

REPORT NUMBER: 214P-CAL-24-014

**SAFETY COMPLIANCE TESTING FOR FMVSS 214
DYNAMIC SIDE IMPACT PROTECTION
RIGID POLE TEST**

**Ford Motor Co.
2024 Lincoln Nautilus Hybrid
5 Door SUV**

NHTSA No: C20240202

**PREPARED BY:
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June 27, 2024

FINAL REPORT

**PREPARED FOR:
U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVE. S.E.
WASHINGTON, D.C. 20590**

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Date: _____

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16. Abstract A 31.00 km/h (19.3 mph), 75° oblique compliance test was conducted on the subject 2024 Lincoln Nautilus Hybrid 5 Door SUV in accordance with the specifications of the Office of Vehicle Safety Compliance TP-214P-01 for the determination of FMVSS No.214 Side Impact Protection compliance. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on June 7, 2024. The impact velocity of the vehicle was 30.91 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 298 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>382.412</td> </tr> <tr> <td>Maximum Thoracic Rib Deflection</td> <td>mm</td> <td>44</td> <td>20.362</td> </tr> <tr> <td>Total Abdominal Force</td> <td>N</td> <td>2500</td> <td>837.165</td> </tr> <tr> <td>Pubic Symphysis Force</td> <td>N</td> <td>6000</td> <td>2610.524</td> </tr> </tbody> </table>						Measurement Description	Driver ATD (ES-2re)			Units	IARV	Result	Head Injury Criteria (HIC36)		1000	382.412	Maximum Thoracic Rib Deflection	mm	44	20.362	Total Abdominal Force	N	2500	837.165	Pubic Symphysis Force	N	6000	2610.524
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Pubic Symphysis Force	N	6000	2610.524																									
The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.																												
17. Key Words Compliance Testing Side Impact Protection Pole Test ES-2re SID-IIs				18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services (TIS) Room E12-100 East Bldg. 1200 New Jersey Ave. Washington, D.C. 20590 Telephone No. (202) 366-2588																								
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This side impact test was conducted as part of the FY 2024 FMVSS 214 Side Impact Protection Compliance Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. 693JJ923D000043. The purpose of this test was to evaluate side impact protection in a 2024 Lincoln Nautilus Hybrid 5 Door SUV. The side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure, TP-214P-01 dated September 2012.

SUMMARY

A rigid pole side impact test was conducted on a 2024 Lincoln Nautilus Hybrid 5 Door SUV. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 30.91 km/h. The test was conducted by Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on June 7, 2024. Pre-test and post-test photographs of the test vehicle and side impact dummy (ES2re) are included in Appendix I of this report.

One Part 572U (ES-2re) dummy was placed in the driver designated seating position according to instructions specified in the TP-214P-01 Test Procedure, dated September 2012. The side impact event was documented by nine High Speed Cameras and one real time camera.

The ES2re male dummy was instrumented accordingly:

- 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

Appendix II contains the dummy response data. Dummy configuration and performance verification data can be found in Appendix IV of this report. Appendix V identifies all serial numbers, manufacturers, and calibration dates for test equipment, dummy sensors, potentiometers, and load cells used to collect data during the test.

Injury readings for the ES2re dummy were recorded as follows:

INJURY READINGS

Measurement Description	Driver ATD (ES2re)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	382.412
Upper Rib Deflection	mm	44	19.893
Mid Rib Deflection	mm	44	16.220
Lower Rib Deflection	mm	44	20.362
Abdominal Load (front)	N		223.742
Abdominal Load (mid)	N		281.460
Abdominal Load (rear)	N		359.006
Total Abdominal Force	N	2500	837.165
Pubic Symphysis Force	N	6000	2610.524

SECTION 2
OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

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

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024

TEST VEHICLE INFORMATION AND OPTIONS

Make	Lincoln	Anti-Lock Brakes (ABS)	Yes
Model	Nautilus Hybrid	All-Wheel Drive (AWD)	Yes
Body Style	SUV	Traction Control System (TCS)	Yes
VIN	5LMPJ8J46RJ797253	Electric Stability Control (ECS)	Yes
Body Color	White Platinum Metallic	Curtain Airbags	Yes
Engine Displacement (L)	2.0	Torso Airbags – Front Seats	Yes
Type / No. Cylinders	I4	Torso Airbags – Rear Seats	No
Engine Placement	Transverse	Combination/Head Torso Bag	No
Transmission Type	Automatic	Pelvic Airbag – Front Seats	No
Transmission Speeds	CVT	Pelvis Airbag – Rear Seats	No
Overdrive	Yes	Knee Airbag – Driver	Yes
Final Drive	All Wheel Drive	Knee Airbag – Front Passenger	Yes
Odometer Reading (mi)	171	Seat Belt Pretensioners – Front Seats	Yes
		Seat Belt Pretensioners – Rear Seats	Yes
		Seat Belt Load Limiter – Front Seats	Yes
		Seat Belt Load Limiter – Rear Seats	No
		Tire Pressure Monitoring System (TPMS)	Yes
		Tilt Steering Wheel	Yes
		Automatic Door Locks (ADL)	Yes
		Power Window Auto-reverse	Yes
		Power Seats	Yes
		Other Safety Restraint	N/A

DATA FROM CERTIFICATION LABEL

Manufactured By	Ford Motor Co.	GVWR (kg)	2619
Date of Manufacture	11/2023	GVWR Front (kg)	1320
Vehicle Type	MPV	GVWR Rear (kg)	1390

VEHICLE SEATING AND WEIGHT CAPACITY DATA

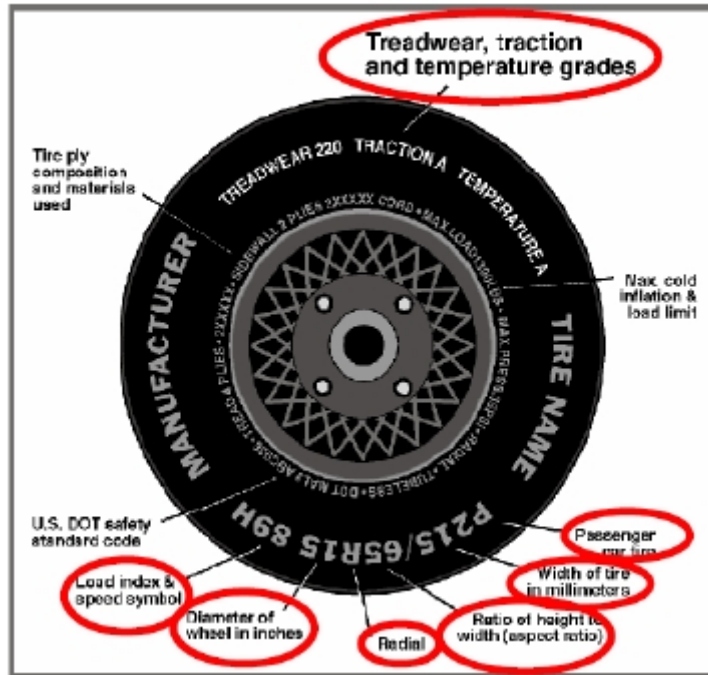
Measured Parameter	Front	Rear	Third	Total
Type of Seats (Bench or Bucket)	Bucket	Split Bench	N/A	
Designated Seating Capacity (DSC)	2	3	N/A	5
Capacity Weight (VCW) (kg)				408
Cargo Weight (RCLW) (kg)				67.8

**DATA SHEET NO. 2
VEHICLE TIRE INFORMATION**

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024

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



VEHICLE TIRE INFORMATION

Tire Placard	Front	Rear
Recommended Cold Pressure (kPa)	230	230
Recommended Tire Size	255/60R19	255/60R19
Tire Sidewall	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Tire Size on Vehicle	255/60R19	255/60R19
Tire Manufacturer Model	Goodyear	Goodyear
Tire Name	Eagle Touring	Eagle Touring
Tire Type	All Season	All Season
Tire Width	255	255
Aspect Ratio	60	60
Radial	Yes	Yes
Wheel Diameter	19	19
Load Index / Speed Symbol	109 H	109 H
Treadwear	400	400
Traction Grade	A	A
Temperature Grades	A	A

**DATA SHEET NO. 3
GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	206	206	206	206
Tire Placard	kPa	230	230	230	230

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			Fully Loaded			As Tested		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	572	472		604	534		602	525	
Right	kg	584	457		596	501		611	491	
Ratio	%	55.4	44.6		53.7	46.3		54.4	45.6	
Totals	kg	1156	929	2085	1200	1035	2235	1213	1016	2229

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	2085	(A)
Weight of Test Dummy	kg	81	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	67.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	2233.8	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	As Delivered	Fully Loaded	As Tested
Driver Door Sill Angle	Deg	+0.05	0.00	0.00
Front Passenger Sill Angle	Deg	-0.45	-0.85	-0.65
Front Bumper-Line Angle	Deg	+0.20	+0.25	+0.20
Rear Bumper-Line Angle	Deg	+0.20	+0.40	+0.25

ND = Nose Down (-), NU = Nose Up (+), LD = Left Down (-), LU = Left Up (+)

CALCULATION OF VERTICAL IMPACT REFFERENCE LINE

Measured Parameter	Units	Value
Test Vehicle Wheelbase	mm	2896
Vertical Impact Reference Line Aft of Front Axle	mm	1292

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	11
Spare Tire	19
Jack	3
Ballast (if any)	40.8

DATA SHEET NO. 4
SEAT AND SEAT BELT ANCHORAGE ADJUSTMENT DATA

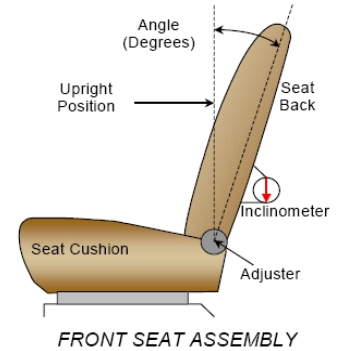
Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
Test Facility: Calspan

NHTSA No.: C20240202
Test Date: 06/07/2024

SEAT BACK ANGLE ADJUSTMENT

The driver and passenger seat backs are positioned to the manufacturer's designated angle provided in the Form 1.

	Units	Seat Back Angle
Driver Seat	degrees	3.0
Front Passenger Seat	degrees	3.0



SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	SCR P Height Position	SCR P Height (mm)		
			Rearmost	Mid-Fore / Aft	Forward-Most
Driver Seat	13.1	Max	51.6	55.0	58.0
		Mid	26.4	30.3	33.6
		Min	1.2	5.7	9.2
Front Passenger Seat	11.85	Max	-	-	-
		Mid	-	-	-
		Min	10.2	15.8	20.6

SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Placed in Position #	
	mm	Detents*	mm	Detents*
Driver Seat	254	Power	127	Power
Front Passenger Seat	254	Power	127	Power

SEAT BELT ANCHORAGE ADJUSTMENT

Seat	Total # of Positions	Placed in Position #
Driver Seat	4 (0-3)	Uppermost

HEAD RESTRAINT ADJUSTMENT

Seat	Total # of Positions	Placed in Position #
Driver Seat	4 (0-3)	Uppermost

**DATA SHEET NO. 5
FUEL SYSTEMS AND STEERING WHEEL POSITION DATA**

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024

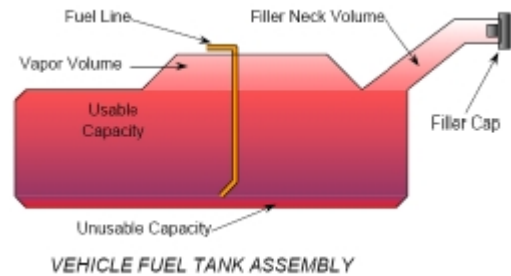
FUEL TANK CAPACITY DATA

Description	Liters
Usable Capacity of (Form No.1)	87.2
Usable Capacity of (Owner's Manual)	76
92 - 94% of Usable Capacity	69.9 - 71.4
Actual Amount of Solvent Used in Test	71.2

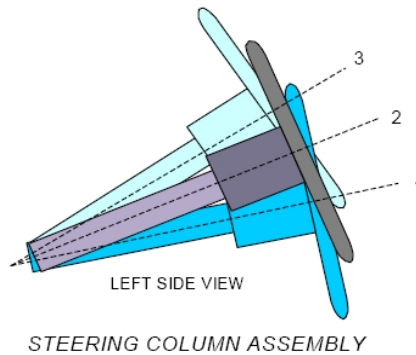
FUEL PUMP

Describe the operation of the fuel pump.

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



STEERING COLUMN POSITIONS

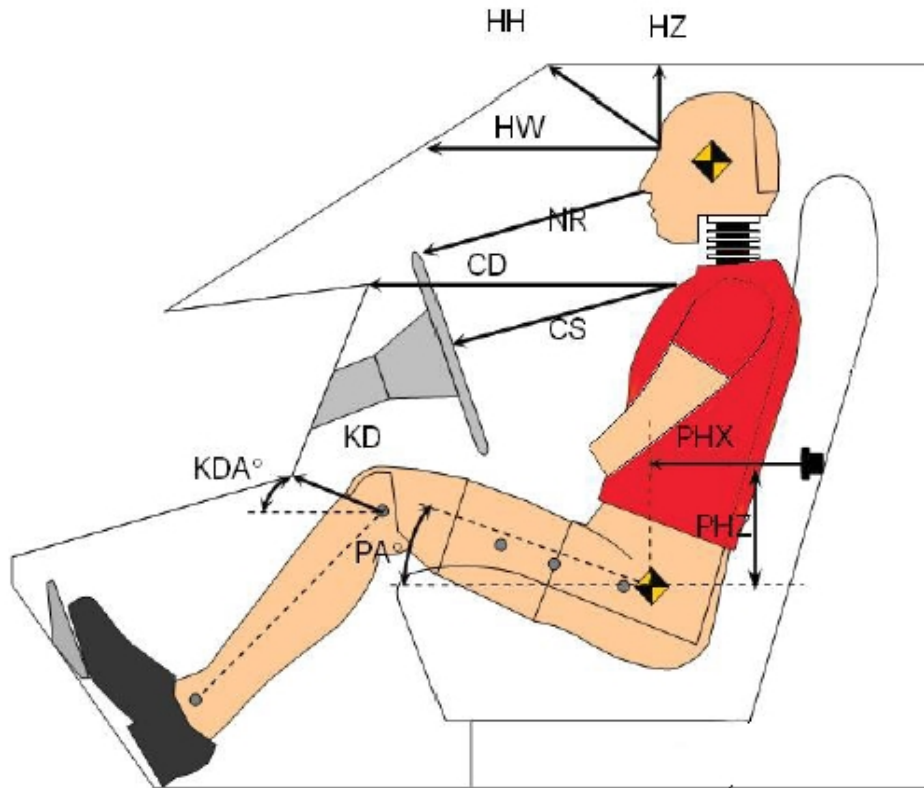


	Degrees	Fore / Aft Position (mm)
Lowermost - Position No. 1	24.2	
Geometric center - Position No. 2	26.7	
Uppermost - Position No. 3	29.2	
Telescoping Steering Wheel Travel		65
Test Position	26.7	32.5

**DATA SHEET NO. 6
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS**

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024



Left Side View

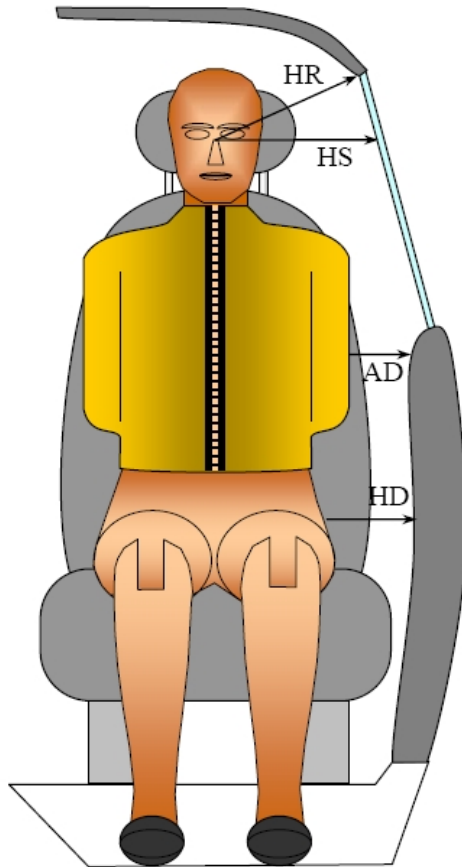
DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Description	Driver	
		Length (mm)	Angle (°)
HH	Head to Header	385	
HW	Head to Windshield	684	
HZ	Head to Roof Liner	189	
NR	Nose to Rim	422	
CD	Chest to Dash	583	
CS	Chest to Steering Wheel	344	
KD(L) / KDA(L)°	Left Knee to Dash	208	23.4
KD(R) / KDA(R)°	Right Knee to Dash	212	28.1
PAX°	Pelvic Tilt Angle (X-Axis)		22.9
PAY°	Pelvic Tilt Angle (Y-Axis)		-0.4
PHX	Hip Point to Striker (X-Axis)	165	
PHZ	Hip Point to Striker (Z-Axis)	89	

**DATA SHEET NO. 7
DUMMY LATERAL CLEARANCE DIMENSIONS**

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024



FRONT VIEW OF DUMMY

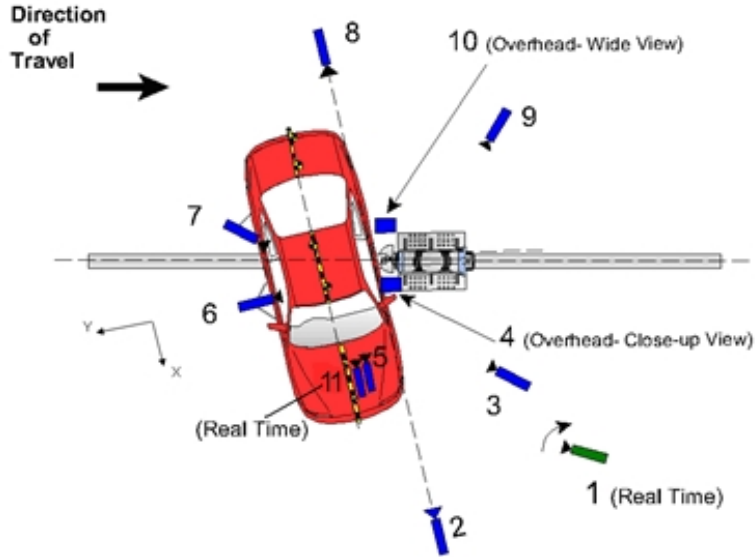
DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver
HR	Head to Side Header	mm	222
HS	Head to Side Window	mm	357
AD	Arm to Door	mm	105
HD	H-Point to Door	mm	163

**DATA SHEET NO. 8
LOCATION OF CAMERA**

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024



CAMERA LOCATIONS AND DATA

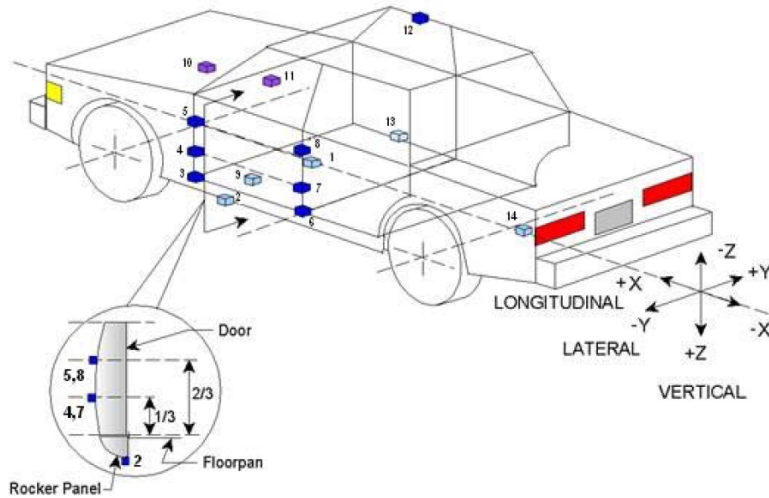
No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Real-time (24 - 30 fps) pan view of impact				Zoom	30
2	Front ground level - impact view	7656	-326	-1489	28	1000
3	Impact side 45° - forward pole view	4106	1013	-1559	24	1000
4	Overhead Close-up view of impact	0	0	-8992	28	1000
5	Onboard - dummy front view				25	1000
6	Onboard - dummy side view				12.5	1000
7	Onboard - dummy rear oblique view				12.5	1000
8	Rear ground level - impact view	-8476	-511	-1472	28	1000
9	Impact side 45° - rearward pole view	-3530	4034	-1522	24	1000
10	Overhead wide - view of impact	0	-407	-8992	16	1000

Notes: Reference - From Point of Impact for X and Y; from Ground for Z
 +X = Forward of vehicle, +Y = Right of vehicle, +Z = Down
 * All measurements accurate to ± 6 mm. Vehicle is at a 75° angle to the rigid pole.

DATA SHEET NO. 9
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
Test Facility: Calspan

NHTSA No.: C20240202
Test Date: 06/07/2024



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2264	-2	471
2	Left Floor Sill	2996	-655	449
3	A-Pillar Sill	3377	-636	444
4	A-Pillar Low	3496	-632	626
5	A-Pillar Mid	3243	-660	1228
6	B-Pillar Sill	2285	-640	438
7	B-Pillar Low	2310	-700	841
8	B-Pillar Mid	2305	-678	1163
9	Seat	2669	-562	490
10	Engine	4172	150	981
11	Firewall	3825	172	971
12	Roof	2513	626	1660
13	Right Floor Sill	2979	653	461
14	Rear Deck	870	-5	537

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

DATA SHEET NO. 10
TEST VEHICLE ACCELEROMETER DATA SUMMARY

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024

Loc. No	Description	Axes	Units	Positive Direction		Negative Direction	
				Max	Time (ms)	Max	Time (ms)
1	Vehicle CG	X	g	6.19	90.05	-6.94	40.15
	Vehicle CG	Y	g	28.82	40.10	-11.48	44.85
	Vehicle CG	Z	g	15.45	29.95	-16.62	21.55
	Vehicle CG Resultant	N/A	g	31.57	39.90	0.04	-19.60
2	Floor Sill (Left)	Y	g	47.88	21.65	-20.17	26.40
3	A Pillar Sill	Y	g	62.96	25.45	-49.81	56.15
4	A Pillar Low	Y	g	27.98	20.90	-3.80	24.95
5	A Pillar Mid	Y	g	79.90	24.25	-37.63	29.80
6	B Pillar Sill	Y	g	70.50	30.05	-57.98	55.40
7	B Pillar Low	Y	g	106.23	73.30	-114.48	19.55
8	B Pillar Mid	Y	g	121.00	45.80	-159.63	122.80
9	Seat	Y	g	36.90	18.00	-20.02	51.45
10	Engine Top	X	g	2.89	159.40	-21.15	50.25
	Engine Top	Y	g	20.83	49.55	-2.64	206.40
11	Firewall	Y	g	14.84	46.60	-1.02	255.40
12	Roof	Y	g	46.20	44.35	-6.07	52.90
13	Floor Sill (Right)	Y	g	18.45	20.85	-2.01	299.60
14	Rear Deck	X	g	1.74	135.90	-6.72	88.70
	Rear Deck	Y	g	17.69	42.85	-2.12	179.35

DATA SHEET NO. 11
DUMMY INJURY RESPONSE DATA
(Subpart U, ES-2re)

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV NHTSA No.: C20240202
 Test Facility: Calspan Test Date: 06/07/2024

Dummy Serial No. DG5348

Description	Axes	Positive Direction		Negative Direction	
		MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (g)					
Longitudinal	X	12.63	172.95	-28.24	55.40
Lateral	Y	49.06	61.35	-8.64	127.60
Vertical	Z	25.42	51.85	-2.40	31.25
Resultant	N/A	56.50	57.15		
HIC36 (t1, t2)	N/A	382.41		t1 = 46.25	t2 = 73.00
THORAX DEFLECTION (mm)					
Upper Rib	Y	19.89	58.10	-0.44	23.45
Middle Rib	Y	16.22	60.00	-0.65	212.15
Lower Rib	Y	20.36	58.95	-1.16	224.45
ABDOMINAL FORCES (N)					
Front	Y	223.74	51.75	-24.53	23.45
Middle	Y	281.46	55.00	-8.27	222.90
Rear	Y	359.01	54.85	-10.46	152.80
SUM	N/A	837.16	53.50		
PELVIS FORCES (N)					
Pubic Symphysis	Y	81.55	170.30	-2610.52	58.30

Reference: Positive Direction - Longitudinal (X) = forward
 - Lateral (Y) = to right
 - Vertical (Z) = down

**DATA SHEET NO. 12
POST-TEST OBSERVATIONS**

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024

IMPACT POINT DATA

Measured Parameter	Units	Value
Vertical Impact Ref Line - Aft of Front Axle, Intended Impact Pt	mm	1292
Actual Impact Point - Aft of Front Axle	mm	1292
Difference	mm	0

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Driver Seat Dummy (ES2-re)
Face Contact	Curtain Airbag
Top of Head Contact	Curtain Airbag, Side Header
Left Side of Head Contact	Curtain Airbag
Back of Head Contact	Curtain Airbag, Side Header, Headrest
Left Shoulder Contact	Door Trim, B-Pillar Trim
Upper Torso Contact	Seat back, Torso/Pelvis Airbag
Lower Torso Contact	Seat back, Torso/Pelvis Airbag
Left Knee Contact	Door Trim
Left Hip Contact	Torso/Pelvis Airbag, Door Trim

POST-TEST DOOR PERFORMANCE

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

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

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	B-Pillar & C-Pillar Buckled
Sill Separation	Minor separation in impact zone
Windshield Damage	Cracked throughout, separation along A-Pillar & roof
Side Window Damage	Driver window cracked throughout
Other Notable Effects	None

**DATA SHEET NO. 12 ... (CONTINUED)
POST-TEST OBSERVATIONS**

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024

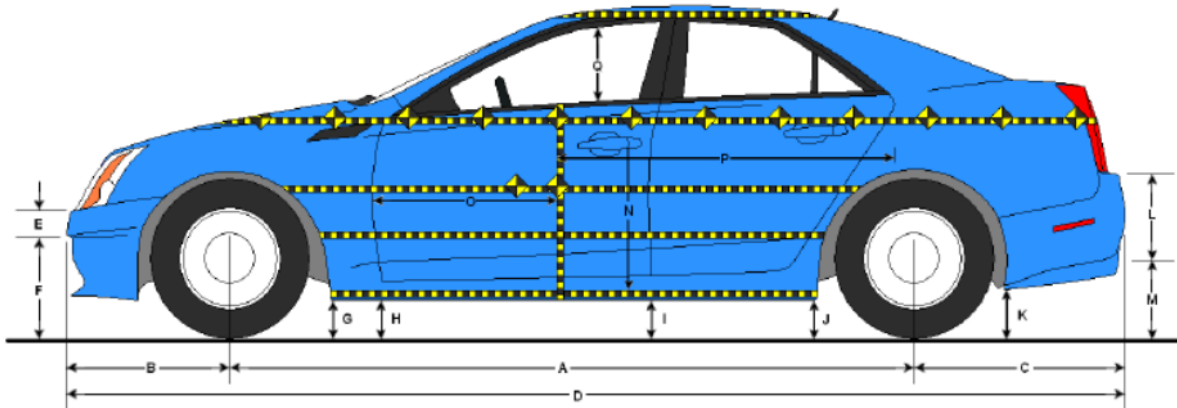
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Front Occupant	
	Mounted	Deployed
Front Airbag	Yes	No
Knee Airbag	Yes	No
Curtain Airbag	Yes	Yes
Side Airbag 2 - Torso/Pelvis Airbag	Yes	Yes
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	Yes
Other		

DATA SHEET NO. 13
VEHICLE PRE TEST AND POST TEST MEASUREMENTS

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024



LEFT SIDE VIEW

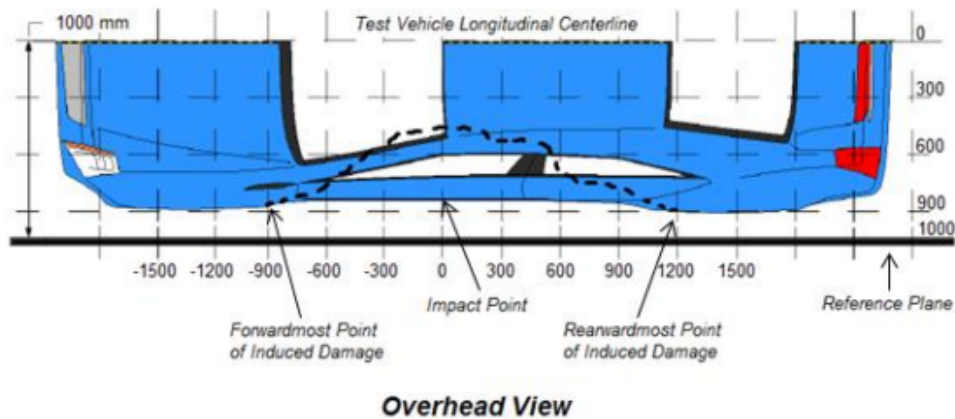
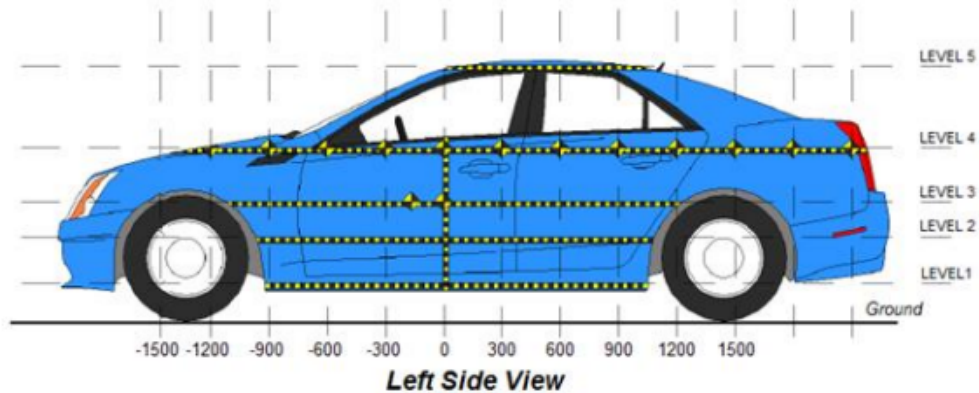
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

No.	Measurement Description	Pre-Test	Post-Test	Difference
A	Vehicle Wheelbase	2896	2847	-49
B	Front Axle to FSOV	963	993	29
C	Rear Axle to RSOV	1048	1045	-2
D	Total Vehicle Length at Centerline	4907	4885	-22
E	Front Bumper Thickness	140	140	0
F	Front Bumper Bottom to Ground	472	478	6
G	Sill Height at Front Wheel Well	253	265	12
H	Sill Height at Front Door Leading Edge	258	268	10
I	Sill Height at B Pillar	257	248	-9
J1	Sill Height at Rear Wheel Well	257	319	62
J2	Pinch Weld Height at Rear Wheel Well	311	278	-33
K	Sill Height Aft of Rear Wheel Well	271	264	-7
L	Rear Bumper Thickness	110	110	0
M	Rear Bumper Bottom to Ground	513	498	-15
N	Sill Height to Window Bottom Sill	839	837	-2
O	Front Door Leading Edge to Impact CL	798	730	-68
P	Rear Door Trailing Edge to Impact CL	1426	1353	-73
Q	Front Window Opening	431	408	-23
R	Right Side Length	4798	4794	-4
S	Left Side Length	4797	4755	-42
T	Vehicle Width at B-Pillars	1947	1867	-80

DATA SHEET NO. 14
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
Test Facility: Calspan

NHTSA No.: C20240202
Test Date: 06/07/2024



MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	371	247	0
2	Occupant H-Point	mm	697	292	0
3	Mid-Door	mm	777	298	0
4	Window Sill	mm	1114	288	0
5	Window Top	mm	1631	76	0

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. 14
VEHICLE EXTERIOR CRUSH MEASUREMENTS (CONTINUED)

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024

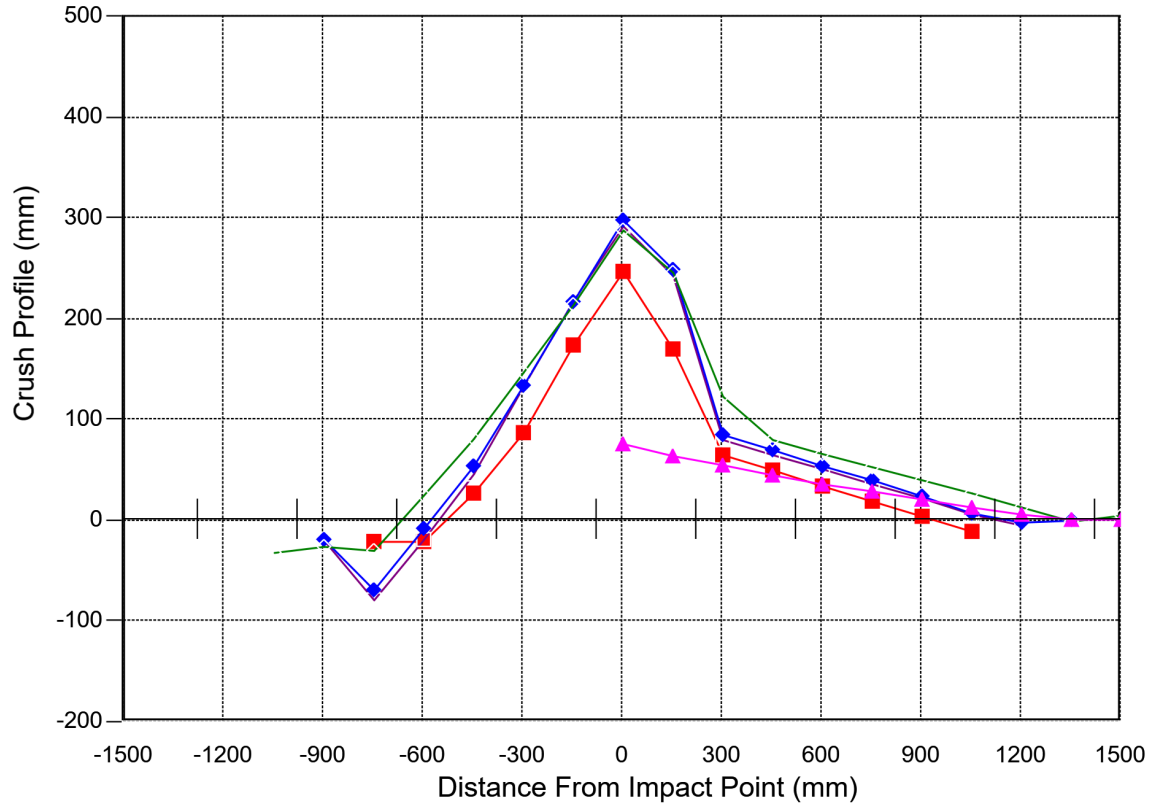
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1500															
-1350															
-1200															
-1050				862					894					-32	
-900		970	967	875			990	986	901			-20	-19	-26	
-750	938	967	966	886		959	1046	1035	916		-21	-79	-69	-30	
-600	928	963	965	918		949	982	973	893		-21	-19	-8	25	
-450	926	959	961	907		899	913	907	826		27	46	54	81	
-300	925	954	958	916		838	821	824	769		87	133	134	147	
-150	924	951	954	922		750	733	737	708		174	218	217	214	
0	924	948	951	927	632	677	656	653	639	556	247	292	298	288	76
150	925	946	948	931	637	755	703	699	685	573	170	243	249	246	64
300	924	946	947	932	638	859	866	862	809	583	65	80	85	123	55
450	923	949	949	934	637	873	884	879	854	592	50	65	70	80	45
600	922	954	952	934	636	888	903	898	868	600	34	51	54	66	36
750	920	959	957	930	635	901	923	917	877	606	19	36	40	53	29
900	916	965	962	928	632	912	943	938	888	611	4	22	24	40	21
1050	922	969	966	921	627	933	963	959	894	614	-11	6	7	27	13
1200		974	971	915	620		979	973	902	614		-5	-2	13	6
1350			975	907	610			975	908	609			0	-1	1
1500				899	591				894	590				5	1

DATA SHEET NO. 14
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS (CONTINUED)

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20240202
 Test Date: 06/07/2024



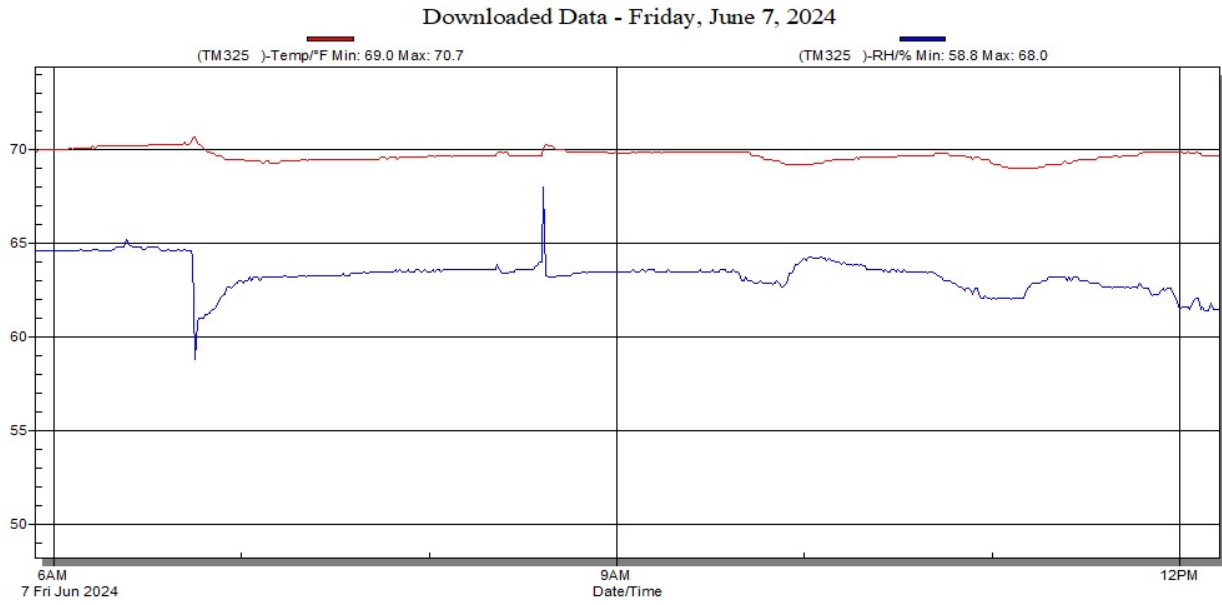
— LEVEL 1 Side Sill: 371 mm above ground	— LEVEL 2 H-Point: 697 mm above ground
— LEVEL 3 Mid Door: 777 mm above ground	— LEVEL 4 Window Sill: 1114 mm above ground
— LEVEL 5 Window Top: 1631 mm above ground	

Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO. 16
DUMMY / VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2024 Lincoln Nautilus Hybrid 5 Door SUV
Test Facility: Calspan

NHTSA No.: C20240202
Test Date: 06/07/2024



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

APPENDIX I
PHOTOGRAPHS

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5	Pre-Test Impacted Side View of Test Vehicle	I-5
6	Post-Test Impacted Side View of Test Vehicle	I-5
7	Pre-Test Left $\frac{3}{4}$ Front View of Vehicle and Pole	I-6
8	Pre-Test Left $\frac{3}{4}$ Rear View of Vehicle and Pole	I-6
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11	Pre-Test Dummy Through Opposite Window	I-8
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15	Pre-Test Dummy with Door Open	I-10
16	Pre-Test Dummy Shoulder and Door Top View	I-10
17	Post-Test Dummy Shoulder and Door Top View	I-11
18	Pre-Test Interior of Front Door Closed (through opposite window)	I-11
19	Post-Test Interior of Front Door Showing Dummy Impact Locations	I-12
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21	Post-Test Impact Zone Close-Up View	I-13
22	Post-Test $\frac{3}{4}$ Front View of Impact Zone	I-13
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24	Post-Test Close-Up View of Impact Point Target	I-14
25	Close-Up View of Vehicle's Certification Label	I-15
26	Close-Up View of Vehicle's Tire Placard Label	I-15



Figure A-1: Pre-Test Frontal View of Test Vehicle



Figure A-2: Post Test Frontal View of Test Vehicle



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

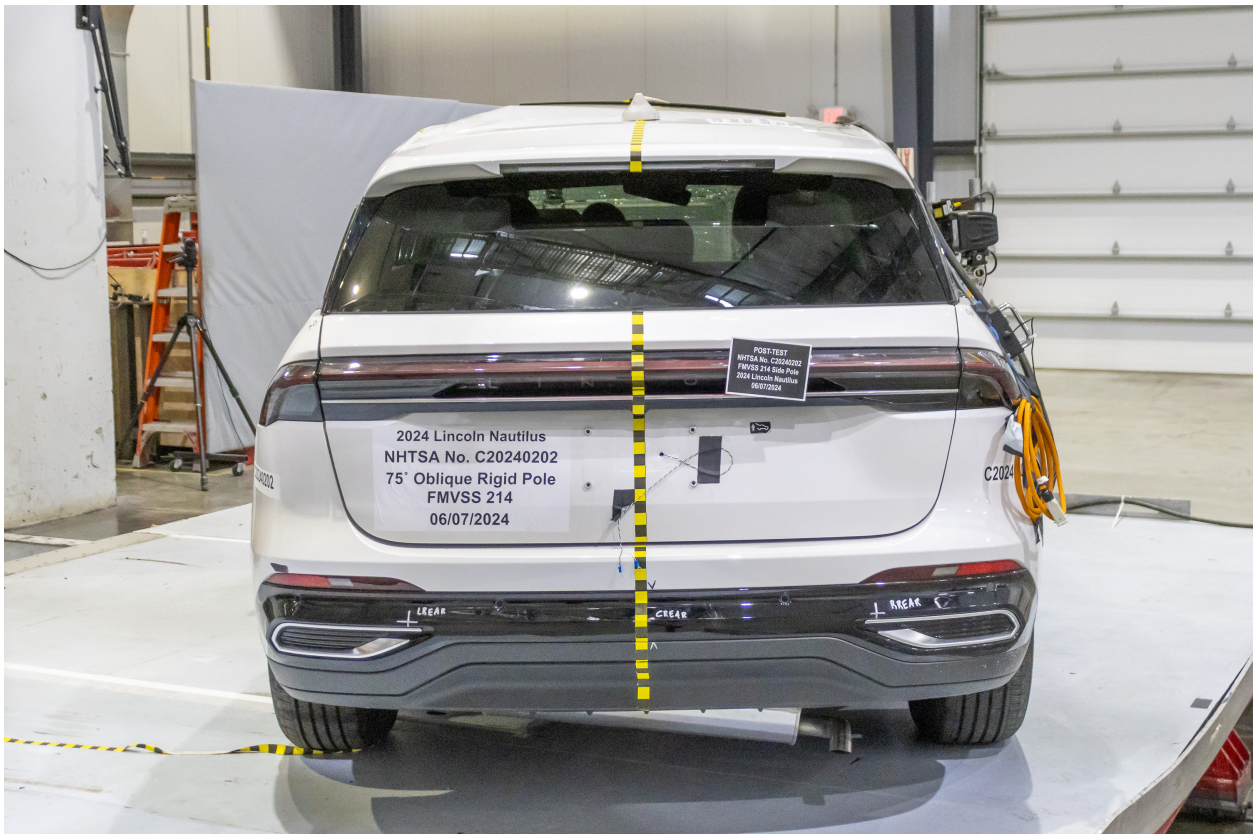


Figure A-4: Post-Test Rear View of Test Vehicle



Figure A-5: Pre-Test Impacted Side View of Test Vehicle



Figure A-6: Post-Test Impacted Side View of Test Vehicle



Figure A-7: Pre-Test Left $\frac{3}{4}$ Front View of Vehicle and Pole



Figure A-8: Pre-Test Left $\frac{3}{4}$ Rear View of Vehicle and Pole

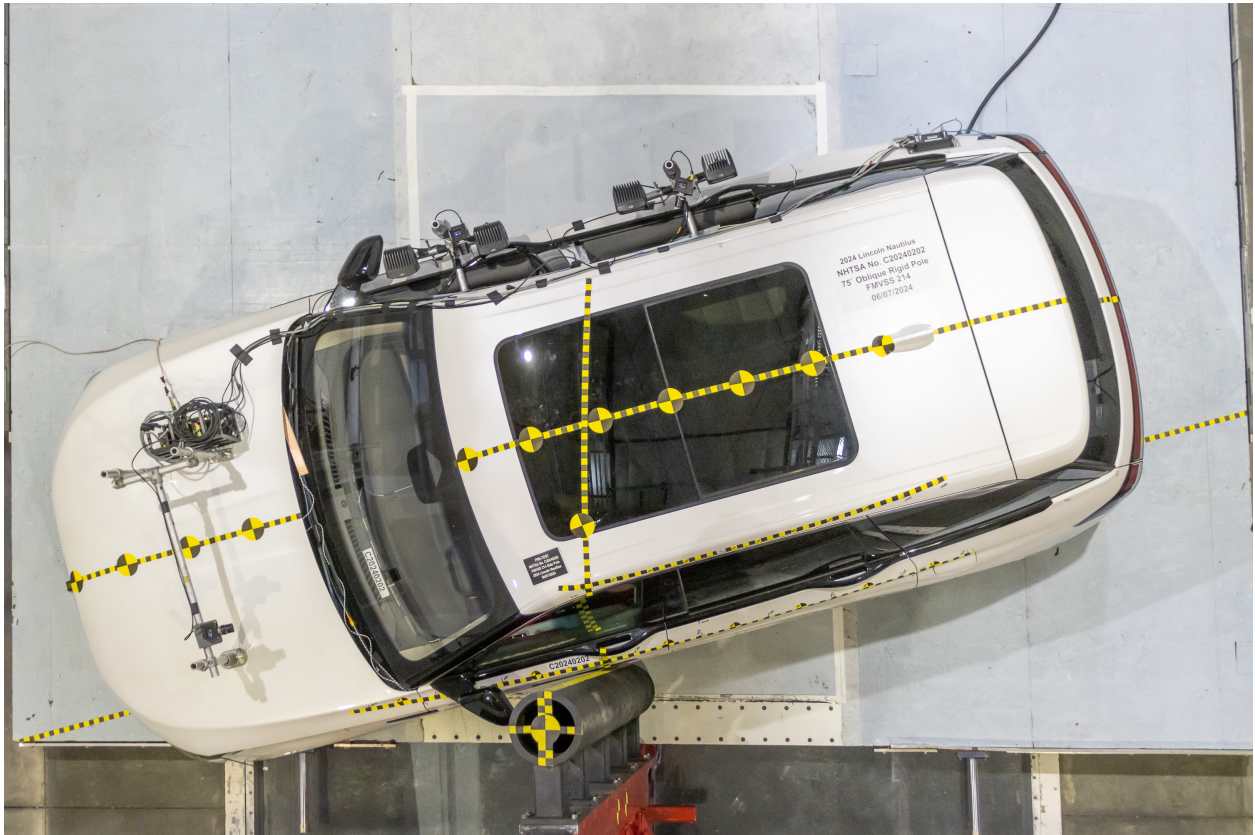


Figure A-9: Pre-Test Overhead View of Test Vehicle



Figure A-10: Post-Test Overhead View of Test Vehicle



Figure A-11: Pre-Test Dummy Through Opposite Window



Figure A-12: Post-Test Dummy Through Opposite Window



Figure A-13: Pre-Test Close-Up of Dummy with Door Closed (Impact Side)



Figure A-14: Post-Test Close-Up of Dummy with Door Closed (Impact Side)



Figure A-15: Pre-Test Dummy with Door Open



Figure A-16: Pre-Test Dummy Shoulder and Door Top View



Figure A-17: Post-Test Dummy Shoulder and Door Top View



Figure A-18: Pre-Test Interior of Front Door Closed (through opposite window)



Figure A-19: Post-Test Interior of Front Door Showing Dummy Impact Locations



Figure A-20: Impact Event



Figure A-21: Post-Test Impact Zone Close-Up View



Figure A-22: Post-Test ¾ Front View of Impact Zone



Figure A-23: Post-Test $\frac{3}{4}$ Rear View of Impact Zone



Figure A-24: Post-Test Close-Up View of Impact Point Target



Figure A-25: Close-Up View of Vehicle's Certification Label

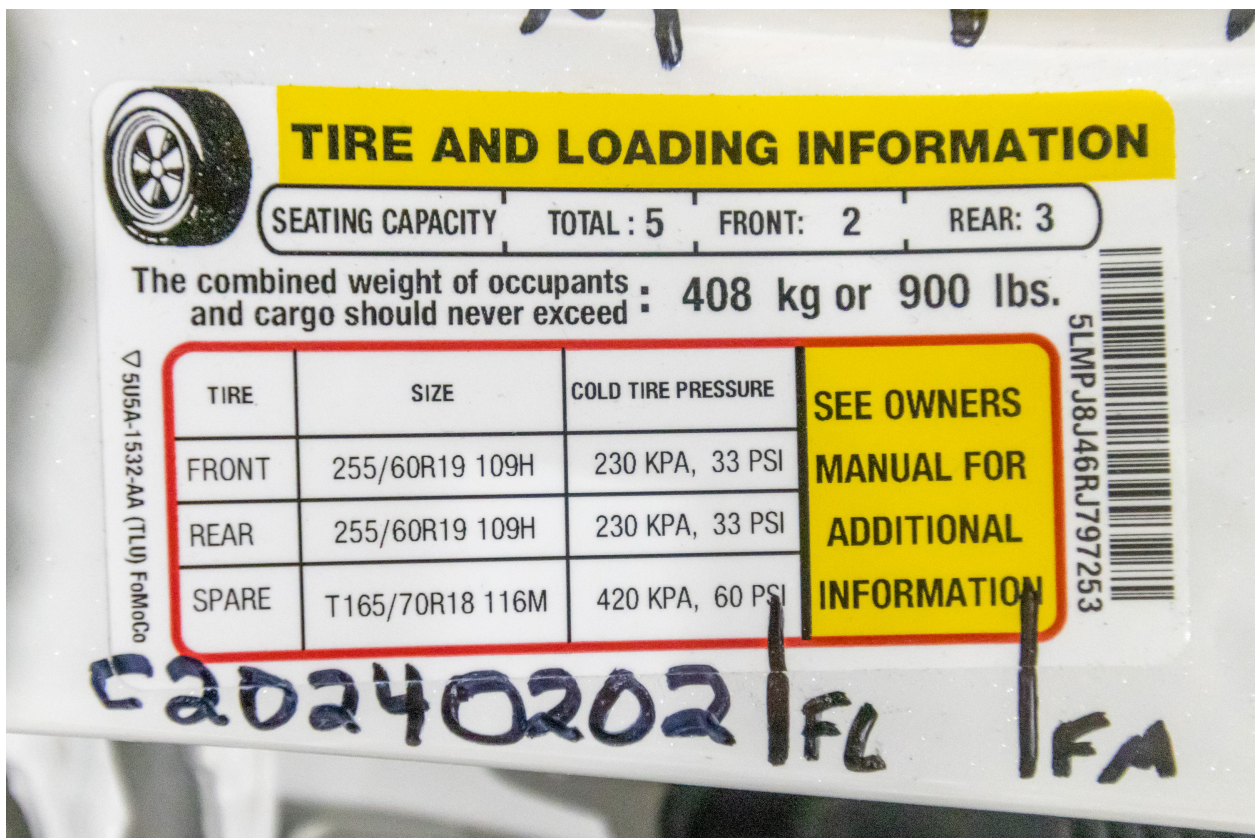


Figure A-26: Close-Up View of Vehicle's Tire Placard Label

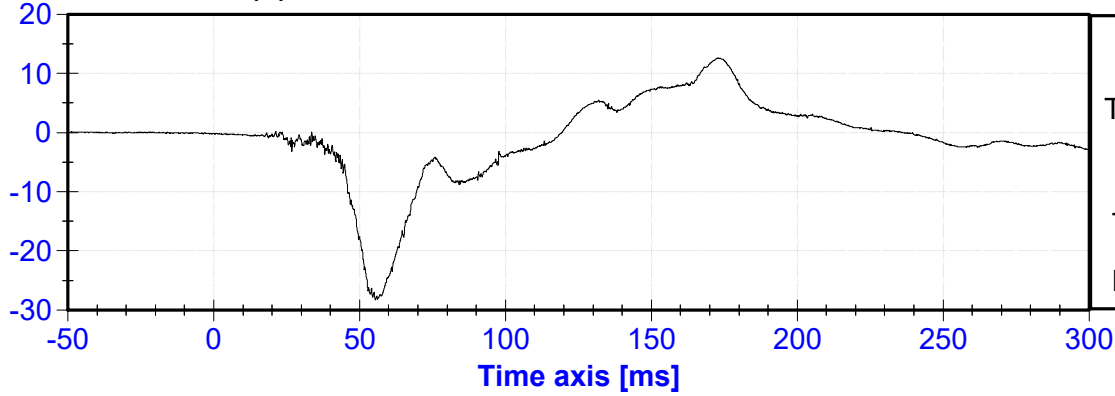
APPENDIX II
ES-2re DUMMY RESPONSE DATA TRACES

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1	ES-2re Head (X) Acceleration vs. Time	II-3
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4	ES-2re Head Resultant Acceleration vs. Time	II-3
5	ES-2re Head (X) Velocity vs. Time	II-4
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7	ES-2re Head (Z) Velocity vs. Time	II-4
8	ES-2re Upper Thorax Rib Deflection Rate vs. Time	II-4
9	ES-2re Upper Thorax Rib Deflection (Y) vs. Time	II-5
10	ES-2re Middle Thorax Rib Deflection Rate vs. Time	II-5
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12	ES-2re Lower Thorax Rib Deflection Rate vs. Time	II-5
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14	ES-2re Front Abdomen Force (Y) vs. Time	II-6
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17	ES-2re Sum of Abdomen Forces vs. Time	II-7
18	ES-2re Pubic Symphysis Force (Y) vs. Time	II-7

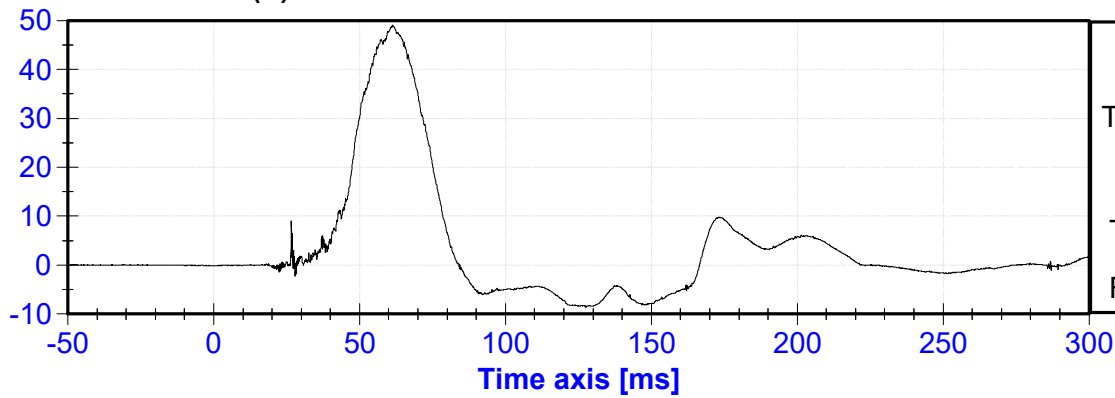
ACCELERATION [g's]

ES-2re Head (X) Acceleration vs. Time



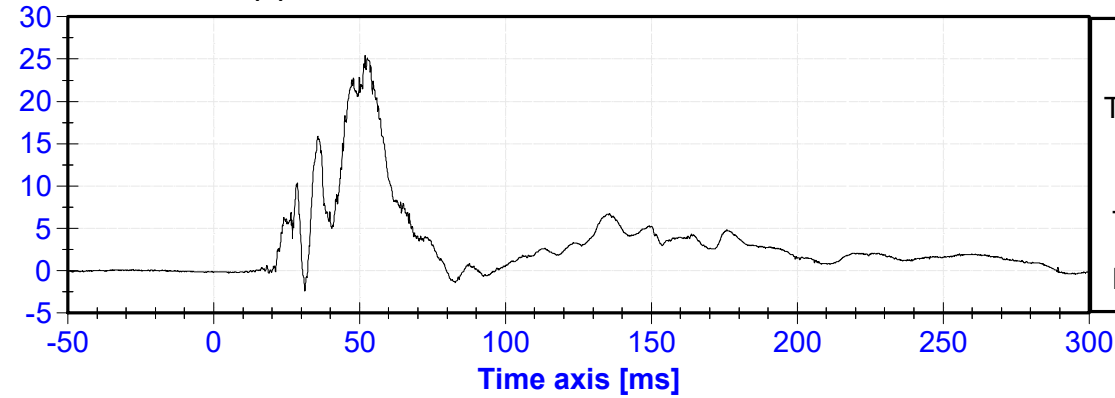
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ES-2re Head (Y) Acceleration vs. Time



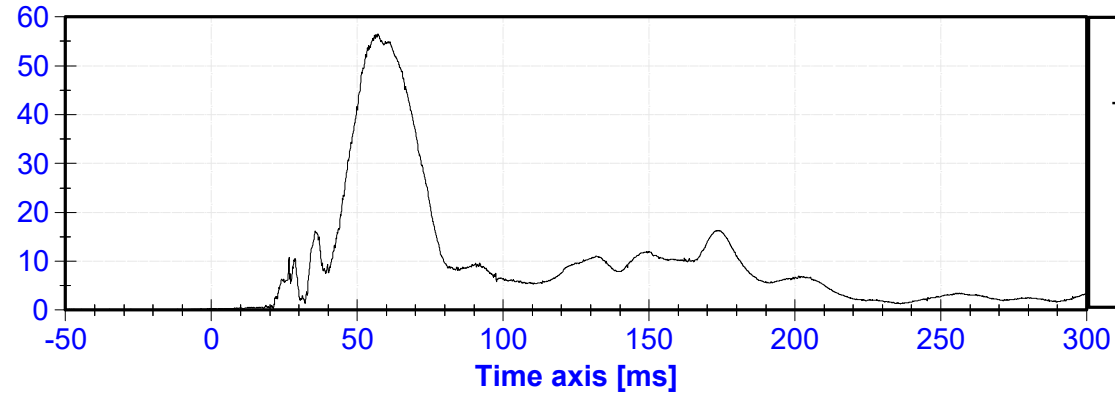
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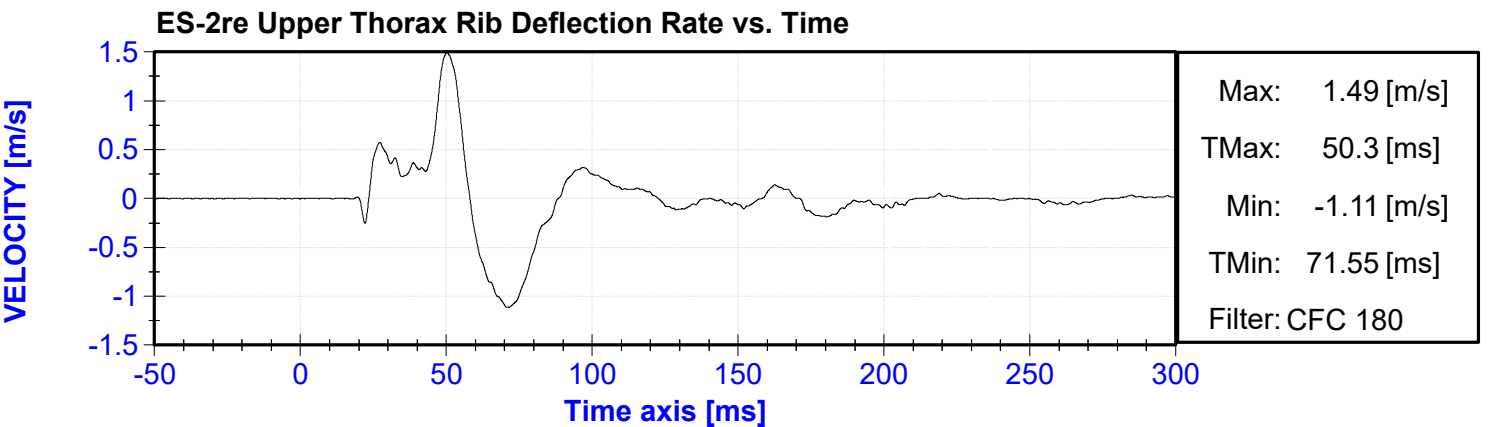
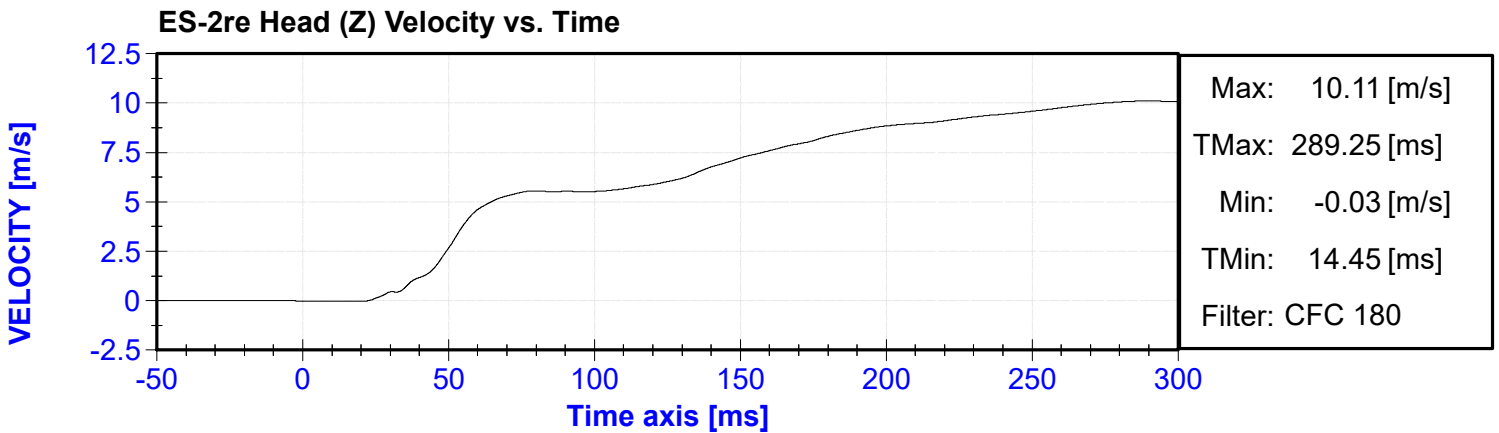
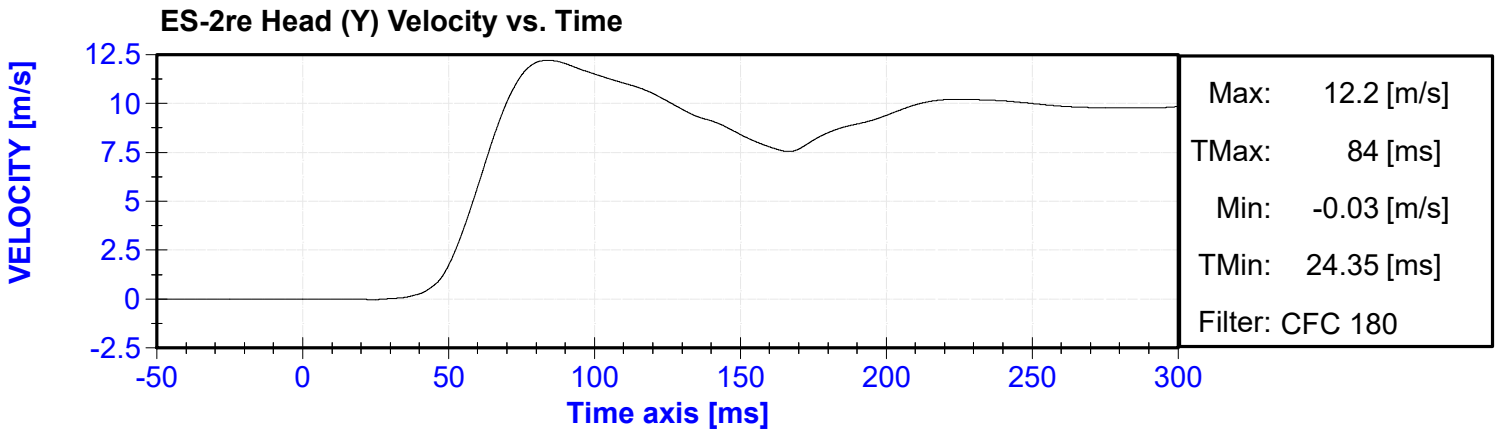
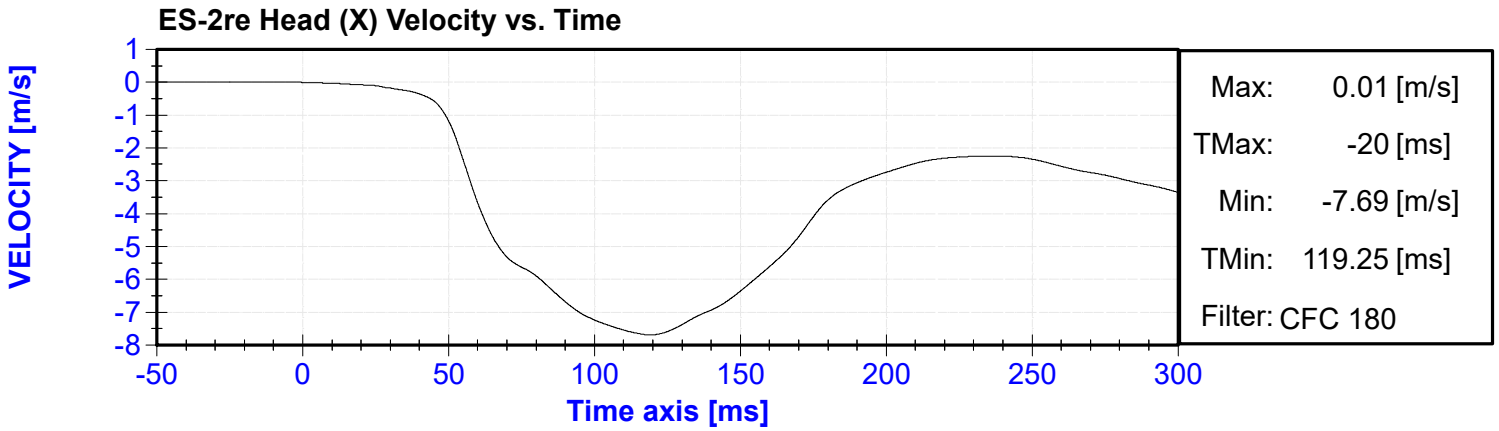
ES-2re Head (Z) Acceleration vs. Time

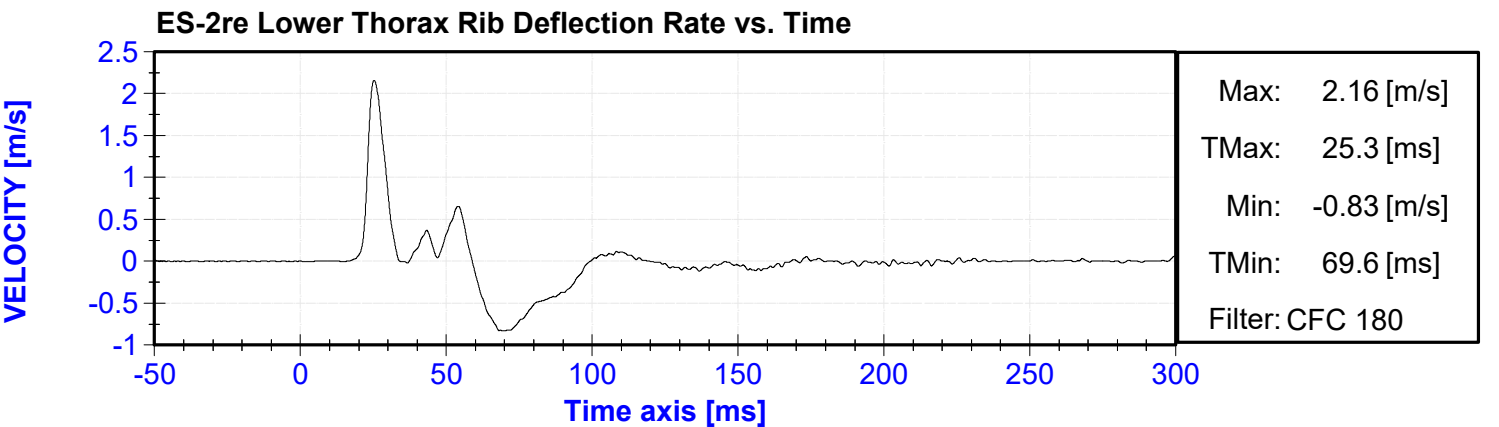
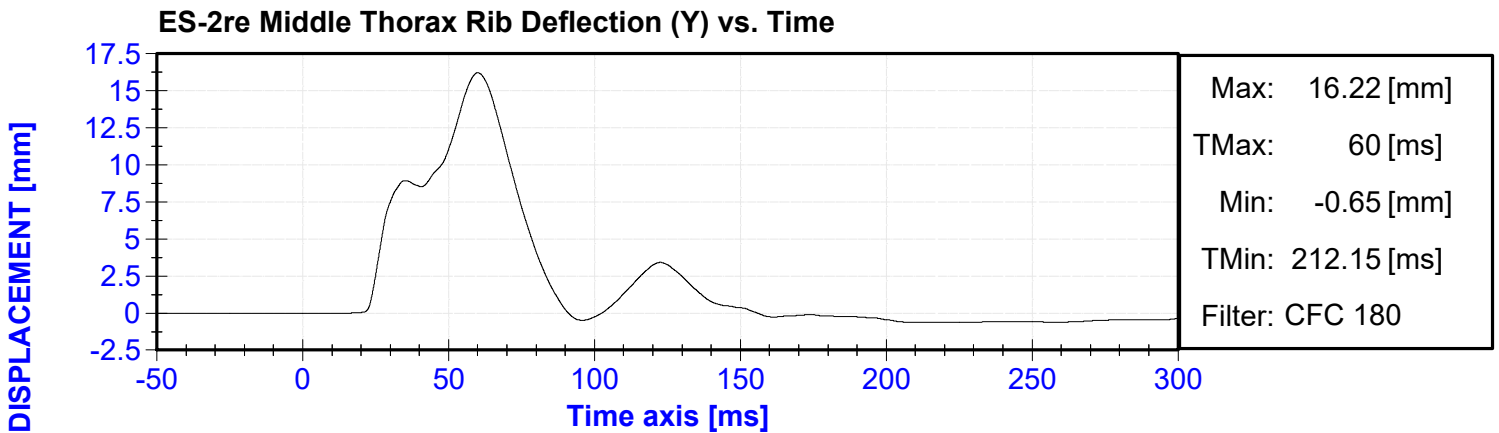
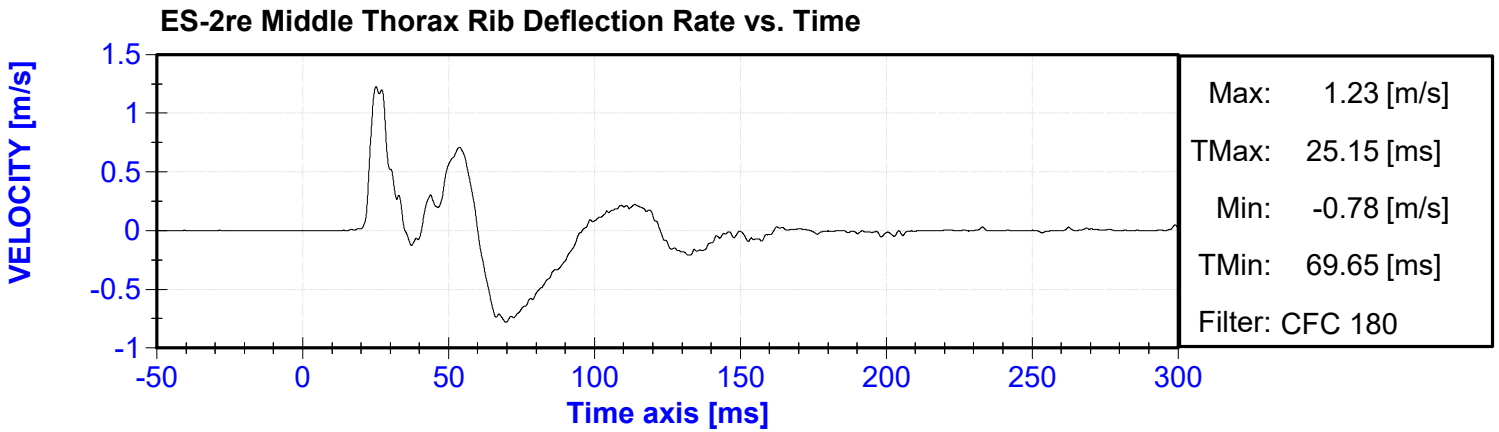
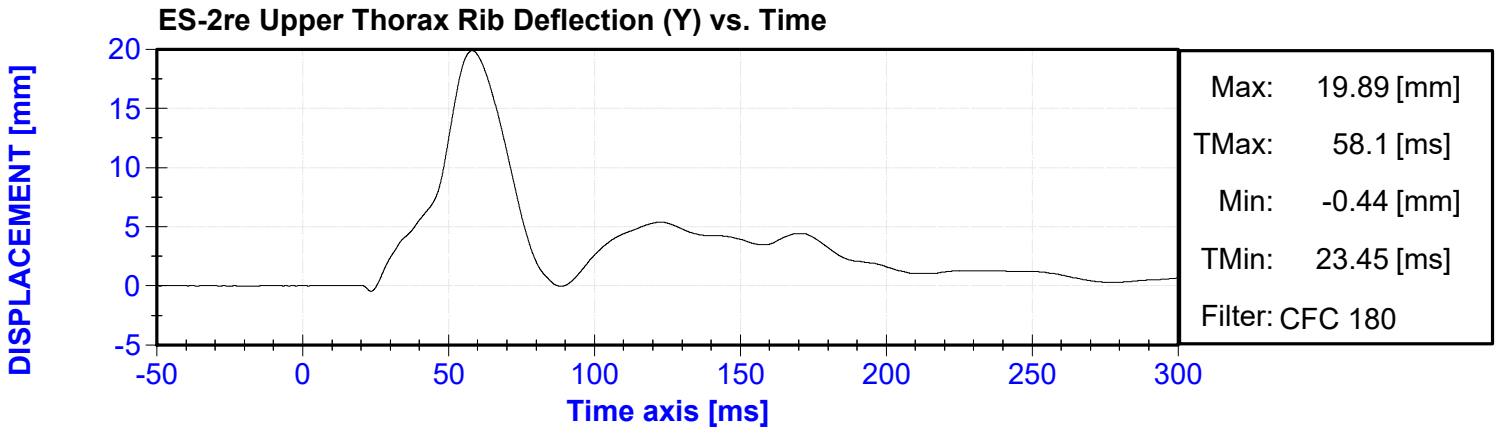


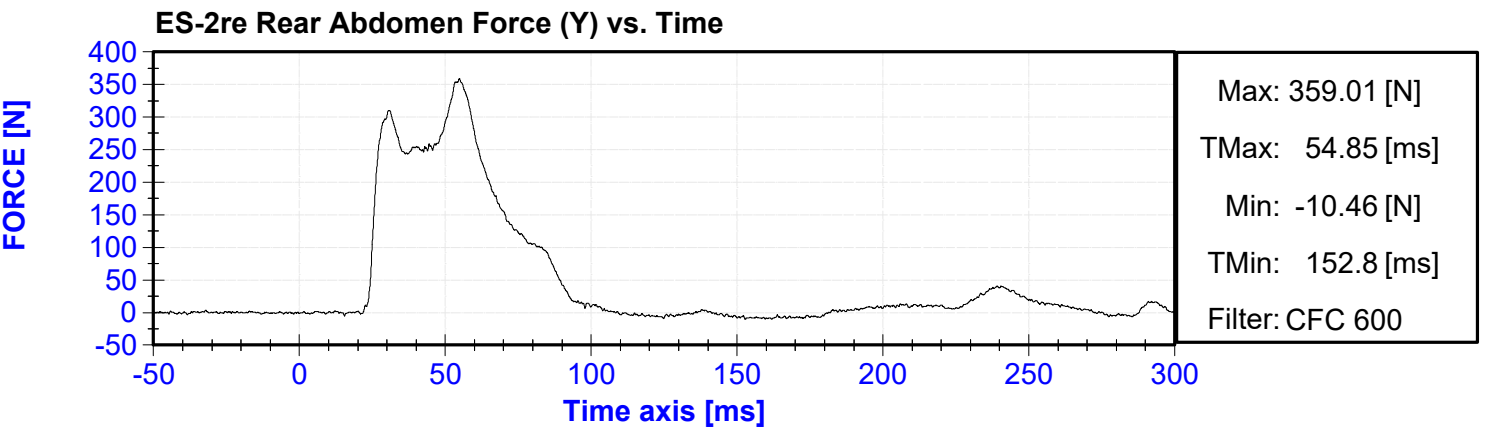
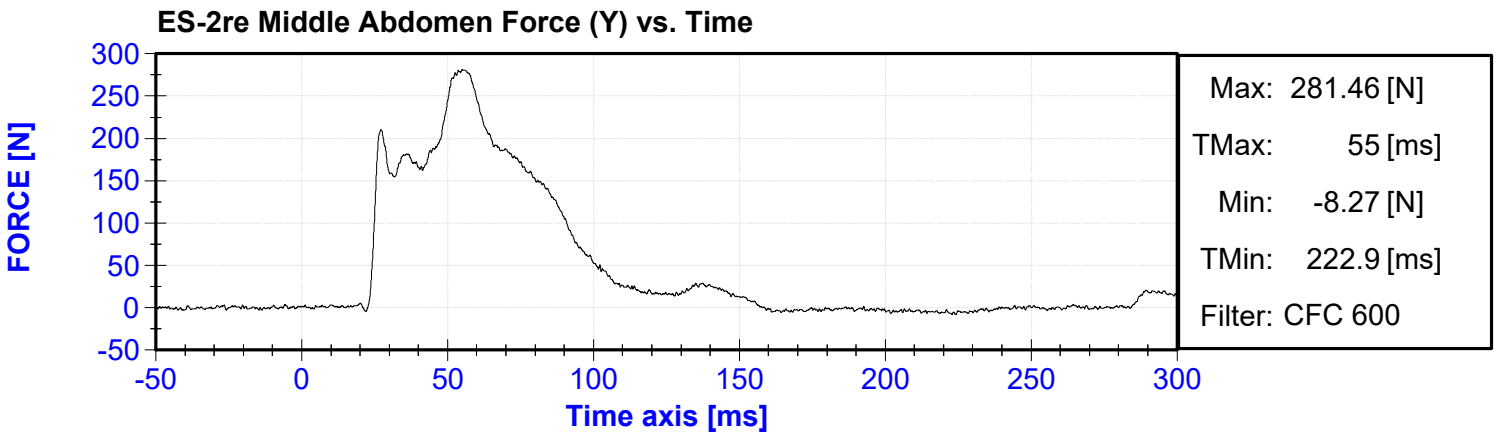
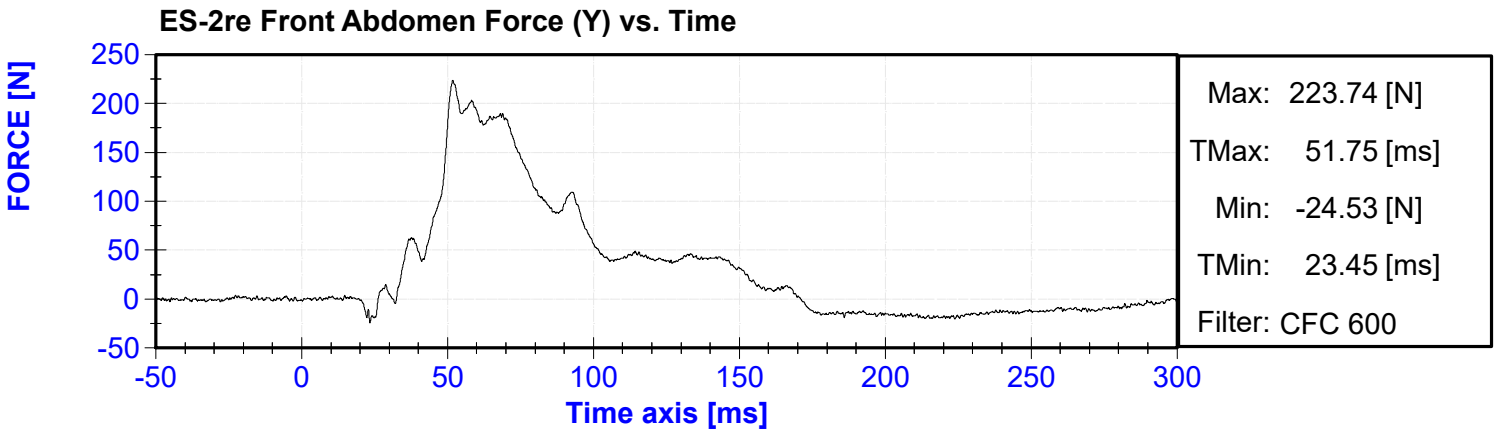
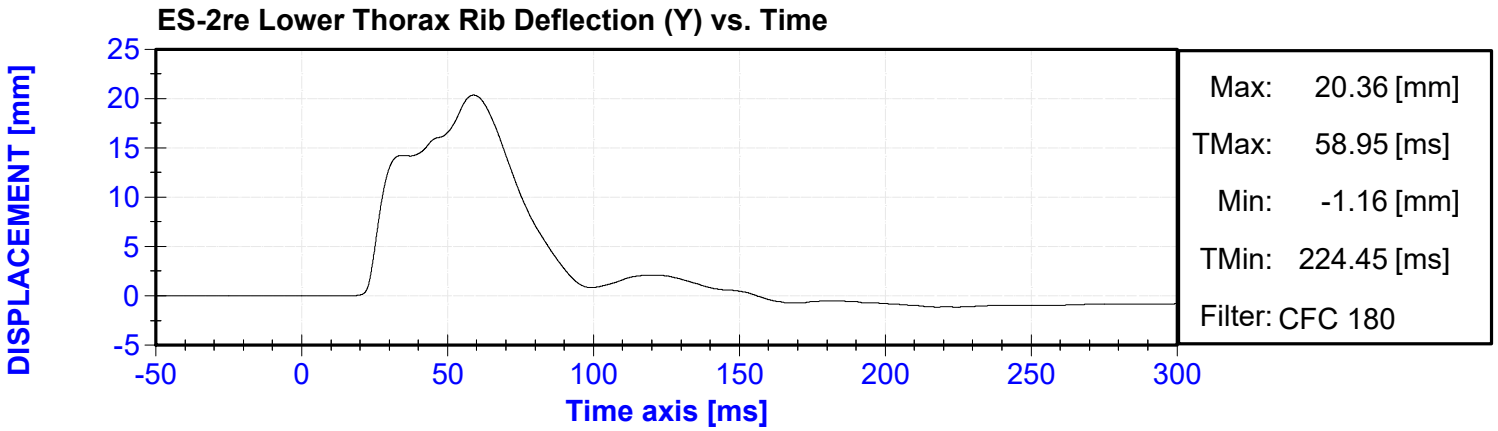
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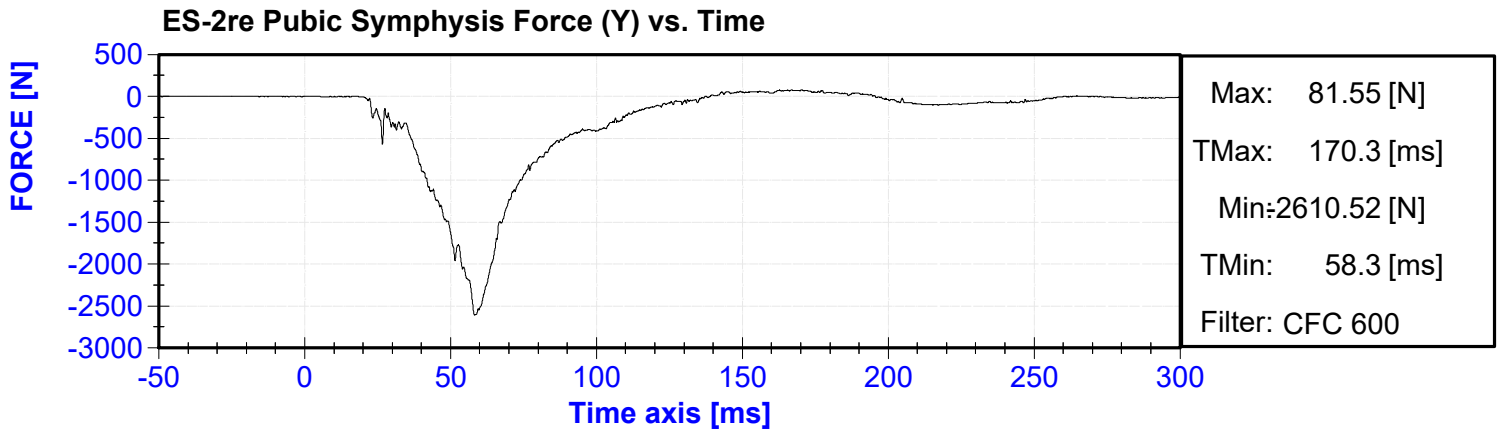
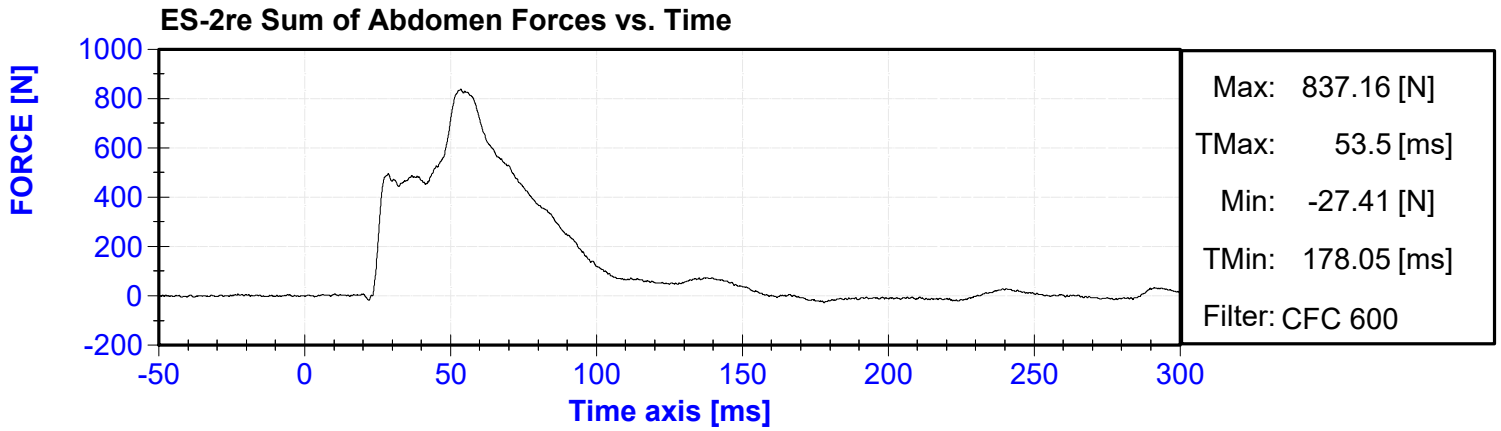
ES-2re Head Resultant Acceleration vs. Time







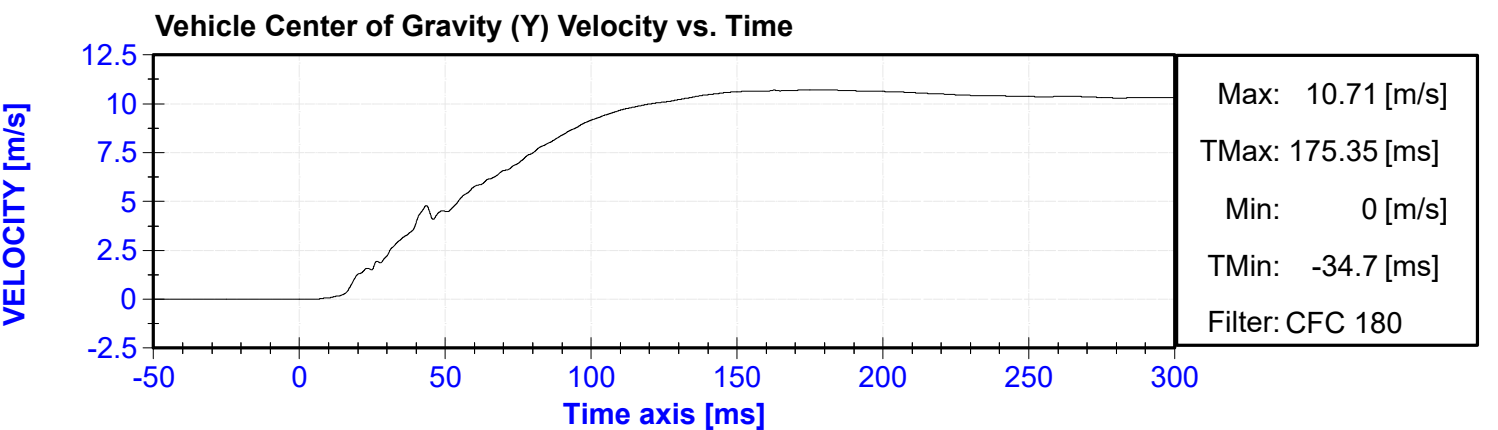
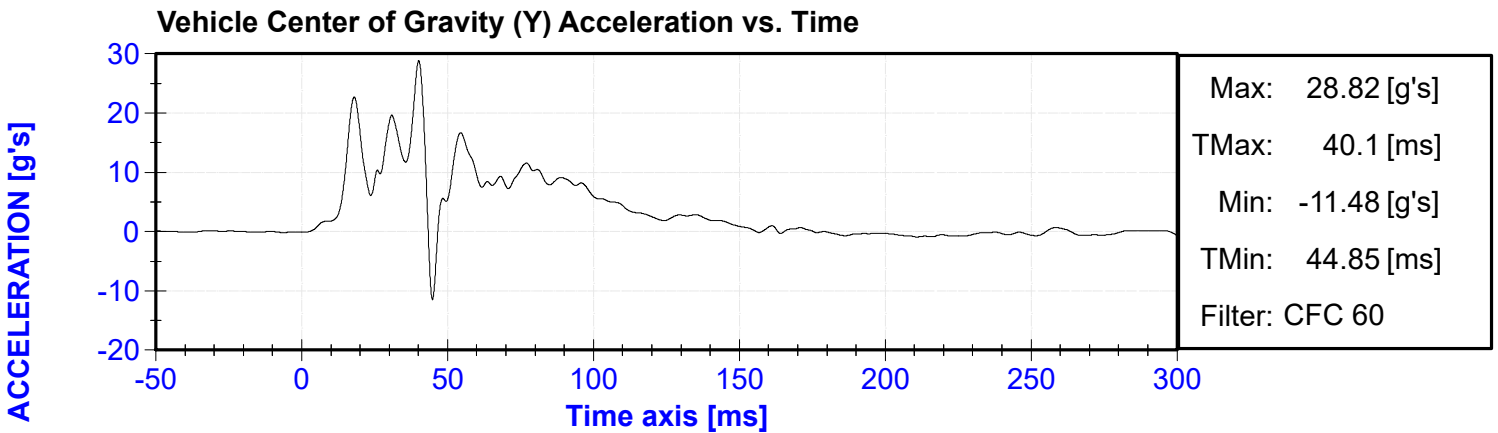
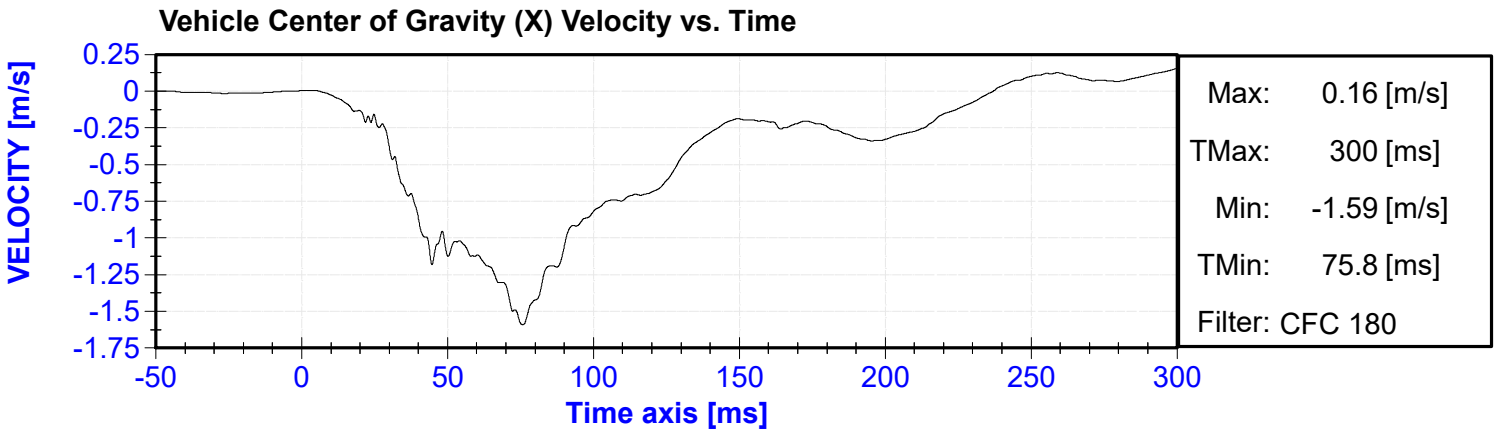
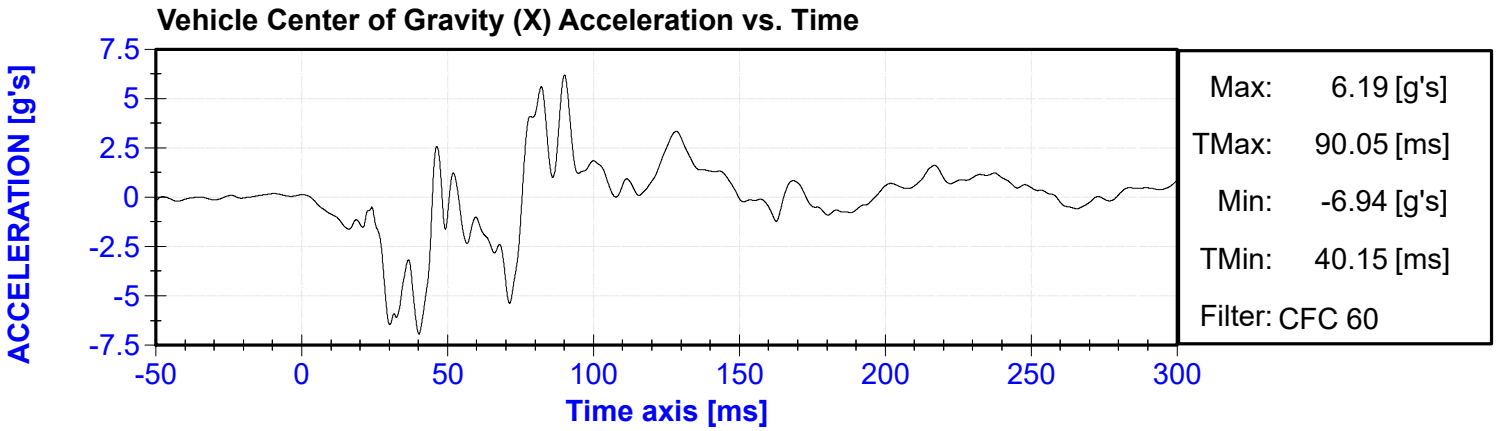


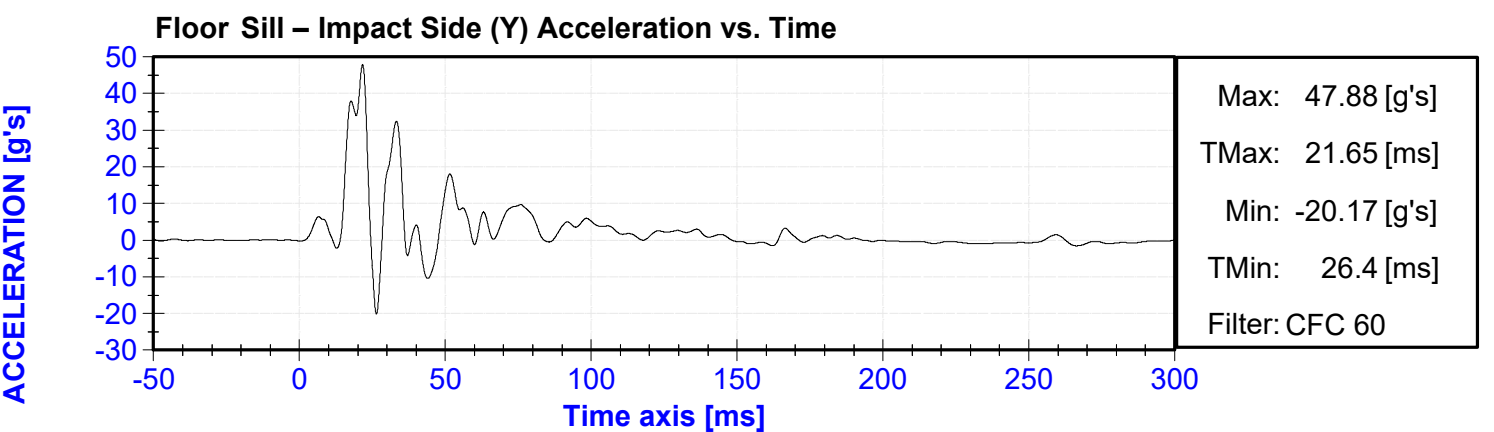
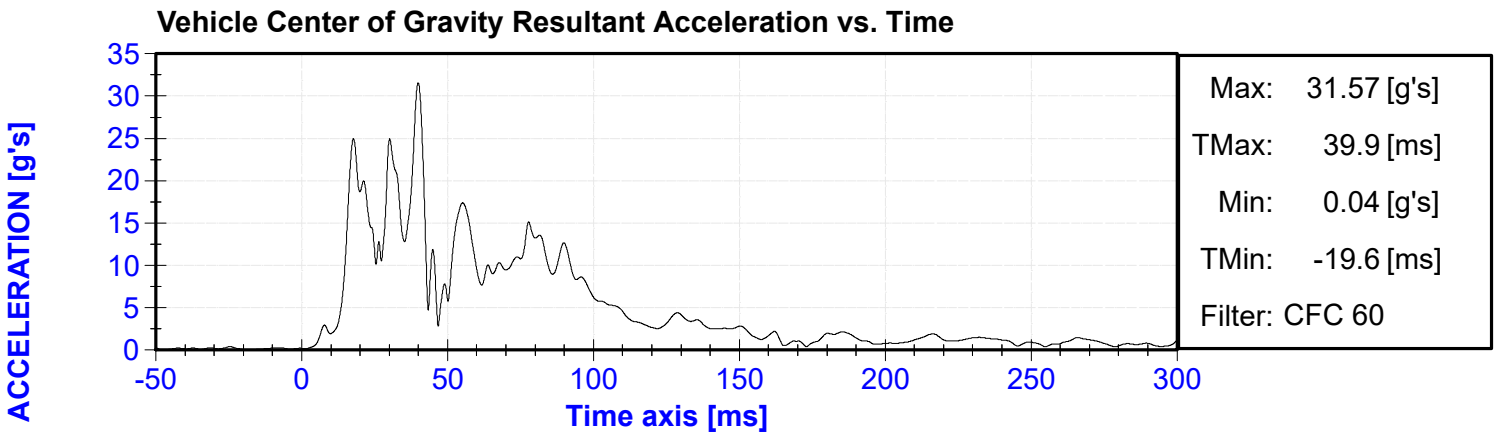
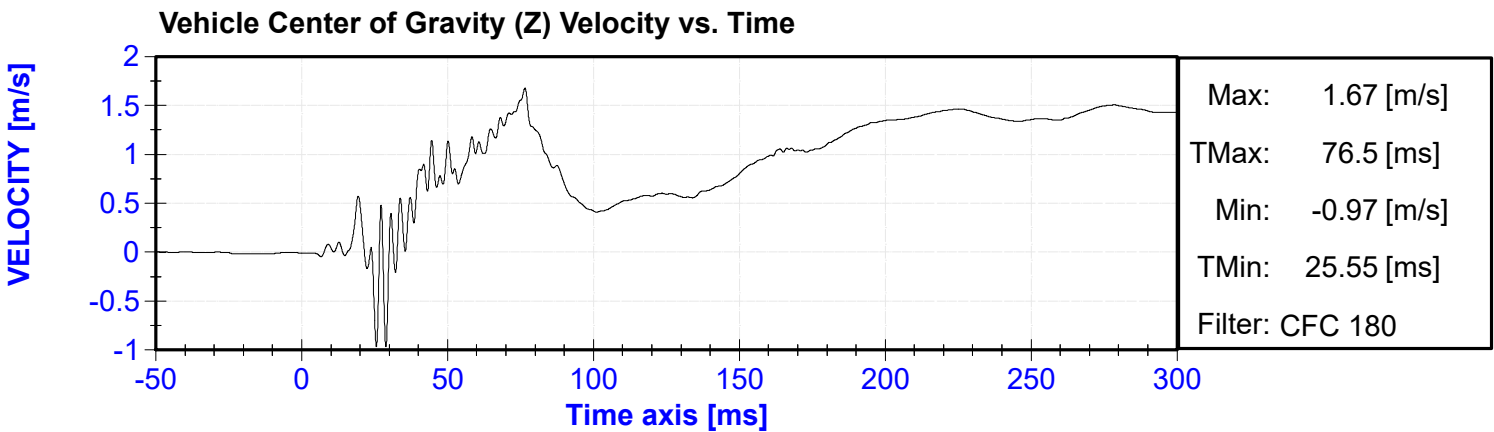
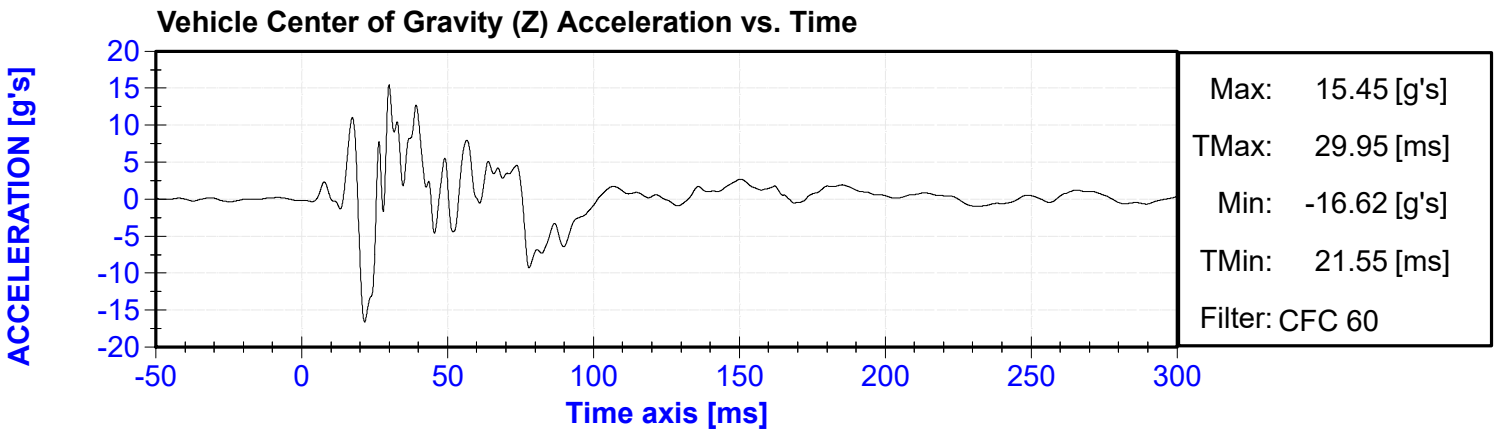


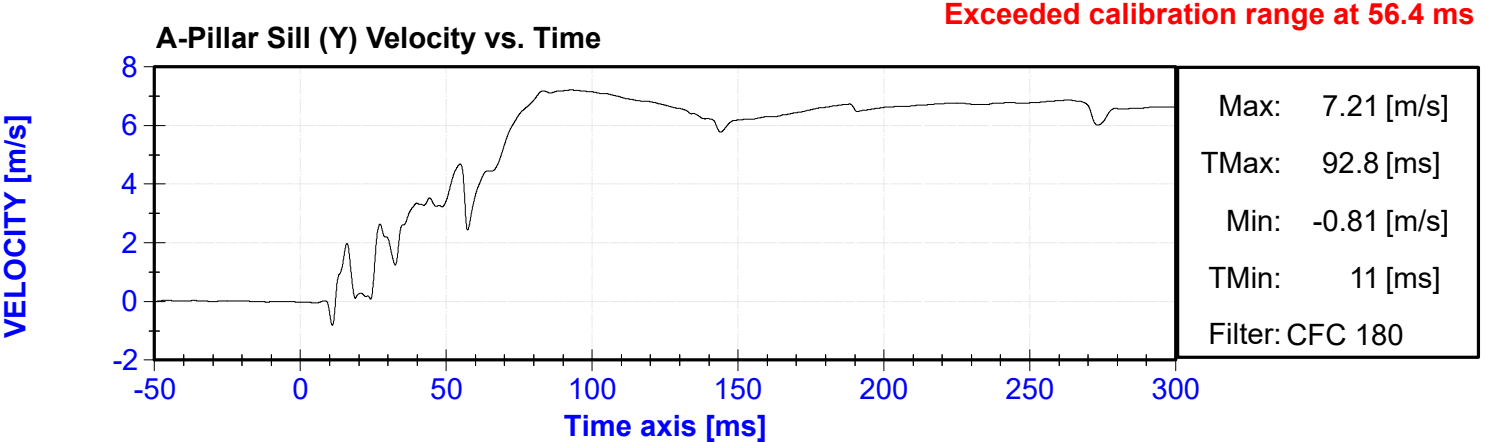
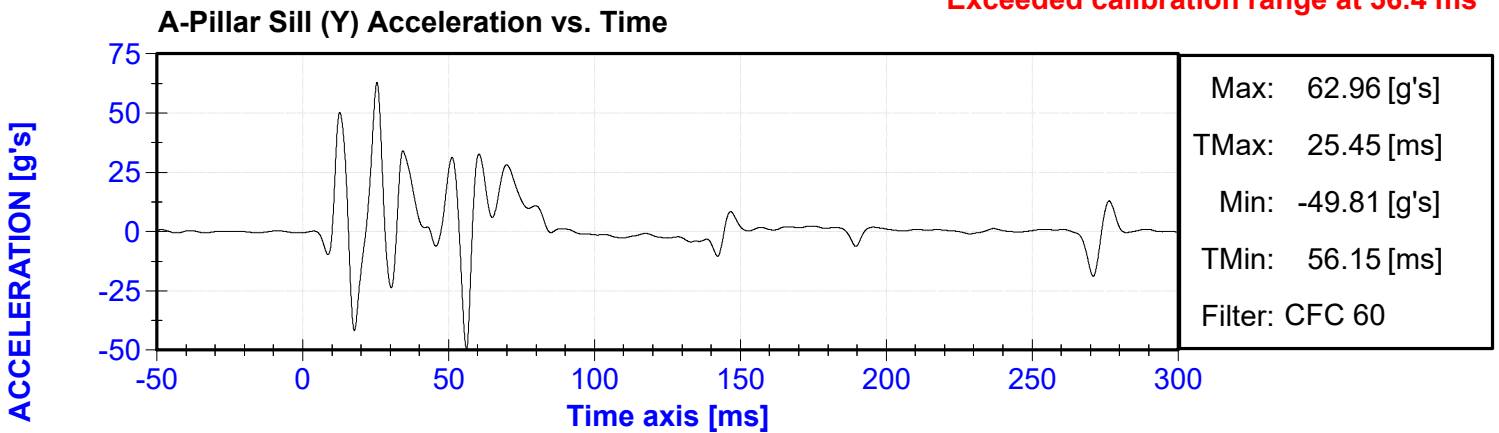
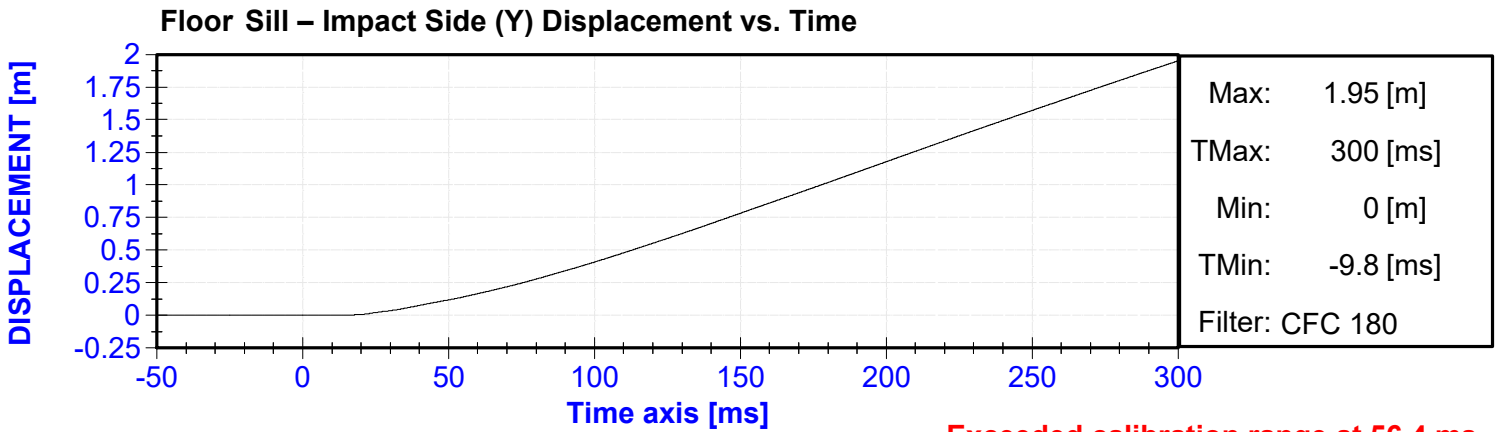
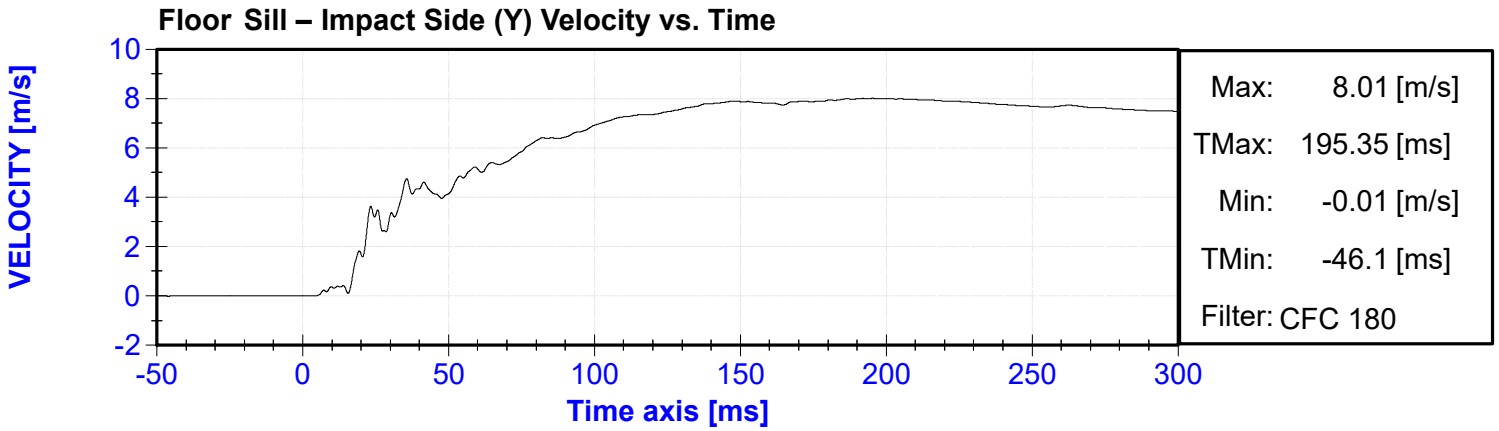
APPENDIX III
VEHICLE ACCELEROMETER RESPONSE DATA

Table of Data Plots

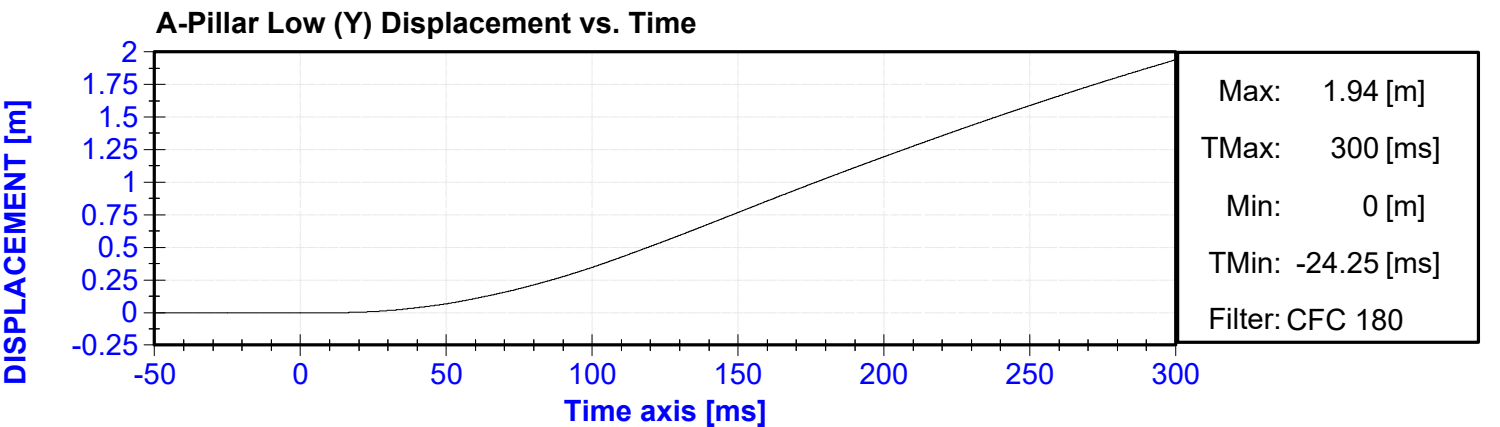
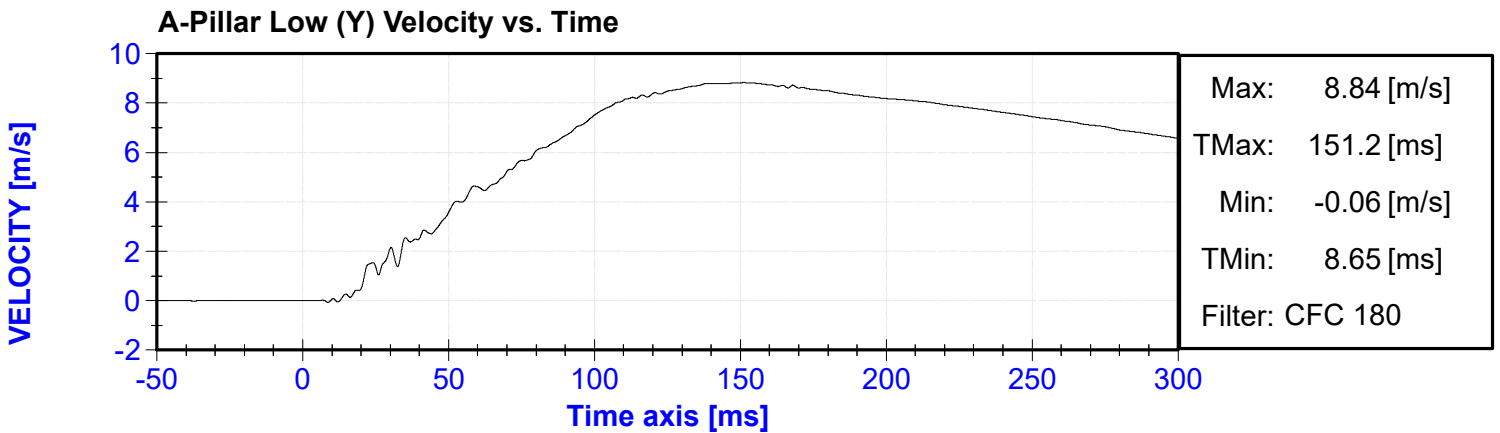
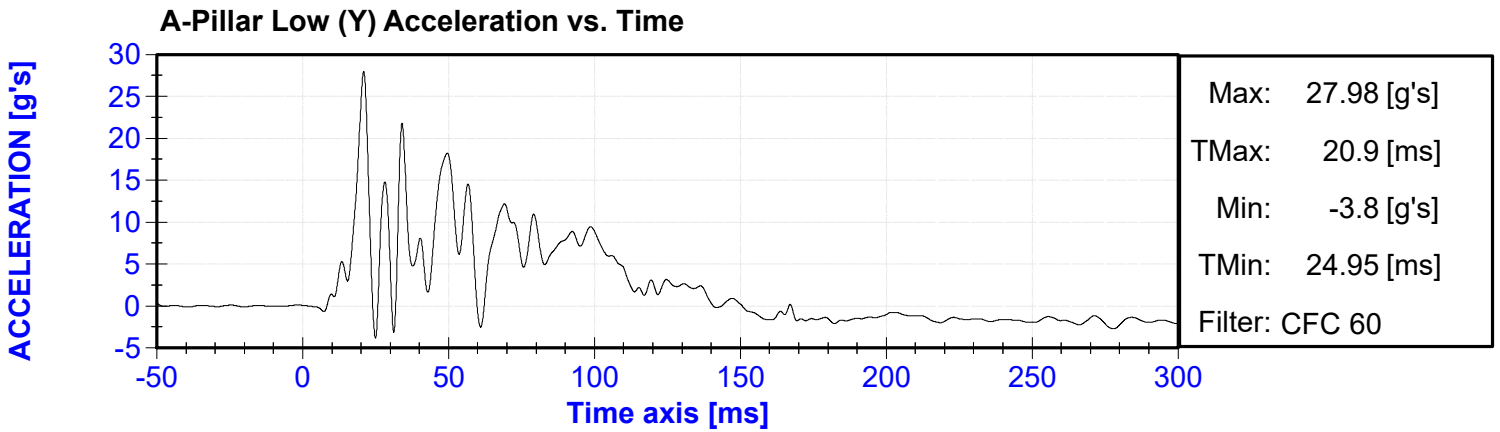
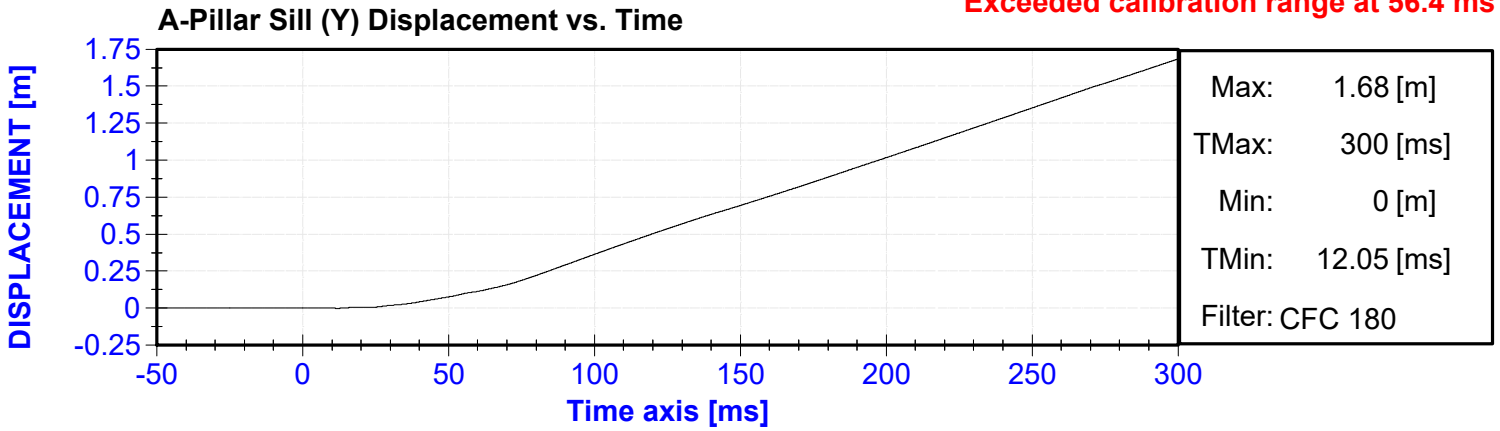
No.	Description	Page
1	Vehicle Center of Gravity (X) Acceleration vs. Time	III-3
2	Vehicle Center of Gravity (X) Velocity vs. Time	III-3
3	Vehicle Center of Gravity (Y) Acceleration vs. Time	III-3
4	Vehicle Center of Gravity (Y) Velocity vs. Time	III-3
5	Vehicle Center of Gravity (Z) Acceleration vs. Time	III-4
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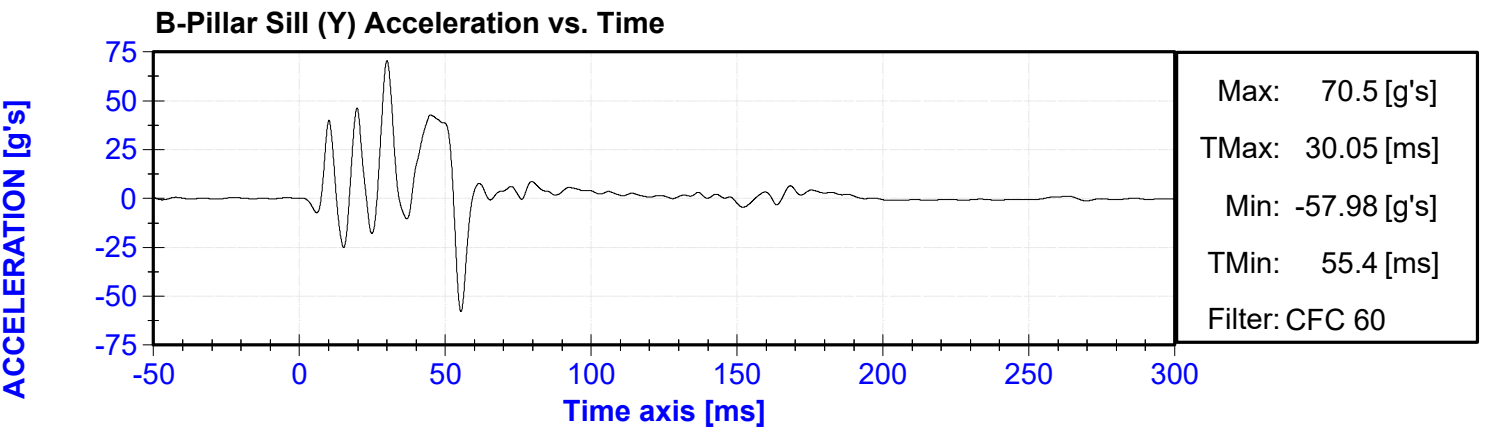
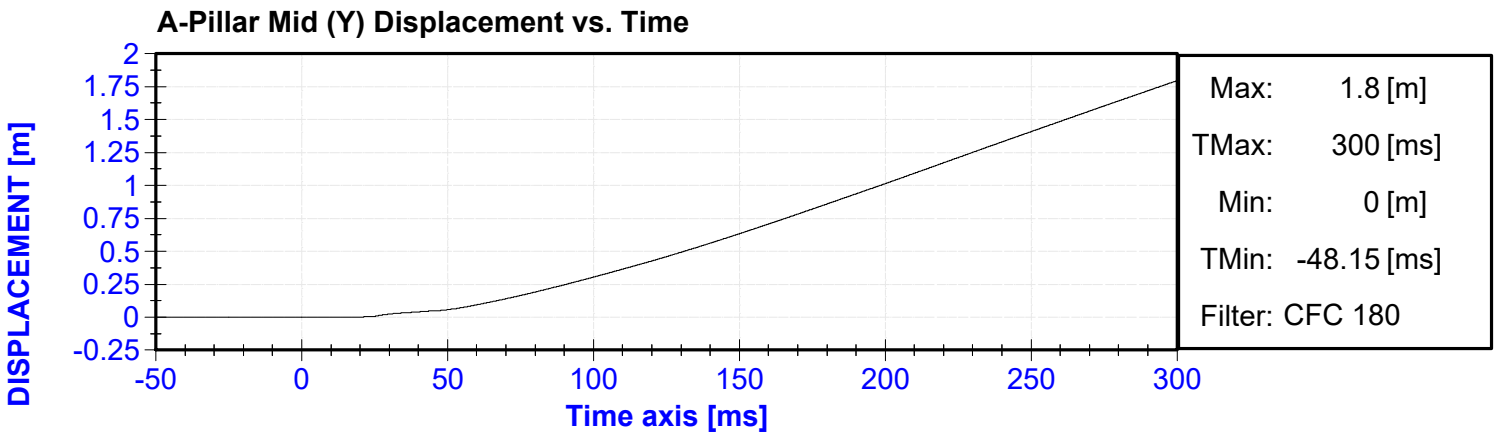
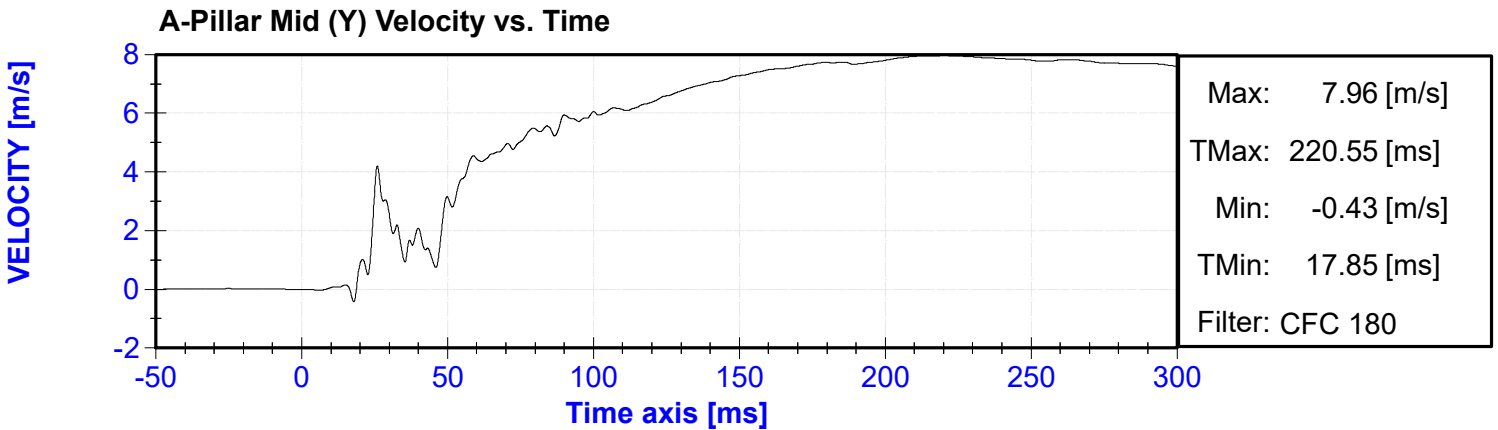
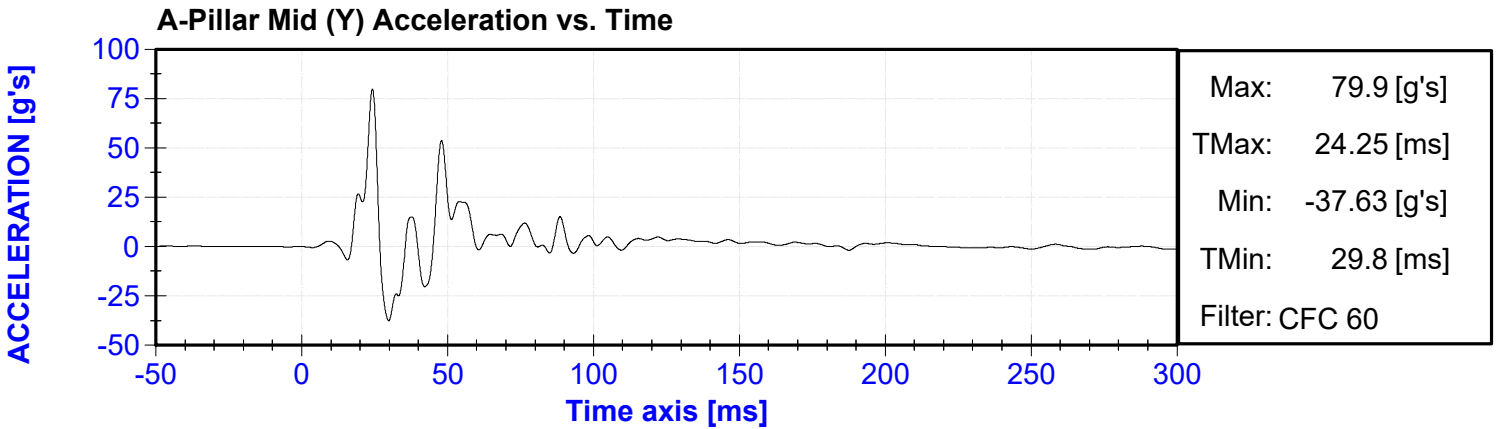


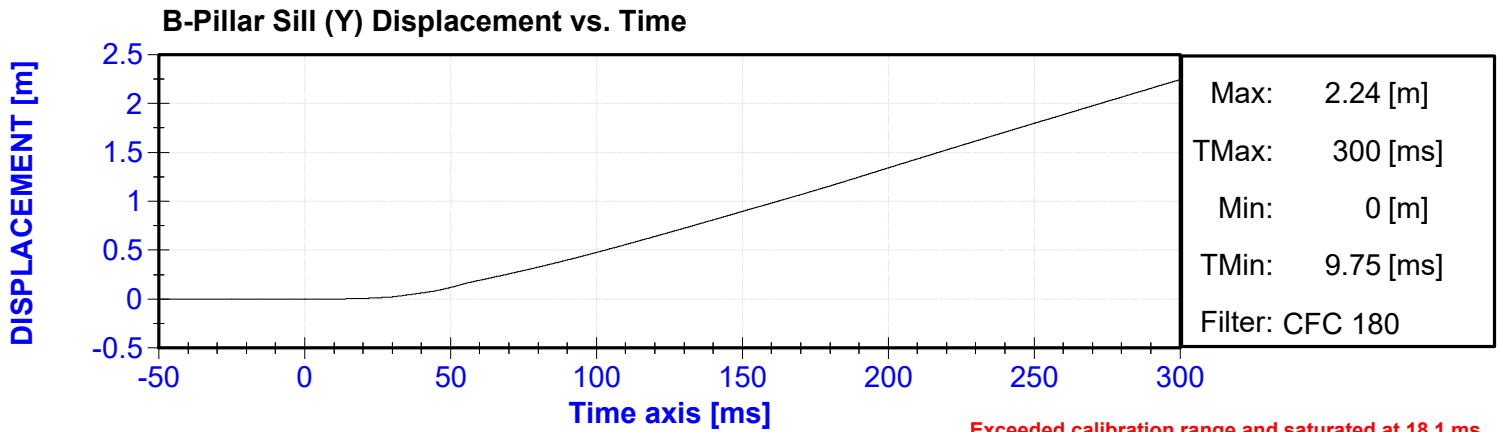
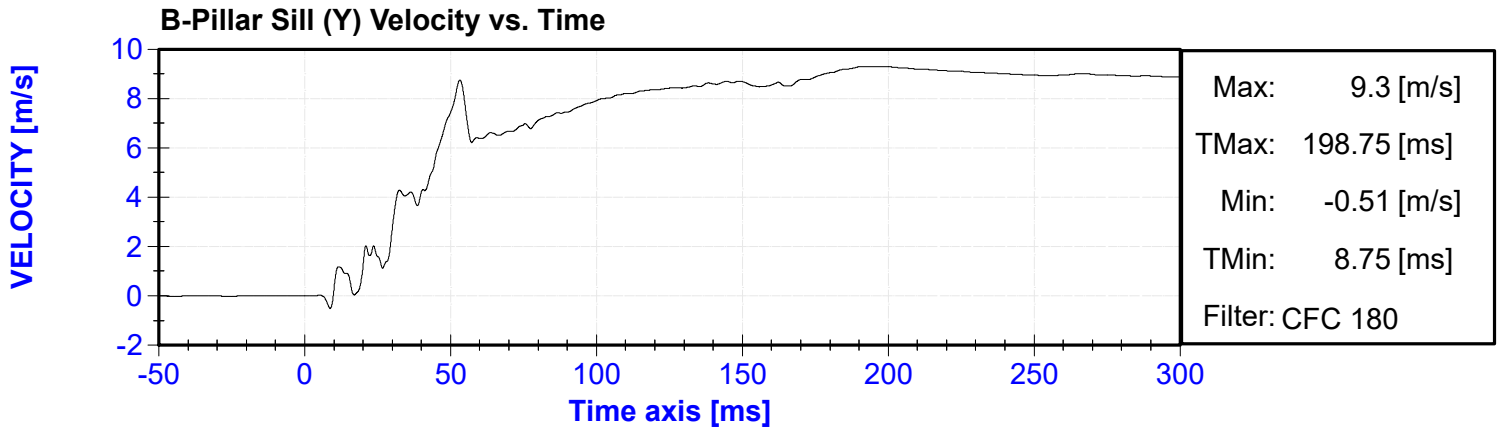




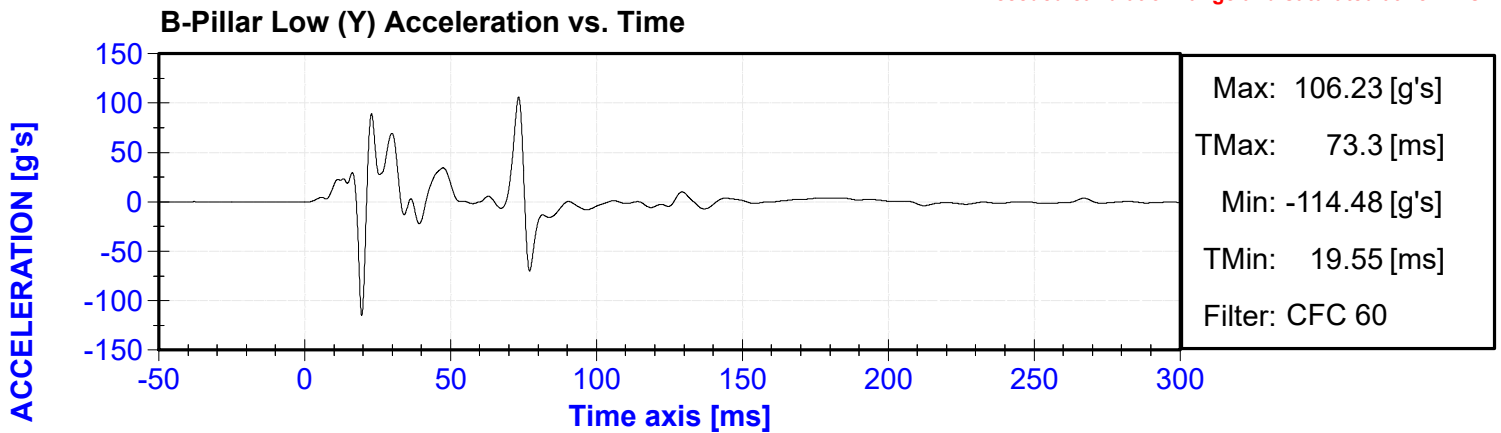
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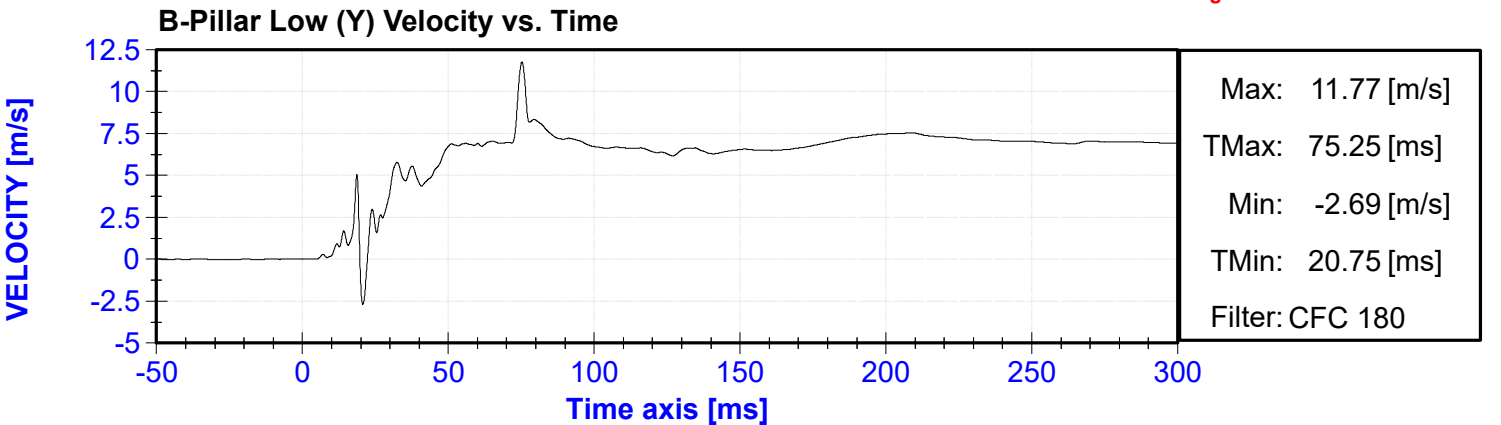




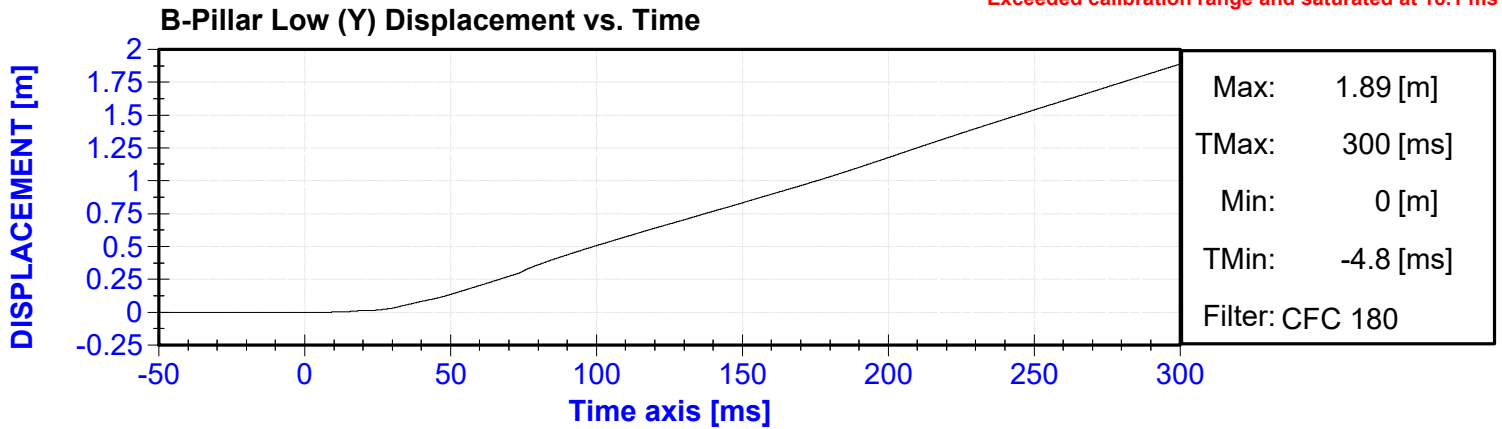
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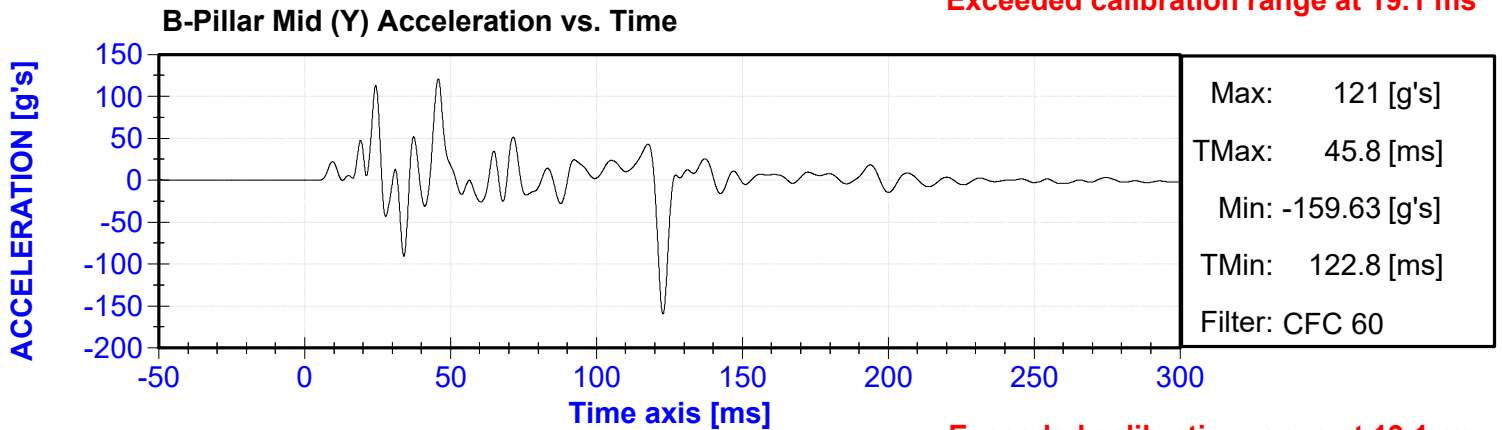
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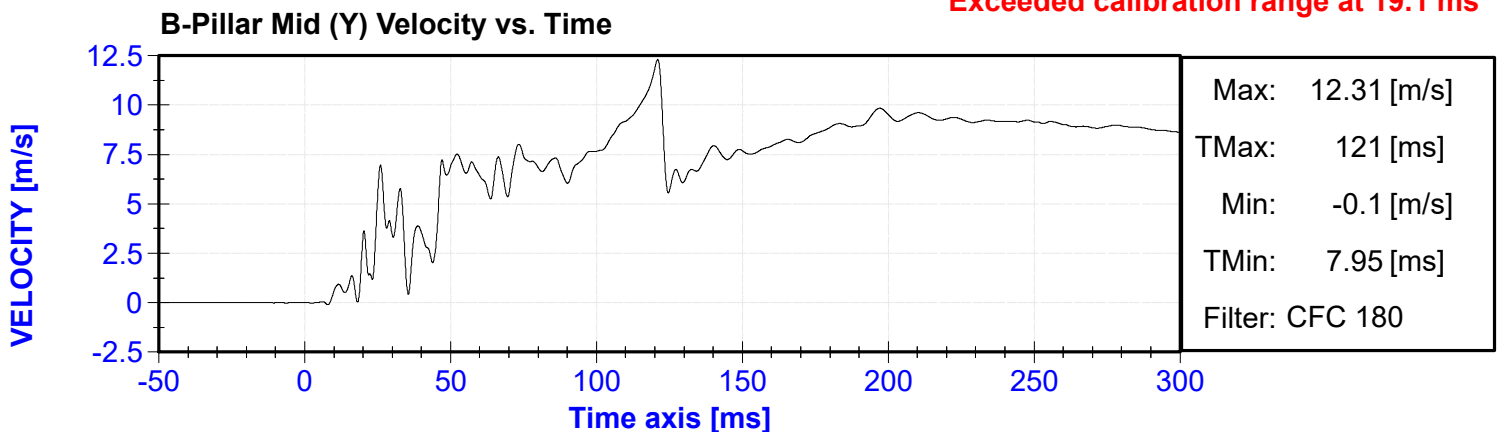
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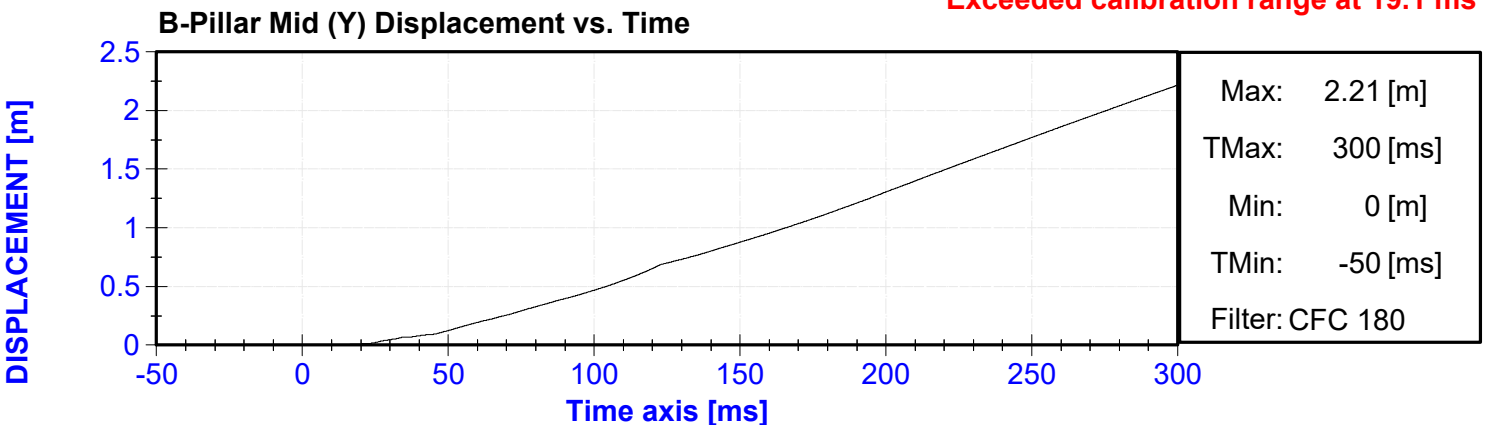
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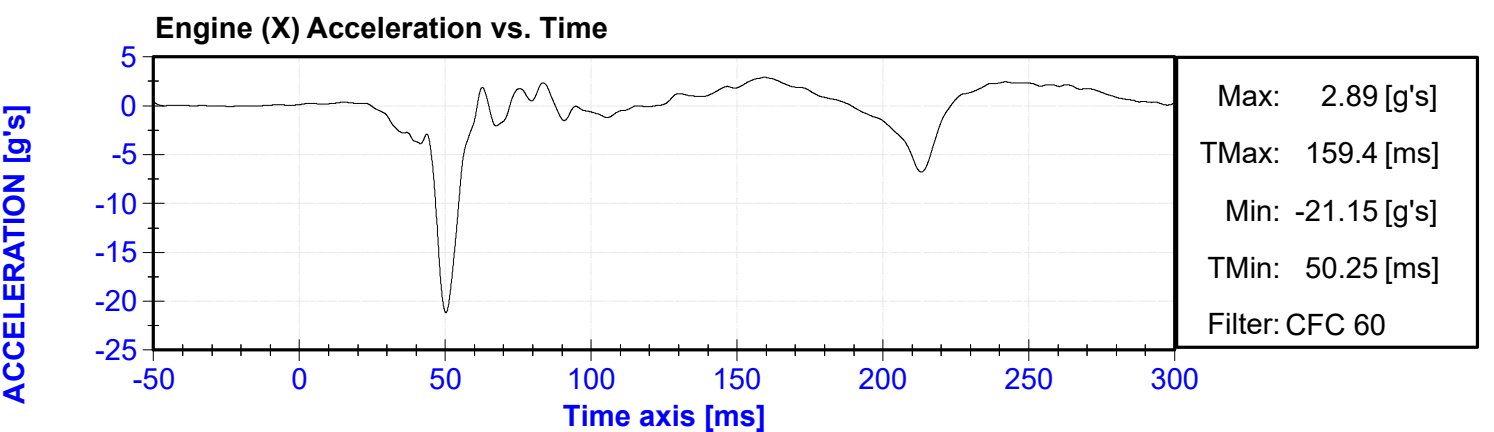
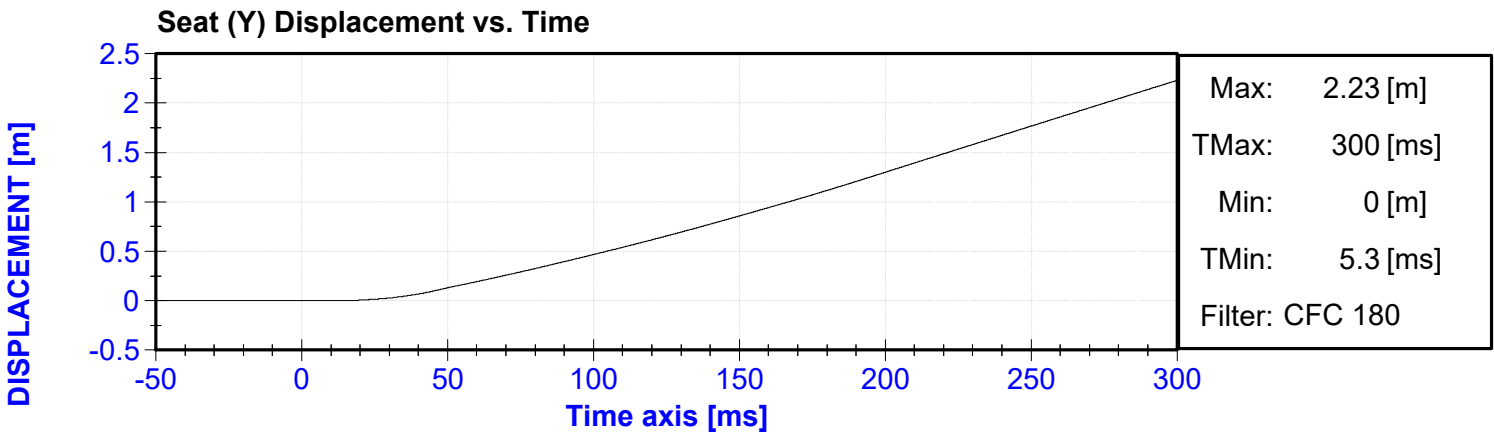
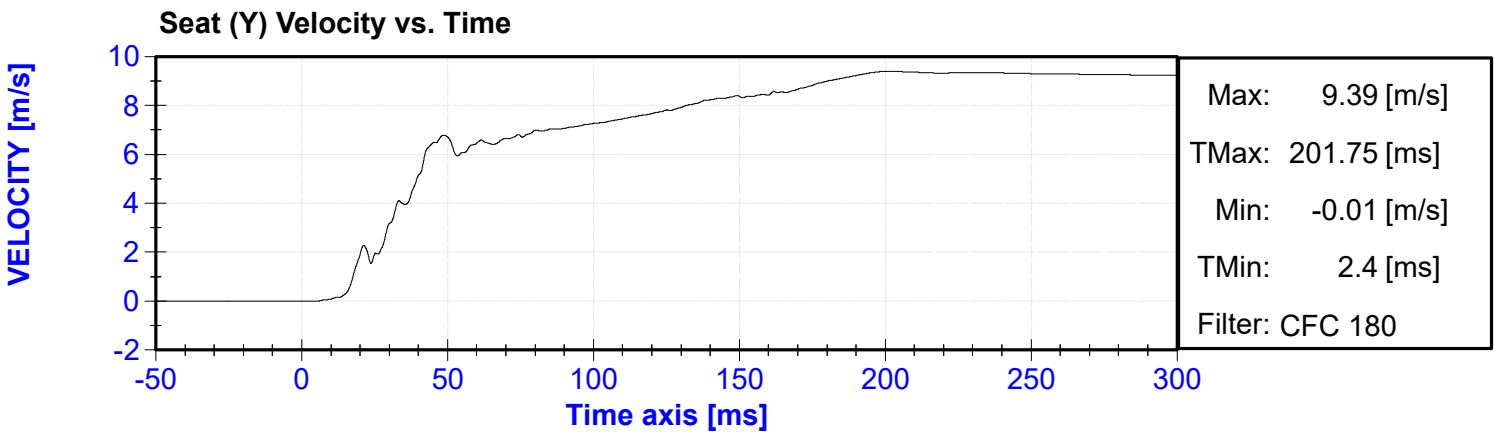
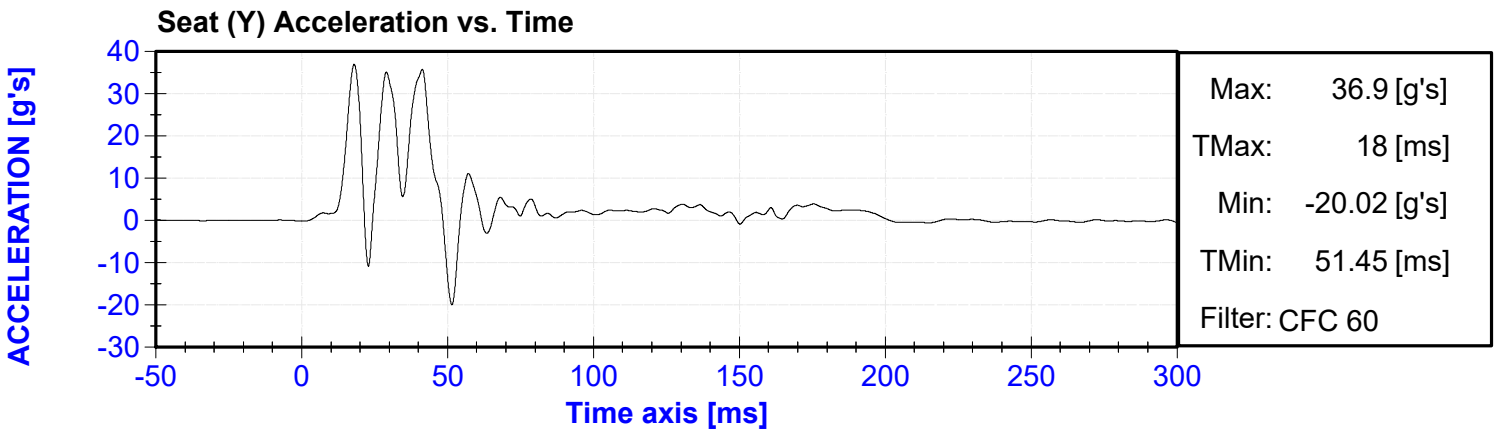


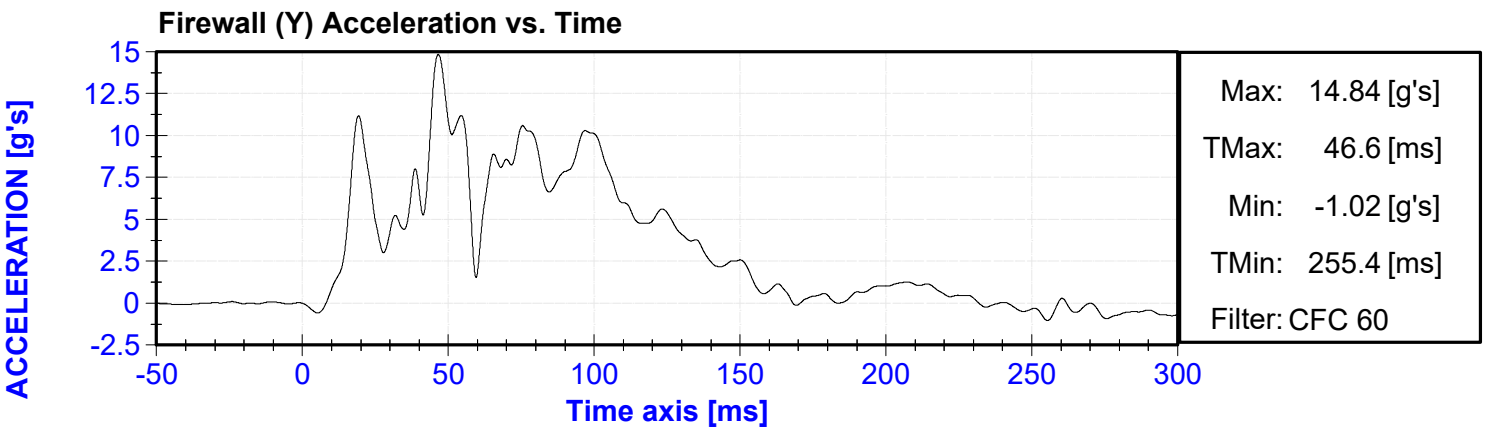
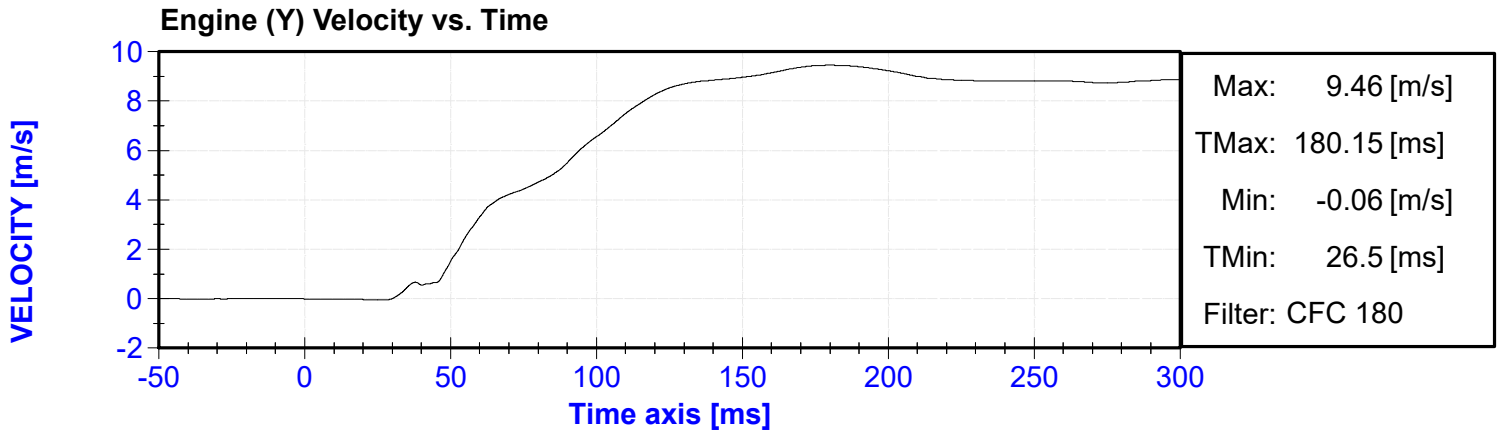
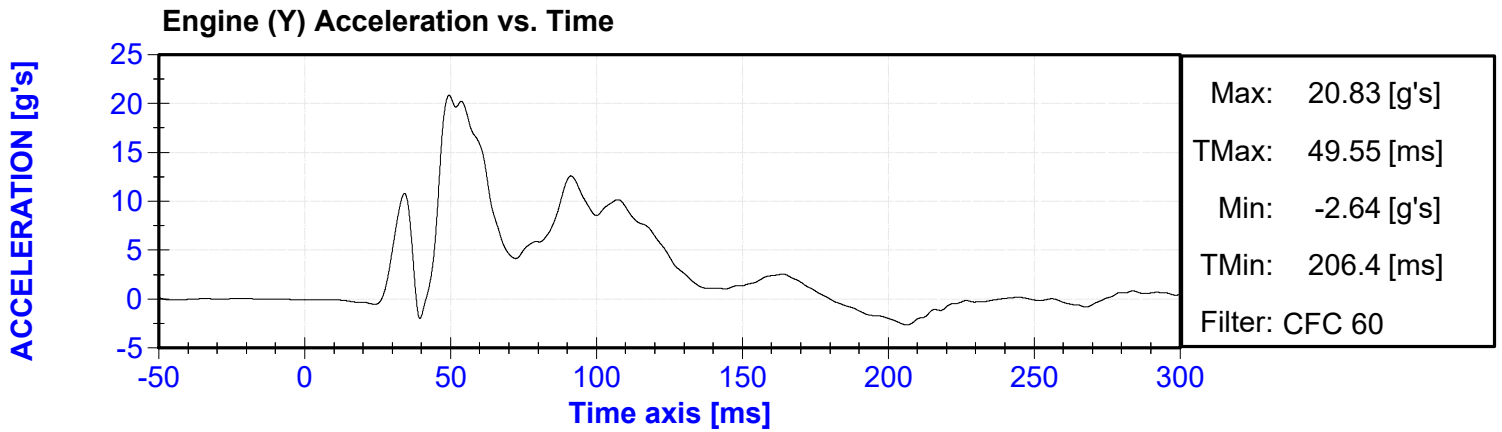
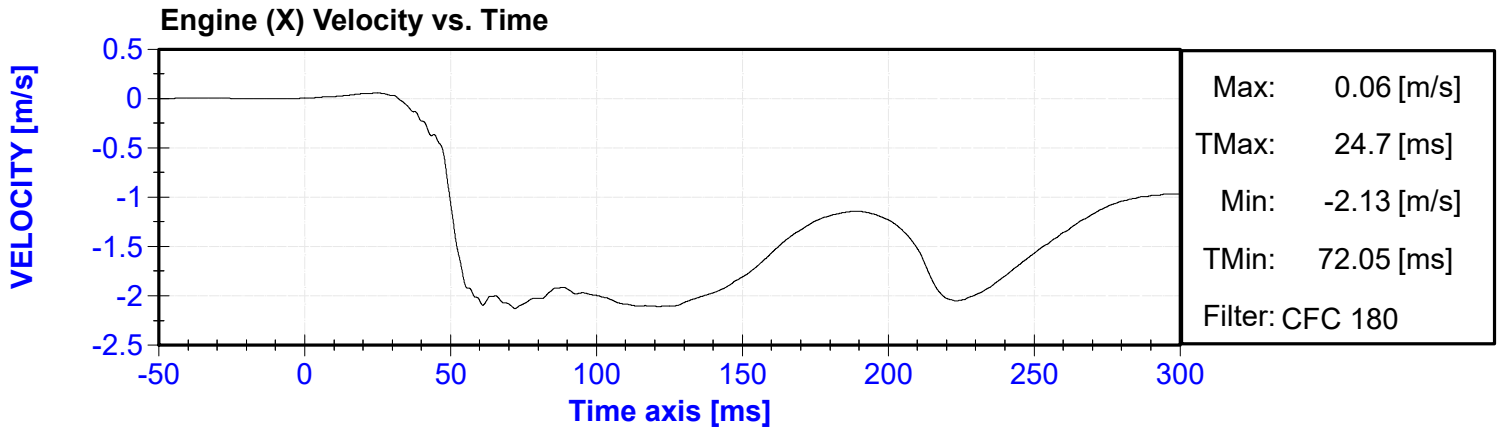
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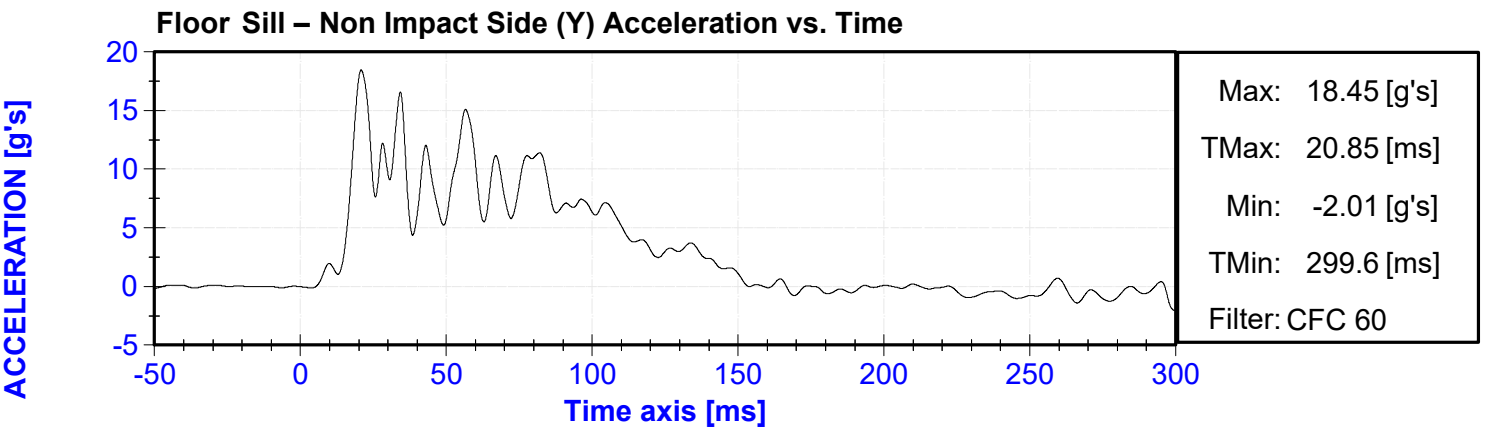
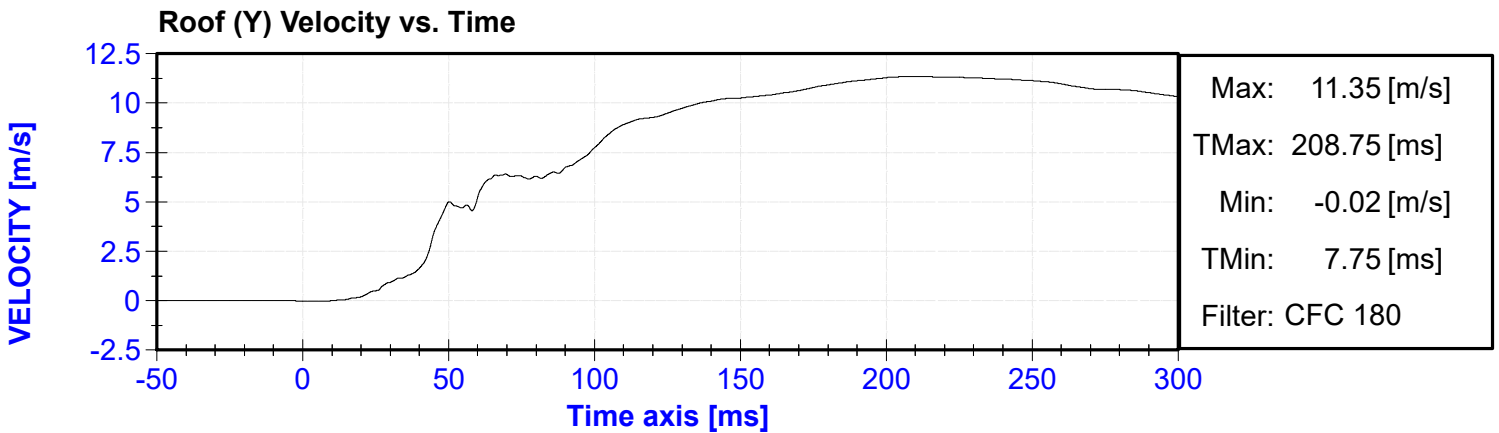
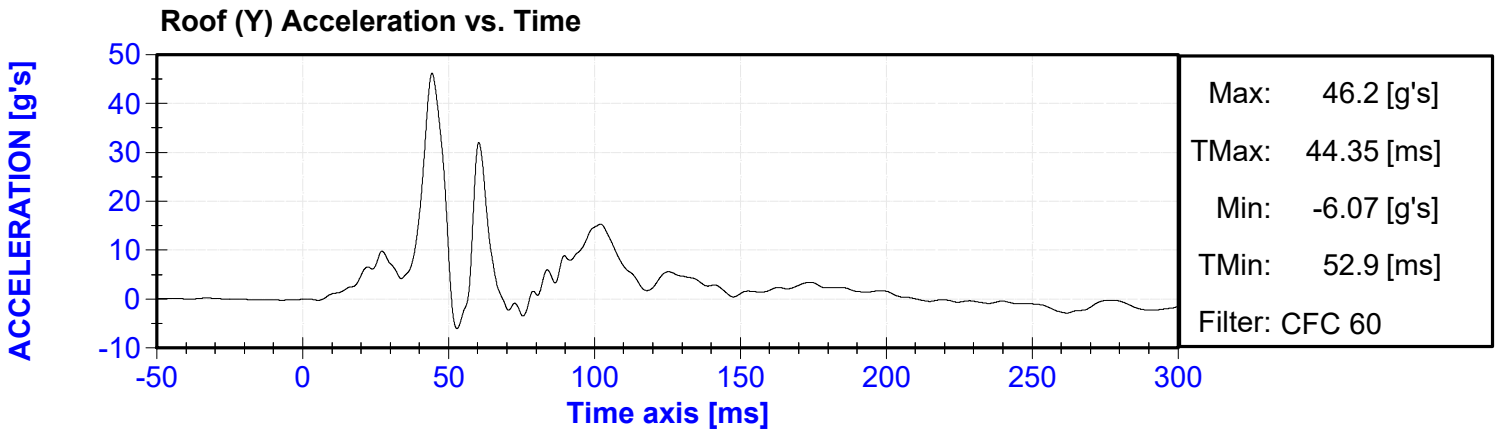
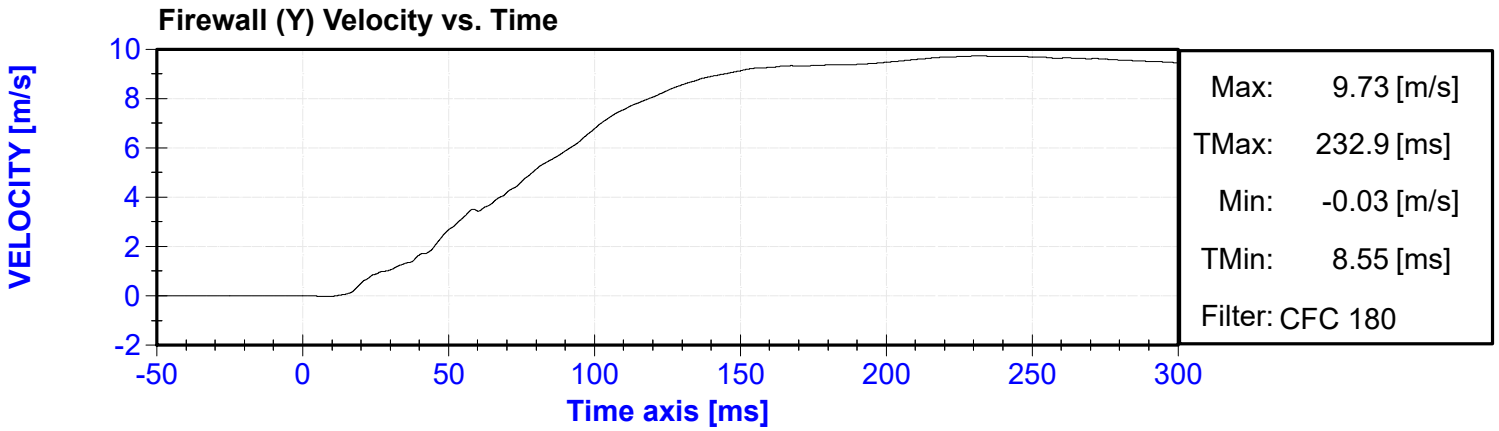


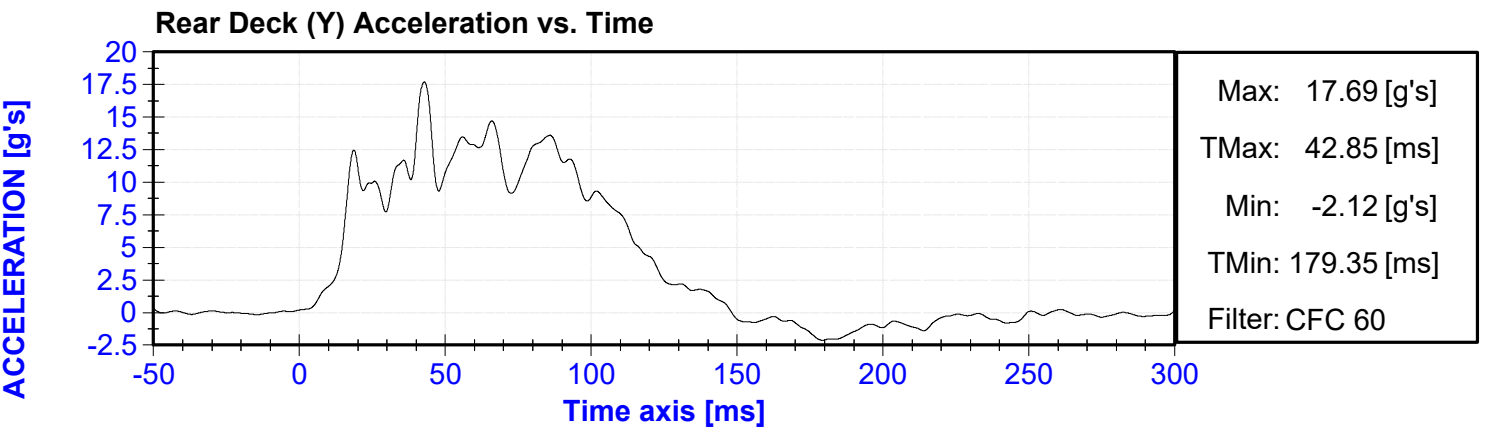
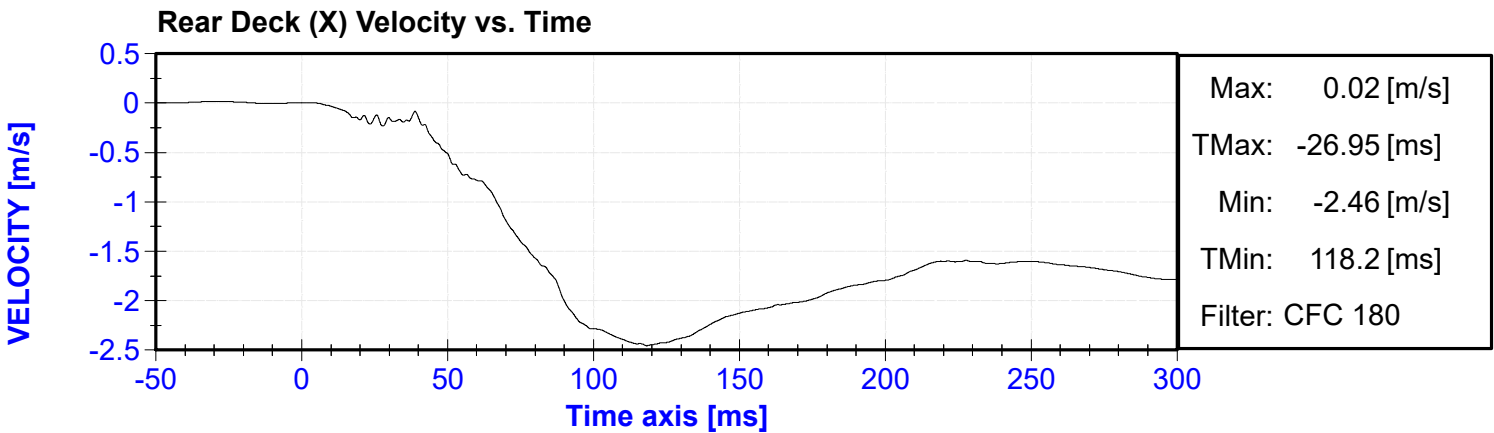
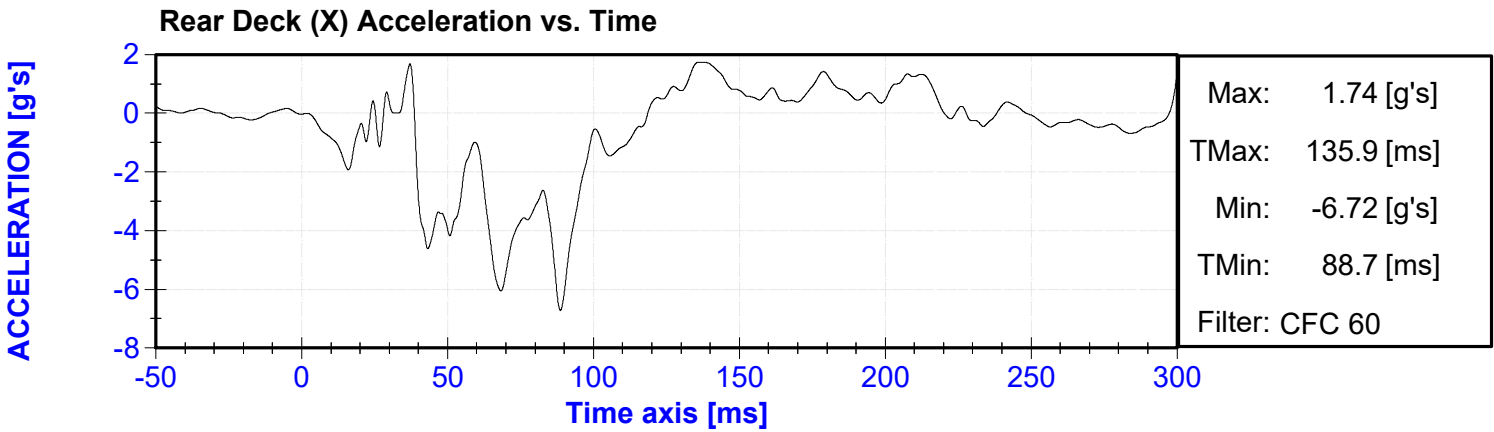
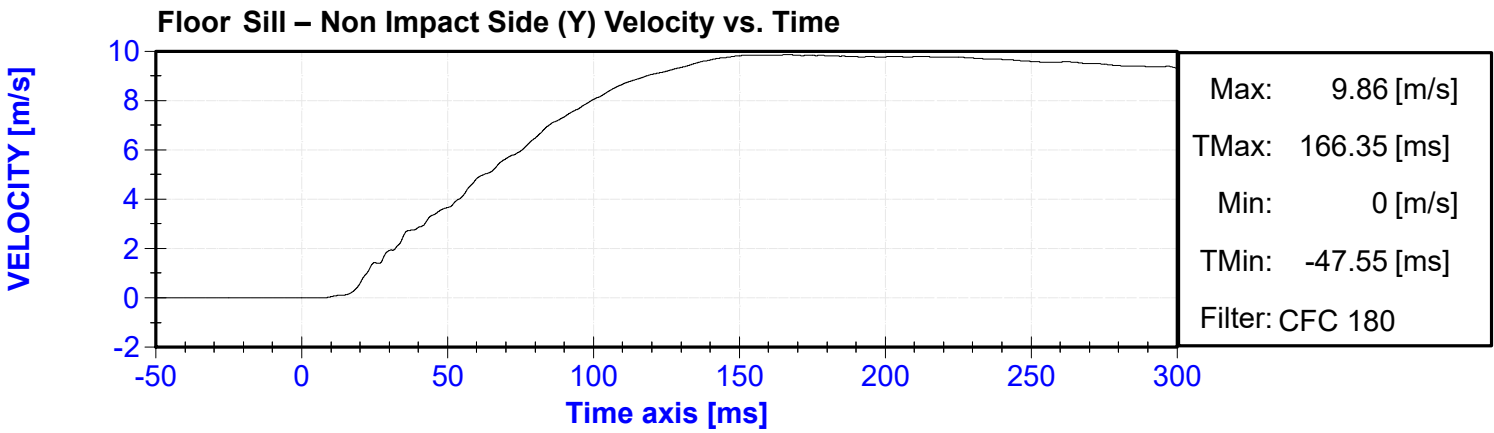
Exceeded calibration range at 19.1 ms

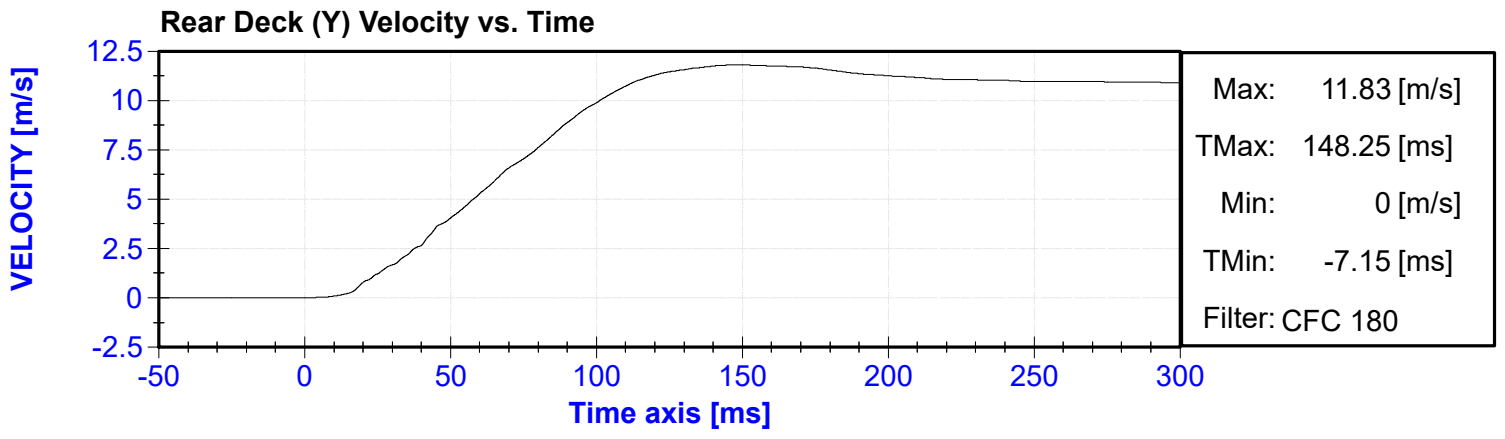












APPENDIX IV

PRE-TEST DUMMY PERFORMANCE CALIBRATION TEST DATA

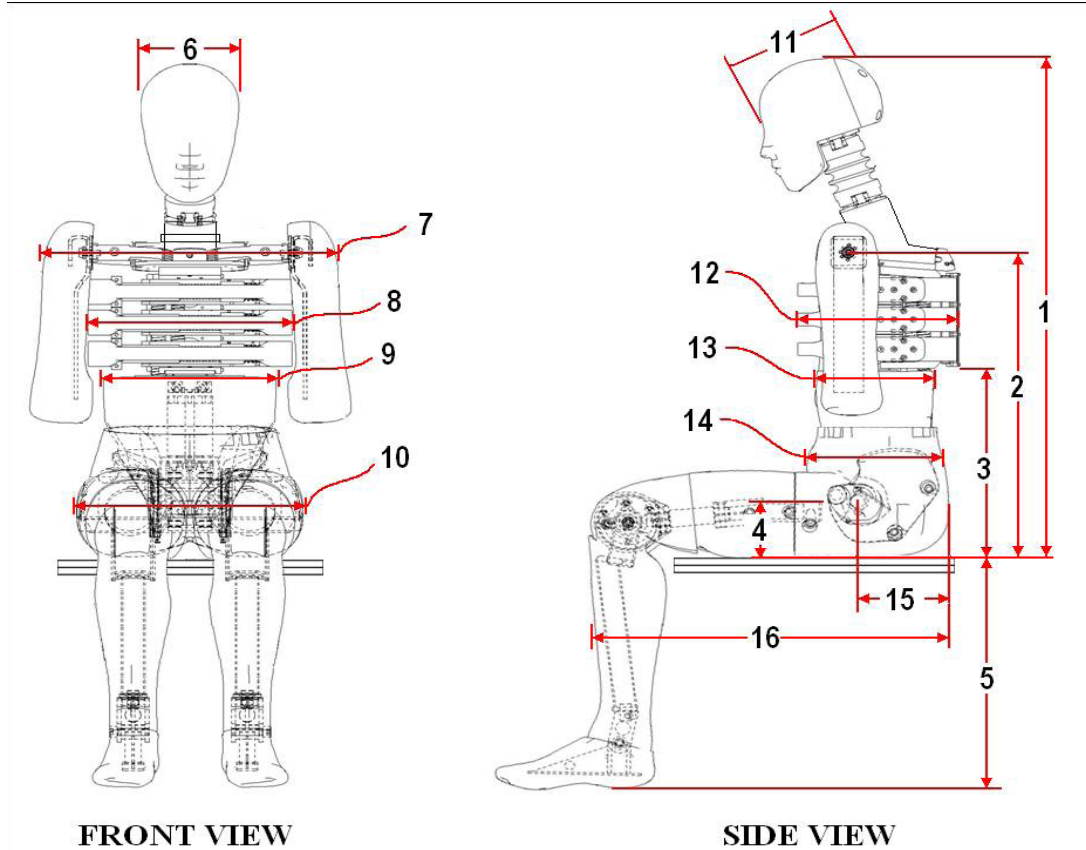
(Subpart U, ES-2re)

External Measurements - EuroSID-2re

Technician: T. Roseman

Date: 04/17/2024

Dummy Serial Number: DG5348



Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	913	Pass
2	Seat to Shoulder Joint	558	572	568	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	351	Pass
4	Seat to Hip Joint (center of bolt)	97	103	102	Pass
5	Sole to Seat, Sitting	333	451	414	Pass
6	Head Width	152	158	155	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	327	Pass
9	Abdomen Width	273	287	280	Pass
10	Pelvis Lap Width	359	373	367	Pass
11	Head Depth	196	206	200	Pass
12	Thorax Depth	262	272	268	Pass
13	Abdomen Depth	194	204	198	Pass
14	Pelvis Depth	235	245	240	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	600	Pass

ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

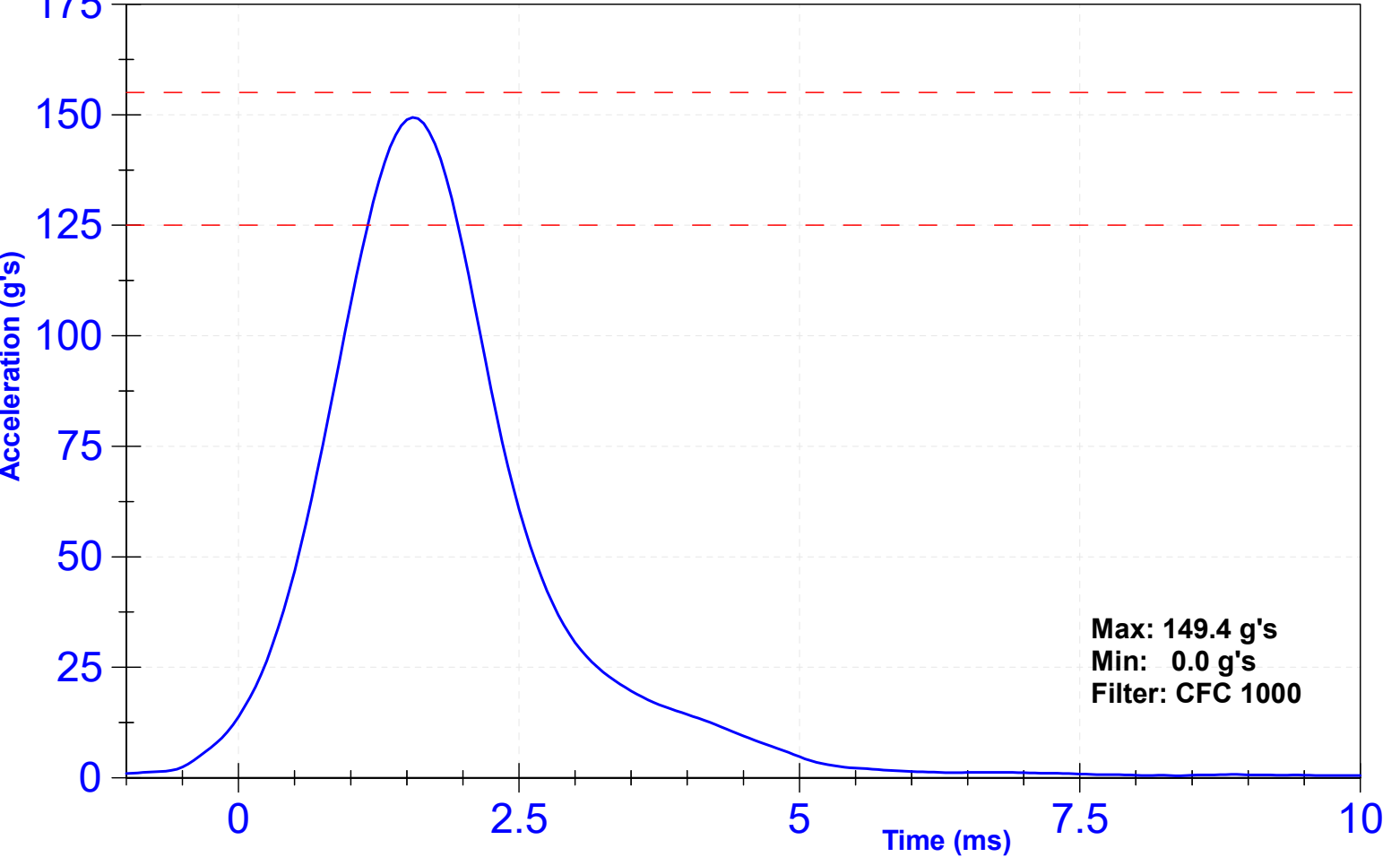
Results

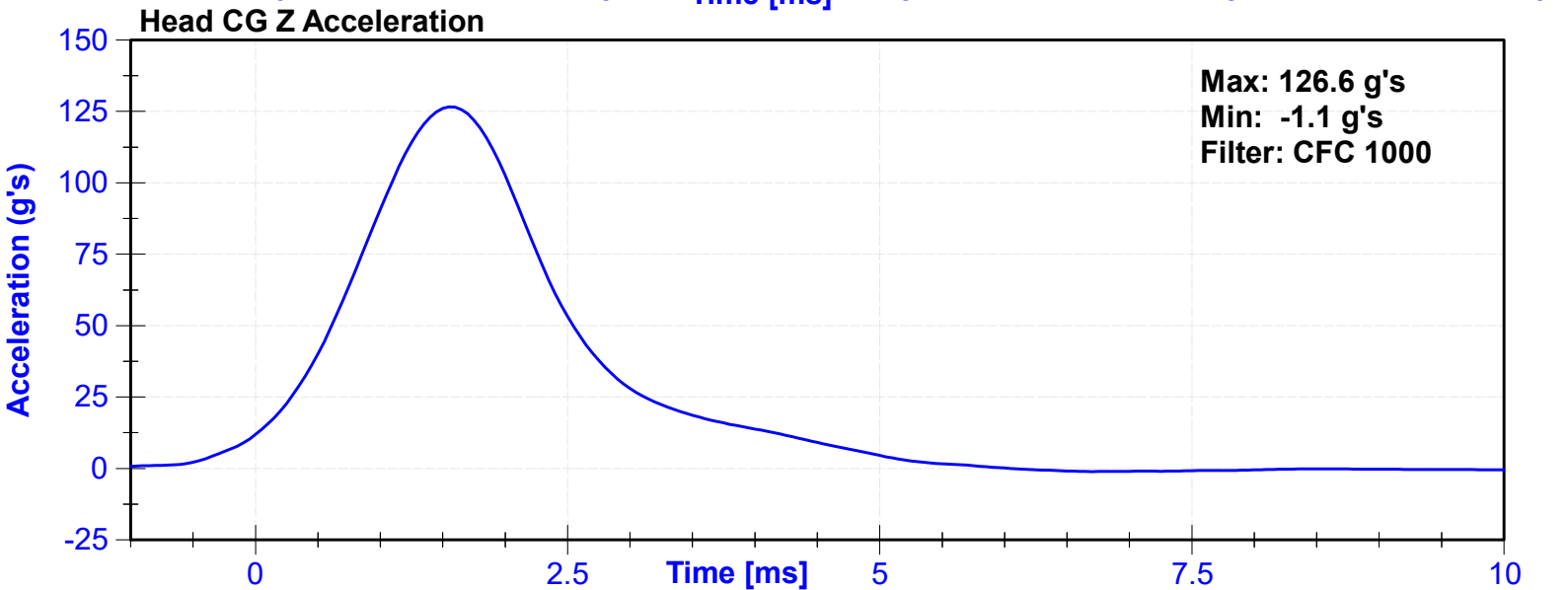
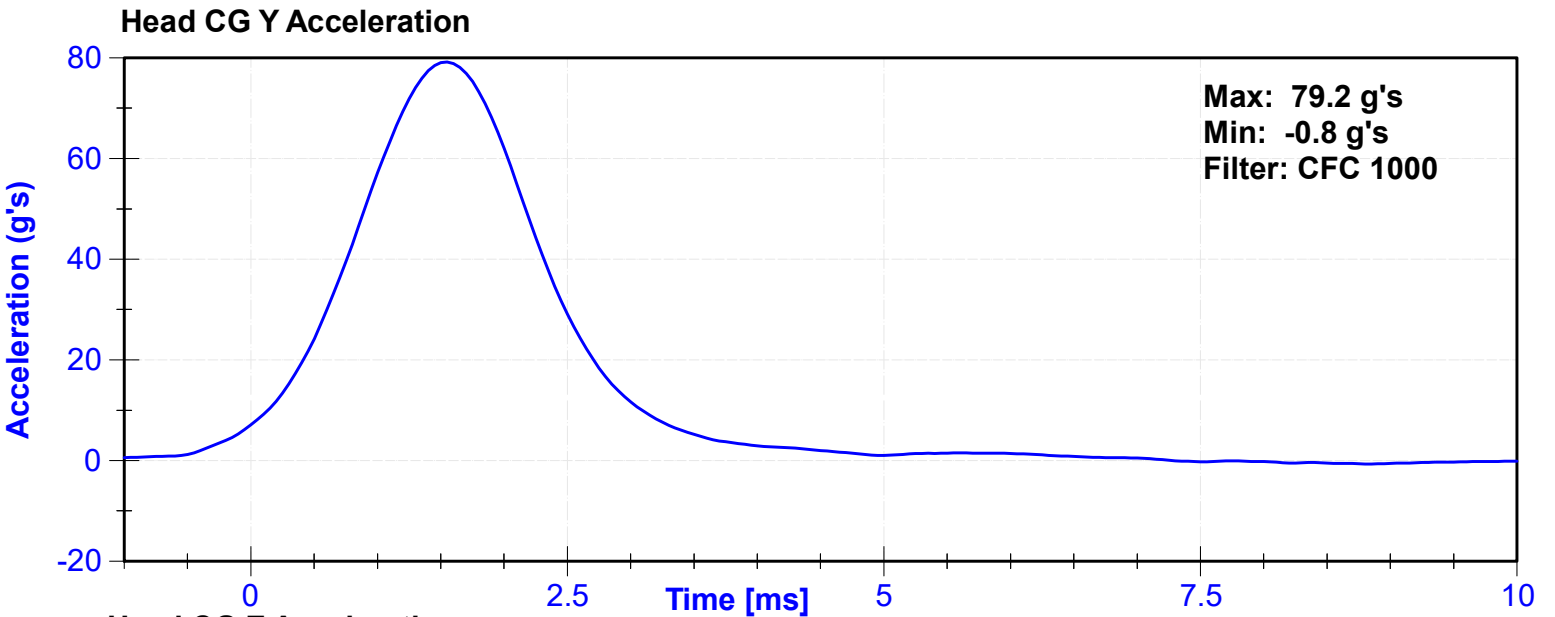
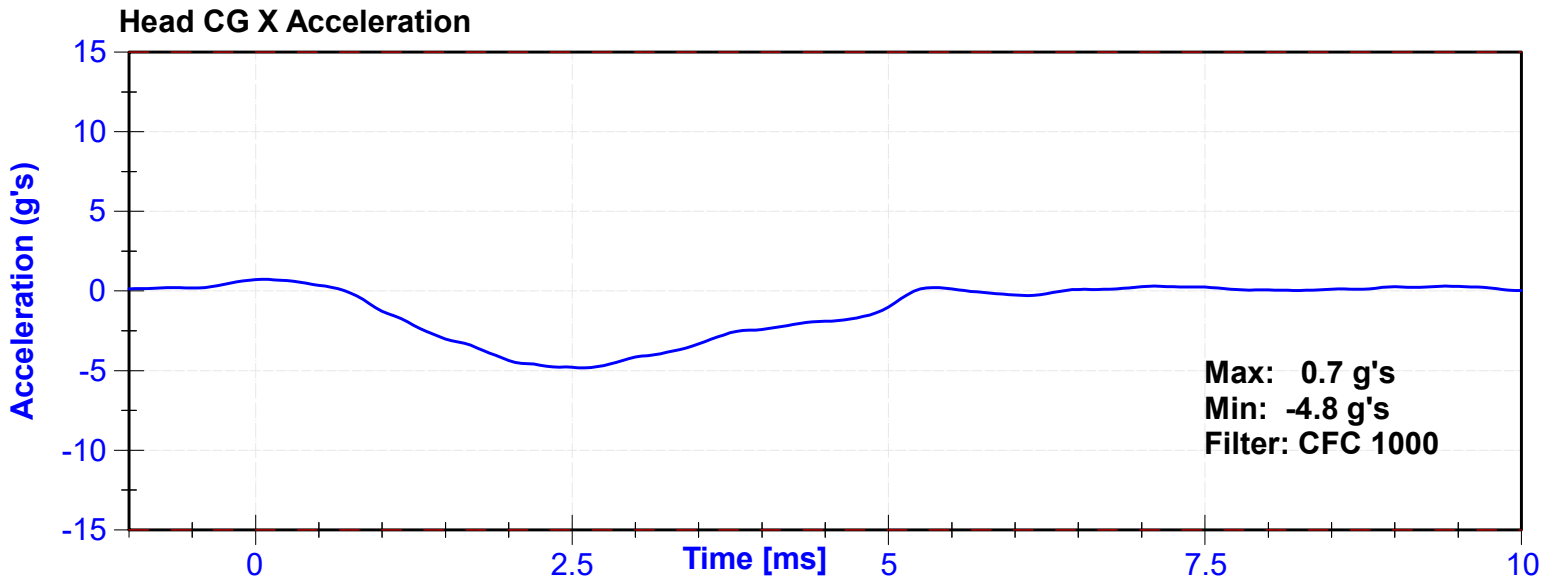
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	37	Pass
Resultant Acceleration	125	155	g's	149.4	Pass
Oscillation	0	15	%	0.84	Pass
Fore-Aft Acceleration	-15	15	g's	-4.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	18613	2/8/2024	8/6/2024
Y Accelerometer	Endevco	18472	2/8/2024	8/6/2024
Z Accelerometer	Endevco	18663	2/8/2024	8/6/2024

Resultant Acceleration





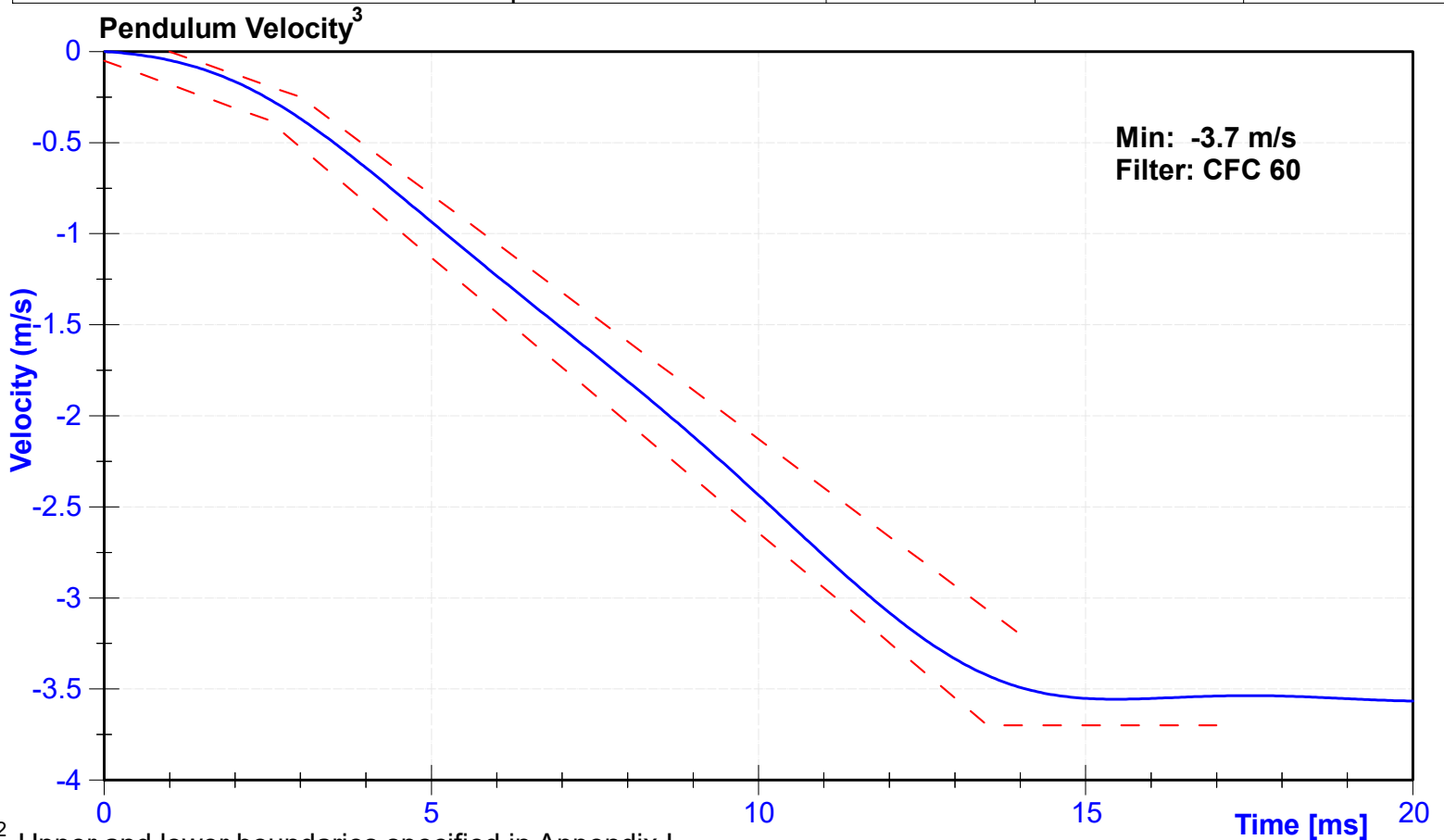
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

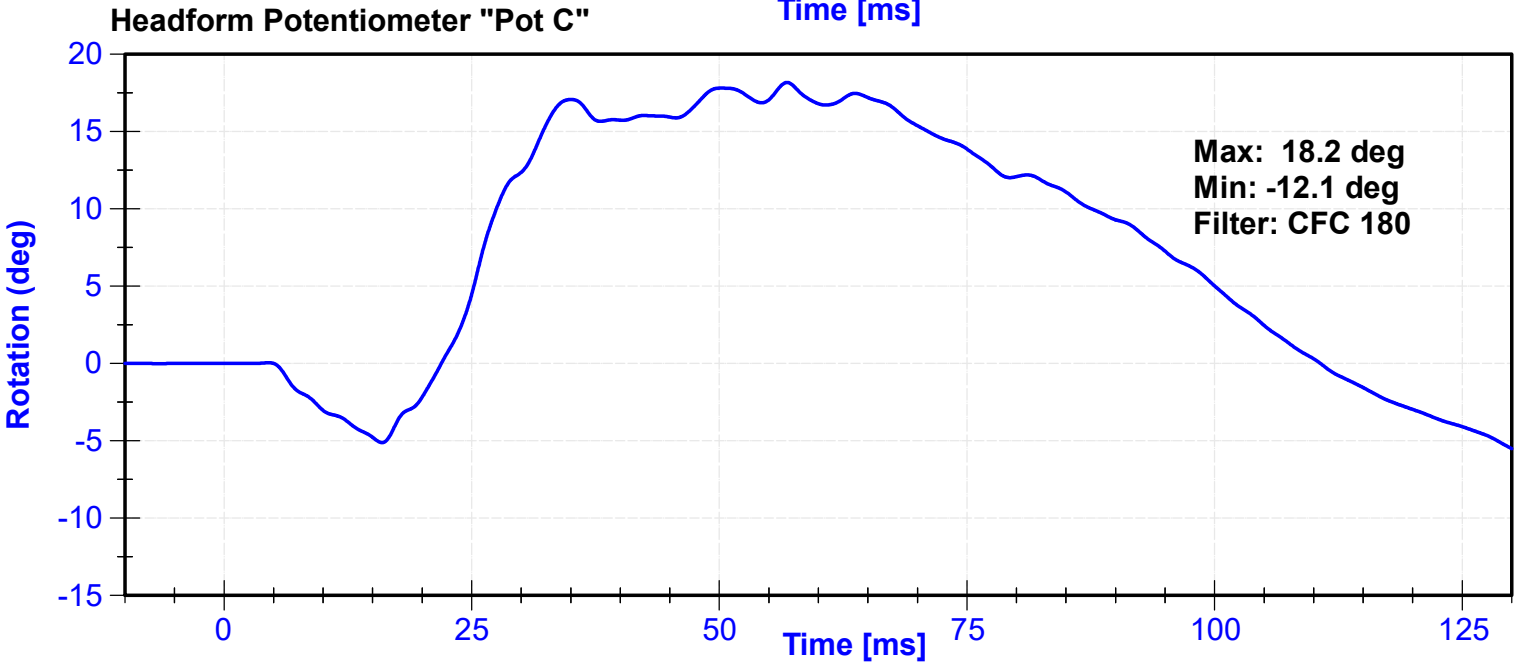
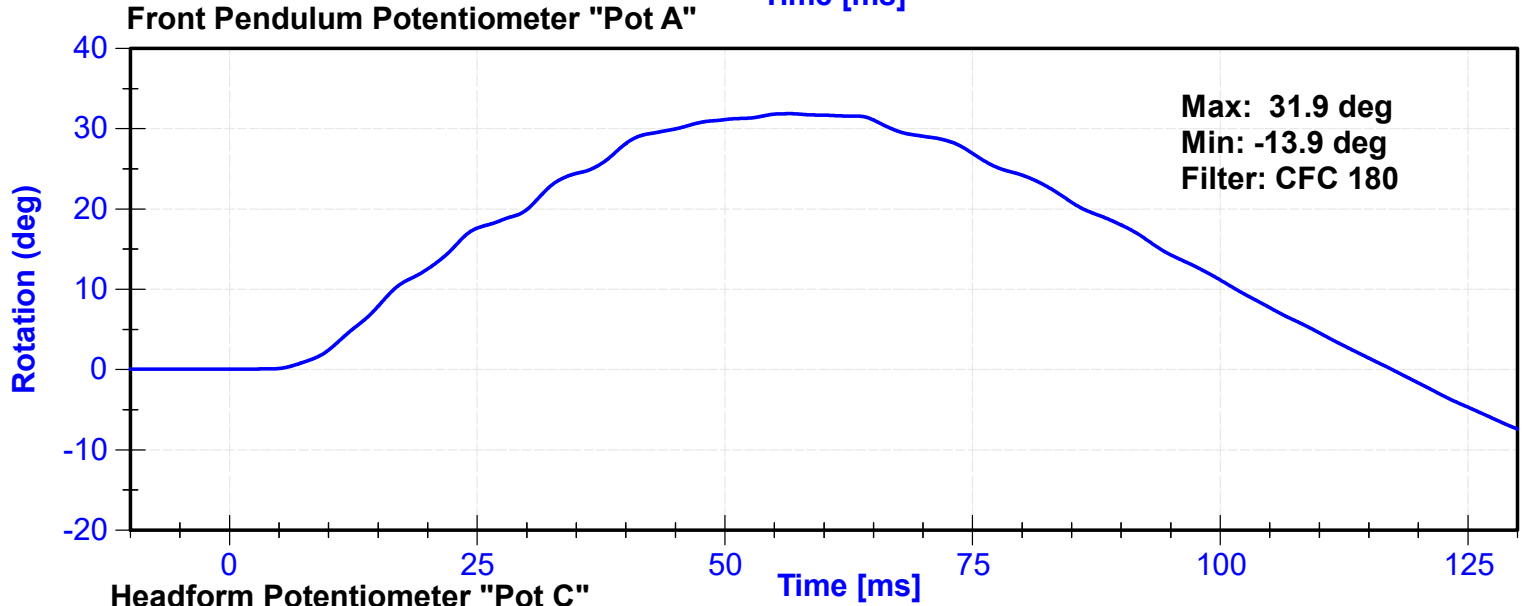
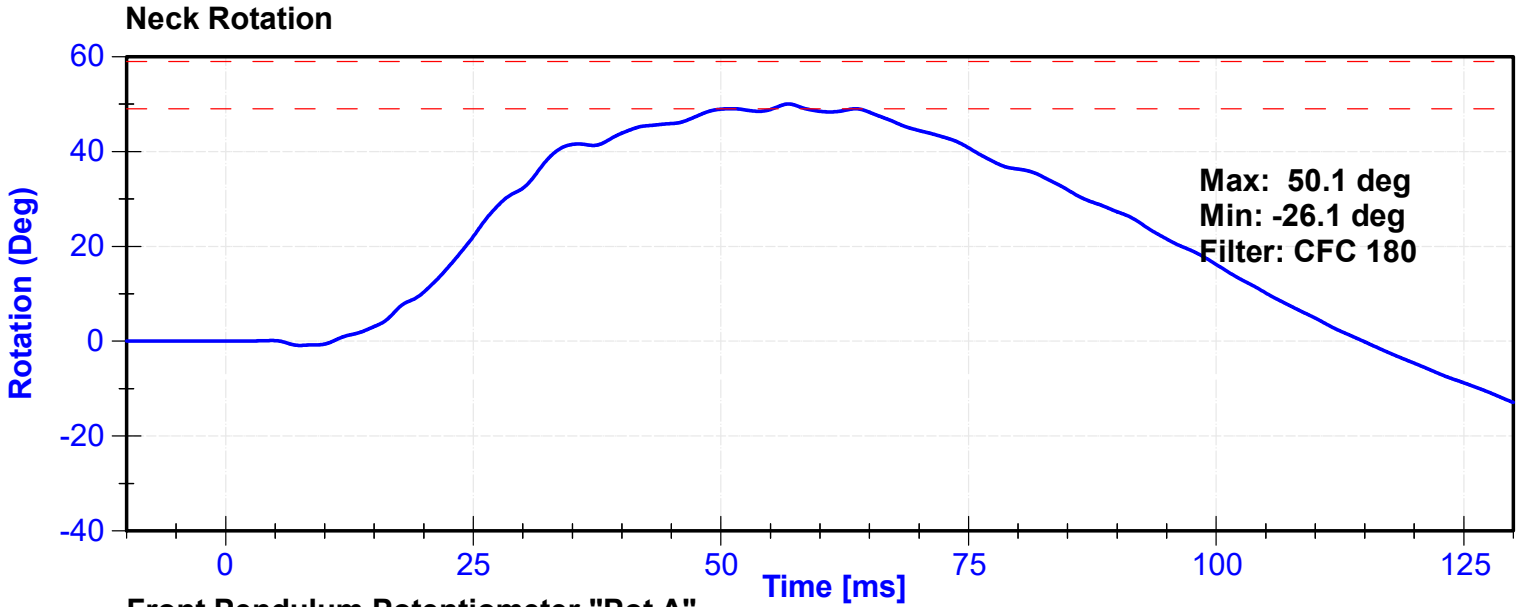
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	32	Pass
Velocity	3.3	3.5	m/s	3.35	Pass
Lateral Neck Rotation	49	59	deg	50.1	Pass
Time at Maximum Rotation	54	66	ms	56.8	Pass
Time of Rotation Decay from Maximum	53	88	ms	58.1	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	10/31/2023	4/28/2024
Front Pendulum Potentiometer	Sfernice	2247	12/5/2023	12/4/2024
Headform Potentiometer	Sfernice	095	9/29/2023	9/28/2024



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



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	DG5348	Laboratory Supervisor	C. Mantell

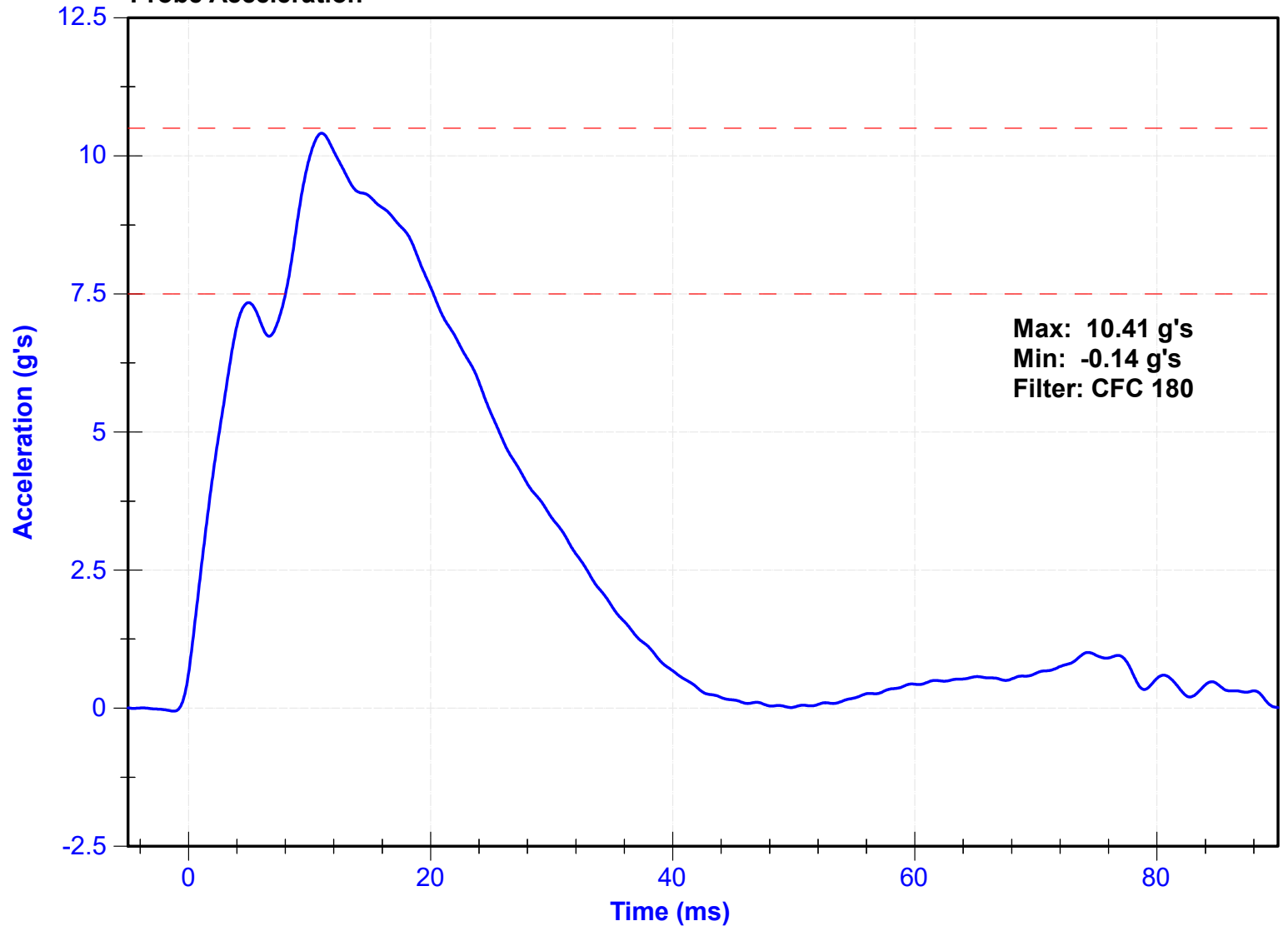
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.9	Pass
Humidity	10	70	%	32	Pass
Velocity	4.2	4.4	m/s	4.30	Pass
Probe Acceleration	7.5	10.5	g's	10.41	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18619	3/29/2024	9/25/2024

Probe Acceleration



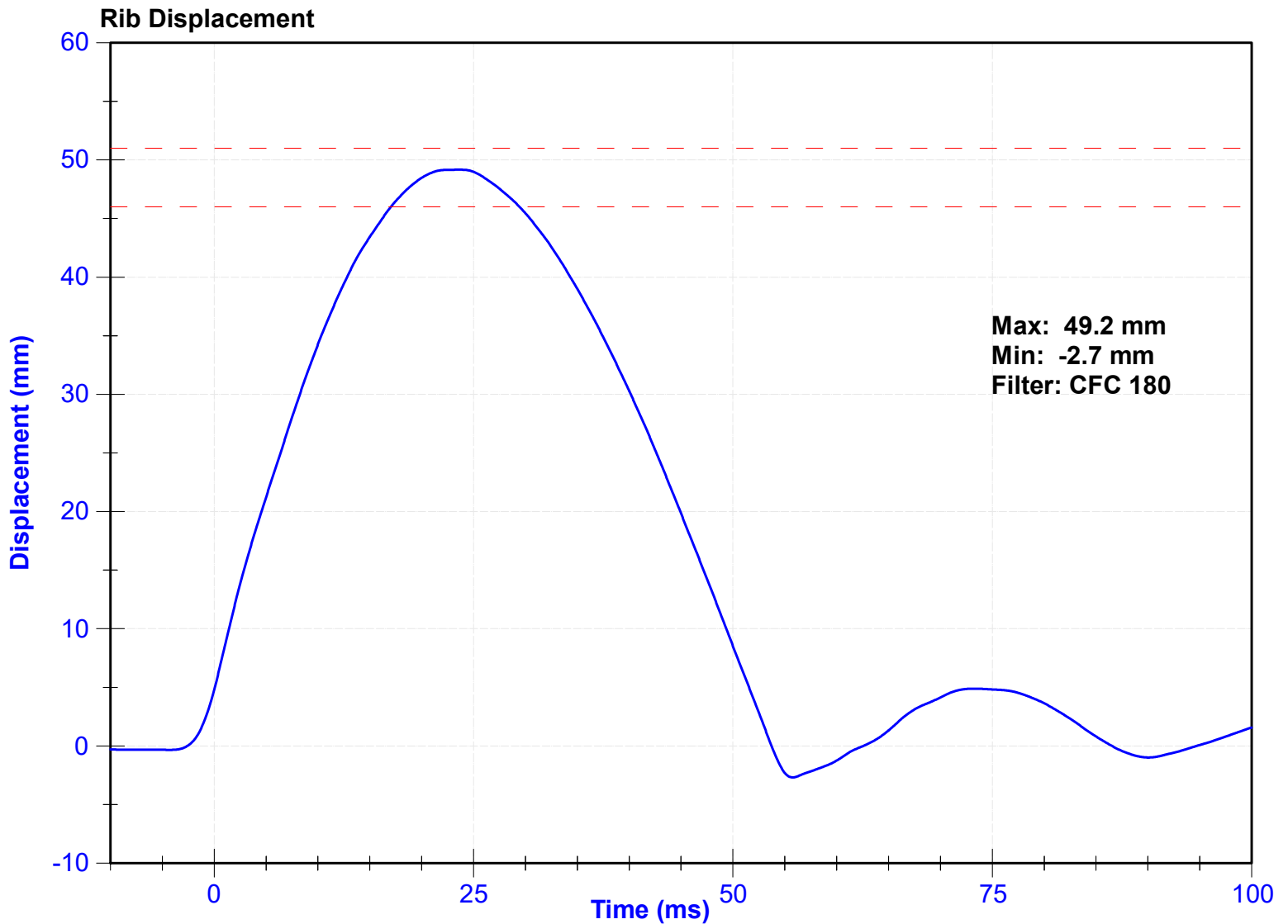
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	37	Pass
Rib Displacement	46	51	mm	49.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	268GFE	2/8/2024	8/8/2024



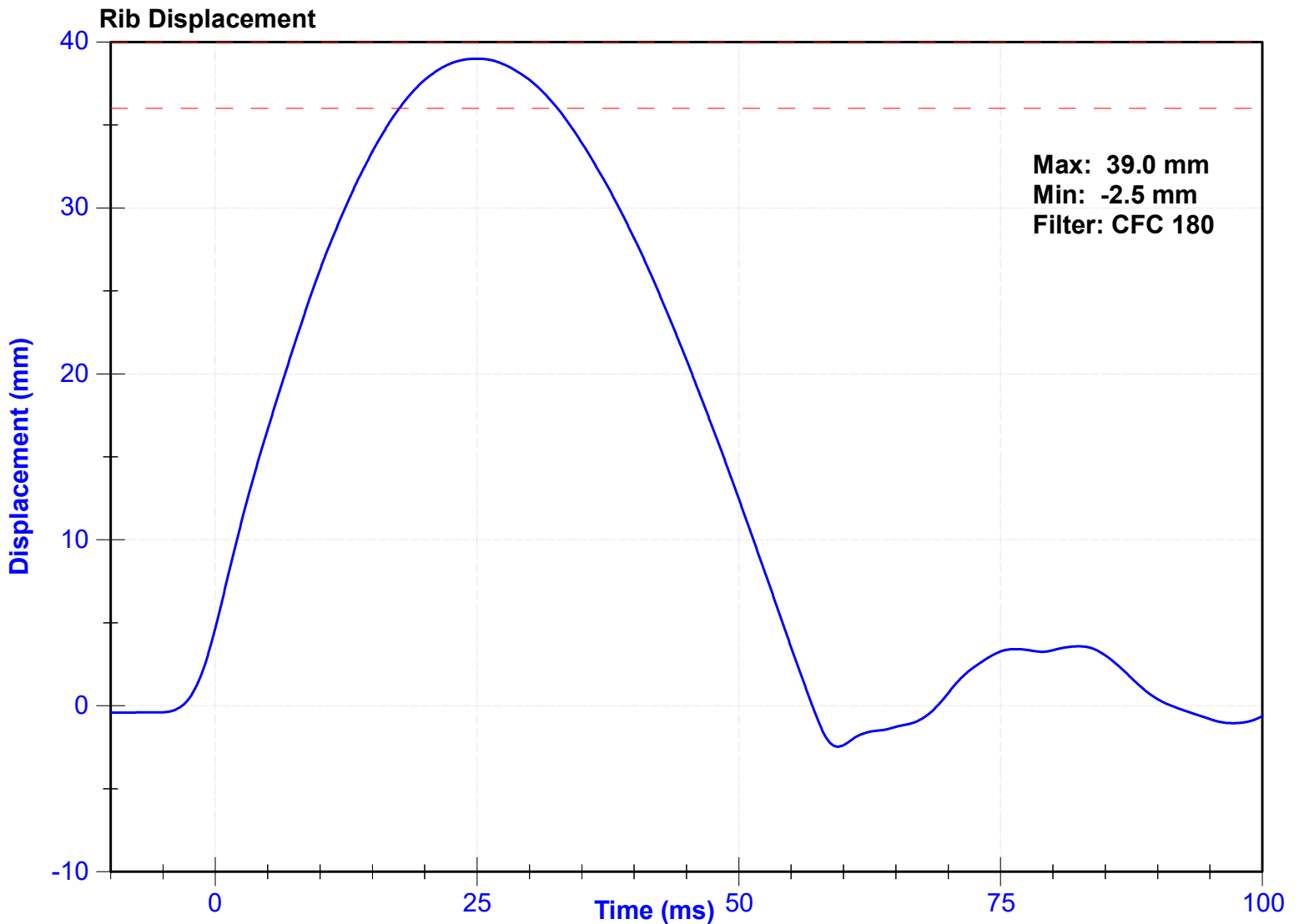
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	37	Pass
Rib Displacement	36	40	mm	39.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	268GFE	2/8/2024	8/8/2024



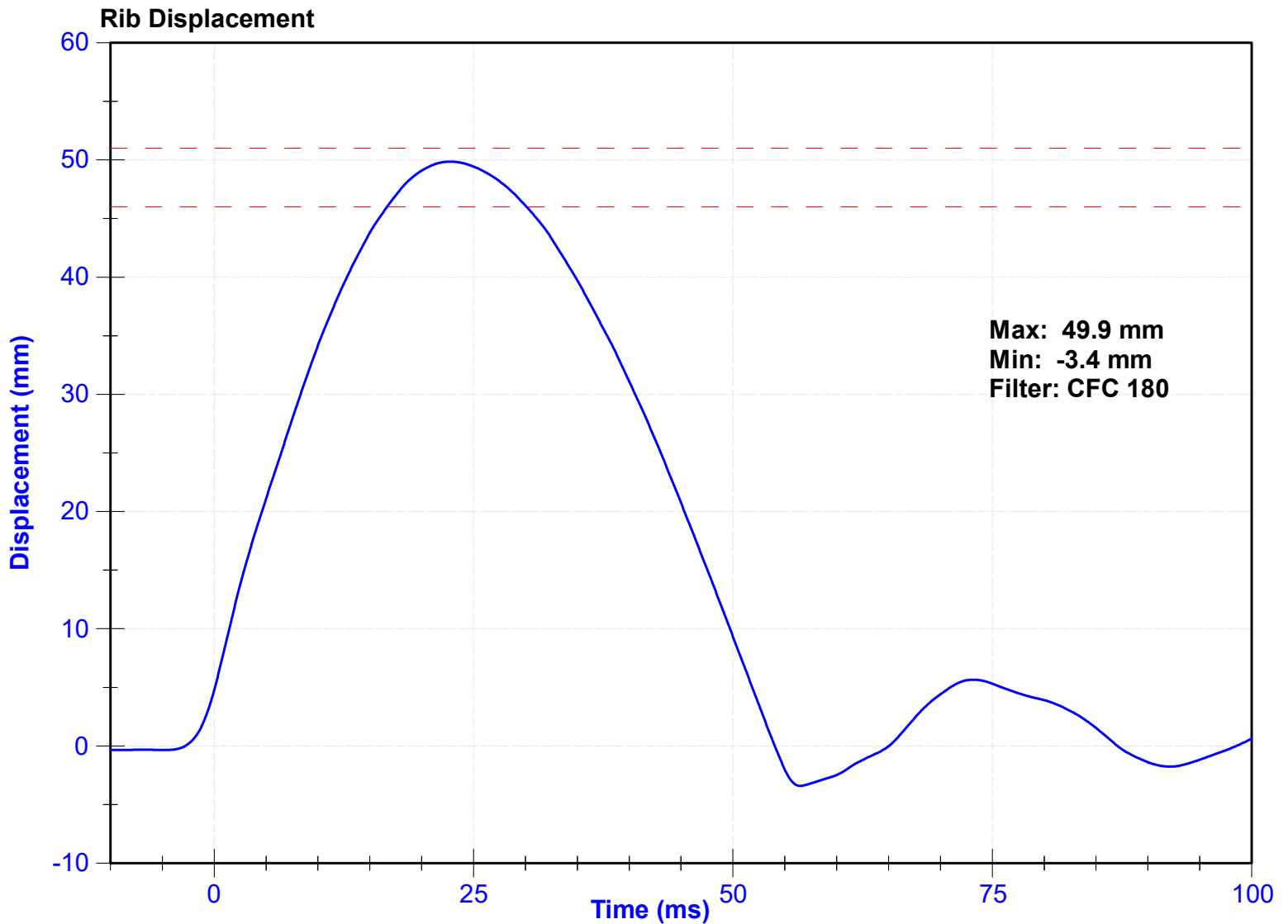
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	37	Pass
Rib Displacement	46	51	mm	49.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	269GFE	2/8/2024	8/8/2024



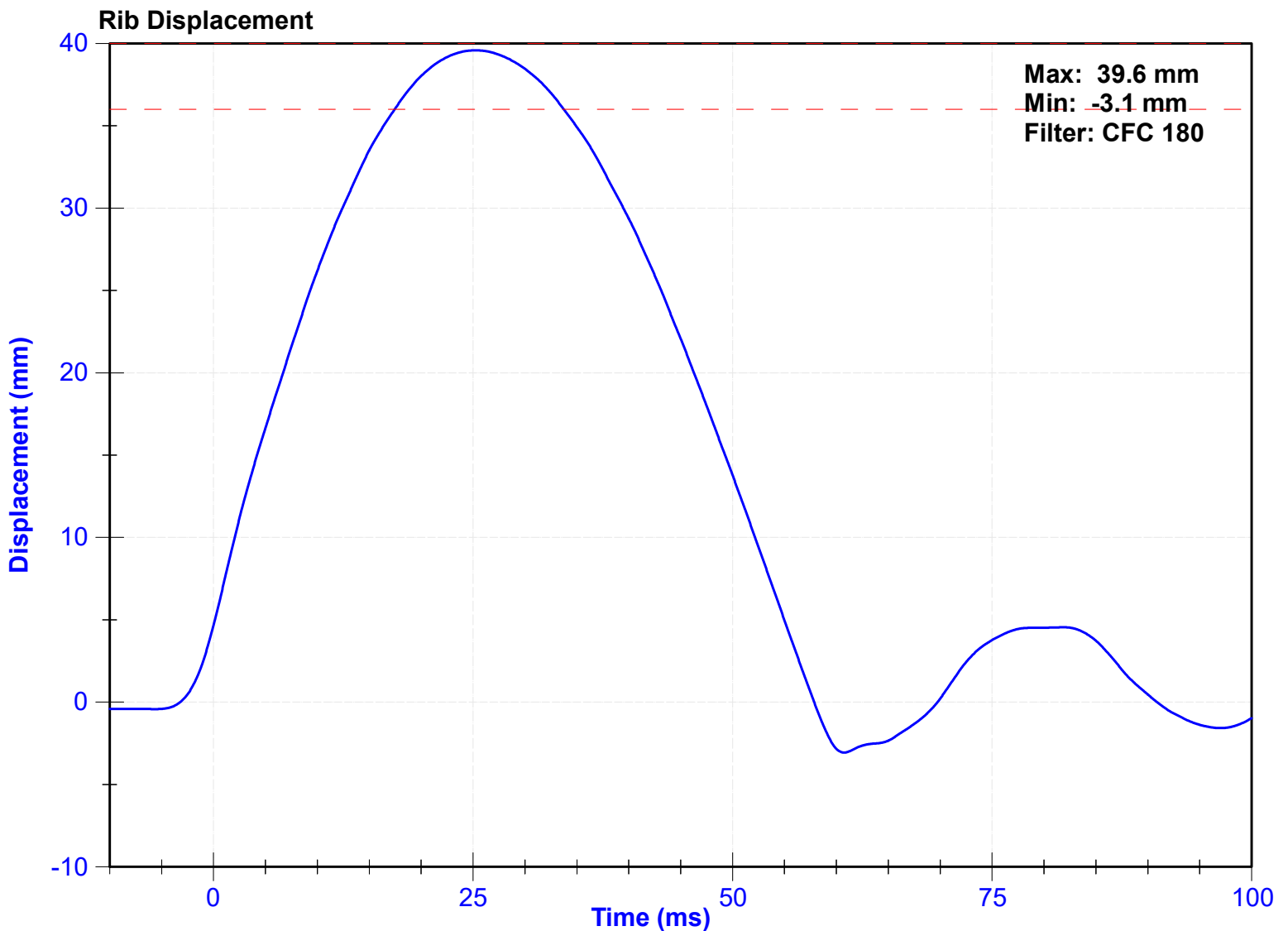
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	37	Pass
Rib Displacement	36	40	mm	39.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	269GFE	2/8/2024	8/8/2024



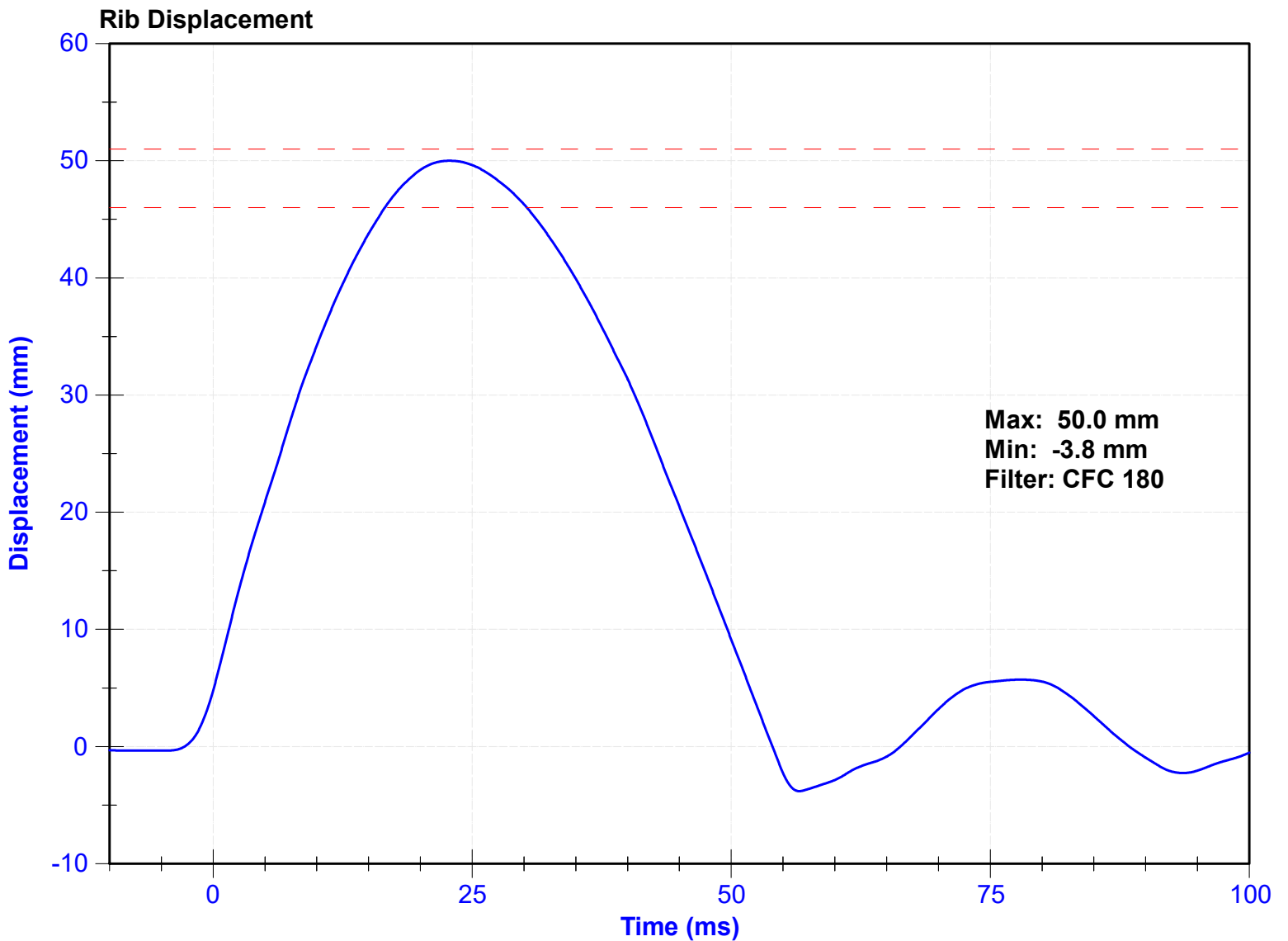
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	37	Pass
Rib Displacement	46	51	mm	50.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	270GFE	2/8/2024	8/8/2024



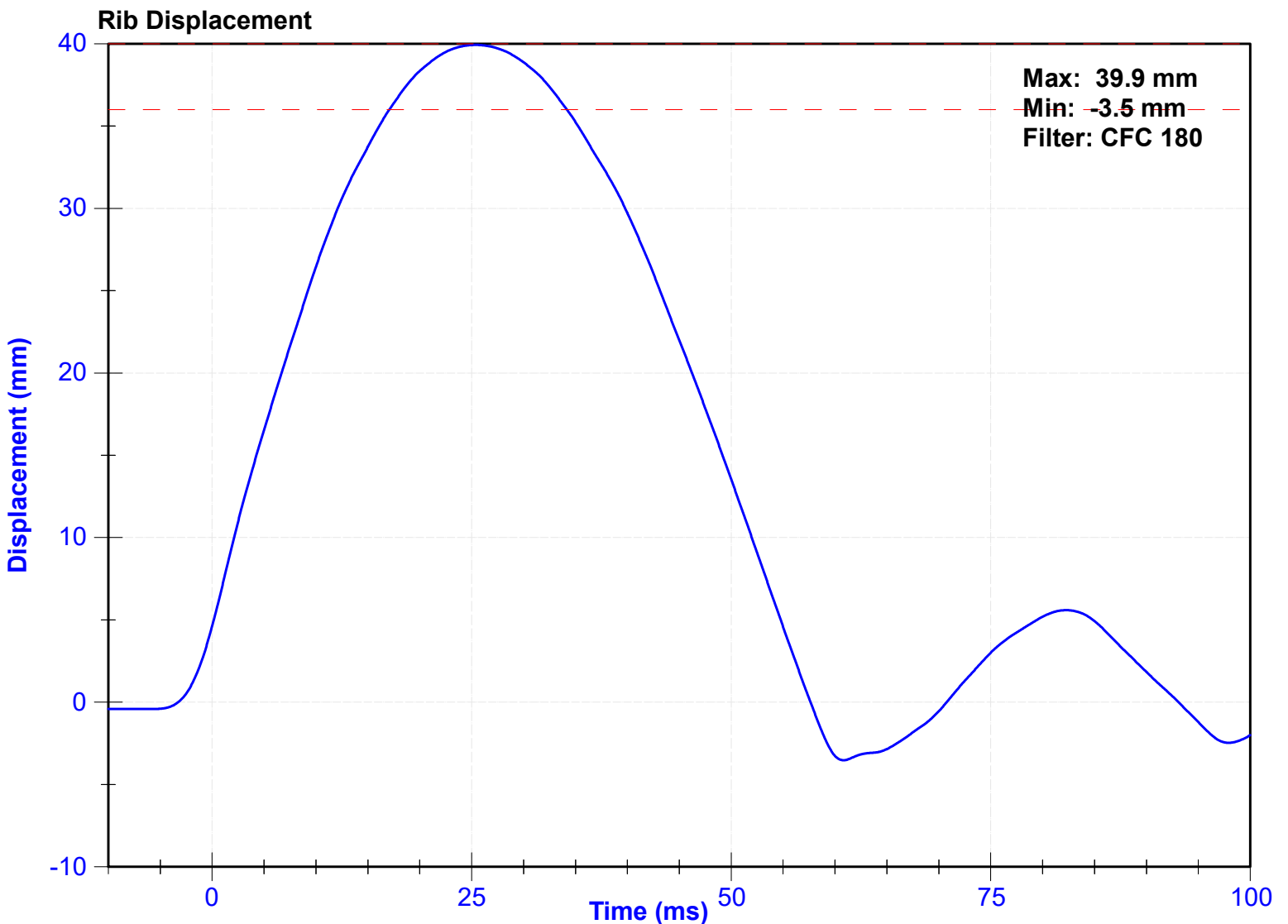
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	37	Pass
Rib Displacement	36	40	mm	39.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	270GFE	2/8/2024	8/8/2024



ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

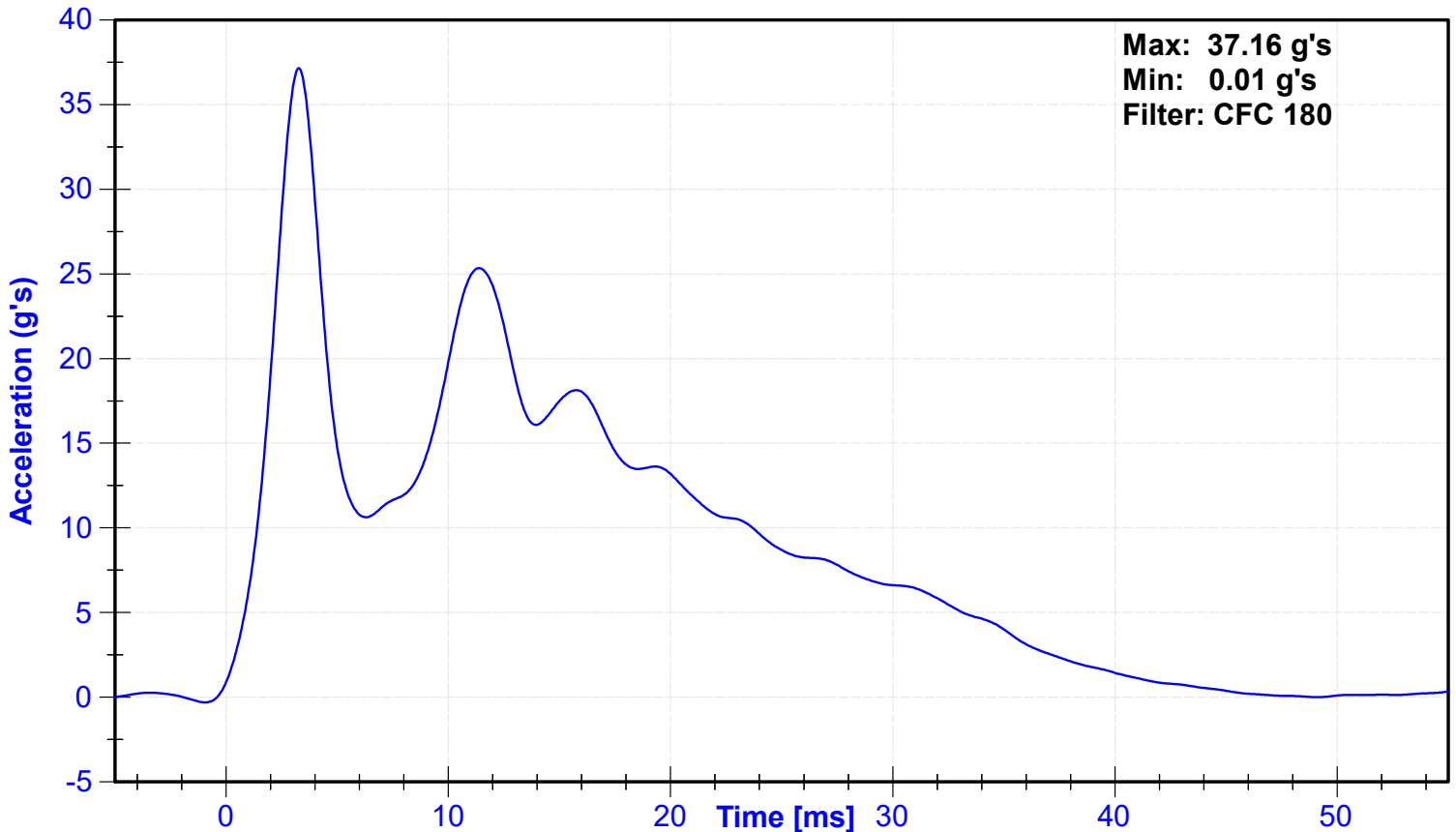
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.9	Pass
Humidity	10	70	%	32	Pass
Velocity	5.4	5.6	m/s	5.53	Pass
Resistive Force after 6ms	5100	6200	N	5806.3	Pass
Upper Thorax Rib Deflection	34	41	mm	40.8	Pass
Mid Thorax Rib Deflection	37	45	mm	39.2	Pass
Lower Thorax Rib Deflection	37	44	mm	40.1	Pass

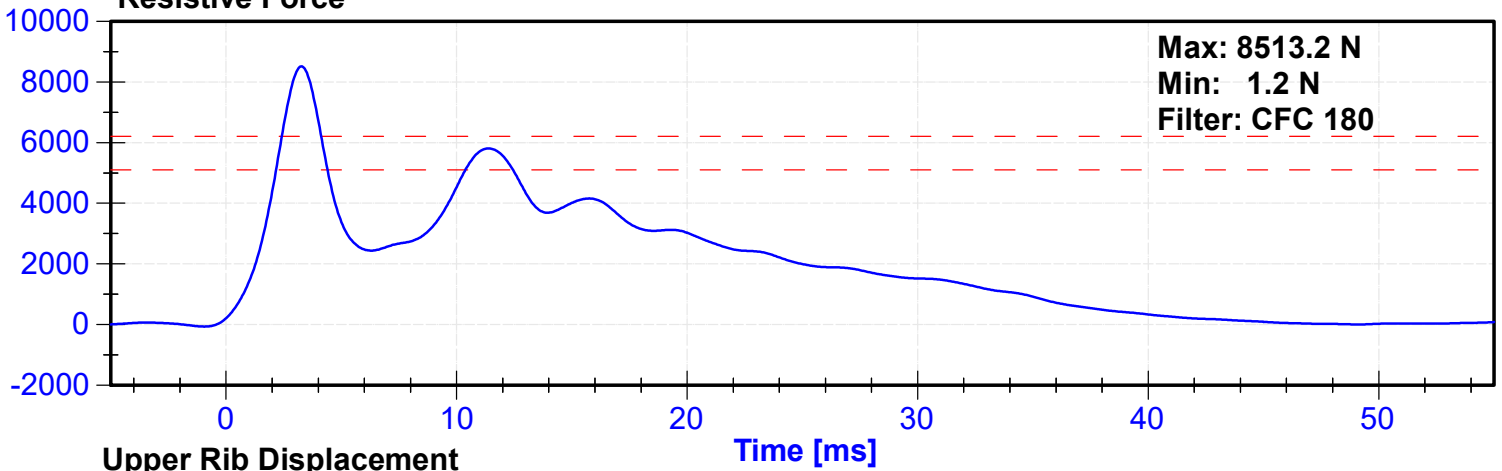
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18619	3/29/2024	9/25/2024
Upper Thorax Rib Potentiometer	Honeywell	269GFE	2/8/2024	8/8/2024
Middle Thorax Rib Potentiometer	Honeywell	268GFE	2/8/2024	8/8/2024
Lower Thorax Rib Potentiometer	Honeywell	270GFE	2/8/2024	8/8/2024

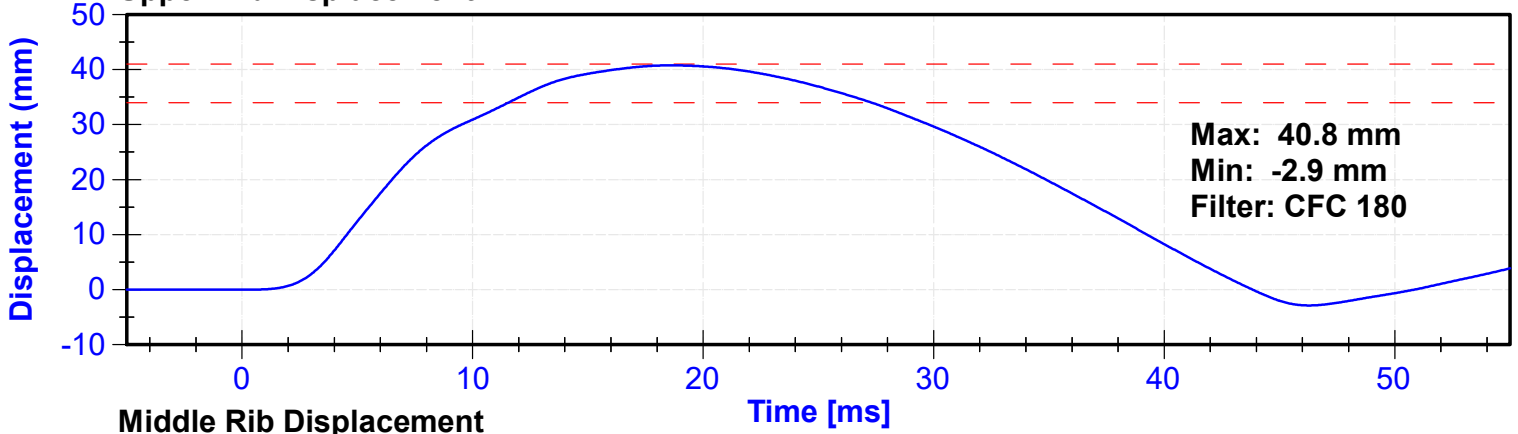
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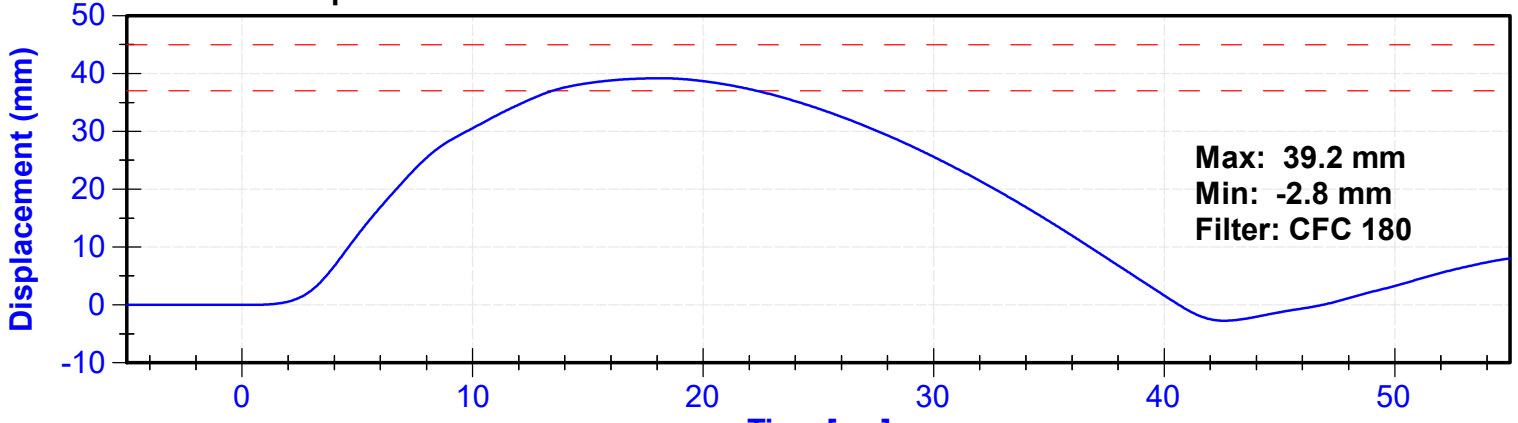
Resistive Force



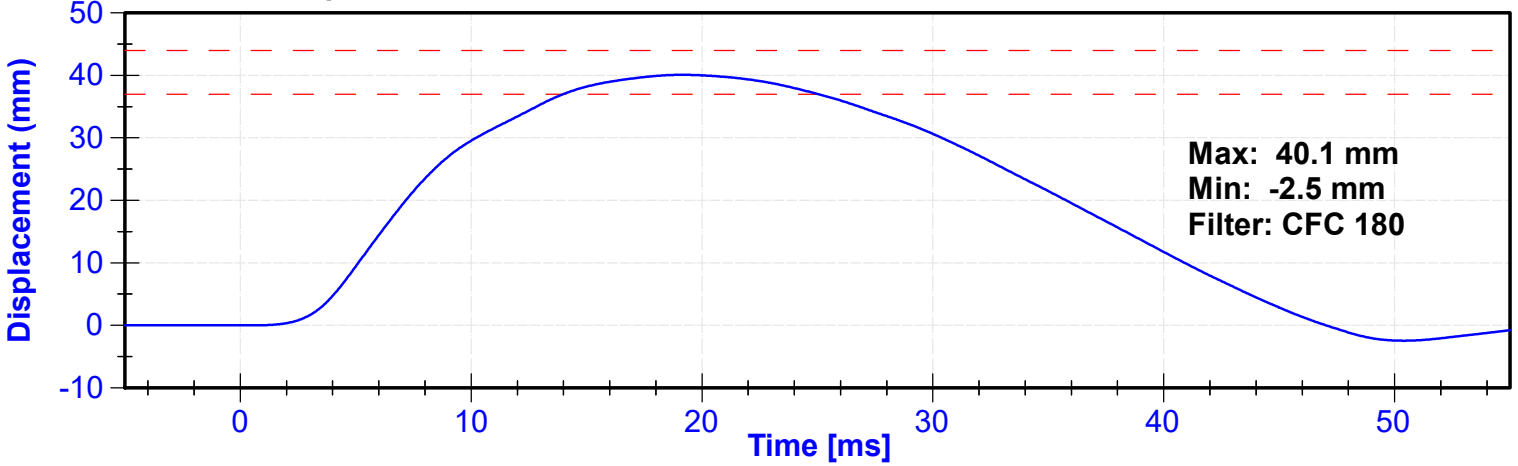
Upper Rib Displacement



Middle Rib Displacement



Lower Rib Displacement



ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

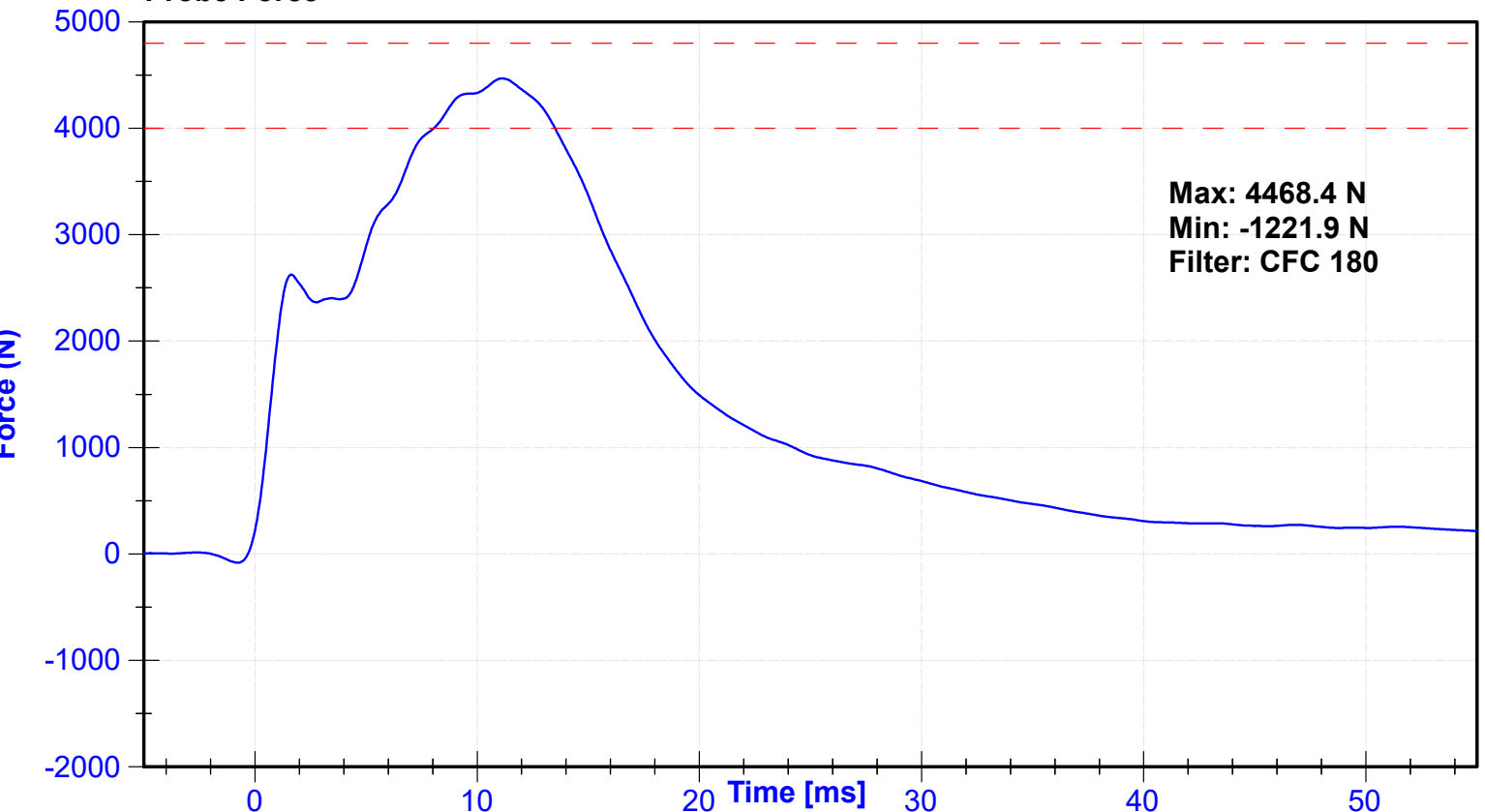
Results

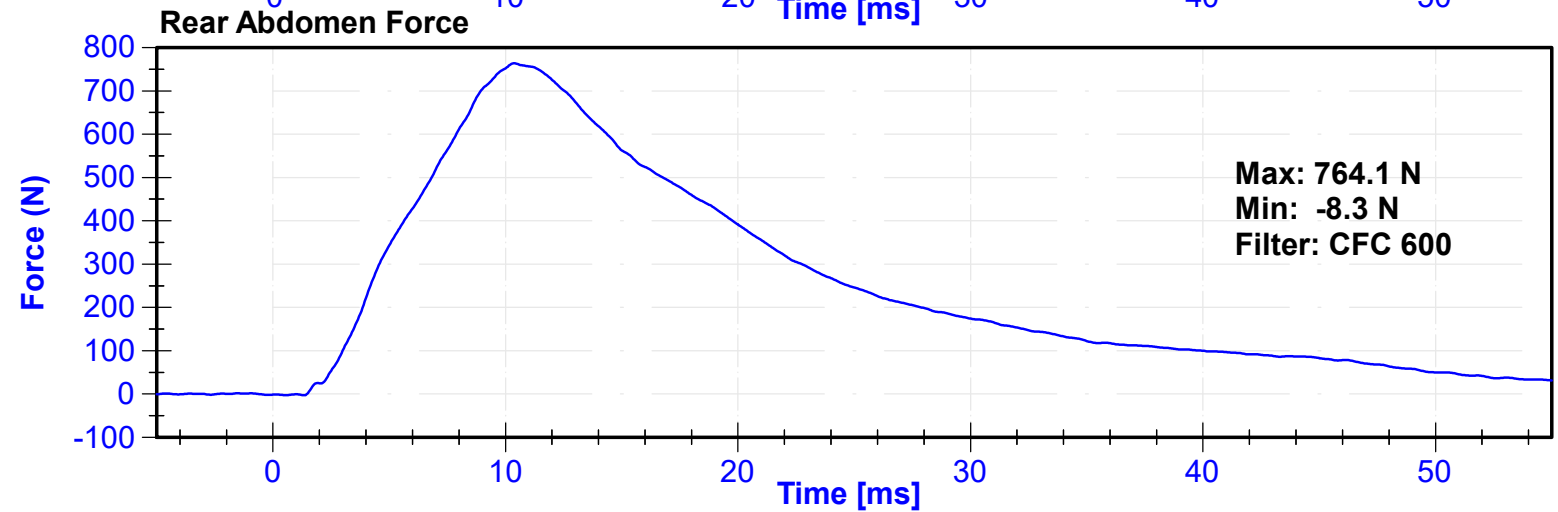
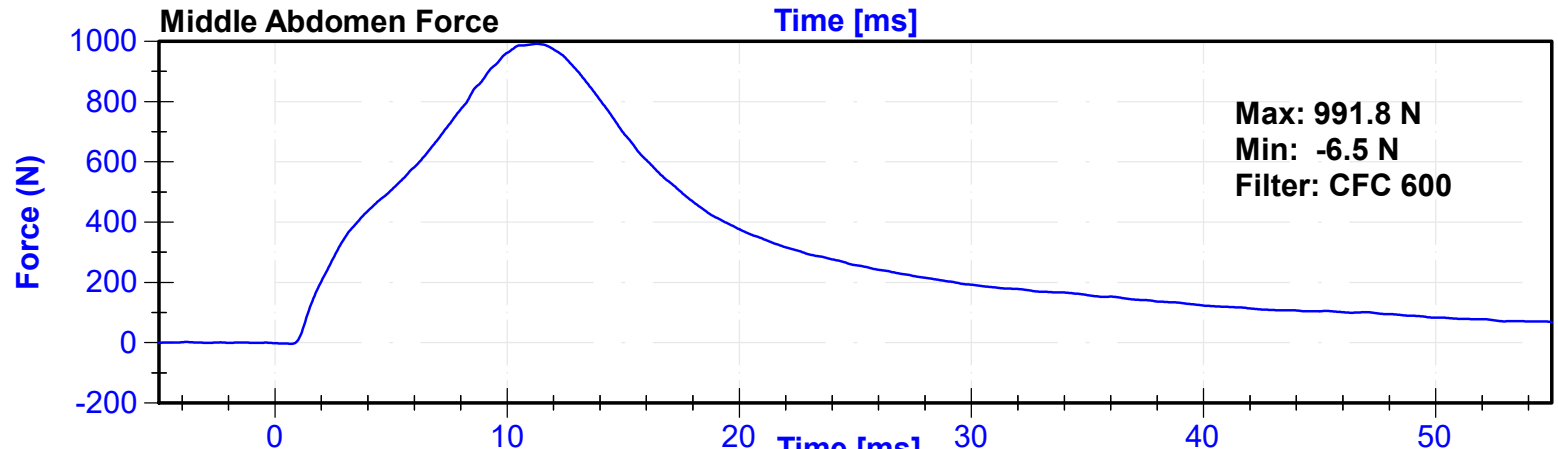
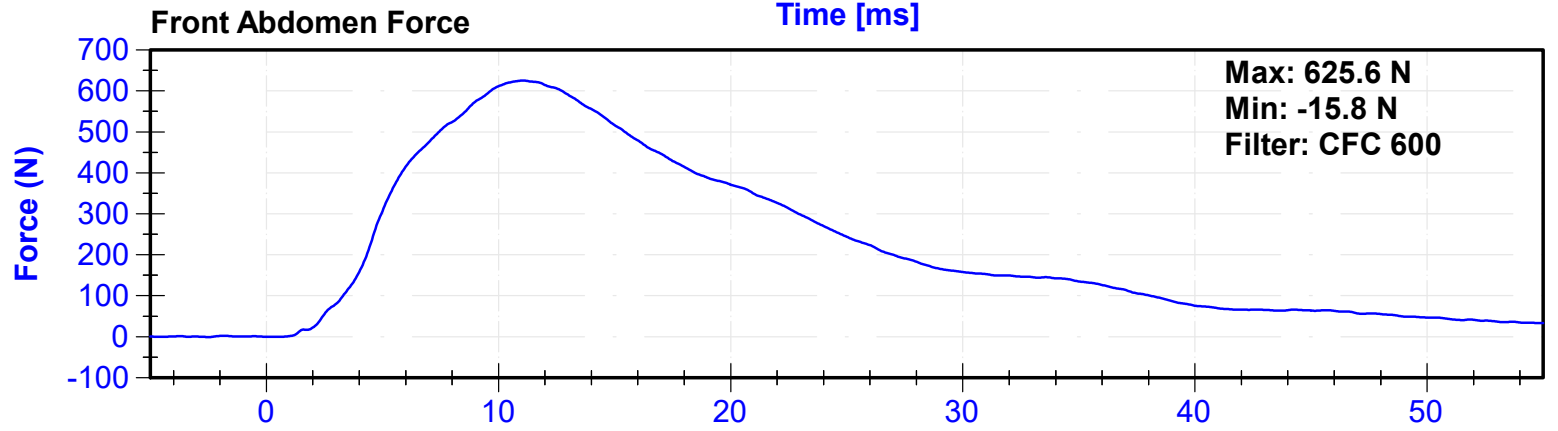
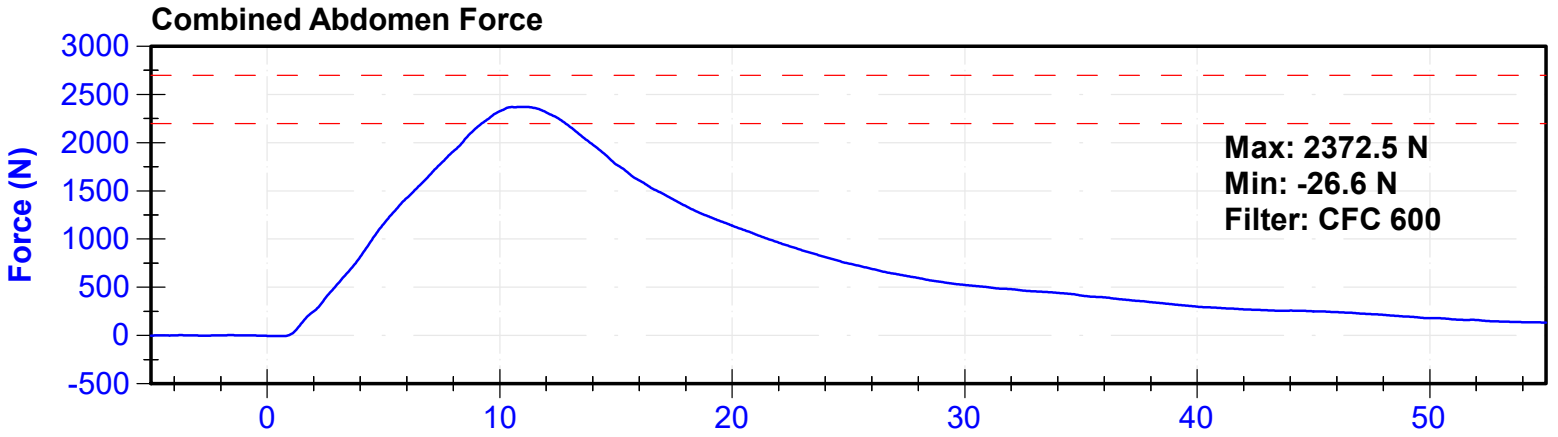
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.9	Pass
Humidity	10	70	%	32	Pass
Velocity	3.9	4.1	m/s	4.04	Pass
Combined Abdomen Force	2200	2700	N	2372.5	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.10	Pass
Resistive Probe Force	4000	4800	N	4468.4	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.15	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18619	3/29/2024	9/25/2024
Front Abdomen Load Cell	Denton	1512	8/15/2023	8/14/2024
Middle Abdomen Load Cell	Denton	1526	8/15/2023	8/14/2024
Rear Abdomen Load Cell	Denton	1516	8/15/2023	8/14/2024

Probe Force





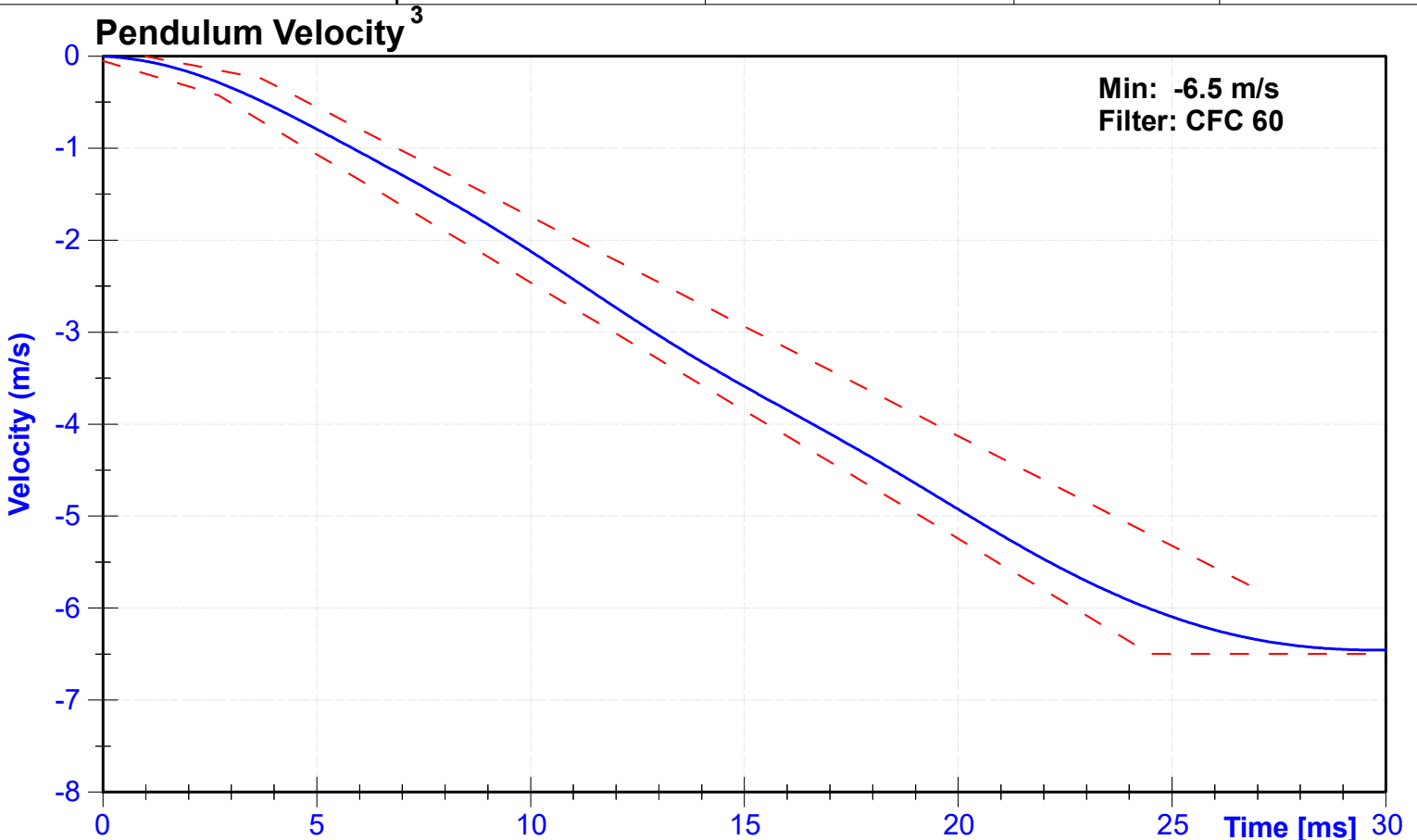
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

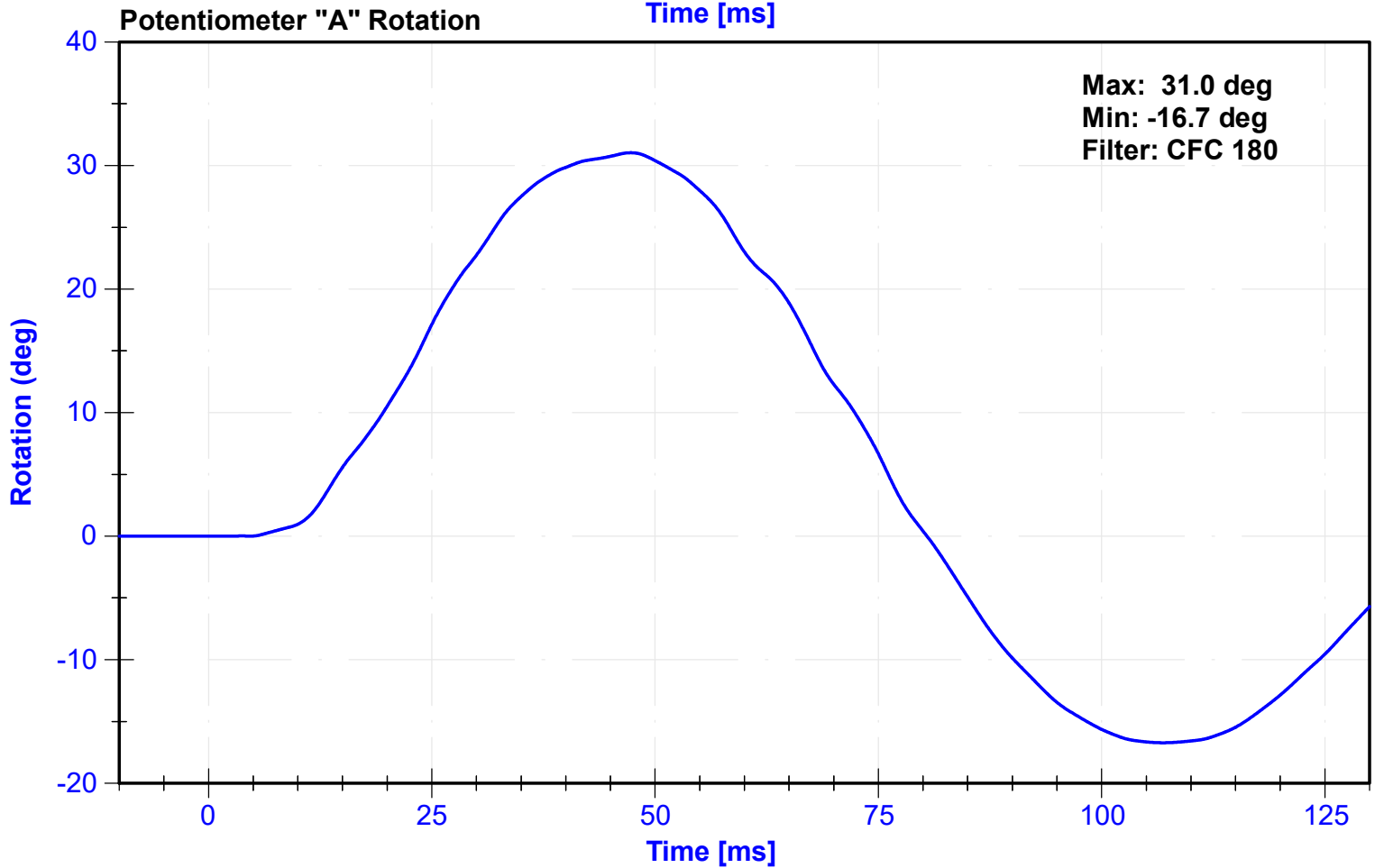
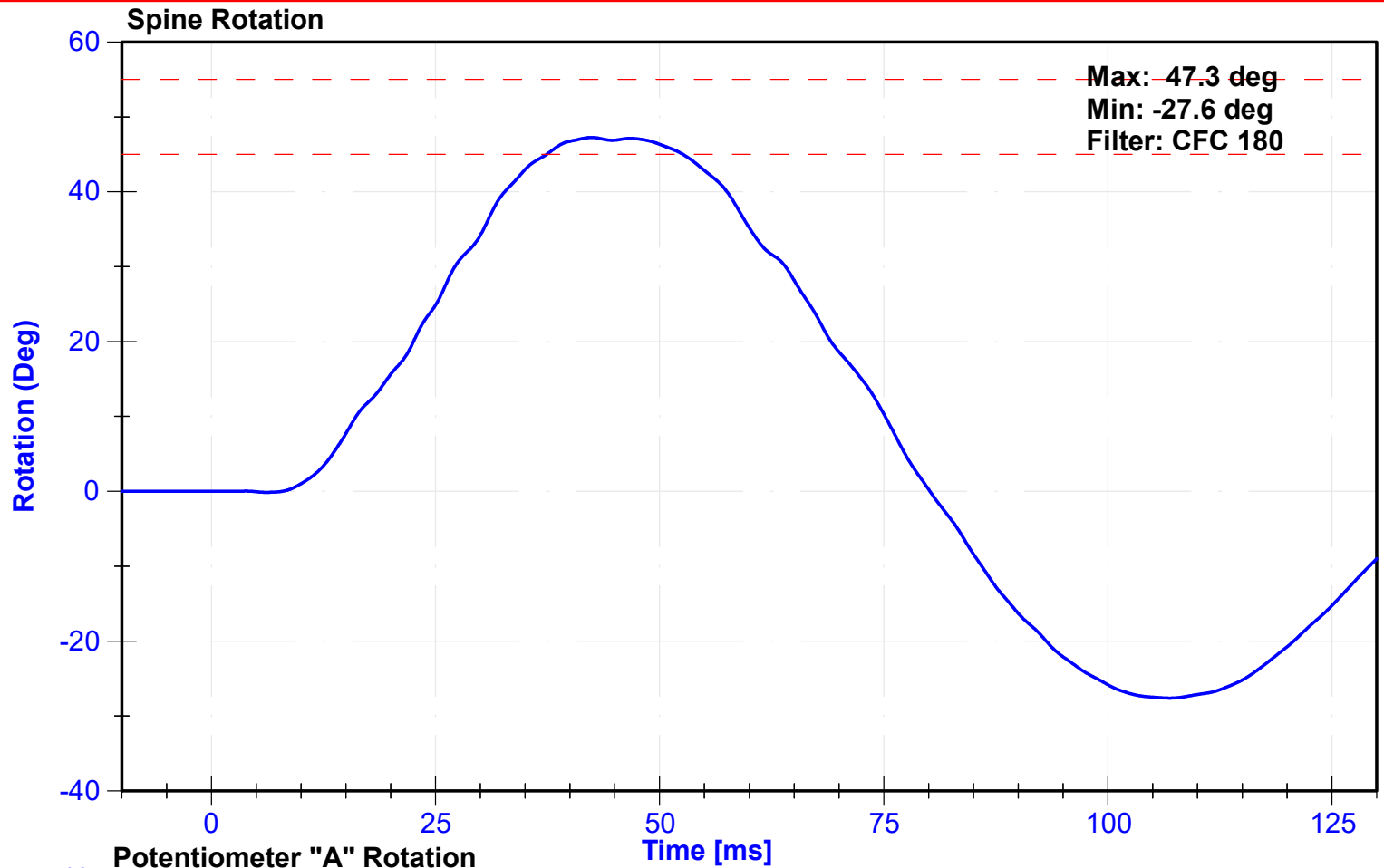
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	32	Pass
Velocity	5.95	6.15	m/s	5.972	Pass
Lateral Spine Rotation	45	55	deg	47.3	Pass
Time at Maximum Rotation	39	53	ms	42.4	Pass
Time of Decay to Zero Degrees	37	57	ms	37.8	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

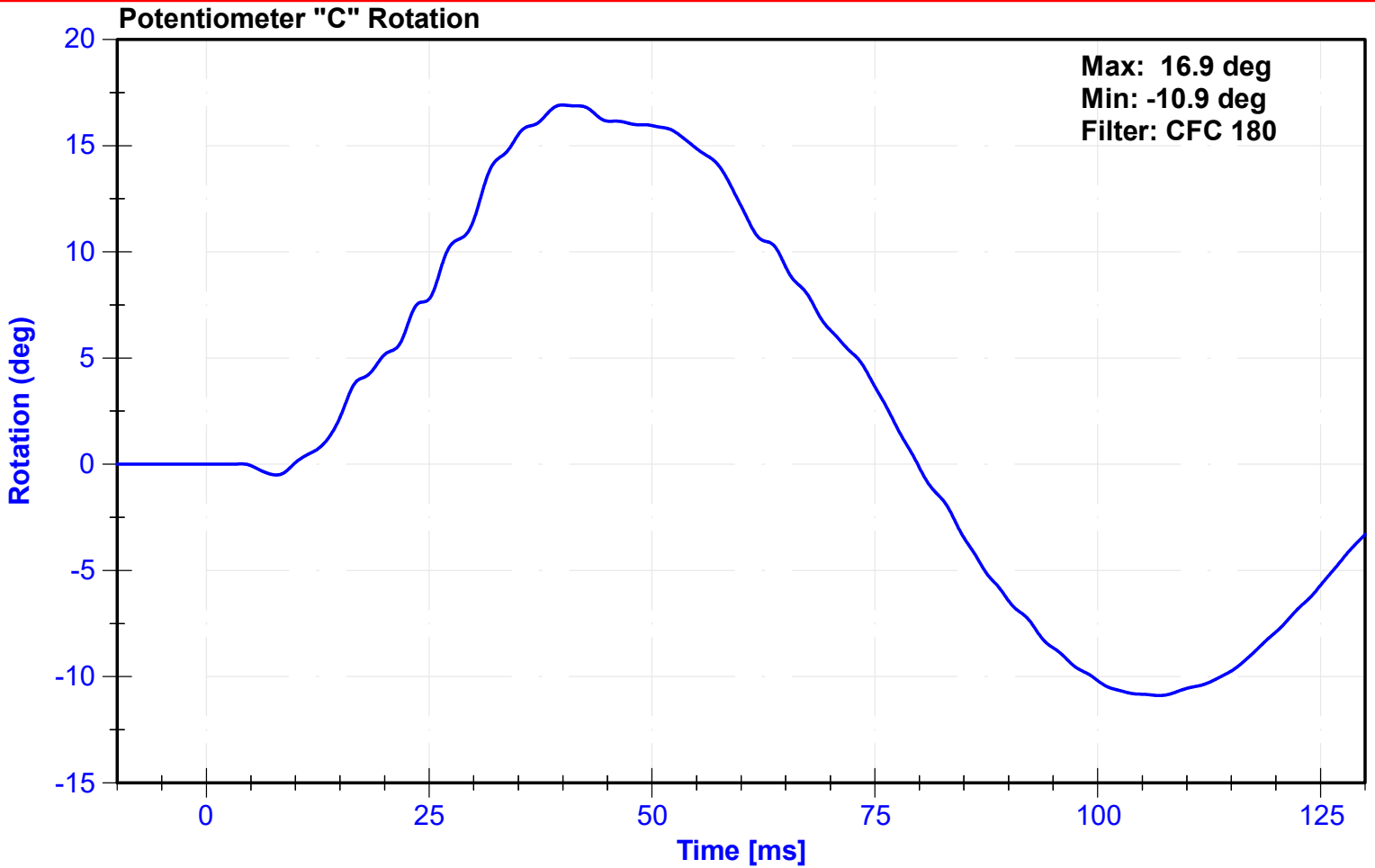
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/31/2023	4/28/2024
Pendulum "A" Potentiometer	Sfernice	2247	12/5/2023	12/4/2024
Condyle "B" Potentiometer	Sfernice	095	9/29/2023	9/28/2024



^{1,2} Upper and lower boundaries specified in Appendix I IV-19





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

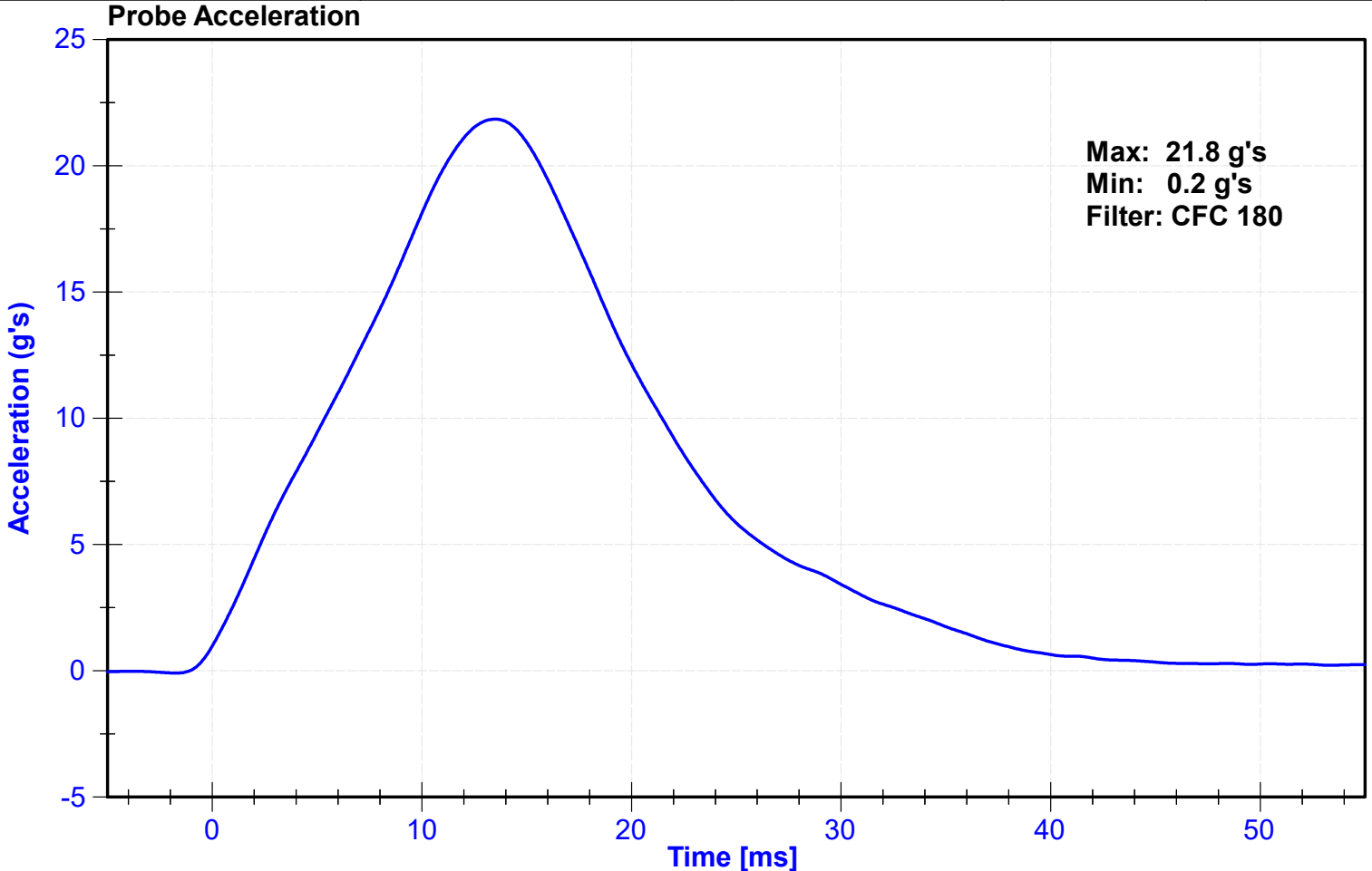
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

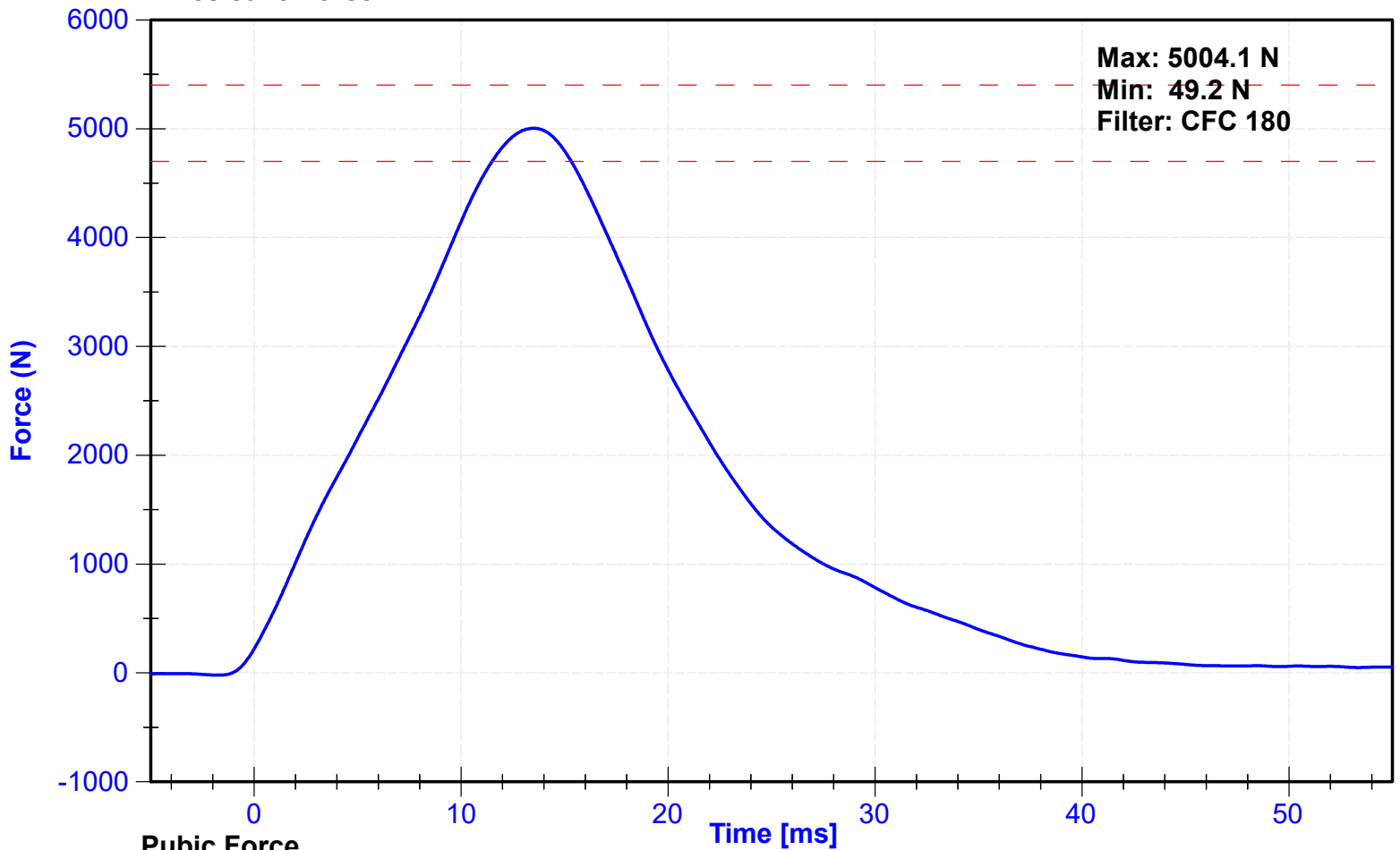
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.9	Pass
Humidity	10	70	%	32	Pass
Velocity	4.2	4.4	m/s	4.30	Pass
Resistive Force	4700	5400	N	5004.1	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.50	Pass
Pubic Force	-1590	-1230	N	-1270.0	Pass
Time at Peak Pubic Force	12.2	17.0	ms	15.50	Pass

Transducer Calibrations

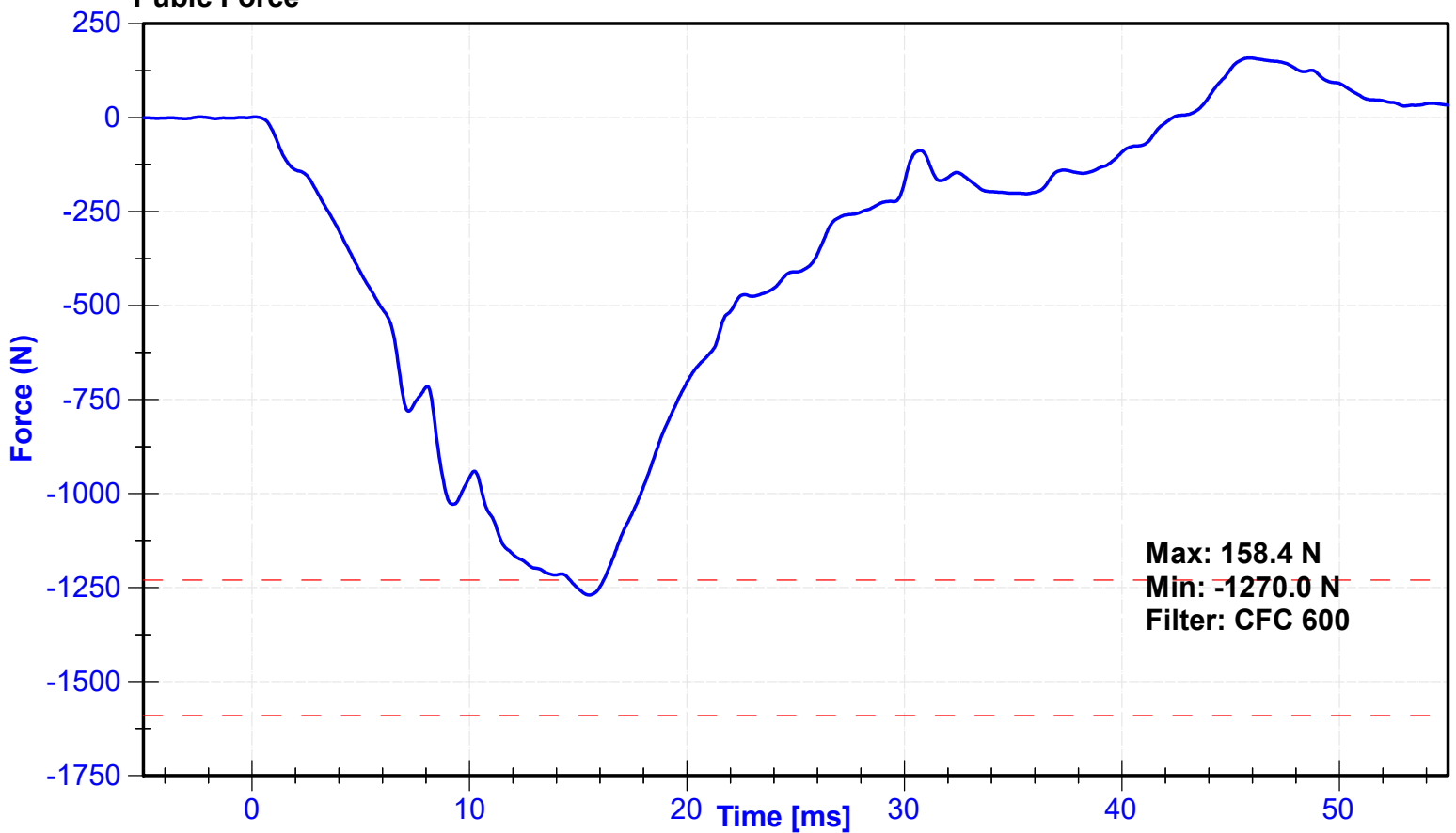
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18619	3/29/2024	9/25/2024
Pubic Load Cell	Denton	464-FY	8/15/2023	8/14/2024



Resistive Force



Pubic Force



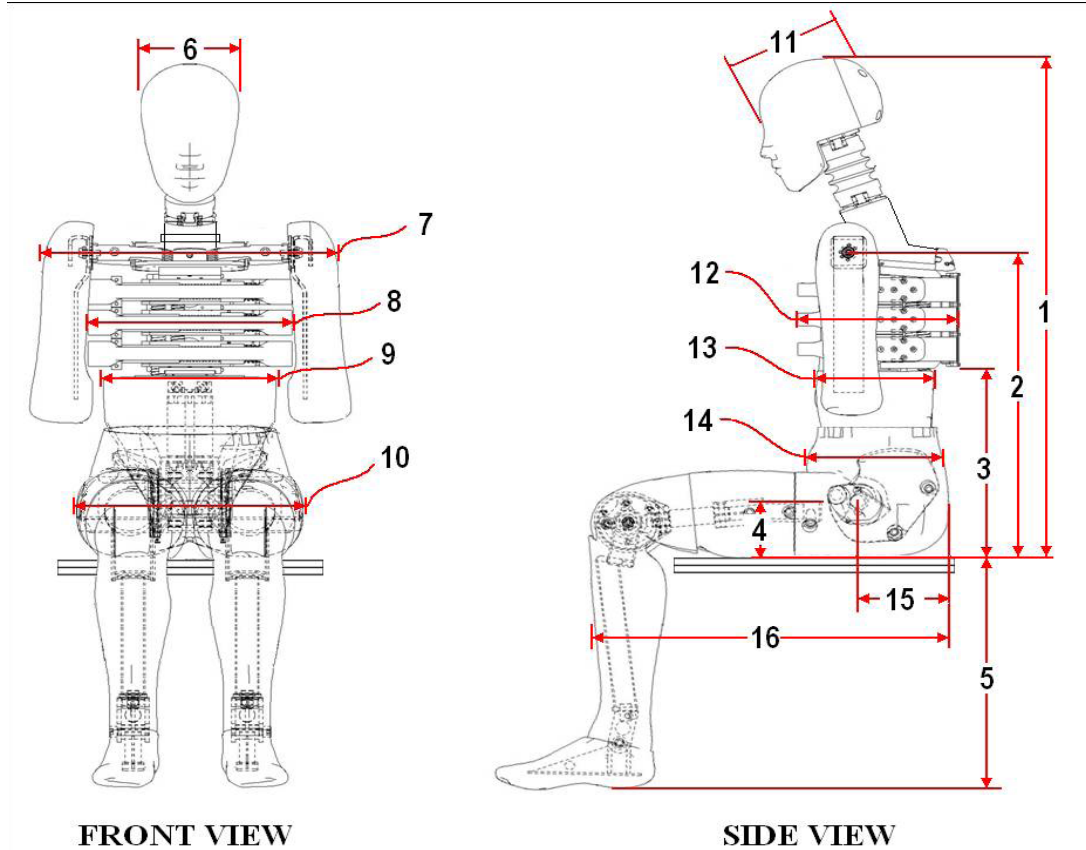
POST-TEST DUMMY PERFORMANCE CALIBRATION TEST DATA
(Subpart U, ES-2re)

External Measurements - EuroSID-2re

Technician: T. Roseman

Date: 06/11/2024

Dummy Serial Number: DG5348



Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	913	Pass
2	Seat to Shoulder Joint	558	572	568	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	351	Pass
4	Seat to Hip Joint (center of bolt)	97	103	102	Pass
5	Sole to Seat, Sitting	333	451	414	Pass
6	Head Width	152	158	155	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	327	Pass
9	Abdomen Width	273	287	280	Pass
10	Pelvis Lap Width	359	373	367	Pass
11	Head Depth	196	206	200	Pass
12	Thorax Depth	262	272	268	Pass
13	Abdomen Depth	194	204	198	Pass
14	Pelvis Depth	235	245	240	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	600	Pass

ATD Manufacturer	FTSS	Test Technician	J.Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

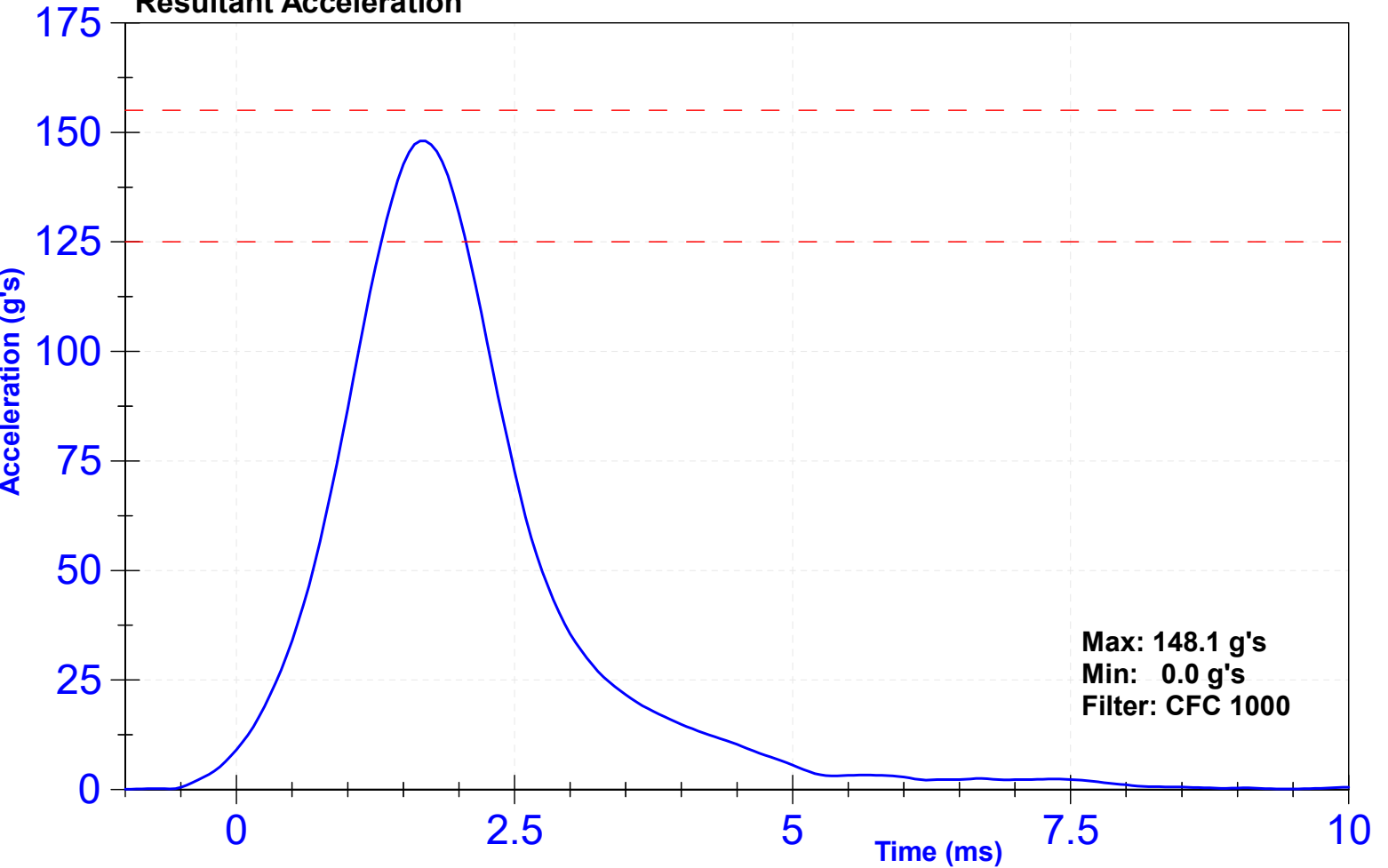
Results

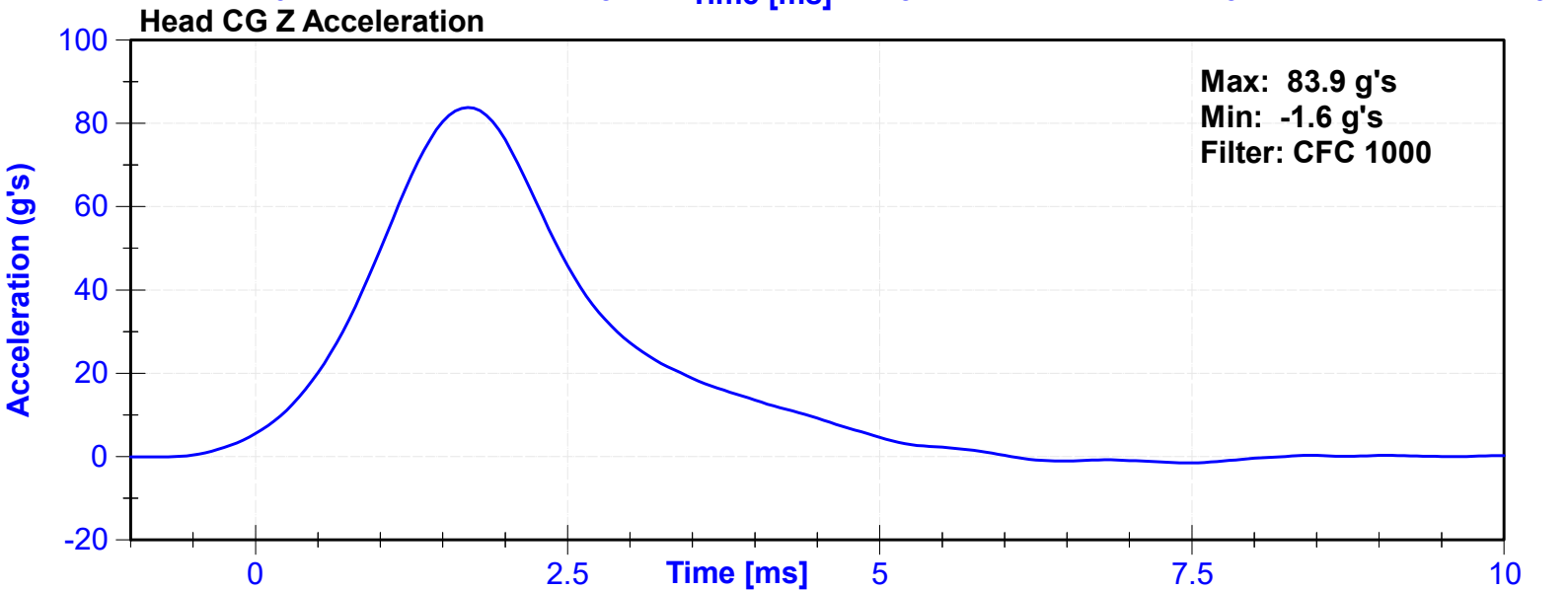
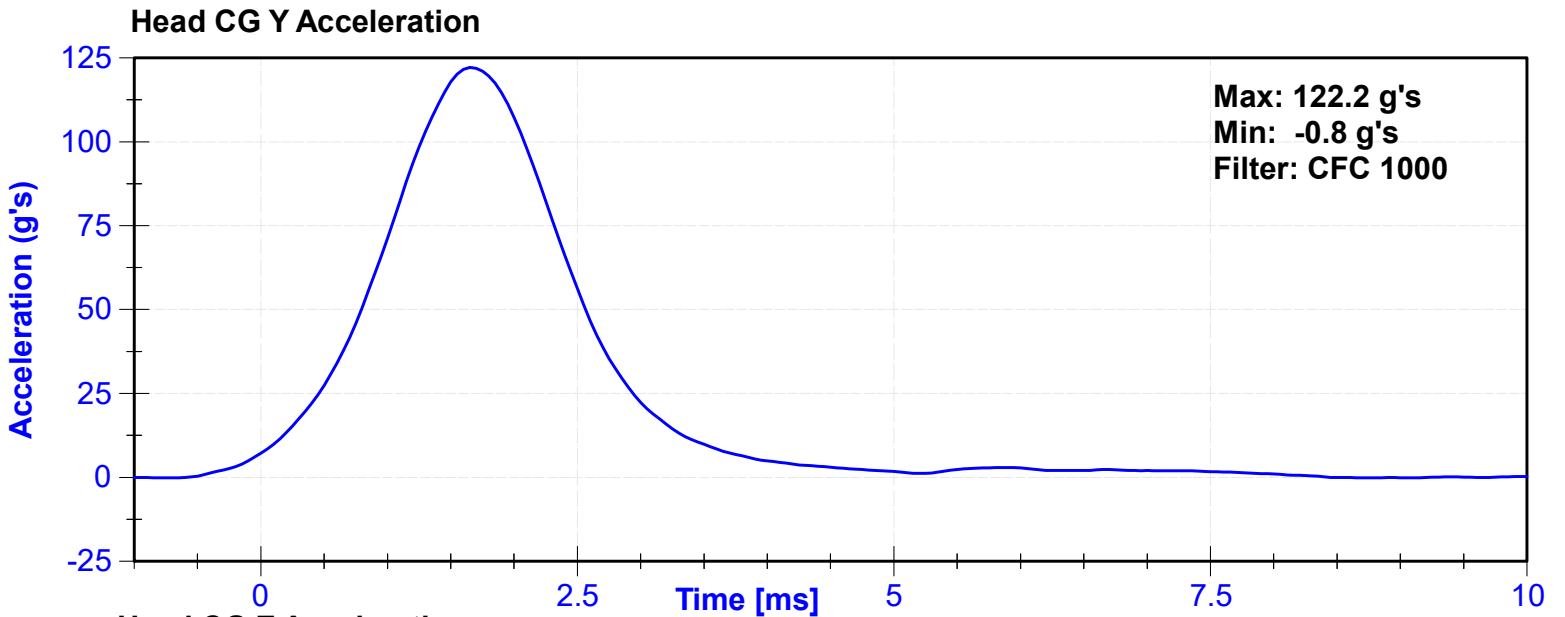
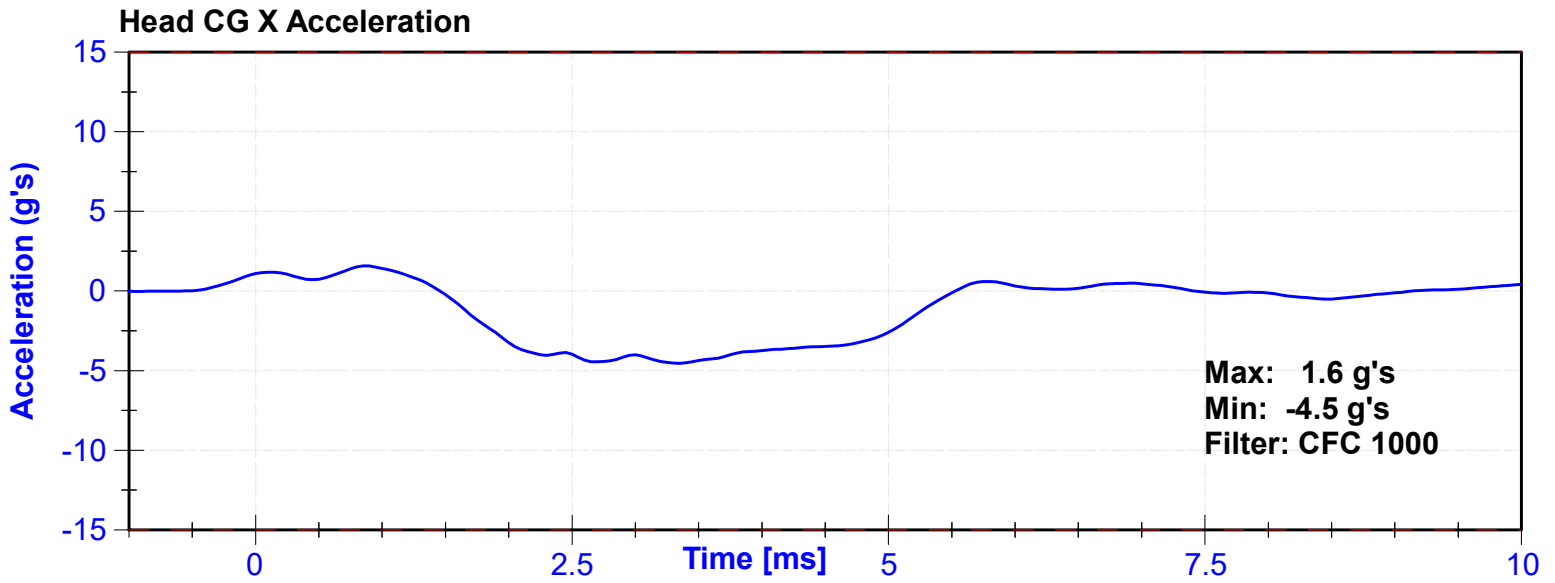
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	47	Pass
Resultant Acceleration	125	155	g's	148.1	Pass
Oscillation	0	15	%	2.22	Pass
Fore-Aft Acceleration	-15	15	g's	-4.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	18613	2/8/2024	8/6/2024
Y Accelerometer	Endevco	18472	2/8/2024	8/6/2024
Z Accelerometer	Endevco	18663	2/8/2024	8/6/2024

Resultant Acceleration





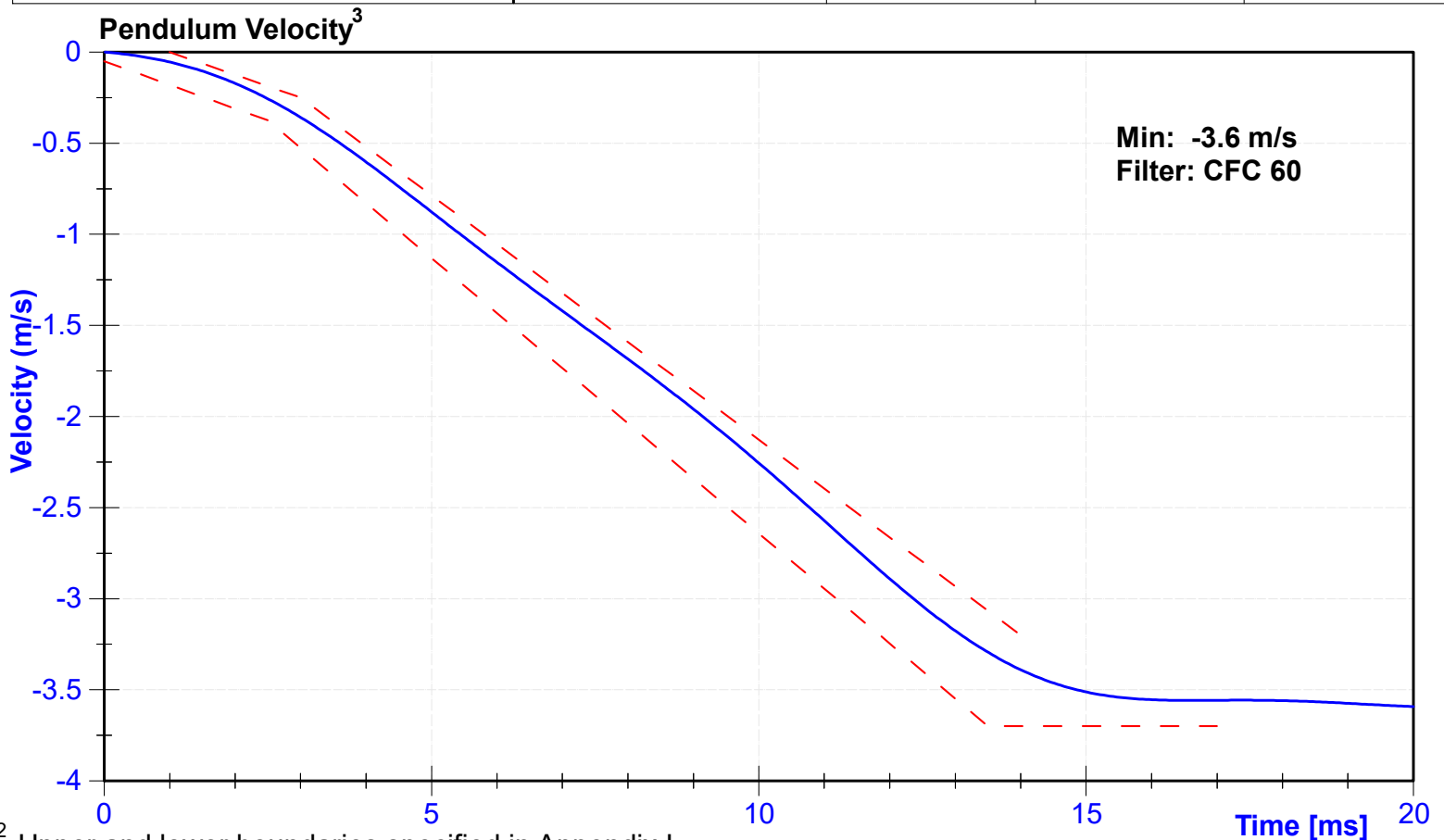
ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

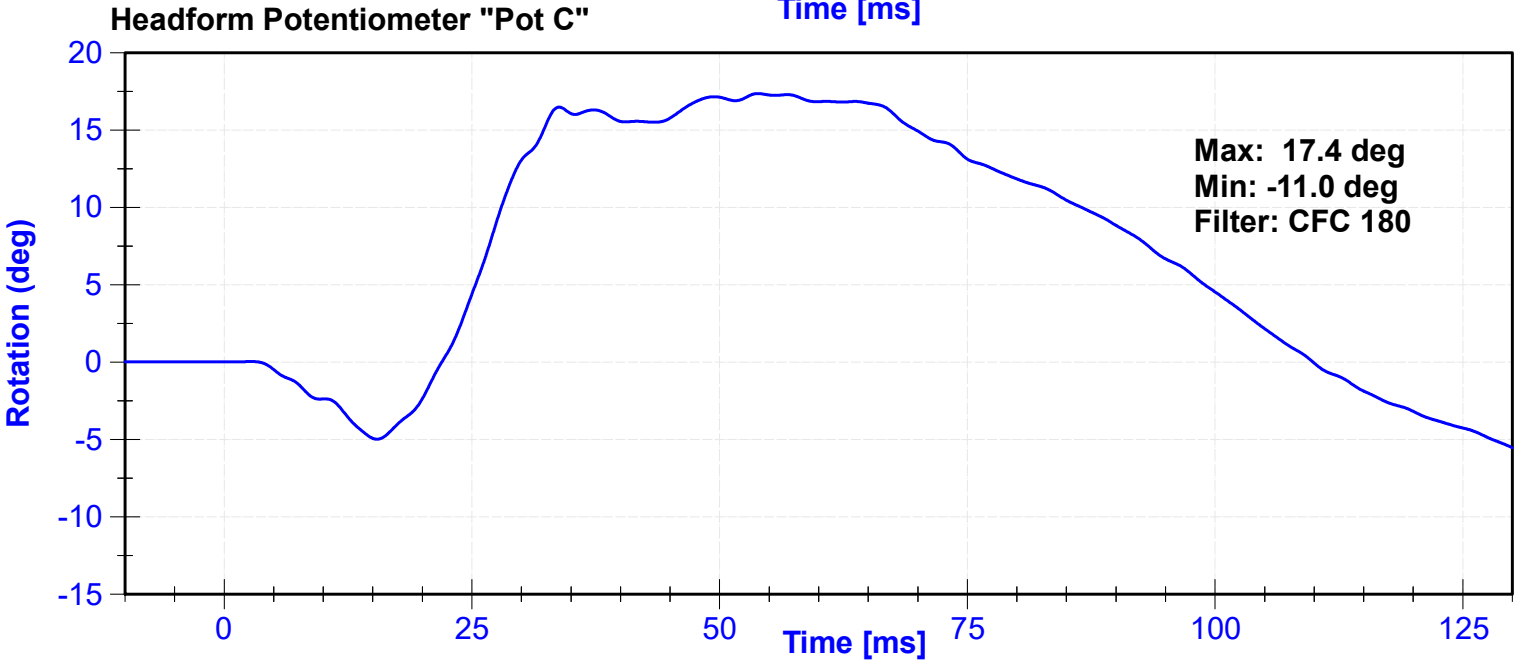
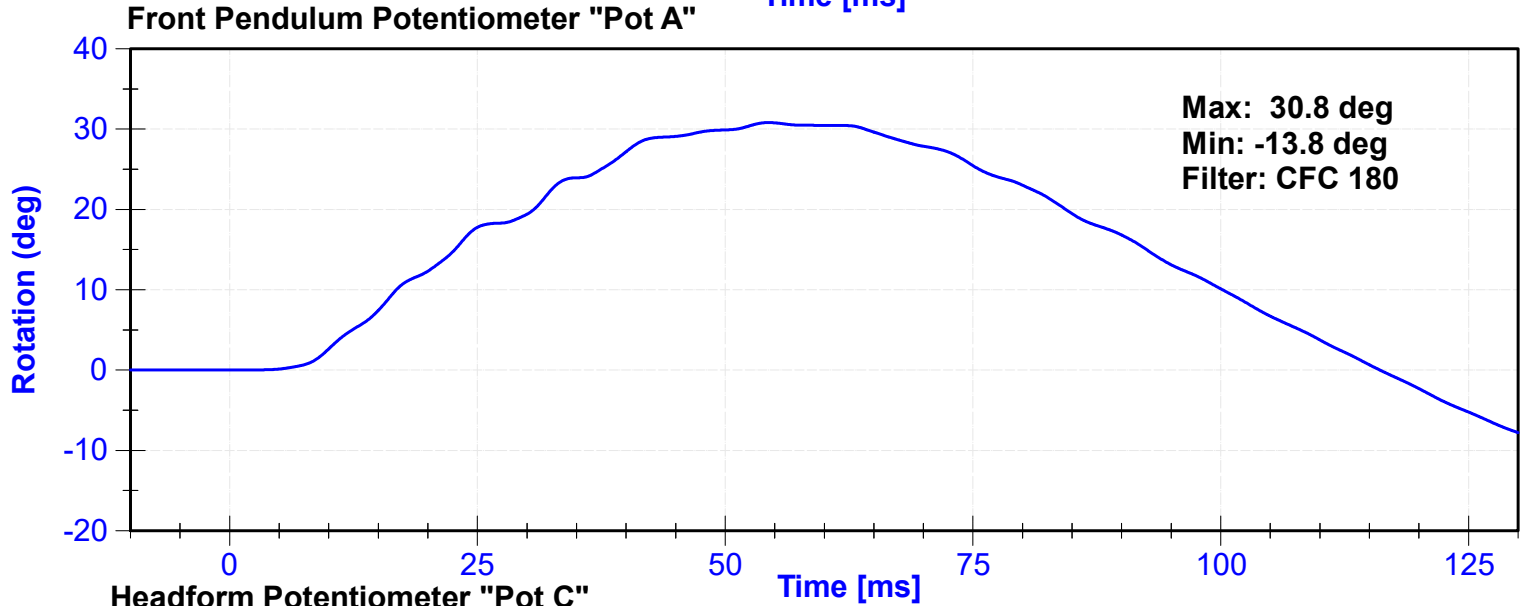
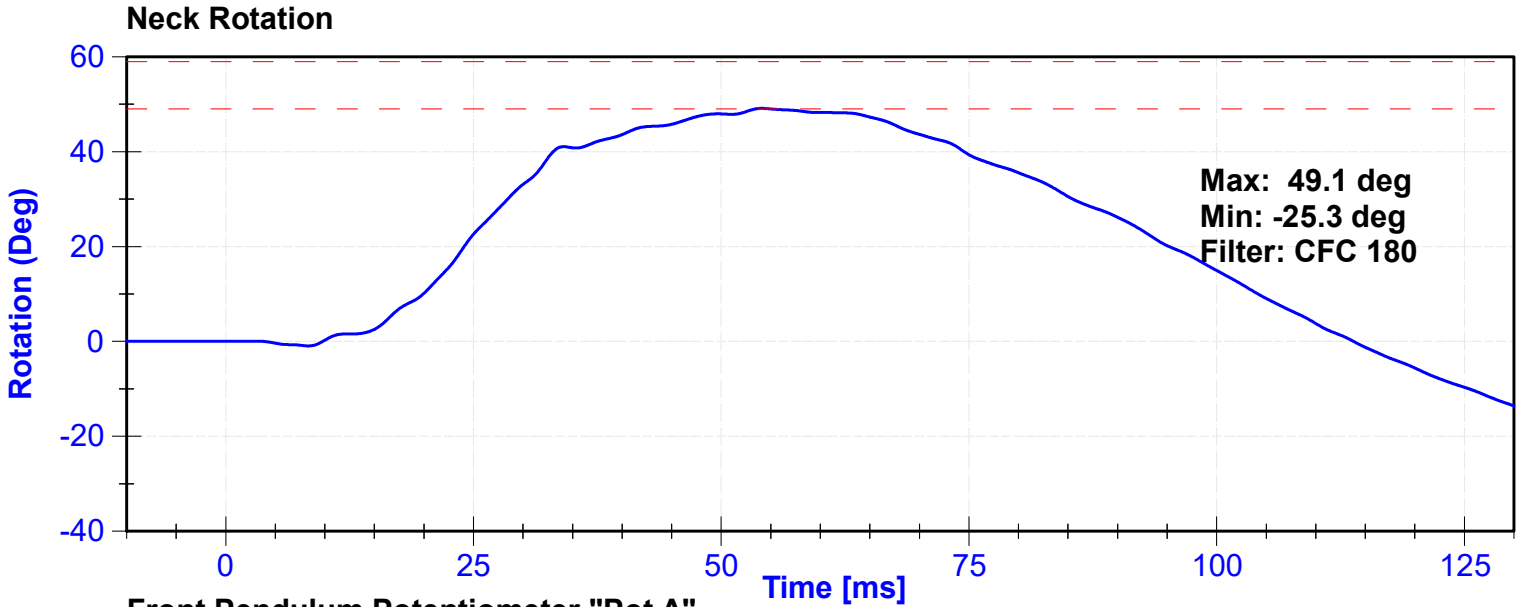
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	49	Pass
Velocity	3.3	3.5	m/s	3.33	Pass
Lateral Neck Rotation	49	59	deg	49.1	Pass
Time at Maximum Rotation	54	66	ms	54.1	Pass
Time of Rotation Decay from Maximum	53	88	ms	59.8	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	4/29/2024	10/26/2024
Front Pendulum Potentiometer	Sfernice	2247	12/5/2023	12/4/2024
Headform Potentiometer	Sfernice	095	9/29/2023	9/28/2024



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



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	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

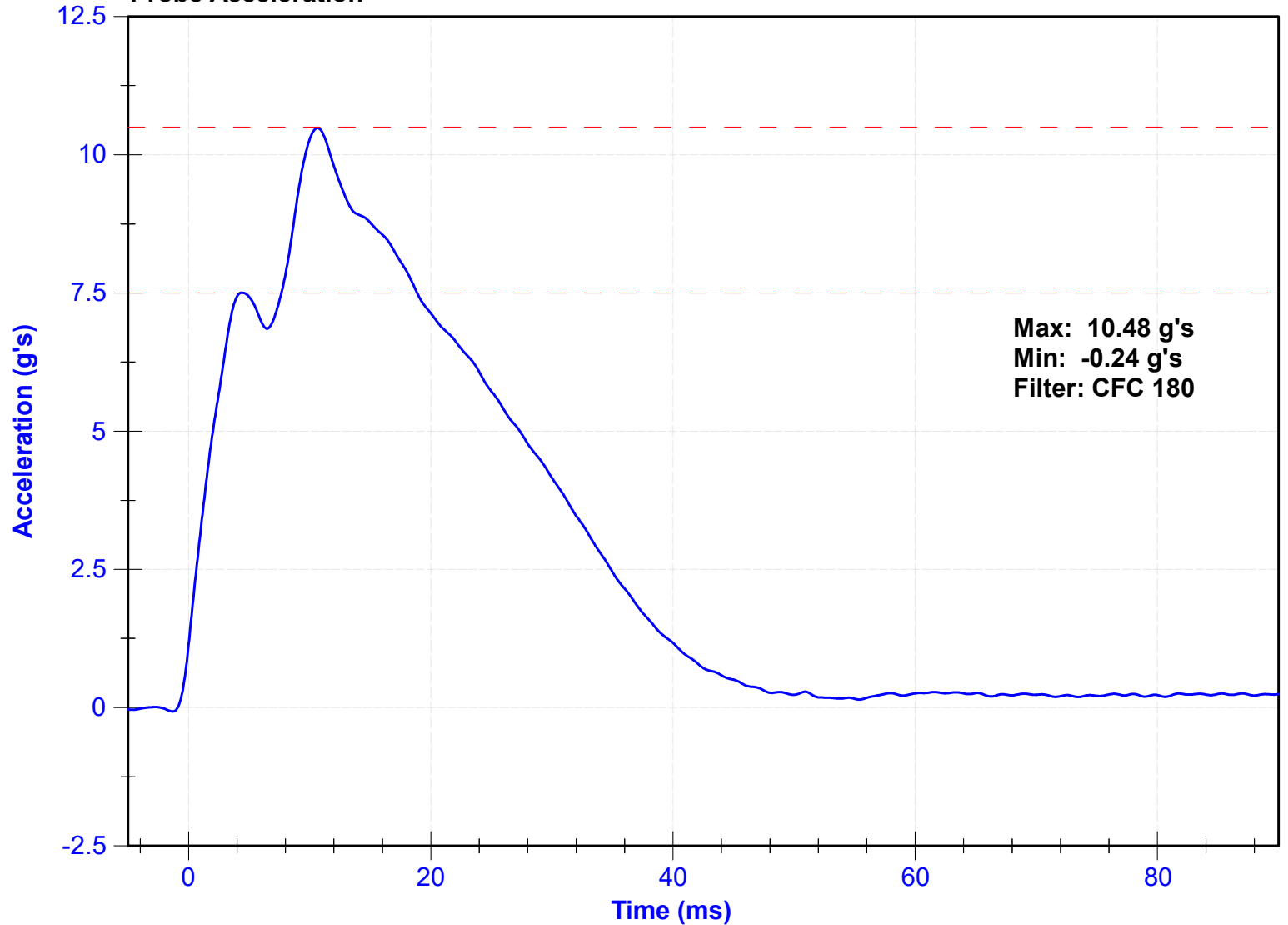
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	47	Pass
Velocity	4.2	4.4	m/s	4.26	Pass
Probe Acceleration	7.5	10.5	g's	10.48	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18587	11/20/2023	11/19/2024

Probe Acceleration



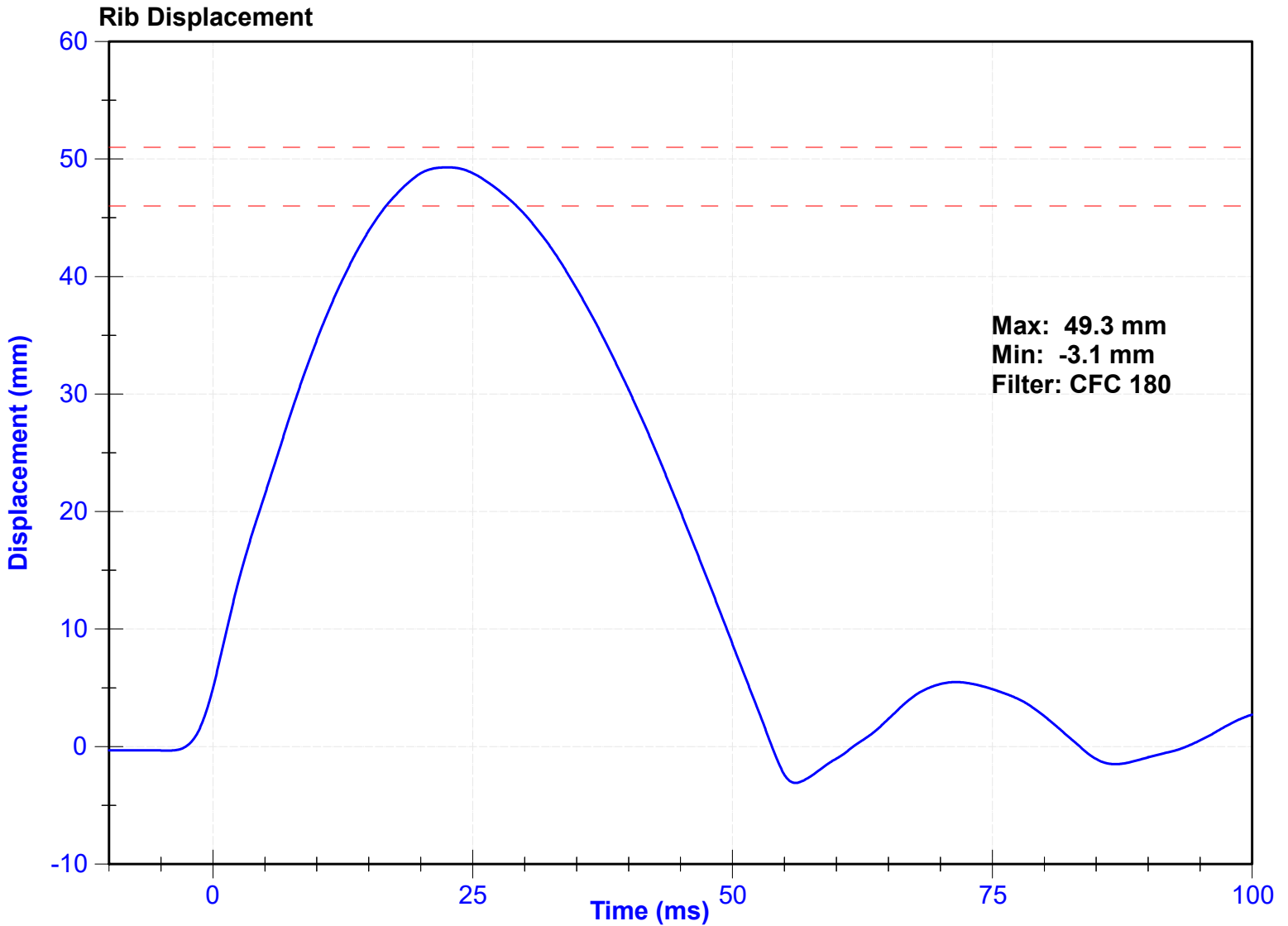
ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	47	Pass
Rib Displacement	46	51	mm	49.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	268GFE	2/8/2024	8/8/2024



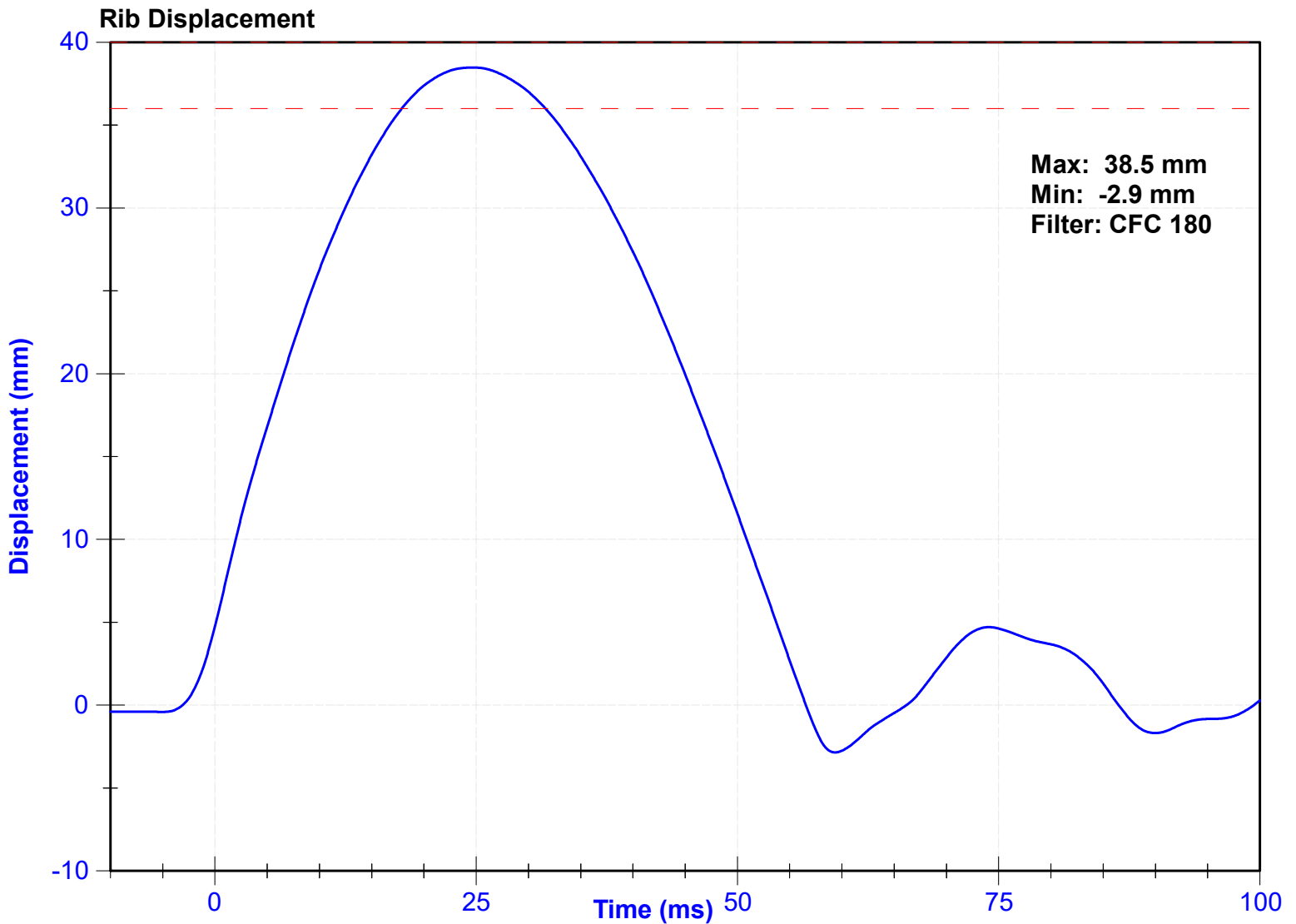
ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	47	Pass
Rib Displacement	36	40	mm	38.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	268GFE	2/8/2024	8/8/2024



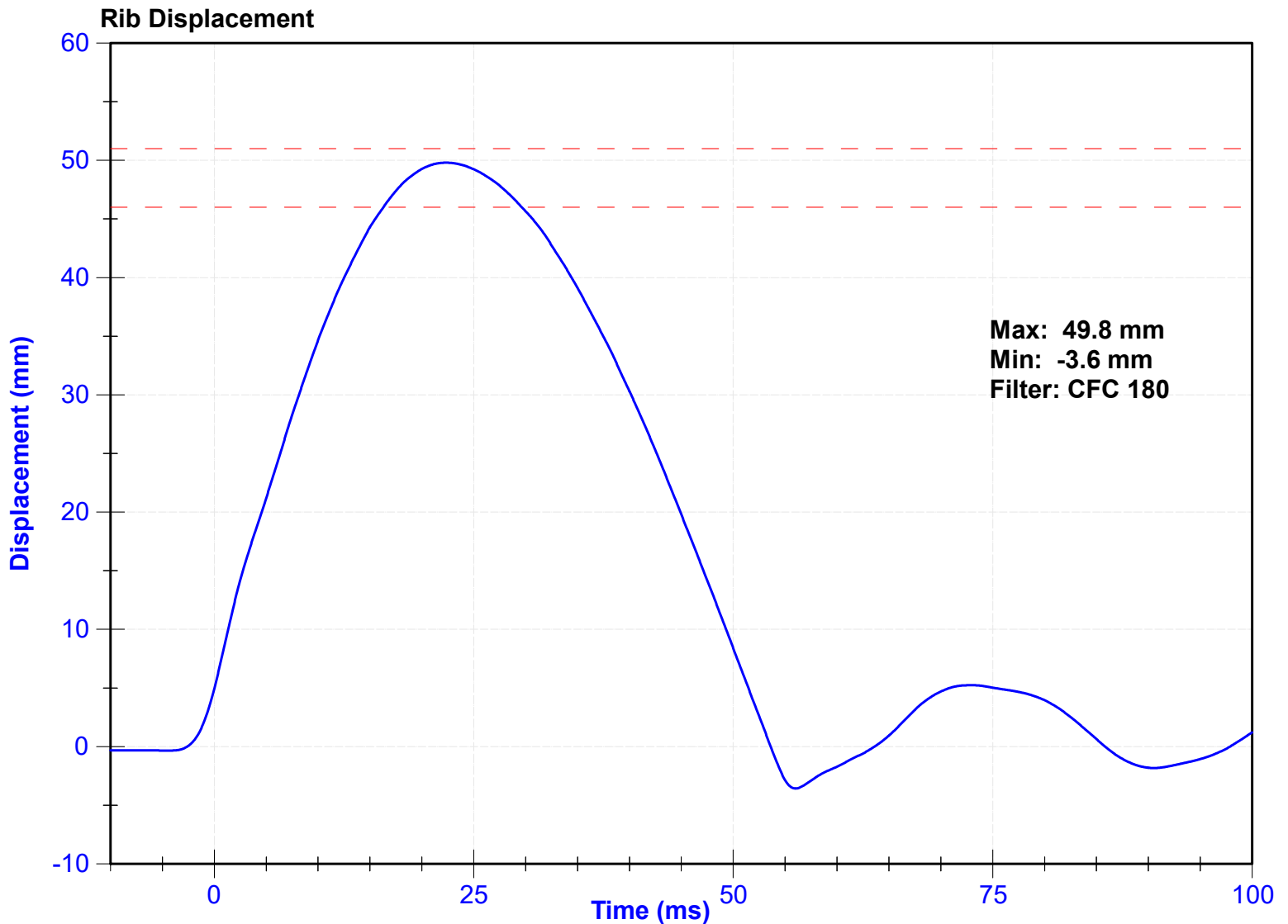
ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	47	Pass
Rib Displacement	46	51	mm	49.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	269GFE	2/8/2024	8/8/2024



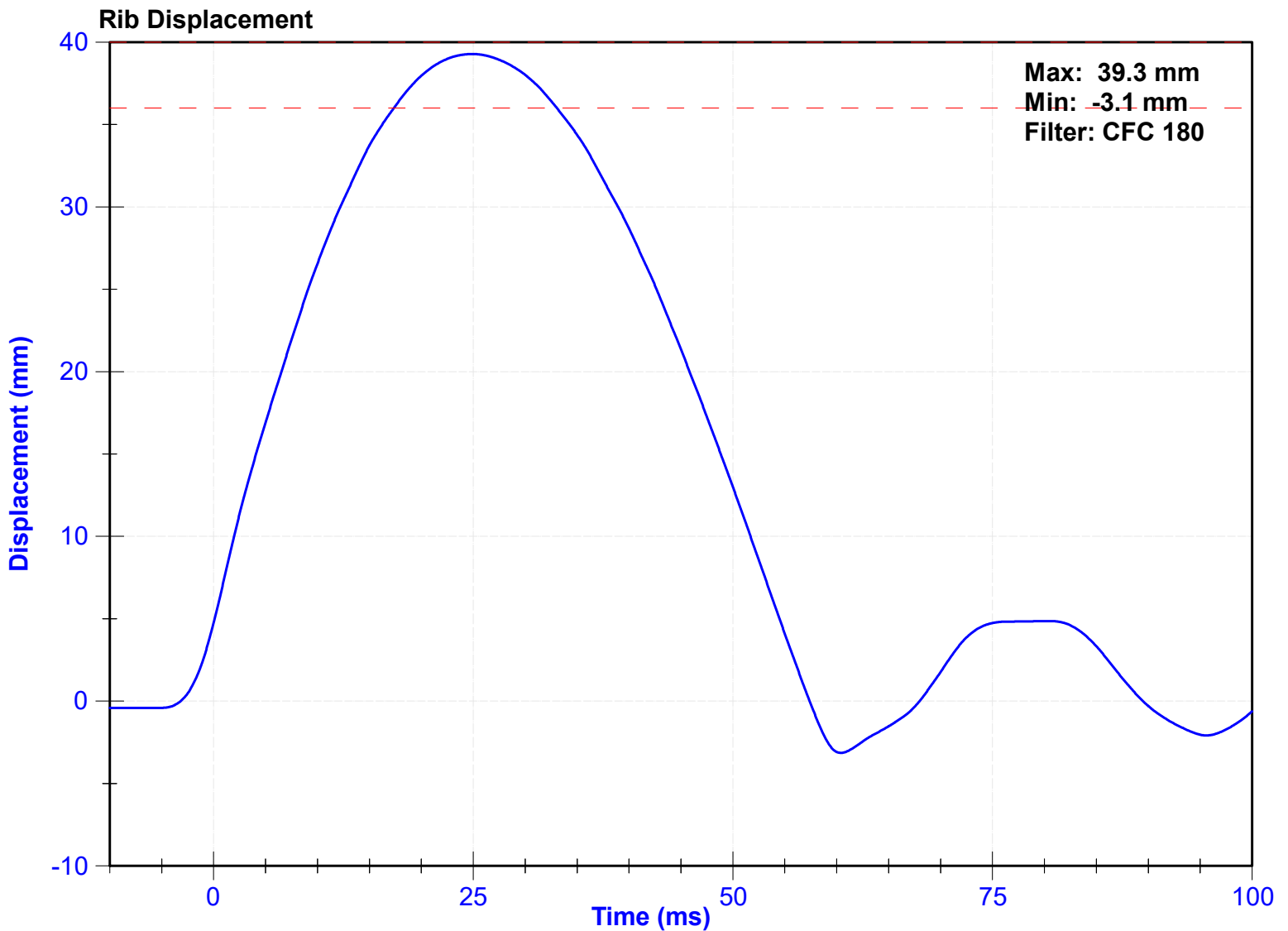
ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	47	Pass
Rib Displacement	36	40	mm	39.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	269GFE	2/8/2024	8/8/2024



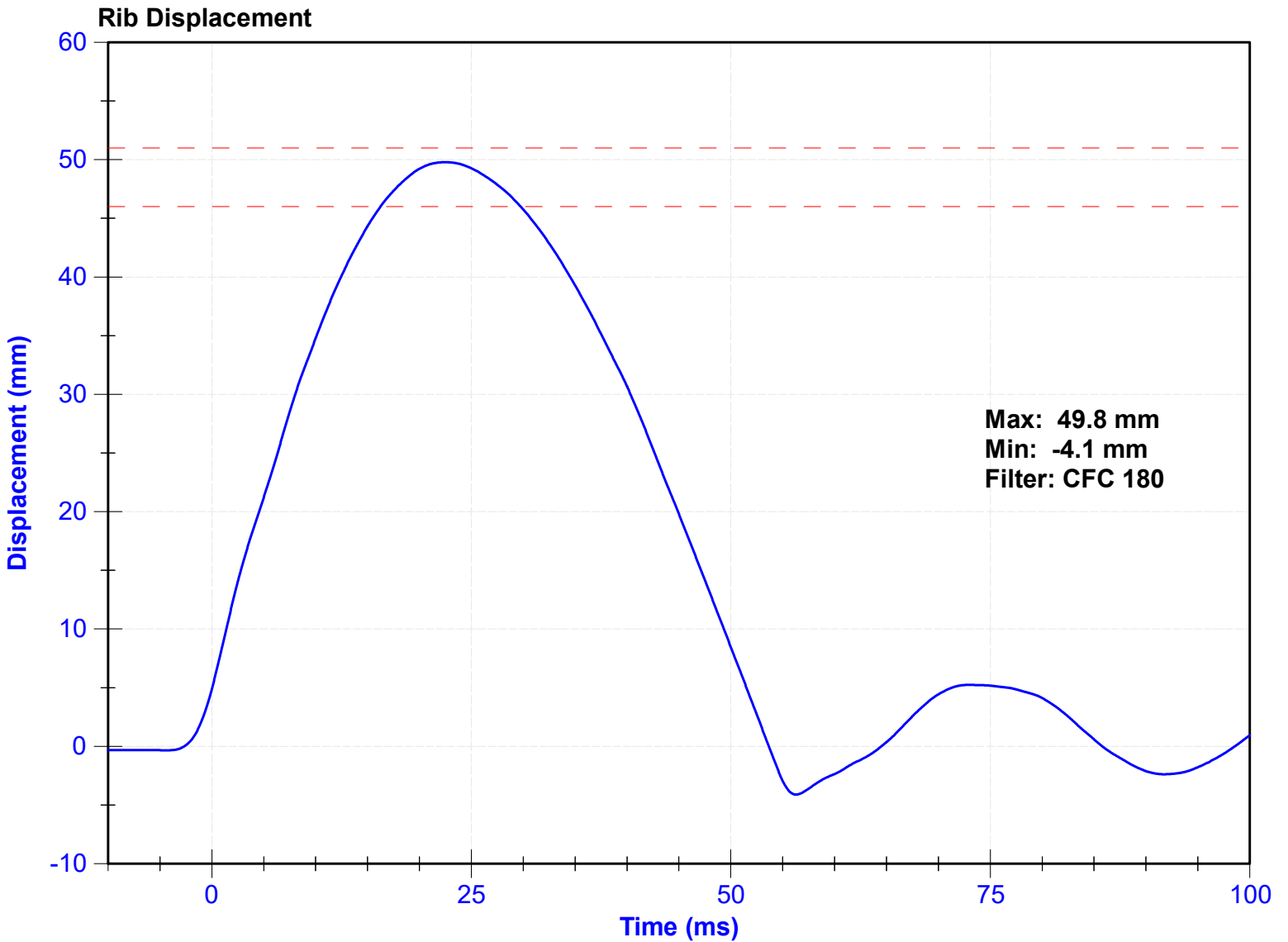
ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	47	Pass
Rib Displacement	46	51	mm	49.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	270GFE	2/8/2024	8/8/2024



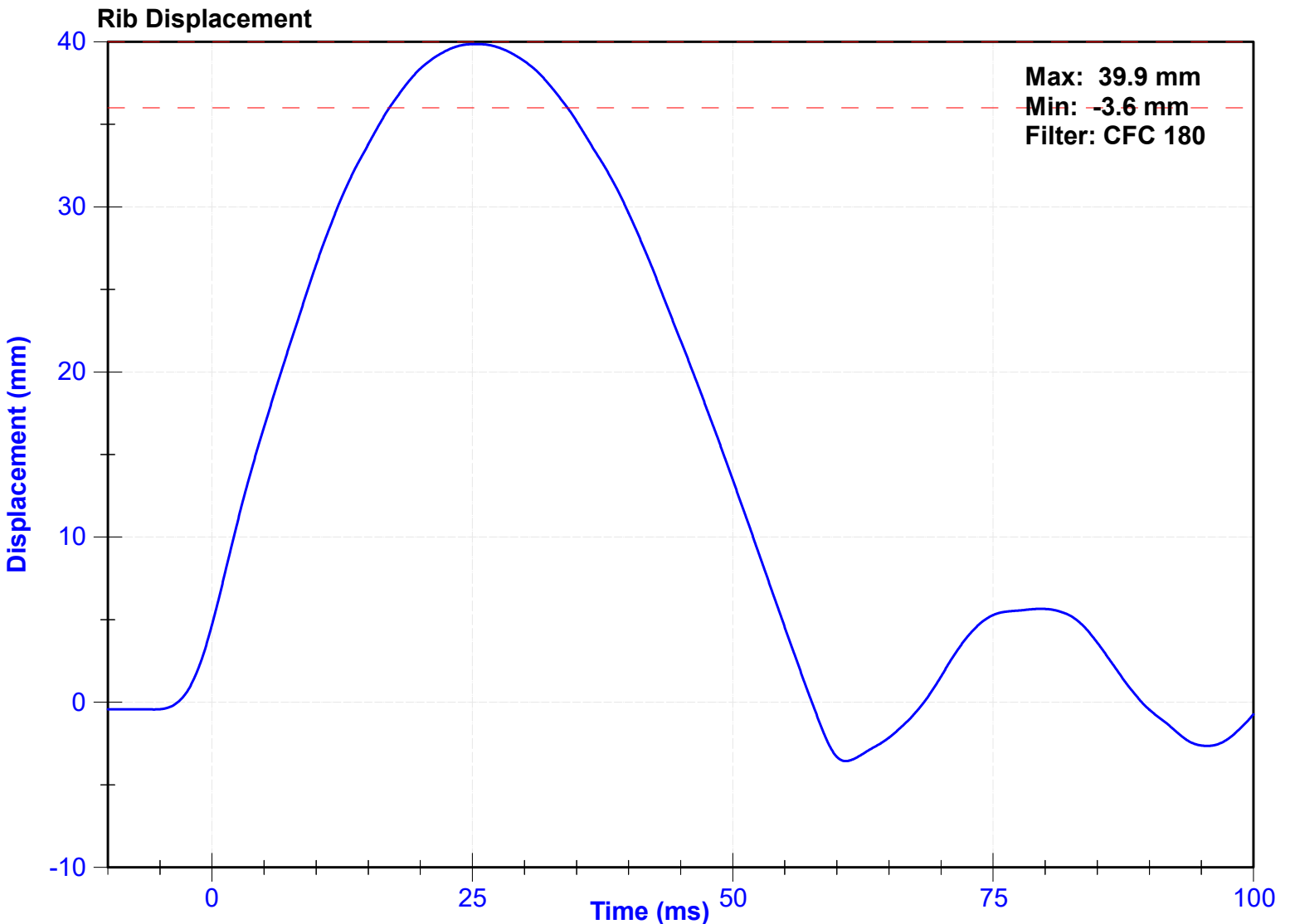
ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	47	Pass
Rib Displacement	36	40	mm	39.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	270GFE	2/8/2024	8/8/2024



ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

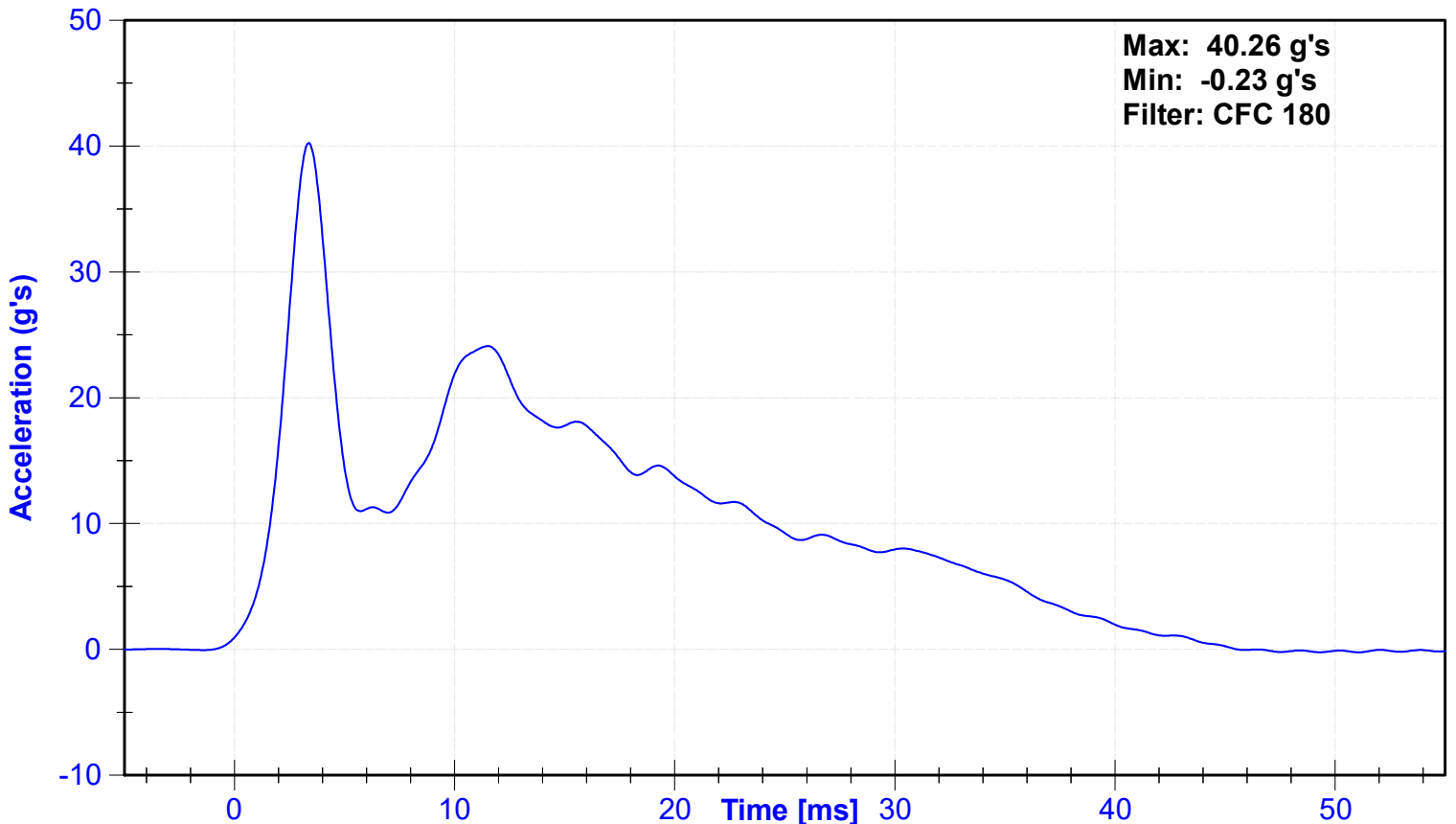
Results

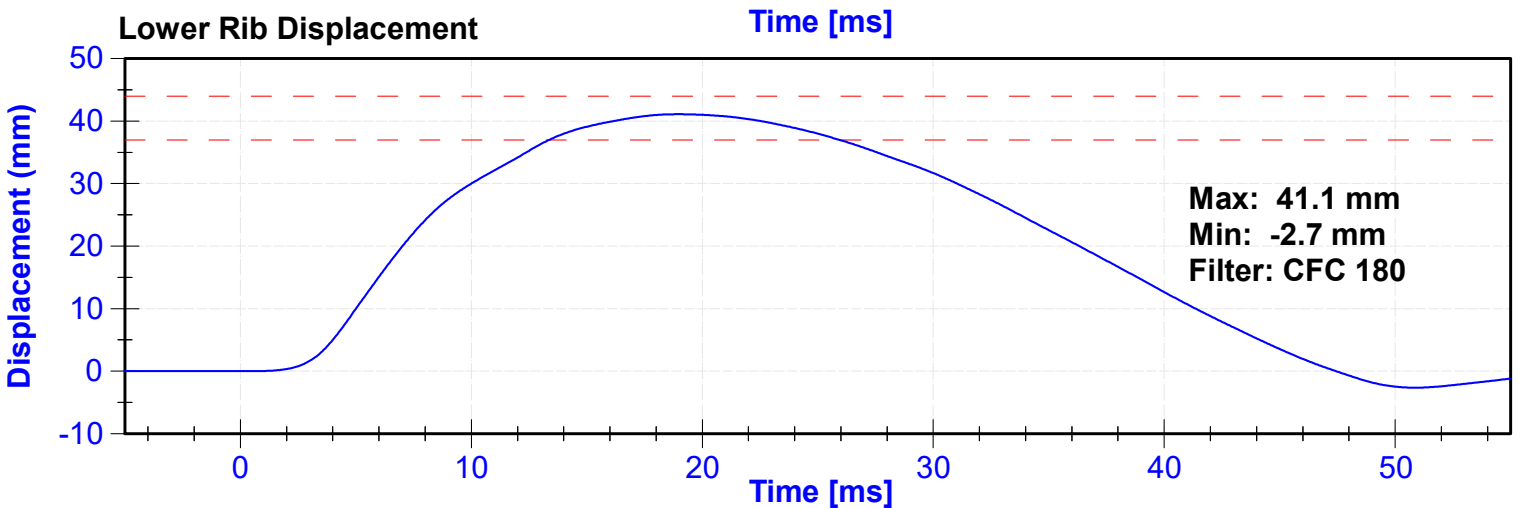
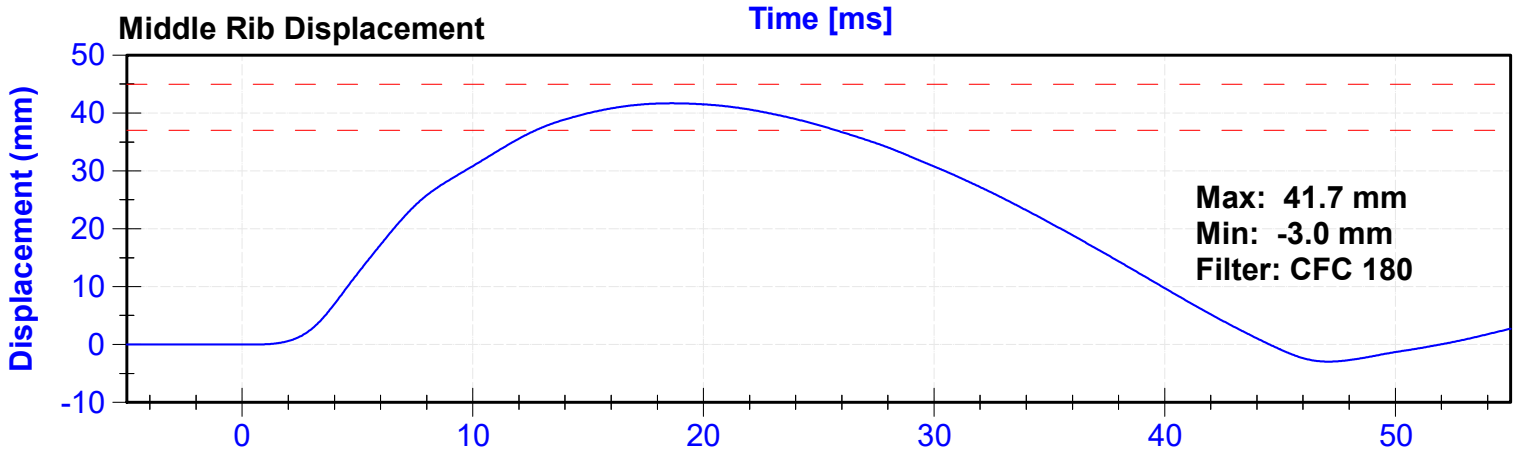
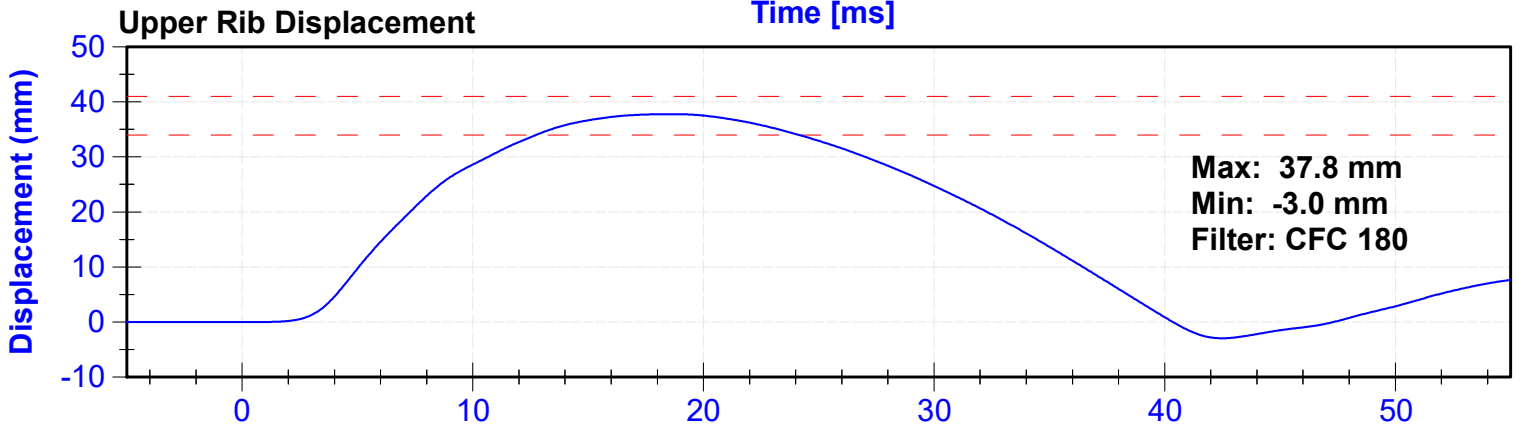
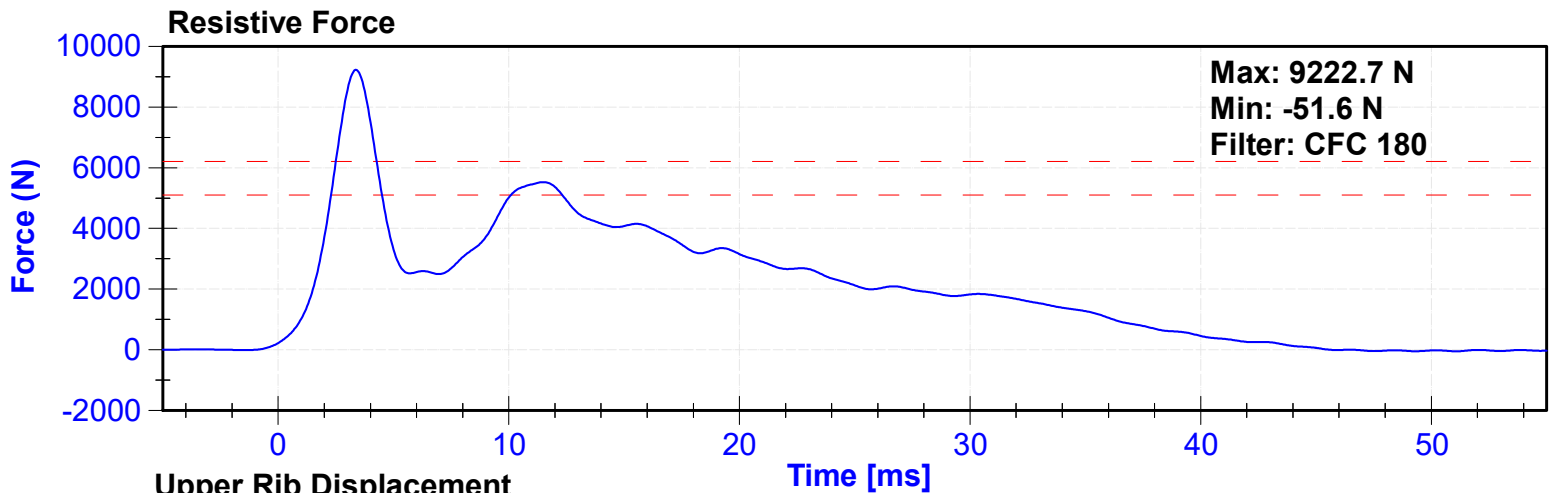
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	47	Pass
Velocity	5.4	5.6	m/s	5.53	Pass
Resistive Force after 6ms	5100	6200	N	5524.1	Pass
Upper Thorax Rib Deflection	34	41	mm	37.8	Pass
Mid Thorax Rib Deflection	37	45	mm	41.7	Pass
Lower Thorax Rib Deflection	37	44	mm	41.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18587	11/20/2023	11/19/2024
Upper Thorax Rib Potentiometer	Honeywell	268GFE	2/8/2024	8/8/2024
Middle Thorax Rib Potentiometer	Honeywell	269GFE	2/8/2024	8/8/2024
Lower Thorax Rib Potentiometer	Honeywell	270GFE	2/8/2024	8/8/2024

Probe Acceleration





ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

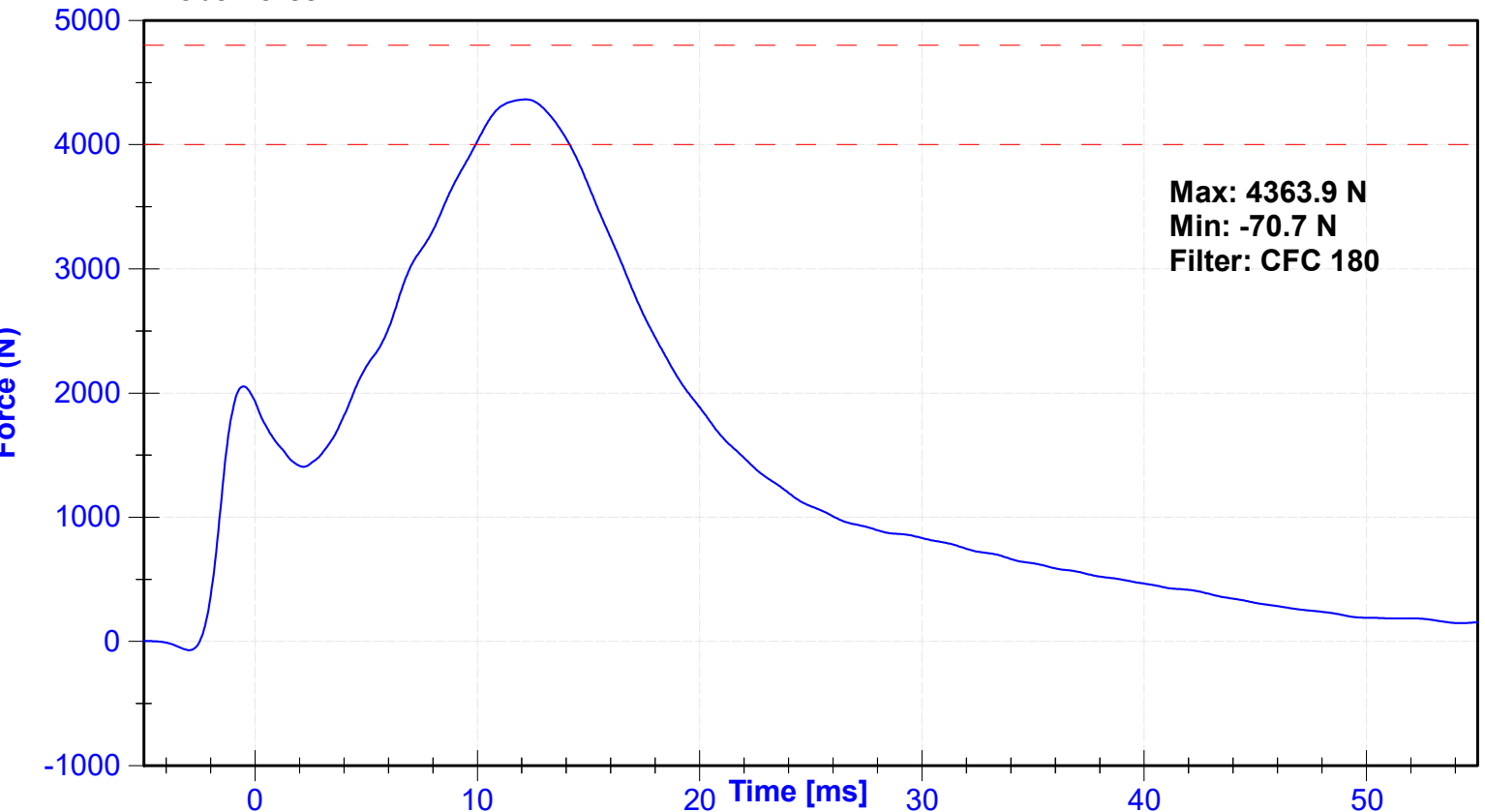
Results

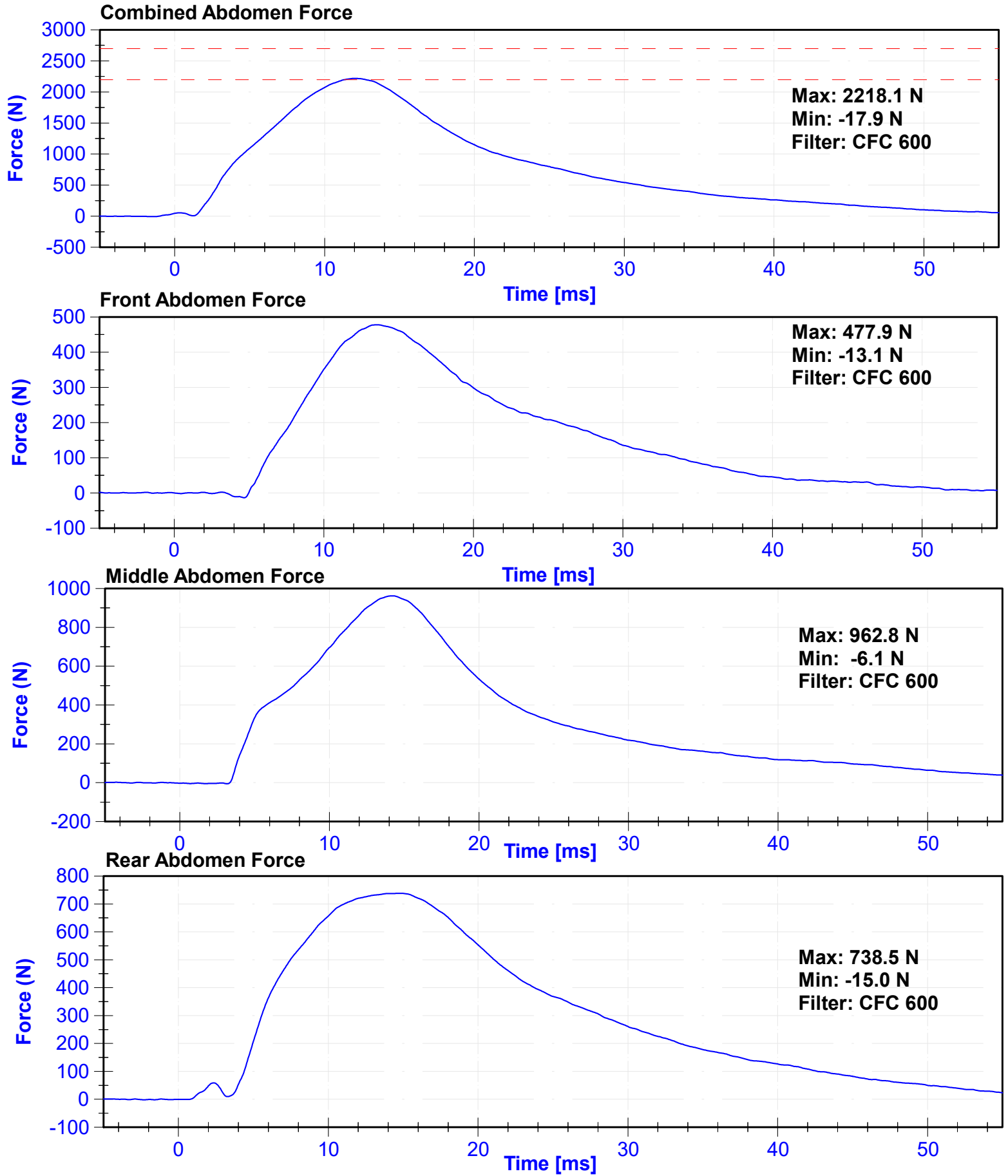
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	47	Pass
Velocity	3.9	4.1	m/s	4.00	Pass
Combined Abdomen Force	2200	2700	N	2218.1	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	12.05	Pass
Resistive Probe Force	4000	4800	N	4363.9	Pass
Time at Peak Resistive Force	10.6	13.0	ms	12.15	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	11/19/2024
Front Abdomen Load Cell	Denton	1512	8/15/2023	8/14/2024
Middle Abdomen Load Cell	Denton	1526	8/15/2023	8/14/2024
Rear Abdomen Load Cell	Denton	1516	8/15/2023	8/14/2024

Probe Force





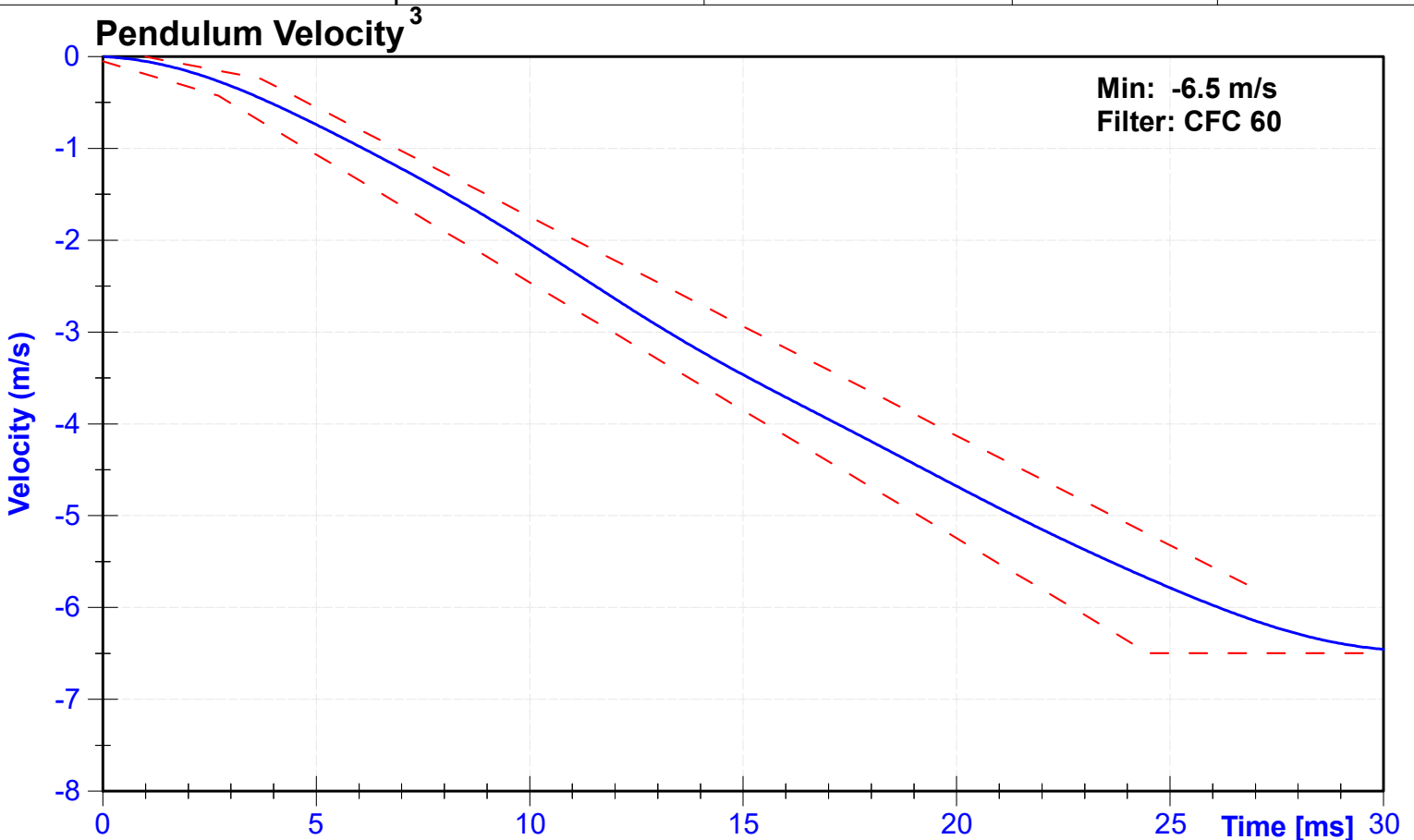
ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

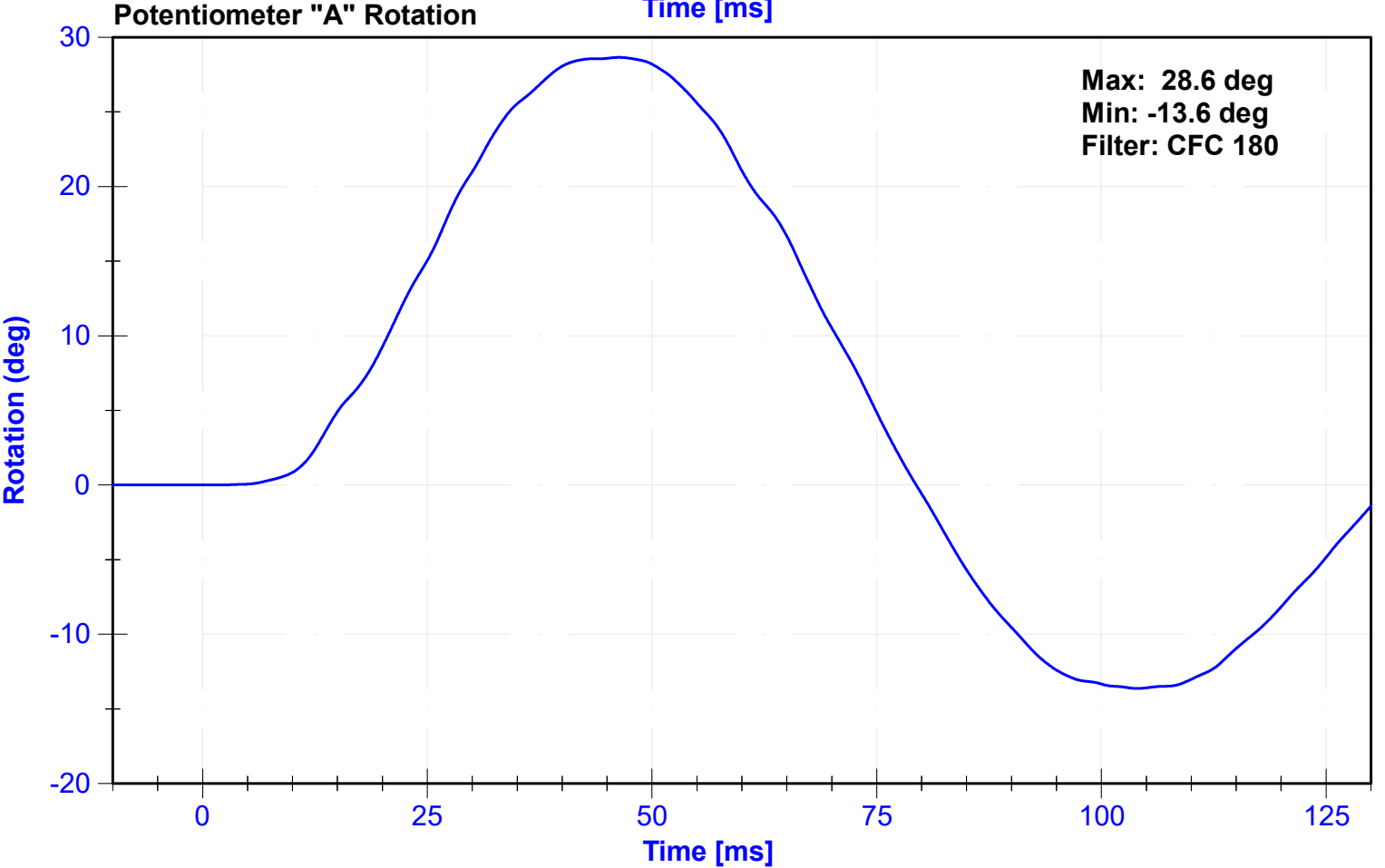
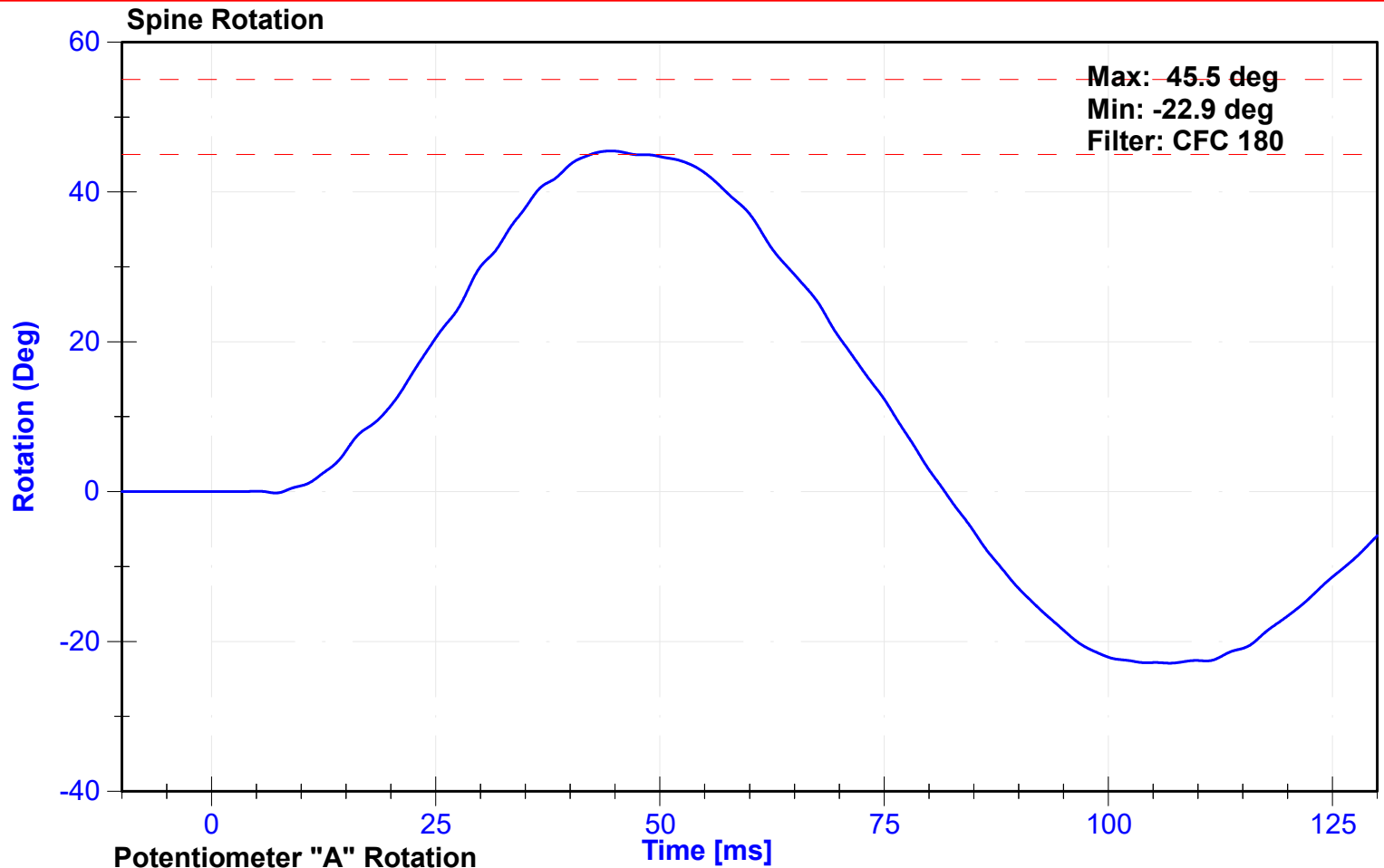
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	49	Pass
Velocity	5.95	6.15	m/s	5.998	Pass
Lateral Spine Rotation	45	55	deg	45.5	Pass
Time at Maximum Rotation	39	53	ms	44.5	Pass
Time of Decay to Zero Degrees	37	57	ms	37.2	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

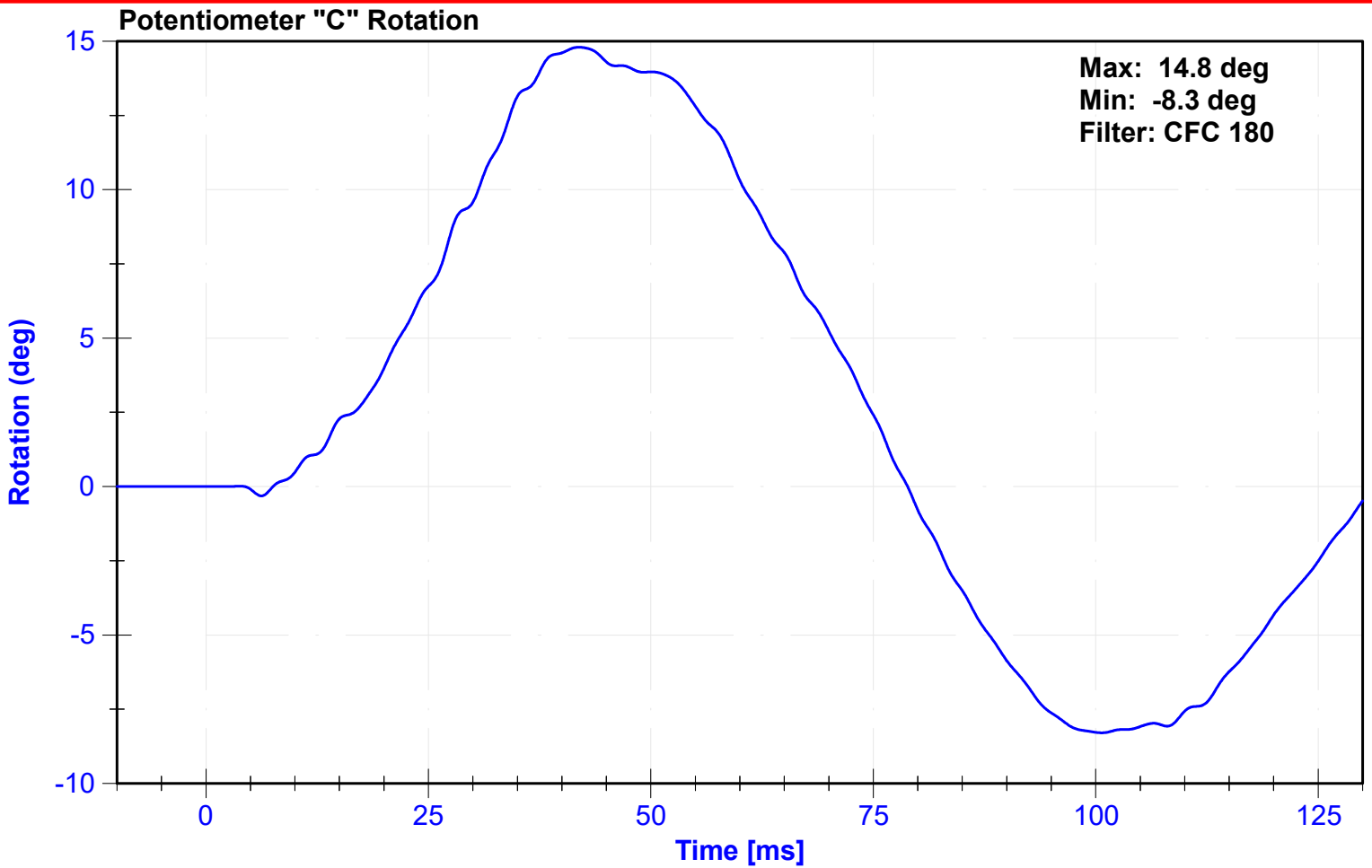
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	4/29/2024	10/26/2024
Pendulum "A" Potentiometer	Sfernice	2247	12/5/2023	12/4/2024
Condyle "B" Potentiometer	Sfernice	095	9/29/2023	9/28/2024



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





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	J. Rios
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

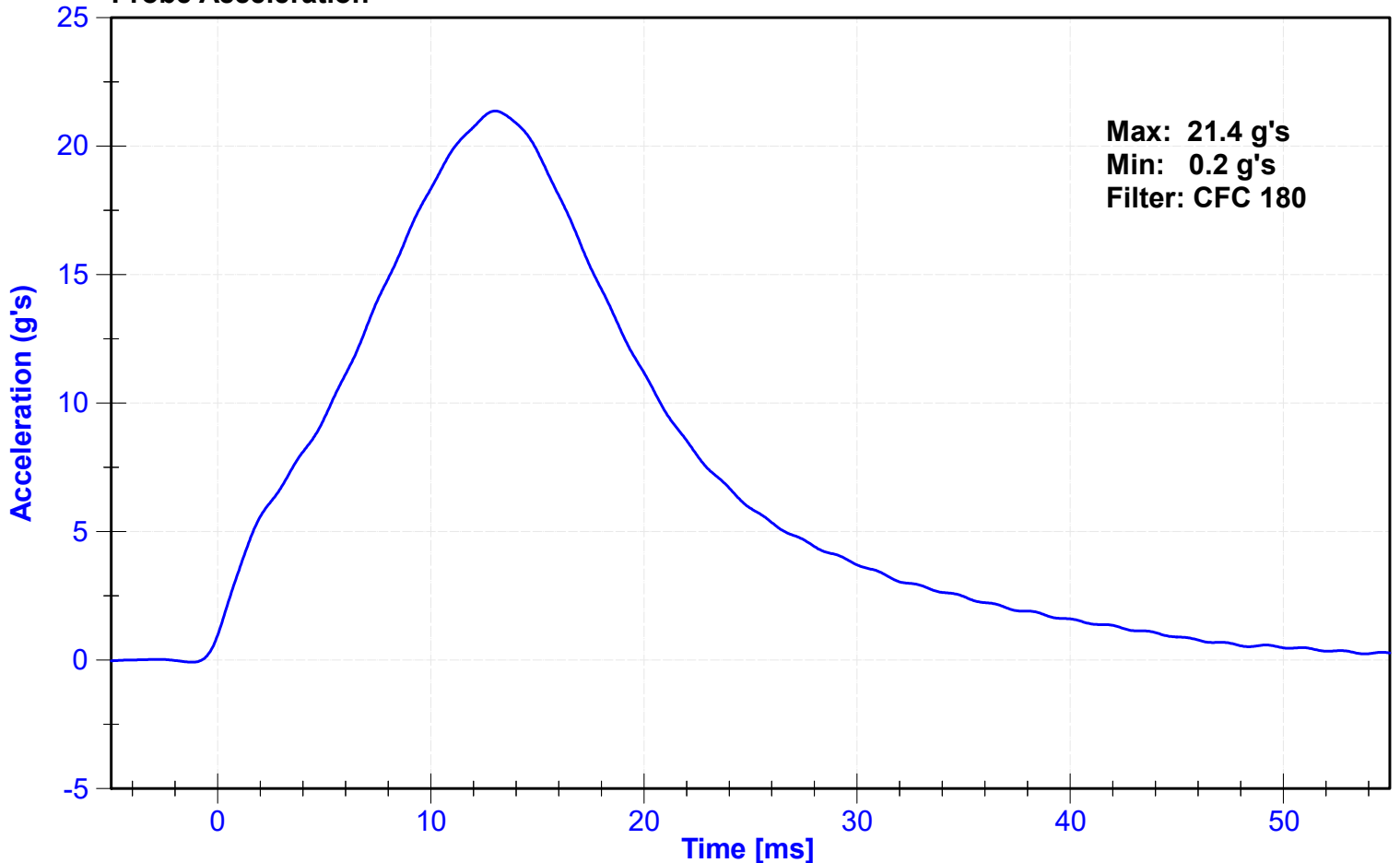
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	47	Pass
Velocity	4.2	4.4	m/s	4.26	Pass
Resistive Force	4700	5400	N	4894.1	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.00	Pass
Pubic Force	-1590	-1230	N	-1336.5	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.55	Pass

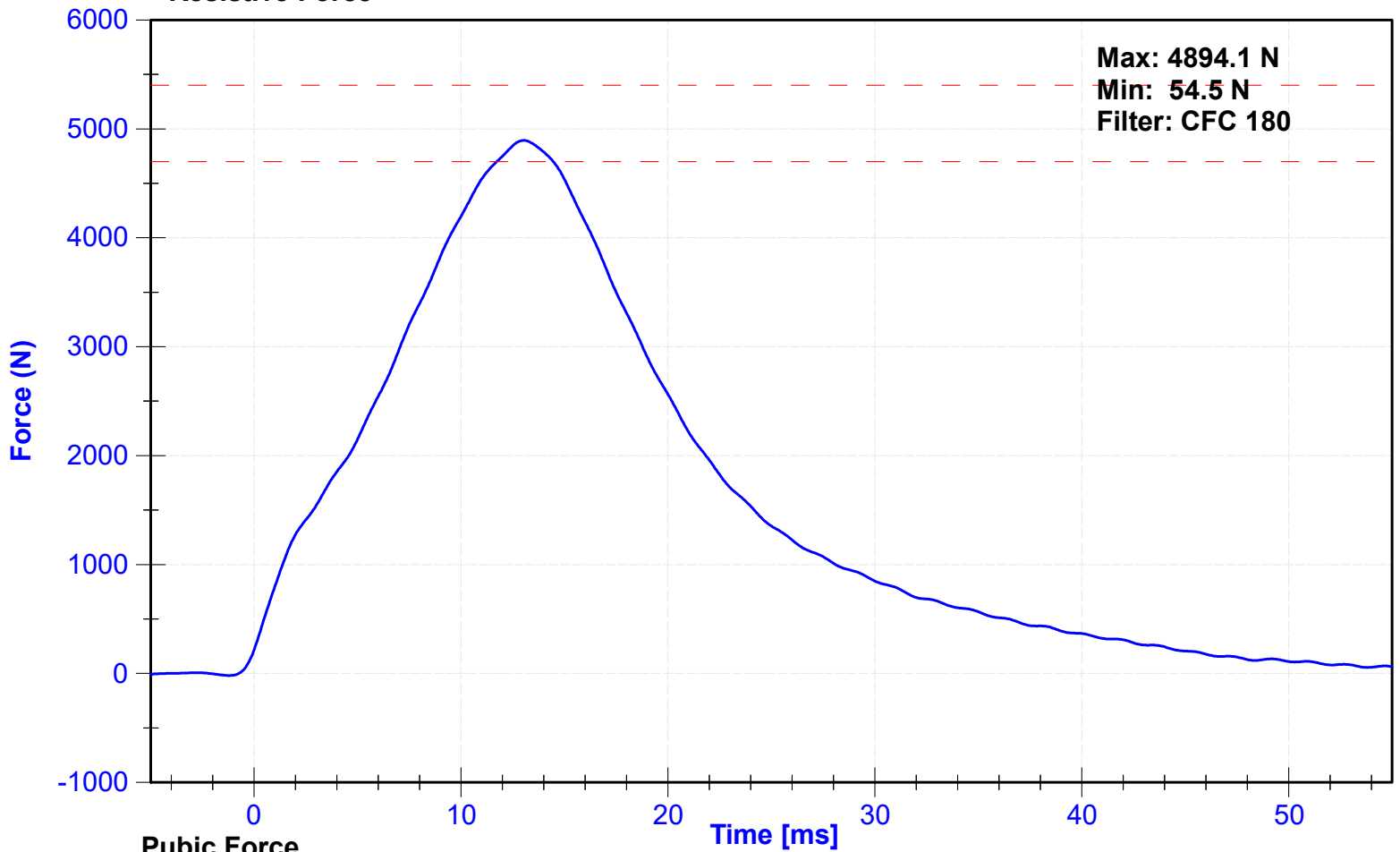
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	11/19/2024
Pubic Load Cell	Denton	464-FY	8/15/2023	8/14/2024

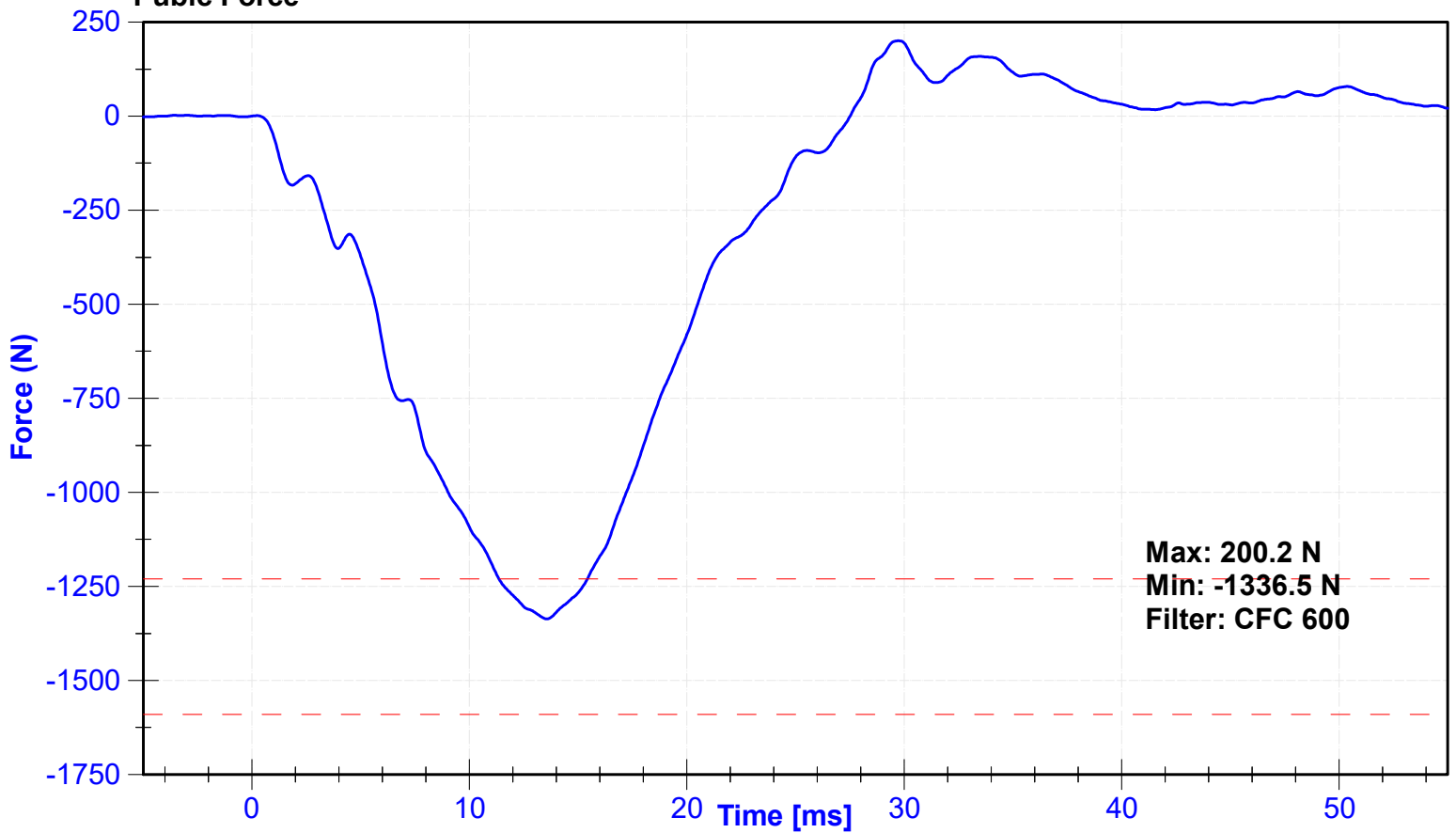
Probe Acceleration



Resistive Force



Pubic Force



APPENDIX V

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N _DG5348_		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X	18613	Endevco	02/08/2024
		Y	18472	Endevco	02/08/2024
		Z	18663	Endevco	02/08/2024
	Redundant	X	18666	Endevco	02/08/2024
		Y	18664	Endevco	02/08/2024
		Z	18675	Endevco	02/07/2024
Thorax Rib Displacement Potentiometers	Upper	Y	268GFE	Honeywell	02/08/2024
	Middle	Y	269GFE	Honeywell	02/08/2024
	Lower	Y	270GFE	Honeywell	02/08/2024
Abdomen Load Cells	Forward	Y	1512	Denton	08/15/2023
	Middle	Y	1526	Denton	08/15/2023
	Rear	Y	1516	Denton	08/15/2023
Lower Spine Accelerometers (T12)		X	18524	Endevco	02/08/2024
		Y	18573	Endevco	02/07/2024
		Z	18657	Endevco	02/08/2024
Pubic Symphysis Load Cell		Y	464-FY	Denton	08/15/2023

Table 2 – Vehicle Instrumentation

Vehicle Instrumentation		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	A335438	Measurement Specialties	01/29/2024
Vehicle Center of Gravity	Y	A352333	Measurement Specialties	01/29/2024
Vehicle Center of Gravity	Z	A372857	Measurement Specialties	01/29/2024
Left Floor Sill	Y	G23853	Endevco	01/30/2024
A-Pillar Sill	Y	G22609	Endevco	02/15/2024
A-Pillar Low	Y	G22116	Endevco	04/15/2024
A-Pillar Mid	Y	A290939	Measurement Specialties	04/15/2024
B-Pillar Sill	Y	G22829	Endevco	04/03/2024
B-Pillar Low	Y	G24041	Endevco	05/03/2024
B-Pillar Mid	Y	A431372	Measurement Specialties	05/03/2024
Driver Seat	Y	G22799	Endevco	05/03/2024
Engine Top	X	G22805	Endevco	01/25/2024
Engine Top	Y	G22812	Endevco	01/25/2024
Firewall	Y	A373231	Measurement Specialties	02/13/2024
Right Roof	Y	A413580	Measurement Specialties	02/13/2024
Right Floor Sill	Y	G22582	Endevco	02/19/2024
Rear Floorpan	X	A291004	Measurement Specialties	04/15/2024
Rear Floorpan	Y	A352405	Measurement Specialties	04/04/2024