

REPORT NUMBER: SINCAP-CAL-23-003

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

**GENERAL MOTORS LLC
2023 Chevrolet Malibu
4 Door Sedan**

NHTSA No: M20230104

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



December 12, 2023

FINAL REPORT

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

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Prepared
by:



Quinn Porzio, Test Engineer

Date: December 12, 2023

Approved
by:



Matthew Pronko, Test Engineer

Date: December 12, 2023

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

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16. Abstract A 55/28, (61.90kph / 38.5 mph), 90° Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2023 Chevrolet Malibu 4 Door Sedan in accordance with the specifications of the Office of Crashworthiness Standards Side NCAP MDB Test Procedure for the generation of consumer information on vehicle side crash protection. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on February 8, 2023. The impact velocity of the Moving Deformable Barrier (MDB) was 61.93 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle was 21°C. The target vehicle's maximum post-test static crush was 275 mm located at level 3. The test vehicle's occupant performance data is as follows: <table border="1"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th colspan="3">Driver ATD (ES-2re)</th> </tr> <tr> <th>Units</th> <th>IARV</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC36)</td> <td></td> <td>1000</td> <td>231.210</td> </tr> <tr> <td>Maximum Thorax Rib Deflection</td> <td>mm</td> <td>44</td> <td>29.649</td> </tr> <tr> <td>Total Abdominal Force</td> <td>N</td> <td>2500</td> <td>1112.498</td> </tr> <tr> <td>Pubic Symphysis Force</td> <td>N</td> <td>6000</td> <td>1225.666</td> </tr> <tr> <td>Lower Spine (T12) Resultant Acceleration</td> <td>G</td> <td>82*</td> <td>32.806</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th colspan="3">Passenger ATD (SID-IIs)</th> </tr> <tr> <th>Units</th> <th>IARV</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC36)</td> <td></td> <td>1000</td> <td>323.106</td> </tr> <tr> <td>Maximum Thorax Rib Deflection</td> <td>mm</td> <td>38*</td> <td>35.348</td> </tr> <tr> <td>Lower Spine (T12) Resultant Acceleration</td> <td>G</td> <td>82</td> <td>60.045</td> </tr> <tr> <td>Total Pelvic Force (sum of acetabular and iliac forces)</td> <td>N</td> <td>5525</td> <td>3929.597</td> </tr> <tr> <td>Maximum Abdominal Rib Deflection</td> <td>mm</td> <td>45*</td> <td>32.554</td> </tr> </tbody> </table> *Proposed IARV						Measurement Description	Driver ATD (ES-2re)			Units	IARV	Result	Head Injury Criteria (HIC36)		1000	231.210	Maximum Thorax Rib Deflection	mm	44	29.649	Total Abdominal Force	N	2500	1112.498	Pubic Symphysis Force	N	6000	1225.666	Lower Spine (T12) Resultant Acceleration	G	82*	32.806	Measurement Description	Passenger ATD (SID-IIs)			Units	IARV	Result	Head Injury Criteria (HIC36)		1000	323.106	Maximum Thorax Rib Deflection	mm	38*	35.348	Lower Spine (T12) Resultant Acceleration	G	82	60.045	Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3929.597	Maximum Abdominal Rib Deflection	mm	45*	32.554
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SECTION 1

TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2023 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number 693JJ920D000016. The purpose of this test is to generate comparative side impact performance in a 2023 Chevrolet Malibu 4 Door Sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP MBD Laboratory Test Procedure dated March 2020.

SECTION 2

SUMMARY OF TEST RESULTS

A 2023 Chevrolet Malibu 4 Door Sedan was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 61.93 km/h. The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by the Calspan Corporation's Transportation Test Operations Center in Buffalo, New York on February 8, 2023. Pre-test and post-test photographs of the test vehicle, the MDB and the dummies (ES-2re and SID-IIs) are included in this report.

Dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OCWS Side Impact Laboratory Test Procedure, dated March 2020. The side impact event was documented by 9 high-speed and 2 real-time cameras. Camera locations are included in this report.

The Dummies were instrumented in the following manner:

DRIVER ATD (ES-2re)

Primary and redundant head CG tri-axial accelerometers

Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers

Abdomen forward, middle, and rear y-axis load cells

Lower spine (T12) tri-axial accelerometers

Public symphysis y-axis load cell

PASSENGER ATD (SID-IIs)

Primary and redundant head CG tri-axial accelerometers

Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers

Abdomen upper rib and lower rib y-axis displacement potentiometers

Lower spine (T12) tri-axial accelerometers

Acetabulum and iliac wing y-axis load cells

Appendix B contains the vehicle and dummy response data. Dummy configuration and performance verification data can be found in APPENDIX C of this report. Appendix D of this report contains the test equipment and instrumentation calibration data.

DUMMY INJURY VALUES

Measurement Description	Driver ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	231.210
Maximum Thorax Rib Deflection	mm	44	29.649
Total Abdominal Force	N	2500	1112.498
Pubic Symphysis Force	N	6000	1225.666
Lower Spine (T12) Resultant Acceleration	G	82*	32.806

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	323.106
Maximum Thorax Rib Deflection	mm	38*	35.348
Lower Spine (T12) Resultant Acceleration	G	82	60.045
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3929.597
Maximum Abdominal Rib Deflection	mm	45*	32.554

*Proposed IARV

SUPPLEMENTAL RESTRAINT INFORMATION

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Front Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Airbag 1 - Curtain	Yes	Yes	Yes	Yes
Side Airbag 2 - Torso/Pelvis Airbag	Yes	Yes	Yes	Yes
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Yes	No	N/A
Other	N/A	N/A	N/A	N/A

GENERAL COMMENTS:

1. P1 serial number - F033
2. P4 serial number - DG8012

Data Anomalies:

The following channel was questionable for:

- Left A-Pillar Lower Y Acceleration, Exceeded calibration range at 43.6 ms
- Left B-Pillar Lower Y Acceleration, Exceeded calibration range and saturated at 12.6 ms
22.4 ms
- Left B-Pillar Middle Y Acceleration, Exceeded calibration range and saturated at 9.3 ms
13.2 ms

SECTION 3
OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

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

Data Sheet No. 2 - Seat, Seat Belt, Steering Wheel Adjustment and Fuel Systems Data

Data Sheet No. 3 - Dummy Longitudinal Clearance Dimensions

Data Sheet No. 4 - Dummy Lateral Clearance Dimensions

Data Sheet No. 5 - Camera and Instrumentation Data

Data Sheet No. 6 - Test Vehicle Accelerometer Locations

Data Sheet No. 7- MDB Accelerometer Locations

Data Sheet No. 8 - Post-Test Observations

Data Sheet No. 9 - MDB Summary of Results

Data Sheet No. 10 - Test Vehicle Profile Measurements

Data Sheet No. 11 - Test Vehicle Exterior Crush Measurements

Data Sheet No. 12 - MDB Exterior Static Crush Measurements

Data Sheet No. 13 - Vehicle and MDB Damage Profile Distances

Data Sheet No. 14 - FMVSS No. 301 Static Rollover Results

Data Sheet No. 15 - Dummy / Vehicle Temperature and Humidity Stabilization Data

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan

NHTSA No.: M20230104

Test Program: NCAP Side MDB Impact Test

Test Date: 02/08/2023

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20230104	Traction Control System (TCS)	Yes
Model Year	2023	Auto-Leveling System	No
Make	Chevrolet	Automatic Door Locks (ADL)	Yes
Model	Malibu	Power Window Auto-Reverse	Yes
Body Style	Sedan	Other Optional Feature	N/A
VIN	1G1ZG5ST8PF129725	Driver Front Airbag	Yes
Body Color	Dark Ash Metallic	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	13 miles	Driver Head/Torso Airbag	No
Engine Displacement (L)	1.5	Driver Torso Airbag	No
Type / No. Cylinders	I4	Driver Torso / Pelvis Airbag	Yes
Engine Placement	Transverse	Driver Pelvis Airbag	No
Transmission Type	Automatic	Driver Knee Airbag	Yes
Transmission Speeds	CVT	Rear Pass. Curtain Airbag	Yes
Overdrive	Yes	Rear Pass. Head / Torso Airbag	No
Final Drive	Front Wheel Drive	Rear Pass. Torso Airbag	No
Roof Rack	No	Rear Pass. Torso / Pelvis Airbag	Yes
Sunroof / T-Top	No	Rear Pass. Pelvis Airbag	No
Running Boards	No	Driver Seat Belt Pretensioner	Yes
Tilt Steering Wheel	Yes	Rear Pass. Seat Belt Pretensioner	No
Power Seats	Yes	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Rear Pass. Load Limiter	No
		Other Safety Restraint	N/A

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

No

DATA FROM CERTIFICATION LABEL

Manufactured By	GENERAL MOTORS LLC	GVWR	1863
Date of Manufacture	11/22	GVWR Front	961
Vehicle Type	Passenger Car	GVWR Rear	902

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3	N/A	5	
Vehicle Capacity Weight (VCW) (kg)				408	(A)
DSC x 68.04 kg				340.2	(B)
Cargo Weight (RCLW) (kg)				67.8	(A-B)

VEHICLE SEAT TYPE

Seating Location	Type Of Seat Pan				Type Of Seat Back		
	Bucket	Bench	Split Bench	Contour	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front	X						X
Rear or Second Row Seat			X		X		
Third Row Seat	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan

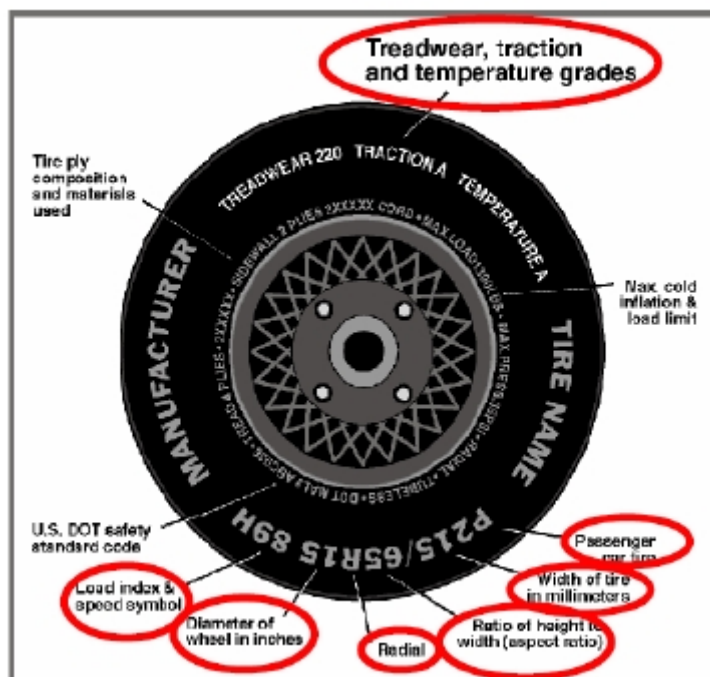
NHTSA No.: M20230104

Test Program: NCAP Side MDB Impact Test

Test Date: 02/08/2023

VEHICLE TIRE INFORMATION

Collected for year, make, model, & VIN, all items circled in red, tire manufacturer and tire name



TIRE SIDEWALL INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	245/45R18	245/45R18
Tire Size on Vehicle	245/45R18	245/45R18
Tire Manufacturer	Continental	Continental
Tire Model	ProContact TX	ProContact TX
Treadwear	500	500
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 2 Steel, 1 Polyamide	1 Polyester, 2 Steel, 1 Polyamide
Load Index / Speed Symbol	96H	96H
Tire Material	Rubber	Rubber
DOT Safety Code Left	IVY0F9LAN3422	IVY0F9ALN3422
DOT Safety Code Right	IVY0F9LAN3422	IVY0F9LAN3422

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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
 Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
 Test Date: 02/08/2023

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	245	244	245	246
Tire Placard	kPa	240	240	240	240
Owner's Manual	kPa	240	240	240	240
As Tested	kPa	240	240	240	240

MDB TIRE SPECIFICATIONS

	Units	Requirements	LF	RF	LR	RR
Tire Size		P205/75R15	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	kPa	200 ± 21	207	207	207	207

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	440.0	303.0		471.5	378.5		480.0	396.0	
Right	kg	428.0	277.0		444.5	341.5		430.0	340.0	
Ratio	%	59.9	40.1		56.0	44.0		55.3	44.7	
Totals	kg	868.0	580.0	1448.0	916.0	720.0	1636.0	910.0	736.0	1646.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1448	(A)
Actual Weight of 2 P572V (ES-2re and SID-IIs) ATDs Used	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	67.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1642.8	(A+B+C)

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

(i.e. Calculated Test Vehicle Target Weight – 4.5 kg to – 9 kg)?

☒

Yes

☐

No

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	As Tested	Fully Loaded	Meets Rqmt***
LF	mm	718	715	Yes
RF	mm	723	732	Yes
RR	mm	714	723	Yes
LR	mm	710	707	Yes
Vehicle CG (Aft of Front Axle)	mm	1245	1265	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	31	52	

***The "As Tested" vehicle attitude measurements must be equal to or within ± 10mm of the "Fully Loaded" vehicle attitude measurements at each wheel well. Indicate "Yes" or "No" for "Meets Requirements".

Test height adjustable suspension setting, if applicable:

N/A

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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan	NHTSA No.: M20230104
Test Program: NCAP Side MDB Impact Test	Test Date: 02/08/2023

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Truck Carpeting	5.5
Spare Tire	12
Jack	3
Ballast / Equipment Added	26

TEST SURFACE MARKINGS

	Distance from 63° Impact Location Line (mm)
Fore 25 mm target	1115
Aft 25 mm target	1114
Pre-Impact Angle Line	235

Parallel Track Target	X Location (mm)	Y Location (mm)
A	0	0
B	2955	1555
C	2955	3355
D	0	3000

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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan

NHTSA No.: M20230104

Test Program: NCAP Side MDB Impact Test

Test Date: 02/08/2023

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and right front passenger's seat should be set to the mid-track, lowest, mid-angle position. The struck-side rear passenger's seat, rear center seat, and non-struck side rear passenger's seats should be set to the rear-most, lowest, mid-angle position

SCRL ANGLE RANGE

Seat	SCRL(°)		
	Max	Min	Mid
Driver Seat	9.2	0.0	4.6
Front Passenger Seat	4.0	0.0	2.0
Front Center Seat			
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid-Fore / Aft	Forward-Most
Driver Seat	4.6	10.7	Max	64	74	83
			Mid	32	42	52
			Min	0	11	20
Front Passenger Seat	2.0	27	Max	N/A	N/A	N/A
			Mid	N/A	N/A	N/A
			Min	17	27	36
Front Center Seat*			Max			
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max			
			Mid			
			Min			
Non-Struck Side Rear Seat	Fixed	Fixed	Max			
			Mid			
			Min			
Rear Center Seat*	Fixed	Fixed	Max			
			Mid			
			Min			

**If applicable*

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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan

NHTSA No.: M20230104

Test Program: NCAP Side MDB Impact Test

Test Date: 02/08/2023

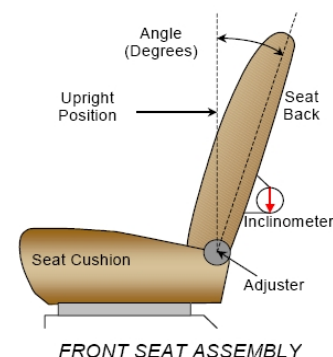
SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forward most Position	
	mm	Detents*	mm	Detents*
Driver Seat	260	Power	130	Power
Front Passenger Seat	240	25 (0-24)	120	12
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed	Fixed

*if applicable

SEAT BACK ANGLE ADJUSTMENT

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



Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degrees	Detents*
Driver Seat	64.9	Power	13.7	Power
Front Passenger Seat	65.7	21 (0-20)	13.6	11
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed	Fixed

*if applicable

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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan

NHTSA No.: M20230104

Test Program: NCAP Side MDB Impact Test

Test Date: 02/08/2023

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. For this test zero is defined as the uppermost position.

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

HEAD RESTRAINT ADJUSTMENT

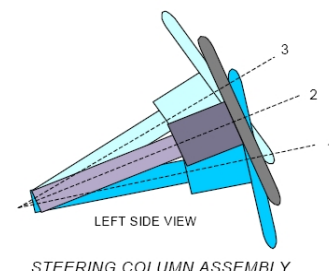
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

Seat	Total # of Positions	Placed in Position #
Driver Seat	9 (0-8)	Uppermost
Rear Seat	3 (0-2)	Lowermost

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.

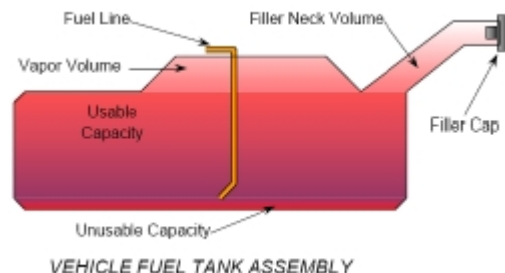
	Degrees	Fore / Aft Position (mm)
Lowermost - Position No. 1	20.7	
Geometric center - Position No. 2	23.15	
Uppermost - Position No. 3	25.6	
Telescoping Steering Wheel Travel		64
Test Position	23.15	32



FUEL PUMP

Describe the fuel pump type, details about how it operates, and the location of the fuel filler neck

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



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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan

NHTSA No.: M20230104

Test Program: NCAP Side MDB Impact Test

Test Date: 02/08/2023

FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	59.8
Usable Capacity of "Optional Tank" (see Form No. 1)	N/A
Usable Capacity of "Standard Tank" (see Owner's Manual)	59.8
Usable Capacity of "Optional Tank" (see Owner's Manual)	N/A
93% of Usable Capacity	55.6
Actual Amount of Solvent Used in Test	55.6
1/3 of Usable Capacity	19.9

Is the Actual Amount of Solvent Used in the test equal to 93% $\pm$ 1% of the Usable

Capacity stated in Form No. 1? ☒ **Yes** ☐ **No**

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

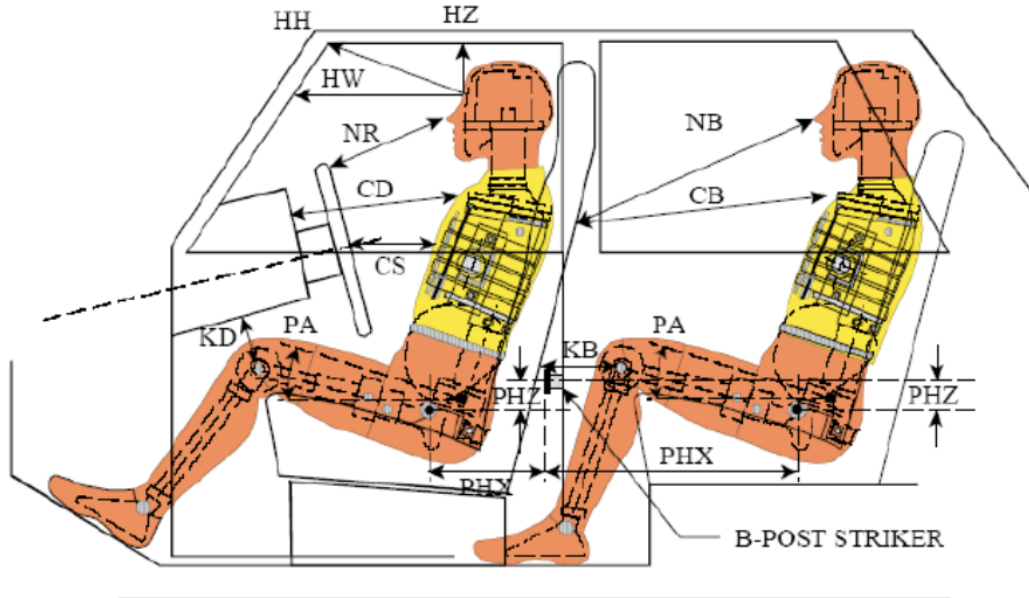
Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan

NHTSA No.: M20230104

Test Program: NCAP Side MDB Impact Test

Test Date: 02/08/2023

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION



LEFT SIDE VIEW

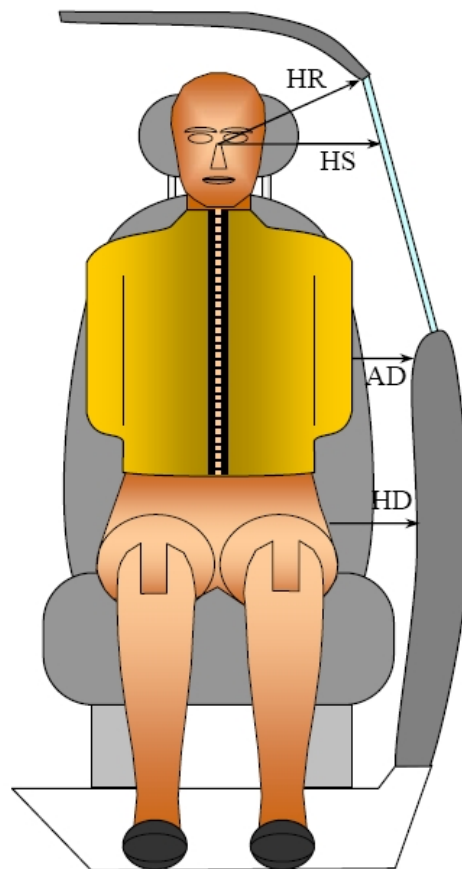
NOTE: 2-DOOR VEHICLE SHOWN.
 REAR DUMMY PHX & PHZ
 MEASUREMENTS FOR A 4-DOOR
 VEHICLE WOULD USE THE C-POST
 STRIKER AS A REFERENCE POINT

Driver Code	Pass. Code	Description	Driver (Serial No. F033)		Left Rear Passenger (Serial No. DG8012)	
			Length (mm)	Angle (°)	Length (mm)	Angle (°)
HH		Header to Header	471			
HW		Header to Windshield	808			
HZ	HZ	Head to Roof Liner	231		274	
NR	NB	Nose to Rim/Seat Back	535		501	
CD	CB	Chest to Dash/Seat Back	652		501	
CS		Chest to Steering Wheel	458			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	241	27.8	256	11.2
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	231	27.6	243	24.6
PAX°	PAX°	Pelvic Tilt Angle X		28.3		22.8
	PAY°	Pelvic Tilt Angle Y				0.2
PHX	PHX	Hip Point to Striker (X-Axis)	147		282	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	180		299	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
 Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
 Test Date: 02/08/2023



FRONT VIEW OF DUMMY

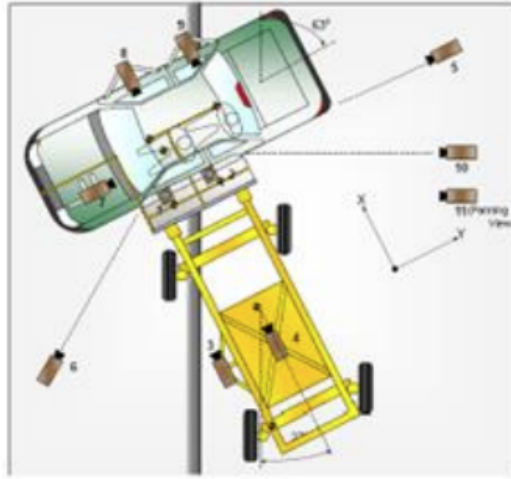
DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver (Serial No. F033)	Left Rear Passenger (Serial No. DG8012)
HR	Head to Side Header	mm	212	235
HS	Head to Side Window	mm	365	374
AD	Arm to Door	mm	114	174
HD	Hip Point to Door	mm	152	170

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
Test Date: 02/08/2023



CAMERA LOCATIONS AND DATA

No.	Camera View	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Overhead Overall	0	0	-8250	12.5	1000
2	Overhead Close-up	0	0	-8250	28	1000
3	Left Impact Point (MDB)	-1470	0	-847	25	1000
4	Side Overall (MDB)	-1140	878	-1587	8	1000
5	Rear	0	8610	-1432	28	1000
6	Left Front	-2640	-5811	-1406	24	1000
7	Driver Front (OB)				25	1000
8	Driver Side (OB)				12.5	1000
9	Passenger Side (OB)				12.5	1000
10	Real-time Left Rear				Zoom	60
11	Real-time In Run				Zoom	60

Notes: Reference: Impact Point projected to Ground
+X = To Front of MDB, +Y = To Right of MDB, +Z = Down
* All measurements accurate to ± 6 mm.

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

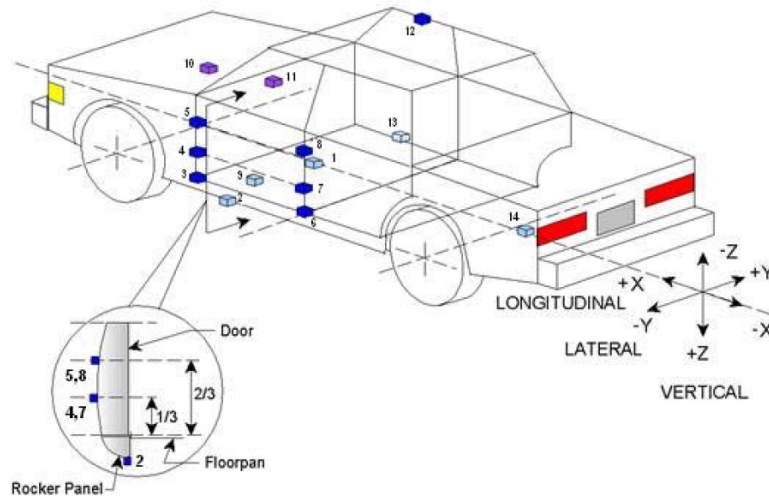
INSTRUMENTATION

Driver Dummy Channels	16
Passenger Dummy Channels	16
Vehicle Structure Accelerometers	23
MDB Accelerometers	7
Total	62

DATA SHEET NO. 6 TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
Test Date: 02/08/2023



TEST VEHICLE ACCELEROMETER LOCATIONS

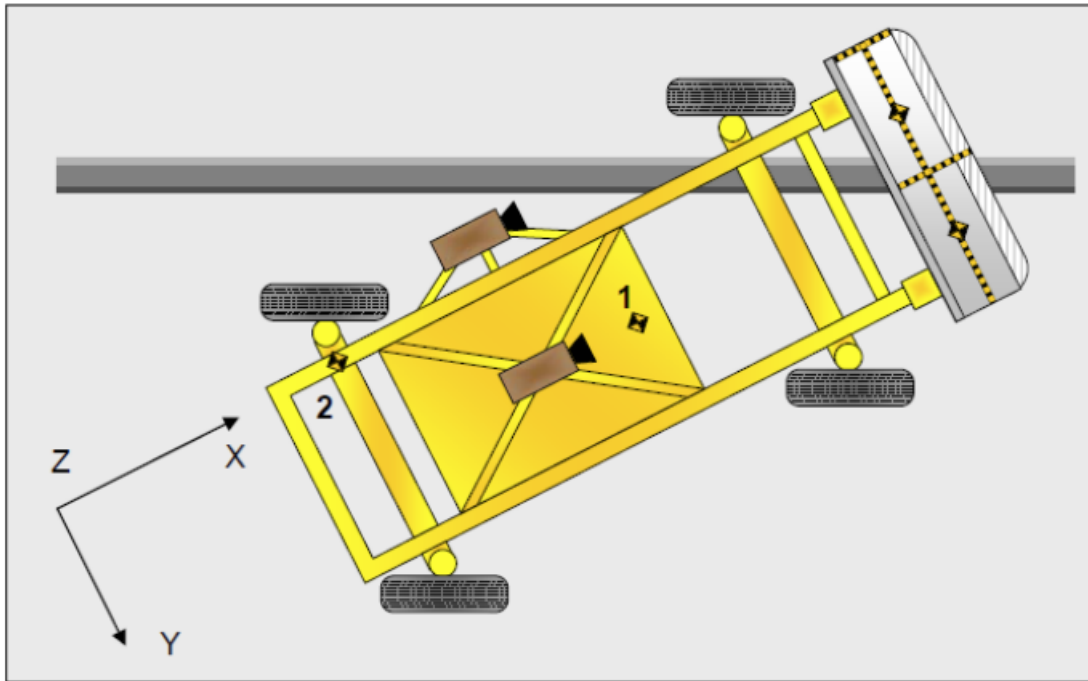
No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2641	-6	-157
2	Right Sill at Front Seat	3020	704	118
3	Right Sill at Rear Seat	2058	697	114
4	Left Sill at Front Door	3171	-700	111
5	Left Sill at Rear Door	2083	-689	109
6	A-Post Lower	3370	-677	-73
7	A-Post Middle	3390	-652	-522
8	B-Post Lower	2348	-688	39
9	B-Post Middle	2273	-656	-504
10	Front Seat Track	2677	-559	150
11	Rear Seat Structure	2003	-468	135
12	Rt. Rear Occ. Compartment	2115	405	234
13	Engine Block	4376	119	-311
14	Rear Above Axle	1035	24	-76

Reference: X – Rear surface of vehicle (+ forward)
Y – Vehicle centerline (+ to right)
Z – Ground plane (+ down)

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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
 Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
 Test Date: 02/08/2023



MDB ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	MDB CG	1859	0	-330
2	MDB Rear	386	-660	-660

Reference: X – Face of MDB (+forward)
 Y – MDB centerline (+ to right)
 Z – Ground plane (+down)

Width between left and right contact switches (mm):

1525

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan

NHTSA No.: M20230104

Test Program: NCAP Side MDB Impact Test

Test Date: 02/08/2023

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Airbag	Curtain Airbag
Top of Head	Side Header Trim	Middle Seatback, Curtain Airbag & Side Header
Left Side of Head	Curtain Airbag & Side Header	Curtain Airbag
Back of Head	Curtain Airbag, Side Header, & Head Restraint	Middle Seatback, Curtain Airbag & Side Header
Left Shoulder	Curtain Airbag	Seatback & Torso/Pelvis Airbag
Upper Torso	Seatback & Torso/Pelvis Airbag	Seatback & Torso/Pelvis Airbag
Lower Torso	Seatback	Seatback & Torso/Pelvis Airbag
Left Hip	Torso/Pelvis Airbag & Driver Door	Seatback & Passenger Door
Left Knee	Driver Door	Passenger Door

POST-TEST DOOR PERFORMANCE

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

POST-TEST SEAT PERFORMANCE

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

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	B-Pillar & C-Pillar buckled
Sill Separation	None
Windshield Damage	None
Side Window Damage	Shattered during impact event
Other Notable Effects	Roof buckled along impact zone

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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
Test Date: 02/08/2023

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2829
Vertical Impact Reference Line (Aft of Front Axle - Intended Impact Point)	mm		474
Actual Impact Point (Aft of Frontal Axle)	mm		464
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	+10
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact Point	-2

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
Test Date: 02/08/2023

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1250
Overall Length Including Honeycomb Frame	4120
Wheelbase of Framework Carriage	2591
CG Location of Front Axle	1122

MDB WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg	396	291.5	687.5
Right	kg	377.5	301	678.5
Ratio	%	56.7	43.3	100
Totals	kg	773.5	592.5	1366

SPEED AND ANGLE AT IMPACT DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.10 to 62.70	61.93
Trap No. 2 Velocity (Redundant)	km/h	61.10 to 62.70	61.94
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.0
MDB Crabbed angle to MDB Forward Line of Motion	degrees	26.0 to 28.0	27.0

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Left	180
B	Top of Bumper	533	800	Left	88
C	Mid-Level	686	800	Left	87
D	Top of Stack	813	800	Left	116

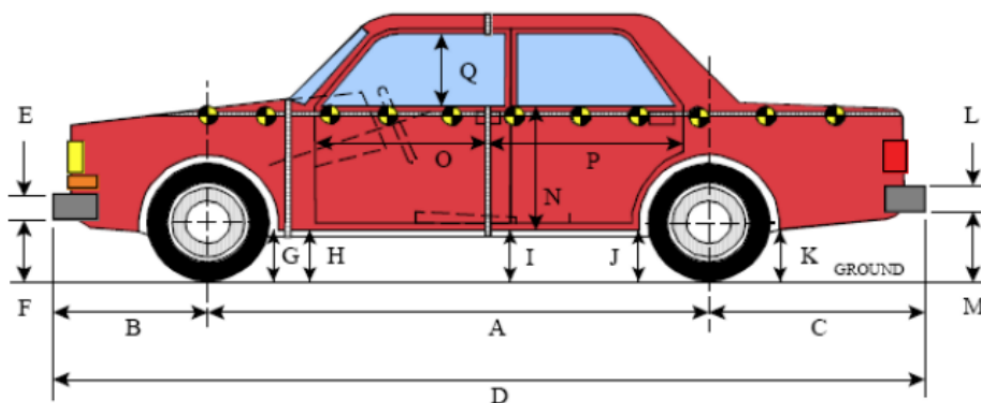
DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan

NHTSA No.: M20230104

Test Program: NCAP Side MDB Impact Test

Test Date: 02/08/2023



LEFT SIDE VIEW

All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3 mm

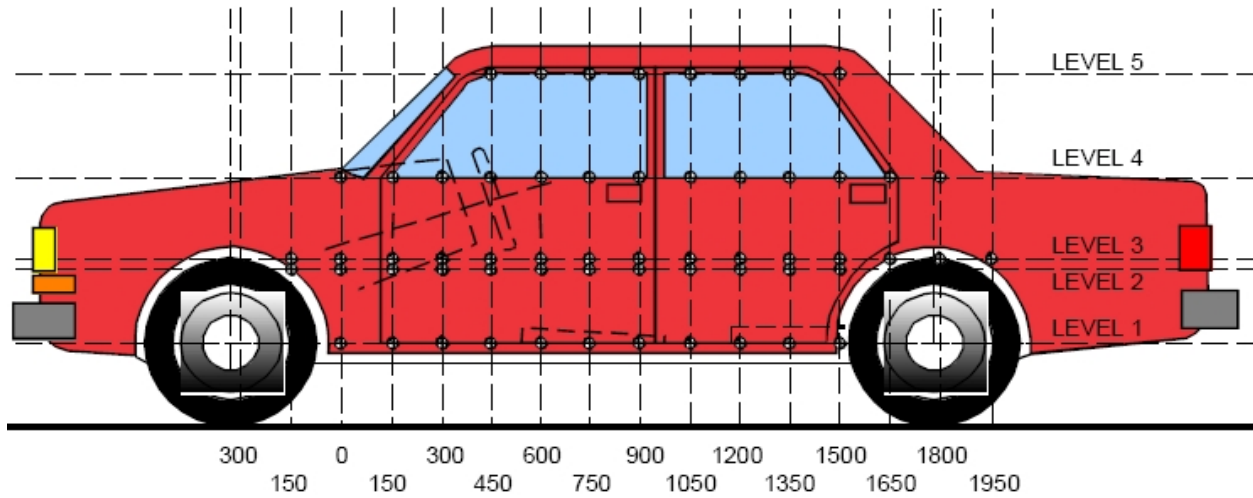
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code.	Measurement Description	Pre-Test	Post-Test	Change
A	Wheelbase	2829	2826	-3
B	Front Axle to FSOV	973	974	1
C	Rear Axle to RSOV	1132	1132	0
D	Total Length at Centerline	4934	4932	-2
E	Front Bumper Thickness	95	100	5
F	Front Bumper Bottom to Ground	420	425	5
G	Sill Height at Front Wheel Well	174	186	12
H	Sill Height at Front Door Leading Edge	183	196	13
I	Sill Height at B Pillar	185	192	7
J1	Sill Height at Rear Wheel Well	173	163	-10
J2	Pinch Weld Height at Rear Wheel Well	155	148	-7
K	Sill Height Aft of Rear Wheel Well	220	228	8
L	Rear Bumper Thickness	172	171	-1
M	Rear Bumper Bottom to Ground	418	433	15
N	Sill Height to Bottom of Front Window Sill	744	691	-53
O	Front Door Leading Edge to Impact CL	795	750	-45
P	Rear Door Trailing Edge to Impact CL	1425	1354	-71
Q	Front Window Opening	422	440	18
R	Right Side Length	4780	4779	-1
S	Left Side Length	4779	4775	-4
T	Maximum Vehicle Width	1838	1653	-185
U	Front Wheel Track Width	1580	1578	-2
V	Rear Wheel Track Width	1590	1580	-10

DATA SHEET NO.11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
 Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
 Test Date: 02/08/2023



LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	242	60	1350
2	Driver H-Point	mm	504	253	1650
3	Mid-Door	mm	630	275	1800
4	Window Sill	mm	929	211	1650
5	Window Top	mm	1390	16	1350

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

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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
 Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
 Test Date: 02/08/2023

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

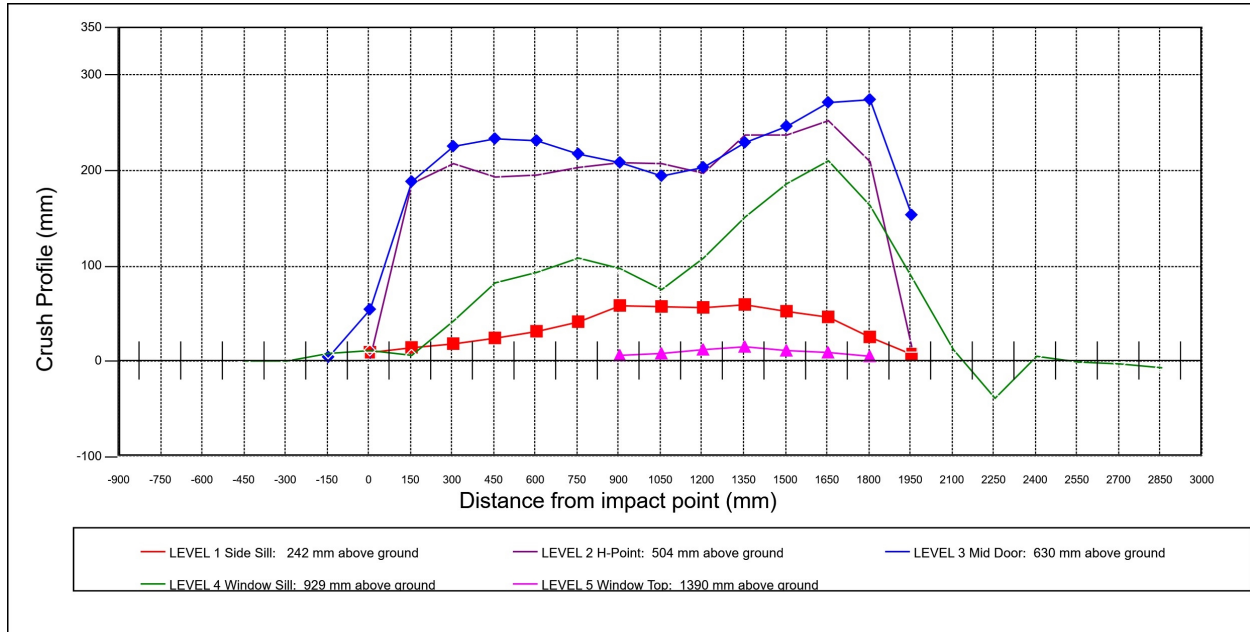
	Pre-Test					Post-Test					Crush				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900															
-750															
-600															
-450				769					768					1	
-300				796					795					1	
-150			925	815				920	806				5	9	
0	882	917	917	830		872	913	866	818		10	4	51	12	
150	881	910	921	841		866	723	732	834		15	187	189	7	
300	880	908	916	852		861	700	690	809		19	208	226	43	
450	880	908	916	860		855	714	682	777		25	194	234	83	
600	879	907	916	867		847	711	684	773		32	196	232	94	
750	878	907	916	871		836	703	698	762		42	204	218	109	
900	877	907	916	873	637	818	698	707	775	630	59	209	209	98	7
1050	875	906	916	872	643	817	698	721	796	634	58	208	195	76	9
1200	875	906	914	869	643	818	708	710	760	630	57	198	204	109	13
1350	875	906	913	866	641	815	668	683	714	625	60	238	230	152	16
1500	875	906	912	863	636	822	668	665	676	624	53	238	247	187	12
1650	877	907	914	862	627	830	654	642	651	617	47	253	272	211	10
1800	881	910	915	860	611	855	700	640	696	605	26	210	275	164	6
1950	887	913	918	887		879	897	764	798		8	16	154	89	
2100				878					865					13	
2250				856					894					-38	
2400				851					845					6	
2550				842					842					0	
2700				831					833					-2	
2850				815					821					-6	
3000															

NOTE: Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush profile grid is established prior to the test based on an estimated impact point. The final distance from impact is determined after the final dummy positioning and the pole is aligned with the center of gravity of the dummy's head.

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

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
 Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
 Test Date: 02/08/2023

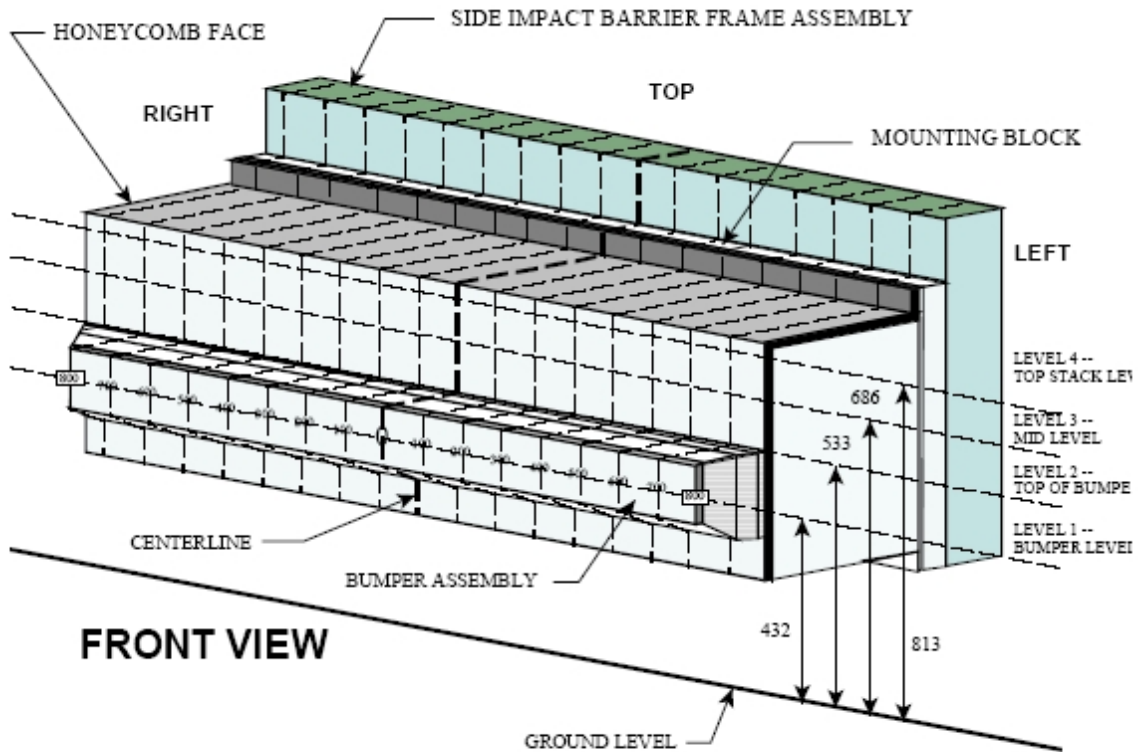


Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO.12 MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
Test Date: 02/08/2023



NOTE: Dimensions are shown in millimeters, mm

DEFORMABLE BARRIER STATIC CRUSH

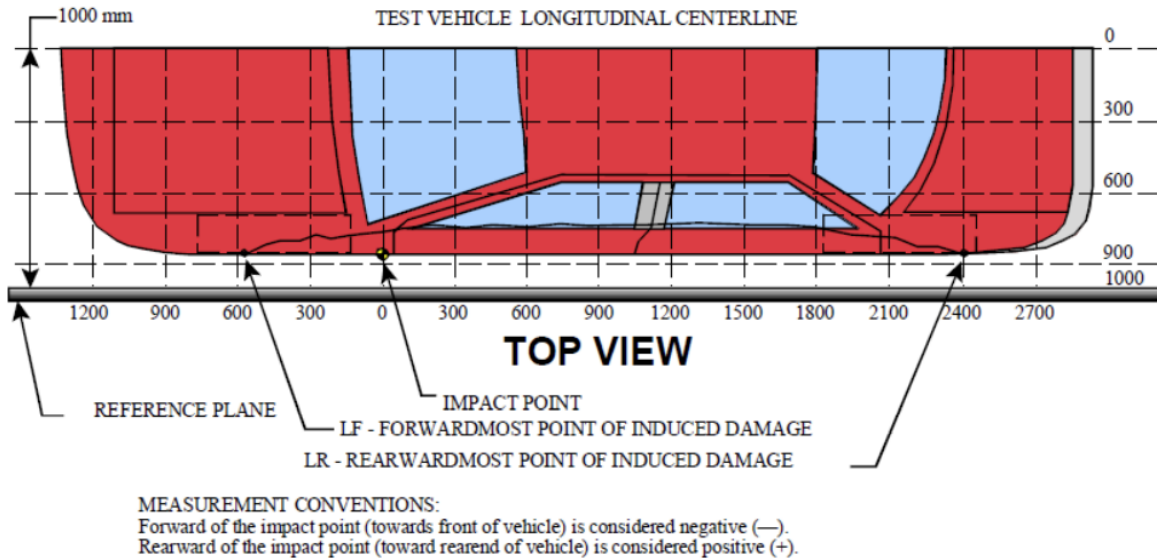
Stack Level	Distance Right of Center								C/L	Distance Left of Center							
	800	700	600	500	400	300	200	100		100	200	300	400	500	600	700	800
1	167	162	158	160	161	163	162	164	166	168	157	158	158	158	159	164	180
2	67	68	70	72	73	77	79	79	75	72	73	75	76	75	76	79	88
3	1	1	9	17	25	54	61	68	37	23	20	21	23	28	34	50	87
4	13	-3	3	18	45	91	96	65	54	49	45	36	45	53	67	95	116

DATA SHEET NO.13 VEHICLE AND MDB DAMAGE PROFILE DISTANCE

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
Test Date: 02/08/2023

For guidance regarding damage profile distance measurements, please refer to the latest version of the *NHTSA Test Reference Guide, Volume 1: Vehicle Tests*.



VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance From Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	-150	3	80	75	5
2	270	3	302	83	219
3	690	3	308	84	224
4	1110	3	283	85	198
5	1530	3	340	88	252
6	1950	3	236	82	154

MDB DAMAGE PROFILE DISTANCES

DPD	Distance From Center of MDB	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	800 mm left of center	1	325	505	-180
2	480 mm left of center	1	356	514	-158
3	160 mm left of center	1	353	514	-161
4	160 mm left of center	1	351	513	-162
5	480 mm left of center	1	353	513	-160
6	800 mm left of center	1	334	501	-167

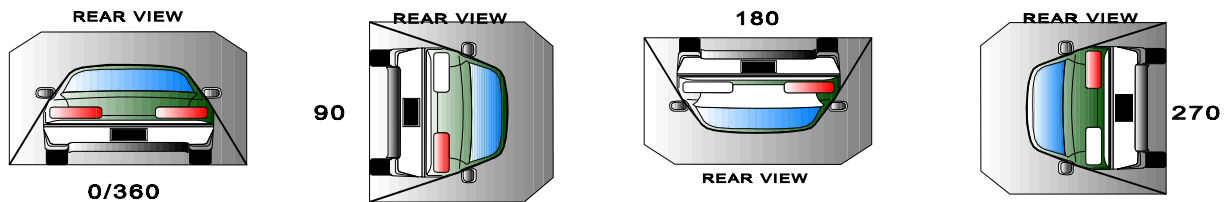
DATA SHEET NO.14
FMVSS NO.301 STATIC ROLLOVER RESULTS

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan NHTSA No.: M20230104
 Test Program: NCAP Side MDB Impact Test Test Date: 02/08/2023

Test Time: 10:51 Temperature: 21.0 °C

A. From impact until vehicle motion ceases: 0 oz
 (Maximum allowable is 1 oz.)
 B. For the 5-minute period after motion ceases: 0 oz
 (Maximum allowable is 5 oz.)
 C. For the following 25 minutes: 0 oz
 (Maximum allowable is 1 oz.)

D. Spillage Detail: No Spillage Occurred



ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	71	300	371
90° to 180°	65	300	365
180° to 270°	69	300	369
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	

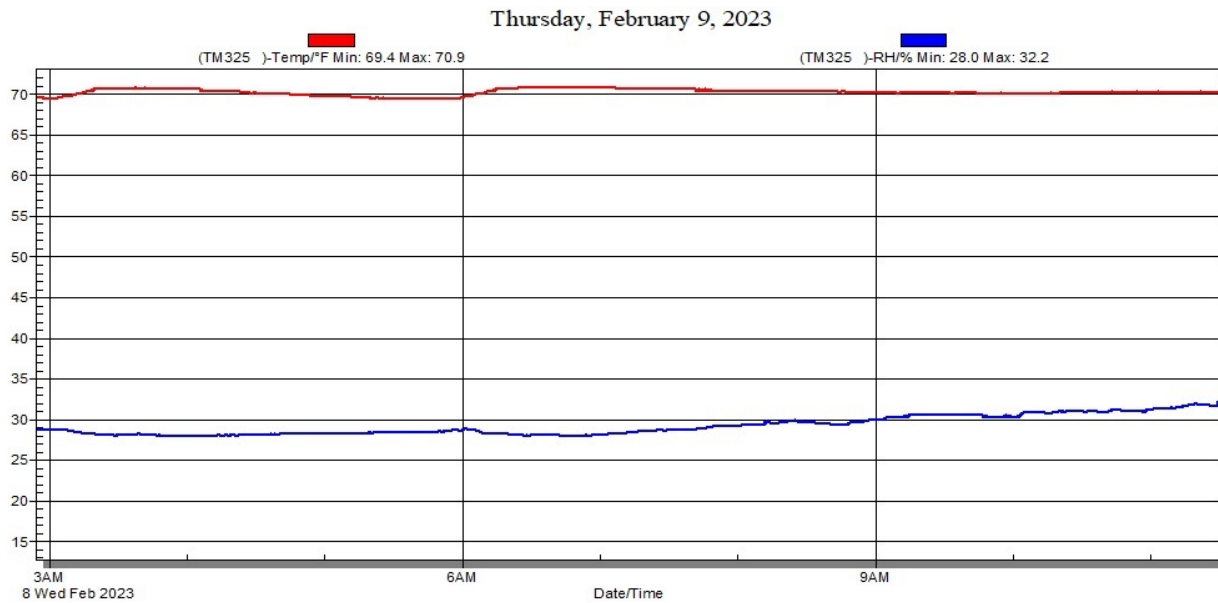
SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 15
DUMMY / VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2023 Chevrolet Malibu 4 Door Sedan
Test Program: NCAP Side MDB Impact Test

NHTSA No.: M20230104
Test Date: 02/08/2023



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

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

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1	As-Delivered Right Front 3/4 View of Test Vehicle	A-5
2	As-Delivered Left Rear 3/4 View of Test Vehicle	A-5
3	Pre-Test Frontal View of Test Vehicle	A-6
4	Post-Test Frontal View of Test Vehicle	A-6
5	Pre-Test Left Front ¾ View of Test Vehicle	A-7
6	Post-Test Left Front ¾ View of Test Vehicle	A-7
7	Pre-Test Left Side View of Test Vehicle	A-8
8	Post-Test Left Side View of Test Vehicle	A-8
9	Pre-Test Left Rear ¾ View of Test Vehicle	A-9
10	Post-Test Left Rear ¾ View of Test Vehicle	A-9
11	Pre-Test Rear View of Test Vehicle	A-10
12	Post-Test Rear View of Test Vehicle	A-10
13	Pre-Test Right Side View of Test Vehicle	A-11
14	Post-Test Right Side View of Test Vehicle	A-11
15	Pre-Test Overhead View of Test Area	A-12
16	Post-Test Overhead View of Test Area	A-12
17	Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle	A-13
18	Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle	A-13
19	Pre-Test Close-Up View of Impact Point Target	A-14
20	Post-Test Close-up View of Impact Point Target	A-14
21	Pre-Test Left Front Door Latch Close-Up	A-15
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23	Pre-Test Left Rear Door Latch Close-Up	A-16
24	Post-Test Left Rear Door Latch Close-Up	A-16
25	Pre-Test Front Close-up View of Driver Dummy	A-17
26	Post-Test Front Close-up View of Driver Dummy	A-17
27	Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking	A-18
28	Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View	A-18
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Figure A-1: As Delivered Right Front $\frac{3}{4}$ View of Test Vehicle



Figure A-2: As Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle



Figure A-3: Pre-Test Frontal View of Test Vehicle



Figure A-4: Post-Test Frontal View of Test Vehicle



Figure A-5: Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



Figure A-6: Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



Figure A-7: Pre-Test Left Side View of Test Vehicle

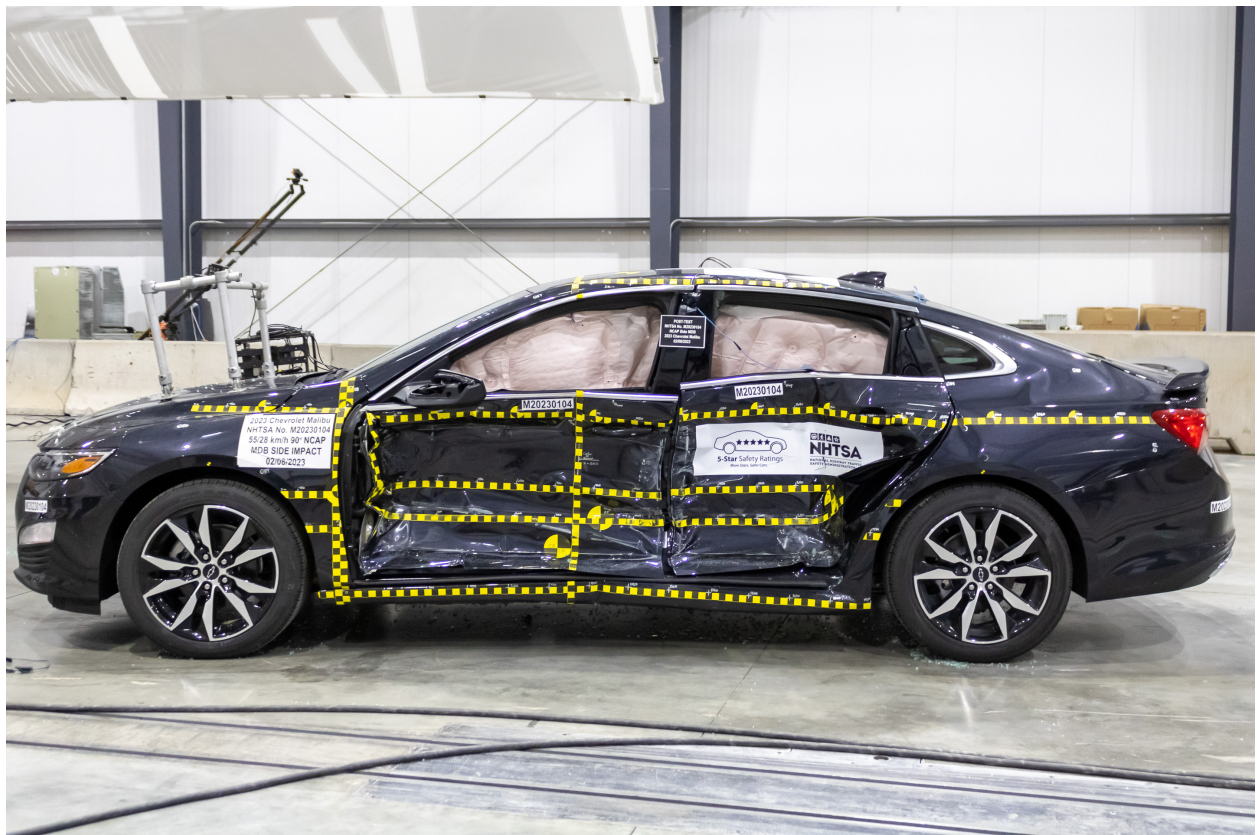


Figure A-8: Post-Test Left Side View of Test Vehicle



Figure A-9: Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



Figure A-10: Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



Figure A-11: Pre-Test Rear View of Test Vehicle



Figure A-12: Post-Test Rear View of Test Vehicle



Figure A-13: Pre-Test Right Side View of Test Vehicle



Figure A-14: Post-Test Right Side View of Test Vehicle

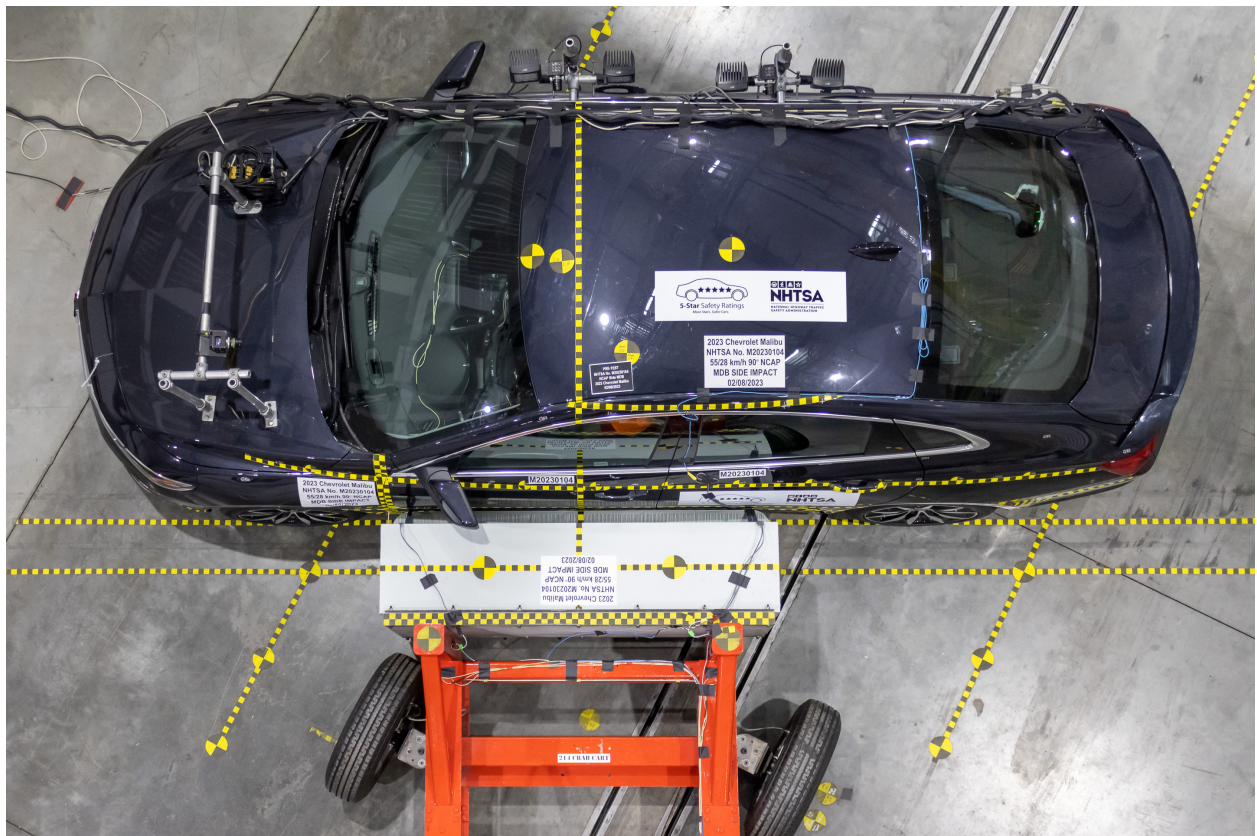


Figure A-15: Pre-Test Overhead View of Test Area



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



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



Figure A-18: Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle



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



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

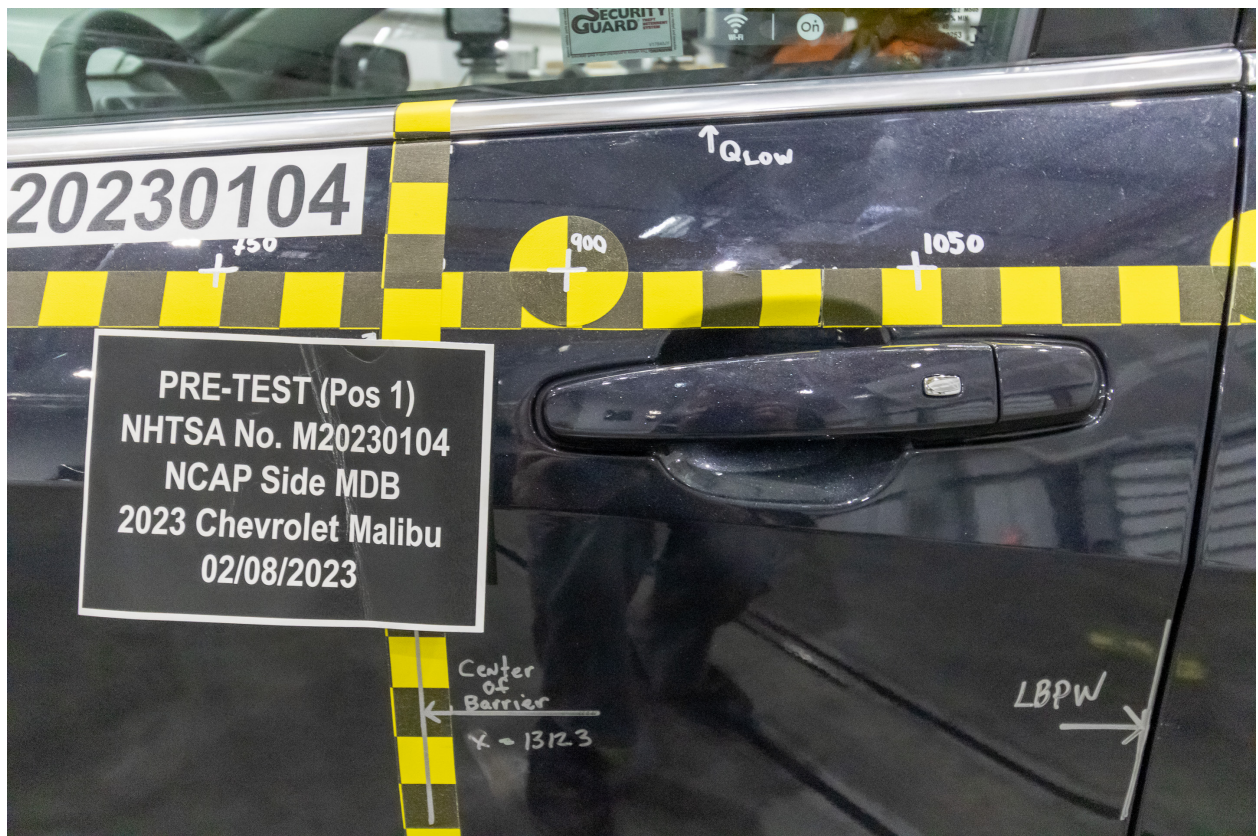


Figure A-21: Pre-Test Left Front Door Latch Close-Up



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



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



Figure A-24: Post-Test Left Rear Door Latch Close-Up



Figure A-25: Pre-Test Front Close-up View of Driver Dummy



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



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



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



Figure A-29: Post-Test Left Side View of Driver Dummy Shoulder and Door Top View



Figure A-30: Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning



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



Figure A-32: Pre-Test Frontal View of Driver Seat Pan Prior to Dummy Positioning



Figure A-33: Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan



Figure A-34: Pre-Test Placement of Driver Dummy's Feet



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



Figure A-36: Pre-Test Left Side View of Steering Wheel



Figure A-37: View of Disengaged Parking Brake



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

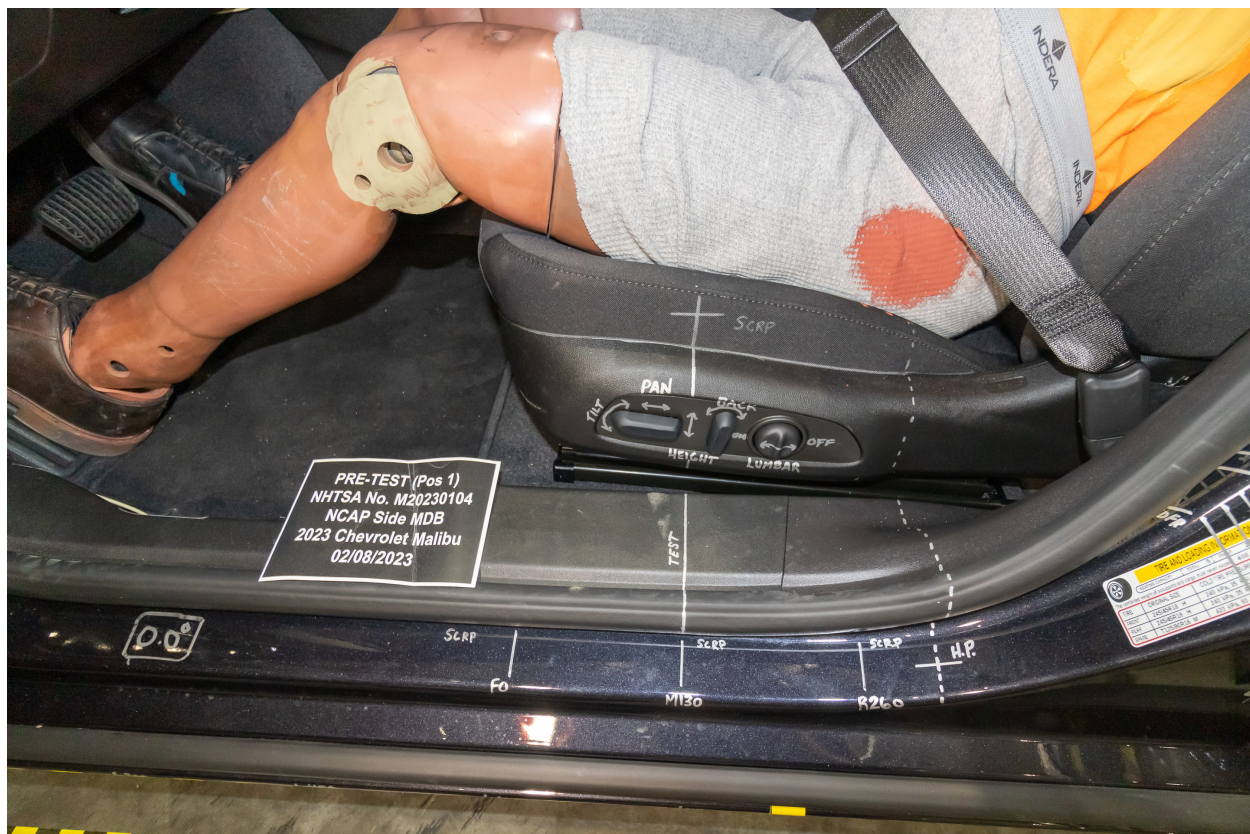


Figure A-39: Pre-Test Close-Up Left Side View of Driver Seat Track



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



Figure A-41: Pre-Test Close-Up View of Driver Seat Back or Head Restraint



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



Figure A-43: Post-Test Driver Dummy and Door Clearance View



Figure A-44: Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment



Figure A-45: Post-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment



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



Figure A-47: Post-Test Driver Inner Door Panel View



Figure A-48: Post-Test Driver Dummy Close-Up Head Contact with Vehicle View

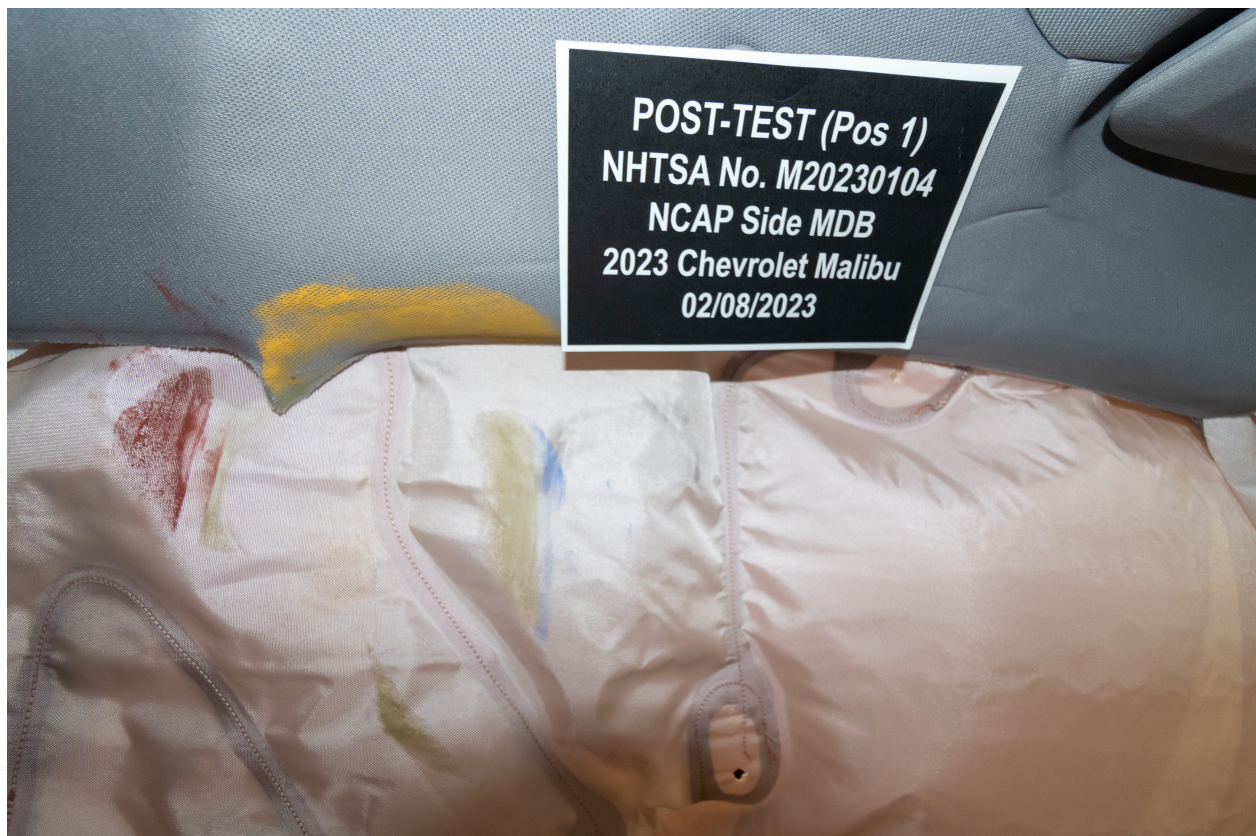


Figure A-49: Post-Test Driver Dummy Close-Up Head Contact with Side Air bag View



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



Figure A-51: Post-Test Driver Dummy Close-Up Torso Contact with Side Air bag View



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



Figure A-53: Post-Test Driver Dummy Close-Up Pelvis Contact with Side Air bag View



Figure A-54: Post-Test Driver Dummy Close-Up Knee Contact View



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



Figure A-56: Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View



Figure A-57: Post-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View



Figure A-58: Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning

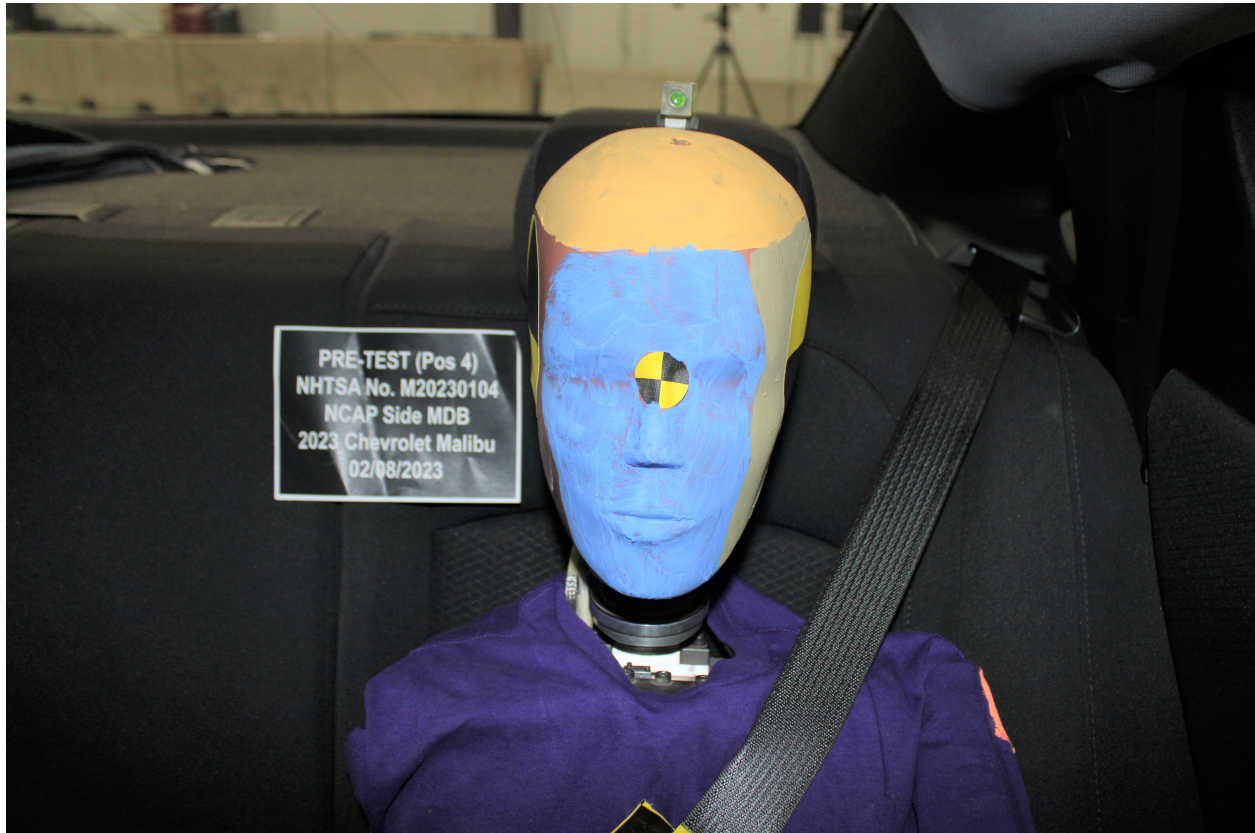


Figure A-59: Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint



Figure A-60: Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning



Figure A-61: Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan



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



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



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



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



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



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

Photo Not Available

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



Figure A-69: Pre-Test Rear Passenger Dummy and Door Clearance View



Figure A-70: Post-Test Rear Passenger Dummy and Door Clearance View



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



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



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



Figure A-74: Post-Test Rear Passenger Inner Door Panel View Showing Rear Passenger Dummy Contact Locations



Figure A-75: Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle View



Figure A-76: Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Air bag View



Figure A-77: Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View



Figure A-78: Post-Test Rear Passenger Dummy Close-Up Torso Contact with Side Air bag View



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

Photo Not Applicable

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



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



Figure A-82: Pre-Test View of Fuel Filler Cap or Fuel Filler Neck



Figure A-83: Post-Test View of Fuel Filler Cap or Fuel Filler Neck

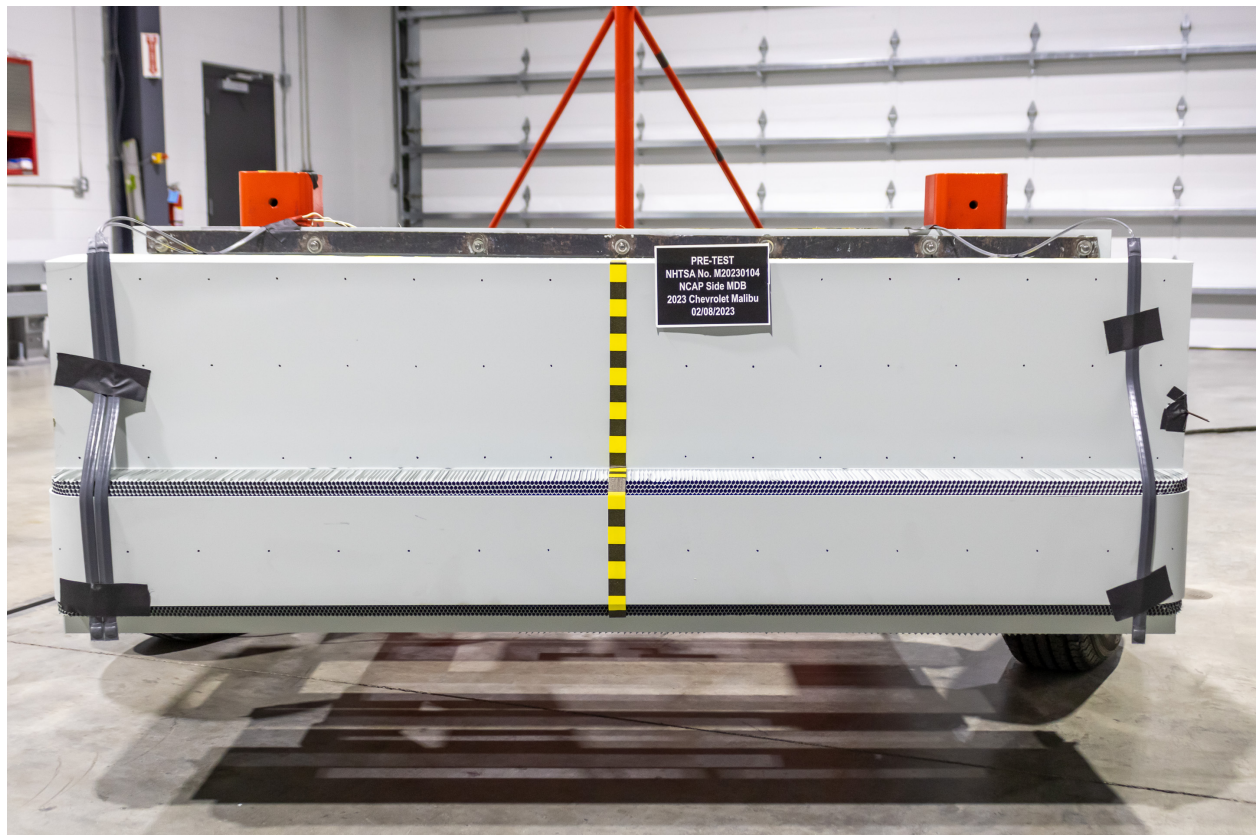


Figure A-84: Pre-Test Front View of MDB Impactor Face



Figure A-85: Post-Test Front View of MDB Impactor Face

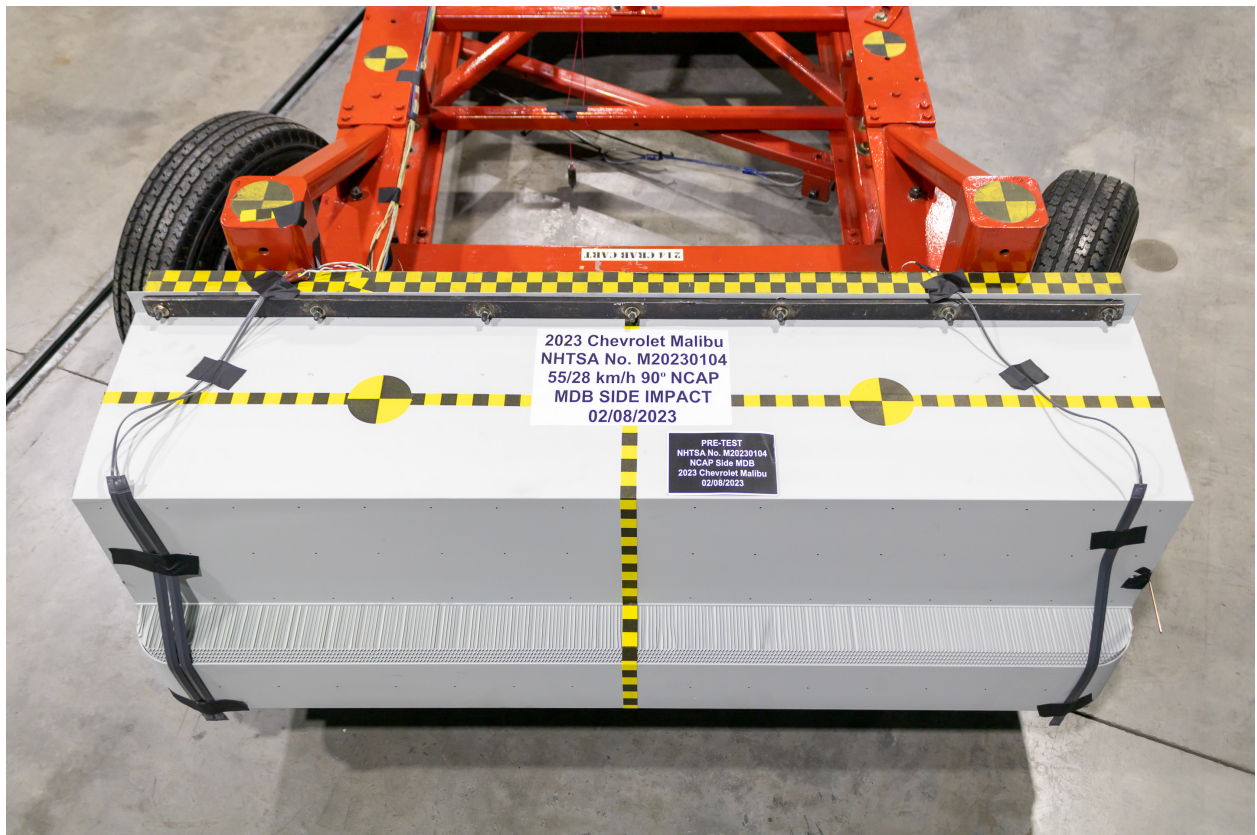


Figure A-86: Pre-Test Top View of MDB Impactor Face



Figure A-87: Post-Test Top View of MDB Impactor Face



Figure A-88: Pre-Test Left Side View of MDB Impactor Face



Figure A-89: Post-Test Left Side View of MDB Impactor Face



Figure A-90: Pre-Test Right Side View of MDB Impactor Face



Figure A-91: Post-Test Right Side View of MDB Impactor Face



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

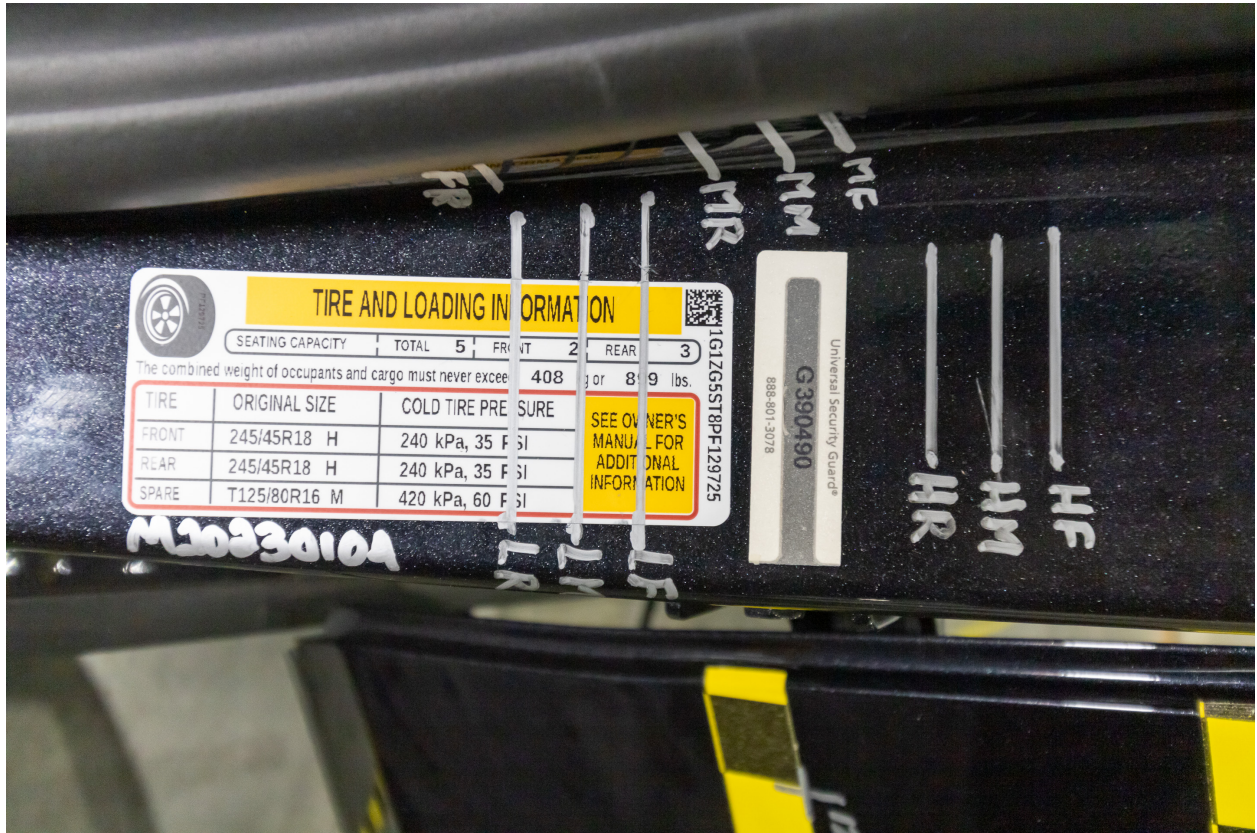


Figure A-93: Close-Up View of Vehicle's Tire Information Placard or Label

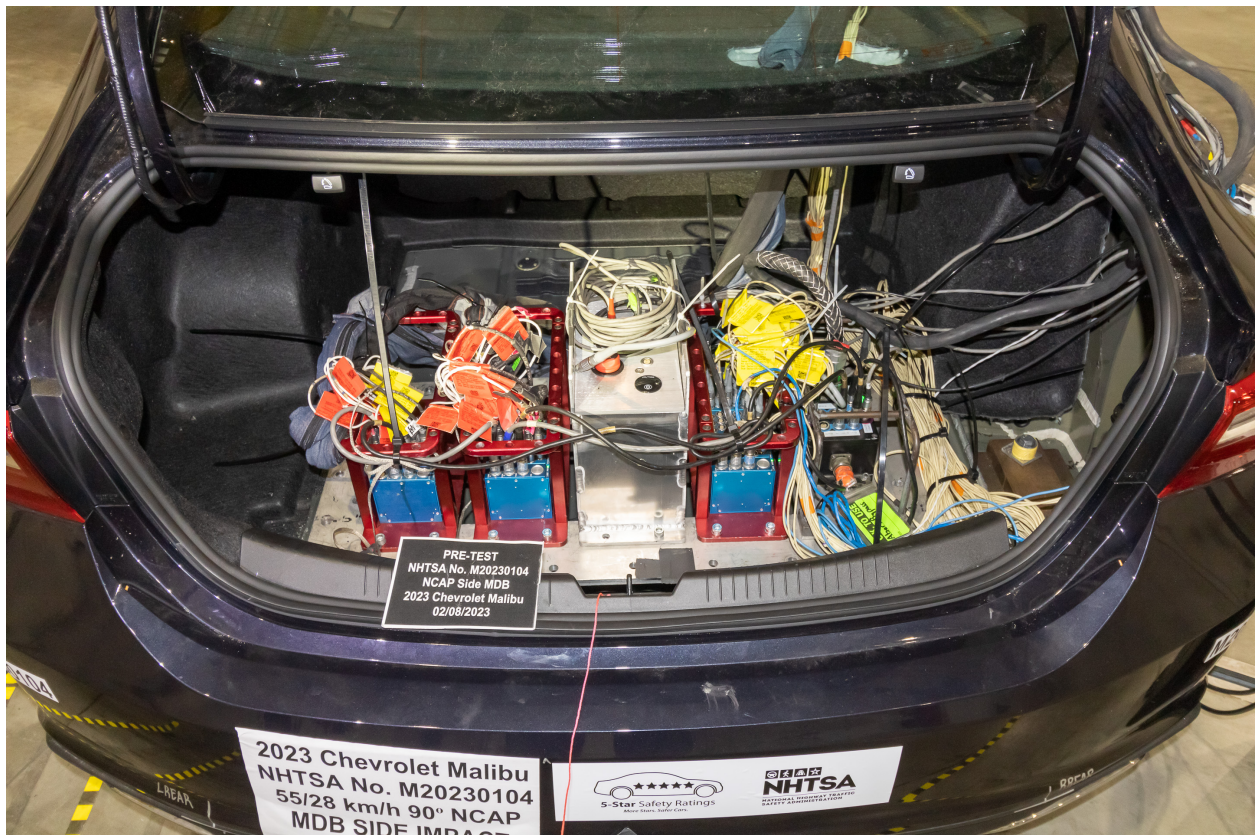


Figure A-94: Pre-Test Ballast View



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



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



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

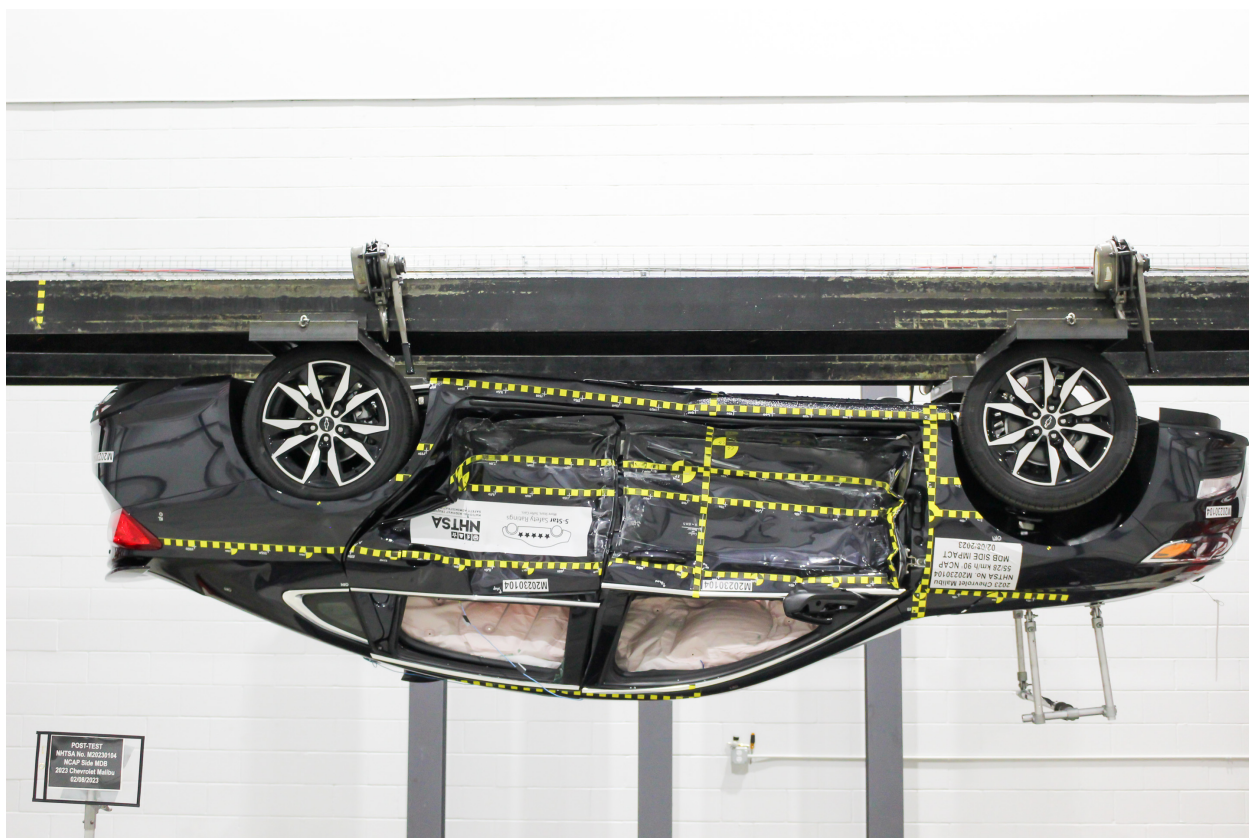


Figure A-98: FMVSS No. 301 Static Rollover 180 Degrees

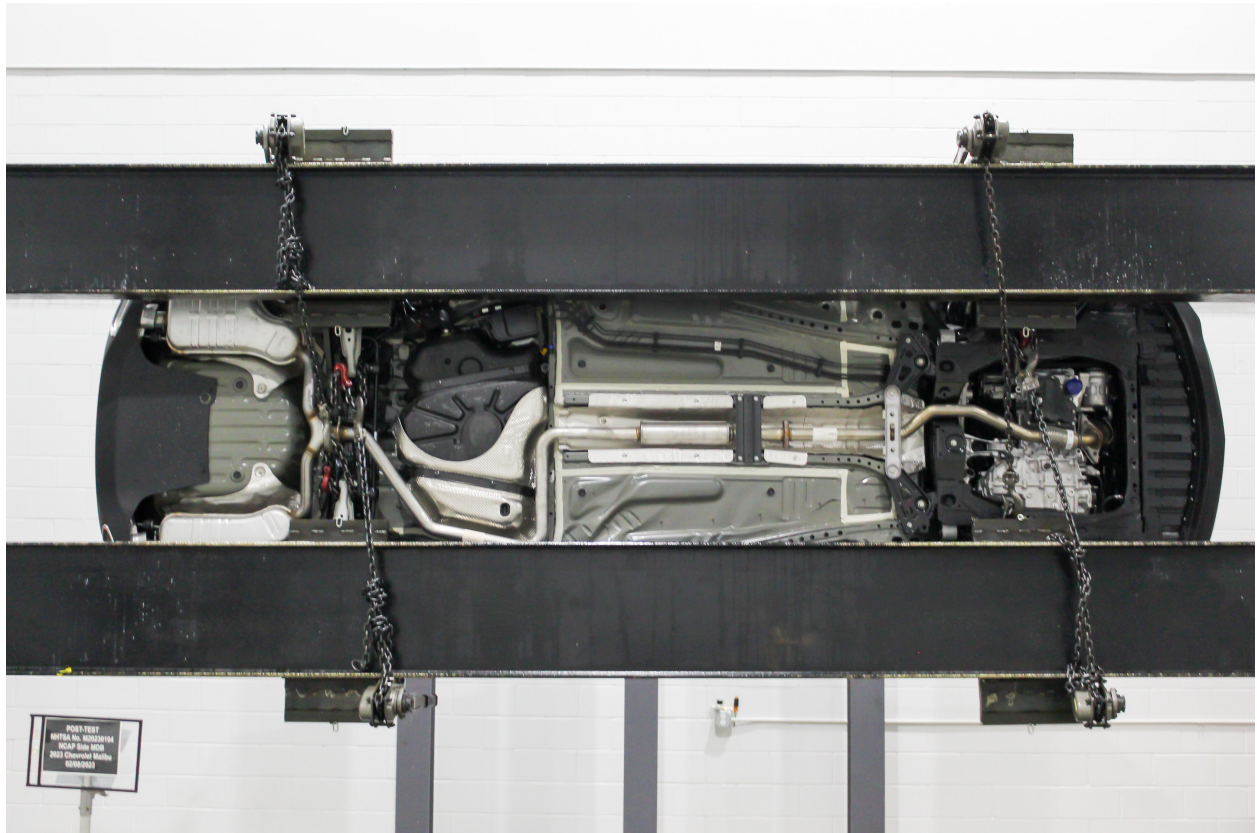


Figure A-99: FMVSS No. 301 Static Rollover 270 Degrees



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



Figure A-101: Impact Event

2023 MALIBU RS

EXTERIOR: DARK ASH METALLIC
INTERIOR: JET BLACK

ENGINE, 1.5L TURBO DOHC 4-CYL
TRANS CONTINUOUSLY VARIABLE

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STANDARD EQUIPMENT ITEMS LISTED BELOW ARE INCLUDED AT NO EXTRA CHARGE IN THE STANDARD VEHICLE PRICE SHOWN. OWNER BENEFITS • 3 YEAR/36,000 MILE* BUMPER-TO-BUMPER LIMITED WARRANTY • 5 YEAR/60,000 MILE* POWERTRAIN LIMITED WARRANTY, ROADSIDE ASSISTANCE & COURTESY TRANSPORTATION • FIRST MAINTENANCE VISIT *WHICHEVER COMES FIRST - SEE CHEVROLET.COM OR DEALER FOR TERMS, DETAILS & LIMITS PERFORMANCE & MECHANICAL • ENG CONTROL STOP/START SYS • TIRE, COMPACT SPARE • STABILITRAK-STABILITY CONTROL INCLUDES TRACTION CONTROL • WHEELS, 18" ALUMINUM	CONNECTIVITY & TECHNOLOGY • KEYLESS OPEN, FRONT DOORS • KEYLESS START • STEERING WHEEL CONTROLS, AUDIO, CRUISE, BLUETOOTH • CHEVROLET INFOTAINMENT 3 8" DIAG COLOR TOUCHSCREEN - ADDITIONAL FEATURES FOR COMPATIBLE PHONES INCLUDE : • BLUETOOTH AUDIO STREAMING VOICE COMMAND PASSTHROUGH TO PHONE, WIRELESS ANDROID AUTO & WIRELESS APPLE CARPLAY CAPABLE • 3 YEARS REMOTE ACCESS PLAN; ONSTAR & WI-FI DATA CAPABLE SEE ONSTAR.COM FOR TERMS INTERIOR • DRIVER INFORMATION CENTER • STEERING COLUMN, TILT AND TELESCOPIC • VISORS, INCL VANITY MIRRORS	• POWER WINDOWS, WITH EXPRESS DOWN ON ALL • PWR SEAT ADJUST- DRIVER, 8-WAY • POWER LUMBAR, DRIVER SEAT • SEAT ADJUSTER, FRNT PASSENGER, 6-WAY MANUAL • REAR SEAT, 60/40 SPLIT FOLDING SEATBACK • STEERING WHEEL, WRAPPED EXTERIOR • DAYTIME RUNNING LAMPS • HEADLAMP CONTROL, AUTOMATIC ON & OFF • BOWTIES, BLACK, FRONT AND REAR • DUAL POWER OUTSIDE MIRRORS, POWER ADJUST, MANUAL FOLD BODY-COLOR • EXHAUST, DUAL STAINLESS STEEL WITH POLISHED TIPS • GRILLE, CHROME SURROUND WITH BLACK INSERTS	• REAR SPOILER SAFETY & SECURITY • TIRE PRESSURE MONITOR SYSTEM • REMOTE PANIC ALARM • REAR DR LOCKS CHILD SECURITY • THEFT DETERRENT SYSTEM, CONTENT THEFT ALARM • CHEVY SAFETY ASSIST *INTELLIBEAM-AUTO HIGH BEAM *FOLLOWING DISTANCE INDICATOR *FORWARD COLLISION ALERT *LANE KEEP ASSIST W/ LANE DEPARTURE WARNING *AUTOMATIC EMERGENCY BRAKING *FRONT PEDESTRIAN BRAKING • REAR VISION CAMERA MANUFACTURER'S SUGGESTED RETAIL PRICE <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">STANDARD VEHICLE PRICE</td> <td style="text-align: right;">\$25,700.00</td> </tr> </table> OPTIONS & PRICING <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center; font-size: small;">OPTIONS INSTALLED BY THE MANUFACTURER (MAY REPLACE STANDARD EQUIPMENT LISTING)</td> </tr> <tr> <td style="text-align: right;">TOTAL OPTIONS</td> <td style="text-align: right;">\$0.00</td> </tr> <tr> <td style="text-align: right;">TOTAL VEHICLE & OPTIONS</td> <td style="text-align: right;">\$25,700.00</td> </tr> <tr> <td style="text-align: right;">DESTINATION CHARGE</td> <td style="text-align: right;">1,095.00</td> </tr> <tr> <td style="text-align: right;">TOTAL VEHICLE PRICE*</td> <td style="text-align: right;">\$26,795.00</td> </tr> </table>	STANDARD VEHICLE PRICE	\$25,700.00	OPTIONS INSTALLED BY THE MANUFACTURER (MAY REPLACE STANDARD EQUIPMENT LISTING)		TOTAL OPTIONS	\$0.00	TOTAL VEHICLE & OPTIONS	\$25,700.00	DESTINATION CHARGE	1,095.00	TOTAL VEHICLE PRICE*	\$26,795.00
STANDARD VEHICLE PRICE	\$25,700.00														
OPTIONS INSTALLED BY THE MANUFACTURER (MAY REPLACE STANDARD EQUIPMENT LISTING)															
TOTAL OPTIONS	\$0.00														
TOTAL VEHICLE & OPTIONS	\$25,700.00														
DESTINATION CHARGE	1,095.00														
TOTAL VEHICLE PRICE*	\$26,795.00														

EPA DOT Fuel Economy and Environment

MALIBU

Fuel Economy

Mid-size cars range from 15 to 132 MPG. The best vehicle rates 132 MPG.

30 MPG

combined city/hwy

27 city 35 highway

3.3 gallons per 100 miles

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

Annual fuel cost \$1,500

Fuel Economy & Greenhouse Gas Rating (tailpipe only)

1 6 10 Best

6

10 Best

7

10 Best

This vehicle emits 292 grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fuelconomy.gov

Smog Rating (tailpipe only)

1 7 10 Best

7

10 Best

This vehicle emits 292 grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fuelconomy.gov

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 28 MPG and costs \$8,000 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$2.95 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

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Calculate personalized estimates and compare vehicles

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score Not Rated

Based on the combined ratings of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight.

Frontal Crash	Driver Passenger	★★★★★
Side Crash	Front seat Rear seat	★★★★★
Rollover	Based on the risk of rollover in a single-vehicle crash.	★★★★★

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

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE: U.S./CANADIAN PARTS CONTENT: 40% MAJOR SOURCES OF FOREIGN PARTS CONTENT: MEXICO 27%

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

FOR THIS VEHICLE: FINAL ASSEMBLY POINT: KANSAS CITY, KS U.S.A. COUNTRY OF ORIGIN: ENGINE: MEXICO TRANSMISSION: MEXICO

ORDER NO C0C047 SALES CODE E SALES MODEL CODE 1206H DEALER NO 14005 FINAL ASSEMBLY KANSAS CITY, KS U.S.A. VIN 1G1ZG5S58T9P129725 DEALER TO WHOM DELIVERED SPORT CHEVROLET COMPANY, LLC 3101 AUTOMOBILE BLVD SILVER SPRING, MD 20904-4999

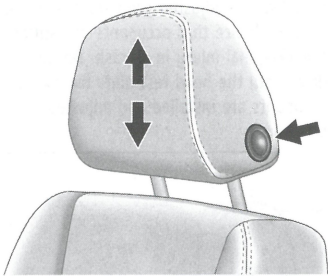
4J

1AG3894108

Figure A-102: Monroney Label

Front Seat

The vehicle's front seats have adjustable head restraints in the outboard seating positions.



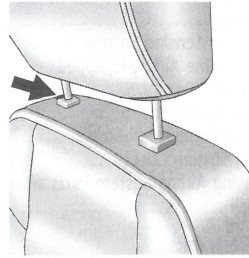
To raise or lower the head restraint, press the button located on the side of the head restraint and pull up or push the head restraint down and release the button.

Pull and push on the head restraint after the button is released to make sure that it is locked in place.

The front seat outboard head restraints are not removable.

Rear Seat

The vehicle's rear seats have adjustable head restraints in the outboard seating positions.



The height of the head restraint can be adjusted. Pull the head restraint up to raise it. Try to move the head restraint to make sure that it is locked in place.

To lower the head restraint, press the button, located on the top of the seatback, and push the head restraint down. Try to move the head restraint after the button is released to make sure that it is locked in place.

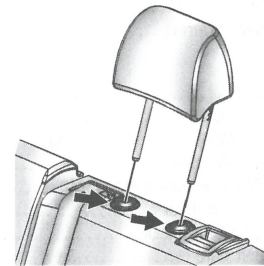
The rear seat outboard head restraints are not intended to be removed. If removal is required see your dealer for assistance with

removal. In the event of an emergency, the following can be used as removal and installation instructions. Store the removed head restraints in a secure place. Reinstall the head restraints before the seating position is occupied.

Head Restraint Removal and Reinstallation

To remove the head restraint:

1. Partially fold the seatback forward. See *Rear Seats* ⇨ 35 for additional information.

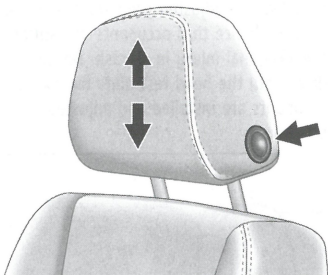


2. Press both buttons on the head restraint posts at the same time, and pull up on the head restraint.

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

Front Seat

The vehicle's front seats have adjustable head restraints in the outboard seating positions.



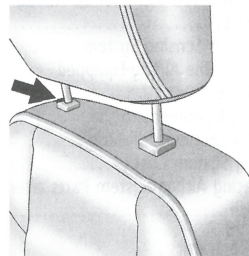
To raise or lower the head restraint, press the button located on the side of the head restraint and pull up or push the head restraint down and release the button.

Pull and push on the head restraint after the button is released to make sure that it is locked in place.

The front seat outboard head restraints are not removable.

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The vehicle's rear seats have adjustable head restraints in the outboard seating positions.



The height of the head restraint can be adjusted. Pull the head restraint up to raise it. Try to move the head restraint to make sure that it is locked in place.

To lower the head restraint, press the button, located on the top of the seatback, and push the head restraint down. Try to move the head restraint after the button is released to make sure that it is locked in place.

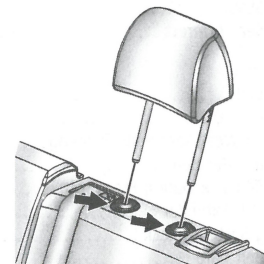
The rear seat outboard head restraints are not intended to be removed. If removal is required see your dealer for assistance with

removal. In the event of an emergency, the following can be used as removal and installation instructions. Store the removed head restraints in a secure place. Reinstall the head restraints before the seating position is occupied.

Head Restraint Removal and Reinstallation

To remove the head restraint:

1. Partially fold the seatback forward. See *Rear Seats* ⇨ 35 for additional information.



2. Press both buttons on the head restraint posts at the same time, and pull up on the head restraint.

Figure A-104: Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

APPENDIX B
VEHICLE & DUMMY RESPONSE DATA TRACES

Table of Data Plots

Driver Dummy Instrumentation Plots

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Plot 22	Passenger Iliac Force on Impact Side (Y) vs. Time	B-10
Plot 23	Passenger Acetabulum Force on Impact Side (Y) vs. Time	B-10
Plot 24	Passenger Total Pelvic Force on Impact Side (Y) vs. Time	B-10

Additional Driver & Passenger Dummy Instrumentation Data

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

Vehicle Instrumentation Data

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

MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)

MDB Center of Gravity Acceleration (Y)

MDB Center of Gravity Acceleration (Z)

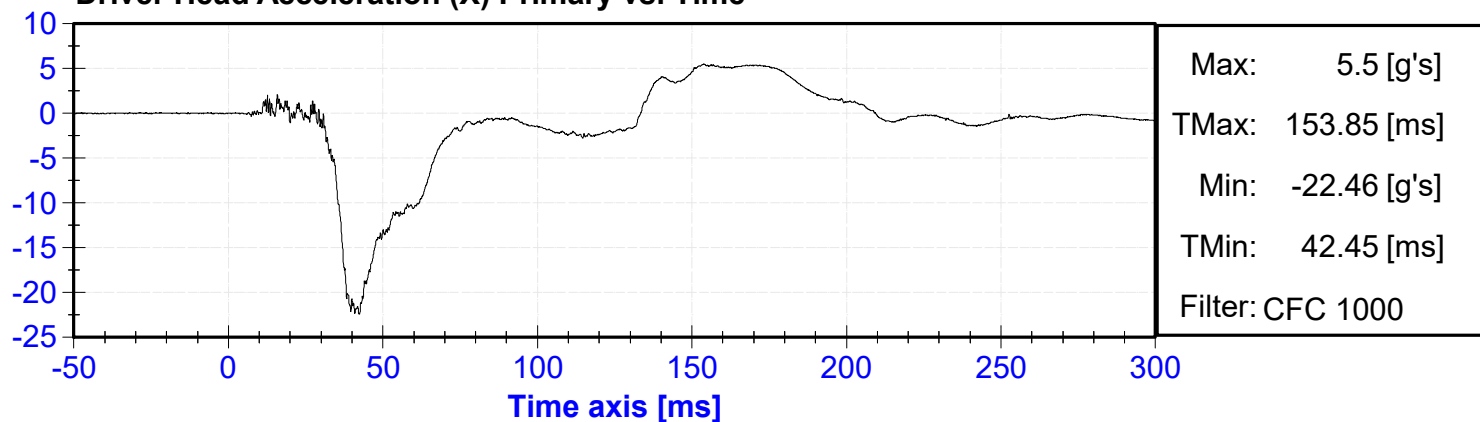
MDB Rear Acceleration (X)

MDB Rear Acceleration (Y)

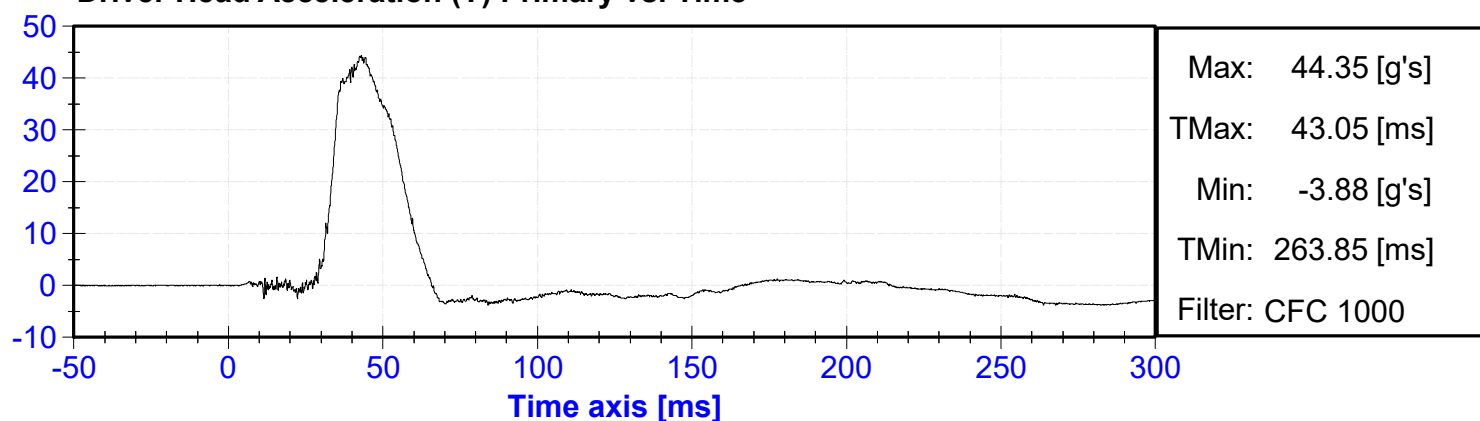
Left MDB Contact Switch

Right MDB Contact Switch

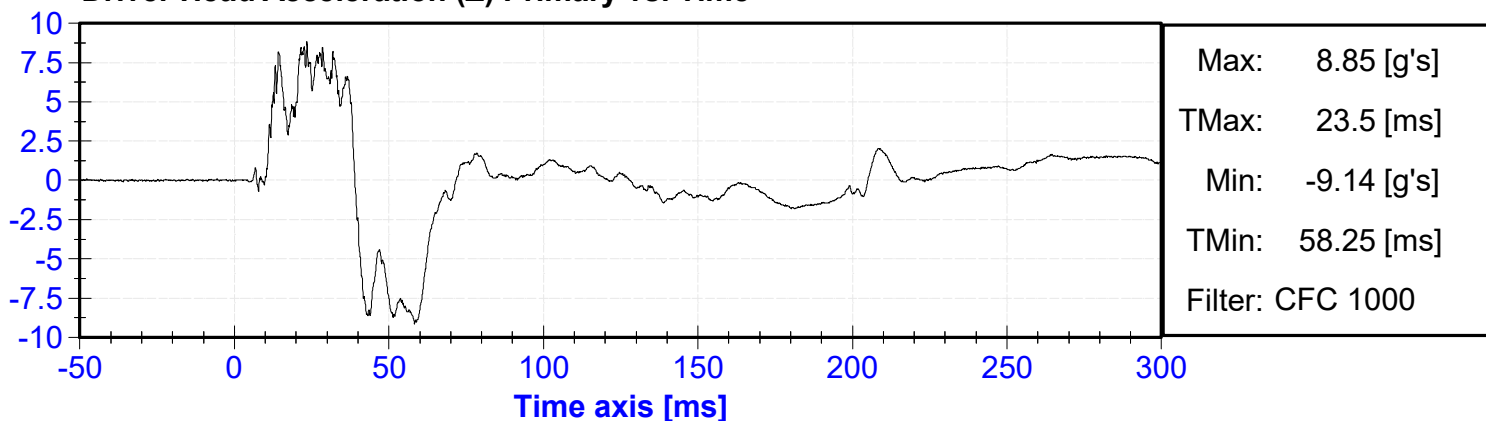
Driver Head Acceleration (X) Primary vs. Time



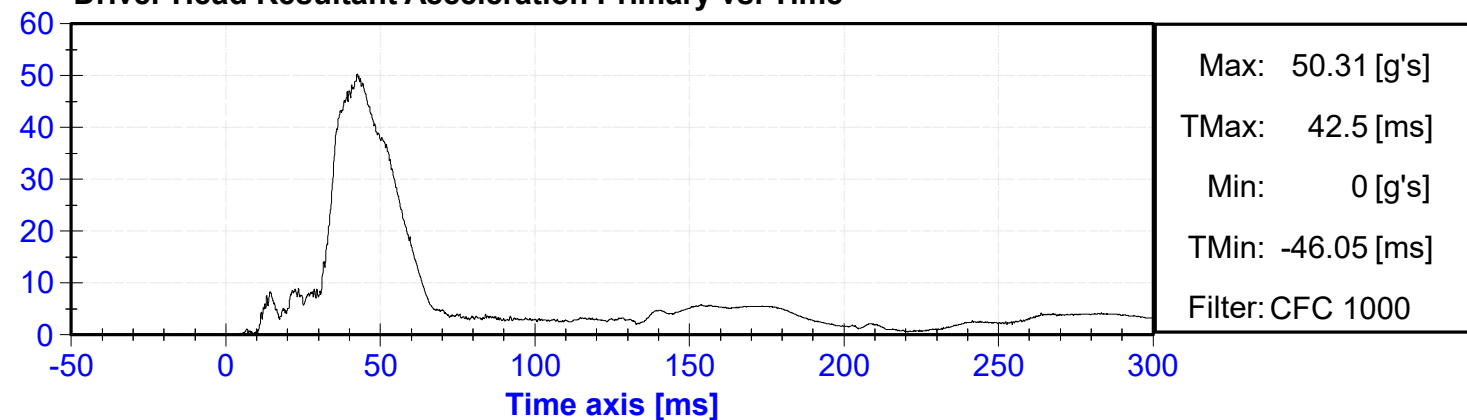
Driver Head Acceleration (Y) Primary vs. Time



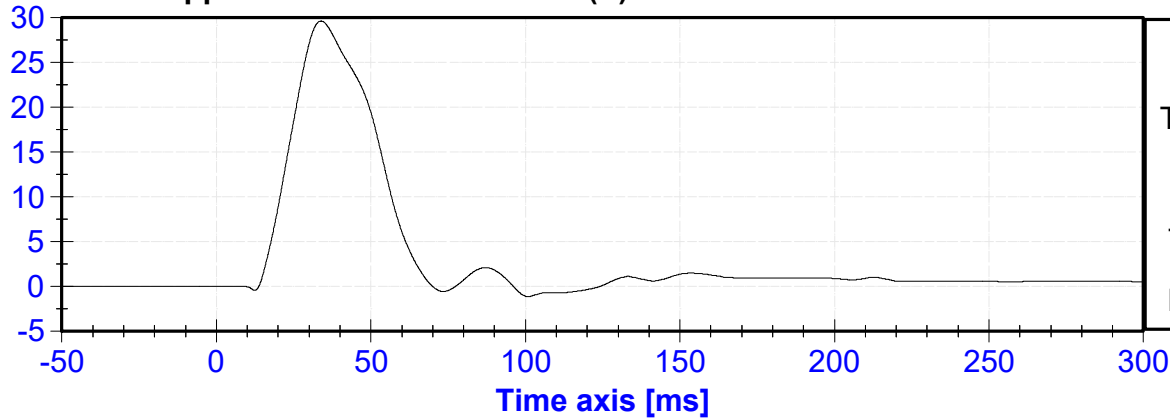
Driver Head Acceleration (Z) Primary vs. Time



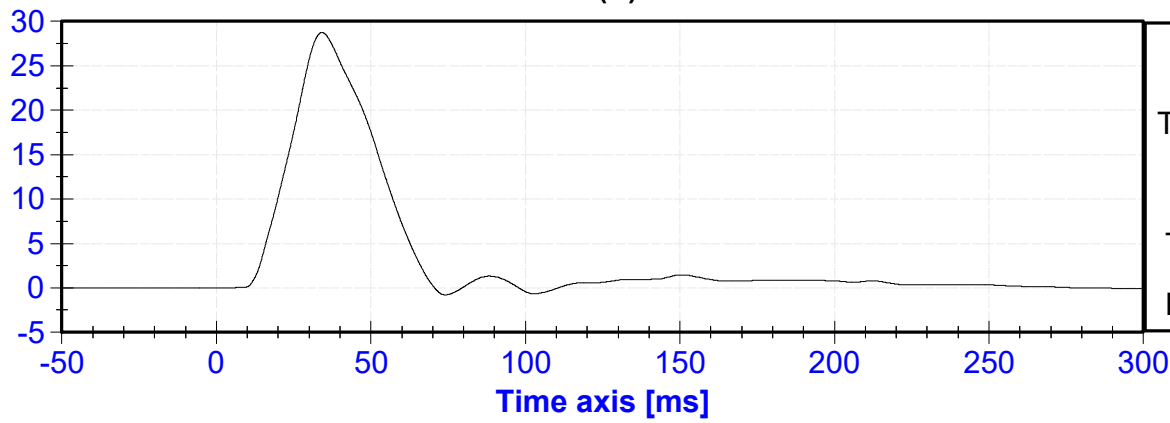
Driver Head Resultant Acceleration Primary vs. Time



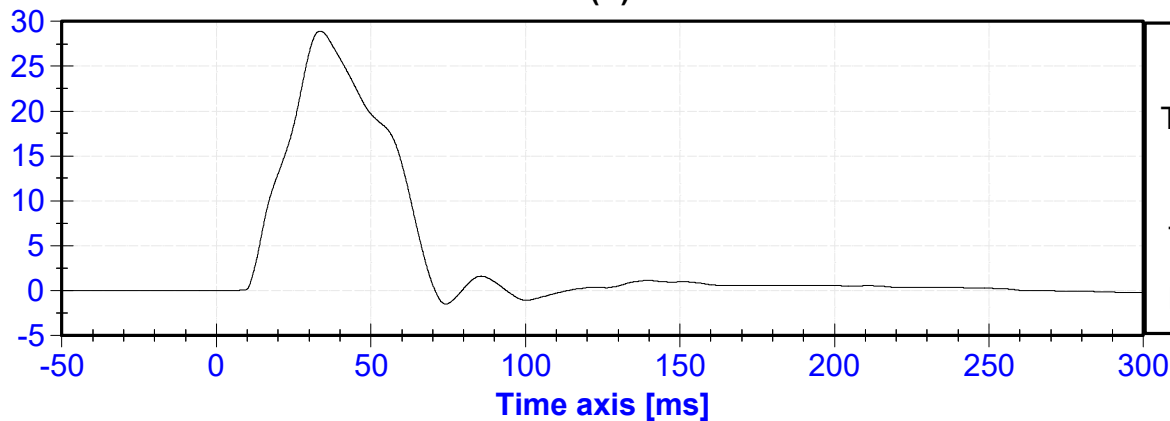
Driver Upper Thorax Rib Deflection (Y) vs. Time



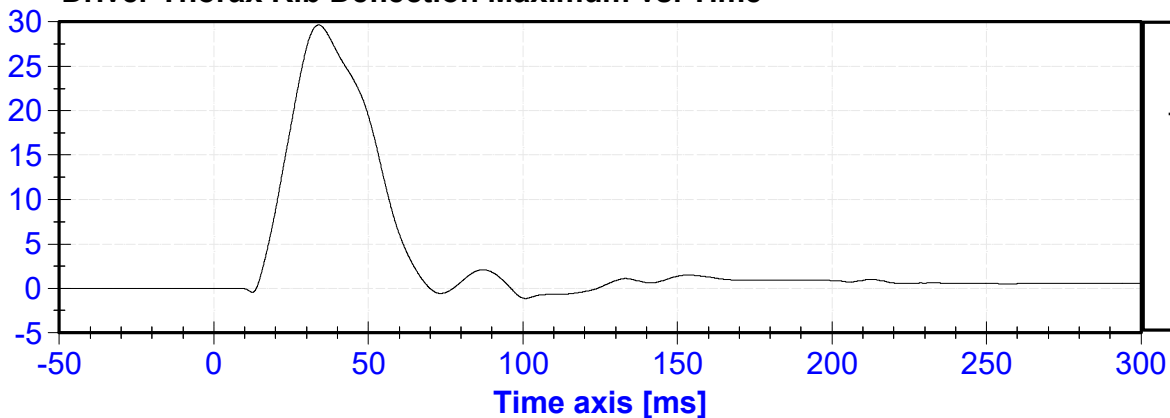
Driver Middle Thorax Rib Deflection (Y) vs. Time



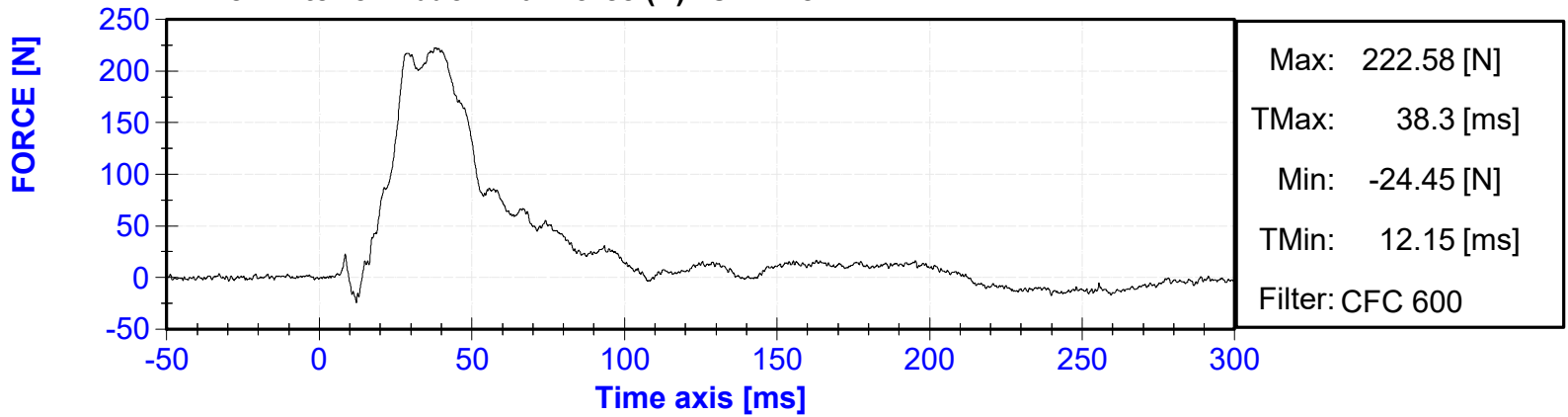
Driver Lower Thorax Rib Deflection (Y) vs. Time



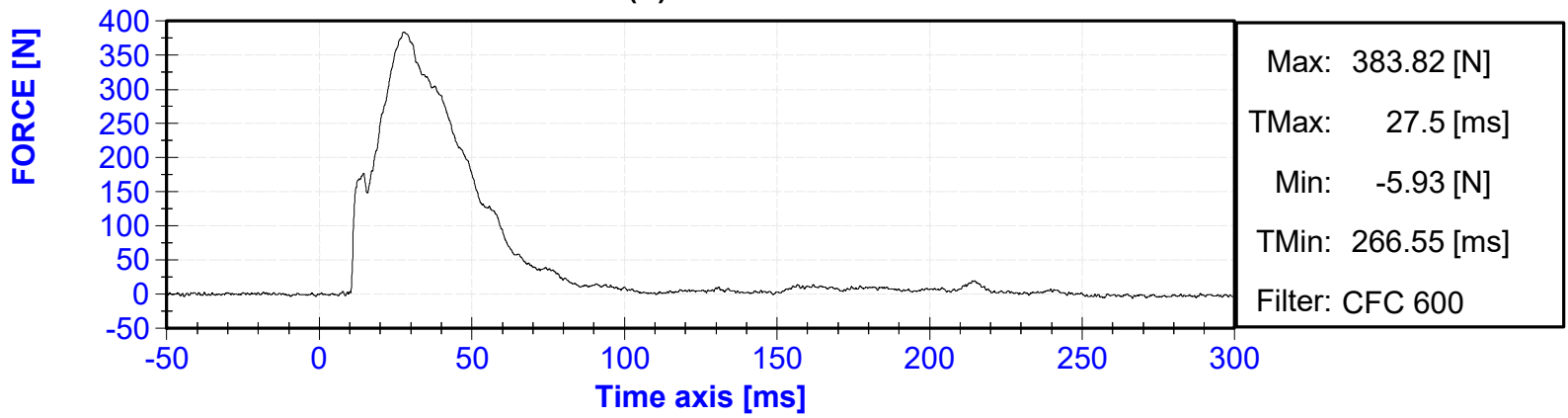
Driver Thorax Rib Deflection Maximum vs. Time



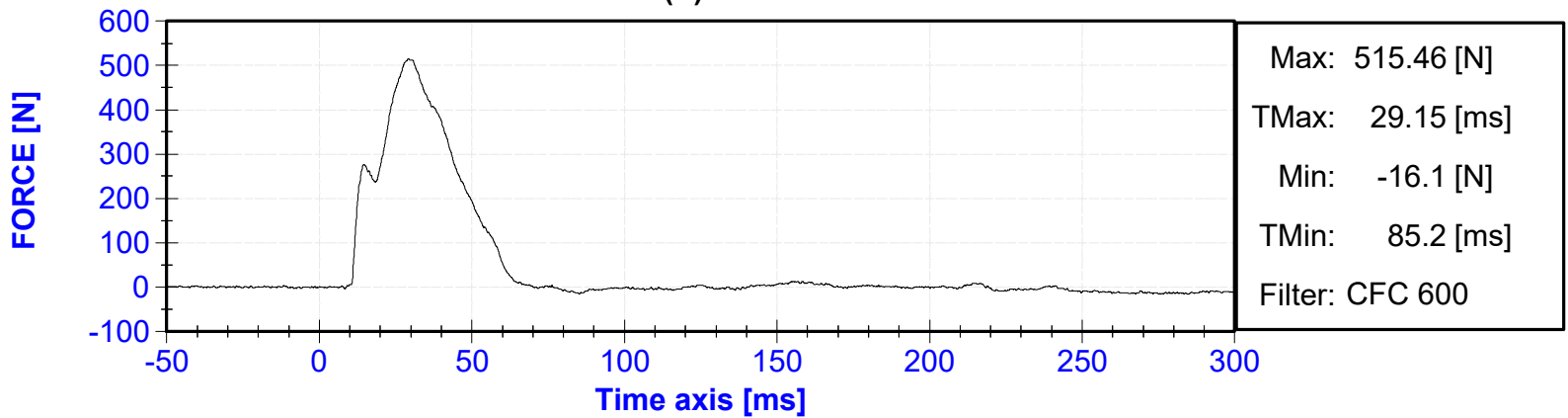
Driver Anterior Abdominal Force (Y) vs. Time



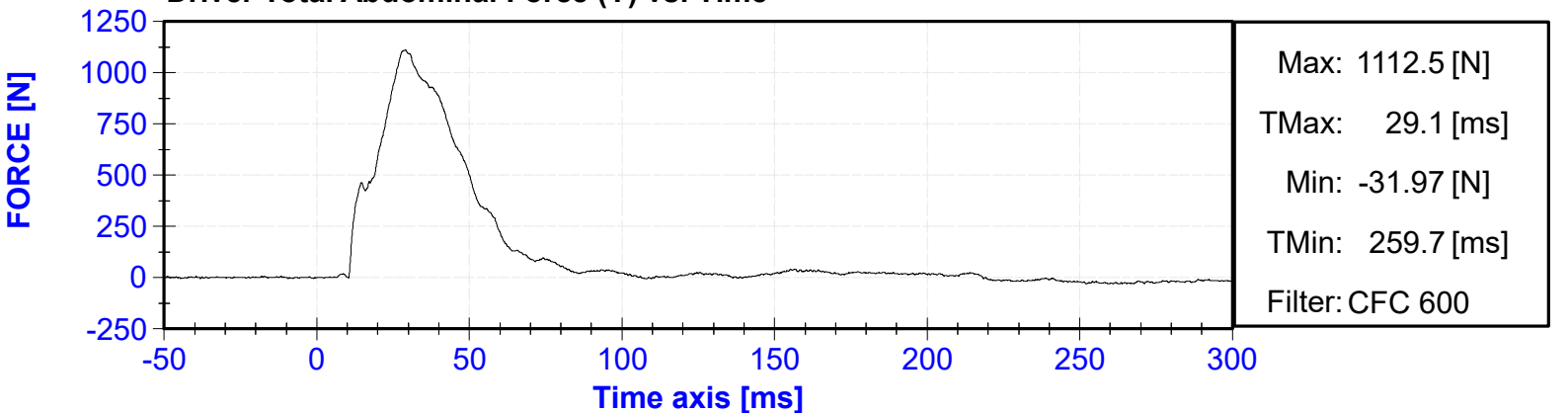
Driver Middle Abdominal Force (Y) vs. Time



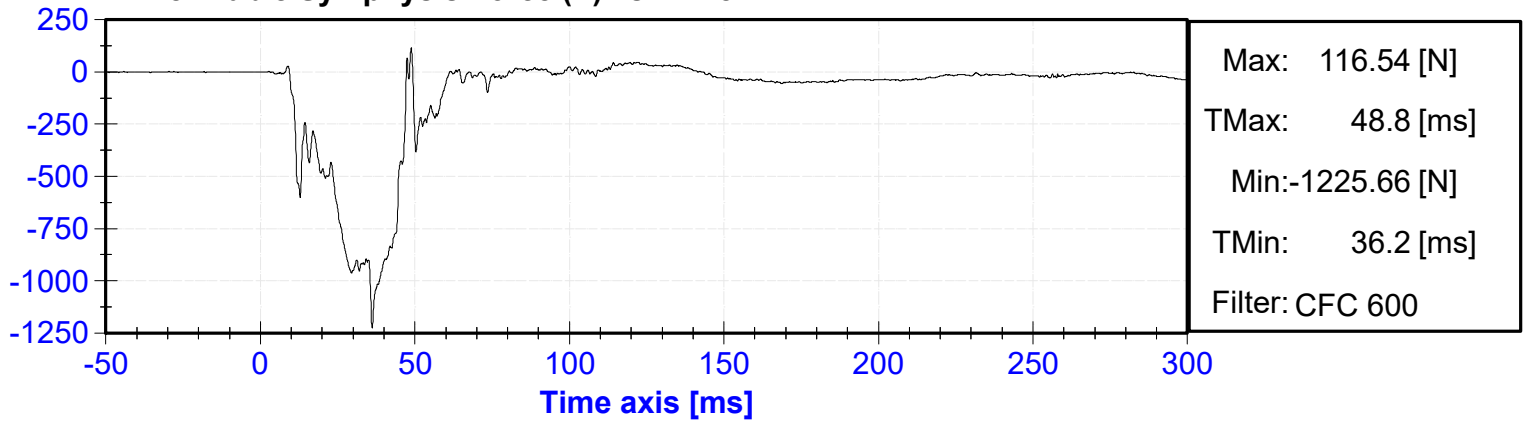
Driver Posterior Abdominal Force (Y) vs. Time



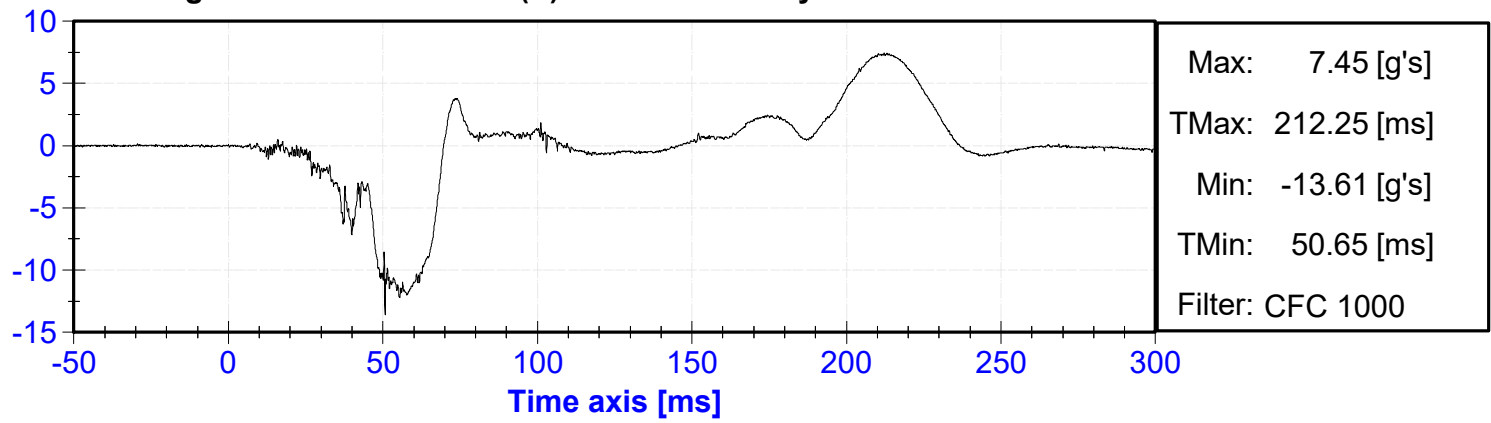
Driver Total Abdominal Force (Y) vs. Time



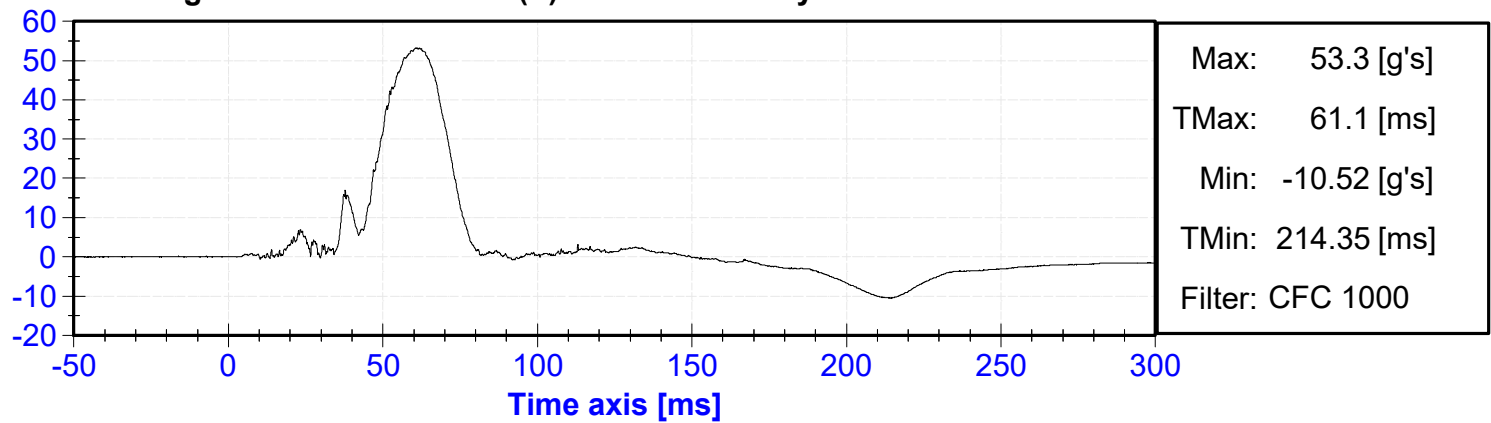
Driver Pubic Symphysis Force (Y) vs. Time



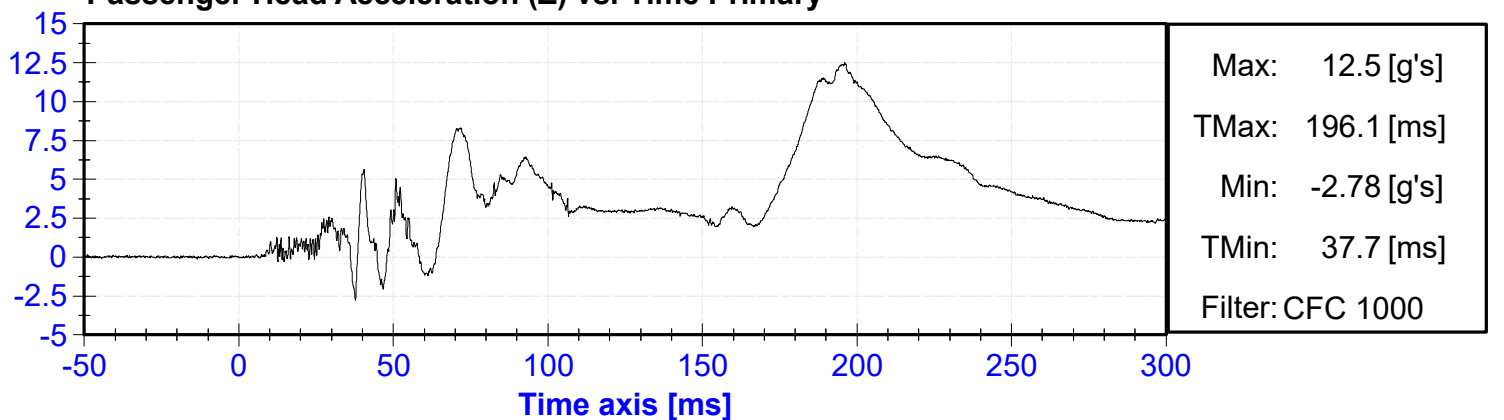
Passenger Head Acceleration (X) vs. Time Primary



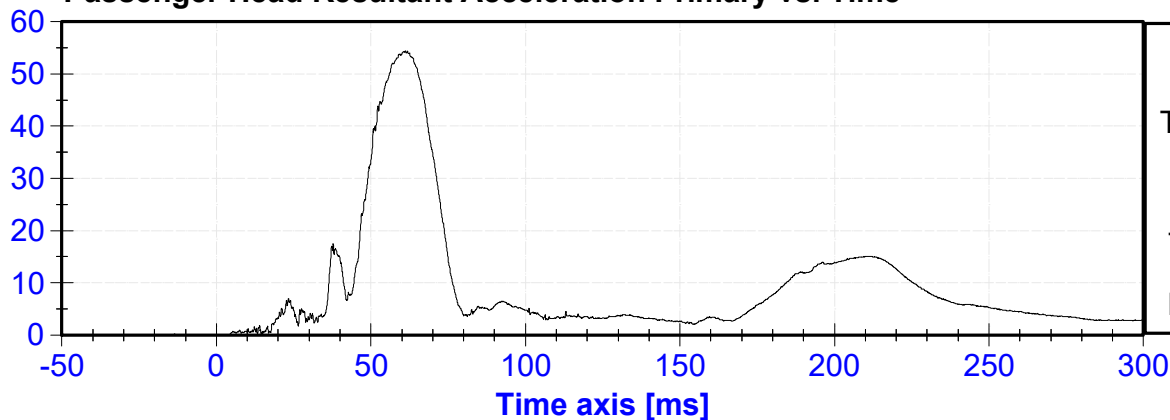
Passenger Head Acceleration (Y) vs. Time Primary



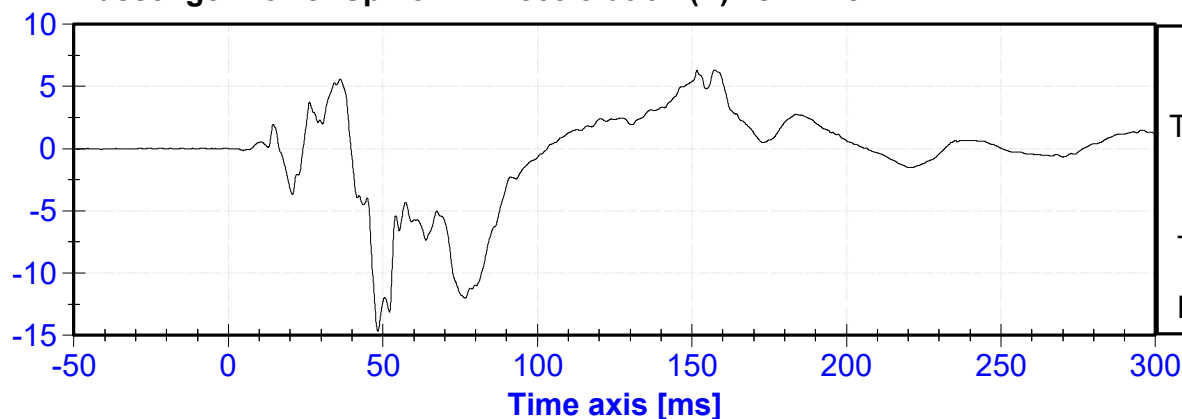
Passenger Head Acceleration (Z) vs. Time Primary



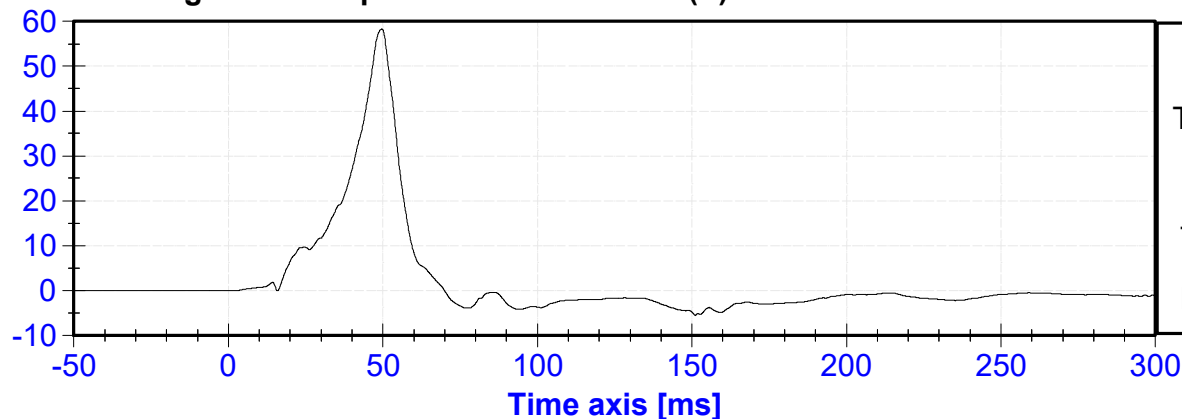
Passenger Head Resultant Acceleration Primary vs. Time



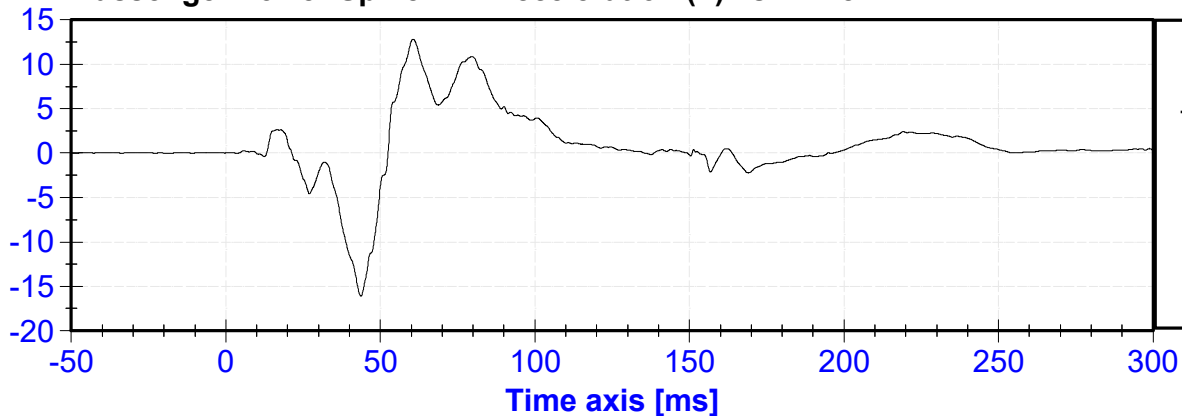
Passenger Lower Spine T12 Acceleration (X) vs. Time



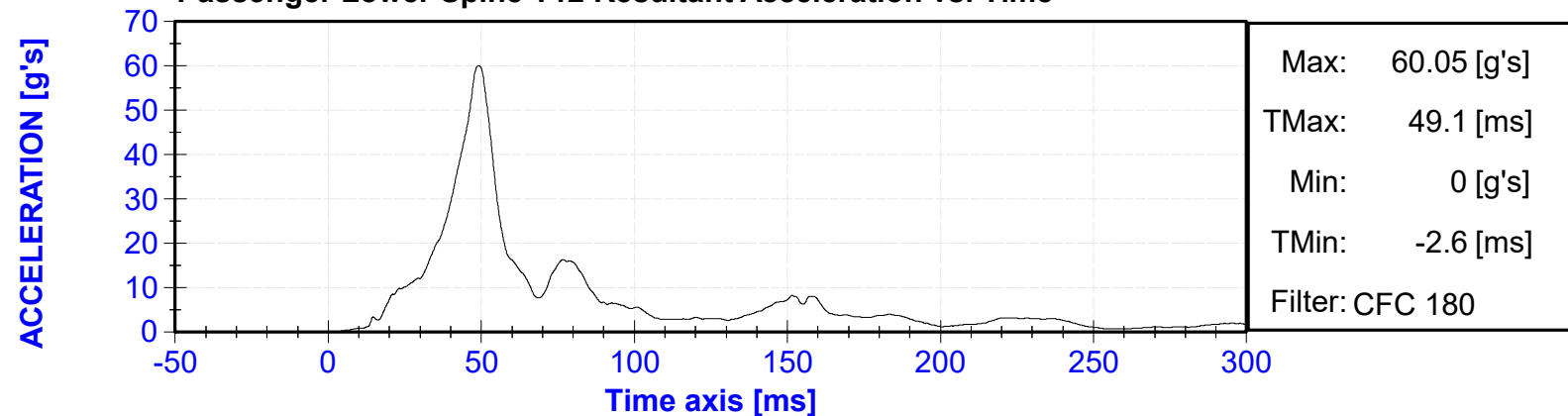
Passenger Lower Spine T12 Acceleration (Y) vs. Time



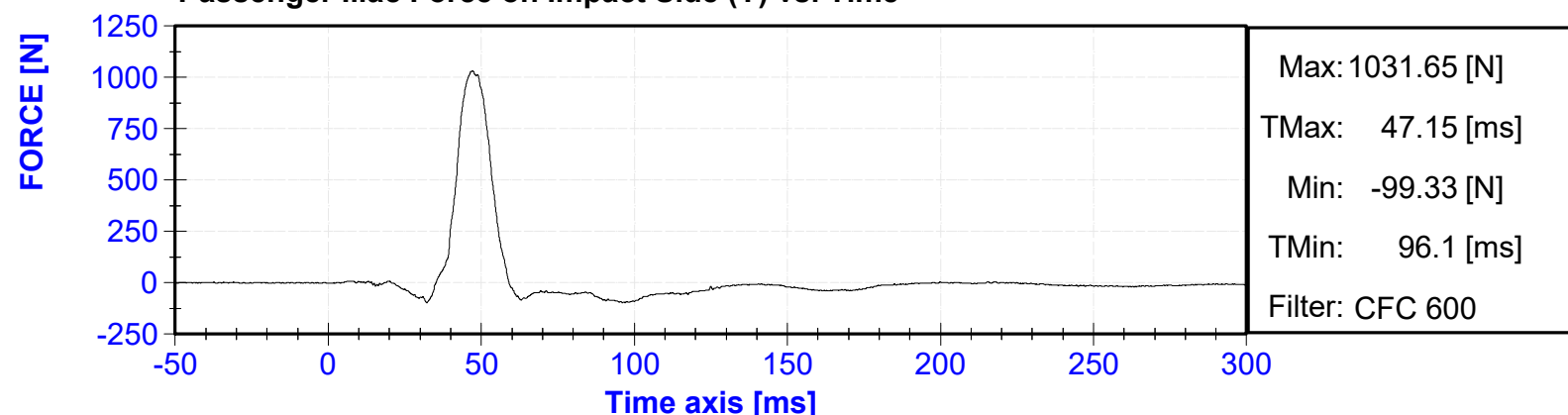
Passenger Lower Spine T12 Acceleration (Z) vs. Time



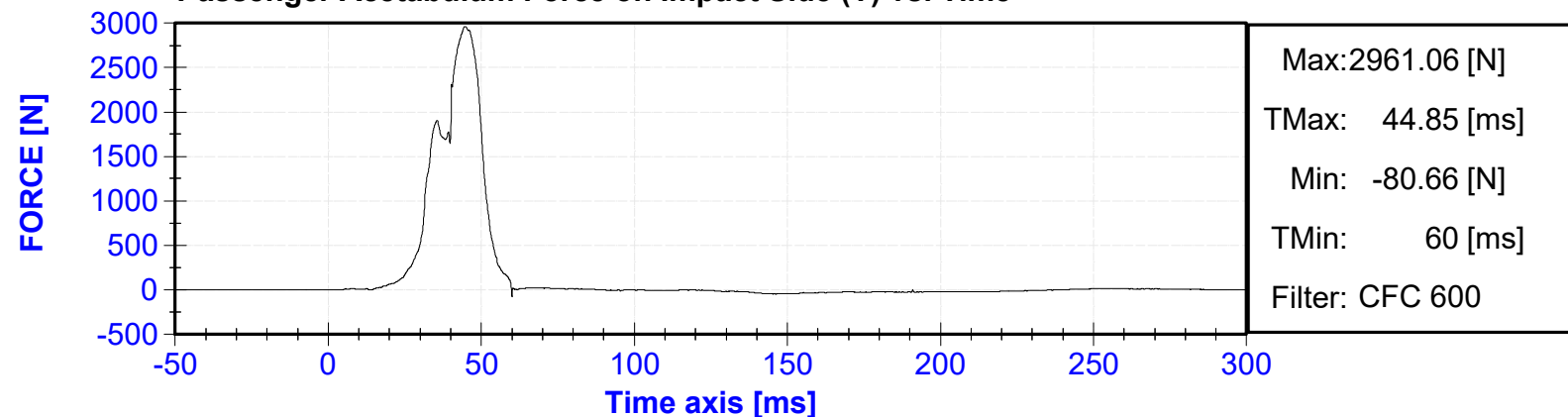
Passenger Lower Spine T12 Resultant Acceleration vs. Time



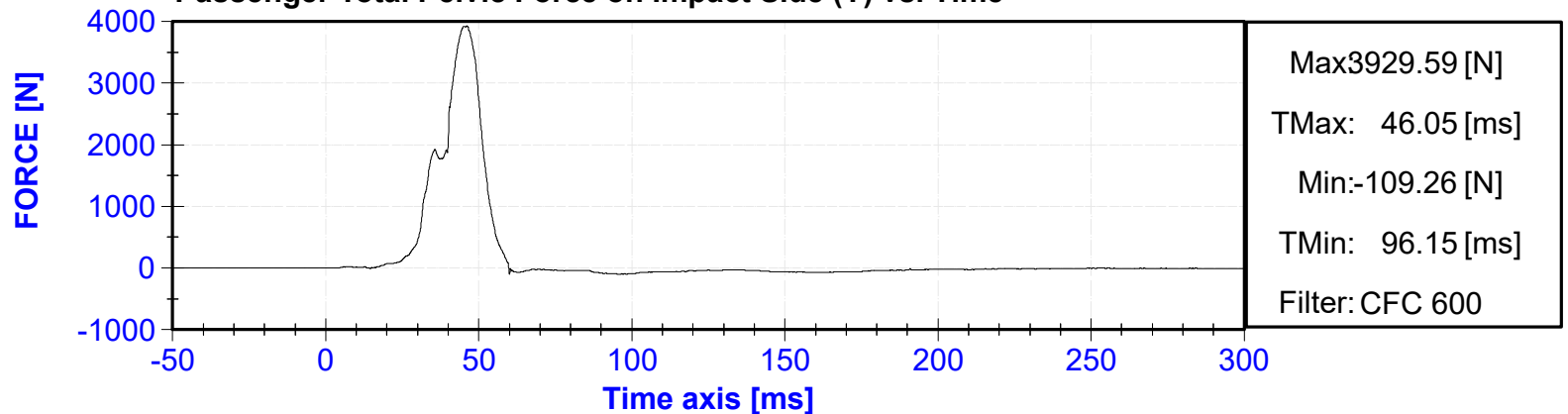
Passenger Iliac Force on Impact Side (Y) vs. Time



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



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



APPENDIX C

DUMMY PERFORMANCE CALIBRATION TEST DATA

CALIBRATION TEST RESULTS

PRE-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

SERIAL NO:F033

(CONFIGURED FOR LEFT SIDE IMPACT)

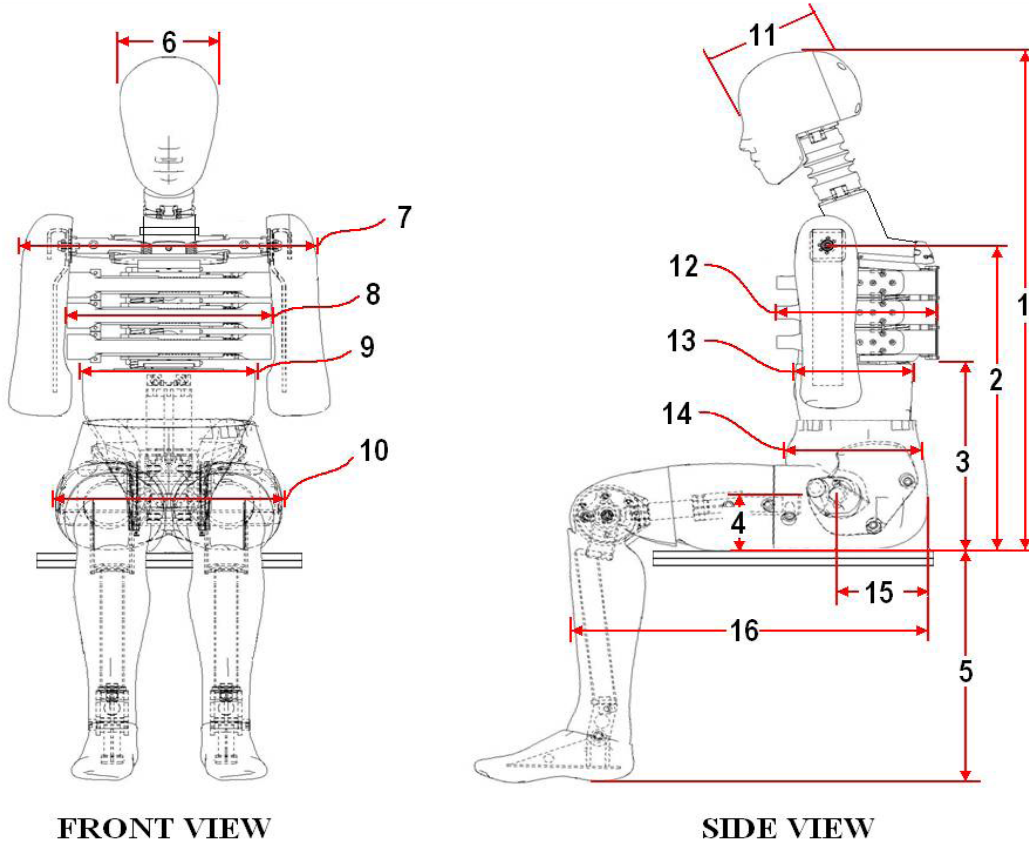


External Measurements - EuroSID-2re

Technician: K. Brogan

Date: 02/06/2023

Dummy Serial Number: F033



FRONT VIEW

SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	911	Pass
2	Seat to Shoulder Joint	558	572	567	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	351	Pass
4	Seat to Hip Joint (center of bolt)	97	103	99	Pass
5	Sole to Seat, Sitting	333	451	420	Pass
6	Head Width	152	158	157	Pass
7	Shoulder/Arm Width	461	479	469	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	281	Pass
10	Pelvis Lap Width	359	373	367	Pass
11	Head Depth	196	206	201	Pass
12	Thorax Depth	262	272	268	Pass
13	Abdomen Depth	194	204	202	Pass
14	Pelvis Depth	235	245	238	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	156	Pass
16	Back of Buttocks to Front Knee	597	615	611	Pass

ATD Manufacturer	FTSS	Test Technician	Z.Schneider
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

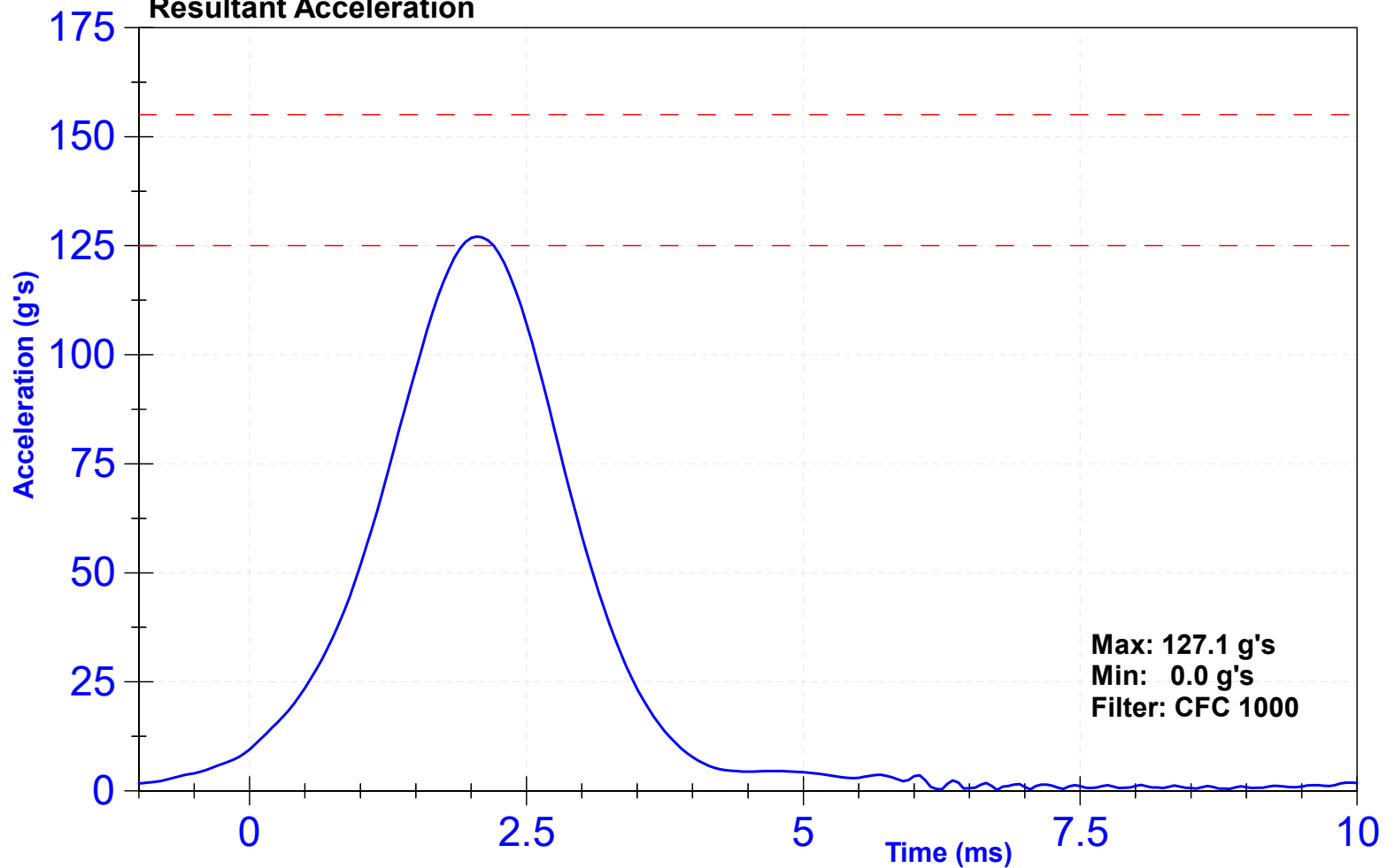
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	13	Pass
Resultant Acceleration	125	155	g's	127.1	Pass
Oscillation	0	15	%	3.59	Pass
Fore-Aft Acceleration	-15	15	g's	7.8	Pass

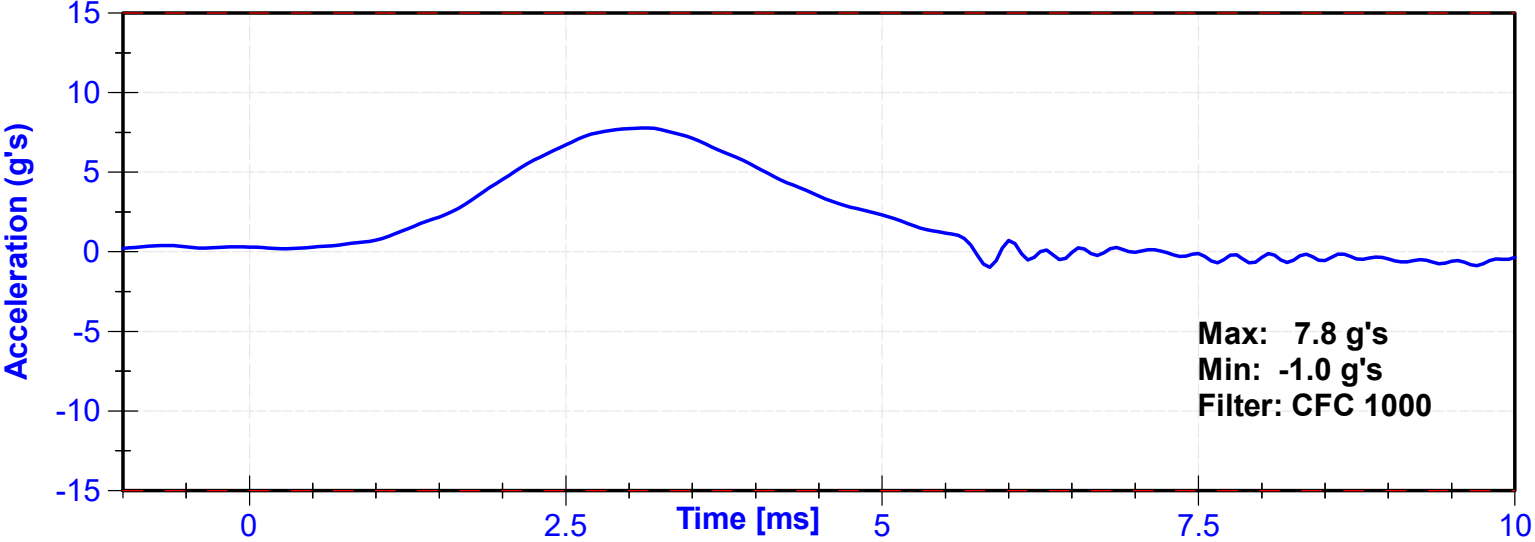
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P63861	1/17/2023	7/16/2023
Y Accelerometer	Endevco	P49216	1/17/2023	7/16/2023
Z Accelerometer	Endevco	P51303	1/17/2023	7/16/2023

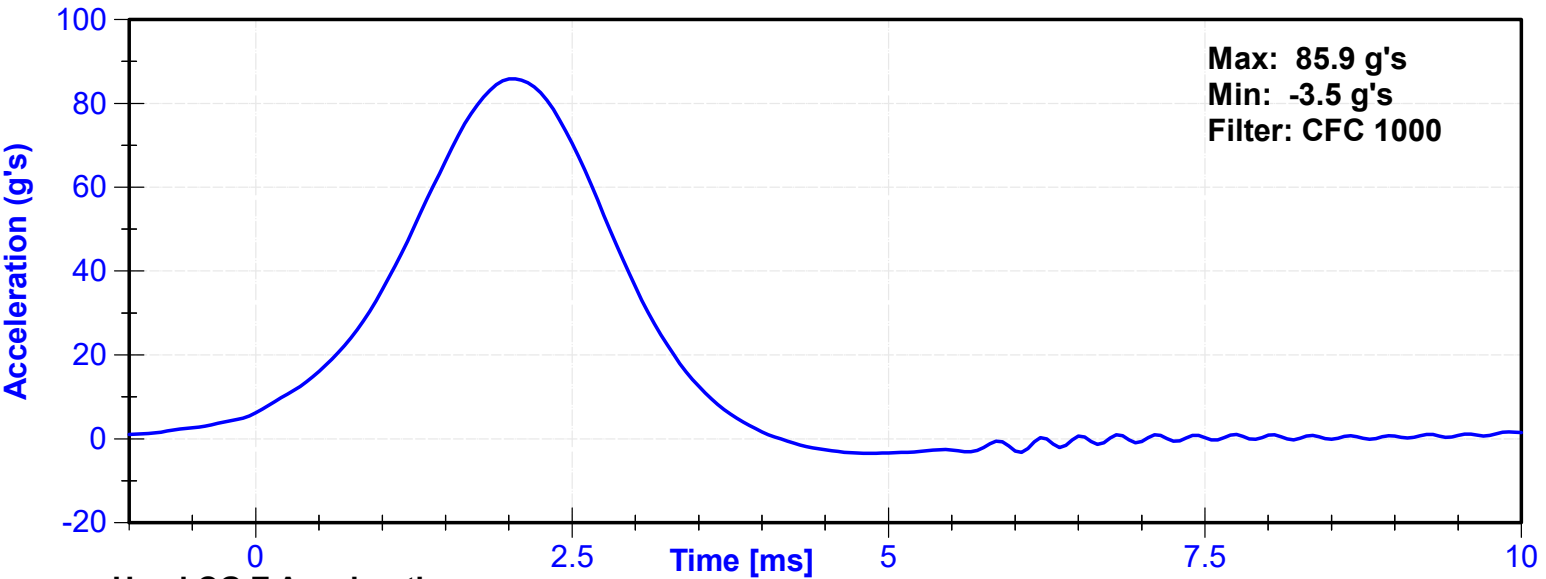
Resultant Acceleration



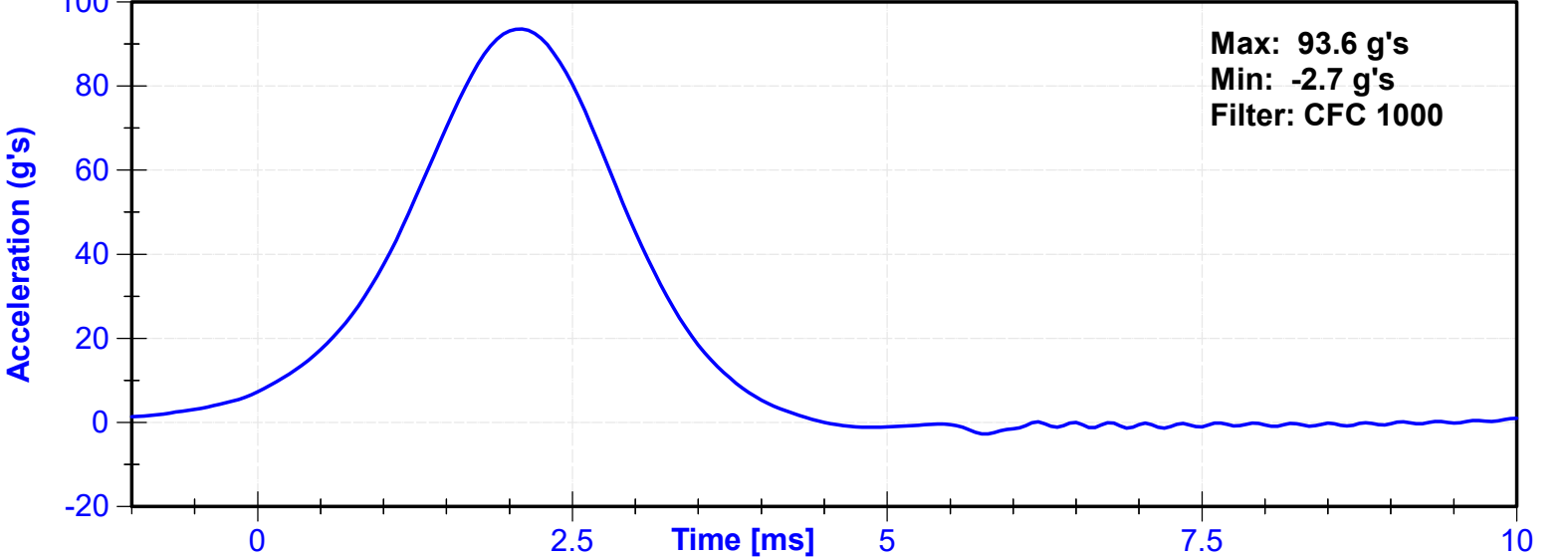
Head CG X Acceleration



Head CG Y Acceleration



Head CG Z Acceleration



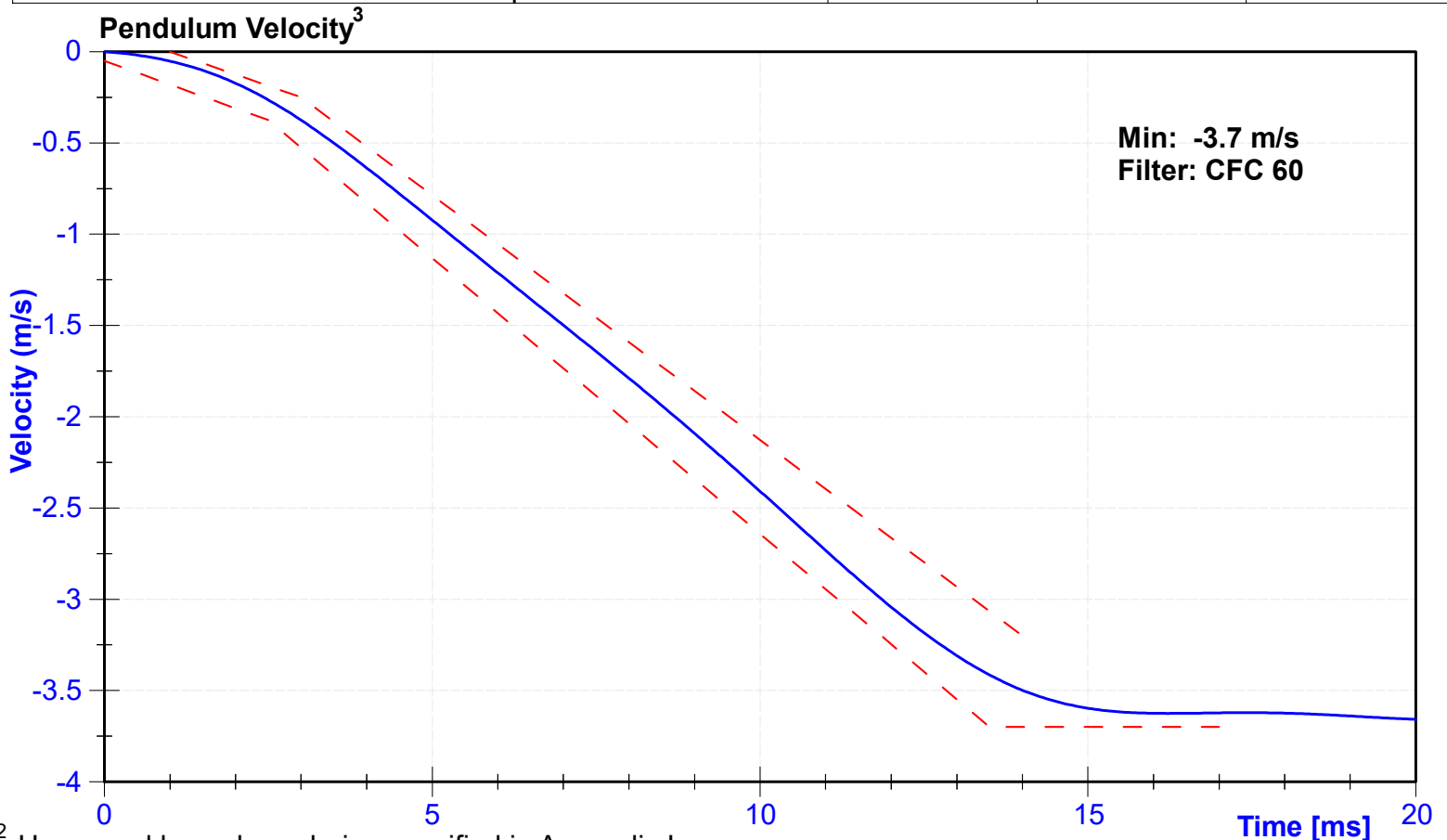
ATD Manufacturer	FTSS	Test Technician	D. Kroll
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	13	Pass
Velocity	3.3	3.5	m/s	3.44	Pass
Lateral Neck Rotation	49	59	deg	55.3	Pass
Time at Maximum Rotation	54	66	ms	57.4	Pass
Time of Rotation Decay from Maximum	53	88	ms	62.6	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

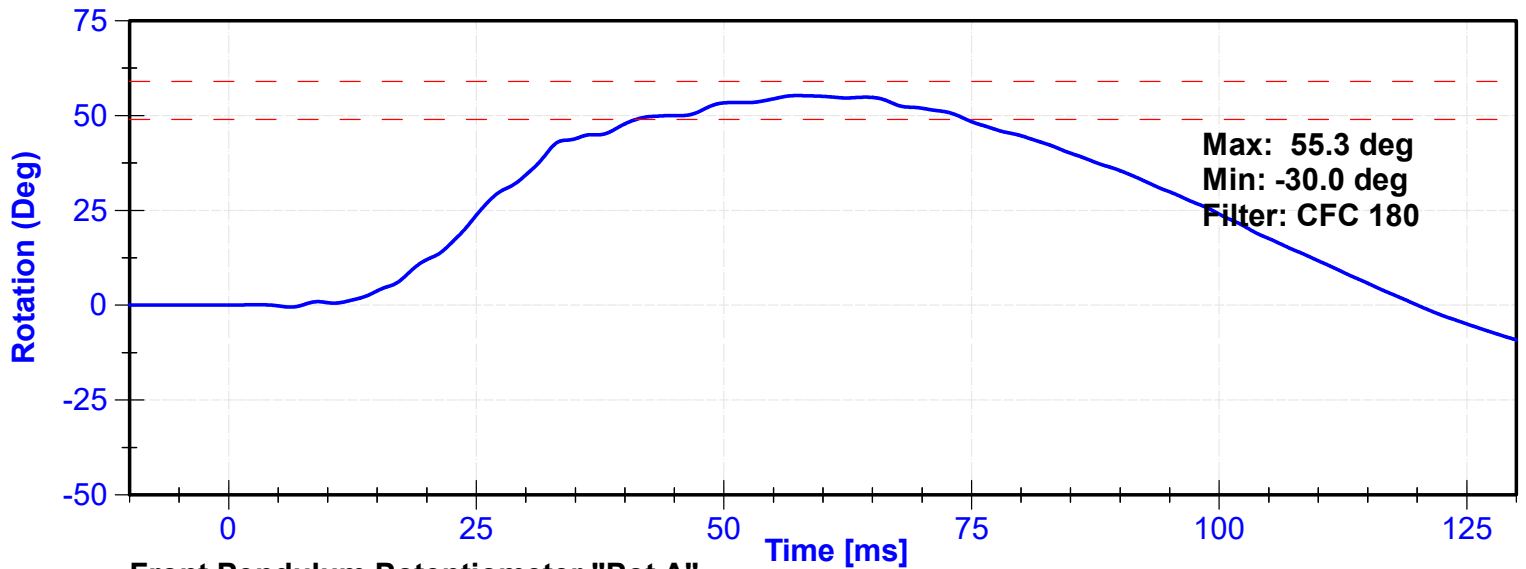
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Front Pendulum Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Headform Potentiometer	Sfernice	095	10/5/2022	10/5/2023

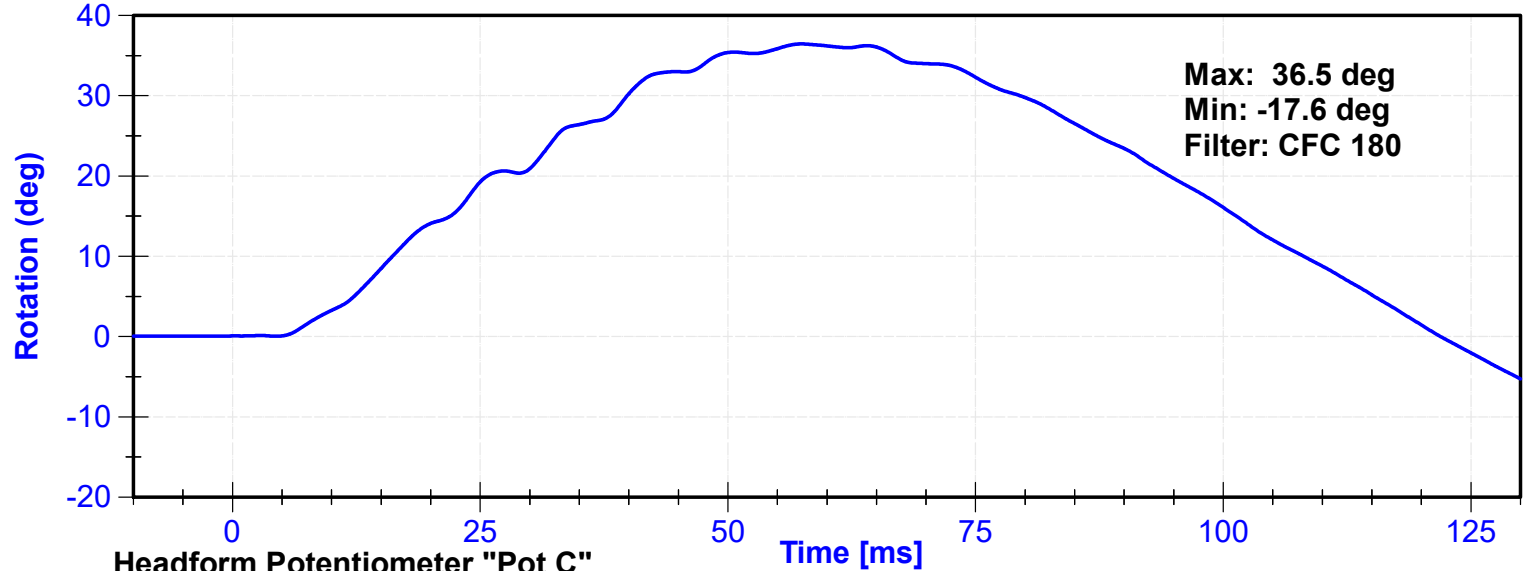


^{1,2} Upper and lower boundaries specified in Appendix I

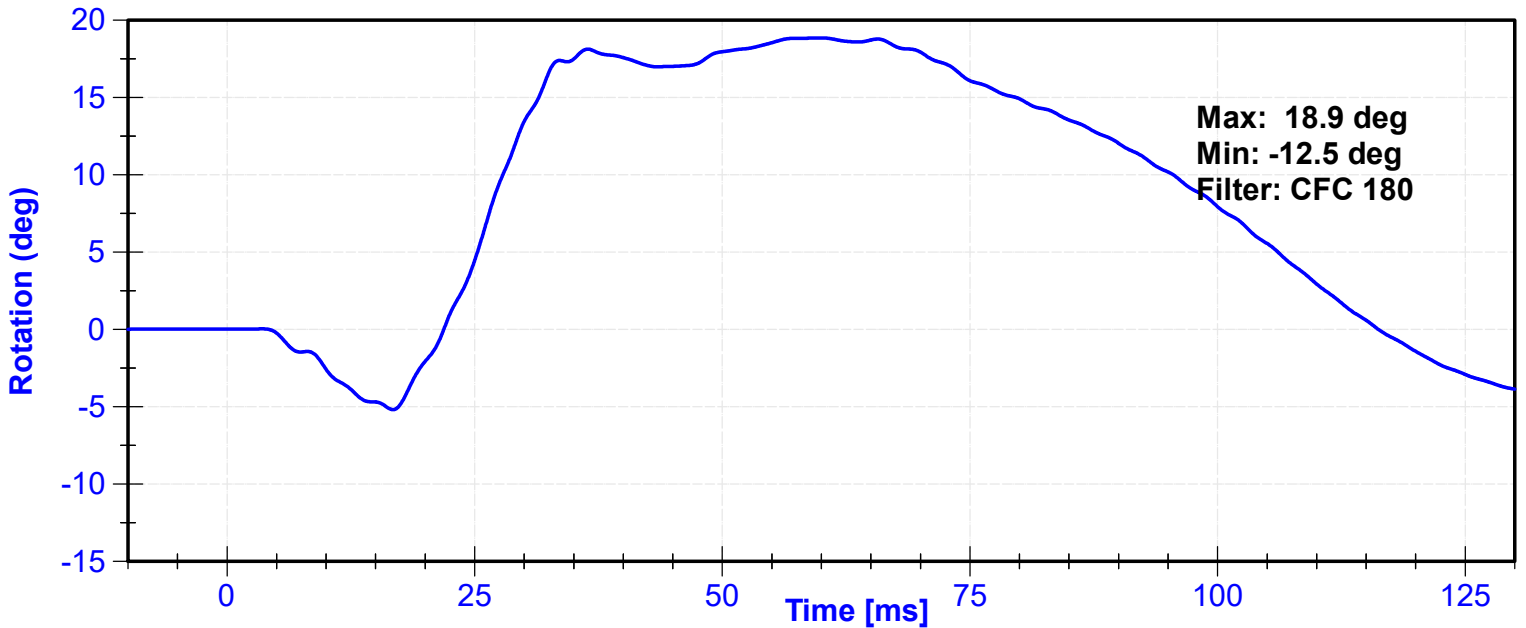
Neck Rotation



Front Pendulum Potentiometer "Pot A"



Headform Potentiometer "Pot C"



Appendix I

² Upper Boundary Corridor		¹ Lower Boundary Corridor	
Time (ms)	Velocity (m/s)	Time (ms)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.0	-0.25	2.5	-0.375
14.0	-3.20	13.5	-3.7
		17.0	-3.7

ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

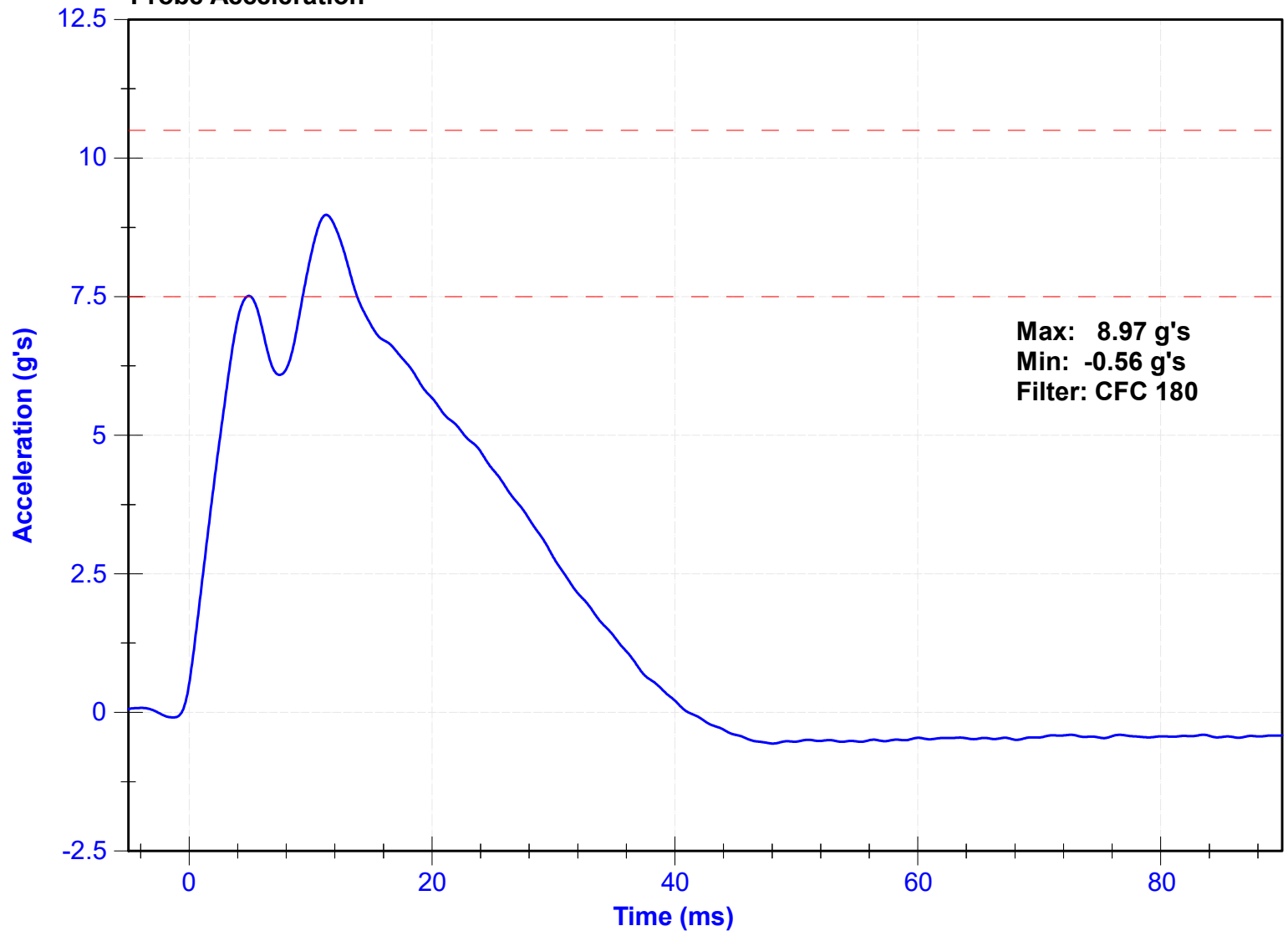
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	15	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	7.5	10.5	g's	8.97	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023

Probe Acceleration



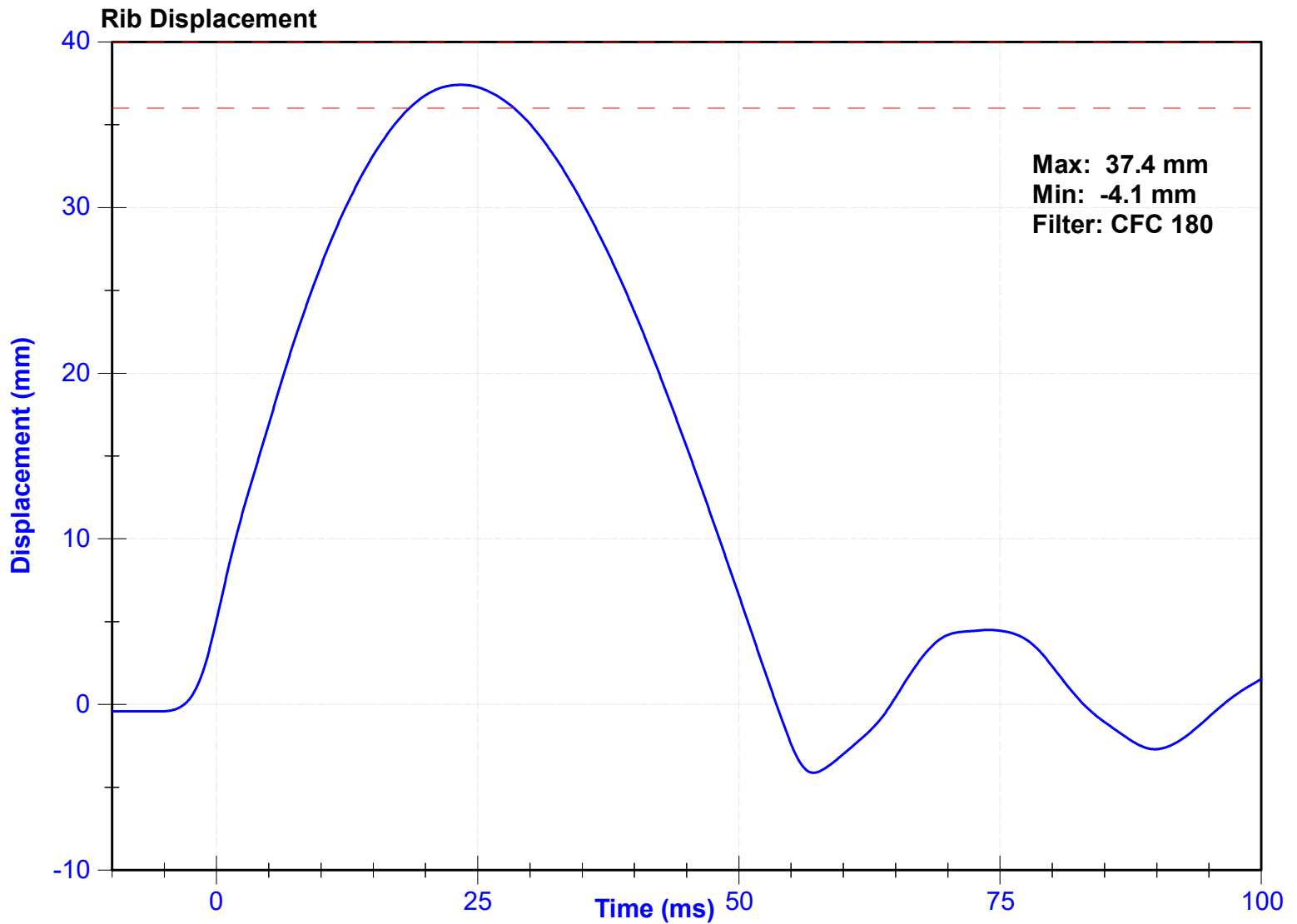
ATD Manufacturer	FTSS	Test Technician	Z. Schneider
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	13	Pass
Rib Displacement	36	40	mm	37.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	179GFE	1/17/2023	7/18/2023



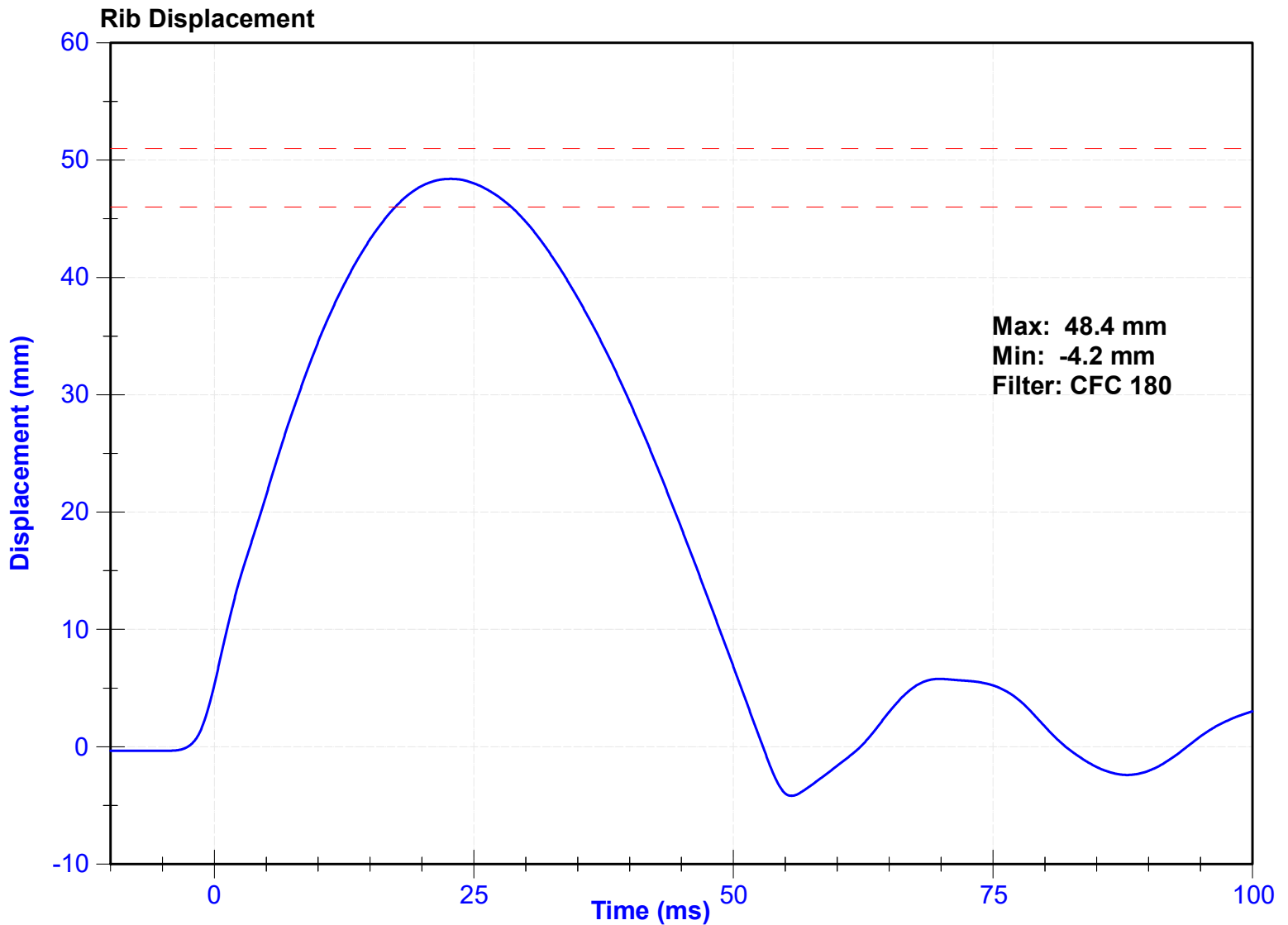
ATD Manufacturer	FTSS	Test Technician	Z. Schneider
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	13	Pass
Rib Displacement	46	51	mm	48.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	179GFE	1/17/2023	7/18/2023



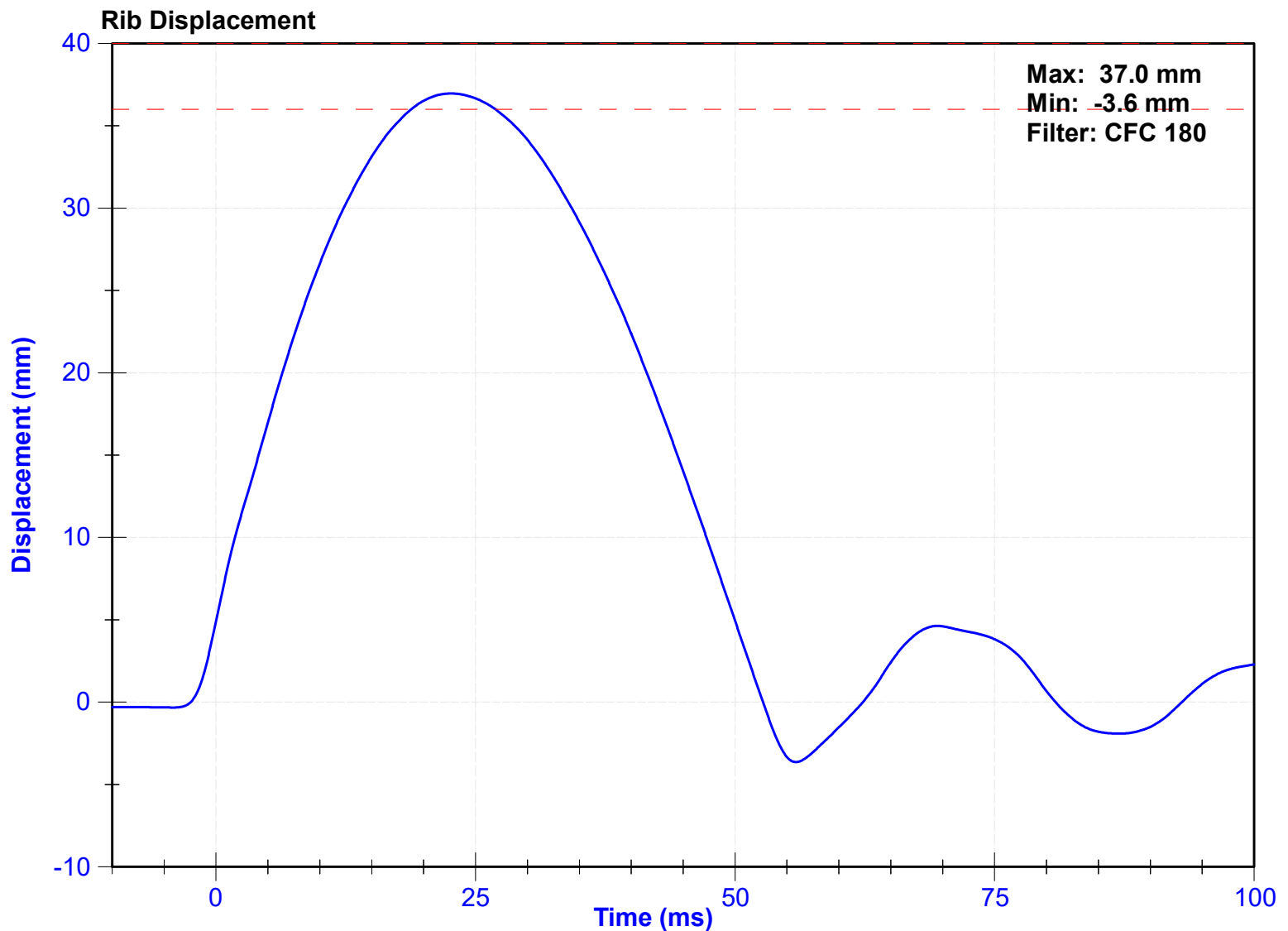
ATD Manufacturer	FTSS	Test Technician	Z. Schneider
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	13	Pass
Rib Displacement	36	40	mm	37.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	185GFE	1/17/2023	7/18/2023



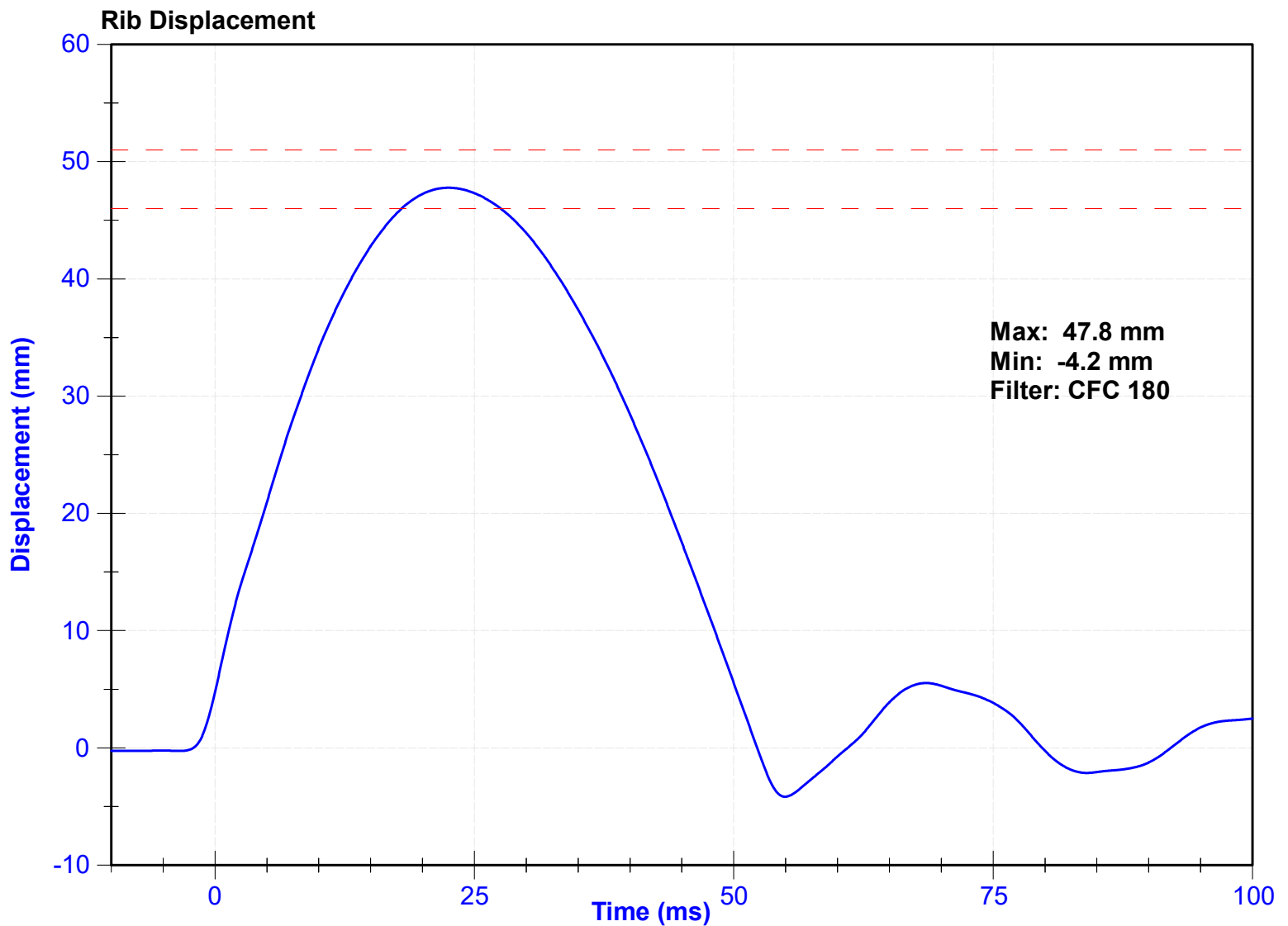
ATD Manufacturer	FTSS	Test Technician	Z. Schneider
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	13	Pass
Rib Displacement	46	51	mm	47.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	185GFE	1/17/2023	7/18/2023



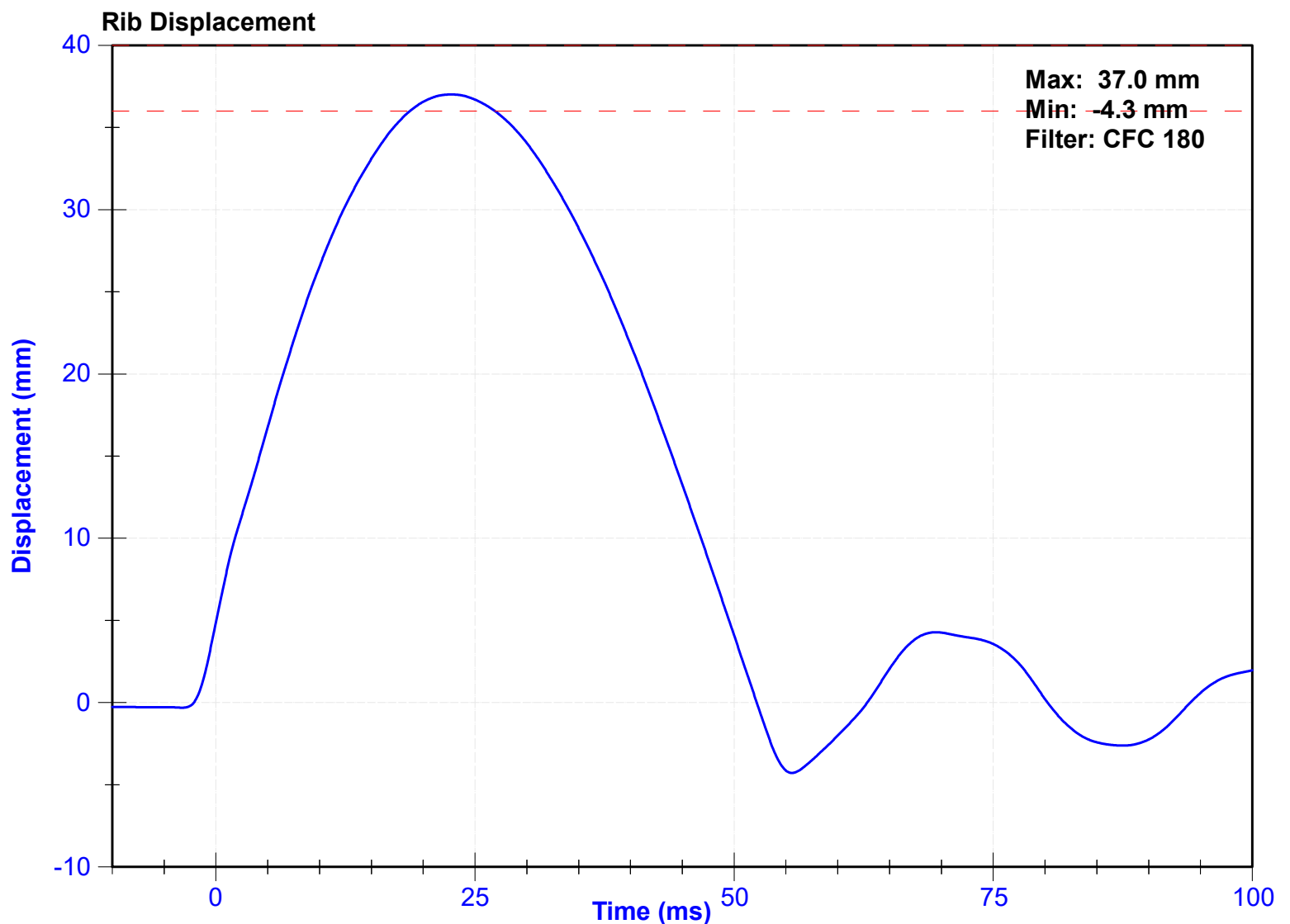
ATD Manufacturer	FTSS	Test Technician	Z. Schneider
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	13	Pass
Rib Displacement	36	40	mm	37.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	178GFE	1/17/2023	7/18/2023



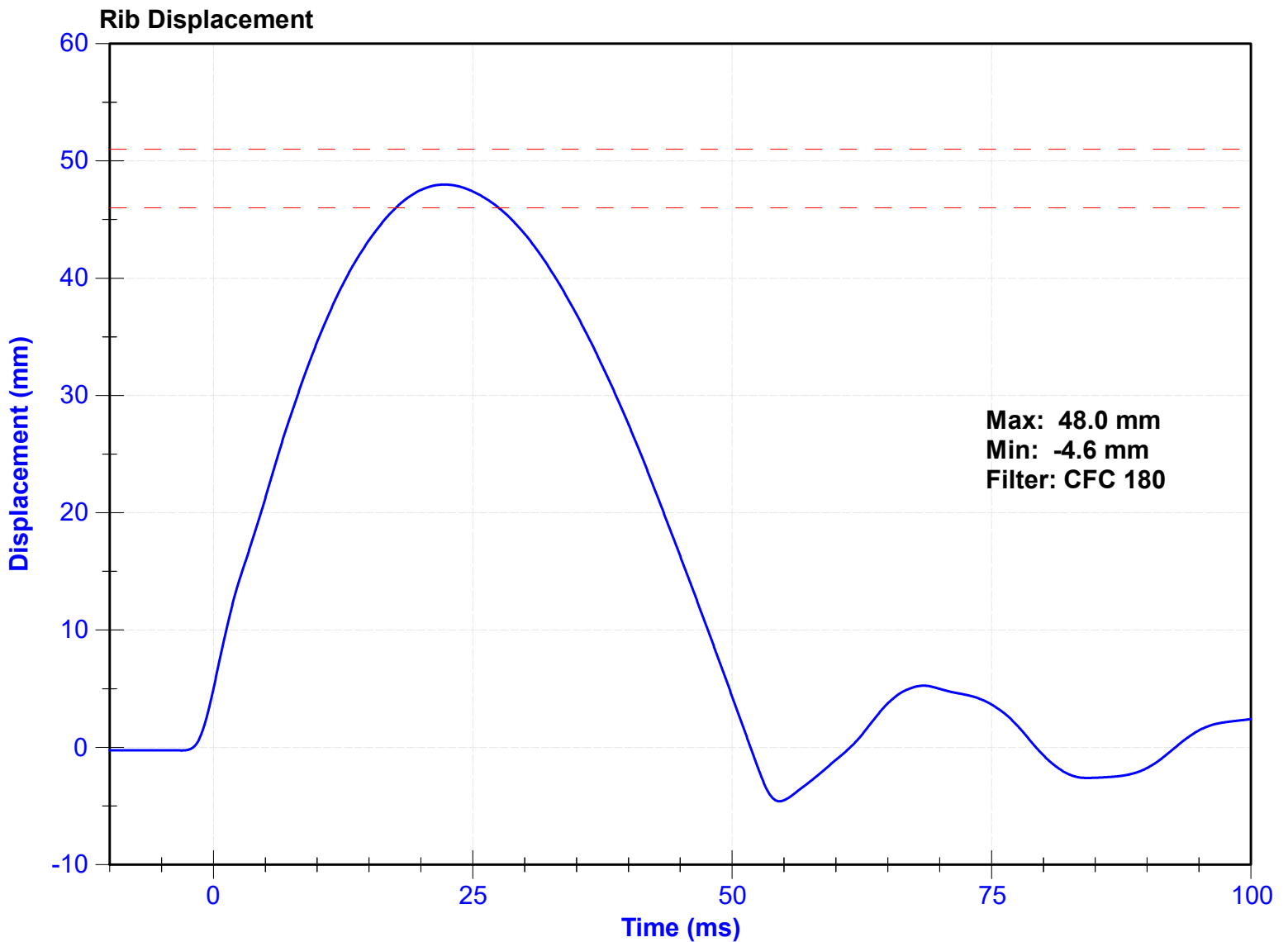
ATD Manufacturer	FTSS	Test Technician	Z. Schneider
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	13	Pass
Rib Displacement	46	51	mm	48.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	178GFE	1/17/2023	7/18/2023



ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

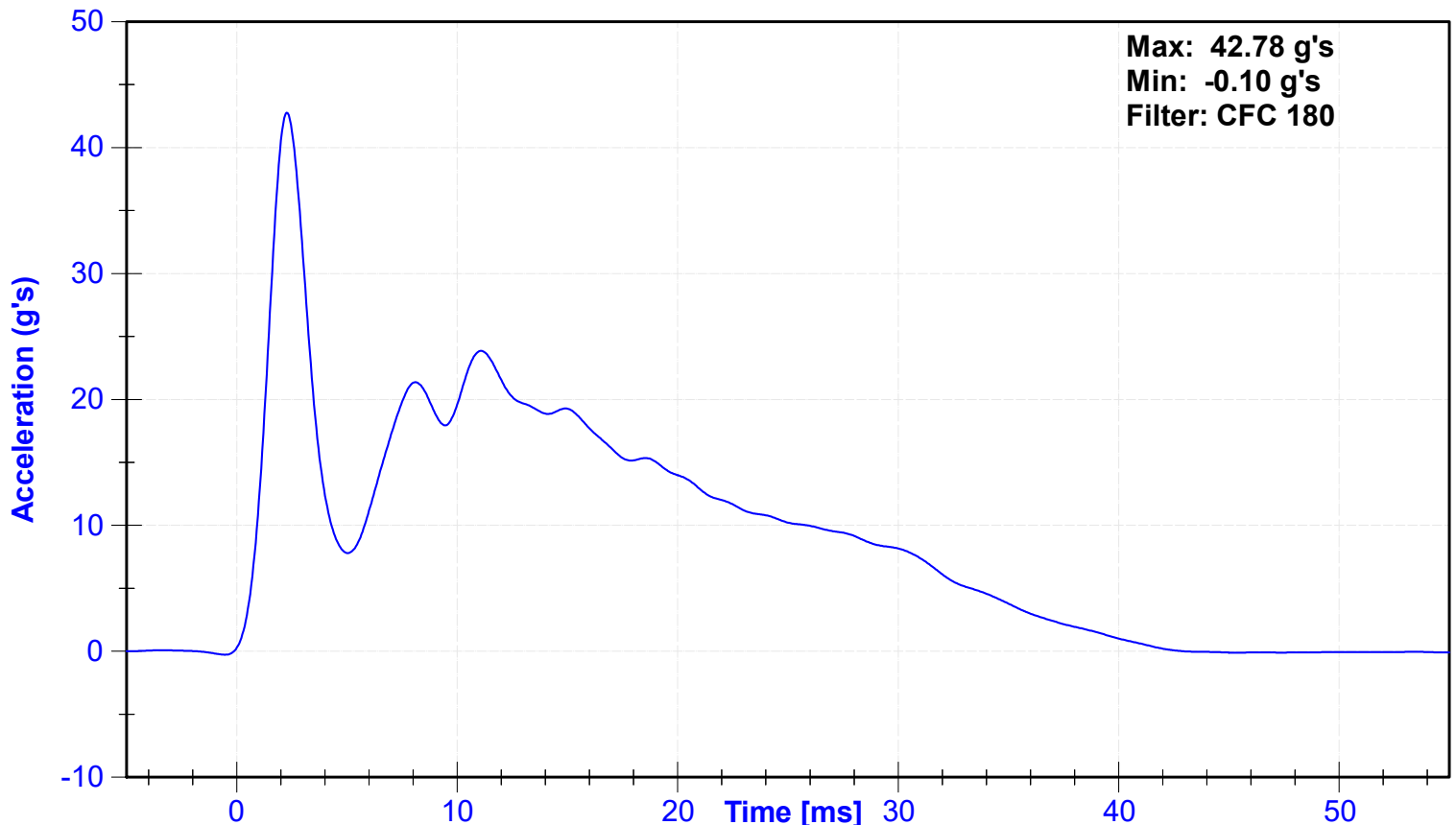
Results

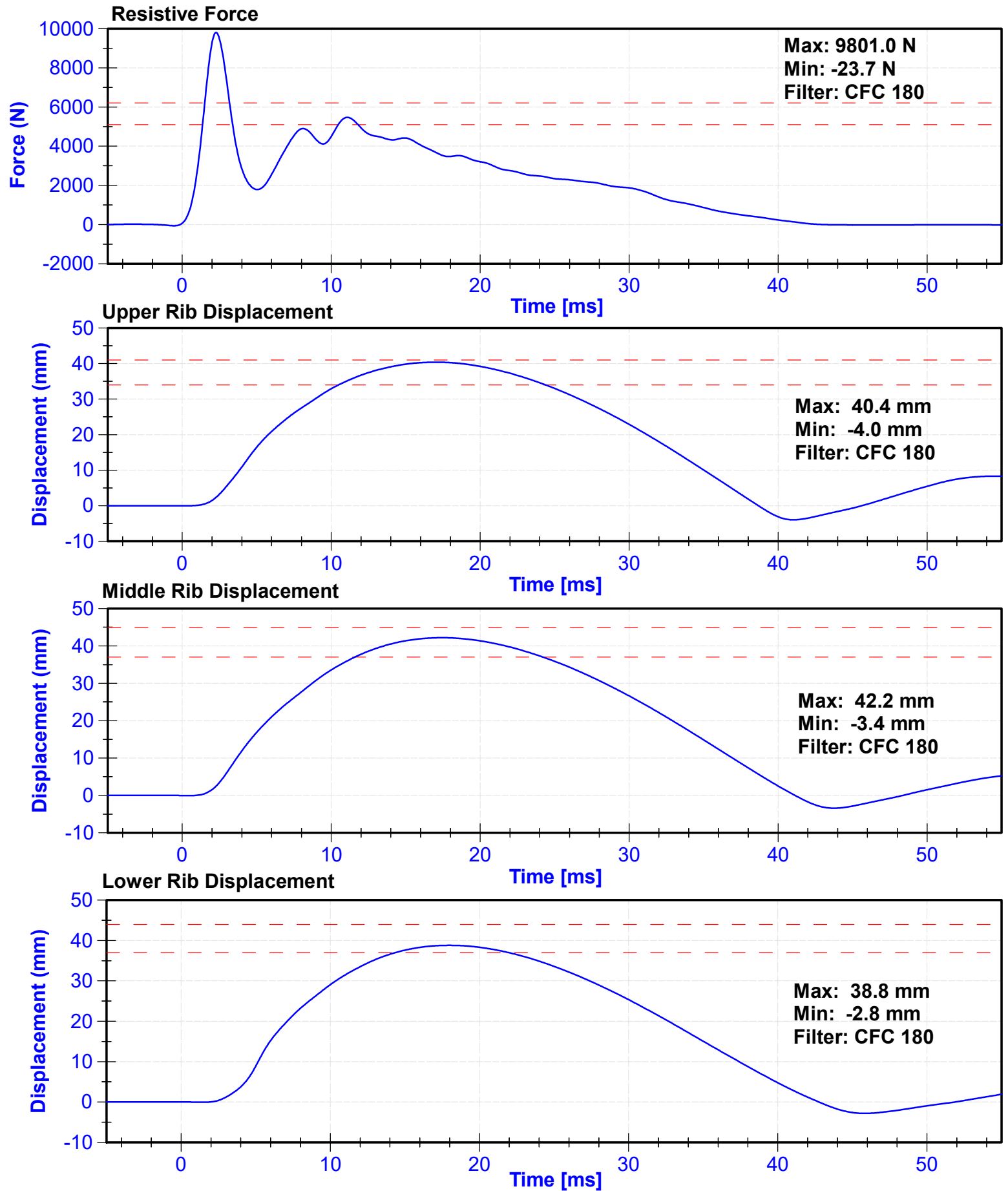
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	22.1	Pass
Velocity	5.4	5.6	m/s	5.50	Pass
Resistive Force after 6ms	5100	6200	N	5468.0	Pass
Upper Thorax Rib Deflection	34	41	mm	40.4	Pass
Mid Thorax Rib Deflection	37	45	mm	42.2	Pass
Lower Thorax Rib Deflection	37	44	mm	38.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Thorax Rib Potentiometer	Honeywell	179GFE	1/17/2023	7/18/2023
Middle Thorax Rib Potentiometer	Honeywell	185GFE	1/17/2023	7/18/2023
Lower Thorax Rib Potentiometer	Honeywell	178GFE	1/17/2023	7/18/2023

Probe Acceleration





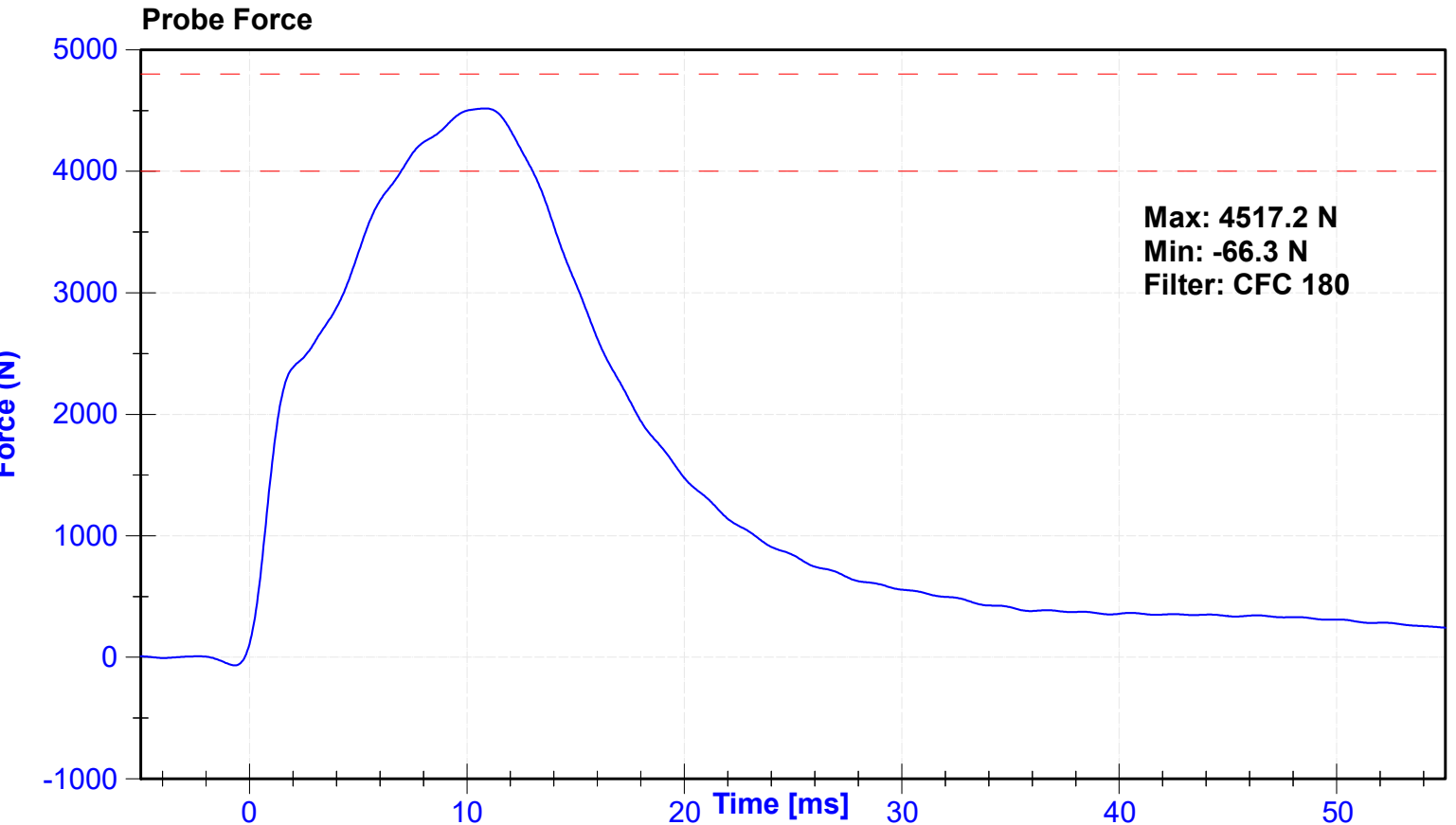
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

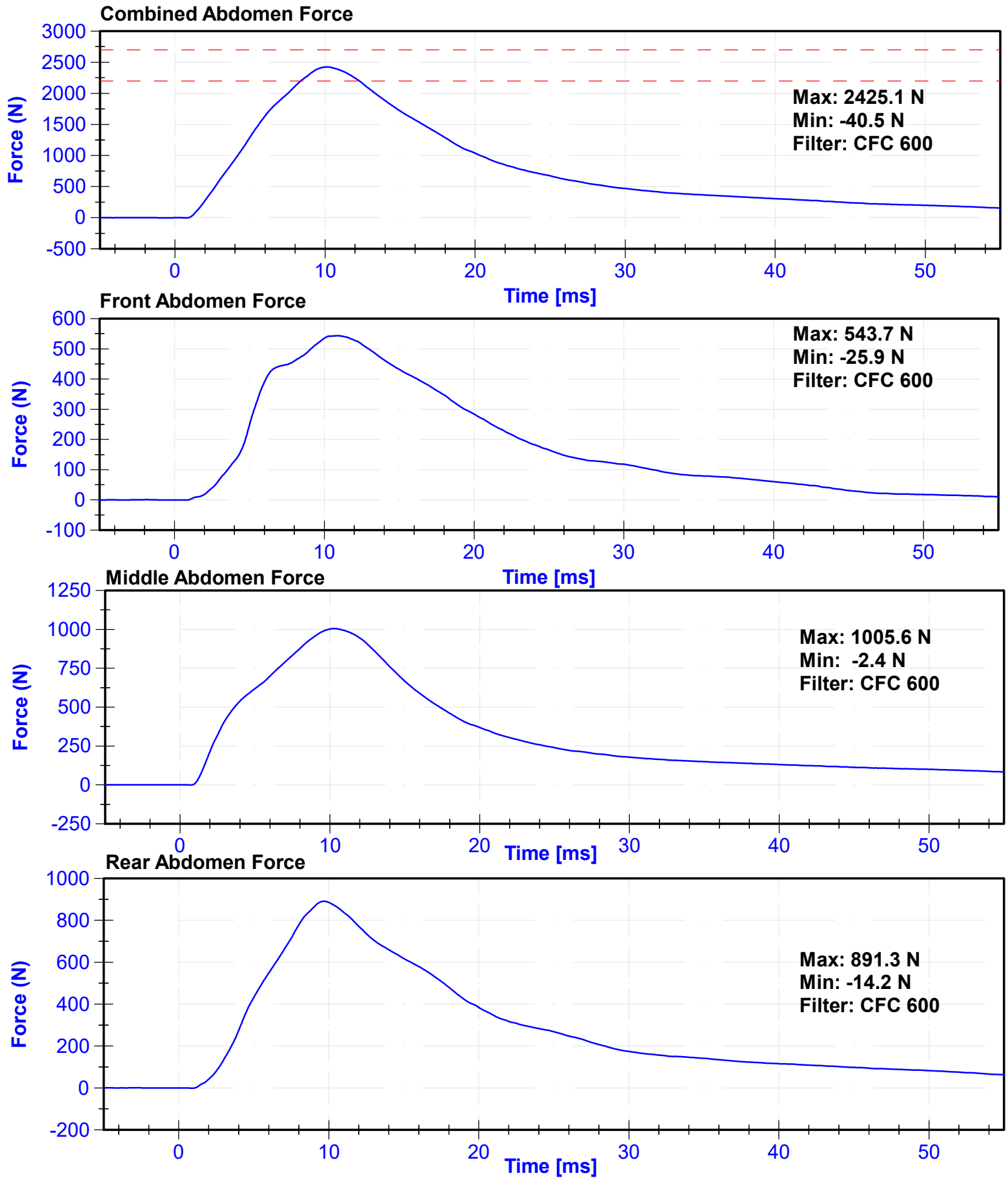
Results

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	3.9	4.1	m/s	4.01	Pass
Combined Abdomen Force	2200	2700	N	2425.1	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.10	Pass
Resistive Probe Force	4000	4800	N	4517.2	Pass
Time at Peak Resistive Force	10.6	13.0	ms	10.80	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Front Abdomen Load Cell	Denton	1509	8/12/2022	8/12/2023
Middle Abdomen Load Cell	Denton	1508	8/12/2022	8/12/2023
Rear Abdomen Load Cell	Denton	1507	8/12/2022	8/12/2023





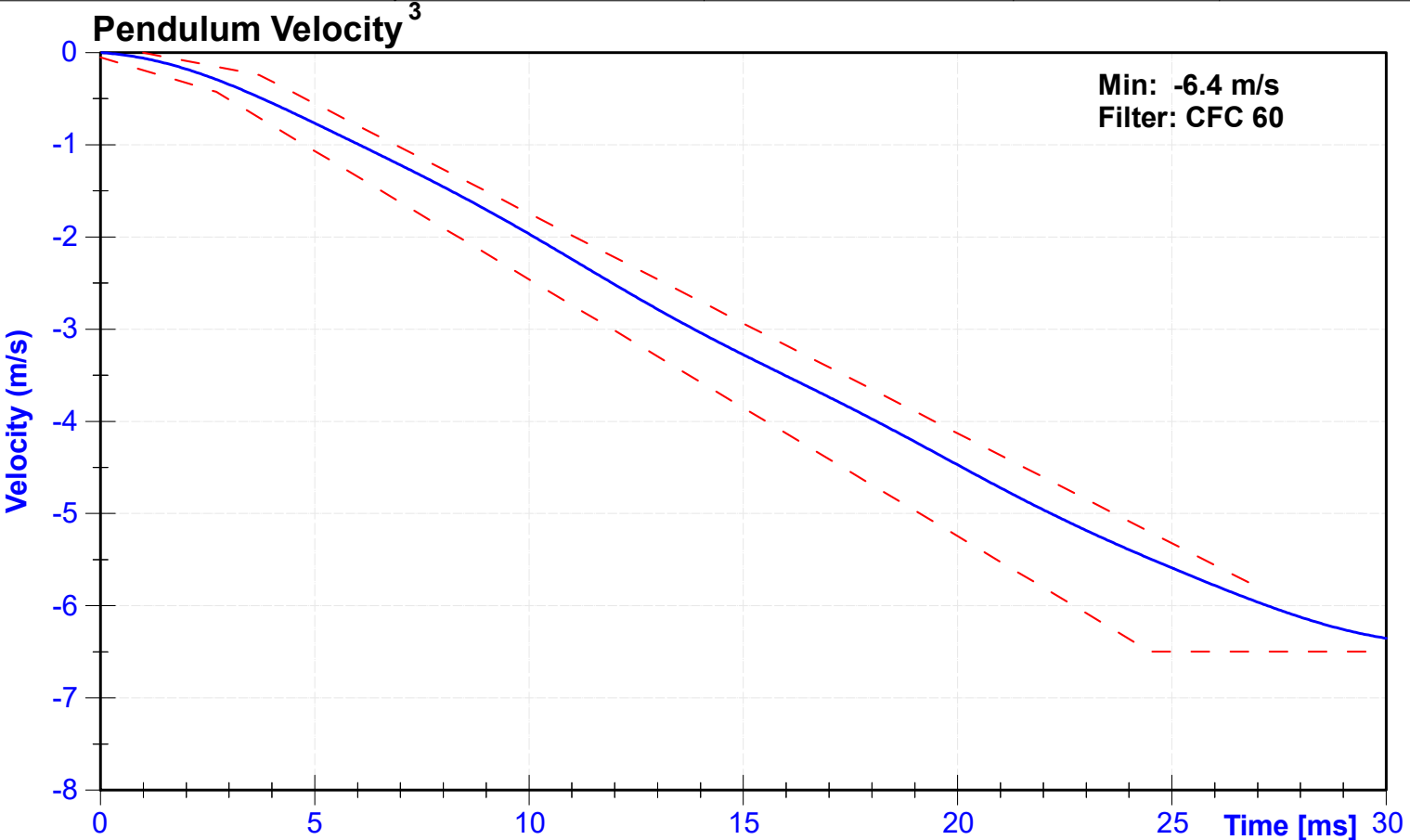
ATD Manufacturer	FTSS	Test Technician	D. Kroll
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

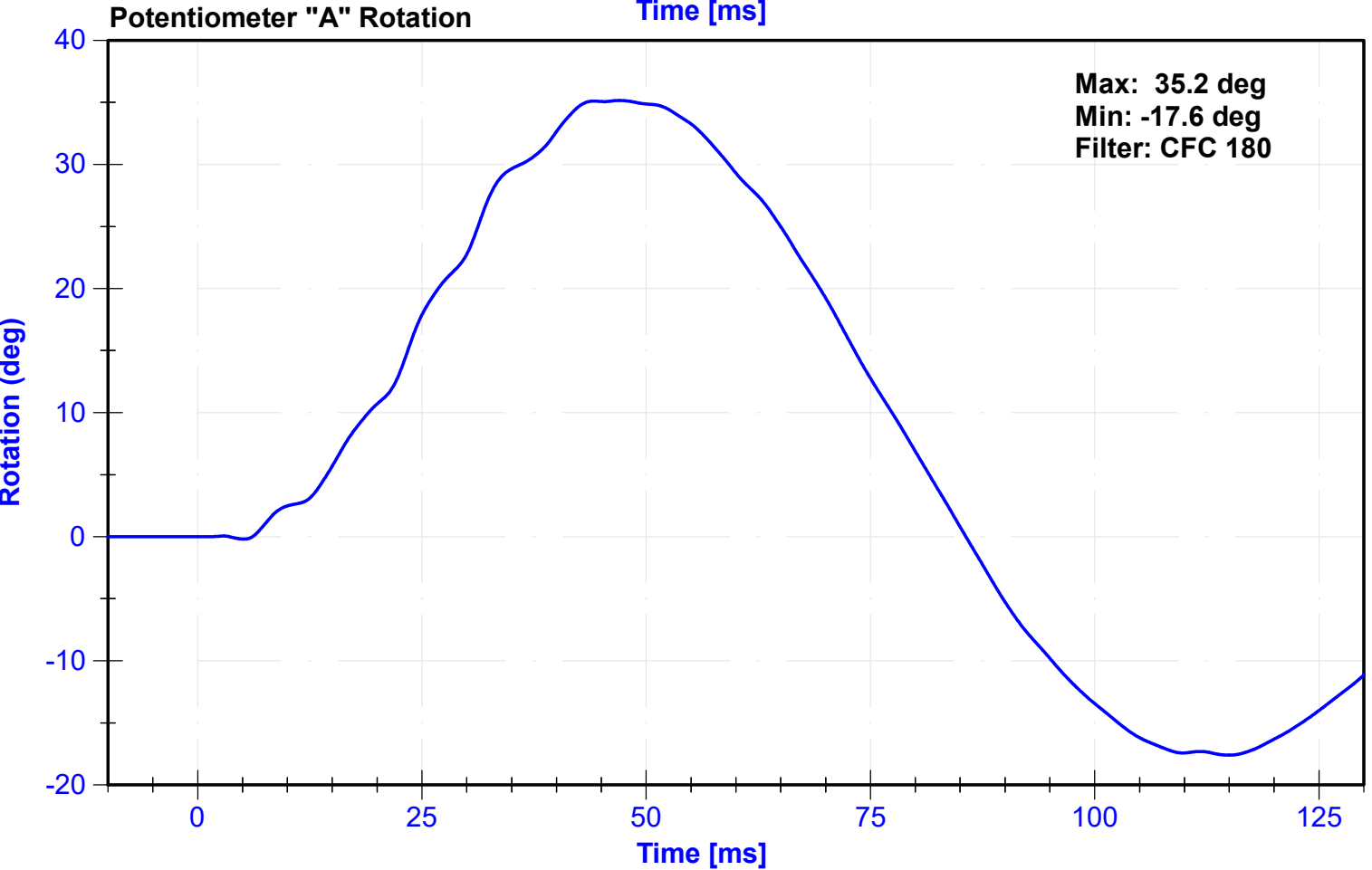
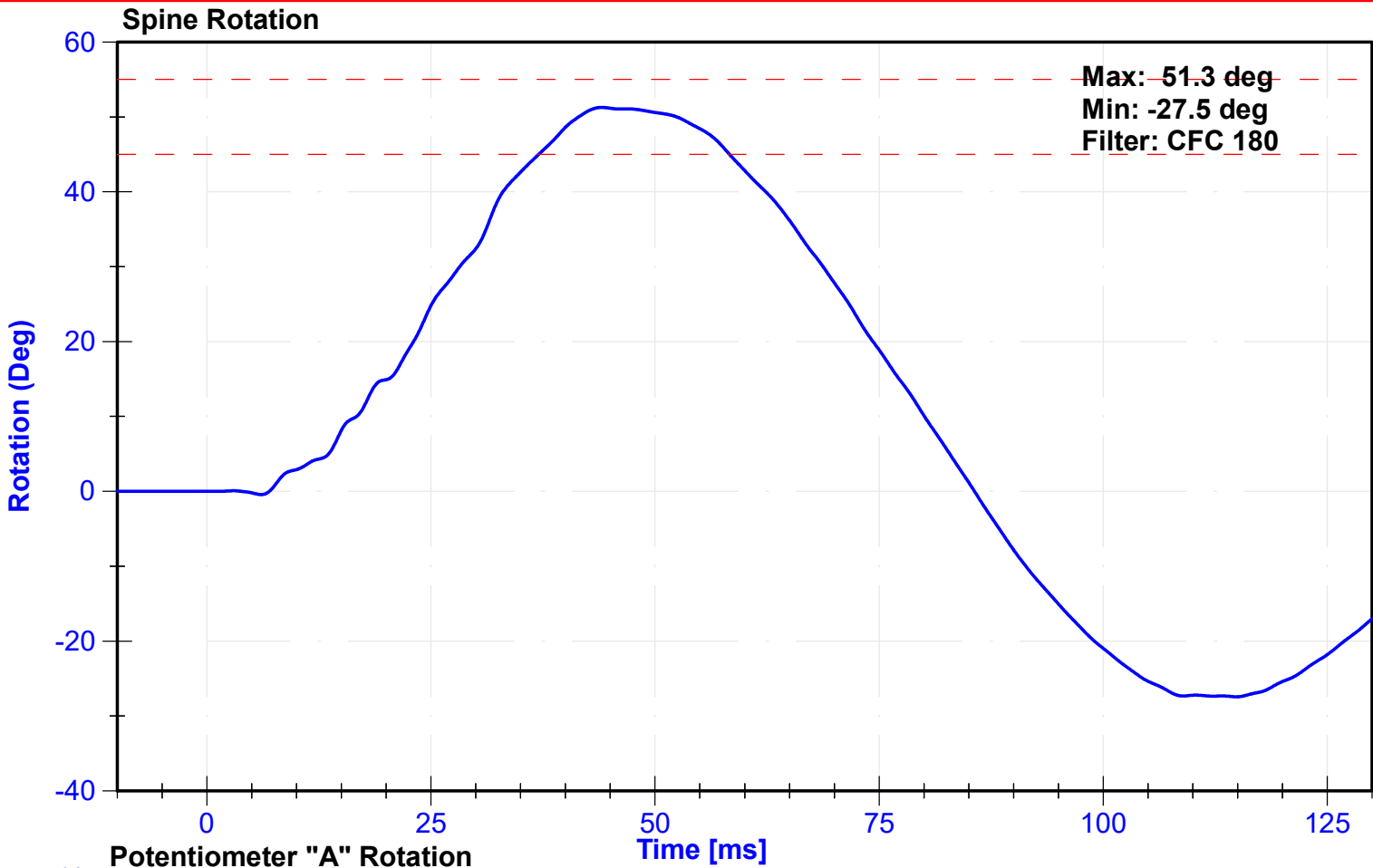
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	13	Pass
Velocity	5.95	6.15	m/s	6.047	Pass
Lateral Spine Rotation	45	55	deg	51.3	Pass
Time at Maximum Rotation	39	53	ms	44.0	Pass
Time of Decay to Zero Degrees	37	57	ms	41.6	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

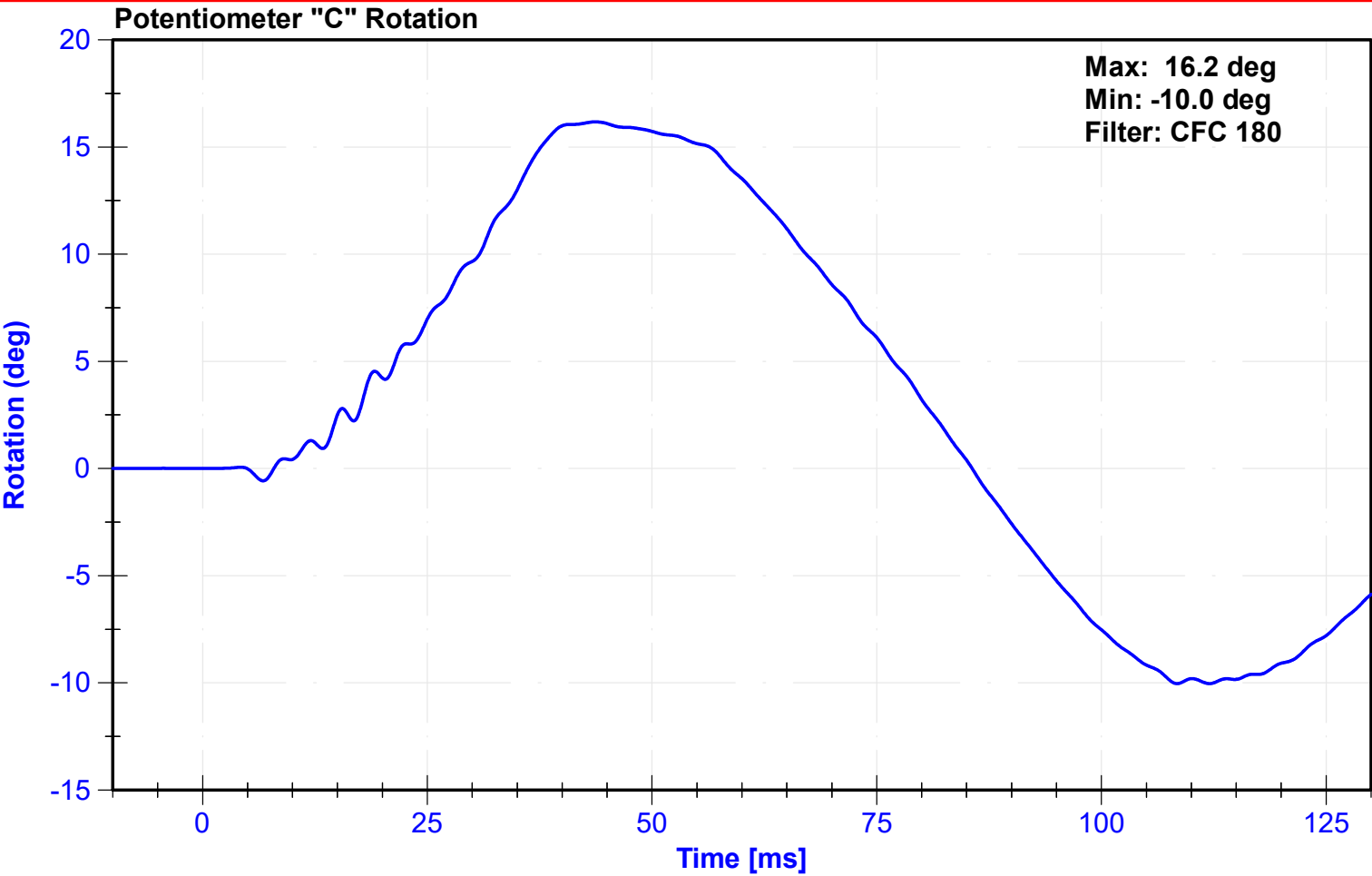
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum "A" Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Condyle "B" Potentiometer	Sfernice	095	10/5/2022	10/5/2023



^{1,2} Upper and lower boundaries specified in Appendix I
 C-20





Appendix I

² Upper Boundary Corridor		¹ Lower Boundary Corridor	
Time (ms)	Velocity (m/s)	Time (ms)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.7	-0.24	2.7	-0.425
27.0	-5.80	24.5	-6.5
		30.0	-6.5

ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

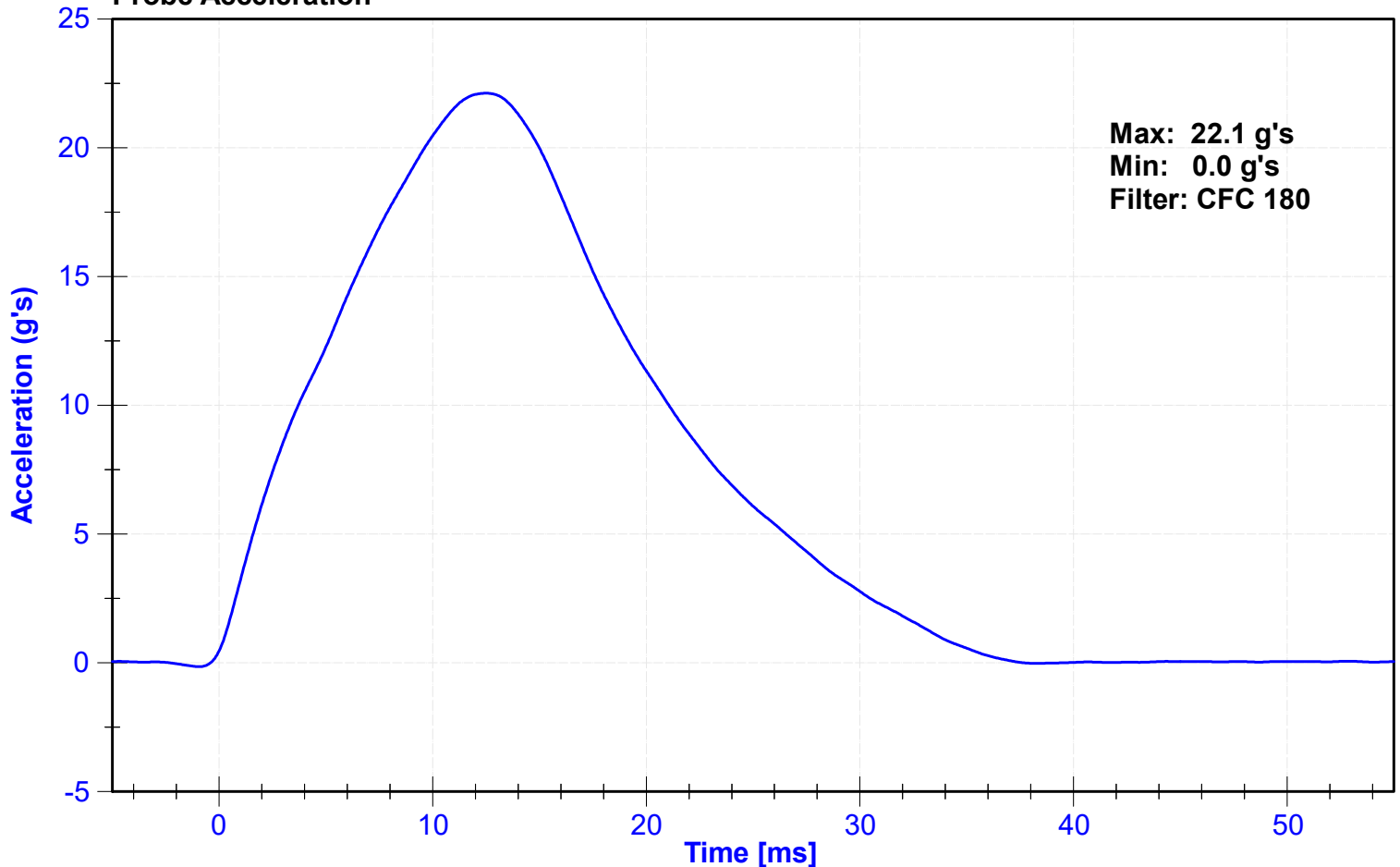
Results

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	4.2	4.4	m/s	4.31	Pass
Resistive Force	4700	5400	N	5066.5	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.50	Pass
Pubic Force	-1590	-1230	N	-1336.5	Pass
Time at Peak Pubic Force	12.2	17.0	ms	12.55	Pass

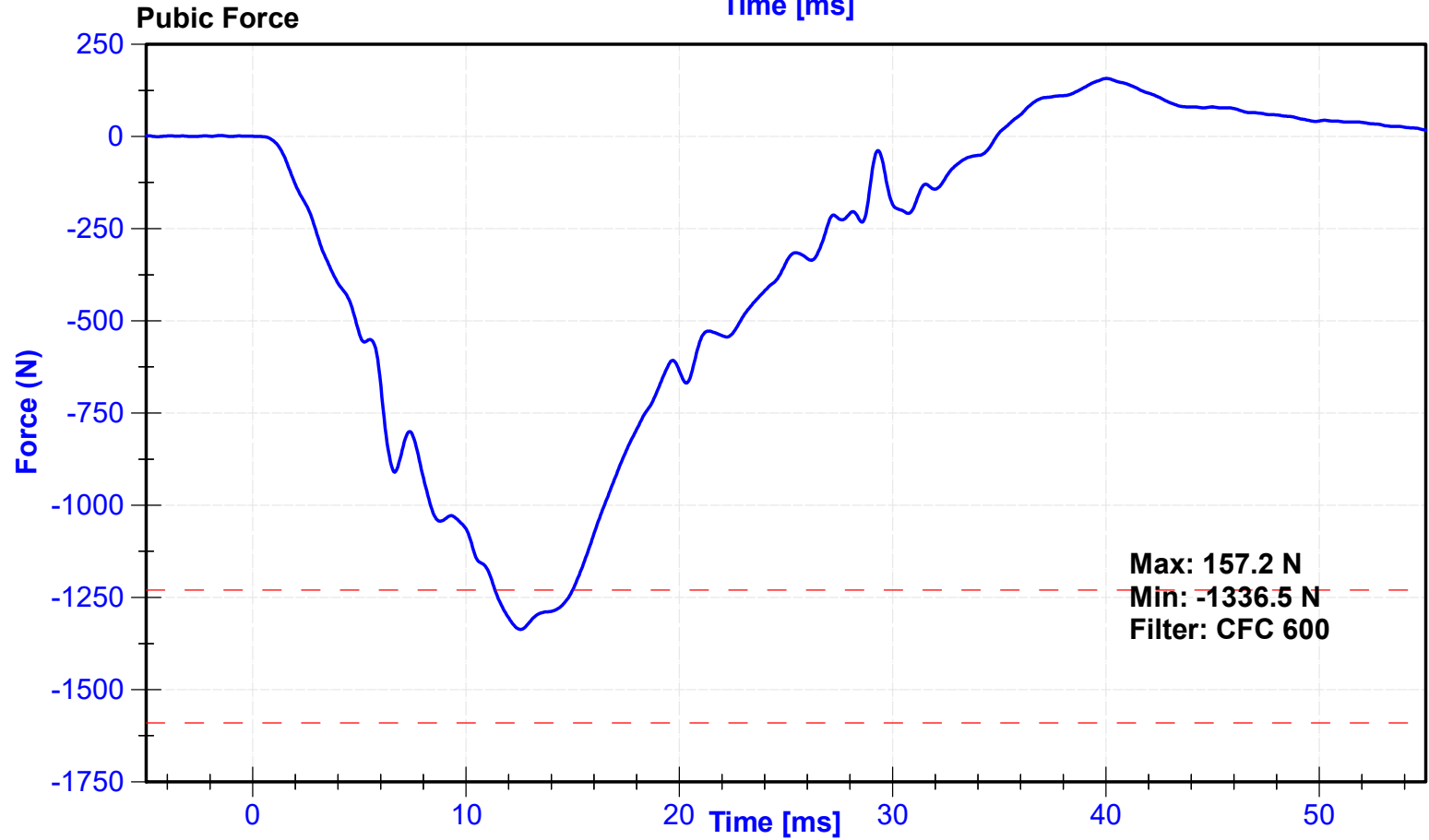
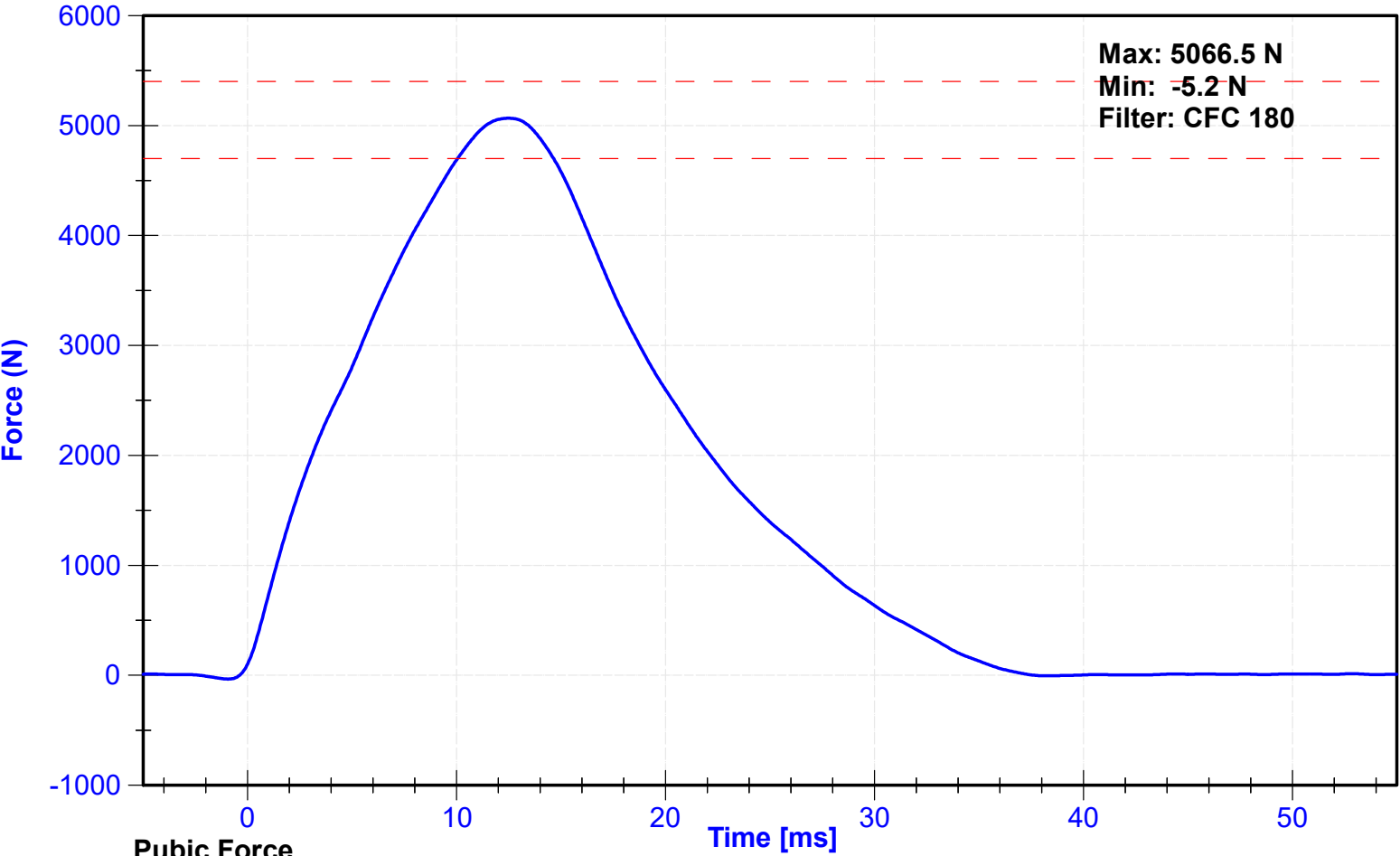
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pubic Load Cell	Denton	459-FY	6/14/2022	6/14/2023

Probe Acceleration



Resistive Force



CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE – PASSENGER ATD

SERIAL NO:DG8012

(CONFIGURED FOR LEFT SIDE IMPACT)

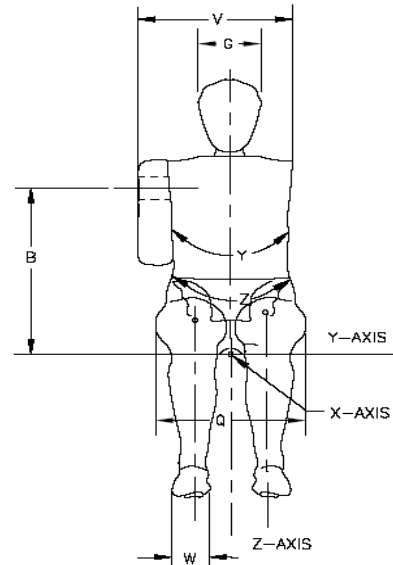
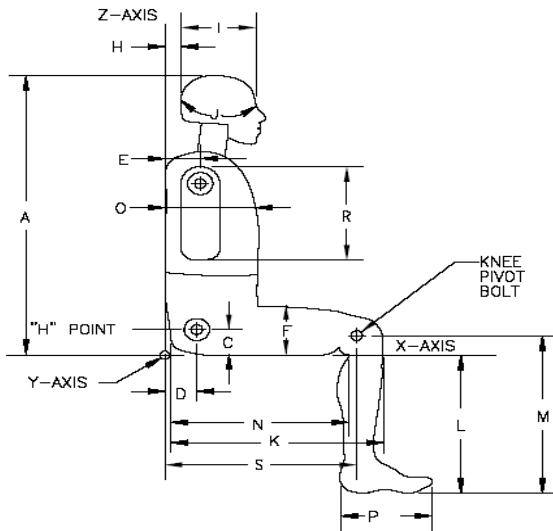


External Measurements - SID-IIs

Technician: **K. Brogan**

Date: **02/03/2023**

Dummy Serial Number: **DG8012**



Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	784	Pass
B	Shoulder Pivot Height	437	453	447	Pass
C	H-point Height	79	89	82	Pass
D	H-point from seatback	141	151	146	Pass
E	Shoulder Pivot from Backline	97	107	103	Pass
F	Thigh Clearance	119	135	127	Pass
G	Head Breadth	140	148	143	Pass
H	Head Back from Backline	40	46	44	Pass
I	Head Depth	178	188	183	Pass
J	Head Circumference	541	551	545	Pass
K	Buttock to Knee Length	514	540	528	Pass
L	Popliteal Height	343	369	359	Pass
M	Knee Pivot to floor height	392	409	402	Pass
N	Buttock Popliteal Length	416	442	432	Pass
O	Chest Depth w/o jacket	195	211	201	Pass
P	Foot Length	216	232	226	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	320	Pass
R	Arm Length	249	259	252	Pass
S	Knee Joint to seatback	477	493	487	Pass
V	Shoulder Width	341	357	351	Pass
W	Foot Width	78	94	85	Pass
Y	Chest Circumference w/jacket	851	881	870	Pass
Z	Waist Circumference	761	791	780	Pass

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

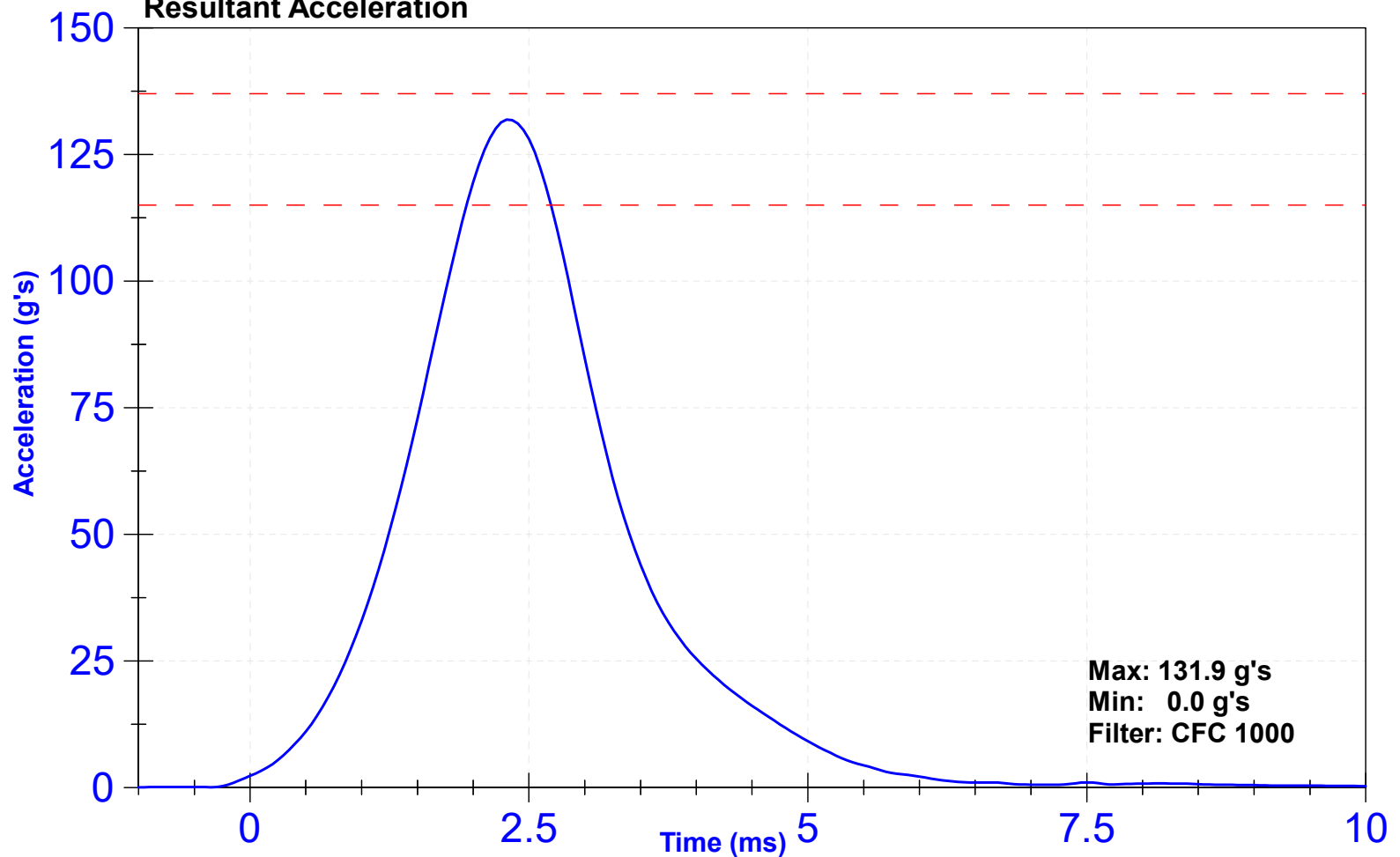
Results

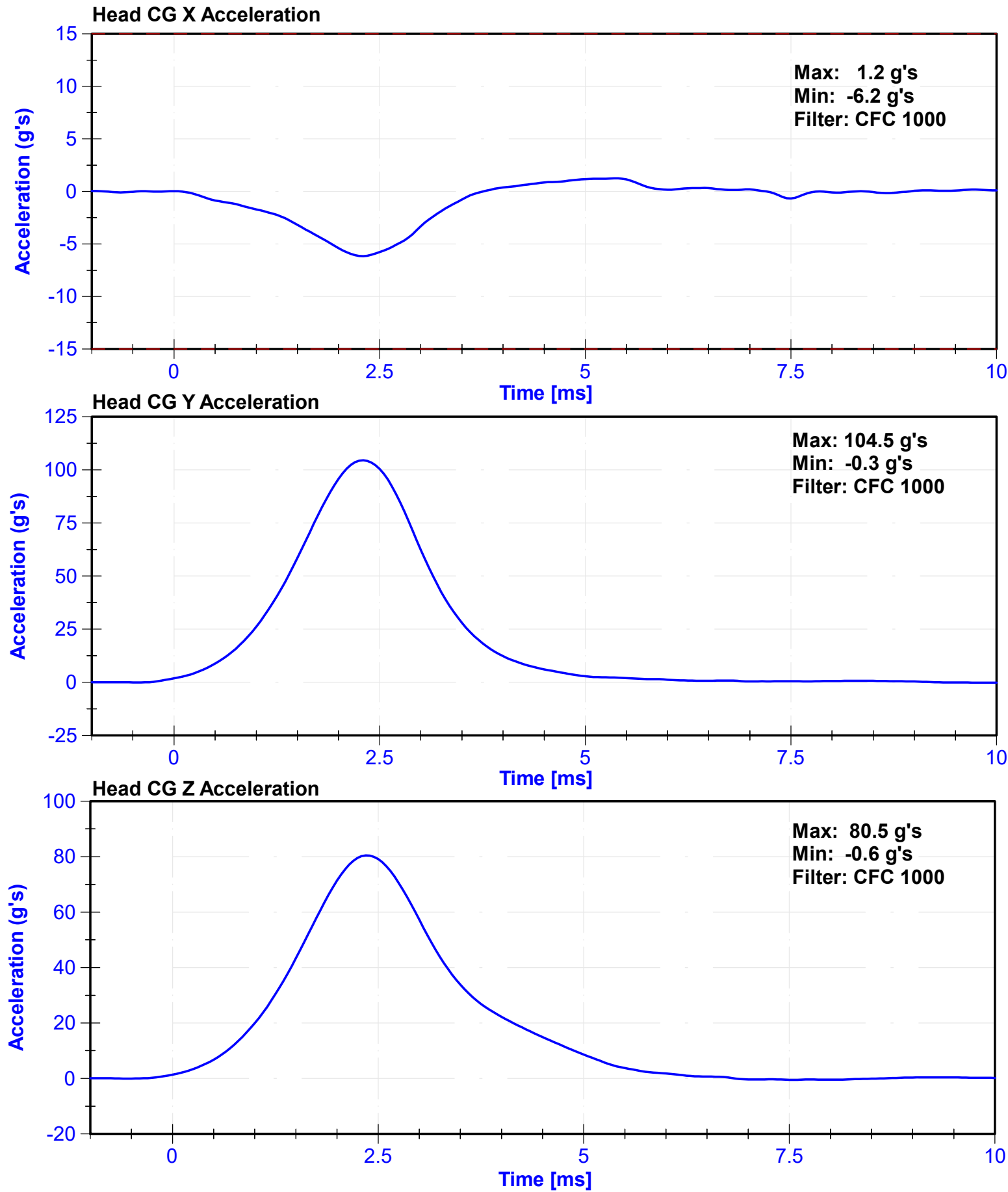
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	15.5	Pass
Resultant Acceleration	115	137	g's	131.9	Pass
Oscillation	0	15	%	0.7	Pass
Fore-Aft Acceleration	-15	15	g's	-6.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibratio Date	Calibratio Due Date
X Accelerometer	Endevco	P74788	12/12/2022	6/10/2023
Y Accelerometer	Endevco	P51668	12/12/2022	6/10/2023
Z Accelerometer	Endevco	P83319	12/12/2022	6/10/2023

Resultant Acceleration





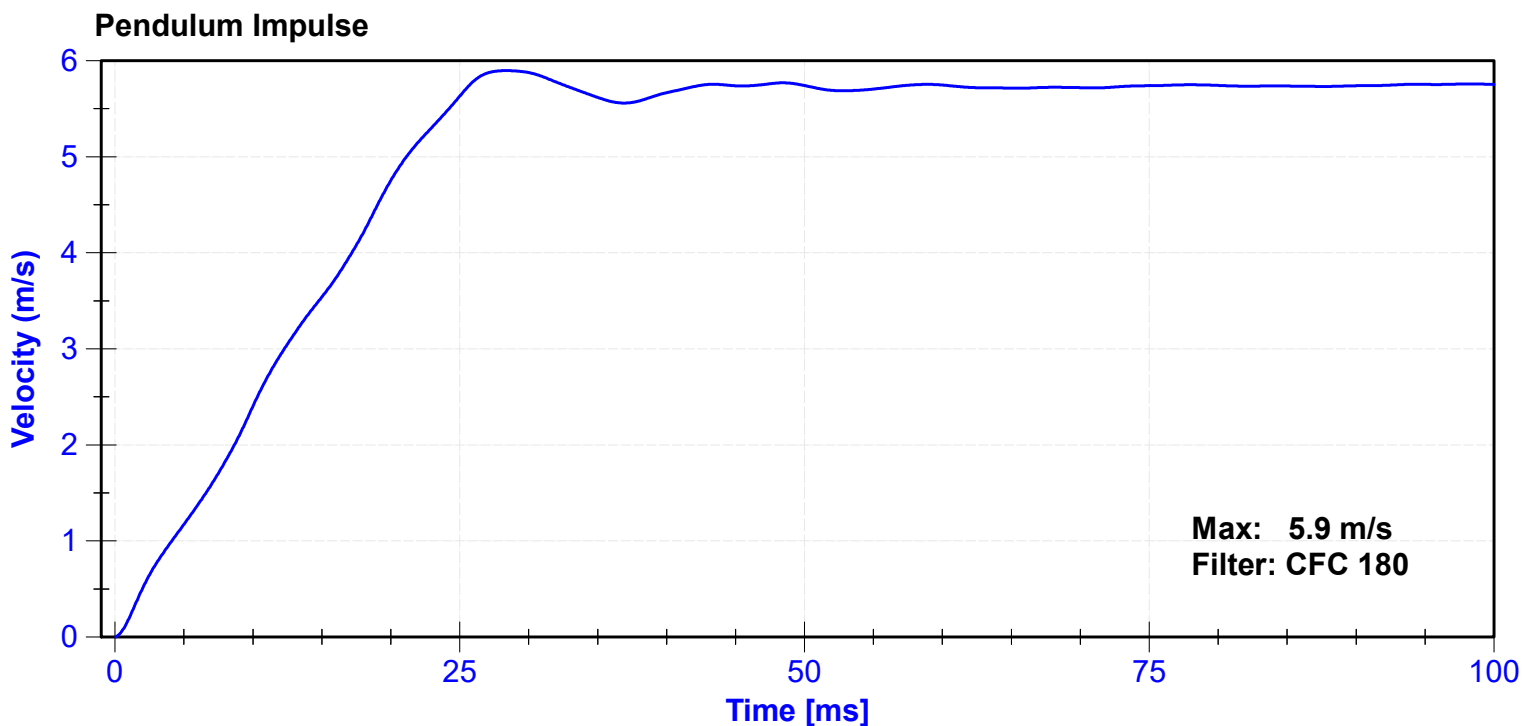
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG8012	Laboratory Supervisor	C. Mantell

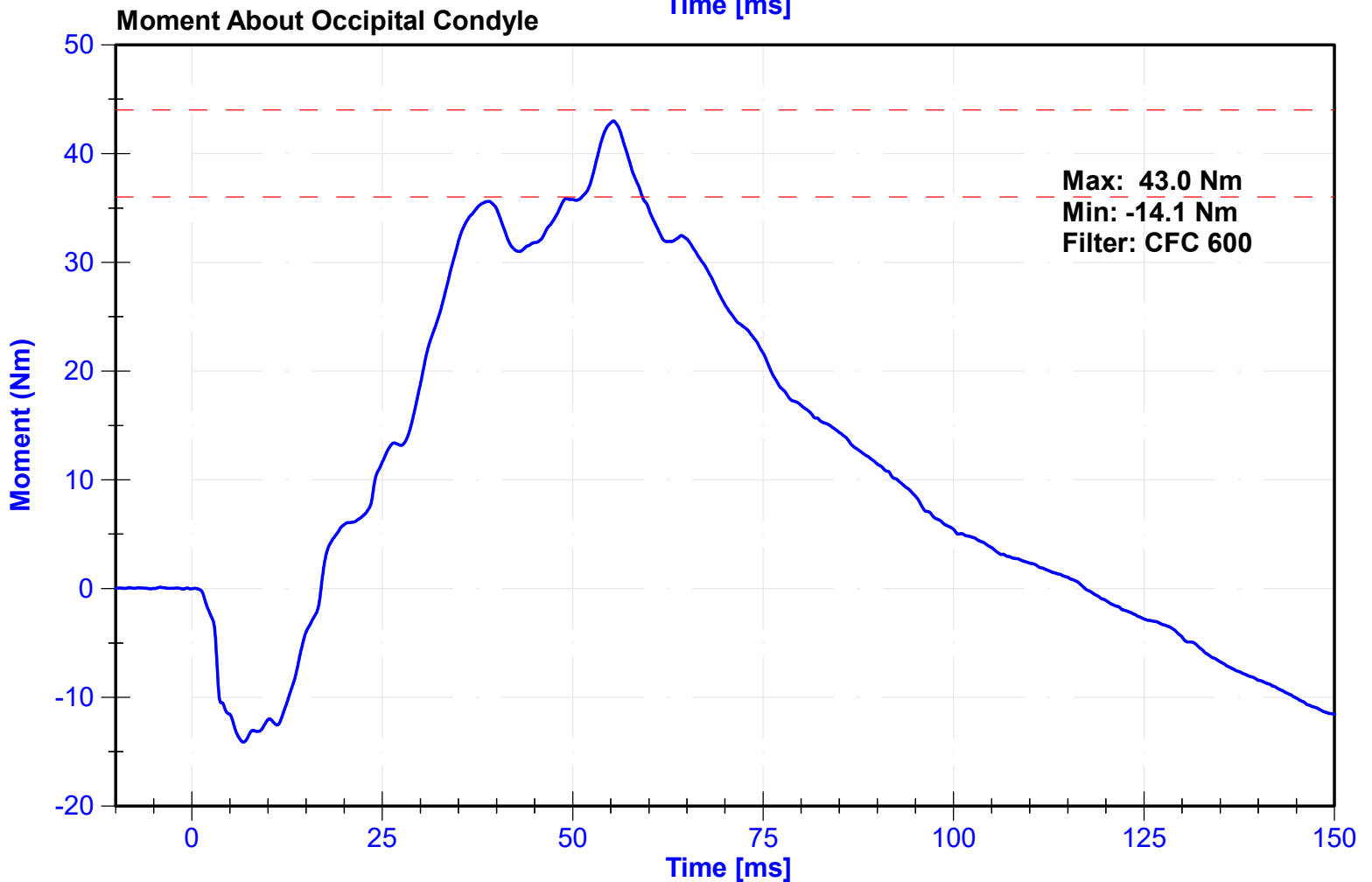
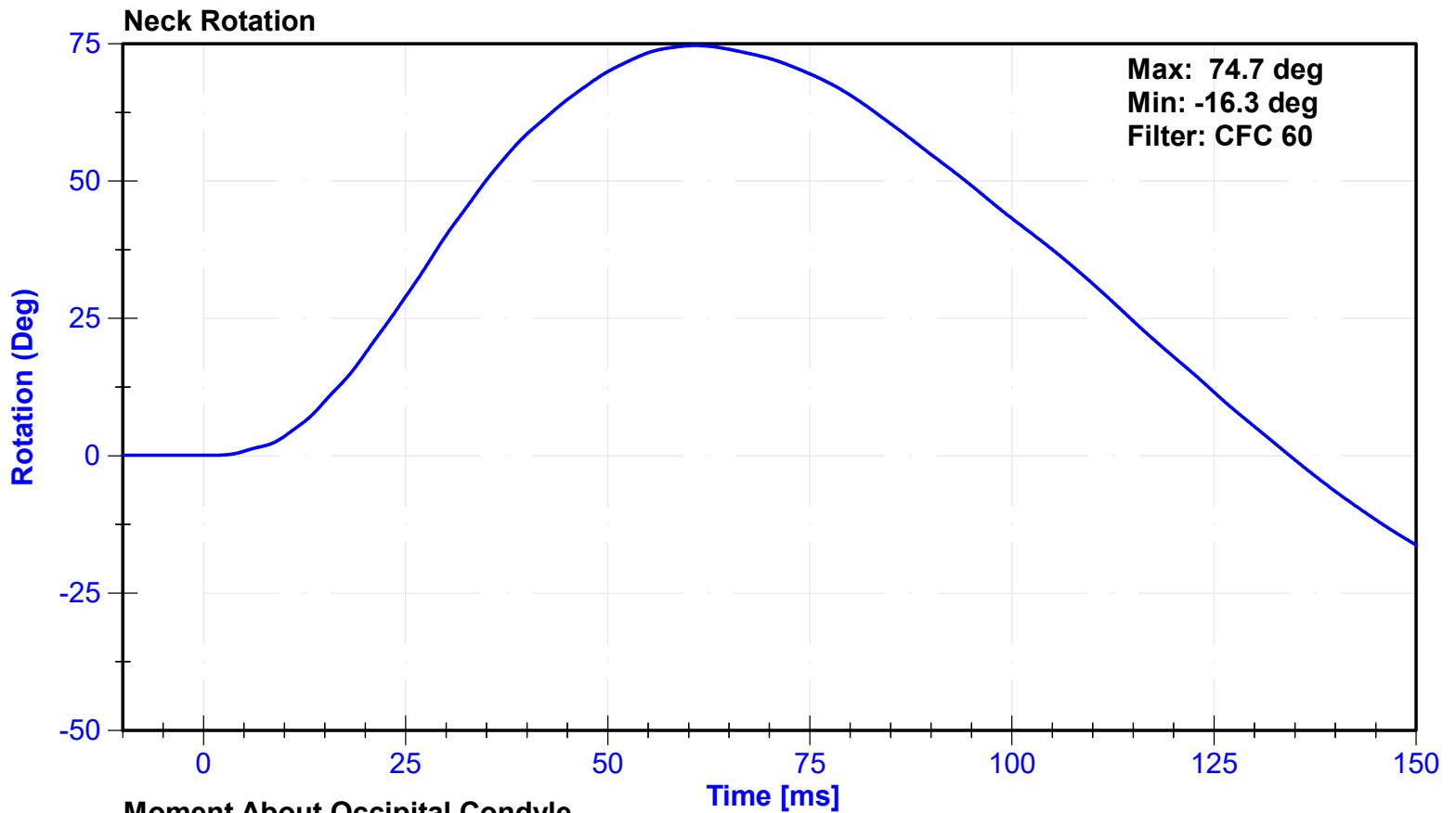
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	15.5	Pass
Velocity	5.51	5.63	m/s	5.545	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.40	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.54	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.75	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.63	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.89	Pass
Neck Rotation	71	81	deg	74.7	Pass
Time at Maximum Rotation	50	70	ms	60.9	Pass
Moment about the OC	36	44	Nm	43.0	Pass
Moment Decay to 0 Nm	102	126	ms	117.3	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	Servo	4961	11/11/2022	11/11/2023
Condyle Potentiometer	Servo	DS185	11/11/2022	11/11/2023
Upper Neck Load Cell	Humanetics	1716A_1872-FY	6/13/2022	6/13/2023





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

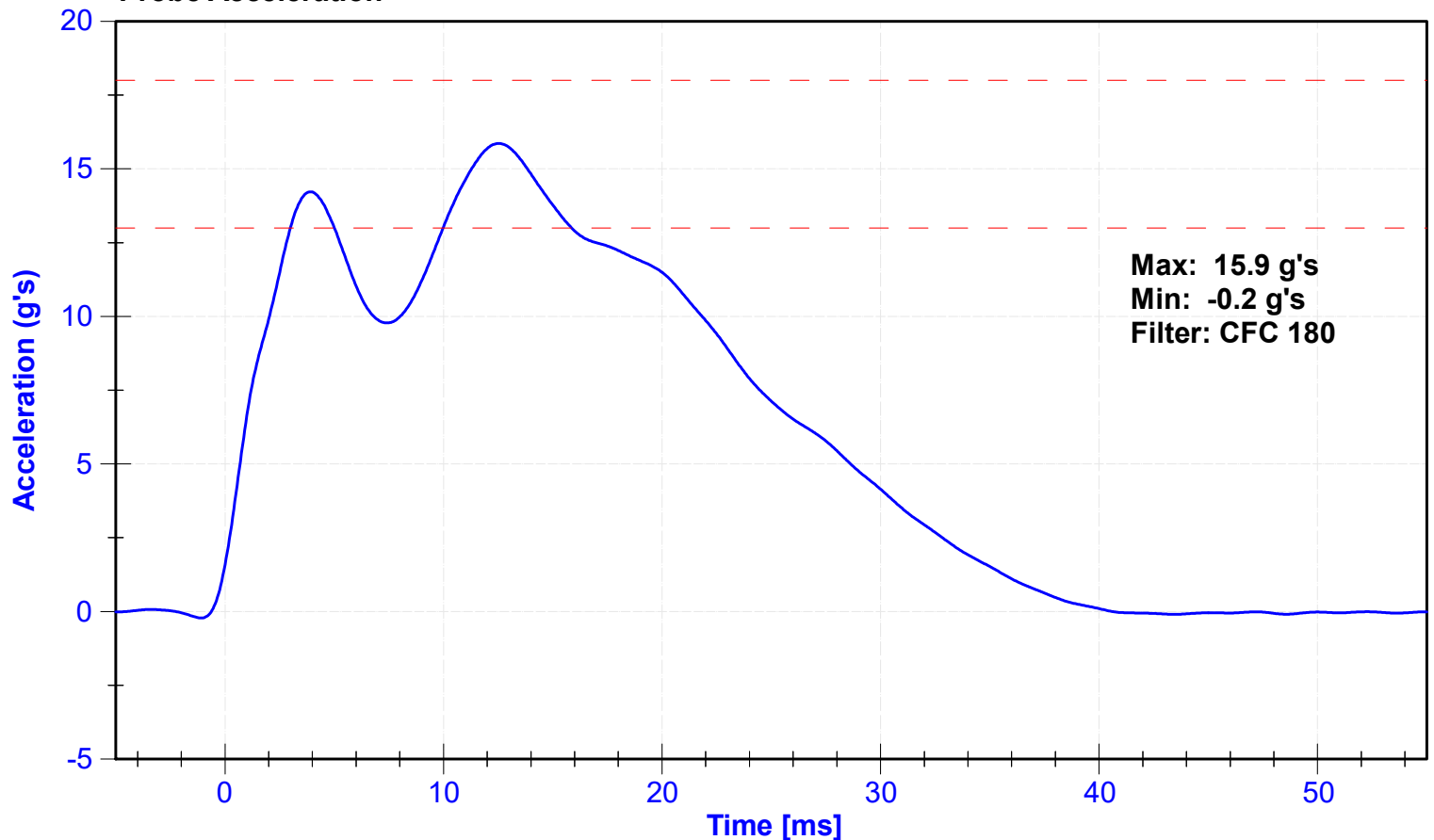
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	15	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	13	18	g's	15.9	Pass
Shoulder Deflection	28	37	mm	28.3	Pass
Lateral Upper Spine Acceleration	17	22	g's	20.5	Pass

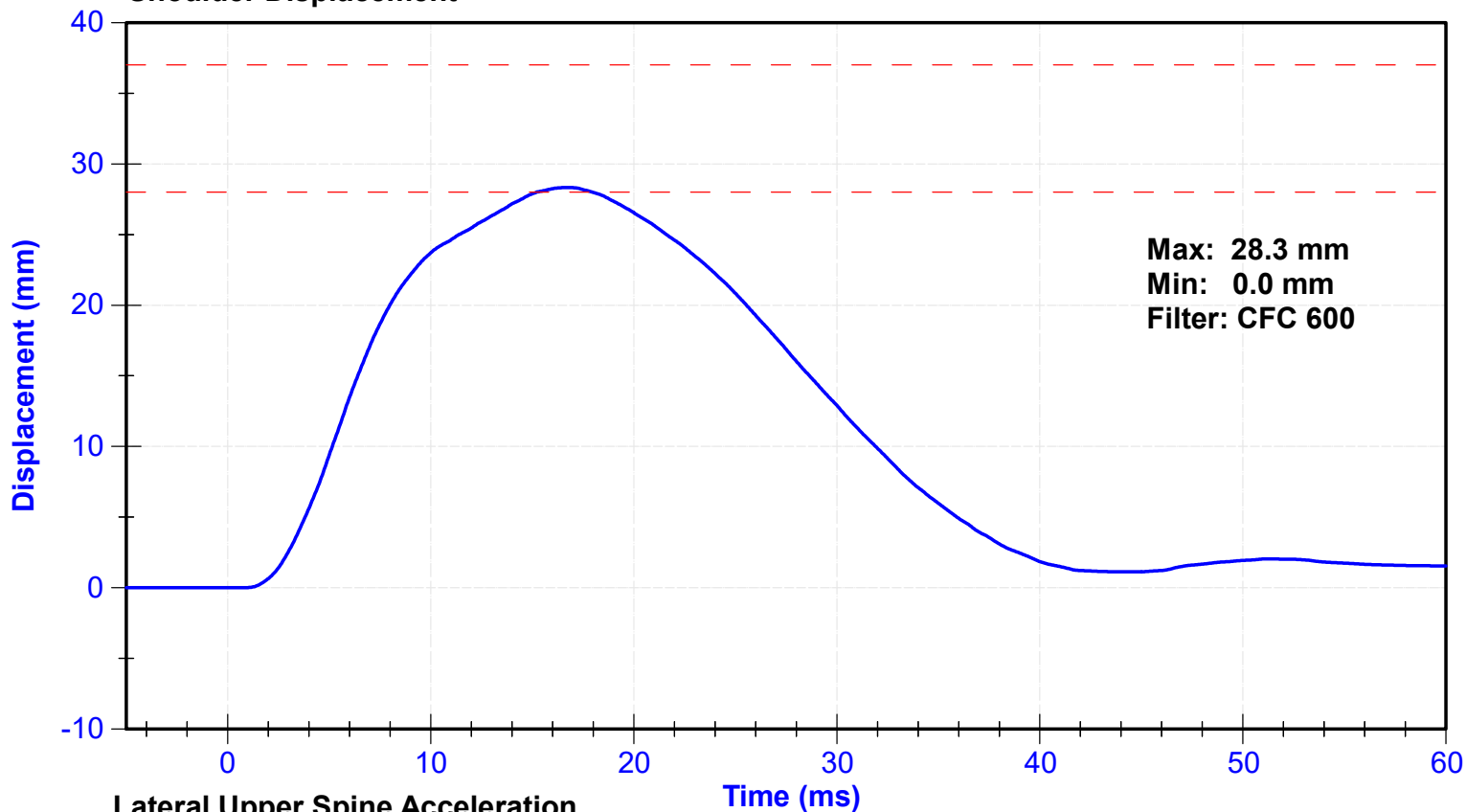
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Shoulder Potentiometer	Servo	1274GFE	12/13/2022	6/13/2023
Upper Spine Y Accelerometer	Endevco	P64148	12/12/2022	6/10/2023

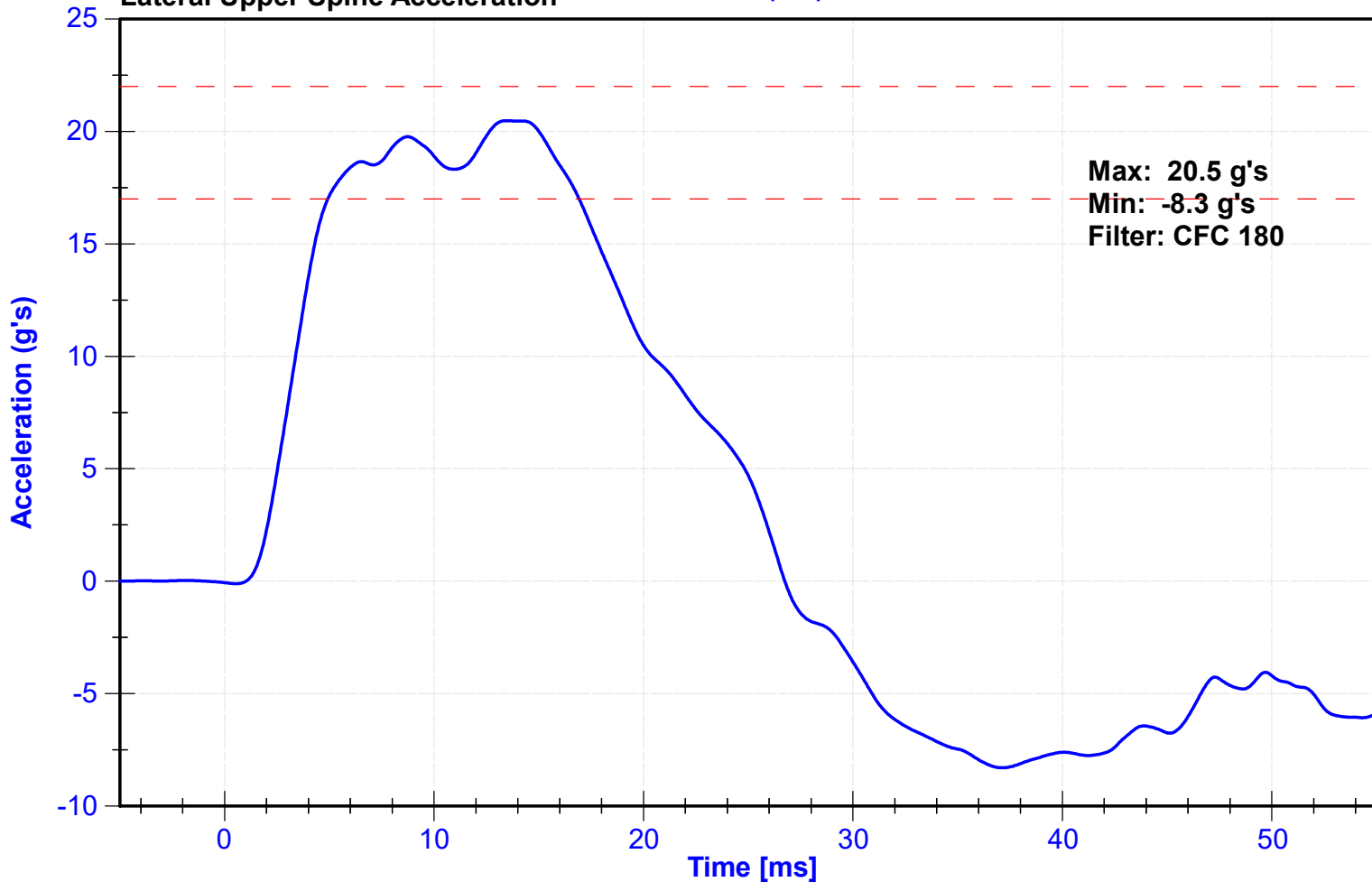
Probe Acceleration



Shoulder Displacement



Lateral Upper Spine Acceleration



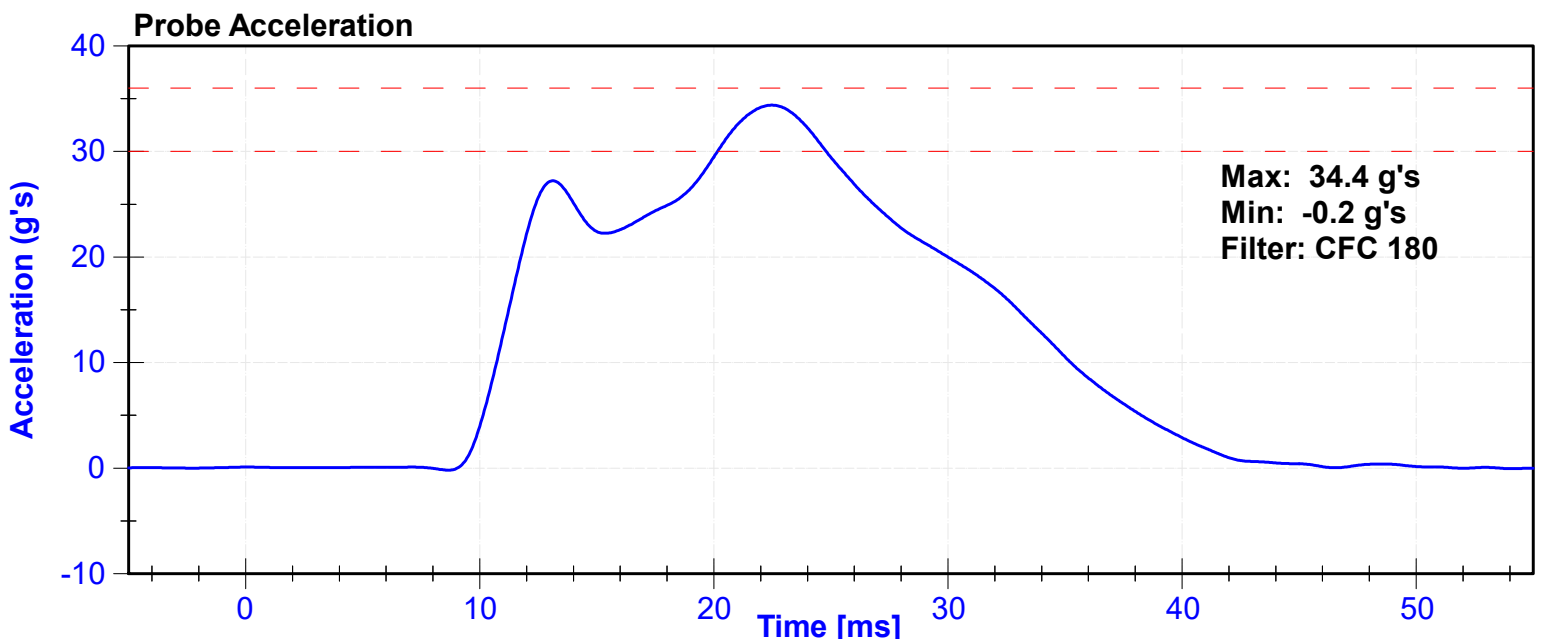
ATD Manufacturer	FTSS	Test Technician	J. Miller
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

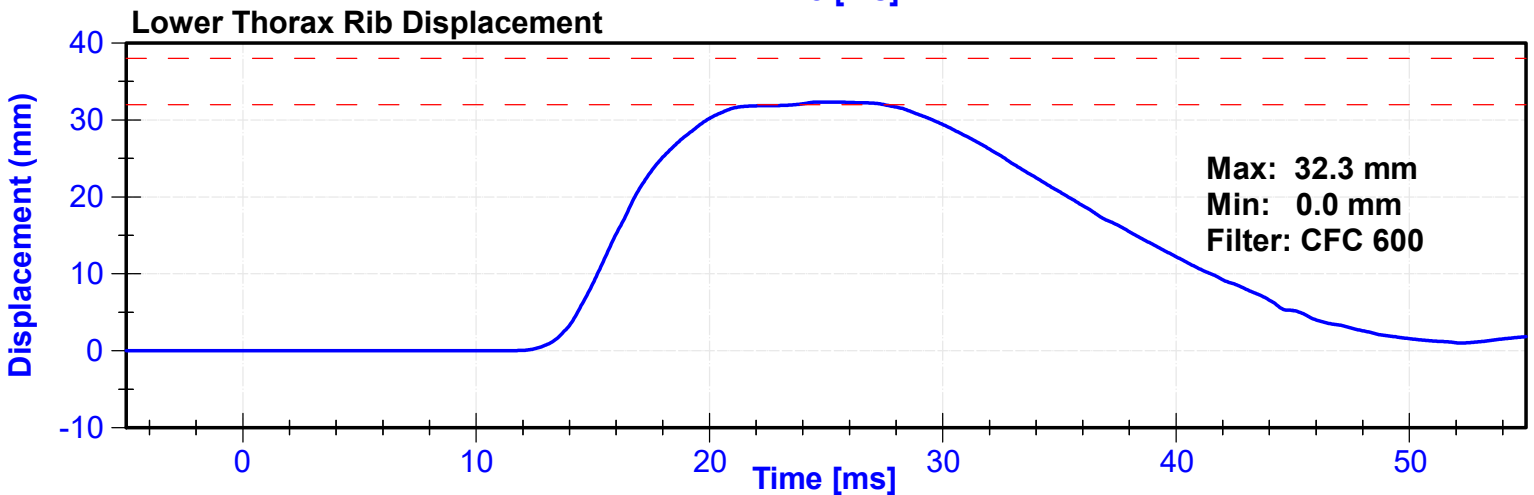
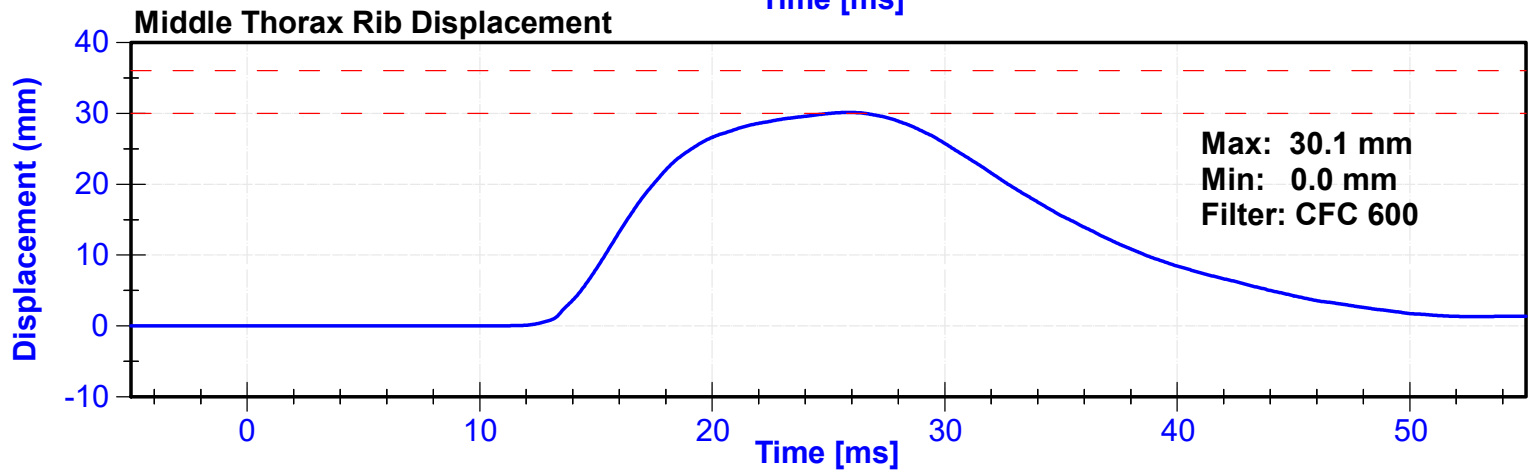
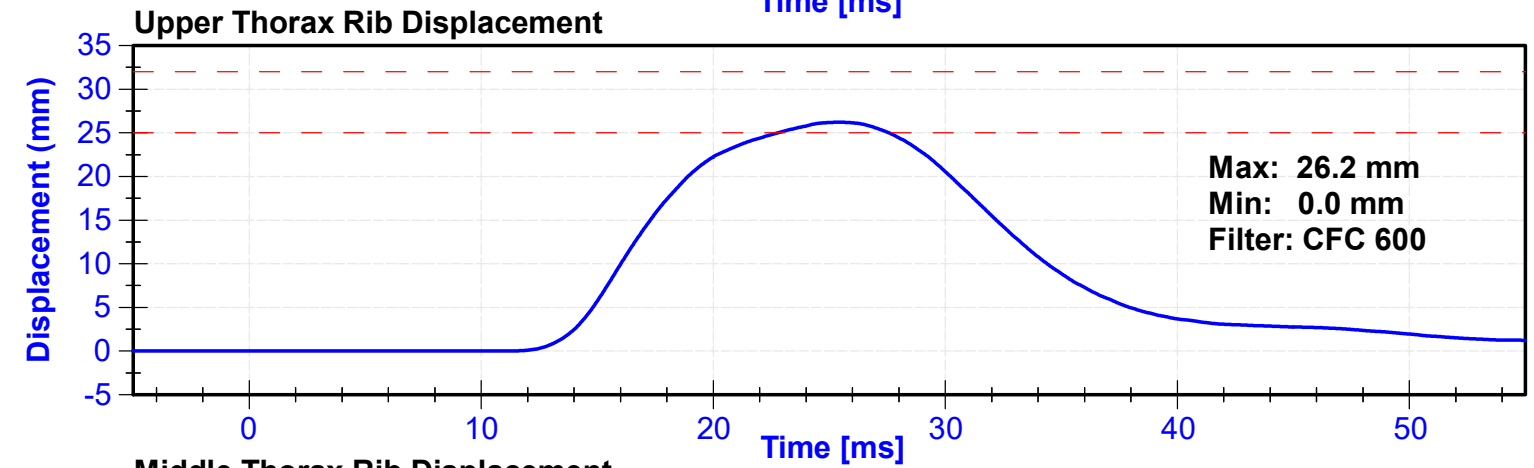
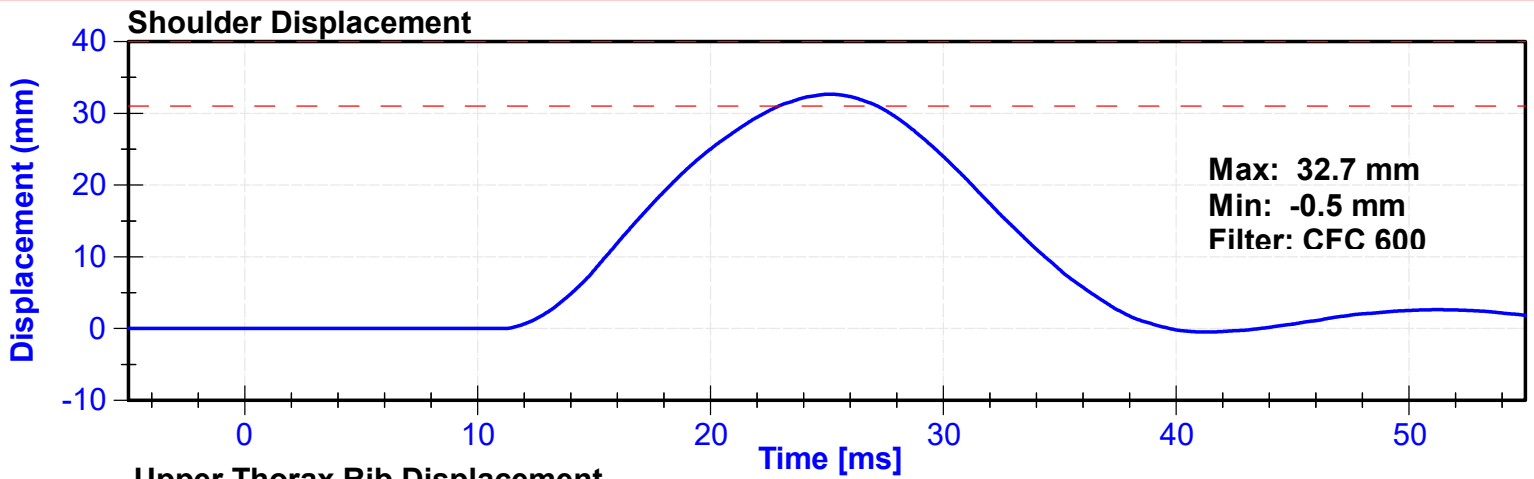
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	15	Pass
Velocity	6.6	6.8	m/s	6.67	Pass
Probe Acceleration after 5 ms	30	36	g's	34.4	Pass
Lateral Upper Spine Acceleration	34	43	g's	40.3	Pass
Lateral Lower Spine Acceleration	29	37	g's	34.5	Pass
Shoulder Deflection	31	40	mm	32.7	Pass
Upper Thorax Rib Deflection	25	32	mm	26.2	Pass
Mid Thorax Rib Deflection	30	36	mm	30.1	Pass
Lower Thorax Rib Deflection	32	38	mm	32.3	Pass

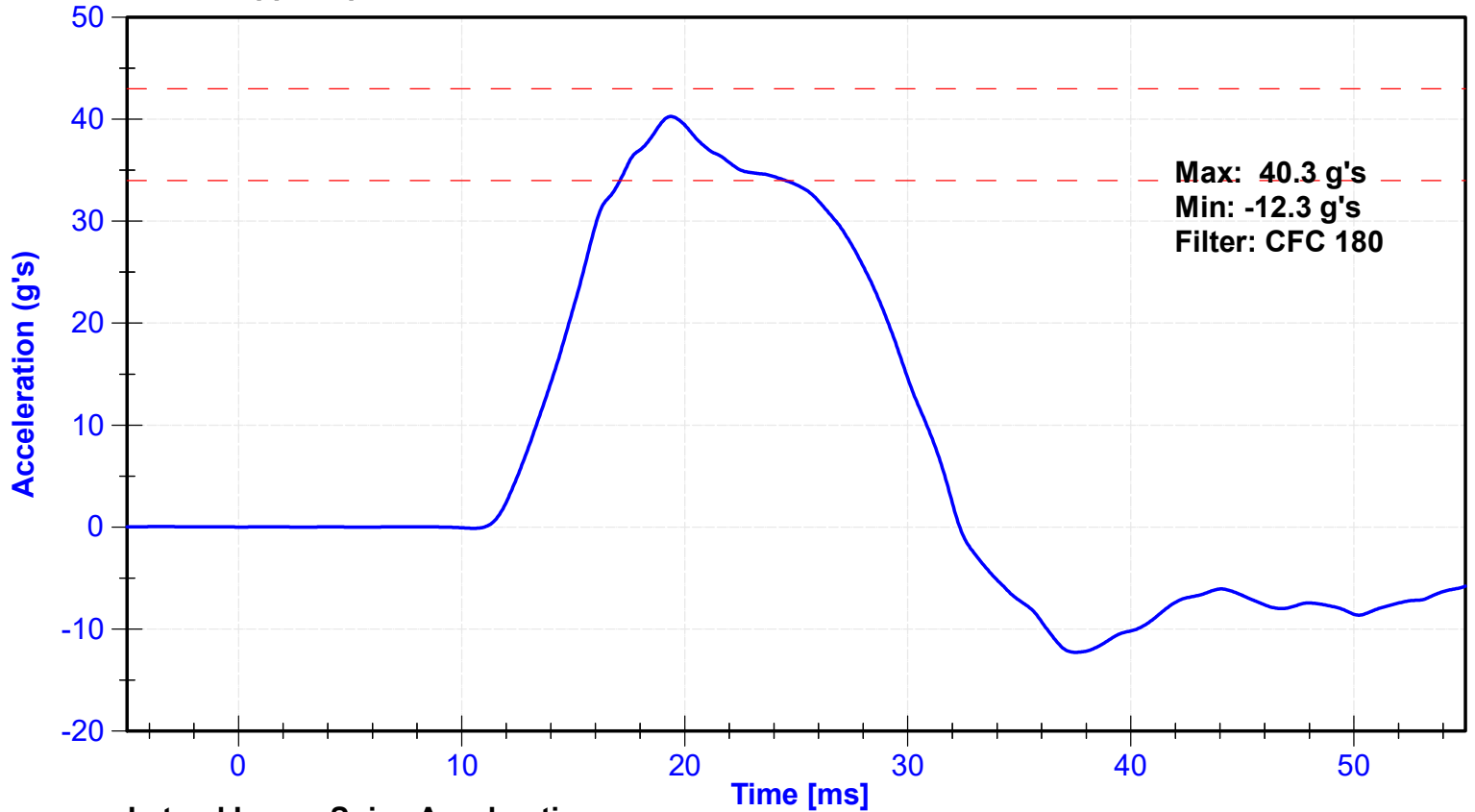
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Spine T1 Y Accelerometer	Endevco	P64148	12/12/2022	6/10/2023
Upper Spine T12 Y Accelerometer	Endevco	P51327	12/12/2022	6/10/2023
Shoulder Potentiometer	Servo	1274GFE	12/13/2022	6/13/2023
Upper Thorax Rib Potentiometer	Servo	1199GFE	12/13/2022	6/13/2023
Middle Thorax Rib Potentiometer	Servo	1246GFE	12/13/2022	6/13/2023
Lower Thorax Rib Potentiometer	Servo	011GFE	12/13/2022	6/13/2023

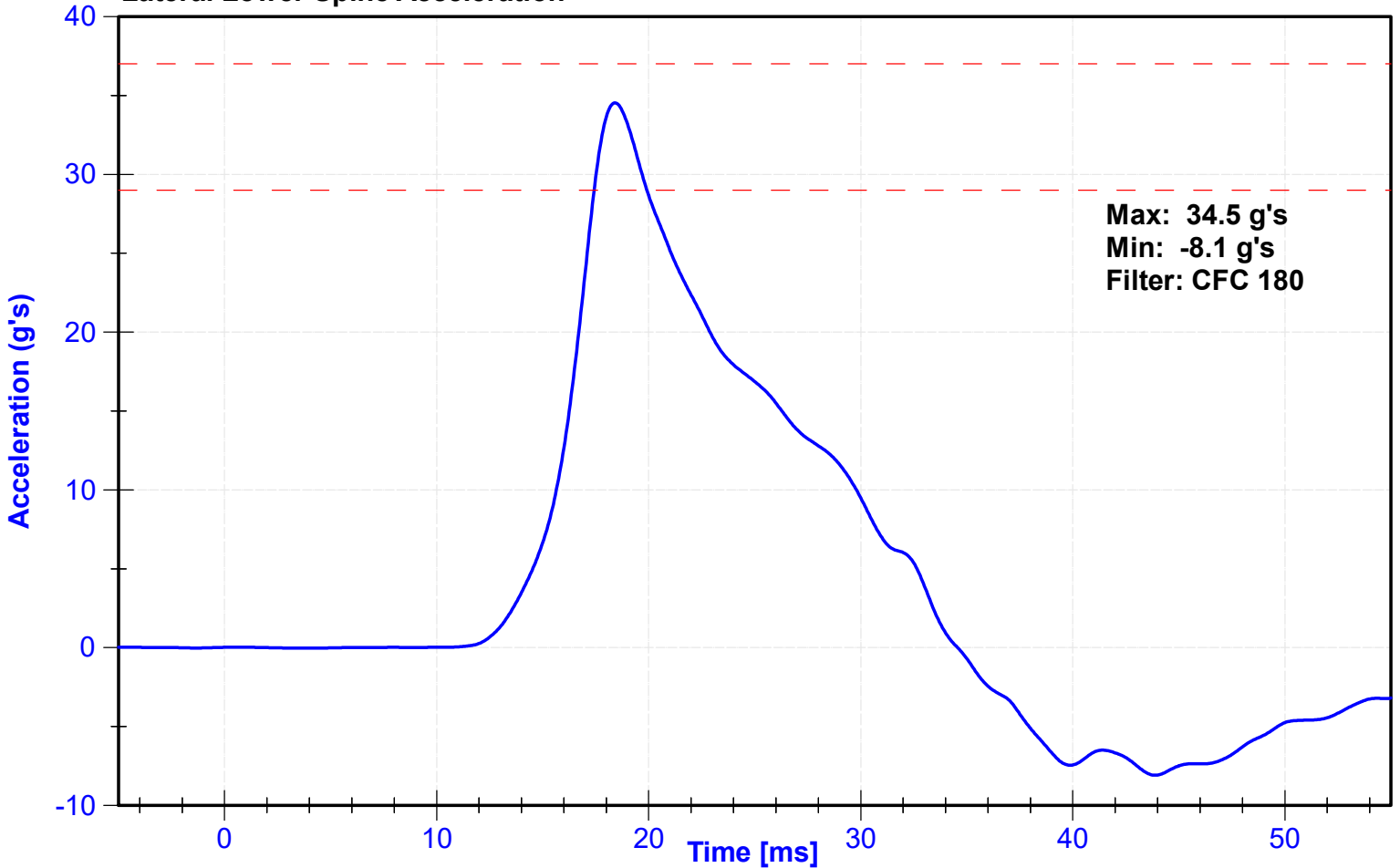




Lateral Upper Spine Acceleration



Lateral Lower Spine Acceleration



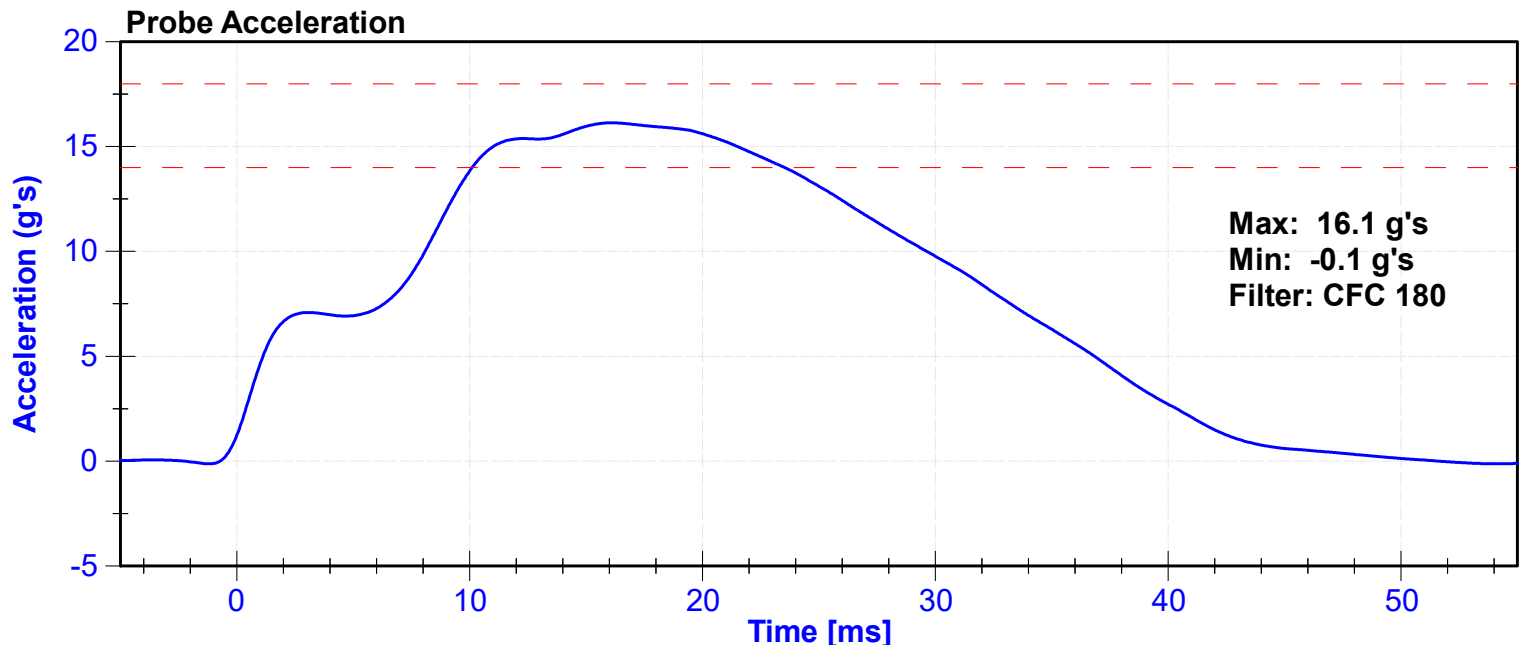
ATD Manufacturer	FTSS	Test Technician	J. Miller
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

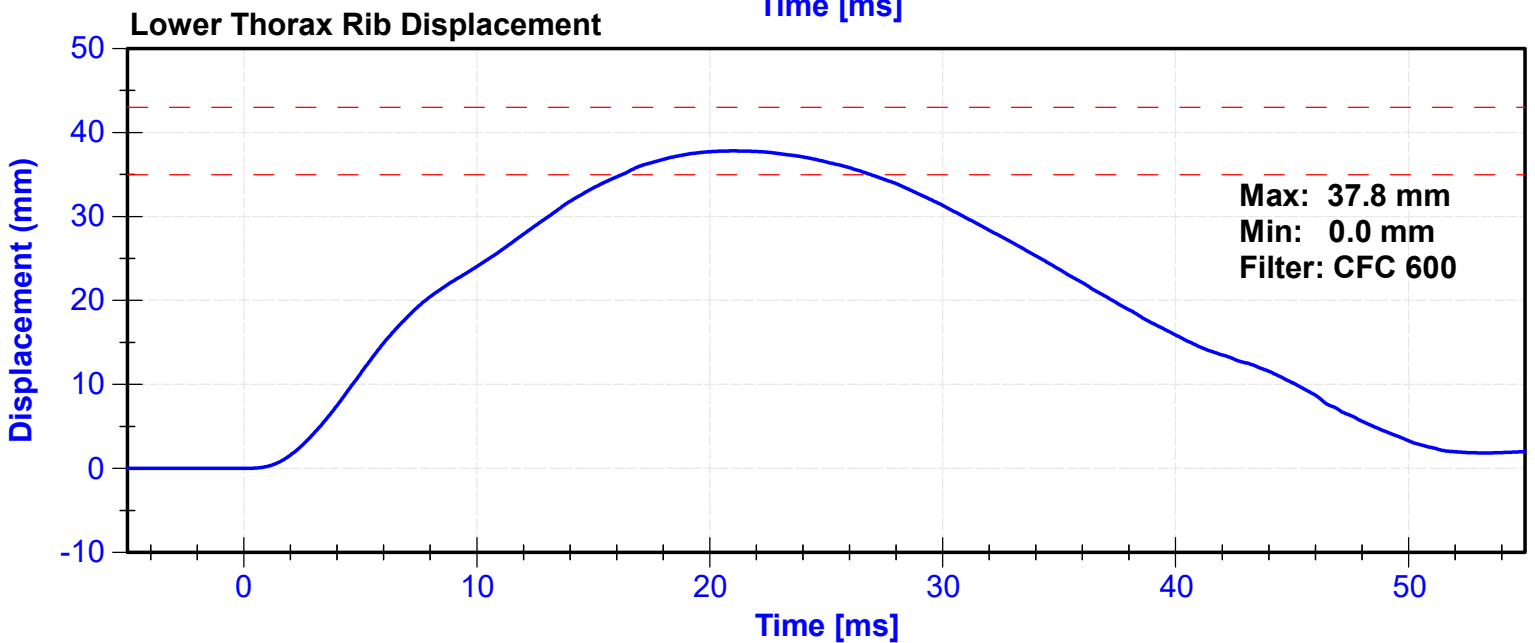
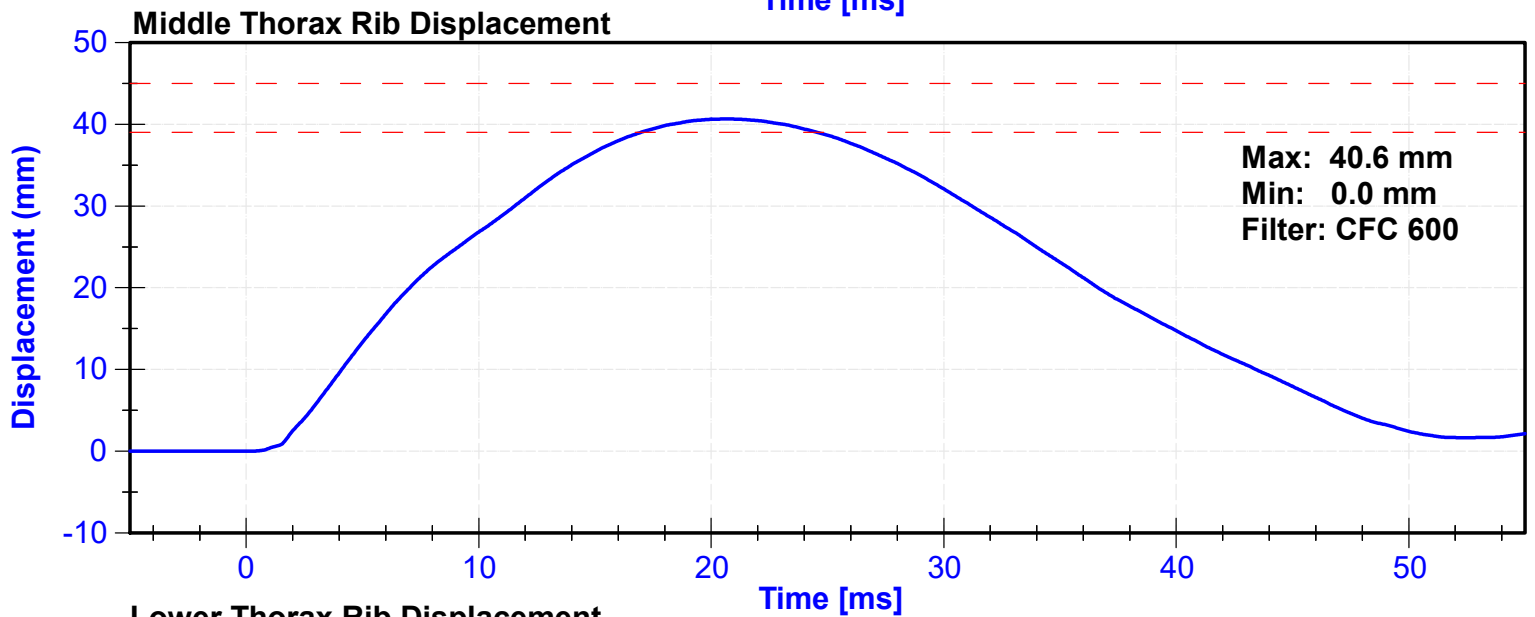
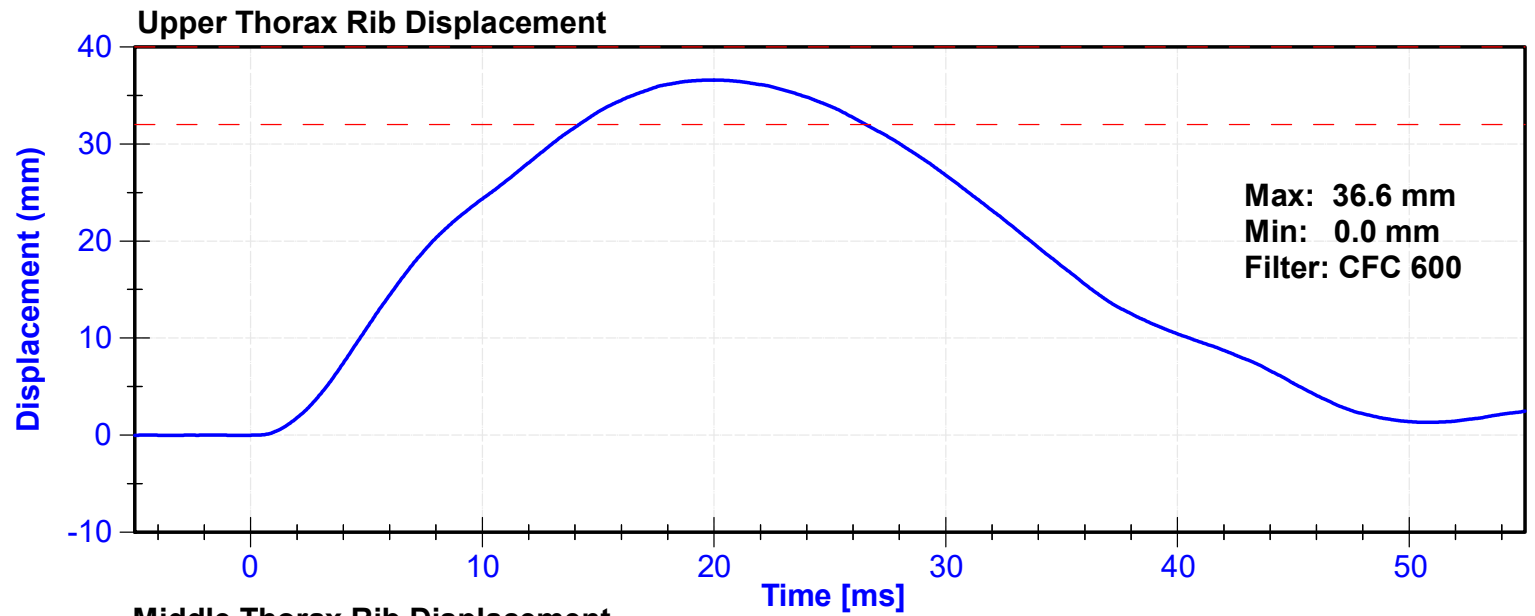
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	15	Pass
Velocity	4.2	4.4	m/s	4.32	Pass
Probe Acceleration	14	18	g's	16.1	Pass
Lateral Upper Spine Acceleration	13	17	g's	15.5	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.0	Pass
Upper Thorax Rib Deflection	32	40	mm	36.6	Pass
Middle Thorax Rib Deflection	39	45	mm	40.6	Pass
Lower Thorax Rib Deflection	35	43	mm	37.8	Pass

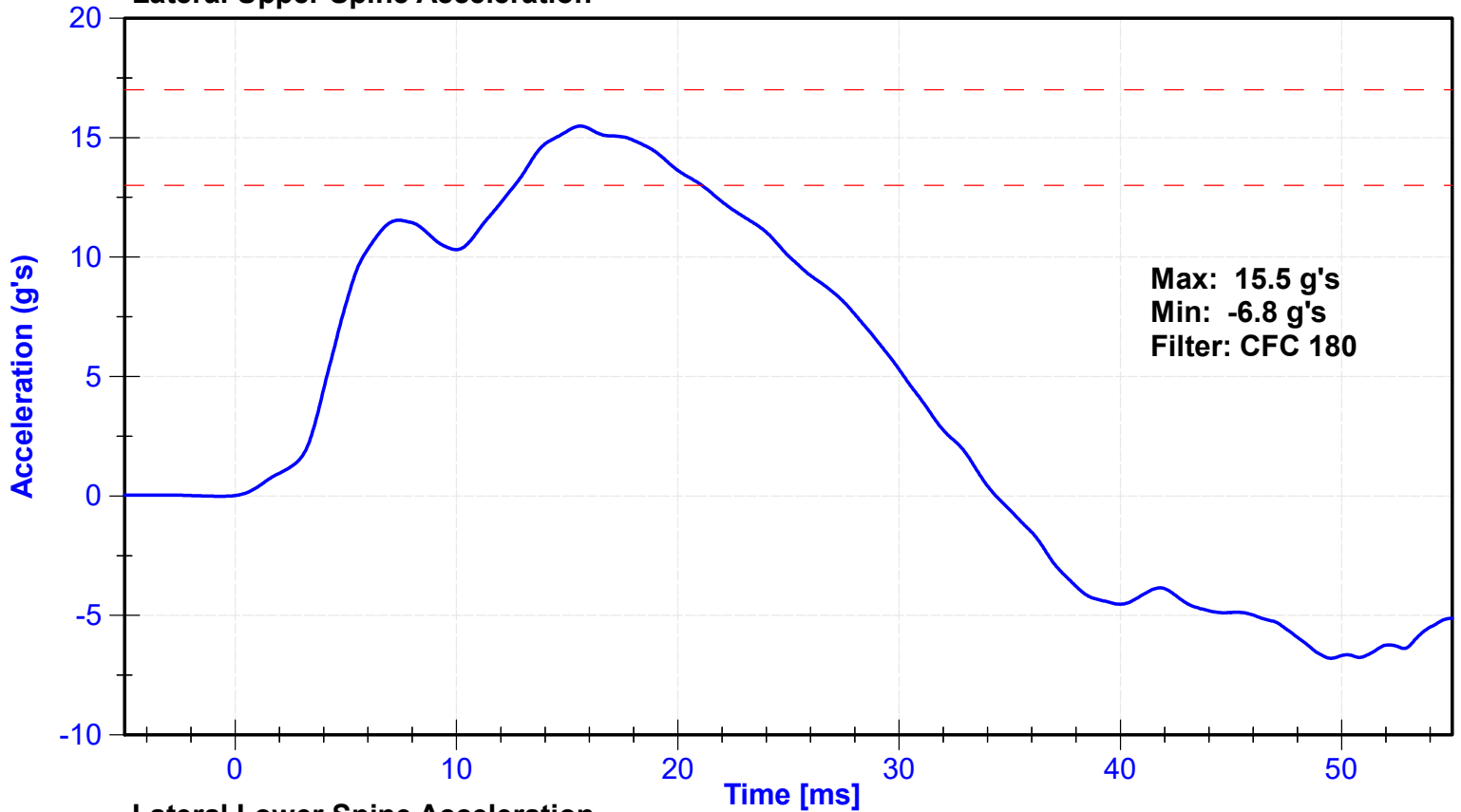
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Spine Y Accelerometer	Endevco	P64148	12/12/2022	6/10/2023
Lower Spine Y Accelerometer	Endevco	P51327	12/12/2022	6/10/2023
Upper Thorax Rib Potentiometer	Servo	1199GFE	12/13/2022	6/13/2023
Middle Thorax Rib Potentiometer	Servo	1246GFE	12/13/2022	6/13/2023
Lower Thorax Rib Potentiometer	Servo	011GFE	12/13/2022	6/13/2023

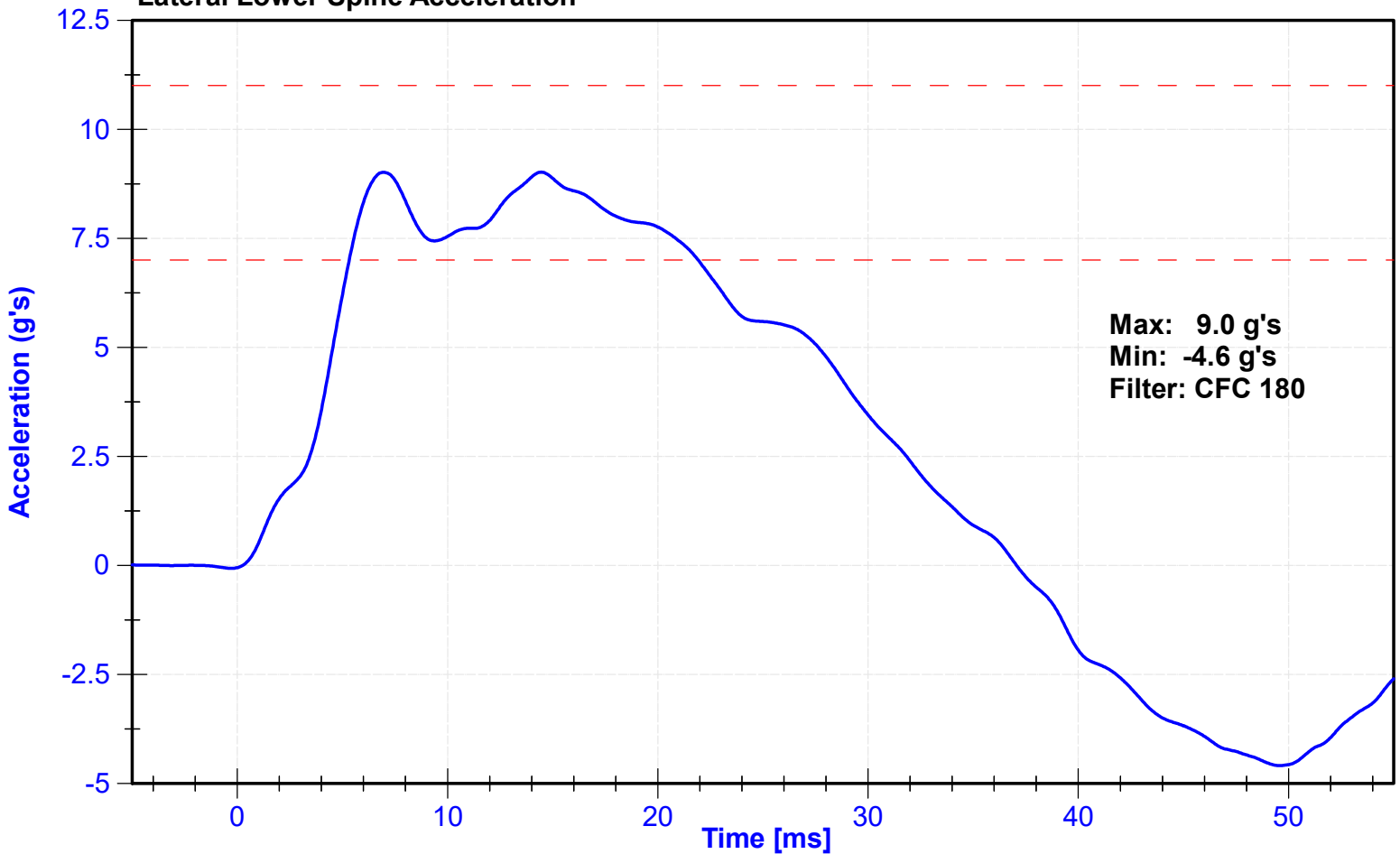




Lateral Upper Spine Acceleration



Lateral Lower Spine Acceleration



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

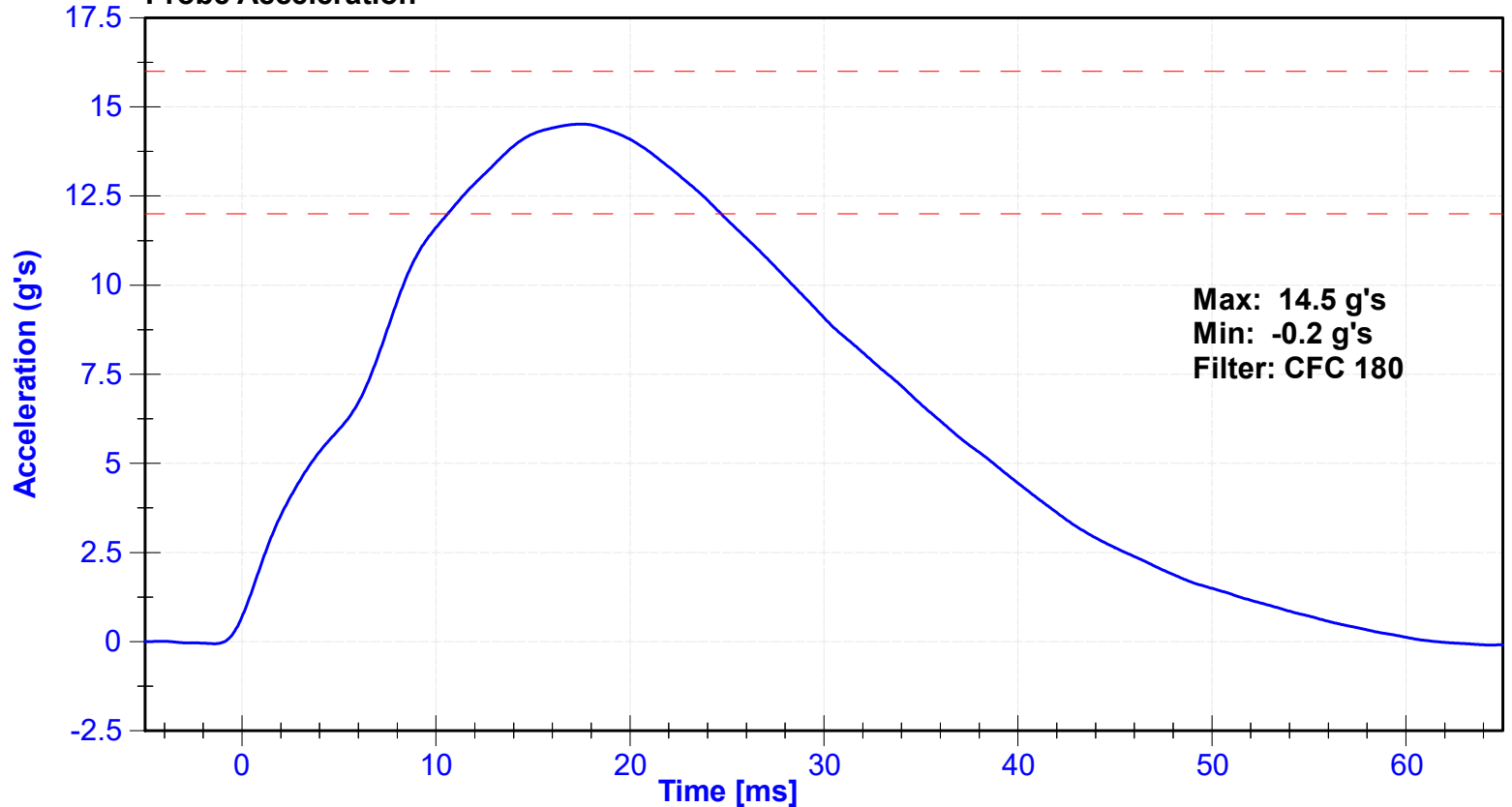
Results

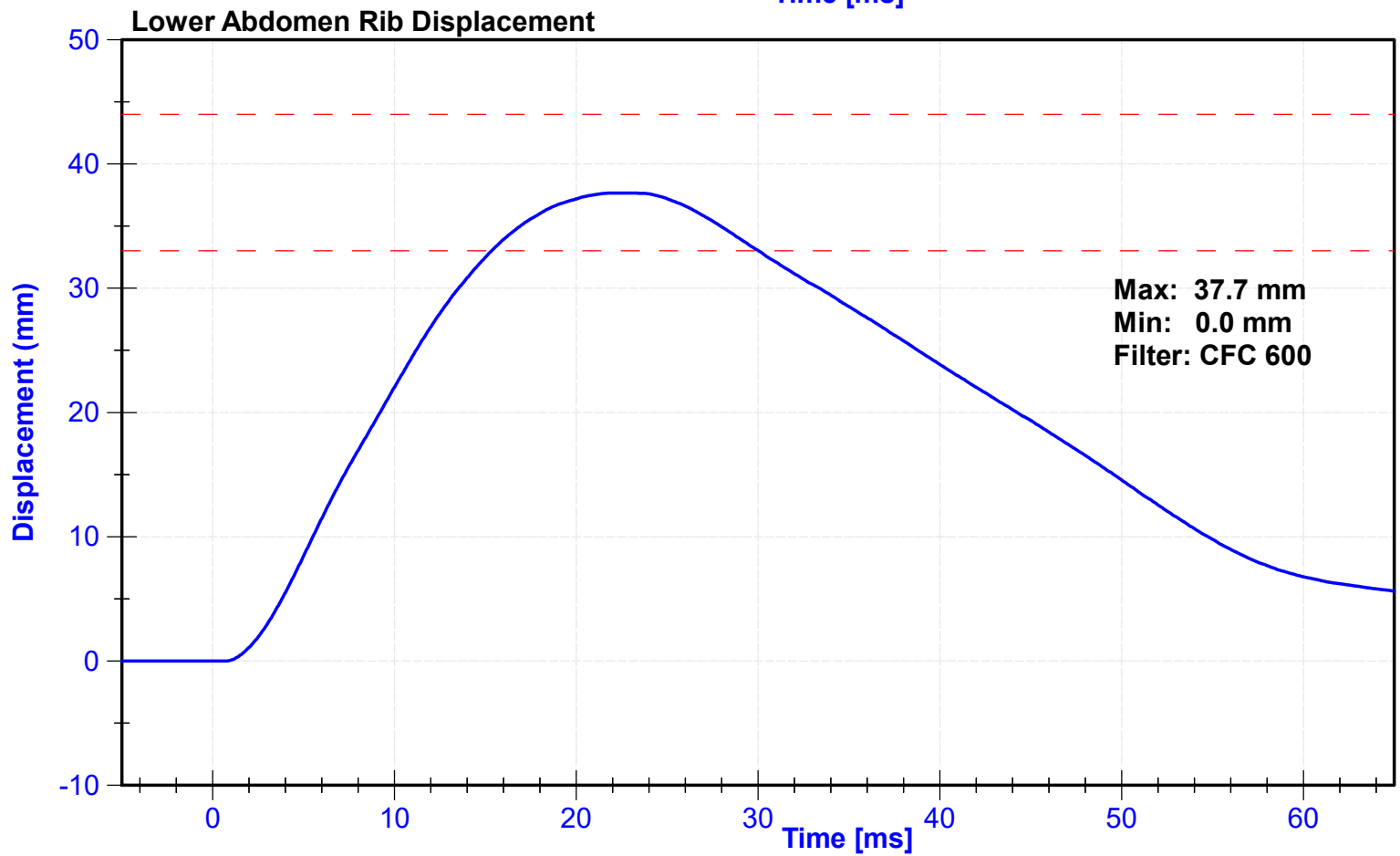
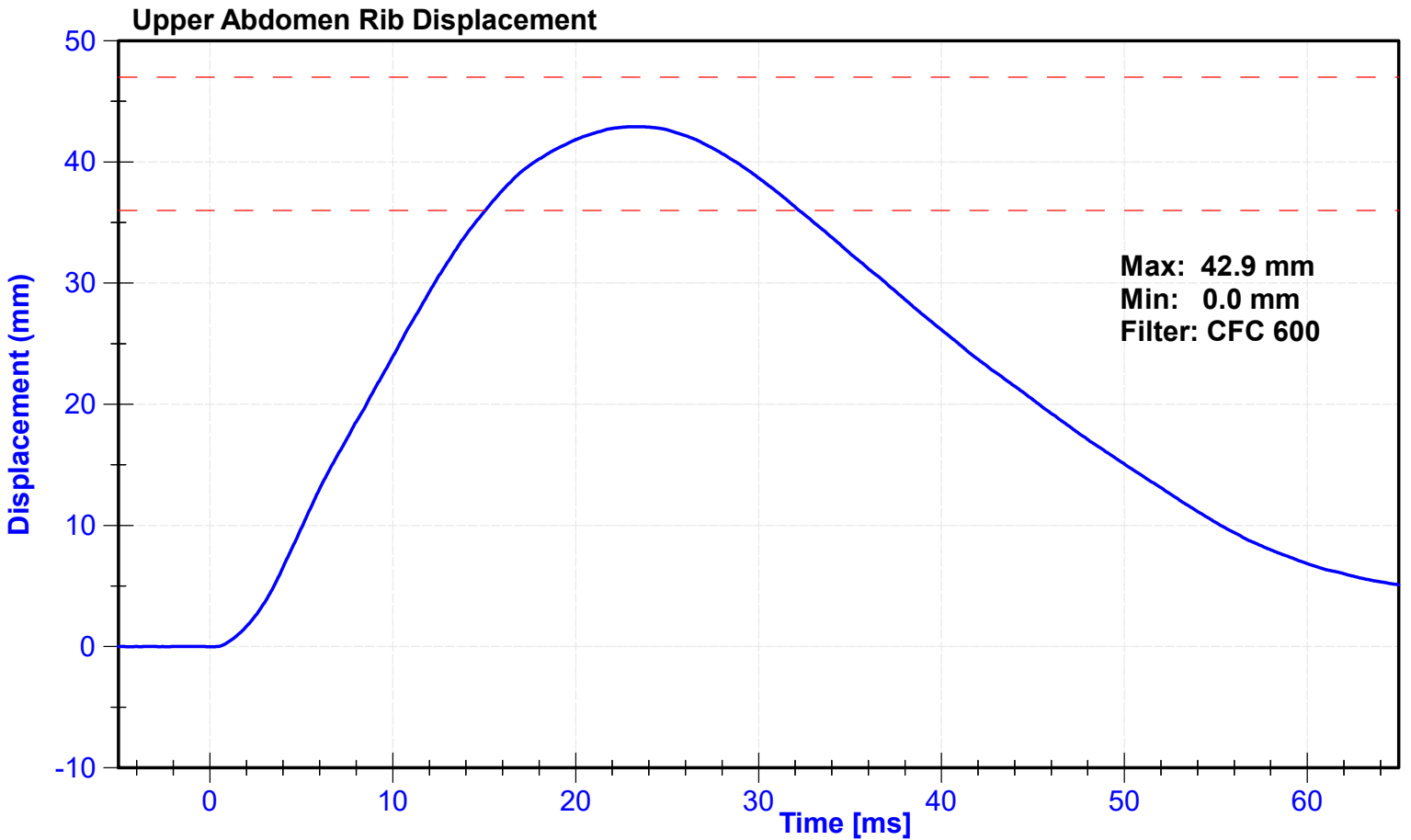
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	13.2	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	12	16	g's	14.5	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.0	Pass
Upper Abdomen Rib Deflection	36	47	mm	42.9	Pass
Lower Abdomen Rib Deflection	33	44	mm	37.7	Pass

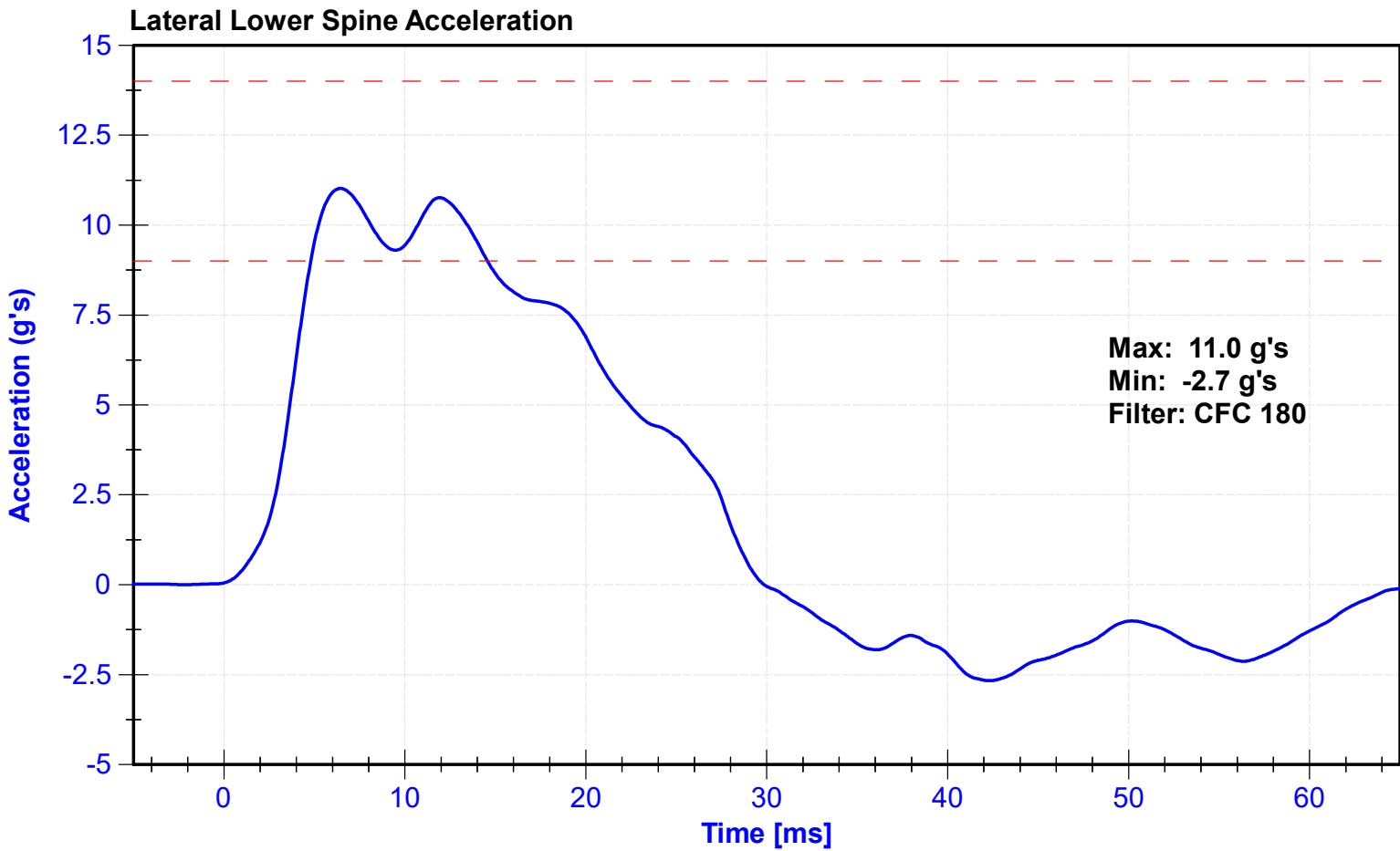
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Lower Spine Y Accelerometer	Endevco	P51327	12/12/2022	6/10/2023
Upper Abdomen Rib Potentiometer	Servo	008GFE	12/13/2022	6/13/2023
Lower Abdomen Rib Potentiometer	Servo	041 GFE	12/13/2022	6/13/2023

Probe Acceleration







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

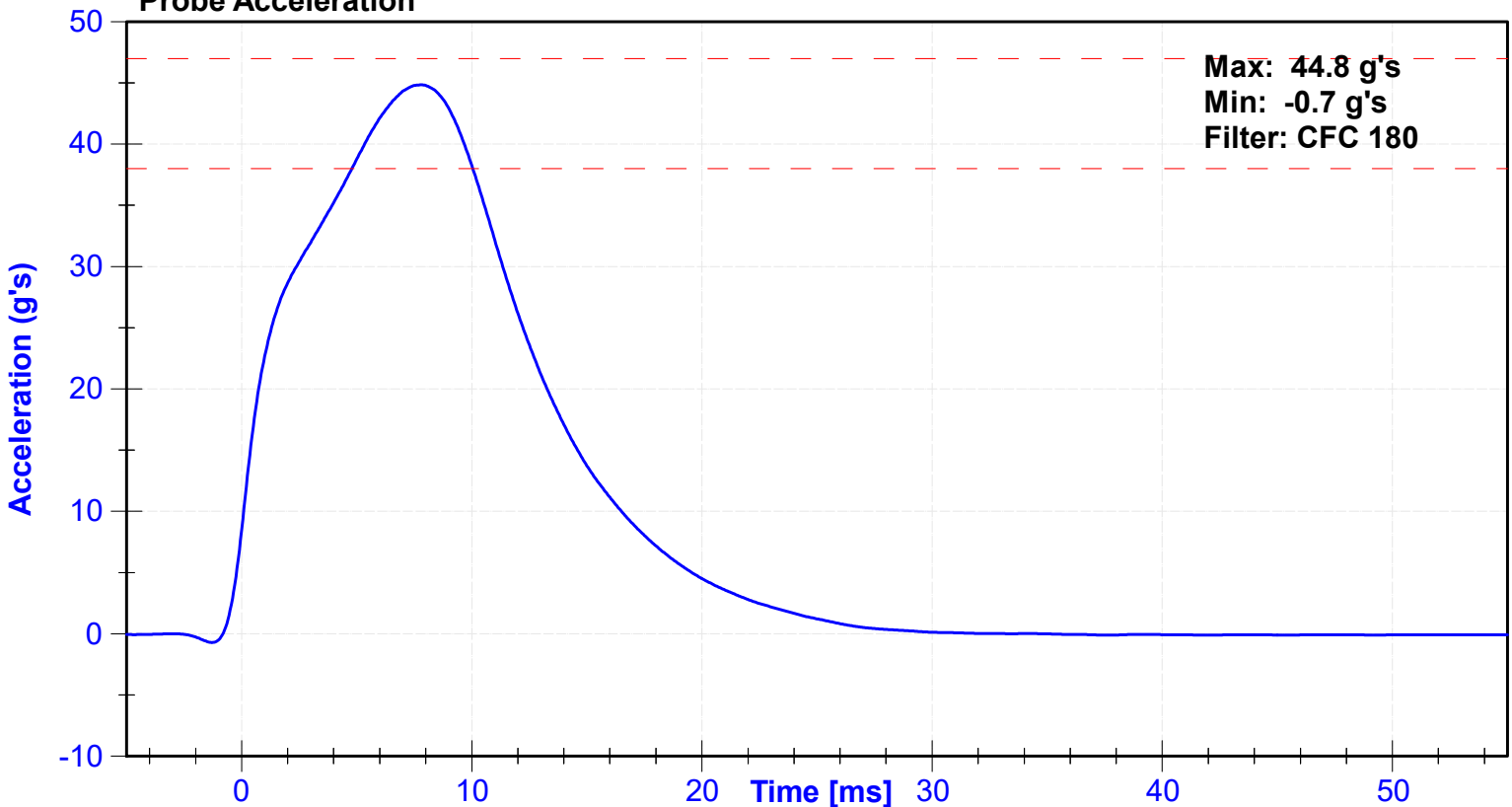
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	13.2	Pass
Velocity	6.6	6.8	m/s	6.66	Pass
Probe Acceleration	38	47	g's	44.8	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	39.2	Pass
Acetabulum Force	3600	4300	N	3735.2	Pass

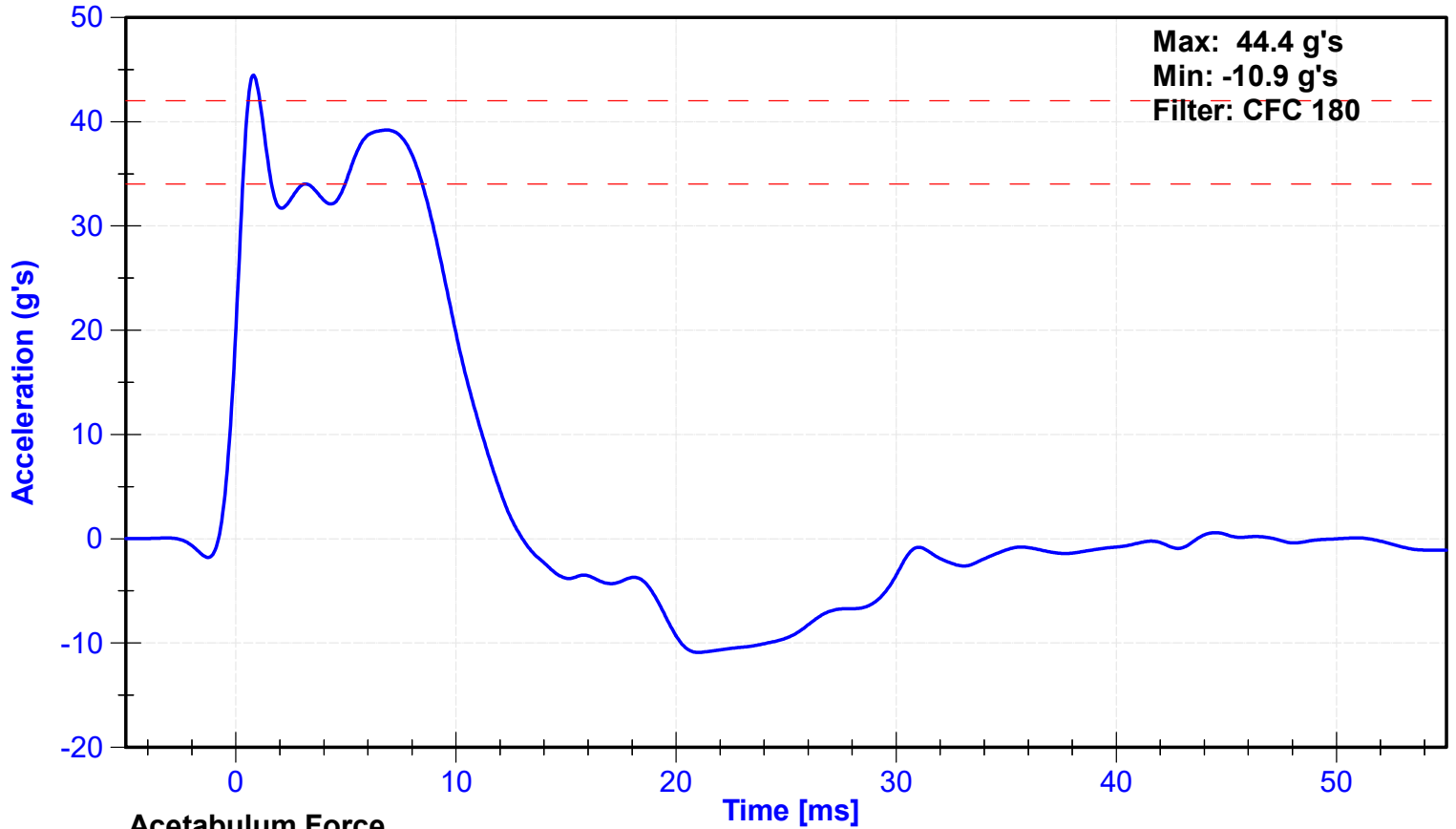
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pelvis Y Accelerometer	Endevco	P51875	12/12/2022	6/10/2023
Acetabulum Load Cell	Denton	276-FY	8/11/2022	8/11/2023
Certification Plug	SACO			N/A
Crash Test Plug	SACO			N/A

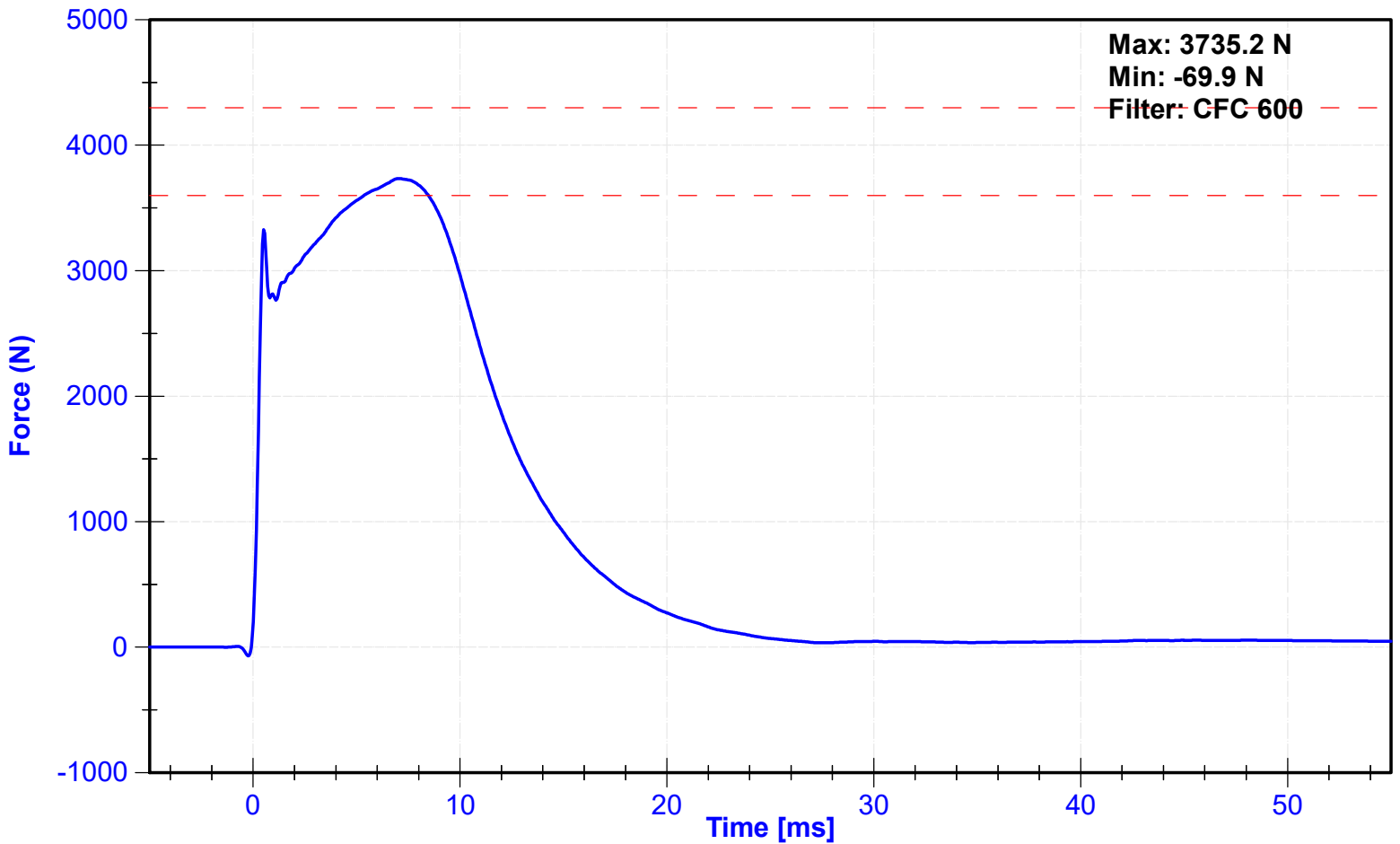
Probe Acceleration



Lateral Pelvis Acceleration



Acetabulum Force





SID-IIs Pelvis Plug Certification Test

Plug S/N 15434 *CERTIFICATION 2/3/23 JRM*

Test Number 20095

Report Number 20149

Test Date 9/9/2021 10:14:57 AM

Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	50	600
Force @ 1.5 mm (N)	850	1,400
Force @ 2.5 mm (N)	1,306	1,618
Force @ 3.0 mm (N)	1,361	1,673

Testing Machine STM-20 5965542

Load Cell S/N (FI360947), U_{CL} (LBS) 1000

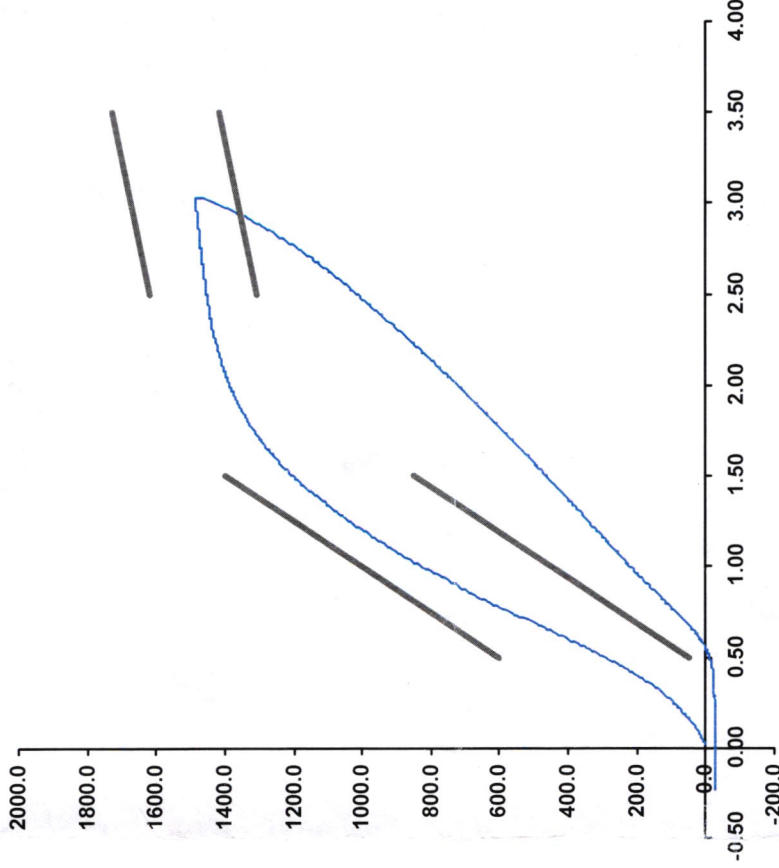
Preload Value (-N) 22.24

Crosshead Speed (mm / min) or Rate 12.7

Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 09-Sep-21

SACO Research

By: *DC* Date: *9/9/2021*

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



SID-IIs Pelvis Plug Certification Test

Plug S/N 15450 *CRASH LEFT IMPACT 2/3/23 JPM*

Test Number 20111

Report Number 20165

Test Date 9/9/2021 10:49:14 AM

Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	50	600
Force @ 1.5 mm (N)	850	1,400
Force @ 2.5 mm (N)	1,306	1,618
Force @ 3.0 mm (N)	1,361	1,673

Testing Machine STM-20 5965542

Load Cell S/N (FI360947), Units (LBS) 1000

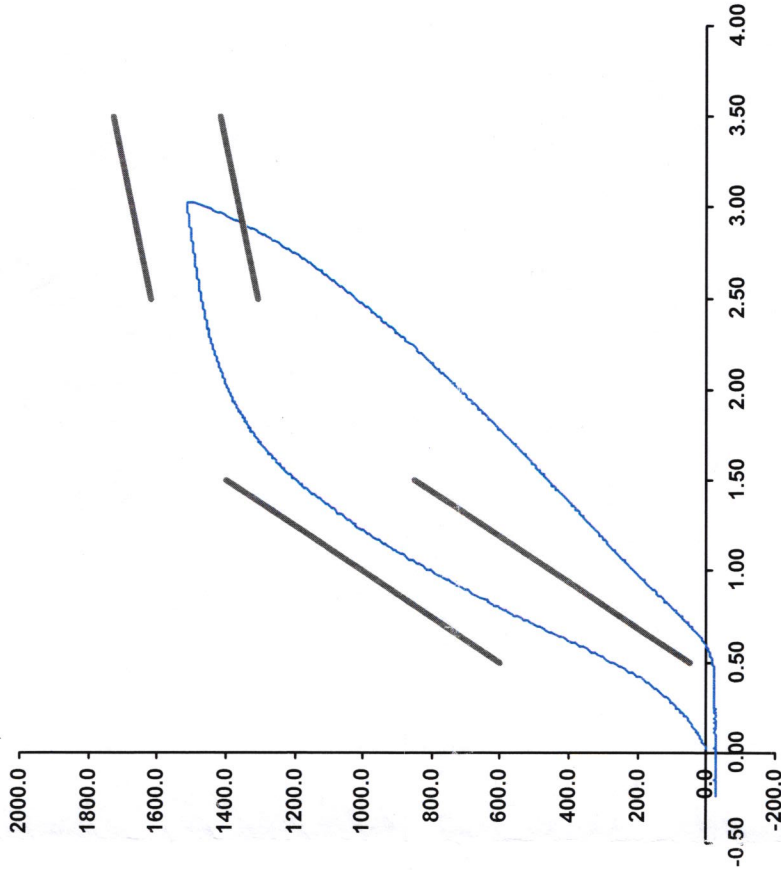
Preload Value (-N) 22.24

Crosshead Speed (mm / min) or Rate 12.7

Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 09-Sep-21

SACO Research

By: *DC* Date: *9/9/2021*

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



SID-IIs Pelvis Plug Certification Test

Plug S/N 15278 *CRASH RIGHT NON-IMPACT 2/3/23 JPH*

Test Number 18153

Report Number 18201

Test Date 3/22/2021 11:17:18 AM

Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	50	600
Force @ 1.5 mm (N)	850	1,400
Force @ 2.5 mm (N)	1,306	1,618
Force @ 3.0 mm (N)	1,361	1,673

Testing Machine STM-20 5965542

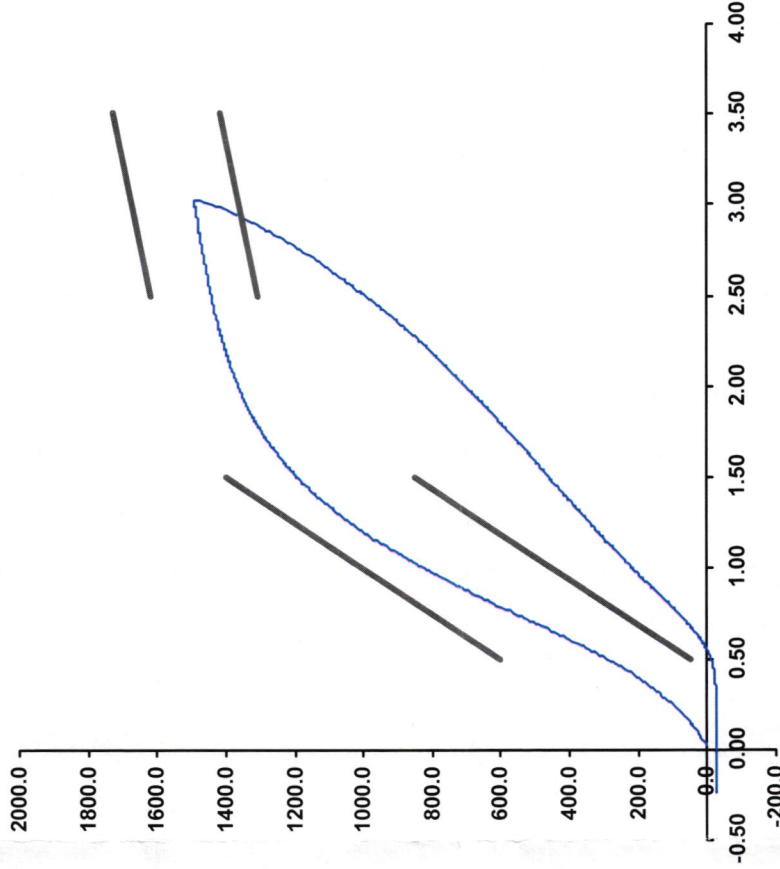
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7

Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 22-Mar-21

SACO Research

By: *DC* Date: *3/22/2021*

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

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

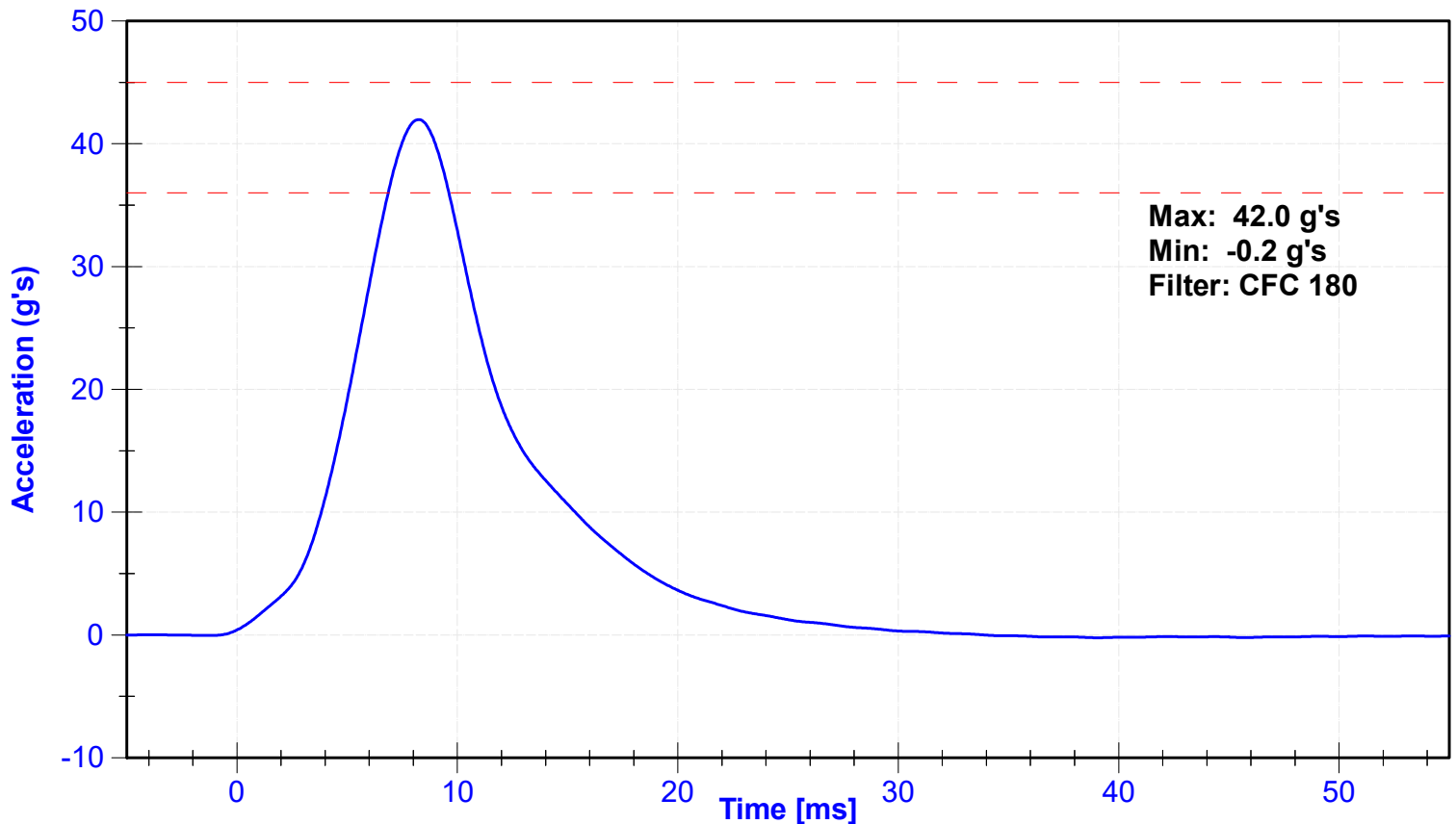
Results

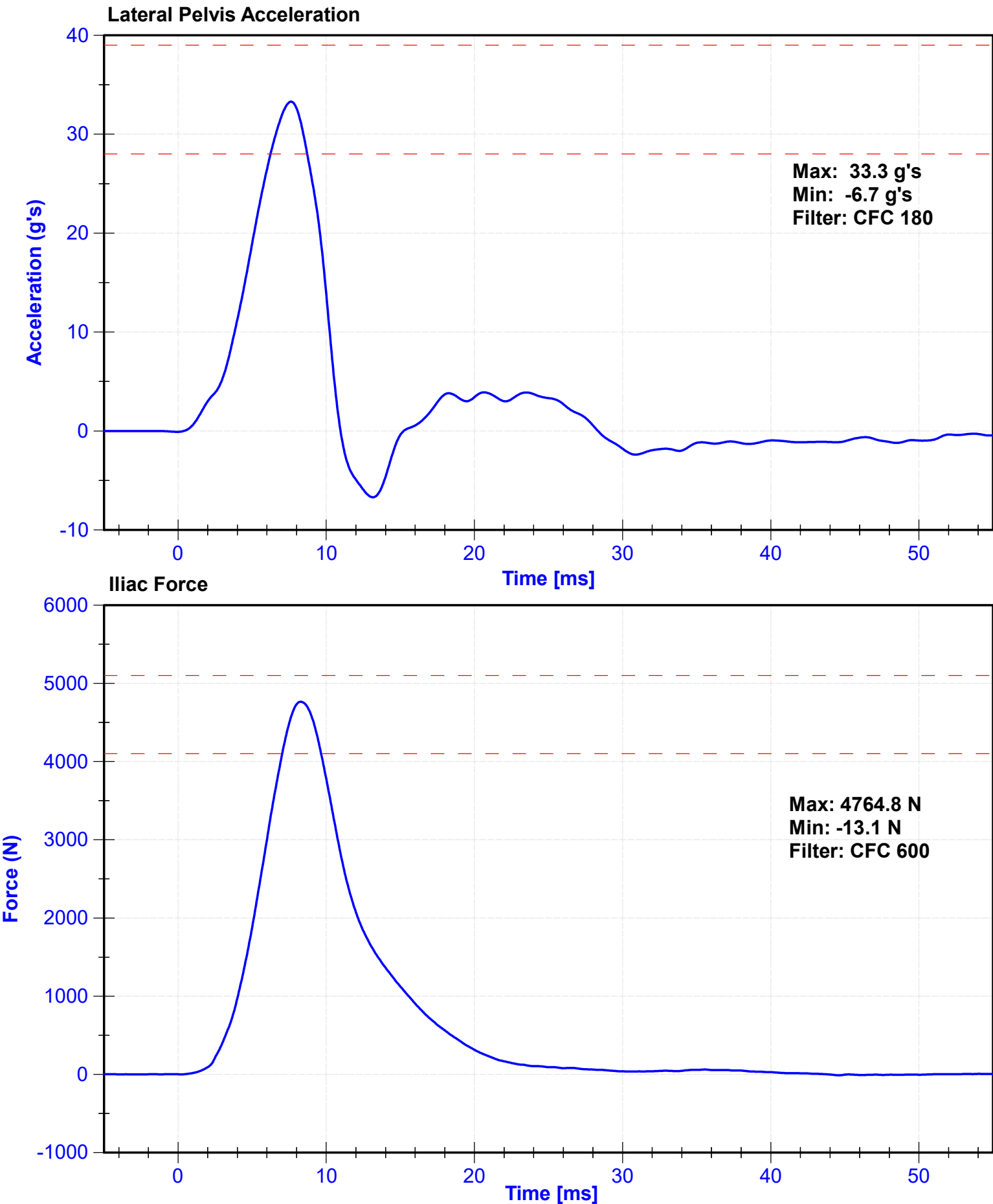
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	13.0	Pass
Velocity	4.2	4.4	m/s	4.20	Pass
Probe Acceleration	36	45	g's	42.0	Pass
Lateral Pelvis Acceleration	28	39	g's	33.3	Pass
Iliac Force	4100	5100	N	4764.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pelvis Y Accelerometer	Endevco	P51875	12/12/2022	6/10/2023
Iliac Load Cell	Denton	290-FY	8/11/2022	8/11/2023

Probe Acceleration





CALIBRATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

SERIAL NO:F033

(CONFIGURED FOR LEFT SIDE IMPACT)

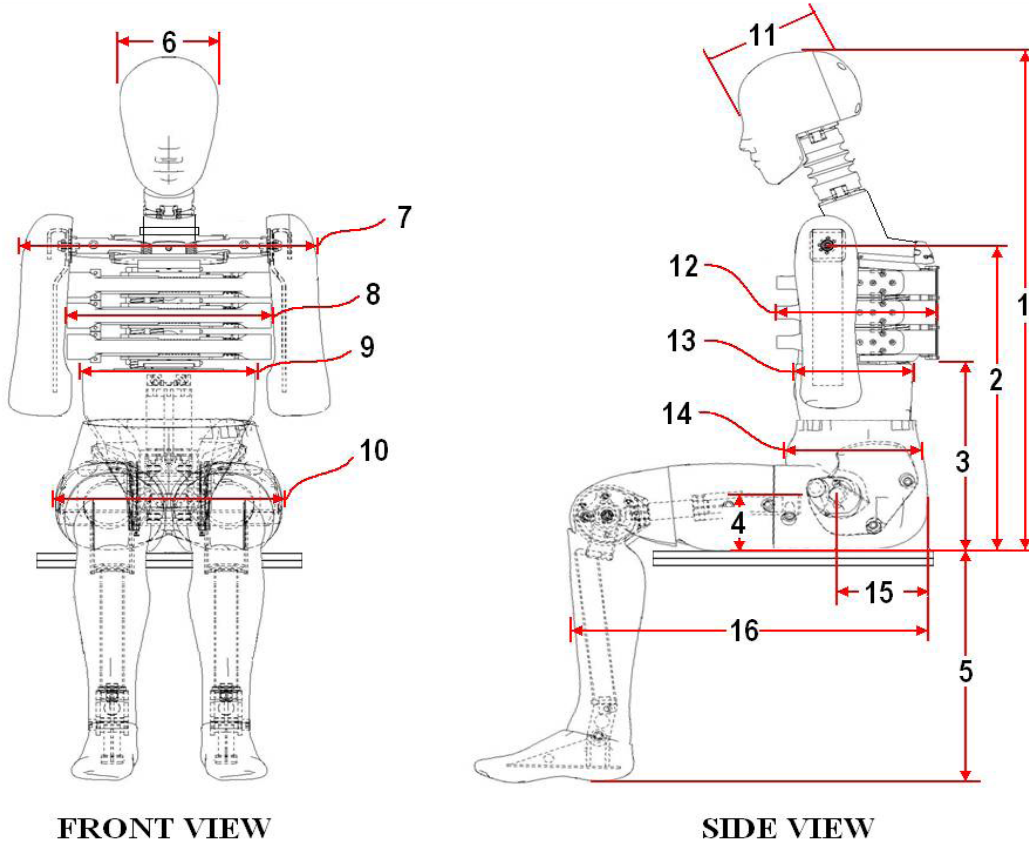


External Measurements - EuroSID-2re

Technician: K. Brogan

Date: 02/13/2023

Dummy Serial Number: F033



FRONT VIEW

SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	911	Pass
2	Seat to Shoulder Joint	558	572	567	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	351	Pass
4	Seat to Hip Joint (center of bolt)	97	103	99	Pass
5	Sole to Seat, Sitting	333	451	420	Pass
6	Head Width	152	158	157	Pass
7	Shoulder/Arm Width	461	479	469	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	281	Pass
10	Pelvis Lap Width	359	373	367	Pass
11	Head Depth	196	206	201	Pass
12	Thorax Depth	262	272	268	Pass
13	Abdomen Depth	194	204	202	Pass
14	Pelvis Depth	235	245	238	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	156	Pass
16	Back of Buttocks to Front Knee	597	615	611	Pass

ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

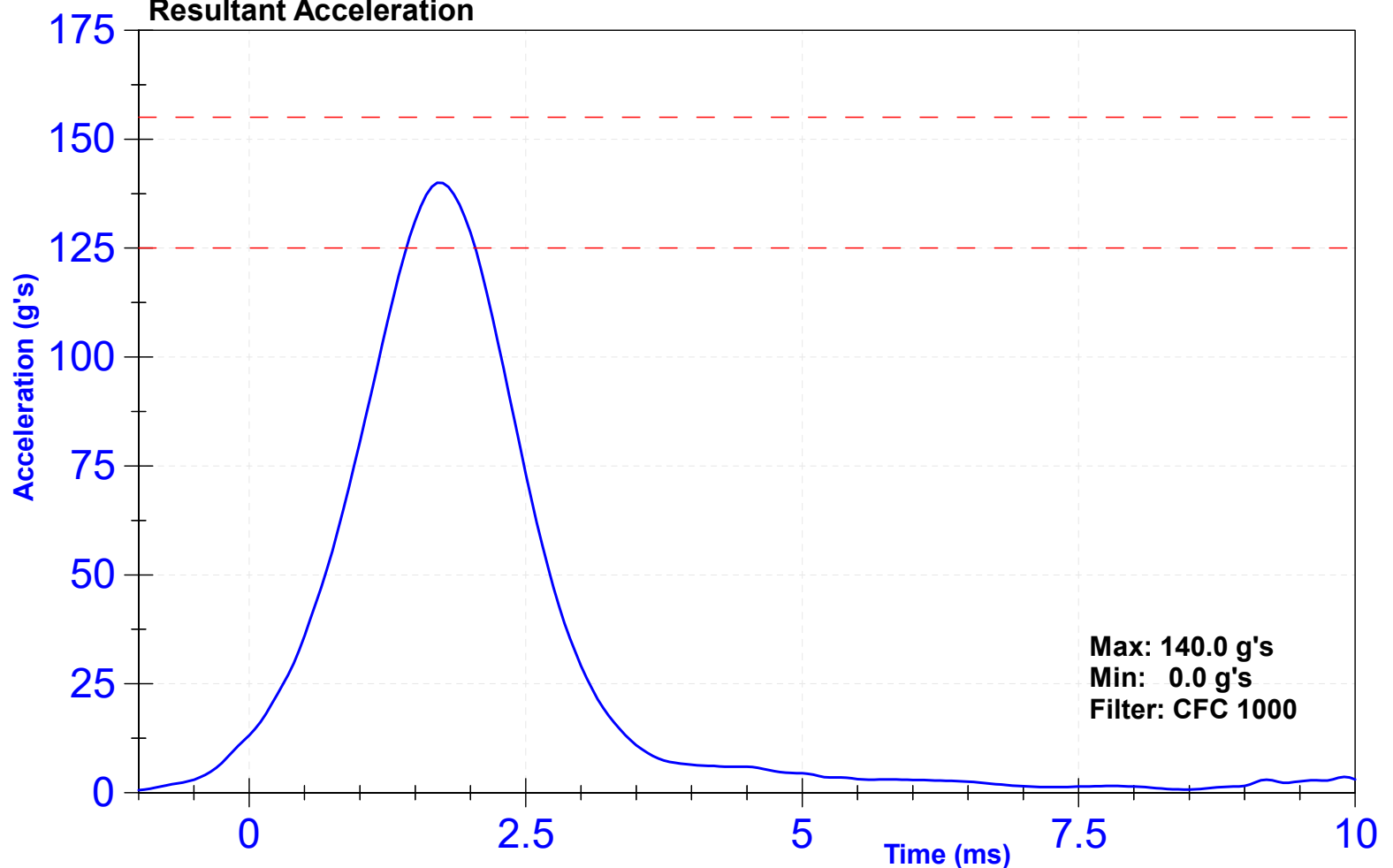
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	30.5	Pass
Resultant Acceleration	125	155	g's	140.0	Pass
Oscillation	0	15	%	4.28	Pass
Fore-Aft Acceleration	-15	15	g's	7.5	Pass

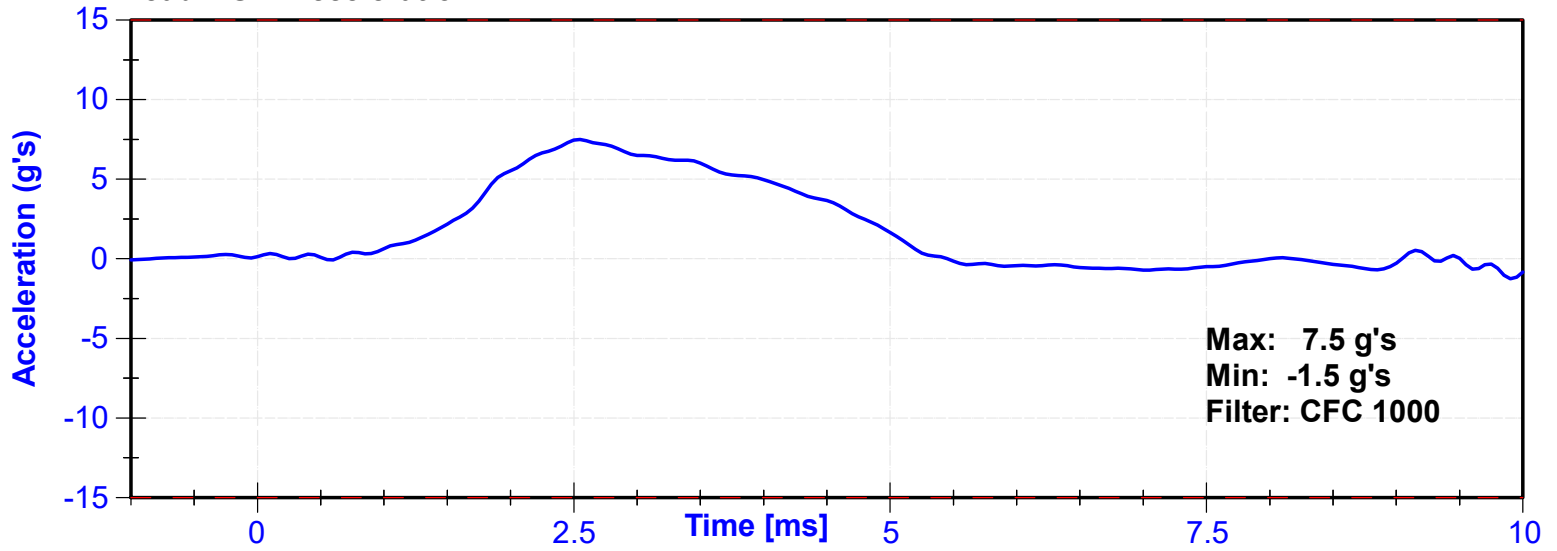
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P63861	1/17/2023	7/16/2023
Y Accelerometer	Endevco	P49216	1/17/2023	7/16/2023
Z Accelerometer	Endevco	P51303	1/17/2023	7/16/2023

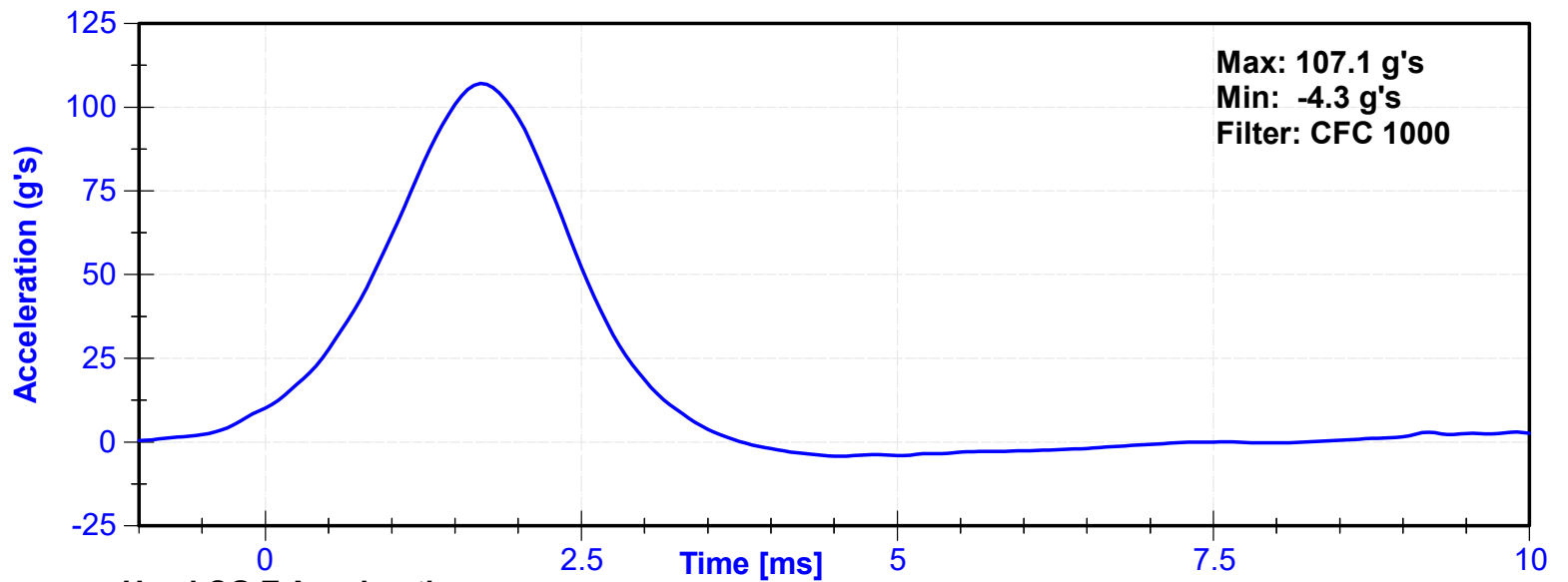
Resultant Acceleration



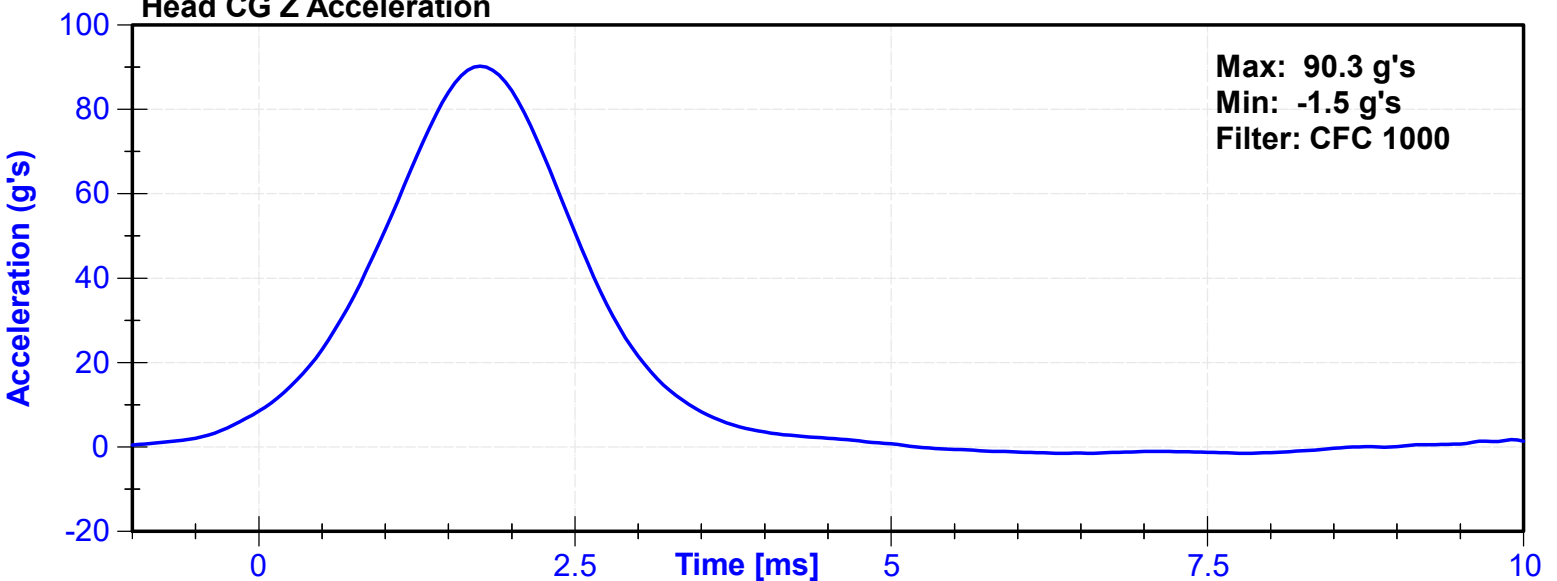
Head CG X Acceleration



Head CG Y Acceleration



Head CG Z Acceleration



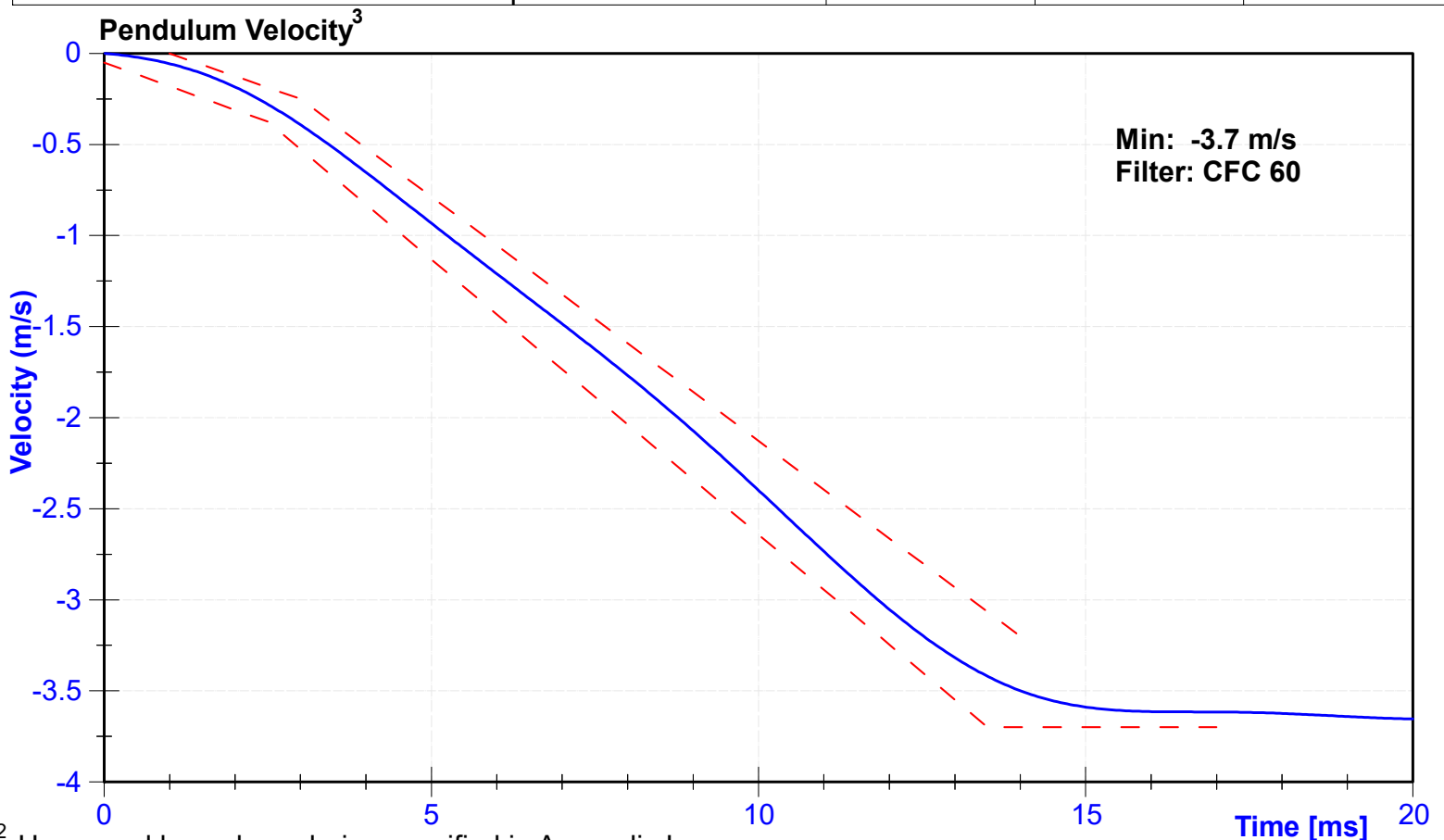
ATD Manufacturer	FTSS	Test Technician	D. Kroll
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	27.5	Pass
Velocity	3.3	3.5	m/s	3.40	Pass
Lateral Neck Rotation	49	59	deg	49.2	Pass
Time at Maximum Rotation	54	66	ms	58.0	Pass
Time of Rotation Decay from Maximum	53	88	ms	53.6	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

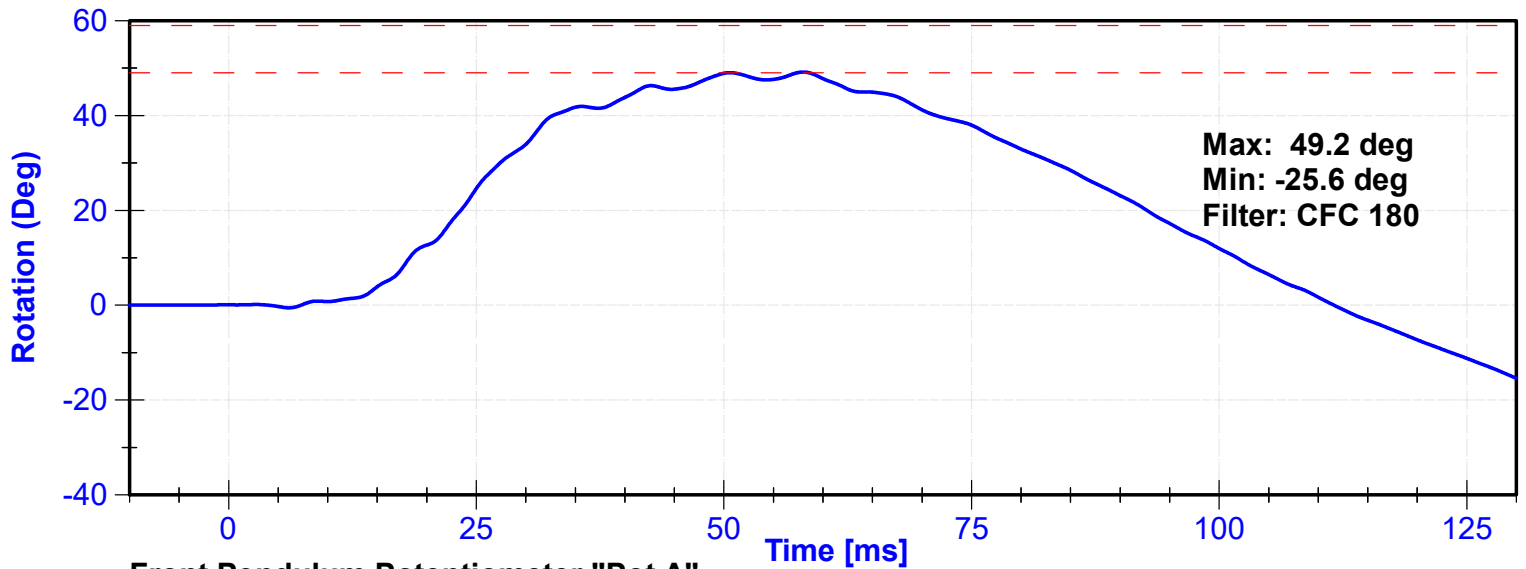
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Front Pendulum Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Headform Potentiometer	Sfernice	095	10/5/2022	10/5/2023

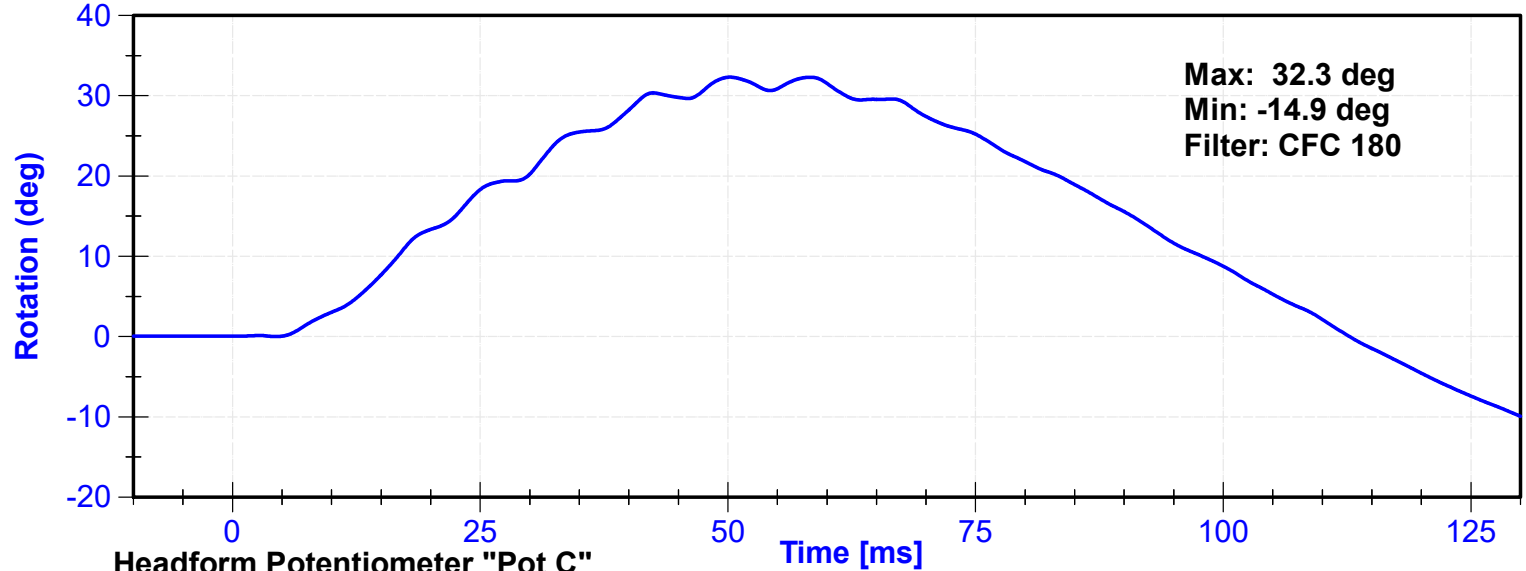


^{1,2} Upper and lower boundaries specified in Appendix I

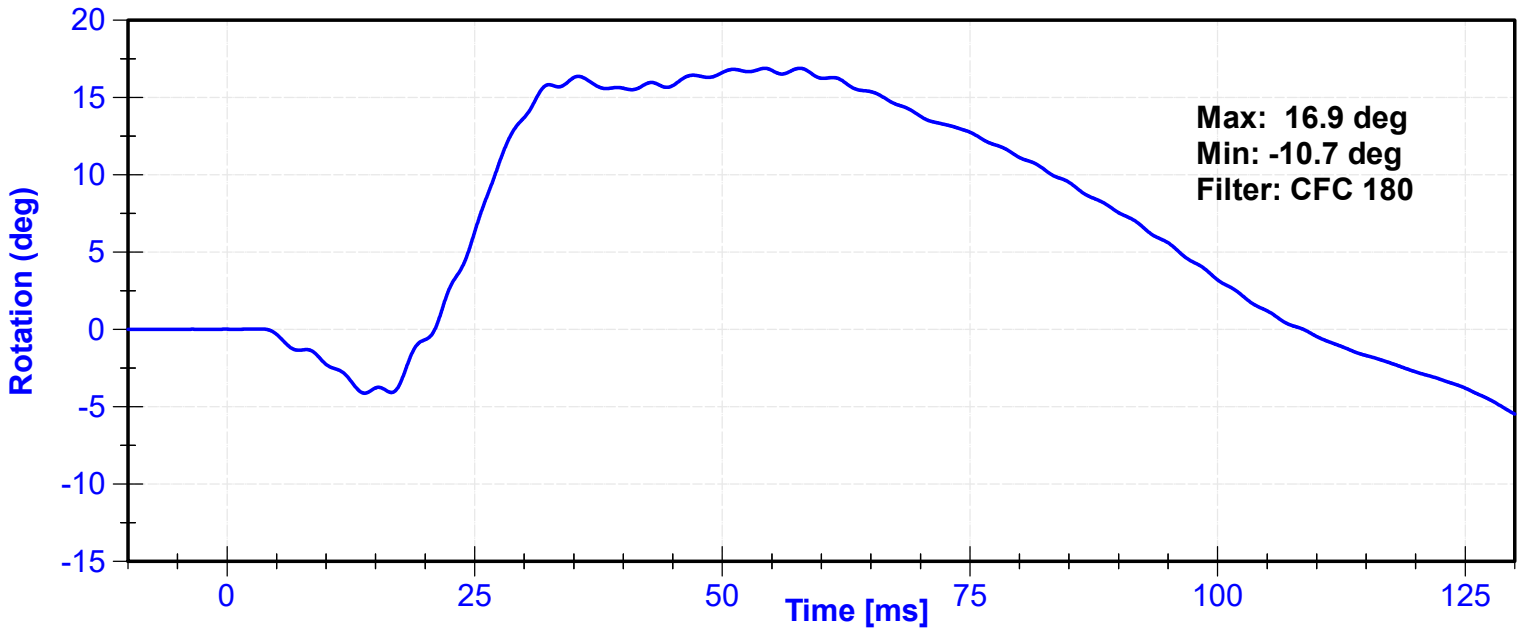
Neck Rotation



Front Pendulum Potentiometer "Pot A"



Headform Potentiometer "Pot C"



Appendix I

² Upper Boundary Corridor		¹ Lower Boundary Corridor	
Time (ms)	Velocity (m/s)	Time (ms)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.0	-0.25	2.5	-0.375
14.0	-3.20	13.5	-3.7
		17.0	-3.7

ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

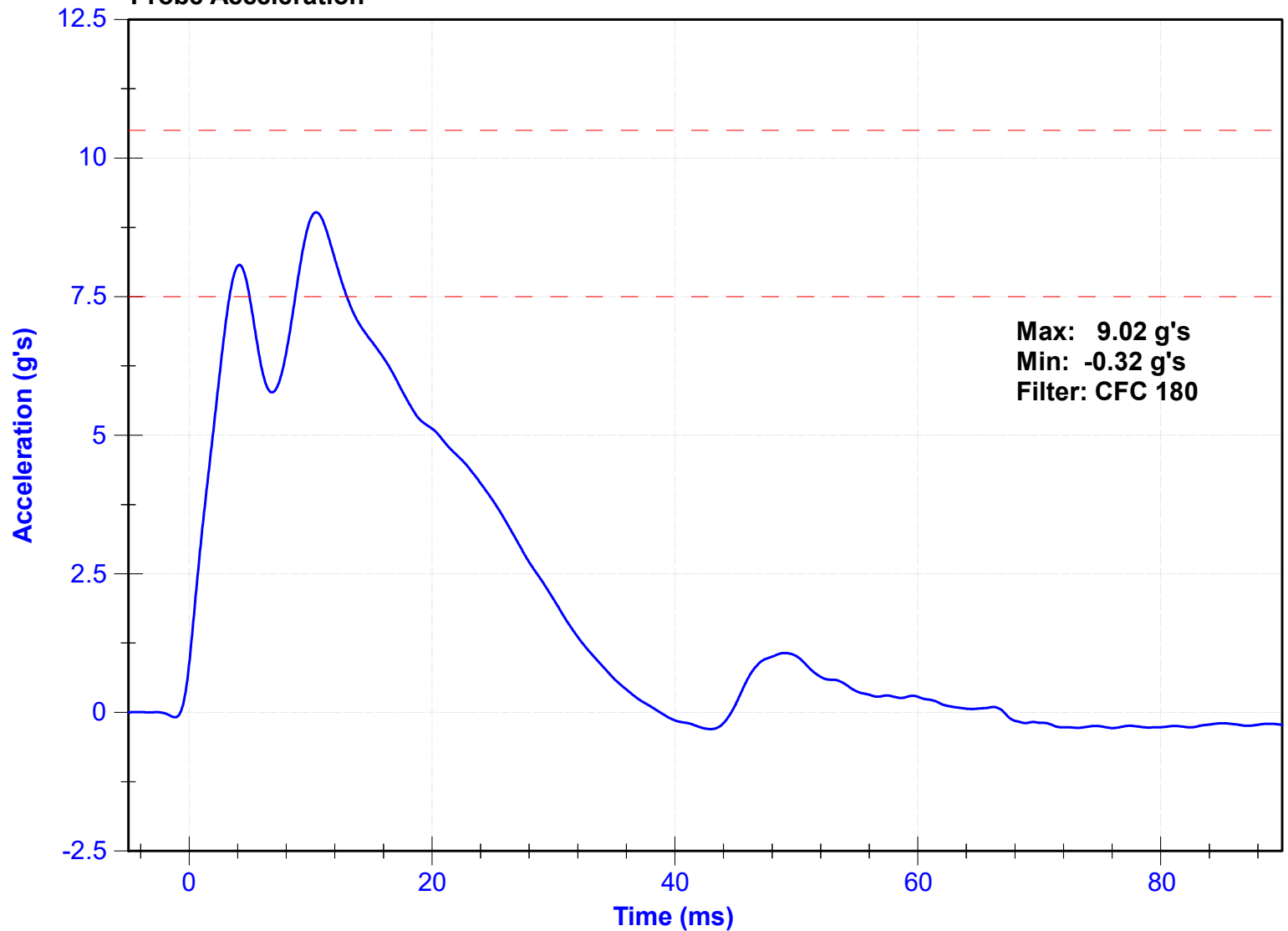
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	19.5	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	7.5	10.5	g's	9.02	Pass

Transducer Calibrations

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

Probe Acceleration



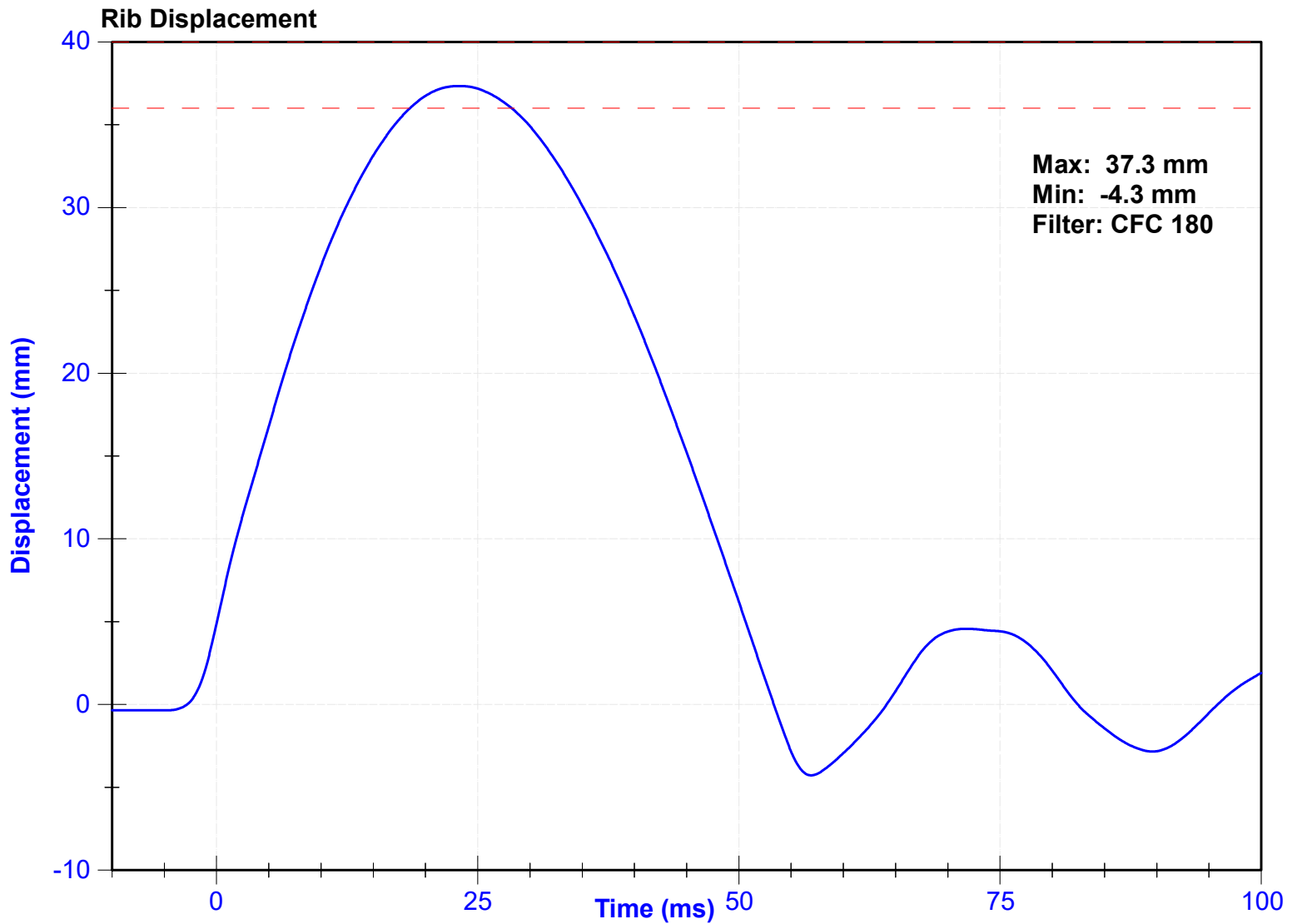
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	37.5	Pass
Rib Displacement	36	40	mm	37.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	179GFE	1/17/2023	7/18/2023



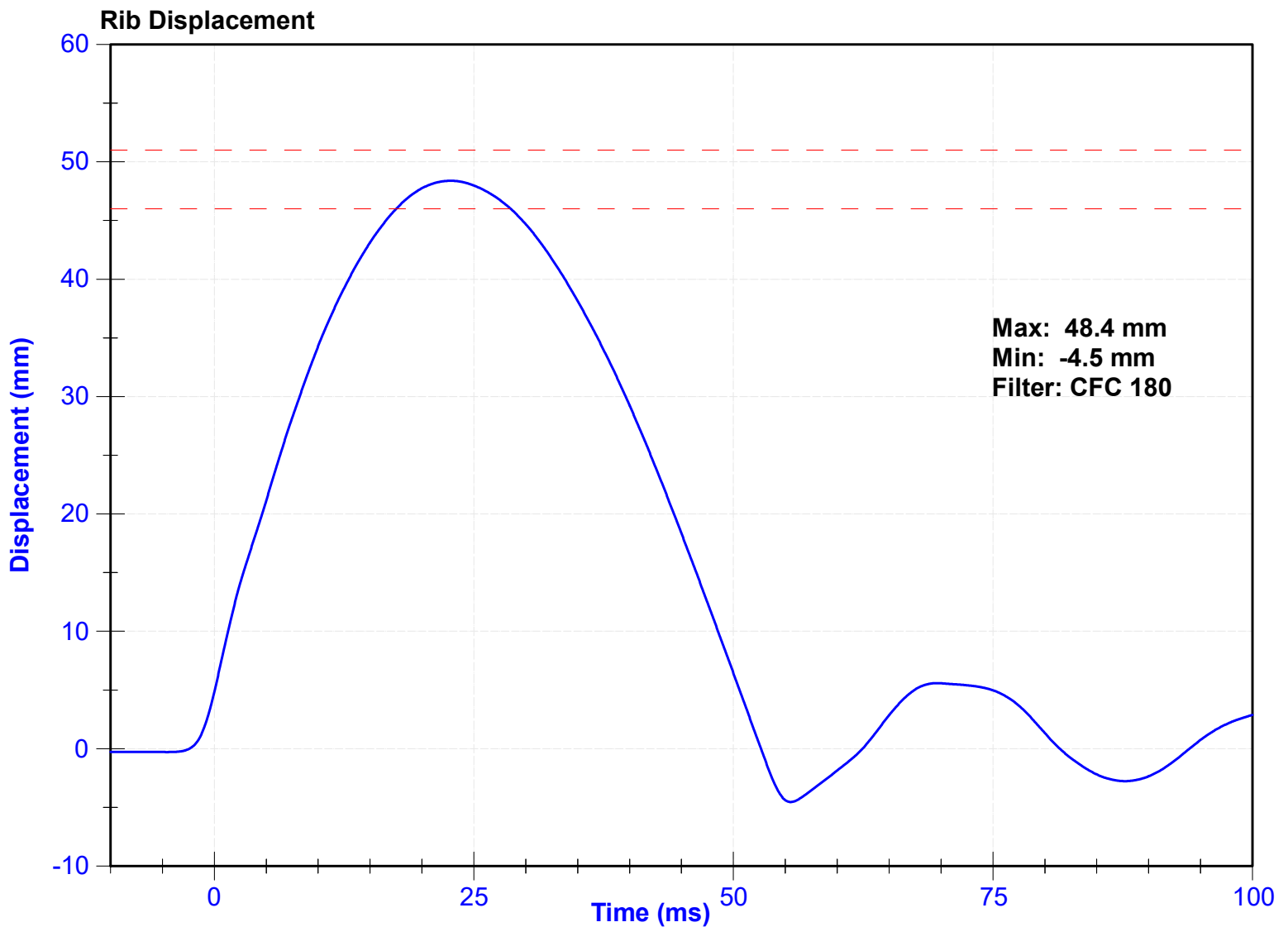
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	37.5	Pass
Rib Displacement	46	51	mm	48.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	179GFE	1/17/2023	7/18/2023



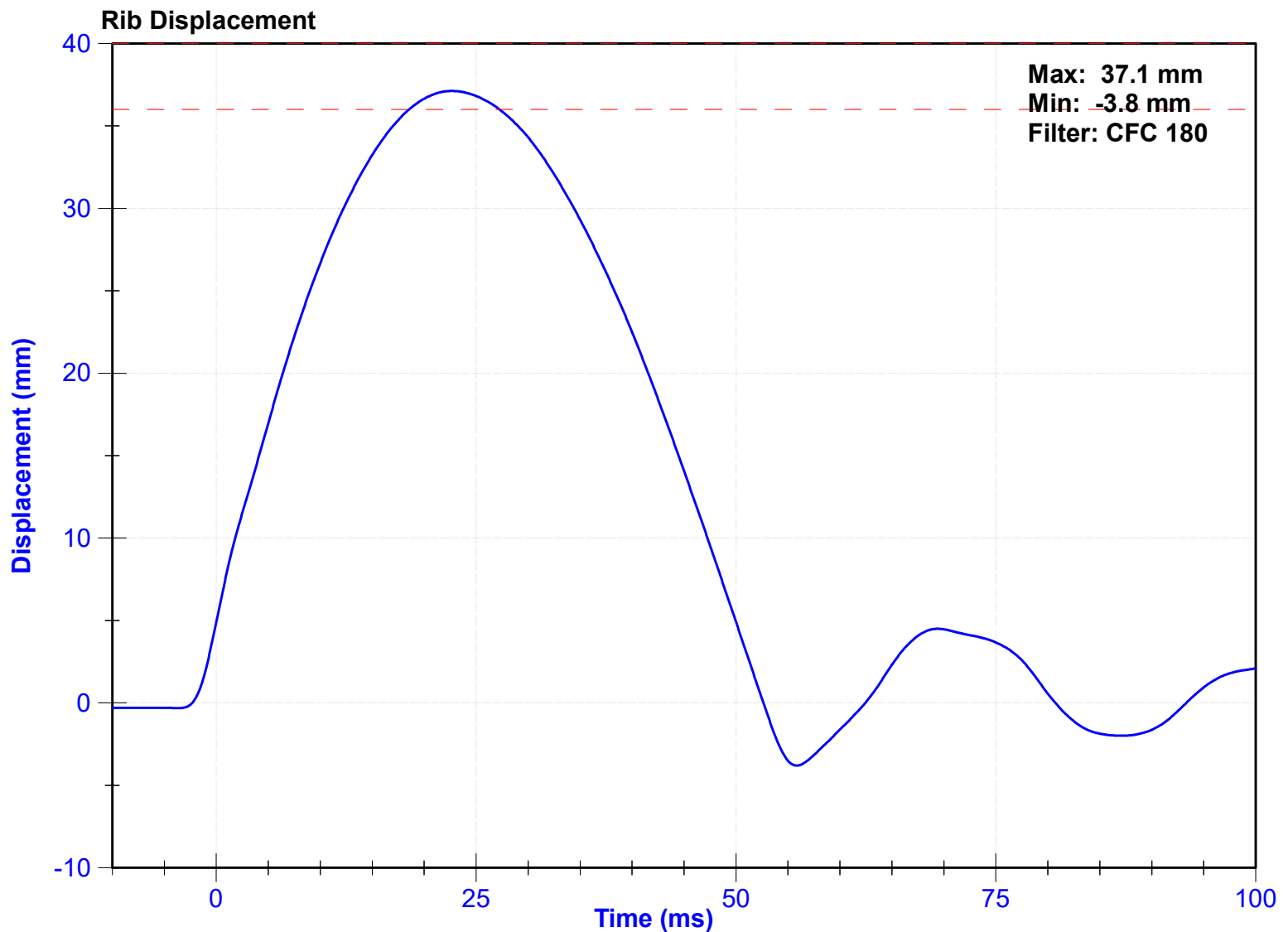
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	37.5	Pass
Rib Displacement	36	40	mm	37.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	185GFE	1/17/2023	7/18/2023



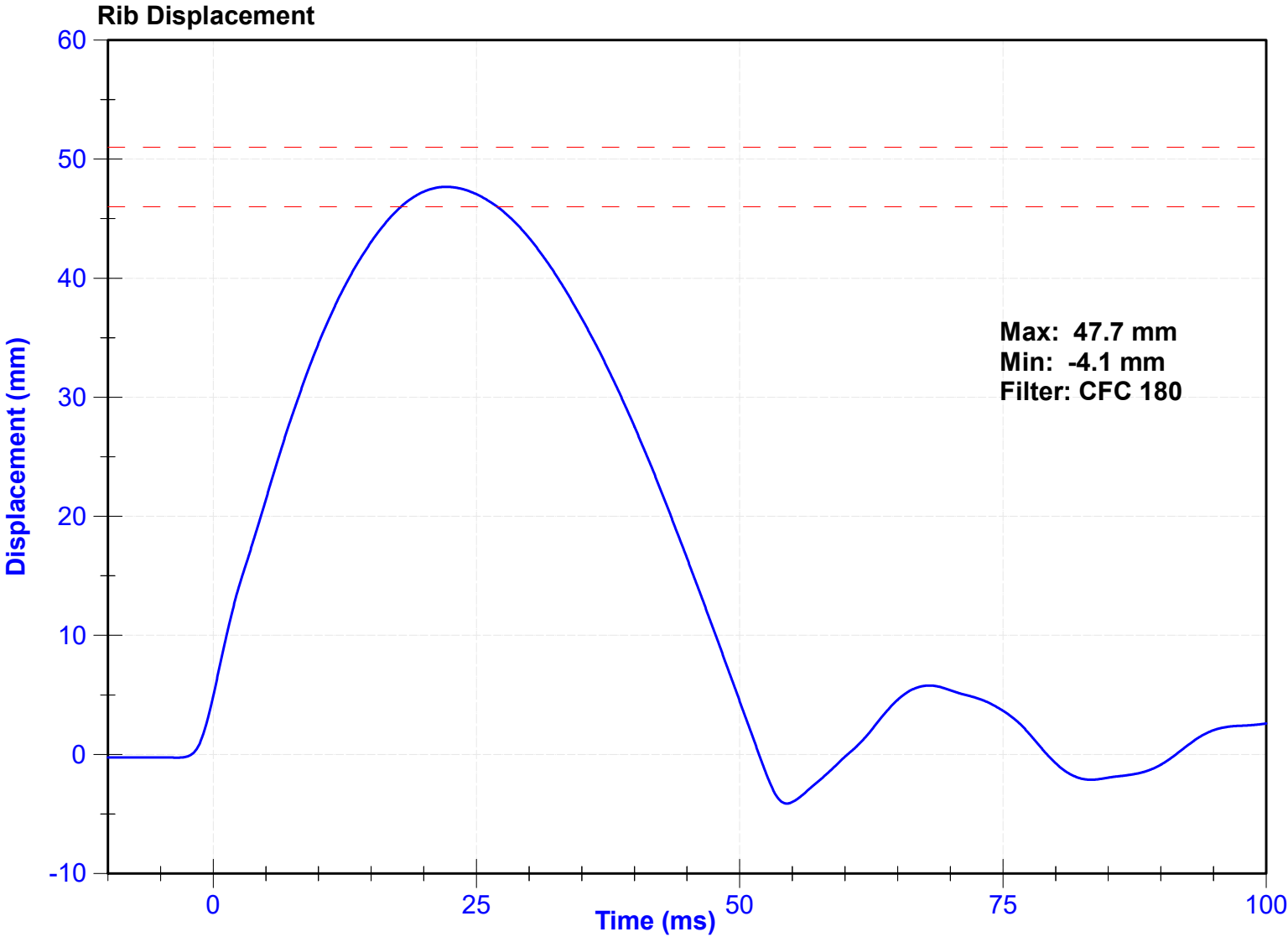
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	37.5	Pass
Rib Displacement	46	51	mm	47.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	185GFE	1/17/2023	7/18/2023



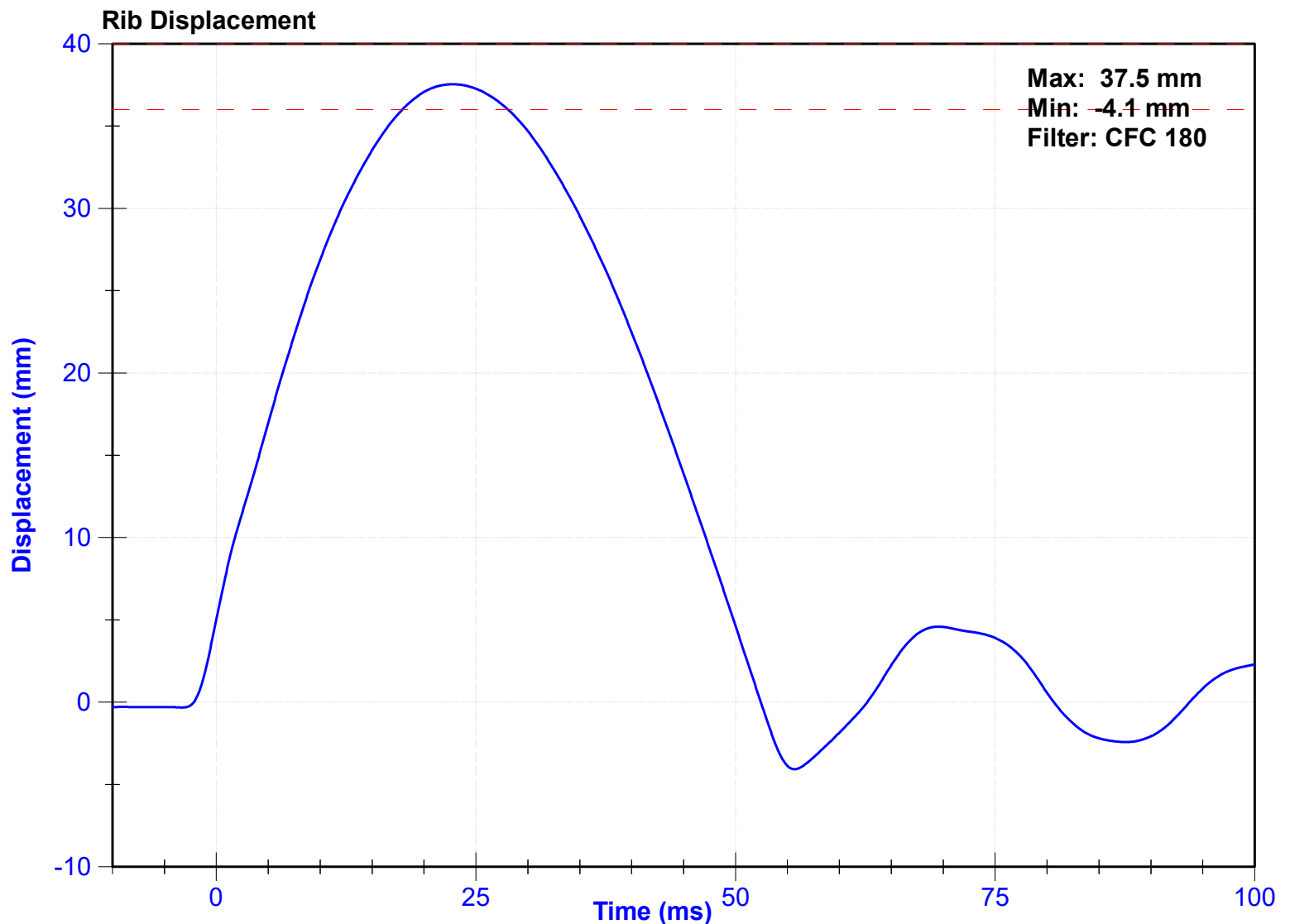
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	37.5	Pass
Rib Displacement	36	40	mm	37.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	178GFE	1/17/2023	7/18/2023



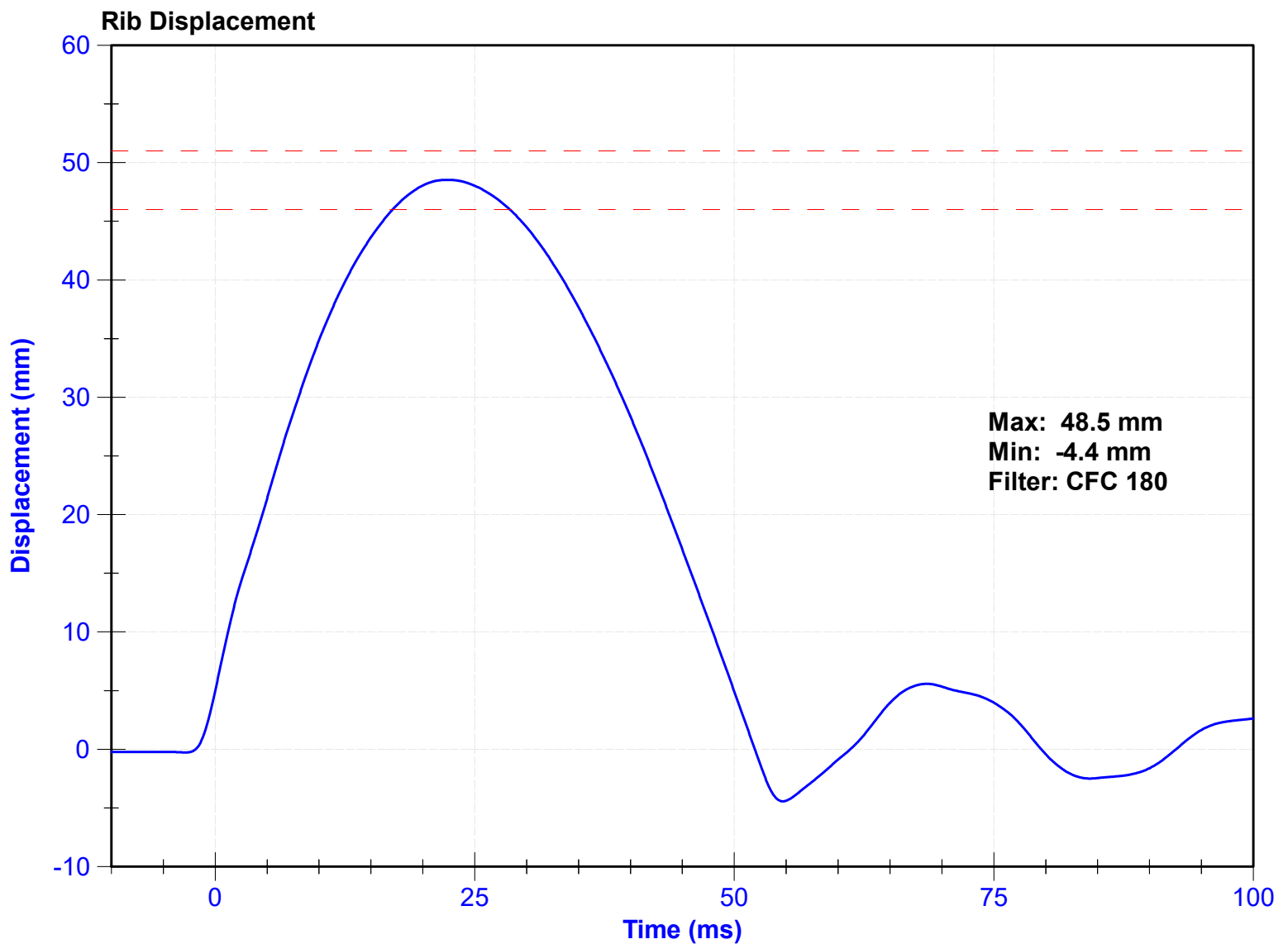
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	37.5	Pass
Rib Displacement	46	51	mm	48.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	178GFE	1/17/2023	7/18/2023



ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

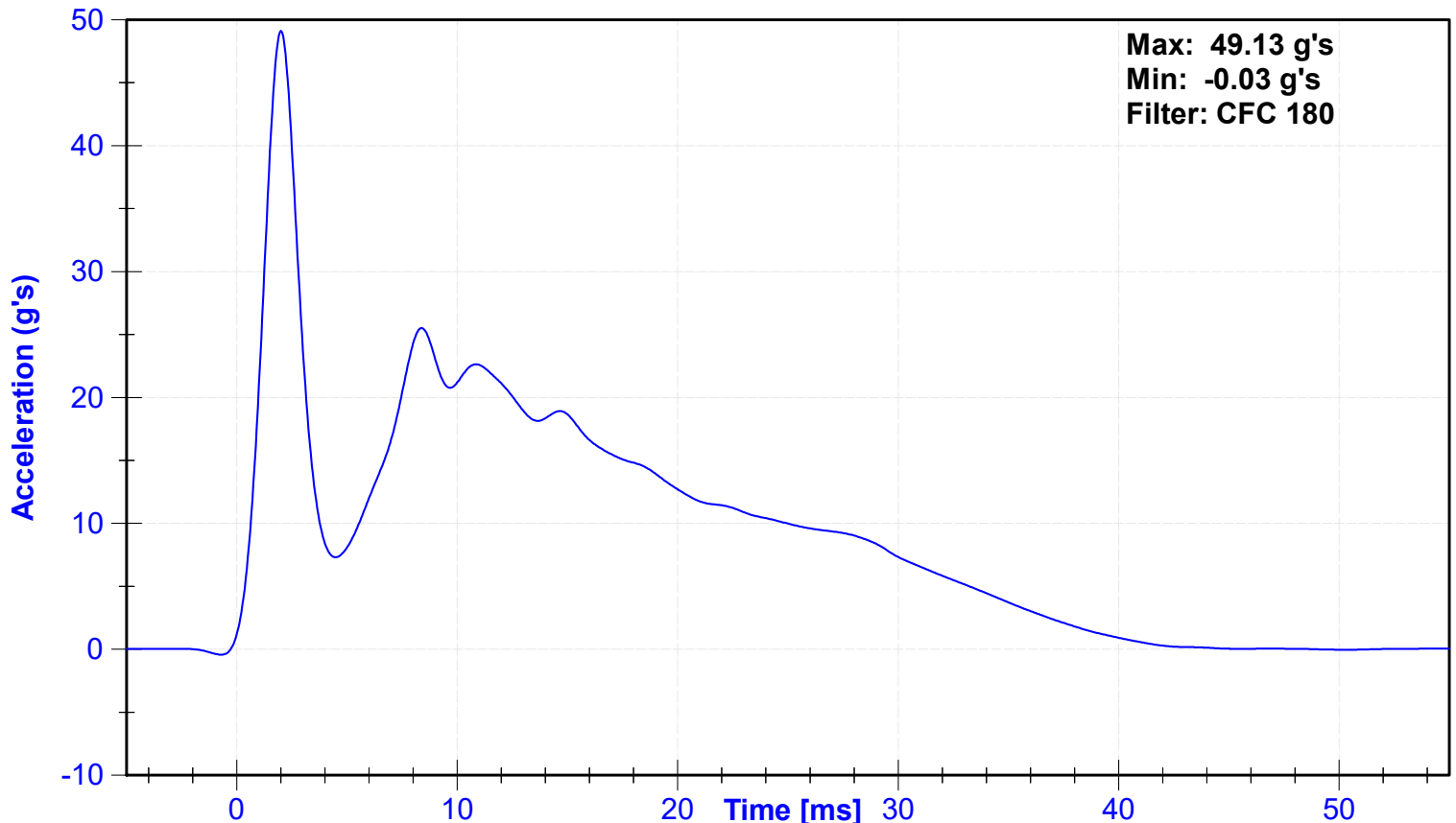
Results

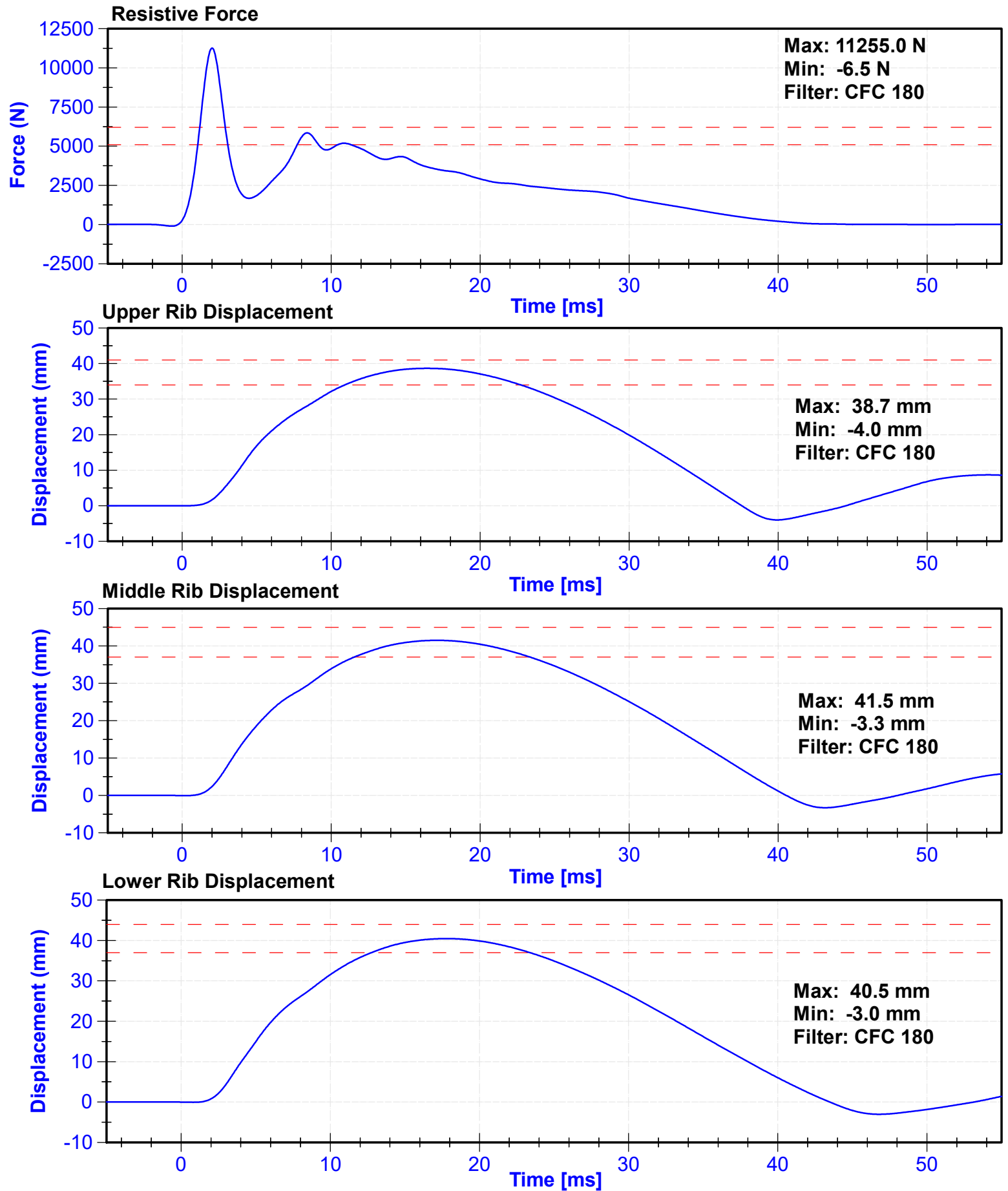
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	19.5	Pass
Velocity	5.4	5.6	m/s	5.52	Pass
Resistive Force after 6ms	5100	6200	N	5846.8	Pass
Upper Thorax Rib Deflection	34	41	mm	38.7	Pass
Mid Thorax Rib Deflection	37	45	mm	41.5	Pass
Lower Thorax Rib Deflection	37	44	mm	40.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18546	11/19/2022	5/18/2023
Upper Thorax Rib Potentiometer	Honeywell	179GFE	1/17/2023	7/18/2023
Middle Thorax Rib Potentiometer	Honeywell	185GFE	1/17/2023	7/18/2023
Lower Thorax Rib Potentiometer	Honeywell	178GFE	1/17/2023	7/18/2023

Probe Acceleration





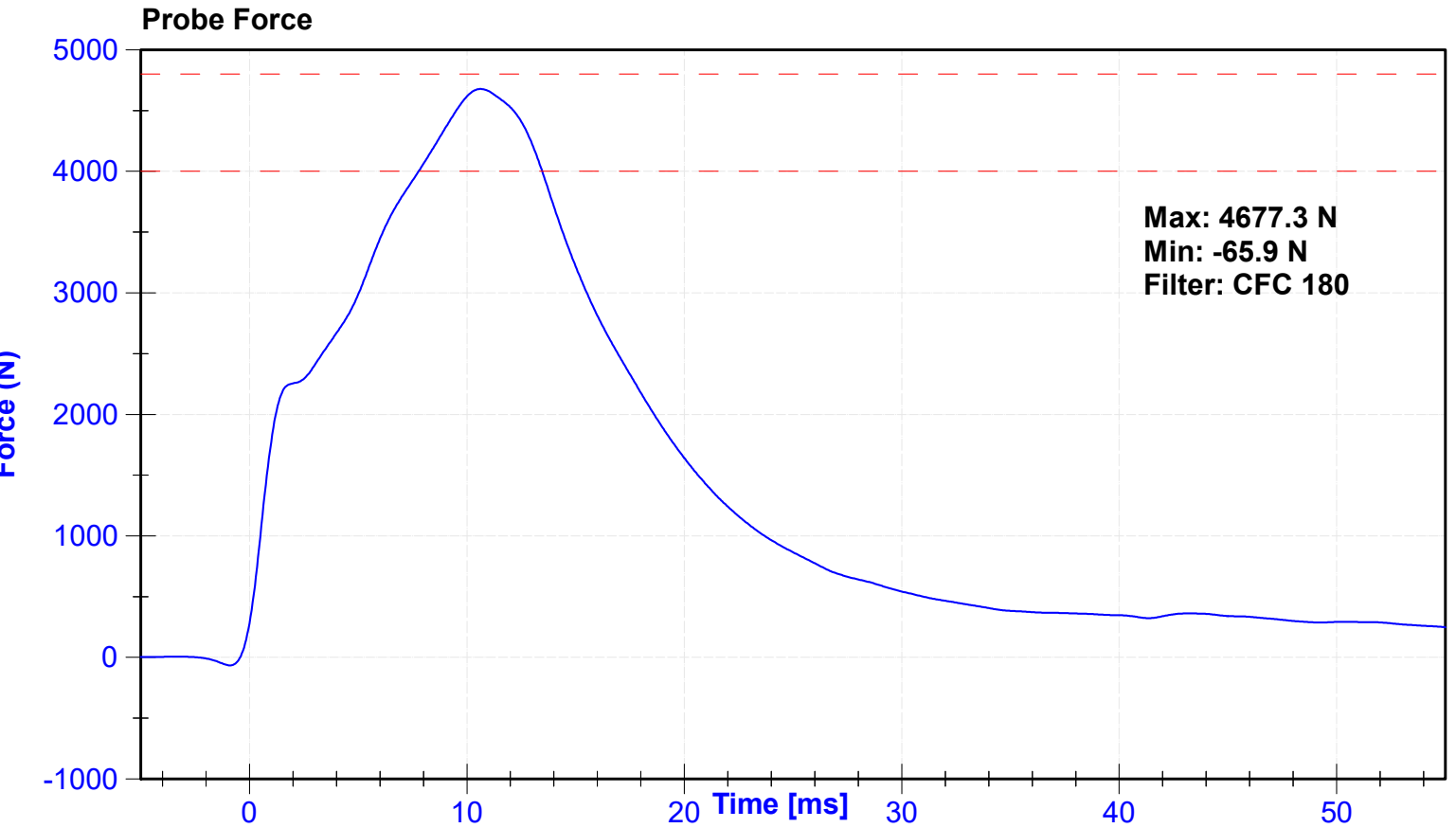
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

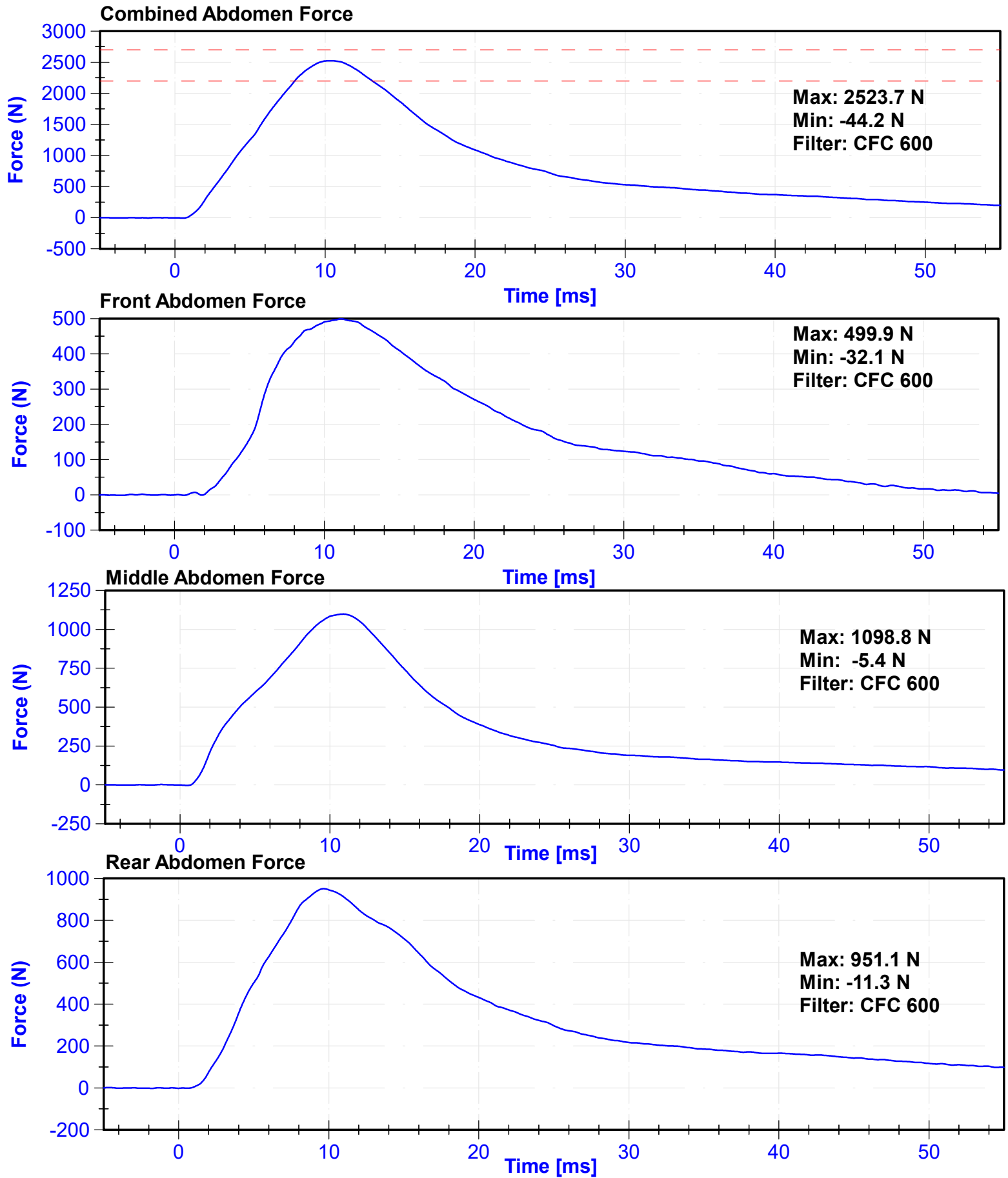
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	19.5	Pass
Velocity	3.9	4.1	m/s	4.02	Pass
Combined Abdomen Force	2200	2700	N	2523.7	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.45	Pass
Resistive Probe Force	4000	4800	N	4677.3	Pass
Time at Peak Resistive Force	10.6	13.0	ms	10.65	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023
Front Abdomen Load Cell	Denton	1509	8/12/2022	8/12/2023
Middle Abdomen Load Cell	Denton	1508	8/12/2022	8/12/2023
Rear Abdomen Load Cell	Denton	1507	8/12/2022	8/12/2023





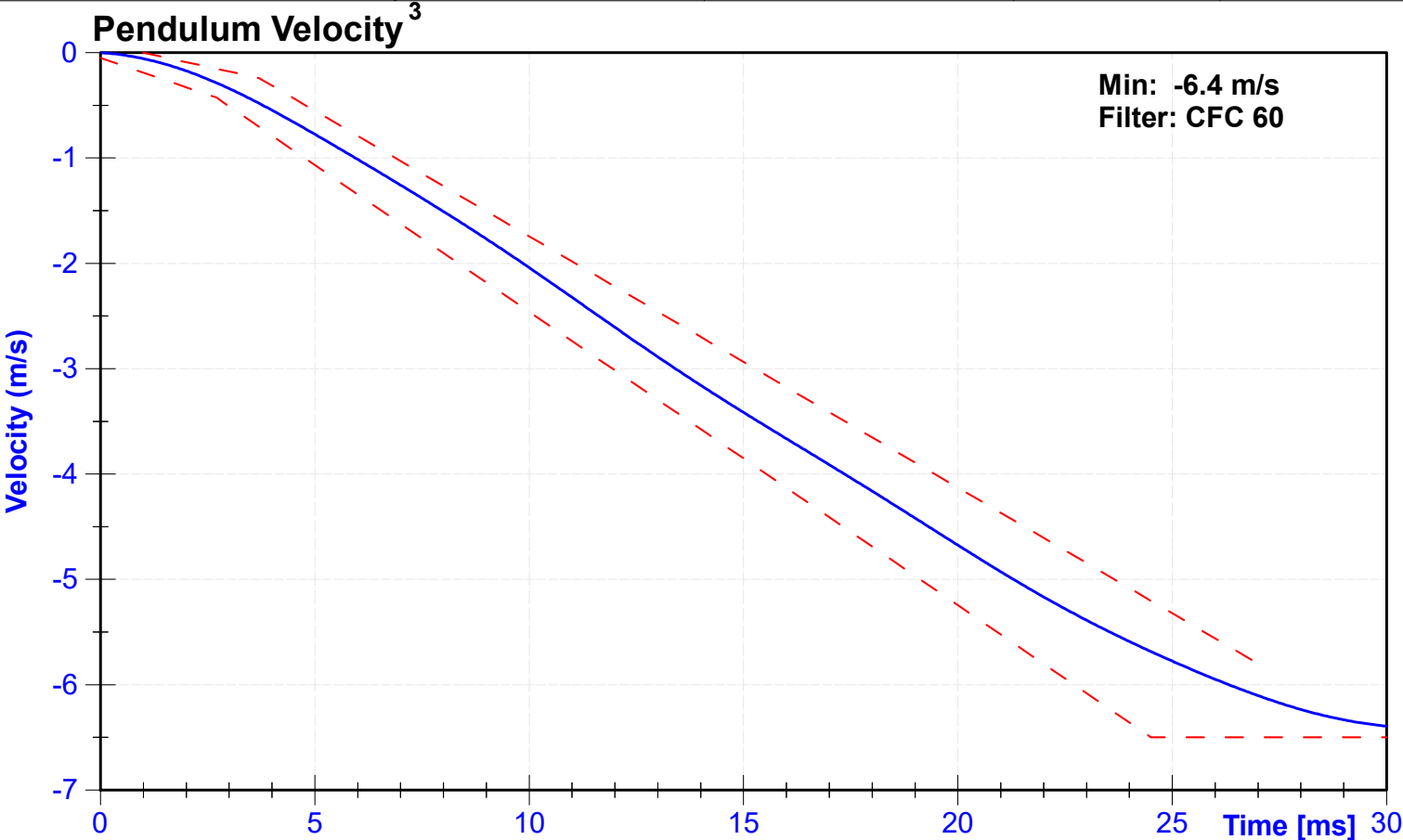
ATD Manufacturer	FTSS	Test Technician	D. Kroll
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	27.5	Pass
Velocity	5.95	6.15	m/s	6.042	Pass
Lateral Spine Rotation	45	55	deg	54.9	Pass
Time at Maximum Rotation	39	53	ms	49.7	Pass
Time of Decay to Zero Degrees	37	57	ms	38.2	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

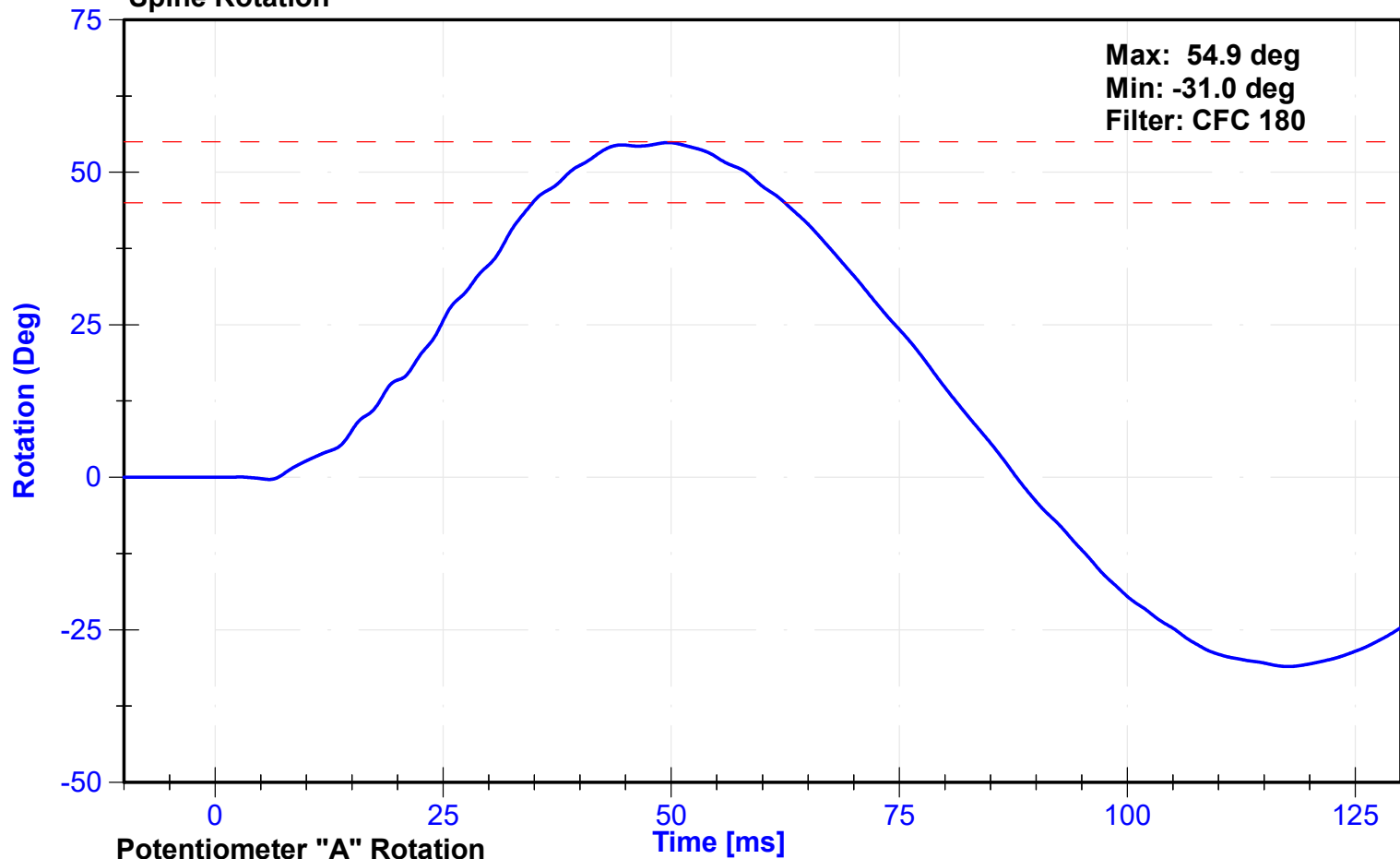
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum "A" Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Condyle "B" Potentiometer	Sfernice	095	10/5/2022	10/5/2023

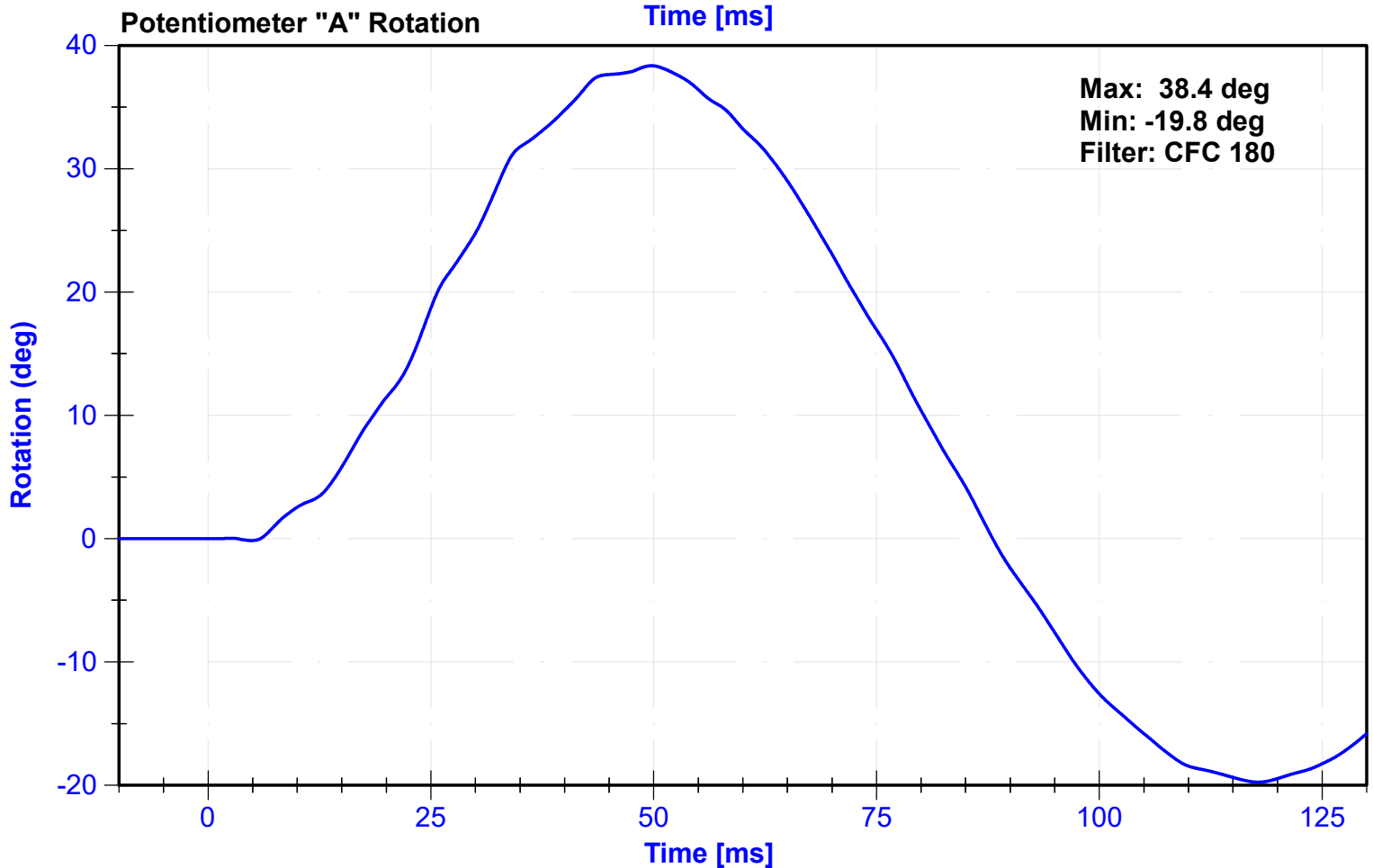


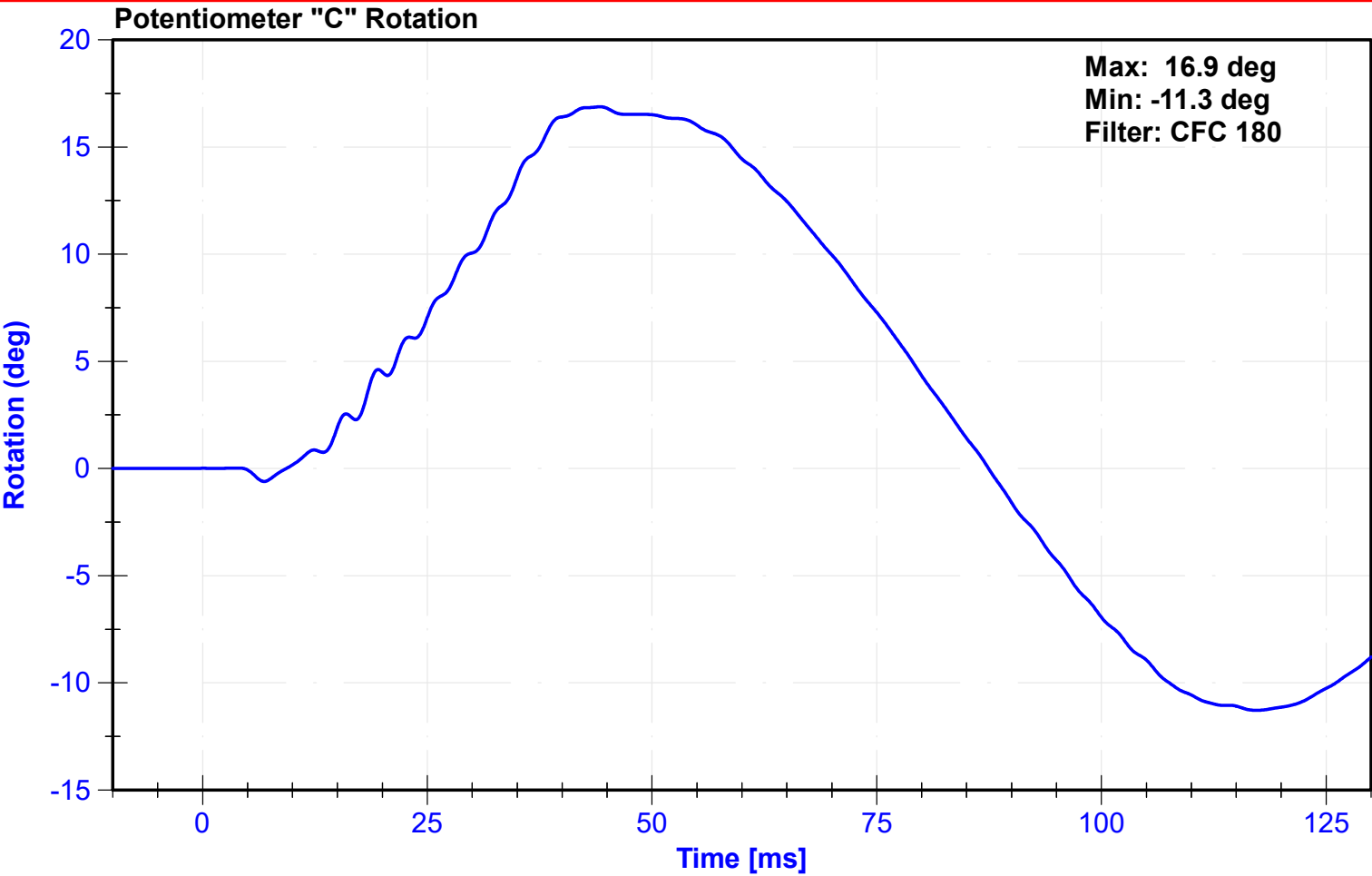
^{1,2} Upper and lower boundaries specified in Appendix I C-67

Spine Rotation



Potentiometer "A" Rotation





Appendix I

² Upper Boundary Corridor		¹ Lower Boundary Corridor	
Time (ms)	Velocity (m/s)	Time (ms)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.7	-0.24	2.7	-0.425
27.0	-5.80	24.5	-6.5
		30.0	-6.5

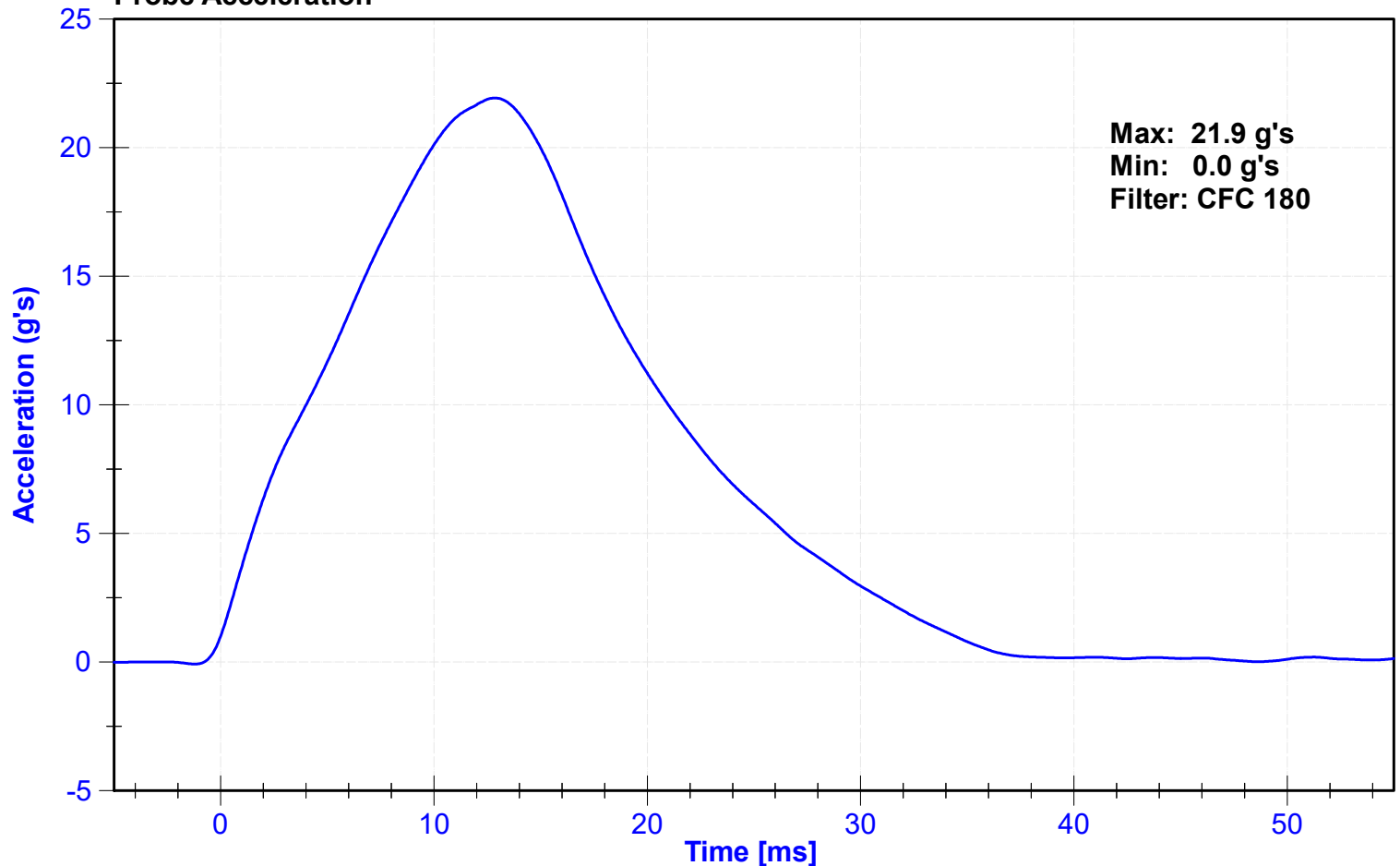
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

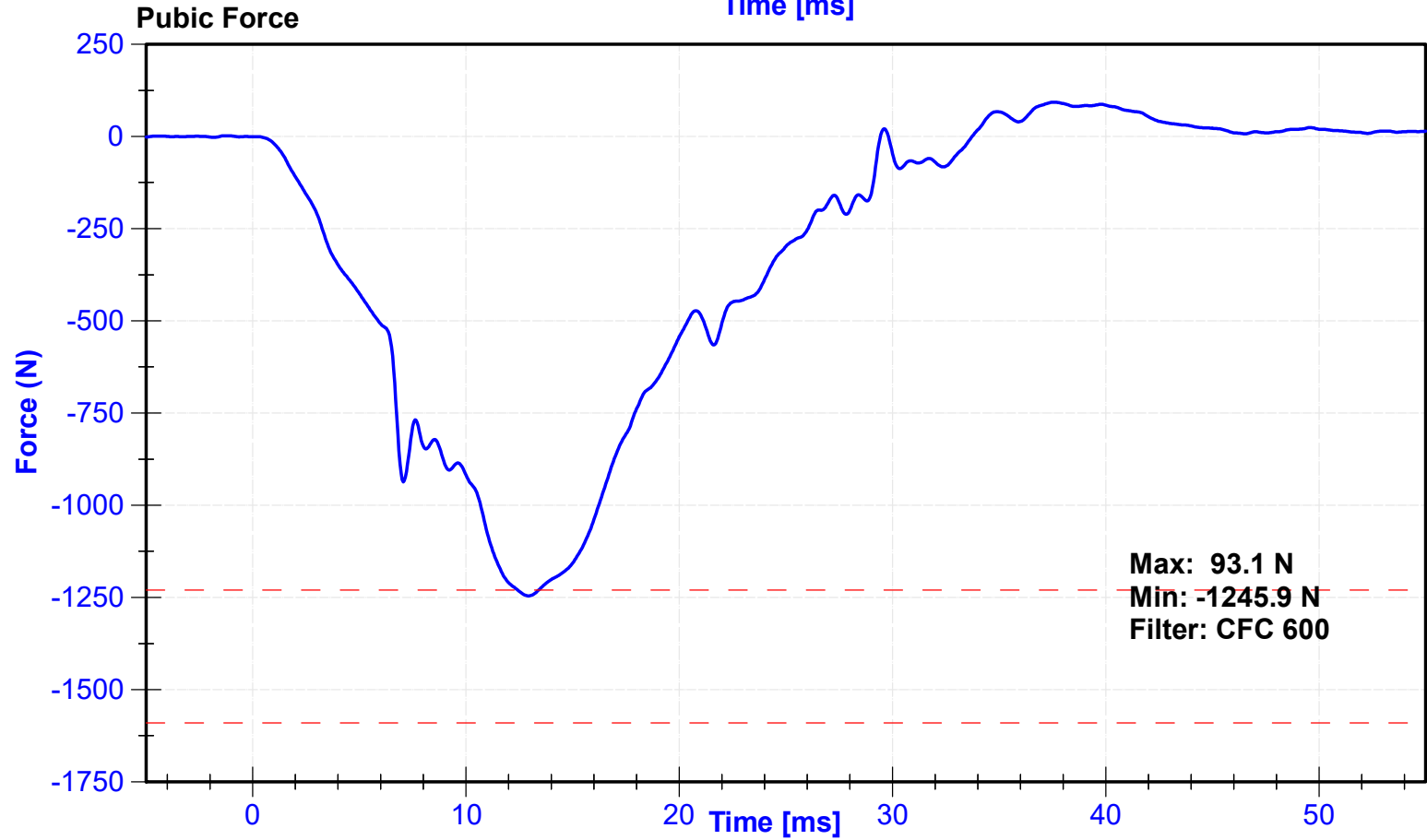
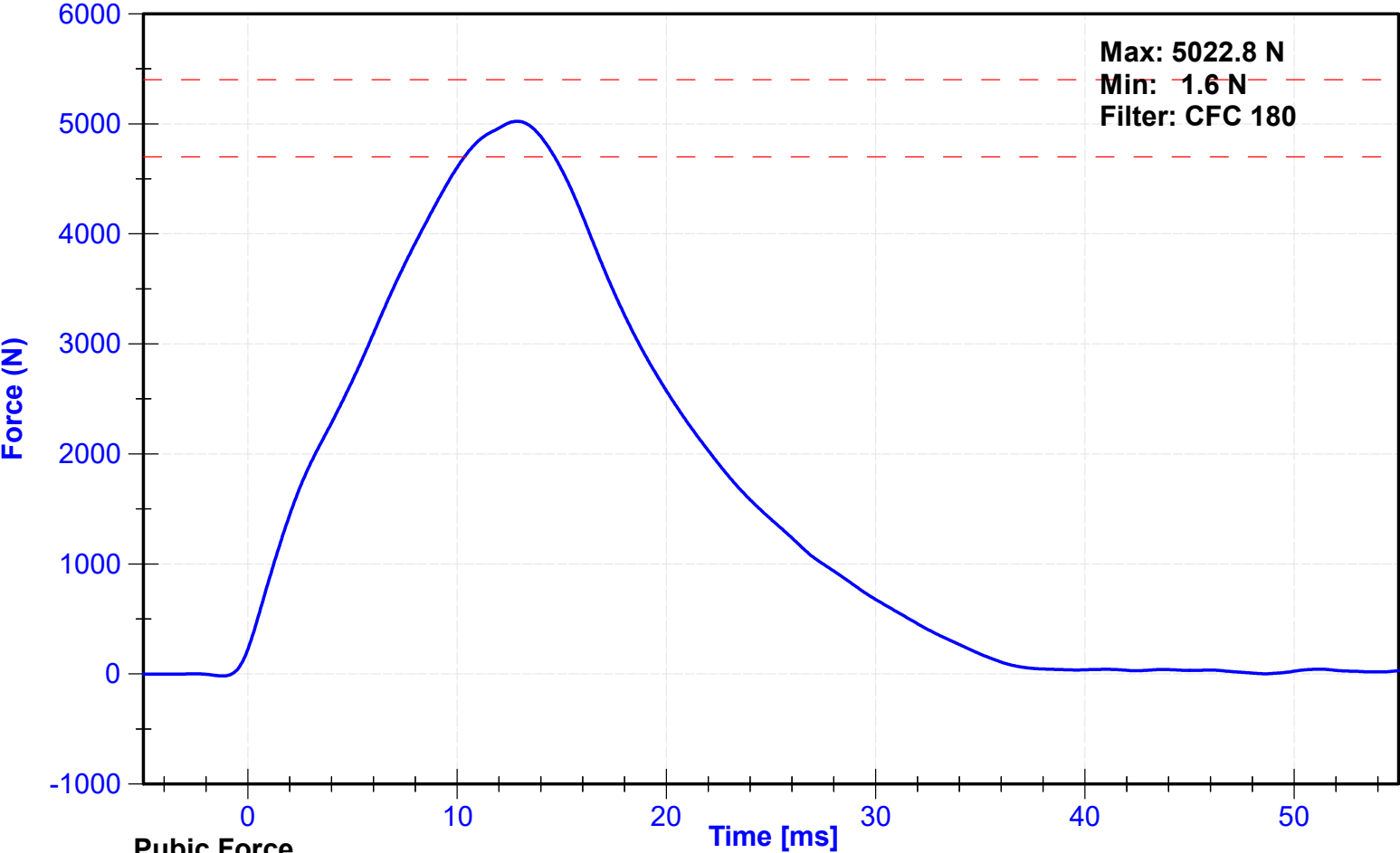
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	19.5	Pass
Velocity	4.2	4.4	m/s	4.32	Pass
Resistive Force	4700	5400	N	5022.8	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.85	Pass
Pubic Force	-1590	-1230	N	-1245.9	Pass
Time at Peak Pubic Force	12.2	17.0	ms	12.95	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023
Pubic Load Cell	Denton	459-FY	6/14/2022	6/14/2023

Probe Acceleration

Resistive Force



CALIBRATION TEST RESULTS

POST-TEST

SID-IIS 5TH PERCENTILE FEMALE – PASSENGER ATD

SERIAL NO:DG8012

(CONFIGURED FOR LEFT SIDE IMPACT)

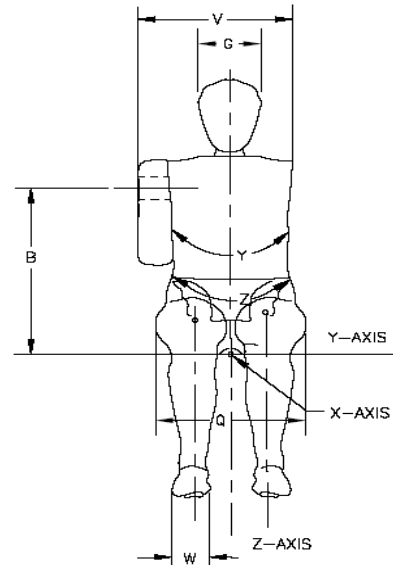
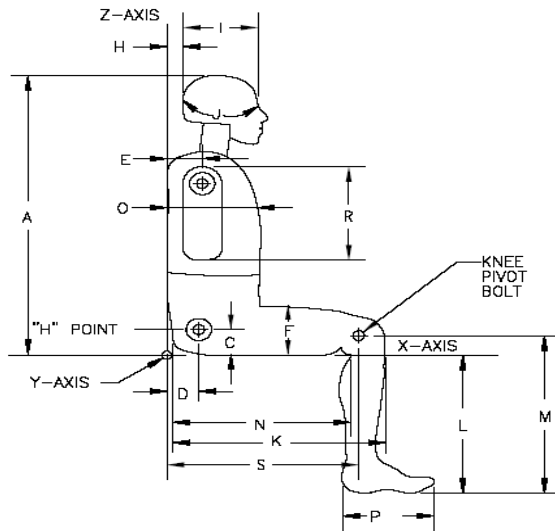


External Measurements - SID-IIs

Technician: **K. Brogan**

Date: **02/13/2023**

Dummy Serial Number: **DG8012**



Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	785	Pass
B	Shoulder Pivot Height	437	453	447	Pass
C	H-point Height	79	89	82	Pass
D	H-point from seatback	141	151	147	Pass
E	Shoulder Pivot from Backline	97	107	103	Pass
F	Thigh Clearance	119	135	127	Pass
G	Head Breadth	140	148	143	Pass
H	Head Back from Backline	40	46	44	Pass
I	Head Depth	178	188	182	Pass
J	Head Circumference	541	551	545	Pass
K	Buttock to Knee Length	514	540	528	Pass
L	Popliteal Height	343	369	359	Pass
M	Knee Pivot to floor height	392	409	402	Pass
N	Buttock Popliteal Length	416	442	431	Pass
O	Chest Depth w/o jacket	195	211	201	Pass
P	Foot Length	216	232	226	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	320	Pass
R	Arm Length	249	259	251	Pass
S	Knee Joint to seatback	477	493	487	Pass
V	Shoulder Width	341	357	351	Pass
W	Foot Width	78	94	85	Pass
Y	Chest Circumference w/jacket	851	881	872	Pass
Z	Waist Circumference	761	791	778	Pass

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

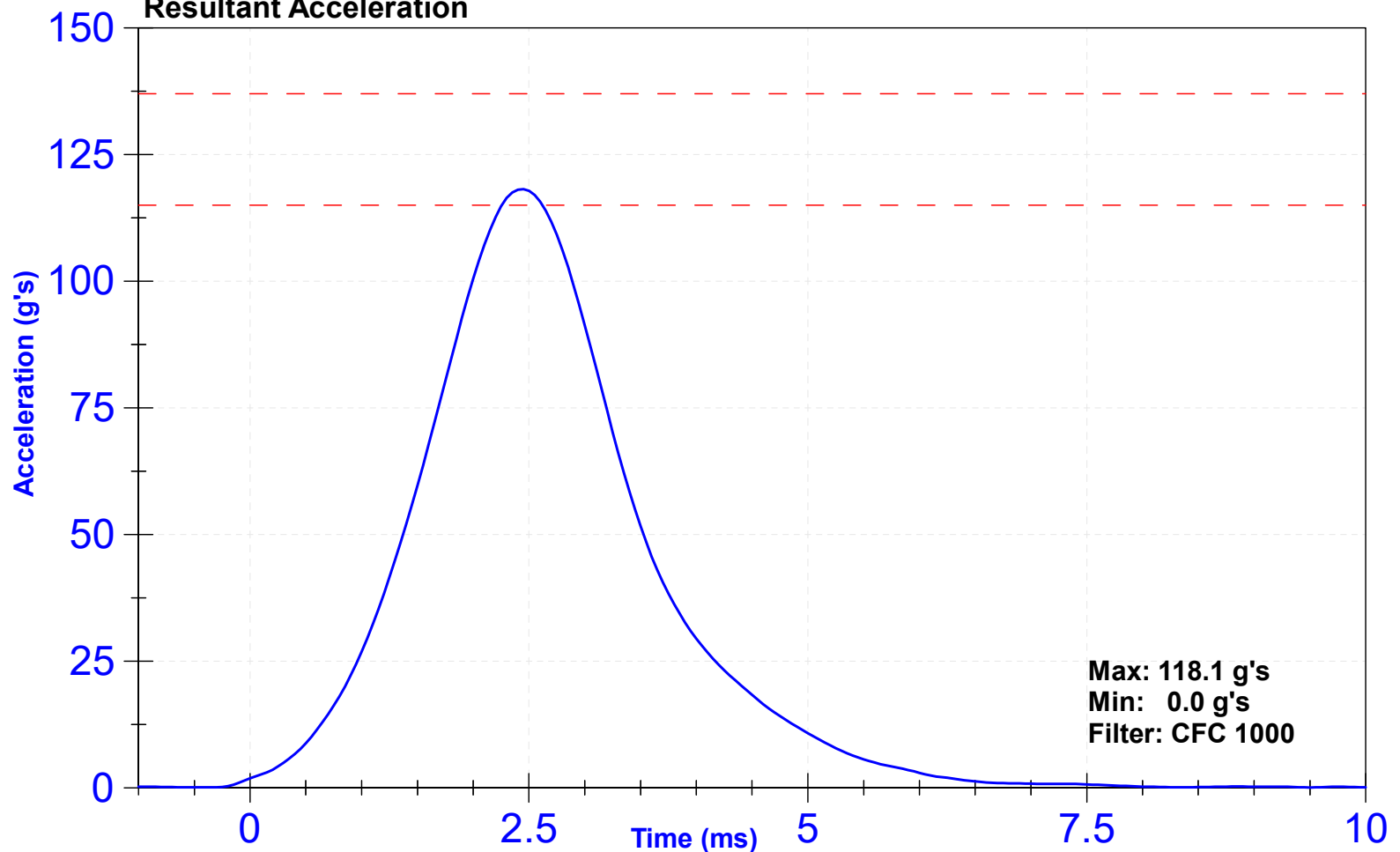
Results

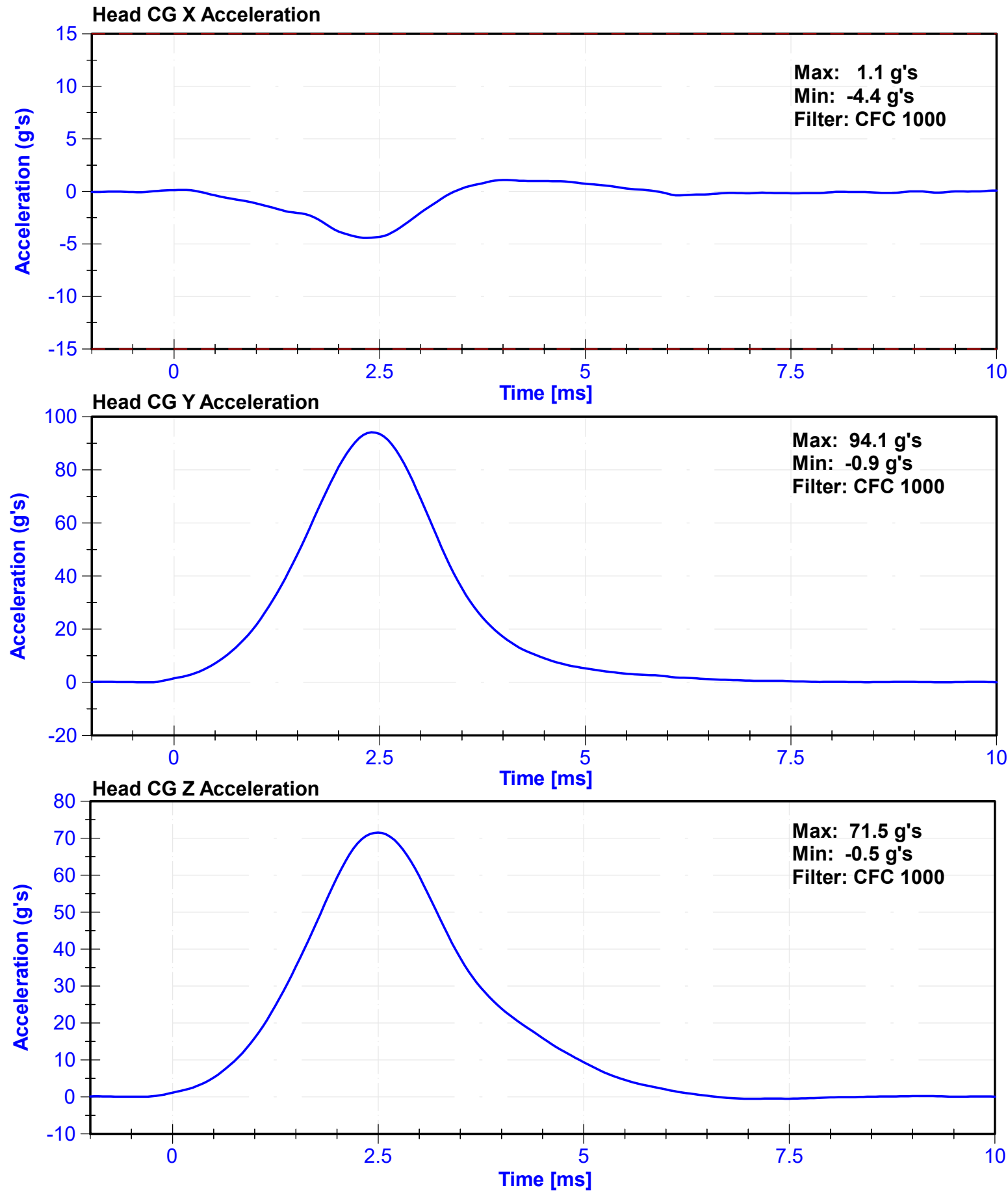
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	29.5	Pass
Resultant Acceleration	115	137	g's	118.1	Pass
Oscillation	0	15	%	0.8	Pass
Fore-Aft Acceleration	-15	15	g's	-4.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibratio Date	Calibratio Due Date
X Accelerometer	Endevco	P74788	12/12/2022	6/10/2023
Y Accelerometer	Endevco	P51668	12/12/2022	6/10/2023
Z Accelerometer	Endevco	P83319	12/12/2022	6/10/2023

Resultant Acceleration





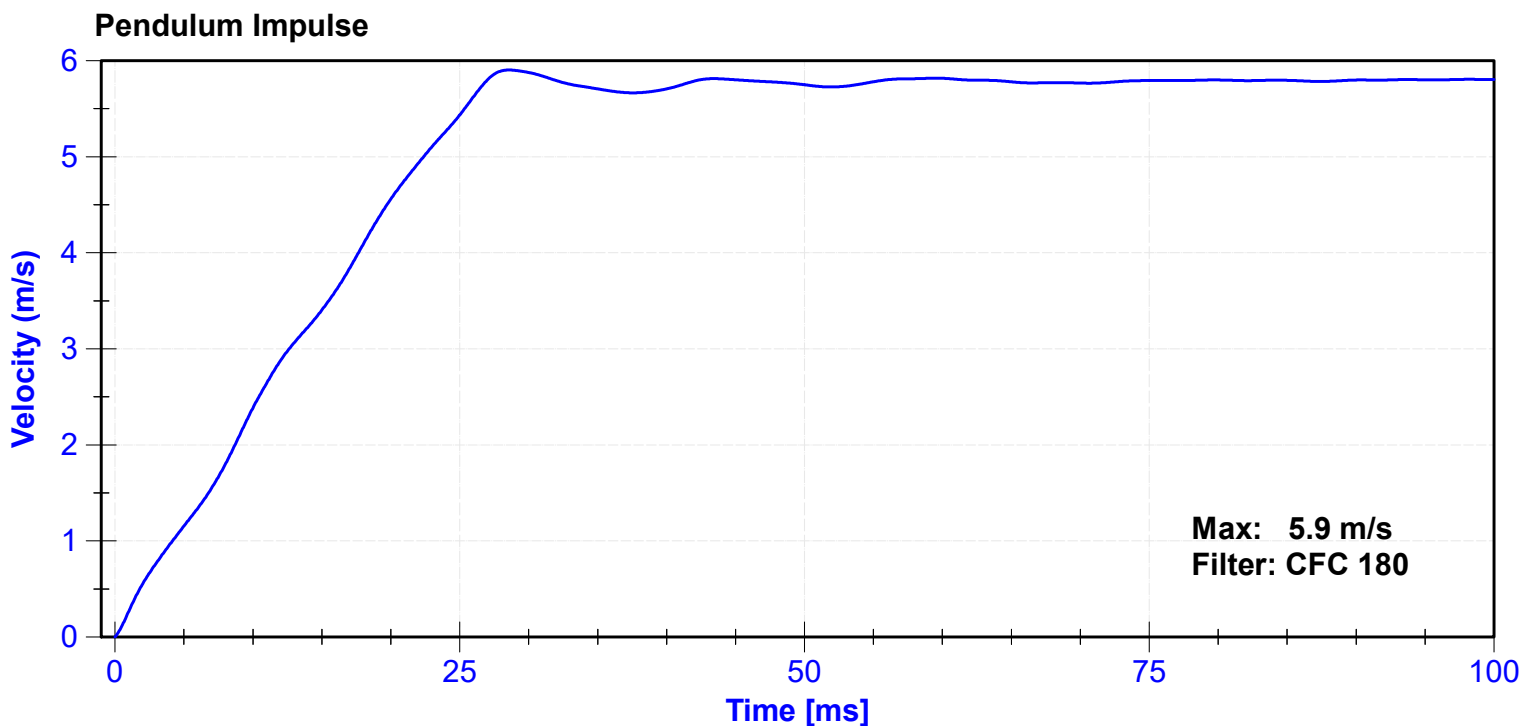
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG8012	Laboratory Supervisor	C. Mantell

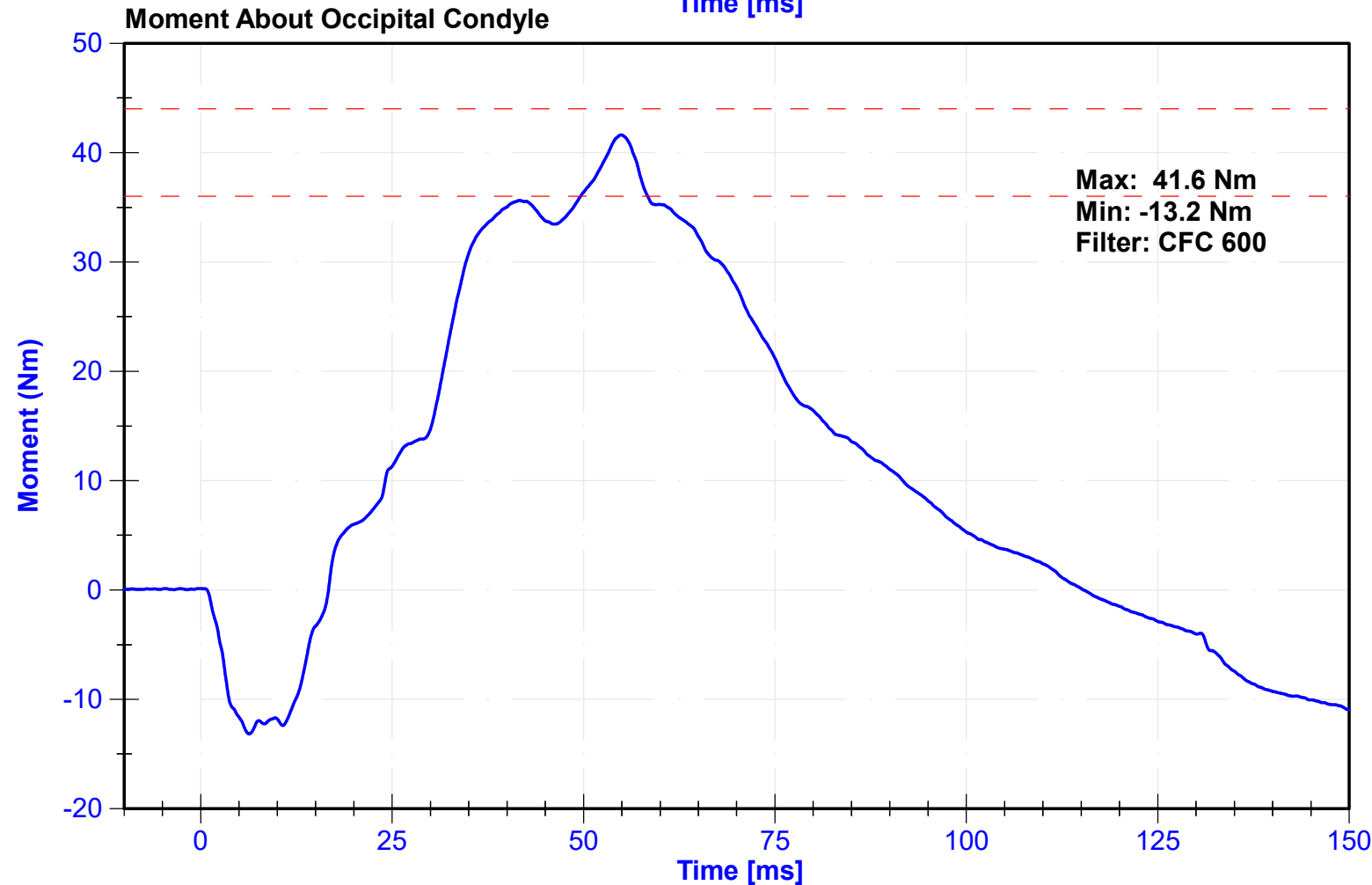
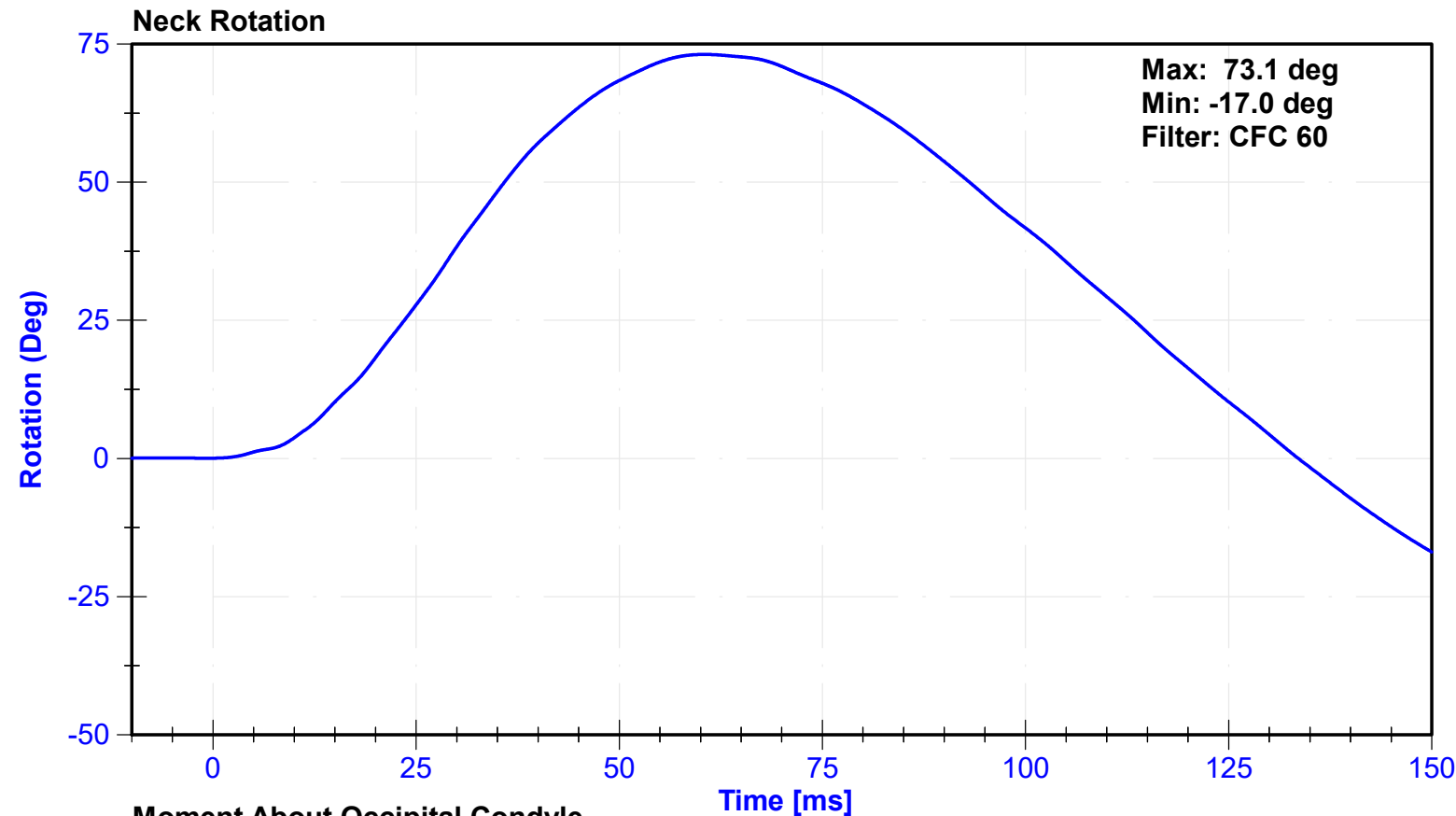
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	19.5	Pass
Velocity	5.51	5.63	m/s	5.532	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.39	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.40	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.56	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.43	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.90	Pass
Neck Rotation	71	81	deg	73.1	Pass
Time at Maximum Rotation	50	70	ms	60.5	Pass
Moment about the OC	36	44	Nm	41.6	Pass
Moment Decay to 0 Nm	102	126	ms	115.3	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	Servo	4961	11/11/2022	11/11/2023
Condyle Potentiometer	Servo	DS185	11/11/2022	11/11/2023
Upper Neck Load Cell	Humanetics	1716A_1872-FY	6/13/2022	6/13/2023





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

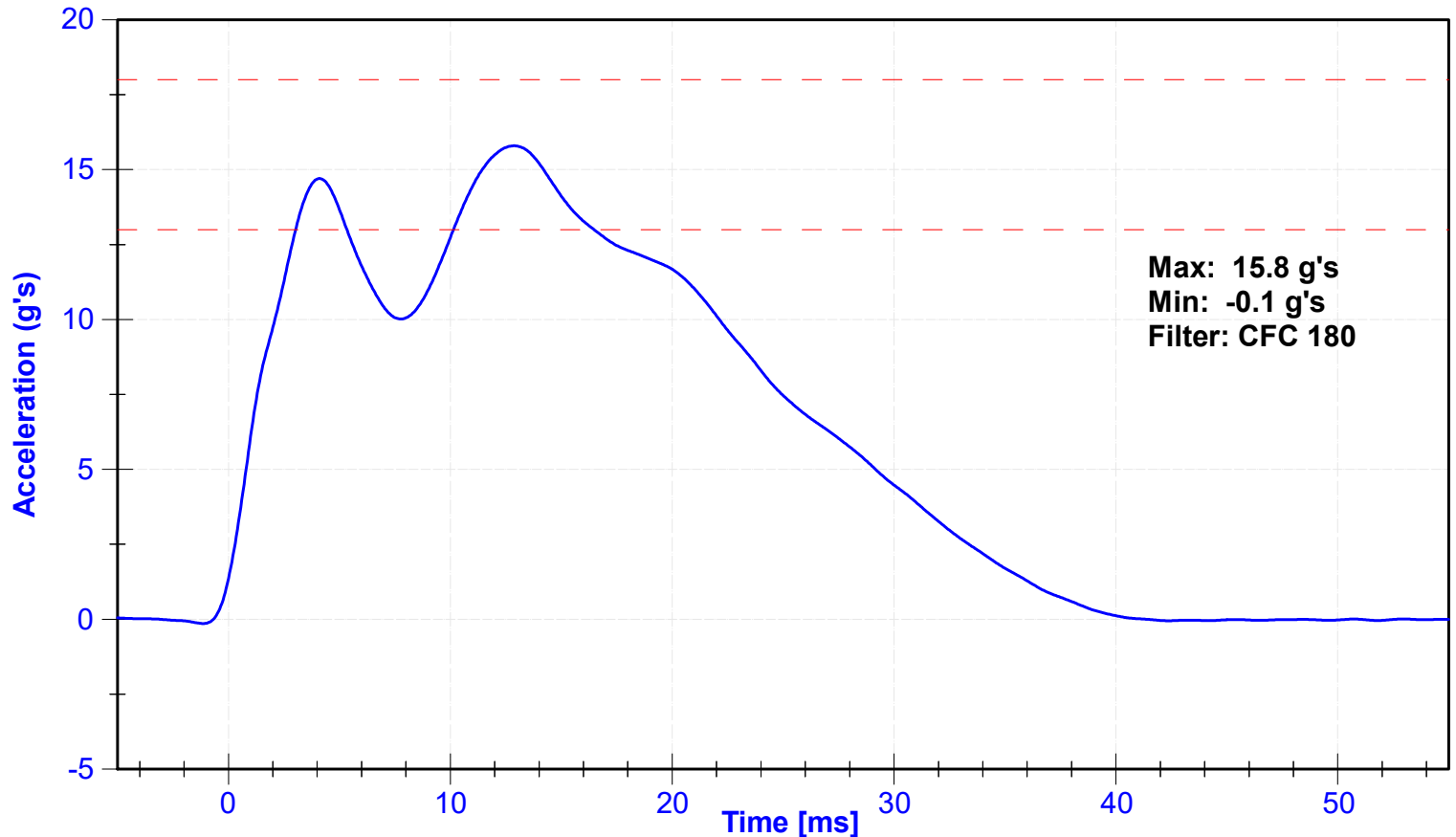
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	19	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	13	18	g's	15.8	Pass
Shoulder Deflection	28	37	mm	28.2	Pass
Lateral Upper Spine Acceleration	17	22	g's	20.2	Pass

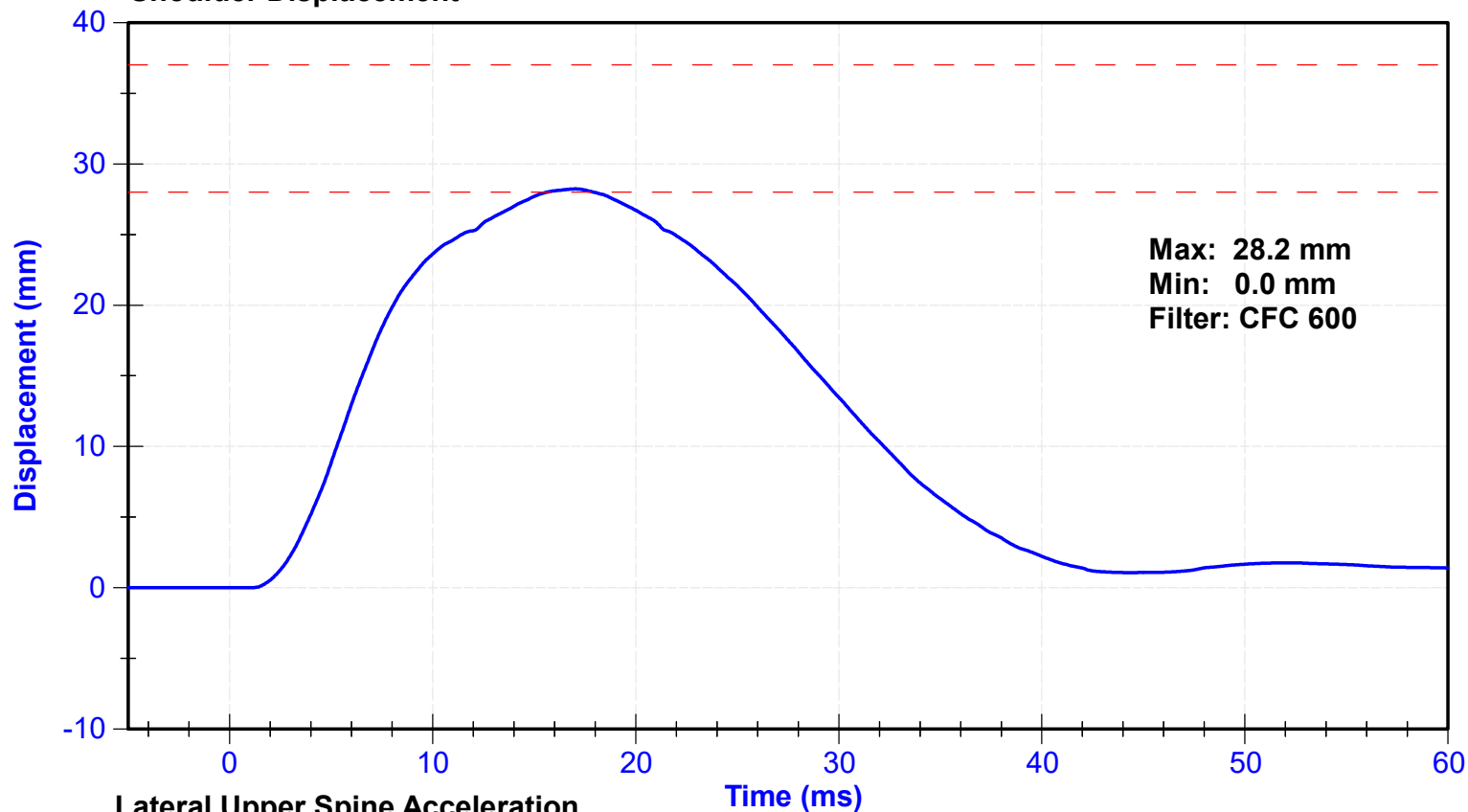
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Shoulder Potentiometer	Servo	1274GFE	12/13/2022	6/13/2023
Upper Spine Y Accelerometer	Endevco	P64148	12/12/2022	6/10/2023

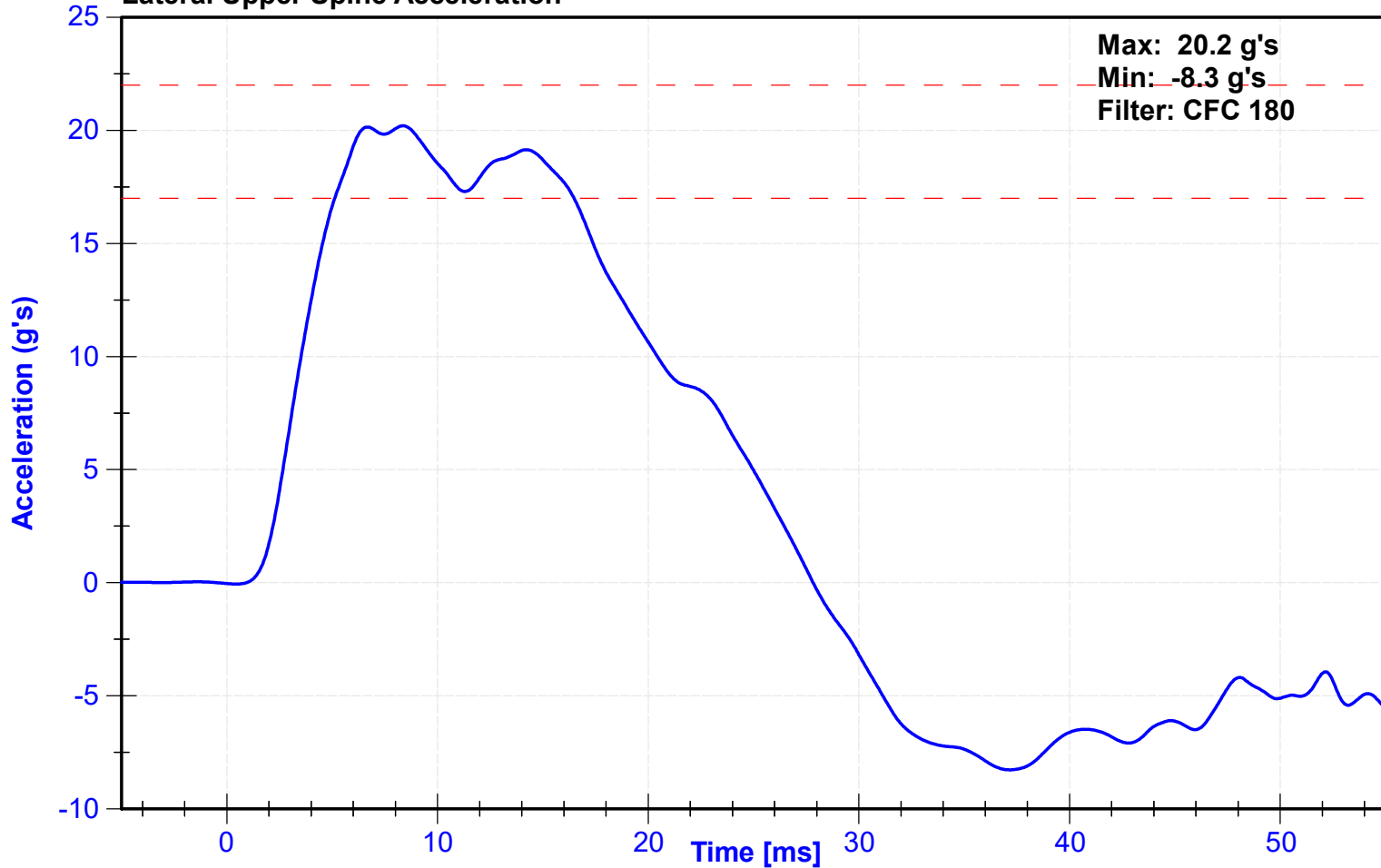
Probe Acceleration



Shoulder Displacement



Lateral Upper Spine Acceleration



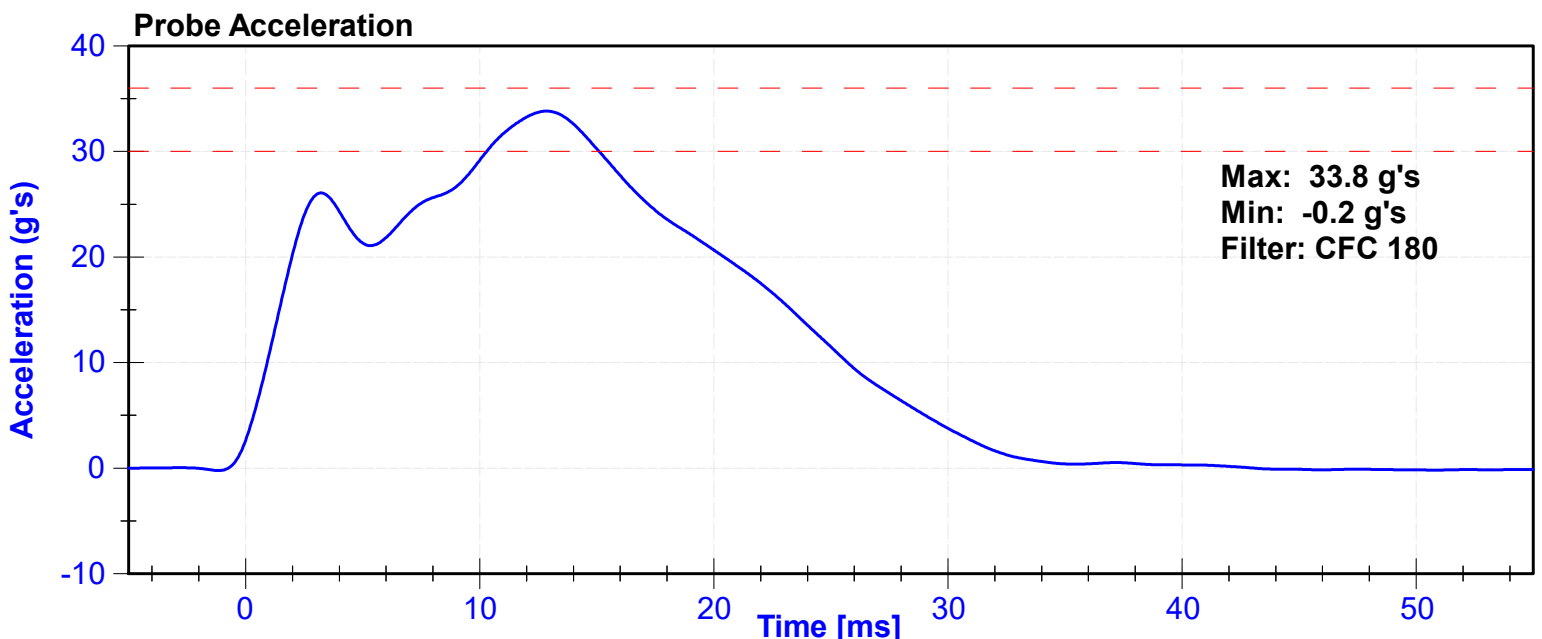
ATD Manufacturer	FTSS	Test Technician	D. Kroll
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

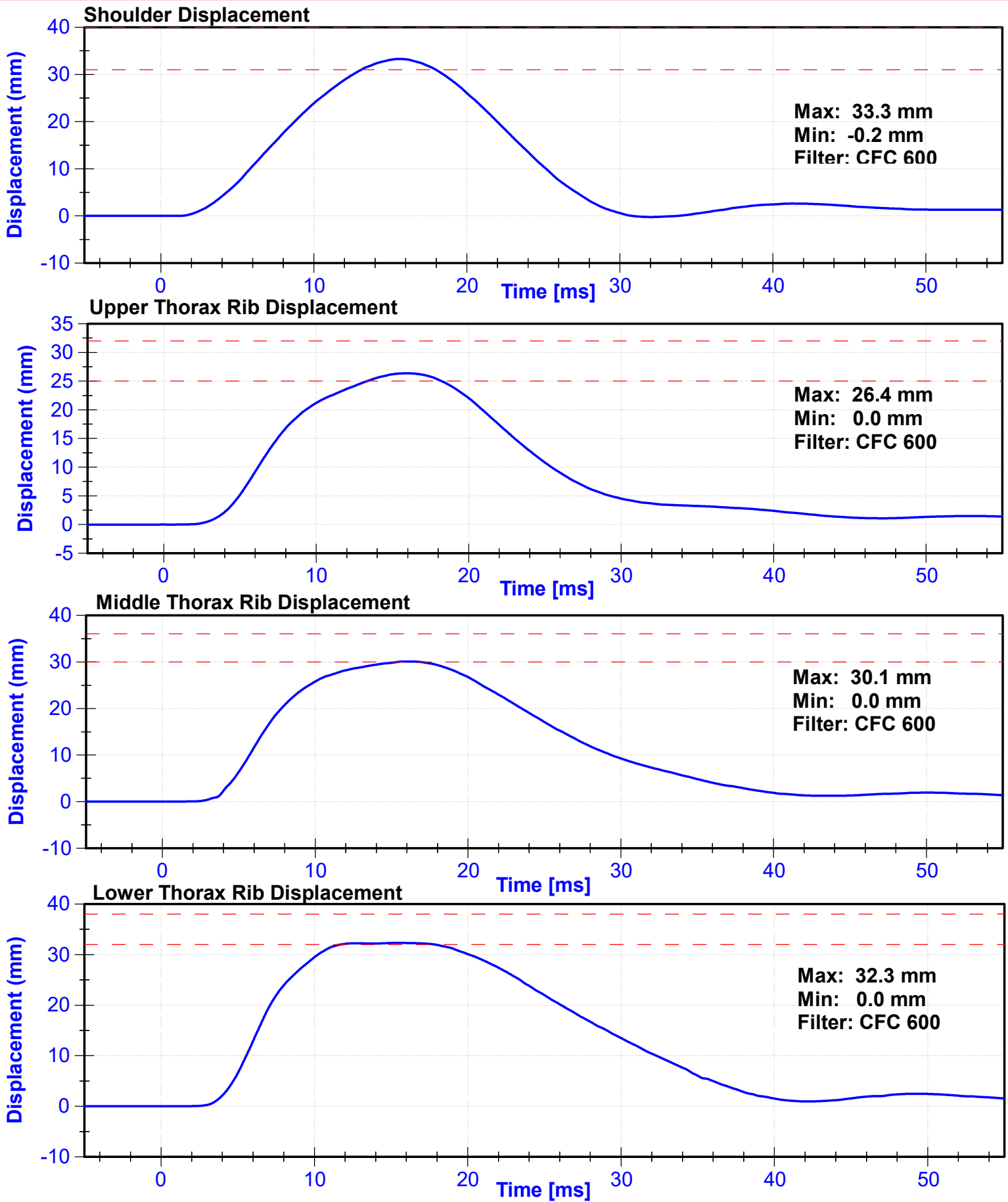
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	19	Pass
Velocity	6.6	6.8	m/s	6.70	Pass
Probe Acceleration after 5 ms	30	36	g's	33.8	Pass
Lateral Upper Spine Acceleration	34	43	g's	38.3	Pass
Lateral Lower Spine Acceleration	29	37	g's	34.7	Pass
Shoulder Deflection	31	40	mm	33.3	Pass
Upper Thorax Rib Deflection	25	32	mm	26.4	Pass
Mid Thorax Rib Deflection	30	36	mm	30.1	Pass
Lower Thorax Rib Deflection	32	38	mm	32.3	Pass

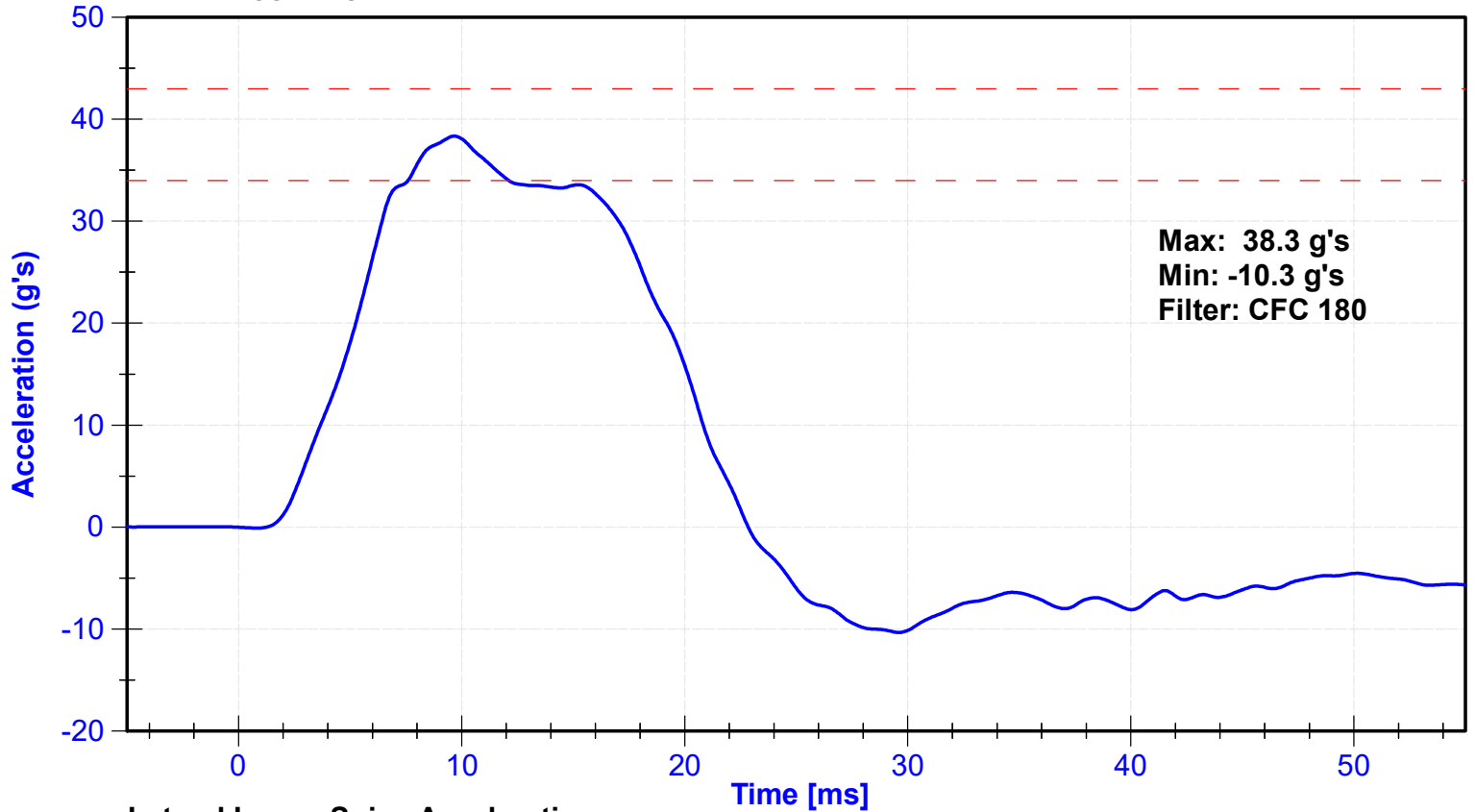
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Spine T1 Y Accelerometer	Endevco	P64148	12/12/2022	6/10/2023
Upper Spine T12 Y Accelerometer	Endevco	P51327	12/12/2022	6/10/2023
Shoulder Potentiometer	Servo	1274GFE	12/13/2022	6/13/2023
Upper Thorax Rib Potentiometer	Servo	1199GFE	12/13/2022	6/13/2023
Middle Thorax Rib Potentiometer	Servo	1246GFE	12/13/2022	6/13/2023
Lower Thorax Rib Potentiometer	Servo	011GFE	12/13/2022	6/13/2023

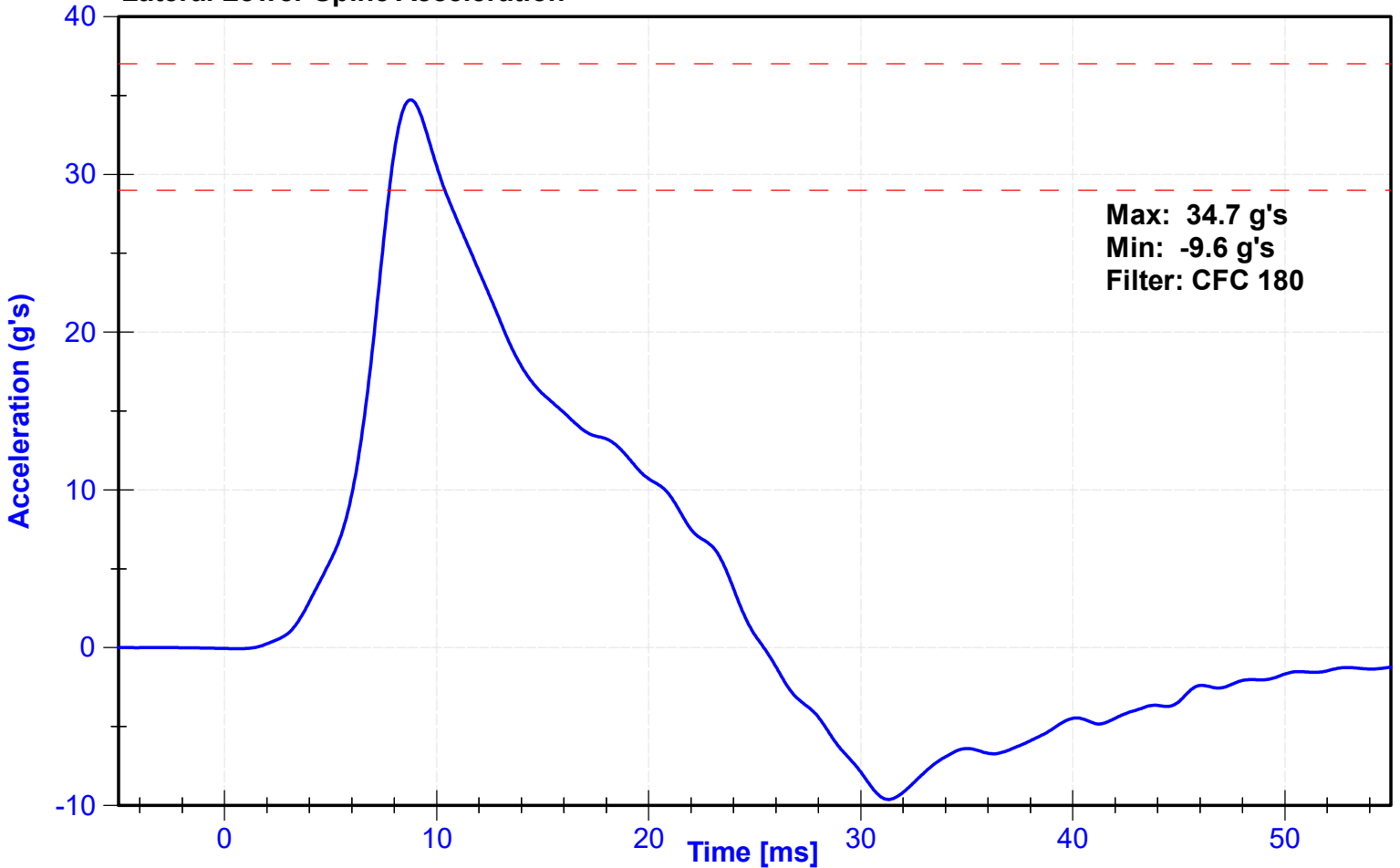




Lateral Upper Spine Acceleration



Lateral Lower Spine Acceleration



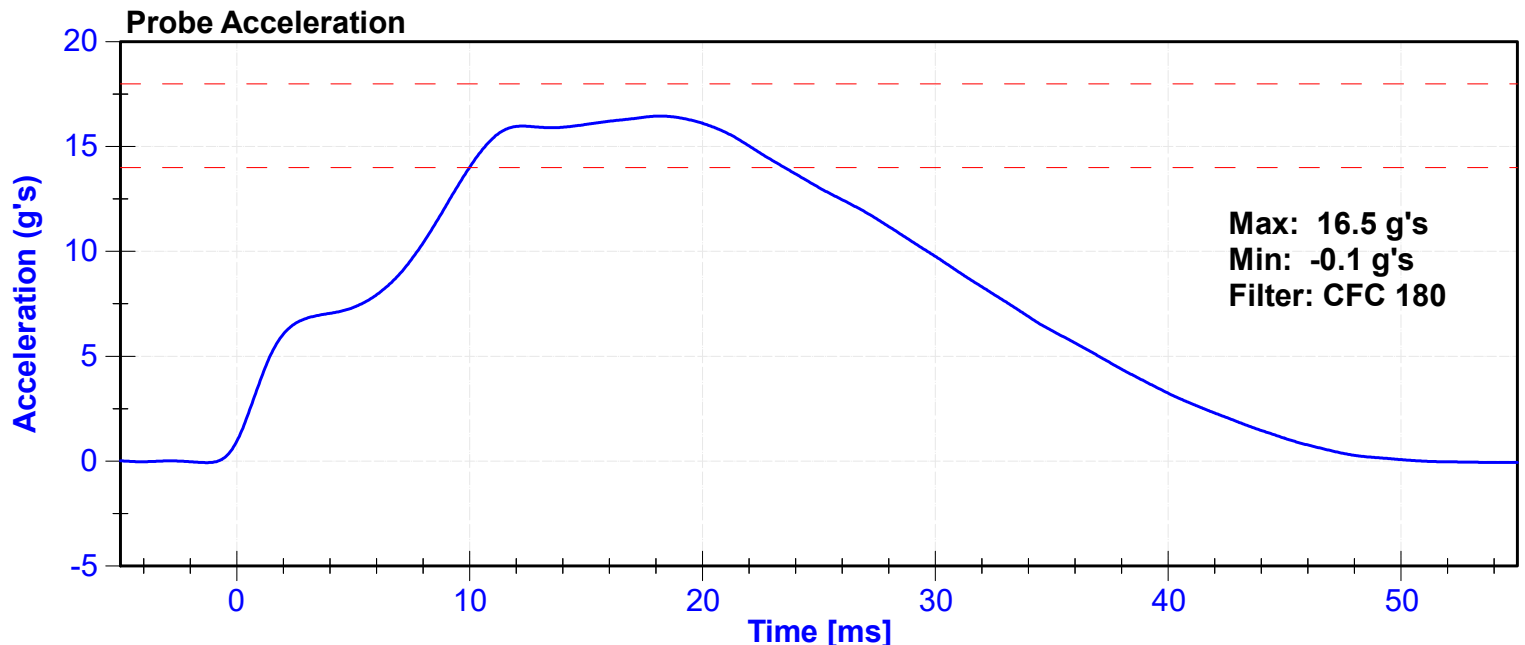
ATD Manufacturer	FTSS	Test Technician	D. Kroll
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

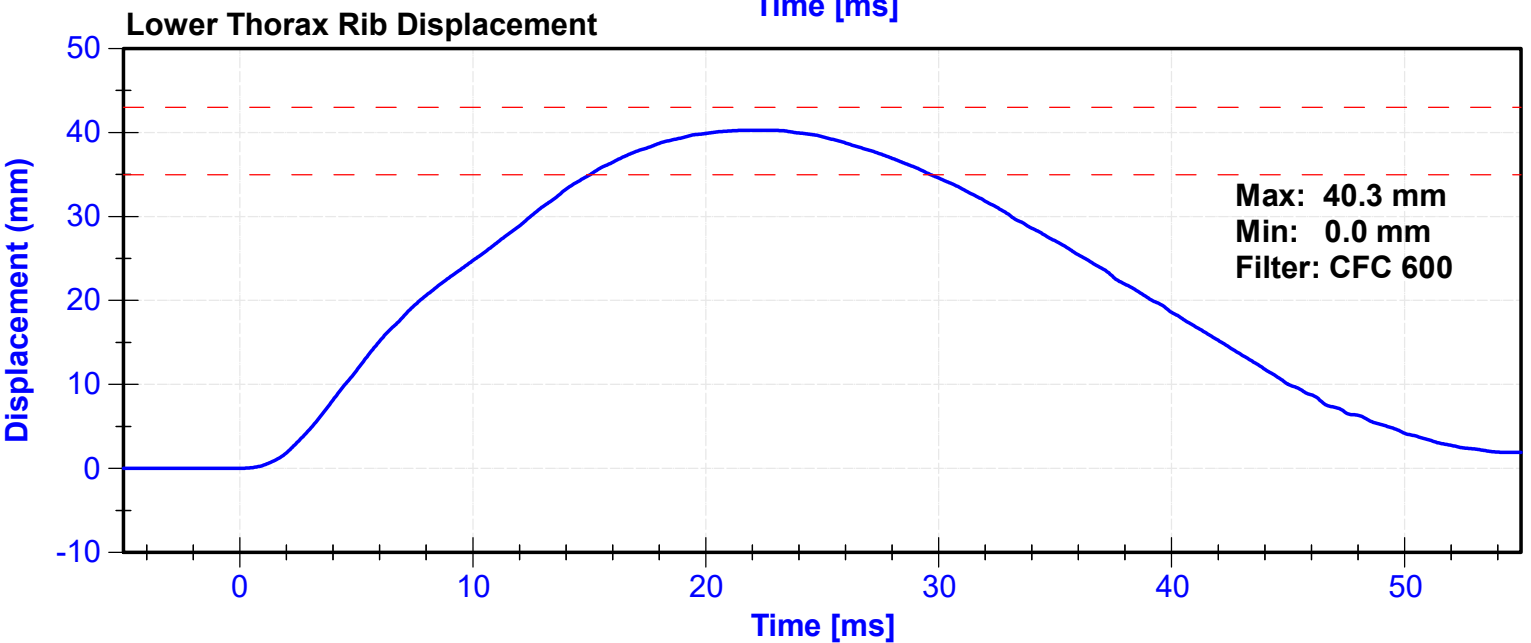
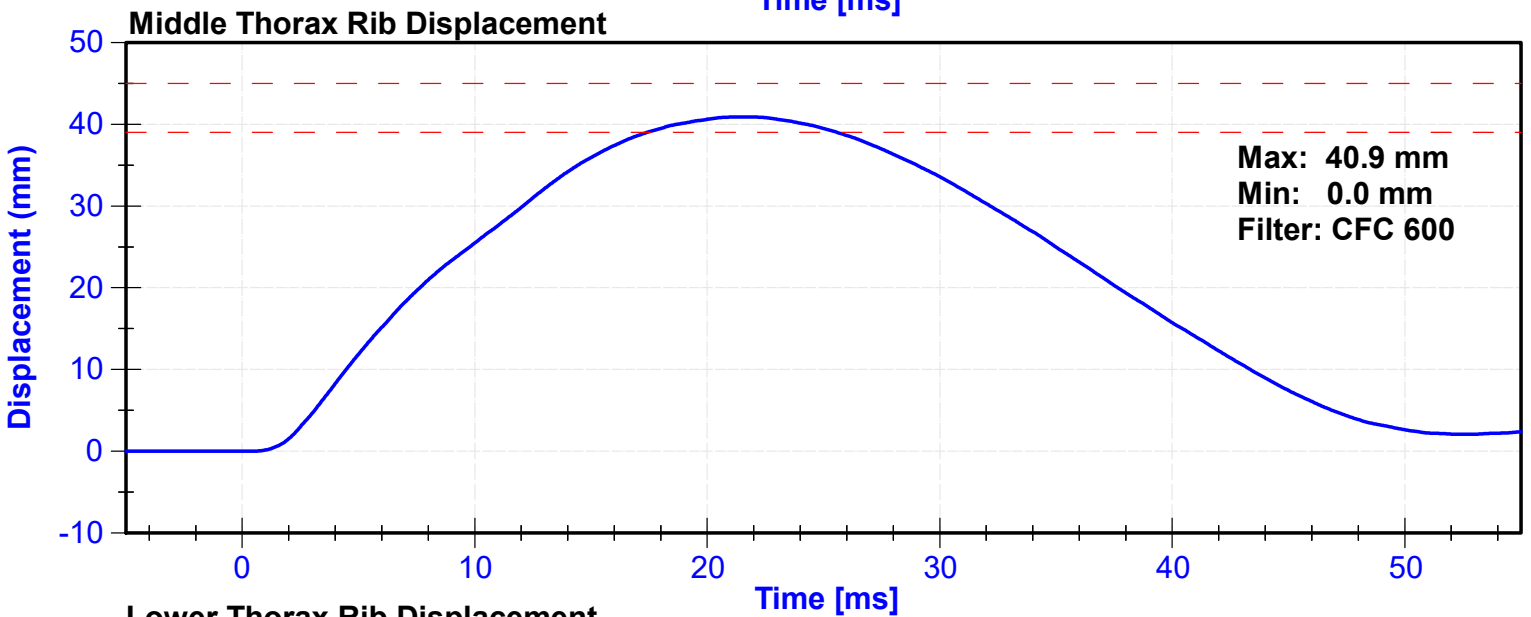
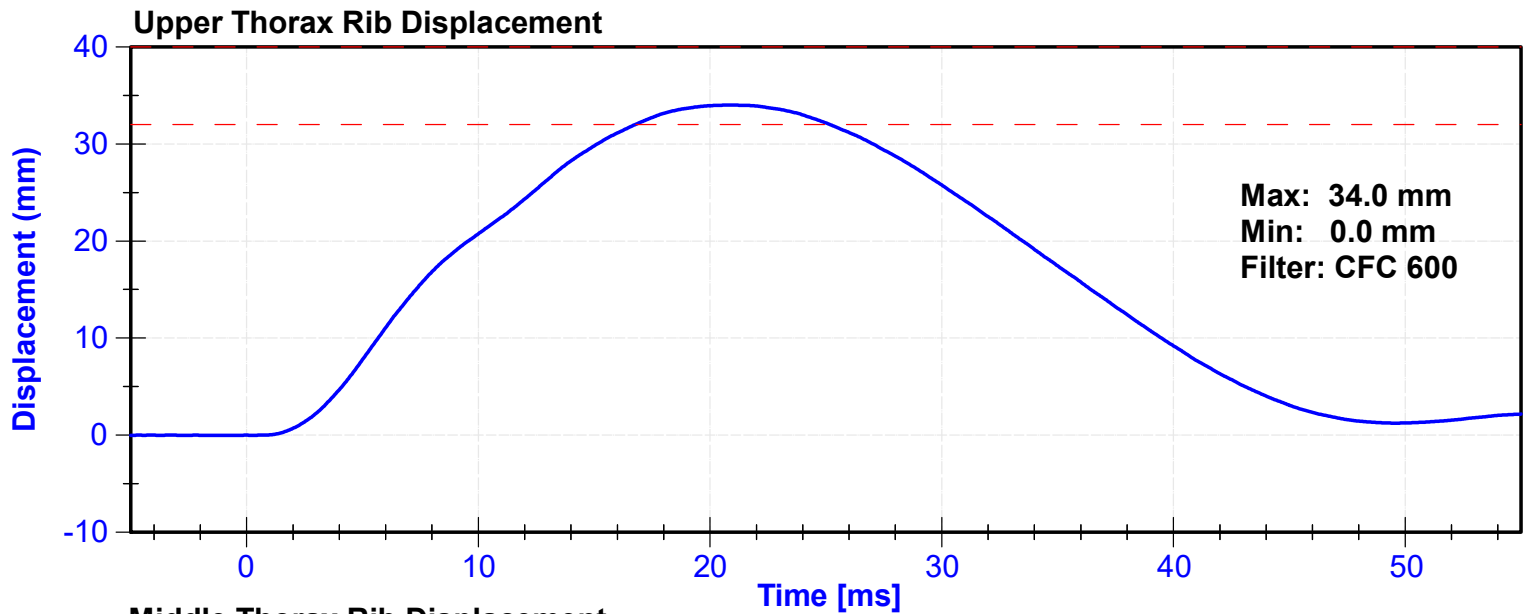
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	19	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	14	18	g's	16.5	Pass
Lateral Upper Spine Acceleration	13	17	g's	15.7	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.9	Pass
Upper Thorax Rib Deflection	32	40	mm	34.0	Pass
Middle Thorax Rib Deflection	39	45	mm	40.9	Pass
Lower Thorax Rib Deflection	35	43	mm	40.3	Pass

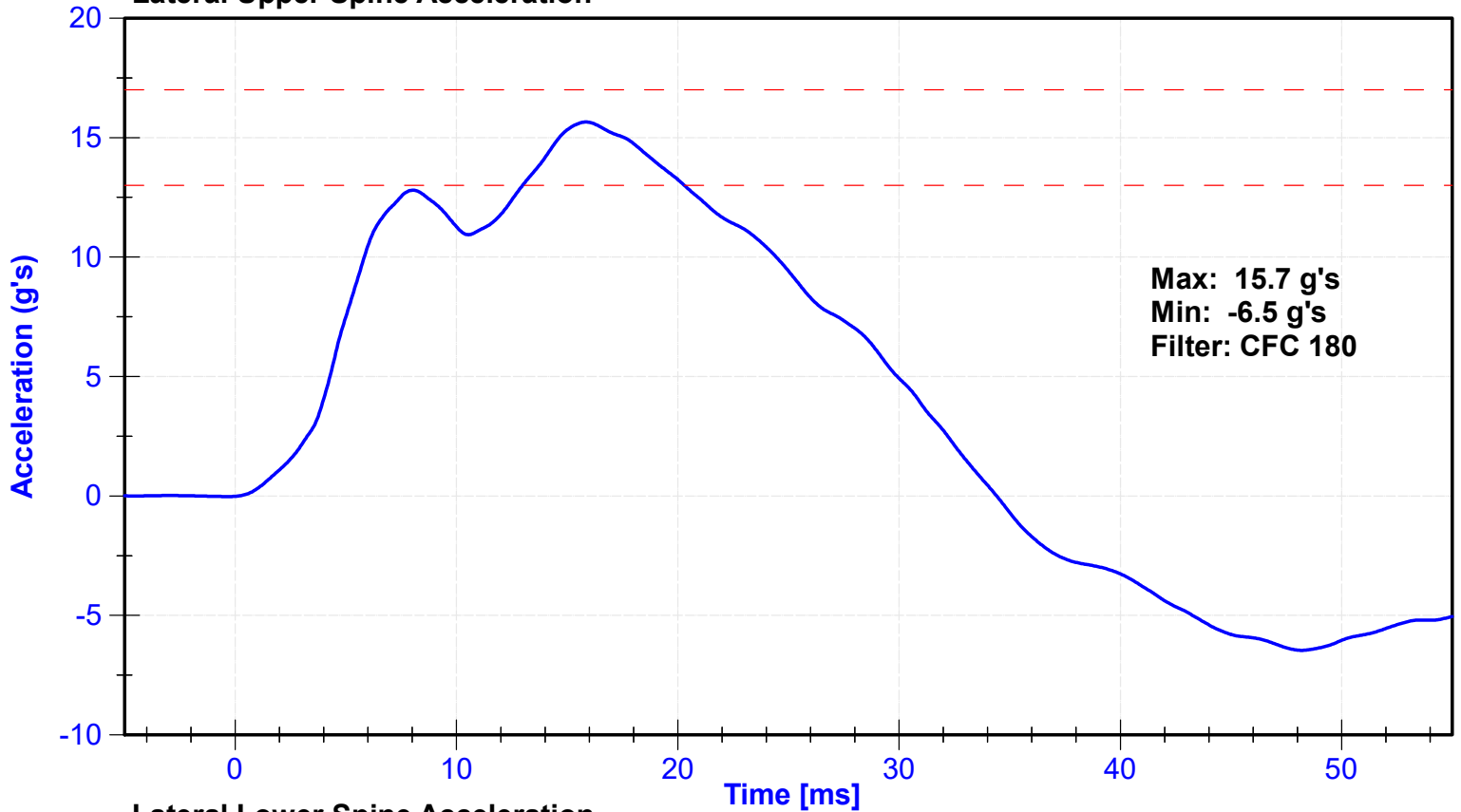
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Spine Y Accelerometer	Endevco	P64148	12/12/2022	6/10/2023
Lower Spine Y Accelerometer	Endevco	P51327	12/12/2022	6/10/2023
Upper Thorax Rib Potentiometer	Servo	1199GFE	12/13/2022	6/13/2023
Middle Thorax Rib Potentiometer	Servo	1246GFE	12/13/2022	6/13/2023
Lower Thorax Rib Potentiometer	Servo	011GFE	12/13/2022	6/13/2023

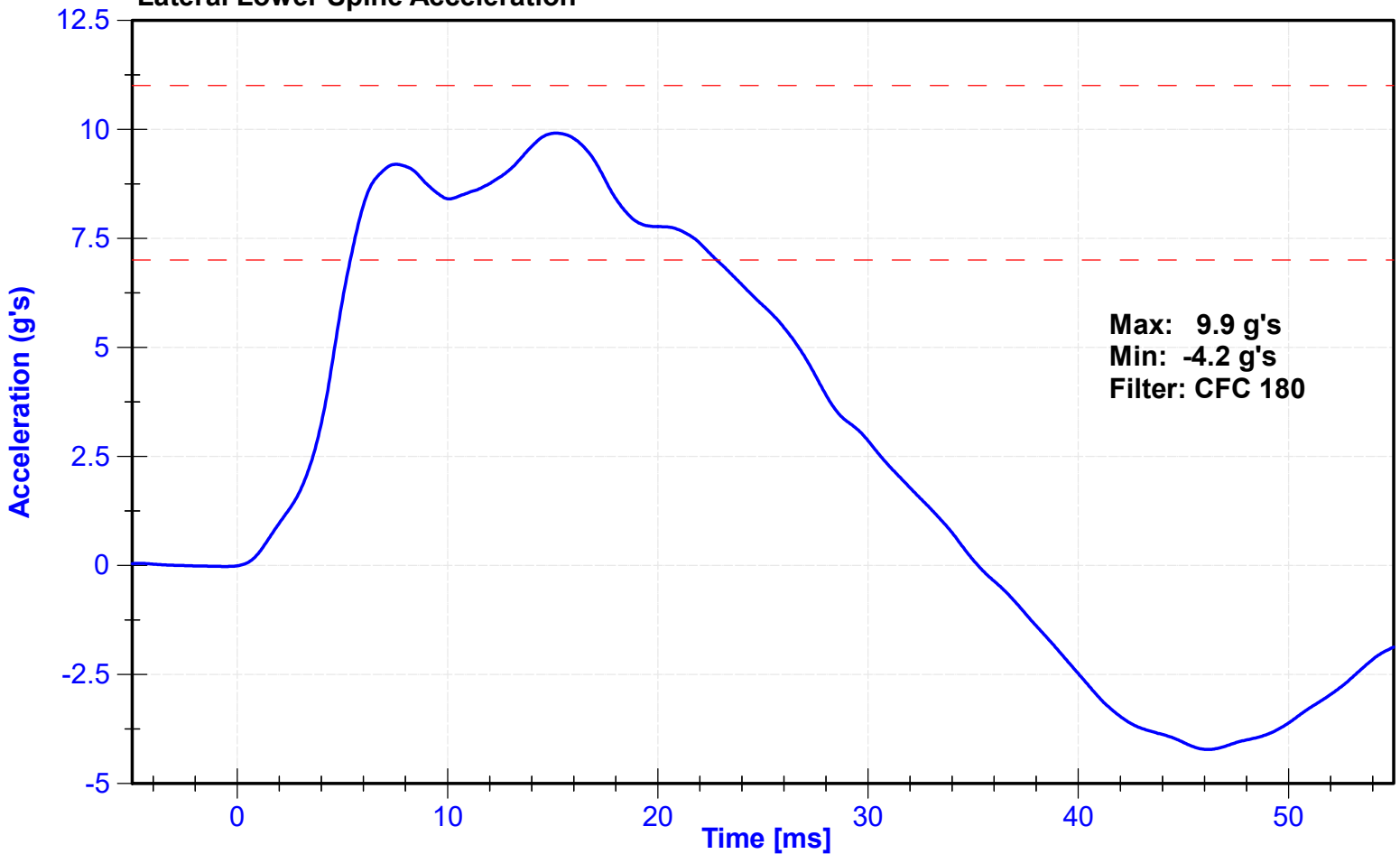




Lateral Upper Spine Acceleration



Lateral Lower Spine Acceleration



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

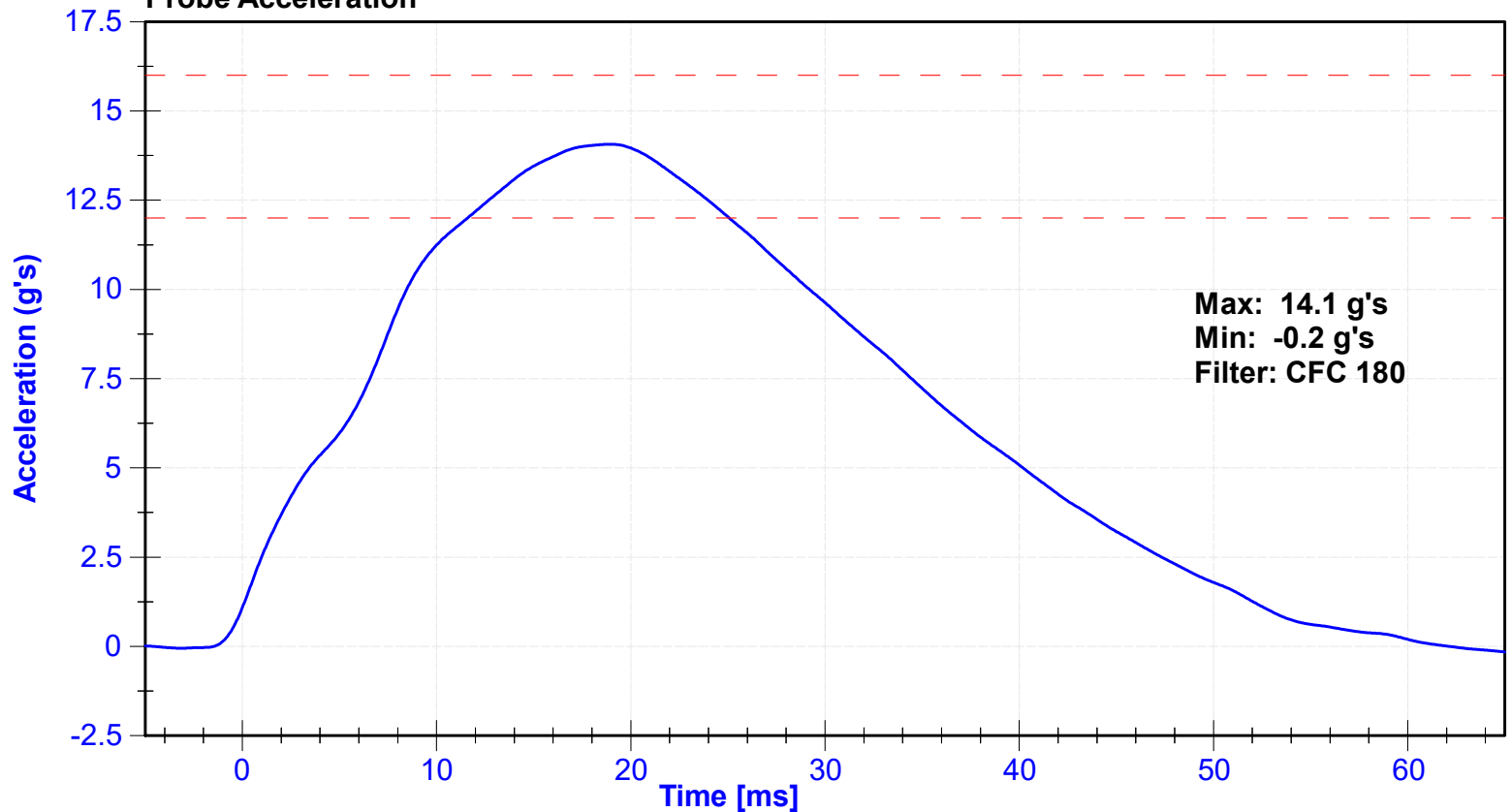
Results

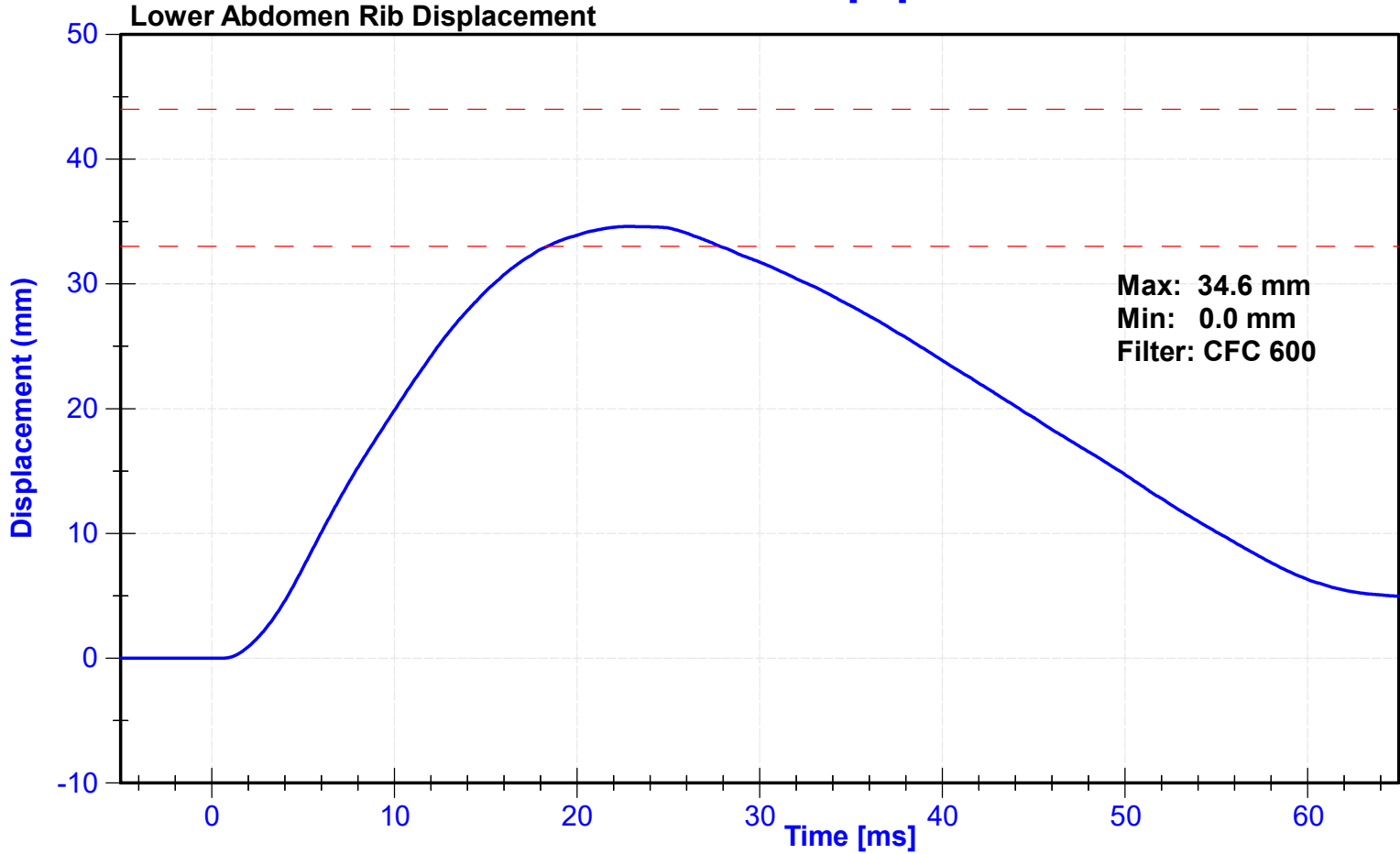
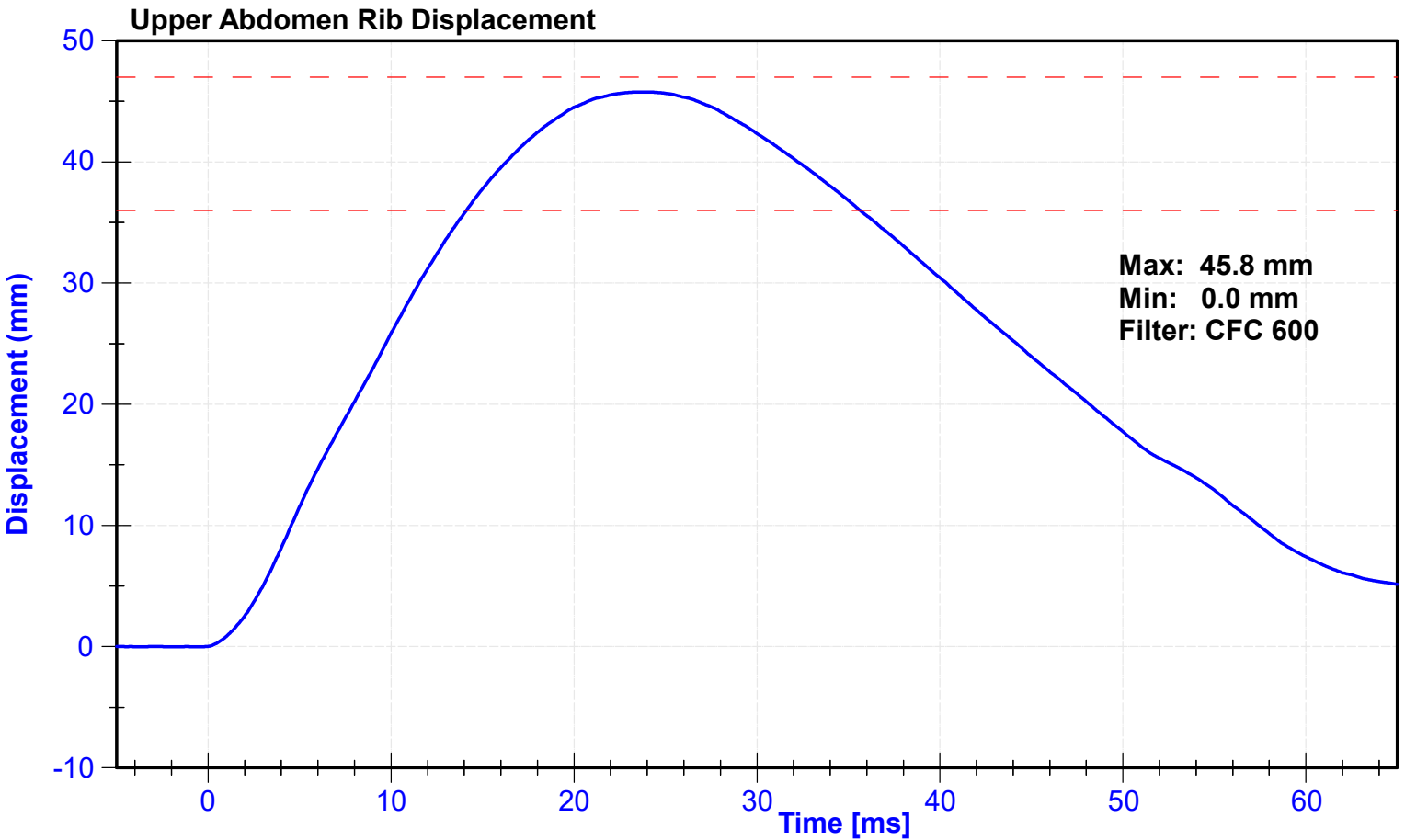
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	19	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	12	16	g's	14.1	Pass
Lateral Lower Spine Acceleration	9	14	g's	10.7	Pass
Upper Abdomen Rib Deflection	36	47	mm	45.8	Pass
Lower Abdomen Rib Deflection	33	44	mm	34.6	Pass

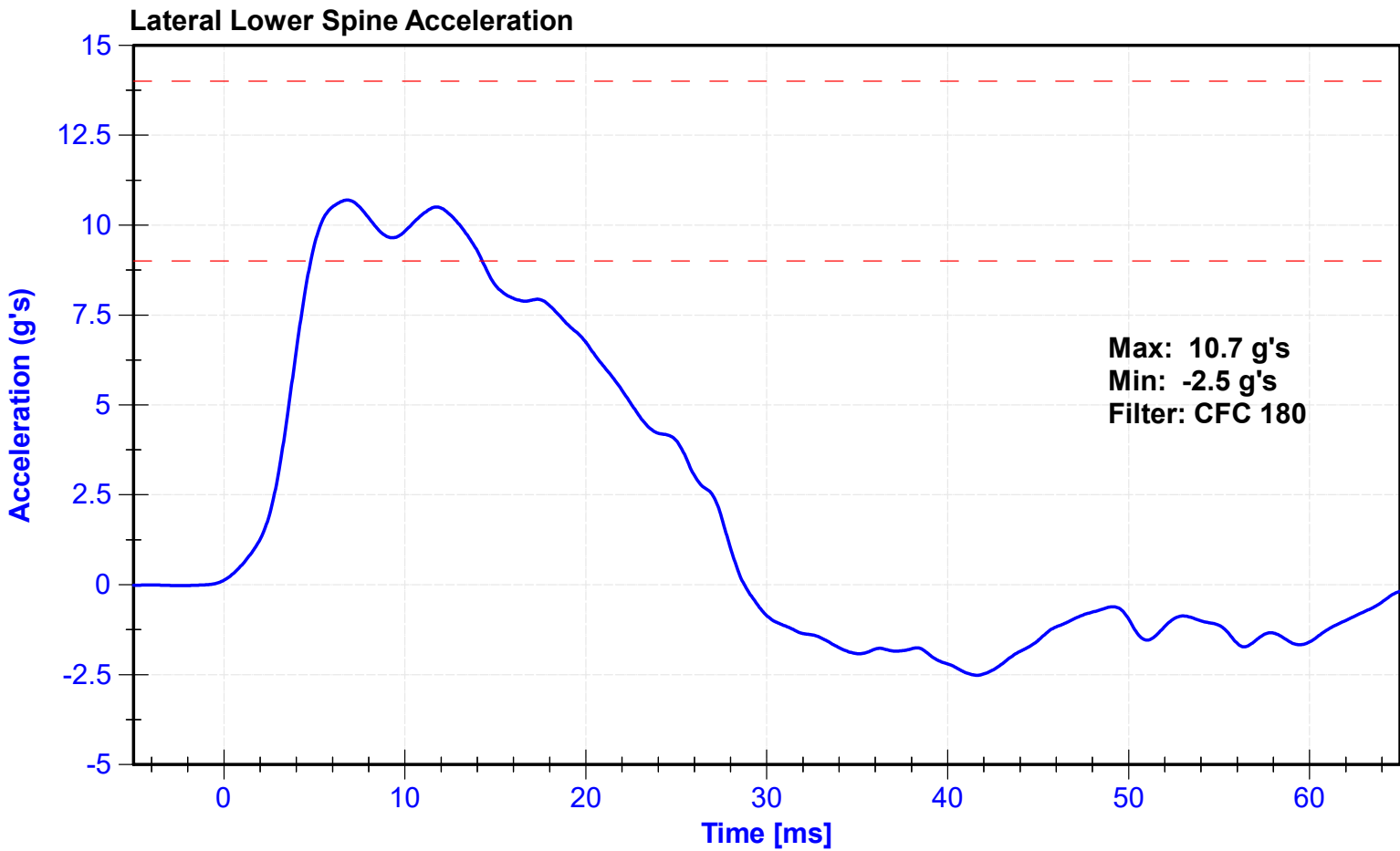
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Lower Spine Y Accelerometer	Endevco	P51327	12/12/2022	6/10/2023
Upper Abdomen Rib Potentiometer	Servo	008GFE	12/13/2022	6/13/2023
Lower Abdomen Rib Potentiometer	Servo	041 GFE	12/13/2022	6/13/2023

Probe Acceleration







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

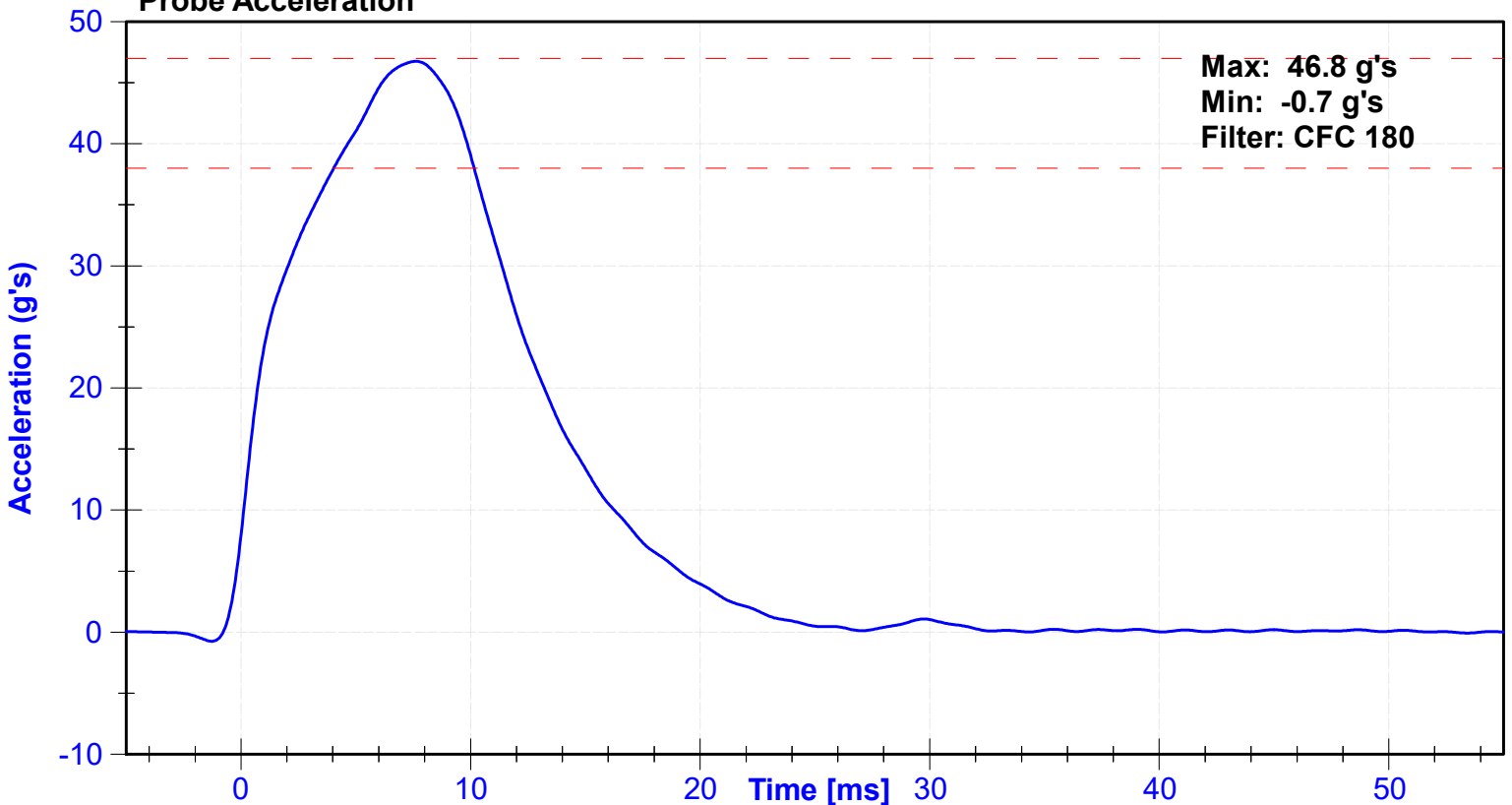
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	19	Pass
Velocity	6.6	6.8	m/s	6.70	Pass
Probe Acceleration	38	47	g's	46.8	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	38.0	Pass
Acetabulum Force	3600	4300	N	4026.2	Pass

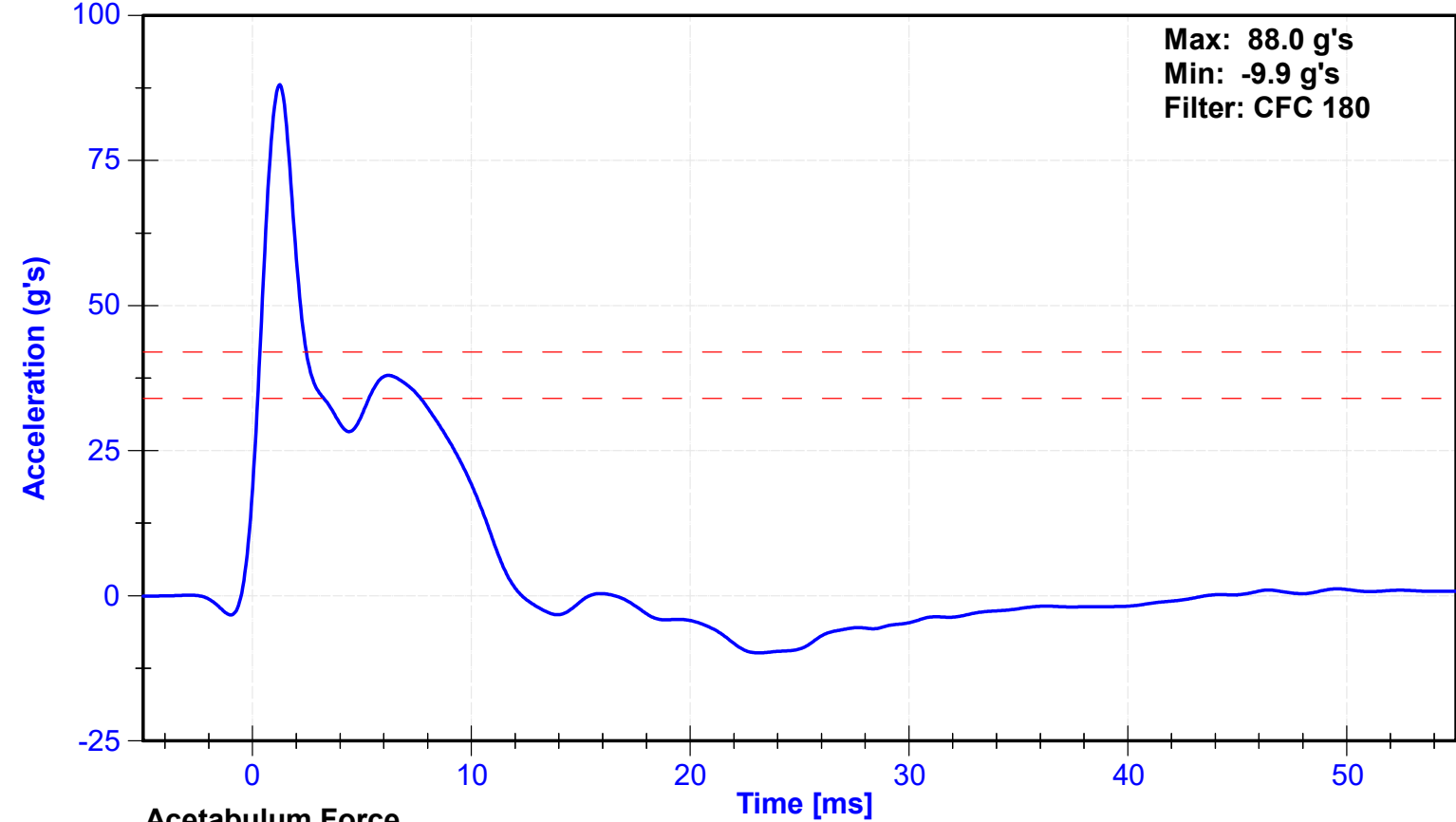
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pelvis Y Accelerometer	Endevco	P51875	12/12/2022	6/10/2023
Acetabulum Load Cell	Denton	276-FY	8/11/2022	8/11/2023
Certification Plug	SACO			N/A
Crash Test Plug	SACO			N/A

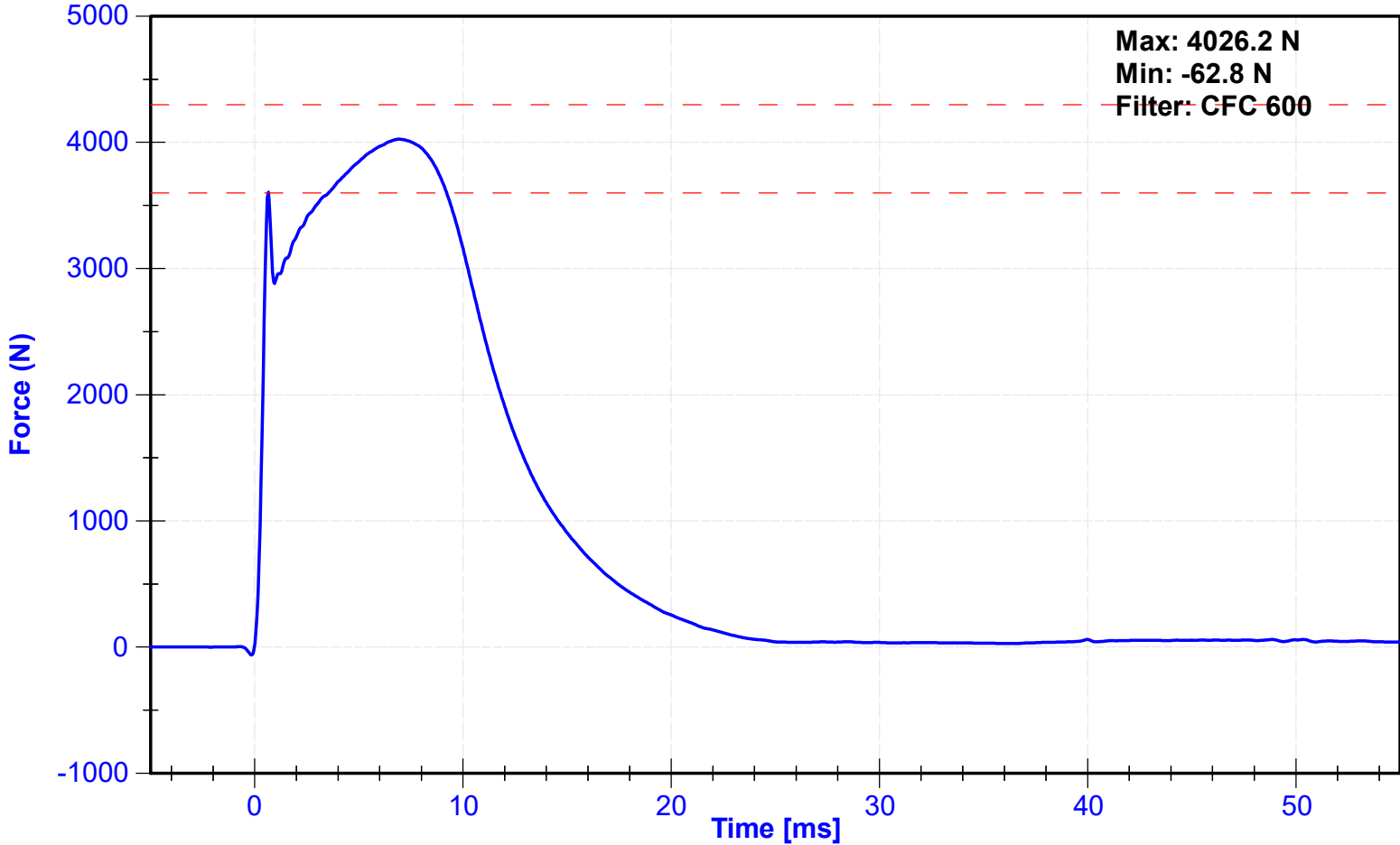
Probe Acceleration



Lateral Pelvis Acceleration



Acetabulum Force



SID-ILs Pelvis Plug Certification Test

Plug S/N 15164

Test Number 17880

Report Number 17929

Test Date 3/8/2021 11:51:56 AM

Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	351	600
Force @ 1.5 mm (N)	1,192	1,400
Force @ 2.5 mm (N)	1,446	1,618
Force @ 3.0 mm (N)	1,497	1,673

Testing Machine STM-20 5965542

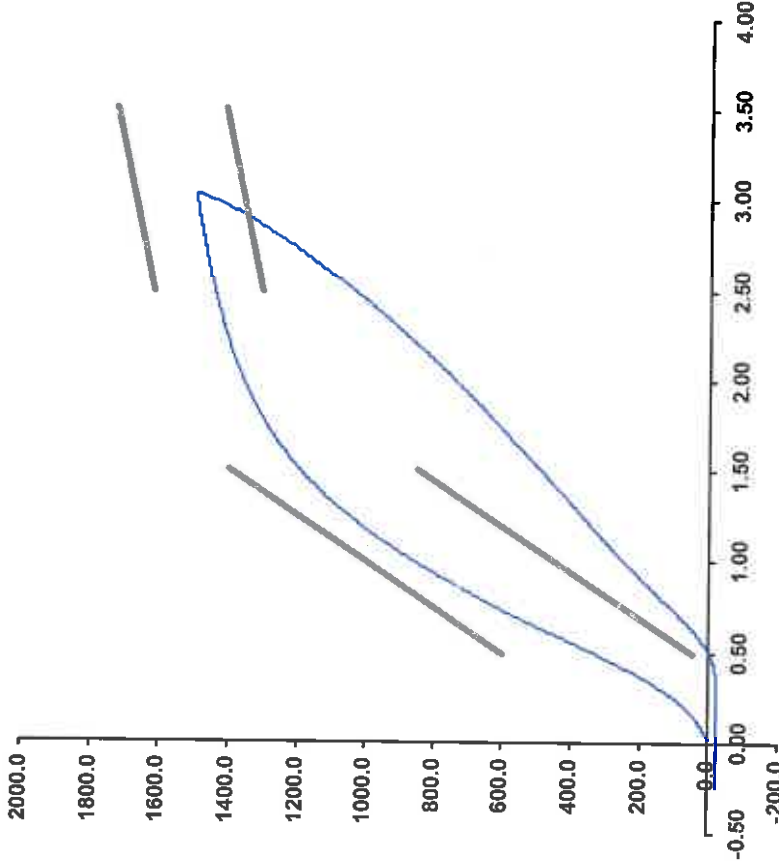
Load Cell S/N (F1360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7

Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 08-Mar-21

SACO Research

By : SC Date : 3/8/2021

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



Coash
Impact

SID-Ils Pelvis Plug Certification Test

Plug S/N 15155

Test Number 17867

Report Number 17916

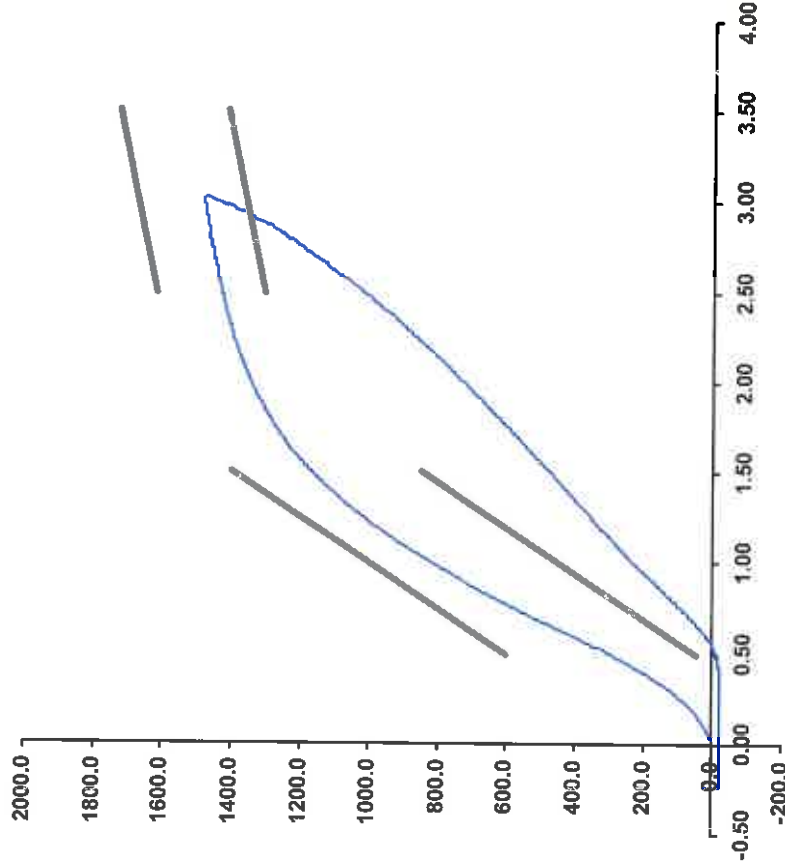
Test Date 3/5/2021 11:19:38 AM

Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	50	600
Force @ 1.5 mm (N)	850	1,400
Force @ 2.5 mm (N)	1,306	1,618
Force @ 3.0 mm (N)	1,361	1,673

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

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 05-Mar-21

SACO Research

By: DC Date: 3/5/2021

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

SID-Ils Pelvis Plug Certification Test

Plug S/N 15447

Test Number 20108

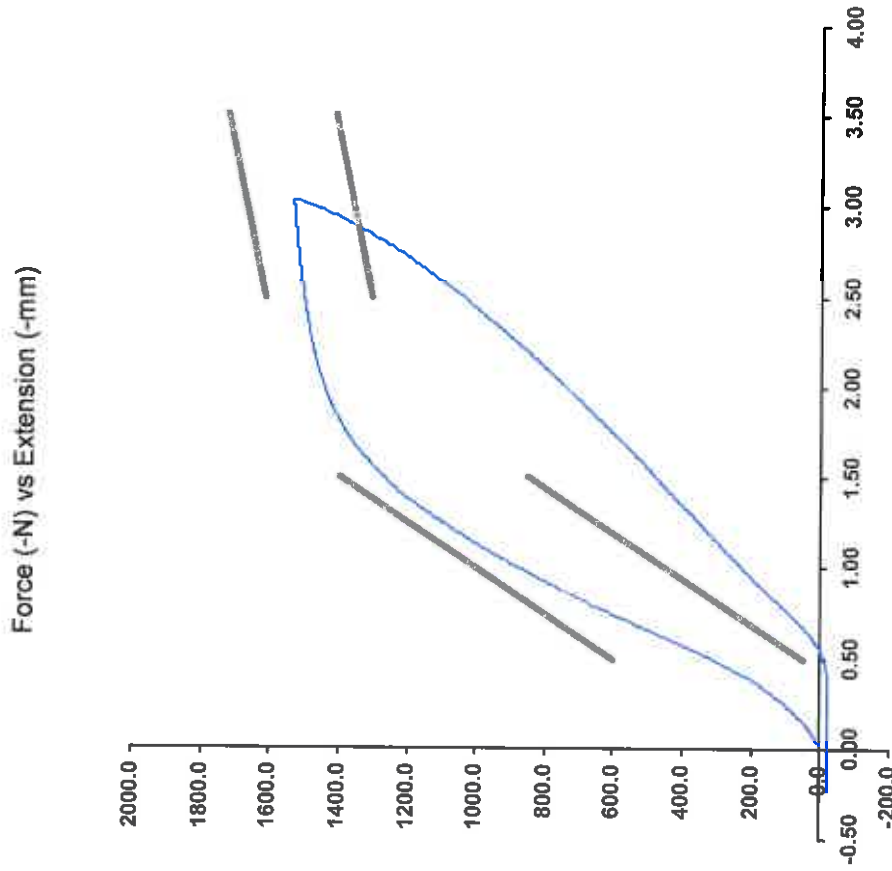
Report Number 20162

Test Date 9/9/2021 10:45:55 AM

Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	327	600
Force @ 1.5 mm (N)	1,274	1,400
Force @ 2.5 mm (N)	1,508	1,618
Force @ 3.0 mm (N)	1,535	1,673

Testing Machine STM-20 5965542	
Load Cell S/N (F1360947), Units (LBS)	1000
Preload Value (-N)	22.24
Crosshead Speed (mm / min) or Rate	12.7
Extension or Position Measured by	XHD_100 (XHD100)

Notes:



Operator

Part Number 180-4450

Template No 107 09-Sep-21

SACO Research

By: *DC* Date: *9/9/2021*

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

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

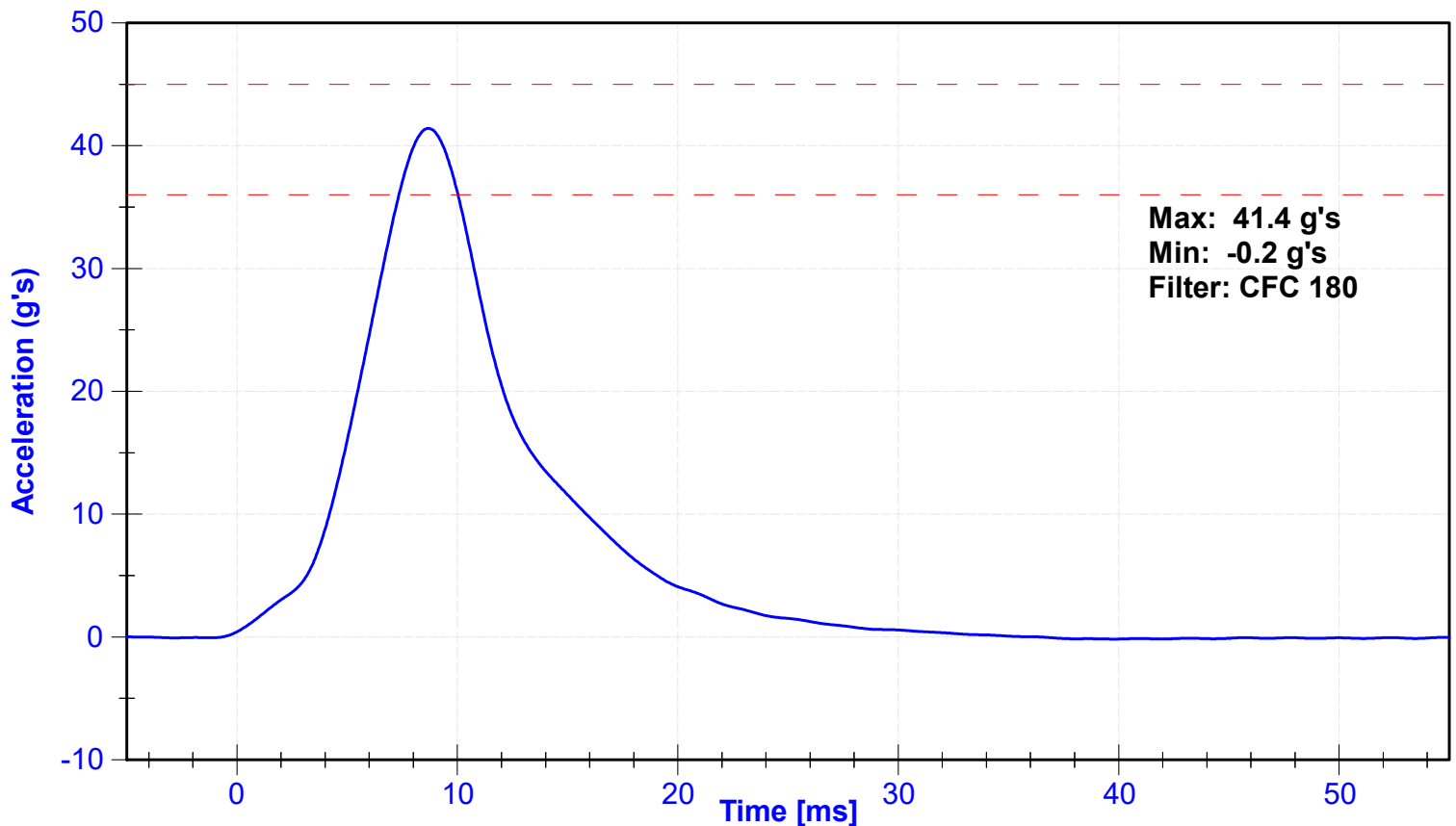
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	19	Pass
Velocity	4.2	4.4	m/s	4.21	Pass
Probe Acceleration	36	45	g's	41.4	Pass
Lateral Pelvis Acceleration	28	39	g's	31.5	Pass
Iliac Force	4100	5100	N	4805.3	Pass

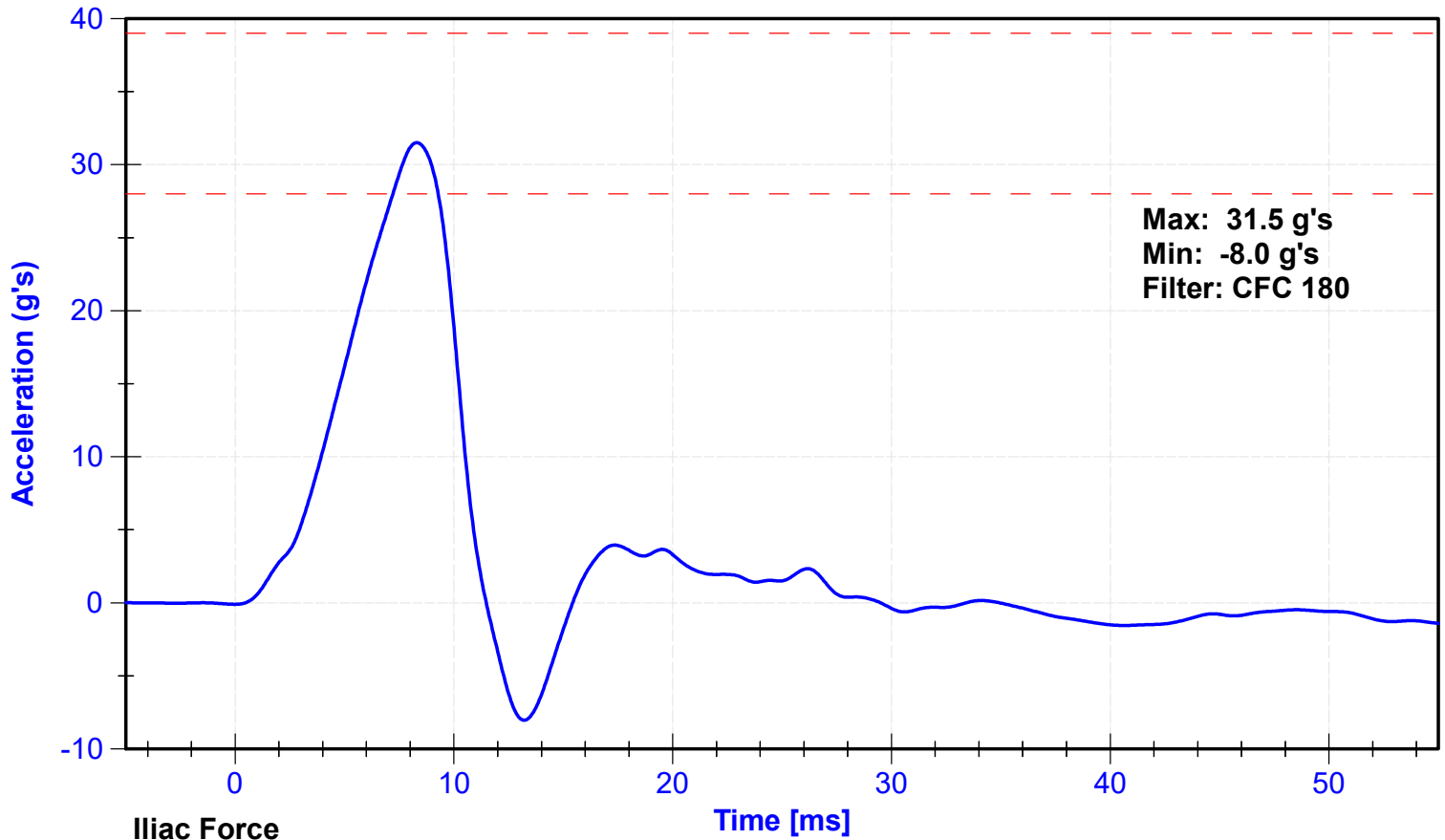
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pelvis Y Accelerometer	Endevco	P51875	12/12/2022	6/10/2023
Iliac Load Cell	Denton	290-FY	8/11/2022	8/11/2023

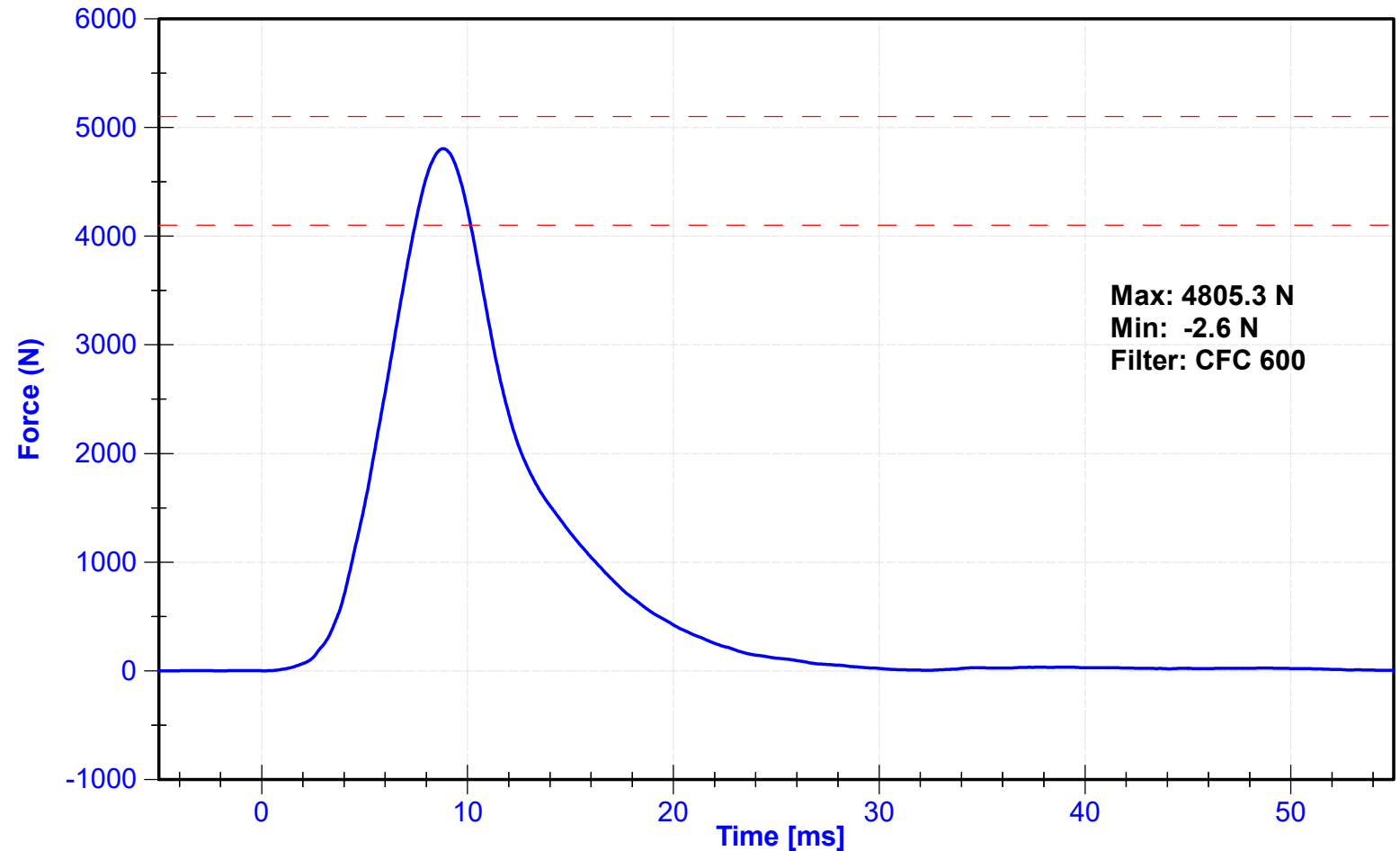
Probe Acceleration



Lateral Pelvis Acceleration



Iliac Force



APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

TABLE 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N _F033_		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X	P63861	Endevco	1/17/2023
		Y	P49216	Endevco	1/17/2023
		Z	P51303	Endevco	1/17/2023
	Redundant	X	P58868	Endevco	1/17/2023
		Y	P59020	Endevco	1/12/2023
		Z	P52132	Endevco	1/17/2023
Thorax Rib Displacement Potentiometers	Upper	Y	179GFE	Honeywell	1/17/2023
	Middle	Y	185GFE	Honeywell	1/17/2023
	Lower	Y	178GFE	Honeywell	1/17/2023
Abdomen Load Cells	Forward	Y	1509	Denton	8/12/2022
	Middle	Y	1508	Denton	8/12/2022
	Rear	Y	1507	Denton	8/12/2022
Lower Spine Accelerometers (T12)		X	P51740	Endevco	1/17/2023
		Y	P83320	Endevco	1/17/2023
		Z	P52033	Endevco	1/17/2023
Pubic Symphysis Load Cell		Y	459-FY	Denton	6/14/2022

TABLE 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N _DG8012_		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers		Primary	X	P74788	Endevco	12/12/2022
			Y	P51668	Endevco	12/12/2022
			Z	P83319	Endevco	12/12/2022
		Redundant	X	P80334	Endevco	12/12/2022
			Y	P52155	Endevco	12/12/2022
			Z	P83322	Endevco	12/12/2022
Displacement Potentiometers	Thoracic Rib	Upper	Y	1199GFE	Servo	12/13/2022
		Middle	Y	1246GFE	Servo	12/13/2022
		Lower	Y	011GFE	Servo	12/13/2022
	Abdominal Rib	Upper	Y	008GFE	Servo	12/13/2022
		Lower	Y	041 GFE	Servo	12/13/2022
Lower Spine Accelerometers (T12)			X	P71272	Endevco	12/12/2022
			Y	P51327	Endevco	12/12/2022
			Z	P52067	Endevco	12/12/2022
Acetabulum Load Cell			Y	276-FY	Denton	8/11/2022
Iliac Wing Load Cell			Y	290-FY	Denton	8/11/2022
Pelvis Plug (struck side)				15450	SACO	9/9/2021
Pelvis Plug (non-struck side)				18153	SACO	3/22/2021

TABLE 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	A281020	Measurement Specialties	9/19/2022
	Vehicle Center of Gravity	Y	A398641	Measurement Specialties	9/19/2022
	Vehicle Center of Gravity	Z	A398658	Measurement Specialties	10/10/2022
2	Right Sill at Front Seat	X	A290902	Measurement Specialties	9/20/2022
	Right Sill at Front Seat	Y	A396642	Measurement Specialties	9/20/2022
	Right Sill at Front Seat	Z	G22424	Endevco	1/12/2023
3	Right Sill at Rear Seat	X	A370891	Measurement Specialties	11/29/2022
	Right Sill at Rear Seat	Y	A370896	Measurement Specialties	11/29/2022
	Right Sill at Rear Seat	Z	A280916	Measurement Specialties	9/20/2022
4	Left Sill at Front Door	Y	A400016	Measurement Specialties	9/20/2022
5	Left Sill at Rear Door	Y	A283654	Measurement Specialties	9/19/2022
6	Left A-Post Lower	Y	G22217	Endevco	9/21/2022
7	Left A-Post Middle	Y	A400019	Measurement Specialties	12/29/2022
8	Left B-Post Lower	Y	A399942	Measurement Specialties	1/16/2023
9	Left B-Post Middle	Y	A396622	Measurement Specialties	9/2/2022
10	Front Seat Track	Y	A413599	Measurement Specialties	9/6/2022
11	Rear Seat Track or Structure	Y	A290929	Measurement Specialties	9/29/2022
12	Right Rear Occ. Compartment	Y	A405580	Measurement Specialties	10/10/2022
13	Engine Block	X	A372808	Measurement Specialties	1/19/2023
	Engine Block	Y	A372817	Measurement Specialties	1/19/2023
14	Rear Floorpan Above Axle	X	A350974	Measurement Specialties	1/3/2023
	Rear Floorpan Above Axle	Y	A352403	Measurement Specialties	1/3/2023
	Rear Floorpan Above Axle	Z	A352421	Measurement Specialties	1/3/2023

TABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	A398663	Measurement Specialties	11/15/2022
MDB Center of Gravity	Y	A413569	Measurement Specialties	11/15/2022
MDB Center of Gravity	Z	A413574	Measurement Specialties	11/15/2022
Left Frame at Rear Axle Centerline	X	A255878	Measurement Specialties	11/15/2022
Left Frame at Rear Axle Centerline	Y	A350971	Measurement Specialties	11/15/2022