

REPORT NUMBER: NCAP-CAL-19-010

**NEW CAR ASSESSMENT PROGRAM (NCAP)
FRONTAL BARRIER IMPACT TEST**

**General Motors LLC
2019 Chevrolet Silverado LD 1500 Quad Cab
Truck**

NHTSA No: M20190120

**PREPARED BY:
CALSPAN CORPORATION
P.O. BOX 400
BUFFALO, NEW YORK 104625**



September 27, 2019


FINAL REPORT


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

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Prepared by:  Date: September 27, 2019
Vince Paolini, Program Engineer

Approved by:  Date: September 27, 2019
Vanessa Hansen, Operations Manager

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

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16. Abstract A 56.30 km/h (35 mph), NCAP Frontal Impact Test was conducted on a 2019 Chevrolet Silverado LD 1500 Quad Cab Truck in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on August 19, 2019. The impact velocity of the vehicle was 56.33 km/h, and the ambient temperature at the barrier face at the time of impact was 21°C. The target vehicle's maximum post-test static crush was 692 mm at the vehicles centerline of the front bumper. The test vehicle's occupant performance data is as follows:																																																									
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-12-D-00260. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards Frontal NCAP Laboratory Test procedure, dated October 2015.

SUMMARY

A ridged fixed barrier was impacted by a 2019 Chevrolet Silverado LD 1500 Quad Cab Truck at a velocity of 56.33 km/h. The test was performed at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on August 19, 2019. Pre- and post-test photographs of the vehicle and dummies to document the test can be found in Appendix A. One real-time camera and 14 high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in Data Sheet 6 of this report.

One Part 572E, 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5th percentile female ATD was placed in the right-front passenger seating position according to dummy placement instructions specified in the Frontal NCAP Laboratory Test Procedure. Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, right / left femur load cells, and lower leg instrumentation. The driver (position 1) ATD (Serial No. 142) and the right-front passenger (position 2) ATD (Serial No. 288) were calibrated previous to this test. Certification details, along with instrumentation calibration data, can be found in Appendix C of this report.

The 136 channels of data were recorded on an on-board data acquisition system. Please refer to Appendix B for the dummy response data traces.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was a total of 0.0 grams of stoddard solvent leakage after the event and including all phases of the static rollover. The maximum static crush of the test vehicle was 692 mm at the vehicles centerline. During and after the impact event, the driver's and passenger's side doors were closed and operational.

The driver's visible contact points were as follows: The driver's head contacted the frontal airbag and then the head restraint. The upper torso contacted the frontal airbag. Both knees contacted the knee bolster.

The passenger's visible contact points were as follows: The passenger's head contacted the frontal airbag and then the head restraint. The upper torso contacted the frontal airbag. Both knees contacted the glove box.

The occupant data is summarized below.

ATD Position	HIC ₁₅	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (Gs)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50 th)	199.822	0.346	1125.412	-709.878	37.838	-25.215	-2047.610	-3626.777
Passenger (5 th)	247.285	0.449	807.181	-373.743	40.411	-13.400	-901.068	-1119.301

GENERAL COMMENTS:

1. P1 (Driver) serial number - 142
2. P2 (Passenger) serial number - 288

Data Anomalies:

- Driver Right Lower Tibia Z Force, Questionable data between 51.1 to 64.5 ms and 85.6 to 102 ms
- Engine Top X Acceleration, Exceeded calibration range at 34.8 ms
- Barrier Load Cell B3 Fx, Questionable data after 115 ms
- Barrier Load Cell B7 Fx, Questionable data after 115 ms

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

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 Adjustment, Fuel System, and Steering Wheel Data

Data Sheet No. 3 – Dummy Longitudinal Clearance Dimensions

Data Sheet No. 4 – Dummy Lateral Clearance Dimensions

Data Sheet No. 5 – Seat Belt Positioning Data

Data Sheet No. 6 – High-Speed Camera Locations and Data

Data Sheet No. 7 – Vehicle Accelerometer Locations

Data Sheet No. 8 – Photographic Reference Target Locations

Data Sheet No. 9 – Load Cell Locations on Fixed Barrier

Data Sheet No. 10 – Test Vehicle Summary of Results

Data Sheet No. 11 – Post-Test Observations

Data Sheet No. 12 – Vehicle Profile Measurements

Data Sheet No. 13 – Accident Investigation Division Data

Data Sheet No. 14 – Vehicle Intrusion Measurements

Data Sheet No. 15 – Summary of FMVSS 212, 219 (Partial), and 301 Data

Data Sheet No. 16 – FMVSS 301 Static Rollover Results

Data Sheet No. 17 – Dummy/Vehicle Temperature Stabilization Chart

**DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20190120	Traction Control System (TCS)	Yes
Model Year	2019	Power Steering	Yes
Make	Chevrolet	Power Window Auto-Reverse	No
Model	Silverado LD 1500	Driver Frontal Airbag	Yes
Body Style	Quad Cab Truck	Driver Curtain Airbag	Yes
VIN	2GCVKMEC7K1208071	Driver Head/Torso Airbag	No
Body Color	Red	Driver Torso Airbag	No
Odometer Reading (km /mi)	182 miles	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	5.3	Driver Pelvis Airbag	No
Type / No. Cylinders	V8	Driver Knee Airbag	No
Engine Placement	Inline	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	6-Speed	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	4x4	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof / T-Top	No	Front Pass. Knee Airbag	No
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	No	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Other	No

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

No

DATA FROM CERTIFICATION LABEL

Manufactured By	General Motors of Canada Company	GVWR (kg)	3266
Date of Manufacture	06/19	GAWR Front (kg)	1792
		GAWR Rear (kg)	1792

VEHICLE SEATING AND WEIGHT CAPACITY DATA

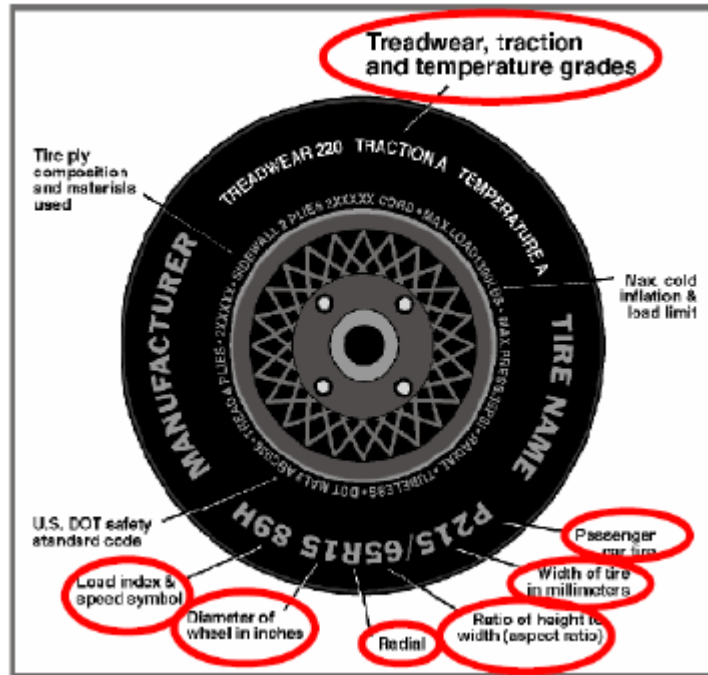
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench	N/A	
Number of Occupants	3	3	N/A	6
Capacity Wt. (VCW) (kg)				805
Cargo Wt. (RCLW) (kg)				136

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

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

Collect items circled in red, tire manufacturer, and tire name.



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	240	240
Recommended Tire Size	LT275/55R20	LT275/55R20
Tire Size on Vehicle	275/55R20	275/55R20
Tire Manufacturer	Continental	Continental
Tire Model	Crosscontact LX20	Crosscontact LX20
Treadwear	740	740
Traction	A	A
Temperature Grades	B	B
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Load Index / Speed Symbol	111T	111T
Tire Material	Rubber	Rubber
DOT Safety Code Left	A32AWD402219	A32AWD402219
DOT Safety Code Right	A32AWD402219	A32AWD402219

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

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

TEST VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	728	503		781	582	
Right	kg	712	493		768	577	
Ratio	%	59	41		57	43	
Totals	kg	1440	996	2436	1549	1159	2708

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	2436	(A)
Weight of 1 P572E ATD & 1 P572O ATD	kg	142	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	136	(C)
Calculated Vehicle Target Weight (TVTW)	kg	2714	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

Condition	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	949	952	1016	1019	1496
As Tested	mm	938	941	995	996	1566
Post-Test	mm	932	964	1000	995	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	3658
Total Vehicle Length at Left Side	mm	5796
Total Vehicle Length at Centerline	mm	5834
Total Vehicle Length at Right Side	mm	5896
Weight of Ballast in Cargo Area	kg	75
Weight of Vehicle Components Removed	kg	0
Amount of Stoddard Solvent in Fuel Tank	L	91.5

LIST OF COMPONENTS REMOVED TO MEET TEST WEIGHT:

None

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

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

TARGET VEHICLE STRUCTURAL MEASUREMENT

No.	Description	Pre-Test
1	Total Length	5834
2	Total Width	2000
3*	Bumper Top Height	617
4*	Bumper Bottom Height	520
5*	Longitudinal Member Top Height	613
6	Distance Between Longitudinal Members	877
7	Longitudinal Member Width	83
8*	Engine Top Height	1169
9*	Engine Bottom Height	428
10	Engine and Gearbox Width	581
11	Front Bumper-Engine Distance	742
12*	Front Shock Absorber Fixing Height	803
13*	Bonnet Leading Edge Height	1173
14	Front Shock Absorber Fixing Width	973
15	Front Bumper – Front Axle Distance	1001
16	Front Axle – A Pillar Distance	566
17	A-Pillar – B-Pillar Distance	1147
18	B-Pillar – Rear Axle Distance	1947
19	B-Pillar – C-Pillar Distance	765
20*	Roof Sill Bottom Height	1725
21*	Roof Sill Top Height	1793
22*	Floor Sill Bottom Height	564
23*	Floor Sill Top Height	571

*Height Measurements are taken from the ground
 Note: All measurements are in millimeters

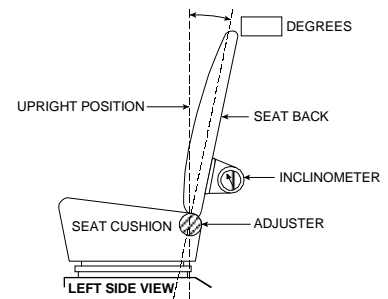
DATA SHEET NO. 2
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

NOMINAL DESIGN RIDING POSITION

The driver's seat back was set to the manufacturer's designated angle. The passenger's seat back was positioned in a similar manner as the driver's seat back. Seat back angles are measured at the headrest post bezel using a digital inclinometer.



FRONT SEAT ASSEMBLY

Seating Position	Degrees
Driver Seat Back Angle	2.7
Passenger Seat Back Angle	2.0

SEAT FORE / AFT POSITIONS

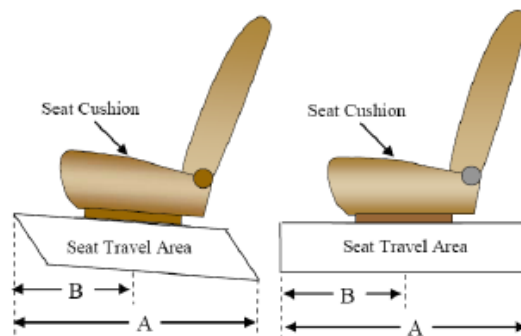
The driver's seat was positioned at the mid-point of fore/aft travel at its lowest position. The passenger's seat was positioned at the most forward position of fore/aft travel. Zero is defined as the forward most position.

Seating Position	Total Fore / Aft Travel	Placed in Position #
Driver Seat	27 (0-26)	13
Passenger Seat	22 (0-21)	0

SEAT BELT UPPER ANCHORAGE

The driver's seat belt anchorage was positioned according to the manufacturer's designated positioning for a 50th percentile adult male ATD. The passenger's seat belt anchorage was positioned according to the manufacturer's designated positioning for a 5th percentile adult female ATD. For this test zero is defined as the uppermost position.

Seating Position	Total # of Positions	Placed in Position #
Driver Seat	5	0 – Uppermost
Passenger Seat	5	0 – Uppermost



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

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

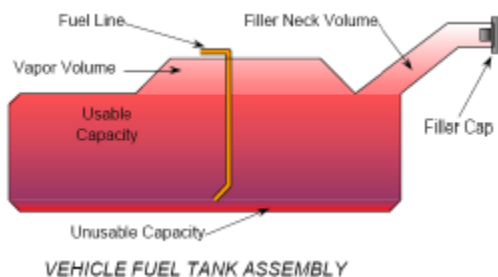
NHTSA No.: M20190120
 Test Date: 8/19/2019

FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank"	98.4
Usable Capacity of "Optional Tank"	N/A
92%-94% of Usable Capacity	90.5 – 92.5
Actual Amount of Solvent Used	91.5
1/3 of Usable Capacity	32.8

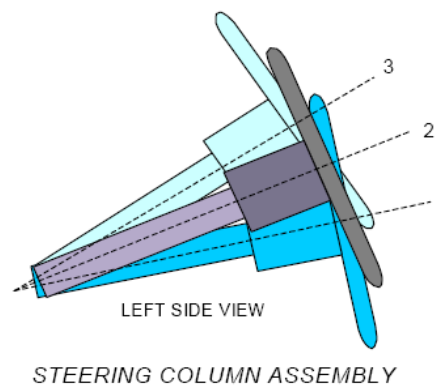
FUEL PUMP

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.



STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. For angular measurements, a digital inclinometer was used to measure a plate which was placed across the steering wheel rim. A tape measure was used to measure the telescoping steering wheel travel.



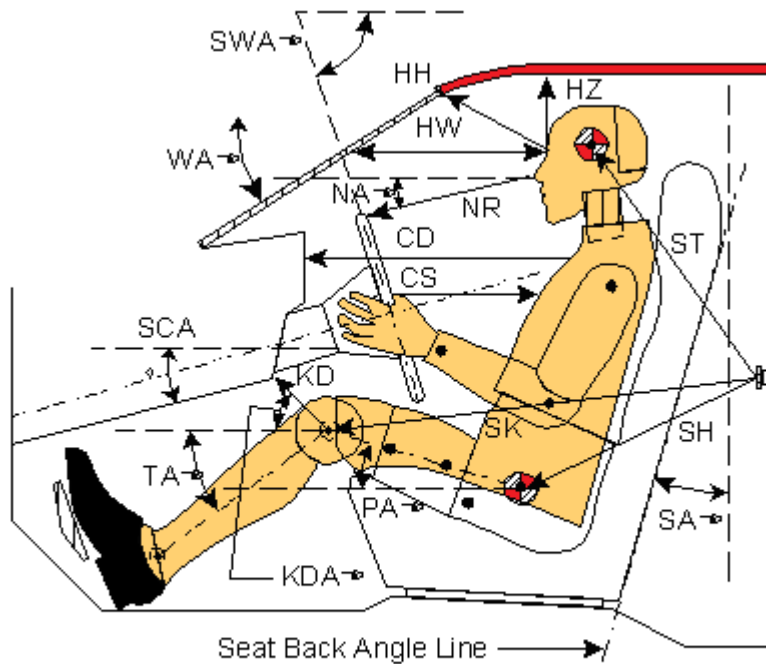
STEERING COLUMN POSITIONS

Description	Degrees	Fore / Aft Position (mm)
Lowermost position No. 1	9.9	
Geometric center position No. 2	20.2	
Uppermost position No. 3	32.7	
Telescoping Steering Wheel Travel		N/A
Test Position	20.2	N/A

**DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS**

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019



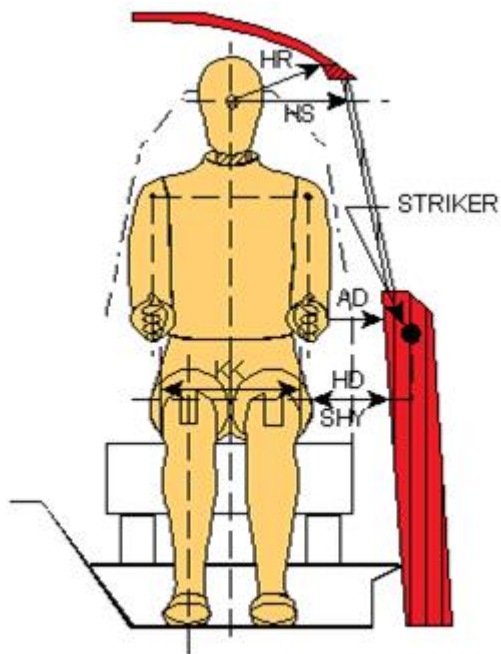
Left Side View

Code	Measurement Description	Driver (SN: 142)		Passenger (SN: 288)	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		31.6		
SWA°	Steering Wheel Angle		20.9		
SCA°	Steering Column Angle		69.1		
SA°	Seat Back Angle (on headrest post)		2.7		2.0
HZ	Head to Roof (Z)	263	90	341	90
HH	Head to Header	462	20.3	458	34.8
HW	Head to Windshield	728	0	798	0
NR	Nose to Rim	404	10.1	480	18.9
CD	Chest to Dash	541		442	
CS	Chest to Steering Hub	319	3.2		
RA	Rim to Abdomen	223	0		
KDL	Left Knee to Dash	190	26.7	147	26.8
KDR	Right Knee to Dash	178	29.6	145	26.2
PA°	Pelvic Angle		22.4		19.8
TA°	Tibia Angle		29.7		44.4
SK	Striker to Knee	598	4.3	666	1.2
ST	Striker to Head	673	83.4	595	65.5
SH	Striker to H-Point	220	4.2	337	11.4

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019



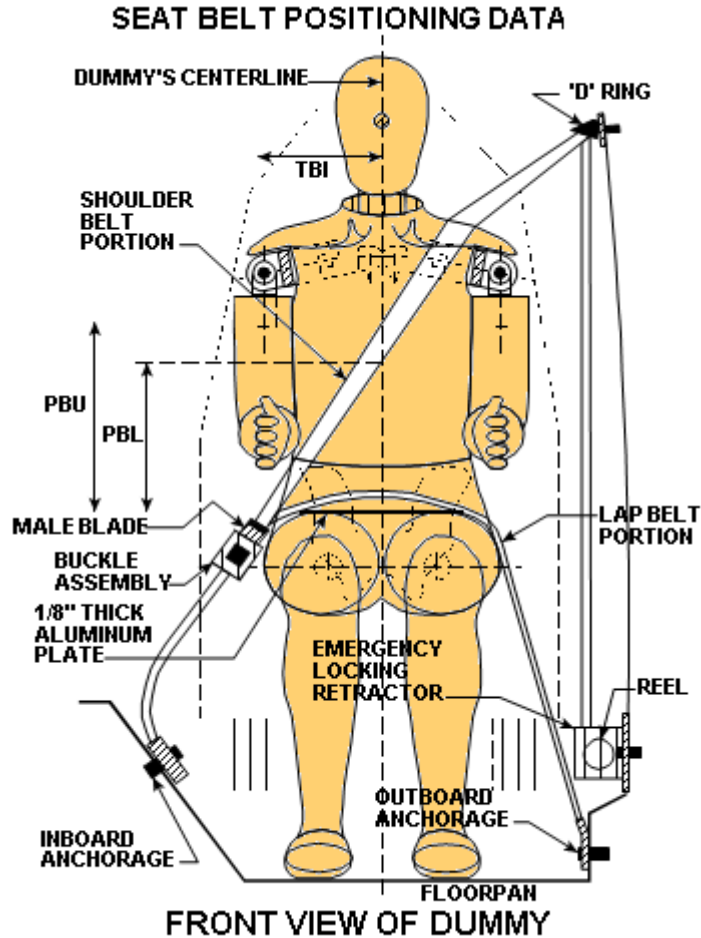
Front View

Code	Description	Driver (mm)	Passenger (mm)
AD	Arm to Door	145	85
HD	H-Point to Door	142	166
HR	Head to Side Header	247	308
HS	Head to Side Window	348	371
KK	Knee to Knee	345	165
SHY	Striker to H-Point (Y Direction)	250	255
AA	Ankle to Ankle	365	165

**DATA SHEET NO. 5
SEAT BELT POSITIONING DATA**

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU — Top surface of reference to belt upper edge	mm	350	290
PBL — Top surface of reference to belt lower edge	mm	275	210

BELT LENGTH DATA

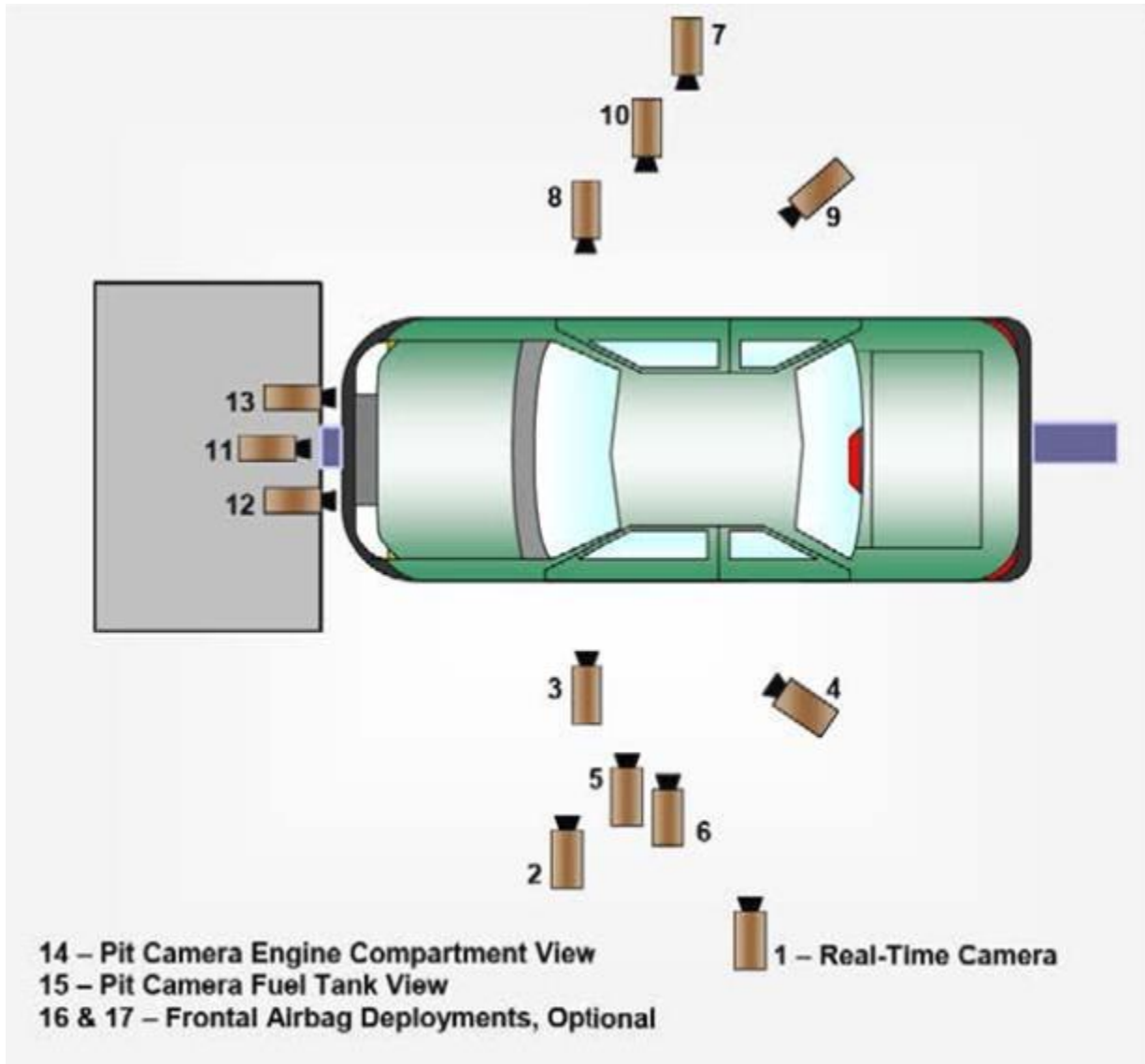
Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	862	878
Lap Belt Length as measured on ATD	mm	530	460
Remainder of belt on reel	mm	868	922
Total belt length for continuous webbing systems	mm	2260	2260

**DATA SHEET NO. 6
HIGH-SPEED CAMERA LOCATIONS AND DATA**

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
Test Date: 8/19/2019

CAMERA POSITIONS FOR FRONTAL IMPACTS



Top View

DATA SHEET NO. 6 ... (CONTINUED)
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

CAMERA LOCATIONS

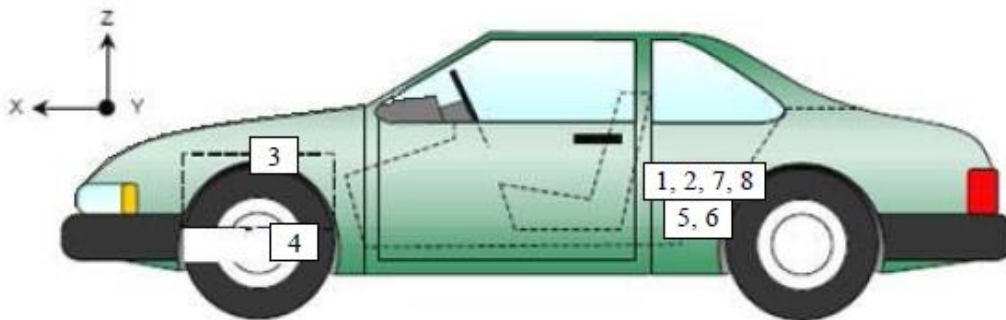
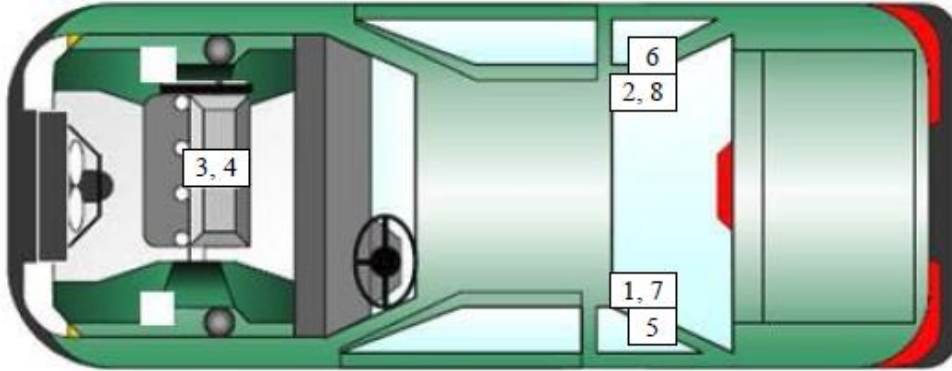
No.	Camera View	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall	-	-	-		60
2	Driver Close-Up	-1739	-6712	-1555	50	1000
3	Left Front Half	-1308	-7020	-1450	28	1000
4	Left Angle	-4603	-4780	-2248	50	1000
5	Steering Column - Top					
6	Steering Column - Bottom					
7	Right Overall	-3002	8831	-1189	24	1000
8	Passenger Close-Up	-1886	7269	-1590	50	1000
9	Right Front Half	-1679	7047	-1278	28	1000
10	Right Angle	-4675	4520	-2344	50	1000
11	Windshield	756	0	-3471	12.5	1000
12	Driver Windshield	681	-314	-2234	12.5	1000
13	Passenger Windshield	681	314	-2234	12.5	1000
14	Pit Front	-723	0	311	12.5	1000
15	Pit Rear	-2738	0	311	12.5	1000
16	Onboard Driver Airbag (Optional)				8	1000
17	Onboard Passenger Airbag (Optional)				8	1000

* COORDINATES: +X = forward of impact plane
 +Y = right of monorail center
 +Z = into ground

**DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Accelerometer – X Direction	2726	-417	-29
2	Right Rear Accelerometer – X Direction	2770	416	-15
3	Engine Top X	4979	60	-529
4	Engine Bottom X	5450	3	211
5	Left Rear Accelerometer – Z Direction	2726	-417	-29
6	Right Rear Accelerometer – Z Direction	2770	416	-15
7	Left Rear Accelerometer – X Direction Redundant	2725	-388	-36
8	Right Rear Accelerometer – X Direction Redundant	2769	436	-14

Reference Points: X – Rear Surface of Vehicle (+ forward)
 Y – Vehicle Centerline (+ to right)
 Z – Ground Plane (+ down)

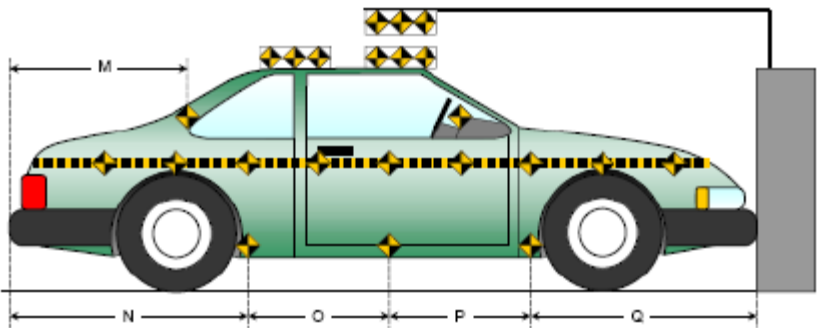
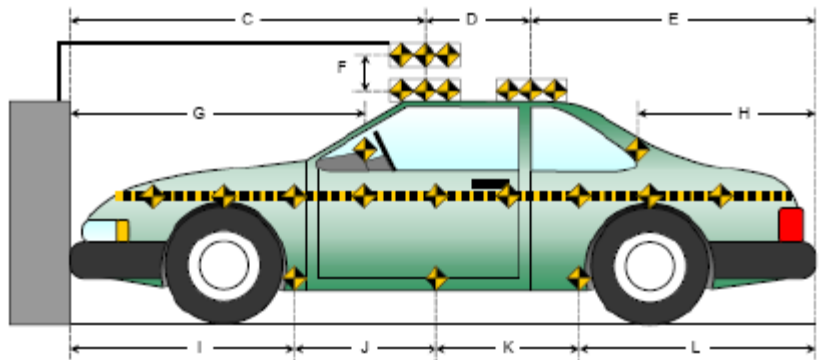
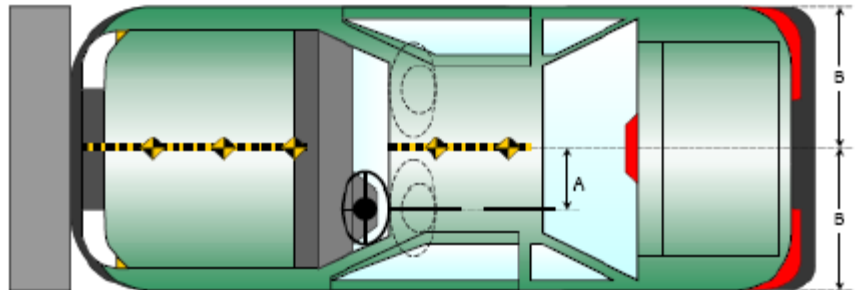
DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

Item	Value
A	439
B	1000
C	2150
D	610
E	3074
F	315
G	1917
H	2366
I	1576
J	935
K	935
L	2388
M	2367
N	2385
O	935
P	939
Q	1575

All units in millimeters



DATA SHEET NO. 9
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

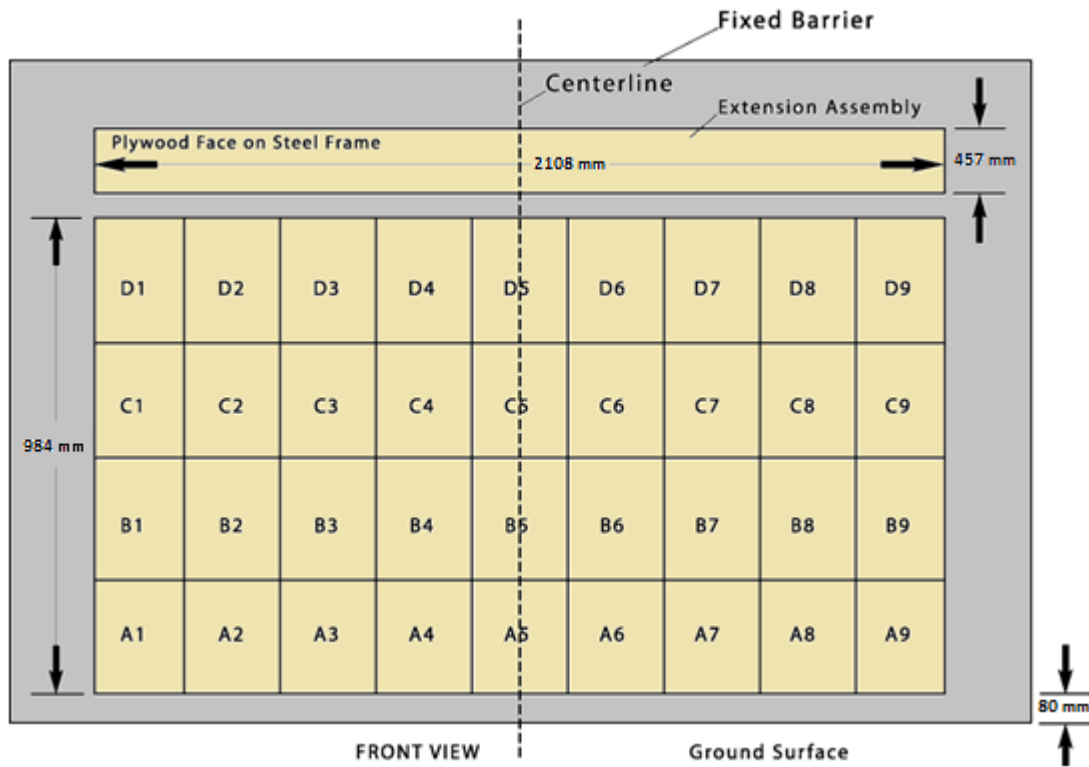


Figure 1 - Load Cell Wall

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Accelerometers	46
Passenger Dummy Accelerometers	46
Vehicle Structure Accelerometers	8
Barrier	36
Total	136

CAMERA COVERAGE

Type of Camera	Number Used in this Test
High-Speed Vehicle Onboard	2
High-Speed Offboard	12
Real-Time Panning	1
Total	15

**DATA SHEET NO. 11
POST-TEST OBSERVATIONS**

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	P572E 50 th Male / 142	P5720 5 th Female / 288
Head Contact	Front Airbag & Headrest	Front Airbag & Headrest
Upper Torso Contact	Front Airbag	Front Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Bolster	Glove Box
Right Knee Contact	Knee Bolster	Glove Box

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked / Unlocked Doors	Unlocked	Unlocked
Front Door Opening	Closed & Operational	Closed & Operational
Rear Door Opening	Closed & Operational	Closed & Operational
Seat Track Shift (mm)	0	0
Seat Back Failure	No	No
Glazing Damage	None	None

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	None
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	606
Center	mm	633
Right Side	mm	616
Average	mm	618

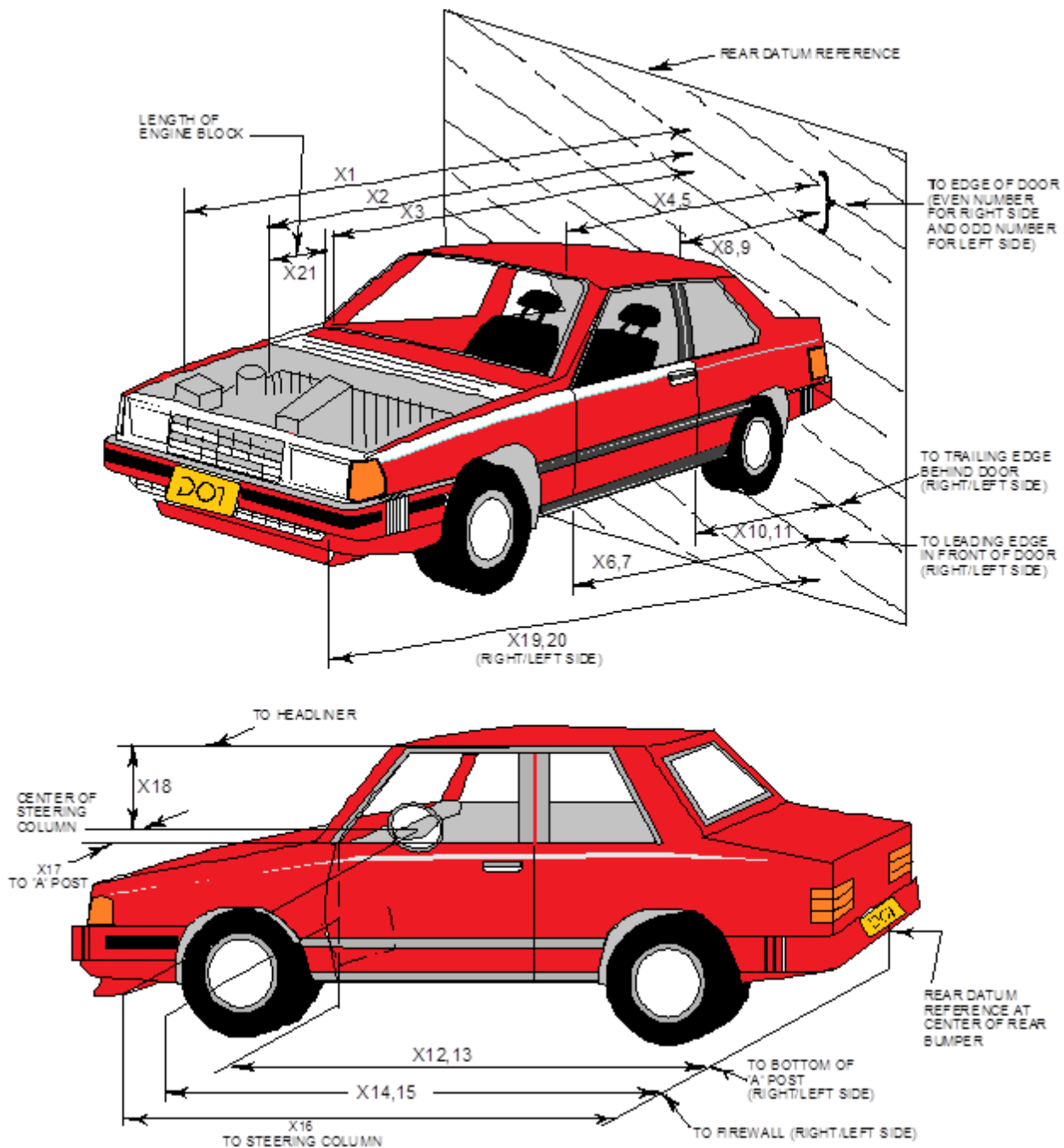
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver		Passenger	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	Yes	Yes	Yes
Side Airbag 1 - Curtain	Yes	Yes	Yes	Yes
Side Airbag 2 - Torso/Pelvis Airbag	Yes	No	Yes	No
Knee Airbag	No	N/A	No	N/A
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Yes	Yes	Yes
Other				

**DATA SHEET NO. 12
VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019



**DATA SHEET NO. 12 ... (CONTINUED)
VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

No.	Measurement Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	5834	5142	-692
2	Rear Surface of Vehicle (RSOV) to Front of Engine	5093	4906	-187
3	RSOV to Firewall	4636	4624	-12
4	RSOV to Upper Leading Edge of Right Door	4271	4263	-8
5	RSOV to Upper Leading Edge of Left Door	4272	4252	-20
6	RSOV to Lower Leading Edge of Right Door	4203	4214	11
7	RSOV to Lower Leading Edge of Left Door	4206	4206	0
8	RSOV to Upper Trailing Edge of Right Door	3122	3111	-11
9	RSOV to Upper Trailing Edge of Left Door	3123	3104	-19
10	RSOV to Lower Trailing Edge of Right Door	3093	3100	7
11	RSOV to Lower Trailing Edge of Left Door	3097	3095	-2
12	RSOV to Bottom of "A" Post of Right Side	4360	4350	-10
13	RSOV to Bottom of "A" Post of Left Side	4362	4345	-17
14	RSOV to Firewall, Right Side	4585	4544	-41
15	RSOV to Firewall, Left Side	4590	4568	-22
16	RSOV to Steering Column	3754	3777	23
17	Center of Steering Column to "A" Post	306	285	-21
18	Center of Steering Column to Headliner	451	417	-34
19	RSOV to Right Side of Front Bumper	5791	5182	-609
20	RSOV to Left Side of Front Bumper	5792	5176	-616
21	Length of Engine Block	456	456	0
RD	RSOV to Right Side of Dash Panel	3912	3905	-7
CD	RSOV to Center of Dash Panel	3901	3873	-28
LD	RSOV to Left Side of Dash Panel	3913	3903	-10

*UR= Unrecoverable data point
 All Dimensions in mm

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
Test Date: 8/19/2019

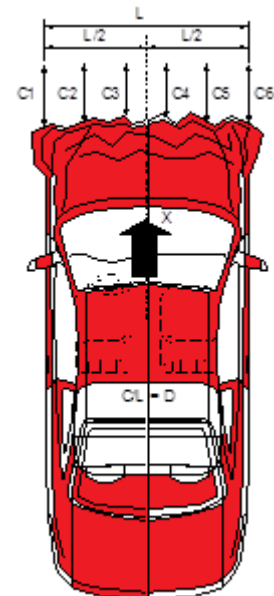
VEHICLE INFORMATION

VIN: 2GCVKMEC7K1208071
Vehicle Size Category: Truck

Wheelbase (mm): 3658
Test Weight (kg): 2708

ACCELEROMETER DATA

Accelerometer Locations: Please See Data Sheet No. 7
Cal. Procedure / Interval: Calspan Procedure / 6 month
Integration Algorithm: Trapezoidal
Linearity: > 99%
Impact Velocity (km/h): 56.33
Velocity Change (km/h): 63.63
Time of Separation (ms): 164



CRUSH PROFILE

Collision Deformation Classification: 12FDEW3
Midpoint of Damage: C3
Damage Region Length (mm): 1619
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush Zone 1 at Left Side	mm	5665	5235	430
C2	Crush Zone 2 at Left Side	mm	5791	5188	603
C3	Crush Zone 3 at Left Side	mm	5828	5169	659
C4	Crush Zone 4 at Right Side	mm	5828	5169	659
C5	Crush Zone 5 at Right Side	mm	5790	5193	597
C6	Crush Zone 6 at Right Side	mm	5662	5234	428
L	C1 to C6	mm	1619	1602	17

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

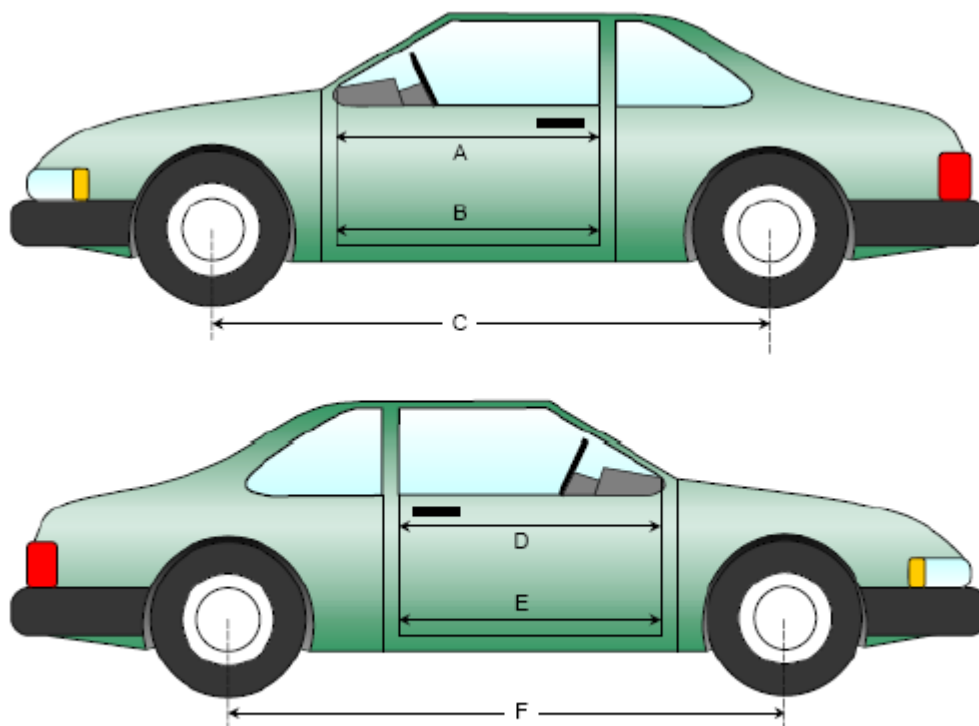
NHTSA No.: M20190120
 Test Date: 8/19/2019

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1037	1035	-2
B	Left Side Lower	mm	952	952	0
D	Right Side Upper	mm	1037	1034	-3
E	Right Side Lower	mm	952	950	-2

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	3658	3594	-64
F	Right Side Wheelbase	mm	3658	3587	-71



Left & Right Side Views

**DATA SHEET NO.14 ... (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS**

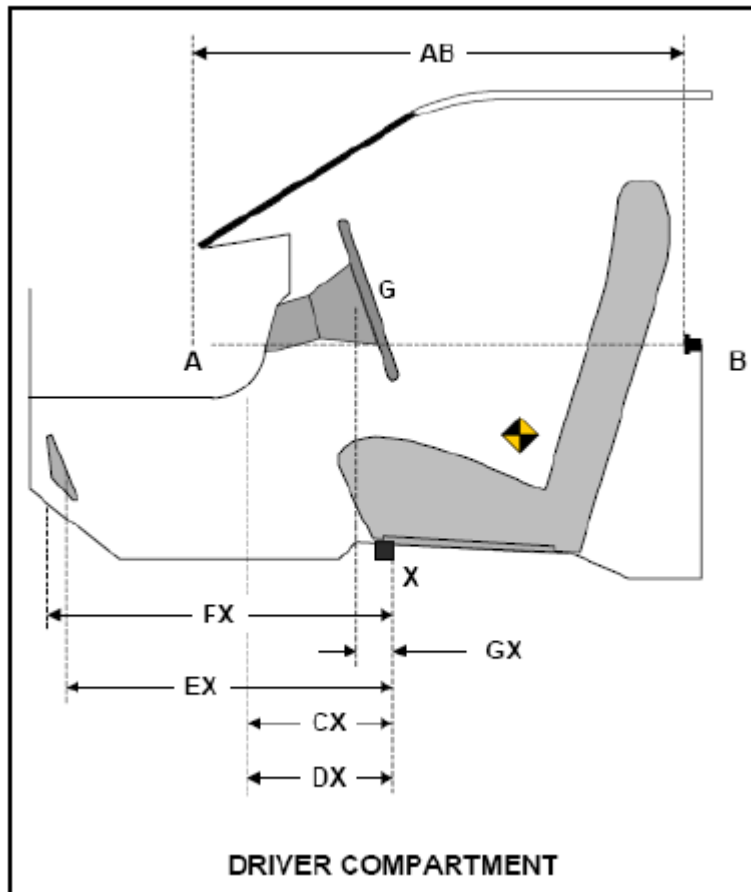
Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	734	740	6
CX	Left Knee Bolster to X	mm	332	315	-17
DX	Right Knee Bolster to X	mm	333	306	-27
EX	Brake Pedal to X	mm	552	546	-6
FX	Foot Rest to X	mm	641	640	-1
GX	Center of Steering Column Wheel Hub to X	mm	95	118	23

X = Front of Seat Track (Stationary)



DATA SHEET NO. 15
SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019

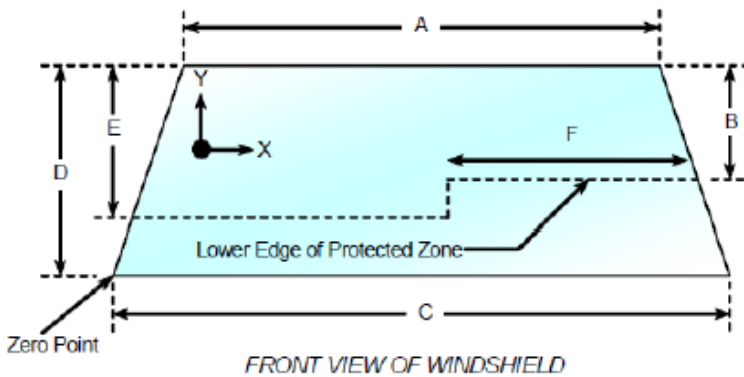
Windshield Mounting Details: A 0.8 mm trim surrounds the top and side of windshield while a plastic shroud is on the bottom.

The standard requires that the post-test retention measurement be a minimum of 75% of the pre-test total periphery measurement for vehicles not equipped with occupant passive restraints and 50% for each side of the windshield for vehicles which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21° C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2296	2296	100
Right Side	2296	2296	100
Total	4592	4592	100



Item	Units	Value
A	mm	1373
B	mm	423
C	mm	1633
D	mm	794
E	mm	435
F	mm	532

AREAS OF PROTECTED ZONE FAILURES

- A. Provide coordinates of the area that the protected zone was penetrated more than .25 inches by a vehicle component other than one that is normally in contact with the windshield.
- No Penetration

X	Y

- B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.
- No Penetration

X	Y

DATA SHEET NO. 15 ... (CONTINUED)
SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
Test Date: 8/19/2019

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21 ° C

Test Time: 10:01 AM

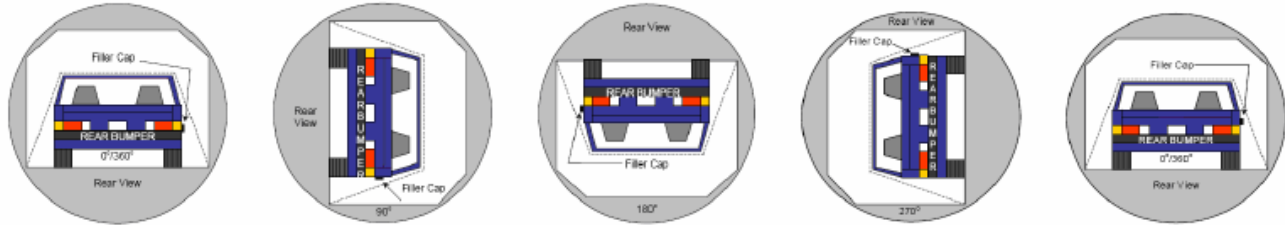
STODDARD SOLVENT SPILLAGE MEASUREMENTS

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

**DATA SHEET NO. 16
FMVSS 301 STATIC ROLLOVER RESULTS**

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019



0° TO 90° 90° TO 180° 180° TO 270° 270° TO 360°

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent Spillage: No Spillage Occurred

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	67	300	367
90° to 180°	64	300	364
180° to 270°	65	300	365
270° to 360°	67	300	367

FMVSS 301 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	

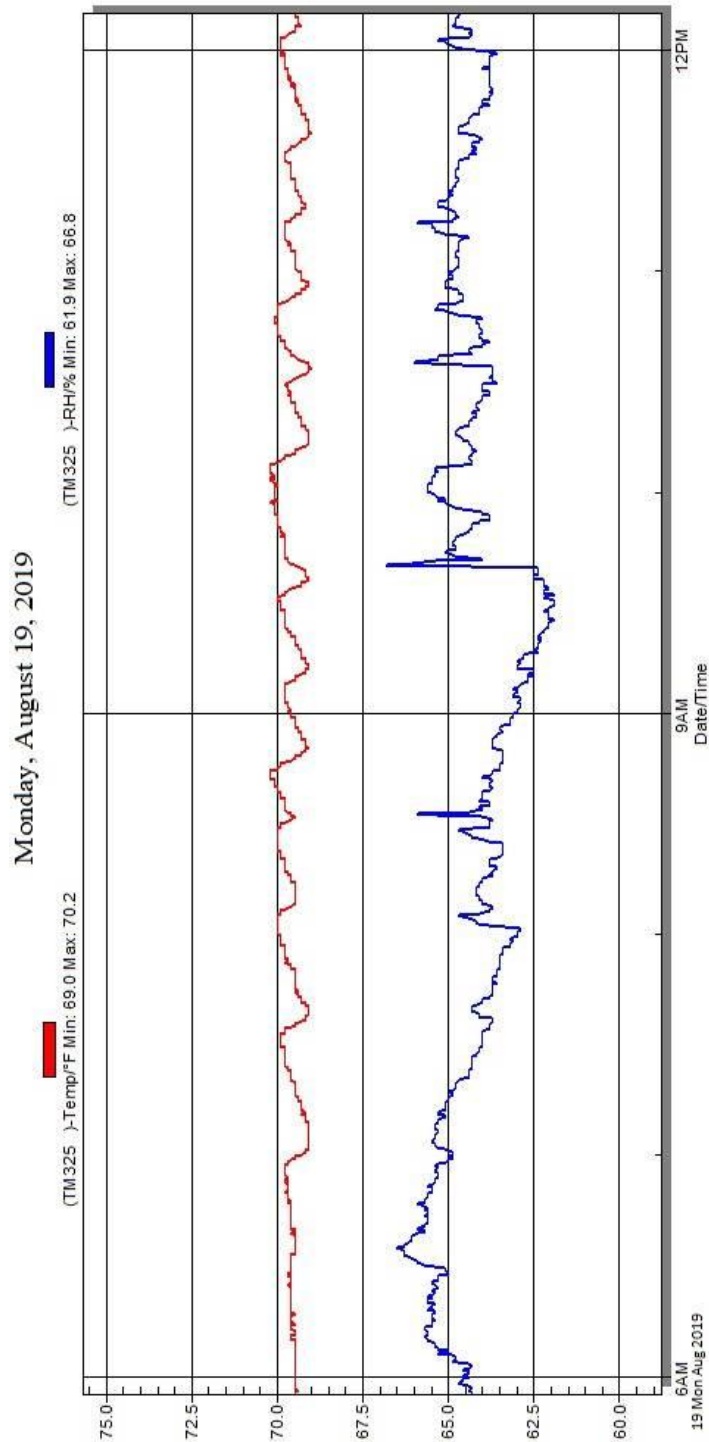
SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 17
DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2019 Chevrolet Silverado LD 1500 Quad Cab Truck
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20190120
 Test Date: 8/19/2019



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

APPENDIX A
PHOTOGRAPHS

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Fig.	Description	Page
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45	Post-Test Driver's Side Floorpan	A-27
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Fig.	Description	Page
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¹NOTE: *The underbody views should include the following vehicle components: fuel pump, fuel lines, sender unit, fuel tank filler pipe and any other visible system components.*

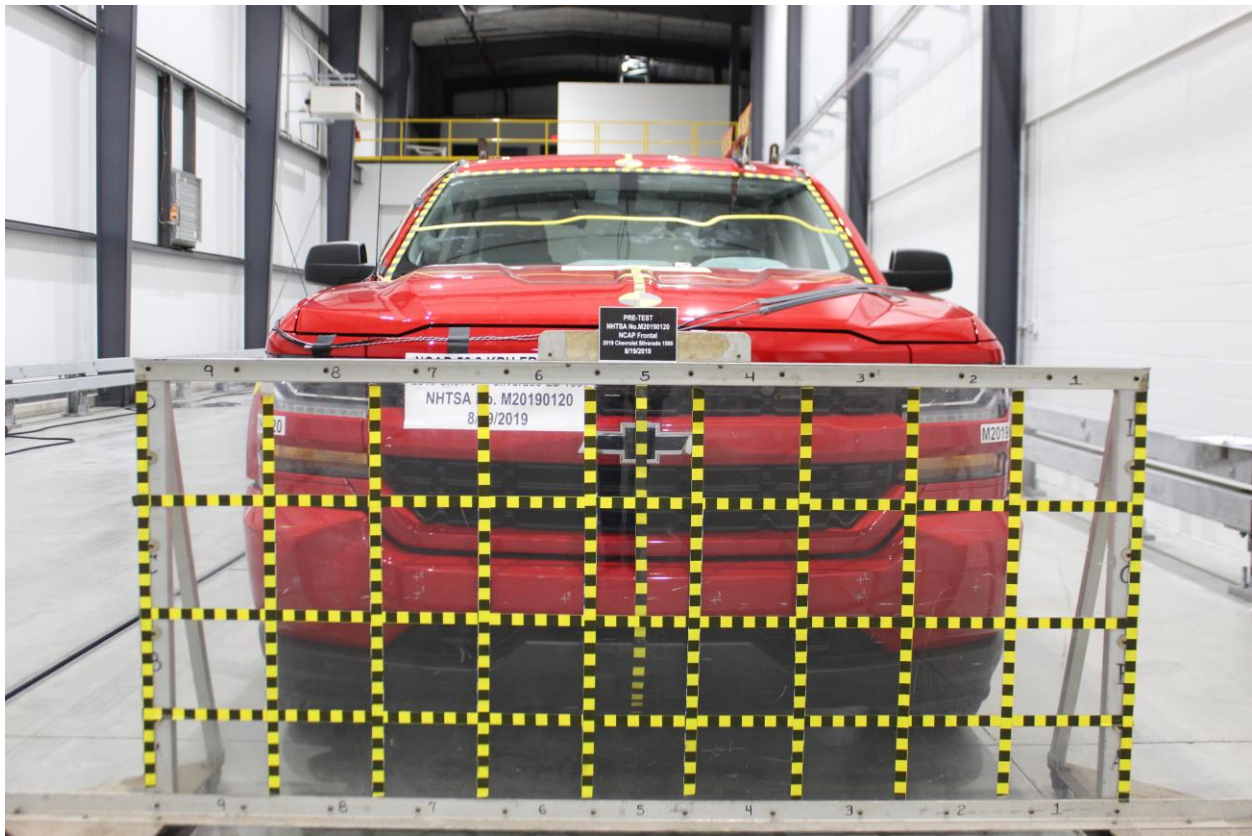


Figure A-1: Load Cell Location



Figure A-2: Pre-Test Load Cell Wall



Figure A-3: Post-Test Load Cell Wall



Figure A-4: Manufacturer's Label



Figure A-5: Tire Placard



Figure A-6: 2019 Chevrolet Silverado LD 1500 Quad Cab Frontal As Delivered



Figure A-7: Left Rear 3-4 View, As Received



Figure A-8: Pre-Test Front View of Test Vehicle



Figure A-9: Post-Test Front View of Test Vehicle



Figure A-10: Pre-Test Left View of Test Vehicle



Figure A-11: Post-Test Left View of Test Vehicle



Figure A-12: Pre-Test Right View of Test Vehicle



Figure A-13: Post-Test Right View of Test Vehicle



Figure A-14: Pre-Test Right Front 3-4 View



Figure A-15: Post-Test Right Front 3-4 View



Figure A-16: Pre-Test Left Rear 3-4 View



Figure A-17: Post-Test Left Rear 3-4 View



Figure A-18: Pre-Test Windshield View



Figure A-19: Post-Test Windshield View



Figure A-20: Pre-Test Engine Compartment View



Figure A-21: Post-Test Engine Compartment View



Figure A-22: Pre-Test Fuel Filler Cap View



Figure A-23: Post-Test Fuel Filler Cap View

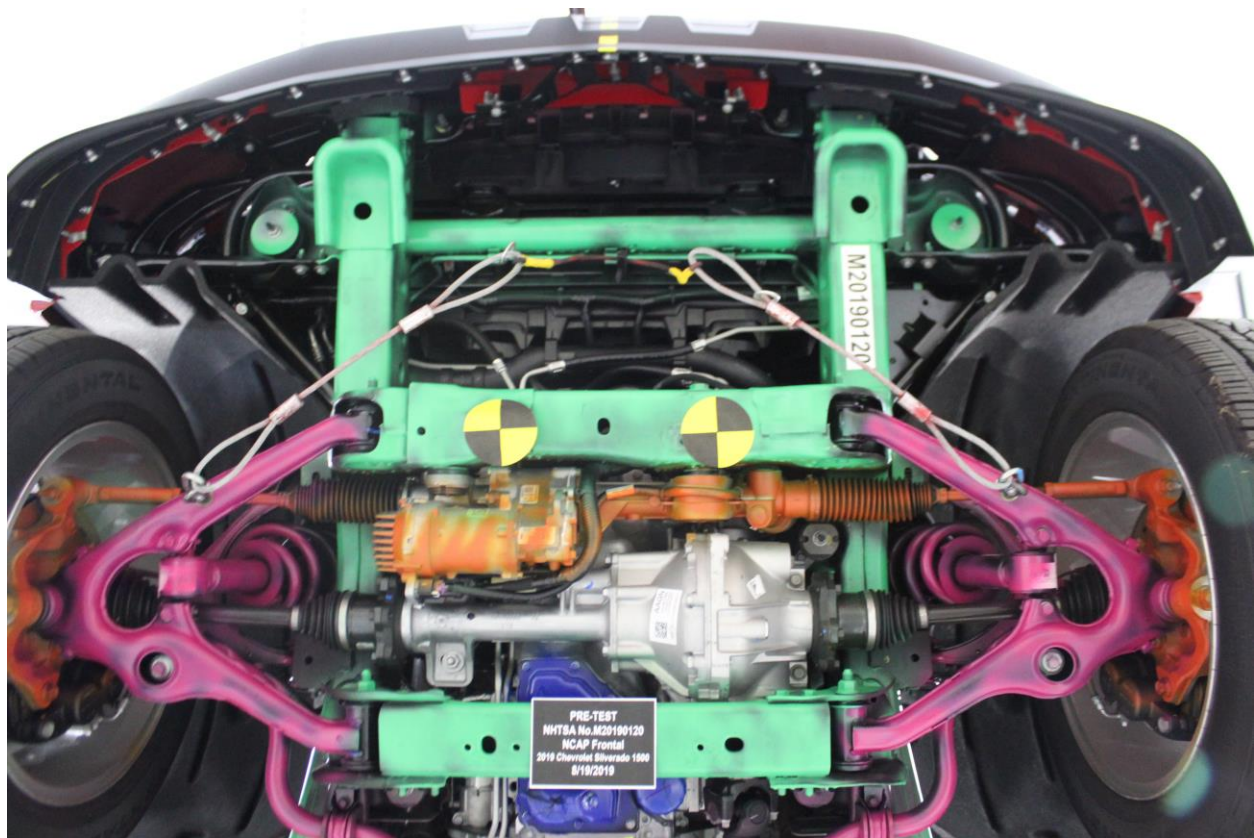


Figure A-24: Pre-Test Front Underbody View

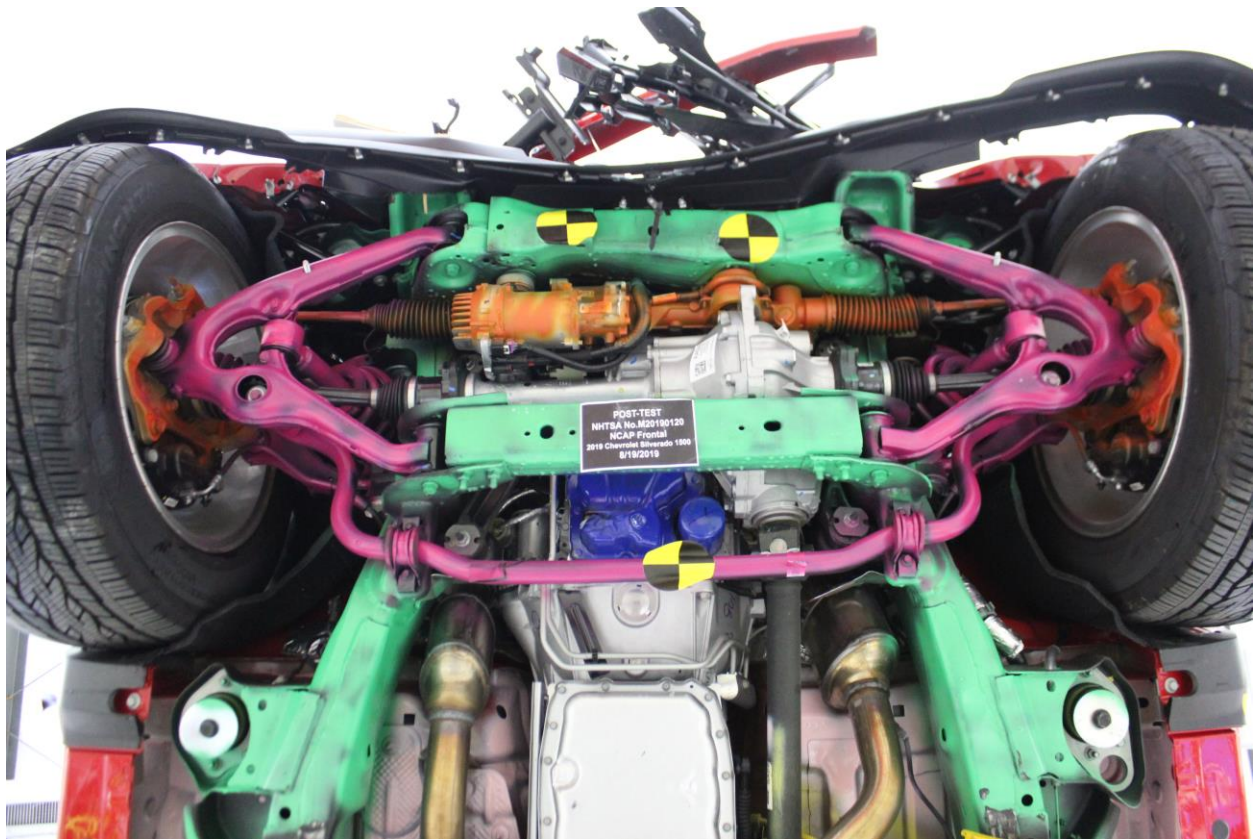


Figure A-25: Post-Test Front Underbody View

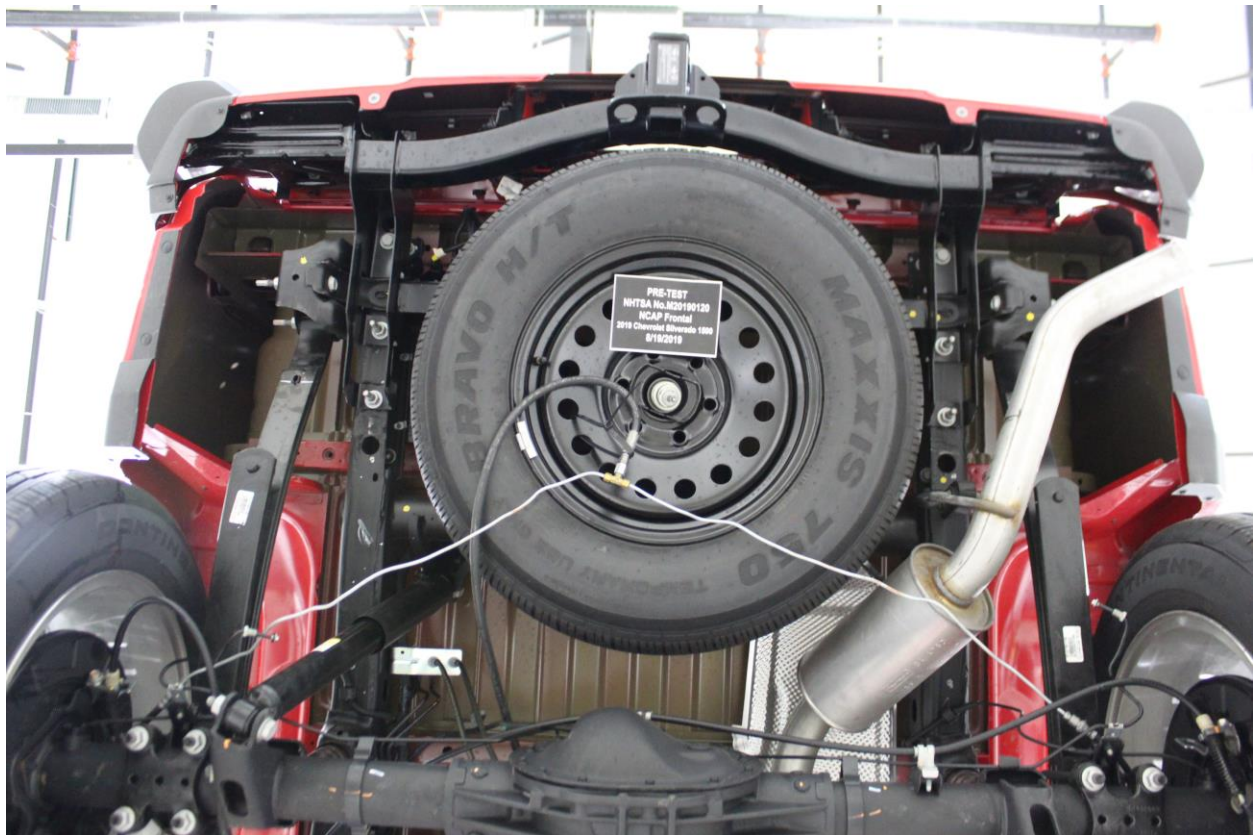


Figure A-26: Pre-Test Rear Underbody View

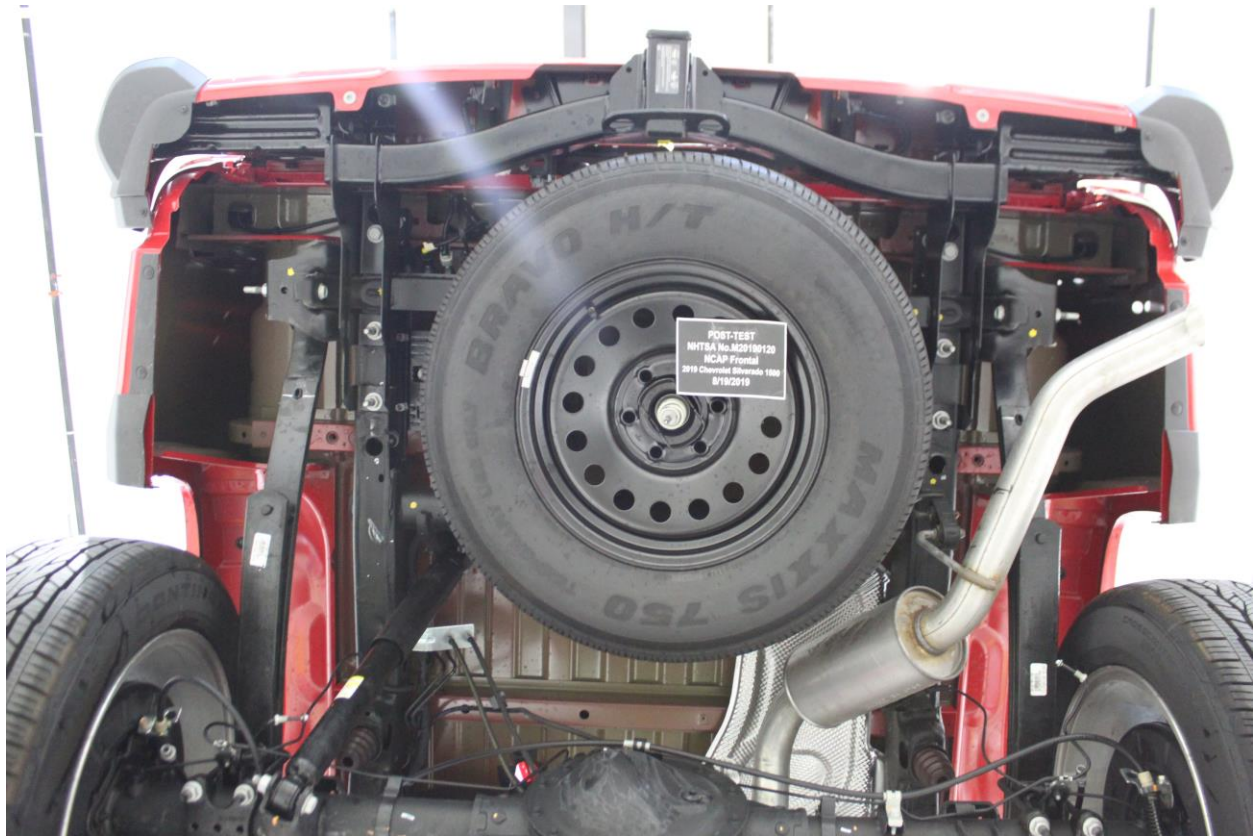


Figure A-27: Post-Test Rear Underbody View



Figure A-28: Pre-Test Dummy Cable Routing



Figure A-29: Post-Test Dummy Cable Routing

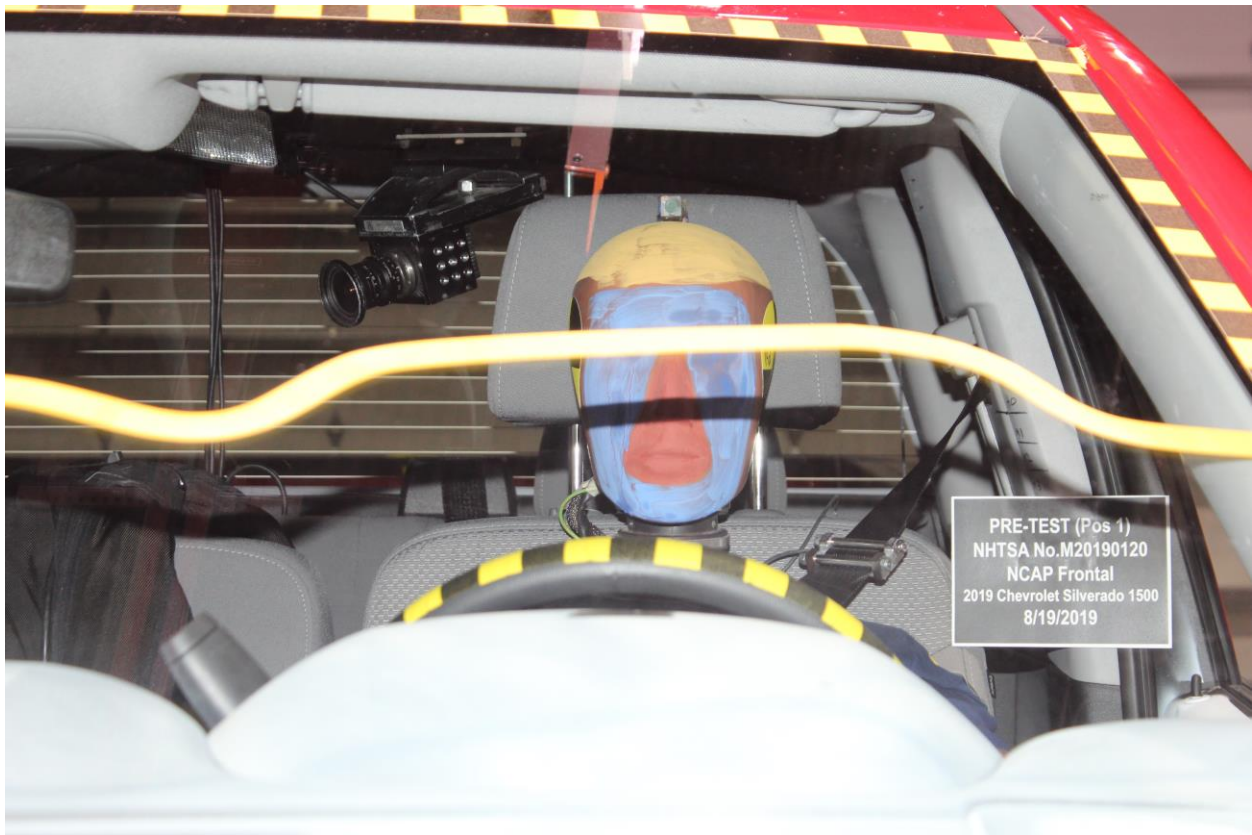


Figure A-30: Pre-Test Driver Dummy Front View

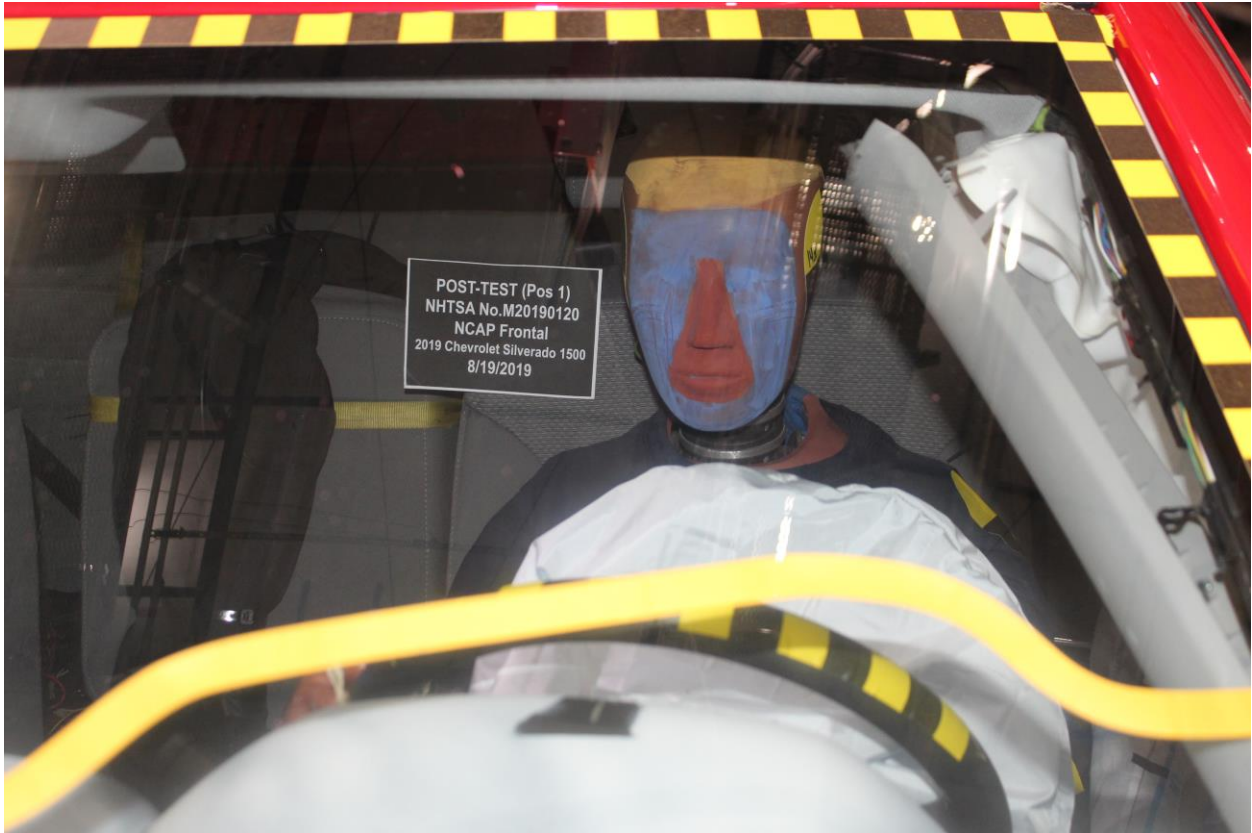


Figure A-31: Post-Test Driver Dummy Front View



Figure A-32: Pre-Test Driver Dummy Window View



Figure A-33: Post-Test Driver Dummy Window View



Figure A-34: Pre-Test Driver Dummy and Vehicle Interior View



Figure A-35: Post-Test Driver Dummy and Vehicle Interior View



Figure A-36: Pre-Test Driver's Seat Fore-Aft Markings



Figure A-37: Post-Test Driver's Seat Fore-Aft Markings

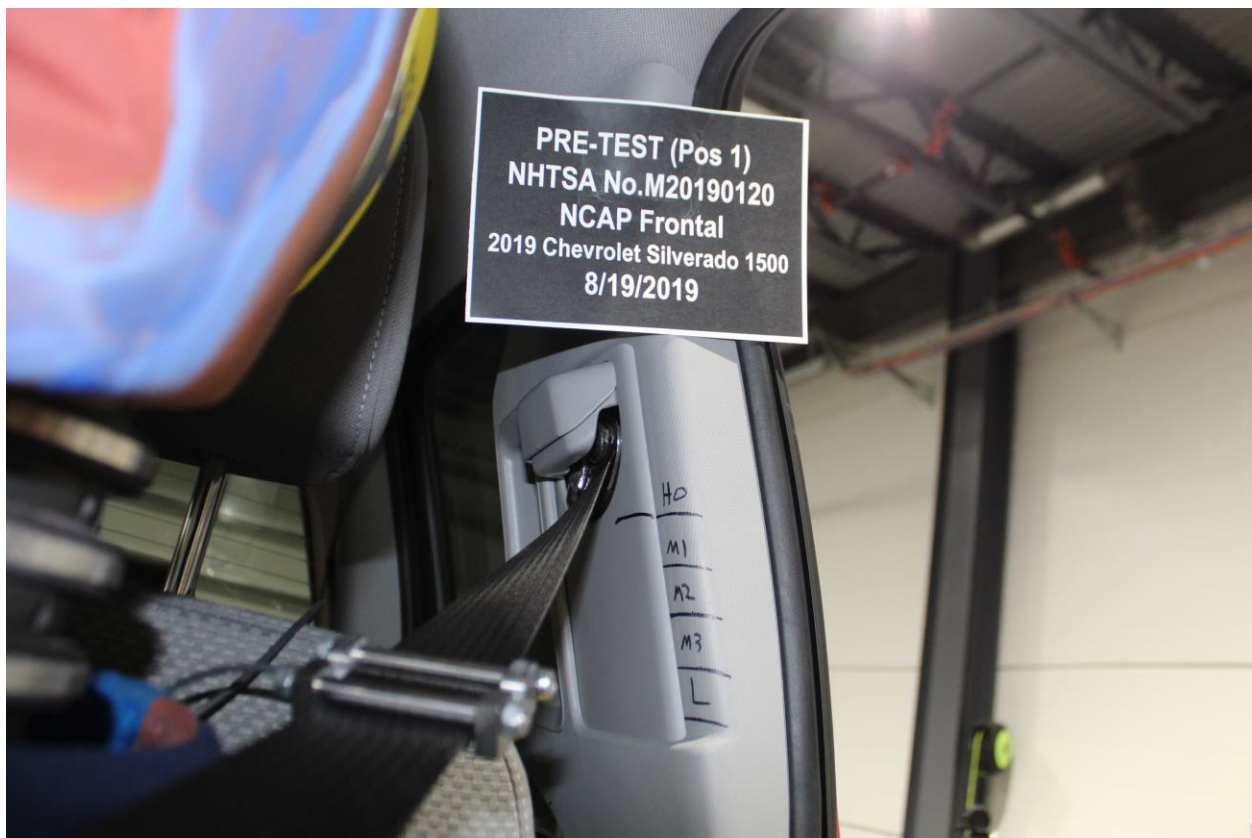


Figure A-38: Pre-Test View of Belt Anchorage for Driver Dummy



Figure A-39: Post-Test View of Belt Anchorage for Driver Dummy



Figure A-40: Pre-Test Driver Dummy Feet



Figure A-41: Post-Test Driver Dummy Feet



Figure A-42: Pre-Test Driver's Side Knee Bolster



Figure A-43: Post-Test Driver's Side Knee Bolster



Figure A-44: Pre-Test Driver's Side Floorpan



Figure A-45: Post-Test Driver's Side Floorpan

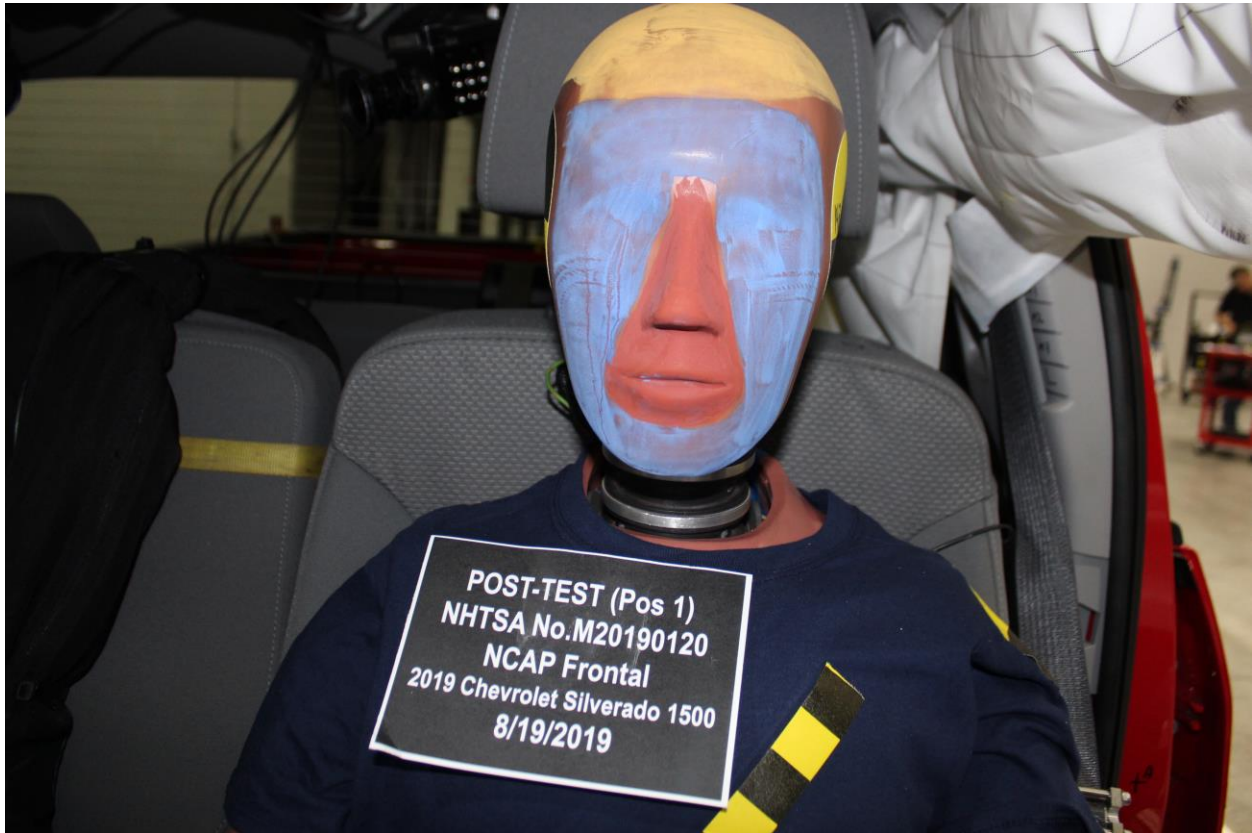


Figure A-46: Post-Test Driver Dummy Face



Figure A-47: Post-Test Driver Dummy Contact With Airbag



Figure A-48: Post-Test Driver Dummy Contact With Headrest



Figure A-49: Pre-Test View of the Steering Wheel



Figure A-50: Post-Test View of the Steering Wheel



Figure A-51: Pre-Test Passenger Dummy Front View



Figure A-52: Post-Test Passenger Dummy Front View



Figure A-53: Pre-Test Passenger Dummy Window View



Figure A-54: Post-Test Passenger Dummy Window View



Figure A-55: Pre-Test Passenger Dummy and Vehicle Interior View



Figure A-56: Post-Test Passenger Dummy and Vehicle Interior View

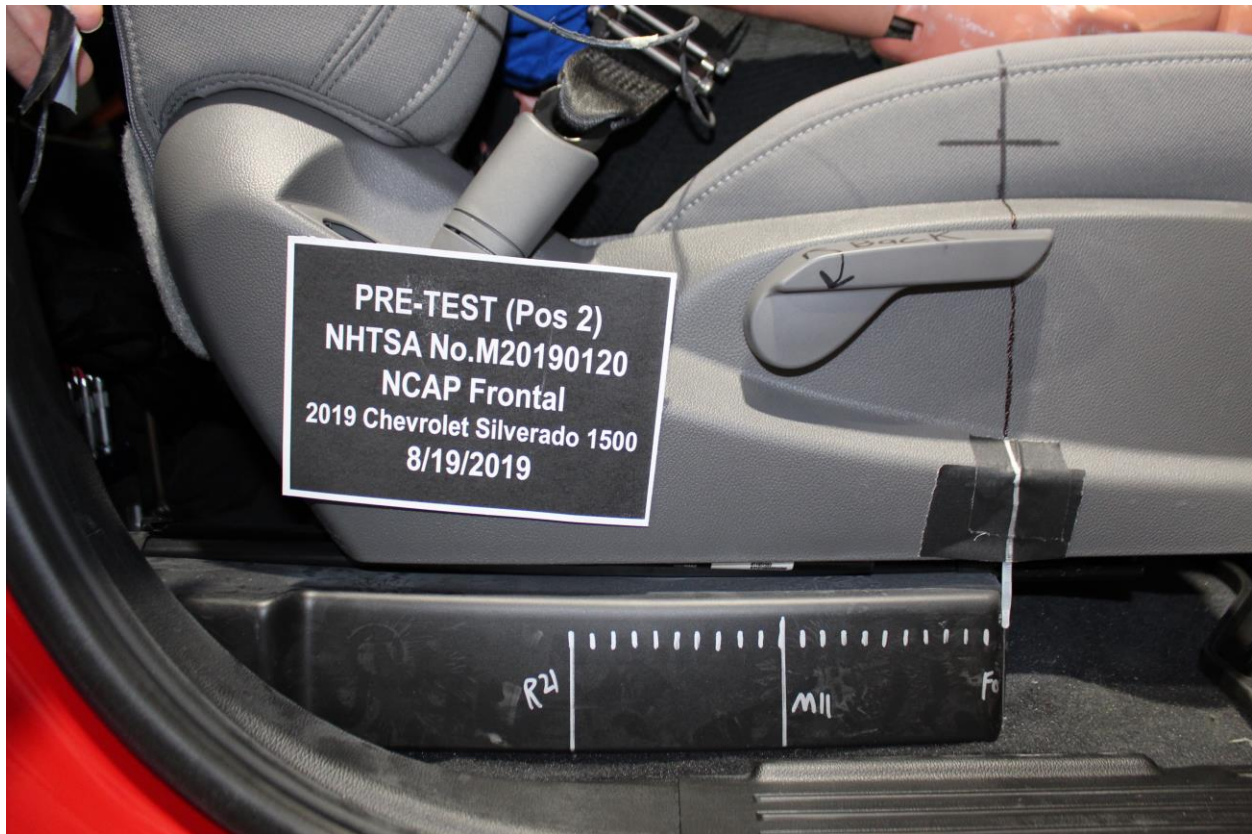


Figure A-57: Pre-Test Passenger's Seat Fore-Aft Markings

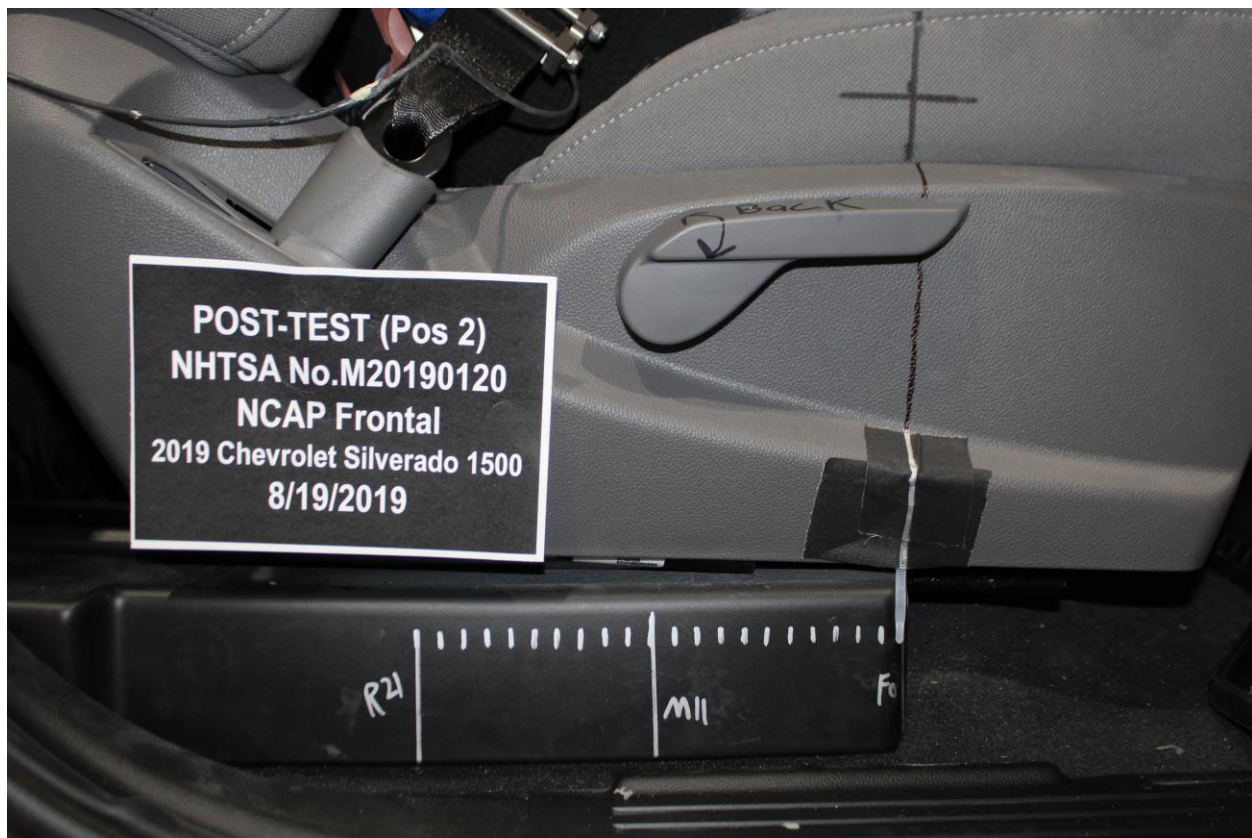


Figure A-58: Post-Test Passenger's Seat Fore-Aft Markings



Figure A-59: Pre-Test View of Belt Anchorage for Passenger Dummy



Figure A-60: Post-Test View of Belt Anchorage for Passenger Dummy



Figure A-61: Pre-Test Passenger Dummy Feet



Figure A-62: Post-Test Passenger Dummy Feet



Figure A-63: Pre-Test Passenger's Side Knee Bolster



Figure A-64: Post-Test Passenger's Side Knee Bolster



Figure A-65: Pre-Test Passenger's Side Floorpan



Figure A-66: Post-Test Passenger's Side Floorpan



Figure A-67: Post-Test Passenger Dummy Face



Figure A-68: Post-Test Passenger Dummy Contact With Airbag



Figure A-69: Post-Test Passenger Dummy Contact With Headrest

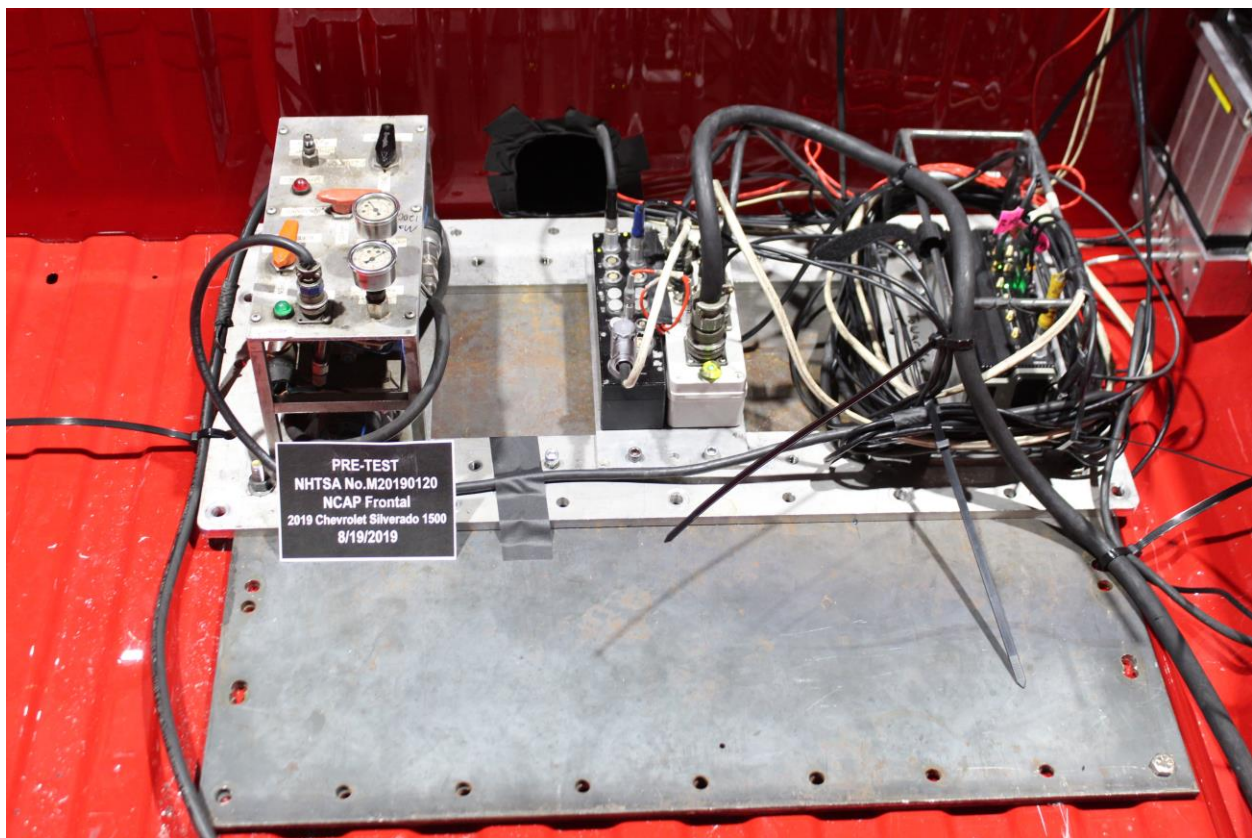


Figure A-70: Photograph of Ballast Installed in Vehicle

Photo Not Applicable

Figure A-71: Post-Test Stoddard Solvent Spillage Location View, If Required



Figure A-72: Post-Test Speed Trap Read-Out



Figure A-73: Vehicle at 0° on Static Rollover Device

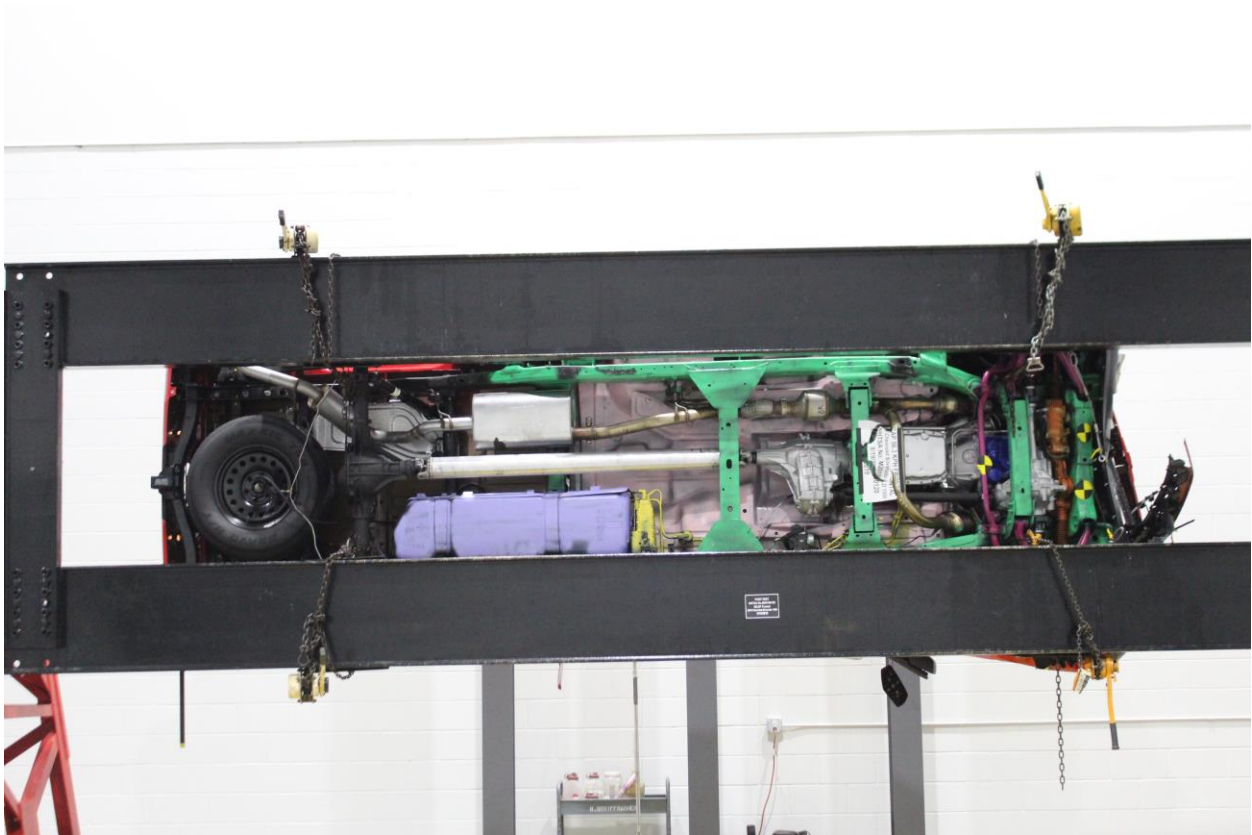


Figure A-74: Vehicle at 90° on Static Rollover Device



Figure A-75: Vehicle at 180° on Static Rollover Device



Figure A-76: Vehicle at 270° on Static Rollover Device



Figure A-77: Vehicle at 360° on Static Rollover Device



Figure A-78: 2019 Chevrolet Silverado LD 1500 Quad Cab Frontal Impact Event



**2019 SILVERADO LD 1500 4WD
CUSTOM**

**EXTERIOR: RED HOT
INTERIOR: DARK ASH / JET BLACK
ACCENTS**

**ENGINE, 5.3L V8 ECOTEC3
TRANSMISSION, 6 SPD AUTOMATIC**

Visit us at www.chevy.com

<p>STANDARD EQUIPMENT</p> <p>ITEMS FEATURED BELOW ARE INCLUDED AT NO EXTRA CHARGE IN THE STANDARD VEHICLE PRICE SHOWN</p> <ul style="list-style-type: none"> FIRST MAINTENANCE VISIT OIL CHANGE TIRE ROTATION & MULTI-POINT VEHICLE INSPECTION SEE WWW.CHEVY.COM OR DEALER FOR DETAILS 3 YR/36,000 MILES BUMPER-TO-BUMPER WARRANTY 5 YR/60,000 MILES POWERTRAIN LIMITED WARRANTY ROADSIDE ASSISTANCE COURTESY TRANSPORTATION SEE WWW.CHEVY.COM OR DEALER FOR TERMS, DETAILS & LIMITS <p>MECHANICAL</p> <ul style="list-style-type: none"> CAPLESS FUEL FILL ENGINE, 5.3L V8 ECOTEC3 TRANSMISSION, 6 SPD AUTOMATIC ELECTRIC POWER STEERING TRANSFER CASE, MANUAL 	<ul style="list-style-type: none"> AUTO LOCKING RR DIFFERENTIAL <p>SAFETY & SECURITY</p> <ul style="list-style-type: none"> TEEN DRIVER MODE STABILITRAK-STABILITY CONTROL W/ TRAILER SWAY CONTROL & HILL START ASSIST ANTI-LOCK BRAKES, 4 WHEEL DISC WITH DURALIFE ROTORS (TM) TIRE PRESSURE MONITOR SYSTEM WITH TIRE FILL ALERT (EXCL. SPARE TIRE) DAYTIME RUNNING LAMPS REAR VISION CAMERA <p>EXTERIOR</p> <ul style="list-style-type: none"> EZ LIFT AND LOWER TAILGATE POWER HEATED OUTSIDE MIRRORS HEADLAMPS, HID PROJECTOR TIRES, ALL SEASON BED RAIL PROTECTORS FRONT BUMPER, BODY COLOR REAR BUMPER, BODY COLOR CORNERSTEP, REAR BUMPER 	<ul style="list-style-type: none"> RECOVERY HOOKS, FRONT <p>INTERIOR</p> <ul style="list-style-type: none"> SEATS, FRONT 40/20/40 BENCH REAR SEAT, FOLDING BENCH POWER WINDOWS, DRIVER EXPRESS POWER DOOR LOCKS FLOOR COVERING, RUBBERIZED-VINYL CRUISE CONTROL DRIVER INFORMATION CENTER STEERING COLUMN, TILT CHEVROLET INFOTAINMENT SYSTEM 7" DIAGONAL COLOR TOUCHSCREEN <p>ADDITIONAL FEATURES FOR COMPATIBLE PHONES INCLUDE:</p> <ul style="list-style-type: none"> BLUETOOTH AUDIO STREAMING VOICE COMMAND PASSTHROUGH TO PHONE, ANDROID AUTO & APPLE CARPLAY CAPABLE <p>MANUFACTURER'S SUGGESTED RETAIL PRICE</p> <p>STANDARD VEHICLE PRICE \$40,300.00</p>	<p>OPTIONS & PRICING</p> <p>OPTIONS INSTALLED BY THE MANUFACTURER (MAY REPLACE STANDARD EQUIPMENT SHOWN)</p> <ul style="list-style-type: none"> CUSTOM CONVENIENCE PACKAGE 910.00 ONSTAR (R) SERVICES CAPABLE (SUBJECT TO TERMS (SEE ONSTAR.COM)) SIRIUSXM ALL ACCESS + SERVICE SUBSCRIPTION SOLD SEPARATELY BY SIRIUSXM AFTER 3 MONTHS REMOTE KEYLESS ENTRY REMOTE LOCKING TAILGATE COLOR-KEYED CARPETING REAR WINDOW DEFOGGER BLACK BOWTIE EMBLEMS PACKAGE (DEALER INSTALLED) 200.00 7,200 LB GVW RATING INC. REAR AXLE 3.42 RATIO INC. 20" CHROME CLAD ALUMINUM WHEELS INC. <p>TOTAL OPTIONS \$1,110.00</p> <p>TOTAL VEHICLE & OPTIONS \$41,410.00</p>	<p>DESTINATION CHARGE 1,495.00</p> <p>TOTAL VEHICLE PRICE* \$42,905.00</p>
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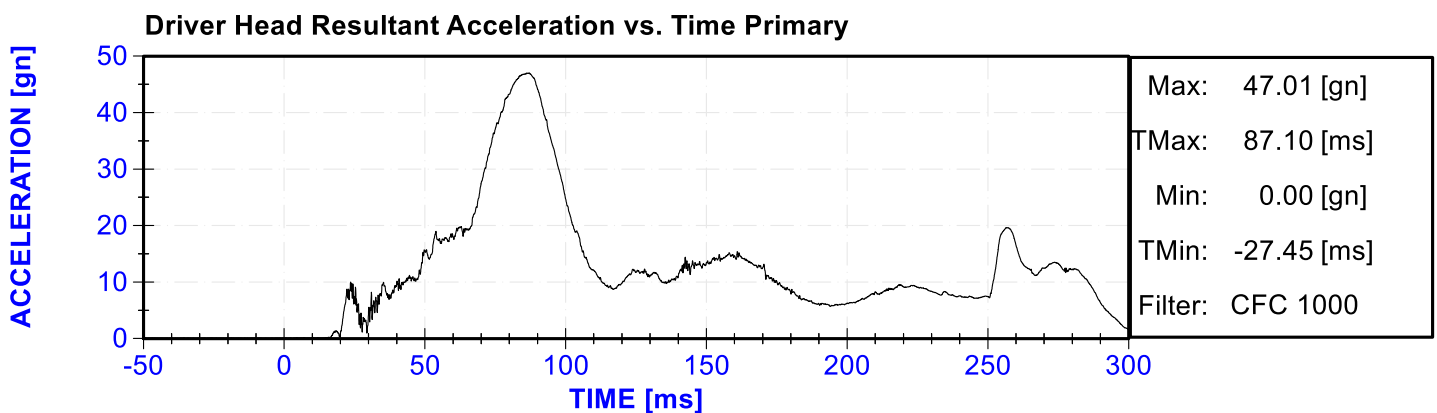
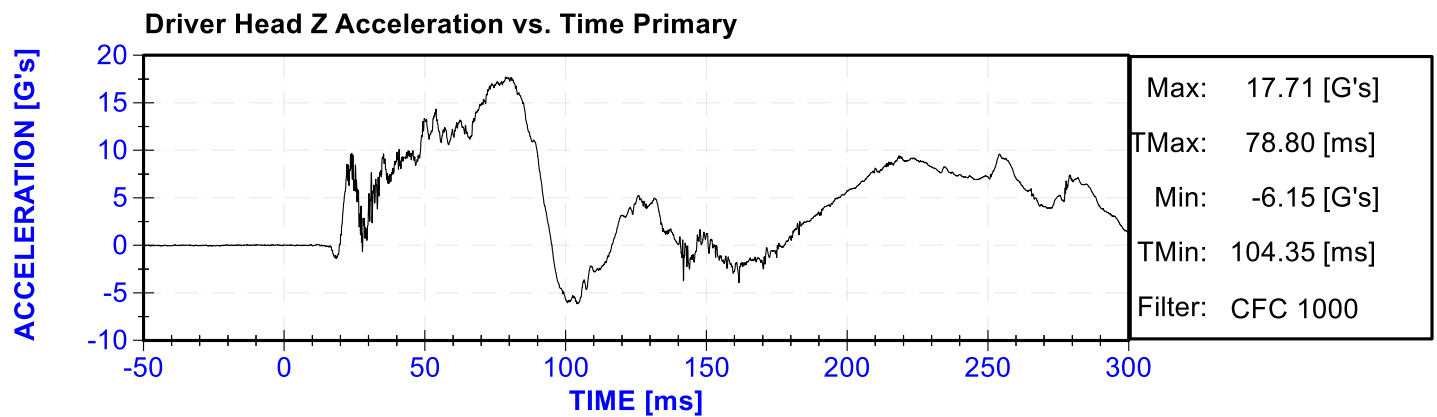
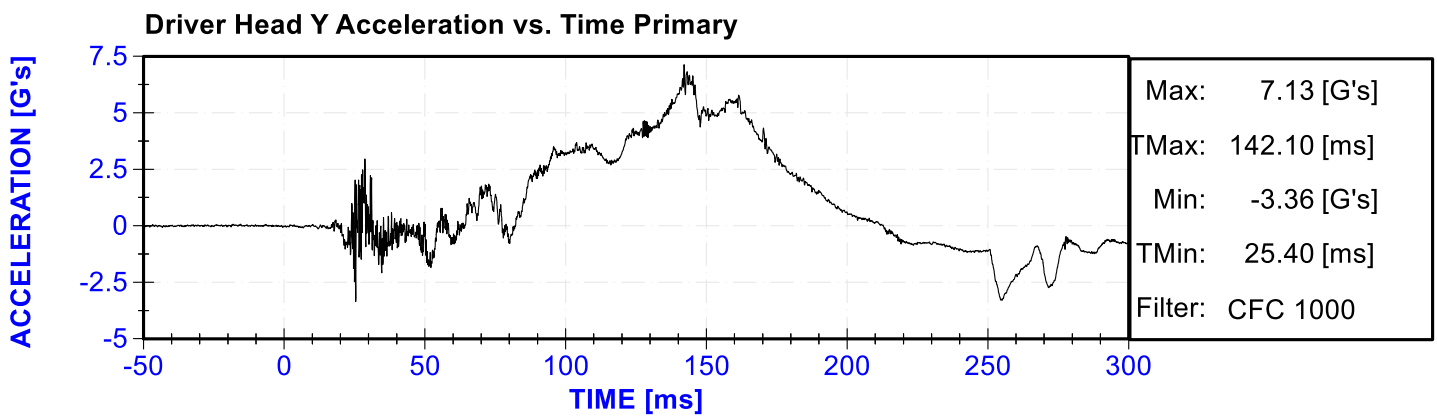
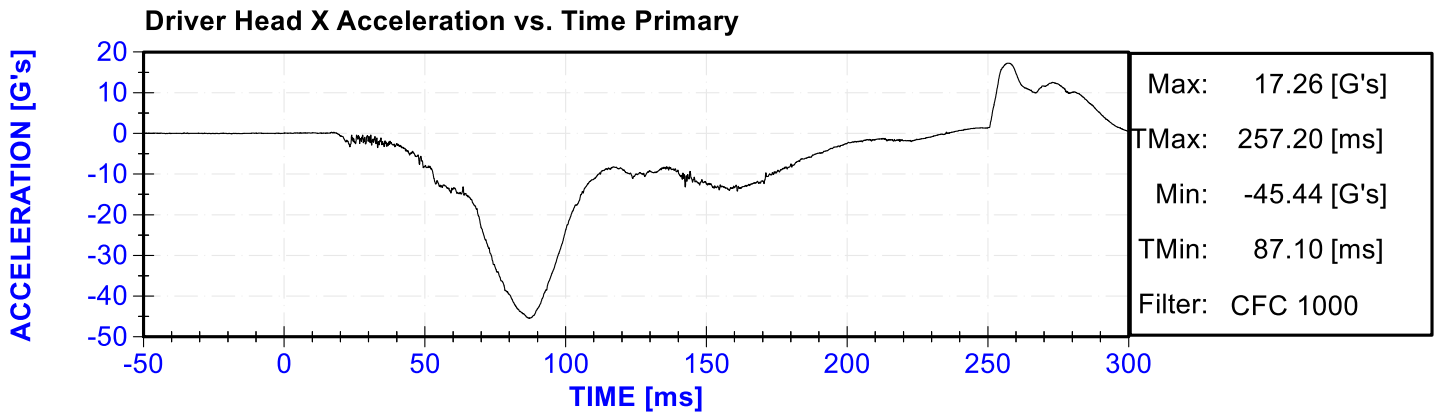
<p>EPA DOT Fuel Economy and Environment</p> <p>Fuel Economy</p> <p>17 combined city/hwy 15 city 21 highway</p> <p>5.9 gallons per 100 miles</p> <p>Annual fuel cost \$2,250</p> <p>Fuel Economy & Greenhouse Gas Rating (tailpipe only)</p> <p>3 (Best)</p> <p>Smog Rating (tailpipe only)</p> <p>3 (Best)</p> <p>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 \$2.59 per gallon. MPG is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.</p> <p>fuel economy.gov</p> <p>Calculate personalized estimates and compare vehicles</p>	<p>Gasoline Vehicle</p> <p>You spend \$4,250 more in fuel costs over 5 years compared to the average new vehicle.</p> <p>SEARCH FOR ON STAR CODE</p>	<p>GOVERNMENT 5-STAR SAFETY RATINGS</p> <p>Overall Vehicle Score Not Rated</p> <p>Based on the combined ratings of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight.</p> <table border="1"> <tr> <td>Frontal Crash</td> <td>Driver Passenger</td> <td>Not Rated</td> </tr> <tr> <td colspan="3">Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight.</td> </tr> <tr> <td>Side Crash</td> <td>Front seat Rear seat</td> <td>★★★★★</td> </tr> <tr> <td colspan="3">Based on the risk of injury in a side impact.</td> </tr> <tr> <td>Rollover</td> <td></td> <td>★★★★</td> </tr> <tr> <td colspan="3">Based on the risk of rollover in a single-vehicle crash.</td> </tr> </table> <p>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</p>	Frontal Crash	Driver Passenger	Not Rated	Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight.			Side Crash	Front seat Rear seat	★★★★★	Based on the risk of injury in a side impact.			Rollover		★★★★	Based on the risk of rollover in a single-vehicle crash.			<p>PARTS CONTENT INFORMATION</p> <p>FOR VEHICLES IN THIS CARLINE: U.S./CANADIAN PARTS CONTENT: 64% MAJOR SOURCES OF FOREIGN PARTS CONTENT: MEXICO 27%</p> <p>NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.</p> <p>FOR THIS VEHICLE: FINAL ASSEMBLY POINT: OSHAWA, ON CANADA COUNTRY OF ORIGIN: ENGINE: UNITED STATES TRANSMISSION: UNITED STATES</p> <p>VO 2GA4792746</p>
Frontal Crash	Driver Passenger	Not Rated																			
Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight.																					
Side Crash	Front seat Rear seat	★★★★★																			
Based on the risk of injury in a side impact.																					
Rollover		★★★★																			
Based on the risk of rollover in a single-vehicle crash.																					

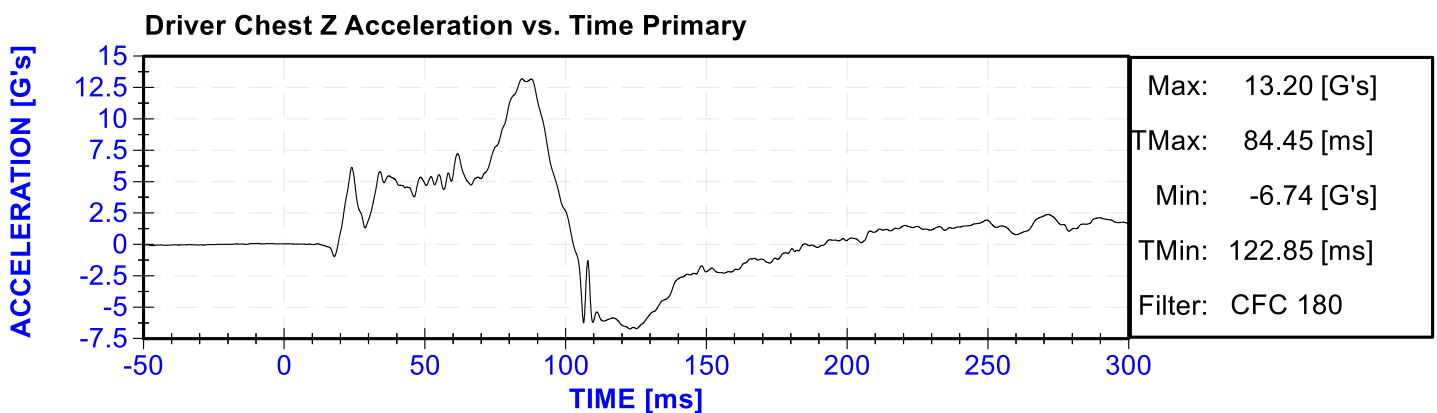
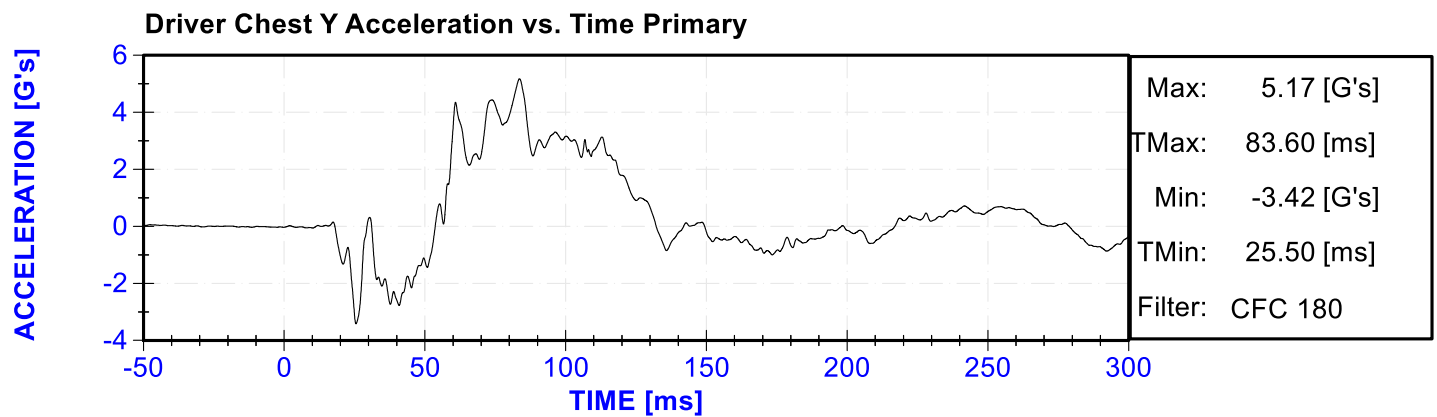
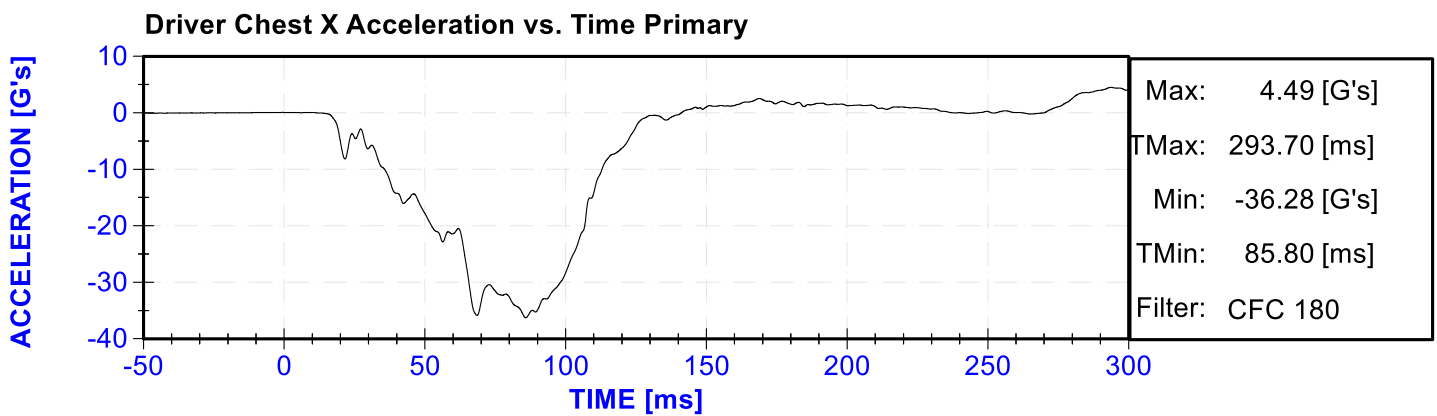
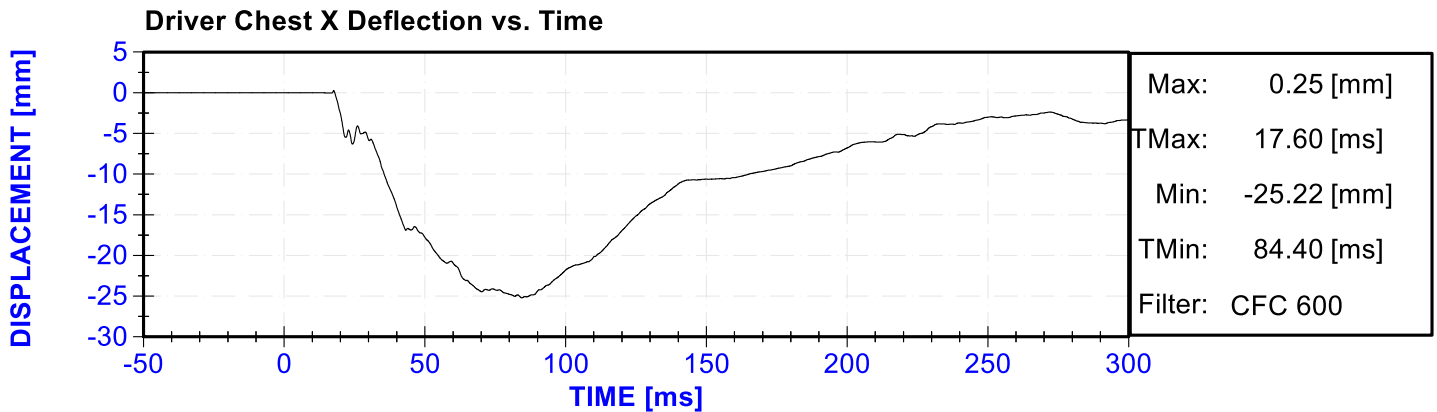
Figure A-79: Monroney Label Photograph

APPENDIX B
VEHICLE & DUMMY RESPONSE DATA TRACES

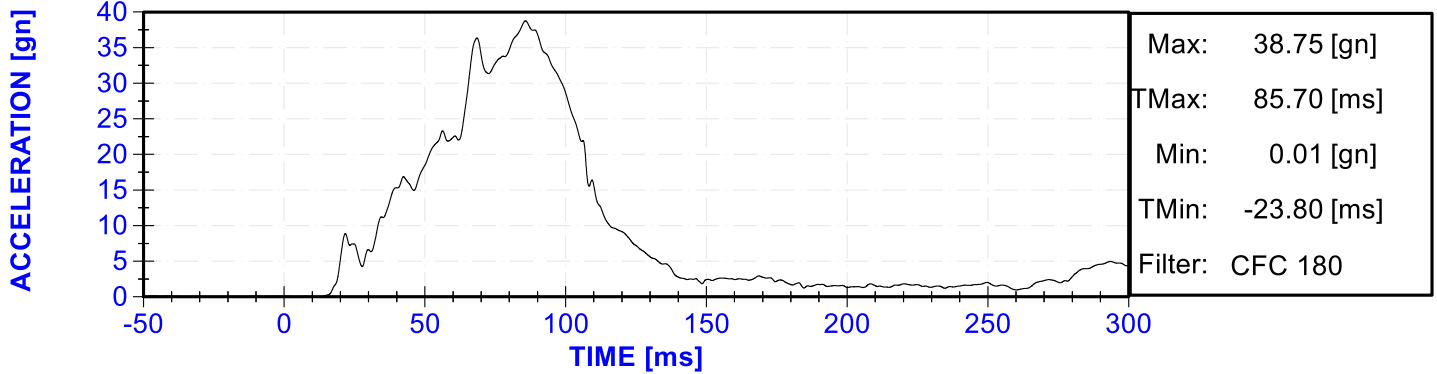
Table of Data Plots

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Plot 2	Driver Head Y Acceleration vs. Time Primary	B-3
Plot 3	Driver Head Z Acceleration vs. Time Primary	B-3
Plot 4	Driver Head Resultant Acceleration vs. Time Primary	B-3
Plot 5	Driver Chest X Deflection vs. Time	B-4
Plot 6	Driver Chest X Acceleration vs. Time Primary	B-4
Plot 7	Driver Chest Y Acceleration vs. Time Primary	B-4
Plot 8	Driver Chest Z Acceleration vs. Time Primary	B-4
Plot 9	Driver Chest Resultant Acceleration vs. Time Primary	B-5
Plot 10	Driver Upper Neck Force X vs. Time Primary	B-5
Plot 11	Driver Upper Neck Force Z vs. Time Primary	B-5
Plot 12	Driver Upper Neck Moment Y vs. Time Primary	B-5
Plot 13	Driver Nij vs. Time Primary	B-6
Plot 14	Driver Left Femur Force vs. Time	B-6
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Plot 16	Passenger Head X Acceleration vs. Time Primary	B-6
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Plot 19	Passenger Head Resultant Acceleration vs. Time Primary	B-7
Plot 20	Passenger Chest X Deflection vs. Time	B-7
Plot 21	Passenger Chest X Acceleration vs. Time Primary	B-8
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Plot 27	Passenger Upper Neck Moment Y vs. Time Primary	B-9
Plot 28	Passenger Nij vs. Time Primary	B-9
Plot 29	Passenger Left Femur Force vs. Time	B-10
Plot 30	Passenger Right Femur Force vs. Time	B-10

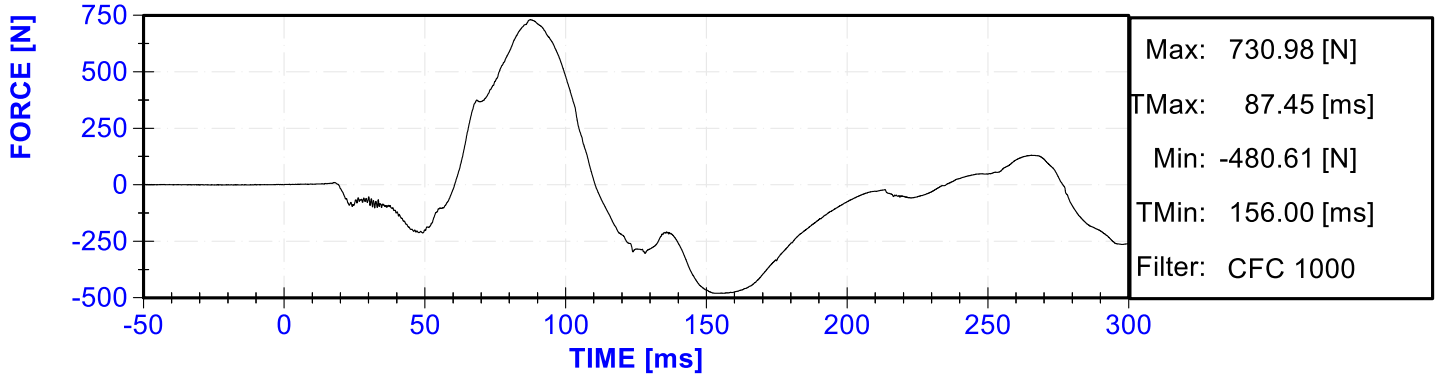




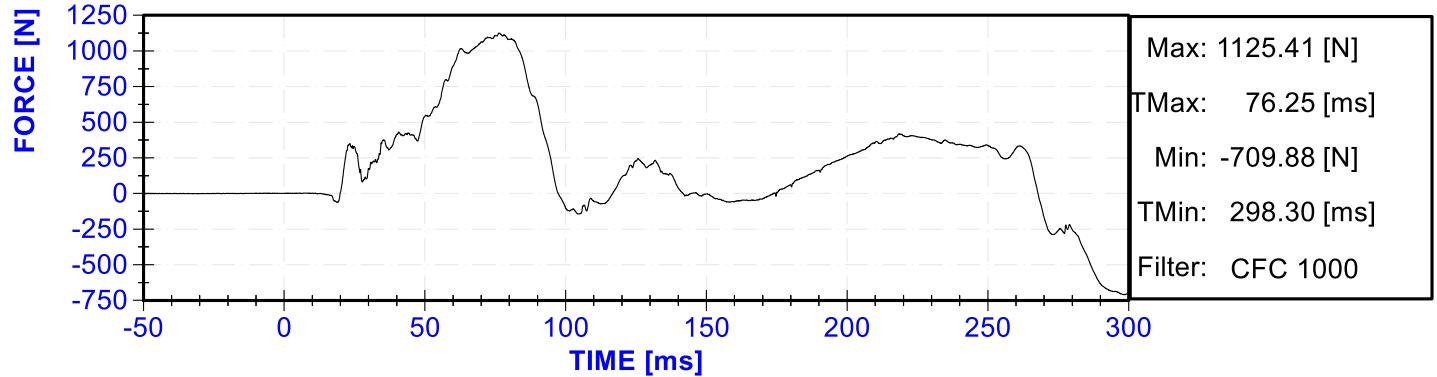
Driver Chest Resultant Acceleration vs. Time Primary



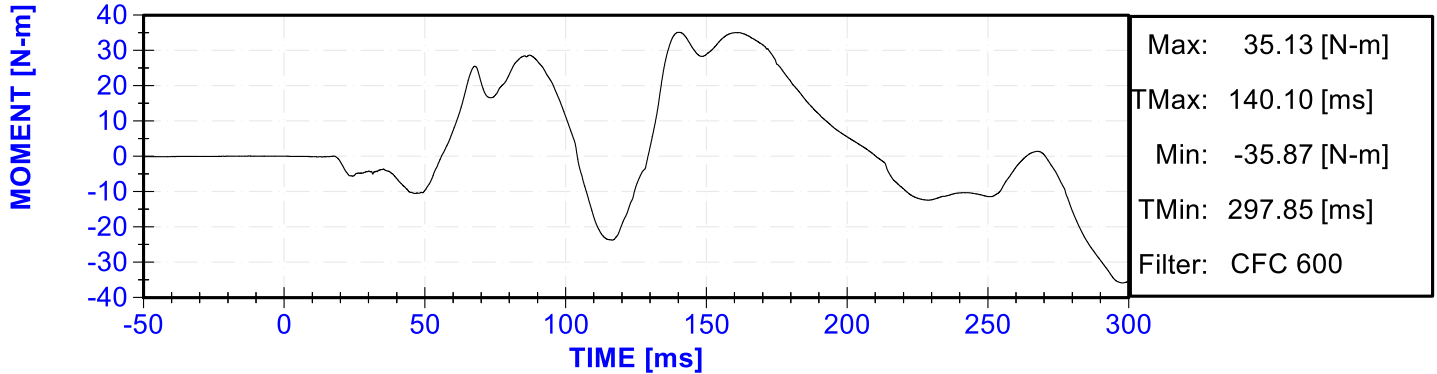
Driver Upper Neck Force X vs. Time Primary

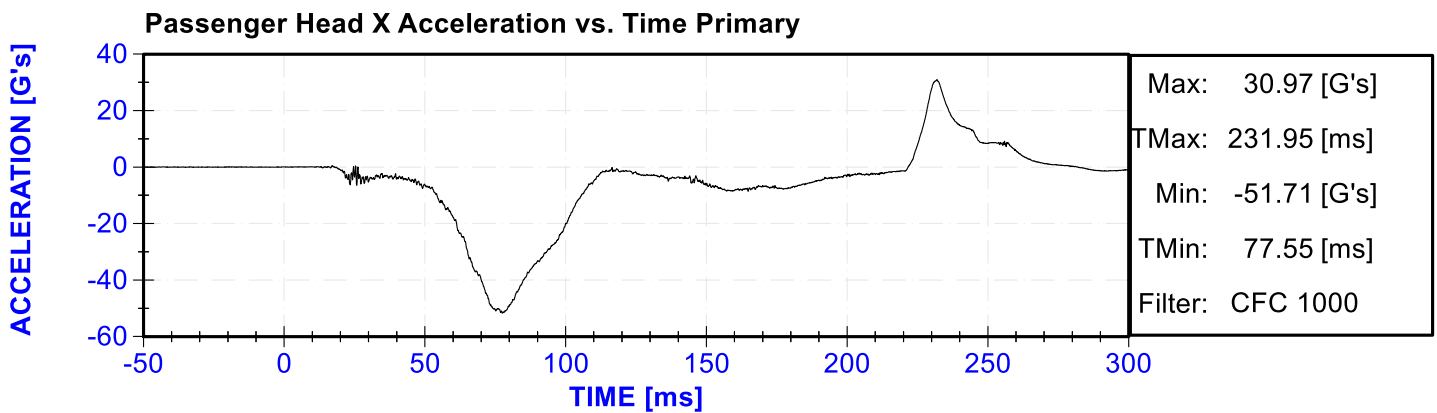
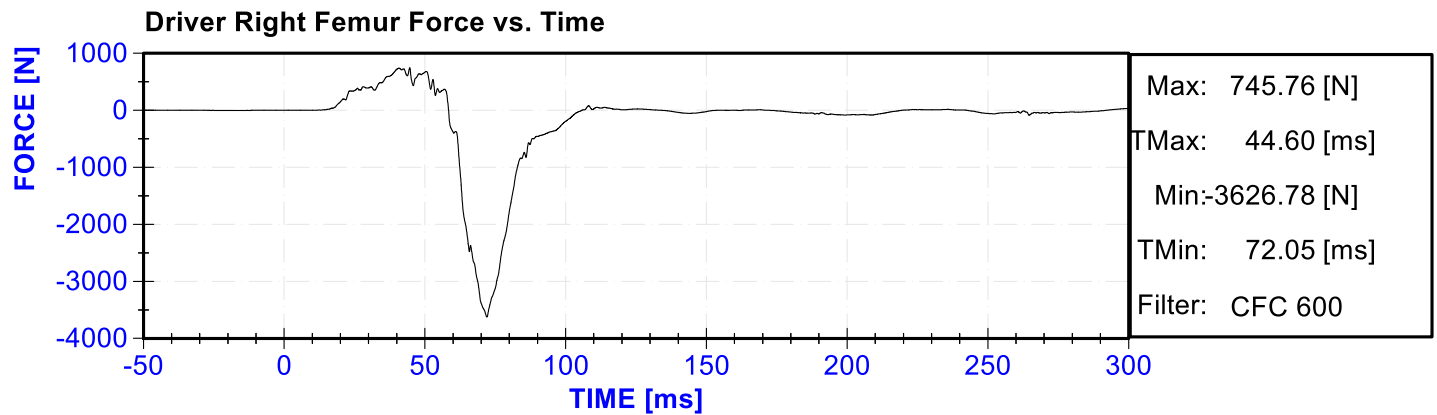
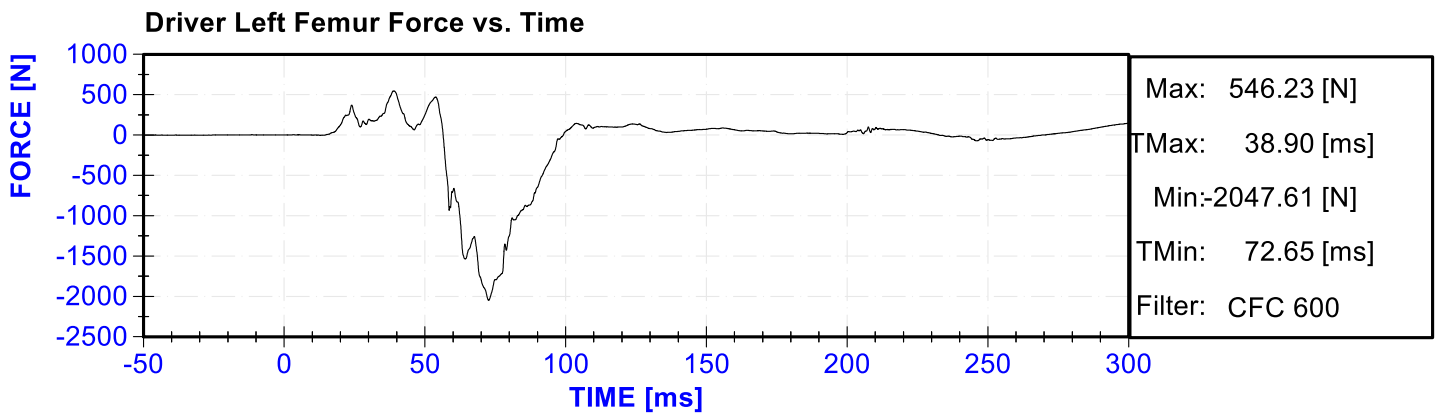
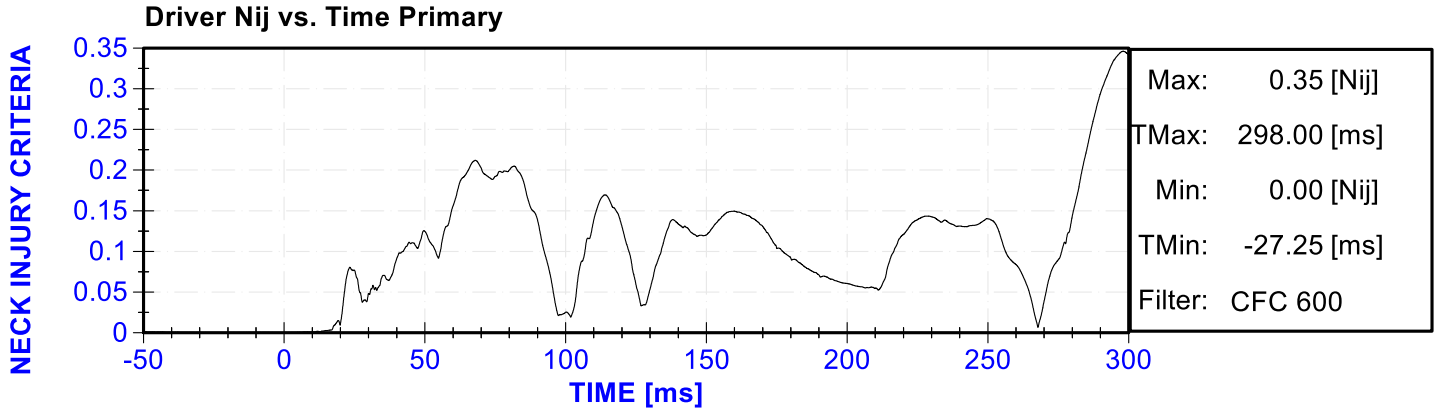


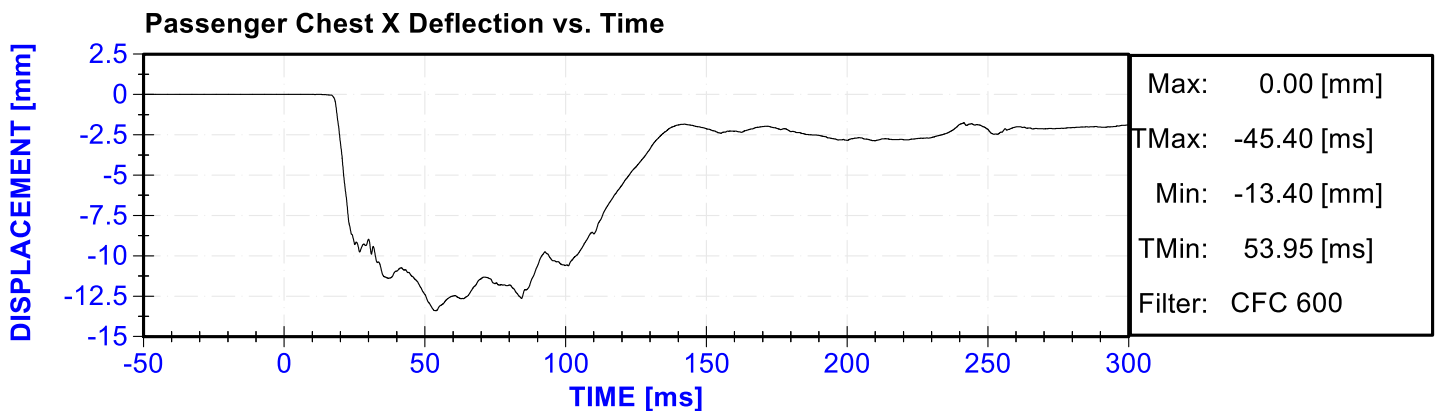
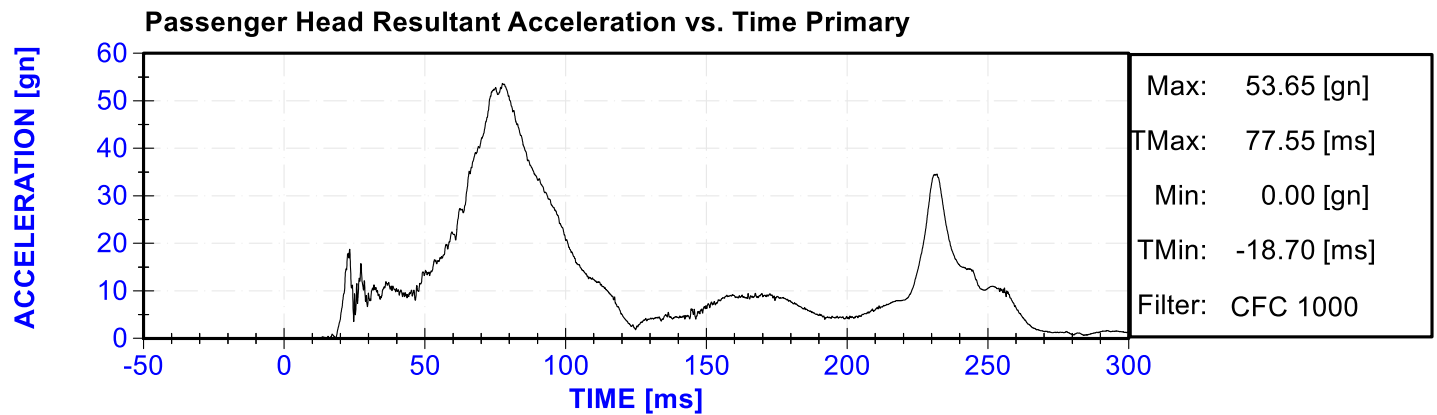
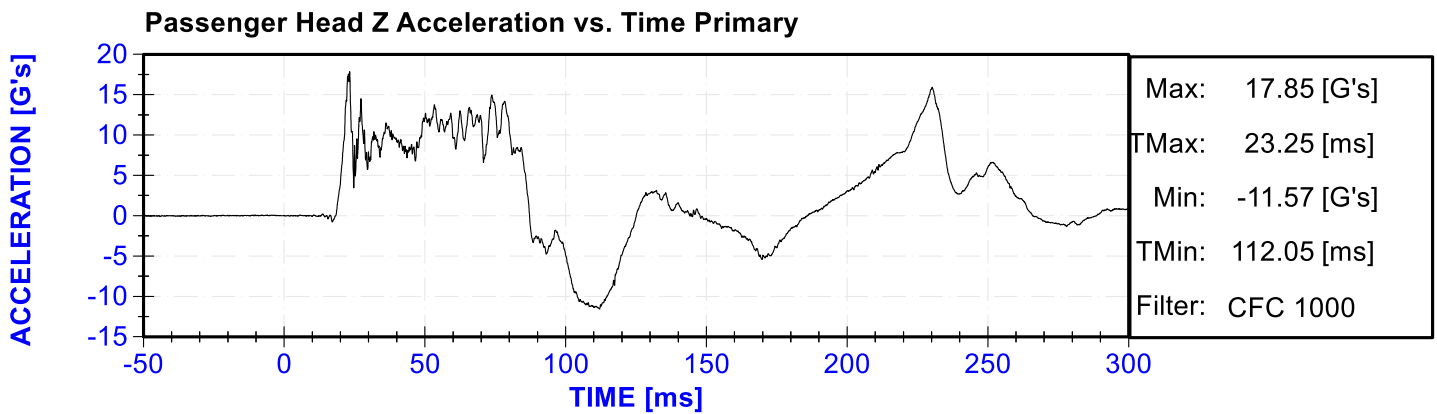
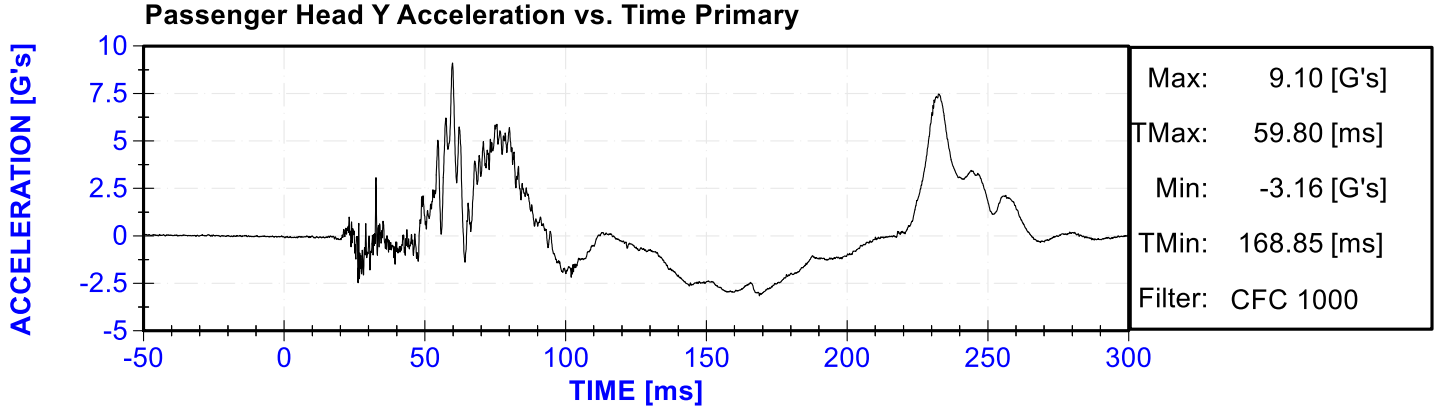
Driver Upper Neck Force Z vs. Time Primary

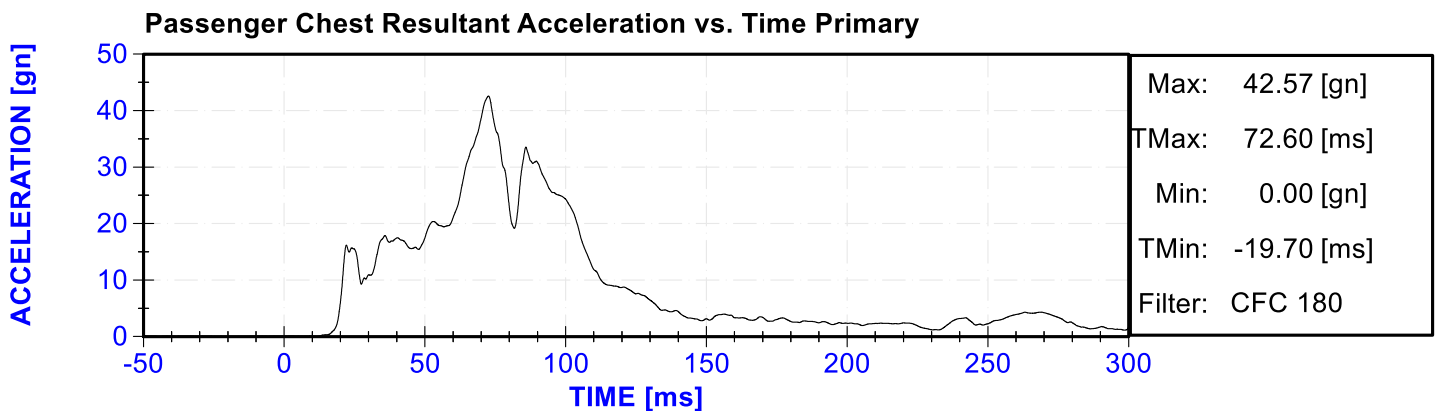
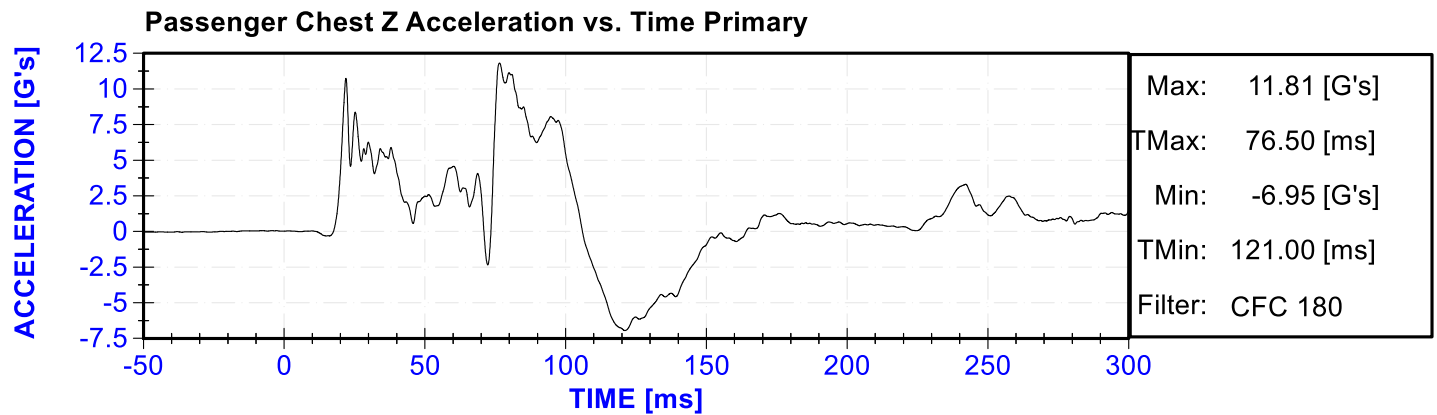
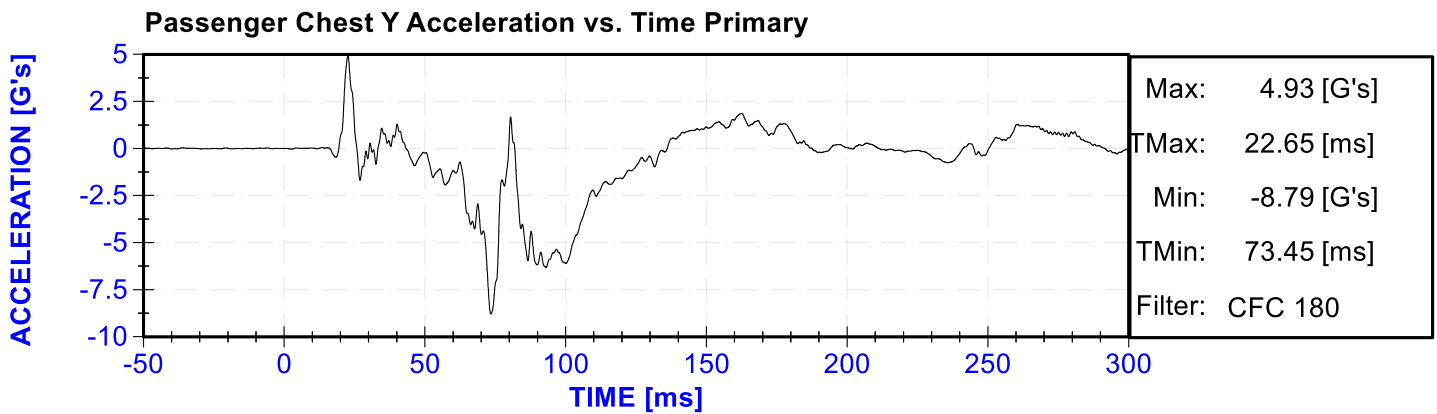
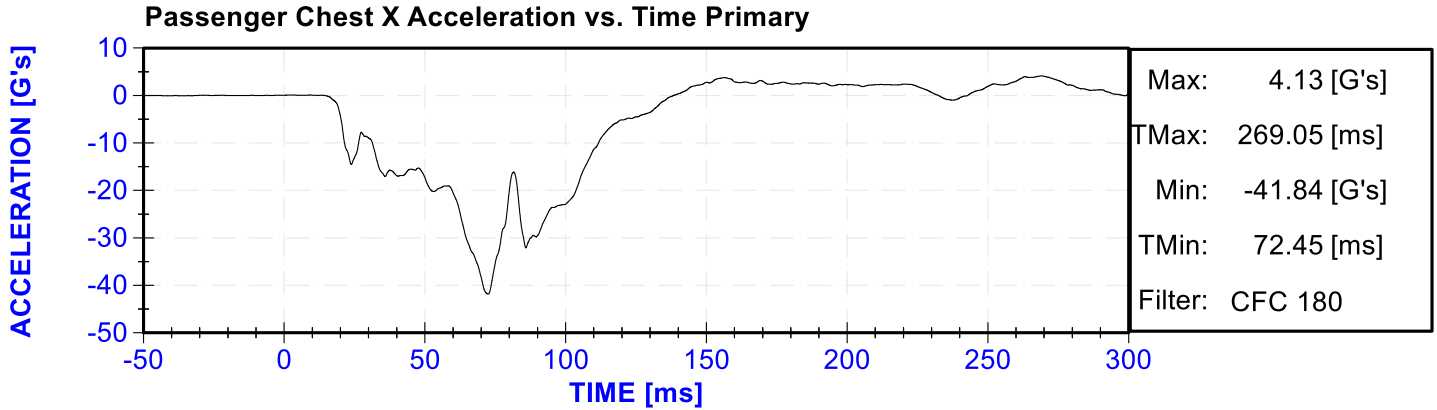


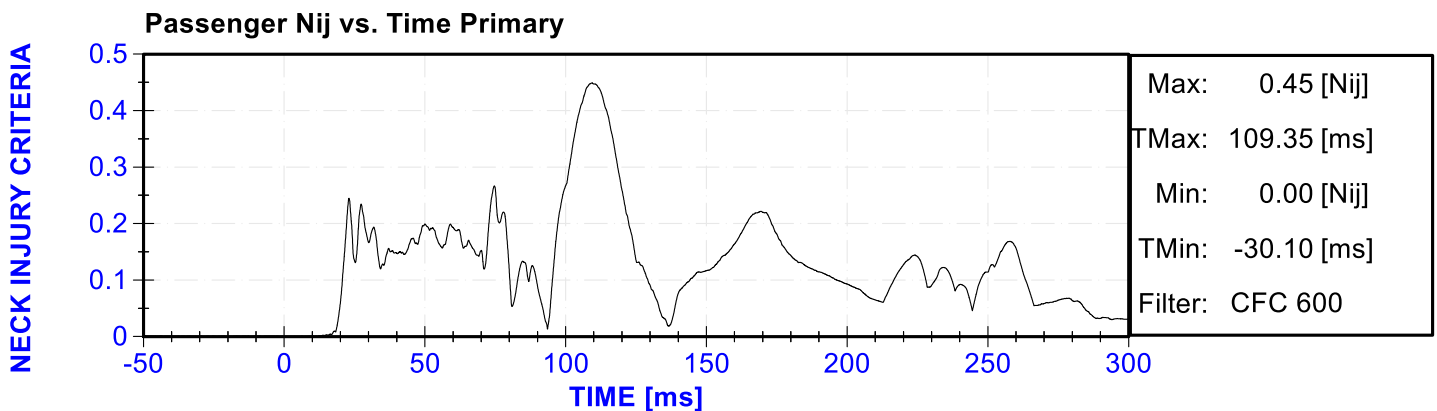
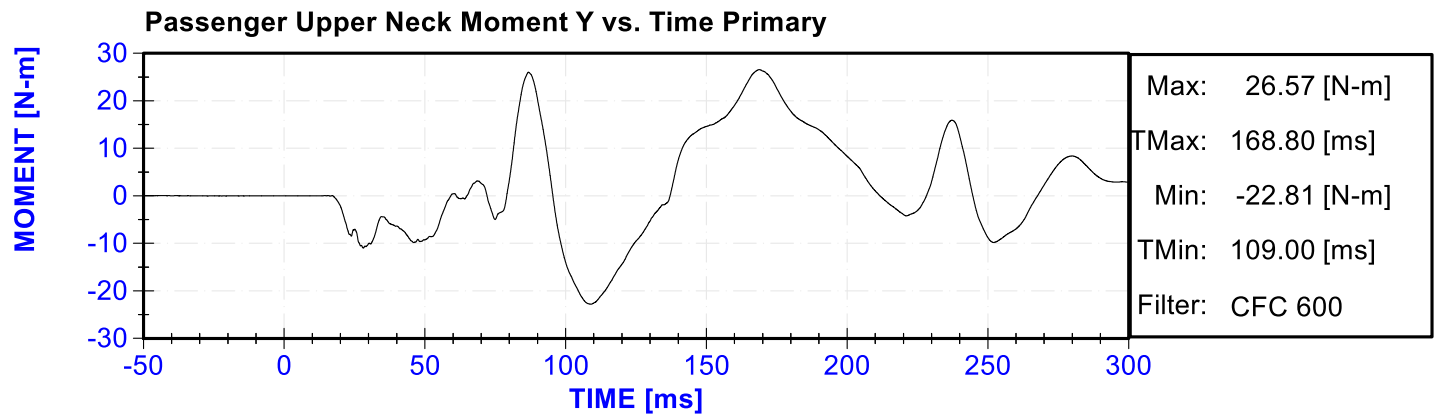
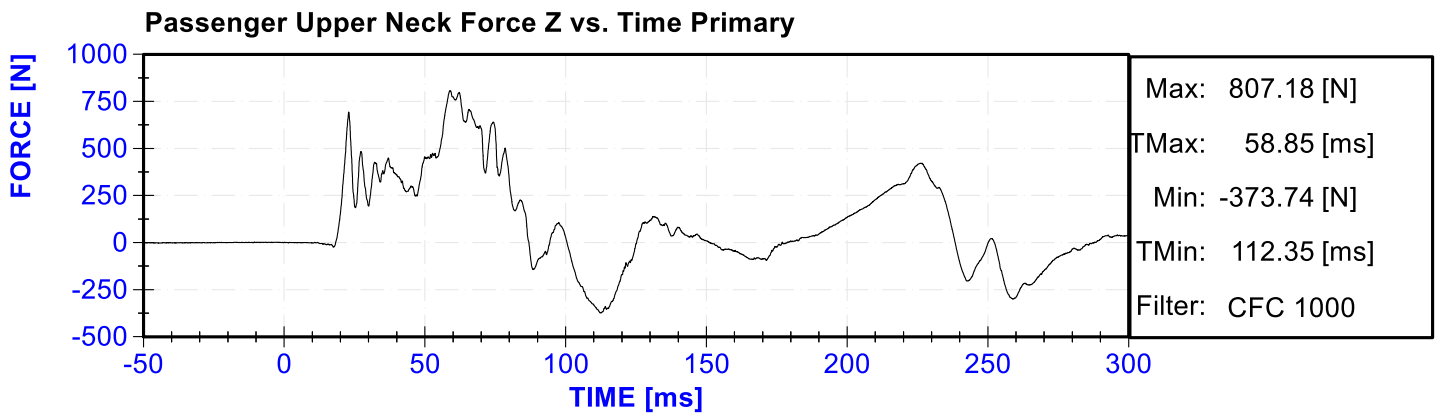
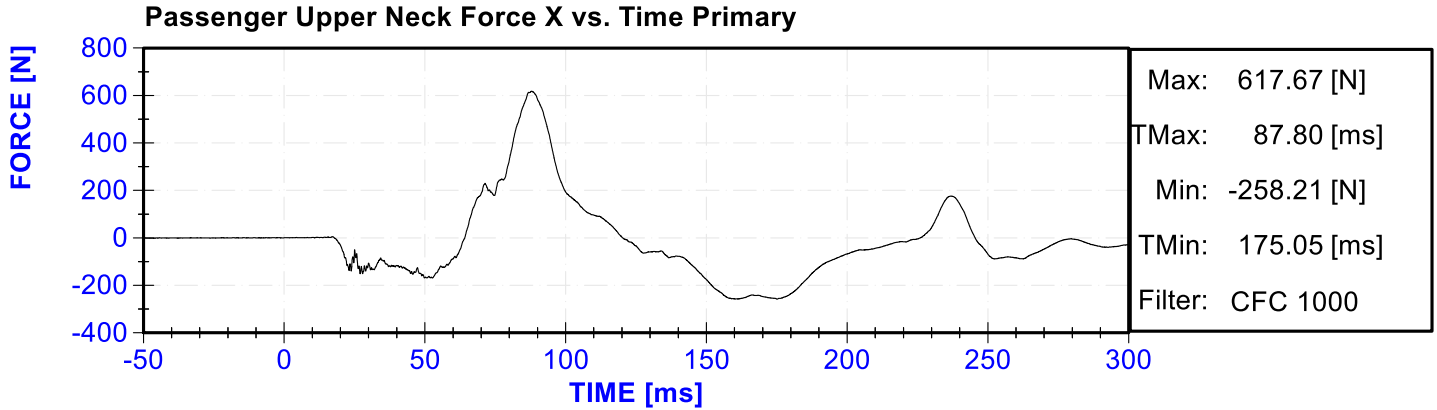
Driver Upper Neck Moment Y vs. Time Primary



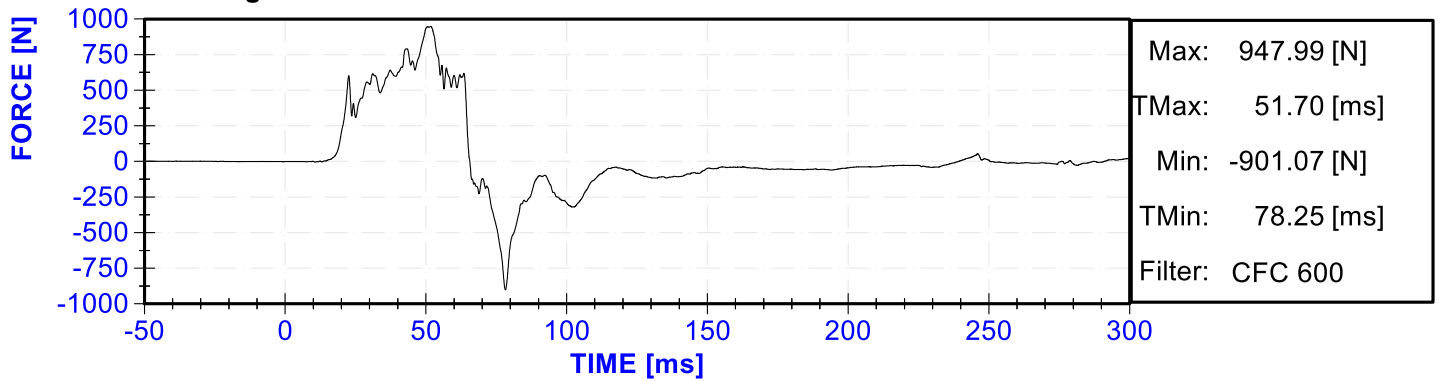




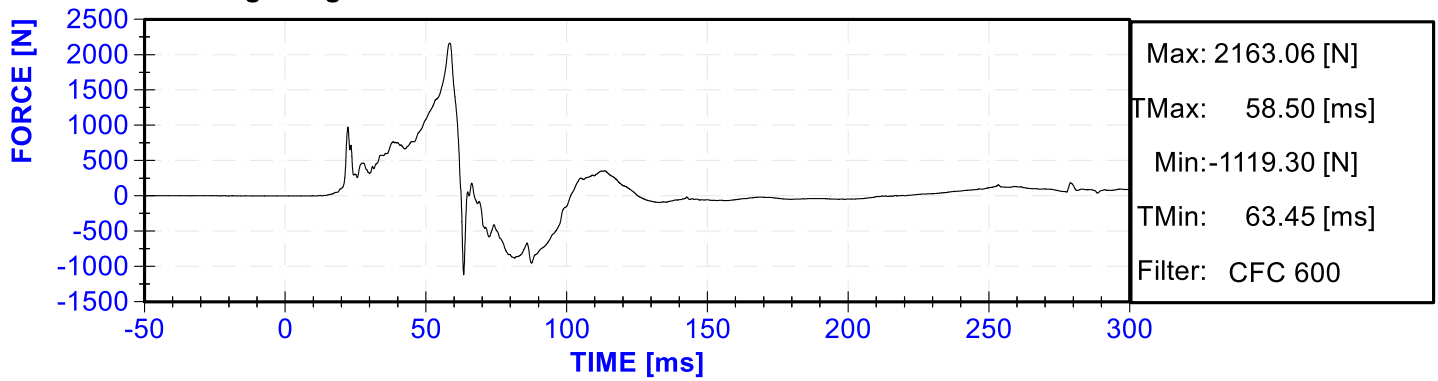




Passenger Left Femur Force vs. Time



Passenger Right Femur Force vs. Time



APPENDIX C

DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

SERIAL NO: 142

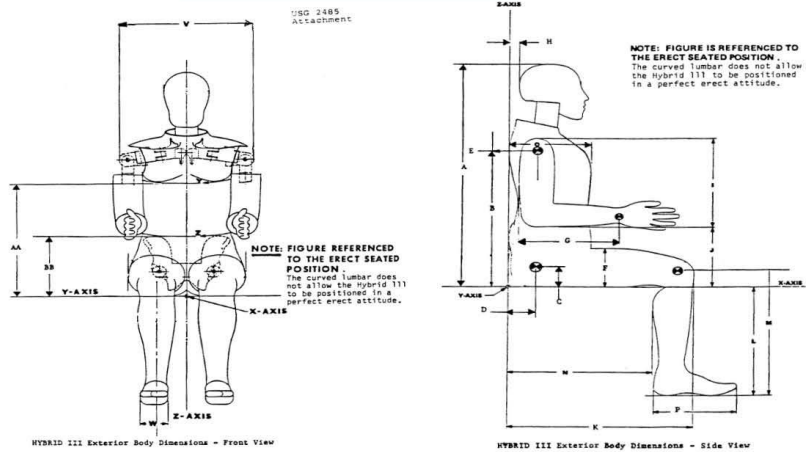


External Measurements - Hybrid 3 - 50th Male

Technician: K. Dutton

Date: 07/19/2019

Dummy Serial Number: 142



Symbol	Description	Specification (in)		Result (in)	Pass/Fail
A	Sitting Height	34.6	35.0	34.8	Pass
B	Shoulder Pivot Height	19.9	20.5	20.2	Pass
C	H-Point Height	3.3	3.5	3.4	Pass
D	H-Point from Backline	5.3	5.5	5.4	Pass
E	Shoulder Pivot from Backline	3.3	3.7	3.5	Pass
F	Thigh Clearance	5.5	6.1	5.8	Pass
G	Back of Elbow to Wrist Pivot	11.4	12.0	11.6	Pass
H	Head Back to Backline	1.6	1.8	1.7	Pass
I	Shoulder to Elbow Length	13.0	13.6	13.5	Pass
J	Elbow Rest Height	7.5	8.3	8.1	Pass
K	Buttock to Knee Length	22.8	23.8	23.4	Pass
L	Popliteal Height	16.9	17.9	17.4	Pass
M	Knee Pivot Height	19.1	19.7	19.4	Pass
N	Buttock Popliteal Length	17.8	18.8	18.4	Pass
O	Chest Depth without Jacket	8.4	9.0	8.7	Pass
P	Foot Length (right)	9.9	10.5	10.3	Pass
V	Shoulder Breadth	16.3	17.2	16.8	Pass
W	Foot Breadth	3.6	4.2	3.9	Pass
Y	Chest Circumference with Jacket	38.2	39.4	38.9	Pass
Z	Waist Circumference	32.9	34.1	33.7	Pass
AA	Reference Location (Chest Circumference)	16.9	17.1	17.0	Pass
BB	Reference Location (Waist Circumference)	8.9	9.1	9.0	Pass

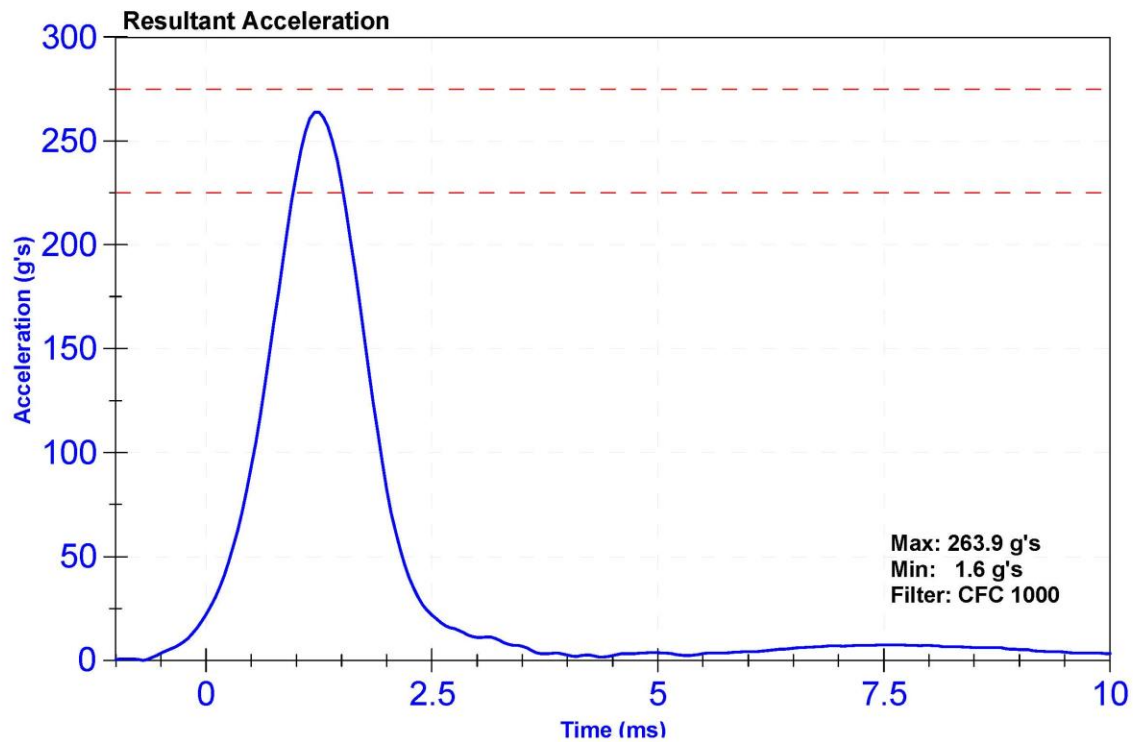
ATD Manufacturer	Humanetics	Test Technician	E. Helenbrook
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

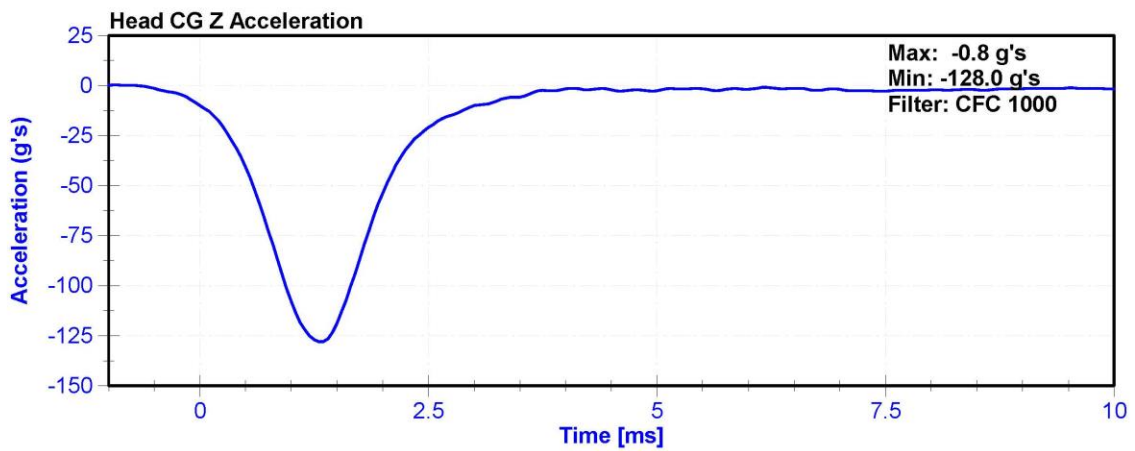
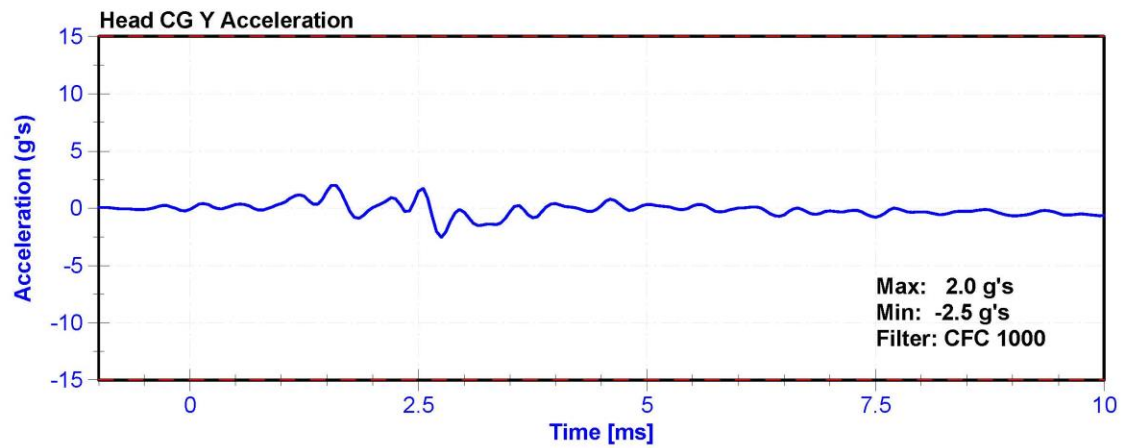
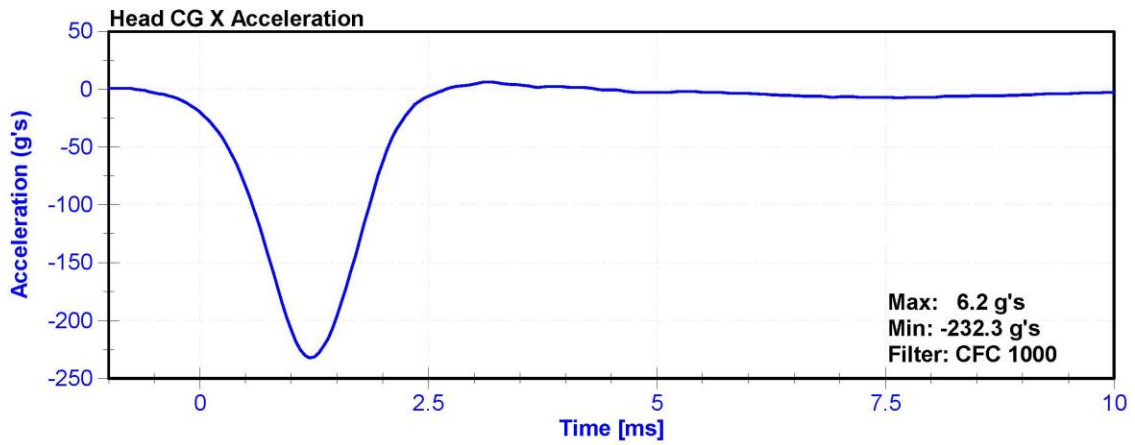
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.4	Pass
Humidity	10	70	%	56.8	Pass
Resultant Acceleration	225	275	g's	263.9	Pass
Oscillation	0	10	%	4.2	Pass
Lateral Acceleration	-15	15	g's	-2.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	P58998	4/19/2019	10/18/2020
Y Accelerometer	ENDEVCO 7264CT	P51722	4/19/2019	10/18/2020
Z Accelerometer	ENDEVCO 7264CT	P58997	4/19/2019	10/18/2020





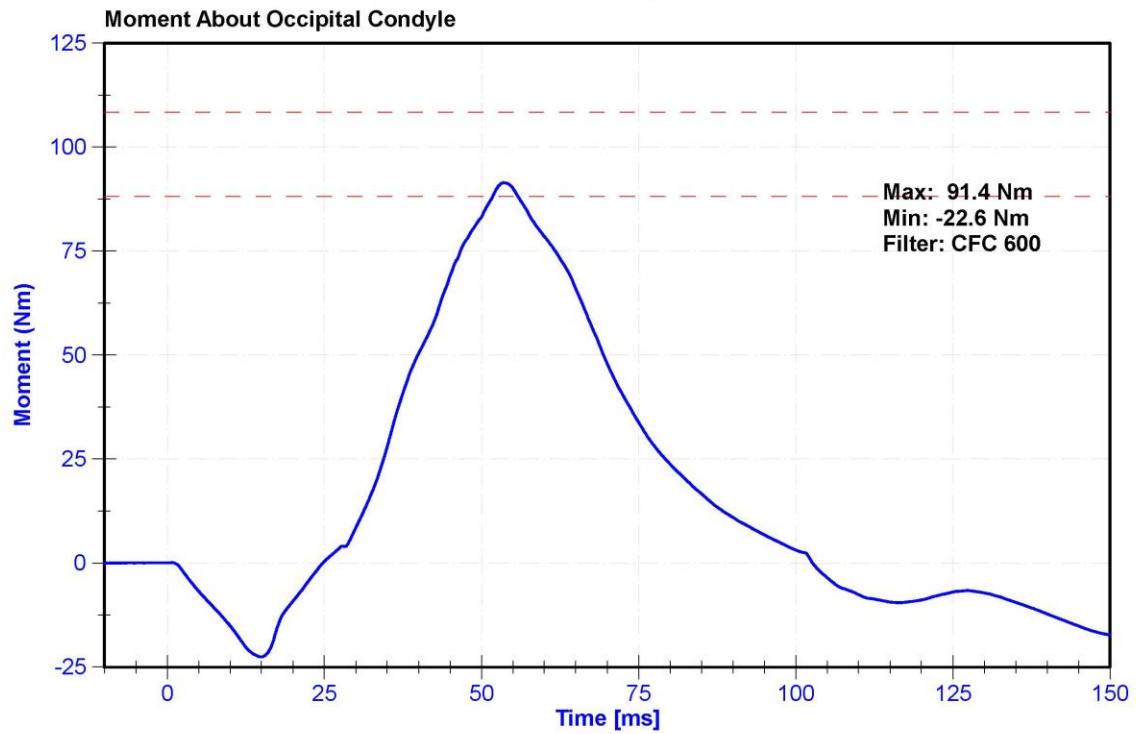
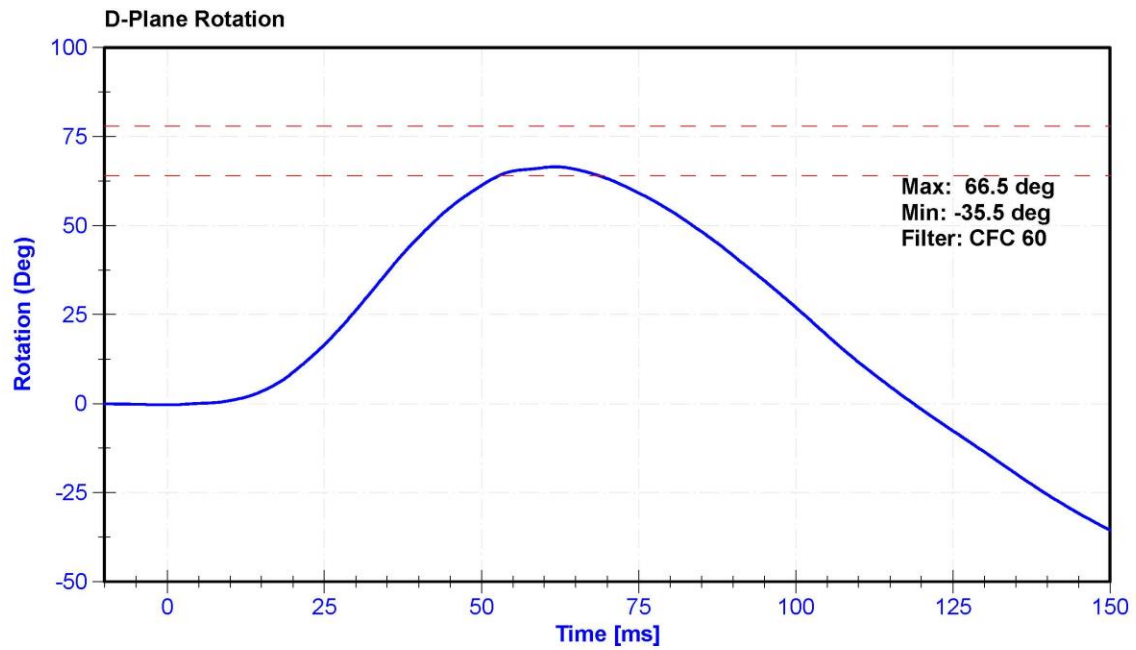
ATD Manufacturer	Humanetics	Test Technician	D.Reinhard
ATD Serial Number	142	Laboratory Supervisor	K.Brogan

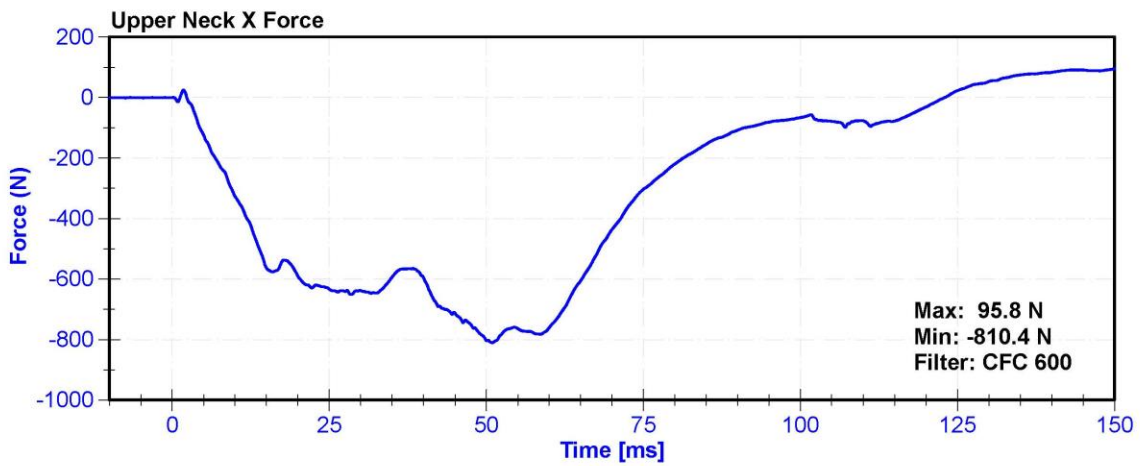
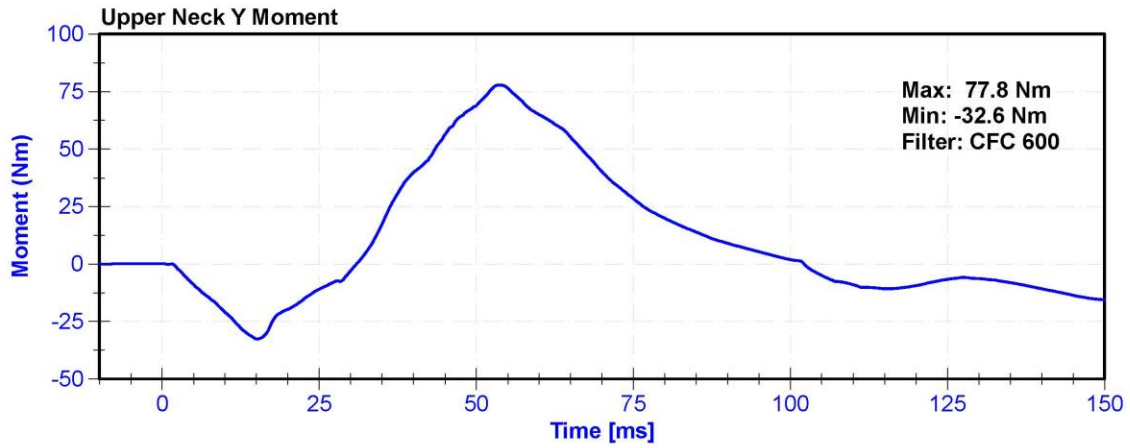
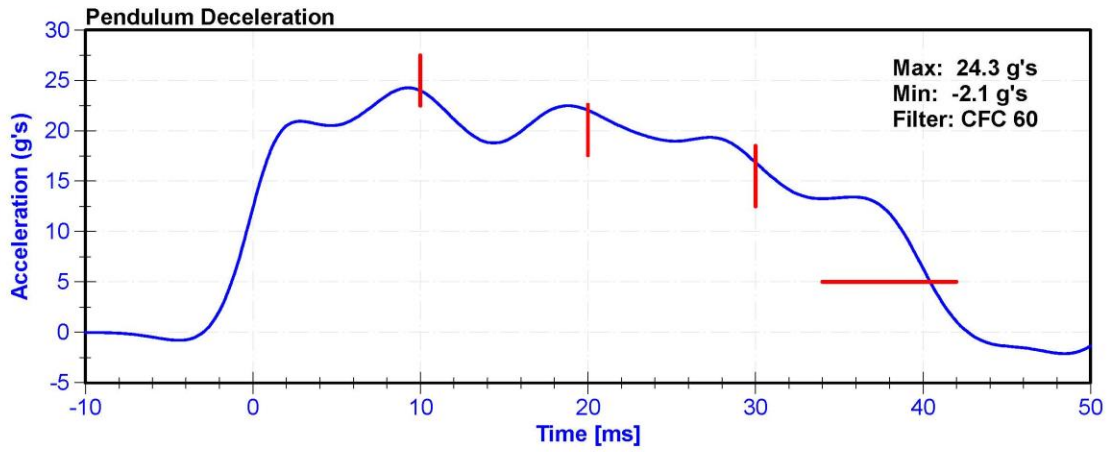
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.8	Pass
Humidity	10	70	%	49.8	Pass
Velocity	6.89	7.13	m/s	6.903	Pass
Pendulum Deceleration at 10ms	22.5	27.5	g's	23.99	Pass
Pendulum Deceleration at 20ms	17.6	22.6	g's	22.04	Pass
Pendulum Deceleration at 30ms	12.5	18.5	g's	16.87	Pass
Max. Pendulum Deceleration After 30ms	0	29	g's	24.3	Pass
Pendulum Deceleration Time to 5 g's	34	42	ms	40.4	Pass
Maximum D Plane Rotation	64	78	deg	66.5	Pass
Time to Maximum Rotation	57	64	ms	61.7	Pass
Rotation Decay to Zero	113	127	ms	118.7	Pass
Moment About Occipital Condyle	88.1	108.4	Nm	91.41	Pass
Time to Maximum Moment	47	58	ms	53.5	Pass
Moment Decay to Zero	97	107	ms	102.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
Pendulum Potentiometer	ETI SP22G	DS-LABPOT1	11/15/2018	11/15/2019
Condyle Potentiometer	ETI SP22G	DS-LABPOT2	11/15/2018	11/15/2019
Upper Neck Load Cell	FTSS IF-205	LC-161Fx	9/28/2018	9/28/2019





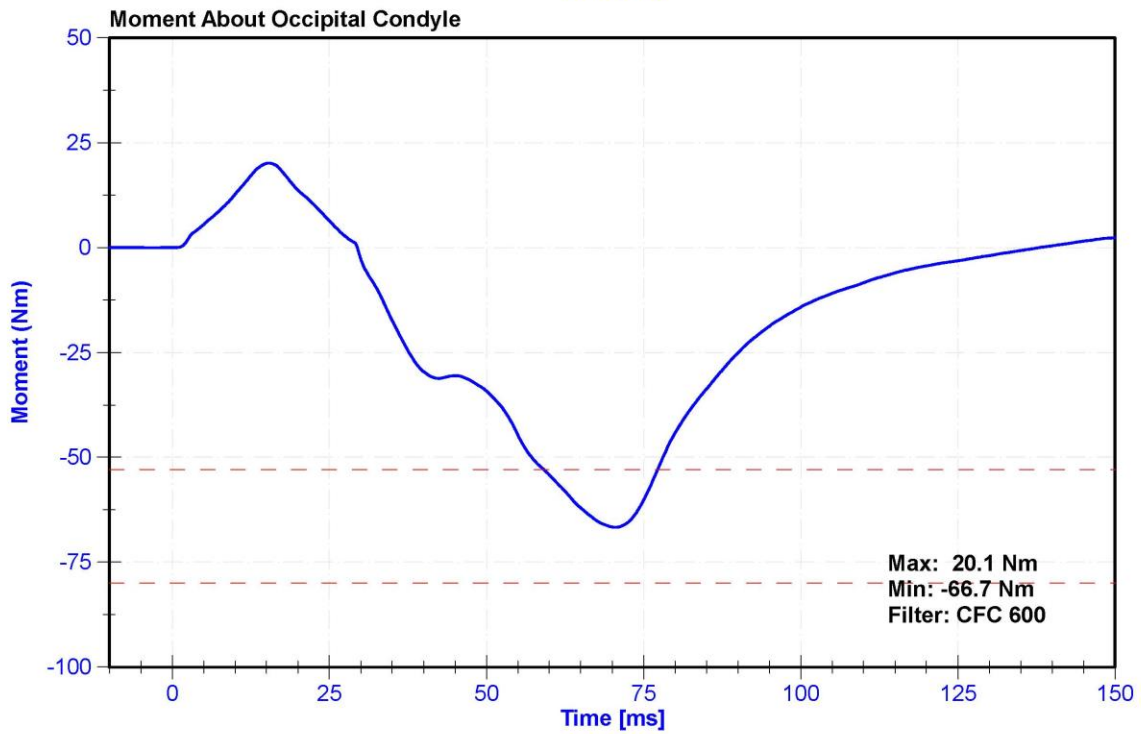
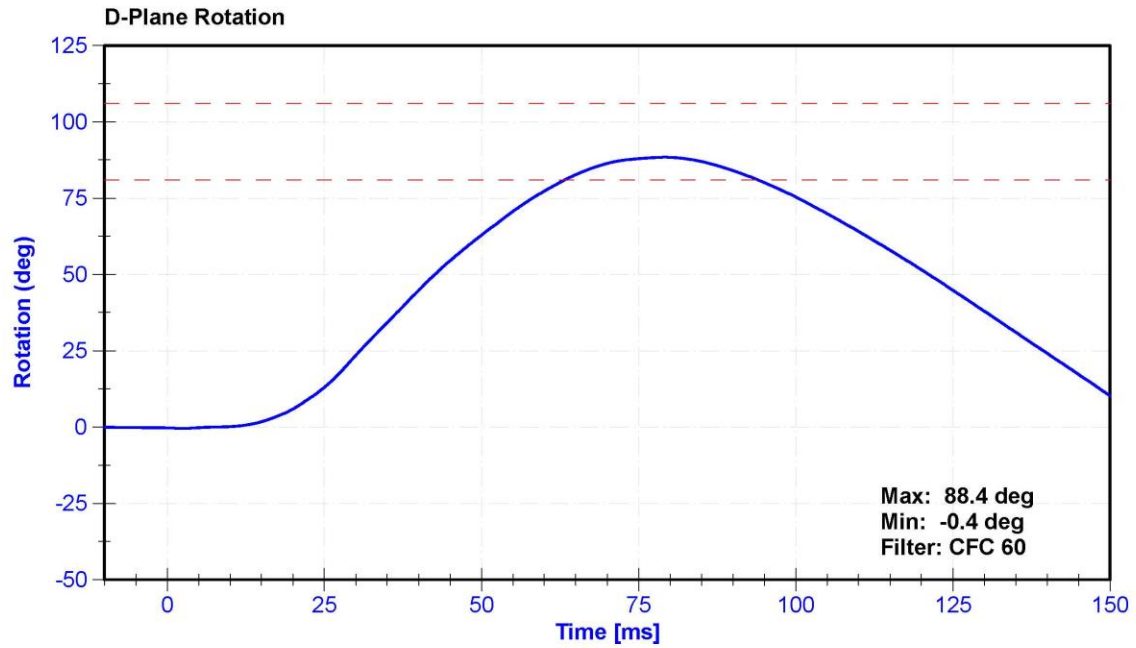
ATD Manufacturer	Humanetics	Test Technician	D.Reinhard
ATD Serial Number	142	Laboratory Supervisor	K.Brogan

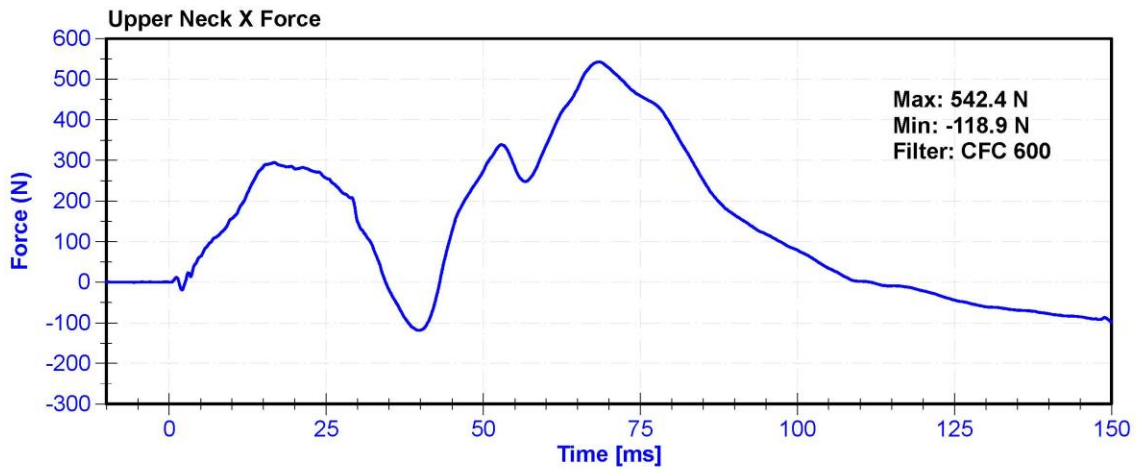
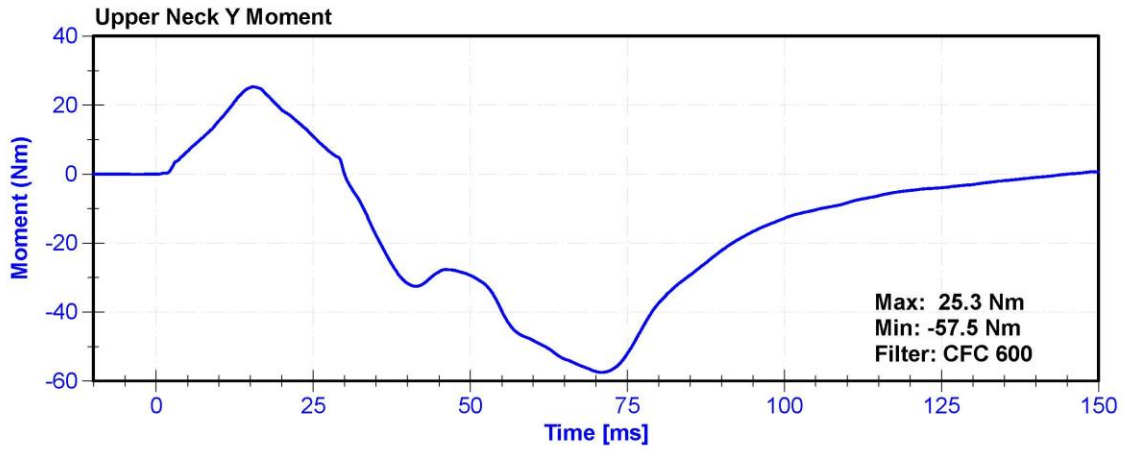
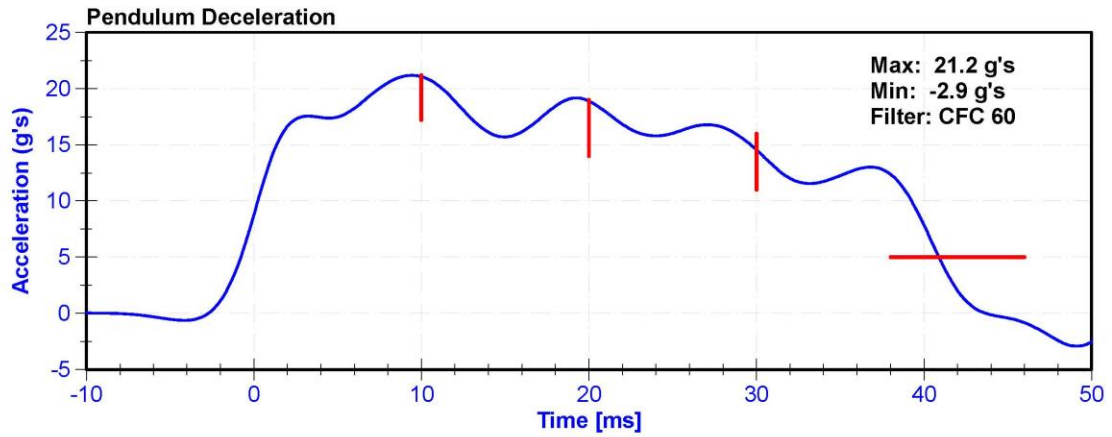
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22	Pass
Humidity	10	70	%	50.8	Pass
Velocity	5.94	6.19	m/s	5.964	Pass
Pendulum Deceleration at 10ms	17.2	21.2	g's	21.06	Pass
Pendulum Deceleration at 20ms	14	19	g's	18.9	Pass
Pendulum Deceleration at 30ms	11	16	g's	14.6	Pass
Max. Pendulum Deceleration After 30ms	0	22	g's	21.2	Pass
Pendulum Deceleration Time to 5 g's	38	46	ms	40.9	Pass
Maximum D Plane Rotation	81	106	deg	88.4	Pass
Time to Maximum Rotation	72	82	ms	79.2	Pass
Rotation Decay to Zero	147	174	ms	157.1	Pass
Minimum Moment About OC	-80	-52.9	Nm	-66.71	Pass
Time to Minimum Moment	65	79	ms	70.4	Pass
Moment Decay to Zero	120	148	ms	138.0	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	ETI SP22G	DS-LABPOT1	11/15/2018	11/15/2019
Condyle Potentiometer	ETI SP22G	DS-LABPOT2	11/15/2018	11/15/2019
Upper Neck Load Cell	FTSS IF-205	LC-161Fx	9/28/2018	9/28/2019





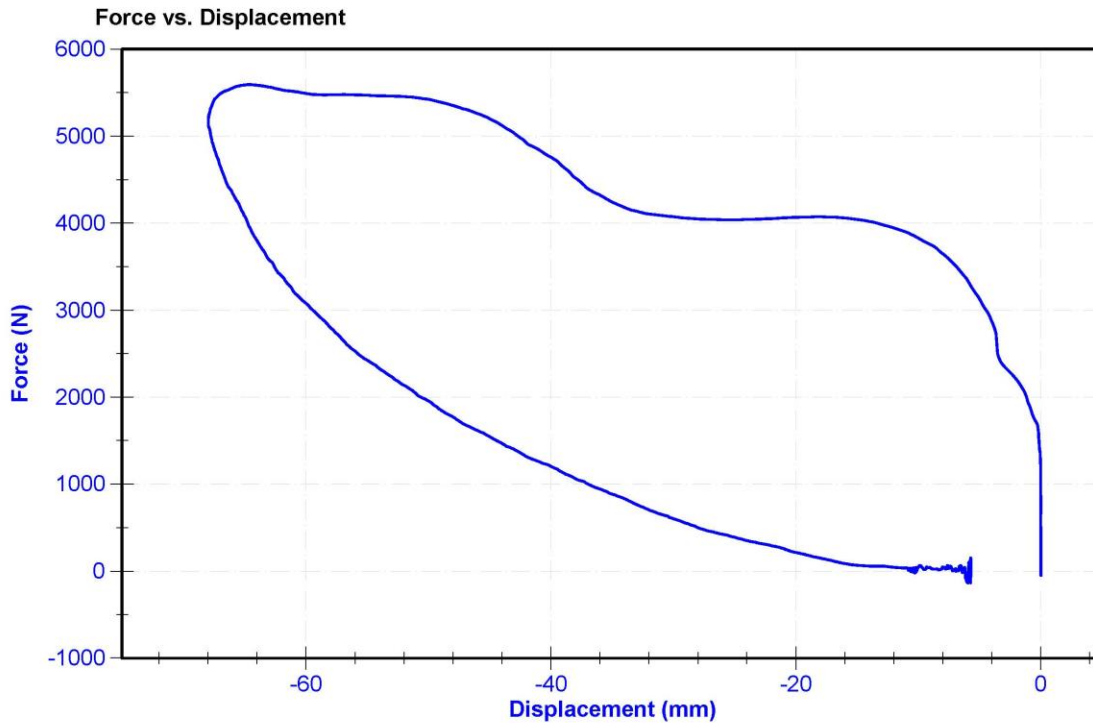
ATD Manufacturer	Humanetics	Test Technician	D.Reinhard
ATD Serial Number	142	Laboratory Supervisor	K.Brogan

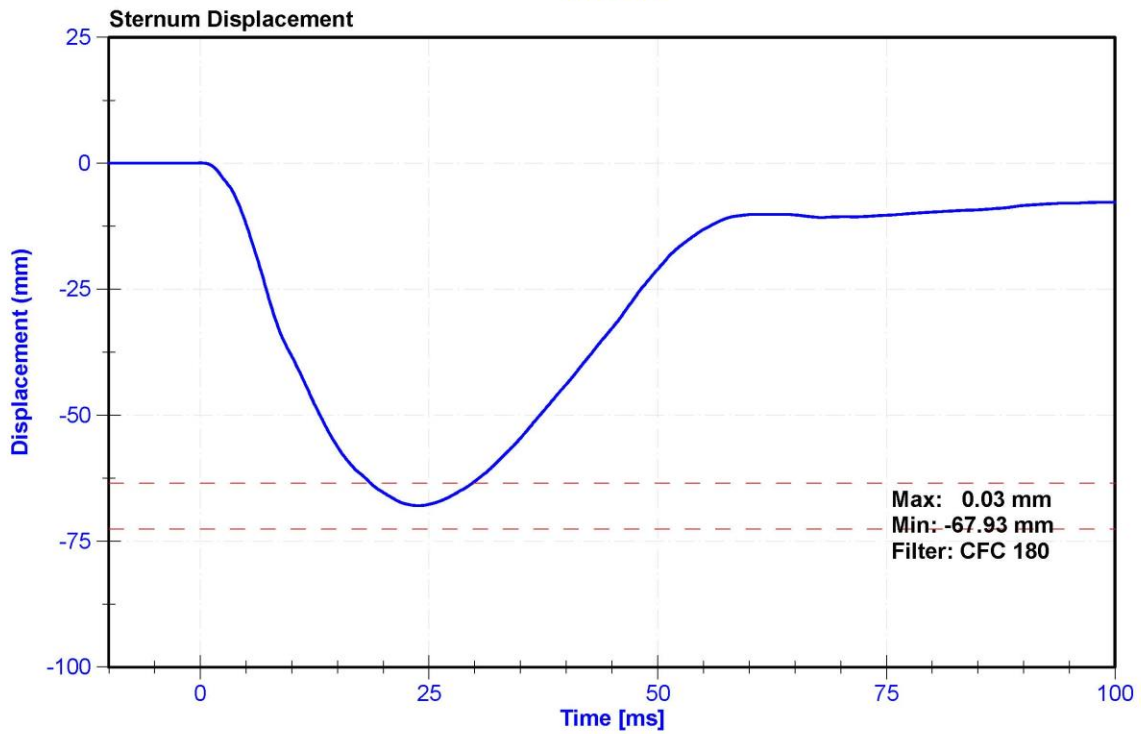
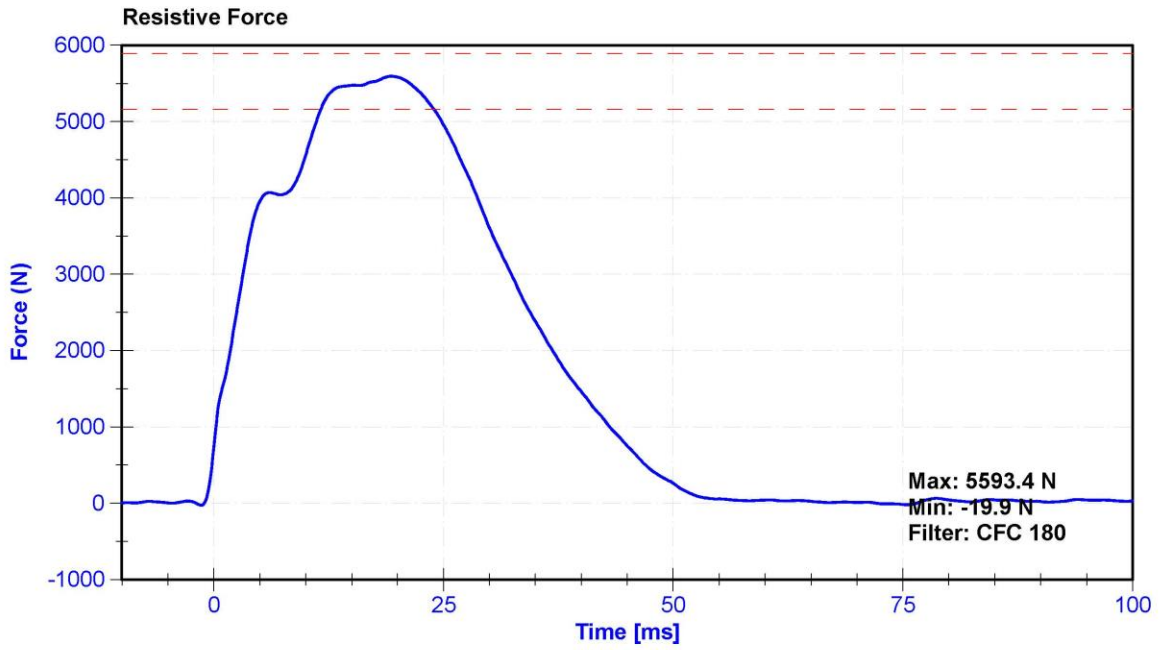
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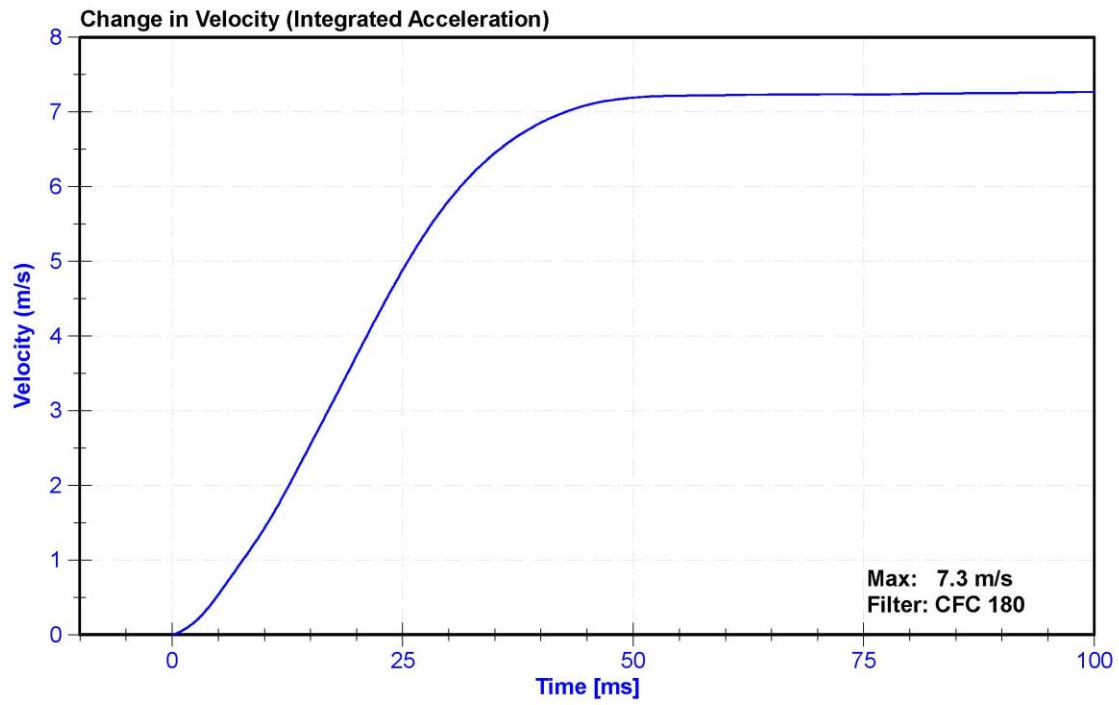
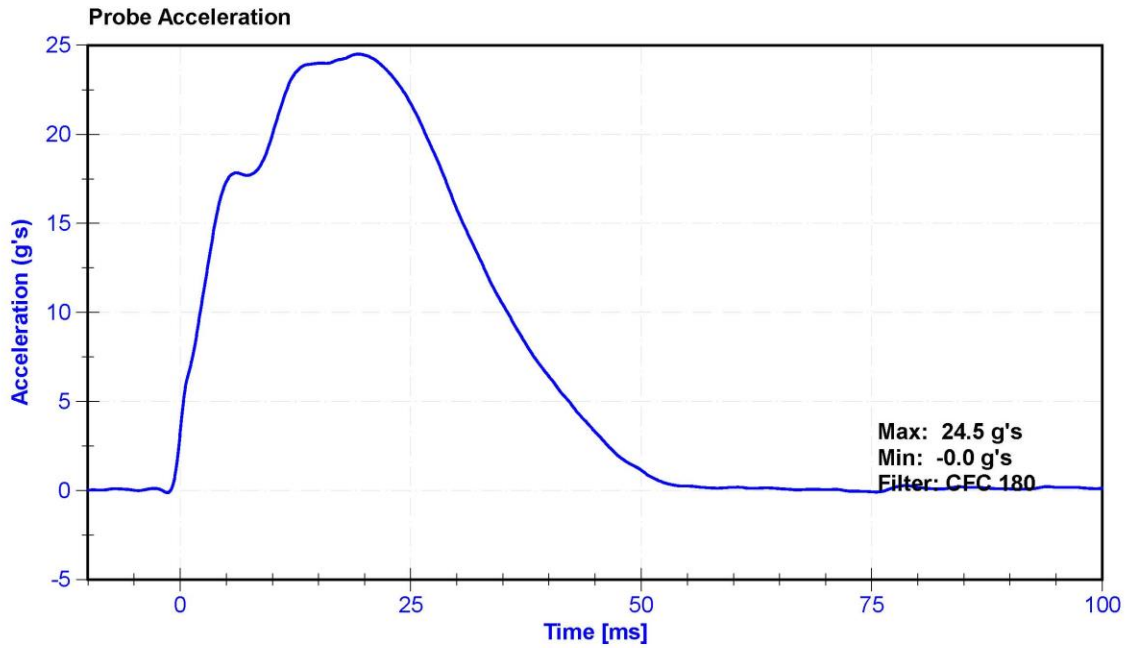
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22	Pass
Humidity	10	70	%	59	Pass
Velocity	6.59	6.83	m/s	6.612	Pass
Chest Displacement	-72.6	-63.5	mm	-67.93	Pass
Resistive Force	5160	5894	N	5593.4	Pass
Hysteresis	65	85	%	72.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P71278	12/14/2018	12/14/2019
Chest Potentiometer	JDK 6209-2038	DS-142	10/22/2018	10/22/2019







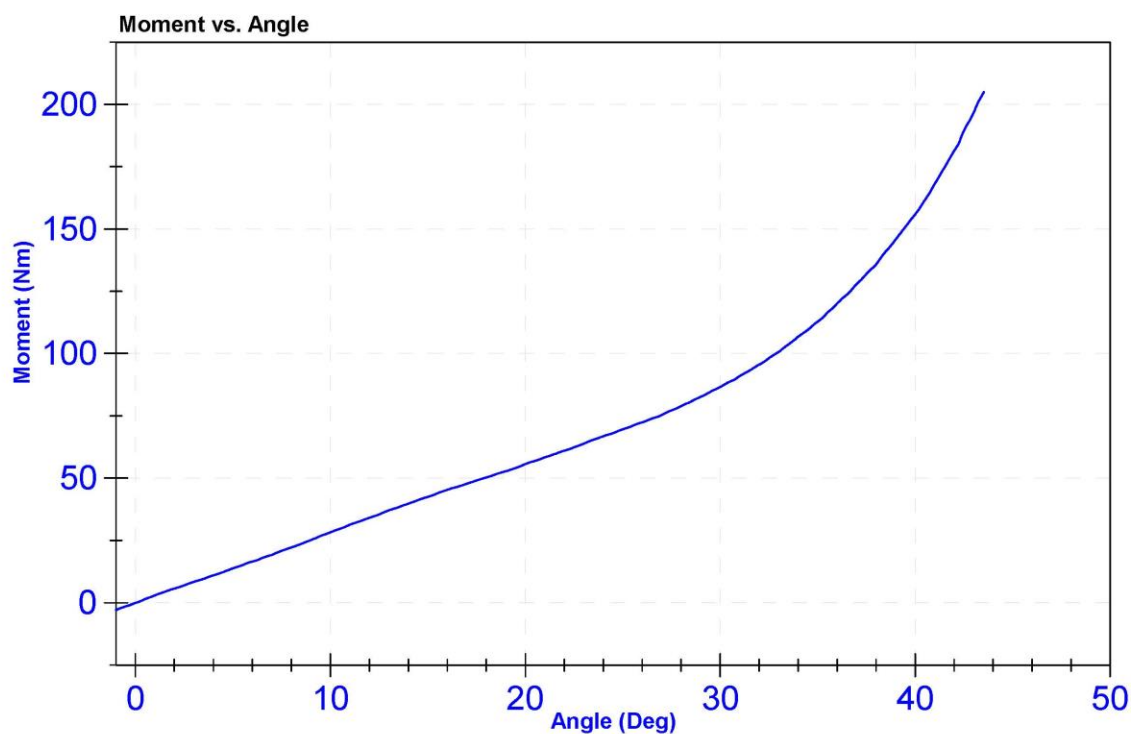
ATD Manufacturer	Humanetics	Test Technician	K. Dutton
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	20.9	Pass
Humidity	10	70	%	45.9	Pass
Average Velocity	5	10	deg/s	7.4	Pass
Angle at 203Nm	40	50	deg	43.4	Pass
Moment at 30 degrees	0	94.9	Nm	86.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	ETI SP22	DS-0008	9/18/2018	9/18/2019
Load Cell	Key Trans 2301-02	LC-115 My	9/6/2018	9/6/2019



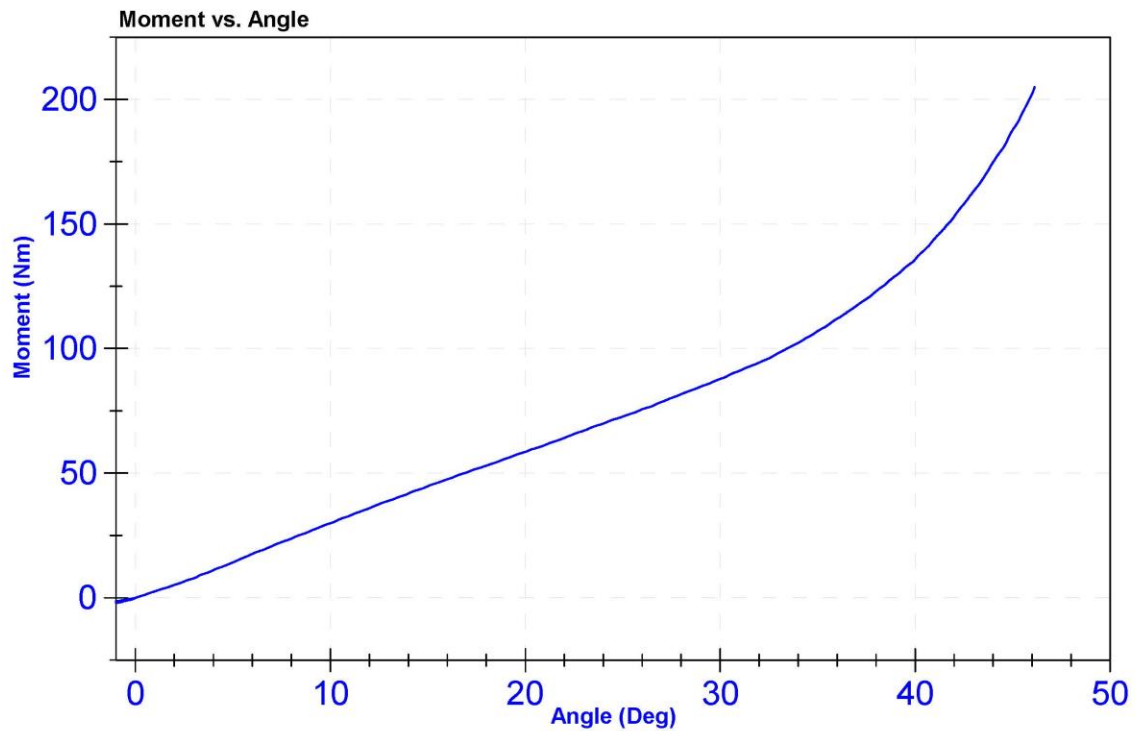
ATD Manufacturer	Humanetics	Test Technician	K. Dutton
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.0	Pass
Humidity	10	70	%	43.9	Pass
Average Velocity	5	10	deg/s	7.5	Pass
Angle at 203Nm	40	50	deg	46.0	Pass
Moment at 30 degrees	0	94.9	Nm	87.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	ETI SP22	DS-0008	9/18/2018	9/18/2019
Load Cell	Key Trans 2301-02	LC-115 My	9/6/2018	9/6/2019



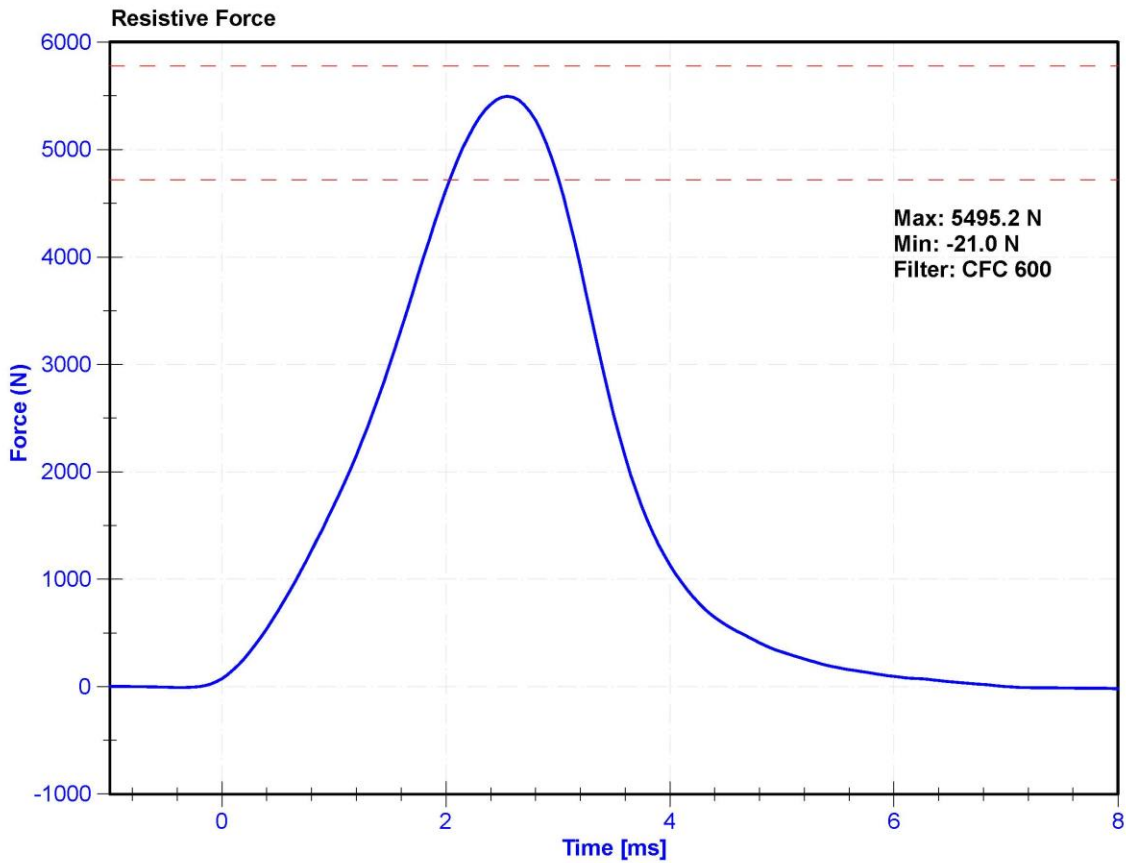
ATD Manufacturer	Humanetics	Test Technician	D.Reinhard
ATD Serial Number	142	Laboratory Supervisor	K.Brogan

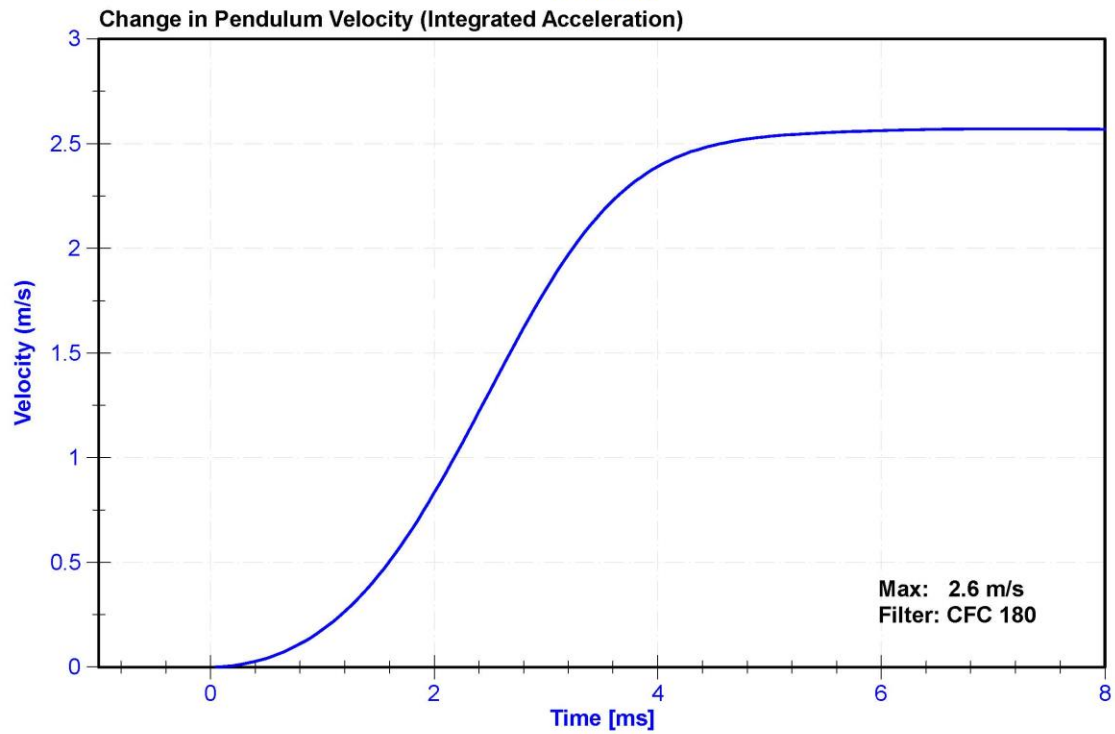
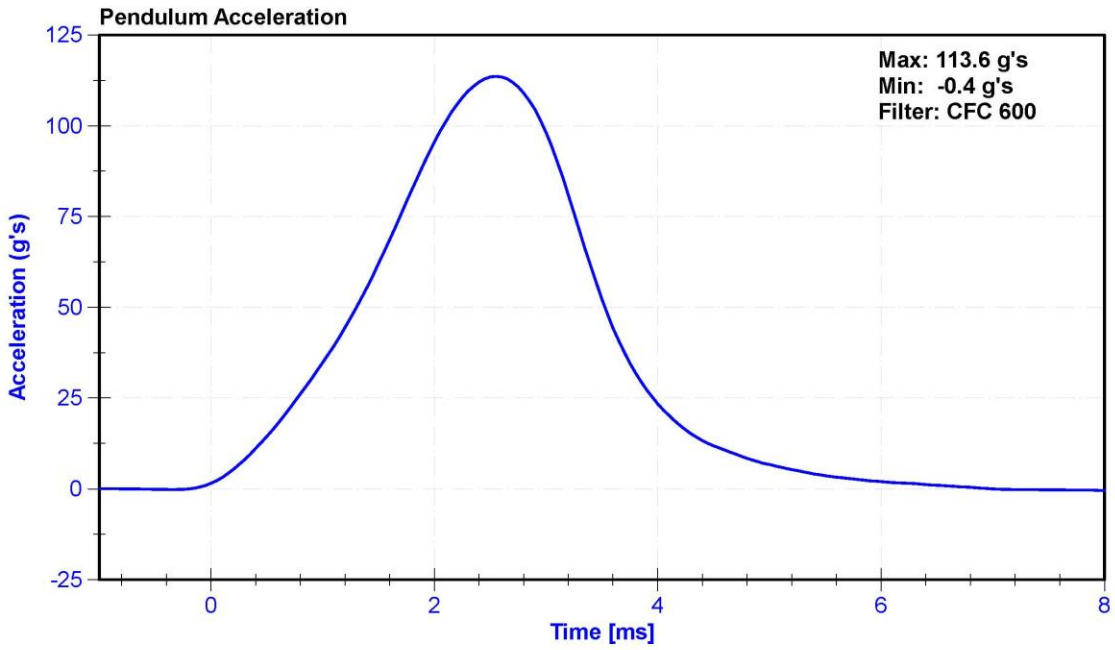
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.1	Pass
Humidity	10	70	%	61	Pass
Velocity	2.07	2.13	m/s	2.102	Pass
Maximum Resistive Force	4720	5780	N	5495.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019





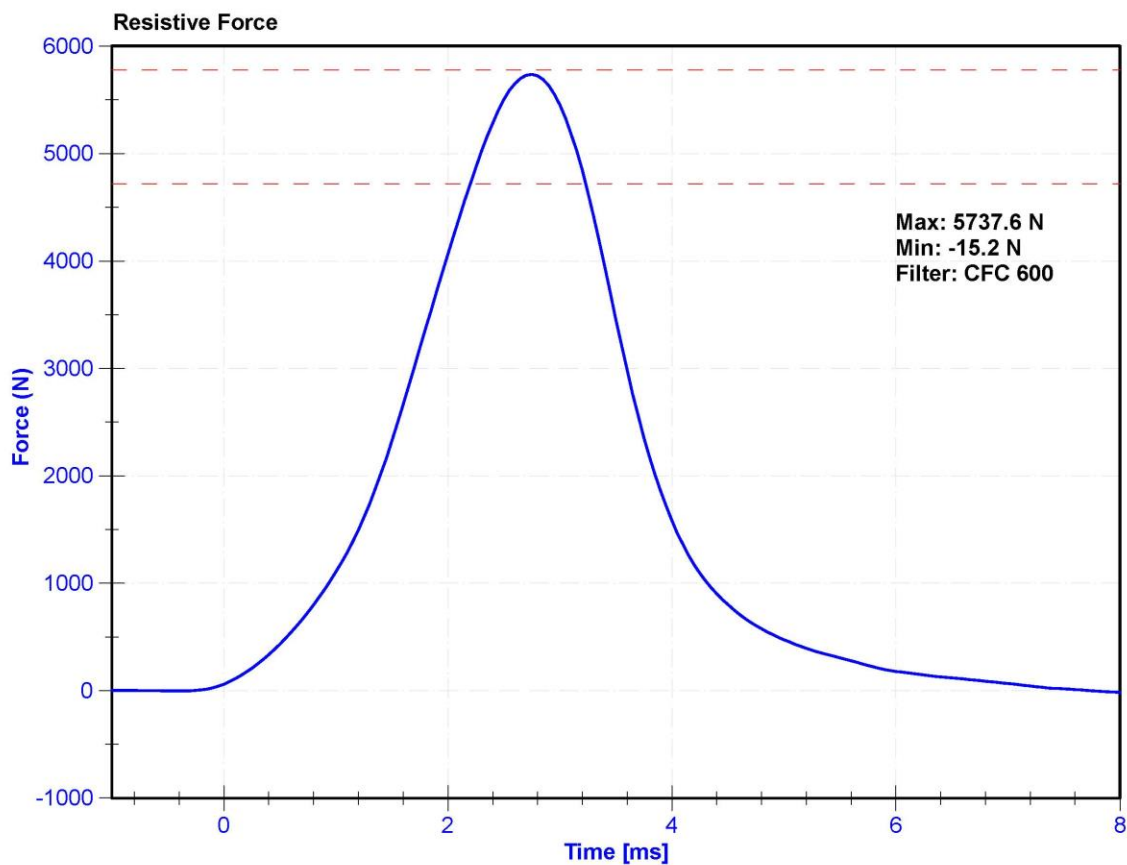
ATD Manufacturer	Humanetics	Test Technician	D.Reinhard
ATD Serial Number	142	Laboratory Supervisor	K.Brogan

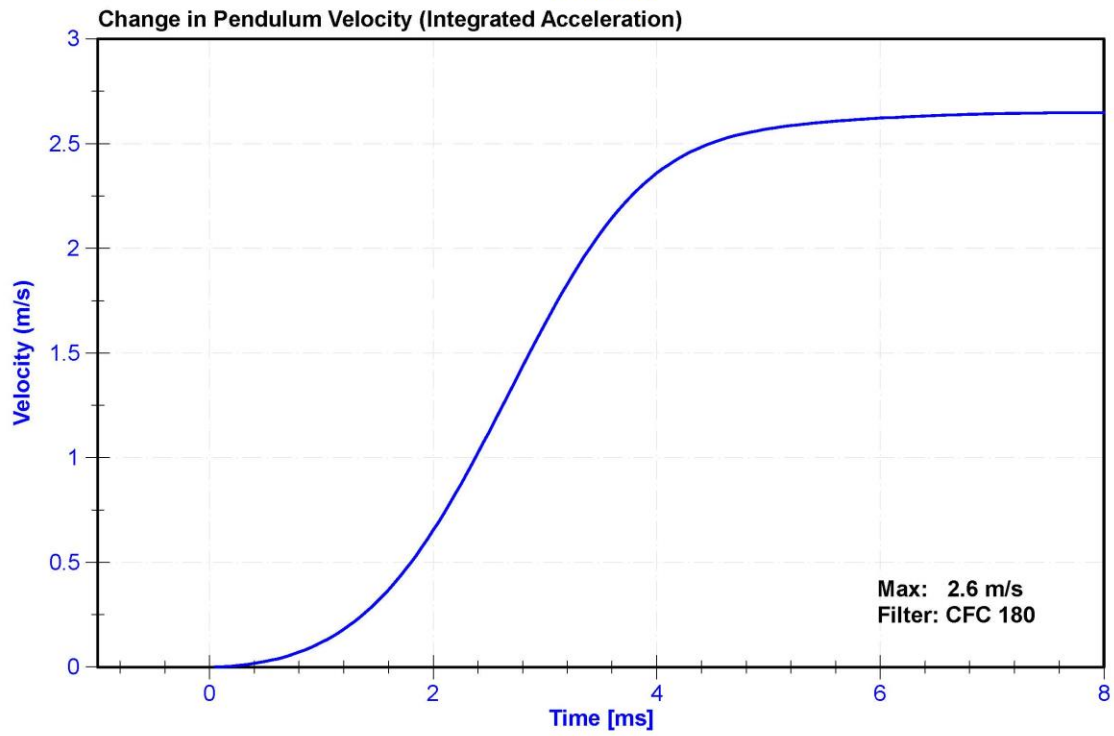
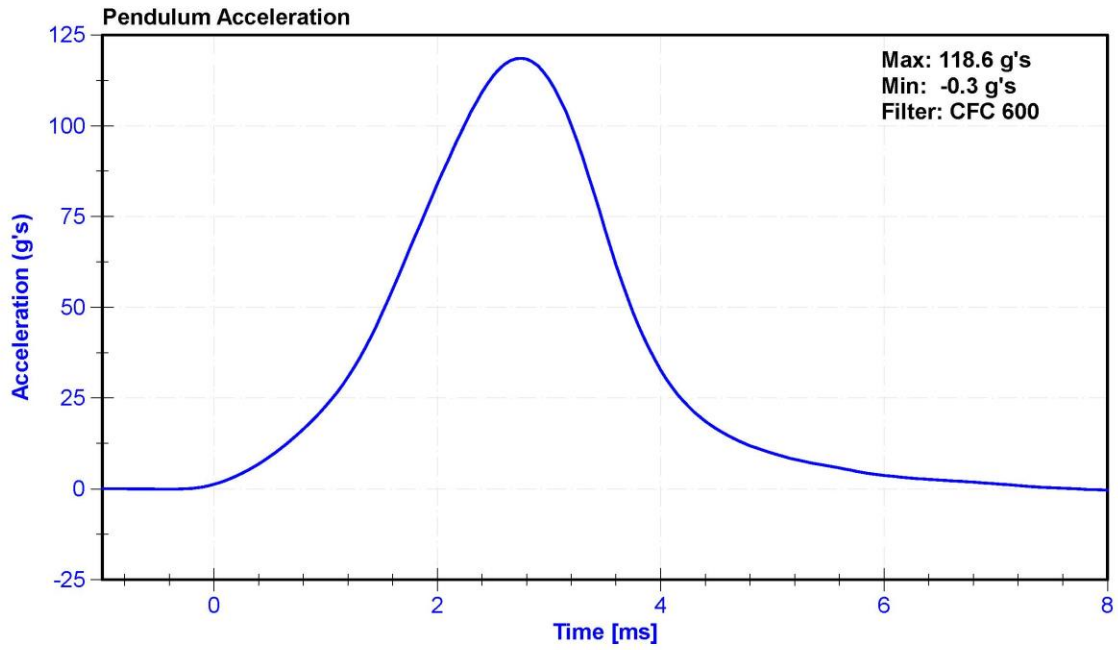
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.1	Pass
Humidity	10	70	%	57.5	Pass
Velocity	2.07	2.13	m/s	2.102	Pass
Maximum Resistive Force	4720	5780	N	5737.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019





CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 5TH PERCENTILE - PASSENGER ATD

SERIAL NO: 288

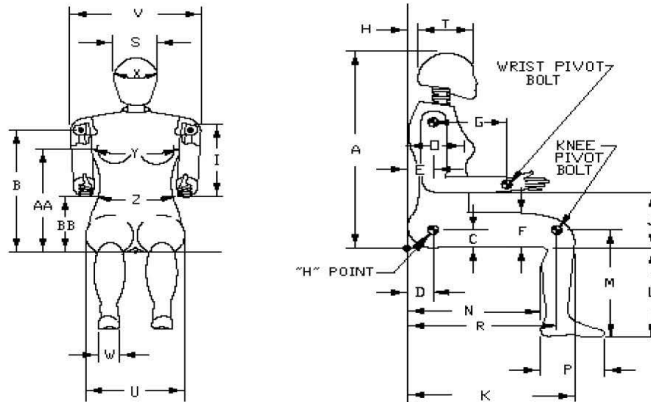


External Measurements - Hybrid 3 - 5th Female

Technician: K. Dutton

Date: 07/19/2019

Dummy Serial Number: 288



Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	775	800	787	Pass
B	Shoulder Pivot Height	432	457	450	Pass
C	H-Point Height	81	86	84	Pass
D	H-Point from Backline	145	150	148	Pass
E	Shoulder Pivot from Backline	69	84	77	Pass
F	Thigh Clearance	119	135	126	Pass
G	Back of Elbow to Wrist Pivot	244	259	256	Pass
H	Head Back to Backline	43	48	45	Pass
I	Shoulder to Elbow Length	277	297	284	Pass
J	Elbow Rest Height	183	203	192	Pass
K	Buttock to Knee Length	521	546	538	Pass
L	Popliteal Height	356	376	365	Pass
M	Knee Pivot Height	394	419	407	Pass
N	Buttock Popliteal Length	414	439	429	Pass
O	Chest Depth without Jacket	175	191	180	Pass
P	Foot Length (right)	219	234	221	Pass
R	Buttock To Knee Pivot Length	457	483	465	Pass
S	Head Breadth	137	147	142	Pass
T	Head Depth	178	188	183	Pass
U	Hip Breadth	300	315	310	Pass
V	Shoulder Breadth	351	366	361	Pass
W	Foot Breadth	79	94	85	Pass
X	Head Circumference	528	549	537	Pass
Y	Chest Circumference with Jacket	851	881	865	Pass
Z	Waist Circumference	460	790	777	Pass
AA	Reference Location (Chest Circumference)	333	358	345	Pass
BB	Reference Location (Waist Circumference)	160	170	164	Pass

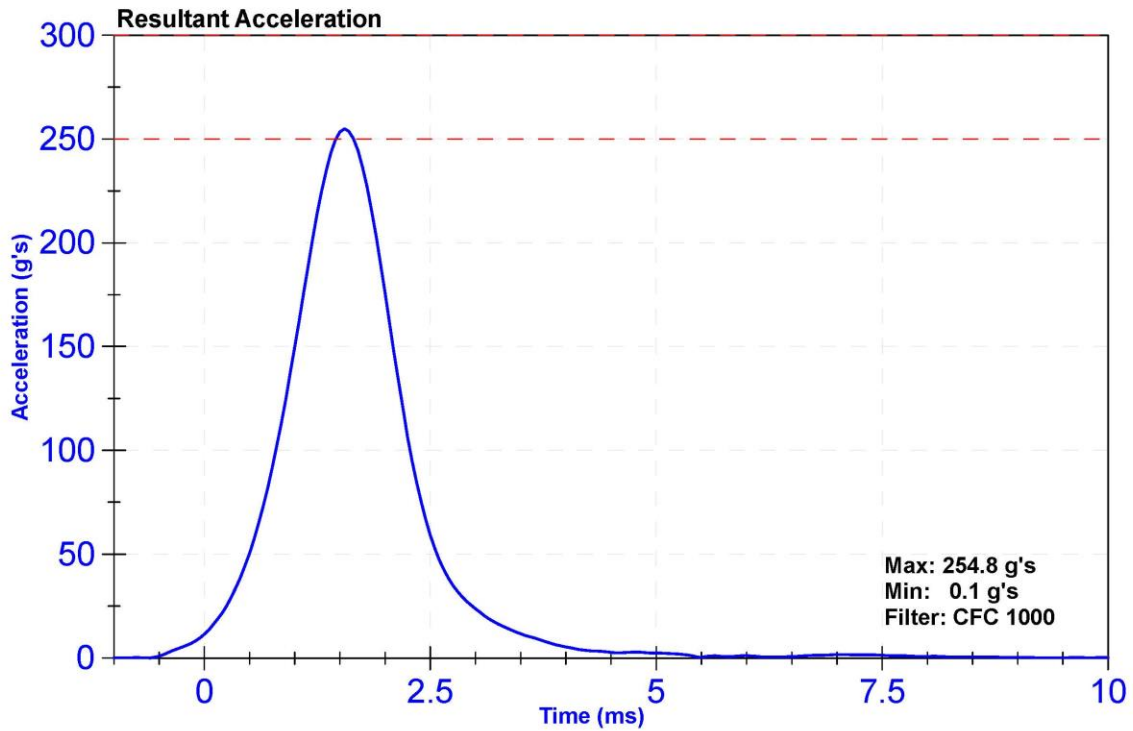
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	288	Laboratory Supervisor	K. Brogan

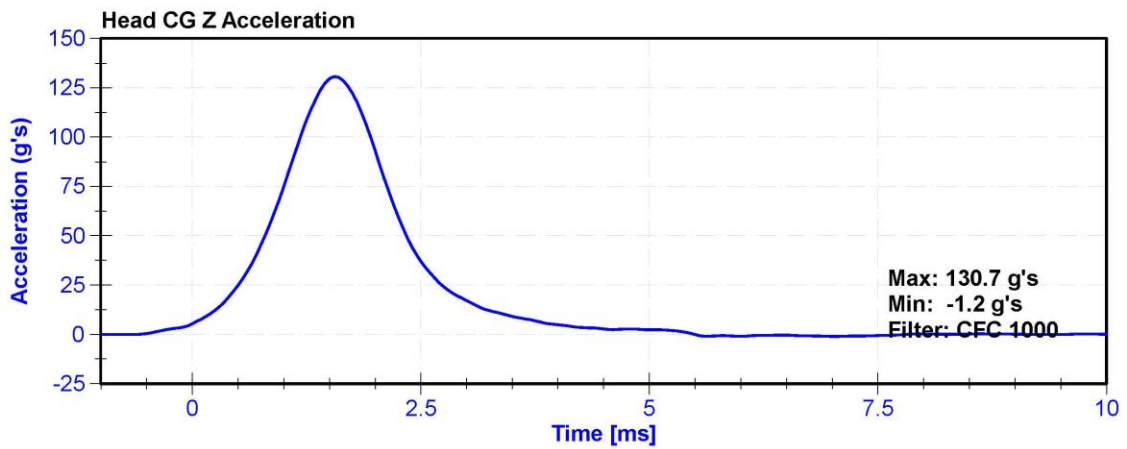
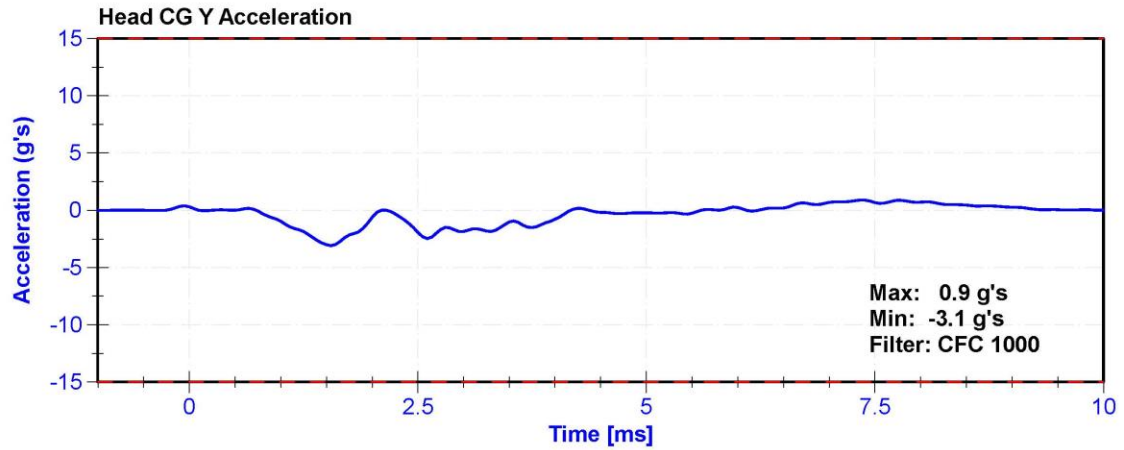
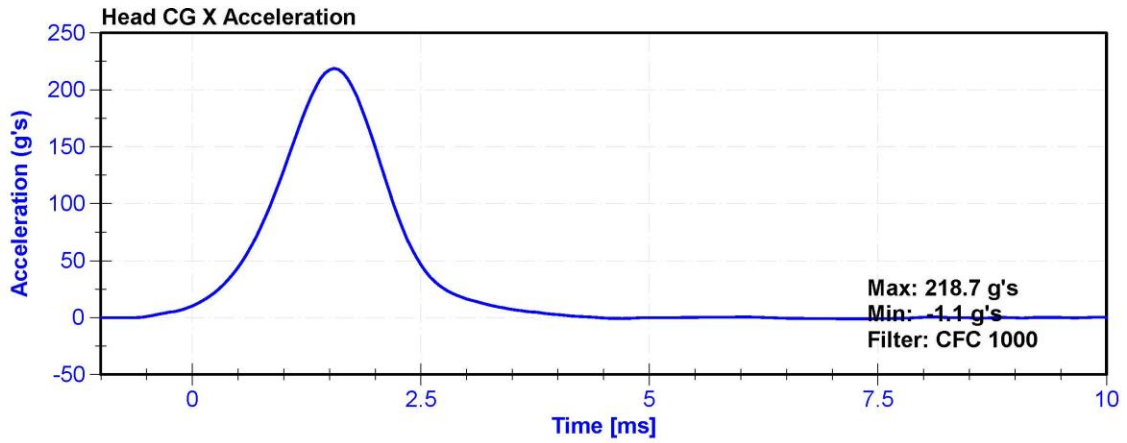
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	20.9	Pass
Humidity	10	70	%	50.5	Pass
Resultant Acceleration	250	300	g's	254.8	Pass
Oscillation	0	10	%	1.1	Pass
Lateral Acceleration	-15	15	g's	-3.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P52133	4/9/2019	10/8/2019
Y Accelerometer	ENDEVCO 7264	AC-P12359	4/9/2019	10/8/2019
Z Accelerometer	ENDEVCO 7264CT	AC-P58871	4/9/2019	10/8/2019





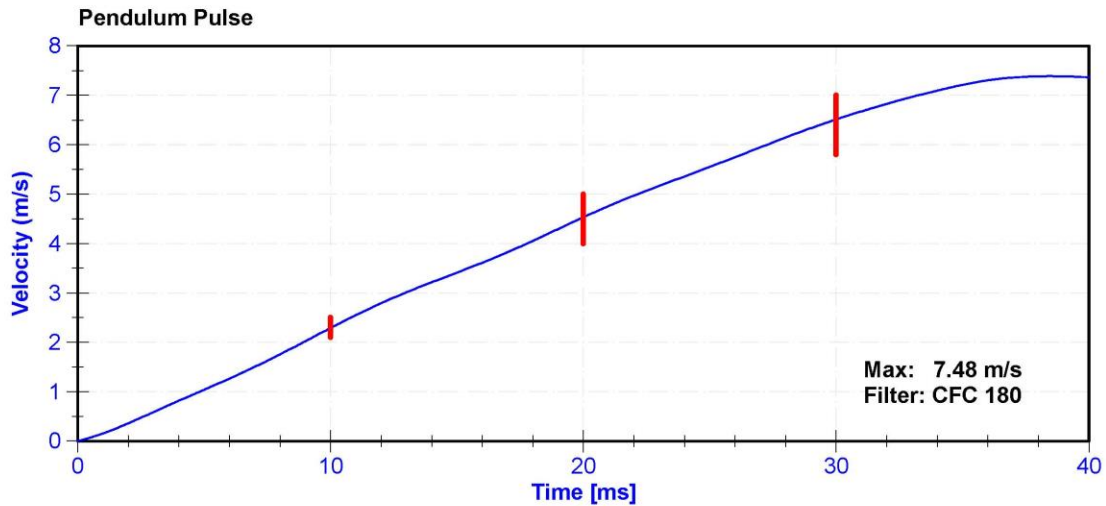
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	288	Laboratory Supervisor	K. Brogan

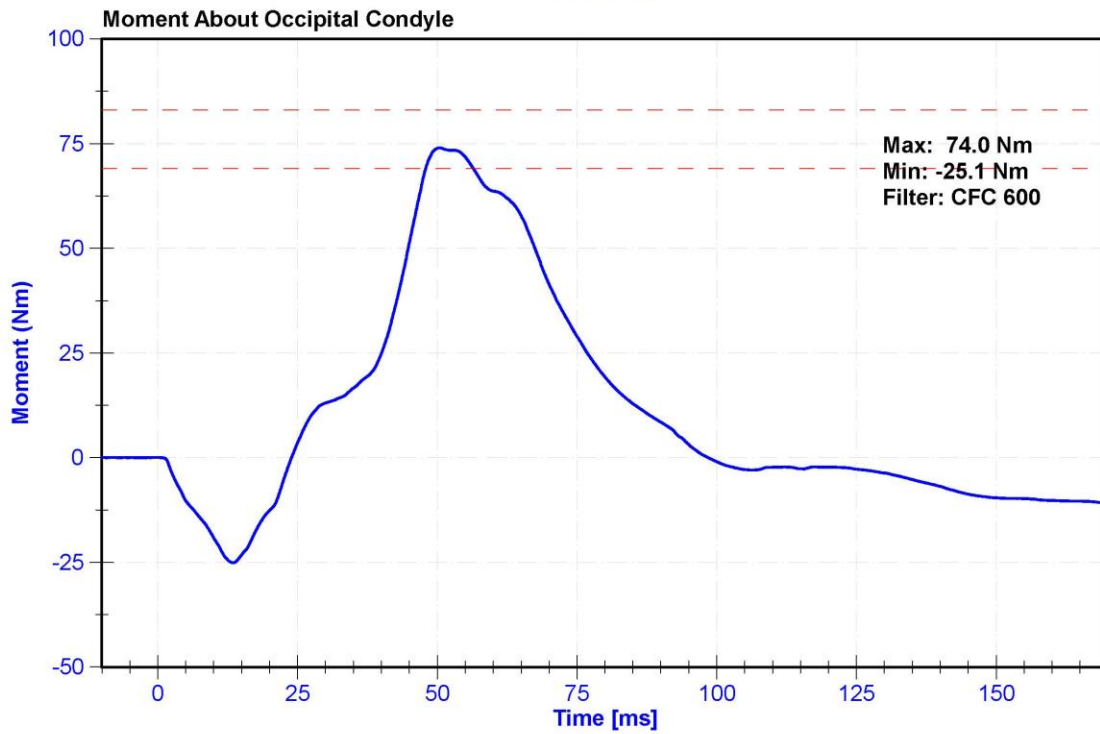
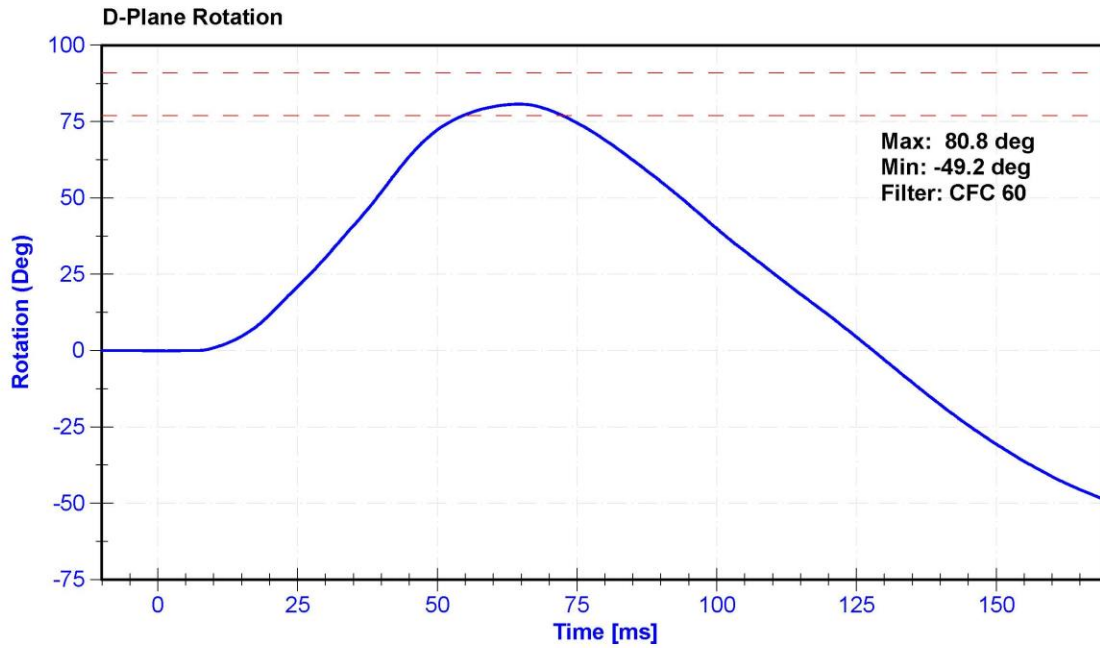
Results

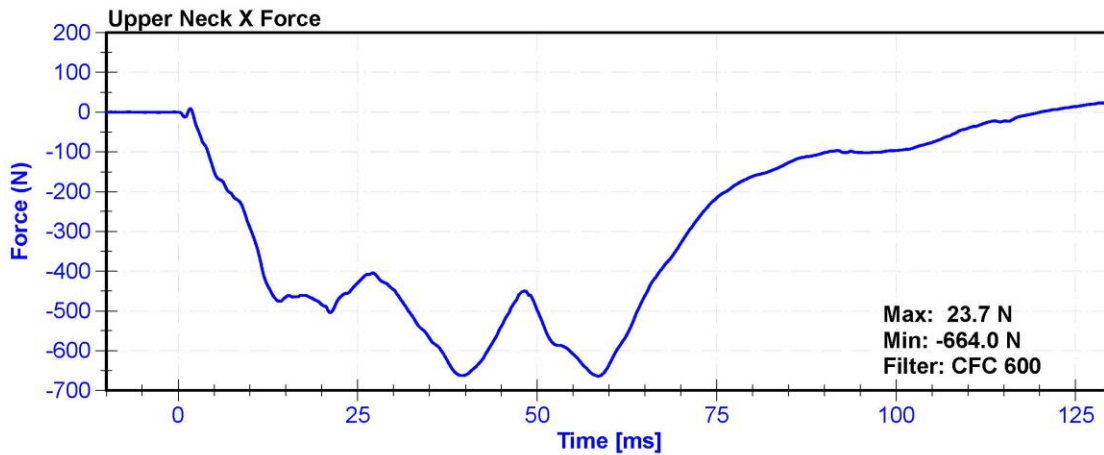
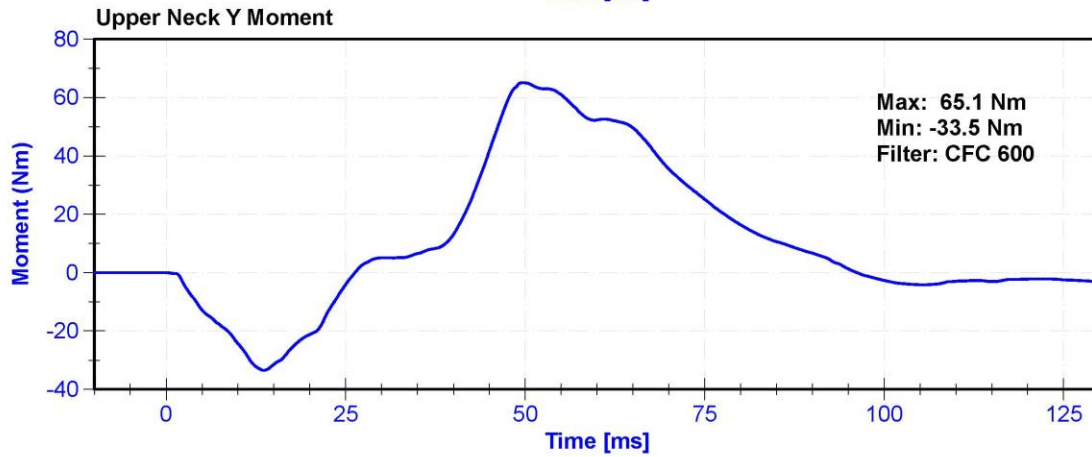
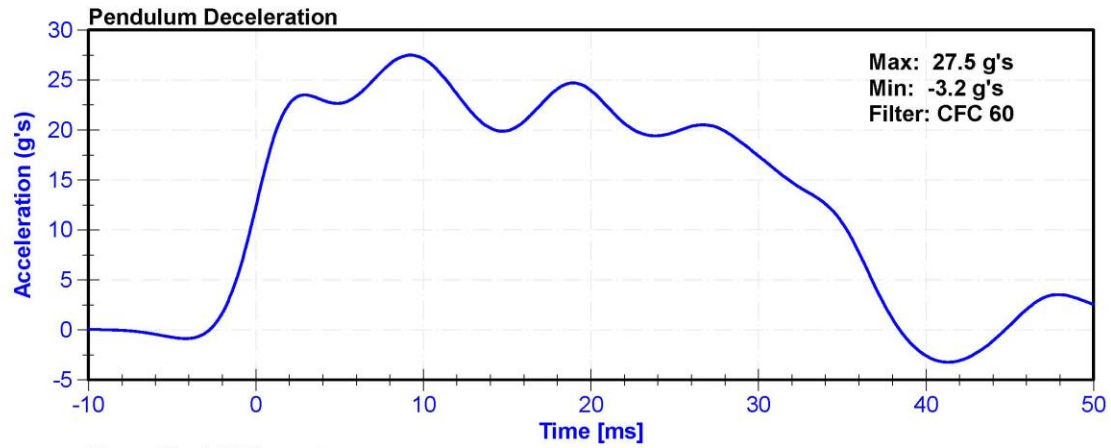
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	48.5	Pass
Velocity	6.89	7.13	m/s	6.958	Pass
Pendulum Impulse at 10ms	2.1	2.5	m/s	2.29	Pass
Pendulum Impulse at 20ms	4.0	5.0	m/s	4.53	Pass
Pendulum Impulse at 30ms	5.8	7.0	m/s	6.51	Pass
Max D Plane Rotation	77	91	deg	80.8	Pass
Max Moment During Rotation Interval	69	83	Nm	74.0	Pass
Moment Decay to 10.0 Nm	80	100	ms	88.2	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	ETI SP22G	DS-LABPOT1	11/15/2018	11/15/2019
Condyle Potentiometer	ETI SP22G	DS-LABPOT2	11/15/2018	11/15/2019
Upper Neck Load Cell	DENTON 1716A	LC-1591Fx	9/28/2018	9/28/2019







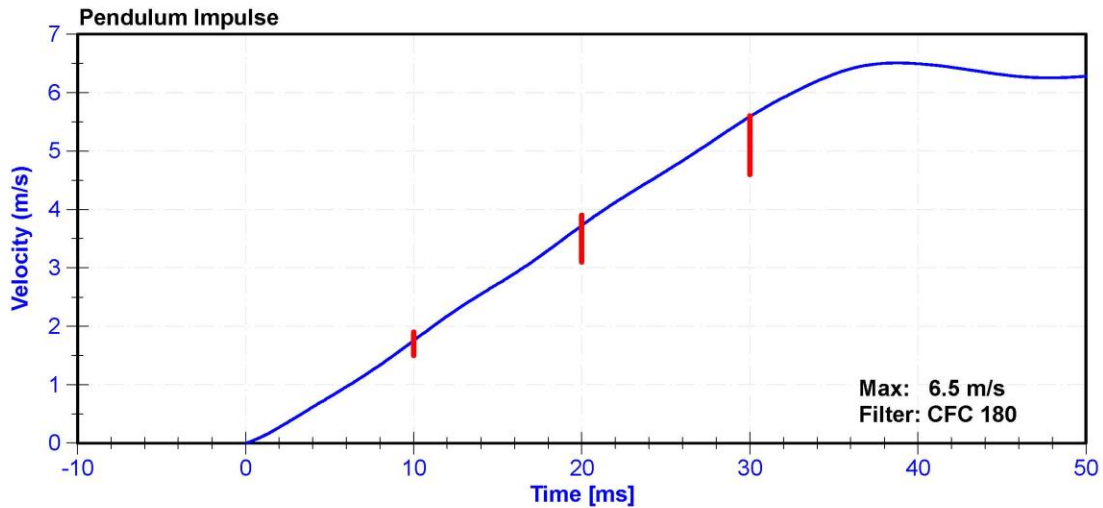
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	288	Laboratory Supervisor	K. Brogan

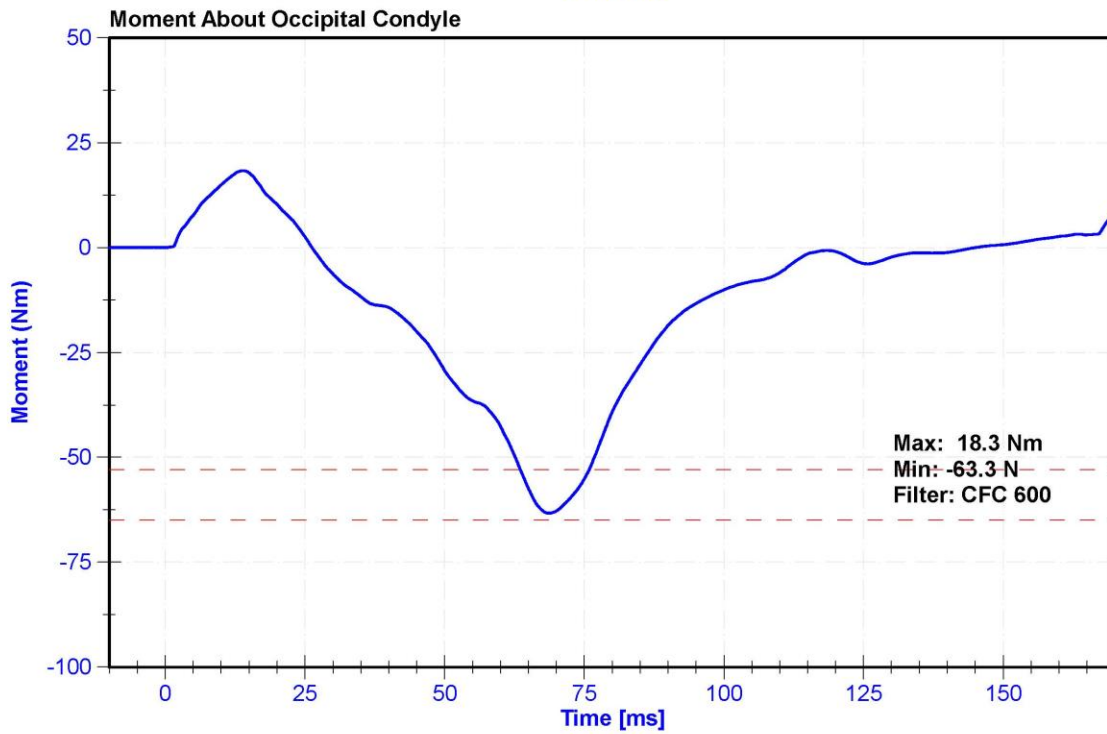
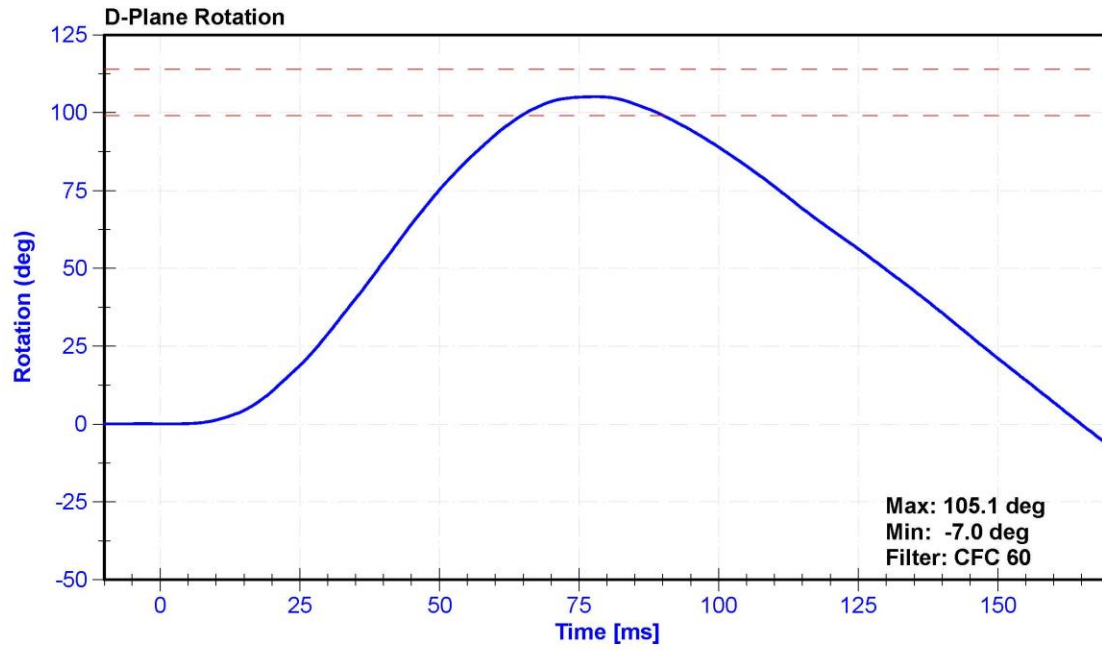
Results

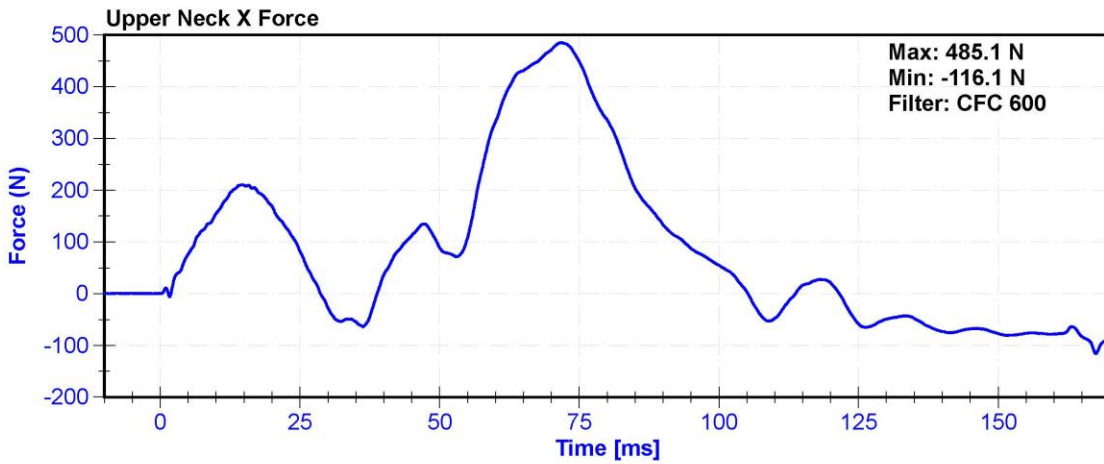
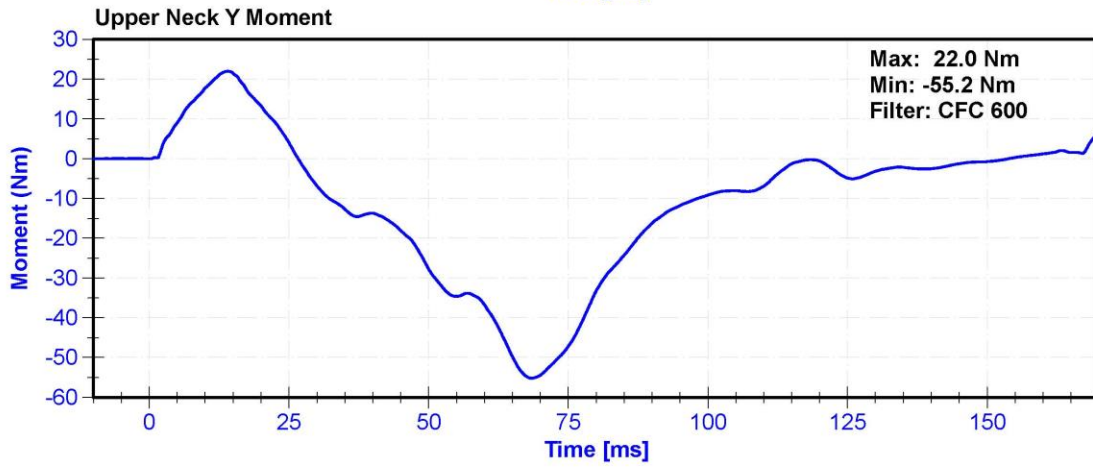
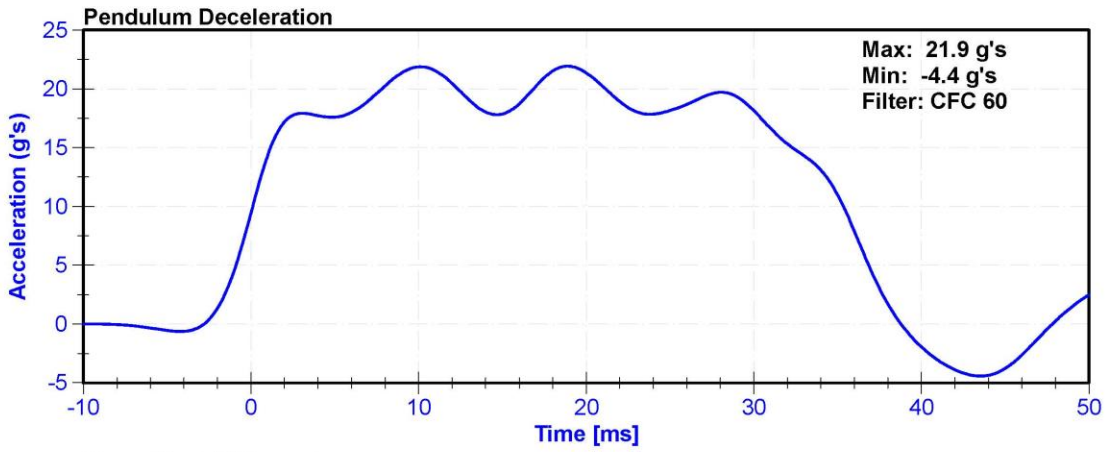
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	62.9	Pass
Velocity	5.95	6.19	m/s	6.005	Pass
Pendulum Impulse at 10ms	1.5	1.9	m/s	1.75	Pass
Pendulum Impulse at 20ms	3.1	3.9	m/s	3.73	Pass
Pendulum Impulse at 30ms	4.6	5.6	m/s	5.59	Pass
D Plane Rotation	99	114	deg	105.1	Pass
Moment During Rotation Interval	-65	-53	Nm	-63.3	Pass
Moment Decay to -10Nm	94	114	ms	100.2	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	ETI SP22G	DS-LABPOT1	11/15/2018	11/15/2019
Condyle Potentiometer	ETI SP22G	DS-LABPOT2	11/15/2018	11/15/2019
Upper Neck Load Cell	DENTON 1716A	LC-1591Fx	9/28/2018	9/28/2019







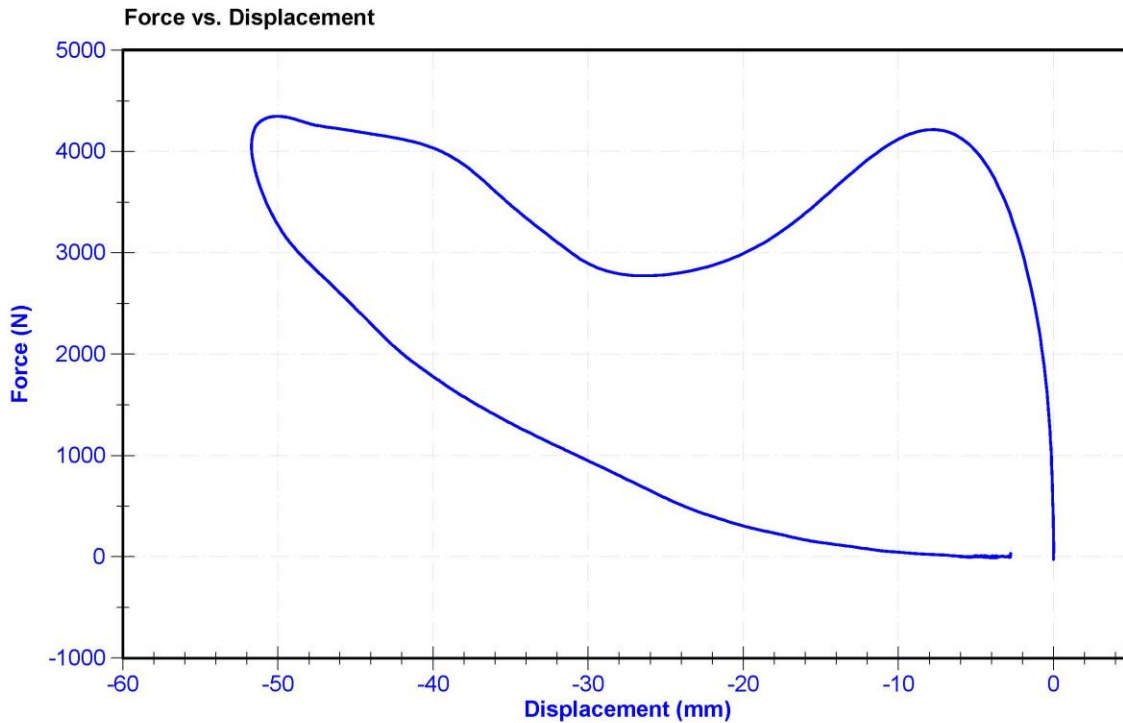
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	288	Laboratory Supervisor	K. Brogan

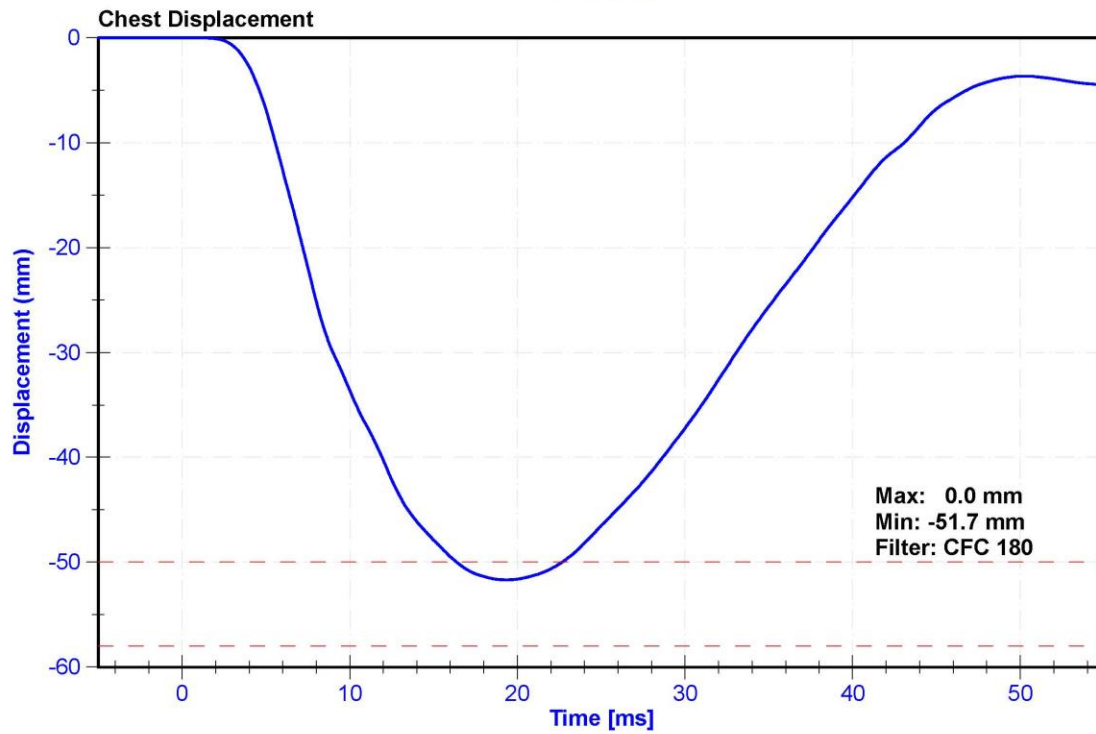
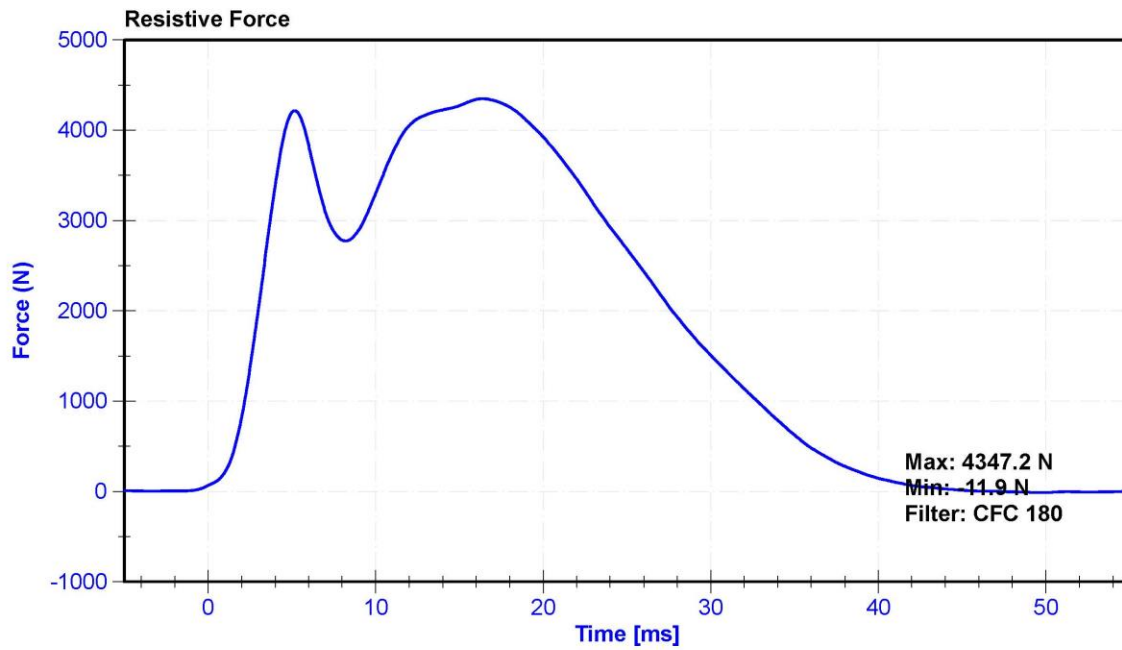
Results

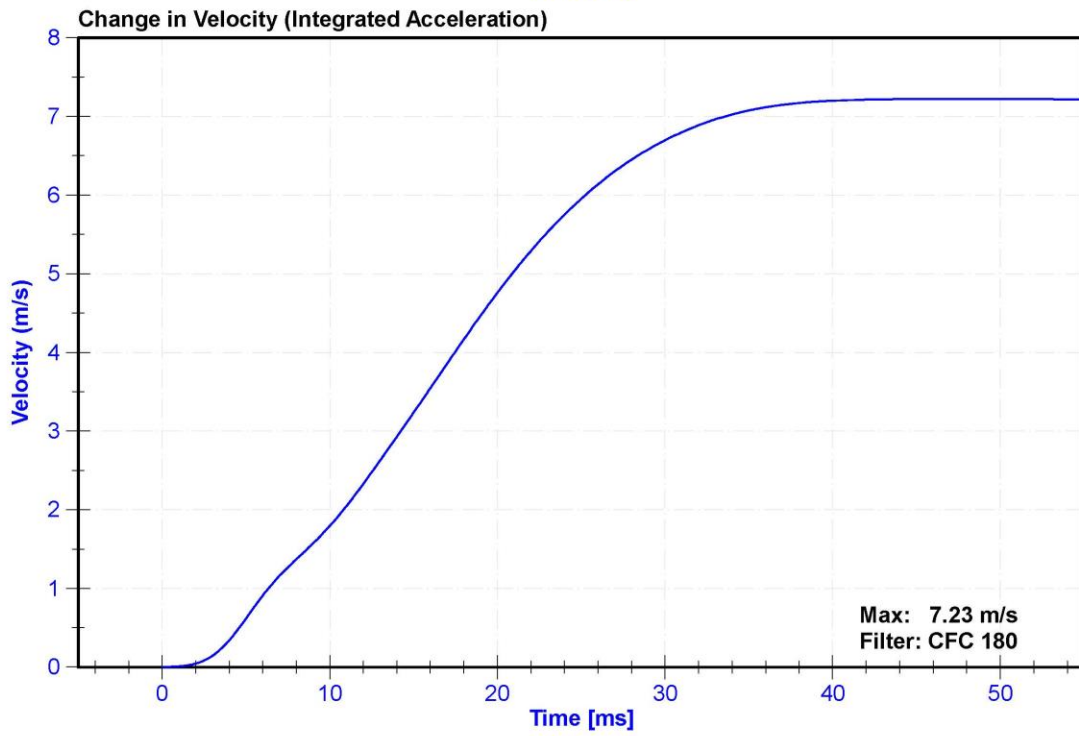
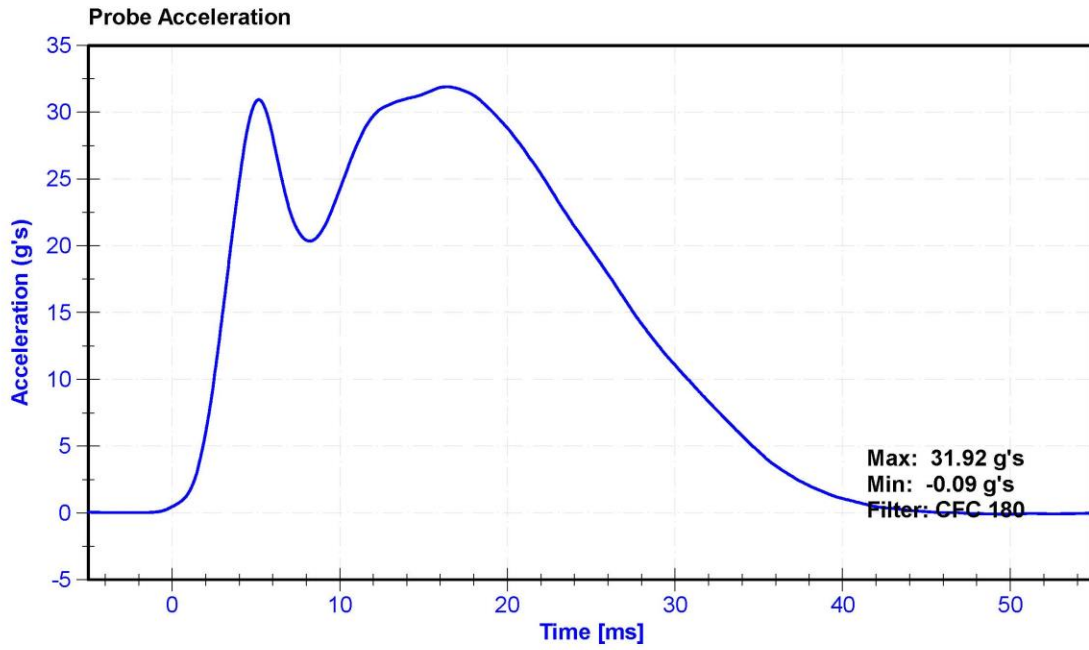
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	64.3	Pass
Velocity	6.59	6.83	m/s	6.626	Pass
Chest Deflection	-58	-50	mm	-51.7	Pass
Maximum Resistive Force (50 to 58mm)	3900	4400	N	4347.2	Pass
Maximum Resistive Force (18 to 50mm)	0	4600	N	4347.2	Pass
Hysteresis	69	85	%	71.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019
Chest Potentiometer	SERVO 14CBI-3615	DS-140GFE	6/21/2019	6/20/2020







ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	288	Laboratory Supervisor	K. Brogan

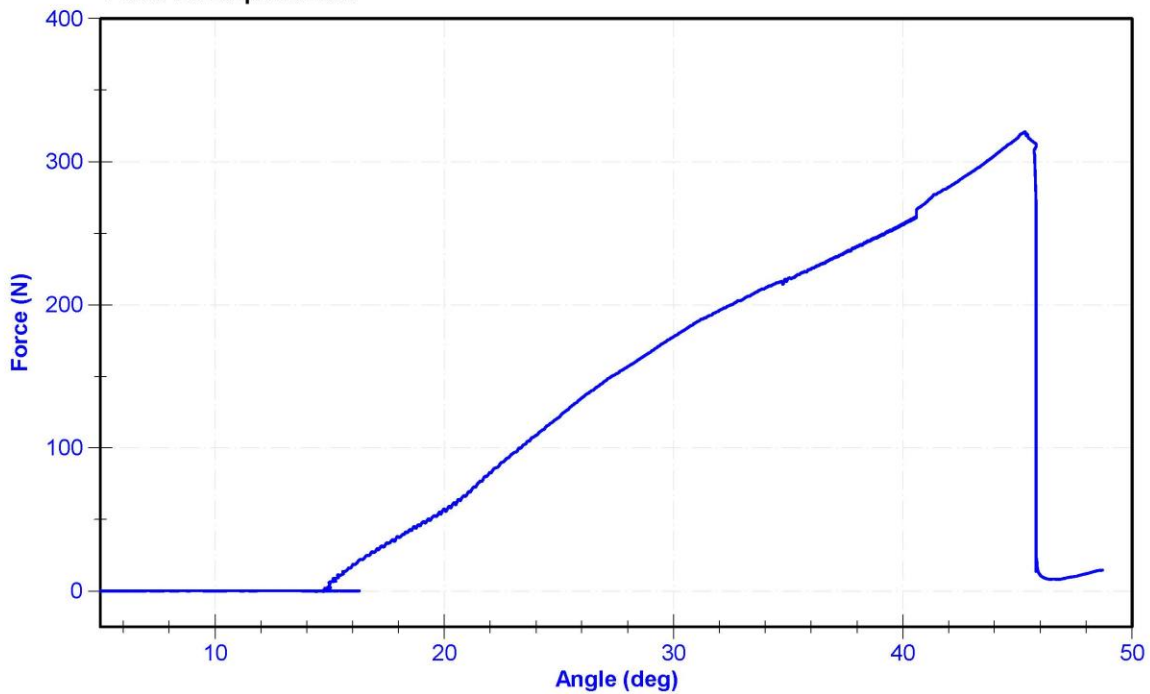
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.6	25.6	°C	20.9	Pass
Humidity	10	70	%	59.9	Pass
Initial Angle	0	20	deg	14.7	Pass
Force at 45 Degrees	320	390	N	320.9	Pass
Return Angle Relative to Initial	0	8	deg	2.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	Rieker N4C-1	DS-13051548	10/25/2018	10/25/2019
Load Cell	Interface SML-200	LC-493319	10/25/2018	10/25/2019

Force vs. Displacement



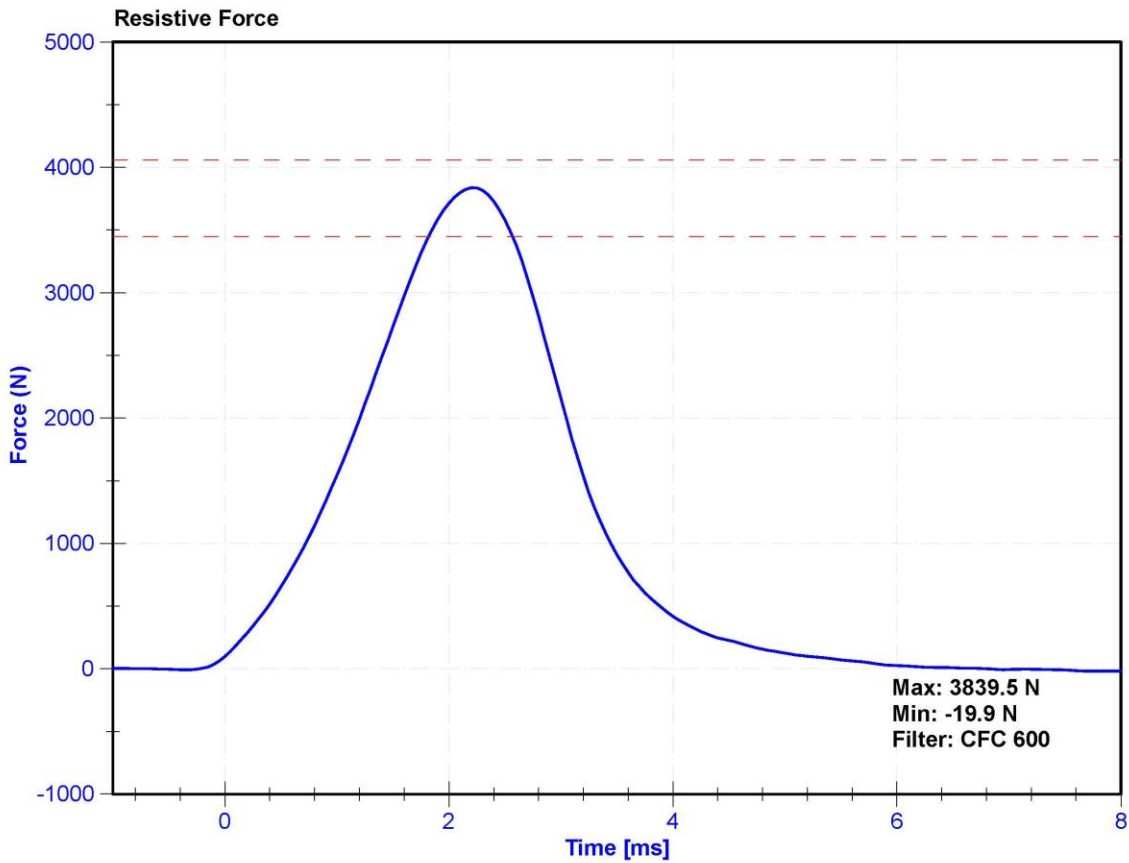
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	288	Laboratory Supervisor	K.Brogan

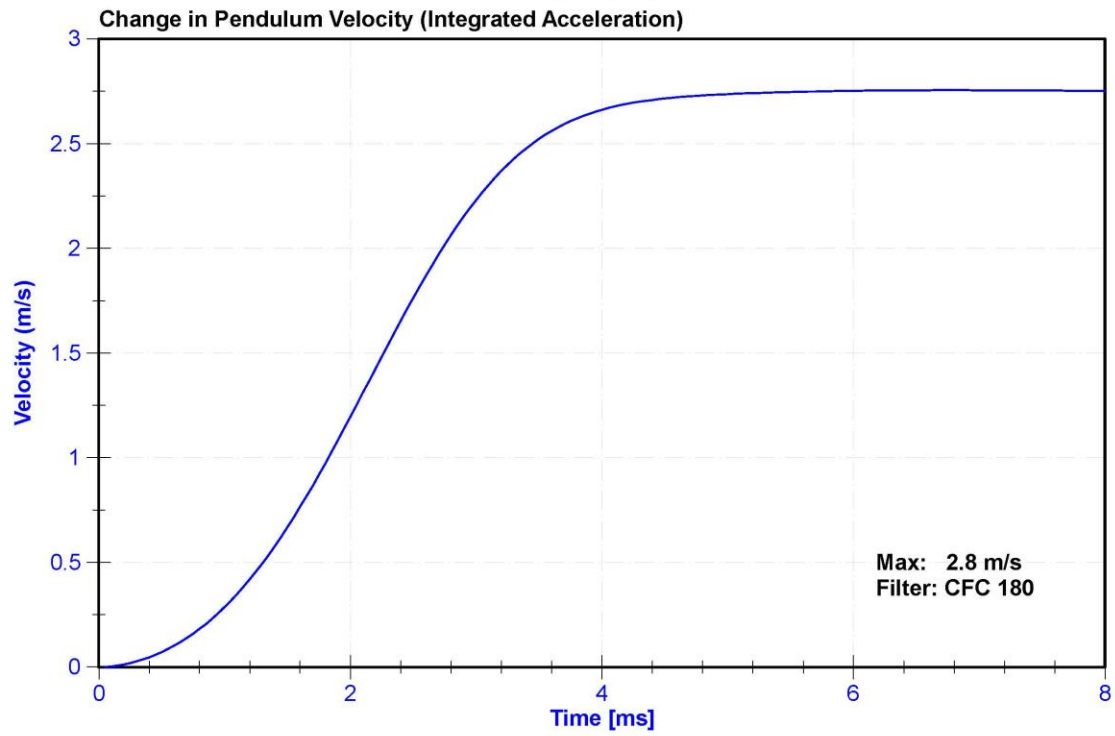
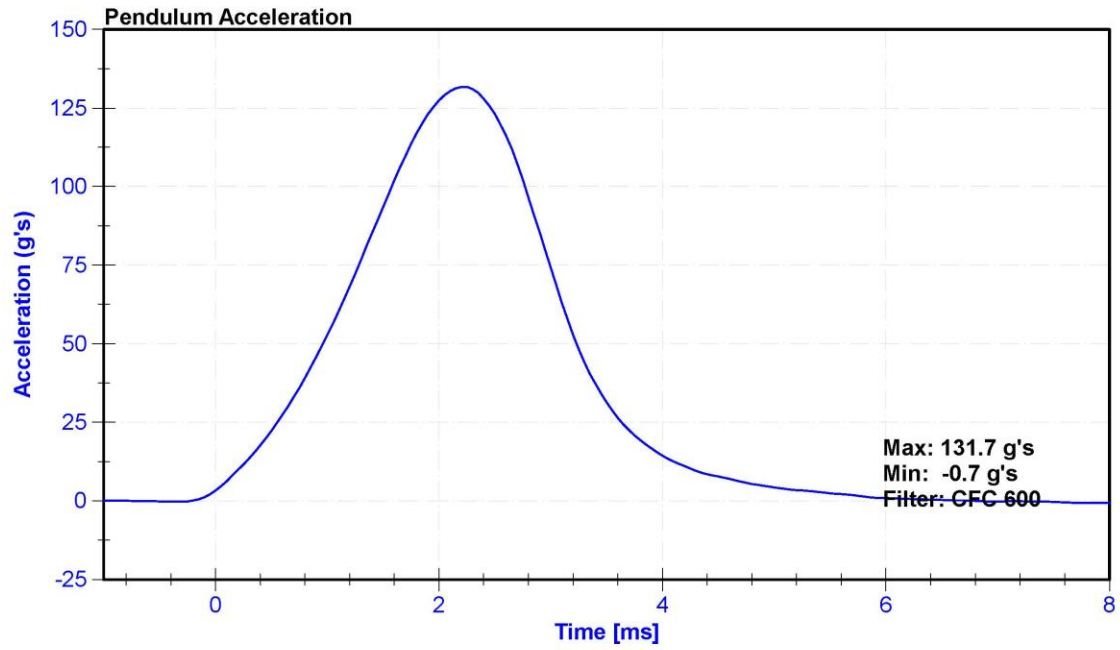
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.2	Pass
Humidity	10	70	%	51.1	Pass
Velocity	2.07	2.13	m/s	2.096	Pass
Resistive Force	3450	4060	N	3839.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019





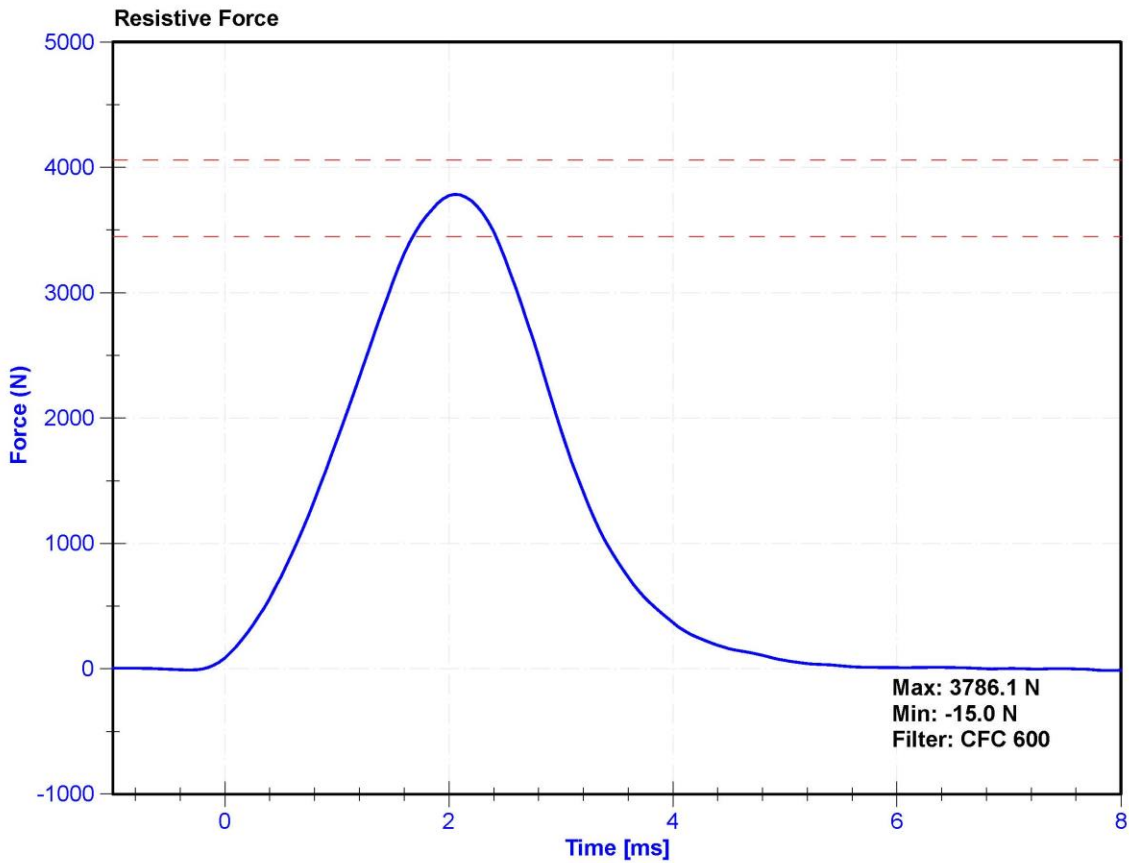
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	288	Laboratory Supervisor	K.Brogan

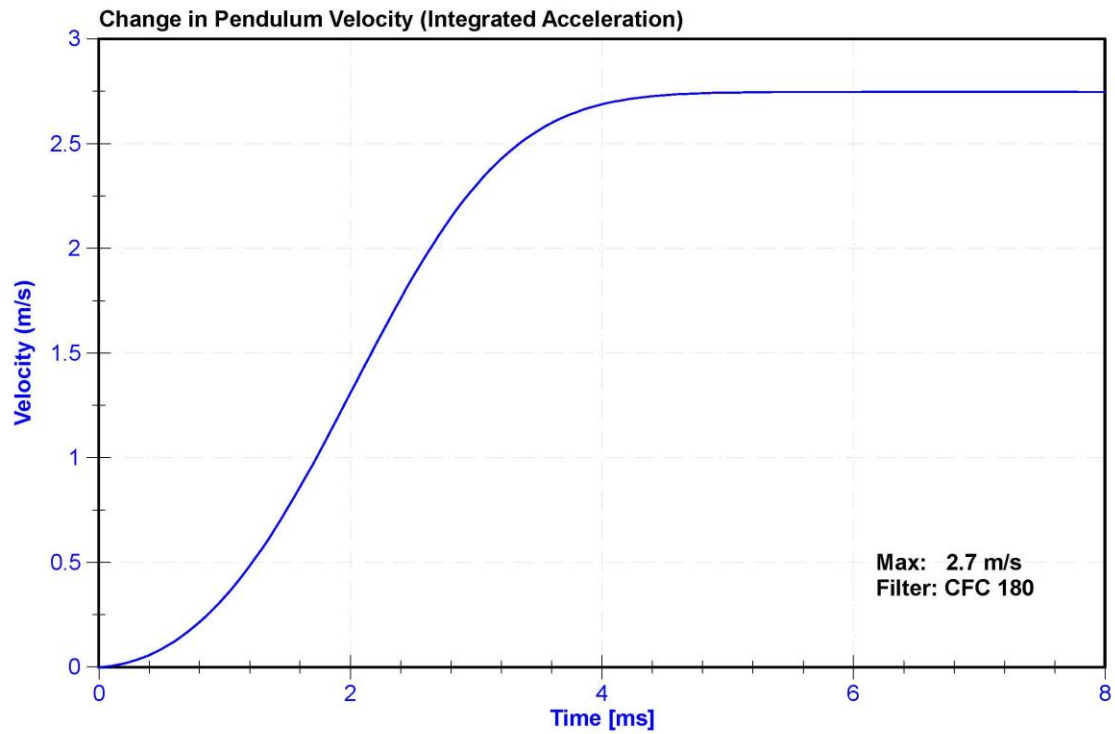
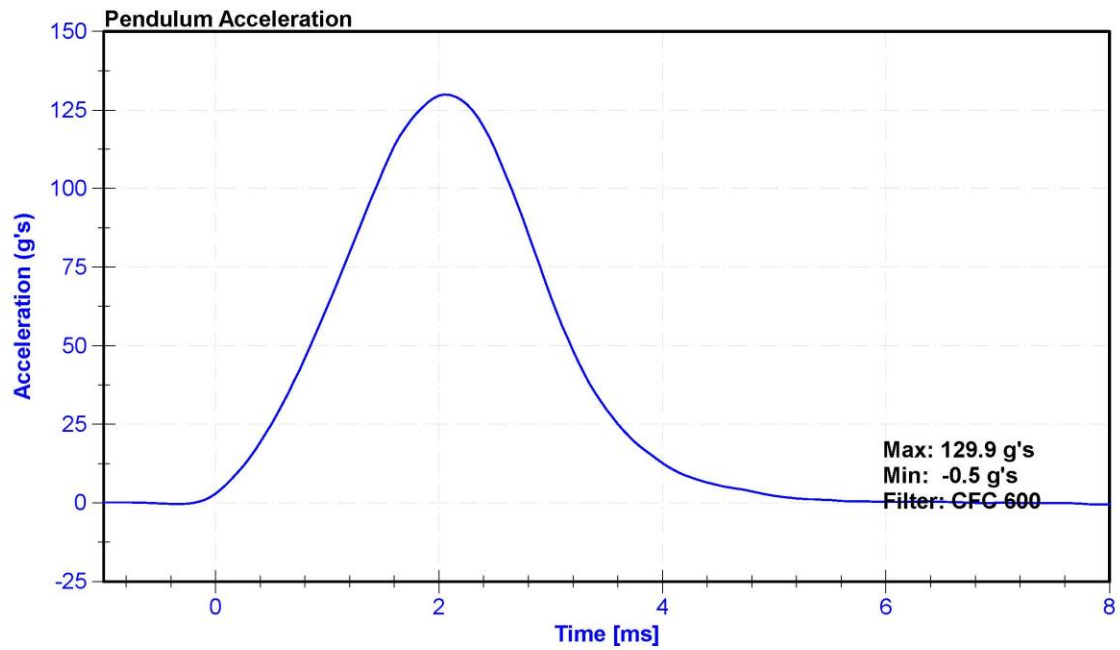
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	20.8	Pass
Humidity	10	70	%	58.9	Pass
Velocity	2.07	2.13	m/s	2.093	Pass
Resistive Force	3450	4060	N	3786.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019





CALIBRATION TEST RESULTS

POST-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

SERIAL NO: 142

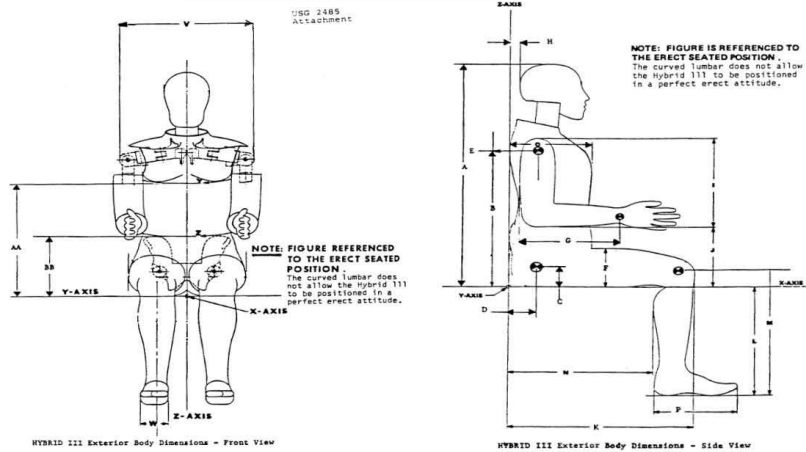


External Measurements - Hybrid 3 - 50th Male

Technician: K. Dutton

Date: 08/20/2019

Dummy Serial Number: 142



Symbol	Description	Specification (in)		Result (in)	Pass/Fail
A	Sitting Height	34.6	35.0	34.8	Pass
B	Shoulder Pivot Height	19.9	20.5	20.2	Pass
C	H-Point Height	3.3	3.5	3.4	Pass
D	H-Point from Backline	5.3	5.5	5.4	Pass
E	Shoulder Pivot from Backline	3.3	3.7	3.5	Pass
F	Thigh Clearance	5.5	6.1	5.6	Pass
G	Back of Elbow to Wrist Pivot	11.4	12.0	11.6	Pass
H	Head Back to Backline	1.6	1.8	1.7	Pass
I	Shoulder to Elbow Length	13.0	13.6	13.5	Pass
J	Elbow Rest Height	7.5	8.3	8.2	Pass
K	Buttock to Knee Length	22.8	23.8	23.4	Pass
L	Popliteal Height	16.9	17.9	17.4	Pass
M	Knee Pivot Height	19.1	19.7	19.4	Pass
N	Buttock Popliteal Length	17.8	18.8	18.4	Pass
O	Chest Depth without Jacket	8.4	9.0	8.6	Pass
P	Foot Length (right)	9.9	10.5	10.3	Pass
V	Shoulder Breadth	16.3	17.2	16.8	Pass
W	Foot Breadth	3.6	4.2	3.9	Pass
Y	Chest Circumference with Jacket	38.2	39.4	38.9	Pass
Z	Waist Circumference	32.9	34.1	33.7	Pass
AA	Reference Location (Chest Circumference)	16.9	17.1	17.0	Pass
BB	Reference Location (Waist Circumference)	8.9	9.1	9.0	Pass

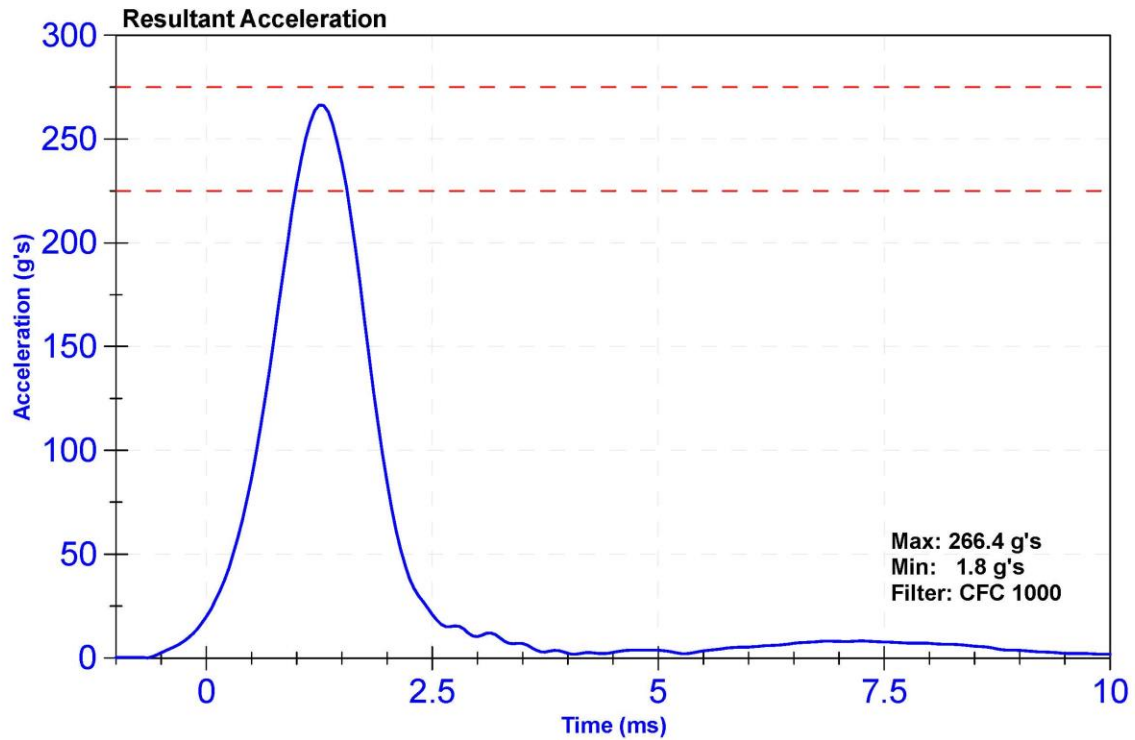
ATD Manufacturer	Humanetics	Test Technician	E. Helenbrook
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

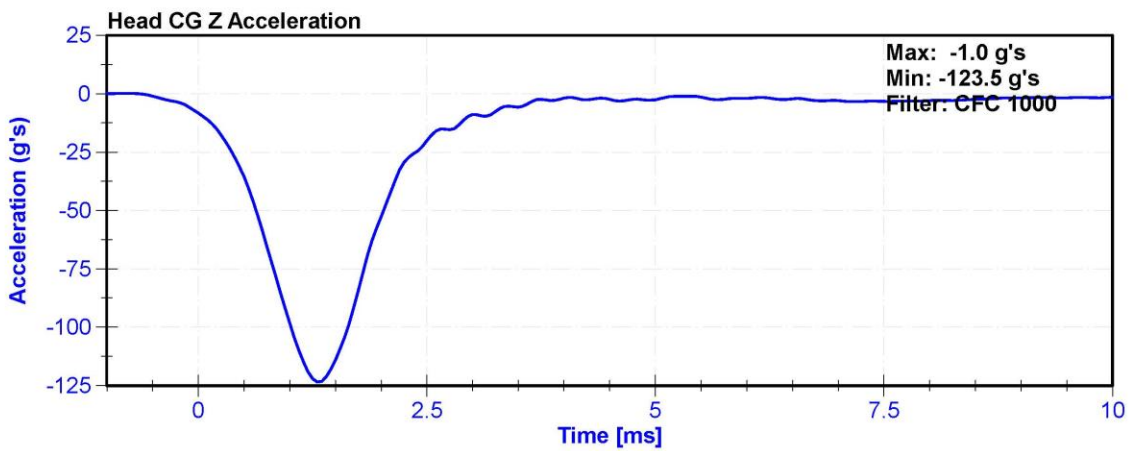
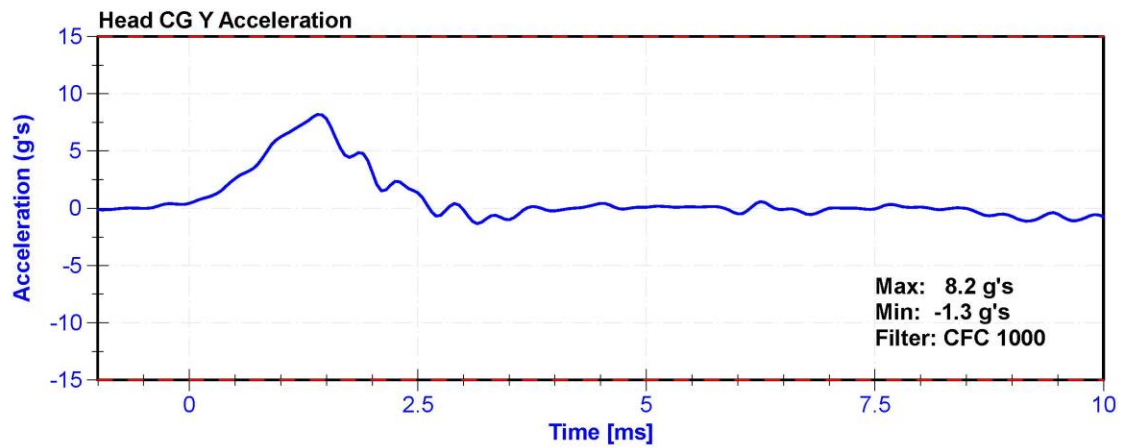
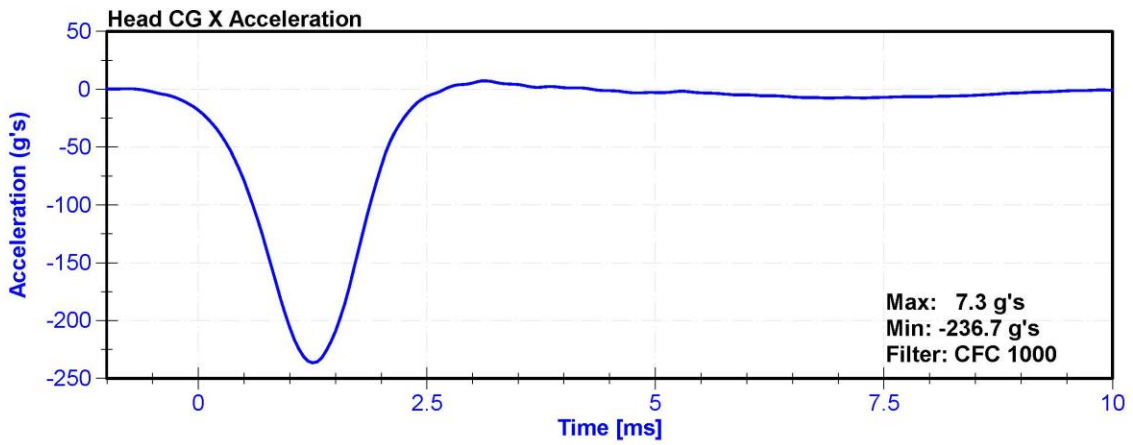
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.1	Pass
Humidity	10	70	%	60.5	Pass
Resultant Acceleration	225	275	g's	266.4	Pass
Oscillation	0	10	%	5.8	Pass
Lateral Acceleration	-15	15	g's	8.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264C	P58998	4/19/2019	10/19/2019
Y Accelerometer	ENDEVCO 7264C	P51722	4/19/2019	10/19/2019
Z Accelerometer	ENDEVCO 7264C	P58997	4/19/2019	10/19/2019





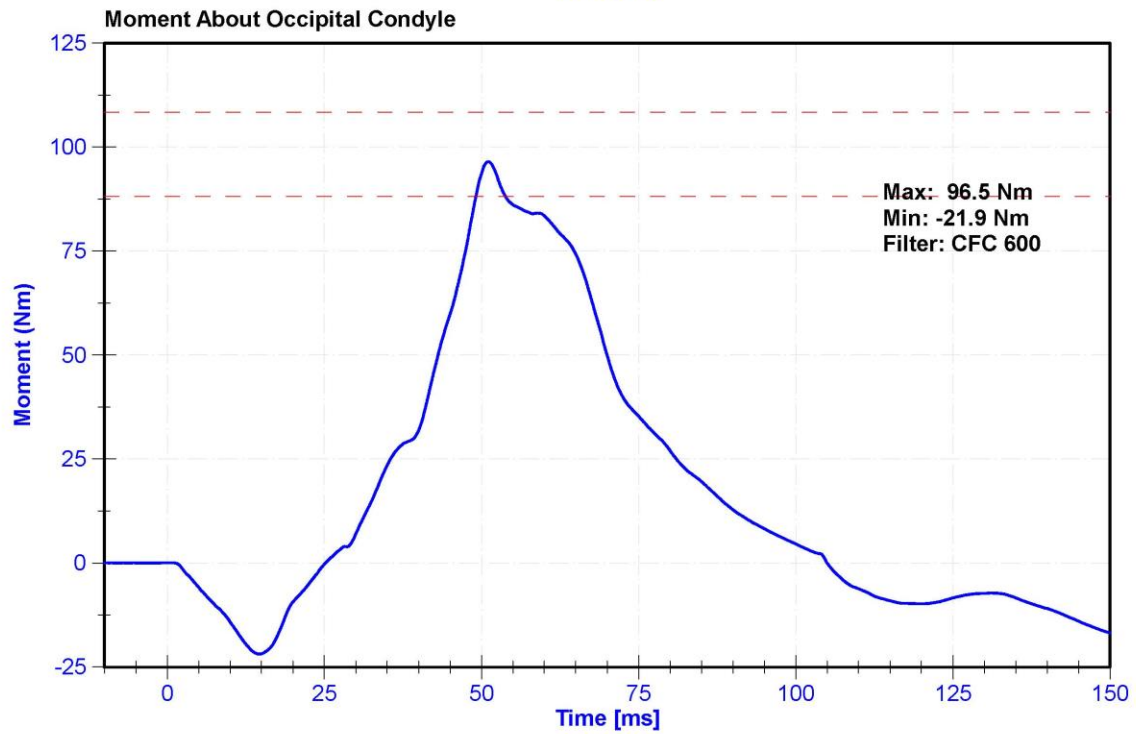
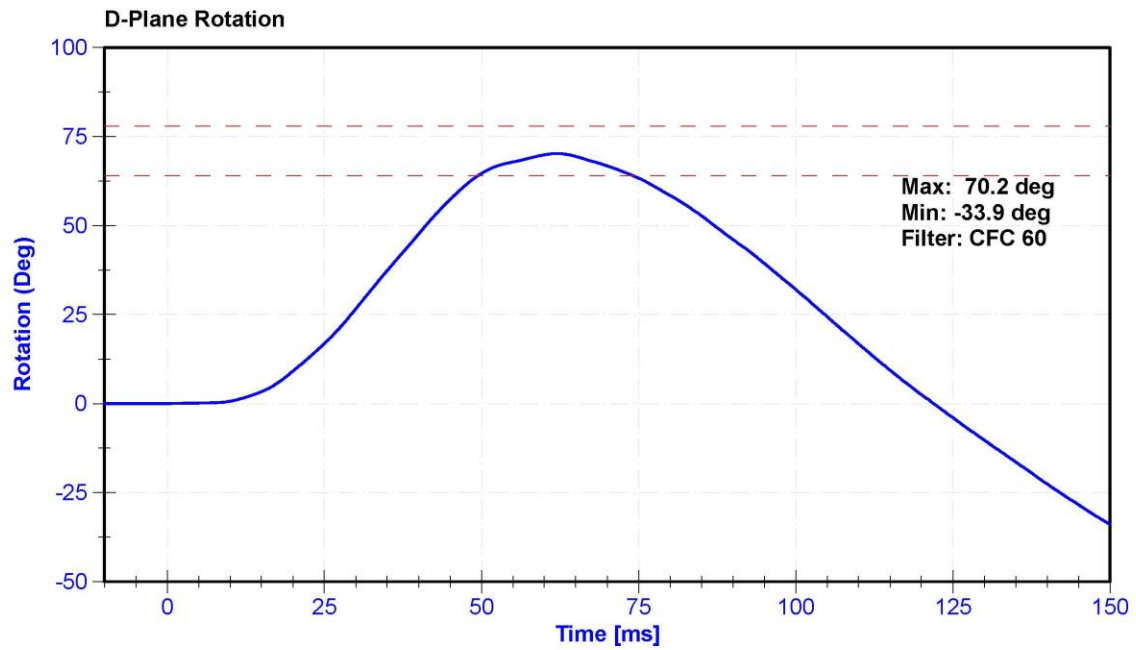
ATD Manufacturer	Humanetics	Test Technician	K. Dutton
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

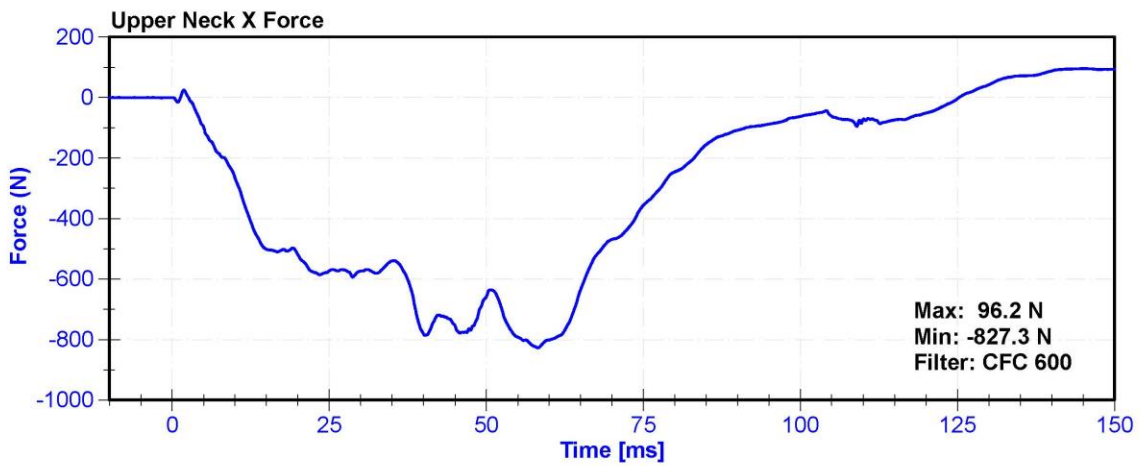
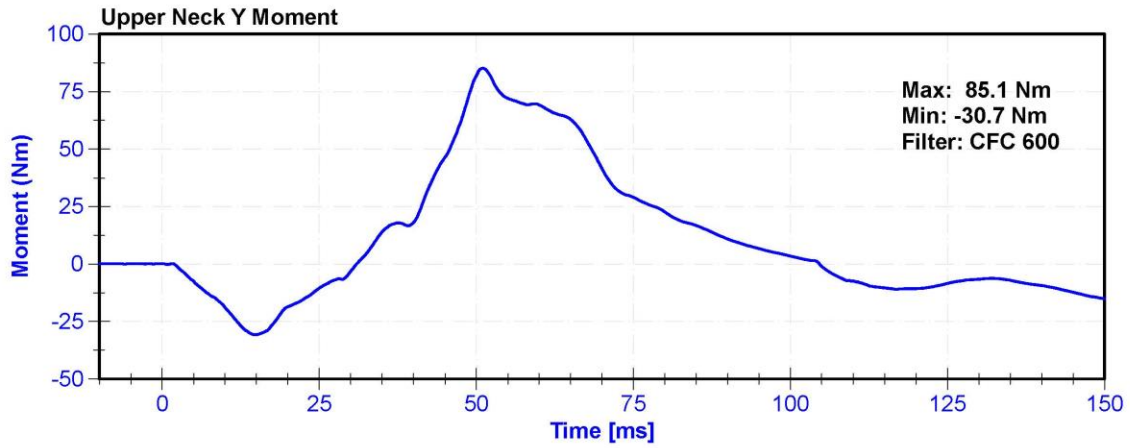
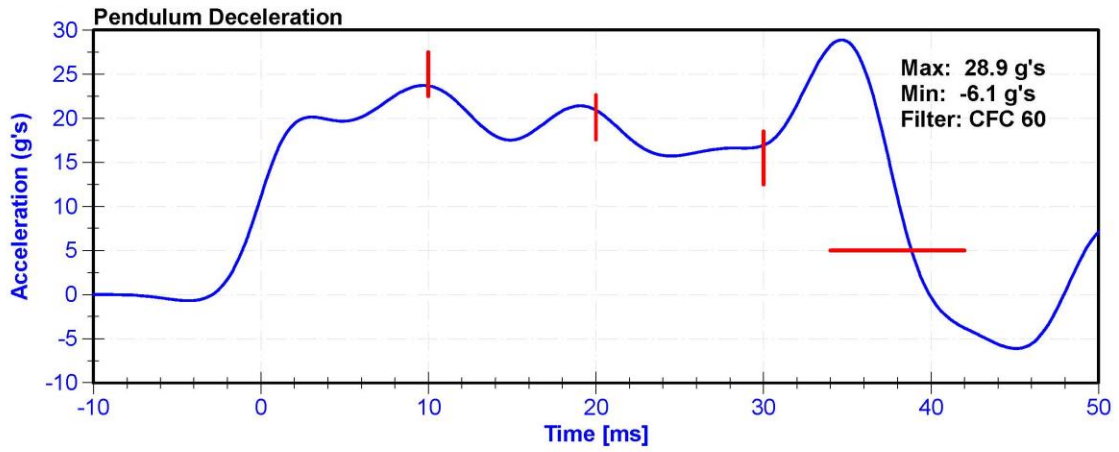
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	66.2	Pass
Velocity	6.89	7.13	m/s	6.903	Pass
Pendulum Deceleration at 10ms	22.5	27.5	g's	23.68	Pass
Pendulum Deceleration at 20ms	17.6	22.6	g's	20.91	Pass
Pendulum Deceleration at 30ms	12.5	18.5	g's	16.92	Pass
Max. Pendulum Deceleration After 30ms	0	29	g's	28.9	Pass
Pendulum Deceleration Time to 5 g's	34	42	ms	38.9	Pass
Maximum D Plane Rotation	64	78	deg	70.2	Pass
Time to Maximum Rotation	57	64	ms	62.0	Pass
Rotation Decay to Zero	113	127	ms	122.0	Pass
Moment About Occipital Condyle	88.1	108.4	Nm	96.47	Pass
Time to Maximum Moment	47	58	ms	51.1	Pass
Moment Decay to Zero	97	107	ms	105.1	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	ETI SP22G	DS-LABPOT1	11/15/2018	11/15/2019
Condyle Potentiometer	ETI SP22G	DS-LABPOT2	11/15/2018	11/15/2019
Upper Neck Load Cell	FTSS IF-205	LC-161Fx	9/28/2018	9/28/2019





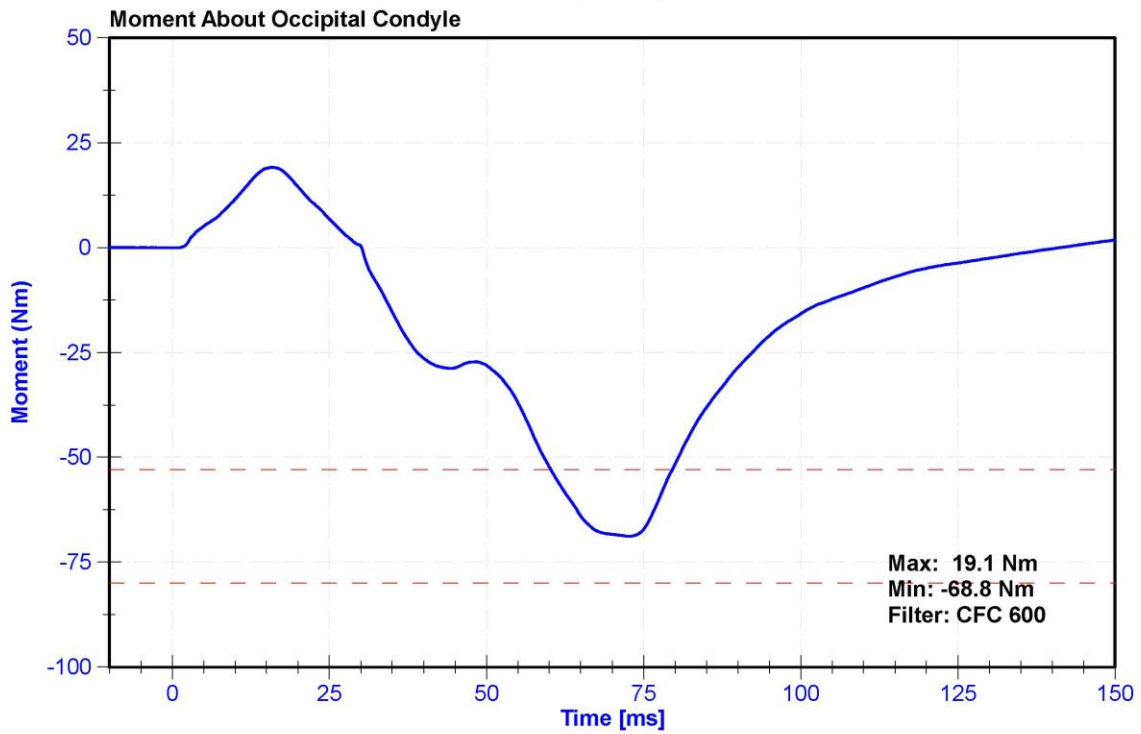
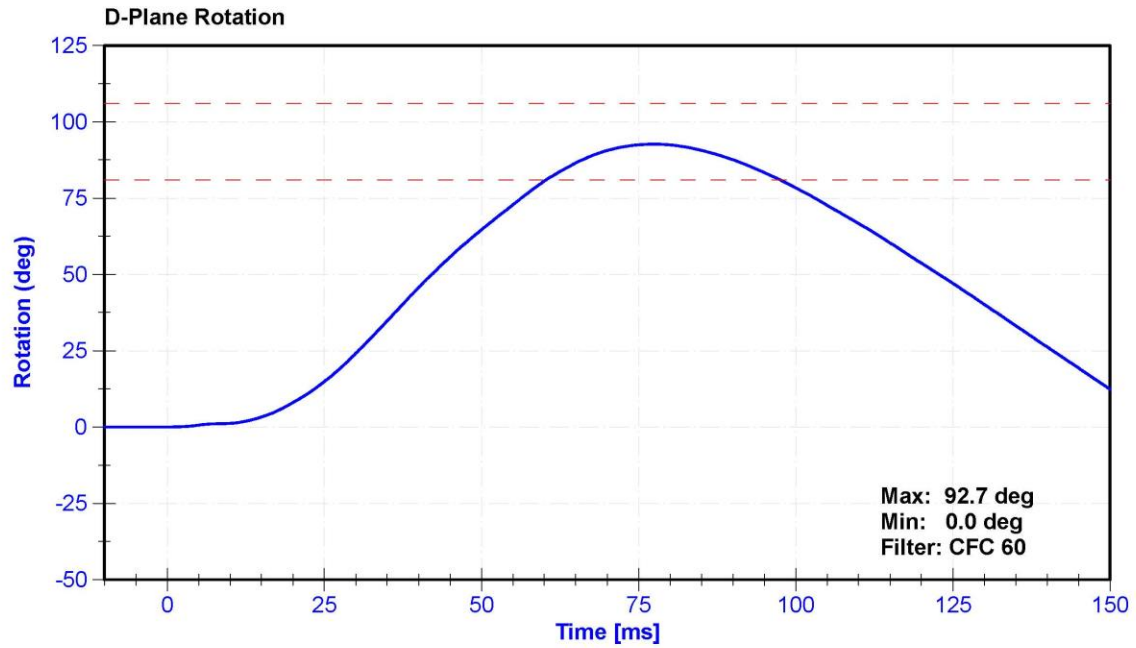
ATD Manufacturer	Humanetics	Test Technician	K. Dutton
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

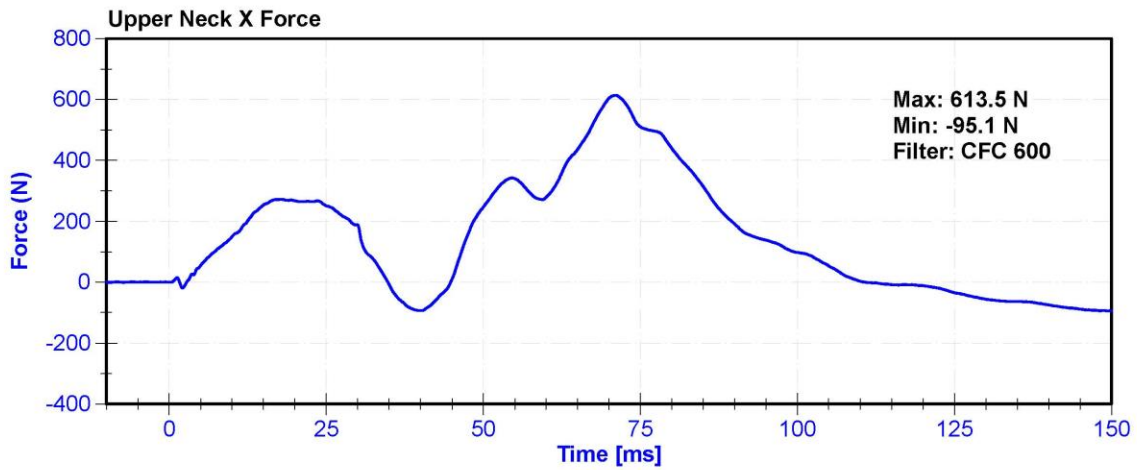
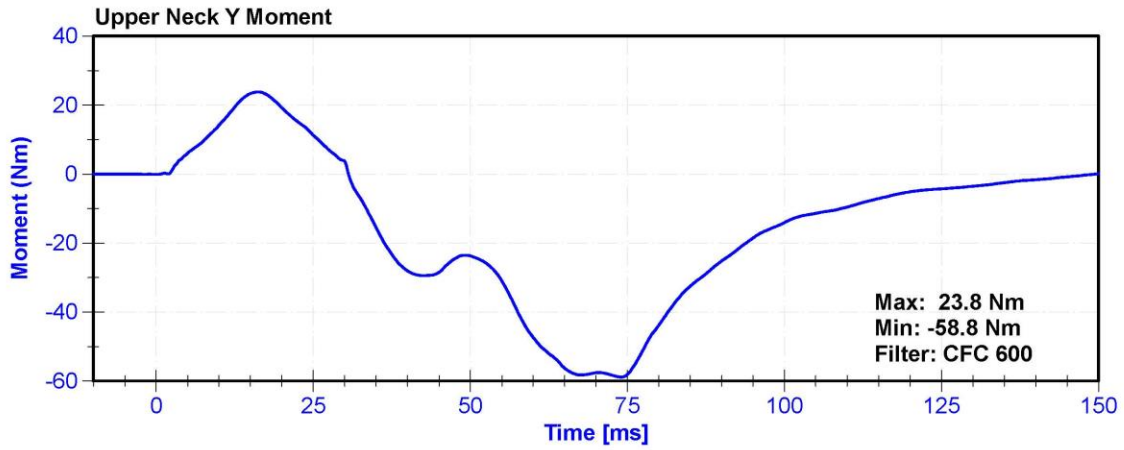
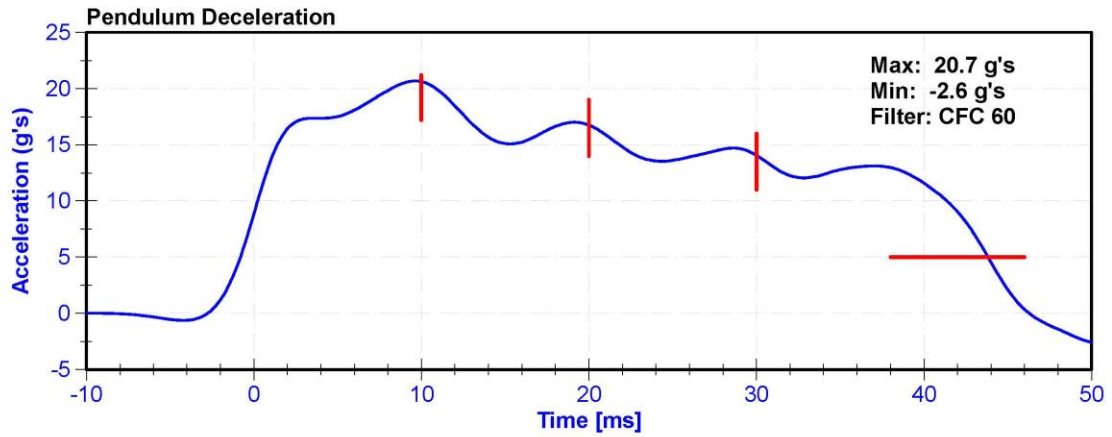
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22	Pass
Humidity	10	70	%	68	Pass
Velocity	5.94	6.19	m/s	5.964	Pass
Pendulum Deceleration at 10ms	17.2	21.2	g's	20.62	Pass
Pendulum Deceleration at 20ms	14	19	g's	16.8	Pass
Pendulum Deceleration at 30ms	11	16	g's	14.1	Pass
Max. Pendulum Deceleration After 30ms	0	22	g's	20.7	Pass
Pendulum Deceleration Time to 5 g's	38	46	ms	43.9	Pass
Maximum D Plane Rotation	81	106	deg	92.7	Pass
Time to Maximum Rotation	72	82	ms	77.5	Pass
Rotation Decay to Zero	147	174	ms	158.8	Pass
Minimum Moment About OC	-80	-52.9	Nm	-68.80	Pass
Time to Minimum Moment	65	79	ms	72.6	Pass
Moment Decay to Zero	120	148	ms	141.5	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	ETI SP22G	DS-LABPOT1	11/15/2018	11/15/2019
Condyle Potentiometer	ETI SP22G	DS-LABPOT2	11/15/2018	11/15/2019
Upper Neck Load Cell	FTSS IF-205	LC-161Fx	9/28/2018	9/28/2019





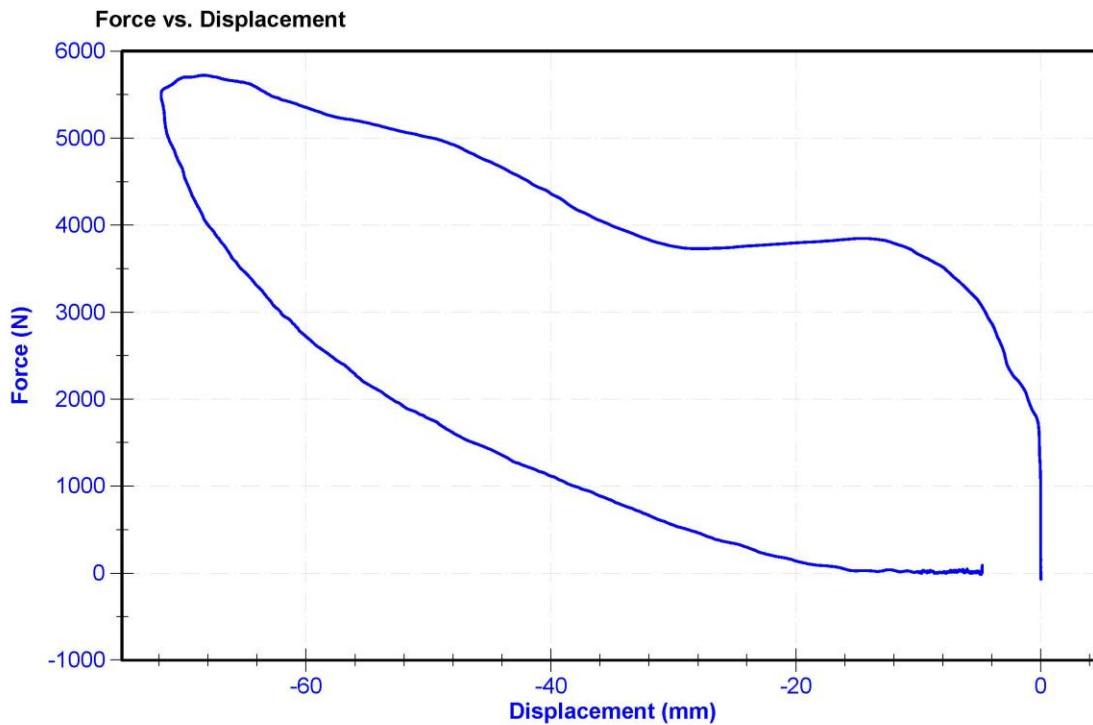
ATD Manufacturer	Humanetics	Test Technician	D.Reinhard
ATD Serial Number	142	Laboratory Supervisor	K.Brogan

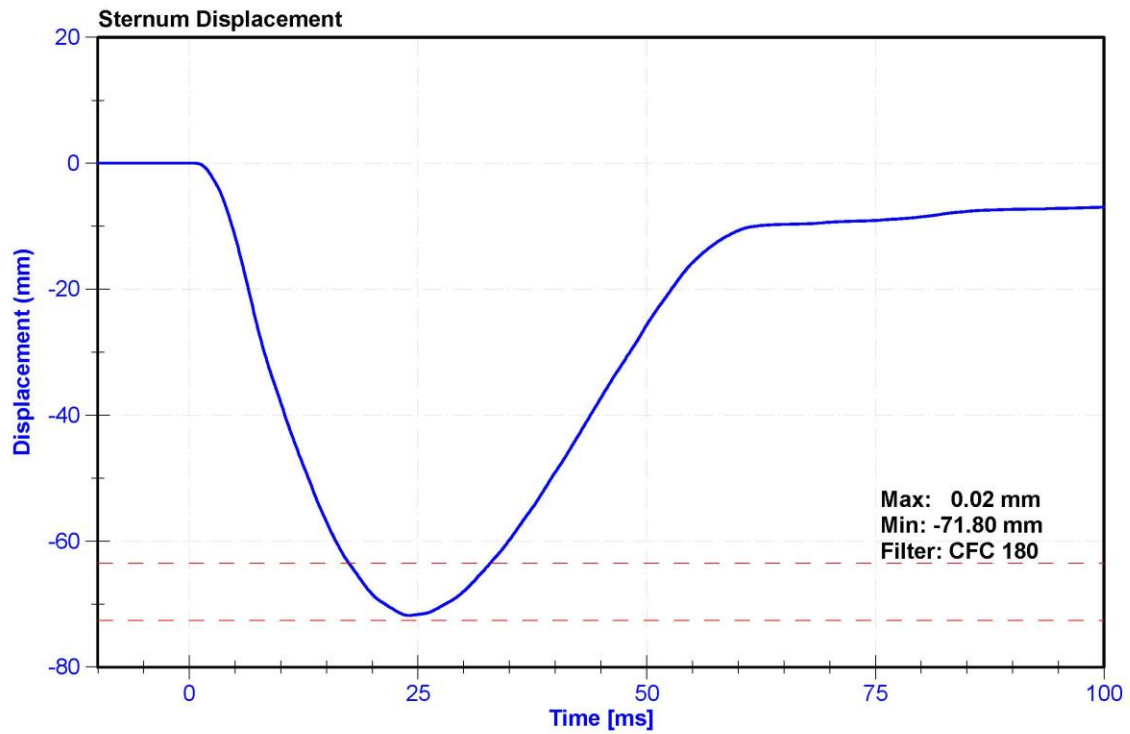
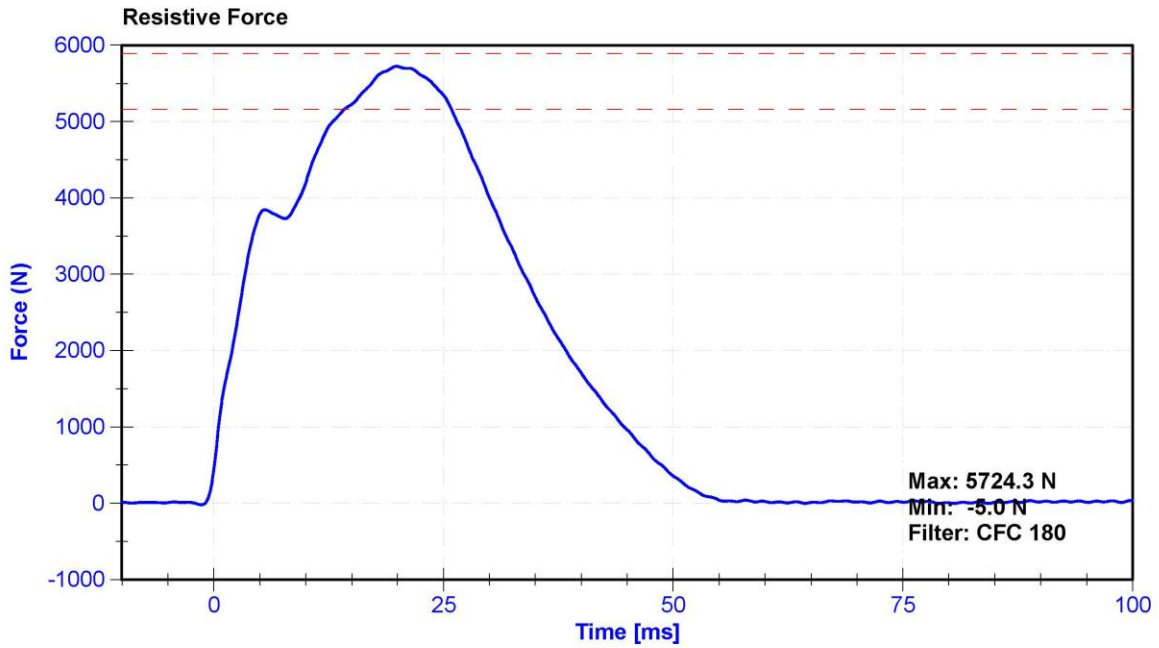
Results

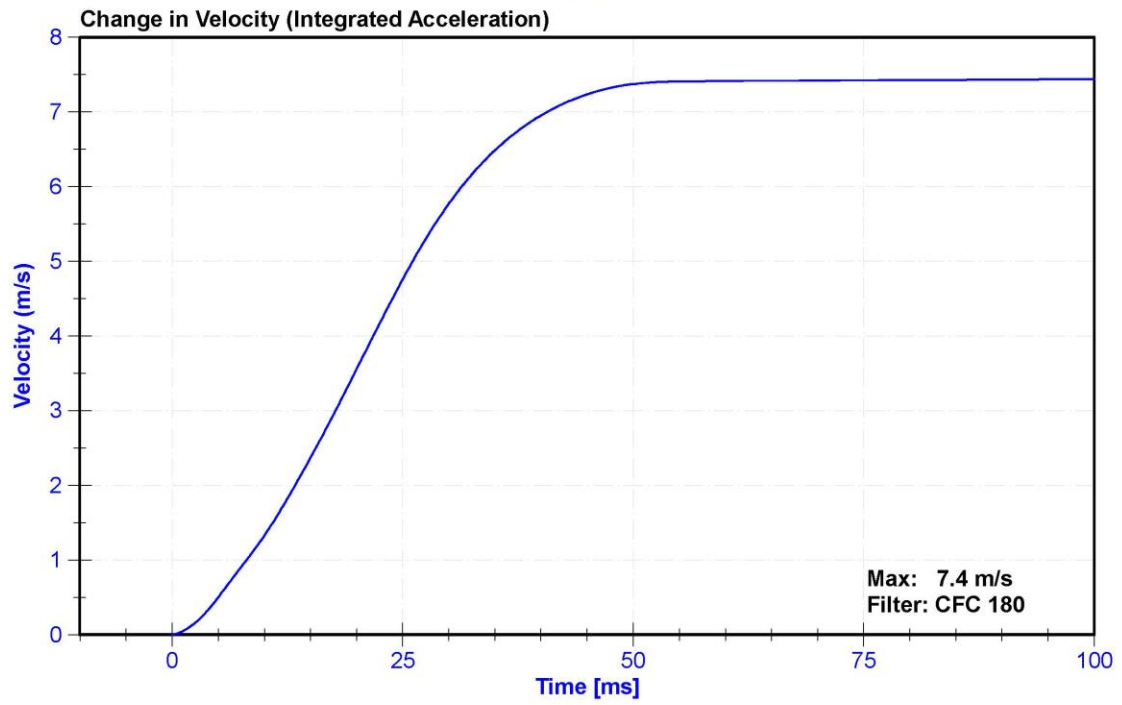
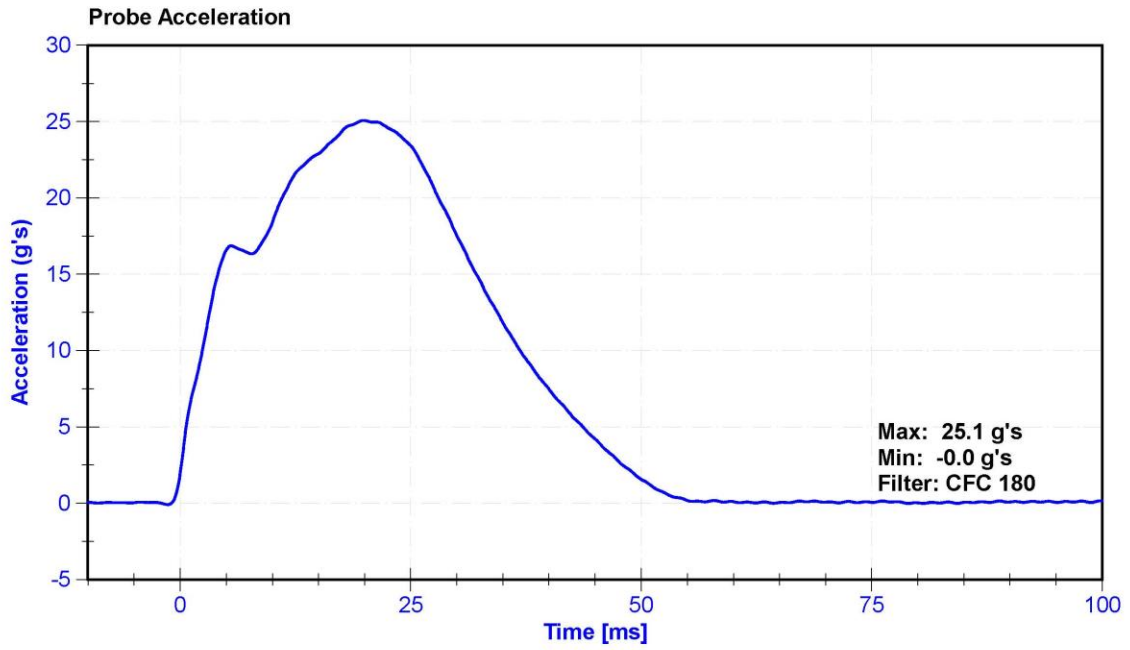
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	63	Pass
Velocity	6.59	6.83	m/s	6.670	Pass
Chest Displacement	-72.6	-63.5	mm	-71.80	Pass
Resistive Force	5160	5894	N	5724.3	Pass
Hysteresis	65	85	%	70.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019
Chest Potentiometer	JDK 6209-2038	DS-142	10/22/2018	10/22/2019







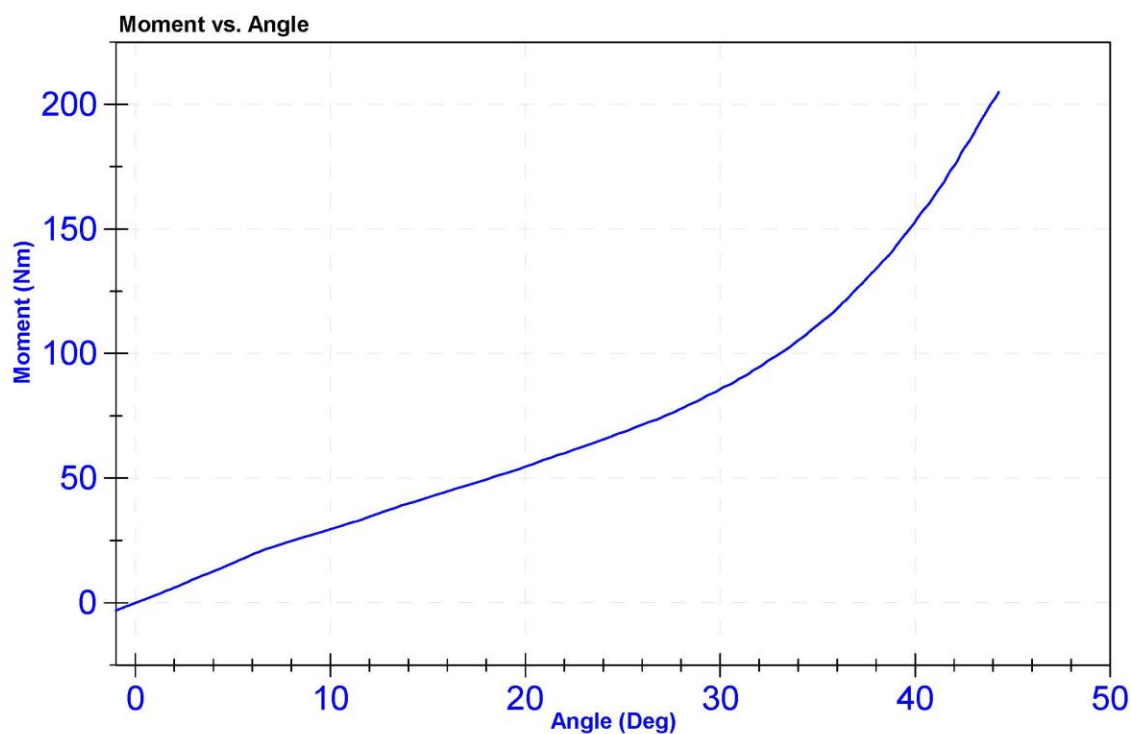
ATD Manufacturer	Humanetics	Test Technician	D.Reinhard
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.1	Pass
Humidity	10	70	%	69.0	Pass
Average Velocity	5	10	deg/s	7.2	Pass
Angle at 203Nm	40	50	deg	44.1	Pass
Moment at 30 degrees	0	94.9	Nm	85.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	ETI SP22	DS-0008	9/18/2018	9/18/2019
Load Cell	Key Trans 2301-02	LC-115 My	9/6/2018	9/6/2019



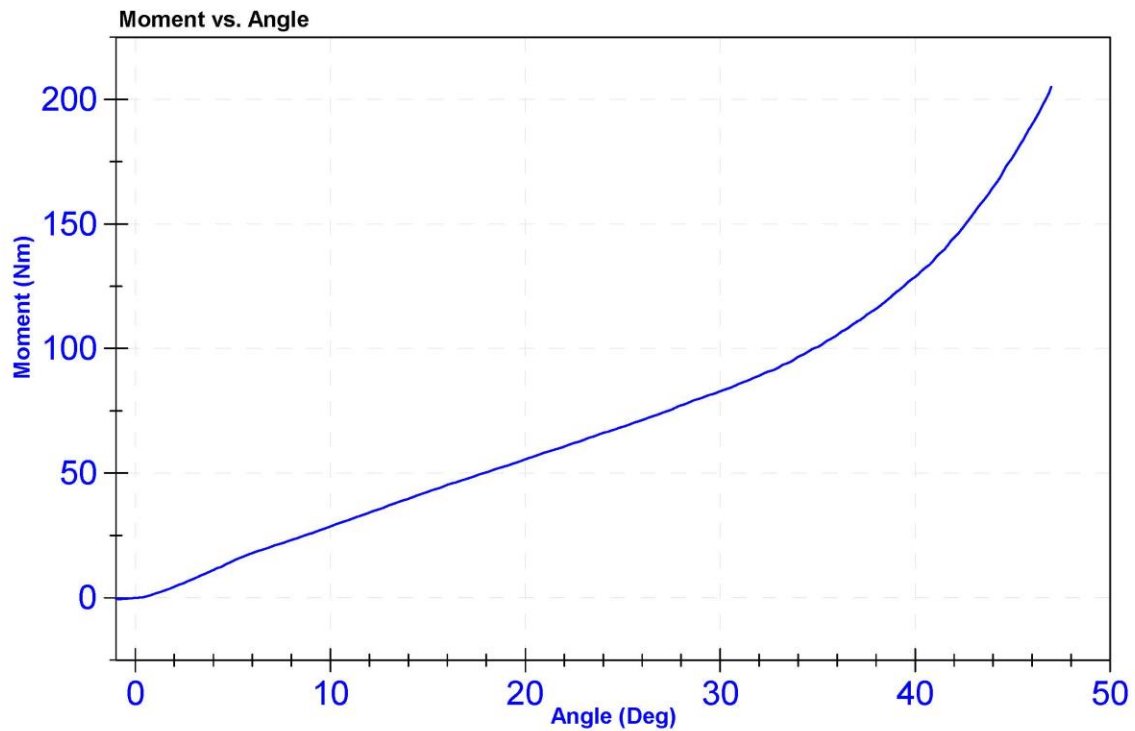
ATD Manufacturer	Humanetics	Test Technician	D.Reinhard
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.0	Pass
Humidity	10	70	%	69.0	Pass
Average Velocity	5	10	deg/s	7.2	Pass
Angle at 203Nm	40	50	deg	46.9	Pass
Moment at 30 degrees	0	94.9	Nm	82.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	ETI SP22	DS-0008	9/18/2018	9/18/2019
Load Cell	Key Trans 2301-02	LC-115 My	9/6/2018	9/6/2019



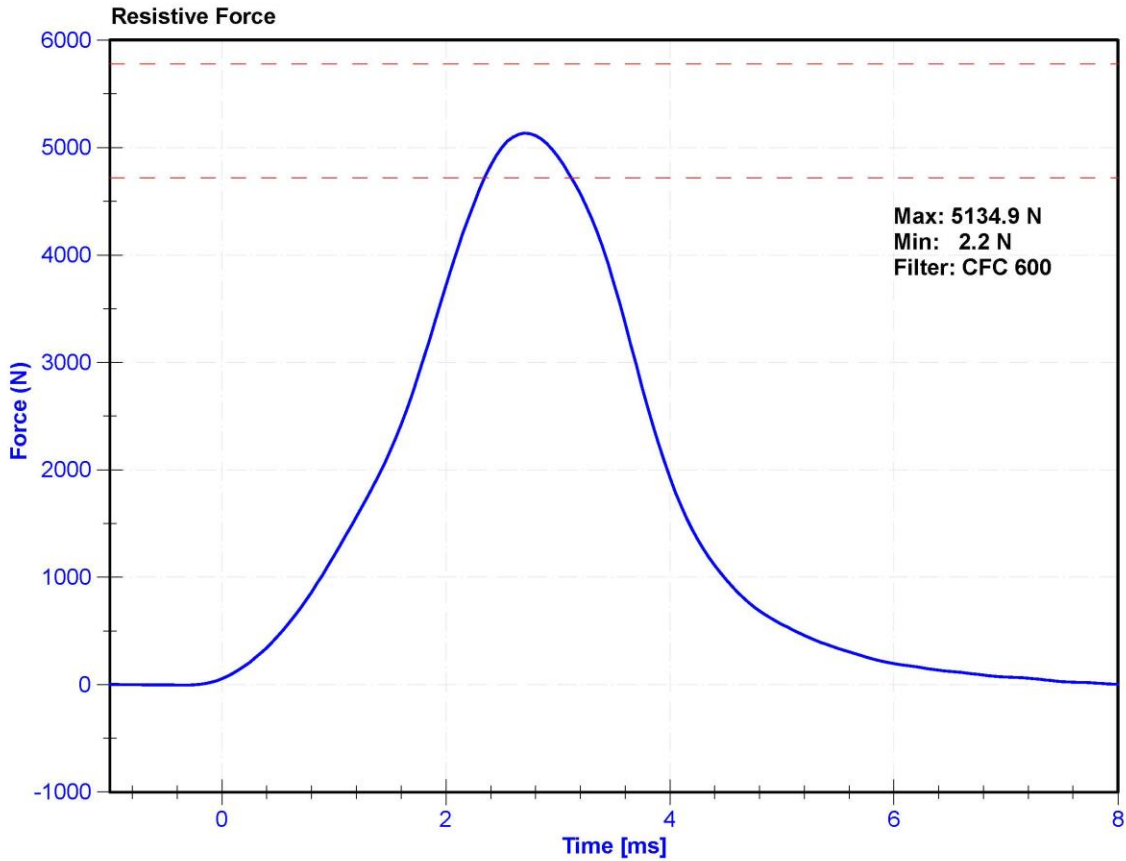
ATD Manufacturer	Humanetics	Test Technician	D.Reinhard
ATD Serial Number	142	Laboratory Supervisor	K.Brogan

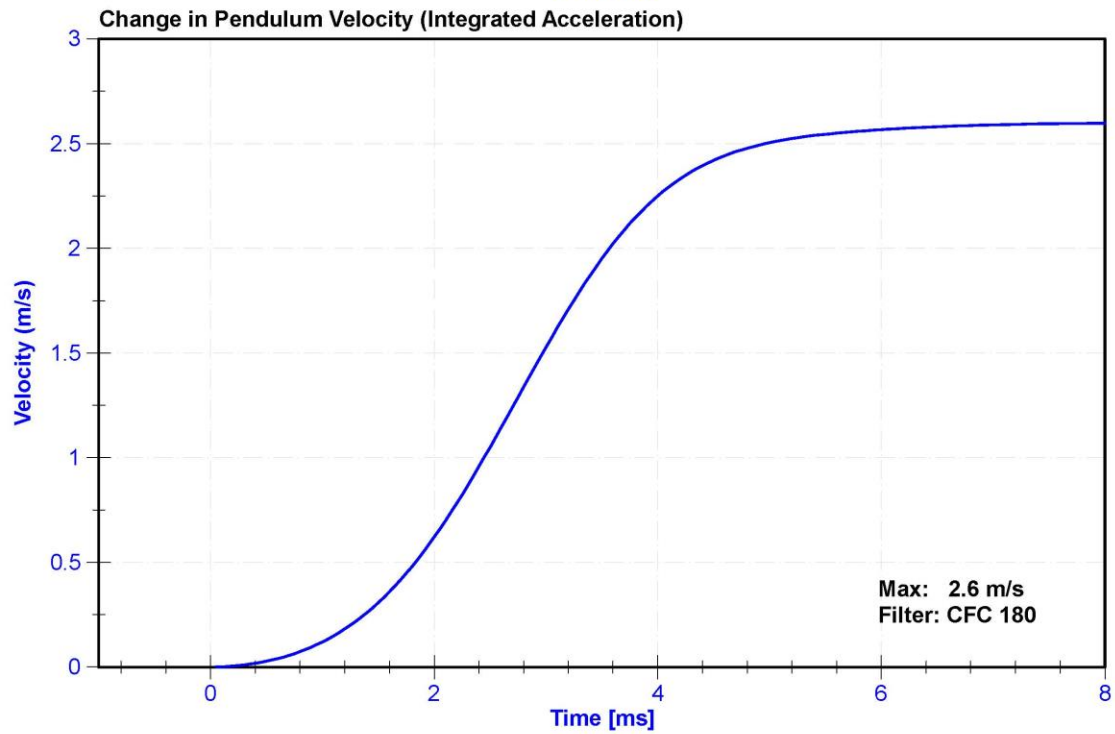
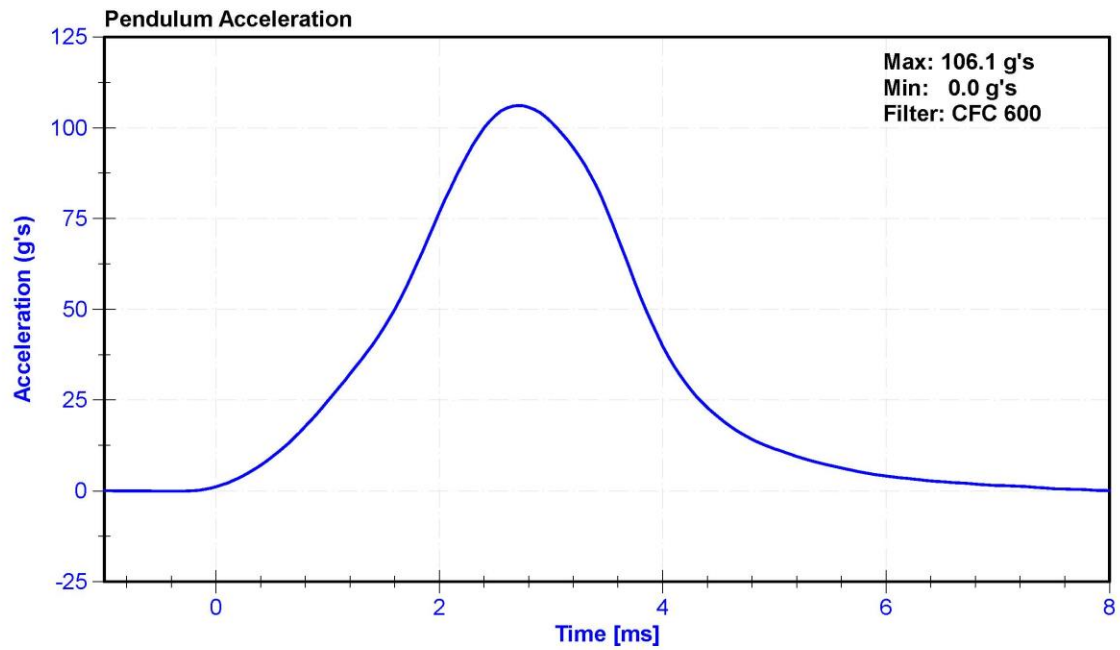
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.1	Pass
Humidity	10	70	%	69.3	Pass
Velocity	2.07	2.13	m/s	2.102	Pass
Maximum Resistive Force	4720	5780	N	5134.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019





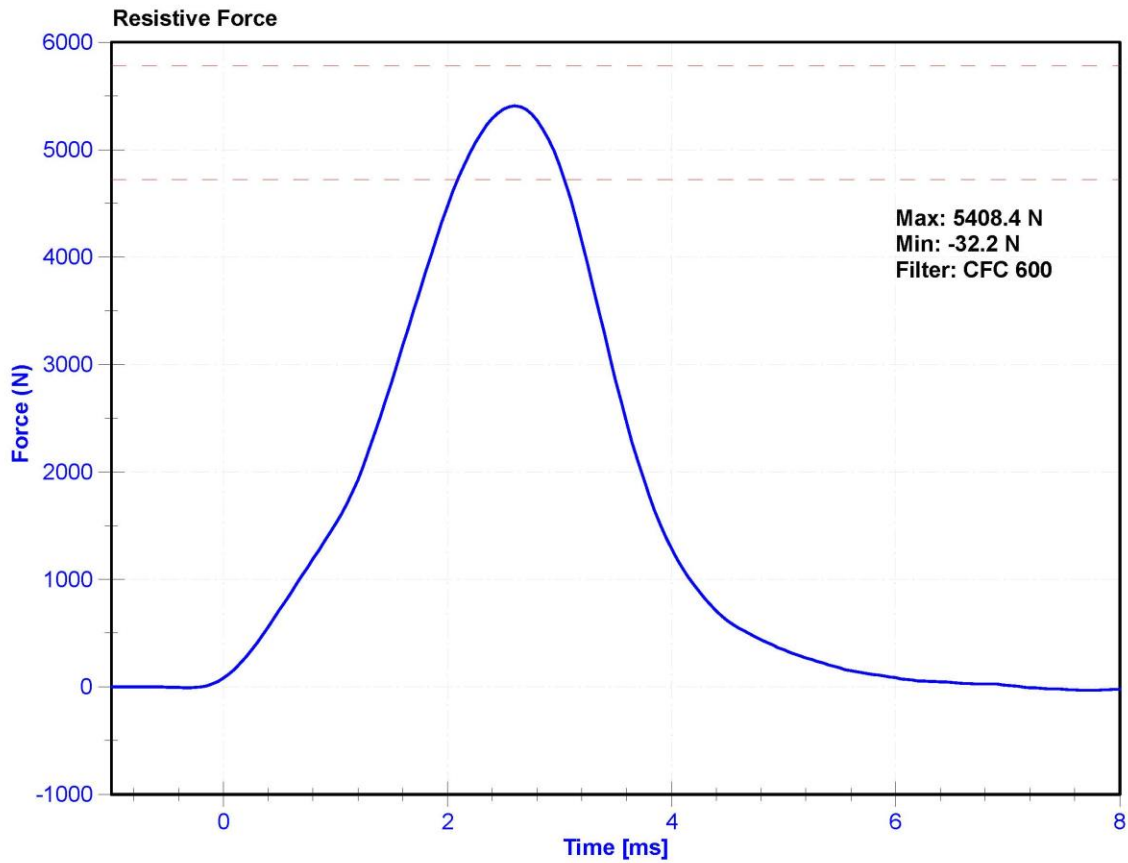
ATD Manufacturer	Humanetics	Test Technician	D.Reinhard
ATD Serial Number	142	Laboratory Supervisor	K.Brogan

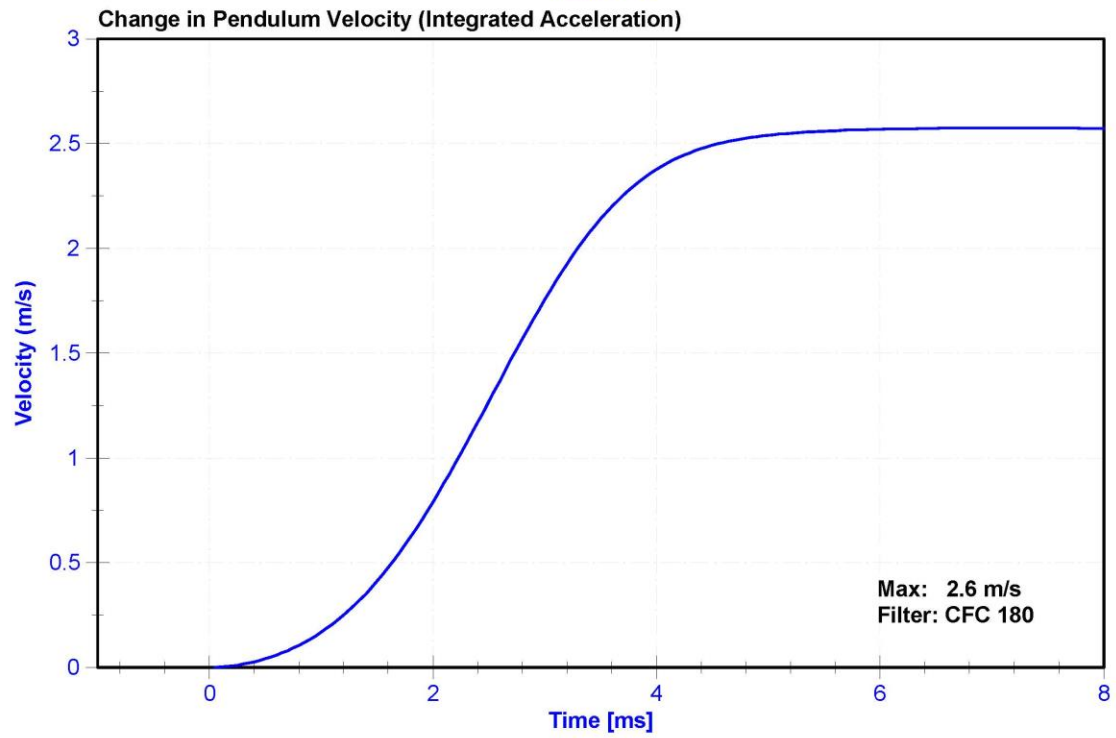
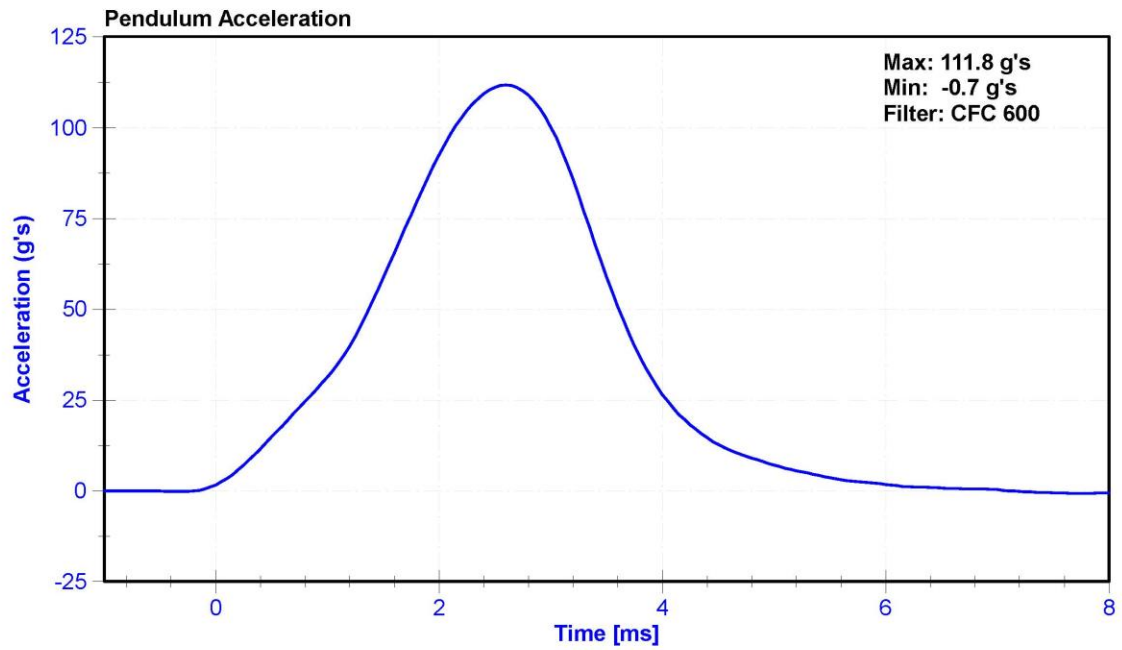
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.1	Pass
Humidity	10	70	%	69.5	Pass
Velocity	2.07	2.13	m/s	2.109	Pass
Maximum Resistive Force	4720	5780	N	5408.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019





CALIBRATION TEST RESULTS

POST-TEST

HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

SERIAL NO: 288

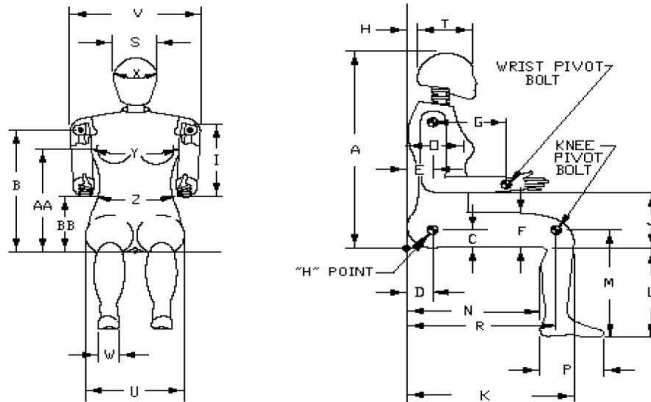


External Measurements - Hybrid 3 - 5th Female

Technician: K. Dutton

Date: 08/20/2019

Dummy Serial Number: 288



Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	775	800	787	Pass
B	Shoulder Pivot Height	432	457	450	Pass
C	H-Point Height	81	86	85	Pass
D	H-Point from Backline	145	150	148	Pass
E	Shoulder Pivot from Backline	69	84	77	Pass
F	Thigh Clearance	119	135	127	Pass
G	Back of Elbow to Wrist Pivot	244	259	256	Pass
H	Head Back to Backline	43	48	45	Pass
I	Shoulder to Elbow Length	277	297	284	Pass
J	Elbow Rest Height	183	203	192	Pass
K	Buttock to Knee Length	521	546	538	Pass
L	Popliteal Height	356	376	365	Pass
M	Knee Pivot Height	394	419	407	Pass
N	Buttock Popliteal Length	414	439	429	Pass
O	Chest Depth without Jacket	175	191	182	Pass
P	Foot Length (right)	219	234	221	Pass
R	Buttock To Knee Pivot Length	457	483	465	Pass
S	Head Breadth	137	147	142	Pass
T	Head Depth	178	188	183	Pass
U	Hip Breadth	300	315	310	Pass
V	Shoulder Breadth	351	366	361	Pass
W	Foot Breadth	79	94	85	Pass
X	Head Circumference	528	549	537	Pass
Y	Chest Circumference with Jacket	851	881	865	Pass
Z	Waist Circumference	460	790	777	Pass
AA	Reference Location (Chest Circumference)	333	358	345	Pass
BB	Reference Location (Waist Circumference)	160	170	164	Pass

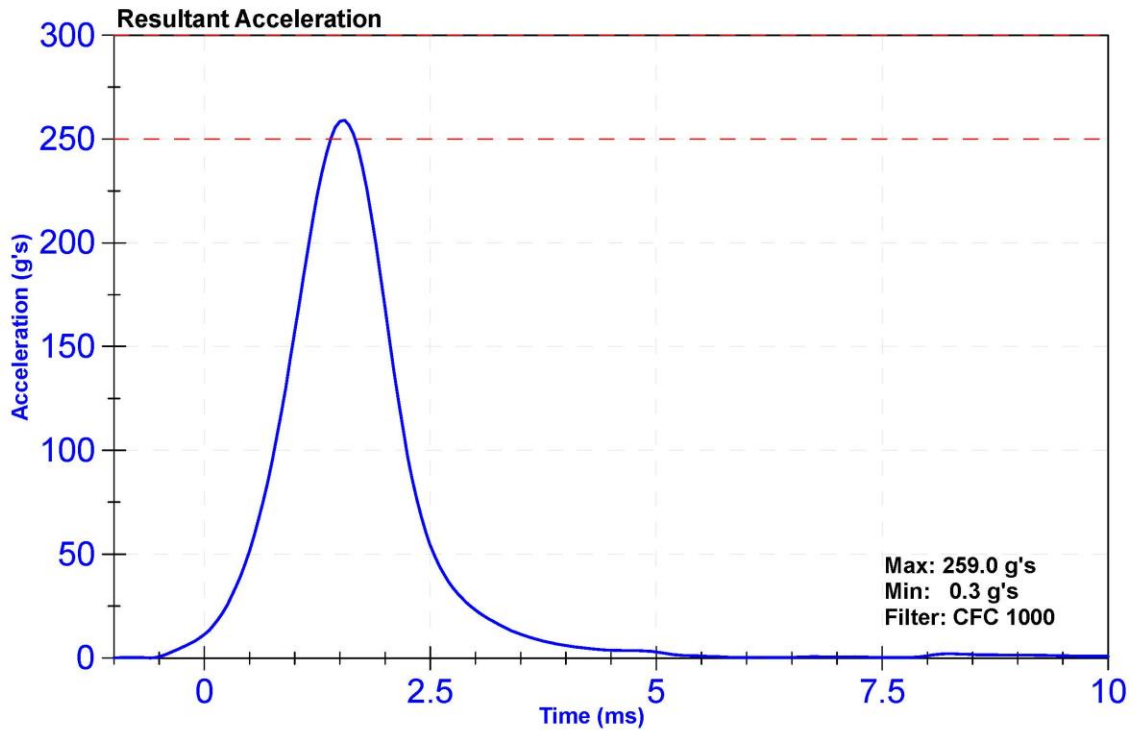
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	288	Laboratory Supervisor	K. Brogan

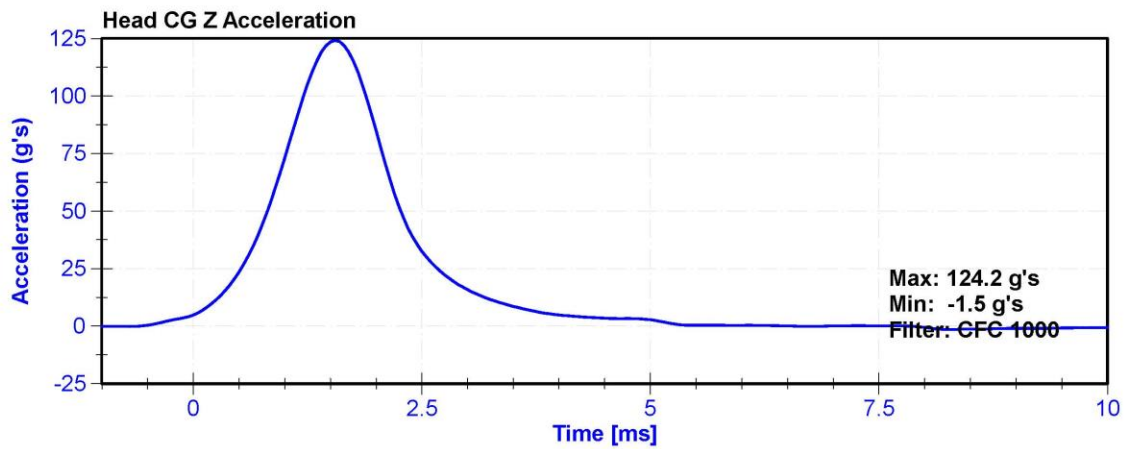
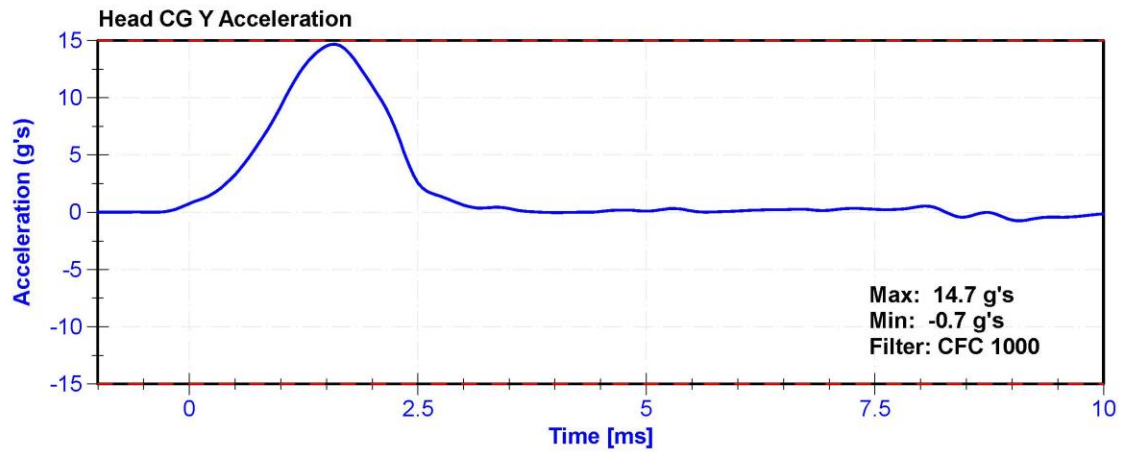
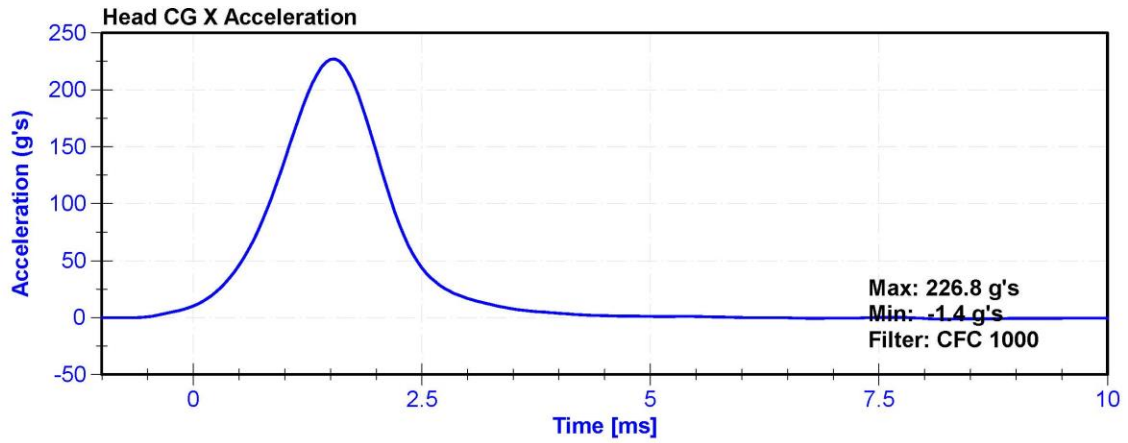
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	20.8	Pass
Humidity	10	70	%	61.7	Pass
Resultant Acceleration	250	300	g's	259.0	Pass
Oscillation	0	10	%	3.1	Pass
Lateral Acceleration	-15	15	g's	14.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P52133	4/9/2019	10/8/2019
Y Accelerometer	ENDEVCO 7264	AC-P12359	4/9/2019	10/8/2019
Z Accelerometer	ENDEVCO 7264CT	AC-P58871	4/9/2019	10/8/2019





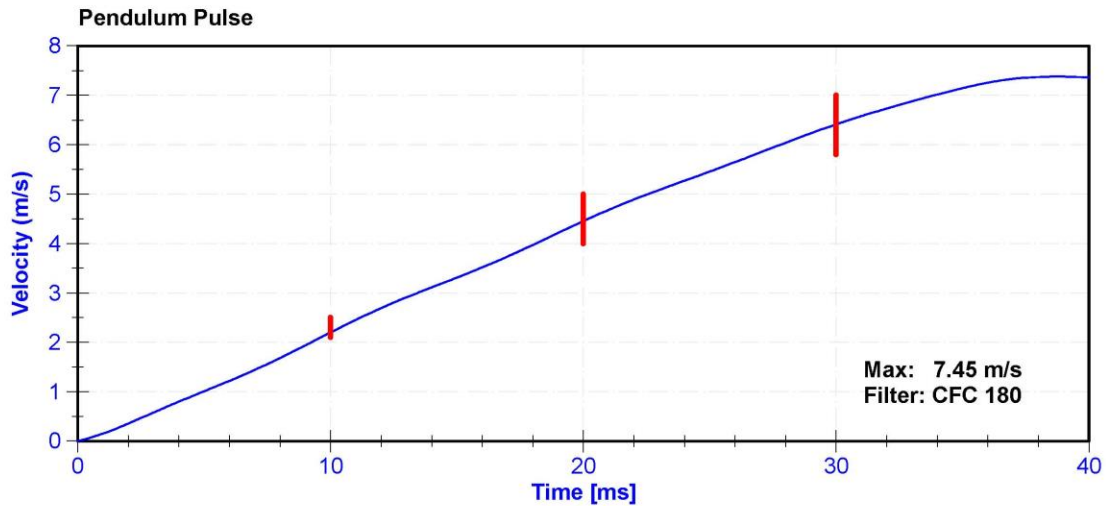
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	288	Laboratory Supervisor	K. Brogan

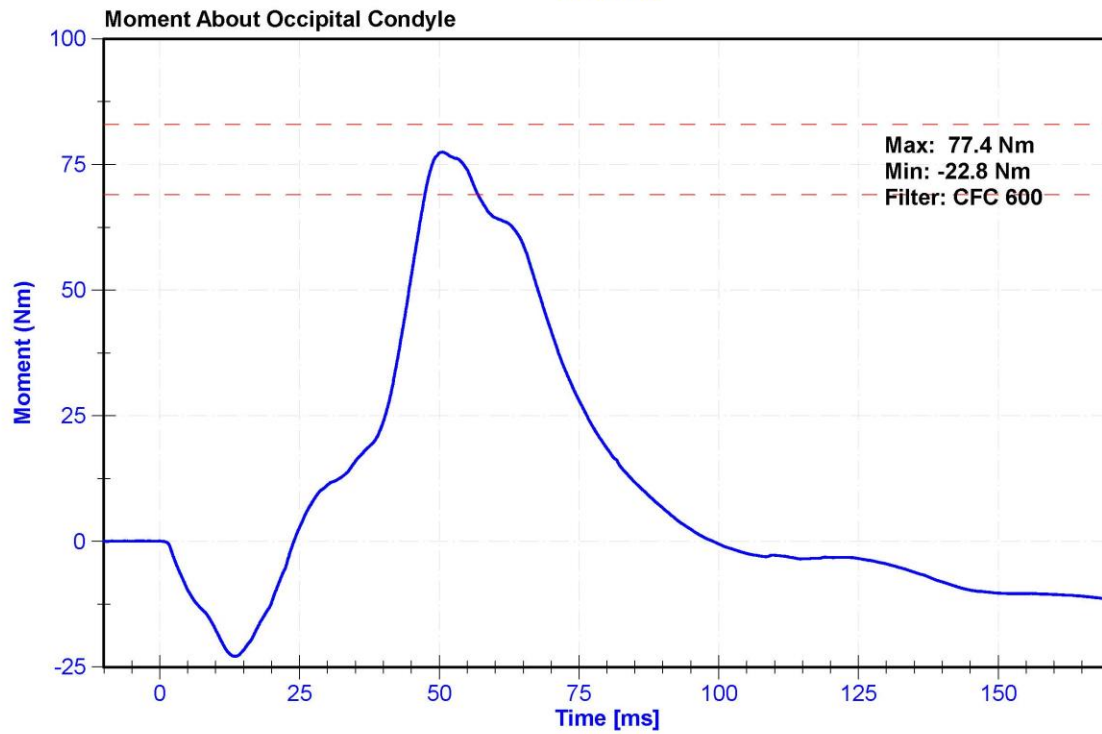
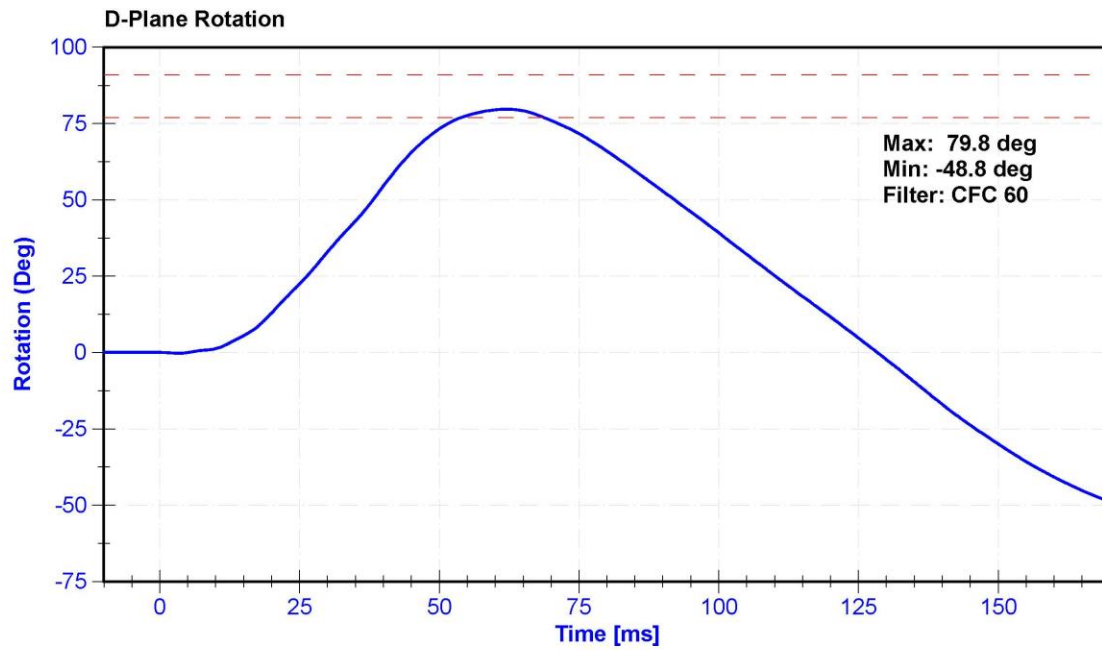
Results

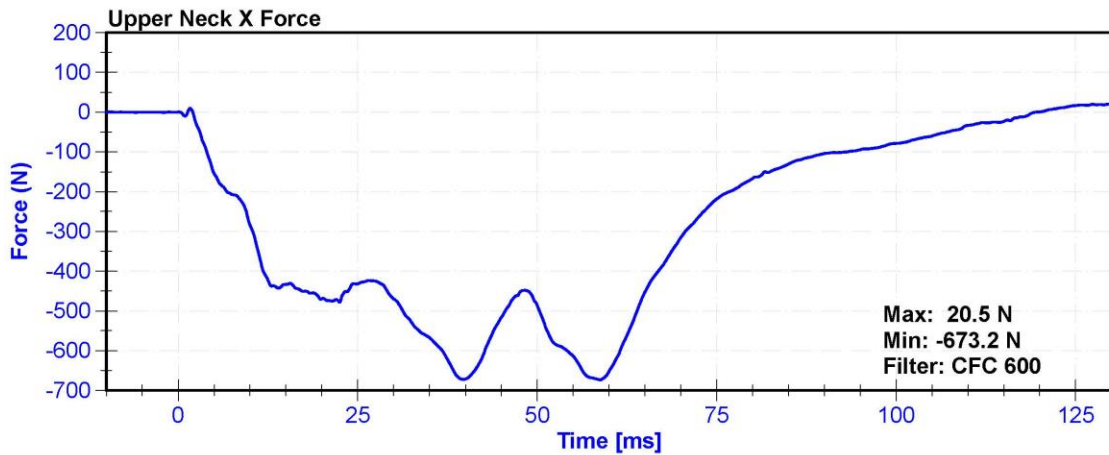
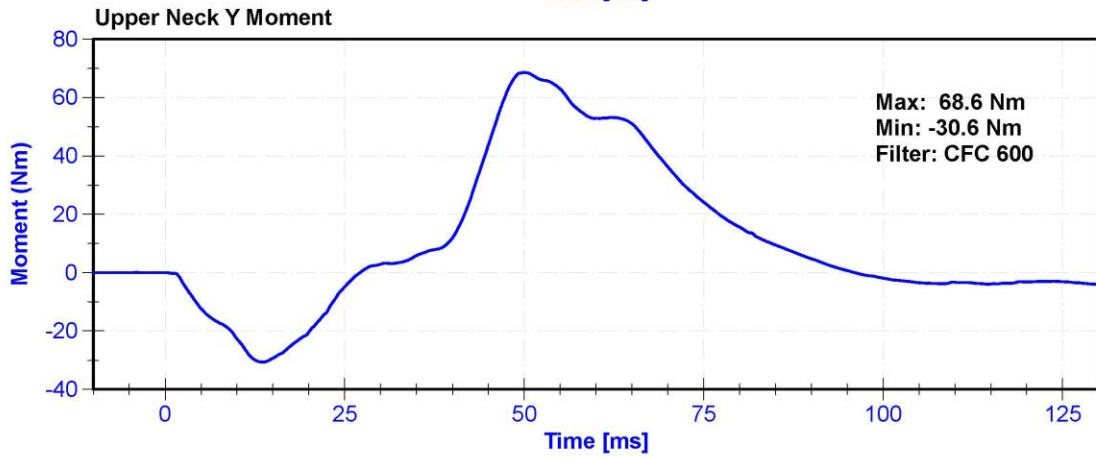
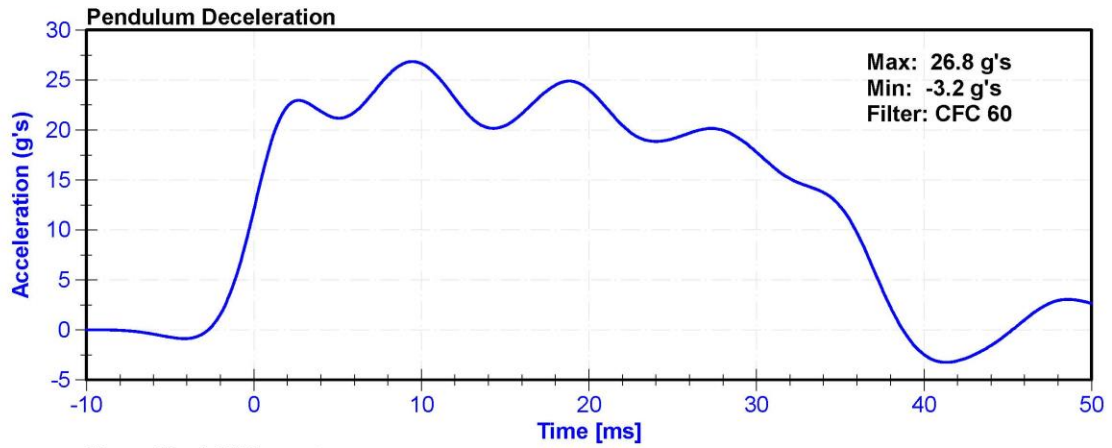
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	64.7	Pass
Velocity	6.89	7.13	m/s	6.903	Pass
Pendulum Impulse at 10ms	2.1	2.5	m/s	2.20	Pass
Pendulum Impulse at 20ms	4.0	5.0	m/s	4.45	Pass
Pendulum Impulse at 30ms	5.8	7.0	m/s	6.41	Pass
Max D Plane Rotation	77	91	deg	79.8	Pass
Max Moment During Rotation Interval	69	83	Nm	77.4	Pass
Moment Decay to 10.0 Nm	80	100	ms	86.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
Pendulum Potentiometer	ETI SP22G	DS-LABPOT1	11/15/2018	11/15/2019
Condyle Potentiometer	ETI SP22G	DS-LABPOT2	11/15/2018	11/15/2019
Upper Neck Load Cell	DENTON 1716A	LC-1591Fx	9/28/2018	9/28/2019







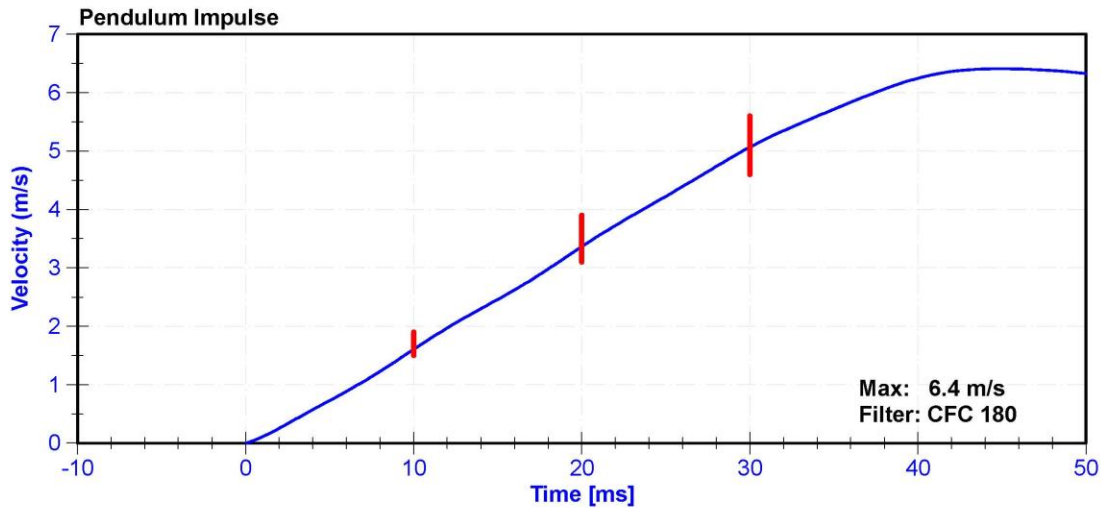
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	288	Laboratory Supervisor	K. Brogan

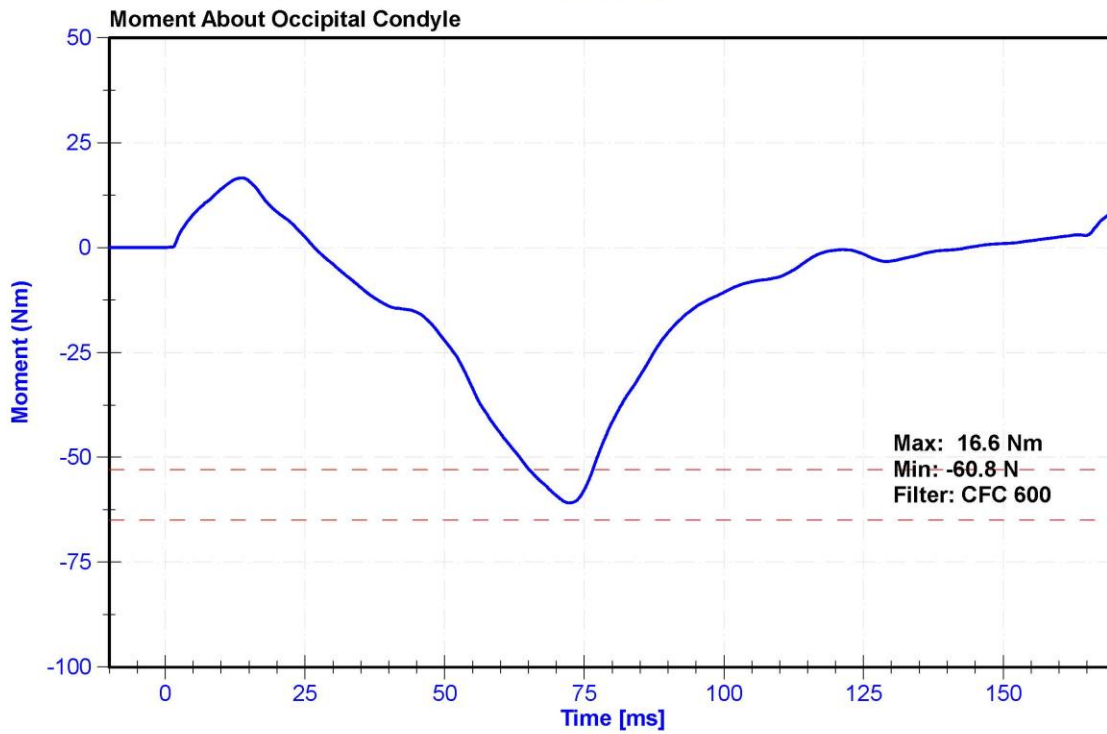
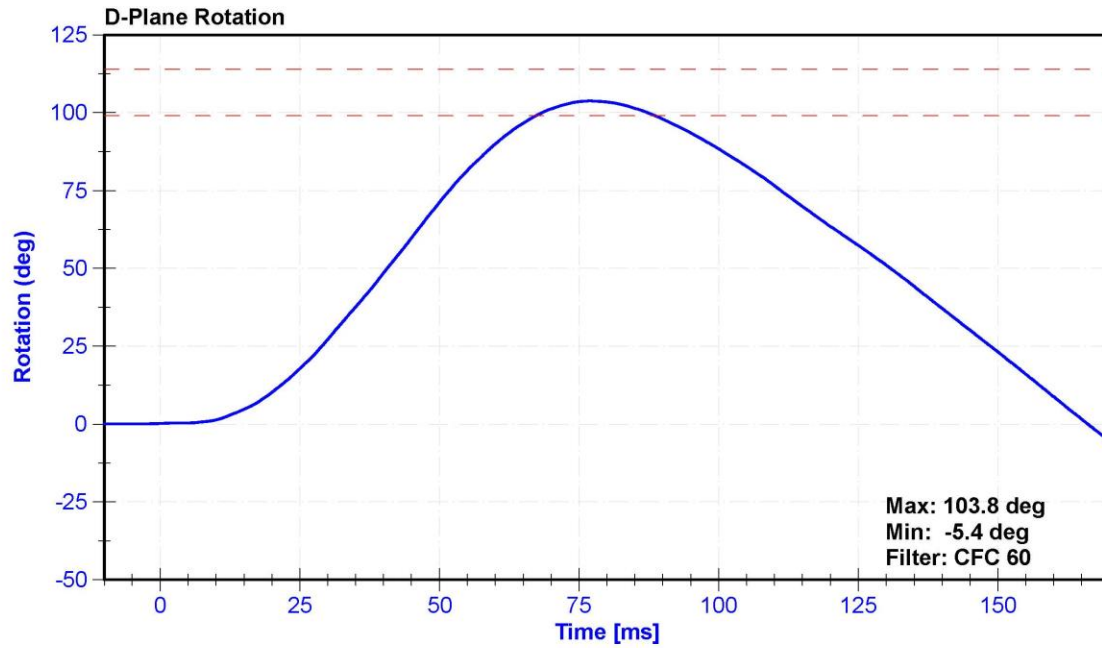
Results

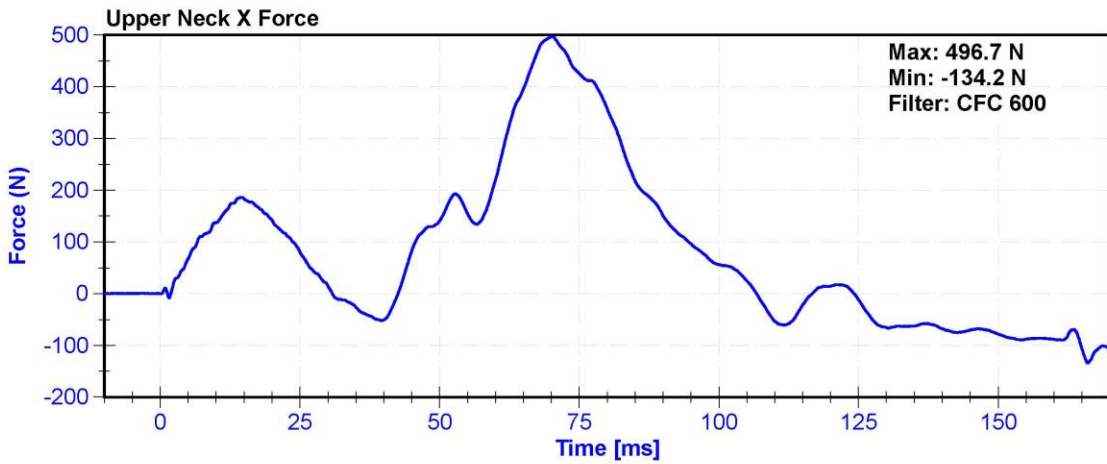
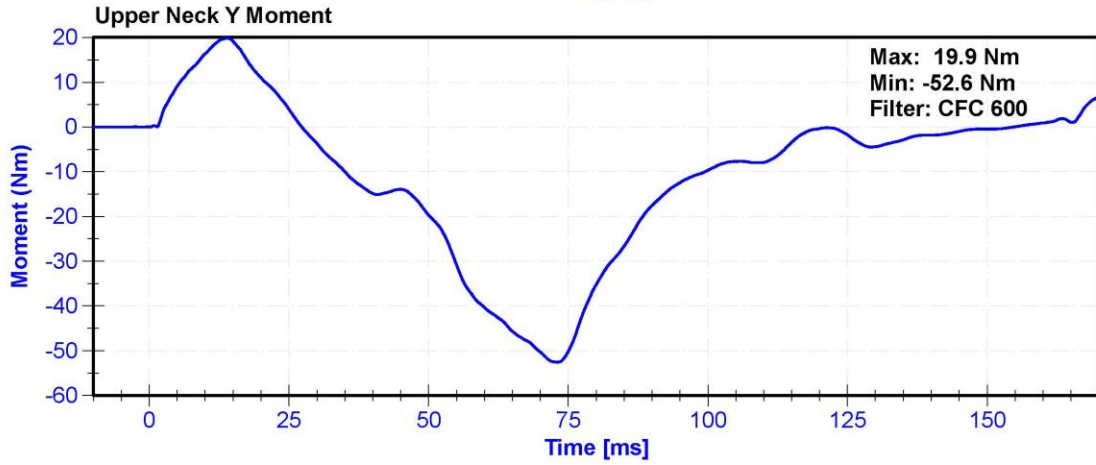
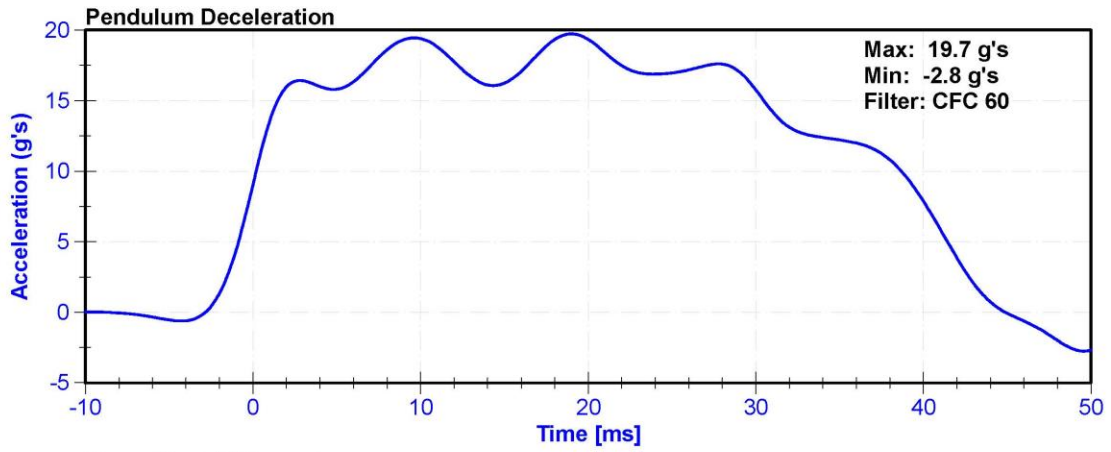
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	65.7	Pass
Velocity	5.95	6.19	m/s	6.005	Pass
Pendulum Impulse at 10ms	1.5	1.9	m/s	1.60	Pass
Pendulum Impulse at 20ms	3.1	3.9	m/s	3.36	Pass
Pendulum Impulse at 30ms	4.6	5.6	m/s	5.07	Pass
D Plane Rotation	99	114	deg	103.8	Pass
Moment During Rotation Interval	-65	-53	Nm	-60.8	Pass
Moment Decay to -10Nm	94	114	ms	101.0	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	ETI SP22G	DS-LABPOT1	11/15/2018	11/15/2019
Condyle Potentiometer	ETI SP22G	DS-LABPOT2	11/15/2018	11/15/2019
Upper Neck Load Cell	DENTON 1716A	LC-1591Fx	9/28/2018	9/28/2019







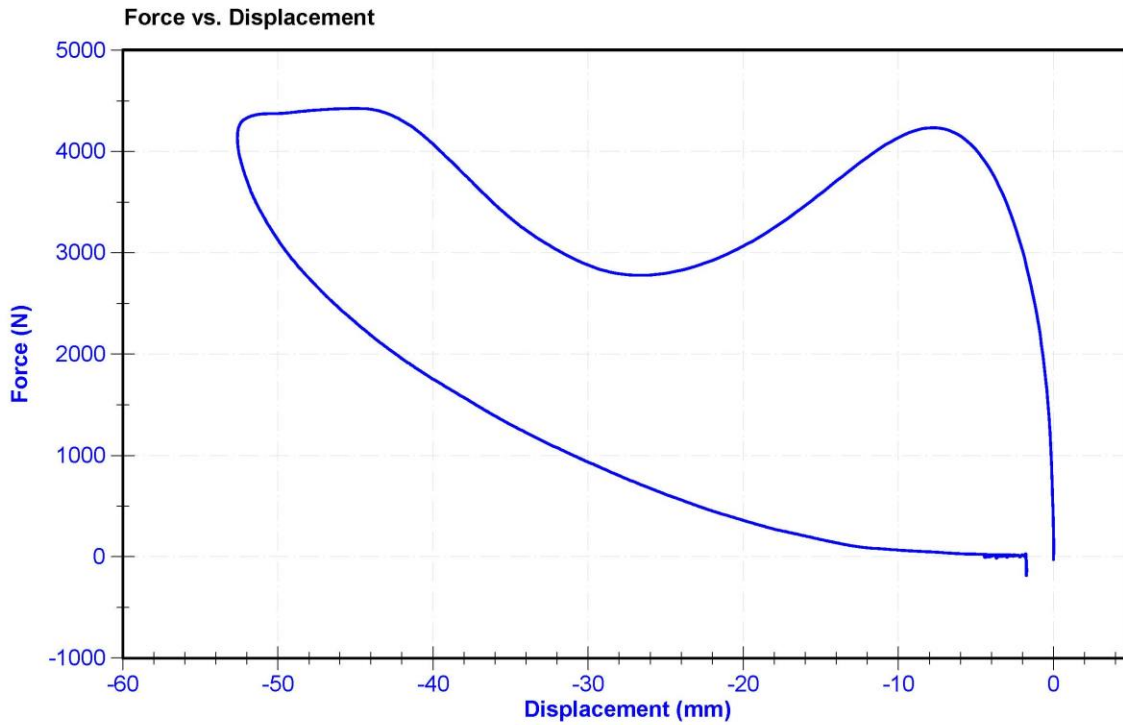
ATD Manufacturer	FTSS	Test Technician	M. Goehle
ATD Serial Number	288	Laboratory Supervisor	K. Brogan

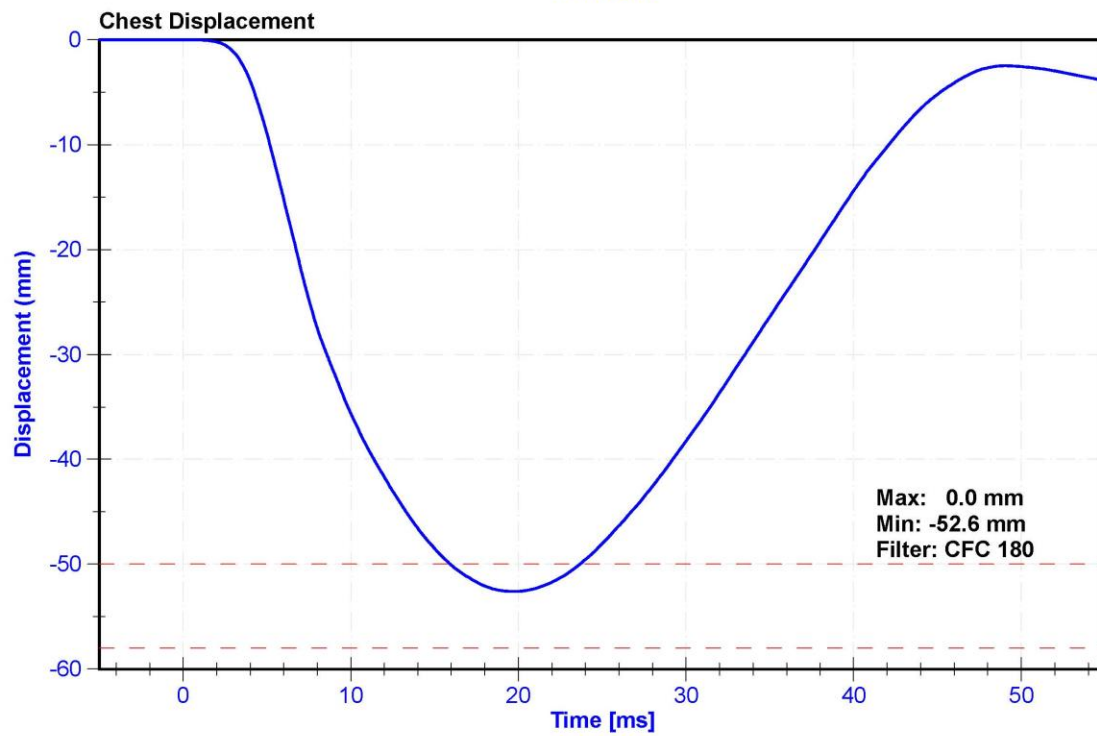
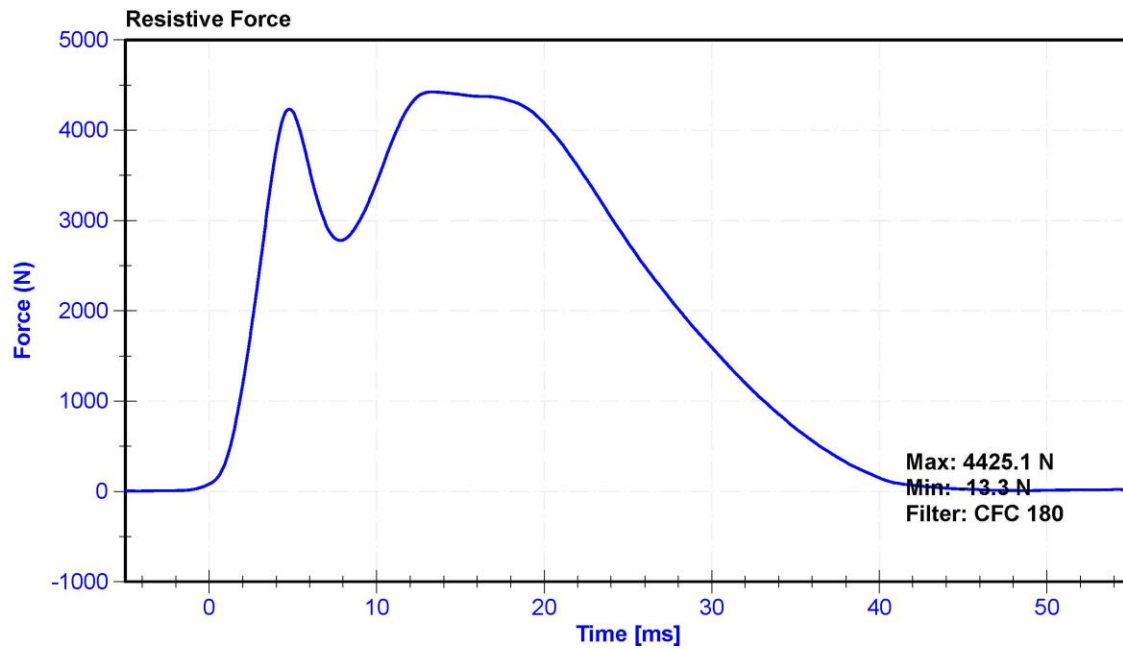
Results

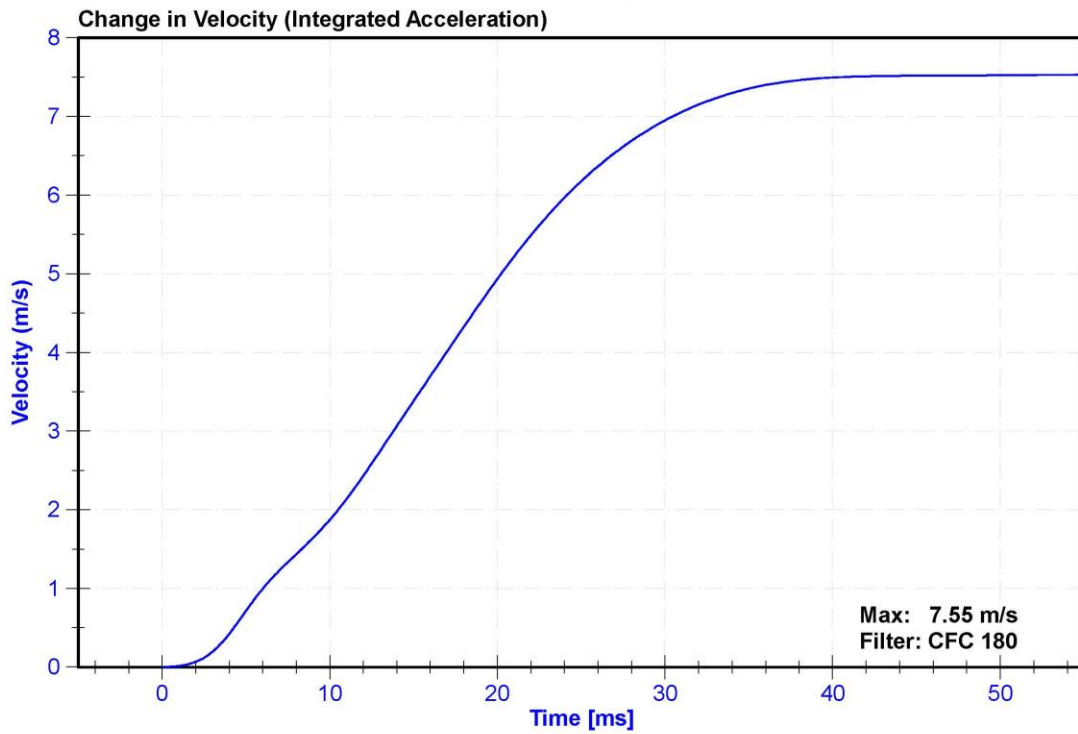
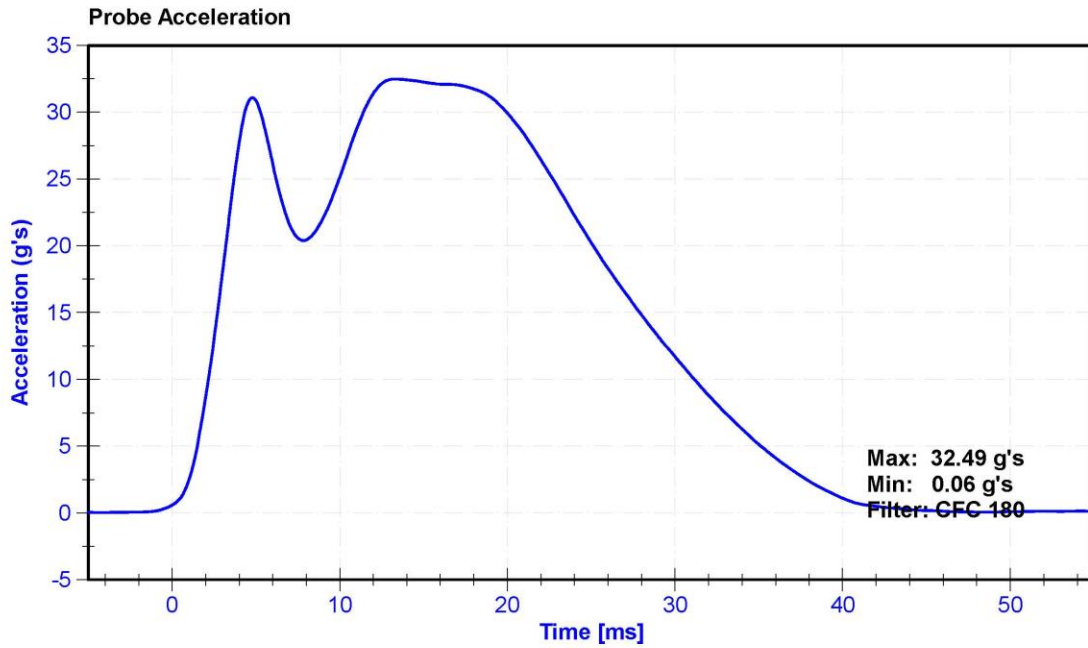
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	60.5	Pass
Velocity	6.59	6.83	m/s	6.684	Pass
Chest Deflection	-58	-50	mm	-52.6	Pass
Maximum Resistive Force (50 to 58mm)	3900	4400	N	4374.0	Pass
Maximum Resistive Force (18 to 50mm)	0	4600	N	4425.1	Pass
Hysteresis	69	85	%	71.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020
Chest Potentiometer	SERVO 14CBI-3615	DS-140GFE	6/21/2019	6/20/2020







ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	288	Laboratory Supervisor	K. Brogan

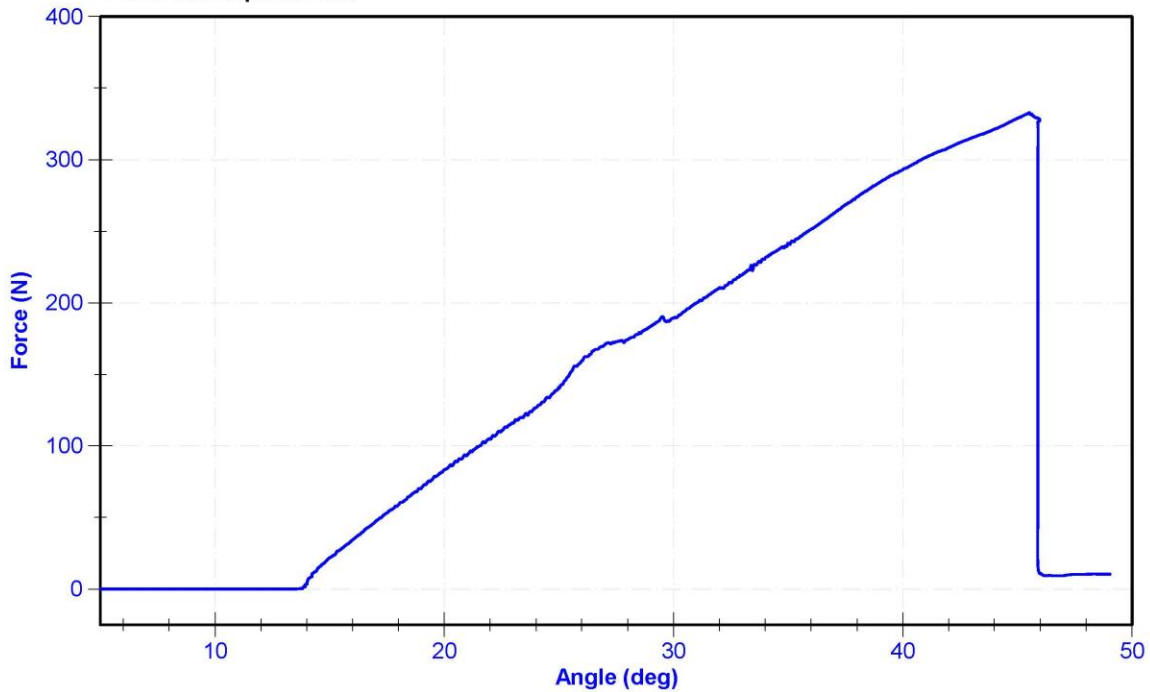
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.6	25.6	°C	21.3	Pass
Humidity	10	70	%	62.6	Pass
Initial Angle	0	20	deg	12.8	Pass
Force at 45 Degrees	320	390	N	332.9	Pass
Return Angle Relative to Initial	0	8	deg	3.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	Rieker N4C-1	DS-13051548	10/25/2018	10/25/2019
Load Cell	Interface SML-200	LC-493319	10/25/2018	10/25/2019

Force vs. Displacement



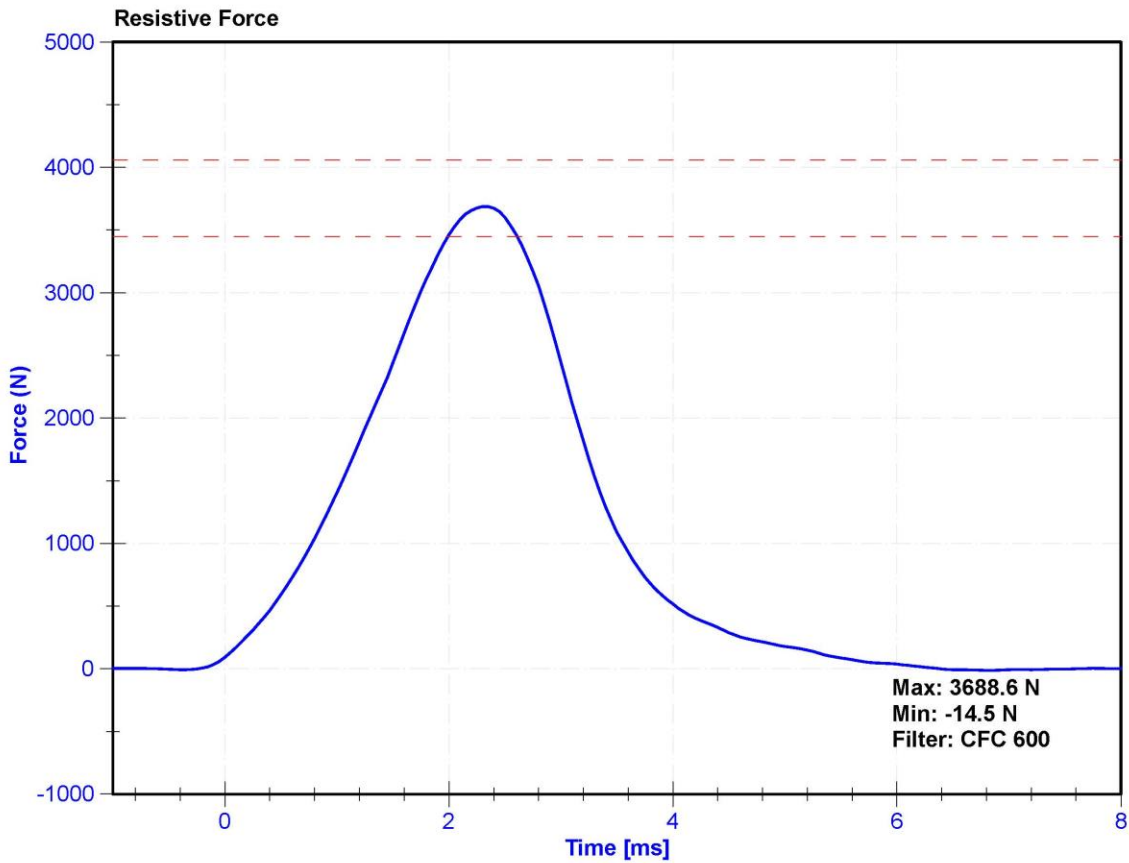
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	288	Laboratory Supervisor	K.Brogan

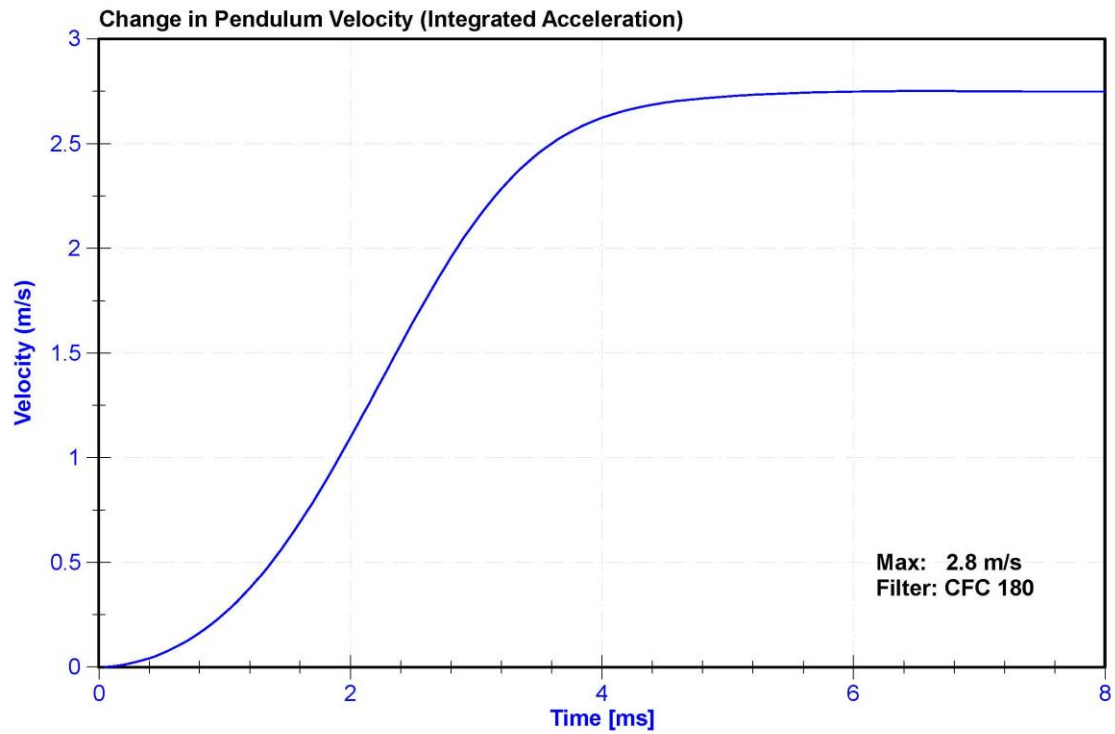
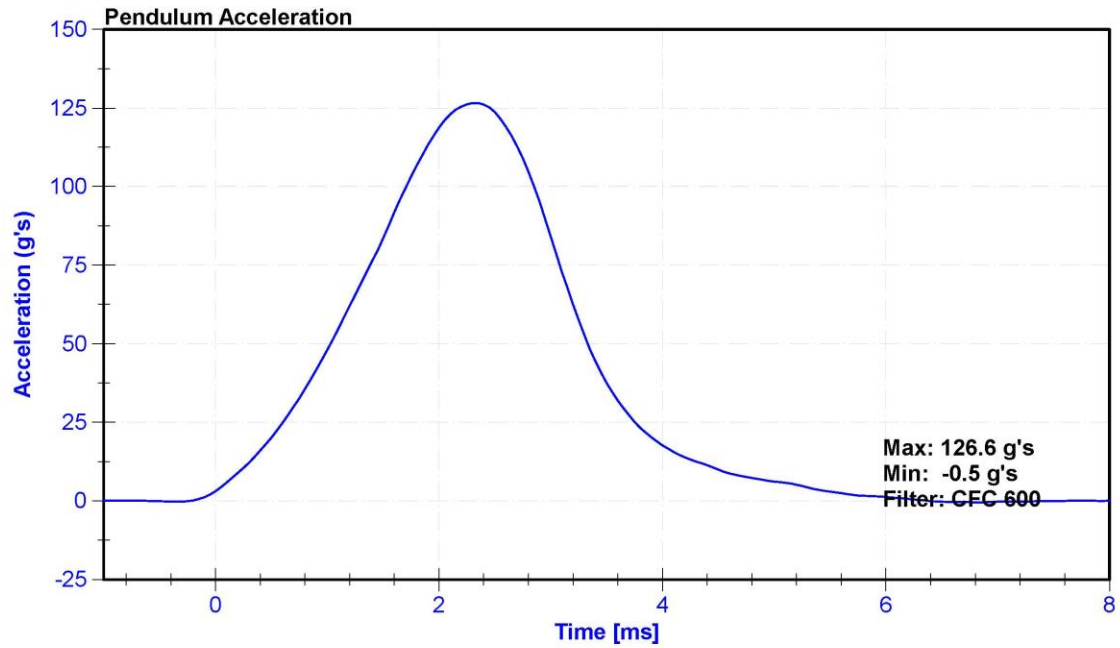
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.4	Pass
Humidity	10	70	%	68.1	Pass
Velocity	2.07	2.13	m/s	2.088	Pass
Resistive Force	3450	4060	N	3688.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019





ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	288	Laboratory Supervisor	K.Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.2	Pass
Humidity	10	70	%	68.6	Pass
Velocity	2.07	2.13	m/s	2.086	Pass
Resistive Force	3450	4060	N	3856.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	2/21/2019	8/22/2019

