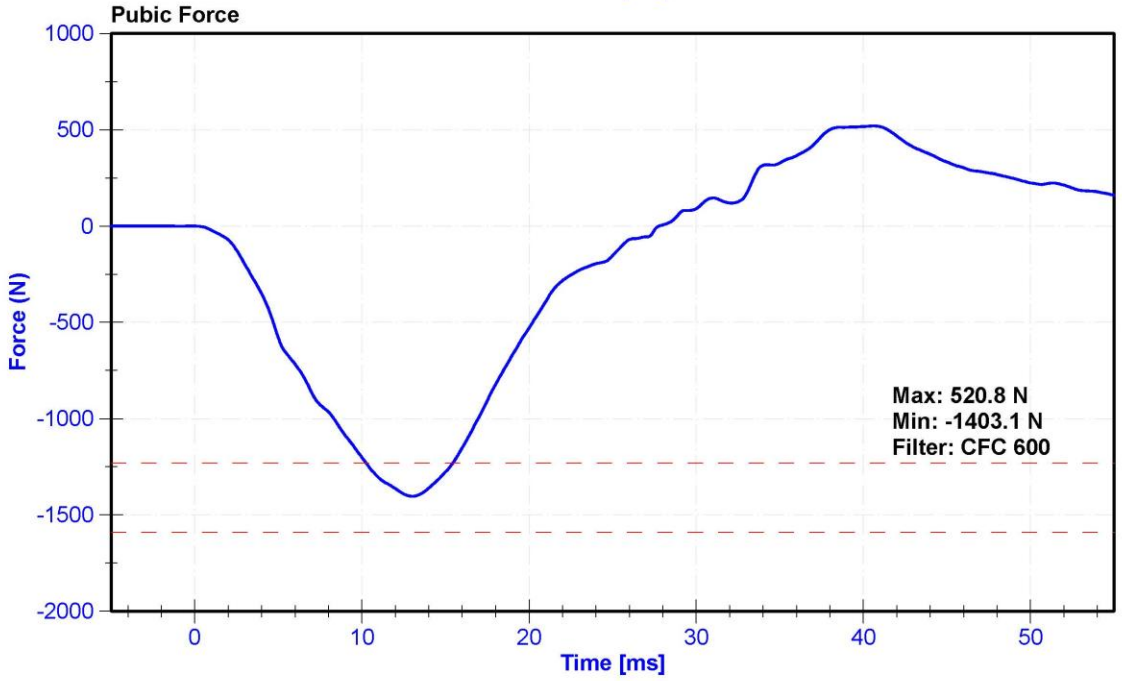
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	26.3	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Resistive Force	4700	5400	N	4887.6	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.50	Pass
Pubic Force	-1590	-1230	N	-1403.1	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.00	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Pubic Load Cell	Denton 3096JFL	LC-464fy	6/4/2018	6/4/2019




Resistive Force
Force (N)
Time [ms]
Max: 4887.6 N
Min: 12.7 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 520.8 N
Min: -1403.1 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

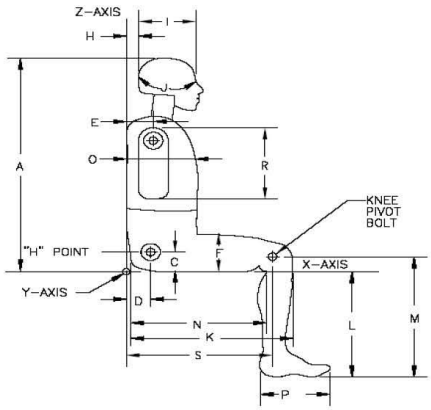
SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

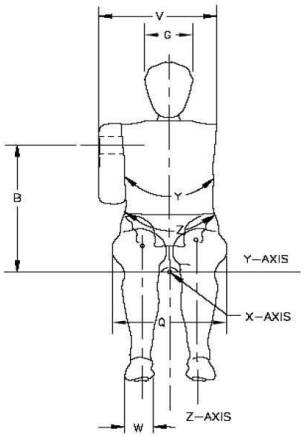
SERIAL No: DG8012

External Measurements - SID-IIs

Technician: K. Dutton Date: 01/31/2019

Dummy Serial Number: DG8012





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	781	Pass
B	Shoulder Pivot Height	437	453	449	Pass
C	H-point Height	79	89	86	Pass
D	H-point from seatback	141	151	146	Pass
E	Shoulder Pivot from Backline	97	107	105	Pass
F	Thigh Clearance	119	135	126	Pass
G	Head Breadth	140	148	143	Pass
H	Head Back from Backline	40	46	44	Pass
I	Head Depth	178	188	185	Pass
J	Head Circumference	541	551	547	Pass
K	Buttock to Knee Length	514	540	531	Pass
L	Popliteal Height	343	369	356	Pass
M	Knee Pivot to floor height	392	409	403	Pass
N	Buttock Popliteal Length	416	442	433	Pass
O	Chest Depth w/o jacket	195	211	207	Pass
P	Foot Length	216	232	221	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	319	Pass
R	Arm Length	249	259	254	Pass
S	Knee Joint to seatback	477	493	485	Pass
V	Shoulder Width	341	357	344	Pass
W	Foot Width	78	94	85	Pass
Y	Chest Circumference w/jacket	851	881	867	Pass
Z	Waist Circumference	761	791	780	Pass

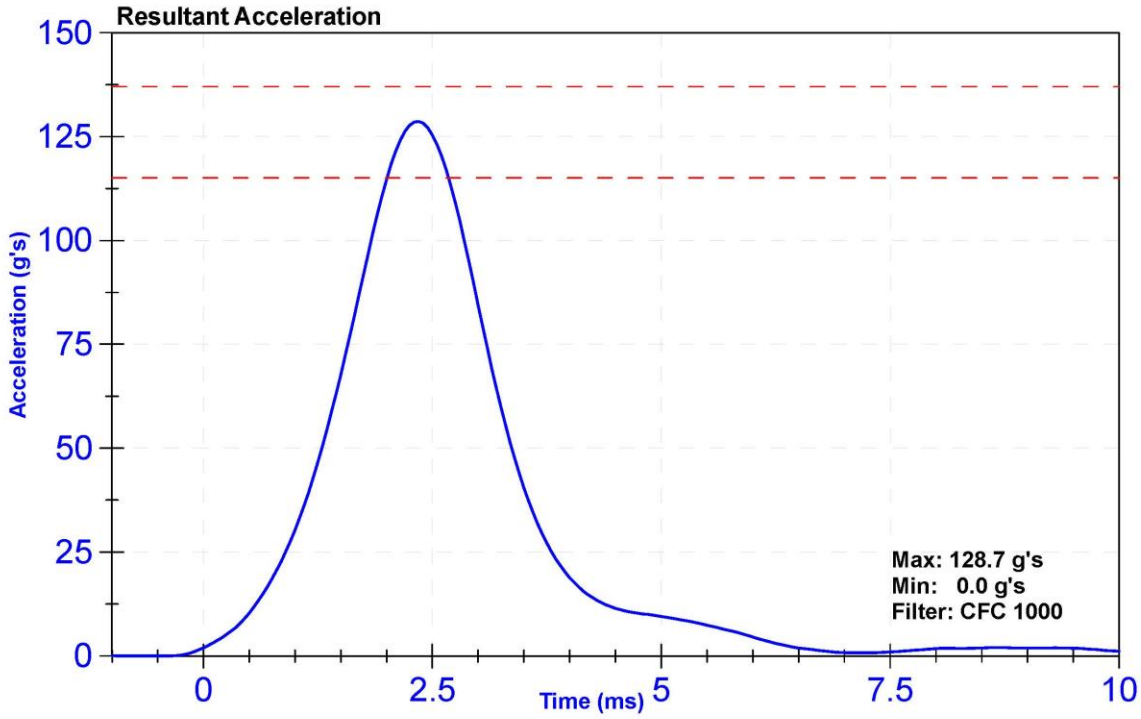
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

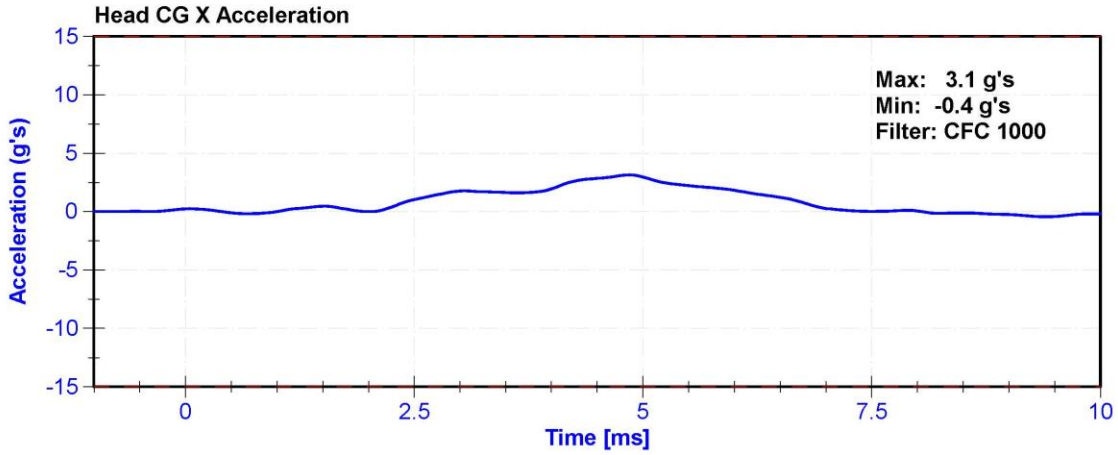
Results

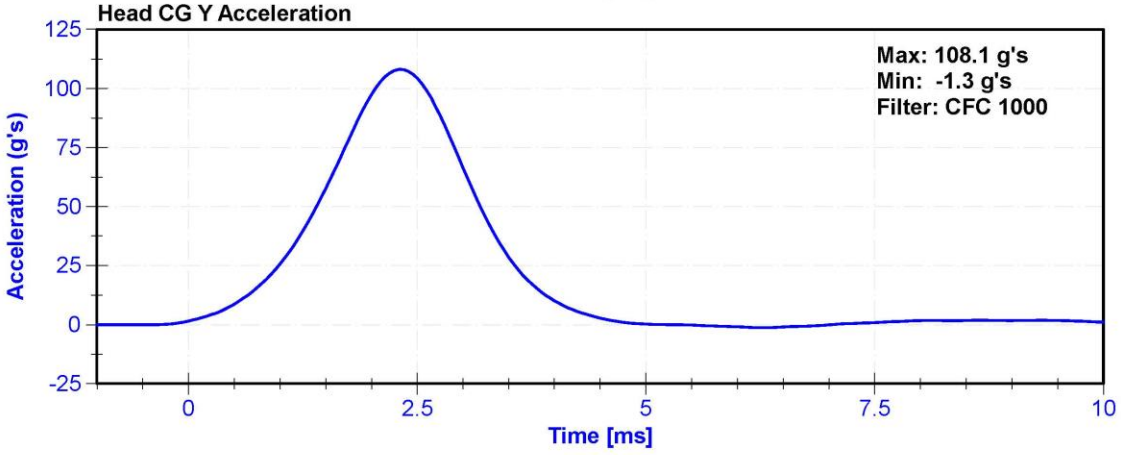
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	37.9	Pass
Resultant Acceleration	115	137	g's	128.7	Pass
Oscillation	0	15	%	1.6	Pass
Fore-Aft Acceleration	-15	15	g's	3.1	Pass

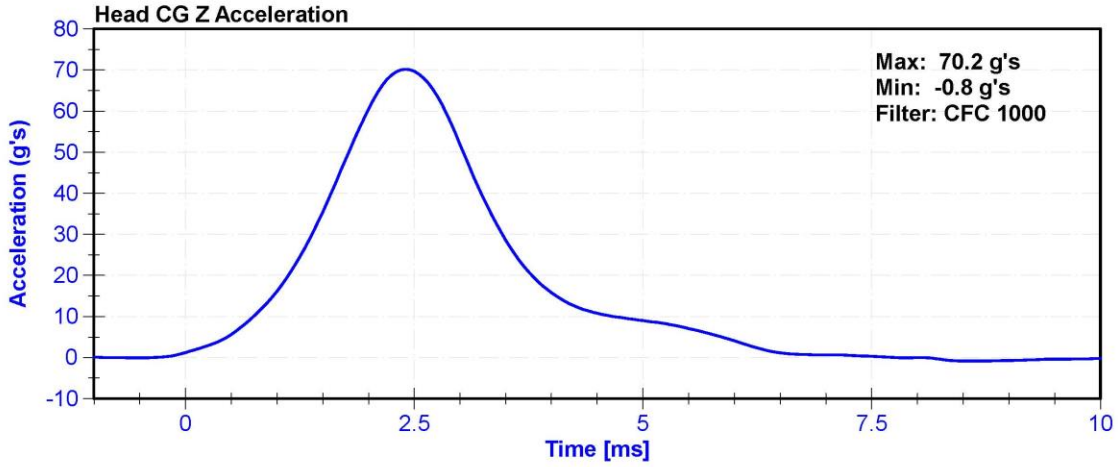
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264	AC-P74788	10/18/2018	4/18/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P83432	10/18/2018	4/18/2019
Z Accelerometer	ENDEVCO 7264	AC-P83319	10/18/2018	4/18/2019




Head CG X Acceleration
Max: 3.1 g's
Min: -0.4 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: 108.1 g's
Min: -1.3 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: 70.2 g's
Min: -0.8 g's
Filter: CFC 1000
Acceleration (g's)
80
70
60
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]

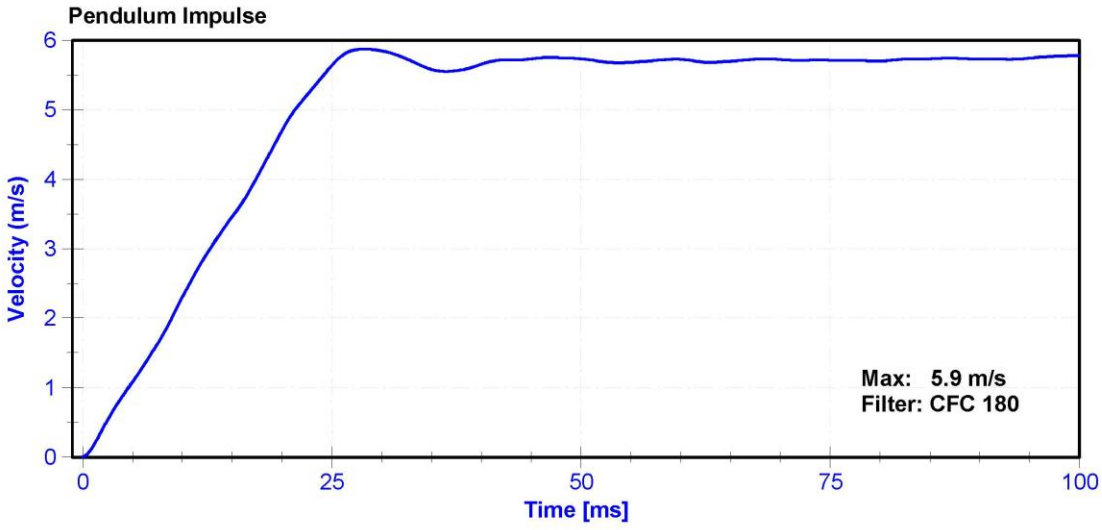
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

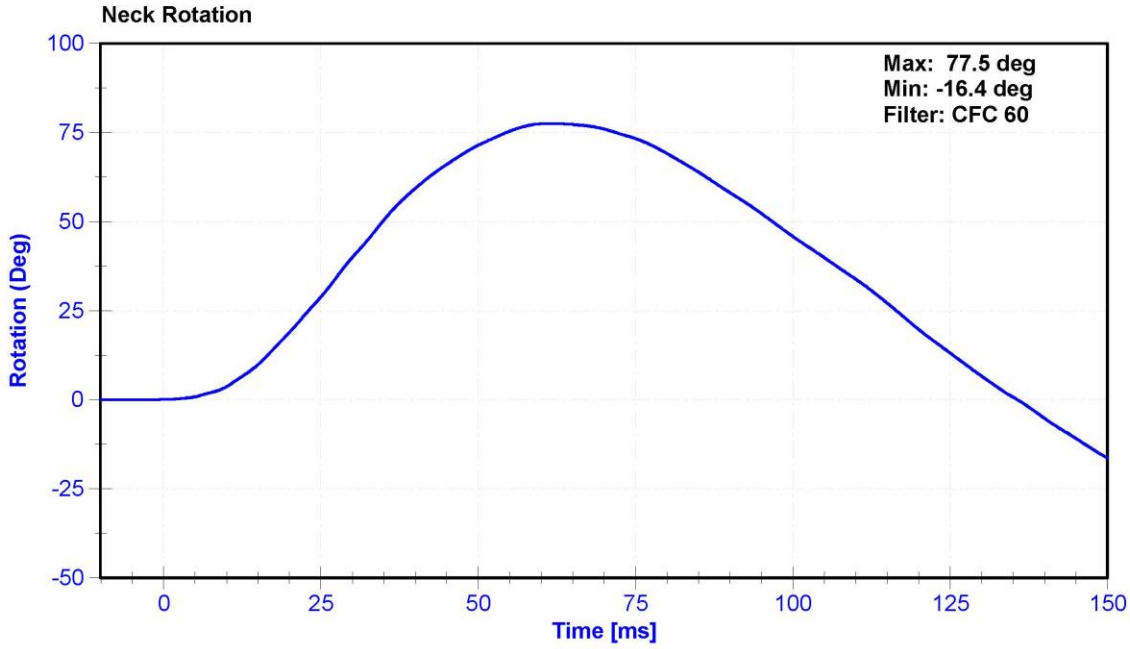
Results

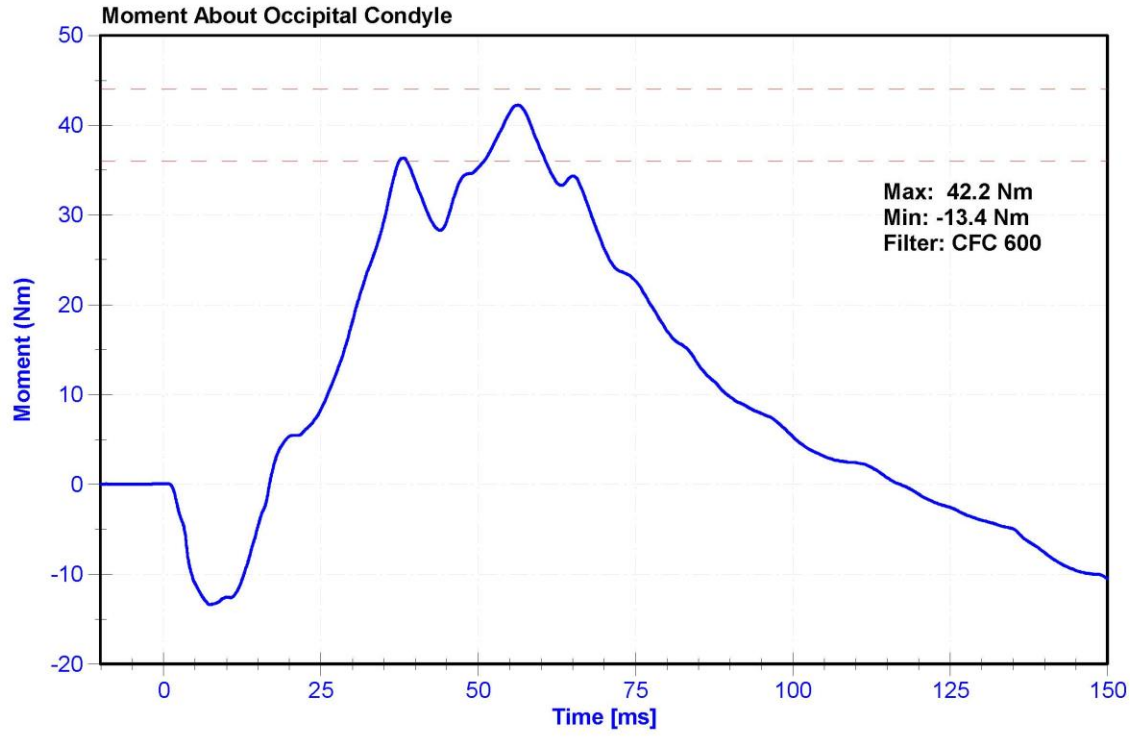
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.1	Pass
Humidity	10	70	%	39.7	Pass
Velocity	5.51	5.63	m/s	5.583	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.30	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.46	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.70	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.64	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.88	Pass
Neck Rotation	71	81	deg	77.5	Pass
Time at Maximum Rotation	50	70	ms	61.7	Pass
Moment about the OC	36	44	Nm	42.2	Pass
Moment Decay to 0 Nm	102	126	ms	117.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5F3	5/11/2018	5/11/2019
Pendulum Potentiometer	Denton 78051-342	DS-184Pend	11/1/2018	11/1/2019
Condyle Potentiometer	Denton 78051-342	DS-185Pend	11/1/2018	11/1/2019
Upper Neck Load Cell	Denton 1716	LC-2018 FY	9/28/2018	9/28/2019




Neck Rotation
Max: 77.5 deg
Min: -16.4 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: 42.2 Nm
Min: -13.4 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

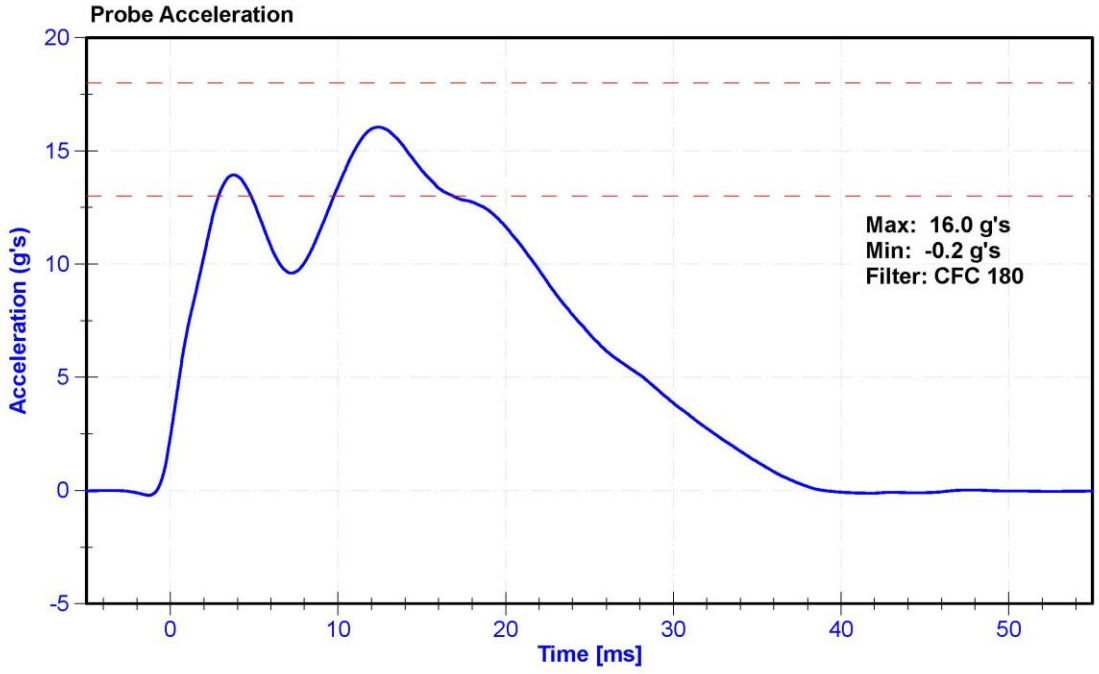
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

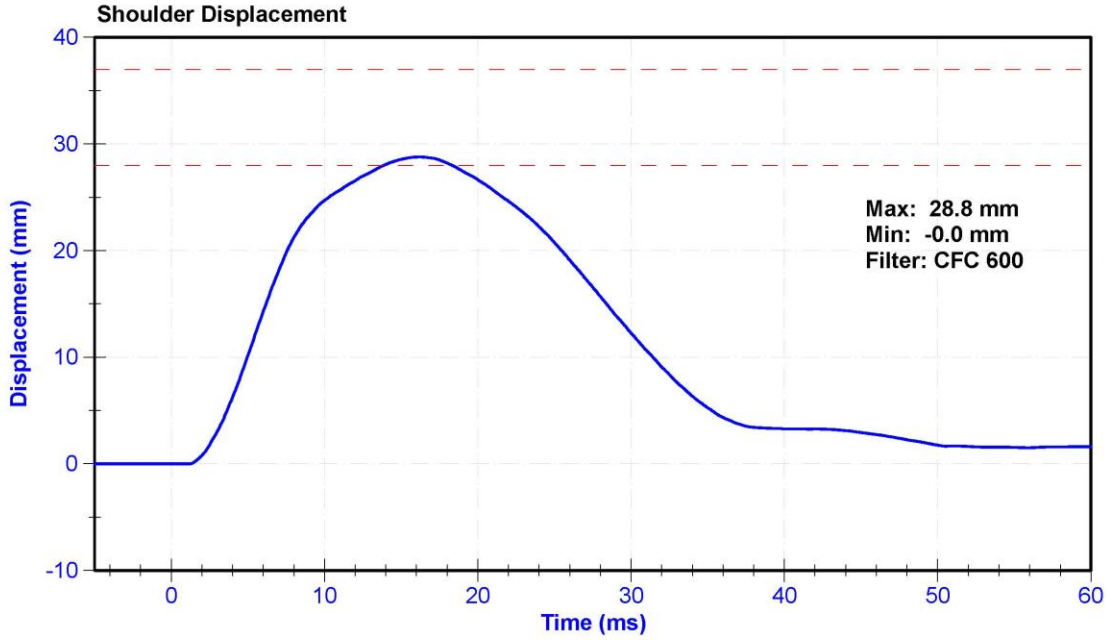
Results

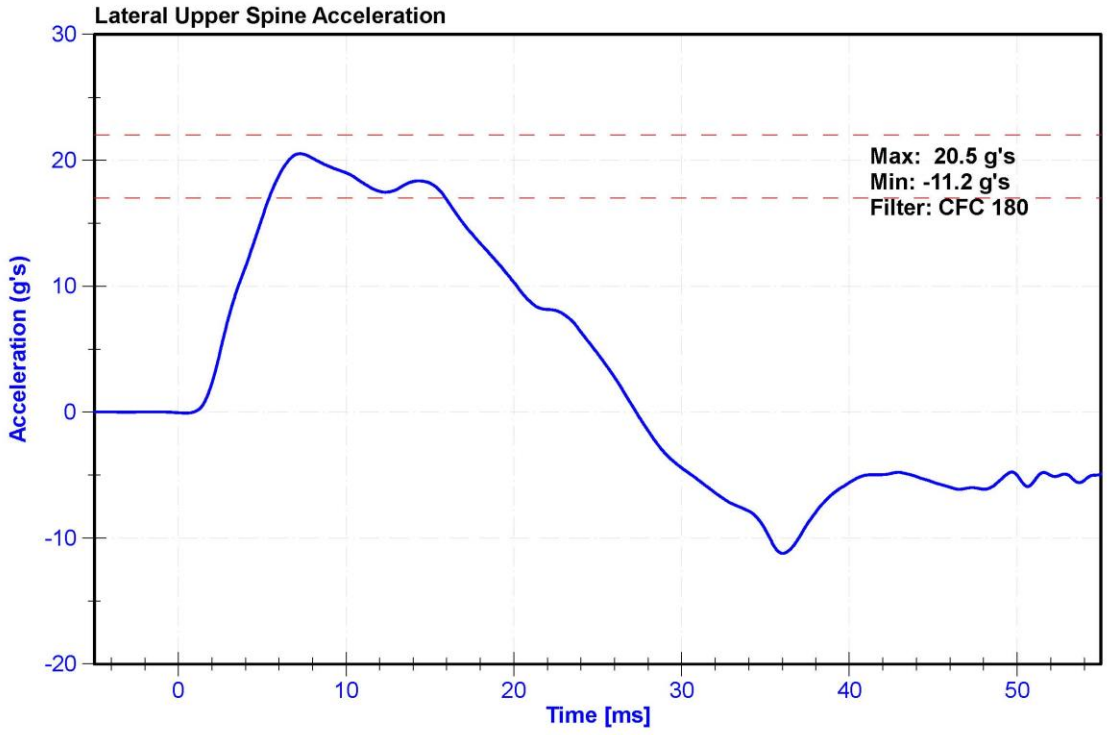
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	38.5	Pass
Velocity	4.2	4.4	m/s	4.37	Pass
Probe Acceleration	13	18	g's	16.0	Pass
Shoulder Deflection	28	37	mm	28.8	Pass
Lateral Upper Spine Acceleration	17	22	g's	20.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360MAC7	AC-P94667	11/1/2018	11/1/2019
Shoulder Potentiometer	Servo 08TC1-3745	DS-1845GFE	10/11/2018	10/11/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/23/2018	4/23/2019




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 28.8 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: 20.5 g's
Min: -11.2 g's
Filter: CFC 180
30
20
10
0
-10
-20
0
10
20
30
40
50

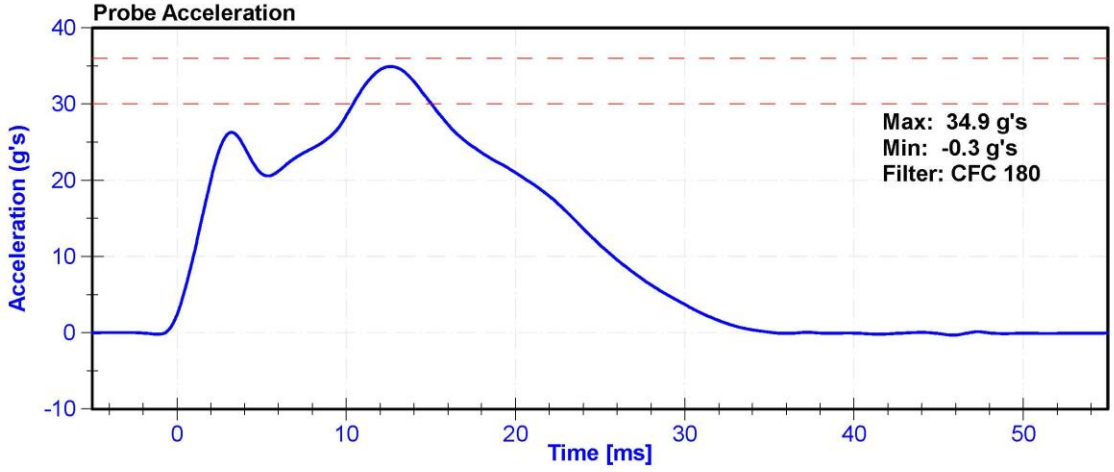
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

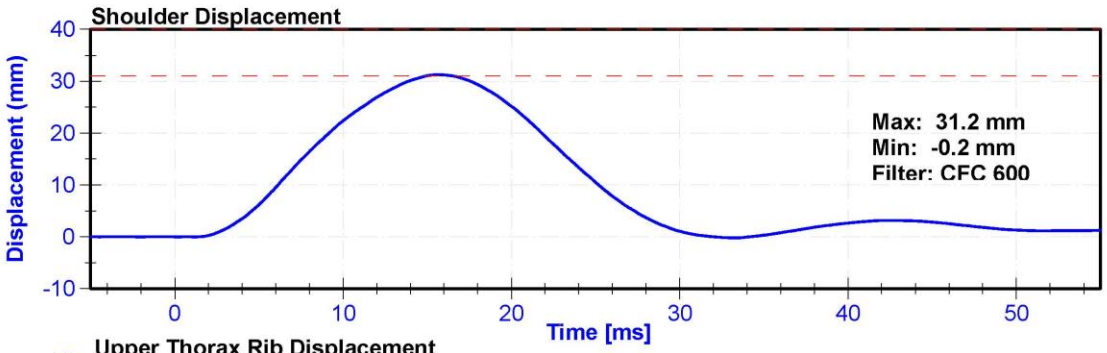
Results

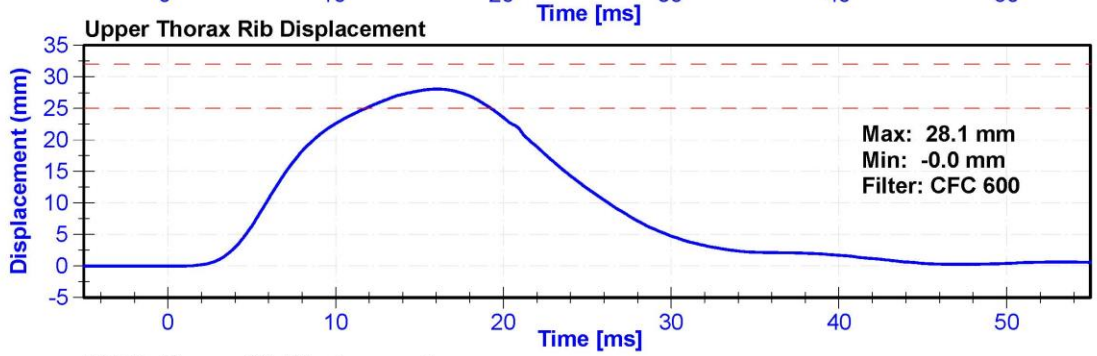
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	36.6	Pass
Velocity	6.6	6.8	m/s	6.77	Pass
Probe Acceleration after 5 ms	30	36	g's	34.9	Pass
Lateral Upper Spine Acceleration	34	43	g's	38.3	Pass
Lateral Lower Spine Acceleration	29	37	g's	32.3	Pass
Shoulder Deflection	31	40	mm	31.2	Pass
Upper Thorax Rib Deflection	25	32	mm	28.1	Pass
Mid Thorax Rib Deflection	30	36	mm	33.7	Pass
Lower Thorax Rib Deflection	32	38	mm	36.2	Pass

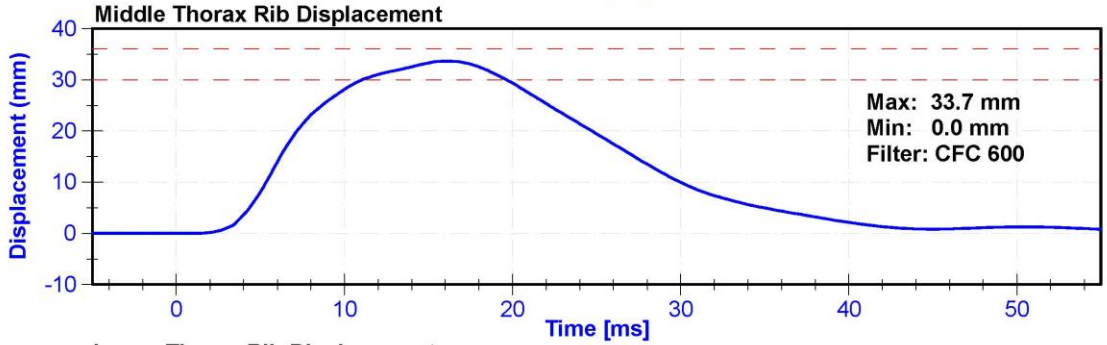
Transducer Calibrations

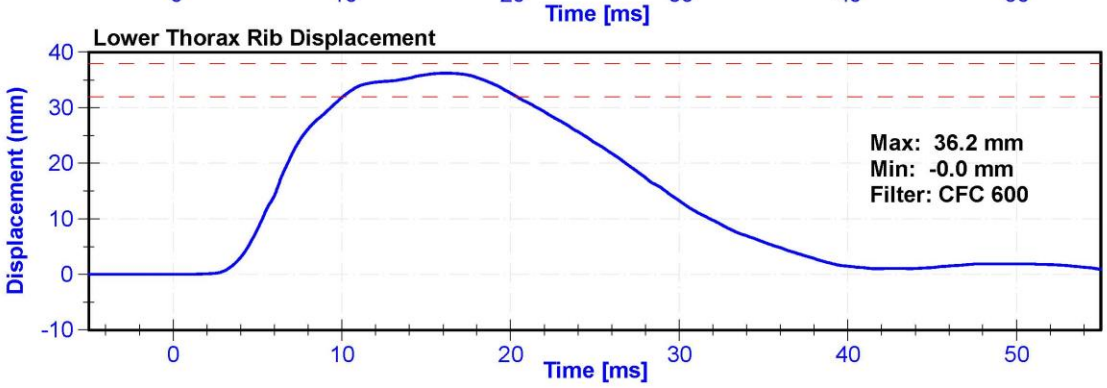
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/23/2018	4/23/2019
Upper Spine T12 Y Accelerometer	ENDEVCO 7264CT	AC-P51699	10/16/2018	4/16/2019
Shoulder Potentiometer	Servo 08TC1-3745	DS-1845GFE	10/11/2018	10/11/2019
Upper Thorax Rib Potentiometer	Servo 1246	DS-2165GFE	5/15/2018	5/15/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3621	DS-45 GFE	10/12/2018	10/12/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3787	DS-011GFE	10/12/2018	10/12/2019

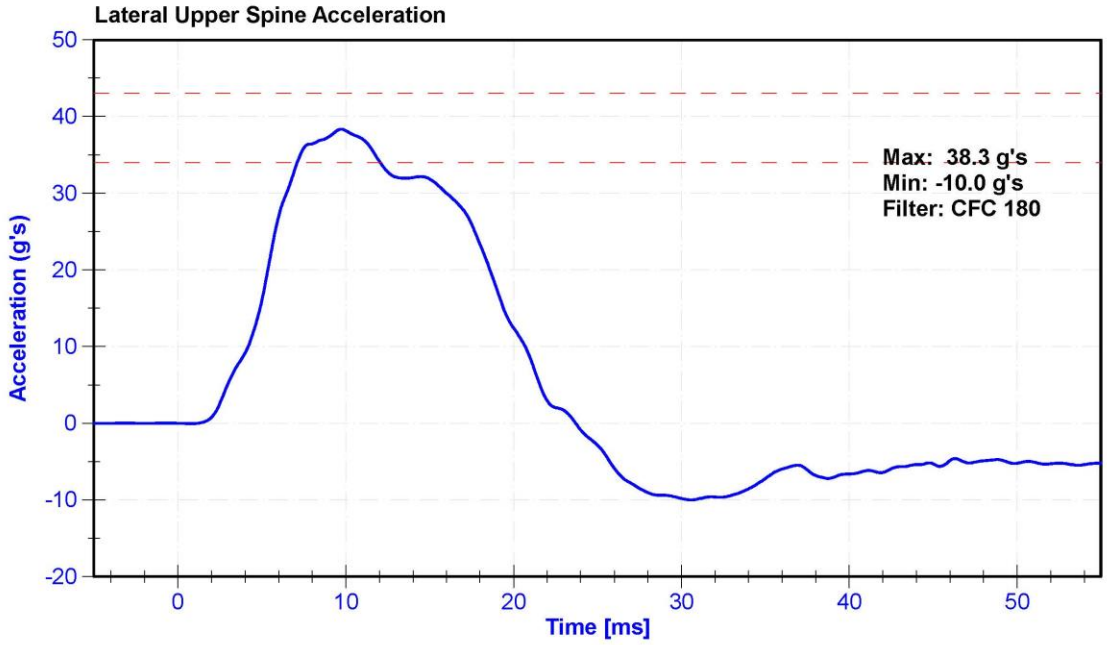


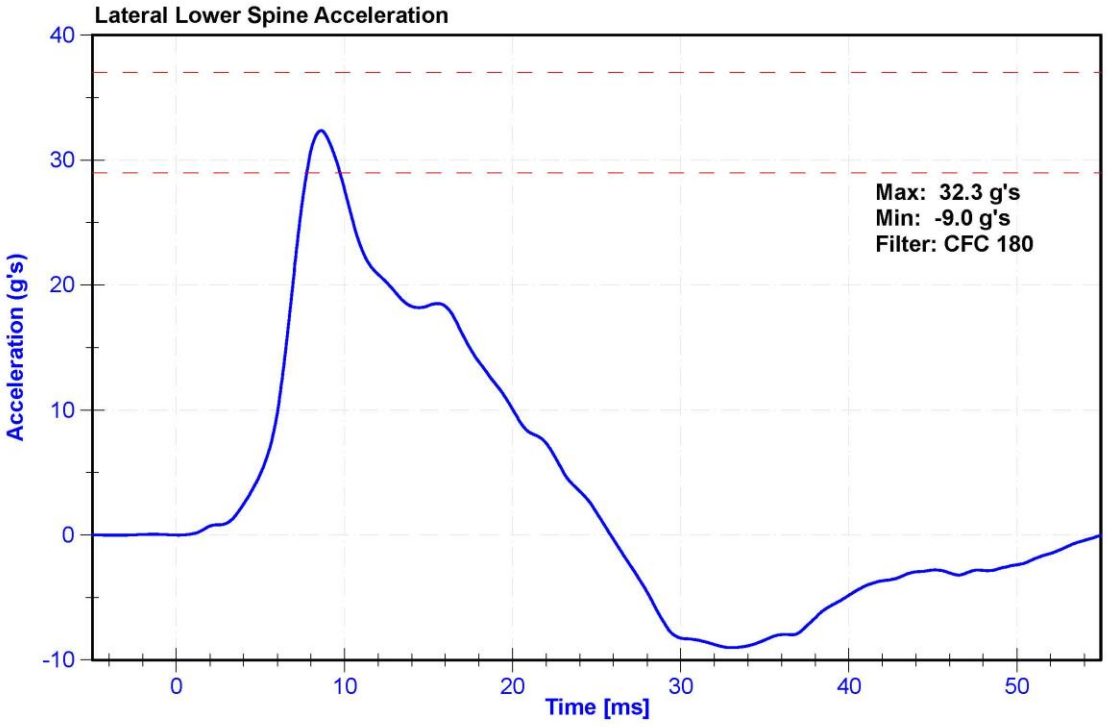

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 31.2 mm
Min: -0.2 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 28.1 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 33.7 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 36.2 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 38.3 g's
Min: -10.0 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: 32.3 g's
Min: -9.0 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50

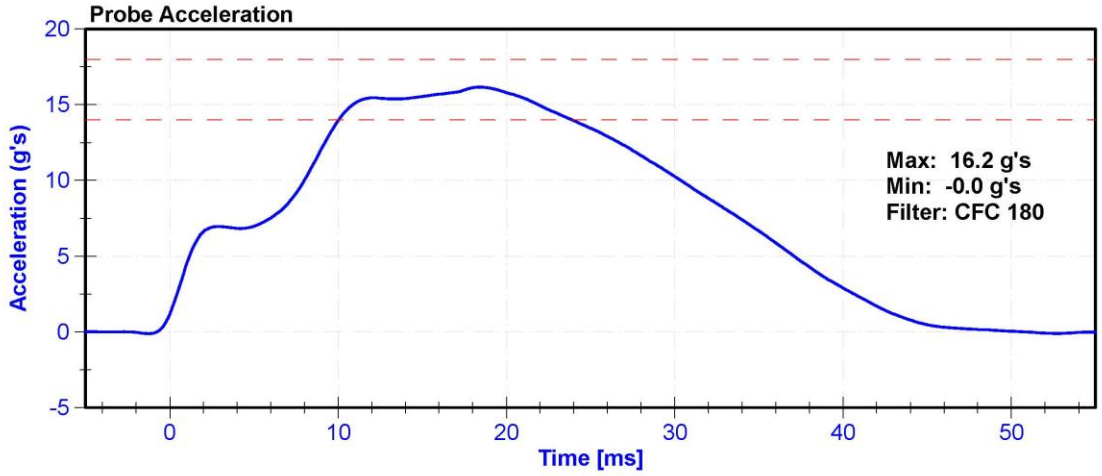
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

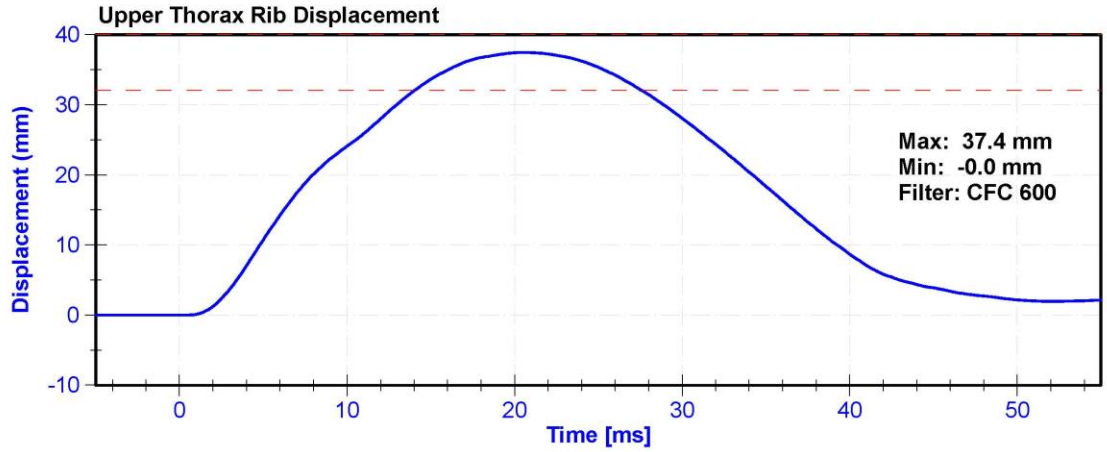
Results

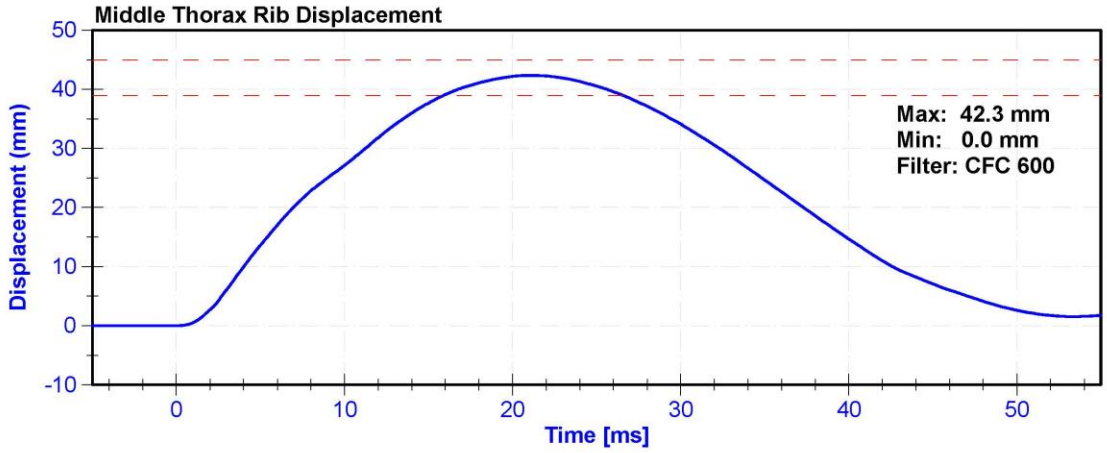
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	36.5	Pass
Velocity	4.2	4.4	m/s	4.35	Pass
Probe Acceleration	14	18	g's	16.2	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.4	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.8	Pass
Upper Thorax Rib Deflection	32	40	mm	37.4	Pass
Middle Thorax Rib Deflection	39	45	mm	42.3	Pass
Lower Thorax Rib Deflection	35	43	mm	38.8	Pass

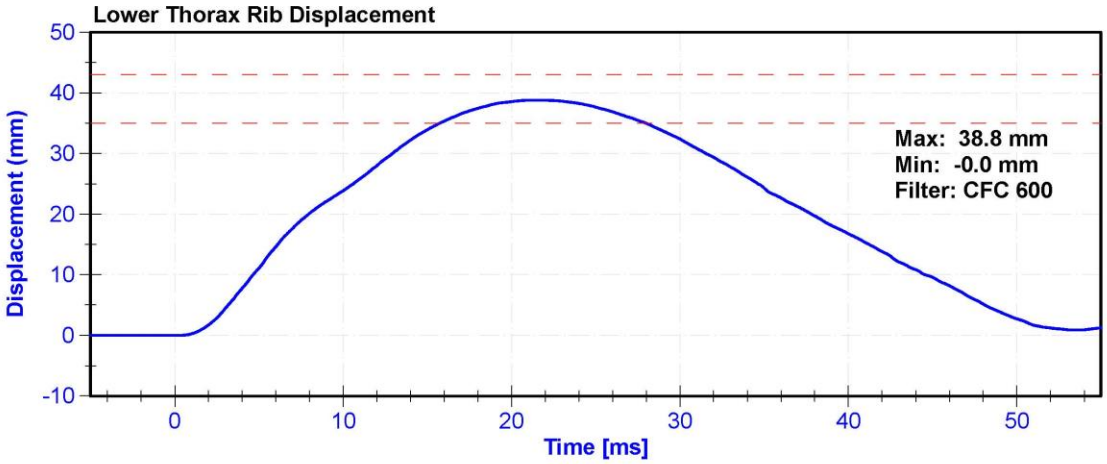
Transducer Calibrations

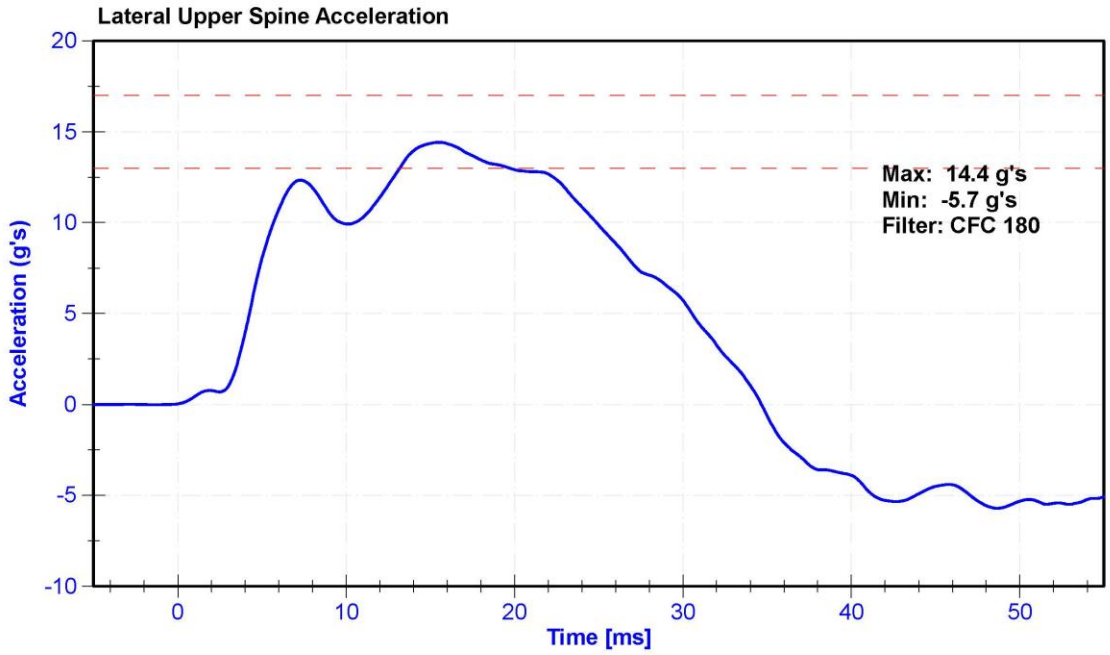
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/23/2018	4/23/2019
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51699	10/16/2018	4/16/2019
Upper Thorax Rib Potentiometer	Servo 1246	DS-2165GFE	5/15/2018	5/15/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3621	DS-45 GFE	10/12/2018	10/12/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3787	DS-011GFE	10/12/2018	10/12/2019

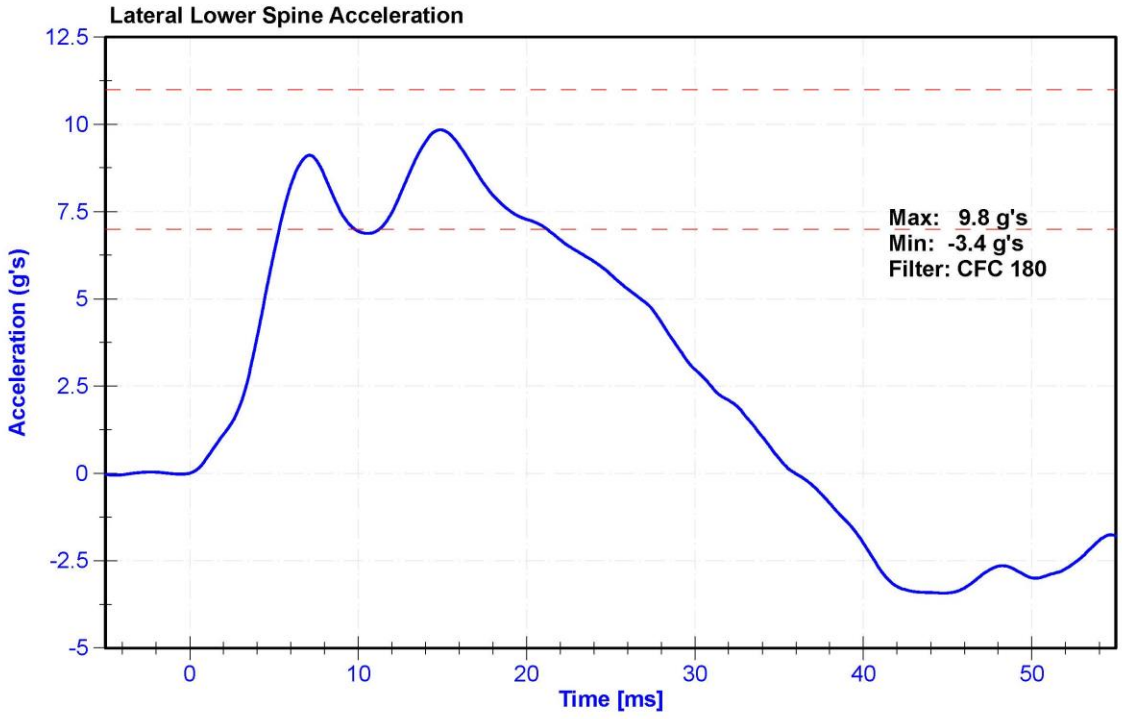



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.4 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 42.3 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 38.8 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 14.4 g's
Min: -5.7 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: -3.4 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

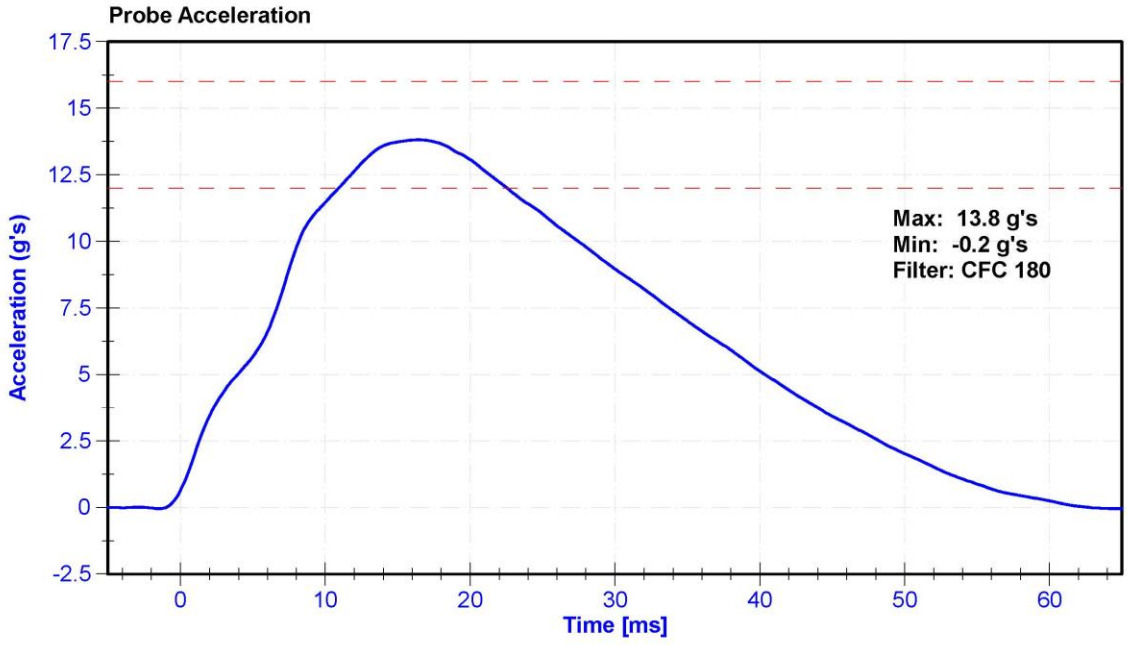
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

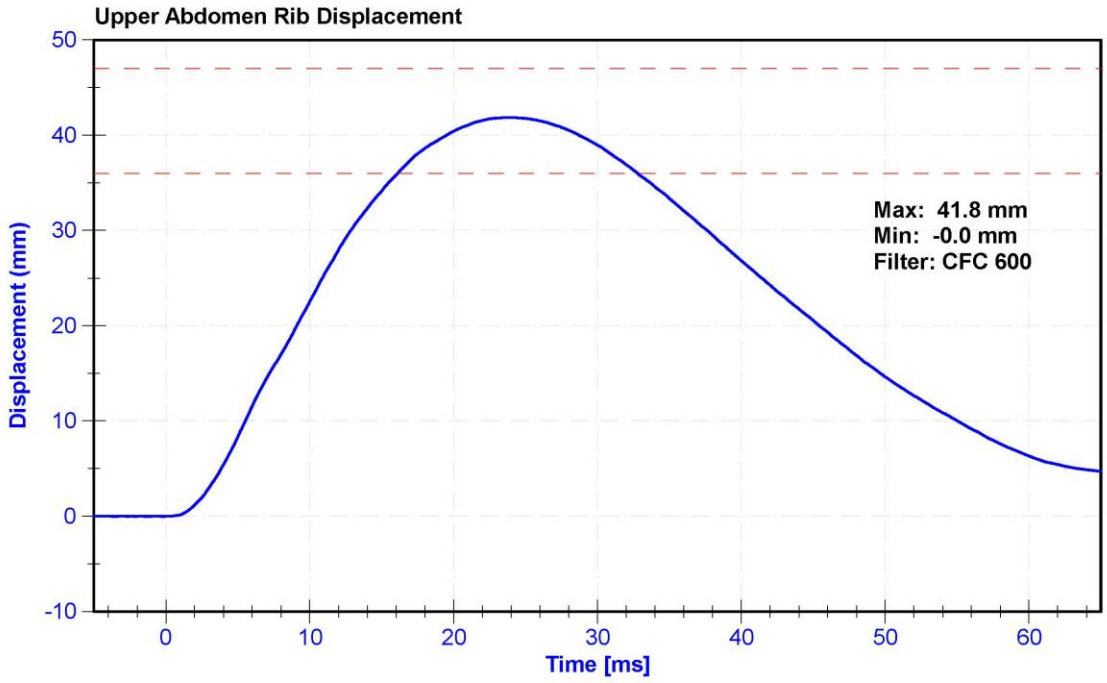
Results

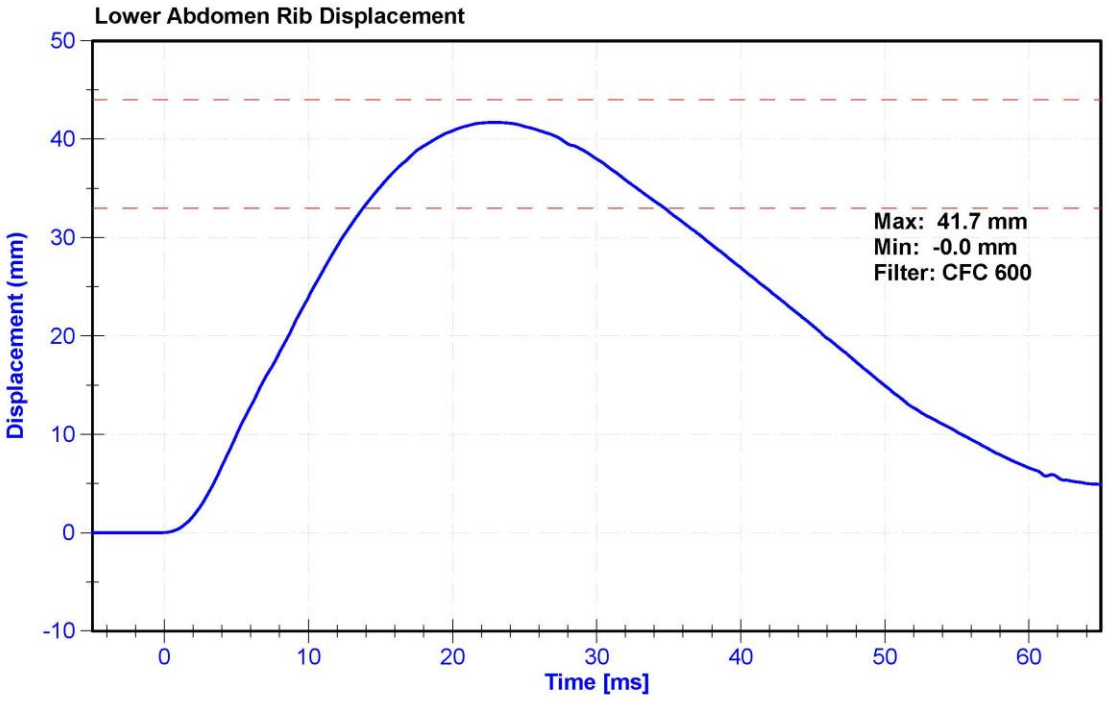
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	34.8	Pass
Velocity	4.2	4.4	m/s	4.37	Pass
Probe Acceleration	12	16	g's	13.8	Pass
Lateral Lower Spine Acceleration	9	14	g's	9.8	Pass
Upper Abdomen Rib Deflection	36	47	mm	41.8	Pass
Lower Abdomen Rib Deflection	33	44	mm	41.7	Pass

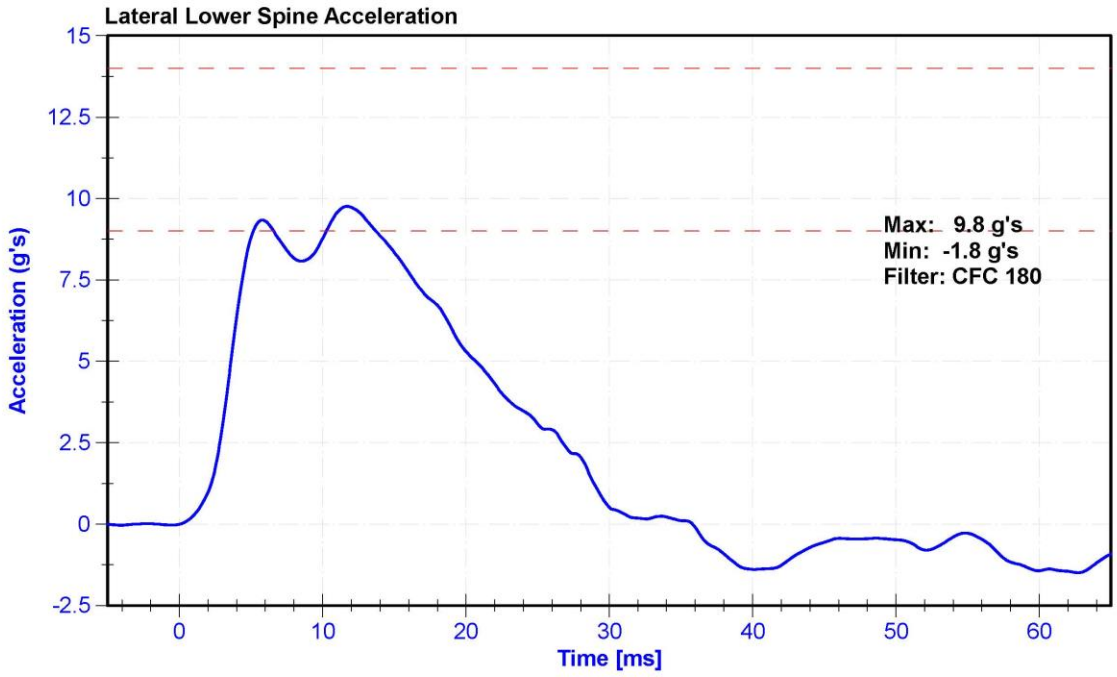
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51699	10/16/2018	4/16/2019
Upper Abdomen Rib Potentiometer	Servo 08TC1-3725	DS-008GFE	10/11/2018	10/11/2019
Lower Abdomen Rib Potentiometer	Servo 08TC1-3745	DS-1774GFE	10/12/2018	10/12/2019




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.8 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.7 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: 9.8 g's
Min: -1.8 g's
Filter: CFC 180

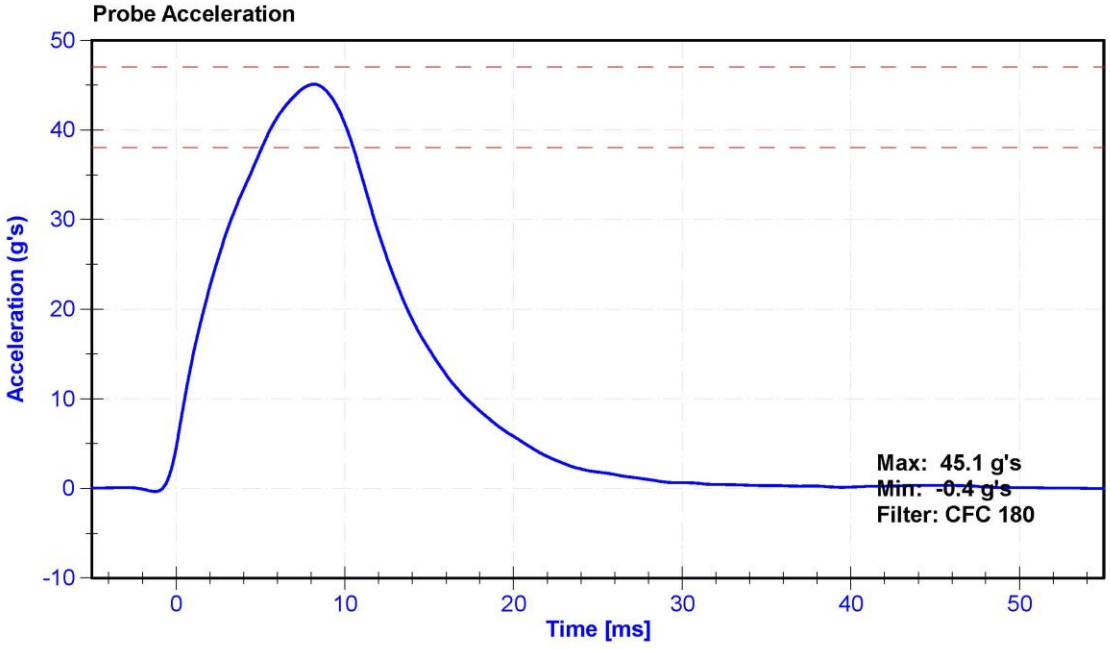
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

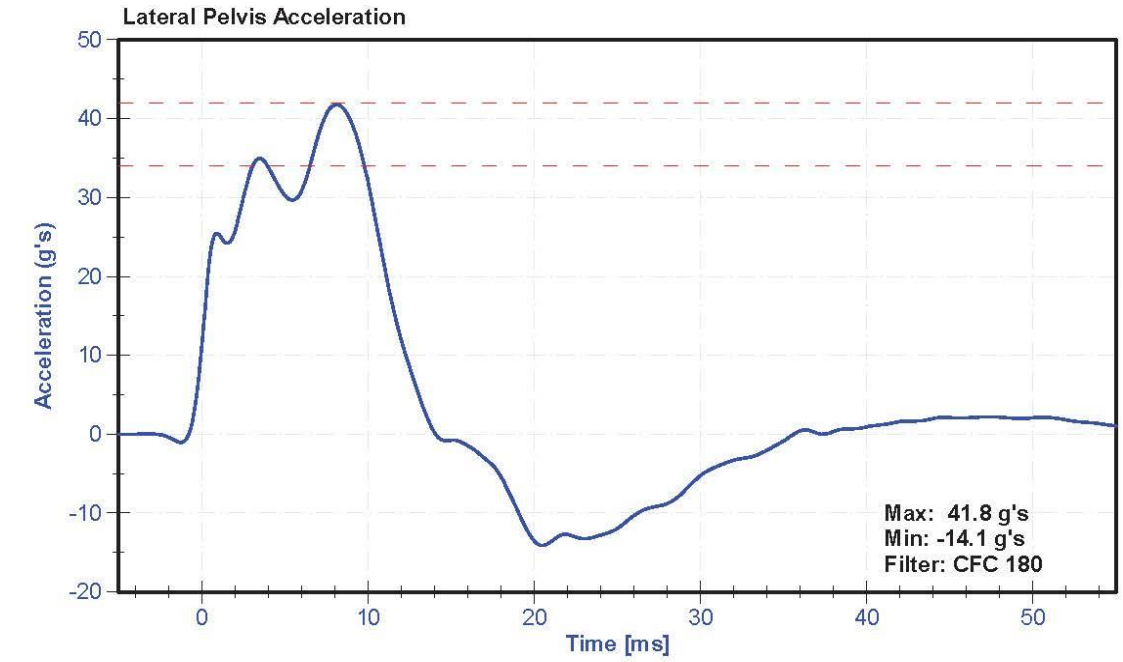
Results

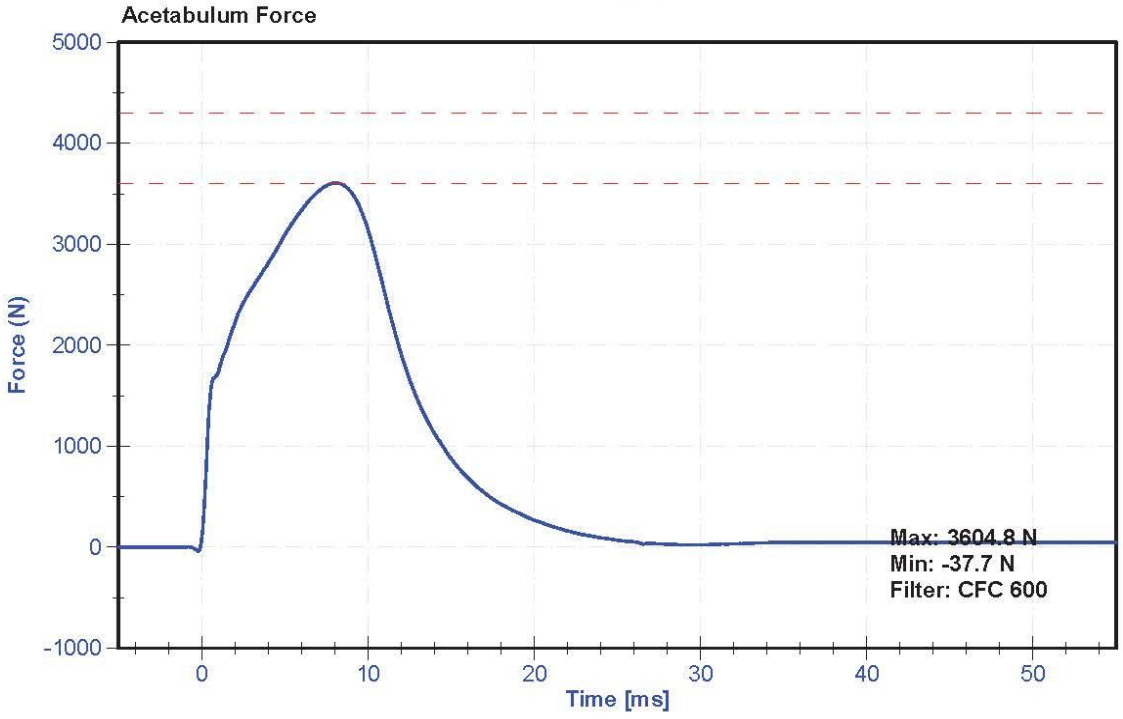
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	28.1	Pass
Velocity	6.6	6.8	m/s	6.64	Pass
Probe Acceleration	38	47	g's	45.1	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.8	Pass
Acetabulum Force	3600	4300	N	3604.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51875	10/17/2018	4/17/2019
Acetabulum Load Cell	Denton 3249J	LC-4986Fy	6/4/2018	6/4/2019
Certification Plug	Humanetics	11950	2/1/2018	N/A
Crash Test Plug	Humanetics	11418	8/29/2016	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: 41.8 g's
Min: -14.1 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: 3604.8 N
Min: -37.7 N
Filter: CFC 600

DG8012 Crash 2/5/19

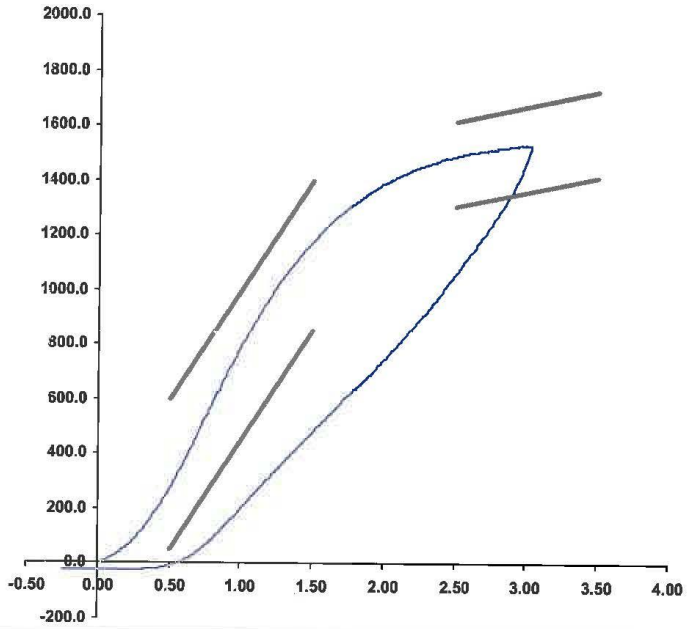
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 11418
Test Number 2887
Report Number 2884
Test Date 8/29/2016 11:08:05 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	272.90	50.00	600.00
Force @ 1.5 mm (N)	1,177.71	850.00	1,400.00
Force @ 2.5 mm (N)	1,490.72	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,532.12	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (TI240813), Units (LBS) 1000

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

Notes:

Operator DC

Part Number 180-4450

Template No 107 29-Aug-16
SACO Research

By : DC Date : 8/29/16

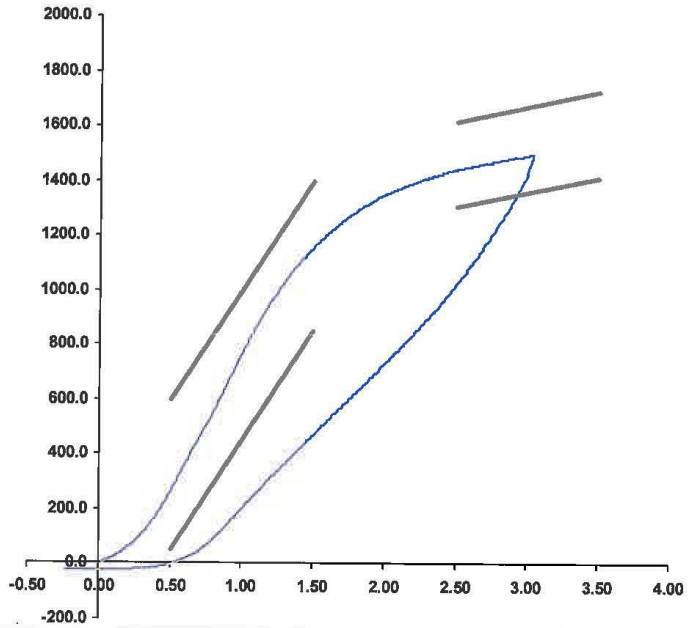
SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

SID-IIs Pelvis Plug Certification Test

Plug S/N 11950
Test Number 6138
Report Number 6155
Test Date 2/1/2018 10:03:38 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	257.91	50.00	600.00
Force @ 1.5 mm (N)	1,163.41	850.00	1,400.00
Force @ 2.5 mm (N)	1,444.14	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,496.02	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 01-Feb-18
SACO Research

By : JC Date : 2/1/18

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

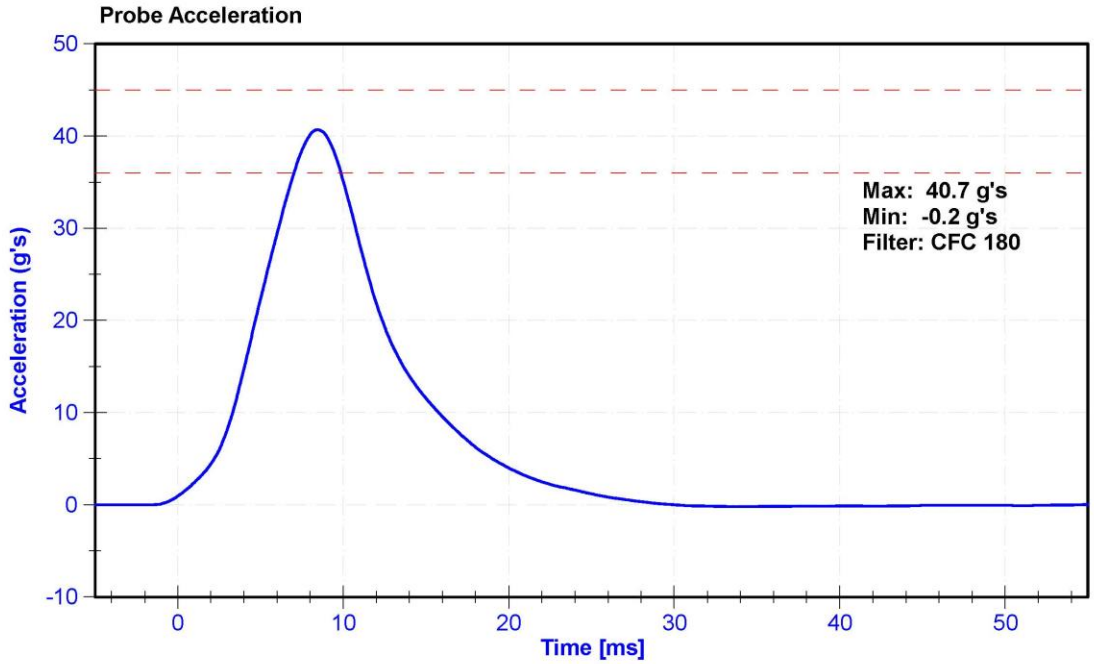
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K.Brogan

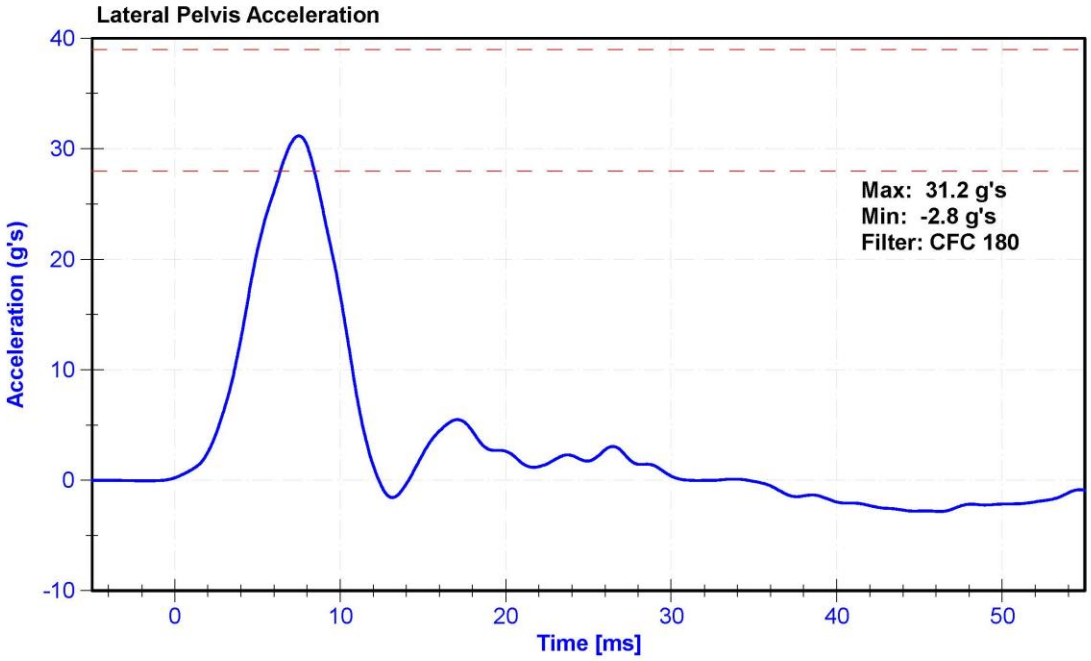
Results

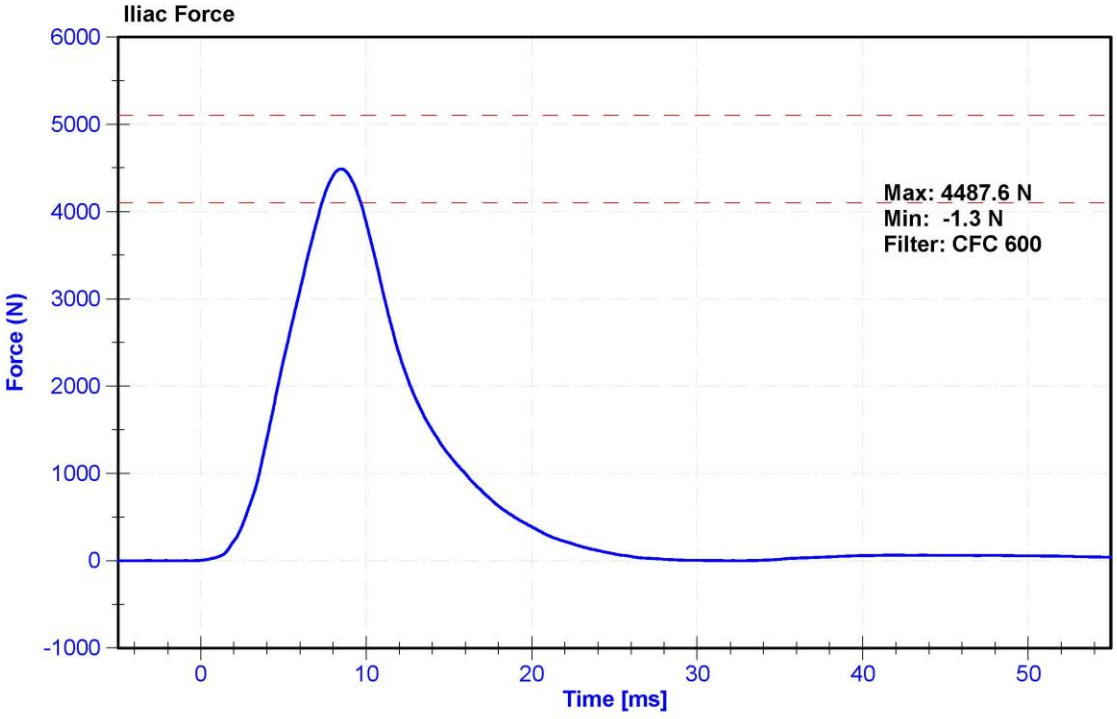
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	28.6	Pass
Velocity	4.2	4.4	m/s	4.38	Pass
Probe Acceleration	36	45	g's	40.7	Pass
Lateral Pelvis Acceleration	28	39	g's	31.2	Pass
Iliac Force	4100	5100	N	4487.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51875	10/17/2018	4/17/2019
Iliac Load Cell	DENTON 3228J	LC-279Fy	10/4/2018	10/4/2019




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 31.2 g's
Min: -2.8 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4487.6 N
Min: -1.3 N
Filter: CFC 600

APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N: F034		
			Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers	Primary	X	AC-P58904	ENDEVCO	10/5/2018
		Y	AC-P58911	ENDEVCO	10/5/2018
		Z	AC-P58776	ENDEVCO	10/5/2018
	Redundant	X	AC-P58887	ENDEVCO	10/5/2018
		Y	AC-P58888	ENDEVCO	10/5/2018
		Z	AC-P51734	ENDEVCO	10/5/2018
Thorax Rib Displacement Potentiometers	Upper	Y	DS-183GFE	Honeywell	10/10/2018
	Middle	Y	DS-184GFE	Honeywell	10/11/2018
	Lower	Y	DS-182GFE	Honeywell	10/10/2018
Abdomen Load Cells	Forward	Y	LC-1440	DENTON	6/4/2018
	Middle	Y	LC-1525	DENTON	6/4/2018
	Rear	Y	LC-1528	DENTON	6/4/2018
Lower Spine Accelerometers (T12)		X	AC-P52079	ENDEVCO	10/4/2018
		Y	AC-P51948	ENDEVCO	10/4/2018
		Z	AC-P51269	ENDEVCO	10/4/2018
Pubic Symphysis Load Cell		Y	LC-464fy	DENTON	6/4/2018

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N: DG8012		
				Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers		Primary	X	AC-P74788	ENDEVCO	10/18/2018
			Y	AC-P83432	ENDEVCO	10/18/2018
			Z	AC-P83319	ENDEVCO	10/18/2018
		Redundant	X	AC-P80334	ENDEVCO	10/18/2018
			Y	AC-P63841	ENDEVCO	1/21/2019
			Z	AC-P83322	ENDEVCO	10/18/2018
Displacement Potentiometers	Thoracic Rib	Upper	Y	DS-2165GFE	Servo	5/15/2018
		Middle	Y	DS-45 GFE	Servo	10/12/2018
		Lower	Y	DS-008GFE	Servo	10/12/2018
	Abdominal Rib	Upper	Y	DS-1774GFE	Servo	10/11/2018
		Lower	Y	AC-P45019	ENDEVCO	10/12/2018
Lower Spine Accelerometers (T12)			X	AC-P45019	ENDEVCO	10/17/2018
			Y	AC-P51699	ENDEVCO	10/16/2018
			Z	AC-P51685	ENDEVCO	10/17/2018
Acetabulum Load Cell			Y	LC-4986Fy	DENTON	6/4/2018
Iliac Wing Load Cell			Y	LC-279Fy	DENTON	10/4/2018
Pelvis Plug (struck side)				1158	SACO	10/4/2016
Pelvis Plug (non-struck side)				-	-	-

Table 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	AC-A196999	MSI 1201-1000	11/30/2018
	Vehicle Center of Gravity	Y	AC-A279978	MSI 1201-1000	11/16/2018
	Vehicle Center of Gravity	Z	AC-A279982	MSI 1201-1000	11/10/2018
2	Right Sill at Front Seat	X	AC-A255838	MSI 1201-1000	1/17/2019
	Right Sill at Front Seat	Y	AC-A262043	MSI 1201-1000	1/17/2019
	Right Sill at Front Seat	Z	AC-A262045	MSI 1201-1000	1/17/2019
3	Right Sill at Rear Seat	X	AC-A280336	MSI 1201-1000	11/14/2018
	Right Sill at Rear Seat	Y	AC-A280372	MSI 1201-1000	11/17/2018
	Right Sill at Rear Seat	Z	AC-A280400	MSI 1201-1000	11/16/2018
4	Left Sill at Front Door	Y	AC-A280969	MSI 1201-1000	11/23/2018
5	Left Sill at Rear Door	Y	AC-A280930	MSI 1201-1000	11/22/2018
6	Left A-Post Lower	Y	AC-A280383	MSI 1201-1000	11/17/2018
7	Left A-Post Middle	Y	AC-A280368	MSI 1201-1000	11/17/2018
8	Left B-Post Lower	Y	AC-A280874	MSI 1201-1000	11/22/2018
9	Left B-Post Middle	Y	AC-A280873	MSI 1201-1000	11/22/2018
10	Front Seat Track	Y	AC-A280835	MSI 1201-1000	11/22/2018
11	Rear Seat Track or Structure	Y	AC-A280896	MSI 1201-1000	11/20/2018
12	Right Rear Occ. Compartment	Y	AC-A280910	MSI 1201-1000	11/21/2018
13	Engine Block	X	AC-A262925	MSI 1201-1000	10/18/2018
	Engine Block	Y	AC-A280914	MSI 1201-1000	11/21/2018
14	Rear Floorpan Above Axle	X	AC-A262918	MSI 1201-1000	10/29/2018
	Rear Floorpan Above Axle	Y	AC-A262919	MSI 1201-1000	10/29/2018
	Rear Floorpan Above Axle	Z	AC-A262921	MSI 1201-1000	10/29/2018

TABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	AC-A251545	MSI 58-2000-360	11/1/2018
MDB Center of Gravity	Y	AC-A255130	MSI 58-2000-360	11/1/2018
MDB Center of Gravity	Z	AC-A255143	MSI 58-2000-360	11/1/2018
Left Frame at Rear Axle Centerline	X	AC-A280950	MSI 1201-1000	11/24/2018
Left Frame at Rear Axle Centerline	Y	AC-A280989	MSI 1201-1000	11/23/2018