REPORT NUMBER: SINCAP-CAL-19-007

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

FCA US LLC
2019 Ram 1500 Quad Cab
Four Door Truck

NHTSA No: M20190317

PREPARED BY:
CALSPAN CORPORATION
P.O. BOX 400
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July 19, 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: _____ Date: July 19, 2019
Vince Paolini, Project Engineer

Approved by: _____ Date: July 19, 2019
Vanessa Hansen, Operations Manager

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. SINCAP-CAL-19-007	***2. Government Accession No.***	***3. Recipient's Catalog No.***
4. Title and Subtitle Final Report of New Car Assessment Program Side Impact MDB Testing of a 2019 Ram 1500 Quad Cab Truck NHTSA No.: M20190317		***5. Report Date*** July 19, 2019 ***6. Performing Organization Code*** CAL
Vince Paolini, Project Engineer Vanessa Hansen , Operations Manager		***8. Performing Organization Report No.*** CAL-DOT-2019-007
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225		***10. Work Unit No.*** ***11. Contract or Grant No.*** DTNH22-14-D-00352
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave., SE, Room W43-410 Washington, D.C. 20590		***13. Type of Report and Period Covered:*** Final Test Report April 29, 2019 - July 19, 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 Ram 1500 Quad Cab Truck 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 April 29, 2019.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.93 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 183mm located at level 1. 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	8.748
Maximum Thoracic Rib Deflection	mm	44	16.406
Total Abdominal Force	N	2500	522.712
Pubic Symphysis Force	N	6000	721.115

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC_{36})	N/A	1000	9.817
Lower Spine Resultant Acceleration	G	82	20.706
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	1608.257
Maximum Thoracic Rib Deflection	mm	38*	9.183
Maximum Abdominal Rib Deflection	mm	45*	10.452

* *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

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UNCLASSIFIED	UNCLASSIFIED	192	

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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 Ram 1500 Quad Cab Truck. 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 Ram 1500 Quad Cab Truck 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 61.93 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 April 29, 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	8.748
Maximum Thorax Rib Deflection	mm	44	16.406
Combined Abdominal Force	N	2500	522.712
Pubic Symphysis Force	N	6000	721.115

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC36)		1000	9.817
Lower Spine (T12) Resultant Acceleration	G	82	20.706
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	1608.257
Maximum Thoracic Rib Deflection	mm	38*	9.183
Maximum Abdominal Rib Deflection	mm	45*	10.452

*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

- Left A-Pillar Middle Y Acceleration,Exceeded calibration range at 20.8 ms
- Driver Seat Track Y Acceleration,Exceeded calibration range at 15 ms
- Left B-Pillar Lower Y Acceleration,Exceeded calibration range at 11.8 ms 16.8 ms
- Left B-Pillar Middle Y Acceleration,Exceeded calibration range at 10 ms 13.4 ms

SECTION 3

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

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

Data Sheet No. 2 – Seat, Seat Belt, Steering Wheel Adjustment and Fuel 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 Ram 1500 Quad Cab Truck NHTSA No.: M20190317
Test Program: NCAP Side MDB Impact Test Test Date: 4/29/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20190317
Model Year	2019
Make	Ram
Model	1500
Body Style	Quad Cab
VIN	1C6RRECT5KN666249
Body Color	Silver
Odometer Reading (km/mi)	15 miles
Engine Displacement (L)	5.7
Type/No. Cylinders	V8
Engine Placement	Inline
Transmission Type	Automatic
Transmission Speeds	8-Speed
Overdrive	Yes
Final Drive	Rear 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	FCA US LLC
Date of Manufacture	10-18
Vehicle Type	Truck

GVWR (kg)	3130
GAWR Front (kg)	1679
GAWR Rear (kg)	1860

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	3	3	-	6	
Capacity Weight (VCW) (kg)				831	(A)
DSC X 68.04 kg				408.24	(B)
Cargo Weight (RCLW) (kg)				136	(A-B)

VEHICLE SEAT TYPE

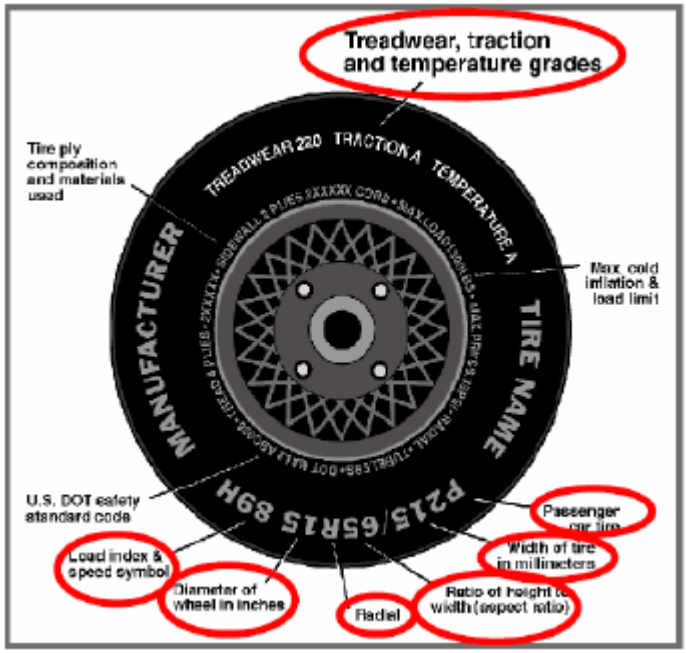
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front Seat	X					X	
Rear or Second Row Seat			X		X		
Third Row seat							

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

Test Vehicle:	2019 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019

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)	300	300
Cold Pressure (kPa)	250	250
Recommended Tire Size	275/65R18	275/65R18
Tire Size on Vehicle	275/65R18	275/65R18
Tire Manufacturer	Bridgestone	Bridgestone
Tire Model	Dueler H/T	Dueler H/T
Treadwear	520	520
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Nylon	2 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	116T	116T
Tire Material	Rubber	Rubber
DOT Safety Code Left	9BYJDHT3718	9BYJDHT3718
DOT Safety Code Right	9BYJDHT3718	9BYJDHT3718

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

Test Vehicle: 2019 Ram 1500 Quad Cab Truck NHTSA No.: M20190317
Test Program: NCAP Side MDB Impact Test Test Date: 4/29/2019

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	260	255	250	260
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	686	486		754	570		762	587	
Right	kg	654	482		686	554		669	559	
Ratio	%	58	42		56	44		56	44	
Totals	kg	1340	968	2308	1440	1124	2564	1431	1146	2577

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	2308	(A)
Sum of Actual Weight of 1 ES2re and 1 P572 ATD (SID-IIs)	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	136	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	2571	(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	914	907	Yes
RF	mm	925	917	Yes
RR	mm	989	982	Yes
LR	mm	980	979	Yes
Vehicle CG (Aft of Front Axle)	mm	1591	1568	
Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline)	mm	41	28	

**** 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 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Non Stuck Side Windows	10
Ballast / Equipment Added	174

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

Test Vehicle:	2019 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019

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	Not Adjustable		
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	Not Adjustable		Max	-	-	-
			Mid	-	-	-
			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 Ram 1500 Quad Cab Truck
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20190317
Test Date: 4/29/2019

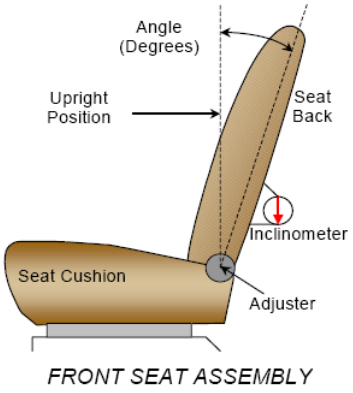
SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forwardmost Position	
	mm	Detents*	mm	Detent*
Driver Seat	220	33 (0-32)	110	16
Front Passenger Seat	220	33 (0-32)	110	16
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	65.1	35	1.0	7
Front Passenger Seat	57.8	35	1.0	7
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 Ram 1500 Quad Cab Truck NHTSA No.: M20190317
Test Program: NCAP Side MDB Impact Test Test Date: 4/29/2019

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	5	0
Rear Seat	Fixed	Fixed

HEAD RESTRAINT ADJUSTMENT

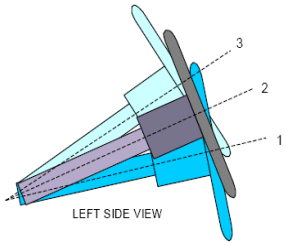
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	5	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	19.6	
Geometric Center – Position 2	21.7	
Uppermost – Position 3	24.2	
Telescoping Steering Wheel Travel		65
Test Position	21.7	32.5

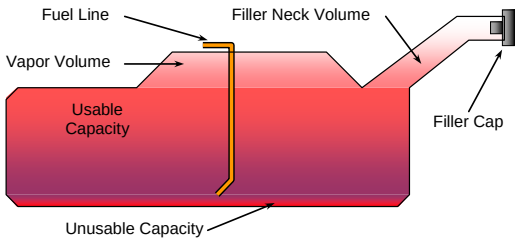


STEERING COLUMN ASSEMBLY

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 left 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 Ram 1500 Quad Cab Truck NHTSA No.: M20190317
Test Program: NCAP Side MDB Impact Test Test Date: 4/29/2019

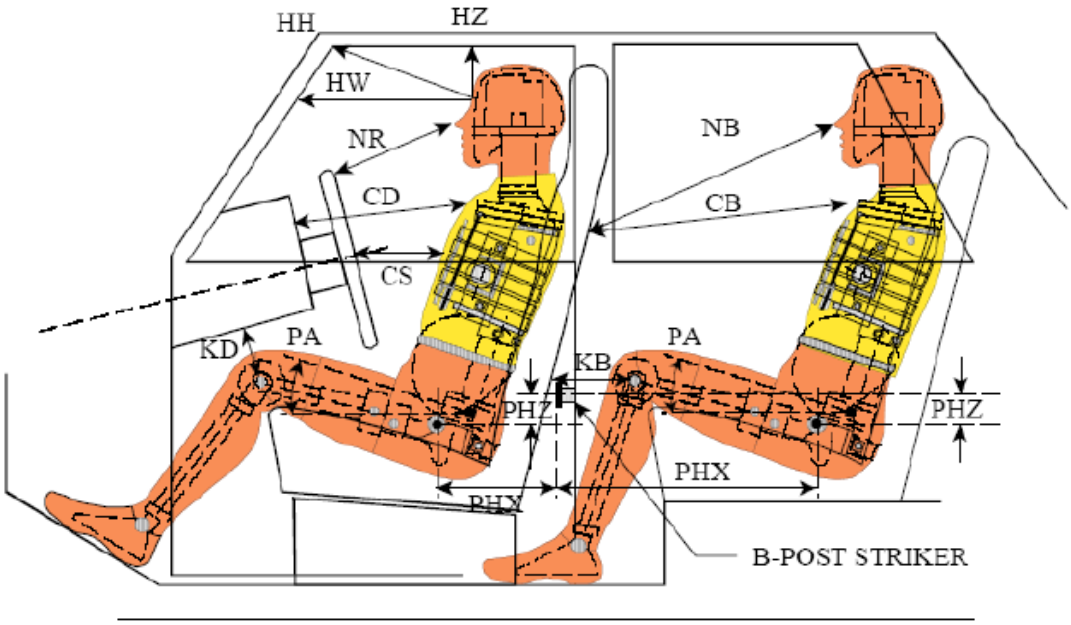
FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	98.4
Usable Capacity of "Optional Tank" (see Form No. 1)	124.9
Usable Capacity of Standard Tank (see Owner's Manual)	98.4
Usable Capacity of Optional Tank (see Owner's Manual)	124.9
93% of Usable Capacity	116.2
Actual Amount of Solvent Used in Test	116.2
1/3 of Usable Capacity	41.6

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 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019



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

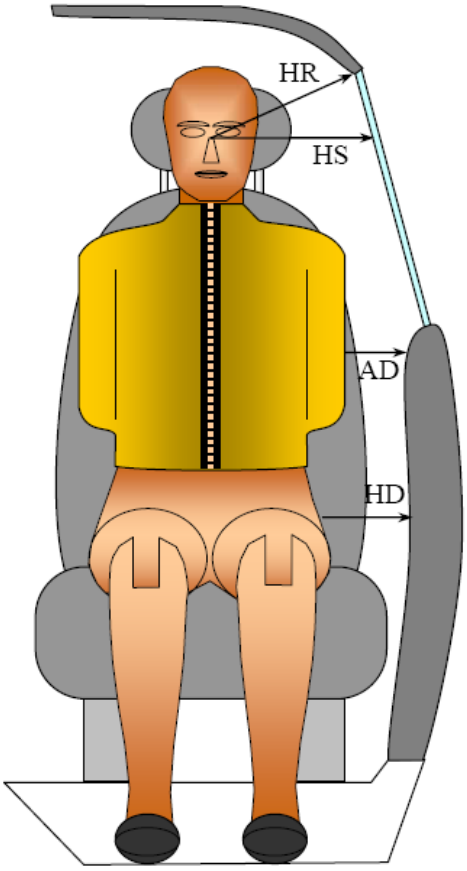
LEFT SIDE VIEW

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	416			
HW		Header to Windshield	685			
HZ	HZ	Head to Roof Liner	173		302	
NR	NB	Nose to Rim/Seat Back	395		436	
CD	CB	Chest to Dash/Seat Back	537		457	
CS		Chest to Steering Wheel	318			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	163	19.8	214	9.4
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	144	19.3	211	9.7
PAX°	PAX°	Pelvic Tilt Angle X		16.2		15.6
	PAY°	Pelvic Tilt Angle Y				0.3
PHX	PHX	Hip Point to Striker (X-Axis)	194		143	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	18		0	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2019 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019



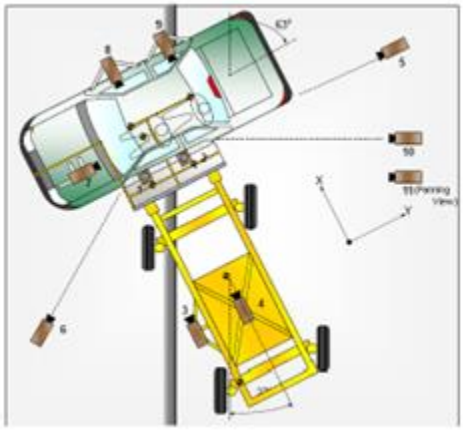
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver (Serial No. F034)	Passenger (Serial No. DG8012)
HR	Head to Side Header	mm	188	264
HS	Head to Side Window	mm	305	360
AD	Arm to Door	mm	106	140
HD	Hip Point to Door	mm	154	180

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2019 Ram 1500 Quad Cab Truck NHTSA No.: M20190317
Test Program: NCAP Side MDB Impact Test Test Date: 4/29/2019



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	392	0	9370	12.5	1000
2	Overhead Close-up	0	-825	9370	24	1000
3	Left Impact Point (MDB)	-1470	0	-847	25	1000
4	Side Overall (MDB)	-1140	878	-1587	8	1000
5	Rear	0	9452	-1251	24	1000
6	Left Front	-4107	-4348	-1341	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.*

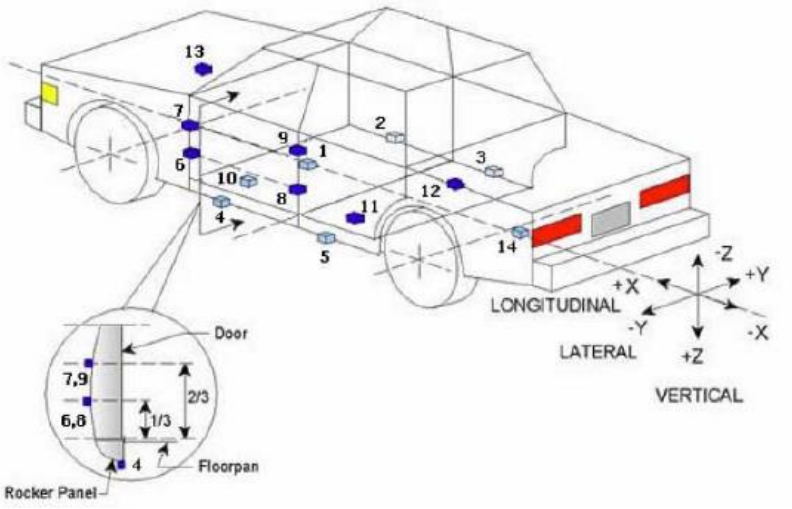
If applicable, explain why camera(s) did not operate as intended: All cameras operated normally

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 Ram 1500 Quad Cab Truck NHTSA No.: M20190317
Test Program: NCAP Side MDB Impact Test Test Date: 4/29/2019



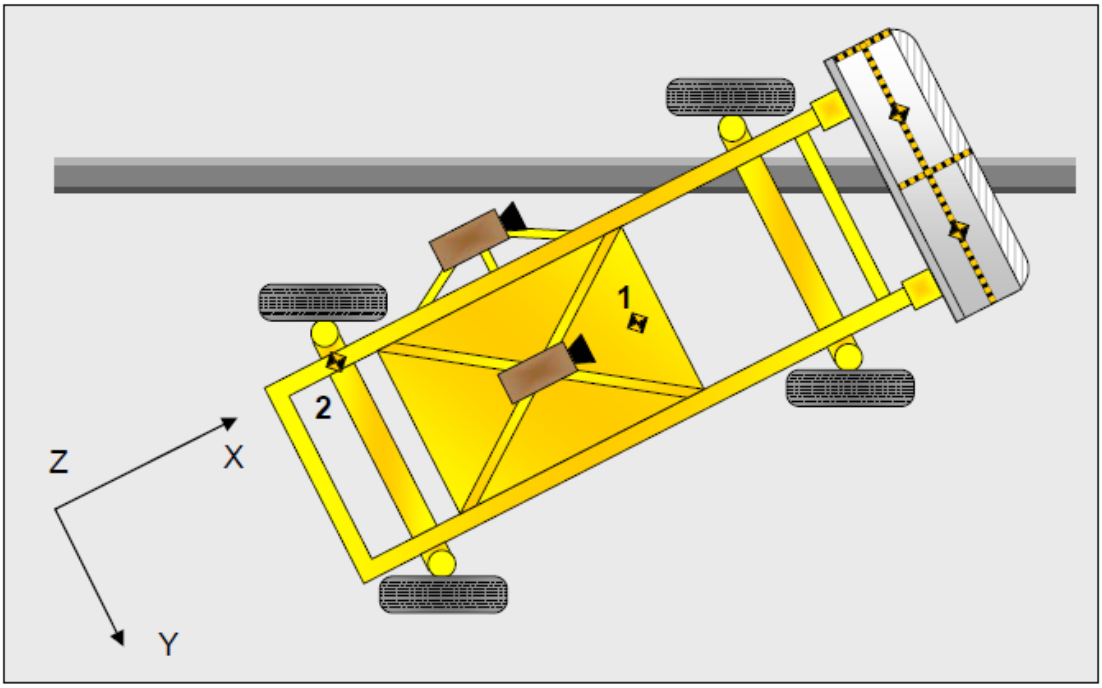
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	3687	-9	-219
2	Right Sill at Front Seat	3866	820	-4
3	Right Sill at Rear Seat	2799	833	-31
4	Left Sill at Front Door	3865	-822	2
5	Left Sill at Rear Door	2827	-826	-26
6	A-Post Lower	4214	-759	-270
7	A-Post Middle	4147	-747	-820
8	B-Post Lower	3140	-779	-263
9	B-Post Middle	3100	-770	-703
10	Front Seat Track	3258	-660	-105
11	Rear Seat Structure	2553	-737	-207
12	Rt. Rear Occ. Compartment	2928	460	-42
13	Engine Block	4815	44	-502
14	Rear Above Axle	1126	-6	-272

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 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019



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 Ram 1500 Quad Cab Truck NHTSA No.: M20190317
Test Program: NCAP Side MDB Impact Test Test Date: 4/29/2019

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 Headliner	Side Headliner
Left Side of Head	Curtain Airbag	Curtain Airbag
Back of Head	Headliner, Curtain Airbag & Headrest	Curtain Airbag & Headrest
Left Shoulder	Curtain Airbag & Torso/Pelvis Airbag	Curtain Airbag & Passenger Door
Upper Torso	Seatback & Torso/Pelvis Airbag	None
Lower Torso	Seatback & Torso/Pelvis Airbag	Passenger Door
Left Hip	Seatpan & Torso/Pelvis Airbag	Seatpan & Passenger Door
Left Knee	Driver Door	Passenger Door

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Rear Hatch/ Other*
	Front	Rear	Front	Rear	
Remained Closed and Operational	No	No	Yes	Yes	Yes
Total Separation from Vehicle at Hinges or Latches	No	No	No	No	No
Latch or Hinge Systems Pulled Out of Their Anchorages	No	No	No	No	No
Disengaged from Latched Position	No	No	No	No	No
Latch Separated from Striker	No	No	No	No	No
Jammed Shut	Yes	Yes	No	No	No
If Door Opened at Striker, Width of Opening at Striker (mm)	0	0	0	0	0

*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	Remained in good condition
Sill Separation	None
Windshield Damage	None
Side Window Damage	None
Other Notable Effects	None

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

Test Vehicle: 2019 Ram 1500 Quad Cab Truck NHTSA No.: M20190317
Test Program: NCAP Side MDB Impact Test Test Date: 4/29/2019

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		3577
Vertical Impact Reference Line (Aft of Front Axle - Intended Impact Point)	mm		508
Actual Impact Point (Aft of Frontal Axle)	mm		506
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	+2
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact Point	+3

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle:	2019 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019

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

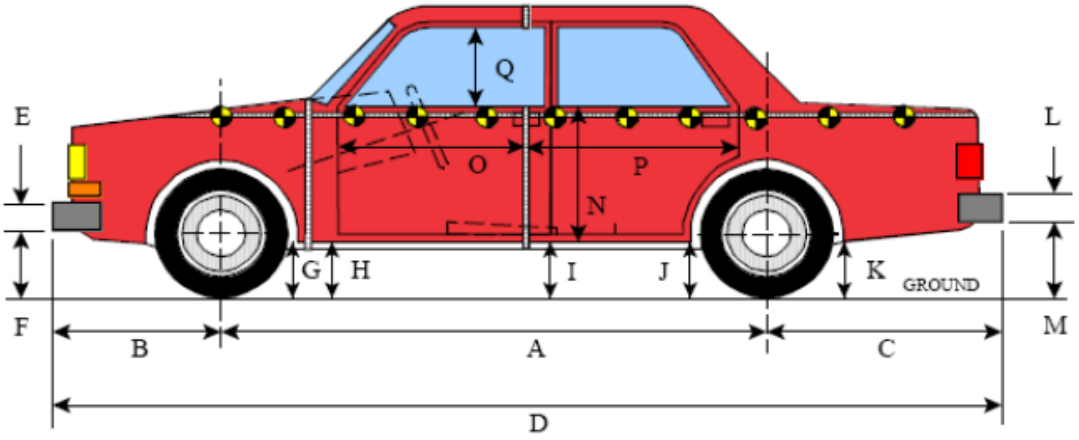
Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.10 to 62.70	61.93
Trap No. 2 Velocity (Redundant)	km/h	61.10 to 62.70	61.94
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.0
MDB Crabbed angle 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	198
B	Top of Bumper	533	700	Left	191
C	Mid-Level	686	800	Left	161
D	Top of Stack	813	800	Right	201

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 Ram 1500 Quad Cab Truck
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20190317
Test Date: 4/29/2019



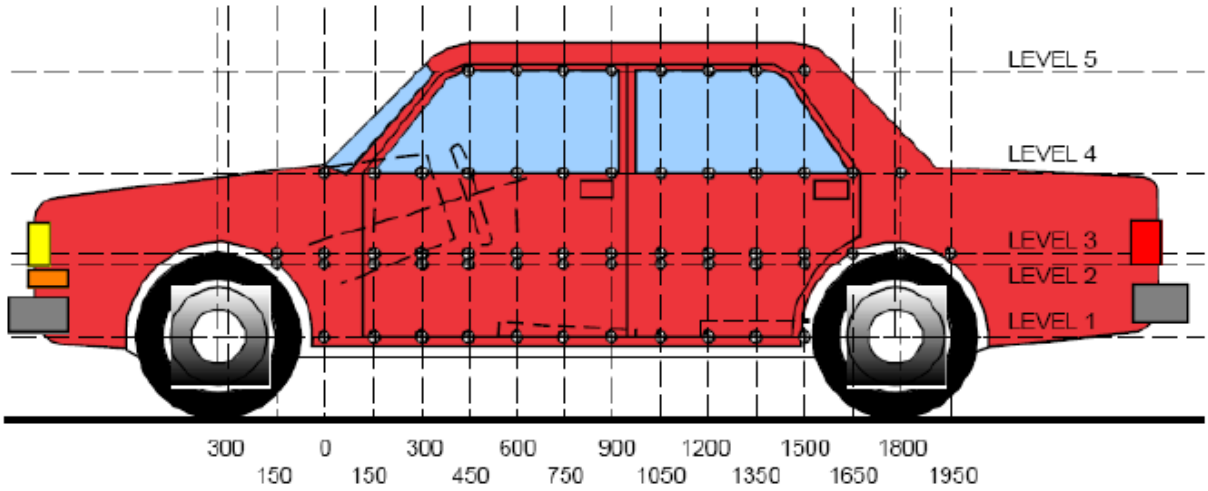
LEFT SIDE VIEW
All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3mm

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Wheelbase	3577	3574	-3
B	Front Axle to FSOV	1005	993	-12
C	Rear Axle to RSOV	1235	1264	29
D	Total Length at Centerline	5819	5829	10
E	Front Bumper Thickness	275	275	0
F	Front Bumper Bottom to Ground	375	386	11
G	Sill Height at Front Wheel Well	320	263	-57
H	Sill Height at Front Door Leading Edge	347	333	-14
I	Sill Height at B Pillar	373	341	-32
J1	Sill Height at Rear Wheel Well	385	377	-8
J2	Pinch Weld Height at Rear Wheel Well	357	348	-9
K	Sill Height Aft of Rear Wheel Well	445	377	-68
L	Rear Bumper Thickness	145	145	0
M	Rear Bumper Bottom to Ground	535	520	-15
N	Sill Height to Window Bottom of Front Window Sill	933	946	13
O	Front Door Leading Edge to Impact CL	800	856	56
P	Rear Door Trailing Edge to Impact CL	1127	1115	-12
Q	Front Window Opening	523	523	0
R	Right Side Length	5749	5748	-1
S	Left Side Length	5755	5745	-10
T	Maximum Vehicle Width	2031	1893	-138

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2019 Ram 1500 Quad Cab Truck NHTSA No.: M20190317
Test Program: NCAP Side MDB Impact Test Test Date: 4/29/2019



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	439	183	1800
2	Driver Hip Point	mm	936	99	1200
3	Mid-Door	mm	887	113	1200
4	Window Sill	mm	1269	31	1200
5	Window Top	mm	1858	-6	1050

*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 Ram 1500 Quad Cab Truck NHTSA No.: M20190317
Test Program: NCAP Side MDB Impact Test Test Date: 4/29/2019

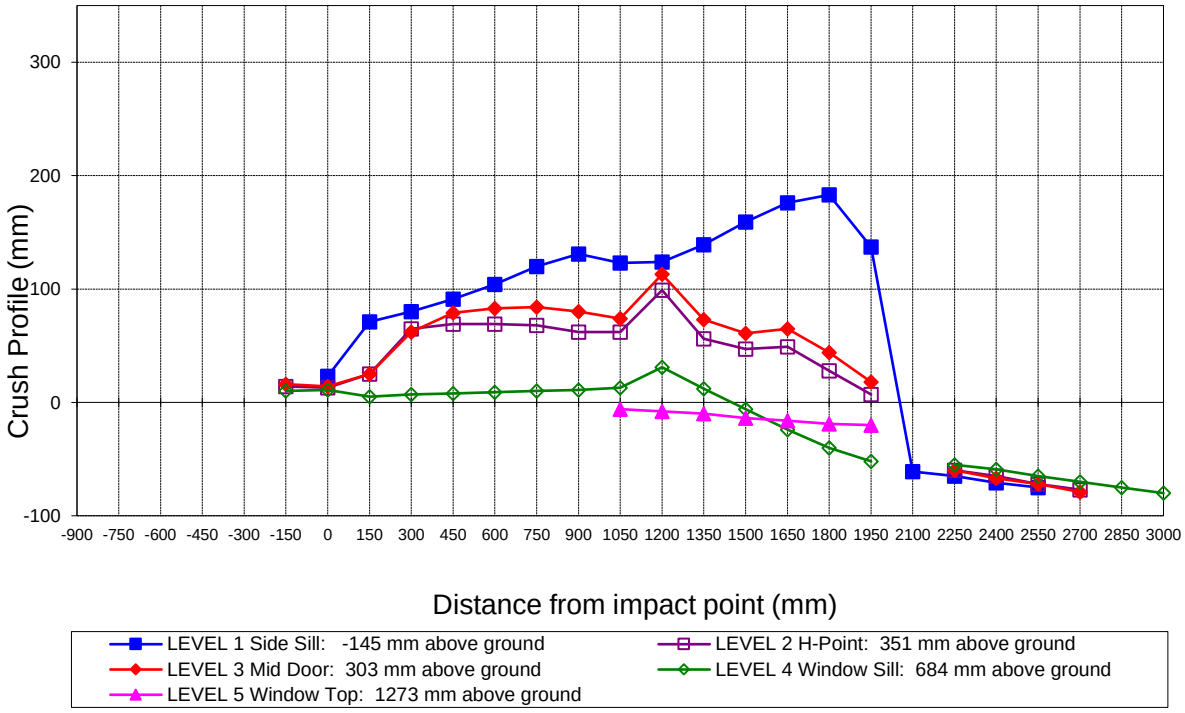
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	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		1017	1018	907			1003	1002	897			14	16	10	
0	984	1013	1013	924		961	1000	1000	913		23	13	13	11	
150	960	1006	1007	930		889	981	982	925		71	25	25	5	
300	945	1002	1002	939		865	937	940	932		80	65	62	7	
450	944	998	998	946		853	929	919	938		91	69	79	8	
600	944	996	996	953		840	927	913	944		104	69	83	9	
750	944	995	996	958		824	927	912	948		120	68	84	10	
900	943	997	998	964		812	935	918	953		131	62	80	11	
1050	942	999	1000	968	712	819	937	926	955	718	123	62	74	13	-6
1200	942	998	1000	973	719	818	899	887	942	727	124	99	113	31	-8
1350	940	998	1000	974	725	801	942	927	962	735	139	56	73	12	-10
1500	936	998	1001	976	729	777	951	940	982	743	159	47	61	-6	-14
1650	932	998	1001	978	731	756	949	936	1002	747	176	49	65	-24	-16
1800	926	996	999	978	730	743	968	955	1018	749	183	28	44	-40	-19
1950	917	992	995	975	715	780	985	977	1027	735	137	7	18	-52	-20
2100	901					962					-61				
2250	910	985	987	960		975	1045	1047	1015		-65	-60	-60	-55	
2400	924	996	996	963		995	1061	1063	1022		-71	-65	-67	-59	
2550	938	1005	1006	964		1013	1077	1078	1029		-75	-72	-72	-65	
2700		1012	1011	966			1089	1090	1036			-77	-79	-70	
2850				966					1041					-75	
3000				967					1047					-80	

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

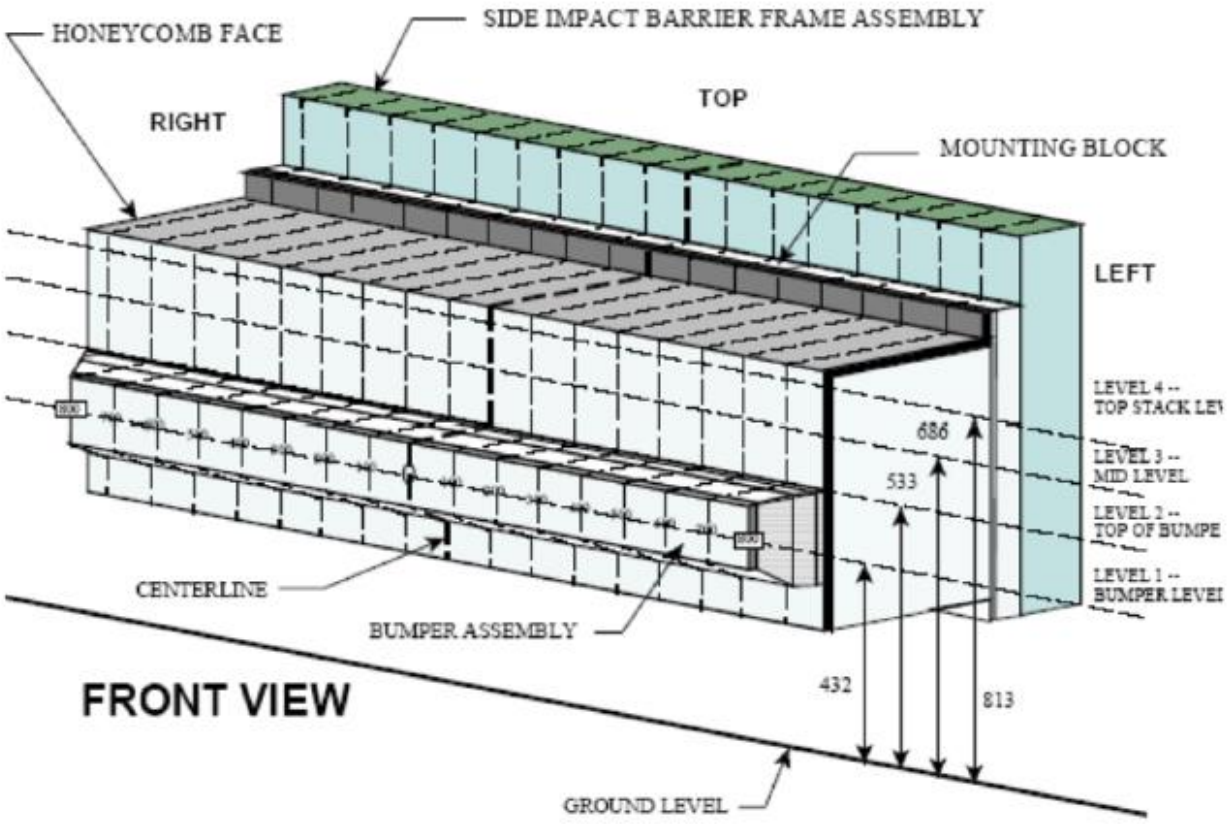
Test Vehicle:	2019 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019



Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle:	2019 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019



NOTE: Dimensions are shown in millimeters, mm

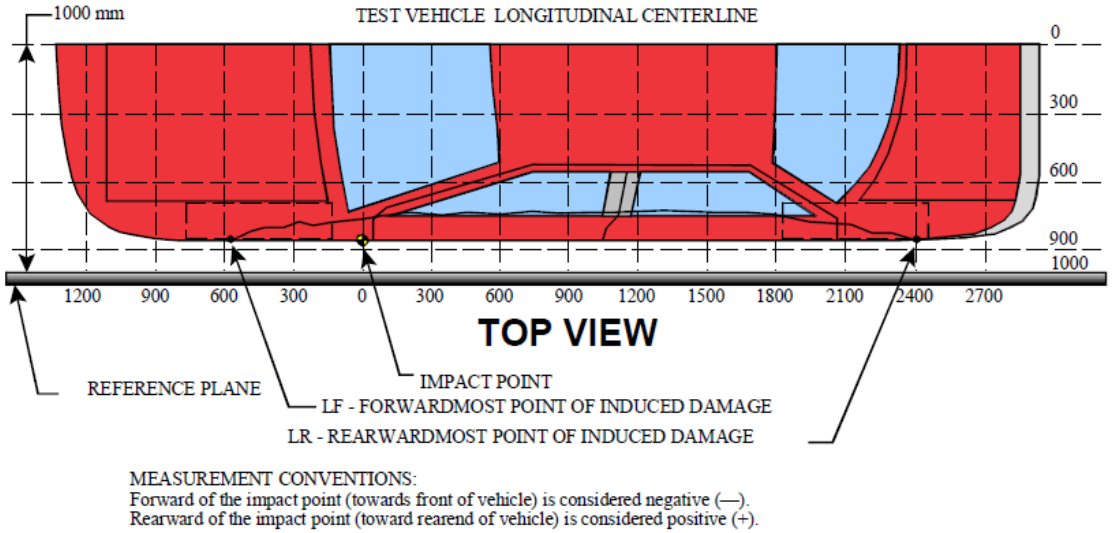
DEFORMABLE BARRIER STATIC CRUSH

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	61	68	77	86	100	114	126	134	135	132	133	141	150	159	169	182	198
2	80	88	97	106	117	127	131	135	137	138	143	149	157	166	175	183	191
3	147	118	104	86	80	104	125	138	124	113	101	100	106	110	120	135	161
4	201	196	179	153	123	120	160	185	153	134	134	131	124	128	141	165	190

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle:	2019 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019

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	-2	-18	16
2	420	3	77	1	76
3	990	377	1	77	76
4	1560	3	62	-1	63
5	2130	3	N/A*	N/A*	N/A*
6	2700	3	-90	-11	-79

*Located in the gap where the cab transitions to the bed of the truck

MDB DAMAGE PROFILE DISTANCES

DPD	Distance From Center of MDB	Level	Post-Test (mm)*
1	800 mm left of center	1	198
2	480 mm left of center	1	158
3	160 mm left of center	1	133
4	160 mm right of center	1	127
5	480 mm right of center	1	87
6	800 mm right of center	1	61

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

Test Vehicle:	2019 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019
Test Time:	12:13 PM	Temperature:	21˚C

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

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

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

D. Spillage Details: — No Spillage Occurred

FMVSS NO. 301 STATIC ROLLOVER DATA

ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	67	300	367
90° to 180°	68	300	368
180° to 270°	71	300	371
270° to 360°	67	300	367

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

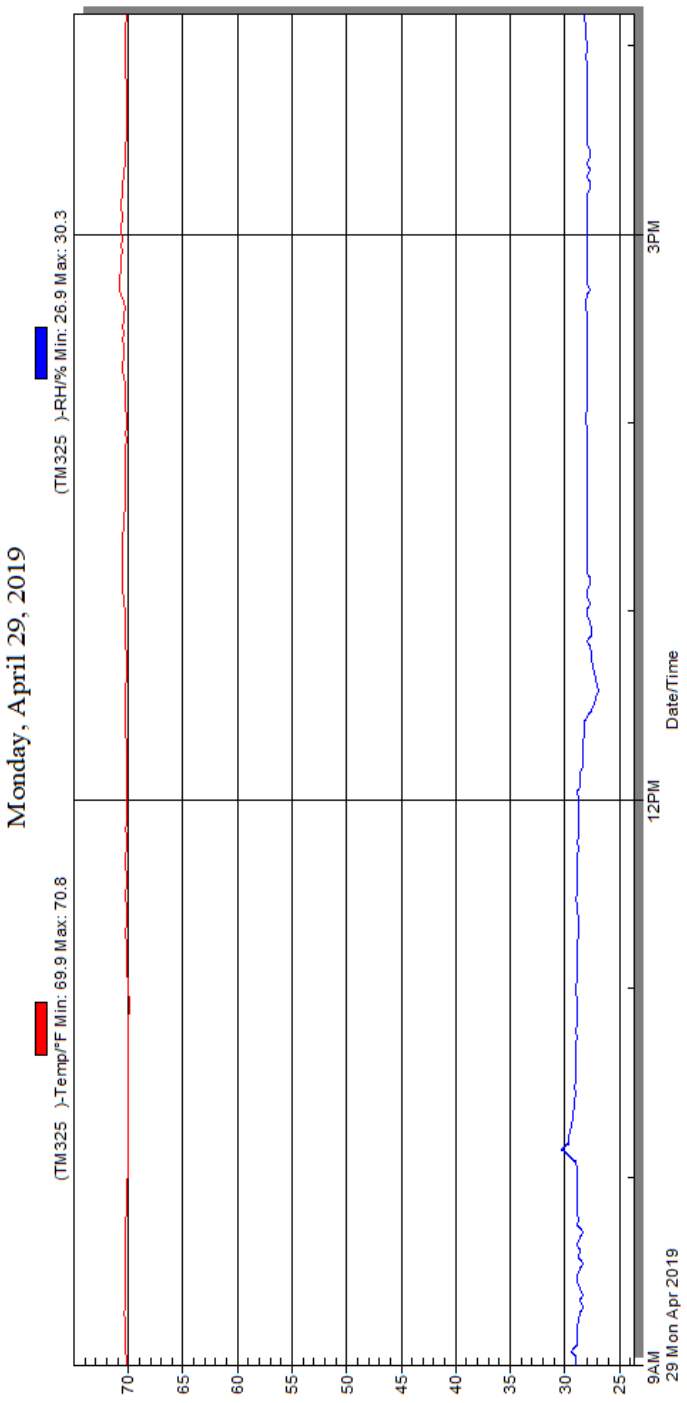
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

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 Ram 1500 Quad Cab Truck	NHTSA No.:	M20190317
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/29/2019



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

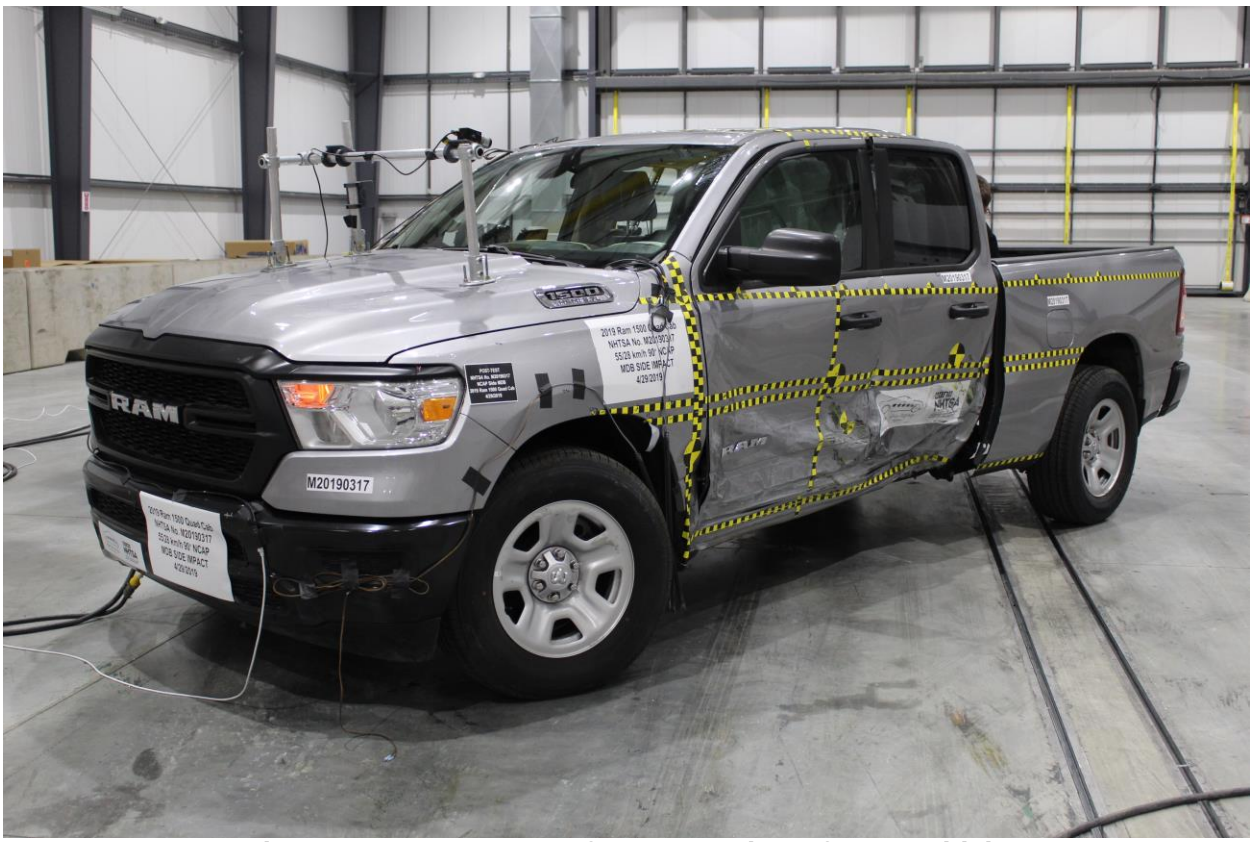


Figure A-6: Post-Test Left Front ¾ View of Test Vehicle

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

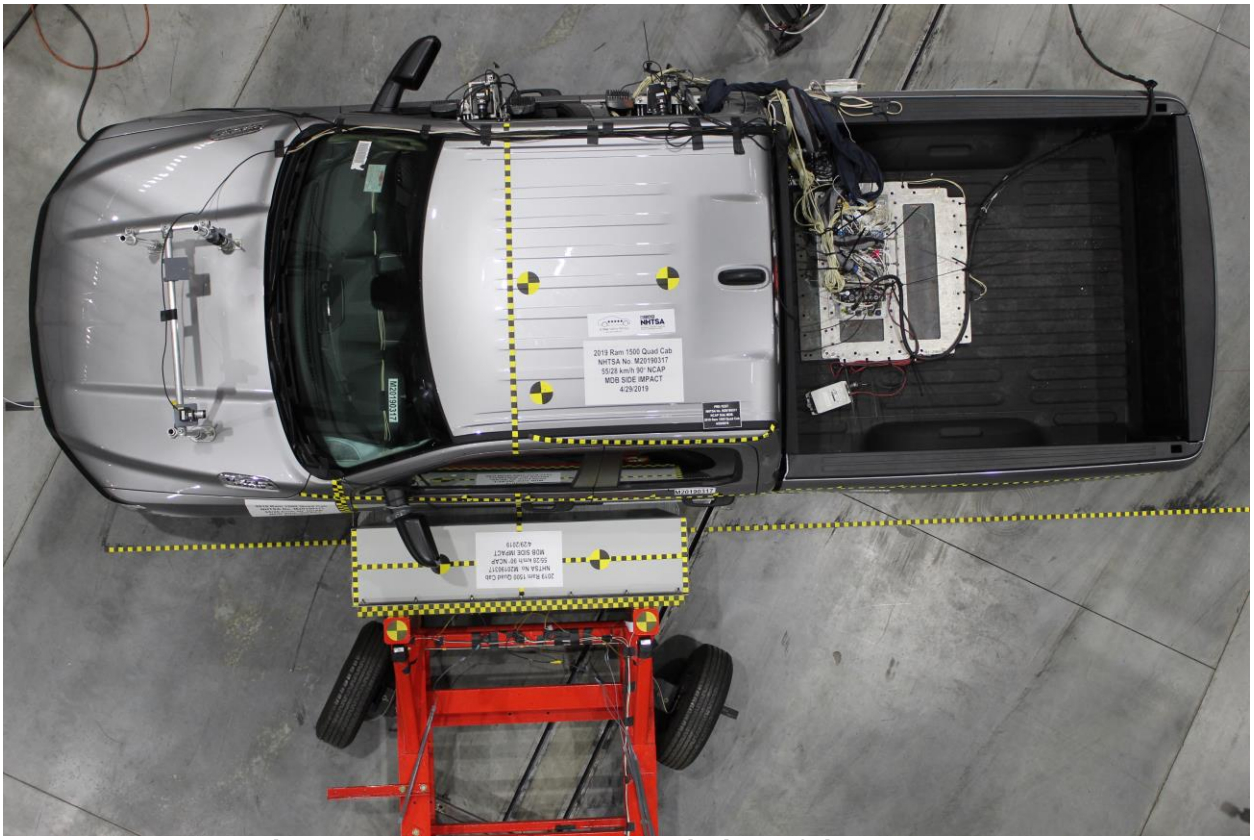


Figure A-15: Pre-Test Overhead View of the Test Area

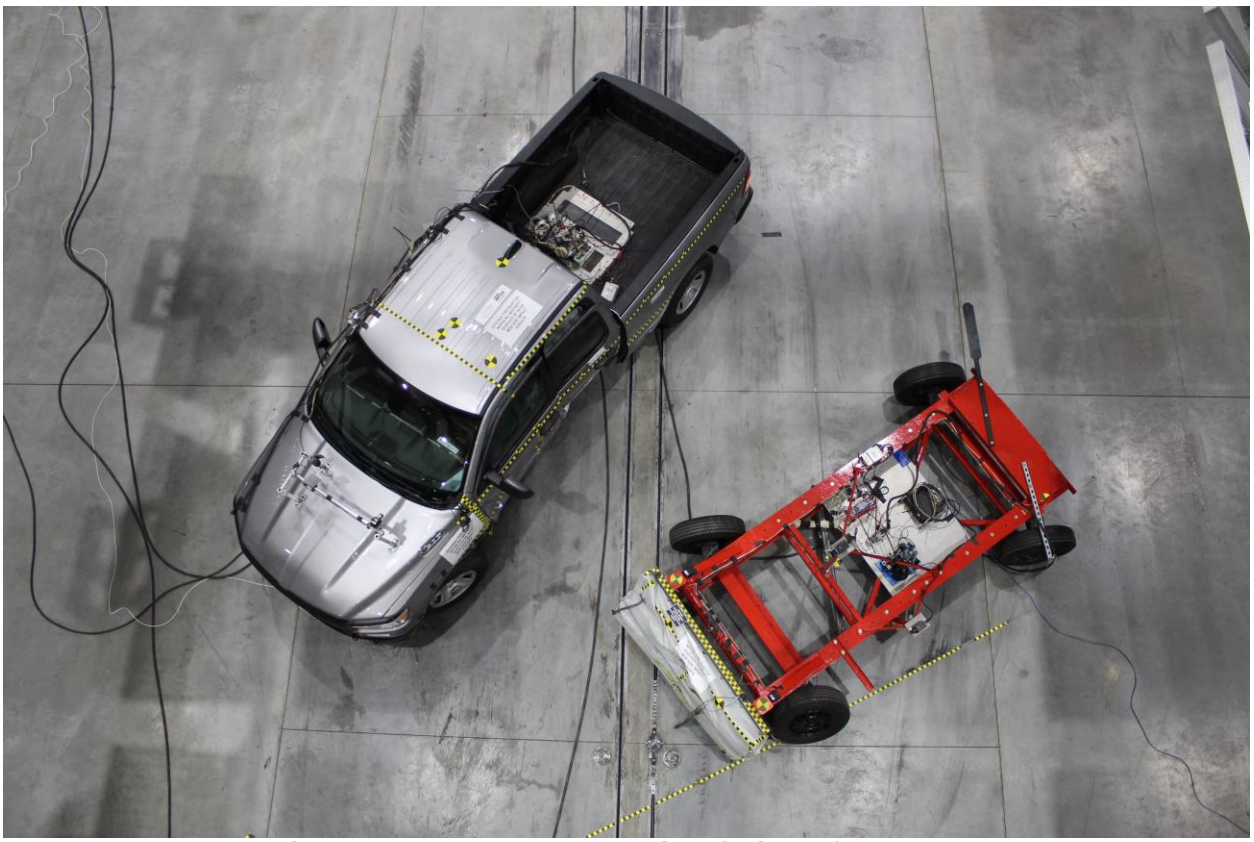


Figure A-16: Post-Test Overhead View of Test Area

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

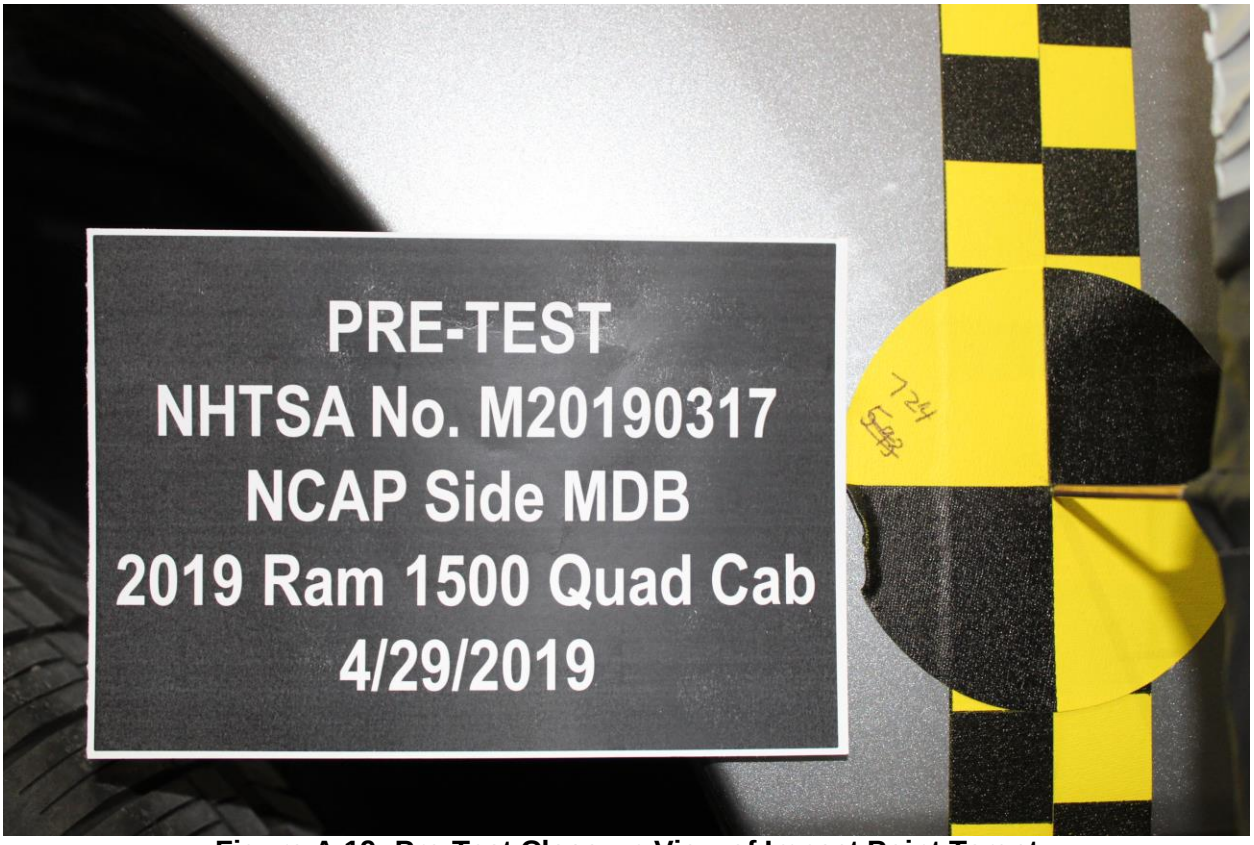


Figure A-19: Pre-Test Close-up View of Impact Point Target

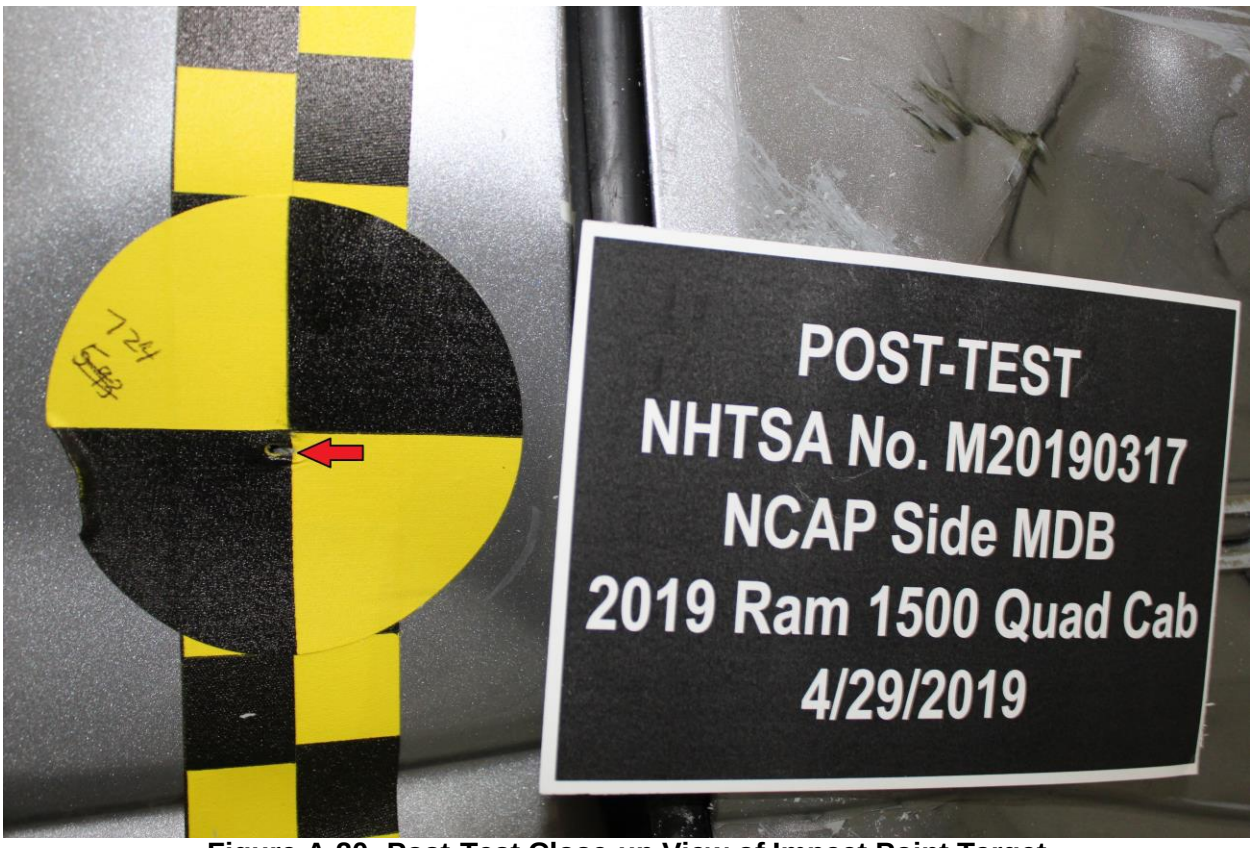


Figure A-20: Post-Test Close-up View of Impact Point Target

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

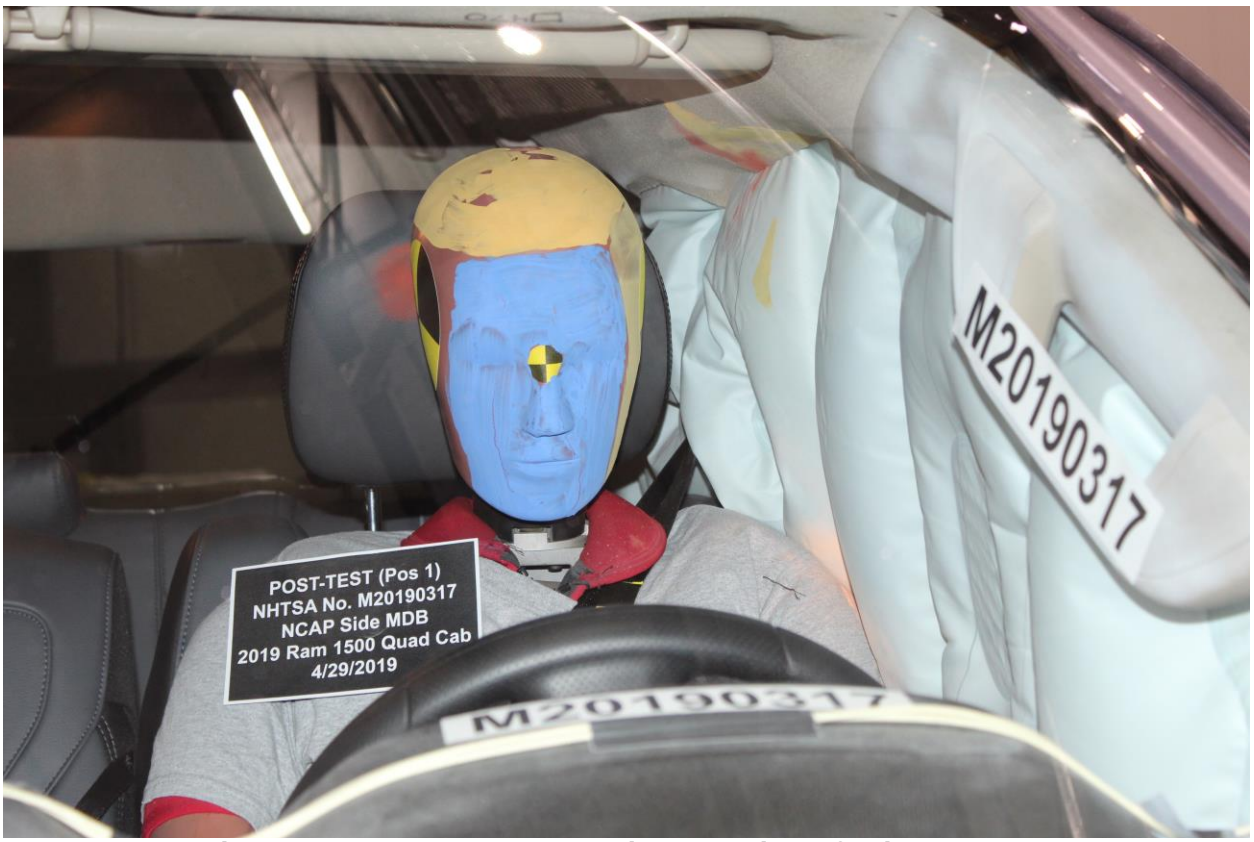


Figure A-26: Post-Test Front Close-up View of Driver Dummy

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

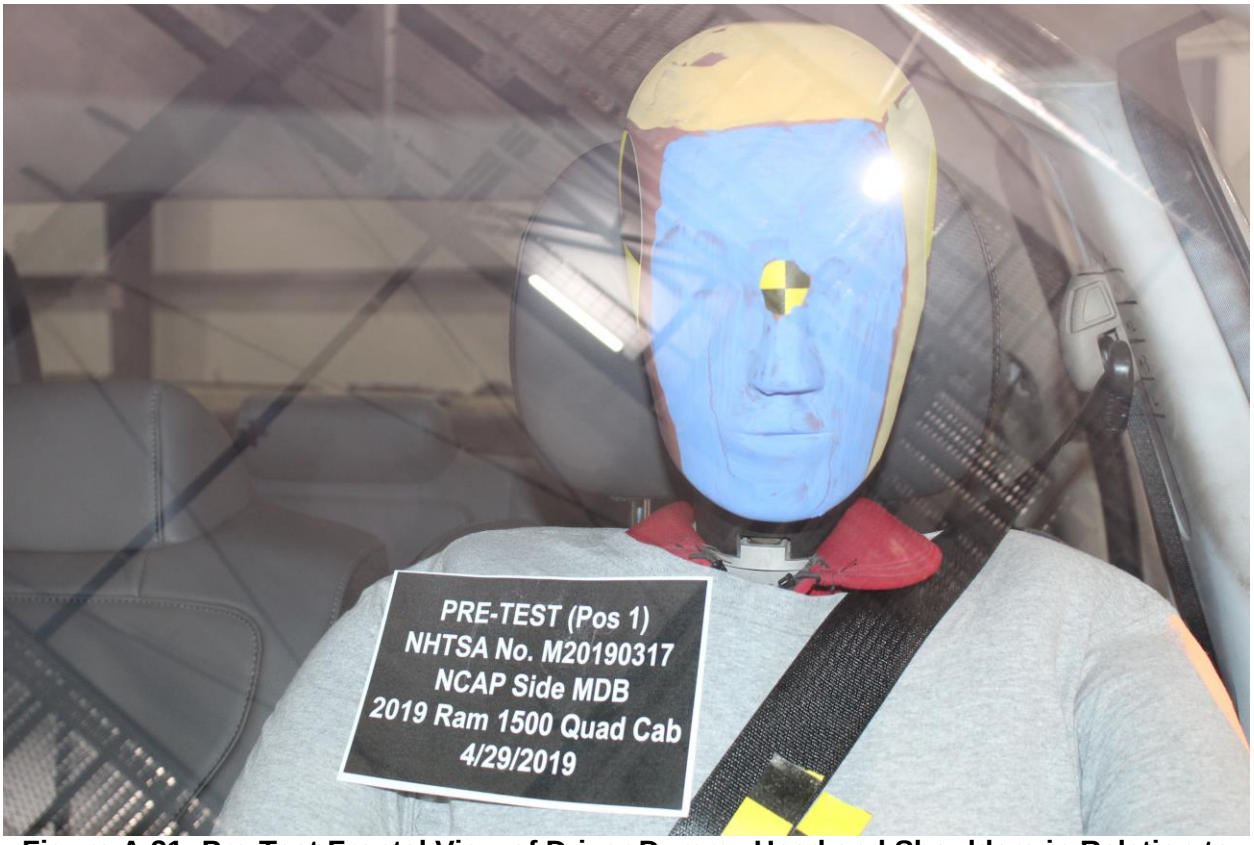


Figure A-31: Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint

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

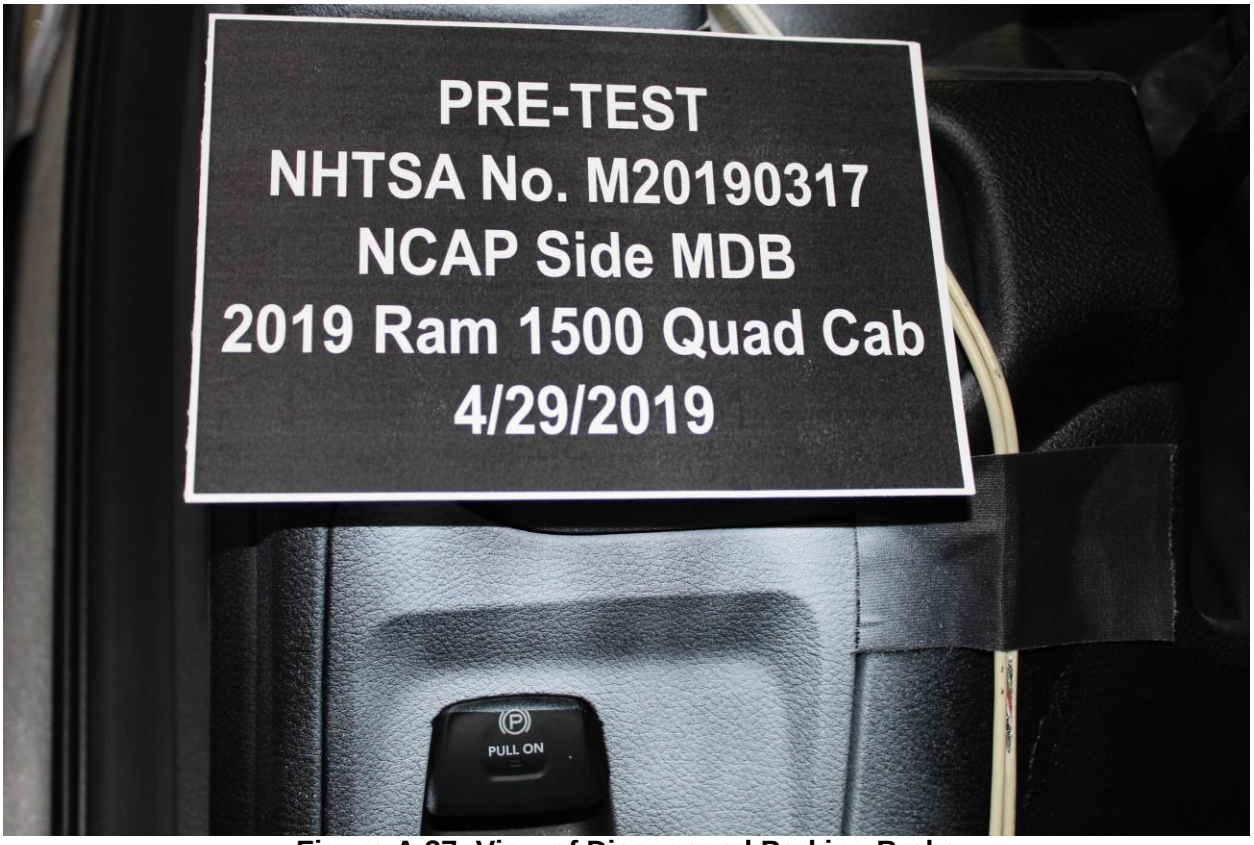


Figure A-37: View of Disengaged Parking Brake

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

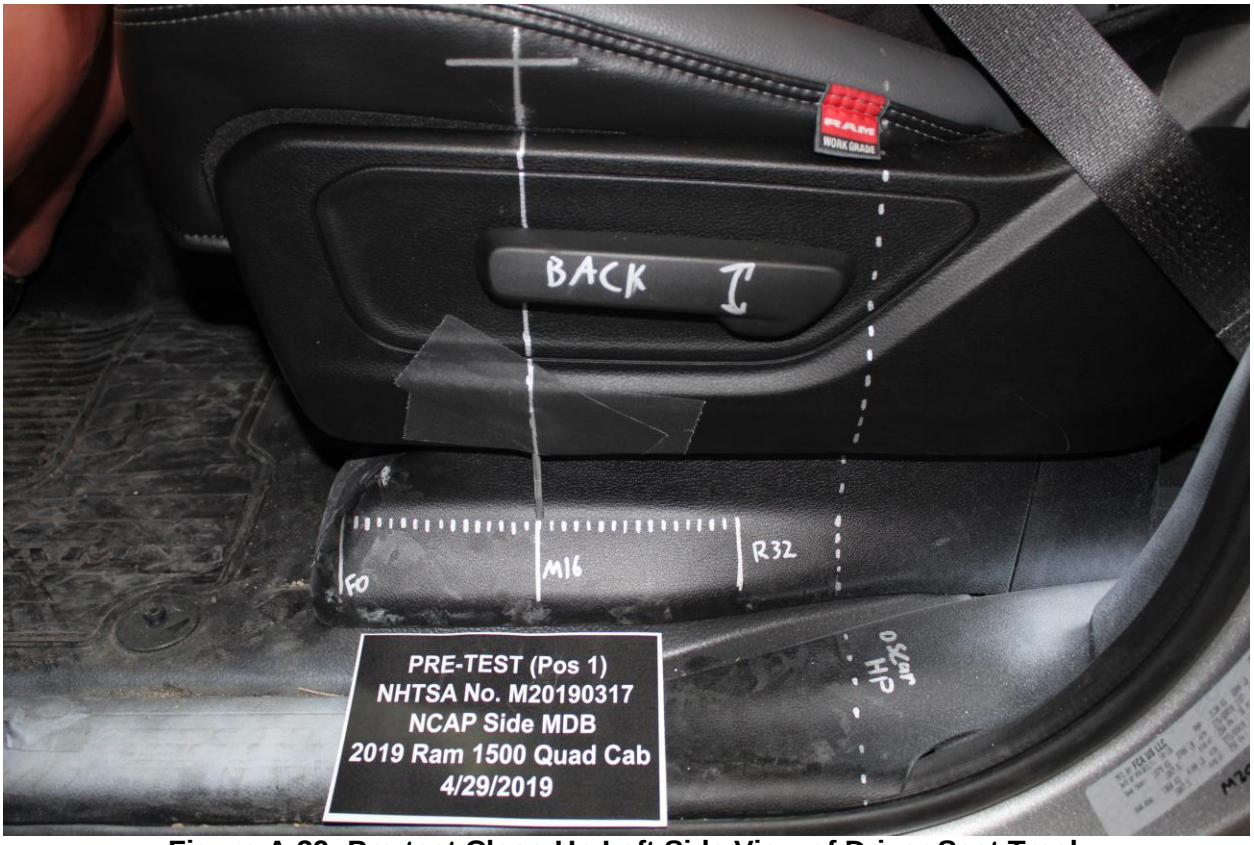


Figure A-39: Pre-test Close-Up Left Side View of Driver Seat Track

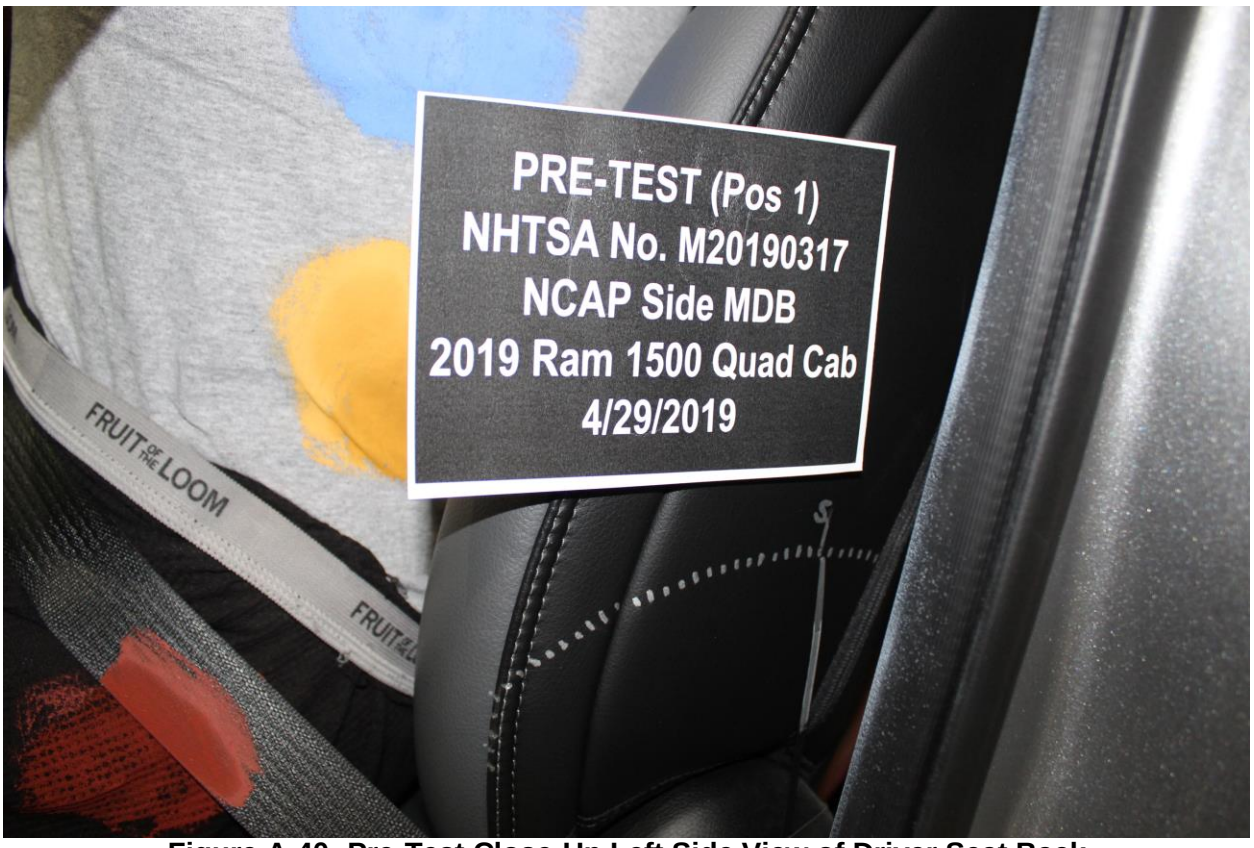


Figure A-40: Pre-Test Close-Up Left Side View of Driver Seat Back

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

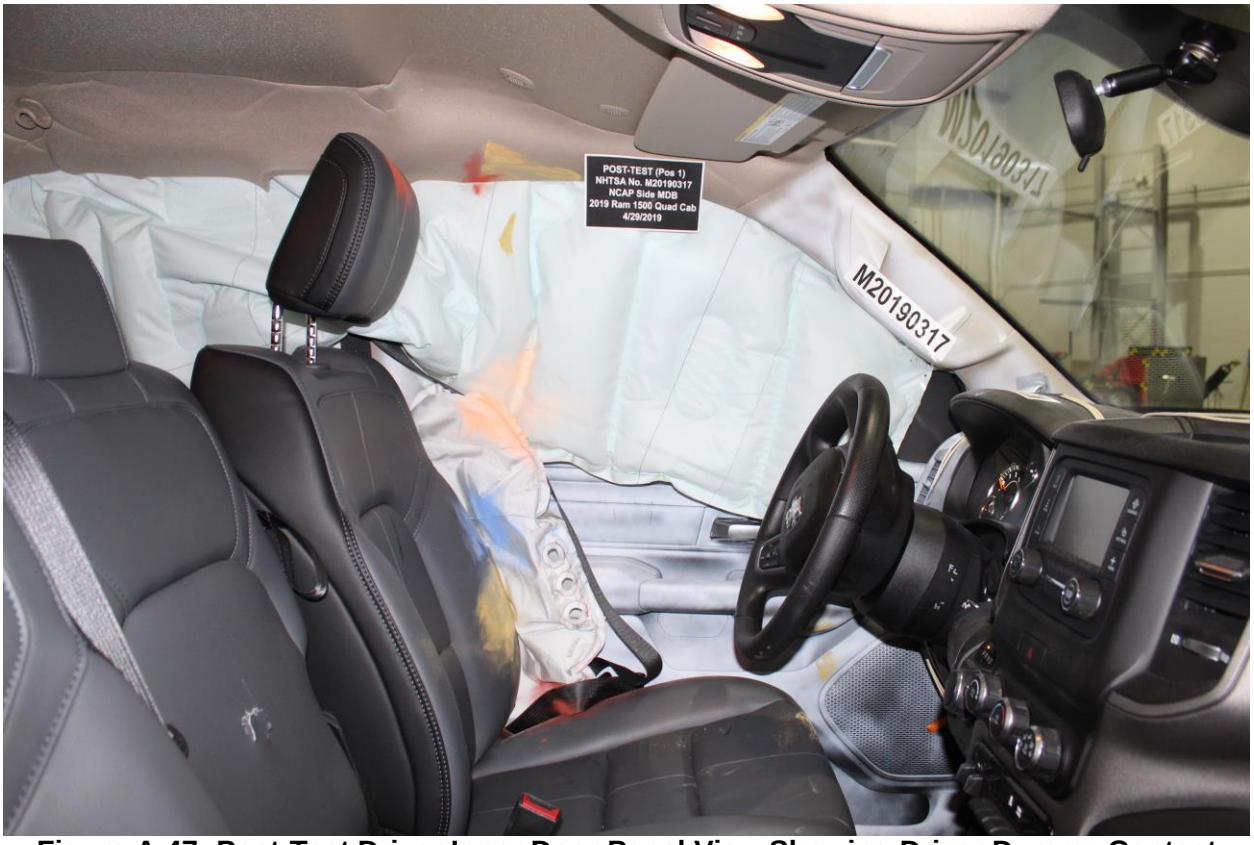


Figure A-47: Post-Test Driver Inner Door Panel View Showing Driver Dummy Contact Locations

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

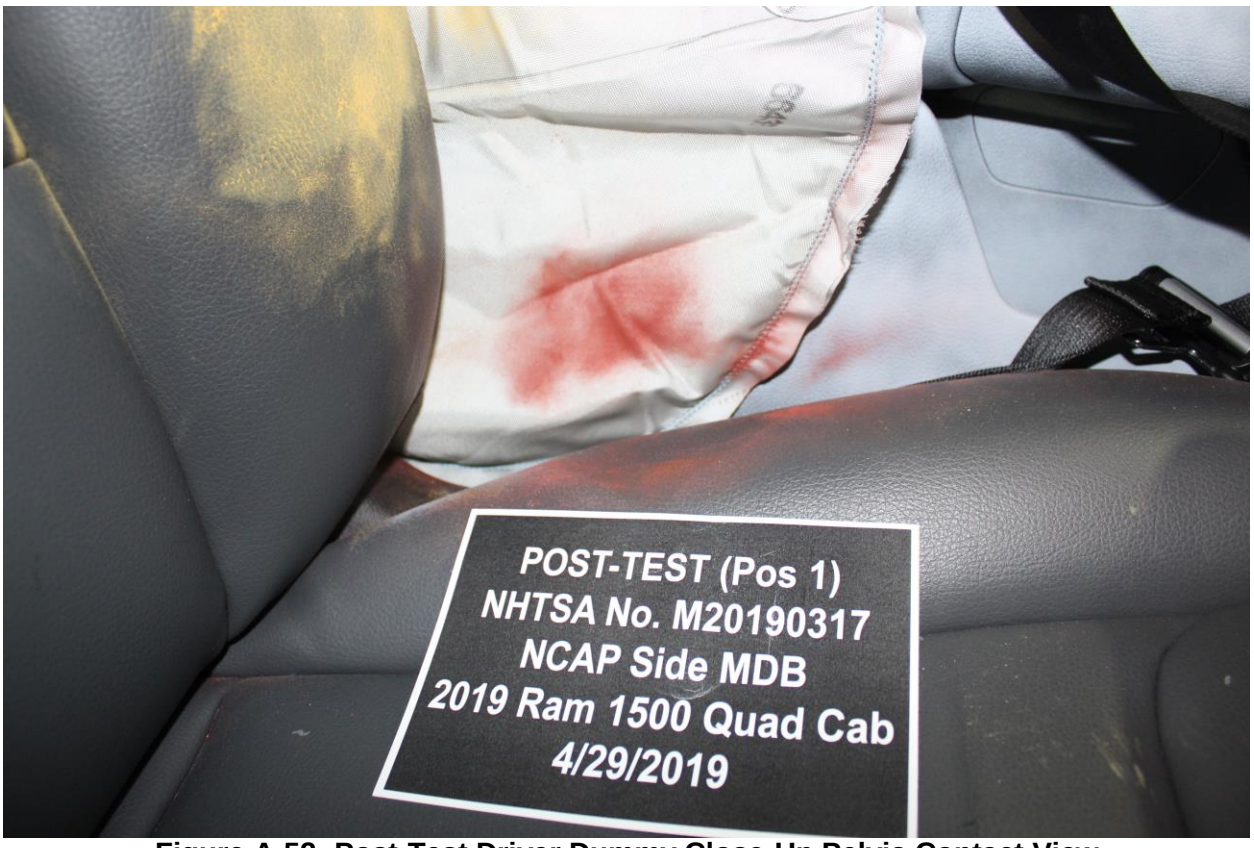


Figure A-52: Post-Test Driver Dummy Close-Up Pelvis Contact View

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

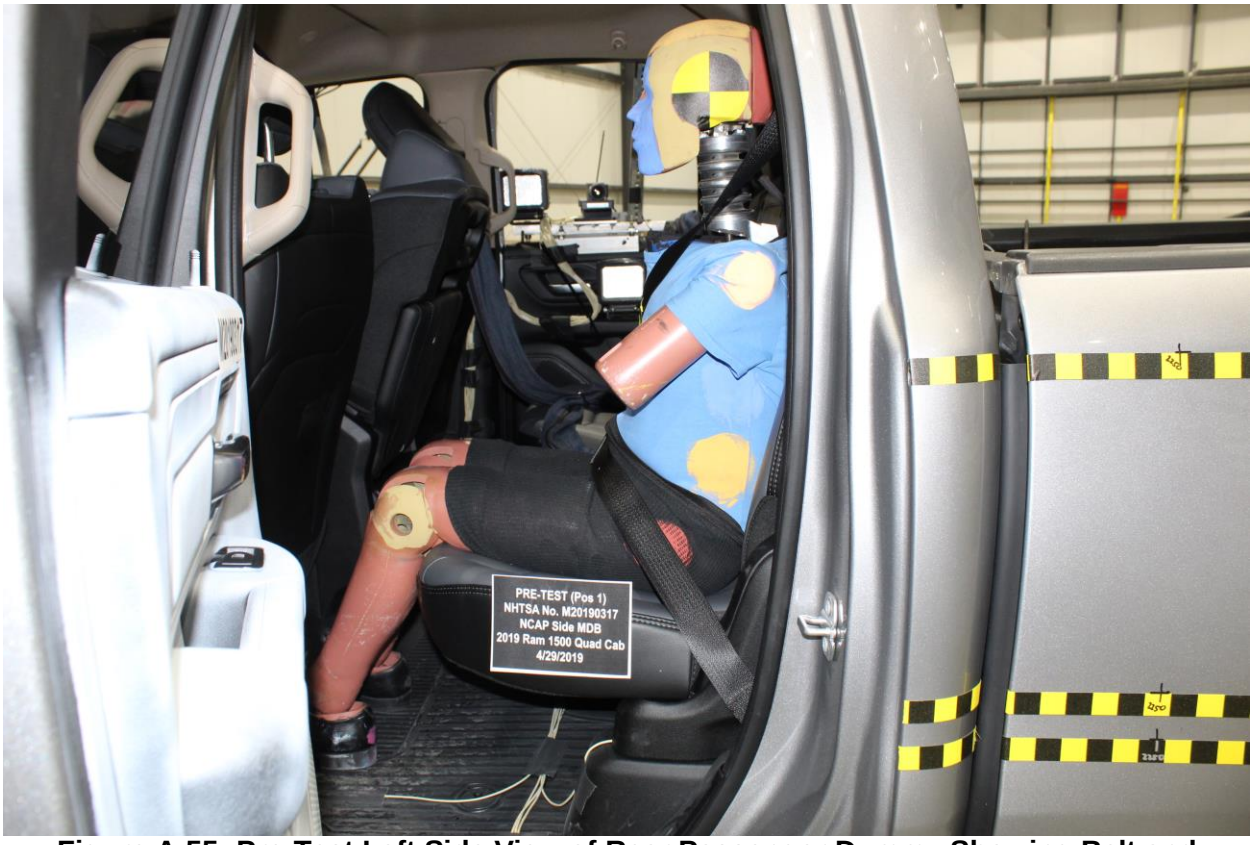


Figure A-55: Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking

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

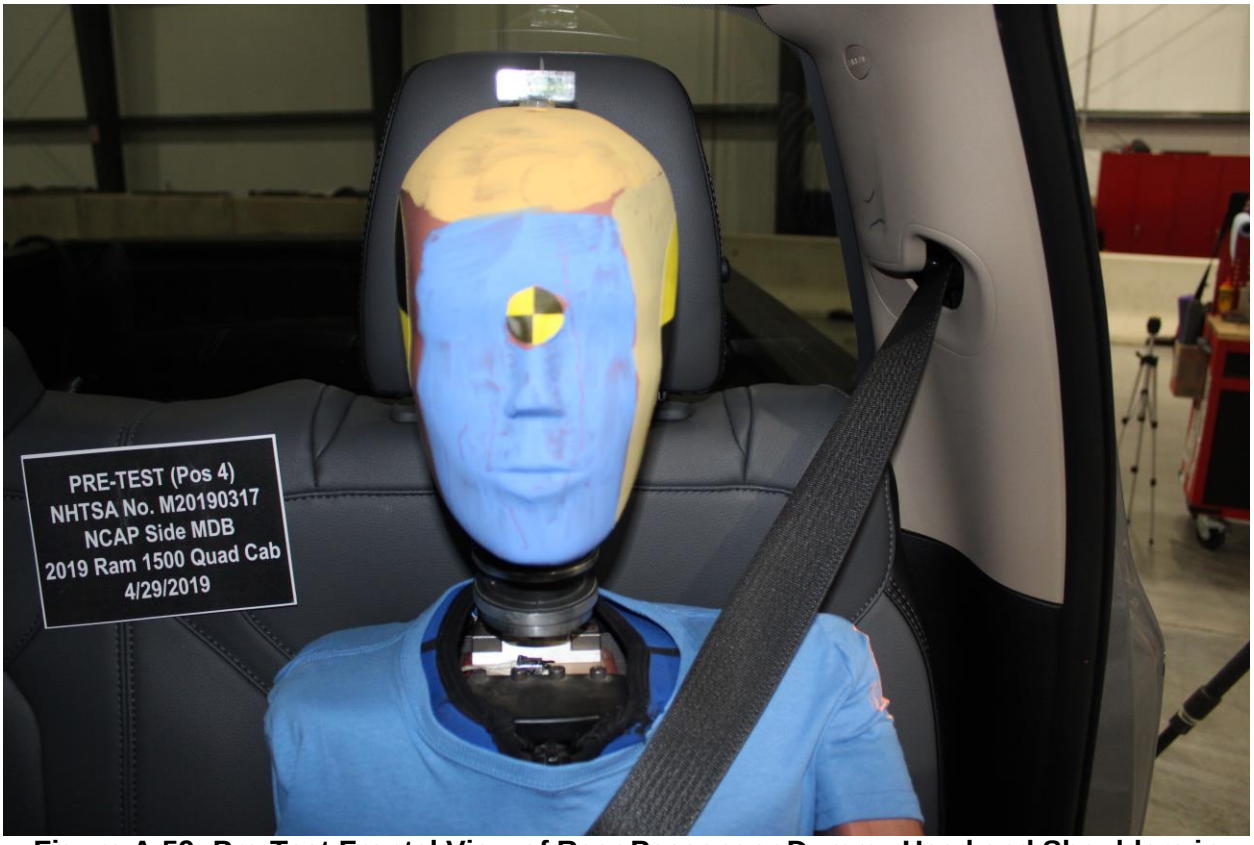


Figure A-59: Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint

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

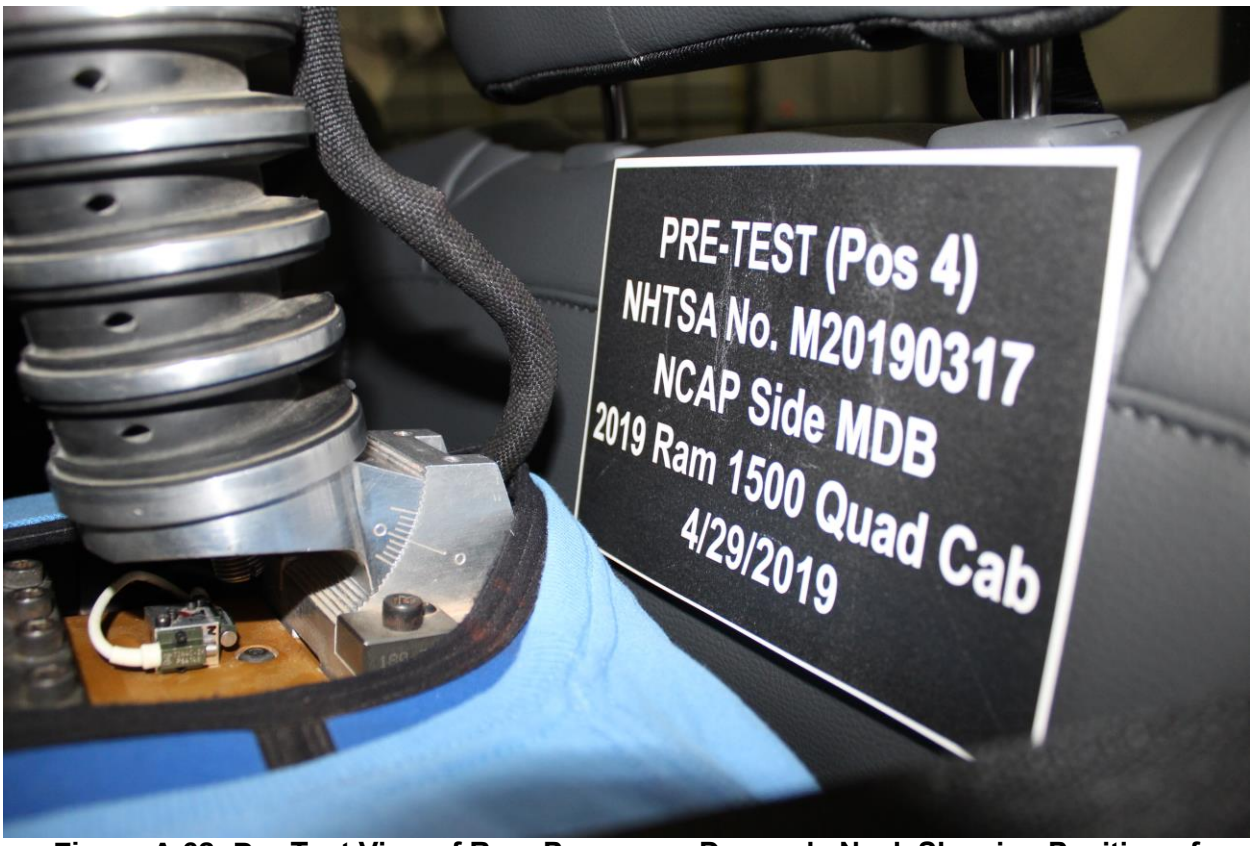


Figure A-62: Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket

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

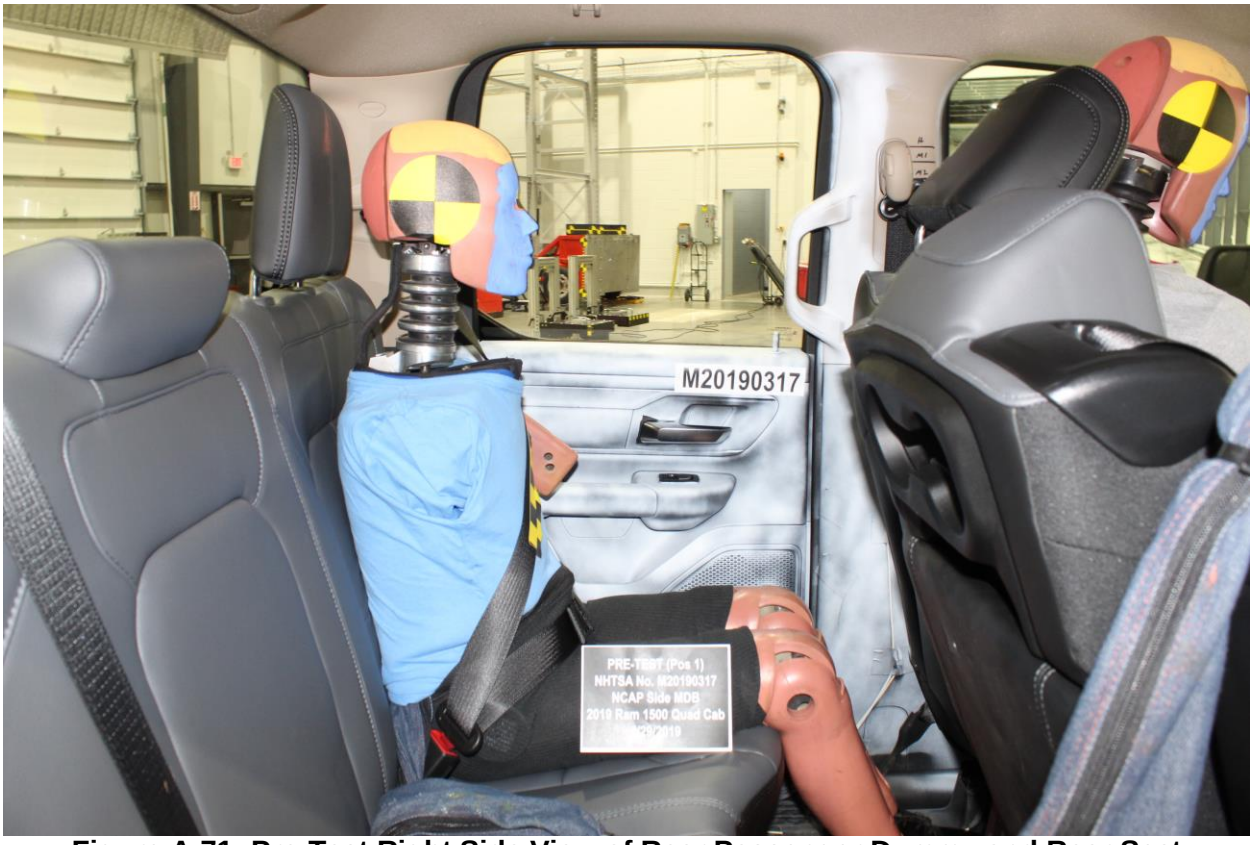


Figure A-71: Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment

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

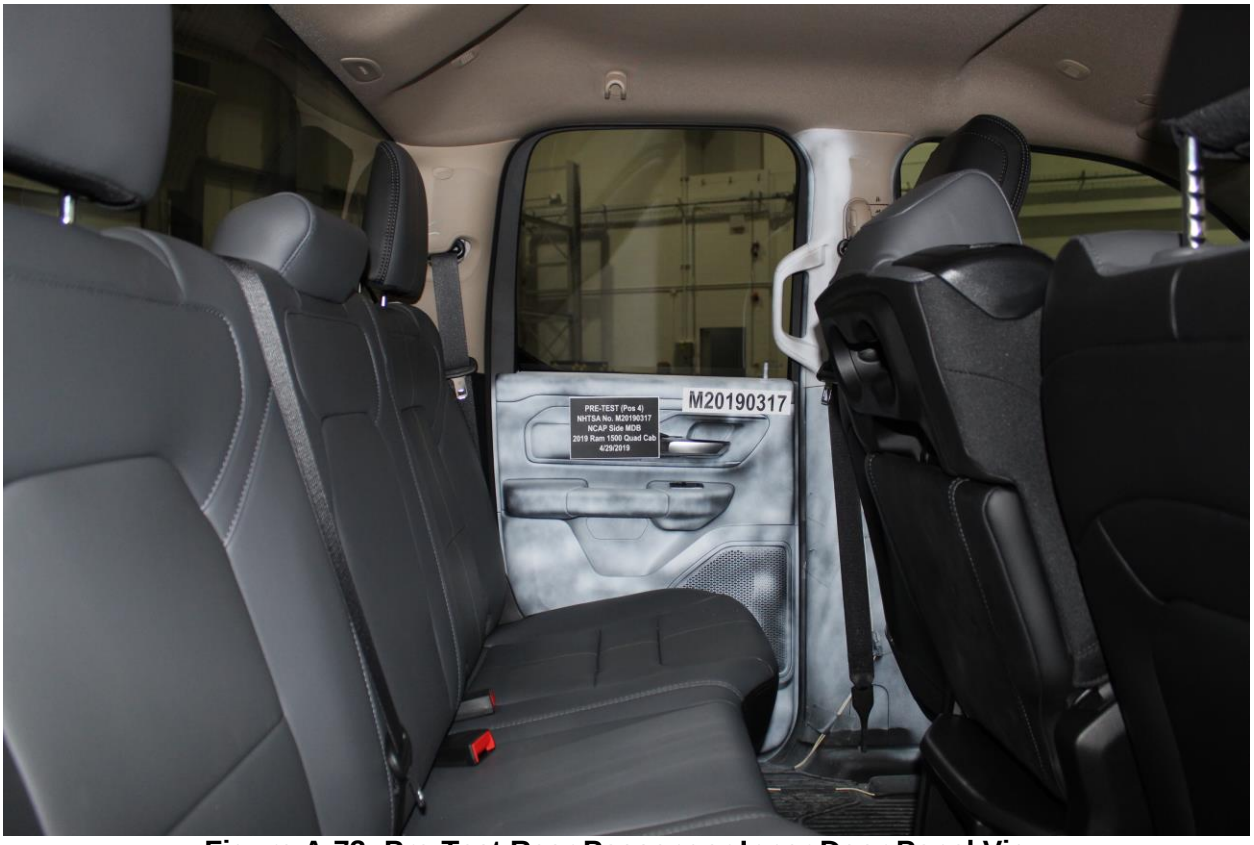


Figure A-73: Pre-Test Rear Passenger Inner Door Panel View

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

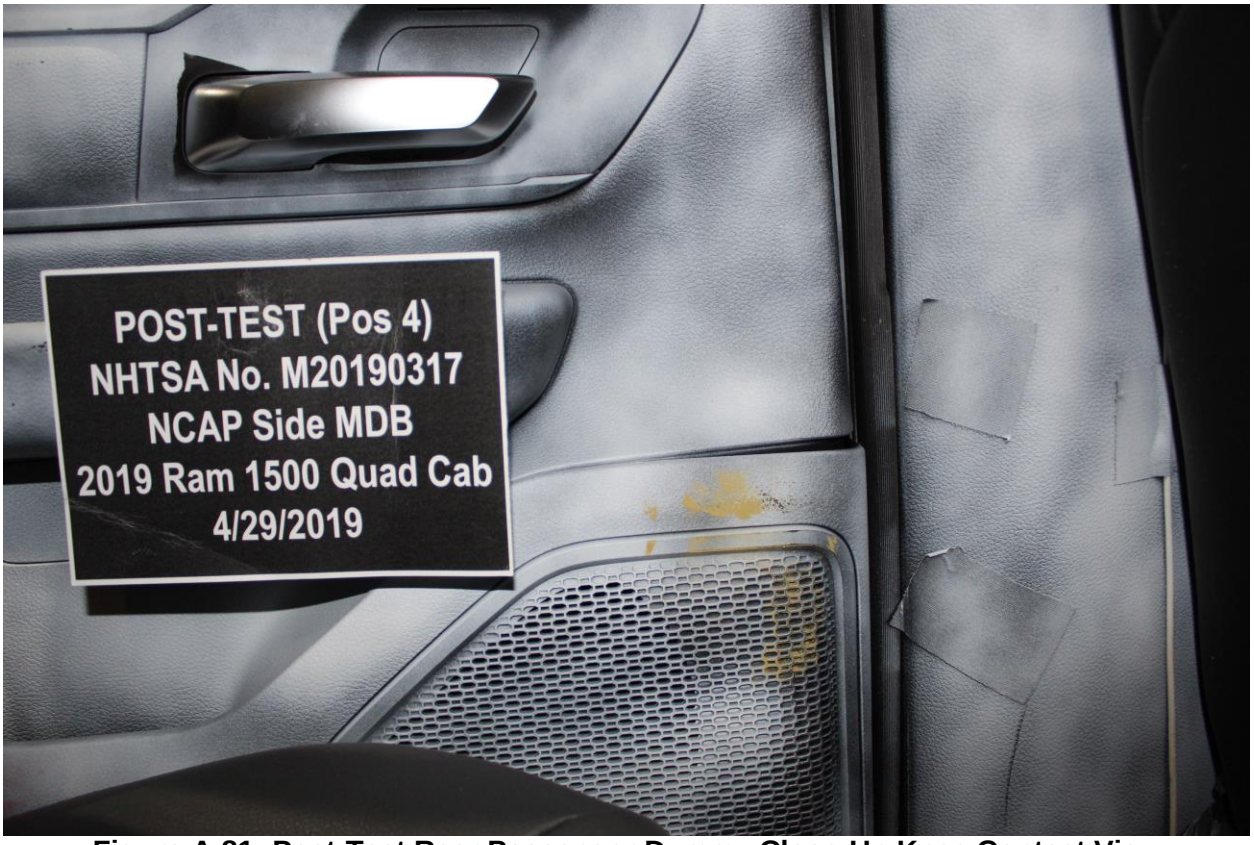


Figure A-81: Post-Test Rear Passenger Dummy Close-Up Knee Contact View

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

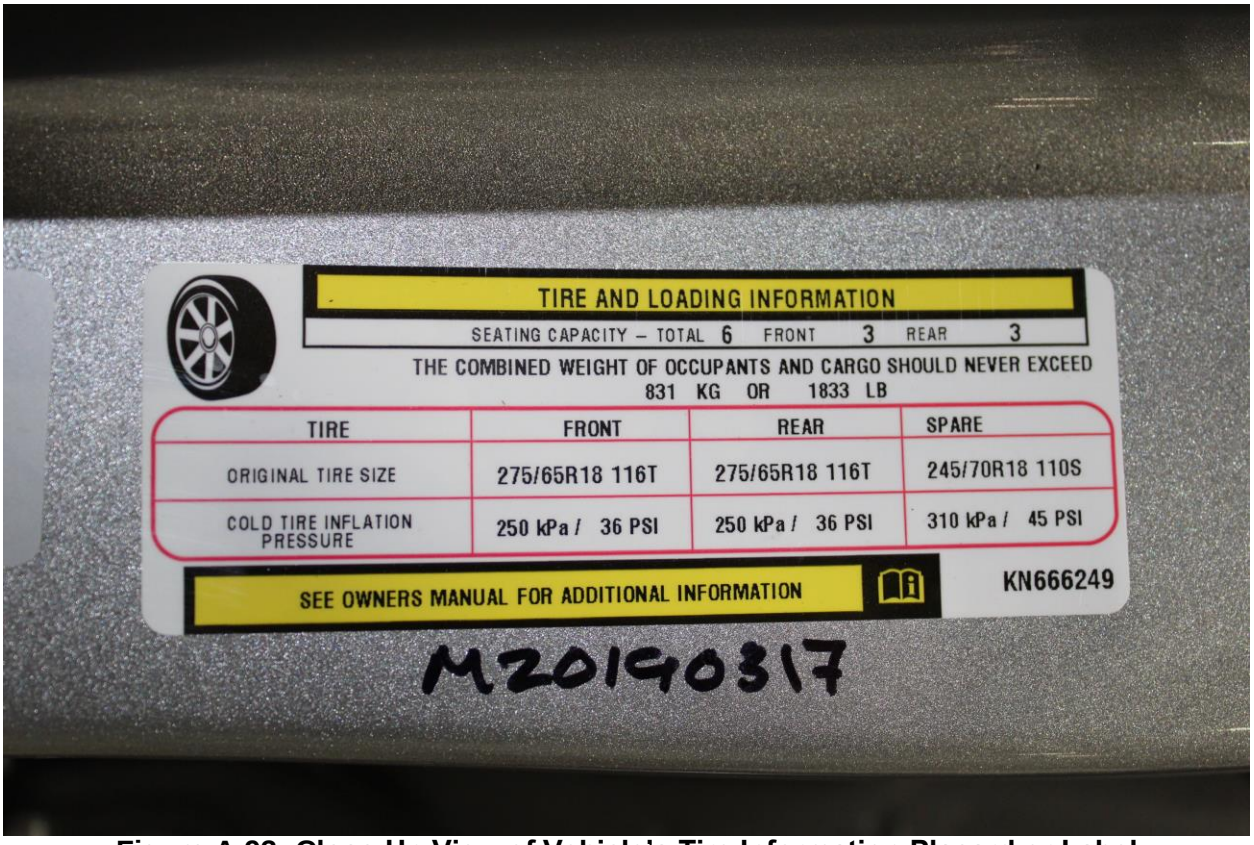


Figure A-93: Close-Up View of Vehicle's Tire Information Placard or Label

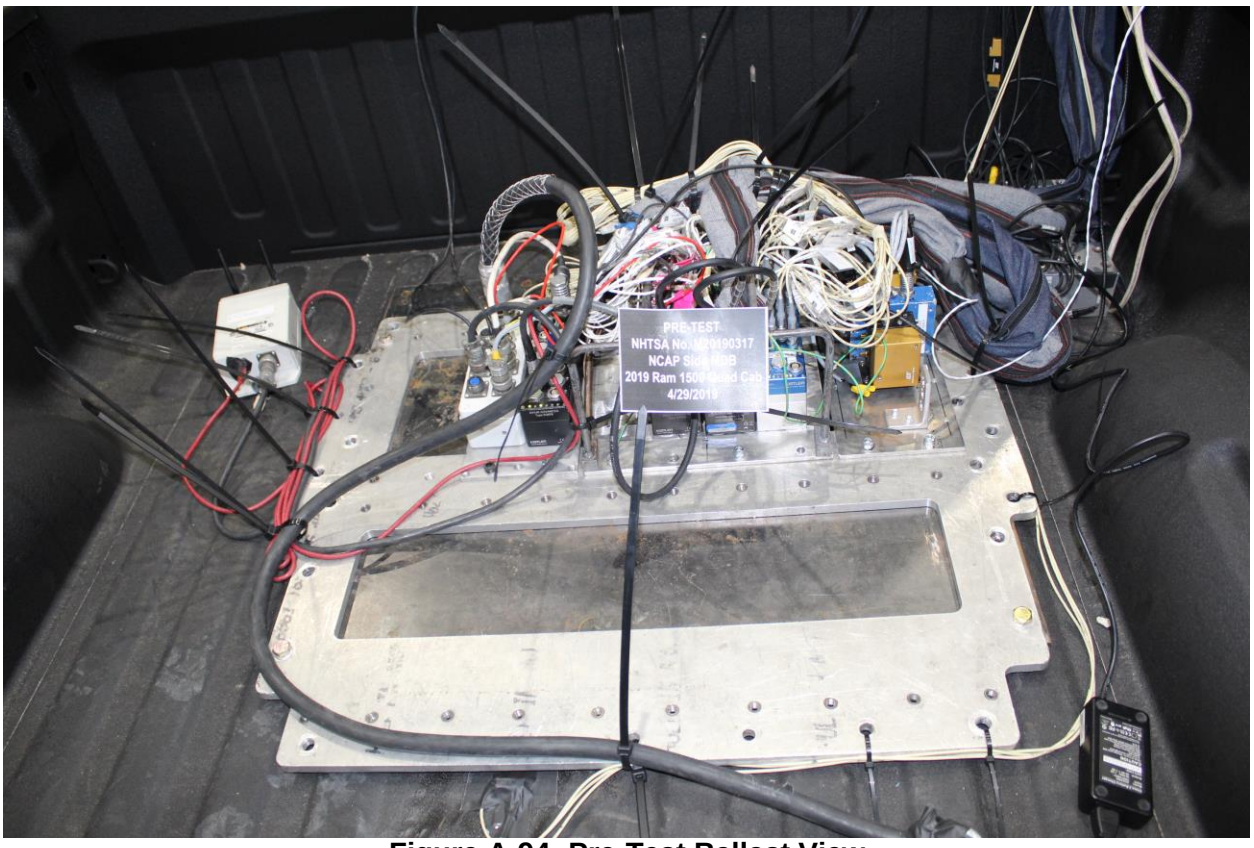


Figure A-94: Pre-Test Ballast View

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

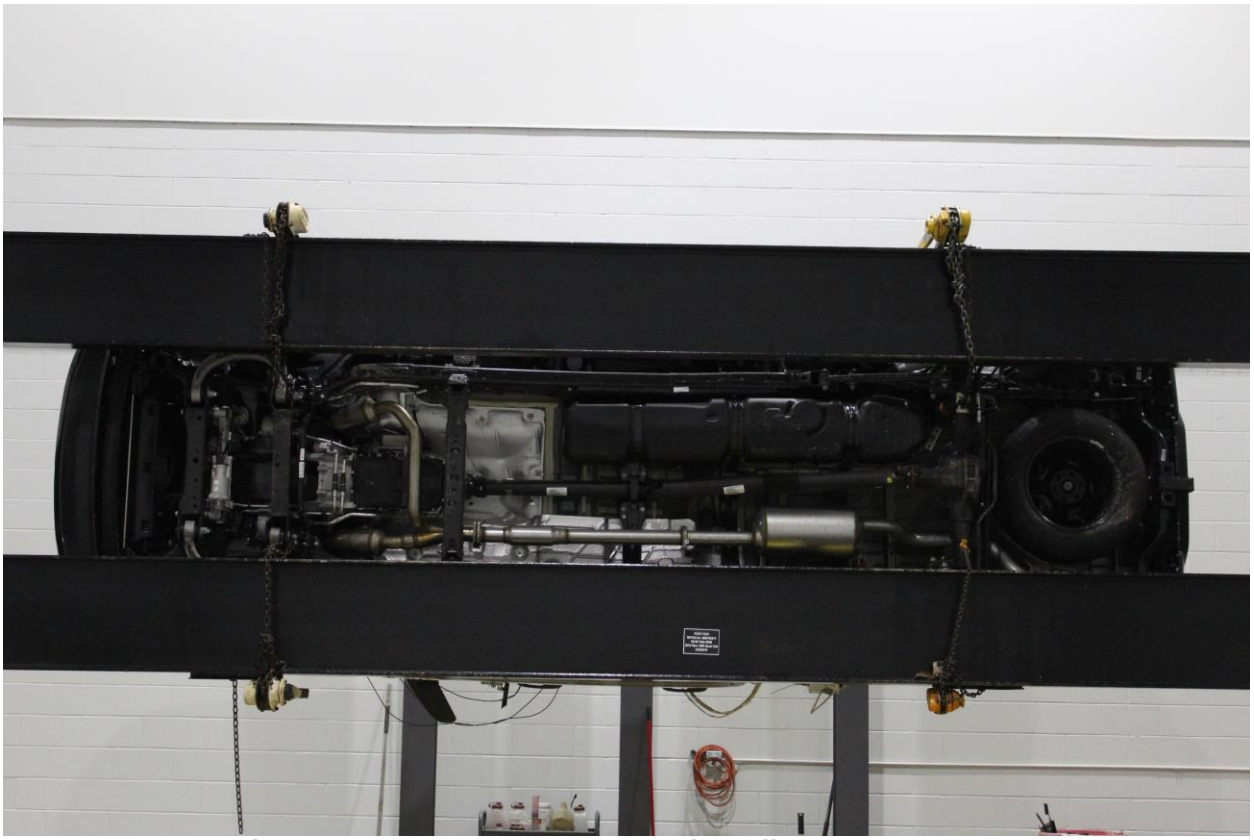


Figure A-99: FMVSS No. 301 Static Rollover 270 Degrees

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

Figure A-101: Impact Event

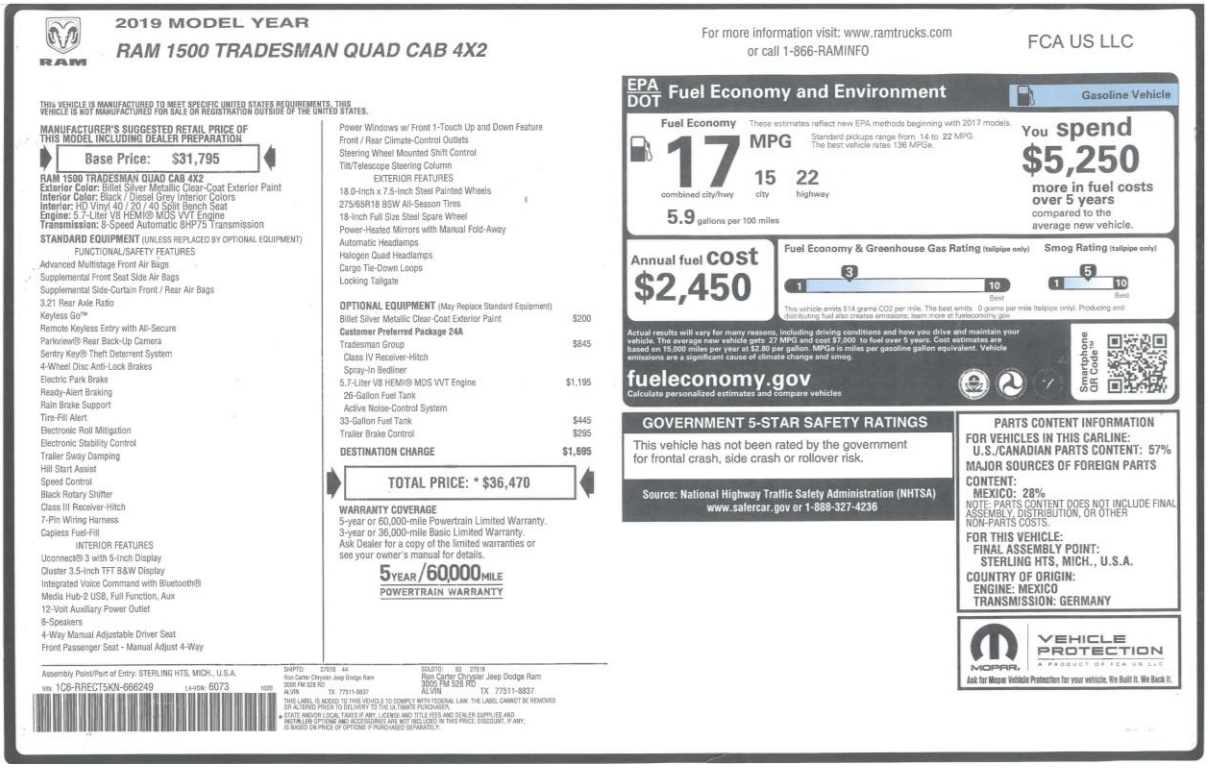


Figure A-102: Monroney Label

- Push the ventilated seat button a third time to choose LO.
- Push the ventilated seat button a fourth time to turn the ventilated seat off.

NOTE:
The engine must be running for the ventilated seats to operate.

HEAD RESTRAINTS

Head restraints are designed to reduce the risk of injury by restricting head movement in the event of a rear impact. Head restraints should be adjusted so that the top of the head restraint is located above the top of your ear.

WARNING!

- All occupants, including the driver, should not operate a vehicle or sit in a vehicle's seat until the head restraints are placed in their proper positions in order to minimize the risk of neck injury in the event of a crash.
- Head restraints should never be adjusted while the vehicle is in motion.

WARNING!

Driving a vehicle with the head restraints improperly adjusted or removed could cause serious injury or death in the event of a collision.

NOTE:
Do not reverse the head restraints (making the rear of the head restraint face forward) in an attempt to gain additional clearance to the back of your head.

Front Head Restraints

Your vehicle is equipped with front four way driver and passenger head restraints.

To raise the head restraint, pull upward on the head restraint. To lower the head restraint, push the adjustment button, located at the base of the head restraint, and push downward on the head restraint.

To adjust the head restraint forward, pull the top of the head restraint toward the front of the vehicle as desired and release. To adjust the head restraint rearward, pull the top of the head restraint to the forward most position and release. The head restraint will return to the rear most position.

NOTE:
If your vehicle is equipped with a front bench seat, the center head restraint is not adjustable or removable.

Head Restraint Adjustment Button

NOTE:
The head restraints should only be removed by qualified technicians, for service purposes only. If either of the head restraints require removal, see an authorized dealer.

WARNING!

- All occupants, including the driver, should not operate a vehicle or sit in a vehicle's seat until the head restraints are placed in their proper positions in order to minimize the risk of neck injury in the event of a crash.
- Head restraints should never be adjusted while the vehicle is in motion. Driving a vehicle with the head restraints improperly adjusted or removed could cause serious injury or death in the event of a collision.

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

the head restraint to the forward most position and release. The head restraint will return to the rear most position.

NOTE:
If your vehicle is equipped with a front bench seat, the center head restraint is not adjustable or removable.

Head Restraint Adjustment Button

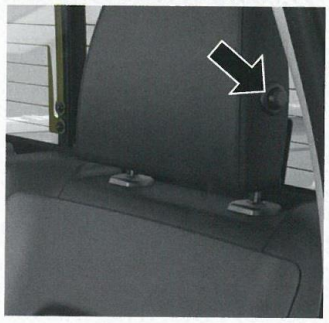
NOTE:
The head restraints should only be removed by qualified technicians, for service purposes only. If either of the head restraints require removal, see an authorized dealer.

WARNING!

- All occupants, including the driver, should not operate a vehicle or sit in a vehicle's seat until the head restraints are placed in their proper positions in order to minimize the risk of neck injury in the event of a crash.
- Head restraints should never be adjusted while the vehicle is in motion. Driving a vehicle with the head restraints improperly adjusted or removed could cause serious injury or death in the event of a collision.

Rear Head Restraints

The outboard head restraints are non-adjustable, but can be folded down for improved rearward visibility. Push the button on the outboard side of the head restraint to release. To return the head restraint to its upright position, push up on the head restraint until it locks back into place.



Release Button

27

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)

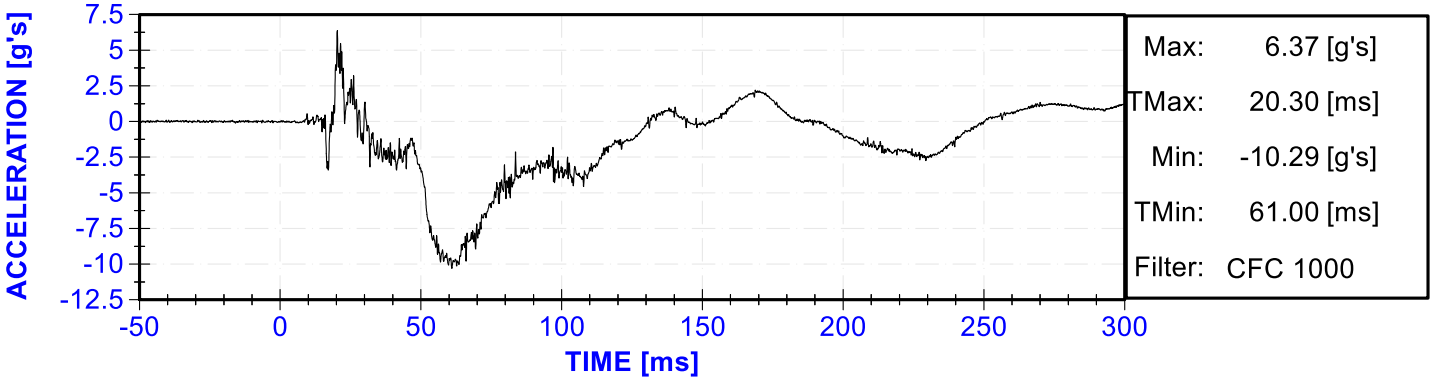
Vehicle Instrumentation Data

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)

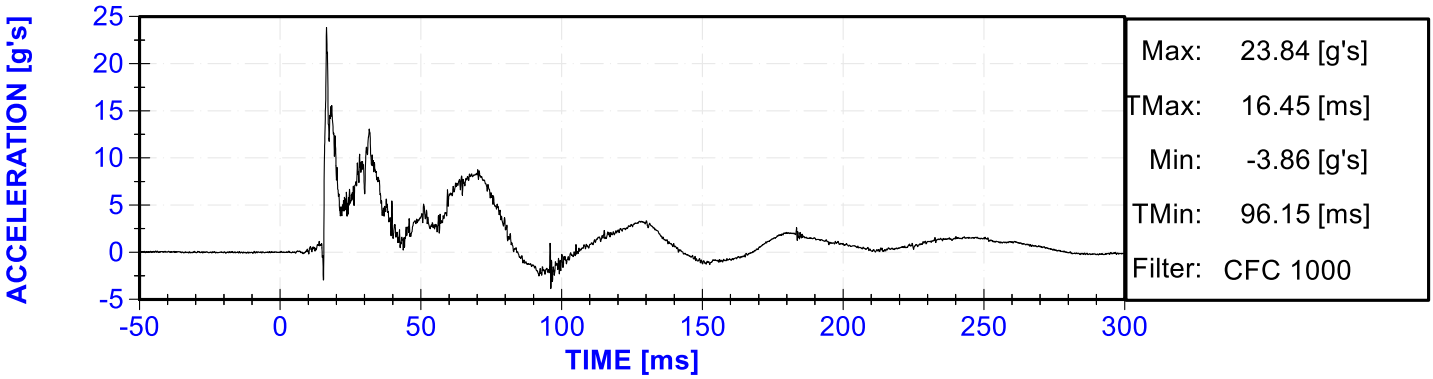
MDB Instrumentation Data

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

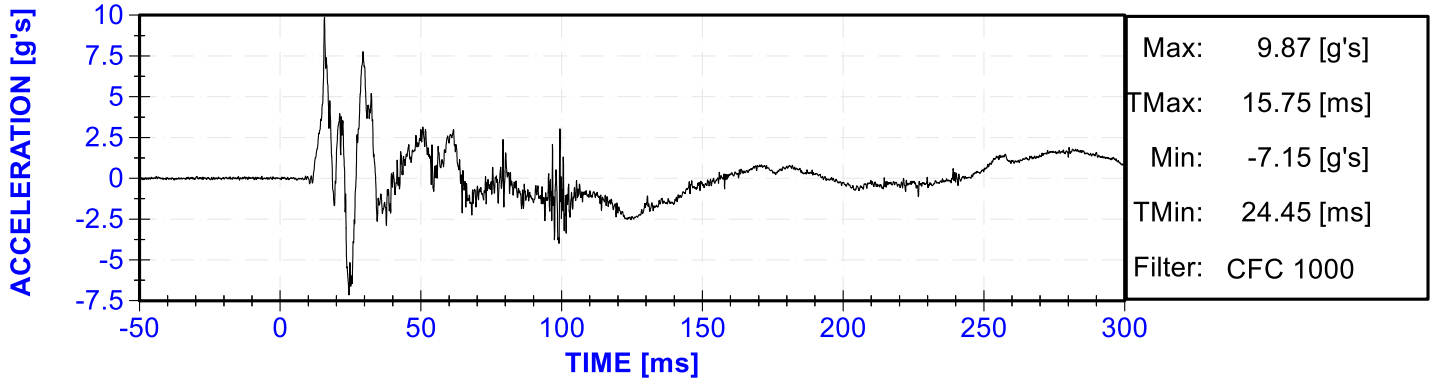
Driver Head Acceleration (X) Primary vs. Time



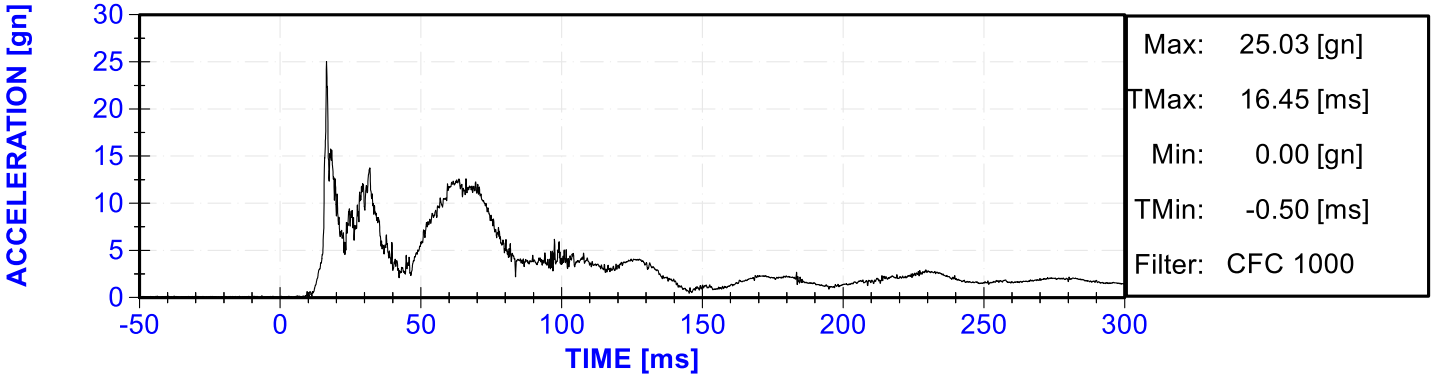
Driver Head Acceleration (Y) Primary vs. Time



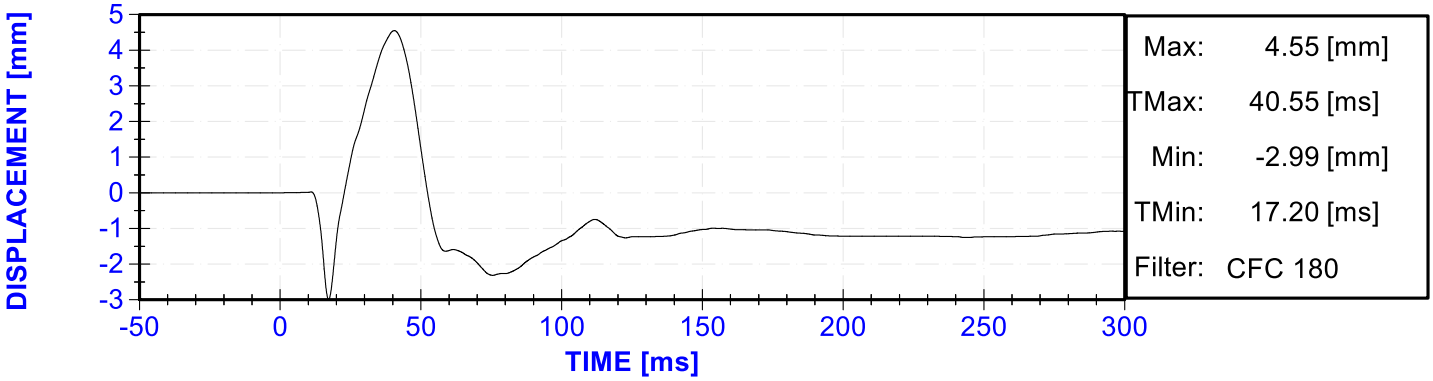
Driver Head Acceleration (Z) Primary vs. Time



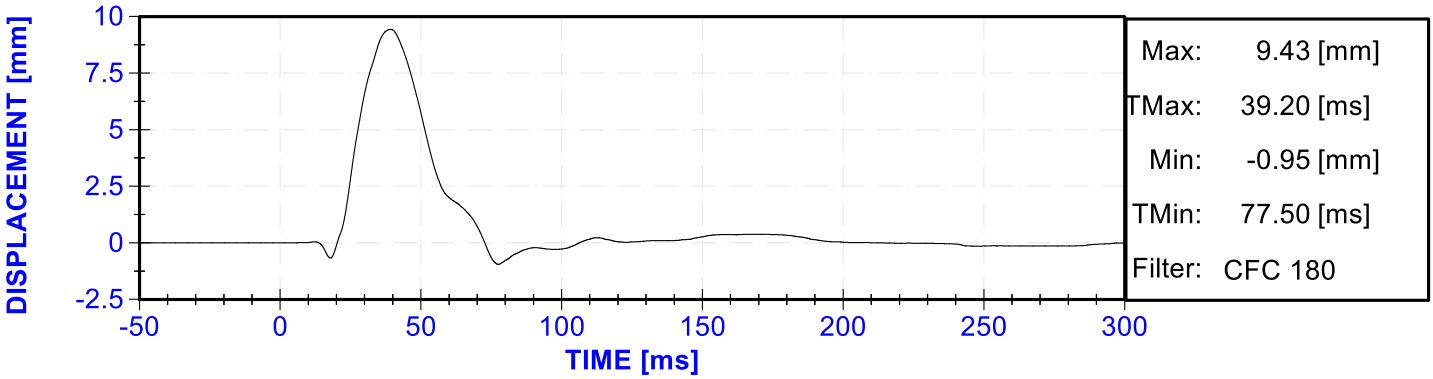
Driver Head Resultant Acceleration Primary vs. Time



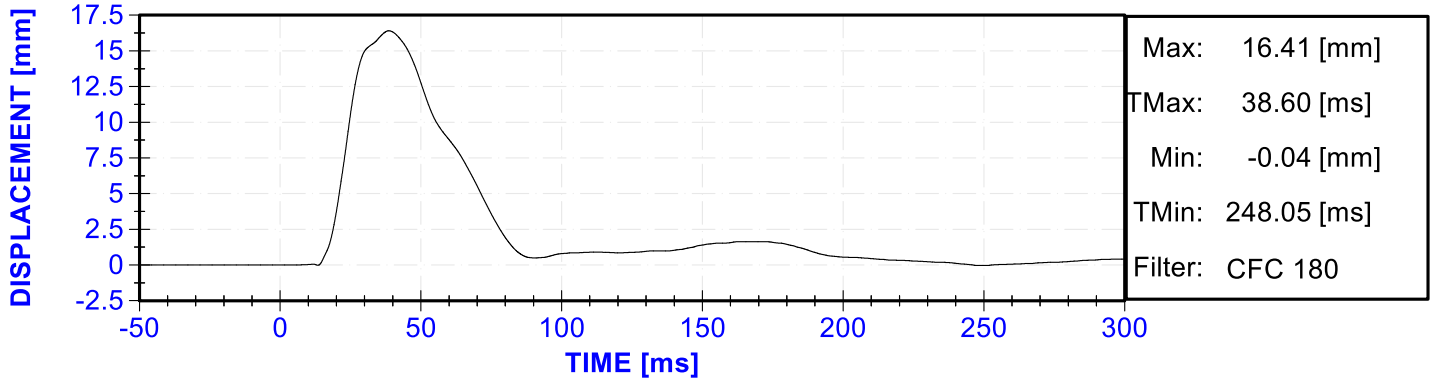
Driver Upper Thorax Rib Deflection (Y) vs. Time



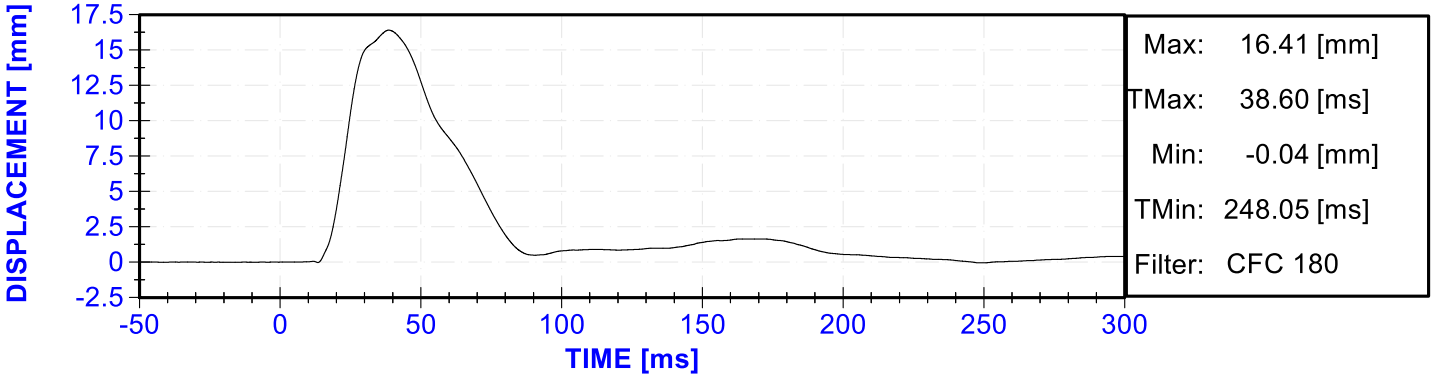
Driver Middle Thorax Rib Deflection (Y) vs. Time

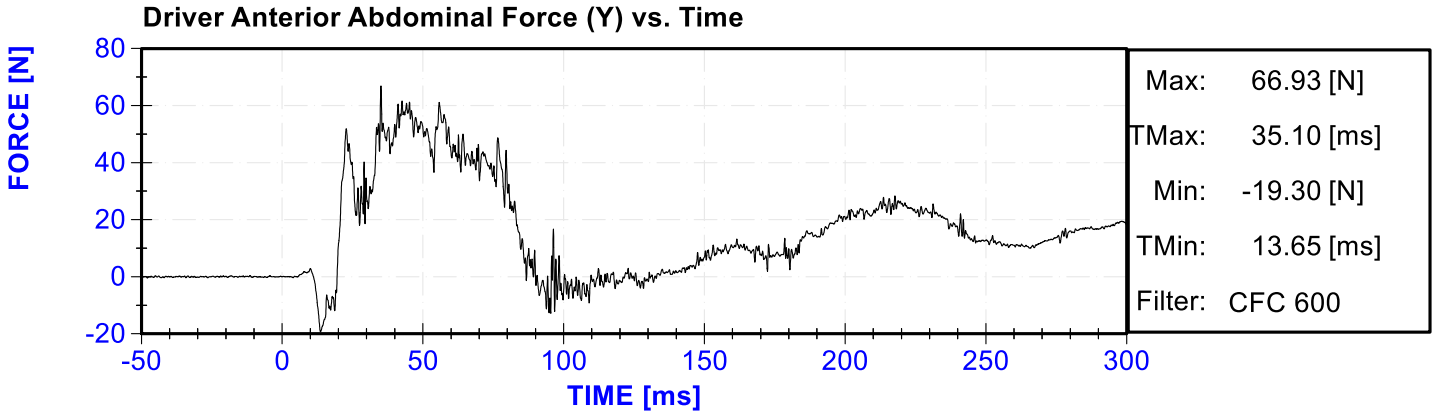


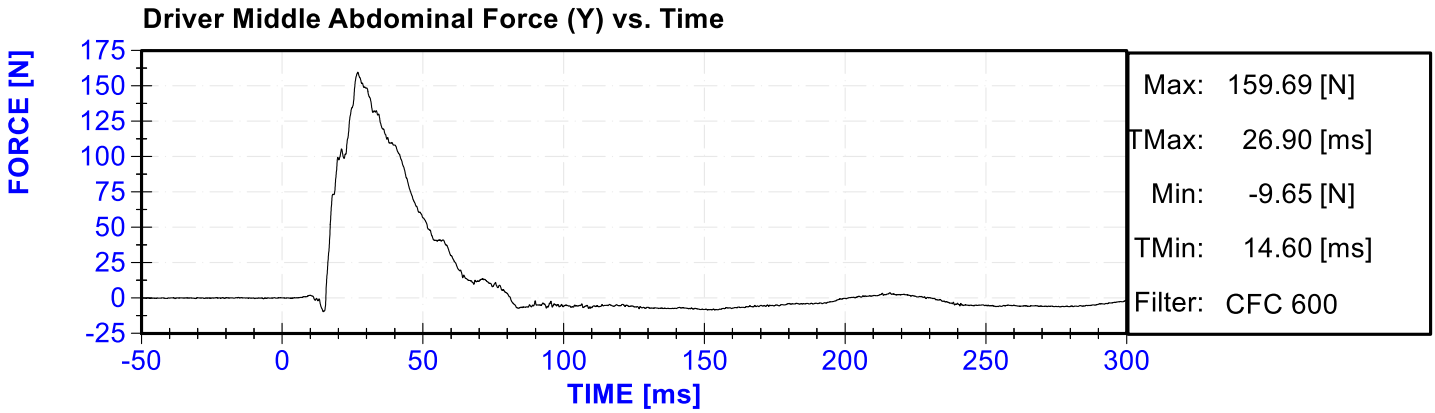
Driver Lower Thorax Rib Deflection (Y) vs. Time

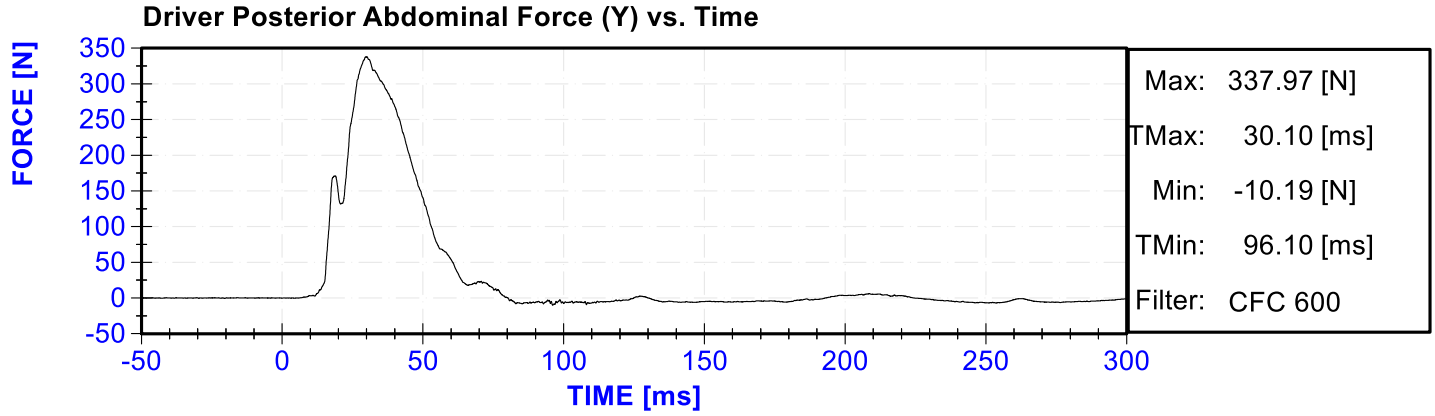


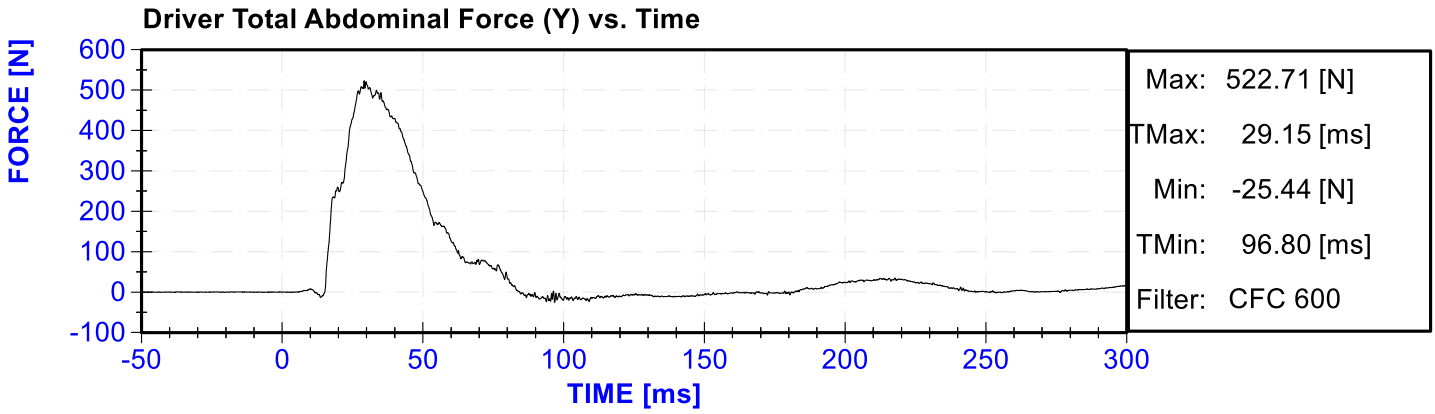
Driver Thorax Rib Deflection Maximum vs. Time



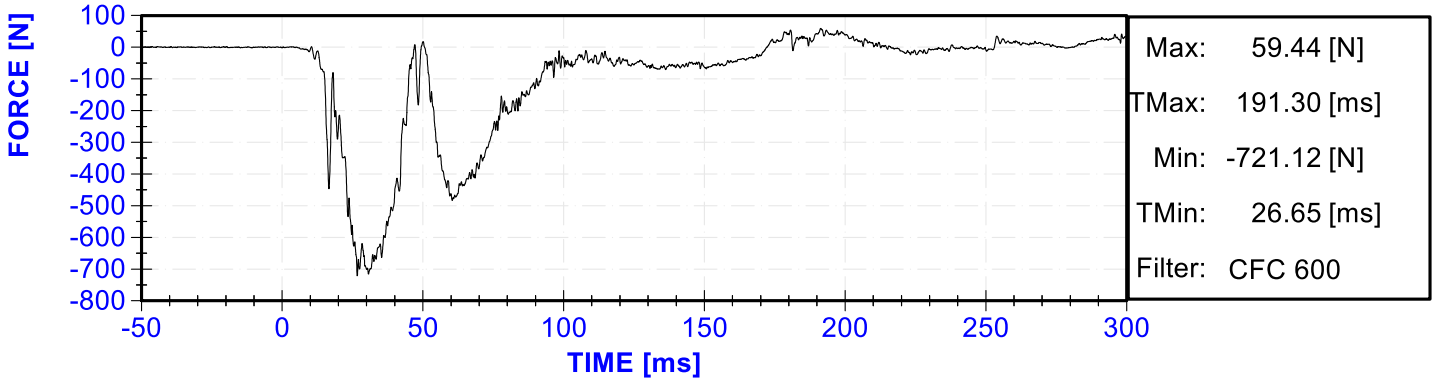

Driver Anterior Abdominal Force (Y) vs. Time
FORCE [N]
80
60
40
20
0
-20
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 66.93 [N]
TMax: 35.10 [ms]
Min: -19.30 [N]
TMin: 13.65 [ms]
Filter: CFC 600


Driver Middle Abdominal Force (Y) vs. Time
FORCE [N]
175
150
125
100
75
50
25
0
-25
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 159.69 [N]
TMax: 26.90 [ms]
Min: -9.65 [N]
TMin: 14.60 [ms]
Filter: CFC 600

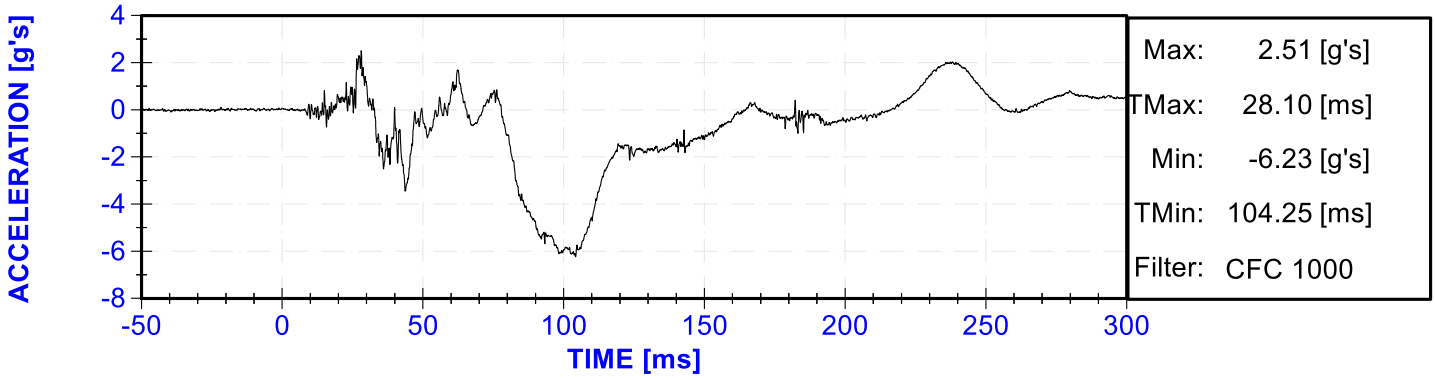

Driver Posterior Abdominal Force (Y) vs. Time
FORCE [N]
350
300
250
200
150
100
50
0
-50
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 337.97 [N]
TMax: 30.10 [ms]
Min: -10.19 [N]
TMin: 96.10 [ms]
Filter: CFC 600


Driver Total Abdominal Force (Y) vs. Time
FORCE [N]
600
500
400
300
200
100
0
-100
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 522.71 [N]
TMax: 29.15 [ms]
Min: -25.44 [N]
TMin: 96.80 [ms]
Filter: CFC 600

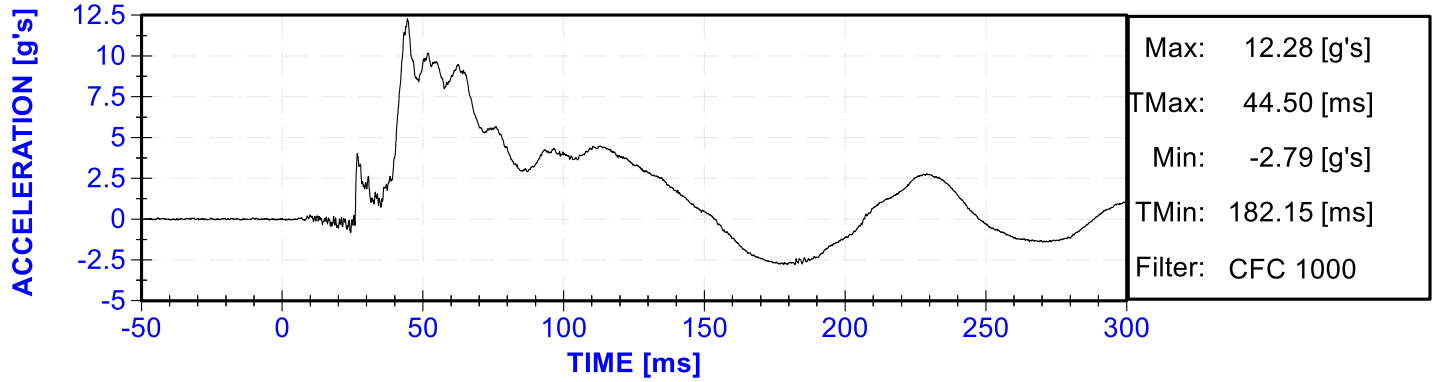
Driver Pubic Symphysis Force (Y) vs. Time



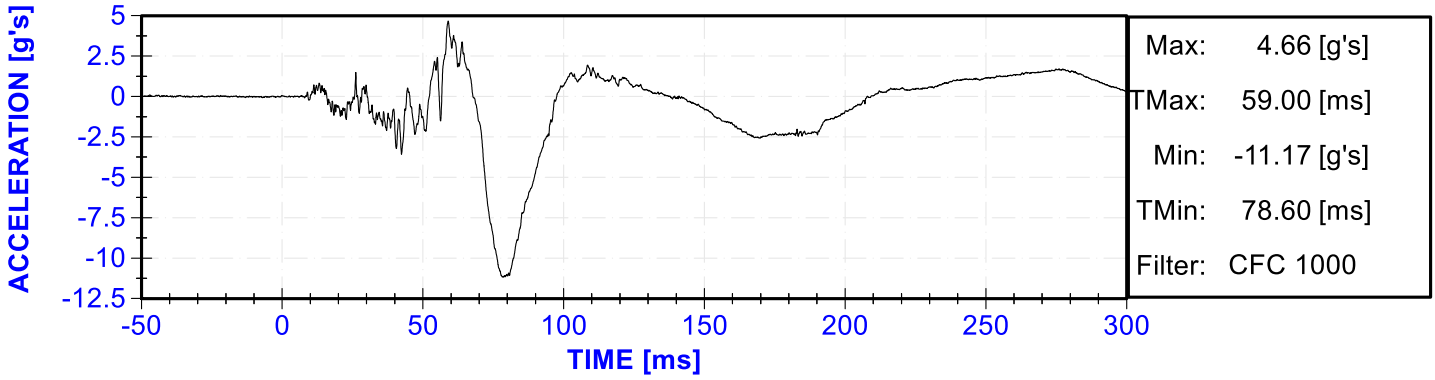
Passenger Head Acceleration (X) vs. Time Primary



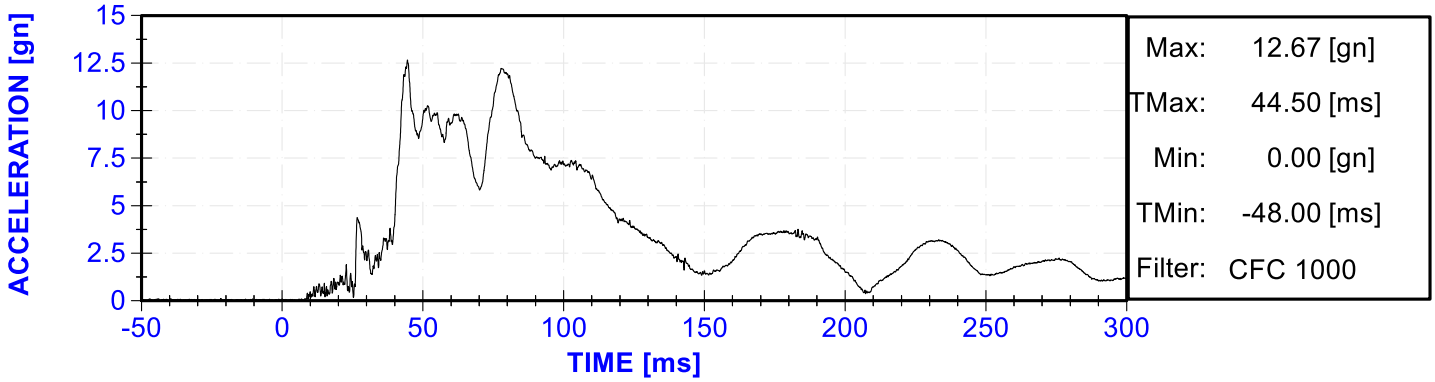
Passenger Head Acceleration (Y) vs. Time Primary



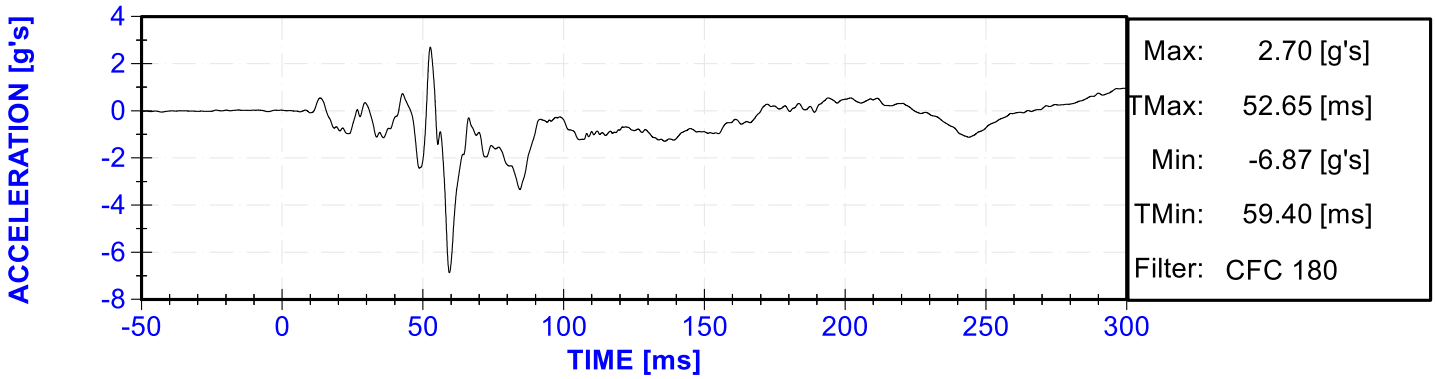
Passenger Head Acceleration (Z) vs. Time Primary



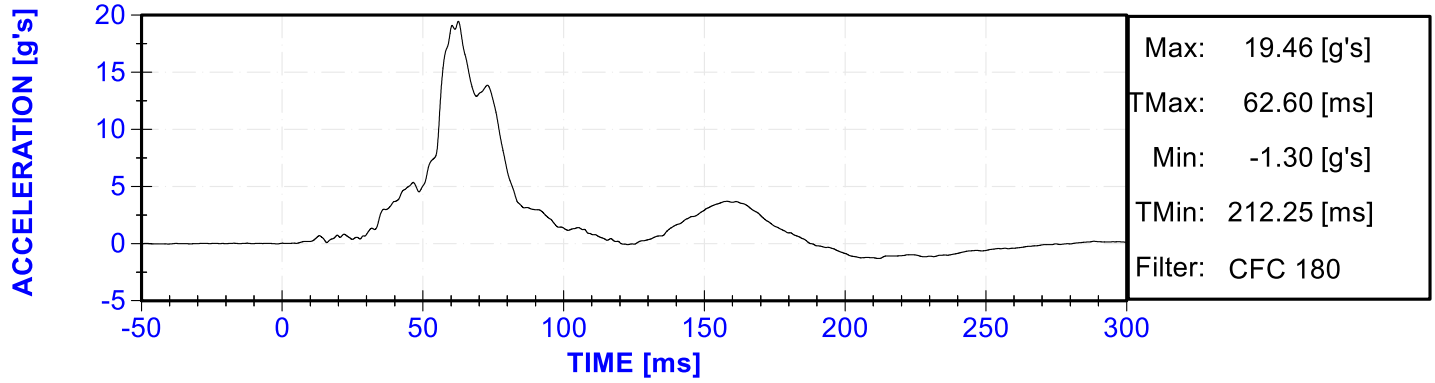
Passenger Head Resultant Acceleration Primary vs. Time



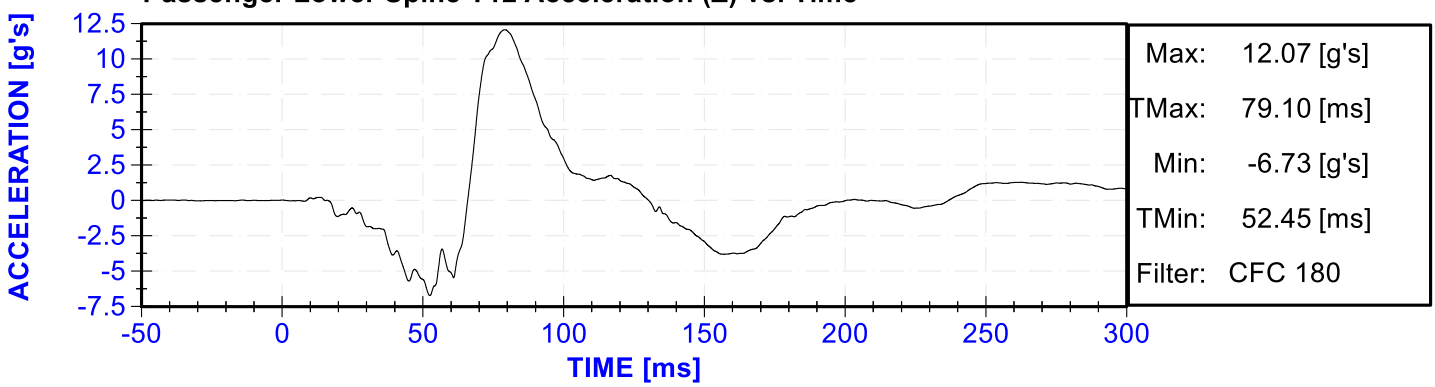
Passenger Lower Spine T12 Acceleration (X) vs. Time



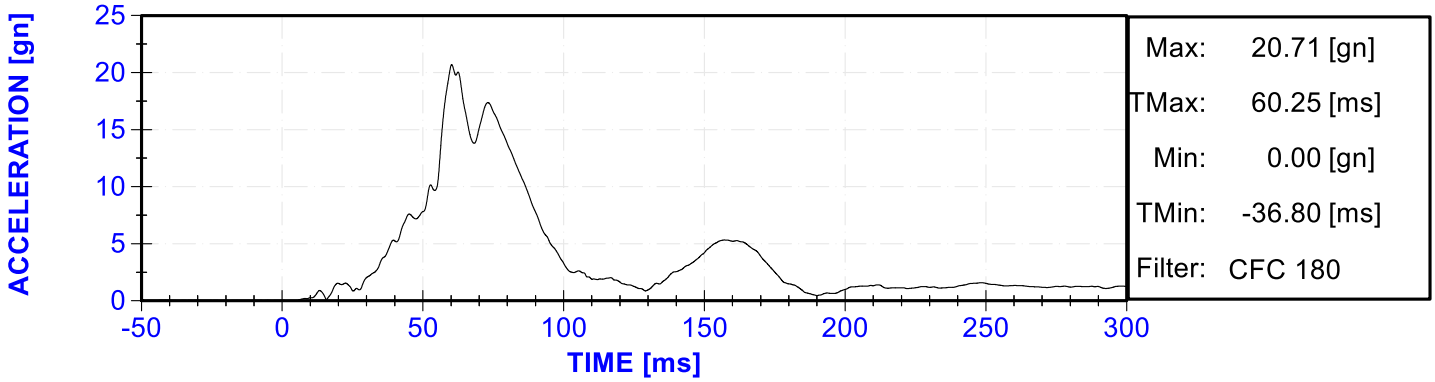
Passenger Lower Spine T12 Acceleration (Y) vs. Time



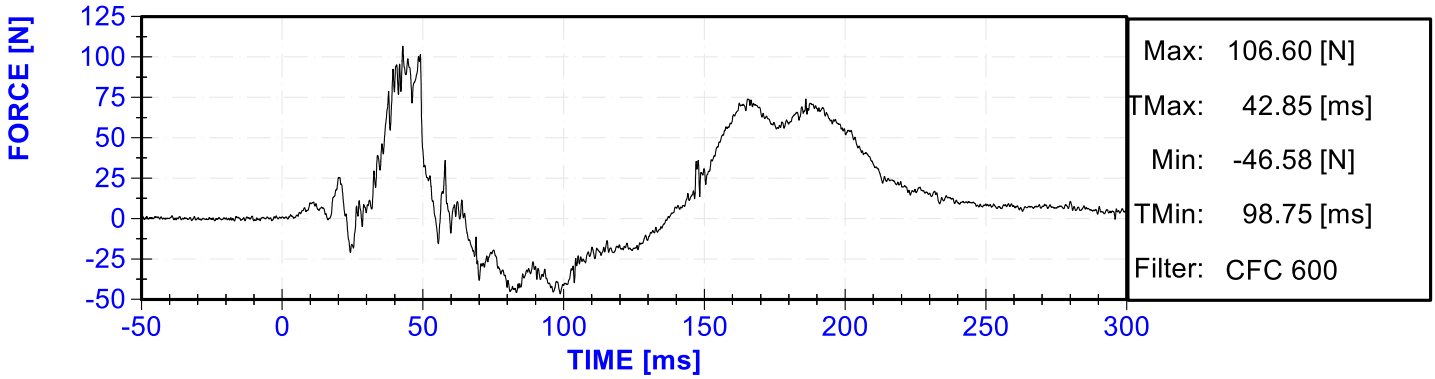
Passenger Lower Spine T12 Acceleration (Z) vs. Time



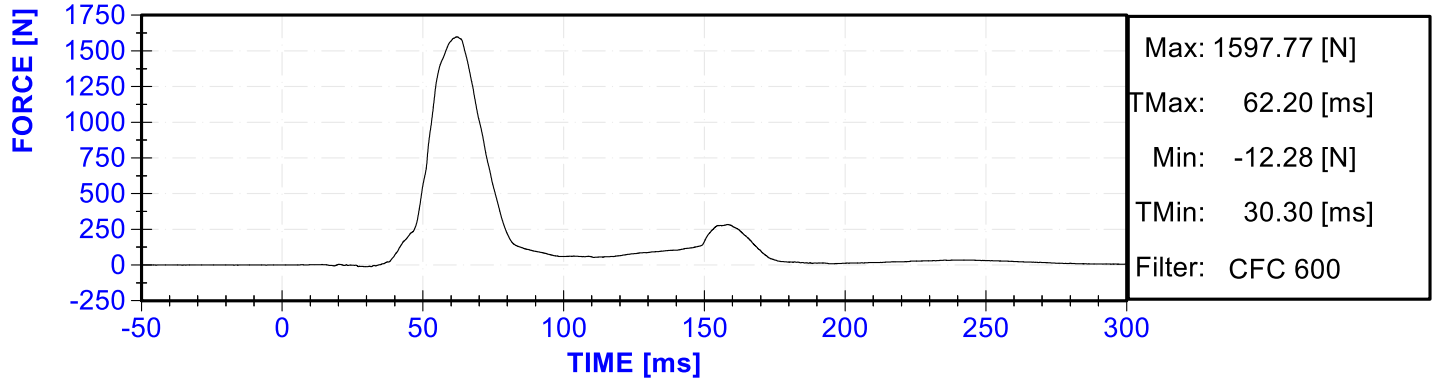
Passenger Lower Spine T12 Resultant Acceleration vs. Time



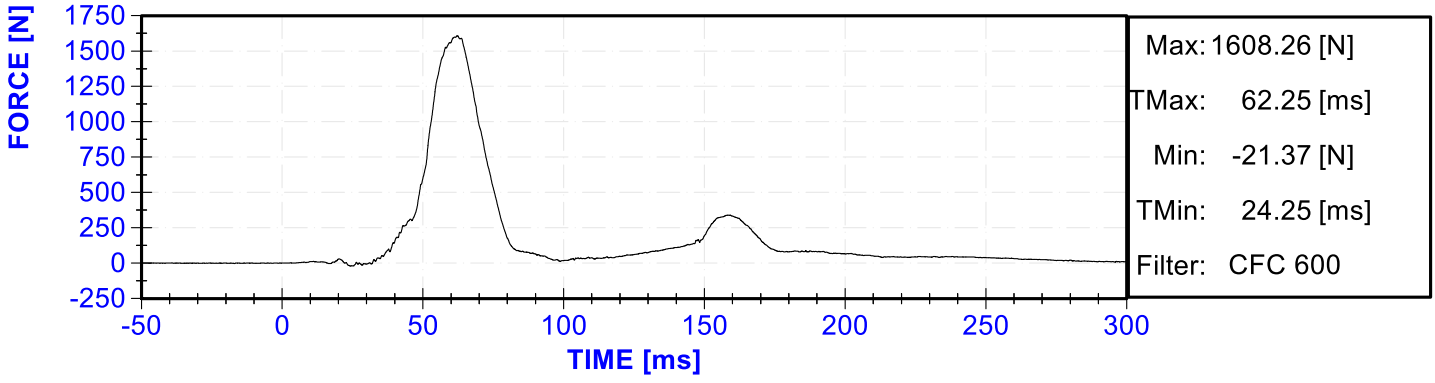
Passenger Iliac Force on Impact Side (Y) vs. Time



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

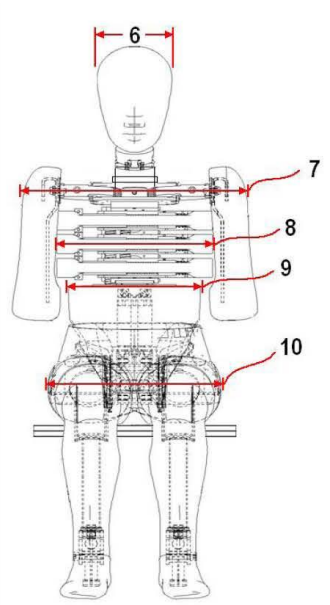
SERIAL NO: F034

(CONFIGURED FOR LEFT SIDE IMPACT)

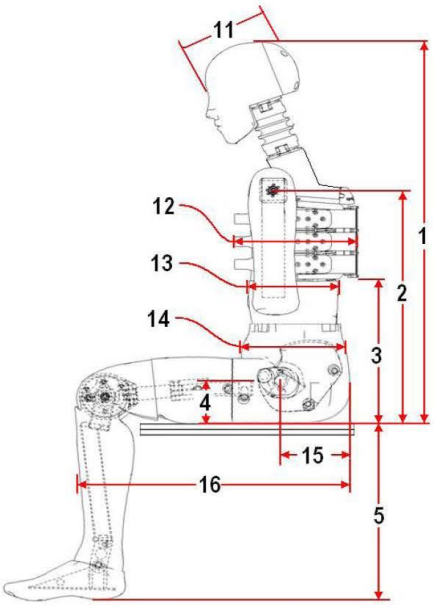
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 3/21/2019

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	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	101	Pass
5	Sole to Seat, Sitting	333	451	419	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	280	Pass
10	Pelvis Lap Width	359	373	365	Pass
11	Head Depth	196	206	200	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	242	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

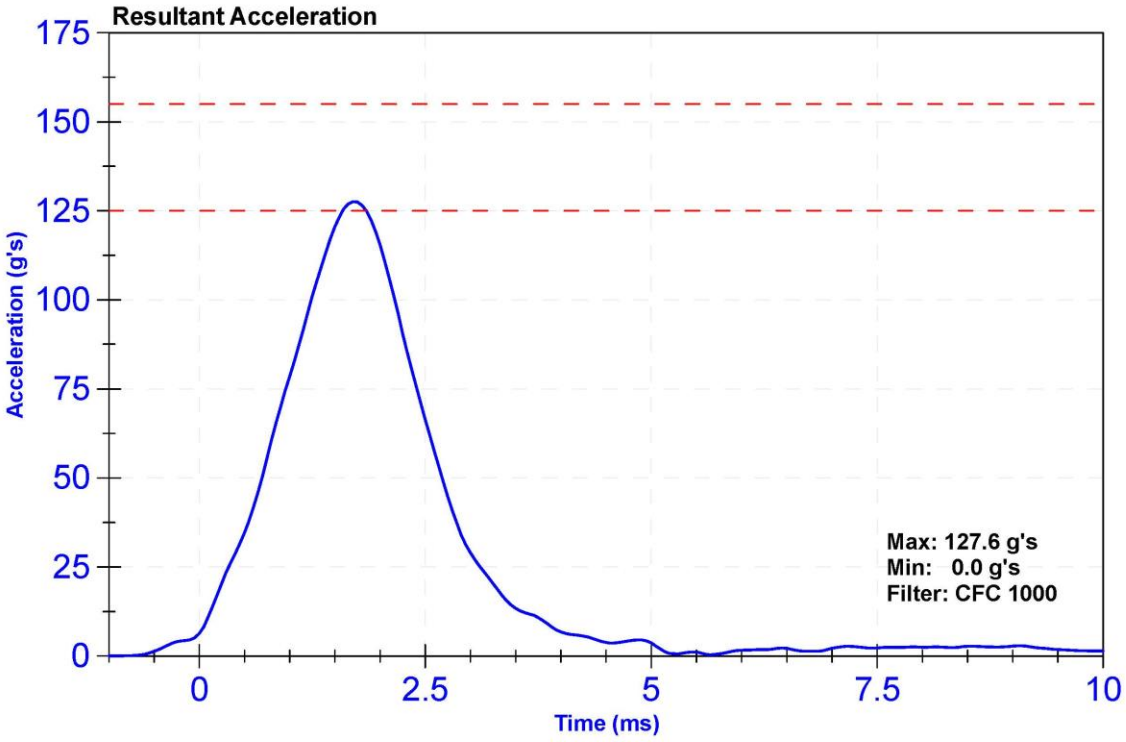
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

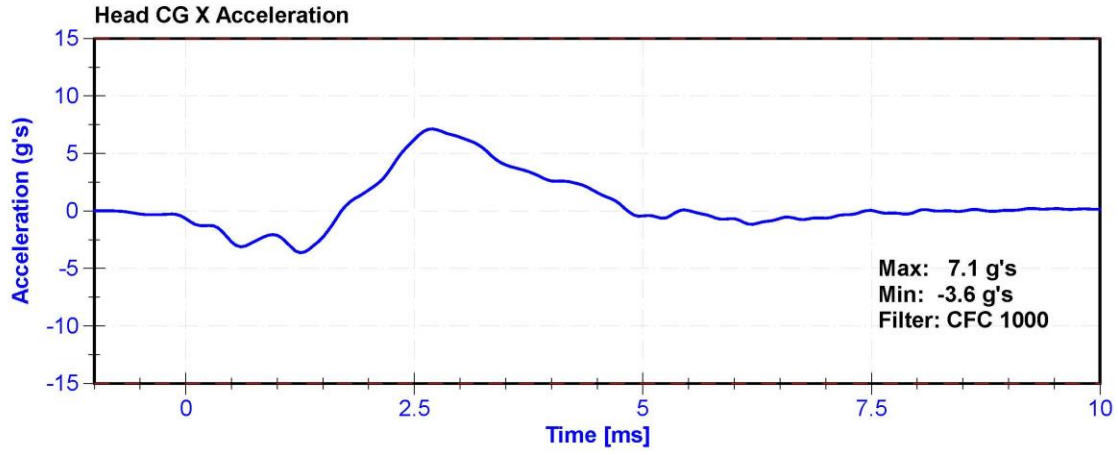
Results

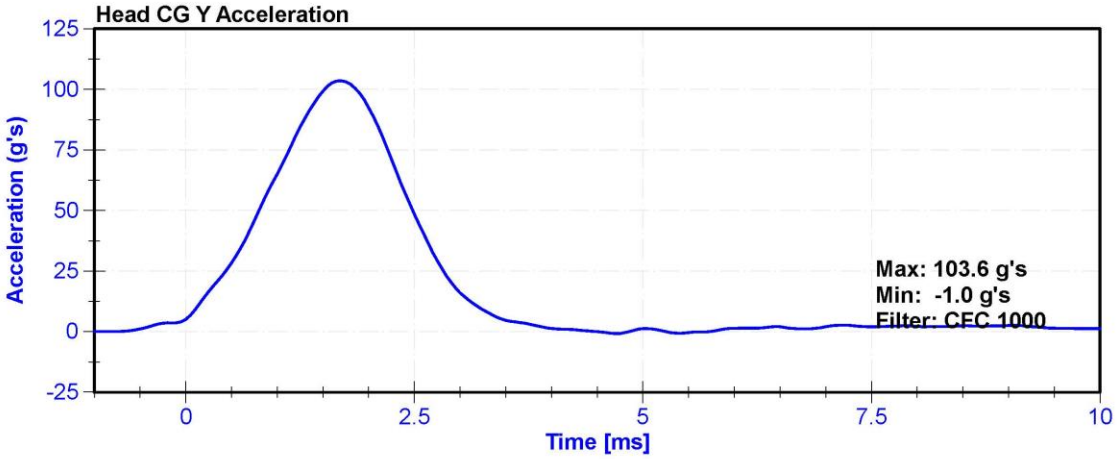
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	31.3	Pass
Resultant Acceleration	125	155	g's	127.6	Pass
Oscillation	0	15	%	3.54	Pass
Fore-Aft Acceleration	-15	15	g's	7.1	Pass

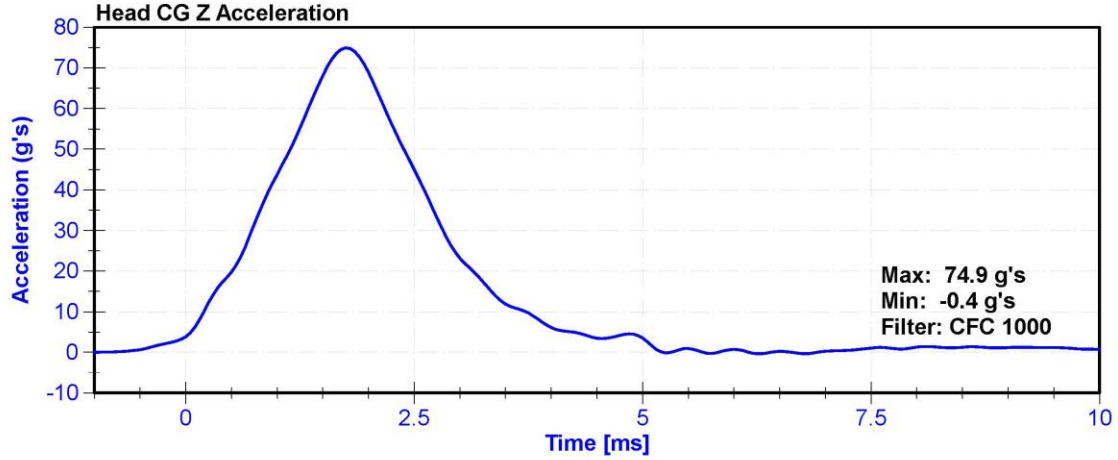
Transducer Calibrations

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: 7.1 g's
Min: -3.6 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: 103.6 g's
Min: -1.0 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
80
70
60
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]
Max: 74.9 g's
Min: -0.4 g's
Filter: CFC 1000

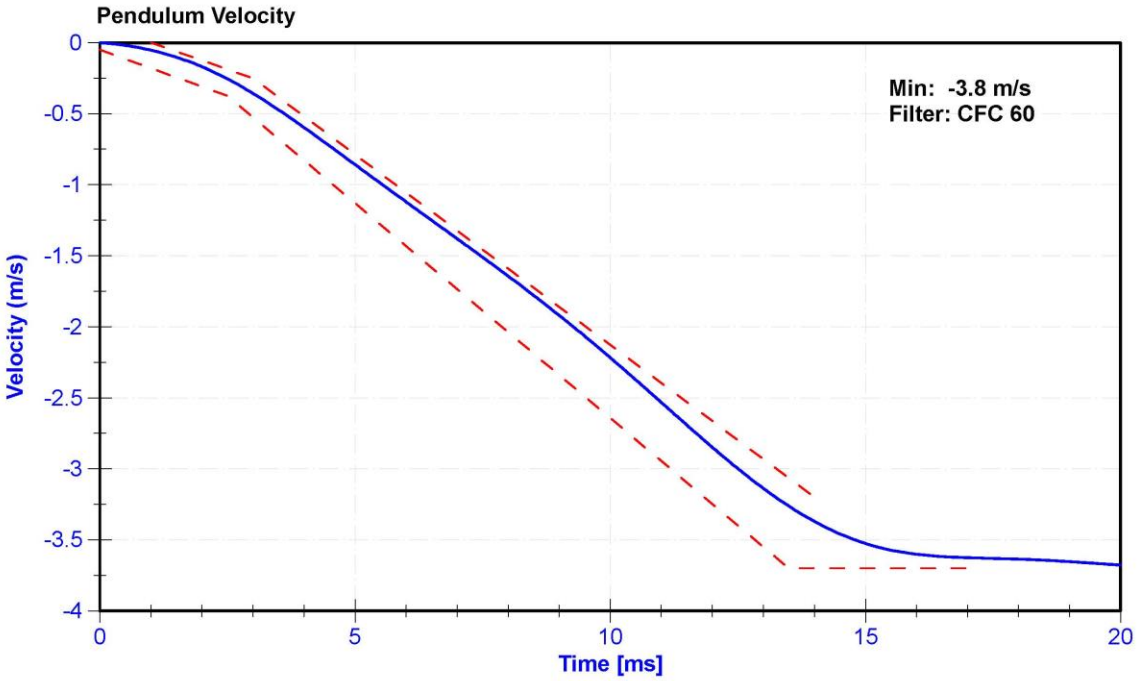
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

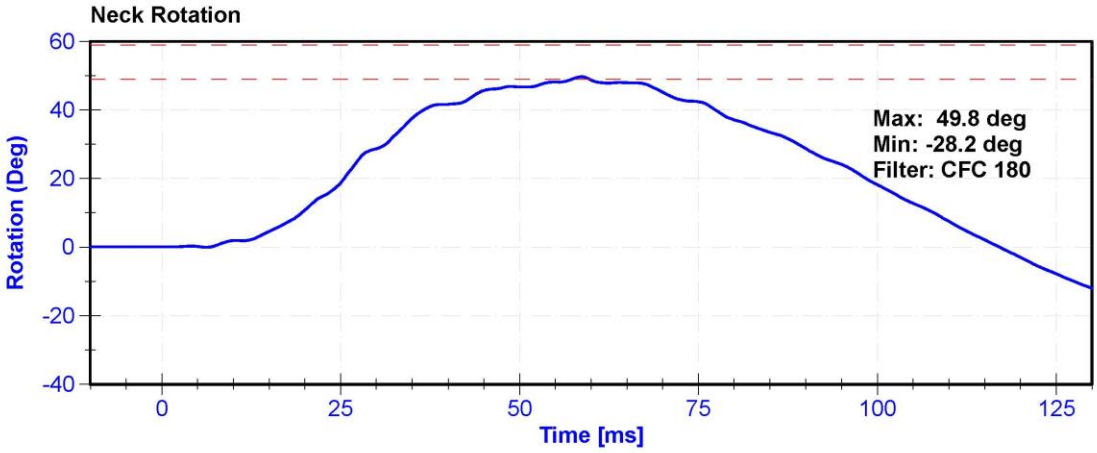
Results

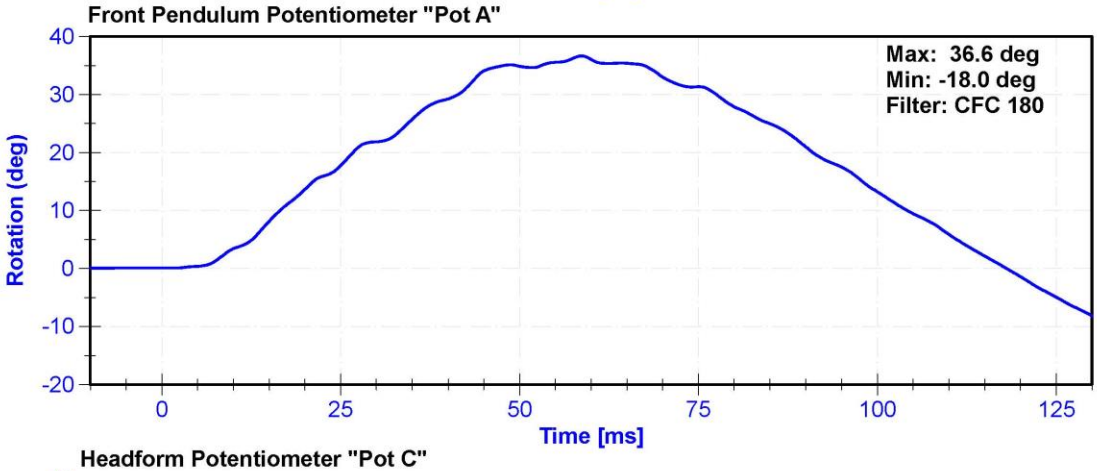
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	30.9	Pass
Velocity	3.3	3.5	m/s	3.35	Pass
Lateral Neck Rotation	49	59	deg	49.8	Pass
Time at Maximum Rotation	54	66	ms	58.7	Pass
Time of Rotation Decay from Maximum	53	88	ms	58.4	Pass

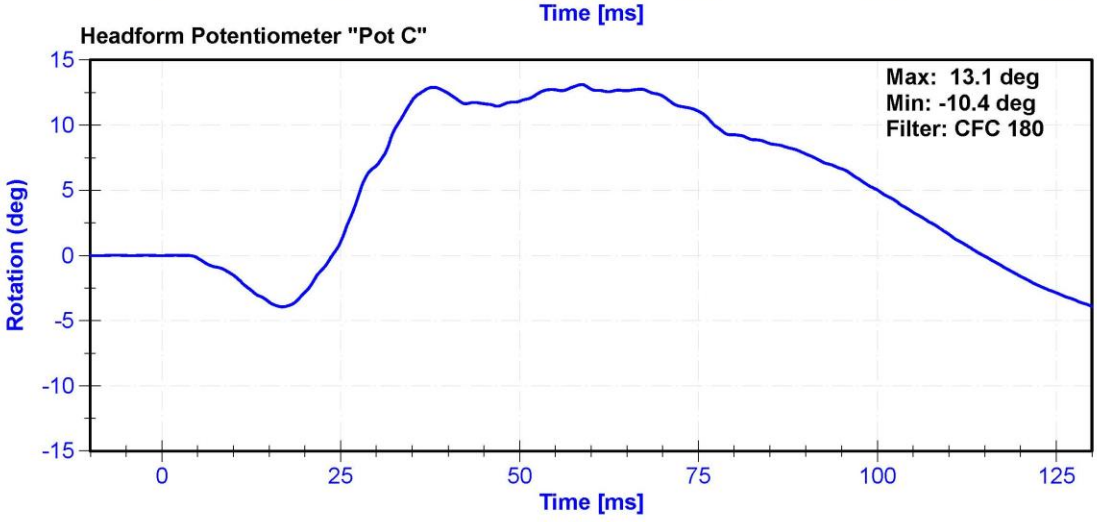
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9	1/29/2019	1/29/2020
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: 49.8 deg
Min: -28.2 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 36.6 deg
Min: -18.0 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 13.1 deg
Min: -10.4 deg
Filter: CFC 180

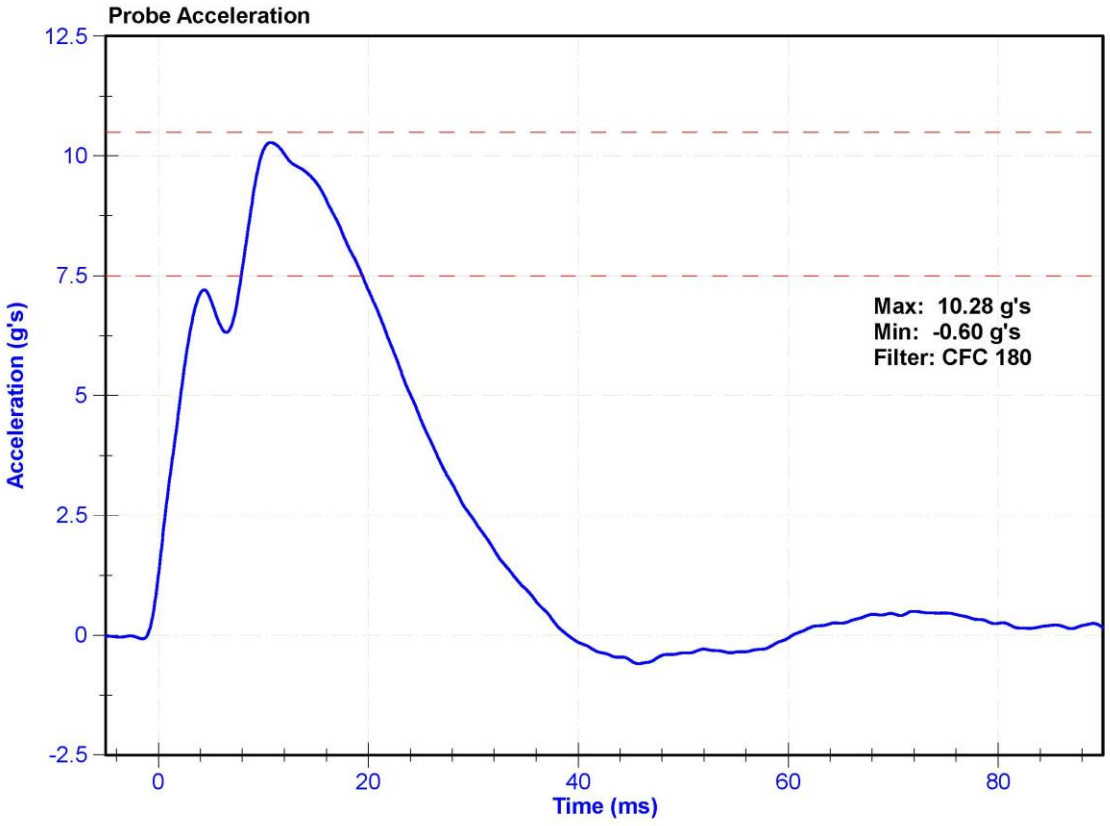
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	31.8	Pass
Velocity	4.2	4.4	m/s	4.20	Pass
Probe Acceleration	7.5	10.5	g's	10.28	Pass

Transducer Calibrations

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



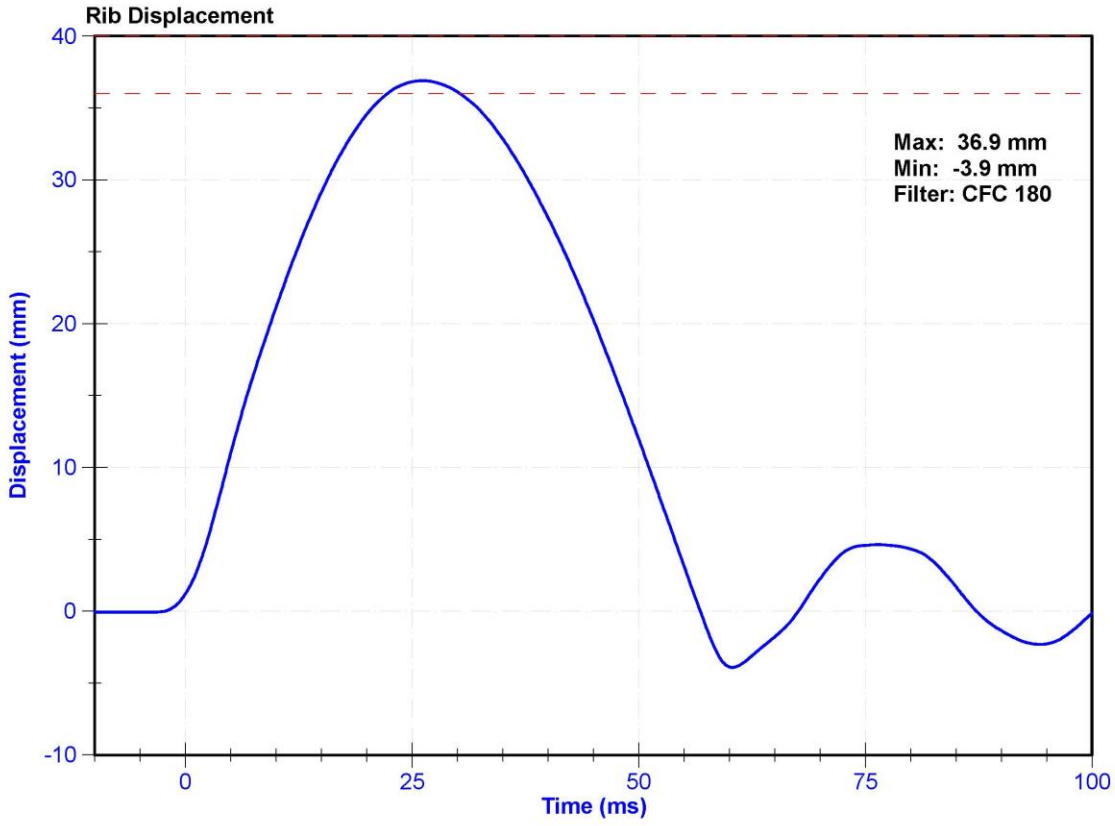
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	31.1	Pass
Rib Displacement	36	40	mm	36.9	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



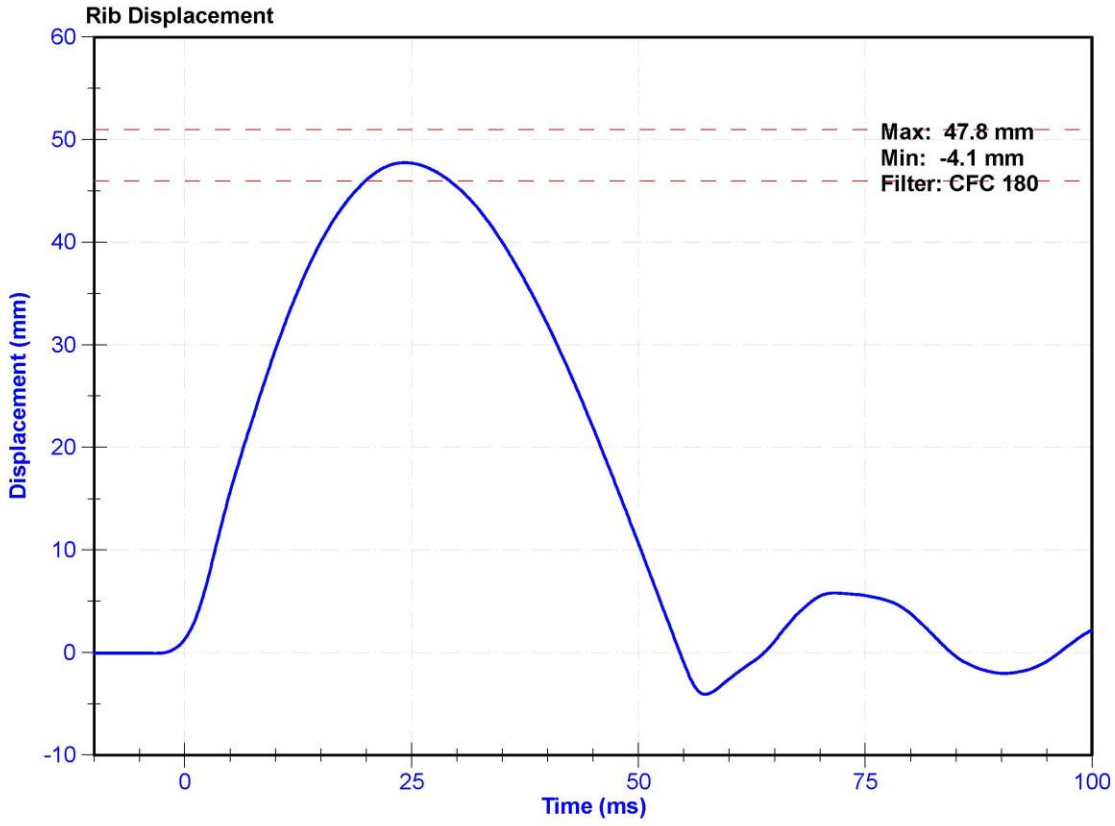
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	31.1	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



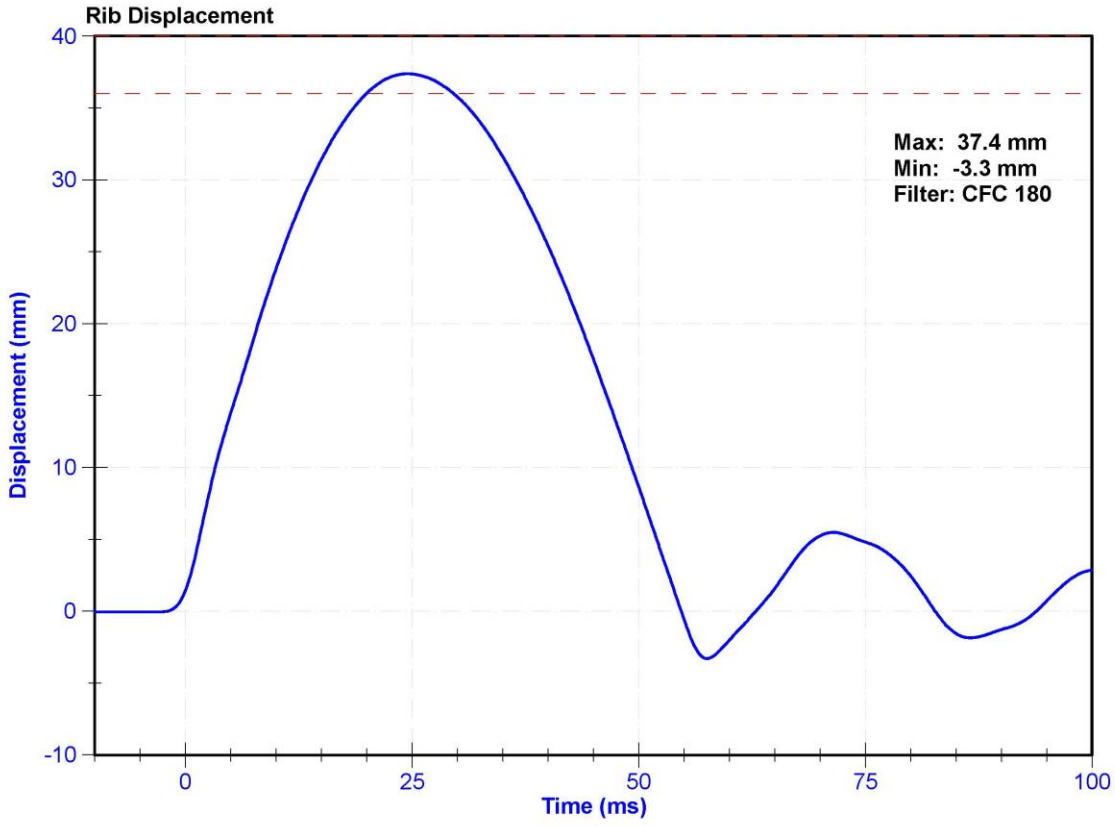
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	30.9	Pass
Rib Displacement	36	40	mm	37.4	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



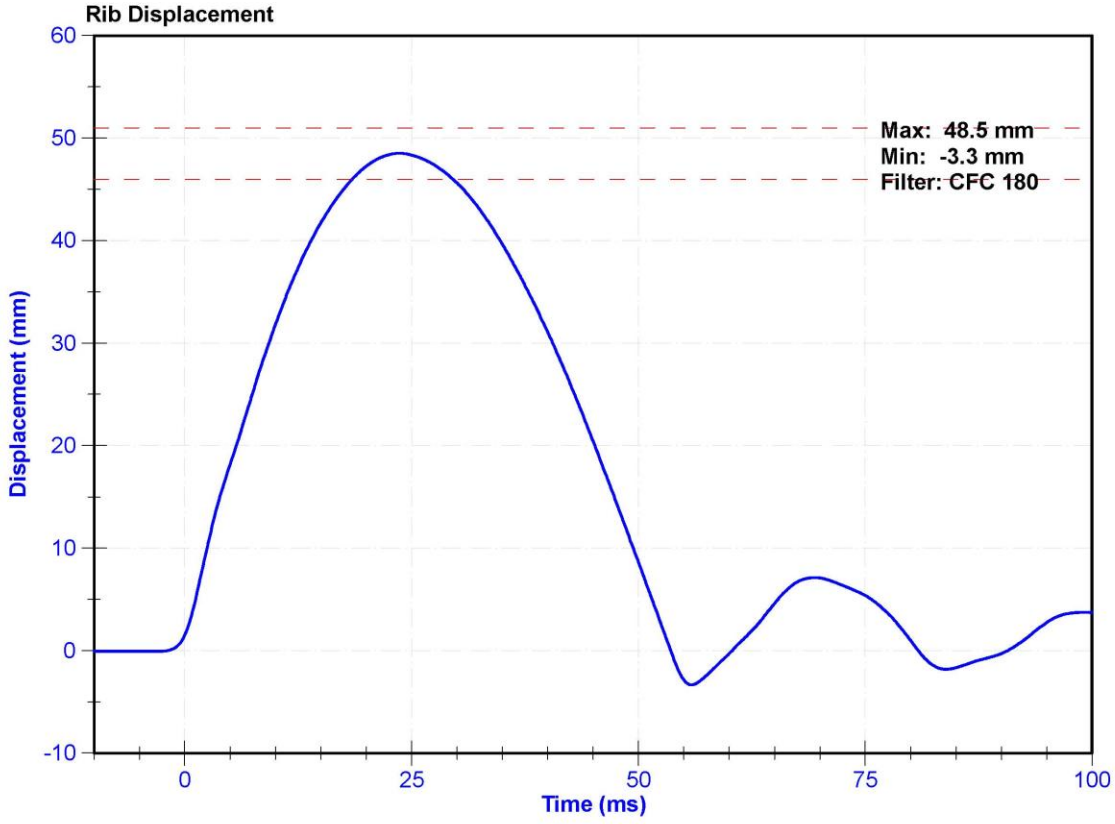
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	30.9	Pass
Rib Displacement	46	51	mm	48.5	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



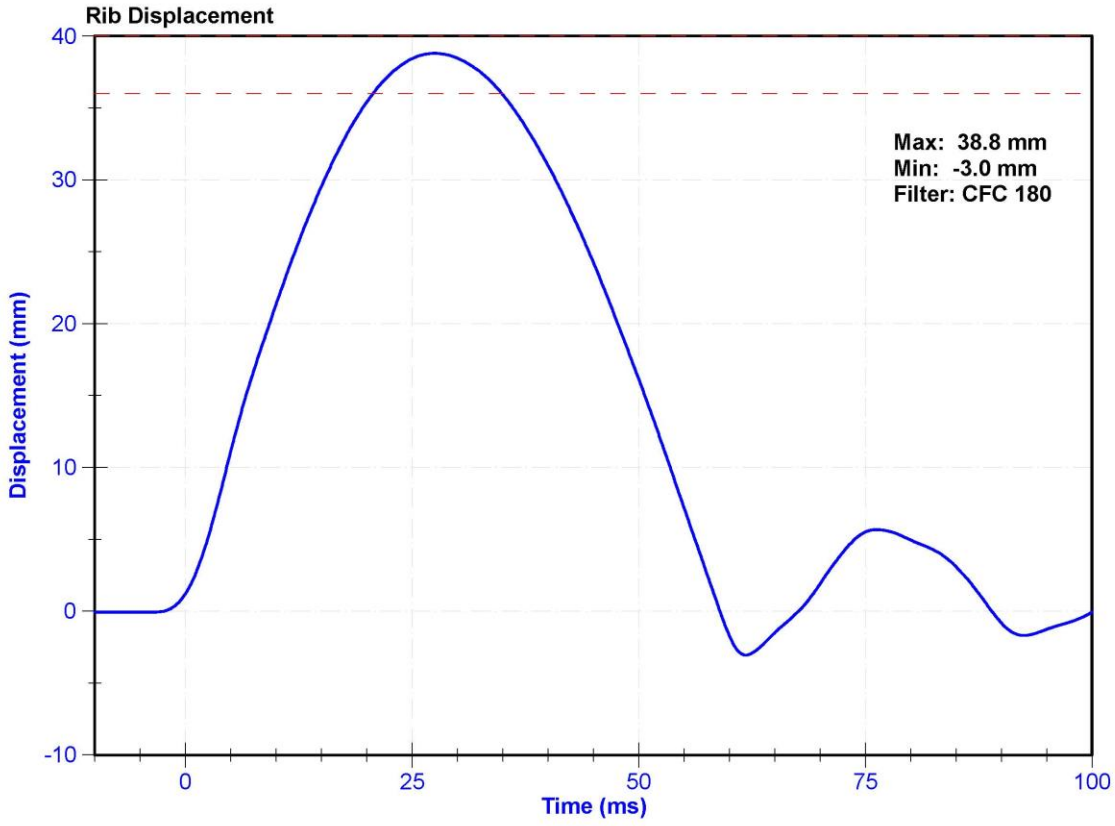
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	31.0	Pass
Rib Displacement	36	40	mm	38.8	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



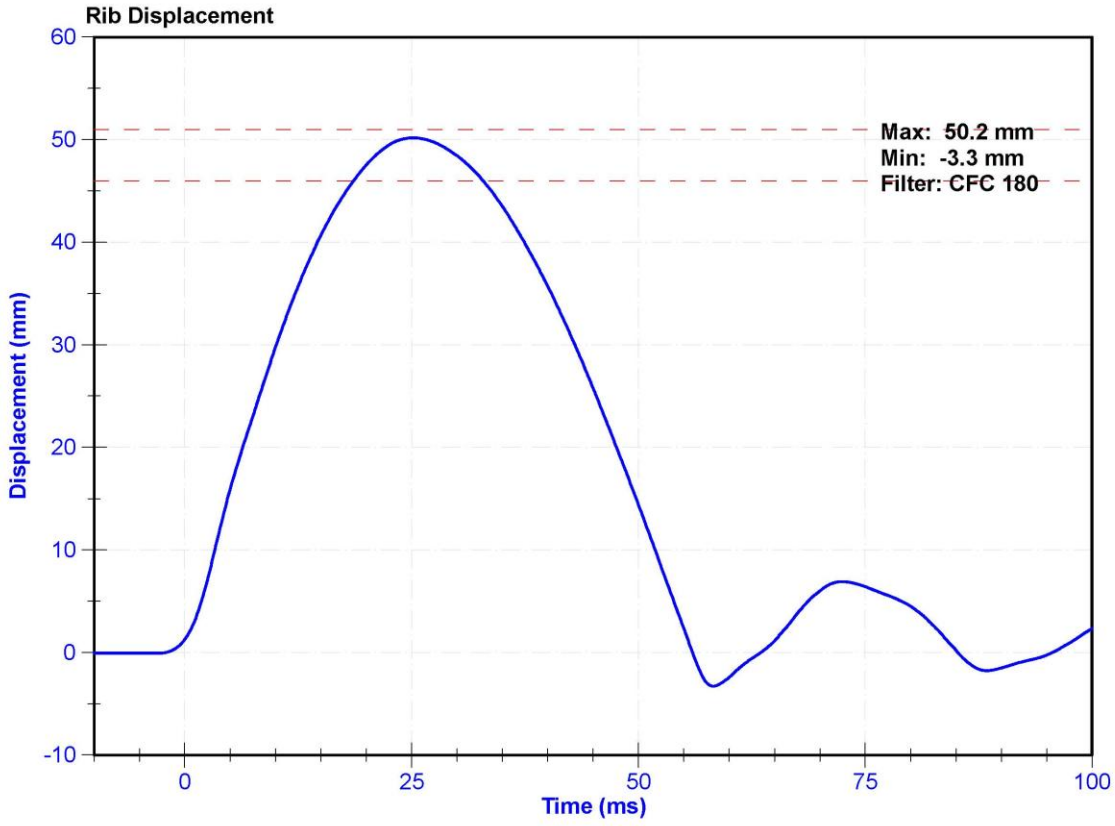
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	31.0	Pass
Rib Displacement	46	51	mm	50.2	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



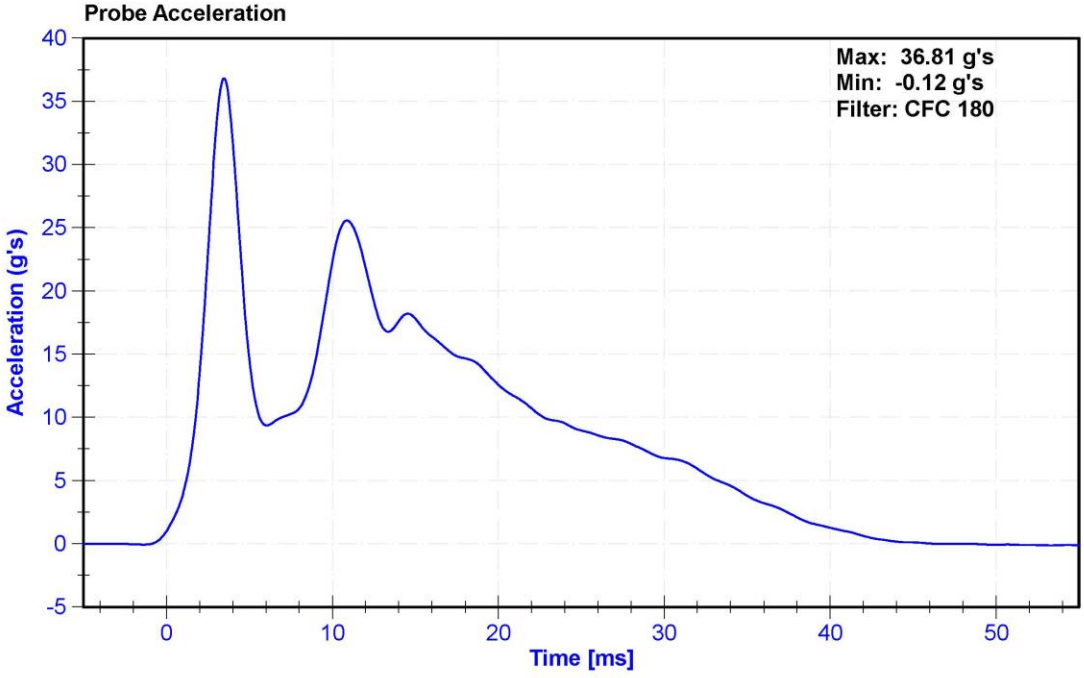
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

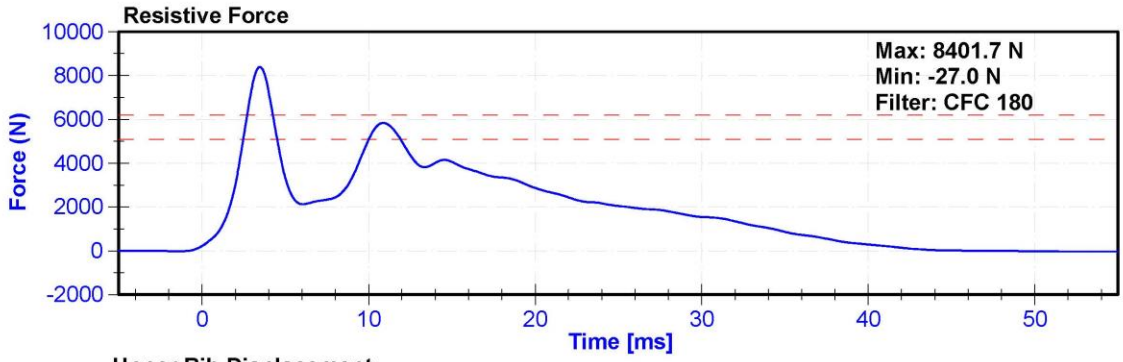
Results

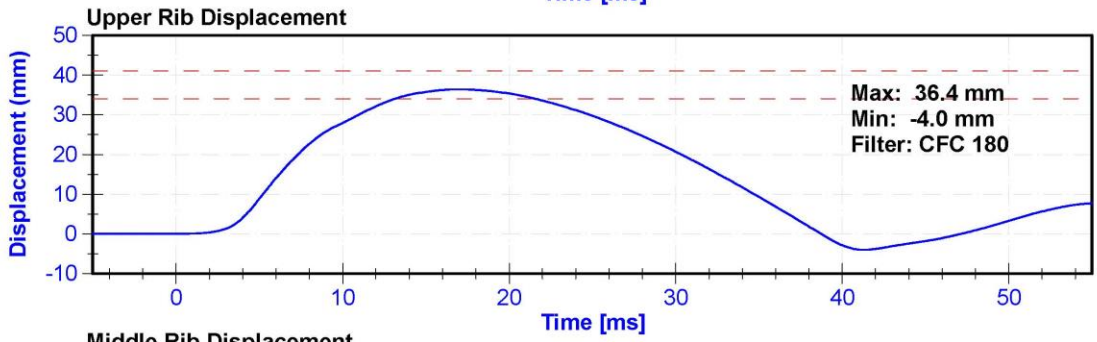
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	30.8	Pass
Velocity	5.4	5.6	m/s	5.48	Pass
Resistive Force after 6ms	5100	6200	N	5837.3	Pass
Upper Thorax Rib Deflection	34	41	mm	36.4	Pass
Mid Thorax Rib Deflection	37	45	mm	39.8	Pass
Lower Thorax Rib Deflection	37	44	mm	40.5	Pass

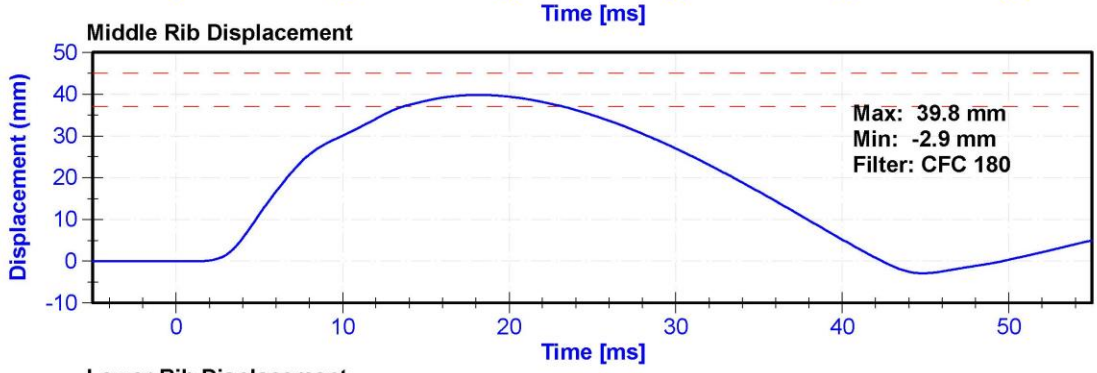
Transducer Calibrations

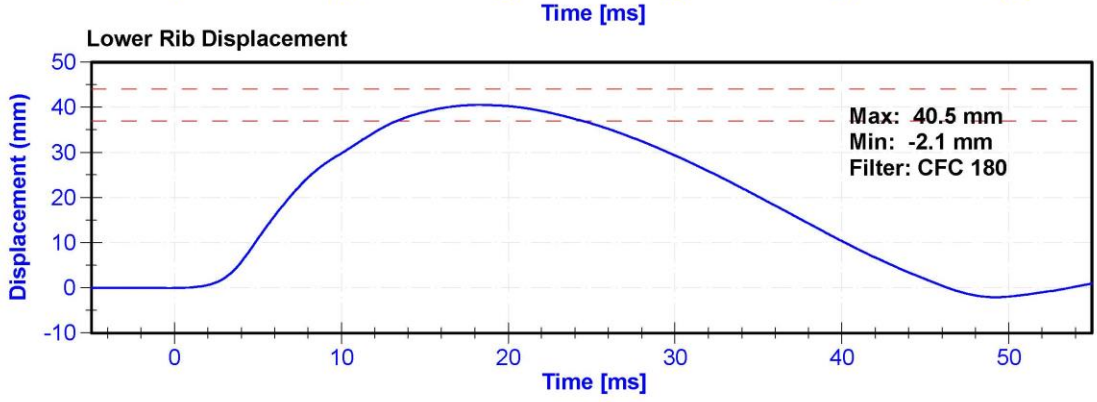
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019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




Resistive Force
Max: 8401.7 N
Min: -27.0 N
Filter: CFC 180
Force (N)
10000
8000
6000
4000
2000
0
-2000
0
10
20
30
40
50
Time [ms]


Upper Rib Displacement
Max: 36.4 mm
Min: -4.0 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Middle Rib Displacement
Max: 39.8 mm
Min: -2.9 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Lower Rib Displacement
Max: 40.5 mm
Min: -2.1 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]

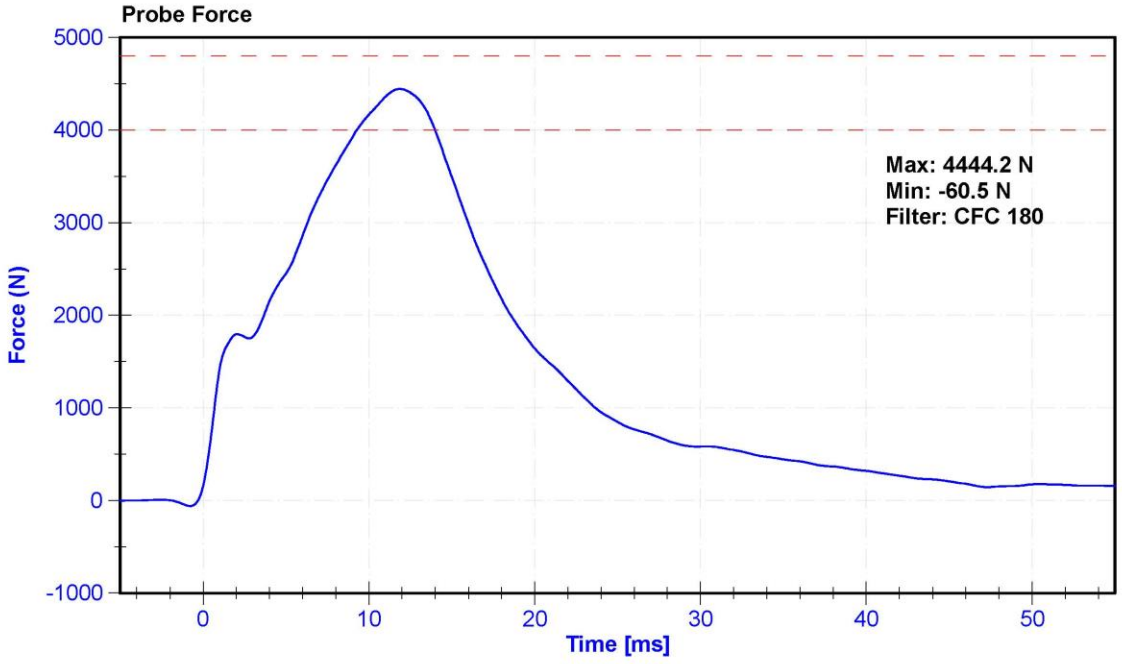
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

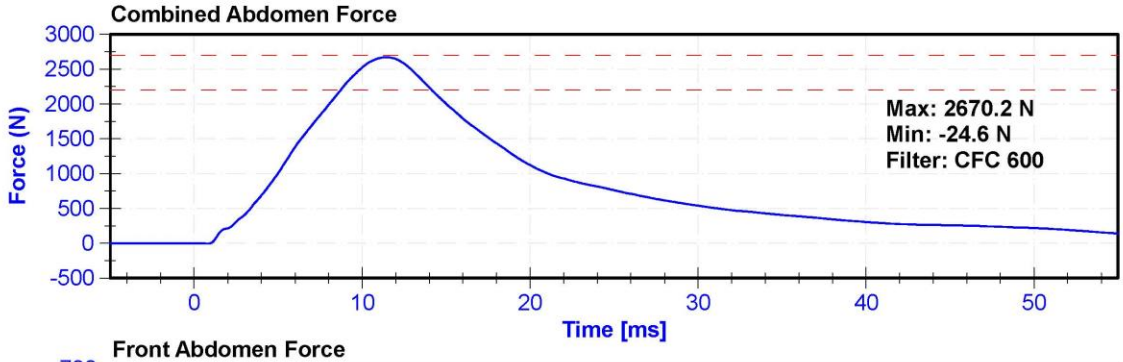
Results

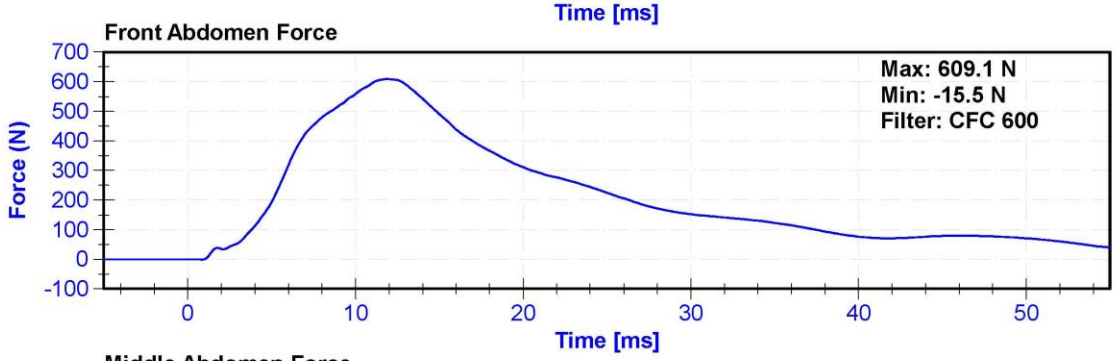
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21	Pass
Humidity	10	70	%	32.2	Pass
Velocity	3.9	4.1	m/s	4.10	Pass
Combined Abdomen Force	2200	2700	N	2670.2	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.40	Pass
Resistive Probe Force	4000	4800	N	4444.2	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.85	Pass

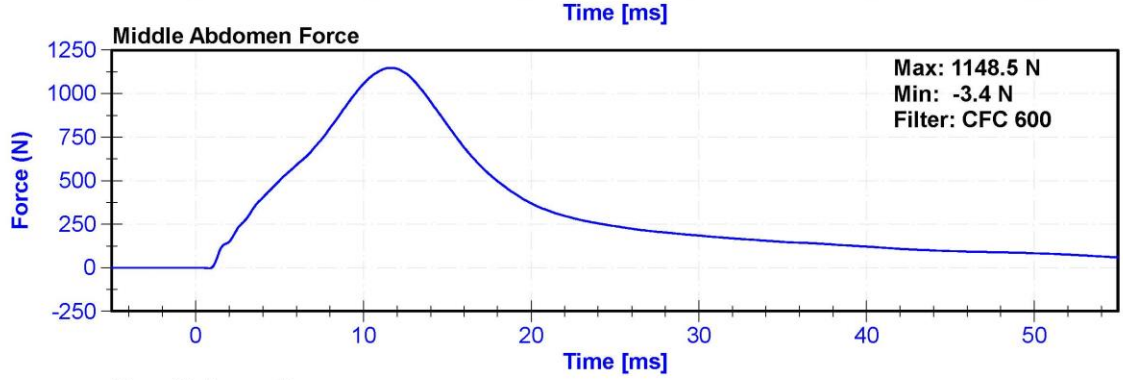
Transducer Calibrations

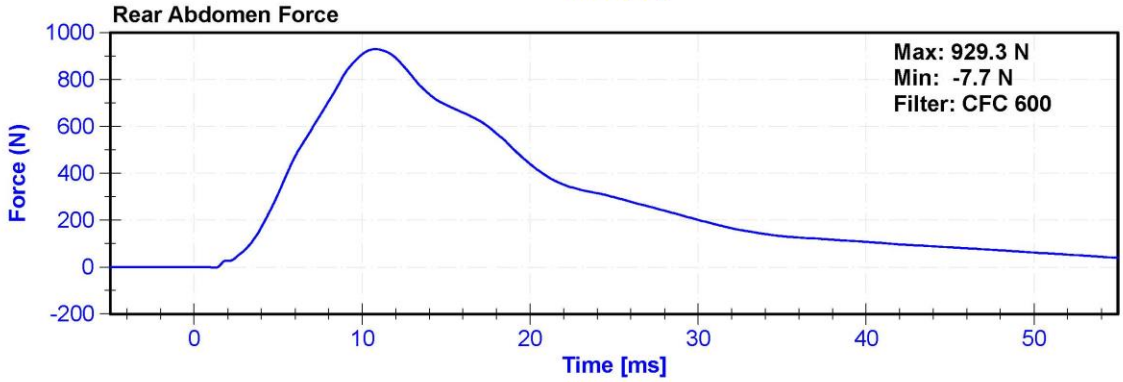
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Front Abdomen Load Cell	DENTON 2631	LC-1440	6/4/2018	6/4/2019
Middle Abdomen Load Cell	DENTON 2631	LC-1525	6/4/2018	6/4/2019
Rear Abdomen Load Cell	DENTON 2631	LC-1528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




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2670.2 N
Min: -24.6 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 609.1 N
Min: -15.5 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1148.5 N
Min: -3.4 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 929.3 N
Min: -7.7 N
Filter: CFC 600

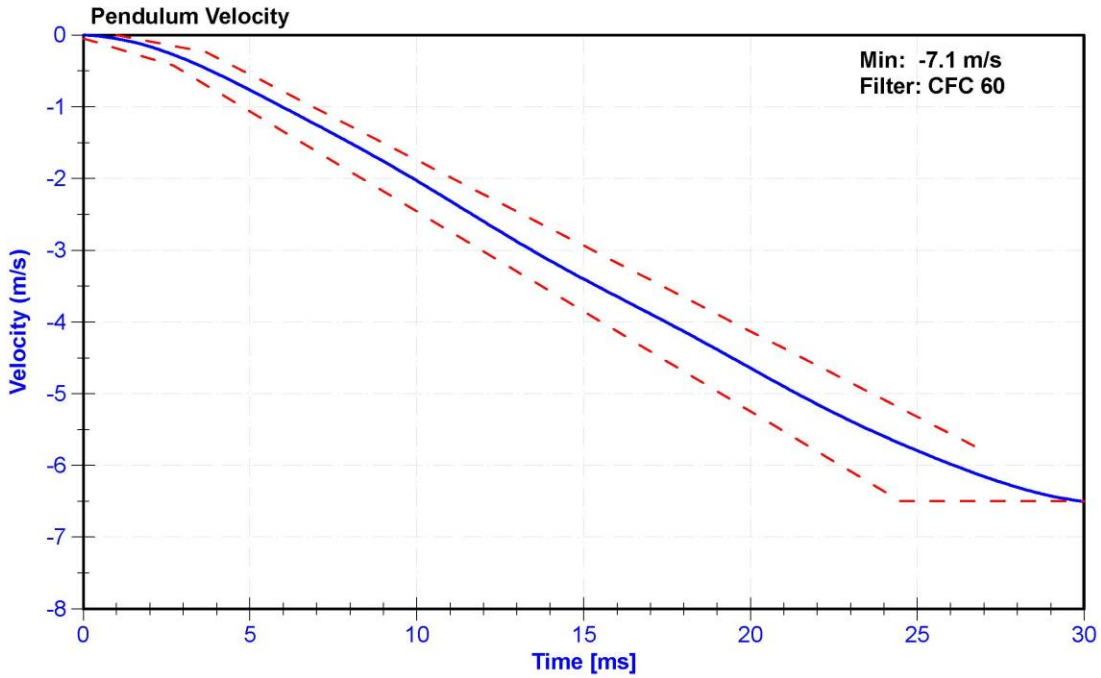
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

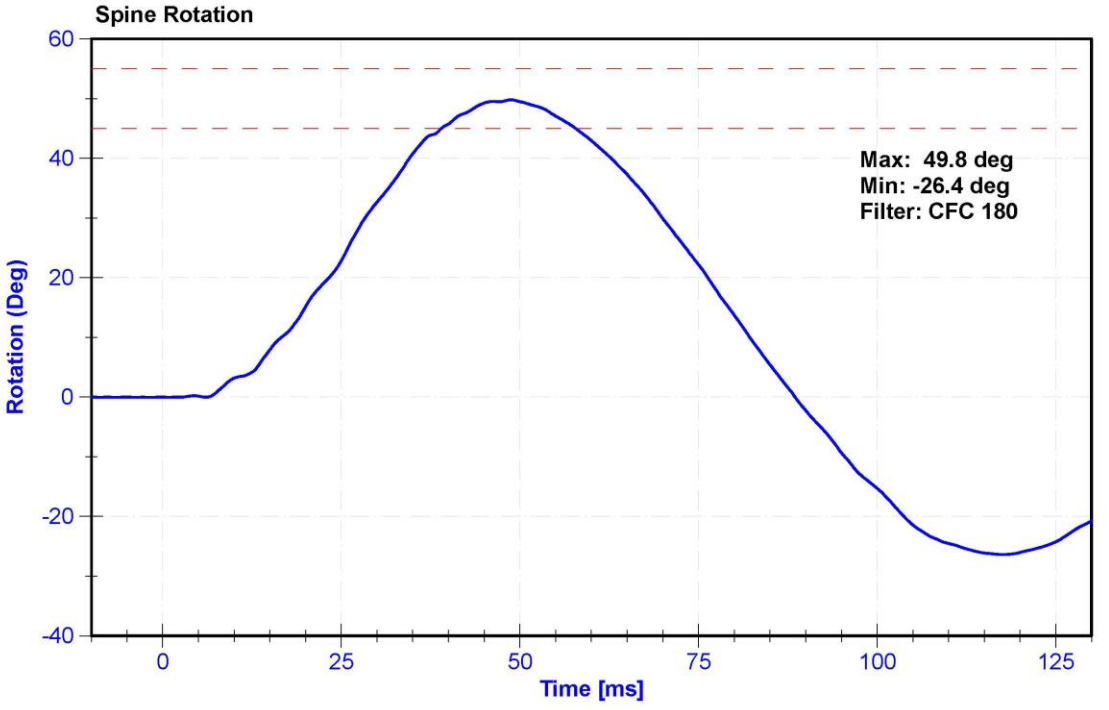
Results

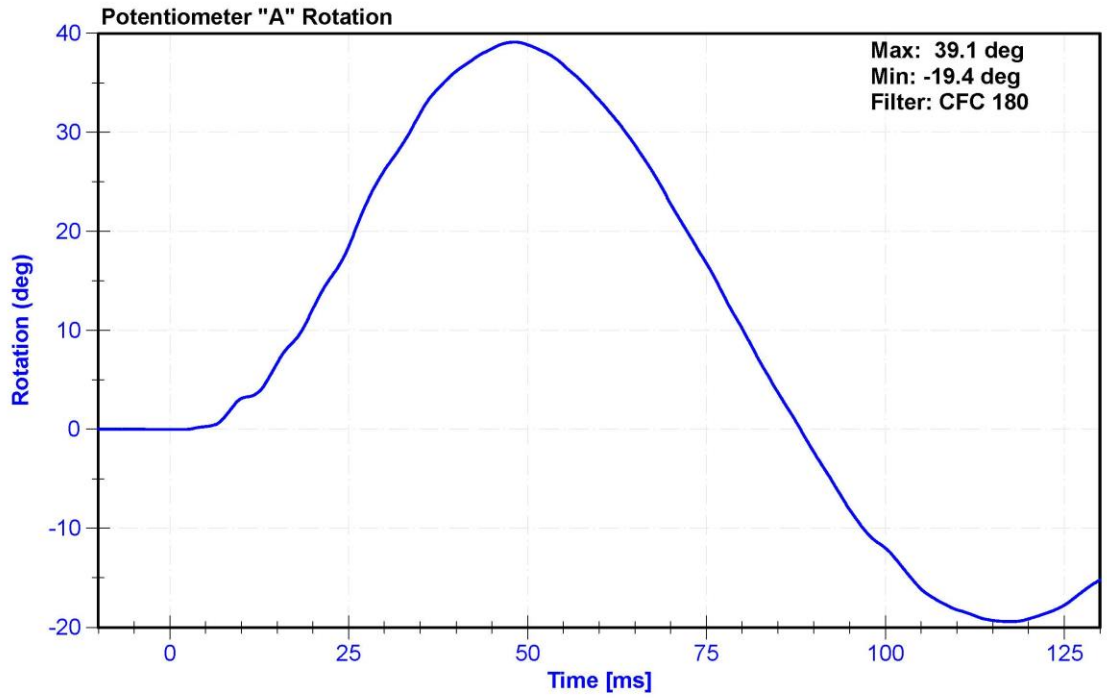
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	31.1	Pass
Velocity	5.95	6.15	m/s	6.005	Pass
Lateral Spine Rotation	45	55	deg	49.8	Pass
Time at Maximum Rotation	39	53	ms	48.7	Pass
Time of Decay to Zero Degrees	37	57	ms	39.8	Pass
Pulse within Corridor?	-	-	-		

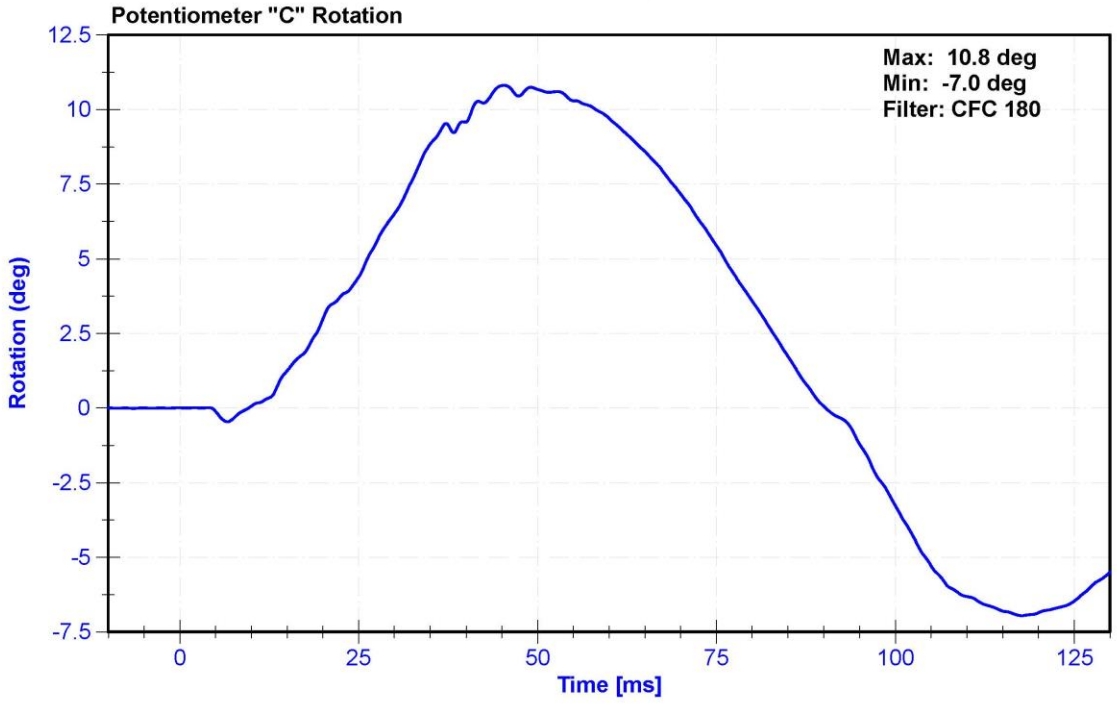
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
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: -7.1 m/s
Filter: CFC 60
Velocity (m/s)
0
-1
-2
-3
-4
-5
-6
-7
-8
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 49.8 deg
Min: -26.4 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 39.1 deg
Min: -19.4 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: 10.8 deg
Min: -7.0 deg
Filter: CFC 180
Rotation (deg)
12.5
10
7.5
5
2.5
0
-2.5
-5
-7.5
0
25
50
75
100
125
Time [ms]

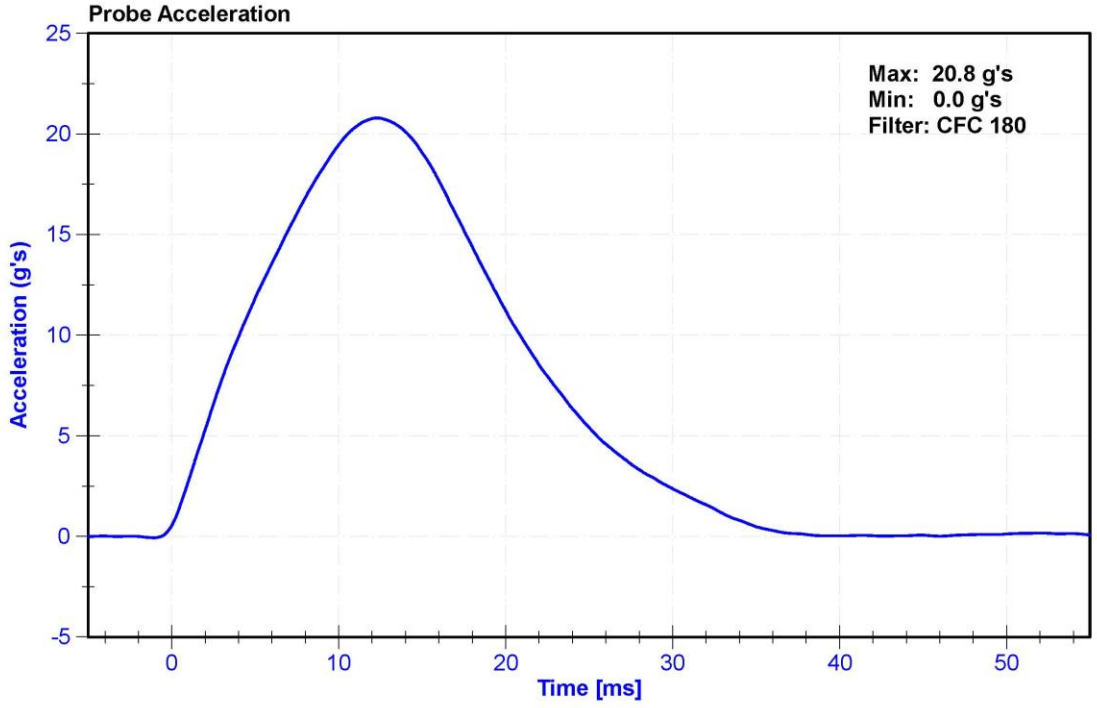
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

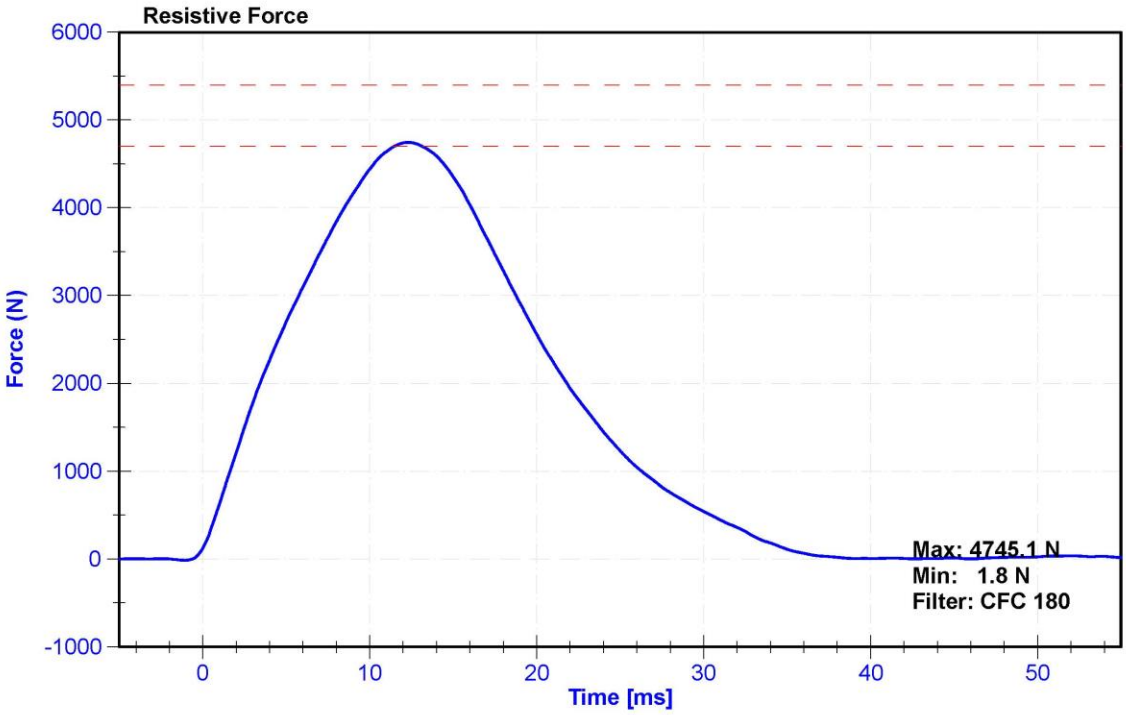
Results

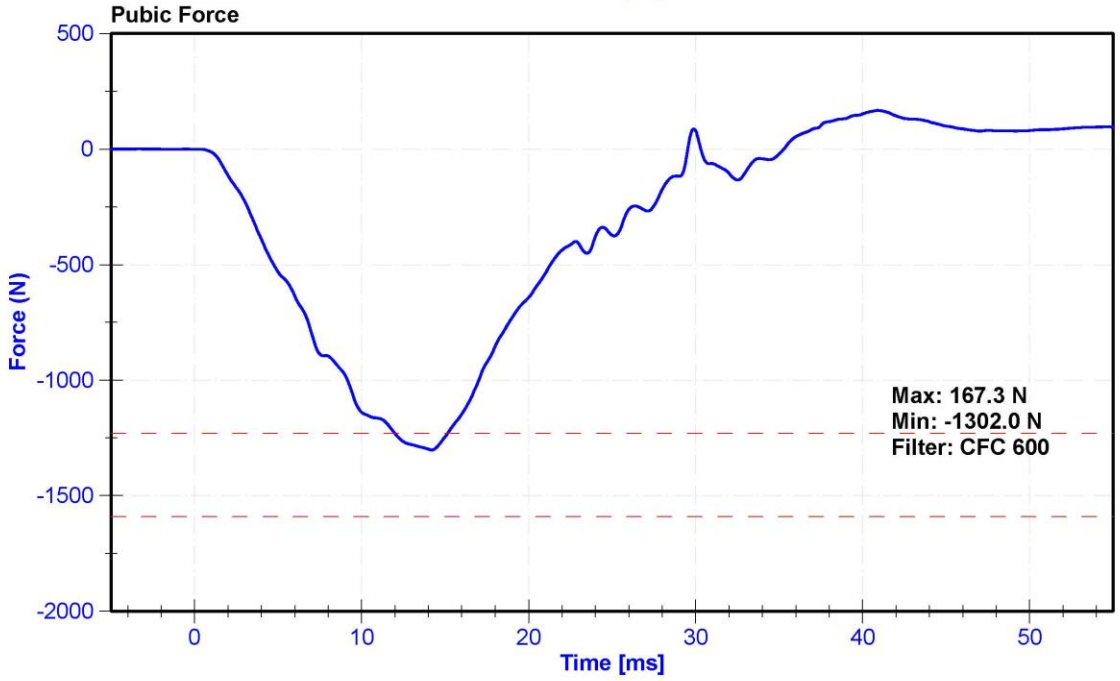
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	30.6	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Resistive Force	4700	5400	N	4745.1	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.30	Pass
Pubic Force	-1590	-1230	N	-1302.0	Pass
Time at Peak Pubic Force	12.2	17.0	ms	14.20	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: 4745.1 N
Min: 1.8 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 167.3 N
Min: -1302.0 N
Filter: CFC 600

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

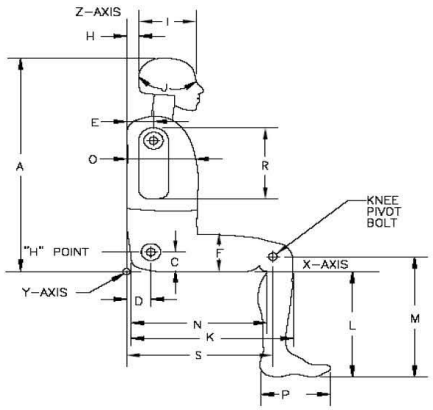
SERIAL No: DG8012

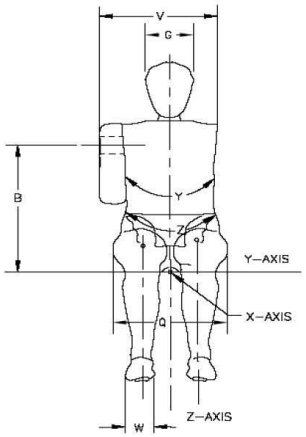
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: K. Dutton Date: 03/21/2019

Dummy Serial Number: DG8012





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	779	Pass
B	Shoulder Pivot Height	437	453	446	Pass
C	H-point Height	79	89	85	Pass
D	H-point from seatback	141	151	147	Pass
E	Shoulder Pivot from Backline	97	107	103	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	183	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	206	Pass
P	Foot Length	216	232	223	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	319	Pass
R	Arm Length	249	259	253	Pass
S	Knee Joint to seatback	477	493	486	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	781	Pass

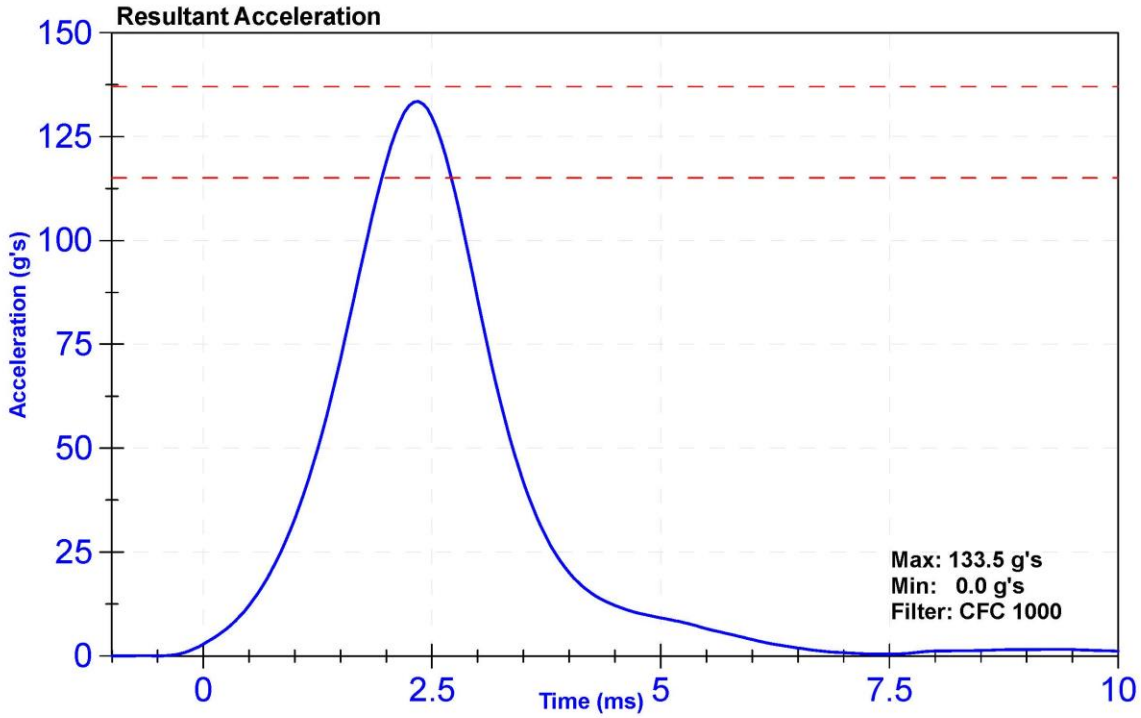
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

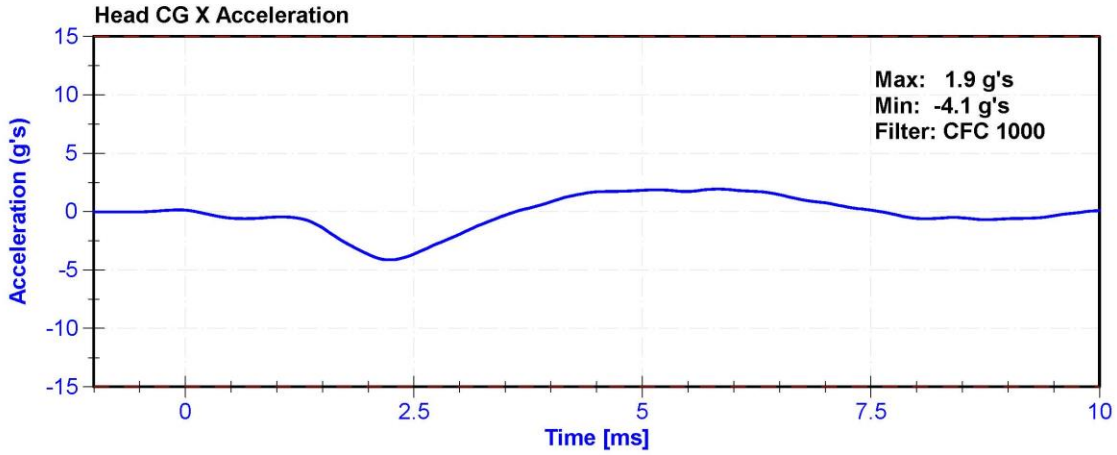
Results

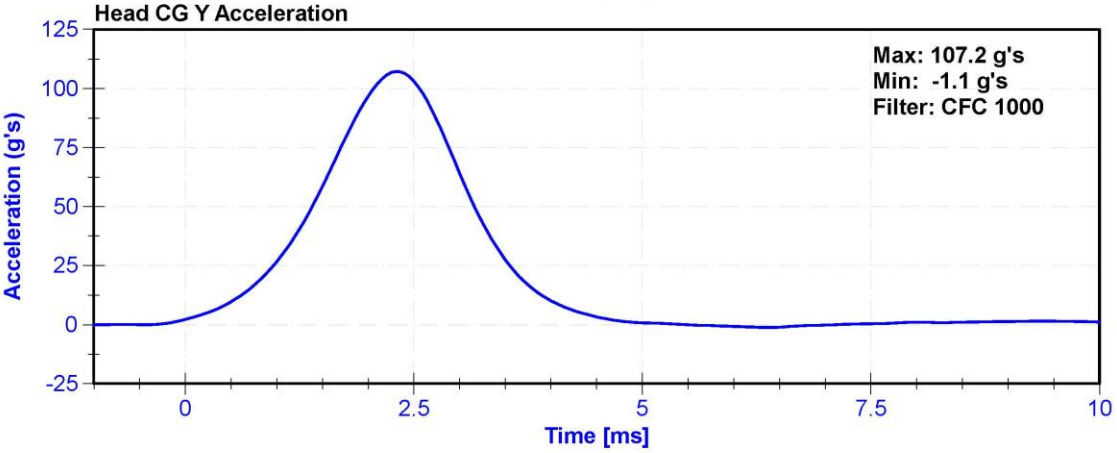
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	30.6	Pass
Resultant Acceleration	115	137	g's	133.5	Pass
Oscillation	0	15	%	2.2	Pass
Fore-Aft Acceleration	-15	15	g's	-4.1	Pass

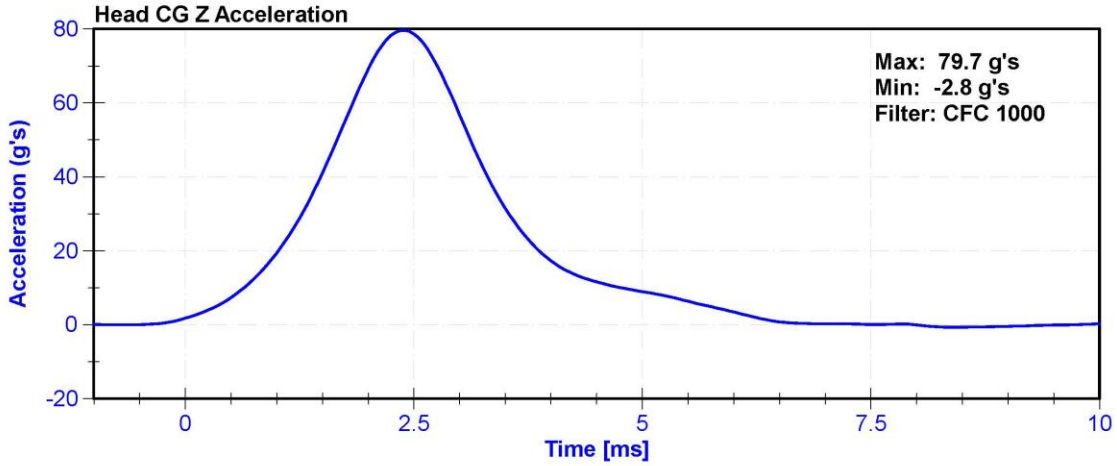
Transducer Calibrations

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: 1.9 g's
Min: -4.1 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: 107.2 g's
Min: -1.1 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: 79.7 g's
Min: -2.8 g's
Filter: CFC 1000
Acceleration (g's)
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]

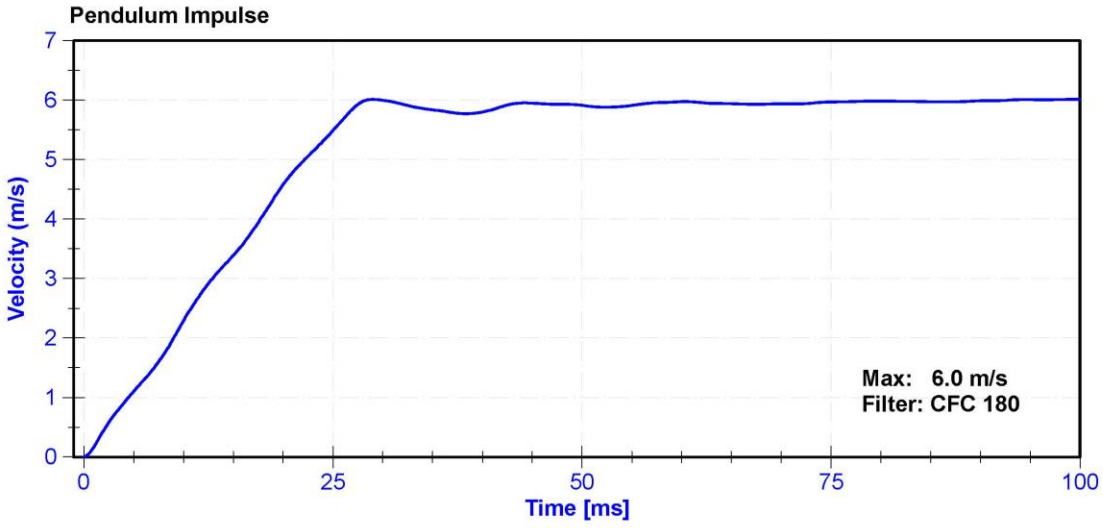
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

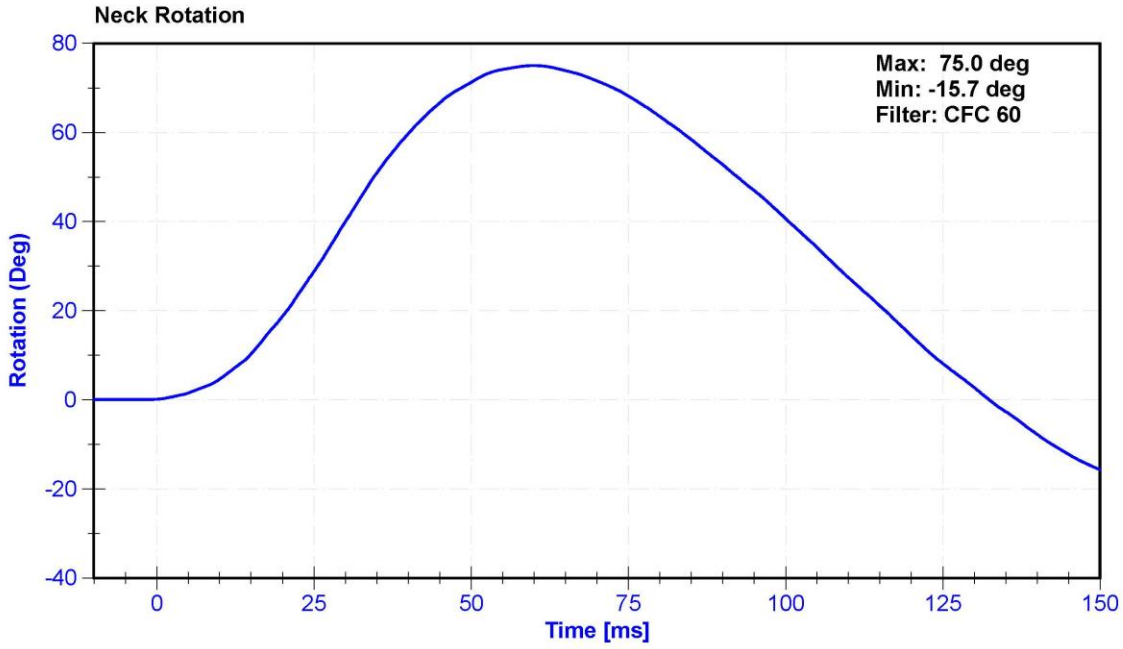
Results

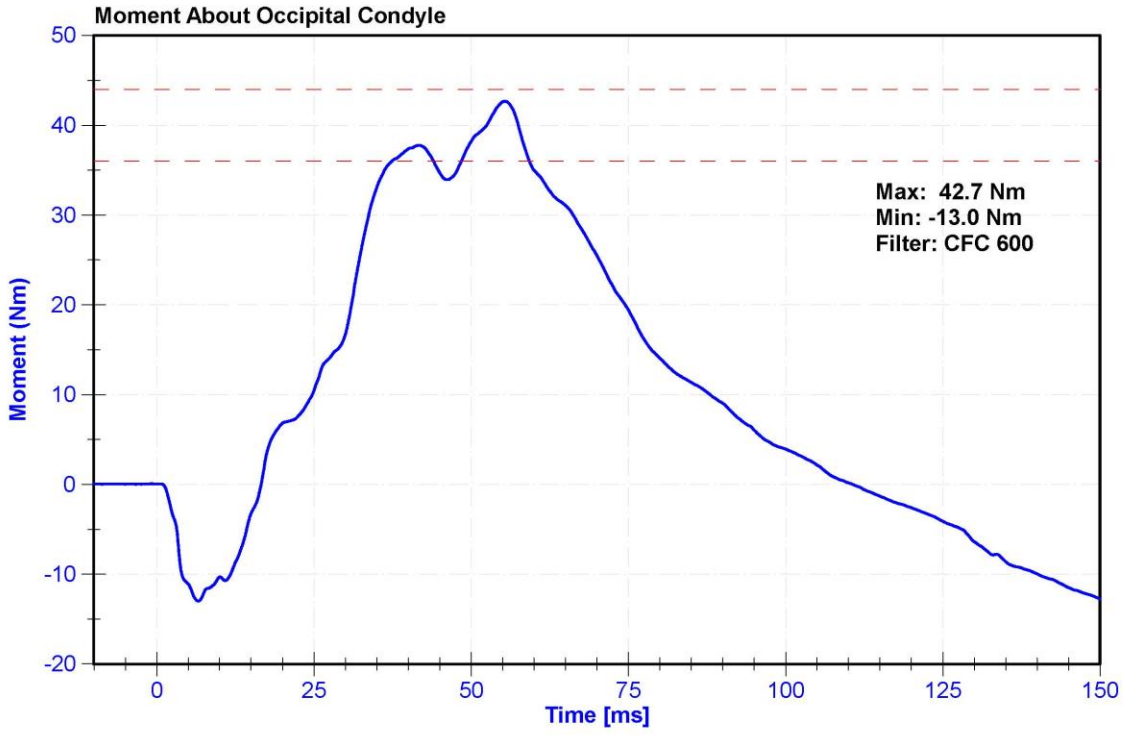
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	30.3	Pass
Velocity	5.51	5.63	m/s	5.514	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.29	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.39	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.58	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.48	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	6.01	Pass
Neck Rotation	71	81	deg	75.0	Pass
Time at Maximum Rotation	50	70	ms	59.9	Pass
Moment about the OC	36	44	Nm	42.7	Pass
Moment Decay to 0 Nm	102	126	ms	110.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
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: 75.0 deg
Min: -15.7 deg
Filter: CFC 60
Rotation (Deg)
80
60
40
20
0
-20
-40
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 42.7 Nm
Min: -13.0 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

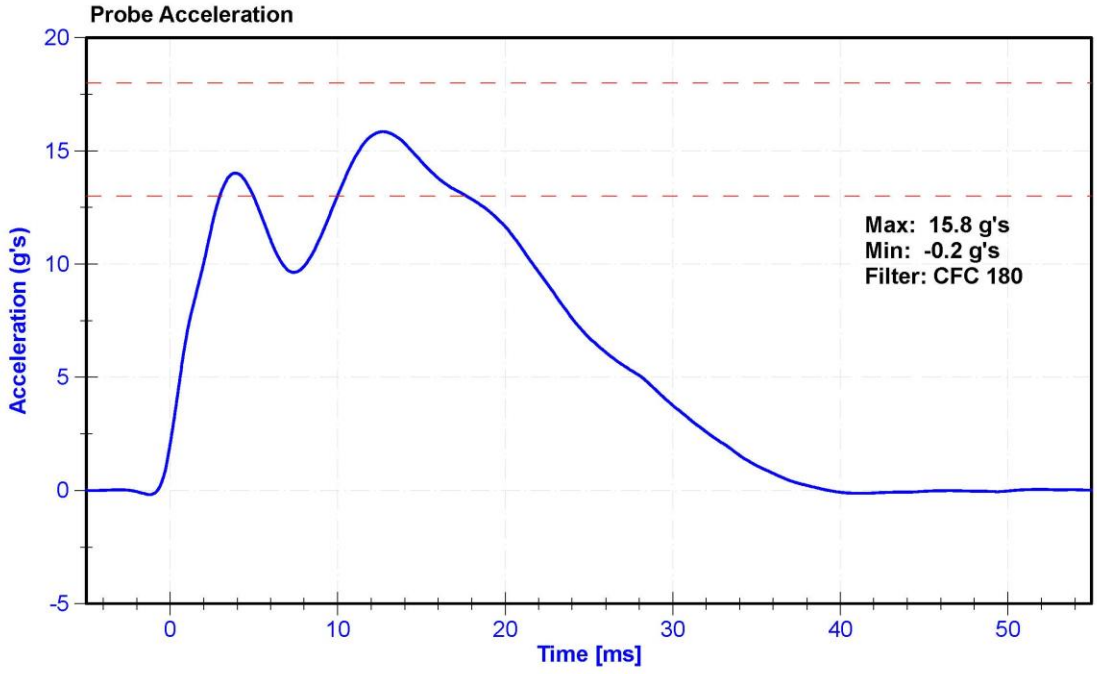
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

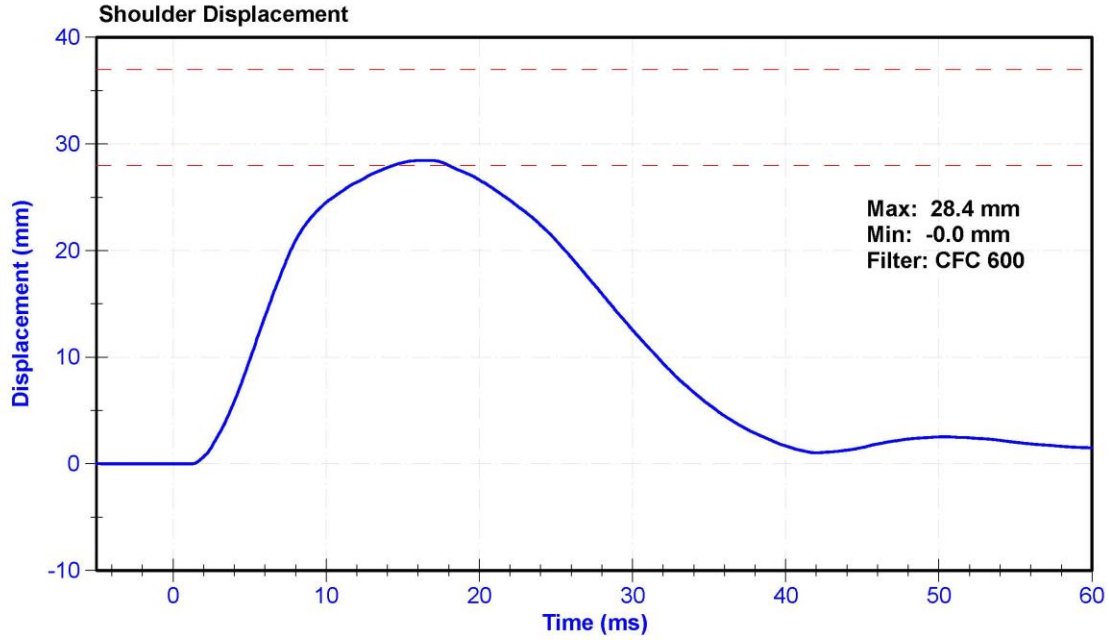
Results

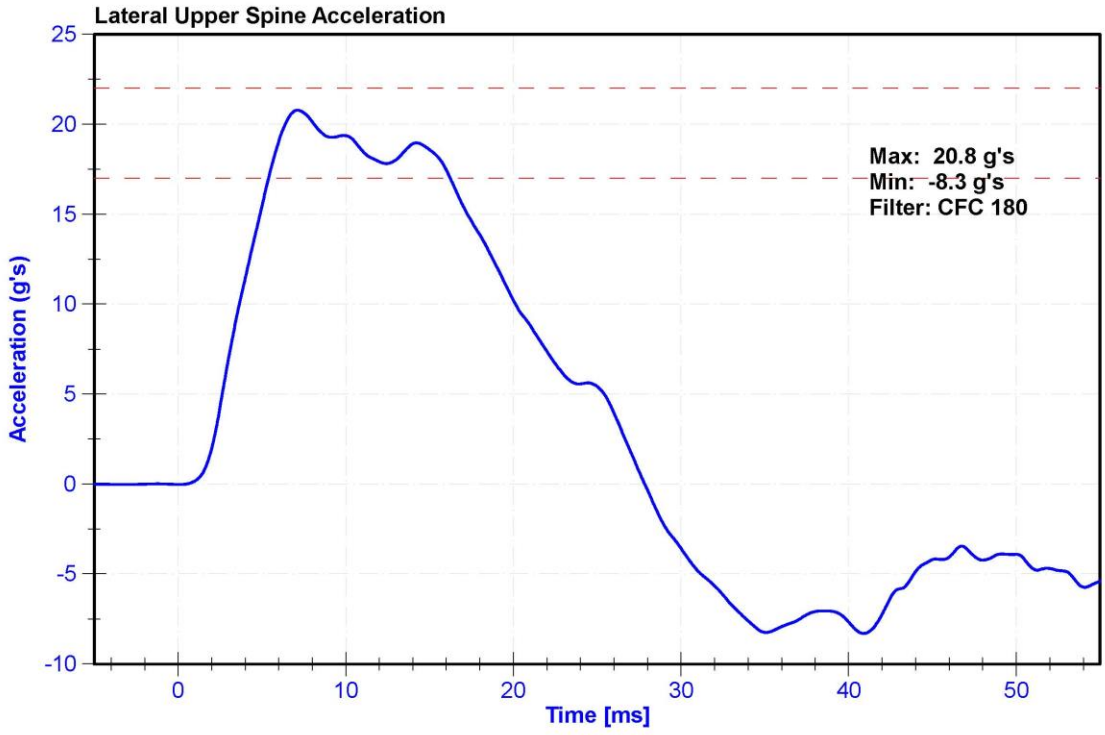
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	30.3	Pass
Velocity	4.2	4.4	m/s	4.36	Pass
Probe Acceleration	13	18	g's	15.8	Pass
Shoulder Deflection	28	37	mm	28.4	Pass
Lateral Upper Spine Acceleration	17	22	g's	20.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	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: 28.4 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 20.8 g's
Min: -8.3 g's
Filter: CFC 180

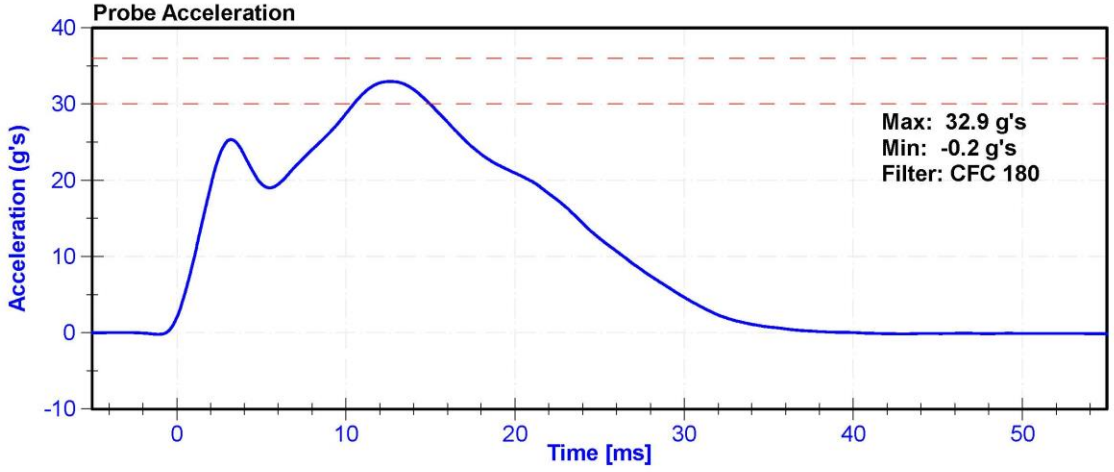
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

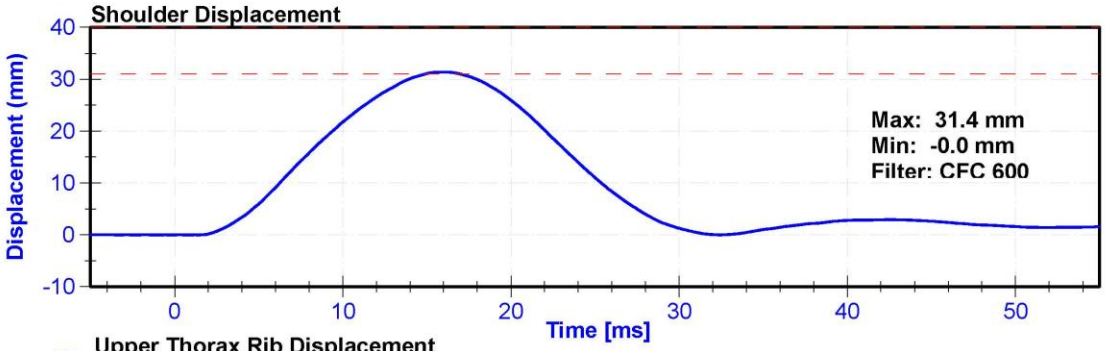
Results

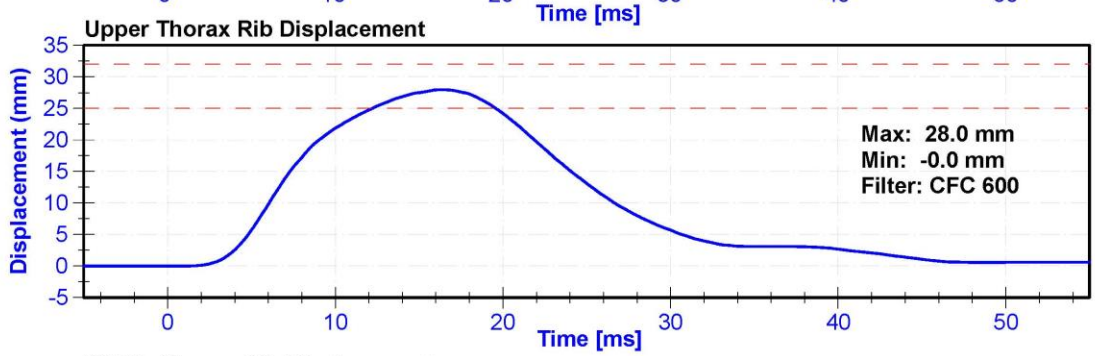
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	30.4	Pass
Velocity	6.6	6.8	m/s	6.67	Pass
Probe Acceleration after 5 ms	30	36	g's	32.9	Pass
Lateral Upper Spine Acceleration	34	43	g's	38.2	Pass
Lateral Lower Spine Acceleration	29	37	g's	32.1	Pass
Shoulder Deflection	31	40	mm	31.4	Pass
Upper Thorax Rib Deflection	25	32	mm	28.0	Pass
Mid Thorax Rib Deflection	30	36	mm	33.0	Pass
Lower Thorax Rib Deflection	32	38	mm	34.8	Pass

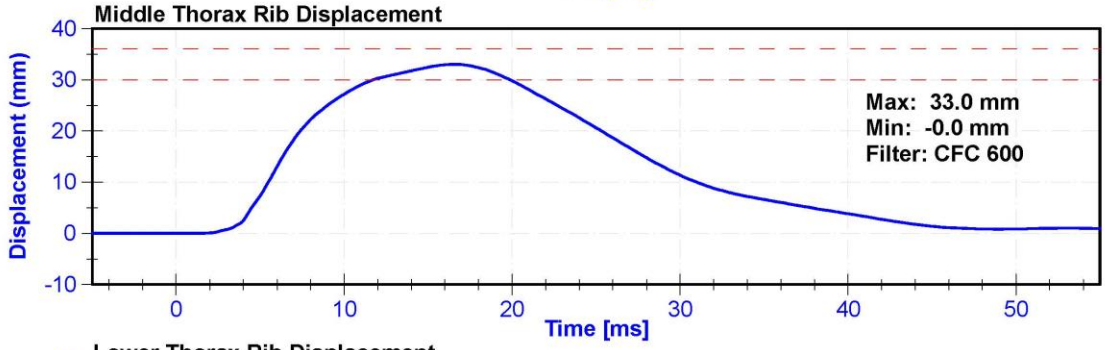
Transducer Calibrations

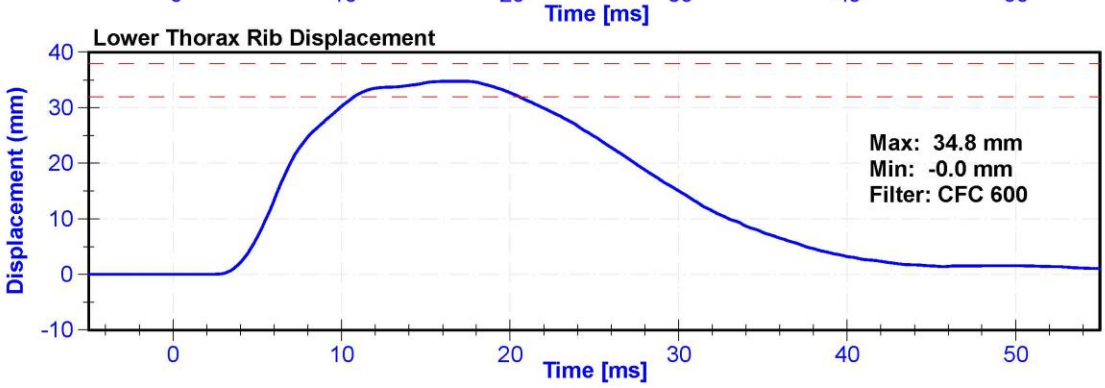
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/23/2018	4/23/2019
Upper Spine T12 Y Accelerometer	ENDEVCO 7264CT	AC-P51699	10/16/2018	4/16/2019
Shoulder 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

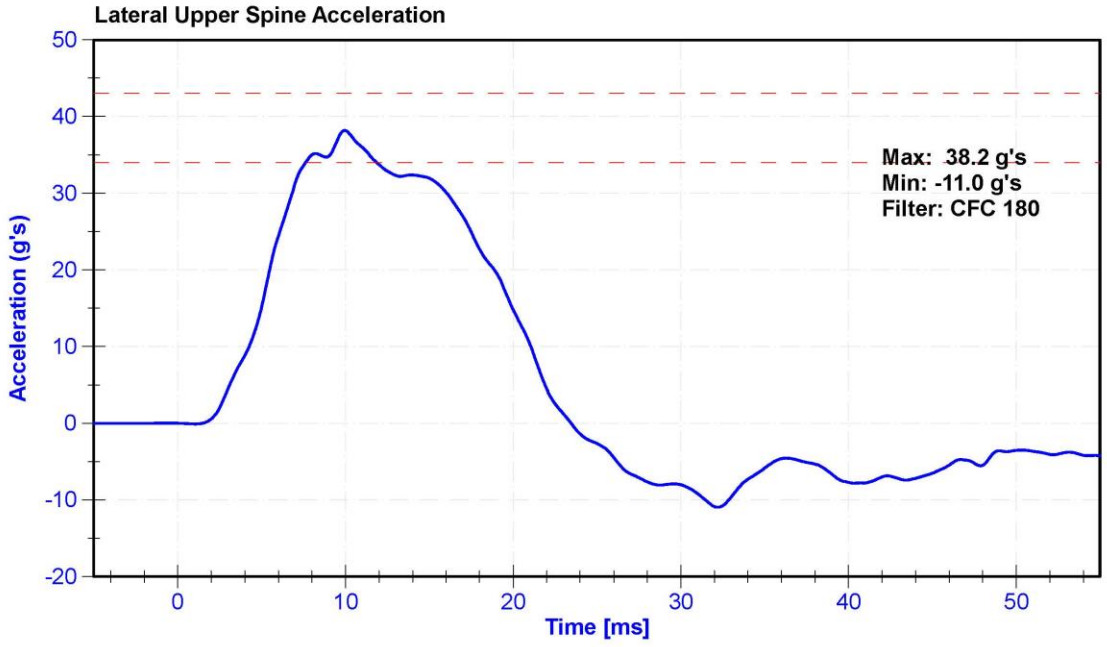


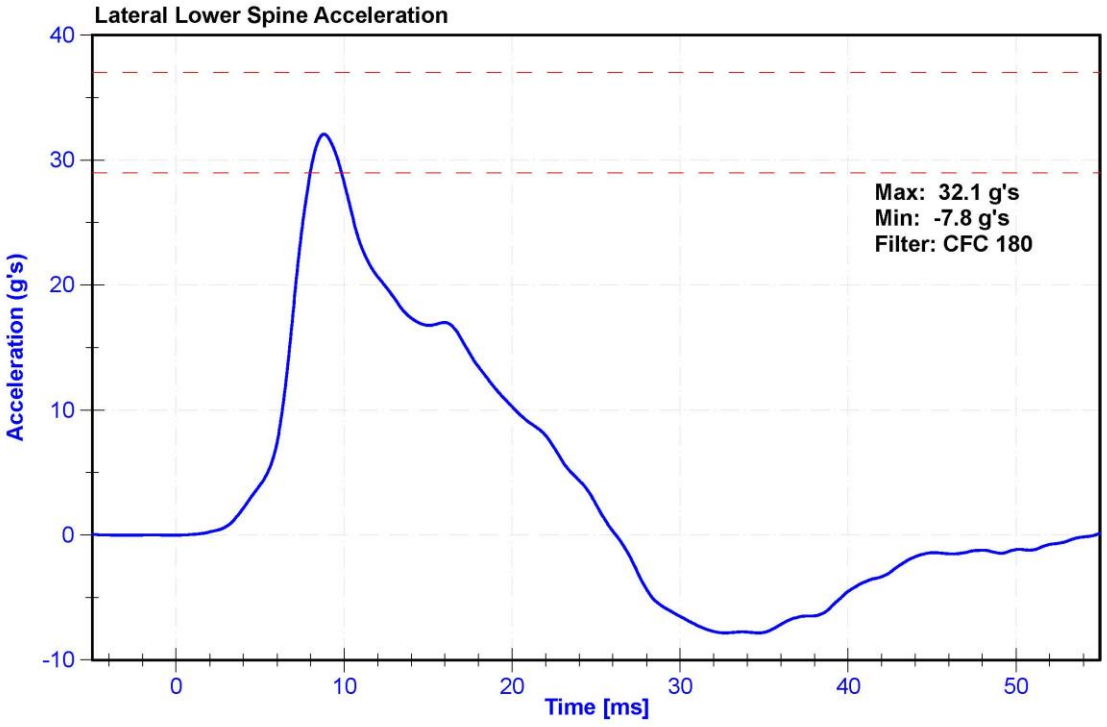

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 31.4 mm
Min: -0.0 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 28.0 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: 34.8 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 38.2 g's
Min: -11.0 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: 32.1 g's
Min: -7.8 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50

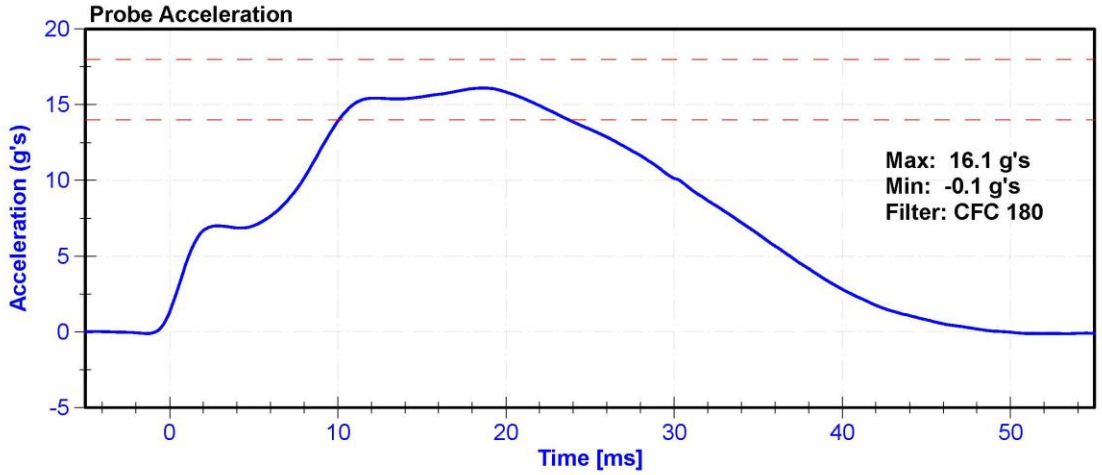
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

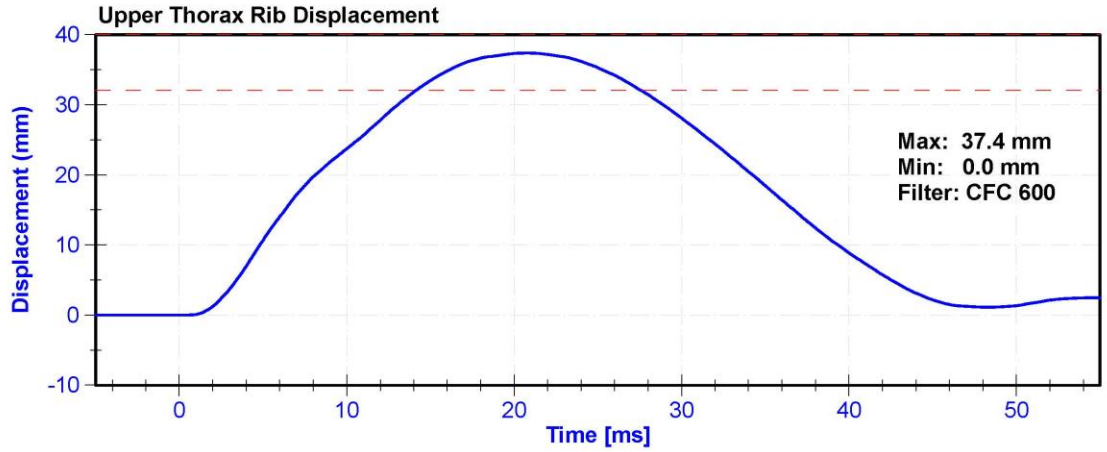
Results

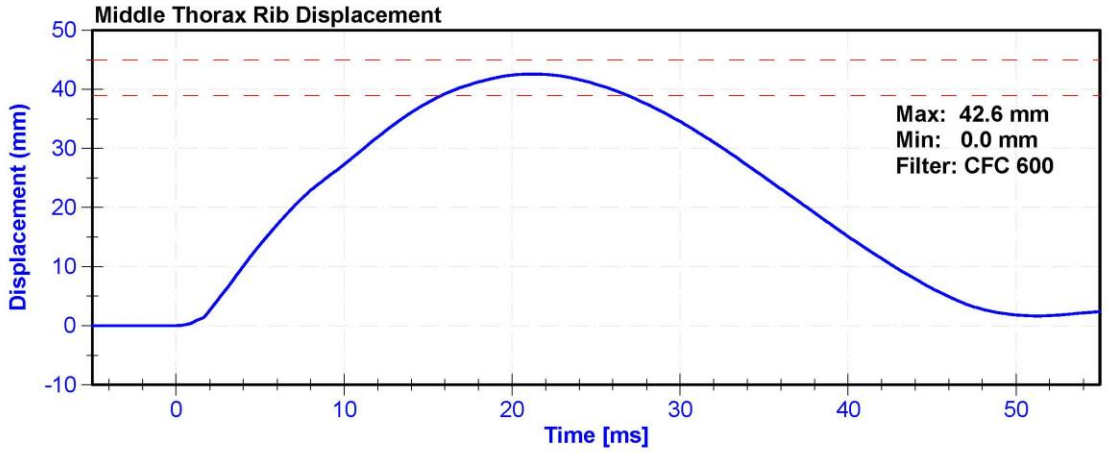
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	30.6	Pass
Velocity	4.2	4.4	m/s	4.35	Pass
Probe Acceleration	14	18	g's	16.1	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.6	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.6	Pass
Upper Thorax Rib Deflection	32	40	mm	37.4	Pass
Middle Thorax Rib Deflection	39	45	mm	42.6	Pass
Lower Thorax Rib Deflection	35	43	mm	39.1	Pass

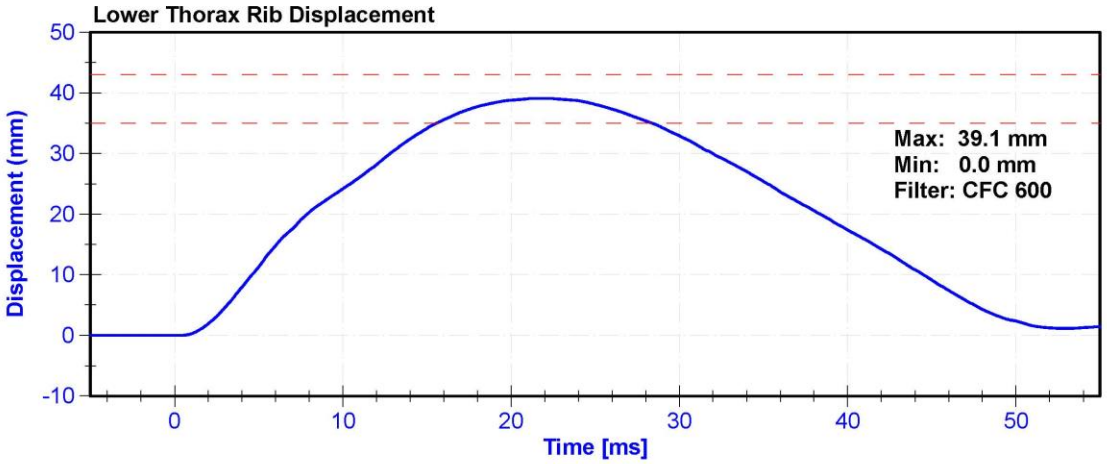
Transducer Calibrations

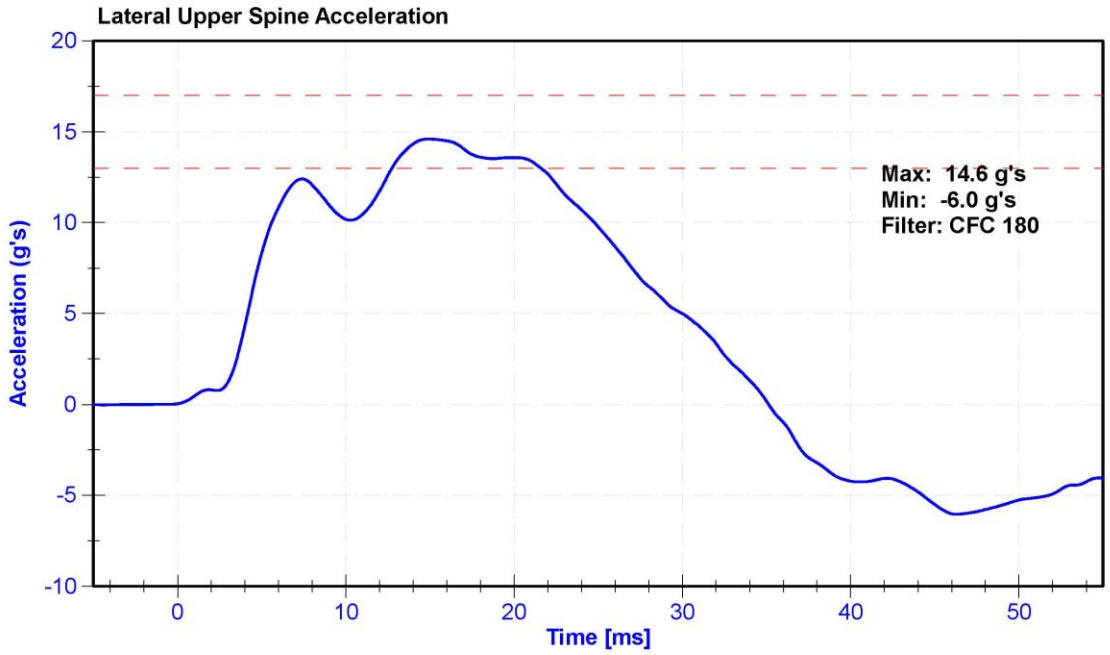
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/23/2018	4/23/2019
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51699	10/16/2018	4/16/2019
Upper Thorax 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

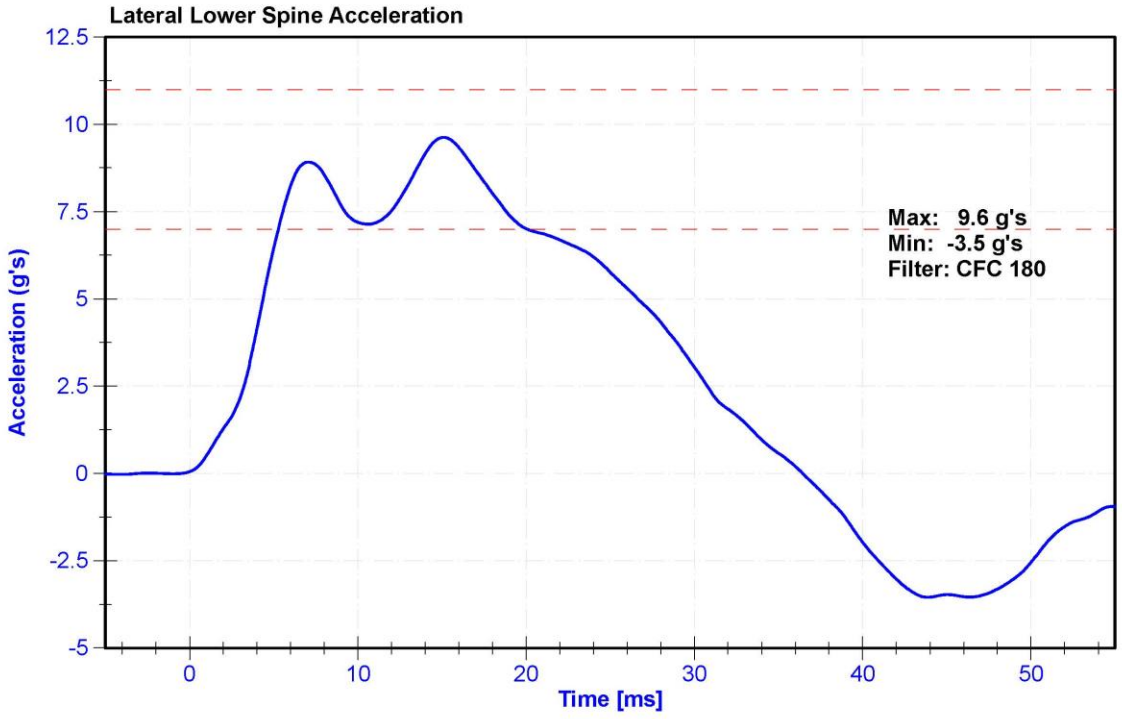



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.4 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 42.6 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 39.1 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 14.6 g's
Min: -6.0 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
20
15
10
5
0
-5
-10
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 9.6 g's
Min: -3.5 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

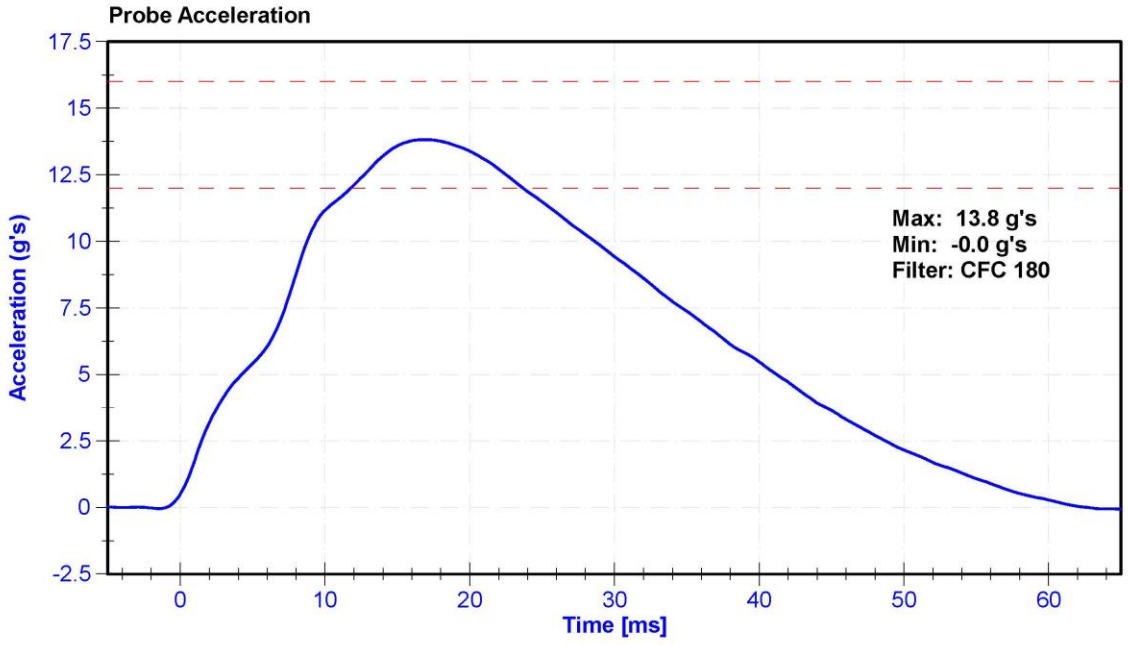
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

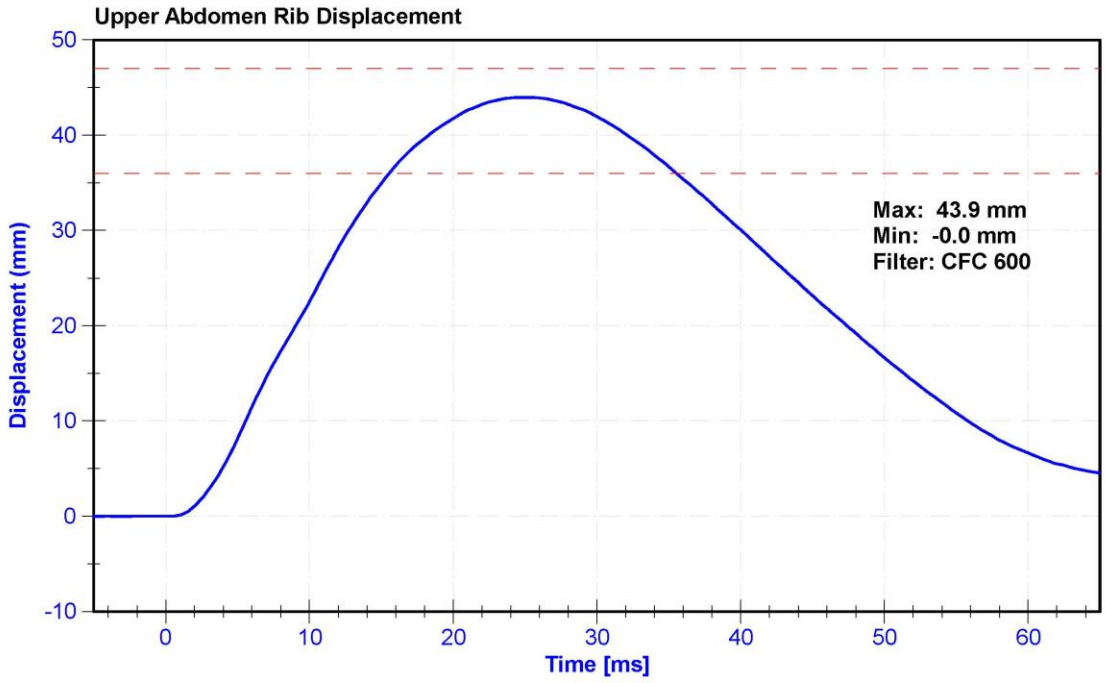
Results

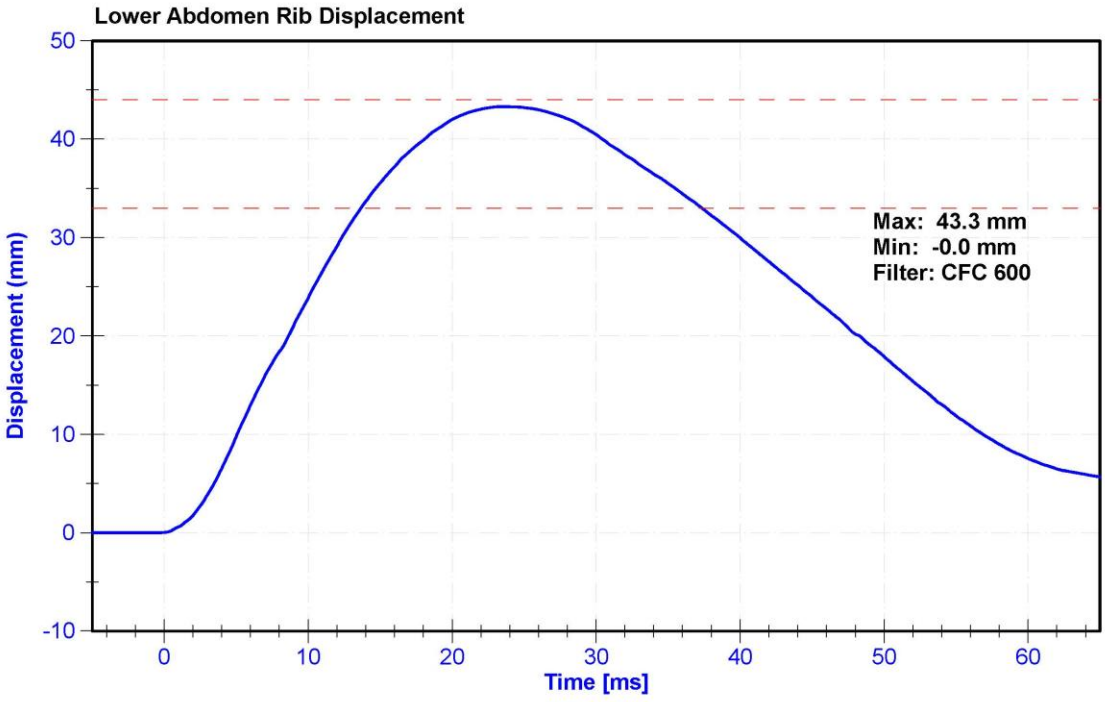
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	31.7	Pass
Velocity	4.2	4.4	m/s	4.35	Pass
Probe Acceleration	12	16	g's	13.8	Pass
Lateral Lower Spine Acceleration	9	14	g's	9.7	Pass
Upper Abdomen Rib Deflection	36	47	mm	43.9	Pass
Lower Abdomen Rib Deflection	33	44	mm	43.3	Pass

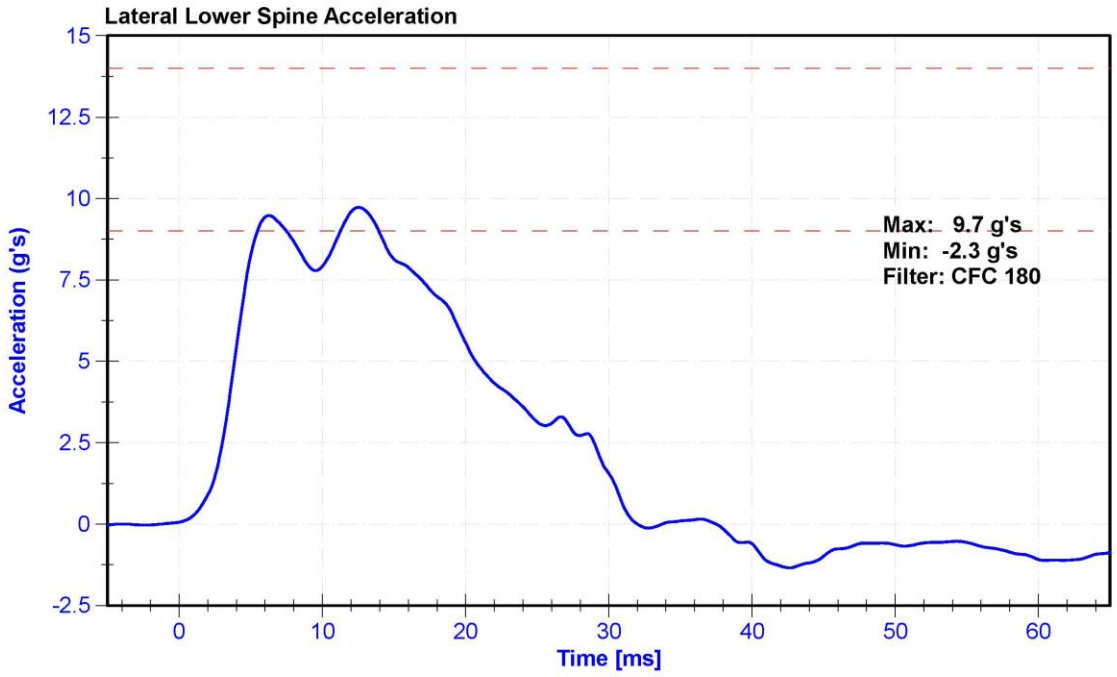
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco 7264C	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: 43.9 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 43.3 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: -2.3 g's
Filter: CFC 180

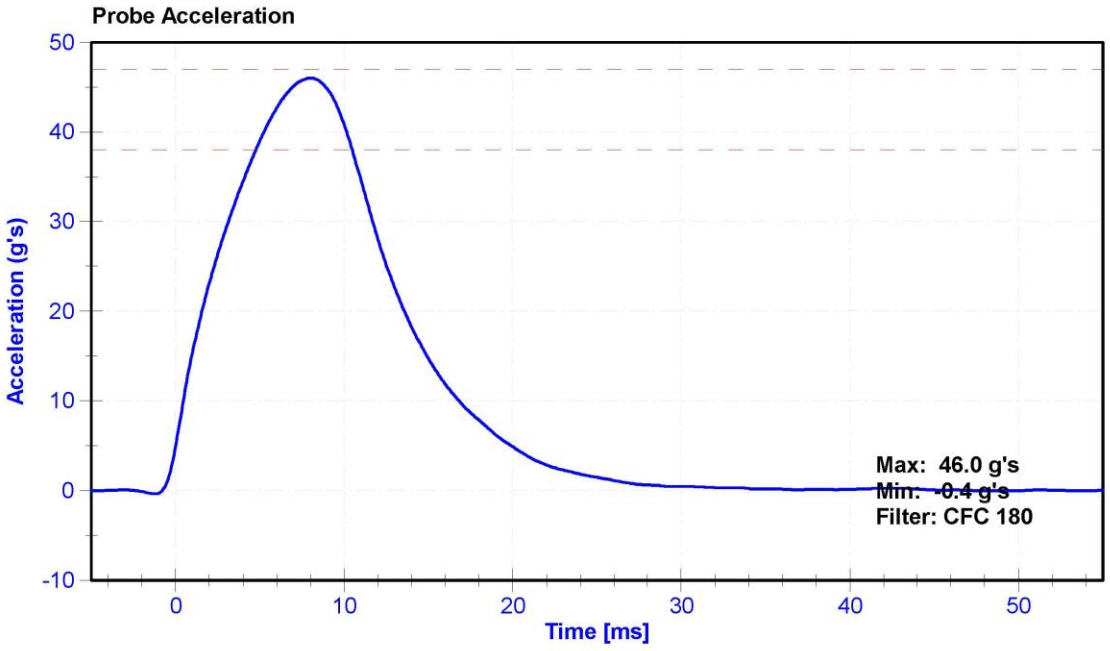
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

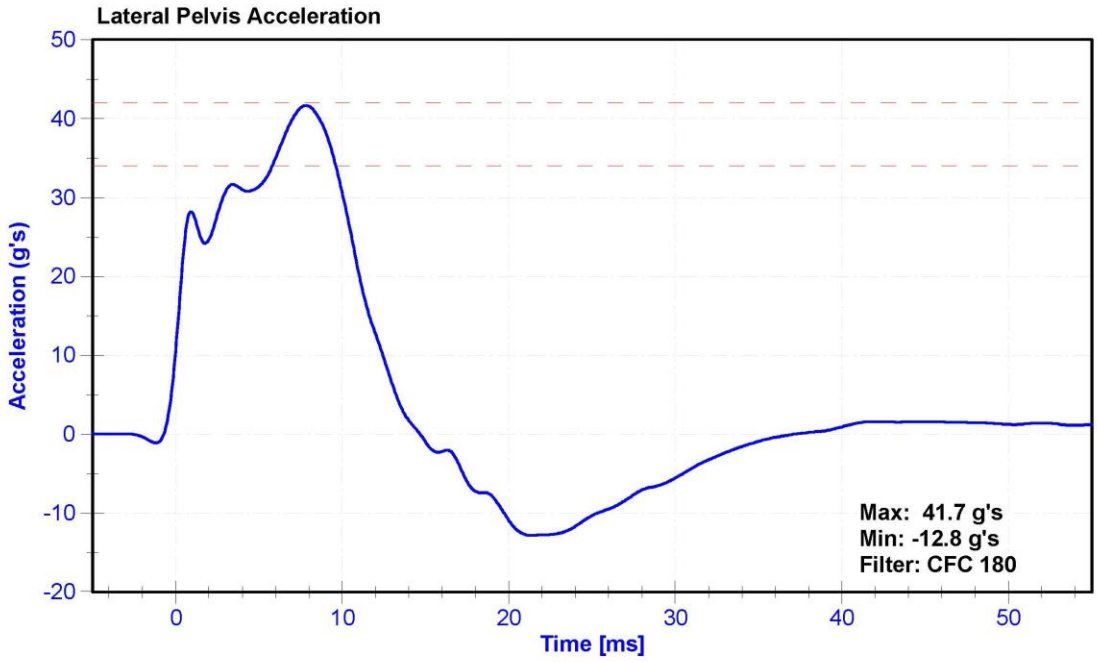
Results

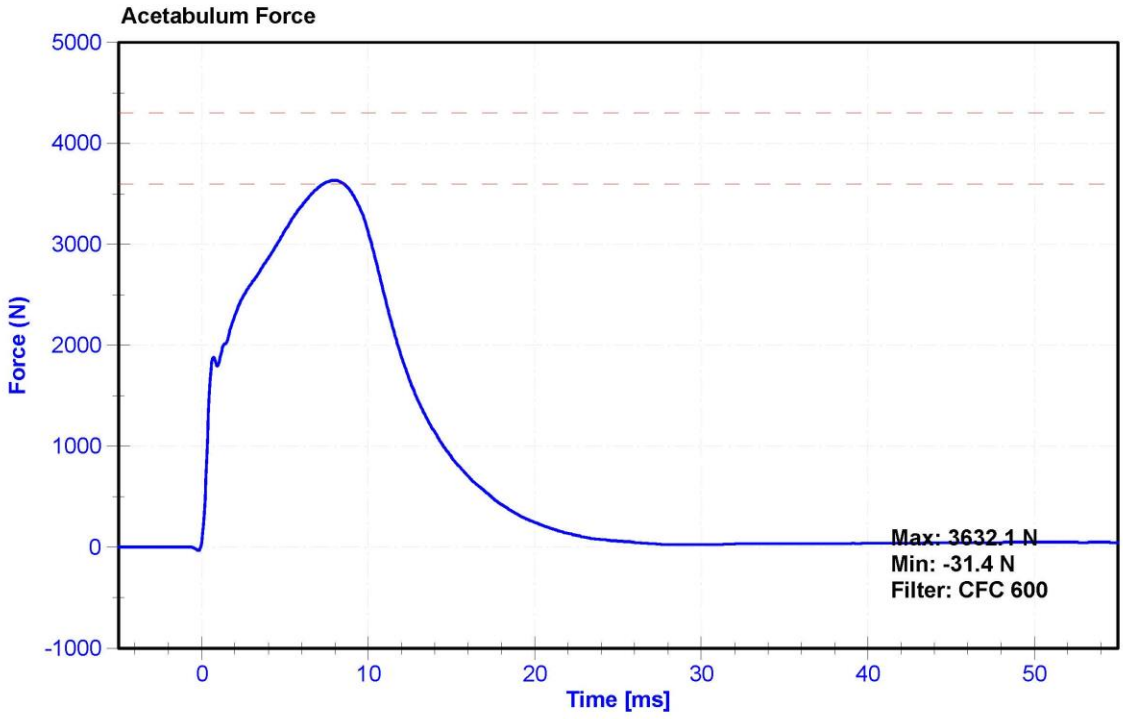
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	31	Pass
Velocity	6.6	6.8	m/s	6.67	Pass
Probe Acceleration	38	47	g's	46.0	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.7	Pass
Acetabulum Force	3600	4300	N	3632.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	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	12326	3/21/2018	N/A
Crash Test Plug	Humanetics	12278	3/15/2018	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: 41.7 g's
Min: -12.8 g's
Filter: CFC 180


Acetabulum Force
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 3632.1 N
Min: -31.4 N
Filter: CFC 600

Cert 2 DC 680 12 3/22/19

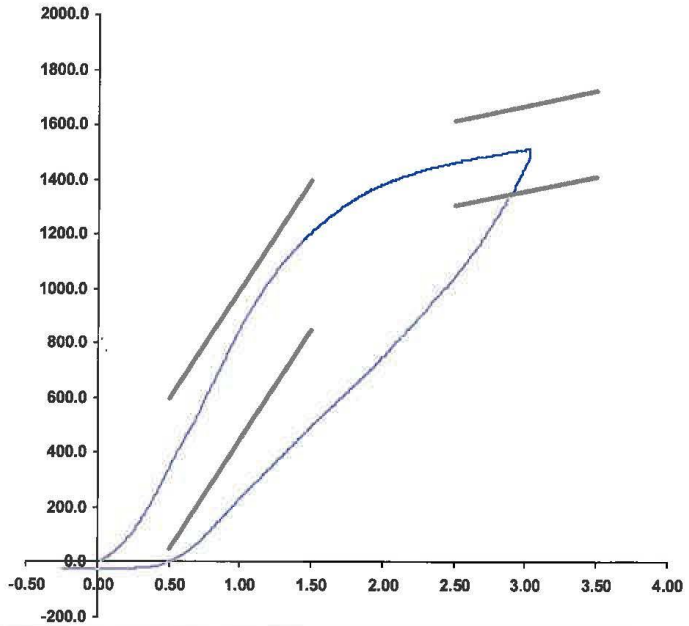
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12326
Test Number 6711
Report Number 6726
Test Date 3/21/2018 12:55:16 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	343.63	50.00	600.00
Force @ 1.5 mm (N)	1,210.63	850.00	1,400.00
Force @ 2.5 mm (N)	1,465.51	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,512.91	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



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

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 22-Mar-18
SACO Research

By : DC Date : 3/21/18

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

DG8012 3/21/2019 Crash

SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12278
Test Number 6663
Report Number 6678
Test Date 3/15/2018 11:18:27 AM

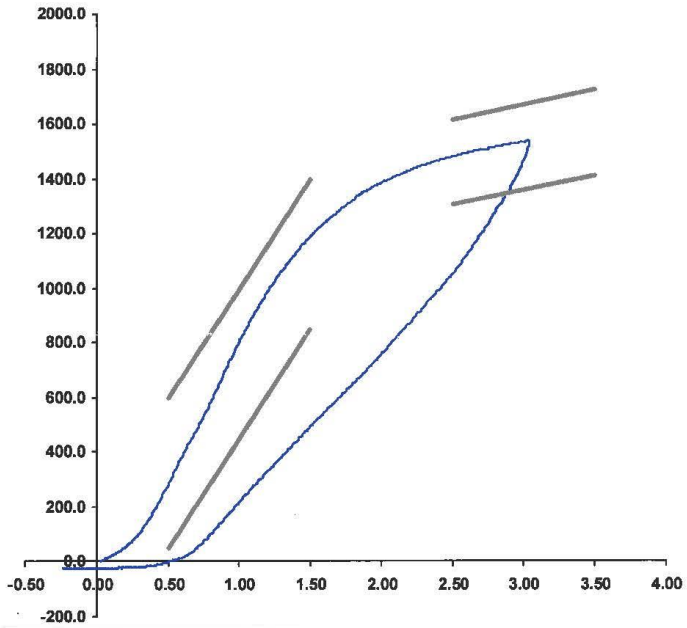
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	288.37	50.00	600.00
Force @ 1.5 mm (N)	1,192.13	850.00	1,400.00
Force @ 2.5 mm (N)	1,483.41	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,538.88	1,361.00	1,673.00

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:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 15-Mar-18
SACO Research

By : DC Date : 3/15/18

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

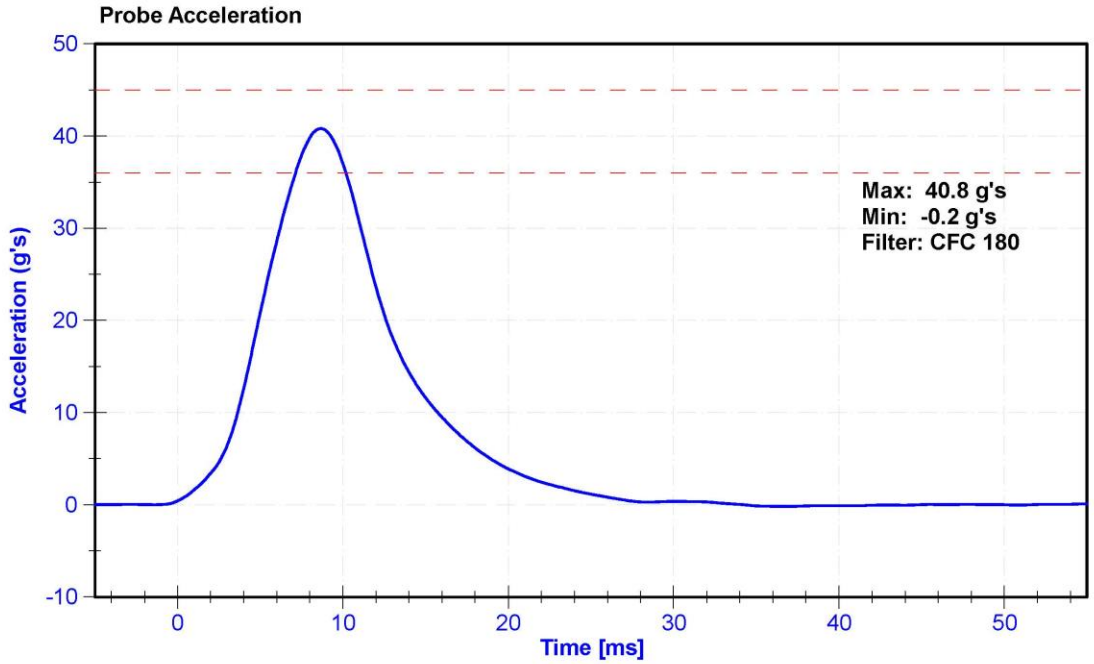
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K.Brogan

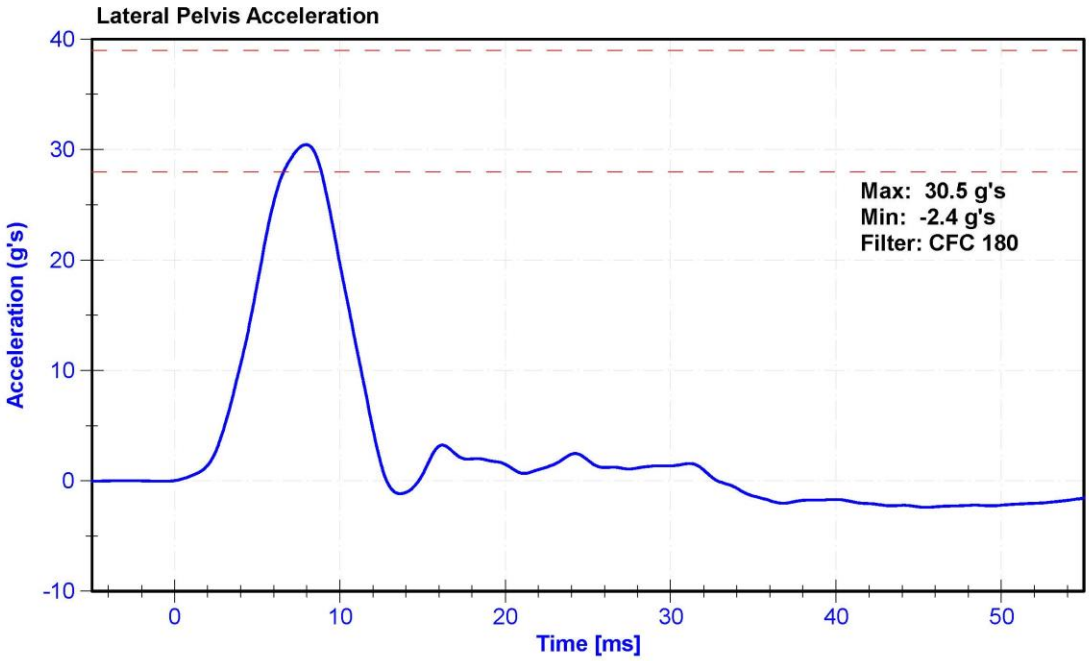
Results

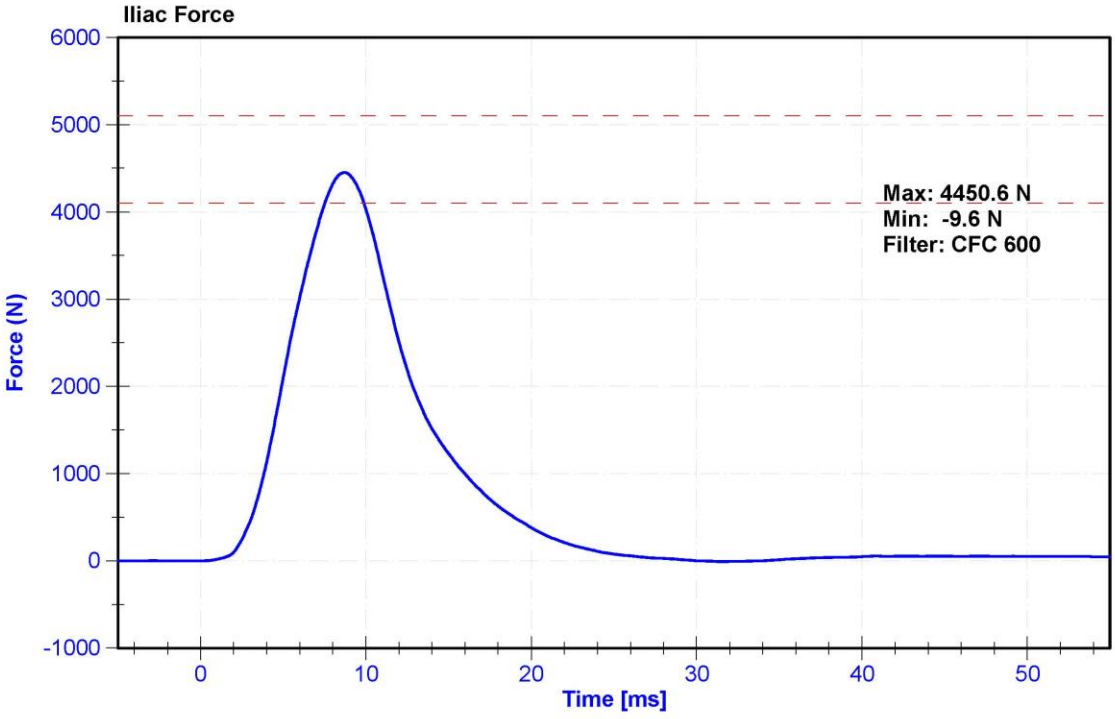
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	30.3	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Probe Acceleration	36	45	g's	40.8	Pass
Lateral Pelvis Acceleration	28	39	g's	30.5	Pass
Iliac Force	4100	5100	N	4450.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	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
Max: 30.5 g's
Min: -2.4 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50


Iliac Force
Max: 4450.6 N
Min: -9.6 N
Filter: CFC 600
Force (N)
Time [ms]
6000
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50

CALIBRATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

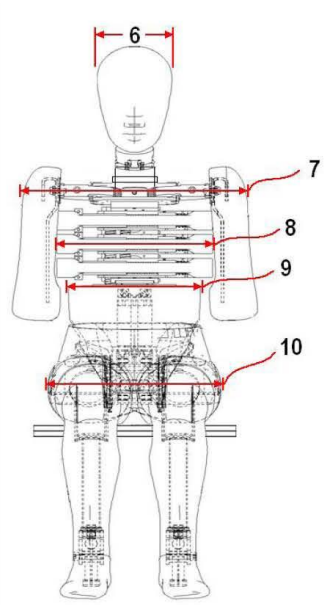
SERIAL NO: F034

(CONFIGURED FOR LEFT SIDE IMPACT)

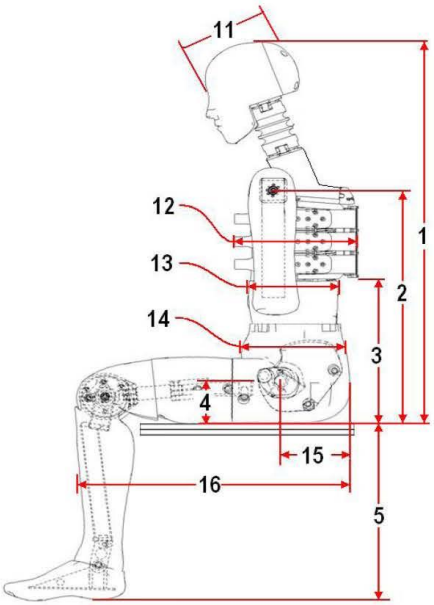
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 4/30/2019

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	568	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	100	Pass
5	Sole to Seat, Sitting	333	451	419	Pass
6	Head Width	152	158	155	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	282	Pass
10	Pelvis Lap Width	359	373	365	Pass
11	Head Depth	196	206	202	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	242	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

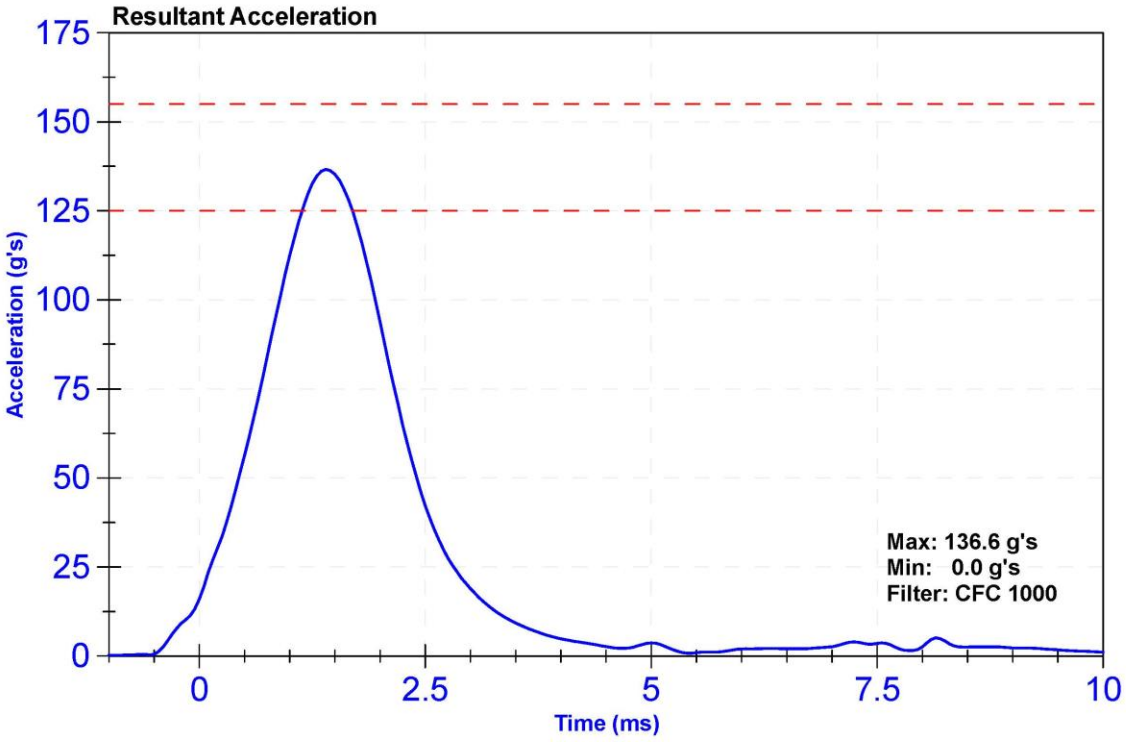
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

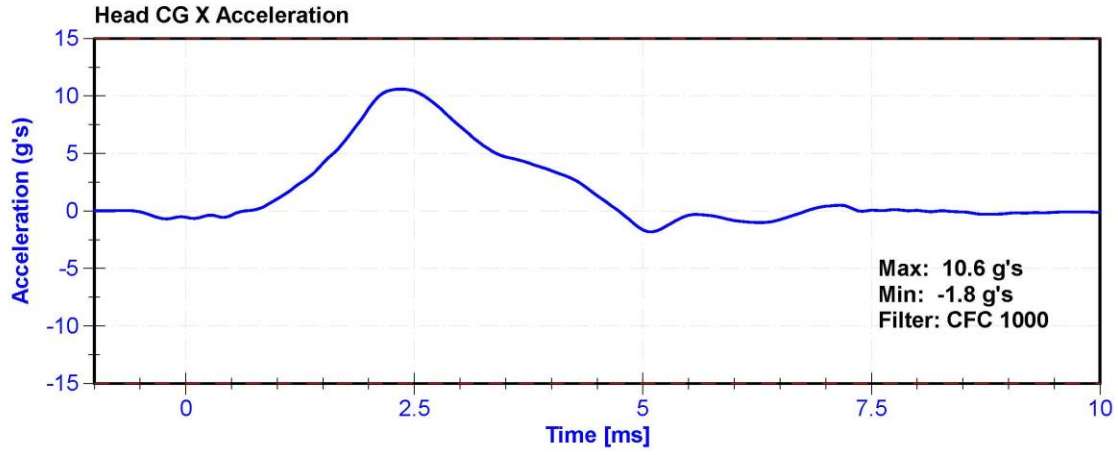
Results

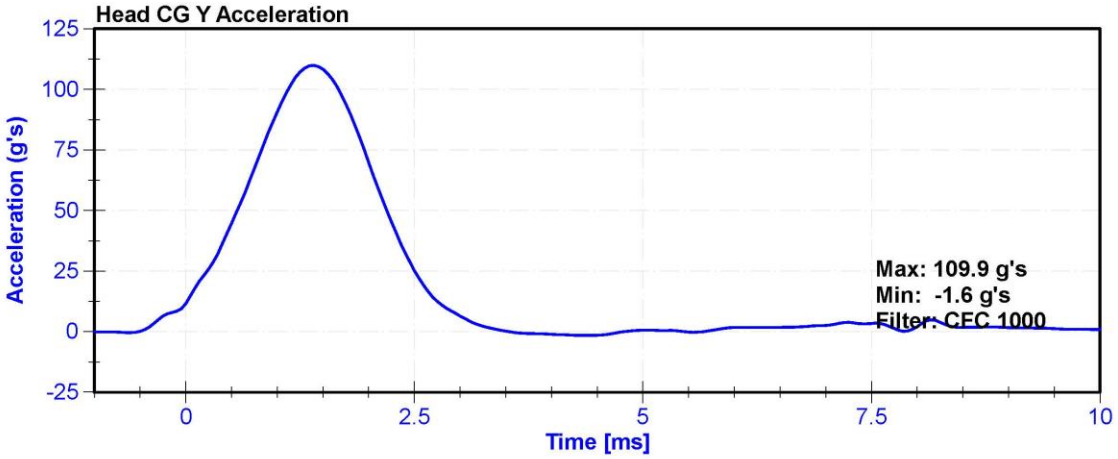
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	36.4	Pass
Resultant Acceleration	125	155	g's	136.6	Pass
Oscillation	0	15	%	3.72	Pass
Fore-Aft Acceleration	-15	15	g's	10.6	Pass

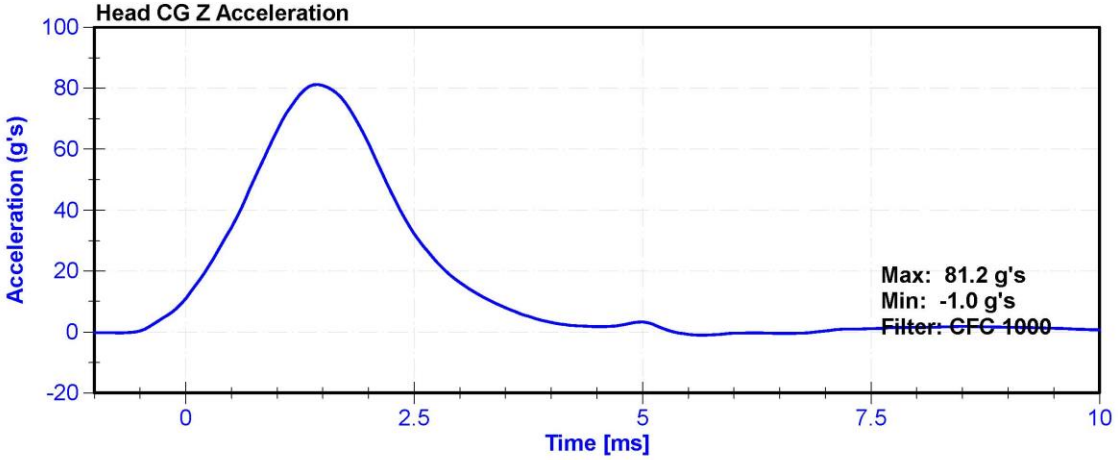
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P58904	4/9/2019	10/8/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P58911	4/9/2019	10/8/2019
Z Accelerometer	ENDEVCO 7264CT	AC-P58776	4/9/2019	10/8/2019




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 10.6 g's
Min: -1.8 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 109.9 g's
Min: -1.6 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]
Max: 81.2 g's
Min: -1.0 g's
Filter: CFC 1000

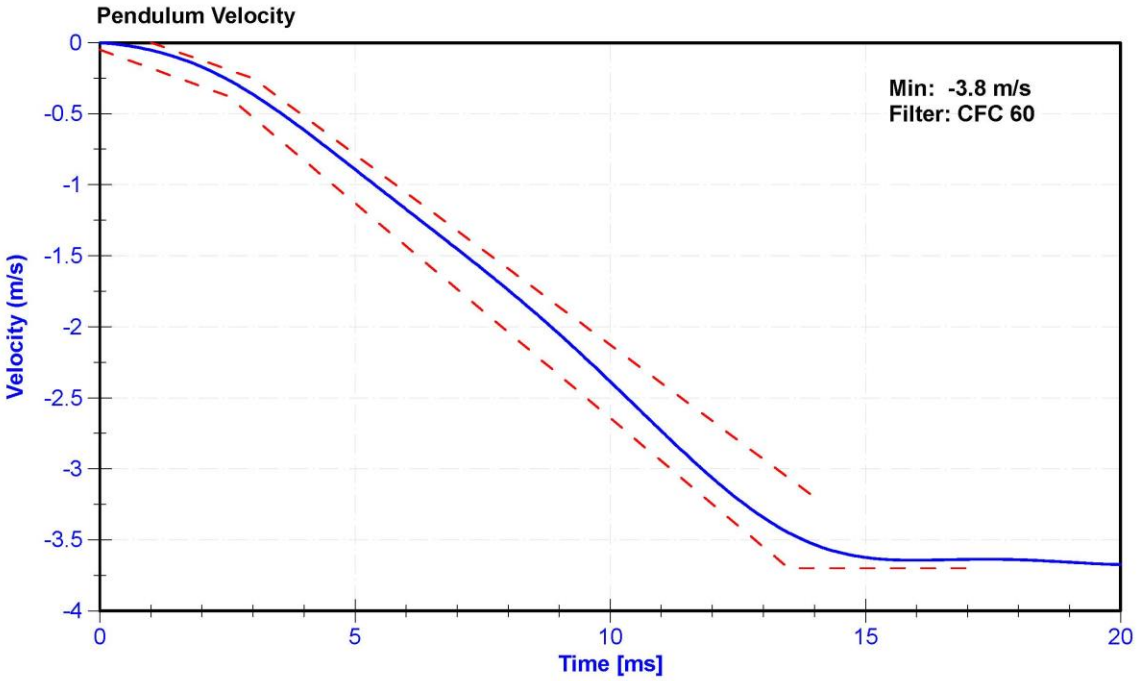
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

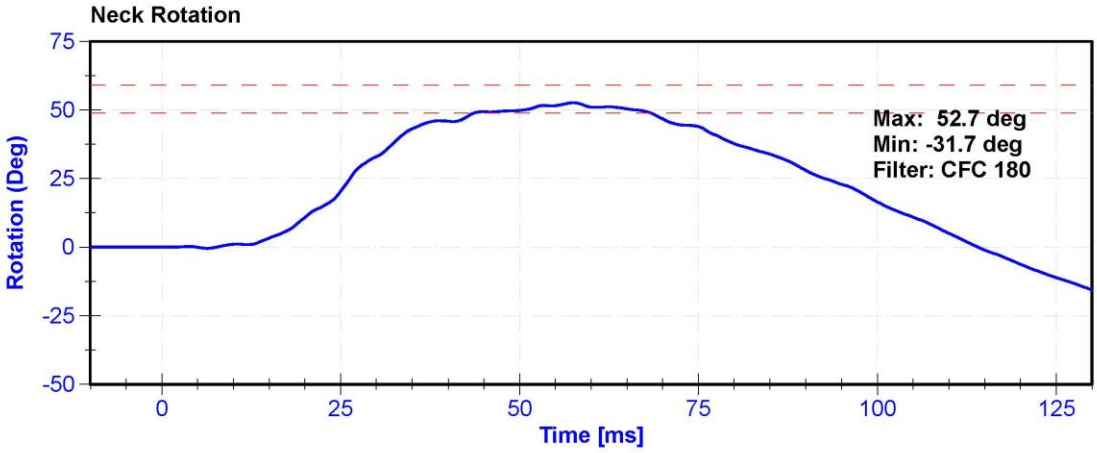
Results

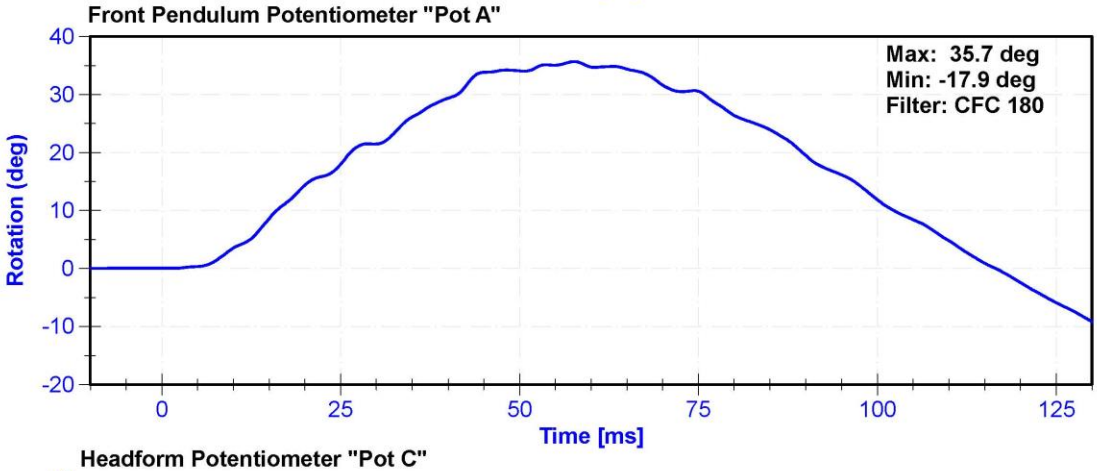
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	36.5	Pass
Velocity	3.3	3.5	m/s	3.35	Pass
Lateral Neck Rotation	49	59	deg	52.7	Pass
Time at Maximum Rotation	54	66	ms	57.5	Pass
Time of Rotation Decay from Maximum	53	88	ms	56.6	Pass

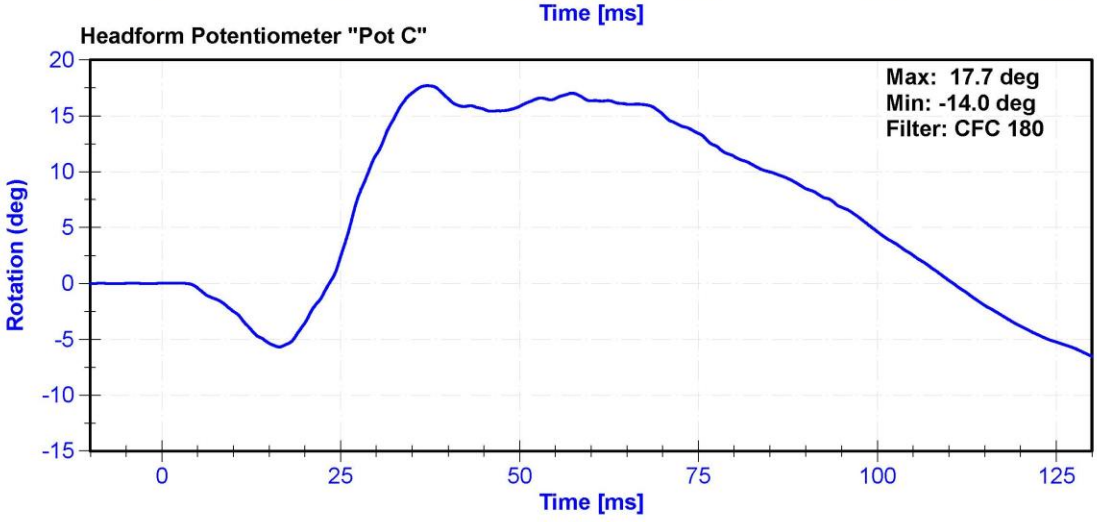
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CTAC-AH5M9 Pend		1/29/2019	1/29/2020
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: 52.7 deg
Min: -31.7 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 35.7 deg
Min: -17.9 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 17.7 deg
Min: -14.0 deg
Filter: CFC 180

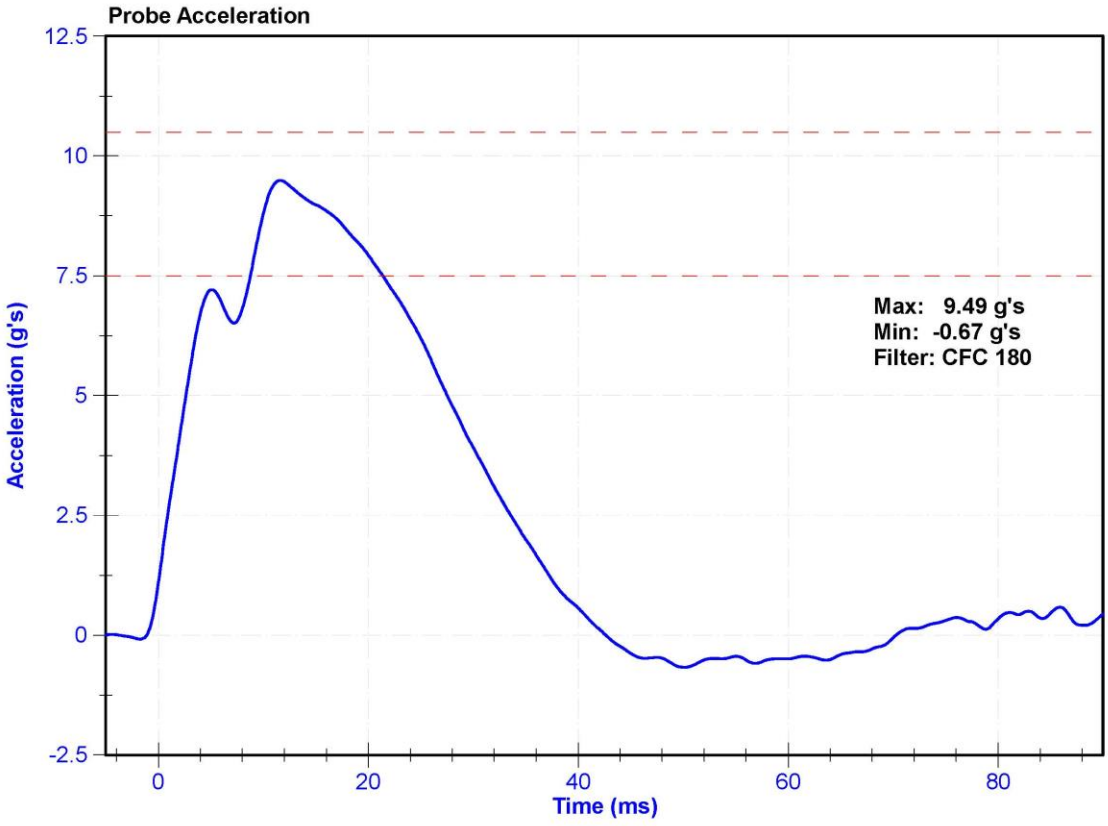
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	49.5	Pass
Velocity	4.2	4.4	m/s	4.21	Pass
Probe Acceleration	7.5	10.5	g's	9.49	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P71278	12/14/2018	12/14/2019



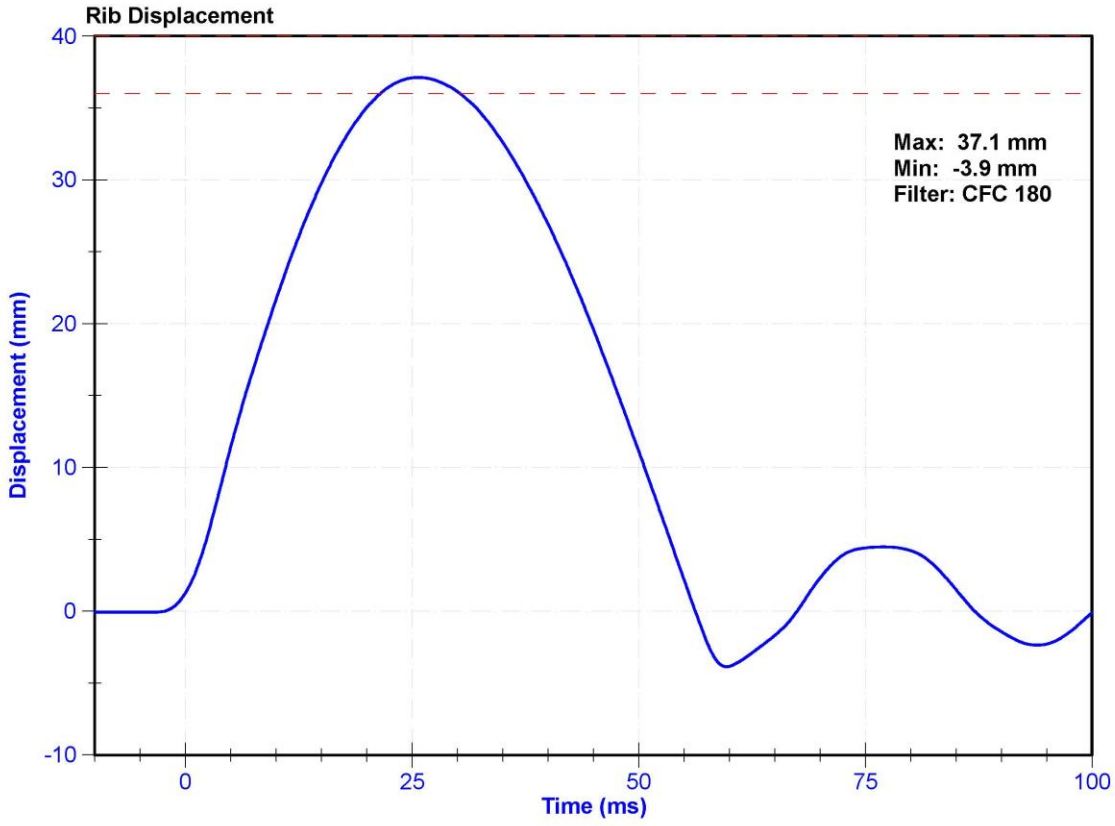
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	31.1	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-183GFE	10/10/2018	10/10/2019



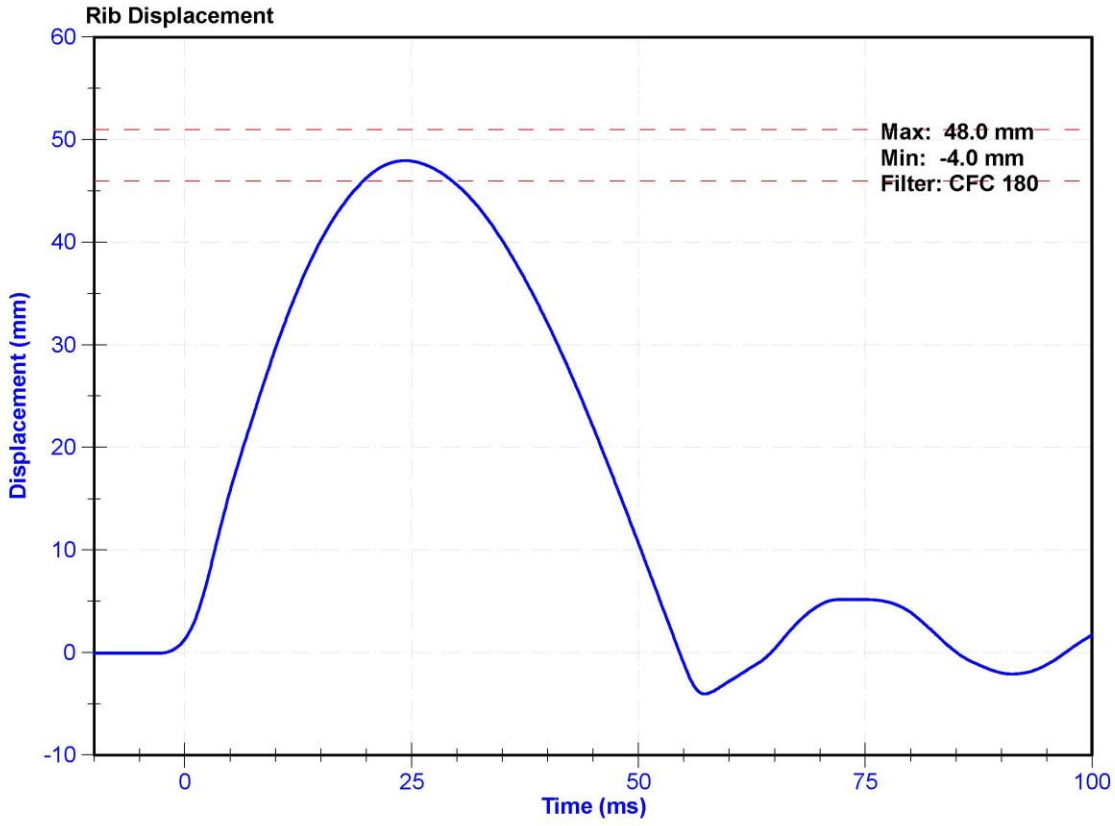
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	37.0	Pass
Rib Displacement	46	51	mm	48.0	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



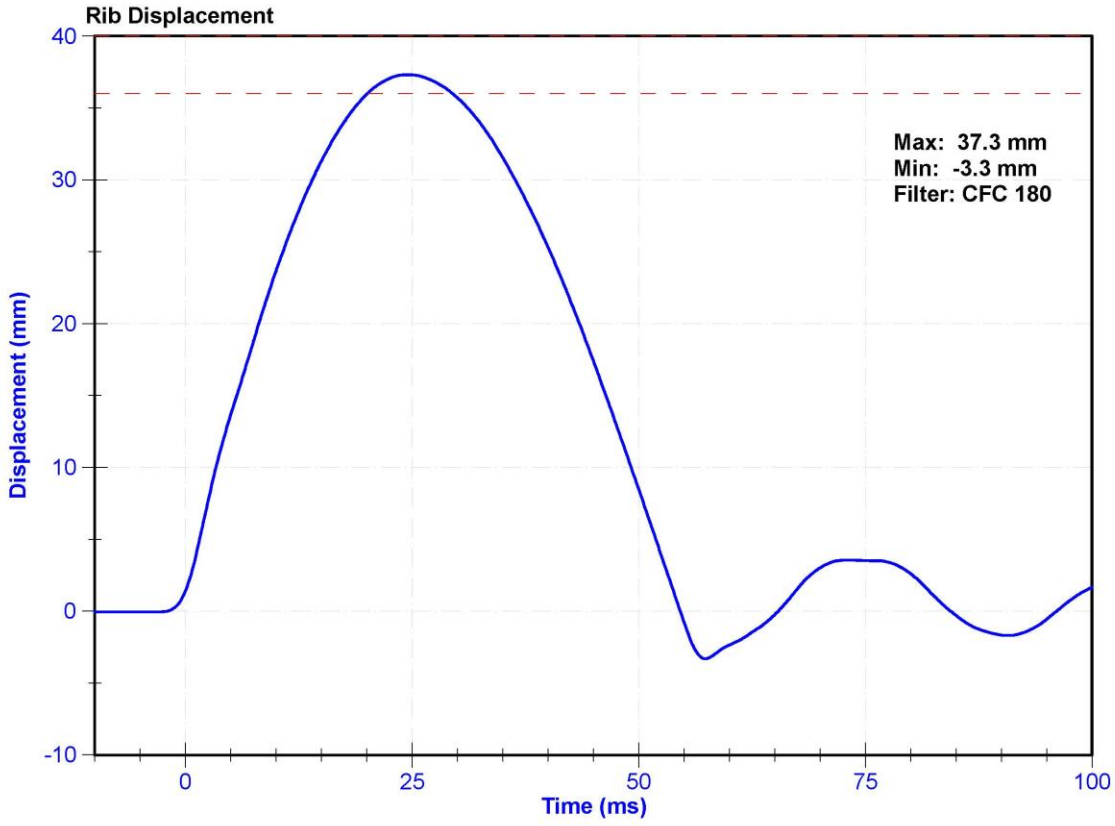
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	36.4	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



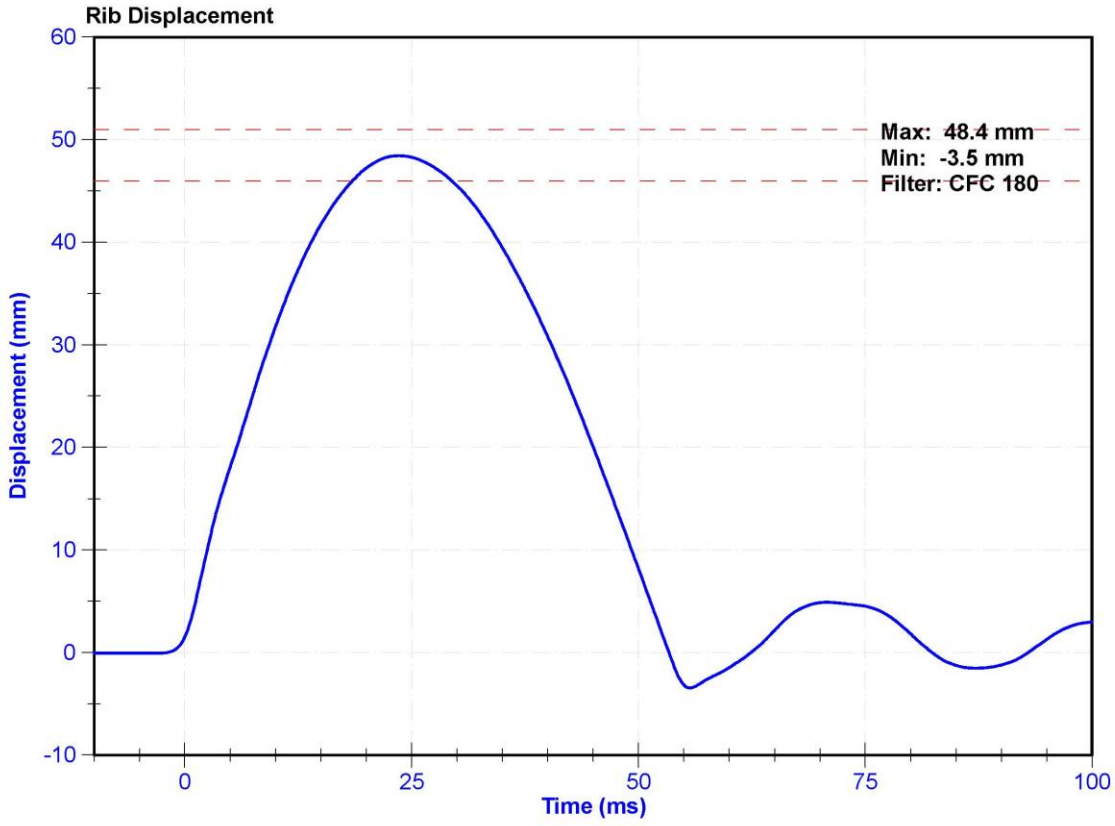
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	36.7	Pass
Rib Displacement	46	51	mm	48.4	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



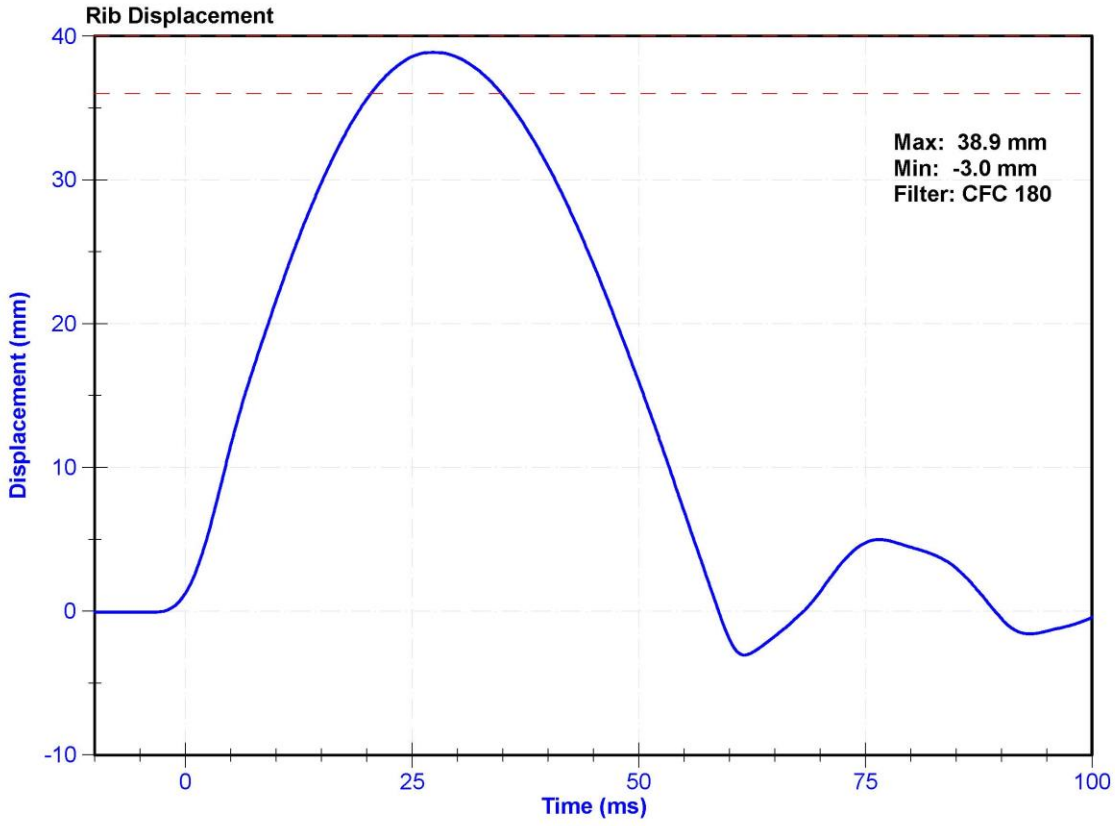
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	35.5	Pass
Rib Displacement	36	40	mm	38.9	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



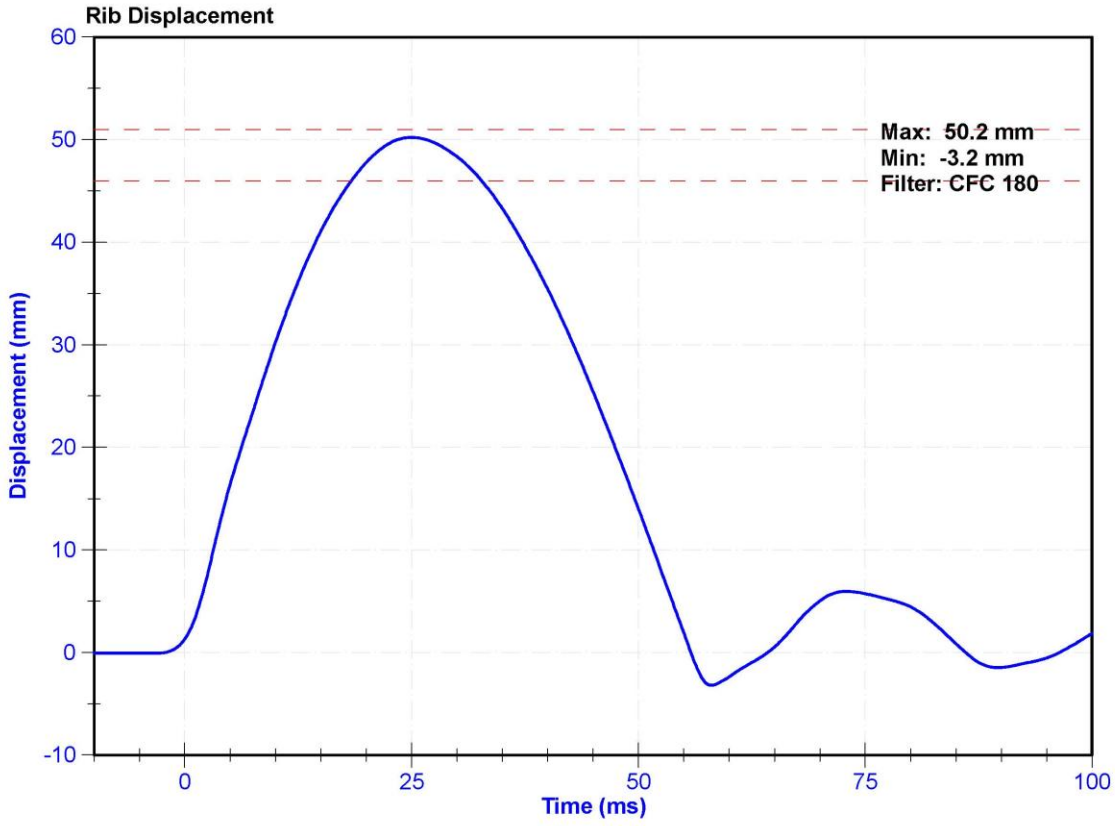
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	36.1	Pass
Rib Displacement	46	51	mm	50.2	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



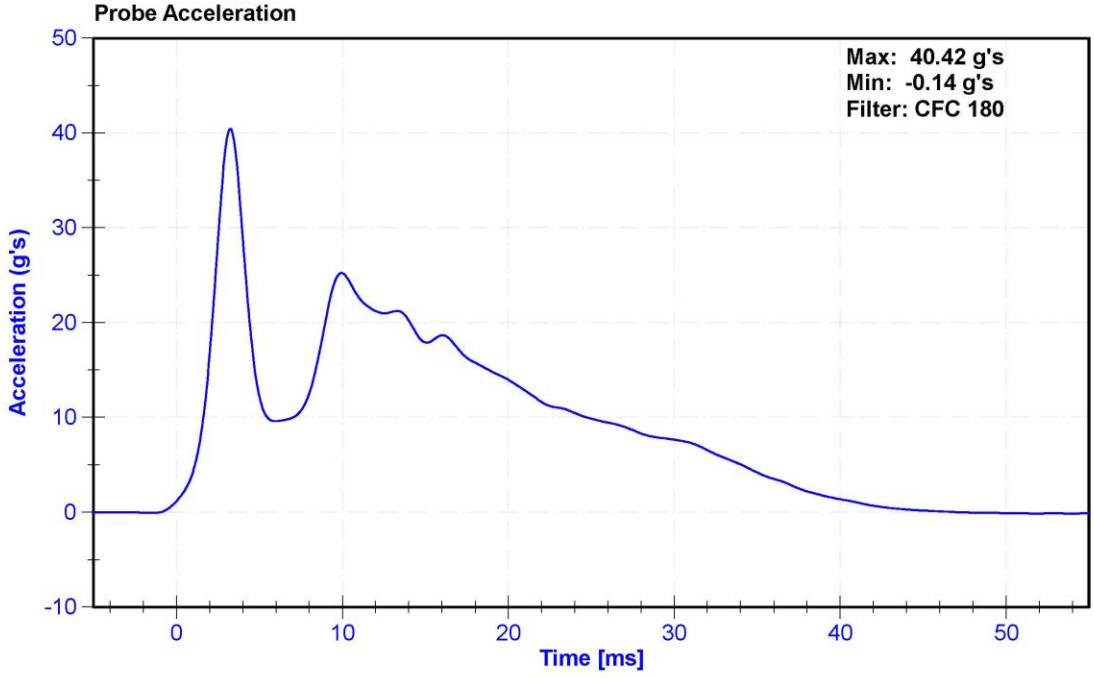
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

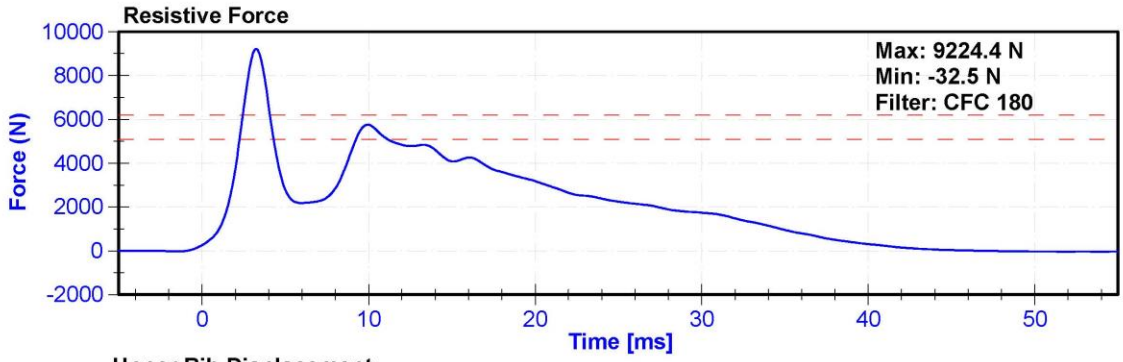
Results

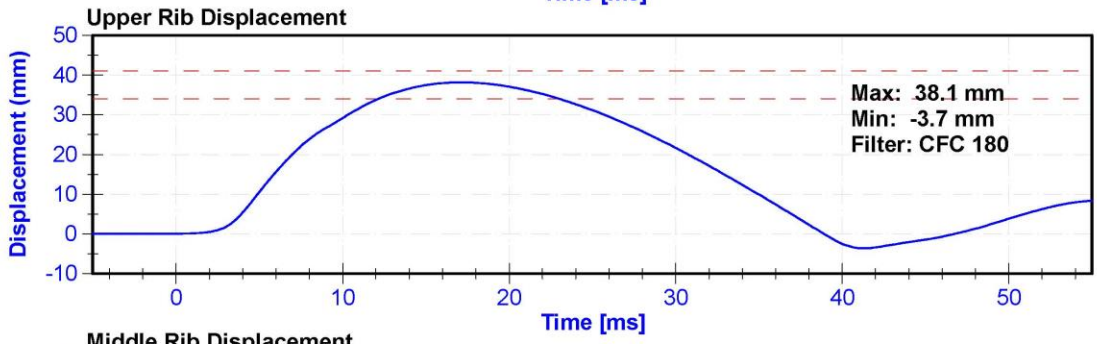
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	42.3	Pass
Velocity	5.4	5.6	m/s	5.48	Pass
Resistive Force after 6ms	5100	6200	N	5758.3	Pass
Upper Thorax Rib Deflection	34	41	mm	38.1	Pass
Mid Thorax Rib Deflection	37	45	mm	40.8	Pass
Lower Thorax Rib Deflection	37	44	mm	41.0	Pass

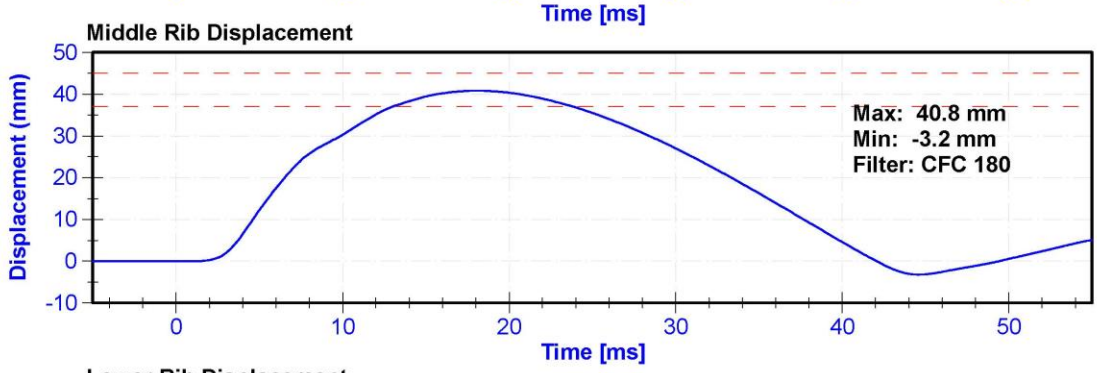
Transducer Calibrations

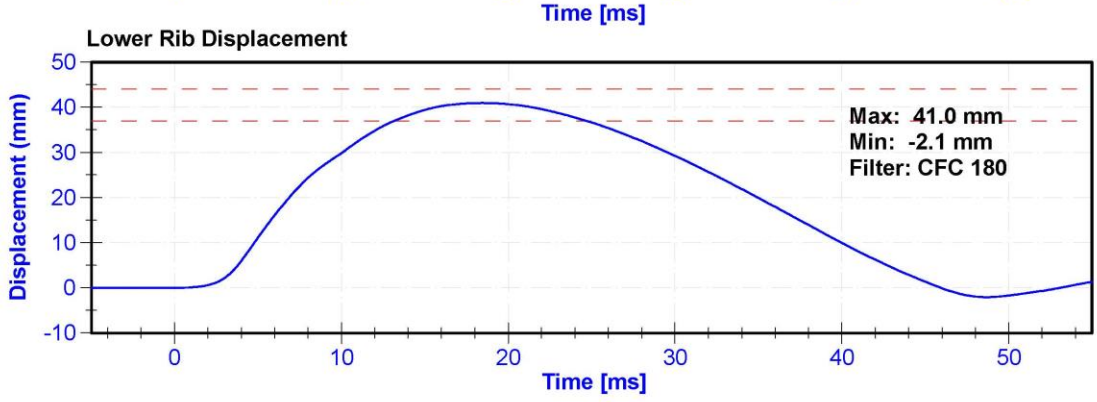
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P71278	12/14/2018	12/14/2019
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019




Resistive Force
Max: 9224.4 N
Min: -32.5 N
Filter: CFC 180
Force (N)
Time [ms]


Upper Rib Displacement
Max: 38.1 mm
Min: -3.7 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Middle Rib Displacement
Max: 40.8 mm
Min: -3.2 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Lower Rib Displacement
Max: 41.0 mm
Min: -2.1 mm
Filter: CFC 180
Displacement (mm)
Time [ms]

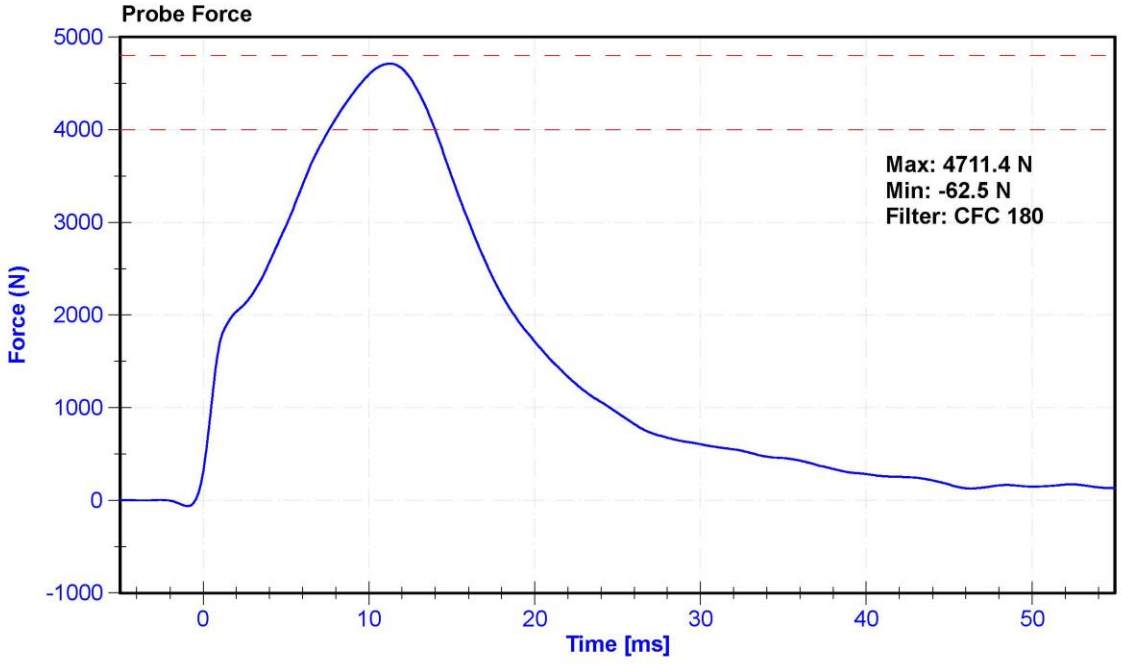
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

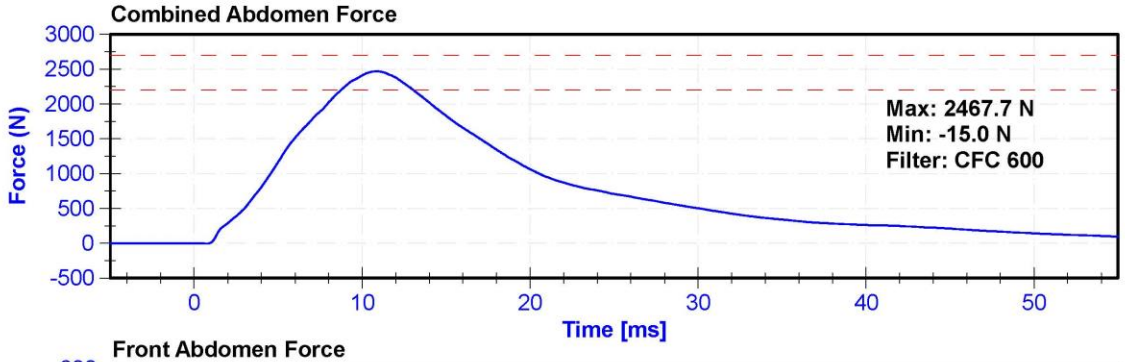
Results

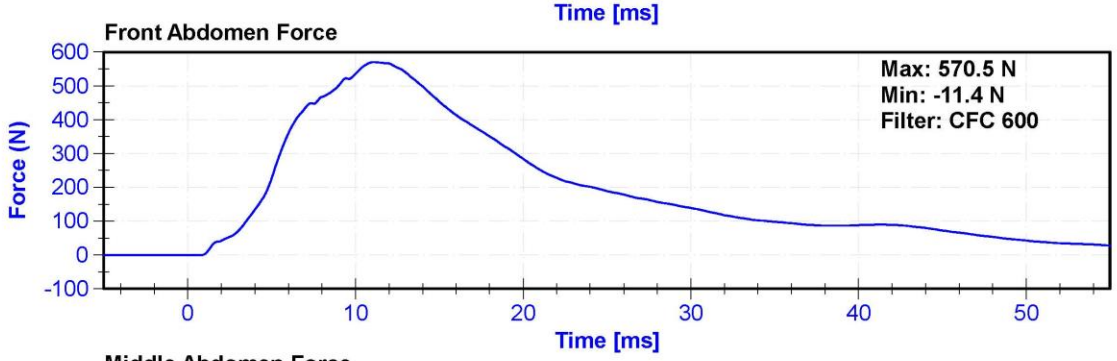
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	42.2	Pass
Velocity	3.9	4.1	m/s	4.10	Pass
Combined Abdomen Force	2200	2700	N	2467.7	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.90	Pass
Resistive Probe Force	4000	4800	N	4711.4	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.25	Pass

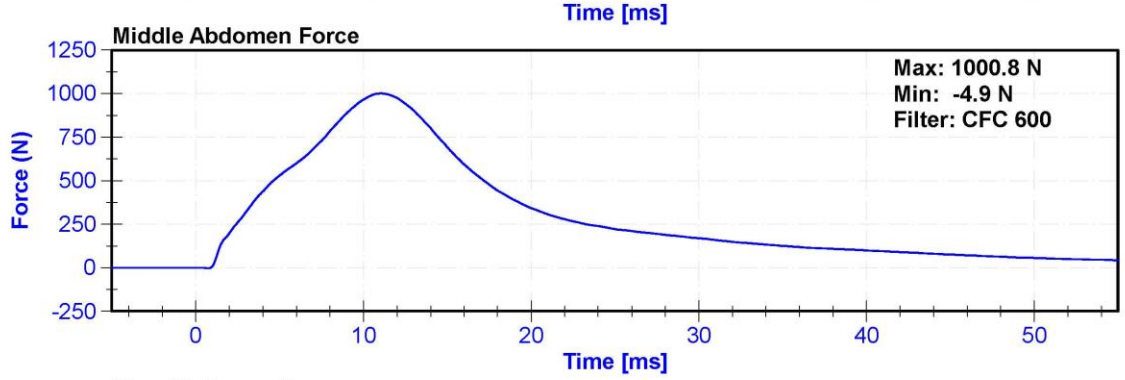
Transducer Calibrations

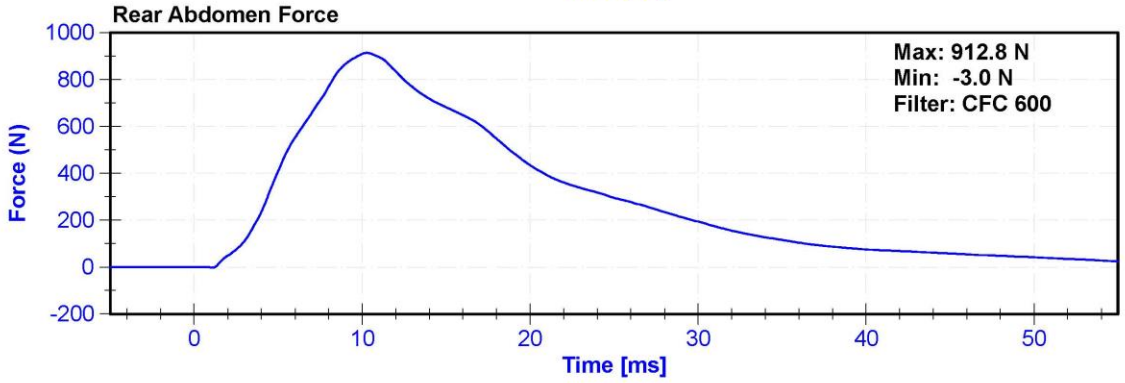
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P71278	12/14/2018	12/14/2019
Front Abdomen Load Cell	DENTON 2631	LC-1440	6/4/2018	6/4/2019
Middle Abdomen Load Cell	DENTON 2631	LC-1525	6/4/2018	6/4/2019
Rear Abdomen Load Cell	DENTON 2631	LC-1528	6/4/2018	6/4/2019




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2467.7 N
Min: -15.0 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 570.5 N
Min: -11.4 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1000.8 N
Min: -4.9 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 912.8 N
Min: -3.0 N
Filter: CFC 600

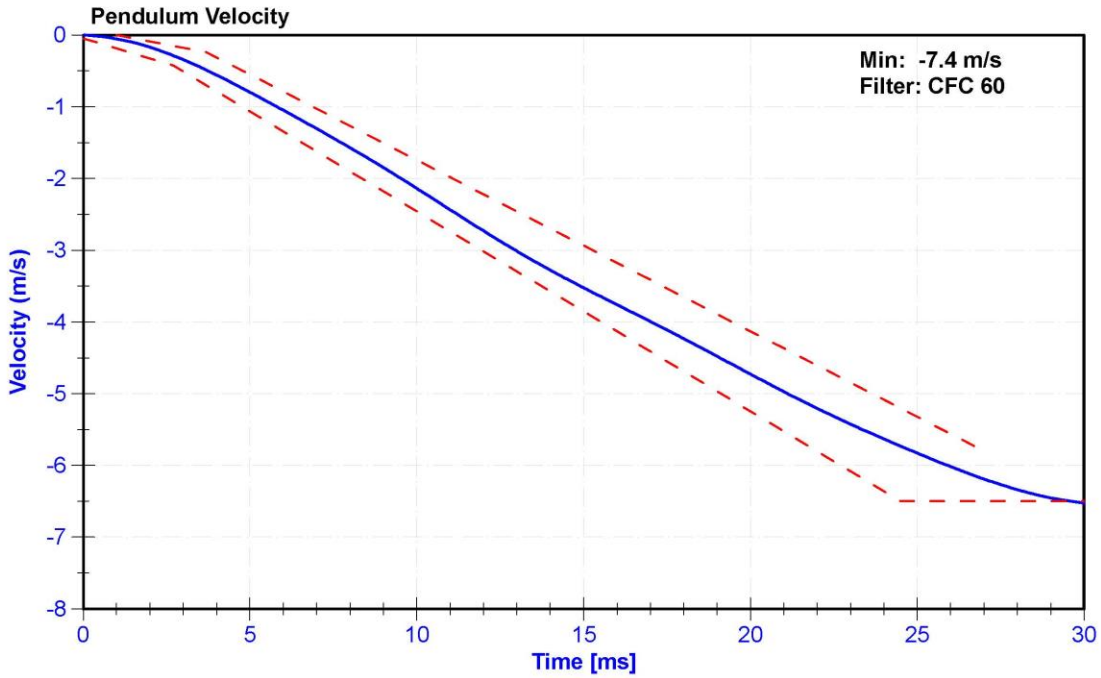
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

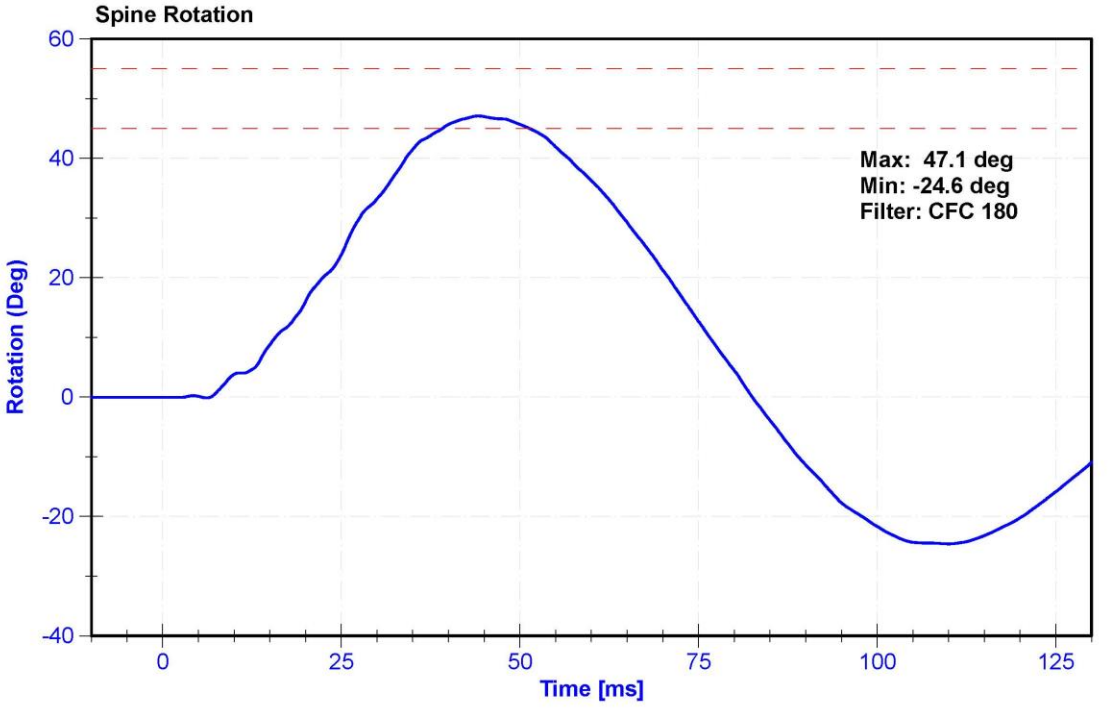
Results

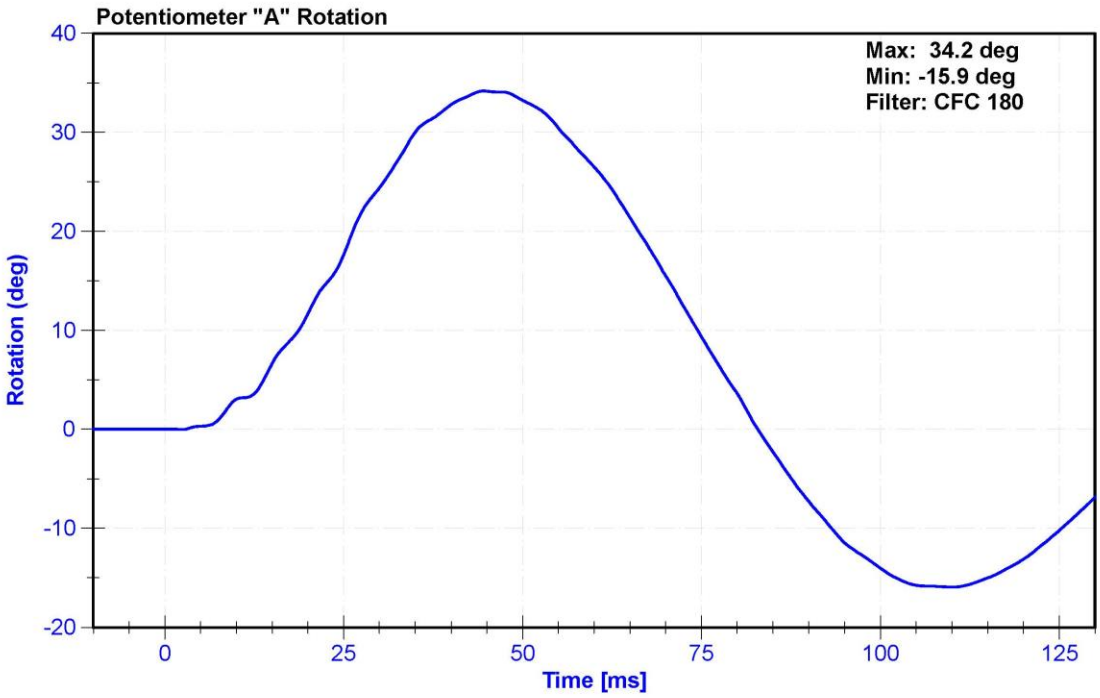
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	36.7	Pass
Velocity	5.95	6.15	m/s	6.005	Pass
Lateral Spine Rotation	45	55	deg	47.1	Pass
Time at Maximum Rotation	39	53	ms	44.2	Pass
Time of Decay to Zero Degrees	37	57	ms	38.4	Pass
Pulse within Corridor?	-	-	-		

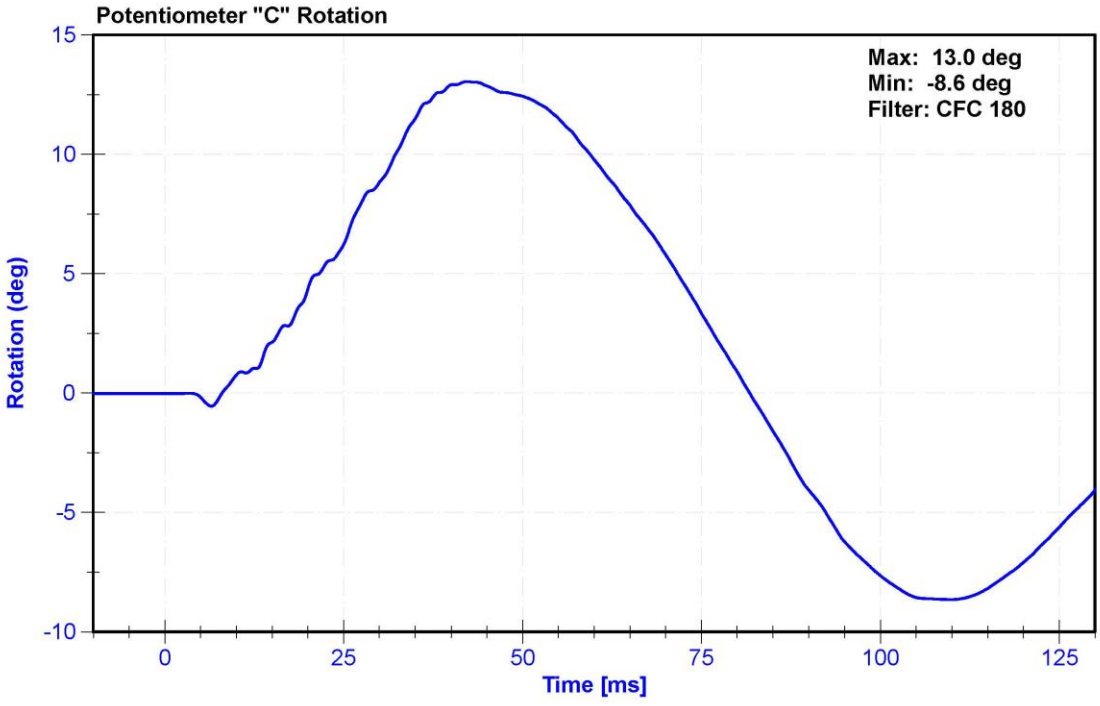
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
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: -7.4 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: 47.1 deg
Min: -24.6 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 34.2 deg
Min: -15.9 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: 13.0 deg
Min: -8.6 deg
Filter: CFC 180
Rotation (deg)
15
10
5
0
-5
-10
0
25
50
75
100
125
Time [ms]

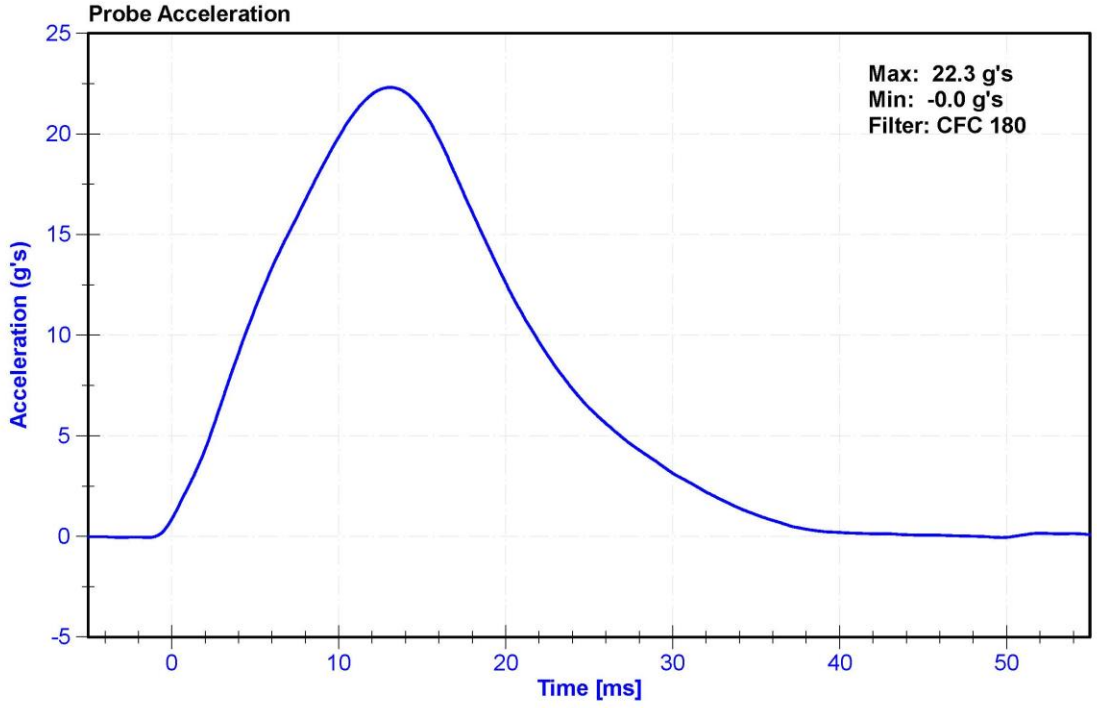
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

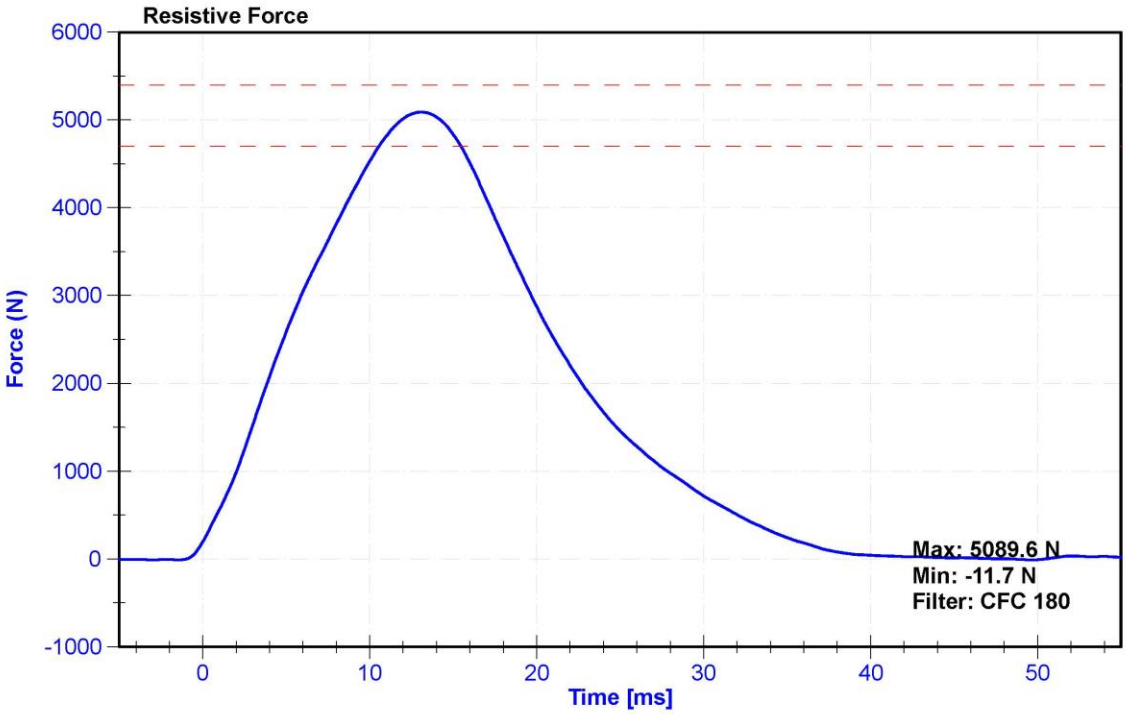
Results

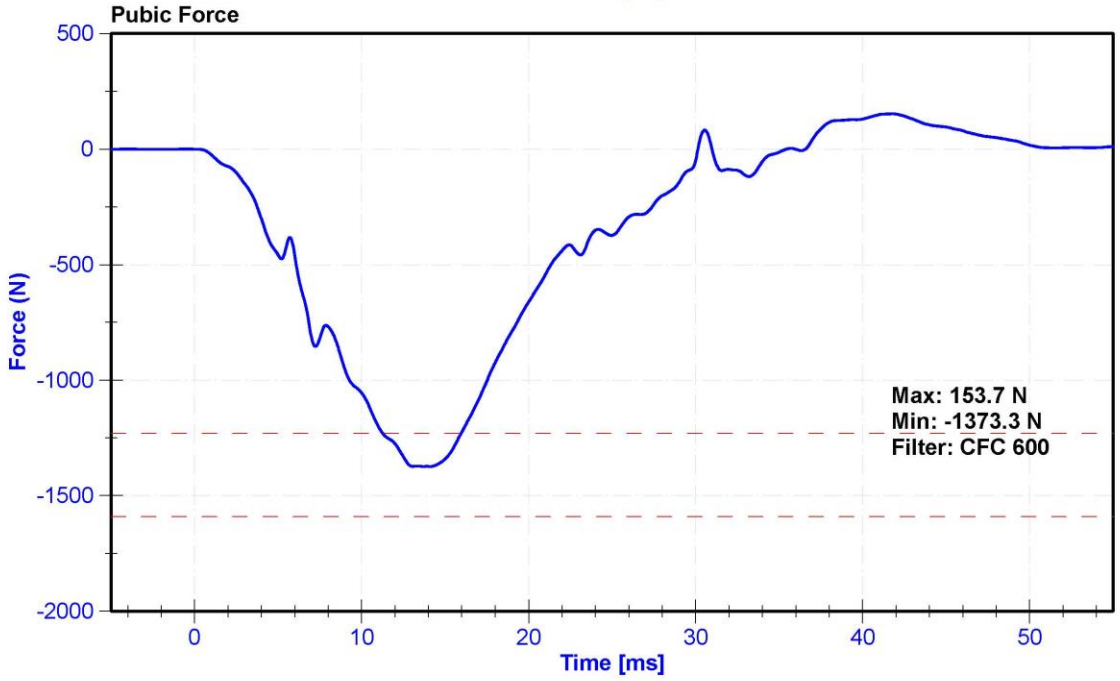
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	42.8	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Resistive Force	4700	5400	N	5089.6	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.10	Pass
Pubic Force	-1590	-1230	N	-1373.3	Pass
Time at Peak Pubic Force	12.2	17.0	ms	14.10	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P71278	12/14/2018	12/14/2019
Pubic Load Cell	Denton 3096JFL	LC-464fy	6/4/2018	6/4/2019




Resistive Force
Force (N)
Time [ms]
Max: 5089.6 N
Min: -11.7 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 153.7 N
Min: -1373.3 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

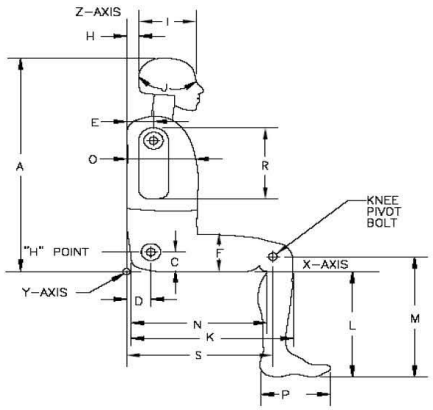
SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

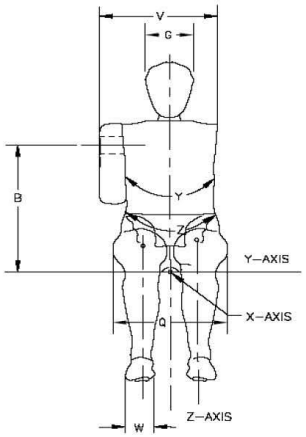
SERIAL No: DG8012

External Measurements - SID-IIs

Technician: K. Dutton Date: 04/29/2019

Dummy Serial Number: DG8012





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	779	Pass
B	Shoulder Pivot Height	437	453	446	Pass
C	H-point Height	79	89	84	Pass
D	H-point from seatback	141	151	147	Pass
E	Shoulder Pivot from Backline	97	107	102	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	402	Pass
N	Buttock Popliteal Length	416	442	433	Pass
O	Chest Depth w/o jacket	195	211	206	Pass
P	Foot Length	216	232	223	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	318	Pass
R	Arm Length	249	259	253	Pass
S	Knee Joint to seatback	477	493	486	Pass
V	Shoulder Width	341	357	345	Pass
W	Foot Width	78	94	85	Pass
Y	Chest Circumference w/jacket	851	881	867	Pass
Z	Waist Circumference	761	791	781	Pass

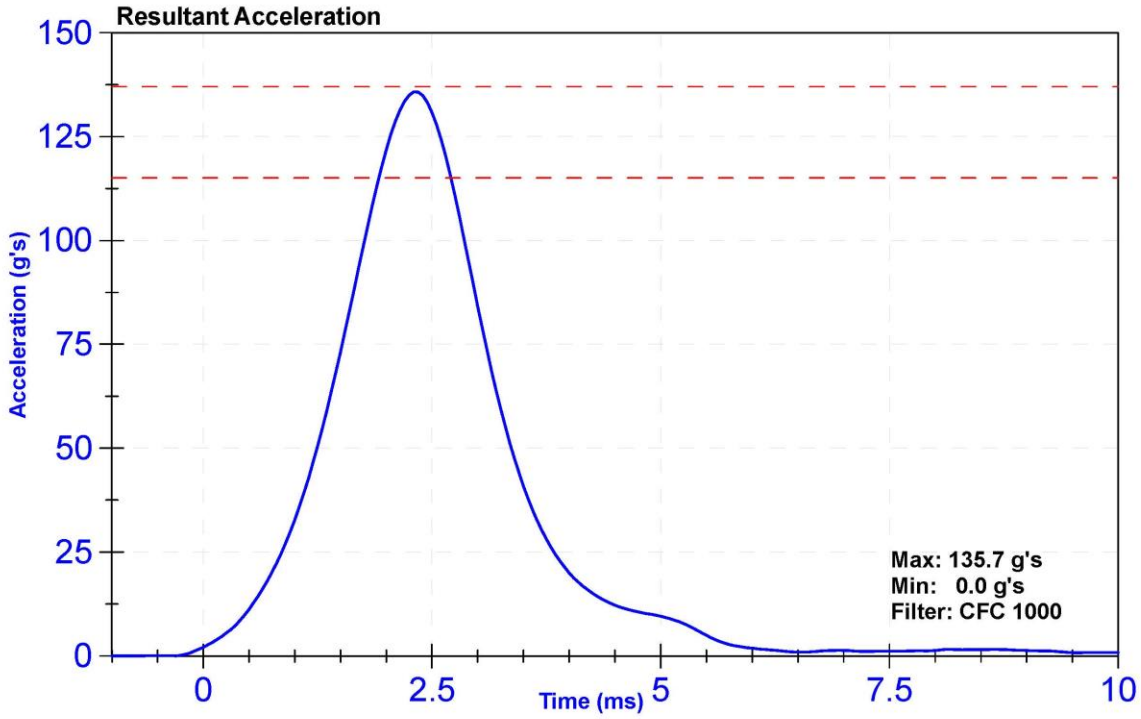
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

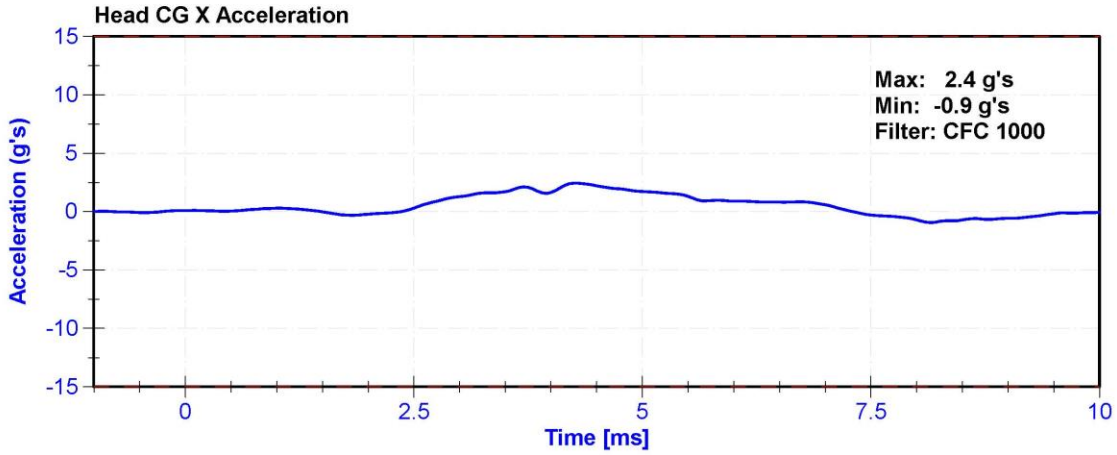
Results

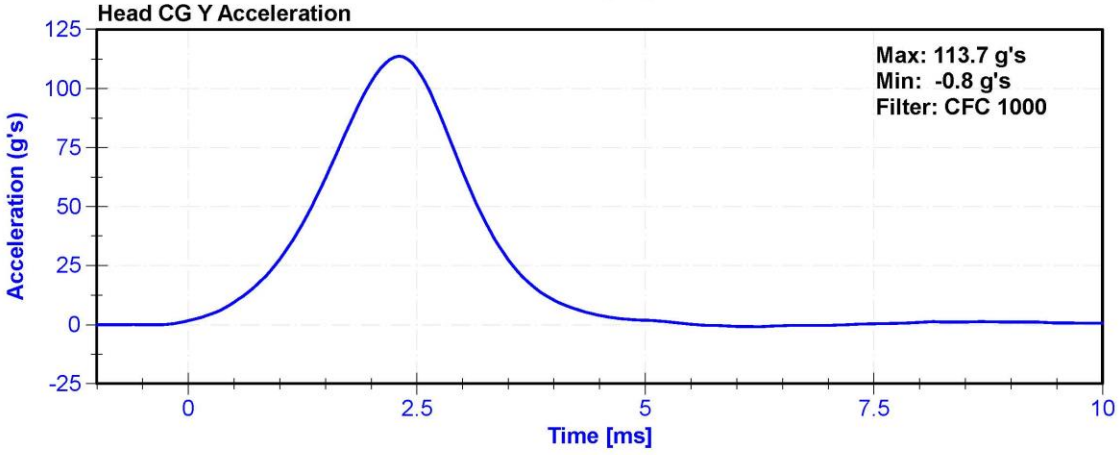
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	36.9	Pass
Resultant Acceleration	115	137	g's	135.7	Pass
Oscillation	0	15	%	1.1	Pass
Fore-Aft Acceleration	-15	15	g's	2.4	Pass

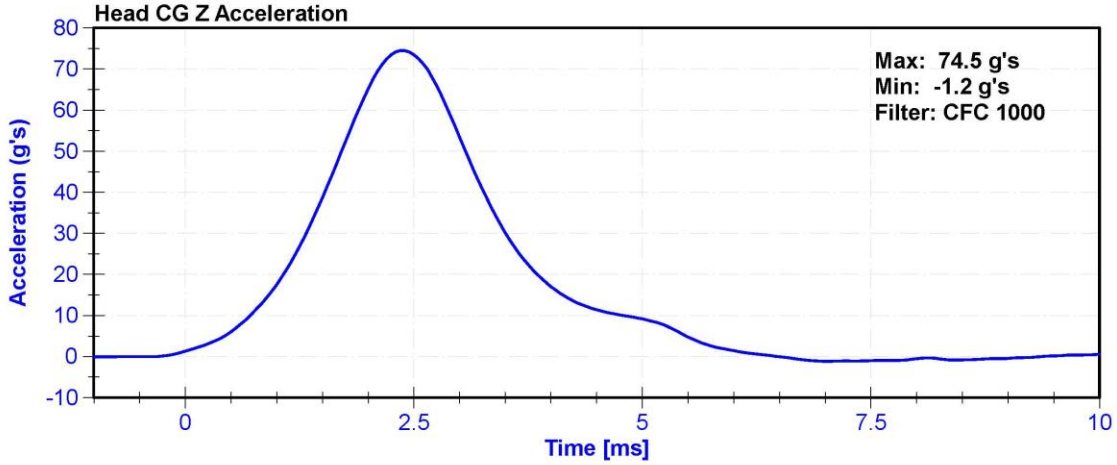
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264	AC-P74788	4/11/2019	10/10/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P83432	4/11/2019	10/10/2019
Z Accelerometer	ENDEVCO 7264	AC-P83319	4/11/2019	10/10/2019




Head CG X Acceleration
Max: 2.4 g's
Min: -0.9 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Y Acceleration
Max: 113.7 g's
Min: -0.8 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Z Acceleration
Max: 74.5 g's
Min: -1.2 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]

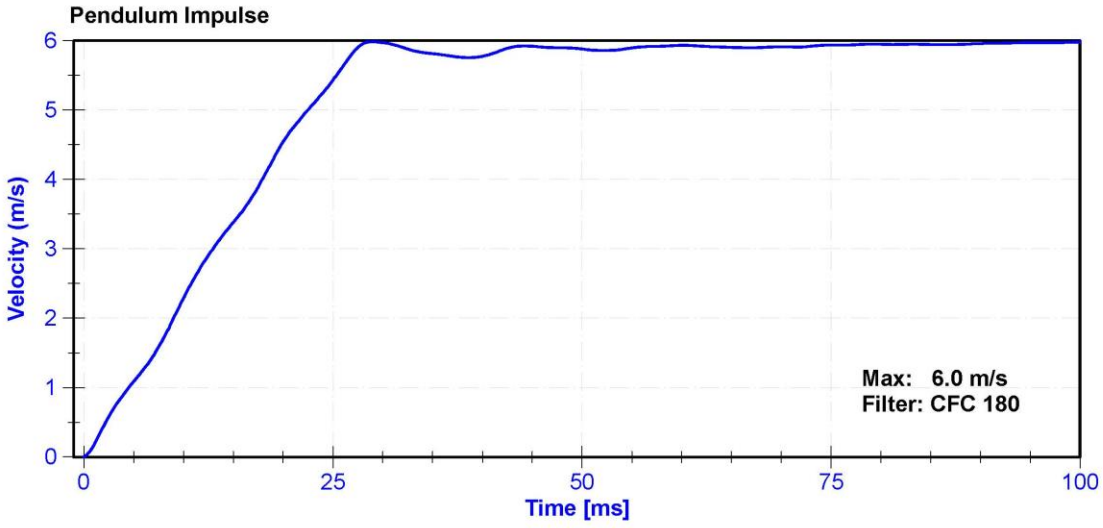
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

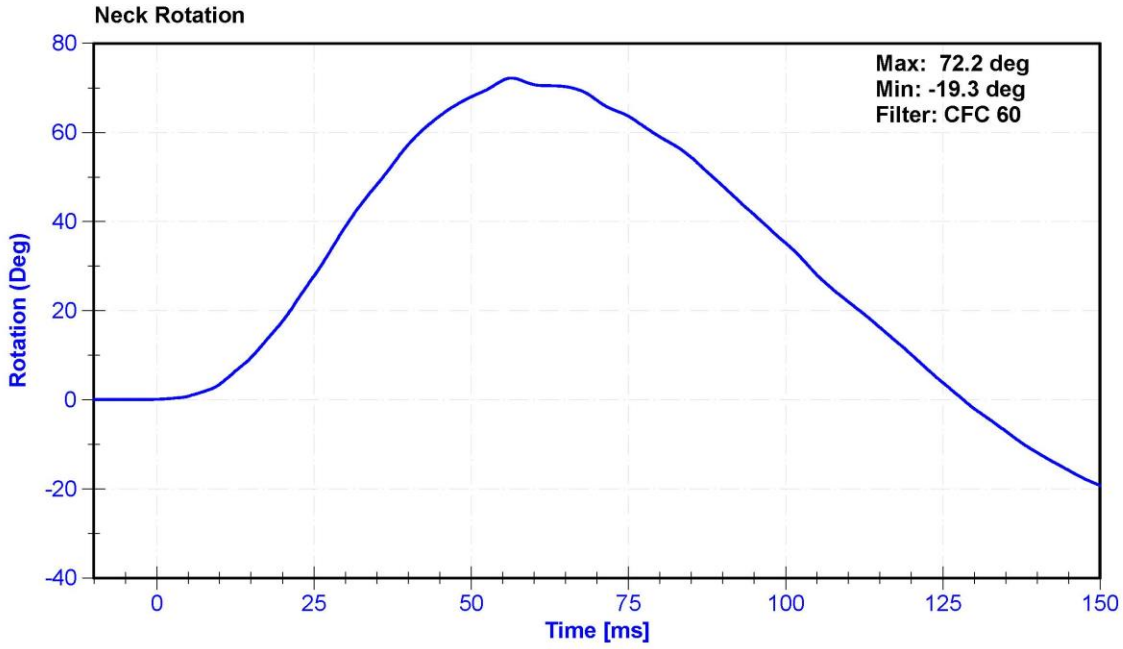
Results

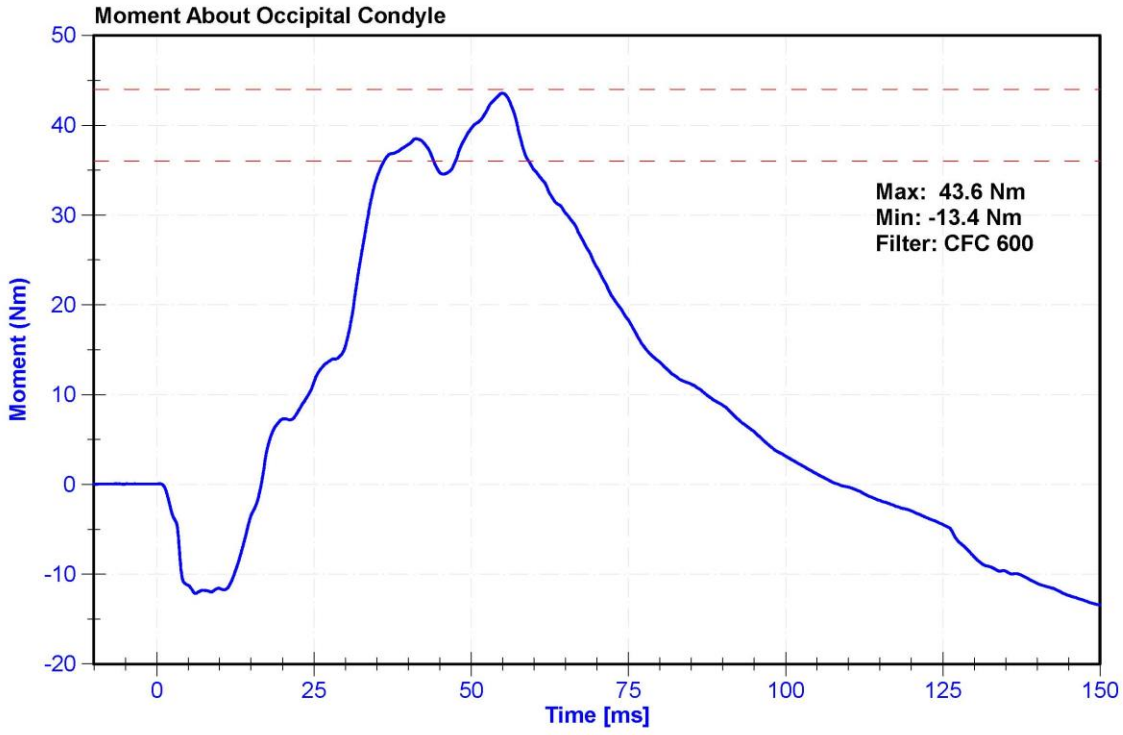
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	30.3	Pass
Velocity	5.51	5.63	m/s	5.514	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.29	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.38	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.54	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.43	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.98	Pass
Neck Rotation	71	81	deg	72.2	Pass
Time at Maximum Rotation	50	70	ms	56.4	Pass
Moment about the OC	36	44	Nm	43.6	Pass
Moment Decay to 0 Nm	102	126	ms	108.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
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: 72.2 deg
Min: -19.3 deg
Filter: CFC 60
Rotation (Deg)
80
60
40
20
0
-20
-40
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 43.6 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]

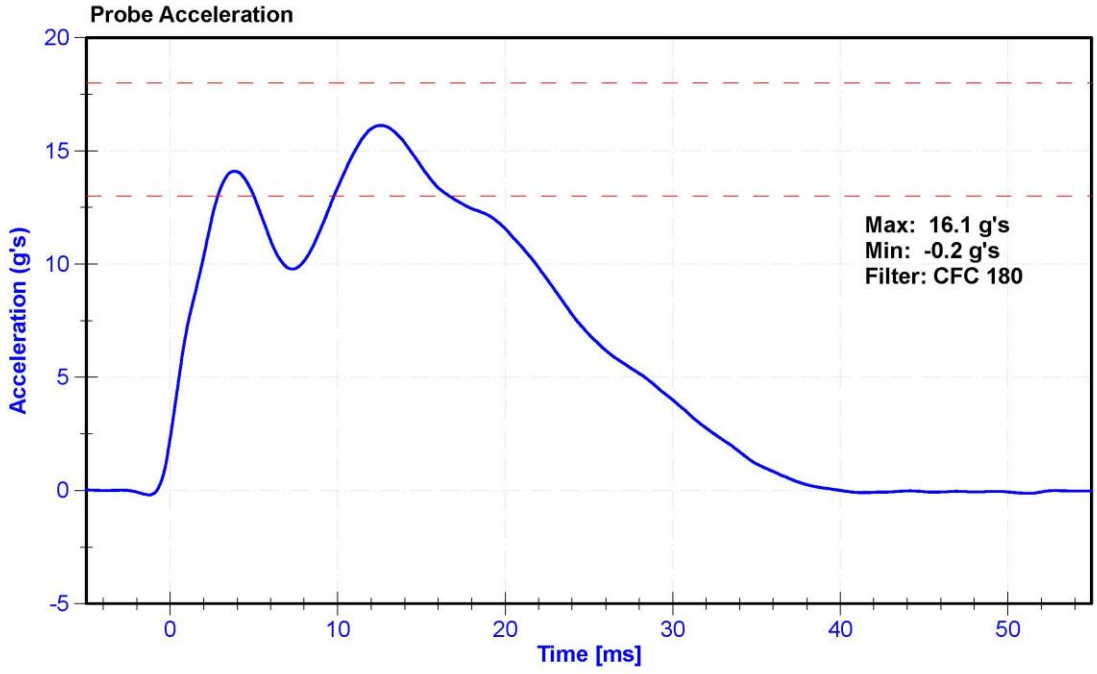
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

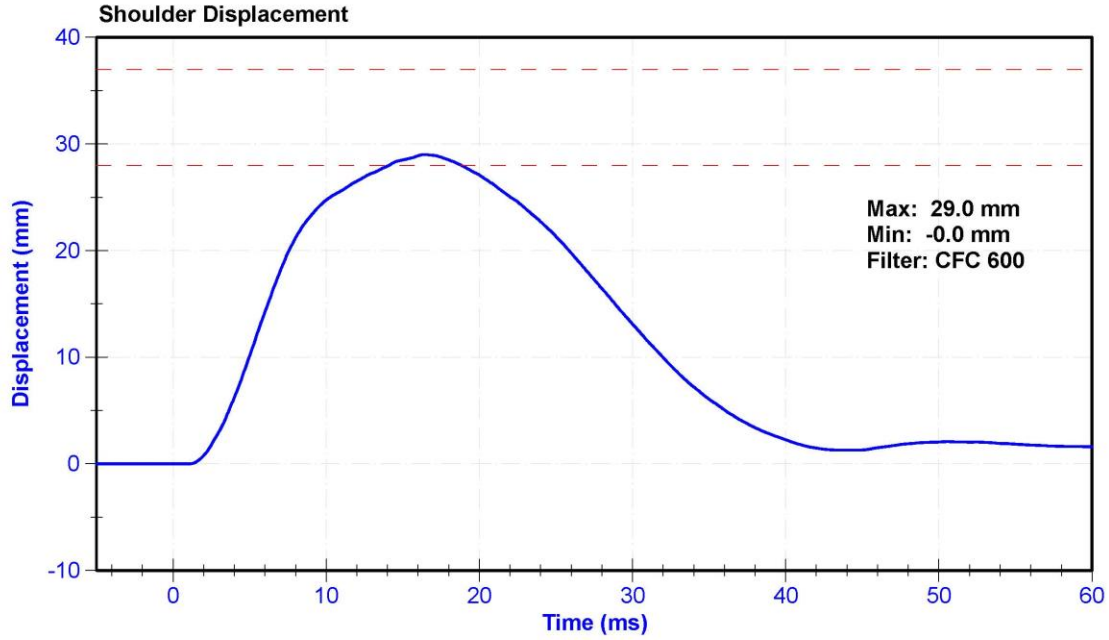
Results

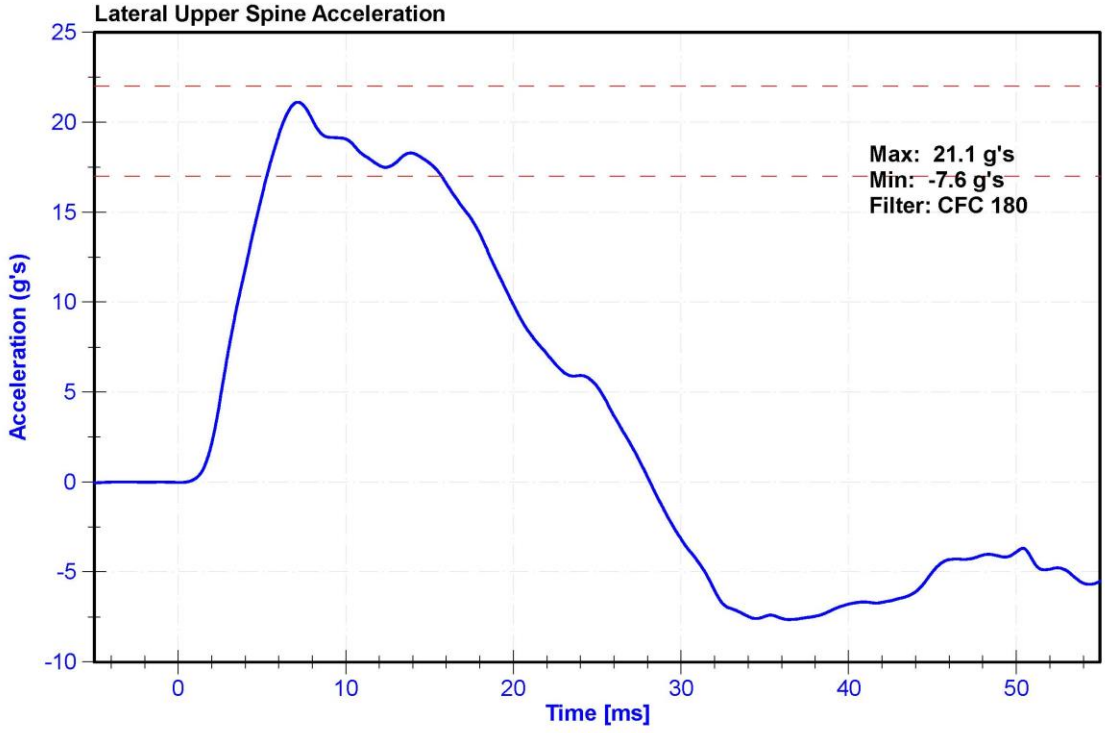
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	28.7	Pass
Velocity	4.2	4.4	m/s	4.37	Pass
Probe Acceleration	13	18	g's	16.1	Pass
Shoulder Deflection	28	37	mm	29.0	Pass
Lateral Upper Spine Acceleration	17	22	g's	21.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019
Shoulder Potentiometer	Servo 08TC1-3745	DS-1845GFE	10/11/2018	10/11/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	4/9/2019	10/8/2019




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 29.0 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 21.1 g's
Min: -7.6 g's
Filter: CFC 180

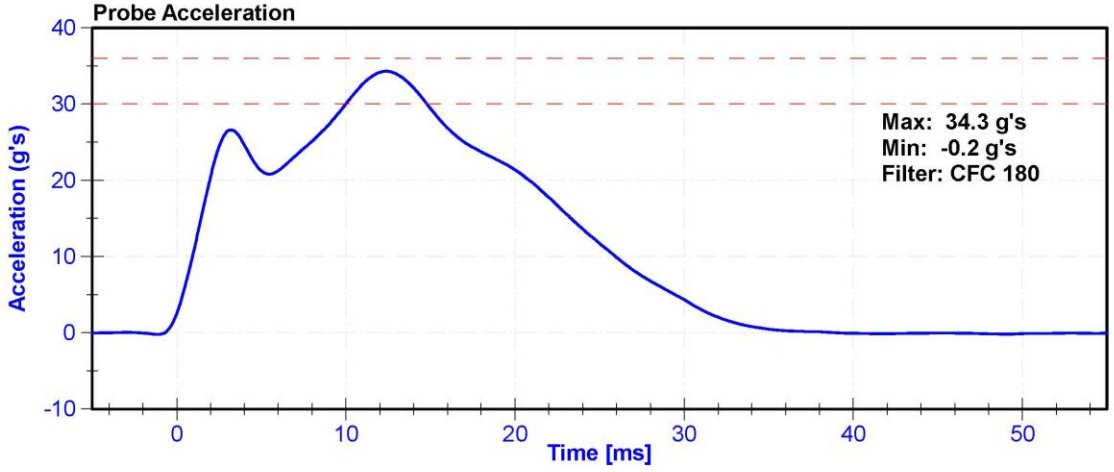
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

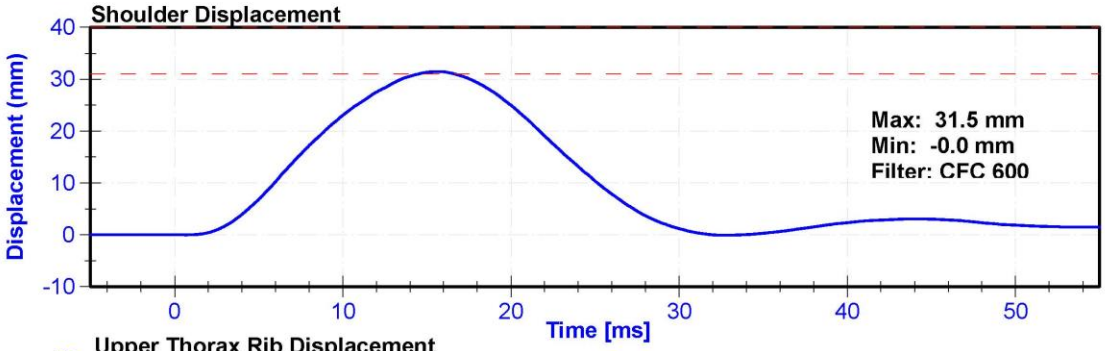
Results

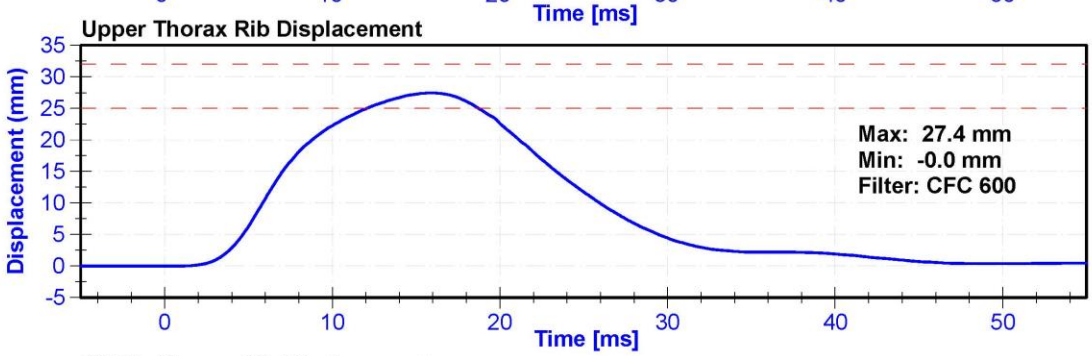
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	28.0	Pass
Velocity	6.6	6.8	m/s	6.68	Pass
Probe Acceleration after 5 ms	30	36	g's	34.3	Pass
Lateral Upper Spine Acceleration	34	43	g's	37.8	Pass
Lateral Lower Spine Acceleration	29	37	g's	33.0	Pass
Shoulder Deflection	31	40	mm	31.5	Pass
Upper Thorax Rib Deflection	25	32	mm	27.4	Pass
Mid Thorax Rib Deflection	30	36	mm	32.3	Pass
Lower Thorax Rib Deflection	32	38	mm	34.7	Pass

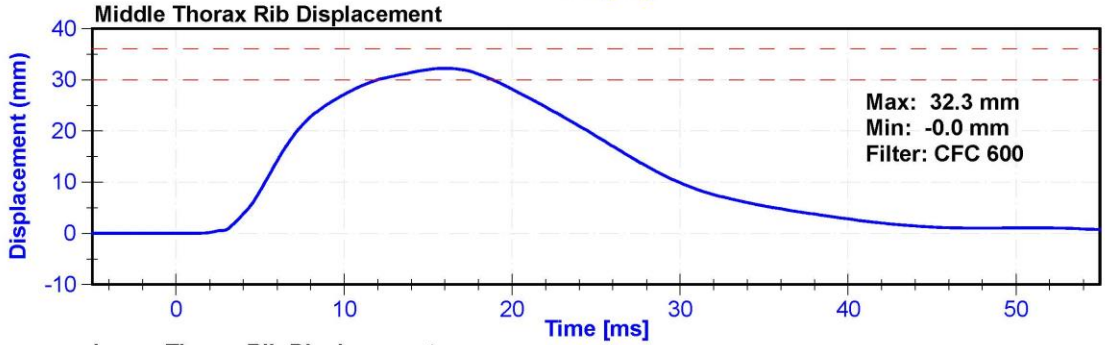
Transducer Calibrations

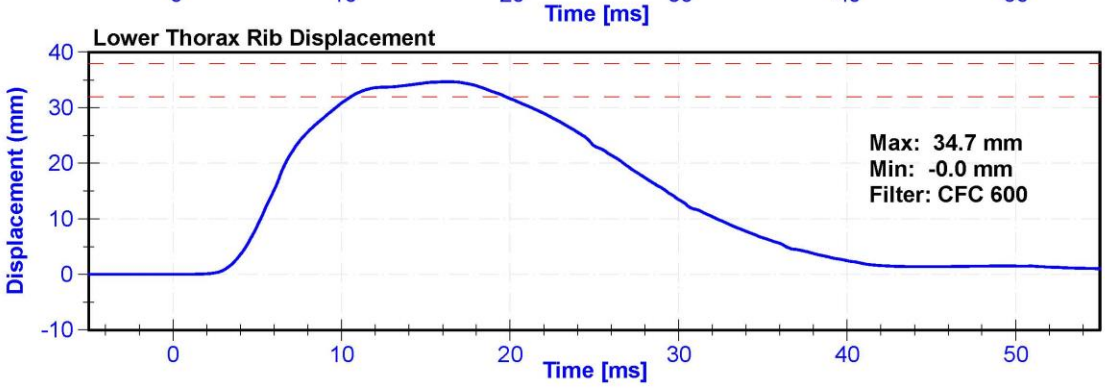
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P64148	4/9/2019	10/8/2019
Upper Spine T12 Y Accelerometer	ENDEVCO 7264CT	AC-P51699	4/9/2019	10/8/2019
Shoulder Potentiometer	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

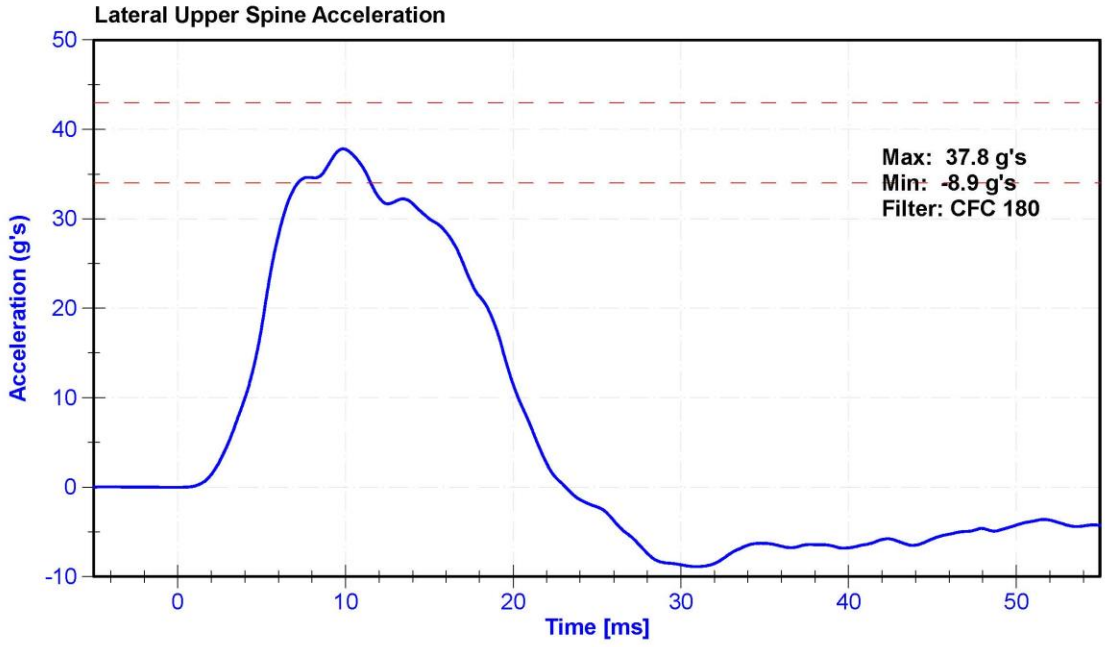


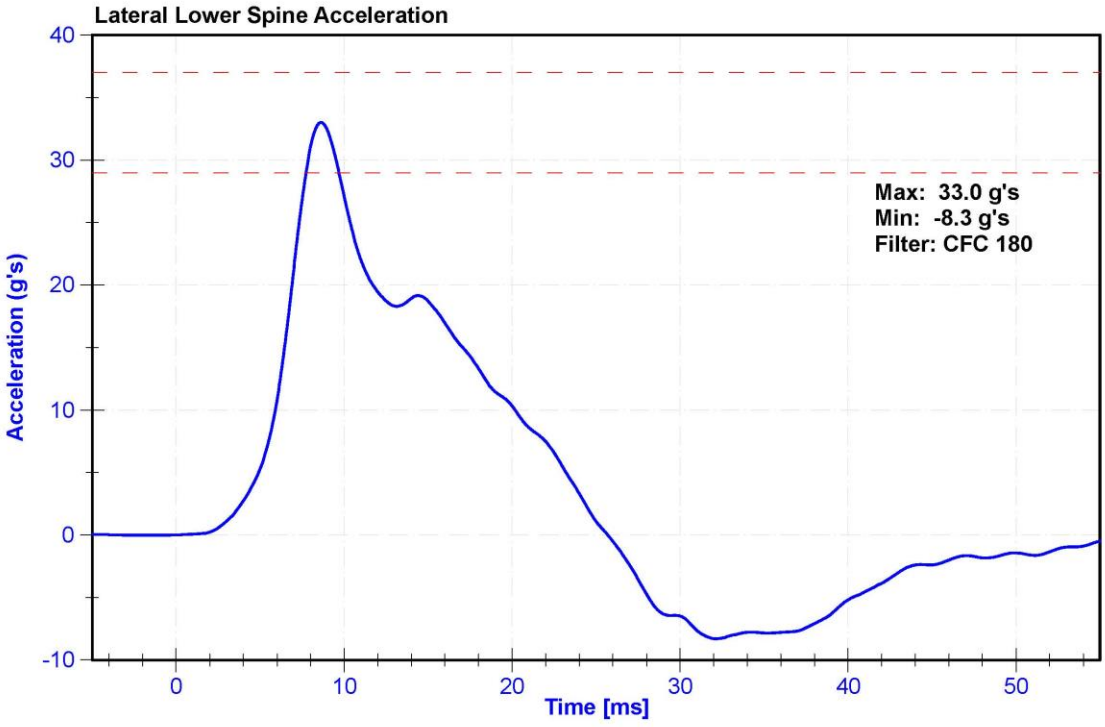

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 31.5 mm
Min: -0.0 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 27.4 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 32.3 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: 37.8 g's
Min: -8.9 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
50
40
30
20
10
0
-10
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 33.0 g's
Min: -8.3 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50

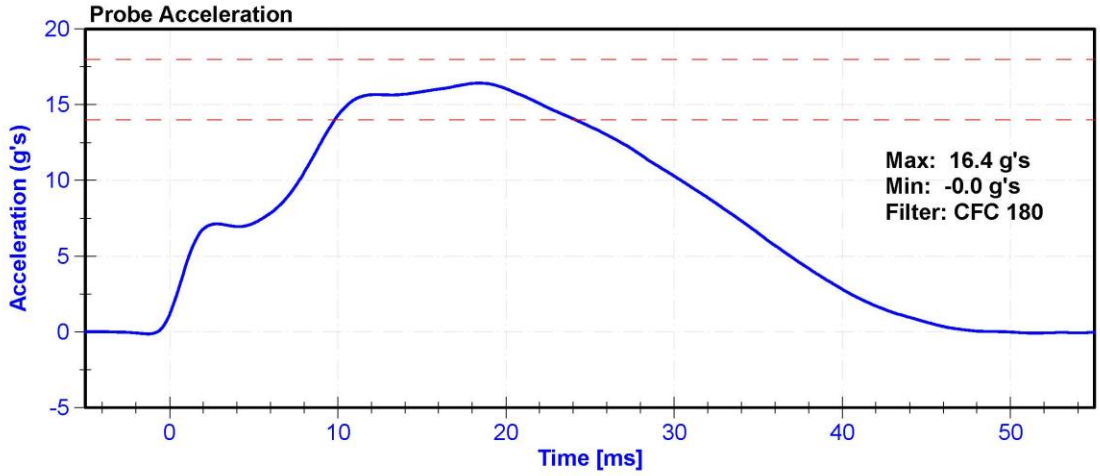
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

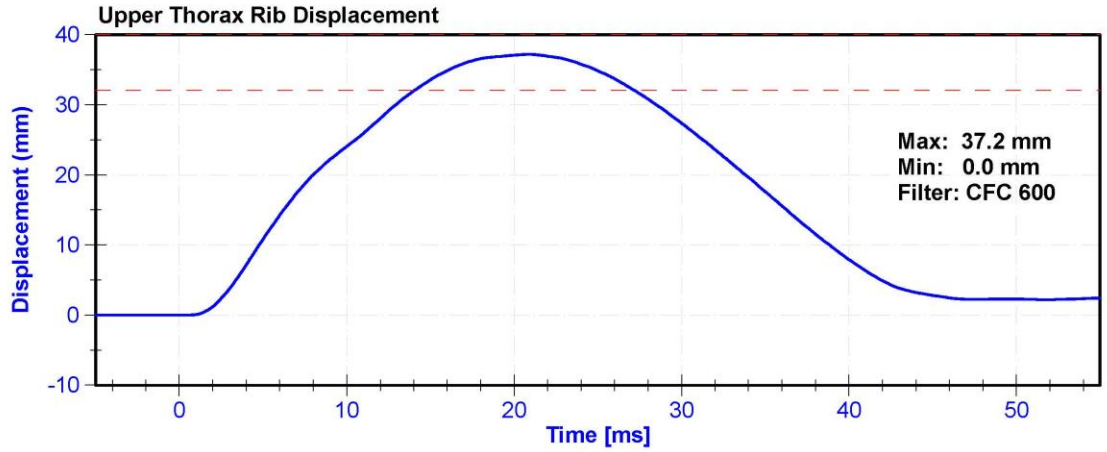
Results

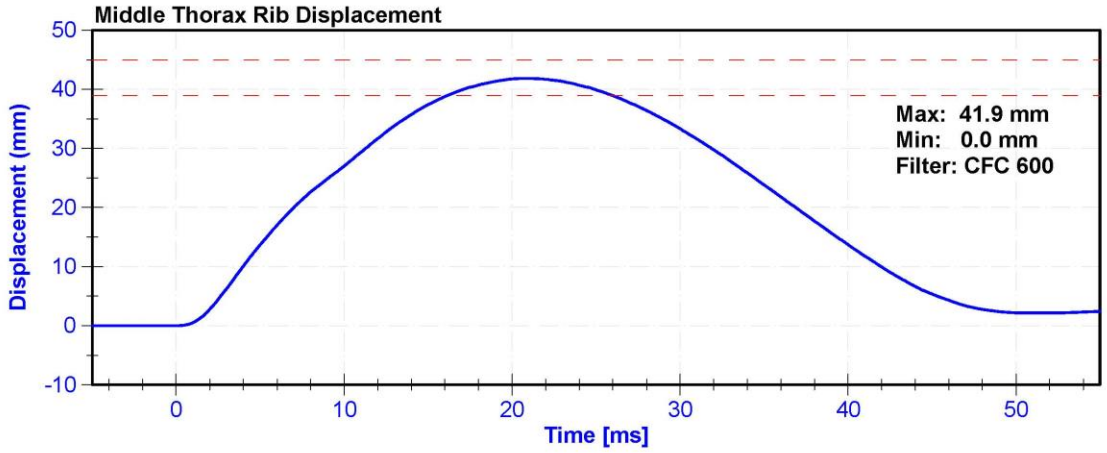
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	29.4	Pass
Velocity	4.2	4.4	m/s	4.35	Pass
Probe Acceleration	14	18	g's	16.4	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.8	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.5	Pass
Upper Thorax Rib Deflection	32	40	mm	37.2	Pass
Middle Thorax Rib Deflection	39	45	mm	41.9	Pass
Lower Thorax Rib Deflection	35	43	mm	38.2	Pass

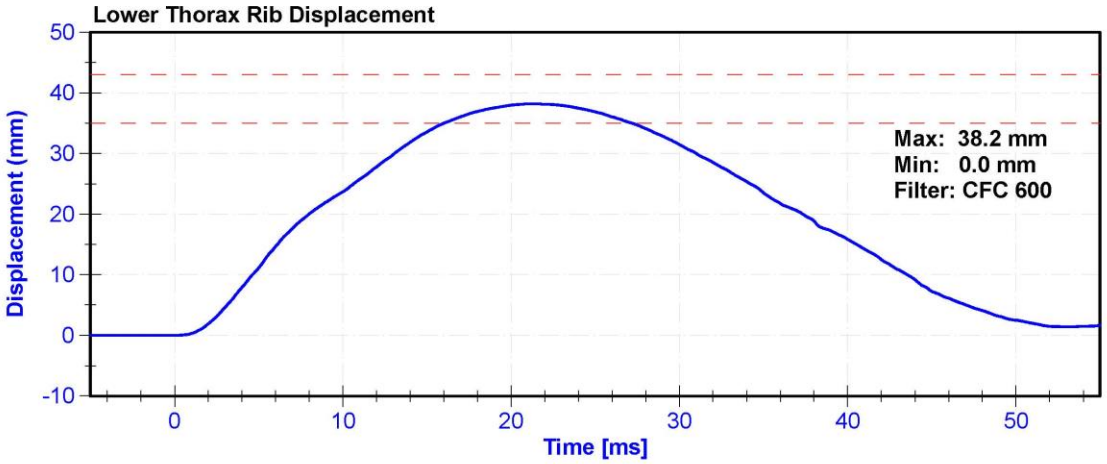
Transducer Calibrations

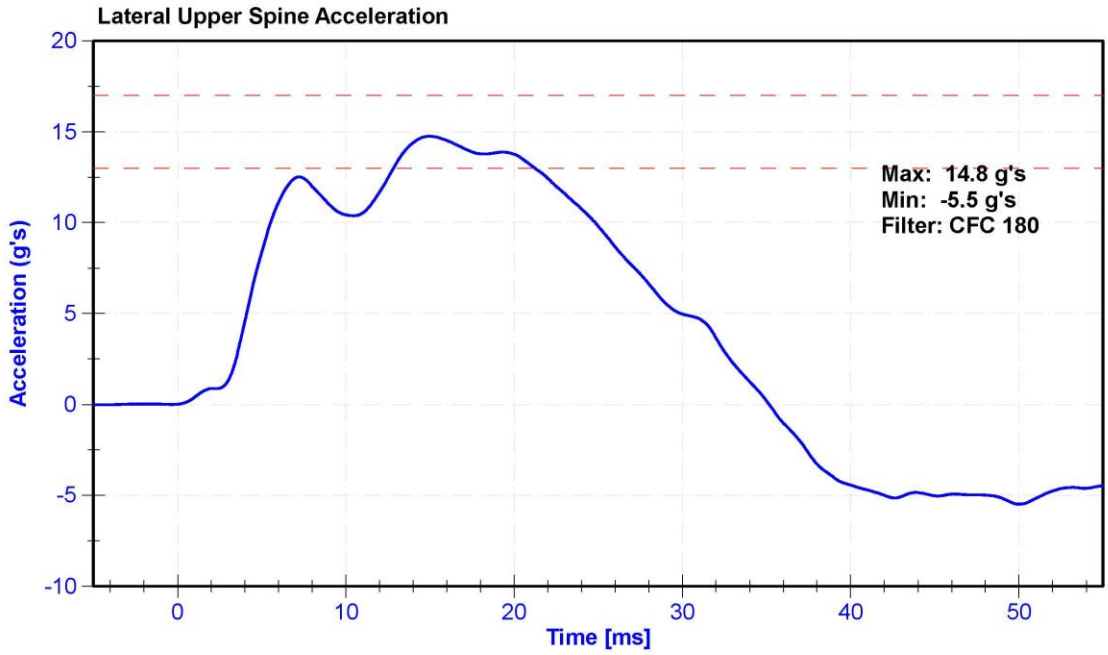
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	4/9/2019	10/8/2019
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51699	4/9/2019	10/8/2019
Upper Thorax Rib Potentiometer	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

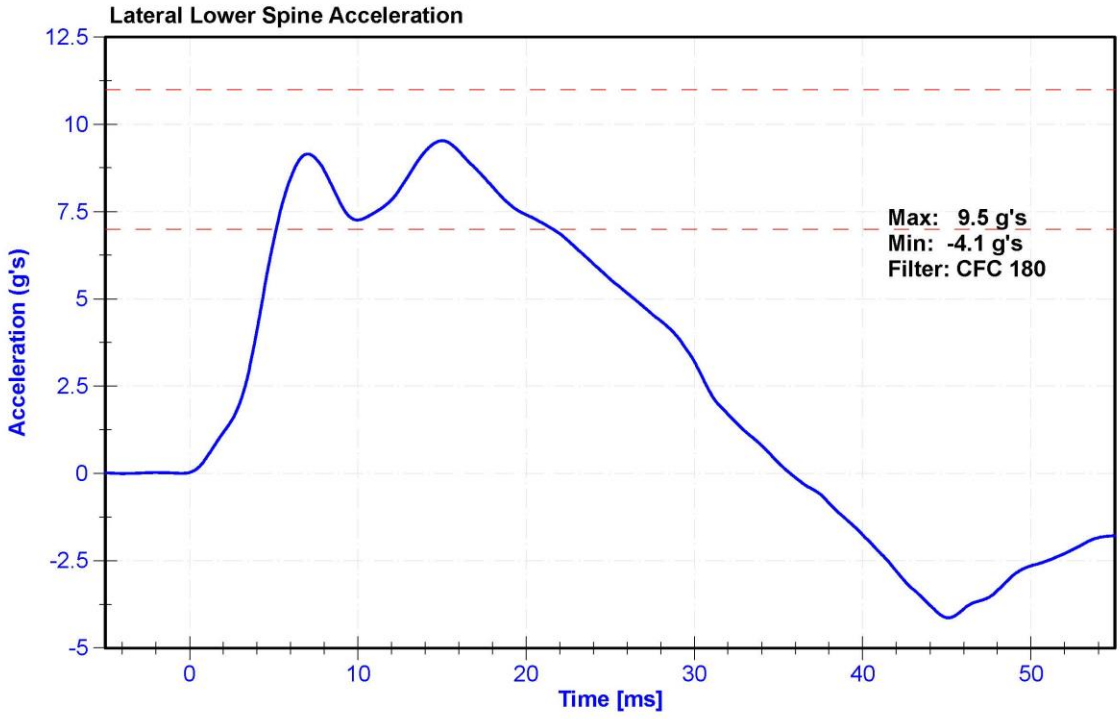



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.2 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.9 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 38.2 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 14.8 g's
Min: -5.5 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: 9.5 g's
Min: -4.1 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

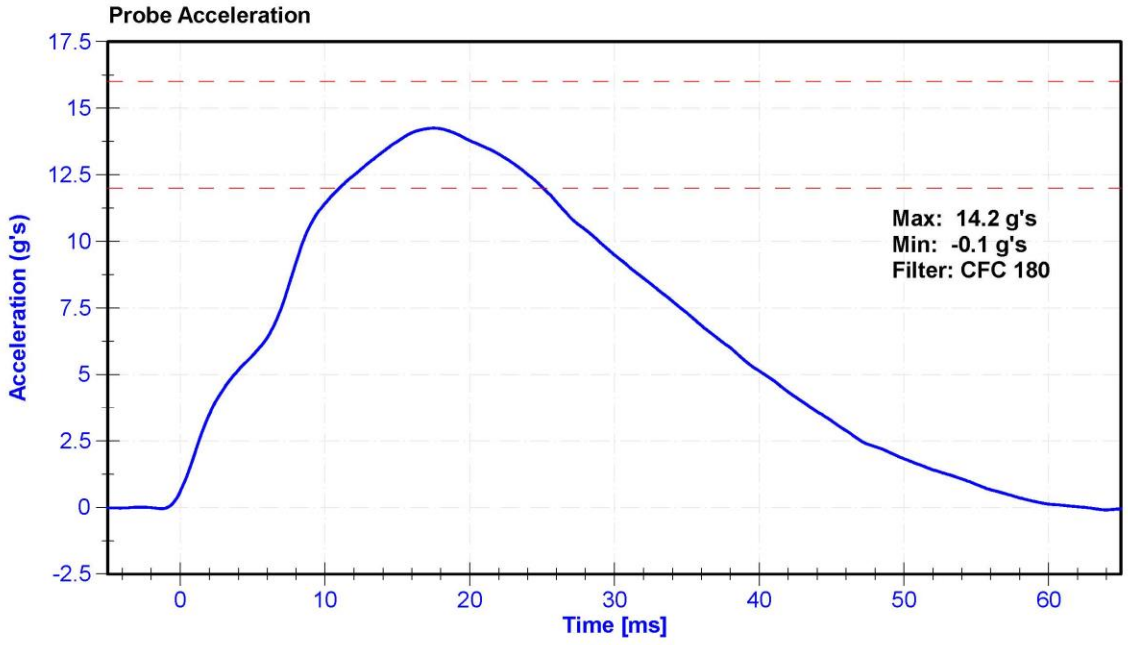
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

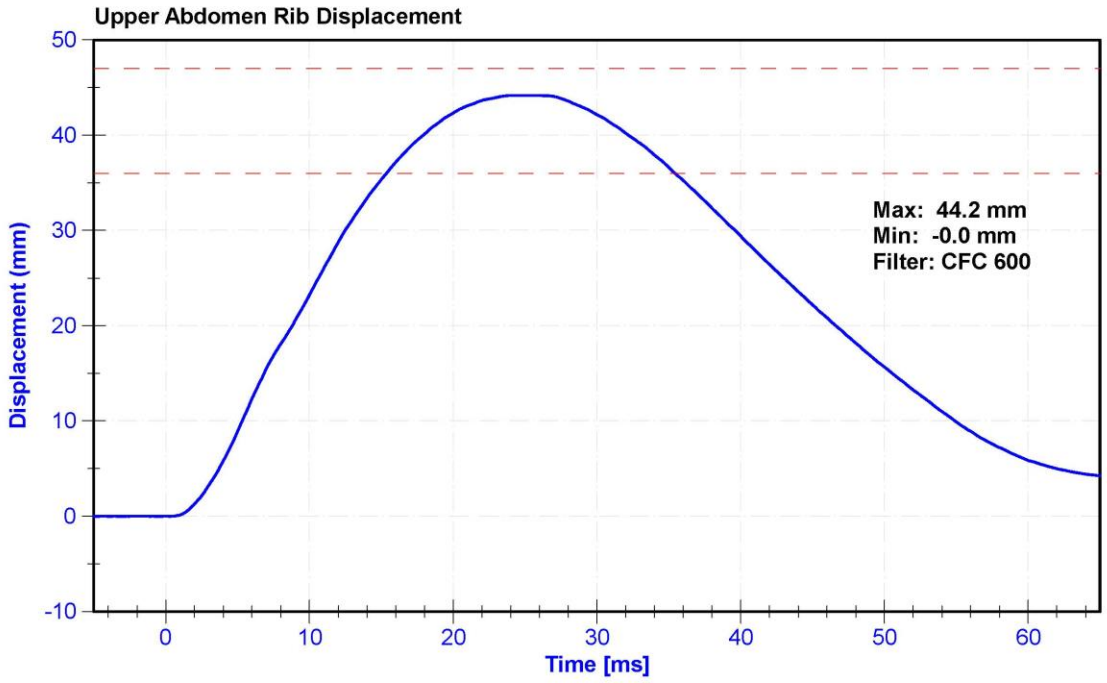
Results

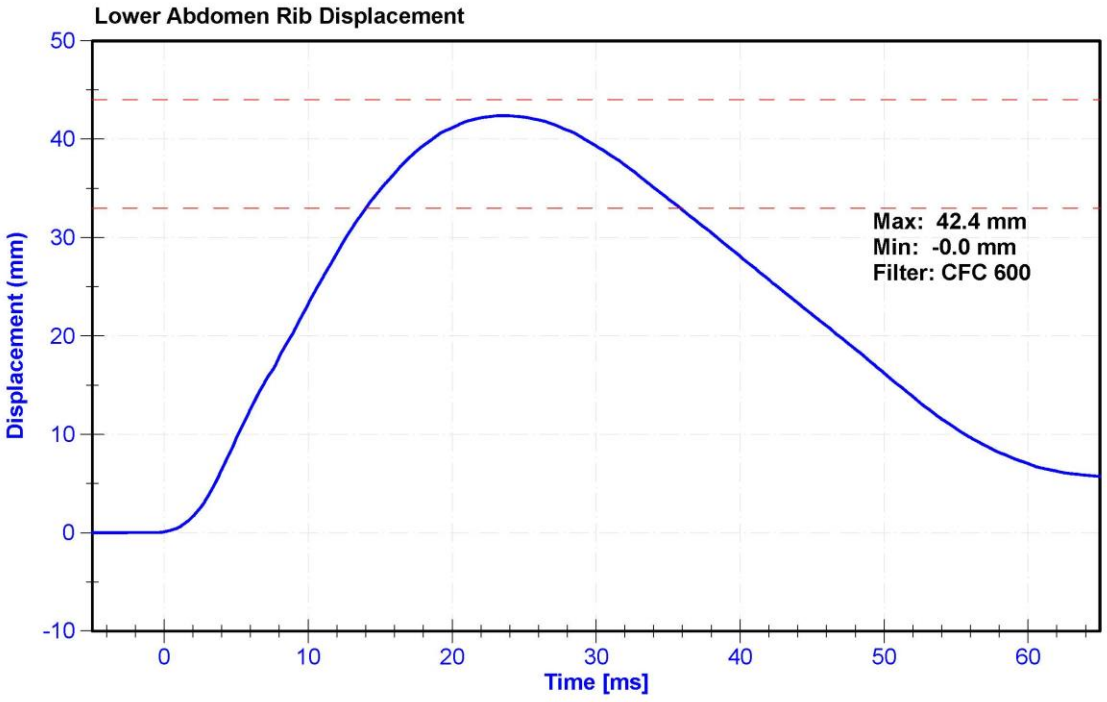
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	30.4	Pass
Velocity	4.2	4.4	m/s	4.36	Pass
Probe Acceleration	12	16	g's	14.2	Pass
Lateral Lower Spine Acceleration	9	14	g's	9.4	Pass
Upper Abdomen Rib Deflection	36	47	mm	44.2	Pass
Lower Abdomen Rib Deflection	33	44	mm	42.4	Pass

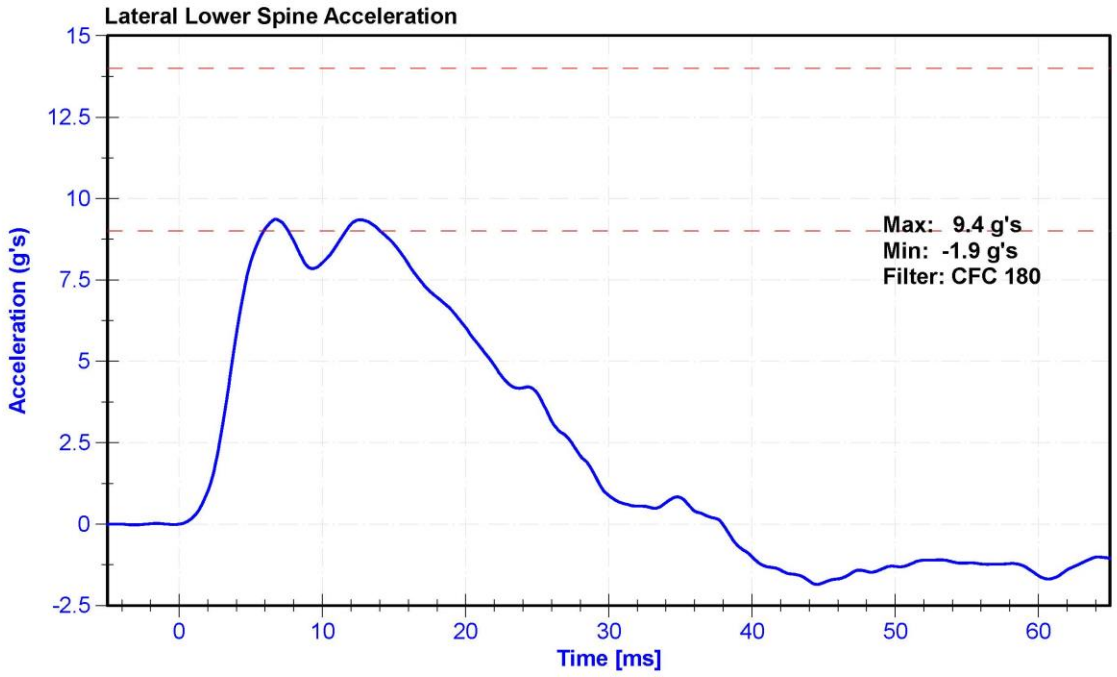
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51699	4/9/2019	10/8/2019
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: 44.2 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 42.4 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: 9.4 g's
Min: -1.9 g's
Filter: CFC 180

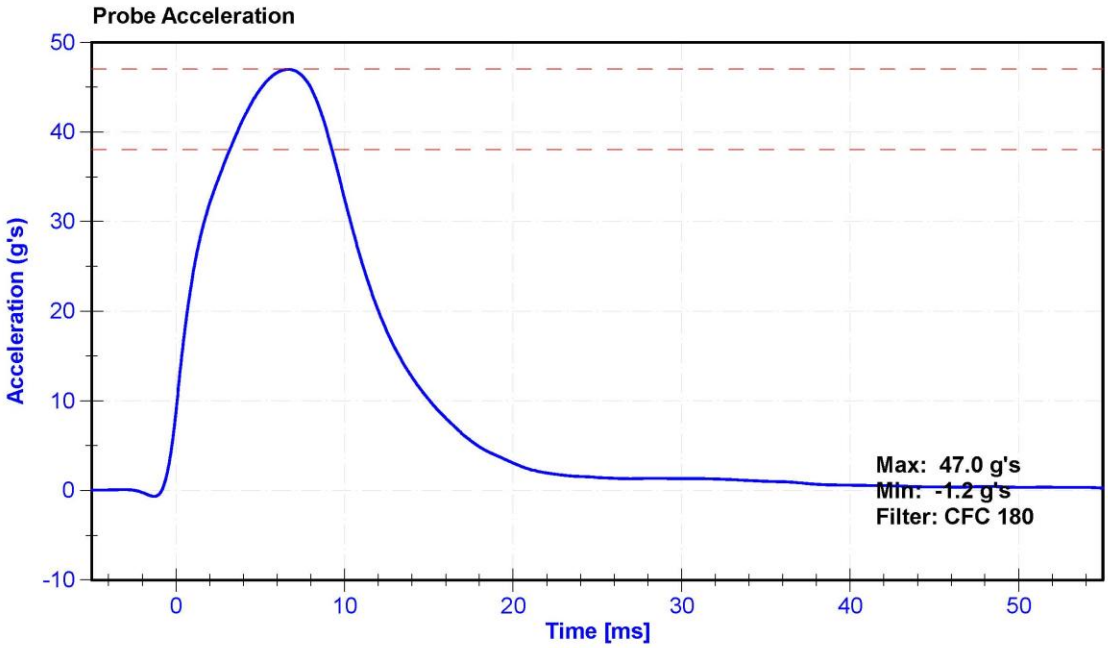
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

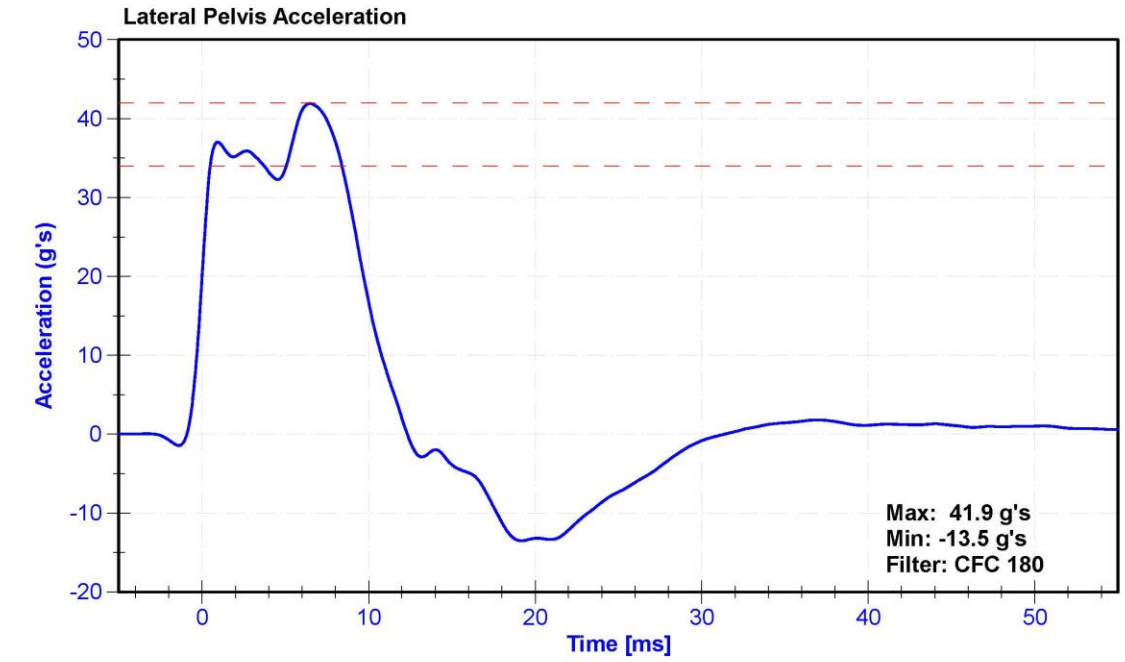
Results

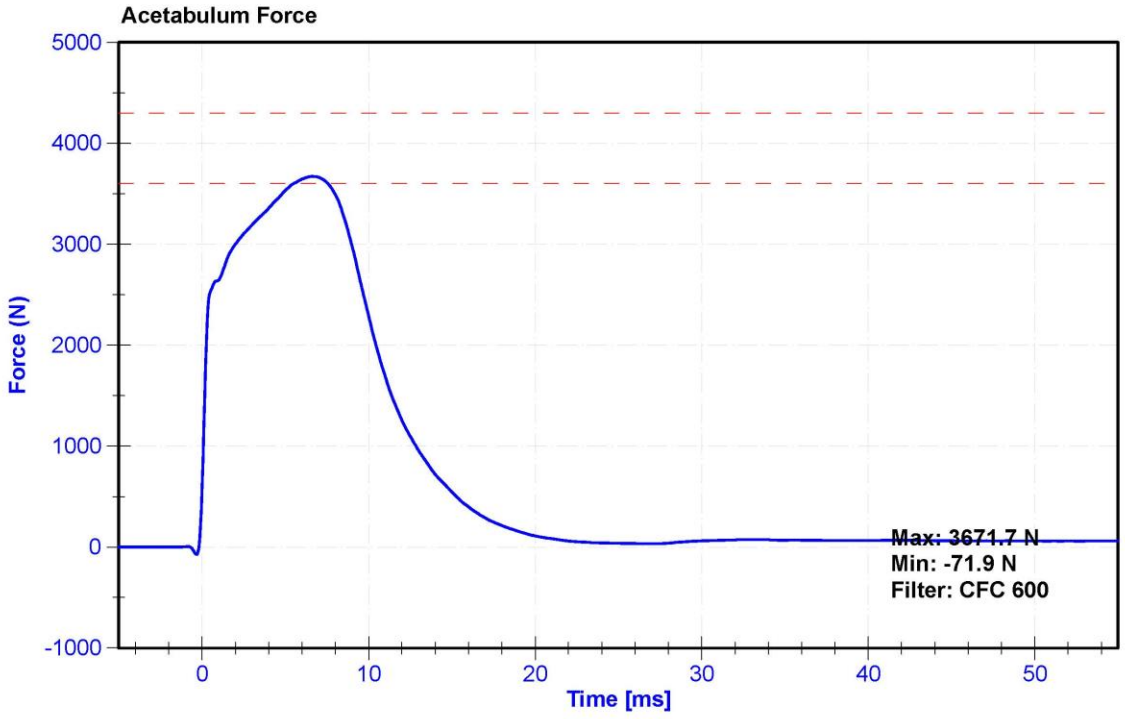
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	36.7	Pass
Velocity	6.6	6.8	m/s	6.68	Pass
Probe Acceleration	38	47	g's	47.0	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.9	Pass
Acetabulum Force	3600	4300	N	3671.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51875	4/11/2019	10/10/2019
Acetabulum Load Cell	Denton 3249J	LC-4986Fy	6/4/2018	6/4/2019
Certification Plug	SACO	11626	10/4/2016	N/A
Crash Test Plug	SACO	12351	3/23/2018	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: 41.9 g's
Min: -13.5 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: 3671.7 N
Min: -71.9 N
Filter: CFC 600

DB 8012 Cert 2
4/30/19

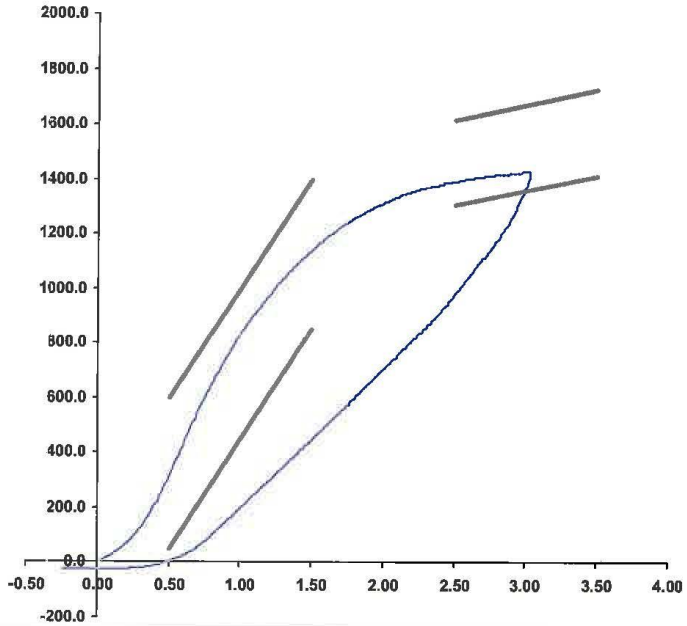
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 11626
Test Number 3169
Report Number 3162
Test Date 10/4/2016 2:19:23 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	318.76	50.00	600.00
Force @ 1.5 mm (N)	1,141.15	850.00	1,400.00
Force @ 2.5 mm (N)	1,393.84	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,429.53	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 04-Oct-16
SACO Research

By : DC Date : 10/4/16

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

DG8012
Crash 4/30/19

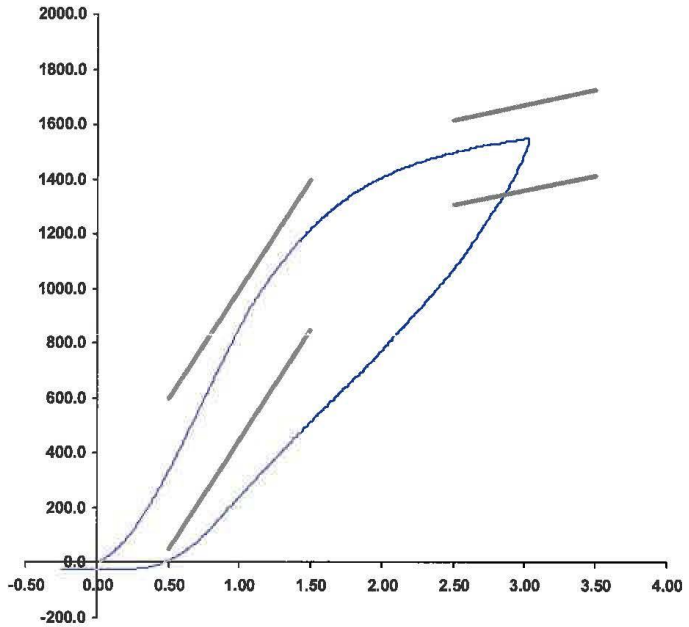
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12351
Test Number 6736
Report Number 6751
Test Date 3/23/2018 8:43:59 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	336.77	50.00	600.00
Force @ 1.5 mm (N)	1,222.17	850.00	1,400.00
Force @ 2.5 mm (N)	1,498.61	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,550.58	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 23-Mar-18
SACO Research

By : DC Date : 3/23/18

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

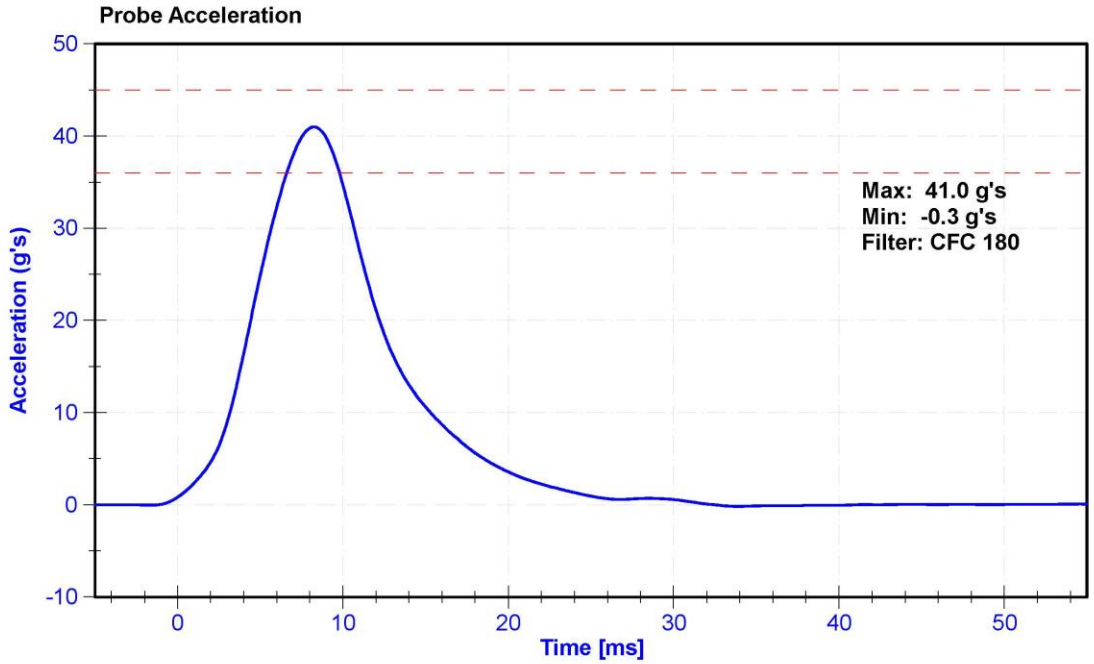
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K.Brogan

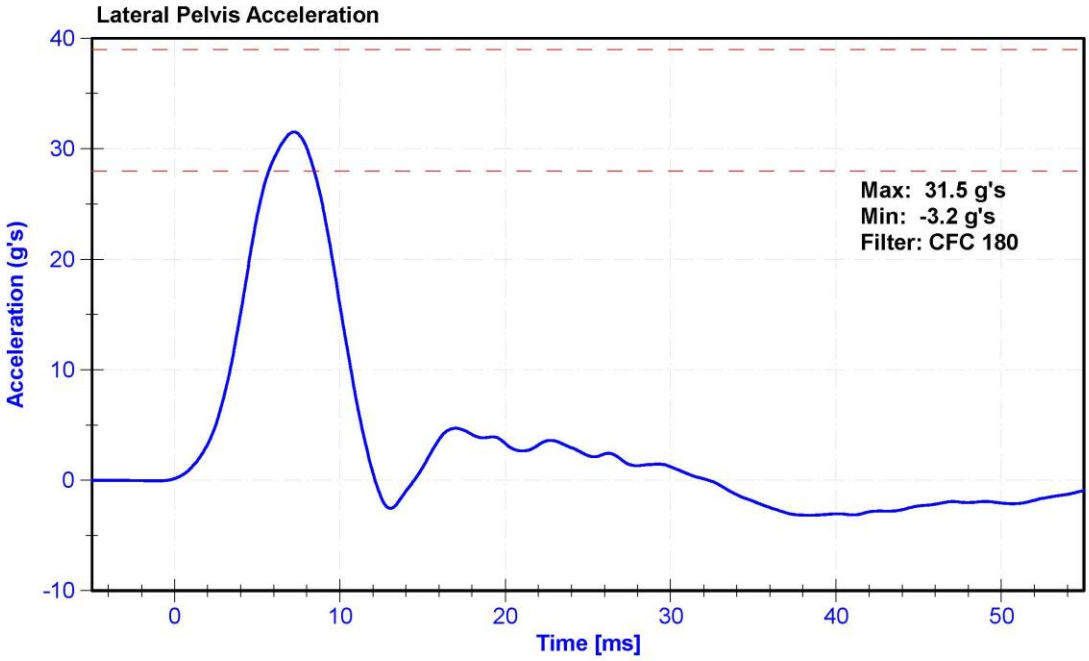
Results

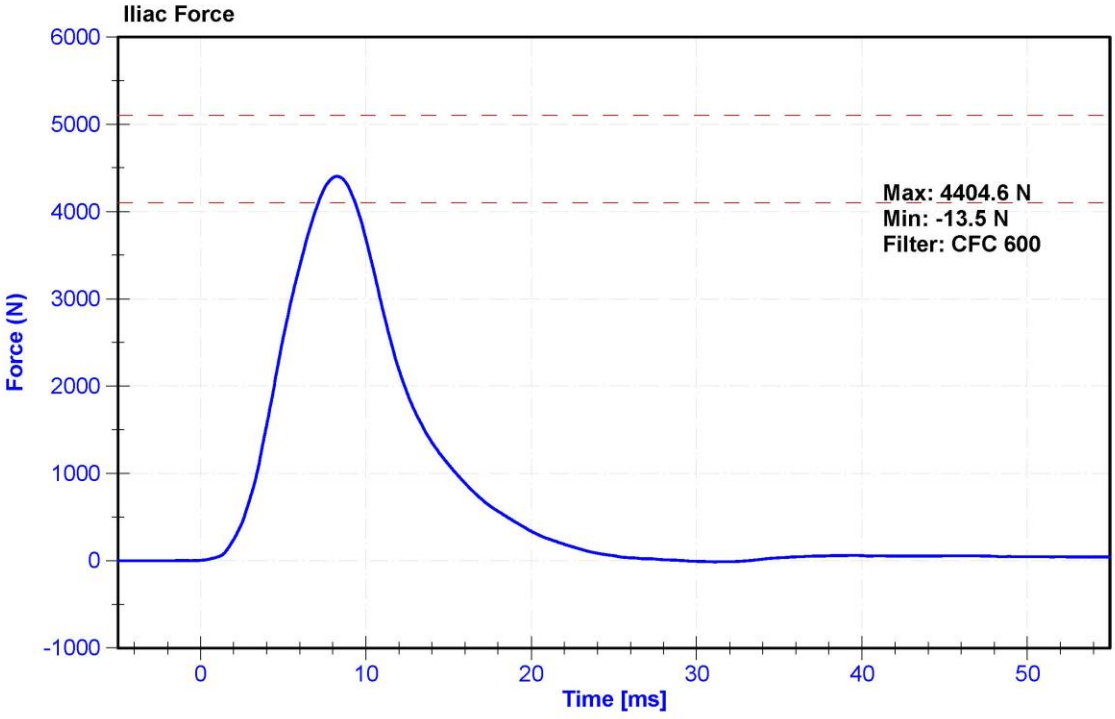
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	30.3	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	36	45	g's	41.0	Pass
Lateral Pelvis Acceleration	28	39	g's	31.5	Pass
Iliac Force	4100	5100	N	4404.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51875	4/11/2019	10/10/2019
Iliac Load Cell	DENTON 3228J	LC-279Fy	10/4/2018	10/4/2019




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 31.5 g's
Min: -3.2 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4404.6 N
Min: -13.5 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	4/9/2019
		Y	AC-P58911	ENDEVCO	4/9/2019
		Z	AC-P58776	ENDEVCO	4/9/2019
	Redundant	X	AC-P58887	ENDEVCO	4/9/2019
		Y	AC-P58888	ENDEVCO	4/9/2019
		Z	AC-P51734	ENDEVCO	4/9/2019
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	4/9/2019
		Y	AC-P51927	ENDEVCO	4/9/2019
		Z	AC-P51269	ENDEVCO	4/9/2019
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	4/11/2019
			Y	AC-P83432	ENDEVCO	4/11/2019
			Z	AC-P83319	ENDEVCO	4/11/2019
		Redundant	X	AC-P80334	ENDEVCO	4/11/2019
			Y	AC-P63841	ENDEVCO	4/11/2019
			Z	AC-P83322	ENDEVCO	4/11/2019
Displacement Potentiometers	Thoracic Rib	Upper	Y	DS-2165GFE	Servo	5/15/2018
		Middle	Y	DS-45 GFE	Servo	10/12/2018
		Lower	Y	DS-011GFE	Servo	10/12/2018
	Abdominal Rib	Upper	Y	DS-008GFE	Servo	10/11/2018
		Lower	Y	DS-1774GFE	Servo	10/12/2018
Lower Spine Accelerometers (T12)			X	AC-P45019	ENDEVCO	4/9/2019
			Y	AC-P51699	ENDEVCO	4/9/2019
			Z	AC-P51685	ENDEVCO	4/9/2019
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)				12278	SACO	3/15/2018
Pelvis Plug (non-struck side)				-	-	-

Table 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	AC-A247206	MSI 1201-1000	2/22/2019
	Vehicle Center of Gravity	Y	AC-A280874	MSI 1201-1000	3/21/2019
	Vehicle Center of Gravity	Z	AC-A281034	MSI 1201-1000	3/21/2019
2	Right Sill at Front Seat	X	AC-A255840	MSI 1201-1000	1/17/2019
	Right Sill at Front Seat	Y	AC-A255844	MSI 1201-1000	1/17/2019
	Right Sill at Front Seat	Z	AC-A255859	MSI 1201-1000	1/17/2019
3	Right Sill at Rear Seat	X	AC-A262918	MSI 1201-1000	3/19/2019
	Right Sill at Rear Seat	Y	AC-A262919	MSI 1201-1000	3/19/2019
	Right Sill at Rear Seat	Z	AC-A262921	MSI 1201-1000	3/19/2019
4	Left Sill at Front Door	Y	AC-A280369	MSI 1201-1000	3/6/2019
5	Left Sill at Rear Door	Y	AC-A280310	MSI 1201-1000	3/21/2019
6	Left A-Post Lower	Y	AC-A280187	MSI 1201-1000	11/13/2018
7	Left A-Post Middle	Y	AC-A280020	MSI 1201-1000	11/11/2018
8	Left B-Post Lower	Y	AC-A280200	MSI 1201-1000	11/13/2018
9	Left B-Post Middle	Y	AC-A209366	MSI 1201-1000	2/22/2019
10	Front Seat Track	Y	AC-A280828	MSI 1201-1000	11/22/2018
11	Rear Seat Track or Structure	Y	AC-A280850	MSI 1201-1000	11/21/2018
12	Right Rear Occ. Compartment	Y	AC-A281033	MSI 1201-1000	3/15/2019
13	Engine Block	X	AC-A250367	MSI 1201-1000	3/11/2019
	Engine Block	Y	AC-A250374	MSI 1201-1000	3/11/2019
14	Rear Floorpan Above Axle	X	AC-A262055	MSI 1201-1000	3/22/2019
	Rear Floorpan Above Axle	Y	AC-A280311	MSI 1201-1000	3/22/2019
	Rear Floorpan Above Axle	Z	AC-A280873	MSI 1201-1000	3/22/2019

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