

REPORT NUMBER: 214P-CAL-23-004

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

**Toyota Motor Corporation
2023 Subaru Solterra
5 Door SUV**

NHTSA No: C20235502

**PREPARED BY:
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March 23, 2023


FINAL REPORT

**PREPARED FOR:
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ENFORCEMENT
OFFICE OF SAFETY COMPLIANCE
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Accepted by

Date: _____

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15. Supplementary Notes																												
16. Abstract A 31.00 km/h (19.3 mph), 285° oblique compliance test was conducted on the subject 2023 Subaru Solterra 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 March 9, 2023. The impact velocity of the vehicle was 31.04 km/h, and the ambient temperature at the struck (passenger's) side of the target vehicle was 21°C. The target vehicle's maximum post-test static crush was 203 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">Front Passenger 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>437.654</td> </tr> <tr> <td>Maximum Thoracic Rib Deflection</td> <td>mm</td> <td>44</td> <td>21.539</td> </tr> <tr> <td>Total Abdominal Force</td> <td>N</td> <td>2500</td> <td>925.901</td> </tr> <tr> <td>Pubic Symphysis Force</td> <td>N</td> <td>6000</td> <td>2040.950</td> </tr> </tbody> </table>						Measurement Description	Front Passenger ATD (ES-2re)			Units	IARV	Result	Head Injury Criteria (HIC36)		1000	437.654	Maximum Thoracic Rib Deflection	mm	44	21.539	Total Abdominal Force	N	2500	925.901	Pubic Symphysis Force	N	6000	2040.950
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Pubic Symphysis Force	N	6000	2040.950																									
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 2023 FMVSS 214 Side Impact Protection Compliance Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH2217D00078. The purpose of this test was to evaluate side impact protection in a 2023 Subaru Solterra 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 2023 Subaru Solterra 5 Door SUV. The subject vehicle was towed into the rigid pole at an angle of 285° and a velocity of 31.04 km/h. The test was conducted by Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on March 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 (ES2re) dummy was placed in the front passenger 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	Front Passenger ATD (ES2re)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	437.654
Upper Rib Deflection	mm	44	21.539
Mid Rib Deflection	mm	44	13.887
Lower Rib Deflection	mm	44	15.240
Abdominal Load (front)	N		149.192
Abdominal Load (mid)	N		297.320
Abdominal Load (rear)	N		488.798
Total Abdominal Force	N	2500	925.901
Pubic Symphysis Force	N	6000	2040.950

SECTION 2

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

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**DATA SHEET NO. 1
TEST VEHICLE INFORMATION AND OPTIONS**

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023

TEST VEHICLE INFORMATION AND OPTIONS

Make	Subaru	Anti-Lock Brakes (ABS)	Yes
Model	Solterra	All-Wheel Drive (AWD)	Yes
Body Style	SUV	Traction Control System (TCS)	Yes
VIN	JTMABABA6PA001328	Electric Stability Control (ECS)	Yes
Body Color	White	Curtain Airbags	Yes
Engine Displacement (L)	N/A	Torso Airbags – Front Seats	Yes
Type / No. Cylinders	N/A	Torso Airbags – Rear Seats	No
Engine Placement	Transverse	Combination/Head Torso Bag	No
Transmission Type	Automatic	Pelvic Airbag – Front Seats	No
Transmission Speeds	Direct Drive	Pelvis Airbag – Rear Seats	No
Overdrive	N/A	Knee Airbag – Driver	Yes
Final Drive	All Wheel Drive	Knee Airbag – Front Passenger	Yes
Odometer Reading (mi)	26 Miles	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	Yes
		Other Safety Restraint	-

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Corporation	GVWR (kg)	2550
Date of Manufacture	04/22	GVWR Front (kg)	1355
Vehicle Type	MPV	GVWR Rear (kg)	1400

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats (Bench or Bucket)	Bucket	Split Bench		
Designated Seating Capacity (DSC)	2	3	N/A	5
Capacity Weight (VCW) (kg)				420
Cargo Weight (RCLW) (kg)				73.8

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	253	258	257	258
Tire Placard	kPa	260	260	260	260

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			Fully Loaded			As Tested		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	541.0	473.0		553.5	525.0		551.5	530.5	
Right	kg	552.0	455.0		587.5	522.5		593.5	494.0	
Ratio	%	54.1	45.9		52.1	47.9		52.8	47.2	
Totals	kg	1093.0	928.0	2021.0	1141.0	1047.5	2188.5	1145.0	1024.5	2169.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	2021	(A)
Weight of Test Dummy	kg	81	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	73.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	2175.8	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	As Delivered	Fully Loaded	As Tested
Driver Door Sill Angle	Deg	- 0.25	- 0.30	-0.25
Front Passenger Sill Angle	Deg	- 0.20	- 0.25	-0.20
Front Bumper-Line Angle	Deg	- 0.05	- 0.05	-0.05
Rear Bumper-Line Angle	Deg	- 0.15	+ 0.10	0.00

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	2853
Vertical Impact Reference Line Aft of Front Axle	mm	1317

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	15
Car Charger	2.5
Ballast (if any)	29.5

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

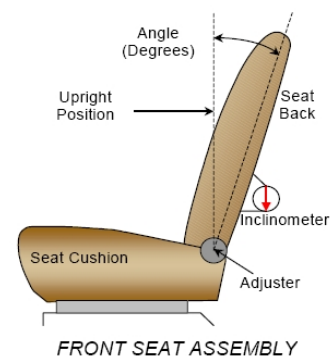
NHTSA No.: C20235502
 Test Date: 03/09/2023

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	2.2
Front Passenger Seat	Degrees	2.2

*Measurement taken on seatback



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	13.8	Max	50	62	72
		Mid	27	40	49
		Min	4	17	27
Front Passenger Seat	13.9	Max	-	-	-
		Mid	-	-	-
		Min	22	34	45

SEAT FORE / AFT POSITION

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

SEAT BELT ANCHORAGE ADJUSTMENT

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

HEAD RESTRAINT ADJUSTMENT

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

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023

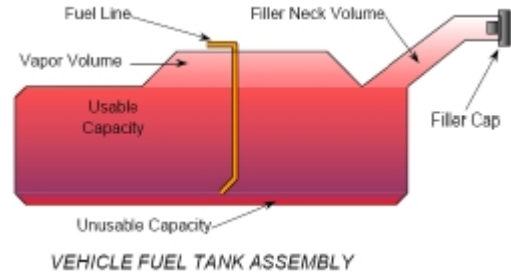
FUEL TANK CAPACITY

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

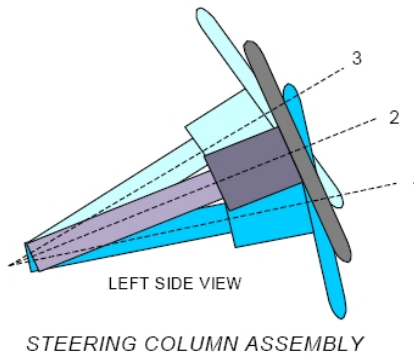
FUEL PUMP

Describe the operation of the fuel pump.

The electrical vehical charging port is on the right side of the vehicle. See form 1 for more information.



STEERING COLUMN POSITIONS

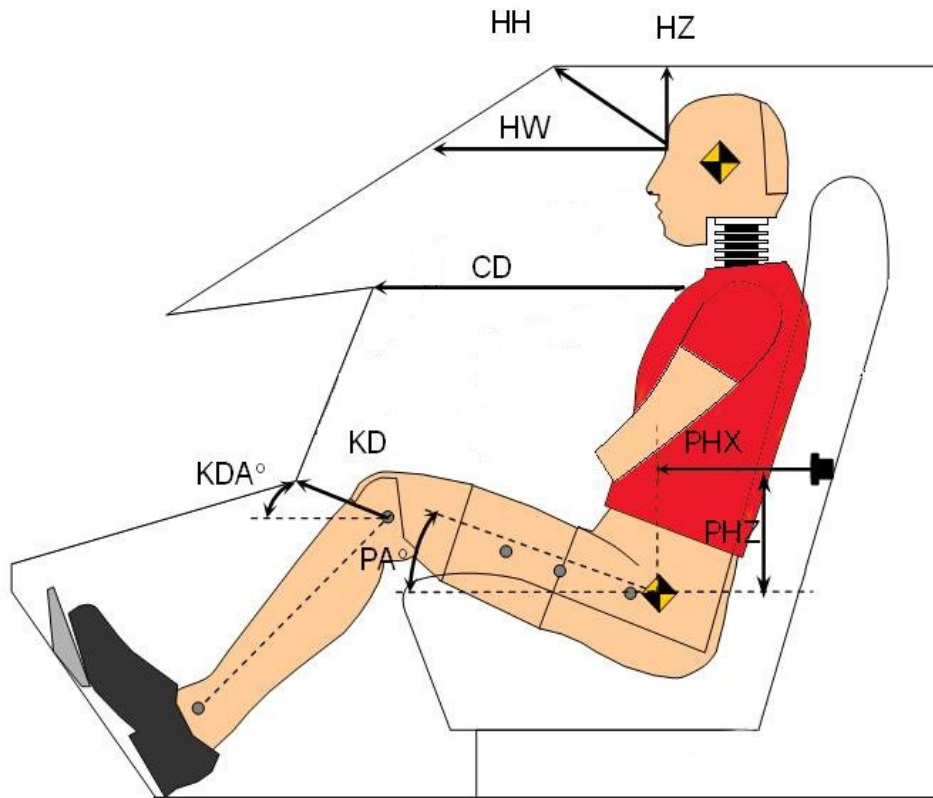


	Degrees	Fore / Aft Position (mm)
Lowermost - Position No. 1	20.3	
Geometric center - Position No. 2	22.5	
Uppermost - Position No. 3	24.7	
Telescoping Steering Wheel Travel		58
Test Position	22.6	29

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023



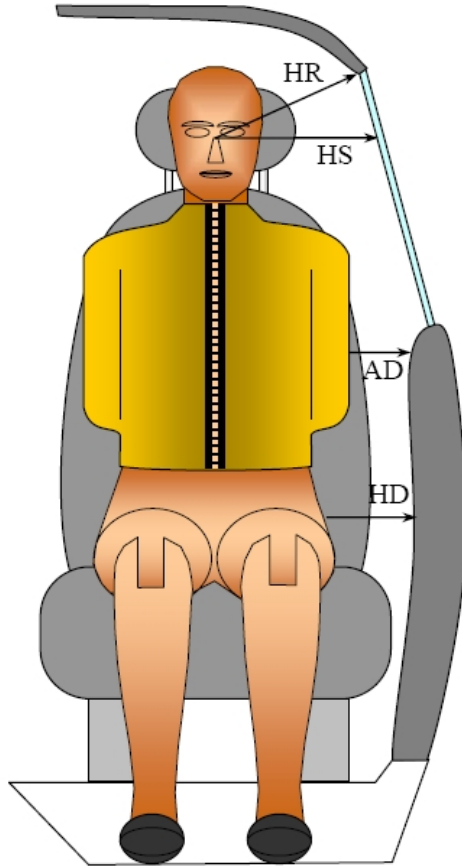
DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Description	Front Passenger	
		Length (mm)	Angle (°)
HH	Head to Header	277	
HW	Head to Windshield	414	
HZ	Head to Roof Liner	100	
CD	Chest to Dash	573	
KD(L) / KDA(L)°	Left Knee to Dash	175	31.3
KD(R) / KDA(R)°	Right Knee to Dash	204	35.4
PAX°	Pelvic Tilt Angle (X-Axis)		21.7
PAY°	Pelvic Tilt Angle (Y-Axis)		0.7
PHX	Hip Point to Striker (X-Axis)	201	
PHZ	Hip Point to Striker (Z-Axis)	133	

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023



FRONT VIEW OF DUMMY

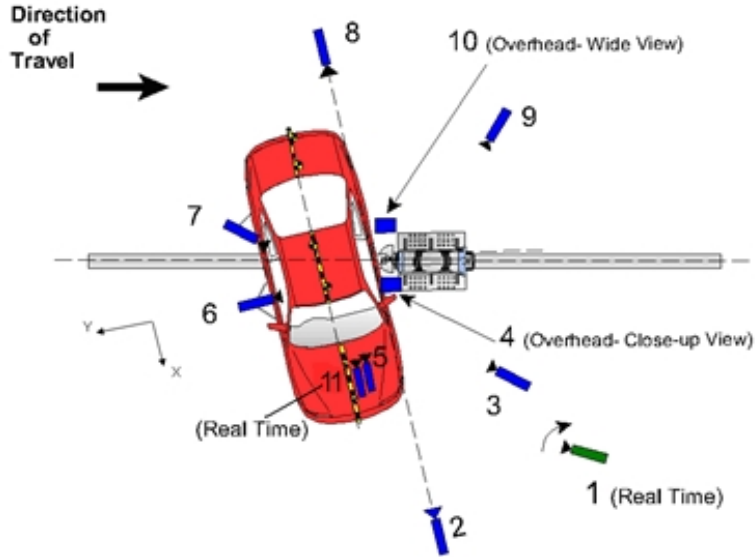
DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Front Passenger
HR	Head to Side Header	mm	210
HS	Head to Side Window	mm	332
AD	Arm to Door	mm	93
HD	H-Point to Door	mm	157

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023



CAMERA LOCATIONS AND DATA

CAMERA LOCATIONS AND DATA

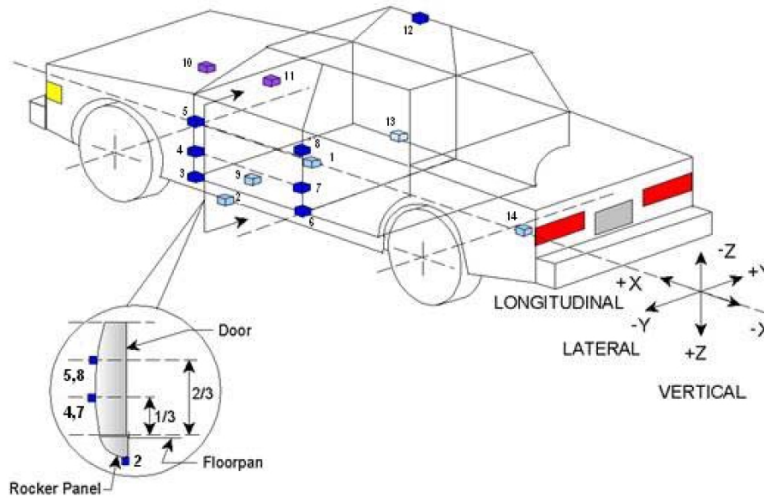
No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Real-time (24 - 30 fps) pan view of impact				Zoom	60
2	Front ground level - impact view	8494	0	-1425	28	1000
3	Impact side 45° - forward pole view	5258	-1055	-1512	24	1000
4	Overhead Close-up view of impact	0	0	-9375	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	-8770	0	-1437	28	1000
9	Impact side 45° - rearward pole view	-5471	-3364	-1546	24	1000
10	Overhead wide - view of impact	0	0	-9375	12.5	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: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2122	-7	755
2	Left Floor Sill	2823	687	748
3	A-Pillar Sill	3274	597	662
4	A-Pillar Low	3288	596	429
5	A-Pillar Mid	3219	663	53
6	B-Pillar Sill	2099	679	763
7	B-Pillar Low	2165	682	391
8	B-Pillar Mid	2109	674	67
9	Seat	2384	602	696
10	Engine	3832	61	229
11	Firewall	3458	55	352
12	Roof	2374	-624	-385
13	Right Floor Sill	2913	-692	744
14	Rear Deck	1004	-29	543

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: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023

Loc. No	Description	Axes	Units	Positive Direction		Negative Direction	
				Max	Time (ms)	Max	Time (ms)
1	Vehicle CG	X	g	1.13	95.55	-8.26	40.60
	Vehicle CG	Y	g	0.96	103.35	-36.82	26.40
	Vehicle CG	Z	g	17.93	48.90	-15.17	35.25
	Vehicle CG Resultant	N/A	g	37.54	26.35	0.03	-11.25
2	Floor Sill (Left)	Y	g	1.88	110.35	-35.87	21.90
3	A Pillar Sill	Y	g	15.02	32.75	-37.00	37.85
4	A Pillar Low	Y	g	12.99	81.75	-46.70	22.85
5	A Pillar Mid	Y	g	38.30	28.95	-51.84	23.40
6	B Pillar Sill	Y	g	179.05	25.75	-170.59	20.35
7	B Pillar Low	Y	g	16.91	48.95	-57.93	15.70
8	B Pillar Mid	Y	g	37.03	51.05	-77.96	39.45
9	Front Passenger Seat	Y	g	5.20	51.50	-93.21	19.55
10	Engine Top	X	g	5.77	78.15	-14.87	45.00
	Engine Top	Y	g	2.80	148.75	-28.84	44.25
11	Firewall	Y	g	1.13	110.25	-25.94	30.05
12	Roof	Y	g	12.07	41.75	-50.67	36.25
13	Floor Sill (Right)	Y	g	11.16	18.60	-48.66	25.90
14	Rear Deck	X	g	12.37	36.00	-16.78	28.45
	Rear Deck	Y	g	1.39	132.85	-32.78	25.90

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV NHTSA No.: C20235502
 Test Facility: Calspan Test Date: 03/09/2023

Dummy Serial No. D037

Description	Axes	Positive Direction		Negative Direction	
		MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (g)					
Longitudinal	X	4.31	169.80	-18.07	48.75
Lateral	Y	18.84	95.50	-59.17	52.10
Vertical	Z	21.52	48.75	-10.13	104.75
Resultant	N/A	64.26	52.10		
HIC36 (t1, t2)	N/A	437.65		t1 = 40.80	t2 = 67.85
THORAX DEFLECTION (mm)					
Upper Rib	Y	21.54	53.75	-4.69	26.20
Middle Rib	Y	13.89	53.10	-4.54	78.90
Lower Rib	Y	15.24	49.05	-1.80	75.00
ABDOMINAL FORCES (N)					
Front	Y	149.19	44.80	-13.74	14.85
Middle	Y	297.32	45.95	-8.56	101.65
Rear	Y	488.80	47.25	-10.25	90.95
SUM	N/A	925.90	46.40		
PELVIS FORCES (N)					
Pubic Symphysis	Y	7.94	297.15	-2040.95	54.90

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

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023

IMPACT POINT DATA

Measured Parameter	Units	Value
Vertical Impact Ref Line - Aft of Front Axle, Intended Impact Pt	mm	1317
Actual Impact Point - Aft of Front Axle	mm	1322
Difference	mm	5

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Passenger Seat Dummy (ES2re)
Head Contact	Side Header, Curtain Airbag & Head Restraint
Upper Torso Contact	Seat Back
Lower Torso Contact	Seat Back
Left Knee Contact	Right Knee
Right Knee Contact	Passenger 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	A-Pillar & C-Pillar Buckled
Sill Separation	138 mm of separation on pinch weld at impact point
Windshield Damage	Cracked throughout with separation along A-pillar
Side Window Damage	Front Passenger window shattered completely
Other Notable Effects	None

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023

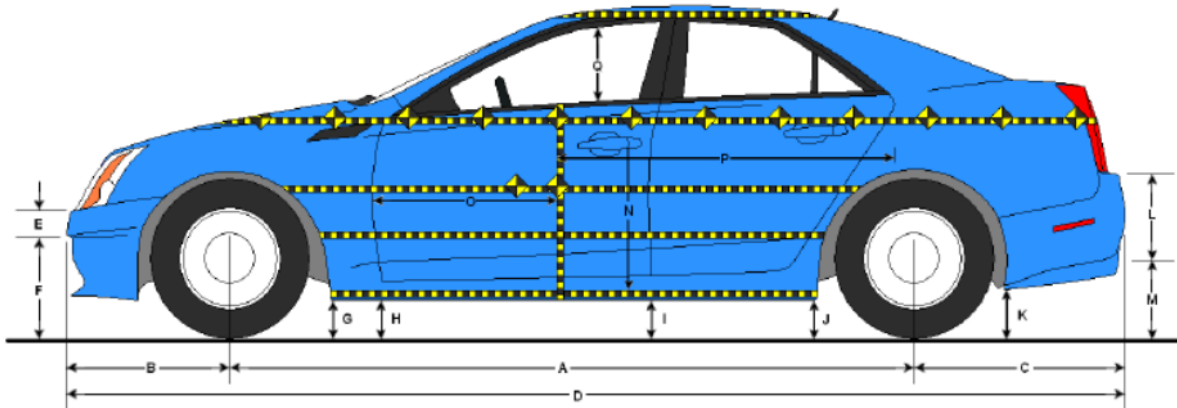
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023



LEFT SIDE VIEW

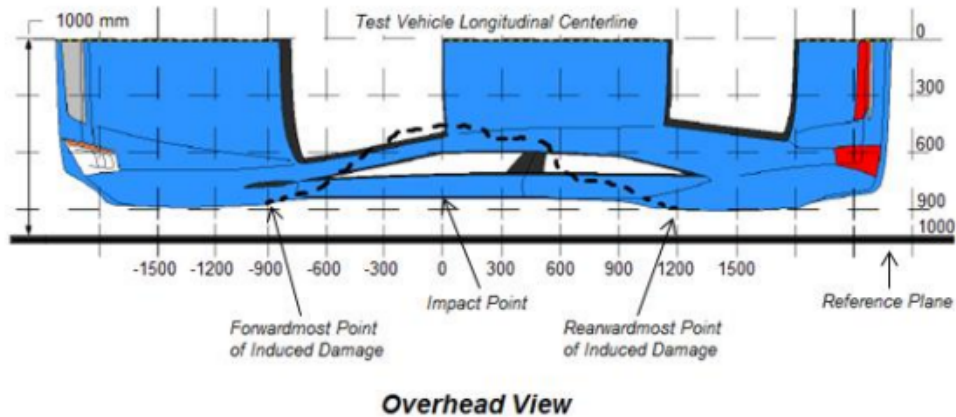
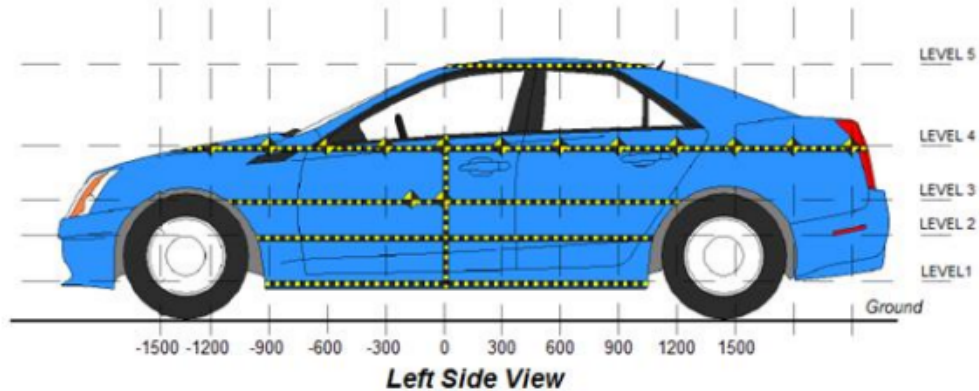
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

No.	Measurement Description	Pre-Test	Post-Test	Difference
A	Vehicle Wheelbase	2853	2871	-18
B	Front Axle to FSOV	911	877	34
C	Rear Axle to RSOV	926	926	0
D	Total Vehicle Length at Centerline	4690	4674	15
E	Front Bumper Thickness	80	80	0
F	Front Bumper Bottom to Ground	440	436	4
G	Sill Height at Front Wheel Well	223	223	0
H	Sill Height at Front Door Leading Edge	226	227	-1
I	Sill Height at B Pillar	237	234	3
J1	Sill Height at Rear Wheel Well	310	311	-1
J2	Pinch Weld Height at Rear Wheel Well	280	281	-1
K	Sill Height Aft of Rear Wheel Well	277	280	-3
L	Rear Bumper Thickness	280	280	0
M	Rear Bumper Bottom to Ground	370	365	5
N	Sill Height to Window Bottom Sill	904	907	-3
O	Front Door Leading Edge to Impact CL	752	720	33
P	Rear Door Trailing Edge to Impact CL	1345	1306	40
Q	Front Window Opening	378	362	16
R	Right Side Length	4630	4611	19
S	Left Side Length	4630	4634	-4
T	Vehicle Width at B-Pillars	1831	1780	51

DATA SHEET NO. 14
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023



MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	409	139	0
2	Occupant H-Point	mm	700	195	0
3	Mid-Door	mm	773	203	0
4	Window Sill	mm	1071	165	0
5	Window Top	mm	1541	52	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: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023

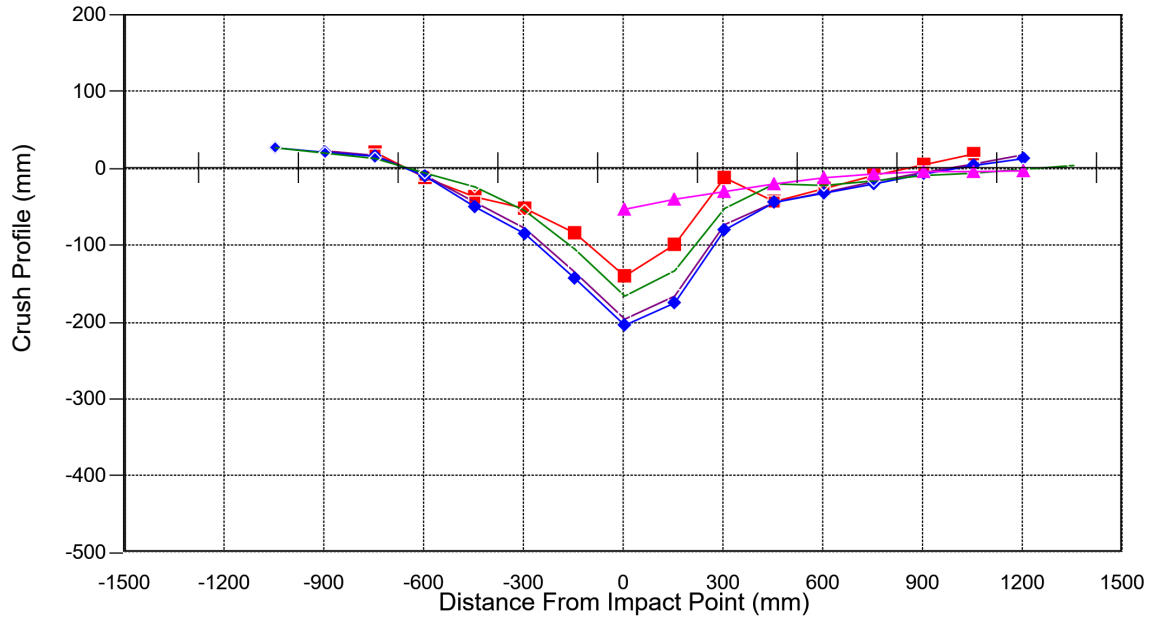
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1500															
-1350															
-1200															
-1050			-930	-822				-958	-850				28	28	
-900		-928	-926	-840			-952	-948	-861			24	22	21	
-750	-909	-927	-925	-849		-931	-945	-942	-863		22	18	17	14	
-600	-896	-923	-923	-839		-885	-915	-914	-834		-11	-8	-9	-5	
-450	-883	-921	-921	-834		-847	-878	-872	-811		-36	-43	-49	-23	
-300	-870	-917	-918	-841		-819	-840	-834	-787		-51	-77	-84	-54	
-150	-866	-914	-915	-844		-783	-780	-773	-740		-83	-134	-142	-104	
0	-867	-911	-913	-849	-623	-728	-716	-710	-684	-571	-139	-195	-203	-165	-52
150	-871	-908	-910	-849	-641	-773	-743	-736	-717	-602	-98	-165	-174	-132	-39
300	-874	-905	-909	-850	-644	-863	-833	-830	-799	-615	-11	-72	-79	-51	-29
450	-876	-904	-907	-849	-644	-834	-861	-864	-830	-625	-42	-43	-43	-19	-19
600	-879	-902	-905	-854	-640	-854	-872	-874	-833	-629	-25	-30	-31	-21	-11
750	-888	-906	-906	-859	-635	-880	-890	-887	-844	-629	-8	-16	-19	-15	-6
900	-902	-919	-914	-862	-627	-908	-915	-908	-854	-624	6	-4	-6	-8	-3
1050	-915	-929	-925	-861	-619	-935	-936	-930	-856	-616	20	7	5	-5	-3
1200		-929	-929	-859	-605		-948	-943	-859	-603		19	14	0	-2
1350				-857					-862					5	
1500															

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
 Test Facility: Calspan

NHTSA No.: C20235502
 Test Date: 03/09/2023



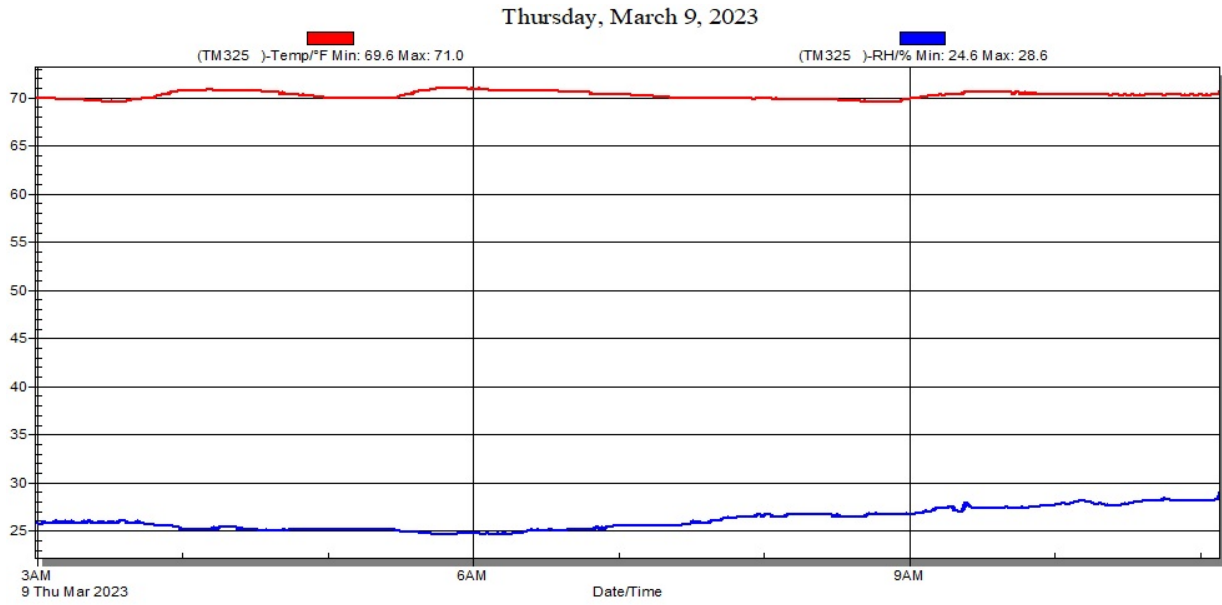
— LEVEL 1 Side Sill: 409 mm above ground	— LEVEL 2 H-Point: 700 mm above ground	— LEVEL 3 Mid Door: 773 mm above ground
— LEVEL 4 Window Sill: 1071 mm above ground	— LEVEL 5 Window Top: 1541 mm above ground	

Vehicle Exterior Crush Measurements - Visual Representation

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

Test Vehicle: 2023 Subaru Solterra 5 Door SUV
Test Facility: Calspan

NHTSA No.: C20235502
Test Date: 03/09/2023



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

APPENDIX I
PHOTOGRAPHS

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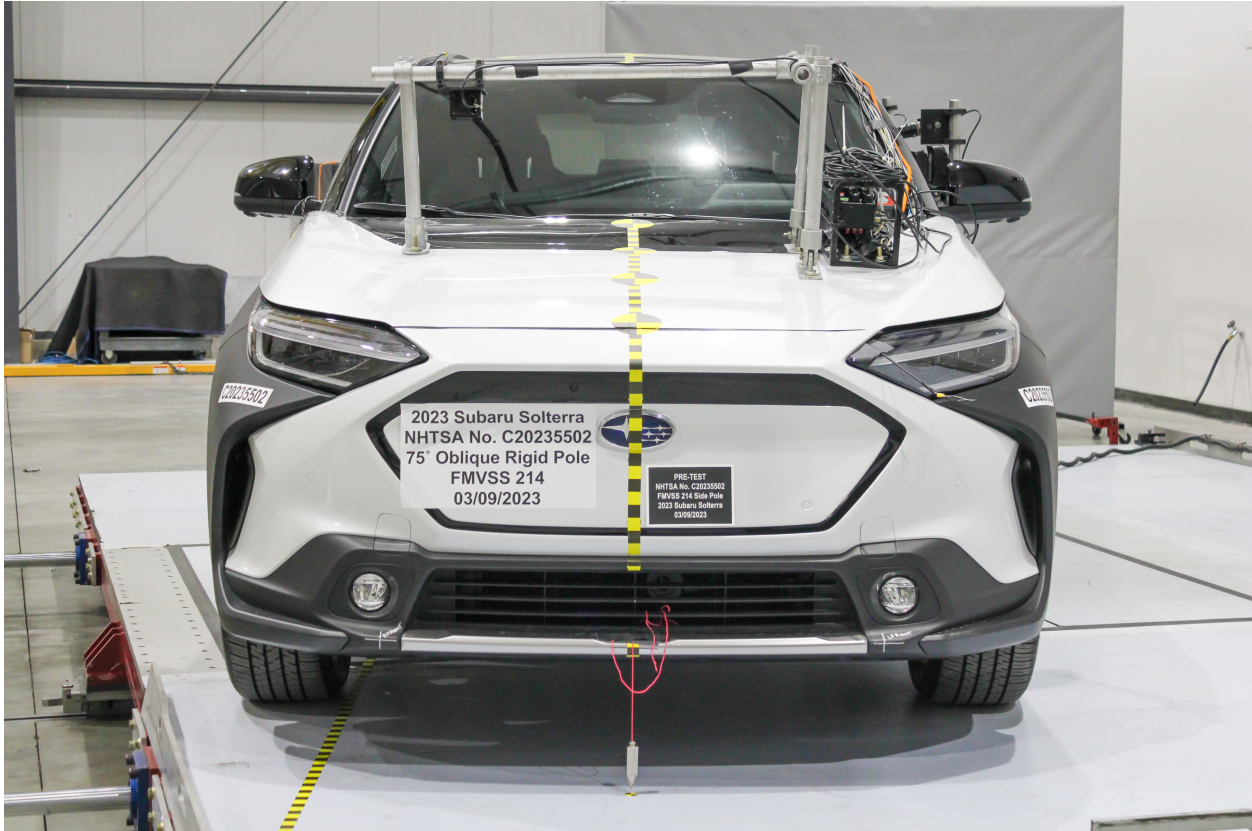


Figure A-1: Pre-Test Frontal View of Test Vehicle



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

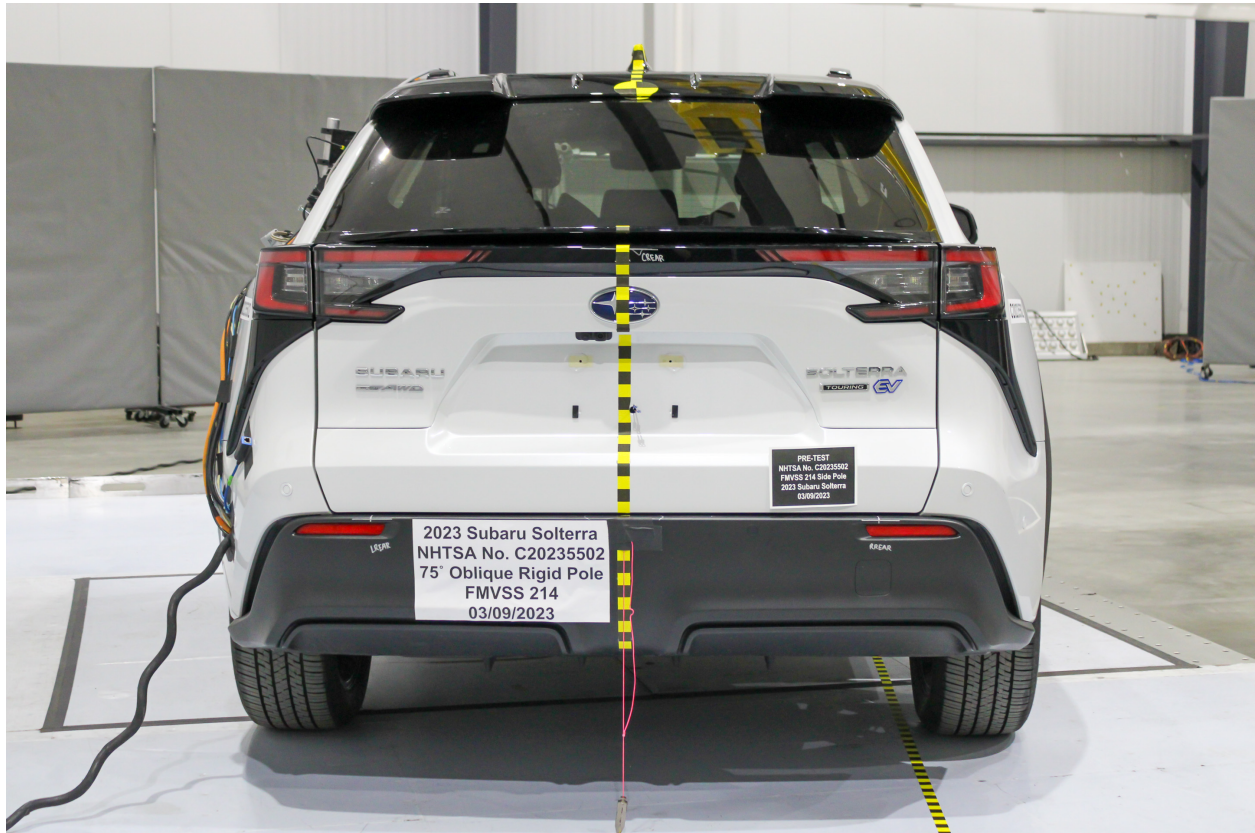


Figure A-3: Pre-Test Rear View of Test Vehicle



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

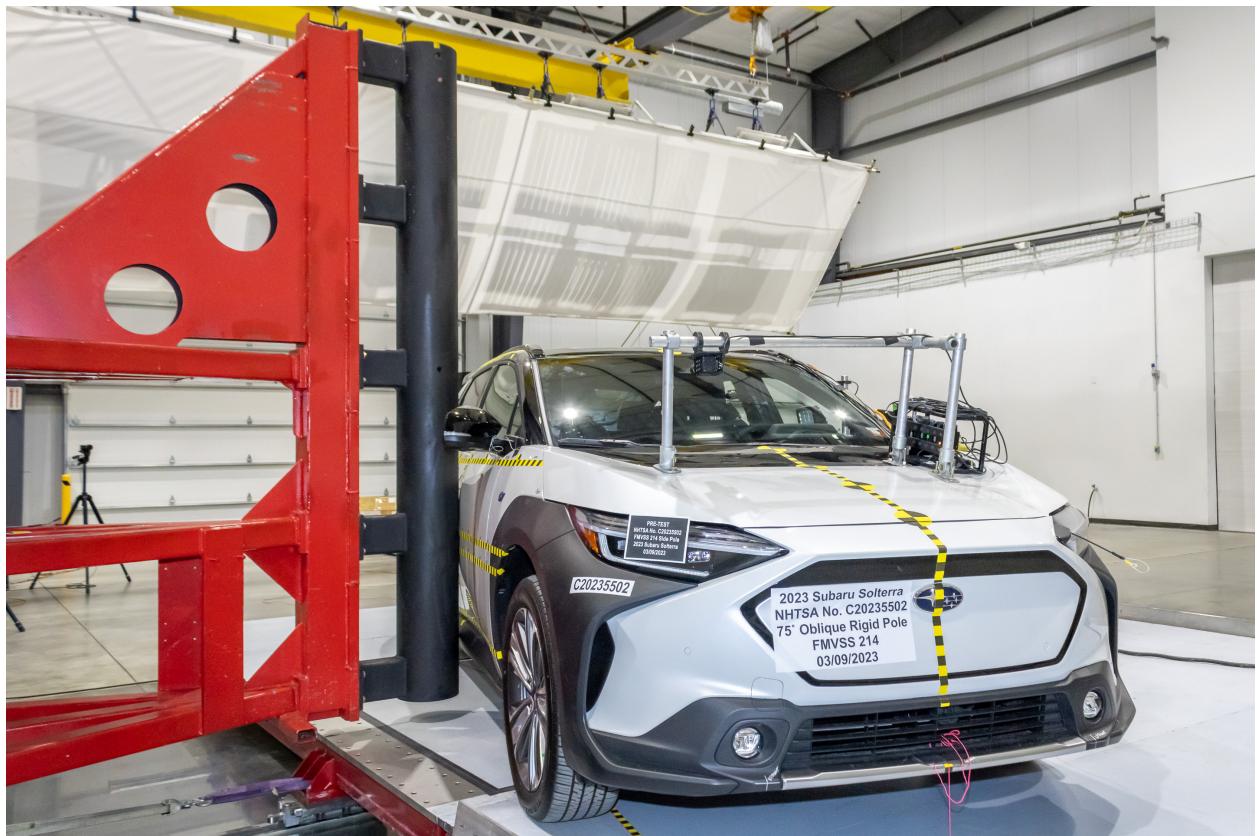


Figure A-7: Pre-Test Impacted Side $\frac{3}{4}$ Front View of Vehicle and Pole



Figure A-8: Pre-Test Impacted Side $\frac{3}{4}$ 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

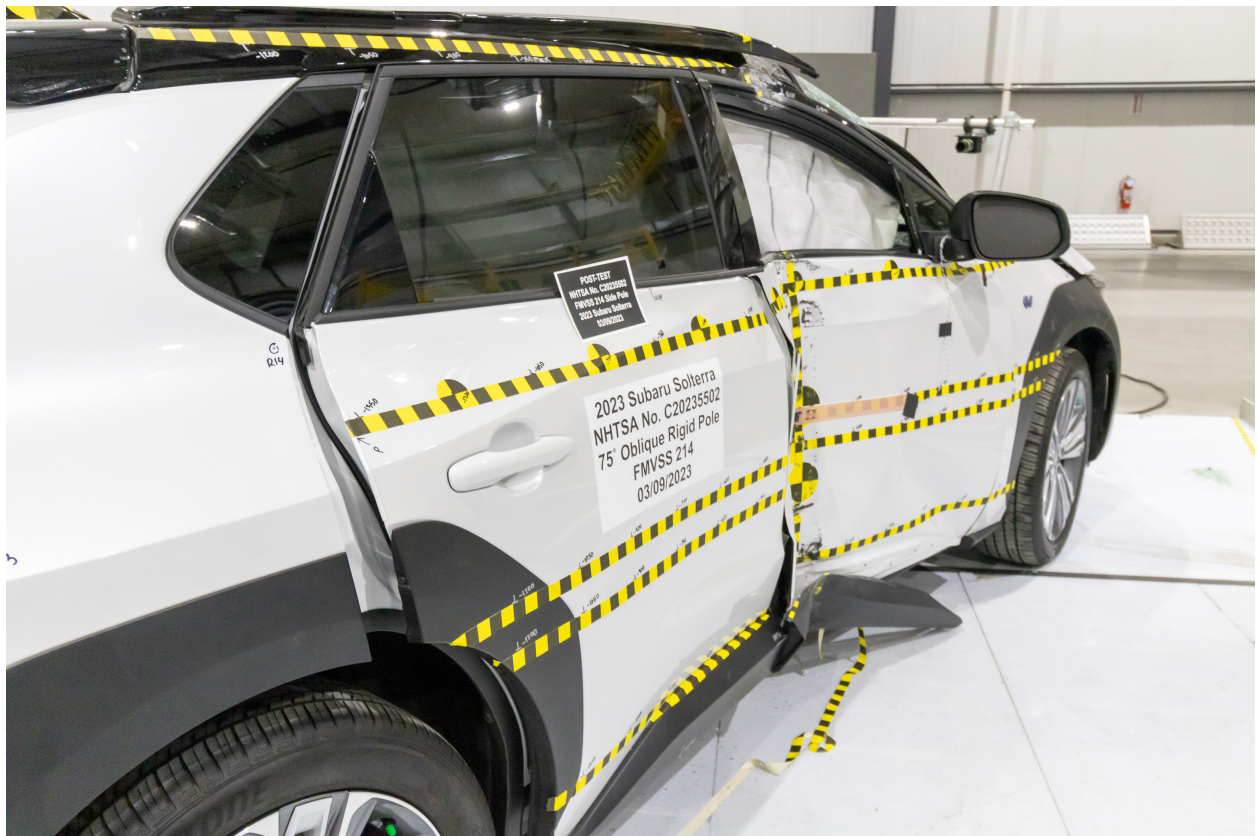



Figure A-23: Post-Test 3/4 Rear View of Impact Zone



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

C20235502

MFD. BY: TOYOTA MOTOR CORPORATION 04/22
GVWR: 2550KG (5620LB)
GAWR: FRT. 1355KG (2985LB) WITH 235/50R20 TIRES.
20X7 1/2J RIMS.
RR. 1400KG (3085LB) WITH 235/50R20 TIRES.
20X7 1/2J RIMS.
THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR
VEHICLE SAFETY AND THEFT PREVENTION STANDARDS IN EFFECT ON
THE DATE OF MANUFACTURE SHOWN ABOVE.
JTMABABA6PA001328 MPV



C/TR: 2VP/EA20 YEAM15L-SWDHSA
TM: Q910-QA10 MADE IN JAPAN 213 AA

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

TIRE AND LOADING INFORMATION RENSEIGNEMENTS SUR LES PNEUS ET LE CHARGEMENT

SEATING CAPACITY: TOTAL 5
FRONT 2: REAR 3
The combined weight of occupants and cargo should never exceed 420 kg or 925 lbs.

NOMBRE DE PLACES: TOTAL 5
AVANT 2: ARRIÈRE 3
Le poids total des occupants et du chargement ne doit jamais dépasser 420 kg ou 925 lb.

TIRE	SIZE	COLD TIRE PRESSURE	PNEU	DIMENSIONS	PRESSION DES PNEUS À FROID
FRONT	235/50R20 100V	260kPa, 38PSI	AVANT	235/50R20 100V	260kPa, 38PSI
REAR	235/50R20 100V	260kPa, 38PSI	ARRIÈRE	235/50R20 100V	260kPa, 38PSI
SPARE	NONE	NONE	DE SECOURS	AUCUN	AUCUN

SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION.

VOIR LE MANUEL DE L'USAGER POUR PLUS DE RENSEIGNEMENTS.

YZ 42D80

C20235502

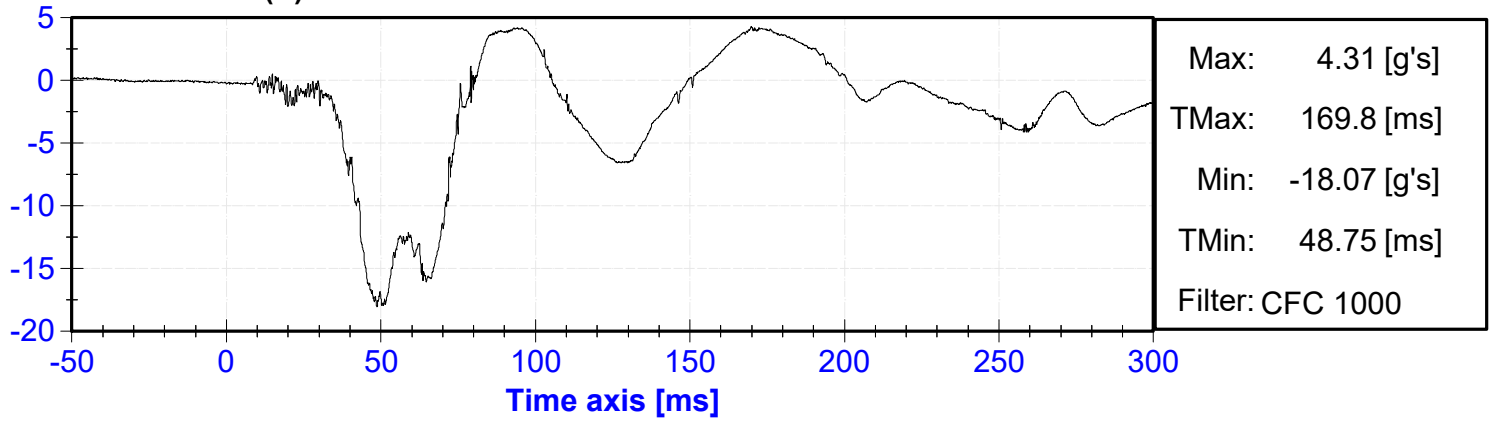
Figure A-26: Close-Up View of Vehicle's Tire Placard Label

APPENDIX II
ES-2re DUMMY RESPONSE DATA TRACES

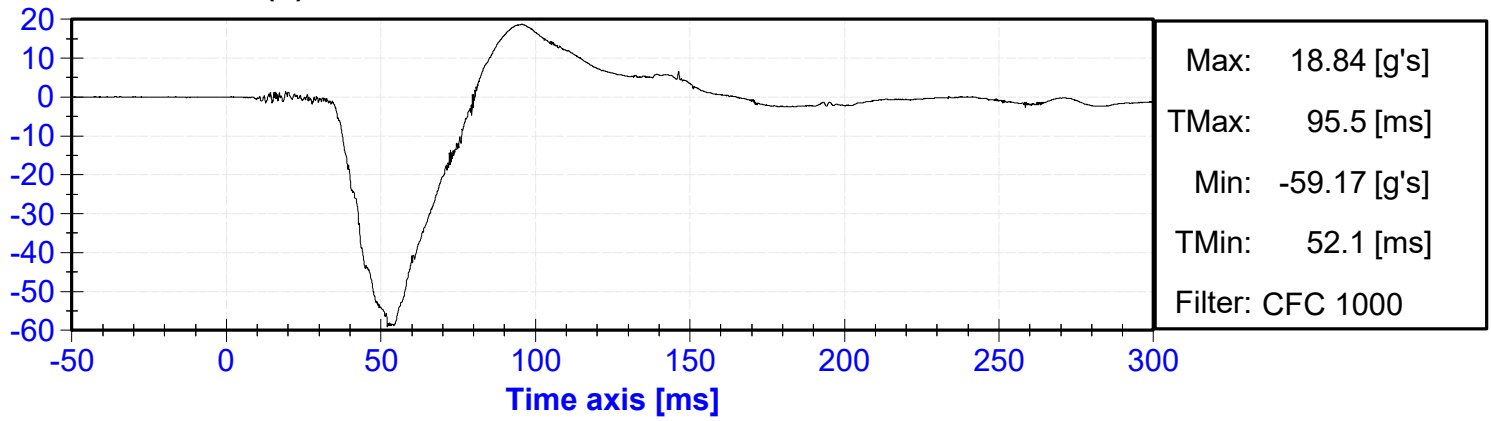
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10	ES-2re Middle Thorax Rib Deflection Rate vs. Time	II-5
11	ES-2re Lower Thorax Rib Deflection Rate vs. Time	II-5
12	ES-2re Middle Thorax Rib Deflection (Y) vs. Time	II-5
13	ES-2re Lower Thorax Rib Deflection (Y) vs. Time	II-6
14	ES-2re Front Abdomen Force (Y) vs. Time	II-6
15	ES-2re Middle 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

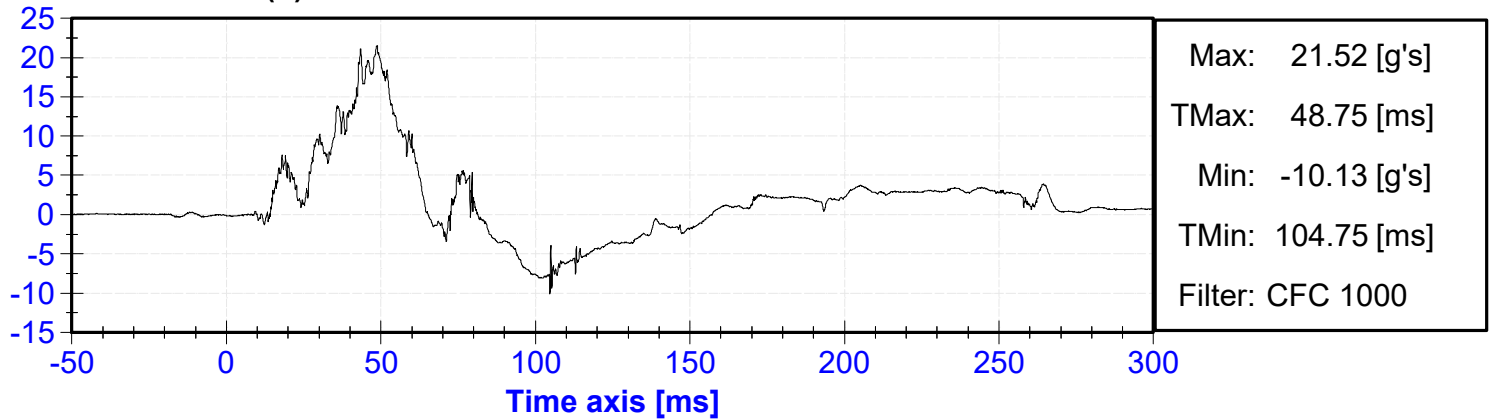
ES-2re Head (X) Acceleration vs. Time



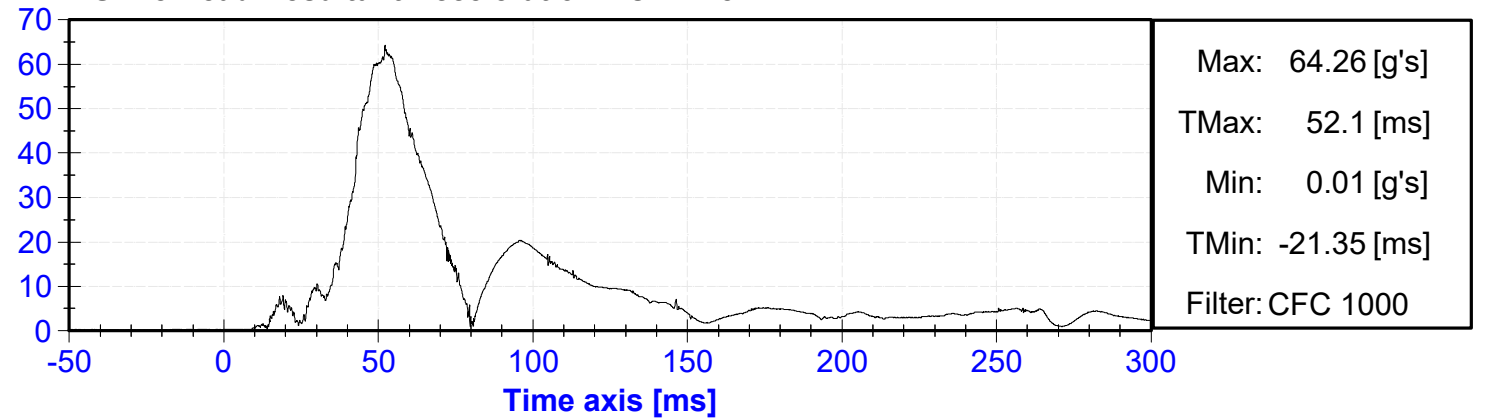
ES-2re Head (Y) Acceleration vs. Time



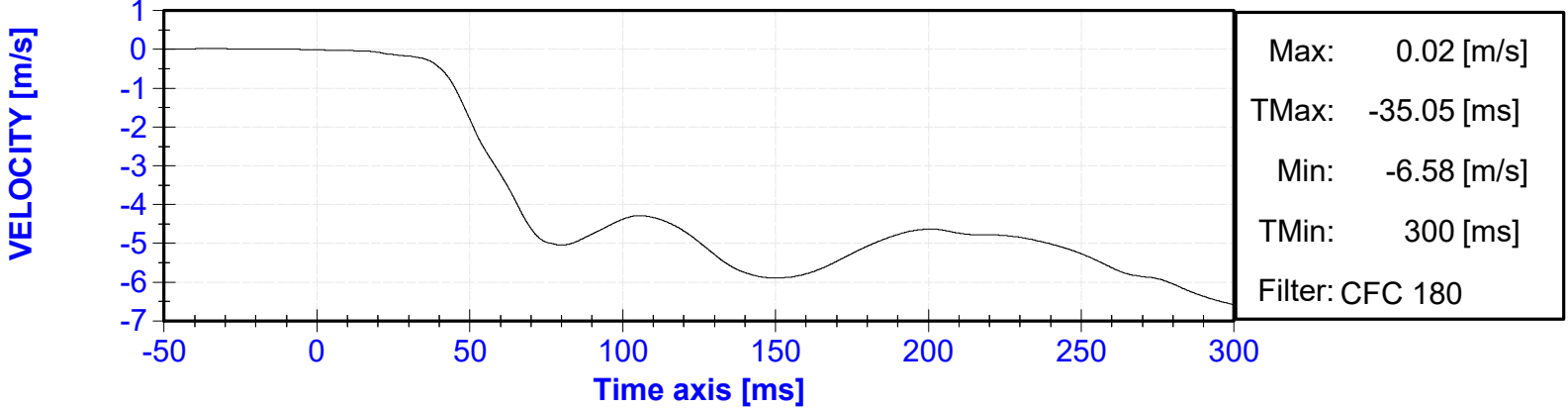
ES-2re Head (Z) Acceleration vs. Time



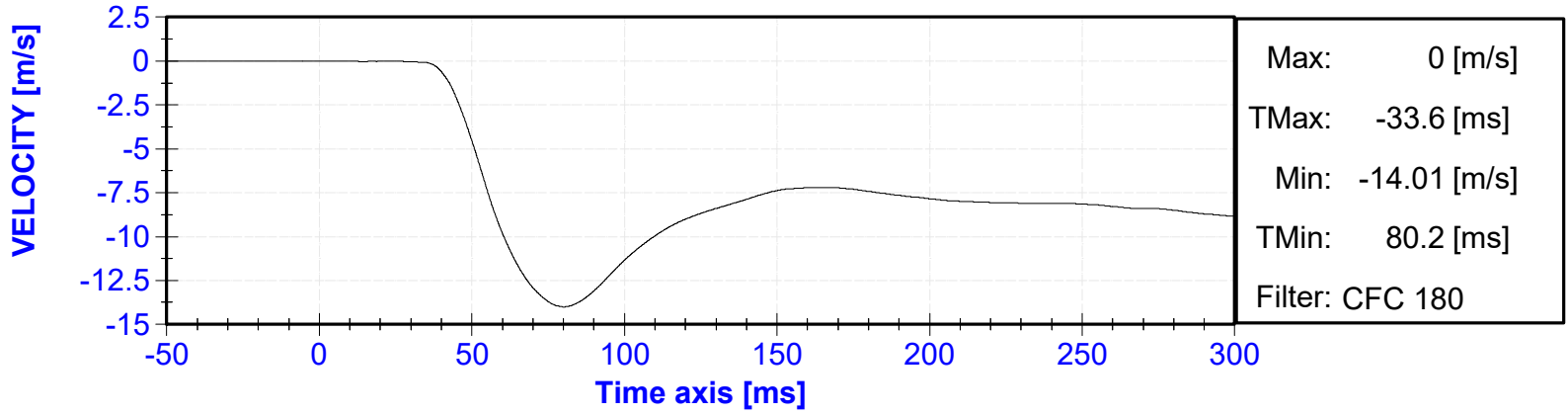
ES-2re Head Resultant Acceleration vs. Time



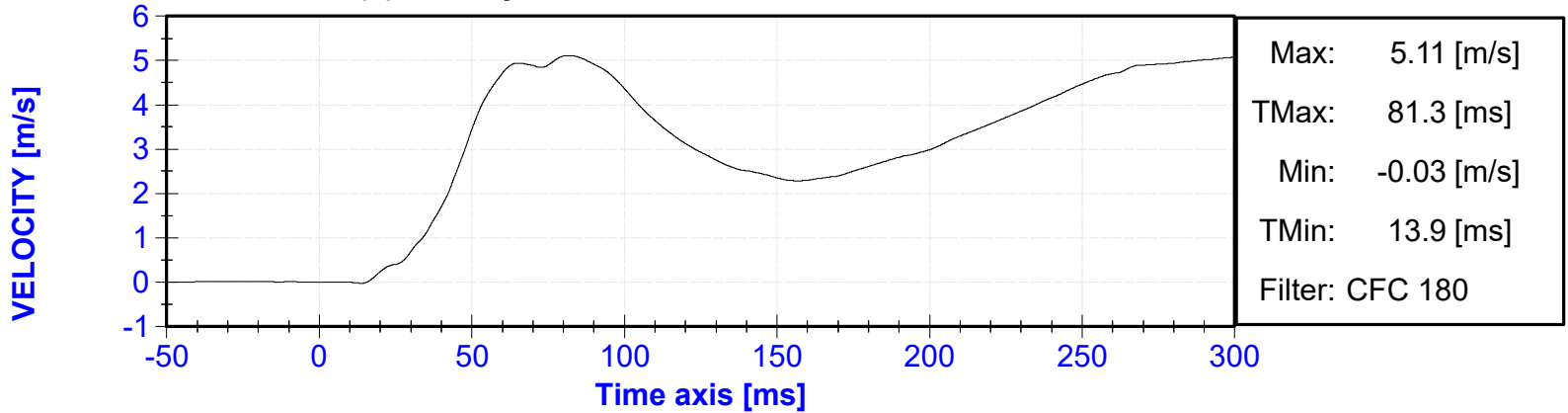
ES-2re Head (X) Velocity vs. Time



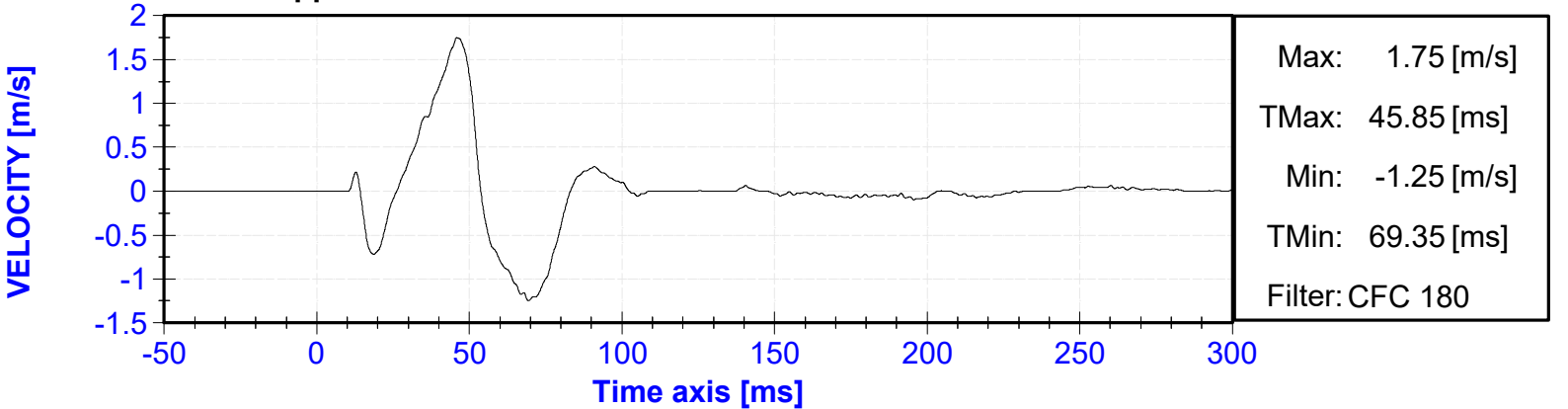
ES-2re Head (Y) Velocity vs. Time



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

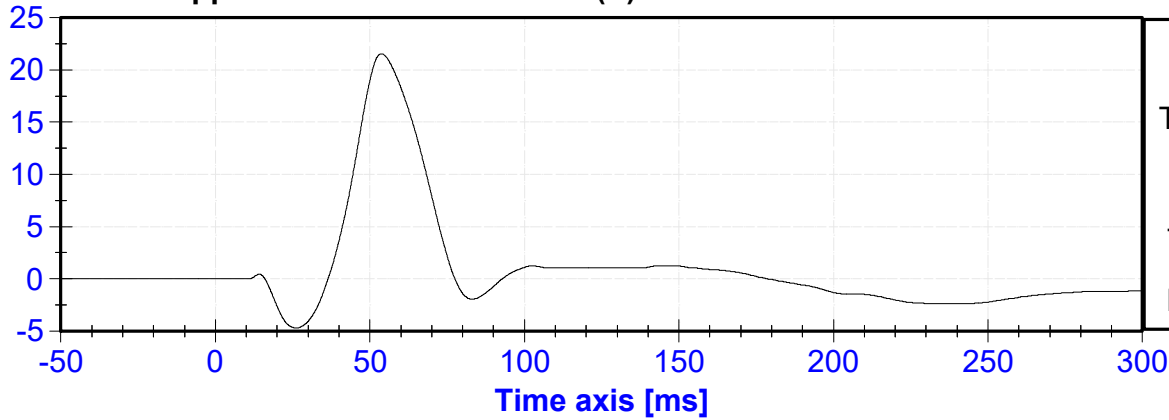


ES-2re Upper Thorax Rib Deflection Rate vs. Time



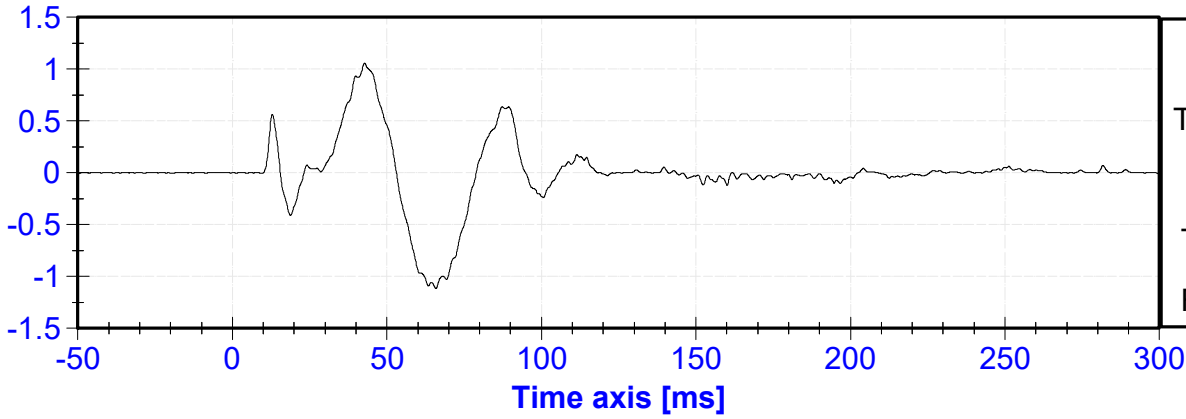
ES-2re Upper Thorax Rib Deflection (Y) vs. Time

DISPLACEMENT [mm]



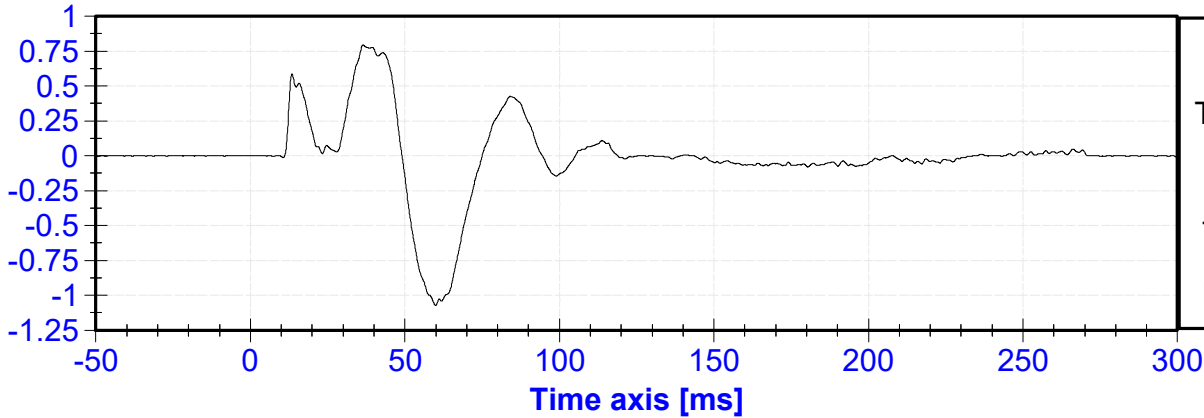
ES-2re Middle Thorax Rib Deflection Rate vs. Time

VELOCITY [m/s]



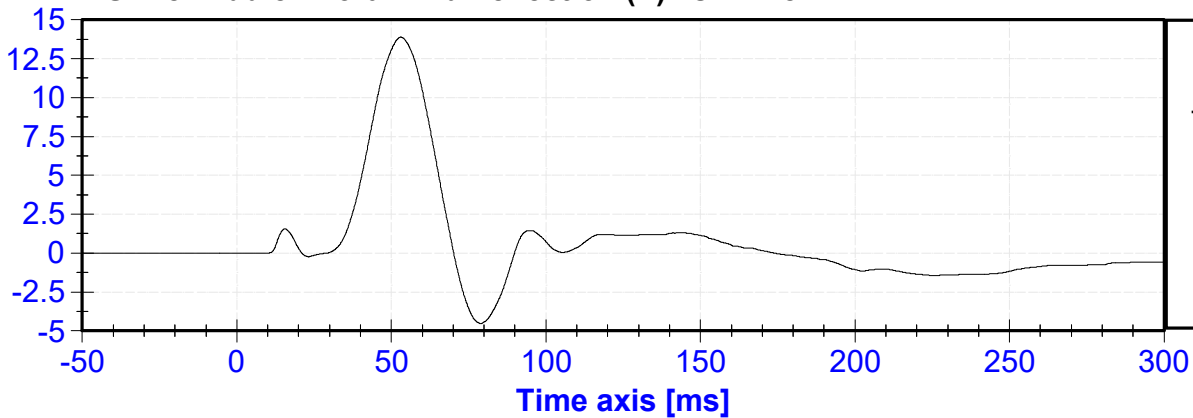
ES-2re Lower Thorax Rib Deflection Rate vs. Time

VELOCITY [m/s]

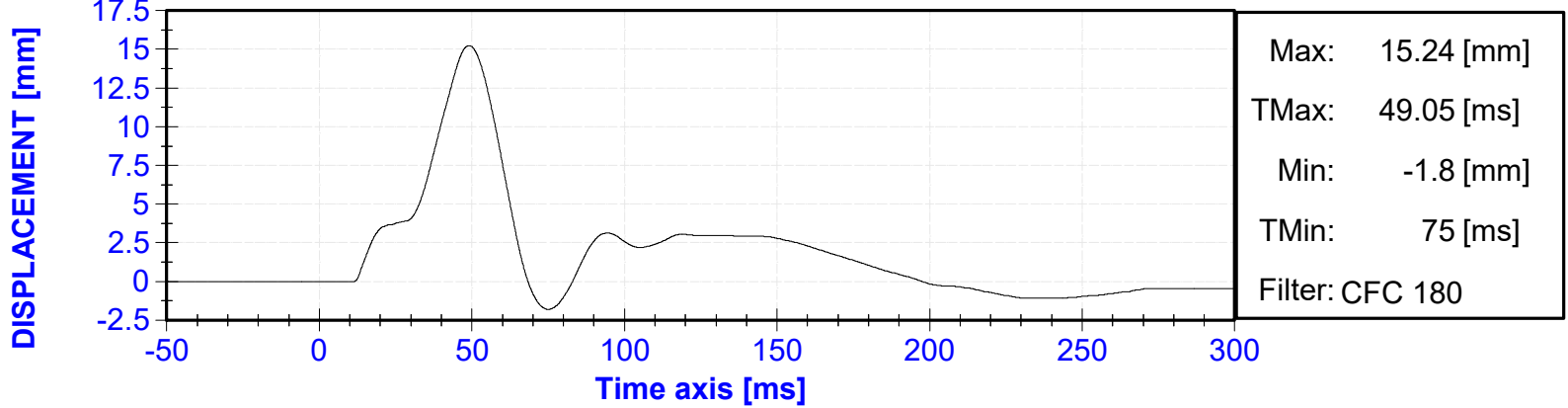


ES-2re Middle Thorax Rib Deflection (Y) vs. Time

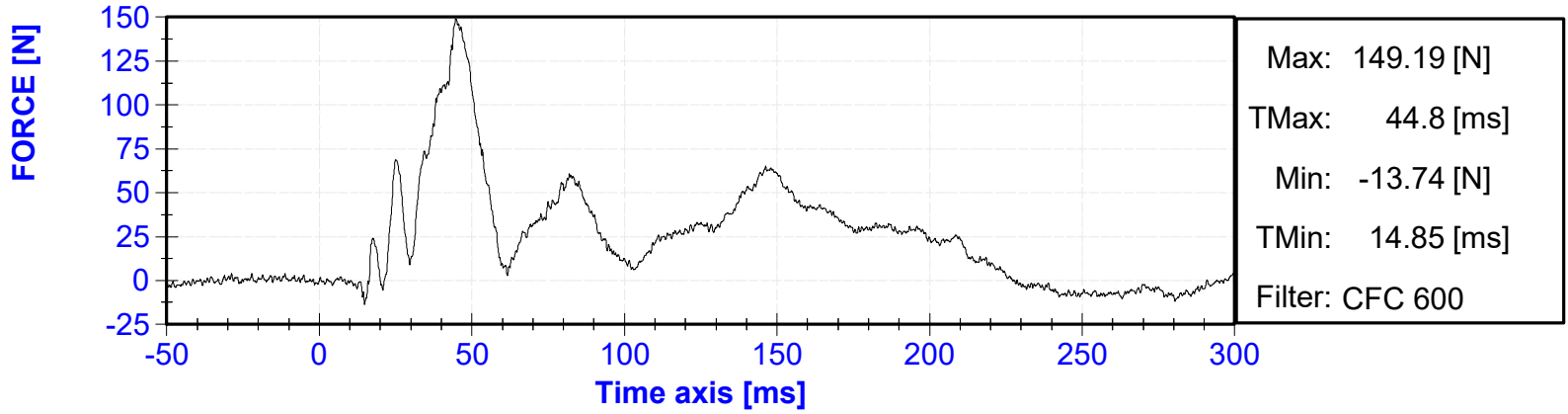
DISPLACEMENT [mm]



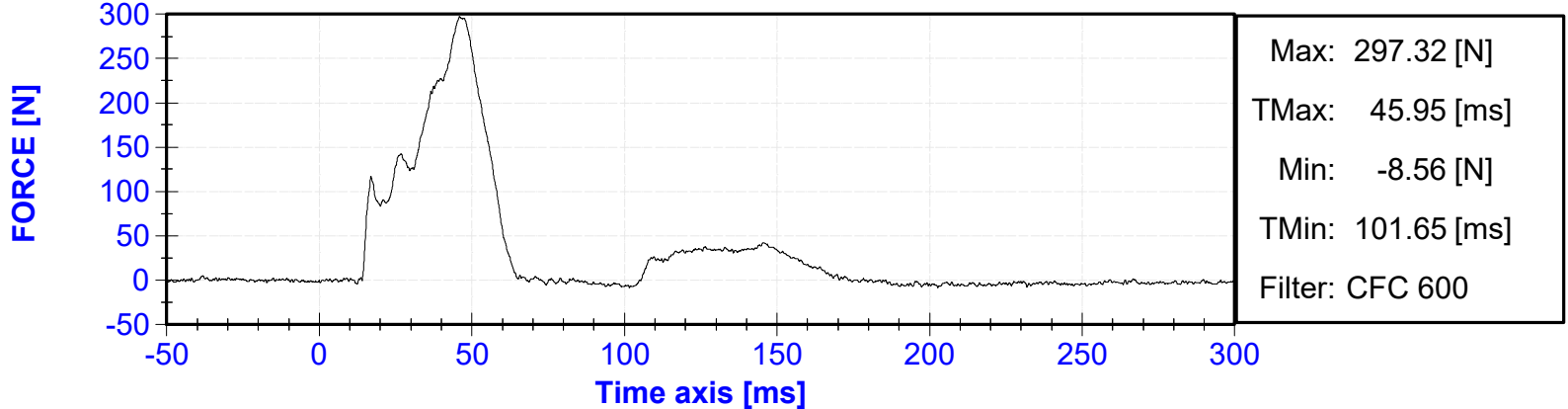
ES-2re Lower Thorax Rib Deflection (Y) vs. Time



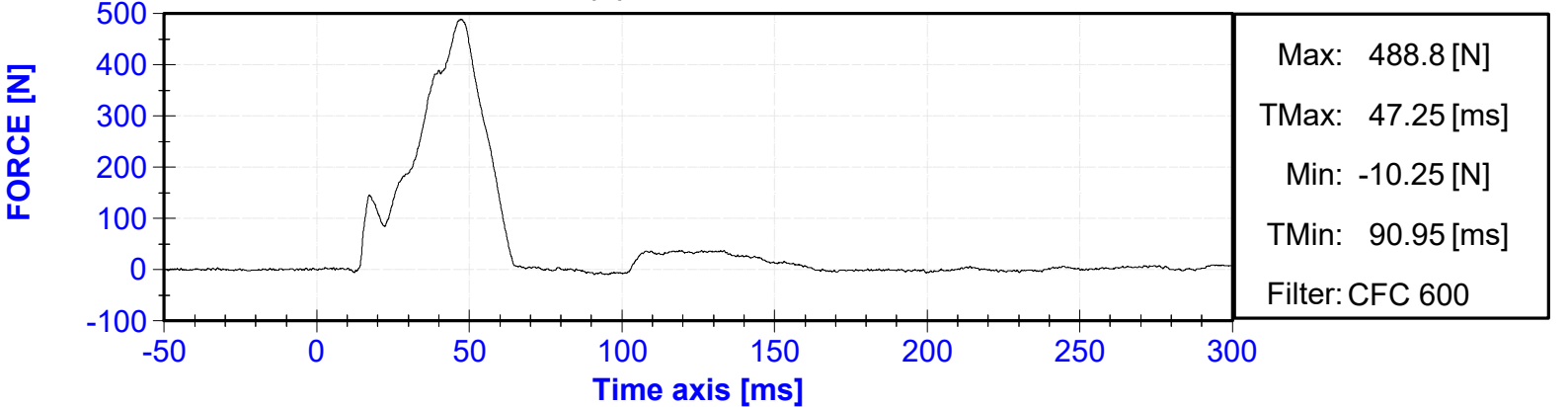
ES-2re Front Abdomen Force (Y) vs. Time



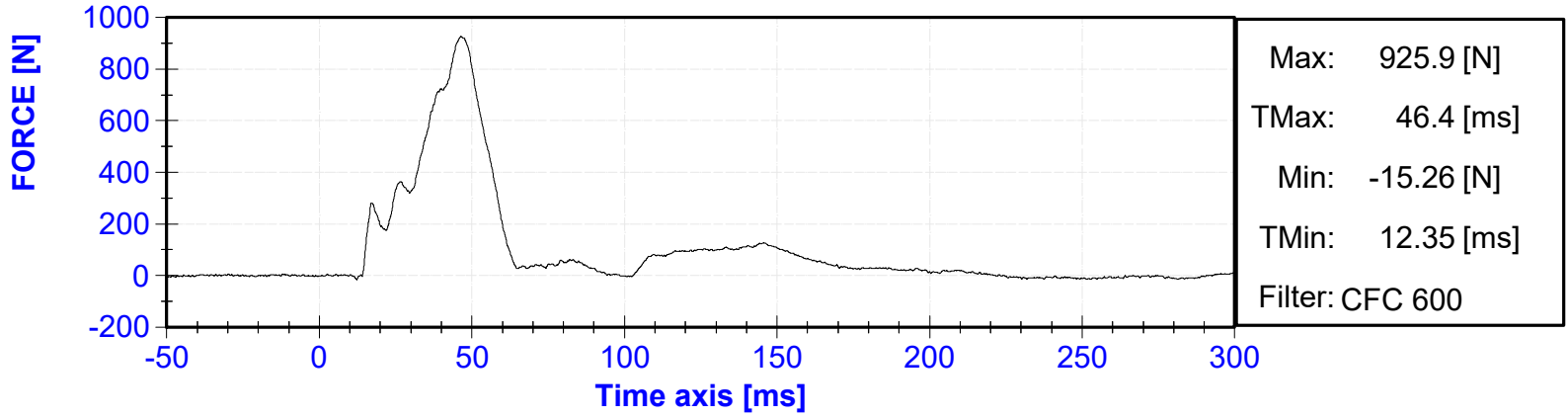
ES-2re Middle Abdomen Force (Y) vs. Time



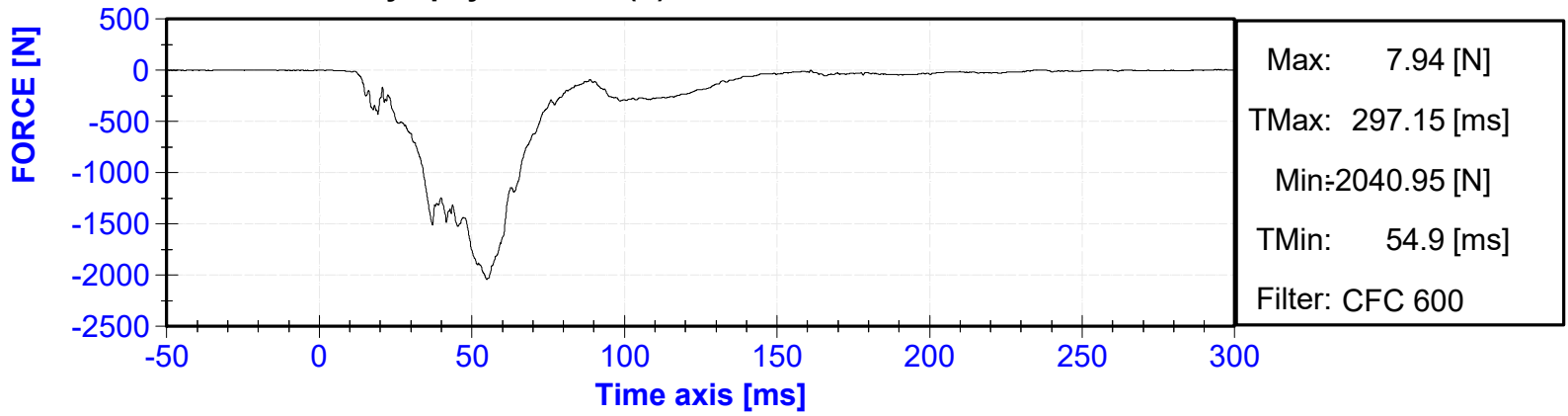
ES-2re Rear Abdomen Force (Y) vs. Time



ES-2re Sum of Abdomen Forces vs. Time



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



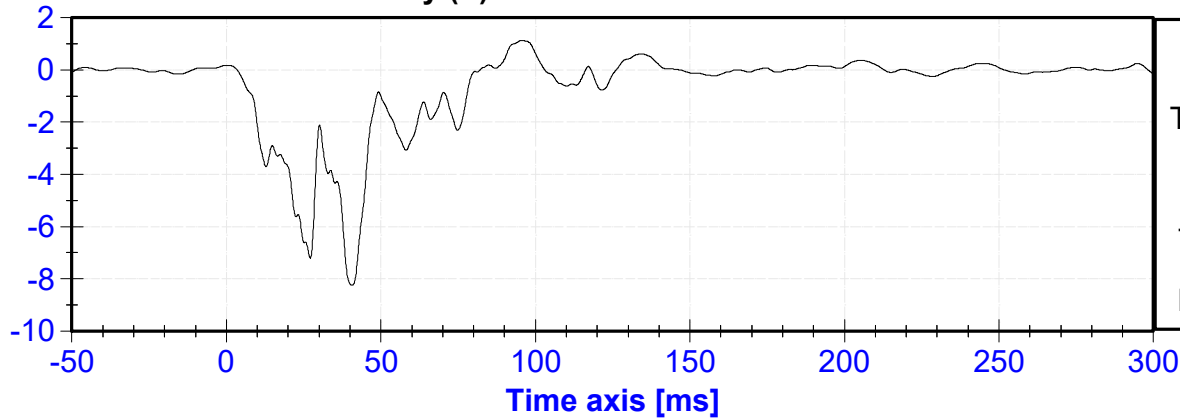
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VEHICLE ACCELEROMETER RESPONSE DATA

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20	B-Pillar Sill (Y) Acceleration vs. Time	III-7
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22	B-Pillar Sill (Y) Displacement vs. Time	III-8
23	B-Pillar Low (Y) Acceleration vs. Time	III-8
24	B-Pillar Low (Y) Velocity vs. Time	III-8
25	B-Pillar Low (Y) Displacement vs. Time	III-9
26	B-Pillar Mid (Y) Acceleration vs. Time	III-9
27	B-Pillar Mid (Y) Velocity vs. Time	III-9
28	B-Pillar Mid (Y) Displacement vs. Time	III-9
29	Seat (Y) Acceleration vs. Time	III-10
30	Seat (Y) Velocity vs. Time	III-10
31	Seat (Y) Displacement vs. Time	III-10
32	Engine (X) Acceleration vs. Time	III-10
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44	Rear Deck (Y) Acceleration vs. Time	III-13
45	Rear Deck (Y) Velocity vs. Time	III-14

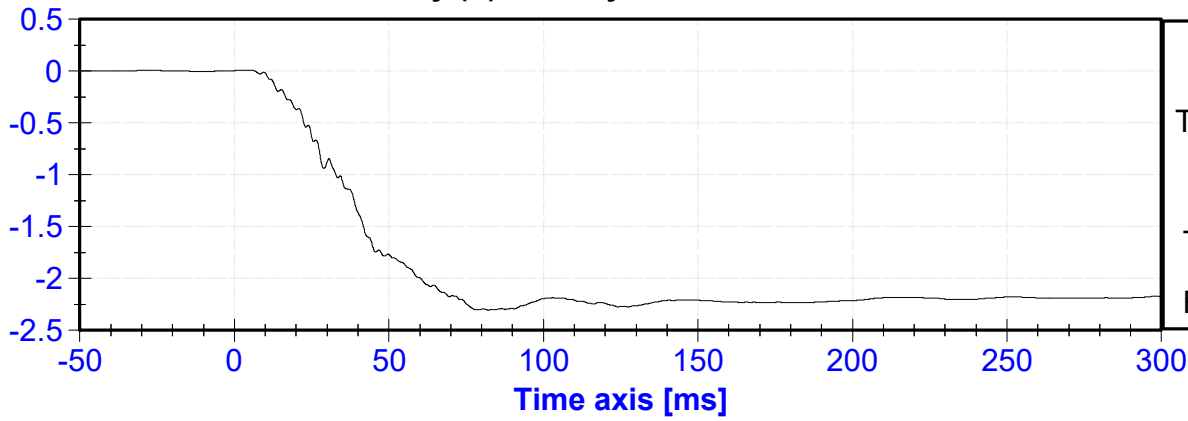
Vehicle Center of Gravity (X) Acceleration vs. Time

ACCELERATION [g's]



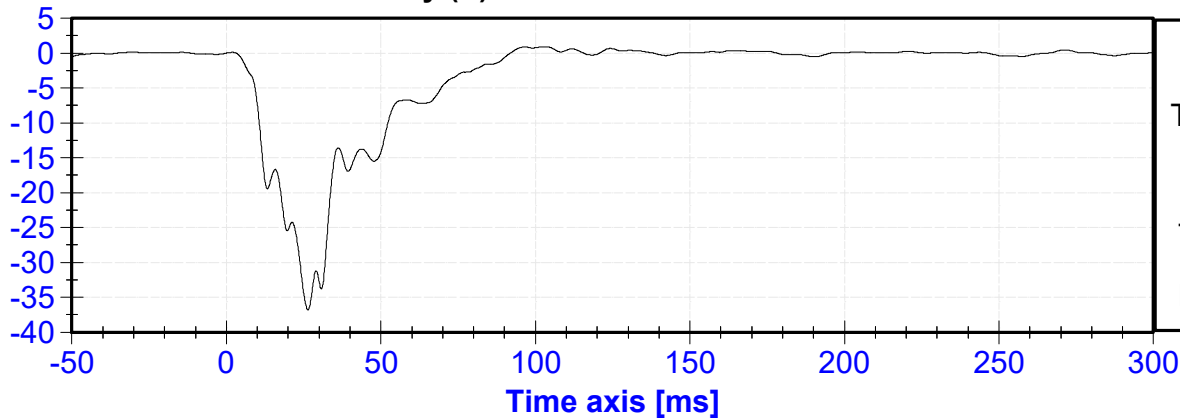
Vehicle Center of Gravity (X) Velocity vs. Time

VELOCITY [m/s]



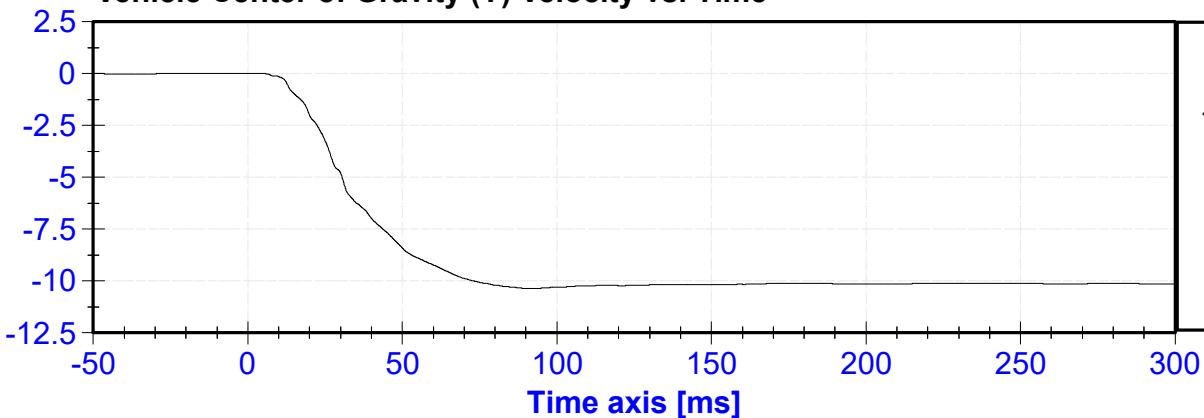
Vehicle Center of Gravity (Y) Acceleration vs. Time

ACCELERATION [g's]



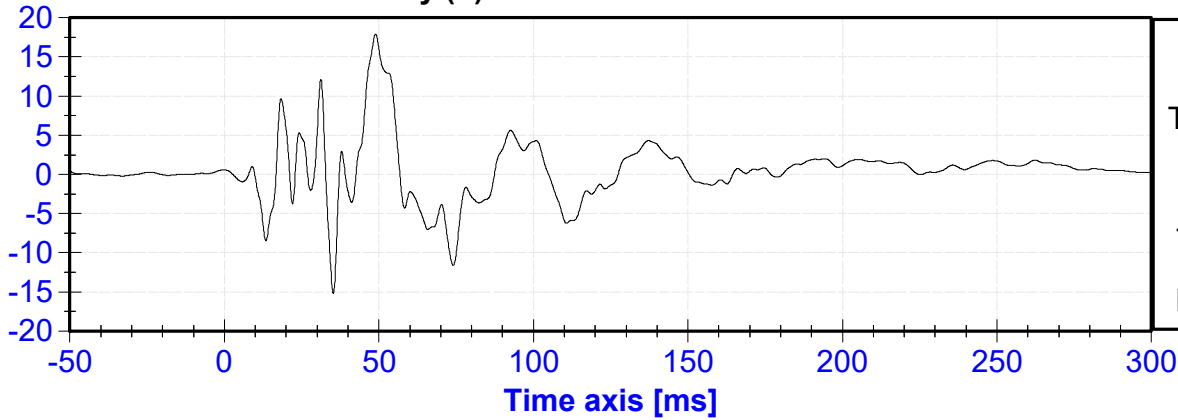
Vehicle Center of Gravity (Y) Velocity vs. Time

VELOCITY [m/s]



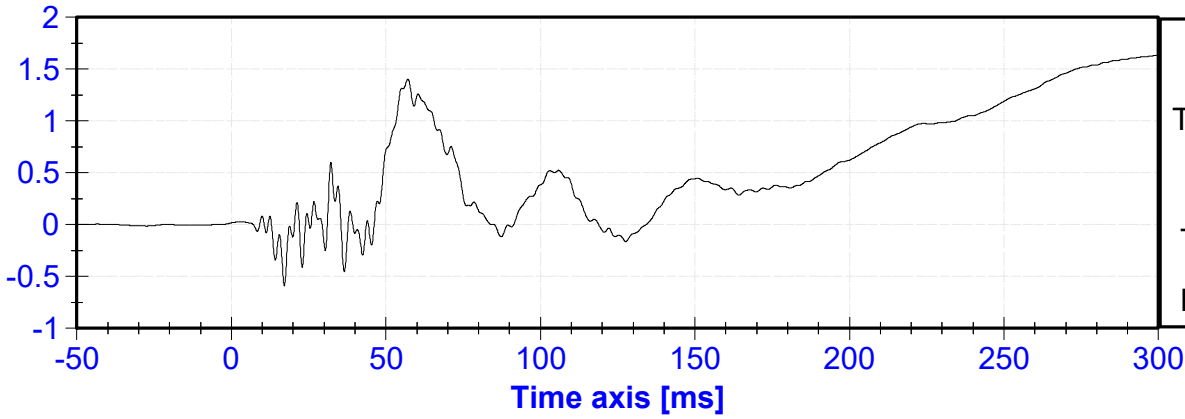
Vehicle Center of Gravity (Z) Acceleration vs. Time

ACCELERATION [g's]



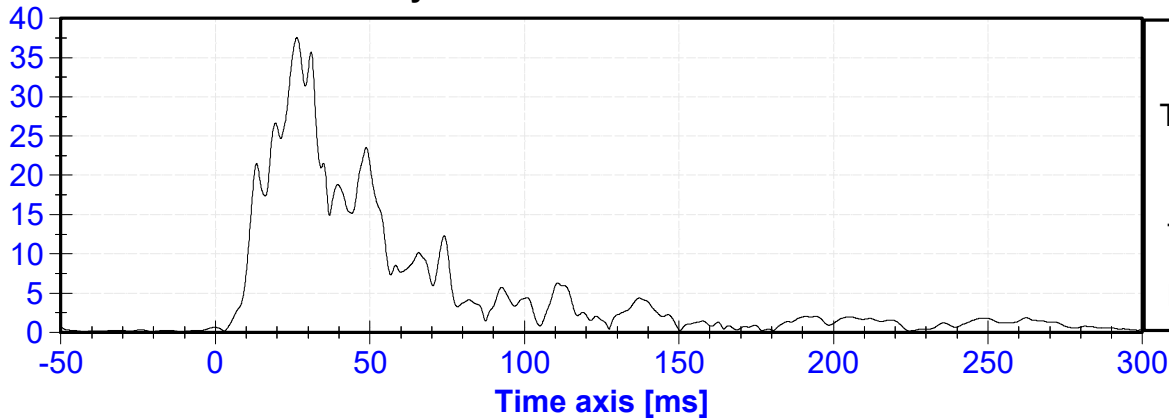
Vehicle Center of Gravity (Z) Velocity vs. Time

VELOCITY [m/s]



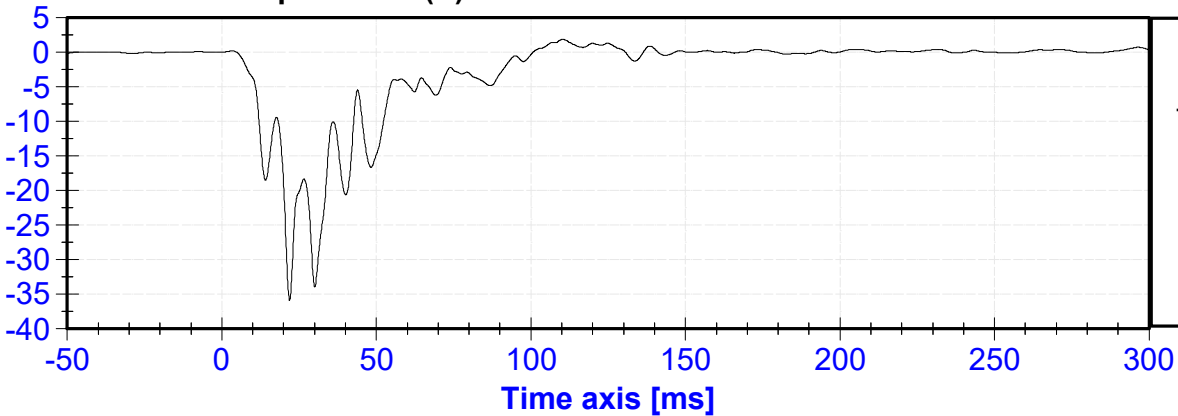
Vehicle Center of Gravity Resultant Acceleration vs. Time

ACCELERATION [g's]



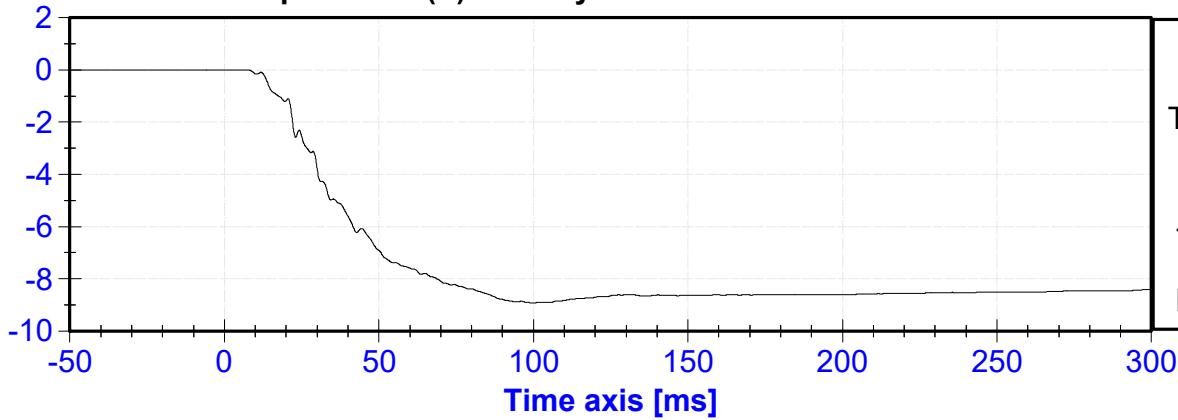
Floor Sill – Impact Side (Y) Acceleration vs. Time

ACCELERATION [g's]



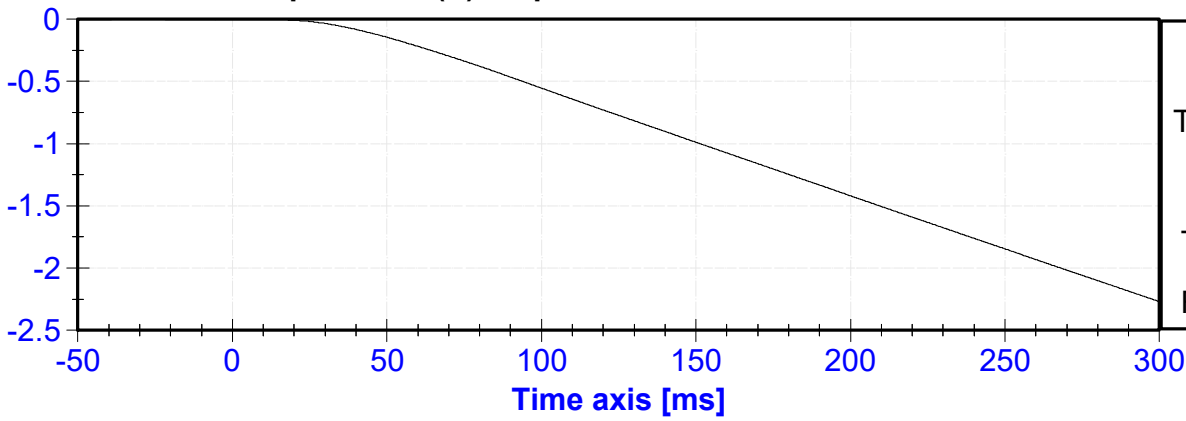
Floor Sill – Impact Side (Y) Velocity vs. Time

VELOCITY [m/s]



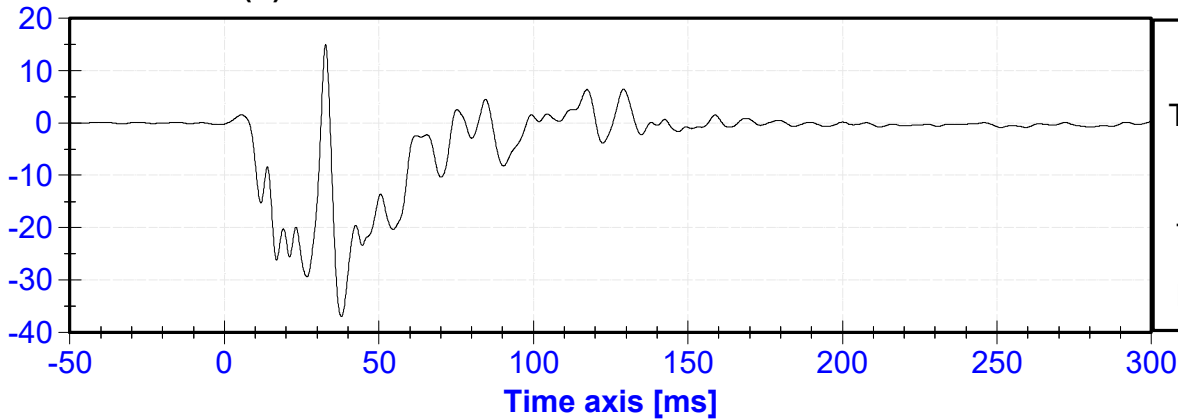
Floor Sill – Impact Side (Y) Displacement vs. Time

DISPLACEMENT [m]



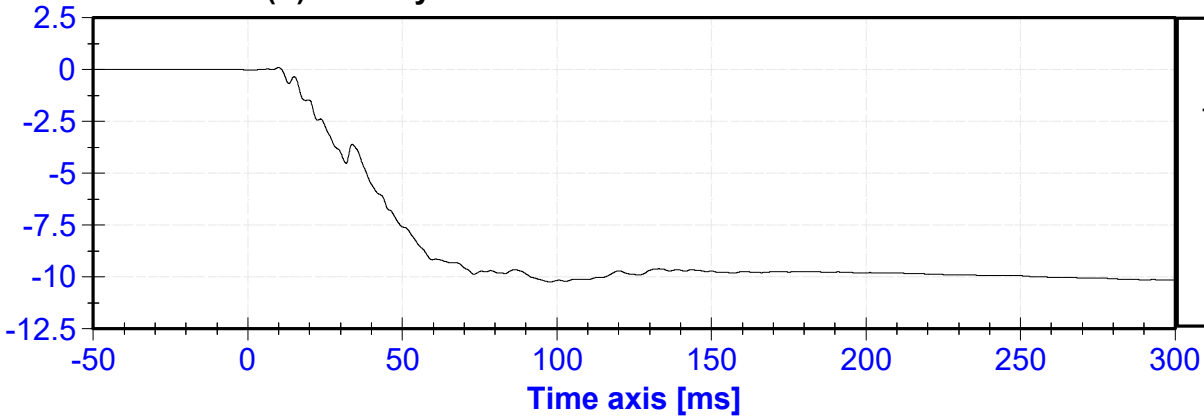
A-Pillar Sill (Y) Acceleration vs. Time

ACCELERATION [g's]

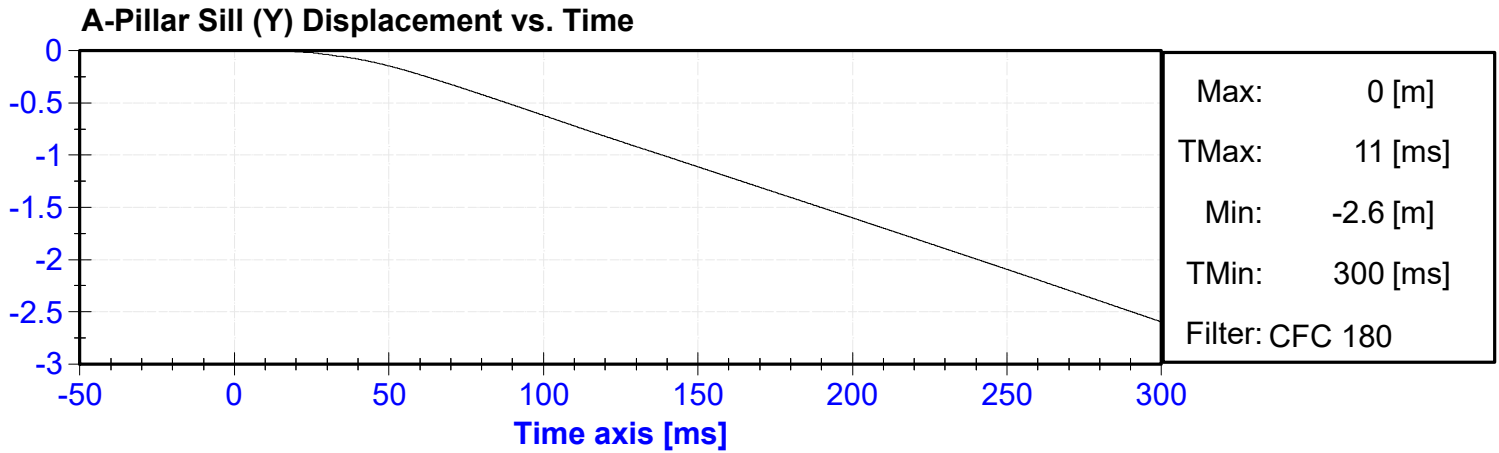


A-Pillar Sill (Y) Velocity vs. Time

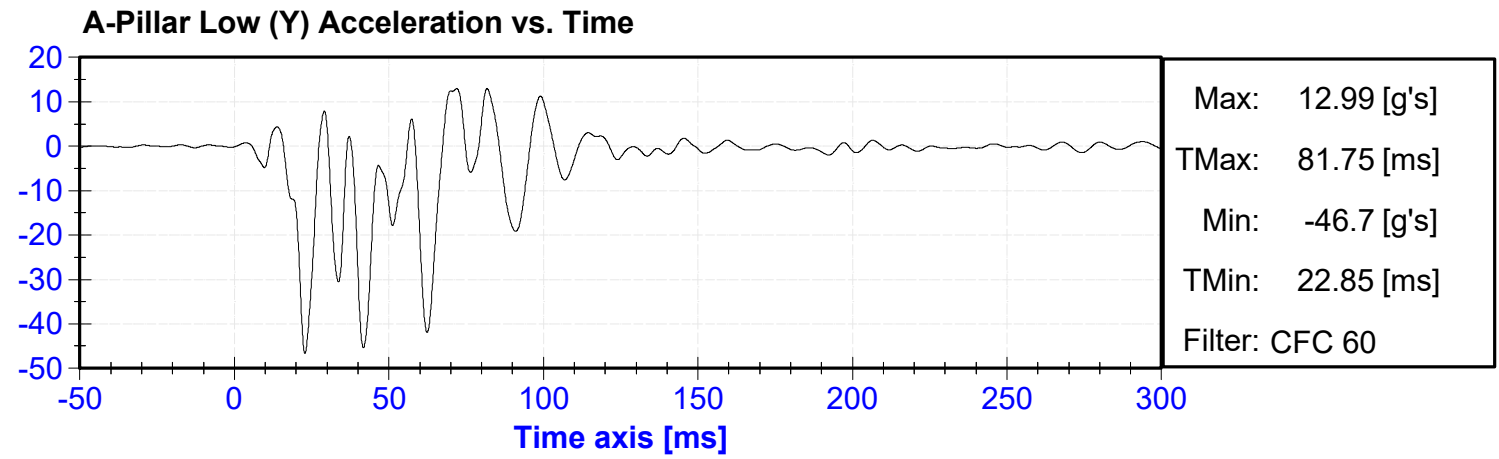
VELOCITY [m/s]



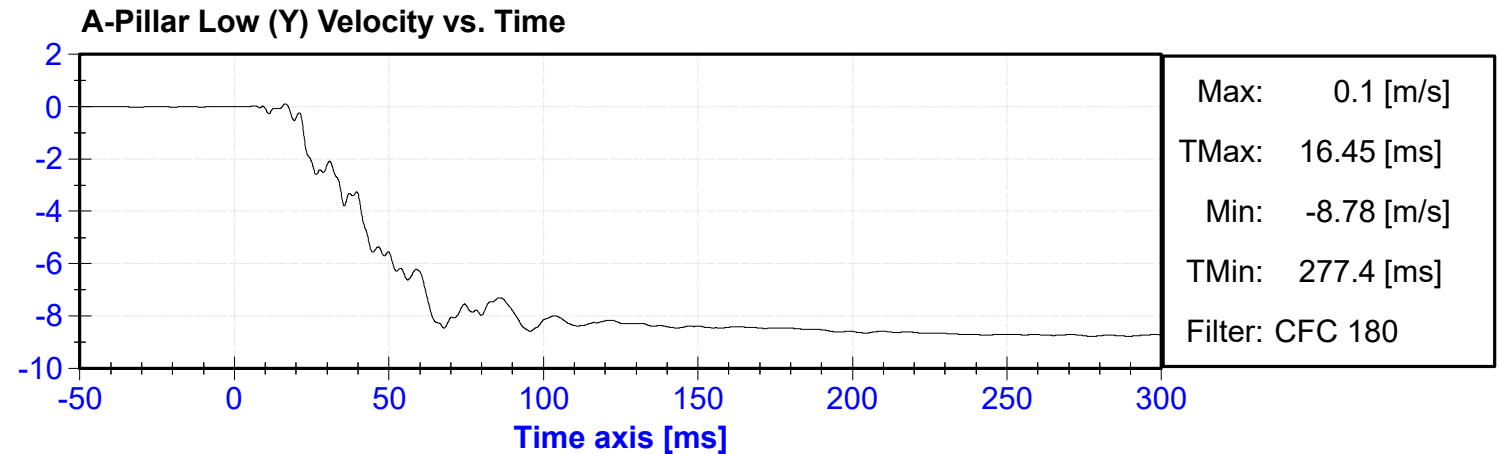
DISPLACEMENT [m]



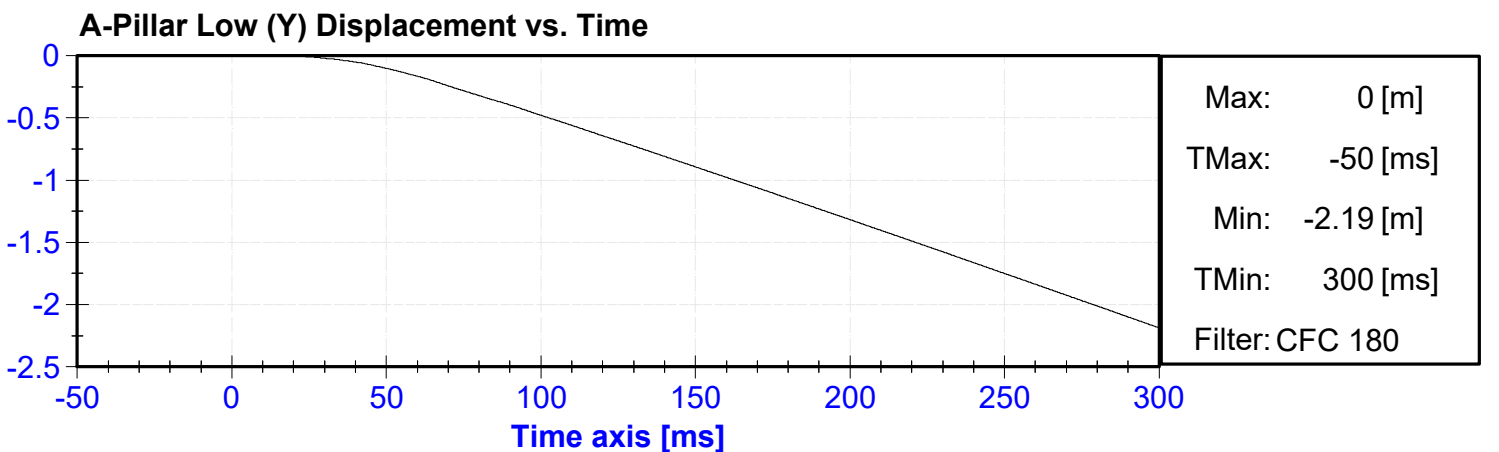
ACCELERATION [g's]



VELOCITY [m/s]

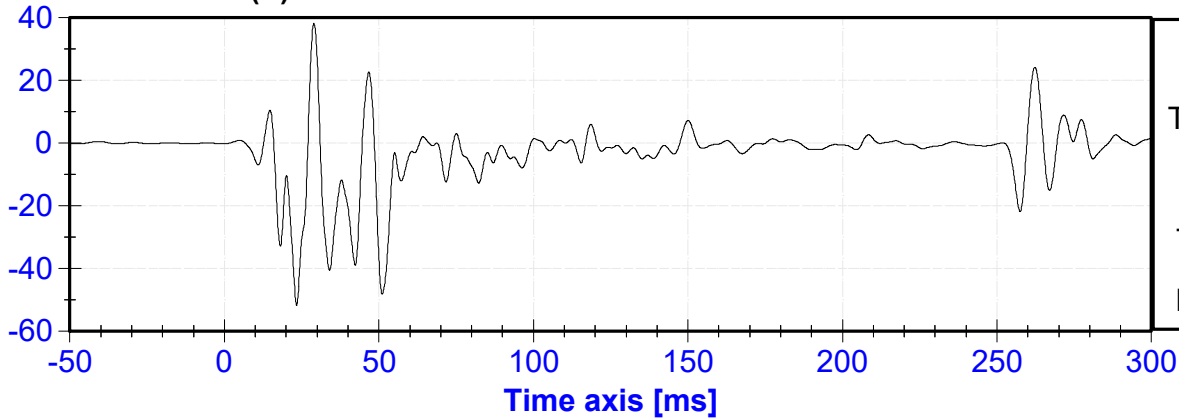


DISPLACEMENT [m]



A-Pillar Mid (Y) Acceleration vs. Time

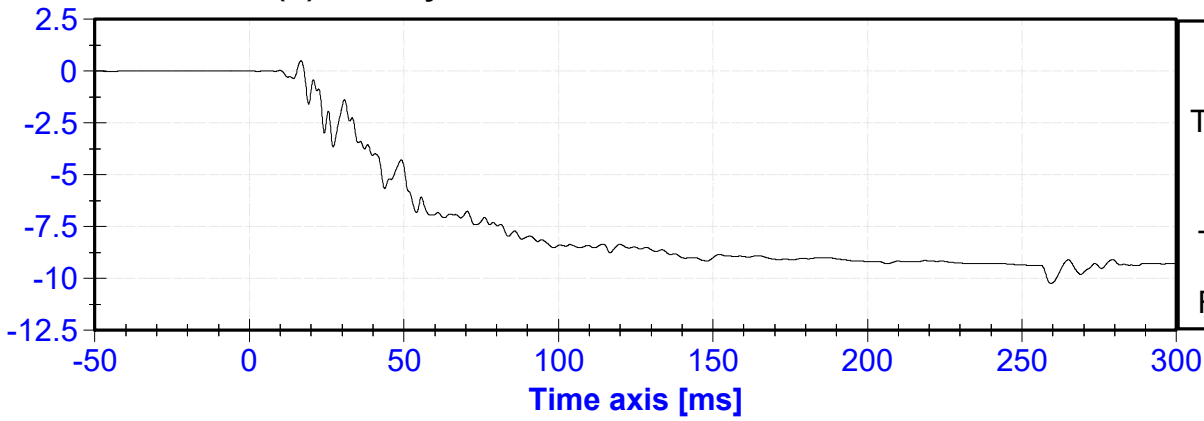
ACCELERATION [g's]



Max: 38.3 [g's]
TMax: 28.95 [ms]
Min: -51.84 [g's]
TMin: 23.4 [ms]
Filter: CFC 60

A-Pillar Mid (Y) Velocity vs. Time

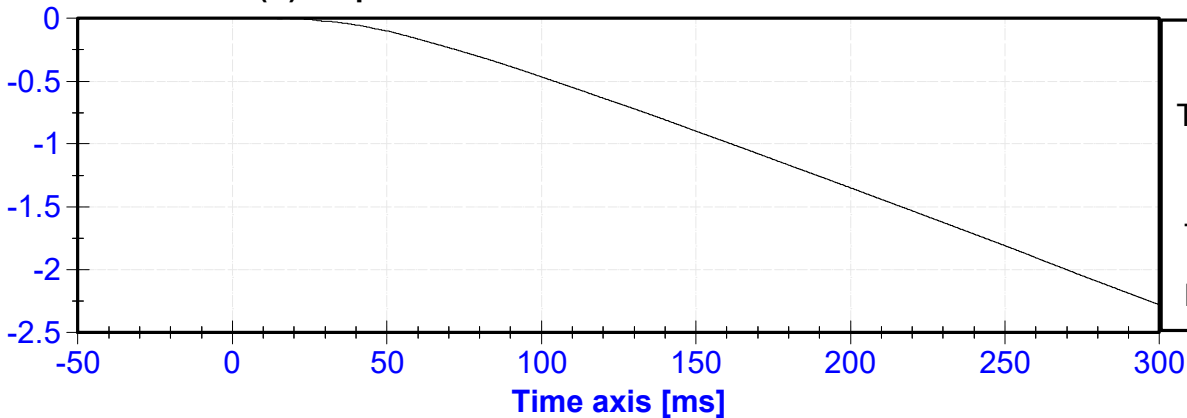
VELOCITY [m/s]



Max: 0.5 [m/s]
TMax: 16.75 [ms]
Min: -10.25 [m/s]
TMin: 259.35 [ms]
Filter: CFC 180

A-Pillar Mid (Y) Displacement vs. Time

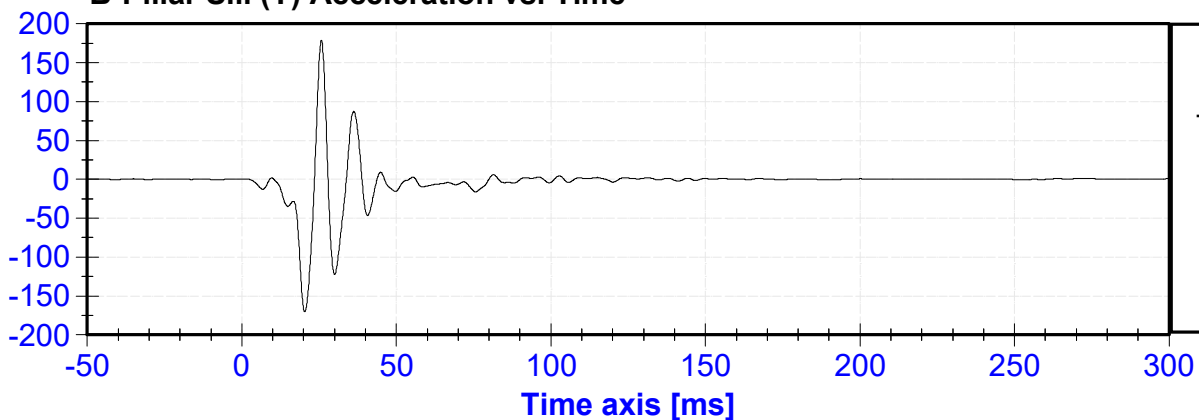
DISPLACEMENT [m]



Max: 0 [m]
TMax: 10.6 [ms]
Min: -2.28 [m]
TMin: 300 [ms]
Filter: CFC 180

B-Pillar Sill (Y) Acceleration vs. Time

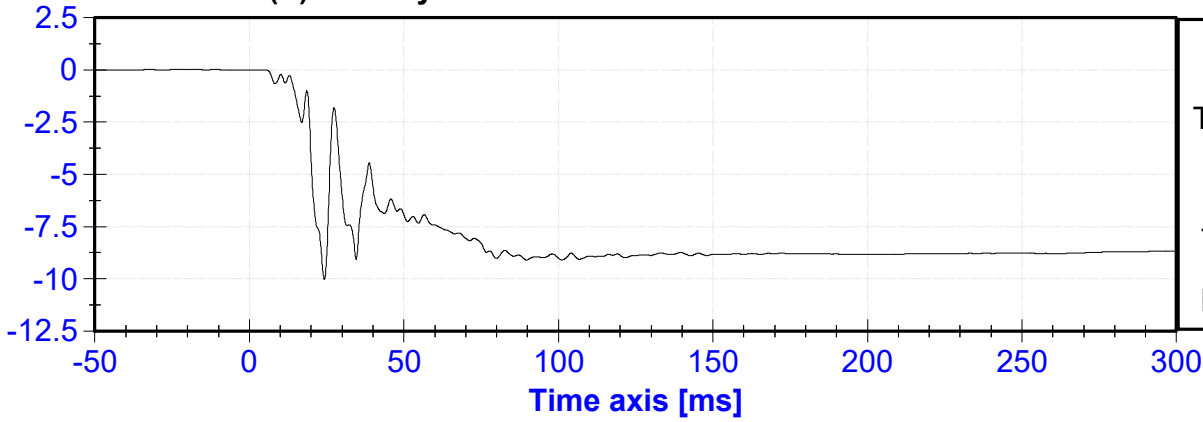
ACCELERATION [g's]



Max: 179.05 [g's]
TMax: 25.75 [ms]
Min: -170.59 [g's]
TMin: 20.35 [ms]
Filter: CFC 60

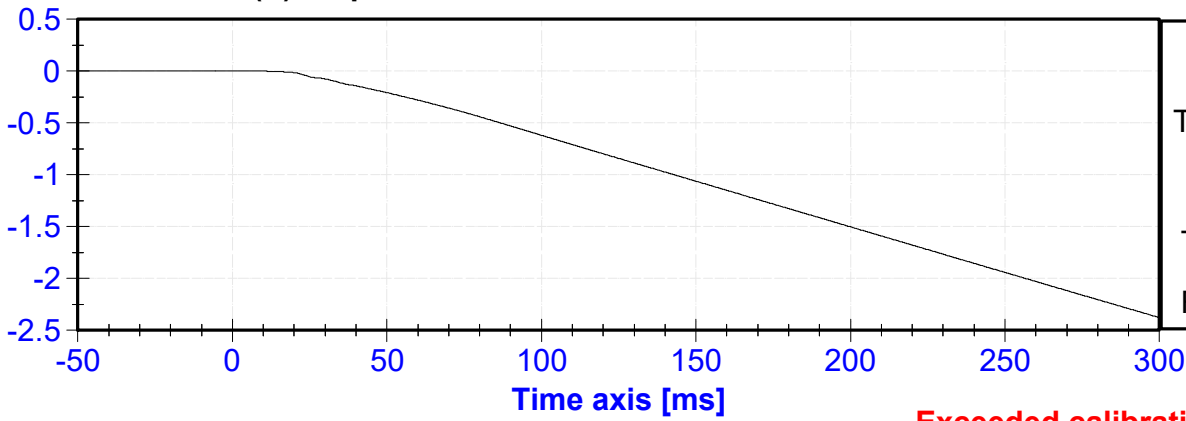
B-Pillar Sill (Y) Velocity vs. Time

VELOCITY [m/s]



B-Pillar Sill (Y) Displacement vs. Time

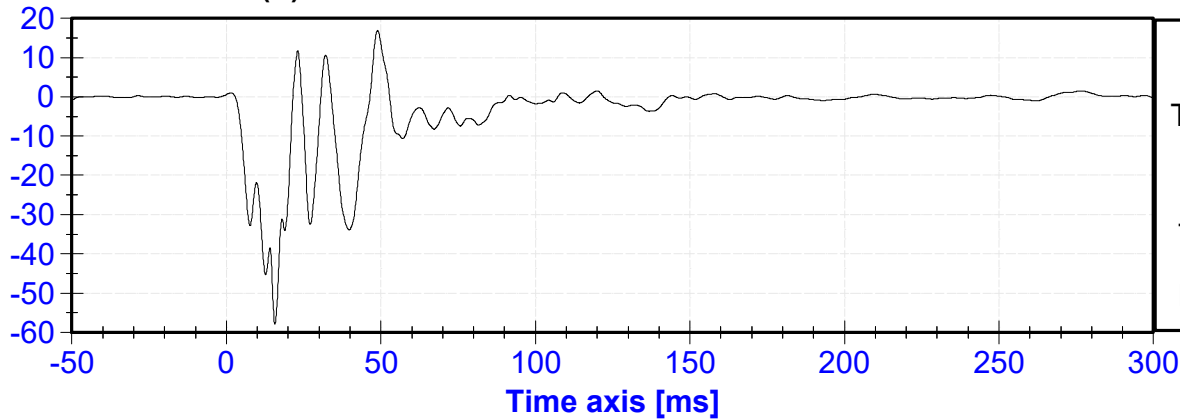
DISPLACEMENT [m]



Exceeded calibration range at 13.7 ms

B-Pillar Low (Y) Acceleration vs. Time

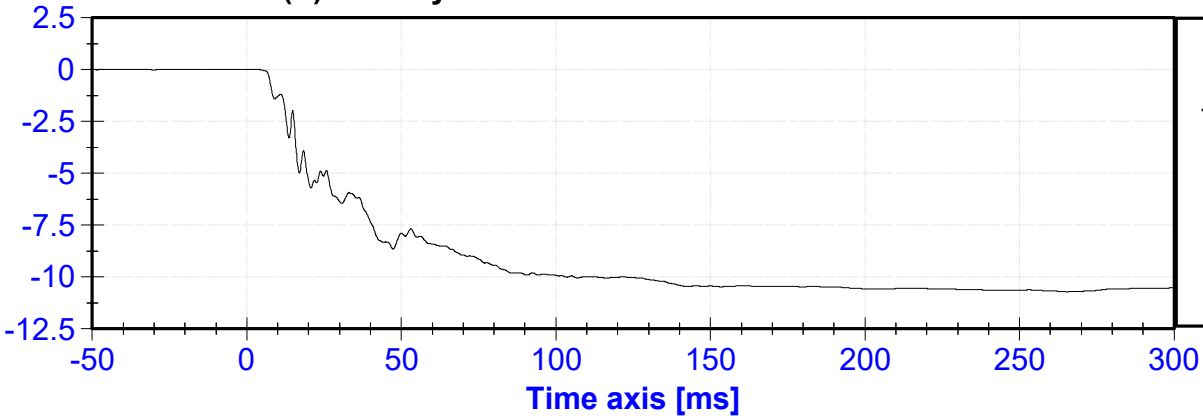
ACCELERATION [g's]



Exceeded calibration range at 13.7 ms

B-Pillar Low (Y) Velocity vs. Time

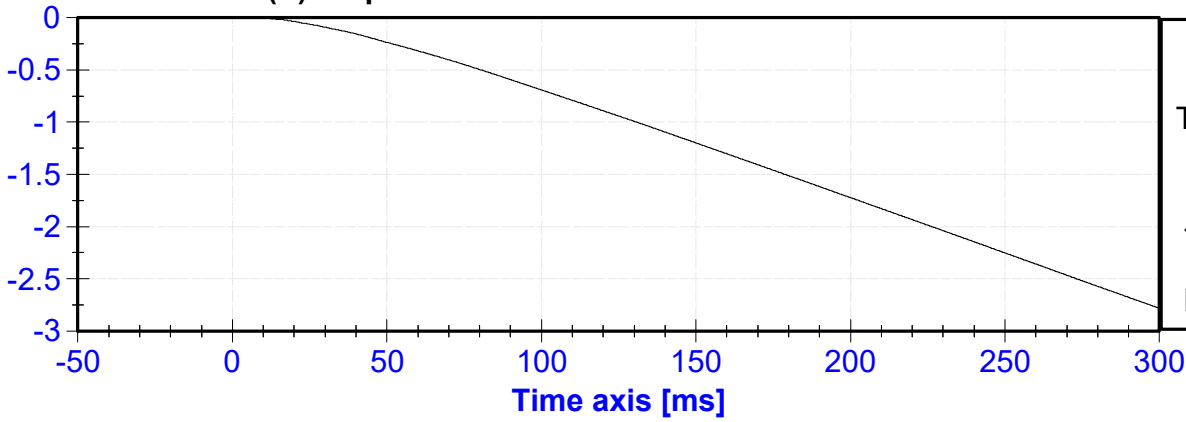
VELOCITY [m/s]



Exceeded calibration range at 13.7 ms

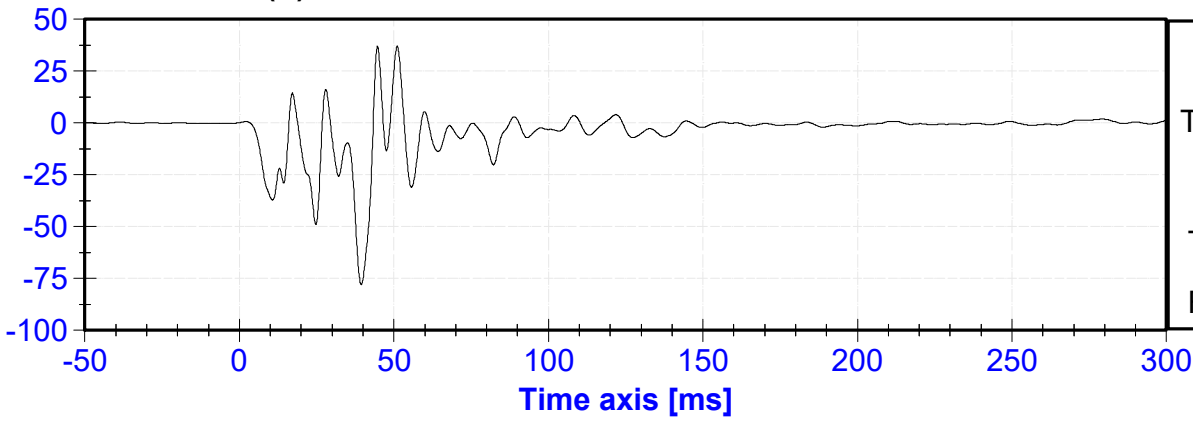
B-Pillar Low (Y) Displacement vs. Time

DISPLACEMENT [m]



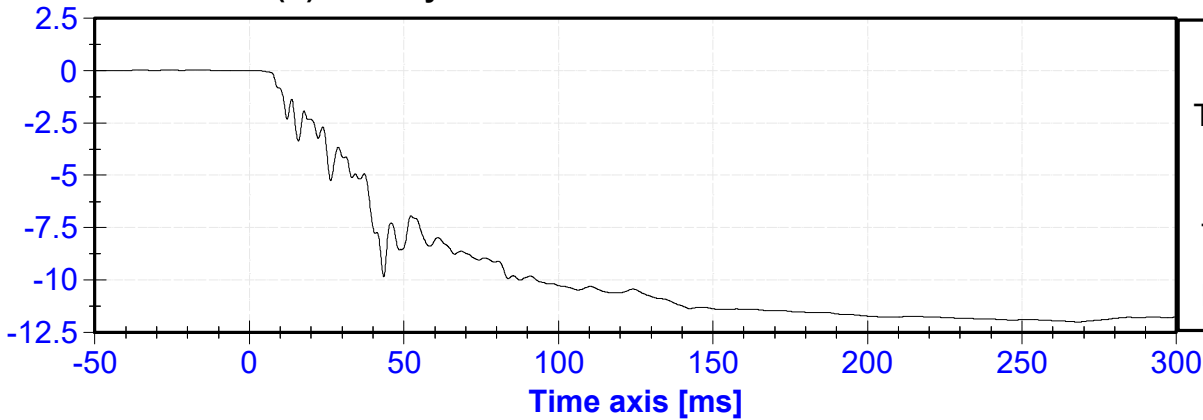
B-Pillar Mid (Y) Acceleration vs. Time

ACCELERATION [g's]



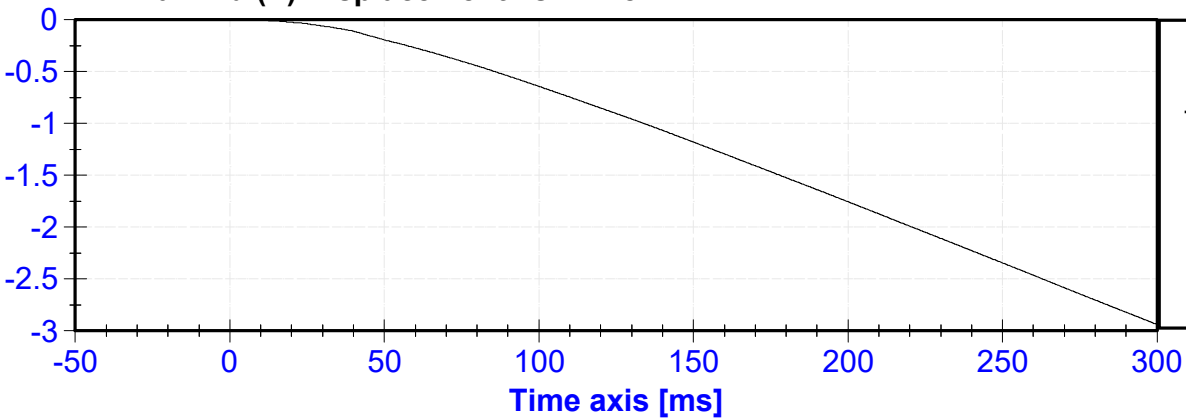
B-Pillar Mid (Y) Velocity vs. Time

VELOCITY [m/s]



B-Pillar Mid (Y) Displacement vs. Time

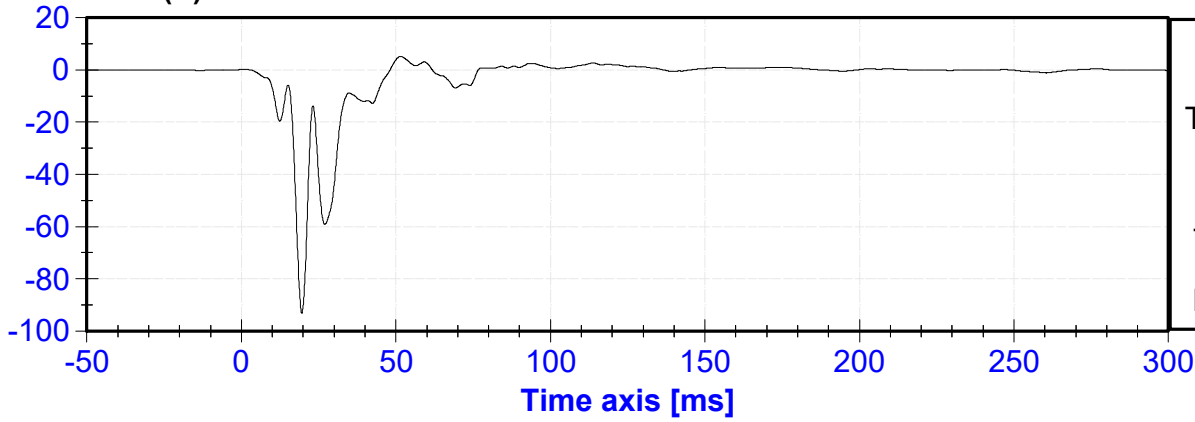
DISPLACEMENT [m]



Exceeded calibration range at 20.8 ms

Seat (Y) Acceleration vs. Time

ACCELERATION [g's]

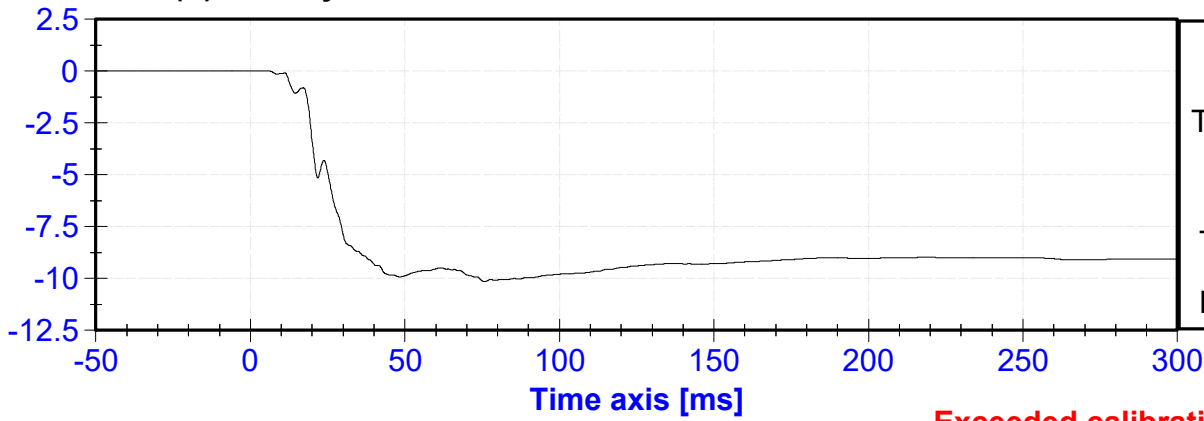


Max:	5.2 [g's]
TMax:	51.5 [ms]
Min:	-93.21 [g's]
TMin:	19.55 [ms]
Filter:	CFC 60

Exceeded calibration range at 20.8 ms

Seat (Y) Velocity vs. Time

VELOCITY [m/s]

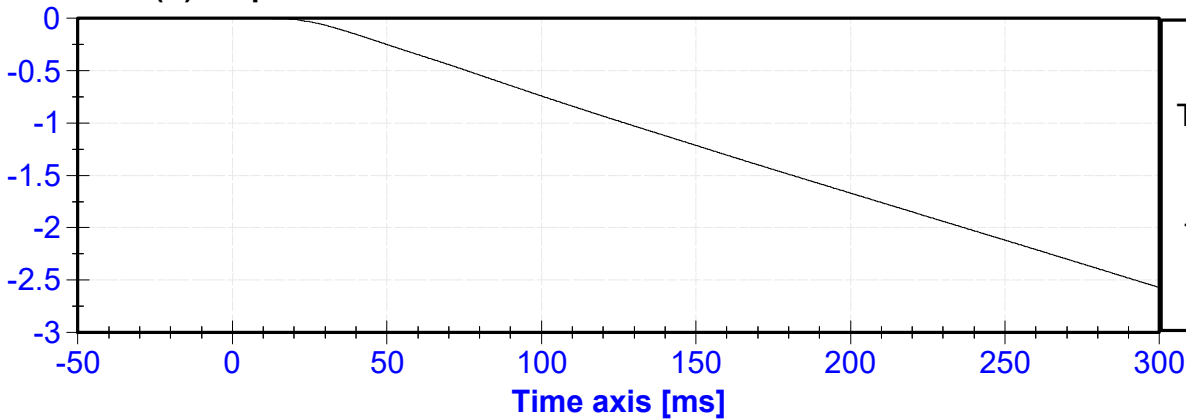


Max:	0.01 [m/s]
TMax:	-20.15 [ms]
Min:	-10.16 [m/s]
TMin:	75.75 [ms]
Filter:	CFC 180

Exceeded calibration range at 20.8 ms

Seat (Y) Displacement vs. Time

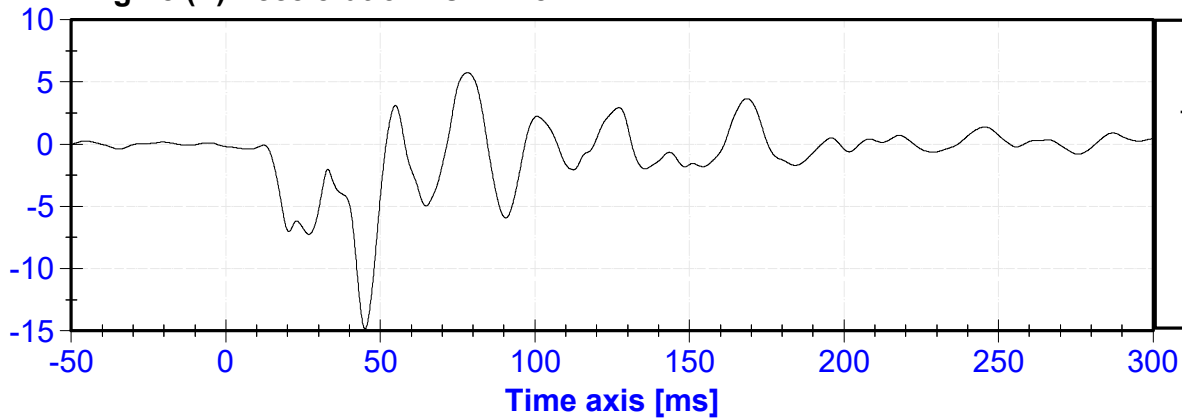
DISPLACEMENT [m]



Max:	0 [m]
TMax:	6.05 [ms]
Min:	-2.57 [m]
TMin:	300 [ms]
Filter:	CFC 180

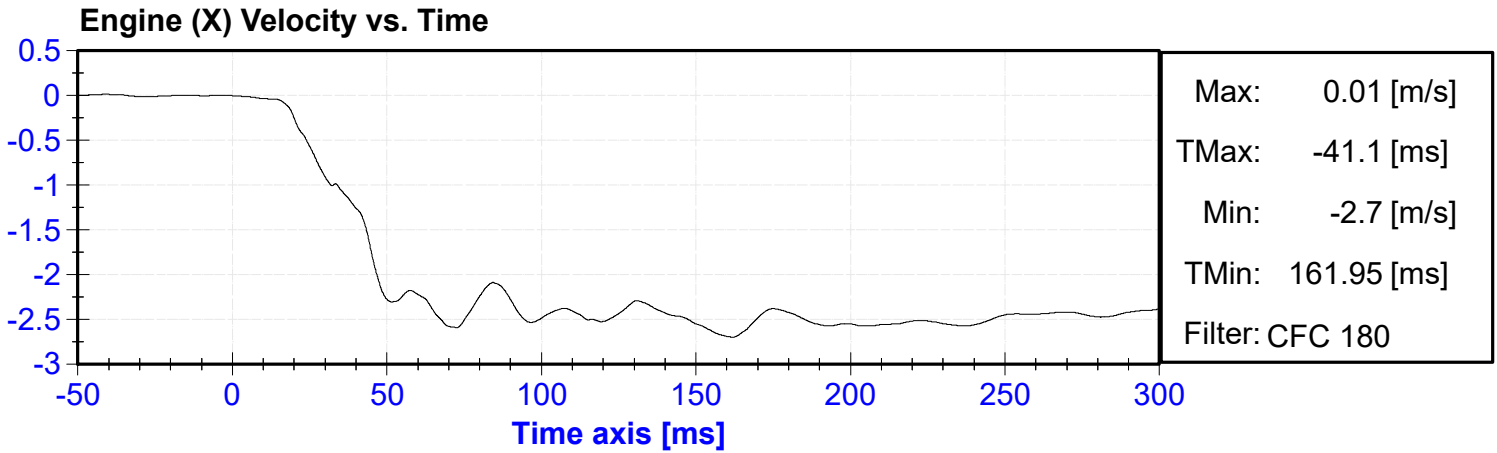
Engine (X) Acceleration vs. Time

ACCELERATION [g's]

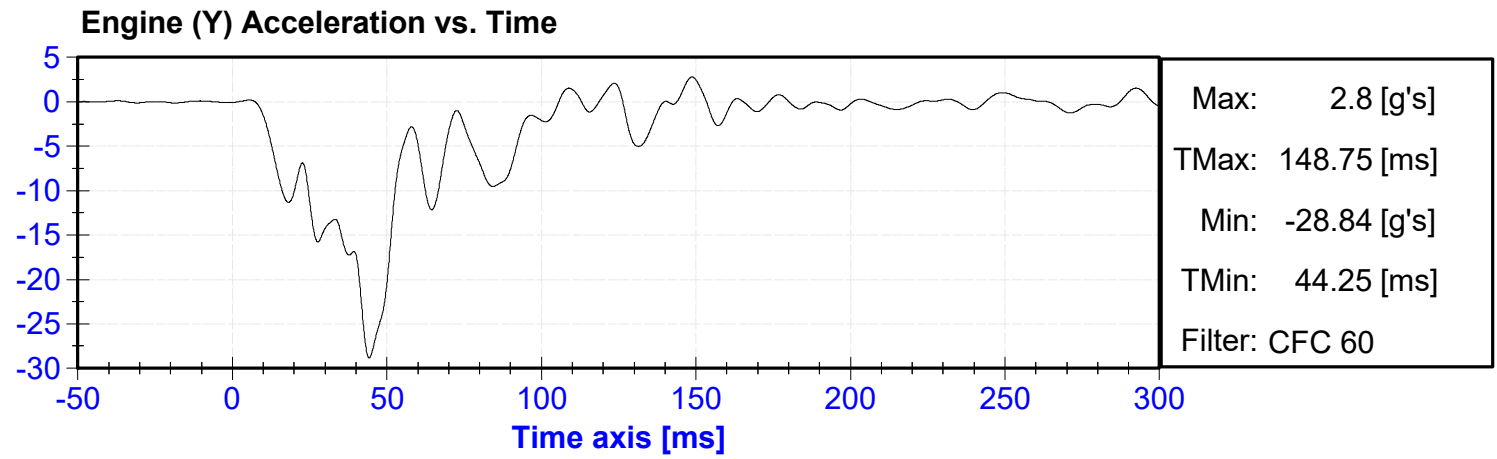


Max:	5.77 [g's]
TMax:	78.15 [ms]
Min:	-14.87 [g's]
TMin:	45 [ms]
Filter:	CFC 60

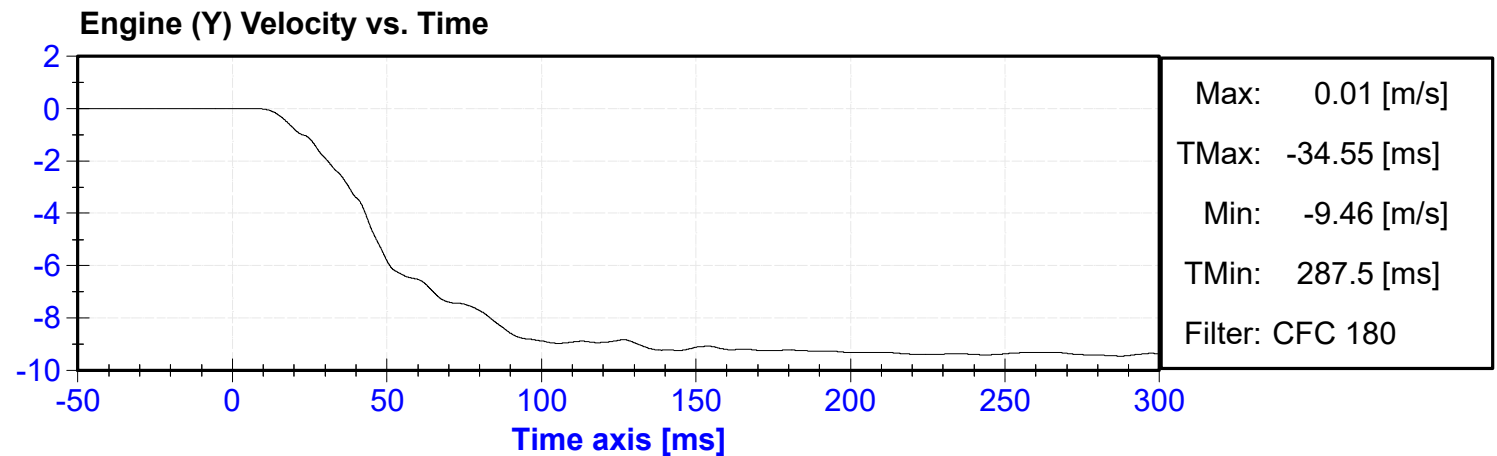
VELOCITY [m/s]



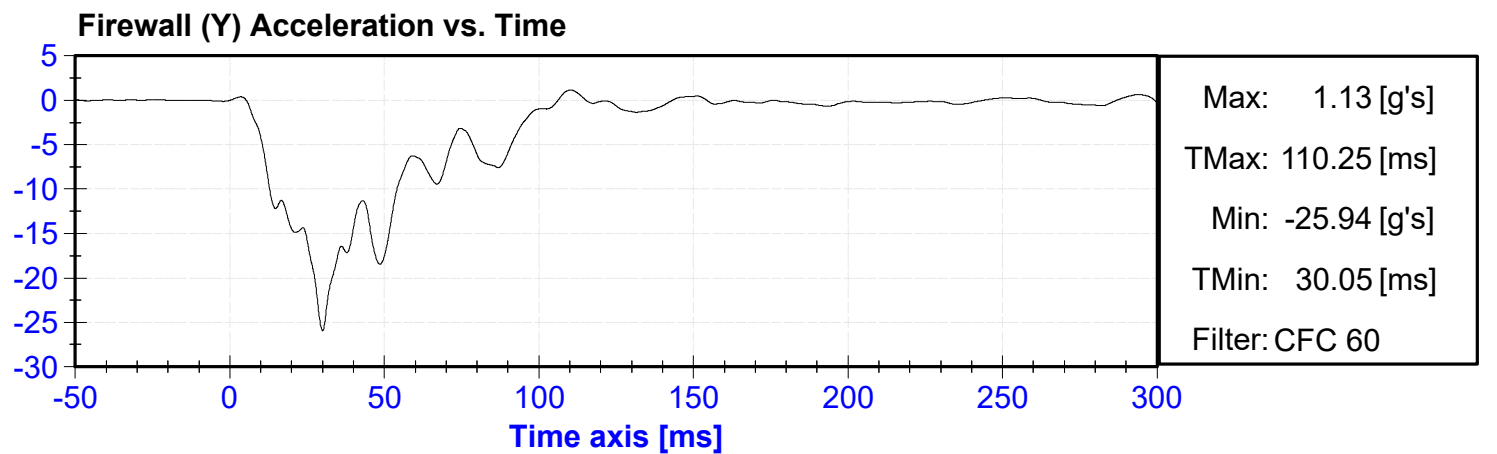
ACCELERATION [g's]



VELOCITY [m/s]

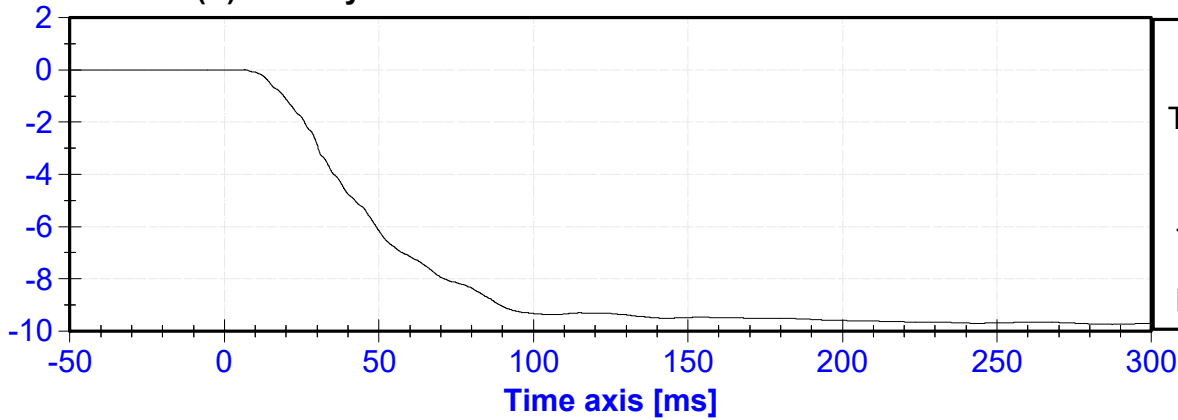


ACCELERATION [g's]



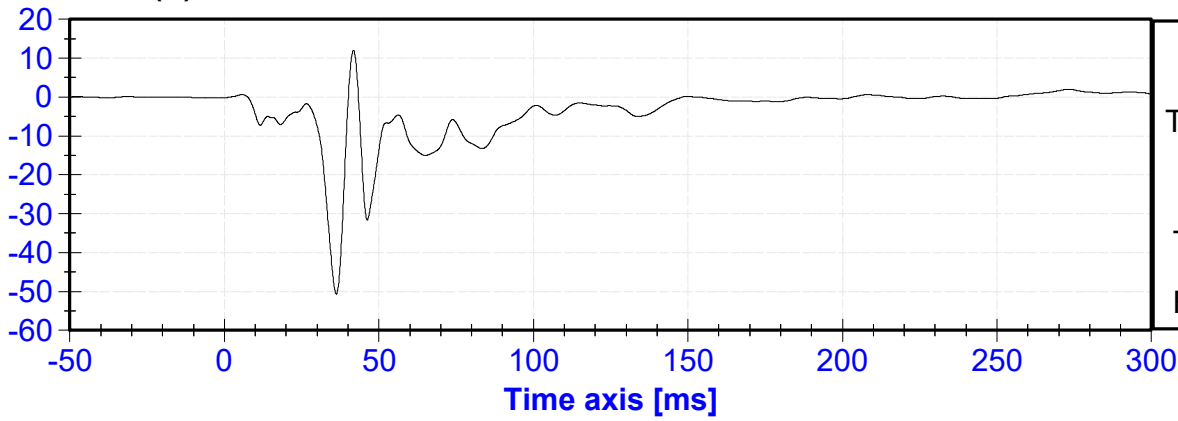
VELOCITY [m/s]

Firewall (Y) Velocity vs. Time



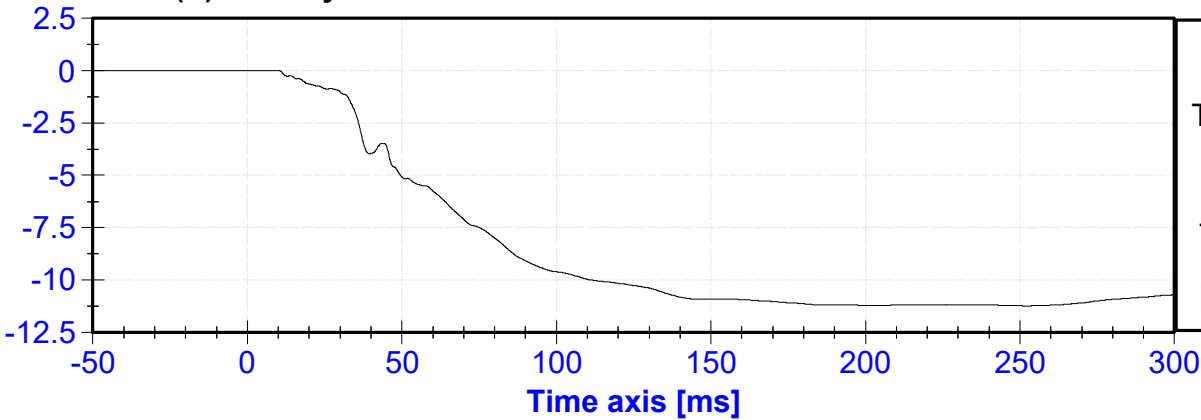
ACCELERATION [g's]

Roof (Y) Acceleration vs. Time



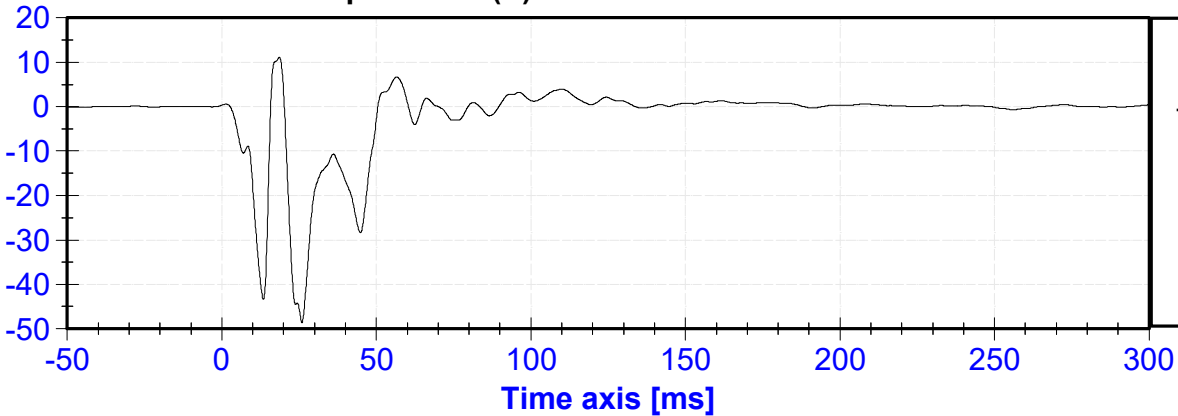
VELOCITY [m/s]

Roof (Y) Velocity vs. Time



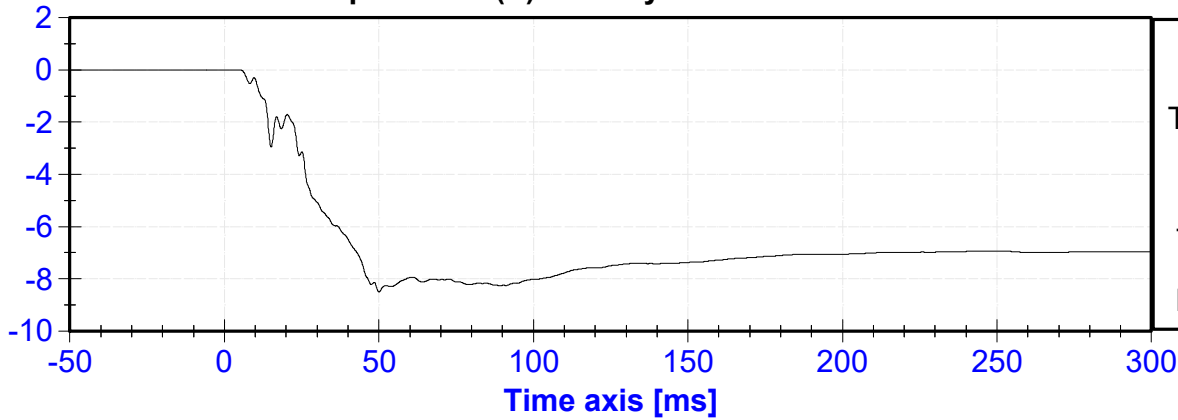
ACCELERATION [g's]

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



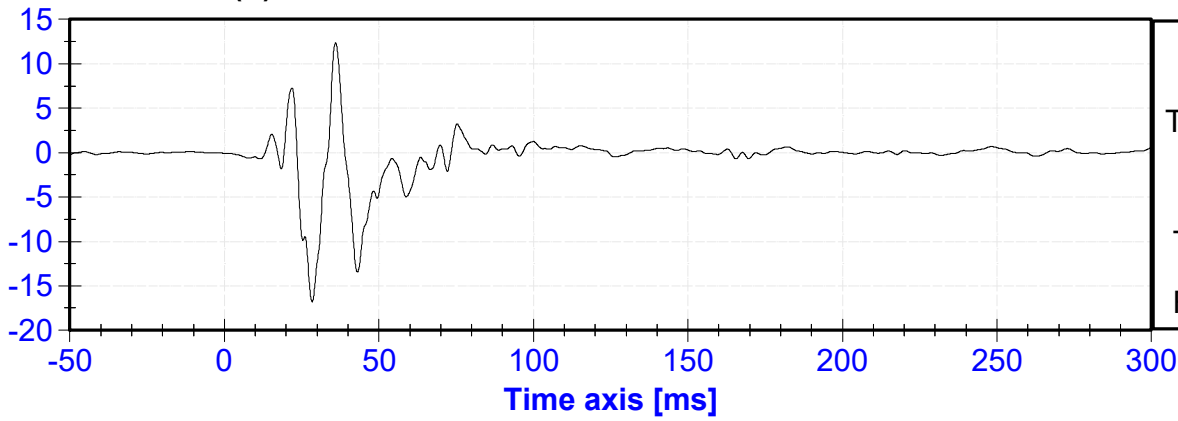
Floor Sill – Non Impact Side (Y) Velocity vs. Time

VELOCITY [m/s]



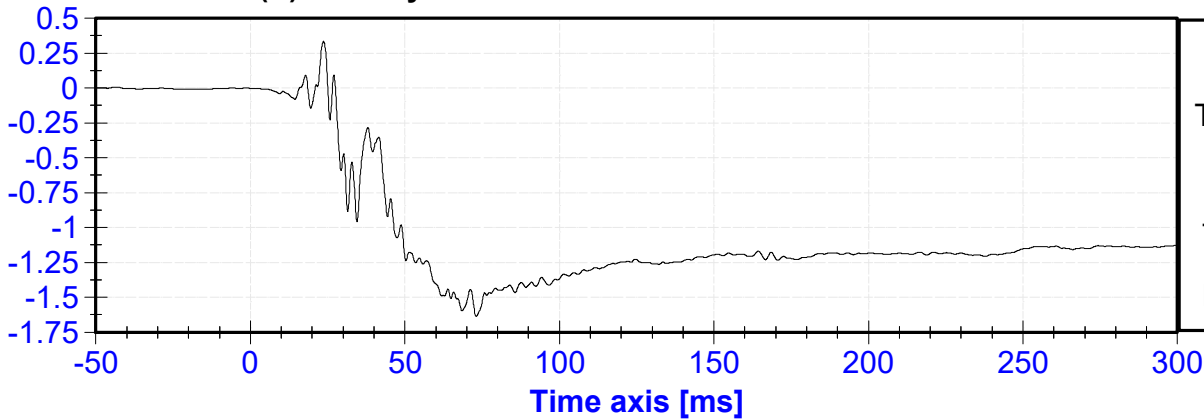
Rear Deck (X) Acceleration vs. Time

ACCELERATION [g's]



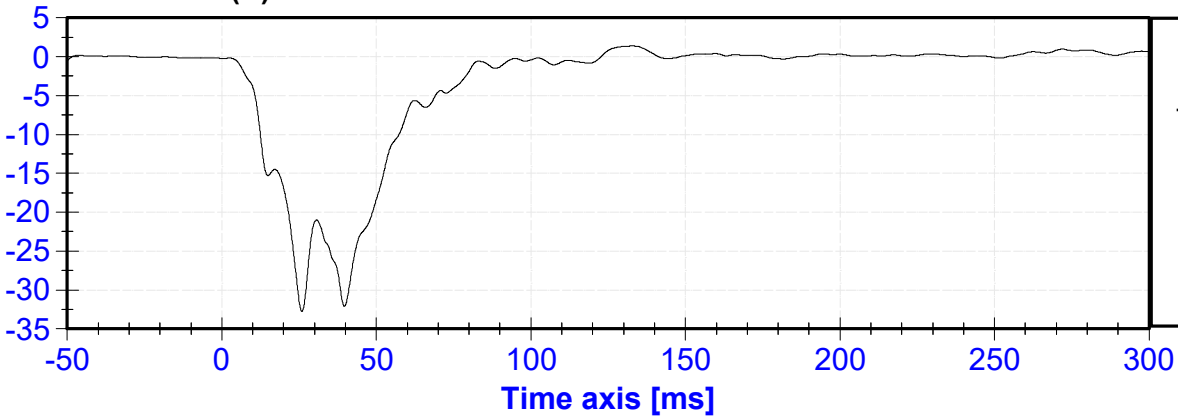
Rear Deck (X) Velocity vs. Time

VELOCITY [m/s]

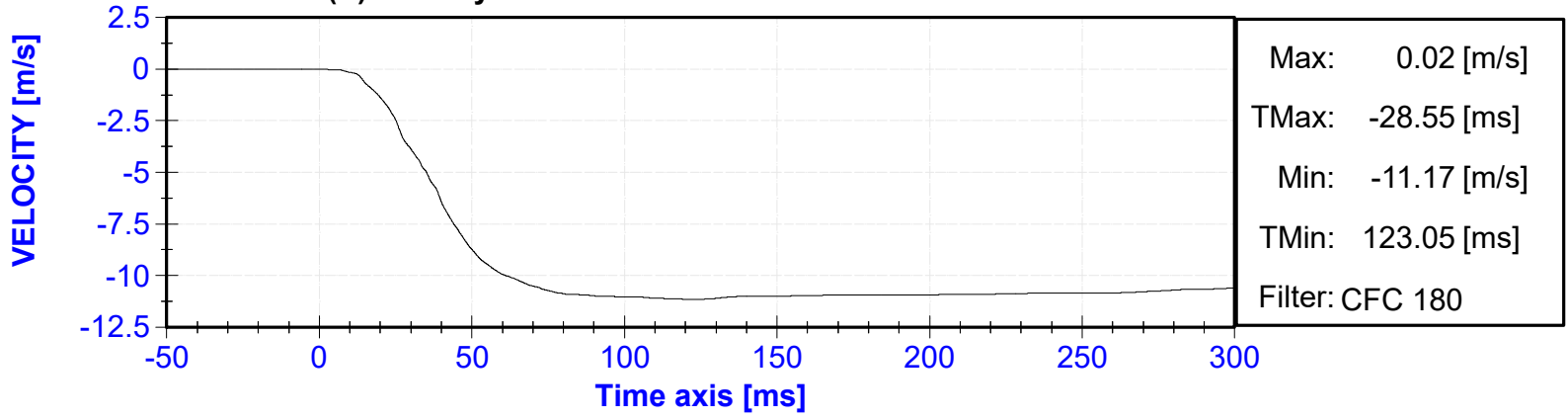


Rear Deck (Y) Acceleration vs. Time

ACCELERATION [g's]



Rear Deck (Y) Velocity vs. Time



APPENDIX IV

PRE-TEST DUMMY PERFORMANCE CALIBRATION TEST DATA

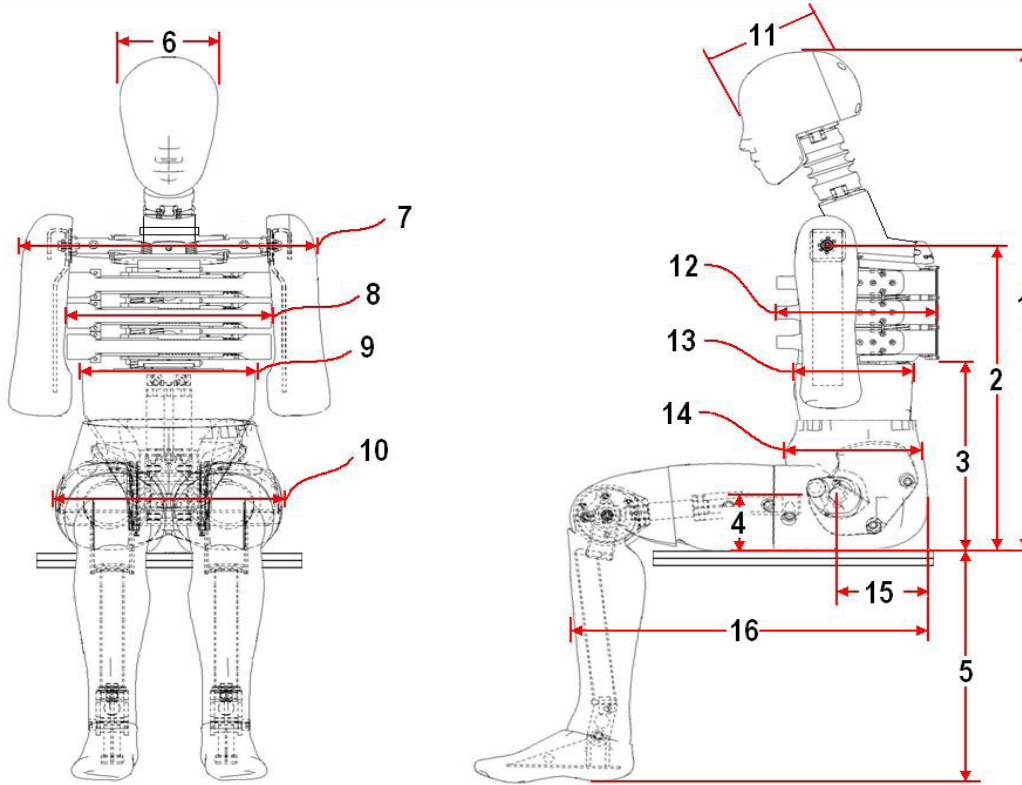
(Subpart U, ES-2re)

External Measurements - EuroSID-2re

Technician: K. Brogan

Date: 03/07/2023

Dummy Serial Number: D037



FRONT VIEW

SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	913	Pass
2	Seat to Shoulder Joint	558	572	564	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	103	Pass
5	Sole to Seat, Sitting	333	451	421	Pass
6	Head Width	152	158	155	Pass
7	Shoulder/Arm Width	461	479	473	Pass
8	Thorax Width	322	332	330	Pass
9	Abdomen Width	273	287	280	Pass
10	Pelvis Lap Width	359	373	365	Pass
11	Head Depth	196	206	199	Pass
12	Thorax Depth	262	272	268	Pass
13	Abdomen Depth	194	204	200	Pass
14	Pelvis Depth	235	245	241	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	153	Pass
16	Back of Buttocks to Front Knee	597	615	605	Pass

ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

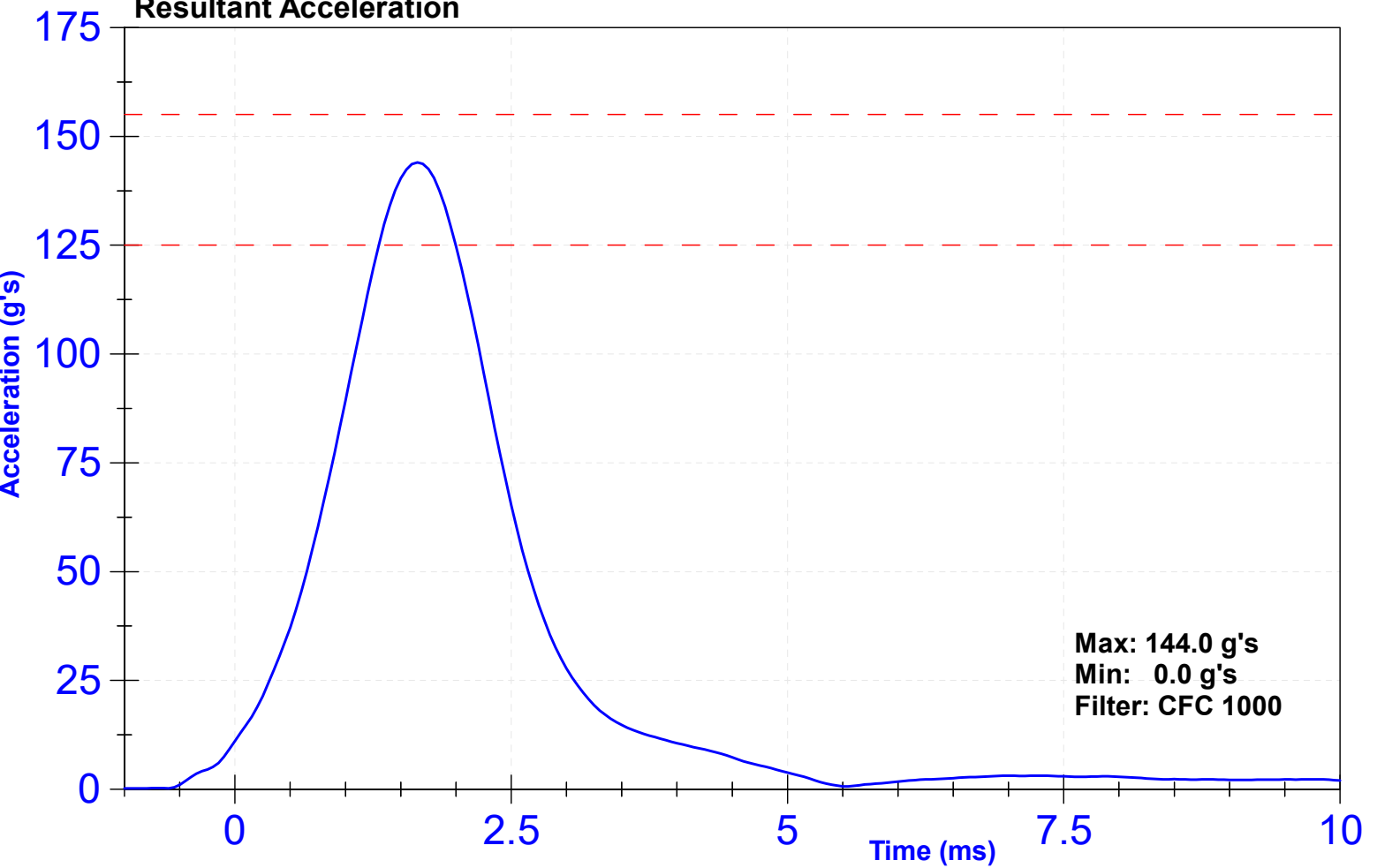
Results

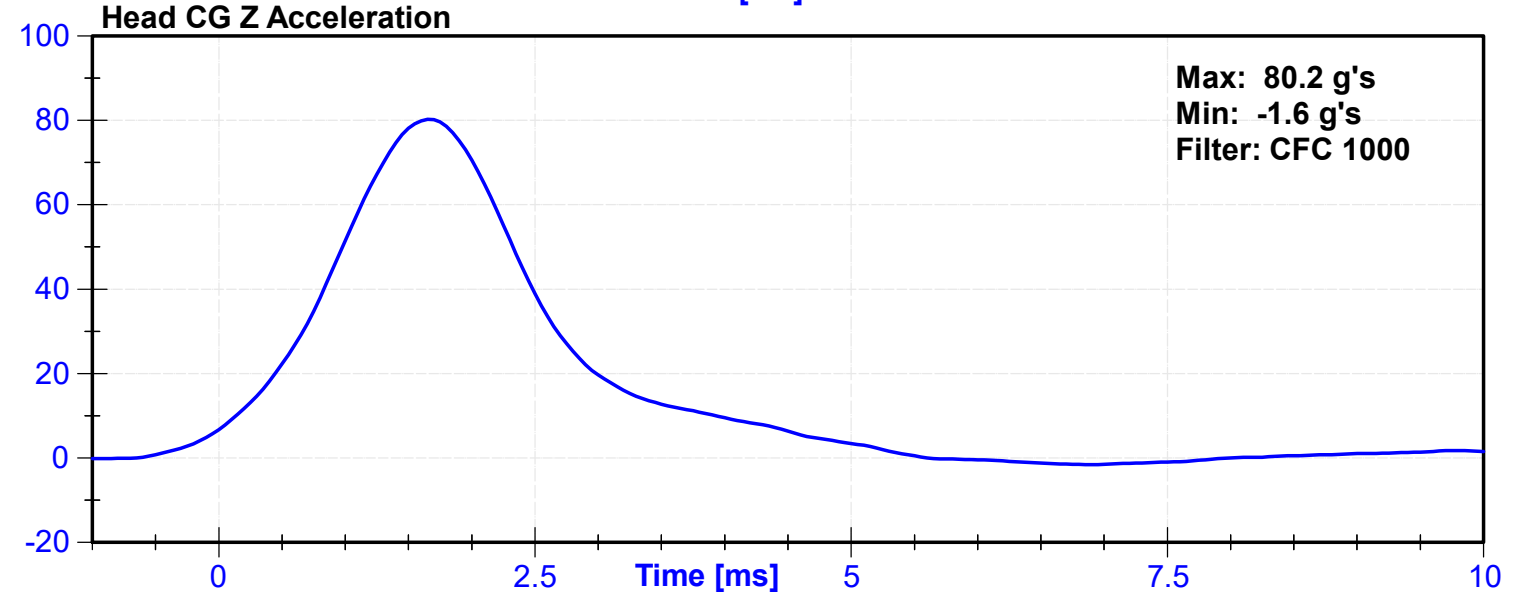
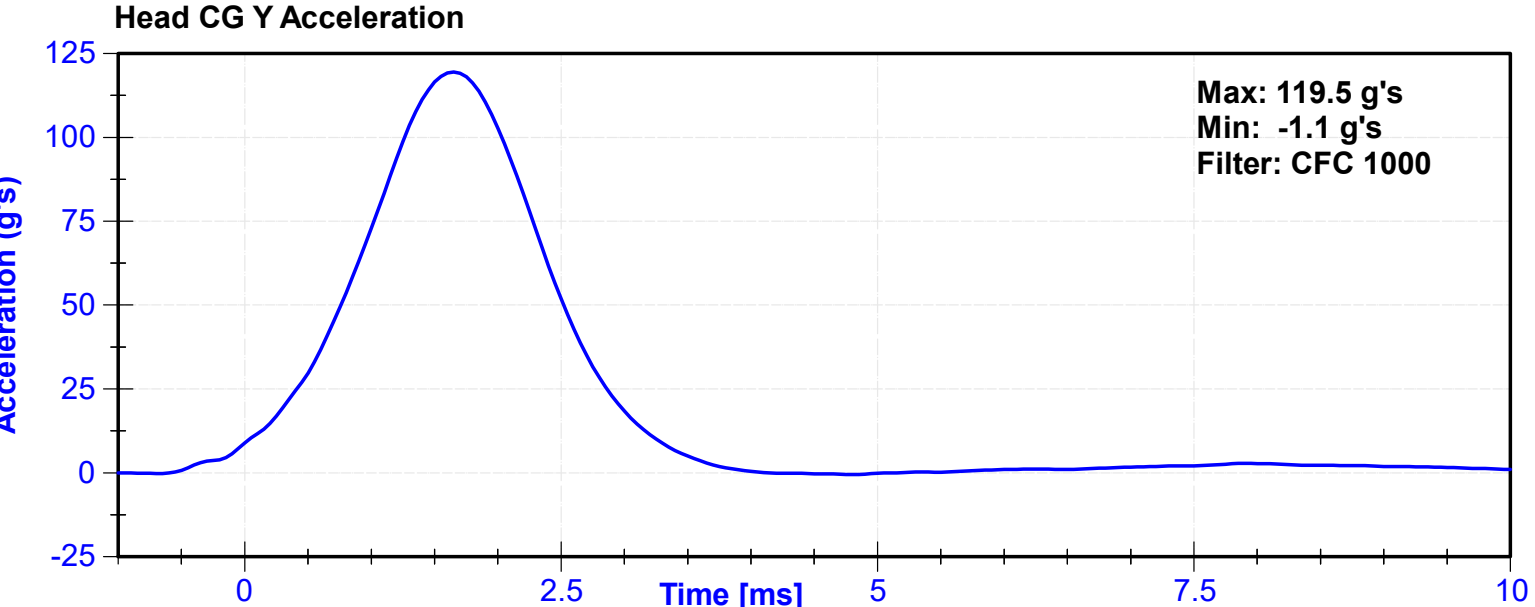
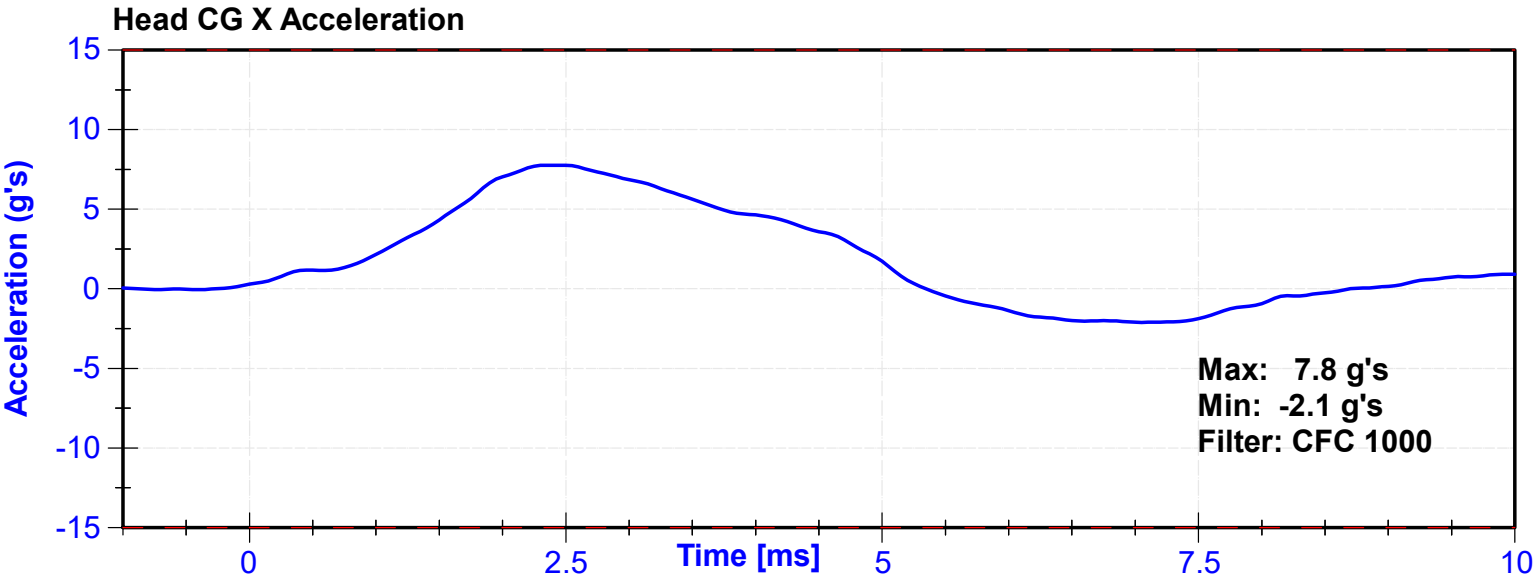
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Resultant Acceleration	125	155	g's	144.0	Pass
Oscillation	0	15	%	2.16	Pass
Fore-Aft Acceleration	-15	15	g's	7.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	T21724	2/27/2023	8/26/2023
Y Accelerometer	Endevco	T22281	2/27/2023	8/26/2023
Z Accelerometer	Endevco	T26050	2/27/2023	8/26/2023

Resultant Acceleration





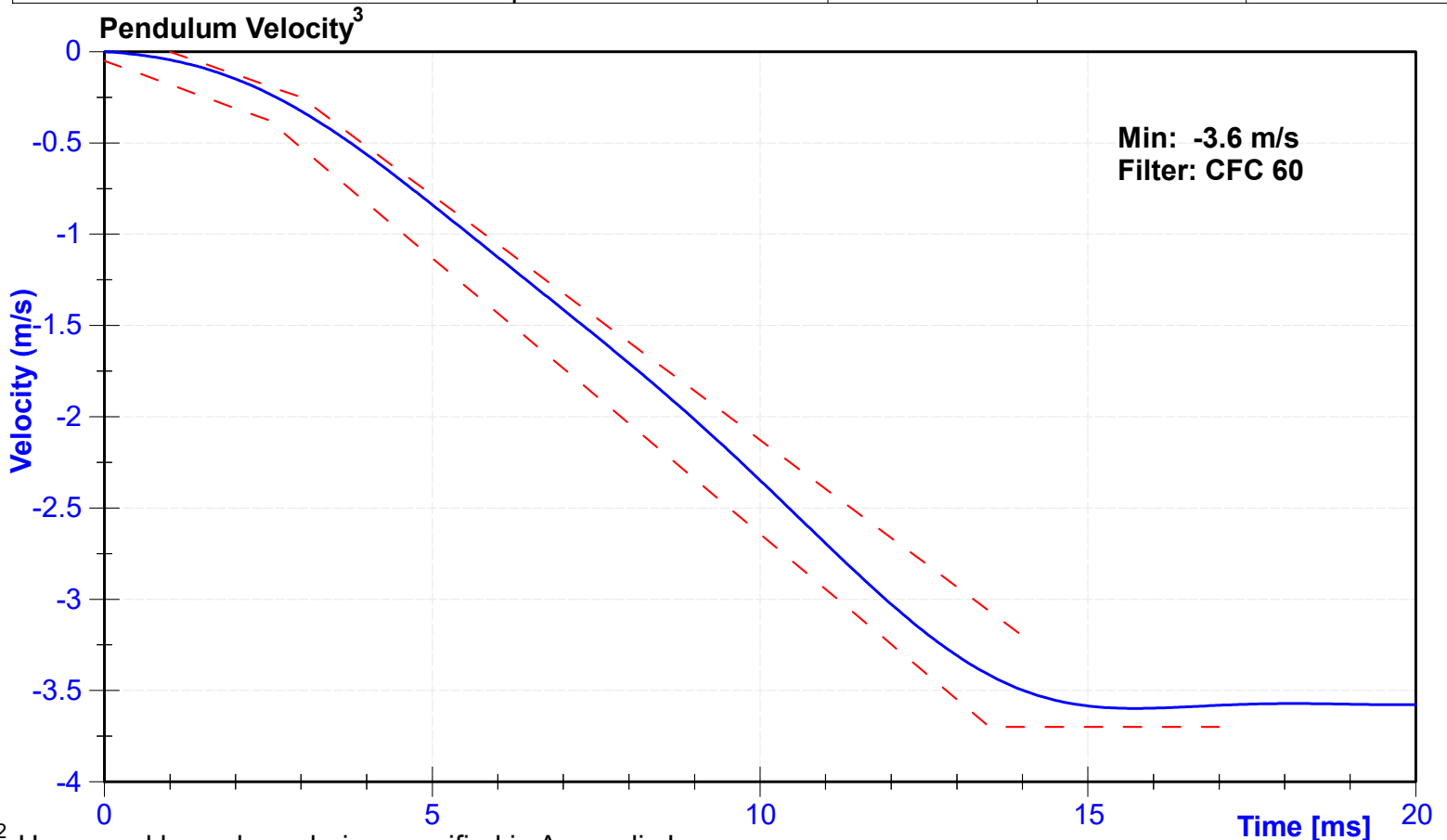
ATD Manufacturer	Denton	Test Technician	C. Mantell
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

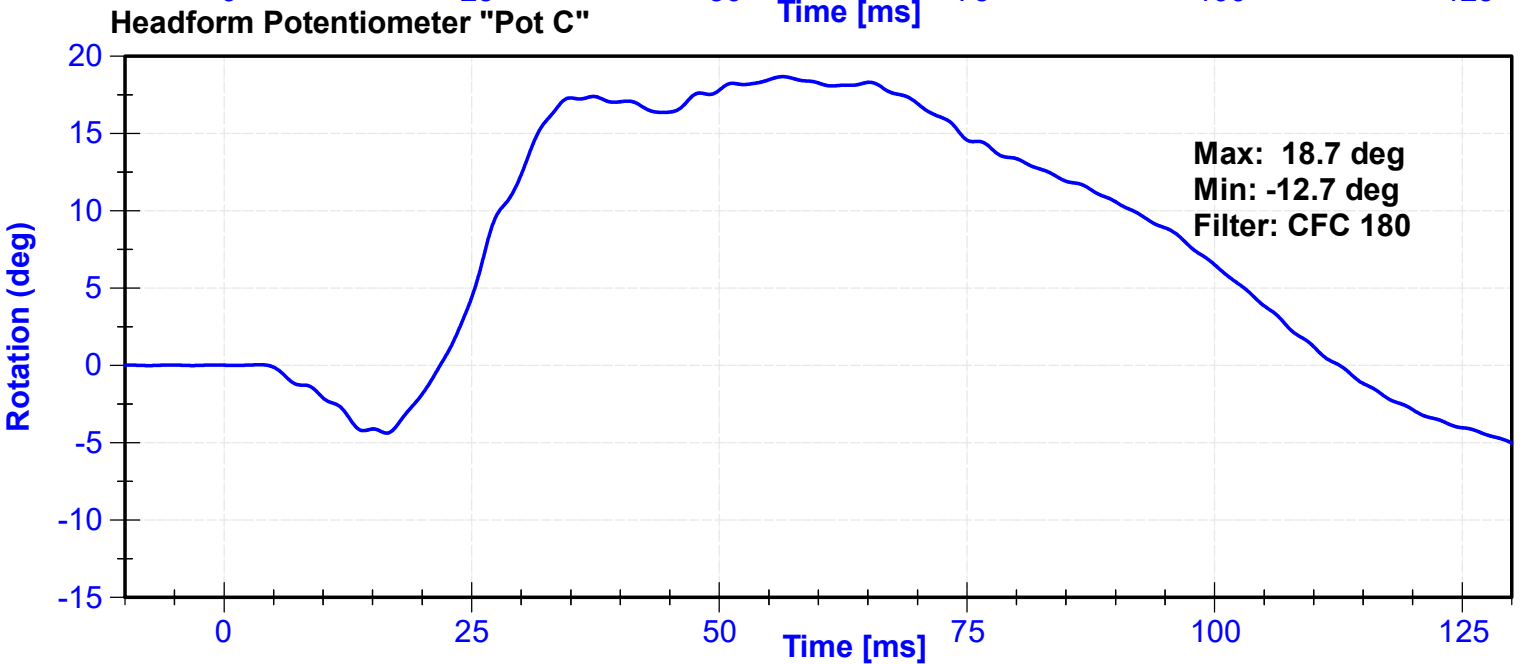
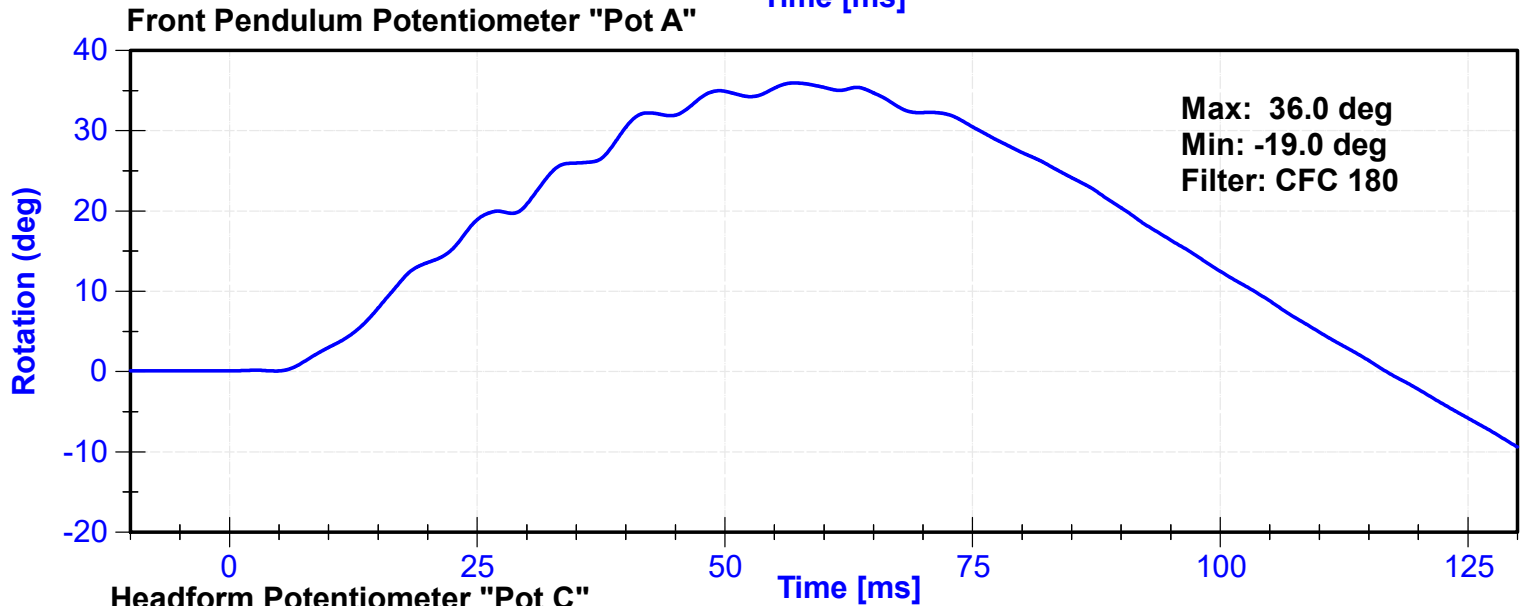
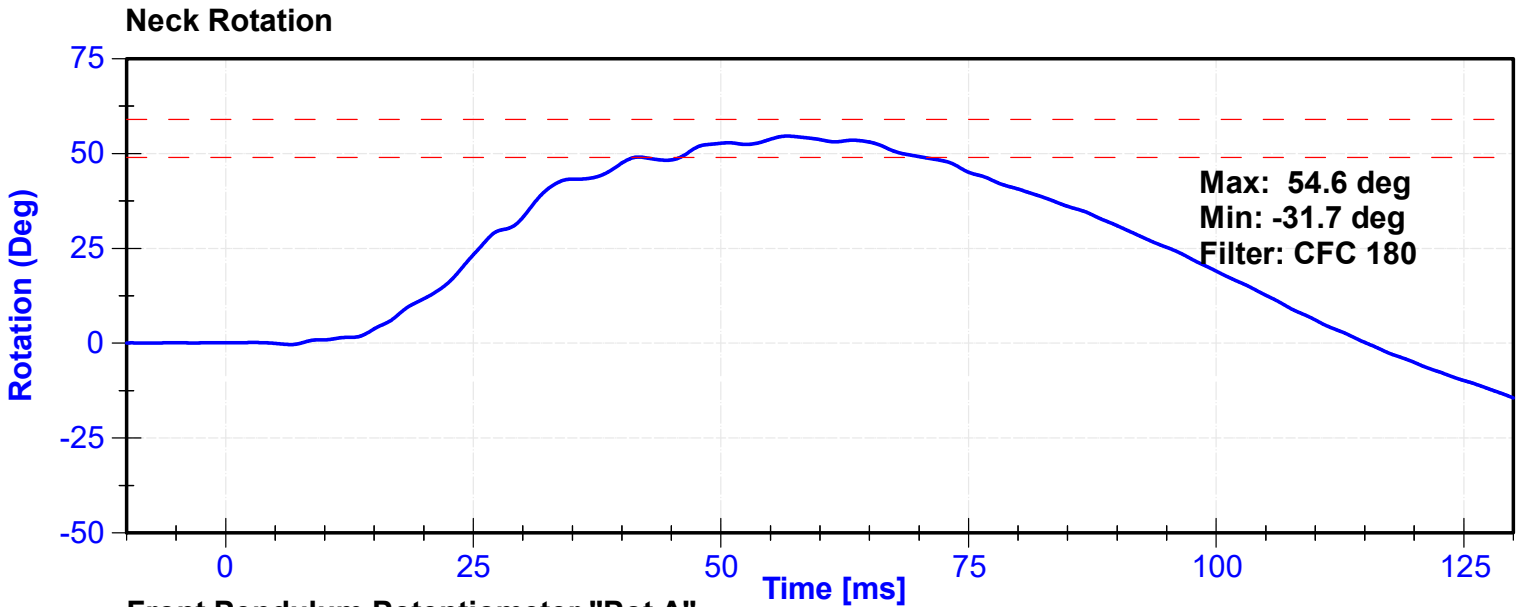
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	23.4	Pass
Velocity	3.3	3.5	m/s	3.38	Pass
Lateral Neck Rotation	49	59	deg	54.6	Pass
Time at Maximum Rotation	54	66	ms	56.7	Pass
Time of Rotation Decay from Maximum	53	88	ms	58.5	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
Front Pendulum Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Headform Potentiometer	Sfernice	095	10/5/2022	10/5/2023



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



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	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

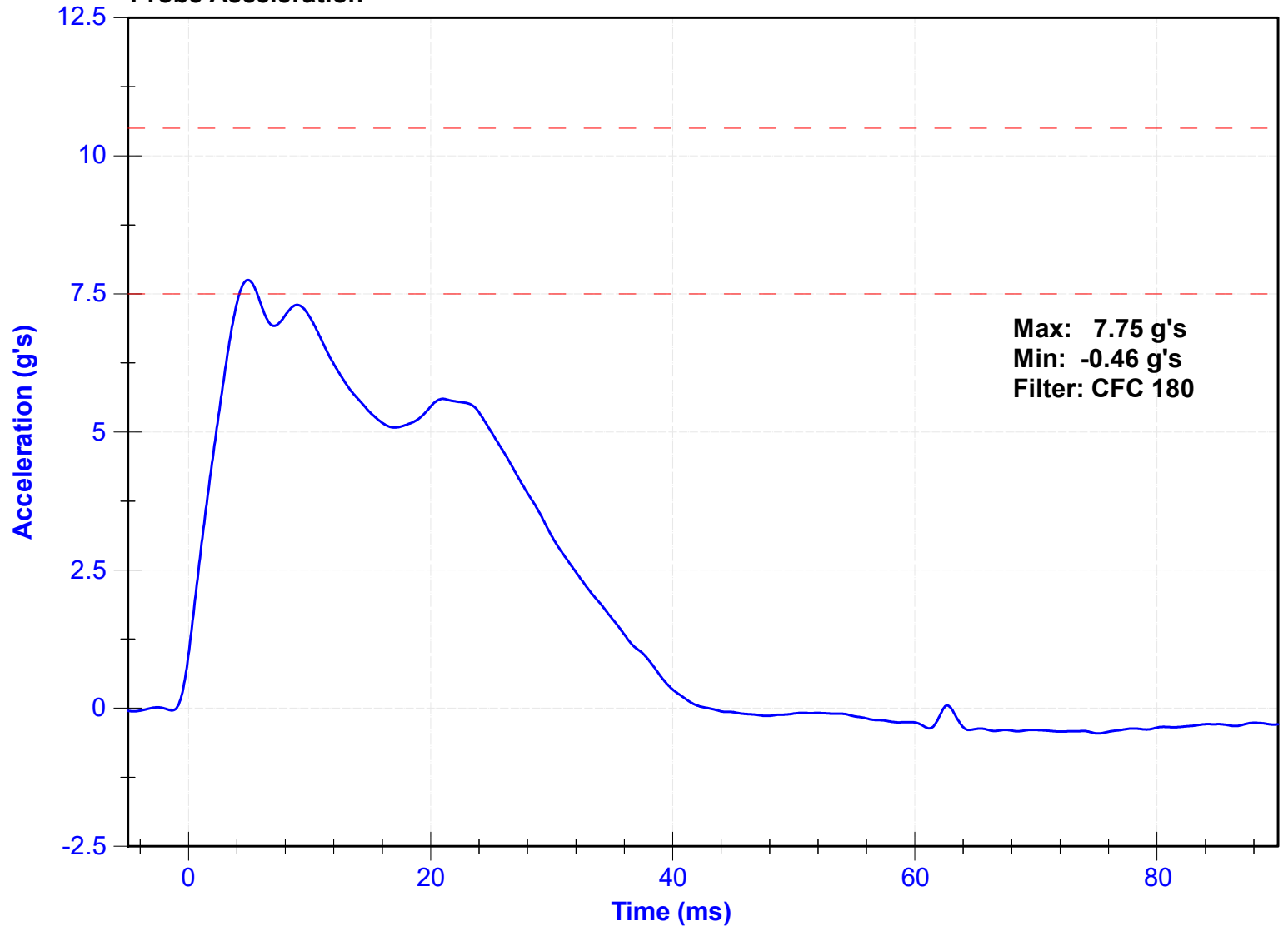
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	19.0	Pass
Velocity	4.2	4.4	m/s	4.36	Pass
Probe Acceleration	7.5	10.5	g's	7.75	Pass

Transducer Calibrations

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

Probe Acceleration



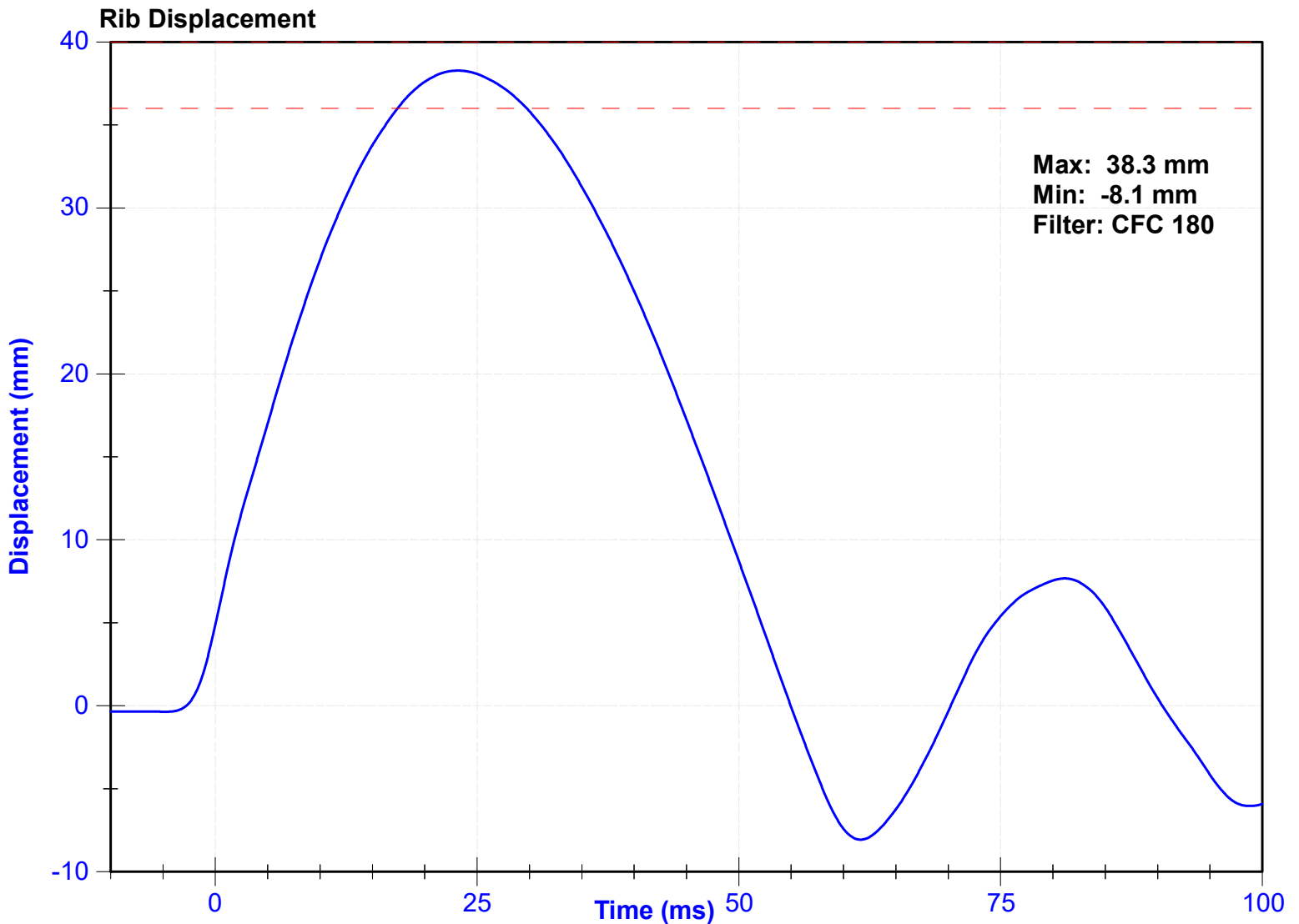
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	36	40	mm	38.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-0552-01	2/27/2023	8/28/2023



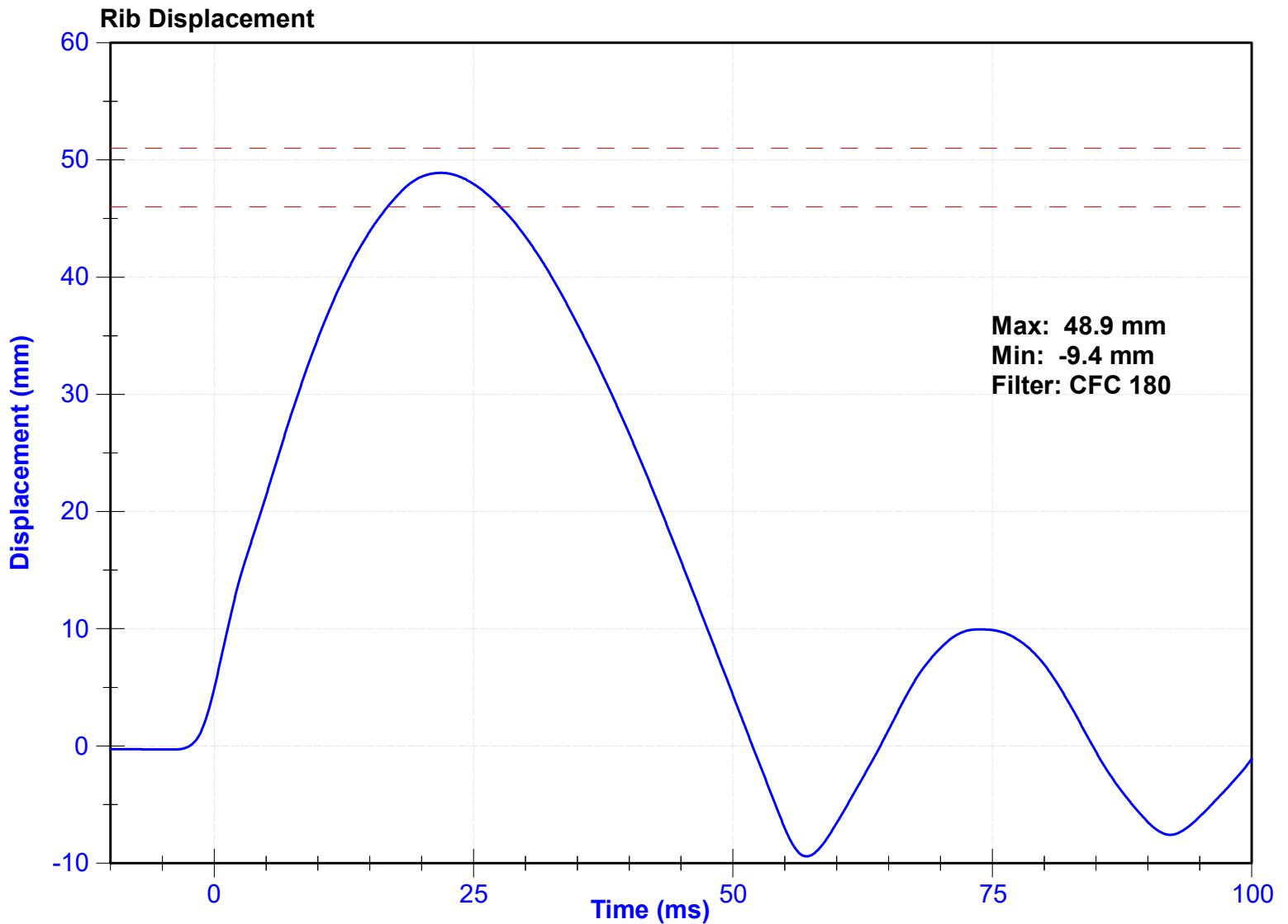
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	46	51	mm	48.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-0552-01	2/27/2023	8/28/2023



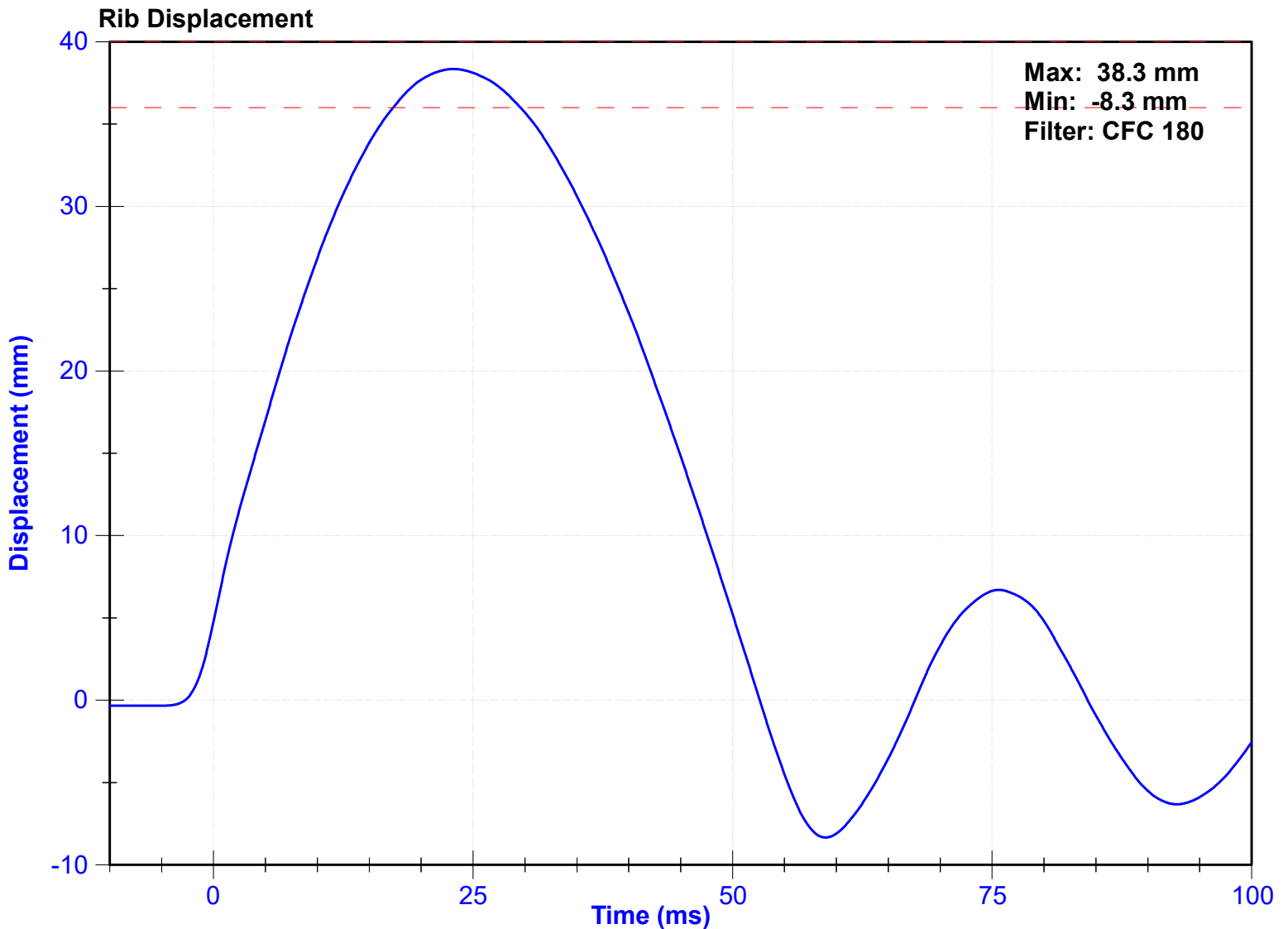
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	36	40	mm	38.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-807	2/27/2023	8/28/2023



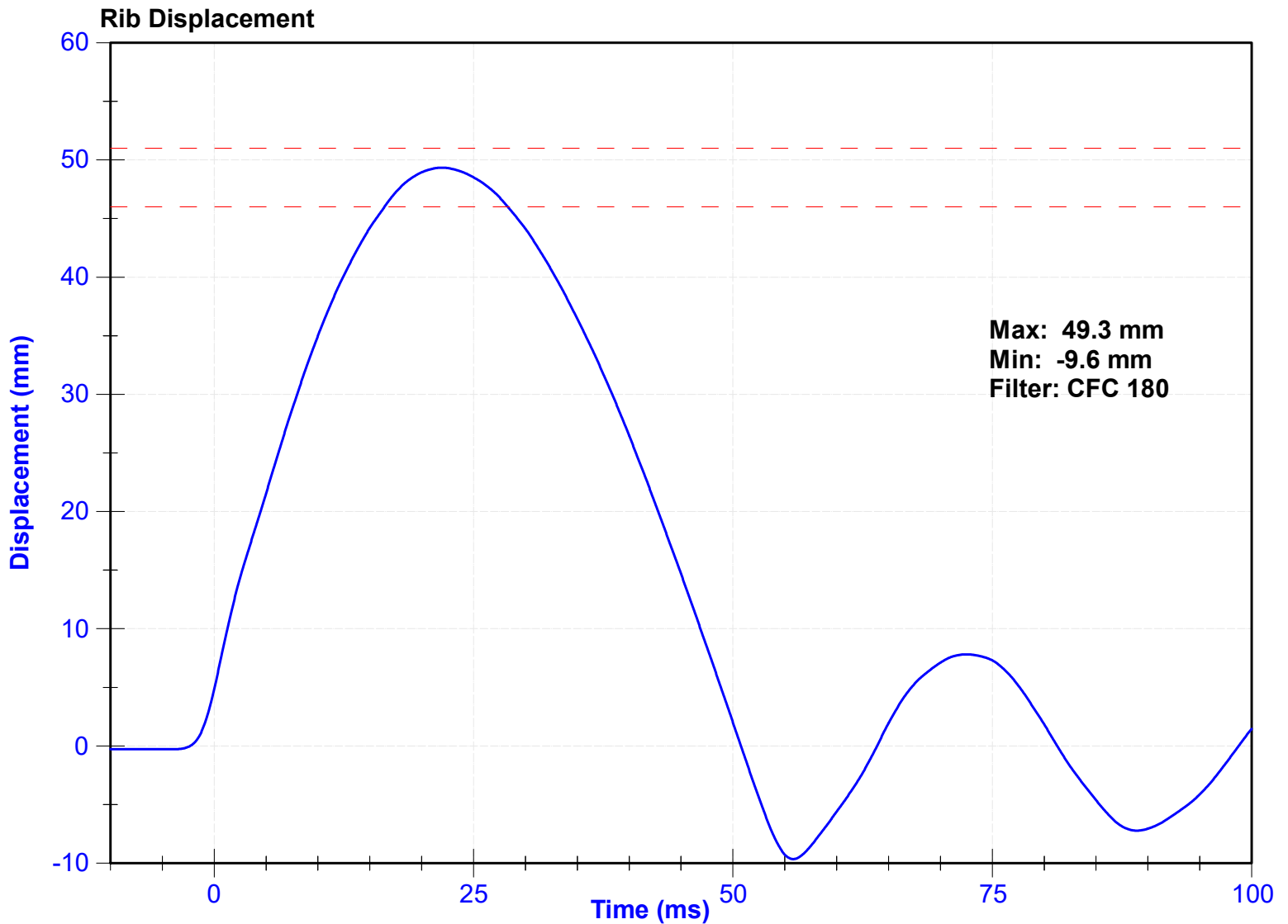
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	46	51	mm	49.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-807	2/27/2023	8/28/2023



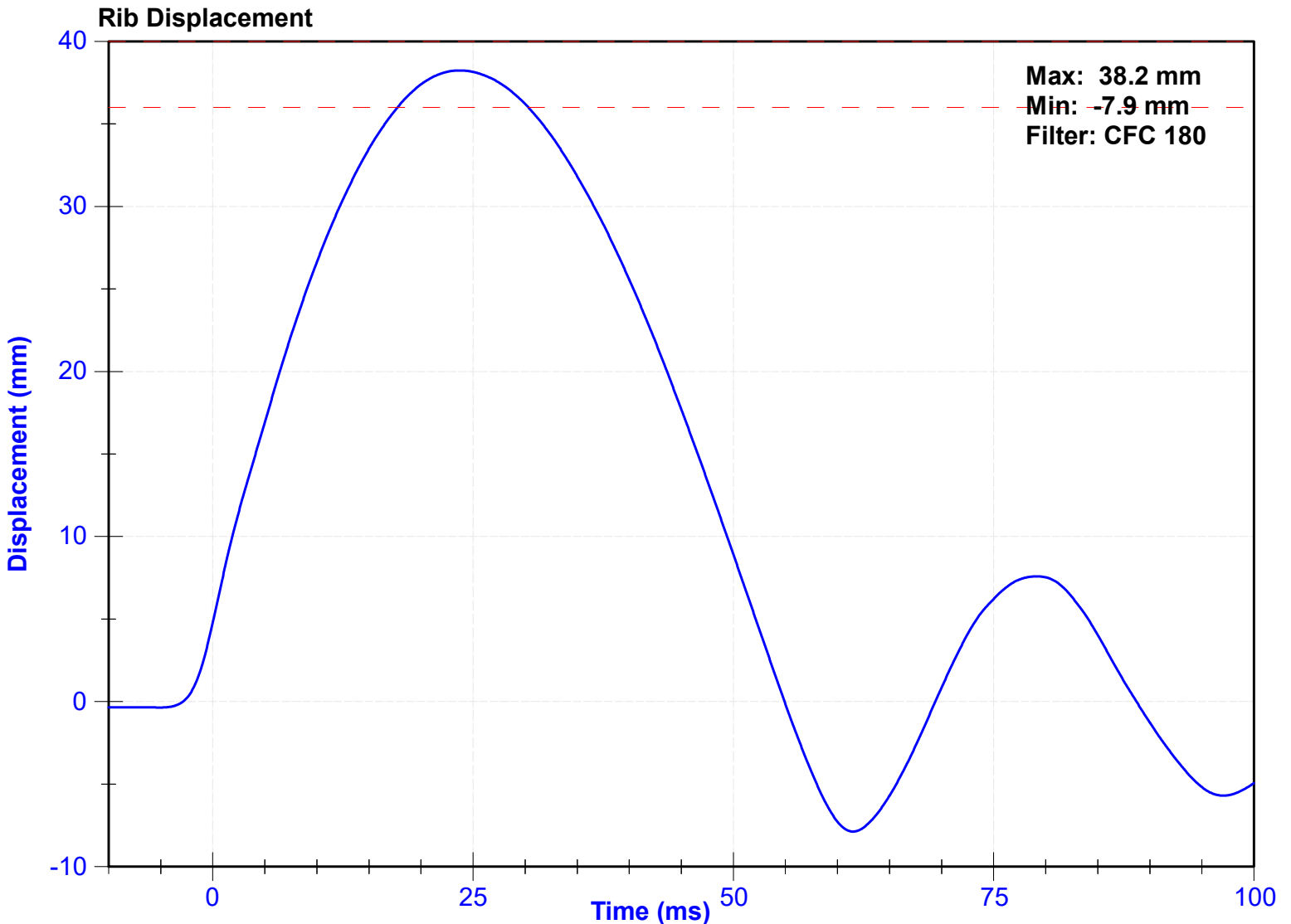
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	36	40	mm	38.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-0552-03	2/27/2023	8/28/2023



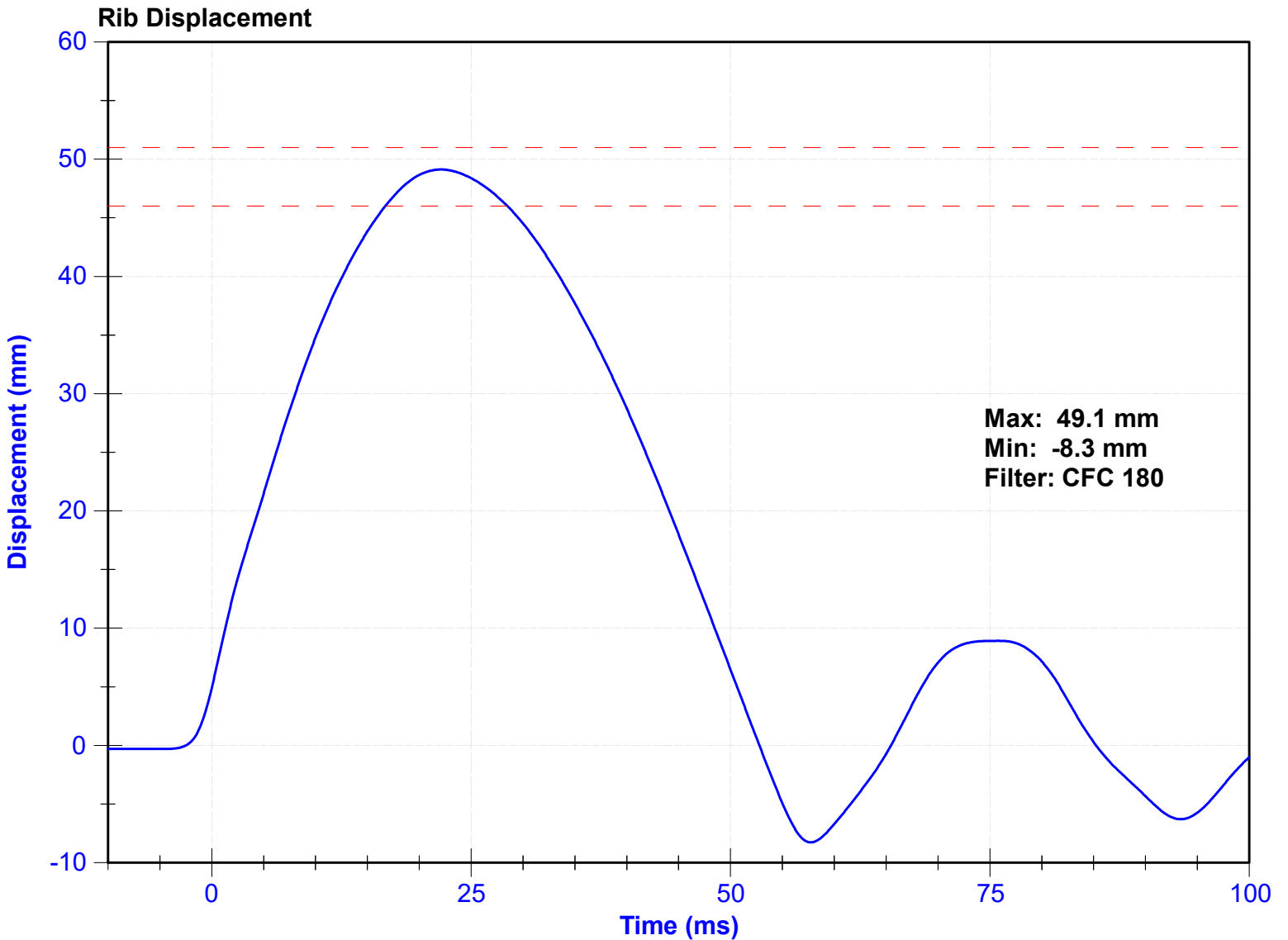
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	46	51	mm	49.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-0552-03	2/27/2023	8/28/2023



ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

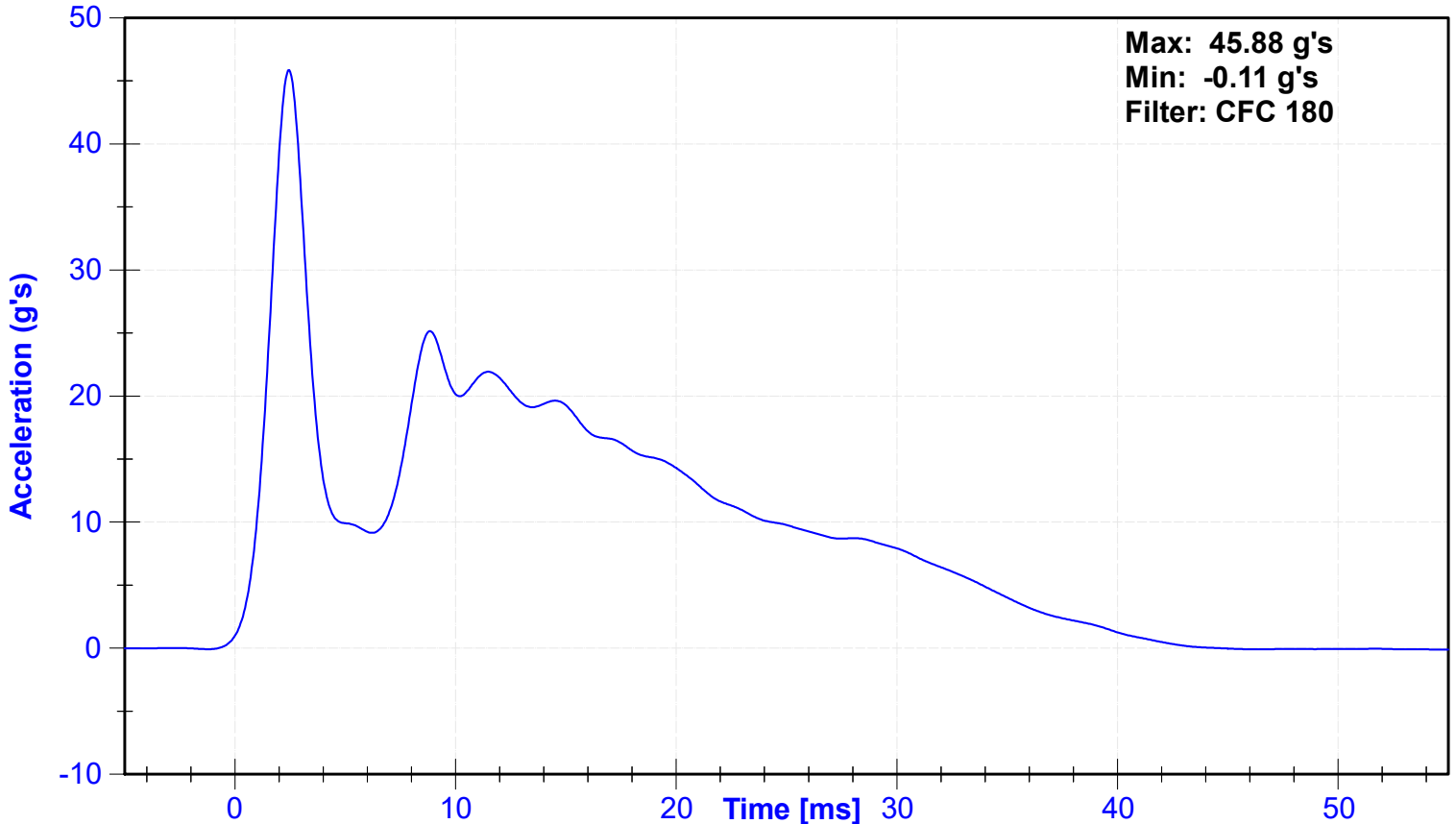
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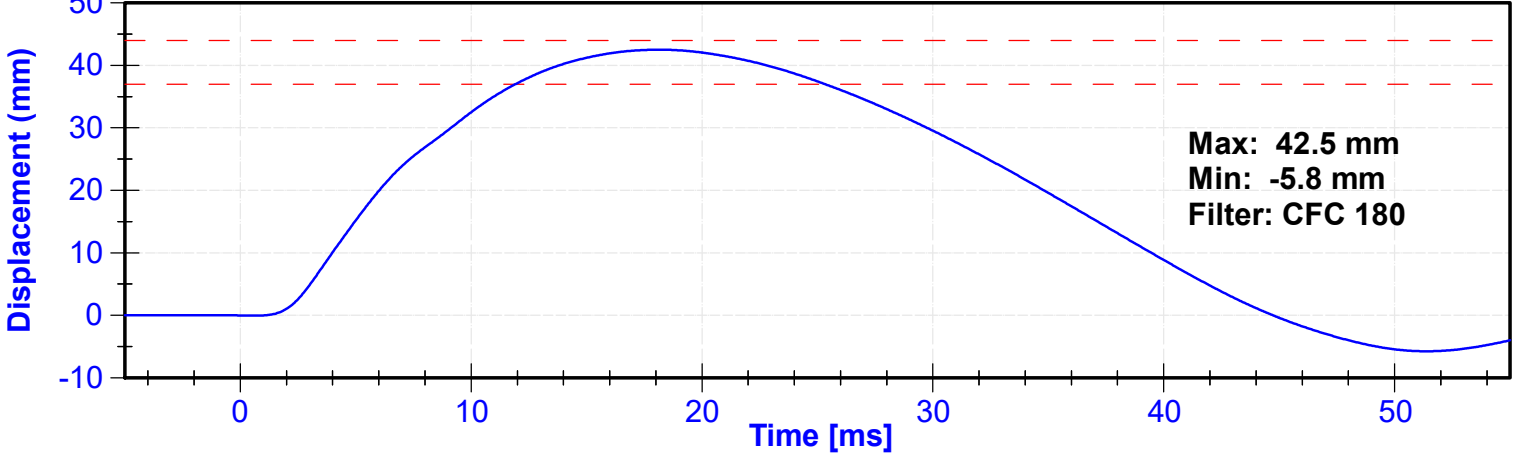
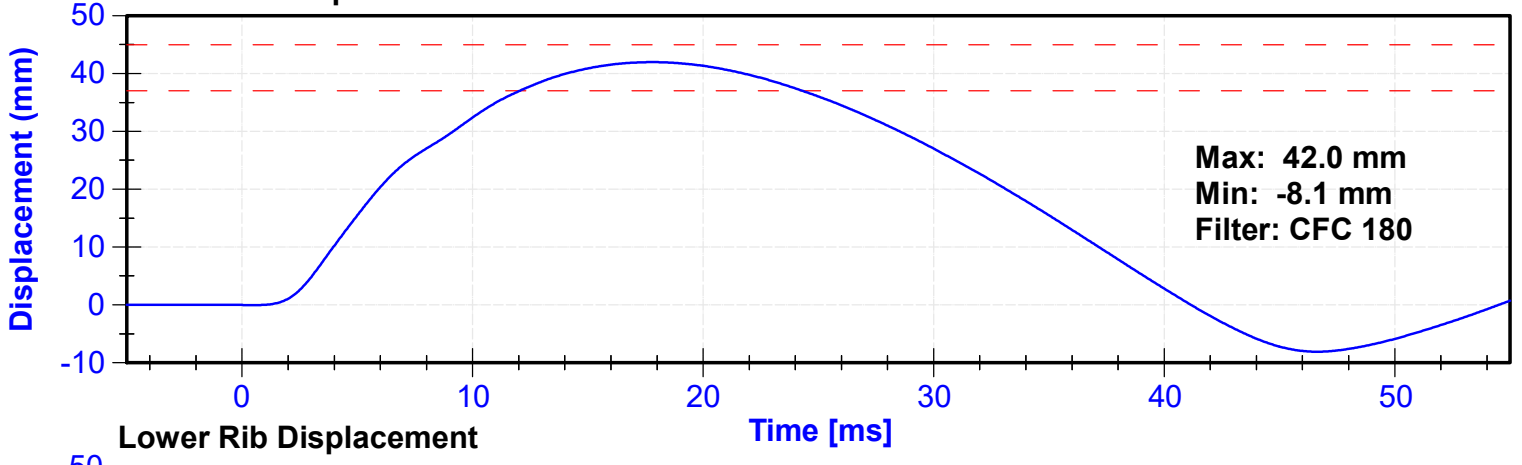
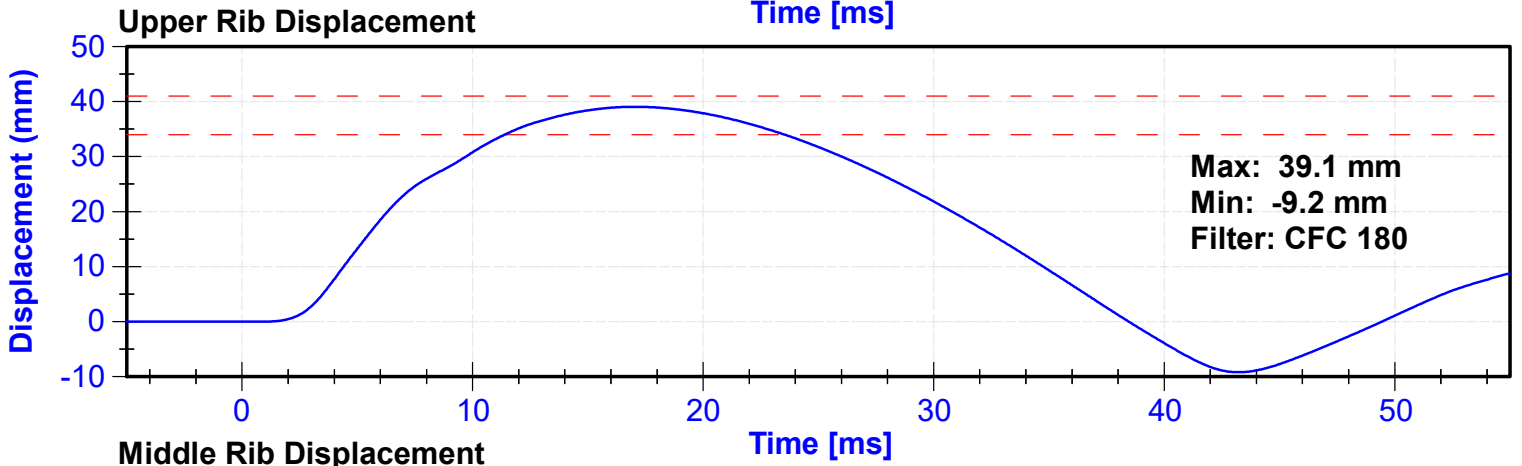
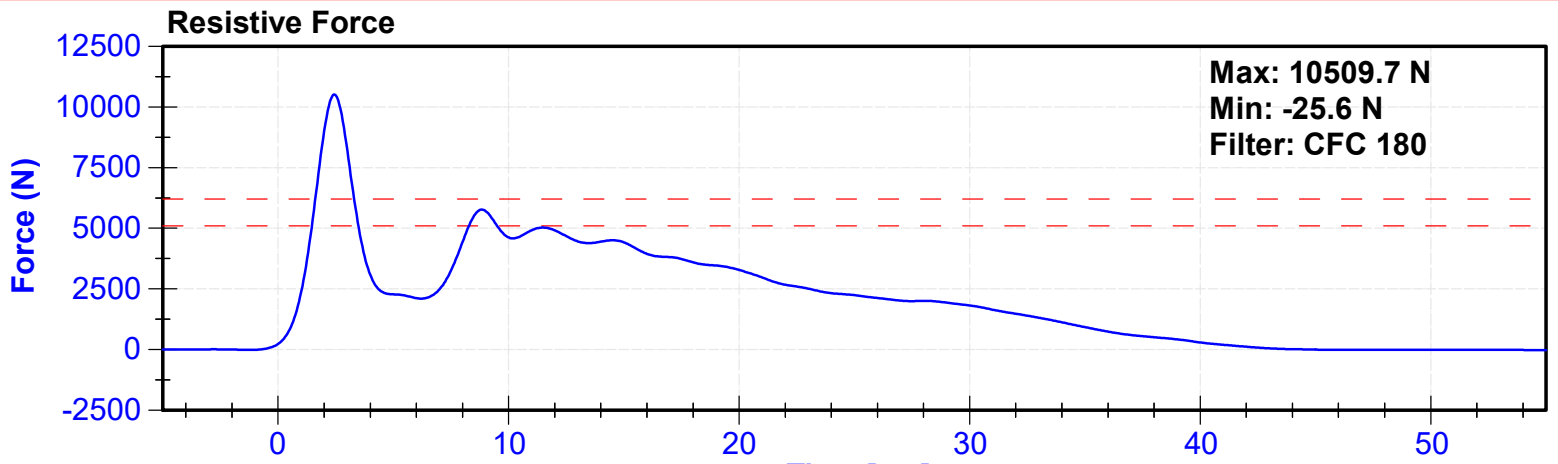
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	19.0	Pass
Velocity	5.4	5.6	m/s	5.54	Pass
Resistive Force after 6ms	5100	6200	N	5763.5	Pass
Upper Thorax Rib Deflection	34	41	mm	39.1	Pass
Mid Thorax Rib Deflection	37	45	mm	42.0	Pass
Lower Thorax Rib Deflection	37	44	mm	42.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18546	11/19/2022	5/18/2023
Upper Thorax Rib Potentiometer	Honeywell	DS-0552-01	2/27/2023	8/28/2023
Middle Thorax Rib Potentiometer	Honeywell	DS-807	2/27/2023	8/28/2023
Lower Thorax Rib Potentiometer	Honeywell	DS-0552-03	2/27/2023	8/28/2023

Probe Acceleration





ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

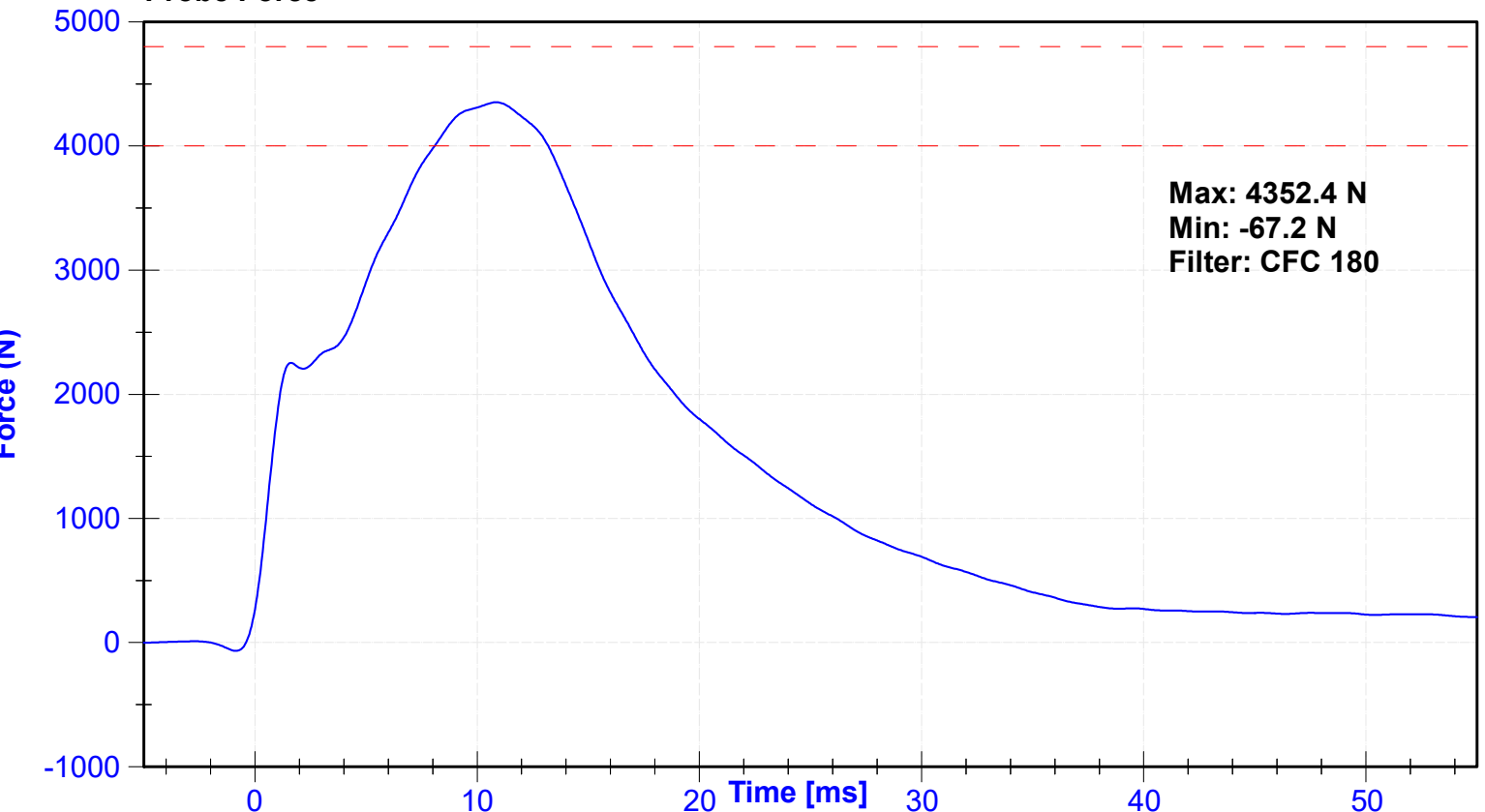
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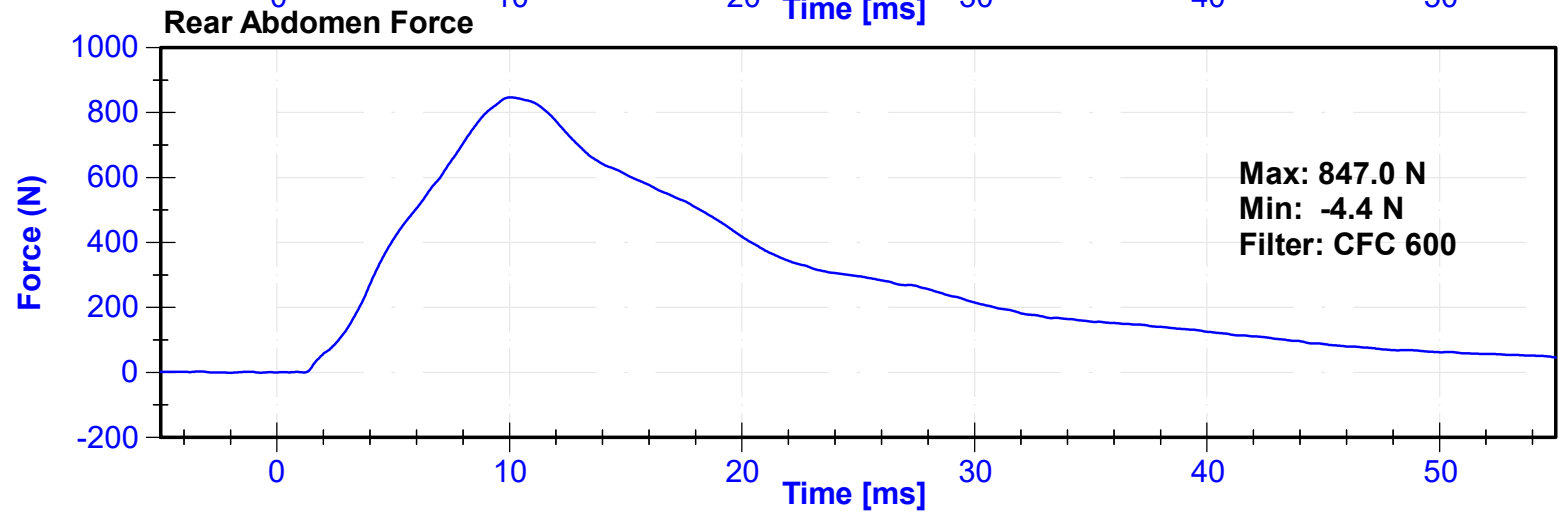
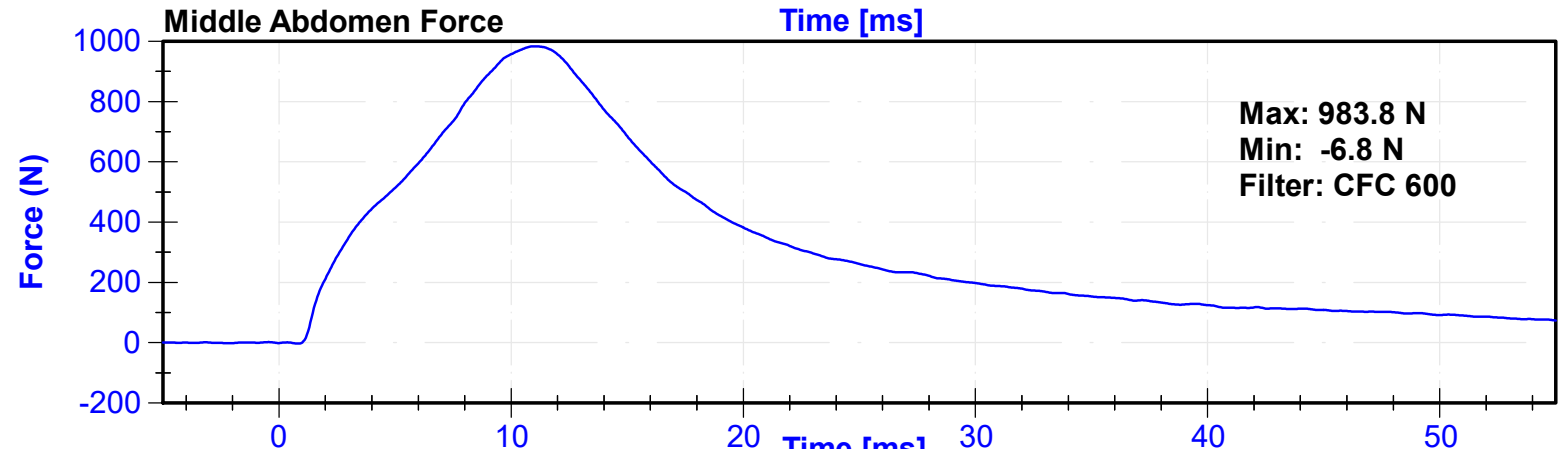
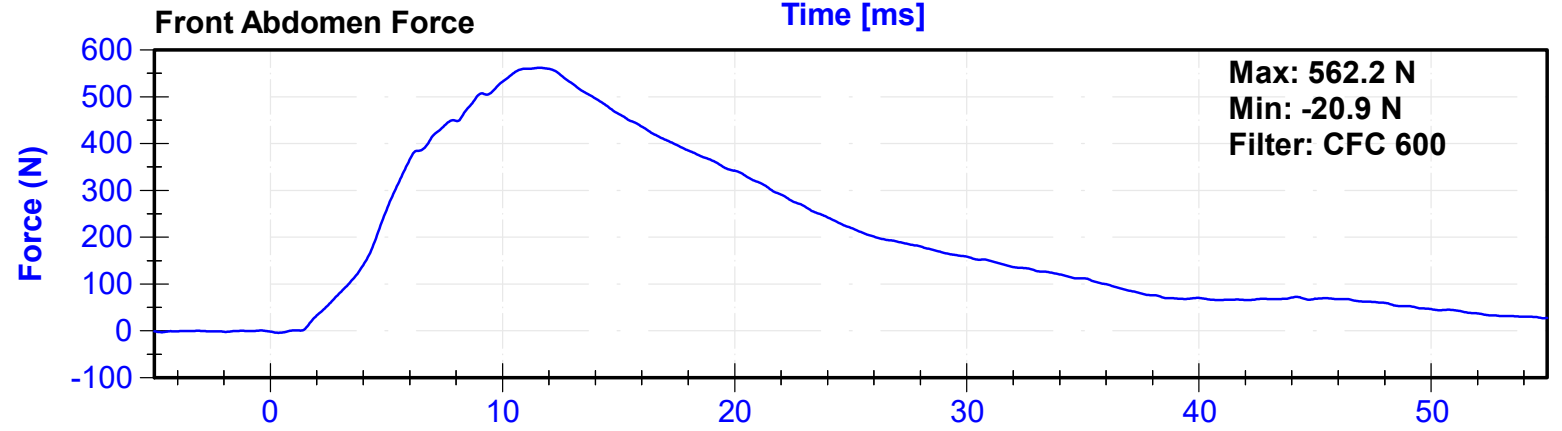
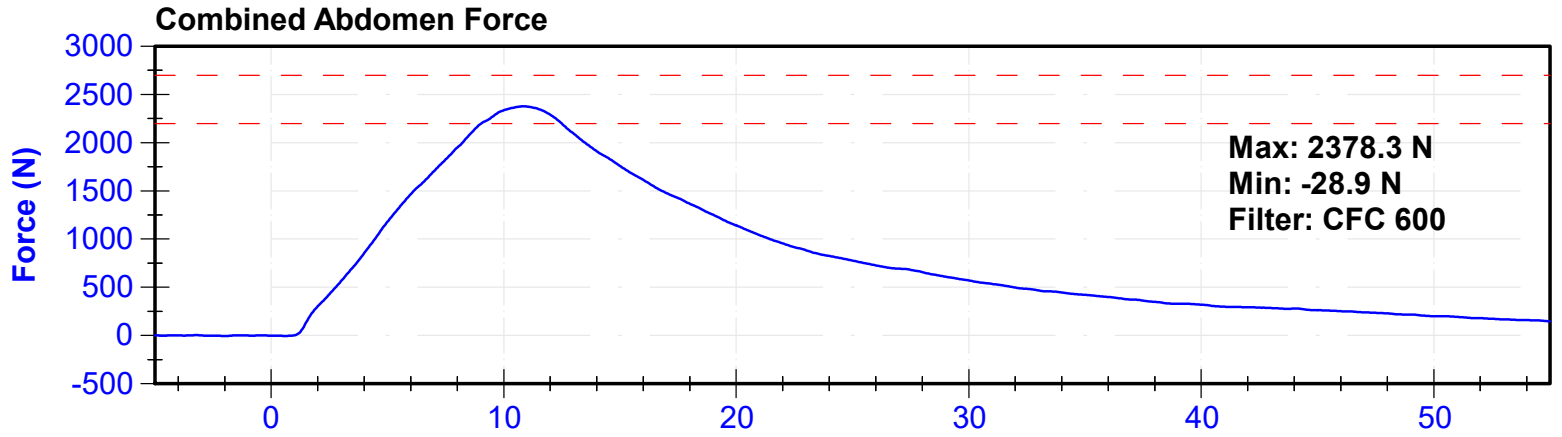
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	19.0	Pass
Velocity	3.9	4.1	m/s	4.02	Pass
Combined Abdomen Force	2200	2700	N	2378.3	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.85	Pass
Resistive Probe Force	4000	4800	N	4352.4	Pass
Time at Peak Resistive Force	10.6	13.0	ms	10.85	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023
Front Abdomen Load Cell	Denton	1440	8/12/2022	8/12/2023
Middle Abdomen Load Cell	Denton	1525	8/12/2022	8/12/2023
Rear Abdomen Load Cell	Denton	1528	8/12/2022	8/12/2023

Probe Force





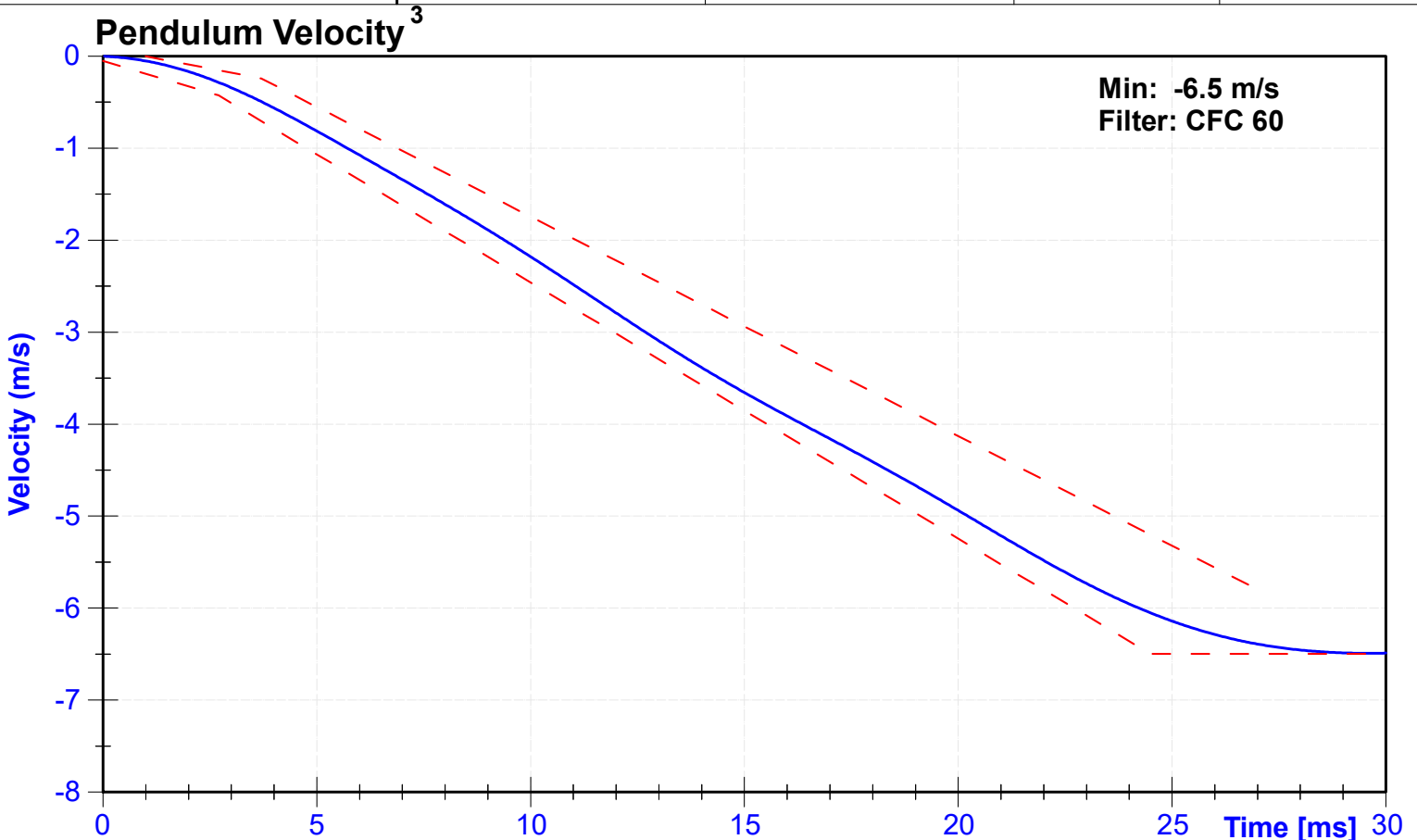
ATD Manufacturer	Denton	Test Technician	C. Mantell
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

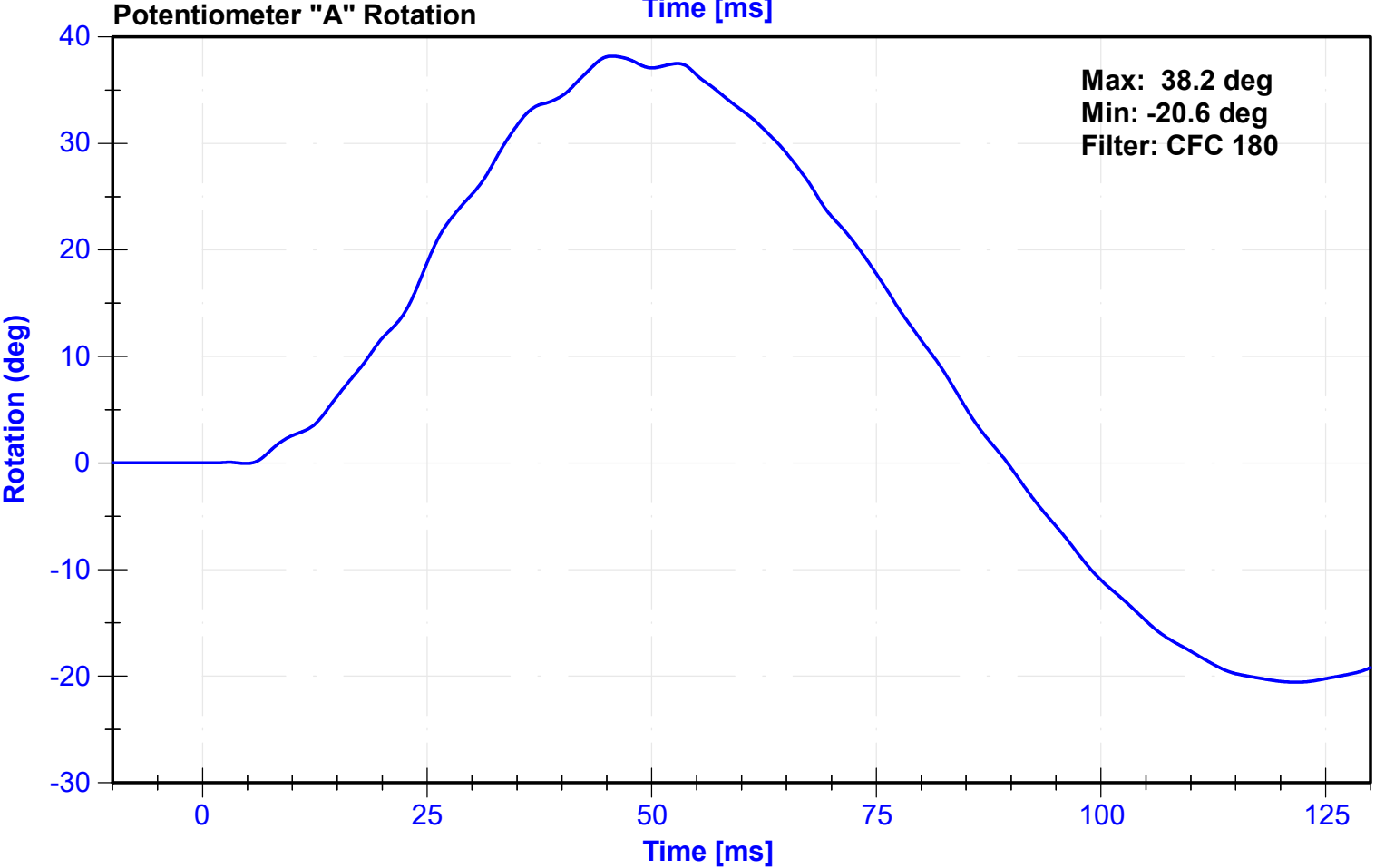
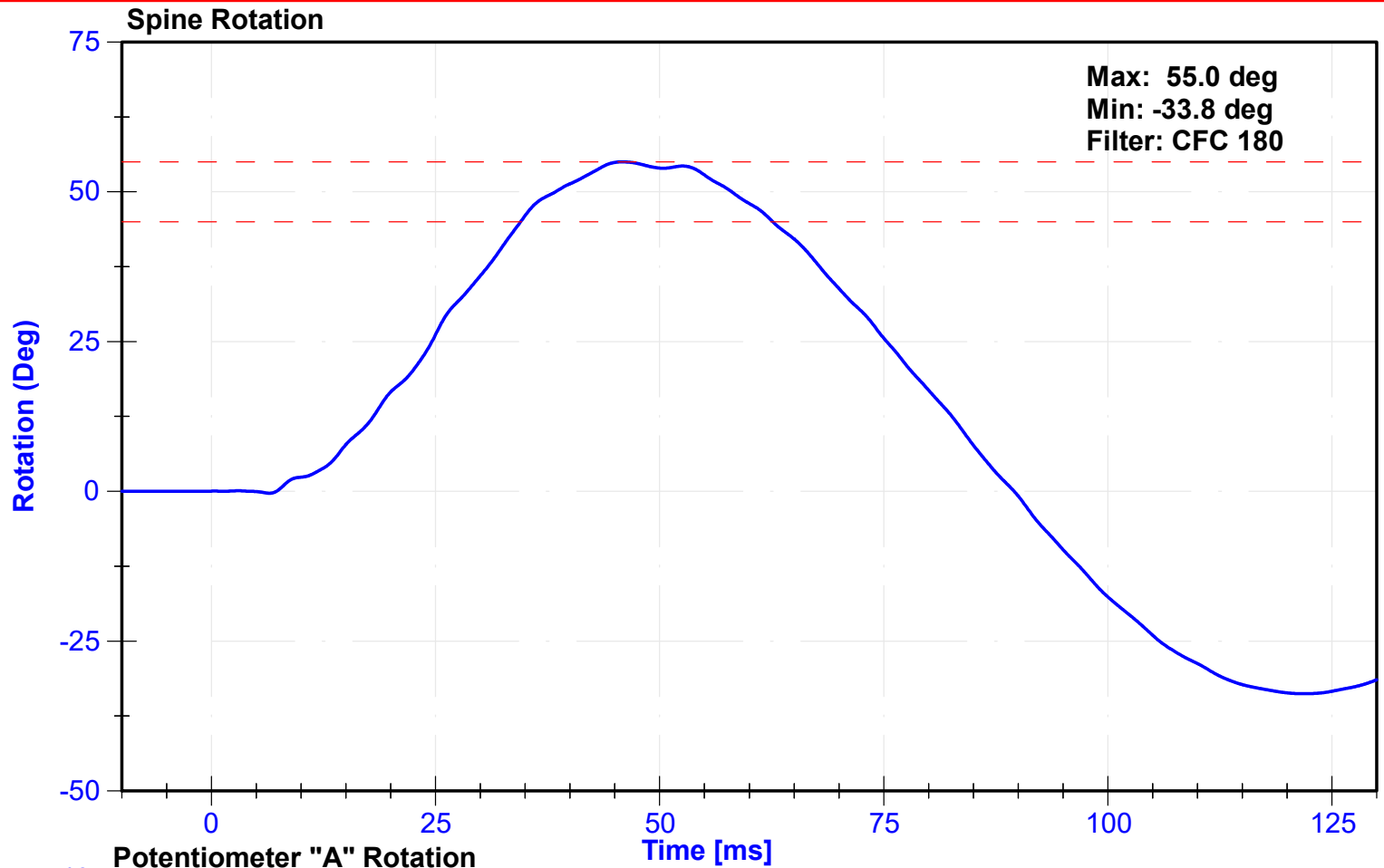
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.0	Pass
Humidity	10	70	%	23.4	Pass
Velocity	5.95	6.15	m/s	6.045	Pass
Lateral Spine Rotation	45	55	deg	55.0	Pass
Time at Maximum Rotation	39	53	ms	45.8	Pass
Time of Decay to Zero Degrees	37	57	ms	43.8	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

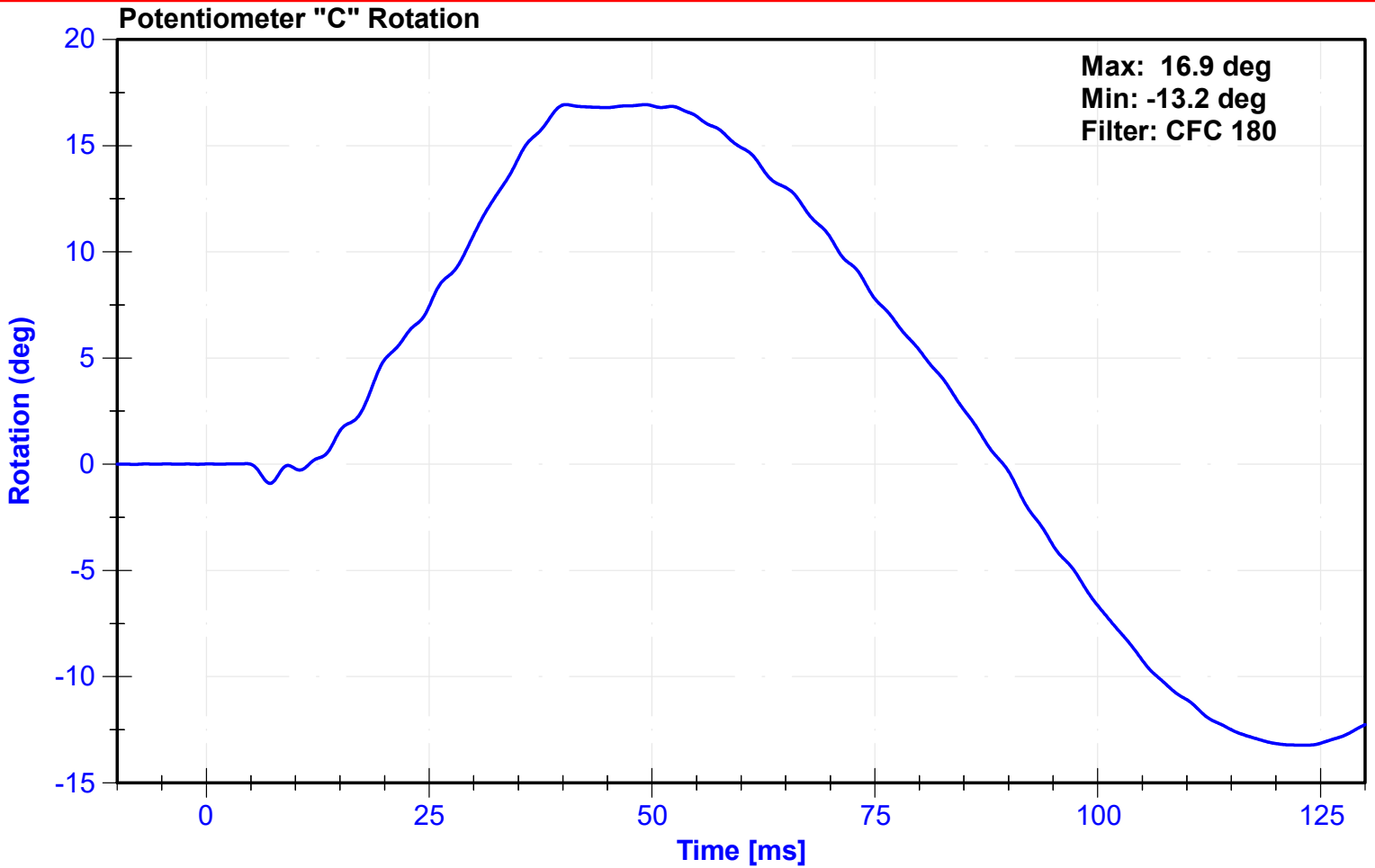
Transducer Calibrations

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



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

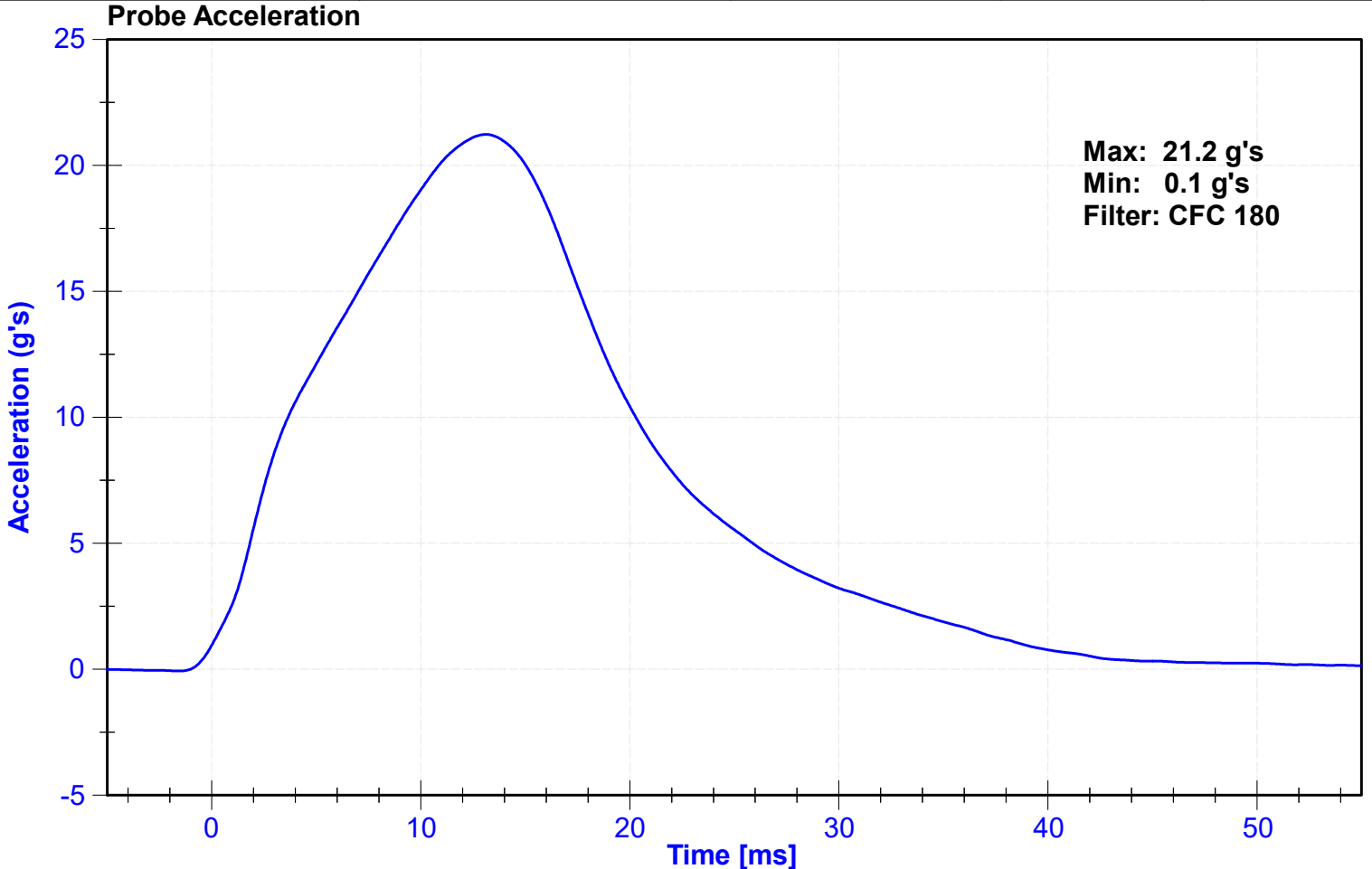
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

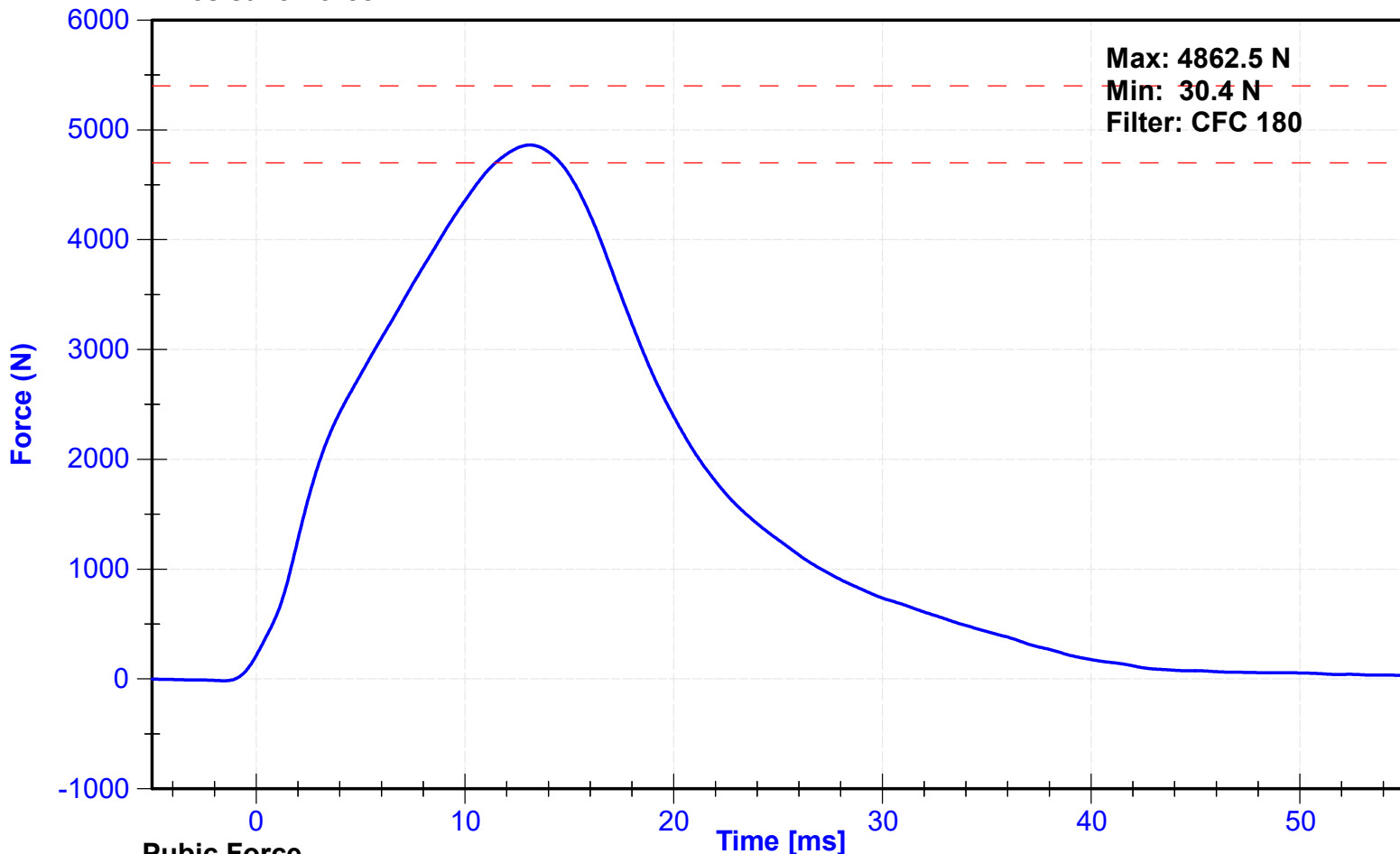
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	19.0	Pass
Velocity	4.2	4.4	m/s	4.35	Pass
Resistive Force	4700	5400	N	4862.5	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.10	Pass
Pubic Force	-1590	-1230	N	-1405.9	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.60	Pass

Transducer Calibrations

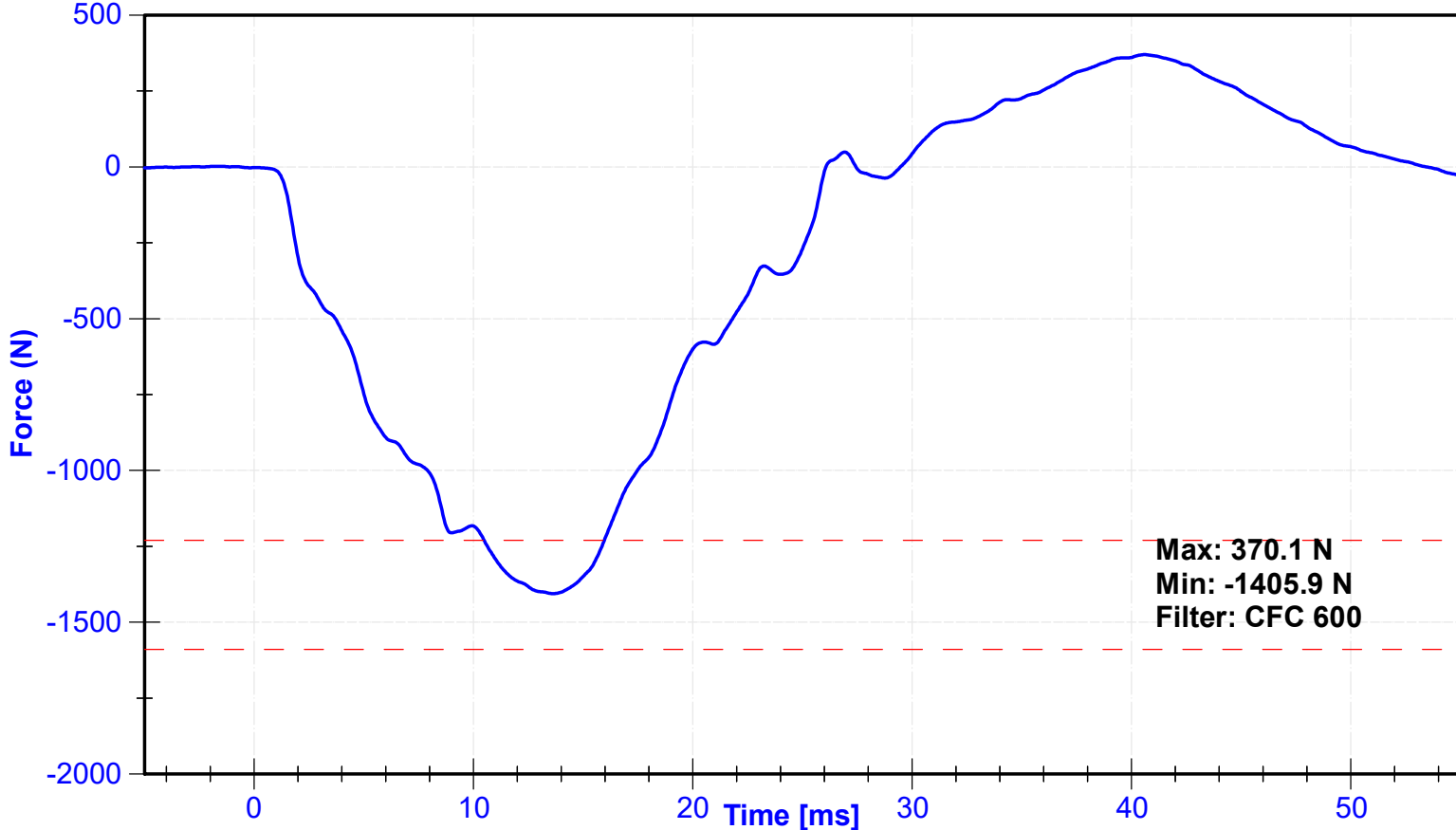
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023
Pubic Load Cell	Denton	456-FY	8/12/2022	8/12/2023



Resistive Force



Pubic Force



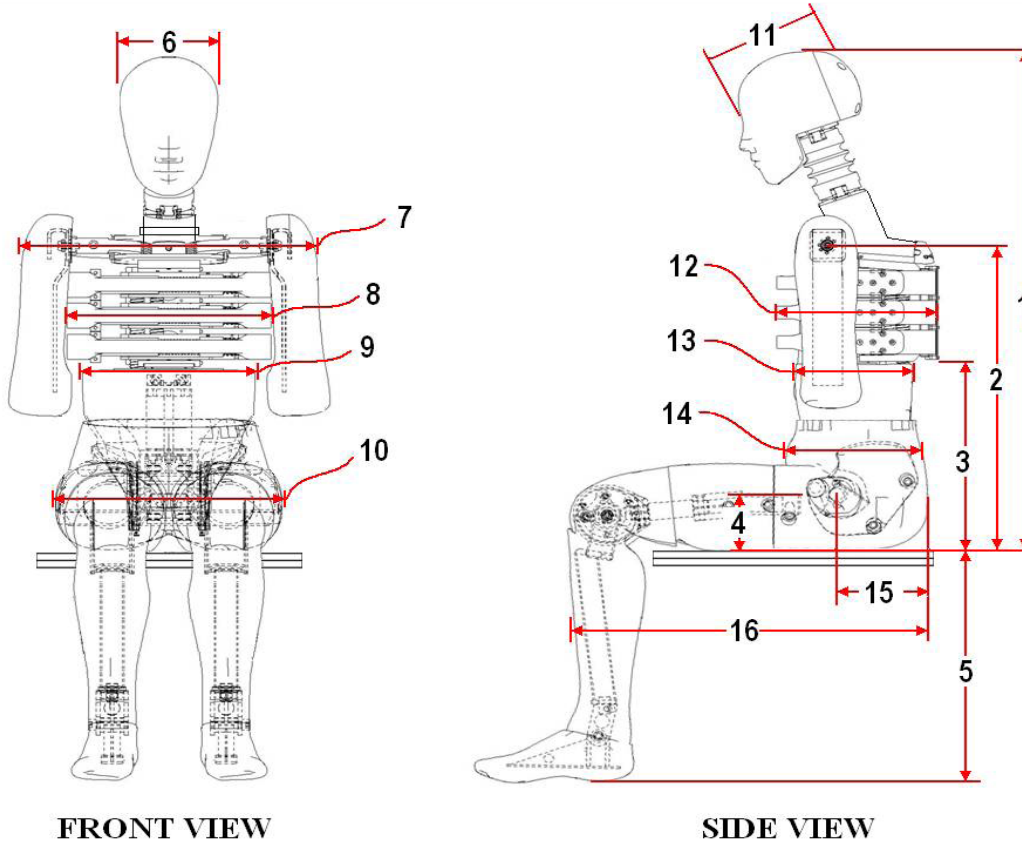
POST-TEST DUMMY PERFORMANCE CALIBRATION TEST DATA
(Subpart U, ES-2re)

External Measurements - EuroSID-2re

Technician: K. Brogan

Date: 03/14/2023

Dummy Serial Number: D037



FRONT VIEW

SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	912	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	103	Pass
5	Sole to Seat, Sitting	333	451	422	Pass
6	Head Width	152	158	155	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	330	Pass
9	Abdomen Width	273	287	281	Pass
10	Pelvis Lap Width	359	373	365	Pass
11	Head Depth	196	206	199	Pass
12	Thorax Depth	262	272	267	Pass
13	Abdomen Depth	194	204	200	Pass
14	Pelvis Depth	235	245	240	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	153	Pass
16	Back of Buttocks to Front Knee	597	615	604	Pass

ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

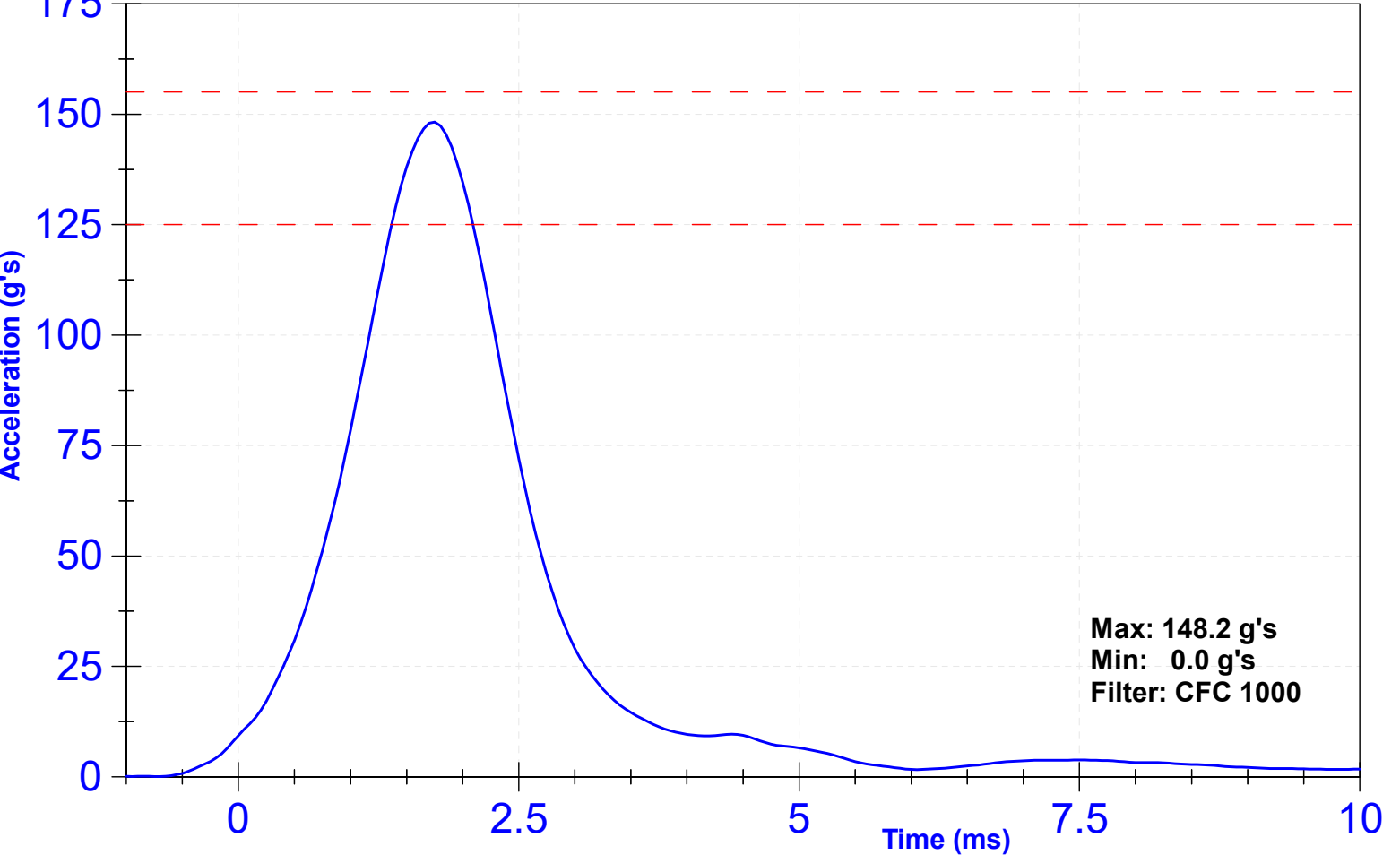
Results

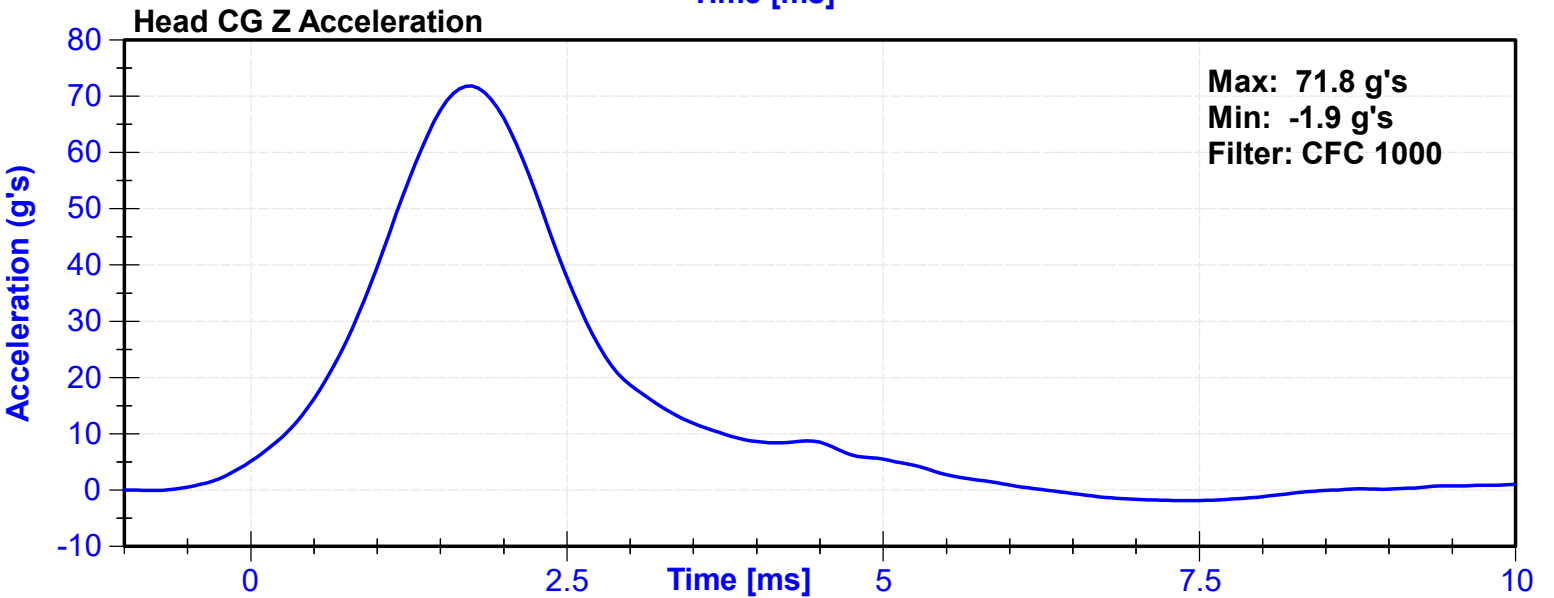
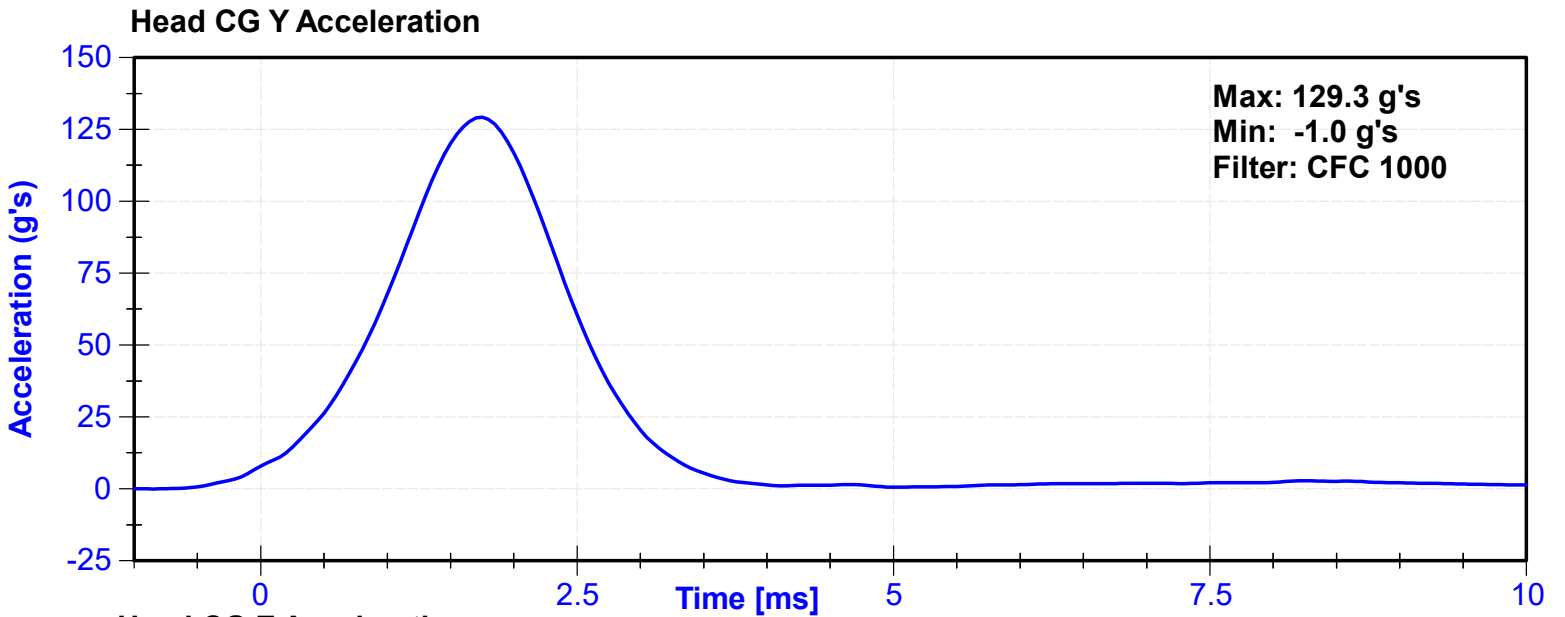
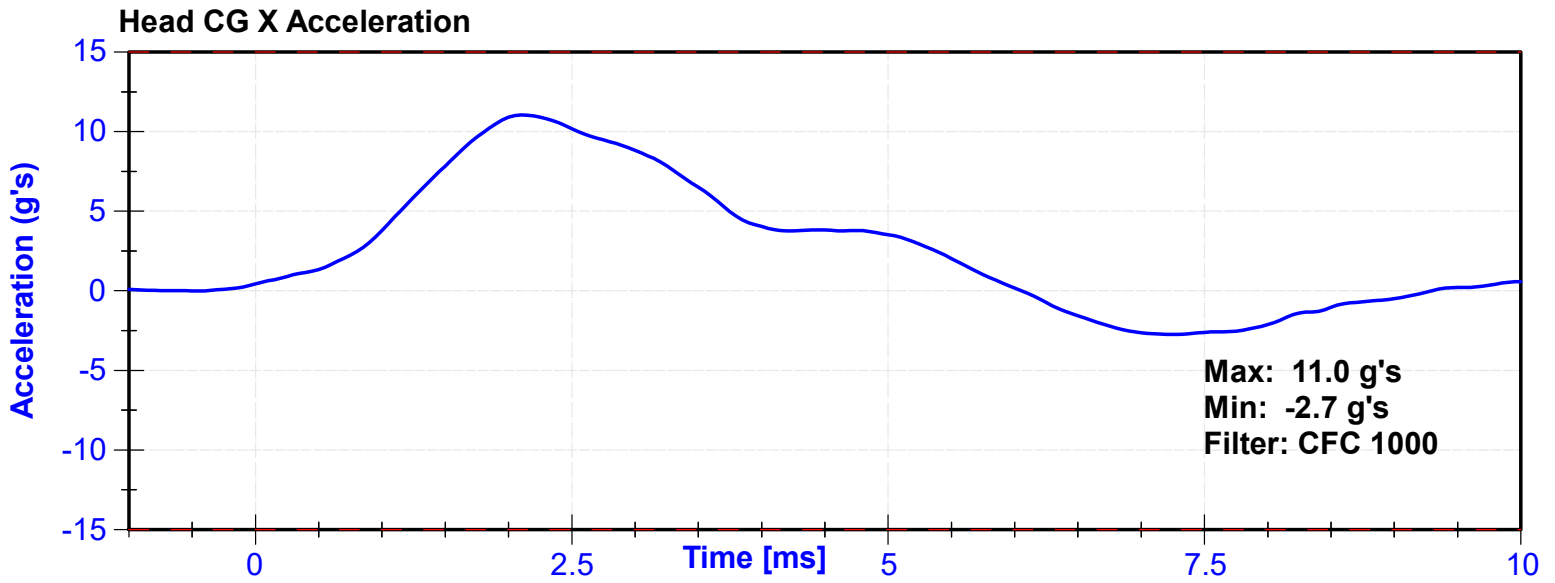
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Resultant Acceleration	125	155	g's	148.2	Pass
Oscillation	0	15	%	6.49	Pass
Fore-Aft Acceleration	-15	15	g's	11.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	T21724	2/27/2023	8/26/2023
Y Accelerometer	Endevco	T22281	2/27/2023	8/26/2023
Z Accelerometer	Endevco	T26050	2/27/2023	8/26/2023

Resultant Acceleration





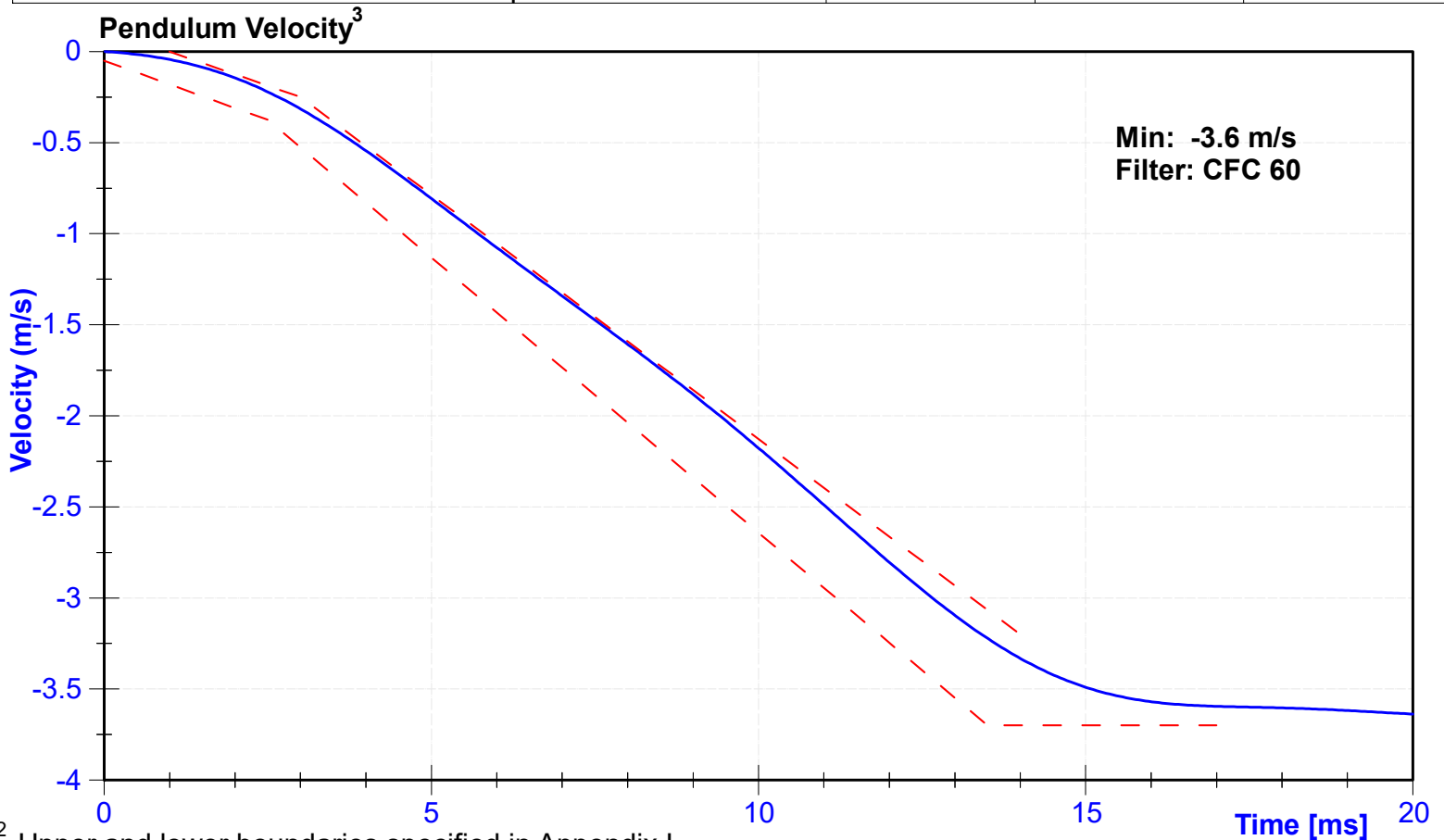
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	21.2	Pass
Velocity	3.3	3.5	m/s	3.36	Pass
Lateral Neck Rotation	49	59	deg	54.0	Pass
Time at Maximum Rotation	54	66	ms	62.9	Pass
Time of Rotation Decay from Maximum	53	88	ms	53.9	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

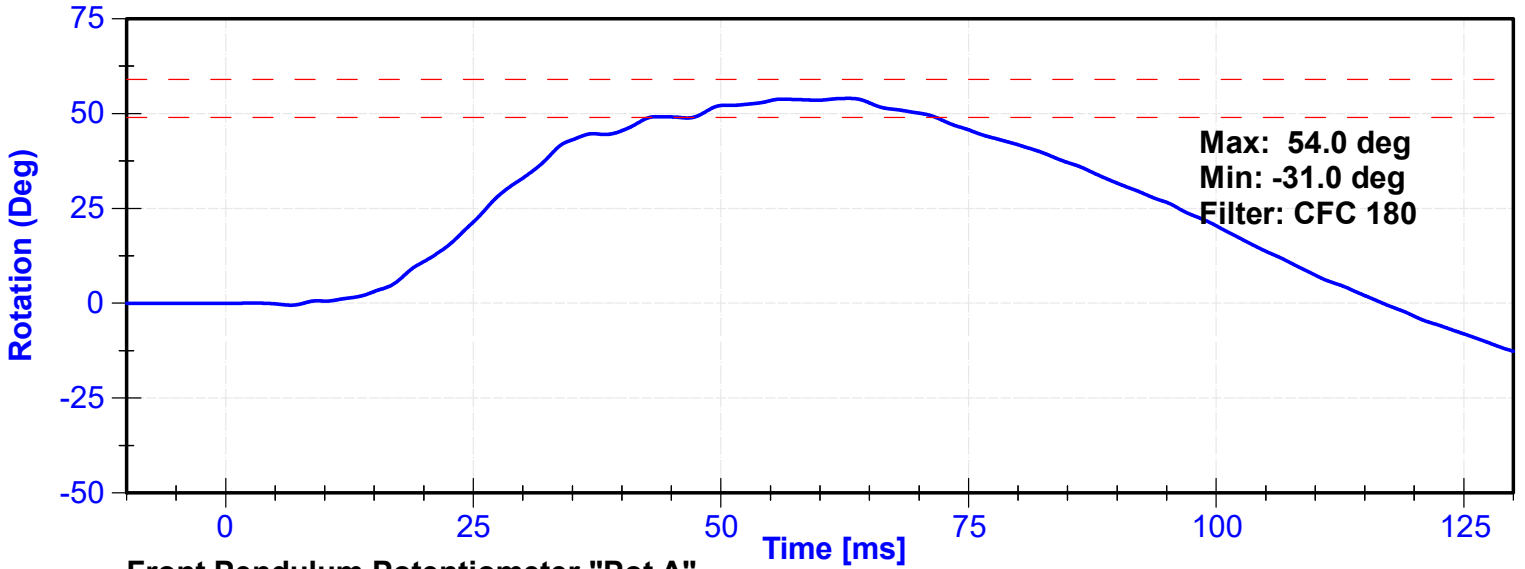
Transducer Calibrations

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

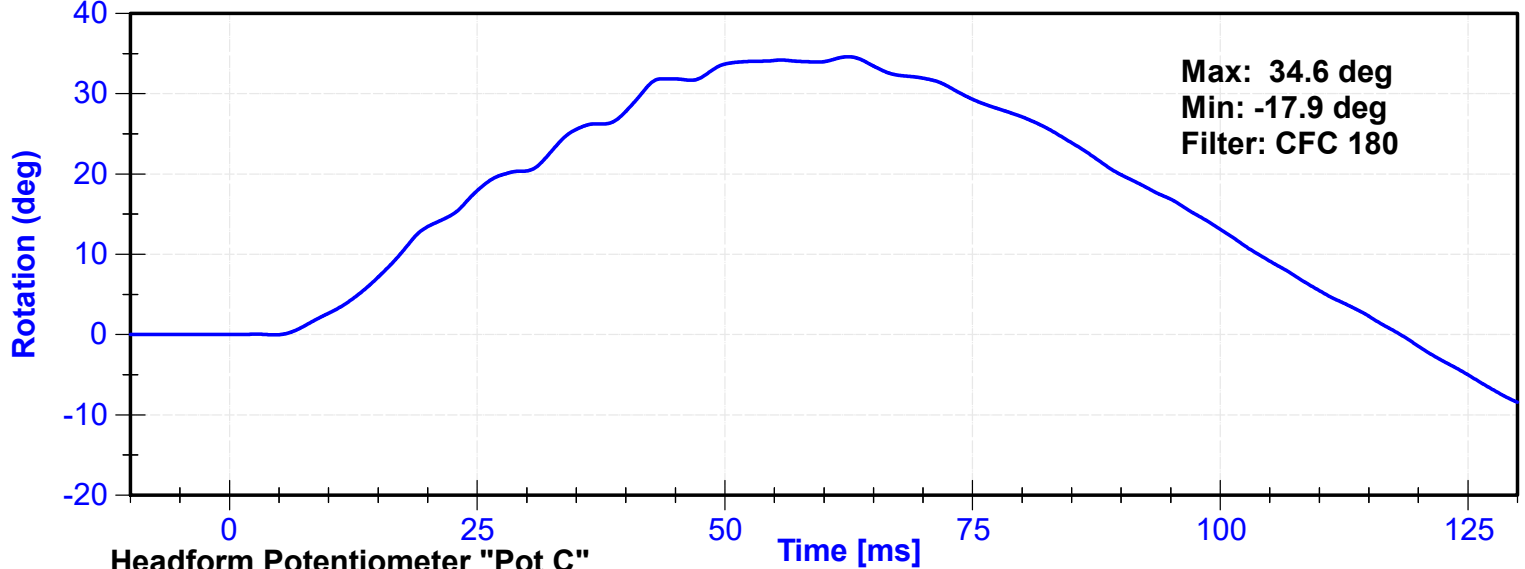


^{1,2} Upper and lower boundaries specified in Appendix I

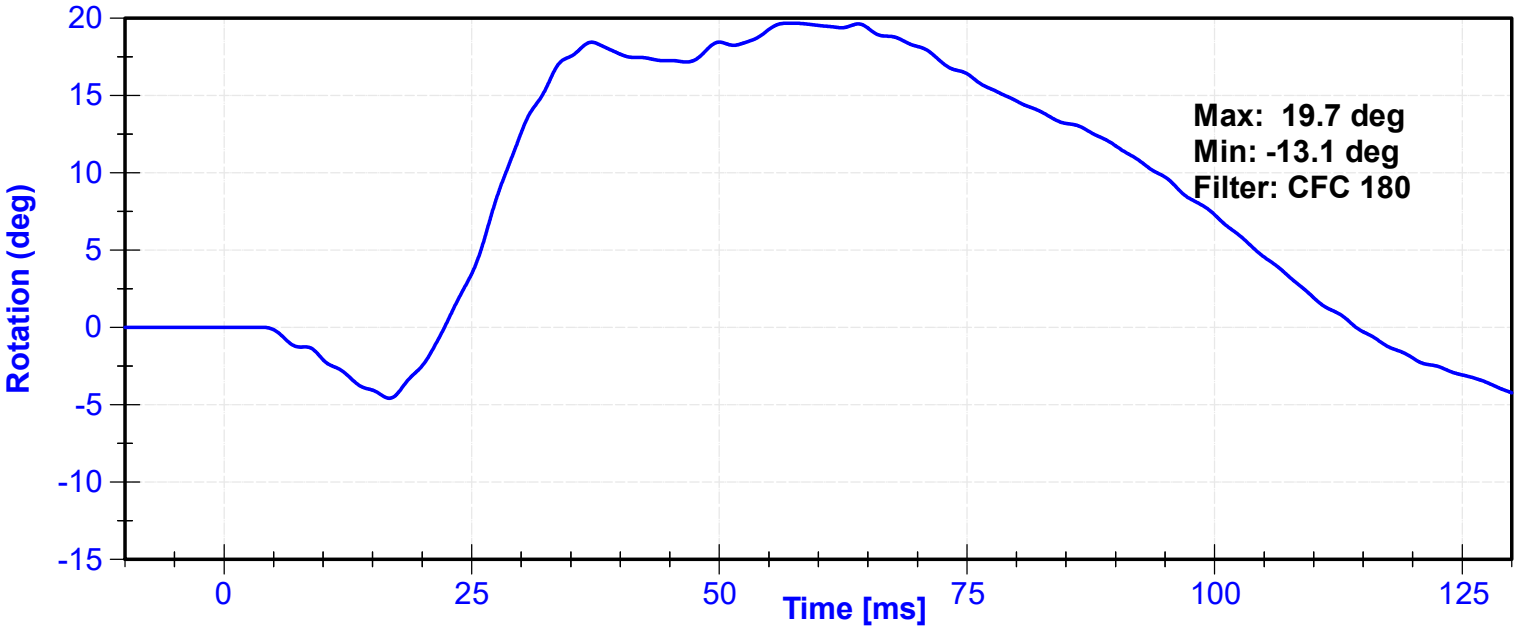
Neck Rotation



Front Pendulum Potentiometer "Pot A"



Headform Potentiometer "Pot C"



Appendix I

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

ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

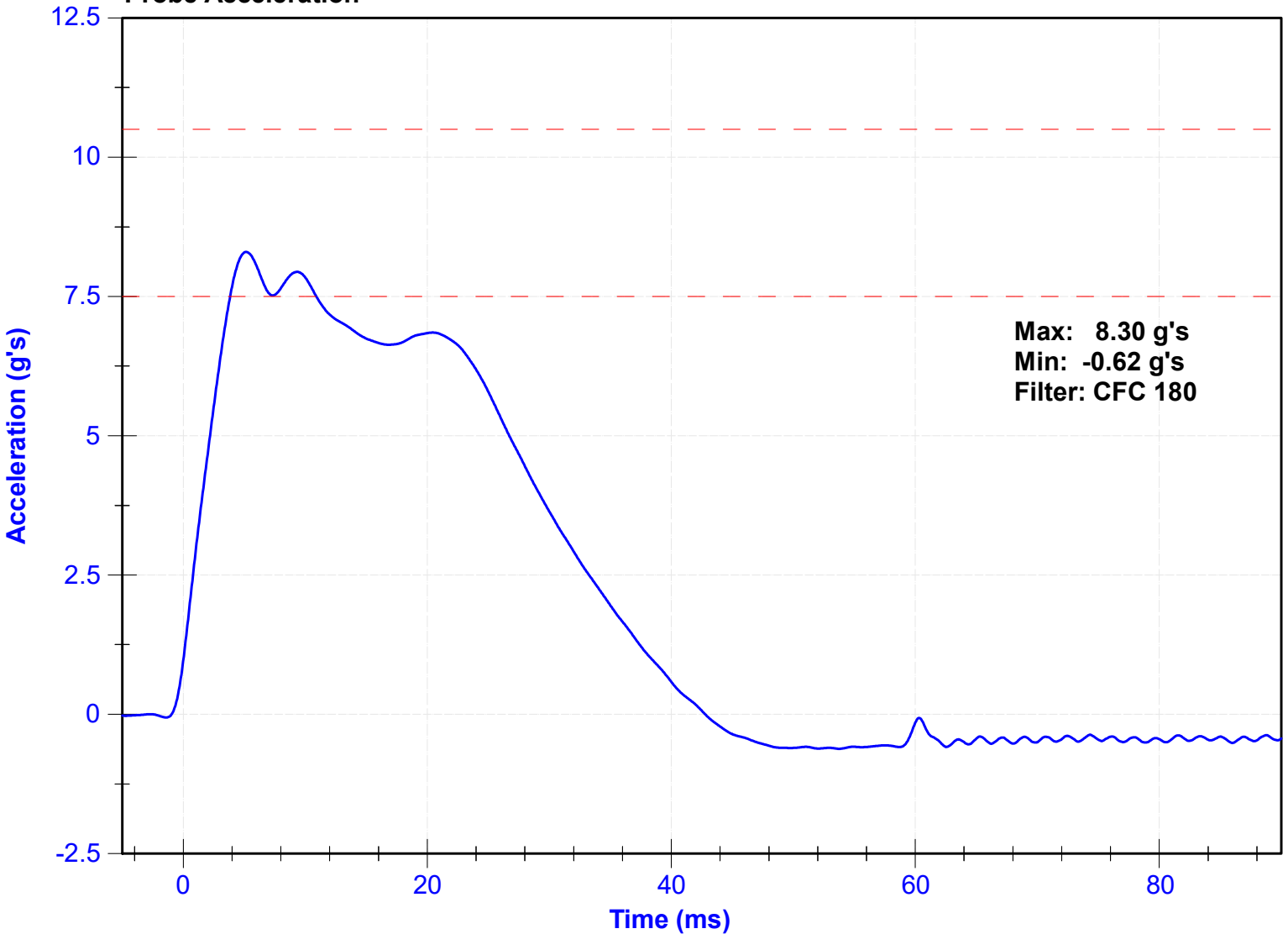
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	22.3	Pass
Velocity	4.2	4.4	m/s	4.32	Pass
Probe Acceleration	7.5	10.5	g's	8.30	Pass

Transducer Calibrations

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

Probe Acceleration



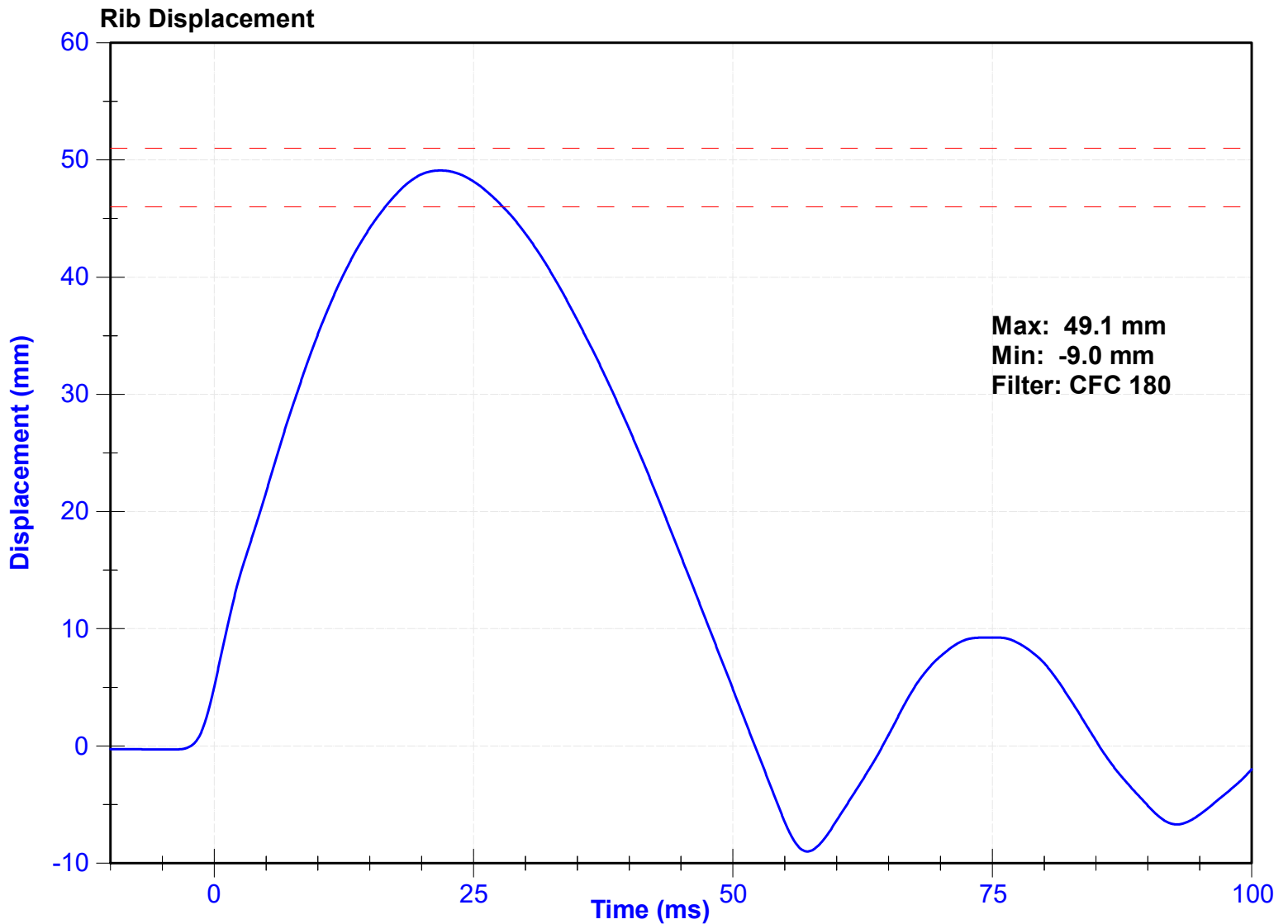
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	46	51	mm	49.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-0552-01	2/27/2023	8/28/2023



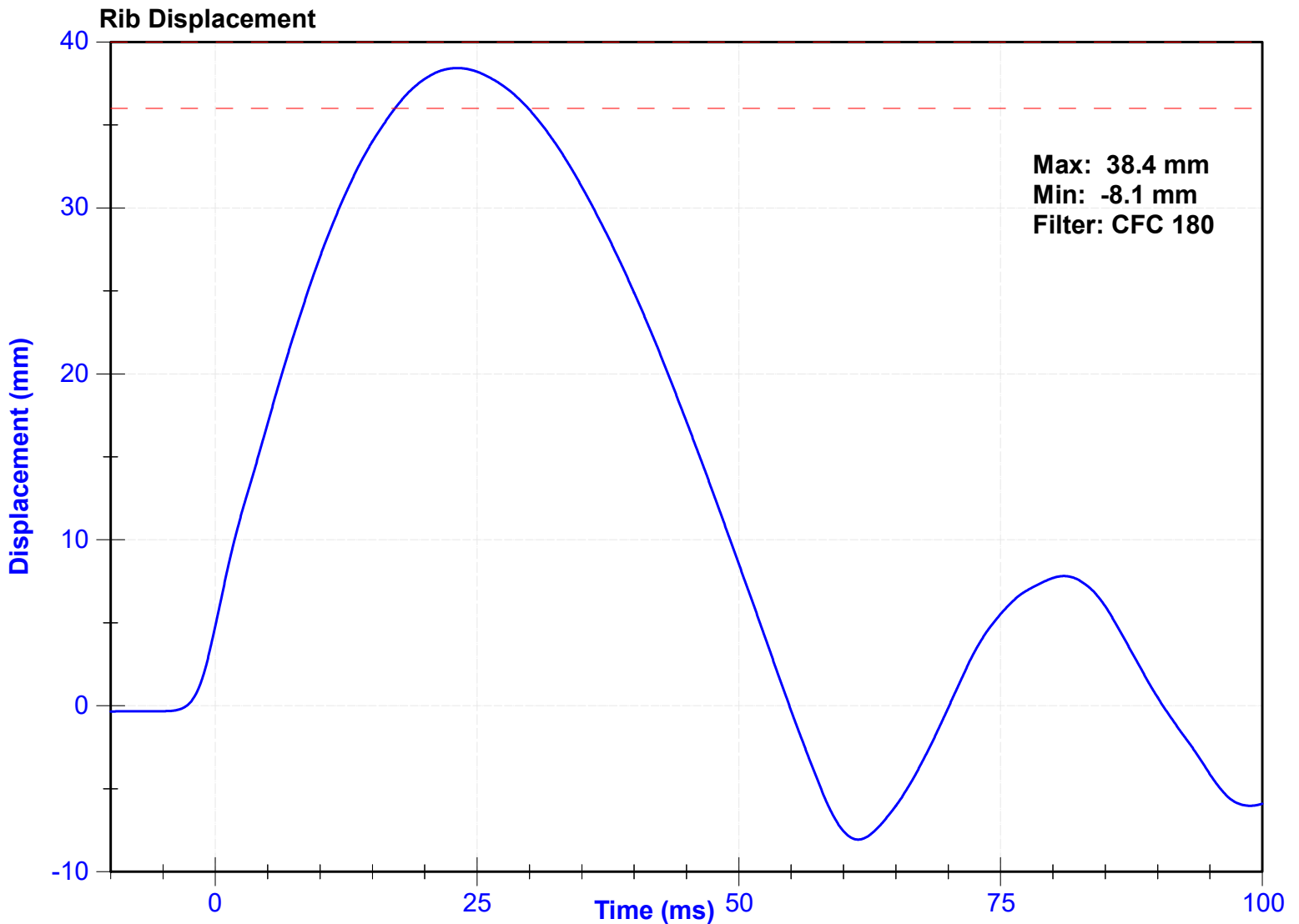
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	36	40	mm	38.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-0552-01	2/27/2023	8/28/2023



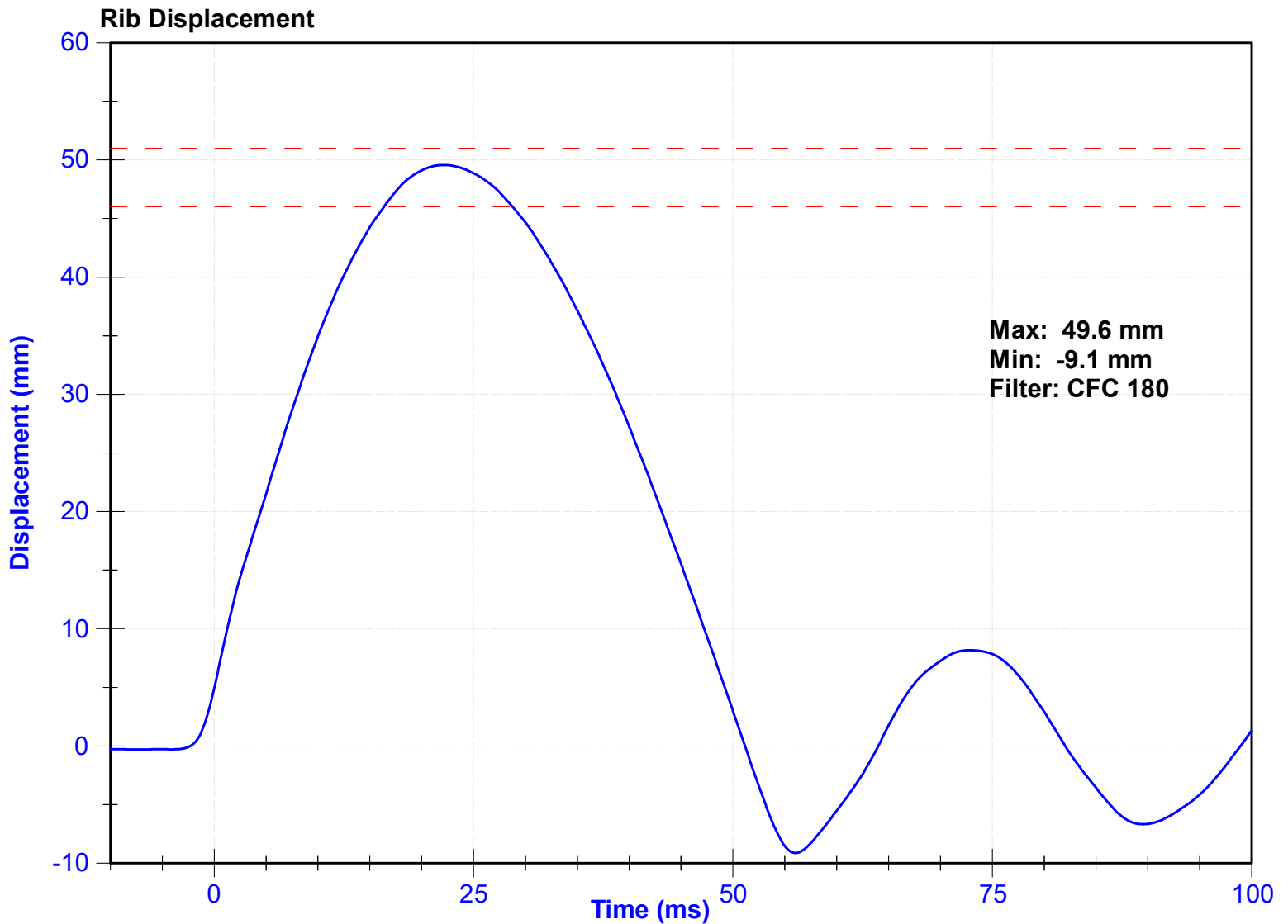
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	46	51	mm	49.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-807	2/27/2023	8/28/2023



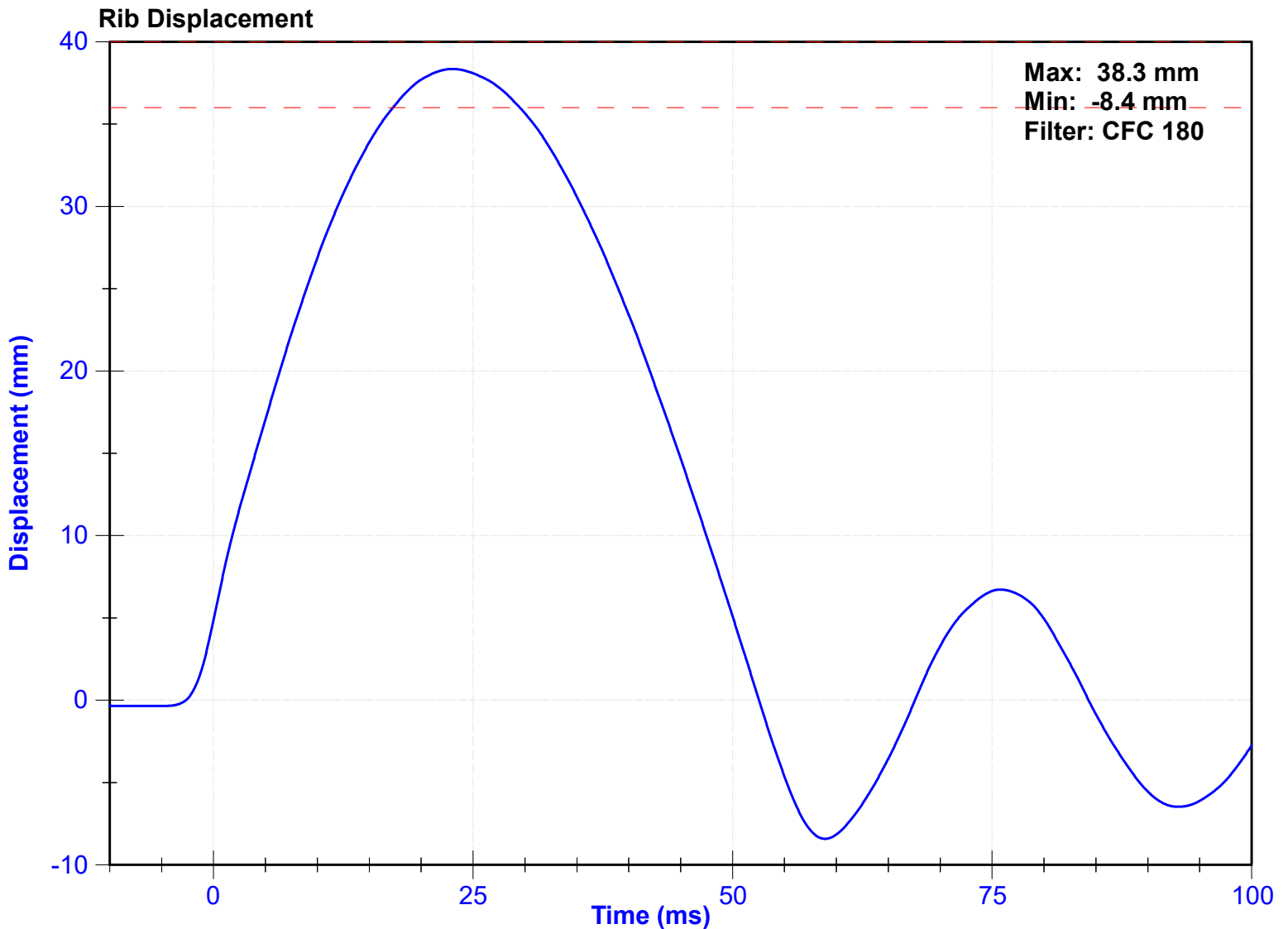
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	36	40	mm	38.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-807	2/27/2023	8/28/2023



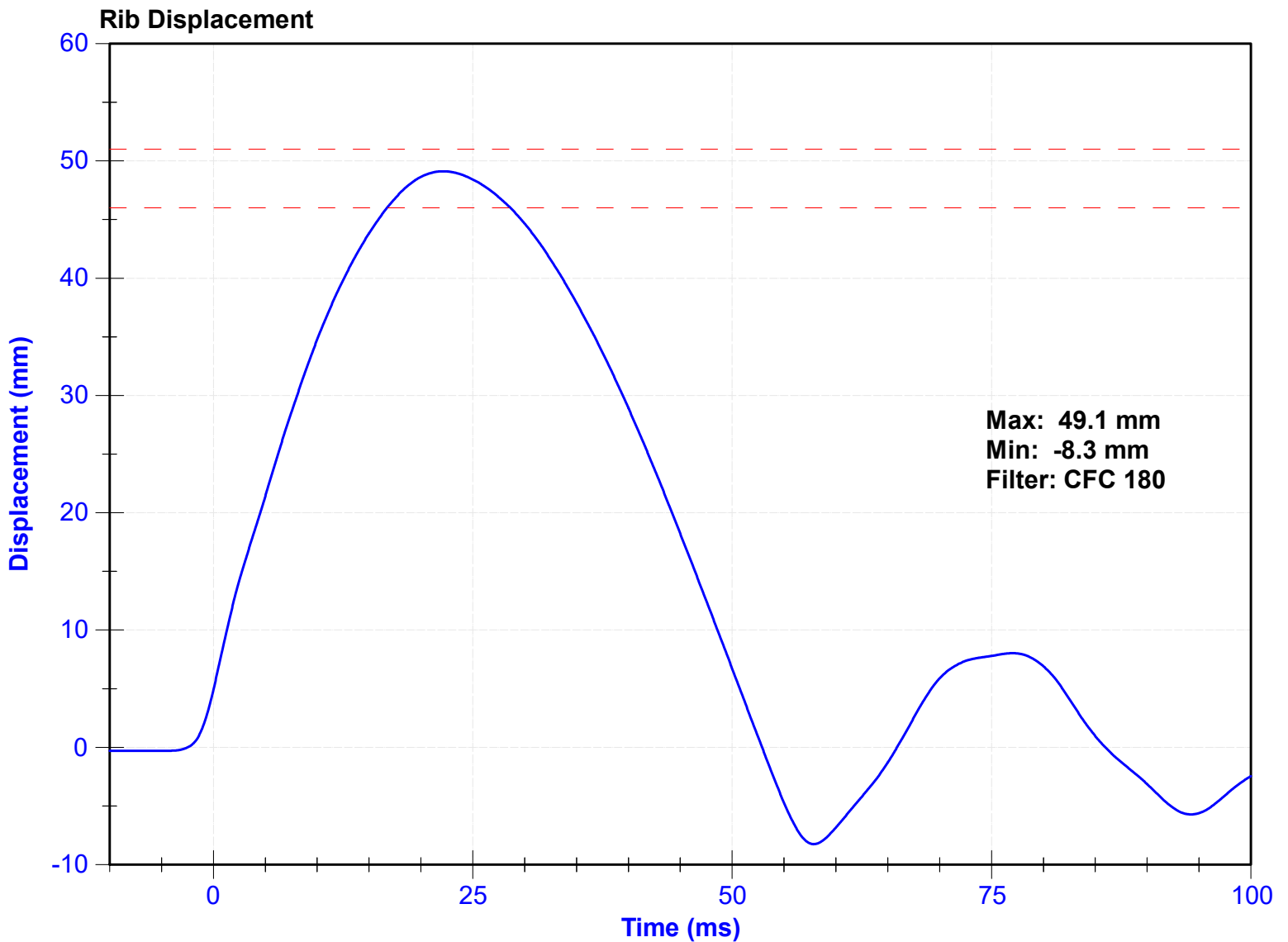
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	46	51	mm	49.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-0552-03	2/27/2023	8/28/2023



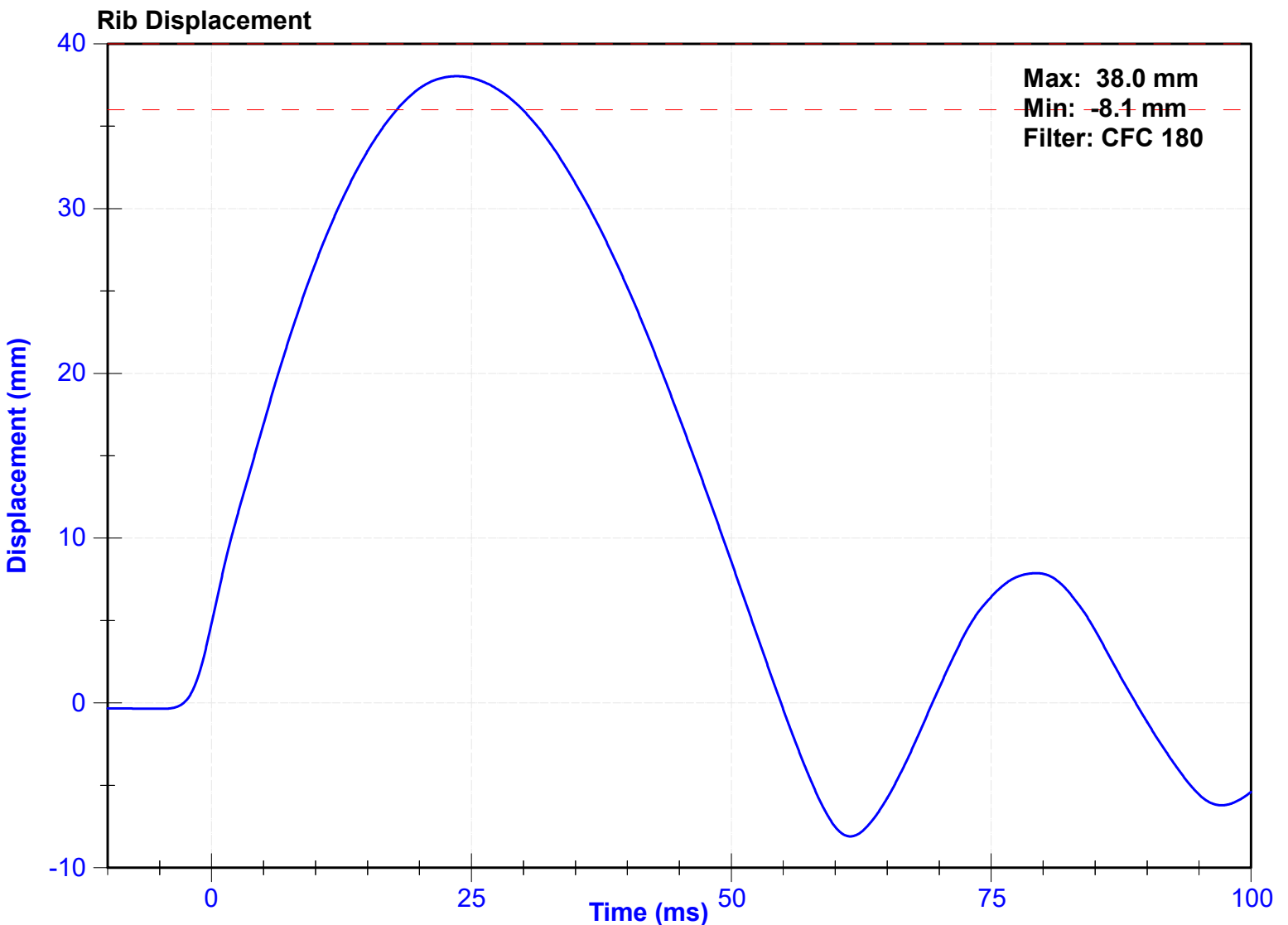
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.8	Pass
Humidity	10	70	%	20.5	Pass
Rib Displacement	36	40	mm	38.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	DS-0552-03	2/27/2023	8/28/2023



ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

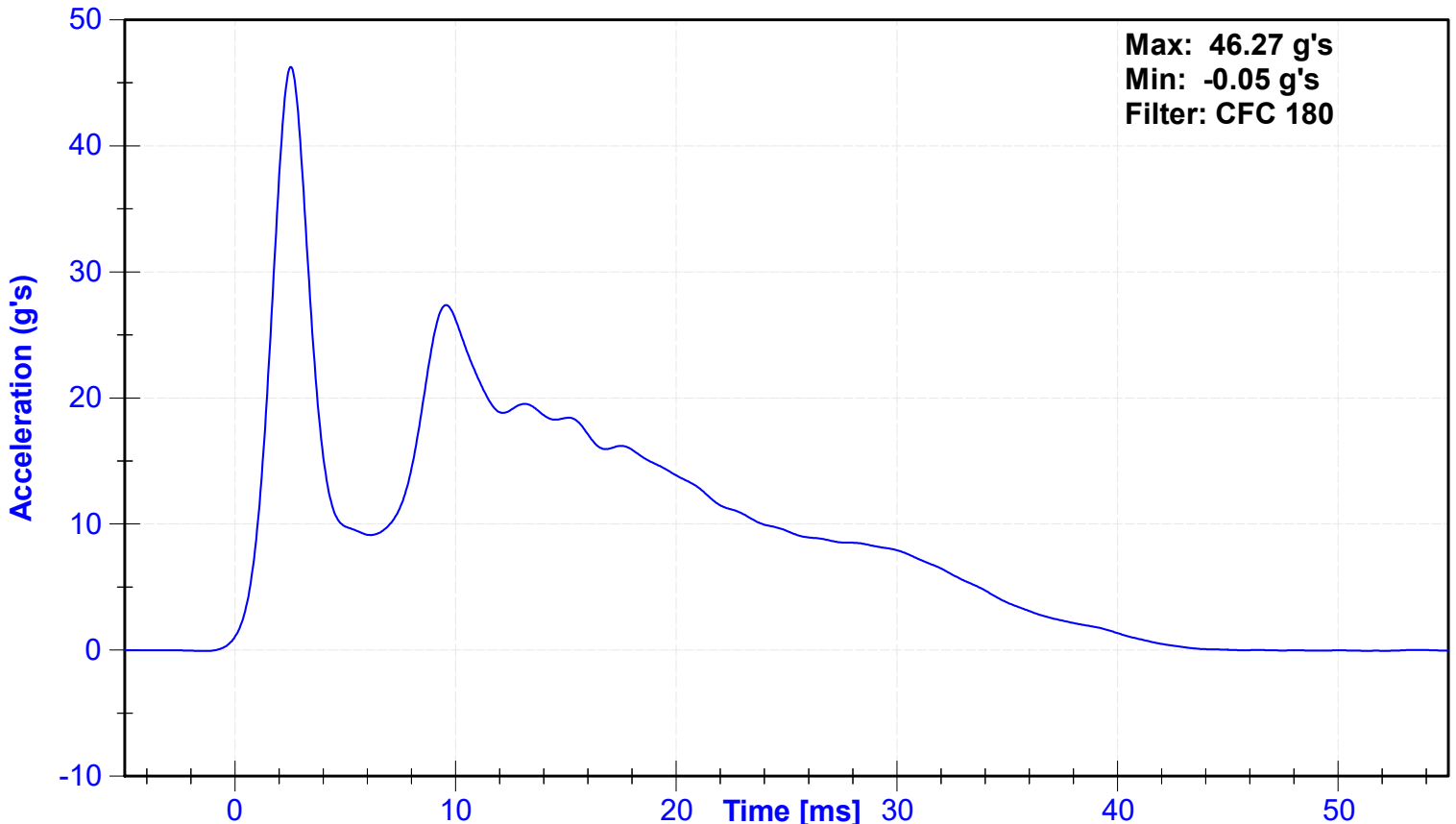
Results

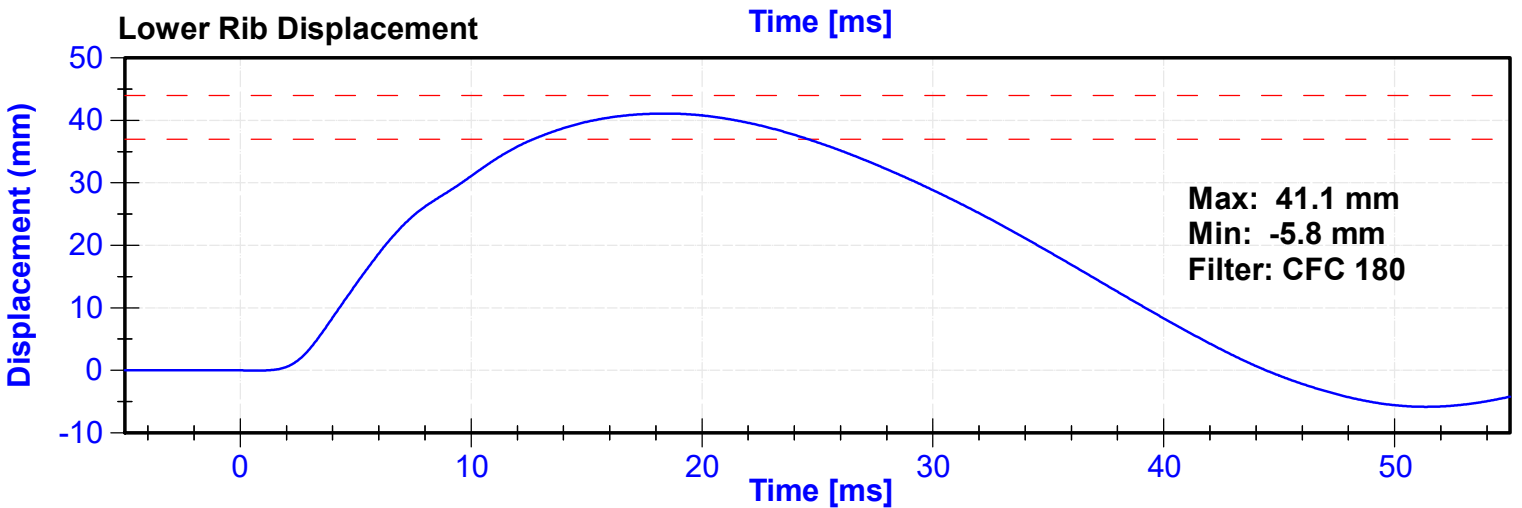
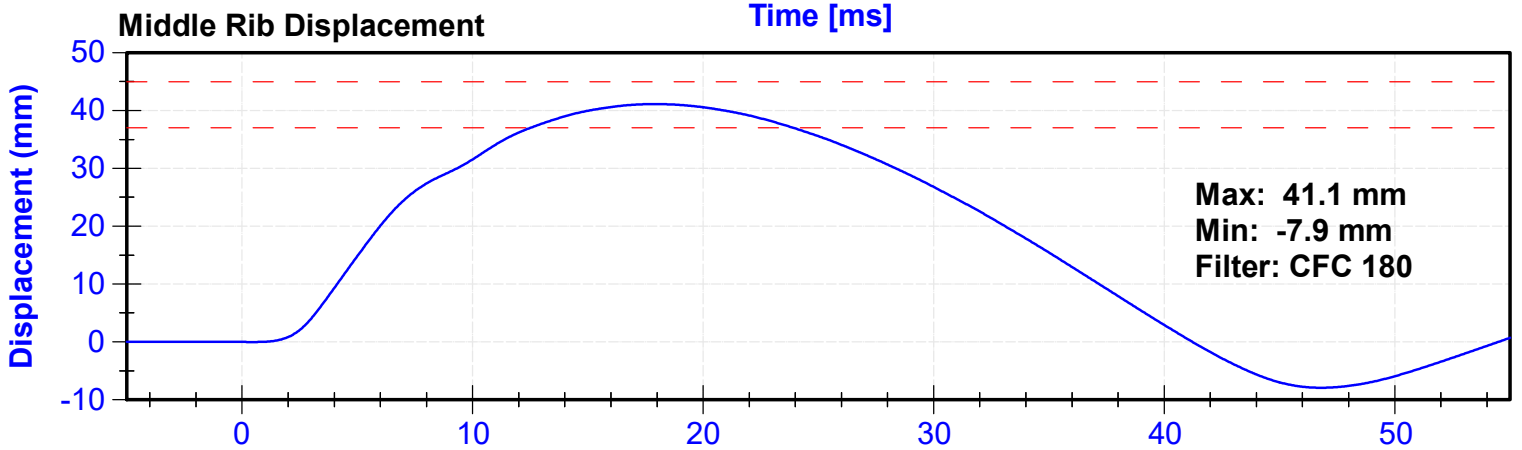
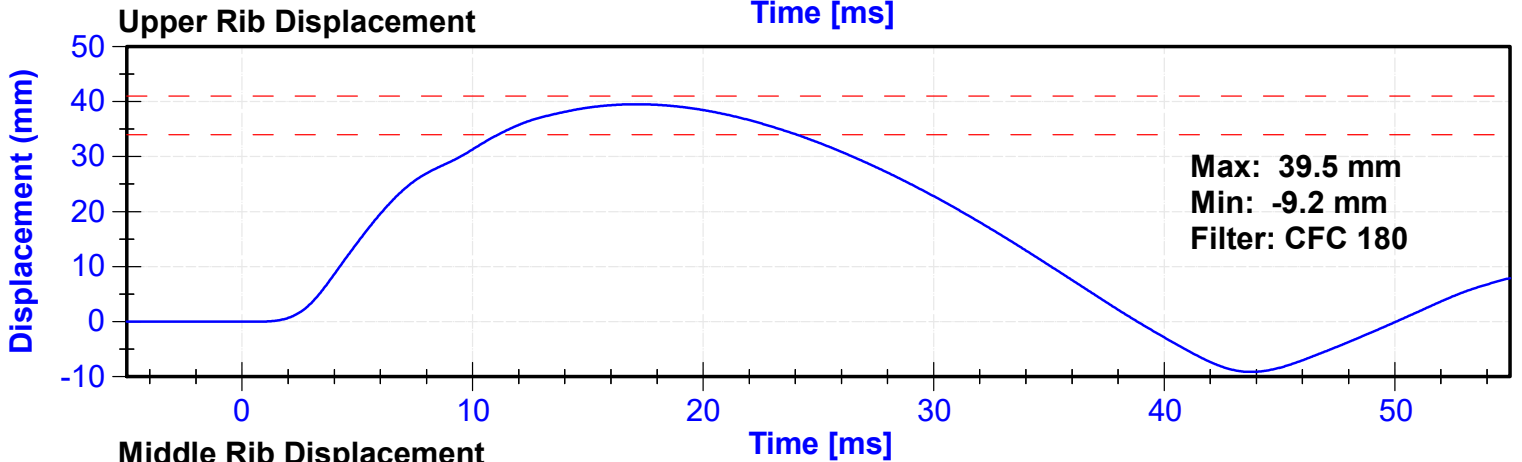
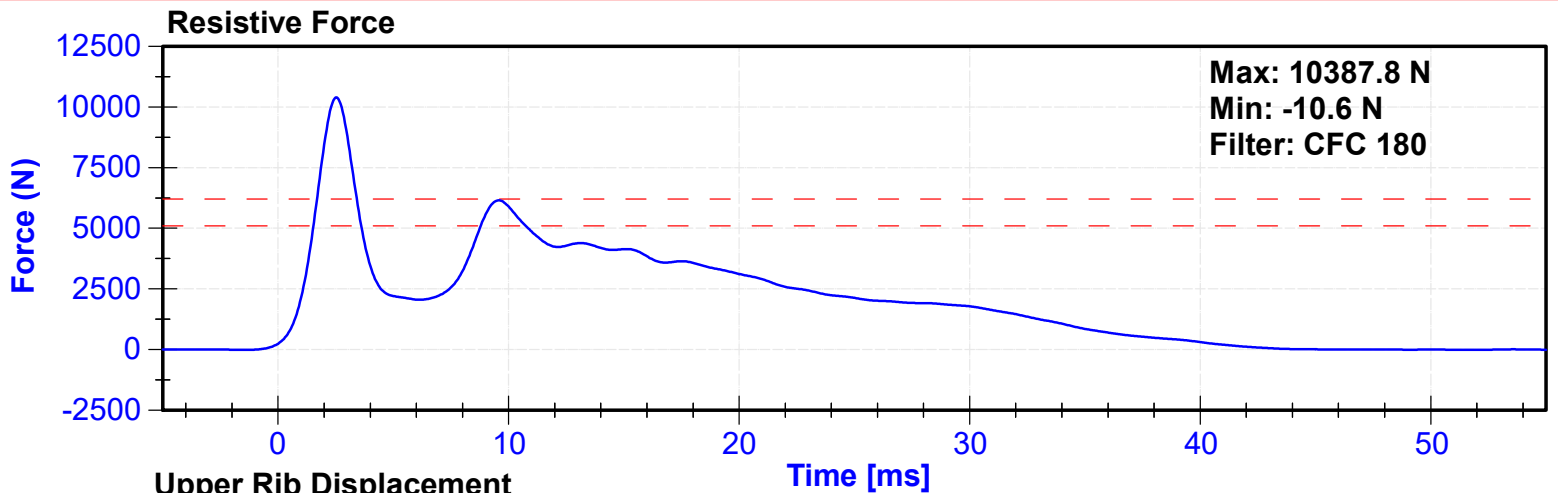
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	22.3	Pass
Velocity	5.4	5.6	m/s	5.52	Pass
Resistive Force after 6ms	5100	6200	N	6147.7	Pass
Upper Thorax Rib Deflection	34	41	mm	39.5	Pass
Mid Thorax Rib Deflection	37	45	mm	41.1	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	18546	11/19/2022	5/18/2023
Upper Thorax Rib Potentiometer	Honeywell	DS-0552-01	2/27/2023	8/28/2023
Middle Thorax Rib Potentiometer	Honeywell	DS-807	2/27/2023	8/28/2023
Lower Thorax Rib Potentiometer	Honeywell	DS-0552-03	2/27/2023	8/28/2023

Probe Acceleration





ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

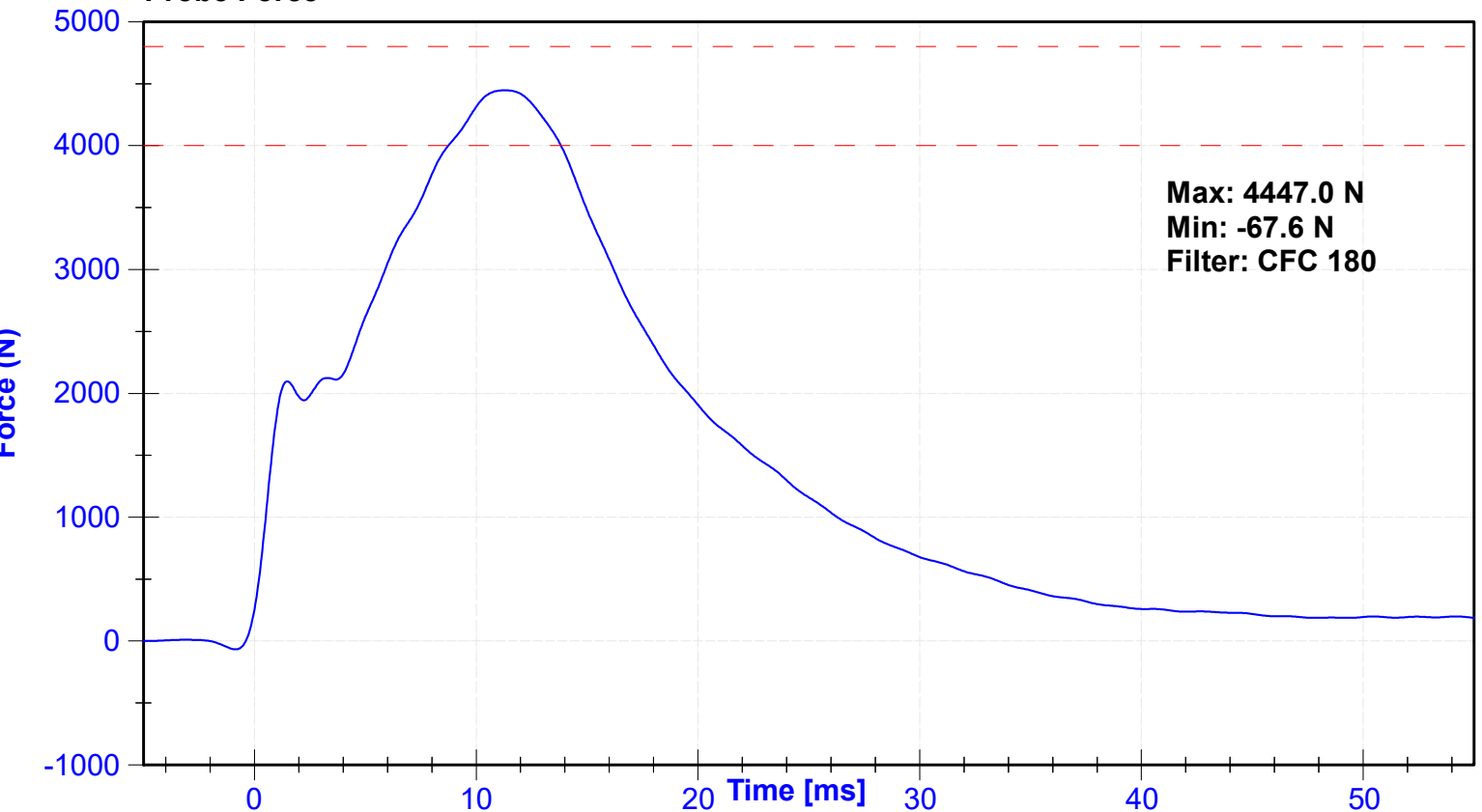
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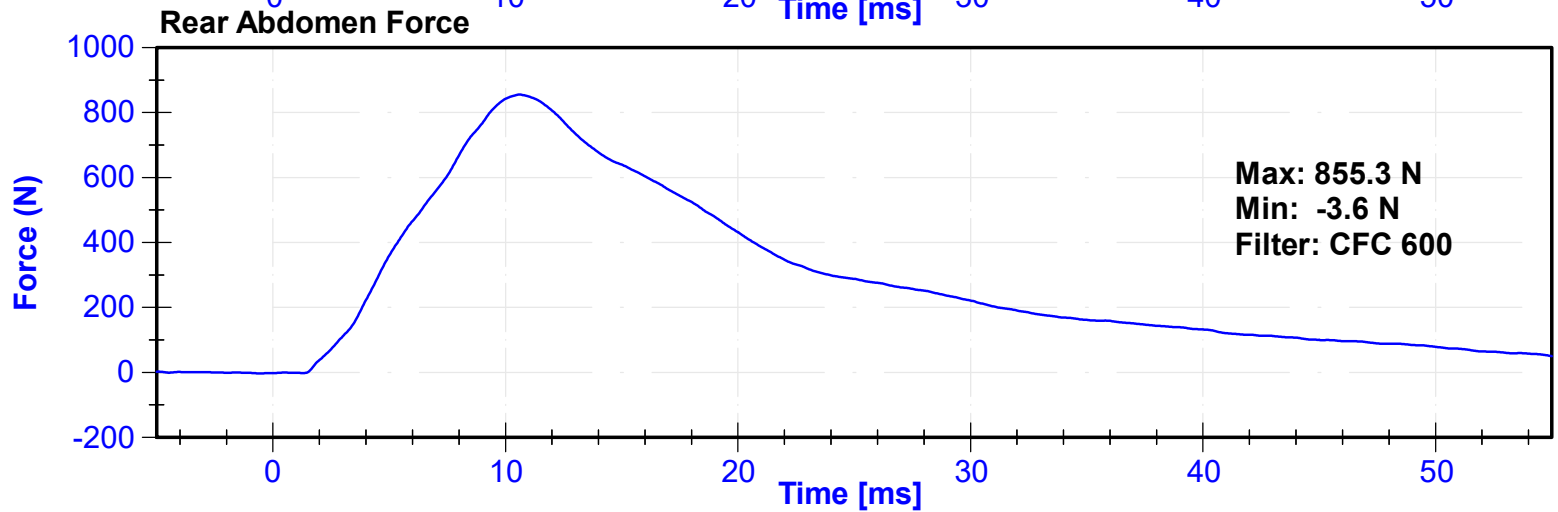
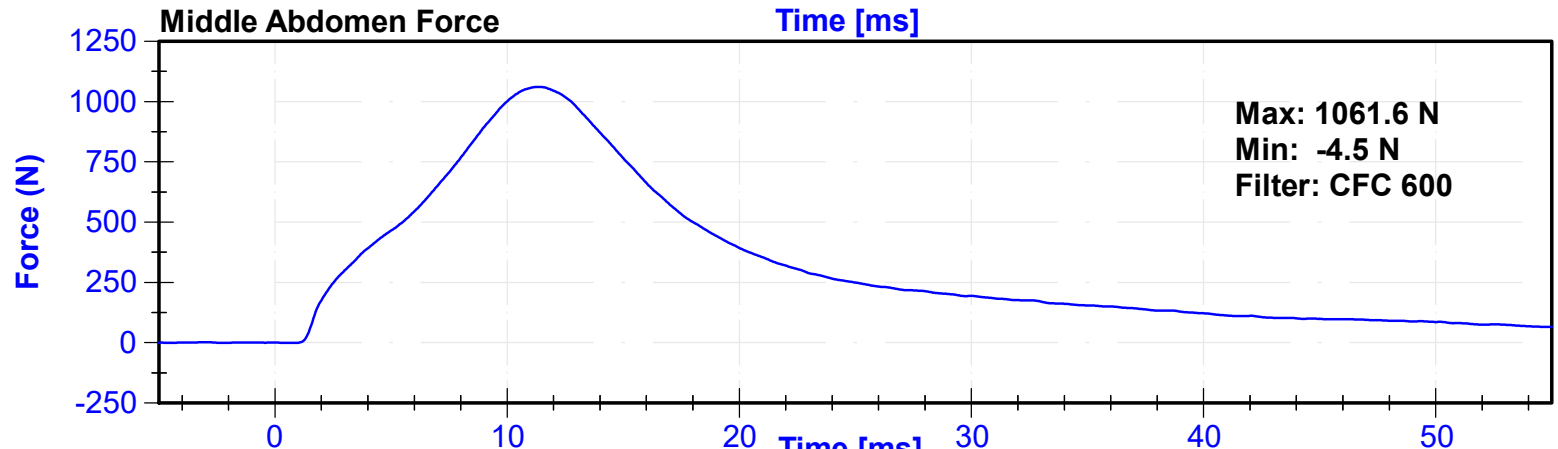
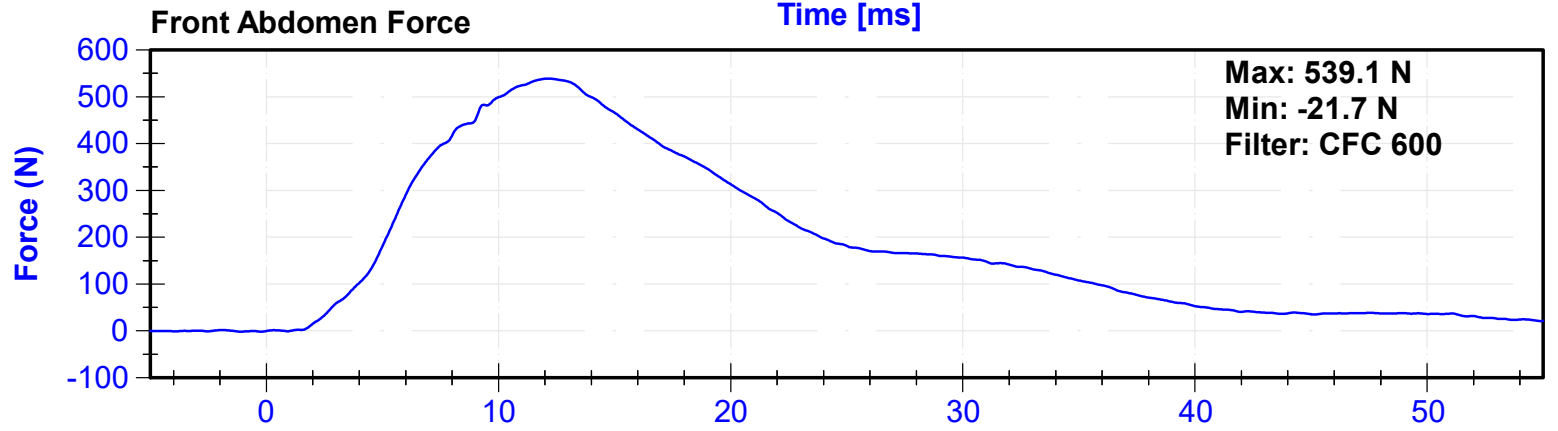
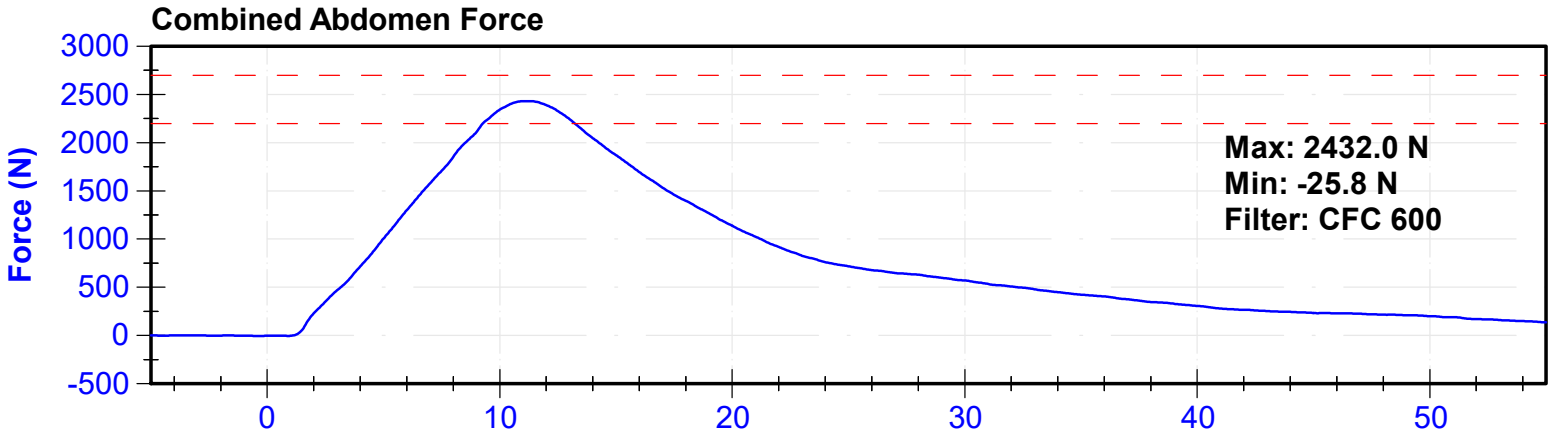
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	22.3	Pass
Velocity	3.9	4.1	m/s	4.01	Pass
Combined Abdomen Force	2200	2700	N	2432.0	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.25	Pass
Resistive Probe Force	4000	4800	N	4447.0	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.30	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023
Front Abdomen Load Cell	Denton	1440	8/12/2022	8/12/2023
Middle Abdomen Load Cell	Denton	1525	8/12/2022	8/12/2023
Rear Abdomen Load Cell	Denton	1528	8/12/2022	8/12/2023

Probe Force





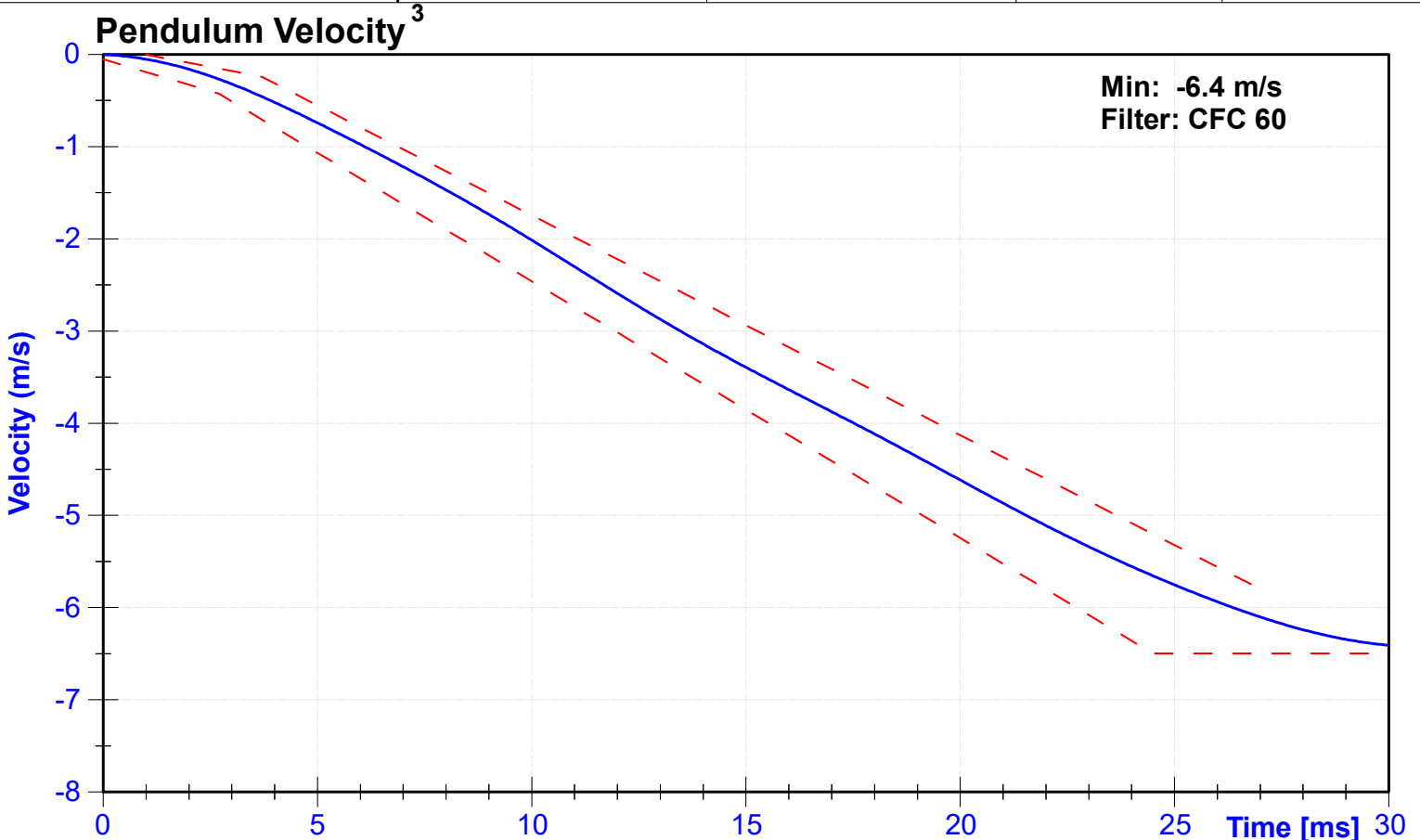
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

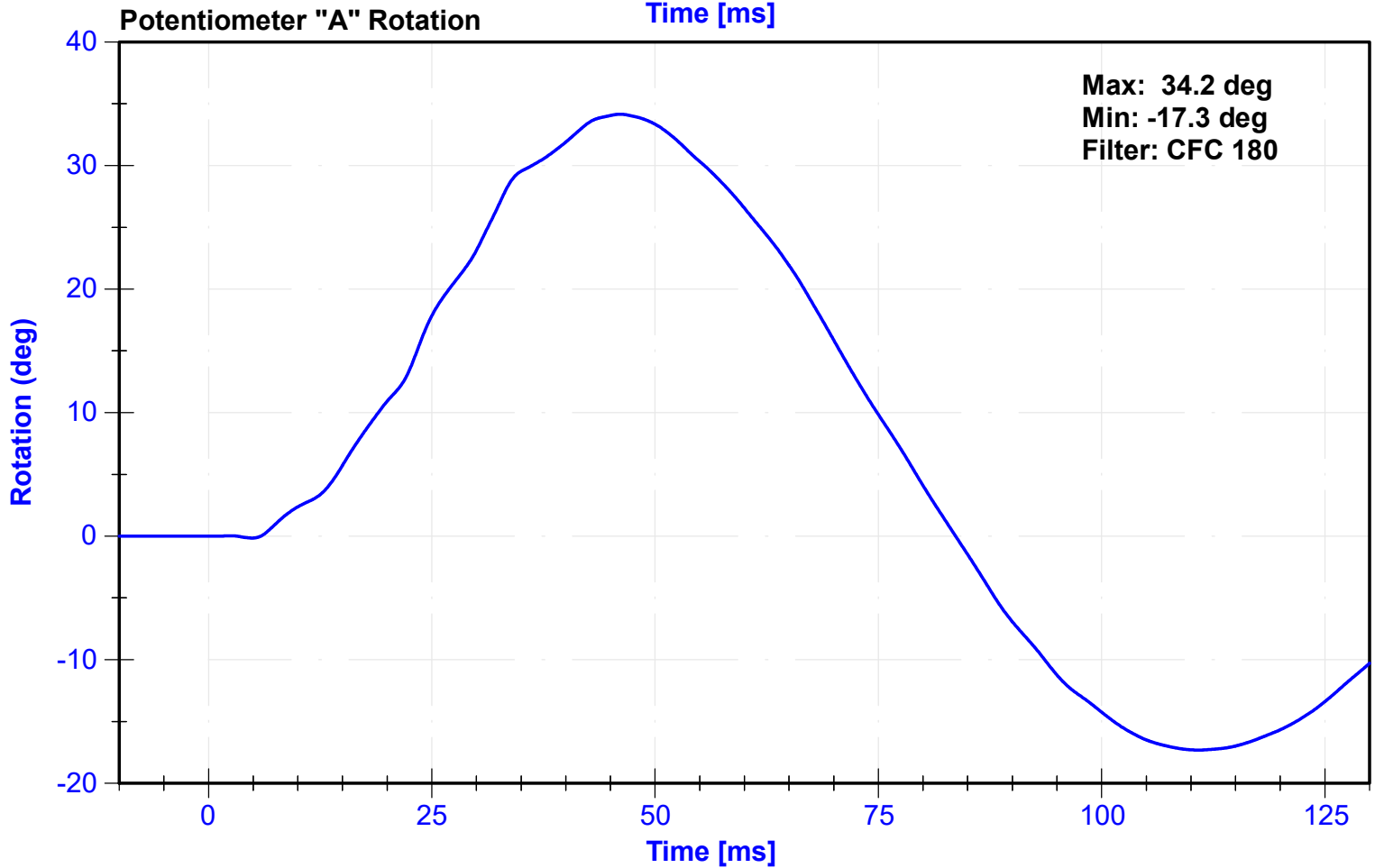
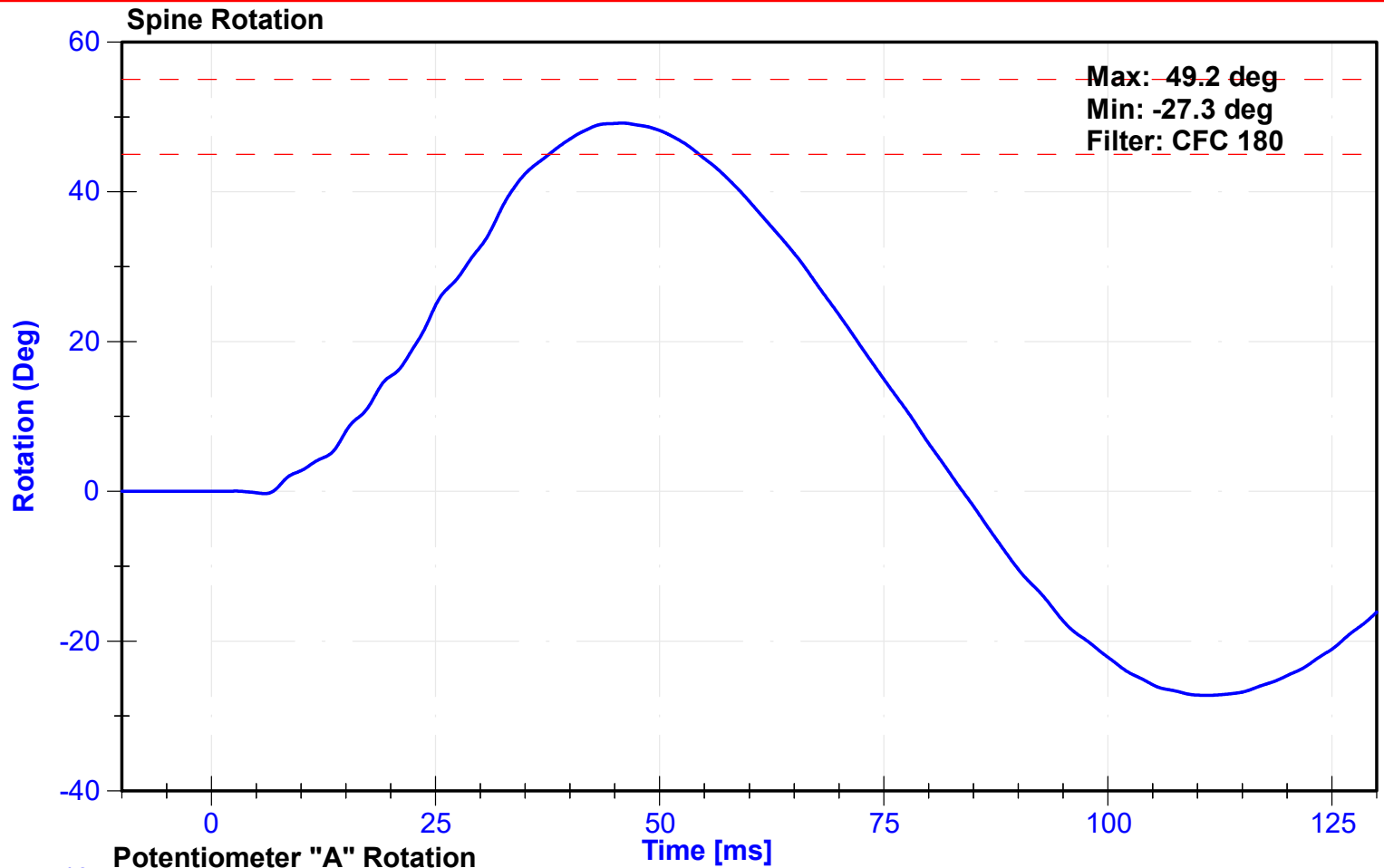
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	21.2	Pass
Velocity	5.95	6.15	m/s	6.044	Pass
Lateral Spine Rotation	45	55	deg	49.2	Pass
Time at Maximum Rotation	39	53	ms	45.8	Pass
Time of Decay to Zero Degrees	37	57	ms	37.9	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

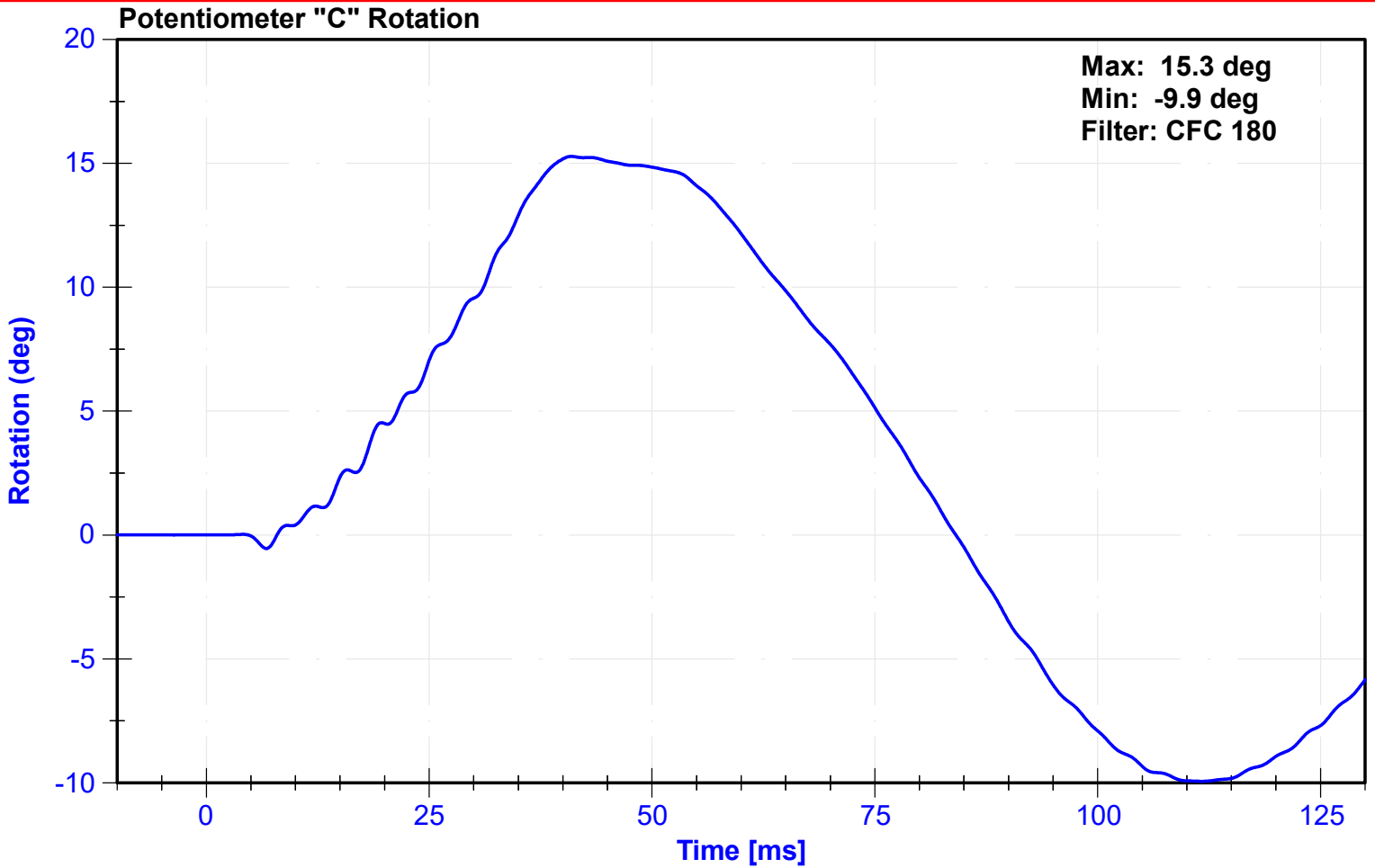
Transducer Calibrations

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



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

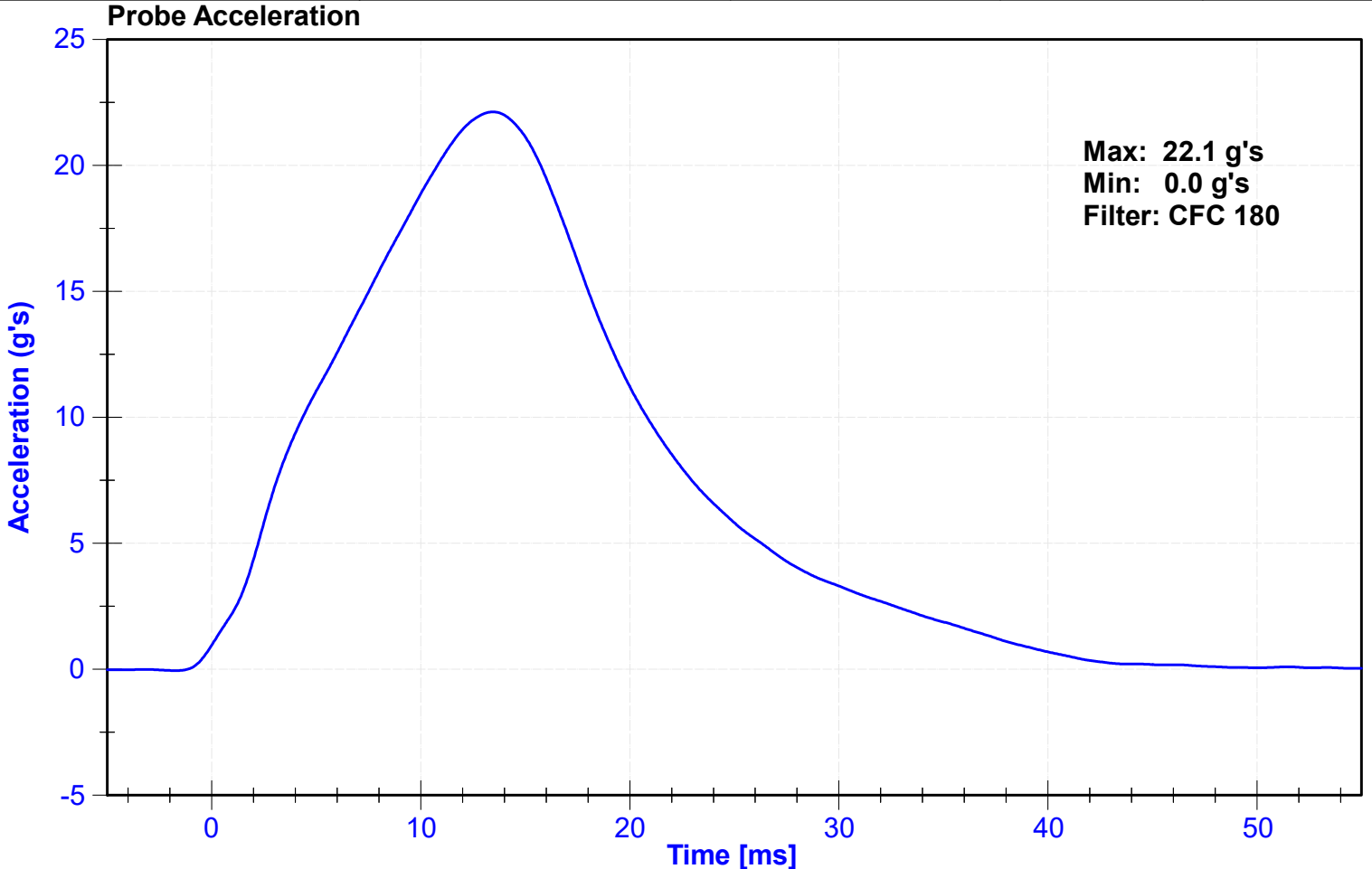
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

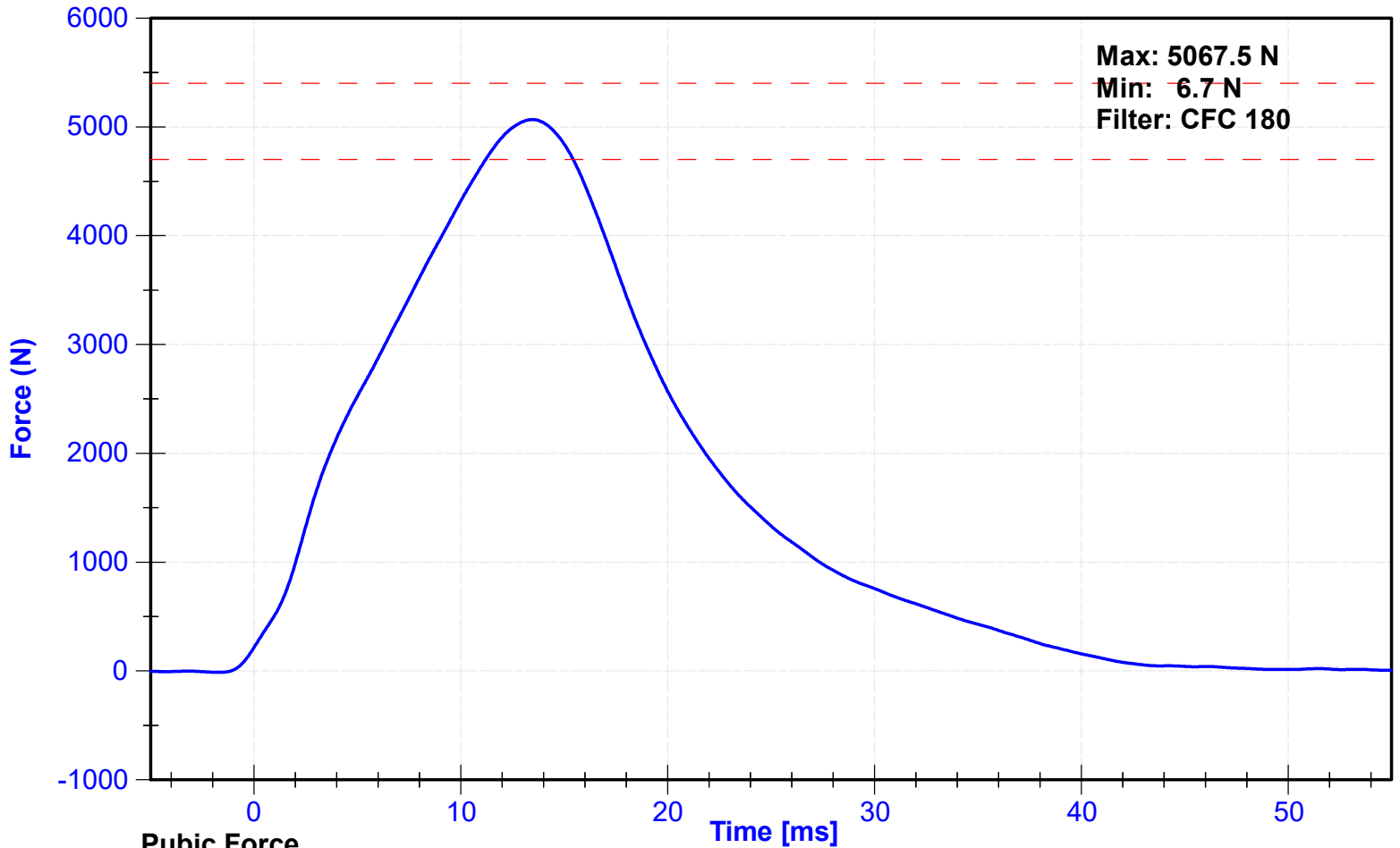
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	22.3	Pass
Velocity	4.2	4.4	m/s	4.33	Pass
Resistive Force	4700	5400	N	5067.5	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.45	Pass
Pubic Force	-1590	-1230	N	-1495.2	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.70	Pass

Transducer Calibrations

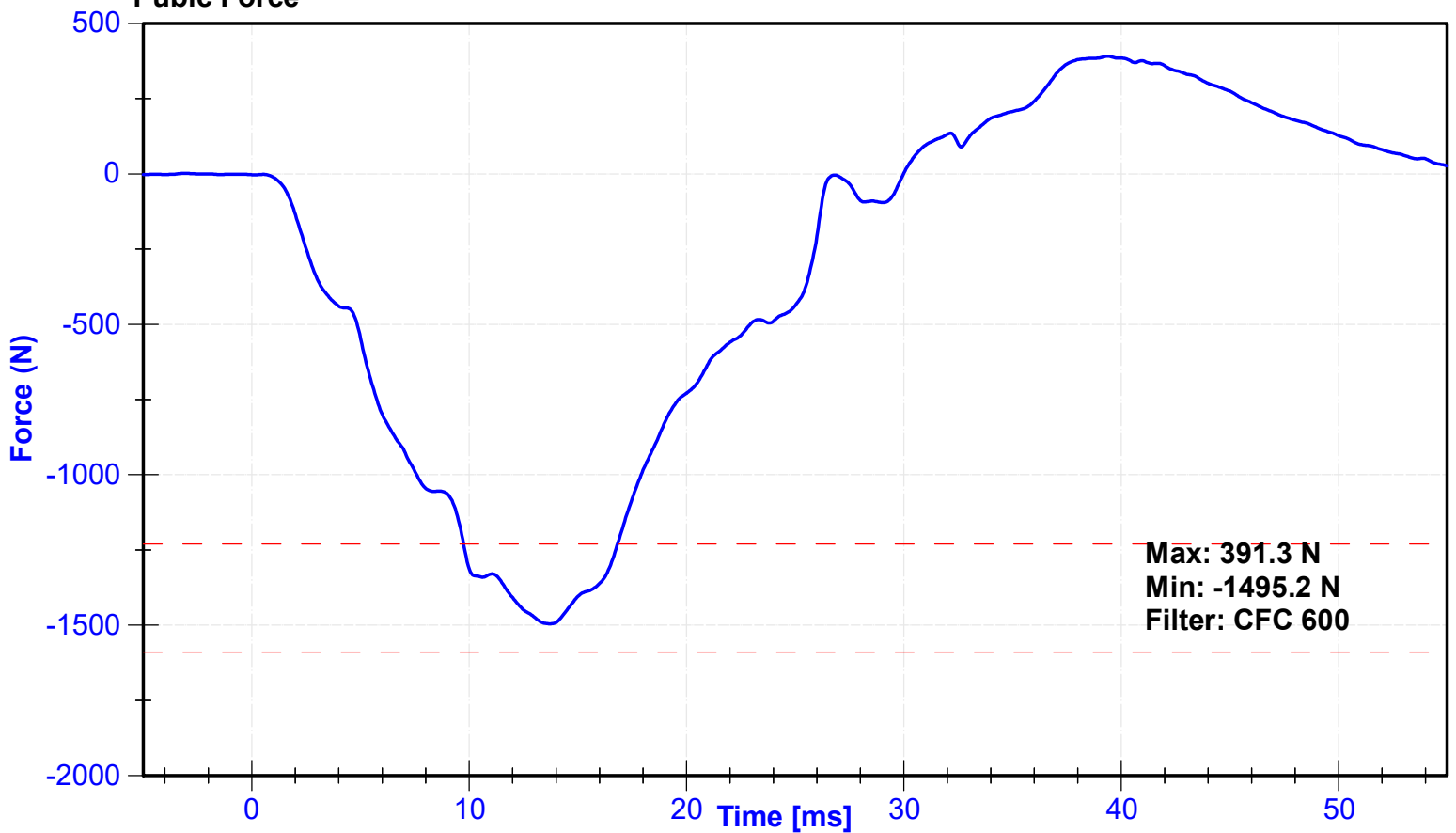
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	5/18/2023
Pubic Load Cell	Denton	3096JFL-456-FY	8/12/2022	8/12/2023



Resistive Force



Pubic Force



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	2/27/2023
		Y	T22281	Endevco	2/27/2023
		Z	T26050	Endevco	2/27/2023
	Redundant	X	T21682	Endevco	2/27/2023
		Y	T25989	Endevco	2/27/2023
		Z	T25864	Endevco	2/27/2023
Thorax Rib Displacement Potentiometers	Upper	Y	DS-0552-01	Honeywell	2/27/2023
	Middle	Y	DS-807	Honeywell	2/27/2023
	Lower	Y	DS-0552-03	Honeywell	2/27/2023
Abdomen Load Cells	Forward	Y	1440	Denton	8/12/2022
	Middle	Y	1525	Denton	8/12/2022
	Rear	Y	1528	Denton	8/12/2022
Lower Spine Accelerometers (T12)	X		P71278	Endevco	2/27/2023
	Y		P71276	Endevco	2/27/2023
	Z		T23573	Endevco	2/27/2023
Pubic Symphysis Load Cell	Y		3096JFL-456-FY	Denton	8/12/2022

Table 2 – Vehicle Instrumentation

Vehicle Instrumentation		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	A352316	Measurement Specialties	11/30/2022
Vehicle Center of Gravity	Y	A400754	Measurement Specialties	11/30/2022
Vehicle Center of Gravity	Z	A405578	Measurement Specialties	11/30/2022
Left Floor Sill	Y	A283595	Measurement Specialties	12/28/2022
A-Pillar Sill	Y	A374234	Measurement Specialties	2/27/2023
A-Pillar Low	Y	A315080	Measurement Specialties	2/27/2023
A-Pillar Mid	Y	A280869	Measurement Specialties	2/28/2023
B-Pillar Sill	Y	A374224	Measurement Specialties	2/27/2023
B-Pillar Low	Y	A352398	Measurement Specialties	2/27/2023
B-Pillar Mid	Y	A431374	Measurement Specialties	2/27/2023
Front Passenger Seat	Y	A280970	Measurement Specialties	2/27/2023
Engine Top	X	A335481	Measurement Specialties	2/25/2023
Engine Top	Y	A374287	Measurement Specialties	2/25/2023
Firewall	Y	A431372	Measurement Specialties	2/27/2023
Right Roof	Y	A413564	Measurement Specialties	12/29/2022
Right Floor Sill	Y	A301868	Measurement Specialties	2/27/2023
Rear Floorpan	X	A280861	Measurement Specialties	2/24/2023
Rear Floorpan	Y	A315810	Measurement Specialties	2/24/2023