REPORT NUMBER: SINCAP-CAL-19-004

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

KIA Motors Mexico S.A. de C.V.
2019 KIA Forte
Four Door Sedan

NHTSA No: M20194208

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

May 10, 2019

FINAL REPORT

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

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

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

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

Prepared by: _____ Date: May 10, 2019
Vincent Paolini, Test Engineer

Approved by: Vanessa Hansen Date: May 10, 2019
Vanessa Hansen, Test Engineer

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-19-004	***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 KIA Forte four door sedan NHTSA No.: M20194208	***5. Report Date*** May 10, 2019
	6. Performing Organization Code CAL
Vanessa Hansen, Senior Test Engineer Edward Dutton , Operations Manager	***8. Performing Organization Report No.*** CAL-DOT-2019-004
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 February 21, 2019 - May 10, 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 KIA Forte four door sedan in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the generation of consumer information on vehicle side crash protection. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on February 21, 2019.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.87 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 203 mm located at level 2. 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	153.200
Maximum Thoracic Rib Deflection	mm	44	27.372
Total Abdominal Force	N	2500	1255.285
Pubic Symphysis Force	N	6000	1444.748

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC_{36})	N/A	1000	286.480
Lower Spine Resultant Acceleration	G	82	88.955
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3271.620
Maximum Thoracic Rib Deflection	mm	38*	41.925
Maximum Abdominal Rib Deflection	mm	45*	46.941

* *Proposed IARV*

The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.

17. Key Words New Car Assessment Program (NCAP) Side Impact MDB ES-2re SID-IIs	***18. Distribution Statement*** Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave. SE Washington, D.C. 20590 e-mail: tis@nhtsa.dot.gov FAX: 202-493-2833

19. Security Class. (of this report)	***20. Security Class. (of this page)***	***21. No. of Pages***	***22. Price***
UNCLASSIFIED	UNCLASSIFIED	192	

TABLE OF CONTENTS

SECTION 1

TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2019 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number DTNH22-14-D-00352. The purpose of this test is to generate comparative side impact performance in a 2019 KIA Forte four door sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure dated October 2015.

SECTION 2

SUMMARY OF TEST RESULTS

A 2019 KIA Forte four door sedan was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 61.87 km/h. The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by the Calspan Corporation's Transportation Test Operations Center in Buffalo, New York on February 21, 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	153.200
Maximum Thorax Rib Deflection	mm	44	27.372
Combined Abdominal Force	N	2500	1255.285
Pubic Symphysis Force	N	6000	1444.748

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC36)		1000	286.480
Lower Spine (T12) Resultant Acceleration	G	82	88.955
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3271.620
Maximum Thoracic Rib Deflection	mm	38*	41.925
Maximum Abdominal Rib Deflection	mm	45*	46.941

*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 – 300
3. The Rear Passenger's Maximum Thoracic Rib Deflection and Maximum Abdominal Rib Deflection exceeded the IARV

Data Anomalies:

The following channel was questionable for

- Left B-Pillar Lower Y Acceleration,Exceeded calibration range and saturated at 7.7 ms
- Left B-Pillar Middle Y Acceleration,Exceeded calibration range at 8.4 ms
- Right Rear Sill Y Acceleration,Exceeded calibration range at 14.1 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 KIA Forte four door sedan NHTSA No.: M20194208
Test Program: NCAP Side MDB Impact Test Test Date: 2/21/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20194208	Traction Control System (TCS)	Yes
Model Year	2019	Auto-Leveling System	No
Make	KIA	Automatic Door Locks (ADL)	Yes
Model	Forte	Power Window Auto-Reverse	No
Body Style	Four Door Sedan	Other Optional Feature	-
VIN	3KPF24AD7KE024125	Driver Front Air bag	Yes
Body Color	Blue	Driver Curtain Air bag	Yes
Odometer Reading (km/mi)	181 miles	Driver Head/Torso Air bag	No
Engine Displacement (L)	2.0	Driver Torso Air bag	No
Type/No. Cylinders	I4	Driver Torso/Pelvis Air bag	Yes
Engine Placement	Transverse	Driver Pelvis Air bag	No
Transmission Type	Automatic	Driver Knee Air bag	No
Transmission Speeds	IVT	Rear Pass. Curtain Air bag	Yes
Overdrive	Yes	Rear Pass. Head/Torso Air bag	No
Final Drive	Front Wheel Drive	Rear Pass. Torso Air bag	No
Roof Rack	No	Rear Pass. Torso/Pelvis Air bag	No
Sunroof/T-Top	No	Rear Pass. Pelvis Air bag	No
Running Boards	No	Driver Seat Belt Pretensioners	Yes
Tilt Steering Wheel	Yes	Rear Pass. Seat Belt Pretensioners	No
Power Seats	No	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Rear Pass. Load Limiter	No
		Other Safety Restraint	-

Does owner's manual provide instructions to turn off automatic door locks? No

DATA FROM CERTIFICATION LABEL

Manufactured By	KIA Motors Mexico S.A. de C.V.	GVWR (kg)	1720
Date of Manufacture	09/18	GAWR Front (kg)	990
Vehicle Type	Passenger Car	GAWR Rear (kg)	950

VEHICLE SEATING AND WEIGHT CAPACITY DATA

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

VEHICLE SEAT TYPE

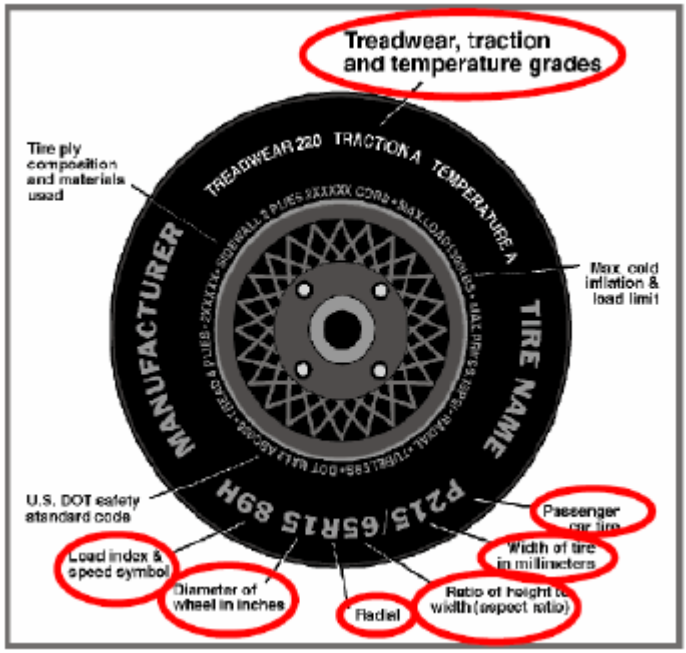
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front Seat	X					X	
Rear or Second Row Seat			X		X		
Third Row seat							

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

Test Vehicle:	2019 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019

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)	230	230
Recommended Tire Size	205/55R16	205/55R16
Tire Size on Vehicle	205/55R16	205/55R16
Tire Manufacturer	Kumho	Kumho
Tire Model	Solus	Solus
Treadwear	500	500
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Steel, 1 Polyester, 1 Nylon	2 Steel, 1 Polyester, 1 Nylon
Load Index/Speed Symbol	91H	91H
Tire Material	Rubber	Rubber
DOT Safety Code Left	000 LMYAY1 3518	000 LMYAY1 3518
DOT Safety Code Right	000 LMYAY1 3518	000 LMYAY1 3518

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

Test Vehicle: 2019 KIA Forte four door sedan NHTSA No.: M20194208
Test Program: NCAP Side MDB Impact Test Test Date: 2/21/2019

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	234	230	240	242
Tire Placard	kPa	230	230	230	230
Owner's Manual	kPa	230	230	230	230
As Tested	kPa	230	230	230	230

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	400	244		436	319		438	320	
Right	kg	389	238		403	278		398	287	
Ratio	%	62	38		58	42		58	42	
Totals	kg	789	482	1271	839	597	1436	836	607	1443

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1271	(A)
Sum of Actual Weight of 1 ES2re and 1 P572 ATD (SID-IIs)	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	44.8	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	1442.8	(A+B+C)

Does the measured As Test Vehicle Weight lie within the required weight range

(i.e. Calculated Test Vehicle Target Weight – 4.5 kg to – 9 kg)? [X] **Yes** [ ] **No**

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	Fully Loaded	As Tested	Meets Requirement**
LF	mm	673	670	Yes
RF	mm	678	678	Yes
RR	mm	664	660	Yes
LR	mm	649	648	Yes
Vehicle CG (Aft of Front Axle)	mm	1136	1123	
Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline)	mm	40	40	

**** 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 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	5
Air Pump	1
Tail Lights	5
Non Struck side windows	8
Rear Bumper and Beam	10
Ballast / Equipment Added	0

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

Test Vehicle:	2019 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019

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	17.0	14.3	15.7
Front Passenger Seat	17.6	14.8	16.2
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	15.7	25	Max	-	-	-
			Mid	15	25	35
			Min	-	-	-
Front Passenger Seat	16.2	25	Max	-	-	-
			Mid	15	25	35
			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 KIA Forte four door sedan NHTSA No.: M20194208
Test Program: NCAP Side MDB Impact Test Test Date: 2/21/2019

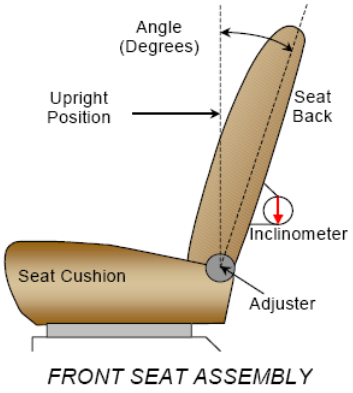
SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forwardmost Position	
	mm	Detents*	mm	Detent*
Driver Seat	240	38 (0–37)	120	19
Front Passenger Seat	240	38 (0-37)	120	19
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat	FIXED	FIXED	FIXED	FIXED
Non-Struck Side Rear Seat	FIXED	FIXED	FIXED	FIXED
Rear Center Seat*	FIXED	FIXED	FIXED	FIXED

**if applicable*

SEAT BACK ANGLE ADJUSTMENT

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



FRONT SEAT ASSEMBLY

Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degrees	Detents*
Driver Seat w/ Seated Dummy	59.3	30	1.9	7
Front Passenger Seat	59.3	30	1.9	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 KIA Forte four door sedan NHTSA No.: M20194208
Test Program: NCAP Side MDB Impact Test Test Date: 2/21/2019

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	3	0
Rear Seat	Fixed	Fixed

HEAD RESTRAINT ADJUSTMENT

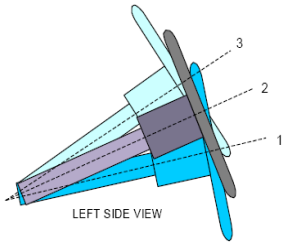
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	6	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	20.3	
Geometric Center – Position 2	23.0	
Uppermost – Position 3	25.6	
Telescoping Steering Wheel Travel		50
Test Position	23.0	25

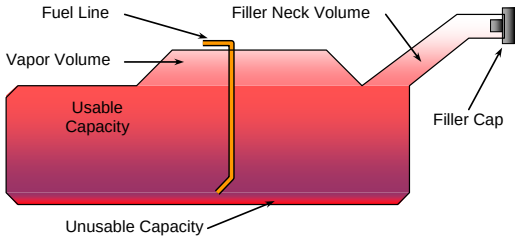


STEERING COLUMN ASSEMBLY

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 KIA Forte four door sedan NHTSA No.: M20194208
Test Program: NCAP Side MDB Impact Test Test Date: 2/21/2019

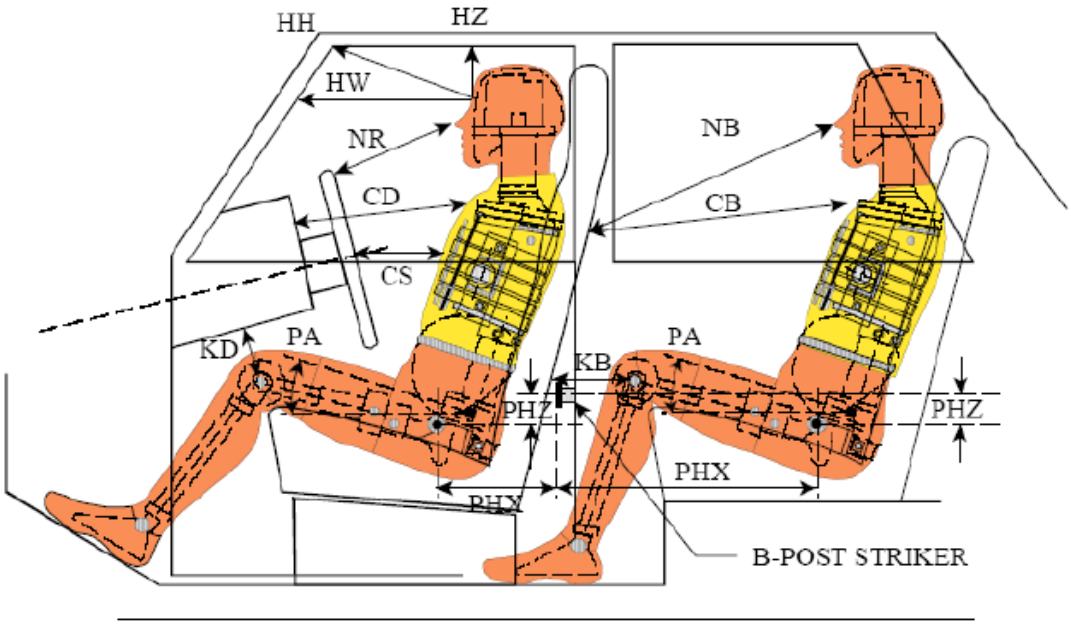
FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	53.0
Usable Capacity of "Optional Tank" (see Form No. 1)	N/A
Usable Capacity of Standard Tank (see Owner's Manual)	53.0
Usable Capacity of Optional Tank (see Owner's Manual)	N/A
93% of Usable Capacity	49.3
Actual Amount of Solvent Used in Test	49.3
1/3 of Usable Capacity	17.67

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 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019



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

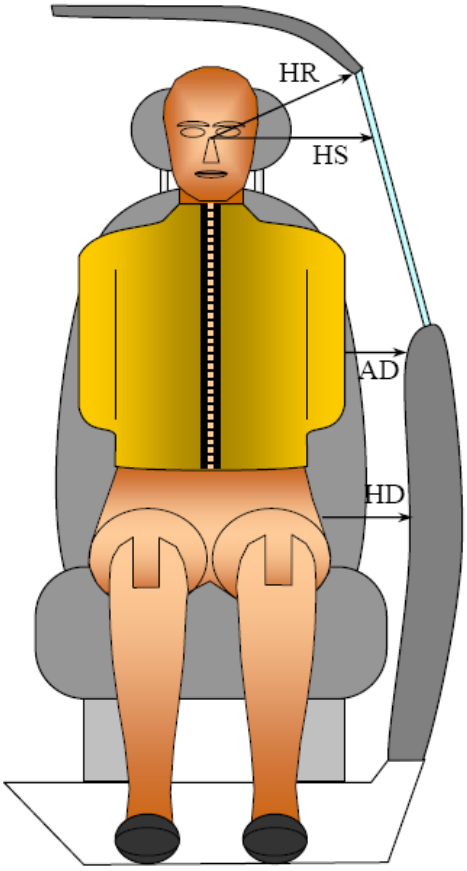
LEFT SIDE VIEW

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Description	Driver (Serial No. F034)		Passenger (Serial No. 300)	
			Length (mm)	Angle	Length (mm)	Angle
HH		Header to Header	380			
HW		Header to Windshield	653			
HZ	HZ	Head to Roof Liner	166		259	
NR	NB	Nose to Rim/Seat Back	444		560	
CD	CB	Chest to Dash/Seat Back	554		553	
CS		Chest to Steering Wheel	347			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	215	22.6	265	10.6
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	195	24.6	265	9.8
PAX°	PAX°	Pelvic Tilt Angle X		21.6		23.3
	PAY°	Pelvic Tilt Angle Y				0.3
PHX	PHX	Hip Point to Striker (X-Axis)	175		241	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	262		267	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2019 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019



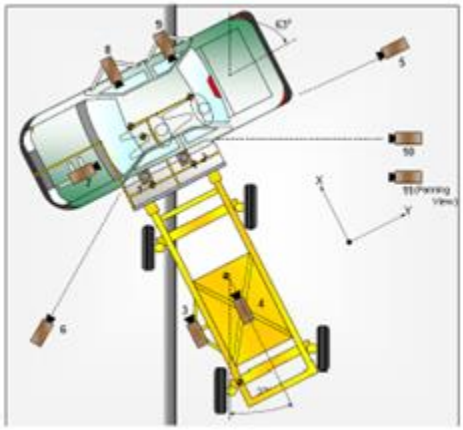
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver (Serial No. F034)	Passenger (Serial No. DG8012)
HR	Head to Side Header	mm	182	242
HS	Head to Side Window	mm	305	365
AD	Arm to Door	mm	122	167
HD	Hip Point to Door	mm	170	204

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2019 KIA Forte four door sedan NHTSA No.: M20194208
Test Program: NCAP Side MDB Impact Test Test Date: 2/21/2019



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	-292	366	-9370	12.5	1000
2	Overhead Close-up	-200	656	-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	7631	-1004	24	1000
6	Left Front	-3074	-4339	-1035	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.*

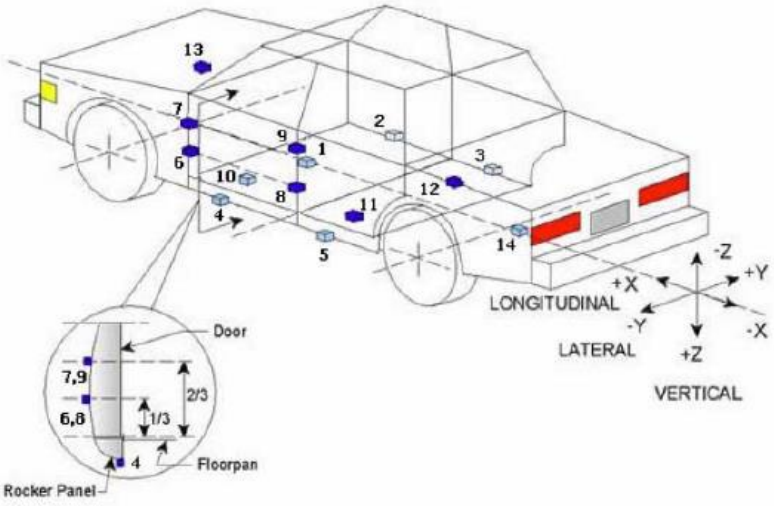
If applicable, explain why camera(s) did not operate as intended: All cameras operated normally

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 KIA Forte four door sedan NHTSA No.: M20194208
Test Program: NCAP Side MDB Impact Test Test Date: 2/21/2019



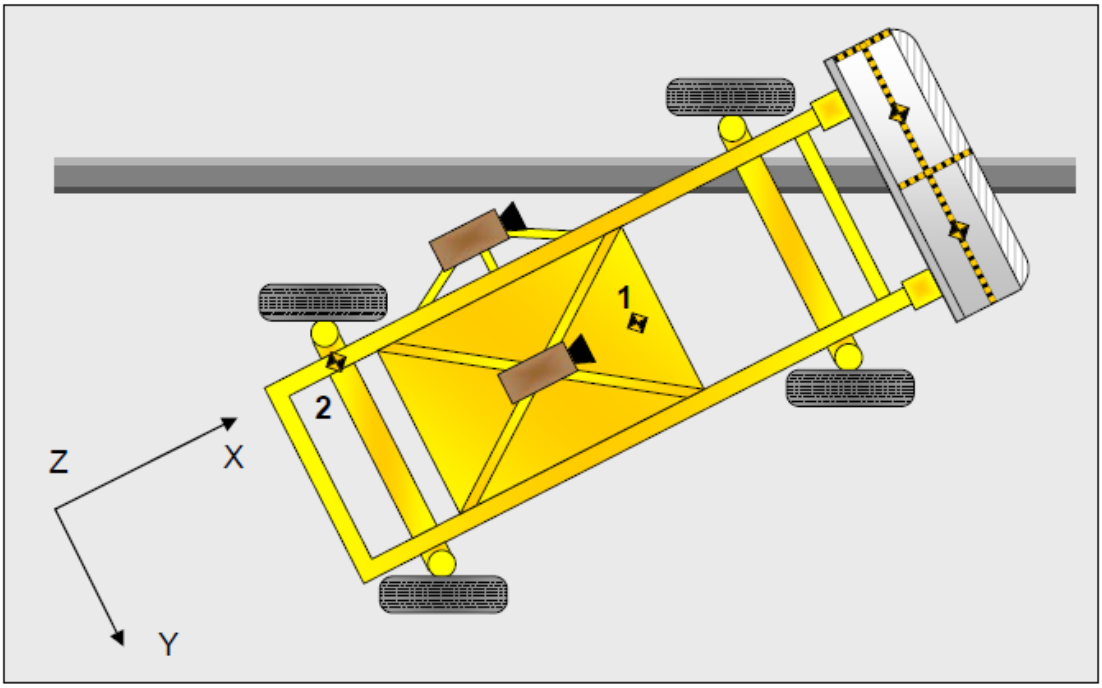
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2593	42	171
2	Right Sill at Front Seat	2828	669	340
3	Right Sill at Rear Seat	1920	669	342
4	Left Sill at Front Door	2900	-669	353
5	Left Sill at Rear Door	1902	-669	345
6	A-Post Lower	3256	-641	89
7	A-Post Middle	3199	-621	-368
8	B-Post Lower	2172	-661	-16
9	B-Post Middle	2134	-643	-366
10	Front Seat Track	2250	-556	344
11	Rear Seat Structure	1747	-361	189
12	Rt. Rear Occ. Compartment	2007	381	399
13	Engine Block	3922	218	-208
14	Rear Above Axle	1127	3	120

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 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019



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 KIA Forte four door sedan NHTSA No.: M20194208
Test Program: NCAP Side MDB Impact Test Test Date: 2/21/2019

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Air Bag	Curtain Air Bag
Top of Head	Side Headliner	Curtain Air Bag
Left Side of Head	Curtain Air Bag & Side Headliner	Curtain Air Bag
Back of Head	Side Headliner & Head Restraint	Curtain Air Bag & Center Seatback
Left Shoulder	Driver Door & Curtain Air Bag	Passenger Door
Upper Torso	Seatback & Torso/Pelvis Air Bag	Seatback & Passenger Door
Lower Torso	Seatback & Driver Door	Seatback & Passenger Door
Left Hip	Torso/Pelvis Air Bag	Seat Pan & 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	B-Pillar buckled
Sill Separation	None
Windshield Damage	None
Side Window Damage	Both windows on struck side shattered
Other Notable Effects	None

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

Test Vehicle: 2019 KIA Forte four door sedan NHTSA No.: M20194208
Test Program: NCAP Side MDB Impact Test Test Date: 2/21/2019

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	Yes	No		
Side Air bag 1 - Curtain	Yes	Yes	Yes	Yes
Side Air bag 2 - Torso/Pelvis Air bag	Yes	Yes	No	N/A
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Yes	No	N/A
Other				

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2701
Vertical Impact Reference Line (Aft of Front Axle - Intended Impact Point)	mm		410
Actual Impact Point (Aft of Frontal Axle)	mm		403
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	+7
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact Point	0

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle:	2019 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019

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

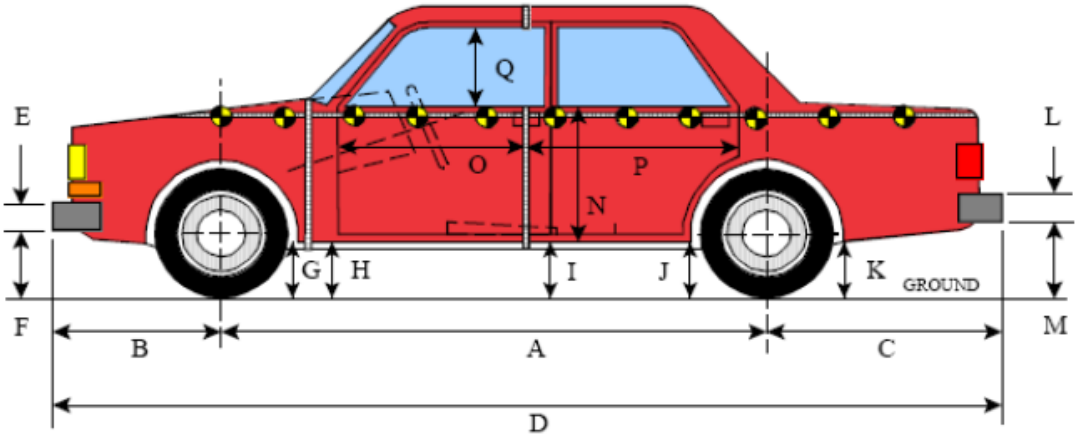
Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.10 to 62.70	61.87
Trap No. 2 Velocity (Redundant)	km/h	61.10 to 62.70	61.85
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.0
MDB Crabbed angle to MDB Forward Line of Motion	degrees	26.0 to 28.0	27.0

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Left	159
B	Top of Bumper	533	800	Left	86
C	Mid-Level	686	800	Left	92
D	Top of Stack	813	800	Left	104

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2019 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019



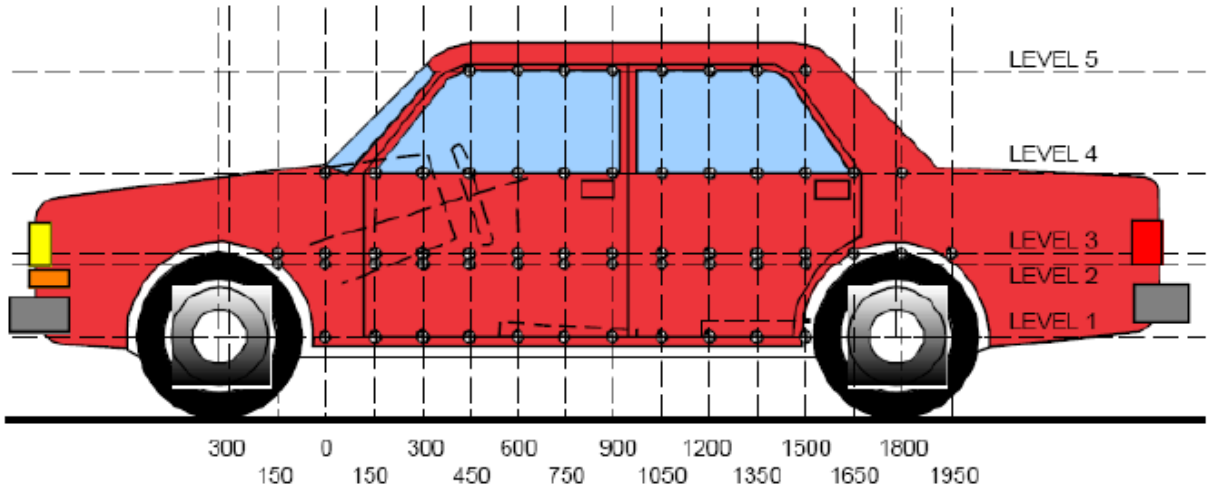
LEFT SIDE VIEW
All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3mm

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2701	2702	1
B	Front Axle to FSOV	898	903	5
C	Rear Axle to RSOV	1037	1031	-6
D	Total Length at Centerline	4637	4636	-1
E	Front Bumper Thickness	110	110	0
F	Front Bumper Bottom to Ground	414	415	1
G	Sill Height at Front Wheel Well	170	185	15
H	Sill Height at Front Door Leading Edge	150	160	10
I	Sill Height at B Pillar	169	195	26
J1	Sill Height at Rear Wheel Well	162	162	0
J2	Pinch Weld Height at Rear Wheel Well	147	146	-1
K	Sill Height Aft of Rear Wheel Well	379	382	3
L	Rear Bumper Thickness	100	100	0
M	Rear Bumper Bottom to Ground	444	455	11
N	Sill Height to Window Bottom of Front Window Sill	802	785	-17
O	Front Door Leading Edge to Impact CL	793	783	-10
P	Rear Door Trailing Edge to Impact CL	1338	1282	-56
Q	Front Window Opening	398	395	-3
R	Right Side Length	4549	4551	2
S	Left Side Length	4548	4550	2
T	Maximum Vehicle Width	1771	1617	-154

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle:	2019 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019



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	232	43	750
2	Driver Hip Point	mm	508	203	1050
3	Mid-Door	mm	642	191	1350
4	Window Sill	mm	919	141	1650
5	Window Top	mm	1364	8	1350

*window top level bent outward from original position

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

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

Test Vehicle: 2019 KIA Forte four door sedan NHTSA No.: M20194208
Test Program: NCAP Side MDB Impact Test Test Date: 2/21/2019

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

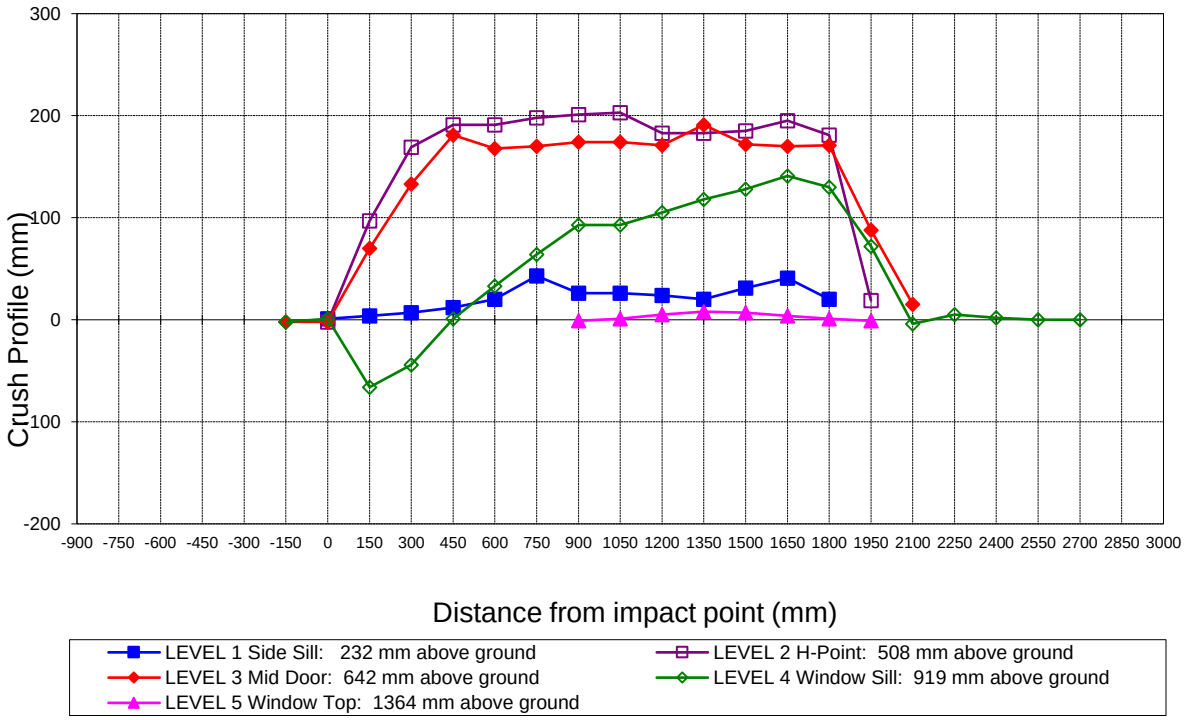
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900															
-750															
-600															
-450															
-300															
-150			892	758				894	760				-2	-2	
0	864	884	884	779		863	886	888	778		1	-2	-4	1	
150	854	875	888	789		850	778	818	855		4	97	70	-66	
300	854	875	890	804		847	706	757	848		7	169	133	-44	
450	855	876	891	816		843	685	710	815		12	191	181	1	
600	855	876	890	828		835	685	722	795		20	191	168	33	
750	854	875	889	837		811	677	719	773		43	198	170	64	
900	853	874	887	843	601	827	673	713	750	602	26	201	174	93	-1
1050	851	872	884	846	610	825	669	710	753	609	26	203	174	93	1
1200	849	870	881	845	612	825	687	710	740	607	24	183	171	105	5
1350	847	870	876	844	610	827	687	685	726	602	20	183	191	118	8
1500	845	871	873	843	606	814	686	701	715	599	31	185	172	128	7
1650	845	874	871	840	600	804	679	701	699	596	41	195	170	141	4
1800	853	880	875	838	586	833	699	704	708	585	20	181	171	130	1
1950		885	886	835	564		866	798	763	565		19	88	72	-1
2100			892	832				877	836				15	-4	
2250				825					820					5	
2400				817					815					2	
2550				807					807					0	
2700				795					795					0	
2850															
3000															

NOTE: *Pre-test measurementsare 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

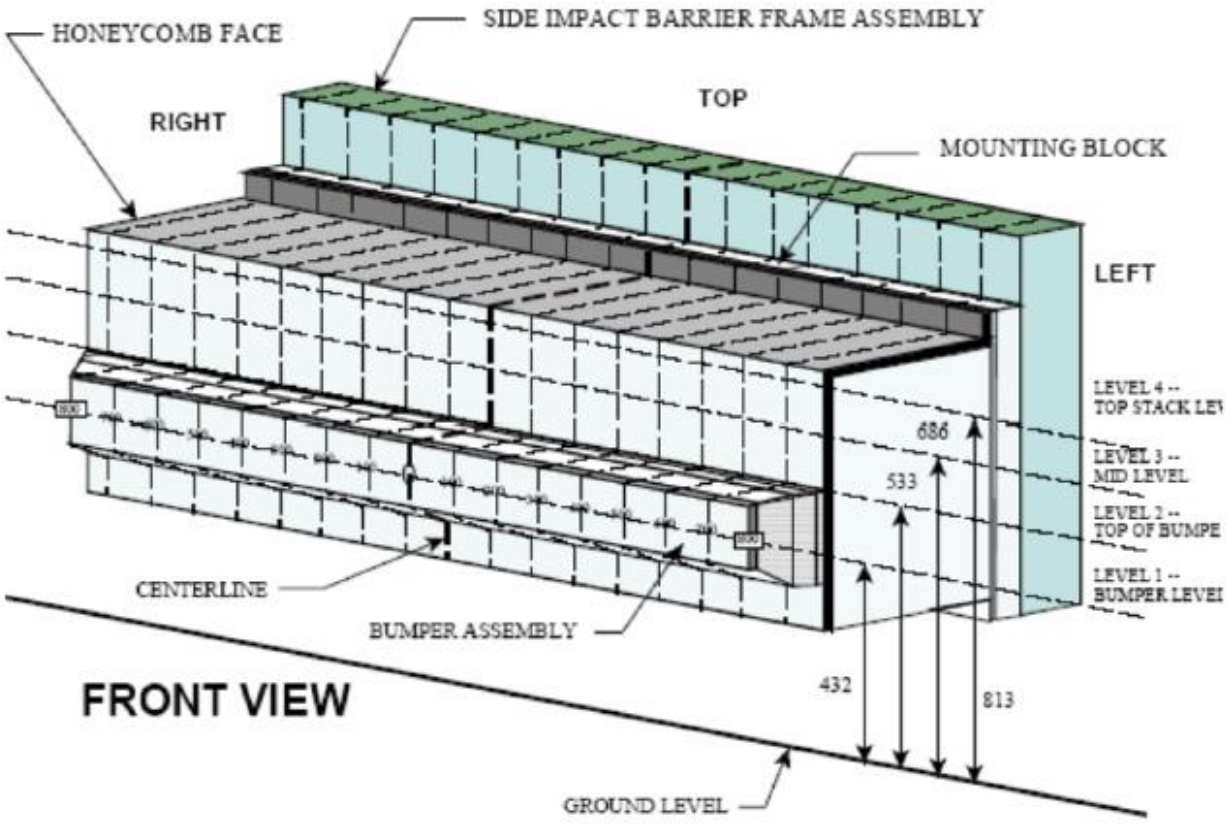
Test Vehicle:	2019 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019

Vehicle Exterior Crush Measurements - Visual Representation



DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle:	2019 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019



NOTE: Dimensions are shown in millimeters, mm

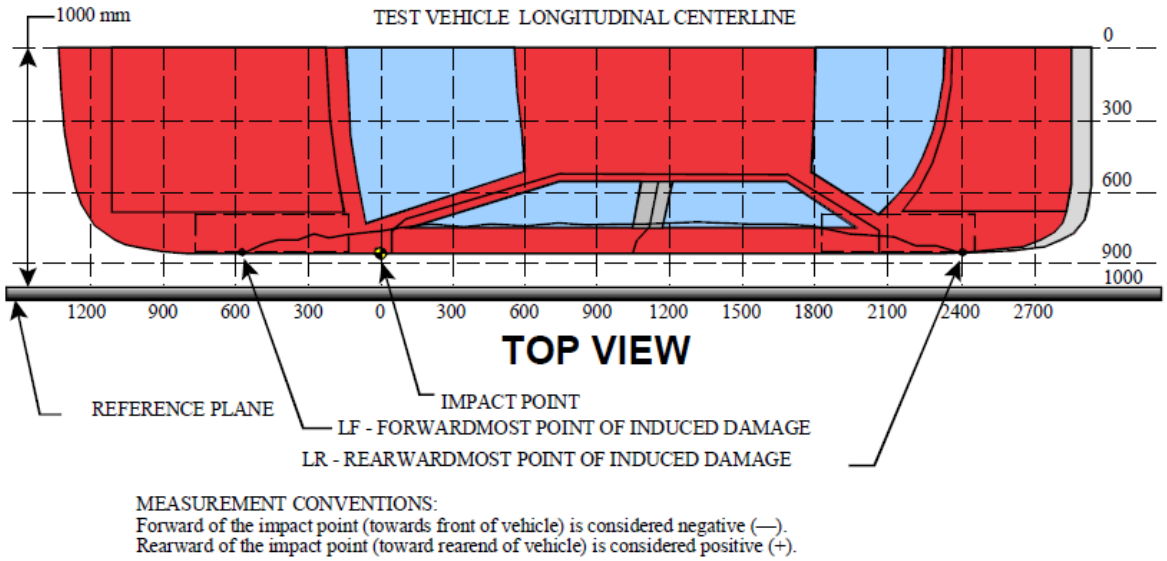
DEFORMABLE BARRIER STATIC CRUSH

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	148	145	138	137	138	147	141	135	132	127	122	120	117	116	116	127	159
2	72	74	71	71	70	65	71	70	65	62	61	59	61	60	59	67	86
3	25	16	15	19	27	35	51	60	34	19	12	11	12	15	26	55	92
4	19	5	8	16	27	49	80	96	73	39	25	28	35	51	62	80	104

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle:	2019 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019

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	106	108	-2
2	300	3	243	110	133
3	750	3	281	111	170
4	1200	3	290	1190	171
5	1650	3	299	129	170
6	2100	3	123	108	15

MDB DAMAGE PROFILE DISTANCES

DPD	Distance From Center of MDB	Level	Post-Test (mm)*
1	800 mm left of center	1	159
2	480 mm left of center	1	116
3	160 mm left of center	1	124
4	160 mm right of center	1	139
5	480 mm right of center	1	137
6	800 mm right of center	1	148

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

Test Vehicle:	2019 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019
Test Time:	11:09 AM	Temperature:	21˚C

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

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

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

D. Spillage Details: — No Spillage Occurred

FMVSS NO. 301 STATIC ROLLOVER DATA

ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	76	300	376
90° to 180°	82	300	382
180° to 270°	74	300	374
270° to 360°	81	300	381

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

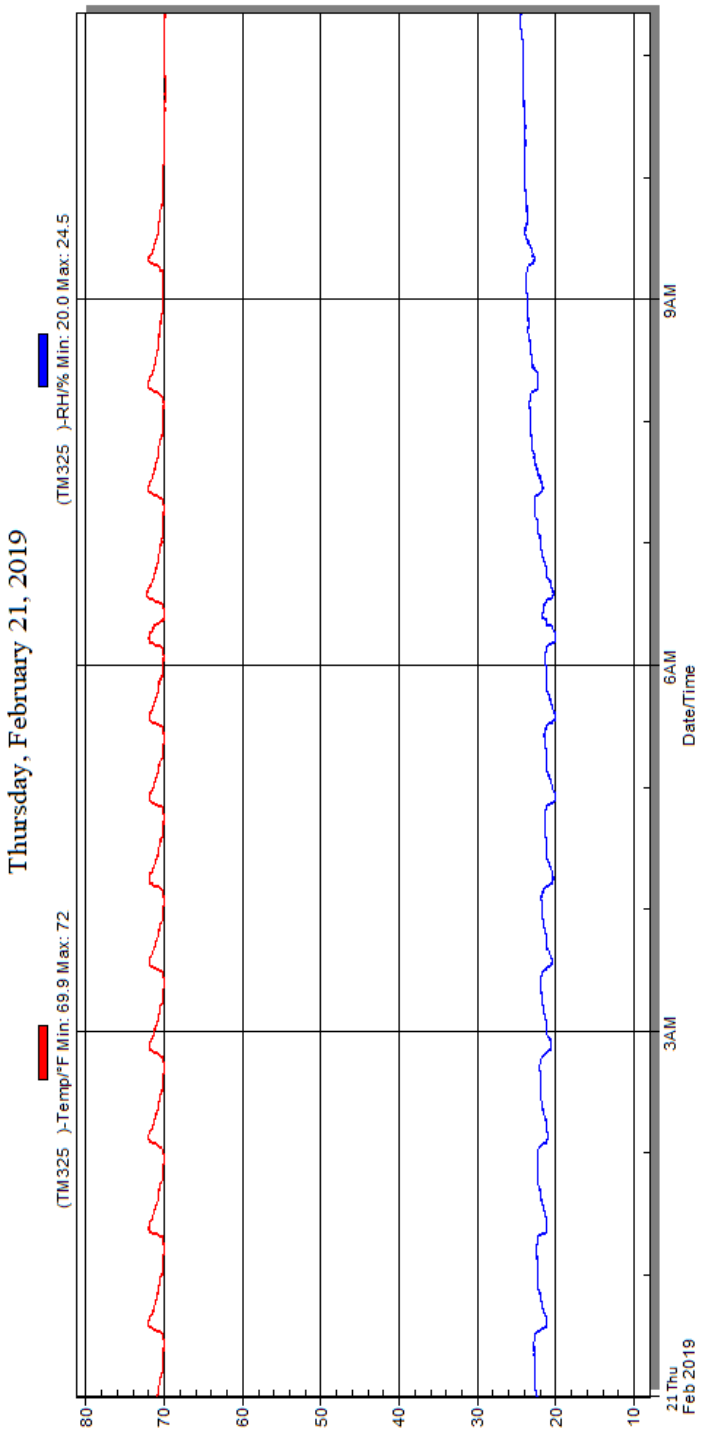
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

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 KIA Forte four door sedan	NHTSA No.:	M20194208
Test Program:	NCAP Side MDB Impact Test	Test Date:	2/21/2019



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

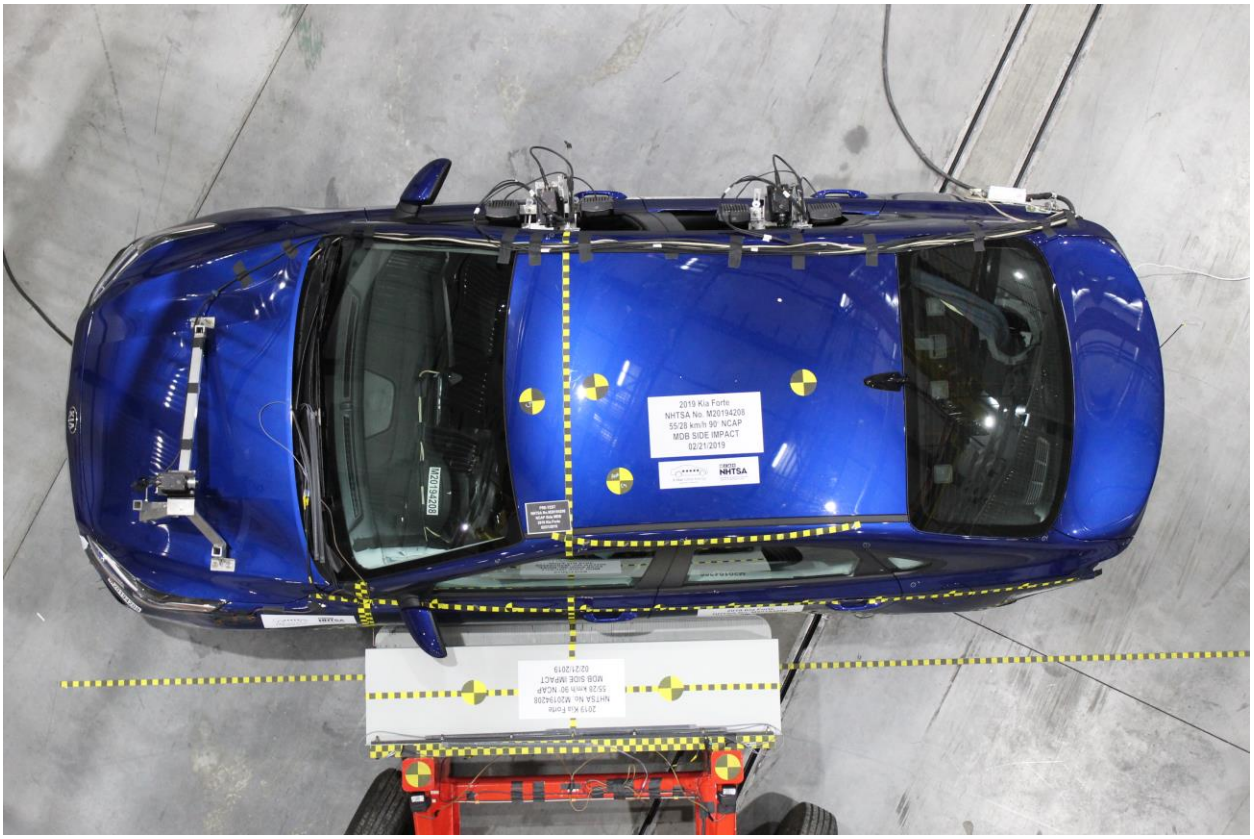


Figure A-15: Pre-Test Overhead View of the Test Area

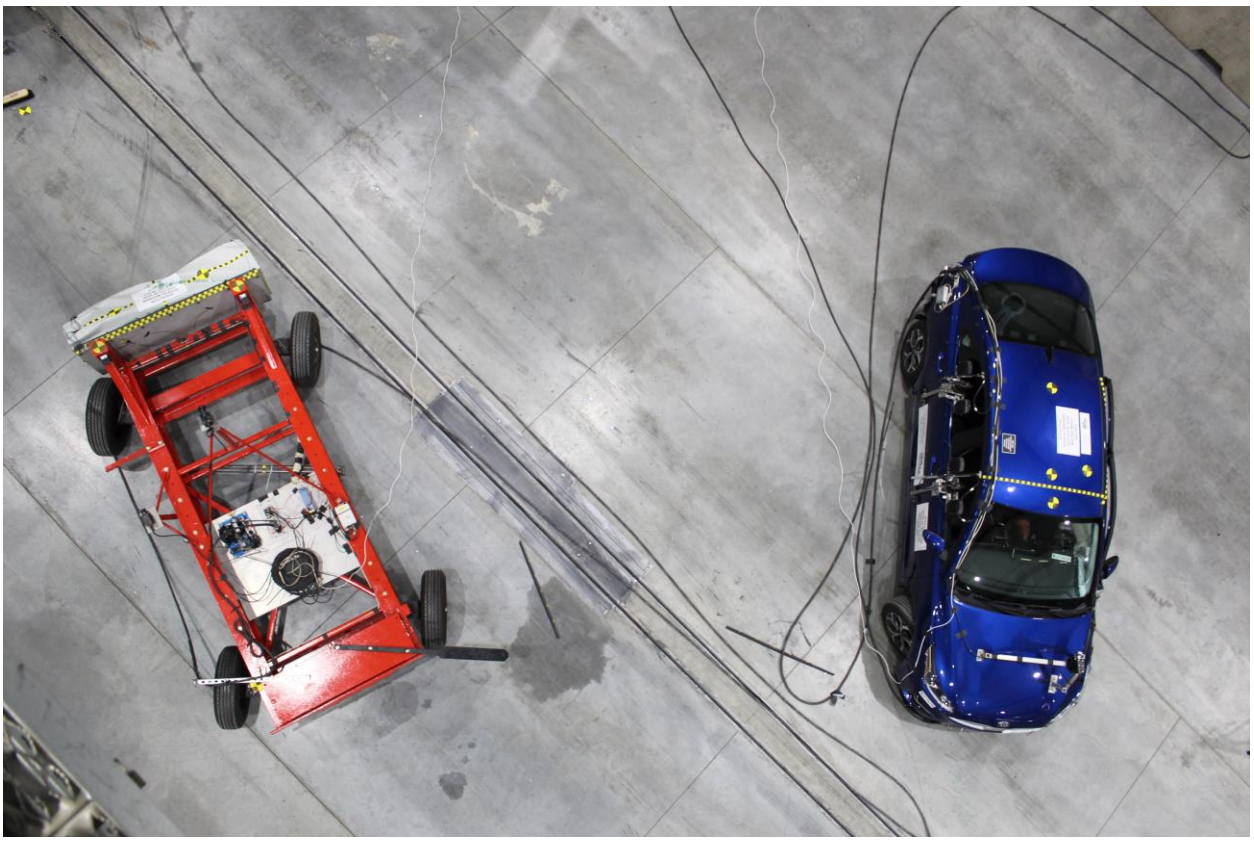


Figure A-16: Post-Test Overhead View of Test Area

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

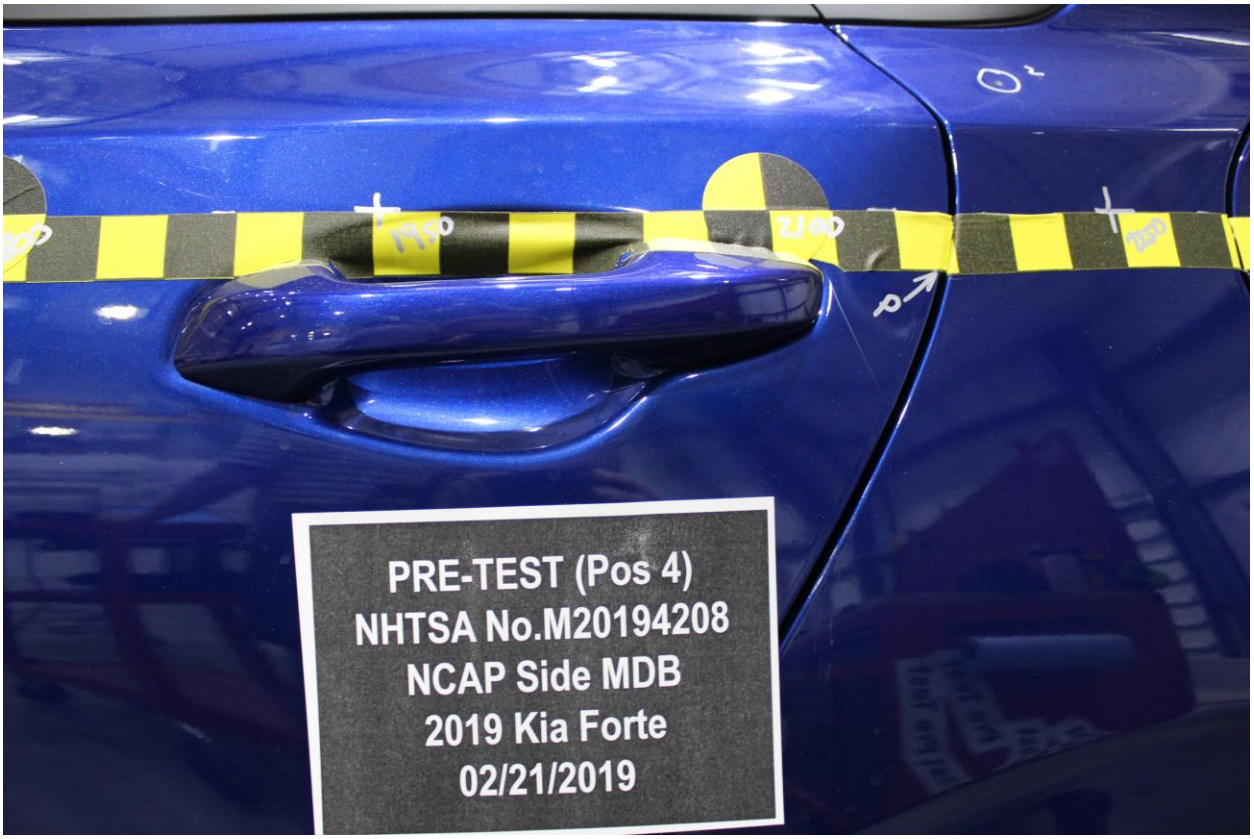


Figure A-23: Pre-Test Left Rear Door Latch Close-Up

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

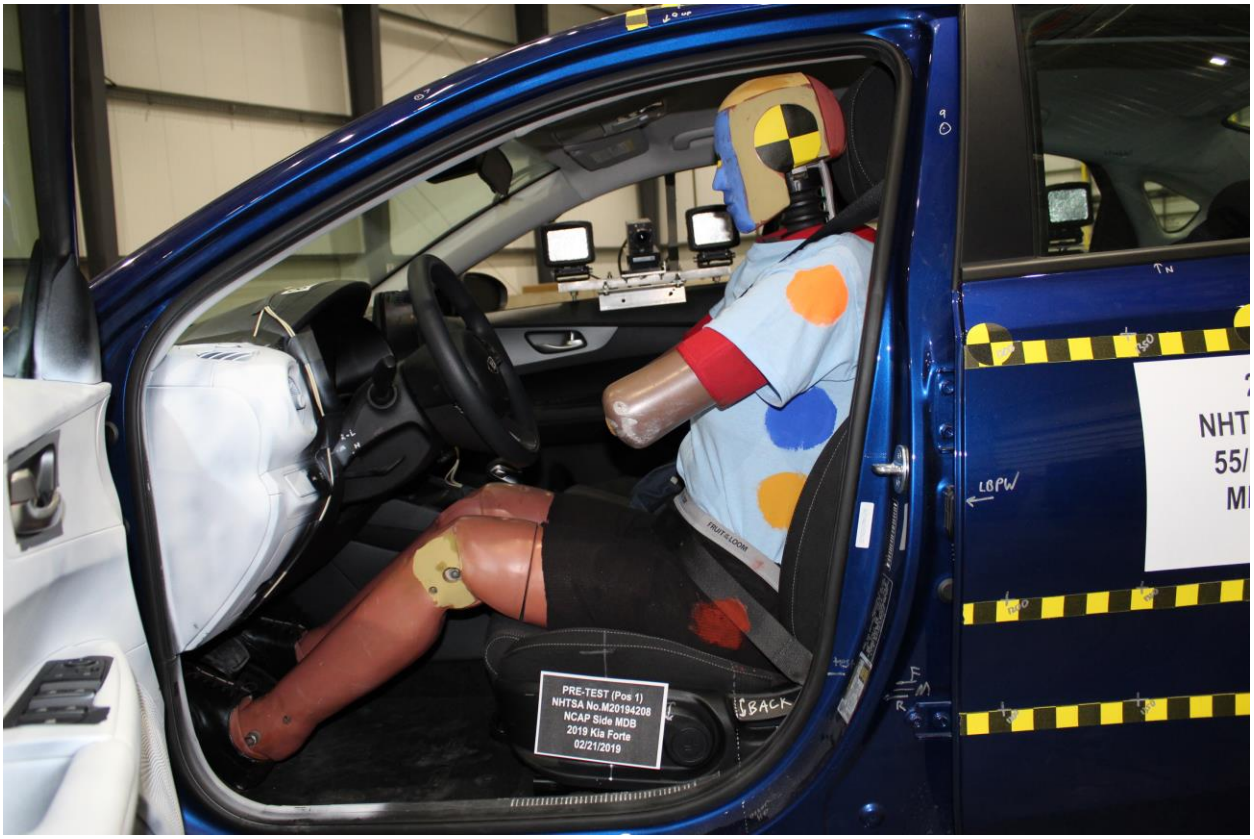


Figure A-27: Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking

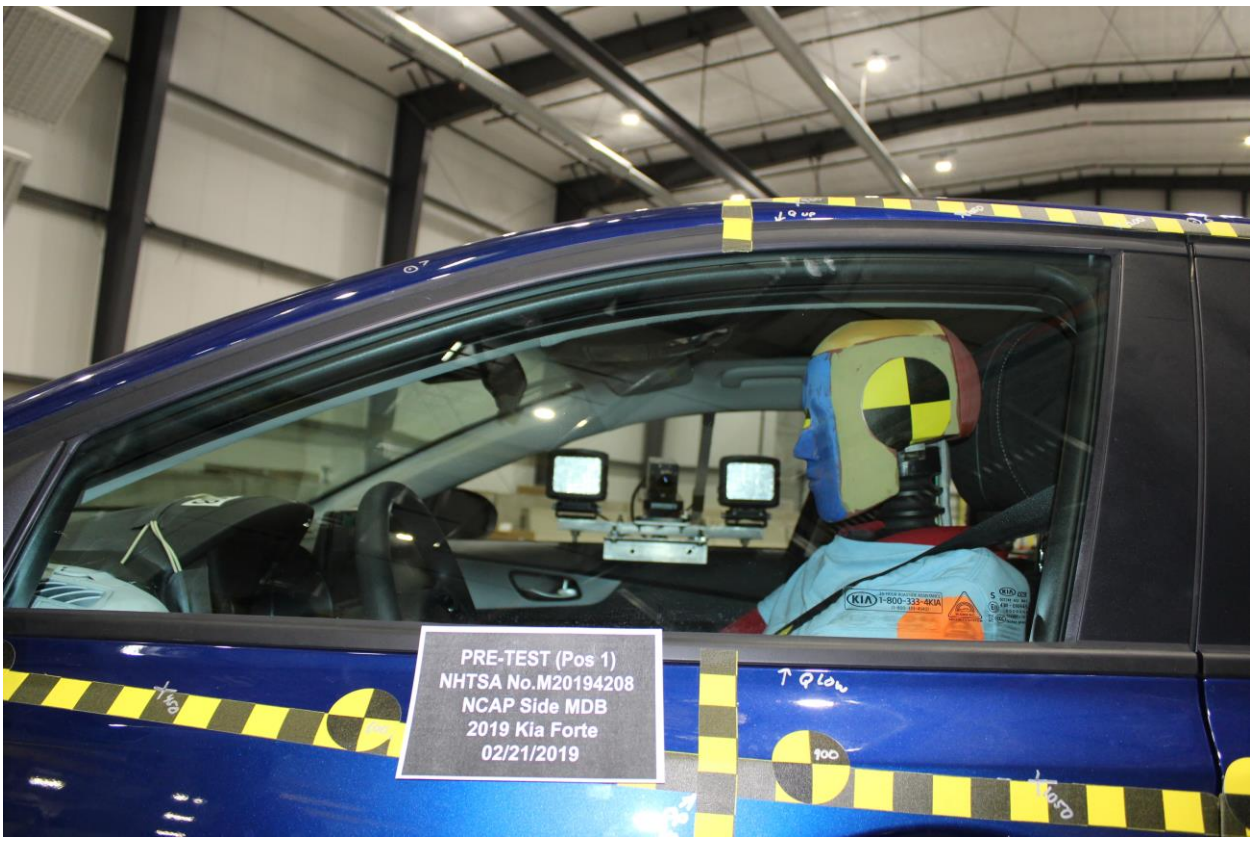


Figure A-28: Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View

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

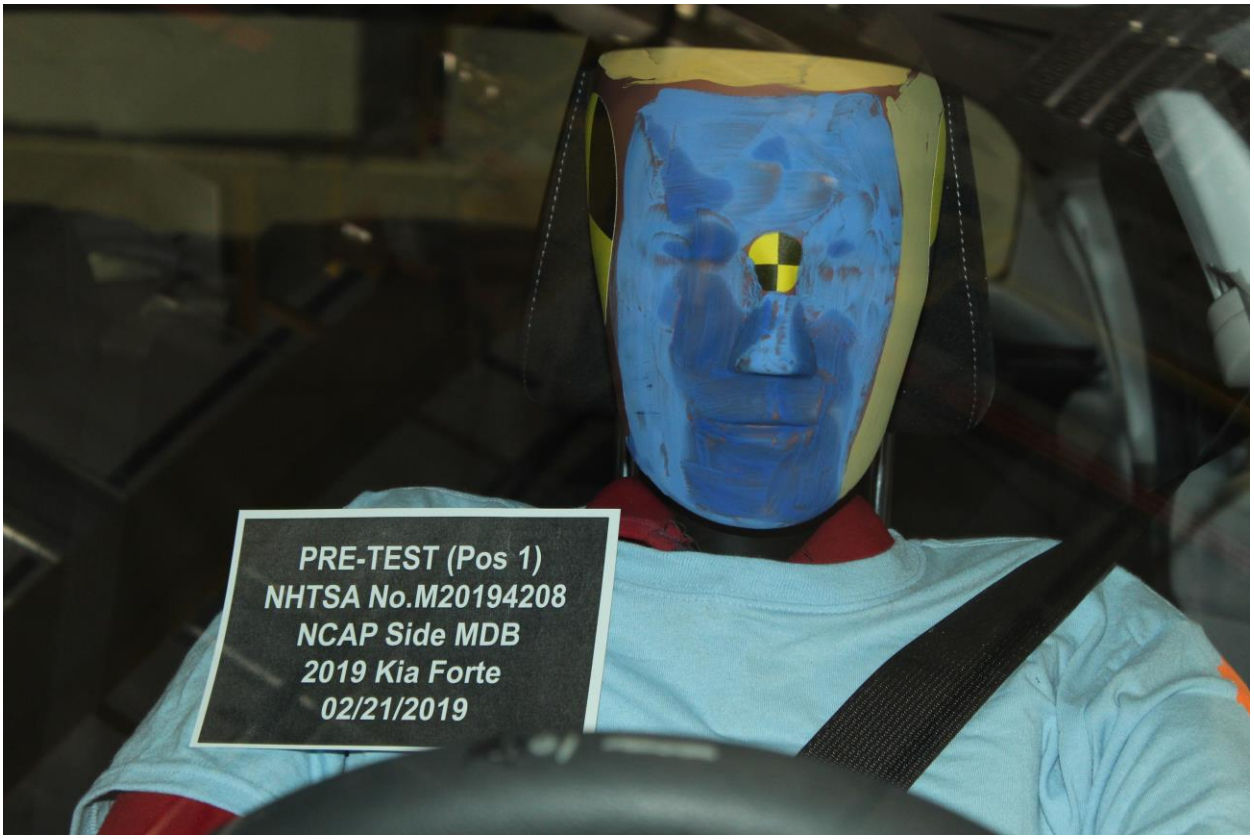


Figure A-31: Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint

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

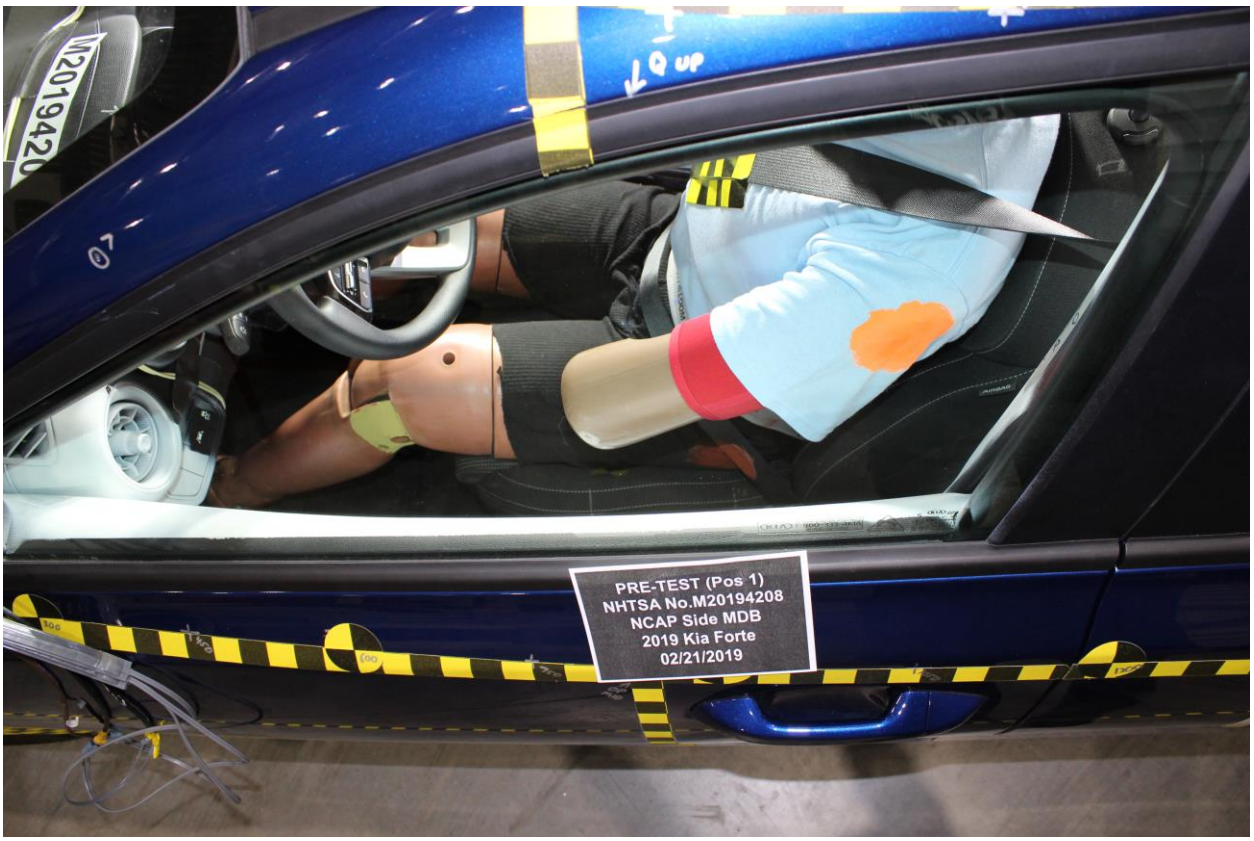


Figure A-42: Pre-Test Driver Dummy and Door Clearance View

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

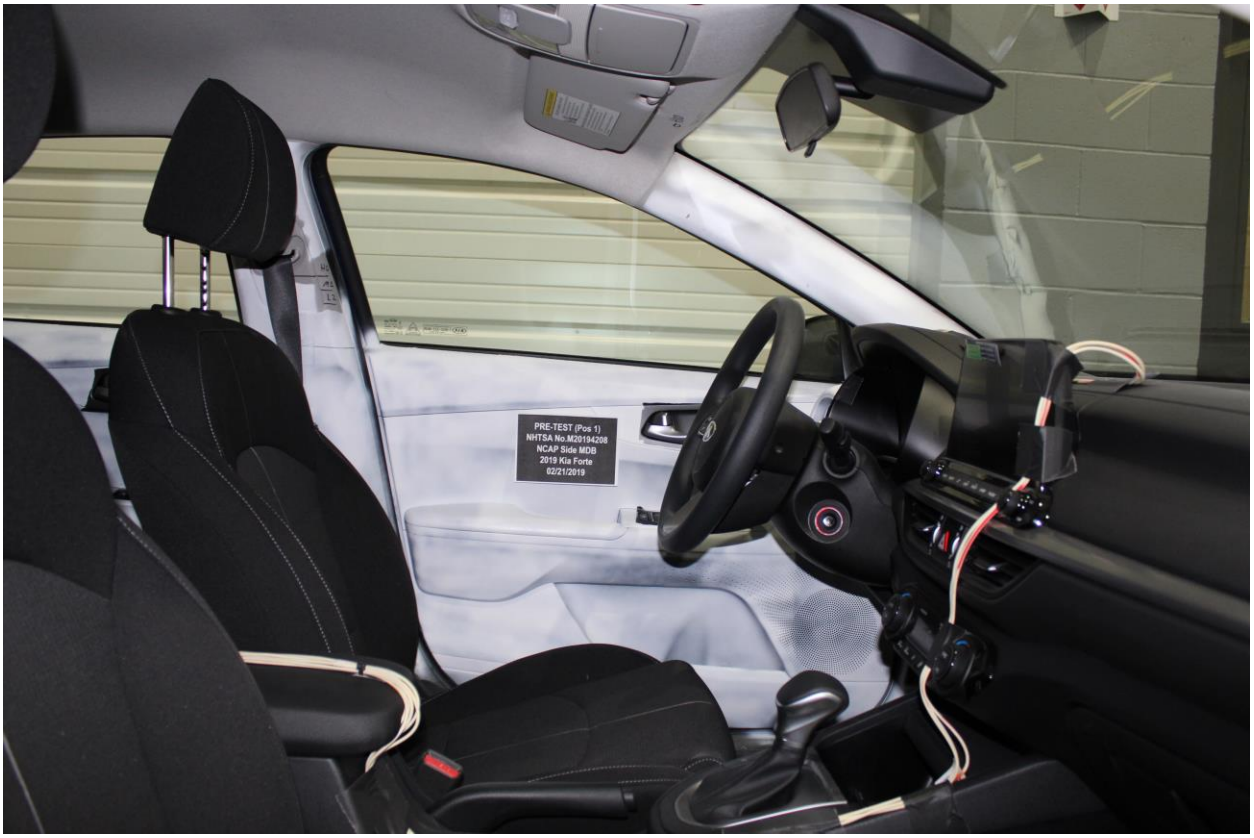


Figure A-46: Pre-Test Driver Inner Door Panel View

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

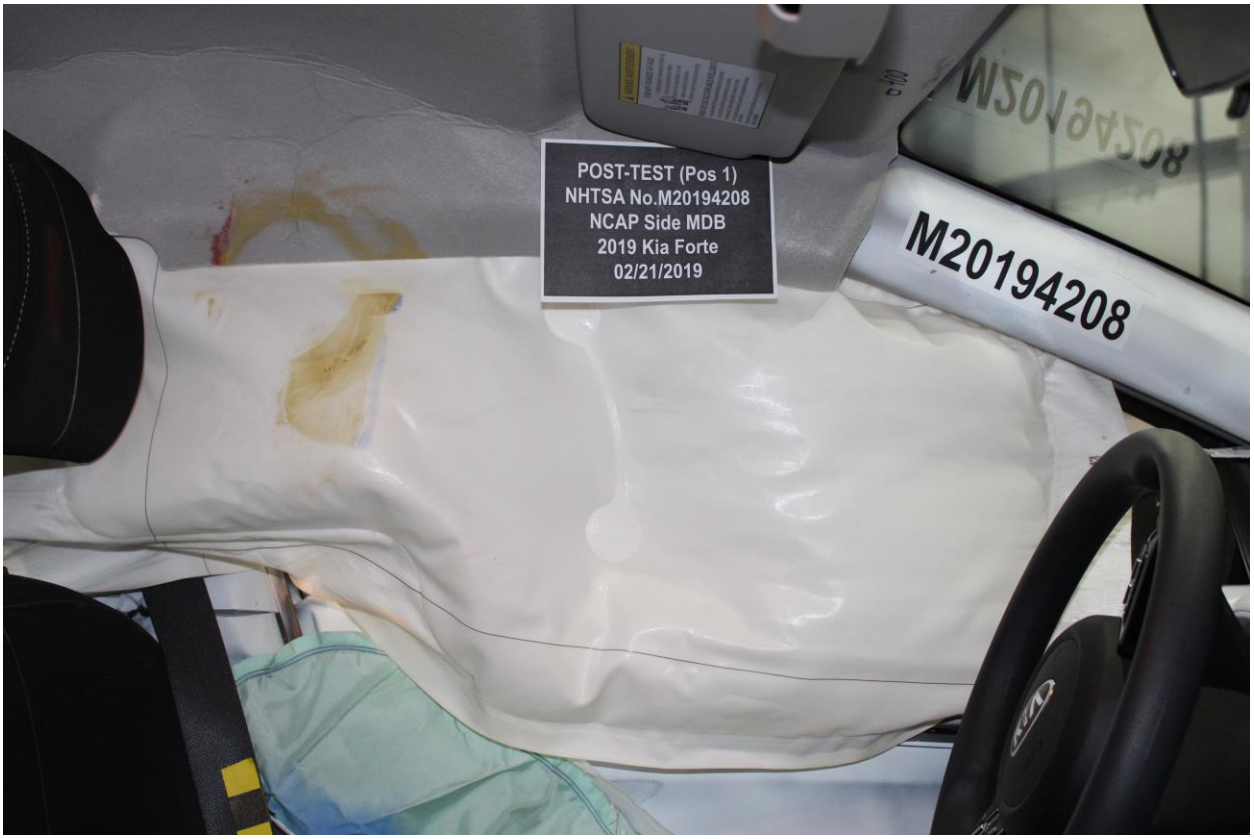


Figure A-49: Post-Test Driver Dummy Close-Up Head Contact with Side Air bag View

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

Photo Not Applicable

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

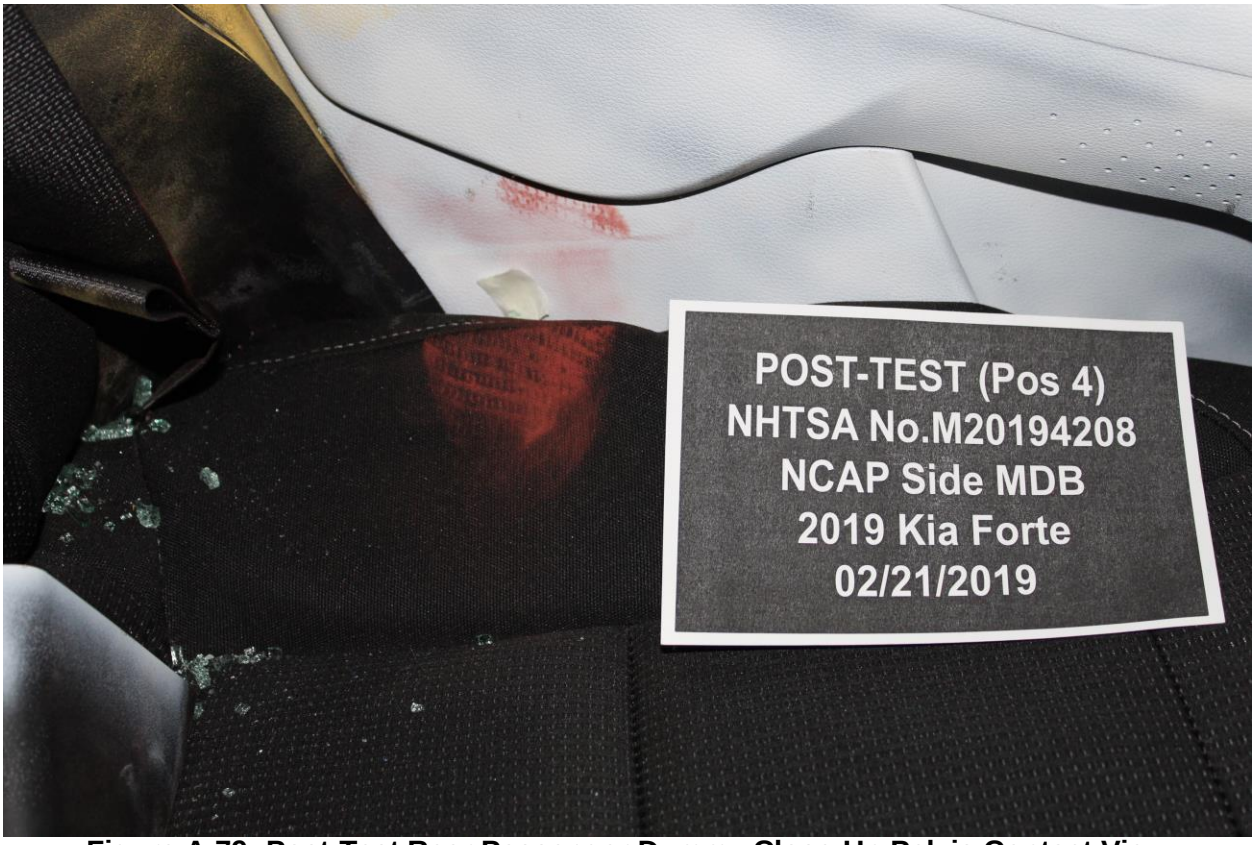


Figure A-79: Post-Test Rear Passenger Dummy Close-Up Pelvis Contact View

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

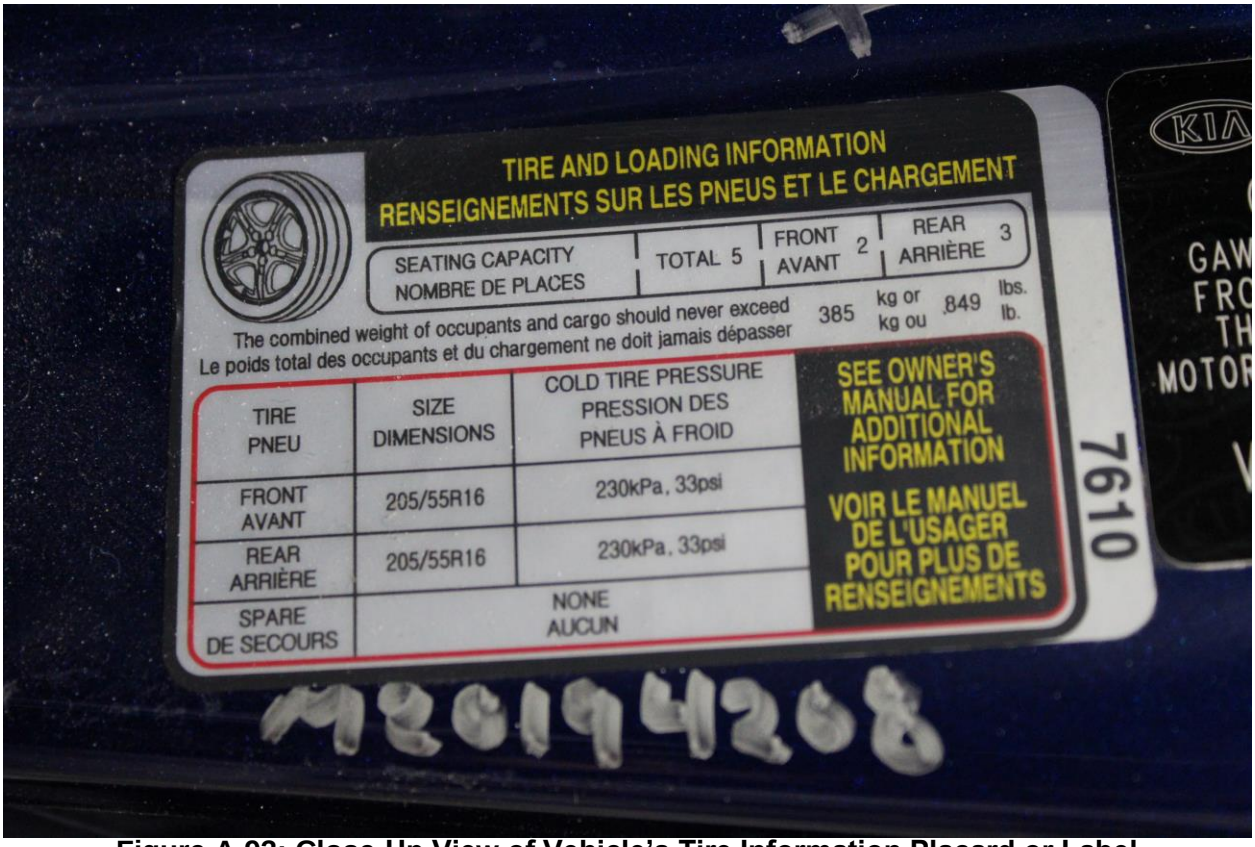


Figure A-93: Close-Up View of Vehicle's Tire Information Placard or Label

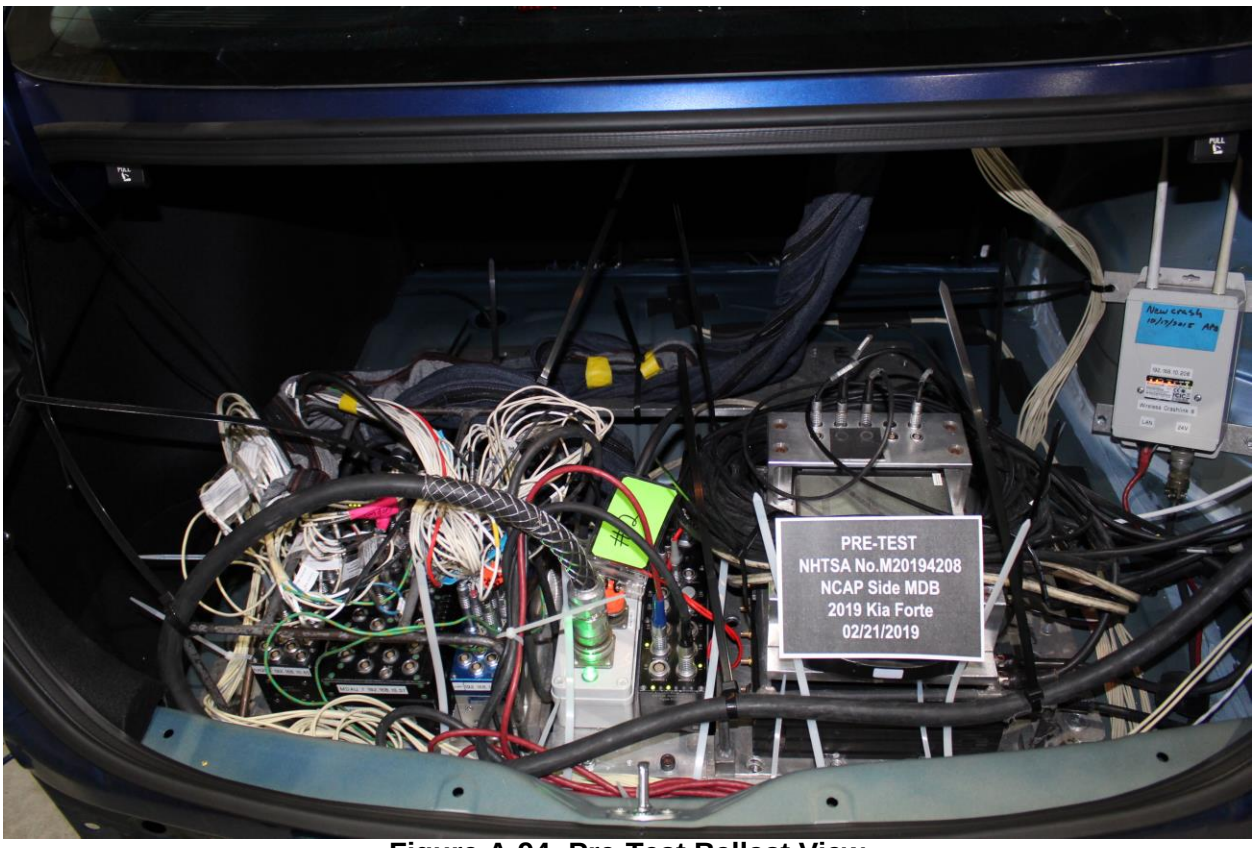


Figure A-94: Pre-Test Ballast View

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

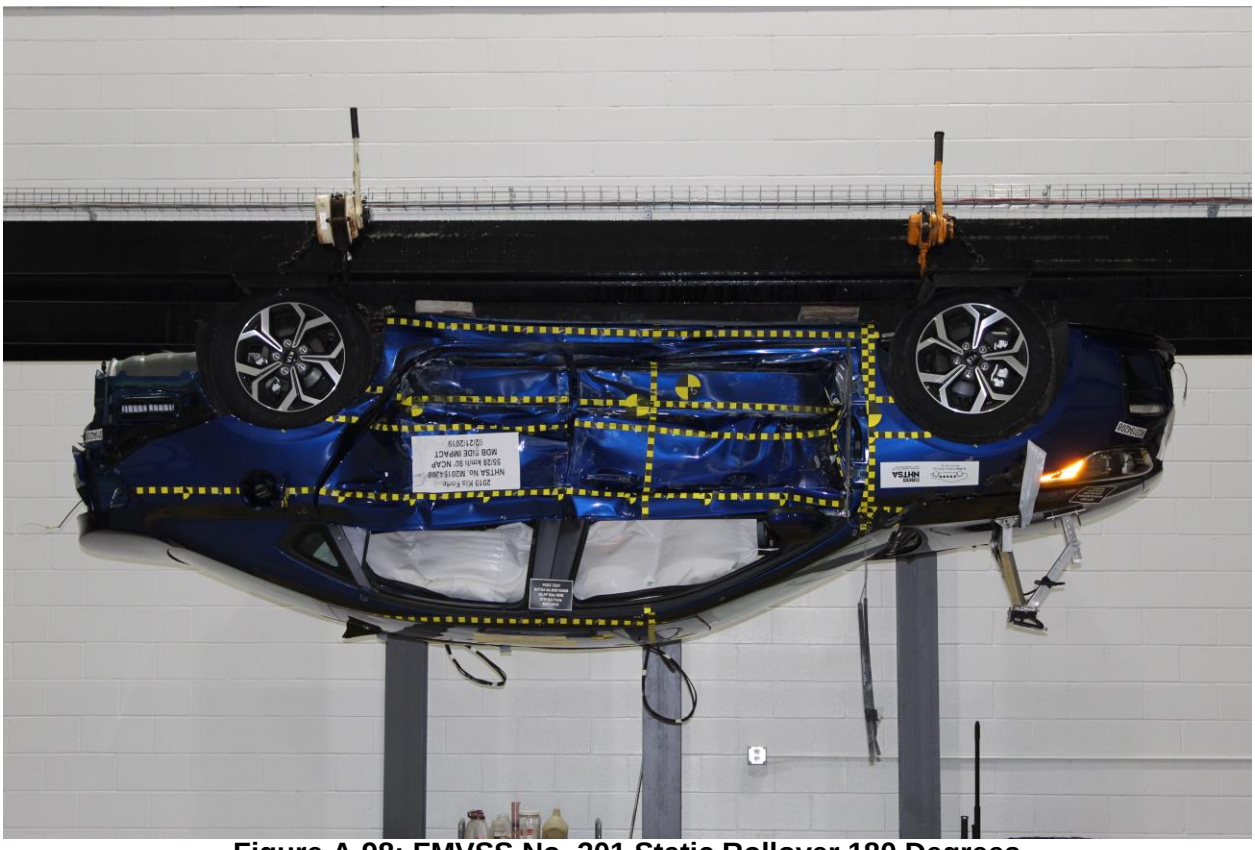


Figure A-98: FMVSS No. 301 Static Rollover 180 Degrees

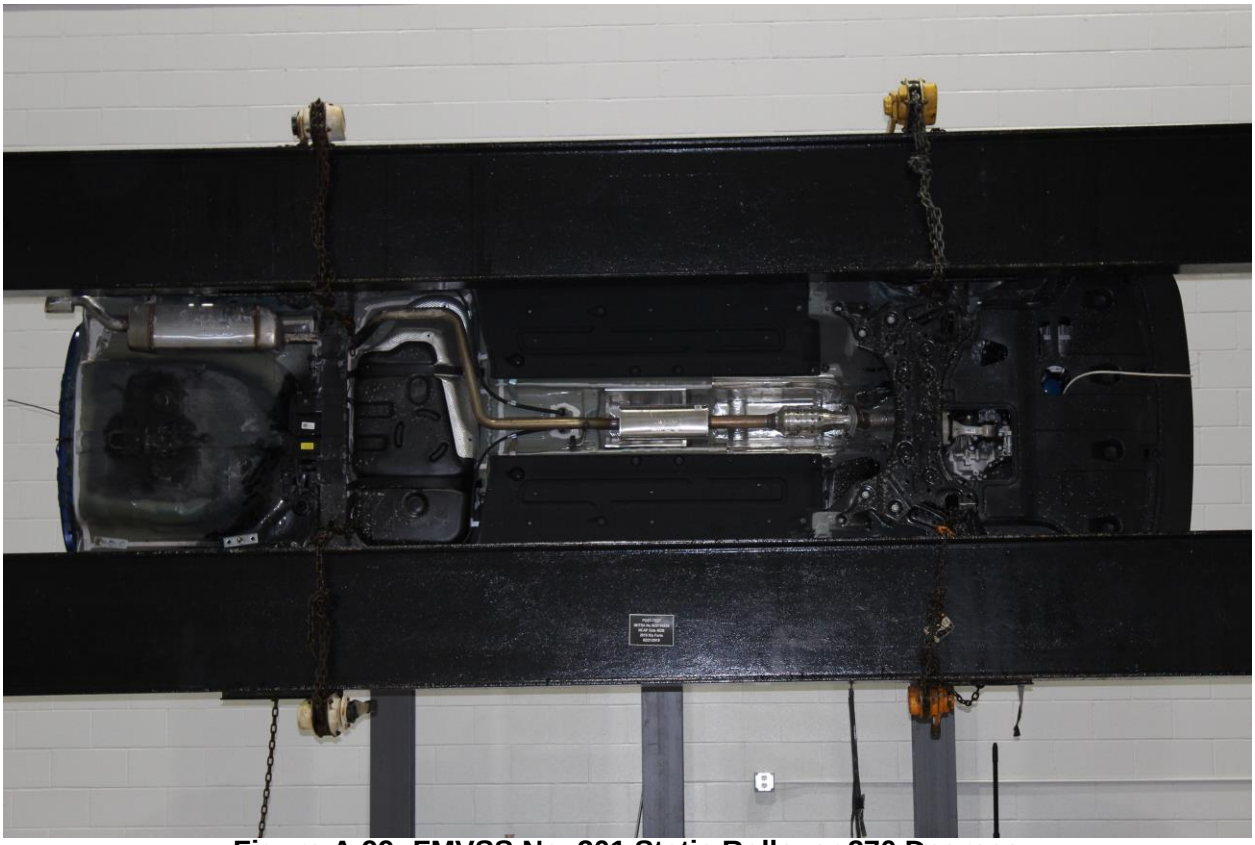
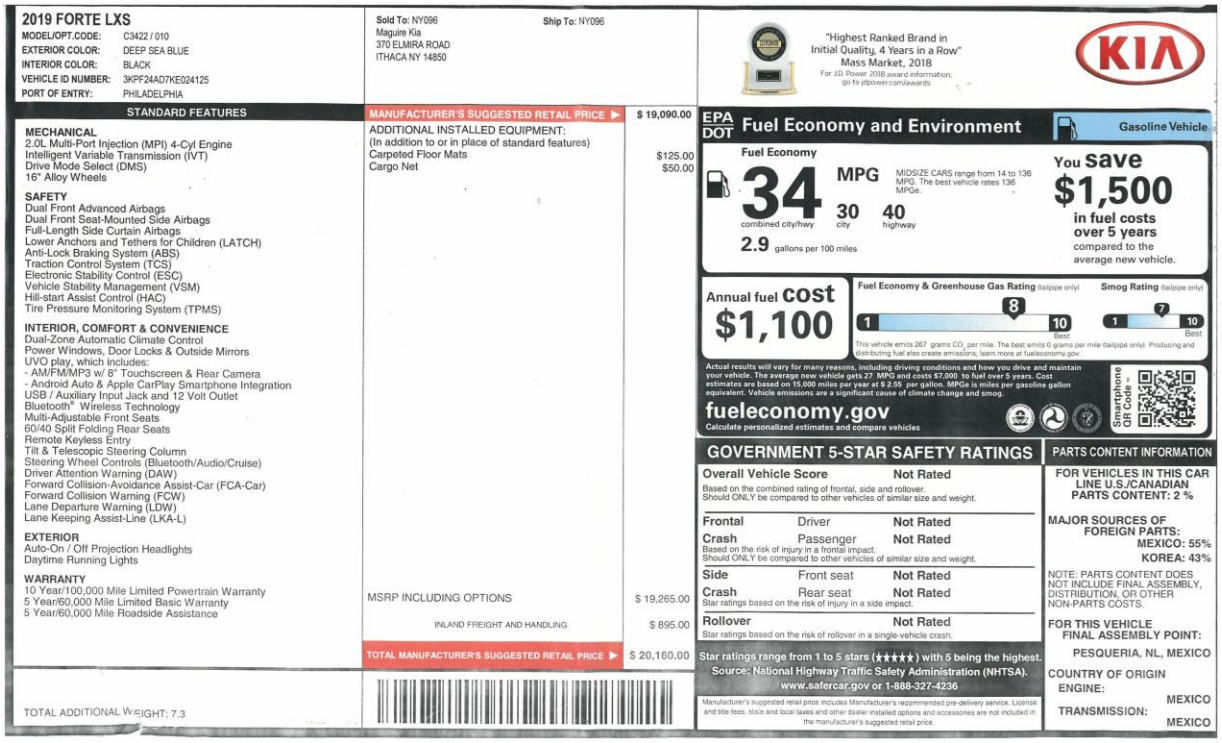


Figure A-99: FMVSS No. 301 Static Rollover 270 Degrees

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

Figure A-101: Impact Event



2019 FORTE LXS

MODEL/OPT.CODE: C3422 / 010
EXTERIOR COLOR: DEEP SEA BLUE
INTERIOR COLOR: BLACK
VEHICLE ID NUMBER: 3KPF24AD7KE024125
PORT OF ENTRY: PHILADELPHIA

Sold To: NY096
Maguire Kia
370 ELMIRA ROAD
ITHACA NY 14850

Ship To: NY096

"Highest Ranked Brand in Initial Quality, 4 Years in a Row" Mass Market, 2018
For J.D. Power 2018 award information, go to jdpower.com/awards

KIA

STANDARD FEATURES

MECHANICAL
2.0L Multi-Port Injection (MPI) 4-Cyl Engine
Intelligent Variable Transmission (IVT)
Drive Mode Select (DMS)
16" Alloy Wheels

SAFETY
Dual Front Advanced Airbags
Dual Front Seat-Mounted Side Airbags
Full-Length Side Curtain Airbags
Lower Anchors and Tethers for Children (LATCH)
Anti-Lock Braking System (ABS)
Traction Control System (TCS)
Electronic Stability Control (ESC)
Vehicle Stability Management (VSM)
Hill-start Assist Control (HAC)
Tire Pressure Monitoring System (TPMS)

INTERIOR, COMFORT & CONVENIENCE
Dual-Zone Automatic Climate Control
Power Windows, Door Locks & Outside Mirrors
UVO play, which includes:
- AM/FM/MP3 w/ 8" Touchscreen & Rear Camera
- Android Auto & Apple CarPlay Smartphone Integration
USB / Auxiliary Input Jack and 12 Volt Outlet
Bluetooth® Wireless Technology
Multi-Adjustable Front Seats
60/40 Split Folding Rear Seats
Remote Keyless Entry
Tilt & Telescopic Steering Column
Steering Wheel Controls (Bluetooth/Audio/Cruise)
Driver Attention Warning (DAW)
Forward Collision-Avoidance Assist-Car (FCA-Car)
Forward Collision Warning (FCW)
Lane Departure Warning (LDW)
Lane Keeping Assist-Line (LKA-L)

EXTERIOR
Auto-On / Off Projection Headlights
Daytime Running Lights

WARRANTY
10 Year/100,000 Mile Limited Powertrain Warranty
5 Year/60,000 Mile Limited Basic Warranty
5 Year/60,000 Mile Roadside Assistance

MANUFACTURER'S SUGGESTED RETAIL PRICE ▶	$ 19,090.00
ADDITIONAL INSTALLED EQUIPMENT: (In addition to or in place of standard features)	
Carpeted Floor Mats	$125.00
Cargo Net	$50.00
MSRP INCLUDING OPTIONS	$ 19,265.00
INLAND FREIGHT AND HANDLING	$ 895.00
TOTAL MANUFACTURER'S SUGGESTED RETAIL PRICE ▶	$ 20,160.00

TOTAL ADDITIONAL WEIGHT: 7.3

EPA DOT Fuel Economy and Environment — Gasoline Vehicle

Fuel Economy: **34** MPG combined city/hwy (30 city, 40 highway)
2.9 gallons per 100 miles
MIDSIZE CARS range from 14 to 136 MPG. The best vehicle rates 136 MPGe.

You save **$1,500** in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost **$1,100**

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 8 (1 Worst, 10 Best)
Smog Rating (tailpipe only): 7 (1 Worst, 10 Best)
This vehicle emits 267 grams CO_2 per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions, learn more at fueleconomy.gov

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 27 MPG and costs $7,000 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $ 2.55 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fueleconomy.gov
Calculate personalized estimates and compare vehicles

Smartphone QR Code +

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score: Not Rated
Based on the combined rating of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight.

Frontal Crash	Driver	Not Rated
	Passenger	Not Rated
Side Crash	Front seat	Not Rated
	Rear seat	Not Rated
Rollover		Not Rated

Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight.
Star ratings based on the risk of injury in a side impact.
Star ratings based on the risk of rollover in a single-vehicle crash.

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.
Source: National Highway Traffic Safety Administration (NHTSA).
www.safercar.gov or 1-888-327-4236

Manufacturer's suggested retail price includes Manufacturer's recommended pre-delivery service. License and title fees, state and local taxes and other dealer installed options and accessories are not included in the manufacturer's suggested retail price.

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CAR LINE U.S./CANADIAN PARTS CONTENT: 2 %

MAJOR SOURCES OF FOREIGN PARTS:
MEXICO: 55%
KOREA: 43%

NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.

FOR THIS VEHICLE FINAL ASSEMBLY POINT:
PESQUERIA, NL, MEXICO

COUNTRY OF ORIGIN
ENGINE: MEXICO
TRANSMISSION: MEXICO

Figure A-102: Monroney Label

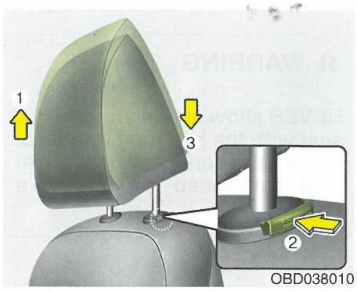
⚠ WARNING - Headrest removal/adjustment

- **Do not operate the vehicle with the headrests removed. Headrests can provide critical neck and head support in a crash.**
- **Do not adjust the headrest height while the vehicle is in motion. Driver may lose control of the vehicle.**

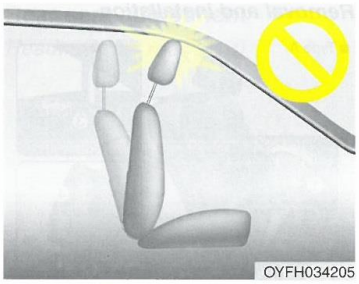
⚠ CAUTION

Excessive pulling or pushing may damage the headrest.

Adjusting the height up and down



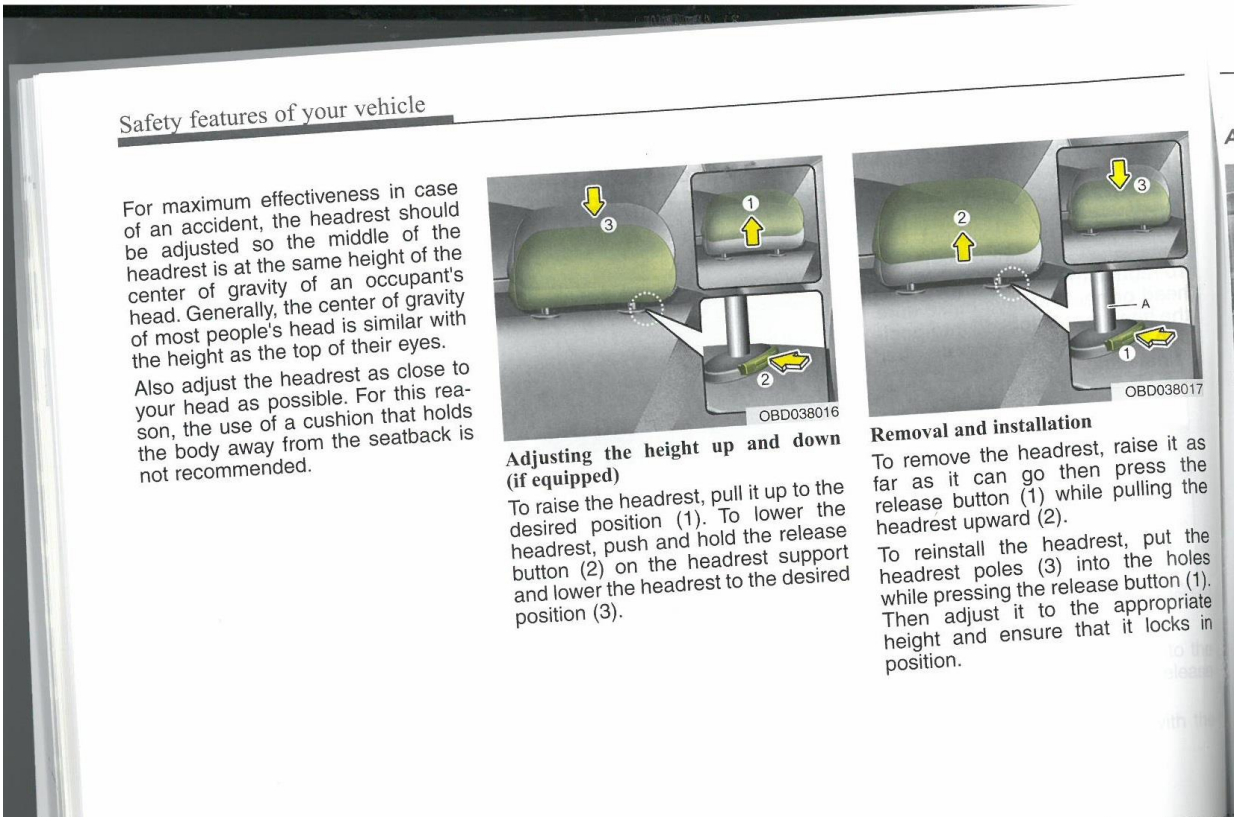
To raise the headrest, pull it up to the desired position (1). To lower the headrest, push and hold the release button (2) on the headrest support and lower the headrest to the desired position (3).



✻ NOTICE

If you recline the seatback towards the front with the headrest and seat cushion raised, the headrest may come in contact with the sunvisor or other parts of the vehicle.

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



For maximum effectiveness in case of an accident, the headrest should be adjusted so the middle of the headrest is at the same height of the center of gravity of an occupant's head. Generally, the center of gravity of most people's head is similar with the height as the top of their eyes.

Also adjust the headrest as close to your head as possible. For this reason, the use of a cushion that holds the body away from the seatback is not recommended.

Adjusting the height up and down (if equipped)

To raise the headrest, pull it up to the desired position (1). To lower the headrest, push and hold the release button (2) on the headrest support and lower the headrest to the desired position (3).

Removal and installation

To remove the headrest, raise it as far as it can go then press the release button (1) while pulling the headrest upward (2).

To reinstall the headrest, put the headrest poles (3) into the holes while pressing the release button (1). Then adjust it to the appropriate height and ensure that it locks in position.

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

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS

Driver & Passenger Dummy Instrumentation Plots

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

Additional Driver & Passenger Dummy Instrumentation Data

Driver Lower Spine T12 Acceleration (X)
Driver Lower Spine T12 Acceleration (Y)
Driver Lower Spine T12 Acceleration (Z)
Passenger Upper Thorax Rib Deflection (Y)
Passenger Middle Thorax Rib Deflection (Y)
Passenger Lower Thorax Rib Deflection (Y)
Passenger Upper Abdomen Rib Deflection (Y)
Passenger Lower Abdomen Rib Deflection (Y)
Driver Head Acceleration Redundant (X)
Driver Head Acceleration Redundant (Y)
Driver Head Acceleration Redundant (Z)
Passenger Head Acceleration Redundant (X)
Passenger Head Acceleration Redundant (Y)
Passenger Head Acceleration Redundant (Z)

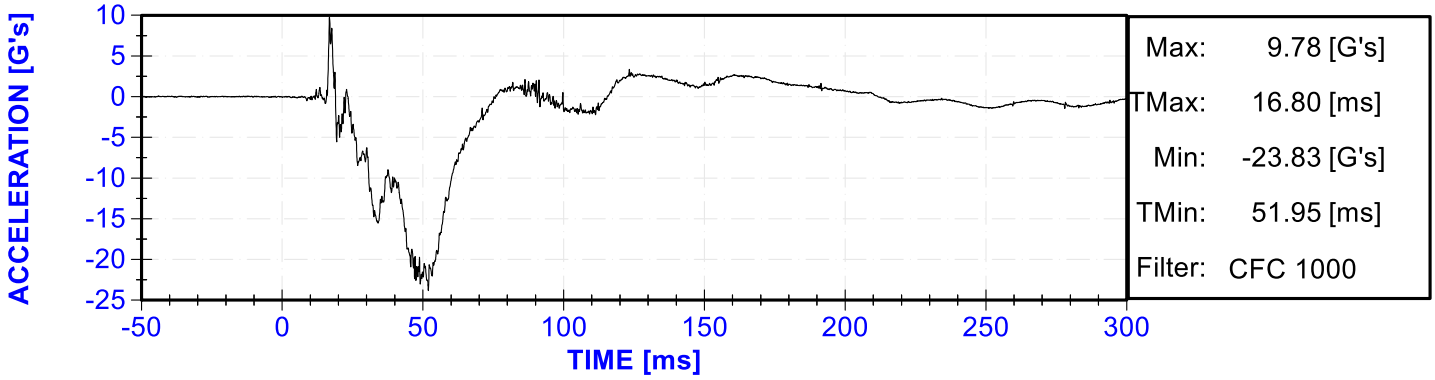
Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)
Vehicle Center of Gravity Acceleration (Y)
Vehicle Center of Gravity Acceleration (Z)
Right Side Sill at Front Seat Acceleration (X)
Right Side Sill at Front Seat Acceleration (Y)
Right Side Sill at Front Seat Acceleration (Z)
Right Side Sill at Rear Seat Acceleration (X)
Right Side Sill at Rear Seat Acceleration (Y)
Right Side Sill at Rear Seat Acceleration (Z)
Left Side Sill at Front Seat Acceleration (Y)
Left Side Sill at Rear Seat Acceleration (Y)
Lower A-Post Acceleration (Y)
Middle A-Post Acceleration (Y)
Lower B-Post Acceleration (Y)
Middle B-Post Acceleration (Y)
Front Seat Track Acceleration (Y)
Rear Seat Structure Acceleration (Y)
Right Rear Occupant Compartment Acceleration (Y)
Engine Block (X)
Engine Block (Y)
Rear Floorpan Above Axle Acceleration (X)
Rear Floorpan Above Axle Acceleration (Y)
Rear Floorpan Above Axle Acceleration (Z)

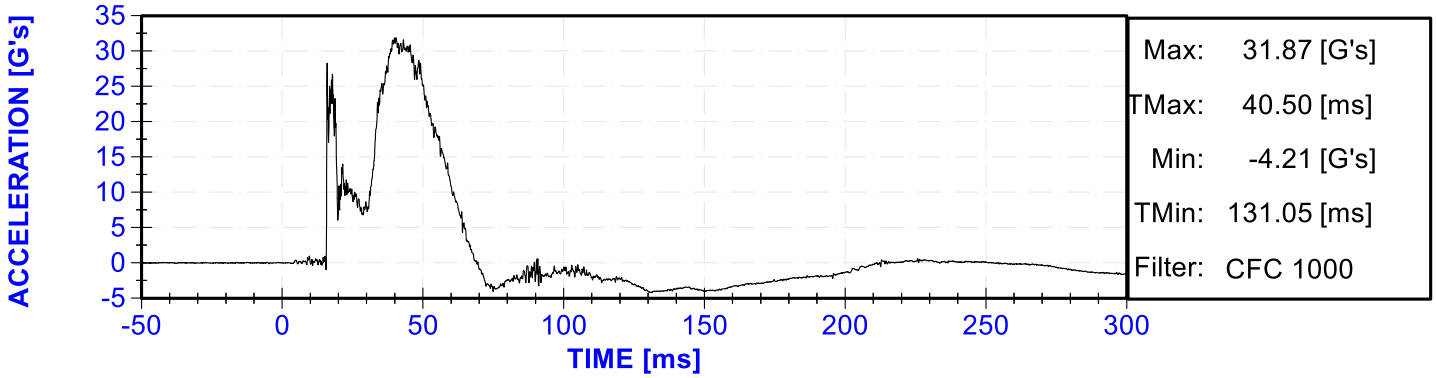
MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)
MDB Center of Gravity Acceleration (Y)
MDB Center of Gravity Acceleration (Z)
MDB Rear Acceleration (X)
MDB Rear Acceleration (Y)
Left MDB Contact Switch
Right MDB Contact Switch

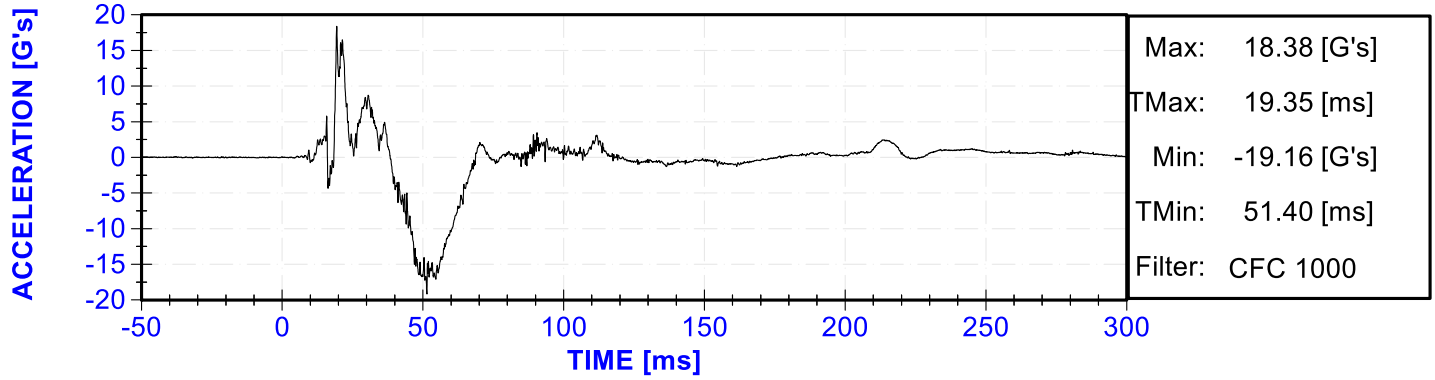
Driver Head Acceleration (X) Primary vs. Time



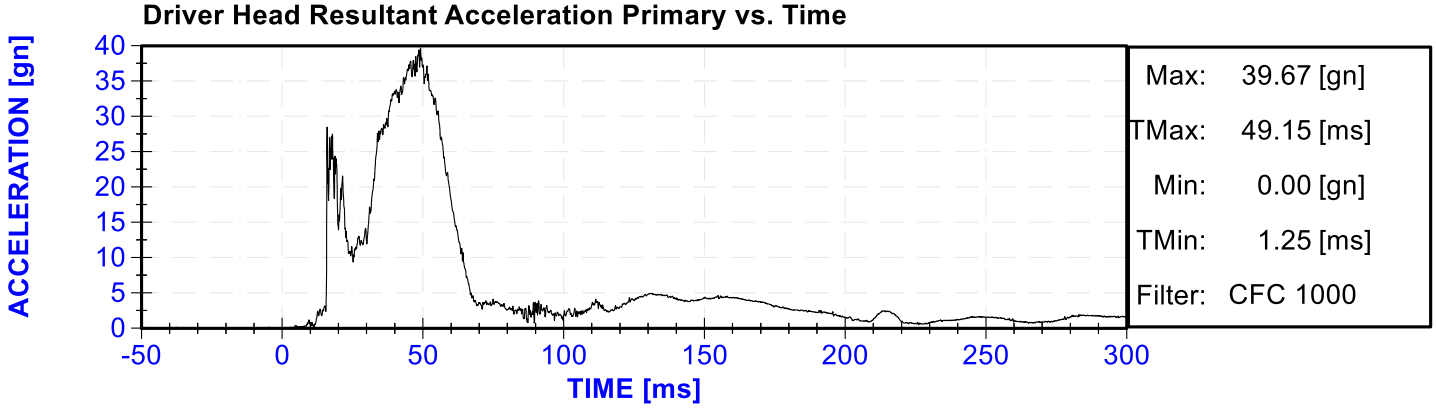
Driver Head Acceleration (Y) Primary vs. Time



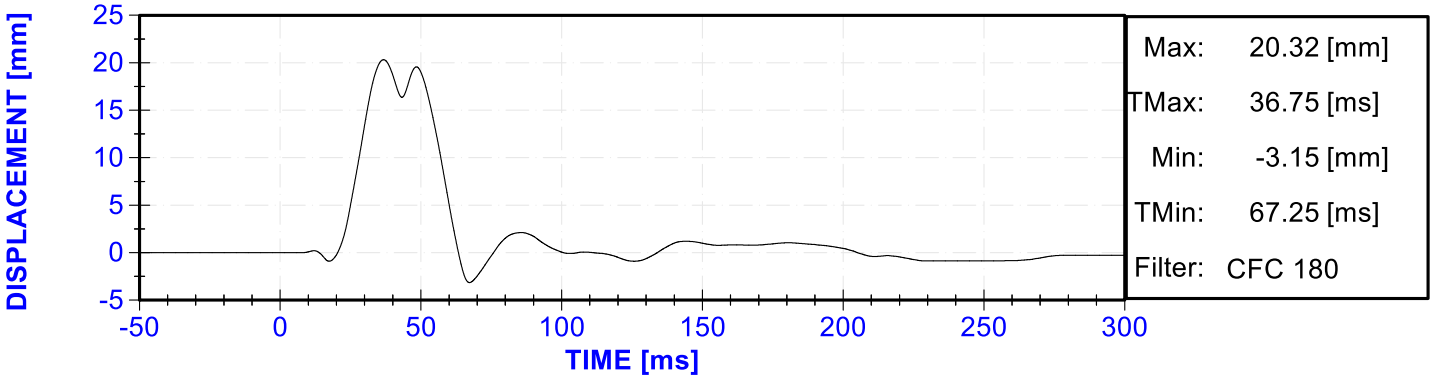
Driver Head Acceleration (Z) Primary vs. Time



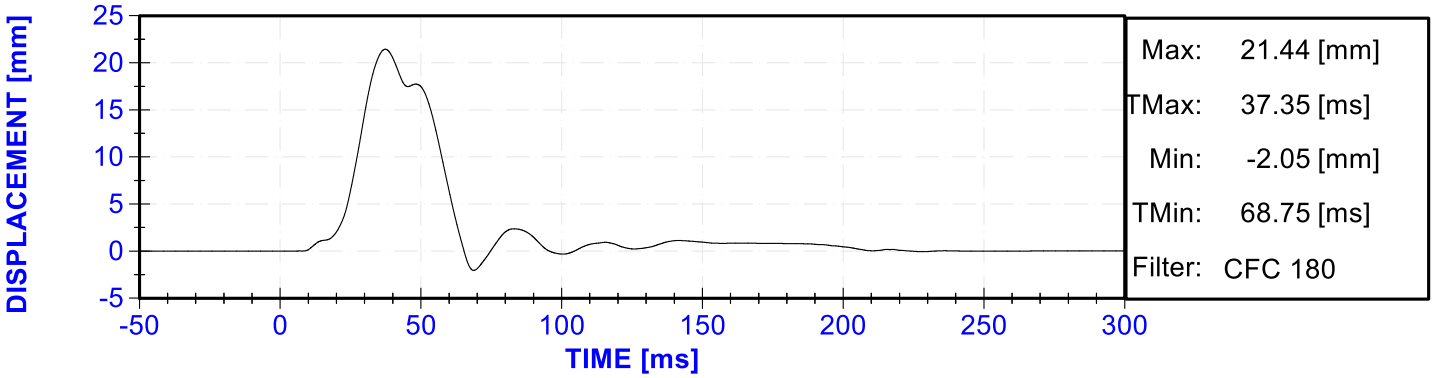
Driver Head Resultant Acceleration Primary vs. Time



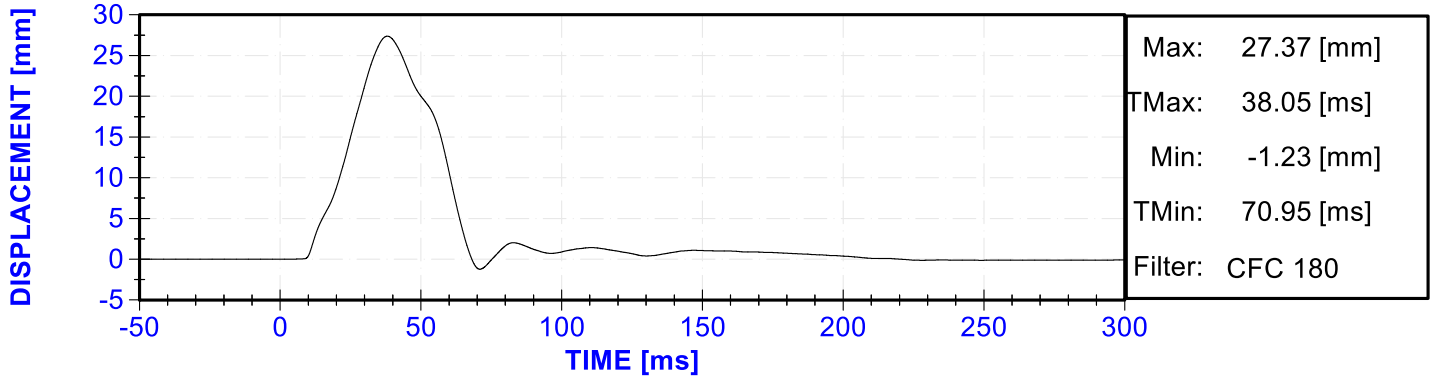
Driver Upper Thorax Rib Deflection (Y) vs. Time



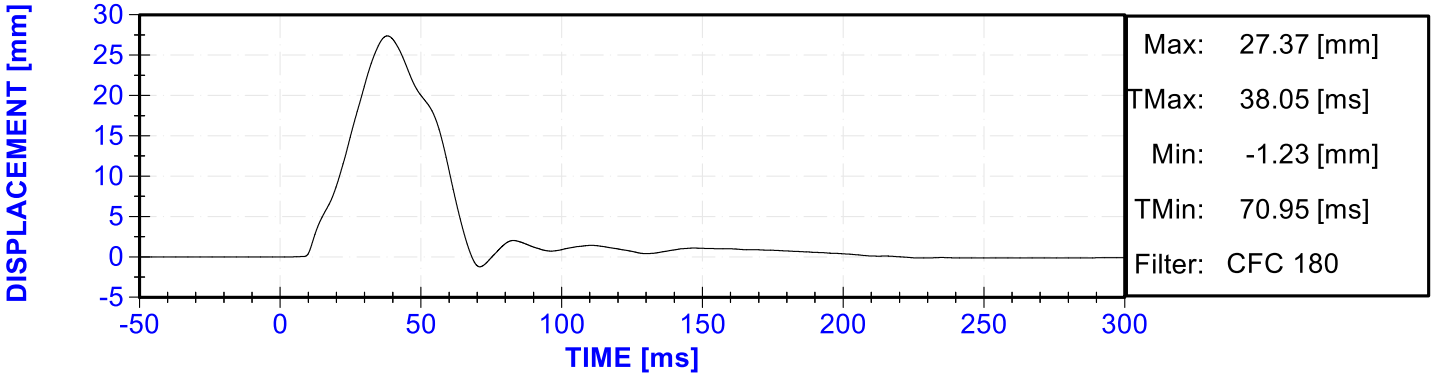
Driver Middle Thorax Rib Deflection (Y) vs. Time



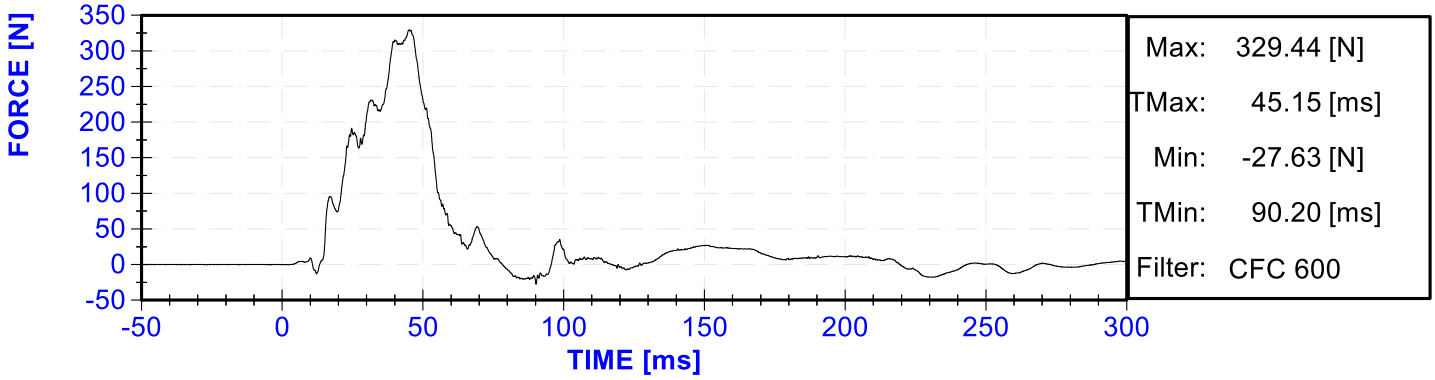
Driver Lower Thorax Rib Deflection (Y) vs. Time



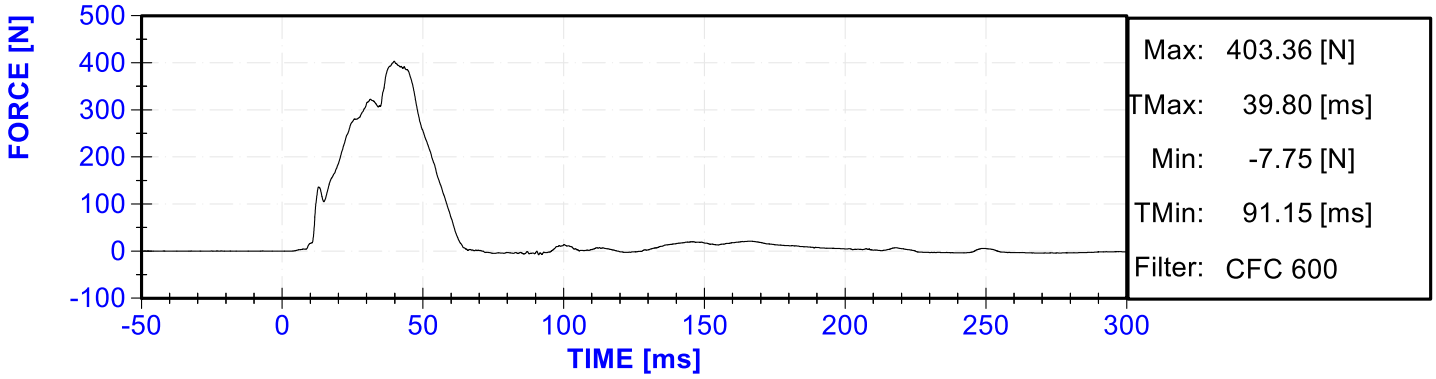
Driver Thorax Rib Deflection Maximum vs. Time



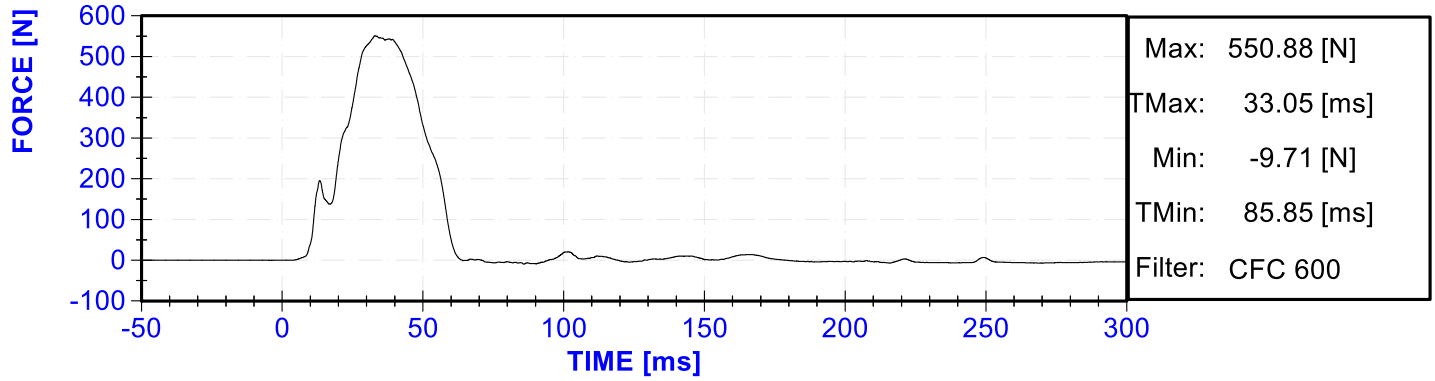
Driver Anterior Abdominal Force (Y) vs. Time



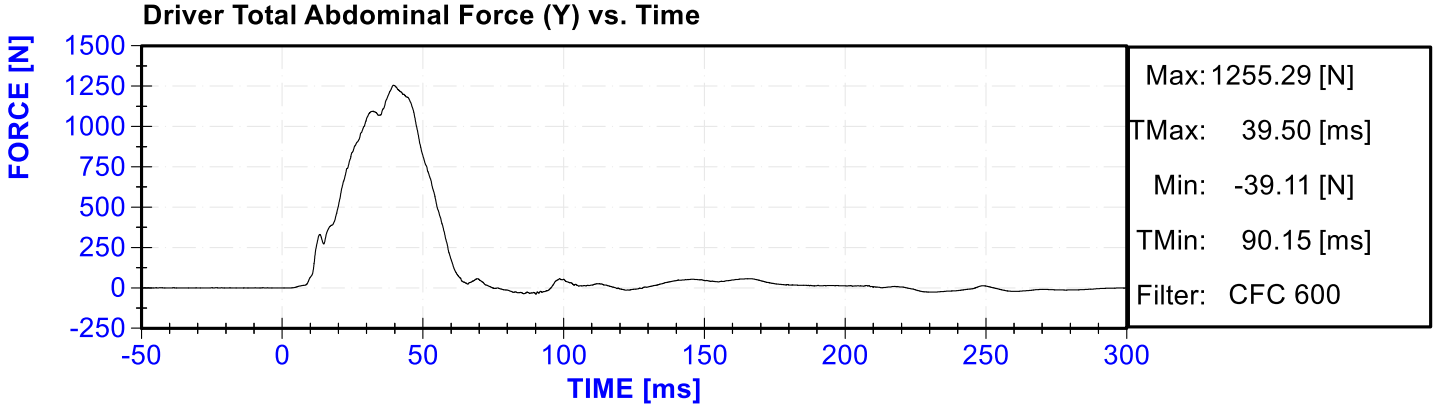
Driver Middle Abdominal Force (Y) vs. Time



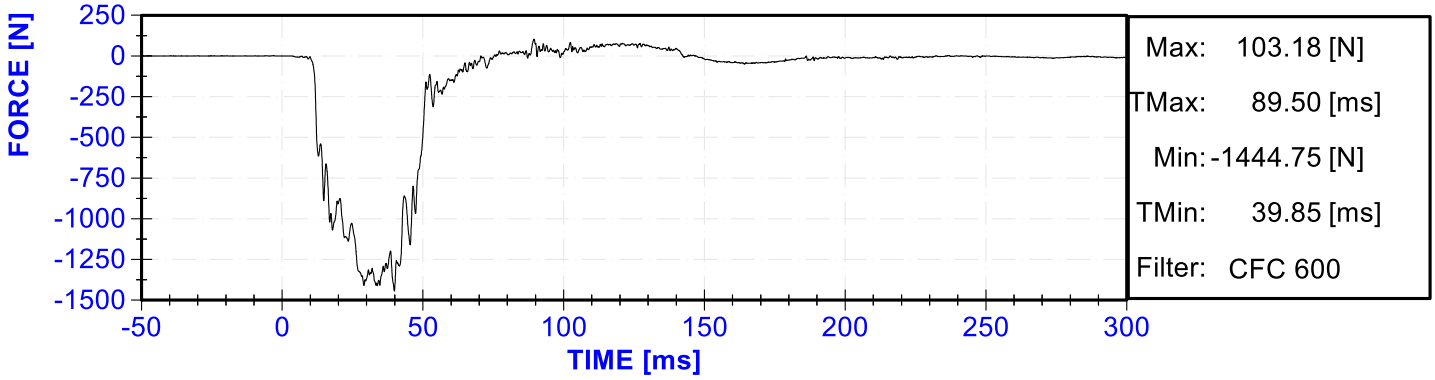
Driver Posterior Abdominal Force (Y) vs. Time



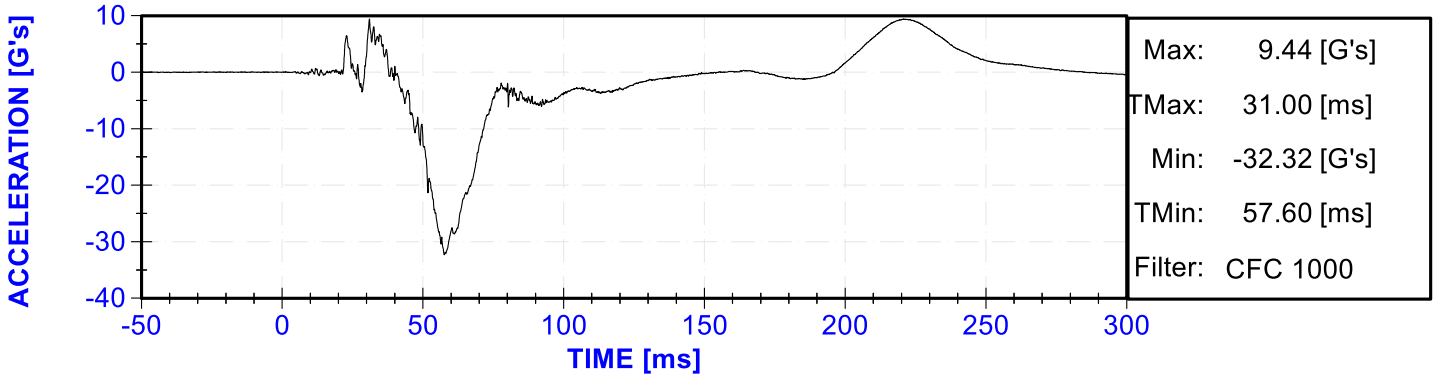
Driver Total Abdominal Force (Y) vs. Time



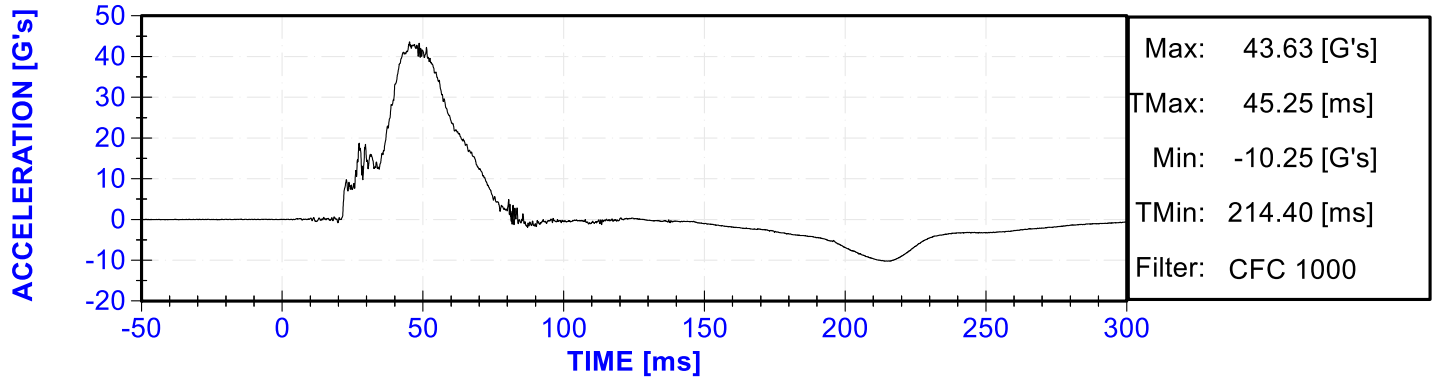
Driver Pubic Symphysis Force (Y) vs. Time



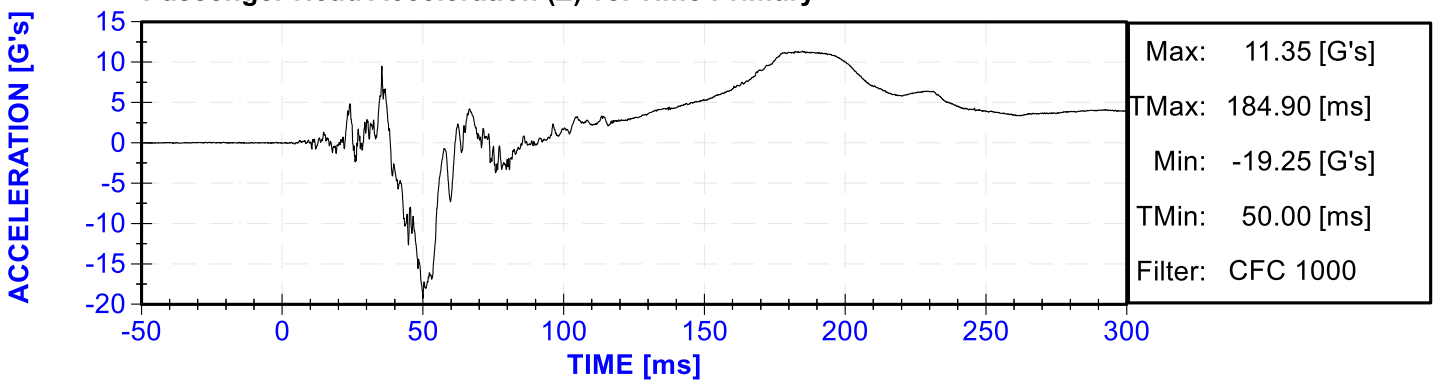
Passenger Head Acceleration (X) vs. Time Primary



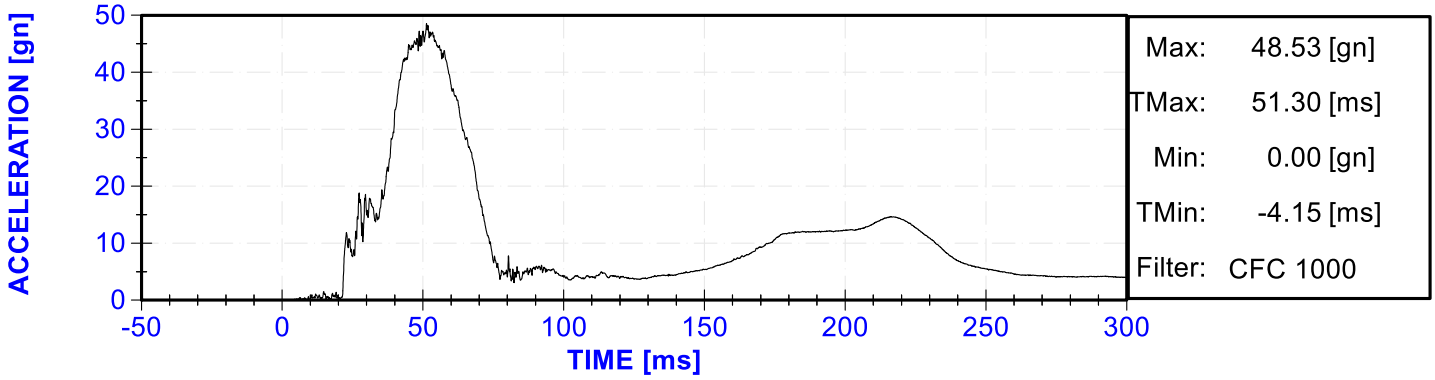
Passenger Head Acceleration (Y) vs. Time Primary



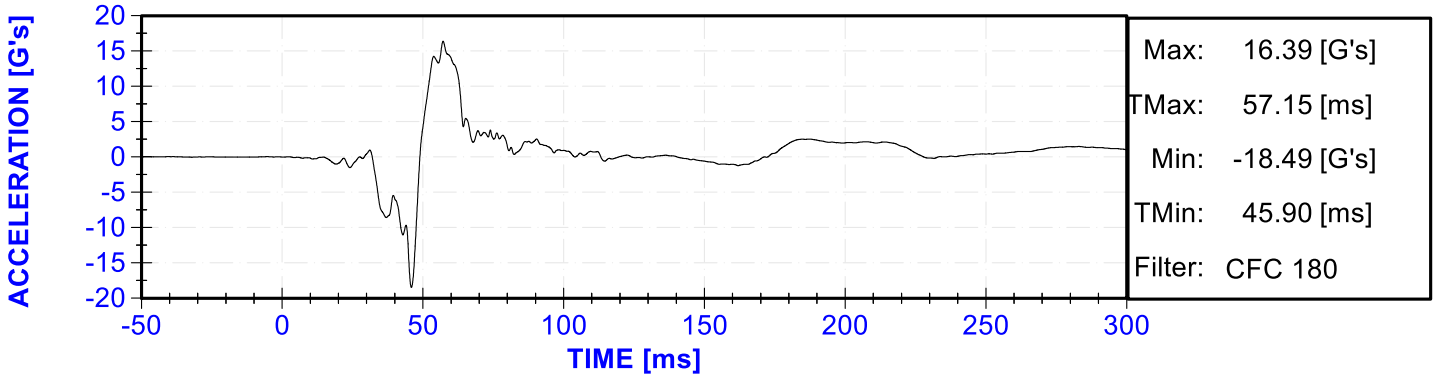
Passenger Head Acceleration (Z) vs. Time Primary



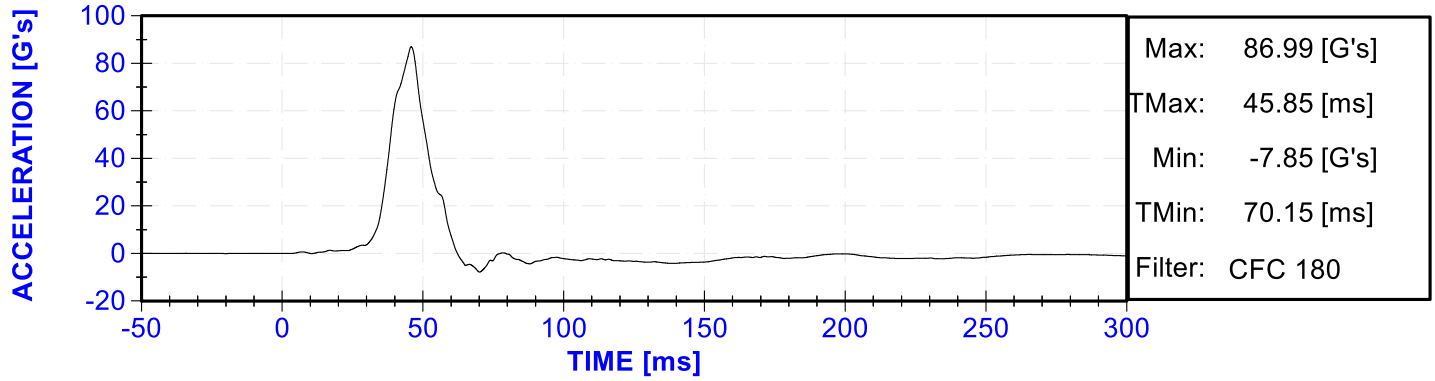
Passenger Head Resultant Acceleration Primary vs. Time



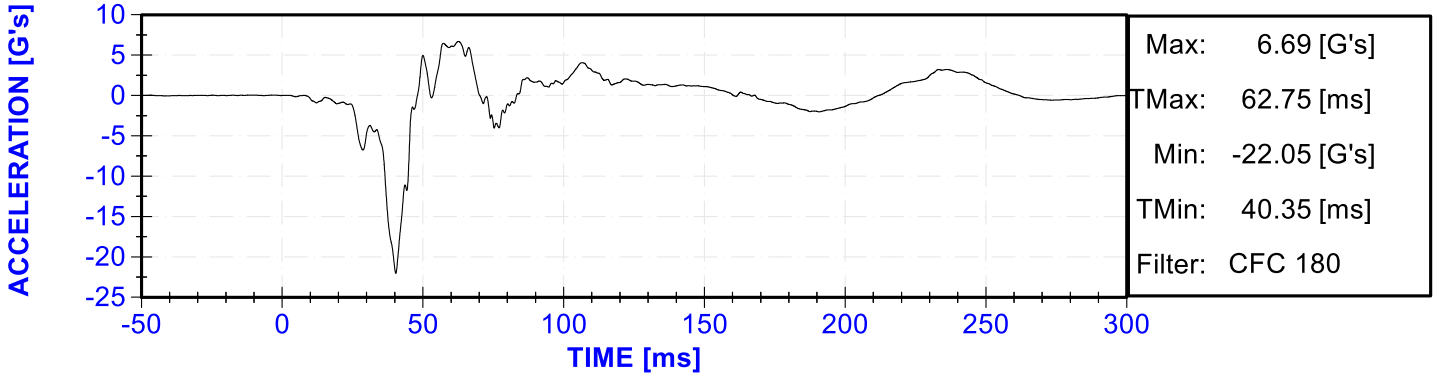
Passenger Lower Spine T12 Acceleration (X) vs. Time



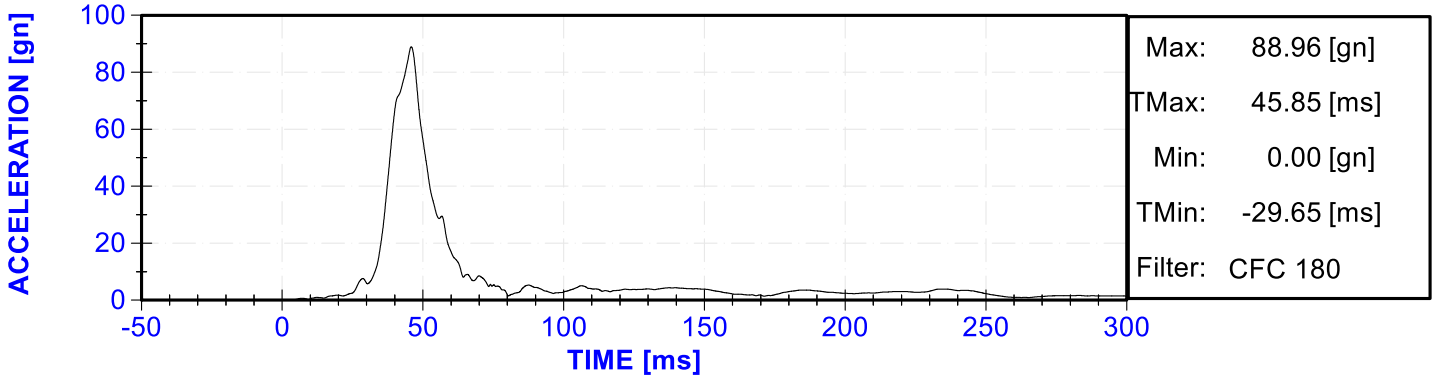
Passenger Lower Spine T12 Acceleration (Y) vs. Time



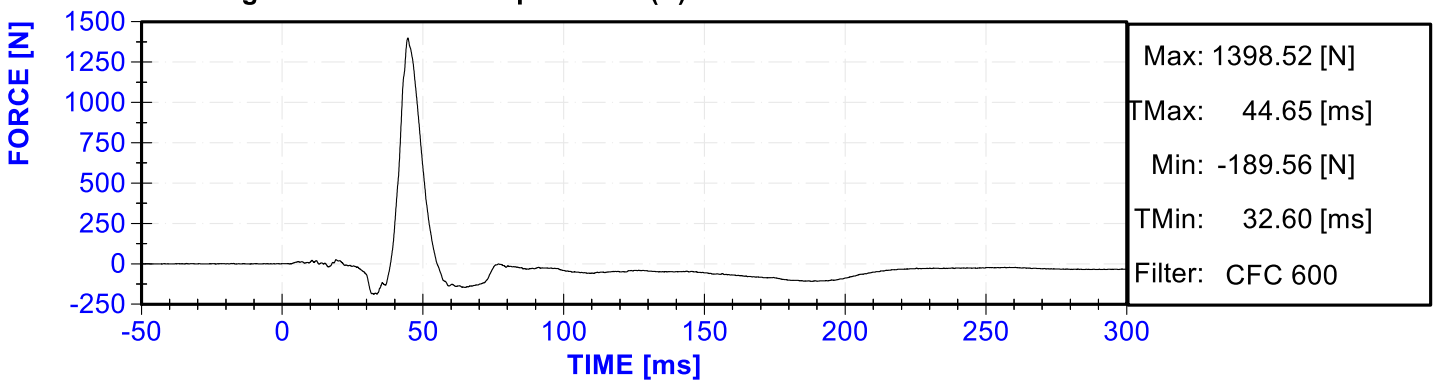
Passenger Lower Spine T12 Acceleration (Z) vs. Time



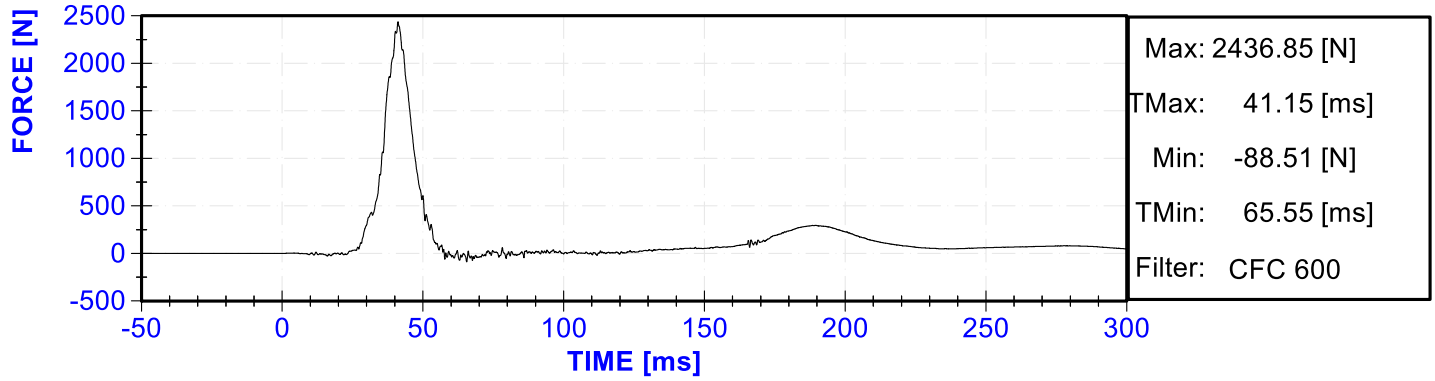
Passenger Lower Spine T12 Resultant Acceleration vs. Time



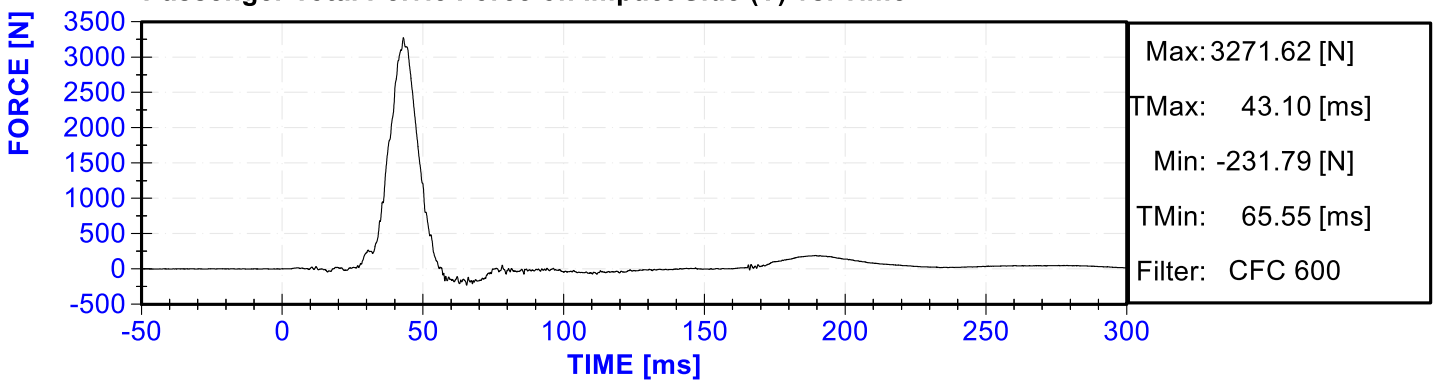
Passenger Iliac Force on Impact Side (Y) vs. Time



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



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



APPENDIX C

DUMMY PERFORMANCE CALIBRATION TEST DATA

CALIBRATION TEST RESULTS

PRE-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

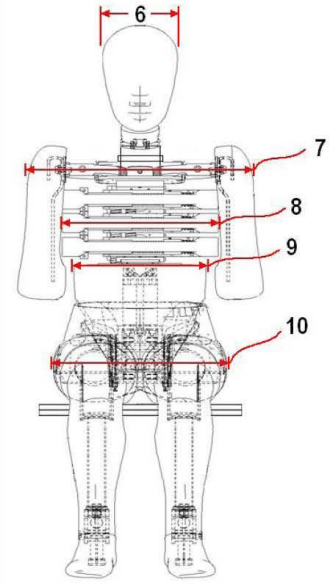
SERIAL NO: F034

(CONFIGURED FOR LEFT SIDE IMPACT)

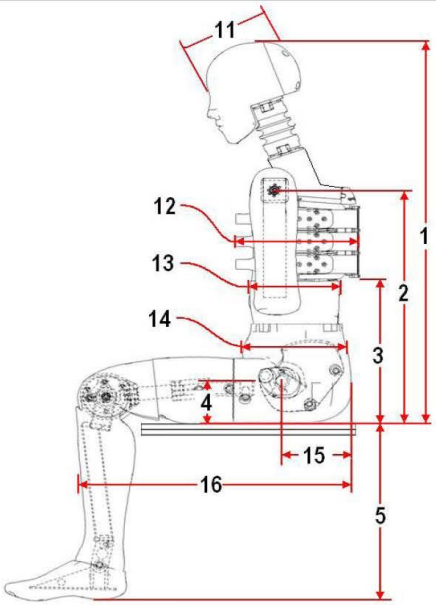
External Measurements - EuroSID-2re

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

Dummy Serial Number: F034



FRONT VIEW



SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	910	Pass
2	Seat to Shoulder Joint	558	572	566	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	350	Pass
4	Seat to Hip Joint (center of bolt)	97	103	100	Pass
5	Sole to Seat, Sitting	333	451	421	Pass
6	Head Width	152	158	152	Pass
7	Shoulder/Arm Width	461	479	470	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	281	Pass
10	Pelvis Lap Width	359	373	366	Pass
11	Head Depth	196	206	201	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	240	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	156	Pass
16	Back of Buttocks to Front Knee	597	615	606	Pass

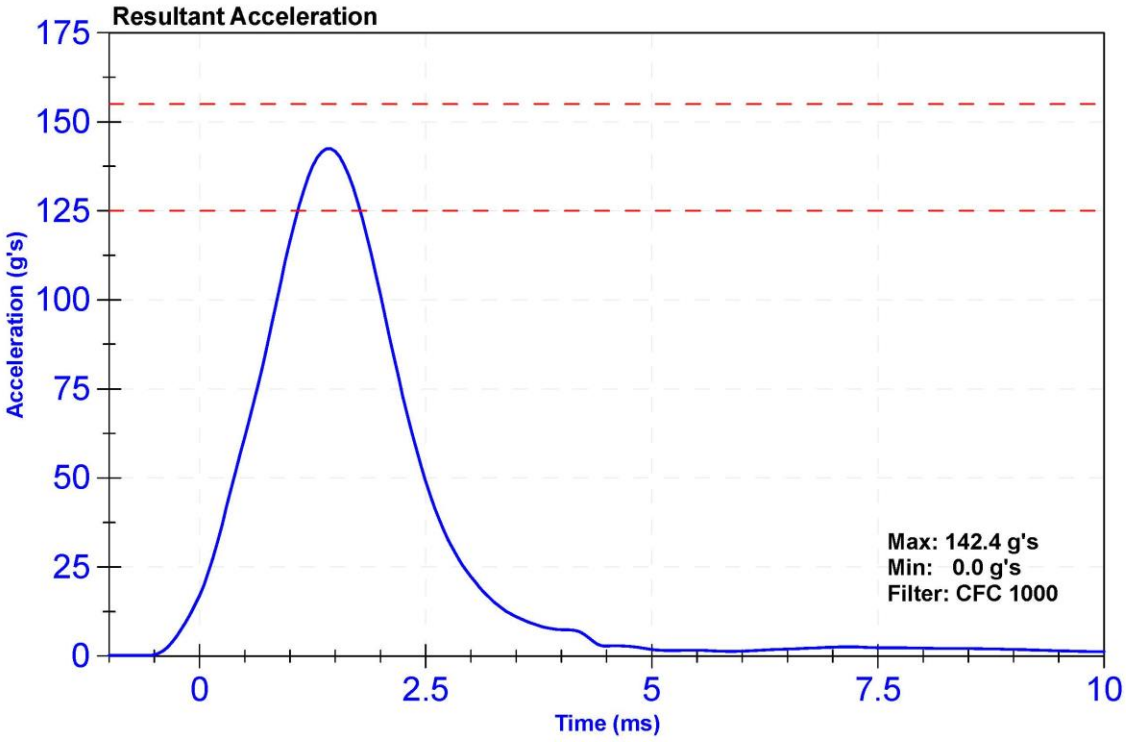
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

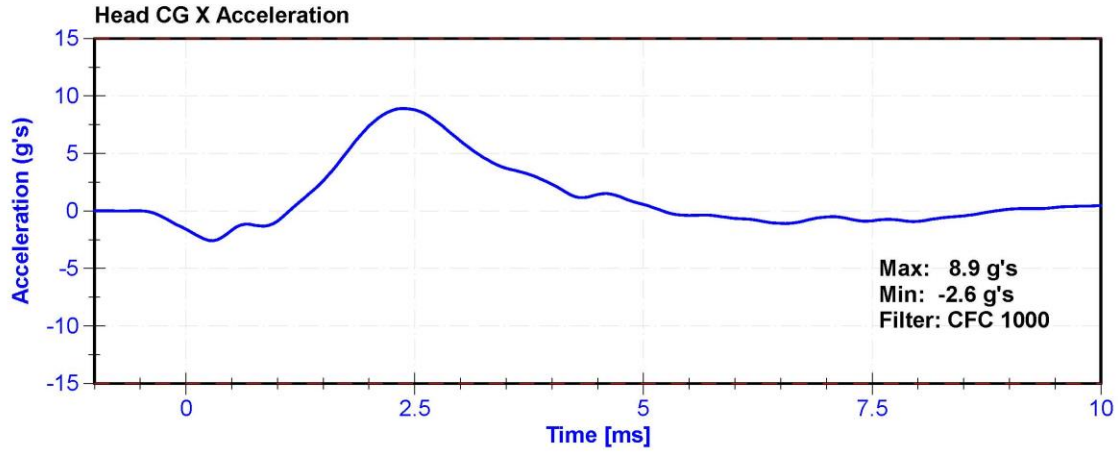
Results

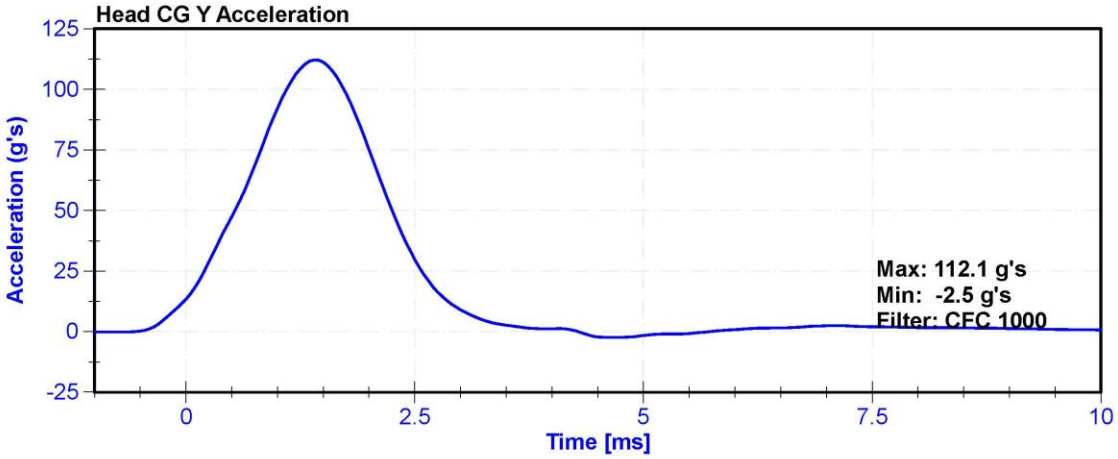
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	20.6	Pass
Resultant Acceleration	125	155	g's	142.4	Pass
Oscillation	0	15	%	2.03	Pass
Fore-Aft Acceleration	-15	15	g's	8.9	Pass

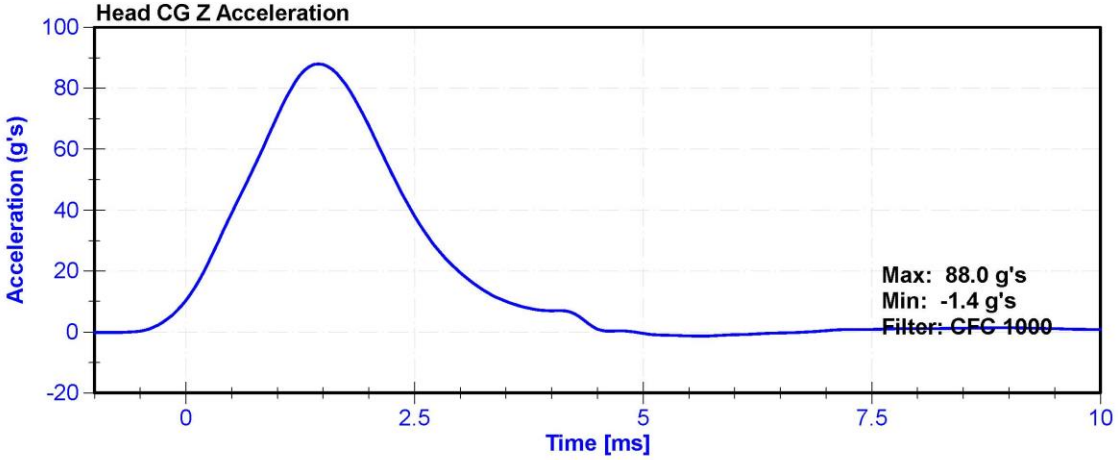
Transducer Calibrations

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




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


Head CG Y Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 112.1 g's
Min: -2.5 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]
Max: 88.0 g's
Min: -1.4 g's
Filter: CFC 1000

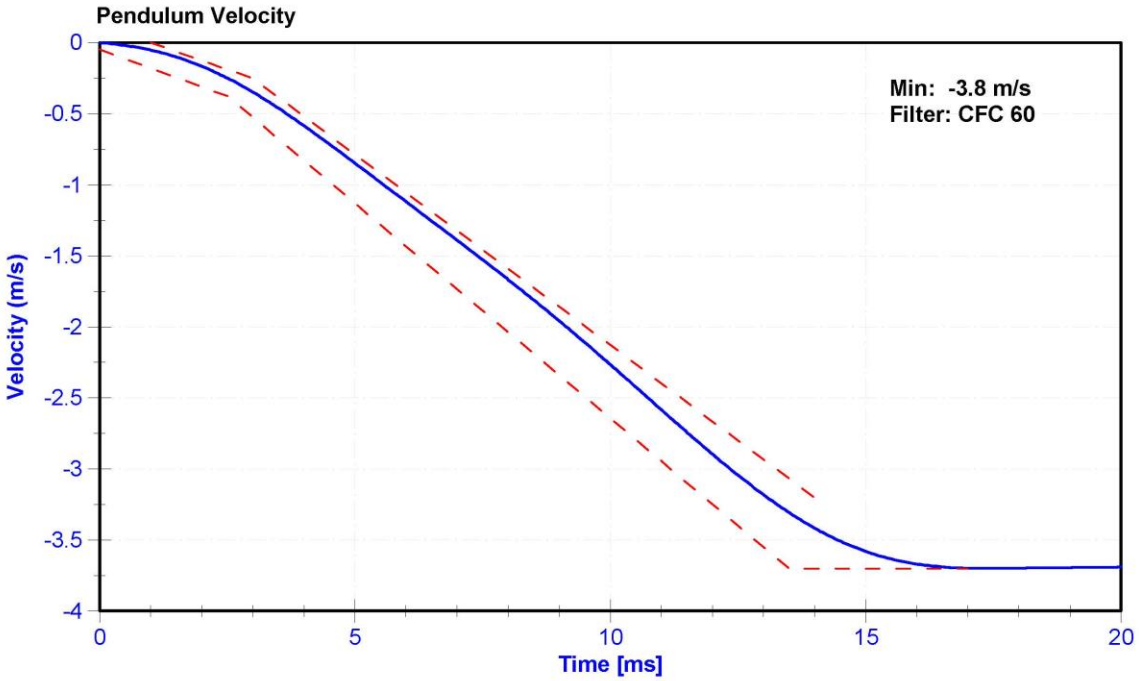
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

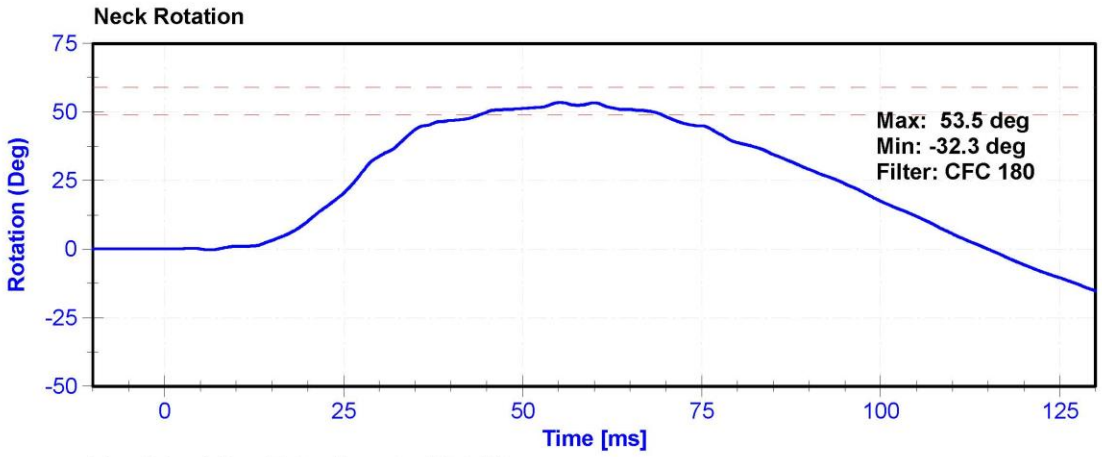
Results

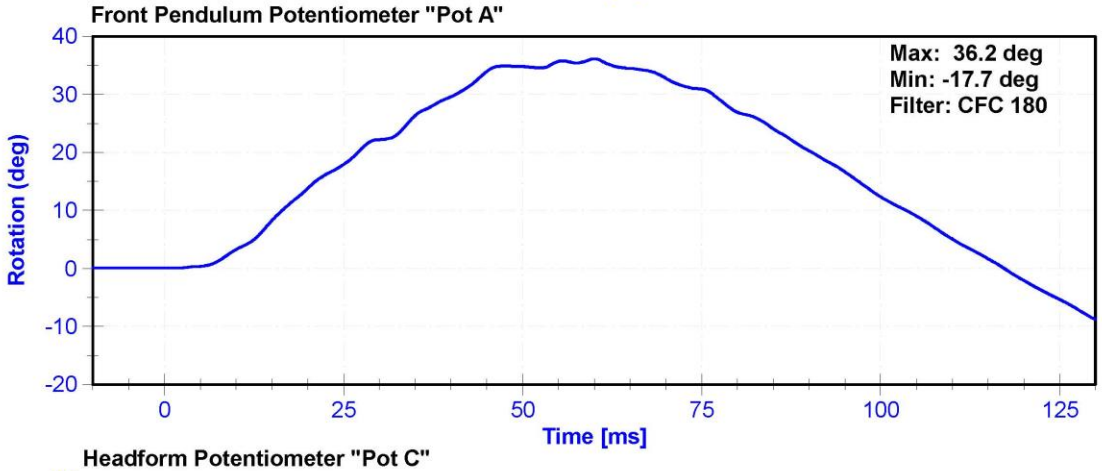
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	40	Pass
Velocity	3.3	3.5	m/s	3.46	Pass
Lateral Neck Rotation	49	59	deg	53.5	Pass
Time at Maximum Rotation	54	66	ms	55.3	Pass
Time of Rotation Decay from Maximum	53	88	ms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

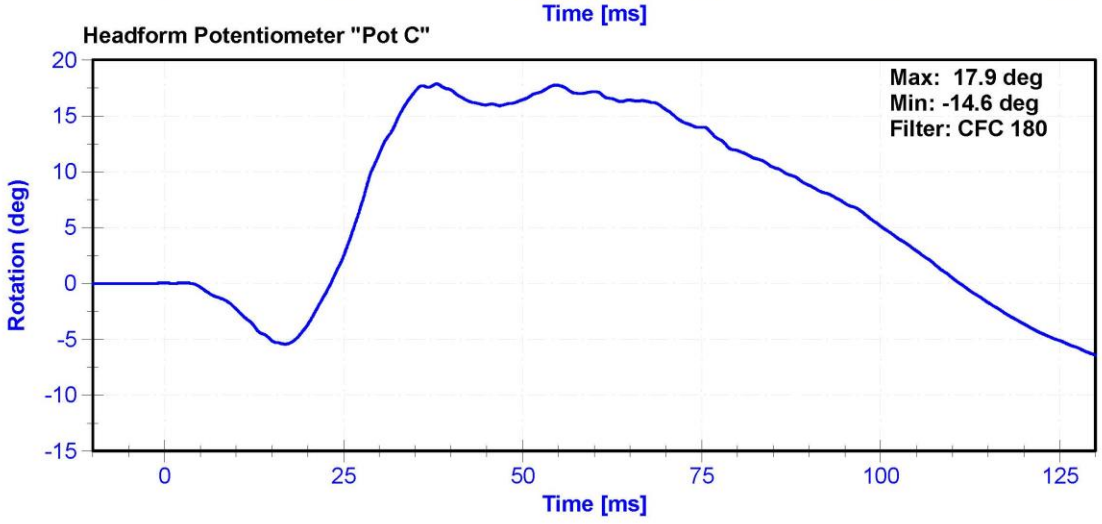
Transducer Calibrations

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




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


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


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

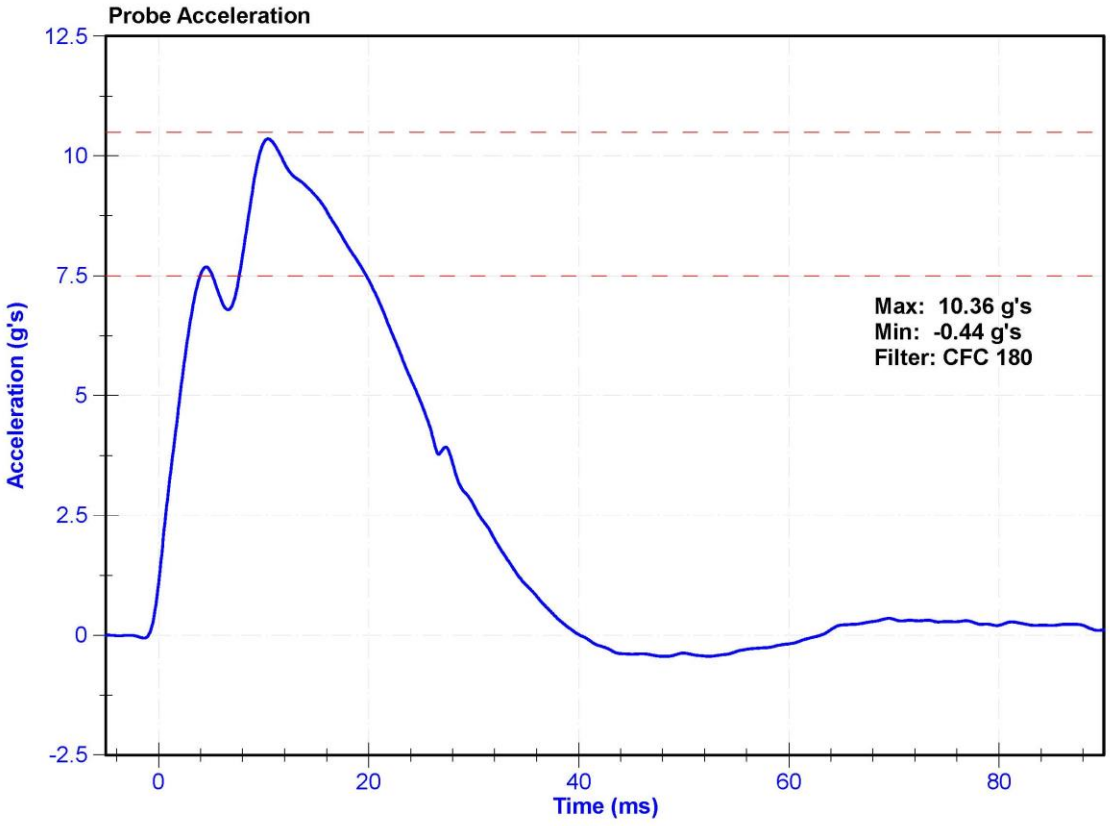
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

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

Transducer Calibrations

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



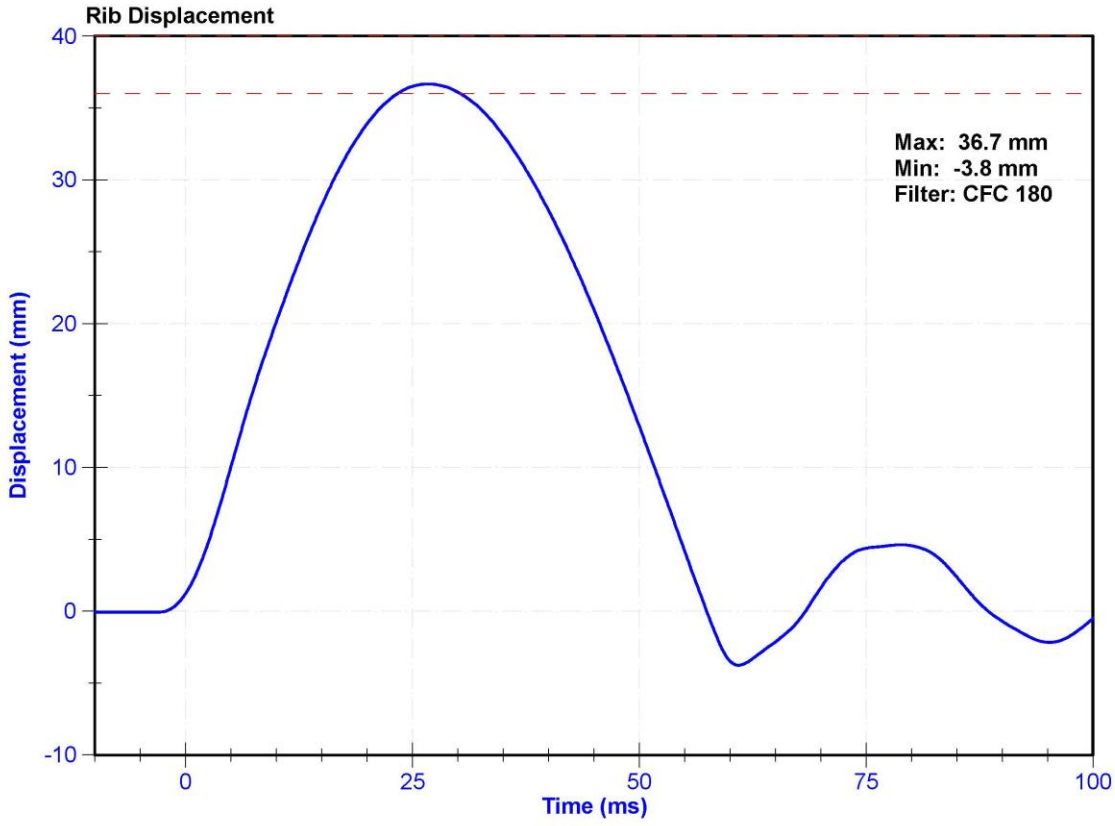
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

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

Transducer Calibrations

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



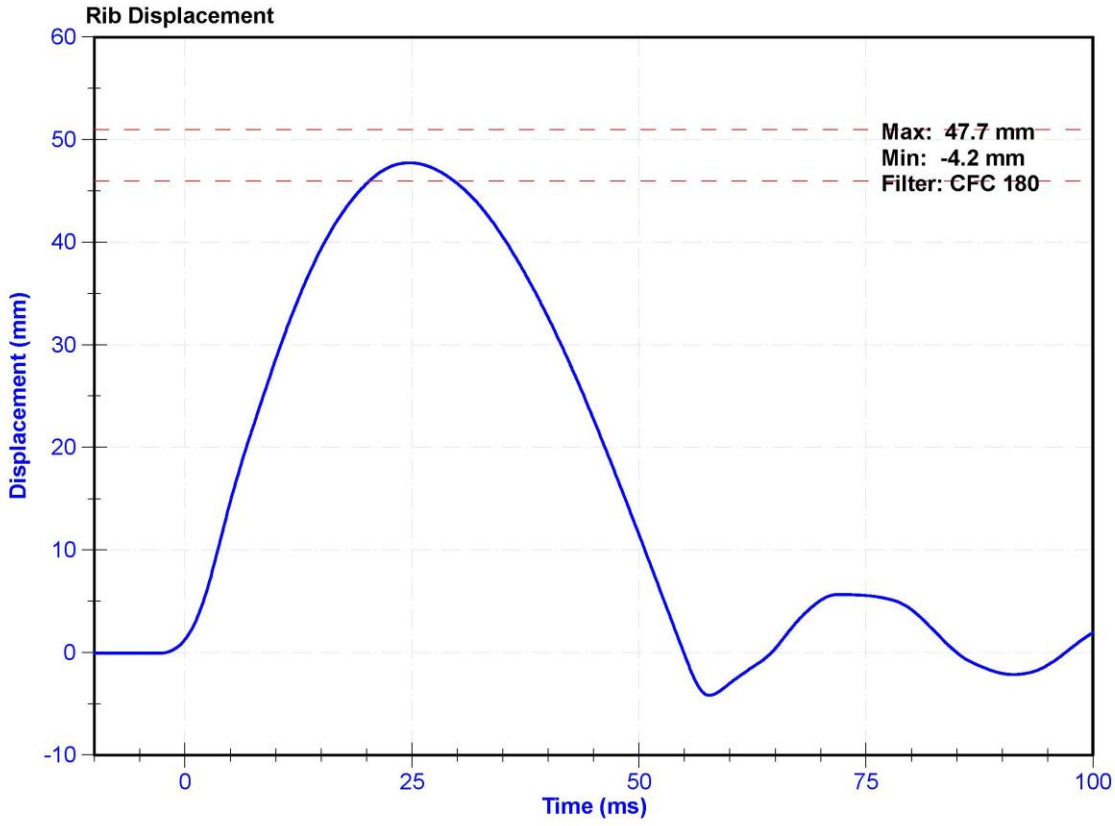
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

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

Transducer Calibrations

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



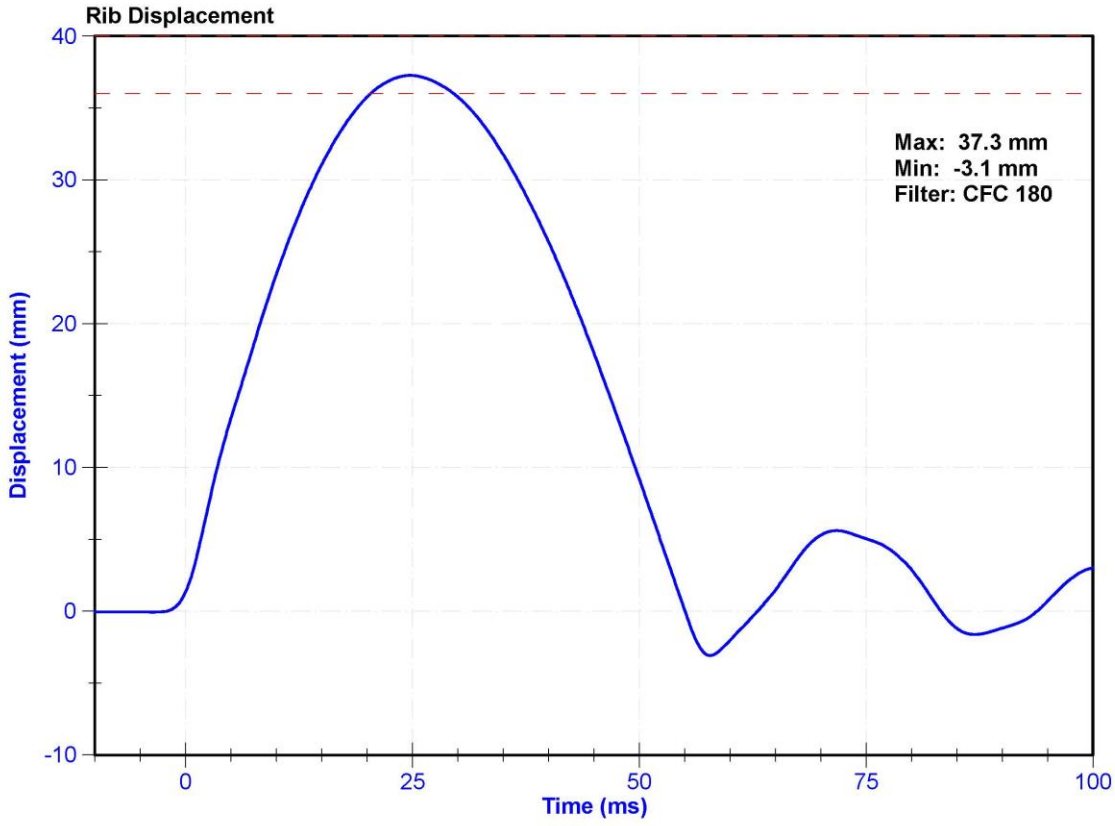
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	36.5	Pass
Rib Displacement	36	40	mm	37.3	Pass

Transducer Calibrations

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



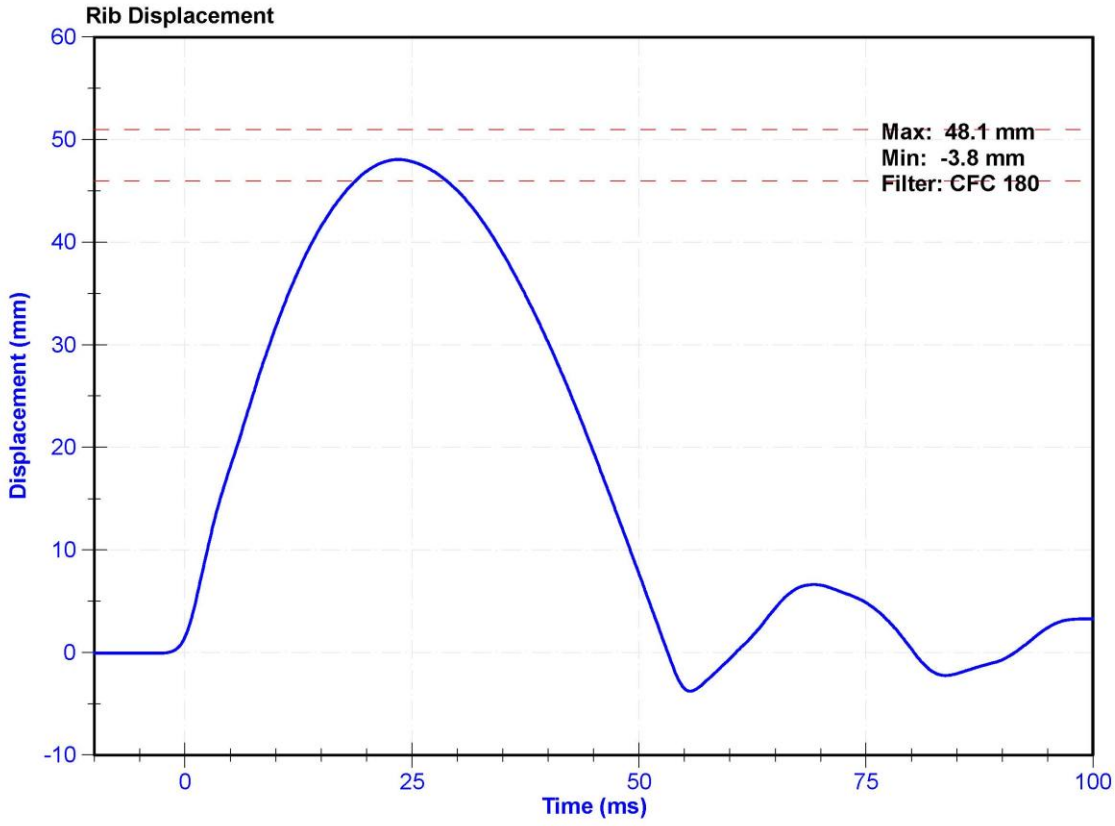
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

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

Transducer Calibrations

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



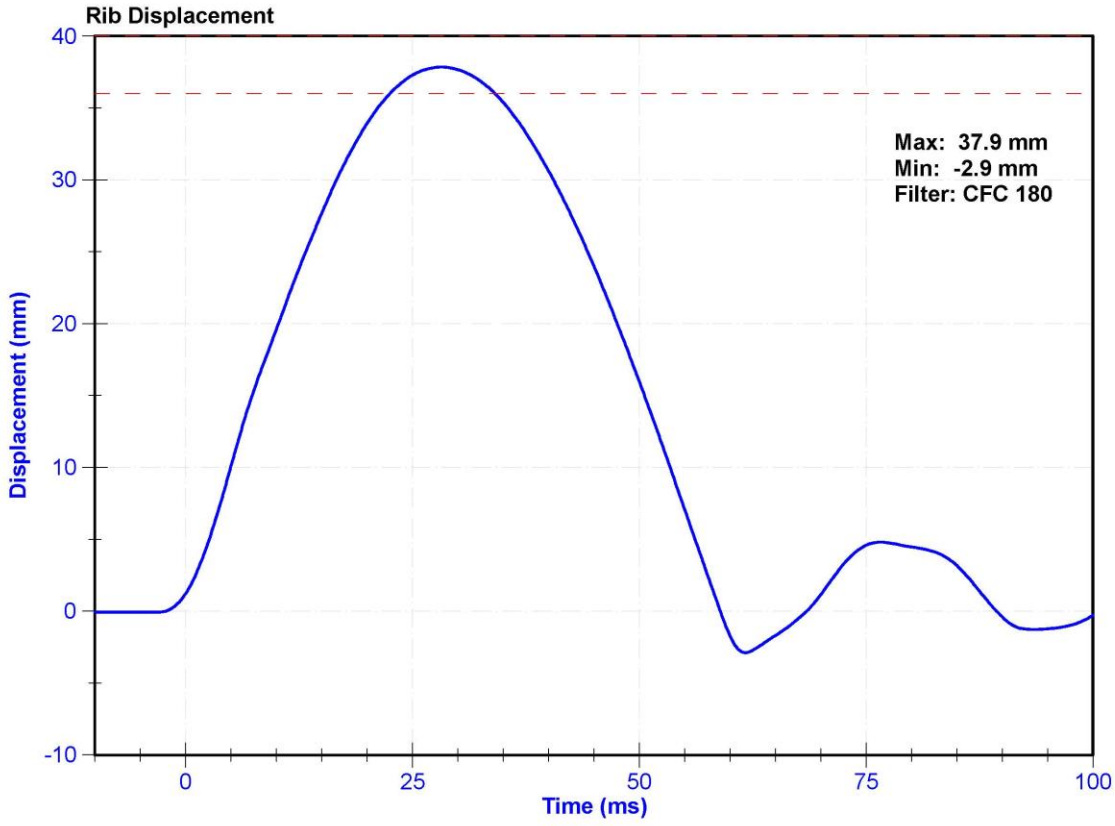
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	36.7	Pass
Rib Displacement	36	40	mm	37.9	Pass

Transducer Calibrations

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



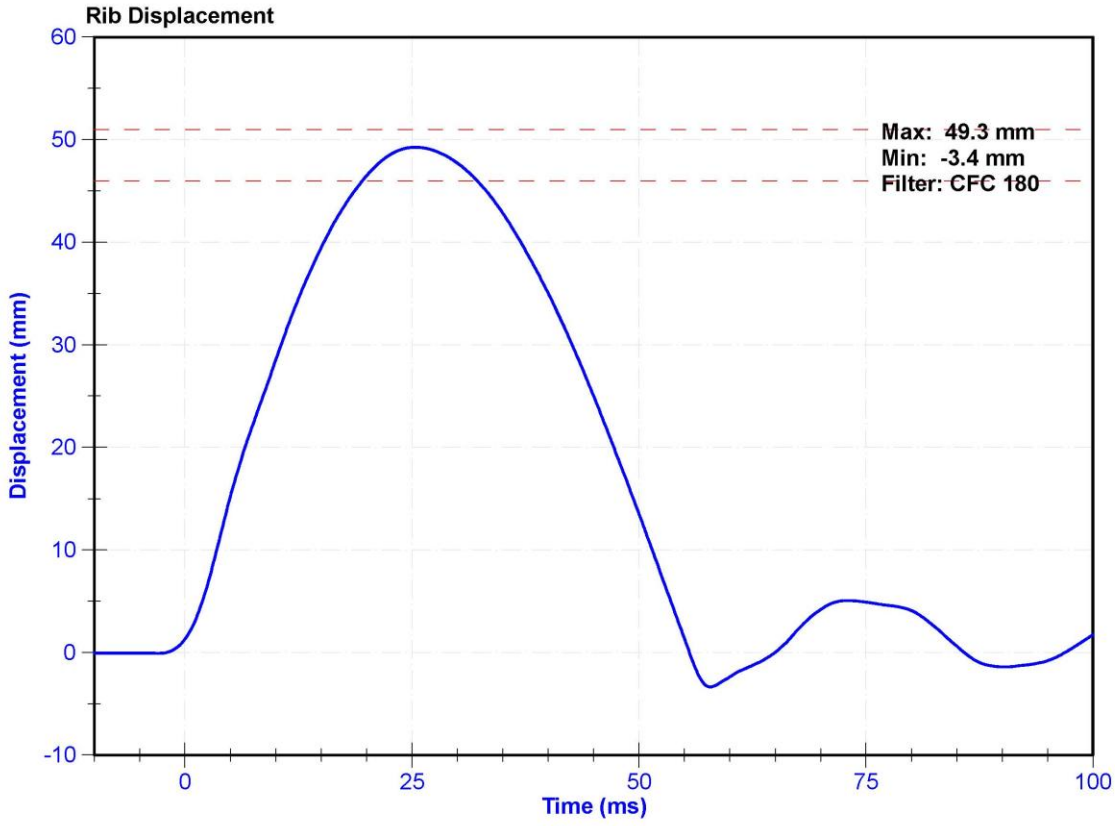
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

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

Transducer Calibrations

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



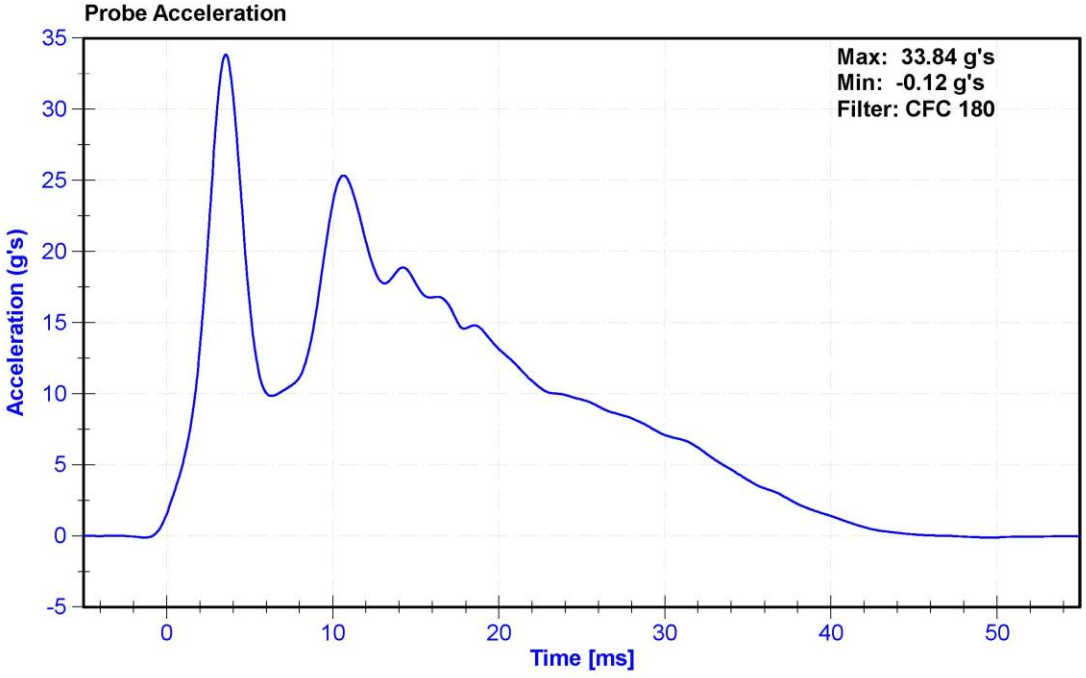
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

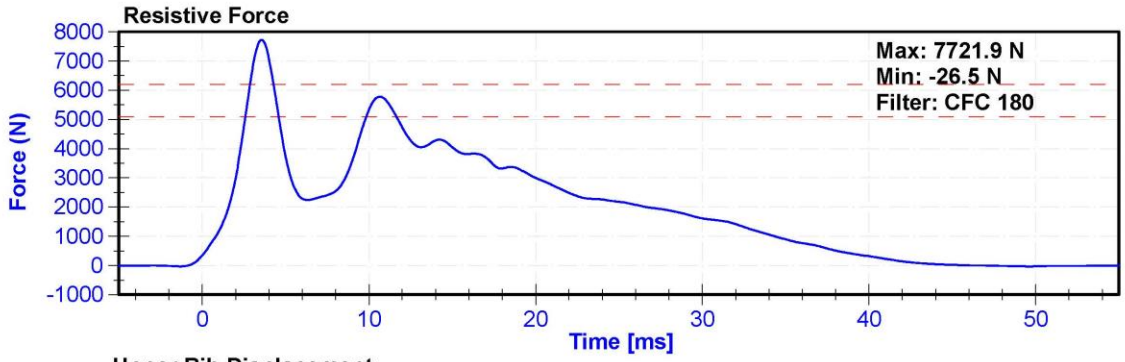
Results

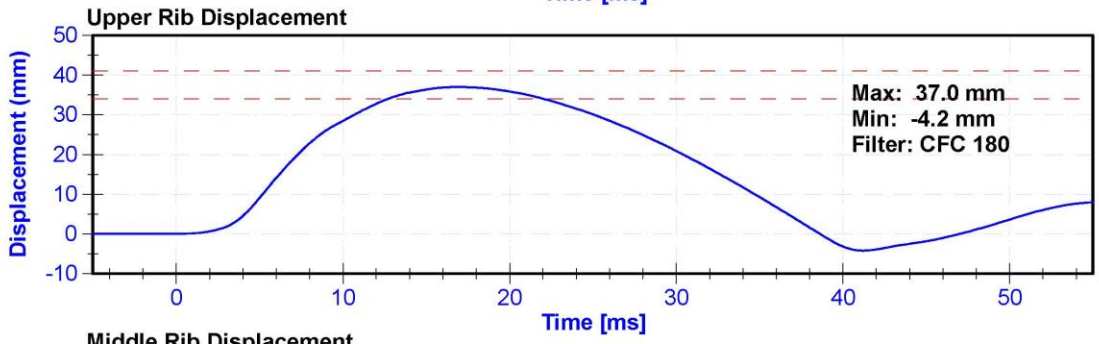
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	25.6	Pass
Velocity	5.4	5.6	m/s	5.55	Pass
Resistive Force after 6ms	5100	6200	N	5780.6	Pass
Upper Thorax Rib Deflection	34	41	mm	37.0	Pass
Mid Thorax Rib Deflection	37	45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

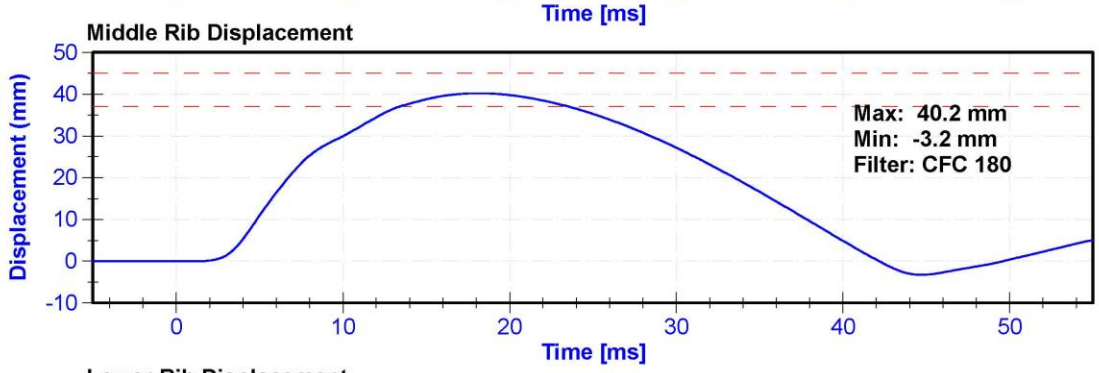
Transducer Calibrations

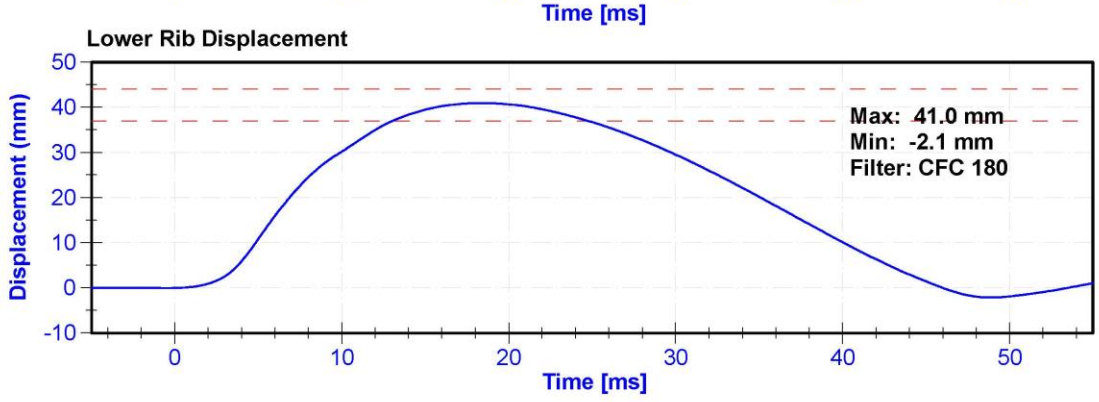
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019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




Resistive Force
Force (N)
Time [ms]
Max: 7721.9 N
Min: -26.5 N
Filter: CFC 180


Upper Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.0 mm
Min: -4.2 mm
Filter: CFC 180


Middle Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.2 mm
Min: -3.2 mm
Filter: CFC 180


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

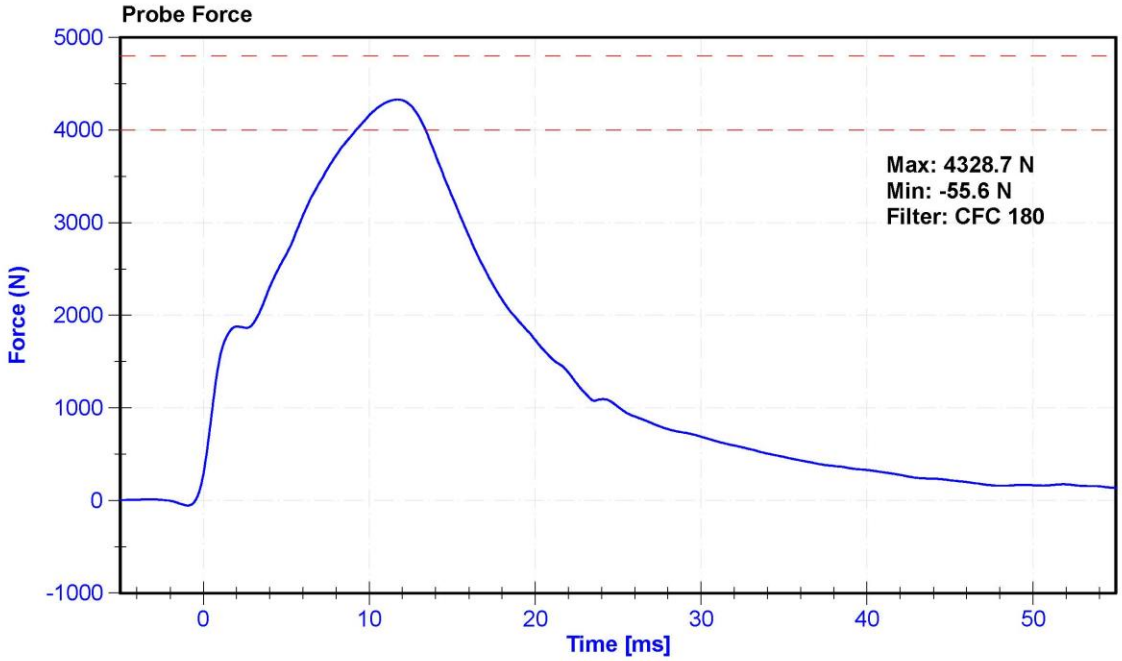
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

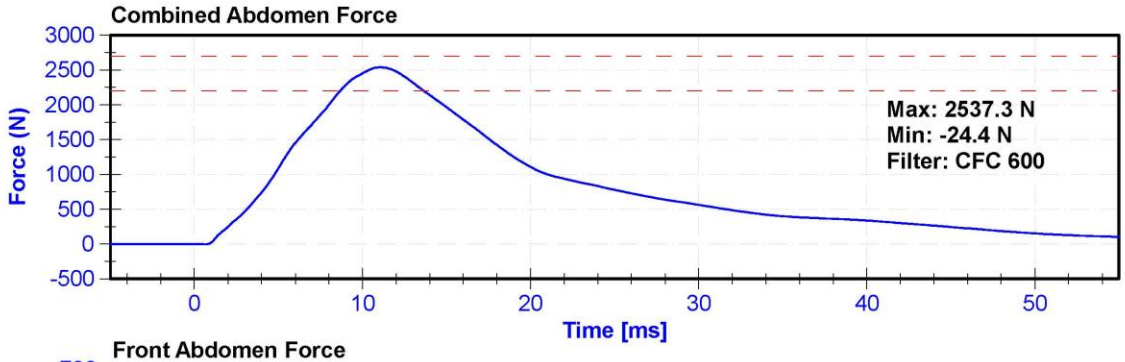
Results

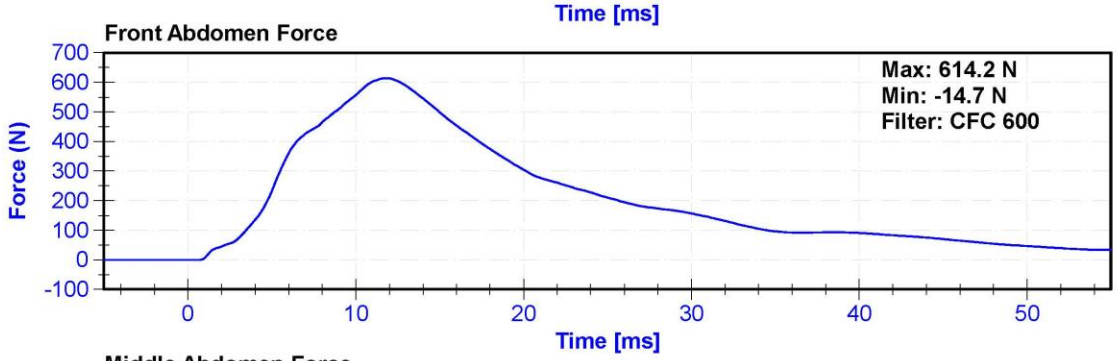
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	23.6	Pass
Velocity	3.9	4.1	m/s	4.09	Pass
Combined Abdomen Force	2200	2700	N	2537.3	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.05	Pass
Resistive Probe Force	4000	4800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

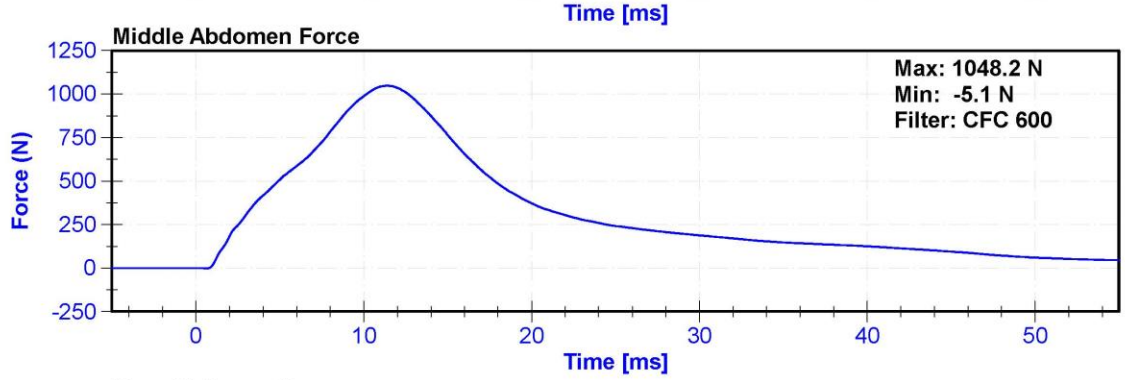
Transducer Calibrations

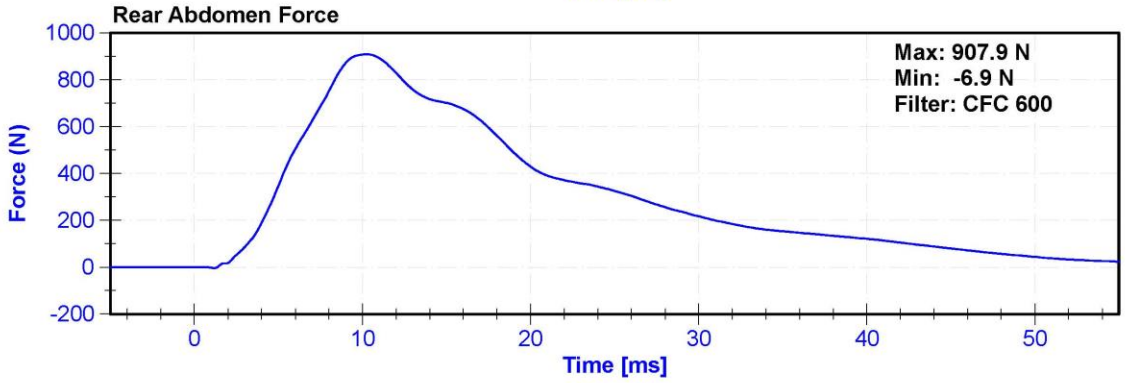
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Front Abdomen Load Cell	DENTON 2631	LC-1440	6/4/2018	6/4/2019
Middle Abdomen Load Cell	DENTON 2631	LC-1525	6/4/2018	6/4/2019
Rear Abdomen Load Cell	DENTON 2631	LC-1528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




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


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


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


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

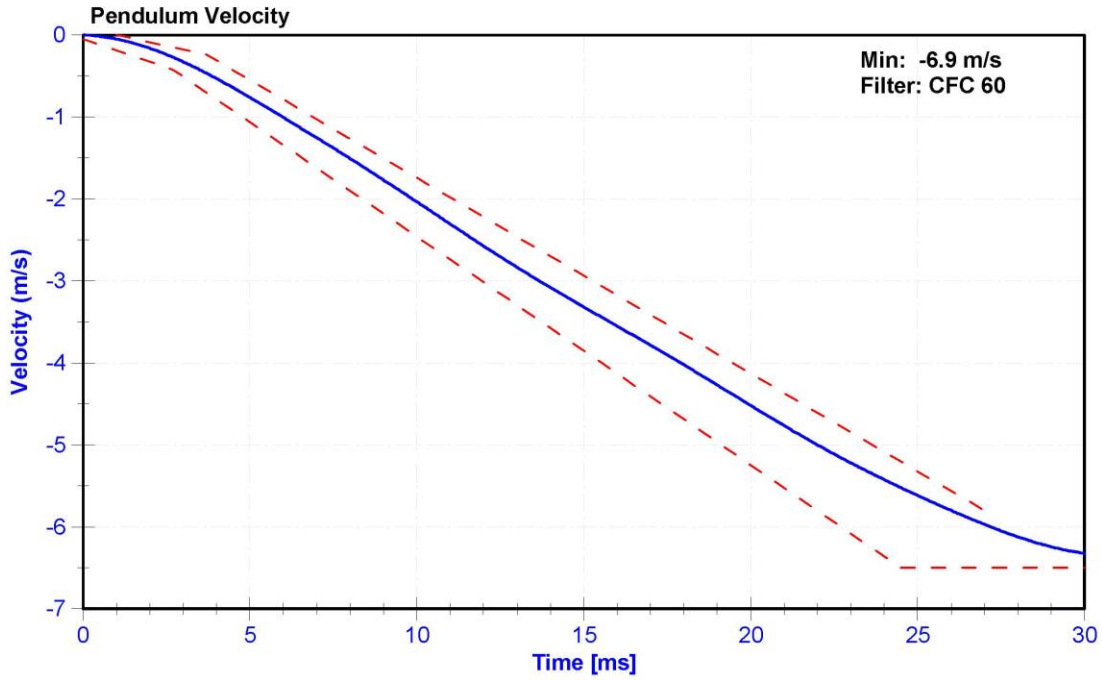
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

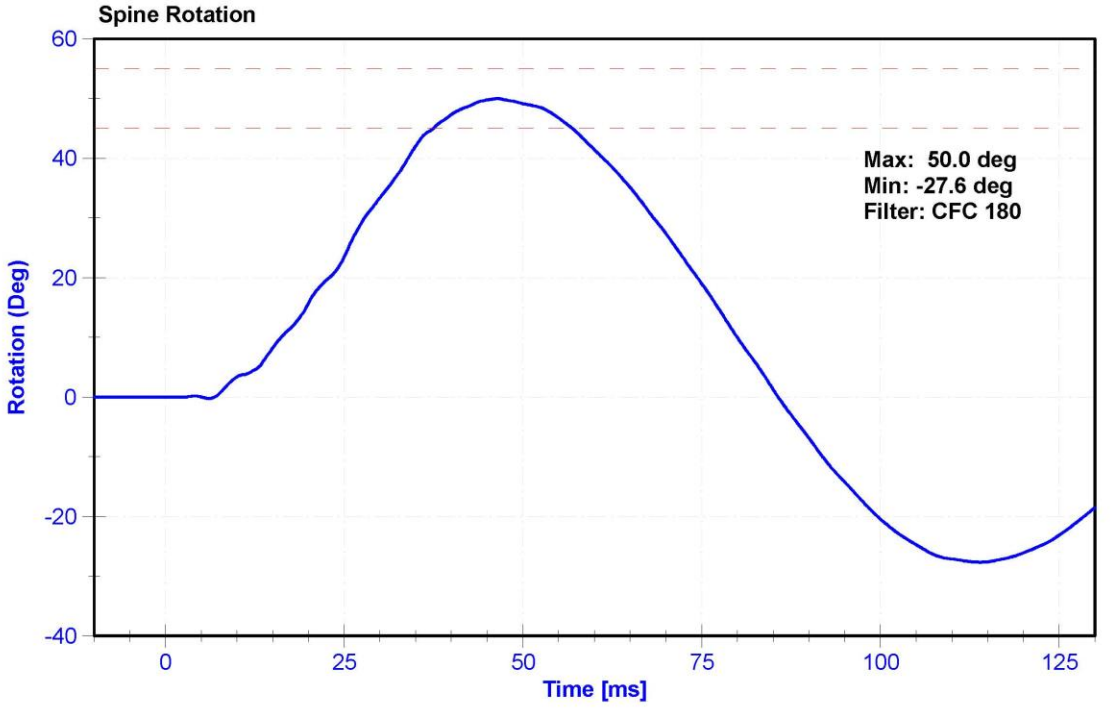
Results

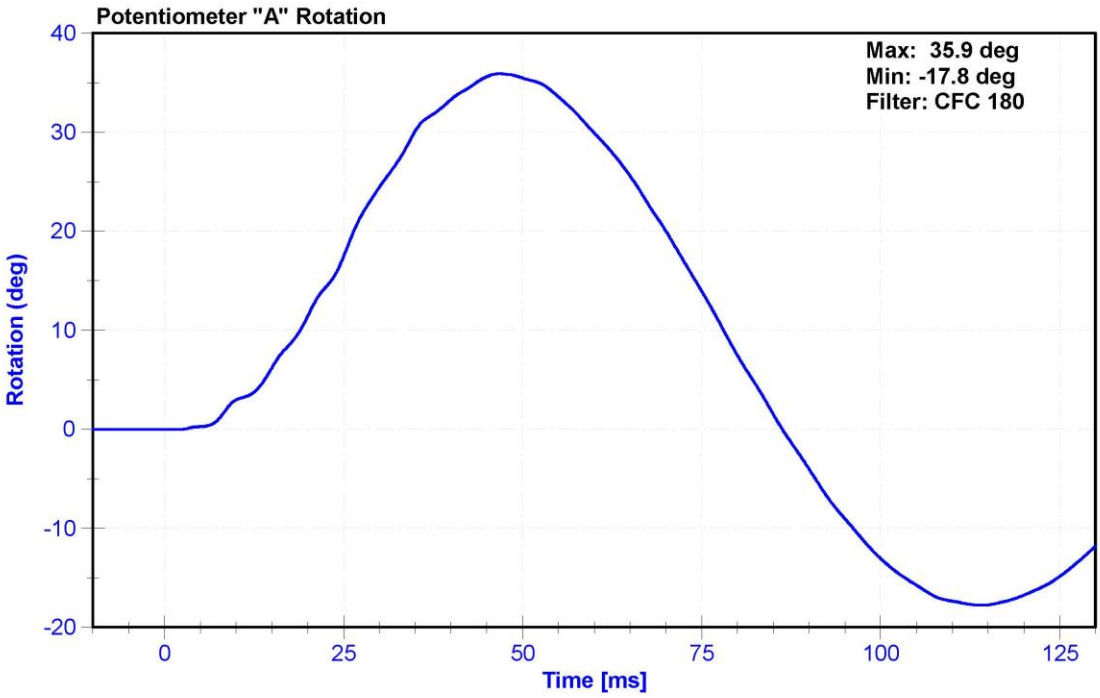
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	37.5	Pass
Velocity	5.95	6.15	m/s	6.025	Pass
Lateral Spine Rotation	45	55	deg	50.0	Pass
Time at Maximum Rotation	39	53	ms	46.4	Pass
Time of Decay to Zero Degrees	37	57	ms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

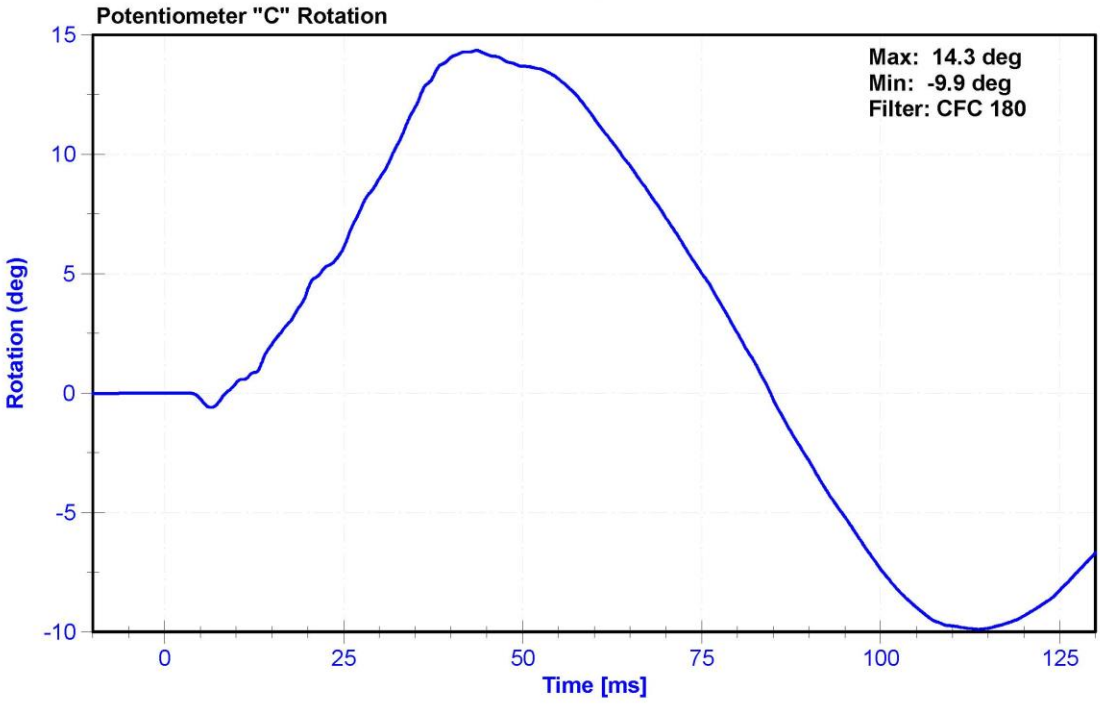
Transducer Calibrations

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


Pendulum Velocity
Min: -6.9 m/s
Filter: CFC 60
Velocity (m/s)
0
-1
-2
-3
-4
-5
-6
-7
0
5
10
15
20
25
30
Time [ms]


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


Potentiometer "A" Rotation
Max: 35.9 deg
Min: -17.8 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
-20
0
25
50
75
100
125
Time [ms]


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

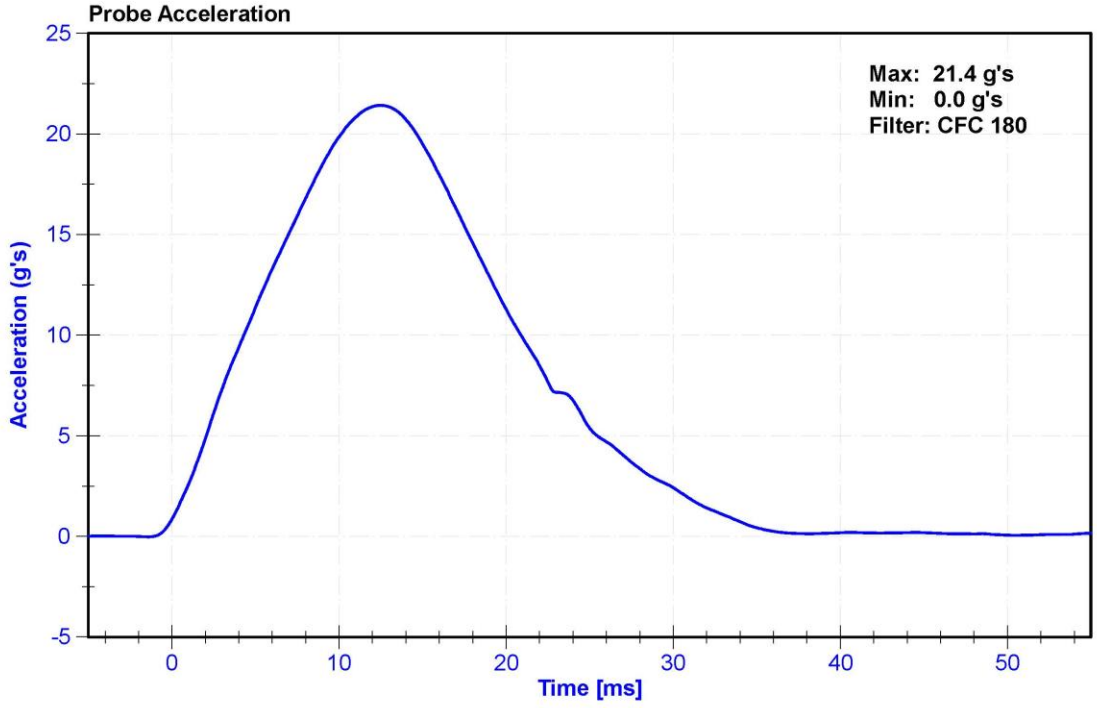
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

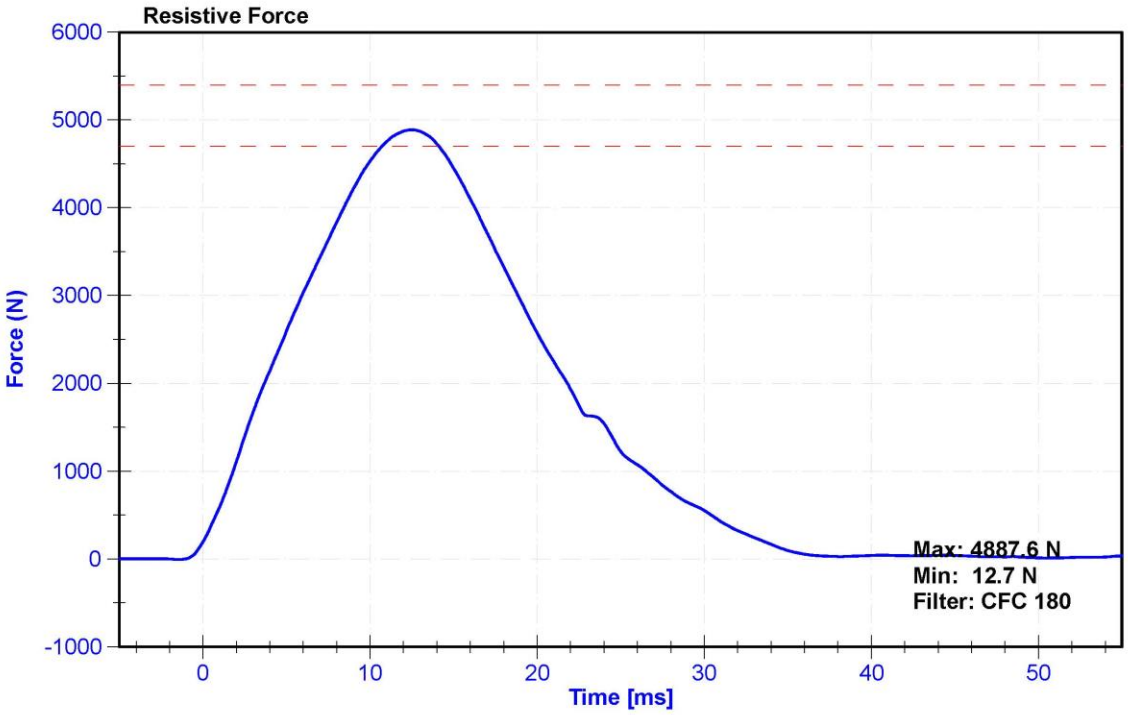
Results

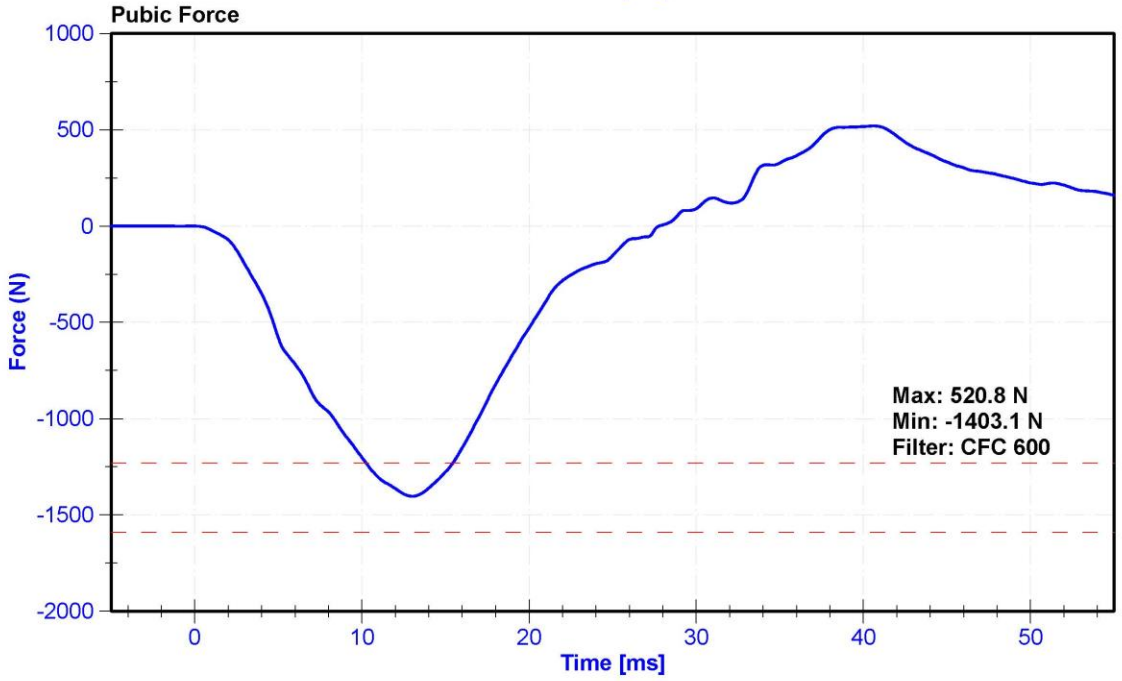
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	26.3	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Resistive Force	4700	5400	N	4887.6	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.50	Pass
Pubic Force	-1590	-1230	N	-1403.1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

Transducer Calibrations

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




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


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

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

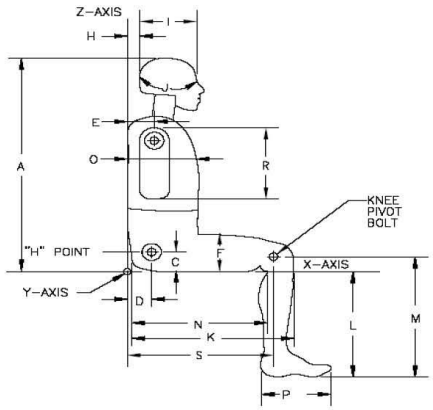
SERIAL No: 300

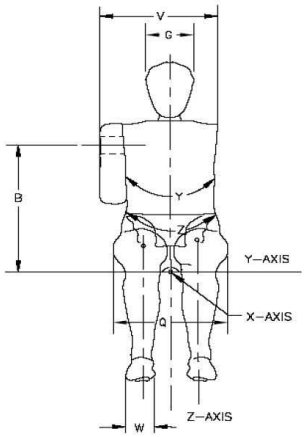
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

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

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	781	Pass
B	Shoulder Pivot Height	437	453	447	Pass
C	H-point Height	79	89	84	Pass
D	H-point from seatback	141	151	145	Pass
E	Shoulder Pivot from Backline	97	107	105	Pass
F	Thigh Clearance	119	135	124	Pass
G	Head Breadth	140	148	144	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	185	Pass
J	Head Circumference	541	551	547	Pass
K	Buttock to Knee Length	514	540	530	Pass
L	Popliteal Height	343	369	358	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	204	Pass
P	Foot Length	216	232	223	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	318	Pass
R	Arm Length	249	259	254	Pass
S	Knee Joint to seatback	477	493	484	Pass
V	Shoulder Width	341	357	351	Pass
W	Foot Width	78	94	84	Pass
Y	Chest Circumference w/jacket	851	881	873	Pass
Z	Waist Circumference	761	791	769	Pass

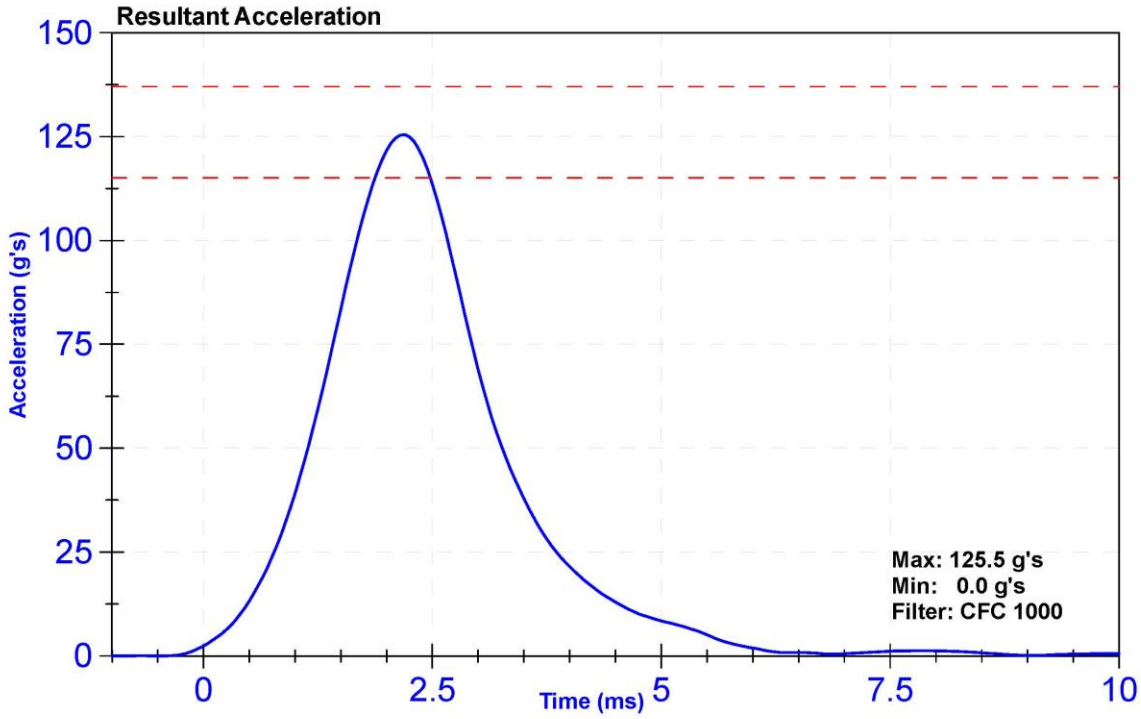
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

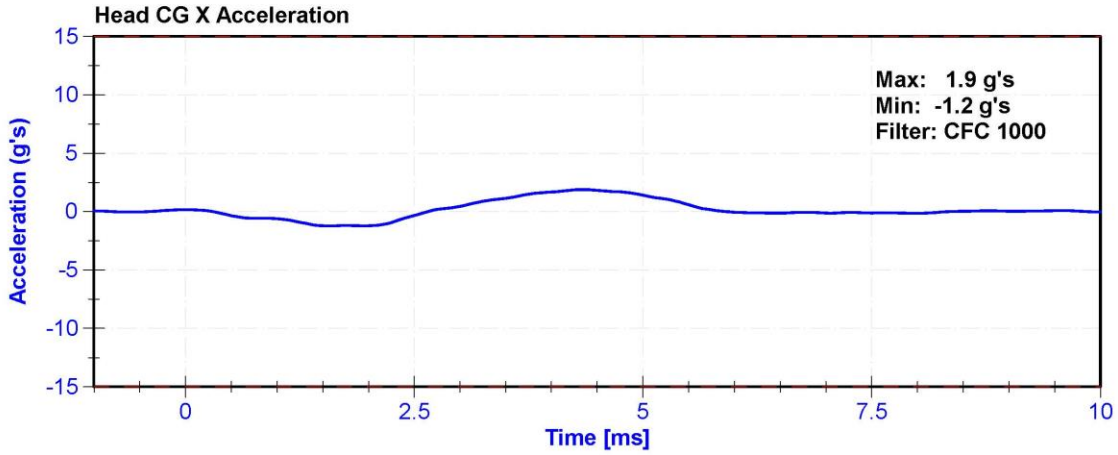
Results

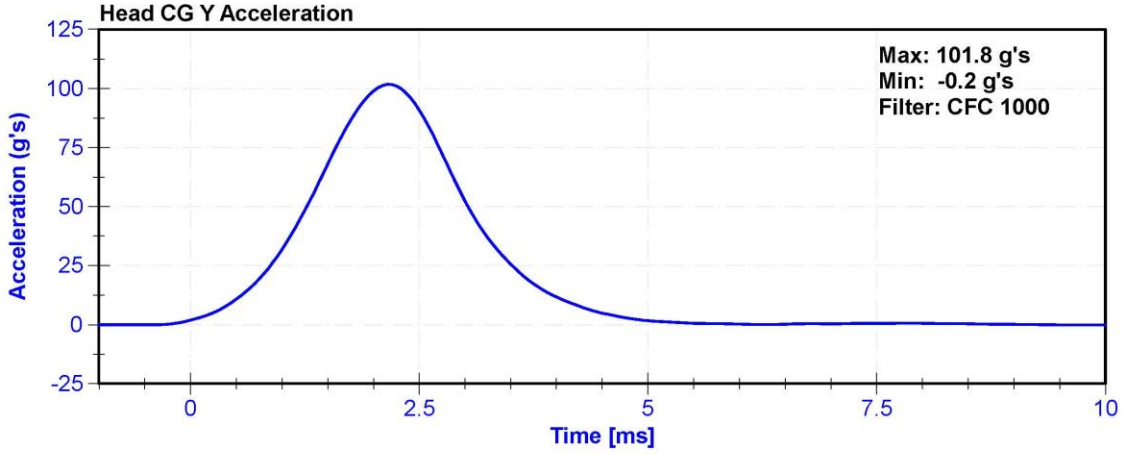
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	13.5	Pass
Resultant Acceleration	115	137	g's	125.5	Pass
Oscillation	0	15	%	0.9	Pass
Fore-Aft Acceleration	-15	15	g's	1.9	Pass

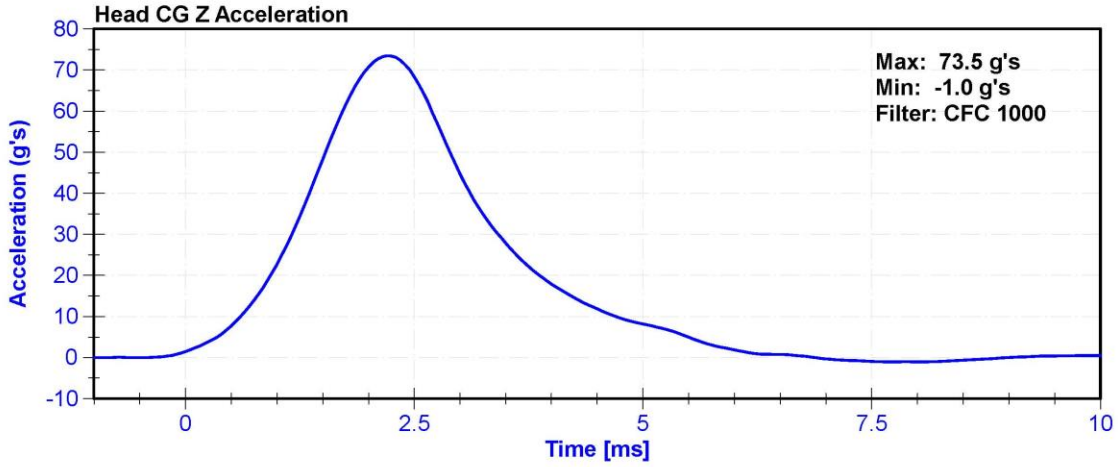
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P58777	10/5/2018	4/5/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P59018	10/5/2018	4/5/2019
Z Accelerometer	ENDEVCO 7264	AC-P79189	10/5/2018	4/5/2019




Head CG X Acceleration
Max: 1.9 g's
Min: -1.2 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Y Acceleration
Max: 101.8 g's
Min: -0.2 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Z Acceleration
Max: 73.5 g's
Min: -1.0 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]

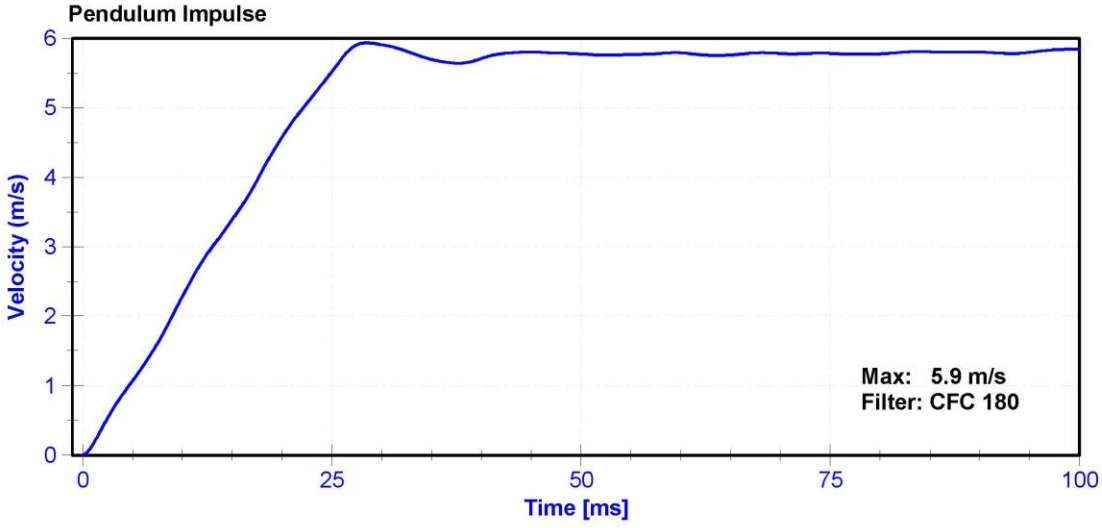
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

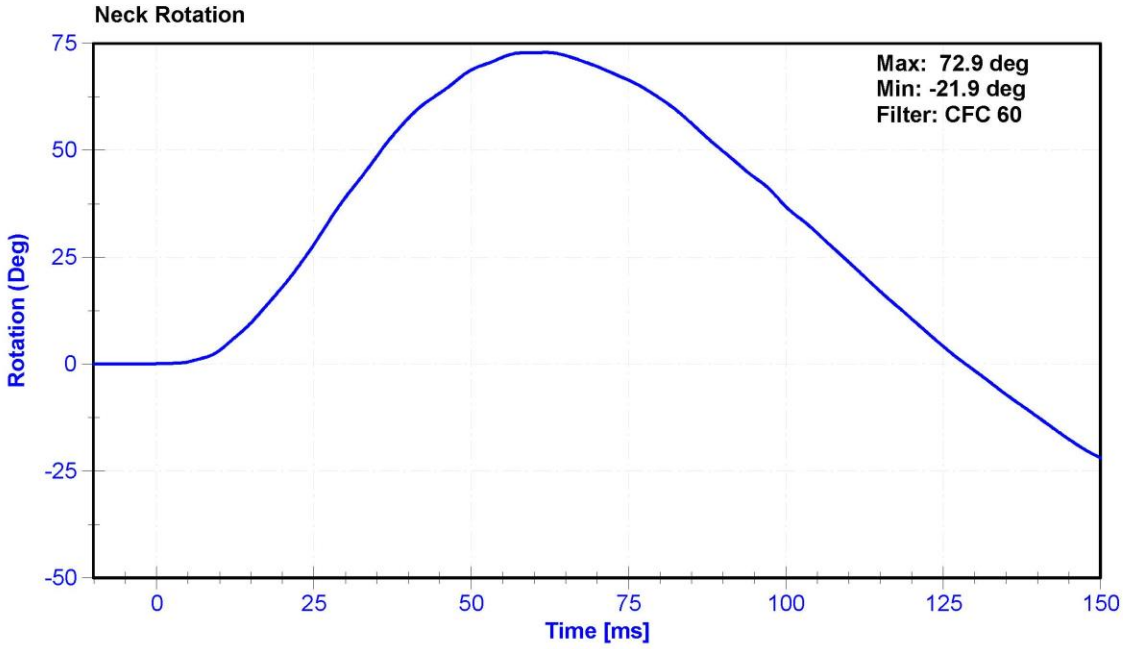
Results

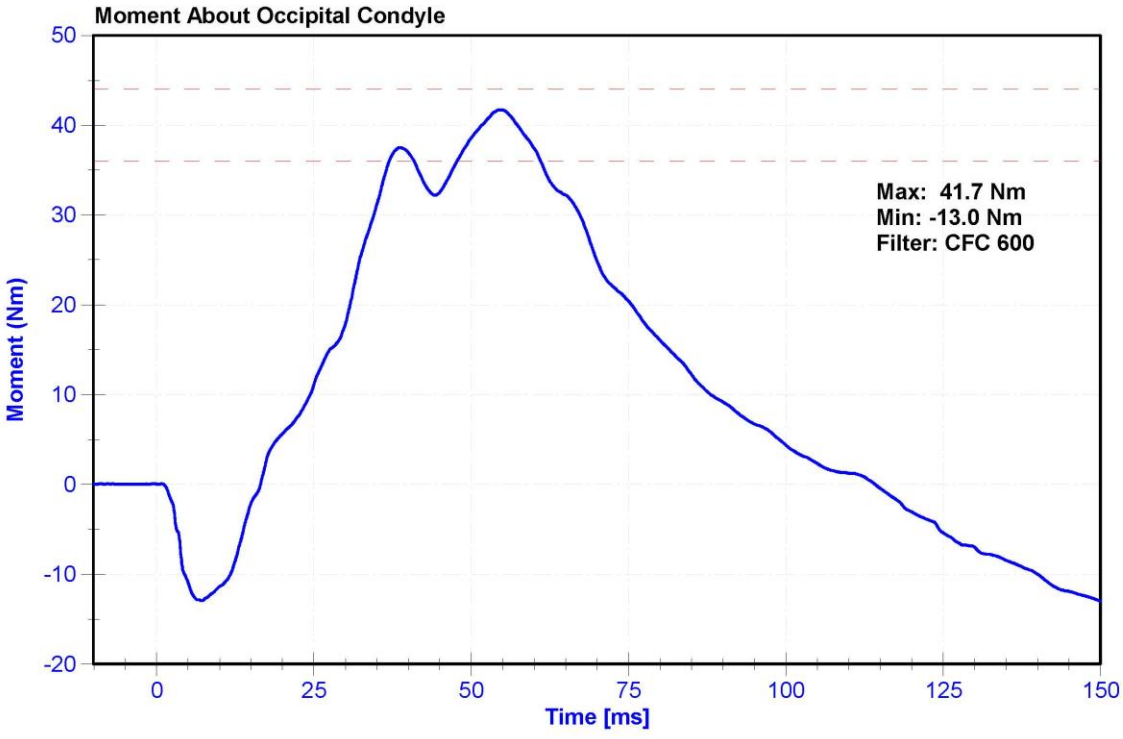
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.9	Pass
Humidity	10	70	%	39.6	Pass
Velocity	5.51	5.63	m/s	5.620	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.28	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.39	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.58	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.52	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.94	Pass
Neck Rotation	71	81	deg	72.9	Pass
Time at Maximum Rotation	50	70	ms	61.8	Pass
Moment about the OC	36	44	Nm	41.7	Pass
Moment Decay to 0 Nm	102	126	ms	114.2	Pass

Transducer Calibrations

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




Neck Rotation
Max: 72.9 deg
Min: -21.9 deg
Filter: CFC 60
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 41.7 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]

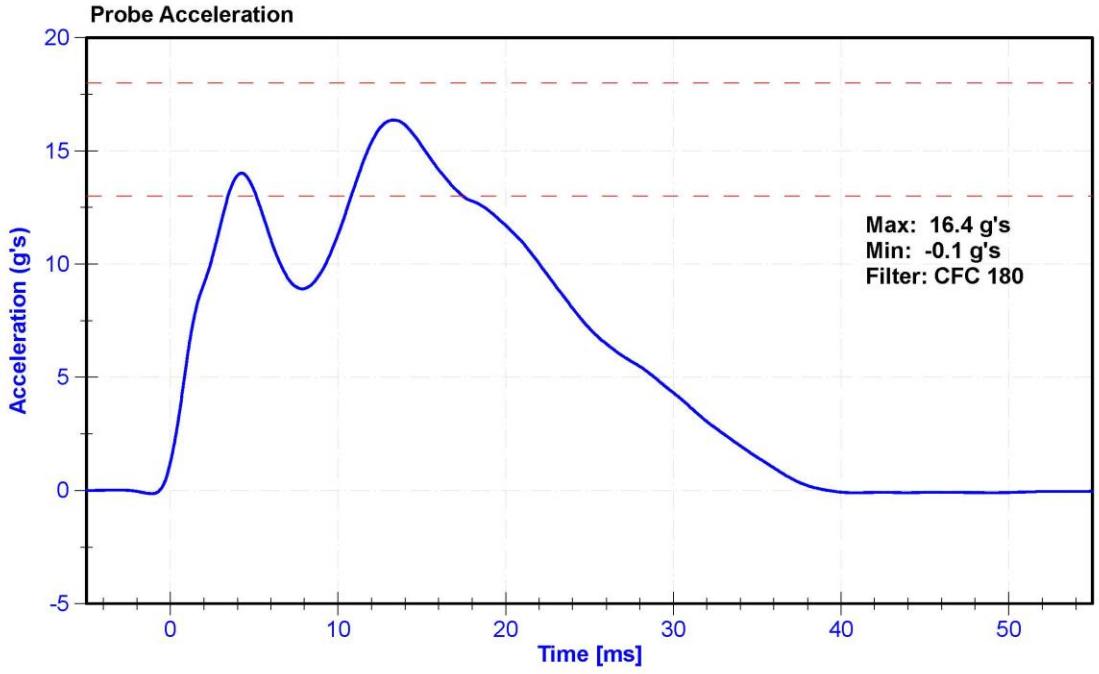
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

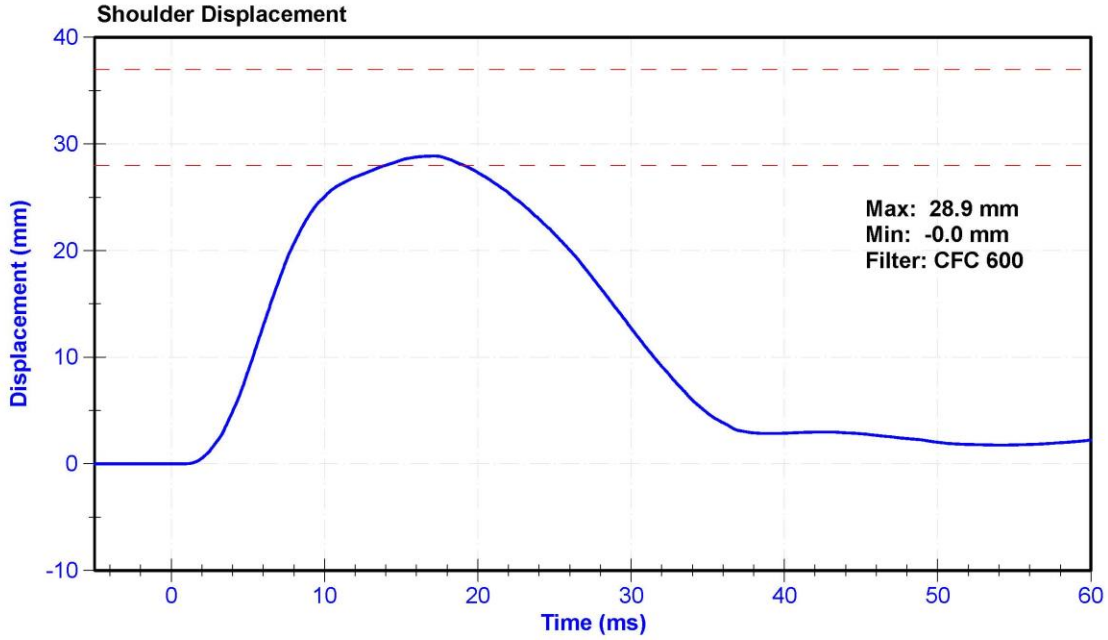
Results

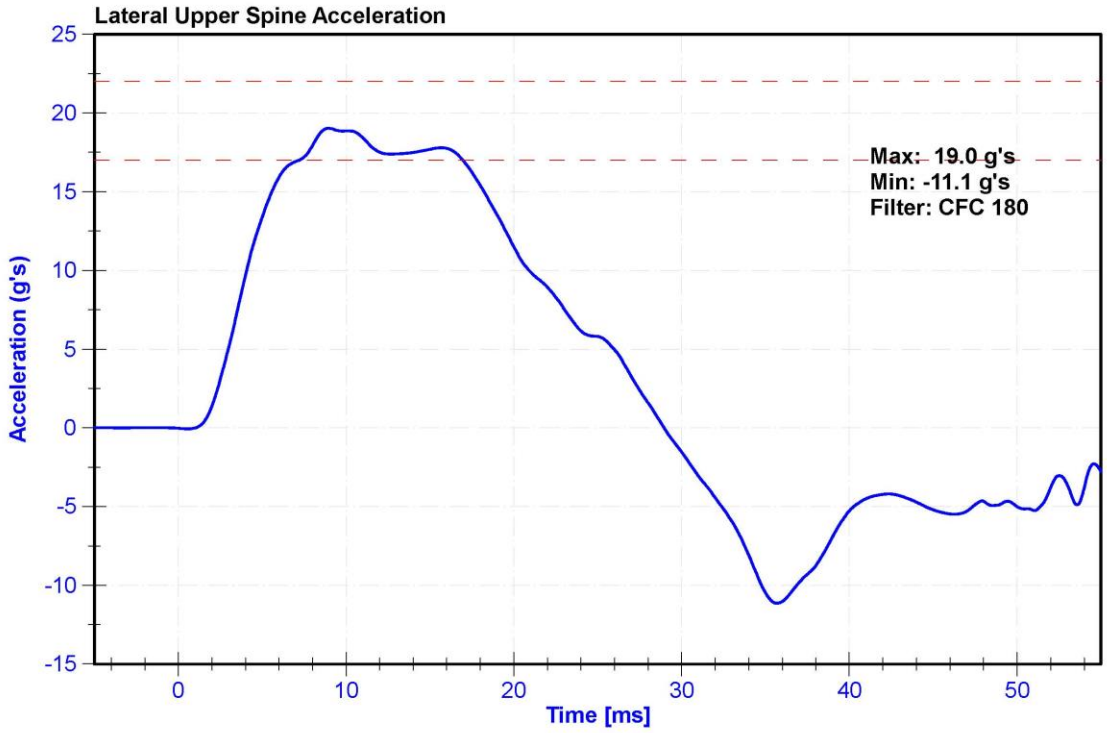
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	38.7	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	13	18	g's	16.4	Pass
Shoulder Deflection	28	37	mm	28.9	Pass
Lateral Upper Spine Acceleration	17	22	g's	19.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360MAC7	AC-P94667	11/1/2018	11/1/2019
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/30/2018	10/30/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 28.9 mm
Min: -0.0 mm
Filter: CFC 600
40
30
20
10
0
-10
0
10
20
30
40
50
60


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 19.0 g's
Min: -11.1 g's
Filter: CFC 180
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50

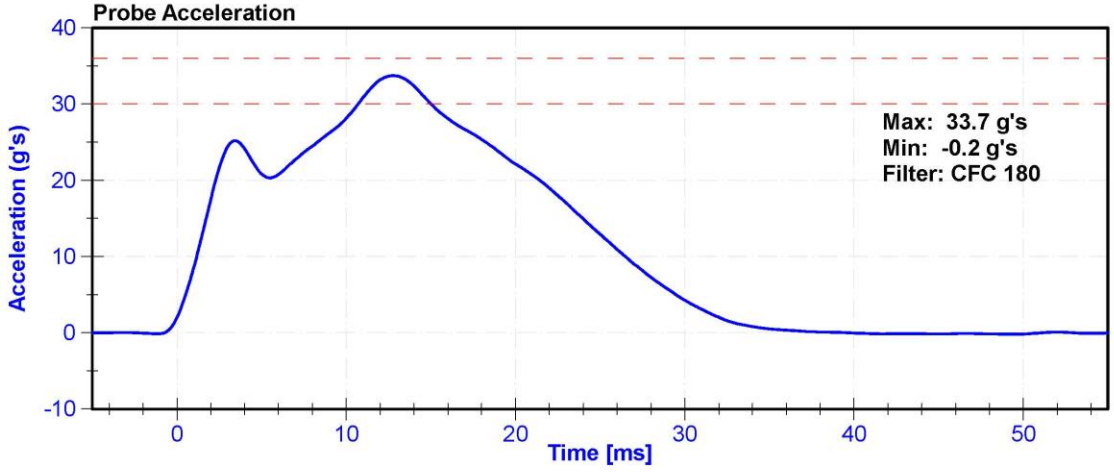
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

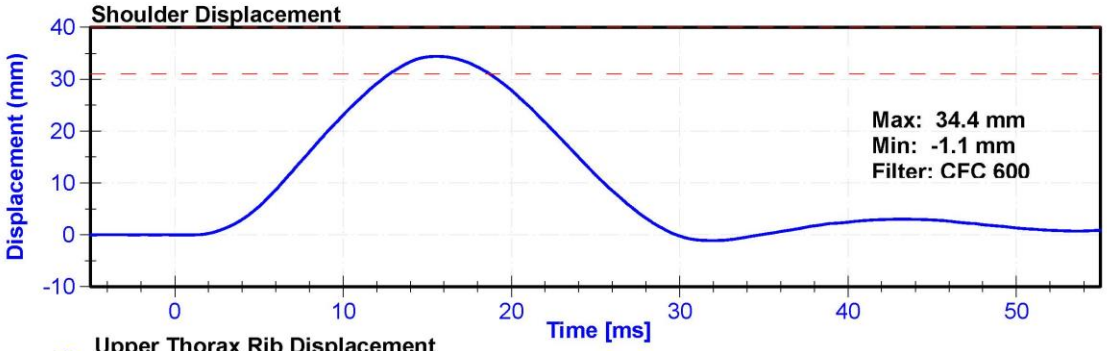
Results

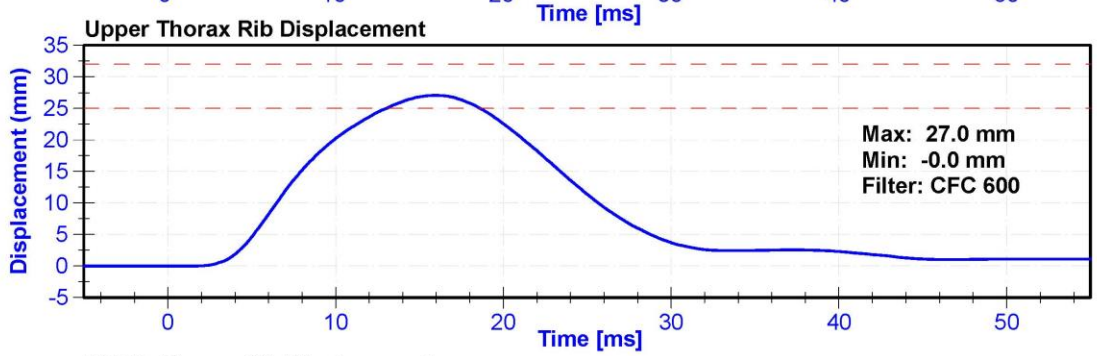
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	32.7	Pass
Velocity	6.6	6.8	m/s	6.66	Pass
Probe Acceleration after 5 ms	30	36	g's	33.7	Pass
Lateral Upper Spine Acceleration	34	43	g's	34.6	Pass
Lateral Lower Spine Acceleration	29	37	g's	34.7	Pass
Shoulder Deflection	31	40	mm	34.4	Pass
Upper Thorax Rib Deflection	25	32	mm	27.0	Pass
Mid Thorax Rib Deflection	30	36	mm	31.6	Pass
Lower Thorax Rib Deflection	32	38	mm	33.7	Pass

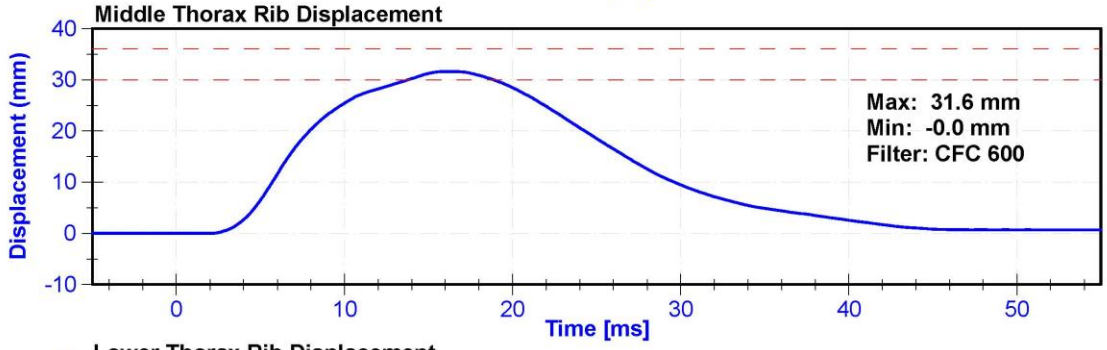
Transducer Calibrations

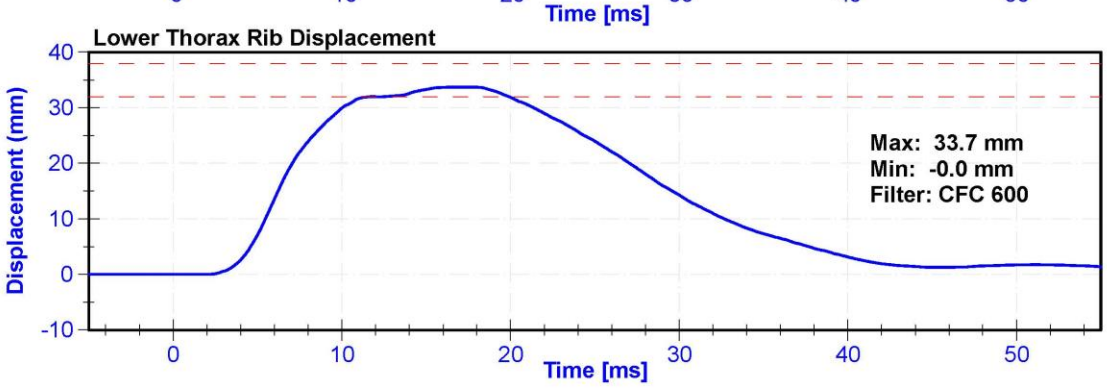
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019
Upper Spine T12 Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/30/2018	10/30/2019
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/10/2018	10/10/2019

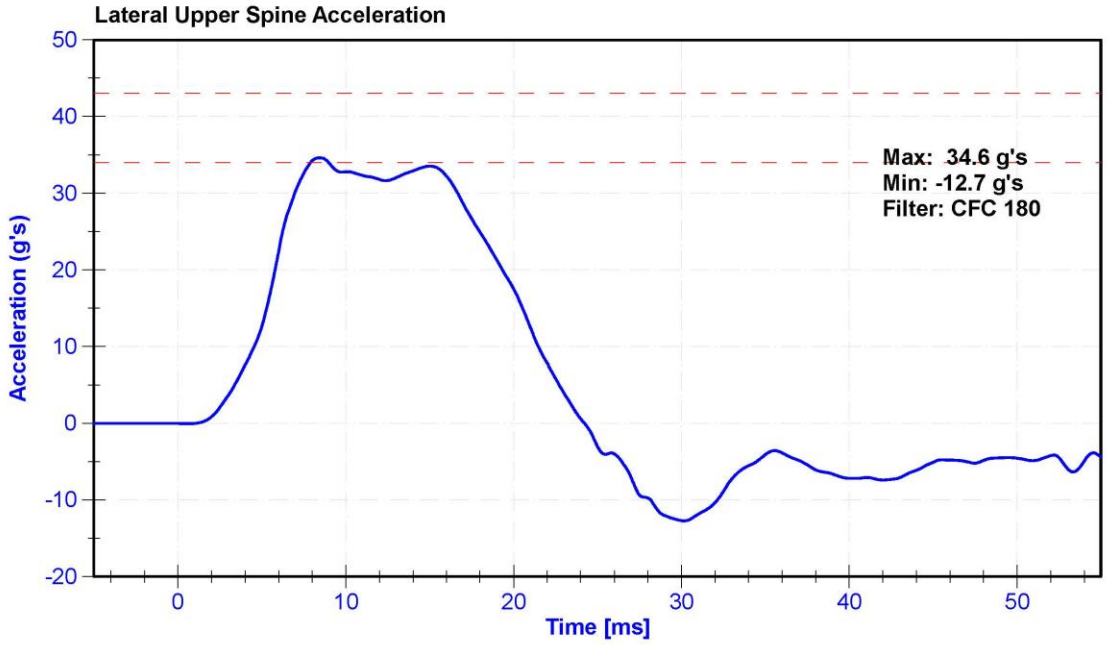


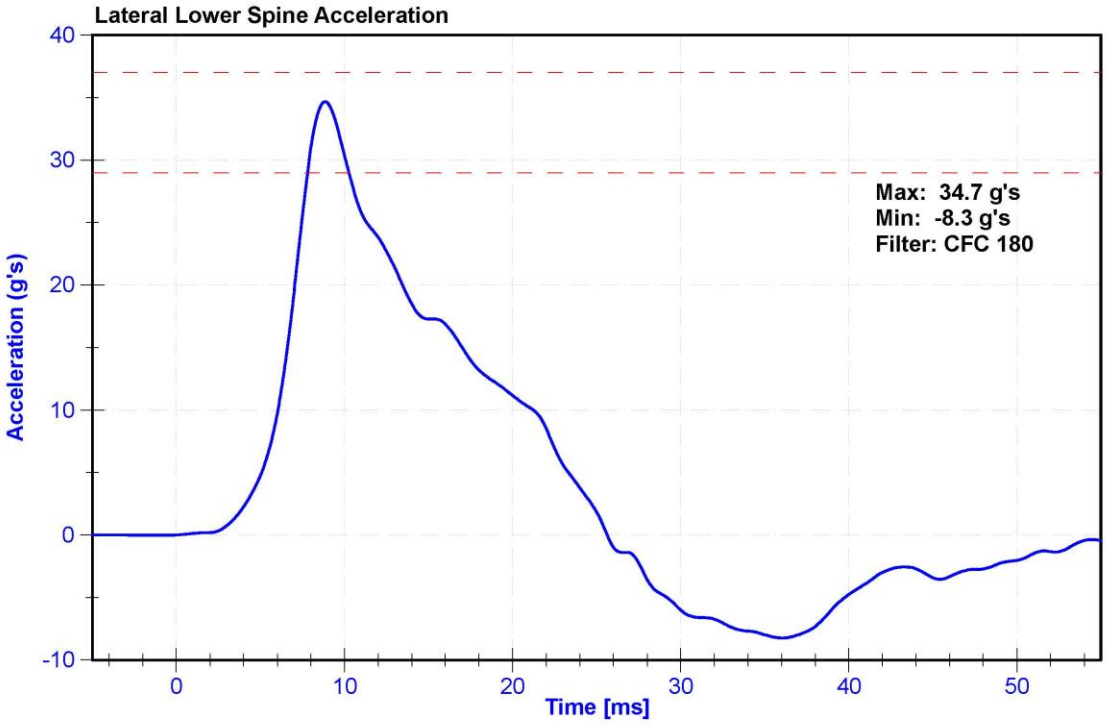

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 34.4 mm
Min: -1.1 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 27.0 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 31.6 mm
Min: -0.0 mm
Filter: CFC 600


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


Lateral Upper Spine Acceleration
Max: 34.6 g's
Min: -12.7 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: 34.7 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

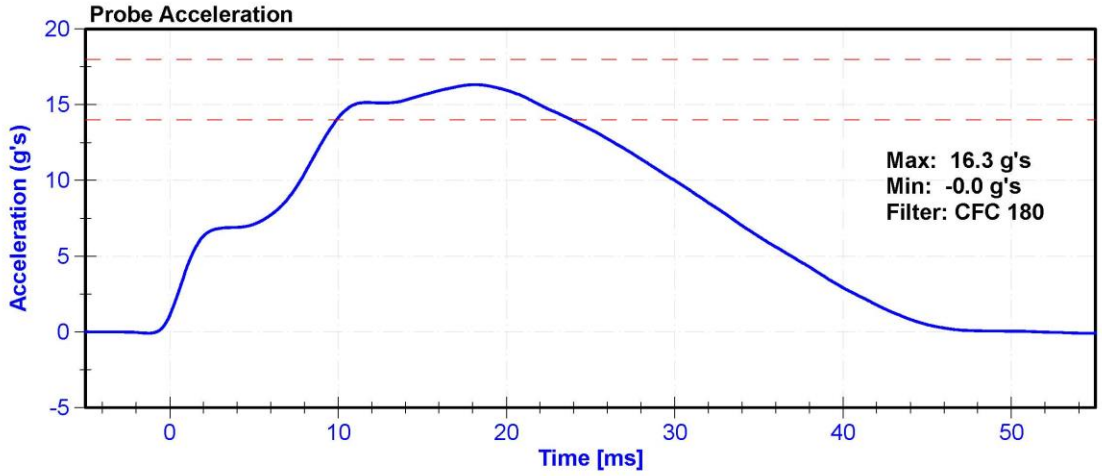
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

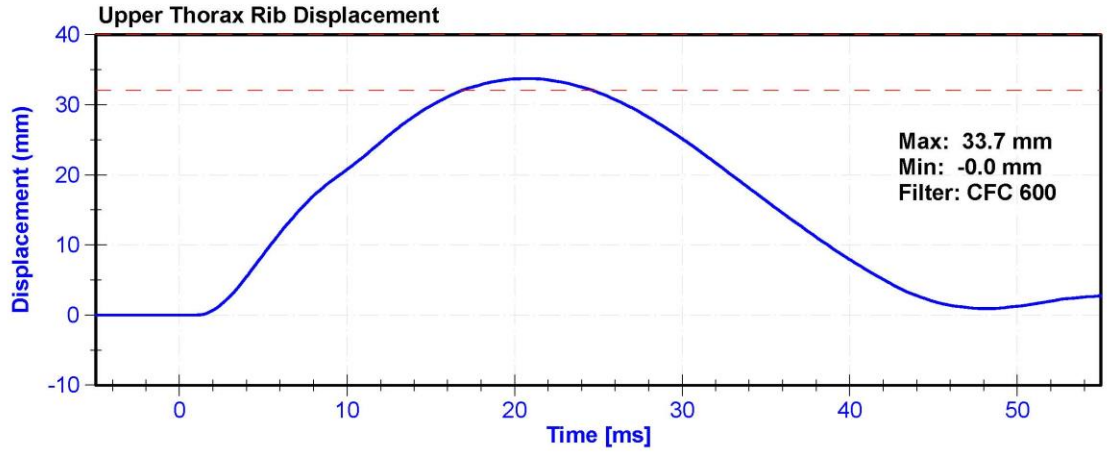
Results

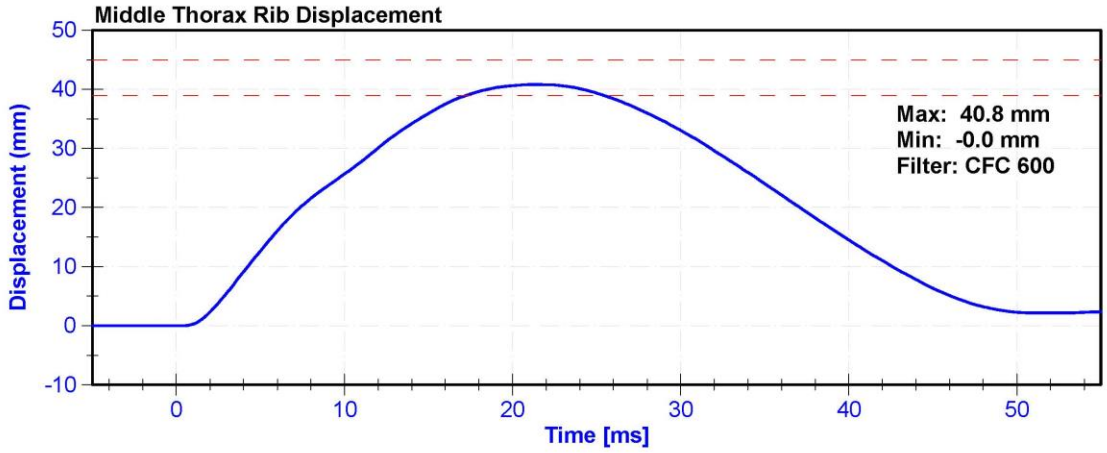
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	34.9	Pass
Velocity	4.2	4.4	m/s	4.30	Pass
Probe Acceleration	14	18	g's	16.3	Pass
Lateral Upper Spine Acceleration	13	17	g's	13.9	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.6	Pass
Upper Thorax Rib Deflection	32	40	mm	33.7	Pass
Middle Thorax Rib Deflection	39	45	mm	40.8	Pass
Lower Thorax Rib Deflection	35	43	mm	39.1	Pass

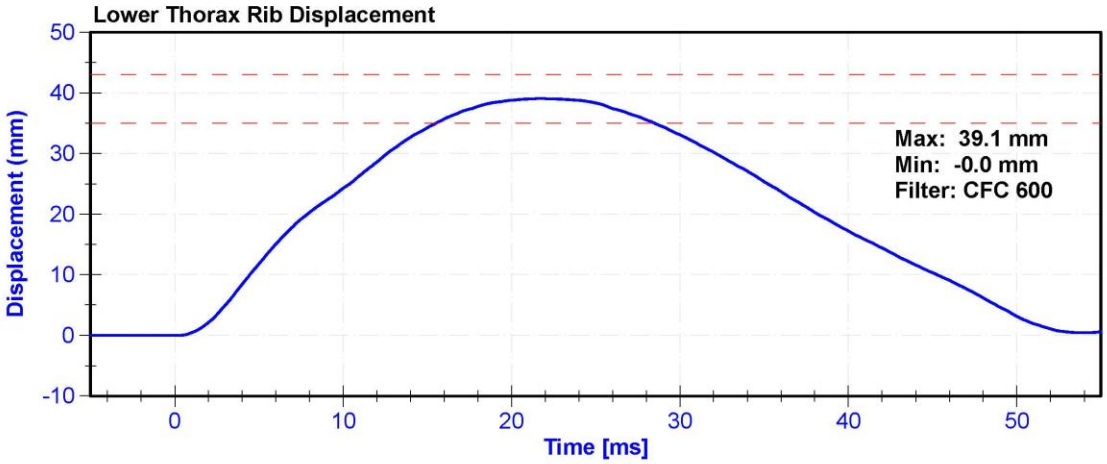
Transducer Calibrations

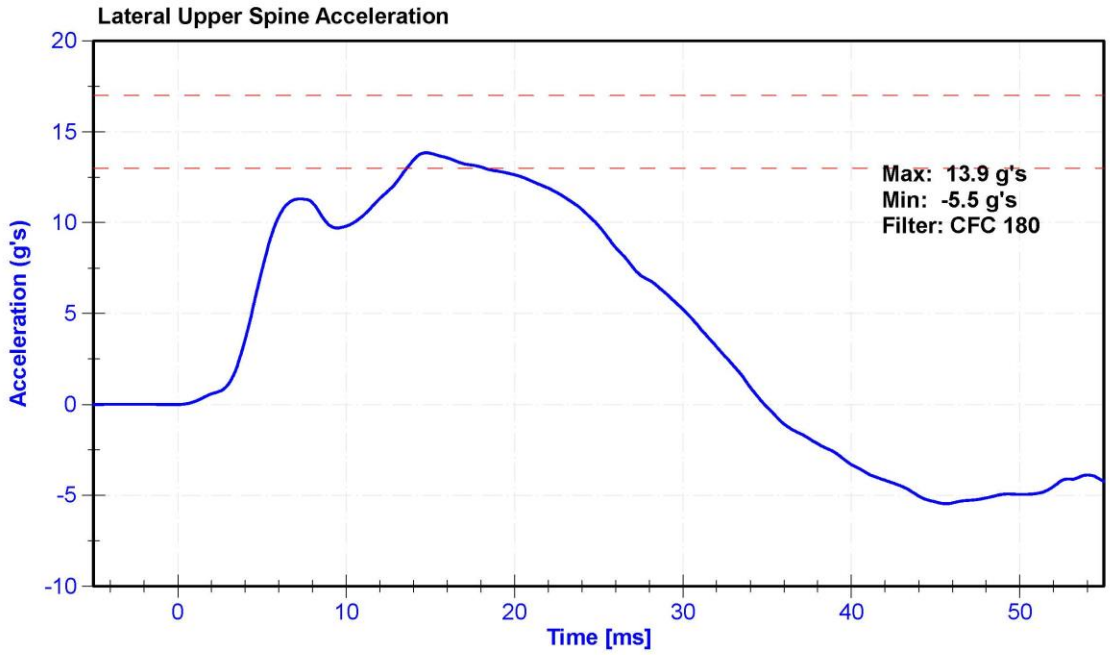
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/10/2018	10/10/2019

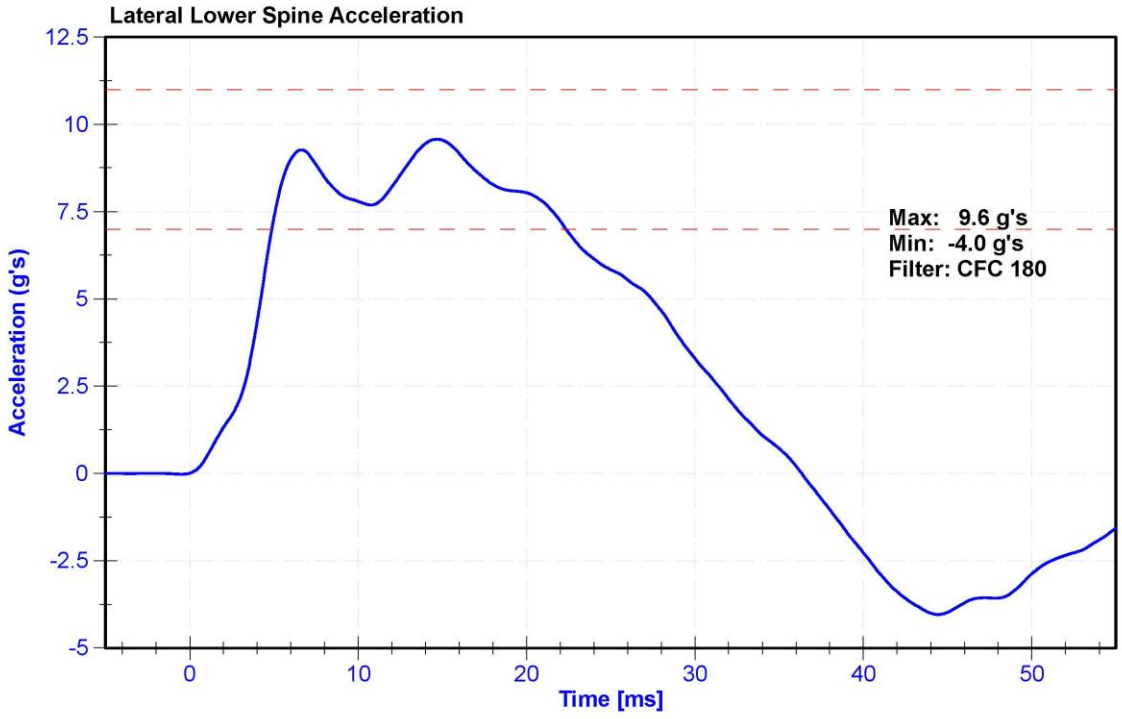



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 33.7 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.8 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: 13.9 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: 9.6 g's
Min: -4.0 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

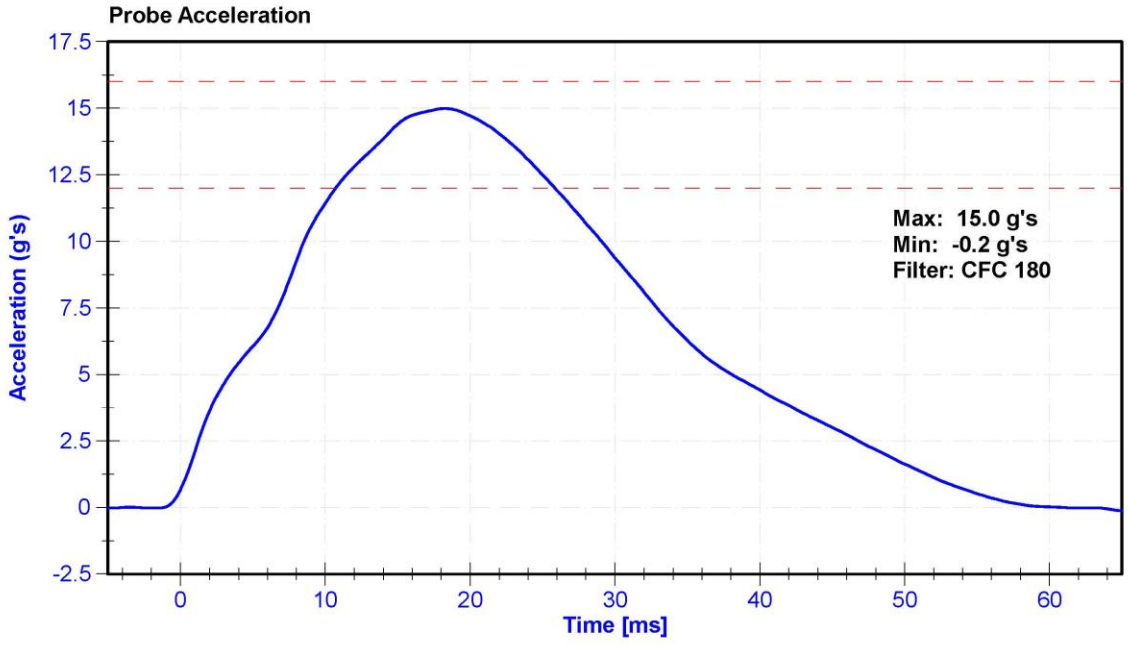
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

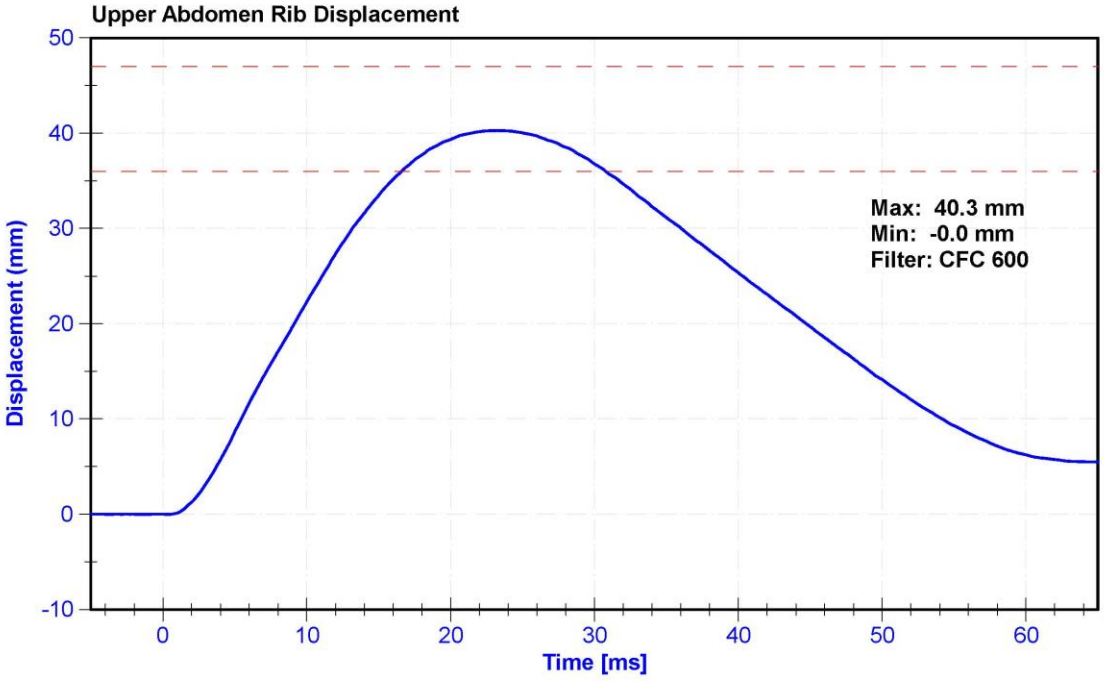
Results

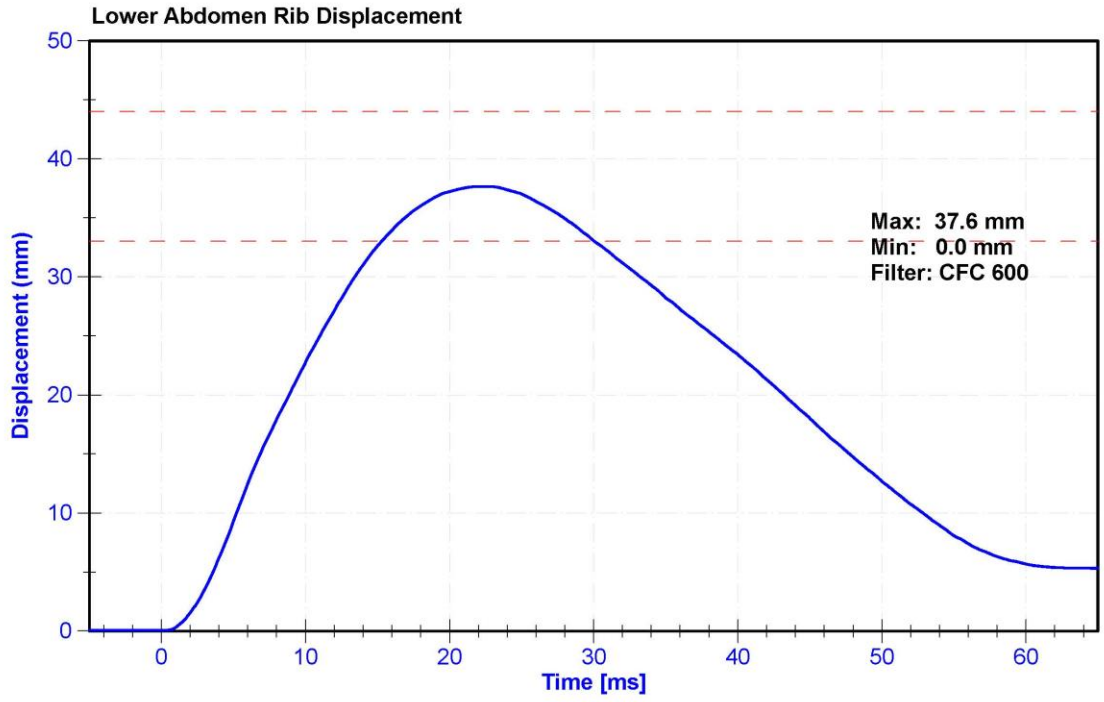
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	33.8	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	12	16	g's	15.0	Pass
Lateral Lower Spine Acceleration	9	14	g's	10.7	Pass
Upper Abdomen Rib Deflection	36	47	mm	40.3	Pass
Lower Abdomen Rib Deflection	33	44	mm	37.6	Pass

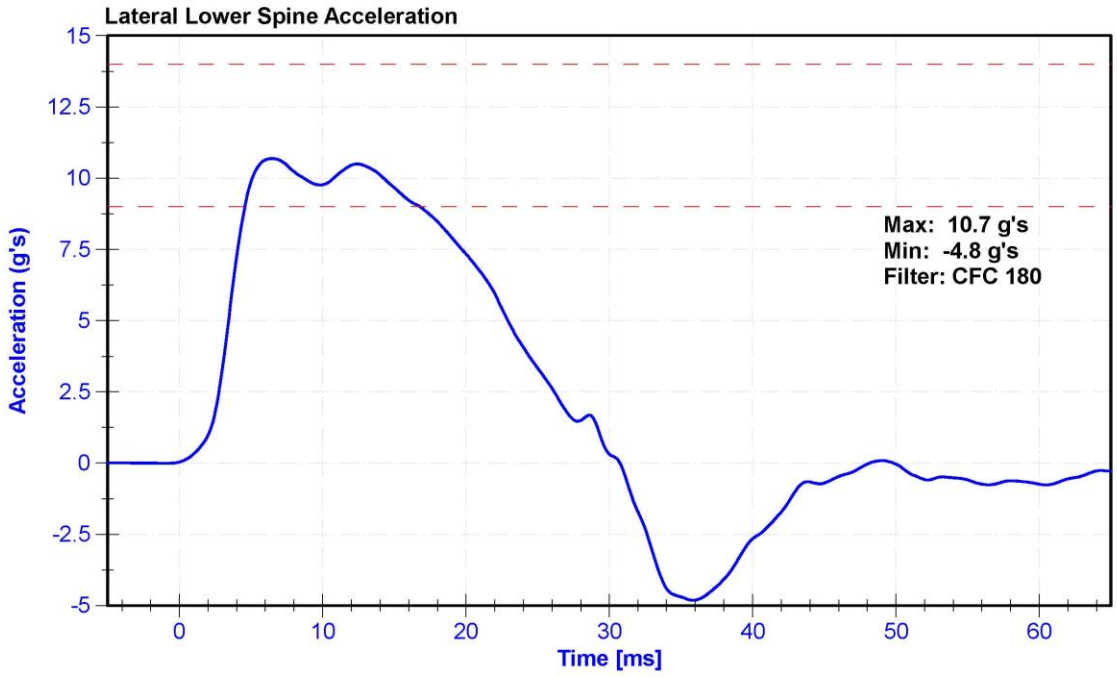
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco 7264C-2KTZ-2-360MAC	AC-P94667	11/1/2018	11/1/2019
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Upper Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-308GFE	10/10/2018	10/10/2019
Lower Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-307GFE	10/11/2018	10/11/2019




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.3 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.6 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Lower Spine Acceleration
Acceleration (g's)
15
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50
60
Time [ms]
Max: 10.7 g's
Min: -4.8 g's
Filter: CFC 180

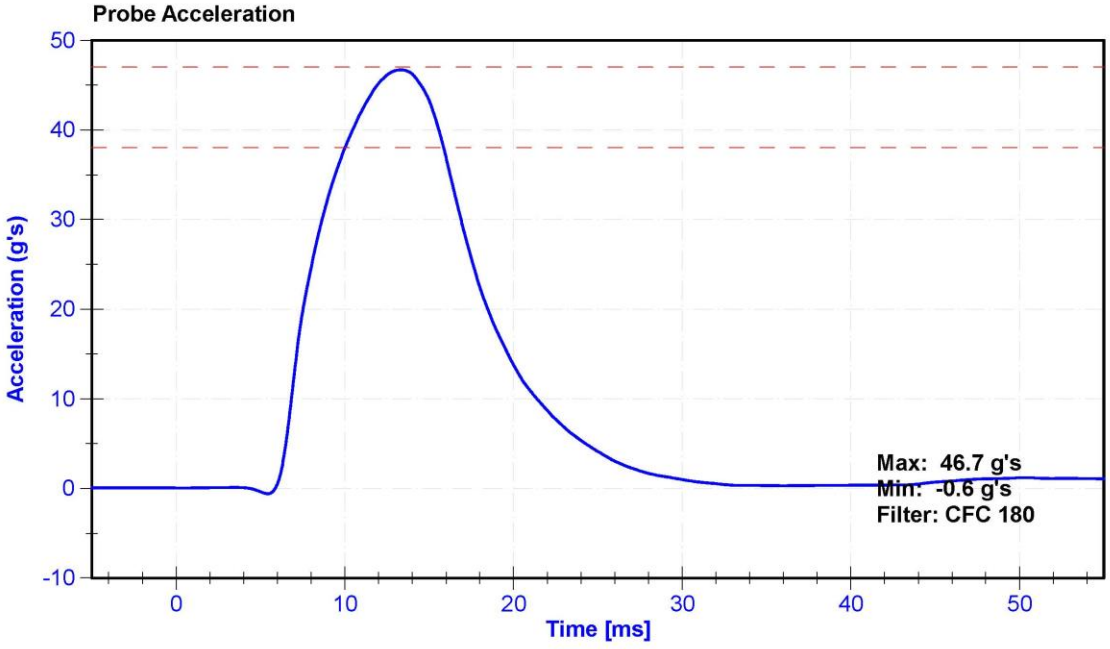
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

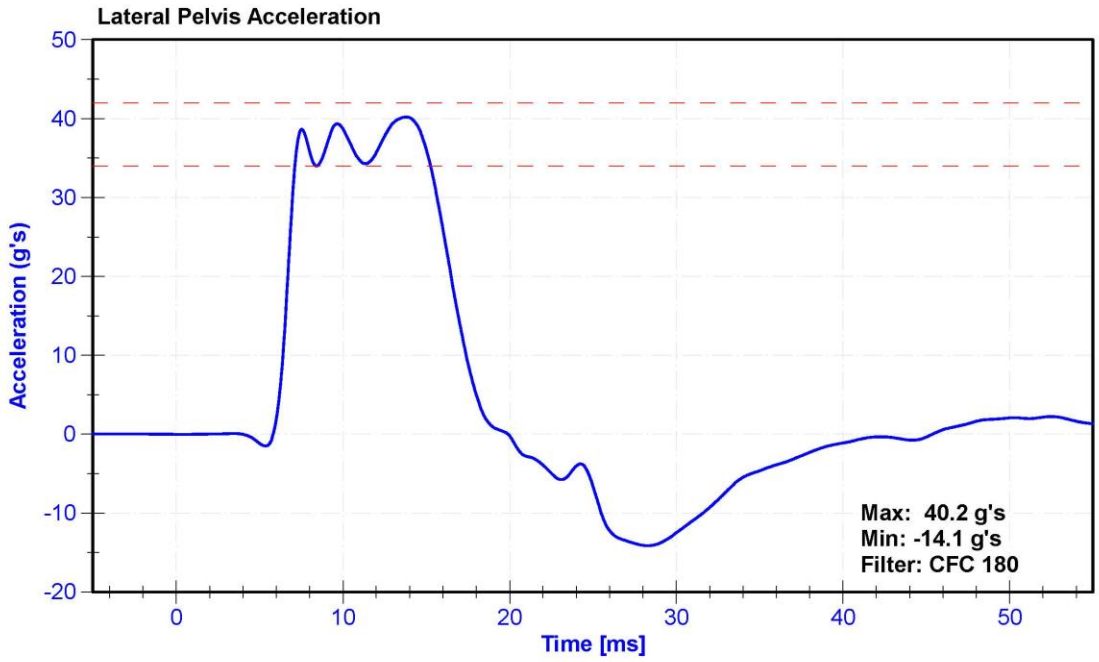
Results

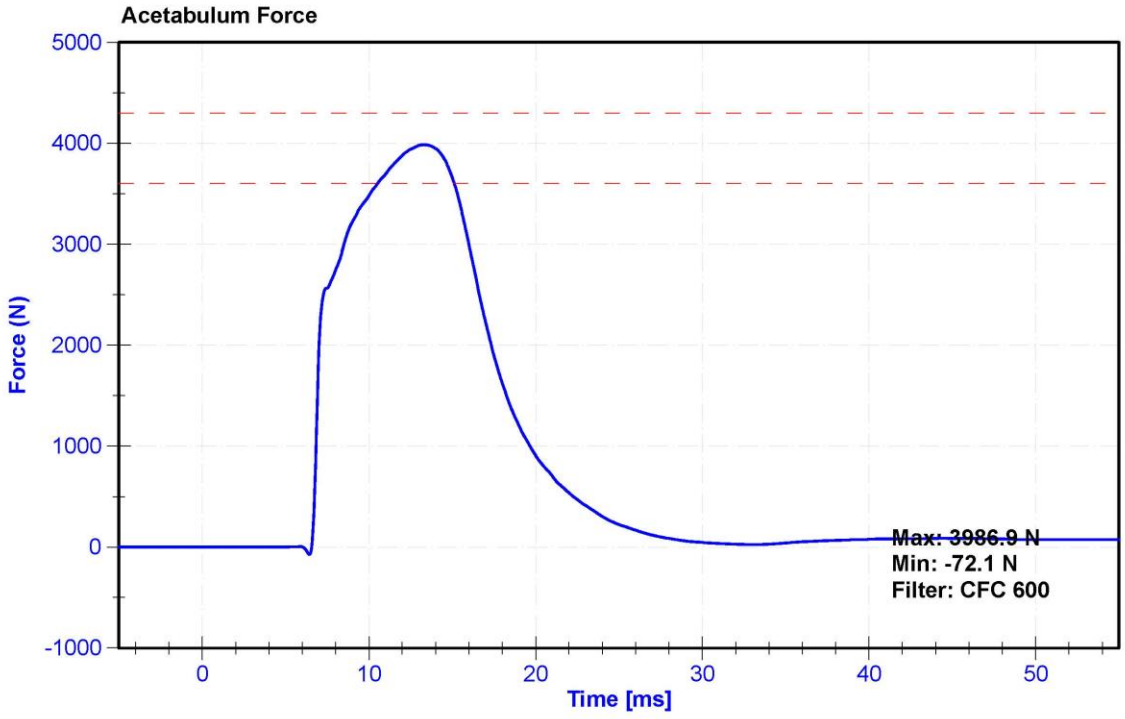
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	37.2	Pass
Velocity	6.6	6.8	m/s	6.62	Pass
Probe Acceleration	38	47	g's	46.7	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	40.2	Pass
Acetabulum Force	3600	4300	N	3986.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/24/2018	4/24/2019
Acetabulum Load Cell	DENTON 3249J	LC-275Fy	10/4/2018	10/4/2019
Certification Plug	SACO	12420	4/9/2018	N/A
Crash Test Plug	SACO	11992	2/6/2018	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: 40.2 g's
Min: -14.1 g's
Filter: CFC 180


Acetabulum Force
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 3986.9 N
Min: -72.1 N
Filter: CFC 600

SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12420

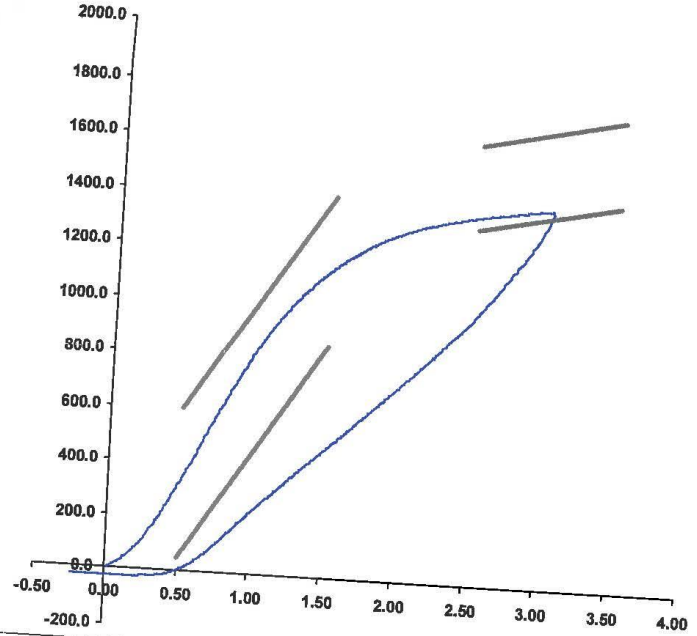
Test Number 6856

Report Number 6871

Test Date 4/9/2018 11:25:32 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	328.86	50.00	600.00
Force @ 1.5 mm (N)	1,131.98	850.00	1,400.00
Force @ 2.5 mm (N)	1,350.14	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,388.87	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 09-Apr-18

SACO Research

By : DC Date : 4/9/18

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

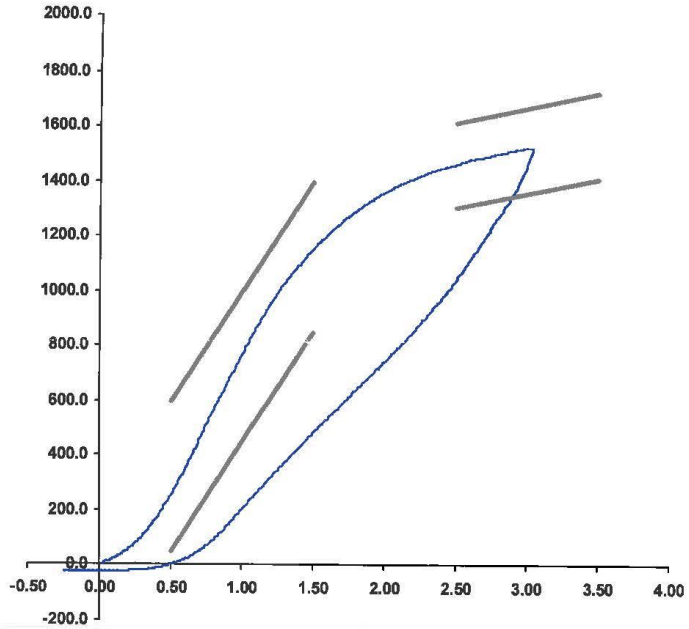
Crash 300 2/4/19

SID-IIs Pelvis Plug Certification Test

Plug S/N 11992
Test Number 6209
Report Number 6226
Test Date 2/6/2018 9:47:12 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	253.56	50.00	600.00
Force @ 1.5 mm (N)	1,154.92	850.00	1,400.00
Force @ 2.5 mm (N)	1,466.31	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,527.15	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



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

Notes:

Operator

Part Number 180-4450

Template No 107 06-Feb-18
SACO Research

By : DC Date : 2/6/18

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

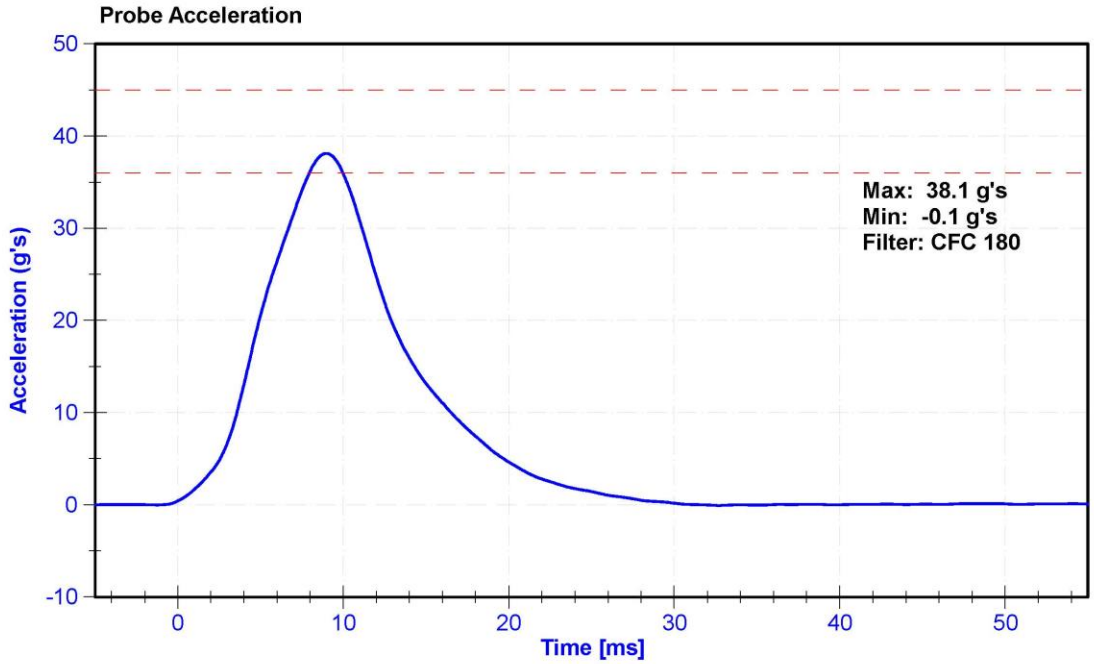
ATD Manufacturer	FTSS	Test Technician	K. Brogan
ATD Serial Number	300	Laboratory Supervisor	K. Dutton

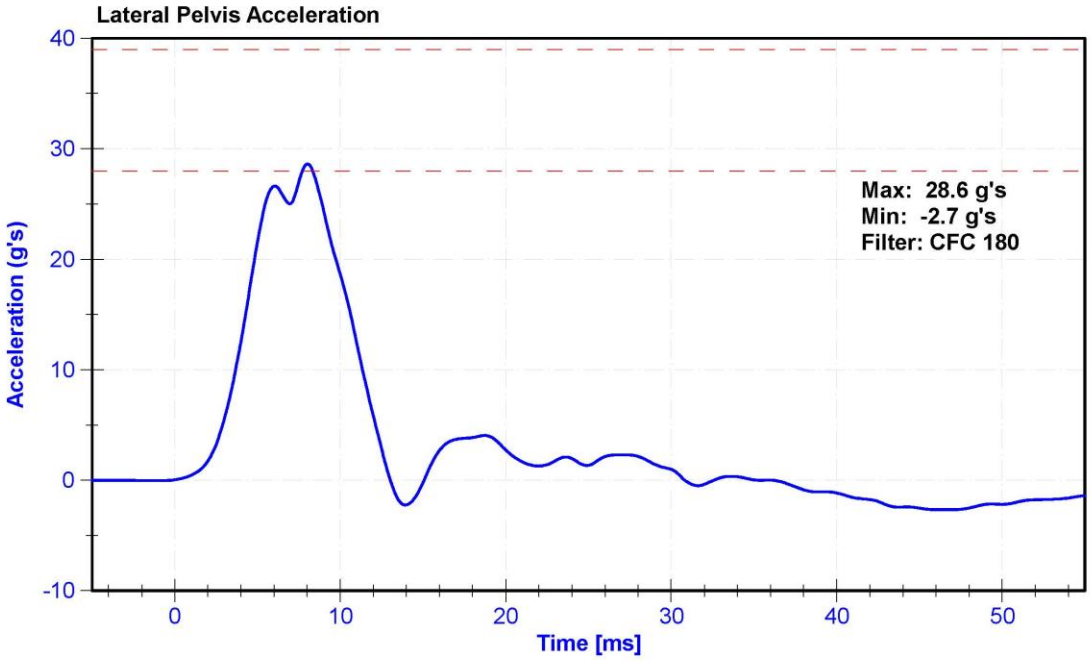
Results

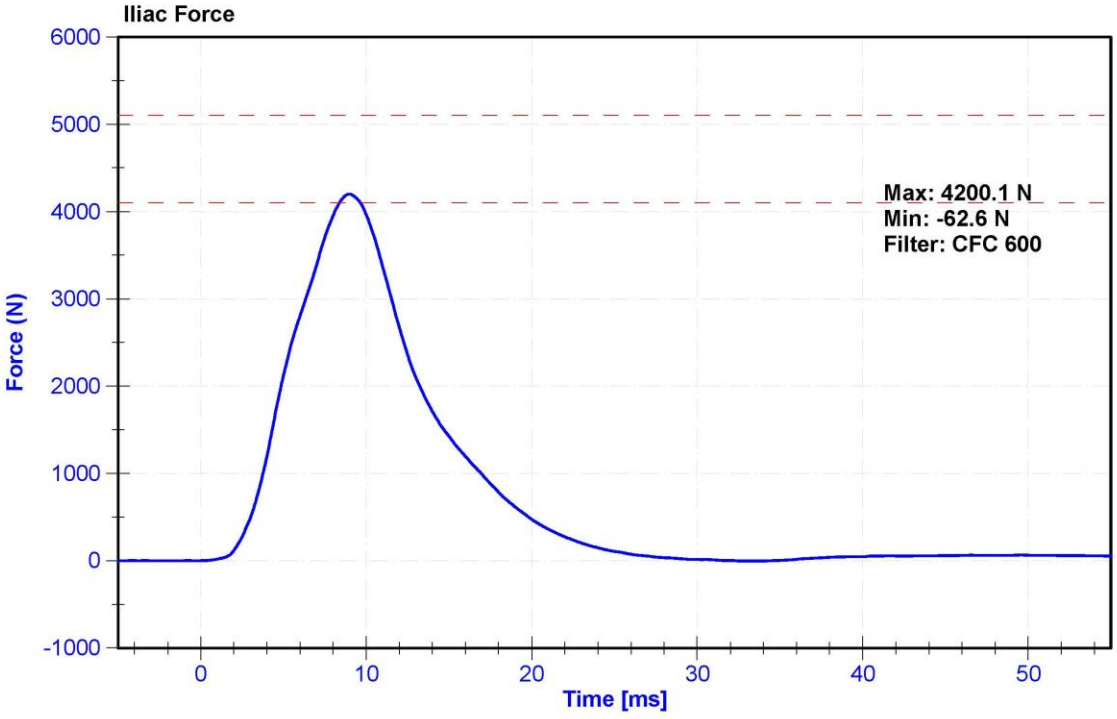
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	20.7	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Probe Acceleration	36	45	g's	38.1	Pass
Lateral Pelvis Acceleration	28	39	g's	28.6	Pass
Iliac Force	4100	5100	N	4200.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C-2KTZ-2-360M	AC-P94667	11/1/2018	11/1/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/24/2018	4/24/2019
Iliac Load Cell	DENTON 3228J	LC-279Fy	10/4/2018	10/4/2019




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 28.6 g's
Min: -2.7 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4200.1 N
Min: -62.6 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

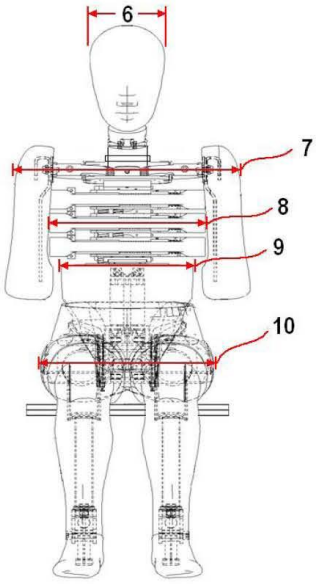
SERIAL NO: F034

(CONFIGURED FOR LEFT SIDE IMPACT)

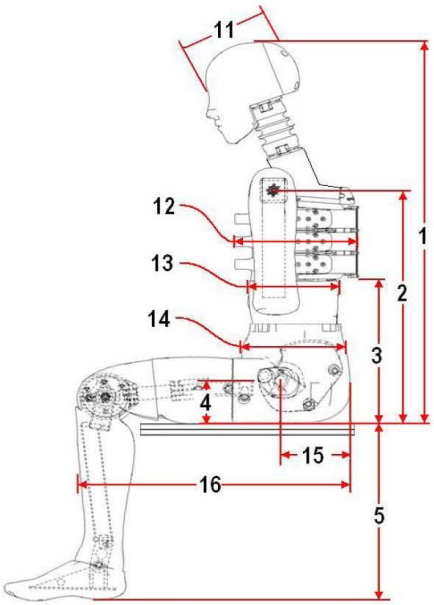
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 2/22/2019

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	567	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	329	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

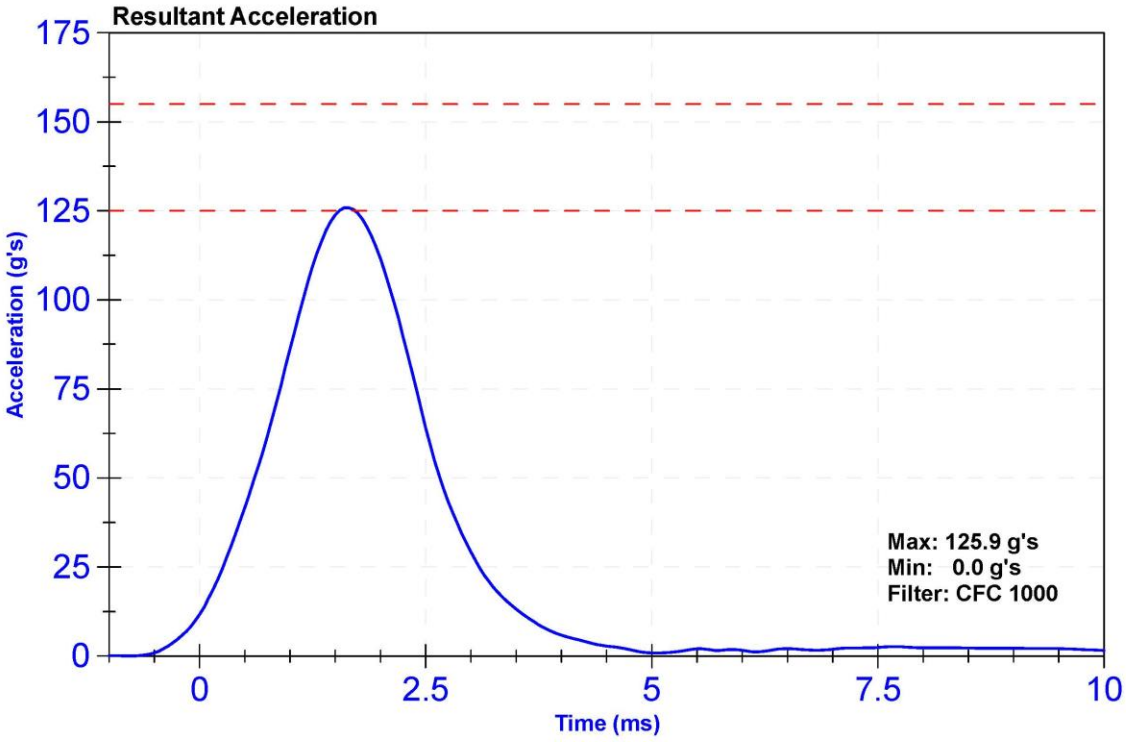
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

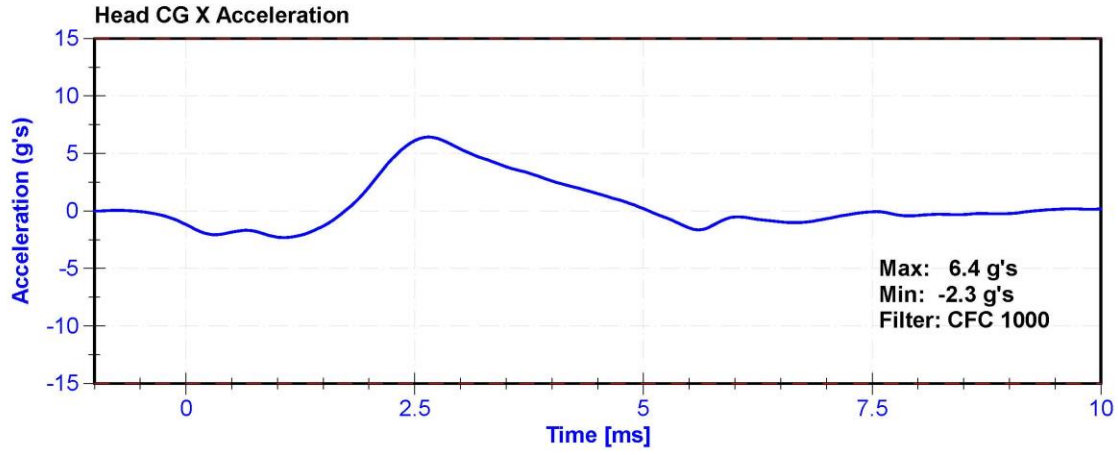
Results

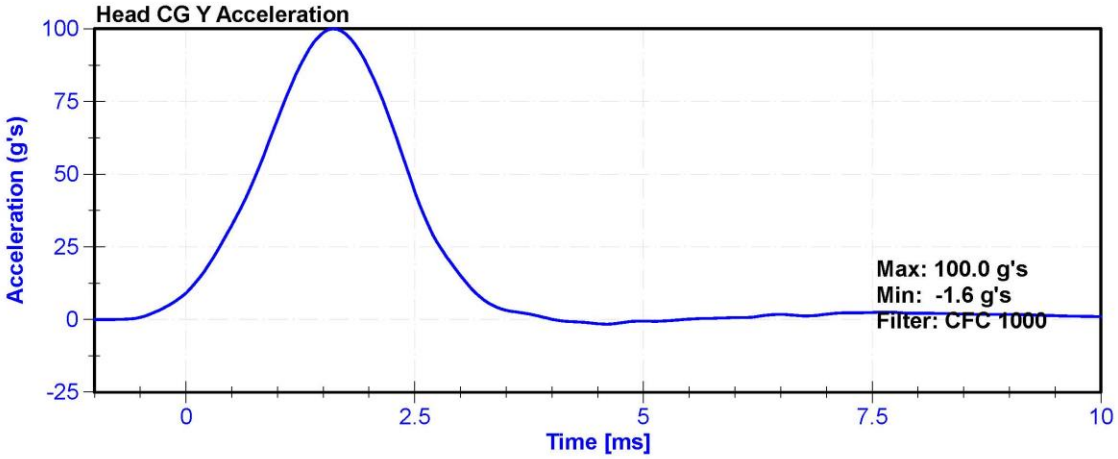
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	28.7	Pass
Resultant Acceleration	125	155	g's	125.9	Pass
Oscillation	0	15	%	2.13	Pass
Fore-Aft Acceleration	-15	15	g's	6.4	Pass

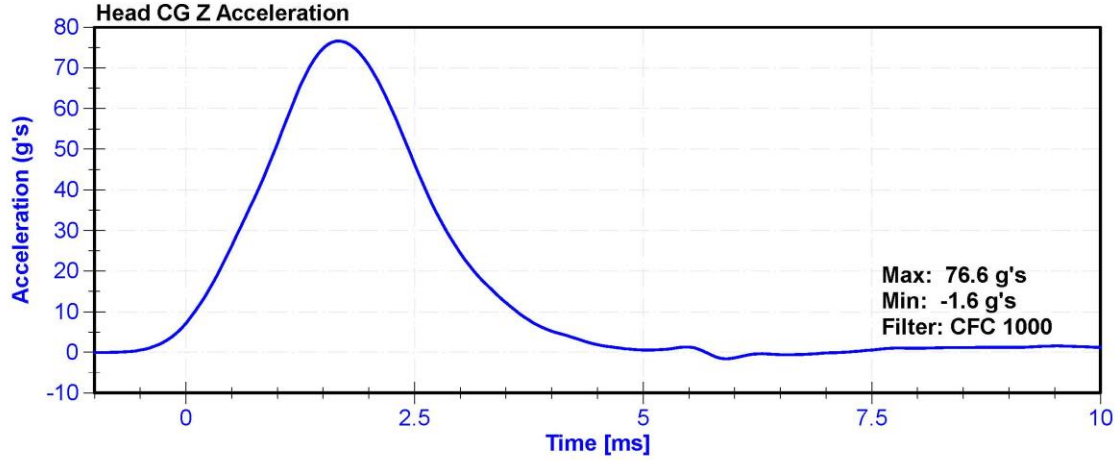
Transducer Calibrations

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: 6.4 g's
Min: -2.3 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 100.0 g's
Min: -1.6 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: 76.6 g's
Min: -1.6 g's
Filter: CFC 1000

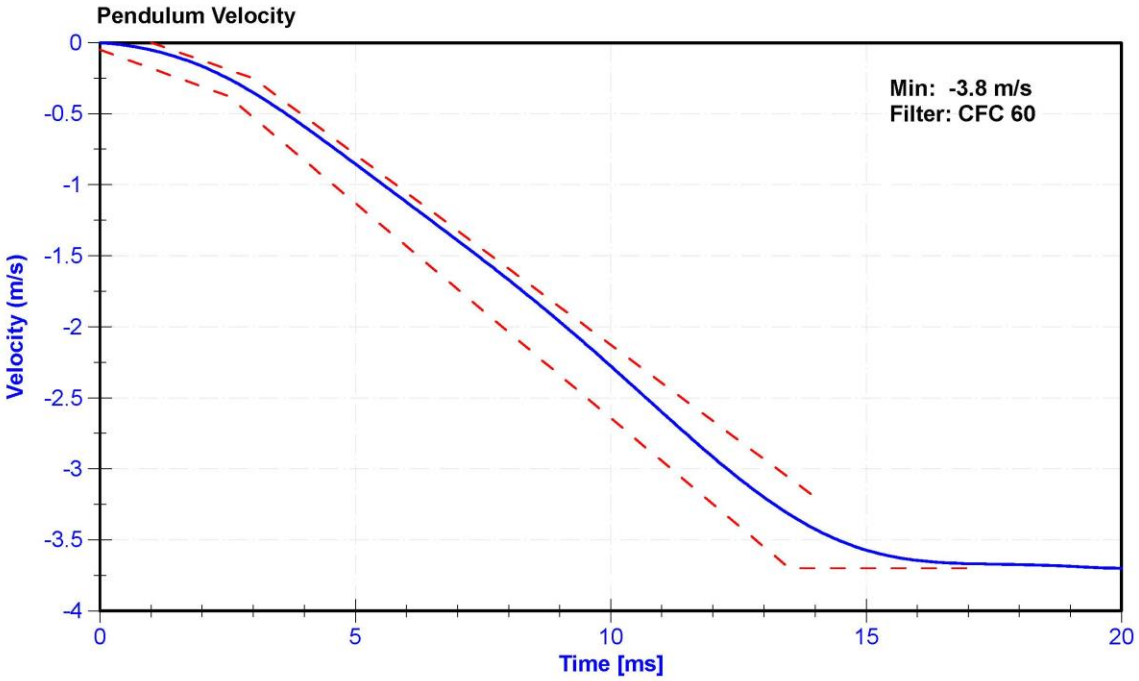
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

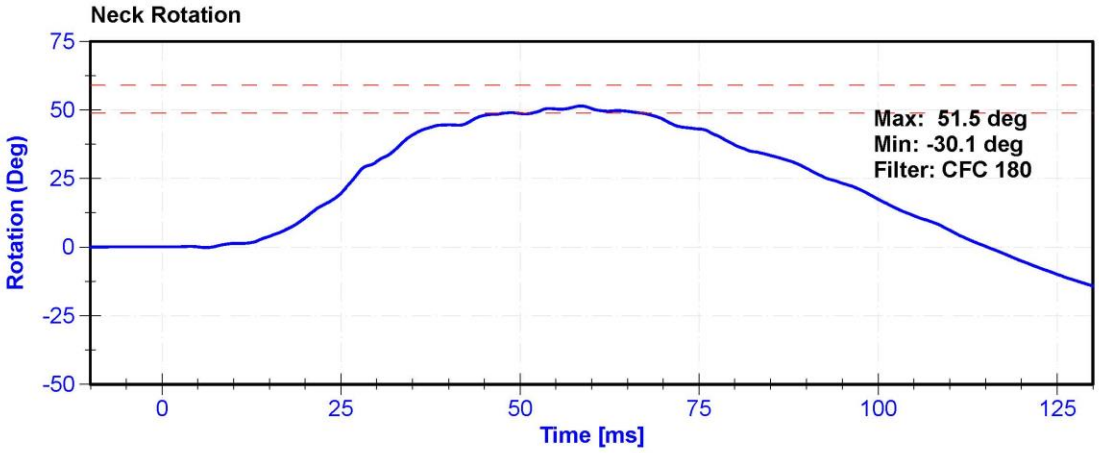
Results

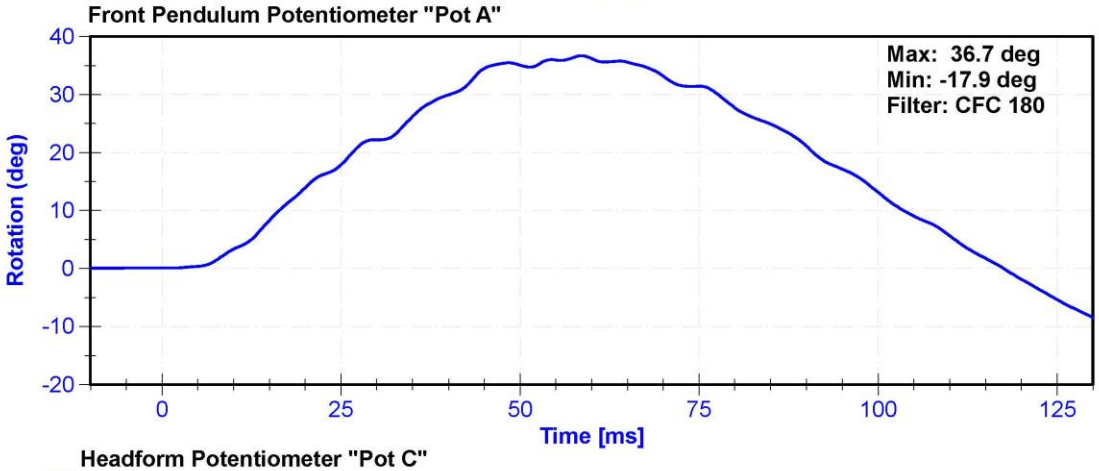
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	23.7	Pass
Velocity	3.3	3.5	m/s	3.38	Pass
Lateral Neck Rotation	49	59	deg	51.5	Pass
Time at Maximum Rotation	54	66	ms	58.5	Pass
Time of Rotation Decay from Maximum	53	88	ms	56.8	Pass

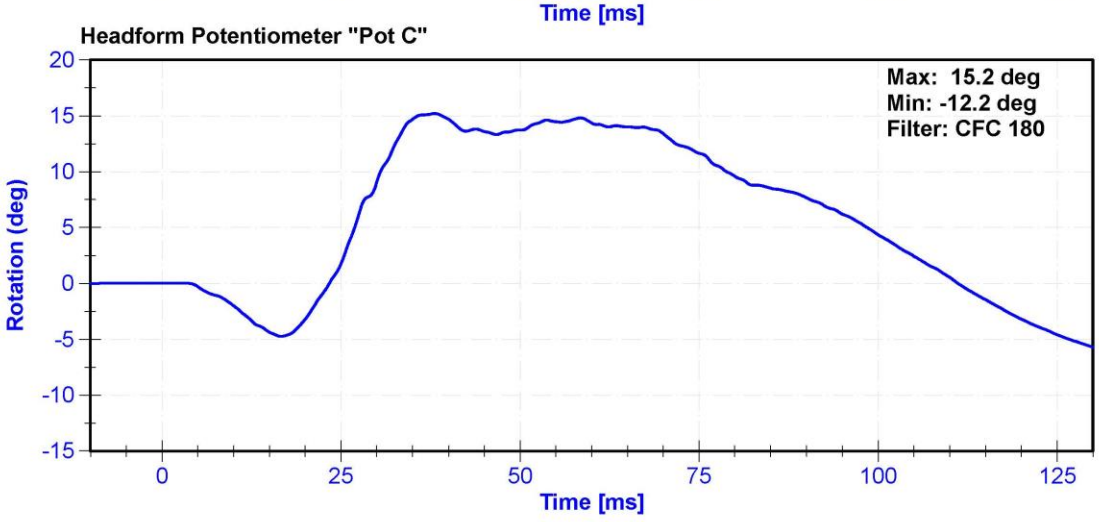
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 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: 51.5 deg
Min: -30.1 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 36.7 deg
Min: -17.9 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 15.2 deg
Min: -12.2 deg
Filter: CFC 180

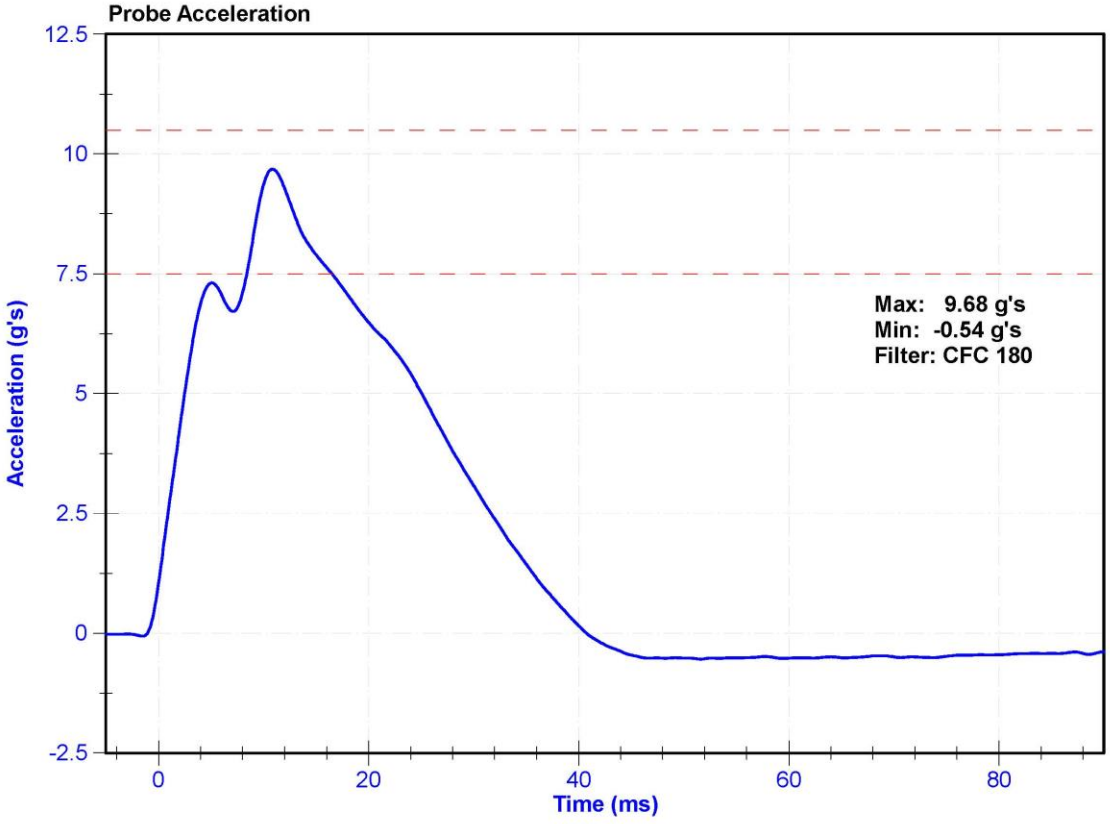
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	25.0	Pass
Velocity	4.2	4.4	m/s	4.20	Pass
Probe Acceleration	7.5	10.5	g's	9.68	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019



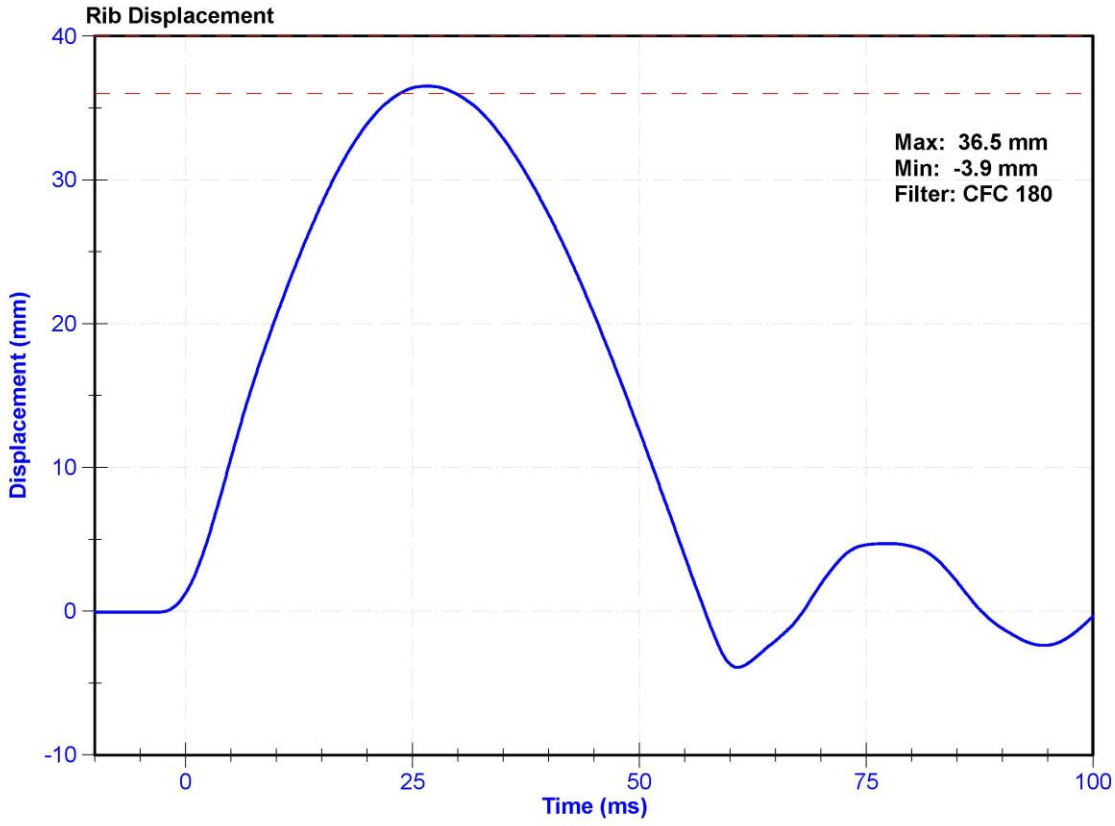
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	23.0	Pass
Rib Displacement	36	40	mm	36.5	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



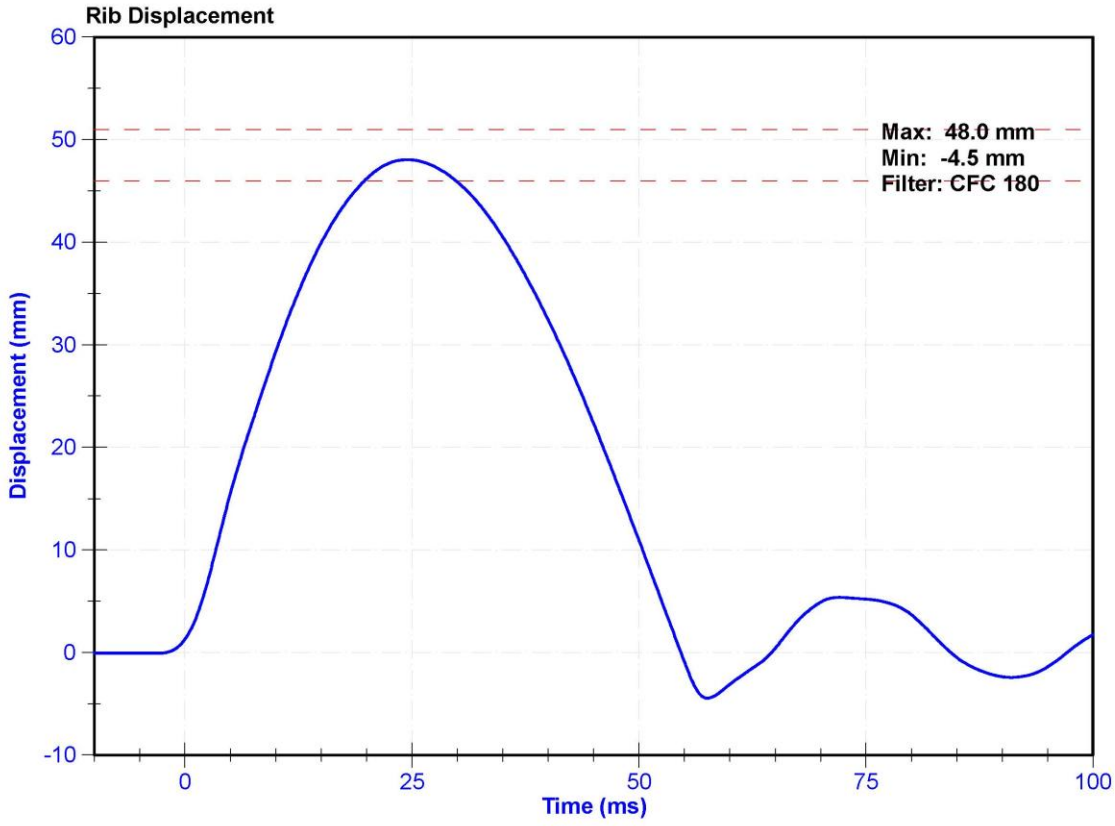
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	23.0	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



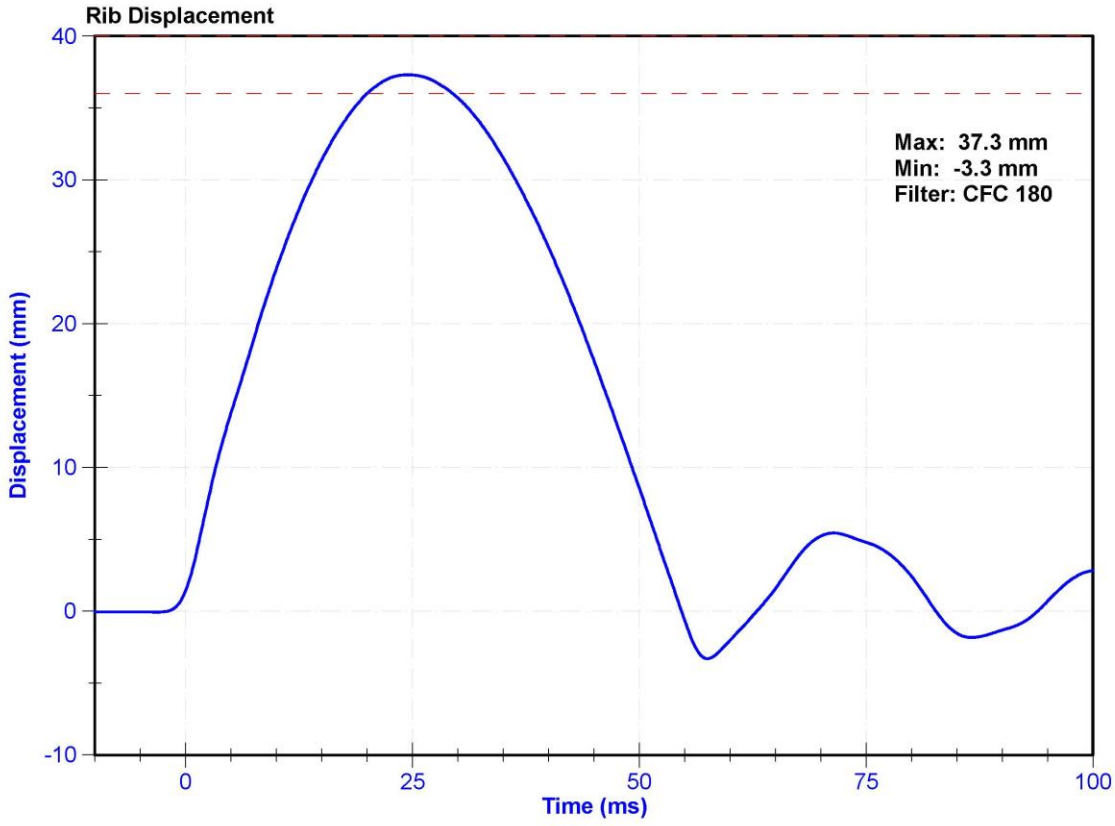
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	23.2	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



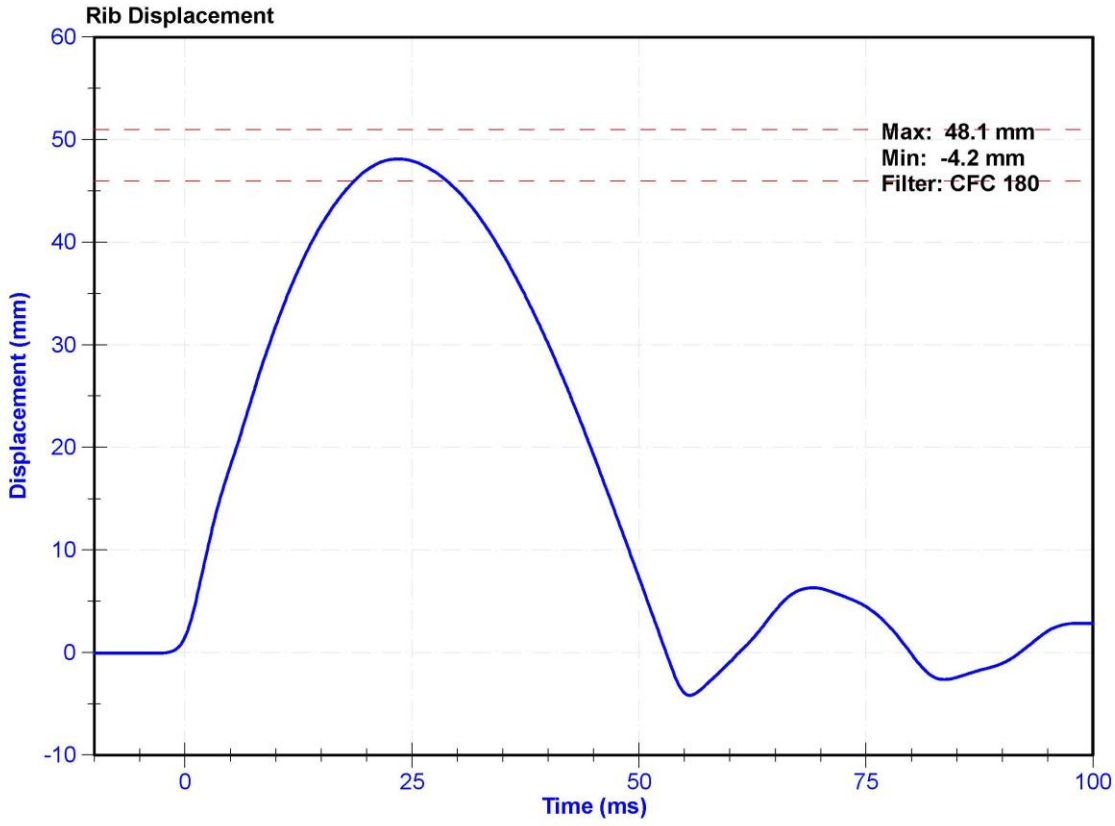
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	25.5	Pass
Rib Displacement	46	51	mm	48.1	Pass

Transducer Calibrations

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



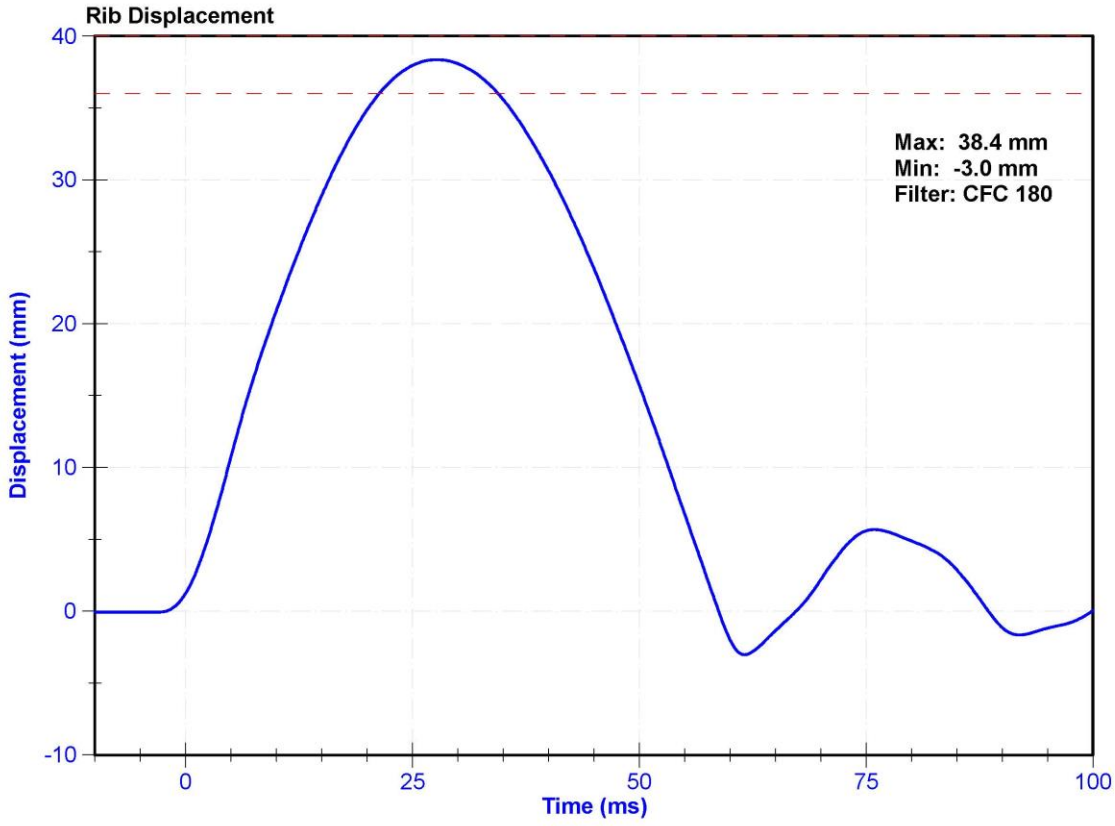
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	25.5	Pass
Rib Displacement	36	40	mm	38.4	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



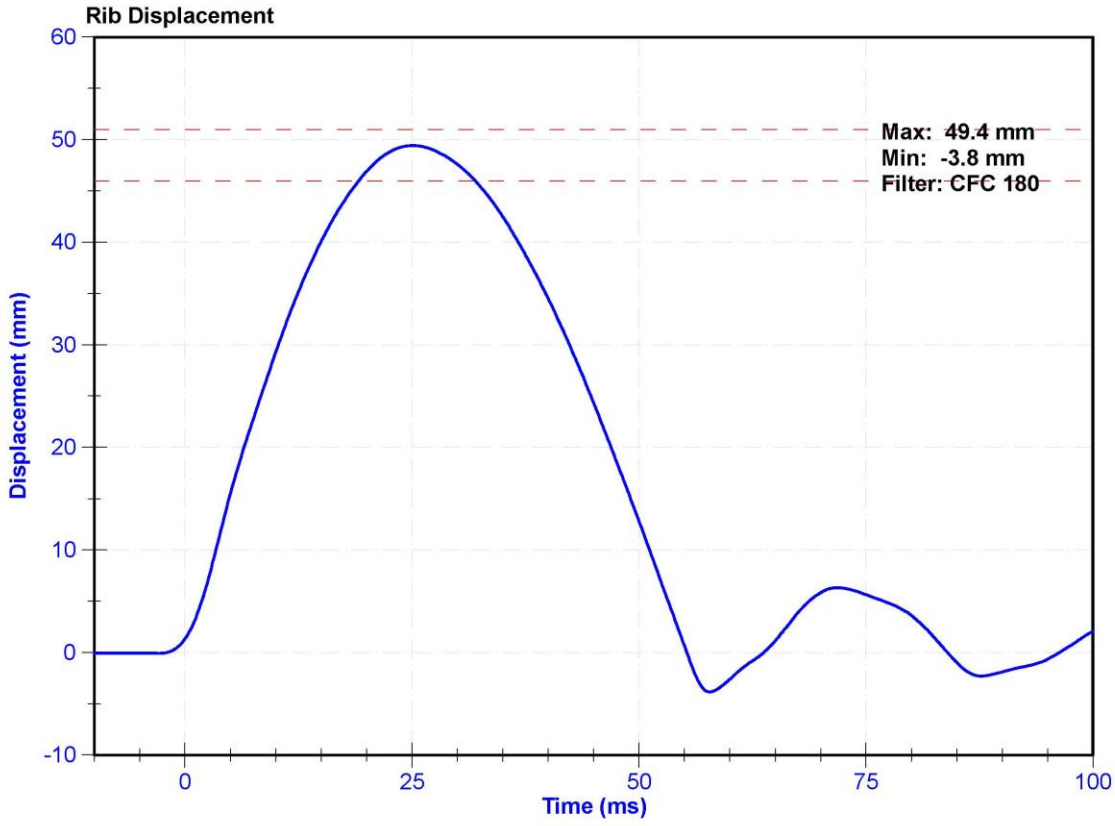
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	25.5	Pass
Rib Displacement	46	51	mm	49.4	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



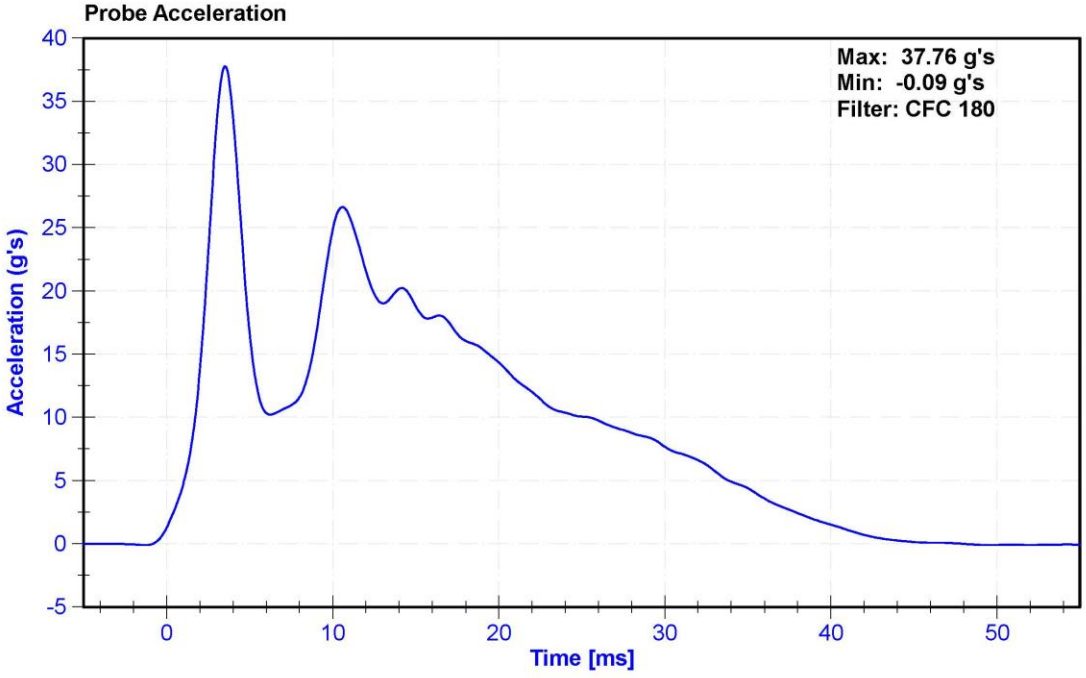
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

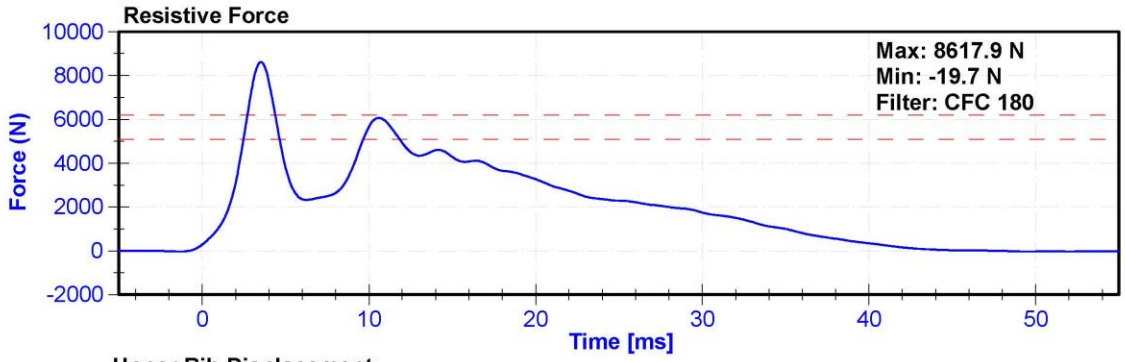
Results

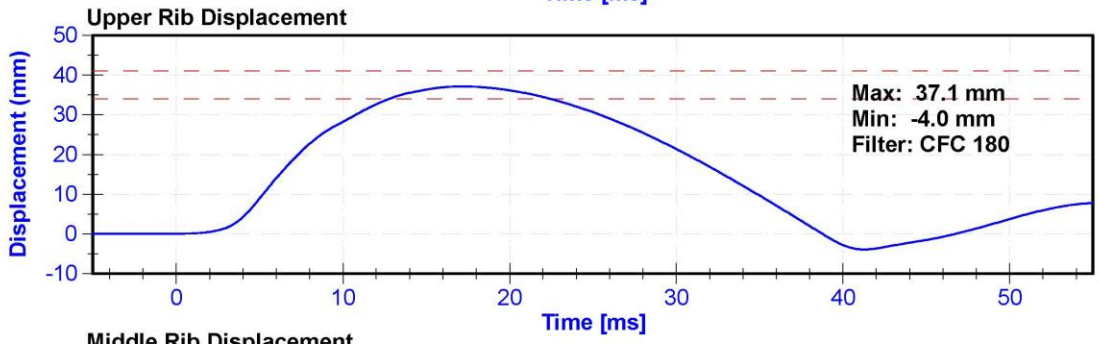
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	25.9	Pass
Velocity	5.4	5.6	m/s	5.52	Pass
Resistive Force after 6ms	5100	6200	N	6078.2	Pass
Upper Thorax Rib Deflection	34	41	mm	37.1	Pass
Mid Thorax Rib Deflection	37	45	mm	40.7	Pass
Lower Thorax Rib Deflection	37	44	mm	40.7	Pass

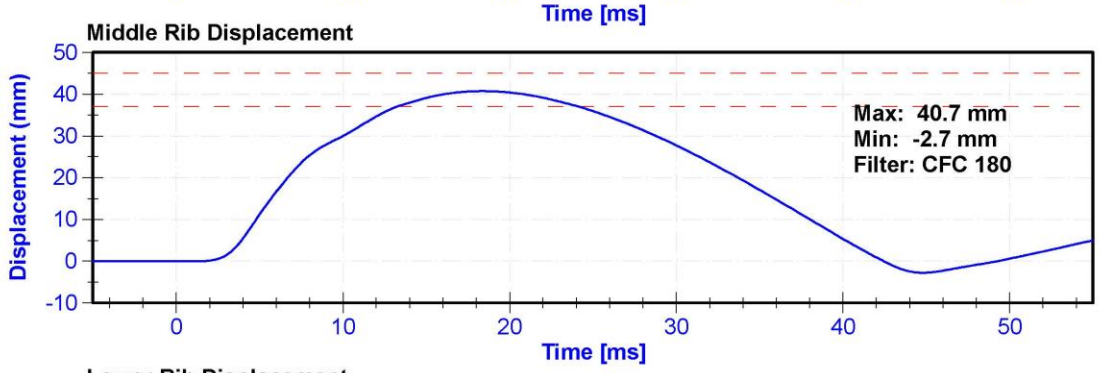
Transducer Calibrations

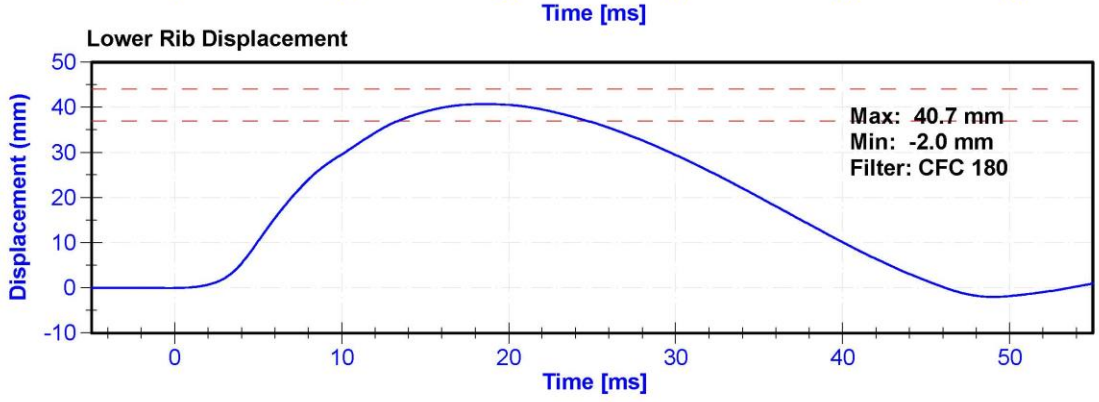
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019




Resistive Force
Max: 8617.9 N
Min: -19.7 N
Filter: CFC 180
Force (N)
Time [ms]


Upper Rib Displacement
Max: 37.1 mm
Min: -4.0 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Middle Rib Displacement
Max: 40.7 mm
Min: -2.7 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Lower Rib Displacement
Max: 40.7 mm
Min: -2.0 mm
Filter: CFC 180
Displacement (mm)
Time [ms]

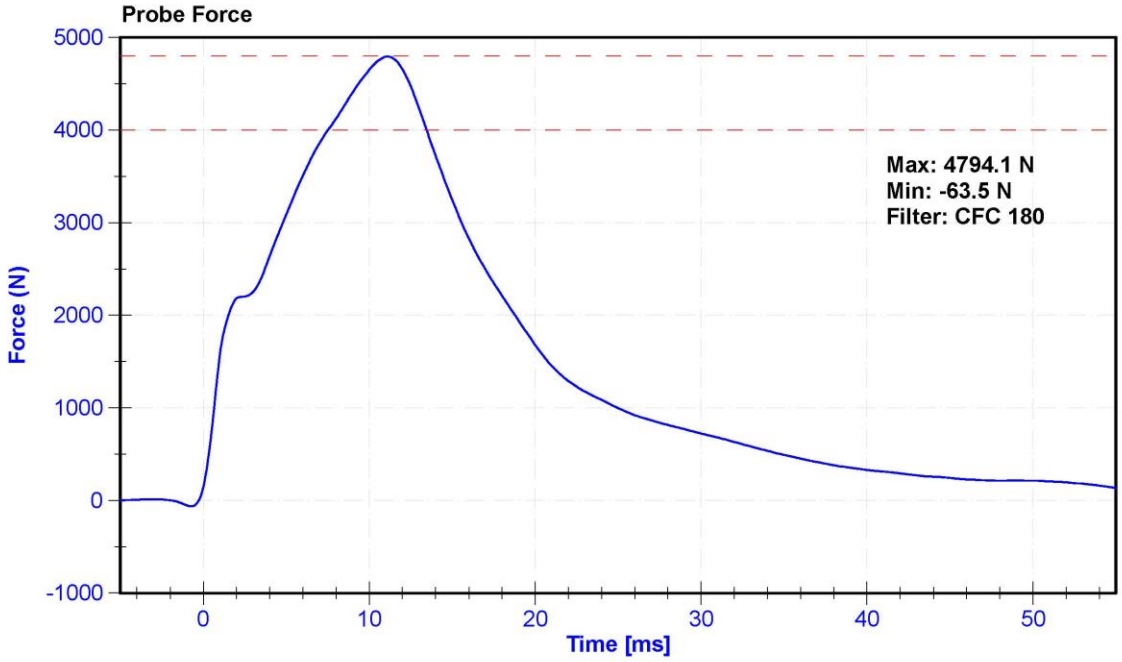
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	FO34	Laboratory Supervisor	K.Brogan

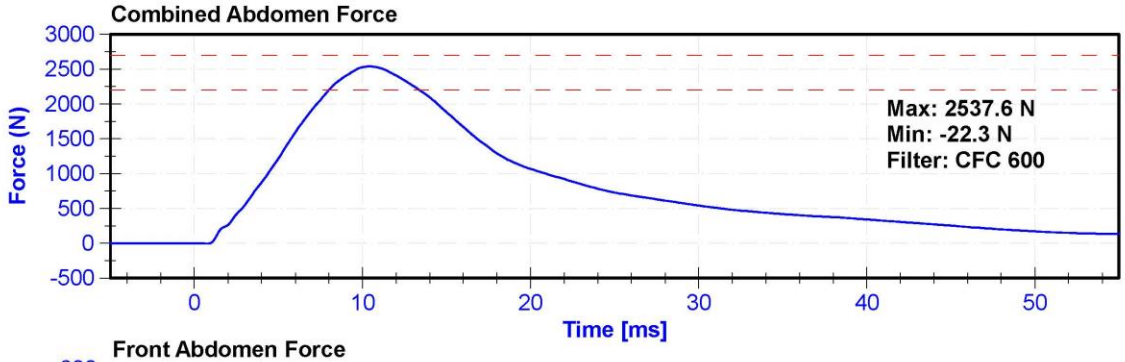
Results

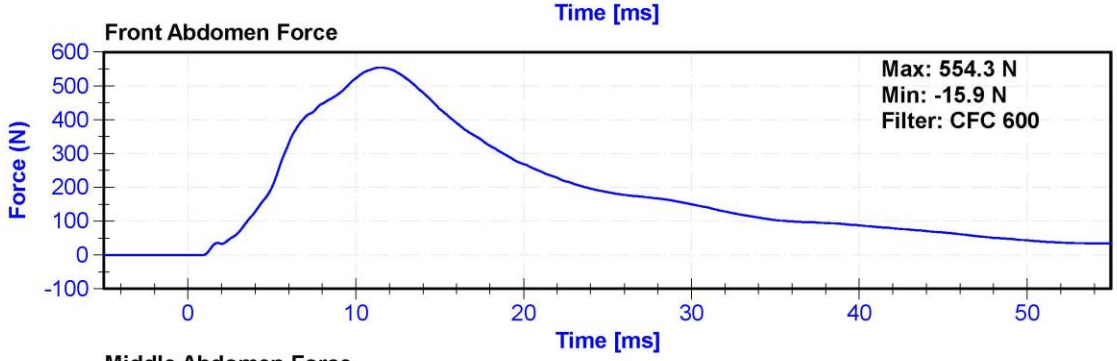
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	25.8	Pass
Velocity	3.9	4.1	m/s	4.09	Pass
Combined Abdomen Force	2200	2700	N	2537.6	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.45	Pass
Resistive Probe Force	4000	4800	N	4794.1	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.10	Pass

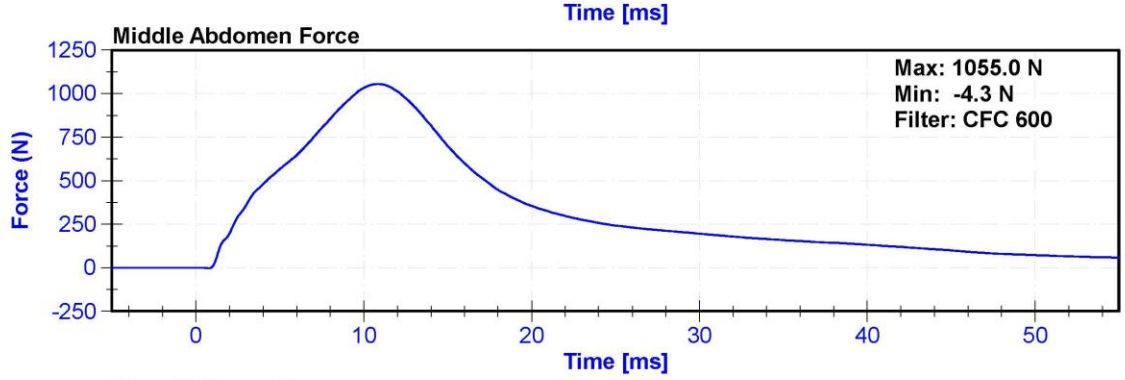
Transducer Calibrations

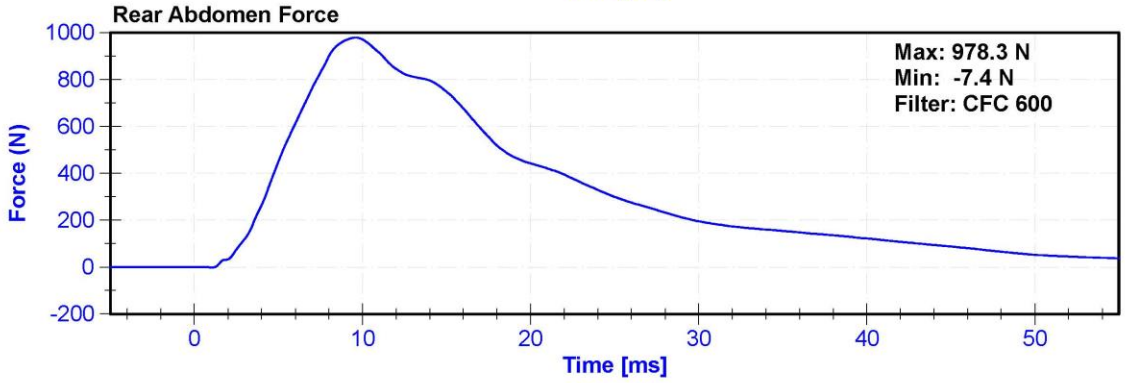
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Front Abdomen Load Cell	DENTON 2631	LC-1440	6/4/2018	6/4/2019
Middle Abdomen Load Cell	DENTON 2631	LC-1525	6/4/2018	6/4/2019
Rear Abdomen Load Cell	DENTON 2631	LC-1528	6/4/2018	6/4/2019




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2537.6 N
Min: -22.3 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 554.3 N
Min: -15.9 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1055.0 N
Min: -4.3 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 978.3 N
Min: -7.4 N
Filter: CFC 600

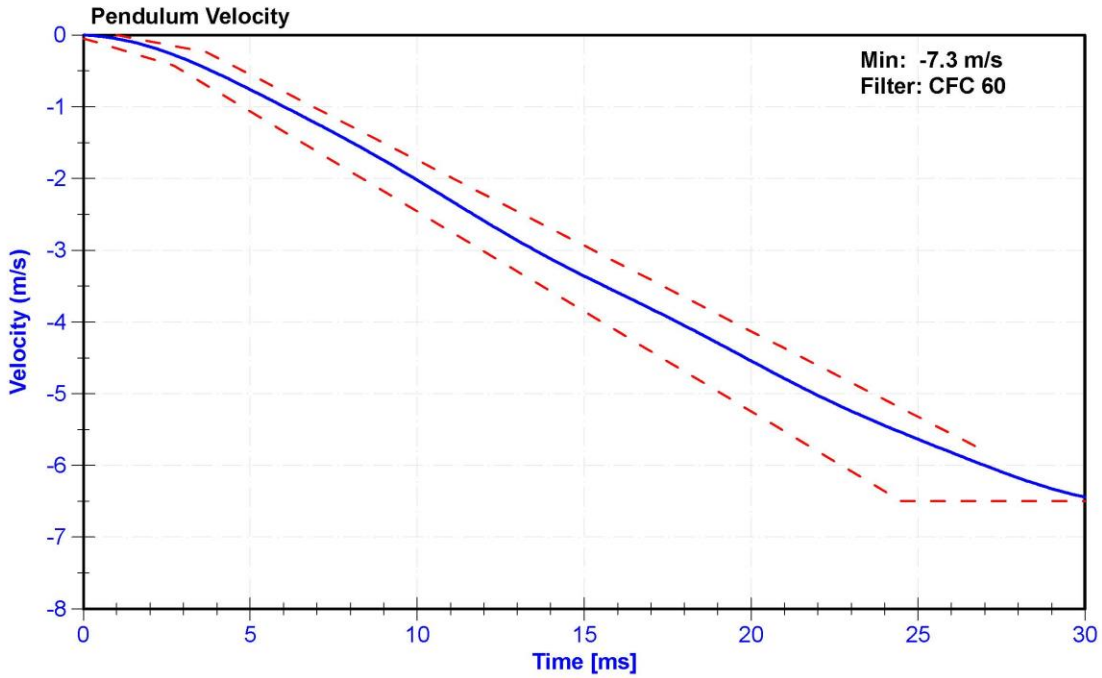
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

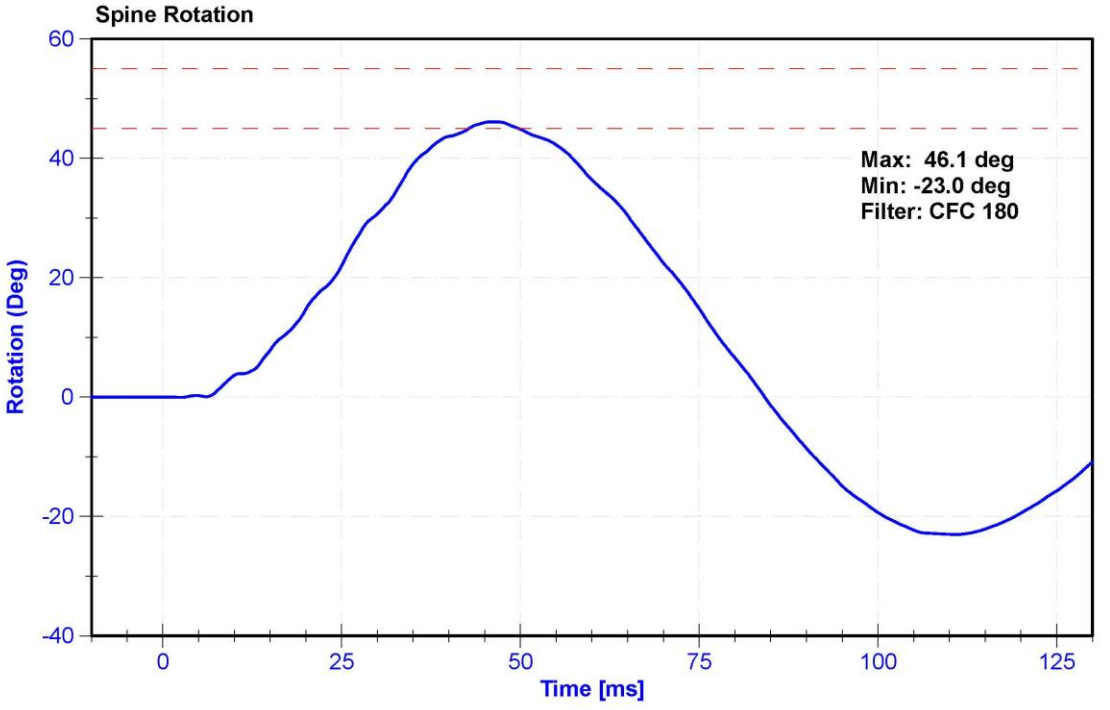
Results

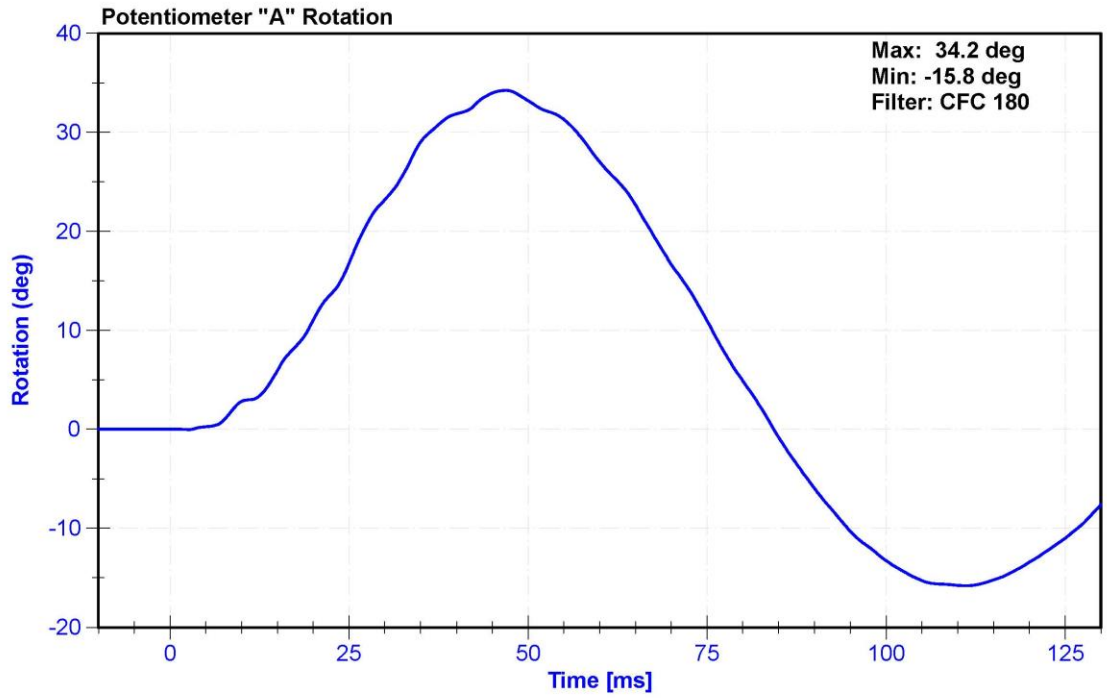
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	23.2	Pass
Velocity	5.95	6.15	m/s	6.046	Pass
Lateral Spine Rotation	45	55	deg	46.1	Pass
Time at Maximum Rotation	39	53	ms	45.8	Pass
Time of Decay to Zero Degrees	37	57	ms	38.3	Pass
Pulse within Corridor?	-	-	-		

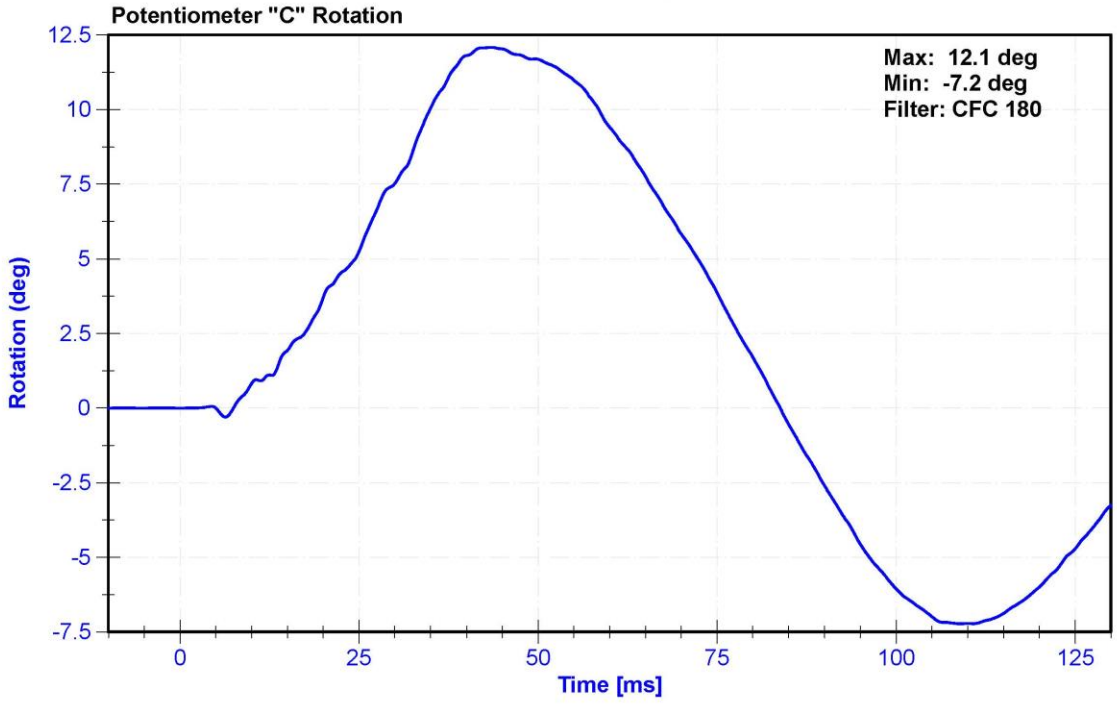
Transducer Calibrations

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: -7.3 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: 46.1 deg
Min: -23.0 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: -15.8 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
-20
0
25
50
75
100
125
Time [ms]


Potentiometer "C" Rotation
Max: 12.1 deg
Min: -7.2 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]

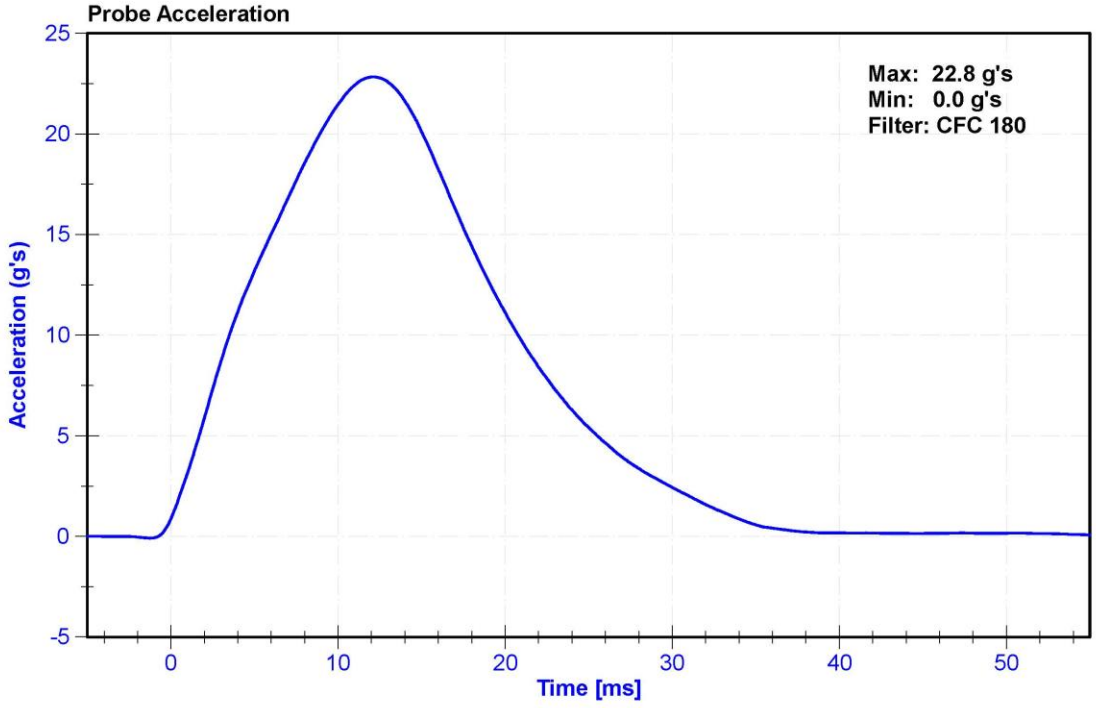
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

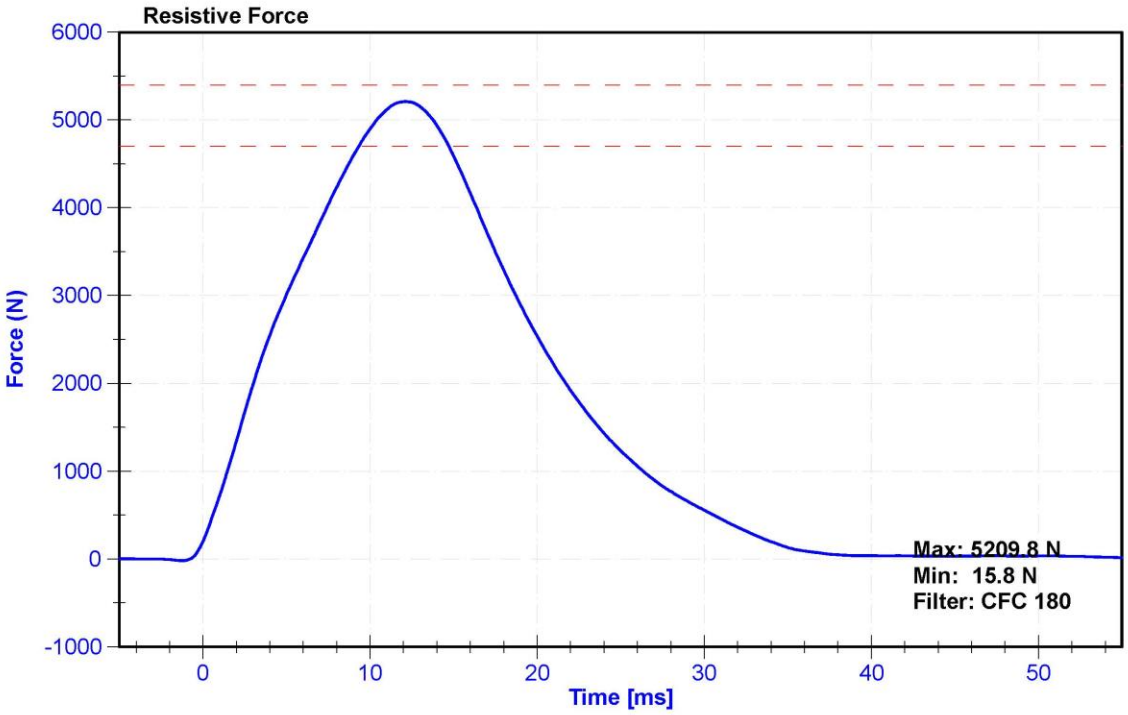
Results

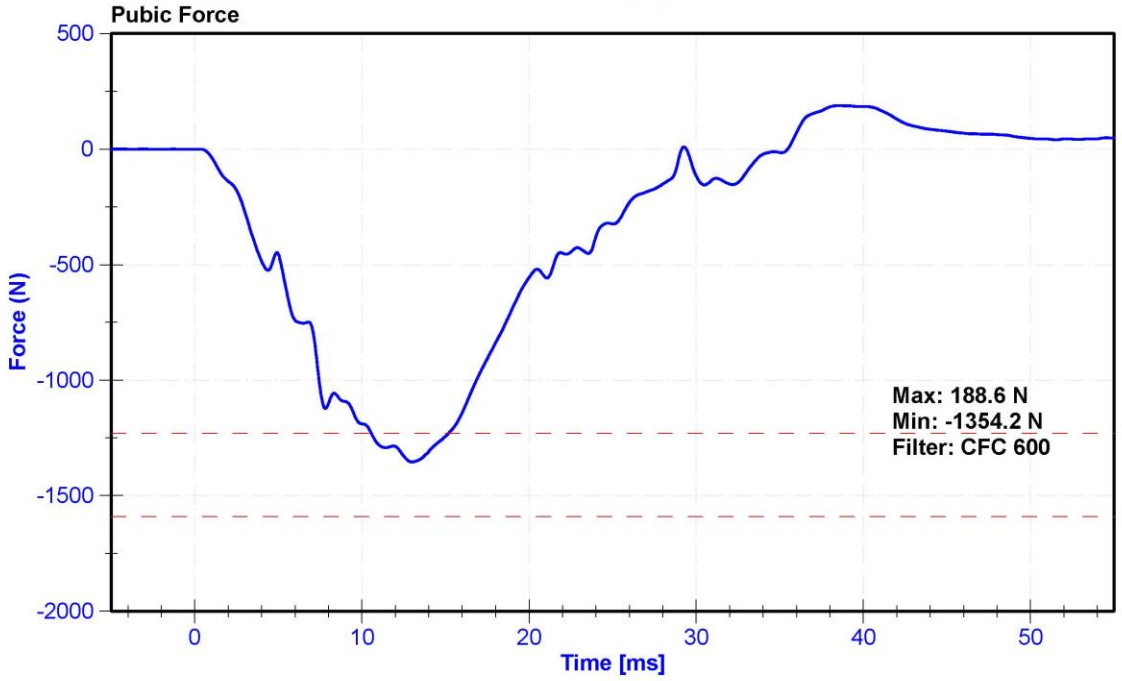
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	26.2	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Resistive Force	4700	5400	N	5209.8	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.10	Pass
Pubic Force	-1590	-1230	N	-1354.2	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.00	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Pubic Load Cell	Denton 3096JFL	LC-464fy	6/4/2018	6/4/2019




Resistive Force
Force (N)
Time [ms]
Max: 5209.8 N
Min: 15.8 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 188.6 N
Min: -1354.2 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

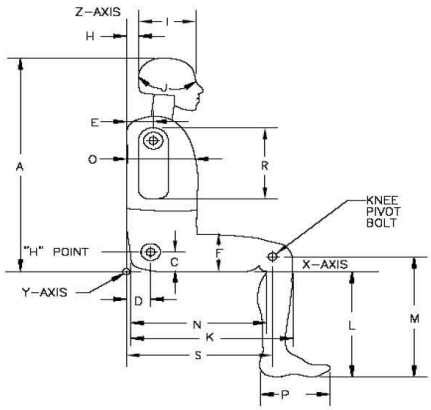
SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

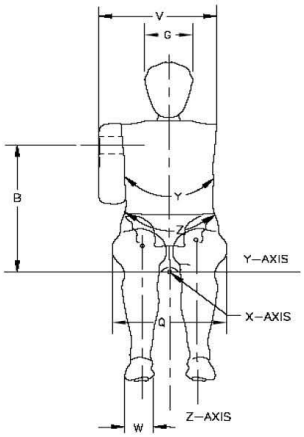
SERIAL No: 300

External Measurements - SID-IIs

Technician: K. Dutton Date: 2/22/2019

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	782	Pass
B	Shoulder Pivot Height	437	453	447	Pass
C	H-point Height	79	89	85	Pass
D	H-point from seatback	141	151	144	Pass
E	Shoulder Pivot from Backline	97	107	104	Pass
F	Thigh Clearance	119	135	124	Pass
G	Head Breadth	140	148	144	Pass
H	Head Back from Backline	40	46	42	Pass
I	Head Depth	178	188	186	Pass
J	Head Circumference	541	551	547	Pass
K	Buttock to Knee Length	514	540	529	Pass
L	Popliteal Height	343	369	358	Pass
M	Knee Pivot to floor height	392	409	402	Pass
N	Buttock Popliteal Length	416	442	432	Pass
O	Chest Depth w/o jacket	195	211	204	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	485	Pass
V	Shoulder Width	341	357	351	Pass
W	Foot Width	78	94	83	Pass
Y	Chest Circumference w/jacket	851	881	872	Pass
Z	Waist Circumference	761	791	770	Pass

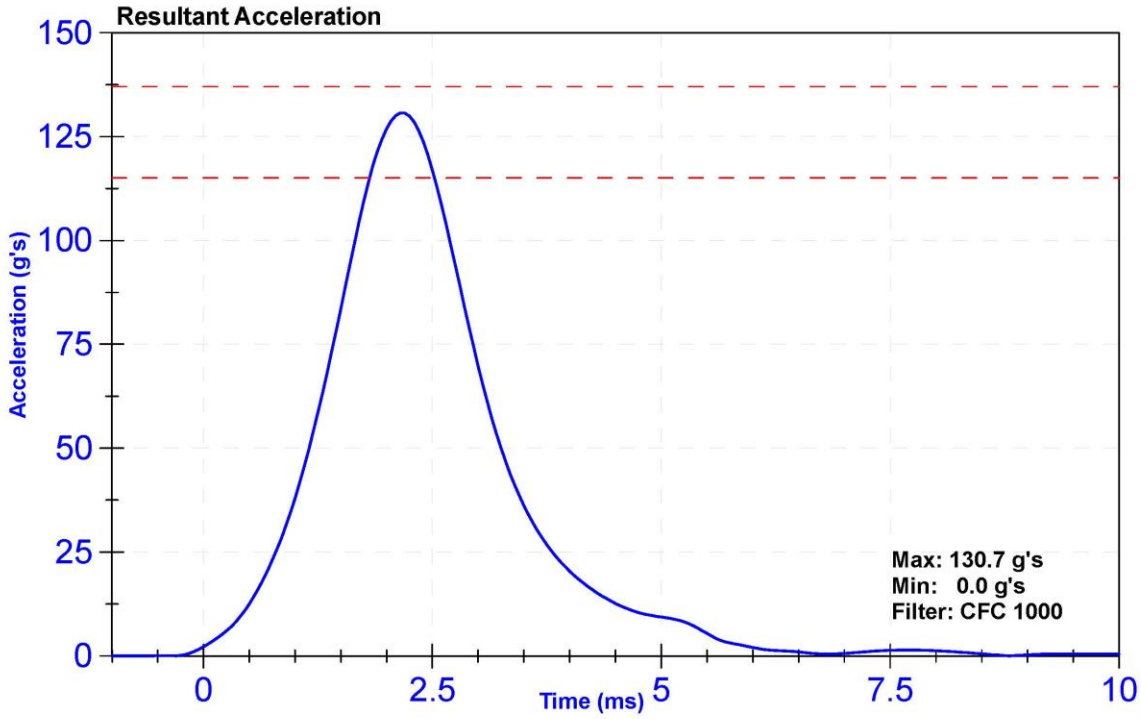
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

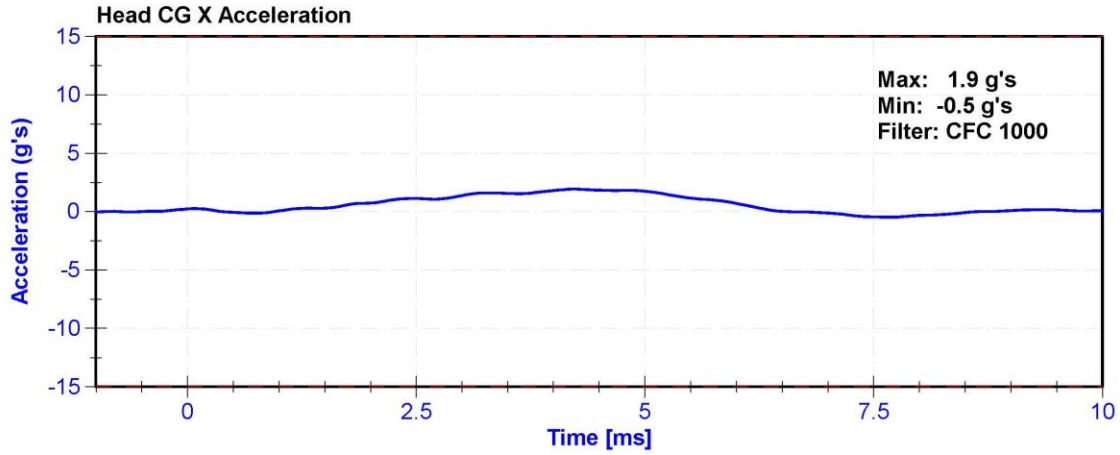
Results

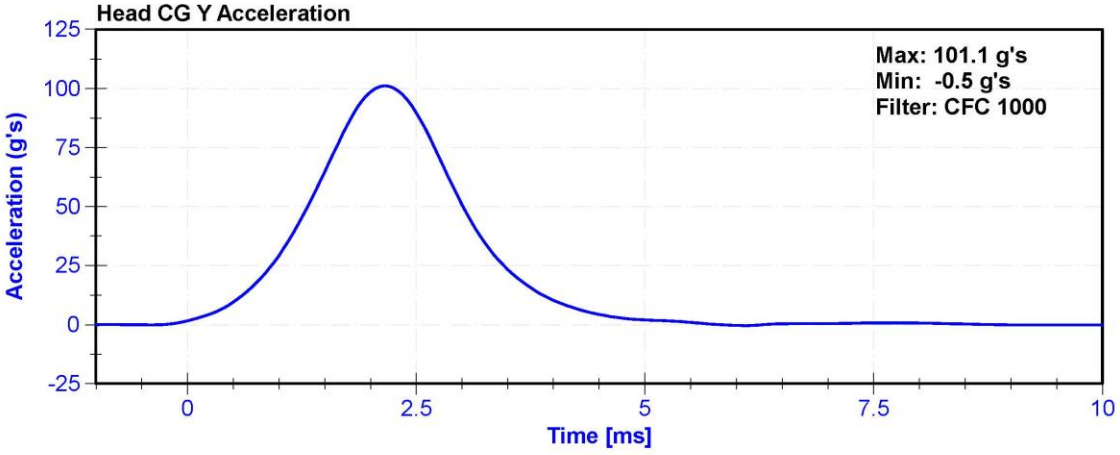
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	24.4	Pass
Resultant Acceleration	115	137	g's	130.7	Pass
Oscillation	0	15	%	1.1	Pass
Fore-Aft Acceleration	-15	15	g's	1.9	Pass

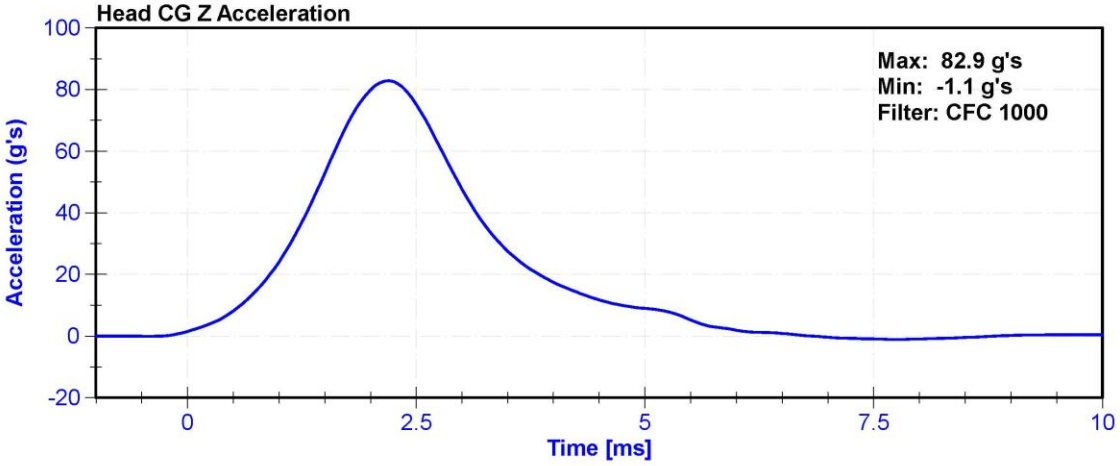
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P58777	10/5/2018	4/5/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P59018	10/5/2018	4/5/2019
Z Accelerometer	ENDEVCO 7264	AC-P79189	10/5/2018	4/5/2019




Head CG X Acceleration
Max: 1.9 g's
Min: -0.5 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Y Acceleration
Max: 101.1 g's
Min: -0.5 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Z Acceleration
Max: 82.9 g's
Min: -1.1 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]

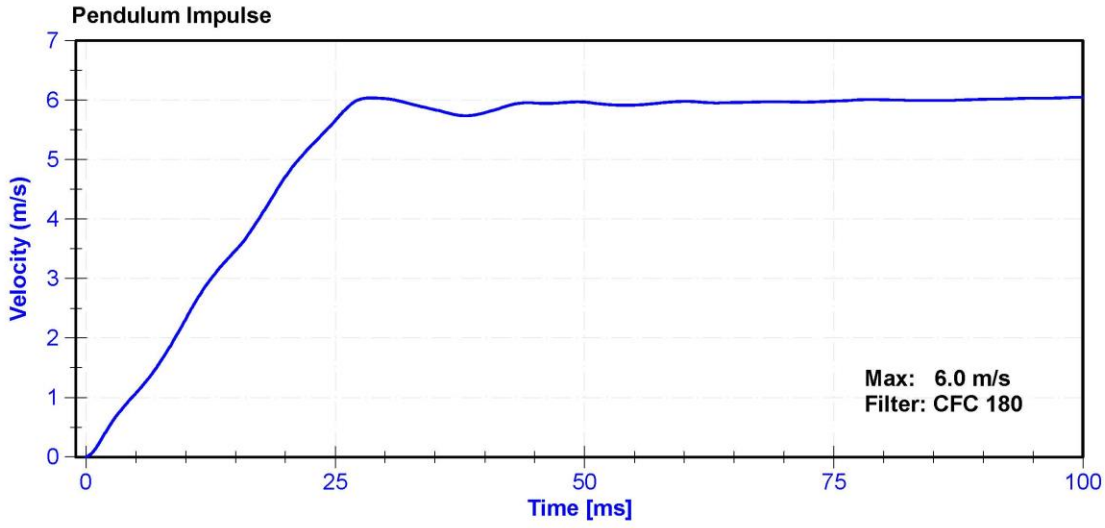
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

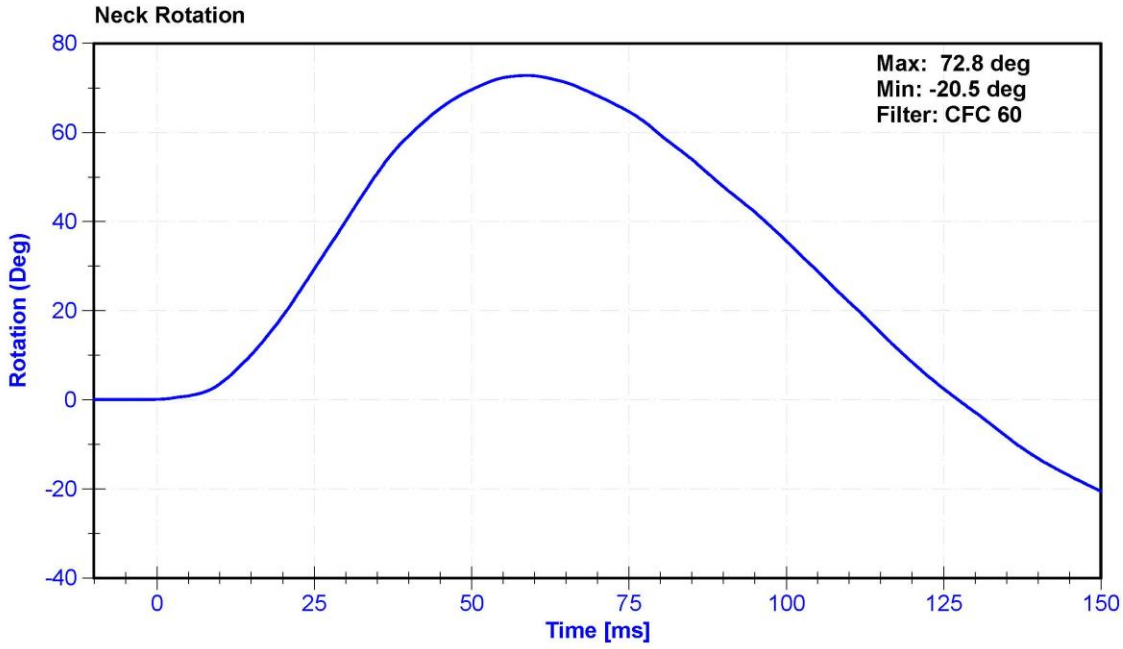
Results

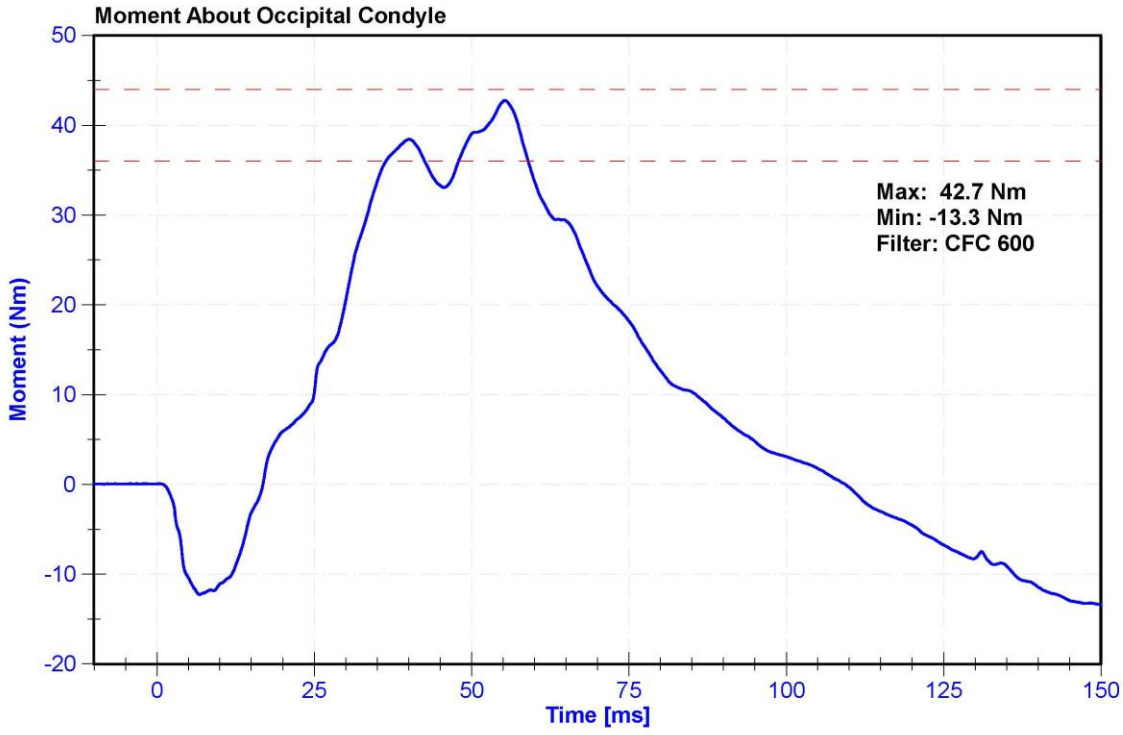
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	23.5	Pass
Velocity	5.51	5.63	m/s	5.514	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.32	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.47	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.71	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.65	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	6.04	Pass
Neck Rotation	71	81	deg	72.8	Pass
Time at Maximum Rotation	50	70	ms	58.9	Pass
Moment about the OC	36	44	Nm	42.7	Pass
Moment Decay to 0 Nm	102	126	ms	109.5	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: 72.8 deg
Min: -20.5 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: -13.3 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

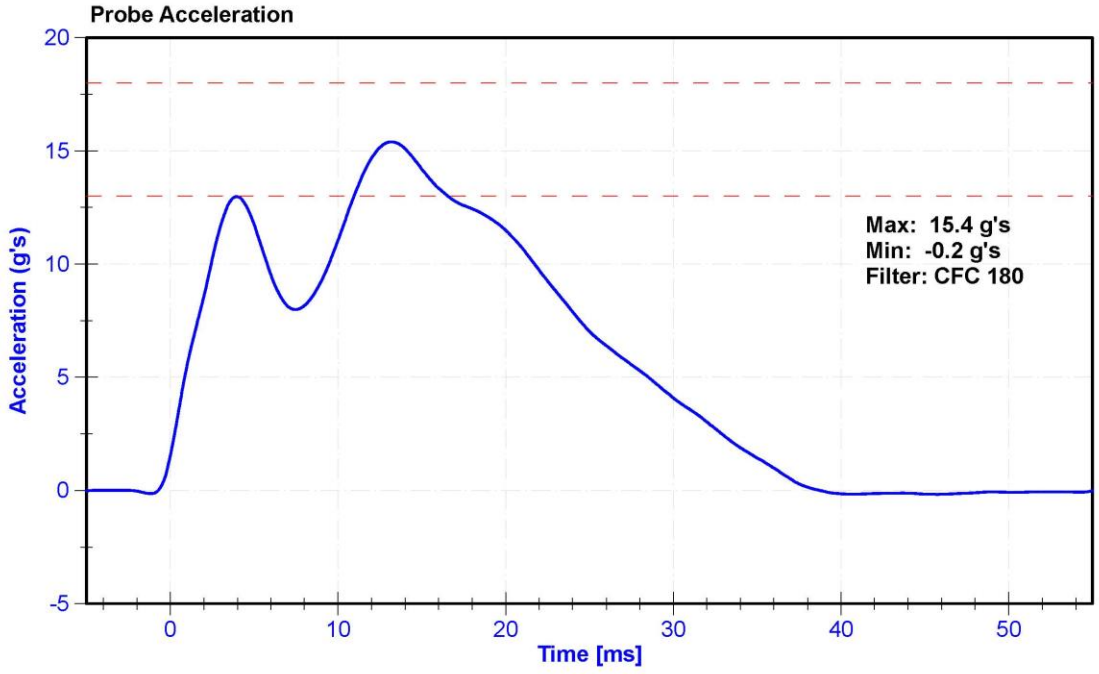
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

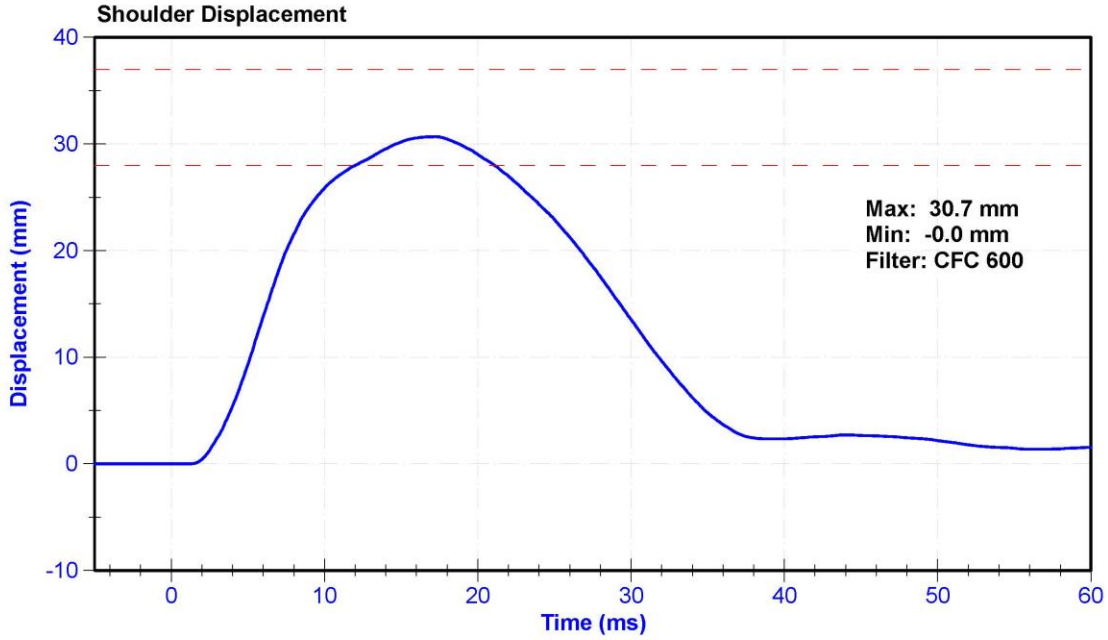
Results

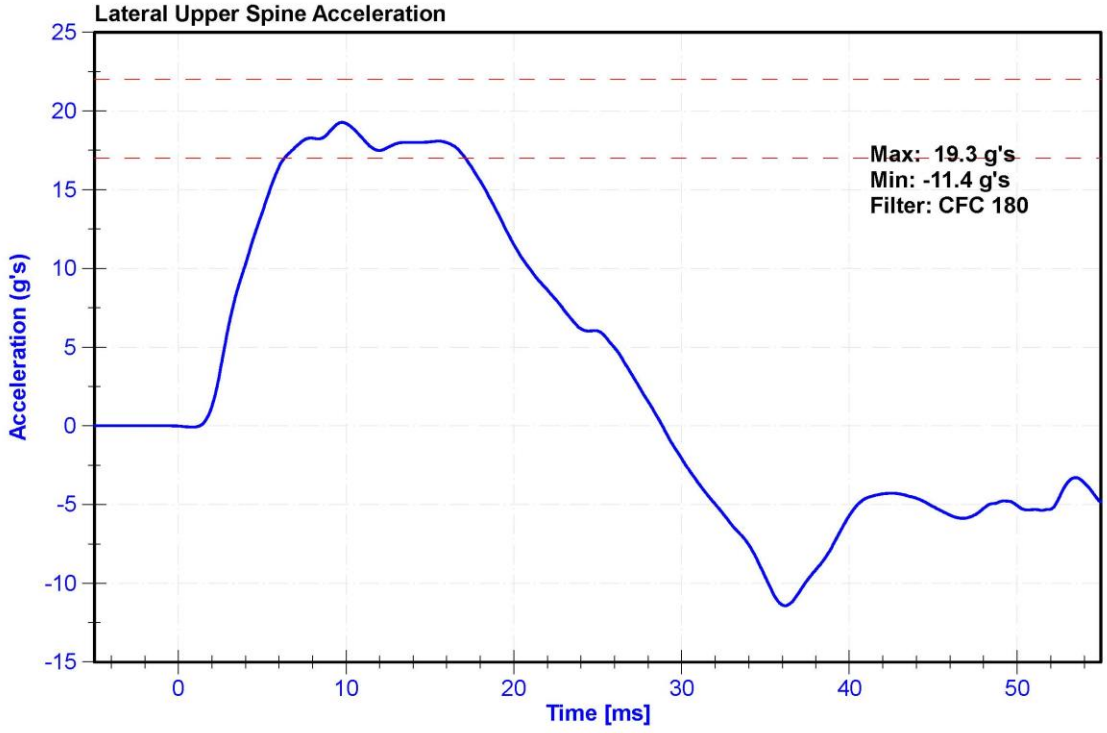
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	24.9	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	13	18	g's	15.4	Pass
Shoulder Deflection	28	37	mm	30.7	Pass
Lateral Upper Spine Acceleration	17	22	g's	19.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/30/2018	10/30/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 30.7 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 19.3 g's
Min: -11.4 g's
Filter: CFC 180

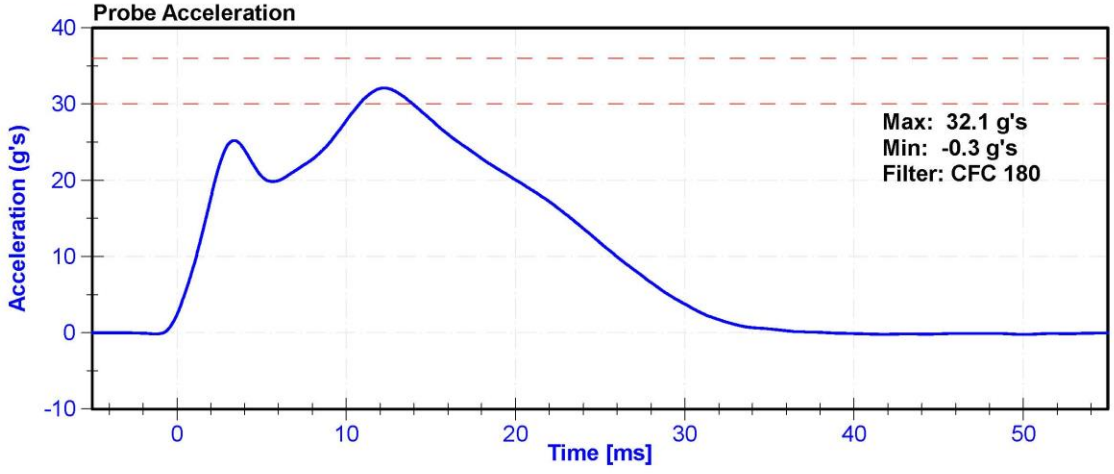
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

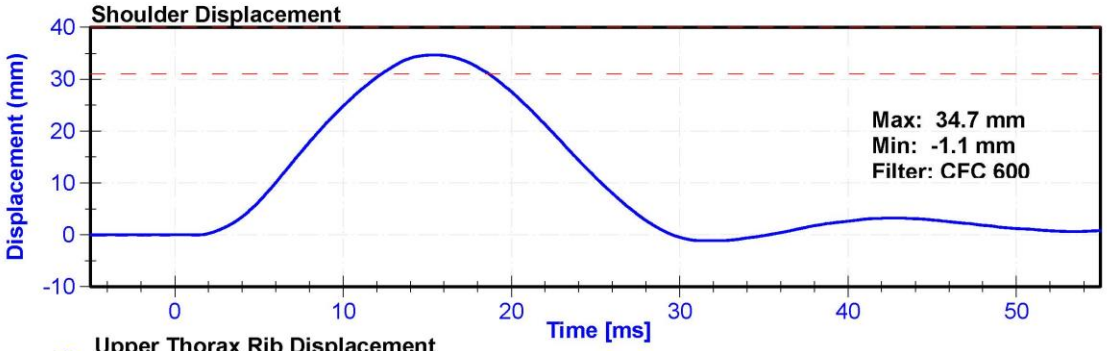
Results

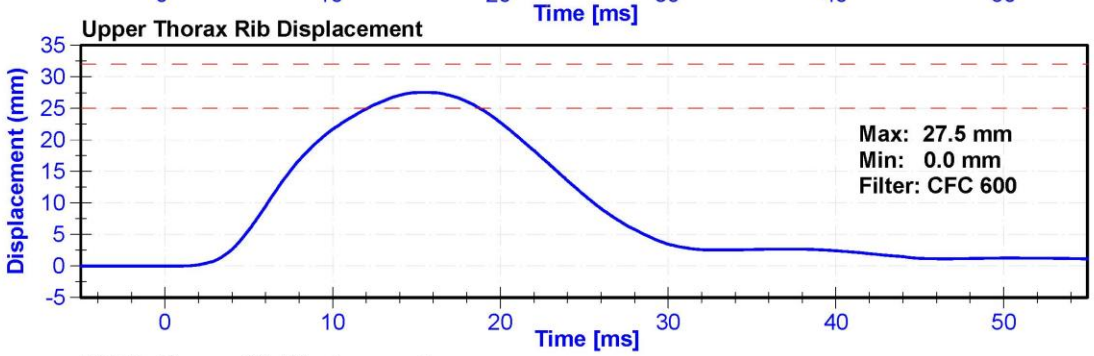
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	27.8	Pass
Velocity	6.6	6.8	m/s	6.74	Pass
Probe Acceleration after 5 ms	30	36	g's	32.1	Pass
Lateral Upper Spine Acceleration	34	43	g's	36.1	Pass
Lateral Lower Spine Acceleration	29	37	g's	34.7	Pass
Shoulder Deflection	31	40	mm	34.7	Pass
Upper Thorax Rib Deflection	25	32	mm	27.5	Pass
Mid Thorax Rib Deflection	30	36	mm	31.5	Pass
Lower Thorax Rib Deflection	32	38	mm	33.4	Pass

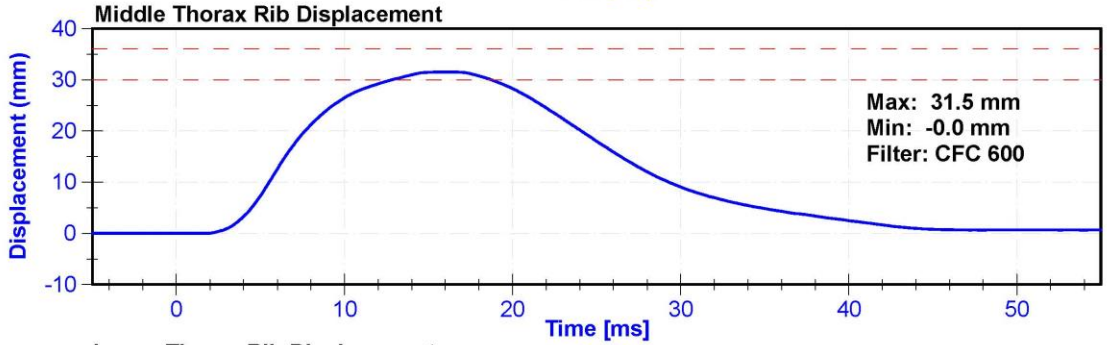
Transducer Calibrations

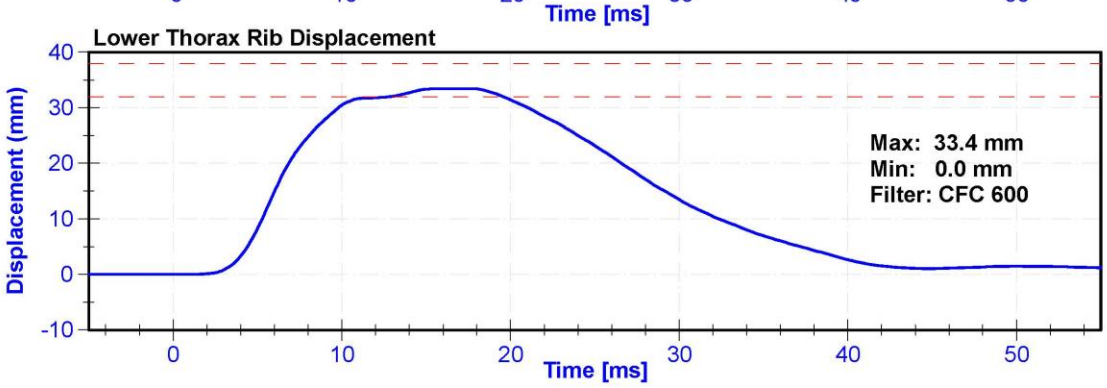
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019
Upper Spine T12 Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/30/2018	10/30/2019
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/10/2018	10/10/2019

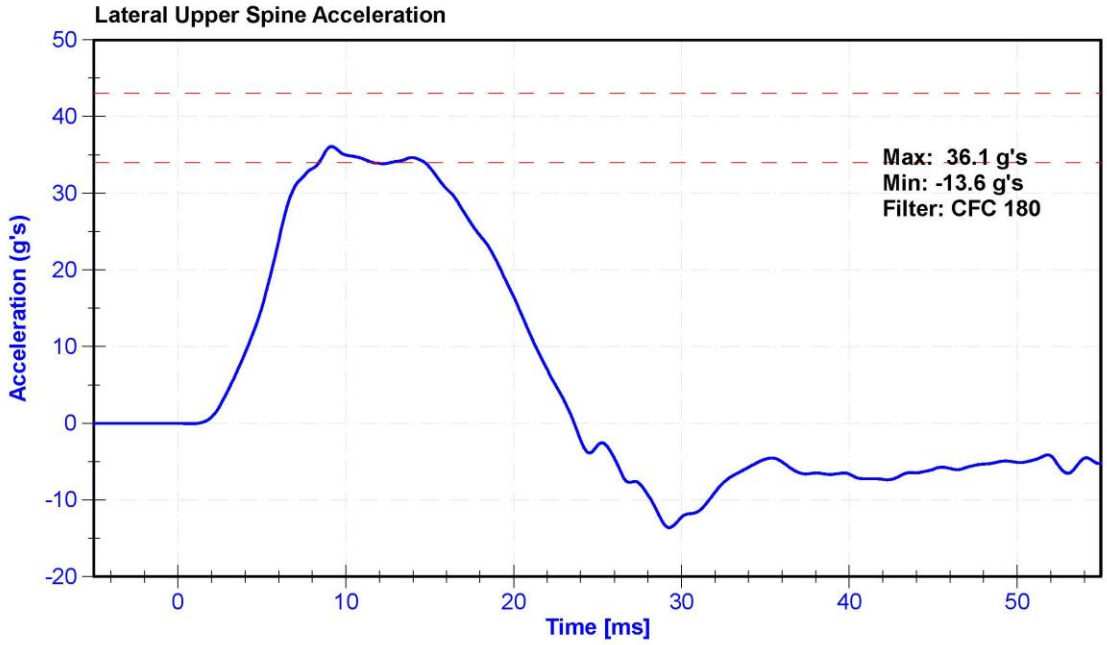


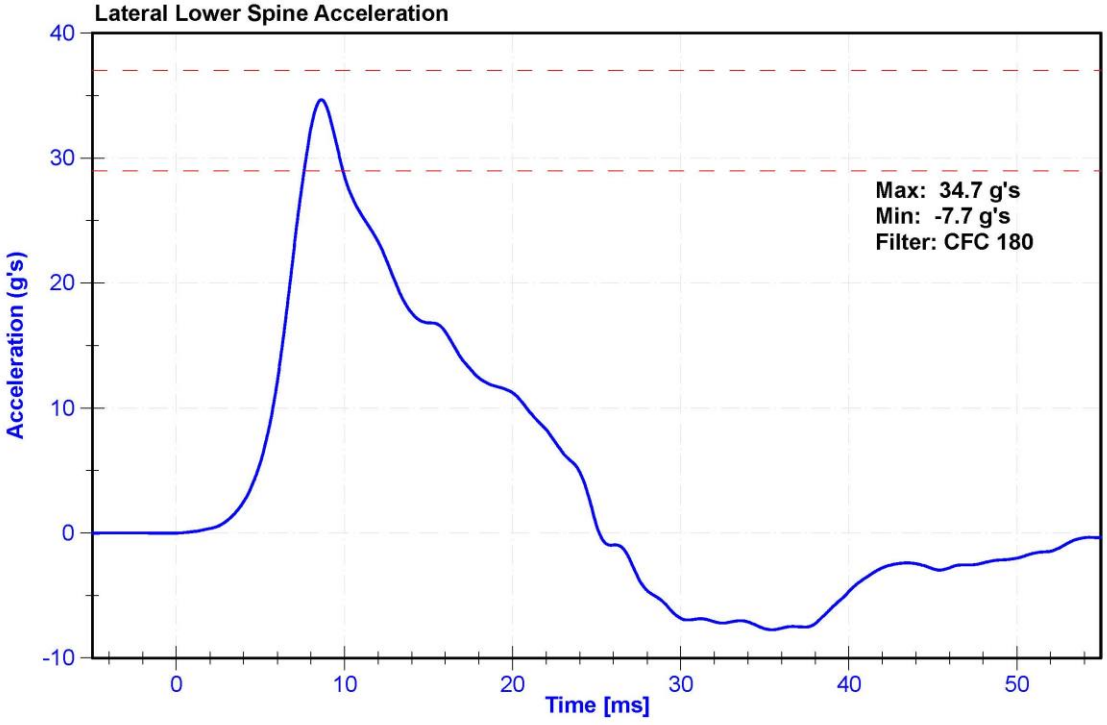

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 34.7 mm
Min: -1.1 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 27.5 mm
Min: 0.0 mm
Filter: CFC 600


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


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 33.4 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 36.1 g's
Min: -13.6 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]


Lateral Lower Spine Acceleration
Max: 34.7 g's
Min: -7.7 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]

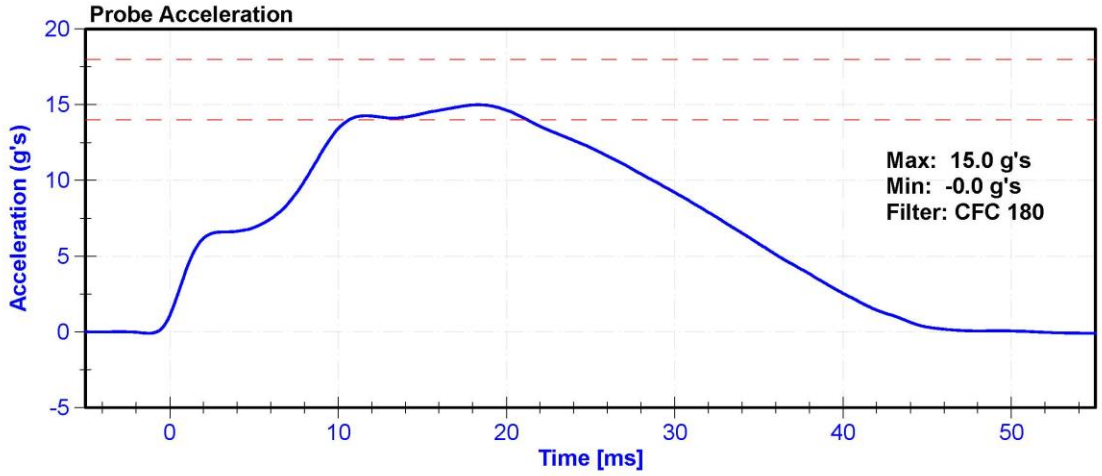
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

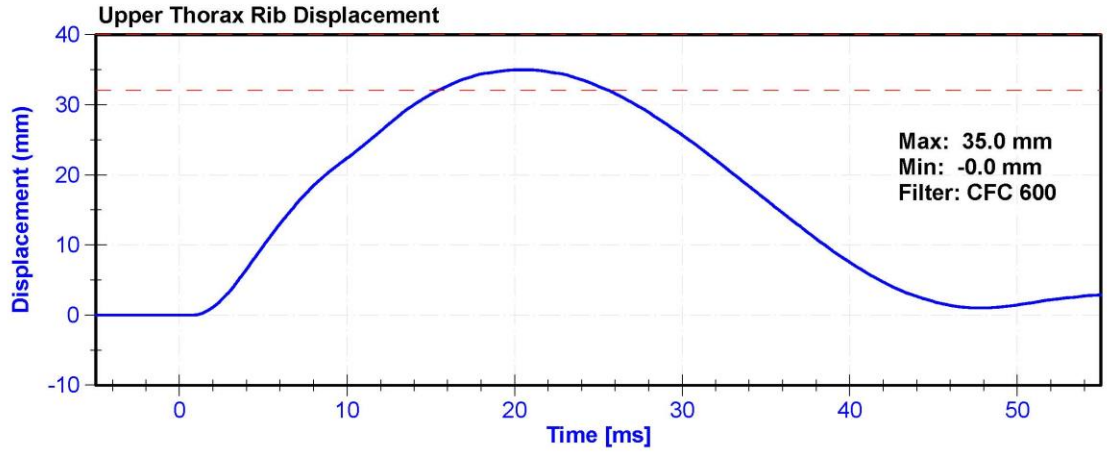
Results

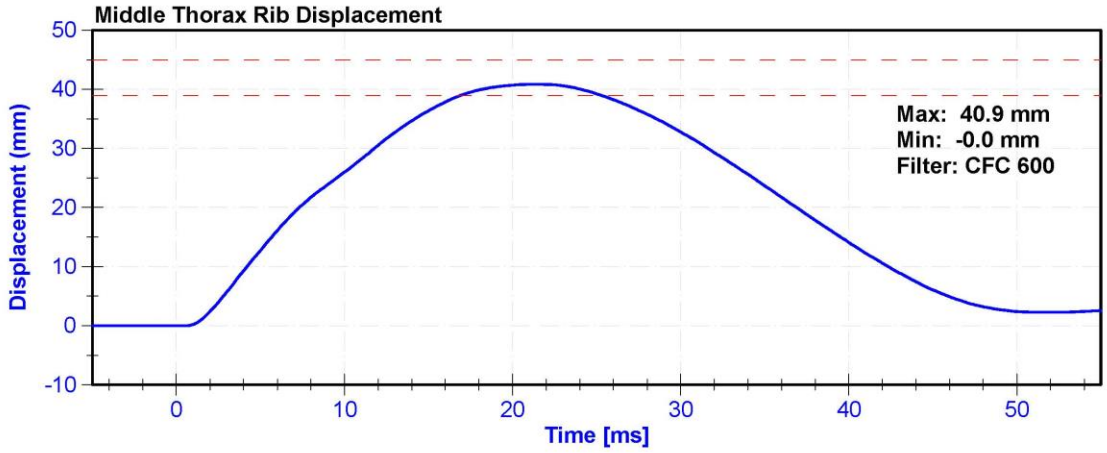
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	35.7	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	14	18	g's	15.0	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.9	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.6	Pass
Upper Thorax Rib Deflection	32	40	mm	35.0	Pass
Middle Thorax Rib Deflection	39	45	mm	40.9	Pass
Lower Thorax Rib Deflection	35	43	mm	38.1	Pass

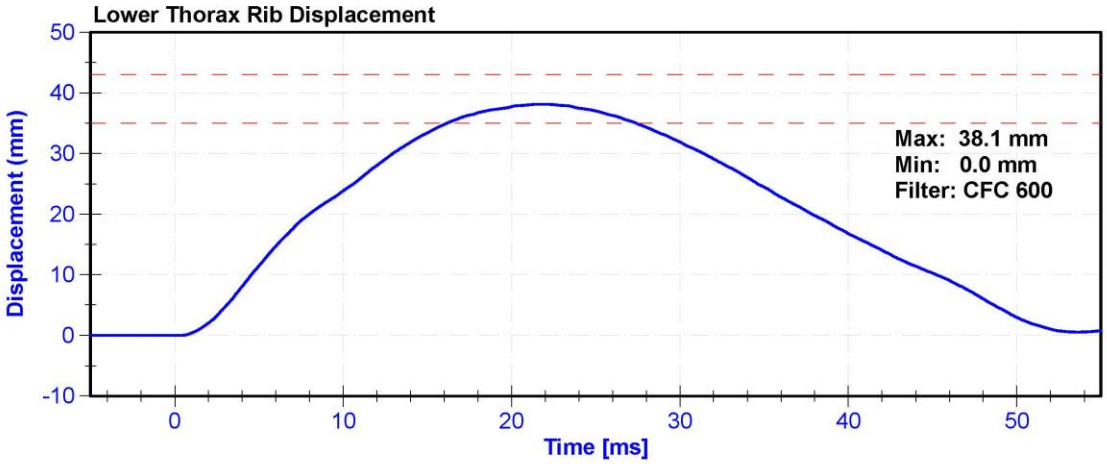
Transducer Calibrations

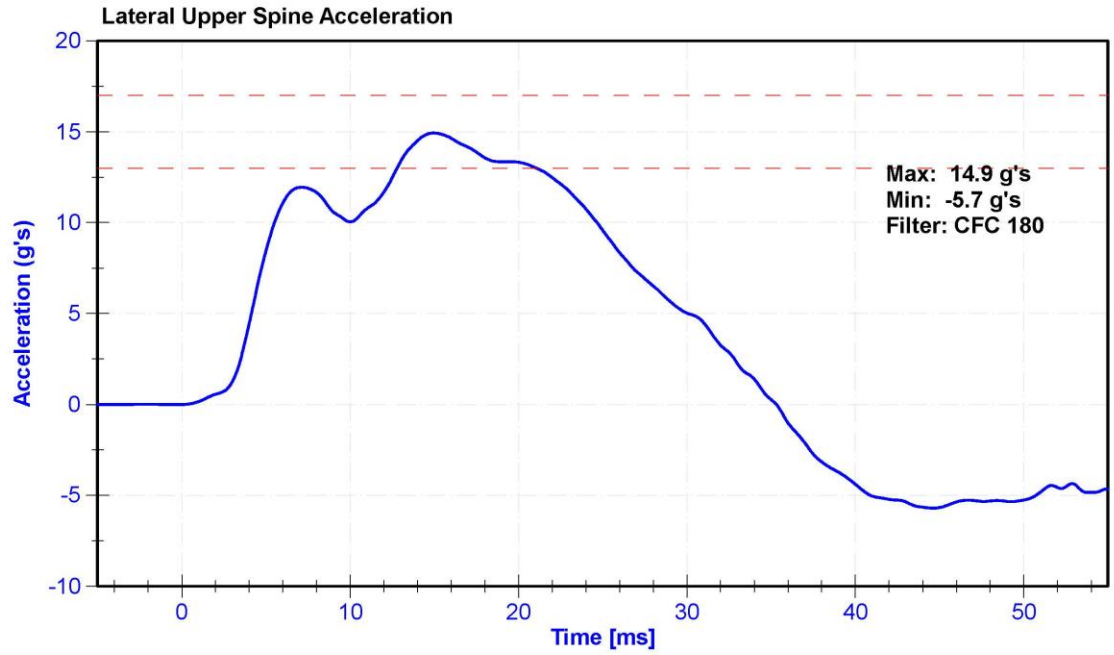
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/10/2018	10/10/2019

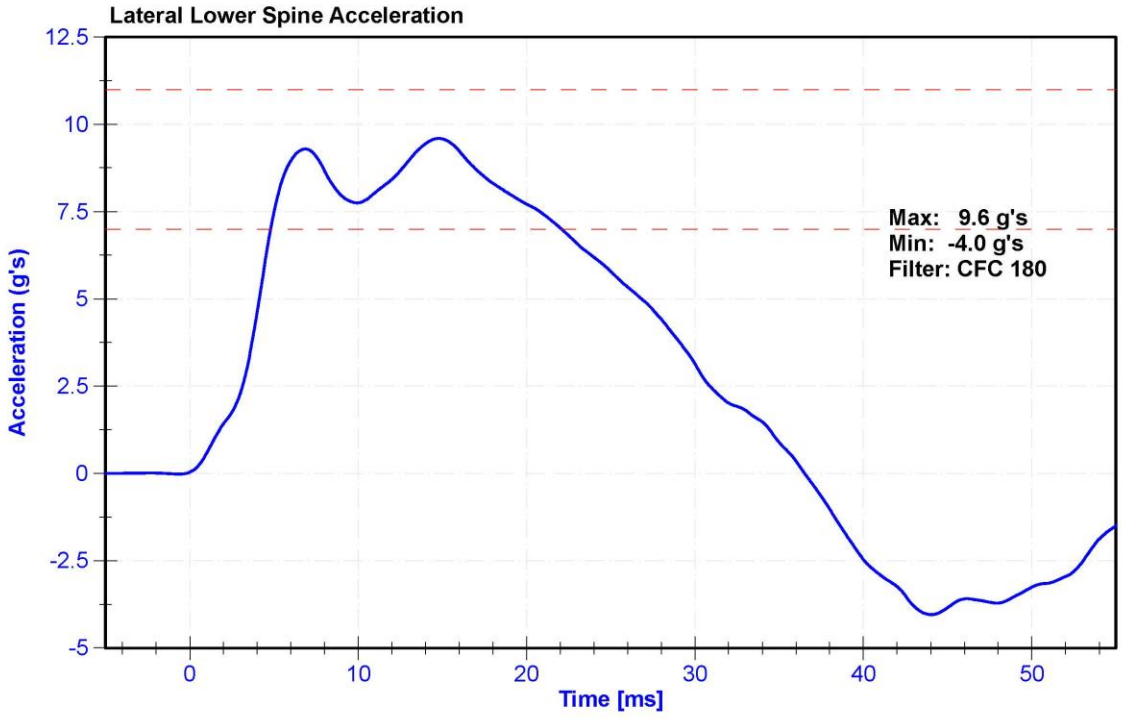



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 35.0 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.9 mm
Min: -0.0 mm
Filter: CFC 600


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


Lateral Upper Spine Acceleration
Max: 14.9 g's
Min: -5.7 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
20
15
10
5
0
-5
-10
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 9.6 g's
Min: -4.0 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

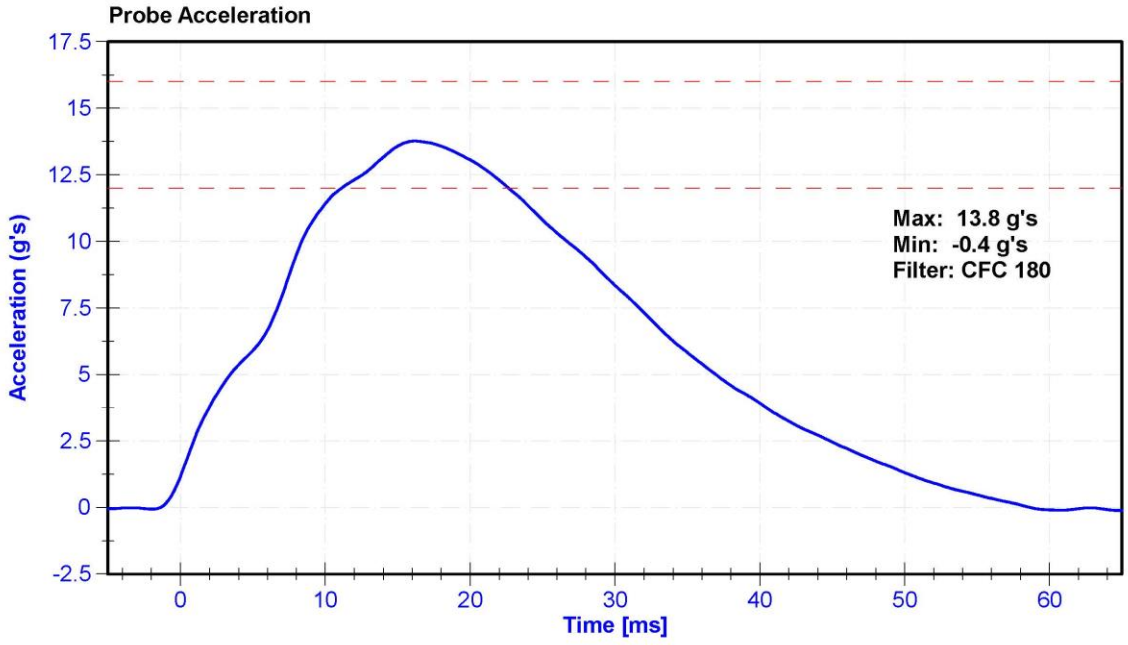
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

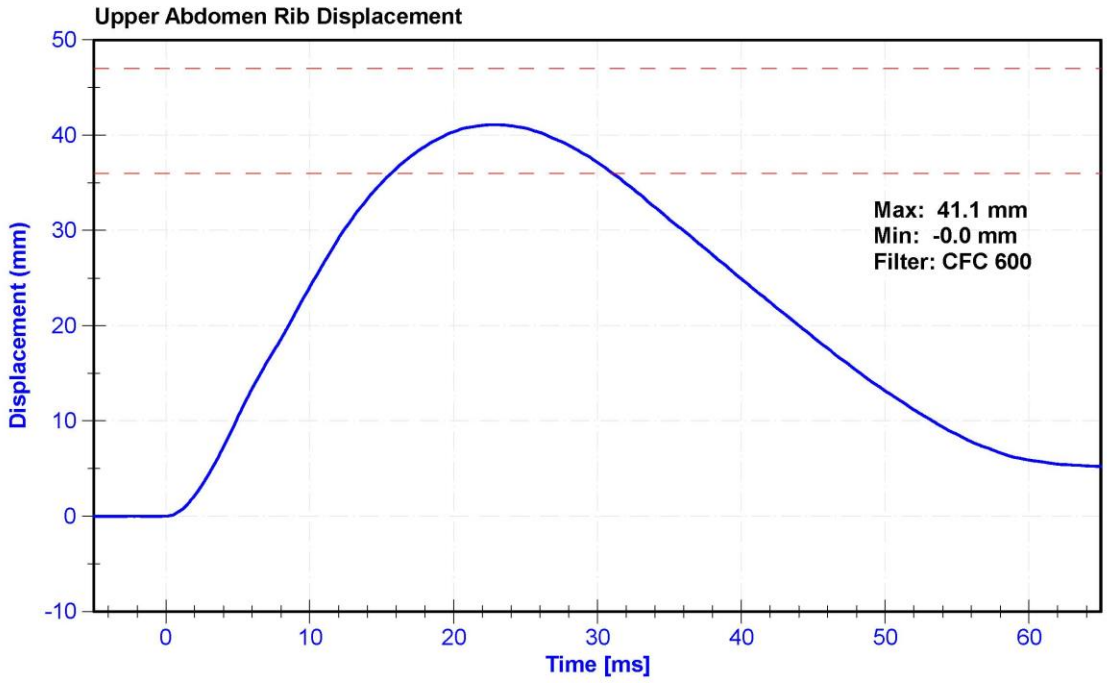
Results

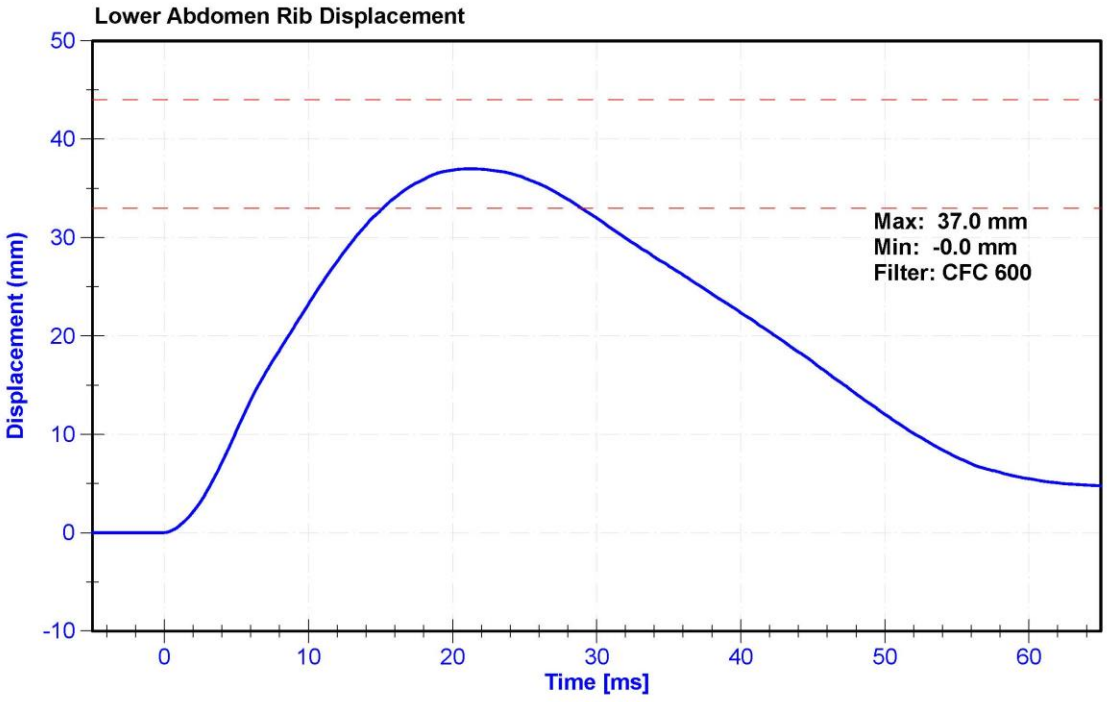
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	20.7	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	12	16	g's	13.8	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.3	Pass
Upper Abdomen Rib Deflection	36	47	mm	41.1	Pass
Lower Abdomen Rib Deflection	33	44	mm	37.0	Pass

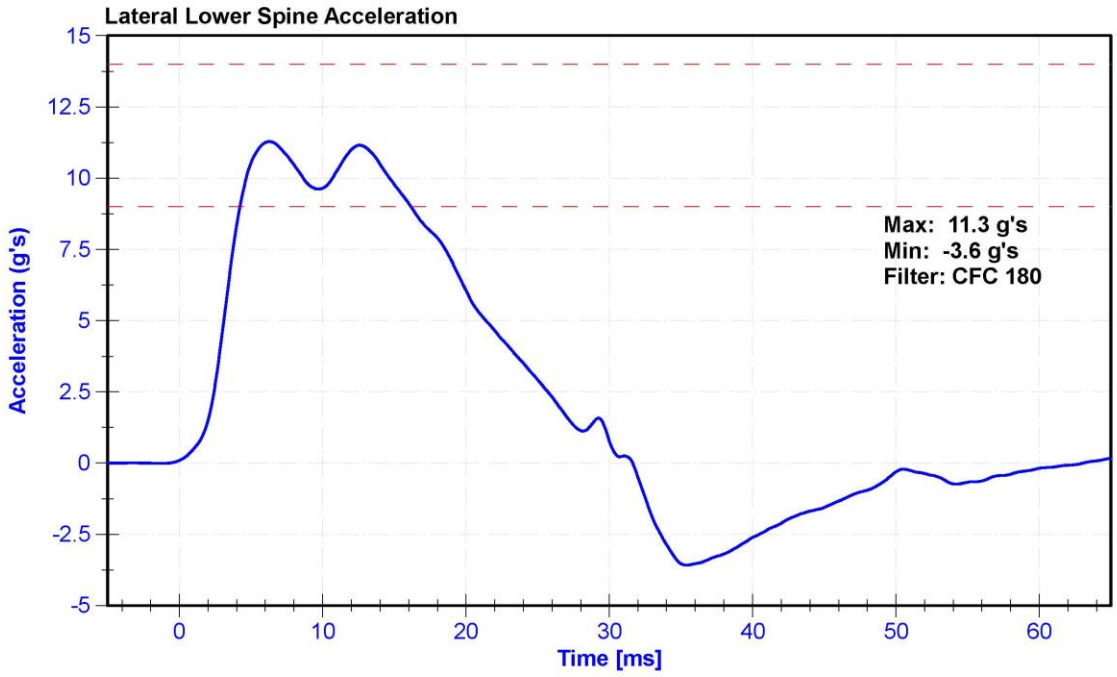
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Upper Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-308GFE	10/10/2018	10/10/2019
Lower Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-307GFE	10/11/2018	10/11/2019




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


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.0 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Lower Spine Acceleration
Acceleration (g's)
15
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50
60
Time [ms]
Max: 11.3 g's
Min: -3.6 g's
Filter: CFC 180

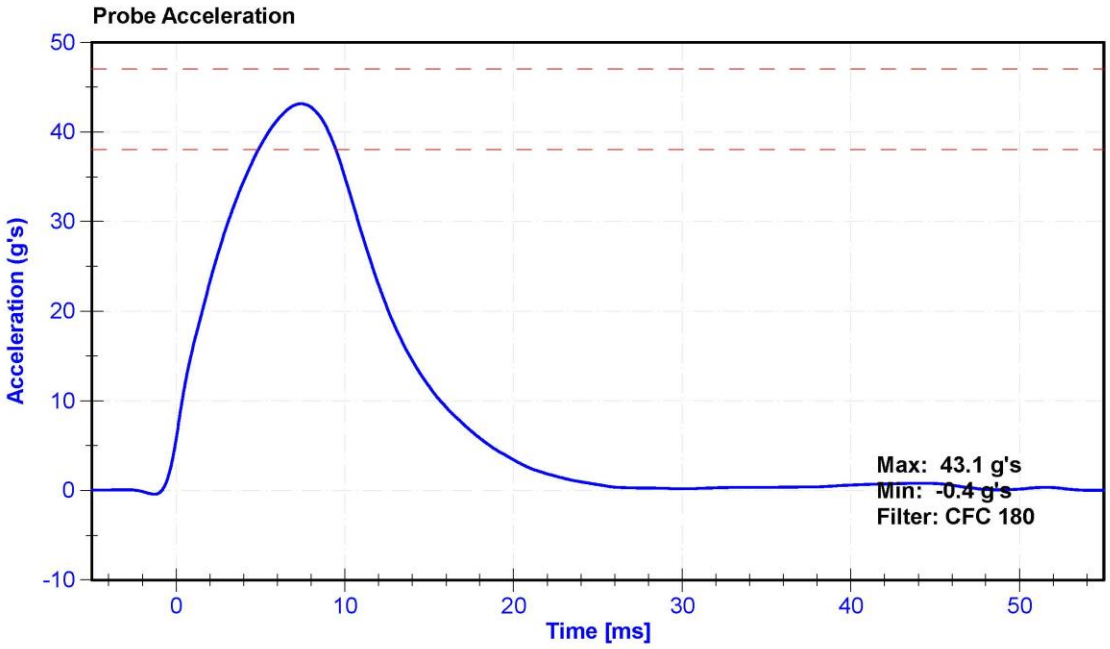
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

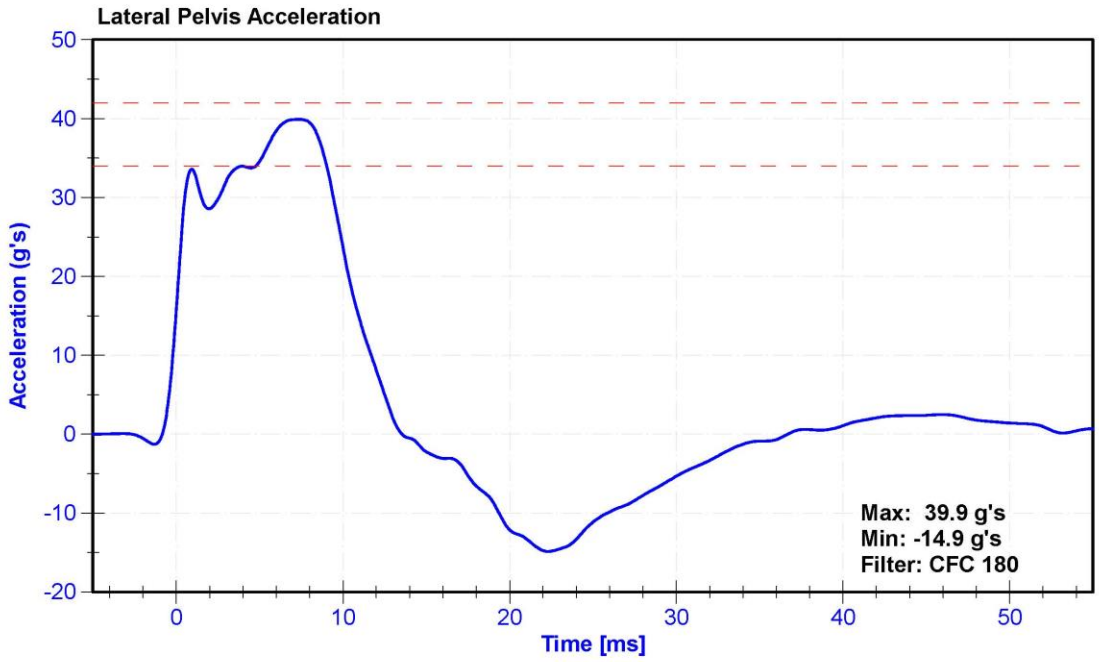
Results

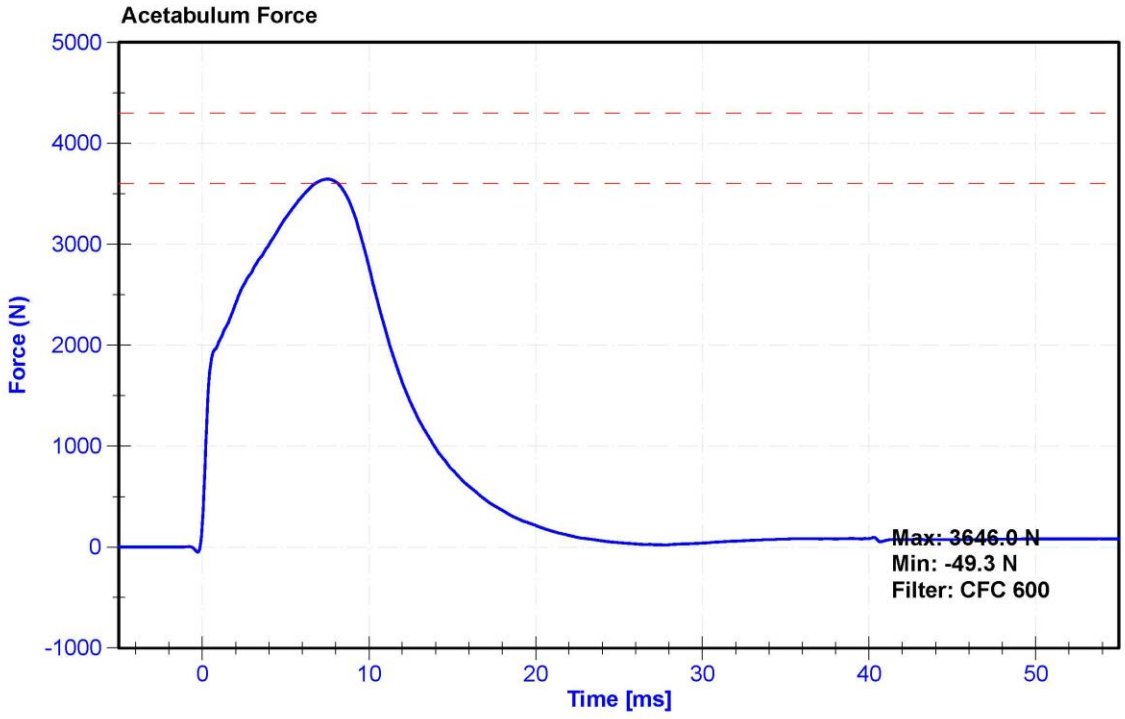
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	20.3	Pass
Velocity	6.6	6.8	m/s	6.63	Pass
Probe Acceleration	38	47	g's	43.1	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	39.9	Pass
Acetabulum Force	3600	4300	N	3646.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/24/2018	4/24/2019
Acetabulum Load Cell	DENTON 3249J	LC-275Fy	10/4/2018	10/4/2019
Certification Plug	Humanetics	11997	2/6/2018	N/A
Crash Test Plug	Humanetics	11475	8/31/2016	N/A




Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 39.9 g's
Min: -14.9 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: 3646.0 N
Min: -49.3 N
Filter: CFC 600

Cert 2
2/25/19

SID-IIs Pelvis Plug Certification Test

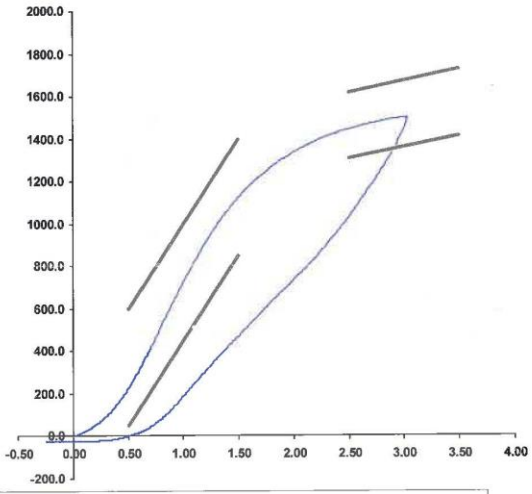
Plug S/N 11997
Test Number 6214
Report Number 6231
Test Date 2/6/2018 9:52:44 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	226.43	50.00	600.00
Force @ 1.5 mm (N)	1,124.06	850.00	1,400.00
Force @ 2.5 mm (N)	1,446.07	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,500.89	1,361.00	1,673.00

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

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 06-Feb-18
SACO Research

By : DC Date : 2/6/18

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

SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 11475
Test Number 2982
Report Number 2979
Test Date 8/31/2016 8:54:30 AM

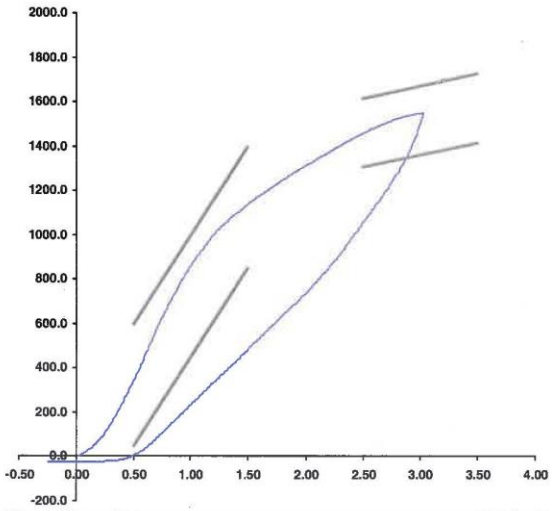
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	342.62	50.00	600.00
Force @ 1.5 mm (N)	1,138.61	850.00	1,400.00
Force @ 2.5 mm (N)	1,459.00	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,548.57	1,361.00	1,673.00

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

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

Notes:

Force (-N) vs Extension (-mm)



Crash Plug

Operator DC

Part Number 180-4450

Template No 107 31-Aug-16
SACO Research

By : DC Date : 8/31/16

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2062 FAX

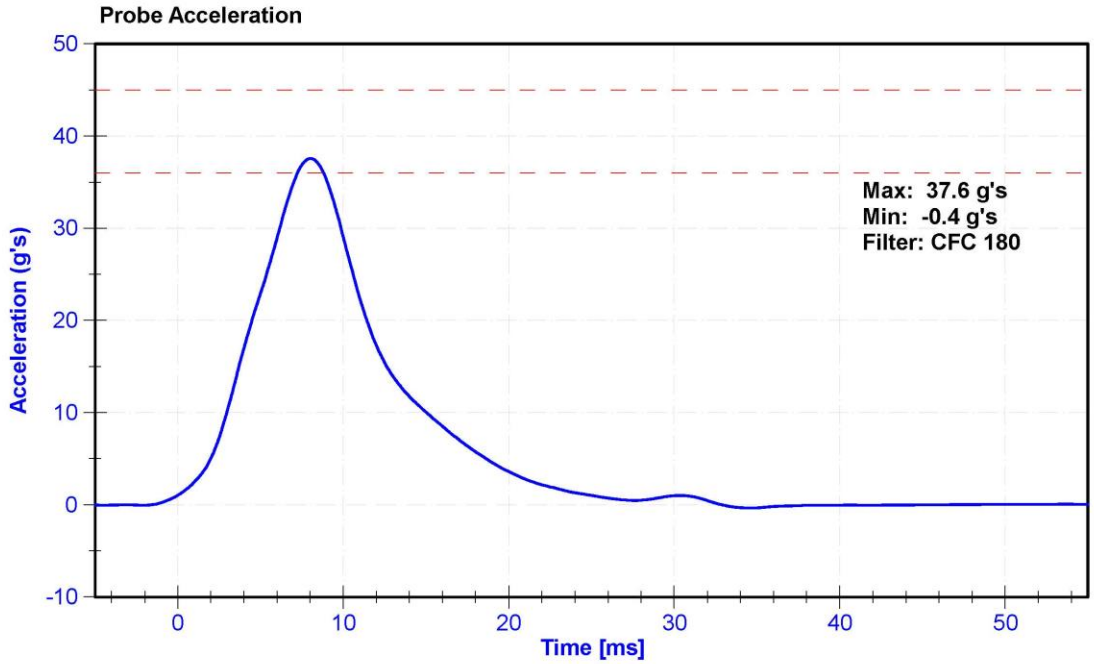
ATD Manufacturer	FTSS	Test Technician	K. Brogan
ATD Serial Number	300	Laboratory Supervisor	K. Dutton

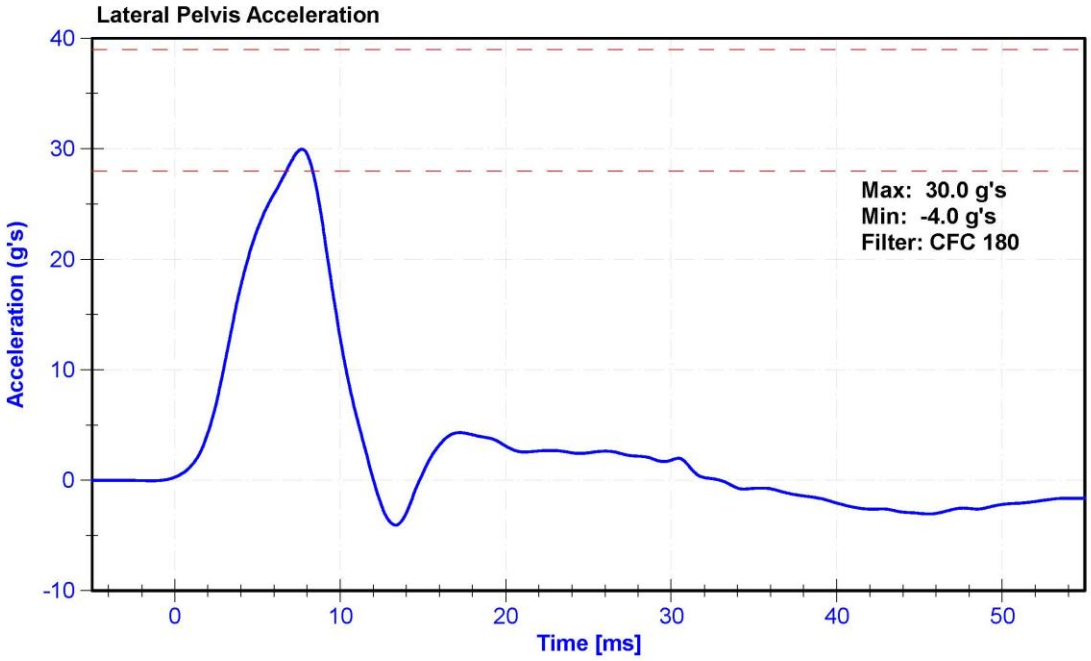
Results

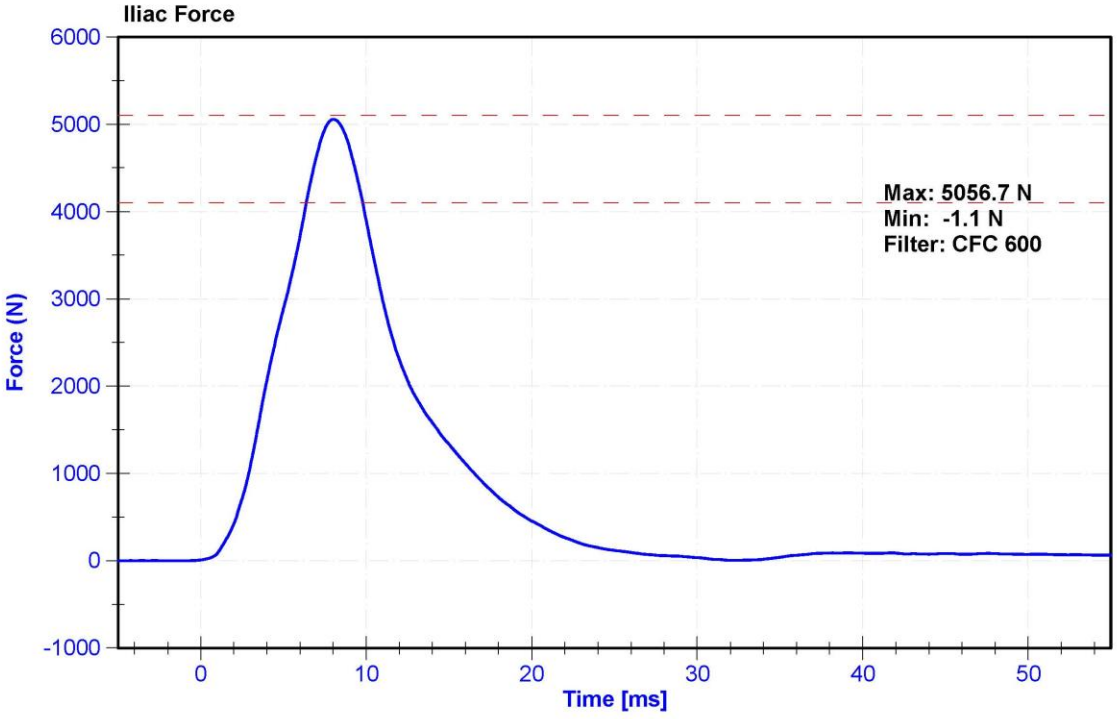
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	19.4	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	36	45	g's	37.6	Pass
Lateral Pelvis Acceleration	28	39	g's	30.0	Pass
Iliac Force	4100	5100	N	5056.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/24/2018	4/24/2019
Iliac Load Cell	Kistler 3228J	LC-DM5054 Fy	2/6/2019	2/6/2020




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 30.0 g's
Min: -4.0 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 5056.7 N
Min: -1.1 N
Filter: CFC 600

APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

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

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N: 300		
				Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers		Primary	X	AC-P58777	ENDEVCO	10/5/2018
			Y	AC-P59018	ENDEVCO	10/5/2018
			Z	AC-P79189	ENDEVCO	10/5/2018
		Redundant	X	AC-P52095	ENDEVCO	10/5/2018
			Y	AC-P58986	ENDEVCO	10/5/2018
			Z	AC-P68057	ENDEVCO	10/5/2018
Displacement Potentiometers	Thoracic Rib	Upper	Y	DS-451GFE	Servo	10/10/2018
		Middle	Y	DS-040GFE	Servo	10/11/2018
		Lower	Y	DS-1156GFE	Servo	10/10/2018
	Abdominal Rib	Upper	Y	DS-308GFE	Servo	10/10/2018
		Lower	Y	DS-307GFE	Servo	10/11/2018
Lower Spine Accelerometers (T12)			X	AC-P58883	ENDEVCO	1/10/2019
			Y	AC-P64147	ENDEVCO	1/10/2019
			Z	AC-P58786	ENDEVCO	1/10/2019
Acetabulum Load Cell			Y	LC-275Fy	DENTON	10/4/2018
Iliac Wing Load Cell			Y	LC-DM5054Fy	Kistler	2/6/2019
Pelvis Plug (struck side)				11992	SACO	2/6/2018
Pelvis Plug (non-struck side)				-	-	-

Table 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	AC-A280180	MSI 1201-1000	11/13/2018
	Vehicle Center of Gravity	Y	AC-A280190	MSI 1201-1000	11/13/2018
	Vehicle Center of Gravity	Z	AC-A280951	MSI 1201-1000	11/24/2018
2	Right Sill at Front Seat	X	AC-A280024	MSI 1201-1000	11/11/2018
	Right Sill at Front Seat	Y	AC-A280825	MSI 1201-1000	11/22/2018
	Right Sill at Front Seat	Z	AC-A280836	MSI 1201-1000	11/22/2018
3	Right Sill at Rear Seat	X	AC-A280347	MSI 1201-1000	11/14/2018
	Right Sill at Rear Seat	Y	AC-A280349	MSI 1201-1000	11/15/2018
	Right Sill at Rear Seat	Z	AC-A280352	MSI 1201-1000	11/15/2018
4	Left Sill at Front Door	Y	AC-A280866	MSI 1201-1000	11/22/2018
5	Left Sill at Rear Door	Y	AC-A279979	MSI 1201-1000	11/10/2018
6	Left A-Post Lower	Y	AC-A280313	MSI 1201-1000	11/14/2018
7	Left A-Post Middle	Y	AC-A280890	MSI 1201-1000	11/20/2018
8	Left B-Post Lower	Y	AC-A280209	MSI 1201-1000	11/16/2018
9	Left B-Post Middle	Y	AC-A280319	MSI 1201-1000	11/14/2018
10	Front Seat Track	Y	AC-A280210	MSI 1201-1000	11/13/2018
11	Rear Seat Track or Structure	Y	AC-A279968	MSI 1201-1000	11/11/2018
12	Right Rear Occ. Compartment	Y	AC-A279992	MSI 1201-1000	11/10/2018
13	Engine Block	X	AC-A280928	MSI 1201-1000	11/22/2018
	Engine Block	Y	AC-A281012	MSI 1201-1000	11/26/2018
14	Rear Floorpan Above Axle	X	AC-A280327	MSI 1201-1000	11/14/2018
	Rear Floorpan Above Axle	Y	AC-A280855	MSI 1201-1000	11/21/2018
	Rear Floorpan Above Axle	Z	AC-A280868	MSI 1201-1000	11/22/2018

TABLE 4 – MDB Instrumentation

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