

REPORT NUMBER: 214P-CAL-24-002

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

**Subaru
2024 Subaru Impreza
5 Door Hatchback**

NHTSA No: C20245502

**PREPARED BY:
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October 25, 2023

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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Vanessa Hansen, Operations Manager

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16. Abstract A 31.00 km/h (19.3 mph), 75° oblique compliance test was conducted on the subject 2024 Subaru Impreza 5 Door Hatchback 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 October 9, 2023. The impact velocity of the vehicle was 31.16 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 301 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>272.234</td> </tr> <tr> <td>Maximum Thoracic Rib Deflection</td> <td>mm</td> <td>44</td> <td>28.248</td> </tr> <tr> <td>Total Abdominal Force</td> <td>N</td> <td>2500</td> <td>892.099</td> </tr> <tr> <td>Pubic Symphysis Force</td> <td>N</td> <td>6000</td> <td>2529.409</td> </tr> </tbody> </table> 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.						Measurement Description	Driver ATD (ES-2re)			Units	IARV	Result	Head Injury Criteria (HIC36)		1000	272.234	Maximum Thoracic Rib Deflection	mm	44	28.248	Total Abdominal Force	N	2500	892.099	Pubic Symphysis Force	N	6000	2529.409
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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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Form DOT F1700.7 (8-72)

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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 Subaru Impreza 5 Door Hatchback. 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 Subaru Impreza 5 Door Hatchback. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 31.16 km/h. The test was conducted by Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on October 9, 2023. 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	272.234
Upper Rib Deflection	mm	44	14.790
Mid Rib Deflection	mm	44	21.713
Lower Rib Deflection	mm	44	28.248
Abdominal Load (front)	N		159.918
Abdominal Load (mid)	N		343.295
Abdominal Load (rear)	N		396.346
Total Abdominal Force	N	2500	892.099
Pubic Symphysis Force	N	6000	2529.409

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 Subaru Impreza 5 Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20245502
 Test Date: 10/09/2023

TEST VEHICLE INFORMATION AND OPTIONS

Make	Subaru	Anti-Lock Brakes (ABS)	Yes
Model	Impreza	All-Wheel Drive (AWD)	Yes
Body Style	Hatchback	Traction Control System (TCS)	Yes
VIN	JF1GUABCXR8261673	Electric Stability Control (ECS)	Yes
Body Color	Gray	Curtain Airbags	Yes
Engine Displacement (L)	2.0	Torso Airbags – Front Seats	Yes
Type / No. Cylinders	I4	Torso Airbags – Rear Seats	No
Engine Placement	Inline	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	No
Odometer Reading (mi)	9.8	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	Yes
		Tire Pressure Monitoring System (TPMS)	Yes
		Tilt Steering Wheel	Yes
		Automatic Door Locks (ADL)	Yes
		Power Window Auto-reverse	Yes
		Power Seats	No
		Other - Front Passenger Seat Airbag	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Subaru Corporation	GVWR (kg)	2185
Date of Manufacture	06/23	GVWR Front (kg)	1165
Vehicle Type	Passenger Car	GVWR Rear (kg)	1130

VEHICLE SEATING AND WEIGHT CAPACITY DATA

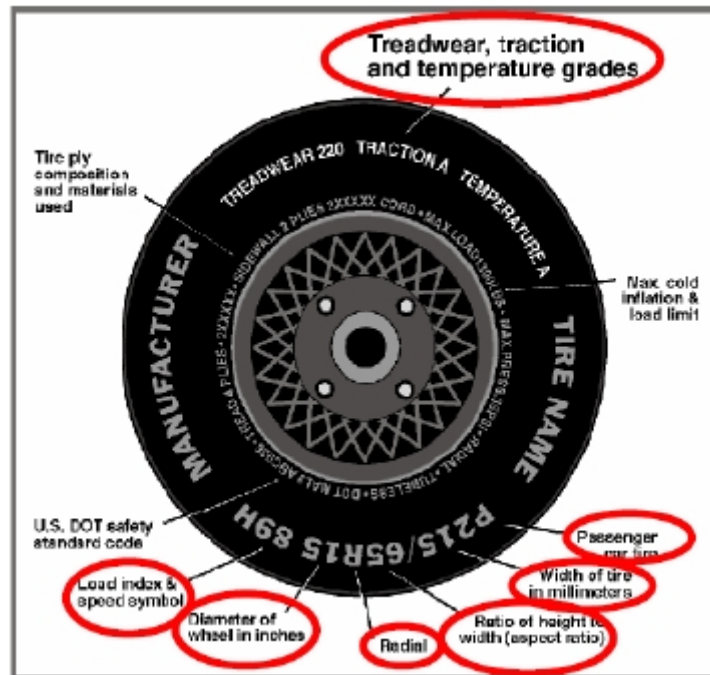
Measured Parameter	Front	Rear	Third	Total
Type of Seats (Bench or Bucket)	Bucket	Bench	N/A	
Designated Seating Capacity (DSC)	2	3	N/A	5
Capacity Weight (VCW) (kg)				408
Cargo Weight (RCLW) (kg)				67.8

DATA SHEET NO. 2 VEHICLE TIRE INFORMATION

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
Test Facility: Calspan

NHTSA No.: C20245502
Test Date: 10/09/2023

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)	250	240
Recommended Tire Size	205/55R16	205/55R16
Tire Sidewall	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Tire Size on Vehicle	205/55R16	205/55R16
Tire Manufacturer Model	Firestone	Firestone
Tire Name	FT140	FT140
Tire Type	All Season	All Season
Tire Width	205	205
Aspect Ratio	55	55
Radial	Yes	Yes
Wheel Diameter	16"	16"
Load Index / Speed Symbol	91V	91V
Treadwear	560	560
Traction Grade	A	A
Temperature Grades	A	A

DATA SHEET NO. 3
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
Test Facility: Calspan

NHTSA No.: C20245502
Test Date: 10/09/2023

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	255	255	260	260
Tire Placard	kPa	250	250	240	240

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			Fully Loaded			As Tested		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	451	292		490	350		477	342	
Right	kg	420	284		430	326		436	335	
Ratio	%	60.2	39.8		57.6	42.4		57.4	42.6	
Totals	kg	871	576	1447	920	676	1596	913	677	1590

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1447	(A)
Weight of Test Dummy	kg	81	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	67.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1595.8	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	As Delivered	Fully Loaded	As Tested
Driver Door Sill Angle	Deg	+0.05	+0.10	+0.05
Front Passenger Sill Angle	Deg	+0.25	+0.20	+0.20
Front Bumper-Line Angle	Deg	-0.25	-0.50	-0.30
Rear Bumper-Line Angle	Deg	-0.30	+0.50	+0.45

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

CALCULATION OF VERTICAL IMPACT REFERENCE LINE

Measured Parameter	Units	Value
Test Vehicle Wheelbase	mm	2672
Vertical Impact Reference Line Aft of Front Axle	mm	1260

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	8
Jack & Compressor Kit	4.5
Floor Mats	6
Tail light	1
Ballast (if any)	20

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

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
Test Facility: Calspan

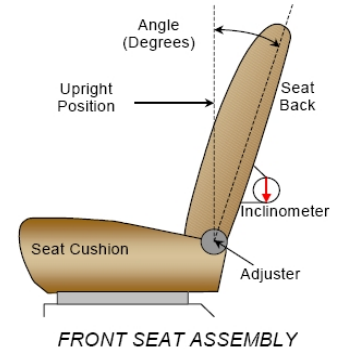
NHTSA No.: C20245502
Test Date: 10/09/2023

SEAT BACK ANGLE ADJUSTMENT

The driver and passenger seat backs are positioned to the manufacturer's designated angle provided in the Form1.

	Units	Seat Back Angle
Driver Seat	Degrees	2.1
Front Passenger Seat	Degrees	1.4

*Measurement taken on headrest post



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	14.8	Max	-	-	-
		Mid	-	-	-
		Min	21	25	30
Front Passenger Seat	Fixed	Max			
		Mid			
		Min			

SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Placed in Position #	
	mm	Detents*	mm	Detents*
Driver Seat	260	27 (0-26)	130	13
Front Passenger Seat	260	27 (0-26)	130	13

SEAT BELT ANCHORAGE ADJUSTMENT

Seat	Total # of Positions	Placed in Position #
Driver Seat	4 (0-3)	1 Down from Uppermost

HEAD RESTRAINT ADJUSTMENT

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

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

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20245502
 Test Date: 10/09/2023

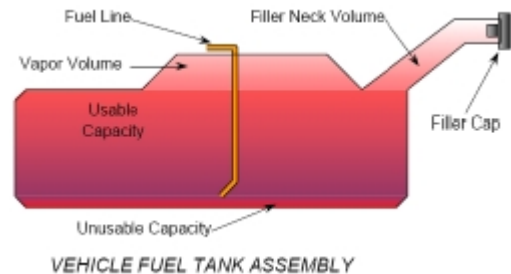
FUEL TANK CAPACITY DATA

Description	Liters
Usable Capacity of (Form No.1)	63
Usable Capacity of (Owner's Manual)	63
92 - 94% of Usable Capacity	57.96 - 59.2
Actual Amount of Solvent Used in Test	58.6

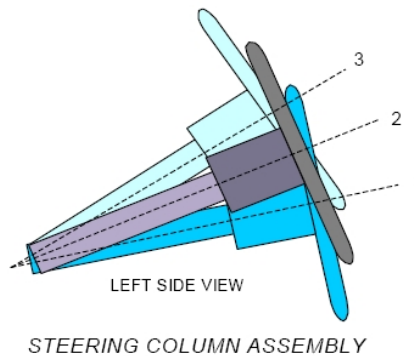
FUEL PUMP

Describe the operation of the fuel pump.

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



STEERING COLUMN POSITIONS

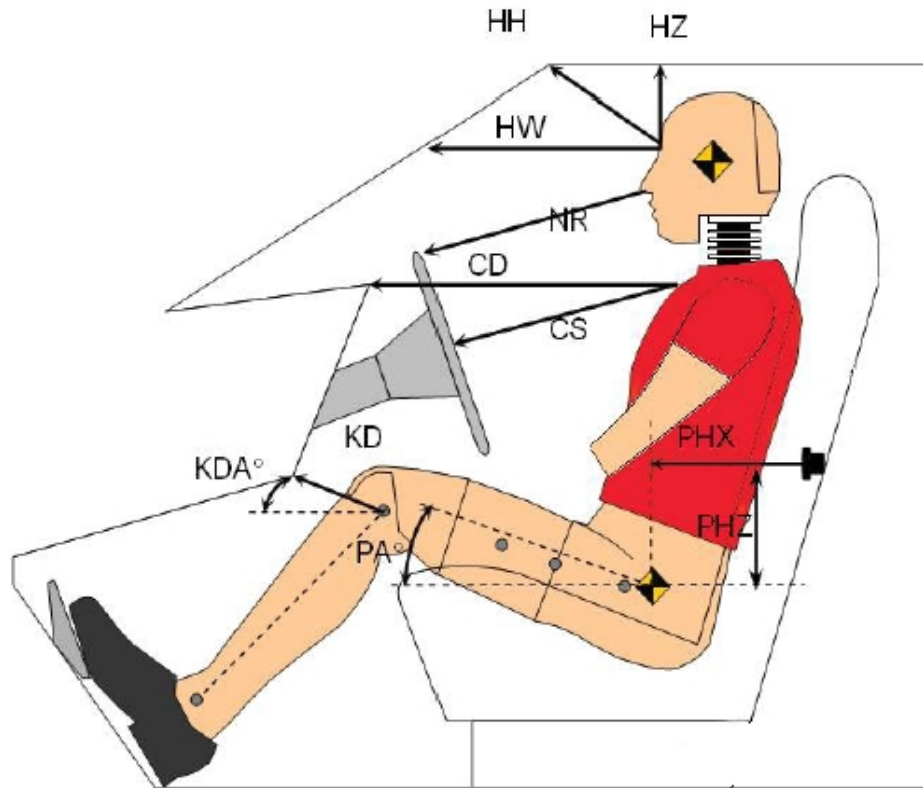


	Degrees	Fore / Aft Position (mm)
Lowermost - Position No. 1	21.0	
Geometric center - Position No. 2	22.8	
Uppermost - Position No. 3	24.6	
Telescoping Steering Wheel Travel		58
Test Position	22.8	29

DATA SHEET NO. 6
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20245502
 Test Date: 10/09/2023



Left Side View

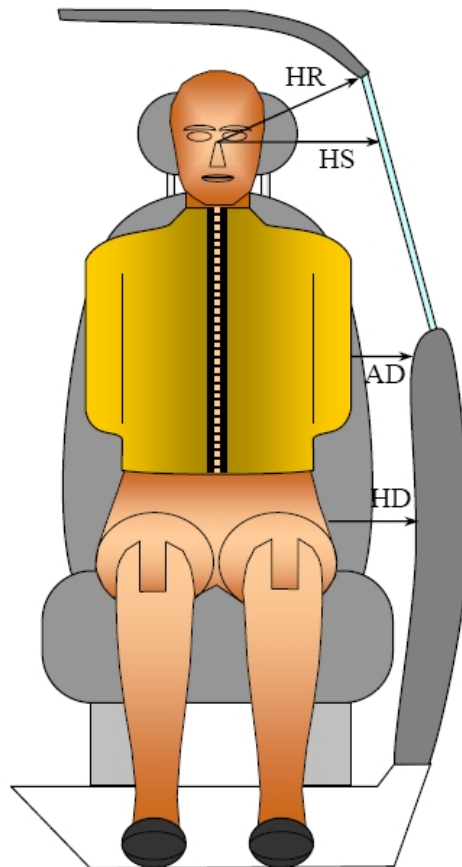
DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Description	Driver	
		Length (mm)	Angle (°)
HH	Head to Header	338	
HW	Head to Windshield	556	
HZ	Head to Roof Liner	164	
NR	Nose to Rim	421	
CD	Chest to Dash	565	
CS	Chest to Steering Wheel	346	
KD(L) / KDA(L)°	Left Knee to Dash	170	27.0
KD(R) / KDA(R)°	Right Knee to Dash	142	25.1
PAX°	Pelvic Tilt Angle (X-Axis)		23.6
PAY°	Pelvic Tilt Angle (Y-Axis)		-0.6
PHX	Hip Point to Striker (X-Axis)	235	
PHZ	Hip Point to Striker (Z-Axis)	193	

DATA SHEET NO. 7
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
Test Facility: Calspan

NHTSA No.: C20245502
Test Date: 10/09/2023



FRONT VIEW OF DUMMY

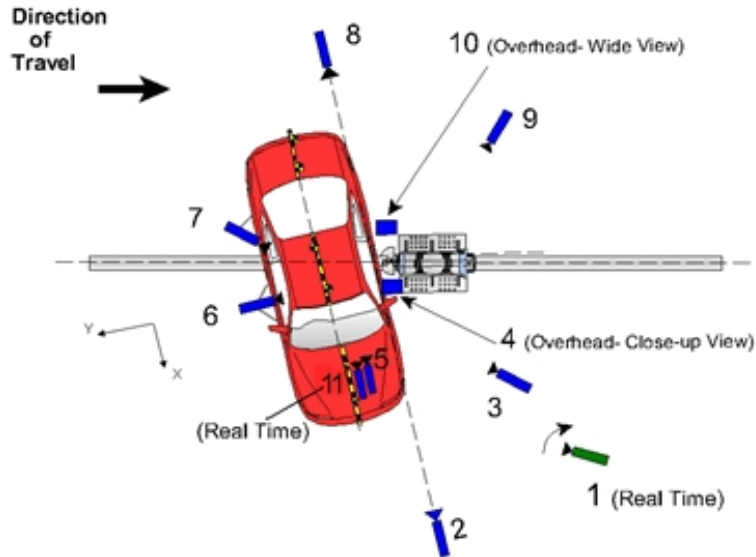
DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver
HR	Head to Side Header	mm	212
HS	Head to Side Window	mm	336
AD	Arm to Door	mm	110
HD	H-Point to Door	mm	167

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

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
Test Facility: Calspan

NHTSA No.: C20245502
Test Date: 10/09/2023



CAMERA LOCATIONS AND DATA

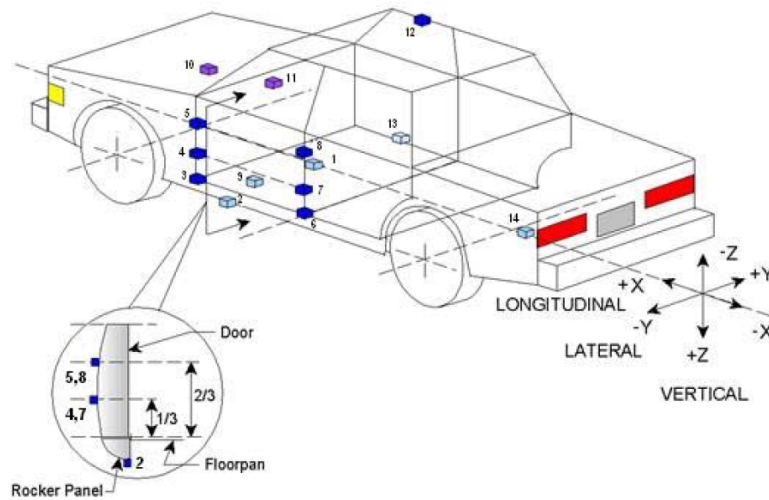
No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Real-time (24 - 30 fps) pan view of impact				Zoom	30
2	Front ground level - impact view	0	8451	-1567	28	1000
3	Impact side 45° - forward pole view	837	5608	-1575	24	1000
4	Overhead Close-up view of impact	0	0	-9200	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	0	-8870	-1454	28	1000
9	Impact side 45° - rearward pole view	2520	-3803	-1517	24	1000
10	Overhead wide - view of impact	0	0	-9200	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 Subaru Impreza 5 Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20245502
 Test Date: 10/09/2023



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	1759	-2	82
2	Left Floor Sill	2699	-668	186
3	A-Pillar Sill	2993	-629	86
4	A-Pillar Low	3059	-634	4
5	A-Pillar Mid	3004	-648	-530
6	B-Pillar Sill	1964	-665	93
7	B-Pillar Low	1973	-671	-96
8	B-Pillar Mid	1882	-644	-530
9	Seat	2183	-549	139
10	Engine	3827	12	-158
11	Firewall	3289	335	-257
12	Roof	2086	595	-988
13	Right Floor Sill	2669	676	180
14	Rear Deck	763	9	3

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 Subaru Impreza 5 Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20245502
 Test Date: 10/09/2023

Loc. No	Description	Axes	Units	Positive Direction		Negative Direction	
				Max	Time (ms)	Max	Time (ms)
1	Vehicle CG	X	g	3.35	95.05	-8.22	41.20
	Vehicle CG	Y	g	18.34	14.55	-1.31	204.90
	Vehicle CG	Z	g	15.72	43.25	-13.28	13.55
	Vehicle CG Resultant	N/A	g	22.49	43.50	0.03	-10.05
2	Floor Sill (Left)	Y	g	42.74	24.20	-9.55	33.15
3	A Pillar Sill	Y	g	10.51	14.30	-12.47	45.75
4	A Pillar Low	Y	g	22.67	30.40	-5.92	26.20
5	A Pillar Mid	Y	g	35.65	24.85	-25.55	28.85
6	B Pillar Sill	Y	g	89.43	20.35	-28.38	25.45
7	B Pillar Low	Y	g	57.84	23.30	-30.01	28.85
8	B Pillar Mid	Y	g	59.96	15.85	-34.14	34.80
9	Seat	Y	g	54.29	37.30	-32.06	44.15
10	Engine Top	X	g	4.59	106.30	-11.88	47.00
	Engine Top	Y	g	12.88	57.85	-3.42	183.25
11	Firewall	Y	g	13.00	41.25	-1.96	151.90
12	Roof	Y	g	40.33	37.40	-2.05	279.85
13	Floor Sill (Right)	Y	g	16.66	30.35	-2.24	151.80
14	Rear Deck	X	g	3.22	105.95	-5.01	42.20
	Rear Deck	Y	g	18.20	45.60	-2.29	155.75

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

Test Vehicle:	2024 Subaru Impreza 5 Door Hatchback	NHTSA No.:	C20245502
Test Facility:	Calspan	Test Date:	10/09/2023

Dummy Serial No. D037

Description	Axes	Positive Direction		Negative Direction	
		MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (g)					
Longitudinal	X	7.35	76.40	-21.57	46.35
Lateral	Y	44.24	48.80	-18.79	99.20
Vertical	Z	13.18	43.20	-4.16	90.45
Resultant	N/A	49.59	48.85		
HIC36 (t1, t2)	N/A	272.23		t1 =40.45	t2 =70.60
THORAX DEFLECTION (mm)					
Upper Rib	Y	14.79	56.25	-5.78	27.30
Middle Rib	Y	21.71	57.25	-3.41	82.20
Lower Rib	Y	28.25	54.95	-0.01	-50.00
ABDOMINAL FORCES (N)					
Front	Y	159.92	55.00	-16.52	19.35
Middle	Y	343.30	52.65	-3.46	-14.65
Rear	Y	396.35	52.95	-9.82	118.80
SUM	N/A	892.10	53.35		
PELVIS FORCES (N)					
Pubic Symphysis	Y	67.23	199.40	-2529.41	50.15

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

DATA SHEET NO. 12
POST-TEST OBSERVATIONS

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
Test Facility: Calspan

NHTSA No.: C20245502
Test Date: 10/09/2023

IMPACT POINT DATA

Measured Parameter	Units	Value
Vertical Impact Ref Line - Aft of Front Axle, Intended Impact Pt	mm	1260
Actual Impact Point - Aft of Front Axle	mm	1263
Difference	mm	-3

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Driver Seat Dummy (ES2re)
Head Contact	Curtain Airbag, Side Header, & Headrest
Upper Torso Contact	Seatback & Torso/Pelvis Airbag
Lower Torso Contact	Seatback
Left Knee Contact	Driver Door
Right Knee Contact	Left Knee

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	A, B, and C-Pillars buckled
Sill Separation	120 mm of separation at impact location
Windshield Damage	Cracked throughout
Side Window Damage	Driver window shattered during impact
Other Notable Effects	None

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

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20245502
 Test Date: 10/09/2023

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

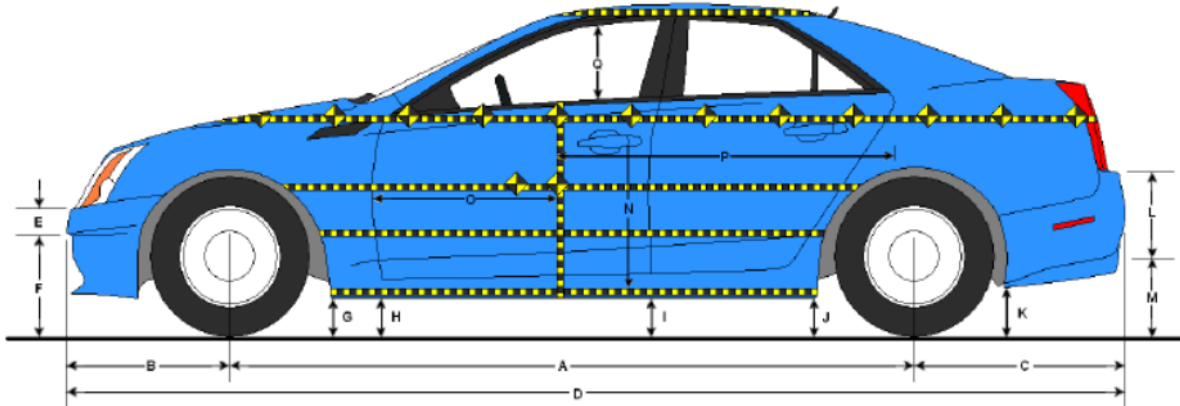
Restraint Type	Struck Side Front Occupant	
	Mounted	Deployed
Front Airbag	Yes	No
Knee Airbag	Yes	No
Head Airbag*	Yes	Yes
Side Airbag 2 - Torso/Pelvis Airbag	Yes	Yes
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	Yes
Other	N/A	N/A

*Head Airbag was a curtain airbag

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

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20245502
 Test Date: 10/09/2023



LEFT SIDE VIEW

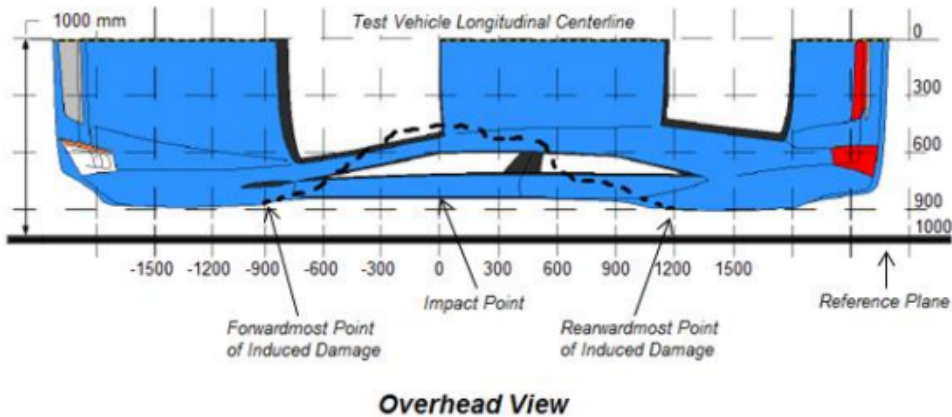
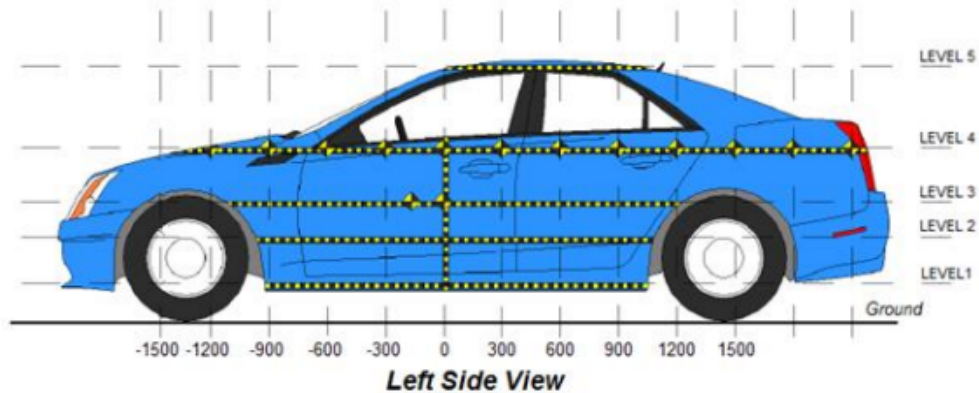
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

No.	Measurement Description	Pre-Test	Post-Test	Difference
A	Vehicle Wheelbase	2672	2607	65
B	Front Axle to FSOV	974	1013	-39
C	Rear Axle to RSOV	830	836	-7
D	Total Vehicle Length at Centerline	4476	4456	20
E	Front Bumper Thickness	77	77	0
F	Front Bumper Bottom to Ground	369	388	-19
G	Sill Height at Front Wheel Well	156	159	-3
H	Sill Height at Front Door Leading Edge	158	162	-4
I	Sill Height at B Pillar	155	171	-16
J1	Sill Height at Rear Wheel Well	156	175	-19
J2	Pinch Weld Height at Rear Wheel Well	130	147	-17
K	Sill Height Aft of Rear Wheel Well	232	235	-3
L	Rear Bumper Thickness	171	171	0
M	Rear Bumper Bottom to Ground	416	400	16
N	Sill Height to Window Bottom Sill	715	720	-5
O	Front Door Leading Edge to Impact CL	803	752	50
P	Rear Door Trailing Edge to Impact CL	1341	1282	59
Q	Front Window Opening	360	359	1
R	Right Side Length	4421	4417	4
S	Left Side Length	4421	4371	49
T	Vehicle Width at B-Pillars	1773	1678	95

DATA SHEET NO. 14
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20245502
 Test Date: 10/09/2023



MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	315	264	0
2	Occupant H-Point	mm	521	296	0
3	Mid-Door	mm	618	301	0
4	Window Sill	mm	922	253	0
5	Window Top	mm	1381	82	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 Subaru Impreza 5 Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20245502
 Test Date: 10/09/2023

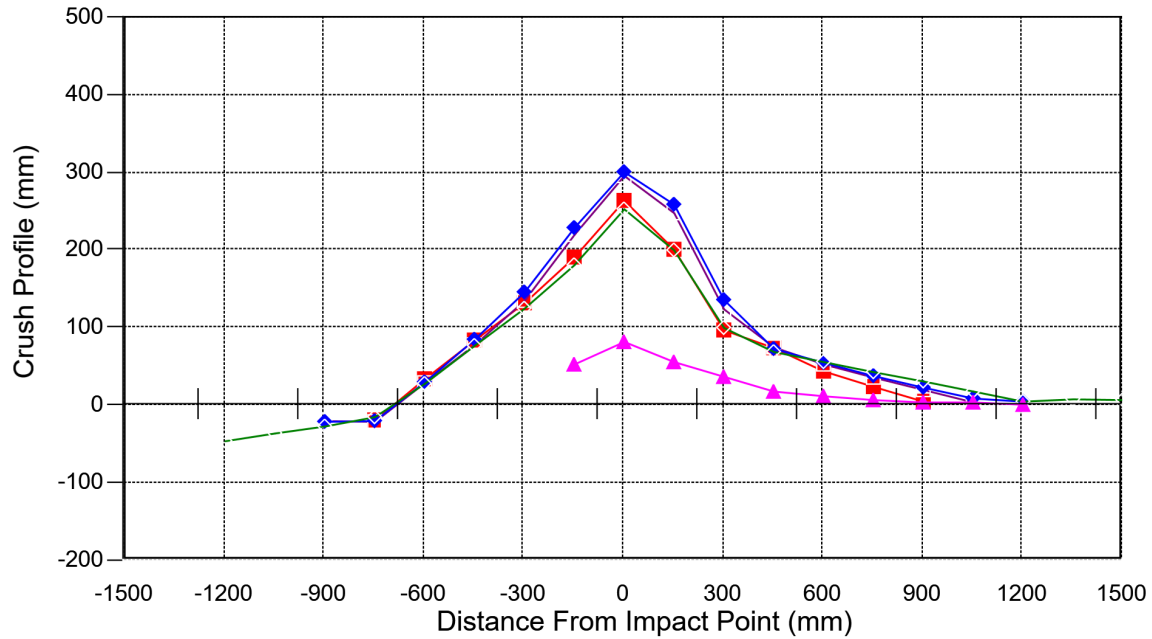
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1500															
-1350															
-1200				768					814					-46	
-1050				787					823					-36	
-900		886	886	799			906	907	826			-20	-21	-27	
-750	865	879	878	804		884	900	898	819		-19	-21	-20	-15	
-600	859	874	881	831		825	845	851	803		34	29	30	28	
-450	857	877	883	806		773	799	798	729		84	78	85	77	
-300	856	879	885	816		724	744	739	691		132	135	146	125	
-150	856	881	886	823	610	665	661	657	642	557	191	220	229	181	53
0	854	883	887	830	621	590	587	586	577	539	264	296	301	253	82
150	852	883	887	835	621	651	635	628	635	565	201	248	259	200	56
300	849	883	887	840	620	752	759	751	740	583	97	124	136	100	37
450	847	880	884	840	619	773	805	811	771	601	74	75	73	69	18
600	846	878	881	839	617	802	825	826	783	605	44	53	55	56	12
750	848	878	878	834	609	824	842	840	791	602	24	36	38	43	7
900	854	881	883	828	596	849	861	860	797	592	5	20	23	31	4
1050		884	889	817	579		880	880	799	575		4	9	18	4
1200			889	825	544			884	820	543			5	5	1
1350				810					802					8	
1500				811					804					7	

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

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
Test Facility: Calspan

NHTSA No.: C20245502
Test Date: 10/09/2023

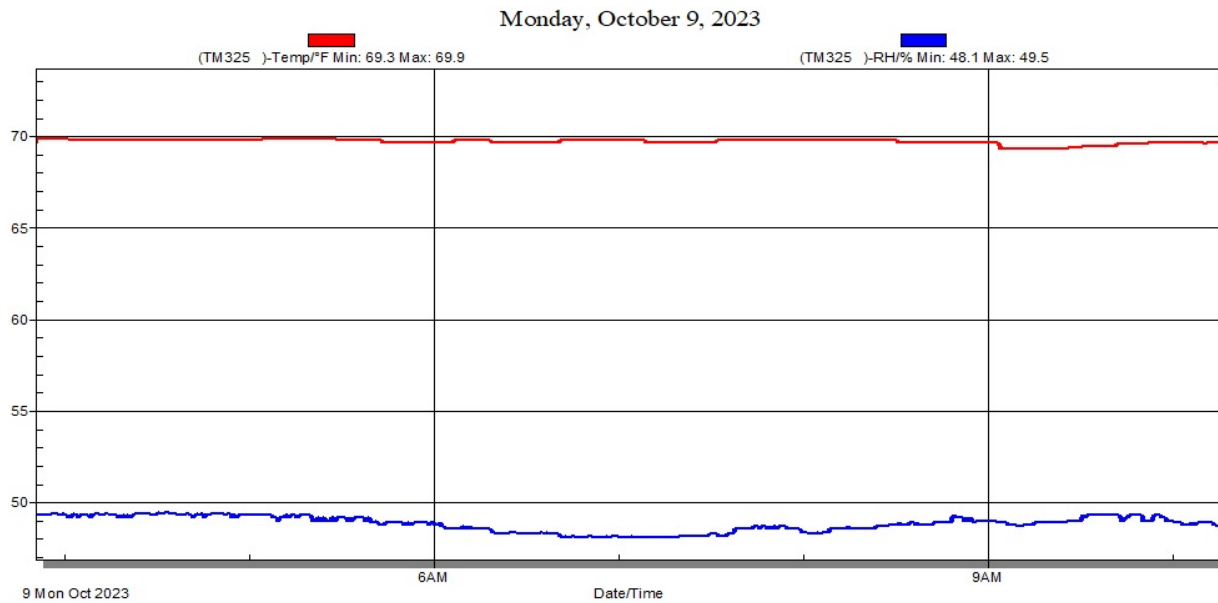


Vehicle Exterior Crush Measurements - Visual Representation

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

Test Vehicle: 2024 Subaru Impreza 5 Door Hatchback
Test Facility: Calspan

NHTSA No.: C20245502
Test Date: 10/09/2023



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
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18	Pre-Test Interior of Front Door Closed (through opposite window)	I-11
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24	Post-Test Close-Up View of Impact Point Target	I-14
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26	Close-Up View of Vehicle's Tire Placard Label	I-15

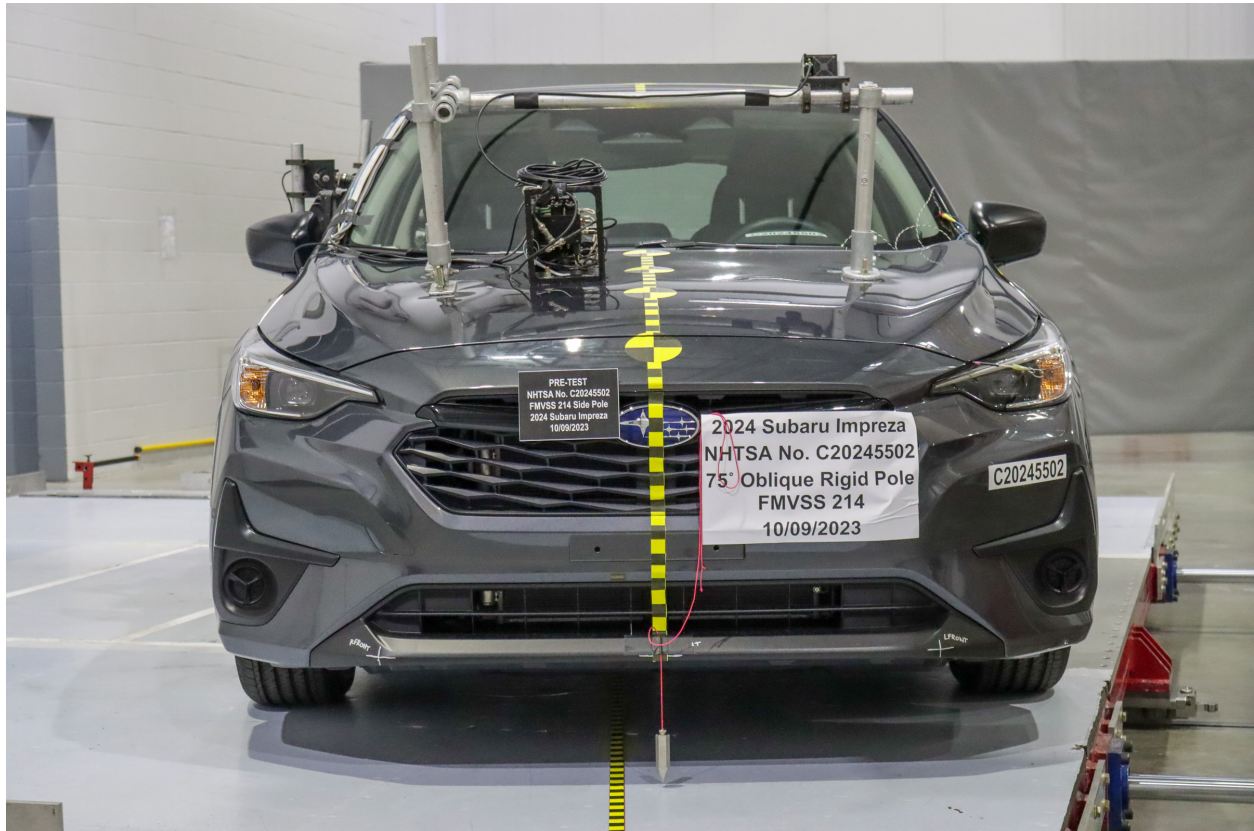


Figure A-1: Pre-Test Frontal View of Test Vehicle

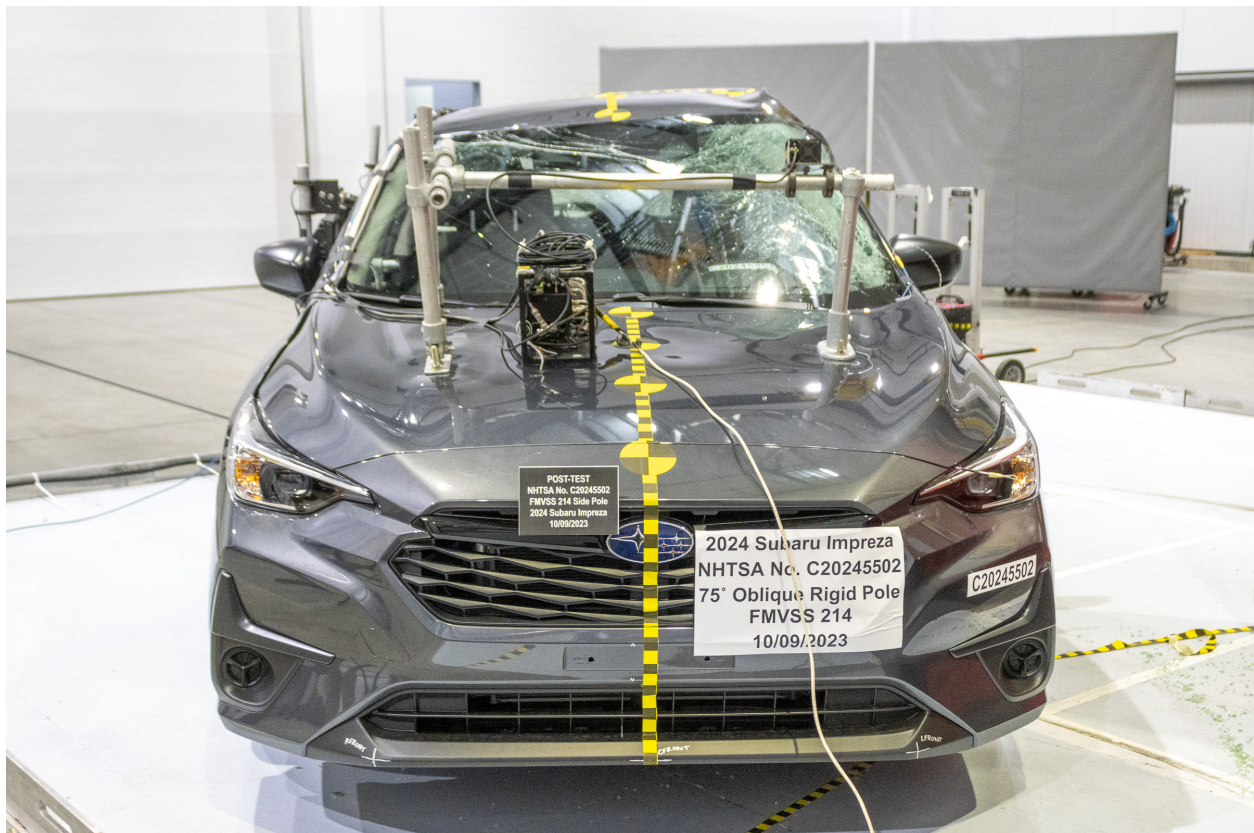


Figure A-2: Post Test Frontal View of Test Vehicle



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

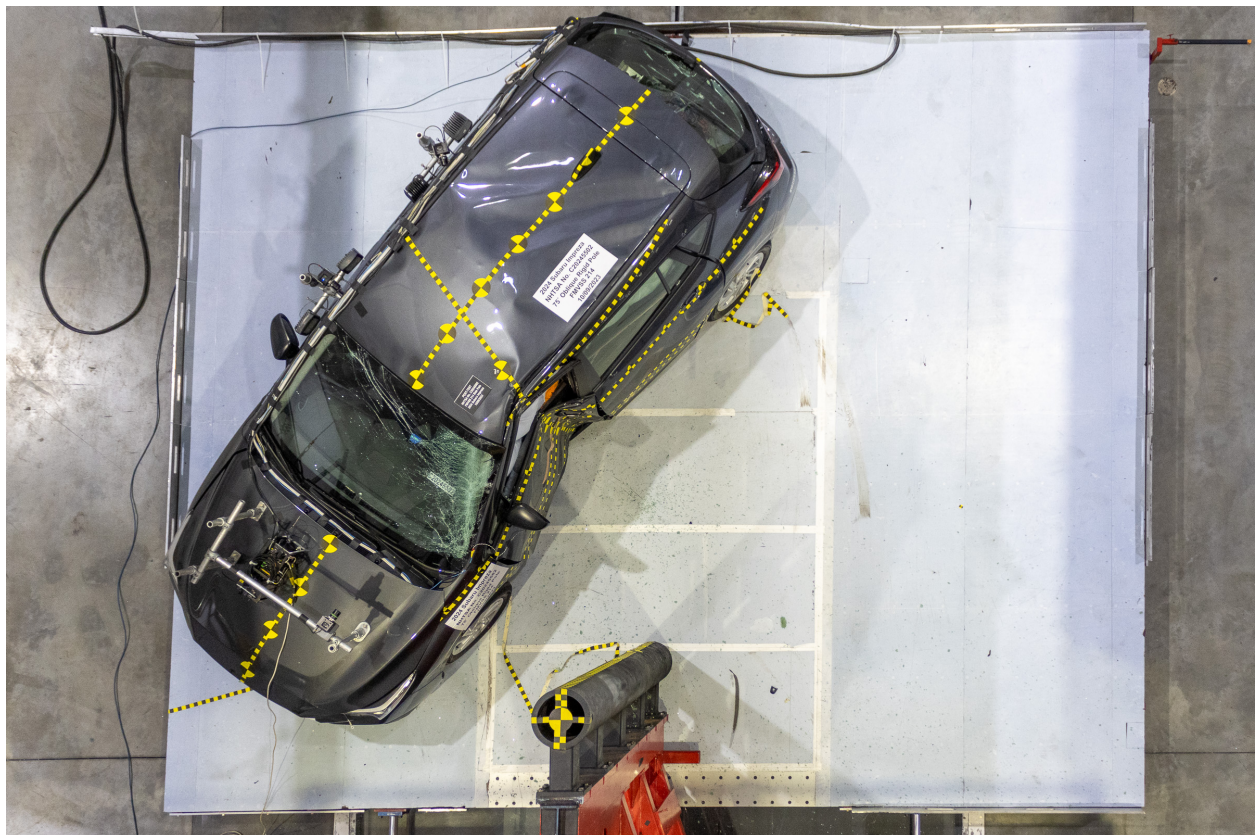


Figure A-10: Post-Test Overhead View of Test Vehicle



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 $\frac{3}{4}$ Front View of Impact Zone



Figure A-23: Post-Test ¾ 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

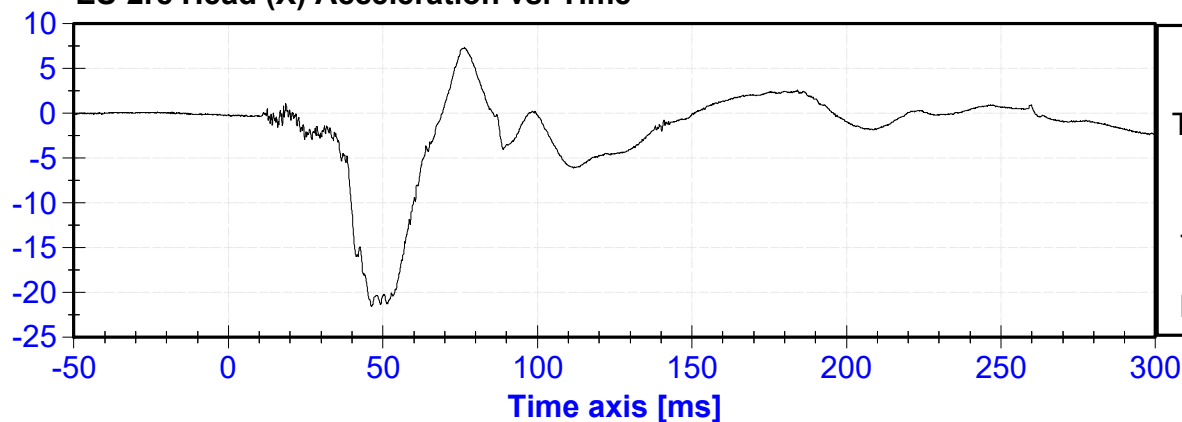
APPENDIX II

ES-2re DUMMY RESPONSE DATA TRACES

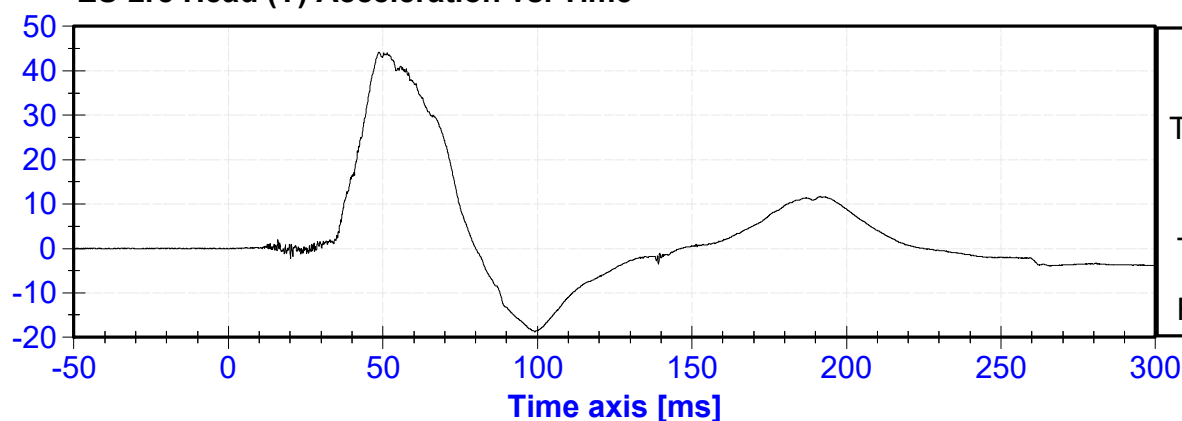
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9	ES-2re Upper Thorax Rib Deflection (Y) vs. Time	II-5
10	ES-2re Middle Thorax Rib Deflection Rate vs. Time	II-5
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17	ES-2re Sum of Abdomen Forces vs. Time	II-7
18	ES-2re Pubic Symphysis Force (Y) vs. Time	II-7

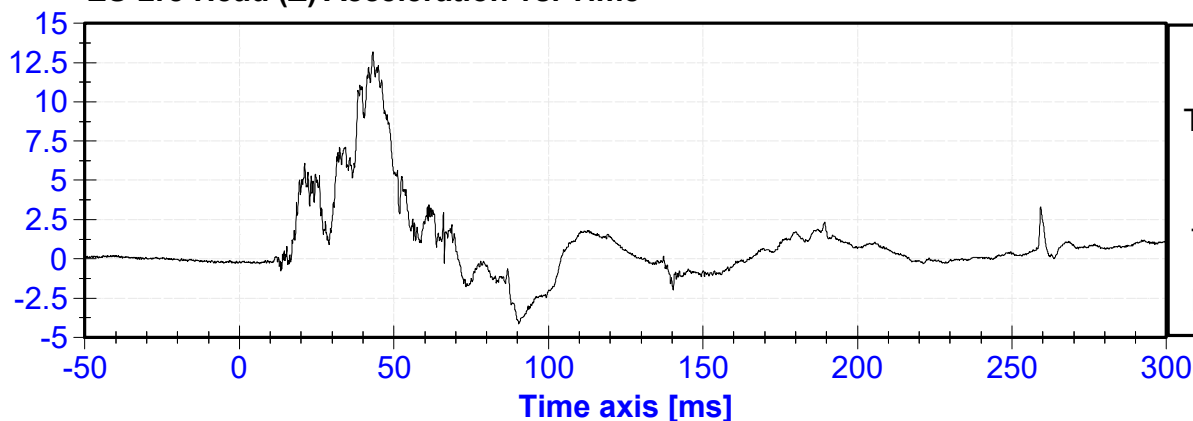
ES-2re Head (X) Acceleration vs. Time



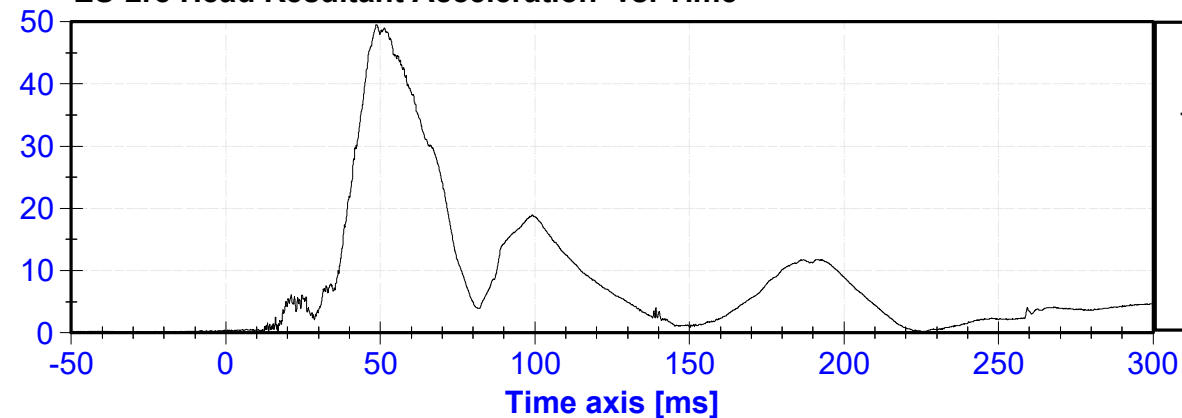
ES-2re Head (Y) Acceleration vs. Time



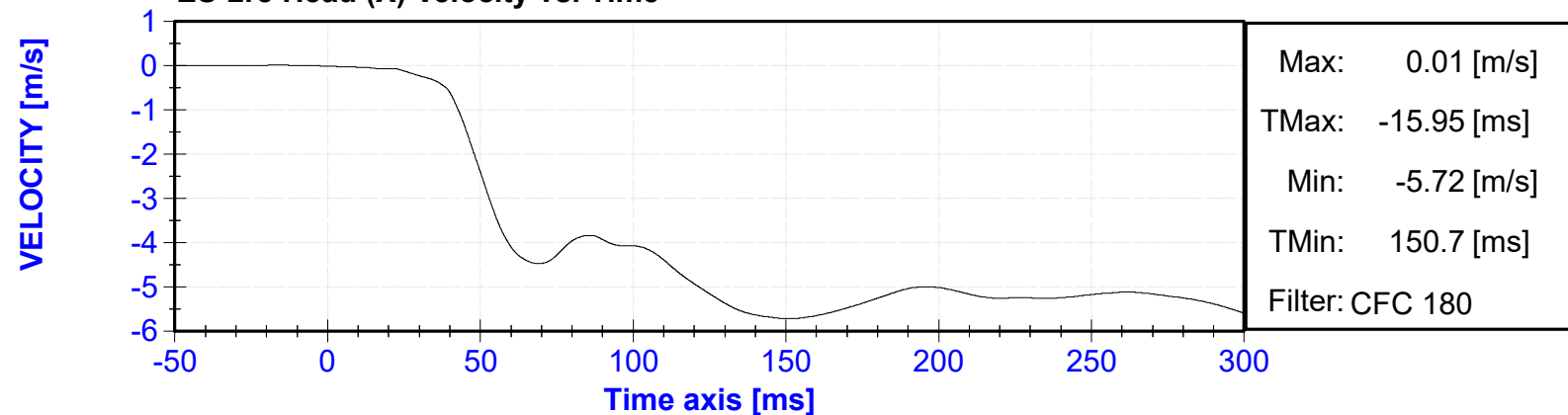
ES-2re Head (Z) Acceleration vs. Time



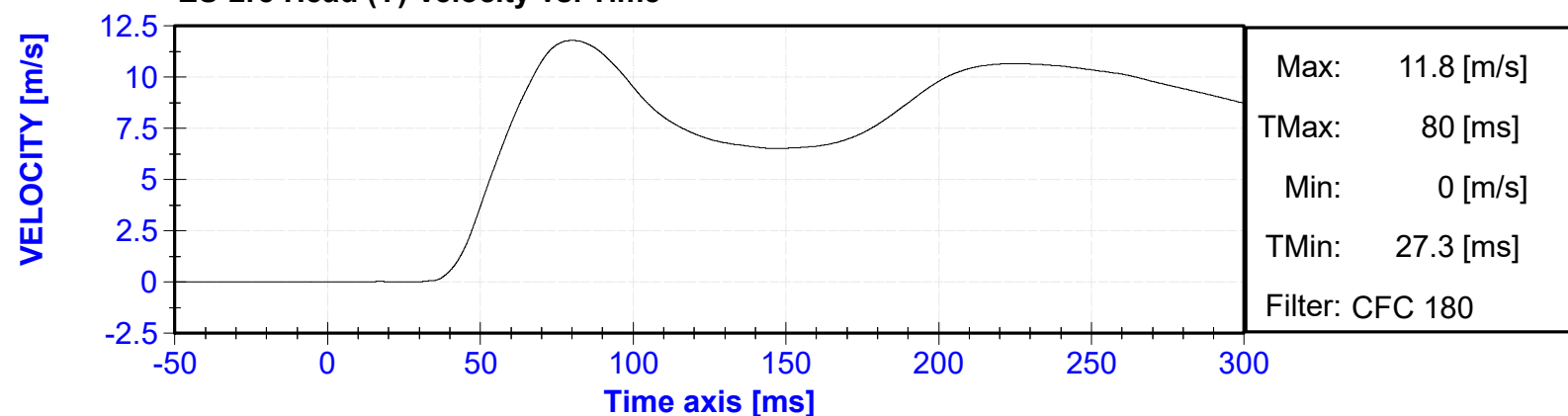
ES-2re Head Resultant Acceleration vs. Time



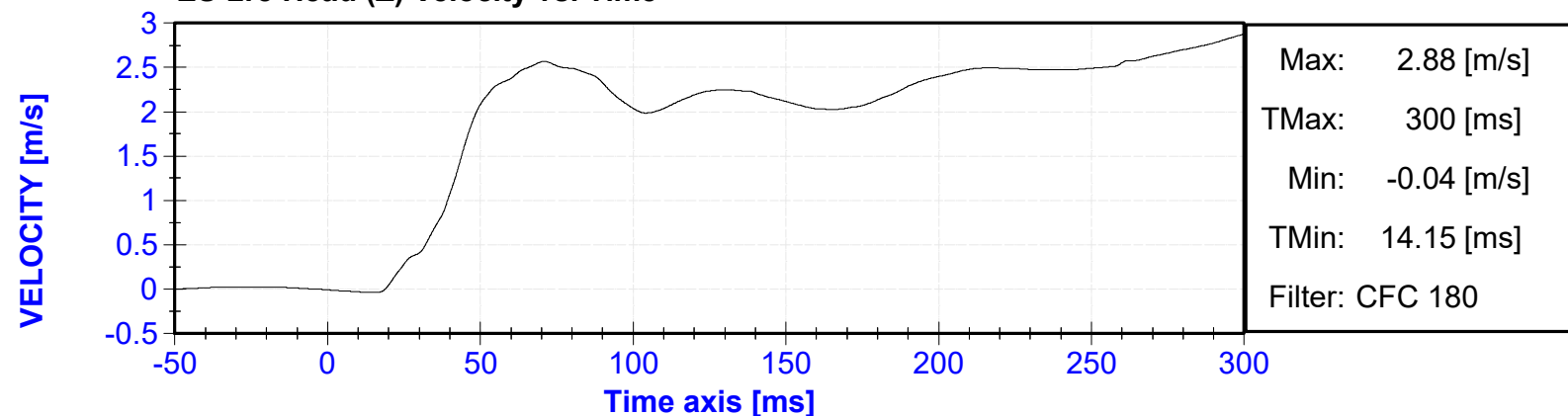
ES-2re Head (X) Velocity vs. Time



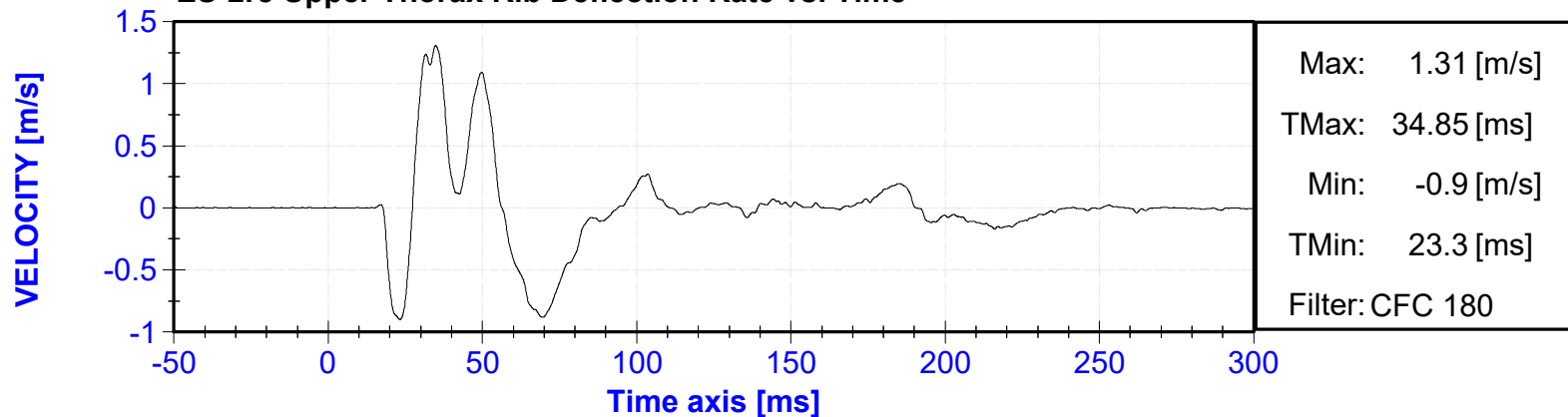
ES-2re Head (Y) Velocity vs. Time



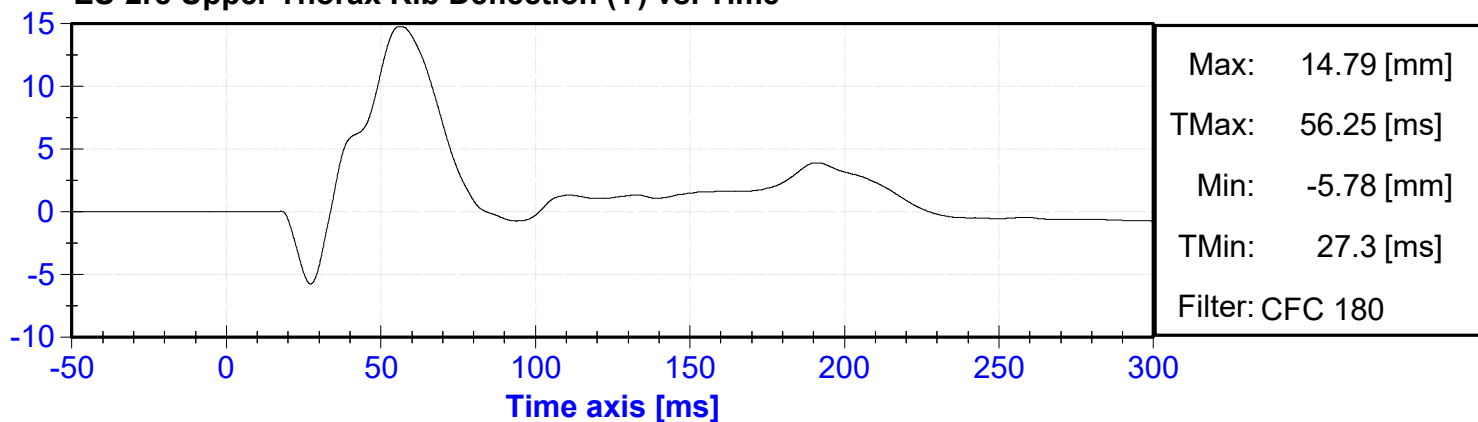
ES-2re Head (Z) Velocity vs. Time



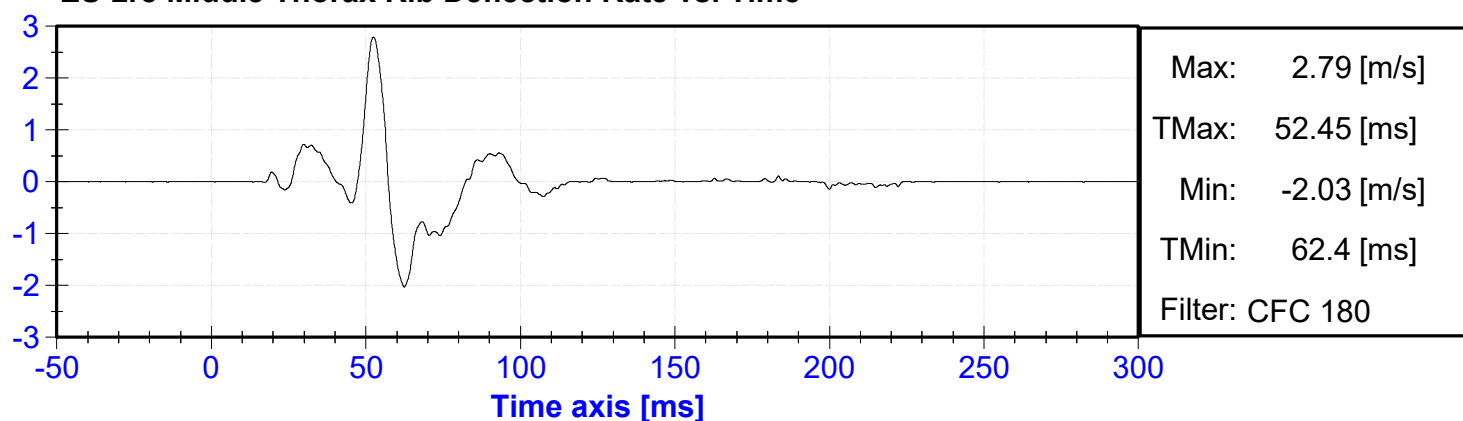
ES-2re Upper Thorax Rib Deflection Rate vs. Time



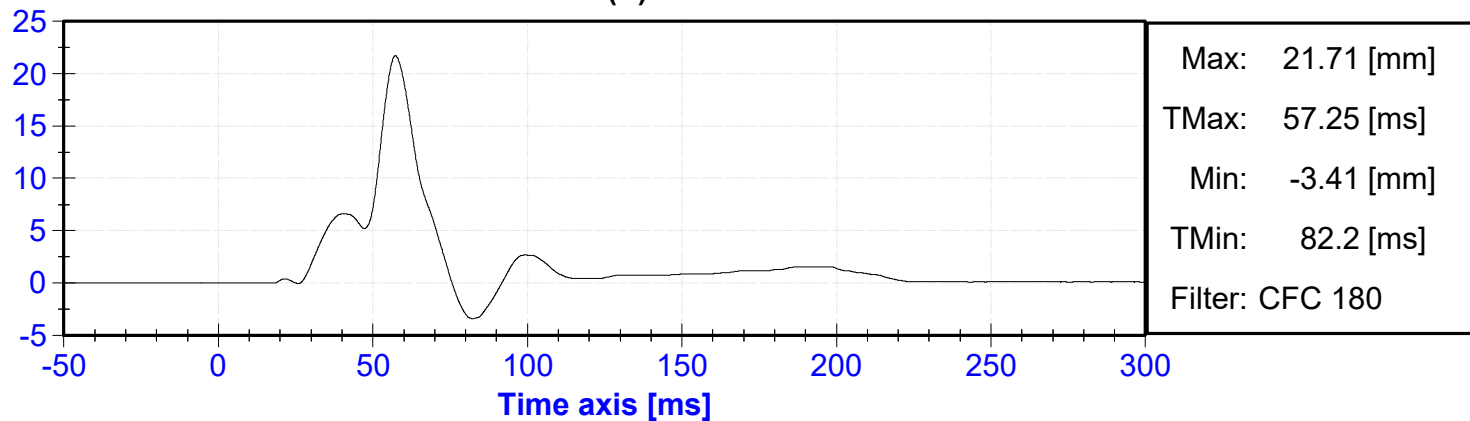
ES-2re Upper Thorax Rib Deflection (Y) vs. Time



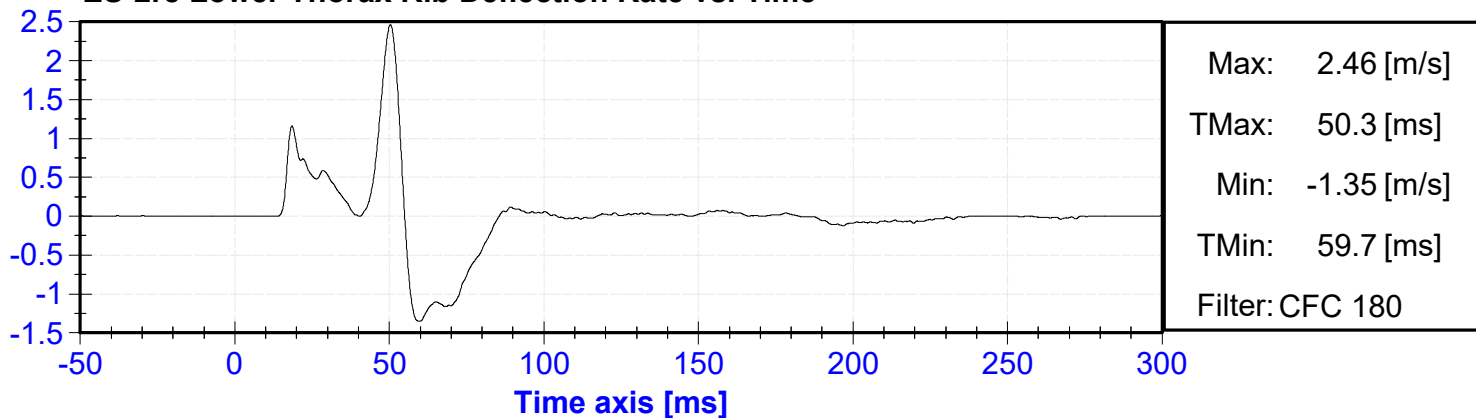
ES-2re Middle Thorax Rib Deflection Rate vs. Time



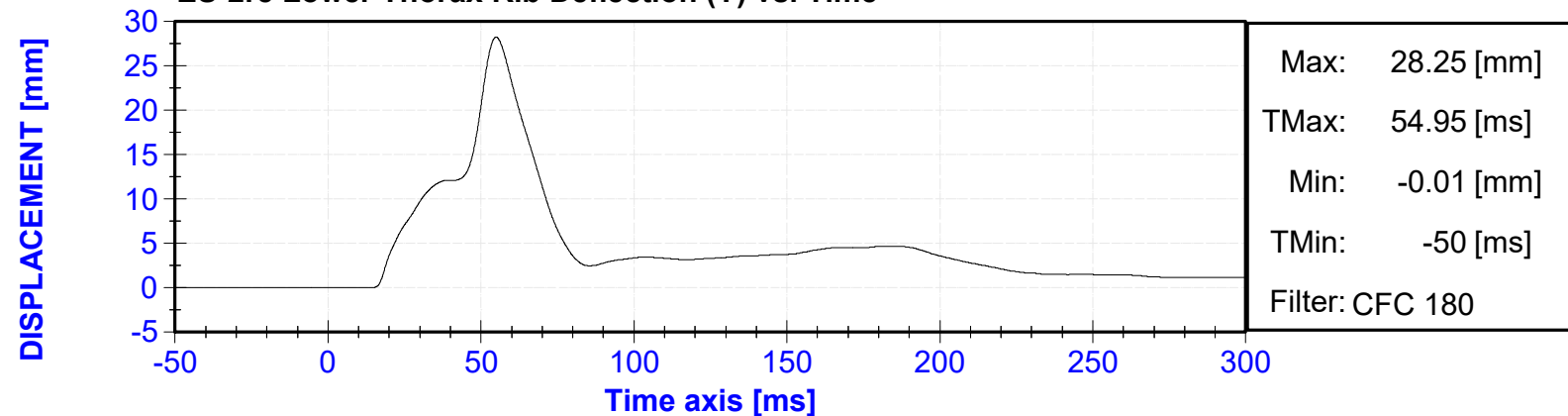
ES-2re Middle Thorax Rib Deflection (Y) vs. Time



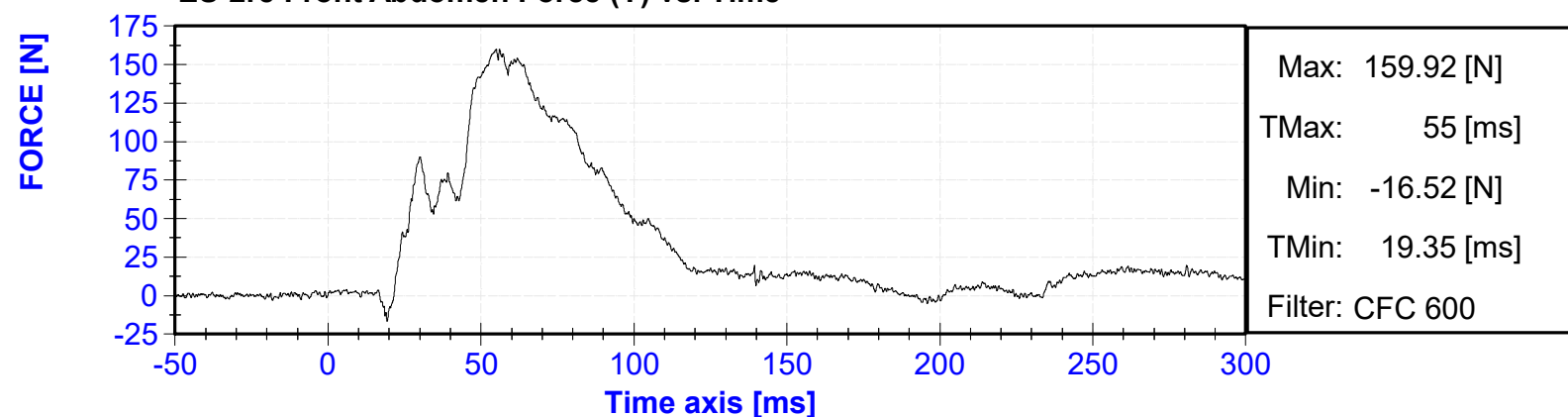
ES-2re Lower Thorax Rib Deflection Rate vs. Time



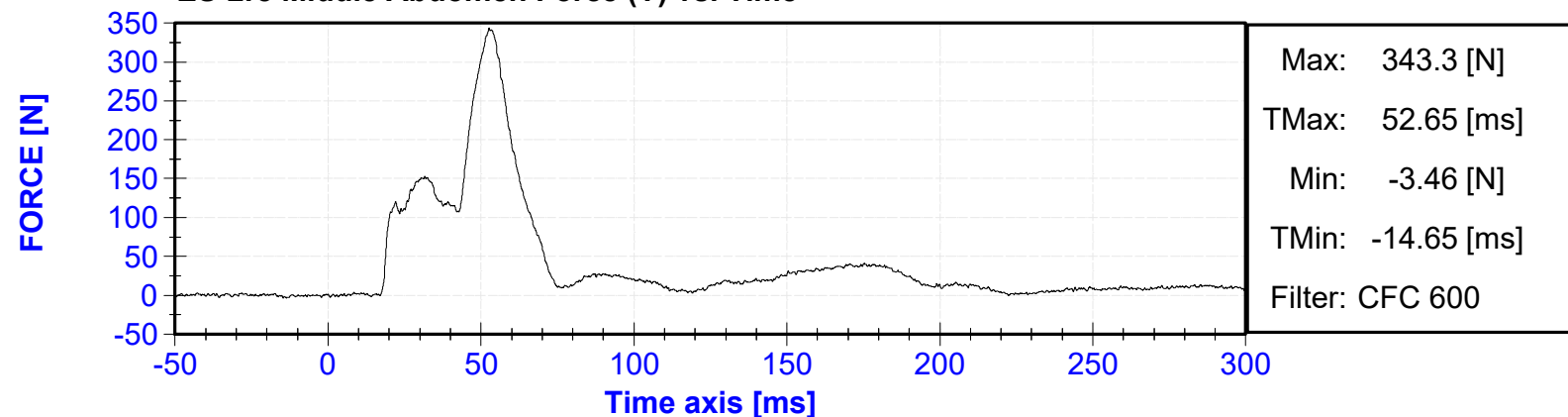
ES-2re Lower Thorax Rib Deflection (Y) vs. Time



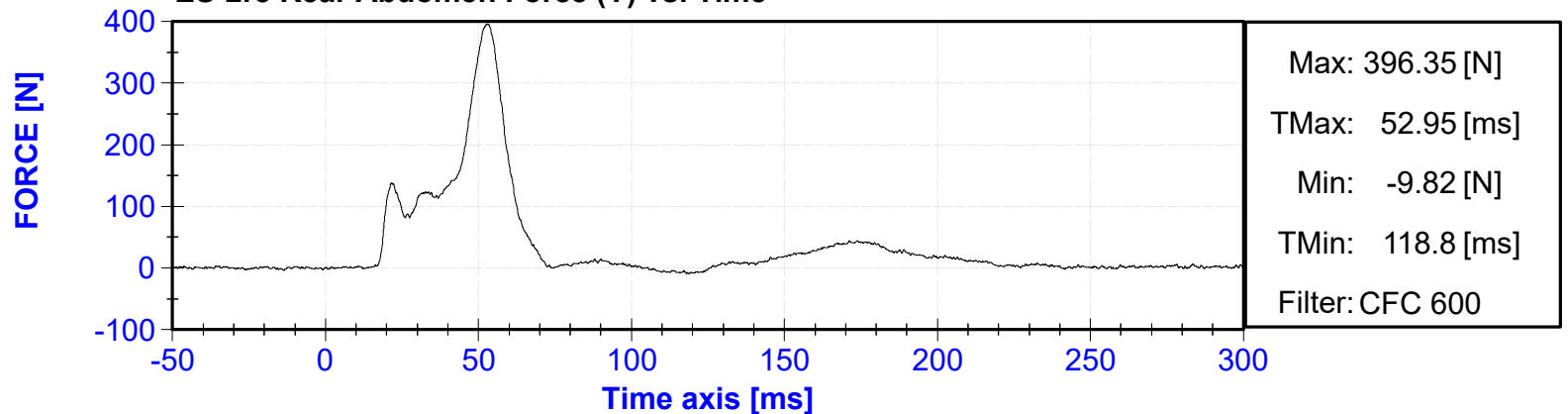
ES-2re Front Abdomen Force (Y) vs. Time



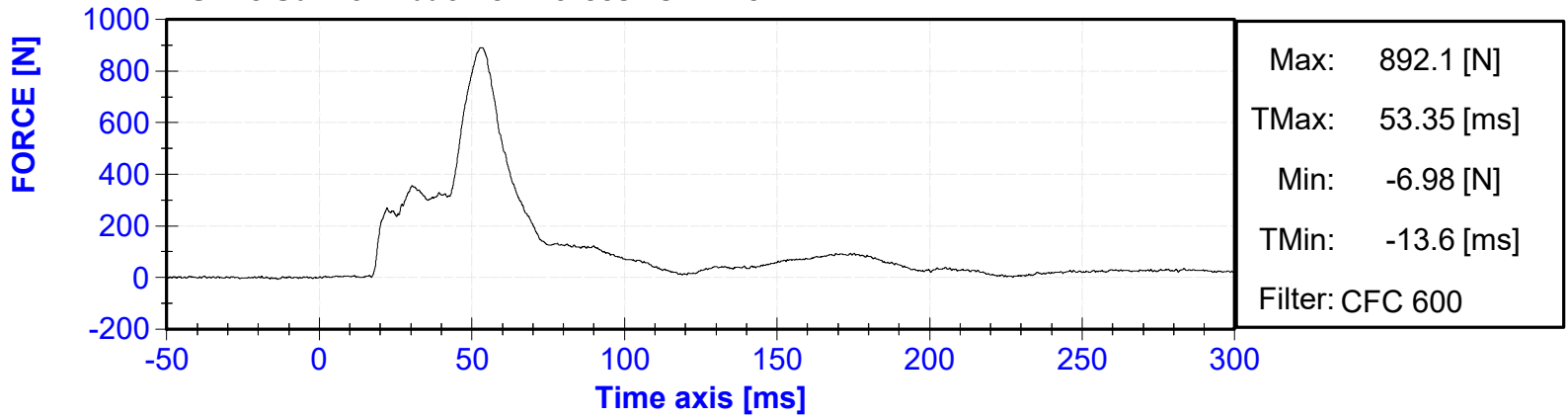
ES-2re Middle Abdomen Force (Y) vs. Time



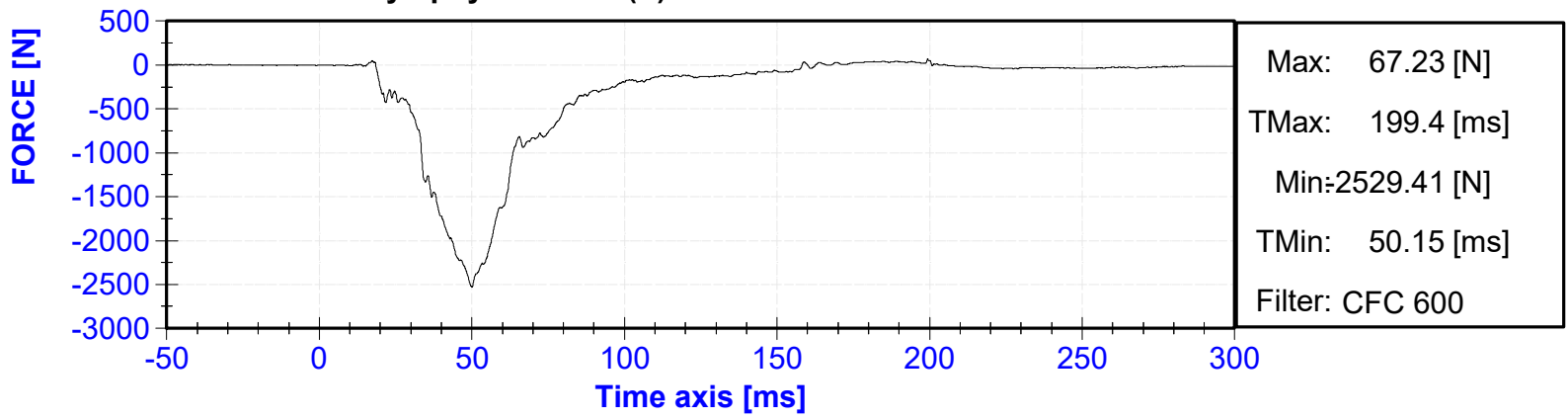
ES-2re Rear Abdomen Force (Y) vs. Time



ES-2re Sum of Abdomen Forces vs. Time



ES-2re Pubic Symphysis Force (Y) vs. Time



APPENDIX III

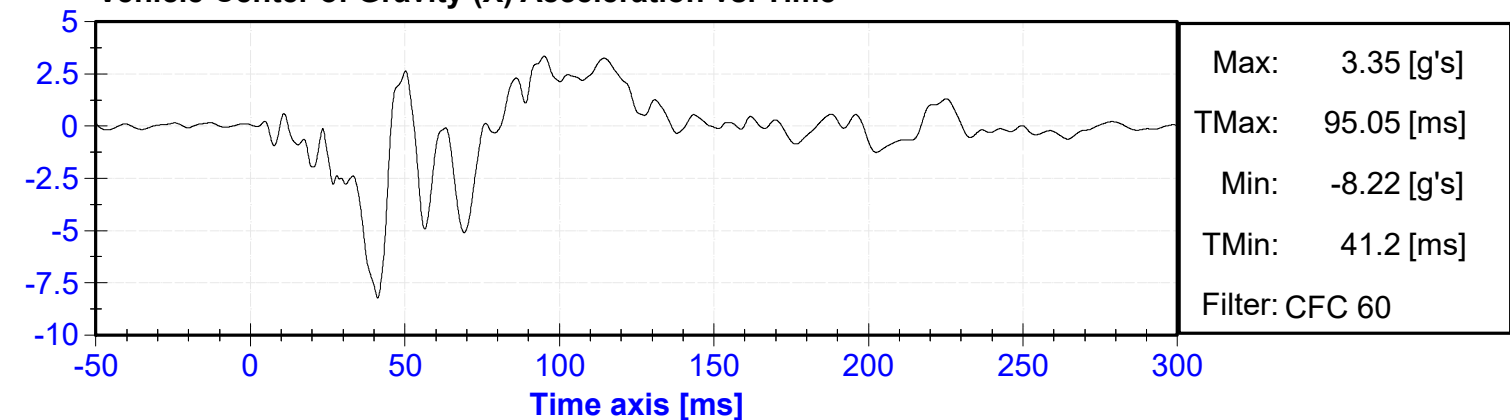
VEHICLE ACCELEROMETER RESPONSE DATA

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18	A-Pillar Mid (Y) Velocity vs. Time	III-7
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20	B-Pillar Sill (Y) Acceleration vs. Time	III-7
21	B-Pillar Sill (Y) Velocity vs. Time	III-8
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23	B-Pillar Low (Y) Acceleration vs. Time	III-8
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44	Rear Deck (Y) Acceleration vs. Time	III-13
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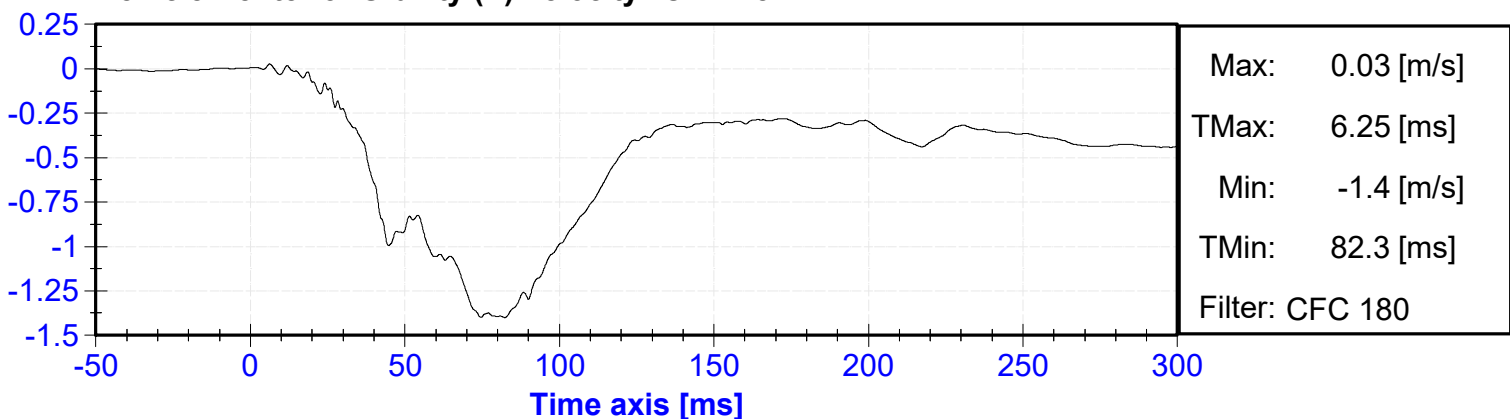
Vehicle Center of Gravity (X) Acceleration vs. Time

ACCELERATION [g's]



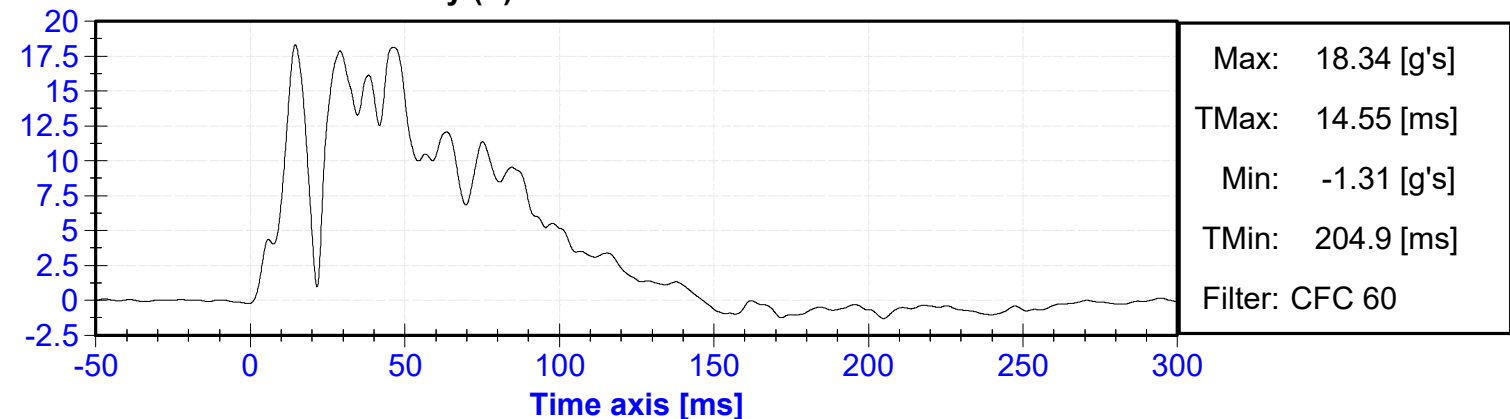
Vehicle Center of Gravity (X) Velocity vs. Time

VELOCITY [m/s]



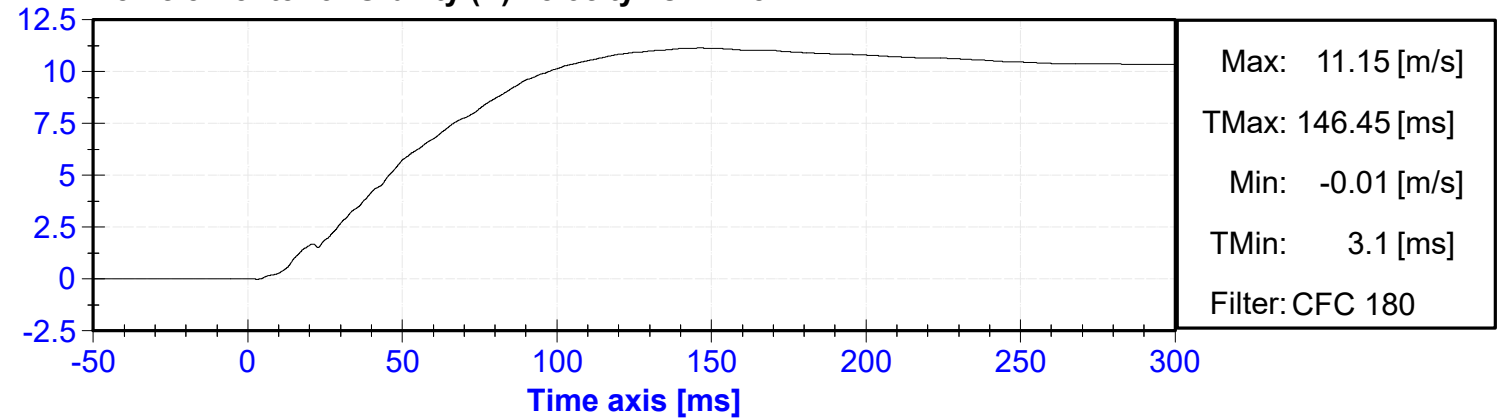
Vehicle Center of Gravity (Y) Acceleration vs. Time

ACCELERATION [g's]



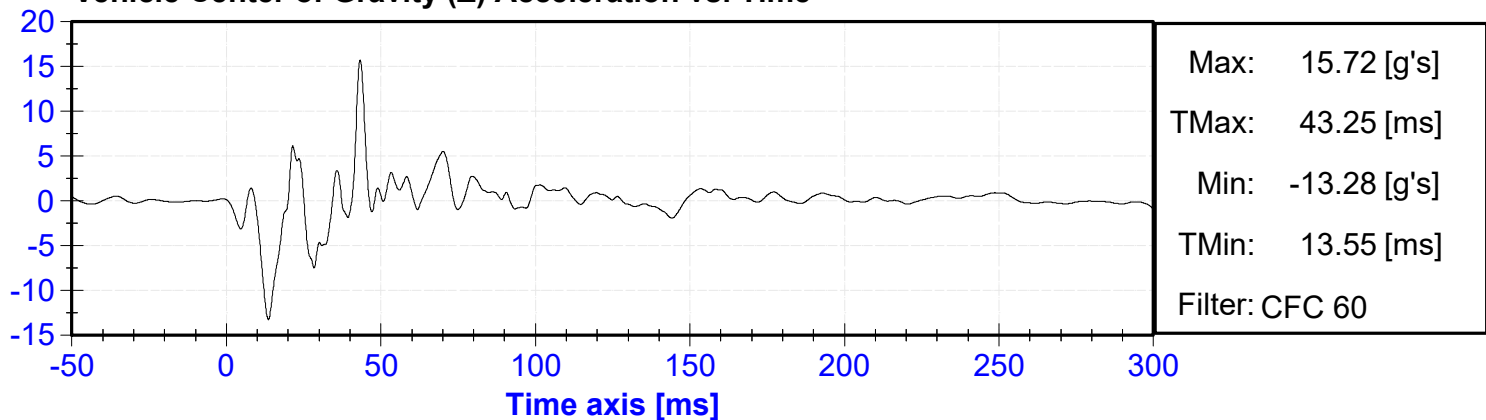
Vehicle Center of Gravity (Y) Velocity vs. Time

VELOCITY [m/s]



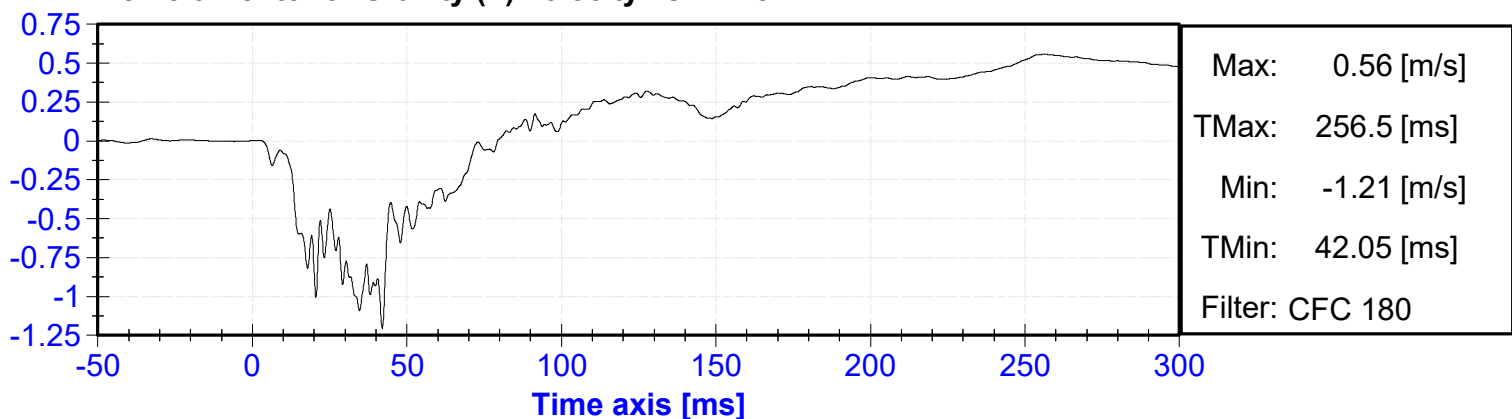
Vehicle Center of Gravity (Z) Acceleration vs. Time

ACCELERATION [g's]



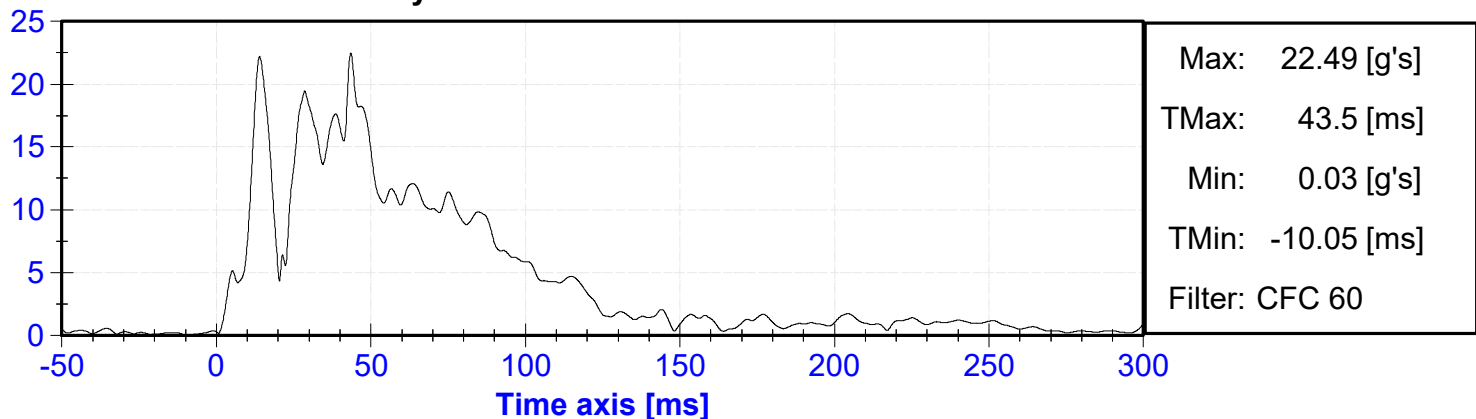
Vehicle Center of Gravity (Z) Velocity vs. Time

VELOCITY [m/s]



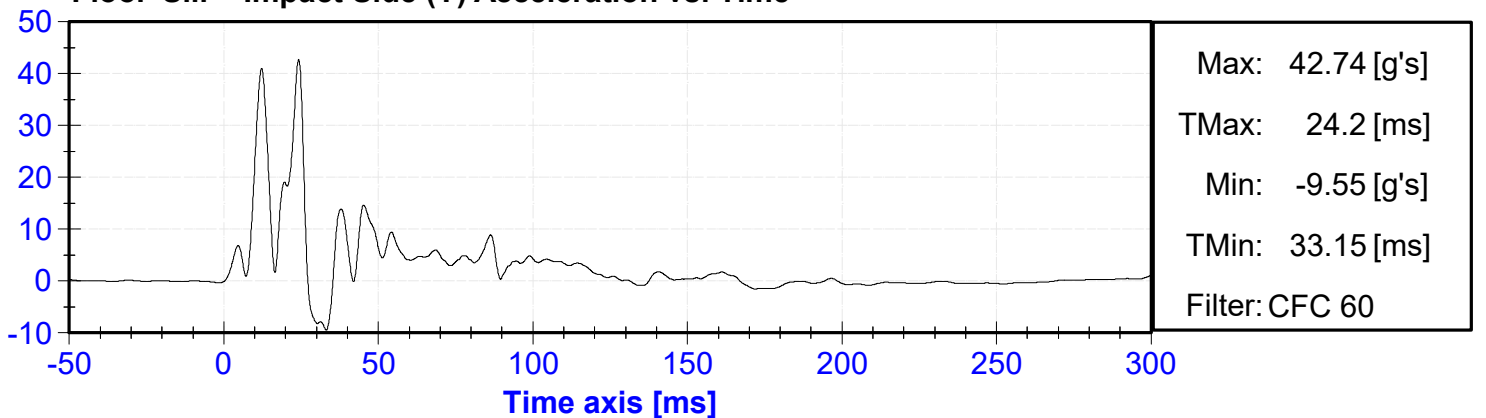
Vehicle Center of Gravity Resultant Acceleration vs. Time

ACCELERATION [g's]



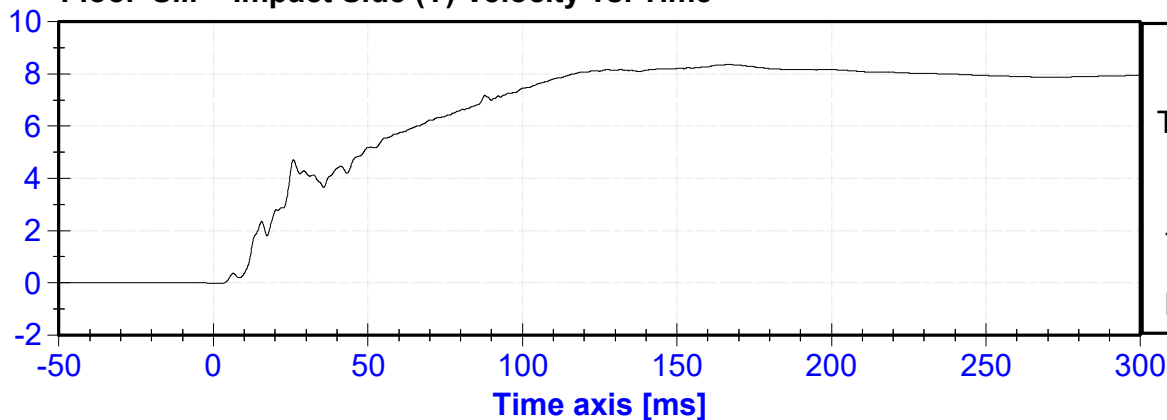
Floor Sill – Impact Side (Y) Acceleration vs. Time

ACCELERATION [g's]



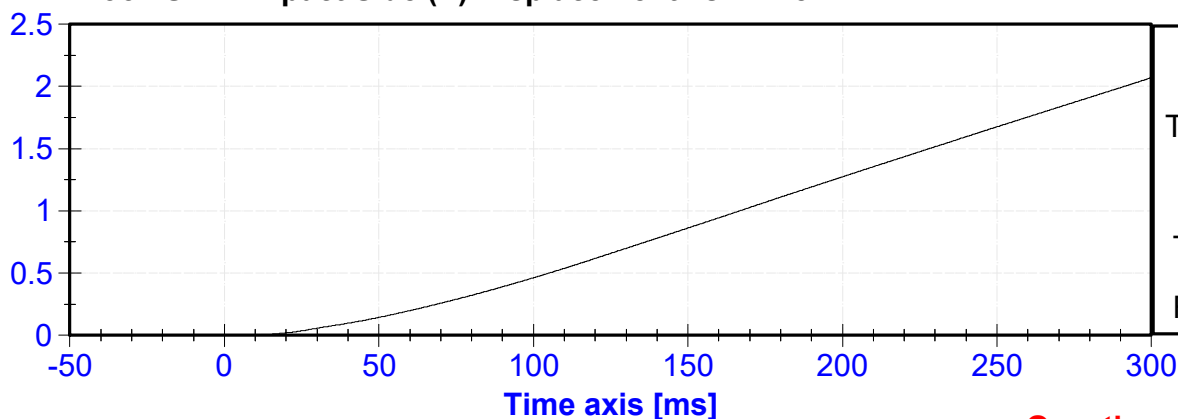
Floor Sill – Impact Side (Y) Velocity vs. Time

VELOCITY [m/s]



Floor Sill – Impact Side (Y) Displacement vs. Time

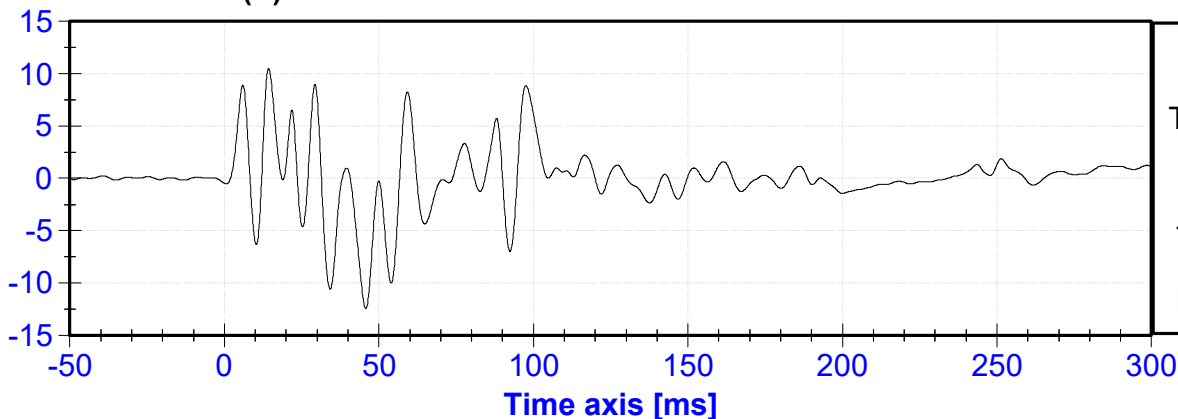
DISPLACEMENT [m]



Questionable data throughout

A-Pillar Sill (Y) Acceleration vs. Time

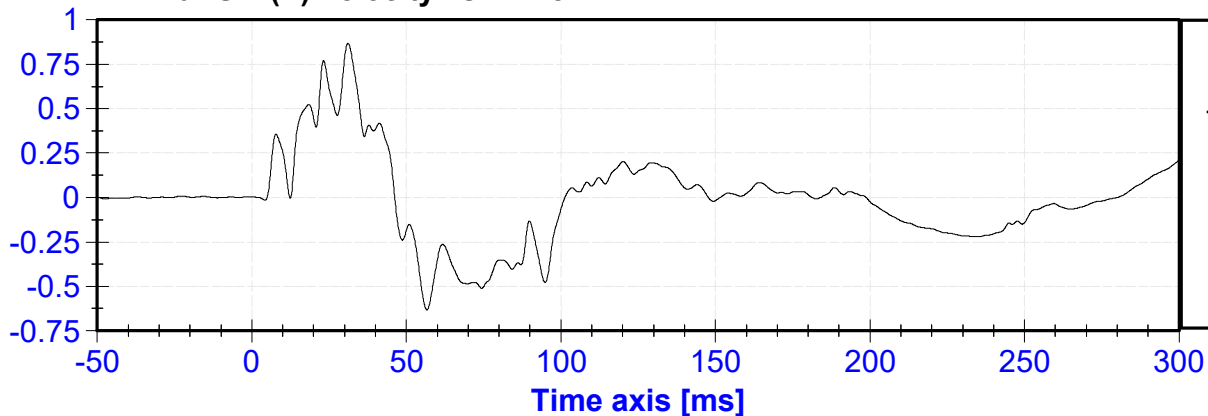
ACCELERATION [g's]



Questionable data throughout

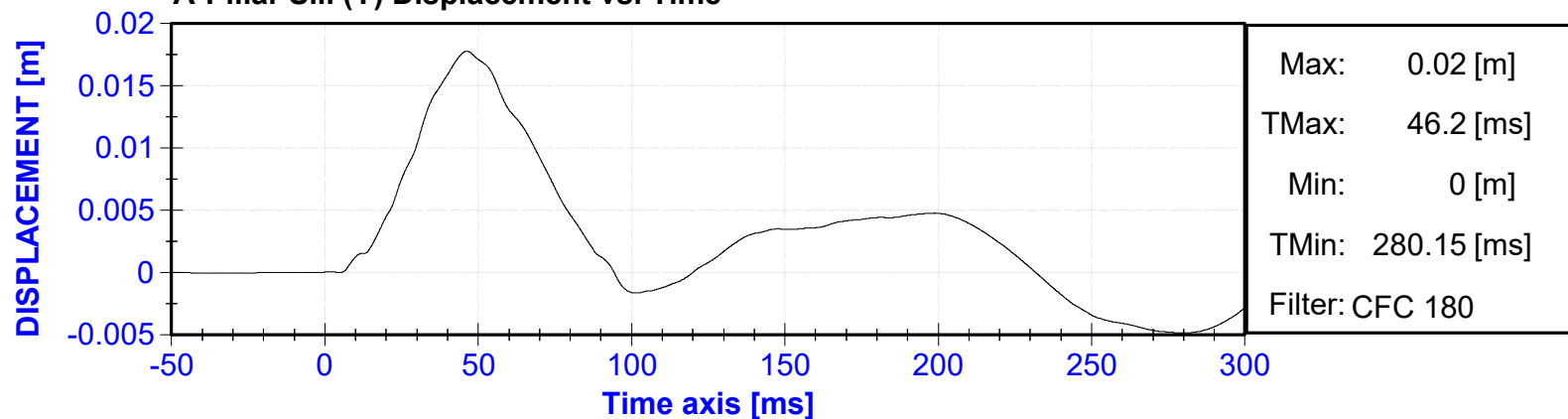
A-Pillar Sill (Y) Velocity vs. Time

VELOCITY [m/s]

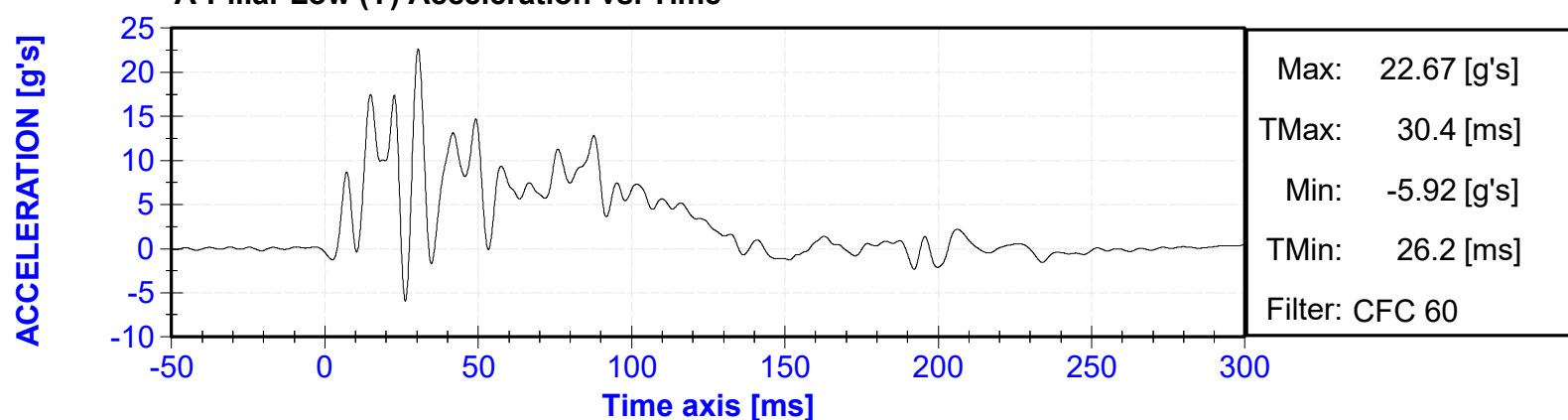


Questionable data throughout

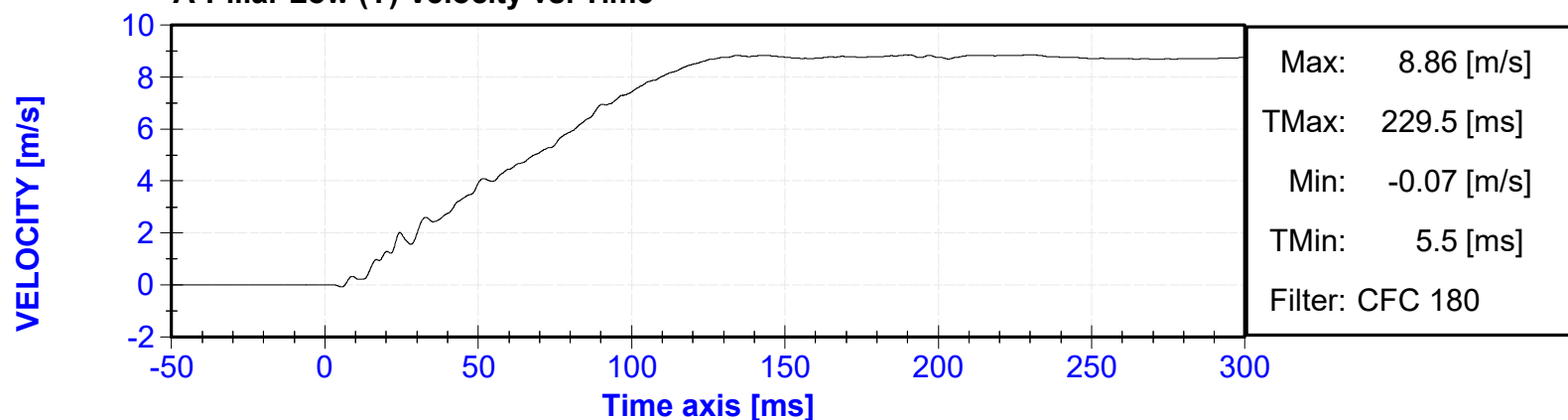
A-Pillar Sill (Y) Displacement vs. Time



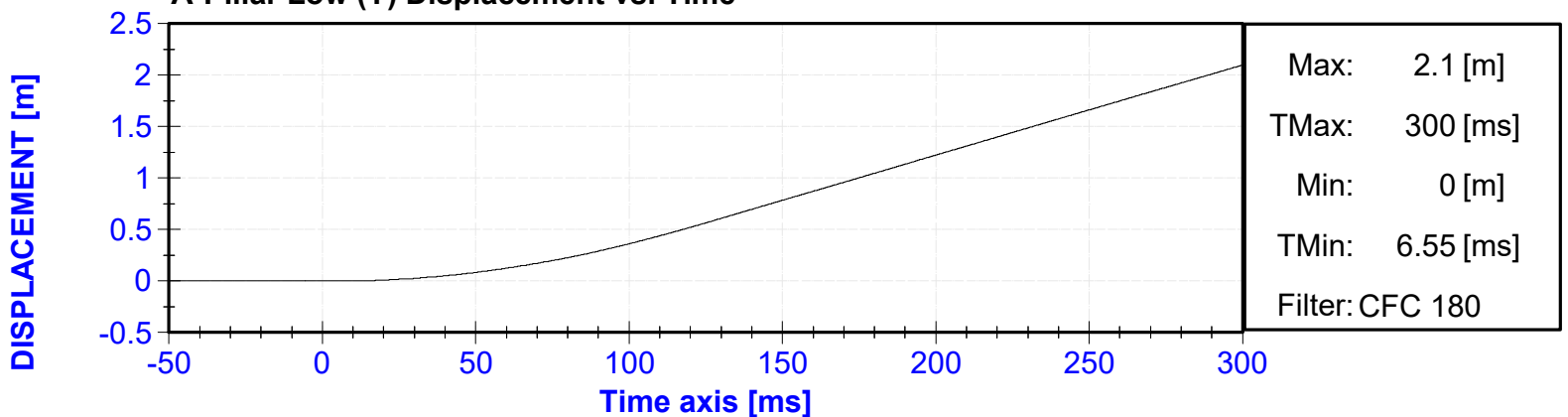
A-Pillar Low (Y) Acceleration vs. Time



A-Pillar Low (Y) Velocity vs. Time

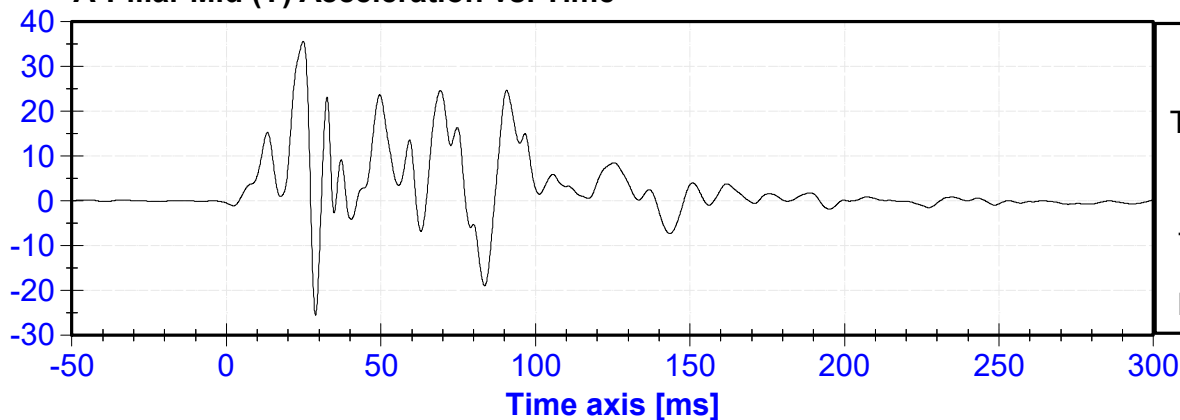


A-Pillar Low (Y) Displacement vs. Time



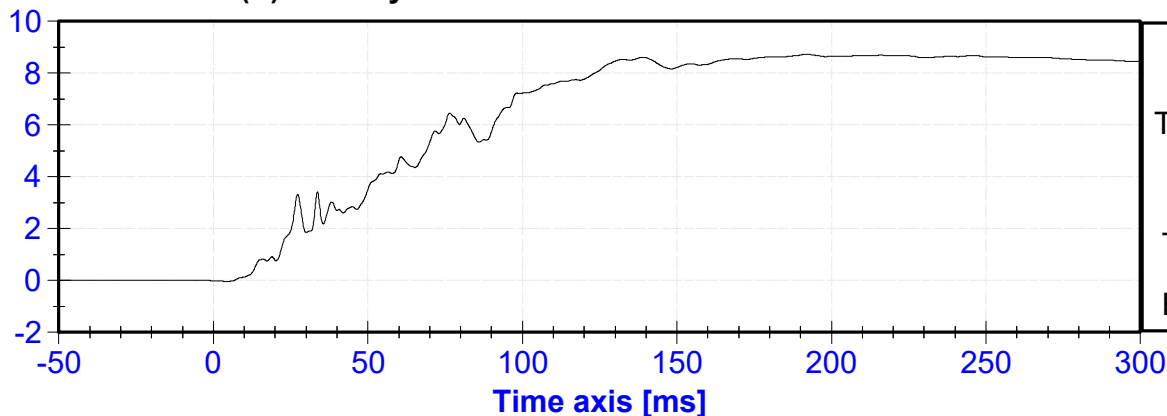
A-Pillar Mid (Y) Acceleration vs. Time

ACCELERATION [g's]



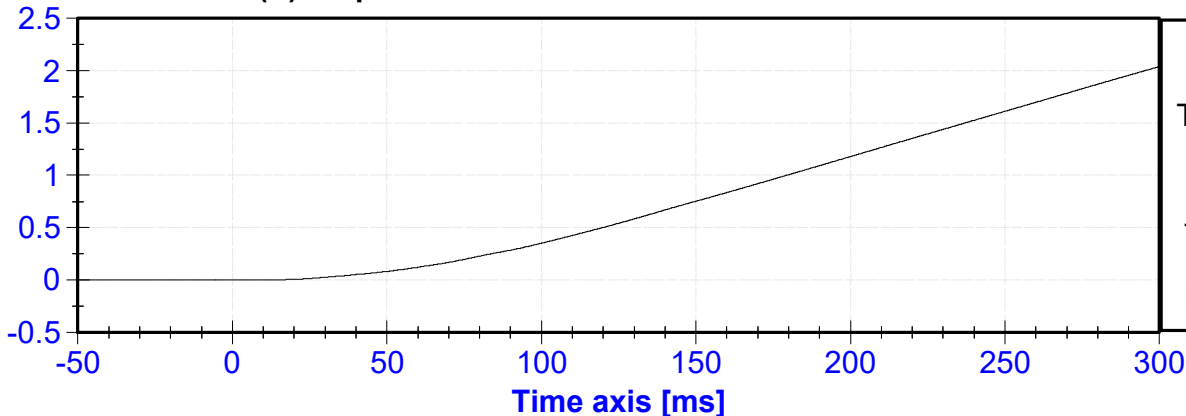
A-Pillar Mid (Y) Velocity vs. Time

VELOCITY [m/s]



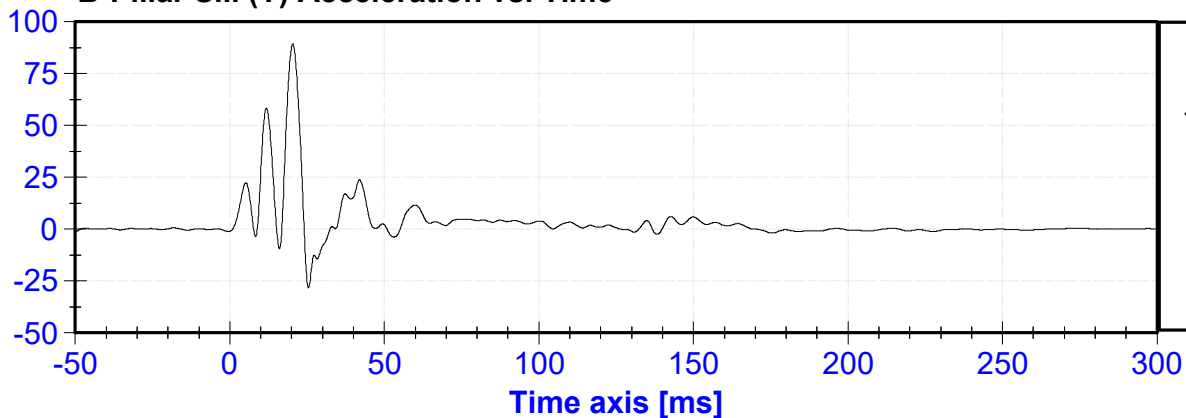
A-Pillar Mid (Y) Displacement vs. Time

DISPLACEMENT [m]



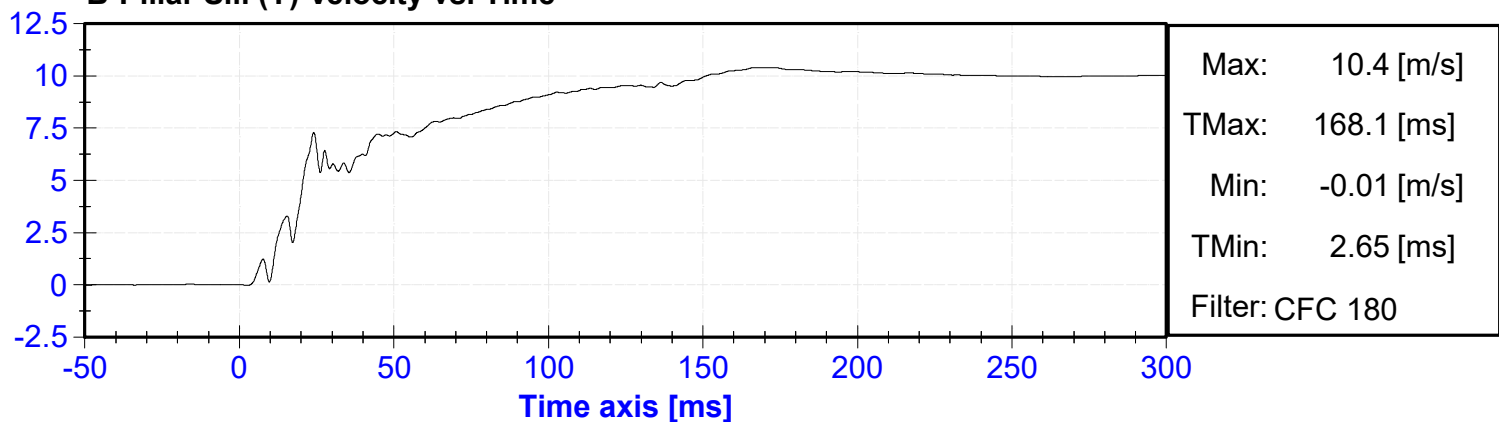
B-Pillar Sill (Y) Acceleration vs. Time

ACCELERATION [g's]



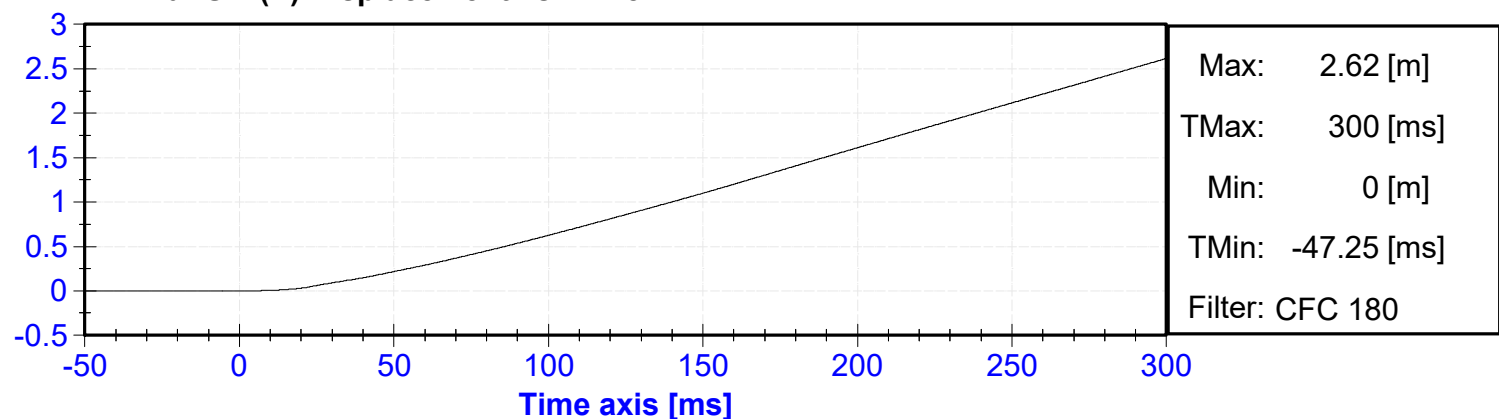
B-Pillar Sill (Y) Velocity vs. Time

VELOCITY [m/s]



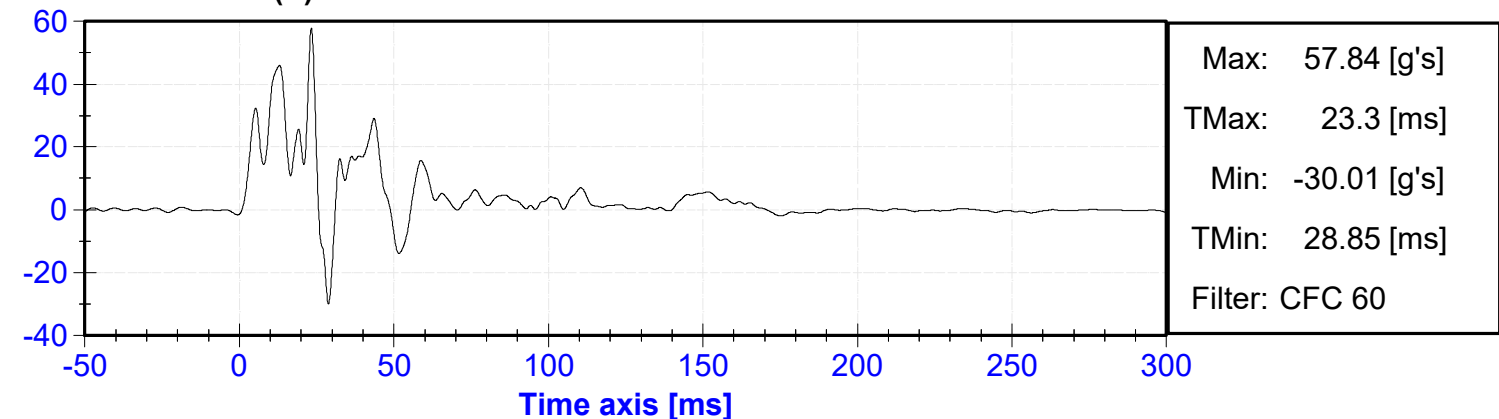
B-Pillar Sill (Y) Displacement vs. Time

DISPLACEMENT [m]



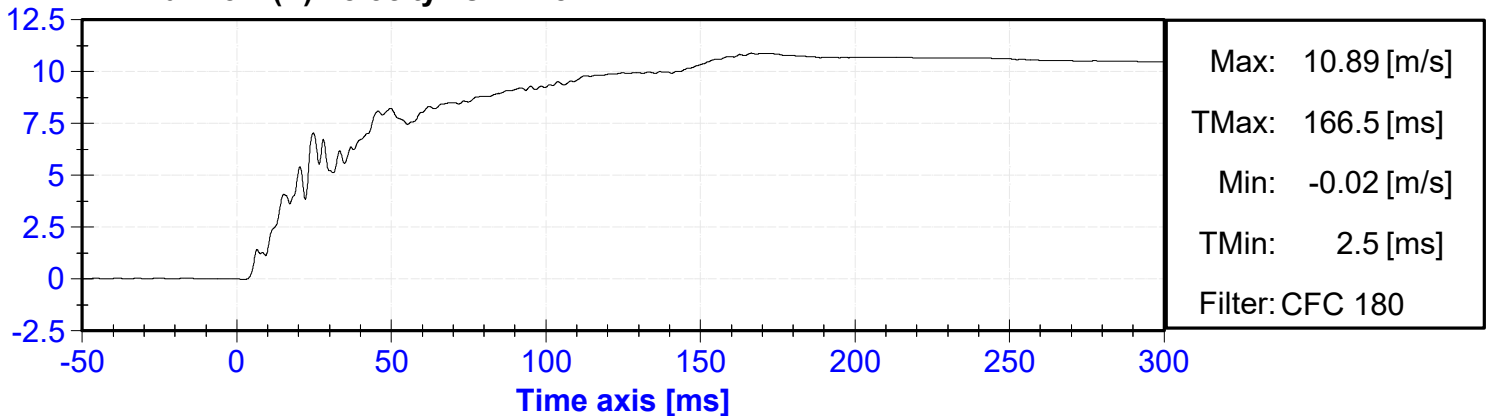
B-Pillar Low (Y) Acceleration vs. Time

ACCELERATION [g's]



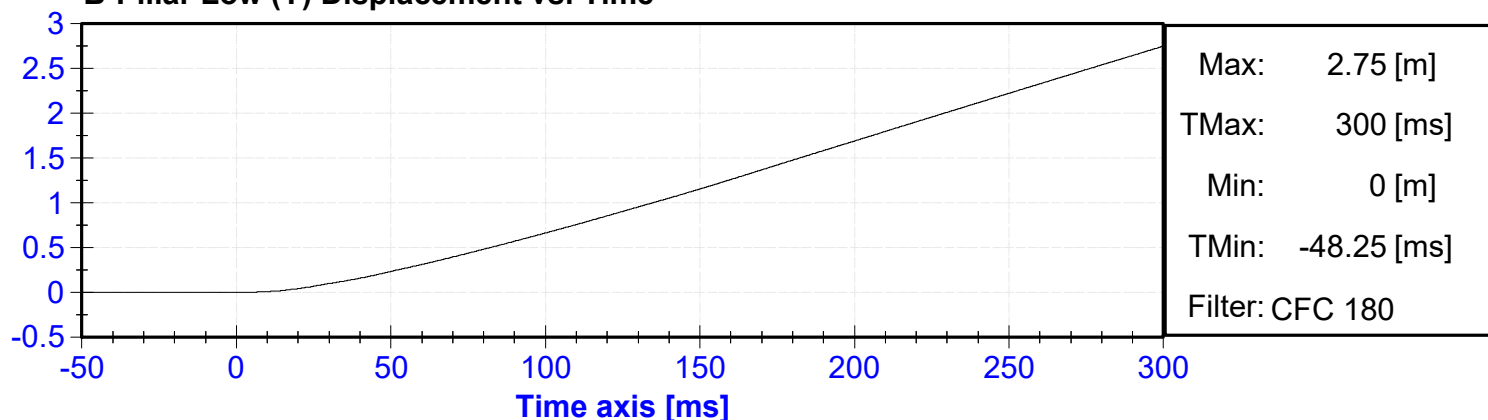
B-Pillar Low (Y) Velocity vs. Time

VELOCITY [m/s]



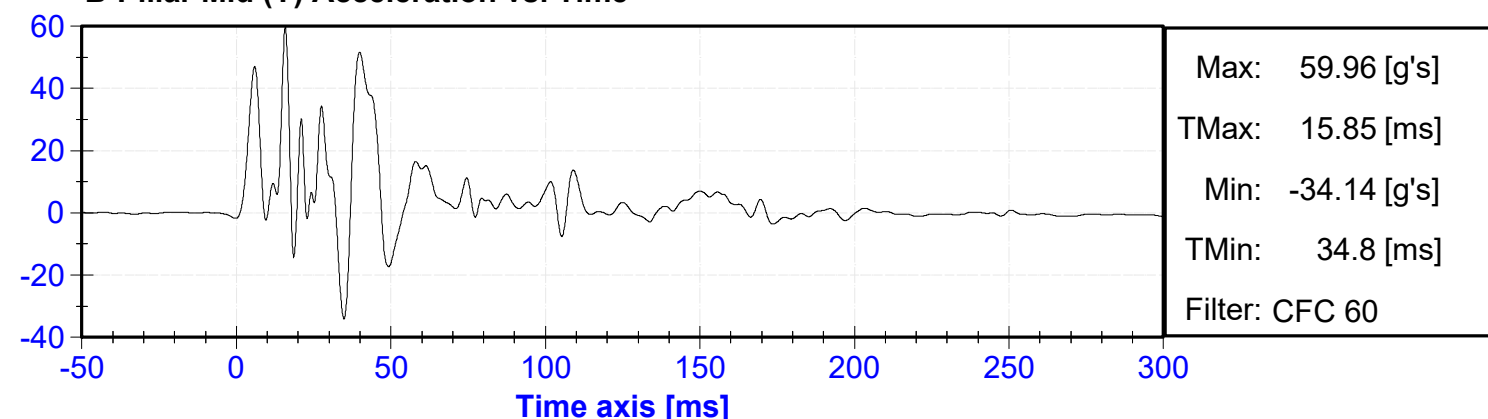
B-Pillar Low (Y) Displacement vs. Time

DISPLACEMENT [m]



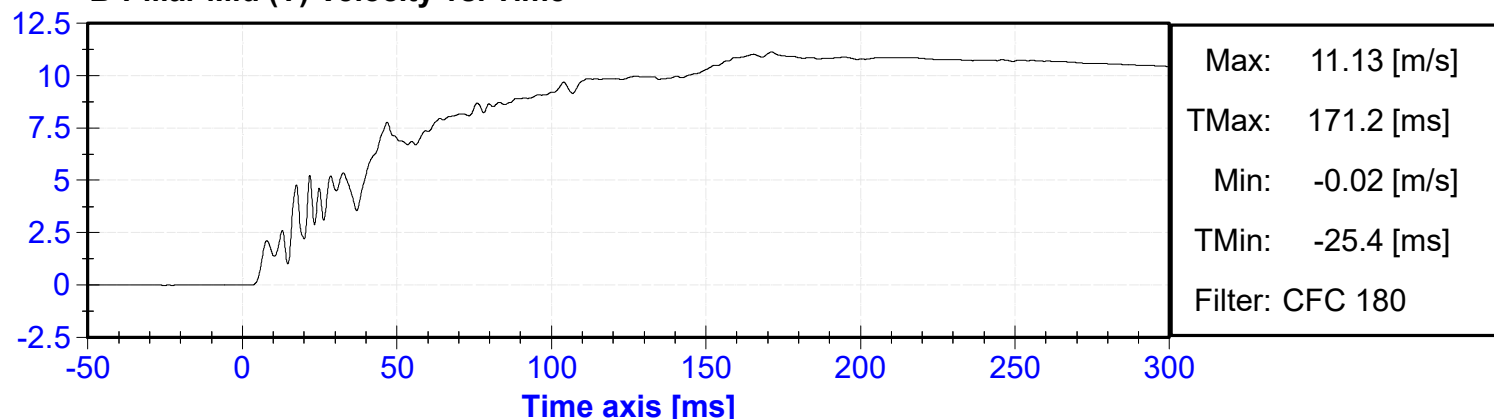
B-Pillar Mid (Y) Acceleration vs. Time

ACCELERATION [g's]



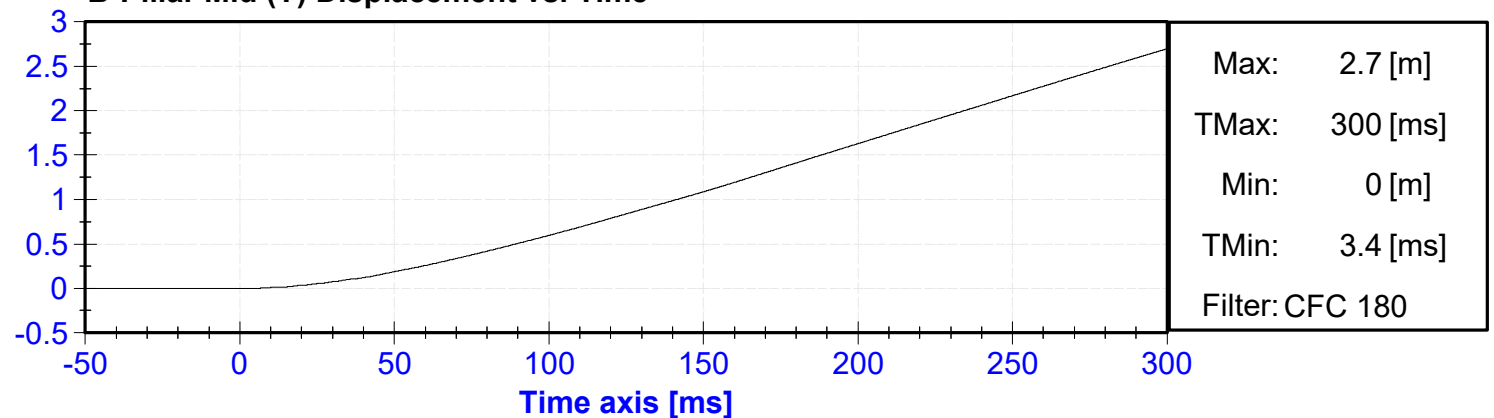
B-Pillar Mid (Y) Velocity vs. Time

VELOCITY [m/s]

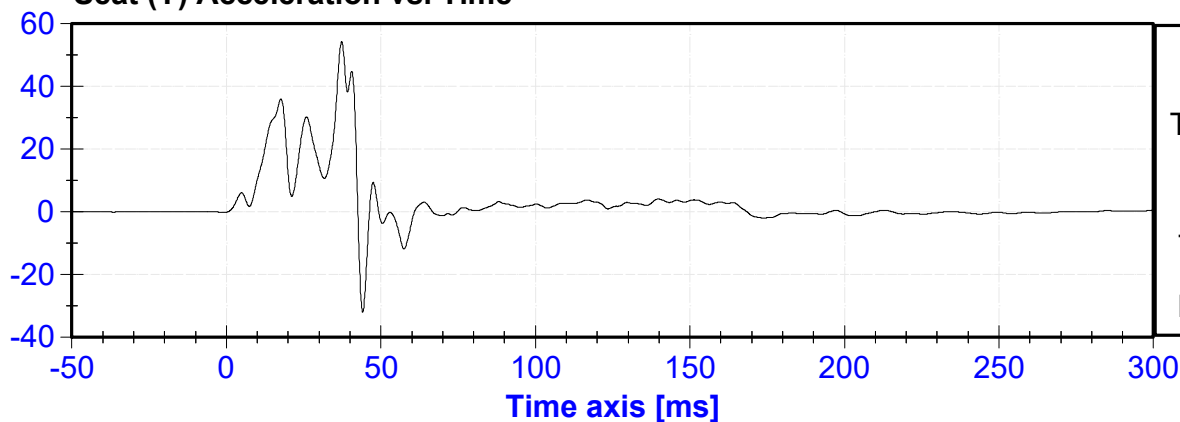


B-Pillar Mid (Y) Displacement vs. Time

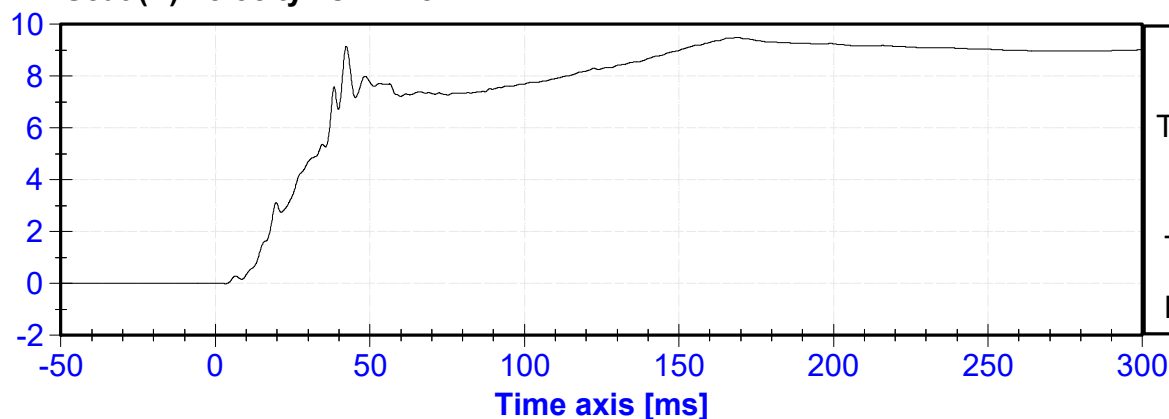
DISPLACEMENT [m]



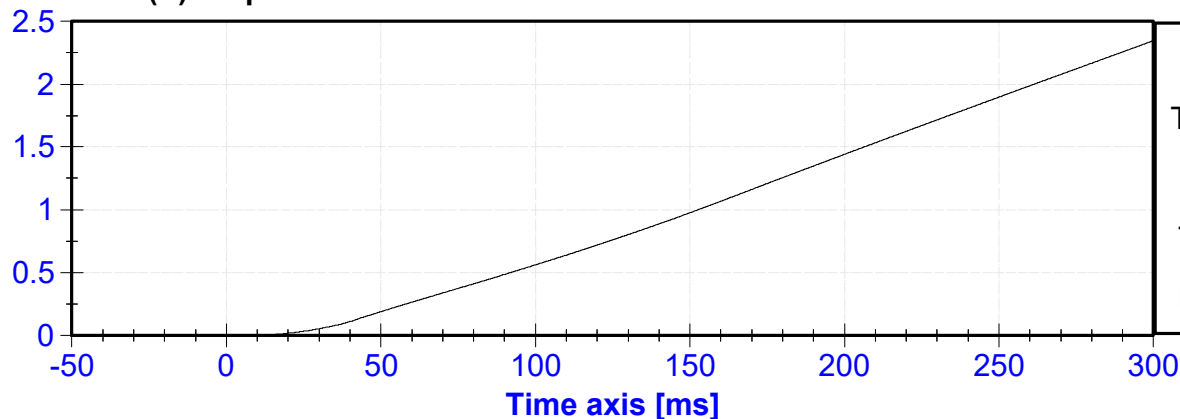
Seat (Y) Acceleration vs. Time



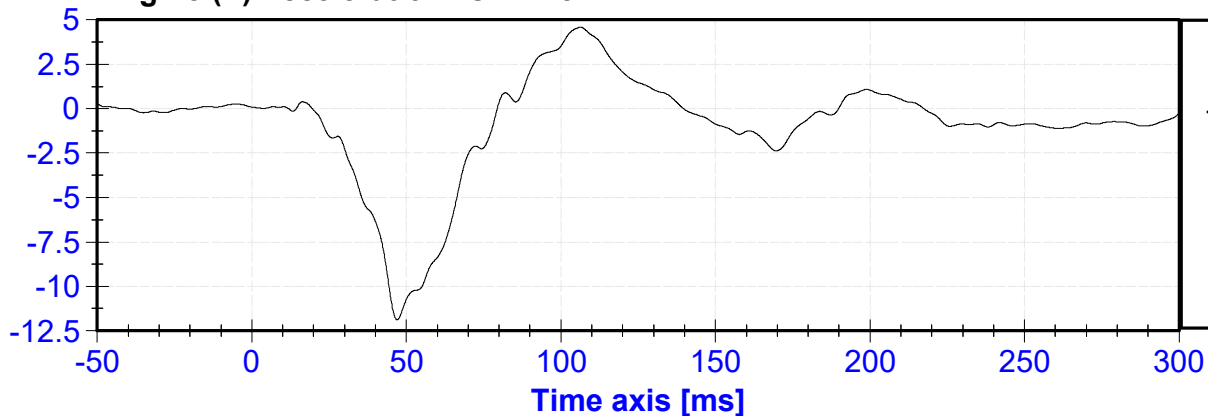
Seat (Y) Velocity vs. Time



Seat (Y) Displacement vs. Time

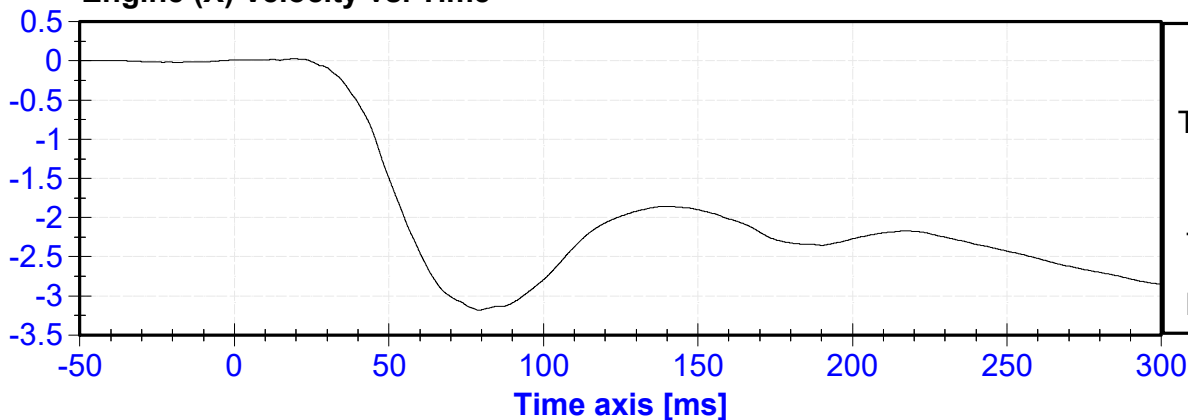


Engine (X) Acceleration vs. Time



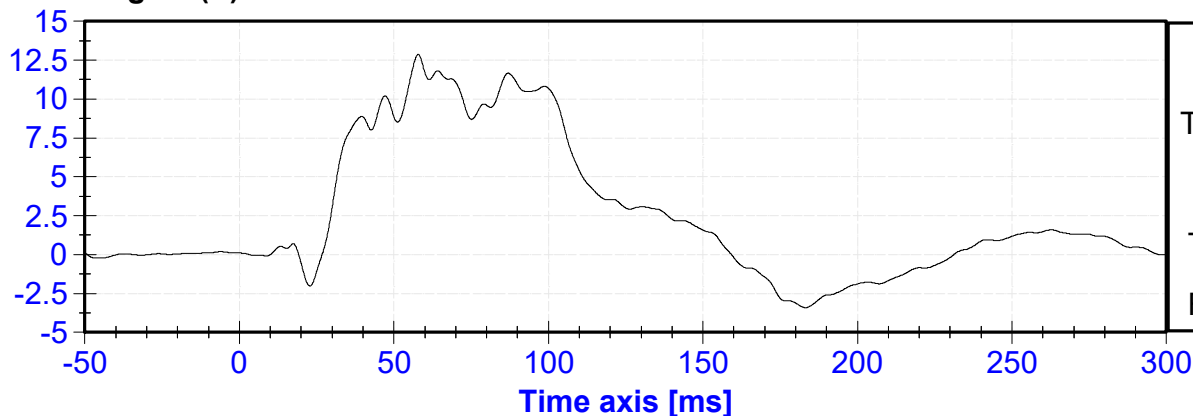
Engine (X) Velocity vs. Time

VELOCITY [m/s]



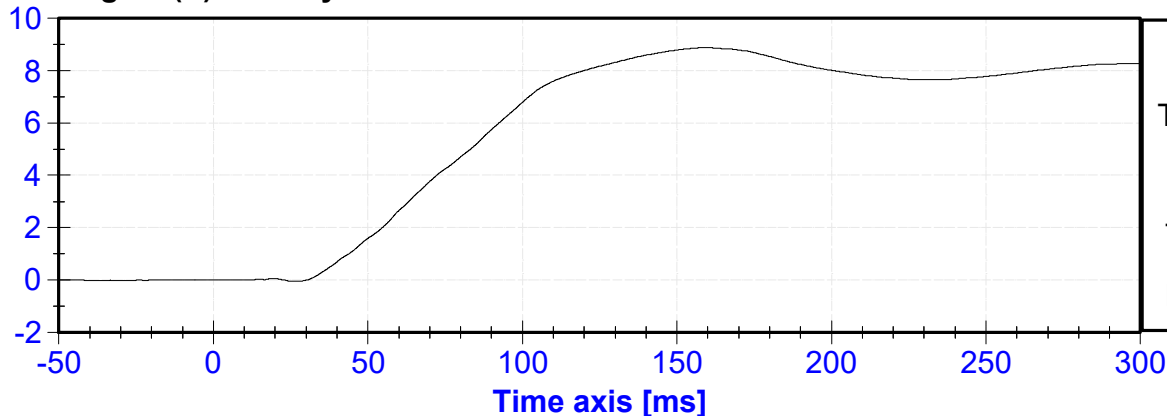
Engine (Y) Acceleration vs. Time

ACCELERATION [g's]



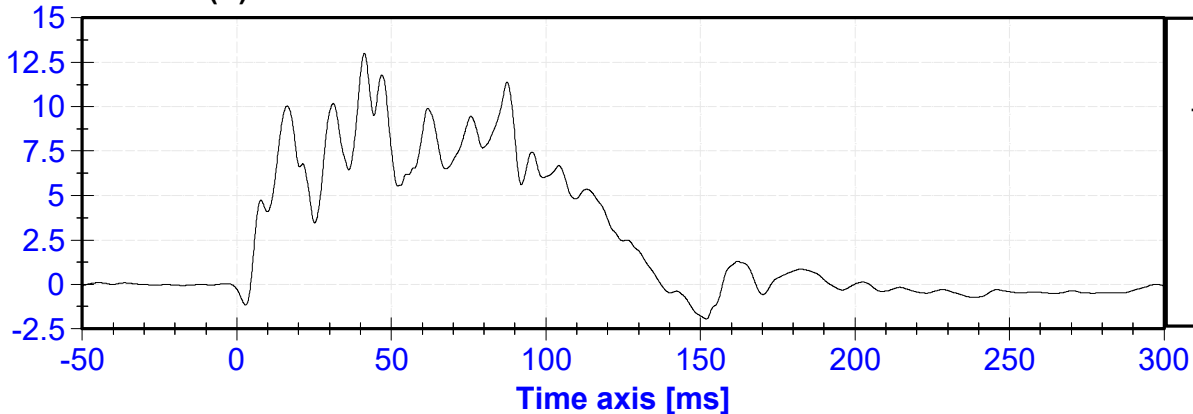
Engine (Y) Velocity vs. Time

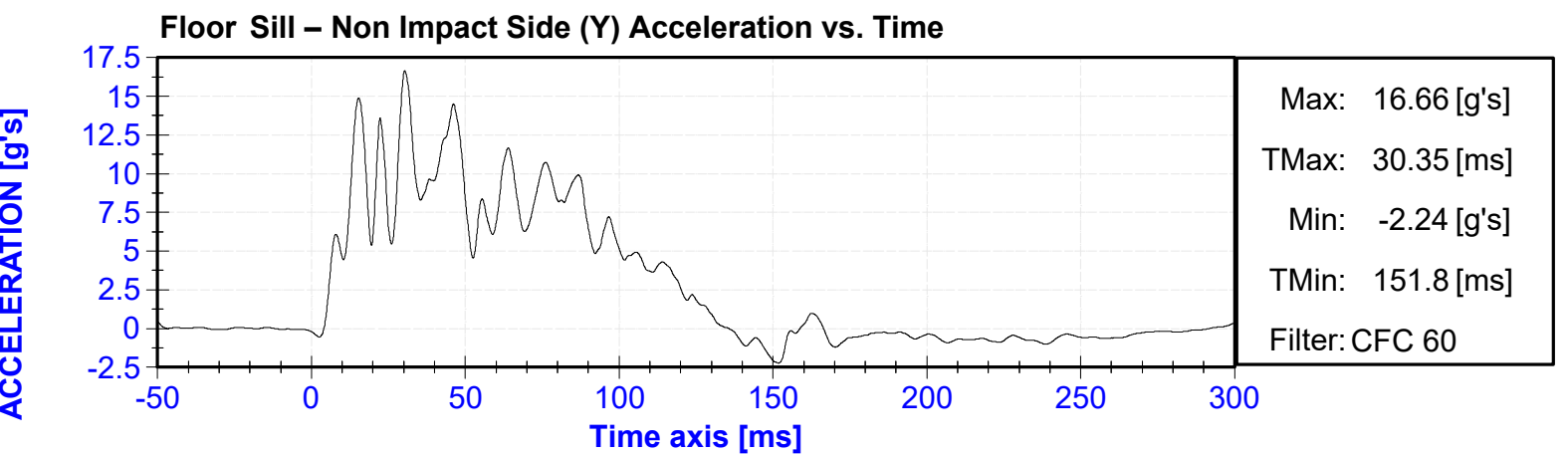
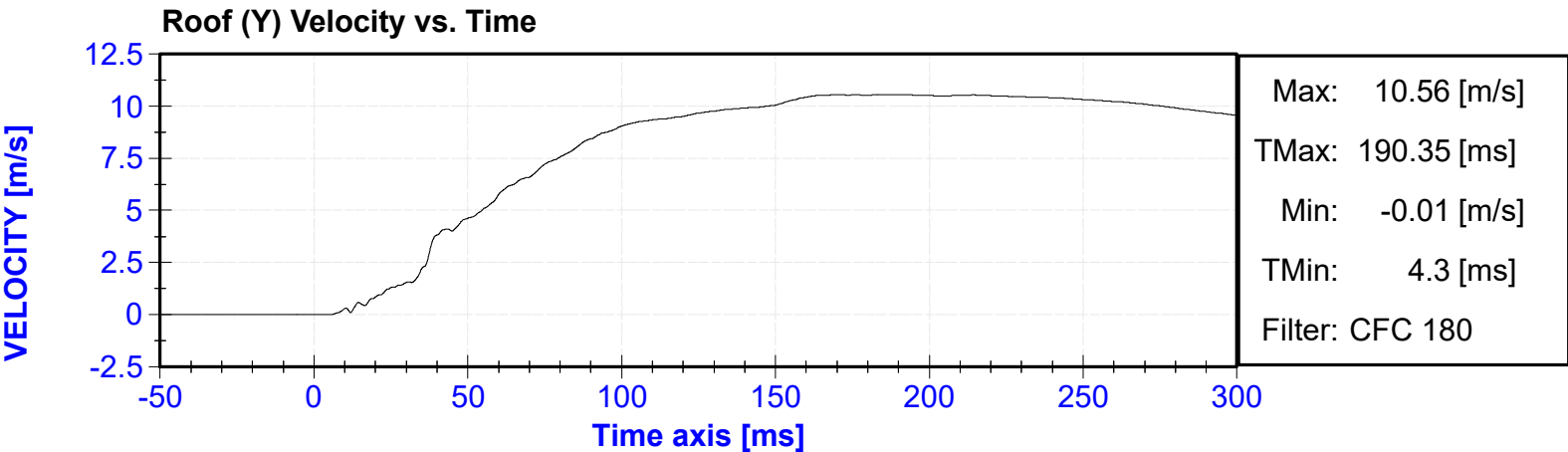
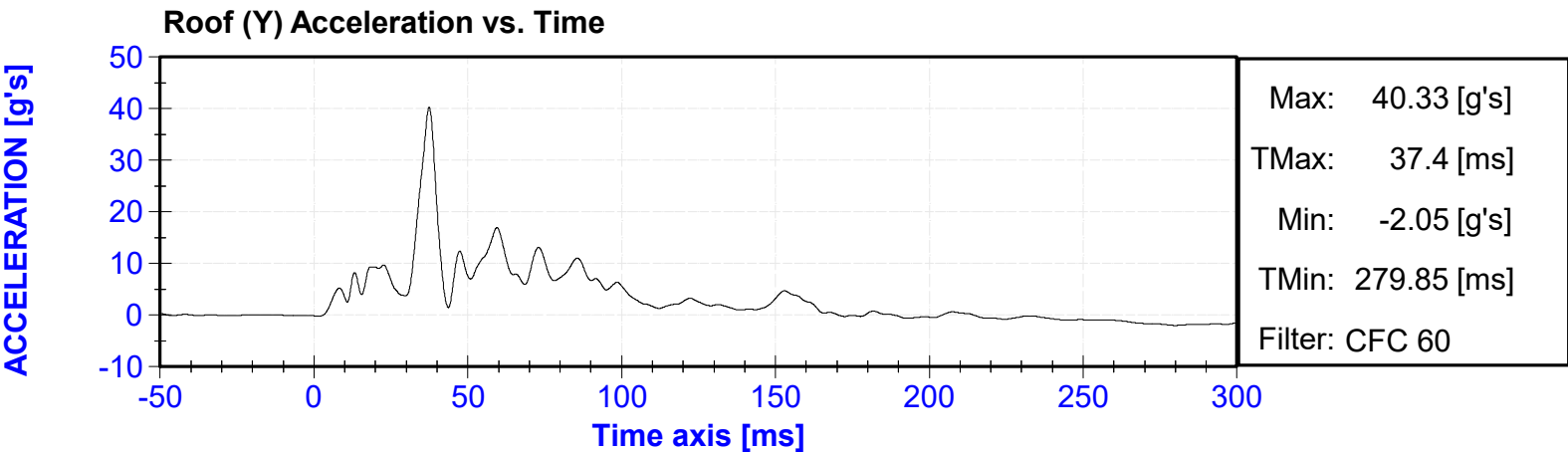
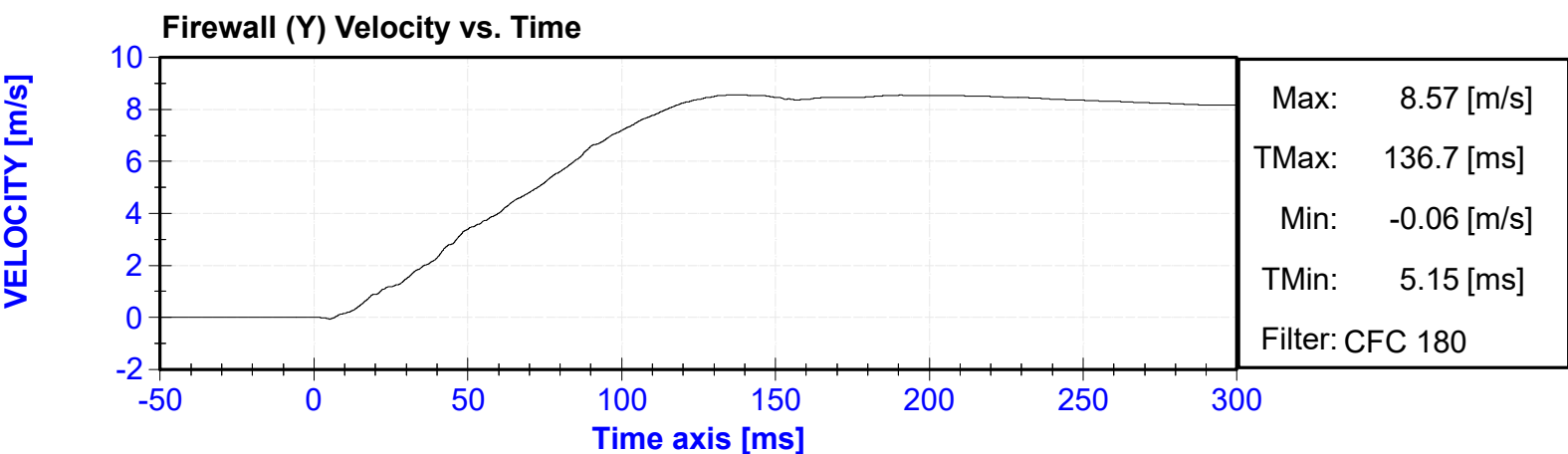
VELOCITY [m/s]



Firewall (Y) Acceleration vs. Time

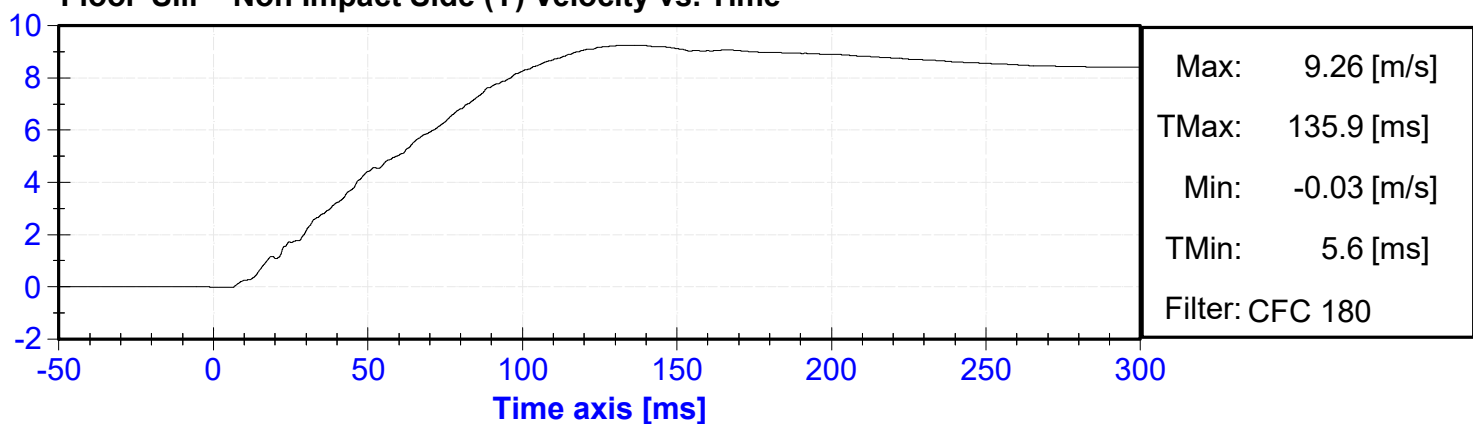
ACCELERATION [g's]





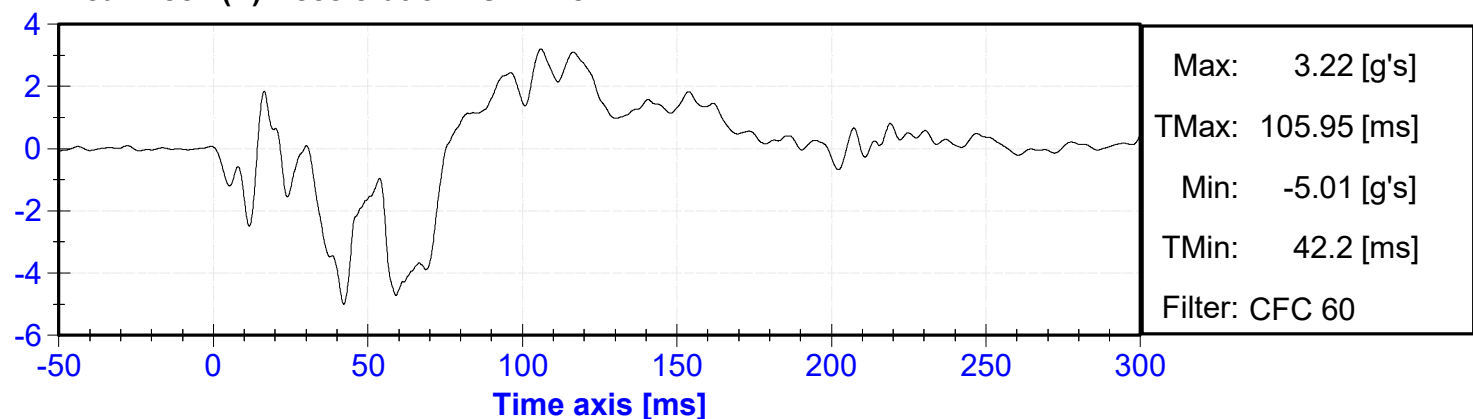
Floor Sill – Non Impact Side (Y) Velocity vs. Time

VELOCITY [m/s]



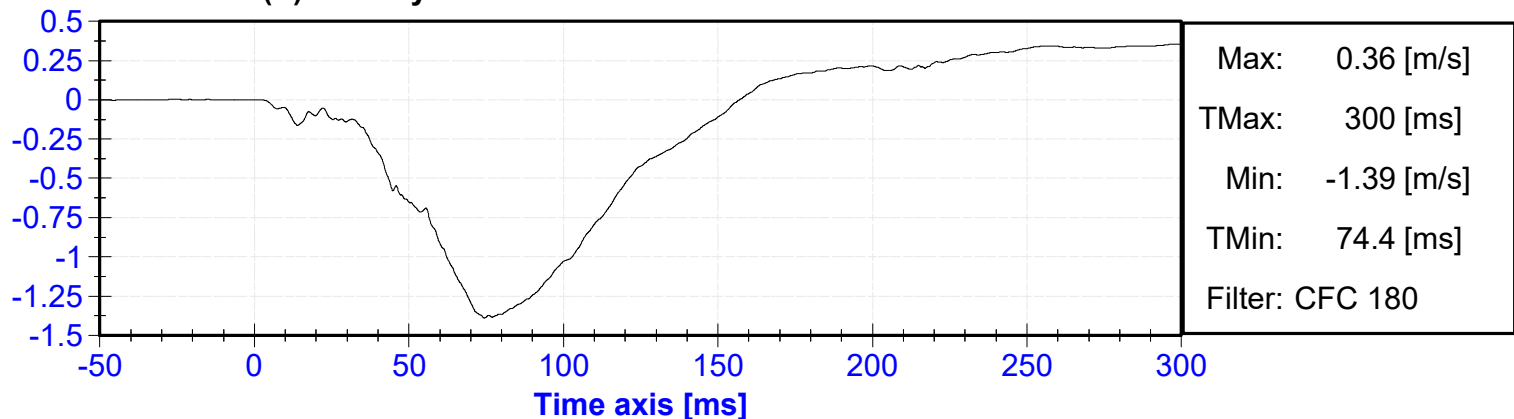
Rear Deck (X) Acceleration vs. Time

ACCELERATION [g's]



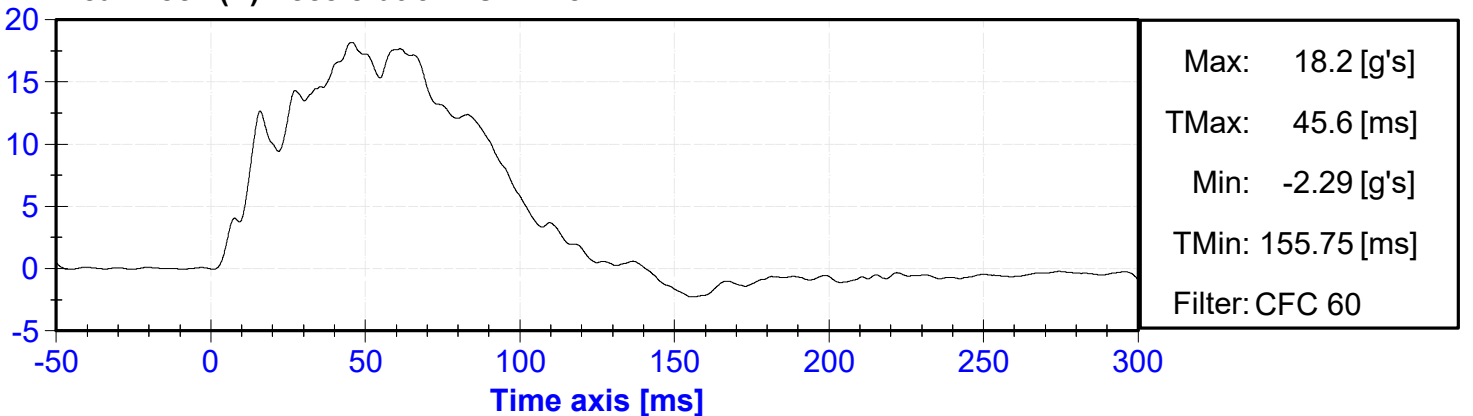
Rear Deck (X) Velocity vs. Time

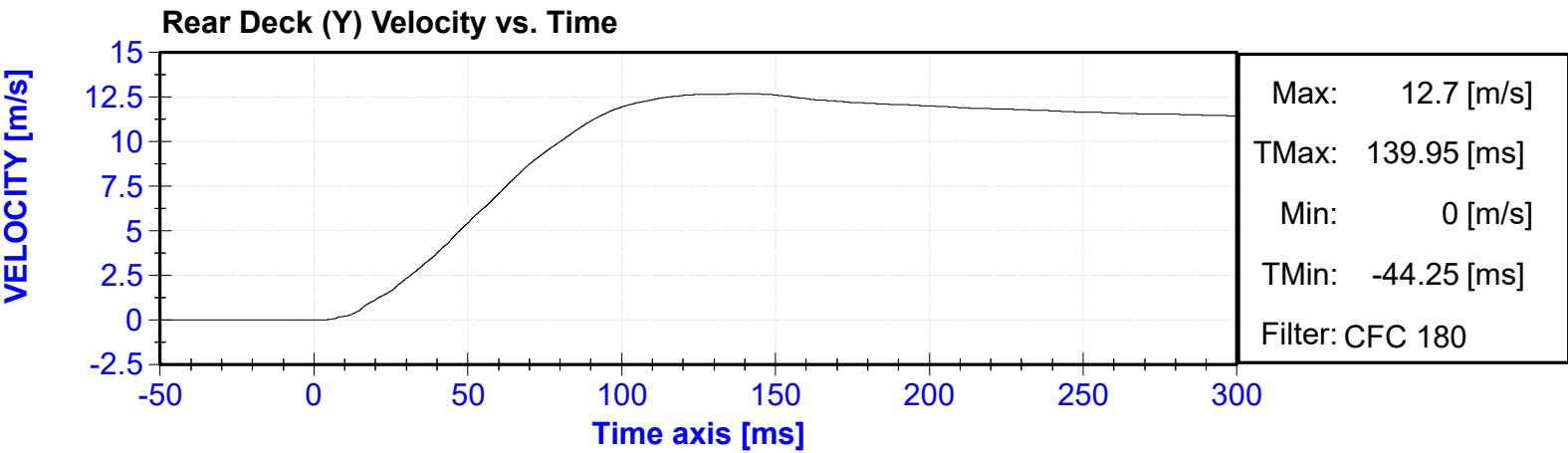
VELOCITY [m/s]



Rear Deck (Y) Acceleration vs. Time

ACCELERATION [g's]





APPENDIX IV

PRE-TEST DUMMY PERFORMANCE CALIBRATION TEST DATA

(Subpart U, ES-2re)

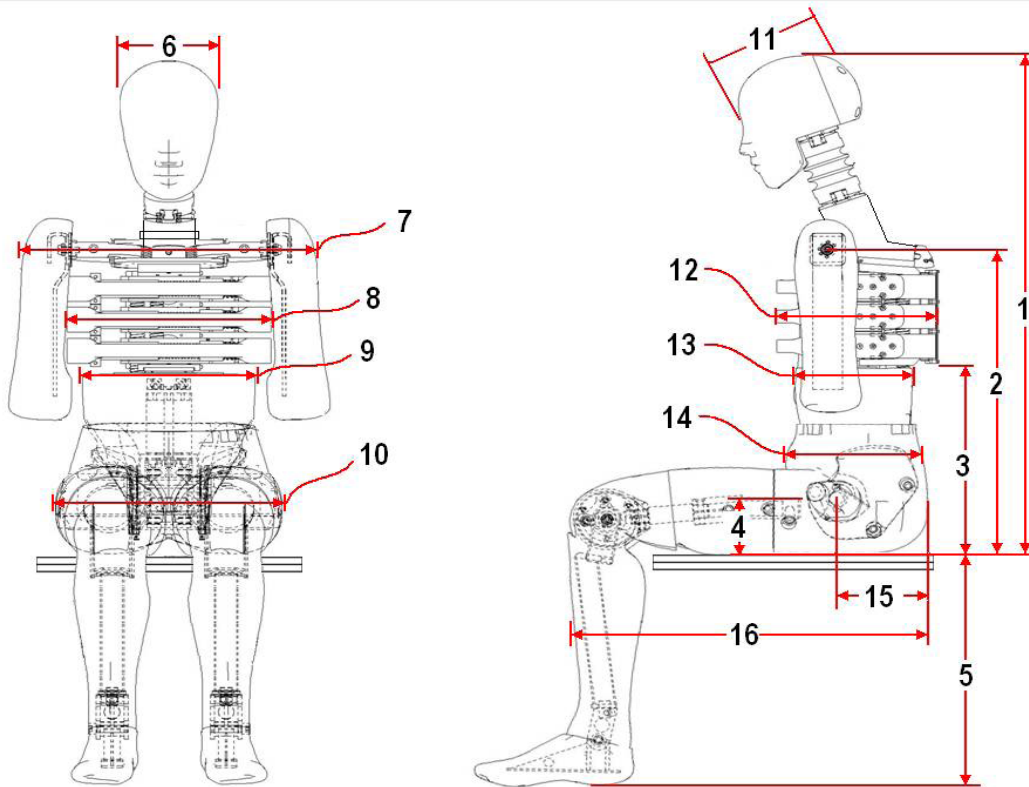


External Measurements - EuroSID-2re

Technician: K. Brogan

Date: 10/02/2023

Dummy Serial Number: D037



FRONT VIEW

SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	909	Pass
2	Seat to Shoulder Joint	558	572	564	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	353	Pass
4	Seat to Hip Joint (center of bolt)	97	103	101	Pass
5	Sole to Seat, Sitting	333	451	423	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	471	Pass
8	Thorax Width	322	332	330	Pass
9	Abdomen Width	273	287	282	Pass
10	Pelvis Lap Width	359	373	364	Pass
11	Head Depth	196	206	200	Pass
12	Thorax Depth	262	272	266	Pass
13	Abdomen Depth	194	204	199	Pass
14	Pelvis Depth	235	245	241	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	154	Pass
16	Back of Buttocks to Front Knee	597	615	604	Pass

ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

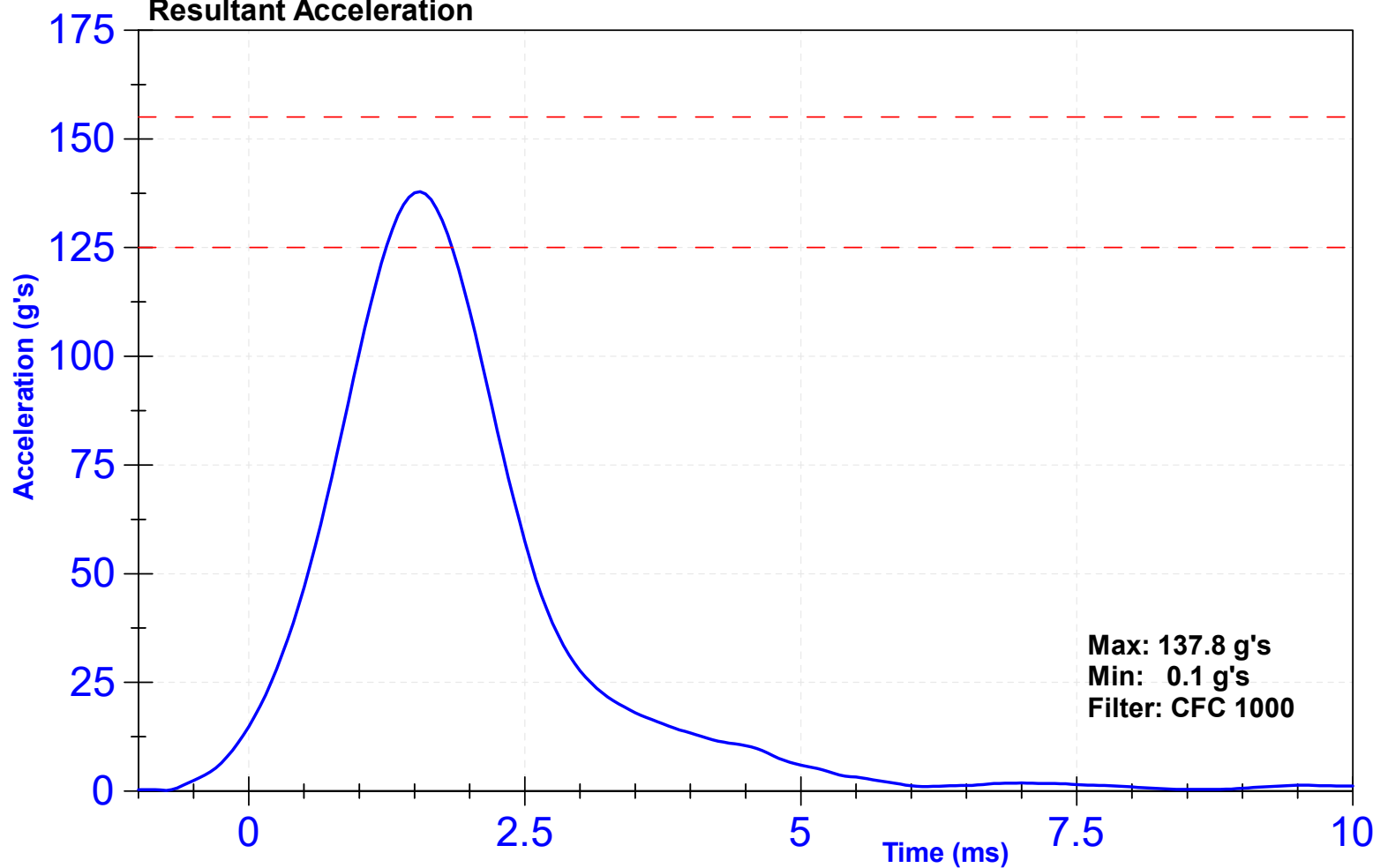
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	62.1	Pass
Resultant Acceleration	125	155	g's	137.8	Pass
Oscillation	0	15	%	1.34	Pass
Fore-Aft Acceleration	-15	15	g's	6.1	Pass

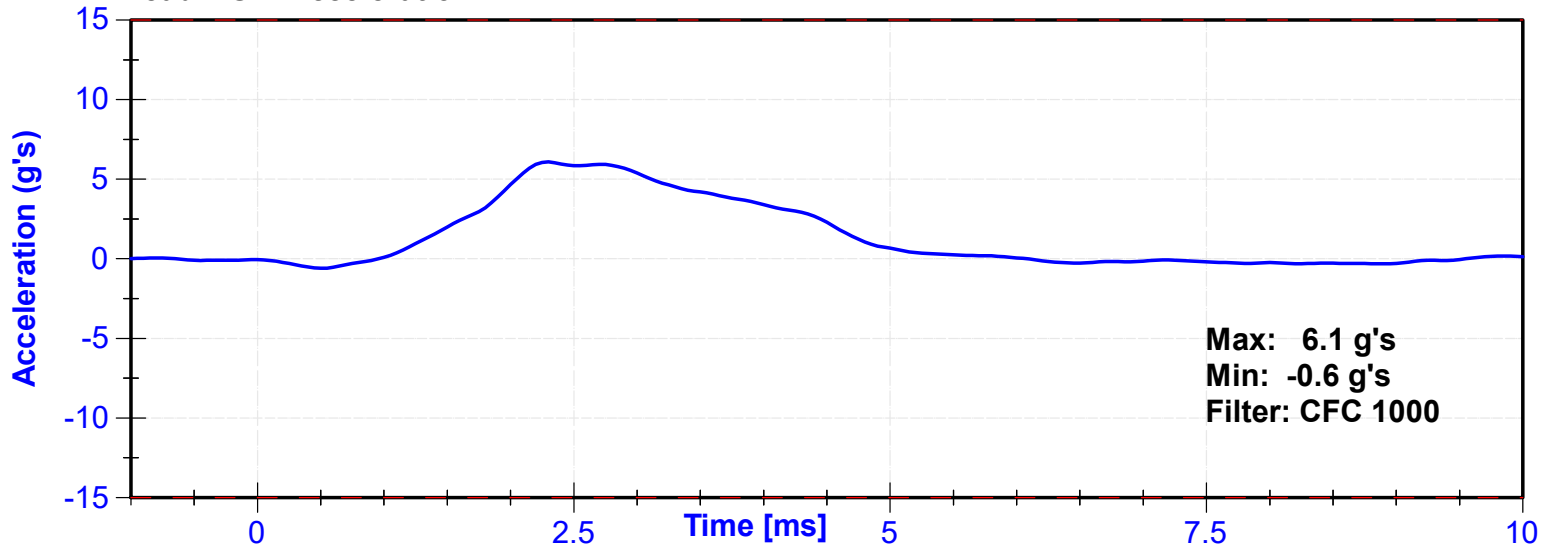
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	T21724	8/8/2023	2/4/2024
Y Accelerometer	Endevco	T22281	8/8/2023	2/4/2024
Z Accelerometer	Endevco	T26050	8/8/2023	2/4/2024

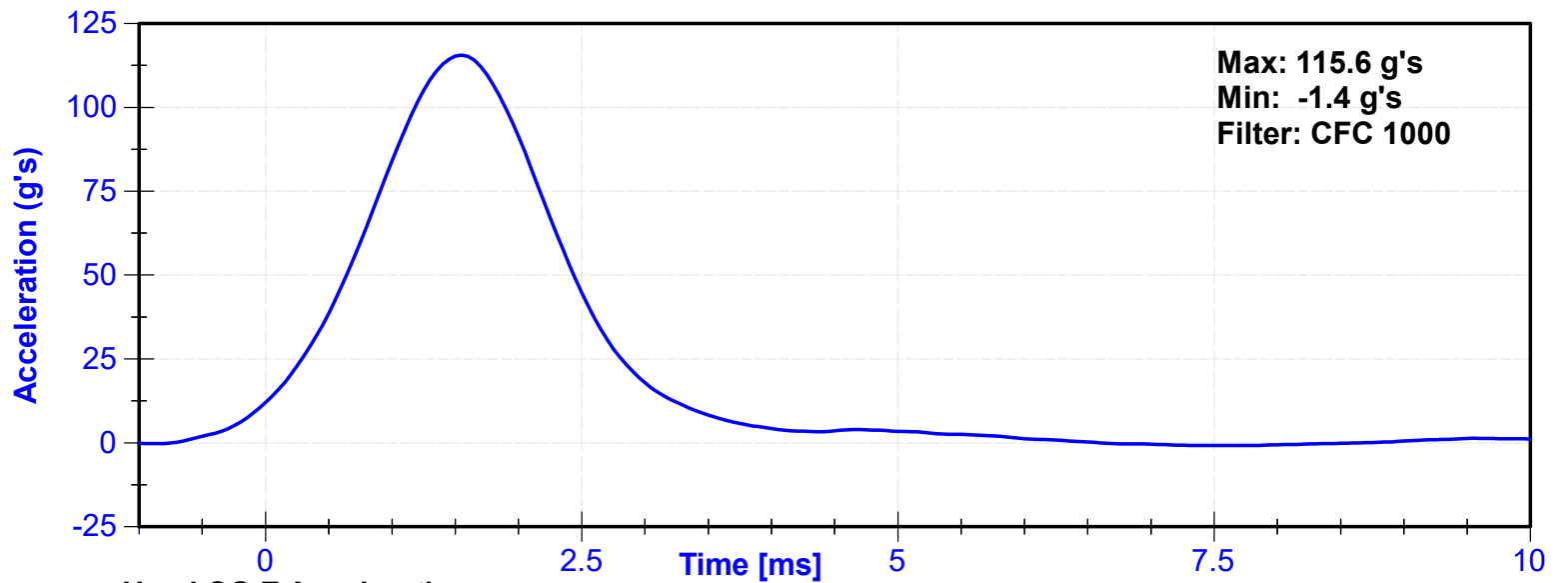
Resultant Acceleration



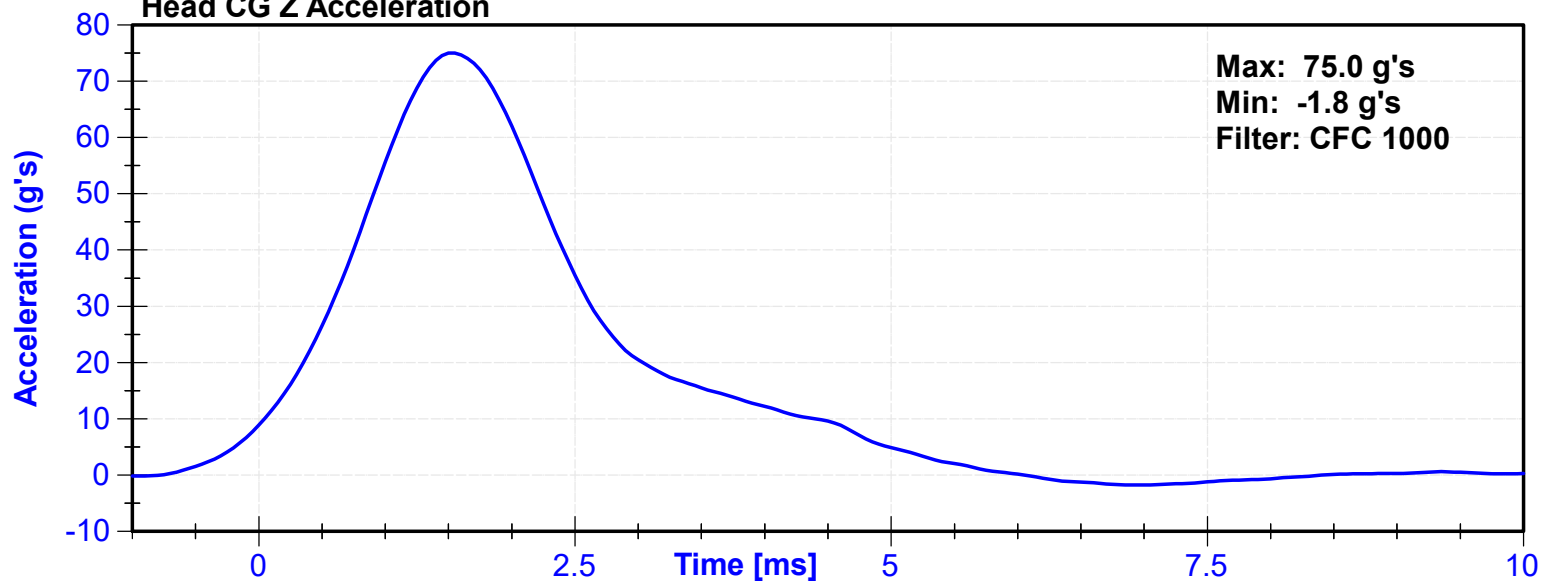
Head CG X Acceleration



Head CG Y Acceleration



Head CG Z Acceleration



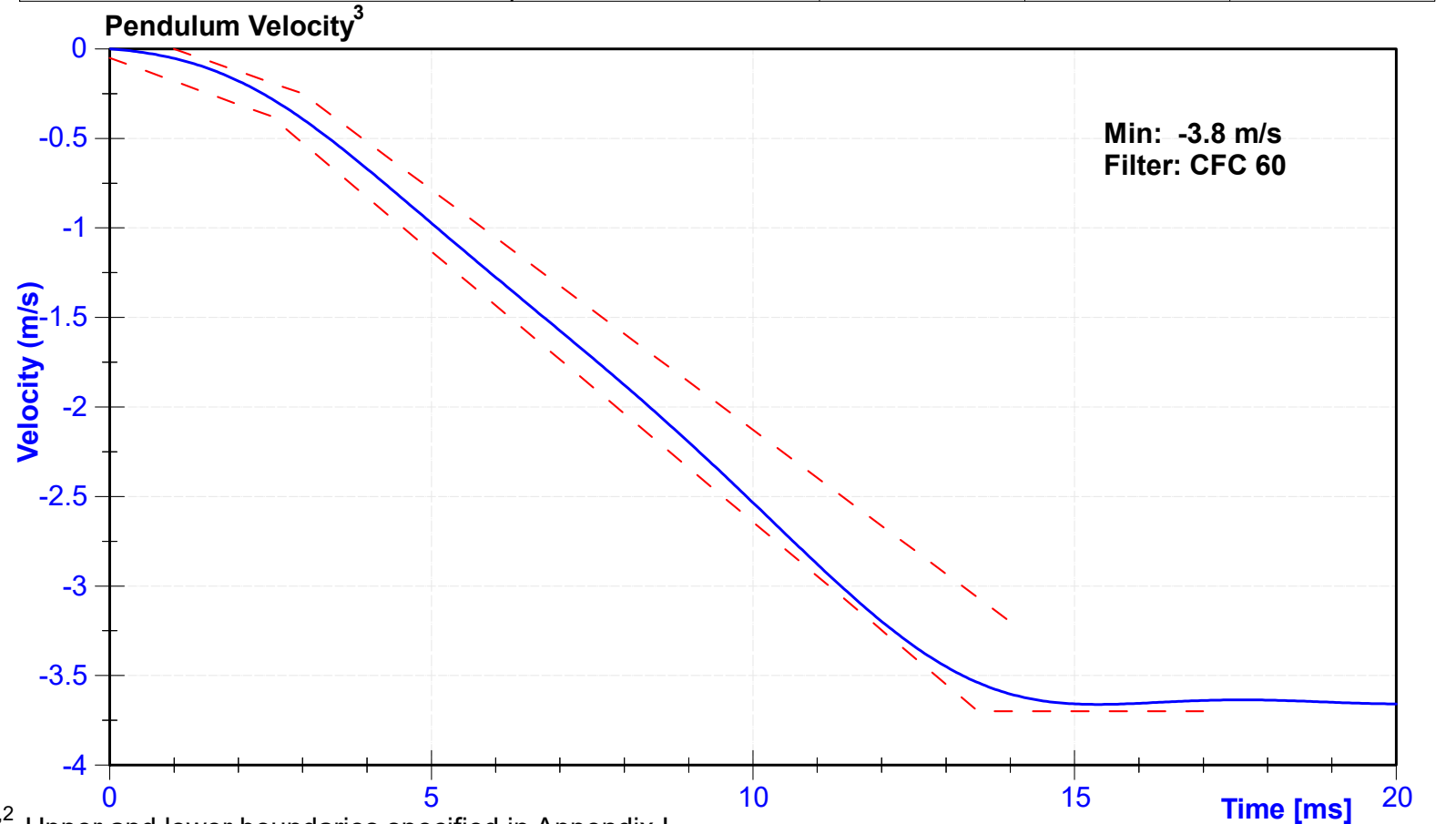
ATD Manufacturer	Denton	Test Technician	J. Miller
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	62.1	Pass
Velocity	3.3	3.5	m/s	3.44	Pass
Lateral Neck Rotation	49	59	deg	51.7	Pass
Time at Maximum Rotation	54	66	ms	56.2	Pass
Time of Rotation Decay from Maximum	53	88	ms	58.0	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

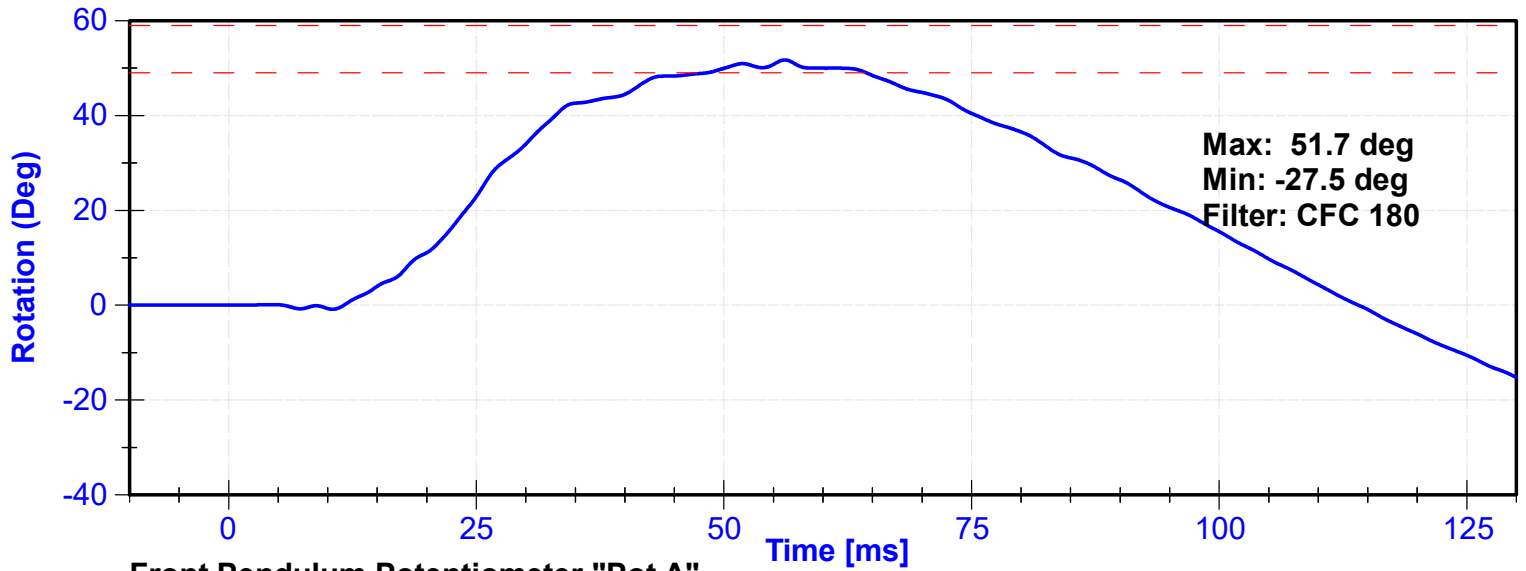
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Front Pendulum Potentiometer	Sfernice	094	9/29/2023	9/28/2024
Headform Potentiometer	Sfernice	095	9/29/2023	9/28/2024

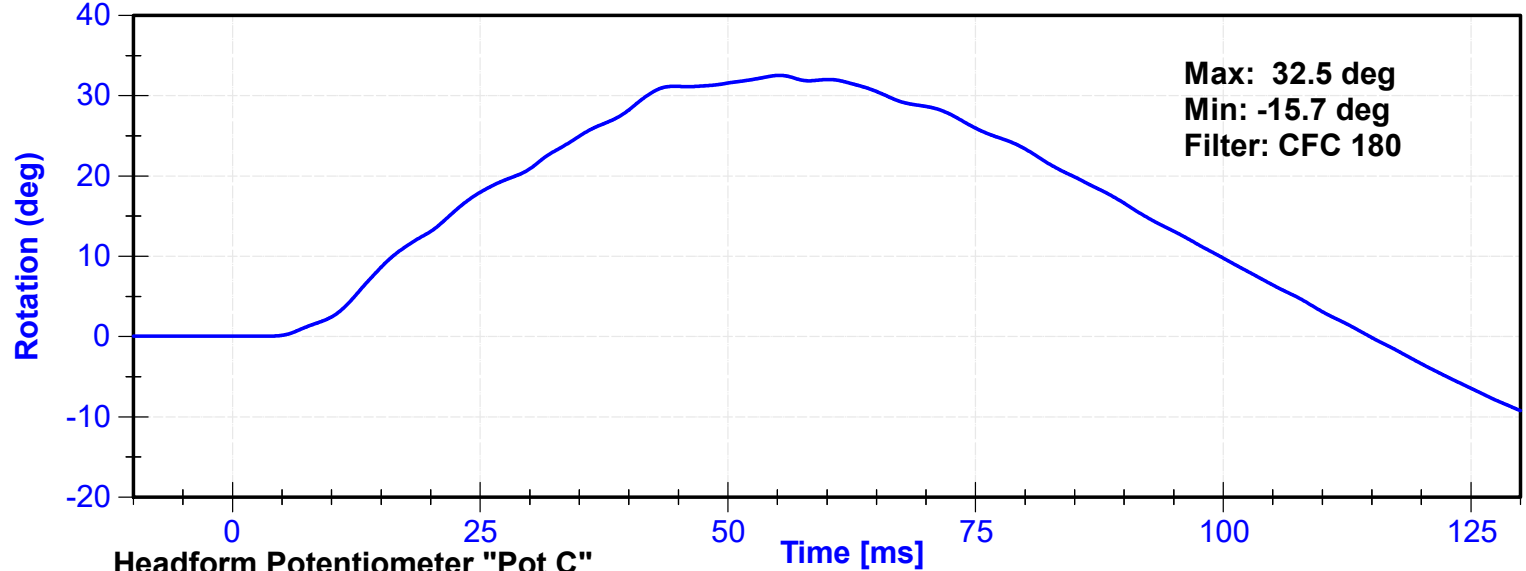


^{1,2} Upper and lower boundaries specified in Appendix I

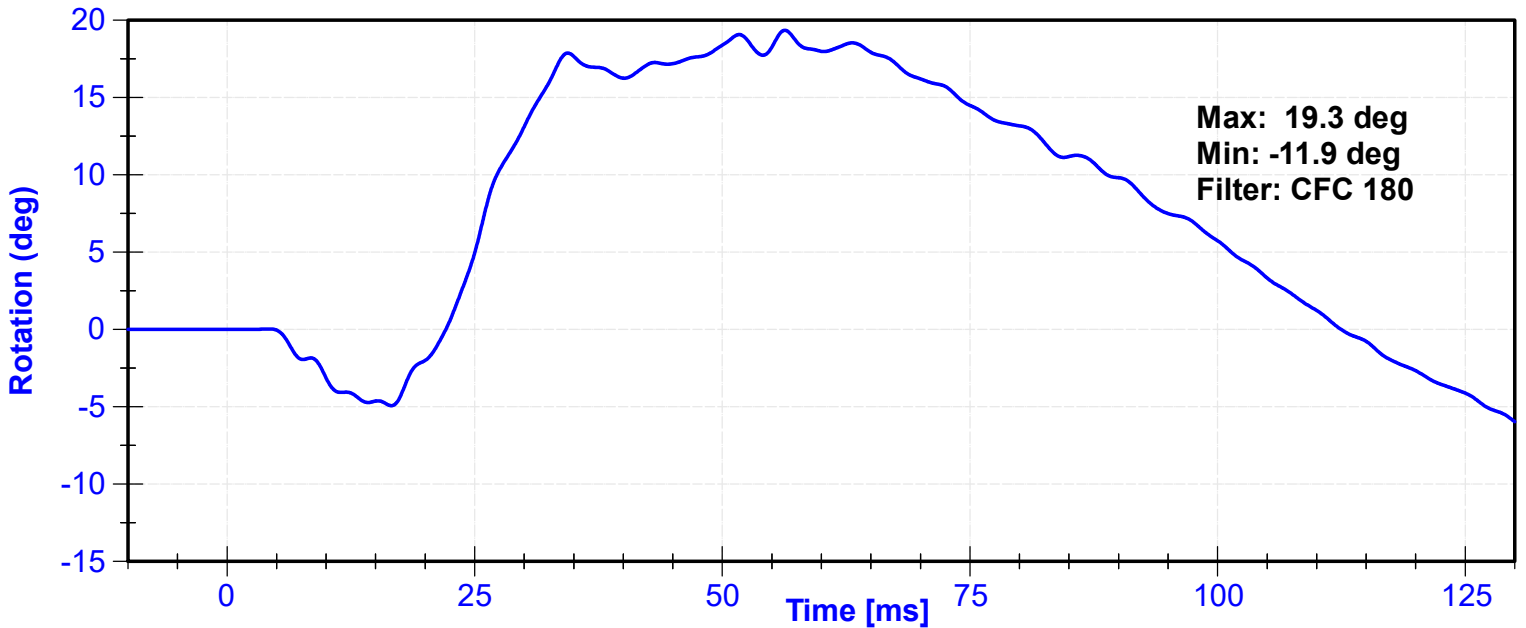
Neck Rotation



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	Denton	Test Technician	J. Miller
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

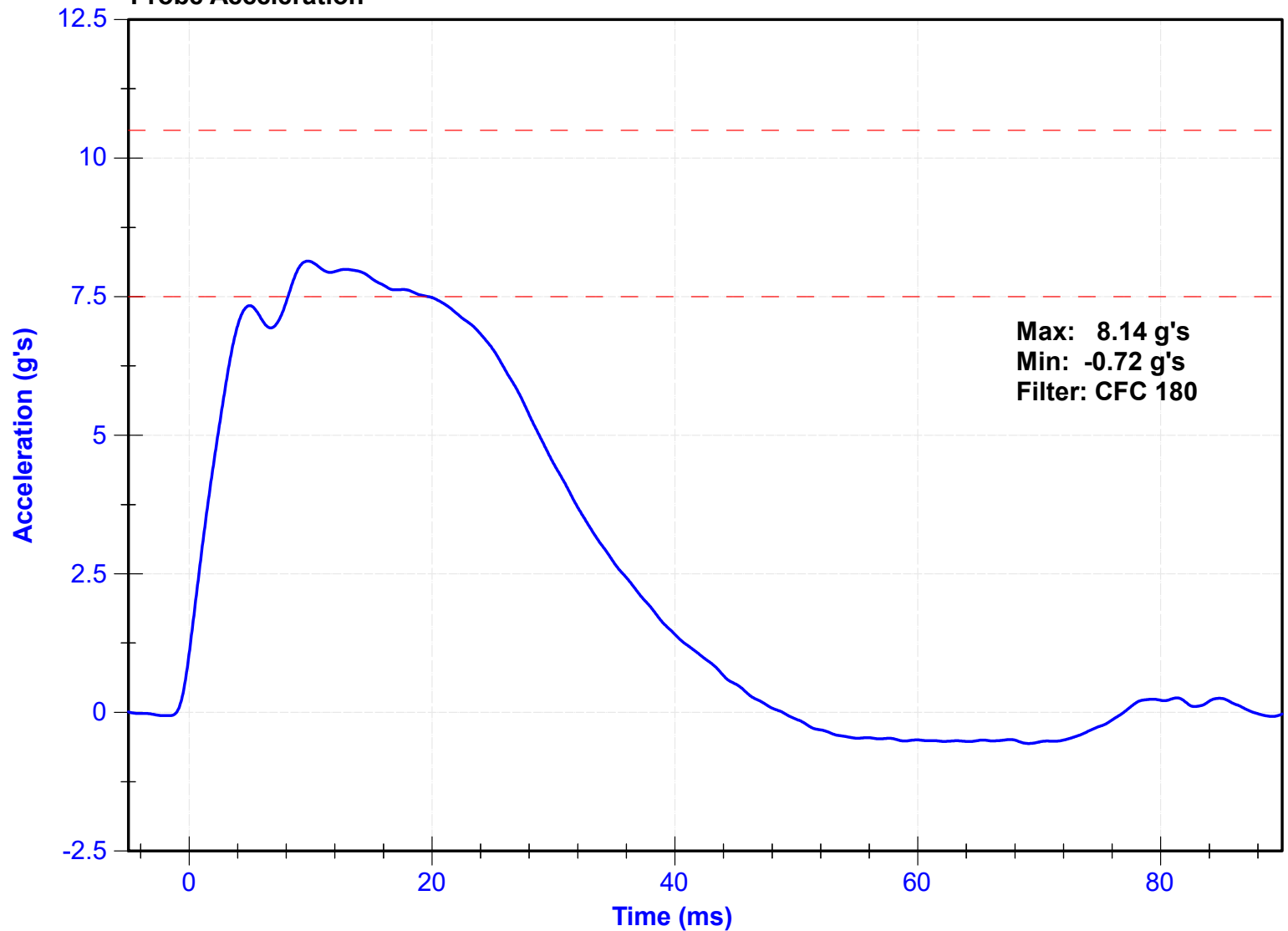
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.8	Pass
Humidity	10	70	%	59.1	Pass
Velocity	4.2	4.4	m/s	4.35	Pass
Probe Acceleration	7.5	10.5	g's	8.14	Pass

Transducer Calibrations

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

Probe Acceleration



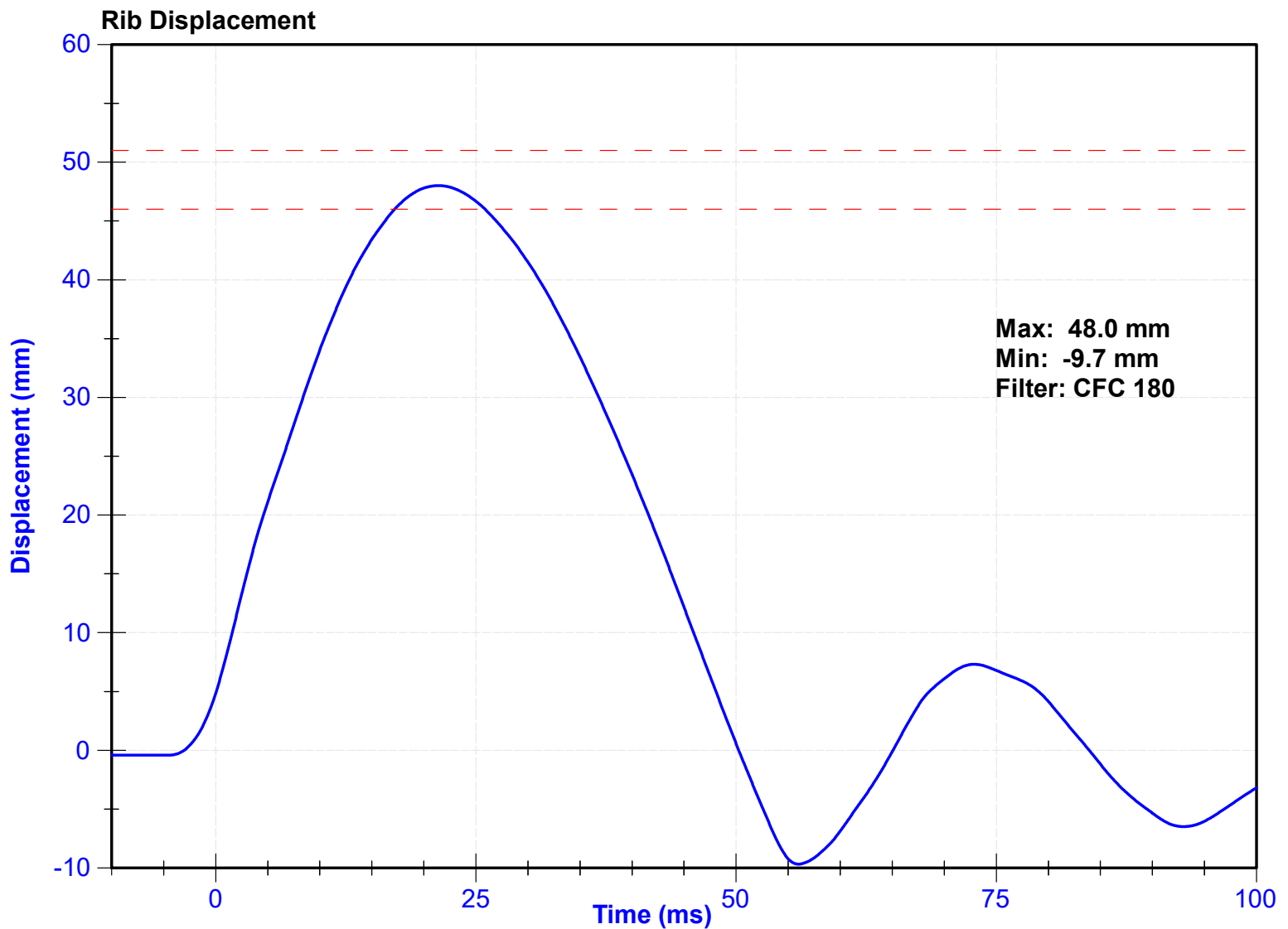
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	62.1	Pass
Rib Displacement	46	51	mm	48.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-01	8/7/2023	2/5/2024



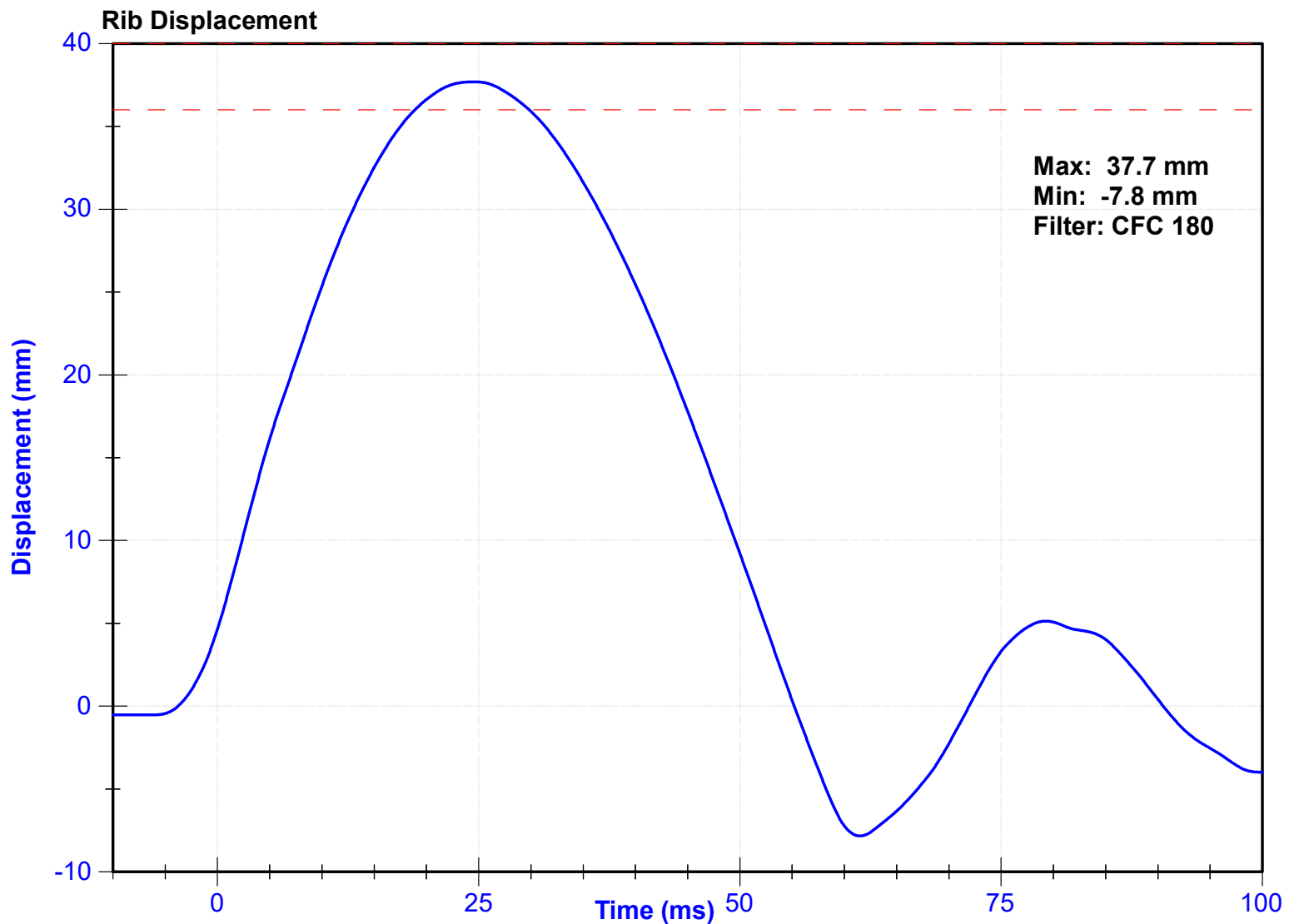
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	62.1	Pass
Rib Displacement	36	40	mm	37.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-01	8/7/2023	2/5/2024



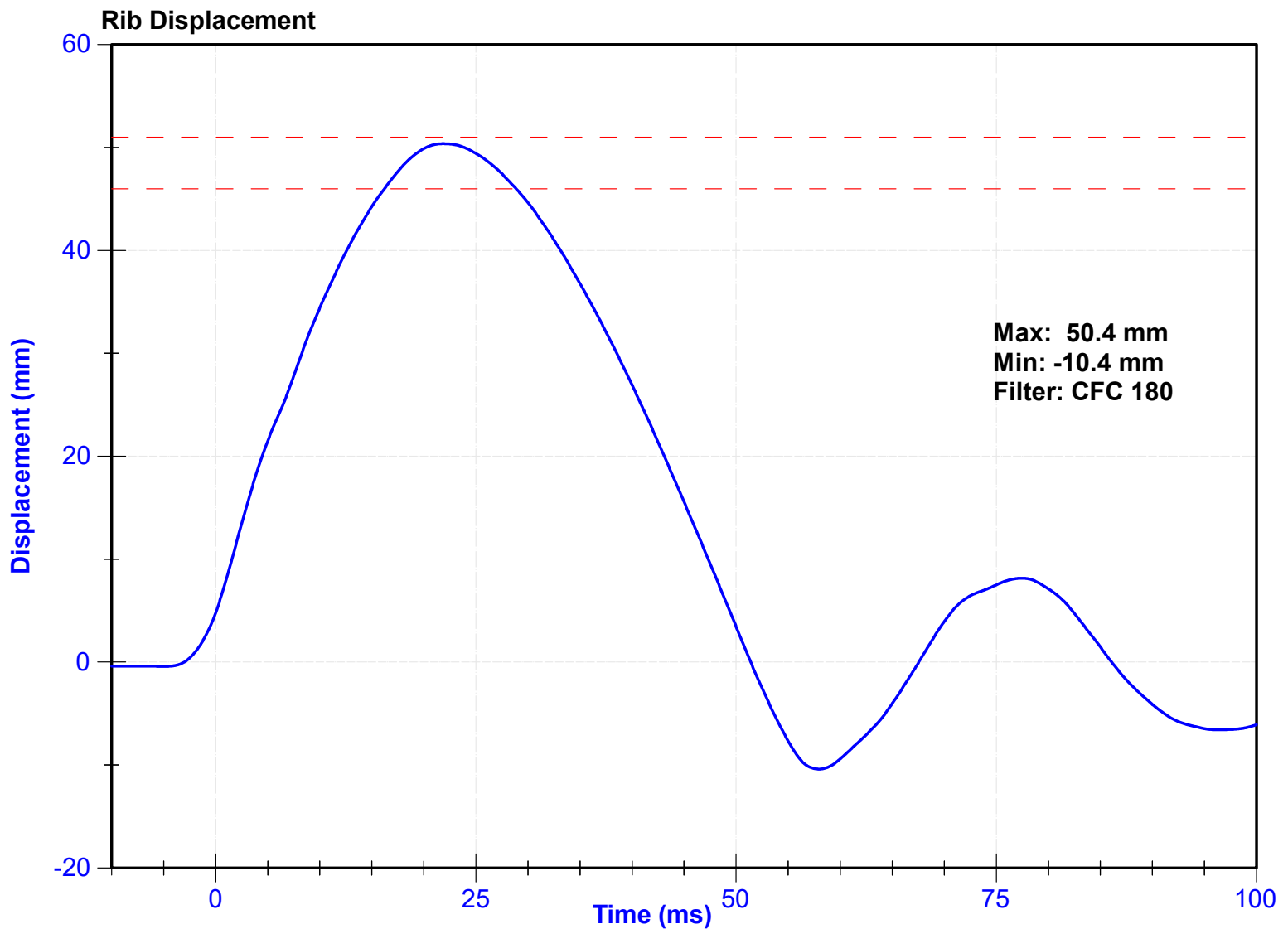
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	62.1	Pass
Rib Displacement	46	51	mm	50.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	807	8/7/2023	2/5/2024



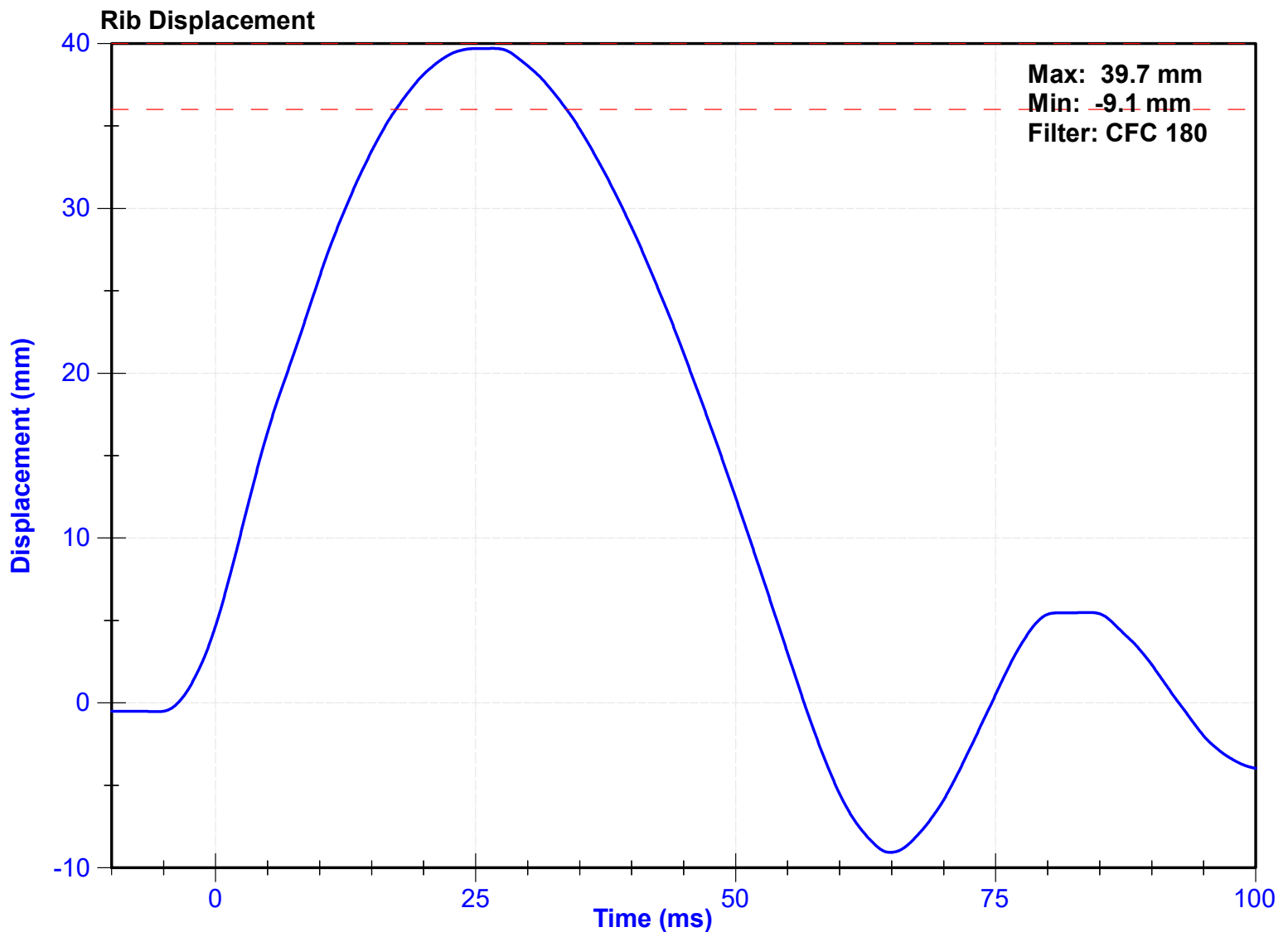
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	62.1	Pass
Rib Displacement	36	40	mm	39.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	807	8/7/2023	2/5/2024



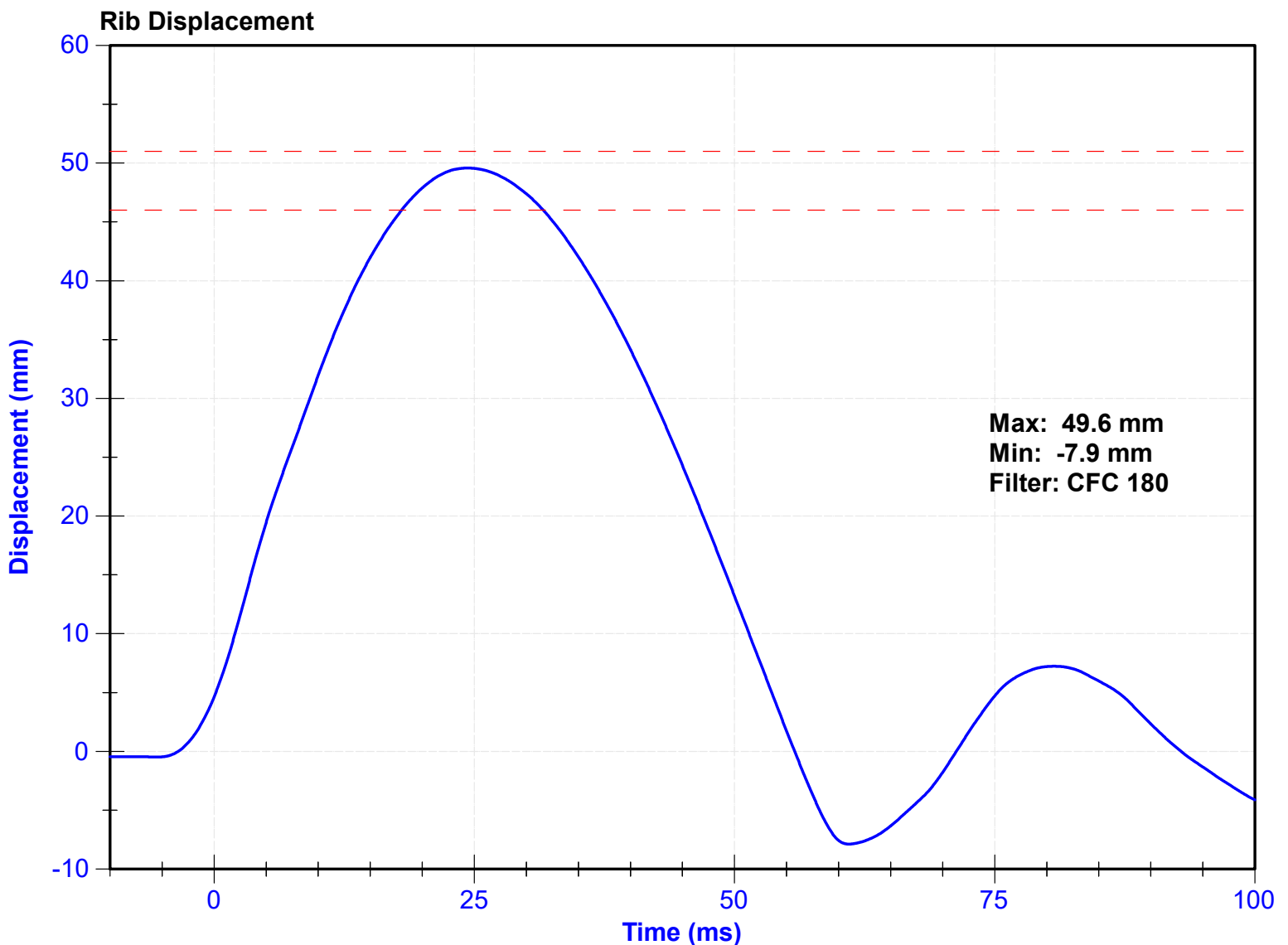
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	62.1	Pass
Rib Displacement	46	51	mm	49.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-03	8/7/2023	2/5/2024



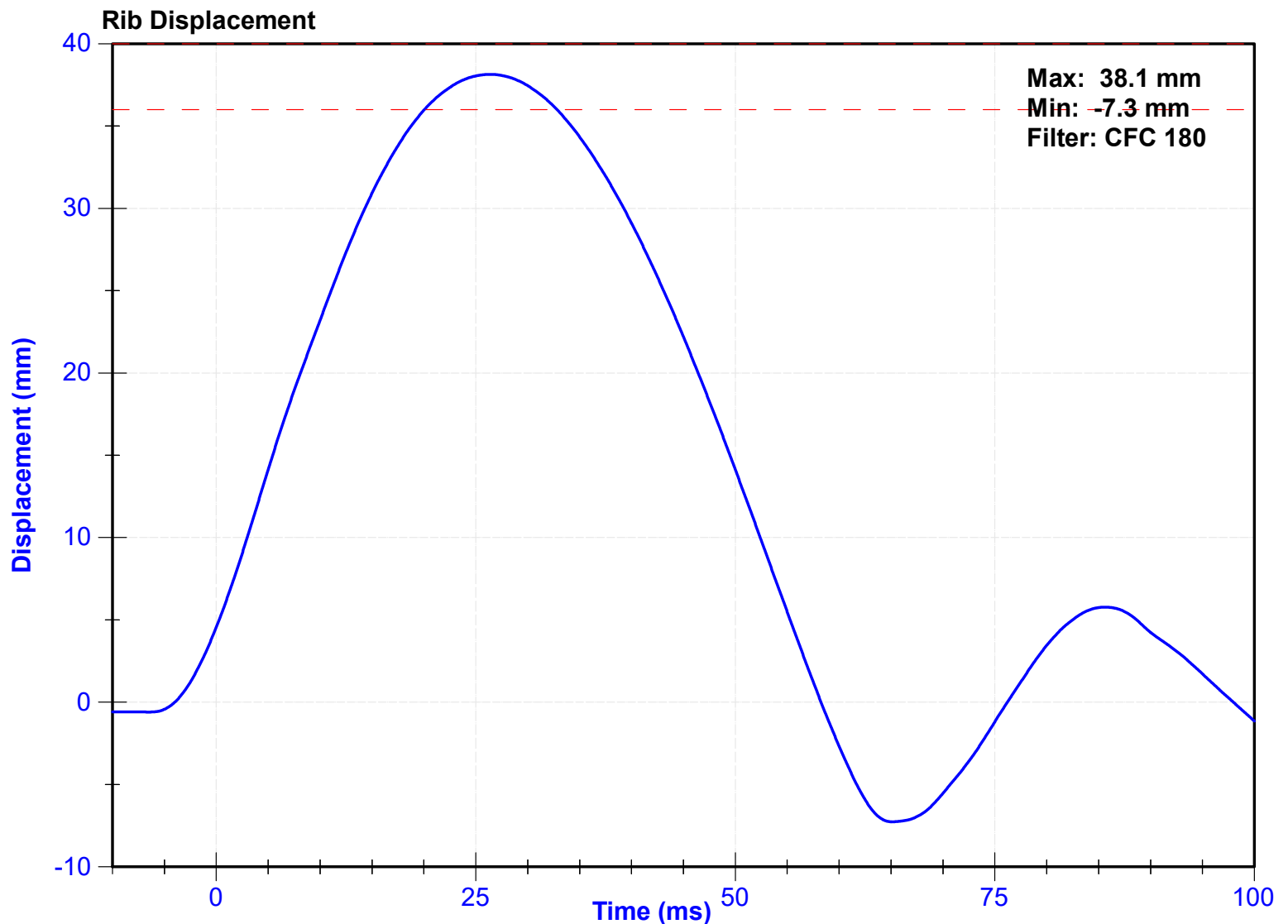
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	62.1	Pass
Rib Displacement	36	40	mm	38.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-03	8/7/2023	2/5/2024



ATD Manufacturer	Denton	Test Technician	J. Miller
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

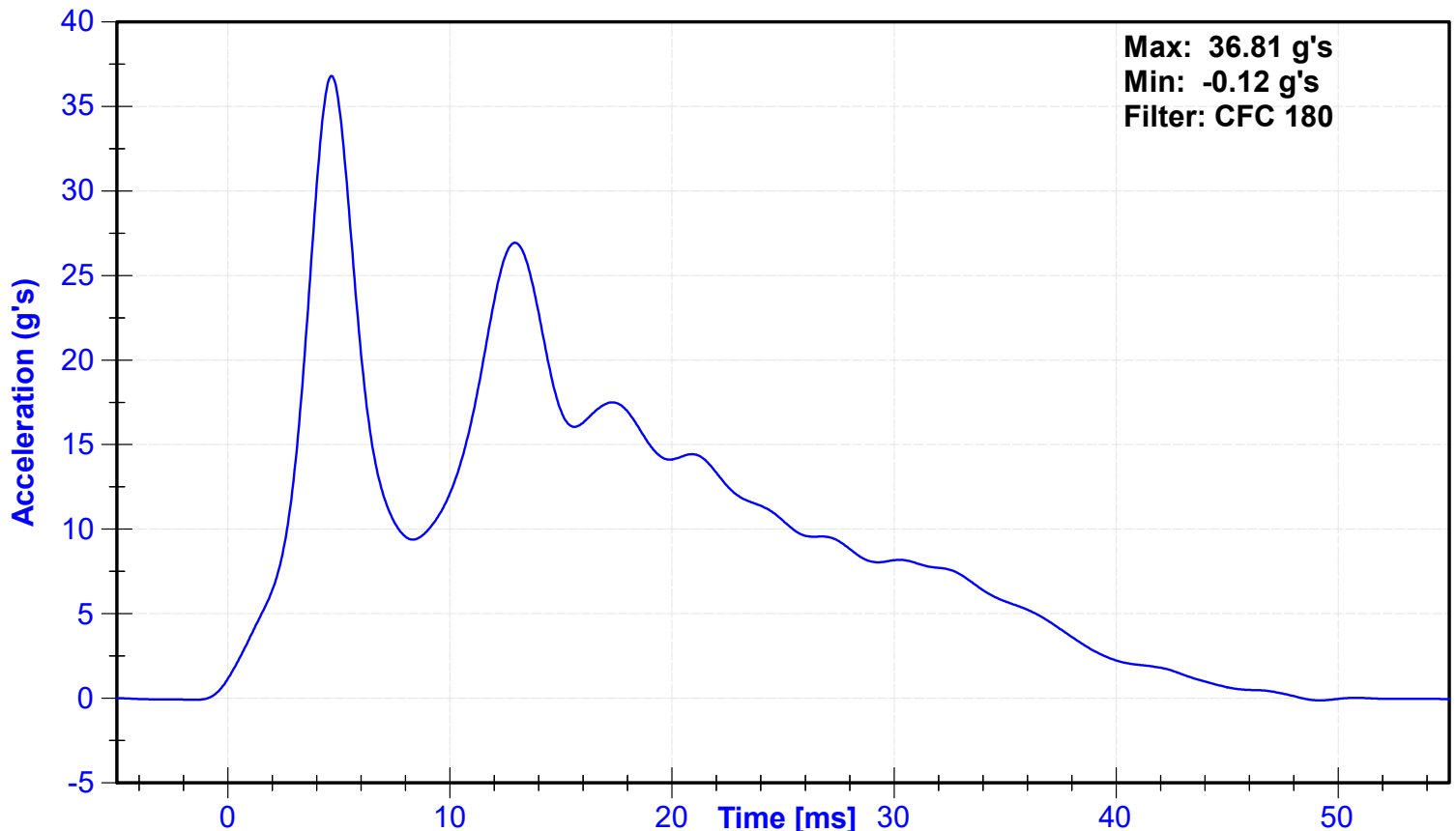
Results

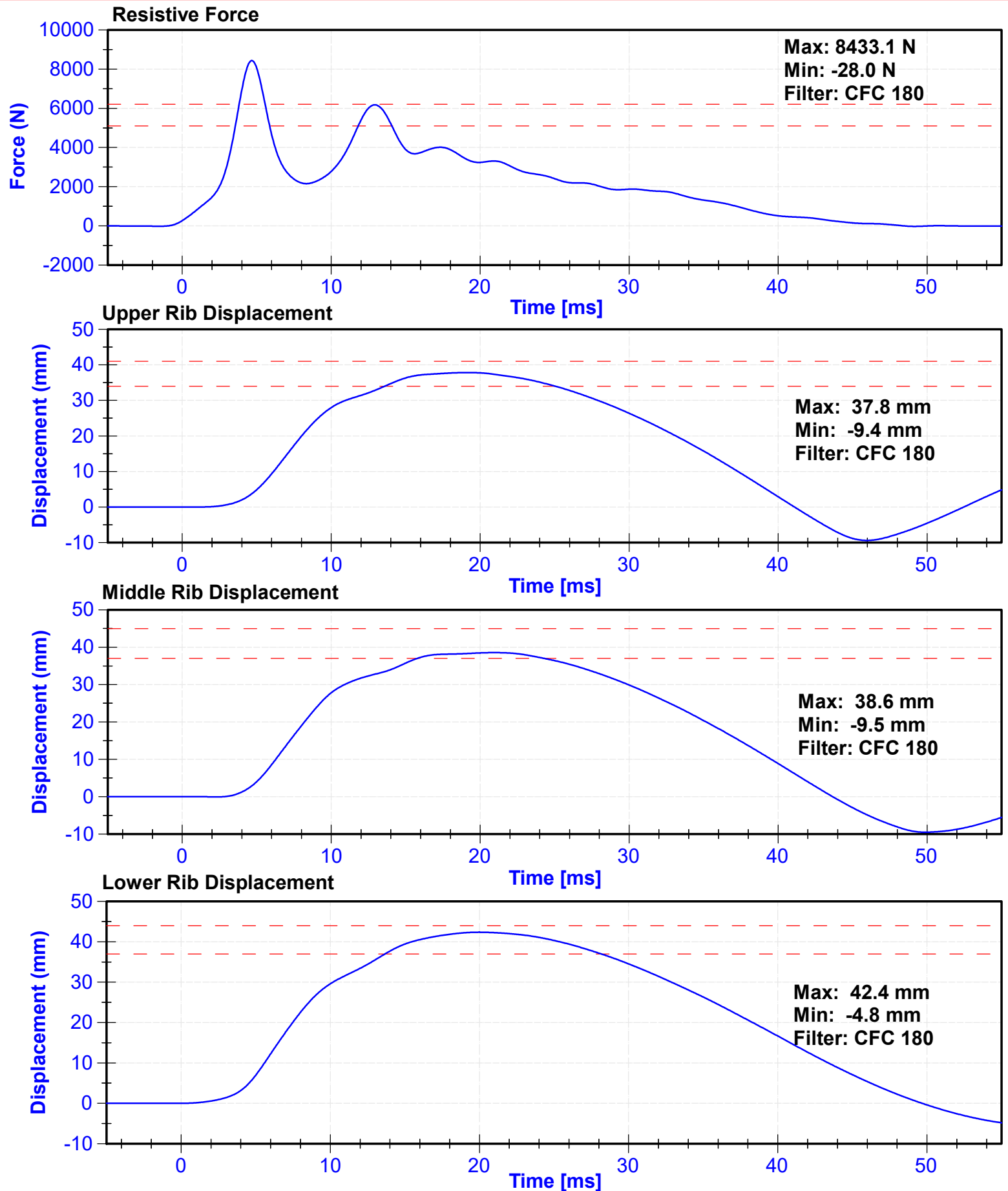
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.8	Pass
Humidity	10	70	%	59.1	Pass
Velocity	5.4	5.6	m/s	5.53	Pass
Resistive Force after 6ms	5100	6200	N	6173.0	Pass
Upper Thorax Rib Deflection	34	41	mm	37.8	Pass
Mid Thorax Rib Deflection	37	45	mm	38.6	Pass
Lower Thorax Rib Deflection	37	44	mm	42.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Upper Thorax Rib Potentiometer	Honeywell	0552-01	8/7/2023	2/5/2024
Middle Thorax Rib Potentiometer	Honeywell	807	8/7/2023	2/5/2024
Lower Thorax Rib Potentiometer	Honeywell	0552-03	8/7/2023	2/5/2024

Probe Acceleration





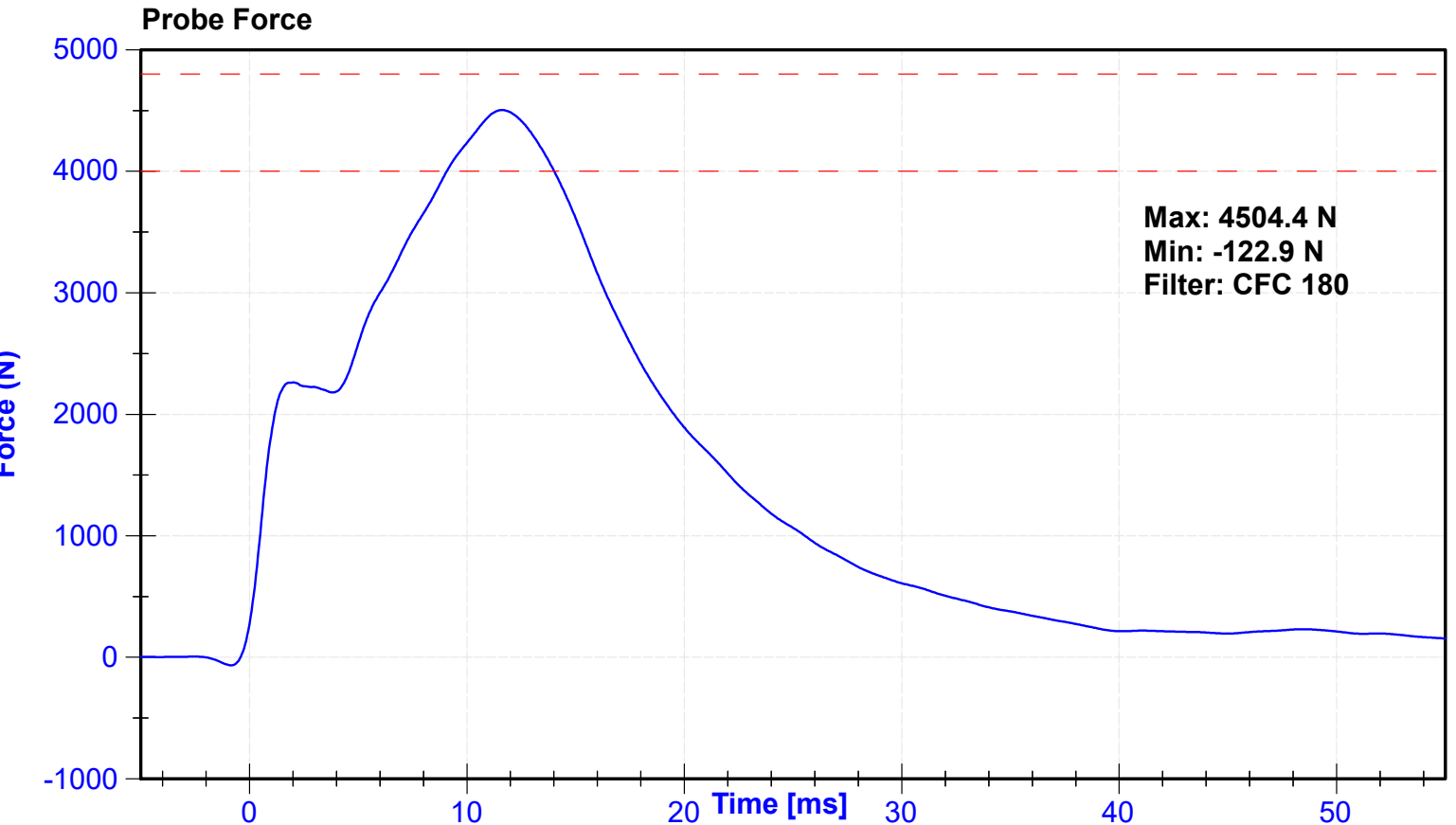
ATD Manufacturer	Denton	Test Technician	J. Miller
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

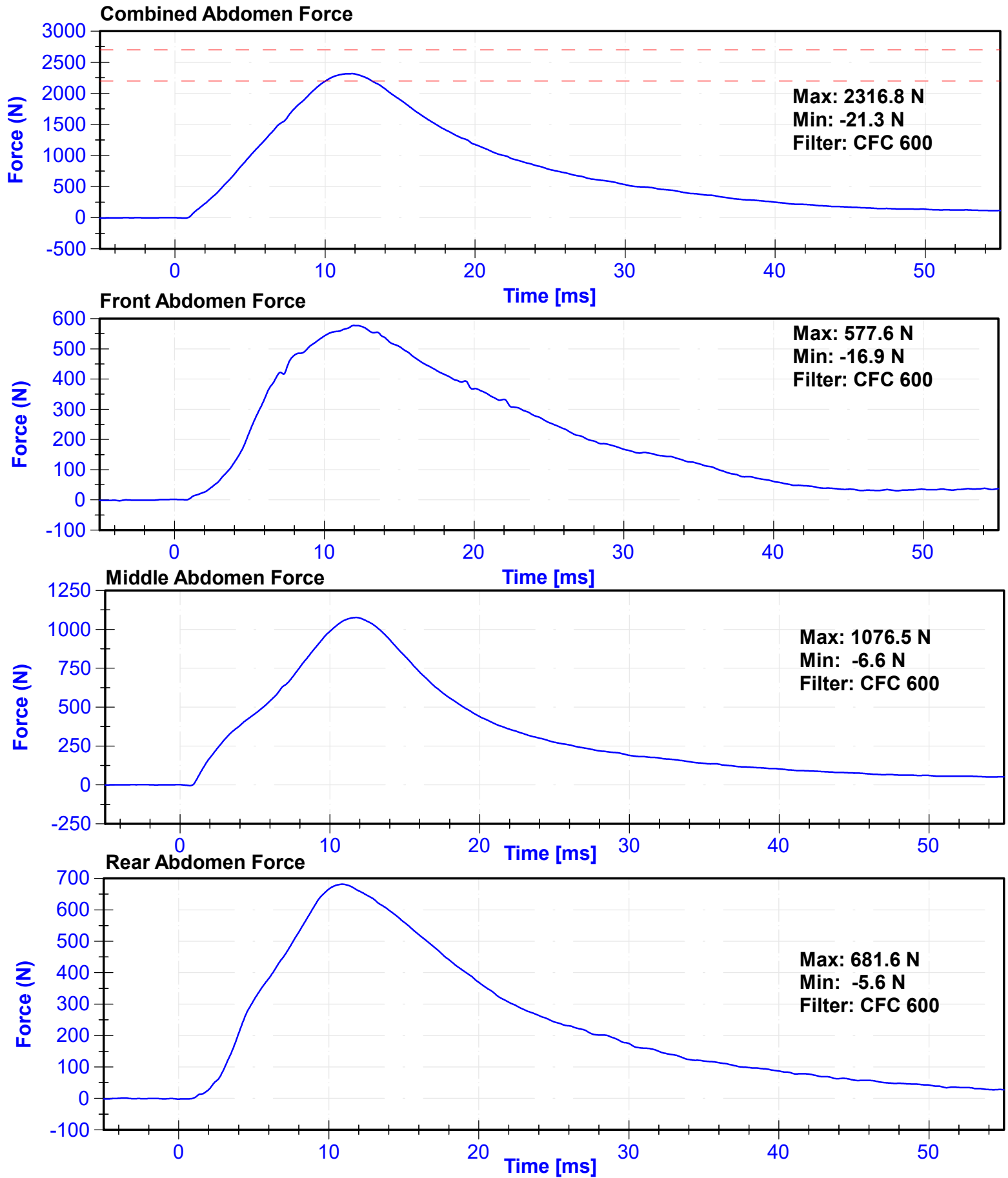
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	59.1	Pass
Velocity	3.9	4.1	m/s	4.03	Pass
Combined Abdomen Force	2200	2700	N	2316.8	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.80	Pass
Resistive Probe Force	4000	4800	N	4504.4	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.60	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Front Abdomen Load Cell	Denton	1440	8/8/2023	8/7/2024
Middle Abdomen Load Cell	Denton	1525	8/8/2023	8/7/2024
Rear Abdomen Load Cell	Denton	1528	8/8/2023	8/7/2024





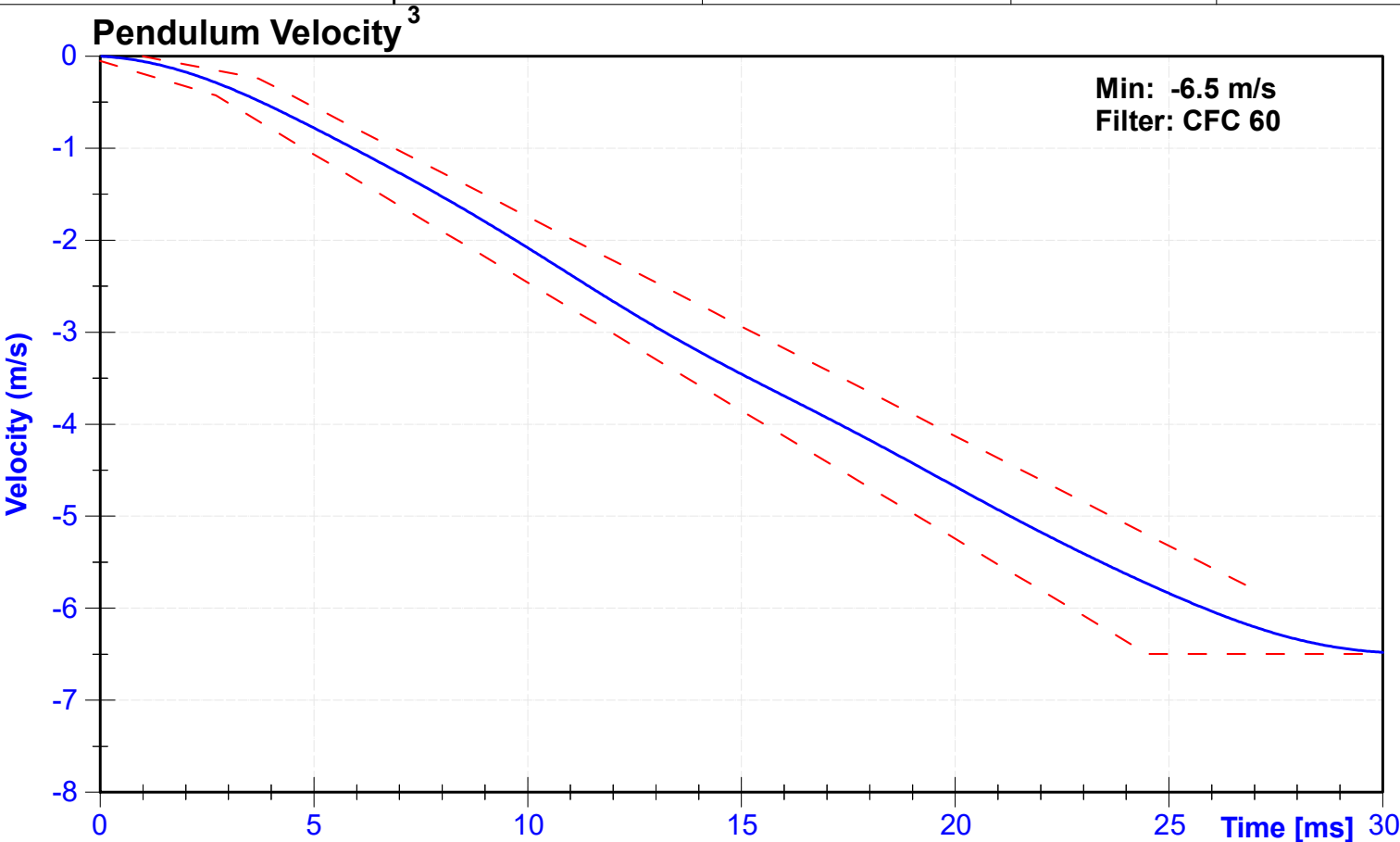
ATD Manufacturer	Denton	Test Technician	J. Miller
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

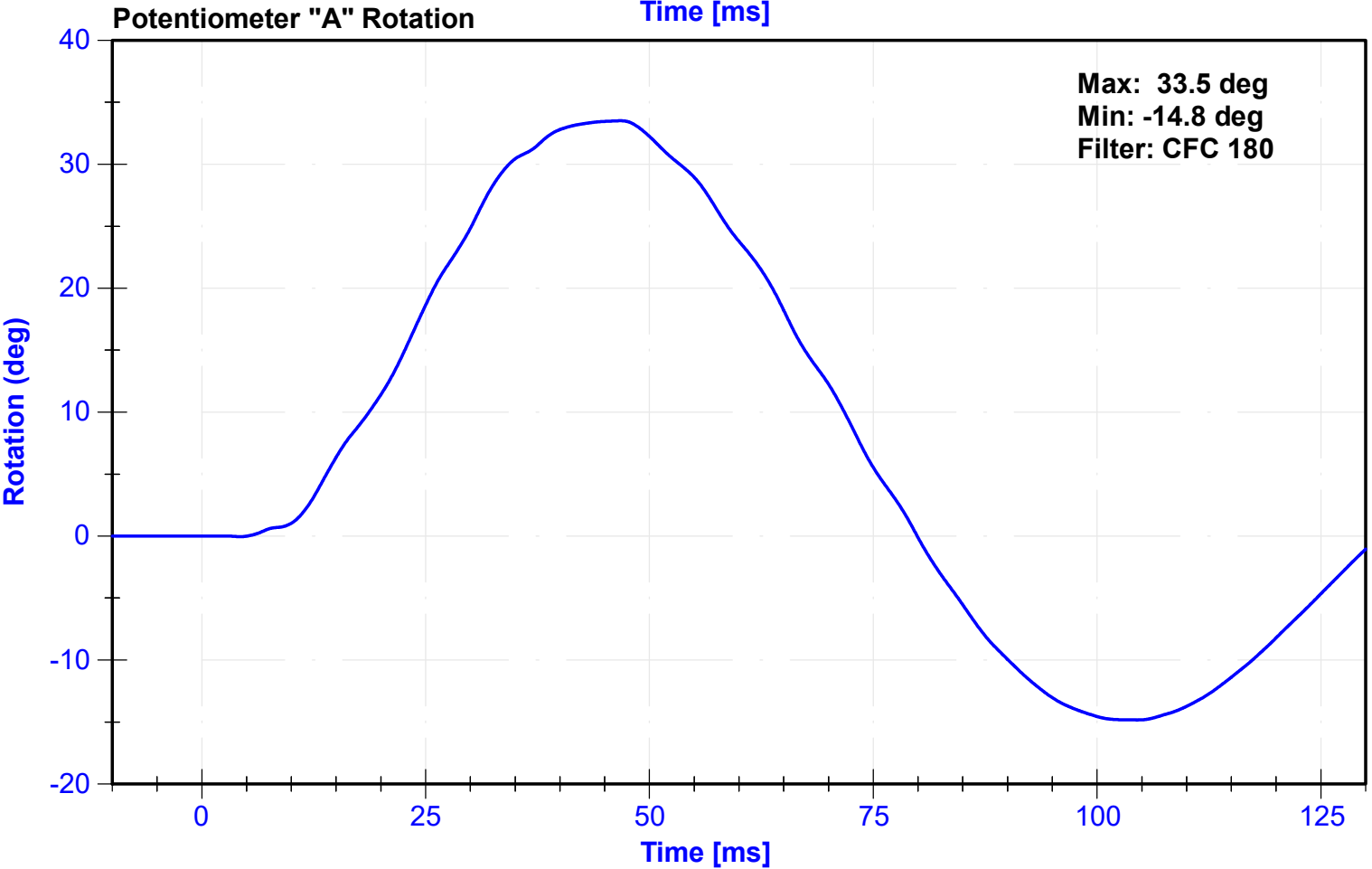
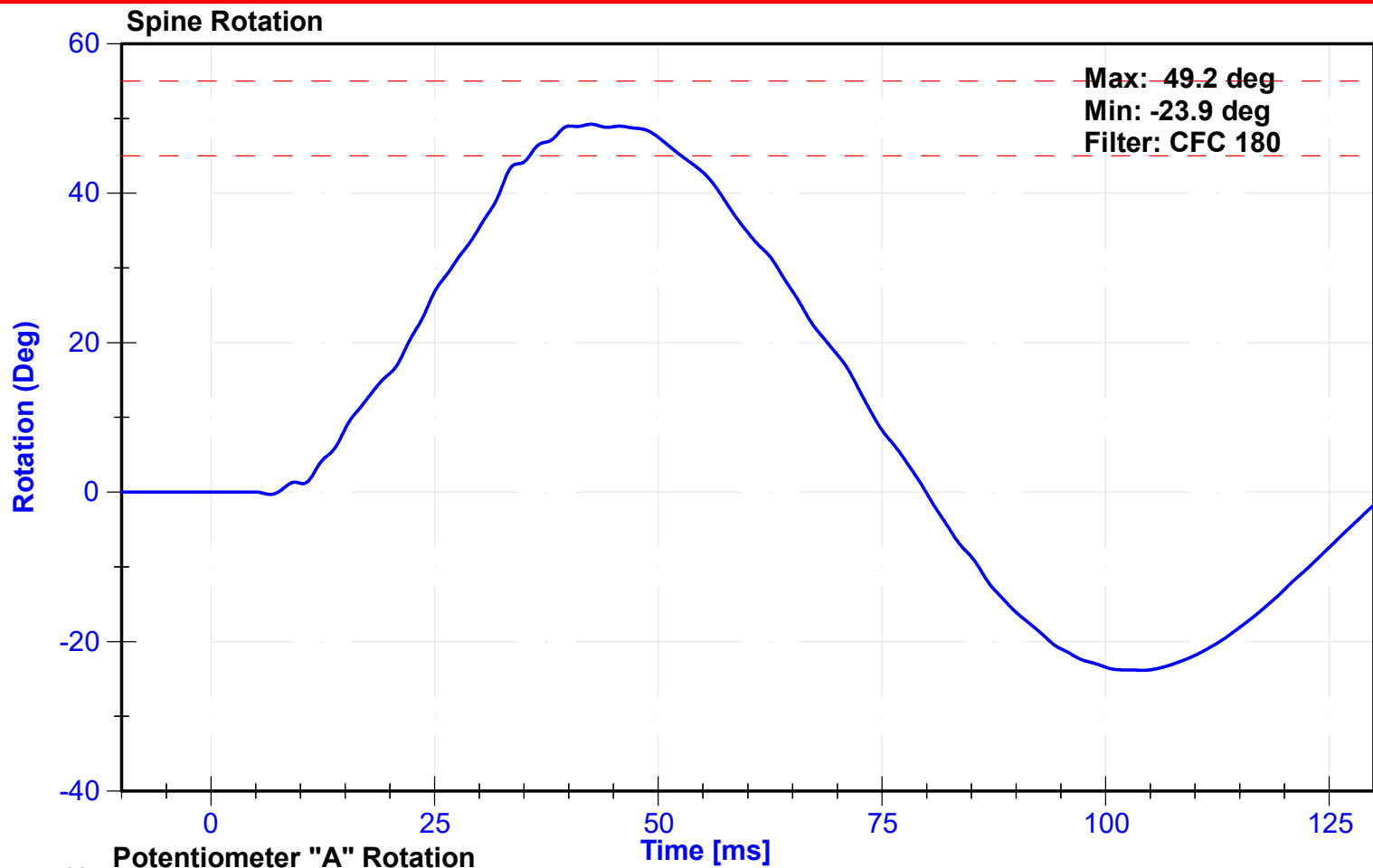
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	62.1	Pass
Velocity	5.95	6.15	m/s	6.061	Pass
Lateral Spine Rotation	45	55	deg	49.2	Pass
Time at Maximum Rotation	39	53	ms	42.5	Pass
Time of Decay to Zero Degrees	37	57	ms	37.5	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

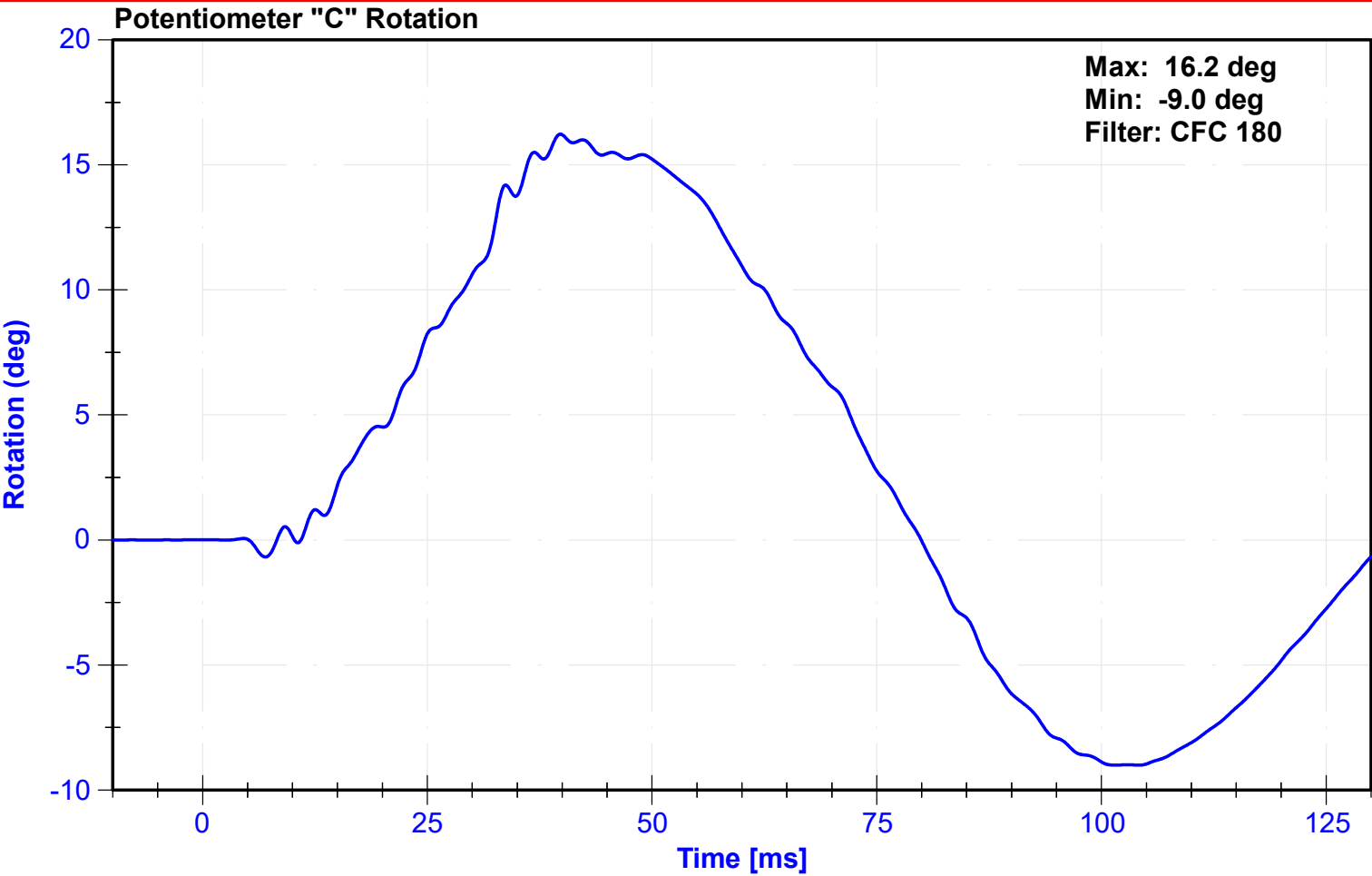
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum "A" Potentiometer	Sfernice	094	9/29/2023	9/28/2024
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

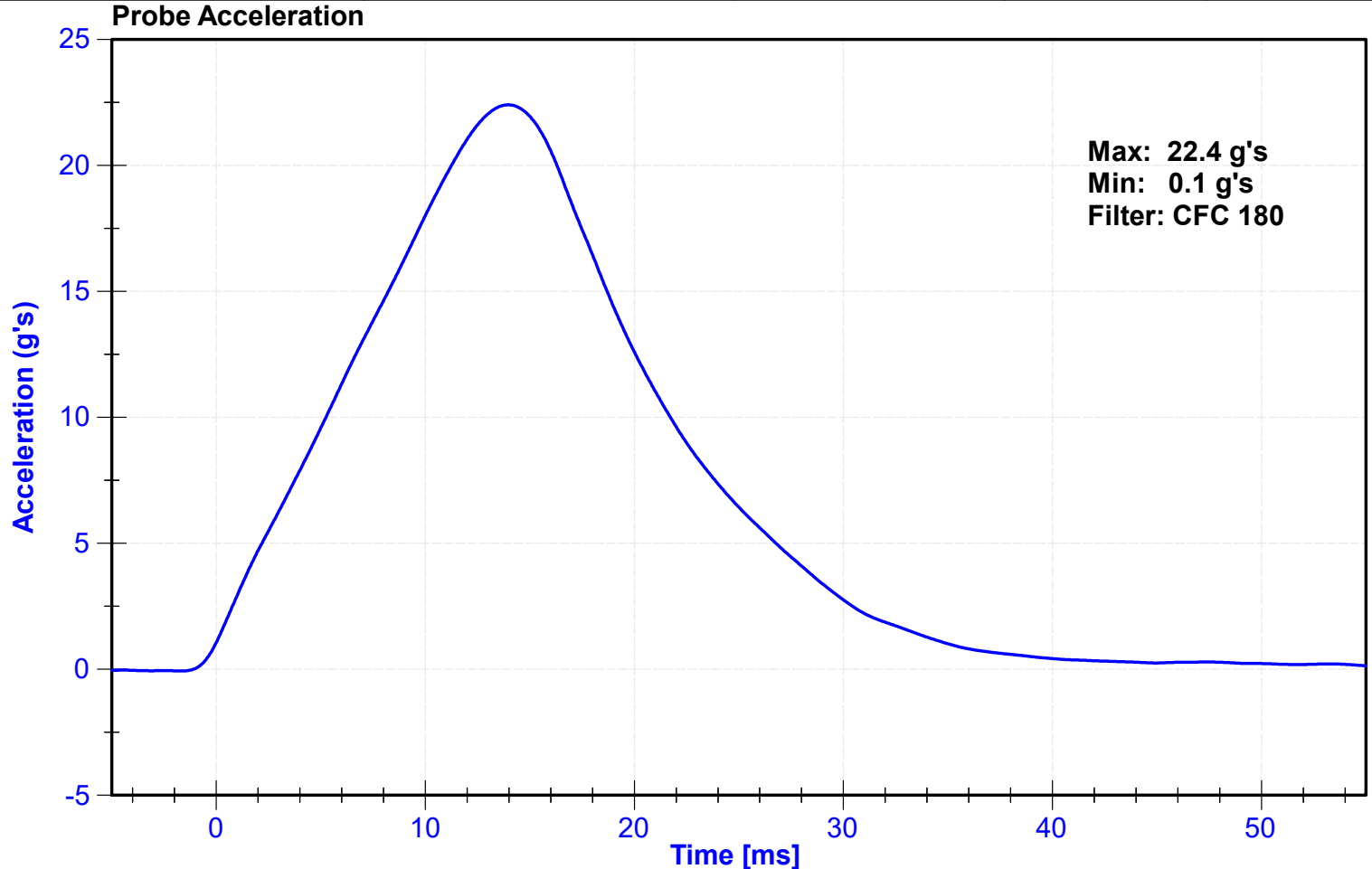
ATD Manufacturer	Denton	Test Technician	J. Miller
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

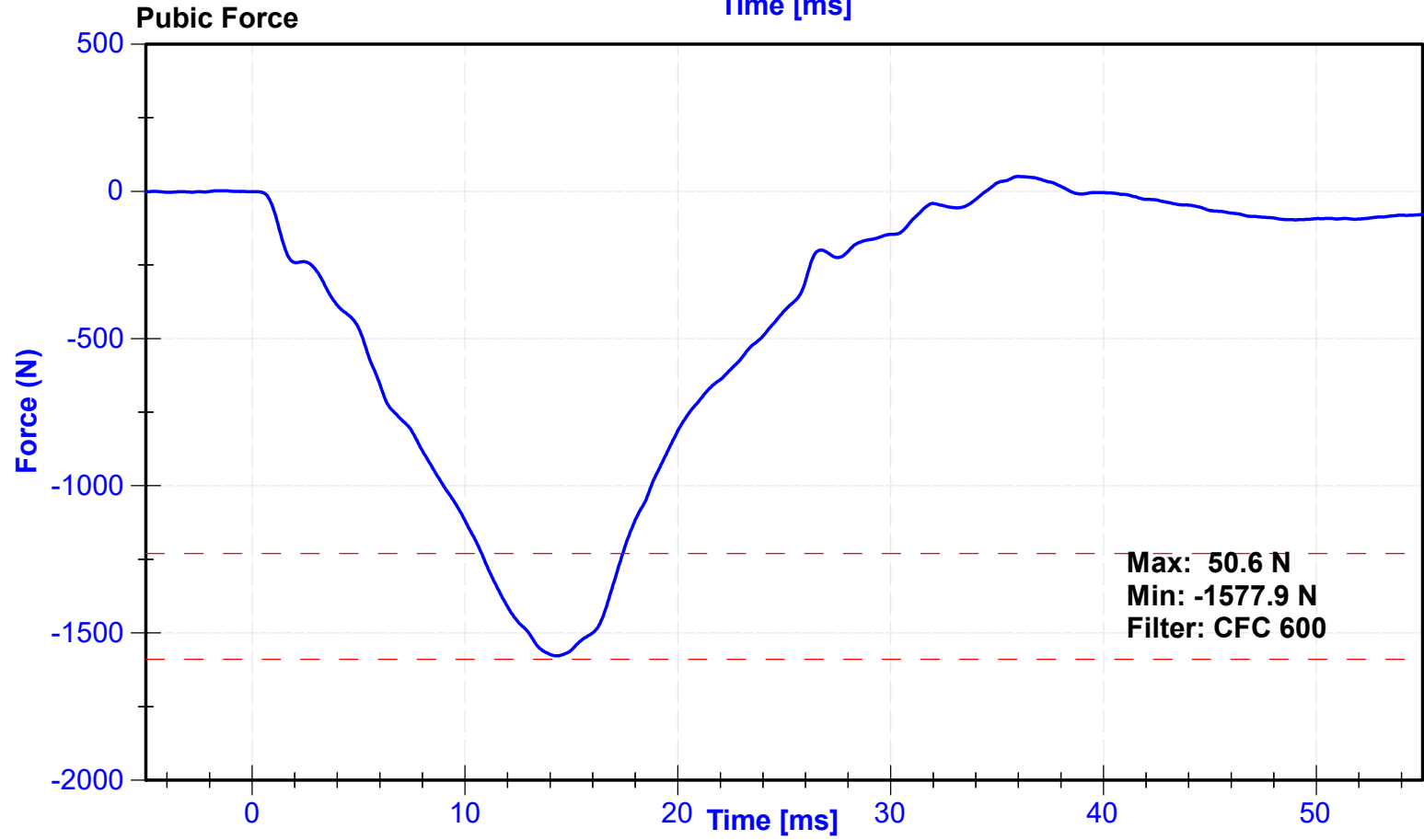
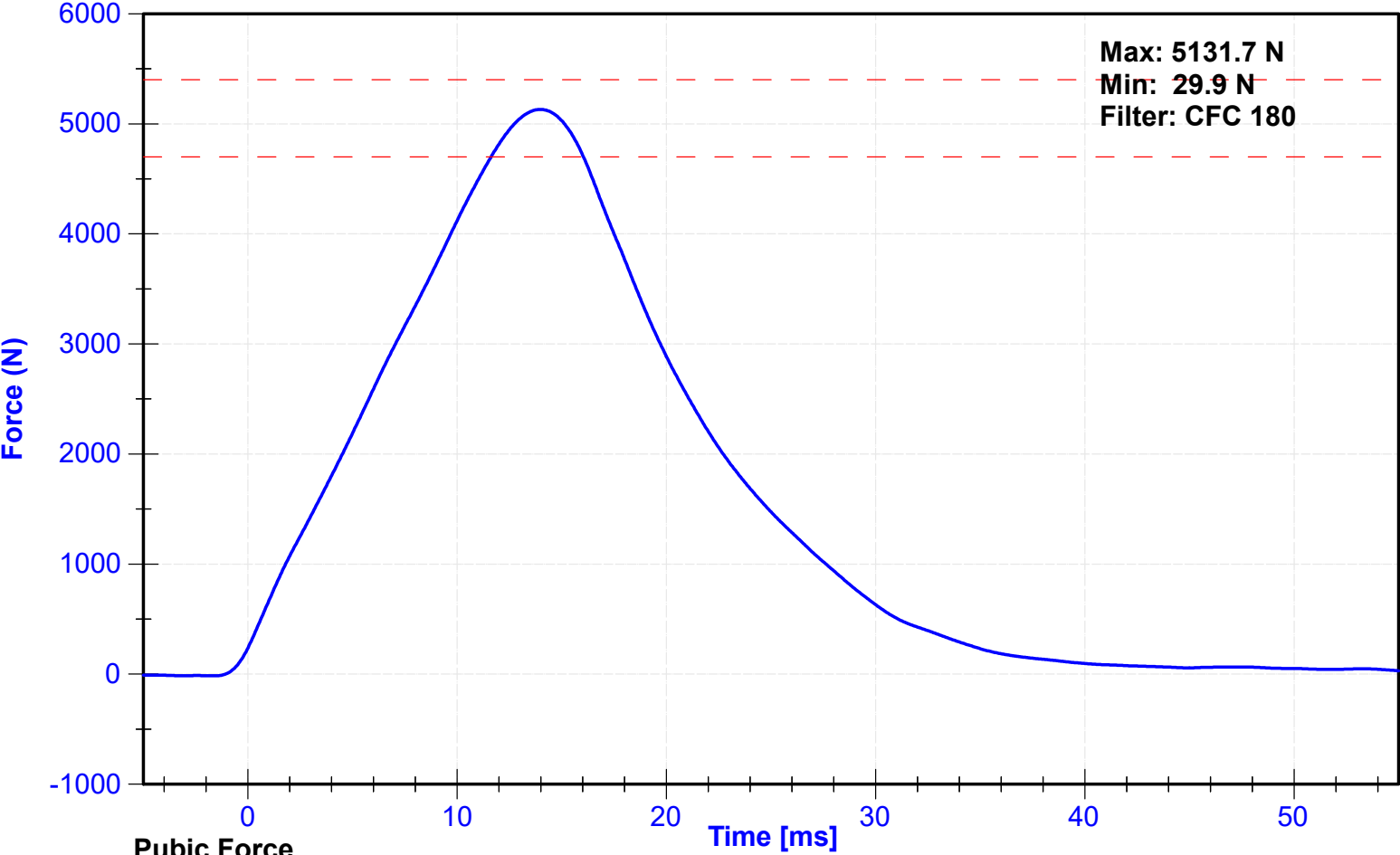
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	61.1	Pass
Velocity	4.2	4.4	m/s	4.23	Pass
Resistive Force	4700	5400	N	5131.7	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.95	Pass
Pubic Force	-1590	-1230	N	-1577.9	Pass
Time at Peak Pubic Force	12.2	17.0	ms	14.30	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Pubic Load Cell	Denton	456-FY	8/8/2023	8/7/2024



Resistive Force



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

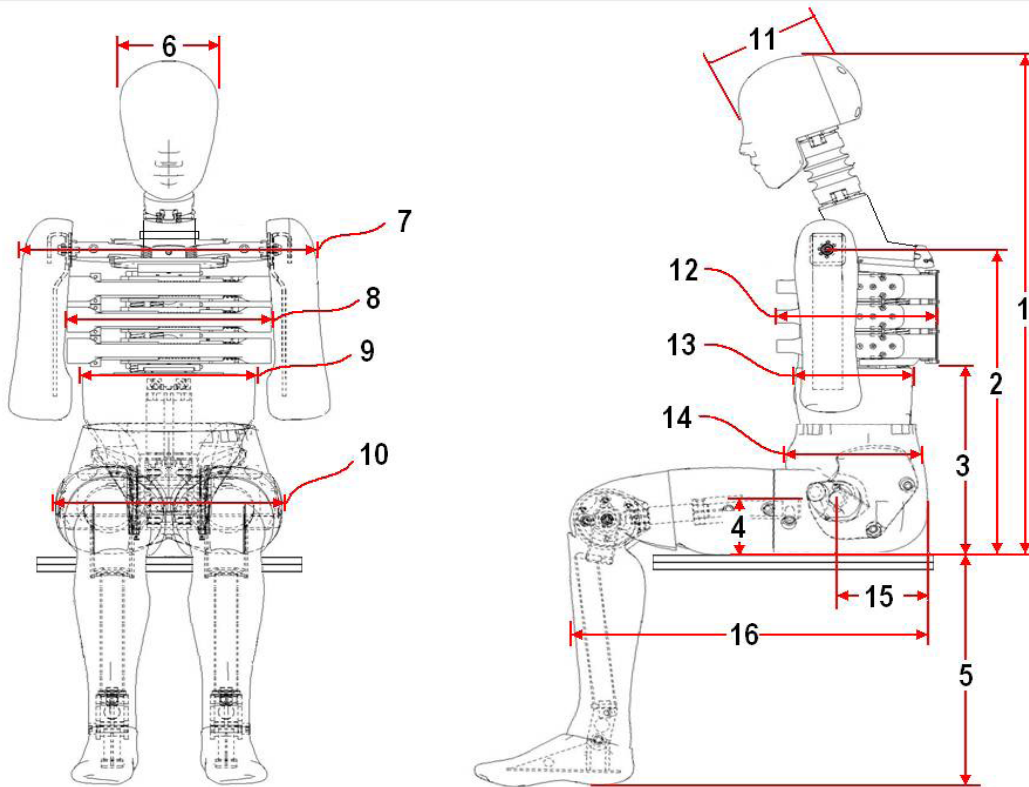


External Measurements - EuroSID-2re

Technician: K. Brogan

Date: 10/10/2023

Dummy Serial Number: D037



FRONT VIEW

SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	909	Pass
2	Seat to Shoulder Joint	558	572	564	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	353	Pass
4	Seat to Hip Joint (center of bolt)	97	103	101	Pass
5	Sole to Seat, Sitting	333	451	420	Pass
6	Head Width	152	158	155	Pass
7	Shoulder/Arm Width	461	479	470	Pass
8	Thorax Width	322	332	329	Pass
9	Abdomen Width	273	287	280	Pass
10	Pelvis Lap Width	359	373	364	Pass
11	Head Depth	196	206	199	Pass
12	Thorax Depth	262	272	266	Pass
13	Abdomen Depth	194	204	197	Pass
14	Pelvis Depth	235	245	241	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	154	Pass
16	Back of Buttocks to Front Knee	597	615	605	Pass

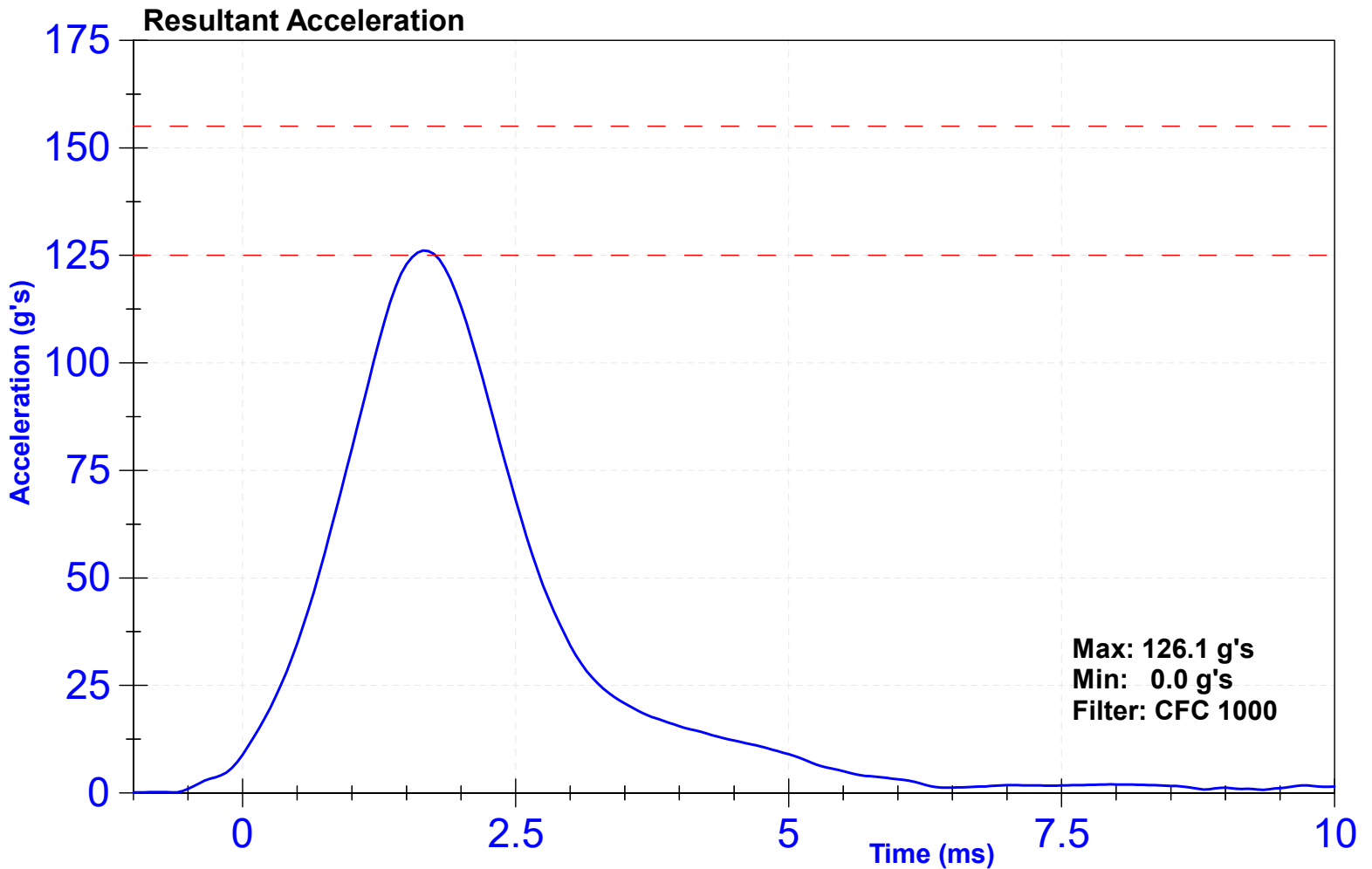
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

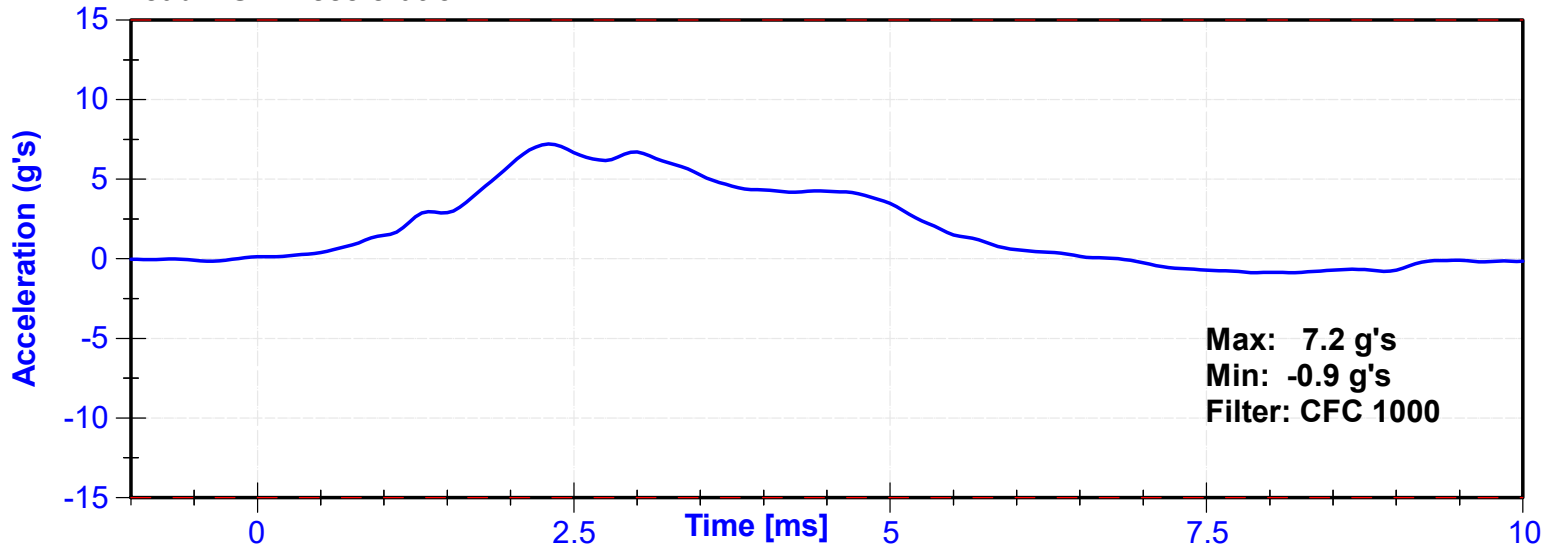
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	33	Pass
Resultant Acceleration	125	155	g's	126.1	Pass
Oscillation	0	15	%	1.85	Pass
Fore-Aft Acceleration	-15	15	g's	7.2	Pass

Transducer Calibrations

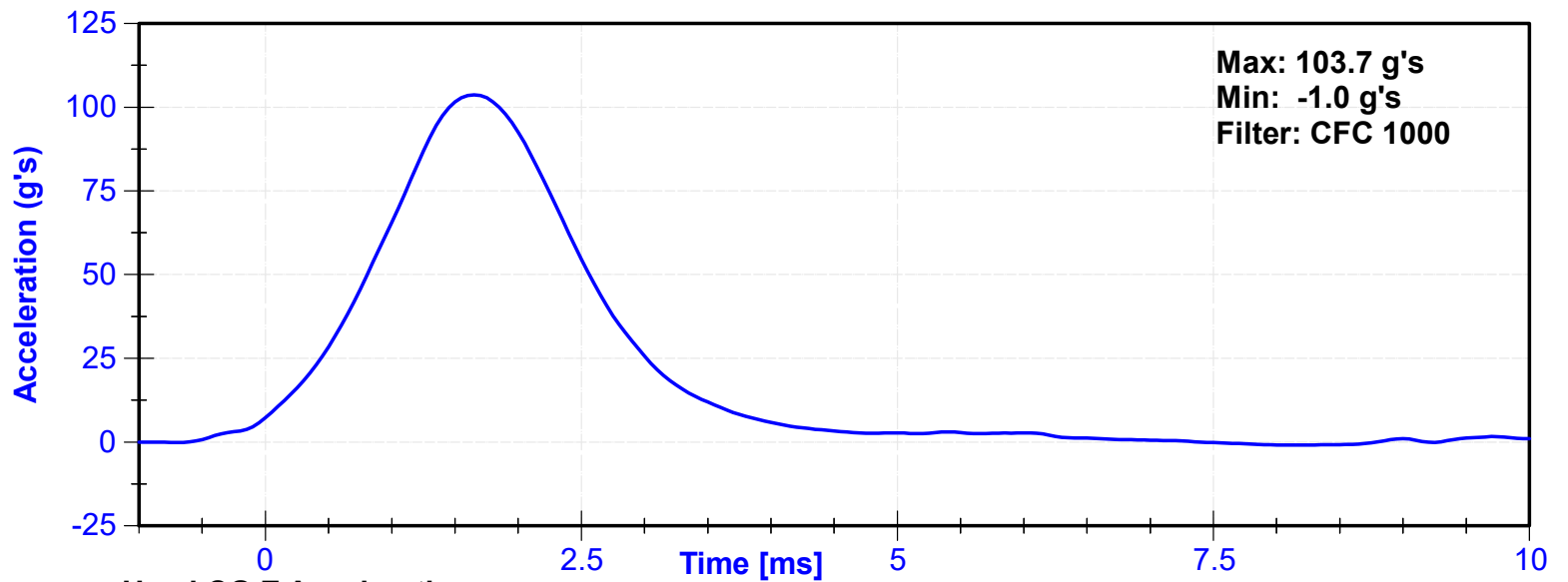
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	T21724	8/8/2023	2/4/2024
Y Accelerometer	Endevco	T22281	8/8/2023	2/4/2024
Z Accelerometer	Endevco	T26050	8/8/2023	2/4/2024



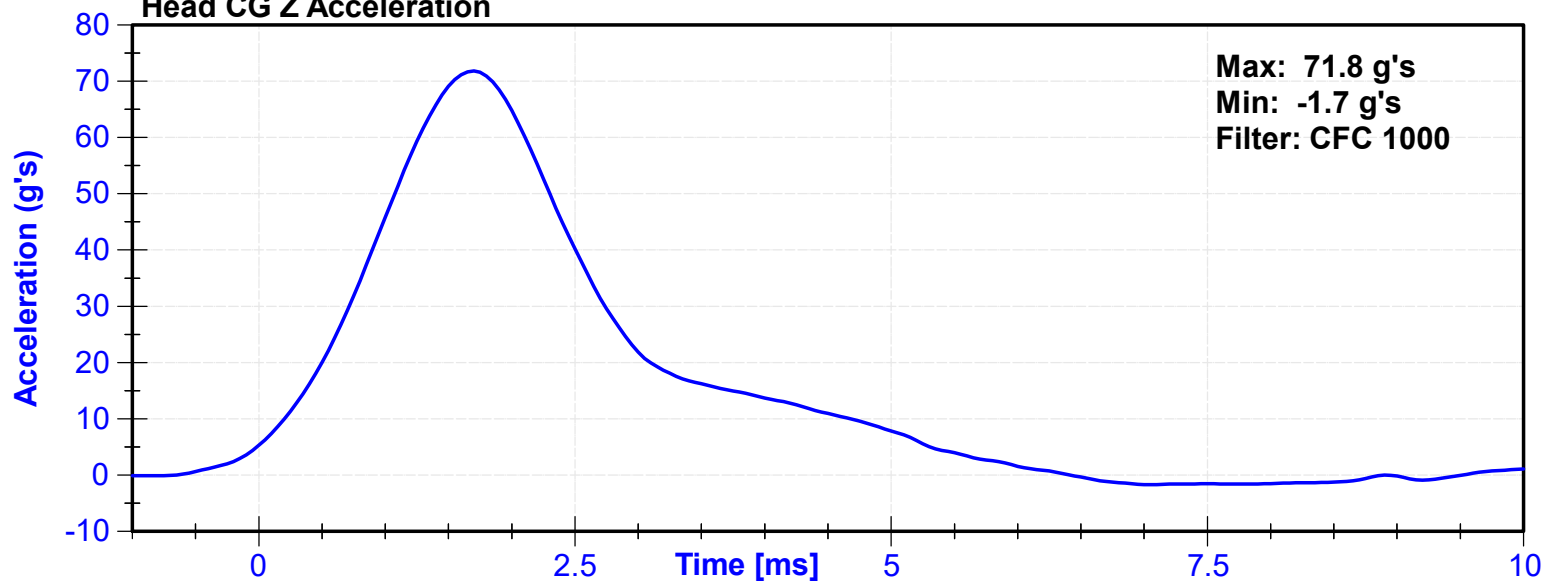
Head CG X Acceleration



Head CG Y Acceleration



Head CG Z Acceleration



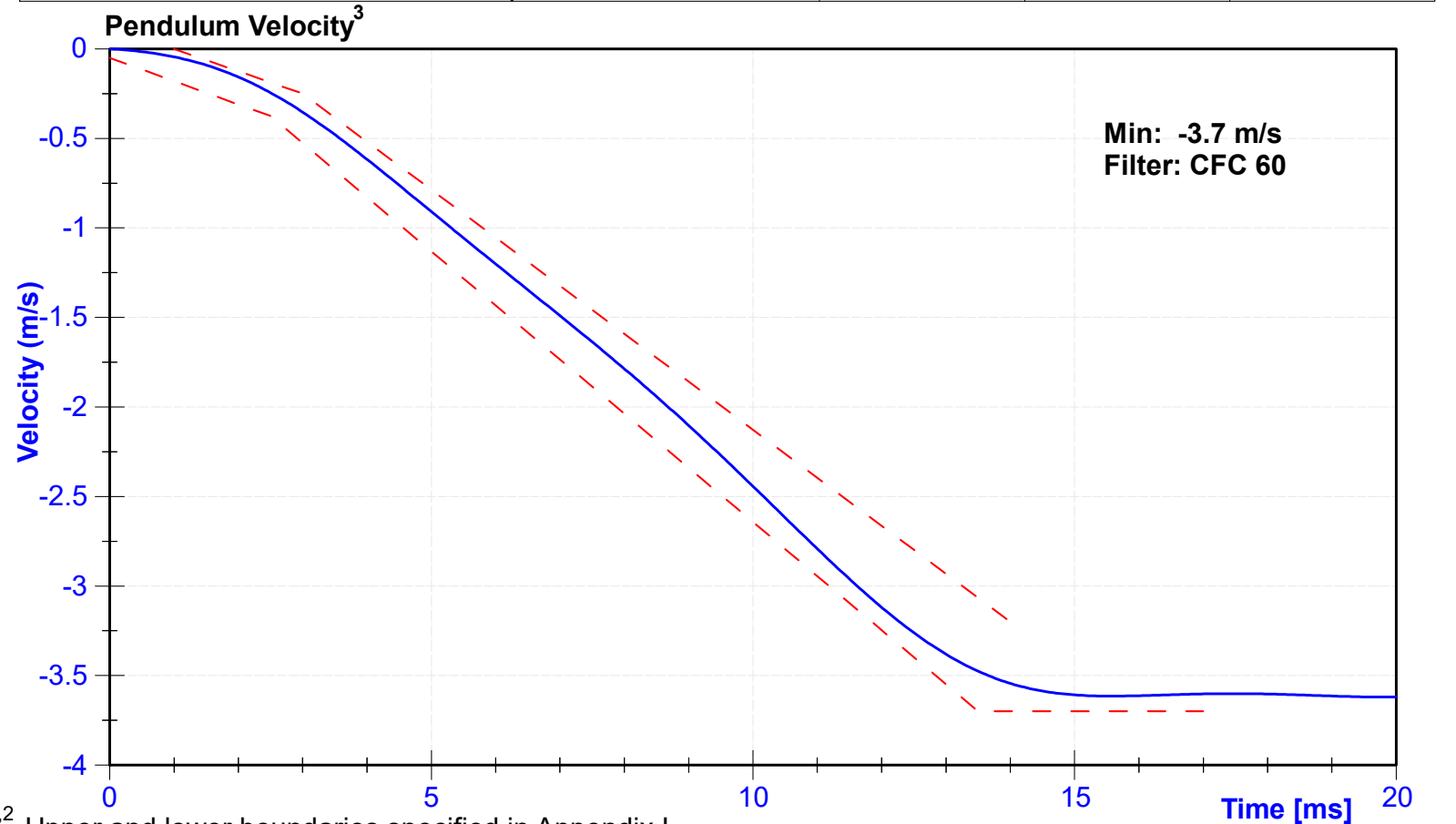
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	32.0	Pass
Velocity	3.3	3.5	m/s	3.40	Pass
Lateral Neck Rotation	49	59	deg	49.9	Pass
Time at Maximum Rotation	54	66	ms	55.3	Pass
Time of Rotation Decay from Maximum	53	88	ms	58.6	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

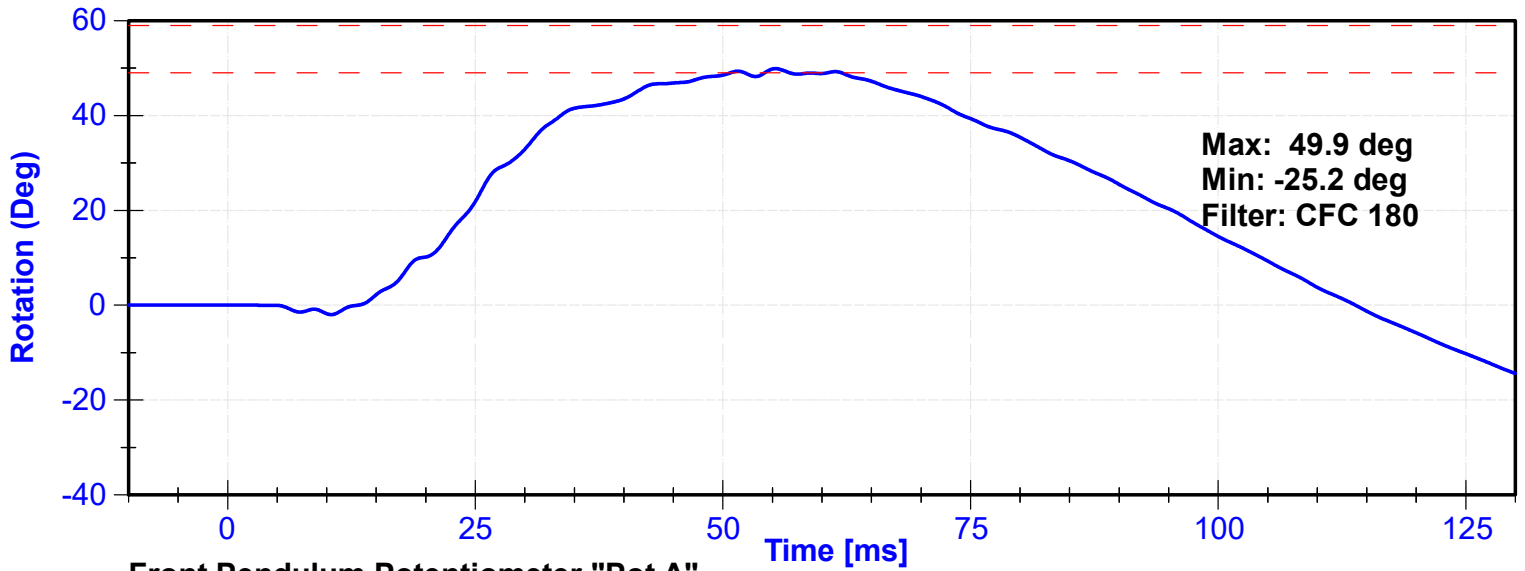
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Front Pendulum Potentiometer	Sfernice	094	9/29/2023	9/28/2024
Headform Potentiometer	Sfernice	095	9/29/2023	9/28/2024

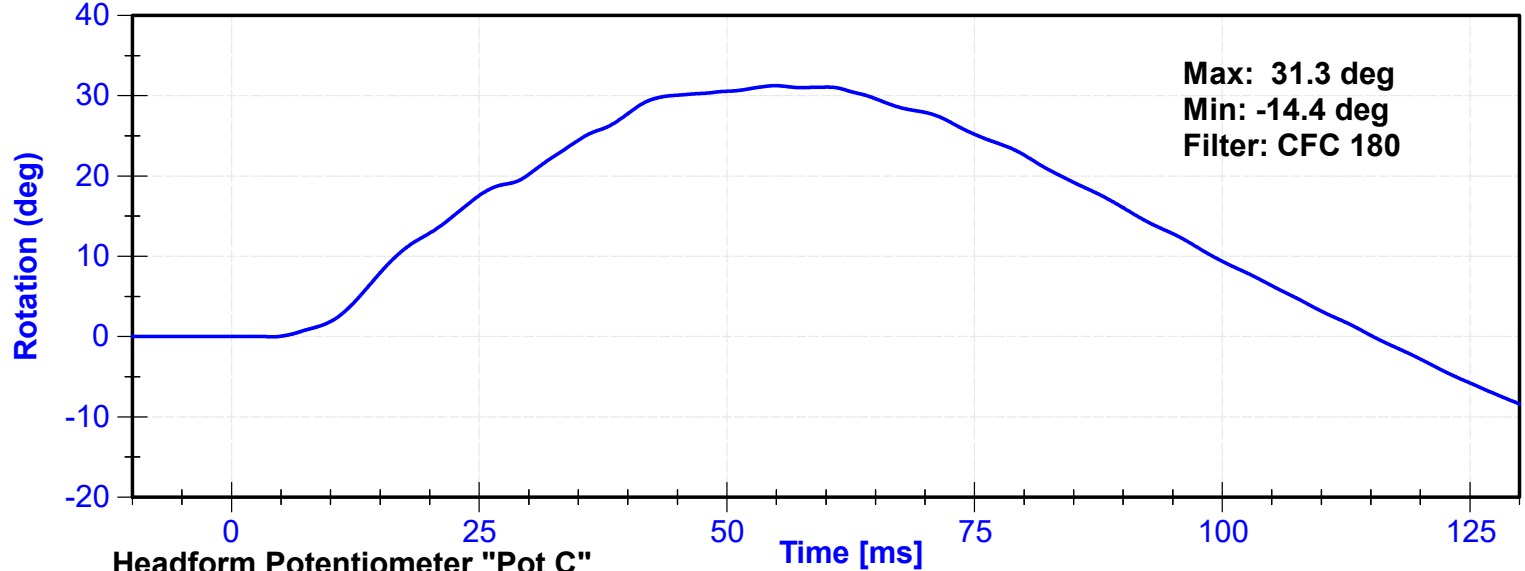


^{1,2} Upper and lower boundaries specified in Appendix I

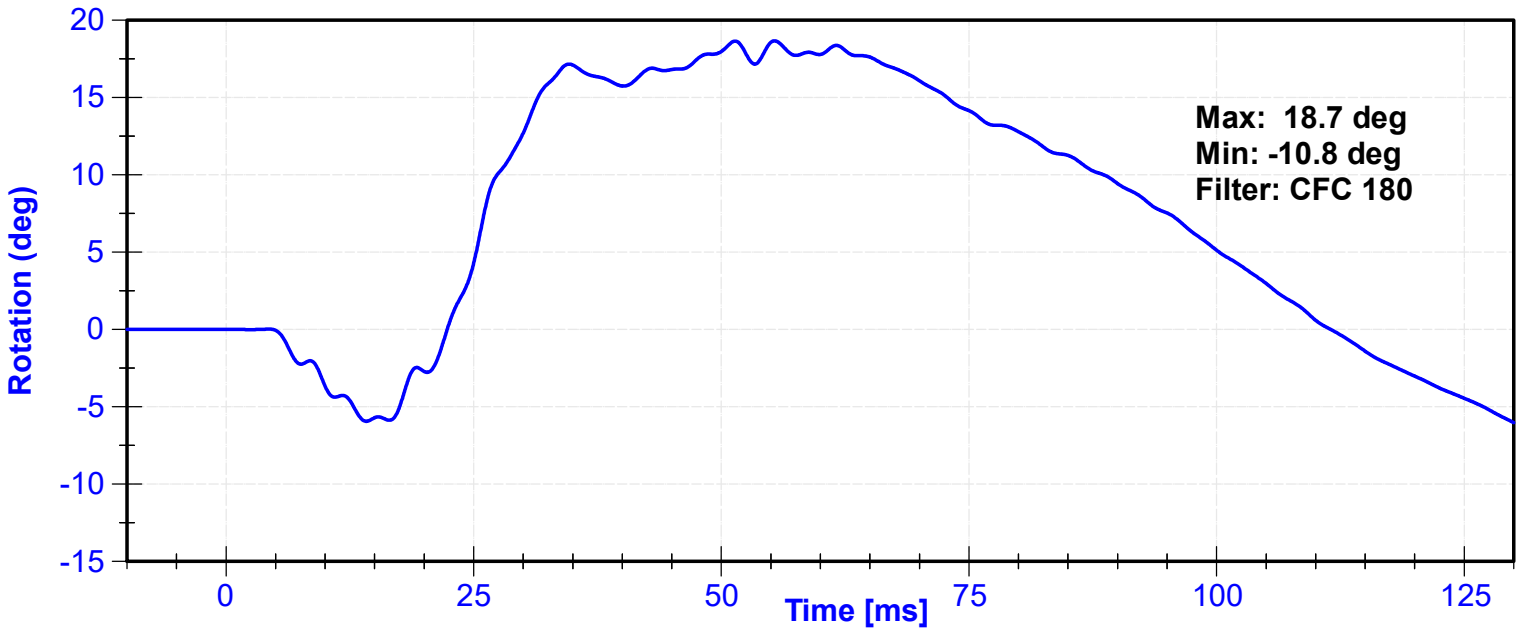
Neck Rotation



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

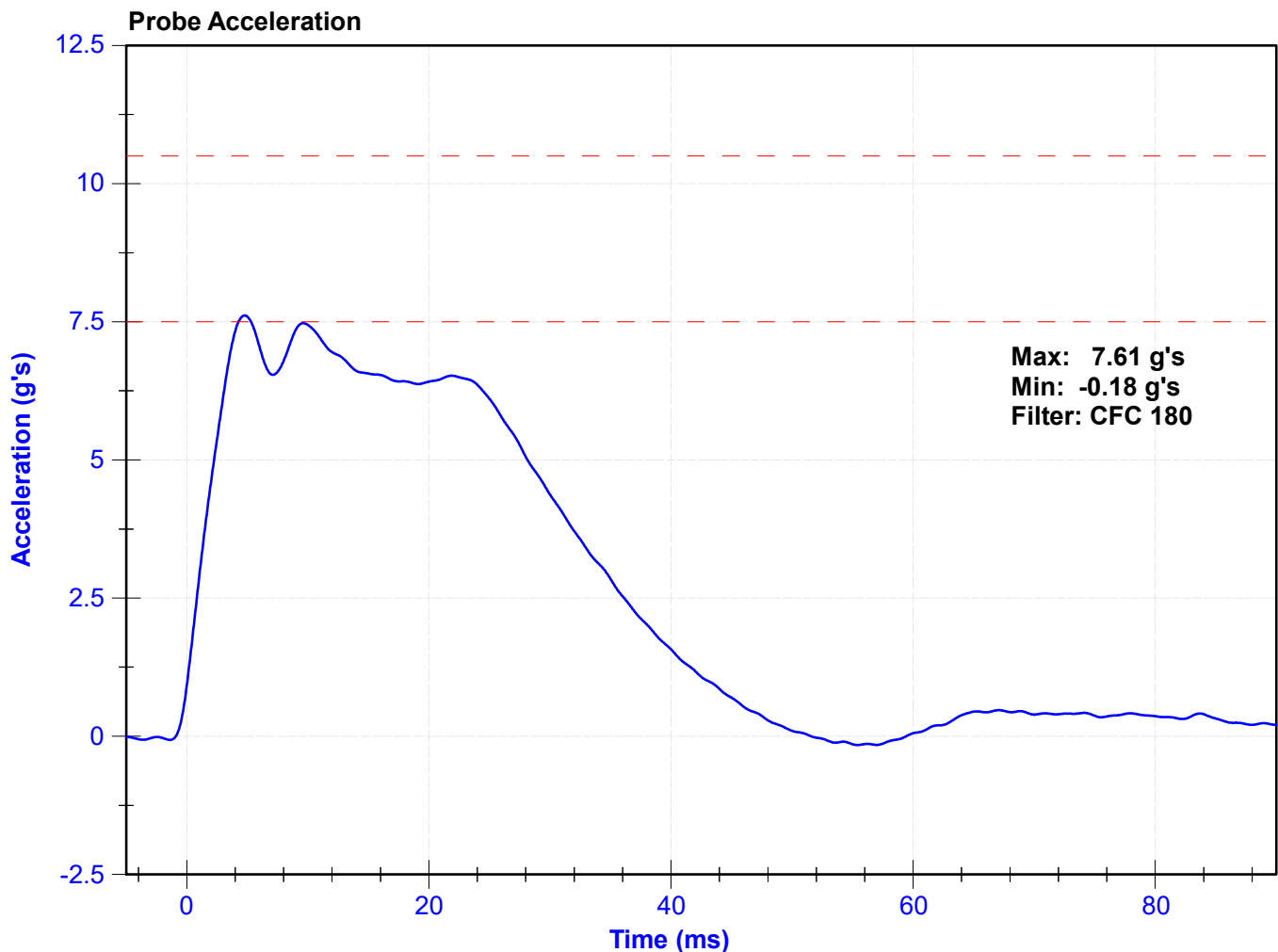
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	39	Pass
Velocity	4.2	4.4	m/s	4.35	Pass
Probe Acceleration	7.5	10.5	g's	7.61	Pass

Transducer Calibrations

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



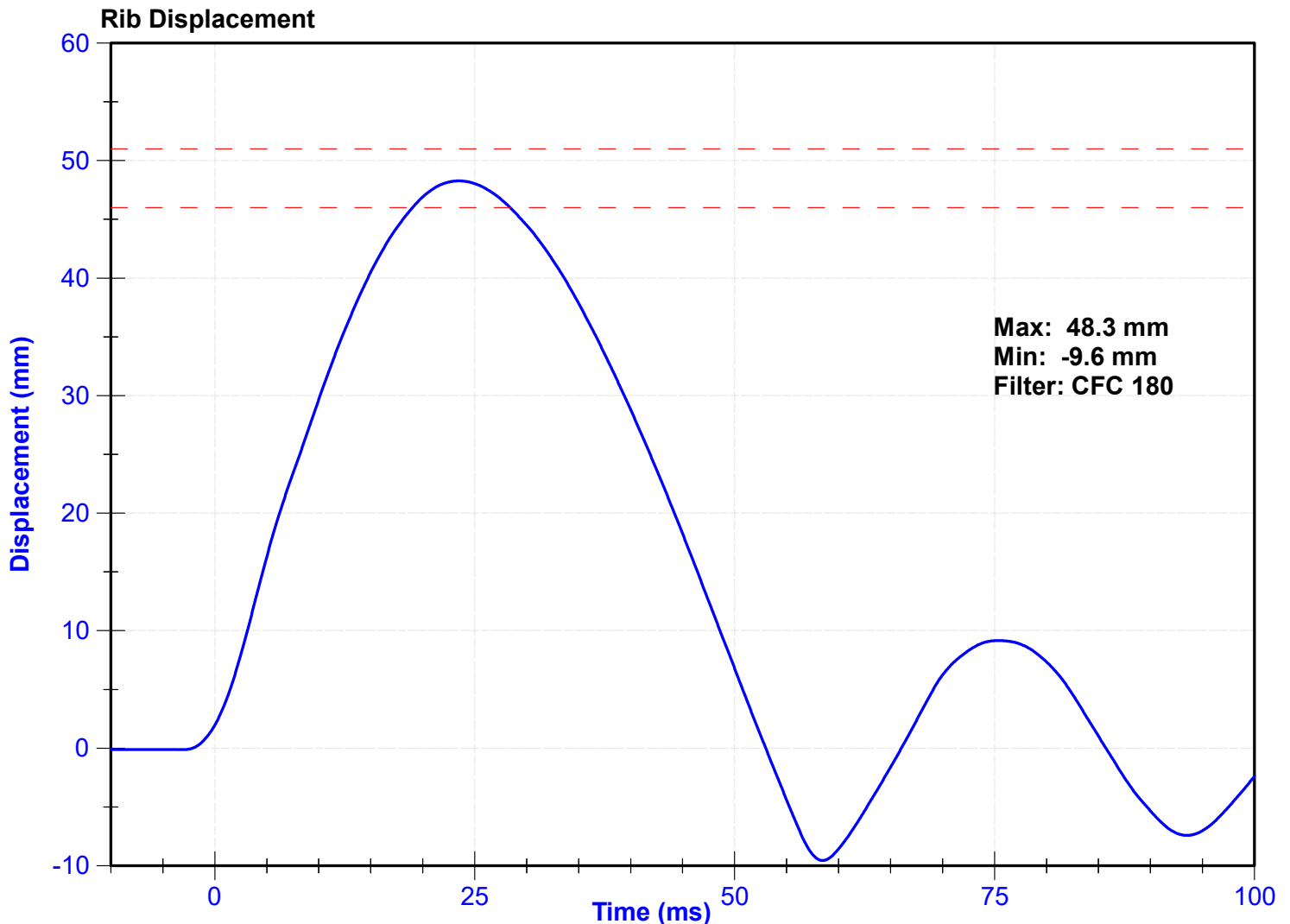
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	36	Pass
Rib Displacement	46	51	mm	48.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-01	8/7/2023	2/5/2024



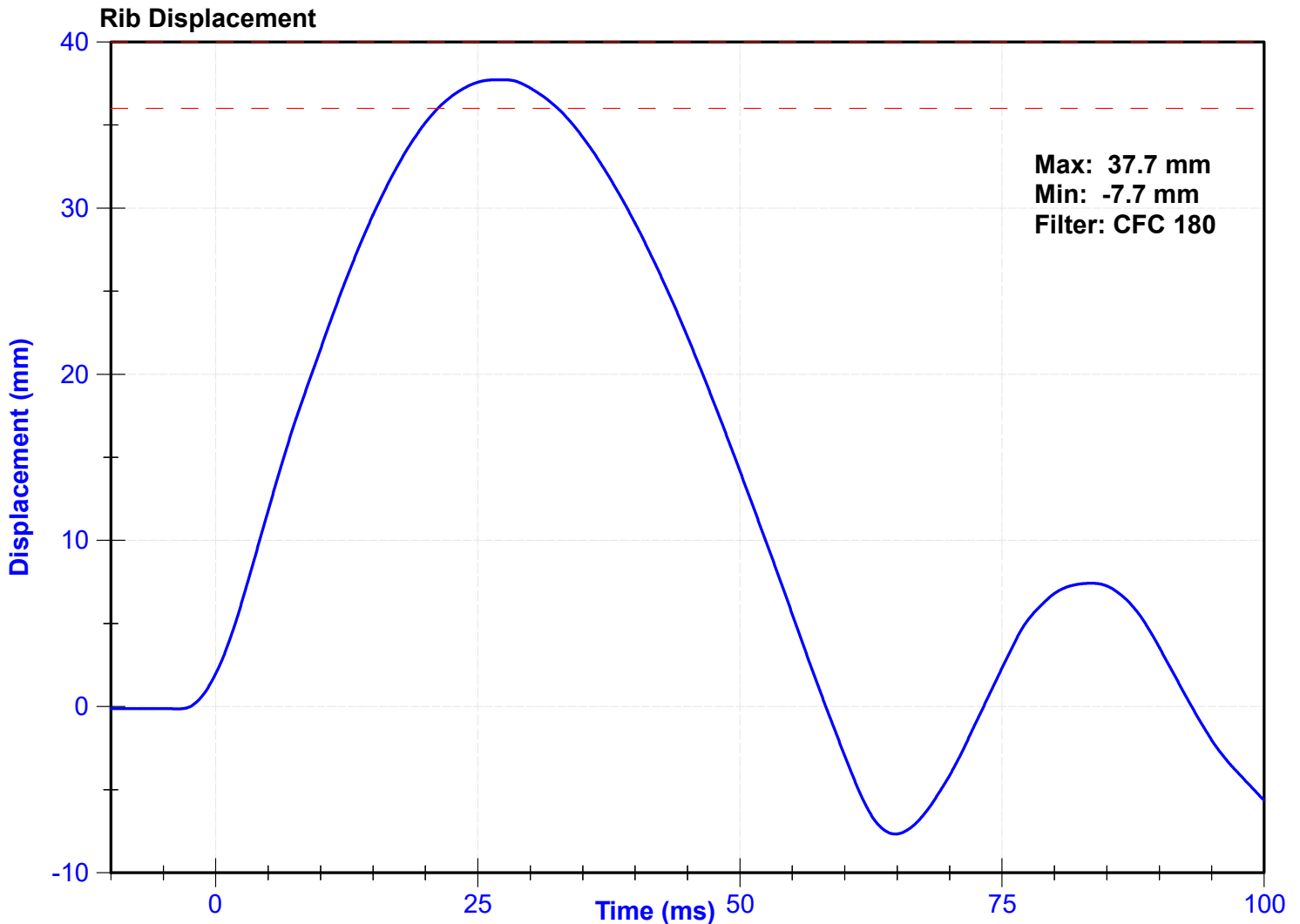
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	36	Pass
Rib Displacement	36	40	mm	37.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-01	8/7/2023	2/5/2024



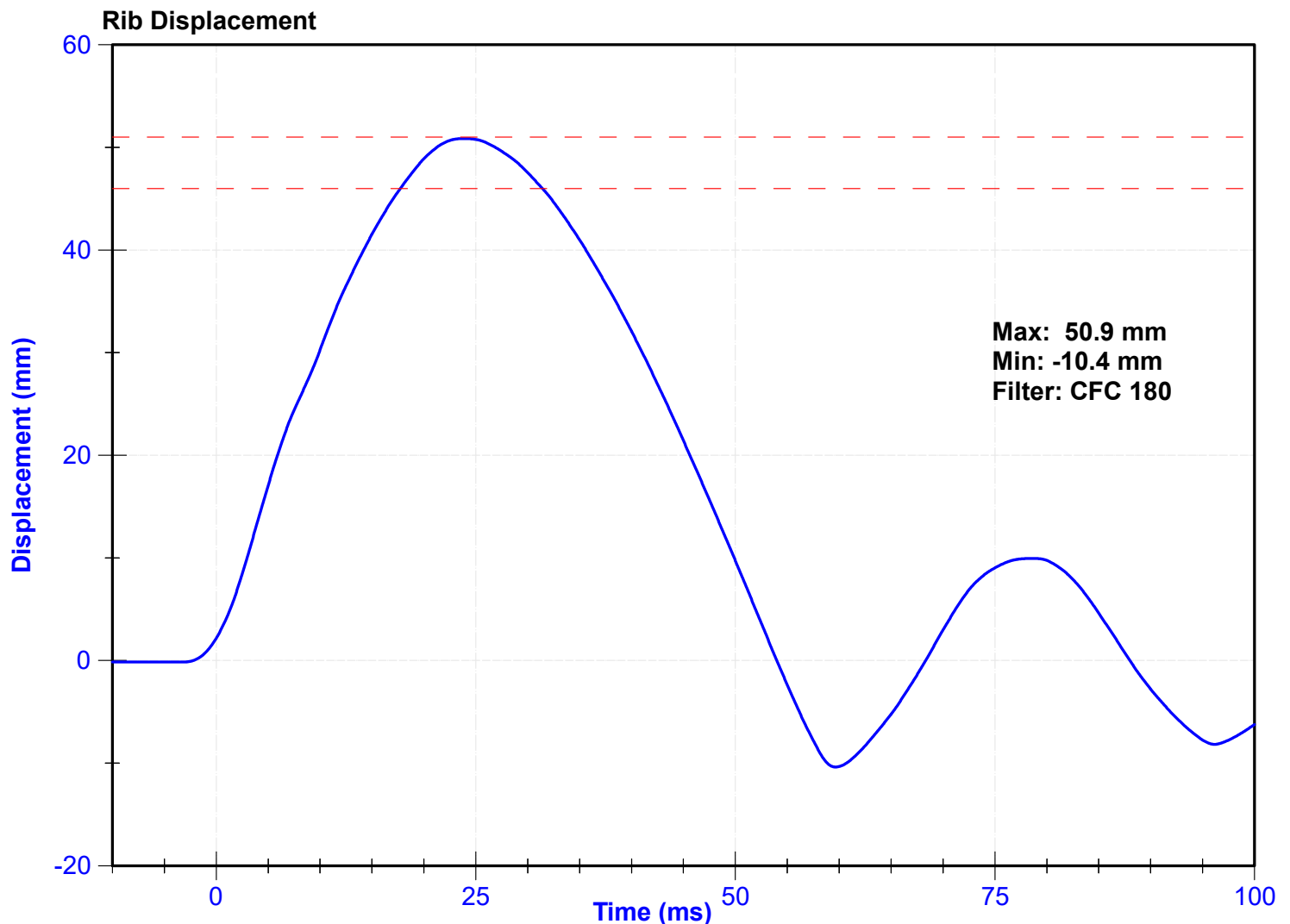
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	36	Pass
Rib Displacement	46	51	mm	50.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	807	8/7/2023	2/5/2024



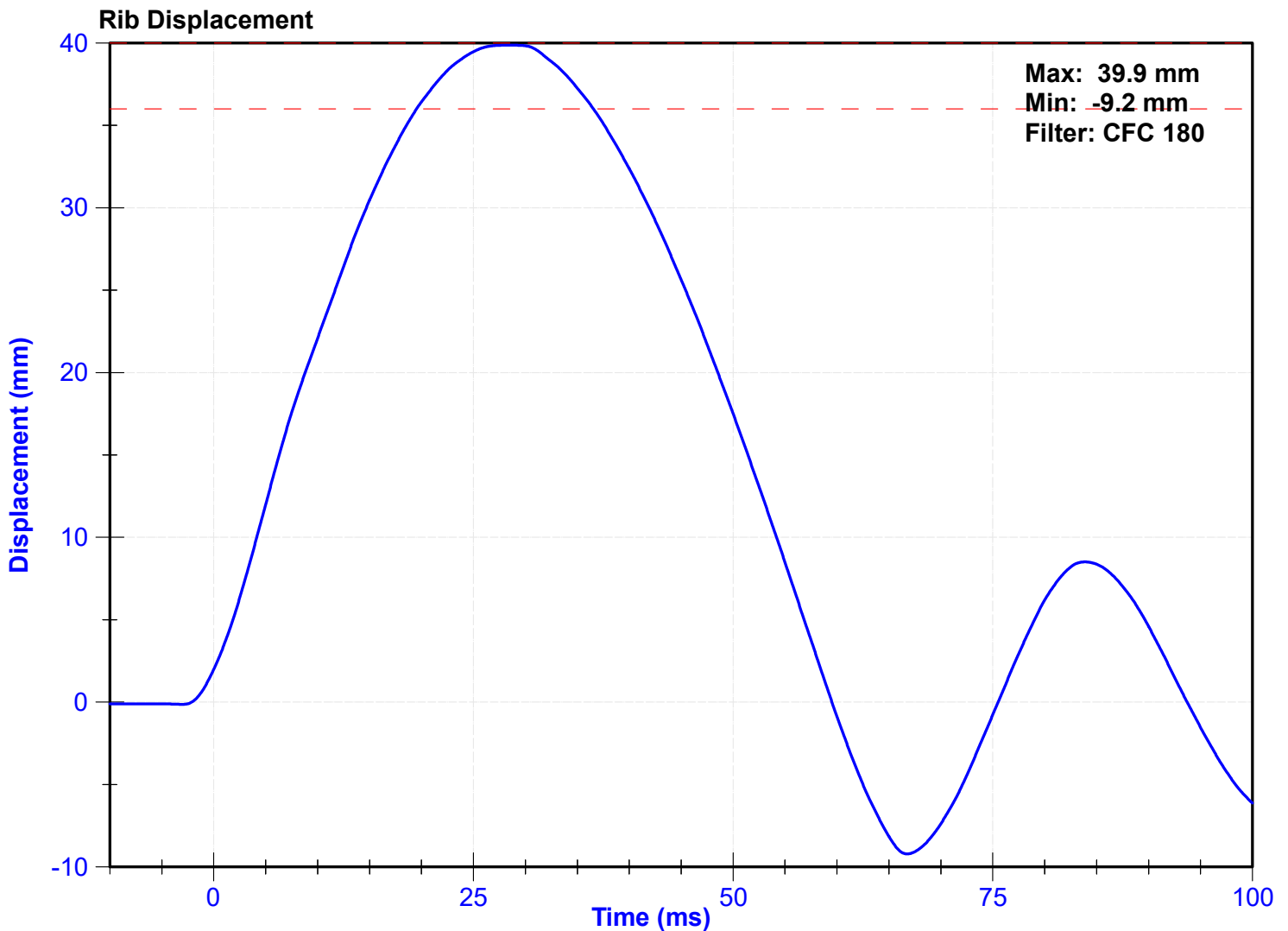
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

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

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	807	8/7/2023	2/5/2024



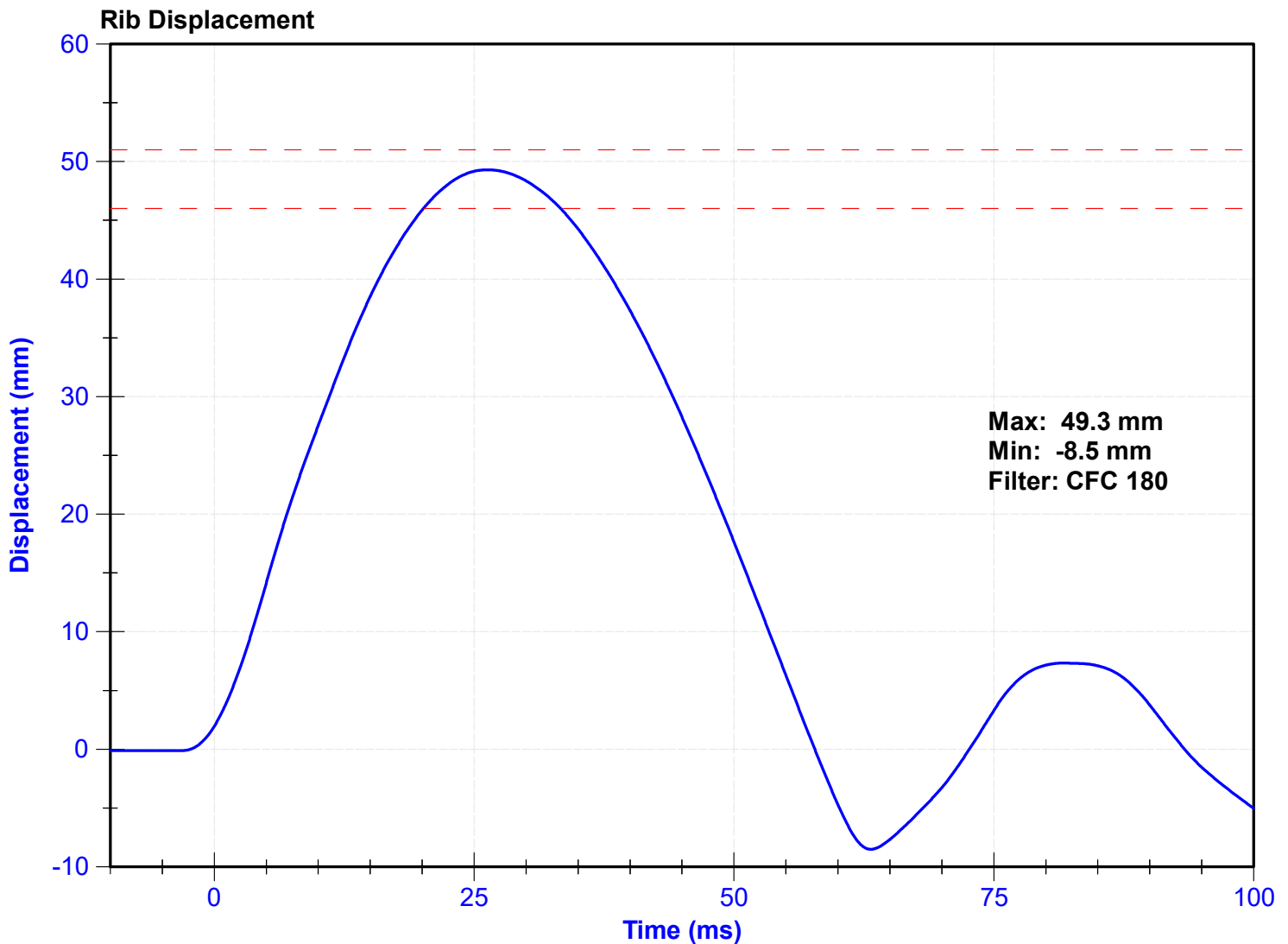
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	36	Pass
Rib Displacement	46	51	mm	49.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-03	8/7/2023	2/5/2024



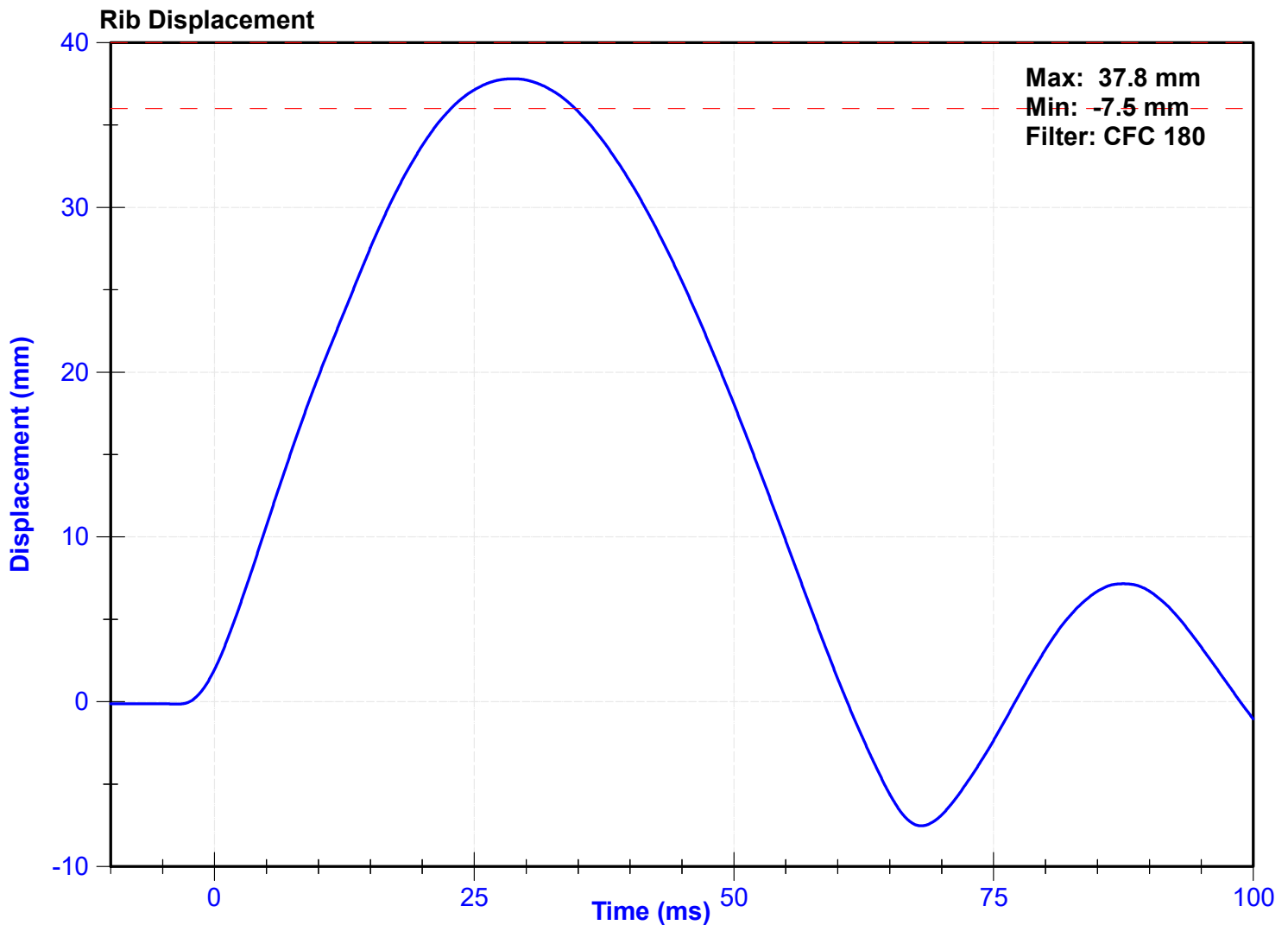
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	36	Pass
Rib Displacement	36	40	mm	37.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-03	8/7/2023	2/5/2024



ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

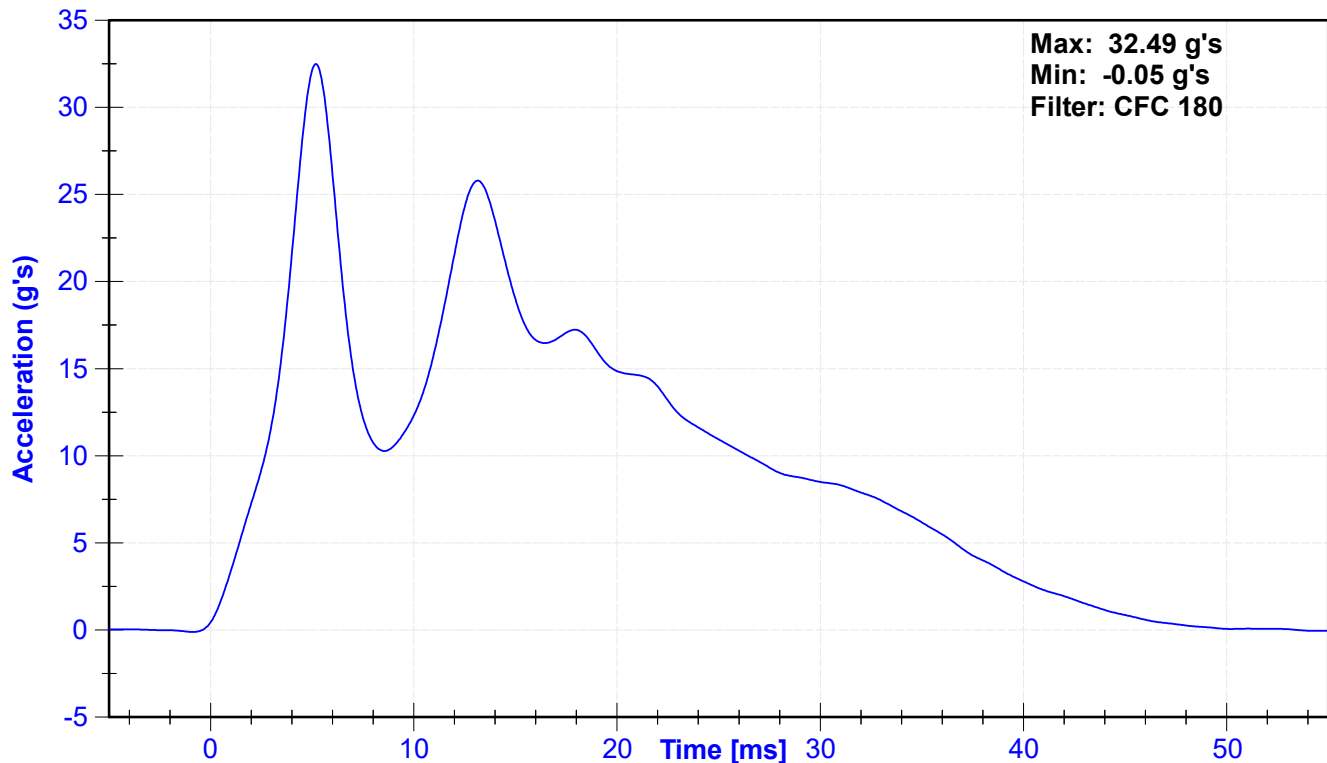
Results

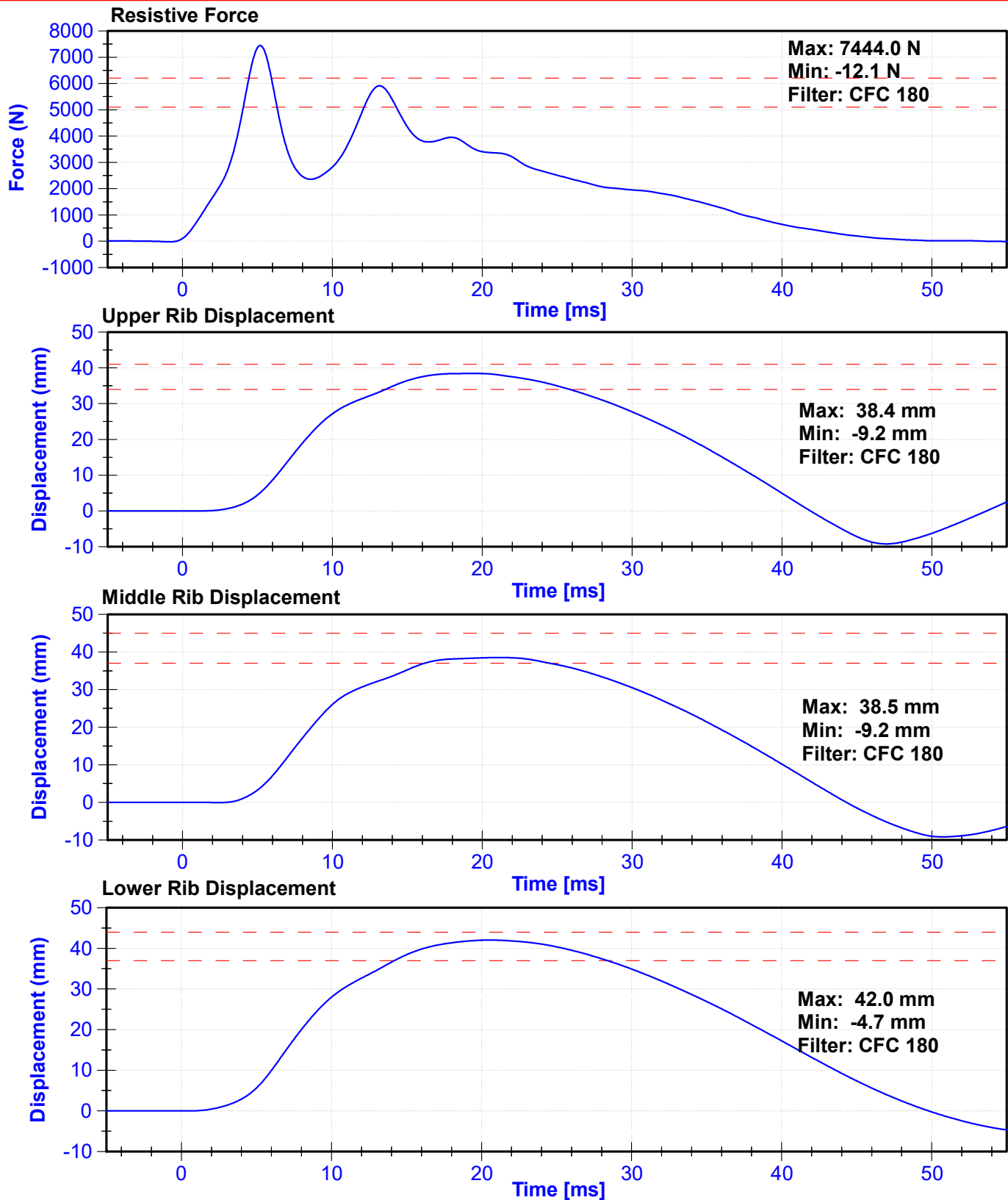
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	39	Pass
Velocity	5.4	5.6	m/s	5.54	Pass
Resistive Force after 6ms	5100	6200	N	5977.5	Pass
Upper Thorax Rib Deflection	34	41	mm	38.4	Pass
Mid Thorax Rib Deflection	37	45	mm	38.5	Pass
Lower Thorax Rib Deflection	37	44	mm	42.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Upper Thorax Rib Potentiometer	Honeywell	0552-01	8/7/2023	2/5/2024
Middle Thorax Rib Potentiometer	Honeywell	807	8/7/2023	2/5/2024
Lower Thorax Rib Potentiometer	Honeywell	0552-03	8/7/2023	2/5/2024

Probe Acceleration





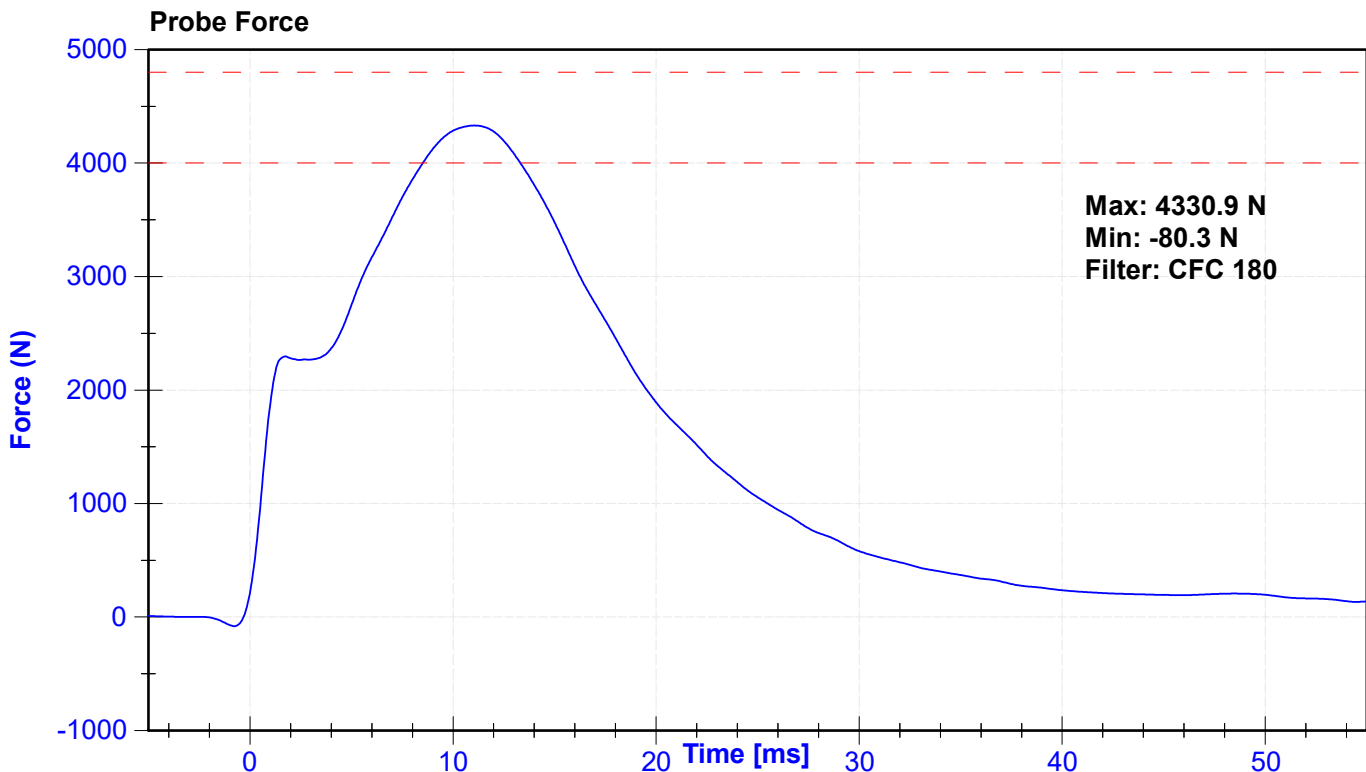
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

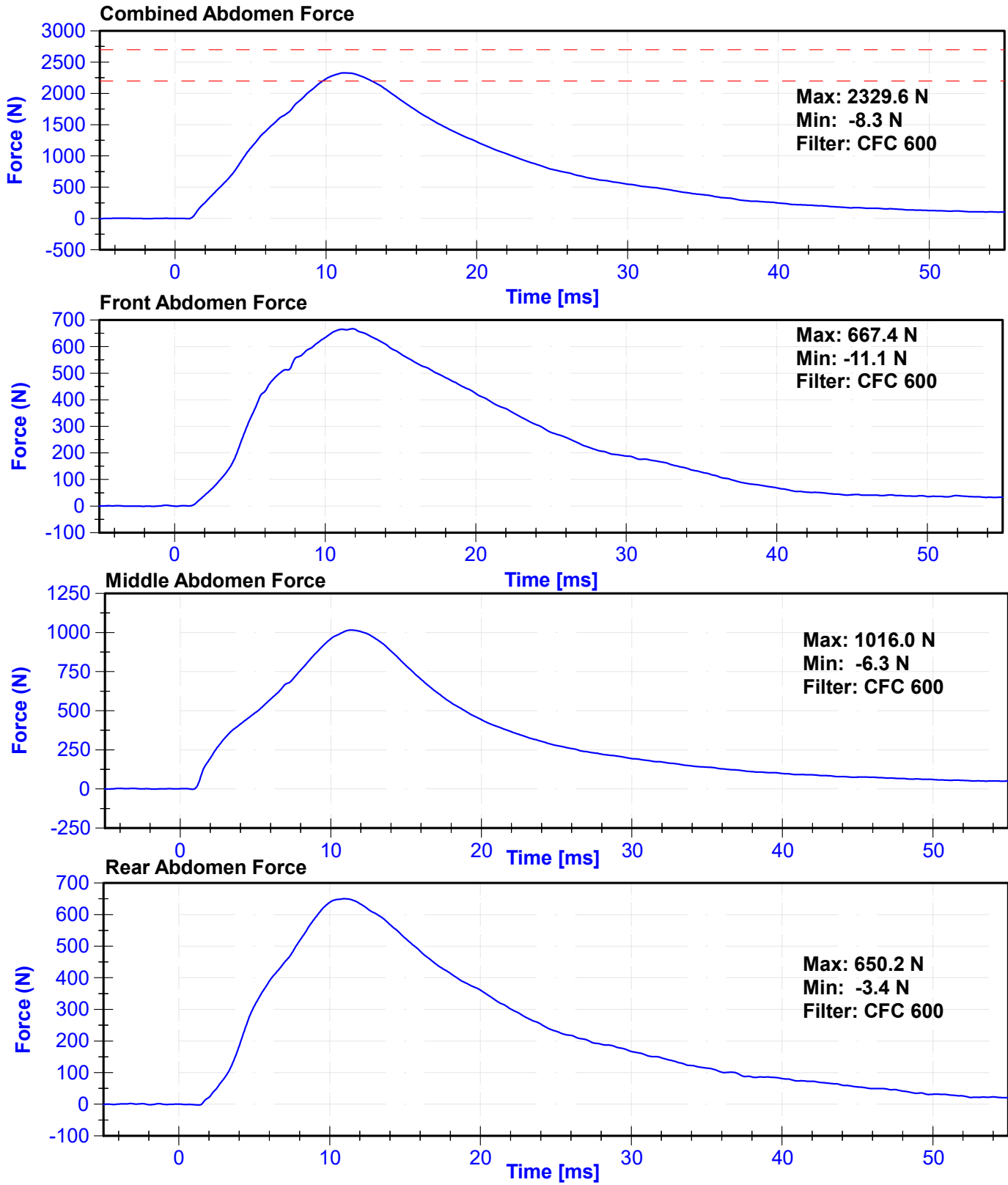
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	39	Pass
Velocity	3.9	4.1	m/s	4.00	Pass
Combined Abdomen Force	2200	2700	N	2329.6	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.20	Pass
Resistive Probe Force	4000	4800	N	4330.9	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.05	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Front Abdomen Load Cell	Denton	1440	8/8/2023	8/7/2024
Middle Abdomen Load Cell	Denton	1525	8/8/2023	8/7/2024
Rear Abdomen Load Cell	Denton	1528	8/8/2023	8/7/2024





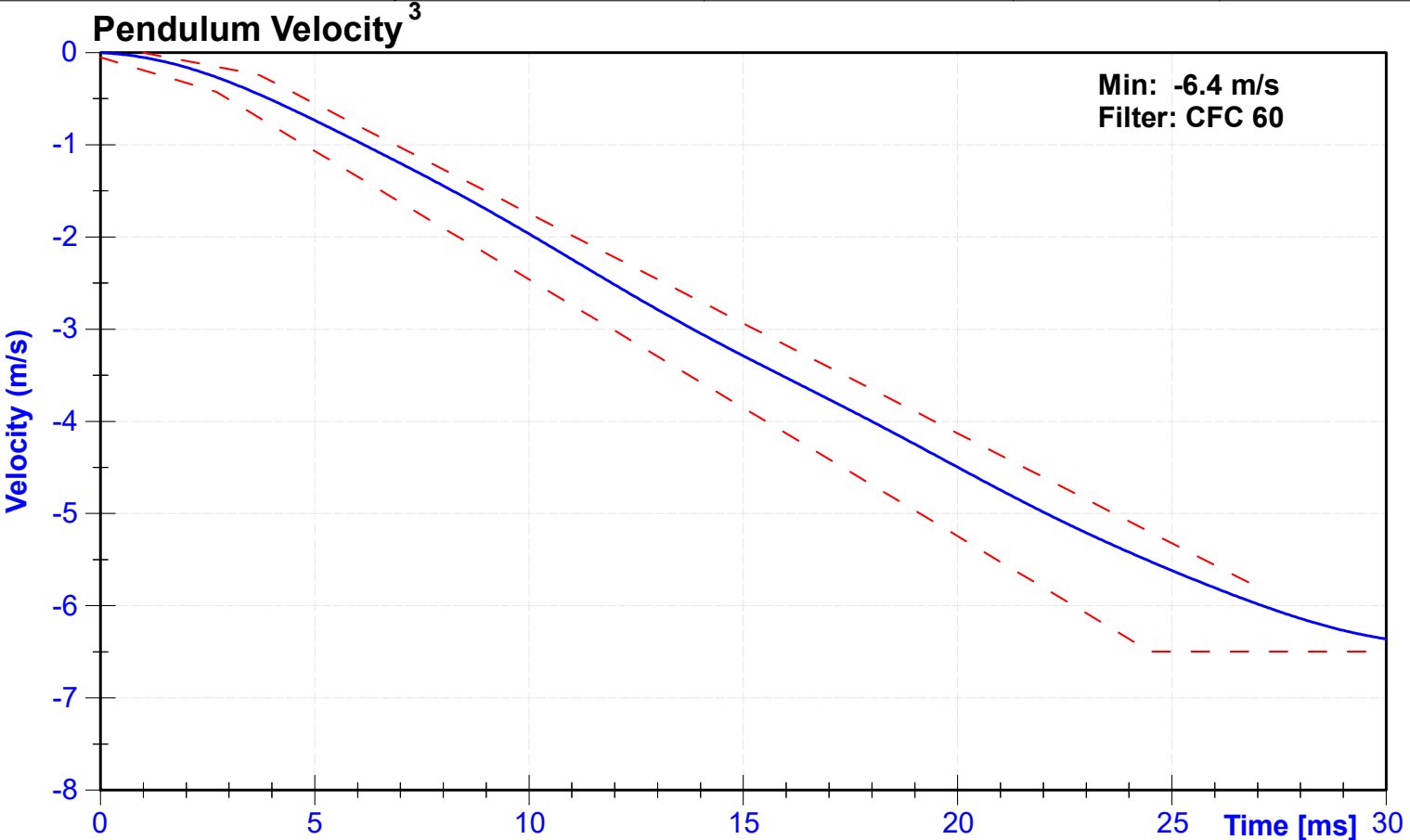
ATD Manufacturer	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

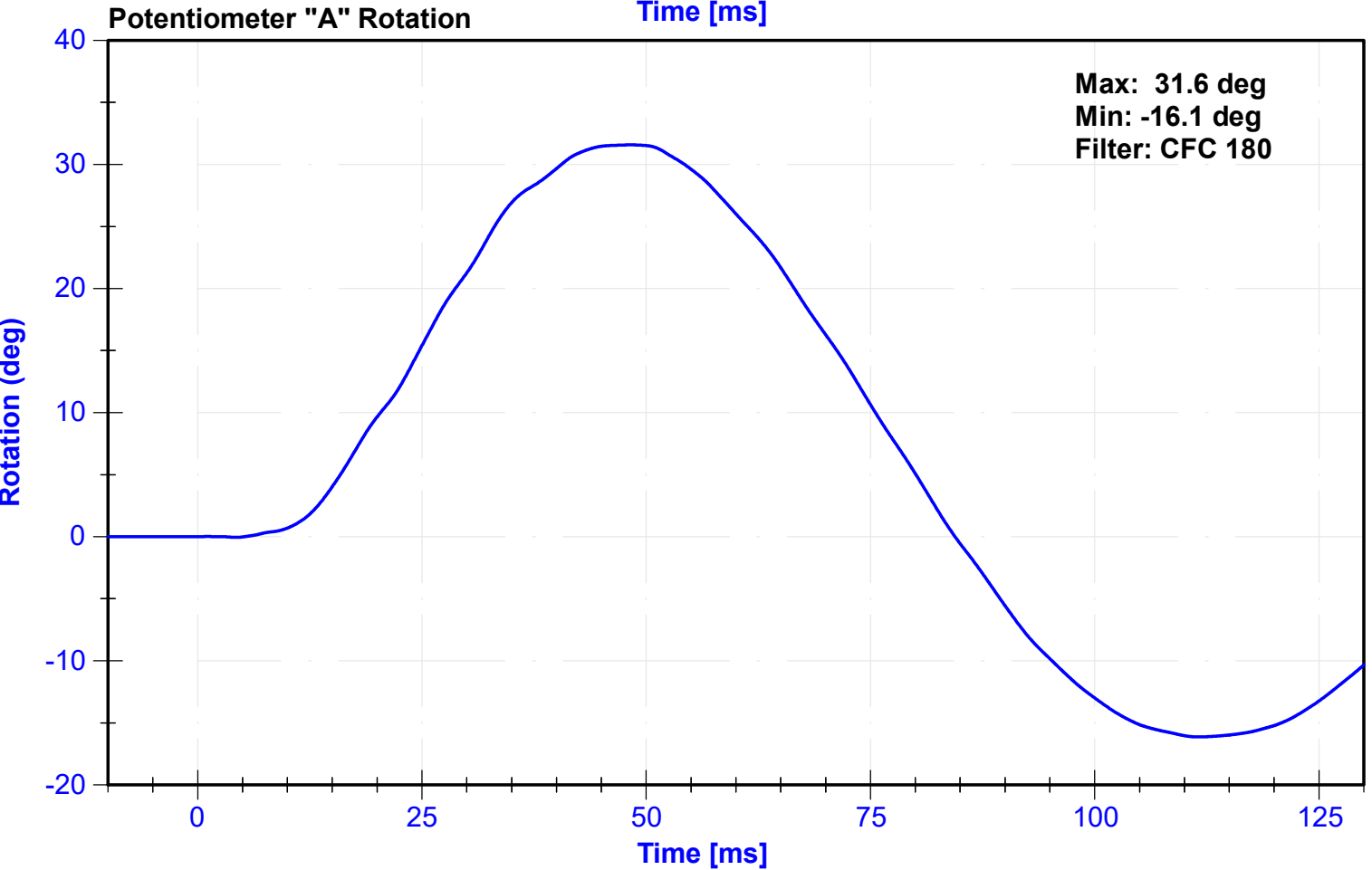
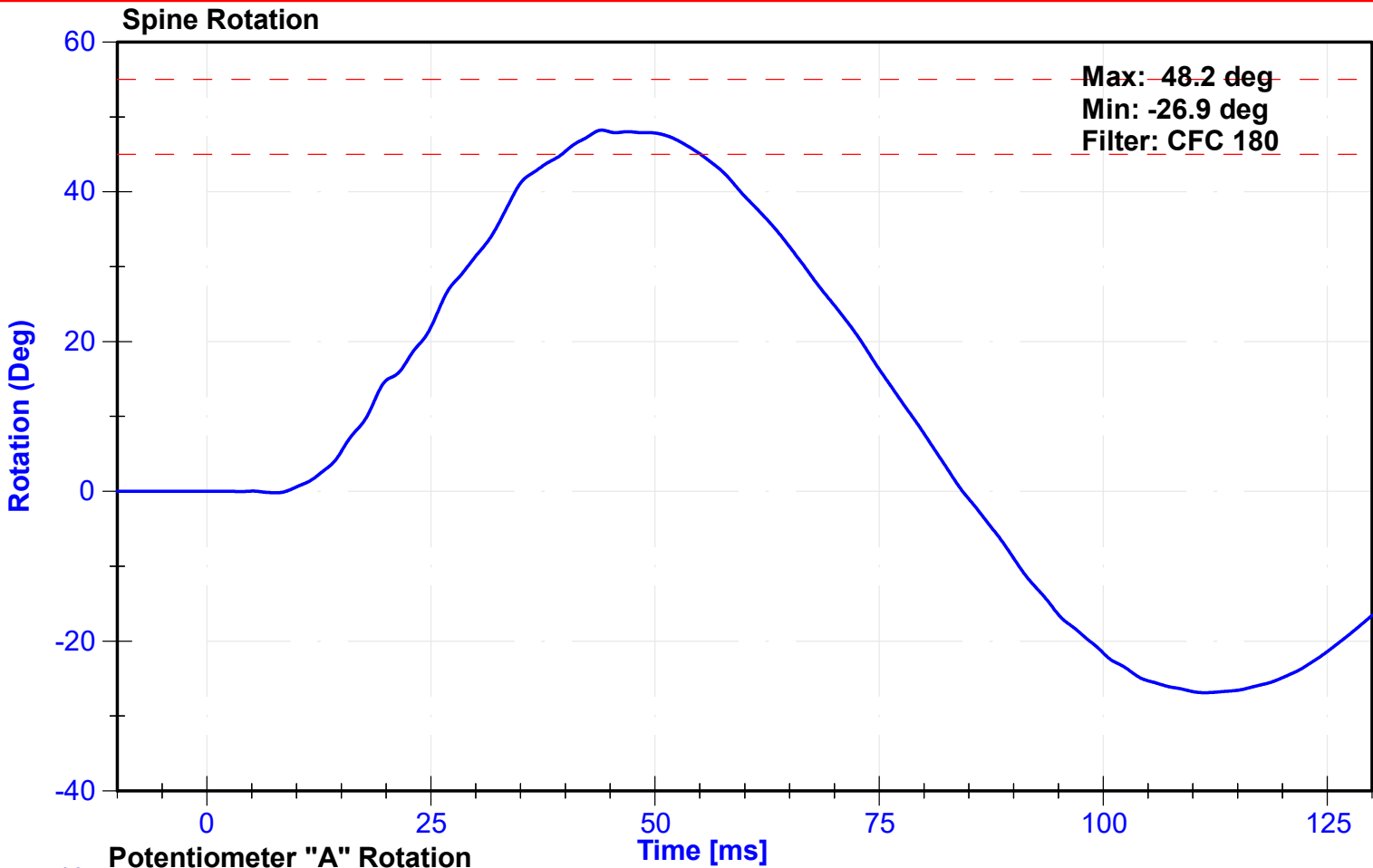
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	32.0	Pass
Velocity	5.95	6.15	m/s	6.033	Pass
Lateral Spine Rotation	45	55	deg	48.2	Pass
Time at Maximum Rotation	39	53	ms	44.0	Pass
Time of Decay to Zero Degrees	37	57	ms	40.3	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

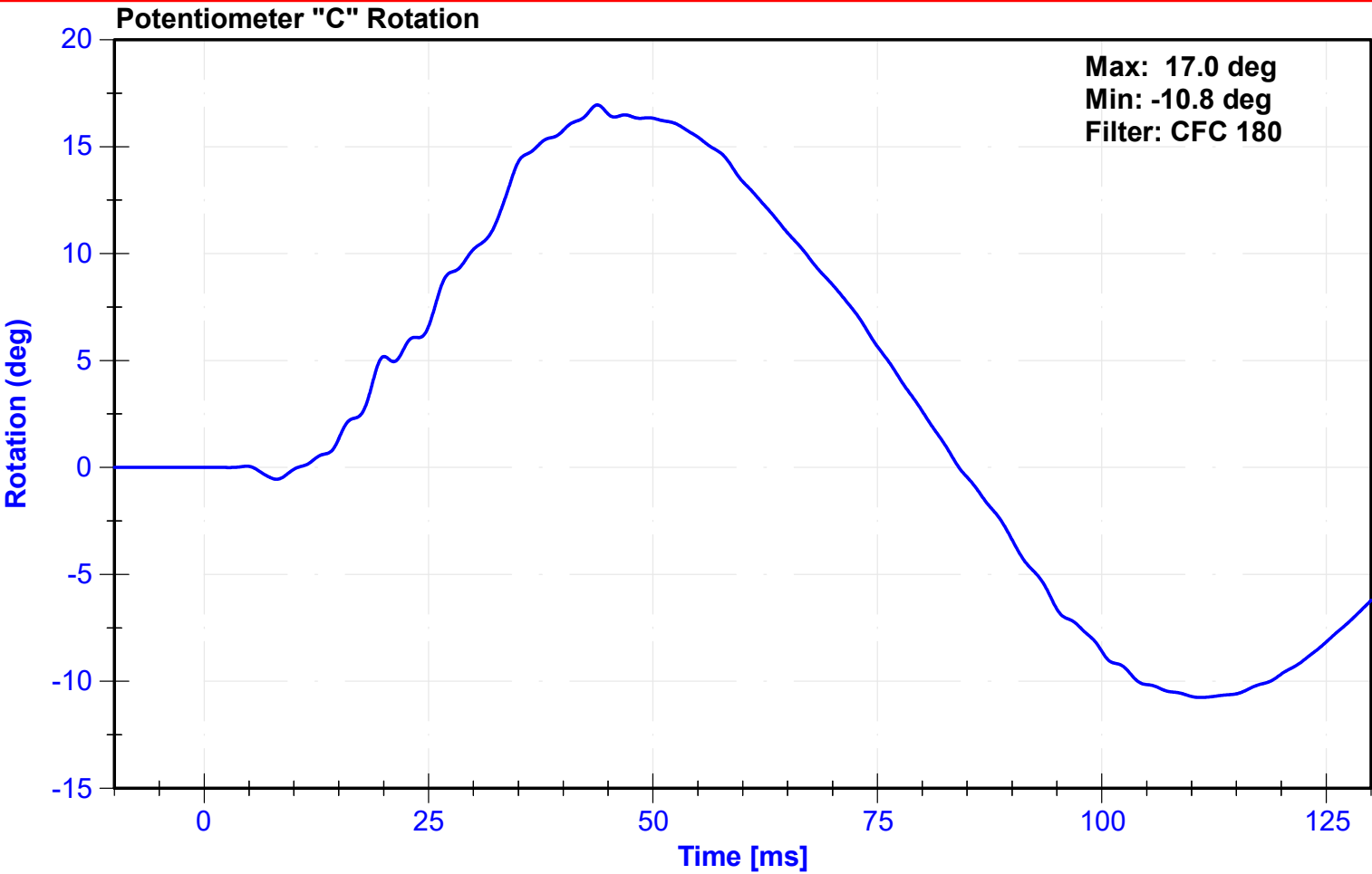
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum "A" Potentiometer	Sfernice	094	9/29/2023	9/28/2024
Condyle "B" Potentiometer	Sfernice	095	9/29/2023	9/28/2024



^{1,2} Upper and lower boundaries specified in Appendix I
IV-42





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	Denton	Test Technician	J. Rios
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

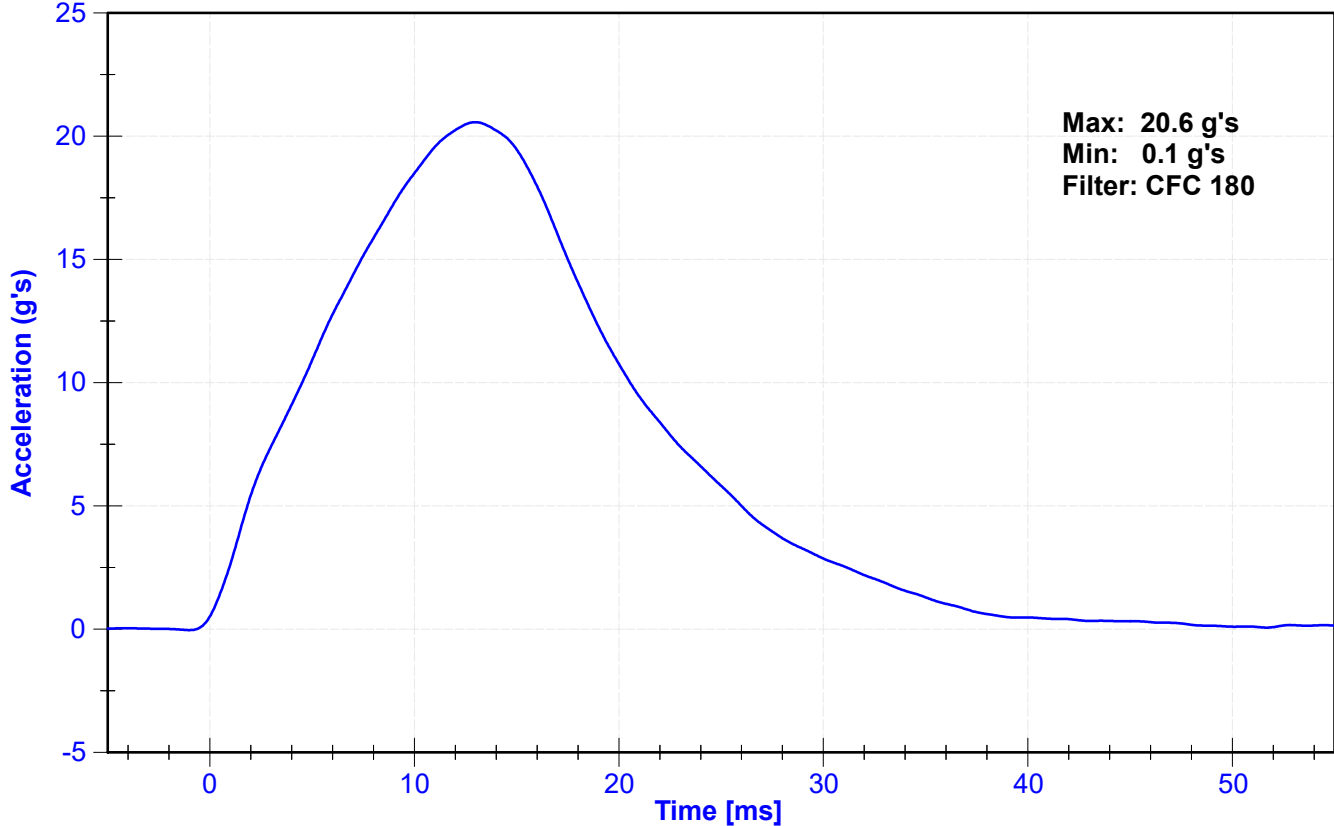
Results

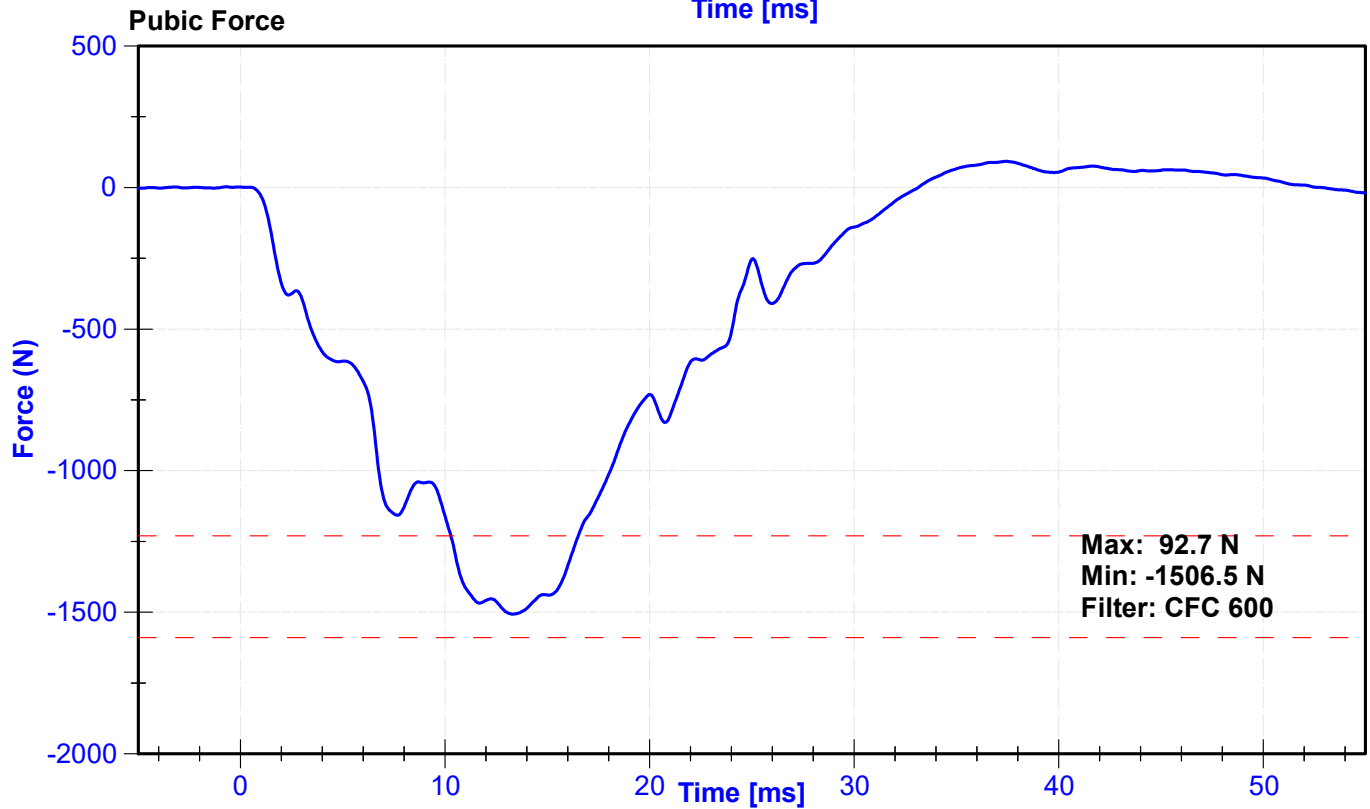
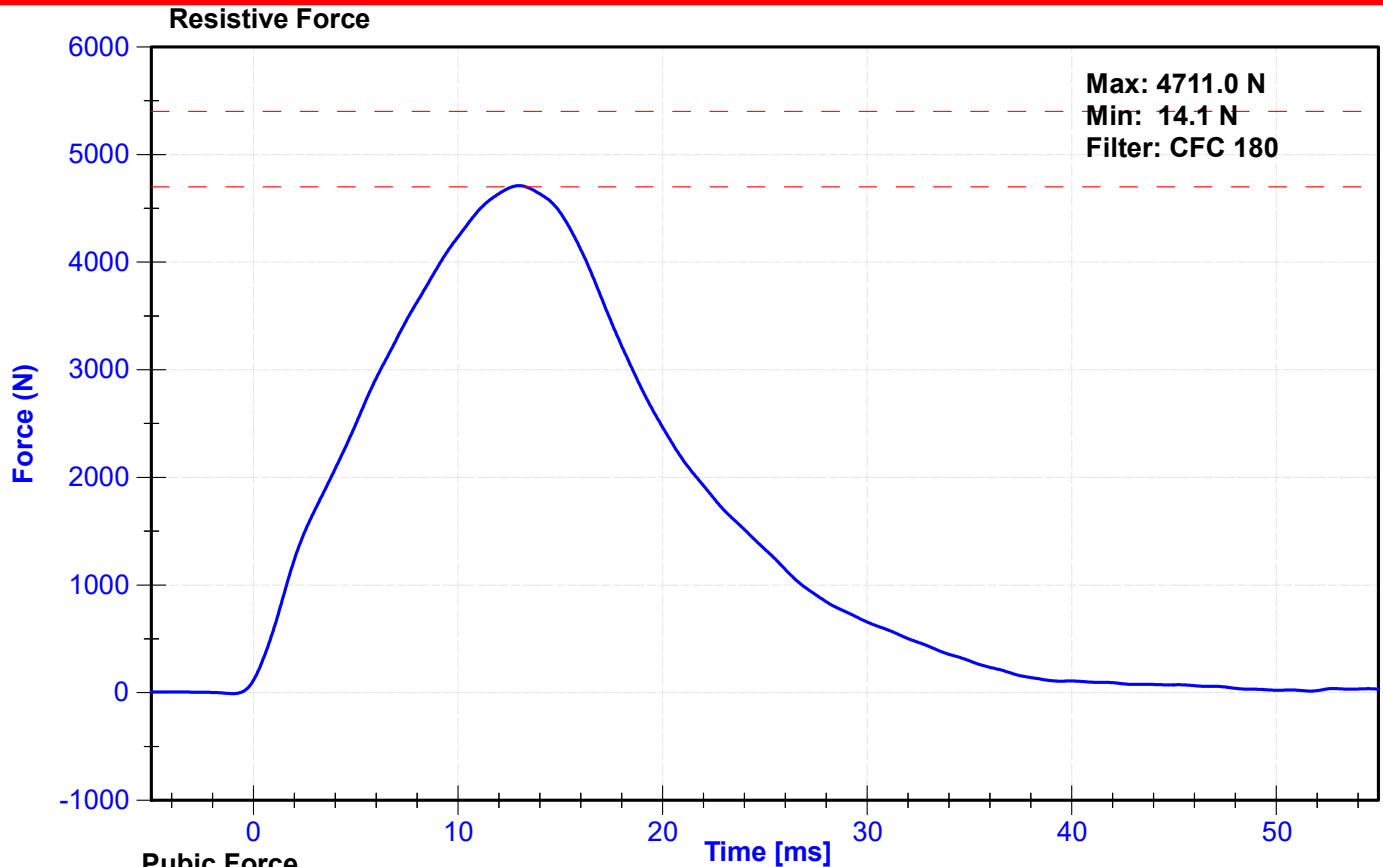
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	39	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Resistive Force	4700	5400	N	4711.0	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.95	Pass
Pubic Force	-1590	-1230	N	-1506.5	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.30	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Pubic Load Cell	Denton	456-FY	8/8/2023	8/7/2024

Probe Acceleration





APPENDIX V

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N _D037__		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X	T21724	Endevco	08/08/2023
		Y	T22281	Endevco	08/08/2023
		Z	T26050	Endevco	08/08/2023
	Redundant	X	T21682	Endevco	08/08/2023
		Y	T25989	Endevco	08/08/2023
		Z	T25864	Endevco	08/08/2023
Thorax Rib Displacement Potentiometers	Upper	Y	0552-01	Honeywell	08/07/2023
	Middle	Y	807	Honeywell	08/07/2023
	Lower	Y	0552-03	Honeywell	08/07/2023
Abdomen Load Cells	Forward	Y	1440	Denton	08/08/2023
	Middle	Y	1525	Denton	08/08/2023
	Rear	Y	1528	Denton	08/08/2023
Lower Spine Accelerometers (T12)		X	P71278	Endevco	08/08/2023
		Y	18618	Endevco	08/10/2023
		Z	18617	Endevco	08/10/2023
Pubic Symphysis Load Cell		Y	456-FY	Denton	08/08/2023

Table 2 – Vehicle Instrumentation

Vehicle Instrumentation		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	A398310	Measurement Specialties	08/02/2023
Vehicle Center of Gravity	Y	A399973	Measurement Specialties	08/02/2023
Vehicle Center of Gravity	Z	A405550	Measurement Specialties	08/02/2023
Left Floor Sill	Y	A280970	Measurement Specialties	09/13/2023
A-Pillar Sill	Y	G21387	Endevco	07/26/2023
A-Pillar Low	Y	G22234	Endevco	09/27/2023
A-Pillar Mid	Y	G22705	Endevco	09/27/2023
B-Pillar Sill	Y	A398317	Measurement Specialties	09/14/2023
B-Pillar Low	Y	A280904	Measurement Specialties	08/09/2023
B-Pillar Mid	Y	A335471	Measurement Specialties	09/13/2023
Driver Seat	Y	A374235	Measurement Specialties	06/01/2023
Engine Top	X	A280861	Measurement Specialties	08/01/2023
Engine Top	Y	A315810	Measurement Specialties	08/01/2023
Firewall	Y	G22904	Endevco	09/28/2023
Right Roof	Y	G22200	Endevco	09/28/2023
Right Floor Sill	Y	G24028	Endevco	08/08/2023
Rear Floorpan	X	G22625	Endevco	09/28/2023
Rear Floorpan	Y	G22677	Endevco	09/27/2023