

REPORT NUMBER: NCAP-CAL-23-001

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

**AUDI AG
2023 Audi Q7
5 Door SUV**

NHTSA No: M20235800

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



October 24, 2023

FINAL REPORT

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

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Administration, in response to Contract Number 693JJ919D000005.

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

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

Prepared by:  Date: October 24, 2023
Quinn Porzio, Test Engineer

Approved by:  Date: October 24, 2023
Matthew Pronko, Test Engineer

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NCAP-CAL-23-001		2. Government Accession No.		3. Recipient's Catalog No.																																																					
4. Title and Subtitle Final Report of New Car Assessment Program Frontal Impact Testing of a 2023 Audi Q7 5 Door SUV NHTSA No.: M20235800				5. Report Date October 24, 2023																																																					
				6. Performing Organization Code CAL																																																					
7. Author(s) Quinn Porzio, Test Engineer Matthew Pronko, Test Engineer				8. Performing Organization Report No. CAL-DOT-2023-001																																																					
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225				10. Work Unit No.																																																					
				11. Contract or Grant No. 693JJ919D000005																																																					
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards 1200 New Jersey Ave., SE Washington, D.C. 20590				13. Type of Report and Period Covered: Final Test Report February 2, 2023 - October 24, 2023																																																					
				14. Sponsoring Agency Code NRM-100																																																					
15. Supplementary Notes																																																									
16. Abstract A 56.30 km/h (35 mph), NCAP frontal rigid barrier impact test was conducted on a 2023 Audi Q7 5 Door SUV in accordance with the specifications of the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing. The test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on February 2, 2023. The impact velocity of the vehicle was 56.29 km/h, and the ambient temperature at the barrier face at the time of impact was 21.1°C. The target vehicle post-test maximum crush was 550 mm at crush zone 3. The test vehicle's occupant performance data is as follows: <table border="1"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">Driver ATD (Serial No. 142)</th> <th colspan="2">Passenger ATD (Serial No. 137)</th> </tr> <tr> <th>Threshold</th> <th>Result</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC15)</td> <td></td> <td>700</td> <td>133.389</td> <td>700</td> <td>184.383</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>-32.457</td> <td>52</td> <td>-15.218</td> </tr> <tr> <td>Nij</td> <td></td> <td>1</td> <td>0.255</td> <td>1</td> <td>0.356</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>920.764</td> <td>2620</td> <td>604.048</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>-205.512</td> <td>2520</td> <td>-386.282</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>-344.213</td> <td>6805</td> <td>-1079.533</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>-224.903</td> <td>6805</td> <td>-89.972</td> </tr> </tbody> </table>						Measurement Description	Units	Driver ATD (Serial No. 142)		Passenger ATD (Serial No. 137)		Threshold	Result	Threshold	Result	Head Injury Criteria (HIC15)		700	133.389	700	184.383	Maximum Chest Compression	mm	63	-32.457	52	-15.218	Nij		1	0.255	1	0.356	Neck Tension	N	4170	920.764	2620	604.048	Neck Compression	N	4000	-205.512	2520	-386.282	Left Femur Force	N	10008	-344.213	6805	-1079.533	Right Femur Force	N	10008	-224.903	6805	-89.972
Measurement Description	Units	Driver ATD (Serial No. 142)		Passenger ATD (Serial No. 137)																																																					
		Threshold	Result	Threshold	Result																																																				
Head Injury Criteria (HIC15)		700	133.389	700	184.383																																																				
Maximum Chest Compression	mm	63	-32.457	52	-15.218																																																				
Nij		1	0.255	1	0.356																																																				
Neck Tension	N	4170	920.764	2620	604.048																																																				
Neck Compression	N	4000	-205.512	2520	-386.282																																																				
Left Femur Force	N	10008	-344.213	6805	-1079.533																																																				
Right Femur Force	N	10008	-224.903	6805	-89.972																																																				
17. Key Words 56.3 km/h (35 mph) Full Frontal Rigid Barrier Impact Test New Car Assessment Program (NCAP)				18. Distribution Statement <u>Copies of this report are available from:</u> National Highway Traffic Safety Administration Technical Information Services Division 1200 New Jersey Ave, SE Washington, DC 20590																																																					
19. Security Class. (of this report) UNCLASSIFIED		20. Security Class. (of this page) UNCLASSIFIED		21. No. of Pages 169	22. Price																																																				

Form DOT F1700.7 (8-69)

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1	Purpose and Summary of the Test	1-1
2	Occupant and Vehicle Information / Data Sheets	2-1
<u>Data Sheet</u>		<u>Page</u>
1	General Test and Vehicle Parameter Data	2-2
2	Seat Adjustment, Fuel System, and Steering Wheel Data	2-6
3	Dummy Longitudinal Clearance Dimensions	2-8
4	Dummy Lateral Clearance Dimensions	2-9
5	Seat Belt Positioning Data	2-10
6	High-Speed Camera Locations and Data	2-11
7	Vehicle Accelerometer Locations	2-13
8	Photographic Reference Target Locations	2-14
9	Load Cell Locations on Fixed Barrier	2-15
10	Test Vehicle Summary of Results	2-16
11	Post-Test Observations	2-17
12	Vehicle Profile Measurements	2-18
13	Accident Investigation Division Data	2-21
14	Vehicle Intrusion Measurements	2-22
15	Summary of Indicant FMVSS No.212 and FMVSS No.219 (Partial) Data	2-24
16	FMVSS 301 Barrier Impact & Static Rollover Results	2-26
17	Dummy/Vehicle Temperature Stabilization Chart	2-27
<u>Appendix</u>		<u>Page</u>
A	Photographs	A-1
B	Dummy Response Data Traces	B-1
C	Dummy Calibration and Performance Verification Data	C-1
D	Test Equipment and Instrumentation Calibration	D-1

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. 693JJ919D000005. 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 Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing.

SUMMARY

A load cell barrier consisting of 128 load cells was impacted by a 2023 Audi Q7 5 Door SUV at a velocity of 56.29 km/h. The test was performed at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on February 2, 2023. 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 16 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 Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing. Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, femur load cells, and lower leg instrumentation. Seat belt load cells were installed on the driver's and passenger's shoulder belts to measure dummy torso section loading. The driver (position 1) ATD (Serial No. 142) and the right-front passenger (position 2) ATD (Serial No. 137) were qualified prior to this test. Certification details, along with instrumentation calibration data, can be found in Appendix C of this report.

The 486 channels of data were recorded on an on-board data acquisition system. Appendix B contains the vehicle, load cell barrier and dummy response data traces.

There was a total of 0.0 grams of Stoddard solvent / electrolyte leakage after the event or during any phase of the static rollover. The maximum static crush of the vehicle was 550 mm and both driver and passenger side doors remained closed during the impact event and were operable after the impact.

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

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

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 (50th)	133.389	0.255	920.764	-205.512	36.615	-32.457	-344.213	-224.903
Passenger (5th)	184.383	0.356	604.048	-386.282	38.810	-15.218	-1079.533	-89.972

GENERAL COMMENTS:

1. P1 (Driver) serial number - 142
2. P2 (Passenger) serial number - 137
3. P1 Seatbelt lap load cells were not installed.
4. P2 Seatbelt lap load cells were not installed.

Data Anomalies:

- Engine Top X Acceleration, Questionable data from 29 ms to 31 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 Indicant FMVSS No. 212 and FMVSS No. 219 (Partial)

Data Sheet No. 16 – FMVSS 301 Barrier Impact and Static Rollover Results

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

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Audi Q7 5 Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
Test Date: 02/02/2023

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20235800	Traction Control System (TCS)	Yes
Model Year	2023	Power Steering	Yes
Make	Audi	Power Window Auto-Reverse	Yes
Model	Q7	Driver Frontal Airbag	Yes
Body Style	SUV	Driver Curtain Airbag	Yes
VIN	WA1ACBF74PD002763	Driver Head/Torso Airbag	No
Body Color	Gray	Driver Torso Airbag	No
Odometer Reading (km /mi)	21 miles	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	2.0	Driver Pelvis Airbag	No
Type / No. Cylinders	I4	Driver Knee Airbag	No
Engine Placement	Inline	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	8-Speed	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	AWD	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof / T-Top	Yes	Front Pass. Knee Airbag	No
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	Yes	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Other –	N/A

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

No

DATA FROM CERTIFICATION LABEL

Manufactured By	AUDI AG	GVWR	2900
Date of Manufacture	09/22	GVWR Front	1450
		GVWR Rear	1650

VEHICLE SEATING AND WEIGHT CAPACITY DATA

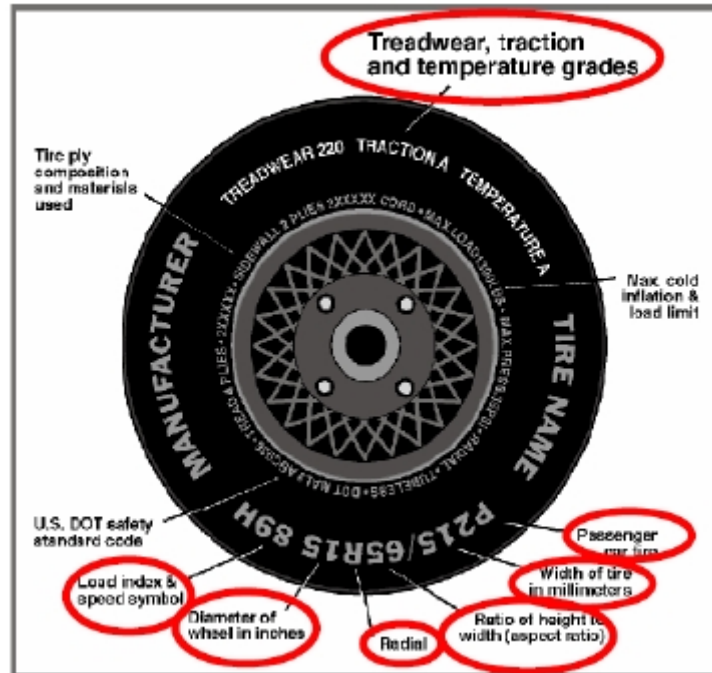
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench	Split Bench	
Number of Occupants	2	3	2	7
Capacity Wt. (VCW) (kg)				610
Cargo Wt. (RCLW) (kg)				133.72

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

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023

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



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	340	340
Cold Pressure (kPa)	250	270
Recommended Tire Size	285/45 R20	285/45 R20
Tire Size on Vehicle	285/45 R20	285/45 R20
Tire Manufacturer	Pirelli	Pirelli
Tire Model	Scorpion Verde	Scorpion Verde
Treadwear	600	600
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2 Rayon	2 Rayon
Tire Plies Body	2 Rayon, 2 Steel, 1 Polyamide	2 Rayon, 2 Steel, 1 Polyamide
Load Index / Speed Symbol	112H	112H
Tire Material	Rubber	Rubber
DOT Safety Code Left	93 PN 454E 2422	93 PN 454E 2422
DOT Safety Code Right	93 PN 454E 2422	93 PN 454E 2422

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

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023

TEST VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	573	518		587	638	
Right	kg	592	509		648	588	
Ratio	%	53.1	46.9		50.2	49.8	
Total	kg	1165	1027	2192	1235	1226	2461

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	2192	(A)
Weight of 1 P572E ATD & 1 P572O ATD	kg	142	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	133.72	(C)
Calculated Vehicle Target Weight (TVTW)	kg	2467.72	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

Condition	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	883	885	901	903	1403
As Tested	mm	881	880	877	878	1492
Post-Test	mm	893	887	874	876	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2995
Total Vehicle Length at Left Side	mm	4985
Total Vehicle Length at Centerline	mm	5061
Total Vehicle Length at Right Side	mm	4985
Weight of Ballast in Cargo Area	kg	125
Weight of Vehicle Components Removed	kg	59
Amount of Stoddard Solvent in Fuel Tank	L	79.1

LIST OF COMPONENTS REMOVED TO MEET TEST WEIGHT:

Trunk Carpeting, Rear Speaker, Third Row Seats

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

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023

TARGET VEHICLE STRUCTURAL MEASUREMENT

No.	Description	Pre-Test
1	Total Length	5061
2	Total Width	1958
3*	Bumper Top Height	562
4*	Bumper Bottom Height	473
5*	Longitudinal Member Top Height	686
6	Distance Between Longitudinal Members	956
7	Longitudinal Member Width	75
8*	Engine Top Height	891
9*	Engine Bottom Height	276
10	Engine and Gearbox Width	496
11	Front Bumper-Engine Distance	689
12*	Front Shock Absorber Fixing Height	972
13*	Bonnet Leading Edge Height	964
14	Front Shock Absorber Fixing Width	873
15	Front Bumper – Front Axle Distance	979
16	Front Axle – A Pillar Distance	603
17	A-Pillar – B-Pillar Distance	1129
18	B-Pillar – Rear Axle Distance	1257
19	B-Pillar – C-Pillar Distance	1093
20*	Roof Sill Bottom Height	1649
21*	Roof Sill Top Height	1702
22*	Floor Sill Bottom Height	453
23*	Floor Sill Top Height	483

*Height Measurements are taken from the ground

Note: All measurements are in millimeters

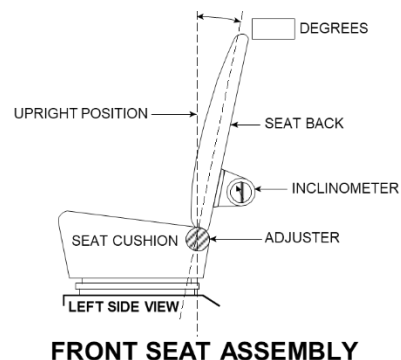
DATA SHEET NO. 2
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023

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.



Seating Position	Degrees
Driver Seat Back Angle	13.7
Passenger Seat Back Angle	21.2

SEAT FORE / AFT POSITIONS

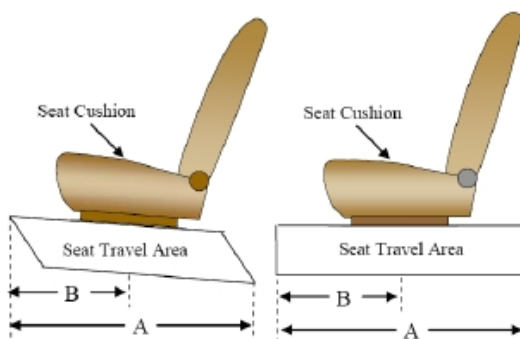
The driver's seat was positioned at the mid-point of fore/aft travel at its lowest position. The passenger's seat was positioned at the most forward position of fore/aft travel. Zero is defined as the forward most position.

Seating Position	Total Fore / Aft Travel	Placed in Position #
Driver Seat	322	161
Passenger Seat	246	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	4 (0-3)	0
Passenger Seat	4 (0-3)	0



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

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

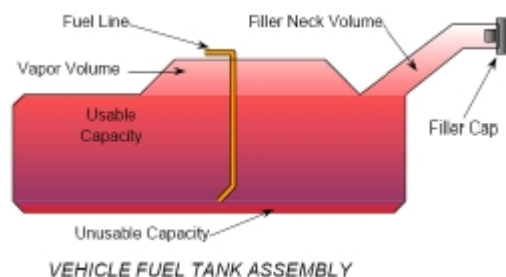
NHTSA No.: M20235800
 Test Date: 02/02/2023

FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank"	85
Usable Capacity of "Optional Tank"	N/A
92%-94% of Usable Capacity	78.2 - 79.9
Actual Amount of Solvent Used	79.1
1/3 of Usable Capacity	28.3

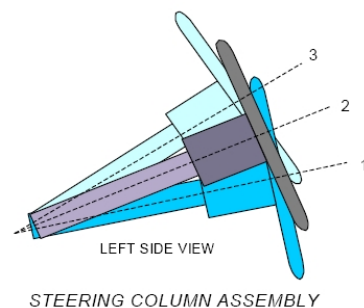
FUEL PUMP

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



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.



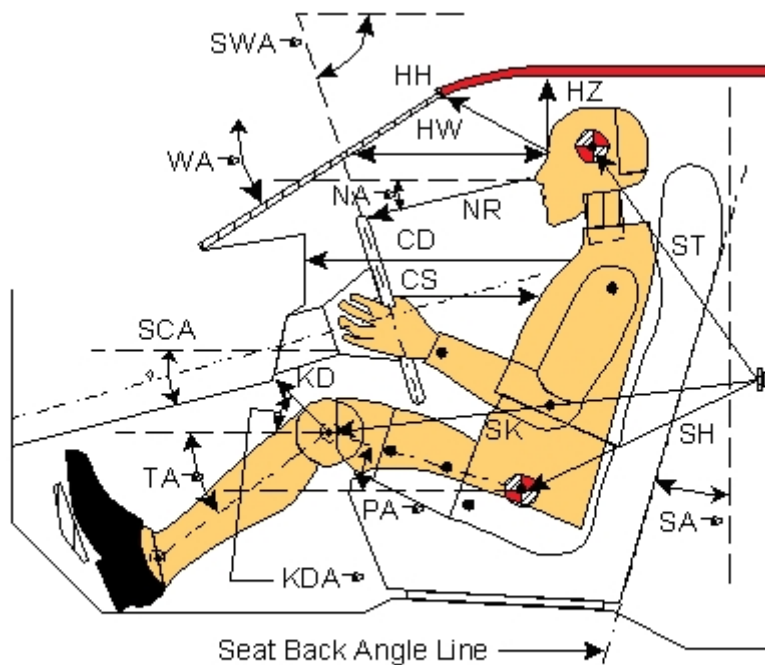
STEERING COLUMN POSITIONS

Description	Degrees	Fore / Aft Position (mm)
Lowermost position No. 1	22.2	
Geometric center position No. 2	24.3	
Uppermost position No. 3	26.3	
Telescoping Steering Wheel Travel		68
Test Position	24.3	34

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023



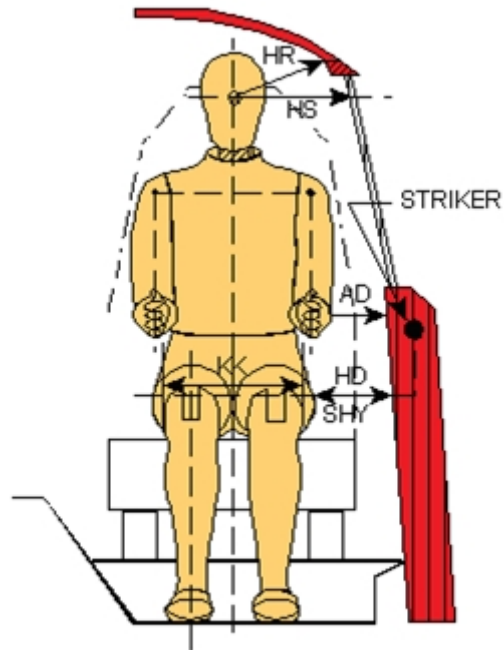
Left Side View

Code	Measurement Description	Driver (SN: 142)		Passenger (SN: 137)	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		31.2		
SWA°	Steering Wheel Angle		24.3		
SCA°	Steering Column Angle		65.7		
SA°	Seat Back Angle (on headrest post)		13.7		21.2
HZ	Head to Roof (Z)	195	90.0	218	90.0
HH	Head to Header	371	24.1	329	46.2
HW	Head to Windshield	623	0.0	651	0.0
NR	Nose to Rim / Dash	380	8.2	414	18.8
CD	Chest to Dash	508		364	
CS	Chest to Steering Hub	313	0.7		
RA	Rim to Abdomen	193	0.0		
KDL	Left Knee to Dash	191	30.5	70	46.6
KDR	Right Knee to Dash	198	31.5	79	45.3
PA°	Pelvic Angle		21.7		21.3
TA°	Tibia Angle		27.9		45.1
SK	Striker to Knee	556	7.5	676	4.4
ST	Striker to Head	510	81.4	389	22.4
SH	Striker to H-Point	260	46.0	485	70.8

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2023 Audi Q7 5 Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
Test Date: 02/02/2023



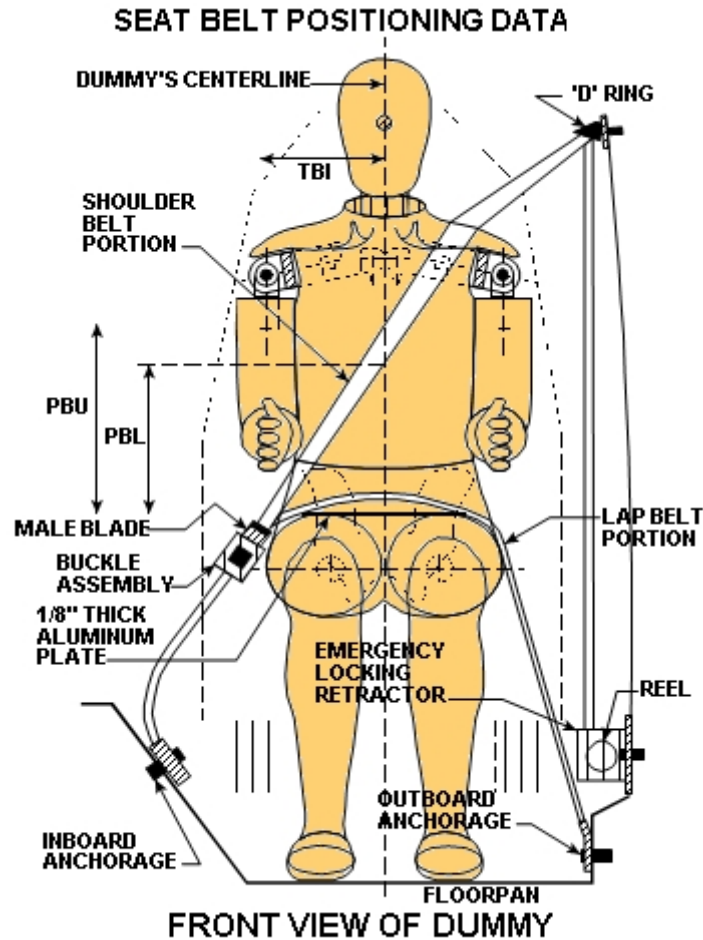
Front View

Code	Description	Driver (mm)	Passenger (mm)
AD	Arm to Door	154	91
HD	H-Point to Door	155	188
HR	Head to Side Header	239	268
HS	Head to Side Window	370	373
KK	Knee to Knee	340	214
SHY	Striker to H-Point (Y Direction)	281	290
AA	Ankle to Ankle	362	184

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle: 2023 Audi Q7 5 Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
Test Date: 02/02/2023



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU — Top surface of reference to belt upper edge	mm	312	286
PBL — Top surface of reference to belt lower edge	mm	232	203

BELT LENGTH DATA

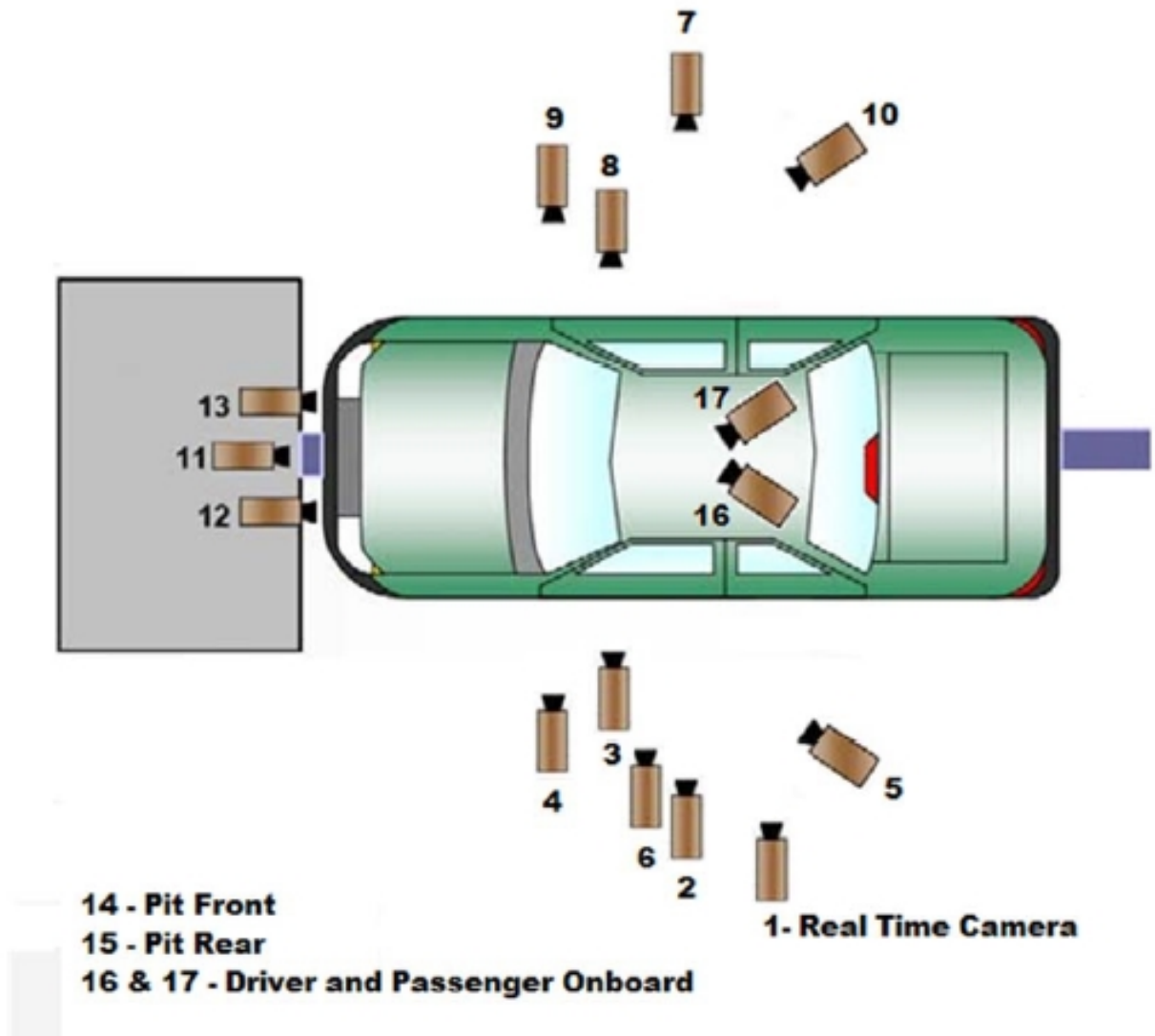
Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	895	957
Lap Belt Length as measured on ATD	mm	824	935
Remainder of belt on reel	mm	766	593
Total belt length for continuous webbing systems	mm	2485	2485

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

Test Vehicle: 2023 Audi Q7 5 Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
Test Date: 02/02/2023

CAMERA POSITIONS FOR FRONTAL IMPACTS



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

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023

CAMERA LOCATIONS

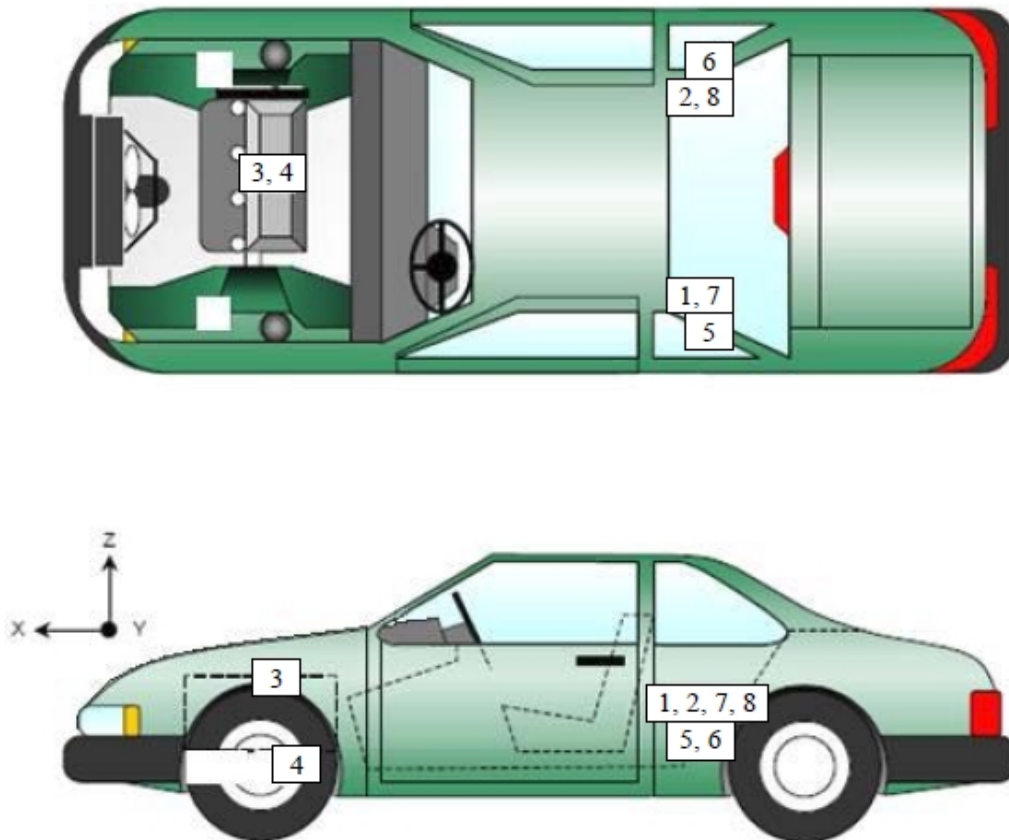
No.	Camera View	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall				Zoom	30
2	Left Overall	-2420	-8641	-1448	24	1000
3	Driver Close-Up	-997	-8039	-1423	50	1000
4	Left Front Half	-564	-8020	-1366	28	1000
5	Left Angle	-4769	-4217	-2301	50	1000
6	Steering Column	-1192	-8660	-2336	75	1000
7	Right Overall	-2232	8423	-1354	24	1000
8	Passenger Close-Up	-1397	8365	-1523	50	1000
9	Right Front Half	-728	8161	-1398	28	1000
10	Right Angle	-3958	5031	-2372	50	1000
11	Windshield	1137	0	-4150	12.5	1000
12	Driver Windshield	981	-400	-2380	25	1000
13	Passenger Windshield	981	400	-2380	25	1000
14	Pit Front	-626	0	2981	12.5	1000
15	Pit Rear	-3234	0	3013	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: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Accelerometer – X Direction	2089	-240	46
2	Right Rear Accelerometer – X Direction	2087	221	44
3	Engine Top X	4477	-181	-285
4	Engine Bottom X	4286	34	169
5	Left Rear Accelerometer – Z Direction	2089	-240	46
6	Right Rear Accelerometer – Z Direction	2087	221	44
7	Left Rear Accelerometer – X Direction Redundant	2090	-253	48
8	Right Rear Accelerometer – X Direction Redundant	2087	244	43

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

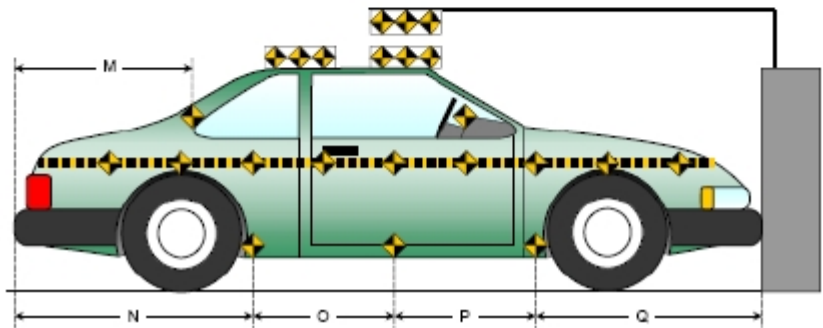
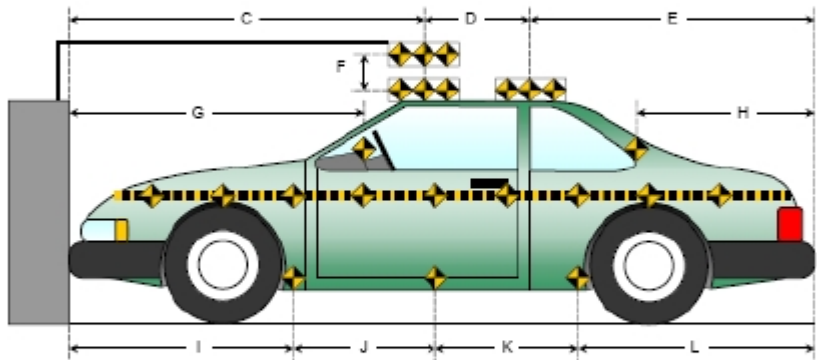
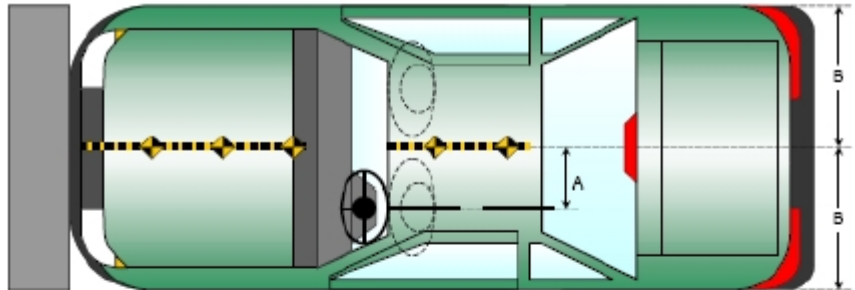
DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023

Item	Value
A	374
B	979
C	2264
D	609
E	2188
F	168
G	1990
H	1192
I	1481
J	997
K	998
L	1585
M	1187
N	1581
O	994
P	1005
Q	1481

All units in millimeters



DATA SHEET NO. 9 **LOAD CELL LOCATIONS ON FIXED BARRIER**

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023

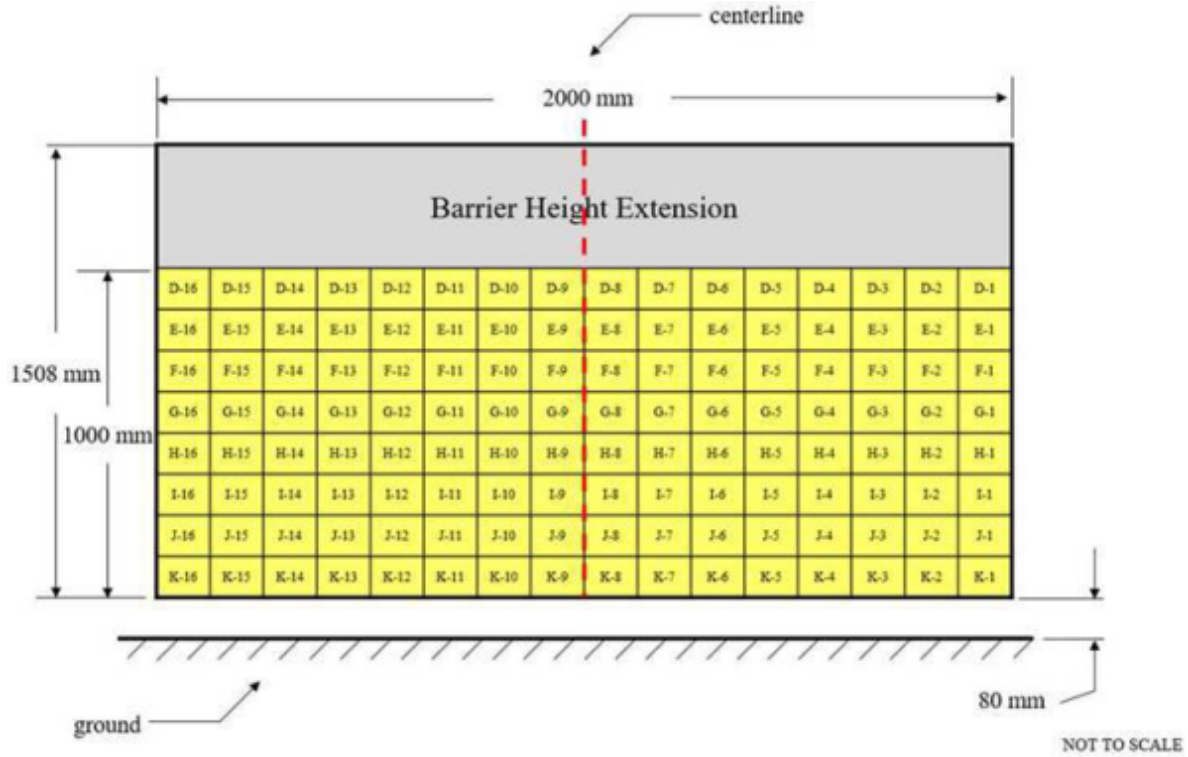


Figure 1 - Load Cell Locations on a 128-Load Cell Barrier with Plywood Height Extension*
 Please note above diagram is not actual representation of load cell barrier used.

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2023 Audi Q7 5 Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
Test Date: 02/02/2023

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Accelerometers	47
Passenger Dummy Accelerometers	47
Vehicle Structure Accelerometers	8
Load Cell Barrier	384
Total	486

CAMERA COVERAGE

Type of Camera	Number Used in this Test
High-Speed Vehicle Onboard	2
High-Speed Offboard	14
Real-Time Panning	1
Total	17

DATA SHEET NO. 11
POST-TEST OBSERVATIONS

Test Vehicle: 2023 Audi Q7 5 Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
Test Date: 02/02/2023

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	H3 50th Male/142	H3 5th Female/137
Head Contact	Frontal Airbag & Head Restraint	Frontal Airbag & Head Restraint
Upper Torso Contact	Frontal Airbag	Frontal Airbag
Lower Torso Contact	None	Frontal Airbag
Left Knee Contact	Knee Bolster	Frontal Airbag & Glove Box
Right Knee Contact	None	Frontal Airbag & Glove Box

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger	Other
Locked / Unlocked Doors	Unlocked	Unlocked	
Front Door Opening	Closed & Operational	Closed & Operational	
Rear Door Opening	Closed & Operational	Closed & Operational	
Trunk/Hatch/Tailgate Opening			Closed & Operational
Seat Track Shift (mm)	0	0	
Seat Back Movement from Initial Position	None	None	

POST-TEST STRUCTURAL OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	875
Center	mm	879
Right Side	mm	890
Average	mm	881

DATA SHEET NO. 11 ... (CONTINUED)
POST-TEST OBSERVATIONS

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023

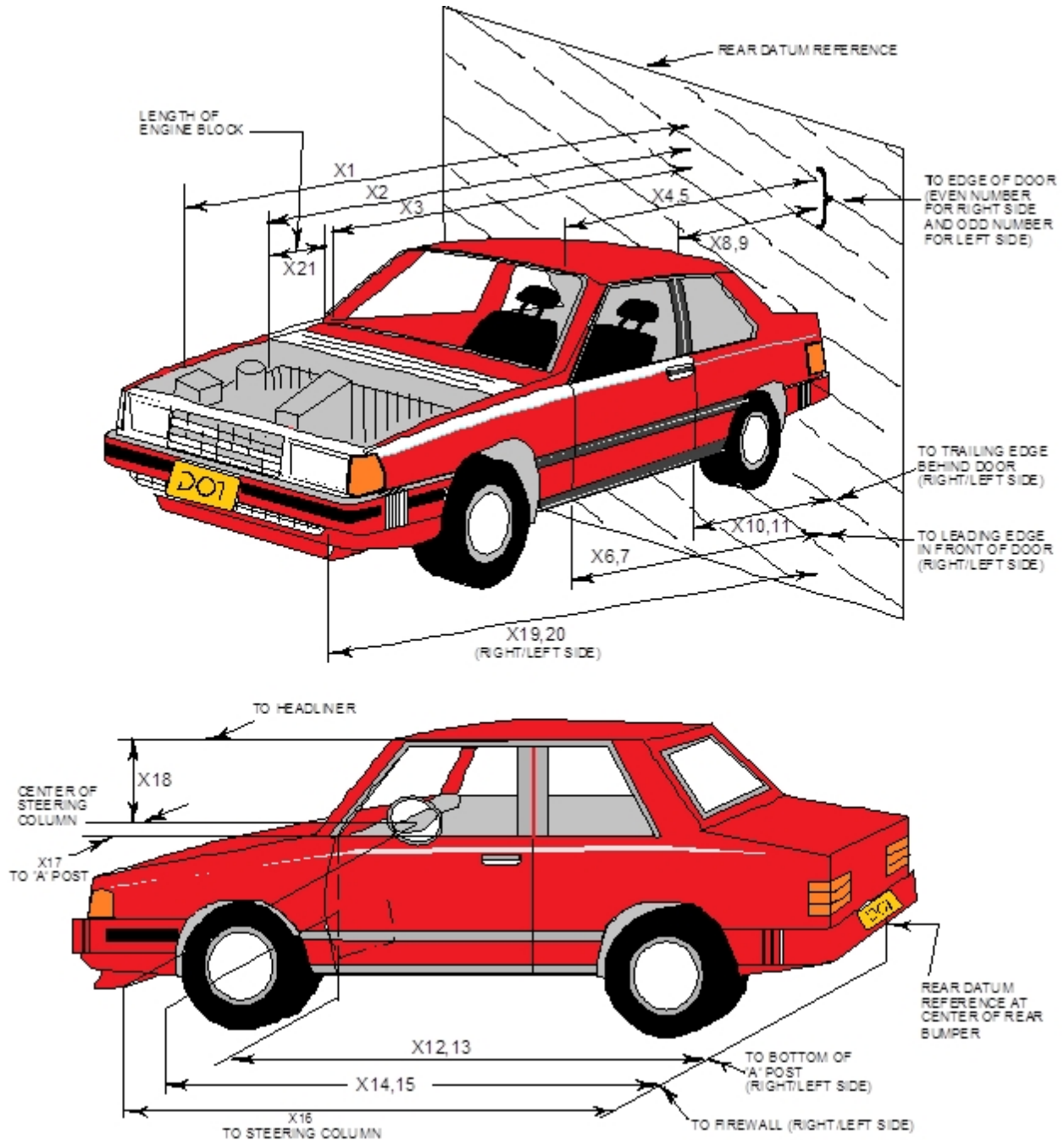
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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	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	N/A	N/A	N/A	N/A

DATA SHEET NO. 12
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023



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

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023

No.	Measurement Description	Pre-Test	Post-Test	Change
1	Total Length of Vehicle at Centerline	5061	4512	-549
2	Rear Surface of Vehicle (RSOV) to Front of Engine	4372	4140	-232
3	RSOV to Firewall	3648	3689	41
4	RSOV to Upper Leading Edge of Right Door	3476	3476	0
5	RSOV to Upper Leading Edge of Left Door	3479	3480	1
6	RSOV to Lower Leading Edge of Right Door	3489	3488	-1
7	RSOV to Lower Leading Edge of Left Door	3495	3493	-2
8	RSOV to Upper Trailing Edge of Right Door	2357	2358	1
9	RSOV to Upper Trailing Edge of Left Door	2363	2362	-1
10	RSOV to Lower Trailing Edge of Right Door	2407	2406	-1
11	RSOV to Lower Trailing Edge of Left Door	2412	2414	2
12	RSOV to Bottom of "A" Post of Right Side	3518	3519	1
13	RSOV to Bottom of "A" Post of Left Side	3555	3559	4
14	RSOV to Firewall, Right Side	3933	3939	6
15	RSOV to Firewall, Left Side	3930	3930	0
16	RSOV to Steering Column	2976	3050	74
17	Center of Steering Column to "A" Post	284	283	-1
18	Center of Steering Column to Headliner	418	451	33
19	RSOV to Right Side of Front Bumper	5023	4518	-505
20	RSOV to Left Side of Front Bumper	5026	4419	-607
21	Length of Engine Block	316	316	0
RD	RSOV to Right Side of Dash Panel	3168	3171	3
CD	RSOV to Center of Dash Panel	3184	3188	4
LD	RSOV to Left Side of Dash Panel	3189	3193	4

All Dimensions in mm

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2023 Audi Q7 5 Door SUV
Test Program: NCAP Frontal Barrier Impact Test

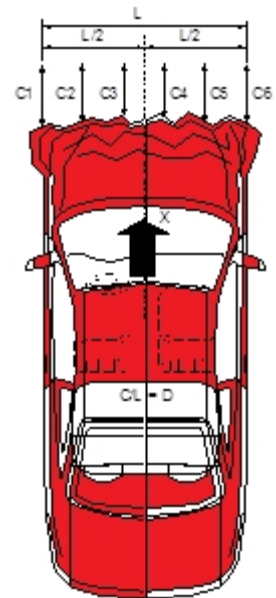
NHTSA No.: M20235800
Test Date: 02/02/2023

VEHICLE INFORMATION

VIN: WA1ACBF74PD002763 Wheelbase (mm): 2995
Vehicle Size Category: MPV Test Weight (kg): 2461

ACCELEROMETER DATA

Accelerometer Locations: Please See Data Sheet No. 7
Cal. Procedure / Interval: 6 Month
Integration Algorithm: Trapezoidal
Linearity: 99%
Impact Velocity (km/h): 56.29
Velocity Change (km/h): 63.18
Time of Separation (ms): 118



CRUSH PROFILE

Collision Deformation Classification: 12FDEW2
Midpoint of Damage: C3
Damage Region Length (mm): 1474
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Crush
C1	Crush Zone 1 at Left Side	mm	4829	4535	294
C2	Crush Zone 2 at Left Side	mm	5019	4483	536
C3	Crush Zone 3 at Left Side	mm	5058	4508	550
C4	Crush Zone 4 at Right Side	mm	5055	4508	547
C5	Crush Zone 5 at Right Side	mm	5015	4504	511
C6	Crush Zone 6 at Right Side	mm	4825	4535	290
L	C1 to C6	mm	1526	1474	52

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2023 Audi Q7 5 Door SUV
Test Program: NCAP Frontal Barrier Impact Test

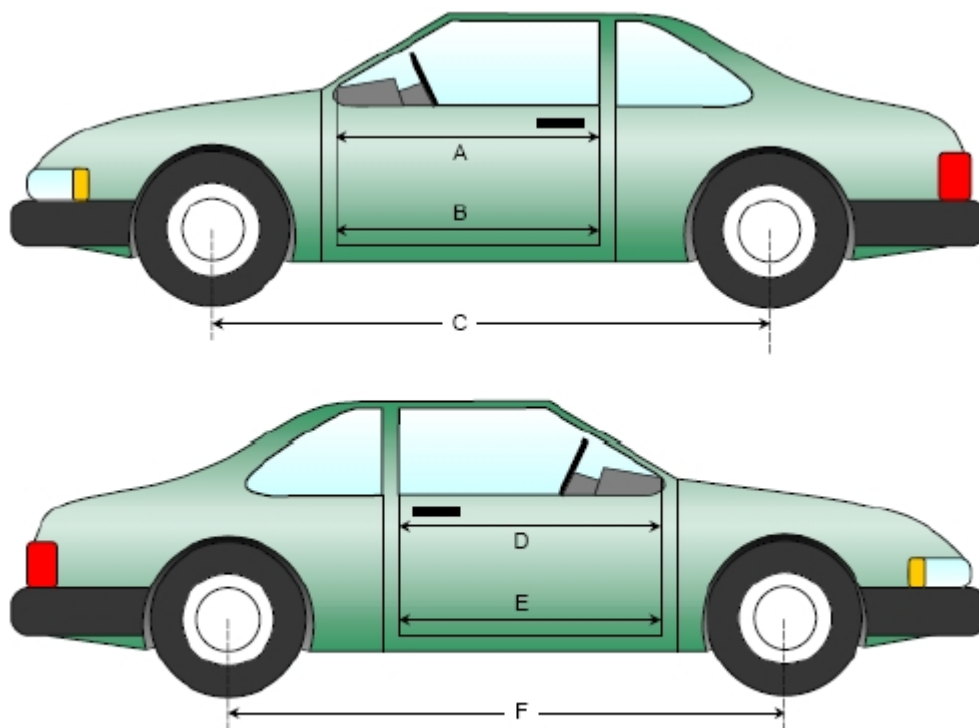
NHTSA No.: M20235800
Test Date: 02/02/2023

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Change
A	Left Side Upper	mm	972	971	-1
B	Left Side Lower	mm	867	867	0
D	Right Side Upper	mm	981	978	-3
E	Right Side Lower	mm	873	872	-1

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Change
C	Left Side Wheelbase	mm	2995	2976	-19
F	Right Side Wheelbase	mm	2995	2979	-16



Left & Right Side Views

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

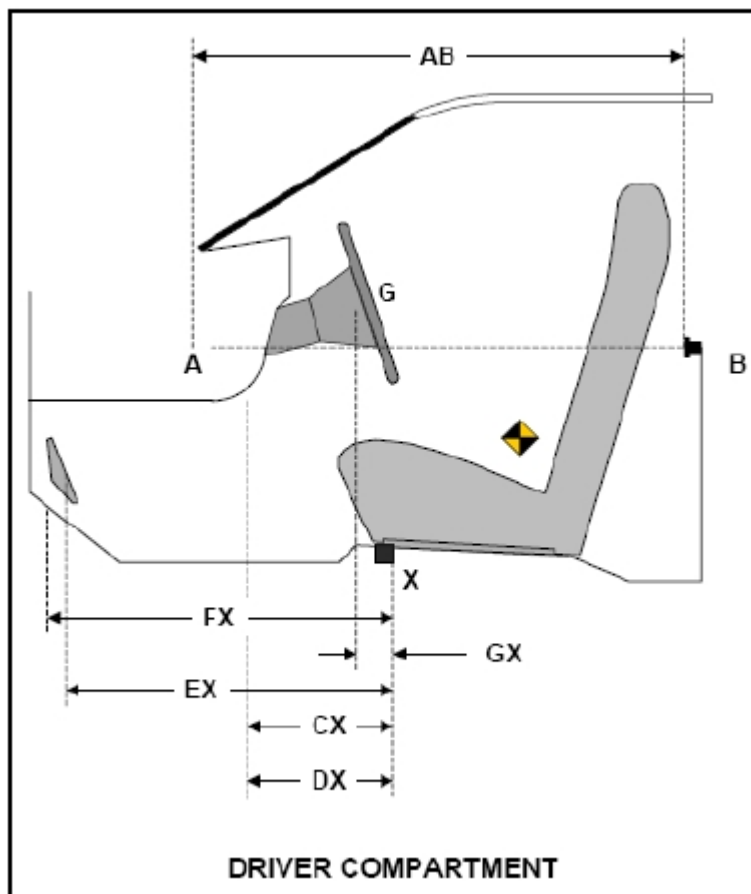
Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Change
AB	Door Opening (Inside Window Jam)	mm	750	747	-3
CX	Left Knee Bolster to X	mm	280	281	1
DX	Right Knee Bolster to X	mm	277	276	-1
EX	Brake Pedal to X	mm	541	551	10
FX	Foot Rest to X	mm	599	599	0
GX	Center of Steering Column Wheel Hub to X	mm	47	121	74

X = Front of Seat Track (Stationary)



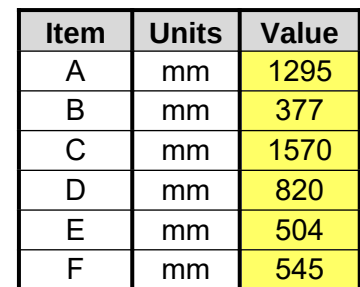
Test Vehicle:	2023 Audi Q7 5 Door SUV
Test Program:	NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
Test Date: 02/02/2023

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.

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2252.5	2252.5	100.0
Right Side	2252.5	2252.5	100.0
Total	4505	4505	100.0



- 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
- 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

X	Y

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

Test Vehicle:	<u>2023 Audi Q7 5 Door SUV</u>	NHTSA No.:	<u>M20235800</u>
Test Program:	<u>NCAP Frontal Barrier Impact Test</u>	Test Date:	<u>02/02/2023</u>

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact:	21.1°C	Test Time:	3:08 PM
--------------------------------	---------------	------------	----------------

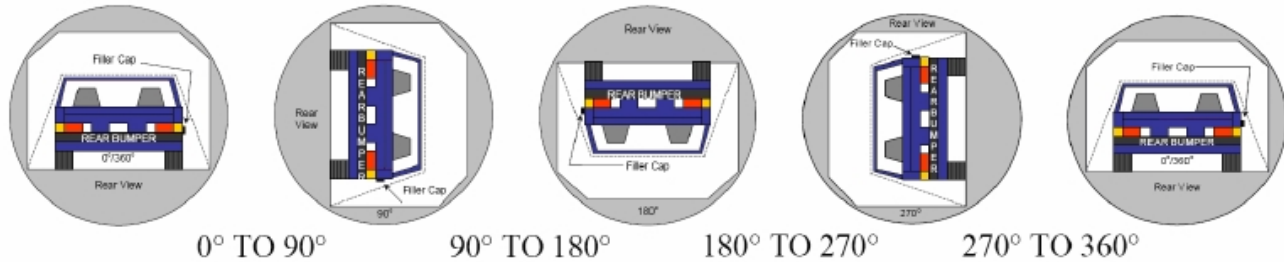
STODDARD SOLVENT SPILLAGE MEASUREMENTS

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

DATA SHEET NO. 16
FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2023 Audi Q7 5 Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
 Test Date: 02/02/2023



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°	66	300	366
90° to 180°	62	300	362
180° to 270°	66	300	366
270° to 360°	68	300	368

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	

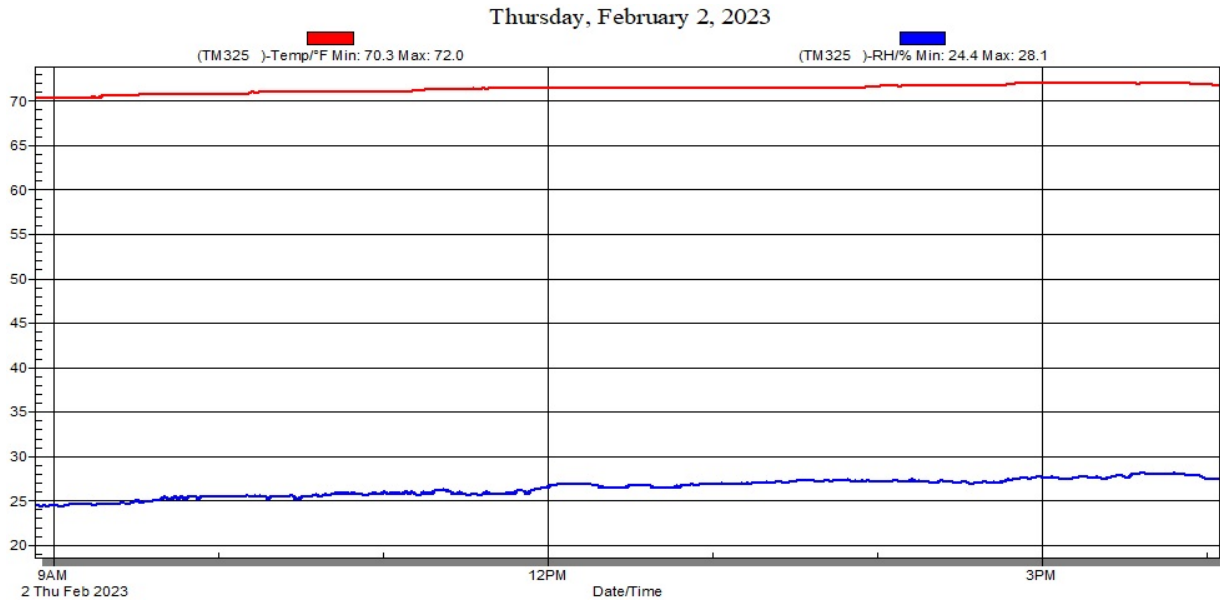
SOLVENT SPILLAGE LOCATION TABLE

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: 2023 Audi Q7 5 Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20235800
Test Date: 02/02/2023



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

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Fig.	Description	Page
1	Load Cell Location	A-5
2	Pre-Test Load Cell Wall	A-5
3	Post-Test Load Cell Wall	A-6
4	Manufacturer's Label	A-6
5	Tire Placard	A-7
6	2023 Audi Q7 Frontal As Delivered	A-7
7	Left Rear 3-4 View, as Received	A-8
8	Pre-Test Front View of Test Vehicle	A-8
9	Post-Test Front View of Test Vehicle	A-9
10	Pre-Test Left View of Test Vehicle	A-9
11	Post-Test Left View of Test Vehicle	A-10
12	Pre-Test Right View of Test Vehicle	A-10
13	Post-Test Right View of Test Vehicle	A-11
14	Pre-Test Right Front 3-4 View	A-11
15	Post-Test Right Front 3-4 View	A-12
16	Pre-Test Left Rear 3-4 View	A-12
17	Post-Test Left Rear 3-4 View	A-13
18	Pre-Test Windshield View	A-13
19	Post-Test Windshield View	A-14
20	Pre-Test Engine Compartment View	A-14
21	Post-Test Engine Compartment View	A-15
22	Pre-Test Fuel Filler Cap View	A-15
23	Post-Test Fuel Filler Cap View	A-16
24	Pre-Test Front Underbody View ¹	A-16
25	Post-Test Front Underbody View ¹	A-17
26	Pre-Test Rear Underbody View ¹	A-17
27	Post-Test Rear Underbody View ¹	A-18
28	Pre-Test Dummy Cable Routing	A-18
29	Post-Test Dummy Cable Routing	A-19
30	Pre-Test Driver Dummy Front View	A-19
31	Post-Test Driver Dummy Front View	A-20
32	Pre-Test Driver Dummy Window View	A-20
33	Post-Test Driver Dummy Window View	A-21
34	Pre-Test Driver Dummy and Vehicle Interior View	A-21
35	Post-Test Driver Dummy and Vehicle Interior View	A-22

Fig.	Description	Page
36	Pre-Test Driver's Seat Fore-Aft Markings	A-22
37	Post-Test Driver's Seat Fore-Aft Markings	A-23
38	Pre-Test View of Belt Anchorage for Driver Dummy	A-23
39	Post-Test View of Belt Anchorage for Driver Dummy	A-24
40	Pre-Test View of Belt Buckle and Latch Plate for Driver Dummy	A-24
41	Post-Test View of Belt Buckle and Latch Plate for Driver Dummy	A-25
42	Pre-Test Driver Dummy Feet	A-25
43	Post-Test Driver Dummy Feet	A-26
44	Pre-Test Driver's Side Knee Bolster	A-26
45	Post-Test Driver's Side Knee Bolster	A-27
46	Pre-Test Driver's Side Floorpan	A-27
47	Post-Test Driver's Side Floorpan	A-28
48	Post-Test Driver Dummy Face	A-28
49	Post-Test Driver Dummy Contact With Airbag	A-29
50	Post-Test Driver Dummy Contact With Headrest	A-29
51	Pre-Test View of the Steering Wheel	A-30
52	Post-Test View of the Steering Wheel	A-30
53	Pre-Test Passenger Dummy Front View	A-31
54	Post-Test Passenger Dummy Front View	A-31
55	Pre-Test Passenger Dummy Window View	A-32
56	Post-Test Passenger Dummy Window View	A-32
57	Pre-Test Passenger Dummy and Vehicle Interior View	A-33
58	Post-Test Passenger Dummy and Vehicle Interior View	A-33
59	Pre-Test Passenger's Seat Fore-Aft Markings	A-34
60	Post-Test Passenger's Seat Fore-Aft Markings	A-34
61	Pre-Test View of Belt Anchorage for Passenger Dummy	A-35
62	Post-Test View of Belt Anchorage for Passenger Dummy	A-35
63	Pre-Test View of Belt Buckle and Latch Plate for Passenger Dummy	A-36
64	Post-Test View of Belt Buckle and Latch Plate for Passenger Dummy	A-36
65	Pre-Test Passenger Dummy Feet	A-37
66	Post-Test Passenger Dummy Feet	A-37
67	Pre-Test Passenger's Side Knee Bolster	A-38
68	Post-Test Passenger's Side Knee Bolster	A-38
69	Pre-Test Passenger's Side Floorpan	A-39
70	Post-Test Passenger's Side Floorpan	A-39
71	Post-Test Passenger Dummy Face	A-40

Fig.	Description	Page
72	Post-Test Passenger Dummy Contact With Airbag	A-40
73	Post-Test Passenger Dummy Contact With Headrest	A-41
74	Photograph of Ballast Installed in Vehicle	A-41
75	Post-Test Stoddard Solvent Spillage Location View, if Required	A-42
76	Post-Test Speed Trap Read-Out	A-42
77	Vehicle at 0° on Static Rollover Device	A-43
78	Vehicle at 90° on Static Rollover Device	A-43
79	Vehicle at 180° on Static Rollover Device	A-44
80	Vehicle at 270° on Static Rollover Device	A-44
81	Vehicle at 360° on Static Rollover Device	A-45
82	2023 Audi Q7 Frontal Impact Event	A-45
83	Monroney Label Photograph	A-46

¹**NOTE:** *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: 2023 Audi Q7 Frontal As Delivered



M20235800

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

Photo Not Available

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

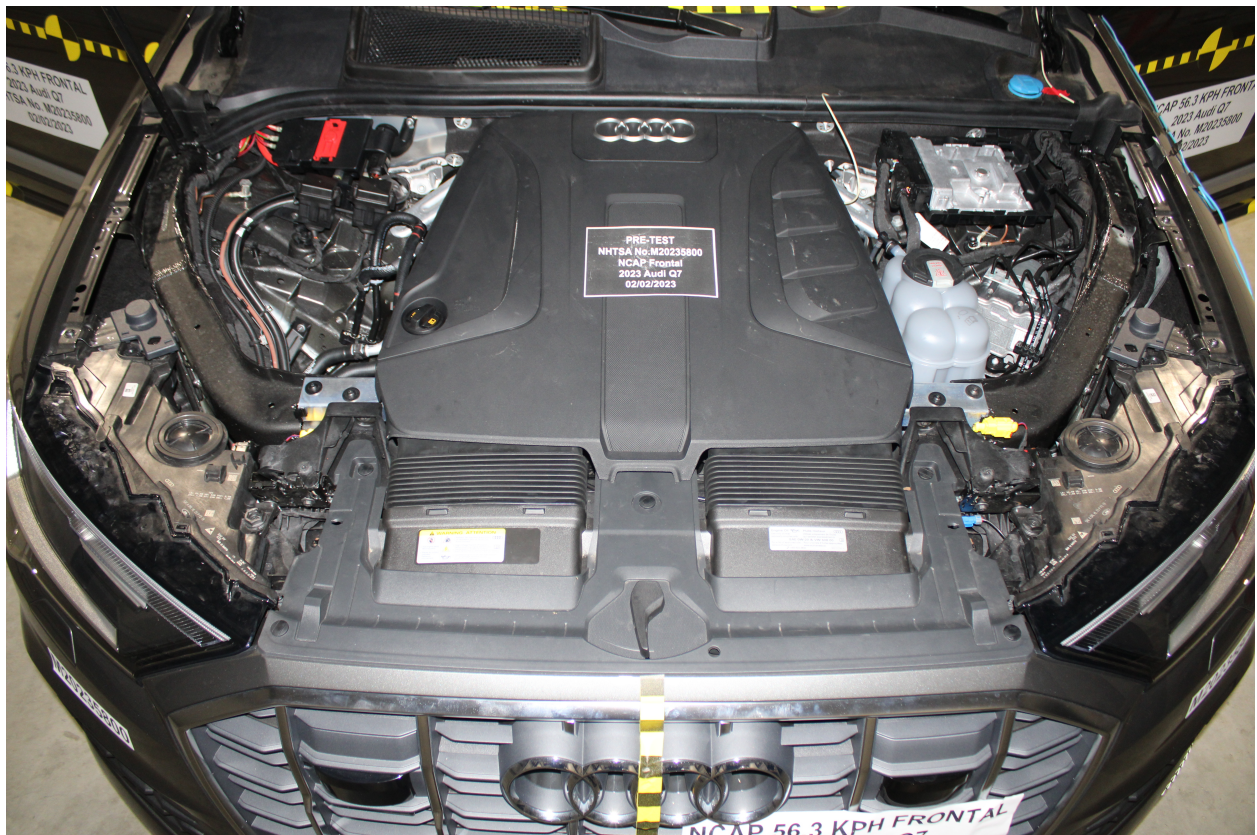


Figure A-20: Pre-Test Engine Compartment View



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

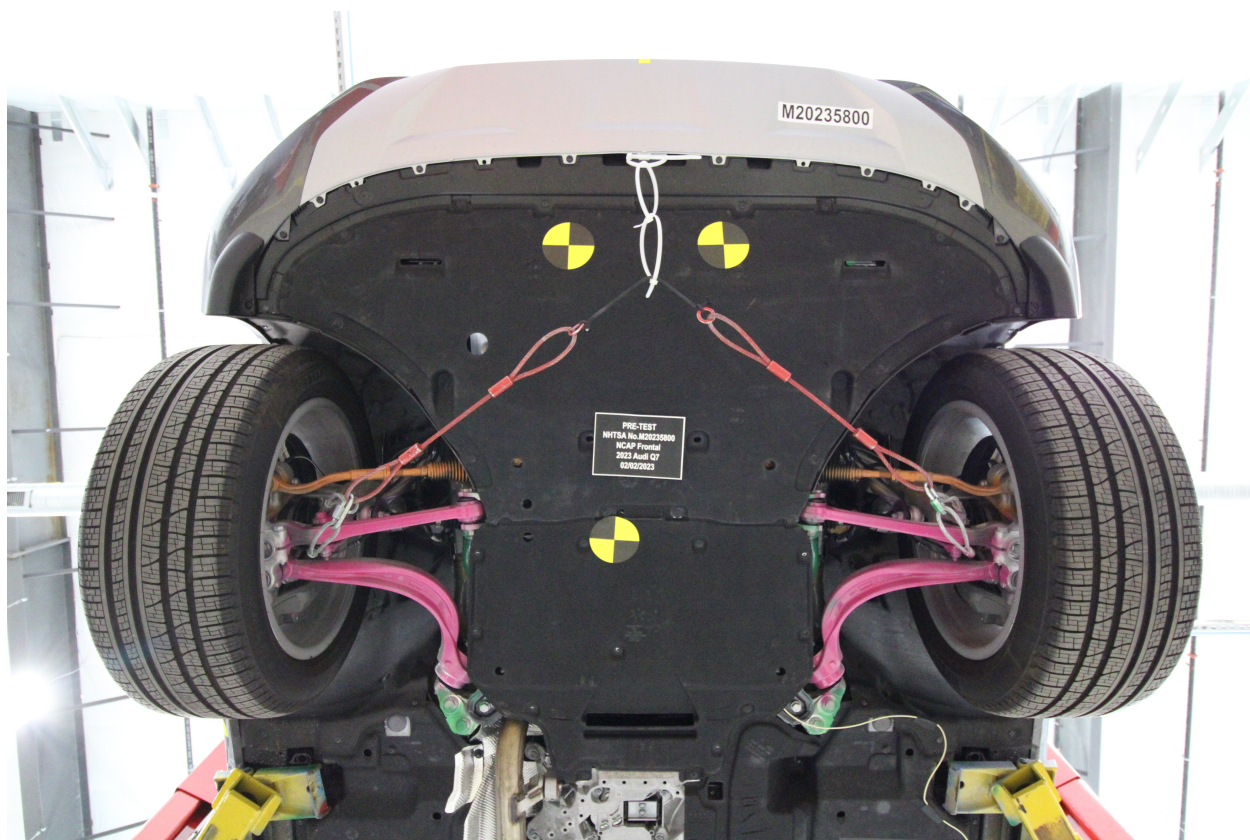


Figure A-24: Pre-Test Front Underbody View

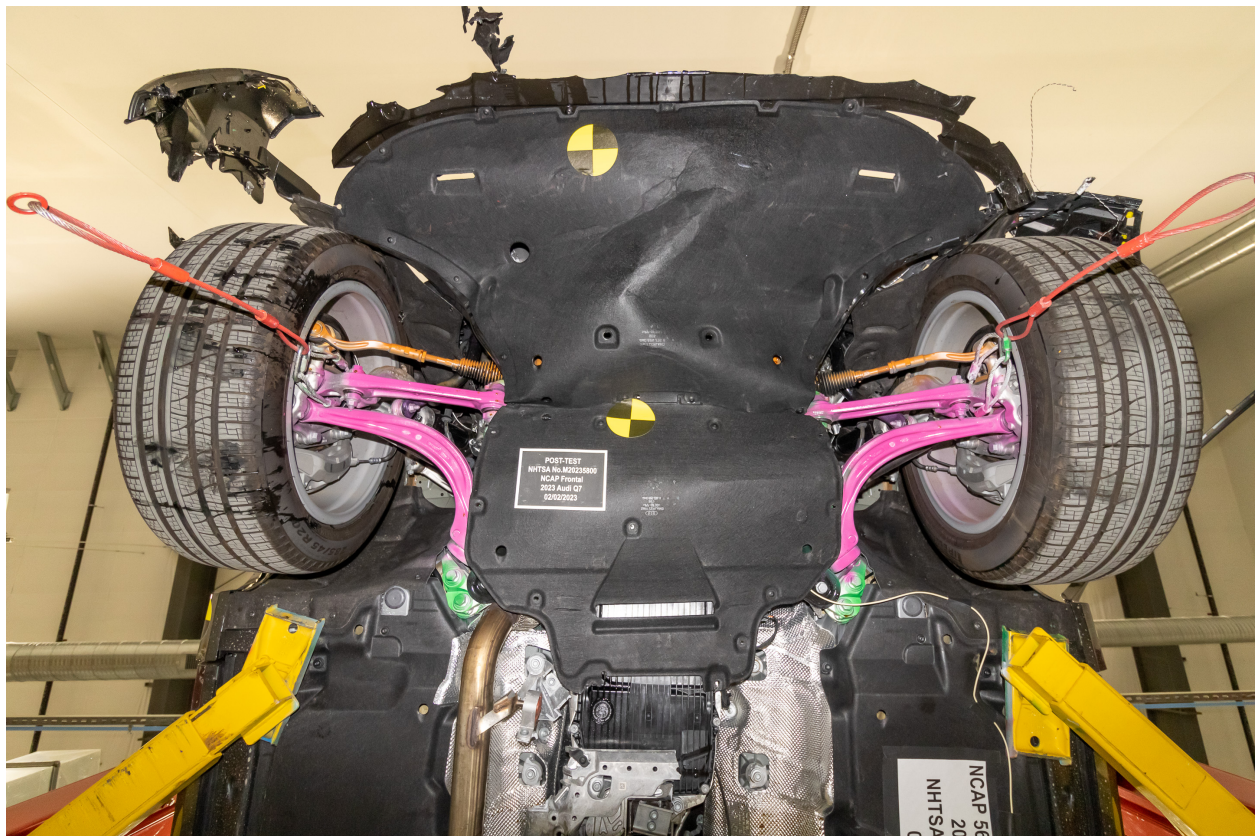


Figure A-25: Post-Test Front Underbody View

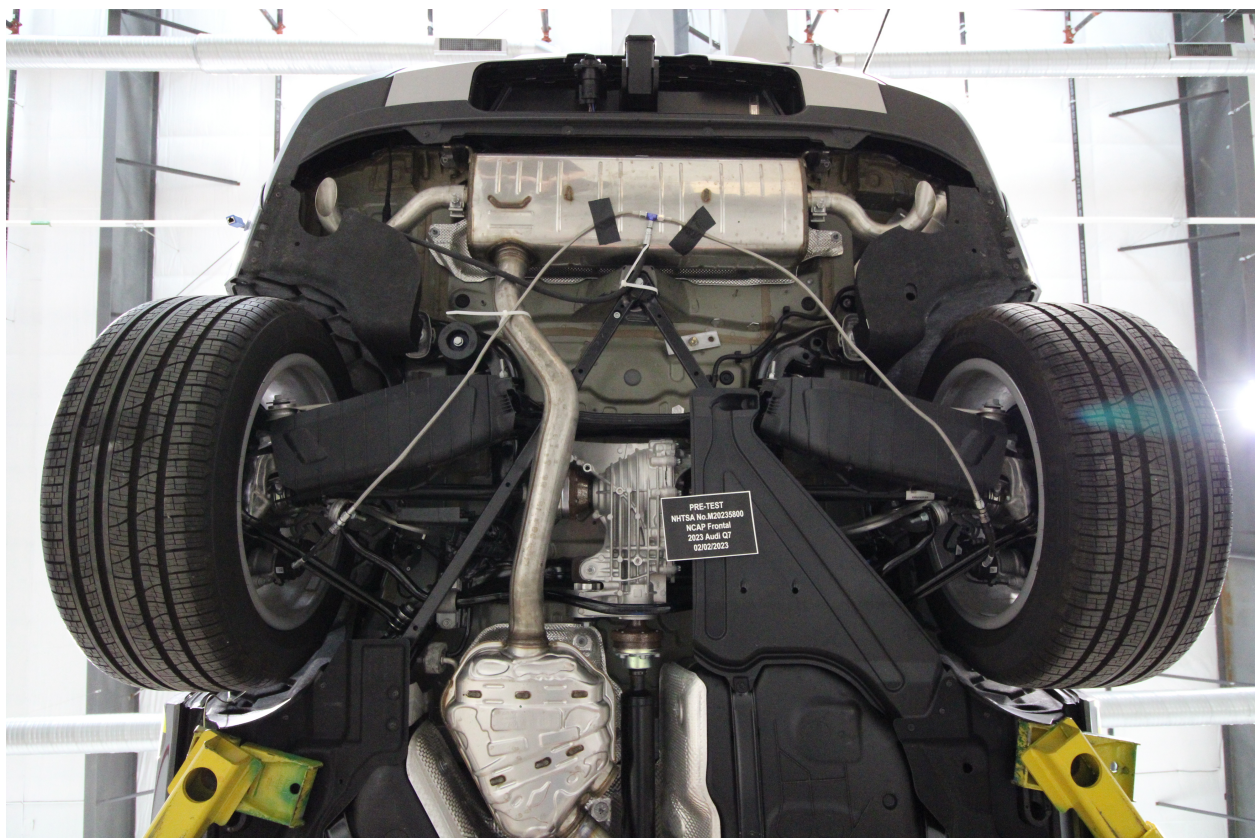


Figure A-26: Pre-Test Rear Underbody View

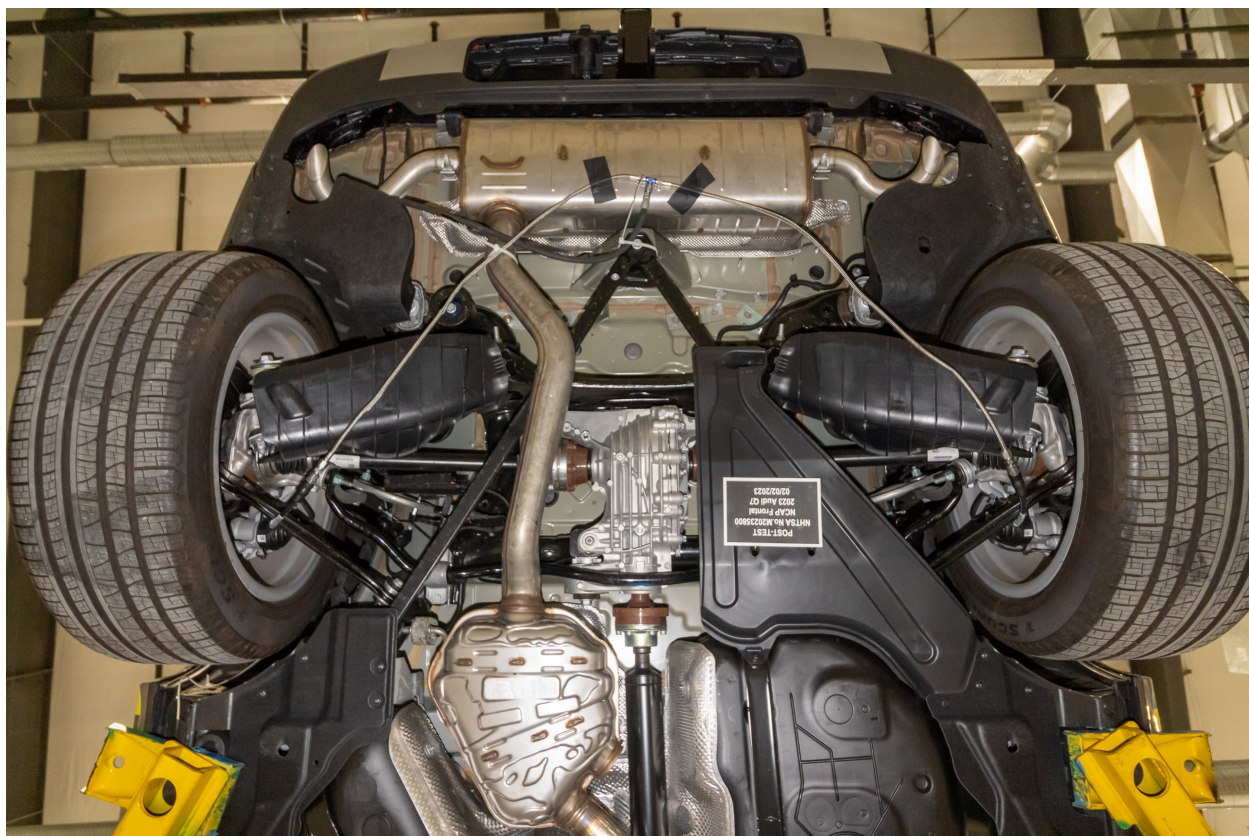


Figure A-27: Post-Test Rear Underbody View



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

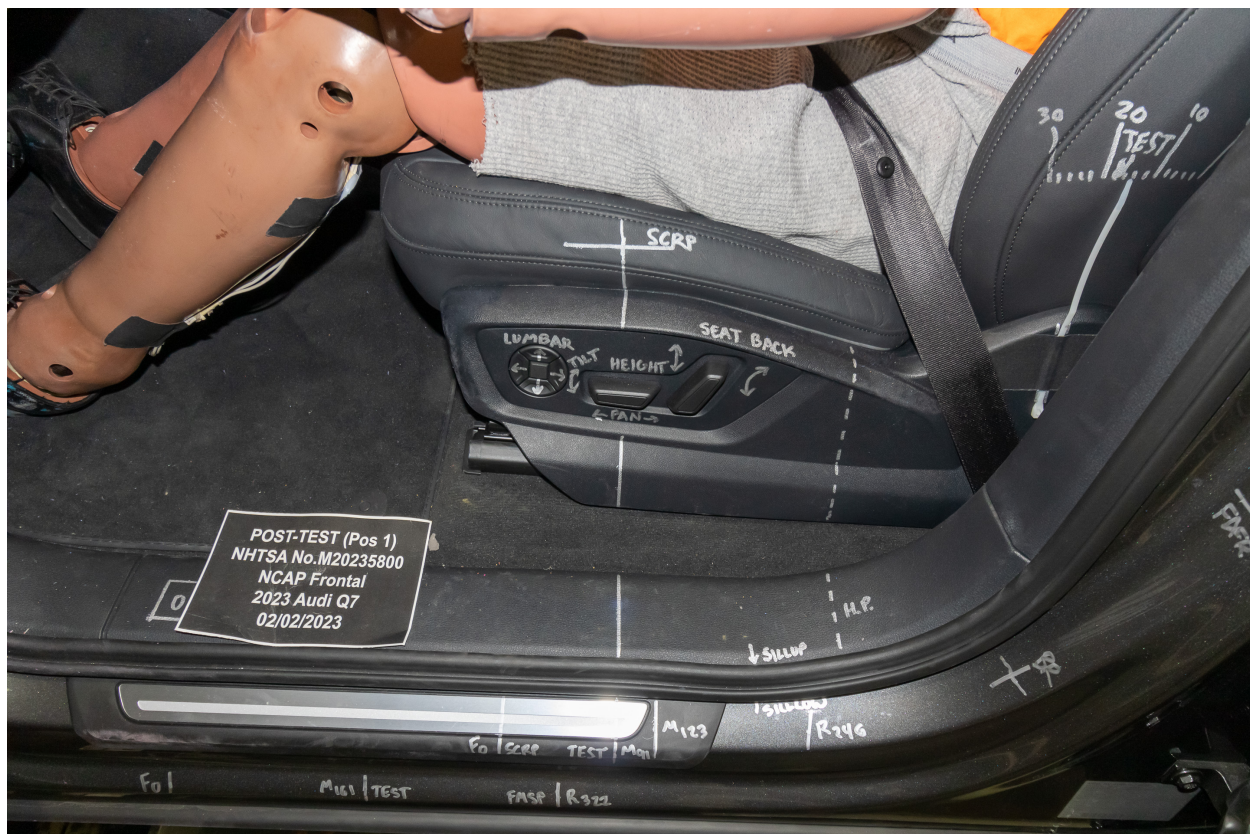


Figure A-37: Post-Test Driver's Seat Fore-Aft Markings



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 View of Belt Buckle and Latch Plate for Driver Dummy



Figure A-41: Post-Test View of Belt Buckle and Latch Plate for Driver Dummy

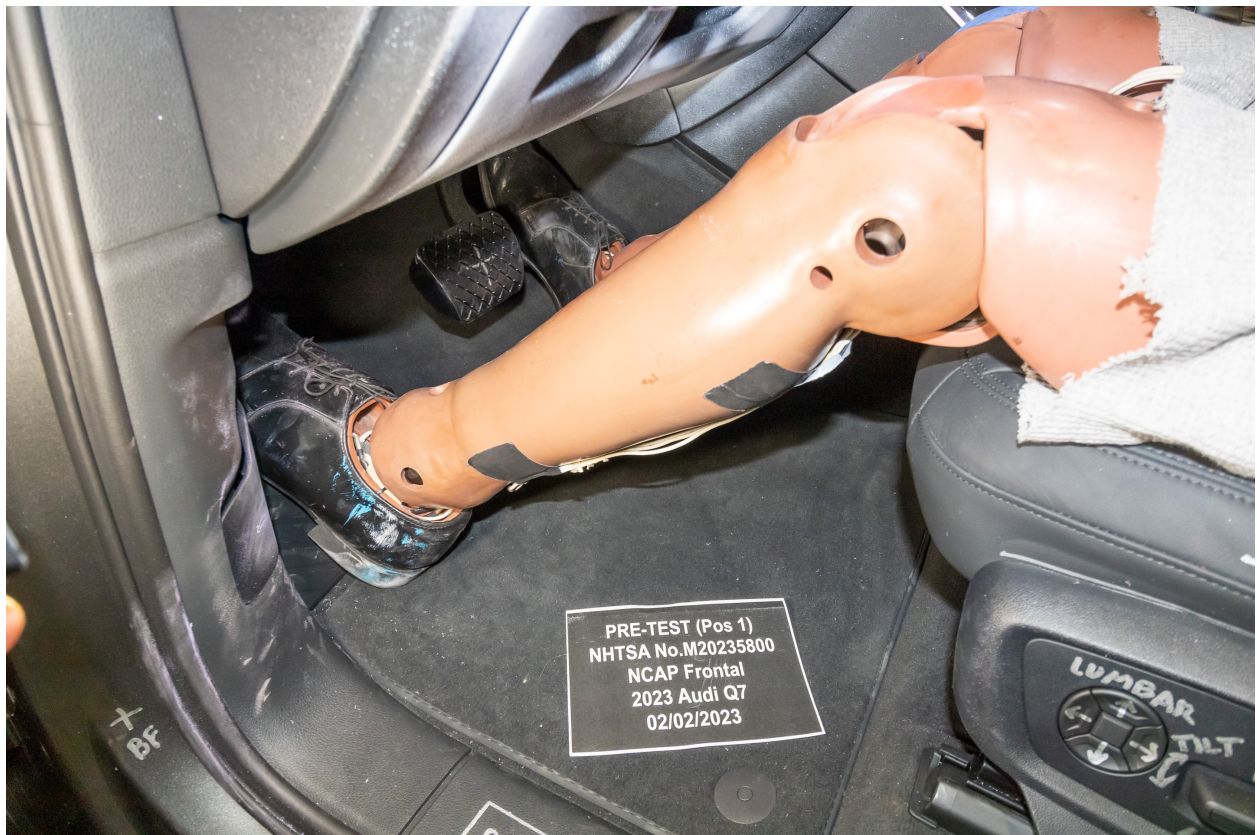


Figure A-42: Pre-Test Driver Dummy Feet

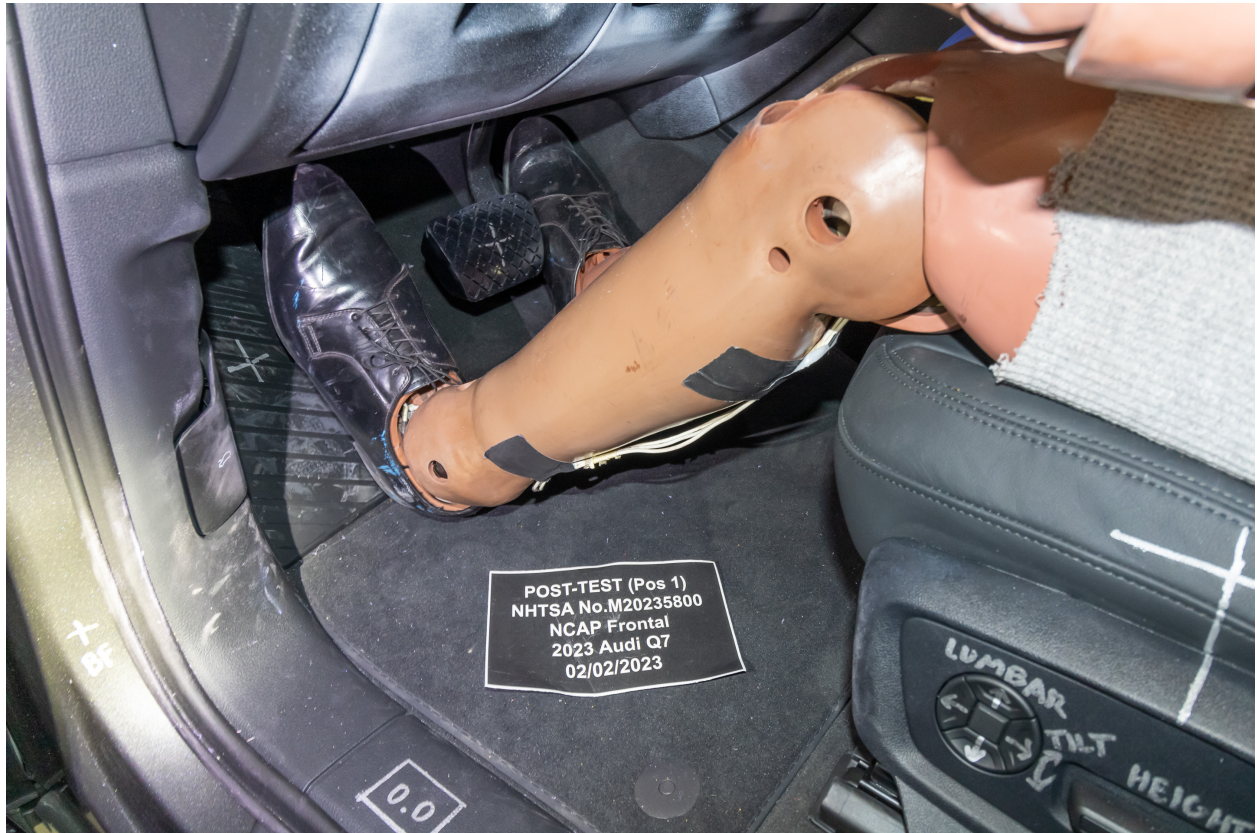


Figure A-43: Post-Test Driver Dummy Feet



Figure A-44: Pre-Test Driver's Side Knee Bolster



Figure A-45: Post-Test Driver's Side Knee Bolster



Figure A-46: Pre-Test Driver's Side Floorpan



Figure A-47: Post-Test Driver's Side Floorpan



Figure A-48: Post-Test Driver Dummy Face

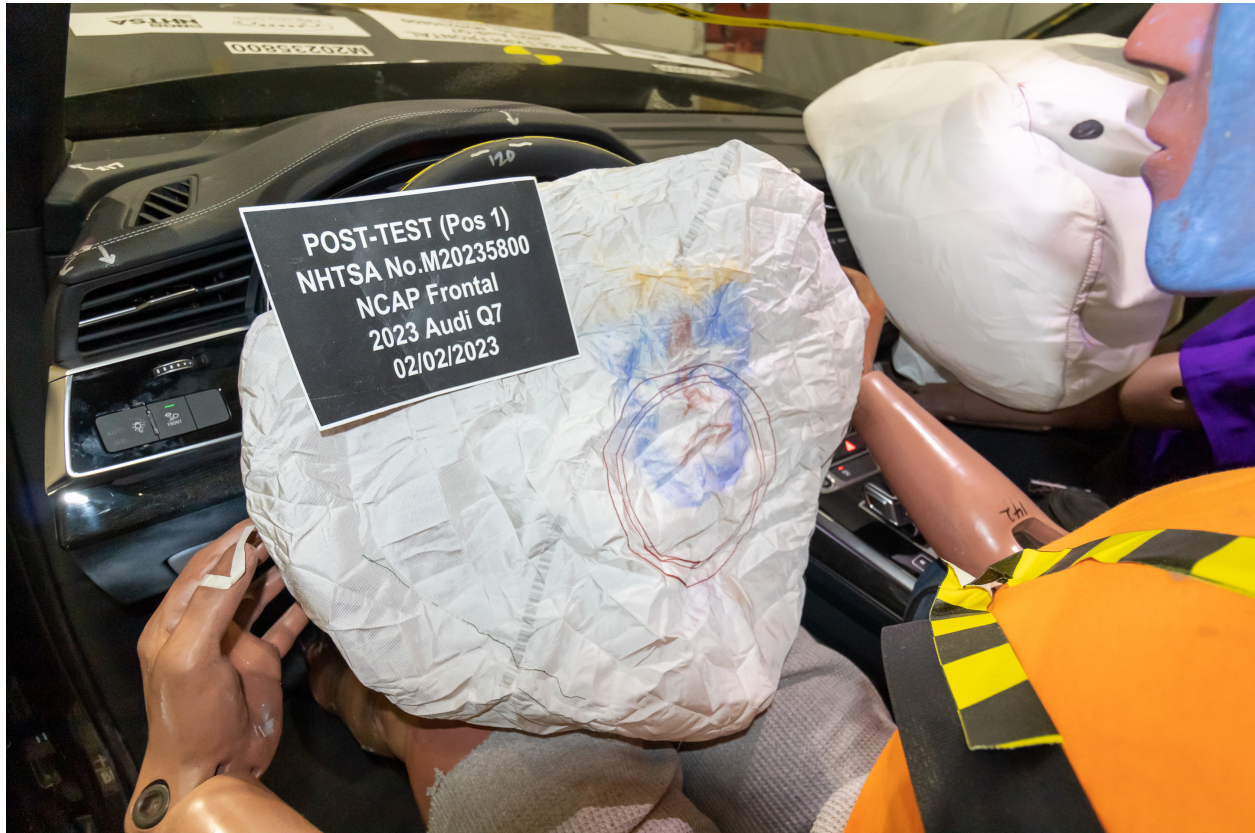


Figure A-49: Post-Test Driver Dummy Contact With Airbag



Figure A-50: Post-Test Driver Dummy Contact With Headrest



Figure A-51: Pre-Test View of the Steering Wheel



Figure A-52: Post-Test View of the Steering Wheel

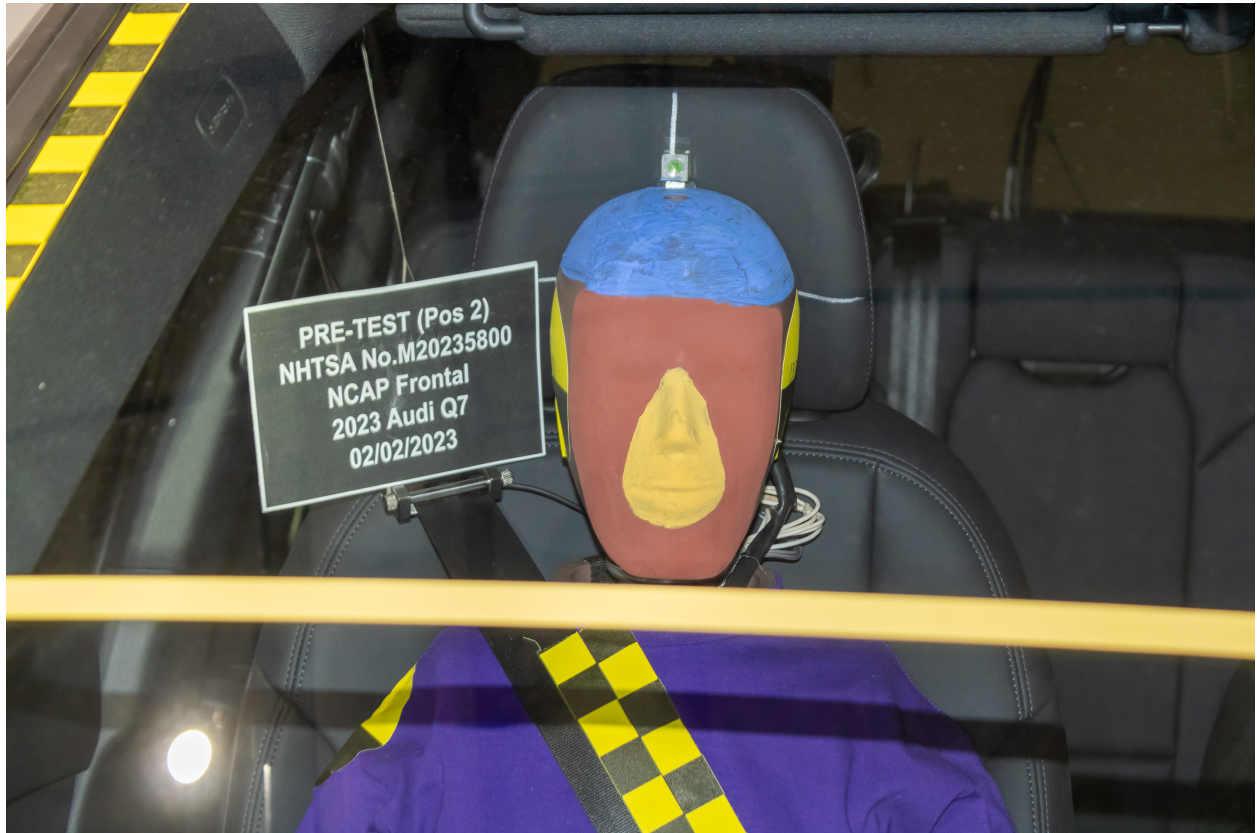


Figure A-53: Pre-Test Passenger Dummy Front View

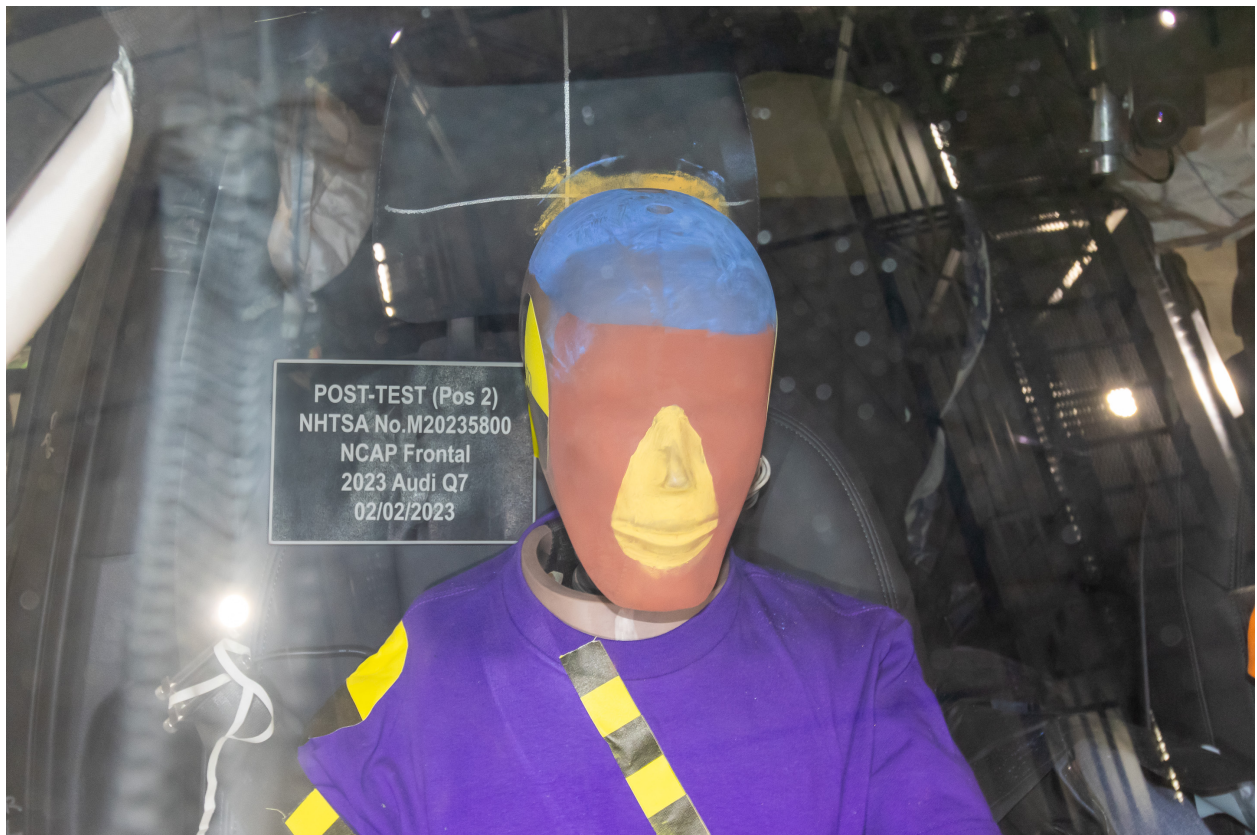


Figure A-54: Post-Test Passenger Dummy Front View



Figure A-55: Pre-Test Passenger Dummy Window View



Figure A-56: Post-Test Passenger Dummy Window View



Figure A-57: Pre-Test Passenger Dummy and Vehicle Interior View



Figure A-58: Post-Test Passenger Dummy and Vehicle Interior View

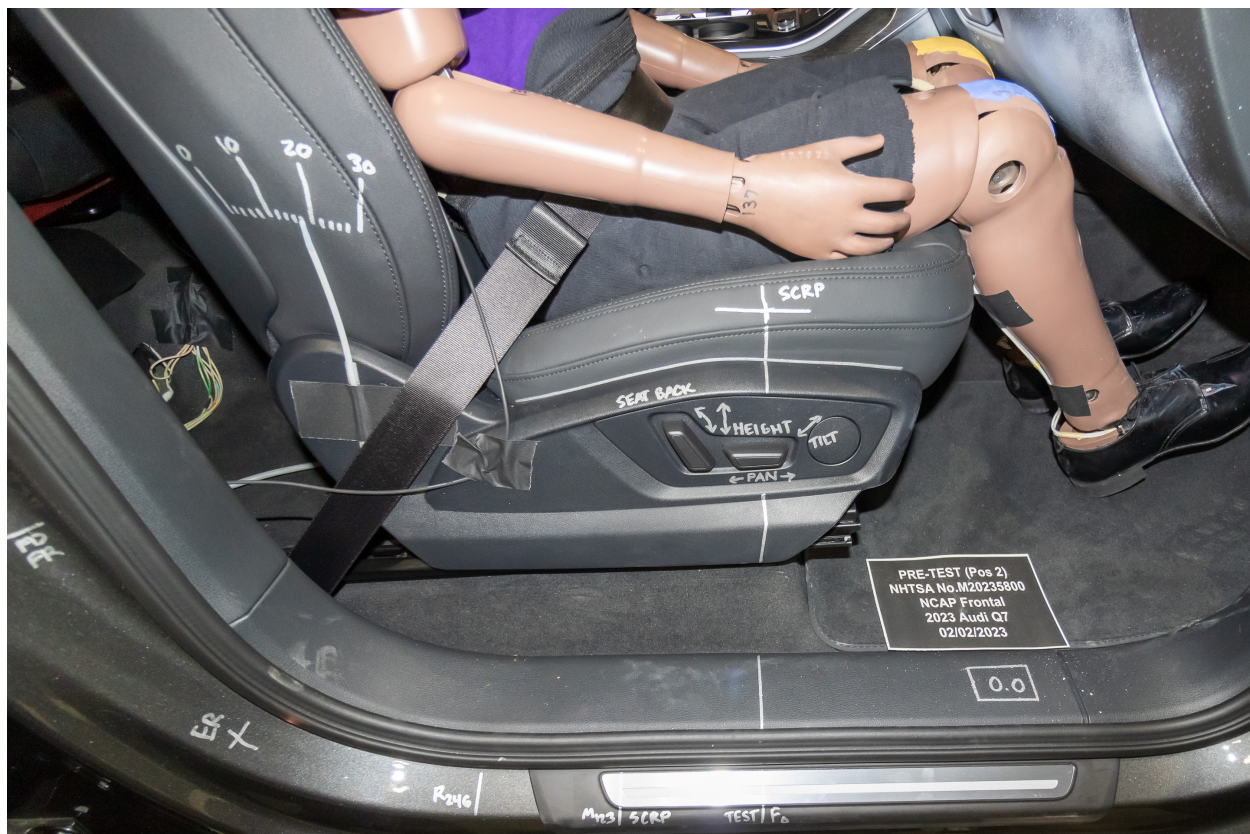


Figure A-59: Pre-Test Passenger's Seat Fore-Aft Markings



Figure A-60: Post-Test Passenger's Seat Fore-Aft Markings



Figure A-61: Pre-Test View of Belt Anchorage for Passenger Dummy



Figure A-62: Post-Test View of Belt Anchorage for Passenger Dummy



Figure A-63: Pre-Test View of Belt Buckle and Latch Plate for Passenger Dummy



Figure A-64: Post-Test View of Belt Buckle and Latch Plate for Passenger Dummy



Figure A-65: Pre-Test Passenger Dummy Feet



Figure A-66: Post-Test Passenger Dummy Feet



Figure A-67: Pre-Test Passenger's Side Knee Bolster



Figure A-68: Post-Test Passenger's Side Knee Bolster



Figure A-69: Pre-Test Passenger's Side Floorpan



Figure A-70: Post-Test Passenger's Side Floorpan



Figure A-71: Post-Test Passenger Dummy Face



Figure A-72: Post-Test Passenger Dummy Contact With Airbag



Figure A-73: Post-Test Passenger Dummy Contact With Headrest



Figure A-74: Photograph of Ballast Installed in Vehicle

Photo Not Applicable

Figure A-75: Post-Test Stoddard Solvent Spillage Location View, If Required



Figure A-76: Post-Test Speed Trap Read-Out



Figure A-77: Vehicle at 0° on Static Rollover Device

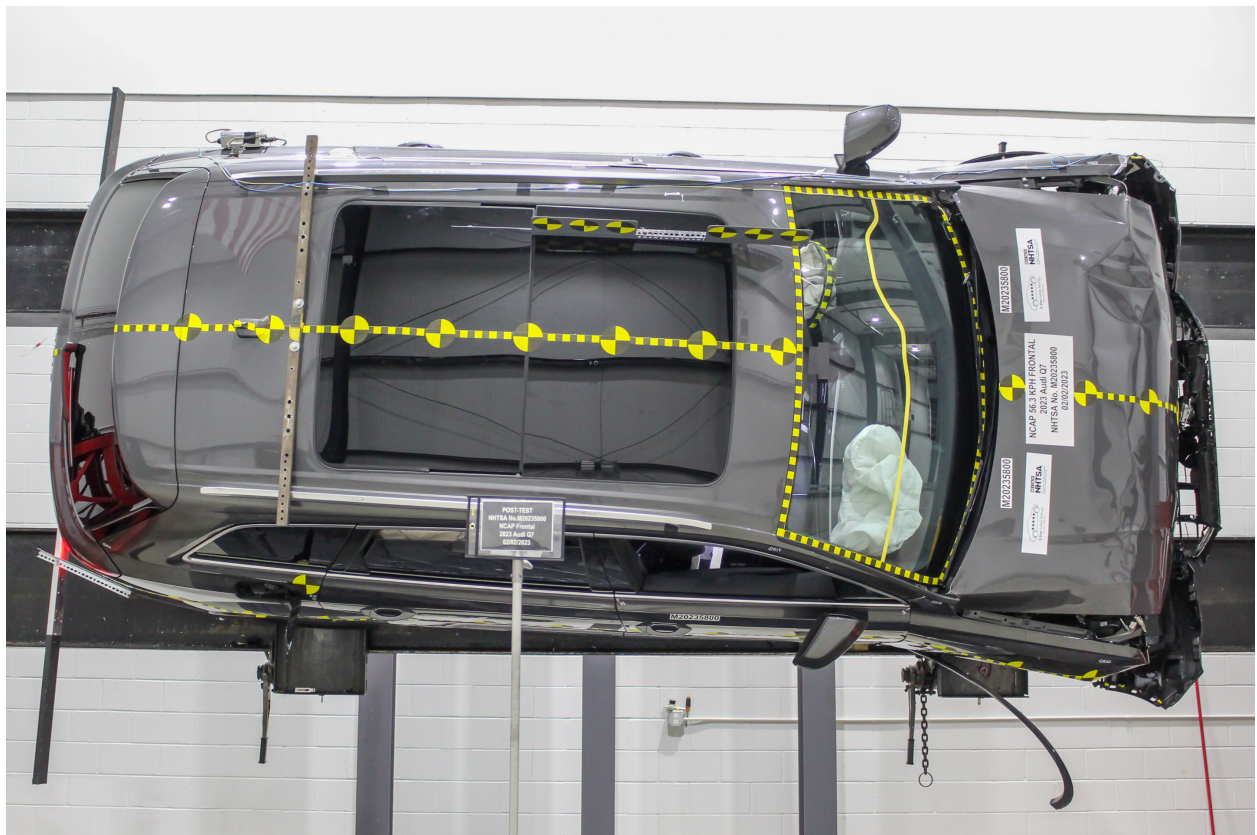


Figure A-78: Vehicle at 90° on Static Rollover Device



Figure A-79: Vehicle at 180° on Static Rollover Device

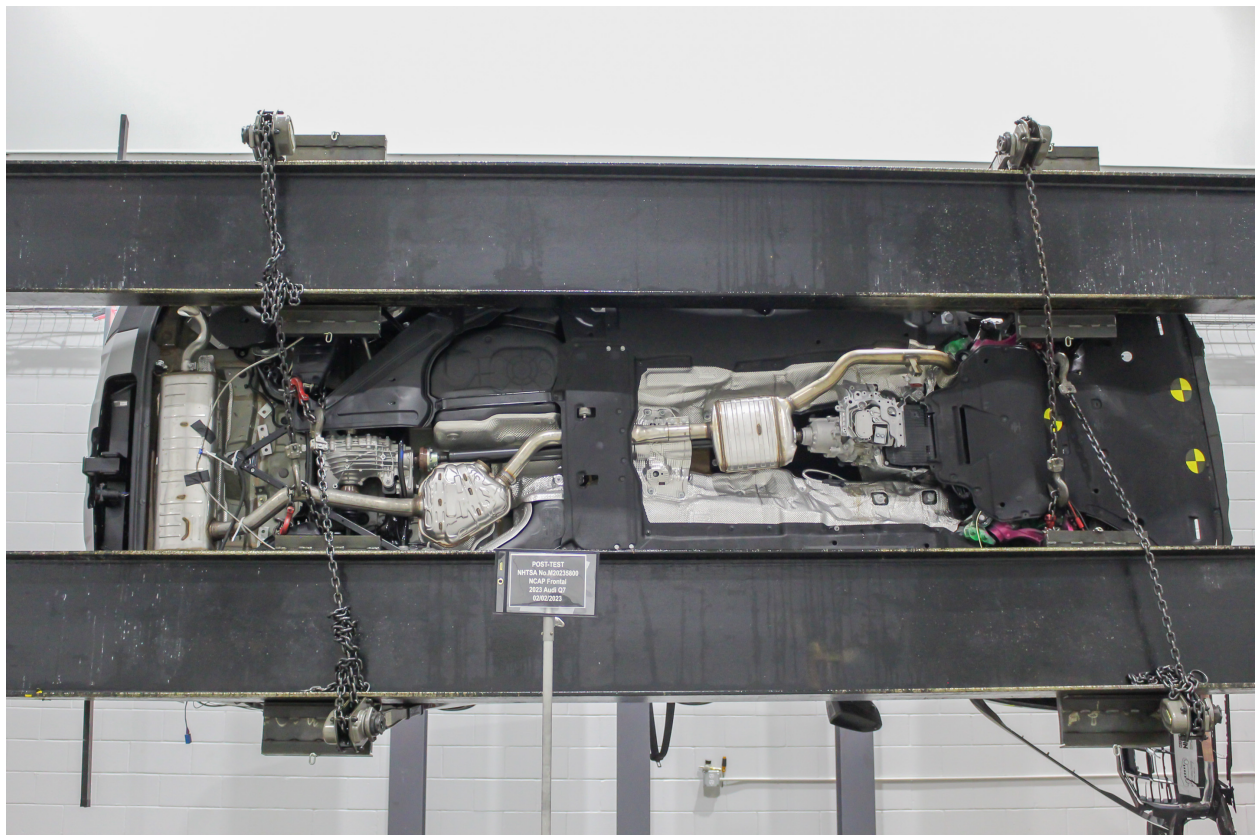


Figure A-80: Vehicle at 270° on Static Rollover Device



Figure A-81: Vehicle at 360° on Static Rollover Device



Figure A-82: 2023 Audi Q7 Frontal Impact Event

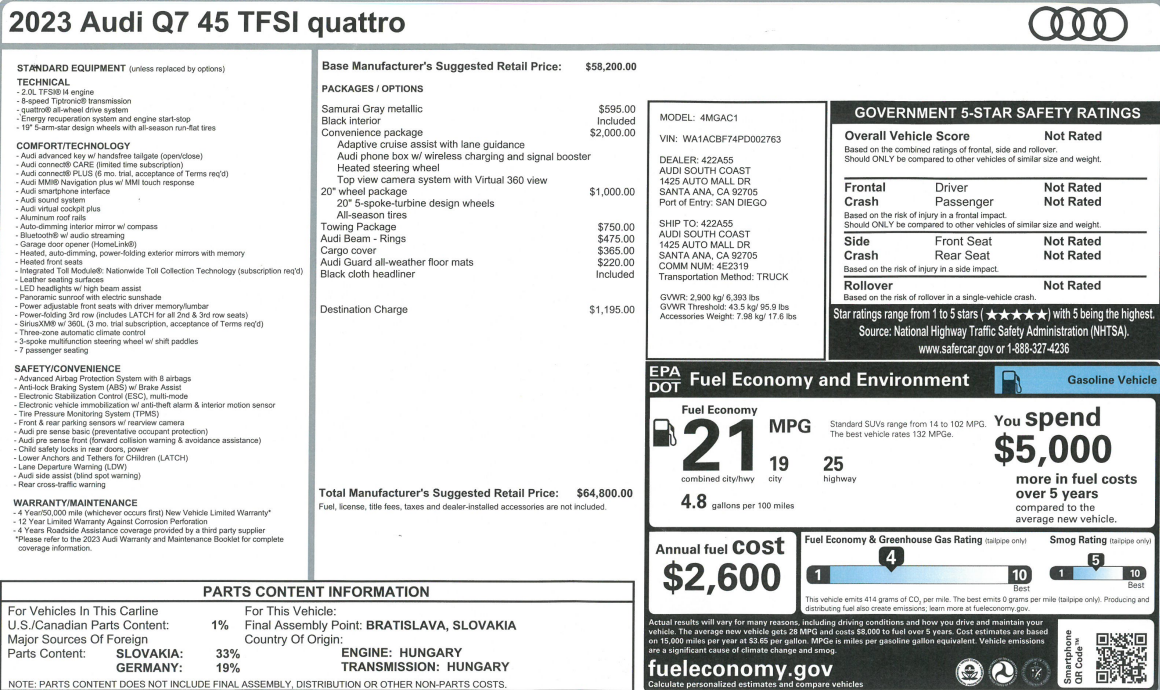


Figure A-83: Monroney Label Photograph

APPENDIX B

VEHICLE & DUMMY RESPONSE DATA TRACES

Table of Data Plots

Fig.	Description	Page
Plot 1	Driver Head X Acceleration vs. Time Primary	B-5
Plot 2	Driver Head Y Acceleration vs. Time Primary	B-5
Plot 3	Driver Head Z Acceleration vs. Time Primary	B-5
Plot 4	Driver Head Resultant Acceleration vs. Time Primary	B-5
Plot 5	Driver Chest X Deflection vs. Time	B-6
Plot 6	Driver Chest X Acceleration vs. Time Primary	B-6
Plot 7	Driver Chest Y Acceleration vs. Time Primary	B-6
Plot 8	Driver Chest Z Acceleration vs. Time Primary	B-6
Plot 9	Driver Chest Resultant Acceleration vs. Time Primary	B-7
Plot 10	Driver Upper Neck Force X vs. Time Primary	B-7
Plot 11	Driver Upper Neck Force Z vs. Time Primary	B-7
Plot 12	Driver Upper Neck Moment Y vs. Time Primary	B-7
Plot 13	Driver Nij vs. Time Primary	B-8
Plot 14	Driver Left Femur Force vs. Time	B-8
Plot 15	Driver Right Femur Force vs. Time	B-8
Plot 16	Passenger Head X Acceleration vs. Time Primary	B-8
Plot 17	Passenger Head Y Acceleration vs. Time Primary	B-9
Plot 18	Passenger Head Z Acceleration vs. Time Primary	B-9
Plot 19	Passenger Head Resultant Acceleration vs. Time Primary	B-9
Plot 20	Passenger Chest X Deflection vs. Time	B-9
Plot 21	Passenger Chest X Acceleration vs. Time Primary	B-10
Plot 22	Passenger Chest Y Acceleration vs. Time Primary	B-10
Plot 23	Passenger Chest Z Acceleration vs. Time Primary	B-10
Plot 24	Passenger Chest Resultant Acceleration vs. Time Primary	B-10
Plot 25	Passenger Upper Neck Force X vs. Time Primary	B-11
Plot 26	Passenger Upper Neck Force Z vs. Time Primary	B-11
Plot 27	Passenger Upper Neck Moment Y vs. Time Primary	B-11
Plot 28	Passenger Nij vs. Time Primary	B-11
Plot 29	Passenger Left Femur Force vs. Time	B-12
Plot 30	Passenger Right Femur Force vs. Time	B-12

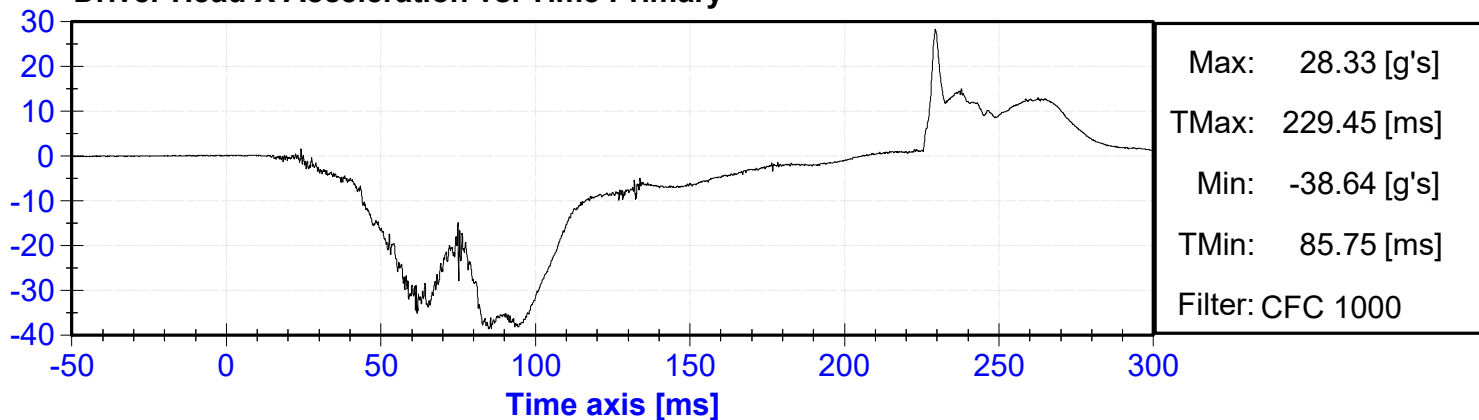
The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.NHTSA.gov

Driver Head X Acceleration Redundant
 Driver Head Y Acceleration Redundant
 Driver Head Z Acceleration Redundant
 Driver Upper Neck Force Y
 Driver Upper Neck Moment X
 Driver Upper Neck Moment Z
 Driver Chest X Acceleration Redundant
 Driver Chest Y Acceleration Redundant
 Driver Chest Z Acceleration Redundant
 Driver Pelvis X
 Driver Pelvis Y
 Driver Pelvis Z
 Driver Left Femur Redundant
 Driver Right Femur Redundant
 Driver Left Upper Tibia Moment X
 Driver Left Upper Tibia Moment Y

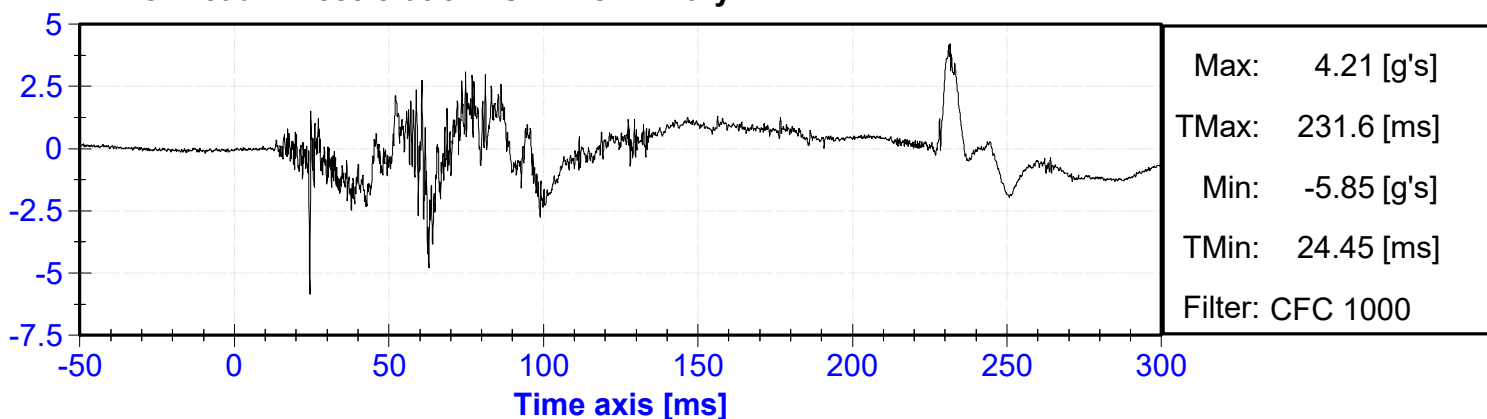
Driver Left Upper Tibia Force Z
Driver Left Lower Tibia Moment X
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Right Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z
Driver Shoulder Belt Force
Driver Lap Belt Force
Driver Head Angular Velocity X
Driver Head Angular Velocity Y
Driver Head Angular Velocity Z
Passenger Head X Acceleration Redundant
Passenger Head Y Acceleration Redundant
Passenger Head Z Acceleration Redundant
Passenger Upper Neck Force X
Passenger Upper Neck Force Z
Passenger Upper Neck Moment Y
Passenger Chest X Acceleration Redundant
Passenger Chest Y Acceleration Redundant
Passenger Chest Z Acceleration Redundant
Passenger Pelvis X
Passenger Pelvis Y
Passenger Pelvis Z
Passenger Left Femur Redundant
Passenger Right Femur Redundant
Passenger Left Upper Tibia Moment X
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right Lower Tibia Moment X
Passenger Right Lower Tibia Moment Y
Passenger Right Lower Tibia Force Z
Passenger Left Foot Fore Z
Passenger Left Foot Aft X
Passenger Left Foot Aft Z

Passenger Right Foot Fore Z
Passenger Right Foot Aft X
Passenger Right Foot Aft Z
Passenger Shoulder Belt Force
Passenger Lap Belt Force
Passenger Head Angular Velocity X
Passenger Head Angular Velocity Y
Passenger Head Angular Velocity Z
Left Rear Seat Crossmember X
Left Rear Seat Crossmember Z
Right Rear Seat Crossmember X
Right Rear Seat Crossmember Z
Left Rear Seat Crossmember X Redundant
Right Rear Seat Crossmember X Redundant
Vehicle Engine Top X
Vehicle Engine Bottom X
Load Cell Barrier Forces and Moments

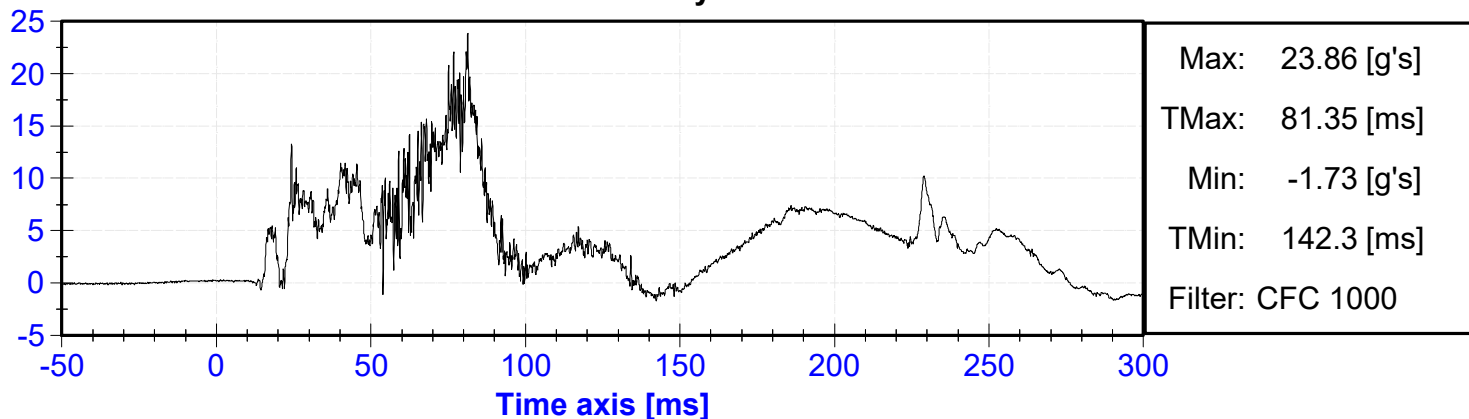
Driver Head X Acceleration vs. Time Primary



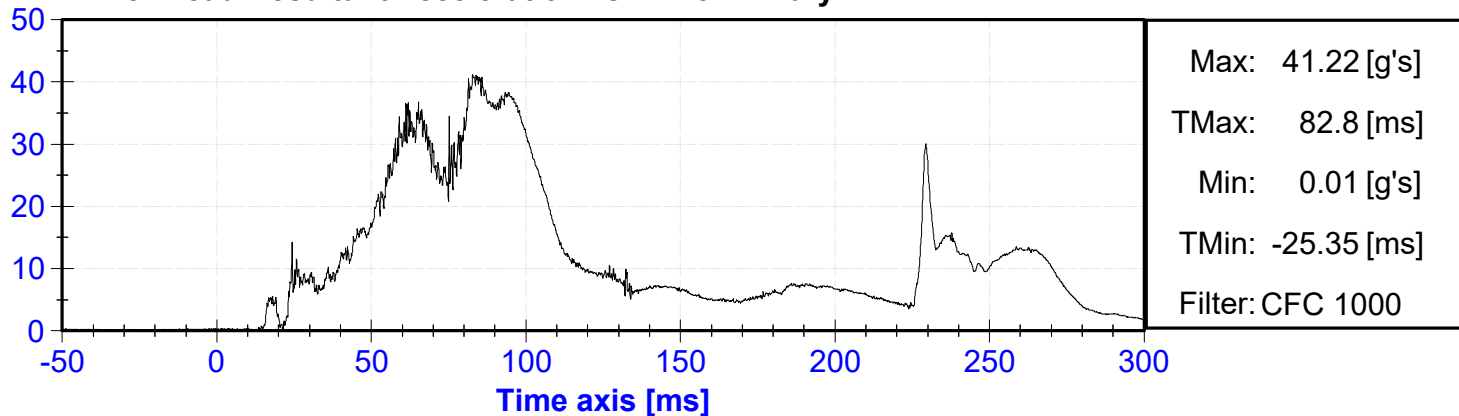
Driver Head Y Acceleration vs. Time Primary



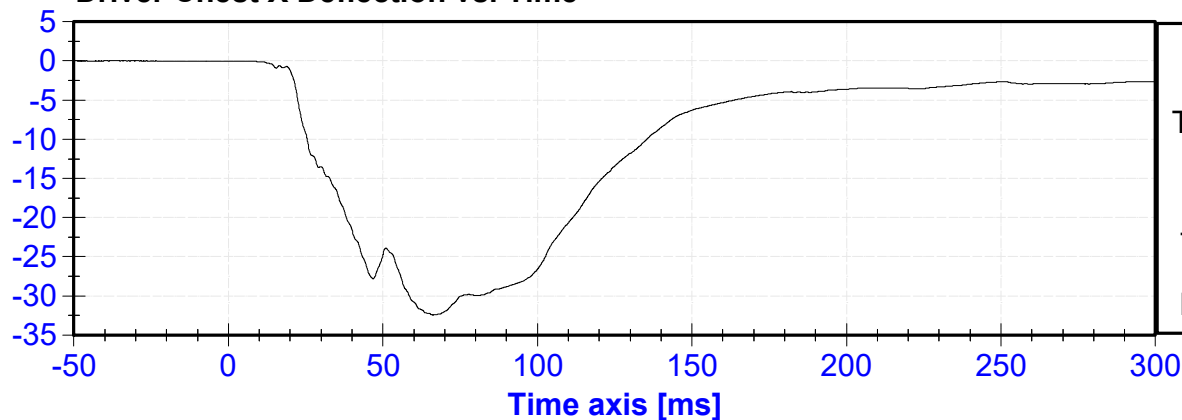
Driver Head Z Acceleration vs. Time Primary



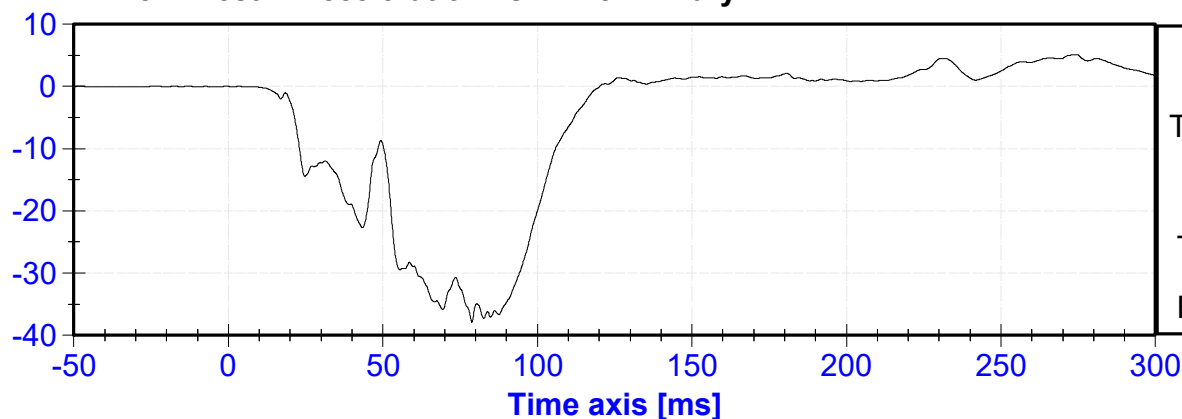
Driver Head Resultant Acceleration vs. Time Primary



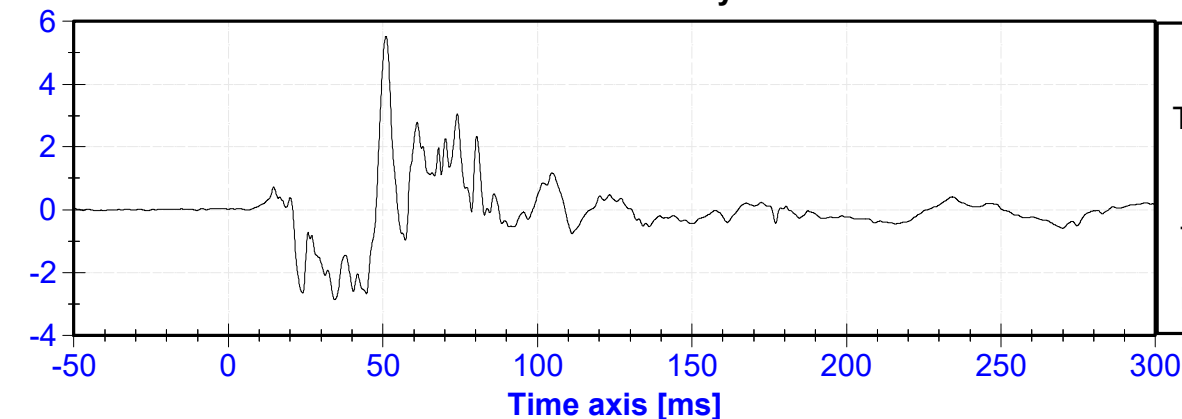
Driver Chest X Deflection vs. Time



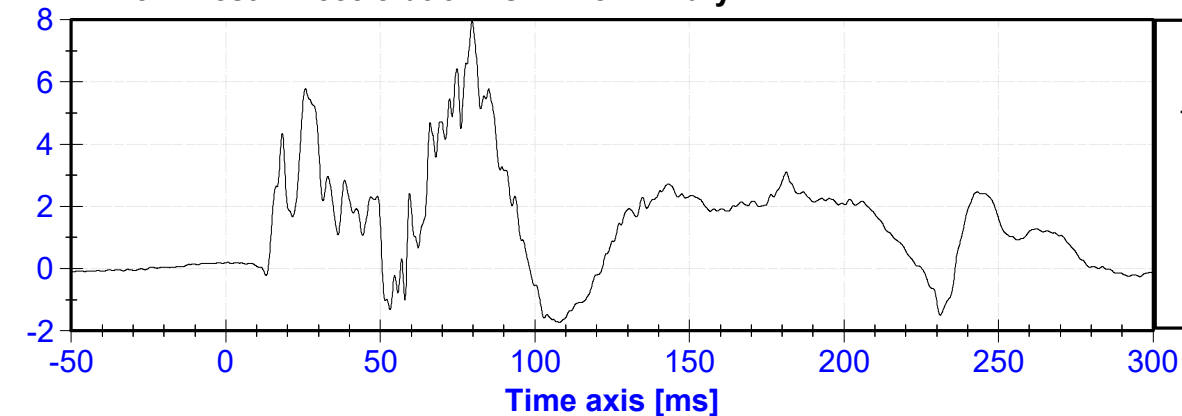
Driver Chest X Acceleration vs. Time Primary



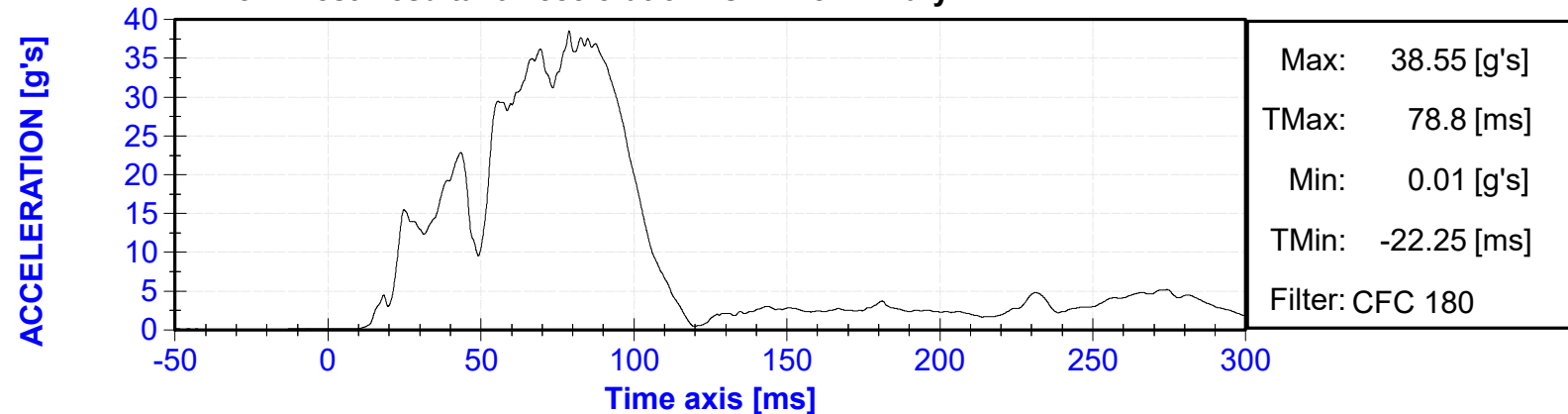
Driver Chest Y Acceleration vs. Time Primary



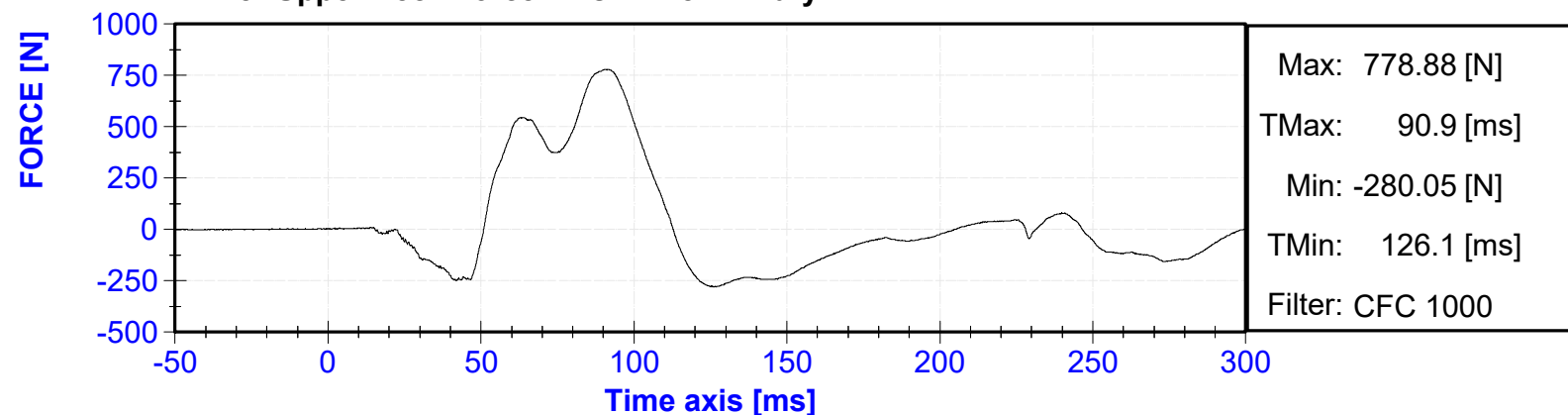
Driver Chest Z Acceleration vs. Time Primary



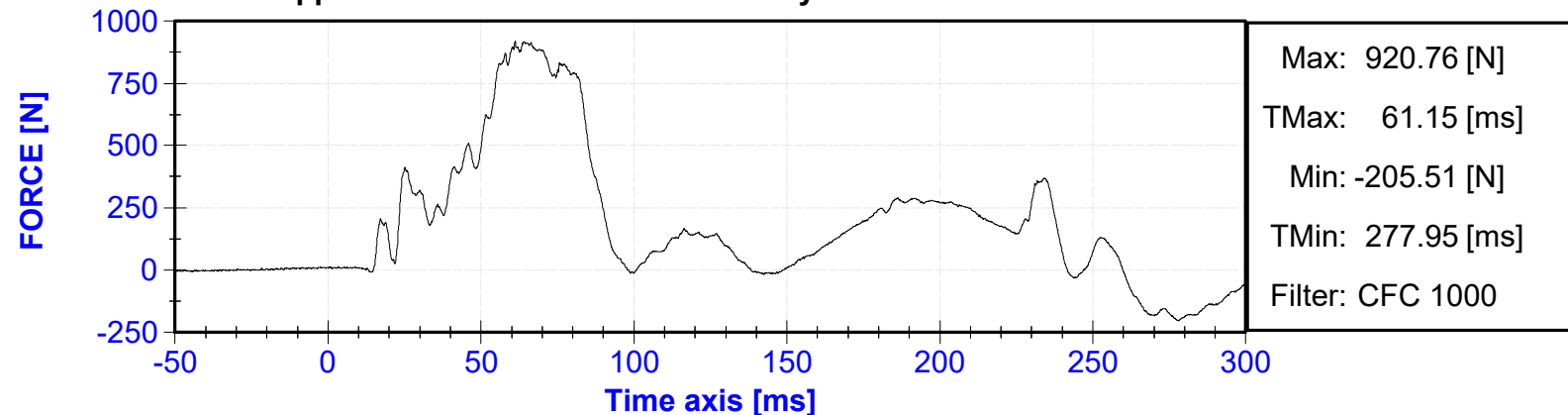
Driver Chest Resultant Acceleration vs. Time Primary



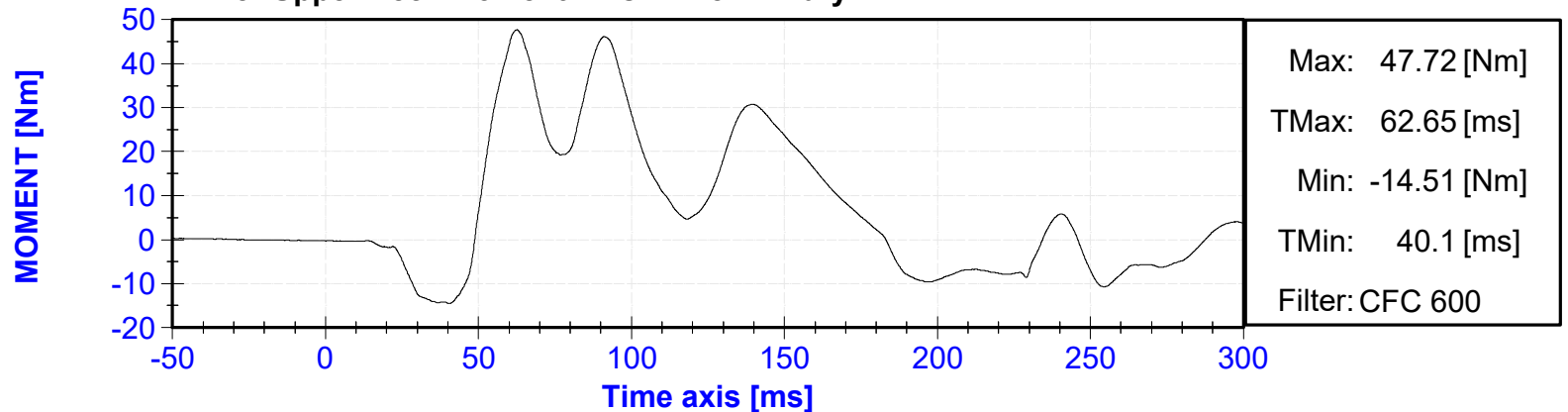
Driver Upper Neck Force X vs. Time Primary



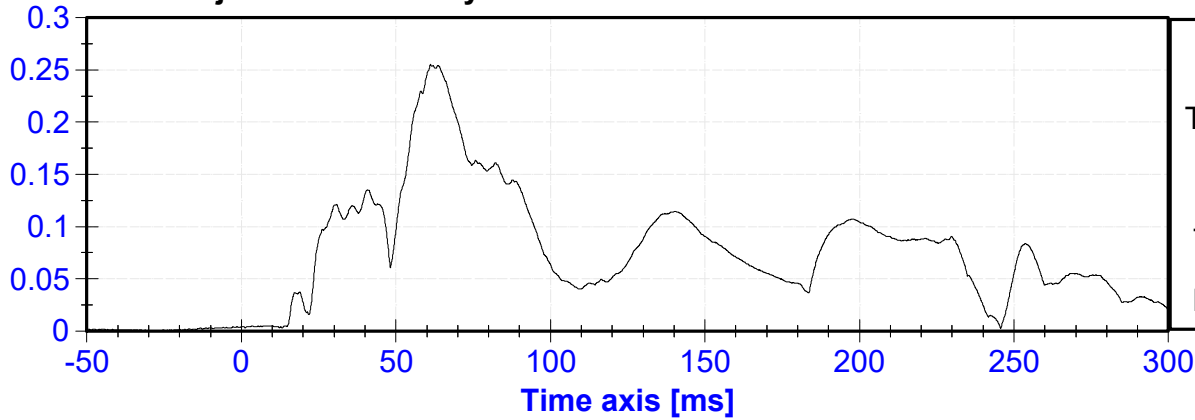
Driver Upper Neck Force Z vs. Time Primary



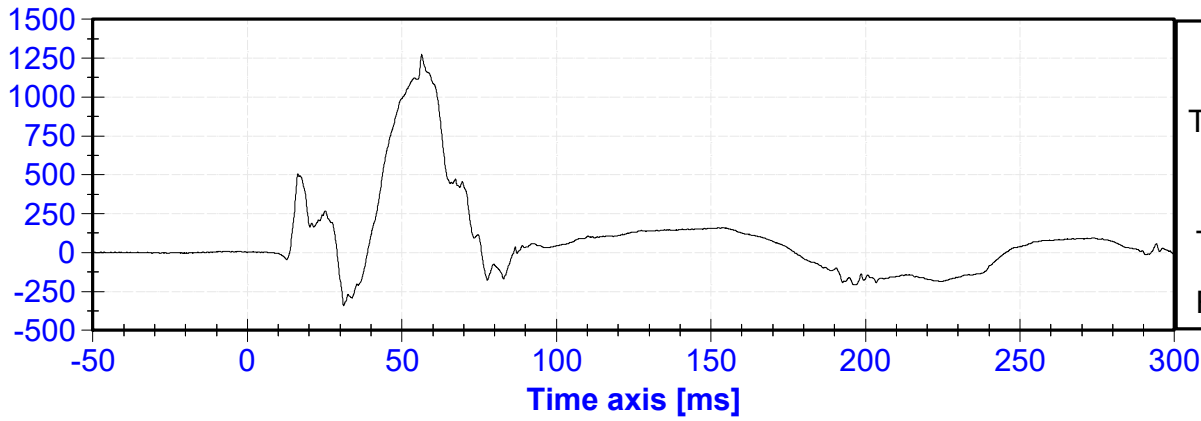
Driver Upper Neck Moment Y vs. Time Primary



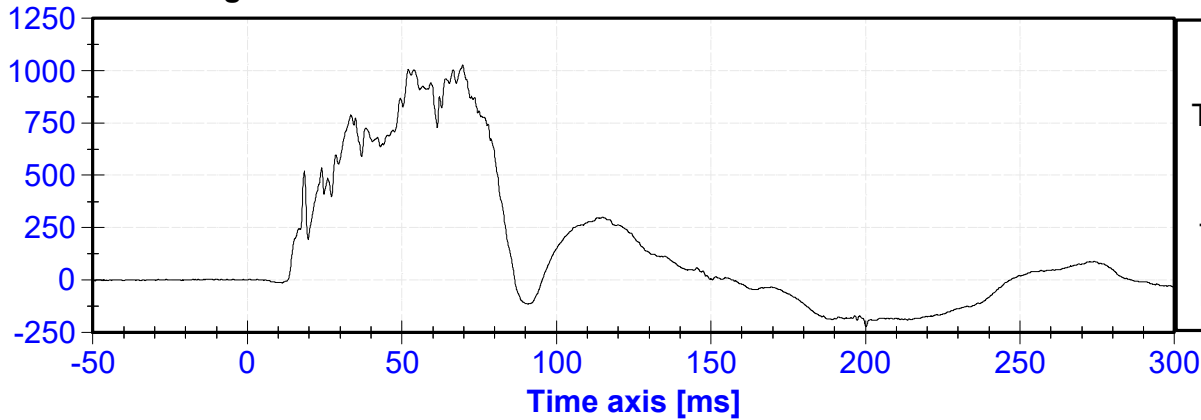
Driver Nij vs. Time Primary



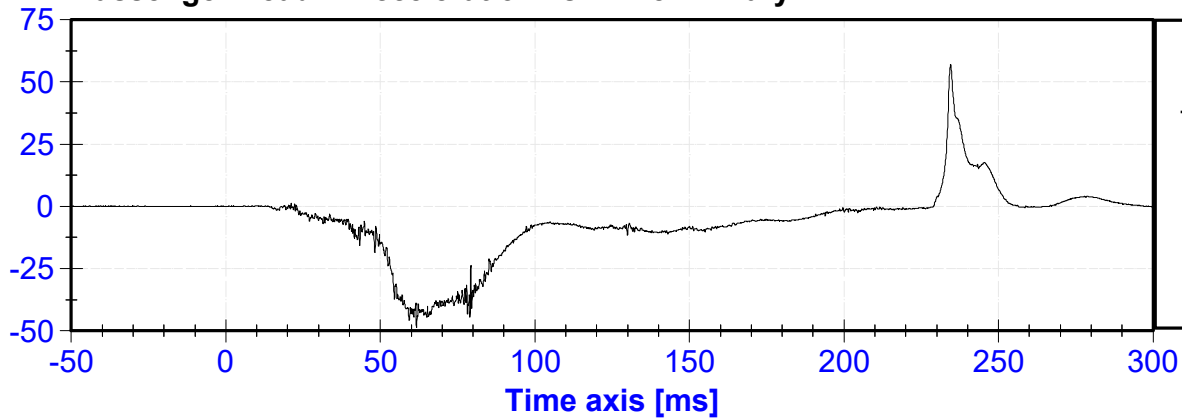
Driver Left Femur Force vs. Time



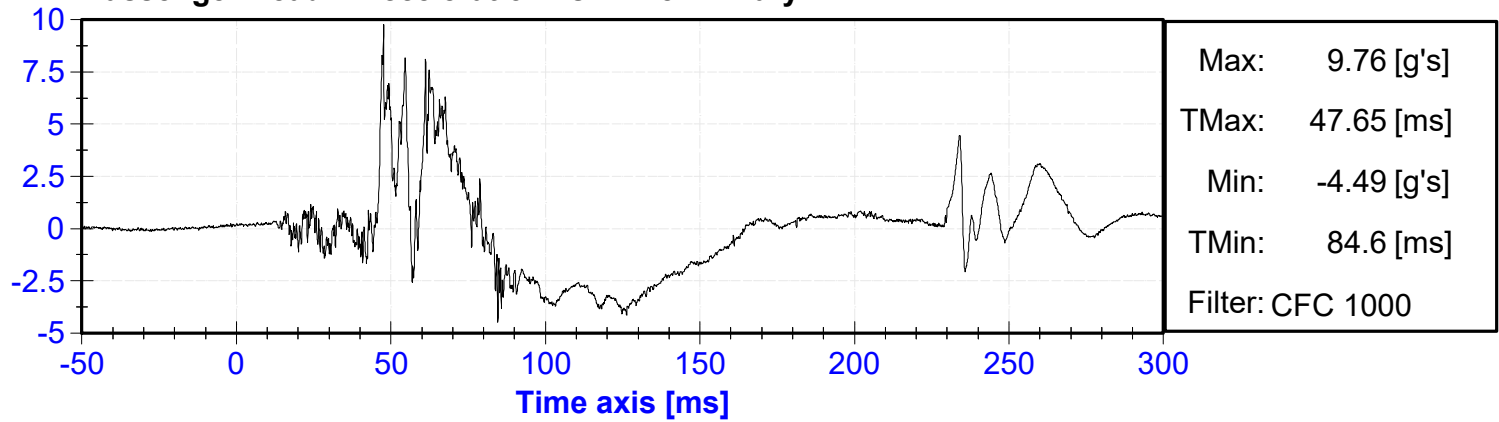
Driver Right Femur Force vs. Time



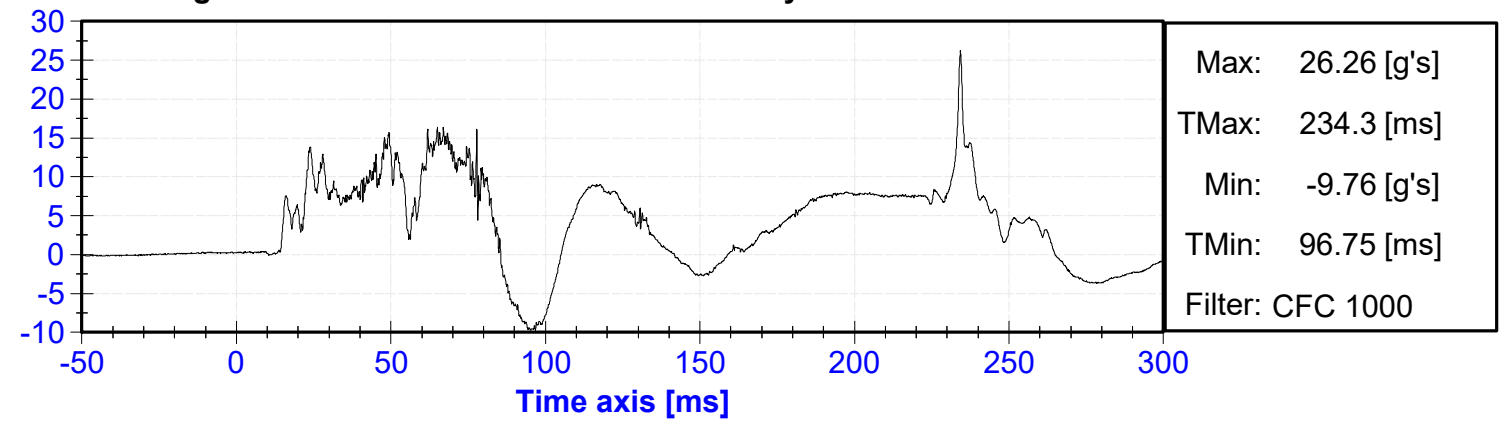
Passenger Head X Acceleration vs. Time Primary



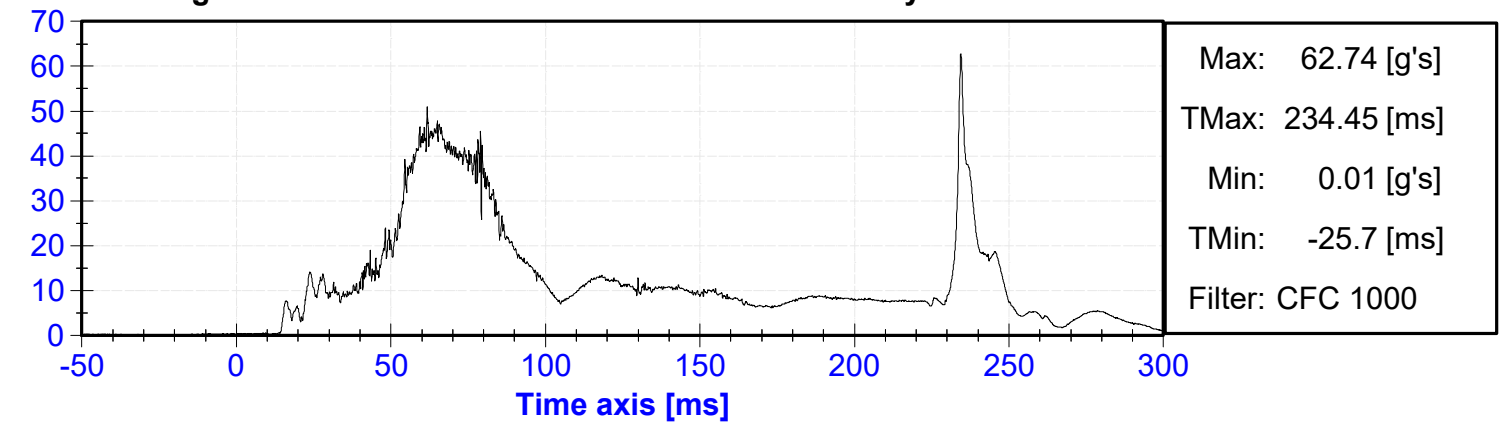
Passenger Head Y Acceleration vs. Time Primary



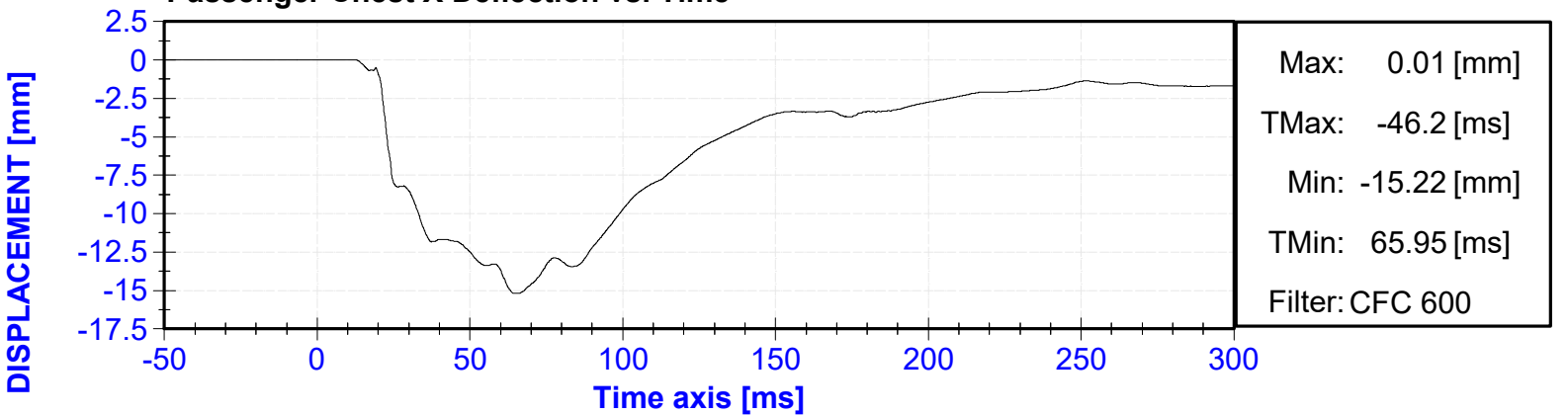
Passenger Head Z Acceleration vs. Time Primary



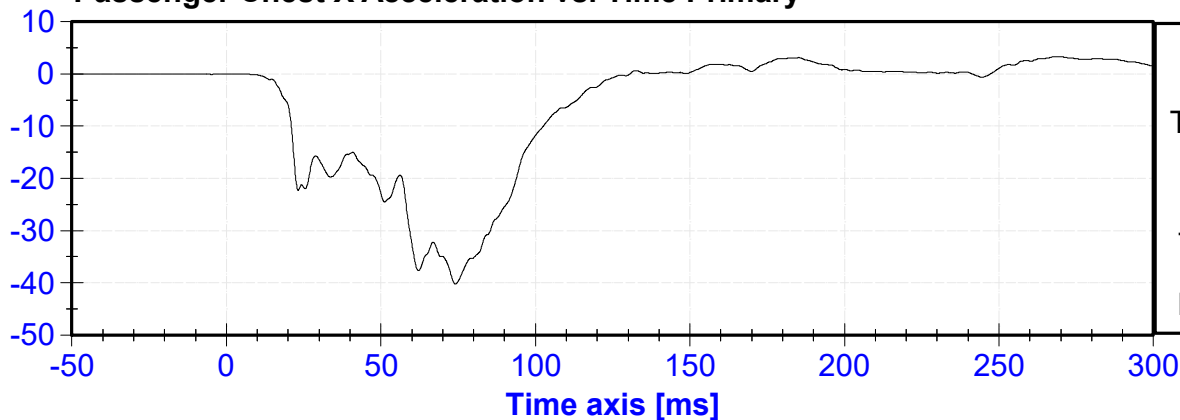
Passenger Head Resultant Acceleration vs. Time Primary



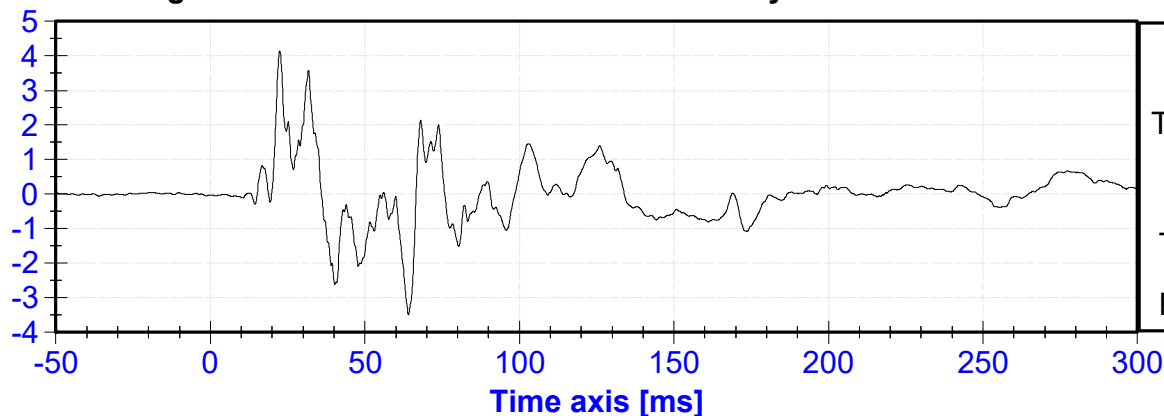
Passenger Chest X Deflection vs. Time



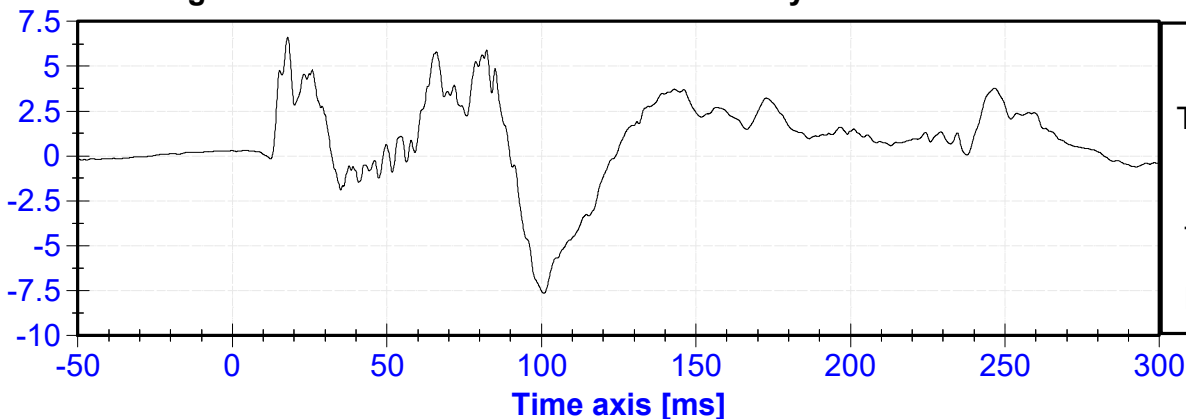
Passenger Chest X Acceleration vs. Time Primary



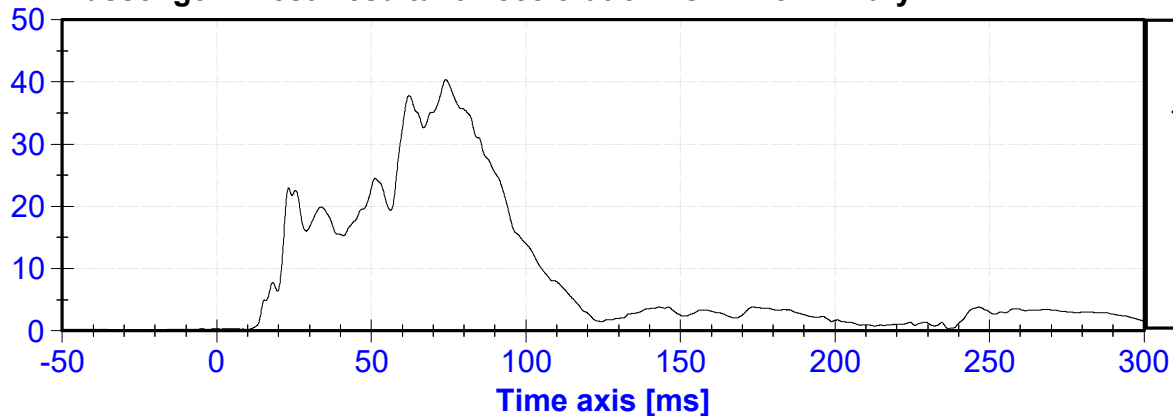
Passenger Chest Y Acceleration vs. Time Primary



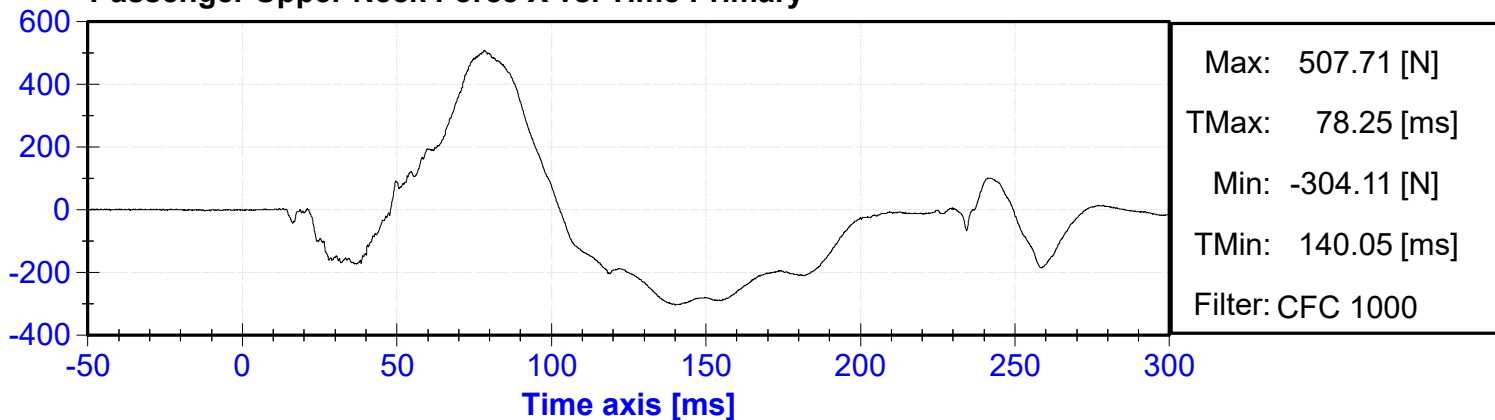
Passenger Chest Z Acceleration vs. Time Primary



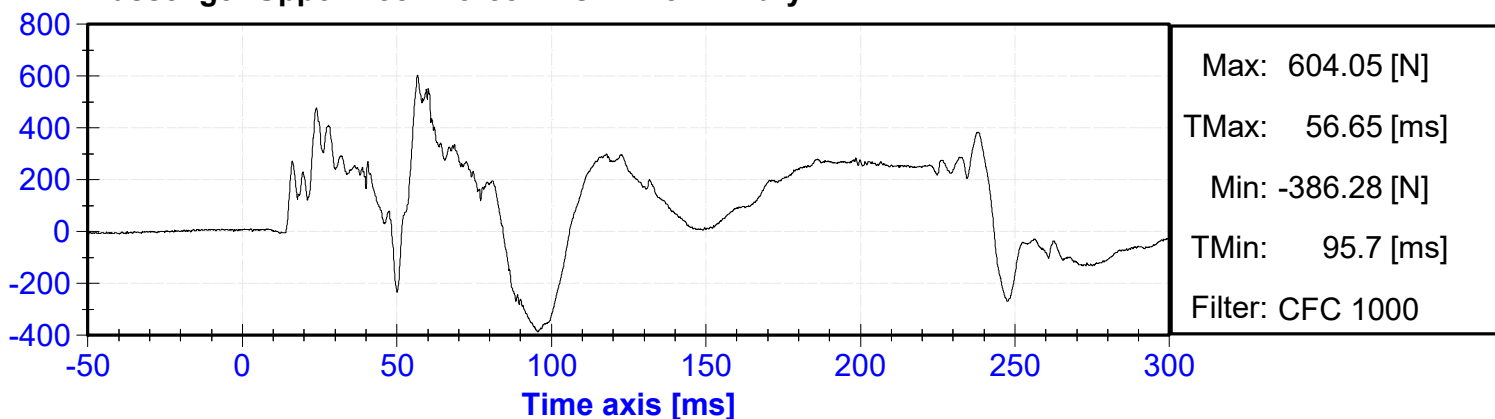
Passenger Chest Resultant Acceleration vs. Time Primary



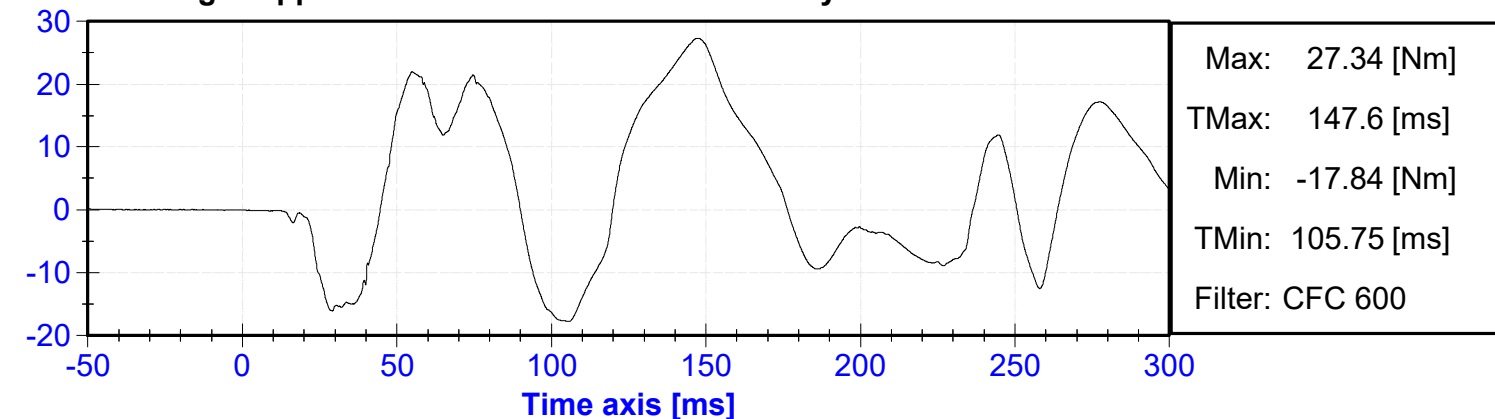
Passenger Upper Neck Force X vs. Time Primary



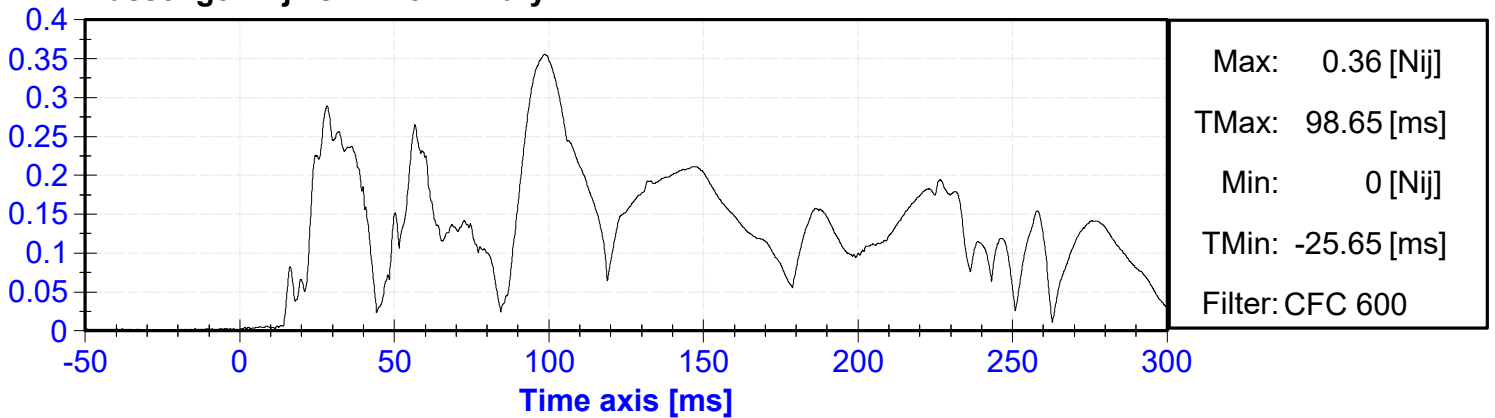
Passenger Upper Neck Force Z vs. Time Primary



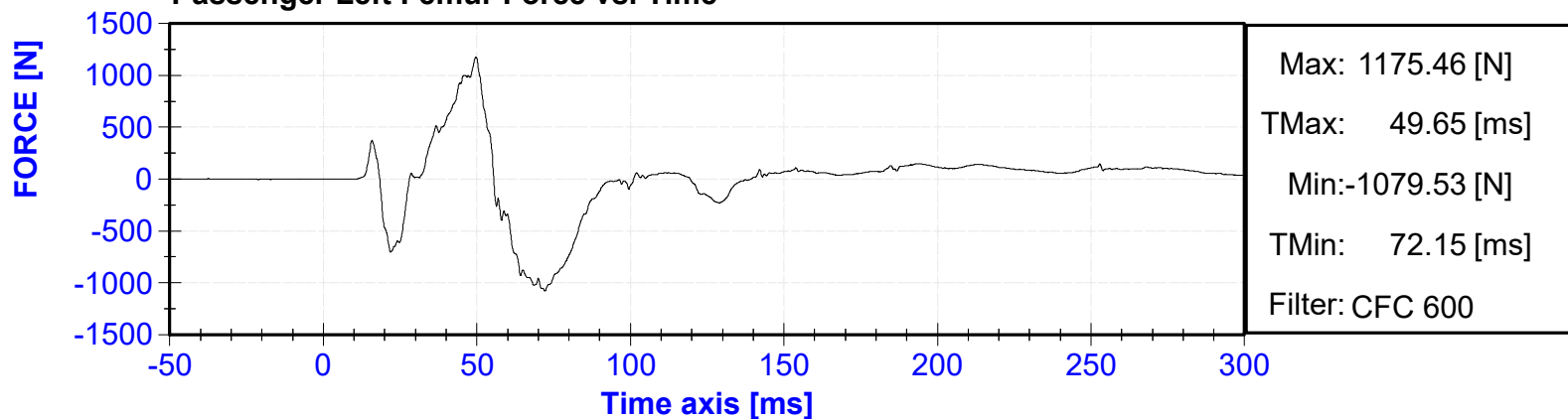
Passenger Upper Neck Moment Y vs. Time Primary



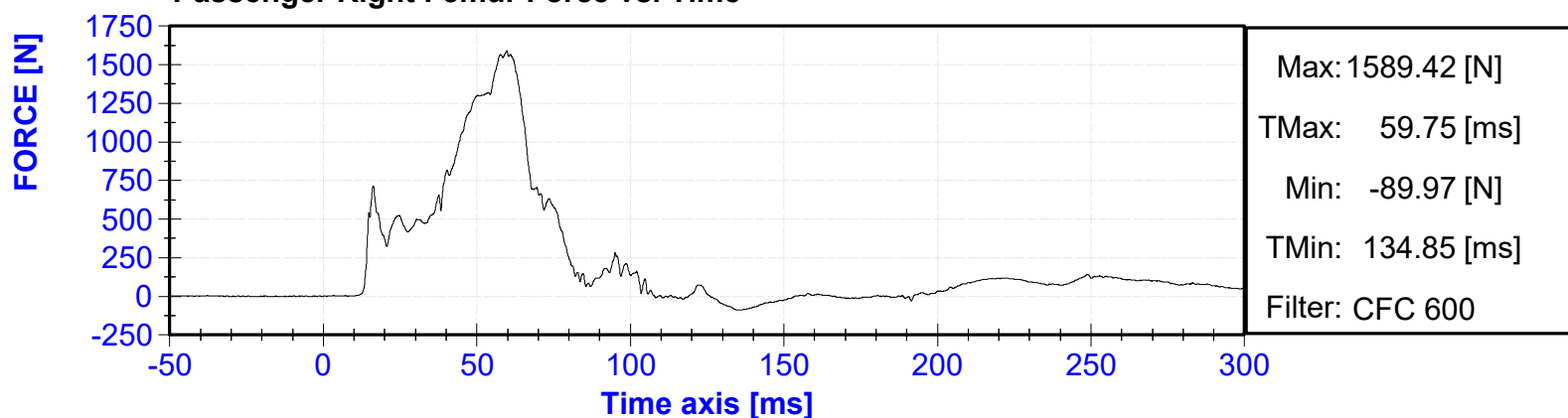
Passenger Nij vs. Time Primary



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

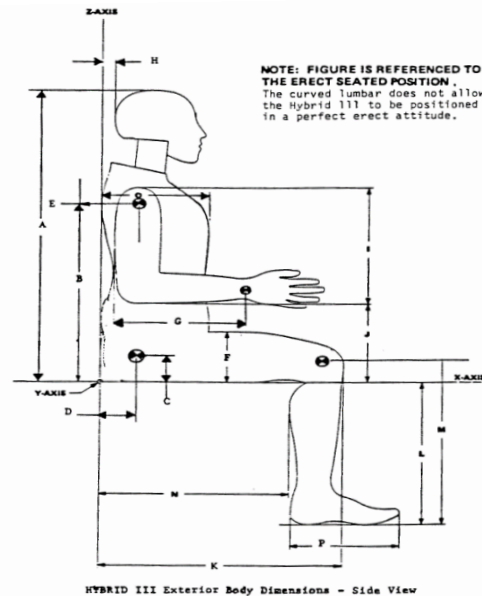
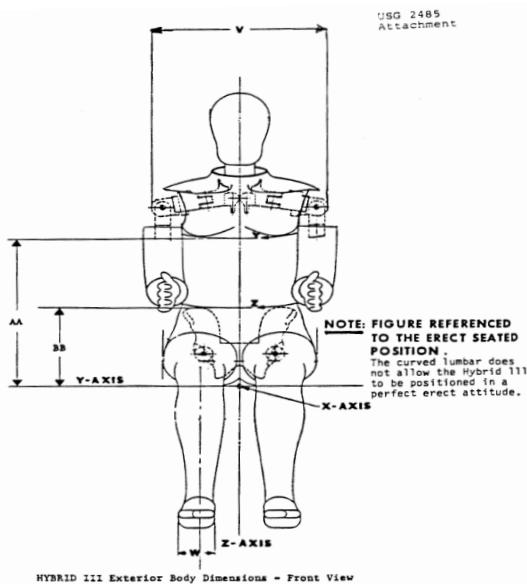


External Measurements - Hybrid 3 - 50th Male

Technician: **K. Brogan**

Date: **01/06/2022**

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	20.3	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	3.4	Pass
F	Thigh Clearance	5.5	6.1	5.8	Pass
G	Back of Elbow to Wrist Pivot	11.4	12.0	11.7	Pass
H	Head Back to Backline	1.6	1.8	1.7	Pass
I	Shoulder to Elbow Length	13.0	13.6	13.2	Pass
J	Elbow Rest Height	7.5	8.3	8.0	Pass
K	Buttock to Knee Length	22.8	23.8	23.4	Pass
L	Popliteal Height	16.9	17.9	17.5	Pass
M	Knee Pivot Height	19.1	19.7	19.5	Pass
N	Buttock Popliteal Length	17.8	18.8	18.2	Pass
O	Chest Depth without Jacket	8.4	9.0	8.8	Pass
P	Foot Length (right)	9.9	10.5	10.2	Pass
V	Shoulder Breadth	16.3	17.2	16.9	Pass
W	Foot Breadth	3.6	4.2	3.9	Pass
Y	Chest Circumference with Jacket	38.2	39.4	39.0	Pass
Z	Waist Circumference	32.9	34.1	33.4	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

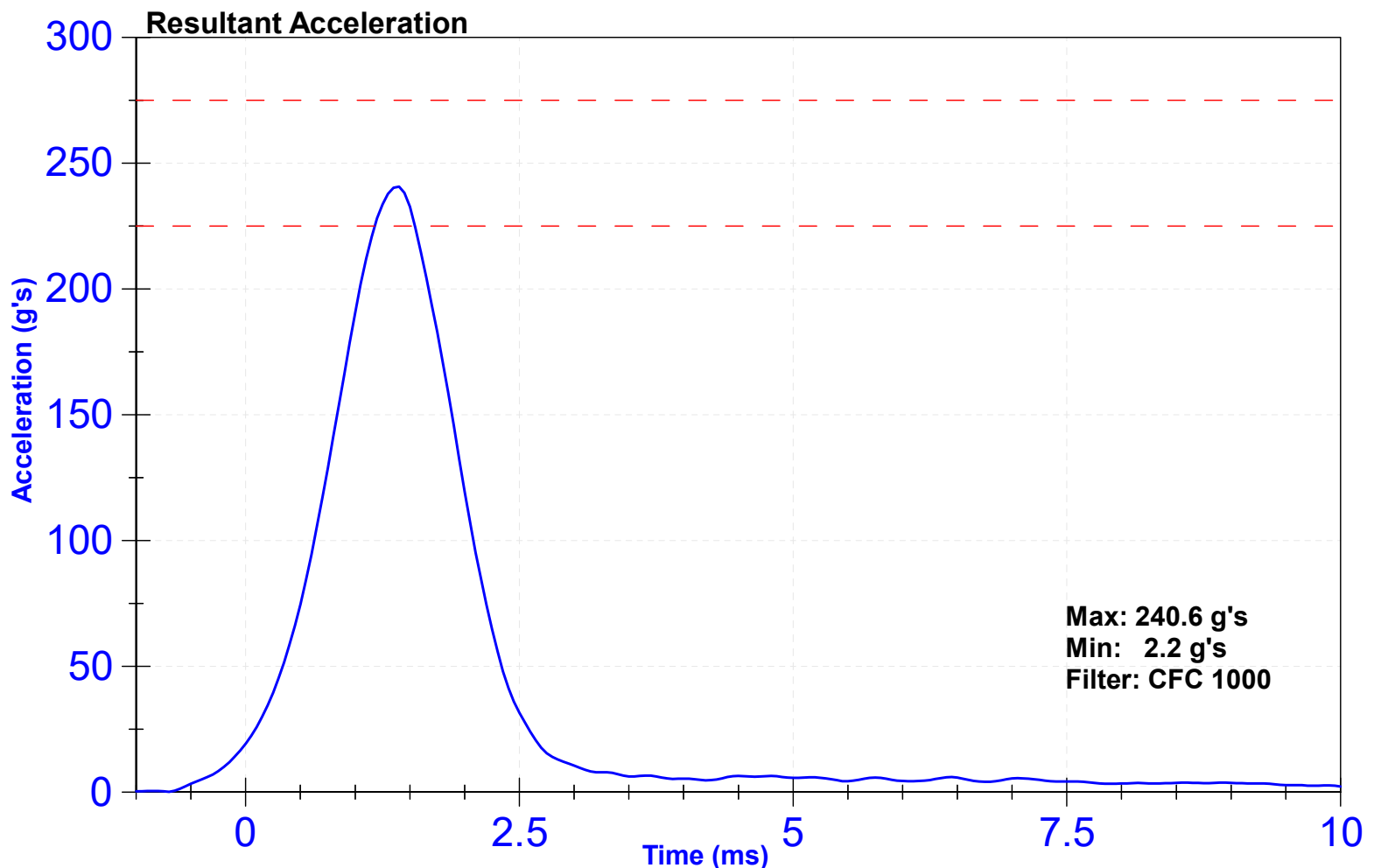
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

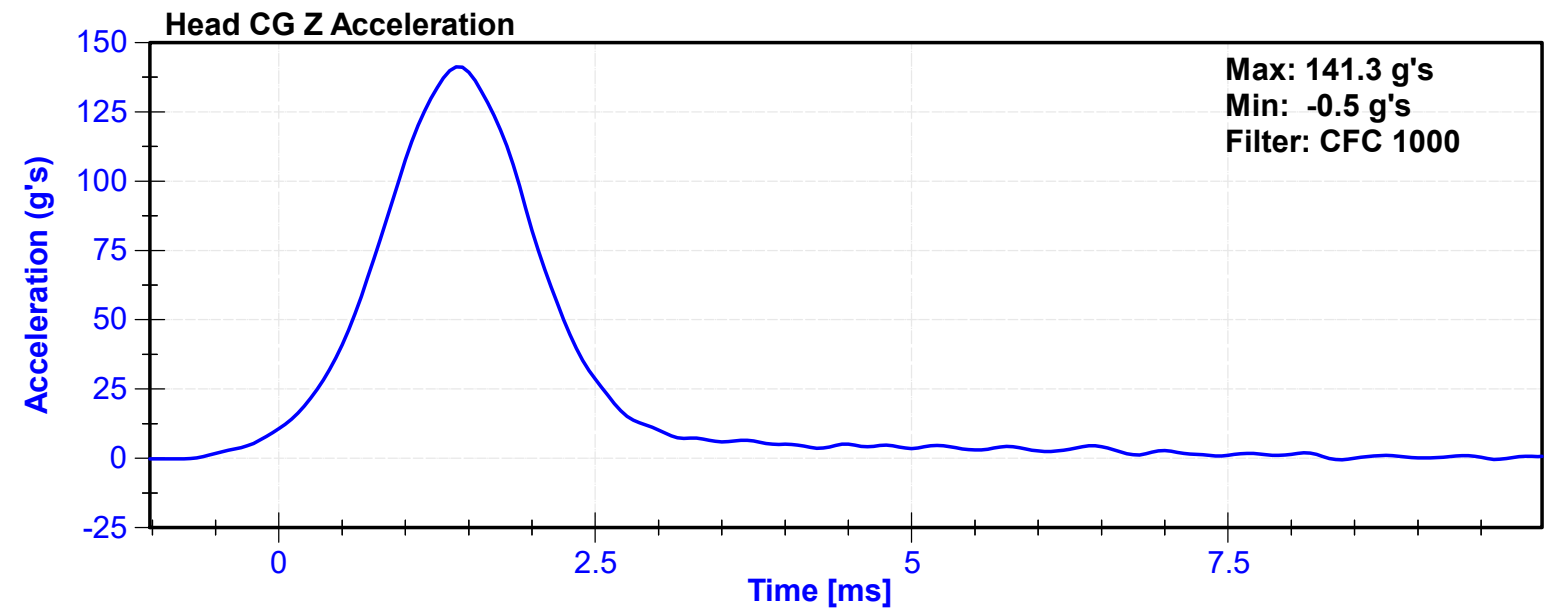
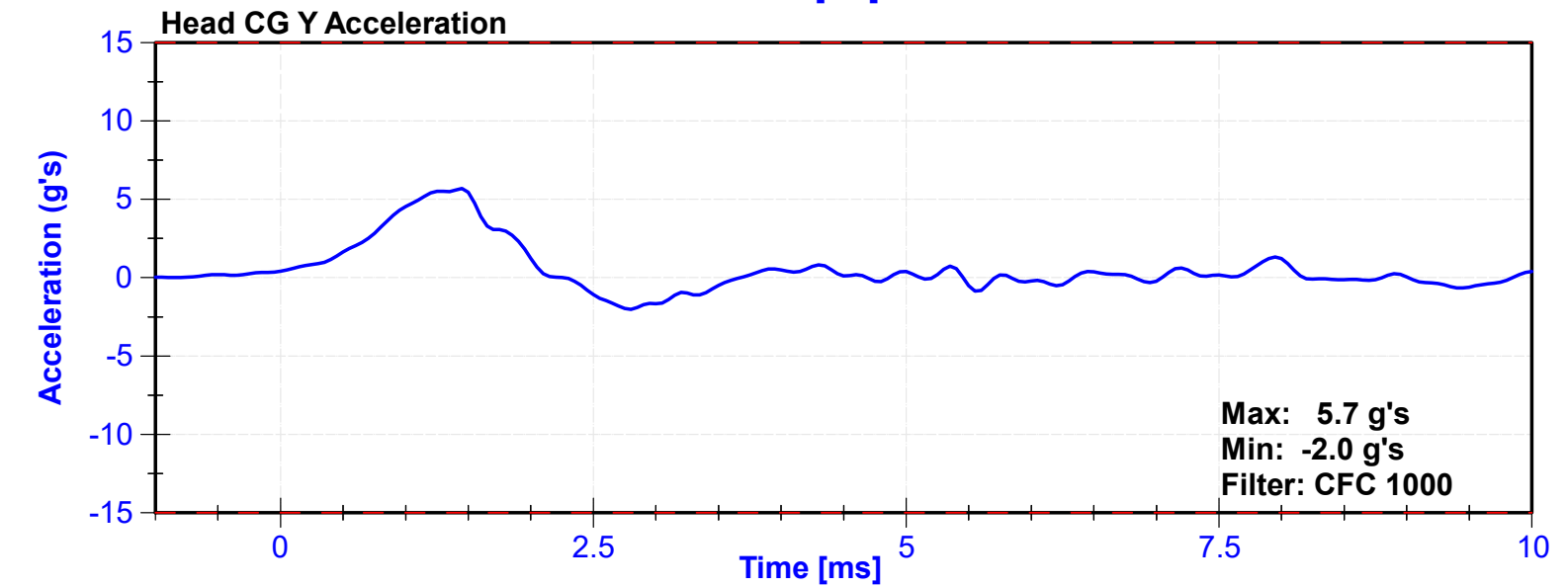
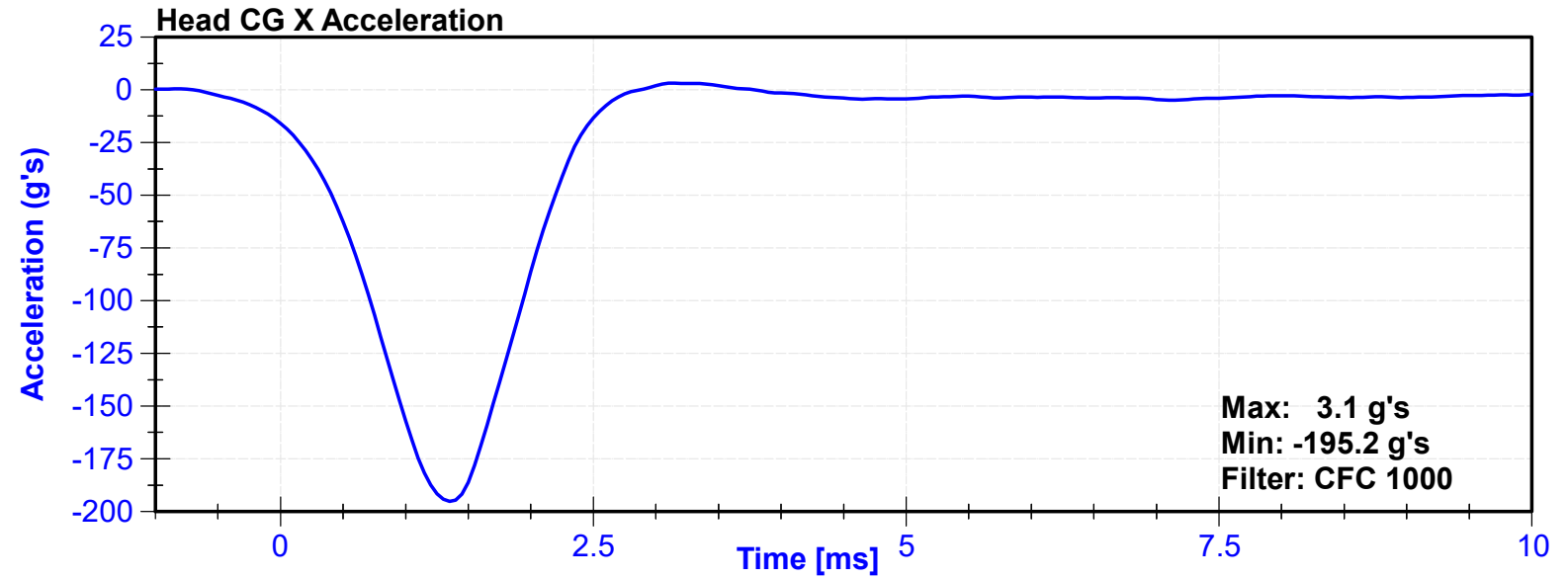
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	20.4	Pass
Humidity	10	70	%	29,5	Pass
Resultant Acceleration	225	275	g's	240.6	Pass
Oscillation	0	10	%	3.2	Pass
Lateral Acceleration	-15	15	g's	5.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P51681	9/30/2022	3/29/2023
Y Accelerometer	Endevco	P64151	9/30/2022	3/29/2023
Z Accelerometer	Endevco	P52114	9/30/2022	3/29/2023





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

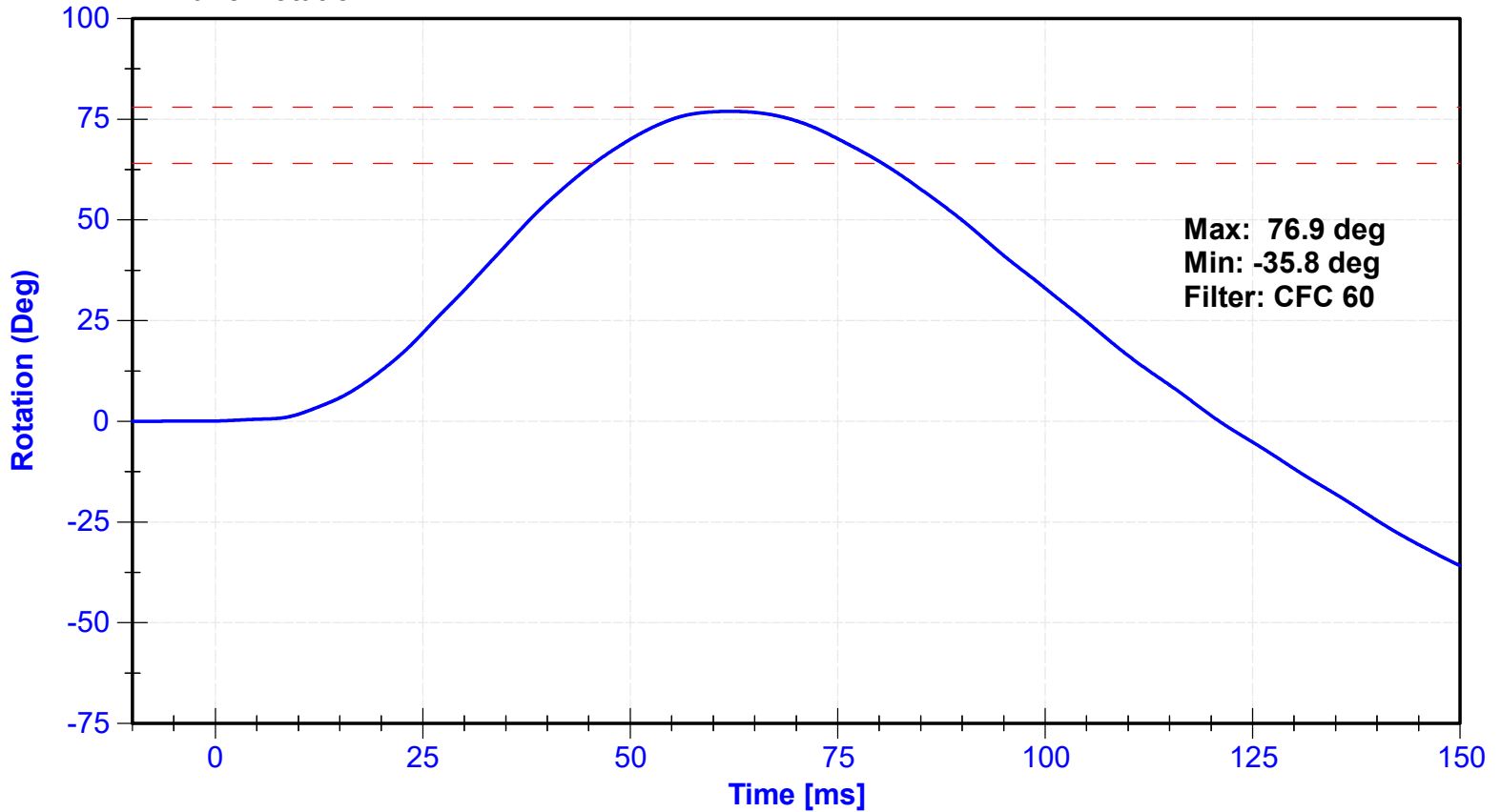
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	29.5	Pass
Velocity	6.89	7.13	m/s	6.924	Pass
Pendulum Deceleration at 10ms	22.5	27.5	g's	25.16	Pass
Pendulum Deceleration at 20ms	17.6	22.6	g's	20.38	Pass
Pendulum Deceleration at 30ms	12.5	18.5	g's	15.70	Pass
Max. Pendulum Deceleration After 30ms	0	29	g's	25.2	Pass
Pendulum Deceleration Time to 5 g's	34	42	ms	41.0	Pass
Maximum D Plane Rotation	64	78	deg	76.9	Pass
Time to Maximum Rotation	57	64	ms	62.0	Pass
Rotation Decay to Zero	113	127	ms	121.0	Pass
Moment About Occipital Condyle	88.1	108.4	Nm	95.21	Pass
Time to Maximum Moment	47	58	ms	55.0	Pass
Moment Decay to Zero	97	107	ms	102.3	Pass

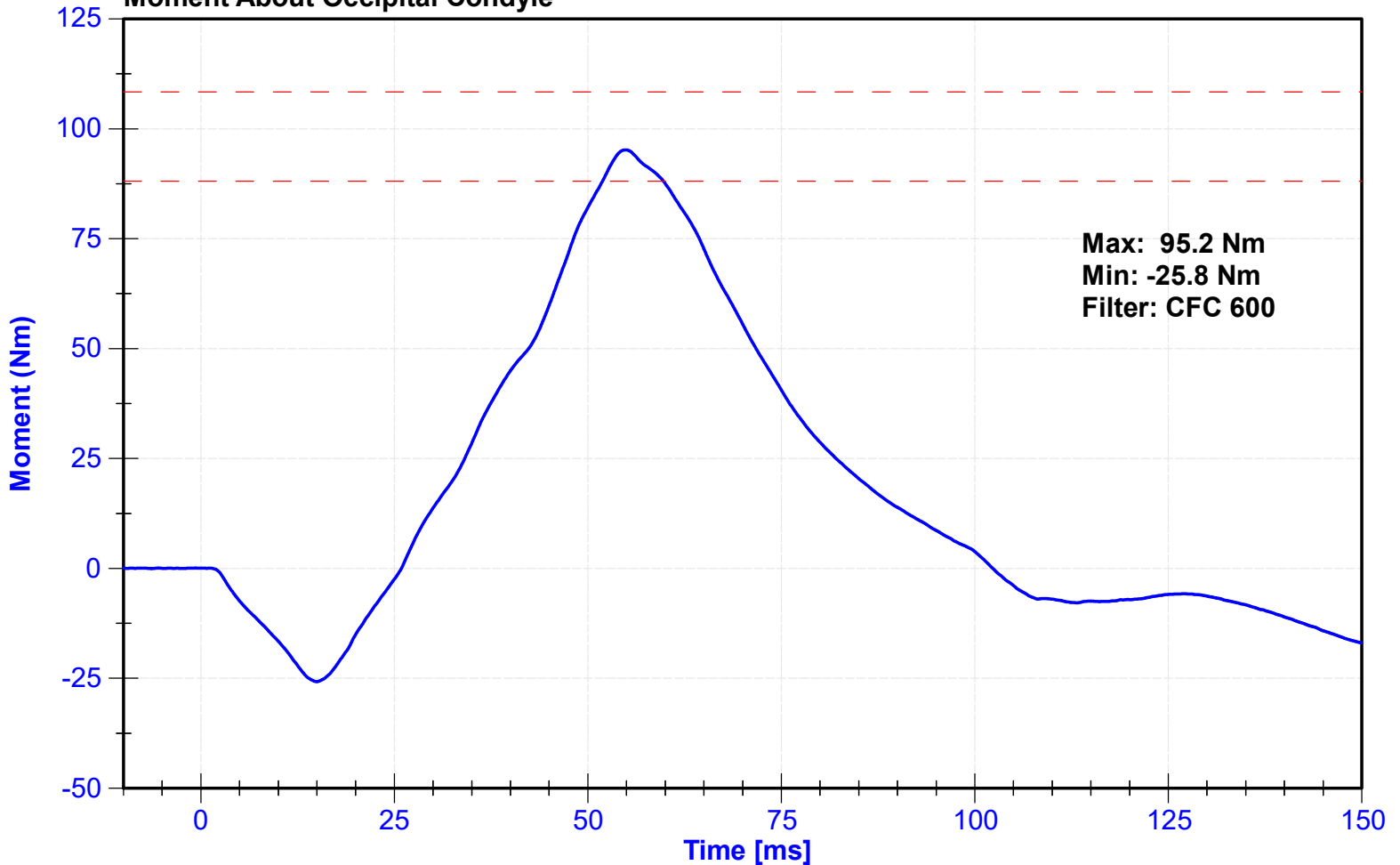
Transducer Calibrations

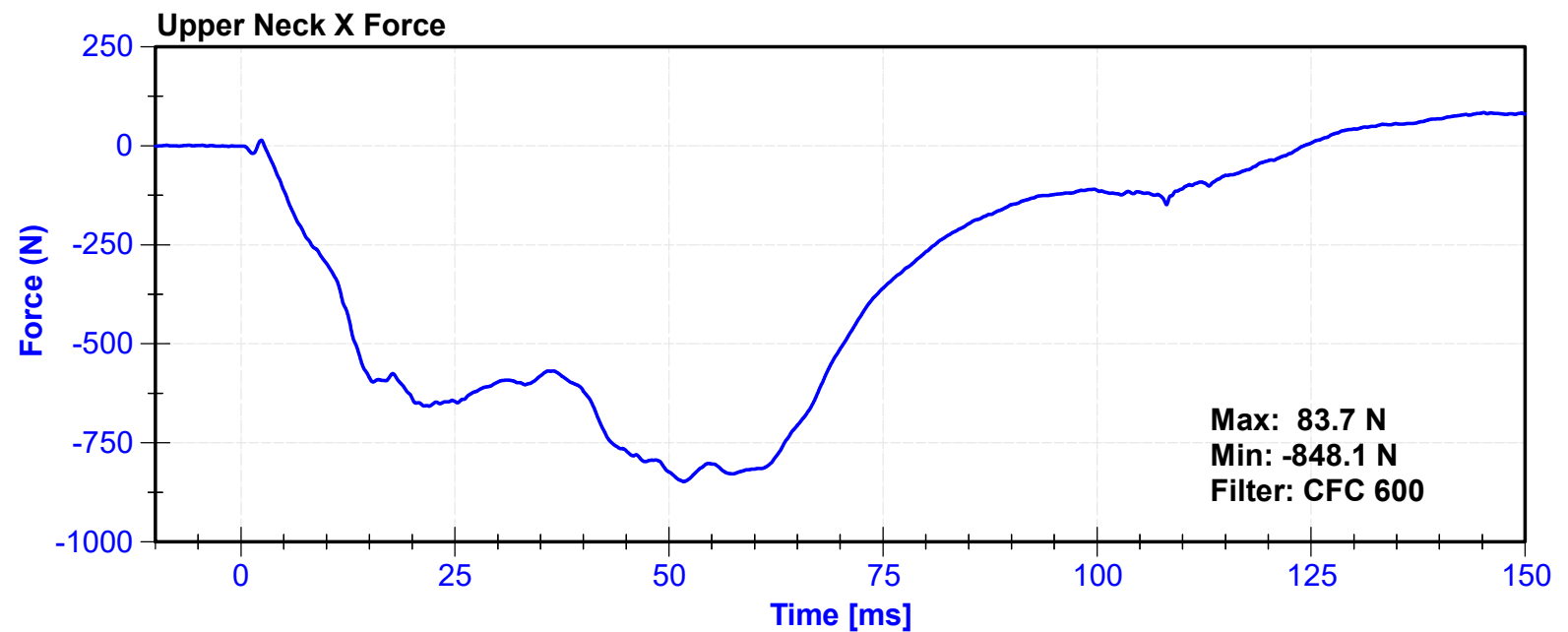
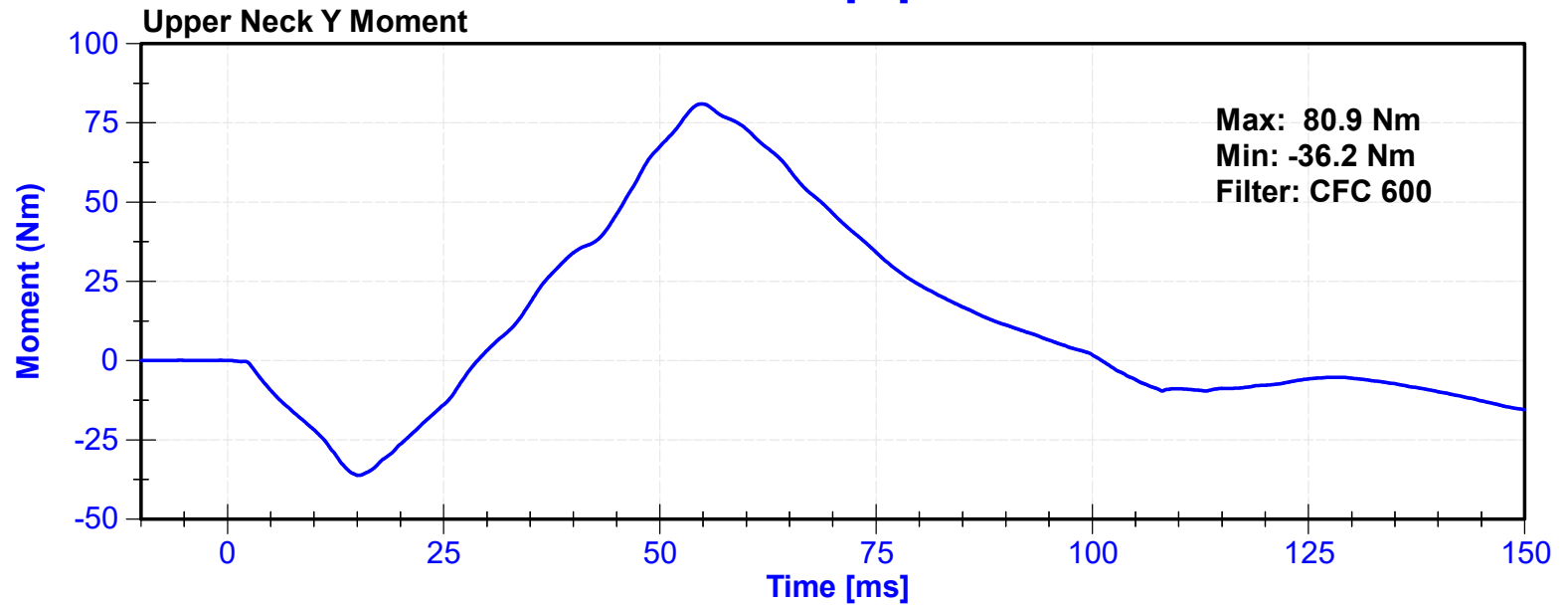
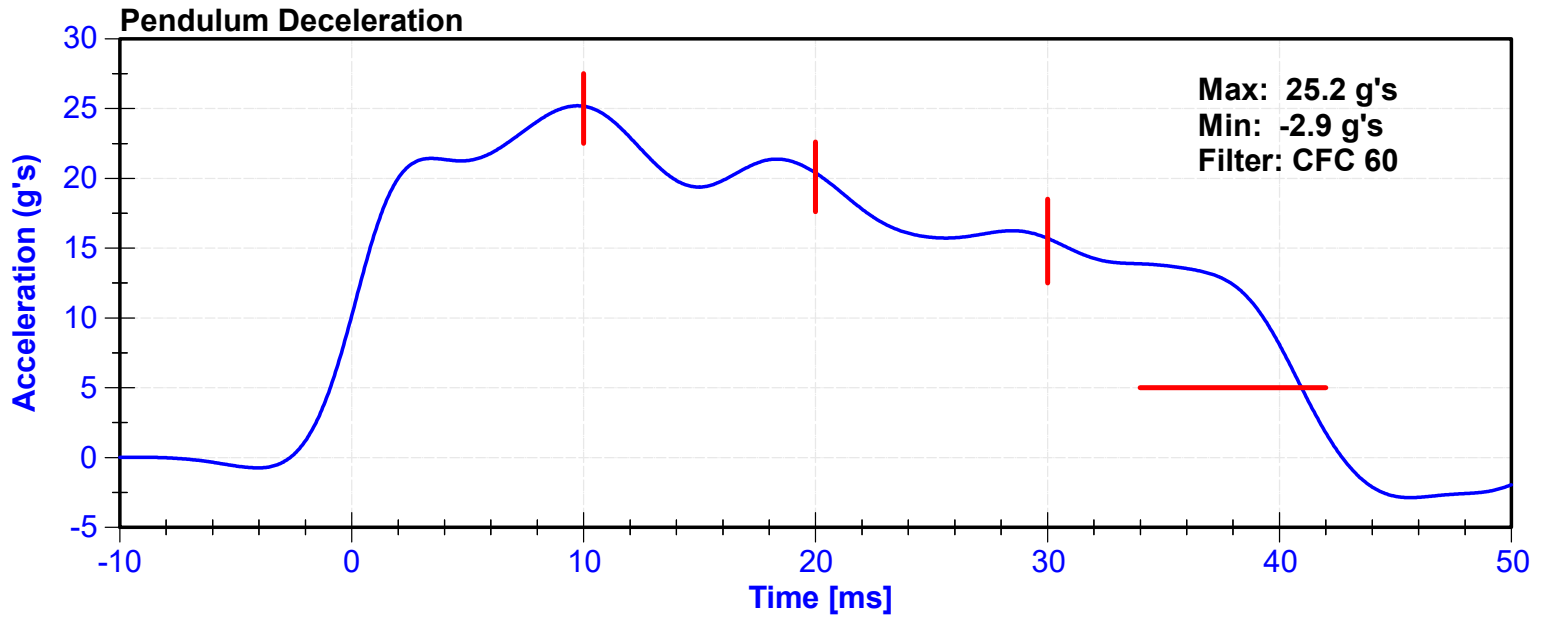
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	7231C-750	10/26/2022	10/26/2023
Pendulum Potentiometer	ETI	LABPOT1	5/9/2022	5/9/2023
Condyle Potentiometer	ETI	LABPOT2	5/9/2022	5/9/2023
Upper Neck Load Cell	Denton	2187-FX	6/13/2022	6/13/2023

D-Plane Rotation



Moment About Occipital Condyle





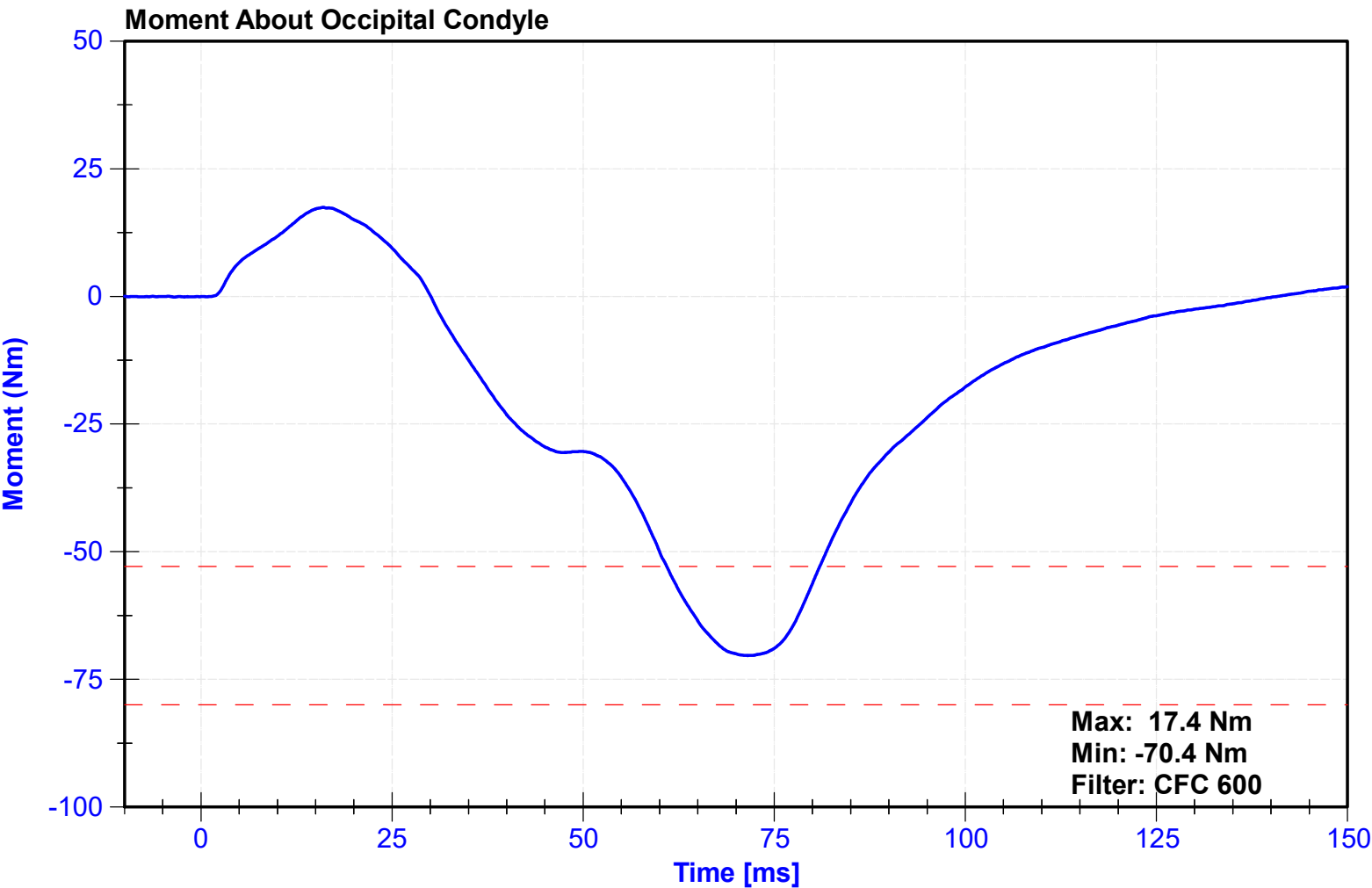
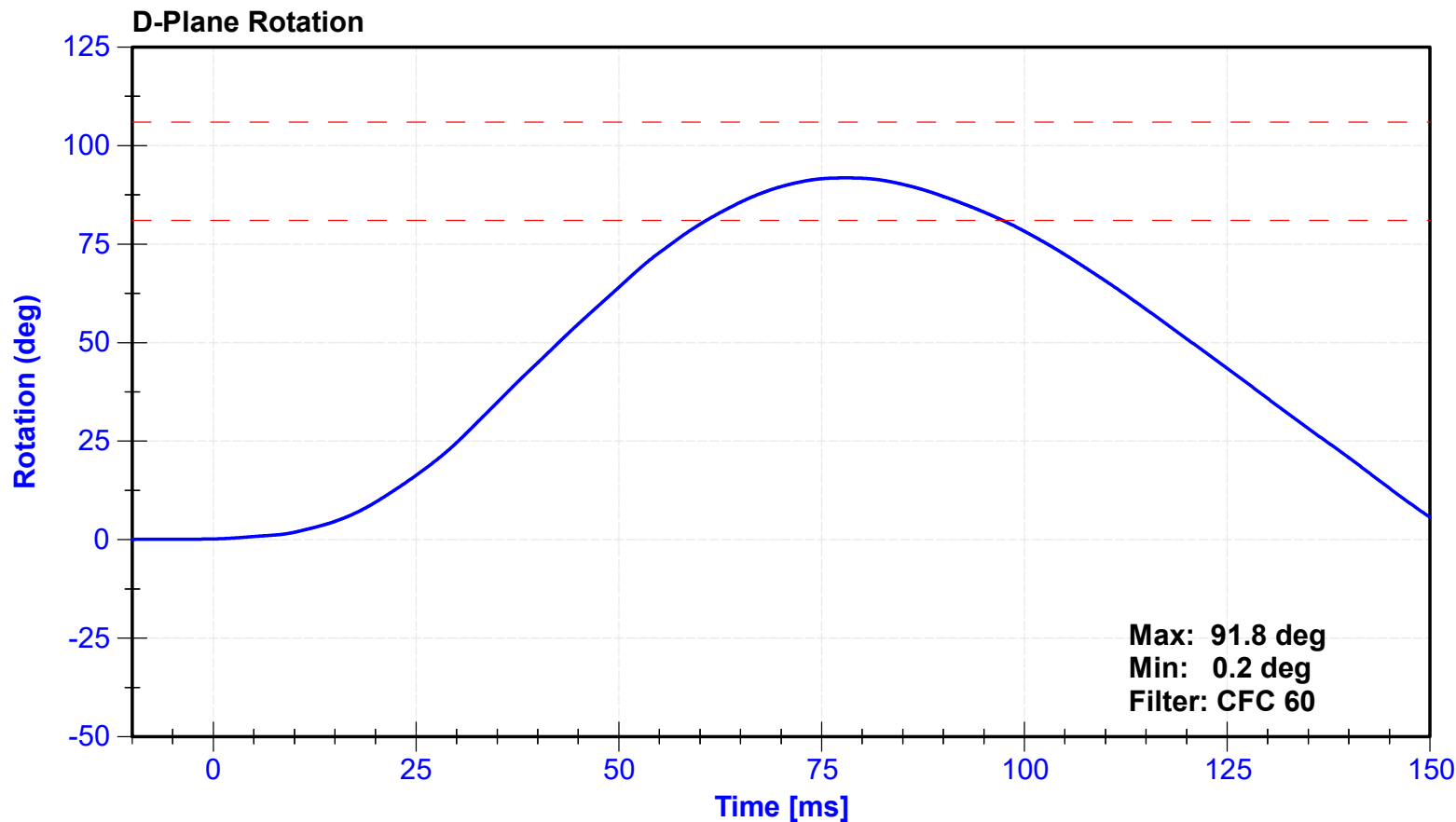
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

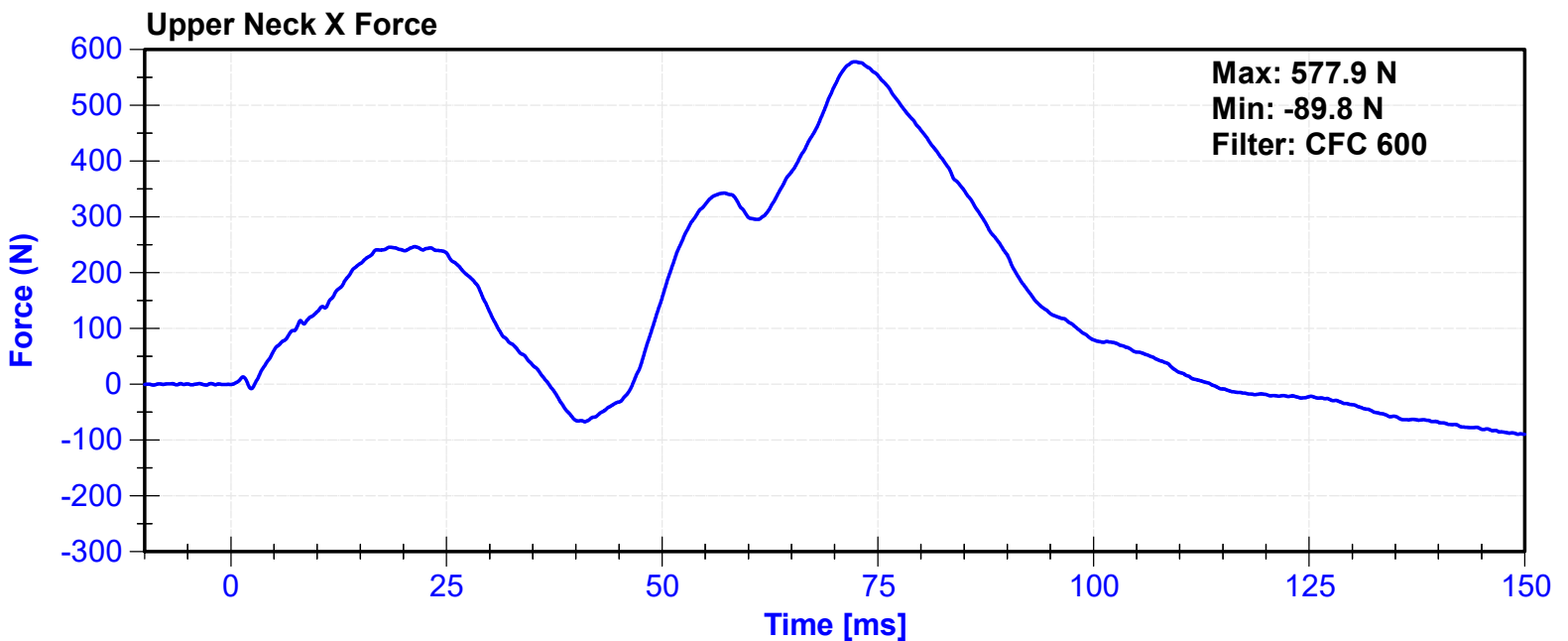
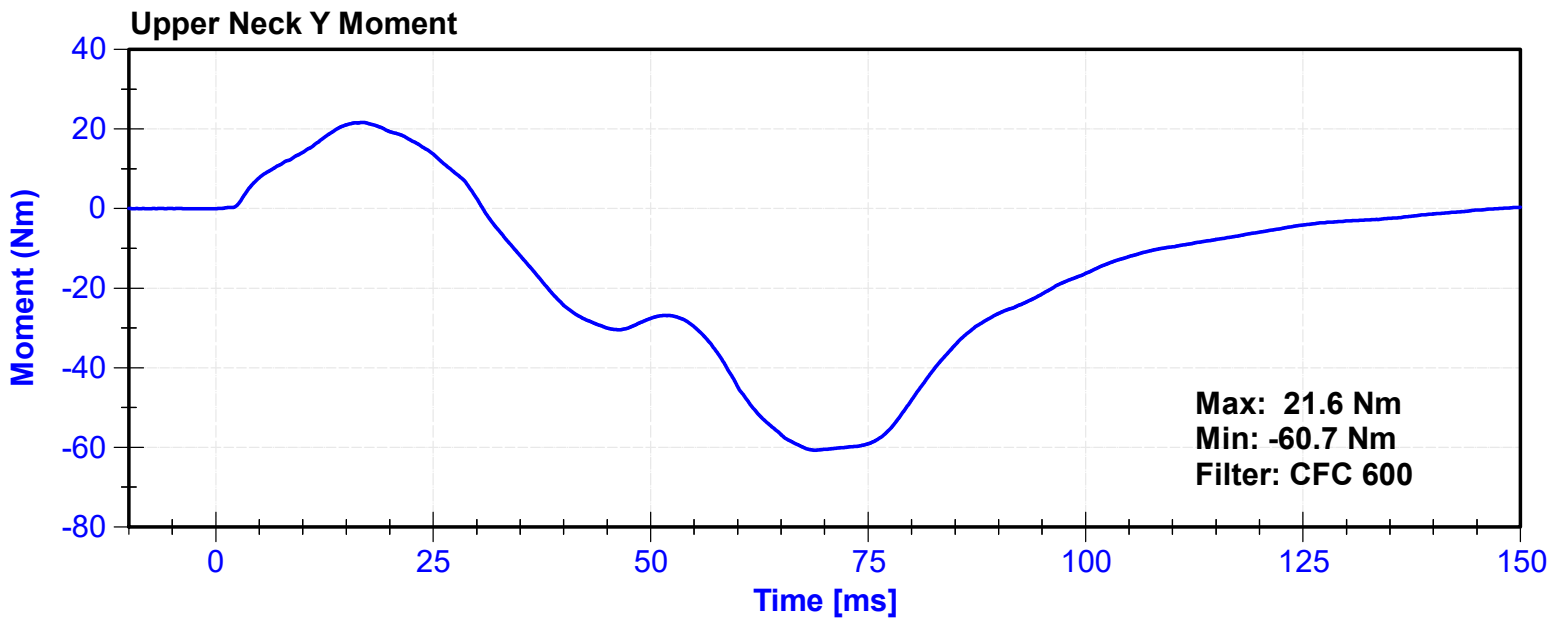
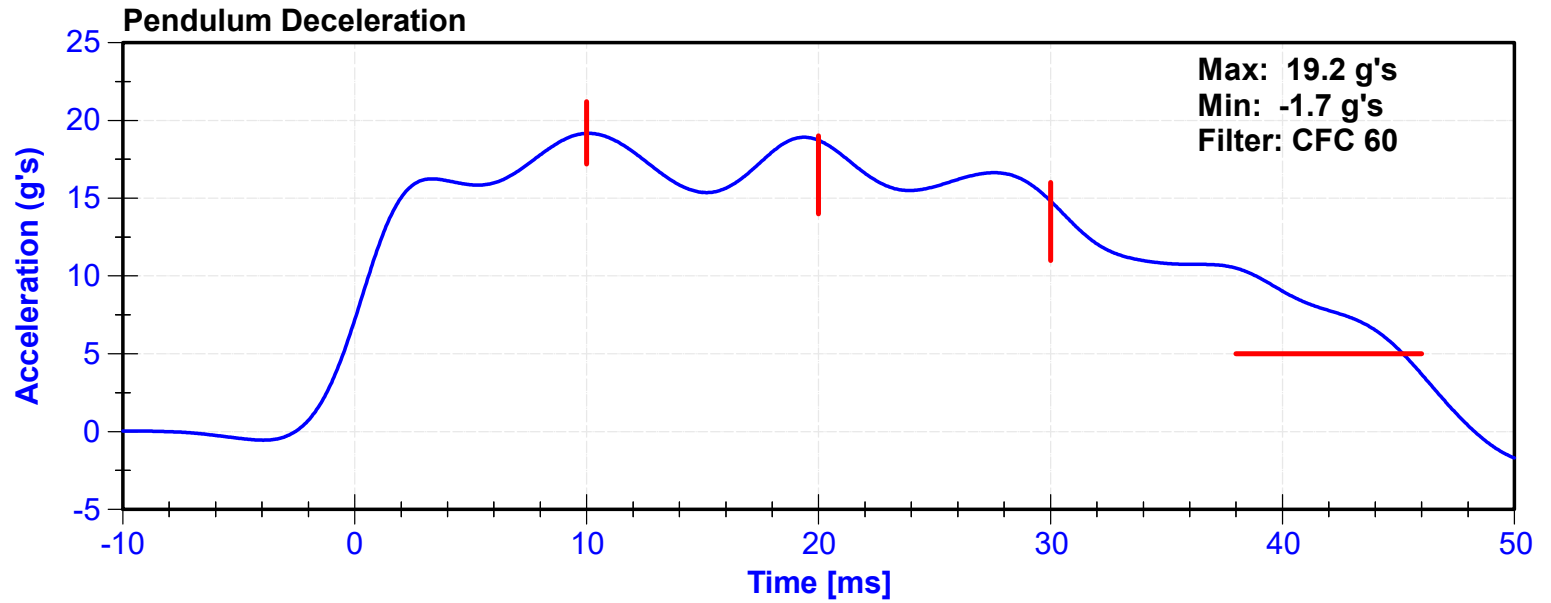
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	29.5	Pass
Velocity	5.94	6.19	m/s	6.072	Pass
Pendulum Deceleration at 10ms	17.2	21.2	g's	19.16	Pass
Pendulum Deceleration at 20ms	14	19	g's	18.7	Pass
Pendulum Deceleration at 30ms	11	16	g's	14.8	Pass
Max. Pendulum Deceleration After 30ms	0	22	g's	19.2	Pass
Pendulum Deceleration Time to 5 g's	38	46	ms	45.2	Pass
Maximum D Plane Rotation	81	106	deg	91.8	Pass
Time to Maximum Rotation	72	82	ms	78.0	Pass
Rotation Decay to Zero	147	174	ms	154.2	Pass
Minimum Moment About OC	-80	-52.9	Nm	-70.36	Pass
Time to Minimum Moment	65	79	ms	71.5	Pass
Moment Decay to Zero	120	148	ms	140.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum Potentiometer	ETI	LABPOT1	5/9/2022	5/9/2023
Condyle Potentiometer	ETI	LABPOT2	5/9/2022	5/9/2023
Upper Neck Load Cell	Denton	2187-FX	6/13/2022	6/13/2023





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

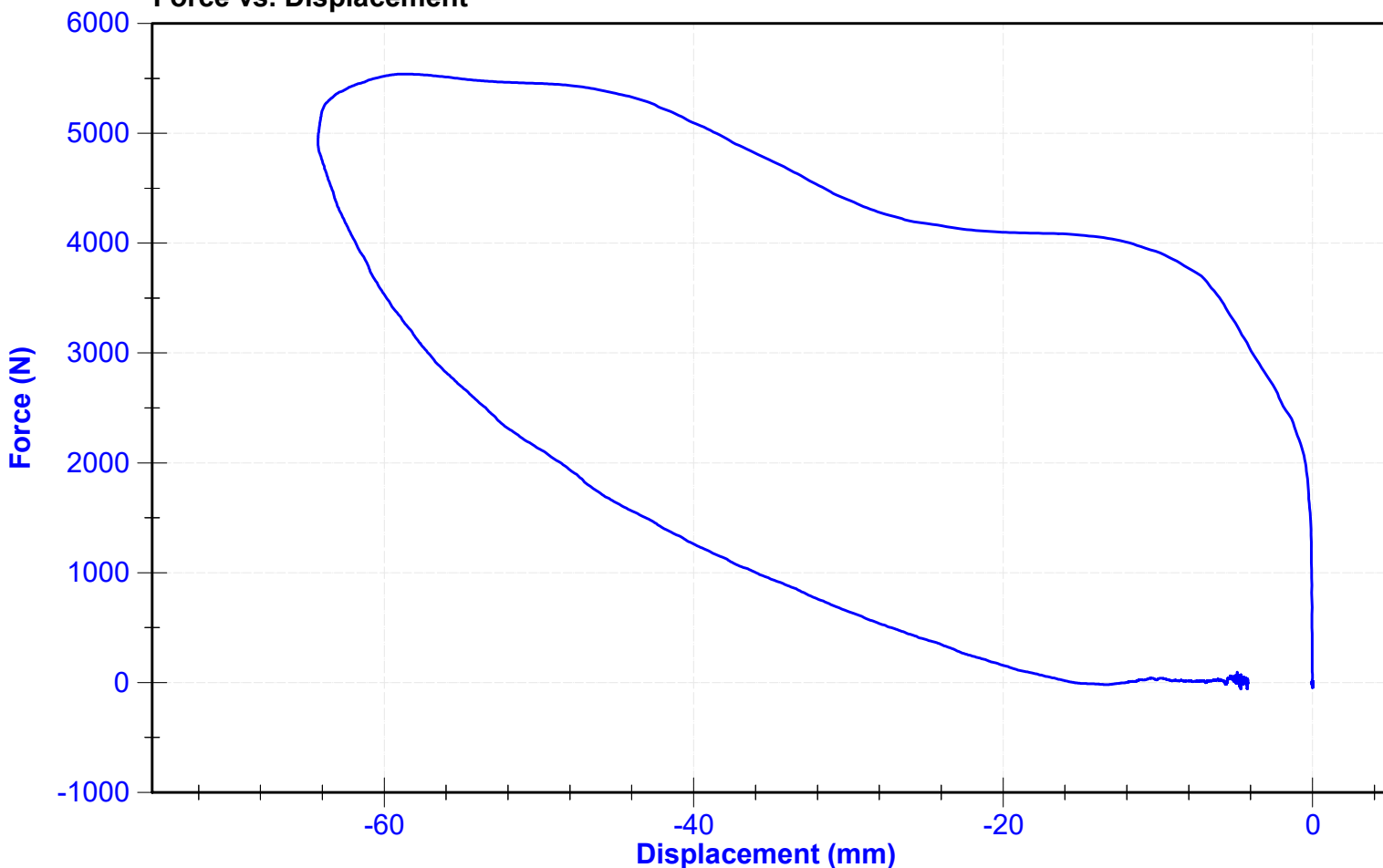
Results

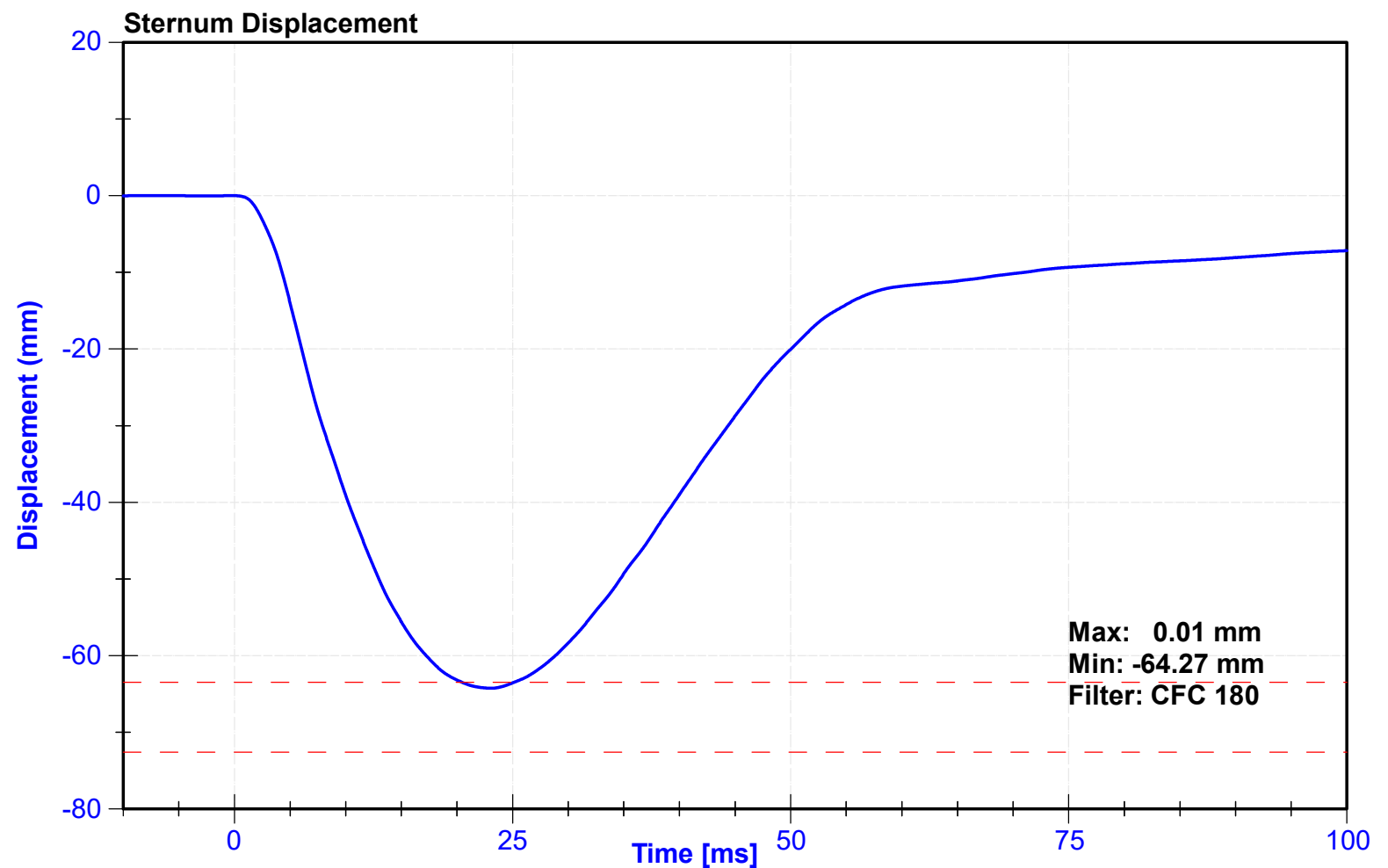
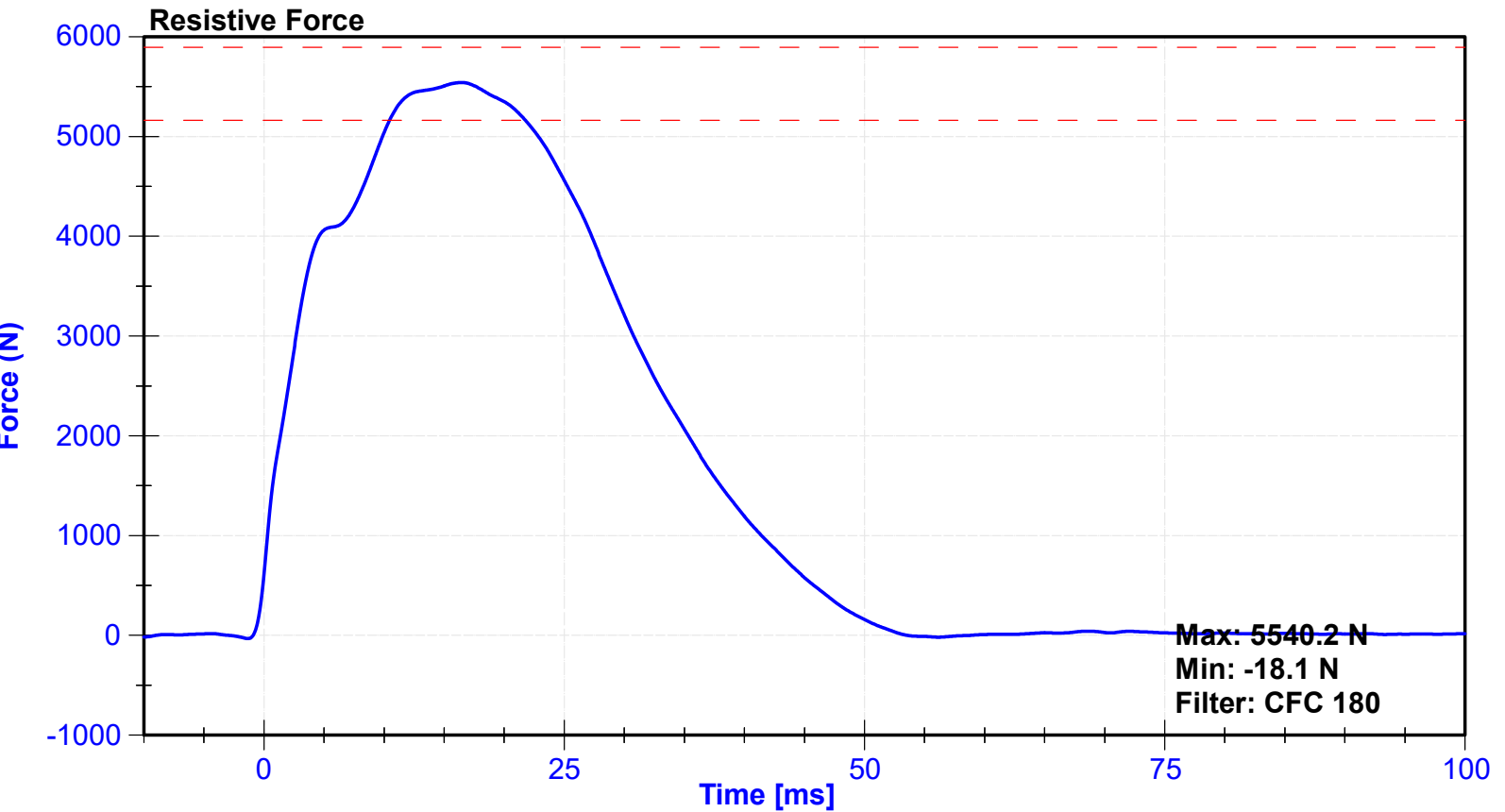
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	20	Pass
Velocity	6.59	6.83	m/s	6.729	Pass
Chest Displacement	-72.6	-63.5	mm	-64.27	Pass
Resistive Force	5160	5894	N	5540.2	Pass
Hysteresis	69	85	%	74.2	Pass

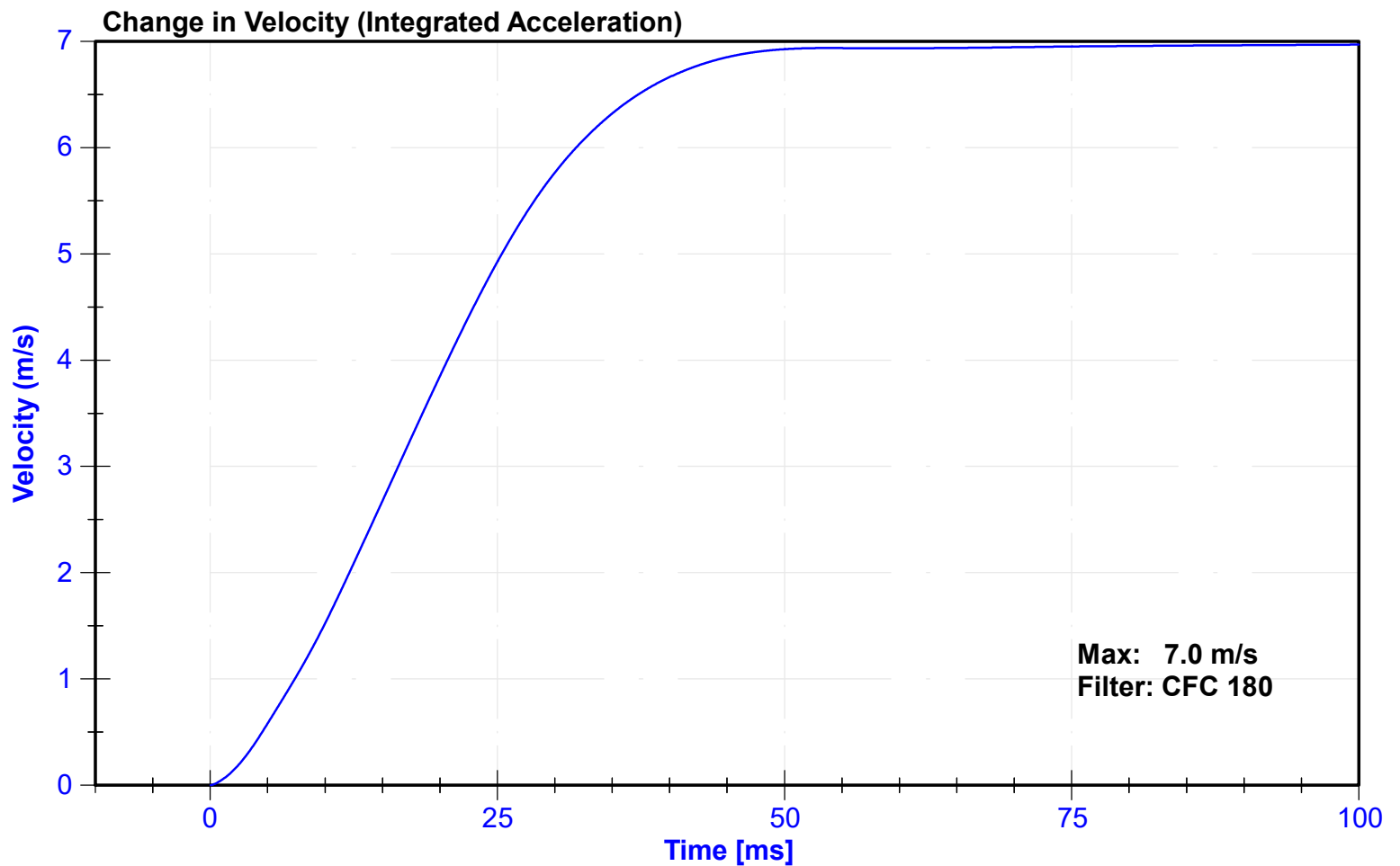
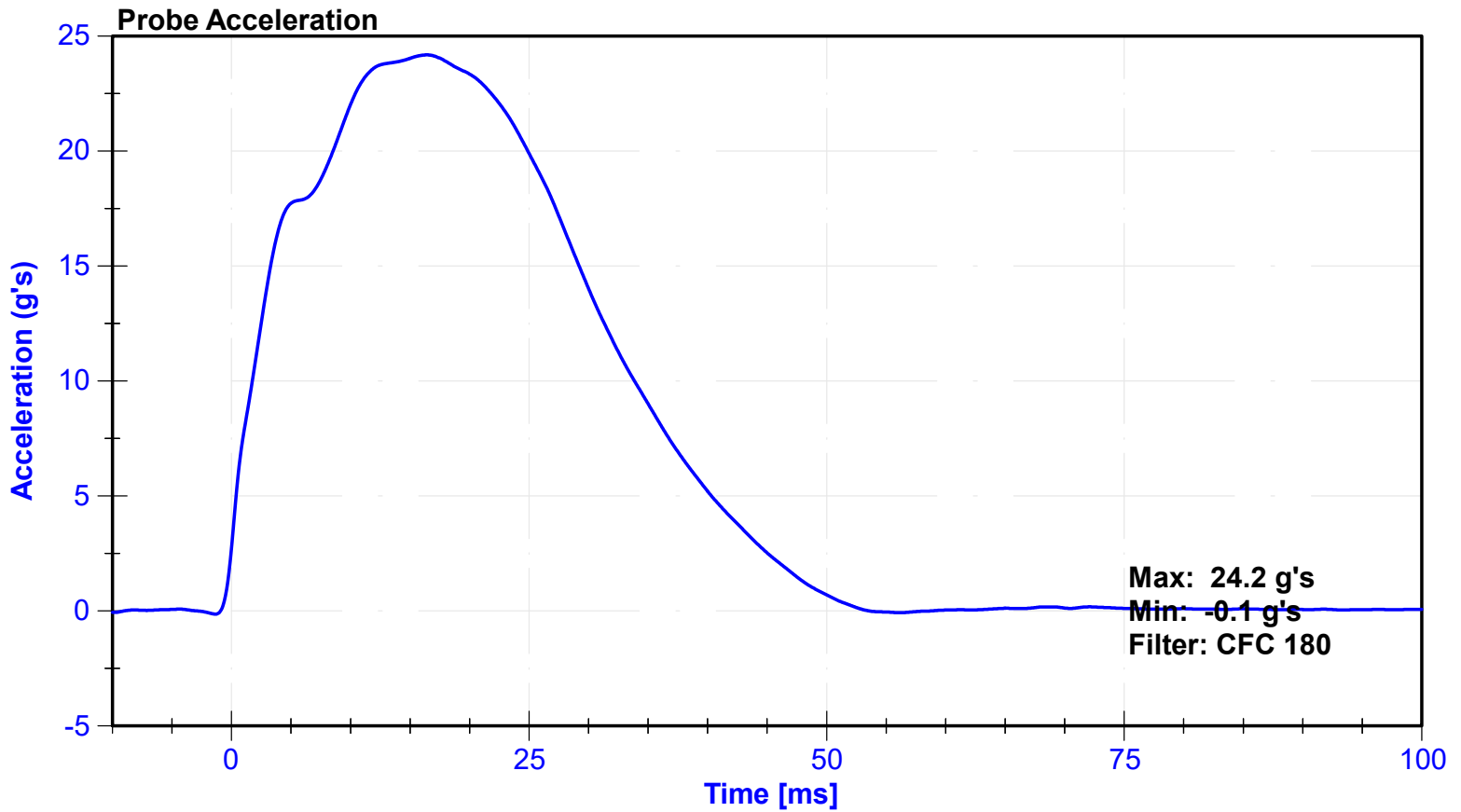
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18494	11/5/2022	5/4/2023
Chest Potentiometer	JDK	0075	10/3/2022	4/3/2023

Force vs. Displacement



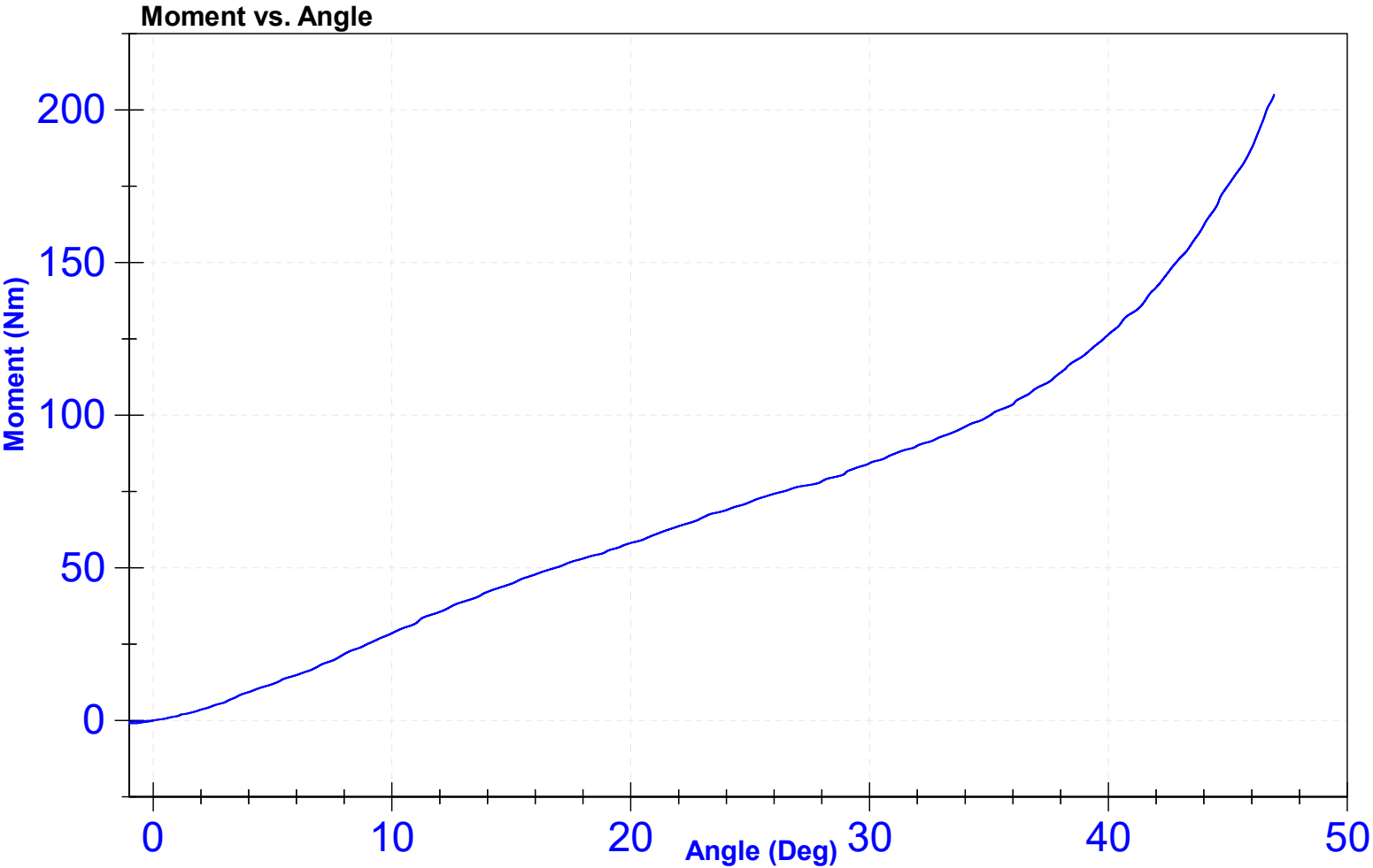




ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

Results					
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	20.6	Pass
Humidity	10	70	%	30.5	Pass
Average Velocity	5	10	deg/s	7.4	Pass
Angle at 203Nm	40	50	deg	46.8	Pass
Moment at 30 degrees	0	94.9	Nm	84.3	Pass

Transducer Calibrations				
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	ETI SP22	DS-0008	10/4/2022	10/4/2023
Load Cell	PCB 2301-02	2301-02_115	2022-09-06	2023-09-06

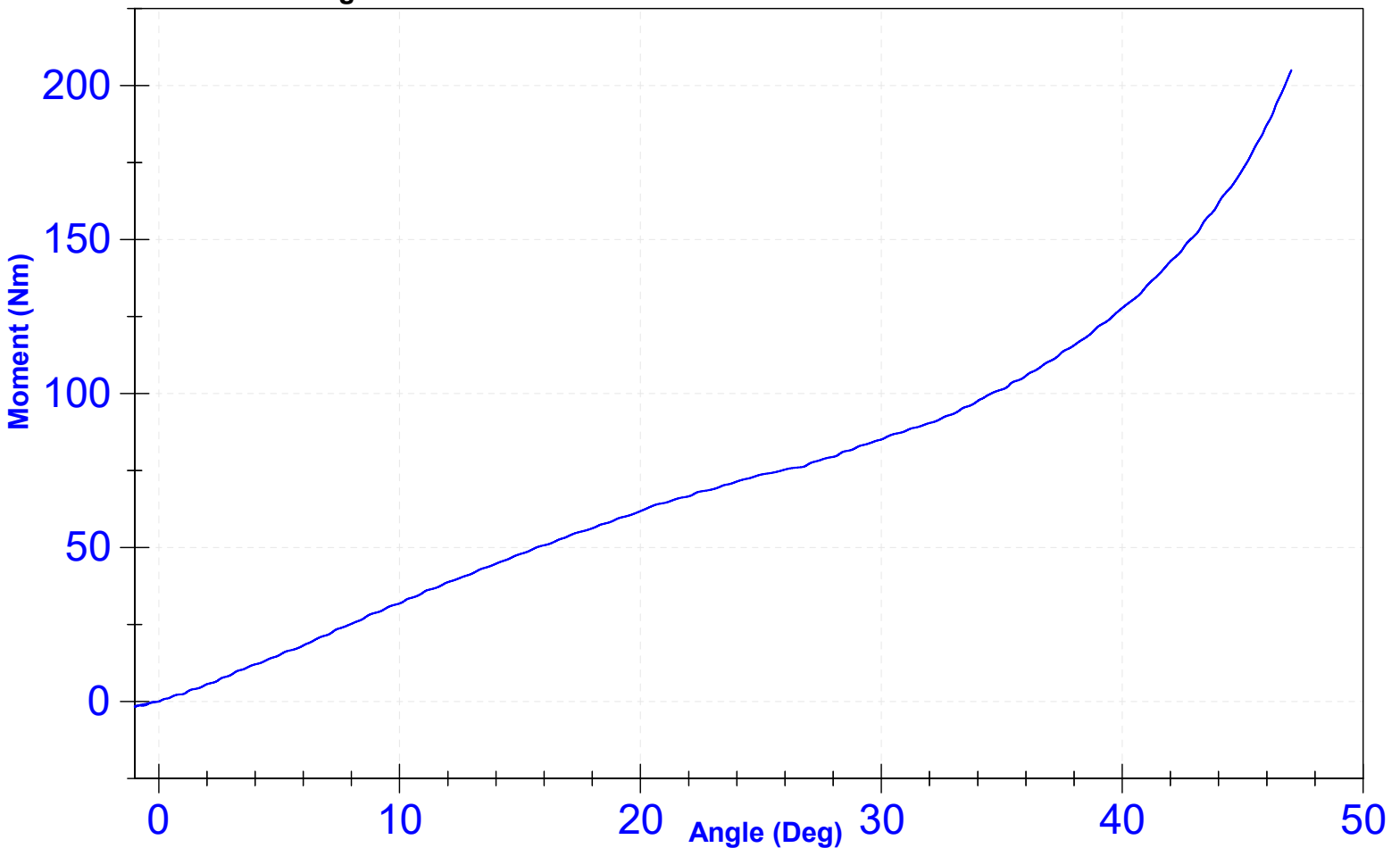


ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

Test Parameter	Results		Unit	Result	Pass/Fail
	Minimum Specification	Maximum Specification			
Temperature	18.9	25.6	°C	20.6	Pass
Humidity	10	70	%	30.5	Pass
Average Velocity	5	10	deg/s	7.4	Pass
Angle at 203Nm	40	50	deg	46.9	Pass
Moment at 30 degrees	0	94.9	Nm	85.0	Pass

Transducer Calibrations				
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	ETI SP22	DS-0008	10/4/2022	10/4/2023
Load Cell	PCB 2301-02	2301-02_115	2022-09-06	2023-09-06

Moment vs. Angle



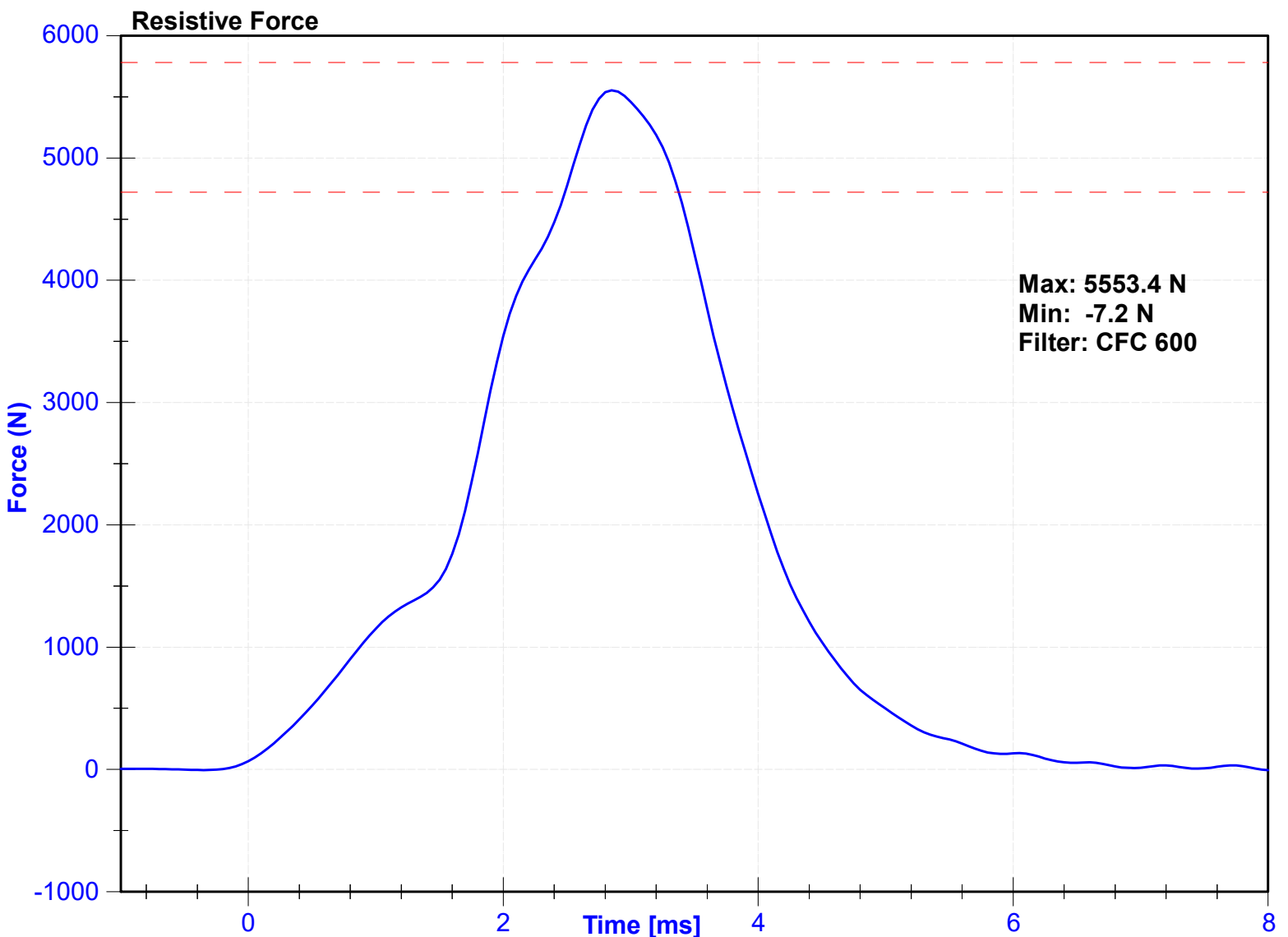
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

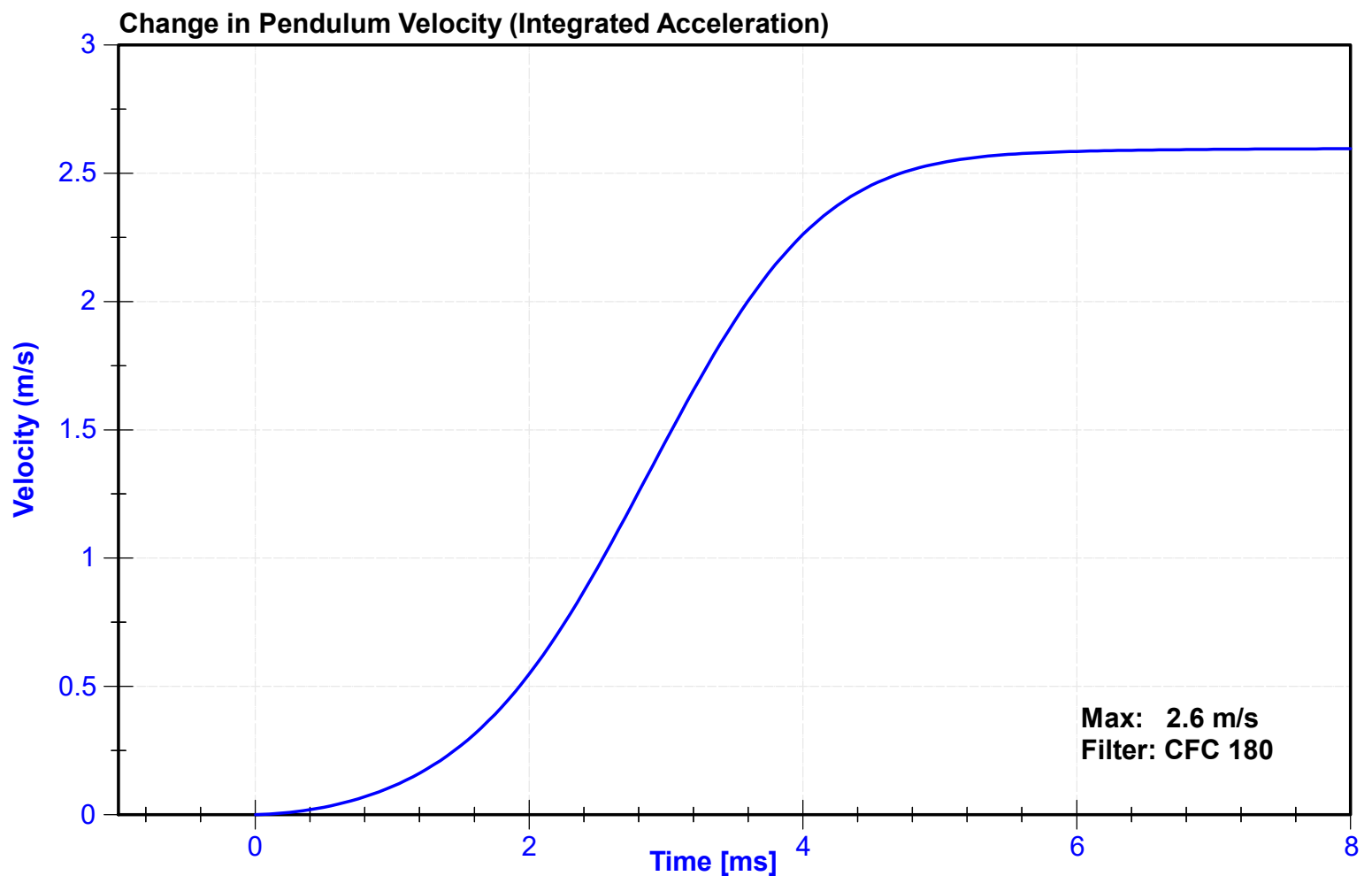
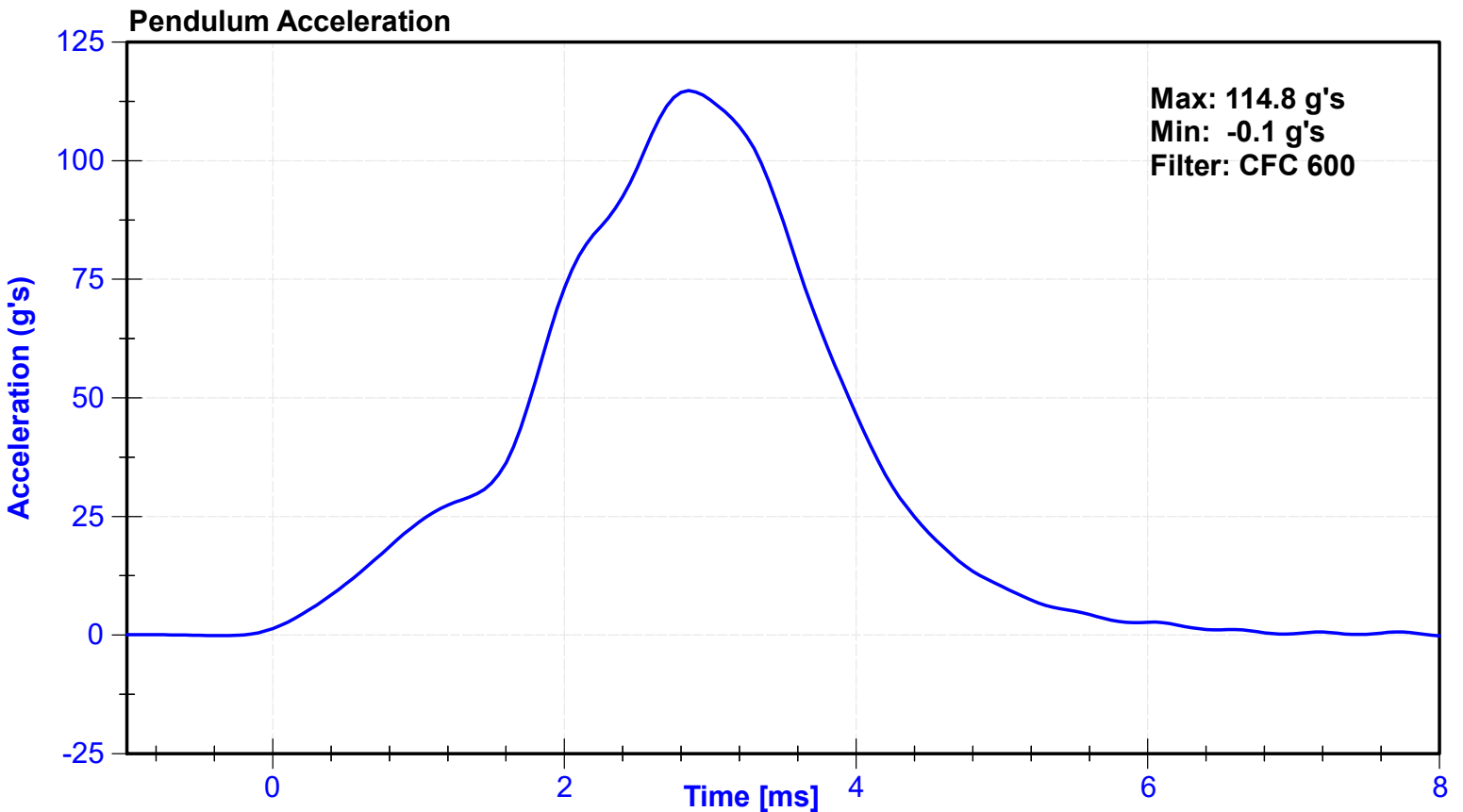
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	20.6	Pass
Humidity	10	70	%	30.5	Pass
Velocity	2.07	2.13	m/s	2.091	Pass
Maximum Resistive Force	4720	5780	N	5553.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18494	11/5/2022	5/4/2023





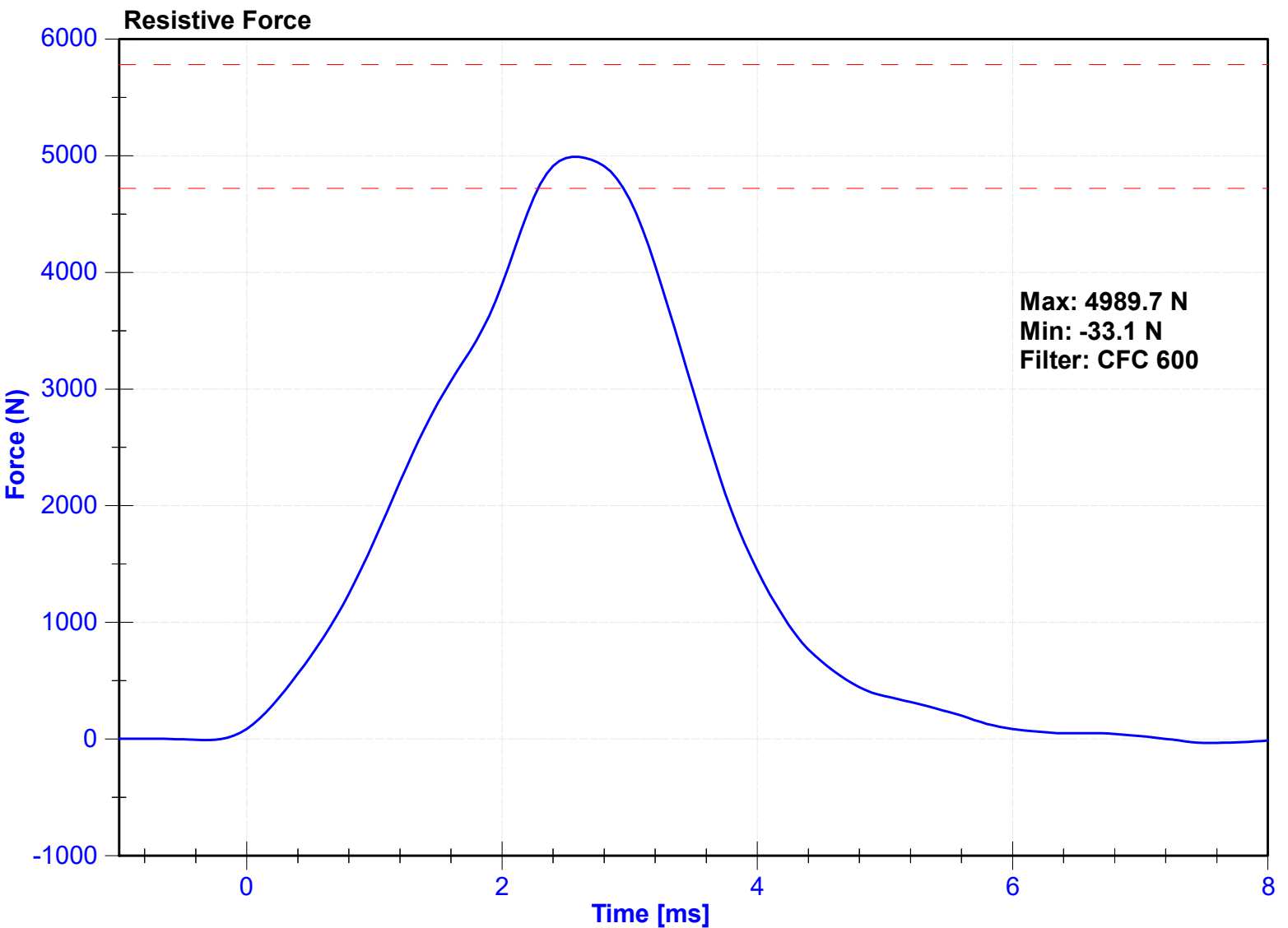
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

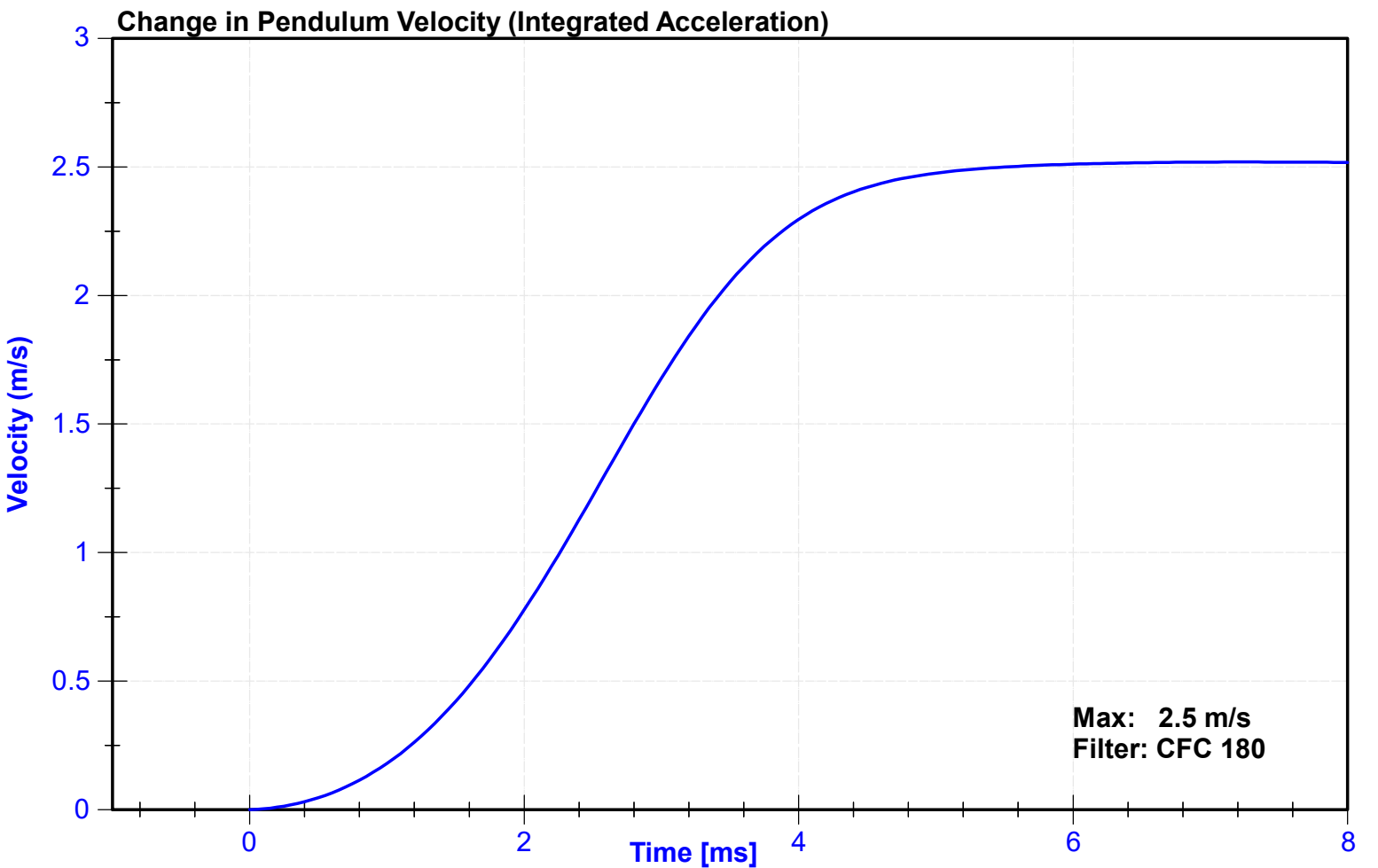
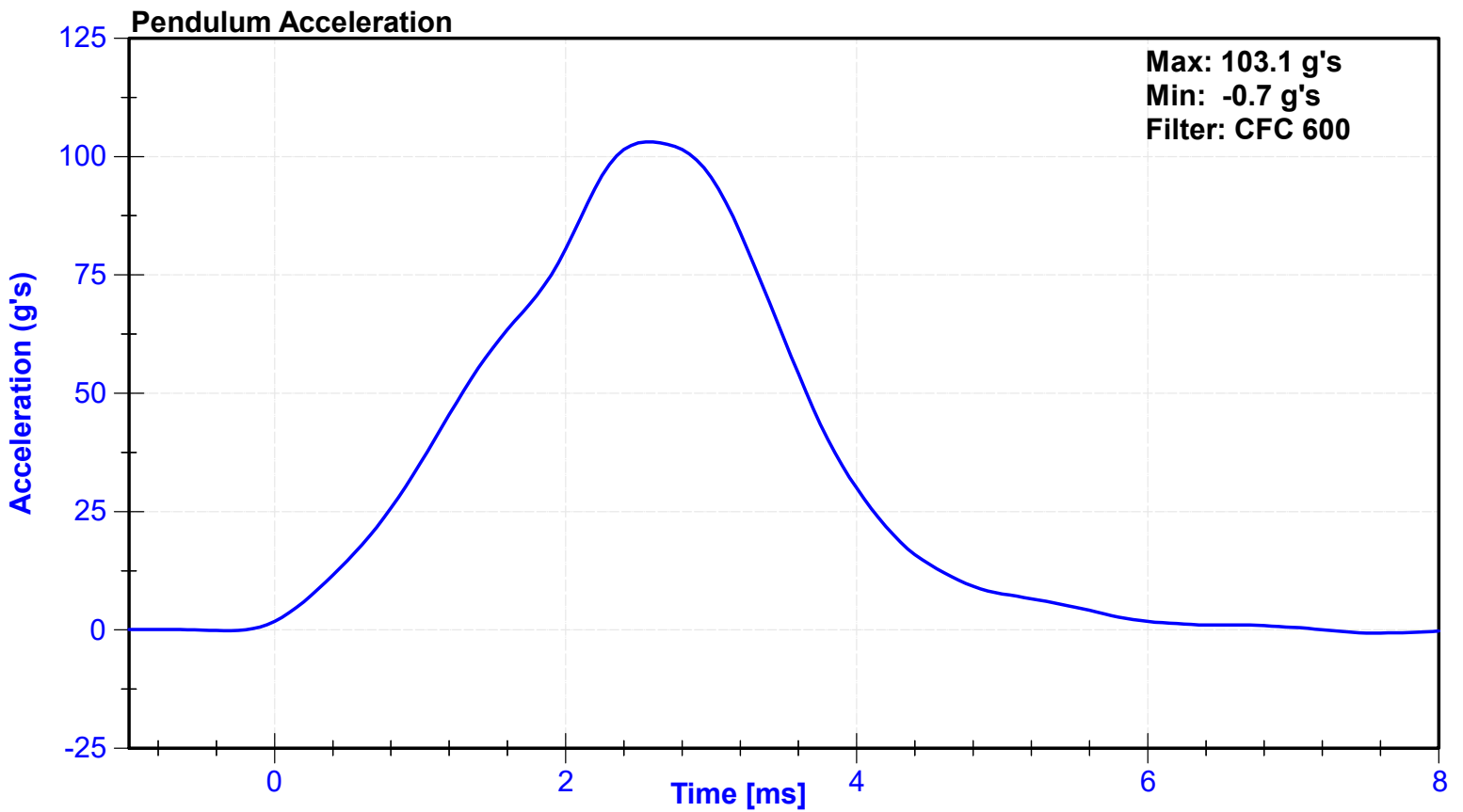
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	20.6	Pass
Humidity	10	70	%	30.5	Pass
Velocity	2.07	2.13	m/s	2.089	Pass
Maximum Resistive Force	4720	5780	N	4989.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18494	11/5/2022	5/4/2023





CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 5TH PERCENTILE - PASSENGER ATD

SERIAL NO: 137

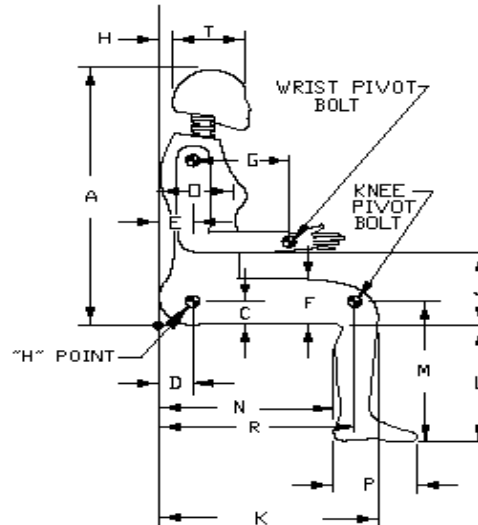
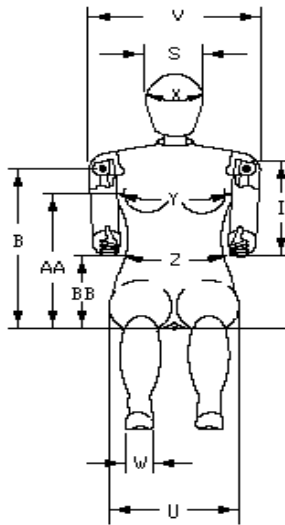


External Measurements - Hybrid 3 - 5th Female

Technician: K. Brogan

Date: 01/05/2022

Dummy Serial Number: 137



Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	775	800	788	Pass
B	Shoulder Pivot Height	432	457	445	Pass
C	H-Point Height	81	86	85	Pass
D	H-Point from Backline	145	150	146	Pass
E	Shoulder Pivot from Backline	69	84	75	Pass
F	Thigh Clearance	119	135	127	Pass
G	Back of Elbow to Wrist Pivot	244	259	251	Pass
H	Head Back to Backline	43	48	45	Pass
I	Shoulder to Elbow Length	277	297	287	Pass
J	Elbow Rest Height	183	203	195	Pass
K	Buttock to Knee Length	521	546	536	Pass
L	Popliteal Height	356	376	369	Pass
M	Knee Pivot Height	394	419	407	Pass
N	Buttock Popliteal Length	414	439	425	Pass
O	Chest Depth without Jacket	175	191	182	Pass
P	Foot Length (right)	219	234	229	Pass
R	Buttock To Knee Pivot Length	457	483	465	Pass
S	Head Breadth	137	147	143	Pass
T	Head Depth	178	188	180	Pass
U	Hip Breadth	300	315	311	Pass
V	Shoulder Breadth	351	366	359	Pass
W	Foot Breadth	79	94	85	Pass
X	Head Circumference	528	549	542	Pass
Y	Chest Circumference with Jacket	851	881	872	Pass
Z	Waist Circumference	460	790	652	Pass
AA	Reference Location (Chest Circumference)	333	358	345	Pass
BB	Reference Location (Waist Circumference)	160	170	164	Pass

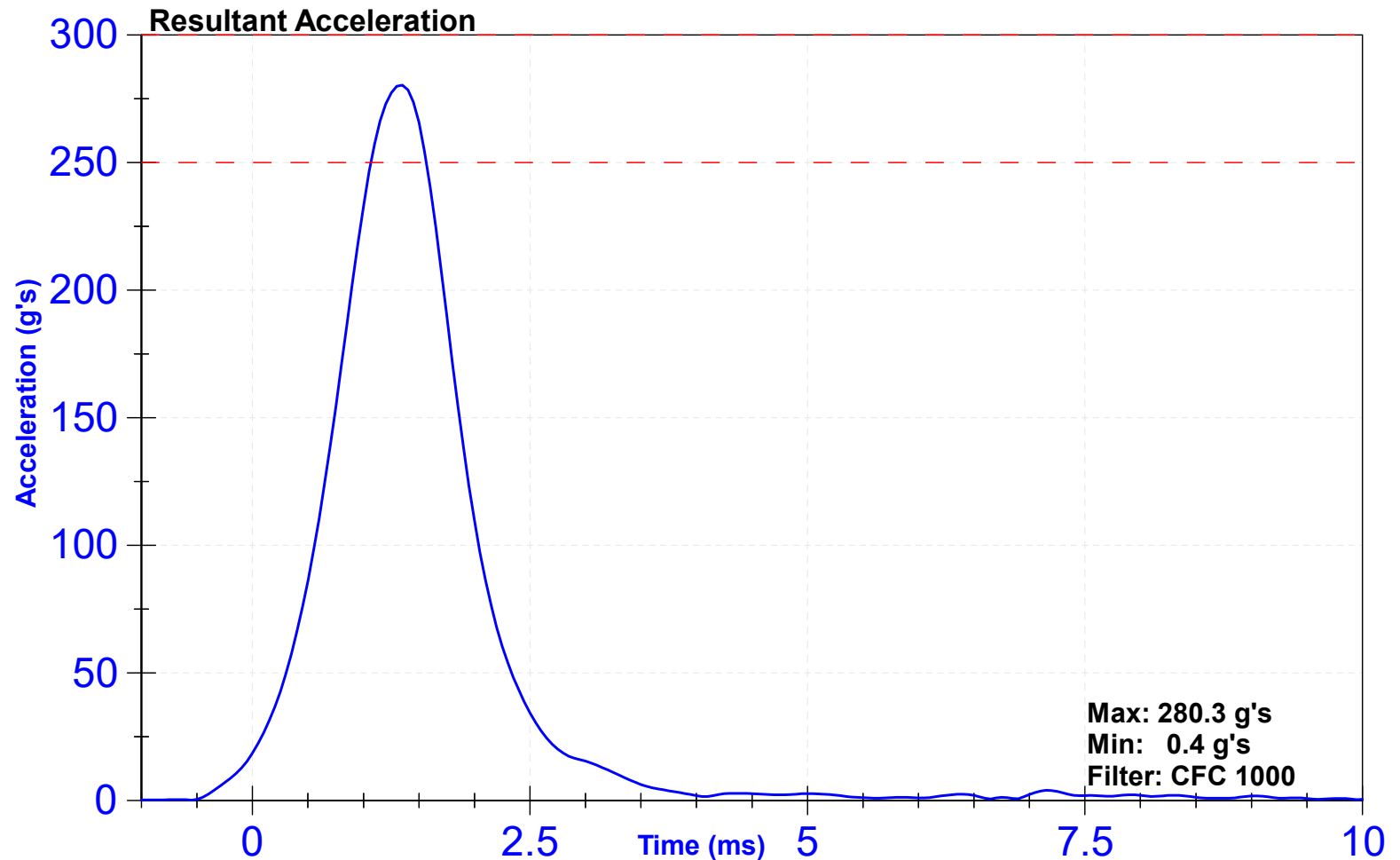
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

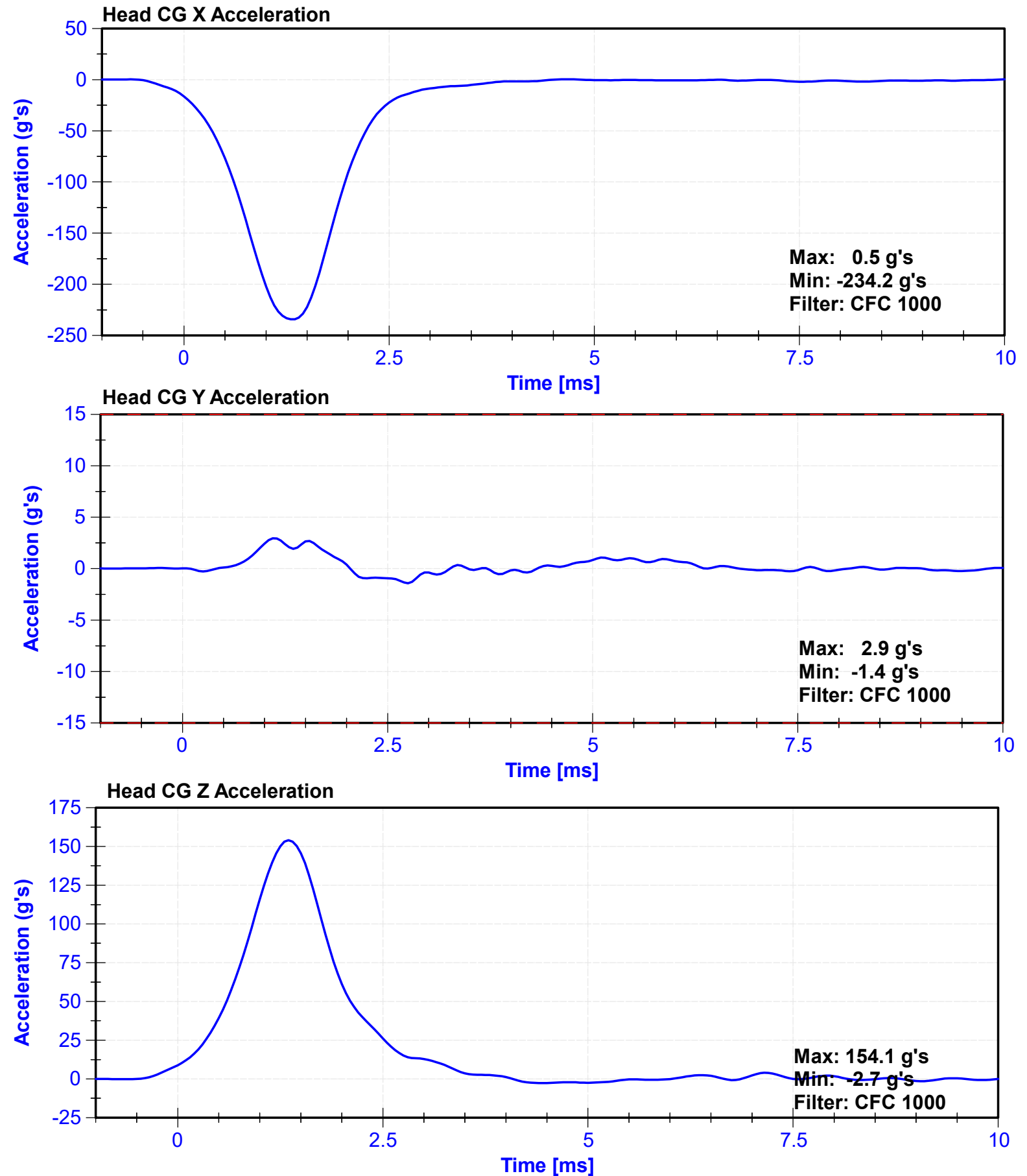
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.1	Pass
Humidity	10	70	%	34.5	Pass
Resultant Acceleration	250	300	g's	280.3	Pass
Oscillation	0	10	%	1.4	Pass
Lateral Acceleration	-15	15	g's	2.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P79417	12/13/2022	6/11/2023
Y Accelerometer	Endevco	P83335	12/13/2022	6/11/2023
Z Accelerometer	Endevco	P64149	12/12/2022	6/10/2023





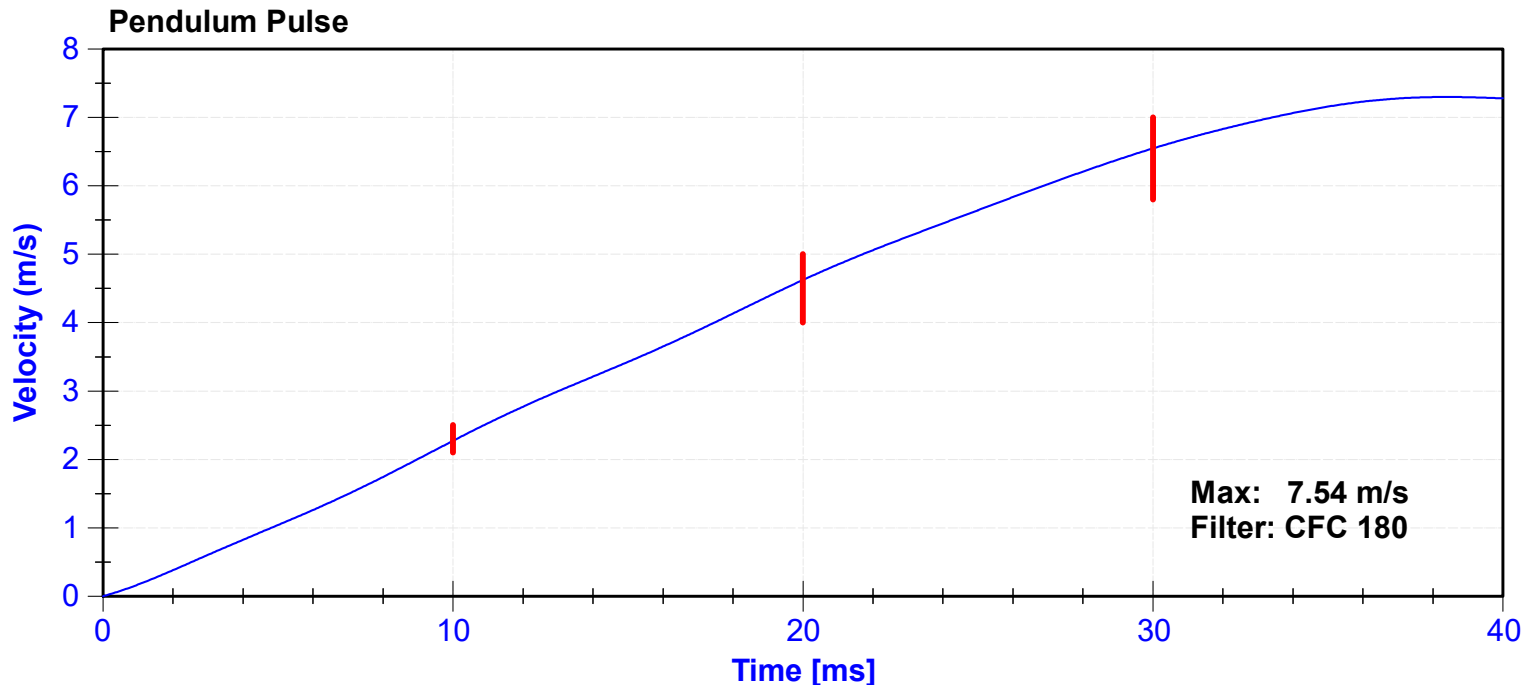
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

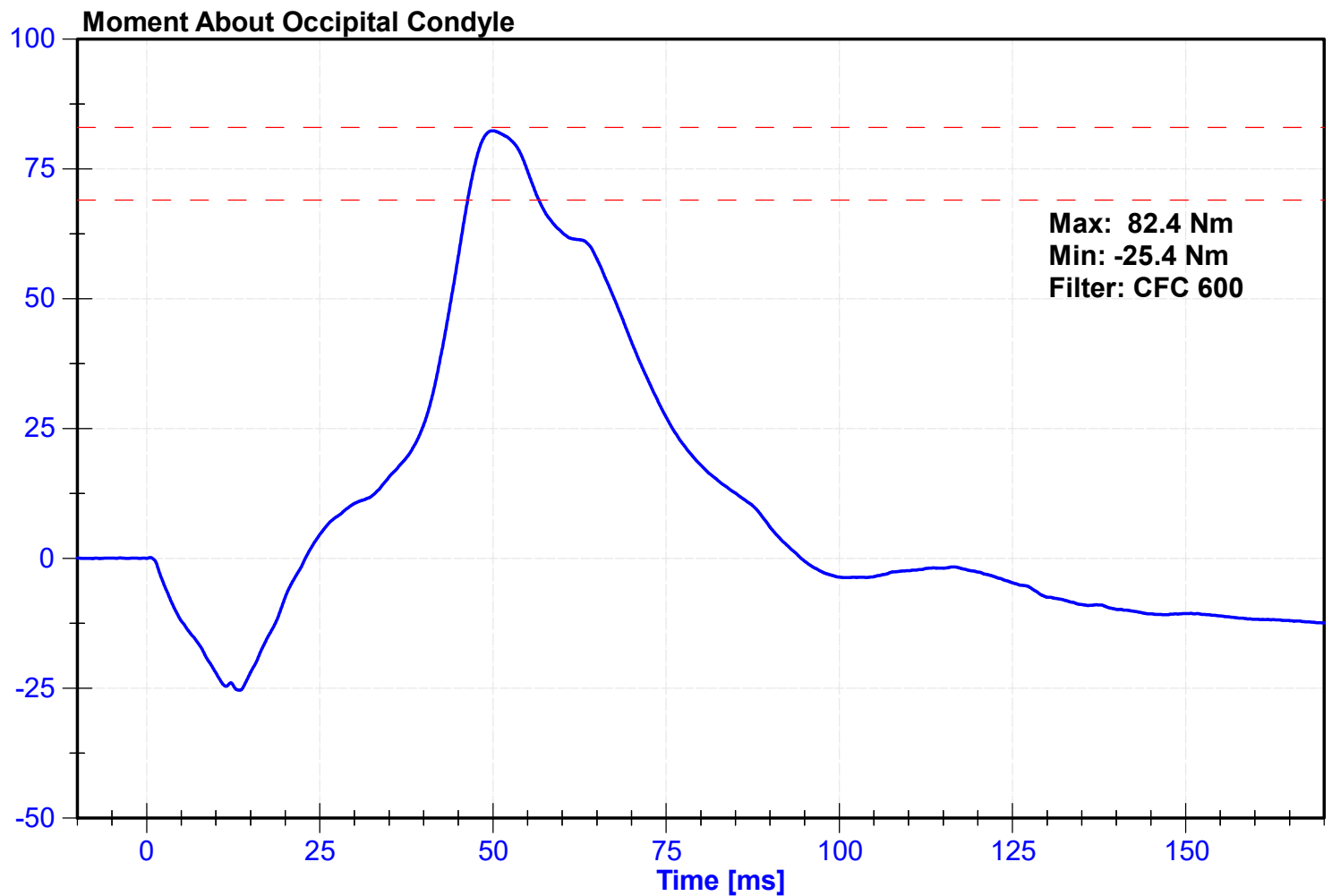
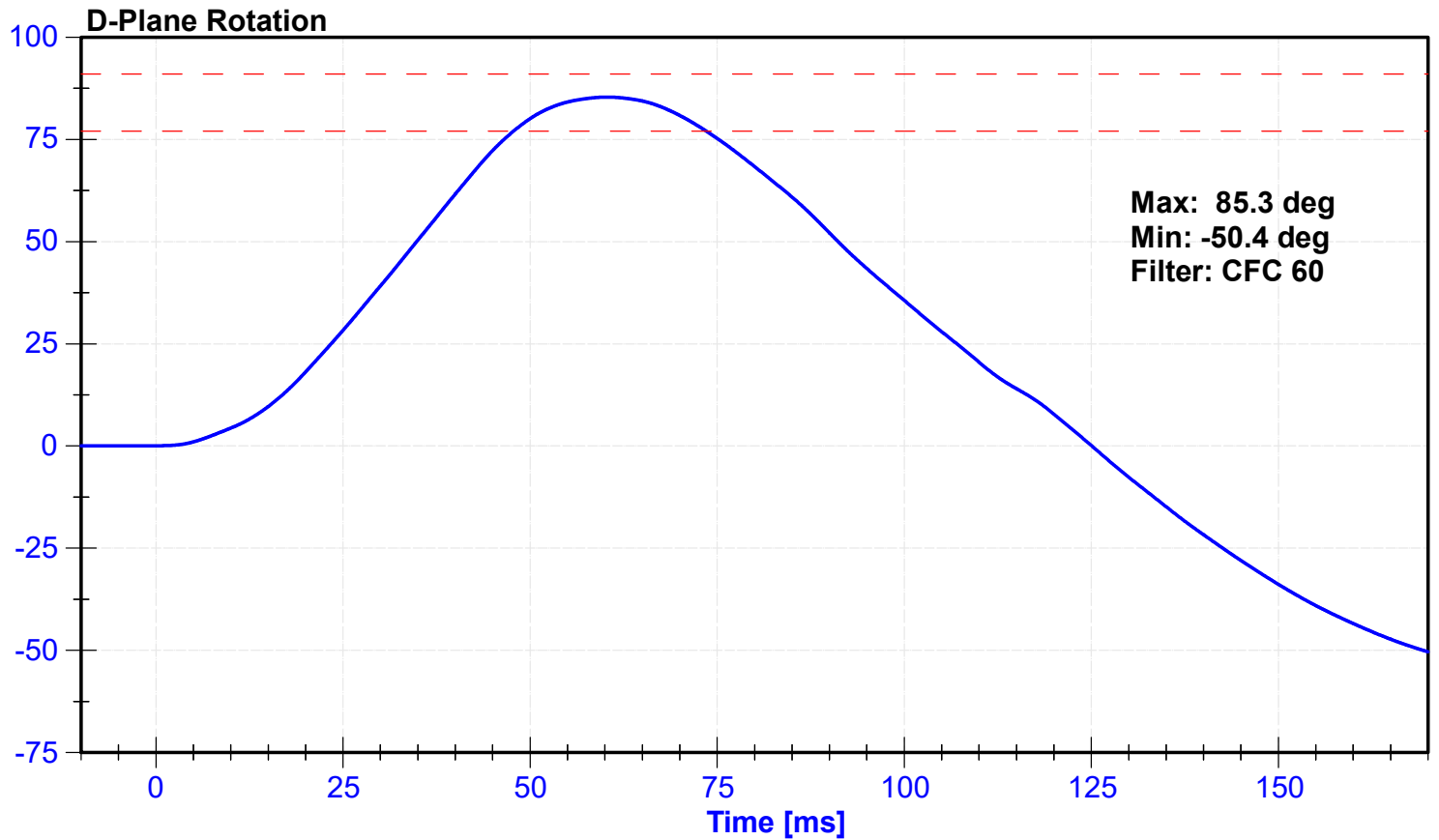
Results

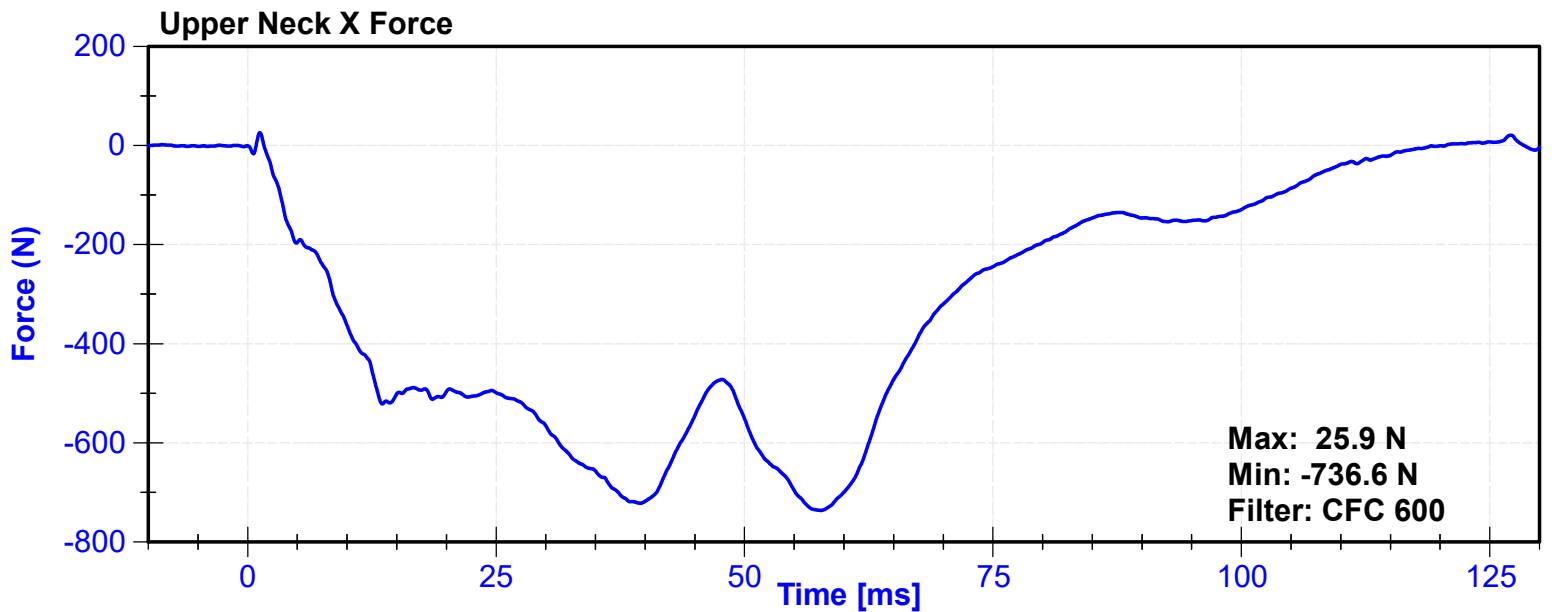
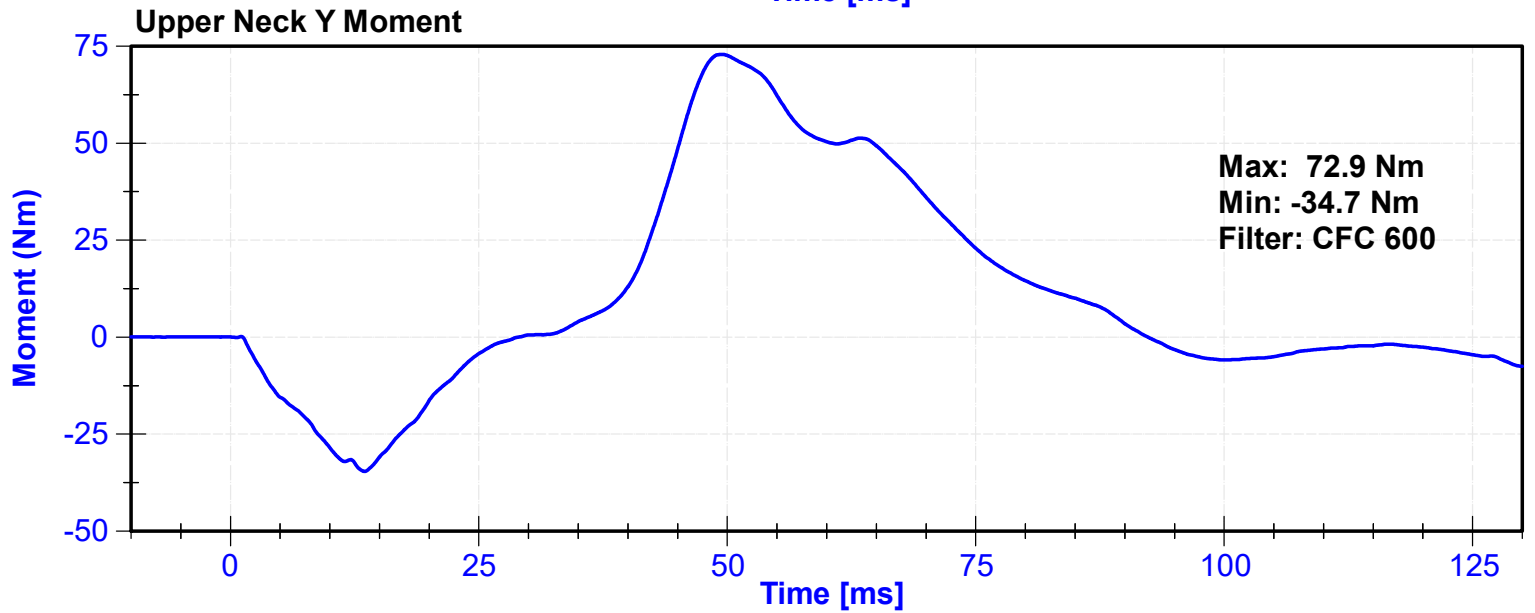
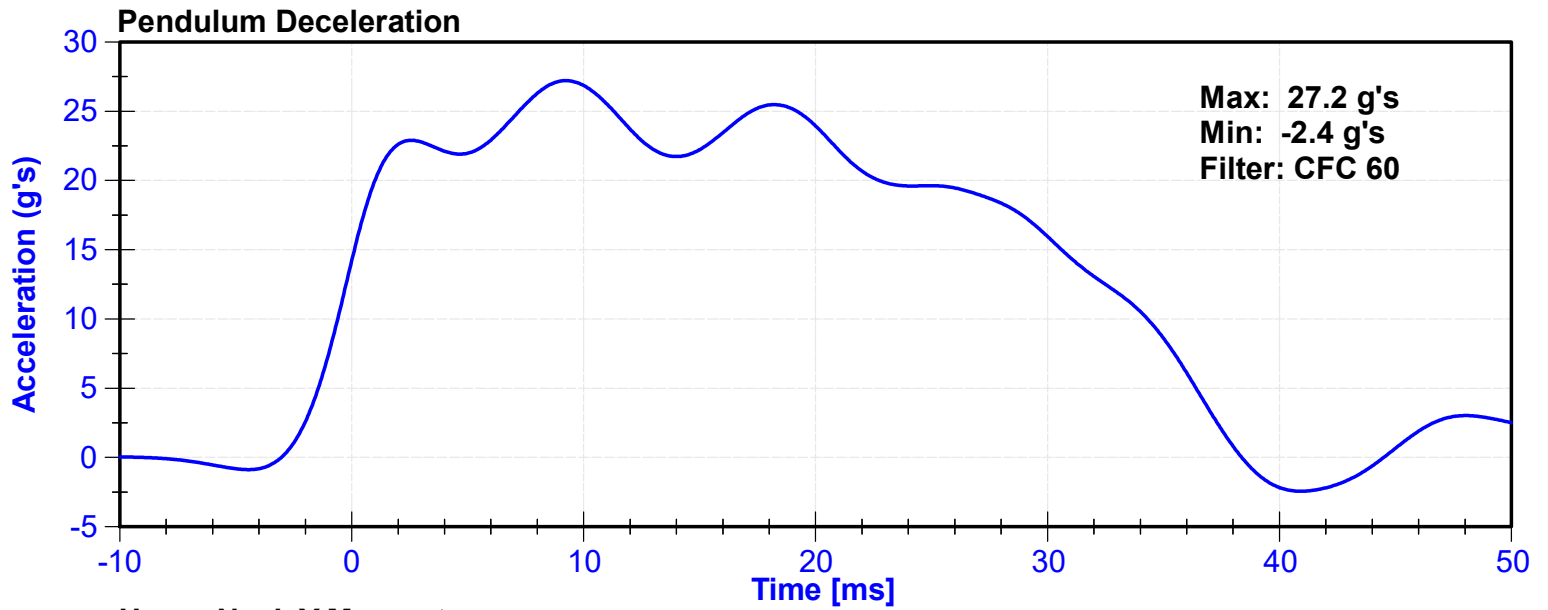
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	30.5	Pass
Velocity	6.89	7.13	m/s	7.023	Pass
Pendulum Impulse at 10ms	2.1	2.5	m/s	2.27	Pass
Pendulum Impulse at 20ms	4.0	5.0	m/s	4.62	Pass
Pendulum Impulse at 30ms	5.8	7.0	m/s	6.55	Pass
Max D Plane Rotation	77	91	deg	85.3	Pass
Max Moment During Rotation Interval	69	83	Nm	82.4	Pass
Moment Decay to 10.0 Nm	80	100	ms	87.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	7231C-750	10/26/2022	10/26/2023
Pendulum Potentiometer	ETI	LABPOT1	5/9/2022	5/9/2023
Condyle Potentiometer	ETI	LABPOT2	5/9/2022	5/9/2023
Upper Neck Load Cell	Humanetics	1916-FX	6/10/2022	6/10/2023







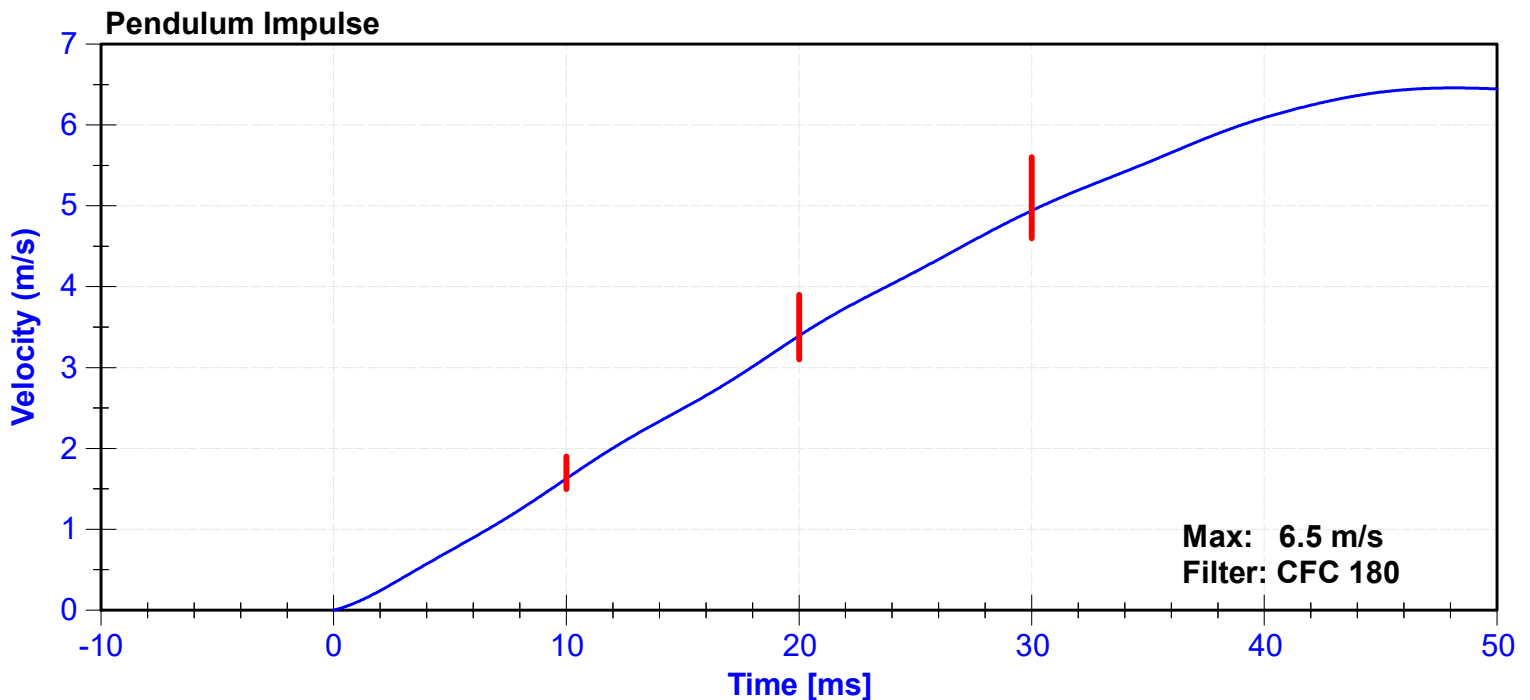
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

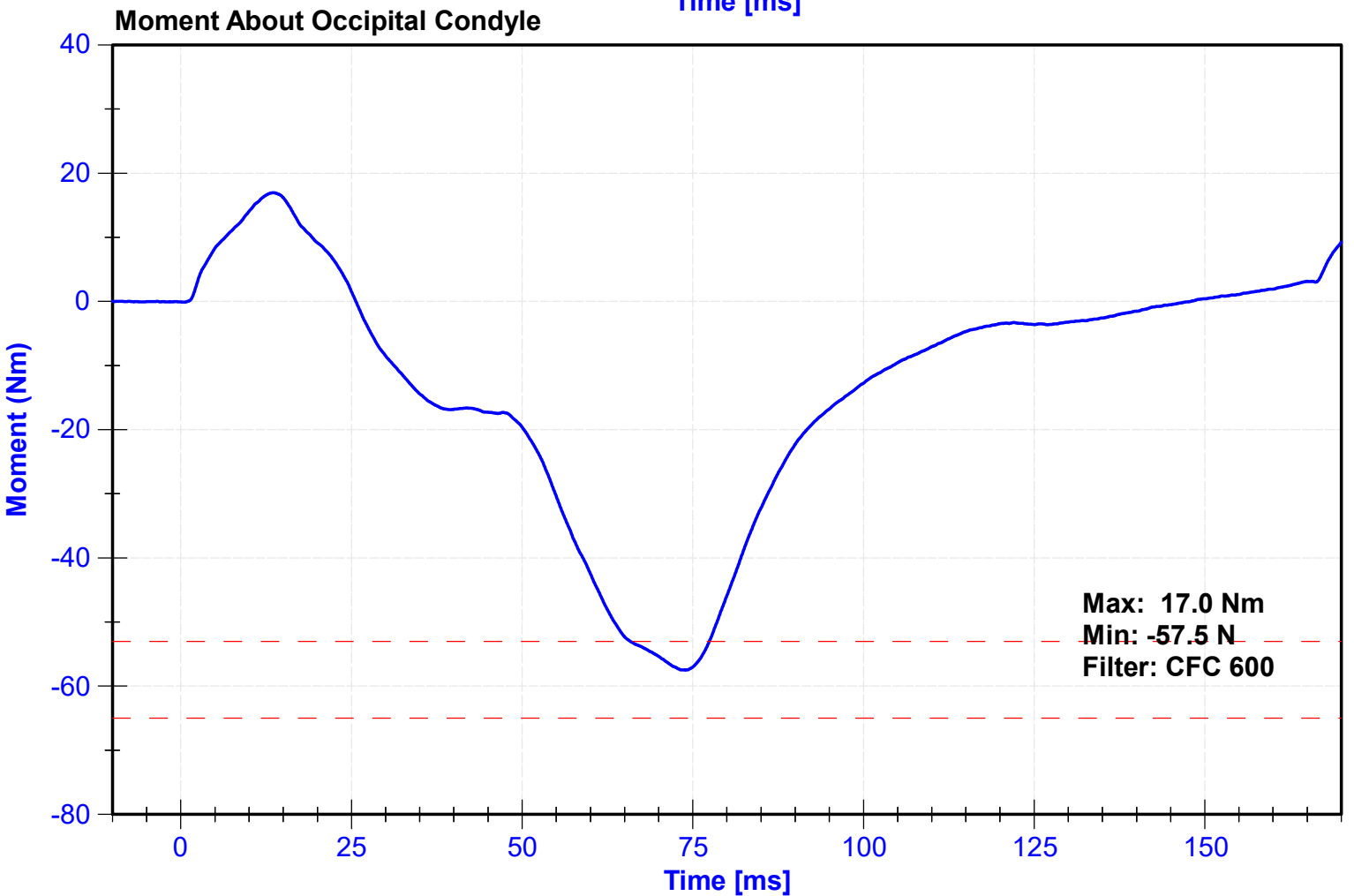
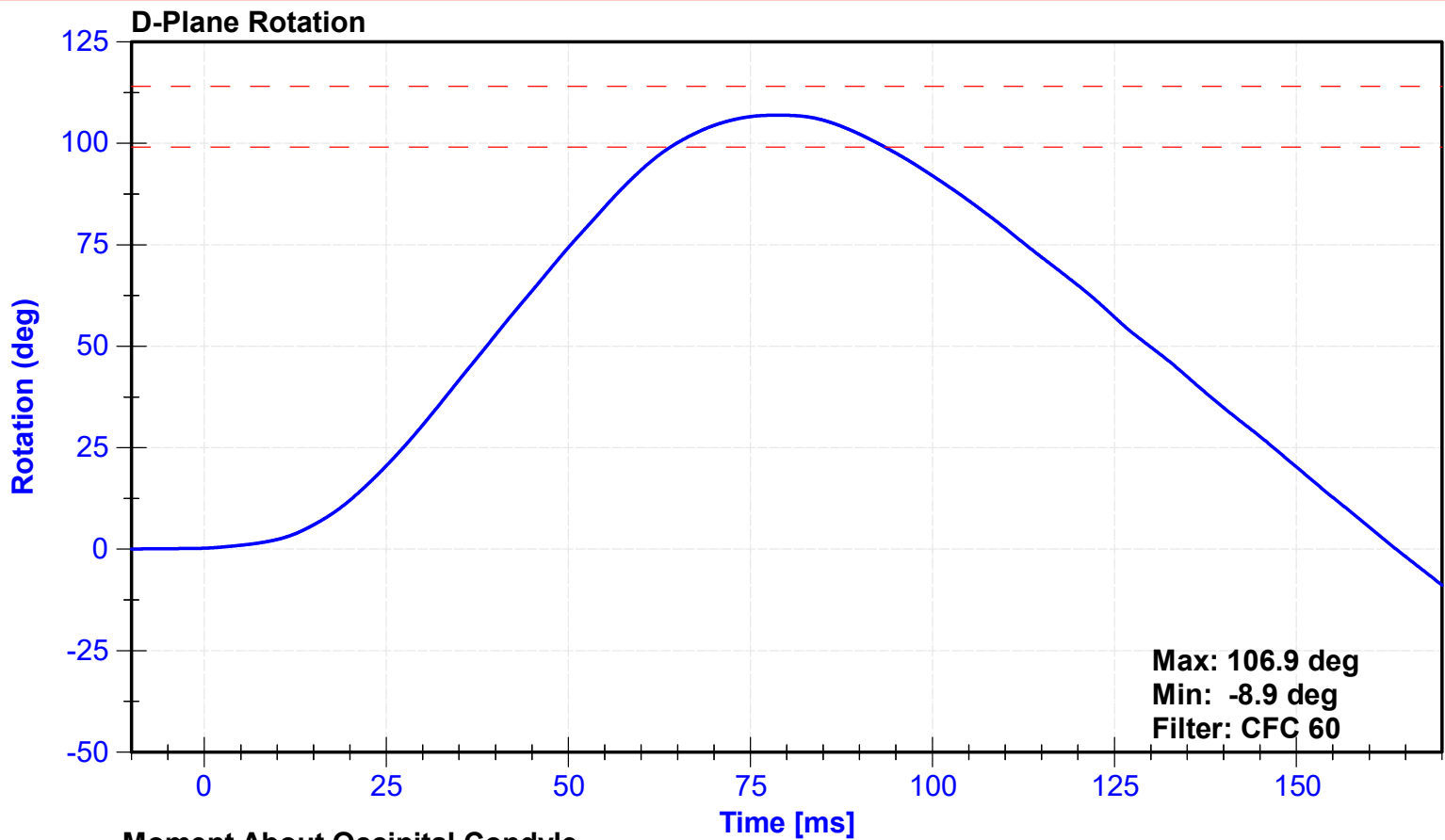
Results

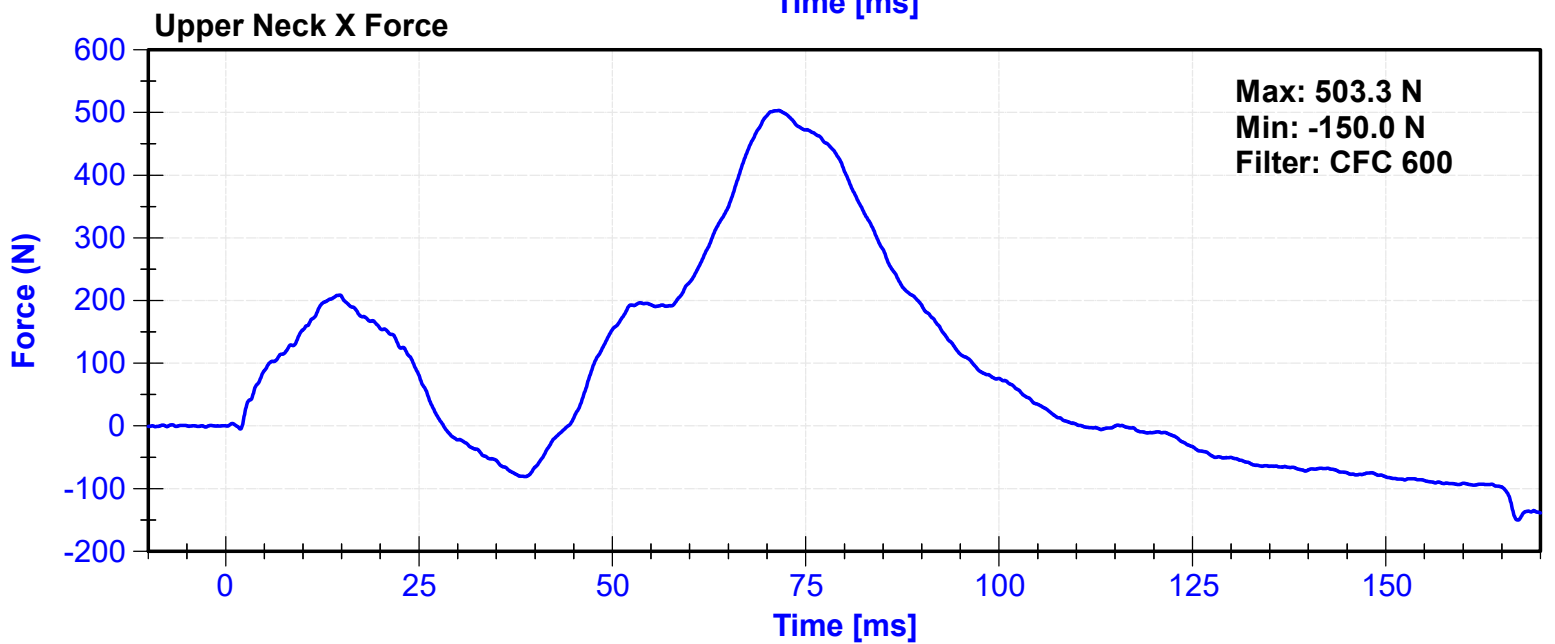
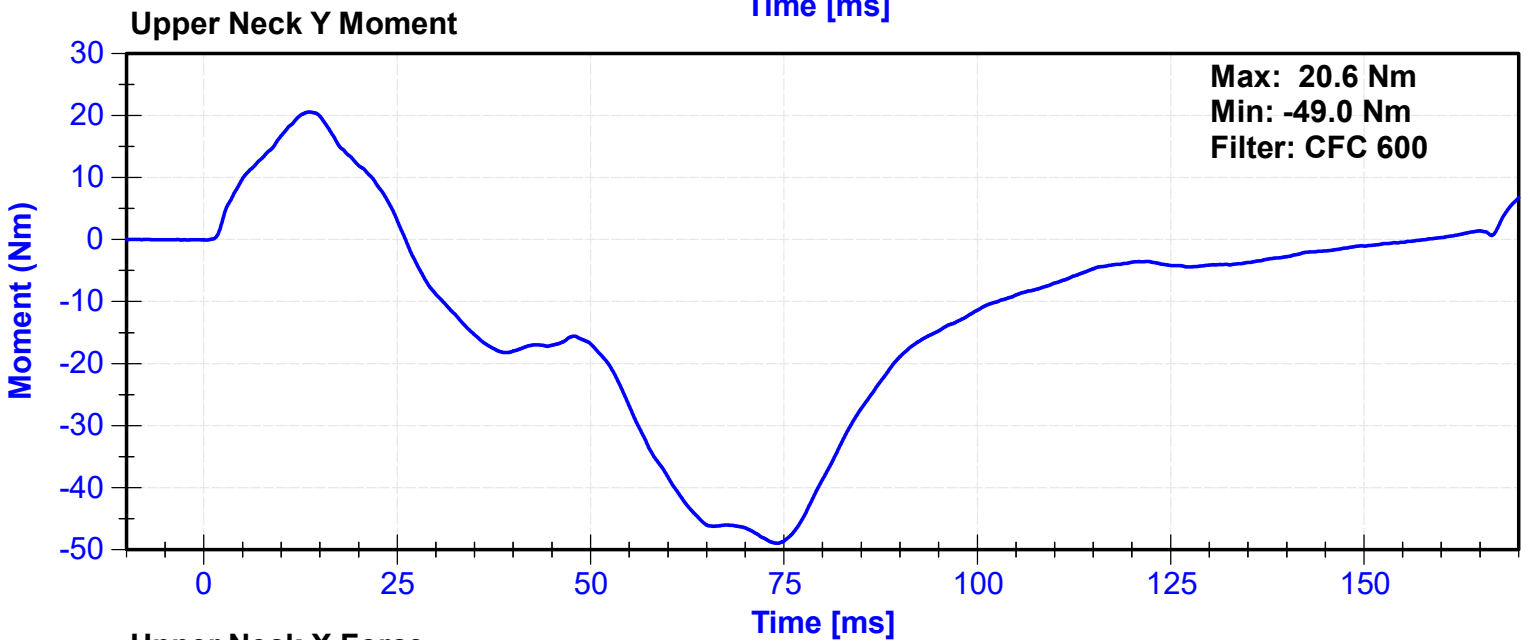
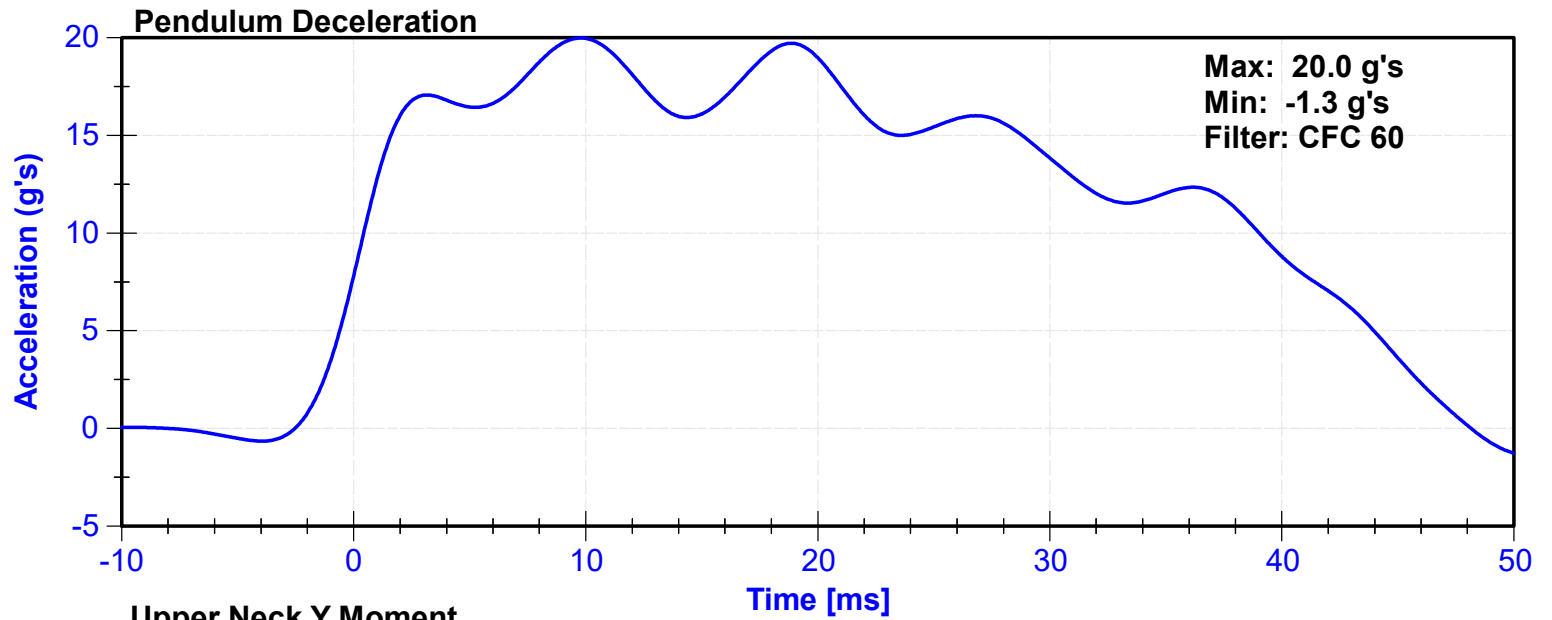
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	30.5	Pass
Velocity	5.95	6.19	m/s	6.112	Pass
Pendulum Impulse at 10ms	1.5	1.9	m/s	1.63	Pass
Pendulum Impulse at 20ms	3.1	3.9	m/s	3.39	Pass
Pendulum Impulse at 30ms	4.6	5.6	m/s	4.94	Pass
D Plane Rotation	99	114	deg	106.9	Pass
Moment During Rotation Interval	-65	-53	Nm	-57.5	Pass
Moment Decay to -10Nm	94	114	ms	104.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum Potentiometer	ETI	LABPOT1	5/9/2022	5/9/2023
Condyle Potentiometer	ETI	LABPOT2	5/9/2022	5/9/2023
Upper Neck Load Cell	Humanetics	1916-FX	6/10/2022	6/10/2023



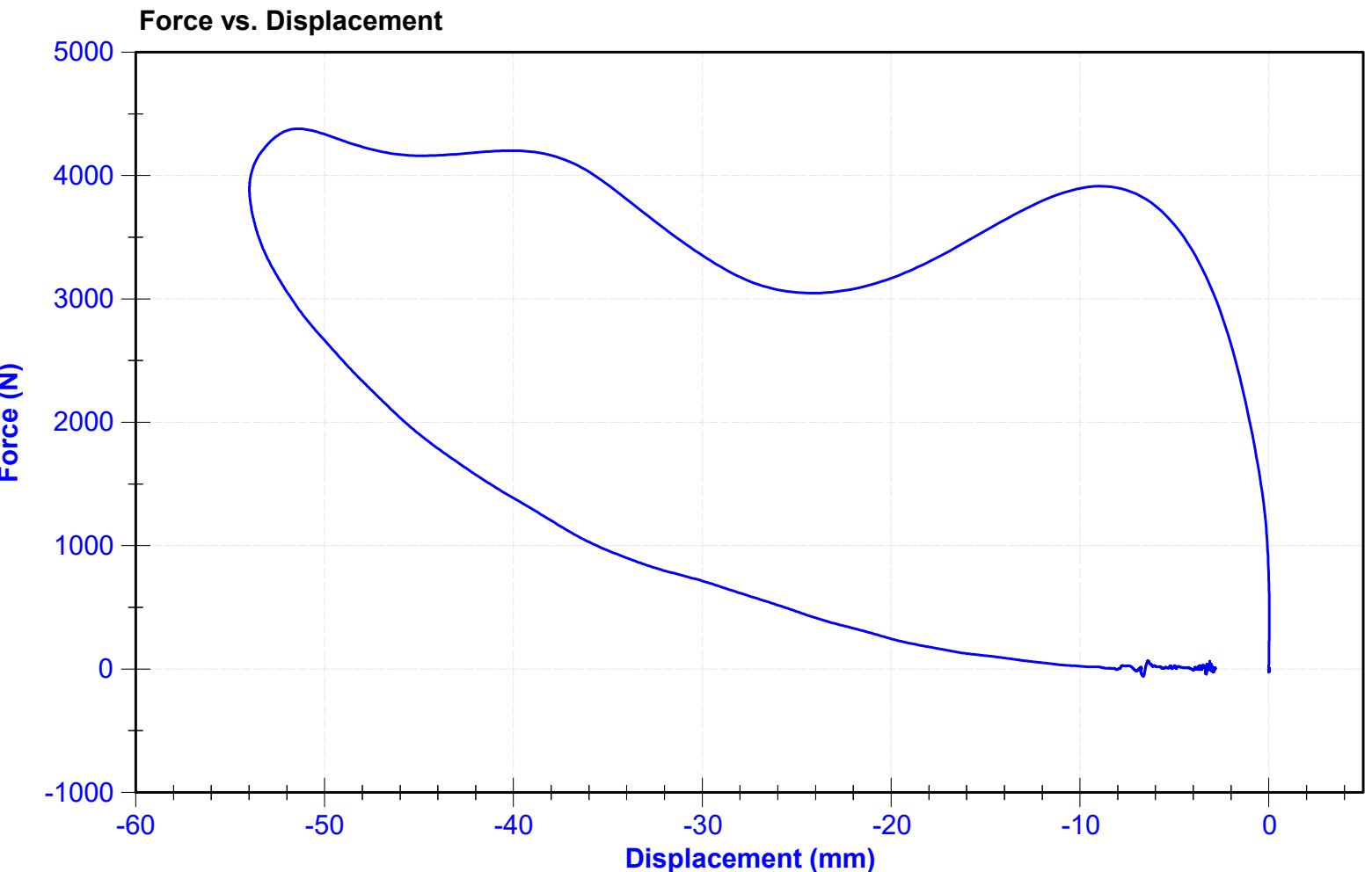


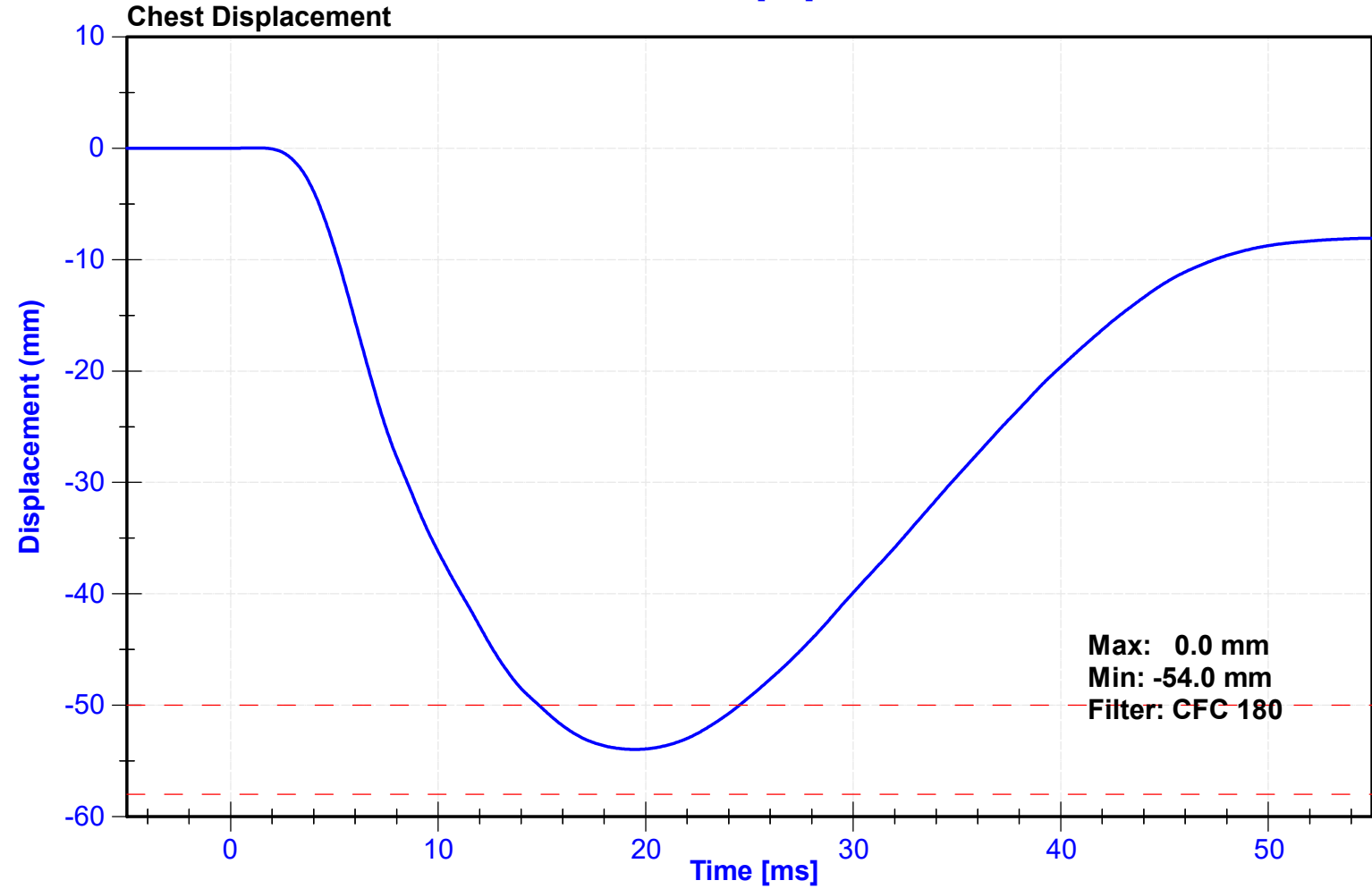
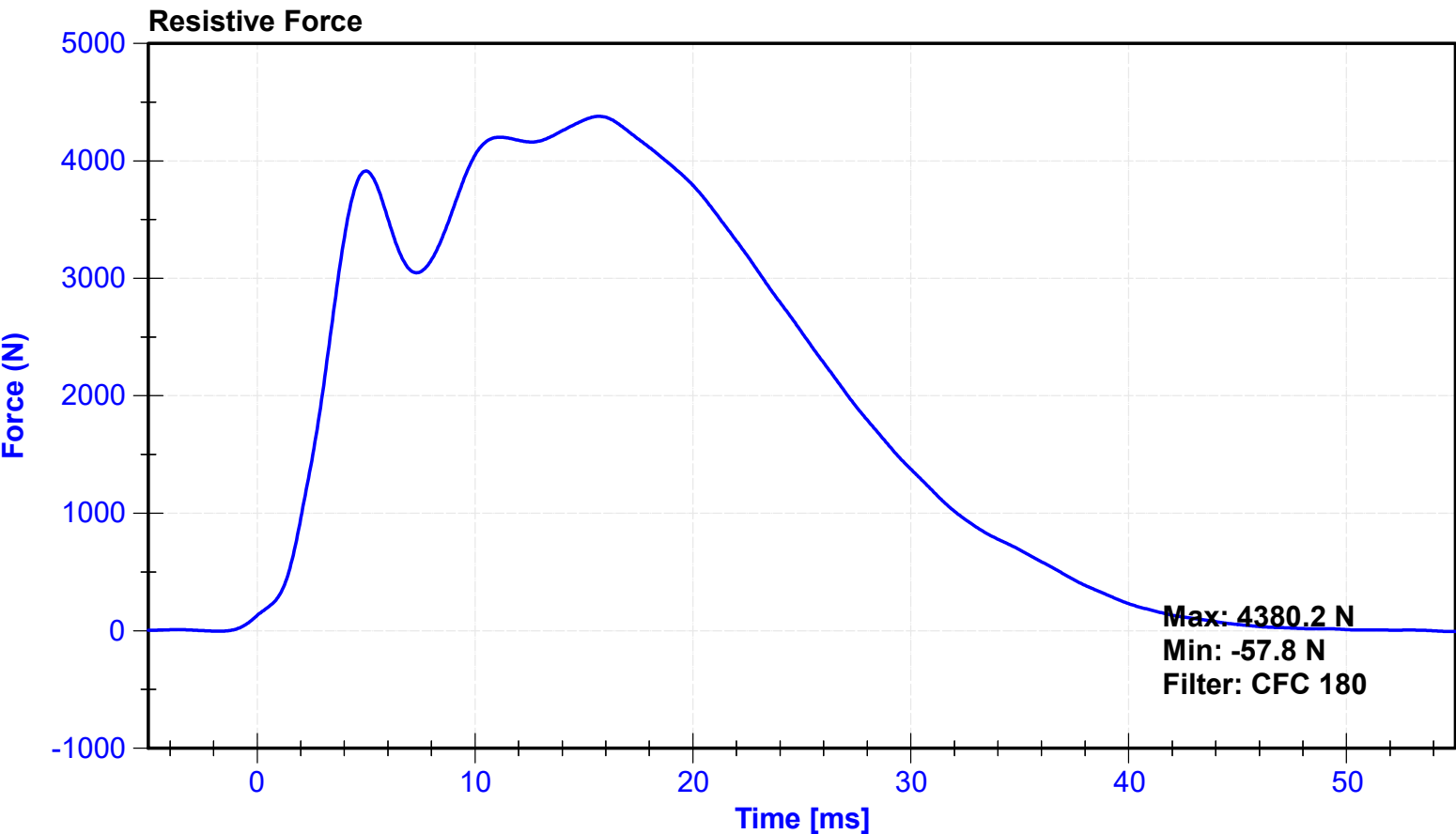


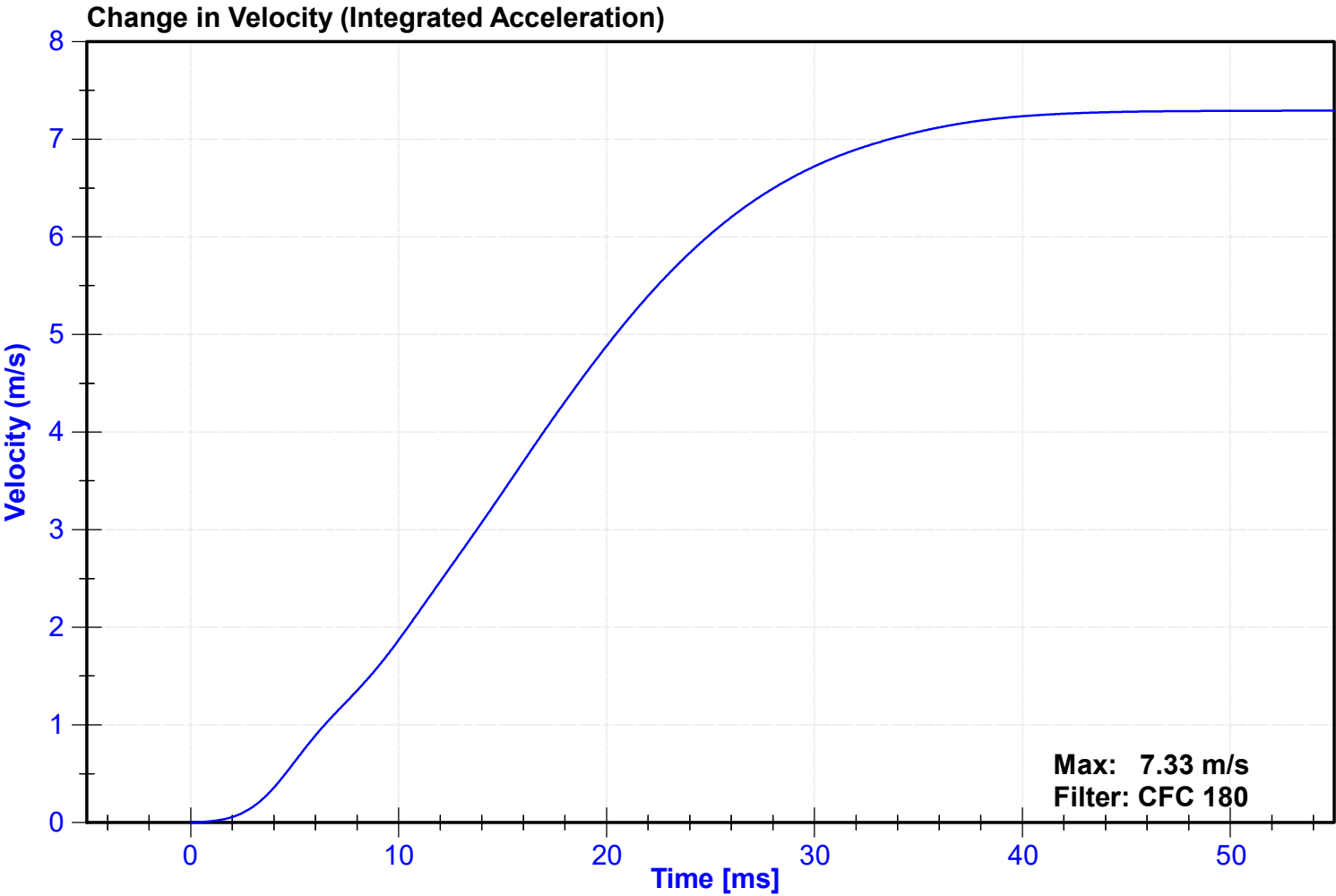
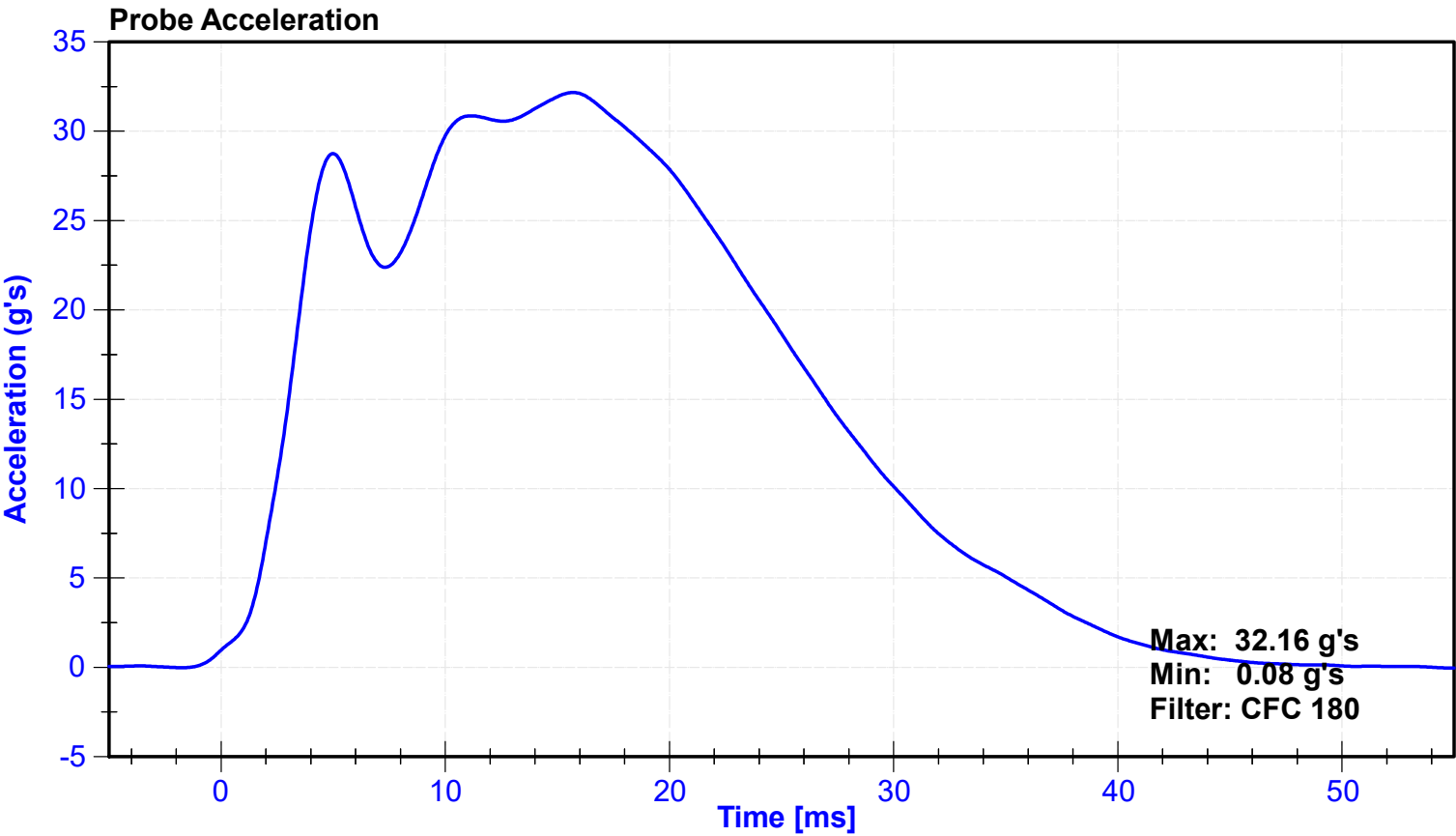
ATD Manufacturer	Humanetics	Test Technician	T. Roseman
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

Test Parameter	Results		Unit	Result	Pass/Fail
	Minimum Specification	Maximum Specification			
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	36.2	Pass
Velocity	6.59	6.83	m/s	6.724	Pass
Chest Deflection	-58	-50	mm	-54.0	Pass
Maximum Resistive Force (50 to 58mm)	3900	4400	N	4380.2	Pass
Maximum Resistive Force (18 to 50mm)	0	4600	N	4331.4	Pass
Hysteresis	69	85	%	75.8	Pass

Transducer Calibrations				
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18494	11/5/2022	5/4/2023
Chest Potentiometer	Servo	0720	12/12/2022	6/12/2023







ATD Manufacturer	Humanetics	Test Technician	T. Roseman
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

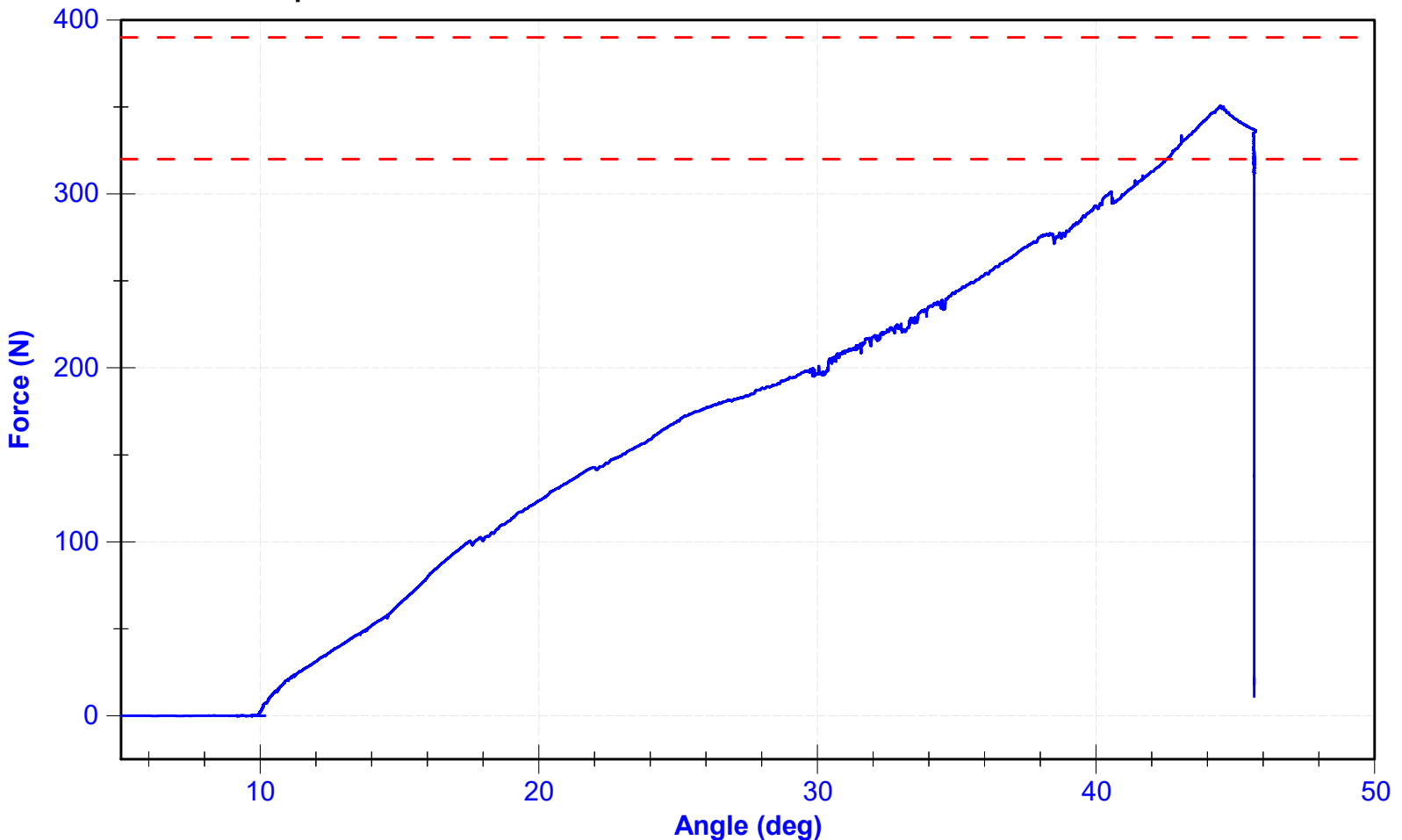
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.6	25.6	°C	21.1	Pass
Humidity	10	70	%	22.3	Pass
Initial Angle	0	20	deg	9.5	Pass
Force at 45 Degrees	320	390	N	350.7	Pass
Return Angle Relative to Initial	0	8	deg	2.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	Rieker	DS-1905226	2022-11-09	2023-11-09
Load Cell	Interface	1134516	2022-09-27	2023-09-27

Force vs. Displacement



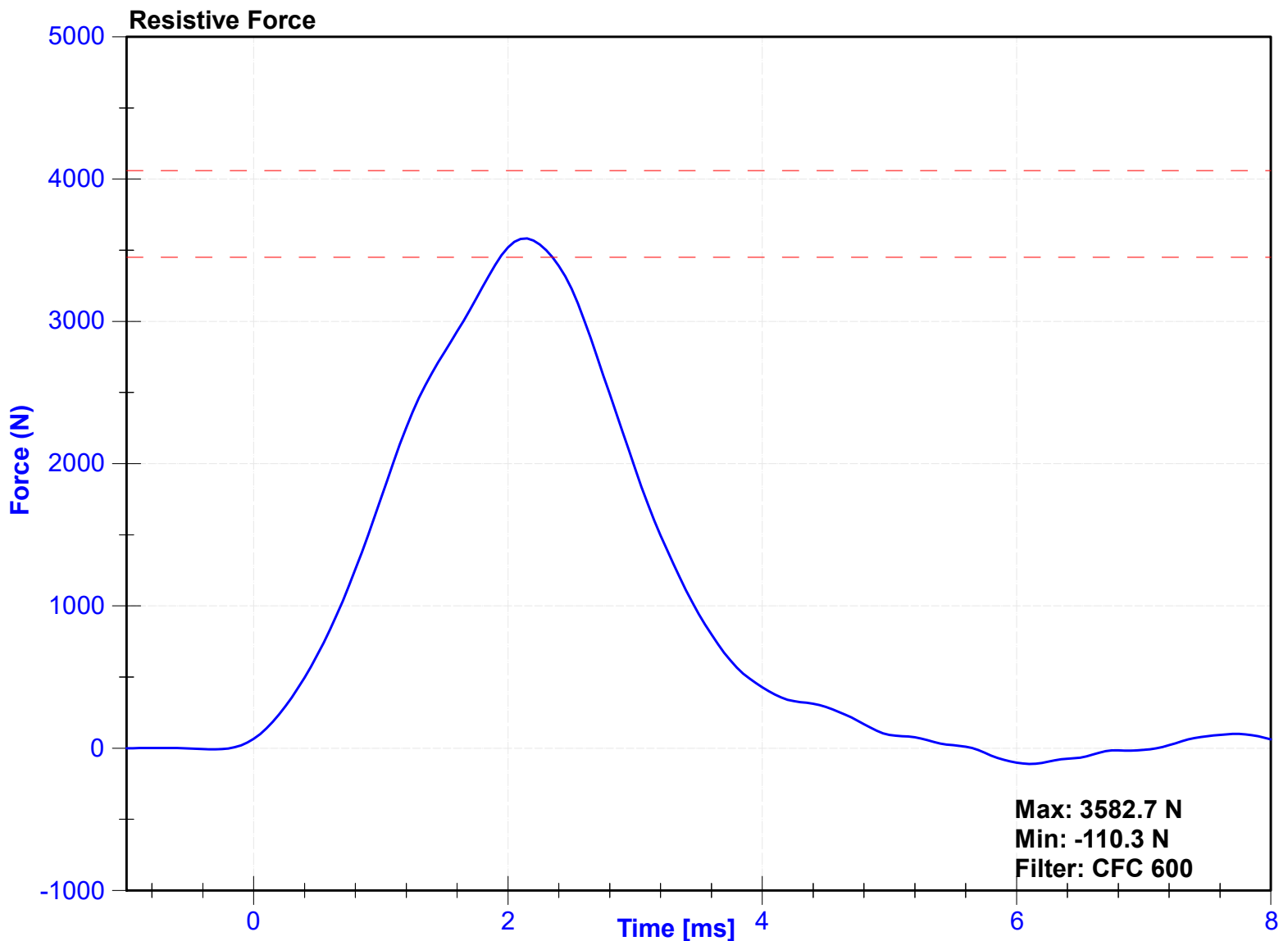
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

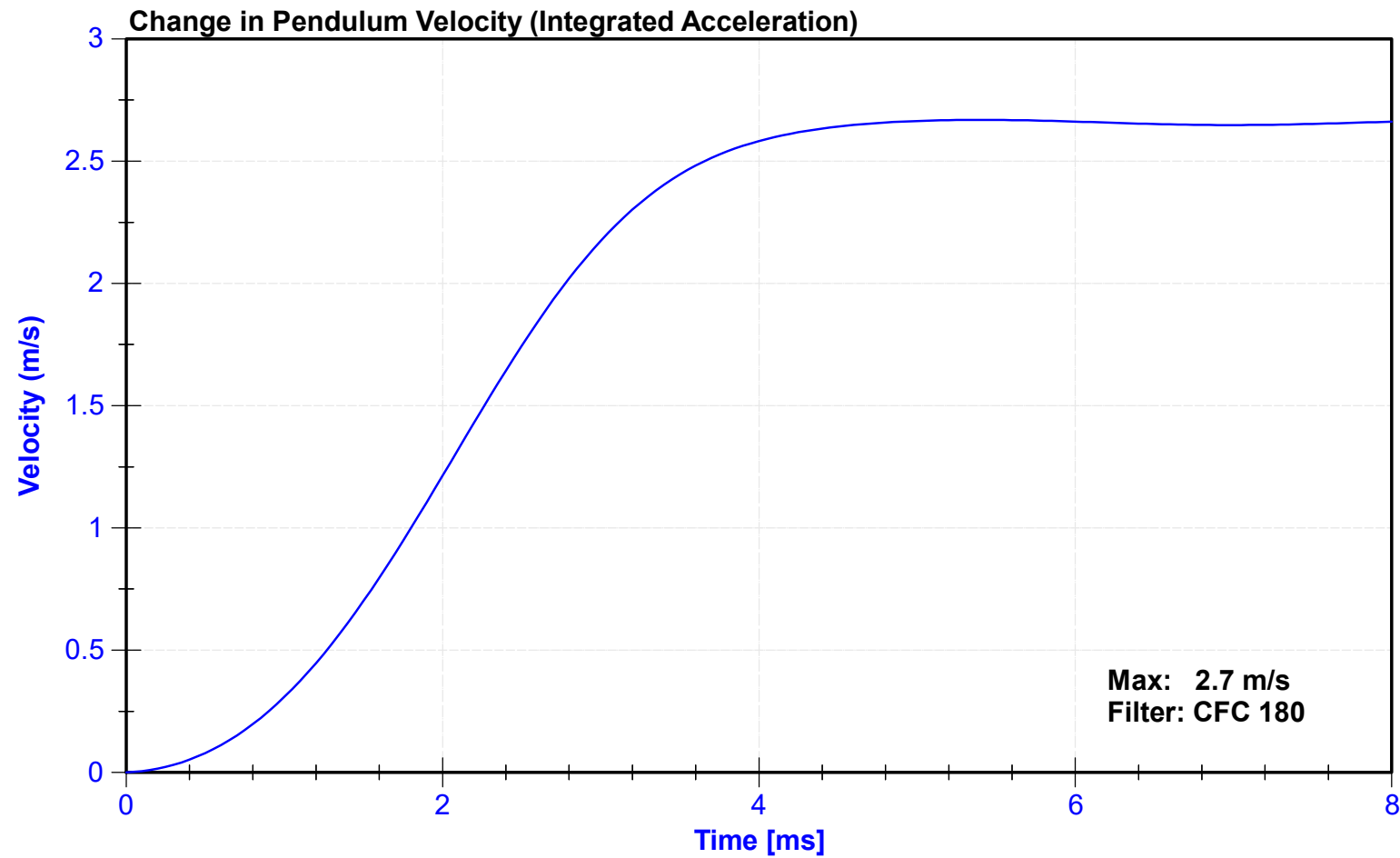
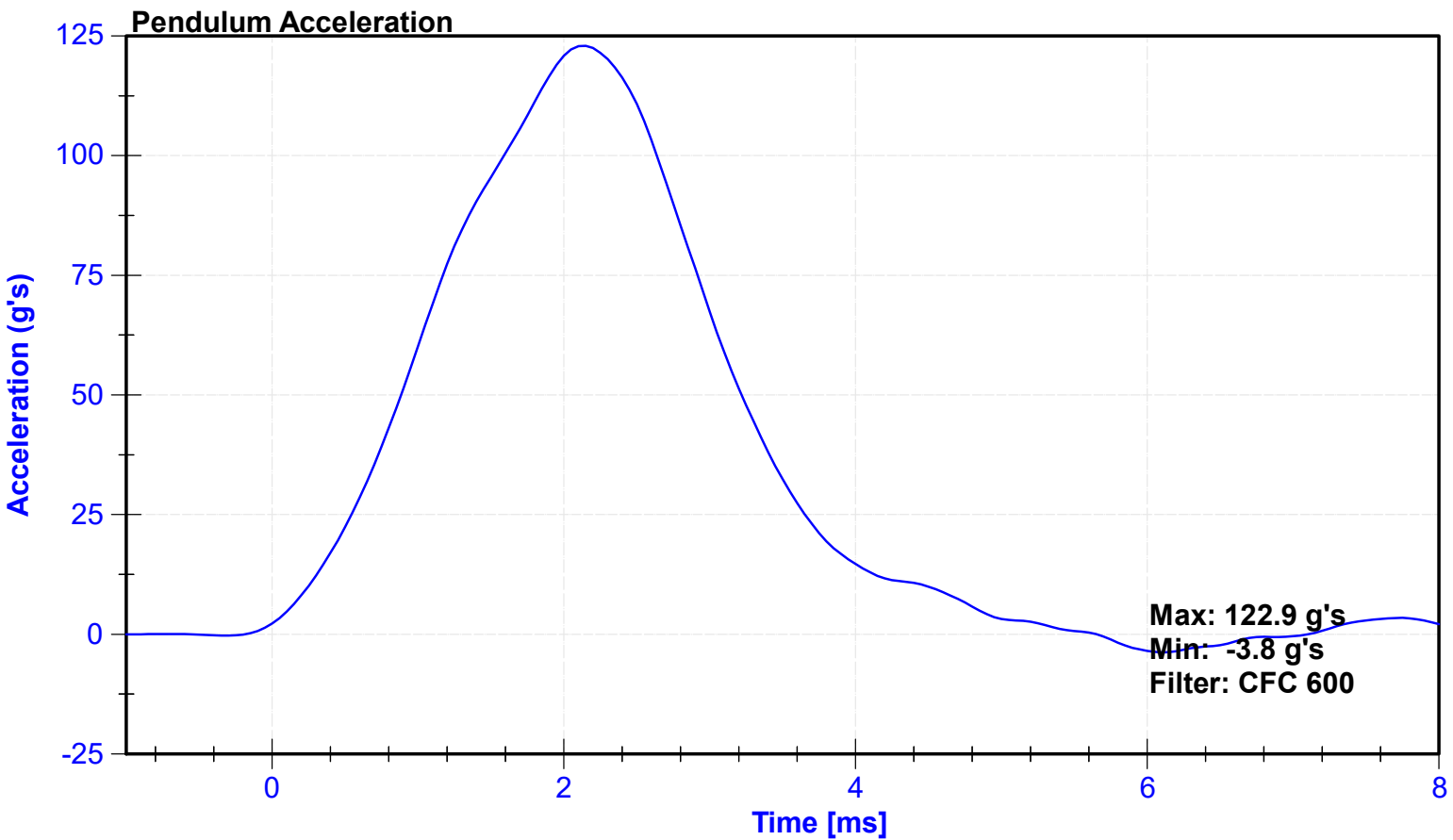
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	20.6	Pass
Humidity	10	70	%	30.5	Pass
Velocity	2.07	2.13	m/s	2.080	Pass
Resistive Force	3450	4060	N	3582.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18494	11/5/2022	5/4/2023





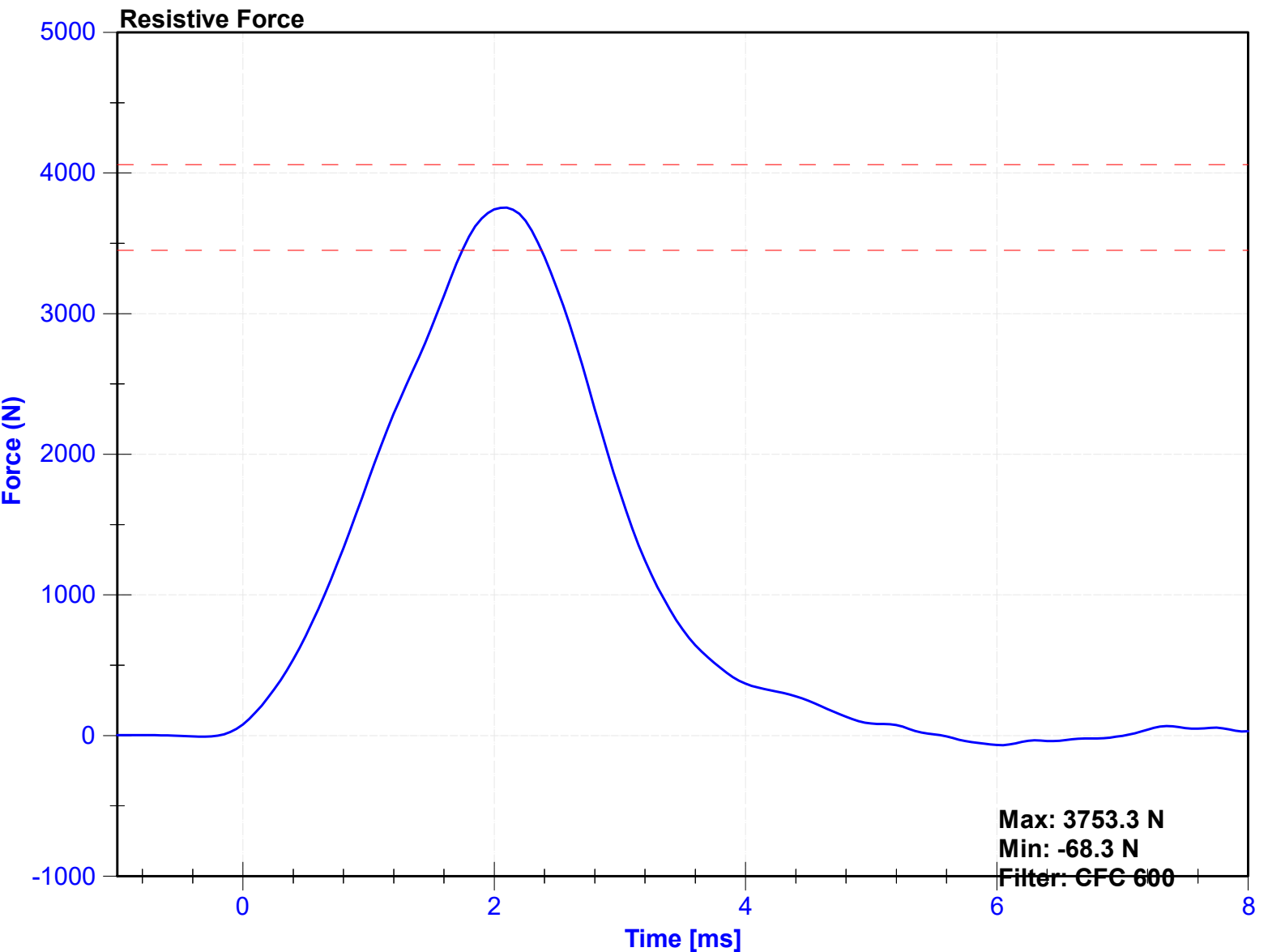
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

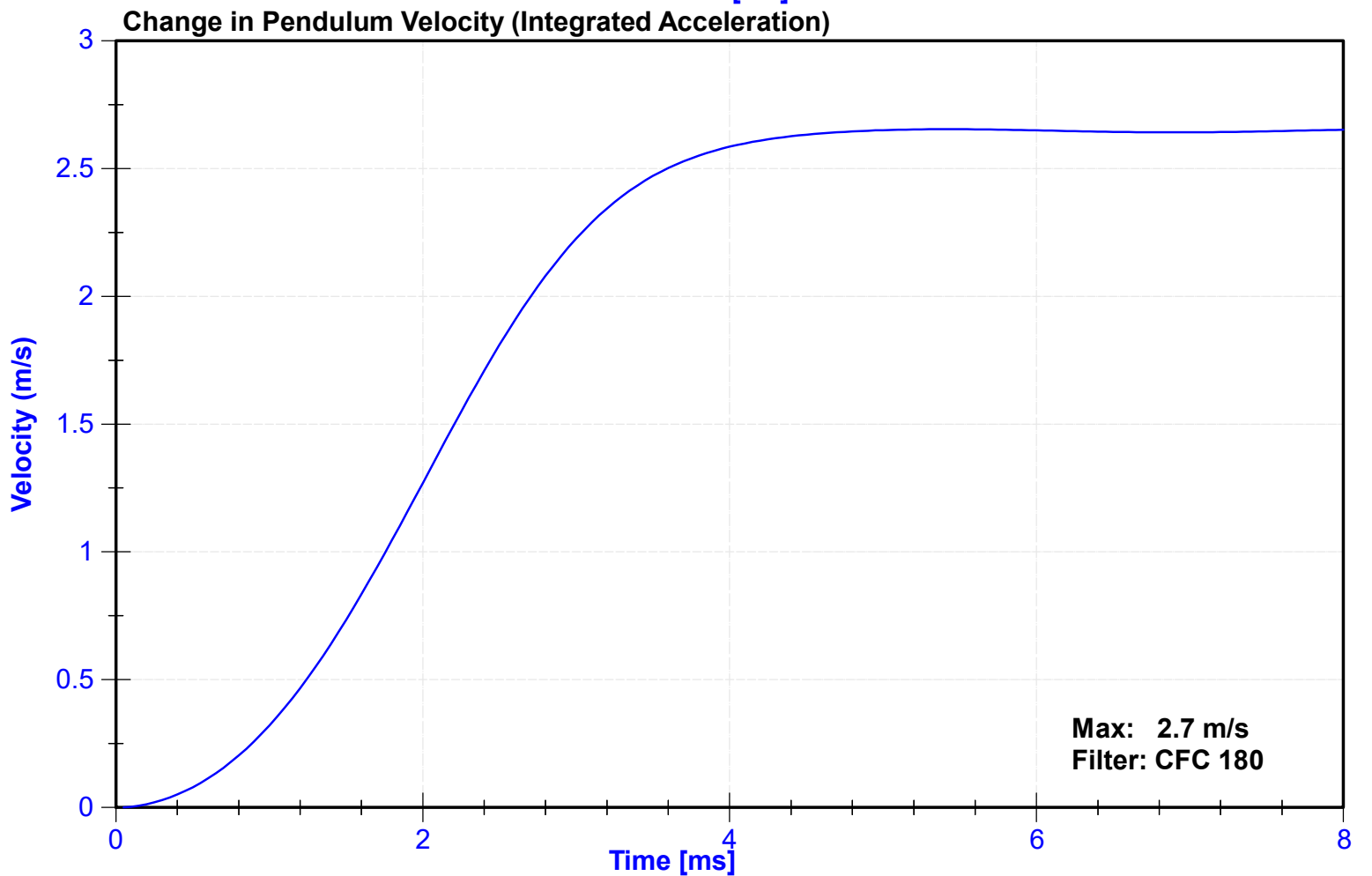
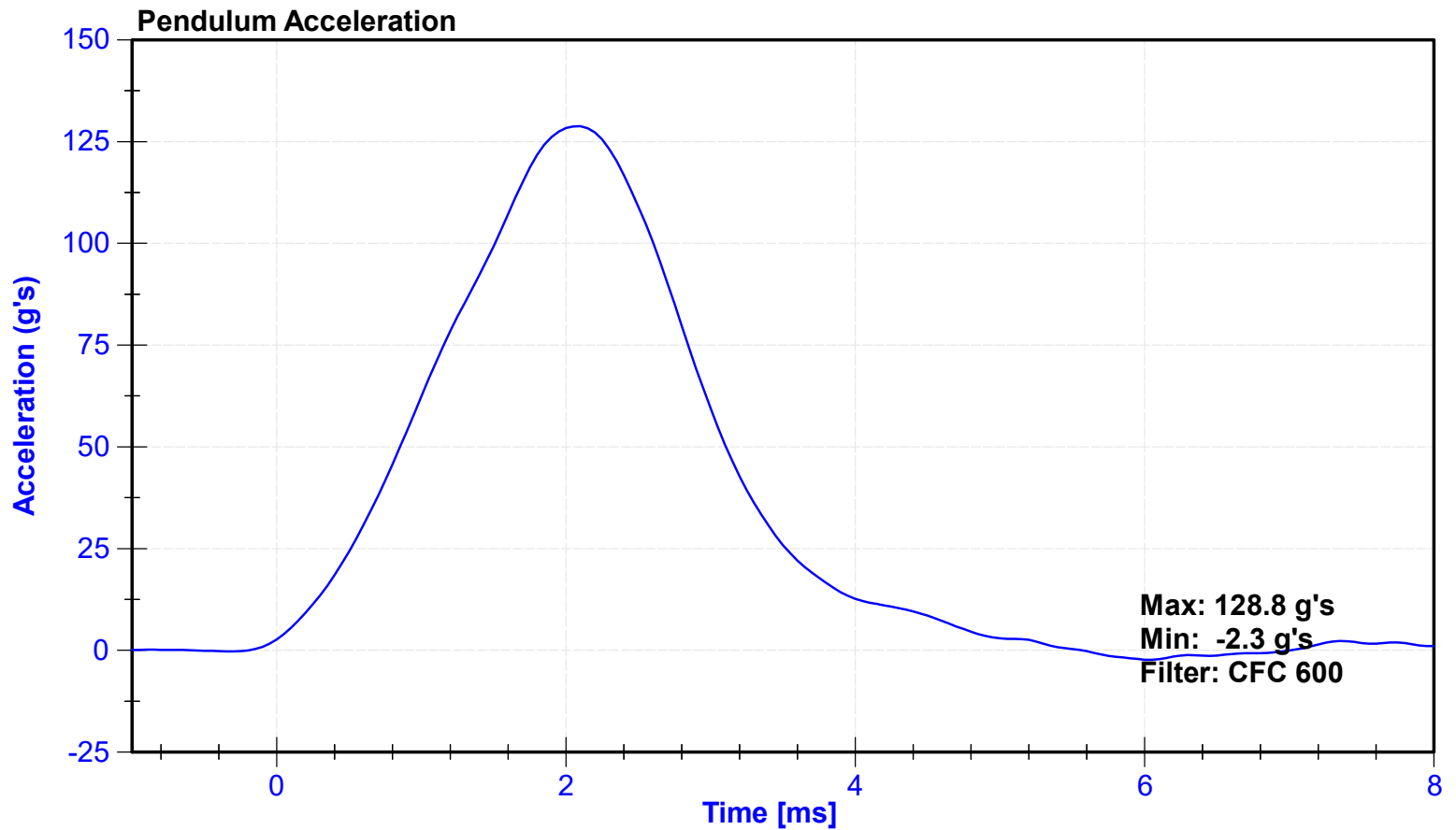
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	20.6	Pass
Humidity	10	70	%	30.5	Pass
Velocity	2.07	2.13	m/s	2.080	Pass
Resistive Force	3450	4060	N	3753.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18494	11/5/2022	5/4/2023





CALIBRATION TEST RESULTS

POST-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

SERIAL NO: 142

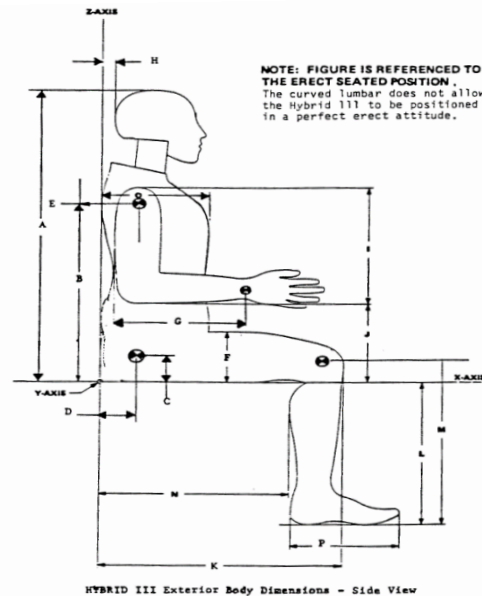
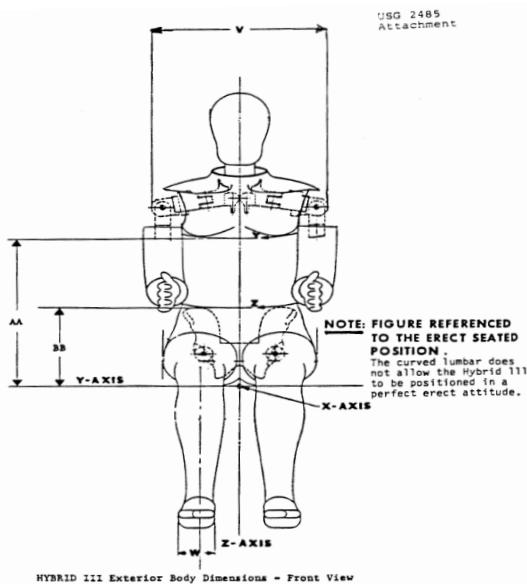


External Measurements - Hybrid 3 - 50th Male

Technician: K. Brogan

Date: 02/07/2023

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	13.2	Pass
J	Elbow Rest Height	7.5	8.3	7.9	Pass
K	Buttock to Knee Length	22.8	23.8	23.4	Pass
L	Popliteal Height	16.9	17.9	17.3	Pass
M	Knee Pivot Height	19.1	19.7	19.5	Pass
N	Buttock Popliteal Length	17.8	18.8	18.3	Pass
O	Chest Depth without Jacket	8.4	9.0	8.8	Pass
P	Foot Length (right)	9.9	10.5	10.2	Pass
V	Shoulder Breadth	16.3	17.2	16.9	Pass
W	Foot Breadth	3.6	4.2	3.9	Pass
Y	Chest Circumference with Jacket	38.2	39.4	39.1	Pass
Z	Waist Circumference	32.9	34.1	33.4	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

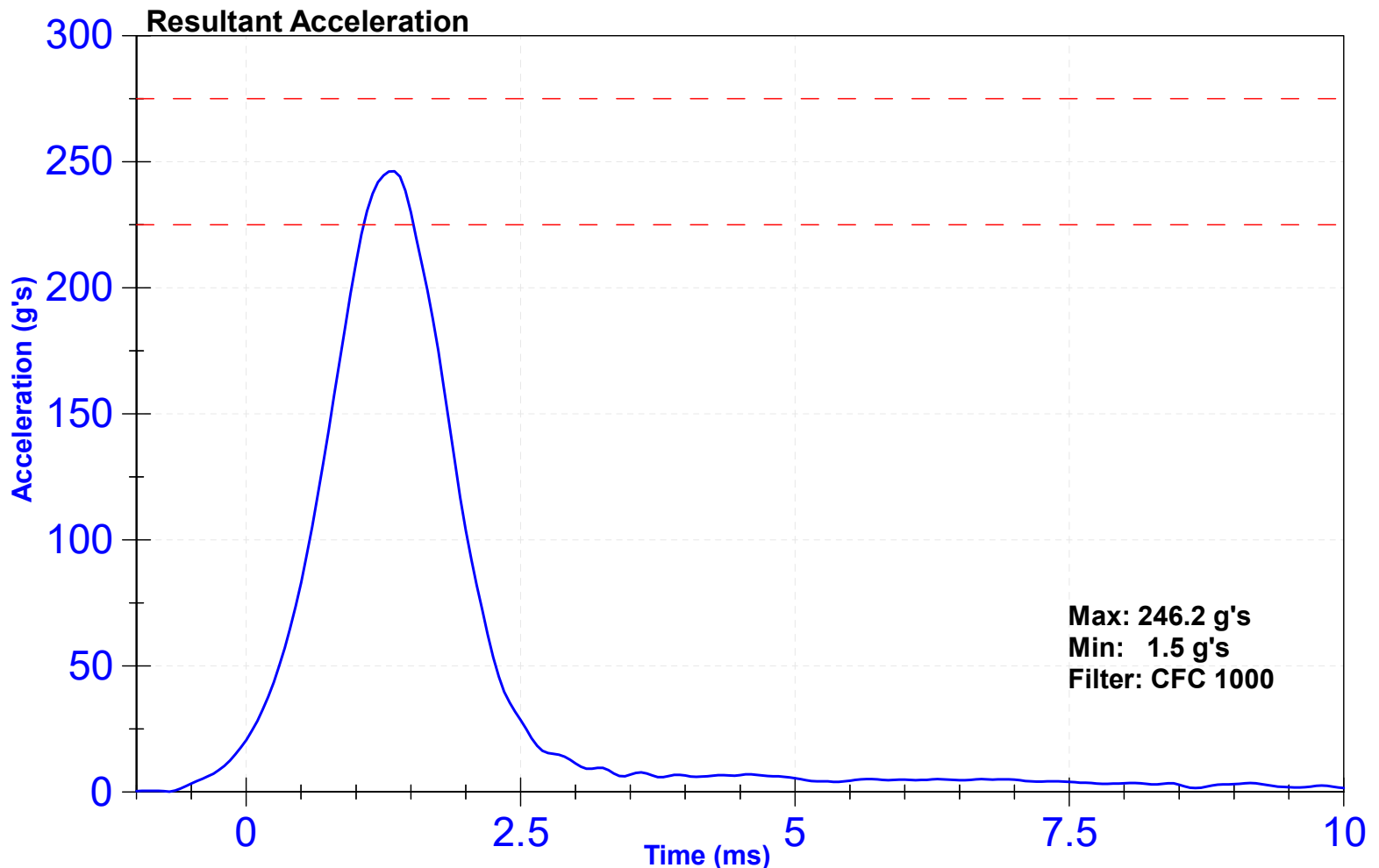
ATD Manufacturer	Humanetics	Test Technician	T. Roseman
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

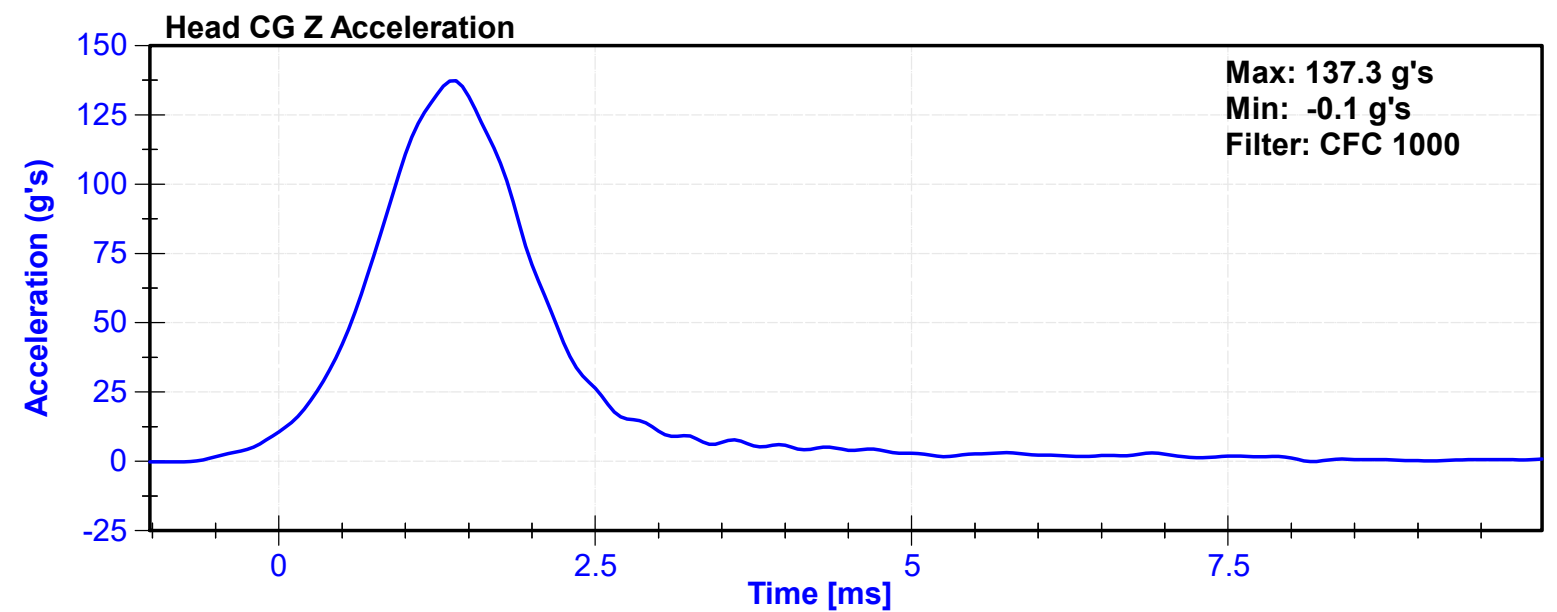
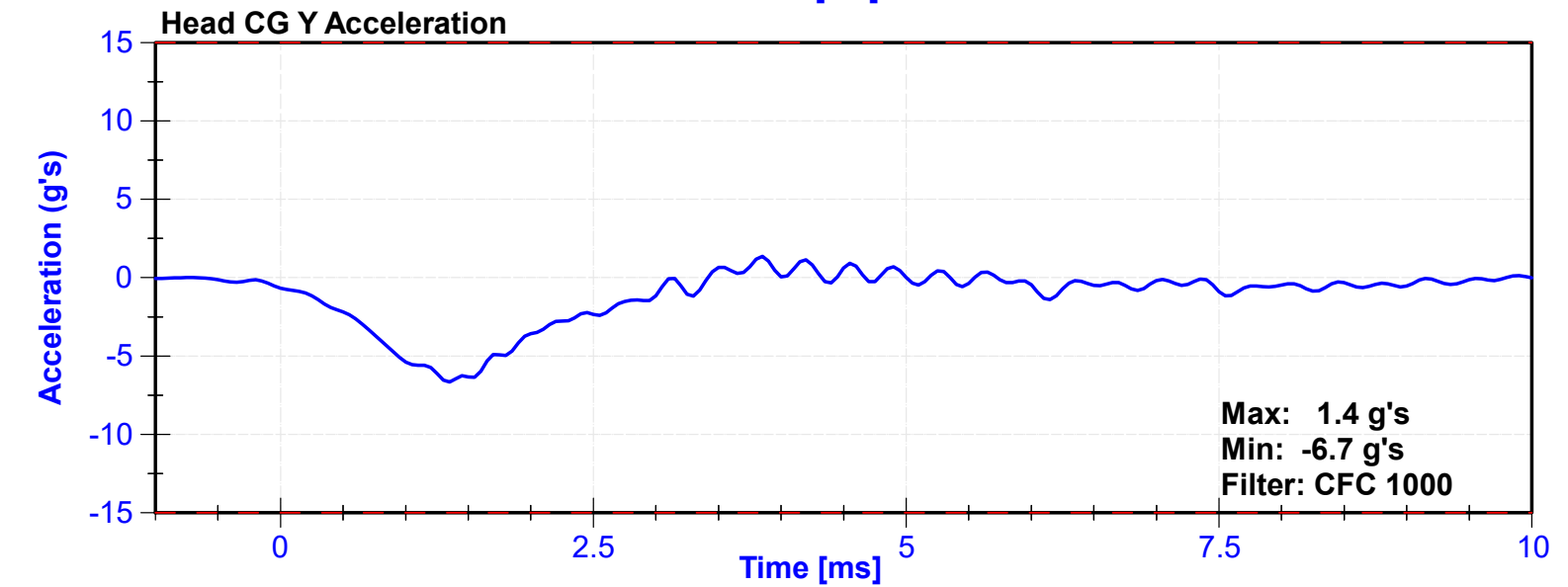
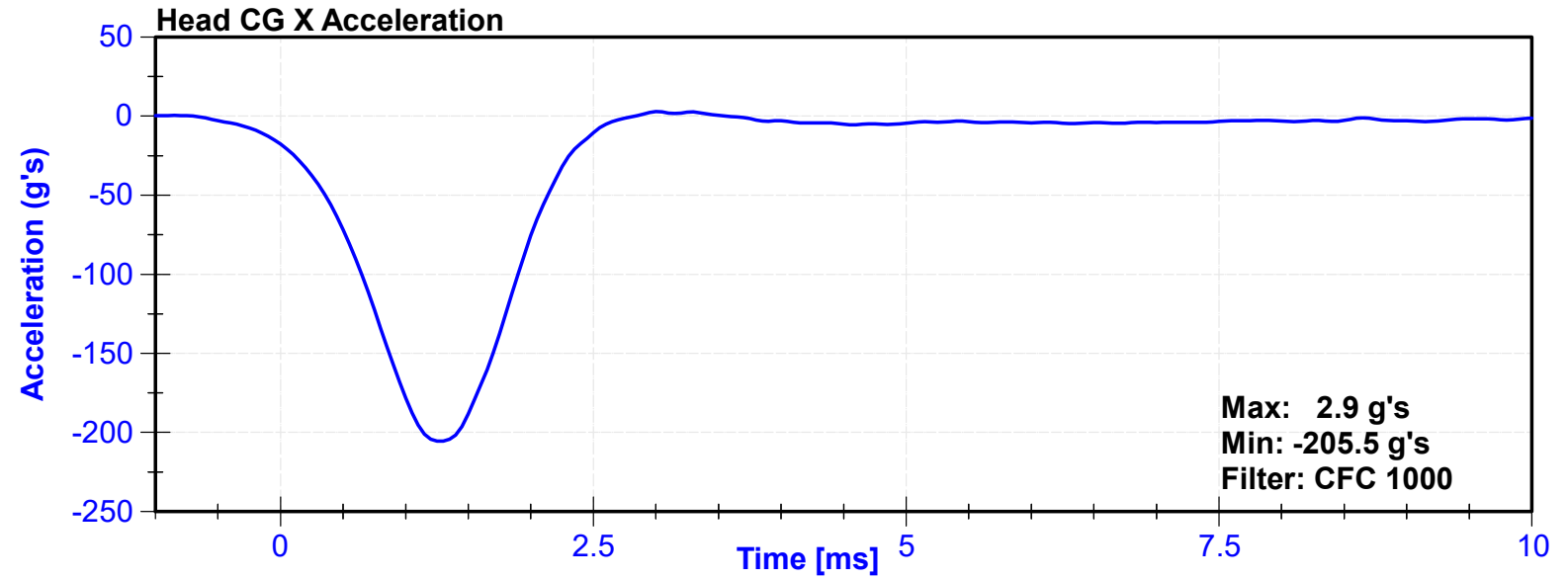
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.0	Pass
Humidity	10	70	%	13.3	Pass
Resultant Acceleration	225	275	g's	246.2	Pass
Oscillation	0	10	%	3.8	Pass
Lateral Acceleration	-15	15	g's	-6.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P51681	9/30/2022	3/29/2023
Y Accelerometer	Endevco	P64151	9/30/2022	3/29/2023
Z Accelerometer	Endevco	P52114	9/30/2022	3/29/2023





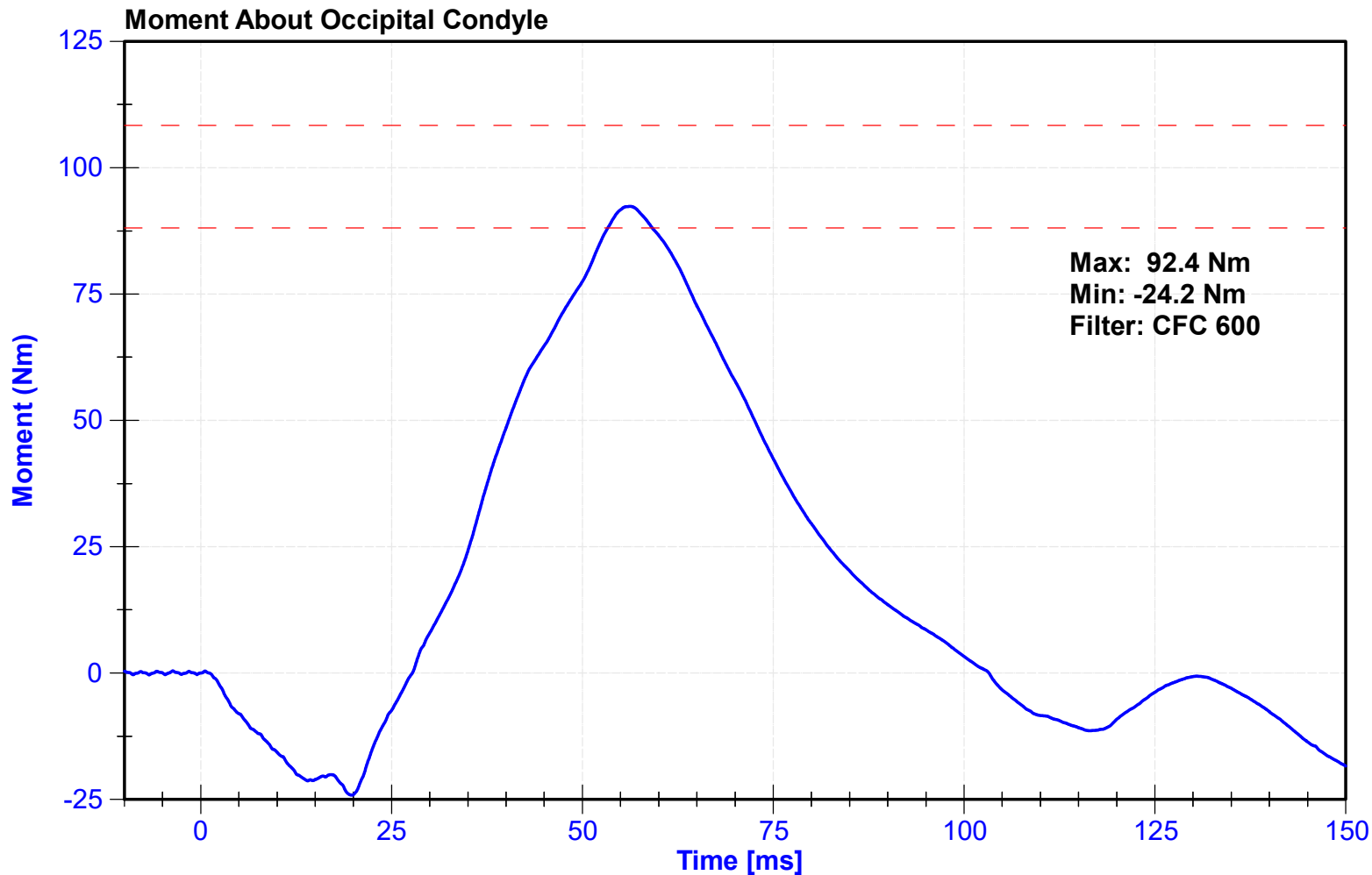
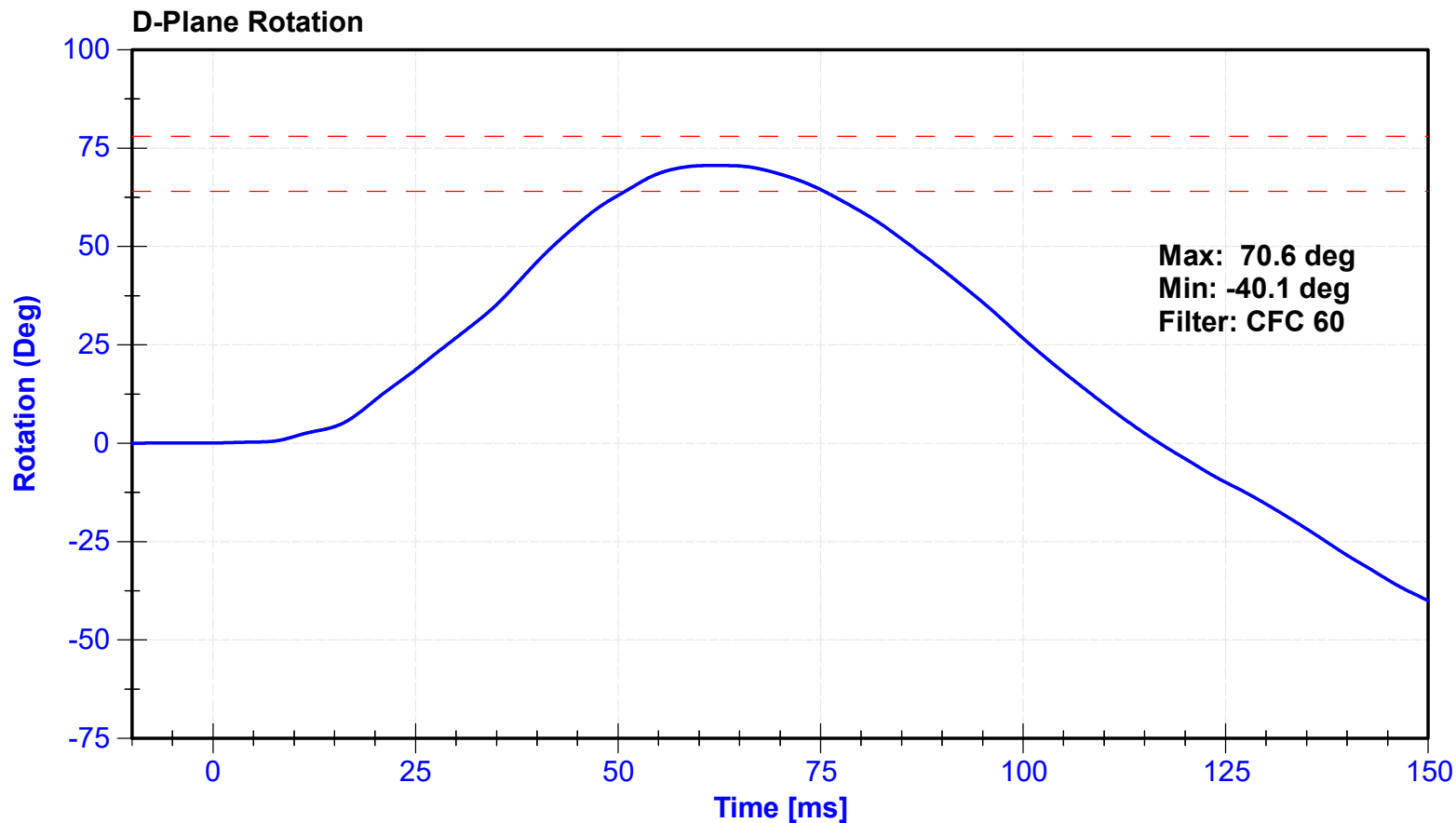
ATD Manufacturer	Humanetics	Test Technician	T. Roseman
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

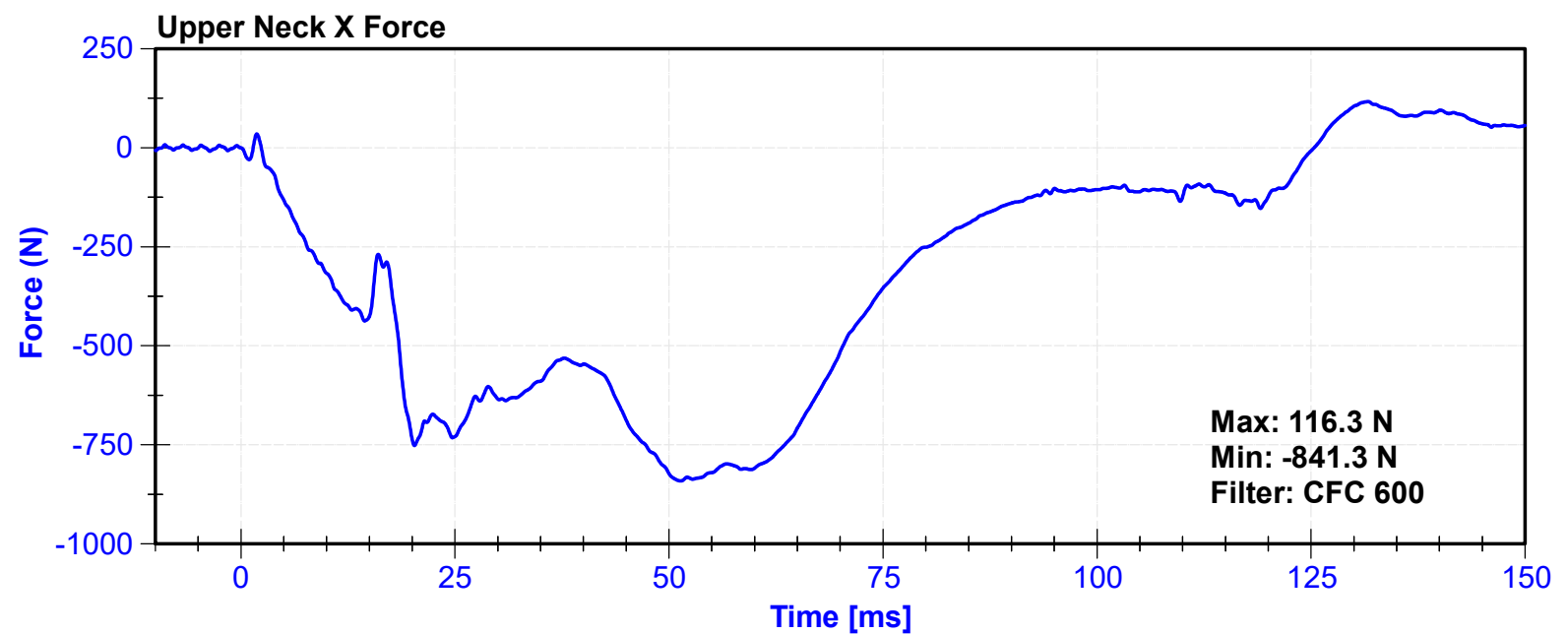
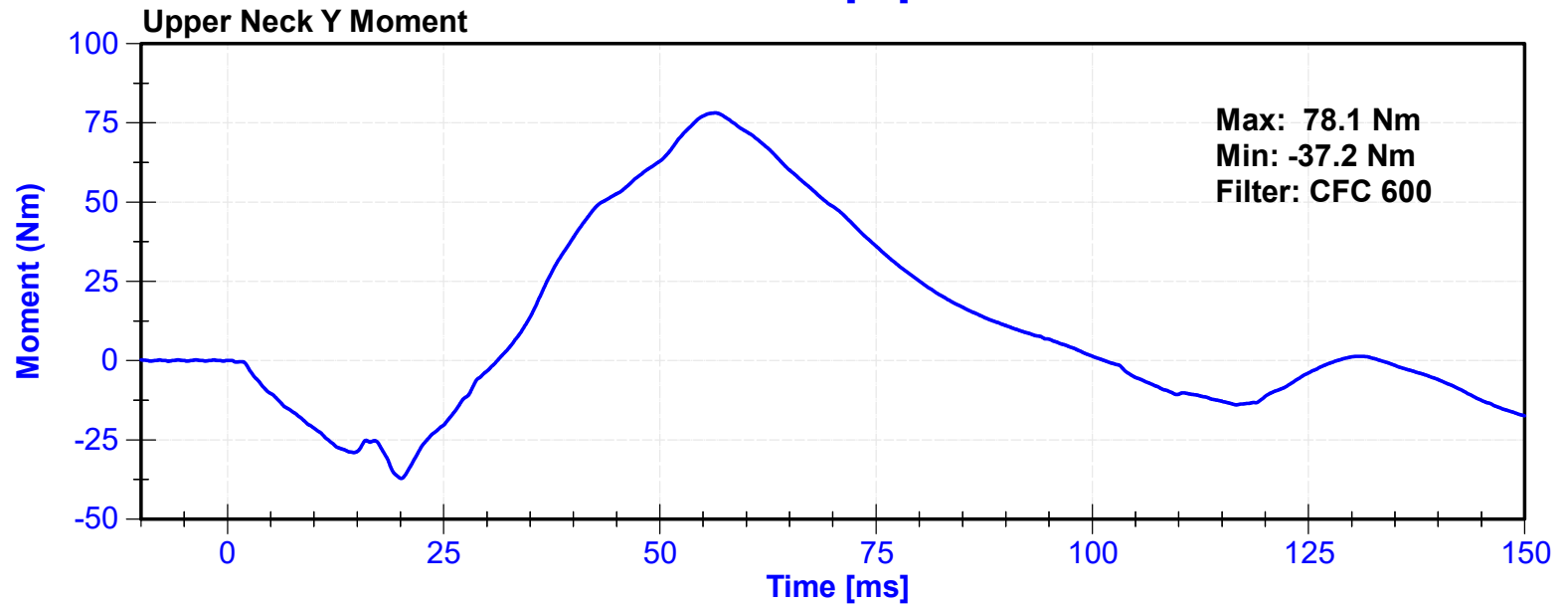
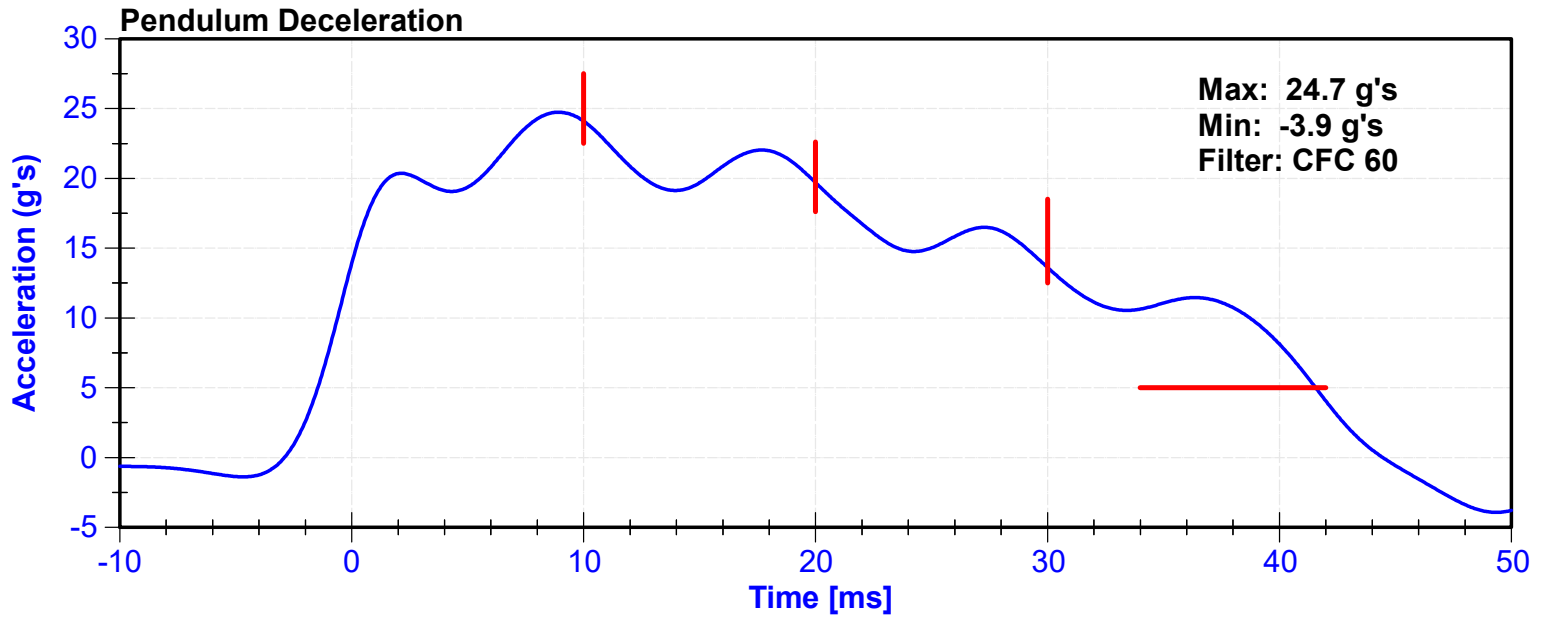
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	22.1	Pass
Velocity	6.89	7.13	m/s	6.935	Pass
Pendulum Deceleration at 10ms	22.5	27.5	g's	24.09	Pass
Pendulum Deceleration at 20ms	17.6	22.6	g's	19.68	Pass
Pendulum Deceleration at 30ms	12.5	18.5	g's	13.62	Pass
Max. Pendulum Deceleration After 30ms	0	29	g's	24.7	Pass
Pendulum Deceleration Time to 5 g's	34	42	ms	41.6	Pass
Maximum D Plane Rotation	64	78	deg	70.6	Pass
Time to Maximum Rotation	57	64	ms	61.5	Pass
Rotation Decay to Zero	113	127	ms	116.9	Pass
Moment About Occipital Condyle	88.1	108.4	Nm	92.36	Pass
Time to Maximum Moment	47	58	ms	56.3	Pass
Moment Decay to Zero	97	107	ms	103.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	7231C-750	10/31/2022	4/29/2023
Pendulum Potentiometer	ETI	LABPOT1	5/9/2022	5/9/2023
Condyle Potentiometer	ETI	LABPOT2	5/9/2022	5/9/2023
Upper Neck Load Cell	Denton	2187-FX	6/13/2022	6/13/2023





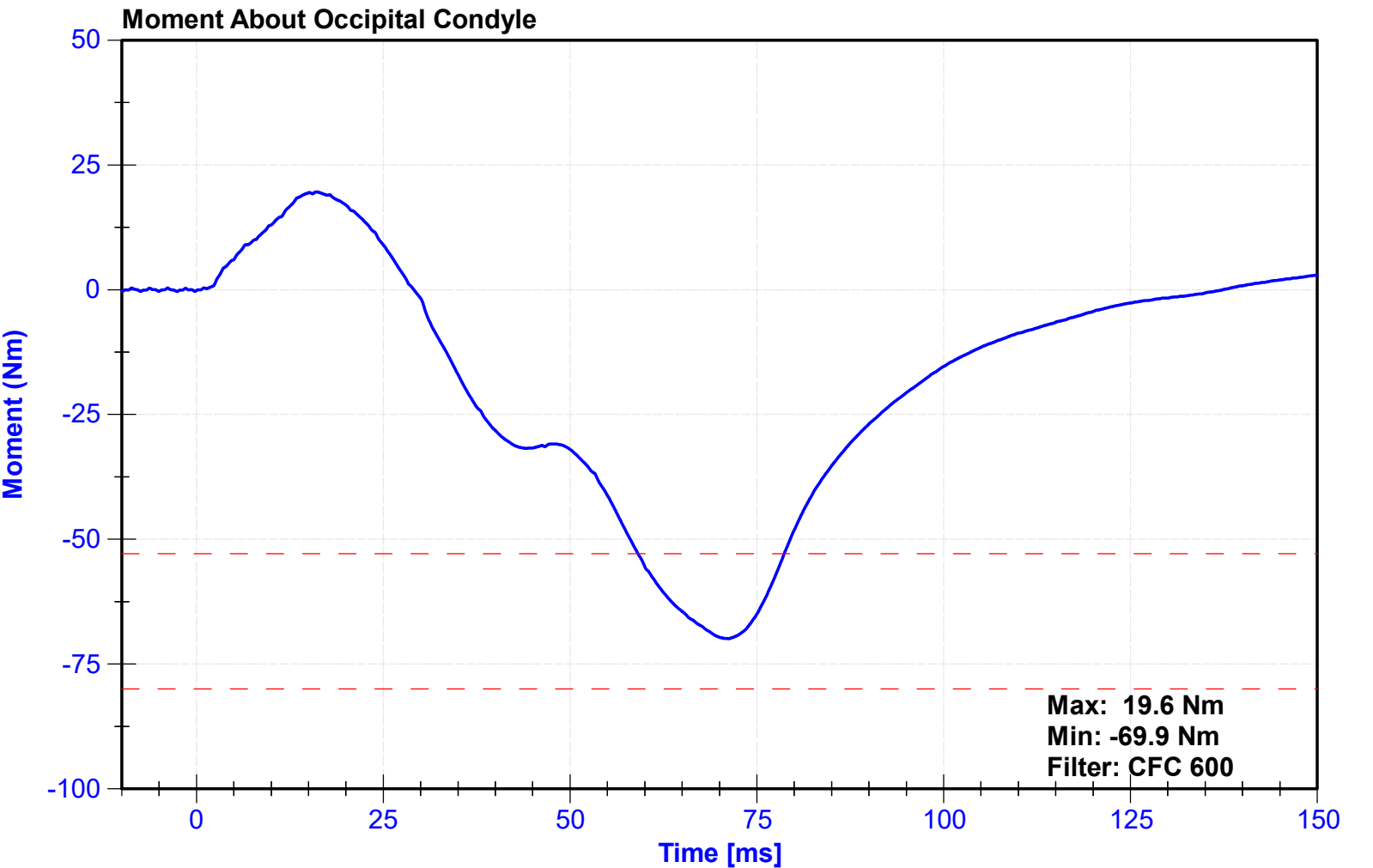
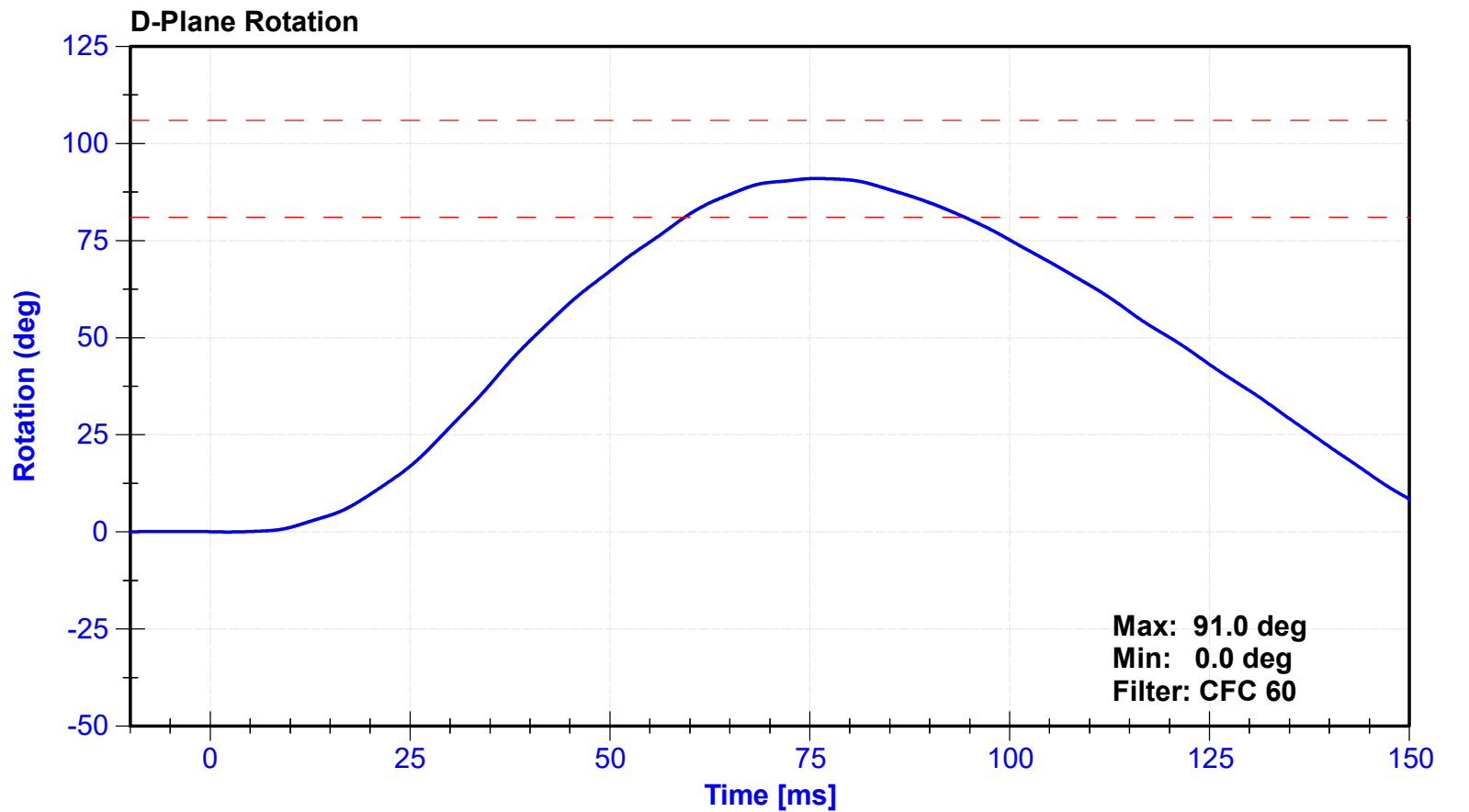
ATD Manufacturer	Humanetics	Test Technician	T. Roseman
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

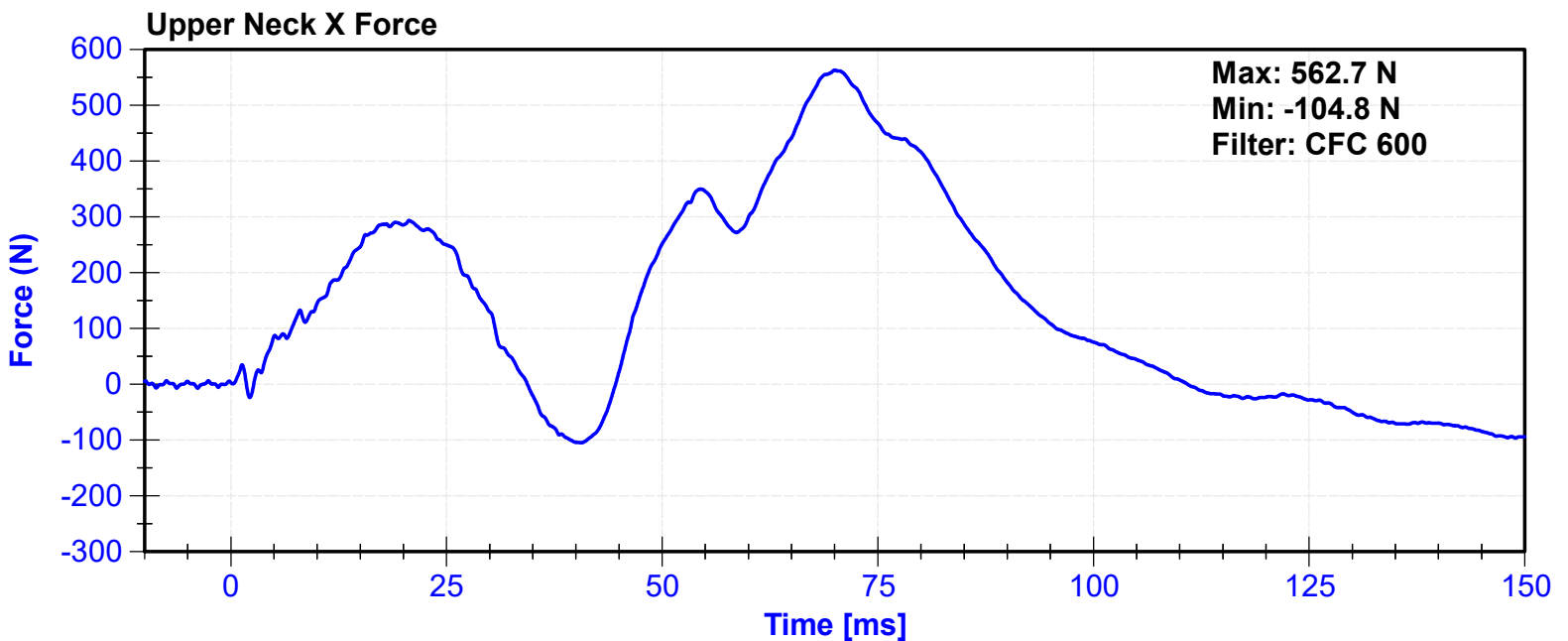
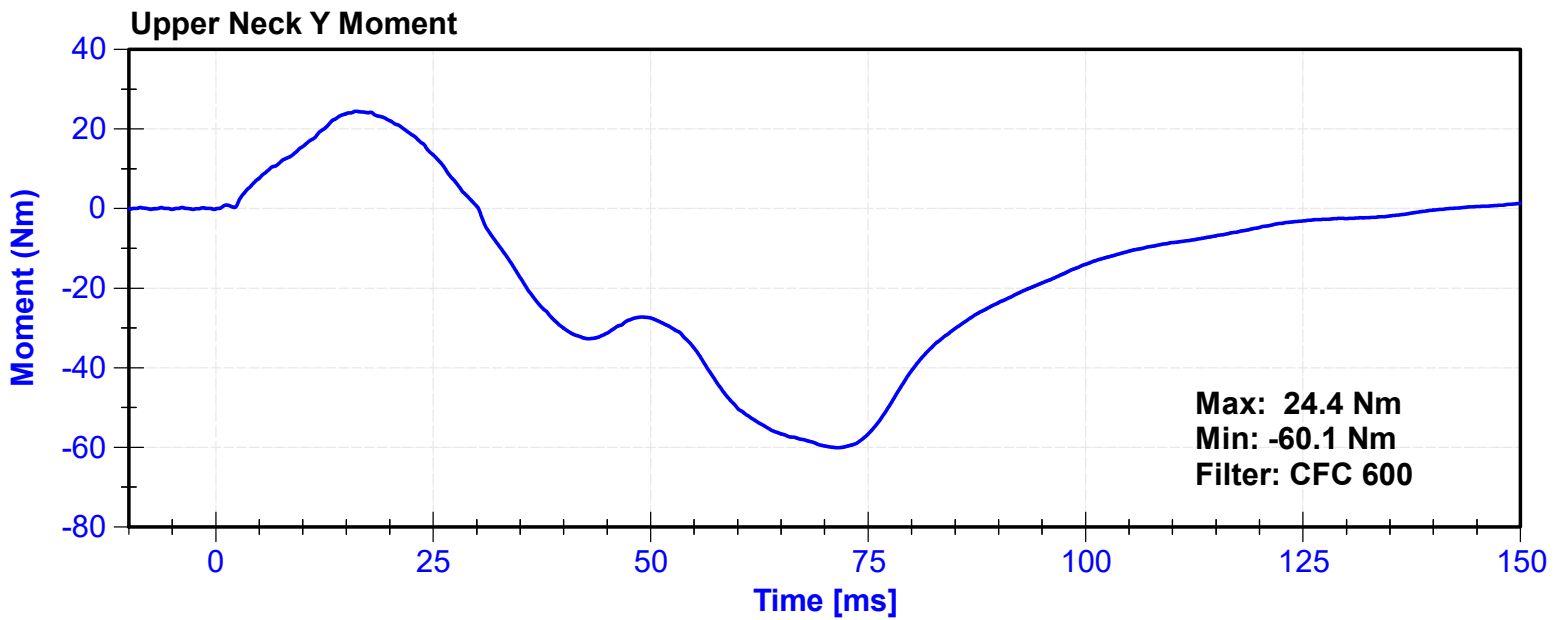
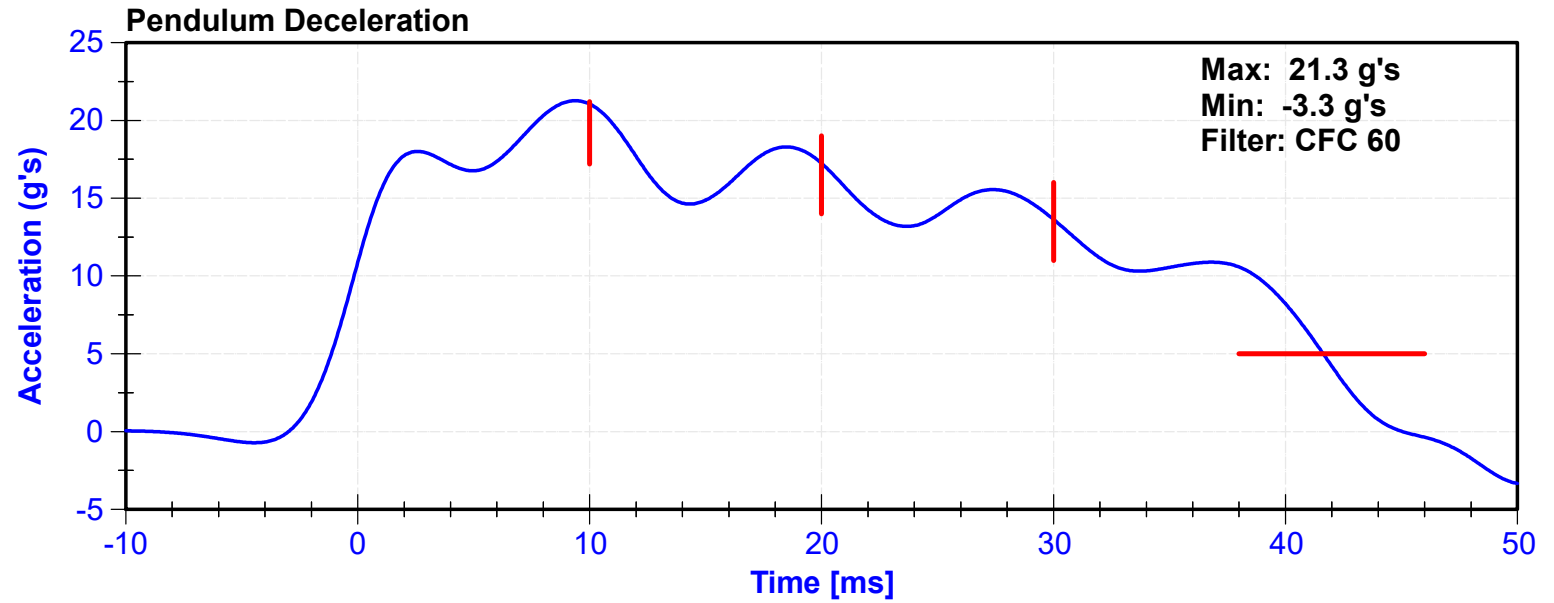
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	22.1	Pass
Velocity	5.94	6.19	m/s	6.045	Pass
Pendulum Deceleration at 10ms	17.2	21.2	g's	21.04	Pass
Pendulum Deceleration at 20ms	14	19	g's	17.2	Pass
Pendulum Deceleration at 30ms	11	16	g's	13.6	Pass
Max. Pendulum Deceleration After 30ms	0	22	g's	21.3	Pass
Pendulum Deceleration Time to 5 g's	38	46	ms	41.6	Pass
Maximum D Plane Rotation	81	106	deg	91.0	Pass
Time to Maximum Rotation	72	82	ms	75.9	Pass
Rotation Decay to Zero	147	174	ms	156.3	Pass
Minimum Moment About OC	-80	-52.9	Nm	-69.93	Pass
Time to Minimum Moment	65	79	ms	71.1	Pass
Moment Decay to Zero	120	148	ms	137.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16650	10/31/2022	4/29/2023
Pendulum Potentiometer	ETI	LABPOT1	5/9/2022	5/9/2023
Condyle Potentiometer	ETI	LABPOT2	5/9/2022	5/9/2023
Upper Neck Load Cell	Denton	2187-FX	6/13/2022	6/13/2023





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

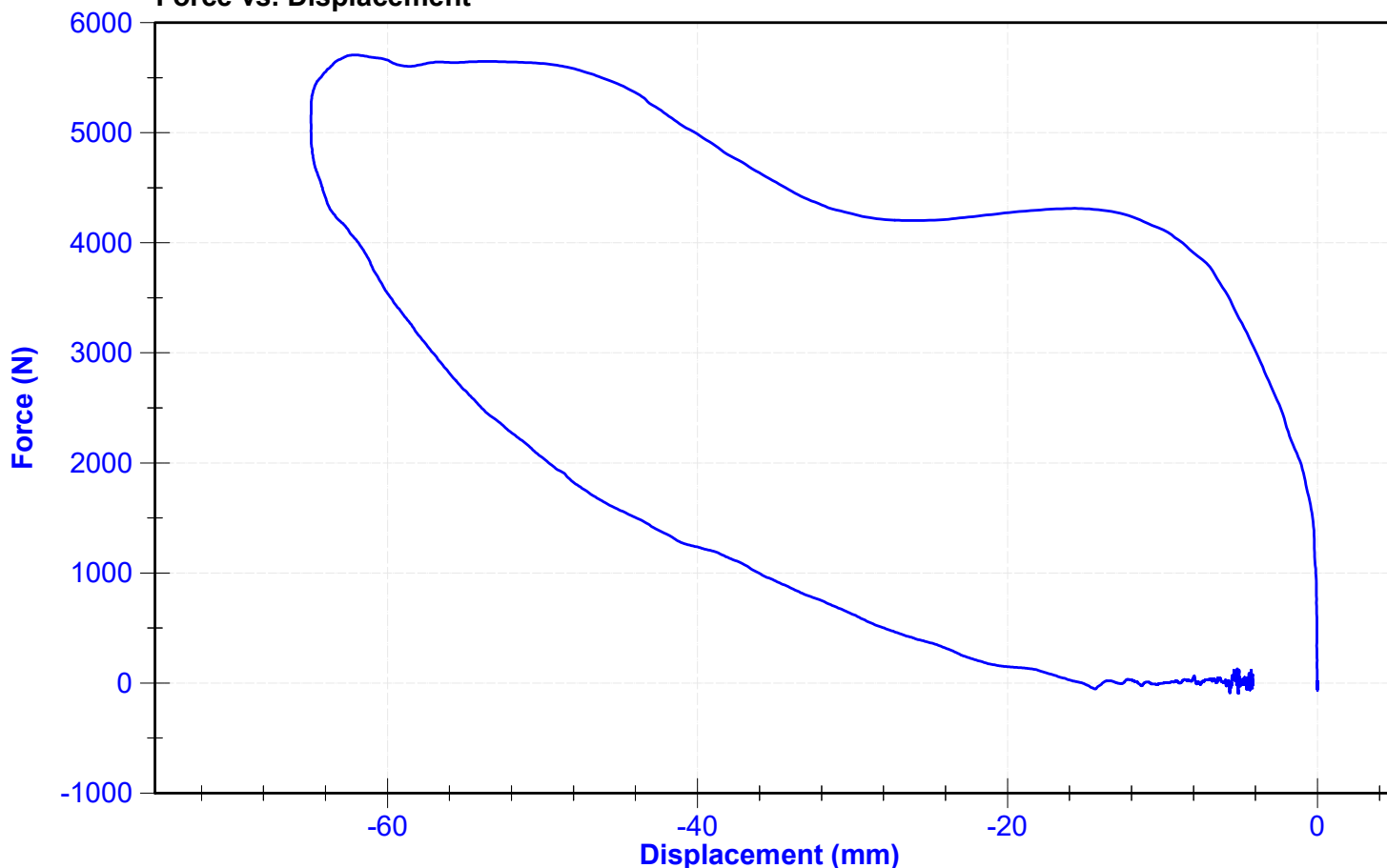
Results

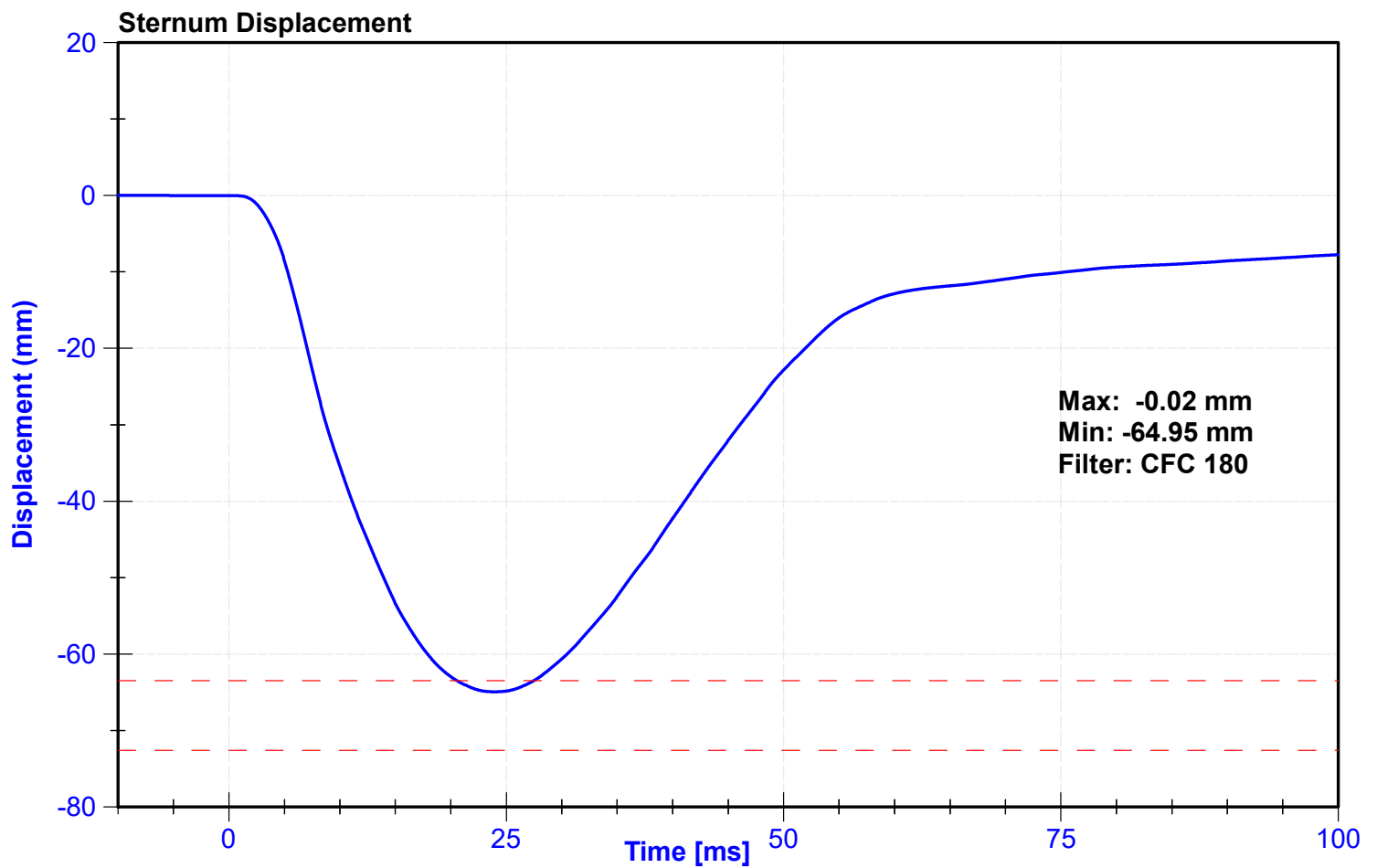
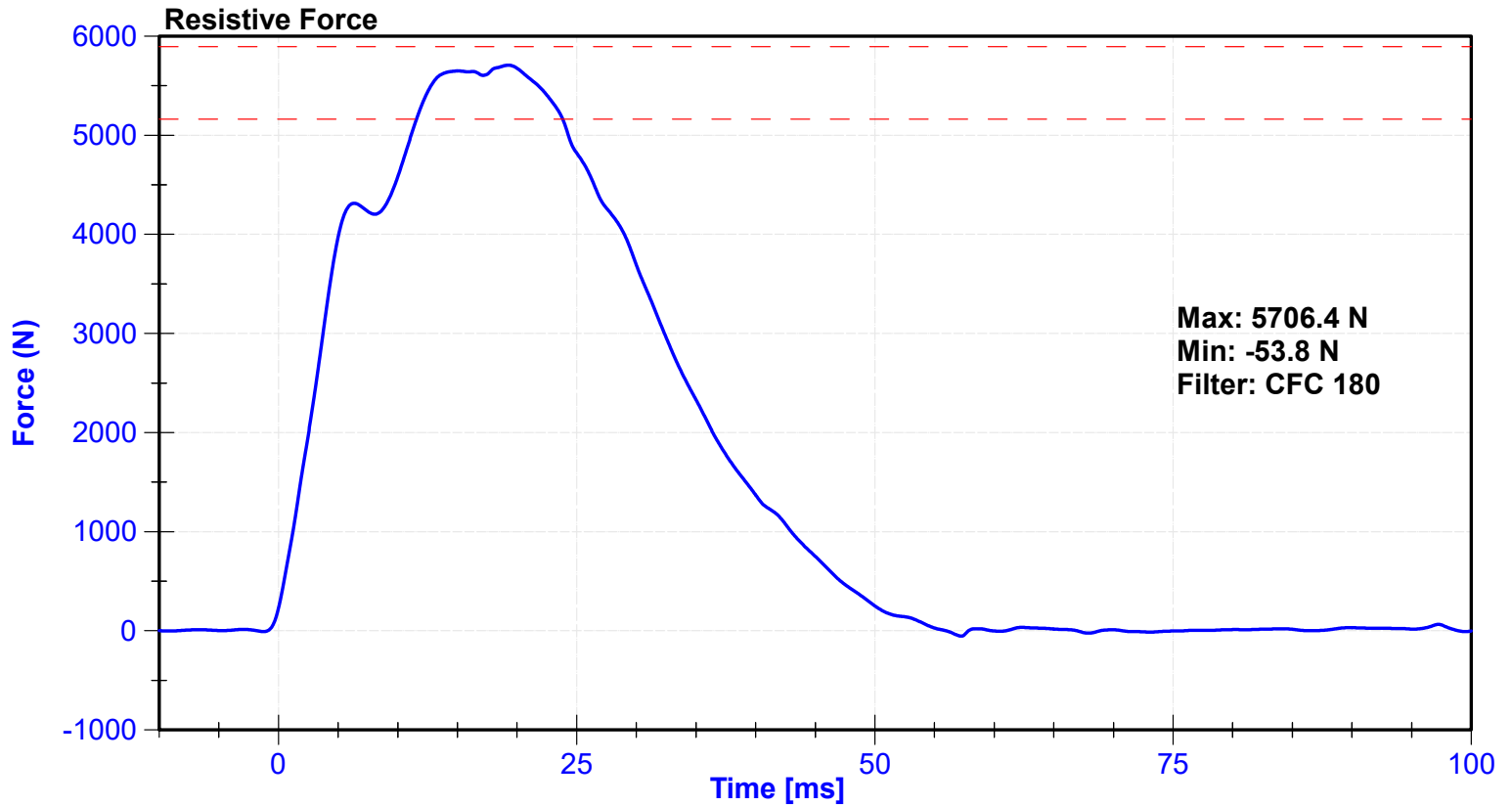
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	19.2	Pass
Velocity	6.59	6.83	m/s	6.745	Pass
Chest Displacement	-72.6	-63.5	mm	-64.95	Pass
Resistive Force	5160	5894	N	5706.4	Pass
Hysteresis	69	85	%	74.4	Pass

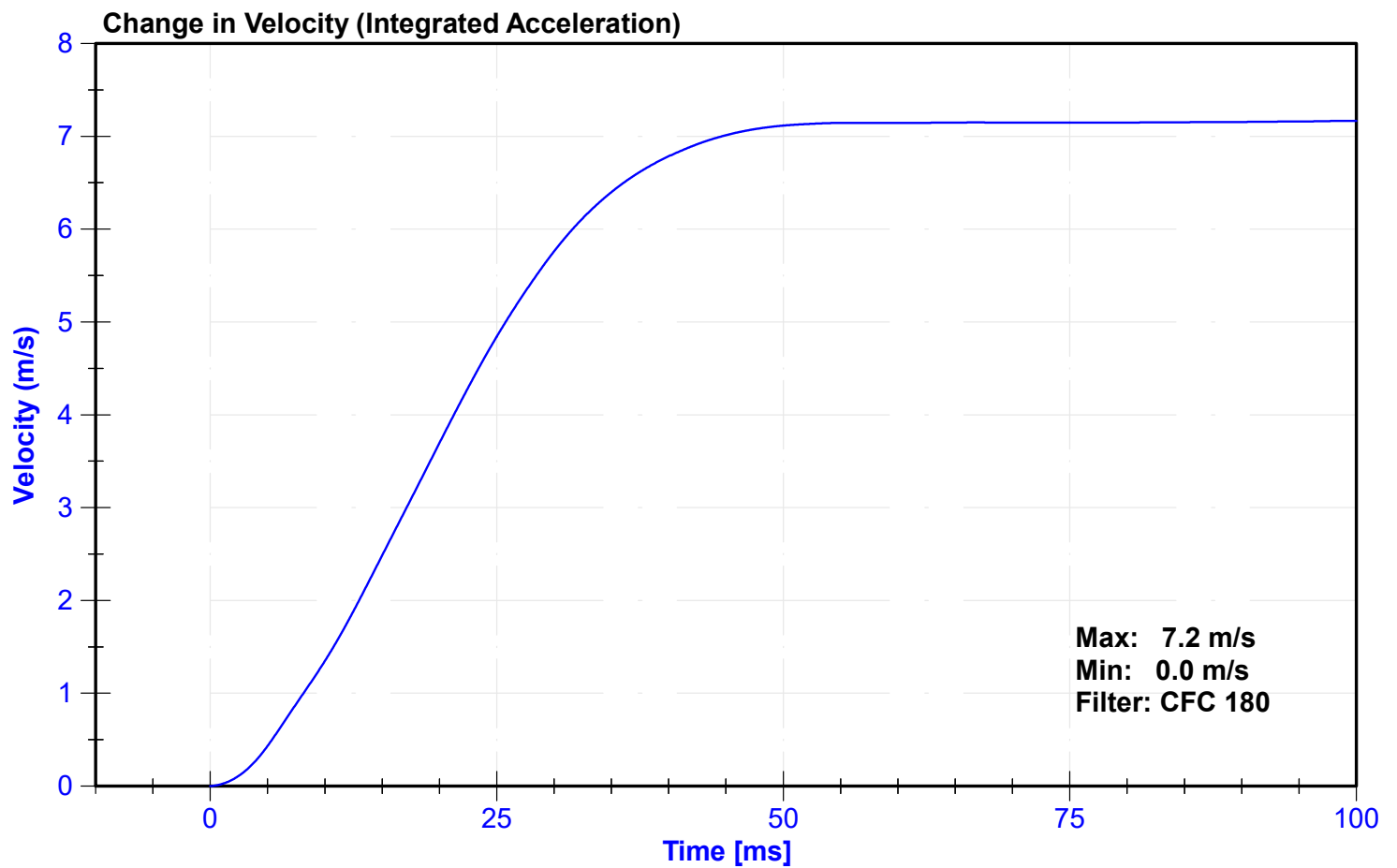
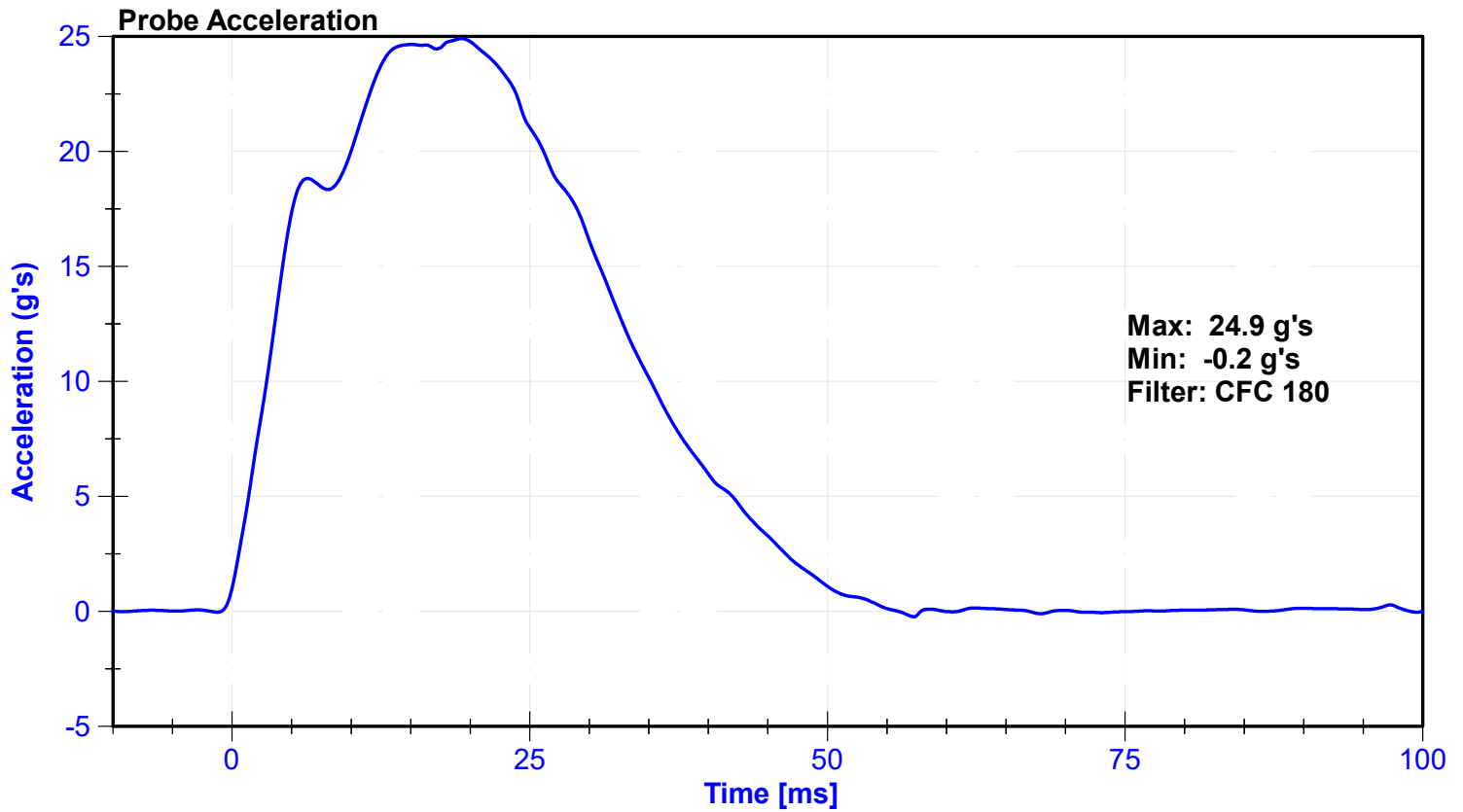
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023
Chest Potentiometer	JDK	0075	10/3/2022	4/3/2023

Force vs. Displacement



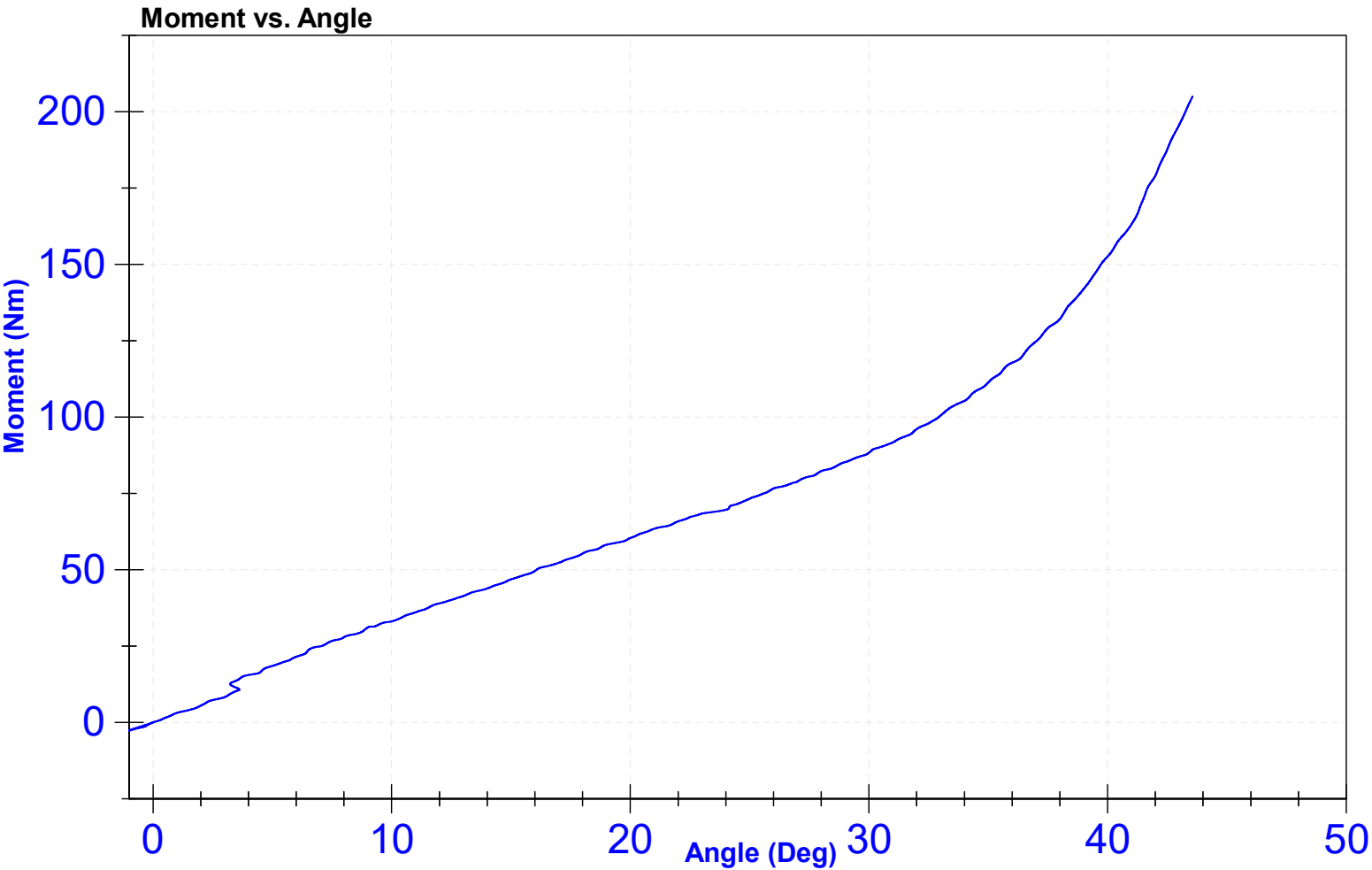




ATD Manufacturer	Humanetics	Test Technician	T. Roseman
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

Results					
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.2	Pass
Humidity	10	70	%	21.0	Pass
Average Velocity	5	10	deg/s	7.3	Pass
Angle at 203Nm	40	50	deg	43.4	Pass
Moment at 30 degrees	0	94.9	Nm	88.3	Pass

Transducer Calibrations				
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	ETI SP22	DS-0008	10/4/2022	10/4/2023
Load Cell	PCB 2301-02	2301-02_115	2022-09-06	2023-09-06

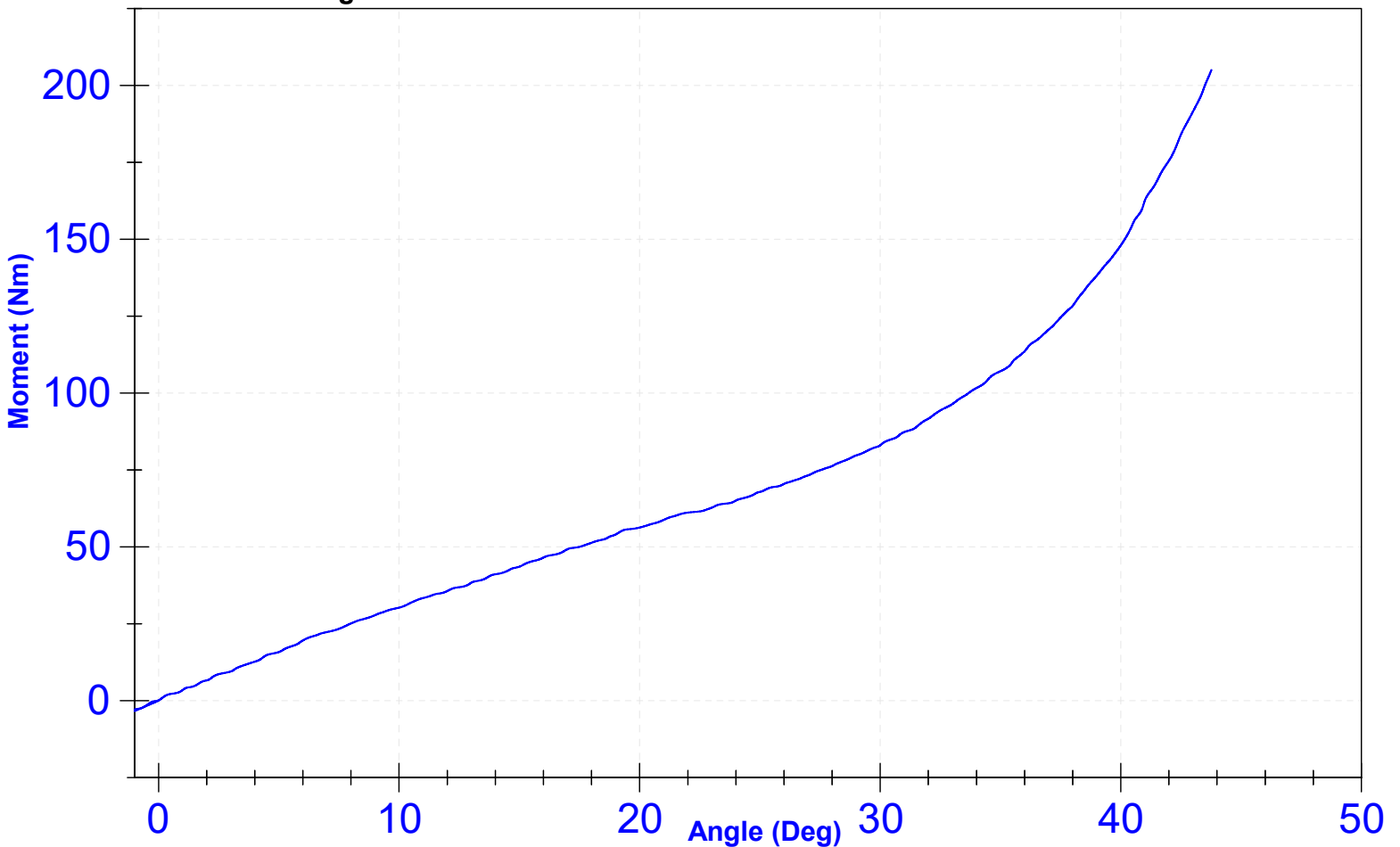


ATD Manufacturer	Humanetics	Test Technician	T. Roseman
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

Test Parameter	Results		Unit	Result	Pass/Fail
	Minimum Specification	Maximum Specification			
Temperature	18.9	25.6	°C	21.2	Pass
Humidity	10	70	%	21.0	Pass
Average Velocity	5	10	deg/s	7.5	Pass
Angle at 203Nm	40	50	deg	43.7	Pass
Moment at 30 degrees	0	94.9	Nm	83.0	Pass

Transducer Calibrations				
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	ETI SP22	DS-0008	10/4/2022	10/4/2023
Load Cell	PCB 2301-02	2301-02_115	2022-09-06	2023-09-06

Moment vs. Angle



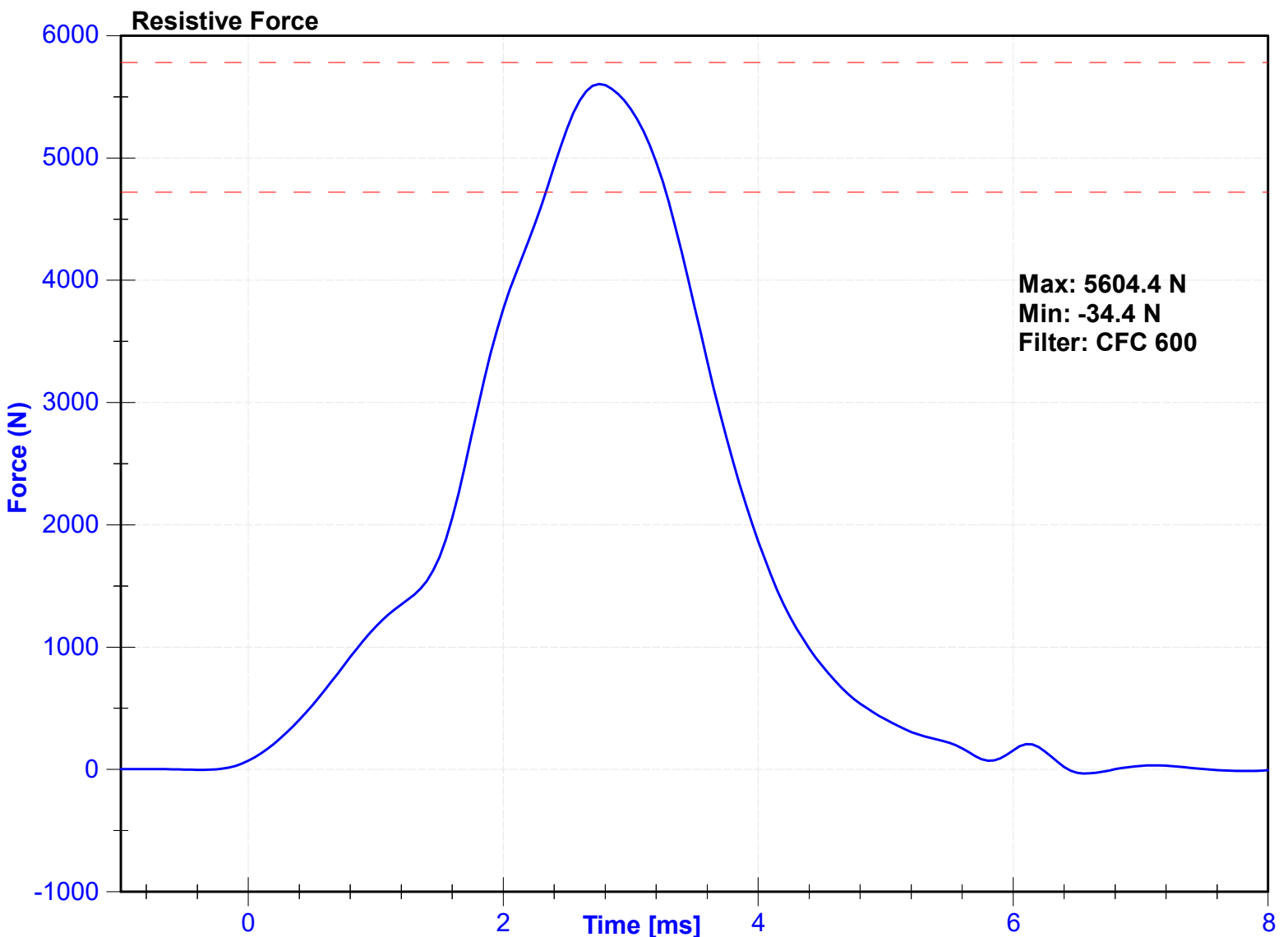
ATD Manufacturer	Humanetics	Test Technician	Z.Schneider
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

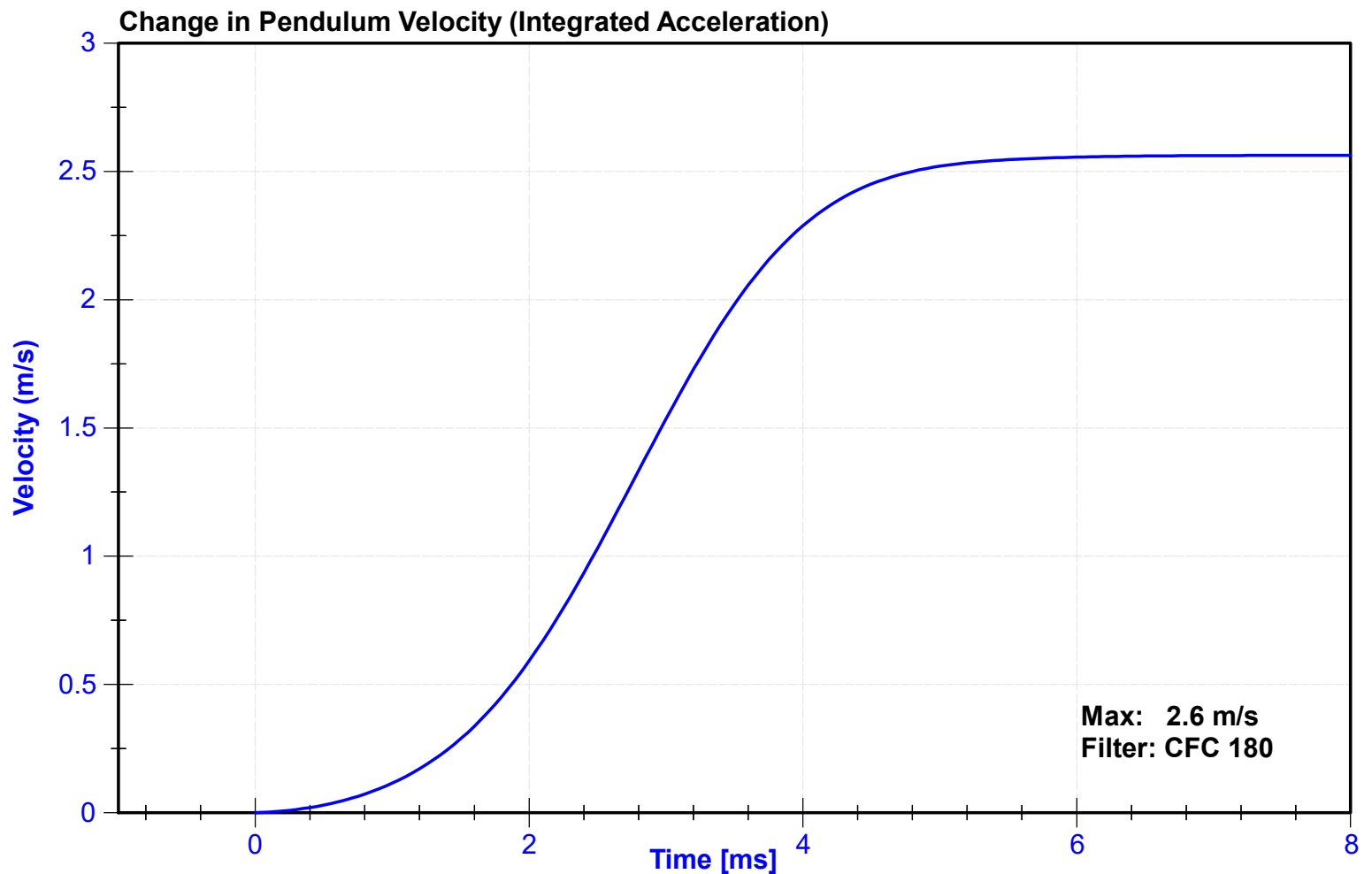
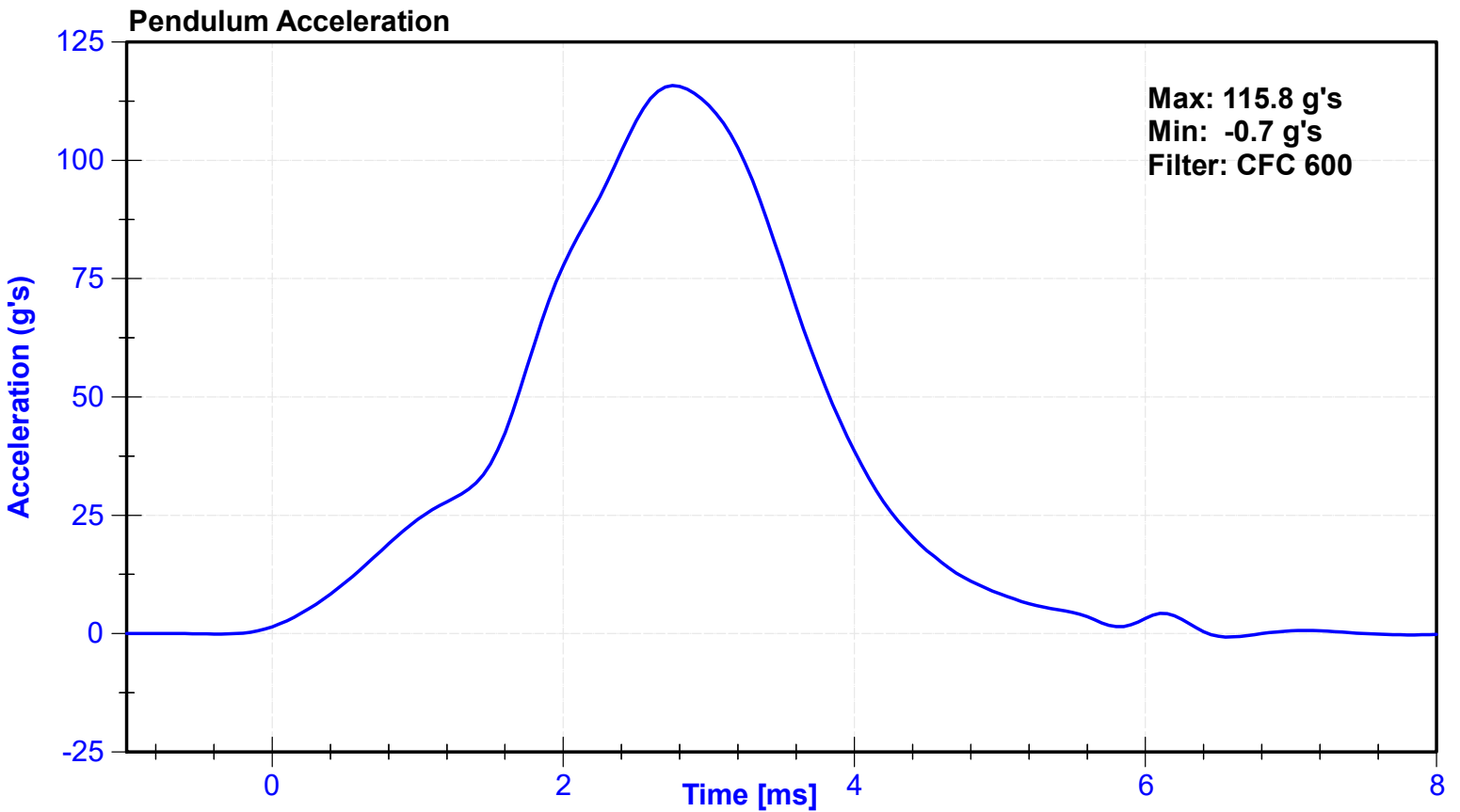
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21	Pass
Humidity	10	70	%	13	Pass
Velocity	2.07	2.13	m/s	2.073	Pass
Maximum Resistive Force	4720	5780	N	5604.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023





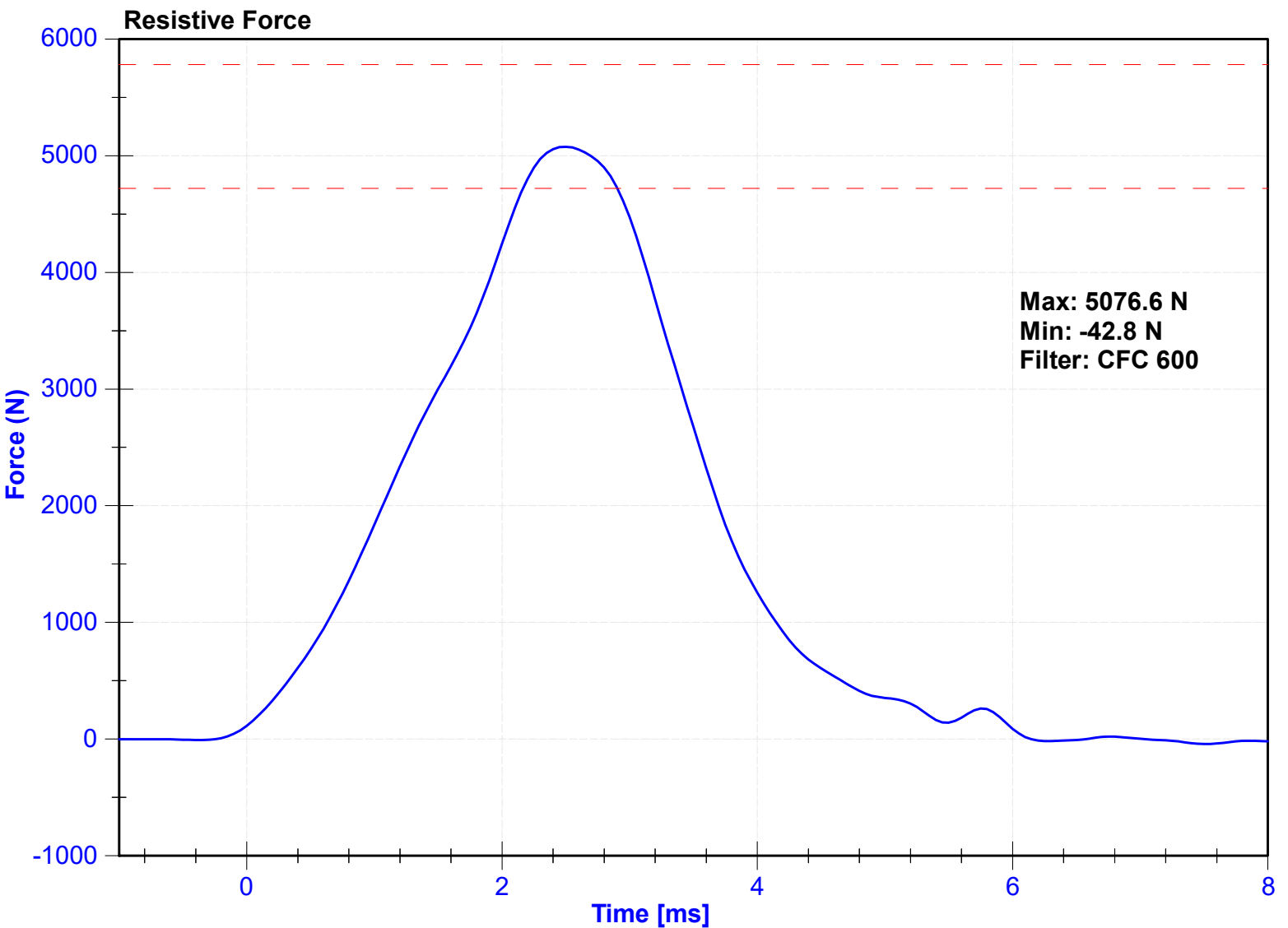
ATD Manufacturer	Humanetics	Test Technician	Z.Schneider
ATD Serial Number	142	Laboratory Supervisor	K. Brogan

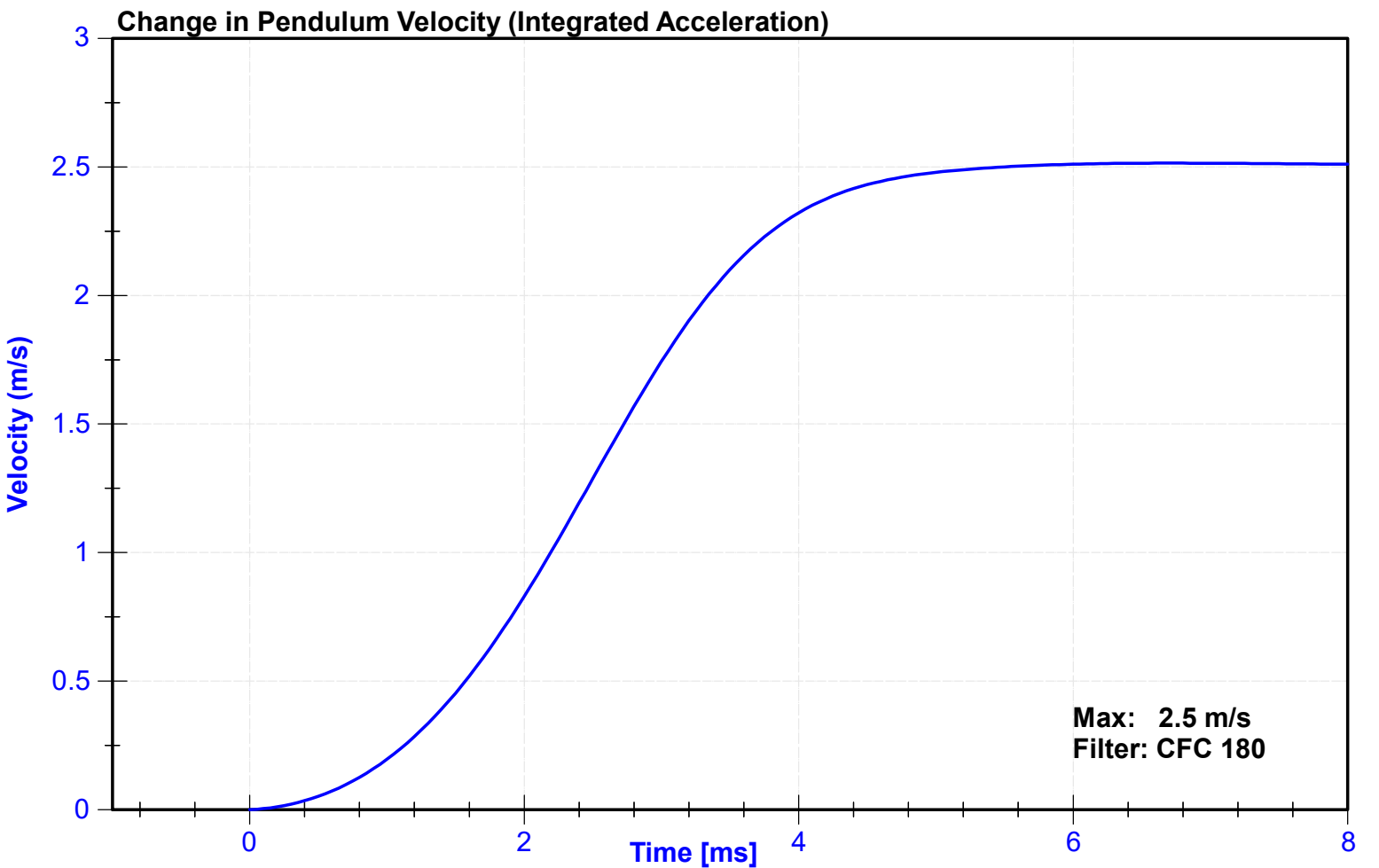
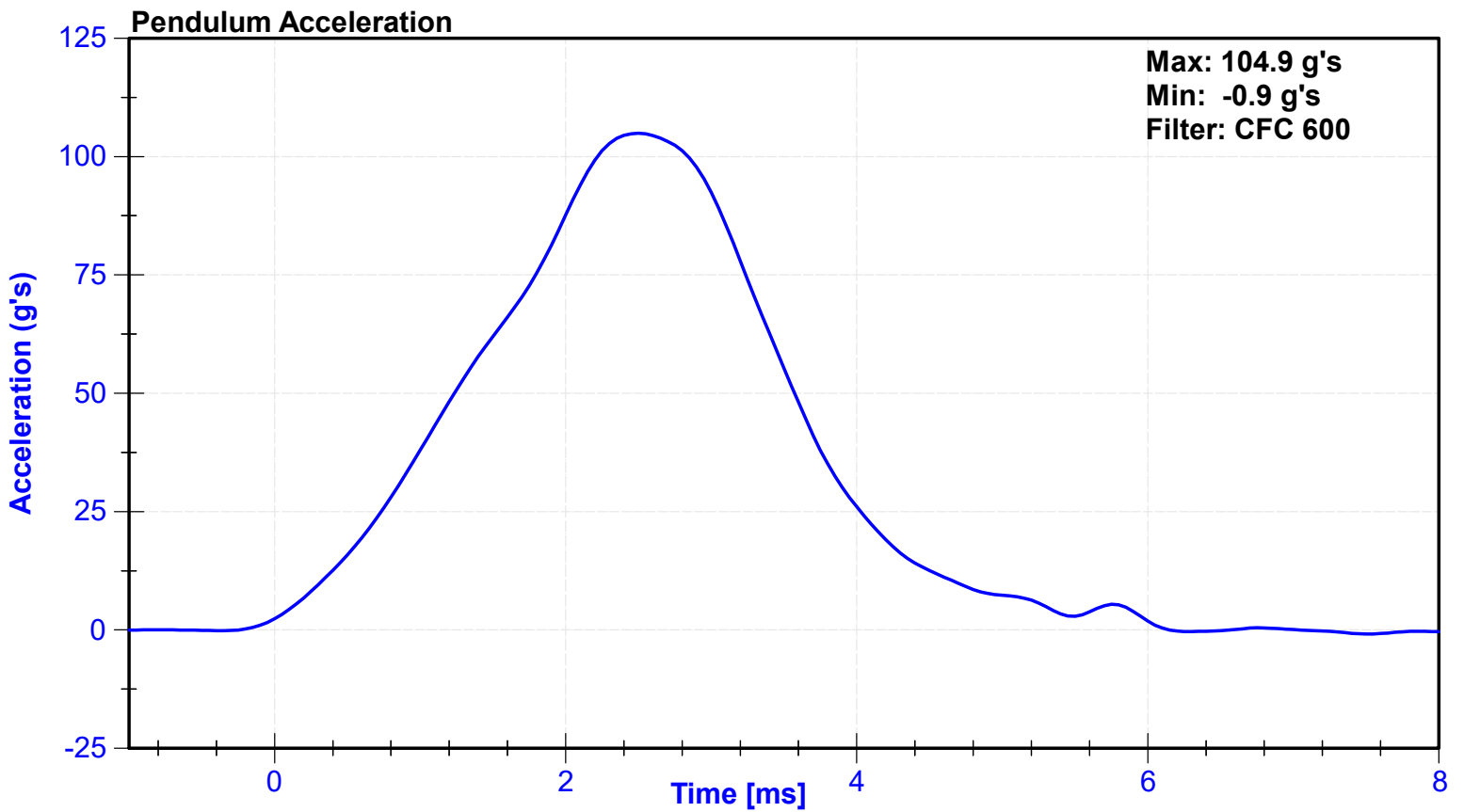
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21	Pass
Humidity	10	70	%	13	Pass
Velocity	2.07	2.13	m/s	2.072	Pass
Maximum Resistive Force	4720	5780	N	5076.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023





CALIBRATION TEST RESULTS

POST-TEST

HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

SERIAL NO: 137

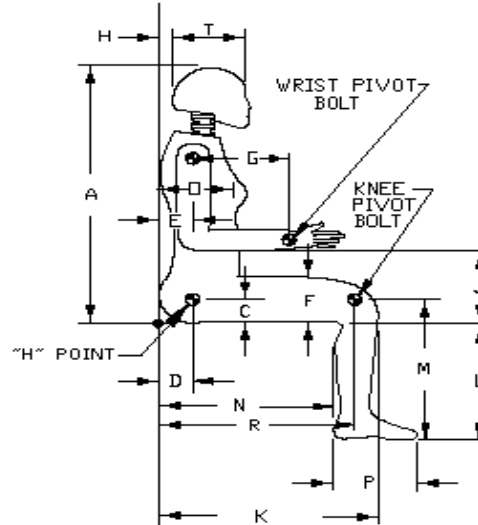
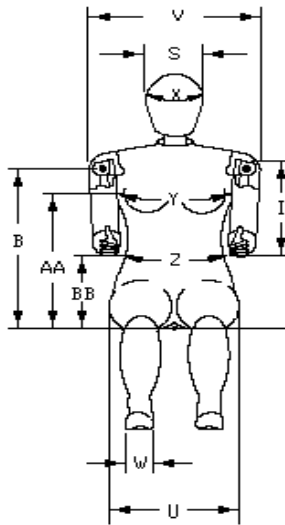


External Measurements - Hybrid 3 - 5th Female

Technician: K. Brogan

Date: 02/03/2023

Dummy Serial Number: 137



Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	775	800	787	Pass
B	Shoulder Pivot Height	432	457	445	Pass
C	H-Point Height	81	86	84	Pass
D	H-Point from Backline	145	150	146	Pass
E	Shoulder Pivot from Backline	69	84	75	Pass
F	Thigh Clearance	119	135	128	Pass
G	Back of Elbow to Wrist Pivot	244	259	251	Pass
H	Head Back to Backline	43	48	45	Pass
I	Shoulder to Elbow Length	277	297	286	Pass
J	Elbow Rest Height	183	203	195	Pass
K	Buttock to Knee Length	521	546	536	Pass
L	Popliteal Height	356	376	368	Pass
M	Knee Pivot Height	394	419	407	Pass
N	Buttock Popliteal Length	414	439	426	Pass
O	Chest Depth without Jacket	175	191	182	Pass
P	Foot Length (right)	219	234	230	Pass
R	Buttock To Knee Pivot Length	457	483	465	Pass
S	Head Breadth	137	147	143	Pass
T	Head Depth	178	188	181	Pass
U	Hip Breadth	300	315	311	Pass
V	Shoulder Breadth	351	366	359	Pass
W	Foot Breadth	79	94	85	Pass
X	Head Circumference	528	549	543	Pass
Y	Chest Circumference with Jacket	851	881	872	Pass
Z	Waist Circumference	460	790	652	Pass
AA	Reference Location (Chest Circumference)	333	358	345	Pass
BB	Reference Location (Waist Circumference)	160	170	165	Pass

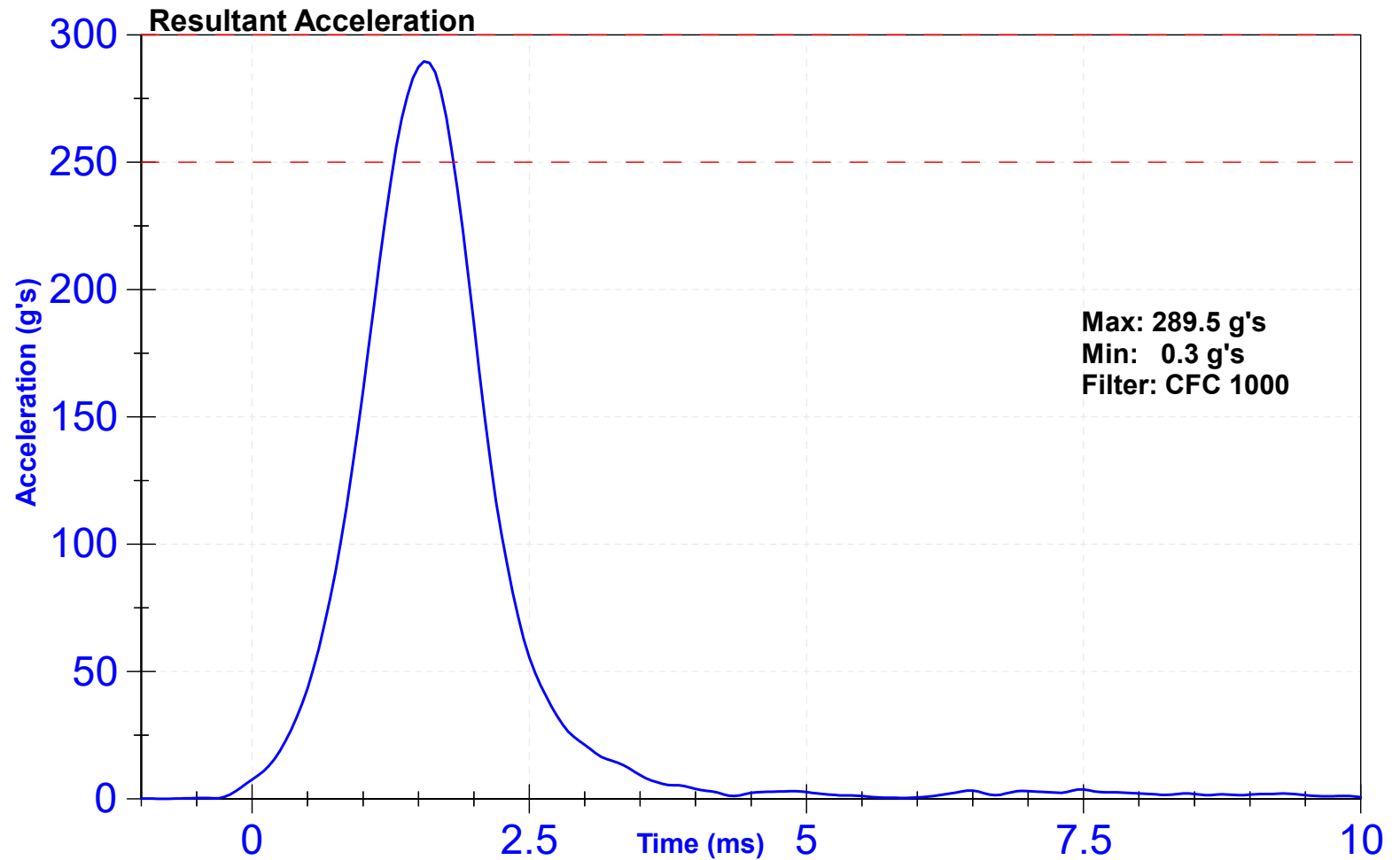
ATD Manufacturer	Humanetics	Test Technician	T. Roseman
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

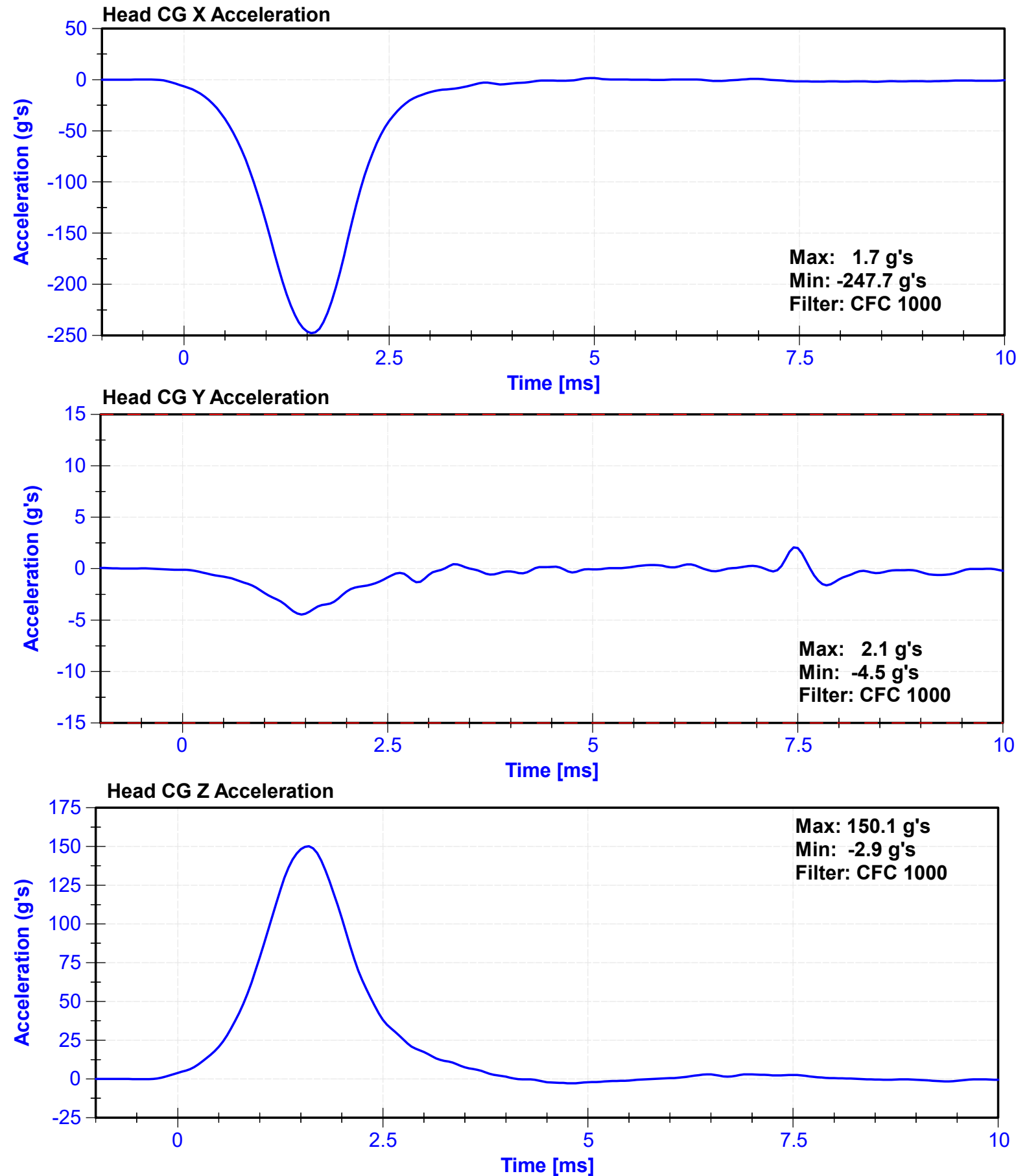
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21.1	Pass
Humidity	10	70	%	13.2	Pass
Resultant Acceleration	250	300	g's	289.5	Pass
Oscillation	0	10	%	1.2	Pass
Lateral Acceleration	-15	15	g's	-4.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P79417	12/13/2022	6/11/2023
Y Accelerometer	Endevco	P83335	12/13/2022	6/11/2023
Z Accelerometer	Endevco	P64149	12/12/2022	6/10/2023





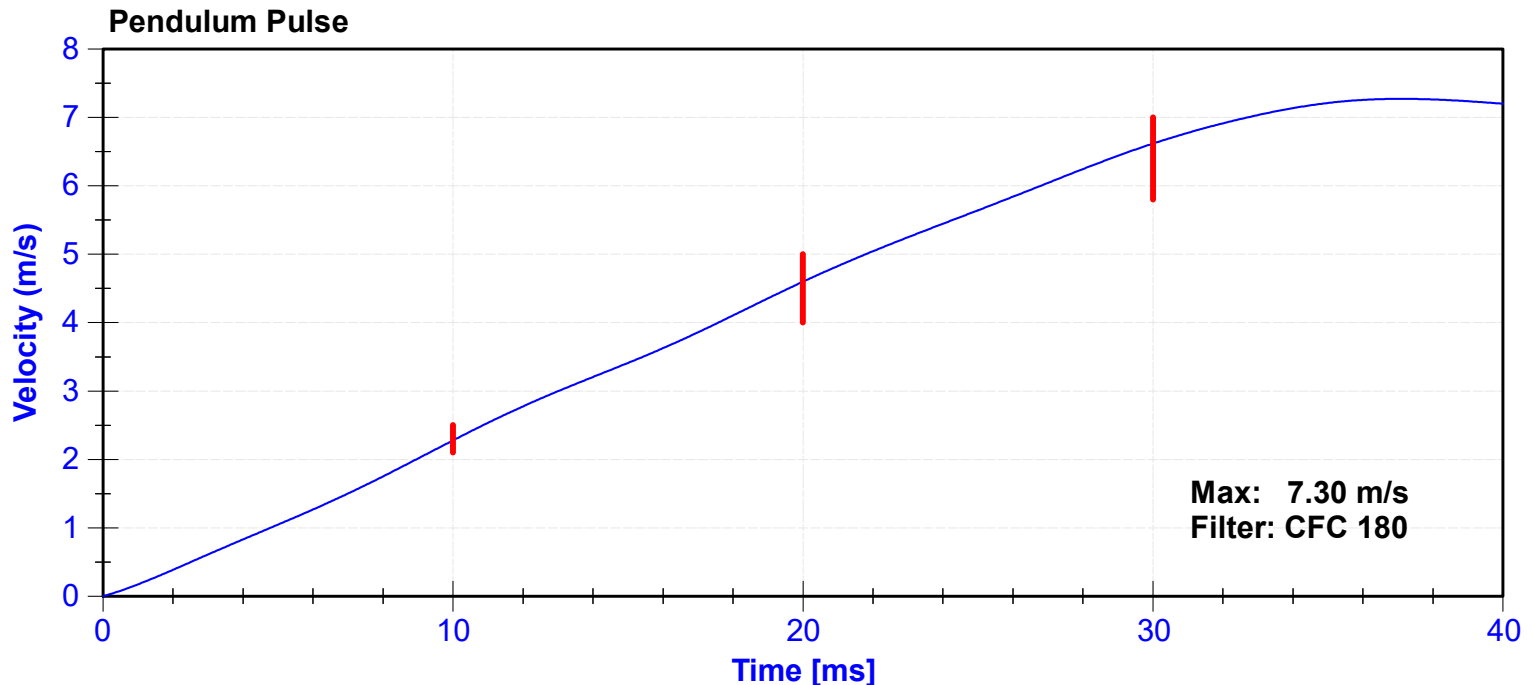
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

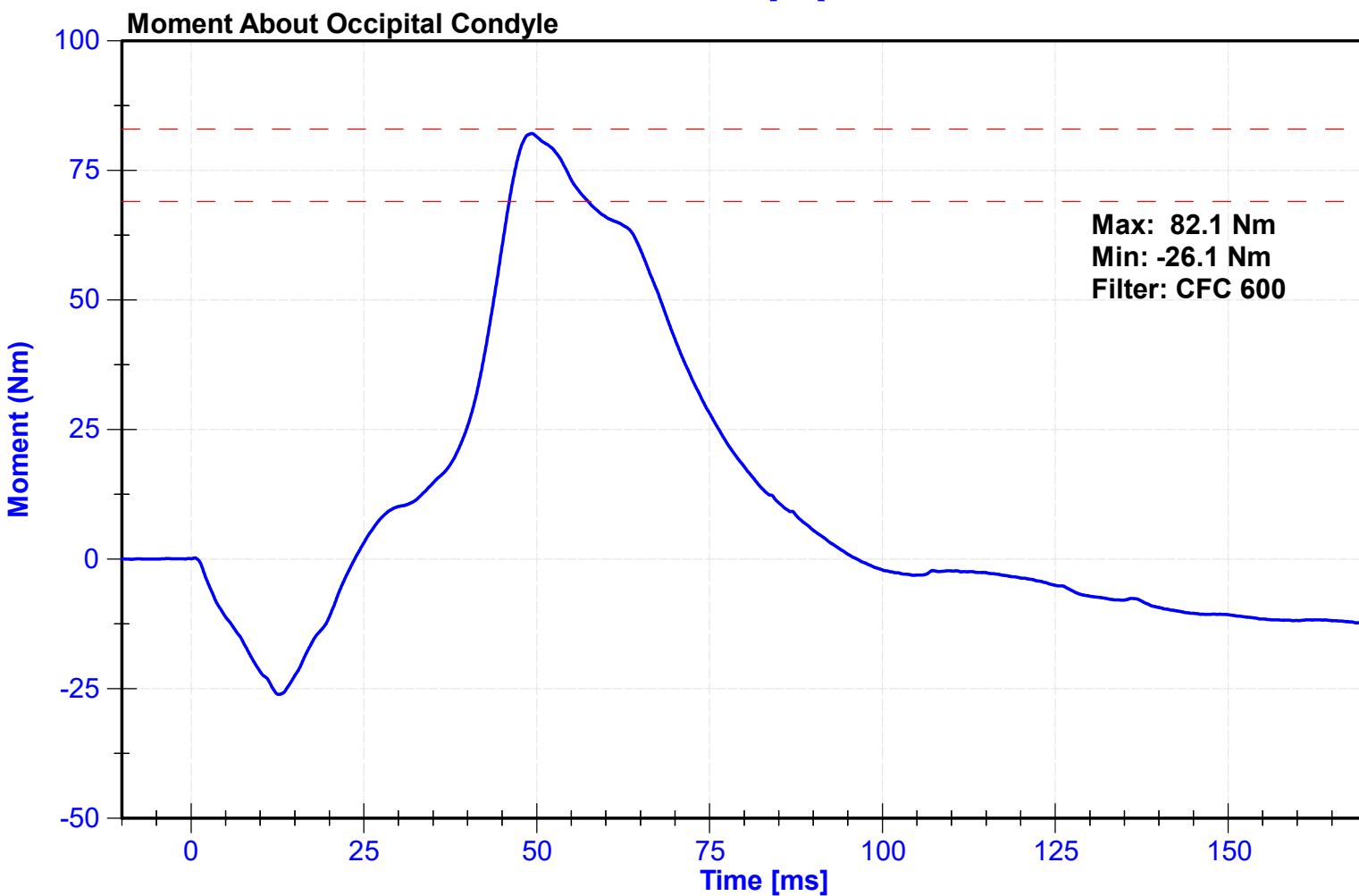
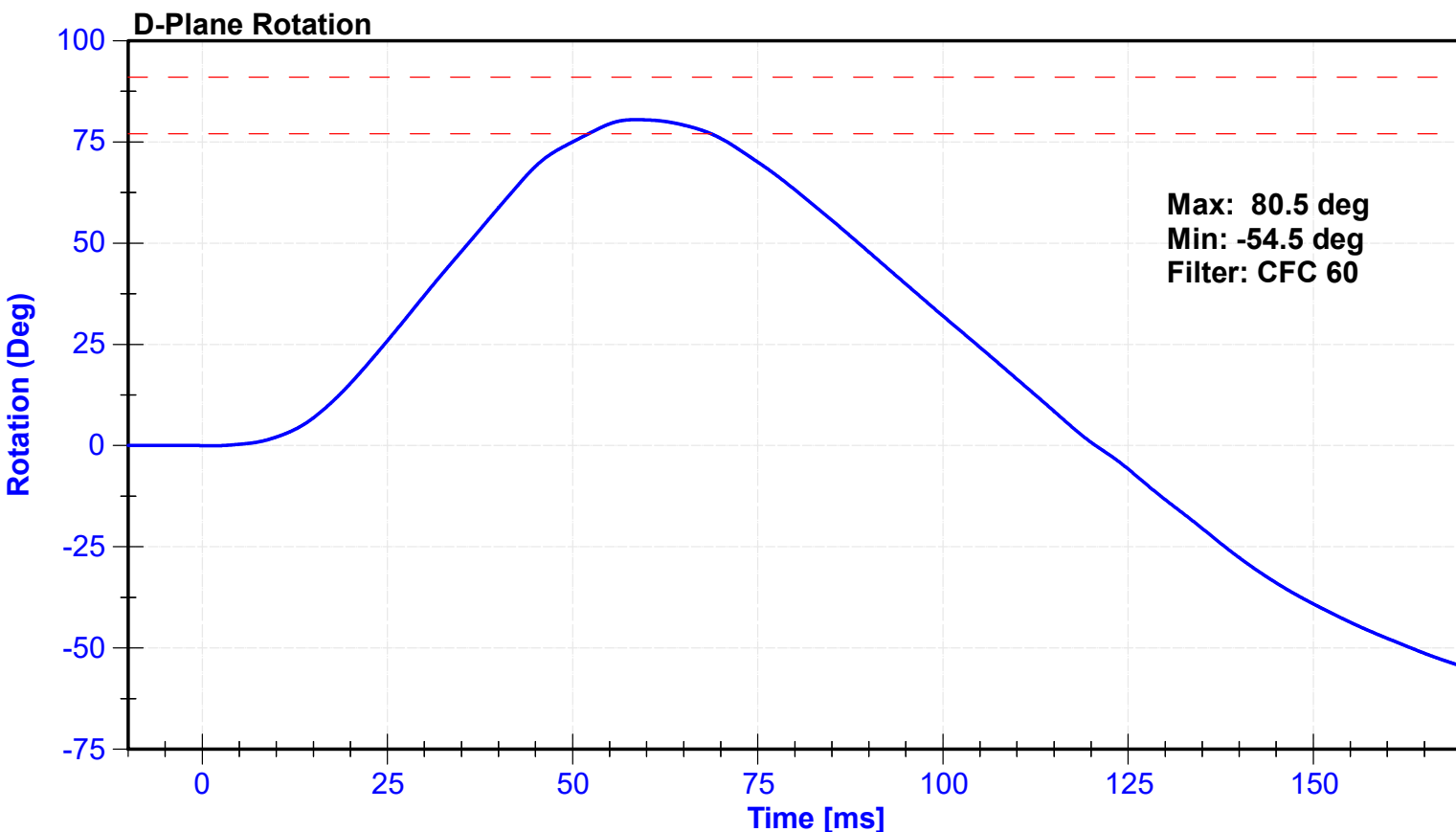
Results

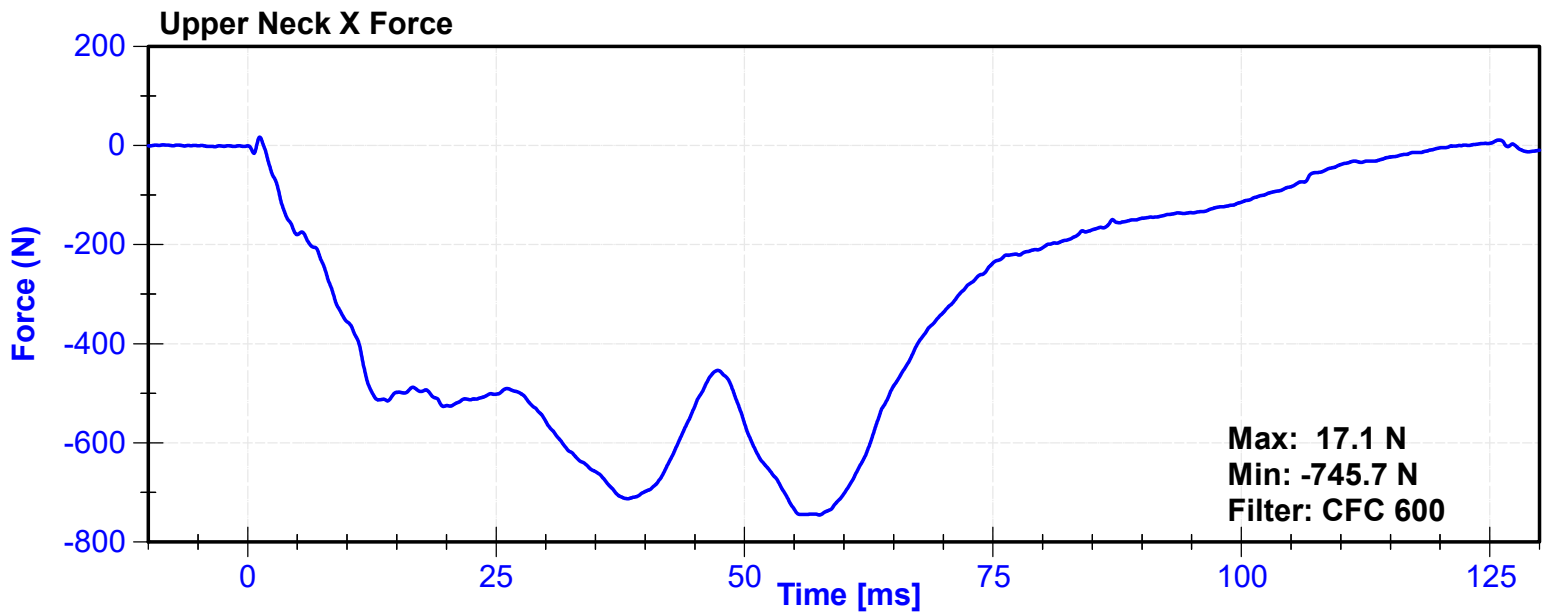
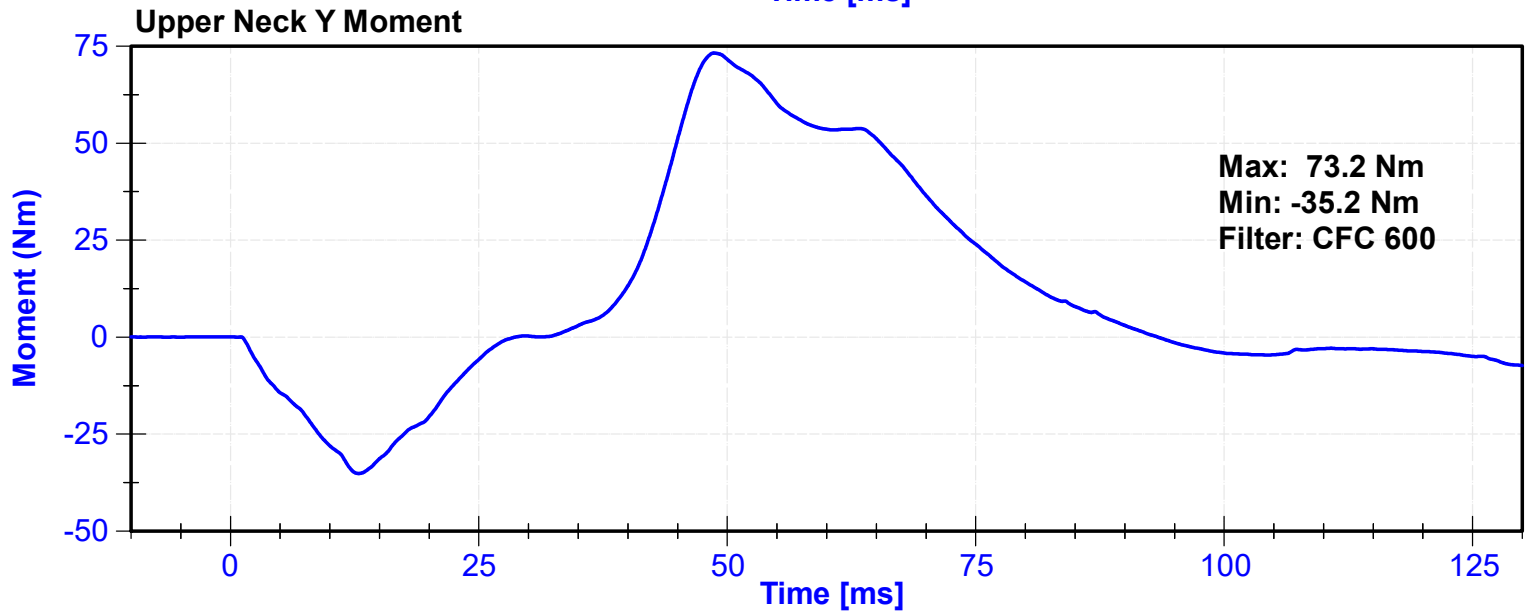
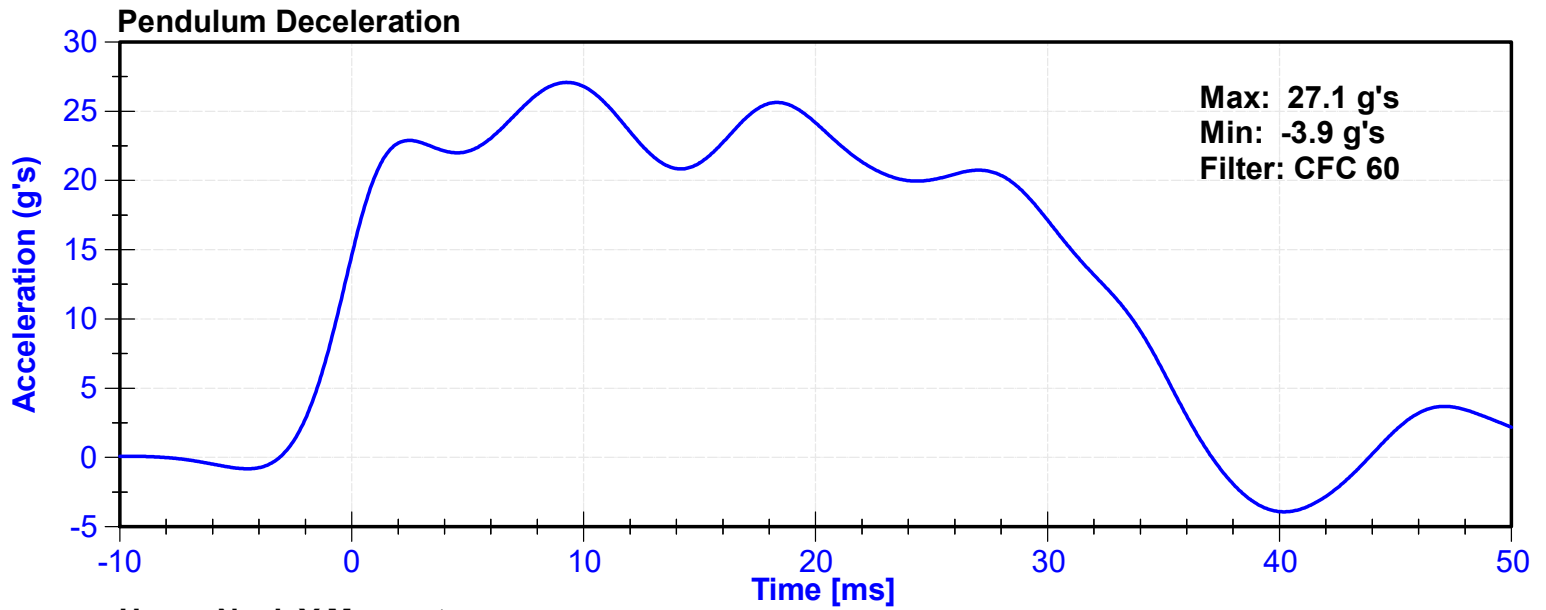
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	13.5	Pass
Velocity	6.89	7.13	m/s	7.038	Pass
Pendulum Impulse at 10ms	2.1	2.5	m/s	2.28	Pass
Pendulum Impulse at 20ms	4.0	5.0	m/s	4.60	Pass
Pendulum Impulse at 30ms	5.8	7.0	m/s	6.62	Pass
Max D Plane Rotation	77	91	deg	80.5	Pass
Max Moment During Rotation Interval	69	83	Nm	82.1	Pass
Moment Decay to 10.0 Nm	80	100	ms	85.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	7231C-750	10/26/2022	10/26/2023
Pendulum Potentiometer	ETI	LABPOT1	5/9/2022	5/9/2023
Condyle Potentiometer	ETI	LABPOT2	5/9/2022	5/9/2023
Upper Neck Load Cell	Humanetics	1916-FX	6/10/2022	6/10/2023







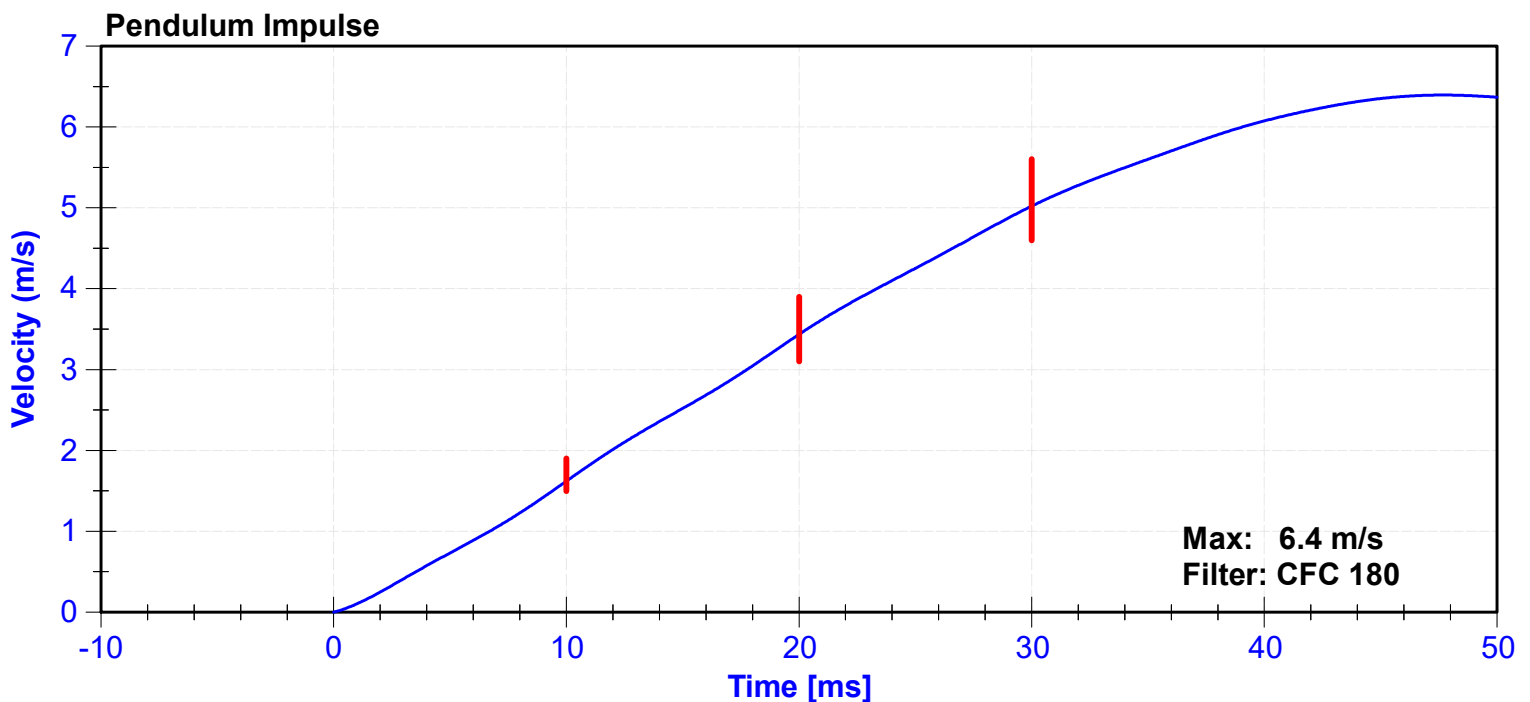
ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

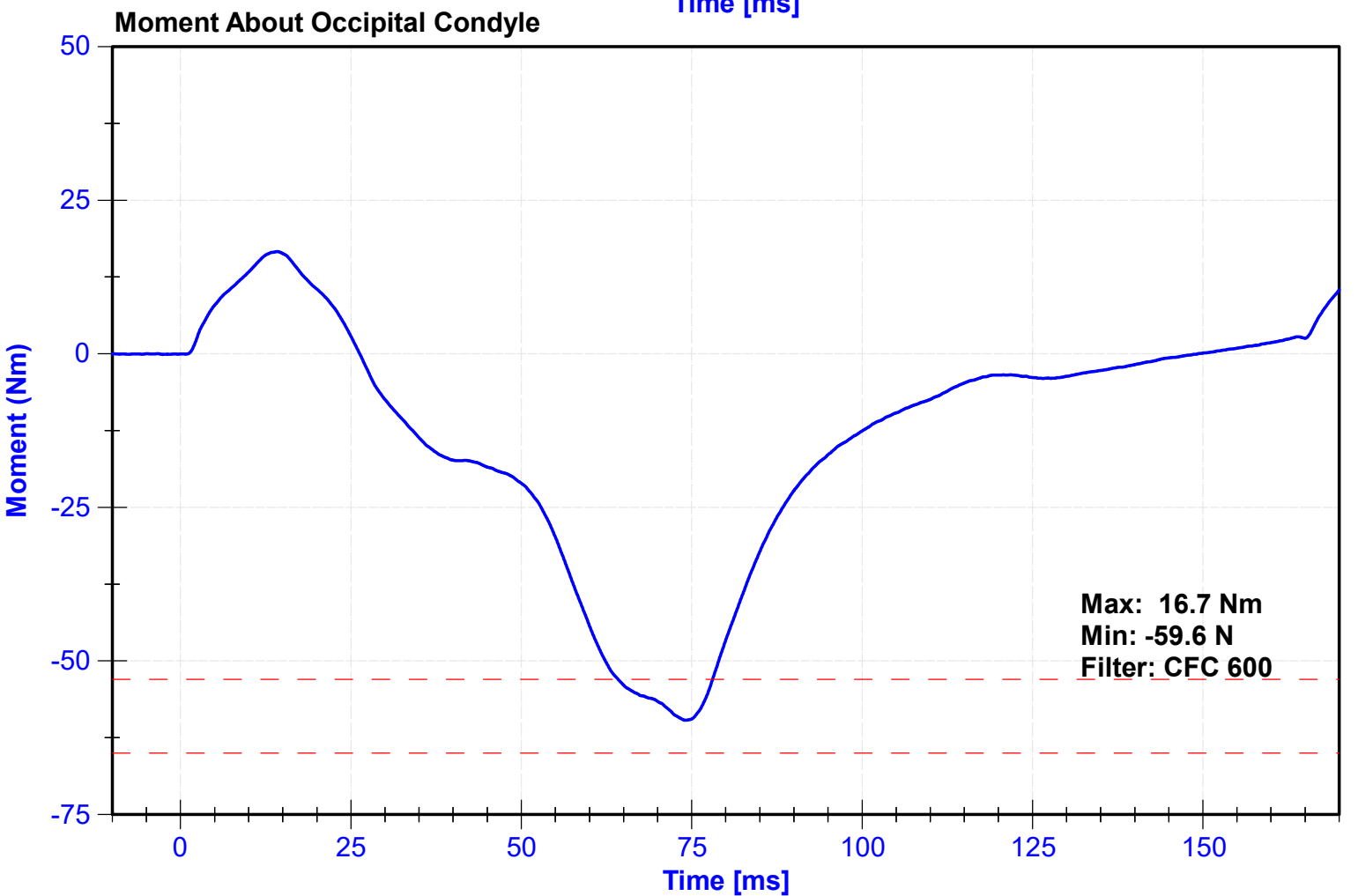
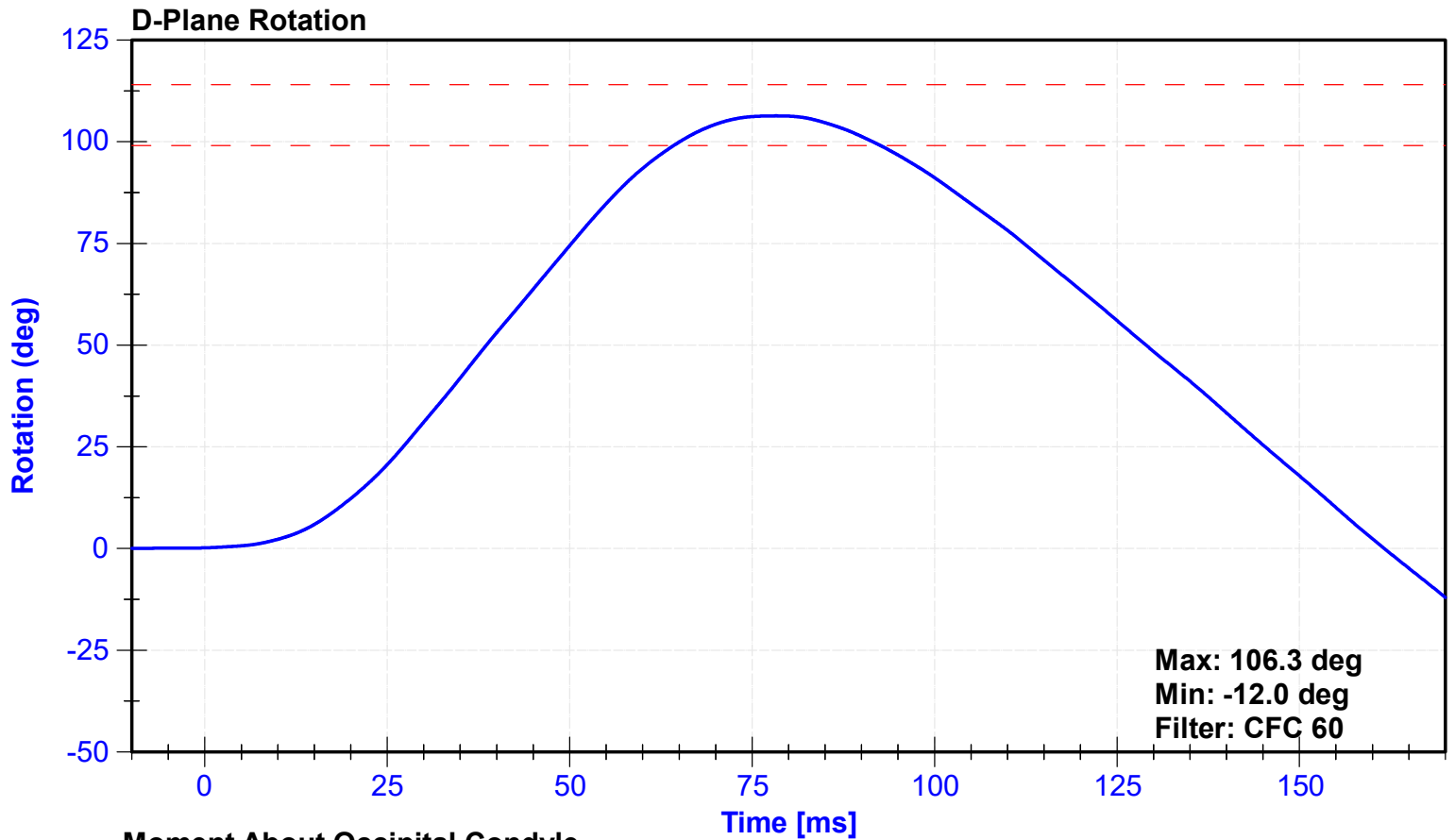
Results

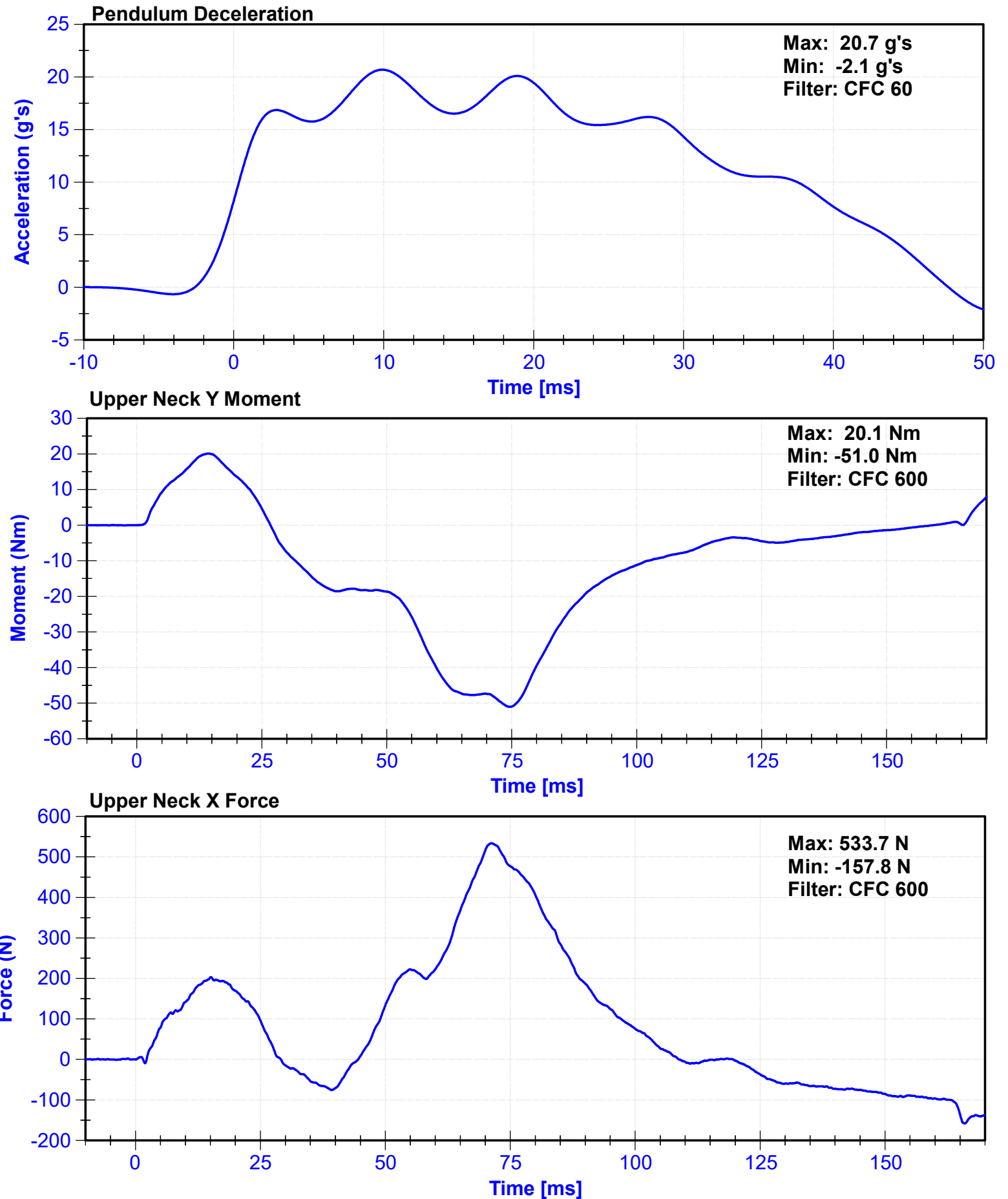
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	13.5	Pass
Velocity	5.95	6.19	m/s	6.122	Pass
Pendulum Impulse at 10ms	1.5	1.9	m/s	1.62	Pass
Pendulum Impulse at 20ms	3.1	3.9	m/s	3.44	Pass
Pendulum Impulse at 30ms	4.6	5.6	m/s	5.02	Pass
D Plane Rotation	99	114	deg	106.3	Pass
Moment During Rotation Interval	-65	-53	Nm	-59.6	Pass
Moment Decay to -10Nm	94	114	ms	104.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum Potentiometer	ETI	LABPOT1	5/9/2022	5/9/2023
Condyle Potentiometer	ETI	LABPOT2	5/9/2022	5/9/2023
Upper Neck Load Cell	Humanetics	1916-FX	6/10/2022	6/10/2023



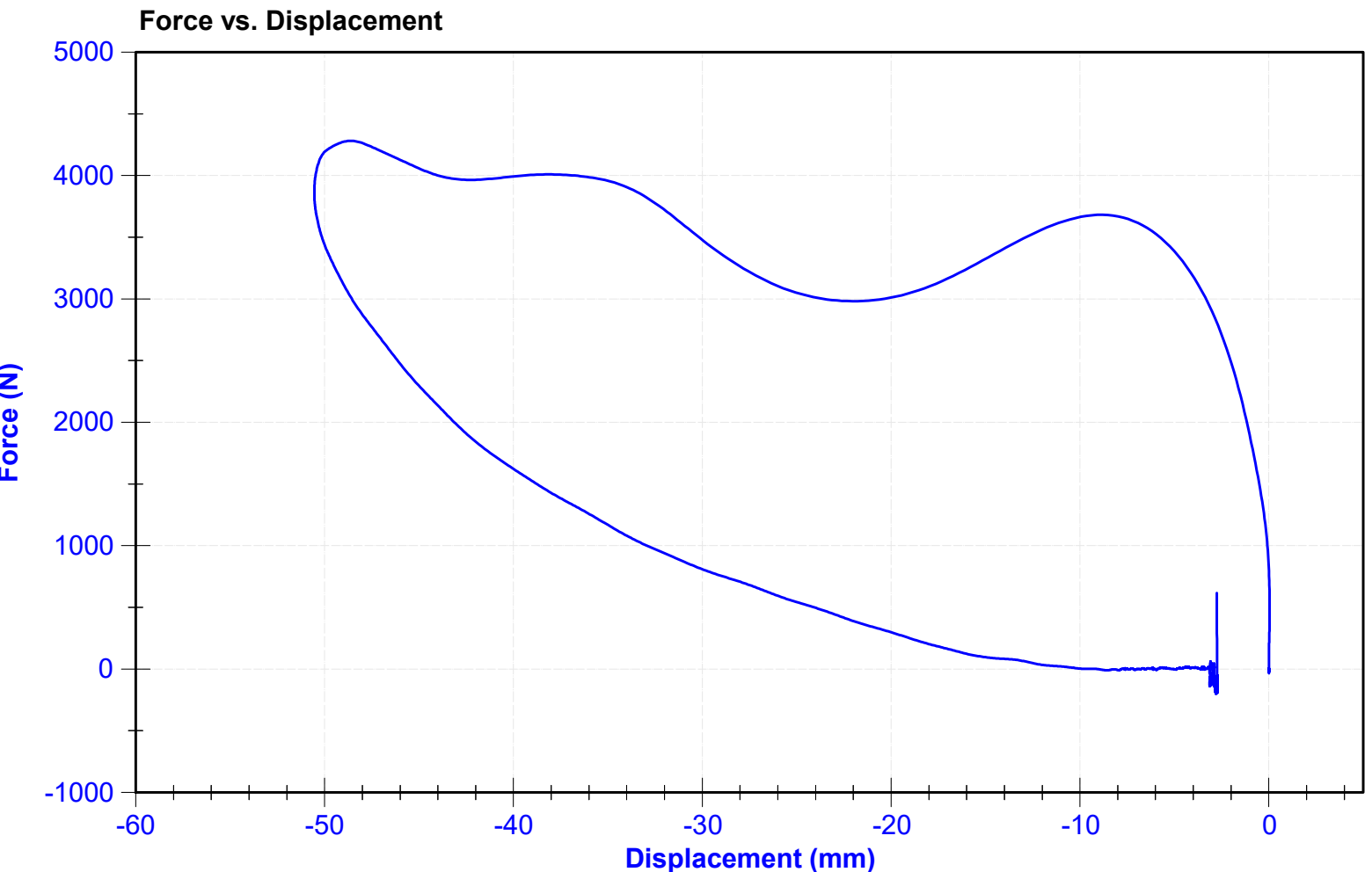


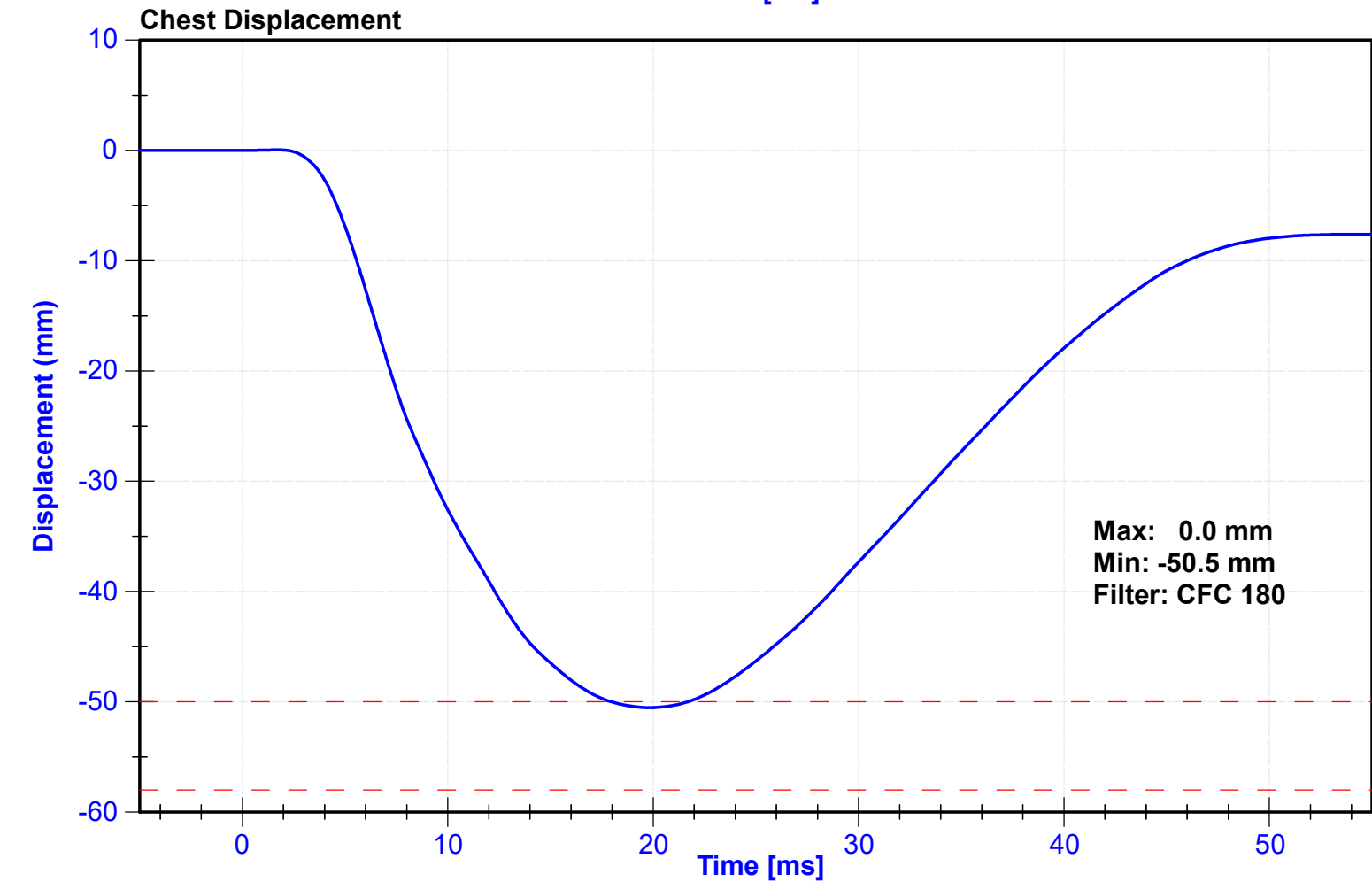
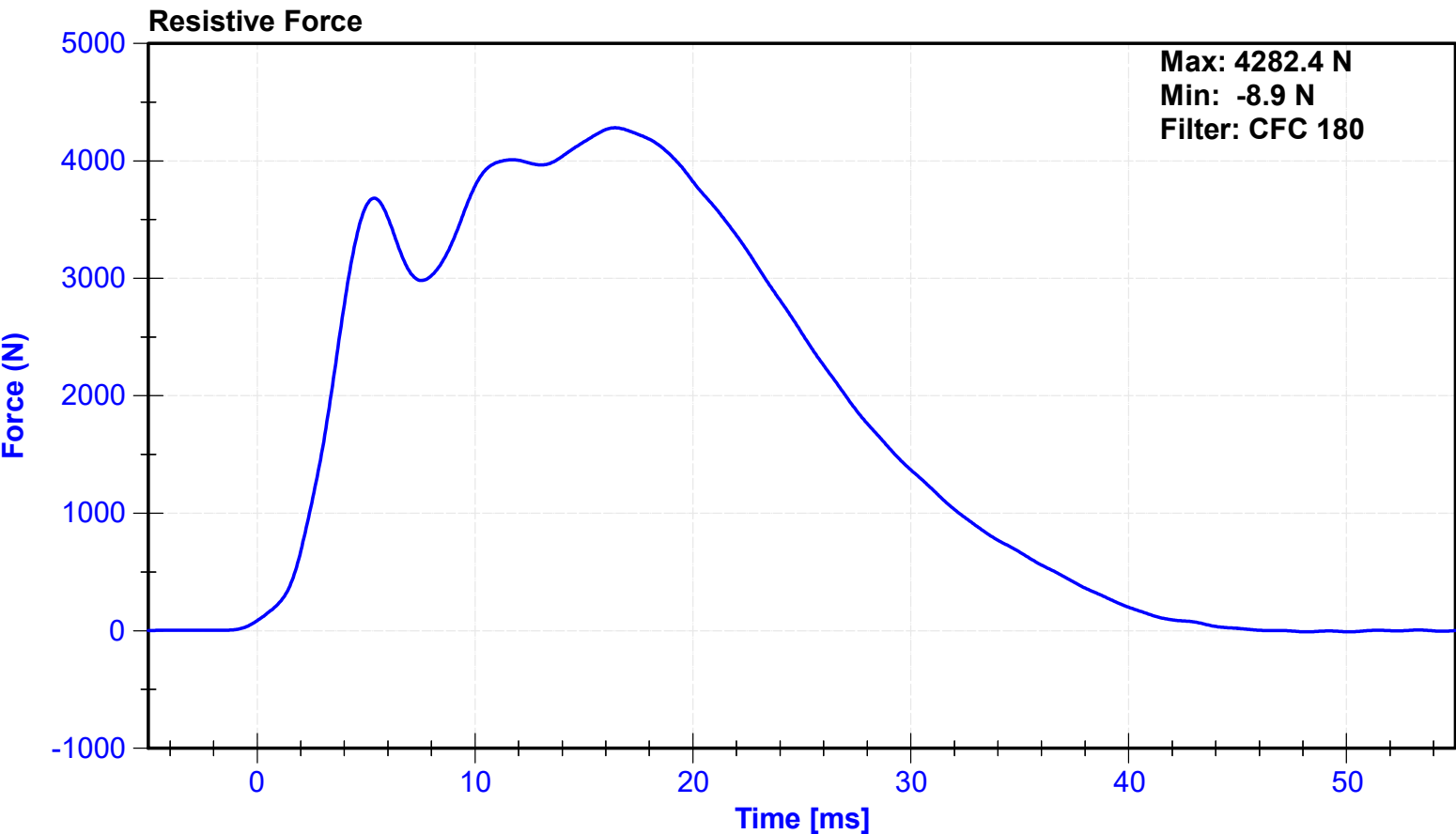


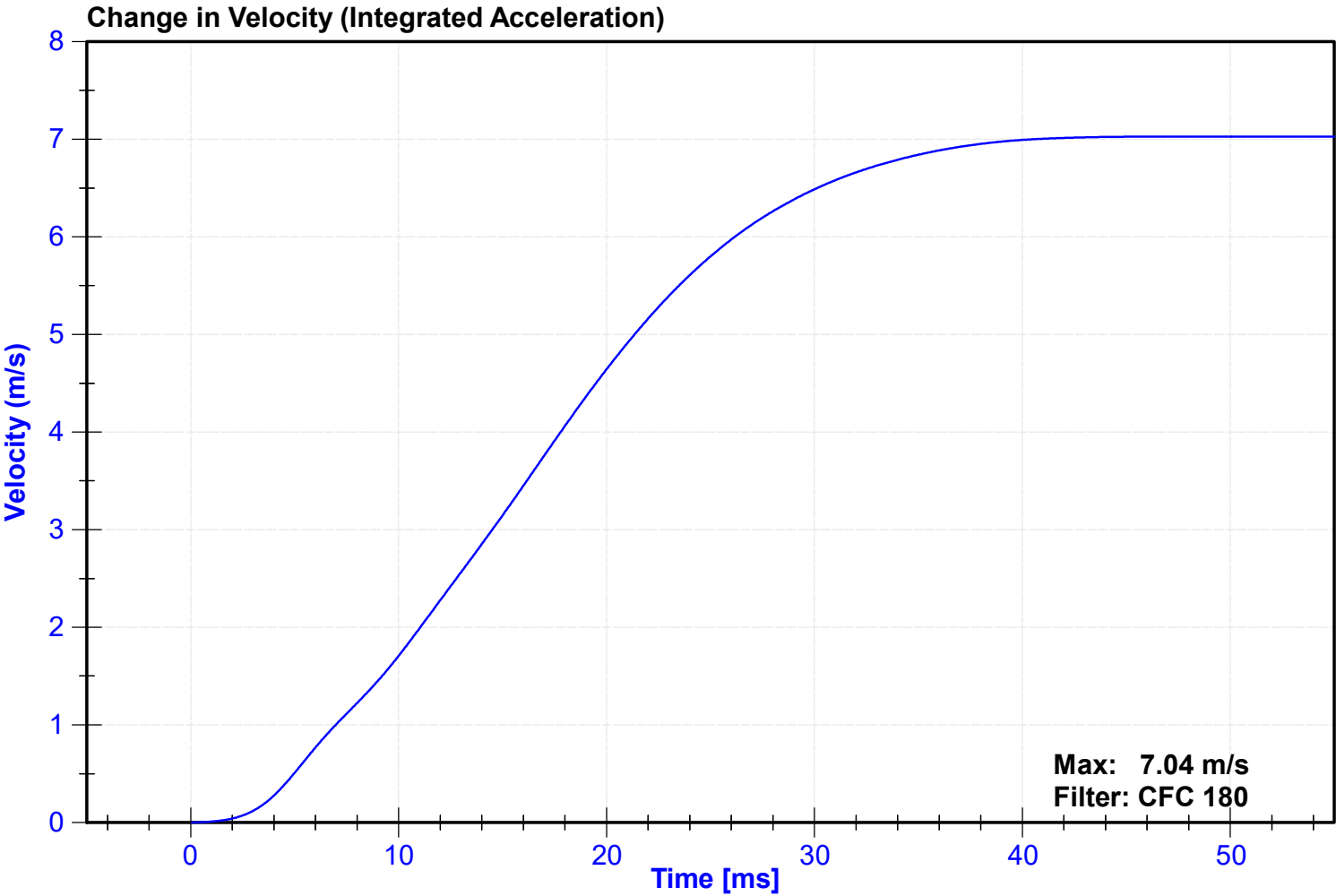
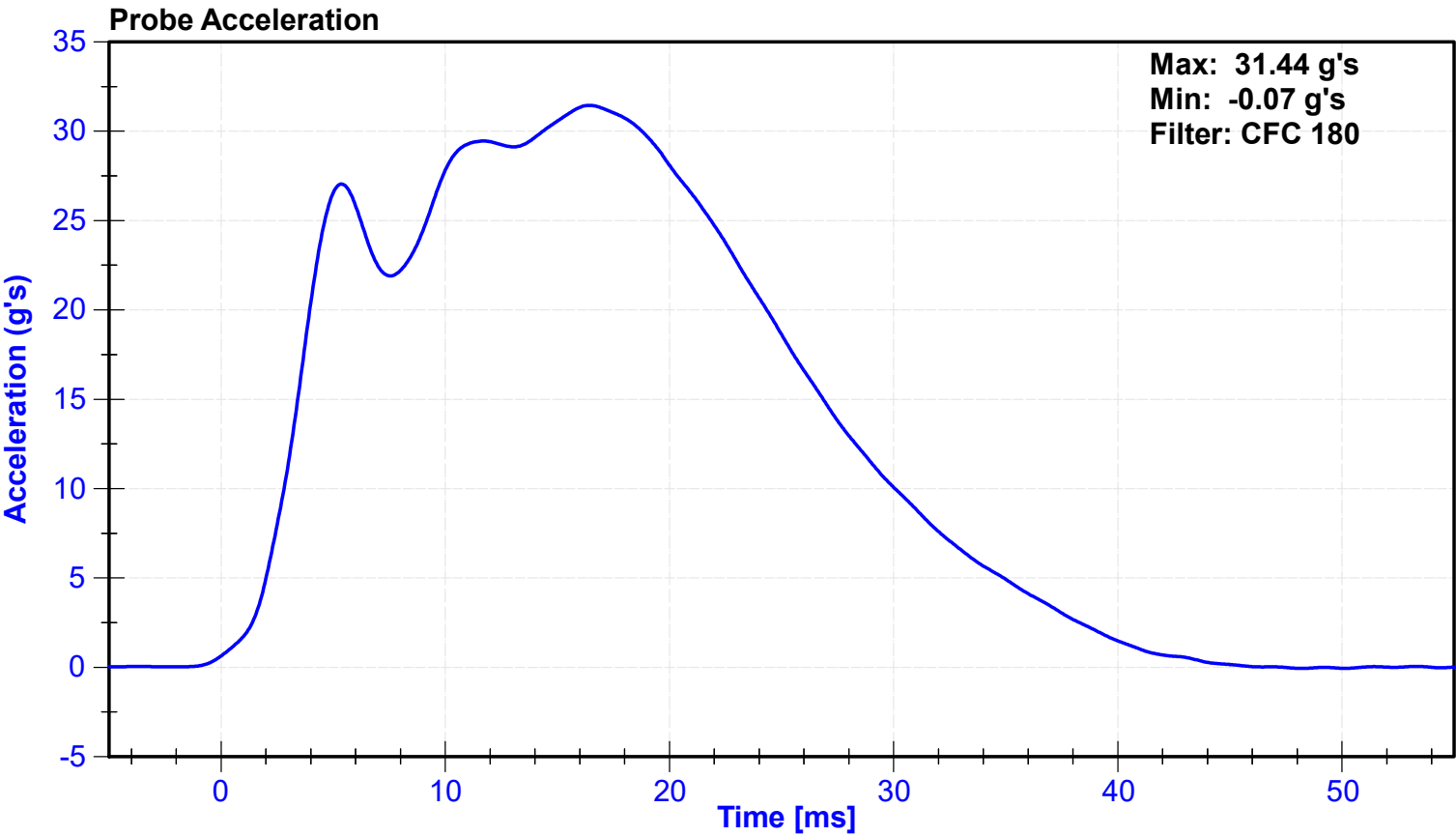
ATD Manufacturer	Humanetics	Test Technician	D. Kroll
ATD Serial Number	137	Laboratory Supervisor	C. Mantell

Test Parameter	Results		Unit	Result	Pass/Fail
	Minimum Specification	Maximum Specification			
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	27	Pass
Velocity	6.59	6.83	m/s	6.719	Pass
Chest Deflection	-58	-50	mm	-50.5	Pass
Maximum Resistive Force (50 to 58mm)	3900	4400	N	4194.3	Pass
Maximum Resistive Force (18 to 50mm)	0	4600	N	4282.4	Pass
Hysteresis	69	85	%	75.1	Pass

Transducer Calibrations				
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023
Chest Potentiometer	Servo	0720	12/12/2022	6/12/2023







ATD Manufacturer	Humanetics	Test Technician	D. Sakona
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

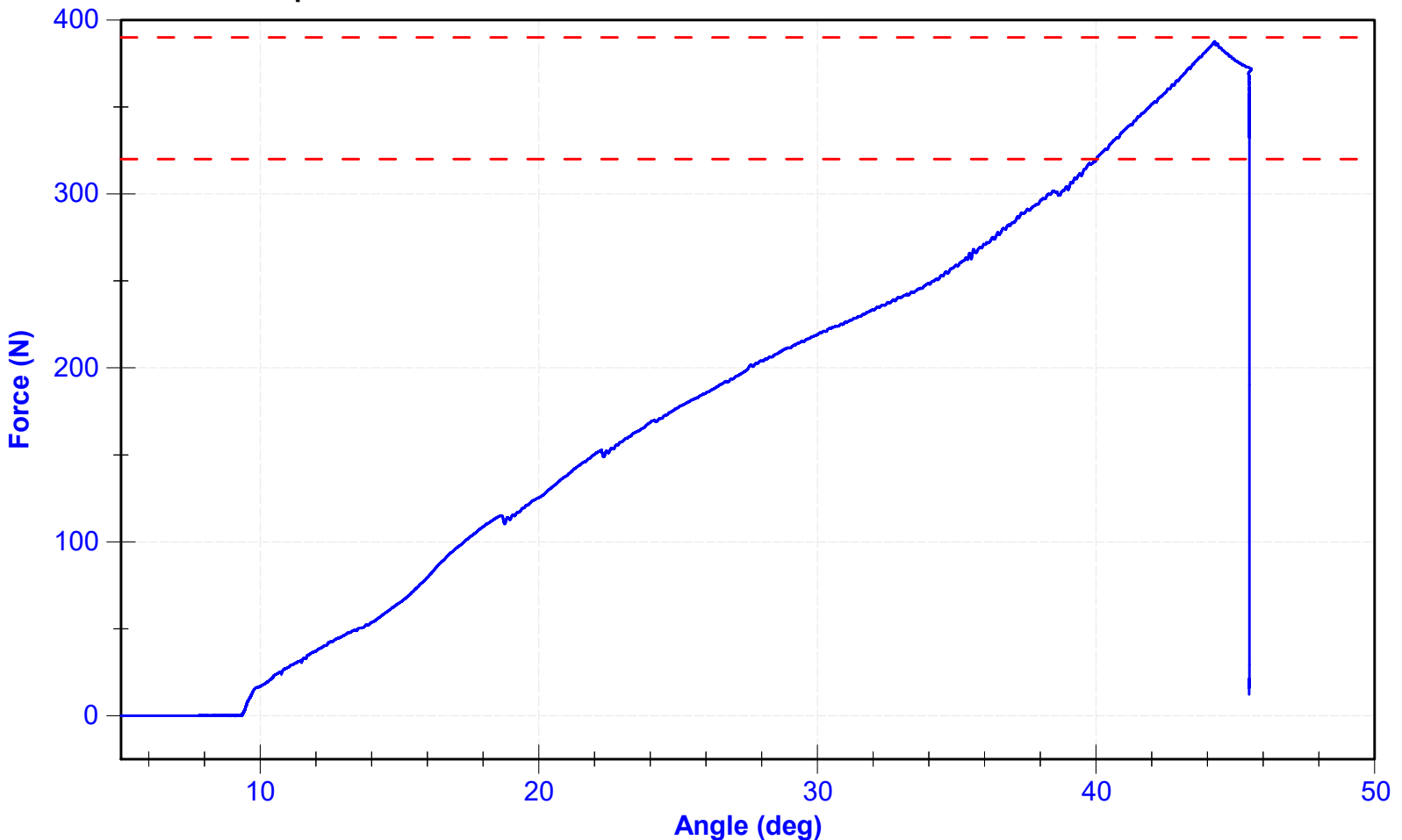
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.6	25.6	°C	21.4	Pass
Humidity	10	70	%	13,5	Pass
Initial Angle	0	20	deg	8.4	Pass
Force at 45 Degrees	320	390	N	387.7	Pass
Return Angle Relative to Initial	0	8	deg	2.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Potentiometer	Rieker	DS-1905226	2022-11-09	2023-11-09
Load Cell	Interface	1134516	2022-09-27	2023-09-27

Force vs. Displacement



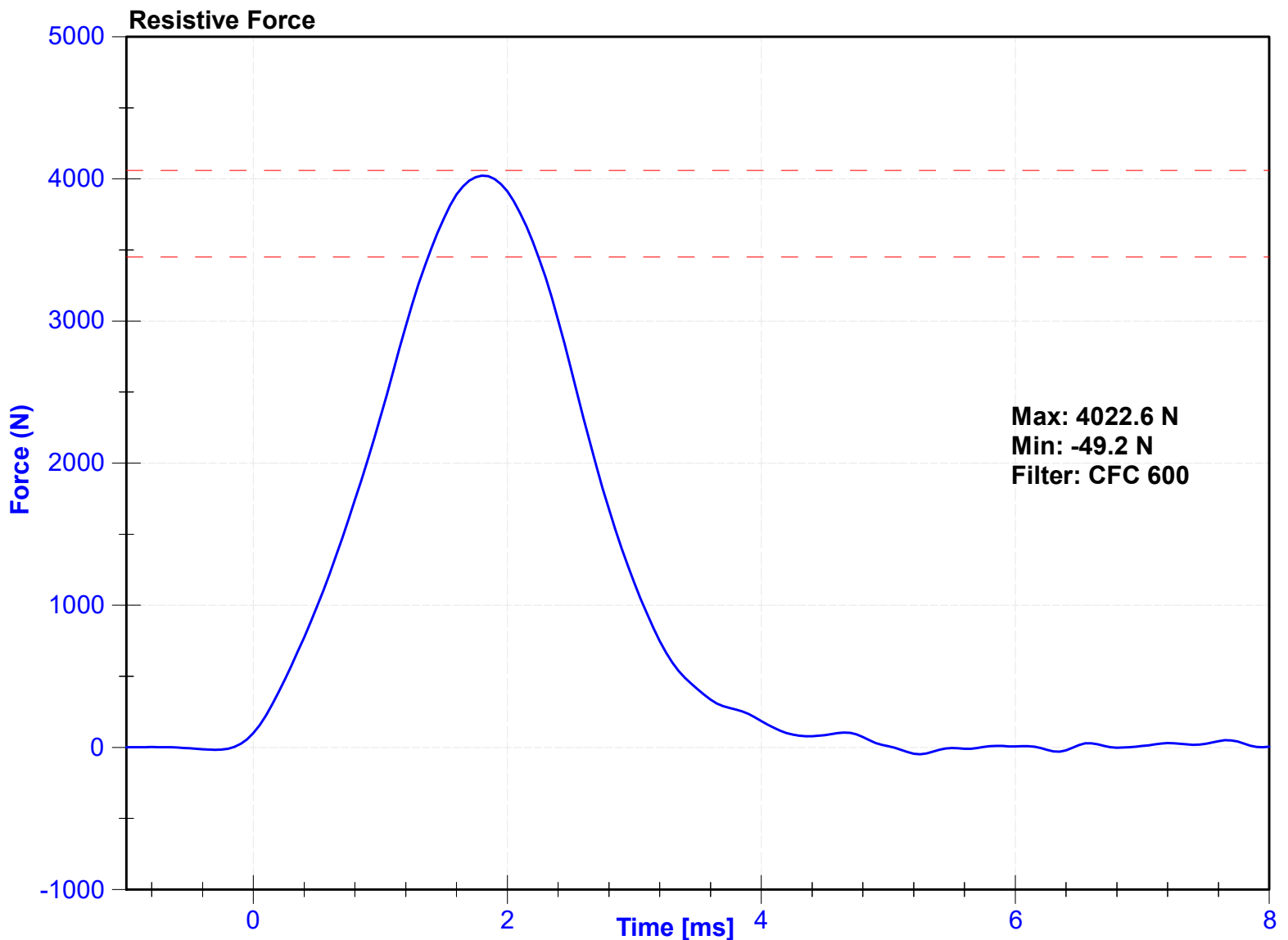
ATD Manufacturer	Humanetics	Test Technician	Z.Schneider
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

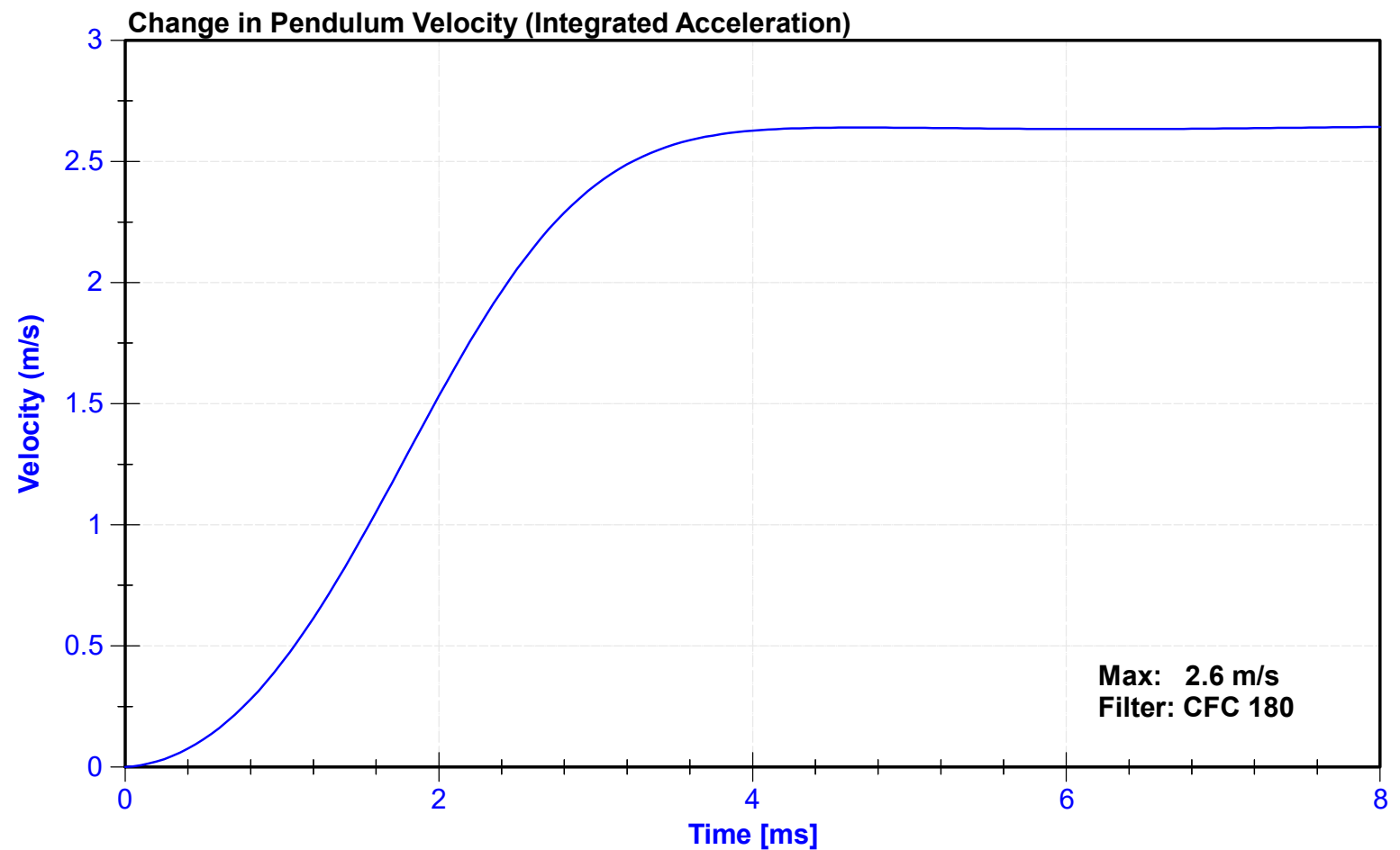
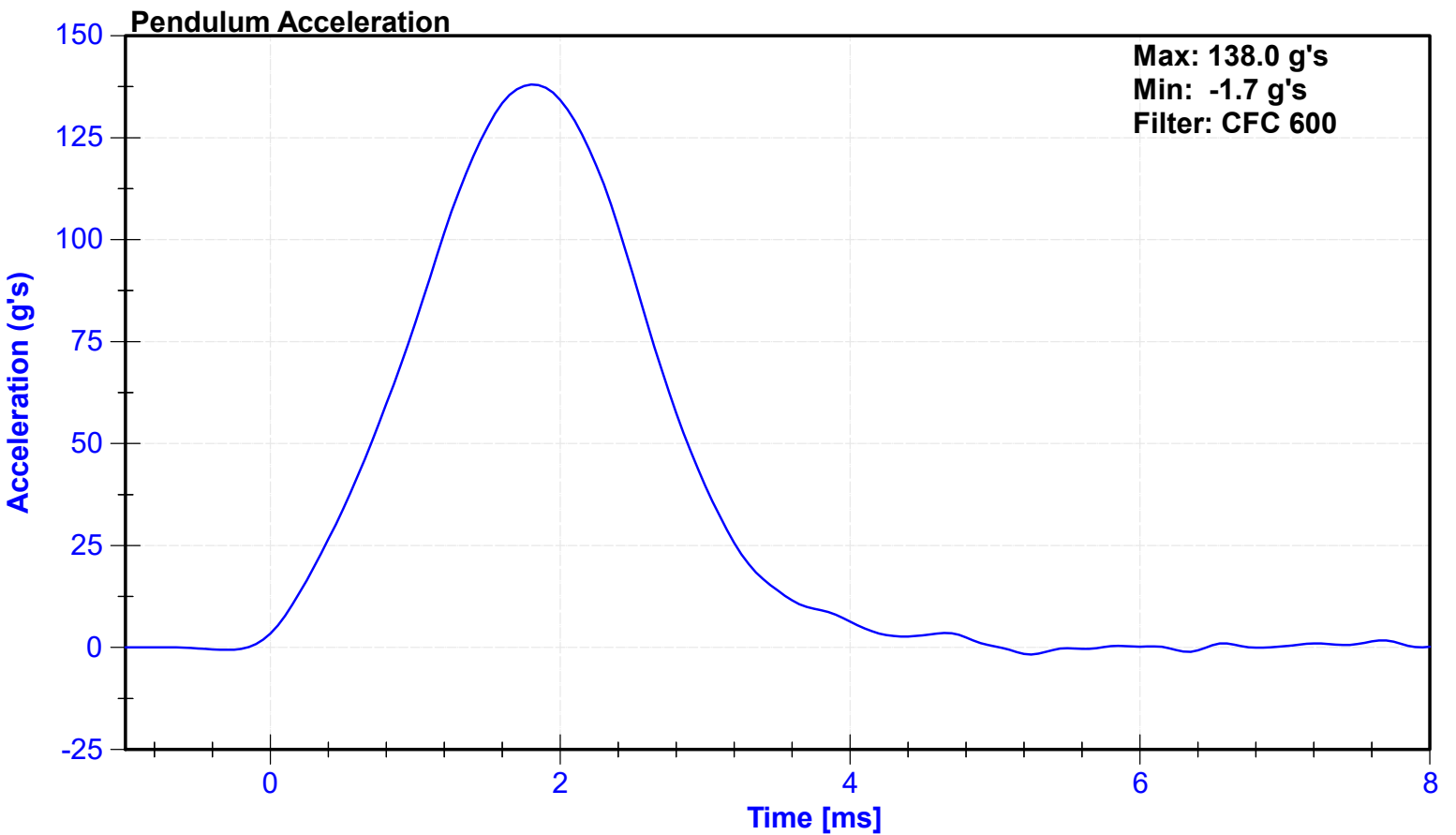
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21	Pass
Humidity	10	70	%	13	Pass
Velocity	2.07	2.13	m/s	2.074	Pass
Resistive Force	3450	4060	N	4022.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023





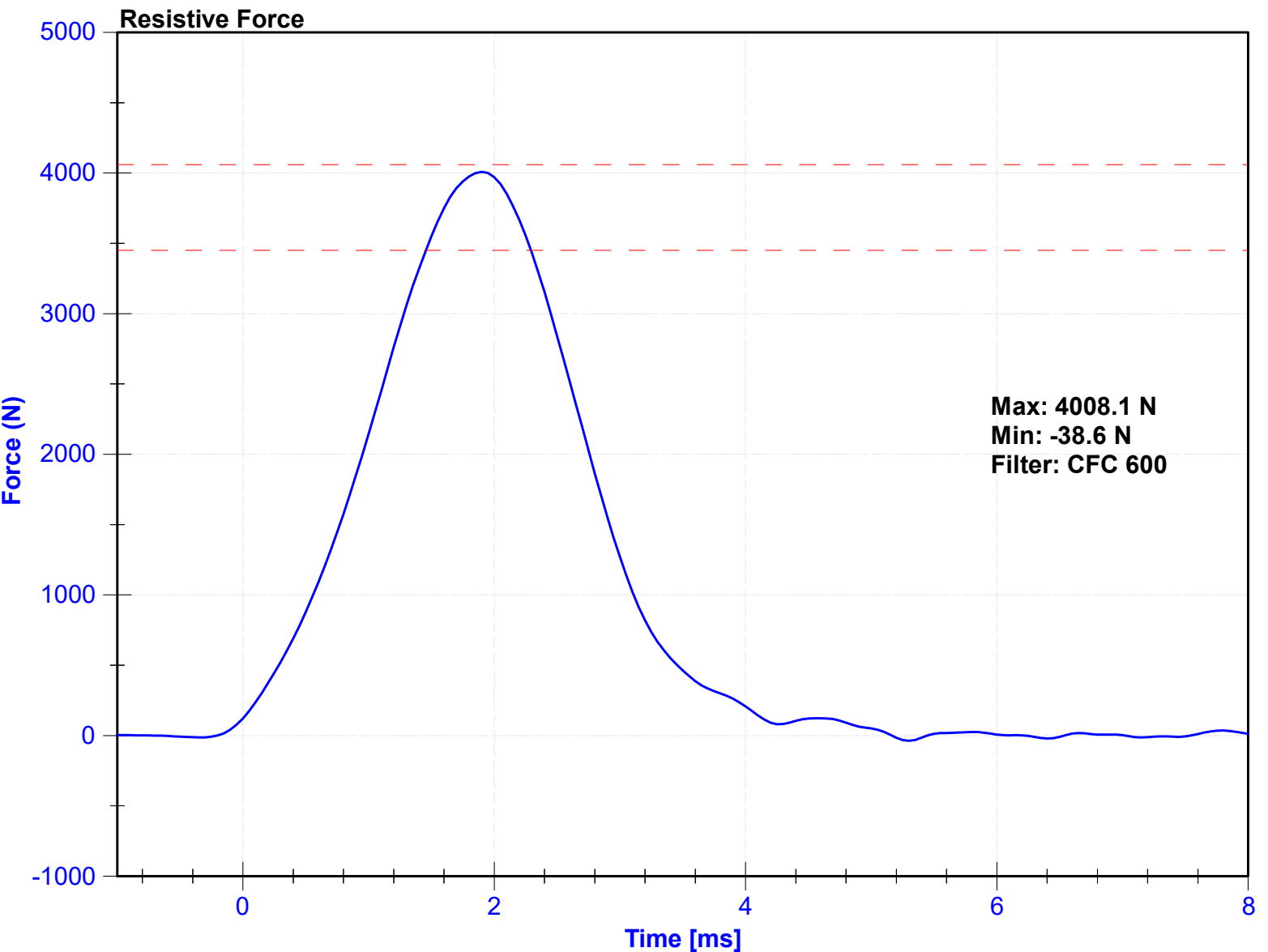
ATD Manufacturer	Humanetics	Test Technician	Z.Schneider
ATD Serial Number	137	Laboratory Supervisor	K. Brogan

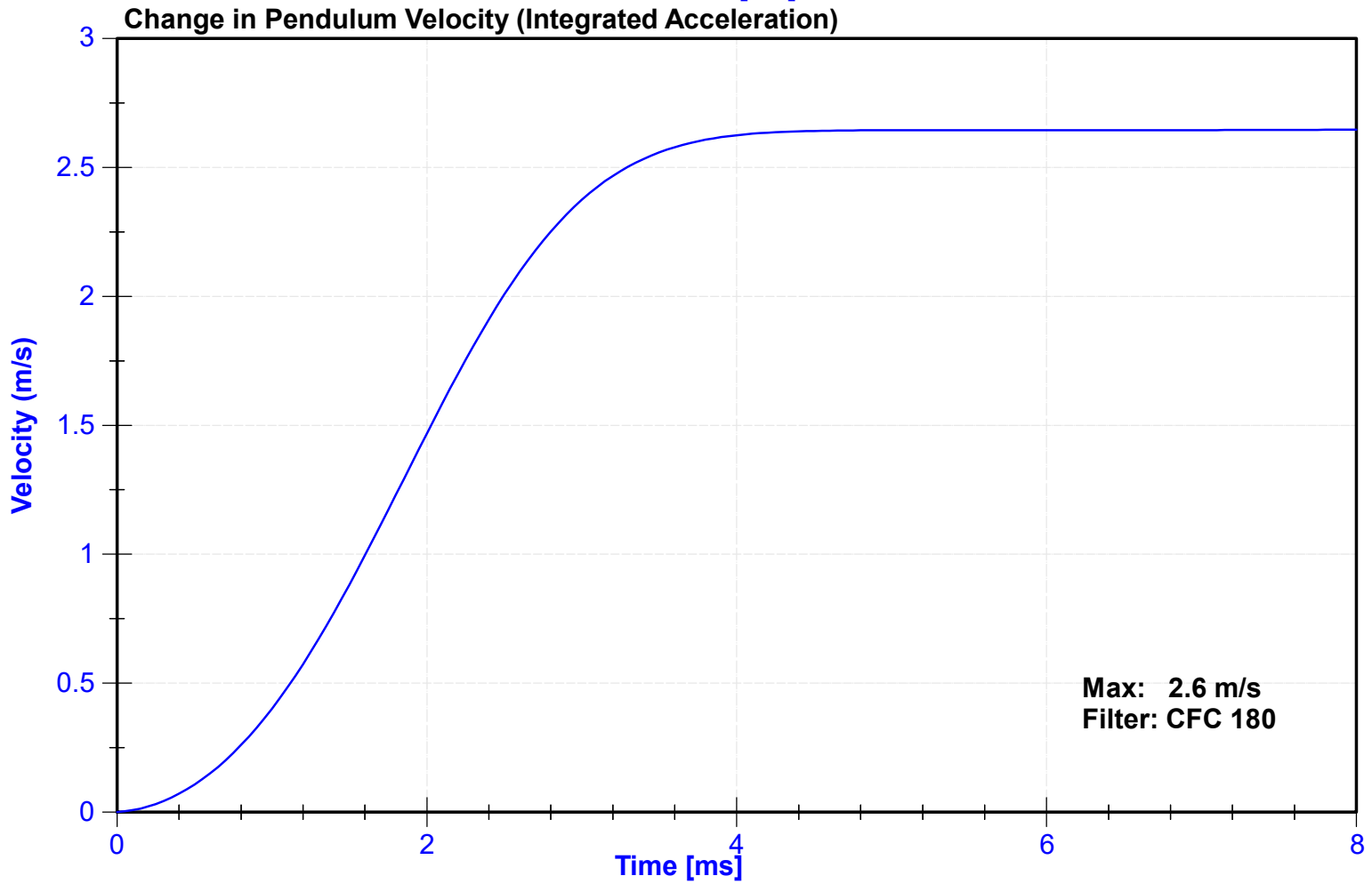
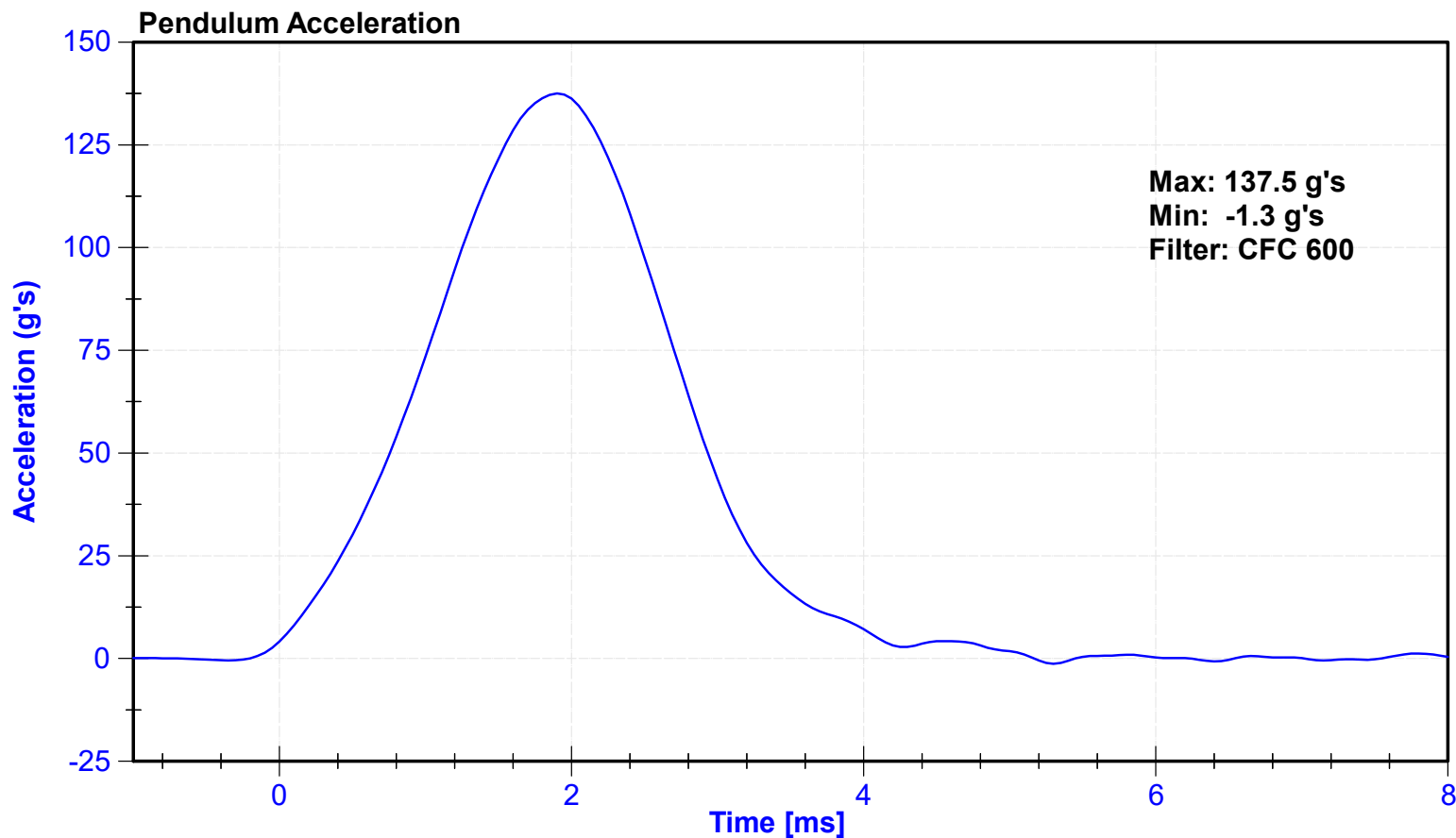
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	18.9	25.6	°C	21	Pass
Humidity	10	70	%	13	Pass
Velocity	2.07	2.13	m/s	2.077	Pass
Resistive Force	3450	4060	N	4008.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023





APPENDIX D

DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

Table 1 – Driver Dummy Instrumentation

Instrumentation		Axis/Location	Hybrid III 50 th S/N: 142		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X	P51681	Endevco	9/30/2022
		Y	P64151	Endevco	9/30/2022
		Z	P52114	Endevco	9/30/2022
	Redundant	X	P52079	Endevco	9/30/2022
		Y	P58905	Endevco	9/30/2022
		Z	P63996	Endevco	9/30/2022
Head Angular Rate Sensors		X	15693	DTS ARS	3/15/2022
		Y	15224	DTS ARS	3/15/2022
		Z	14919	DTS ARS	3/15/2022
Upper Neck Load Cell		FX, Fy, Fz MX,MY, MZ	2187-FX	Denton	6/13/2022
Chest Accelerometers	Primary	X	P51991	Endevco	9/30/2022
		Y	P51269	Endevco	9/30/2022
		Z	P49185	Endevco	9/30/2022
	Redundant	X	P68059	Endevco	9/30/2022
		Y	P51713	Endevco	9/30/2022
		Z	P78824	Endevco	9/30/2022
Chest Potentiometer		X	0075	JDK	10/3/2022
Pelvis Accelerometer		X	P58800	Endevco	9/30/2022
		Y	P52157	Endevco	9/30/2022
		Z	P83317	Endevco	9/30/2022
Femur Load Cells - Left	Primary	Z	DI4211-FZ1	Denton	6/14/2022
	Redundant	Z	DI4211-FZ2	Denton	6/14/2022
Femur Load Cells - Right	Primary	Z	115-FZ1	Denton	6/14/2022
	Redundant	Z	115-FZ2	Denton	6/14/2022
Tibia Load Cells - Left	Upper	MX, MY, FZ	407-FZ	Denton	6/10/2022
	Lower	MX, MY, FZ	396-FZ	Denton	6/9/2022
Tibia Load Cells – Right	Upper	MX, MY, FZ	362-FZ	Denton	6/9/2022
	Lower	MX, MY, FZ	364-FZ	Denton	6/9/2022
Foot Accelerometers - Left	Rear	X	P82756	Endevco	9/30/2022
	Front	Z	P51872	Endevco	9/30/2022
Foot Accelerometers - Right	Rear	X	P66942	Endevco	9/30/2022
	Front	Z	P58779	Endevco	9/30/2022
Seat belt Load Cells	Lap*		NA	NA	11/2/2019
	Shoulder		292	GFE	2/25/2022

*Lap Load Cell was not installed

Table 2 – Front Passenger Dummy Instrumentation

Instrumentation		Axis/Location	Hybrid III 5 th S/N: 137		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X	P79417	Endevco	12/13/2022
		Y	P83335	Endevco	12/13/2022
		Z	P64149	Endevco	12/12/2022
	Redundant	X	P52008	Endevco	12/13/2022
		Y	P52045	Endevco	12/13/2022
		Z	P74774	Endevco	12/12/2022
Head Angular Rate Sensors		X	15217	DTS	3/15/2022
		Y	15697	DTS PRO-18K	3/16/2022
		Z	15696	DTS ARS	3/16/2022
Upper Neck Load Cell		FX, Fy, Fz MX,MY, MZ	1916-FX	Humanetics	6/10/2022
Chest Accelerometers	Primary	X	T21142	Endevco	12/12/2022
		Y	P83346	Endevco	12/12/2022
		Z	P49190	Endevco	12/12/2022
	Redundant	X	P58794	Endevco	12/12/2022
		Y	P69791	Endevco	12/12/2022
		Z	T11253	Endevco	12/12/2022
Chest Potentiometer		X	0720	Servo	12/12/2022
Pelvis Accelerometer		X	P58735	Endevco	12/12/2022
		Y	P77587	Endevco	12/12/2022
		Z	P51285	Endevco	12/12/2022
Femur Load Cells - Left	Primary	Z	135-FZ1	Denton	6/14/2022
	Redundant	Z	135-FZ2	Denton	6/14/2022
Femur Load Cells - Right	Primary	Z	136-FZ1	Denton	6/14/2022
	Redundant	Z	136-FZ2	Denton	6/14/2022
Tibia Load Cells - Left	Upper	MX, MY, FZ	364-FZ	Denton	6/10/2022
	Lower	MX, MY, FZ	398-FZ	Denton	6/8/2022
Tibia Load Cells – Right	Upper	MX, MY, FZ	368-FZ	Denton	6/10/2022
	Lower	MX, MY, FZ	490-FZ	Denton	6/8/2022
Foot Accelerometers - Left	Rear	X	P78959	Endevco	12/12/2022
	Front	Z	P83418	Endevco	12/12/2022
Foot Accelerometers - Right	Rear	X	P83428	Endevco	12/12/2022
	Front	Z	P80265	Endevco	12/12/2022
Seat belt Load Cells	Lap*		NA	NA	5/4/2019
	Shoulder		295	GFE	2/25/2022

*Lap Load Cell was not installed

Table 3 – Vehicle Instrumentation

Instrumentation			Axis	Serial Number	Manufacturer	Calibration Date
Crossmember/Rear Seat Accelerometers	Left	Primary	X	A373222	Measurement Specialties	11/16/2022
			Z	A374236	Measurement Specialties	11/16/2022
		Redundant	X	A290903	Measurement Specialties	12/29/2022
	Right	Primary	X	A374345	Measurement Specialties	11/17/2022
			Z	A374347	Measurement Specialties	11/17/2022
		Redundant	X	A282723	Measurement Specialties	12/28/2022
Engine Accelerometers	Top		X	G22641	Endevco	11/24/2022
	Bottom		X	G22198	Endevco	11/21/2022