

REPORT NUMBER: 214P-CAL-24-010

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

**Toyota Motor Corporation
2024 Toyota Crown
4 Door Sedan**

NHTSA No: C20245103

**PREPARED BY:
CALSPAN CORPORATION
P.O. BOX 400
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April 11, 2024

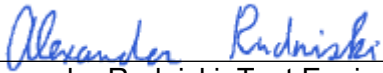
FINAL REPORT

**PREPARED FOR:
U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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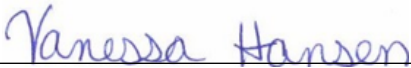
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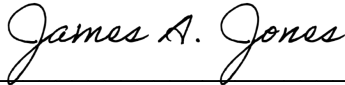
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Date: April 11, 2024

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16. Abstract A 31.00 km/h (19.3 mph), 75° oblique compliance test was conducted on the subject 2024 Toyota Crown 4 Door Sedan 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 20, 2024. The impact velocity of the vehicle was 31.24 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 308 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>201.462</td> </tr> <tr> <td>Maximum Thoracic Rib Deflection</td> <td>mm</td> <td>44</td> <td>15.632</td> </tr> <tr> <td>Total Abdominal Force</td> <td>N</td> <td>2500</td> <td>949.325</td> </tr> <tr> <td>Pubic Symphysis Force</td> <td>N</td> <td>6000</td> <td>2545.573</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	201.462	Maximum Thoracic Rib Deflection	mm	44	15.632	Total Abdominal Force	N	2500	949.325	Pubic Symphysis Force	N	6000	2545.573
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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 Toyota Crown 4 Door Sedan. 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 Toyota Crown 4 Door Sedan. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 31.24 km/h. The test was conducted by Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on March 20, 2024. Pre-test and post-test photographs of the test vehicle and side impact dummy (ES2re) are included in Appendix I of this report.

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

The ES2re male dummy was instrumented accordingly:

- Primary and redundant head CG tri-axial accelerometers
- Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers
- Abdomen forward, middle, and rear y-axis load cells
- Lower spine (T12) tri-axial accelerometers
- Public symphysis y-axis load cell

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

Injury readings for the ES2re dummy were recorded as follows:

INJURY READINGS

Measurement Description	Driver ATD (ES2re)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	201.462
Upper Rib Deflection	mm	44	15.632
Mid Rib Deflection	mm	44	11.503
Lower Rib Deflection	mm	44	14.799
Abdominal Load (front)	N		152.382
Abdominal Load (mid)	N		313.611
Abdominal Load (rear)	N		490.397
Total Abdominal Force	N	2500	949.325
Pubic Symphysis Force	N	6000	2545.573

SECTION 2
OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

<u>Data Sheet</u>	<u>Page</u>
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DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle:	2024 Toyota Crown 4 Door Sedan	NHTSA No.:	C20245103
Test Facility:	Calspan	Test Date:	03/20/2024

TEST VEHICLE INFORMATION AND OPTIONS

Make	Toyota	Anti-Lock Brakes (ABS)	Yes
Model	Crown	All-Wheel Drive (AWD)	Yes
Body Style	Four Door Sedan	Traction Control System (TCS)	Yes
VIN	JTDAAAFXR3021895	Electric Stability Control (ECS)	Yes
Body Color	Magnetic Gray	Curtain Airbags	Yes
Engine Displacement (L)	2.4	Torso Airbags – Front Seats	Yes
Type / No. Cylinders	I4	Torso Airbags – Rear Seats	No
Engine Placement	Transverse	Combination/Head Torso Bag	No
Transmission Type	Automatic	Pelvic Airbag – Front Seats	No
Transmission Speeds	ECVT	Pelvis Airbag – Rear Seats	No
Overdrive	No	Knee Airbag – Driver	Yes
Final Drive	All Wheel Drive	Knee Airbag – Front Passenger	Yes
Odometer Reading (mi)	387 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)	2277
Date of Manufacture	11/23	GVWR Front (kg)	1250
Vehicle Type	Passenger Car	GVWR Rear (kg)	1250

VEHICLE SEATING AND WEIGHT CAPACITY DATA

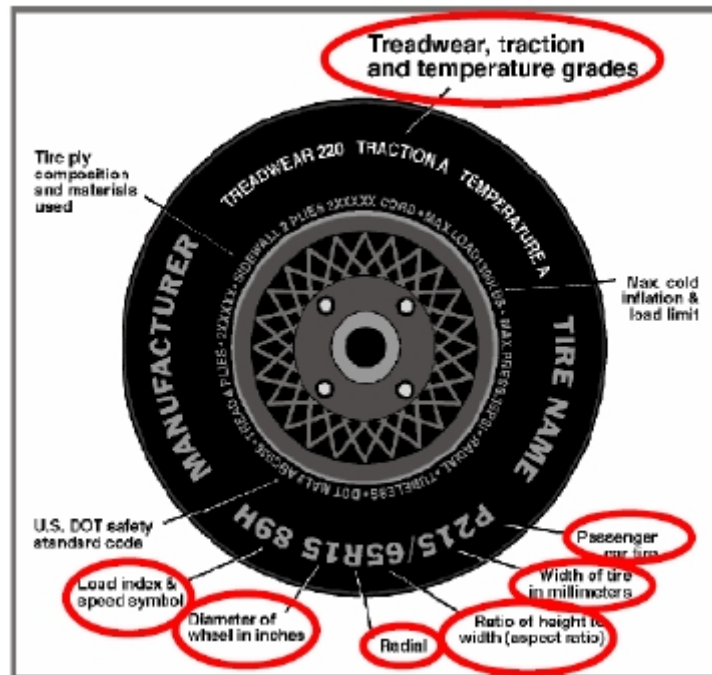
Measured Parameter	Front	Rear	Third	Total
Type of Seats (Bench or Bucket)	Bucket	Split Bench	N/A	
Designated Seating Capacity (DSC)	2	3	N/A	5
Capacity Weight (VCW) (kg)				410
Cargo Weight (RCLW) (kg)				60.8

DATA SHEET NO. 2 VEHICLE TIRE INFORMATION

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
Test Facility: Calspan

NHTSA No.: C20245103
Test Date: 03/20/2024

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



VEHICLE TIRE INFORMATION

Tire Placard	Front	Rear
Recommended Cold Pressure (kPa)	210	210
Recommended Tire Size	225/55R19	225/55R19
Tire Sidewall	Front	Rear
Maximum Tire Pressure (kPa)	340	340
Tire Size on Vehicle	225/55R19	225/55R19
Tire Manufacturer Model	Bridgestone	Bridgestone
Tire Name	Ecopia H/L 422 Plus	Ecopia H/L 422 Plus
Tire Type	All Season	All Season
Tire Width	225	225
Aspect Ratio	55	55
Radial	Yes	Yes
Wheel Diameter	19"	19"
Load Index / Speed Symbol	99V	99V
Treadwear	600	600
Traction Grade	A	A
Temperature Grades	A	A

DATA SHEET NO. 3
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
Test Facility: Calspan

NHTSA No.: C20245103
Test Date: 03/20/2024

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	215	215	217	216
Tire Placard	kPa	210	210	210	210

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			Fully Loaded			As Tested		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	513	395		541	462		540	445	
Right	kg	498	403		500	447		515	444	
Ratio	%	55.9	44.1		53.4	46.6		54.3	45.7	
Totals	kg	1011	798	1809	1041	909	1950	1055	889	1944

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1809	(A)
Weight of Test Dummy	kg	81	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	60.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1950.8	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	As Delivered	Fully Loaded	As Tested
Driver Door Sill Angle	Deg	-0.20	-0.05	-0.05
Front Passenger Sill Angle	Deg	-0.65	-0.45	-0.45
Front Bumper-Line Angle	Deg	+0.10	+0.05	+0.05
Rear Bumper-Line Angle	Deg	+0.20	-0.20	0.0

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	2851
Vertical Impact Reference Line Aft of Front Axle	mm	1321

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	3
Spare Tire	17
Jack	3
Tail light	1
Rubber Floor Mats	5
Spare Tools Kit	1
Ballast (if any)	17.7

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

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
Test Facility: Calspan

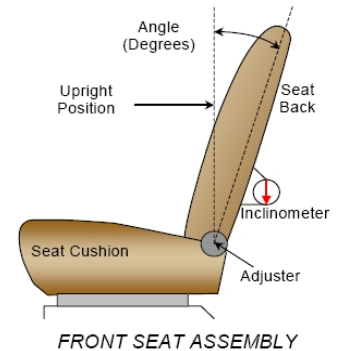
NHTSA No.: C20245103
Test Date: 03/20/2024

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	Degree	2.8
Front Passenger Seat	Degree	2.8

*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	14.6	Max	48	60	70
		Mid	26	37	47
		Min	4	14	25
Front Passenger Seat	14.2	Max	52	62	71
		Mid	28	38	48
		Min	4	15	24

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	Power	130	Power

SEAT BELT ANCHORAGE ADJUSTMENT

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

HEAD RESTRAINT ADJUSTMENT

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

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

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
Test Facility: Calspan

NHTSA No.: C20245103
Test Date: 03/20/2024

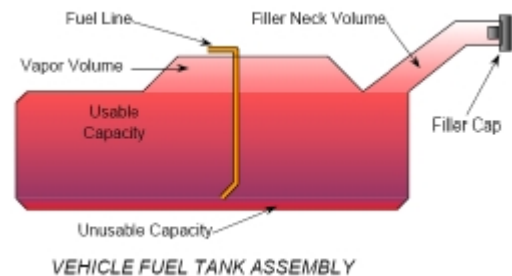
FUEL TANK CAPACITY DATA

Description	Liters
Usable Capacity of (Form No.1)	54.1
Usable Capacity of (Owner's Manual)	55
92 - 94% of Usable Capacity	49.8 - 50.9
Actual Amount of Solvent Used in Test	50.7

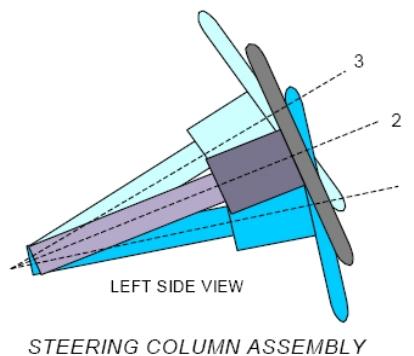
FUEL PUMP

Describe the operation of the fuel pump.

The vehicle is equipped with an electric fuel pump. The fuel filler neck is on the left 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

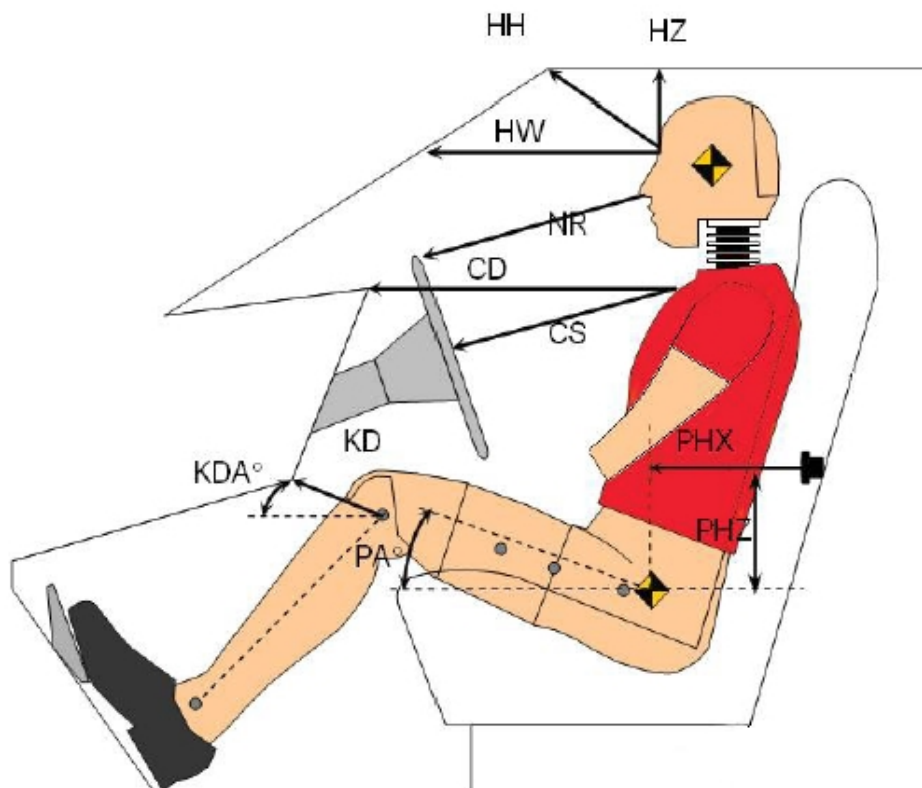


	Degrees	Fore / Aft Position (mm)
Lowermost - Position No. 1	18.0	
Geometric center - Position No. 2	20.0	
Uppermost - Position No. 3	21.9	
Telescoping Steering Wheel Travel		58
Test Position	20.0	29

DATA SHEET NO. 6
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
 Test Facility: Calspan

NHTSA No.: C20245103
 Test Date: 03/20/2024



Left Side View

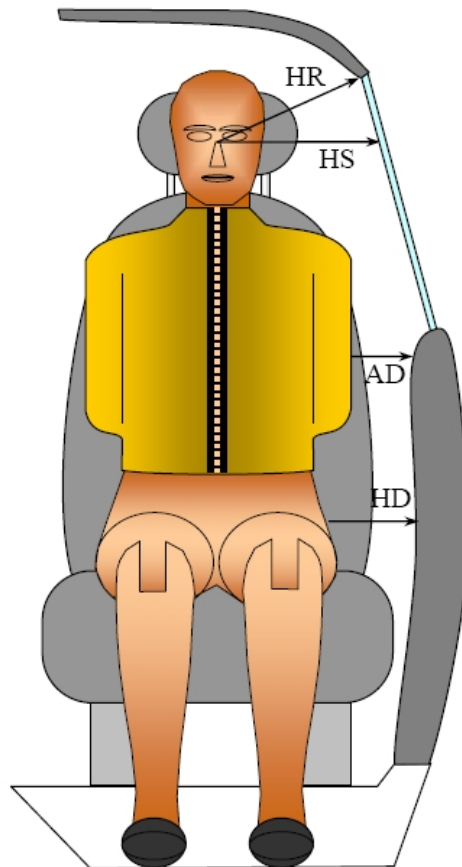
DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Description	Driver	
		Length (mm)	Angle (°)
HH	Head to Header	330	
HW	Head to Windshield	617	
HZ	Head to Roof Liner	153	
NR	Nose to Rim	410	
CD	Chest to Dash	588	
CS	Chest to Steering Wheel	350	
KD(L) / KDA(L)°	Left Knee to Dash	168	35.0
KD(R) / KDA(R)°	Right Knee to Dash	123	61.3
PAX°	Pelvic Tilt Angle (X-Axis)		22.0
PAY°	Pelvic Tilt Angle (Y-Axis)		0.6
PHX	Hip Point to Striker (X-Axis)	199	
PHZ	Hip Point to Striker (Z-Axis)	241	

DATA SHEET NO. 7
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
Test Facility: Calspan

NHTSA No.: C20245103
Test Date: 03/20/2024



FRONT VIEW OF DUMMY

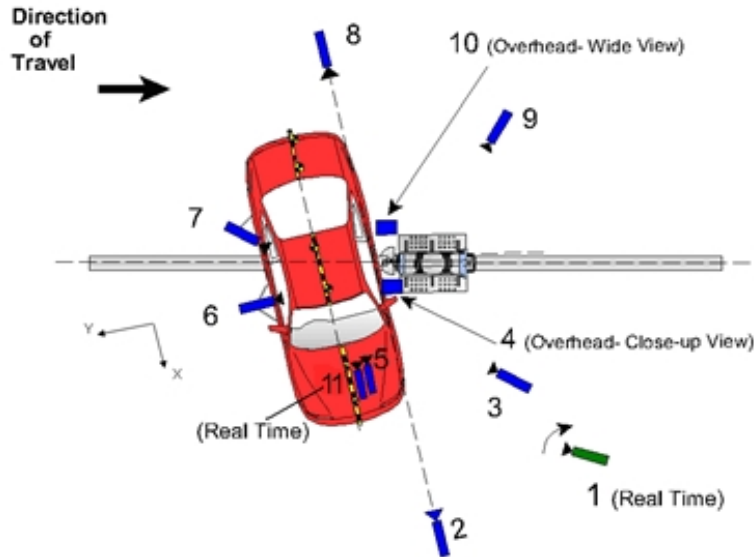
DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver
HR	Head to Side Header	mm	180
HS	Head to Side Window	mm	333
AD	Arm to Door	mm	115
HD	H-Point to Door	mm	173

DATA SHEET NO. 8 LOCATION OF CAMERA

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
Test Facility: Calspan

NHTSA No.: C20245103
Test Date: 03/20/2024



CAMERA LOCATIONS AND DATA

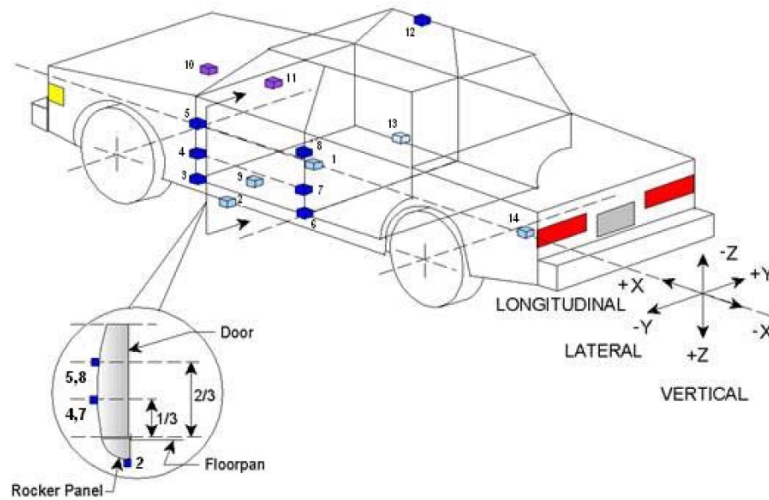
No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Real-time (24 - 30 fps) pan view of impact				Zoom	60
2	Front ground level - impact view	0	8100	-1450	28	1000
3	Impact side 45° - forward pole view	1100	5180	-1450	24	1000
4	Overhead Close-up view of impact	0	0	-9200	24	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	-8800	-1550	28	1000
9	Impact side 45° - rearward pole view	3220	-8800	-1550	28	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 Toyota Crown 4 Door Sedan
 Test Facility: Calspan

NHTSA No.: C20245103
 Test Date: 03/20/2024



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2734	10	-117
2	Left Floor Sill	2987	-688	267
3	A-Pillar Sill	3425	-635	223
4	A-Pillar Low	3438	-633	21
5	A-Pillar Mid	3300	-639	-444
6	B-Pillar Sill	2385	-687	231
7	B-Pillar Low	2356	-676	-117
8	B-Pillar Mid	2309	-660	-380
9	Seat	2603	-597	236
10	Engine	4186	367	-223
11	Firewall	3702	-1	-160
12	Roof	2248	544	-867
13	Right Floor Sill	2990	685	269
14	Rear Deck	1092	7	69

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 Toyota Crown 4Dr Sedan
Test Facility: Calspan

NHTSA No.: C20245103
Test Date: 03/20/2024

Loc. No	Description	Axes	Units	Positive Direction		Negative Direction	
				Max	Time (ms)	Max	Time (ms)
1	Vehicle CG	X	g	5.13	20.55	-12.54	37.65
	Vehicle CG	Y	g	66.67	35.60	-20.36	49.70
	Vehicle CG	Z	g	17.00	57.65	-22.04	18.20
	Vehicle CG Resultant	N/A	g	67.49	35.60	0.03	-37.65
2	Floor Sill (Left)	Y	g	78.08	11.85	-21.27	34.55
3	A Pillar Sill	Y	g	56.16	17.05	-51.73	35.05
4	A Pillar Low	Y	g	73.42	43.75	-93.28	38.60
5	A Pillar Mid	Y	g	58.46	52.15	-37.51	26.70
6	B Pillar Sill	Y	g	132.02	12.95	-25.05	33.10
7	B Pillar Low	Y	g	170.77	14.55	-20.00	22.65
8	B Pillar Mid	Y	g	35.32	6.85	-81.09	12.10
9	Seat	Y	g	74.35	20.50	-14.20	16.40
10	Engine Top	X	g	2.21	113.25	-20.97	37.00
	Engine Top	Y	g	15.58	64.55	-3.21	180.75
11	Firewall	Y	g	21.72	13.25	-4.80	18.45
12	Roof	Y	g	30.04	44.20	-1.99	290.90
13	Floor Sill (Right)	Y	g	26.03	15.95	-2.65	19.85
14	Rear Deck	X	g	7.84	28.50	-8.59	33.25
	Rear Deck	Y	g	19.49	35.40	-1.33	156.60

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

Test Vehicle: 2024 Toyota Crown 4Dr Sedan NHTSA No.: C20245103
Test Facility: Calspan Test Date: 03/20/2024

Dummy Serial No. D037

Description	Axes	Positive Direction		Negative Direction	
		Max	Time (ms)	Max	Time (ms)
HEAD ACCELERATION (g)					
Longitudinal	X	5.27	136.40	-23.15	48.15
Lateral	Y	31.50	52.85	-7.35	132.10
Vertical	Z	8.83	37.35	-3.90	60.95
Resultant	N/A	38.49	48.65		
HIC36 (t1, t2)	N/A	201.46		t1 = 34.60	t2 = 70.60
THORAX DEFLECTION (mm)					
Upper Rib	Y	15.63	52.05	-4.67	94.35
Middle Rib	Y	11.50	46.55	-2.48	87.55
Lower Rib	Y	14.80	44.25	-0.46	294.30
ABDOMINAL FORCES (N)					
Front	Y	152.38	46.50	-16.56	18.20
Middle	Y	313.61	47.40	-7.38	172.75
Rear	Y	490.40	48.20	-7.60	114.60
SUM	N/A	949.33	48.35		
PELVIS FORCES (N)					
Pubic Symphysis	Y	48.43	160.70	-2545.57	58.50

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

DATA SHEET NO. 12
POST-TEST OBSERVATIONS

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
Test Facility: Calspan

NHTSA No.: C20245103
Test Date: 03/20/2024

IMPACT POINT DATA

Measured Parameter	Units	Value
Vertical Impact Ref Line - Aft of Front Axle, Intended Impact Pt	mm	1321
Actual Impact Point - Aft of Front Axle	mm	1325
Difference	mm	4

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Driver Seat Dummy (ES2-re)
Head Contact	Curtain Airbag, Side Header & Headrest
Upper Torso Contact	Seatback
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-Pillar, B-Pillar & C-Pillar Buckled
Sill Separation	340mm rear of impact point
Windshield Damage	Cracked throughout
Side Window Damage	Driver window shattered completely
Other Notable Effects	None

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

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
 Test Facility: Calspan

NHTSA No.: C20245103
 Test Date: 03/20/2024

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

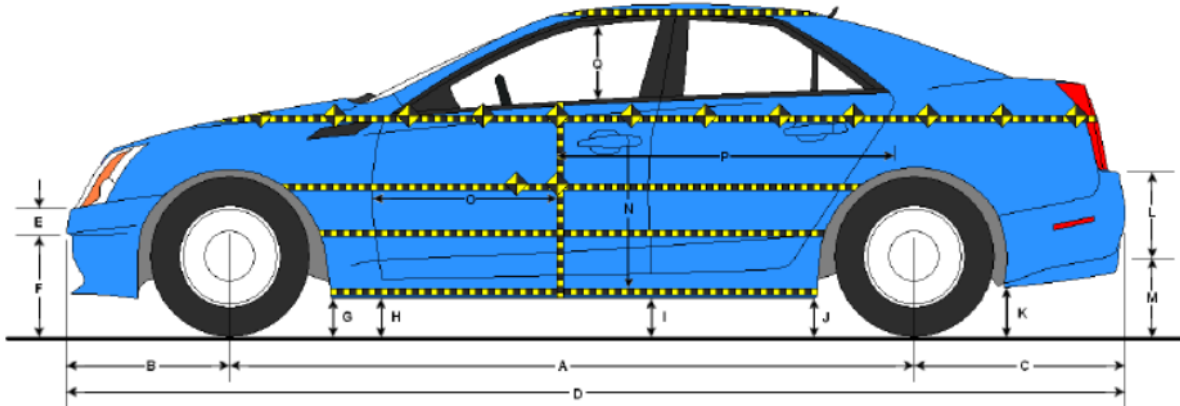
Restraint Type	Struck Side Front Occupant	
	Mounted	Deployed
Front Airbag	Yes	No
Knee Airbag	Yes	No
Head Airbag*	Yes	Yes
Side Airbag 2 - Torso/Pelvis Airbag	Yes	Yes
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	Yes
Other	N/A	N/A

*Head Airbag was a curtain airbag

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

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
 Test Facility: Calspan

NHTSA No.: C20245103
 Test Date: 03/20/2024



LEFT SIDE VIEW

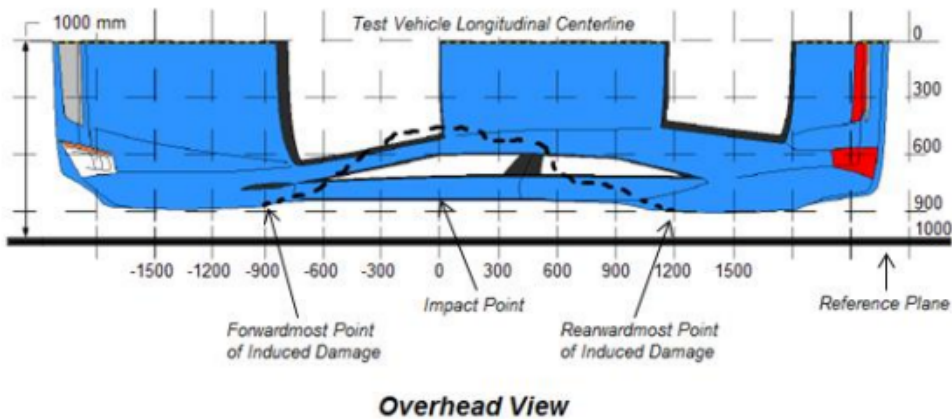
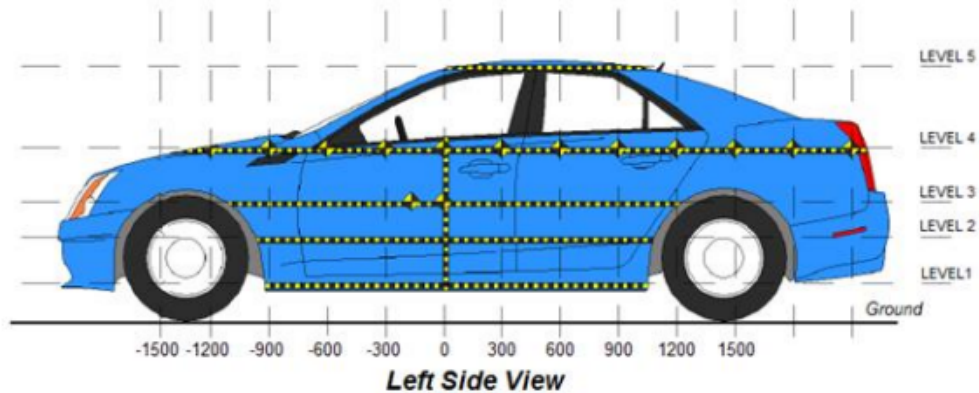
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

No.	Measurement Description	Pre-Test	Post-Test	Difference
A	Vehicle Wheelbase	2851	2811	-40
B	Front Axle to FSOV	1013	1032	19
C	Rear Axle to RSOV	1116	1111	-5
D	Total Vehicle Length at Centerline	4979	4954	-26
E	Front Bumper Thickness	115	115	0
F	Front Bumper Bottom to Ground	420	443	23
G	Sill Height at Front Wheel Well	229	222	-7
H	Sill Height at Front Door Leading Edge	229	224	-5
I	Sill Height at B Pillar	231	246	15
J1	Sill Height at Rear Wheel Well	225	246	21
J2	Pinch Weld Height at Rear Wheel Well	206	225	19
K	Sill Height Aft of Rear Wheel Well	243	247	4
L	Rear Bumper Thickness	130	130	0
M	Rear Bumper Bottom to Ground	437	419	-18
N	Sill Height to Window Bottom Sill	845	858	12
O	Front Door Leading Edge to Impact CL	789	731	-59
P	Rear Door Trailing Edge to Impact CL	1380	1296	-84
Q	Front Window Opening	368	359	-10
R	Right Side Length	4887	4885	-2
S	Left Side Length	4886	4850	-36
T	Vehicle Width at B-Pillars	1838	1713	-125

DATA SHEET NO. 14 **TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
 Test Facility: Calspan

NHTSA No.: C20245103
 Test Date: 03/20/2024



MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	289	250	0
2	Occupant H-Point	mm	599	297	0
3	Mid-Door	mm	689	308	0
4	Window Sill	mm	1034	264	0
5	Window Top	mm	1475	58	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 Toyota Crown 4 Door Sedan
 Test Facility: Calspan

NHTSA No.: C20245103
 Test Date: 03/20/2024

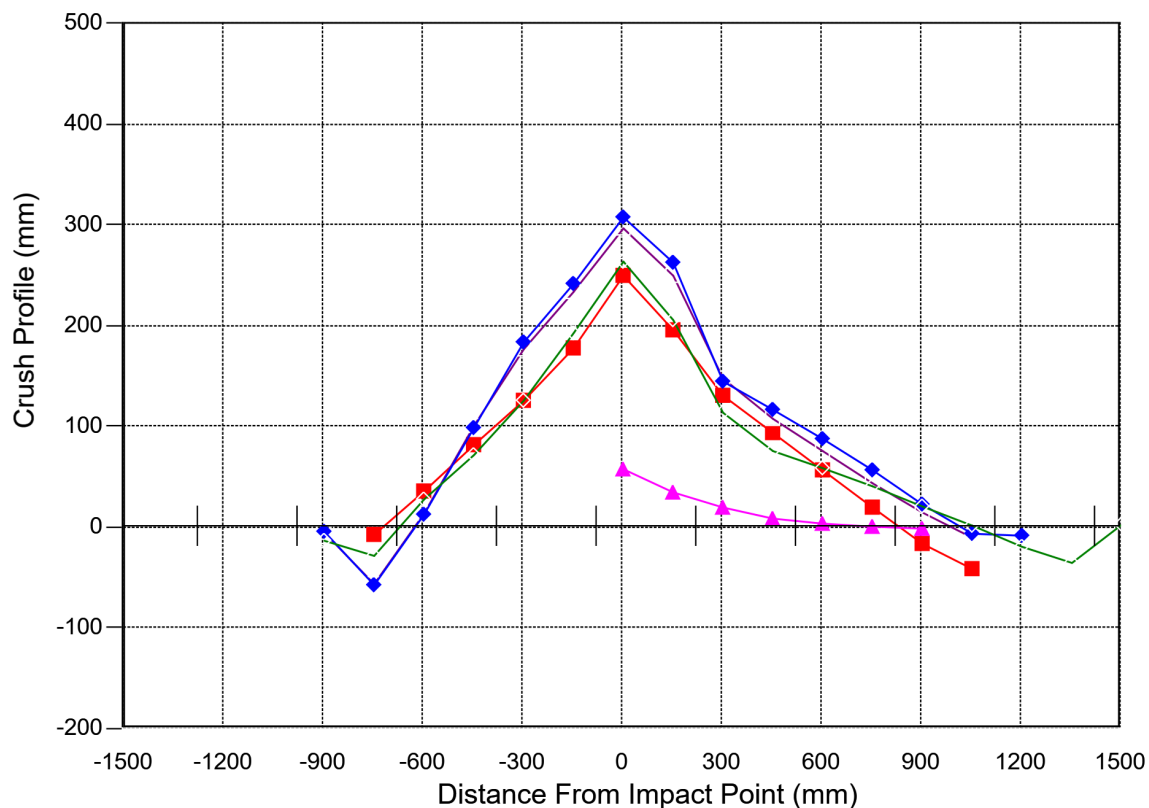
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1500															
-1350															
-1200															
-1050															
-900		918	920	800			923	924	813			-5	-4	-13	
-750	894	917	917	810		901	973	974	838		-7	-56	-57	-28	
-600	892	915	917	858		856	901	904	830		36	14	13	28	
-450	895	913	916	824		813	812	817	752		82	101	99	72	
-300	898	911	916	830		772	734	732	704		126	177	184	126	
-150	901	908	915	838		723	674	673	645		178	234	242	193	
0	903	905	913	845	583	653	608	605	581	525	250	297	308	264	58
150	903	904	911	850	591	707	654	648	644	556	196	250	263	206	35
300	902	906	908	852	592	771	758	763	738	572	131	148	145	114	20
450	904	910	906	851	591	810	802	789	775	582	94	108	117	76	9
600	904	913	906	849	588	847	837	818	790	584	57	76	88	59	4
750	902	916	909	845	580	882	872	852	804	579	20	44	57	41	1
900	898	918	913	839	566	914	903	890	818	567	-16	15	23	21	-1
1050	893	920	918	833		934	930	924	831		-41	-10	-6	2	
1200			921	831				929	850				-8	-19	
1350				839					874					-35	
1500				848					845					3	

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

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
 Test Facility: Calspan

NHTSA No.: C20245103
 Test Date: 03/20/2024



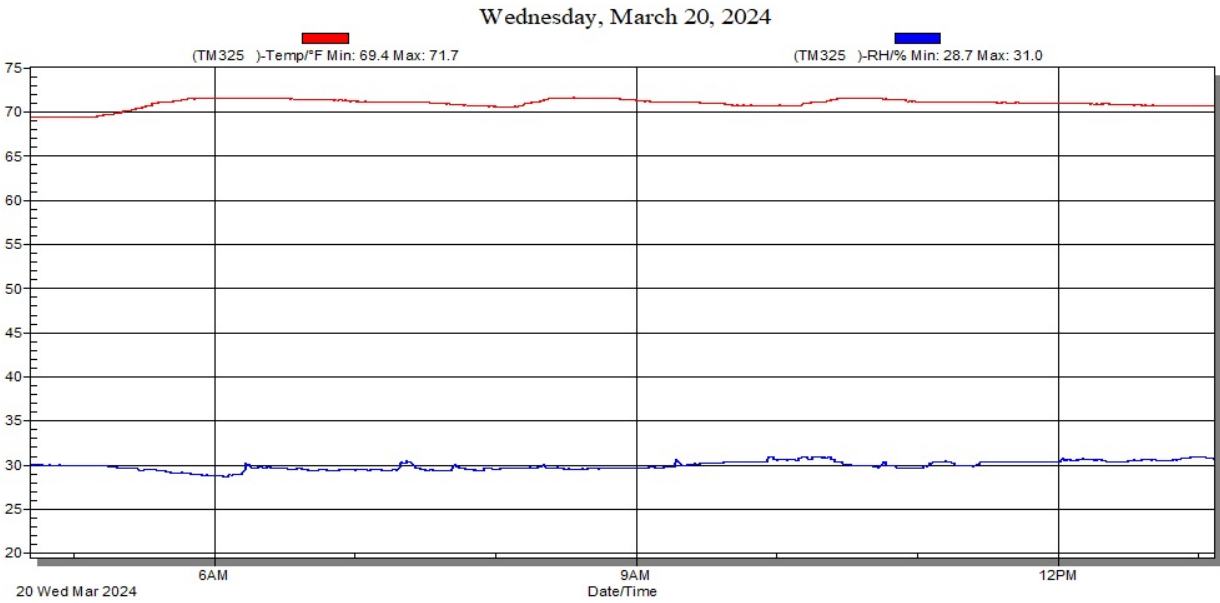
LEVEL 1 Side Sill: -359 mm above ground	LEVEL 2 H-Point: -49 mm above ground
LEVEL 3 Mid Door: 41 mm above ground	LEVEL 4 Window Sill: 386 mm above ground
LEVEL 5 Window Top: 827 mm above ground	

Vehicle Exterior Crush Measurements - Visual Representation

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

Test Vehicle: 2024 Toyota Crown 4 Door Sedan
Test Facility: Calspan

NHTSA No.: C20245103
Test Date: 03/20/2024



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

APPENDIX I
PHOTOGRAPHS

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16	Pre-Test Dummy Shoulder and Door Top View	I-10
17	Post-Test Dummy Shoulder and Door Top View	I-11
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24	Post-Test Close-Up View of Impact Point Target	I-14
25	Close-Up View of Vehicle's Certification Label	I-15
26	Close-Up View of Vehicle's Tire Placard Label	I-15

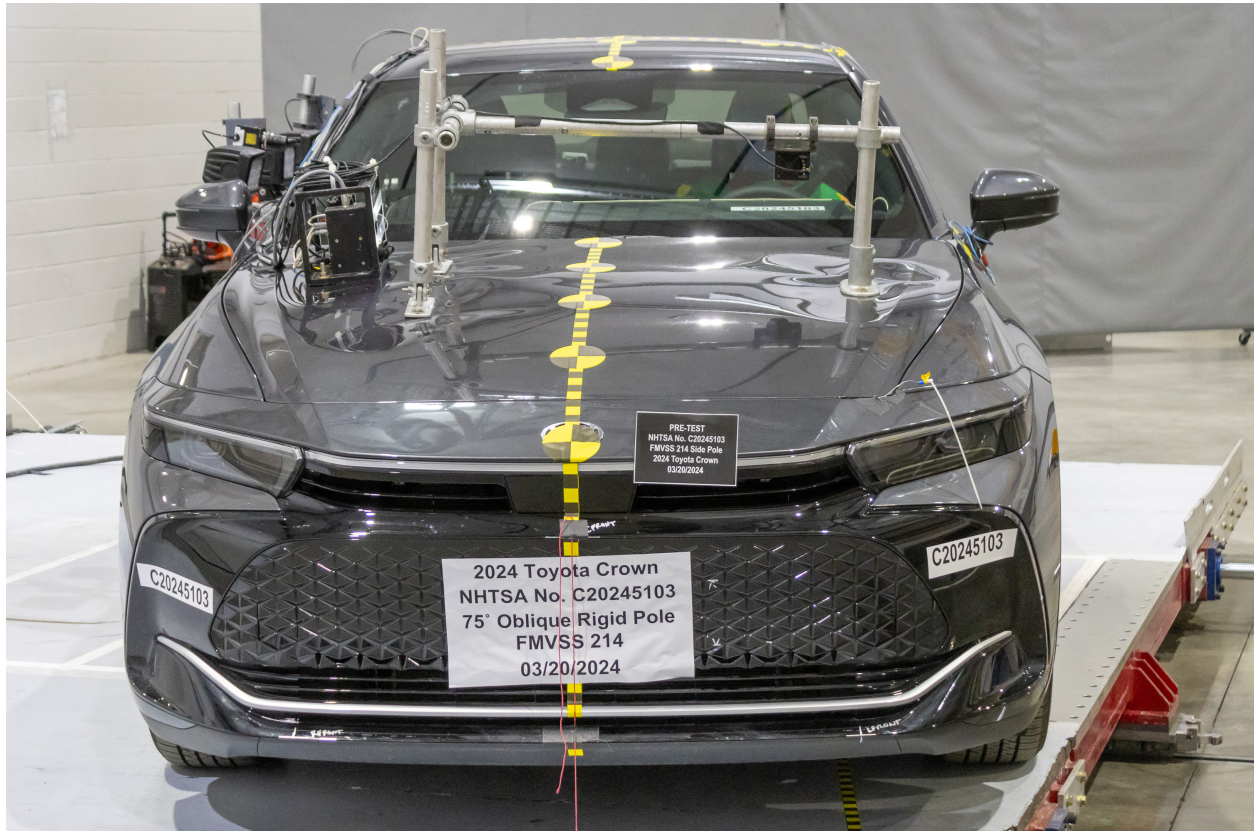


Figure A-1: Pre-Test Frontal View of Test Vehicle

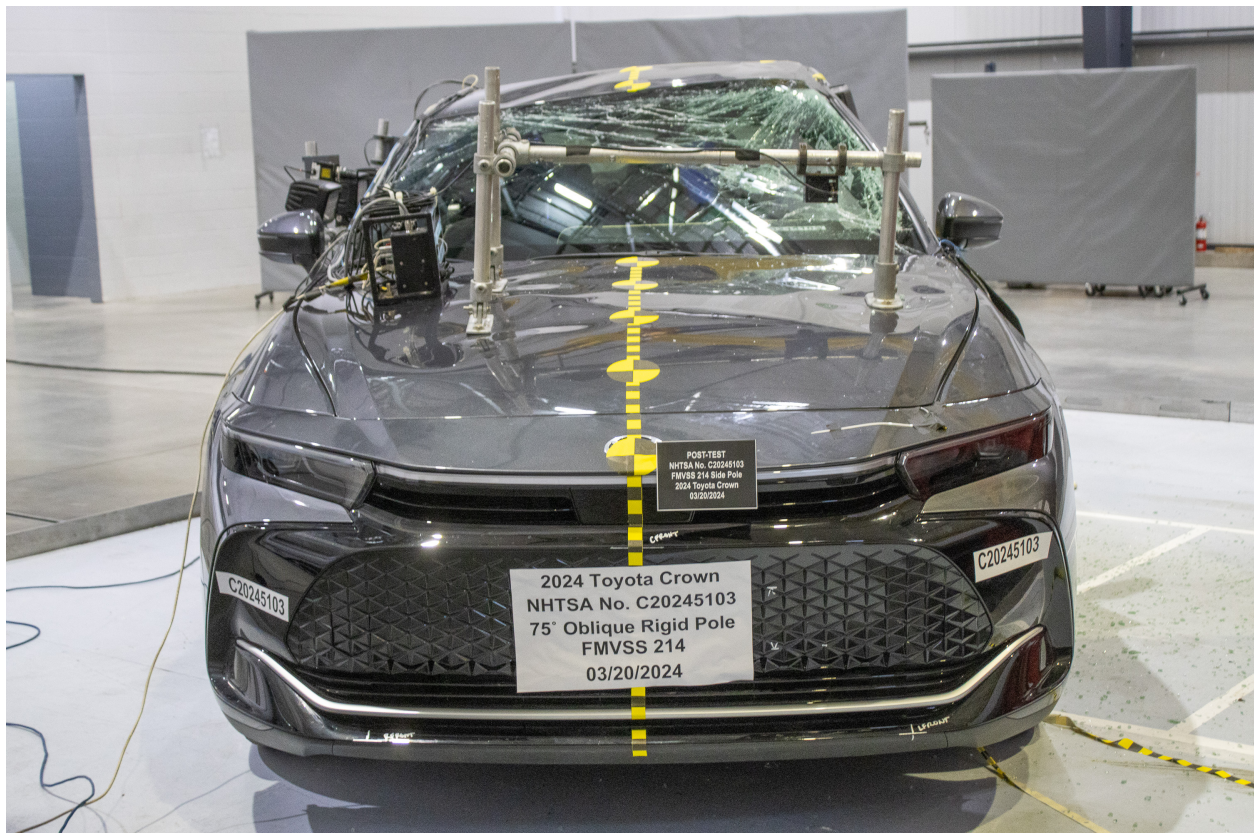


Figure A-2: Post Test Frontal View of Test Vehicle



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



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



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



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



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



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



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

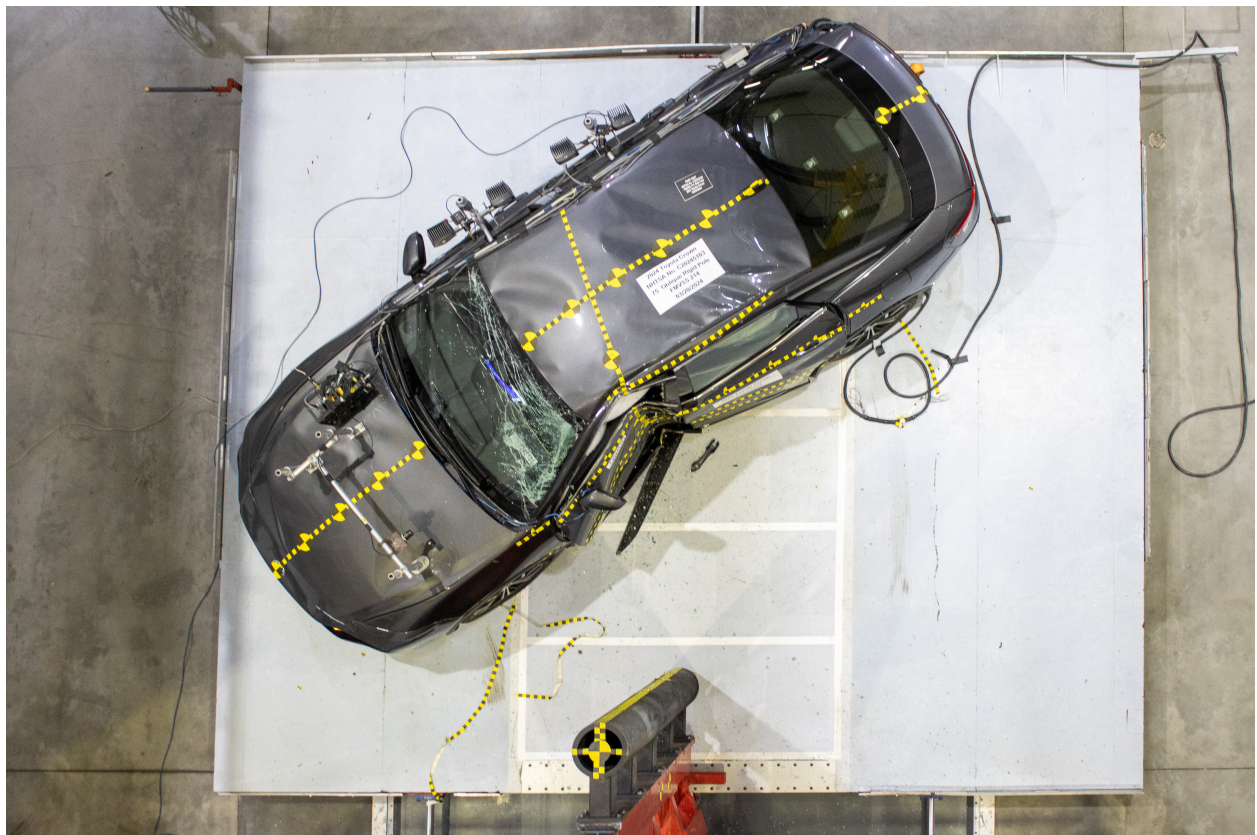


Figure A-10: Post-Test Overhead View of Test Vehicle



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



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



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



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



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



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



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



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



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



Figure A-20: Impact Event



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



Figure A-22: Post-Test $\frac{3}{4}$ 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

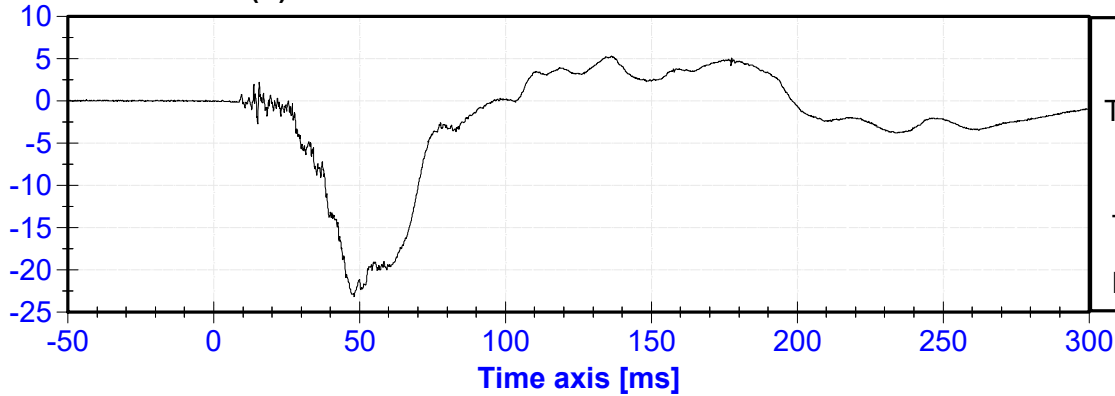
APPENDIX II
ES-2re DUMMY RESPONSE DATA TRACES

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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
11	ES-2re Middle Thorax Rib Deflection (Y) vs. Time	II-5
12	ES-2re Lower Thorax Rib Deflection Rate 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
16	ES-2re Rear Abdomen Force (Y) vs. Time	II-6
17	ES-2re Sum of Abdomen Forces vs. Time	II-7
18	ES-2re Pubic Symphysis Force (Y) vs. Time	II-7

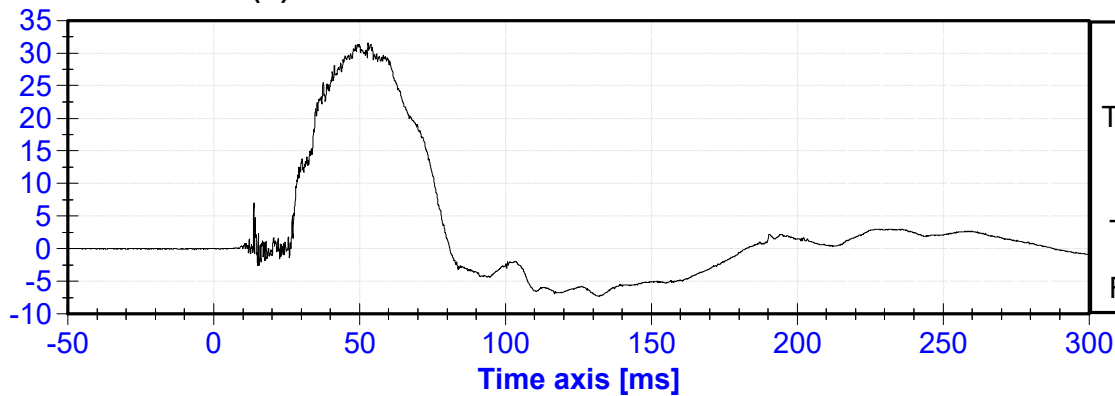
ACCELERATION [g's]

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



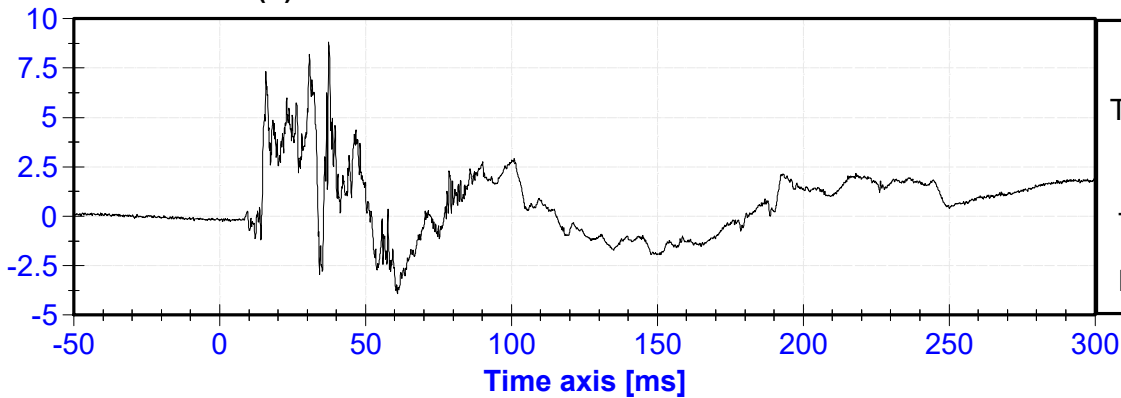
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ES-2re Head (Y) Acceleration vs. Time



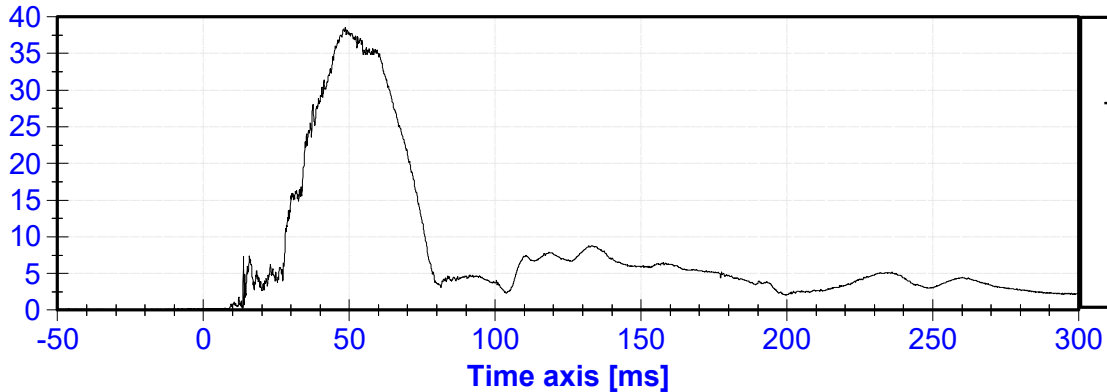
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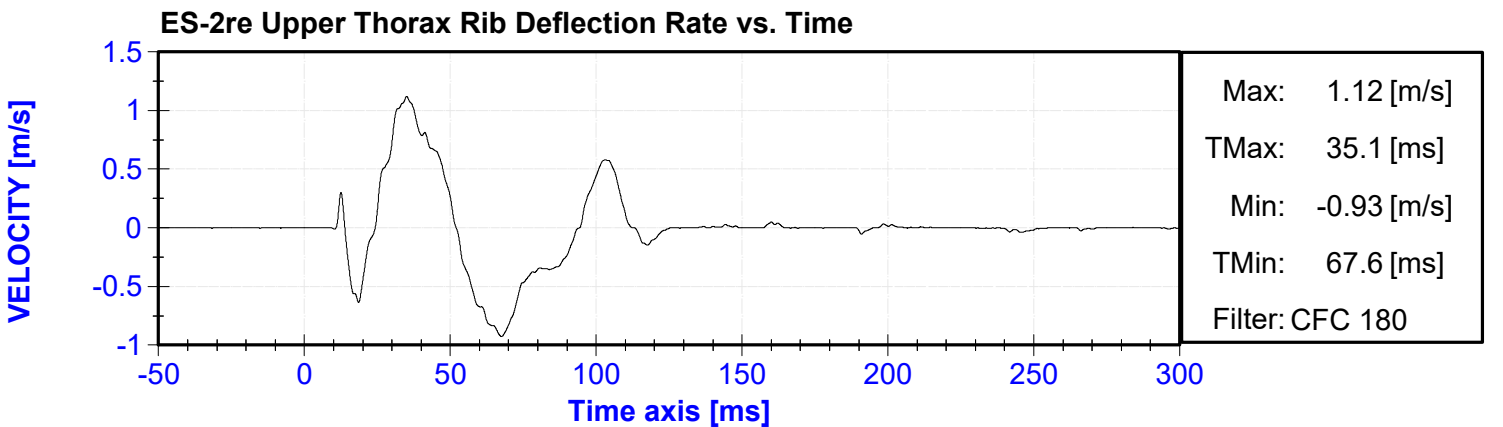
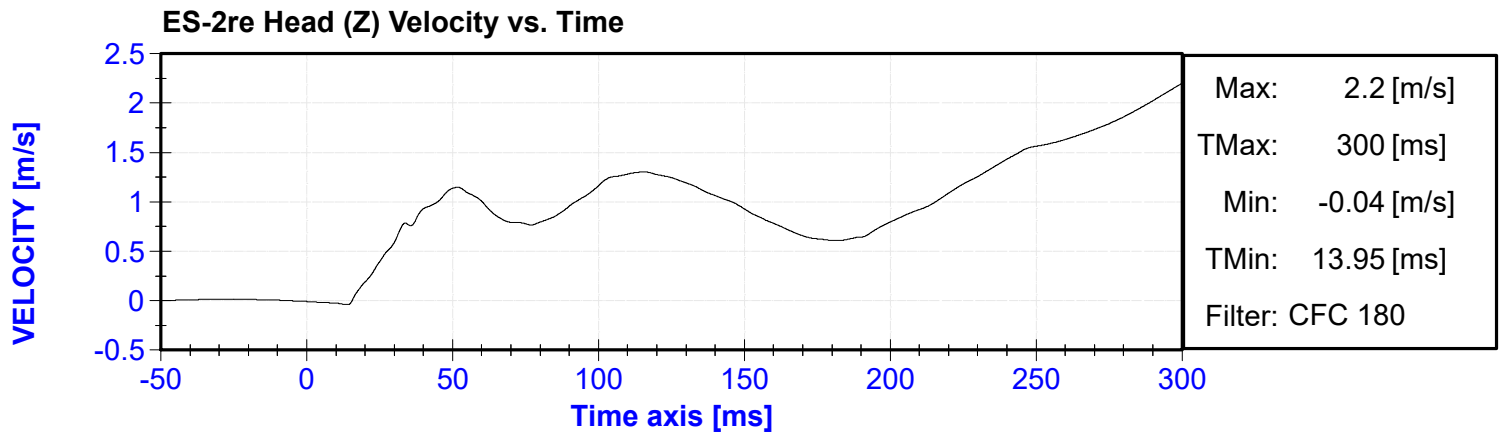
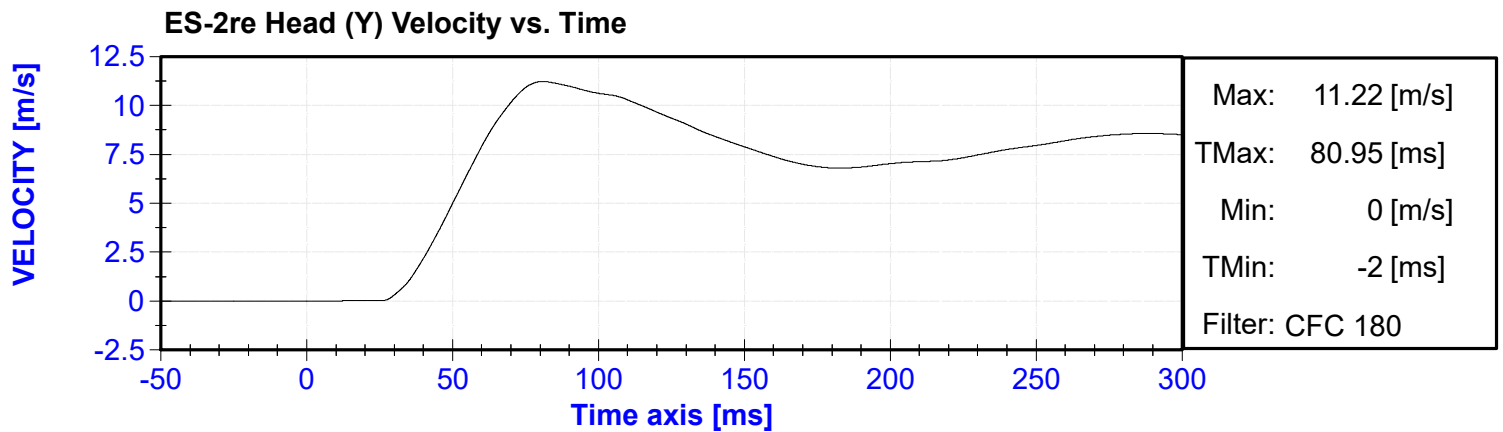
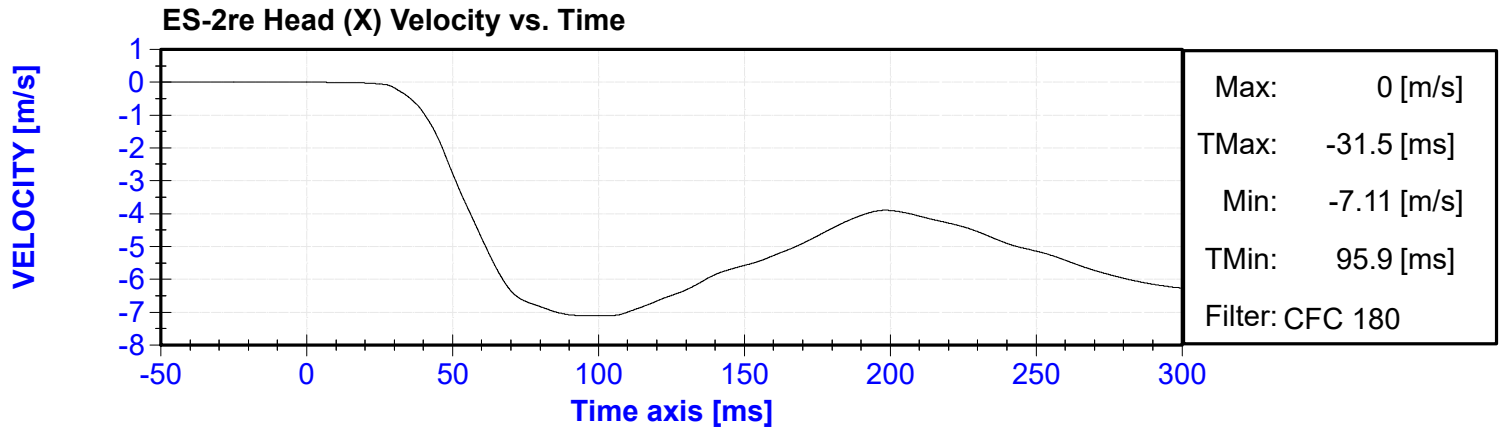
ES-2re Head (Z) Acceleration vs. Time

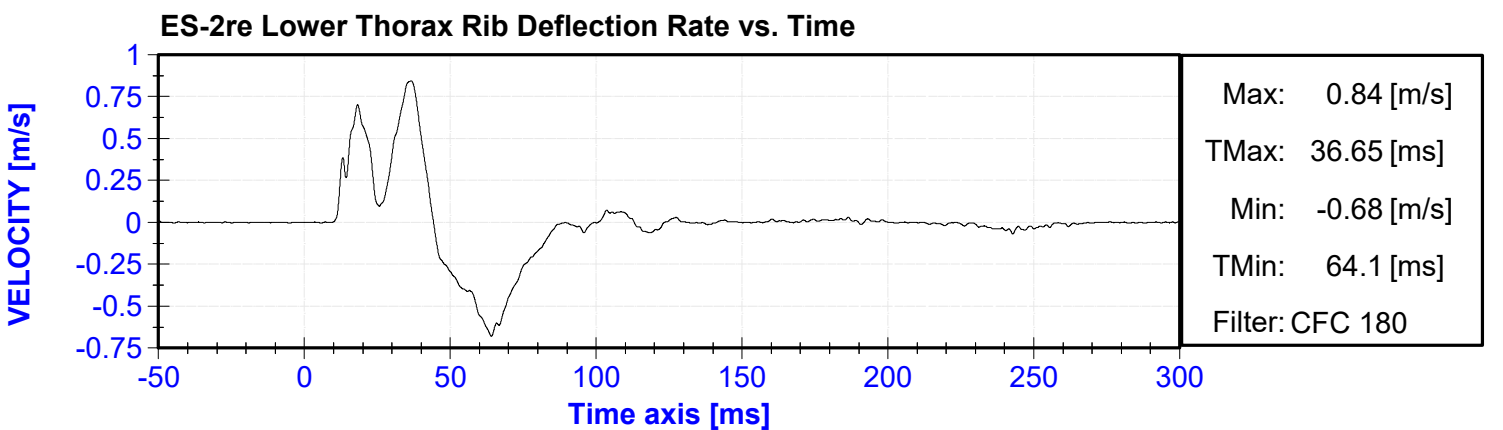
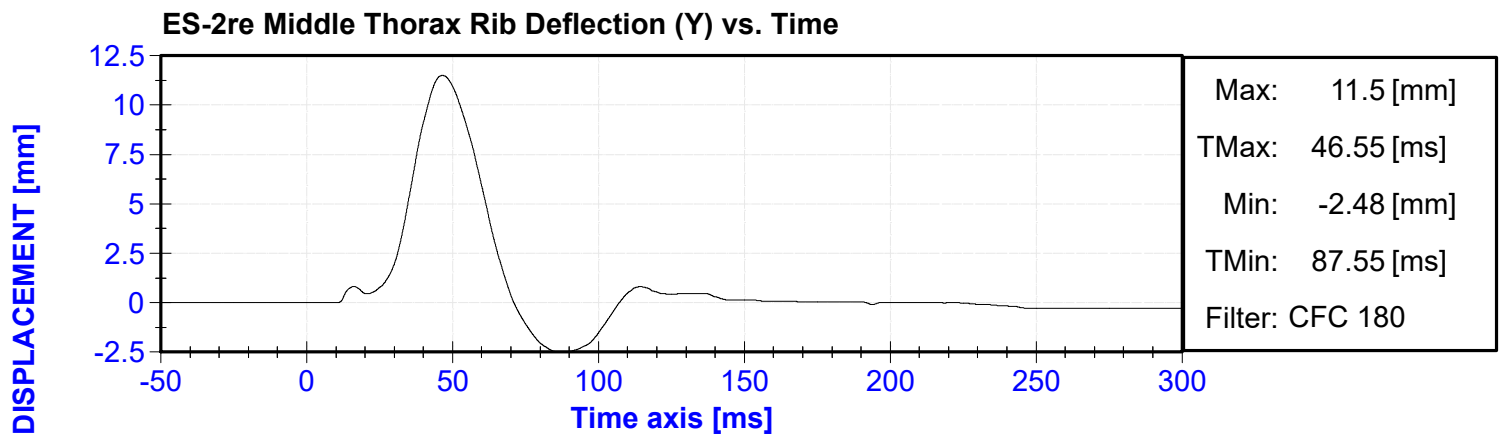
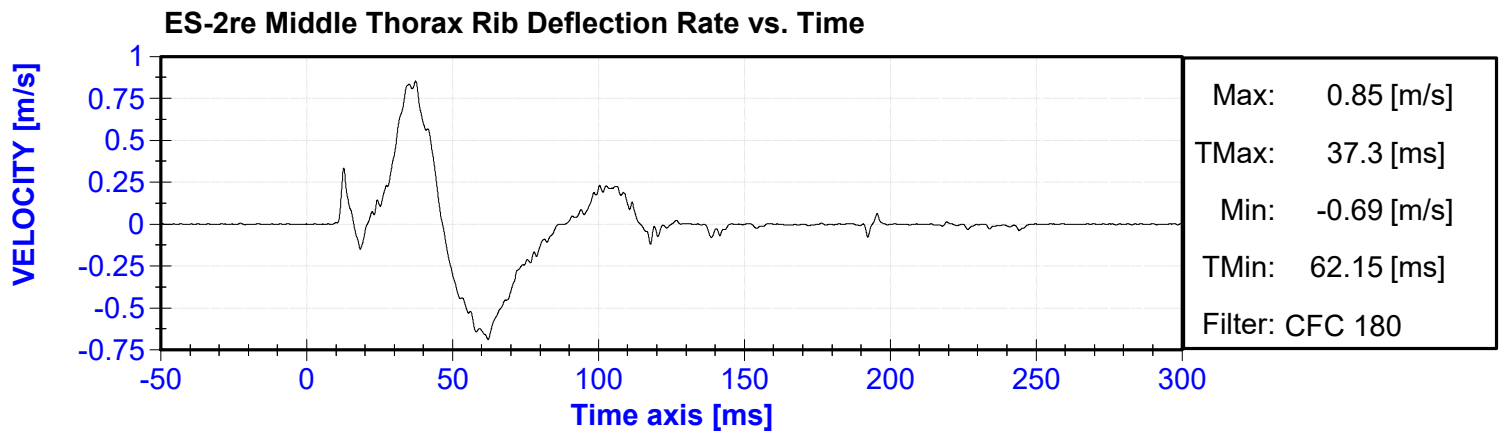
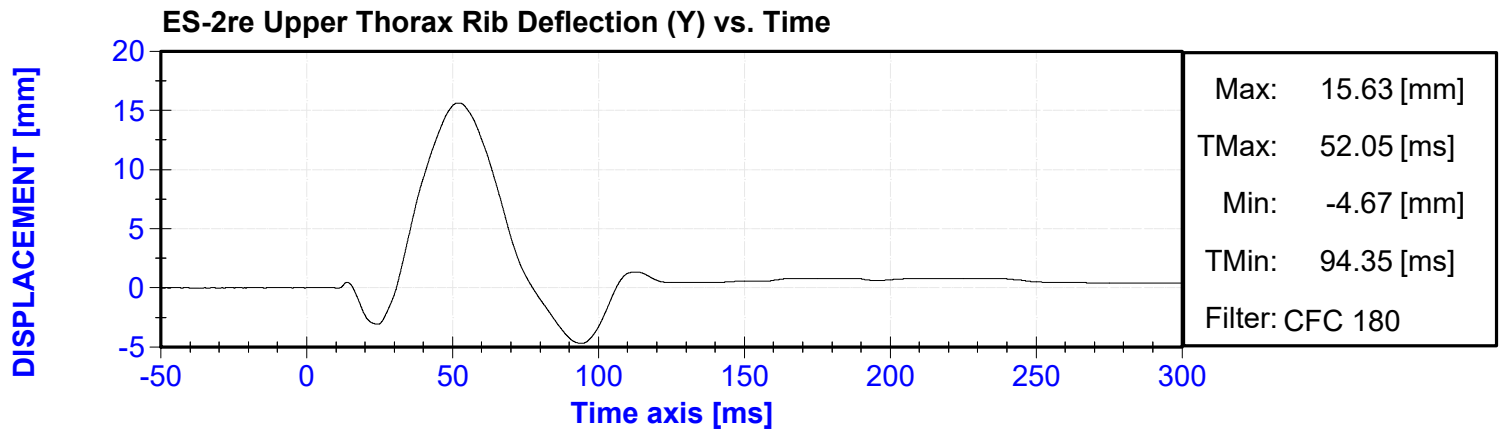


ACCELERATION [g's]

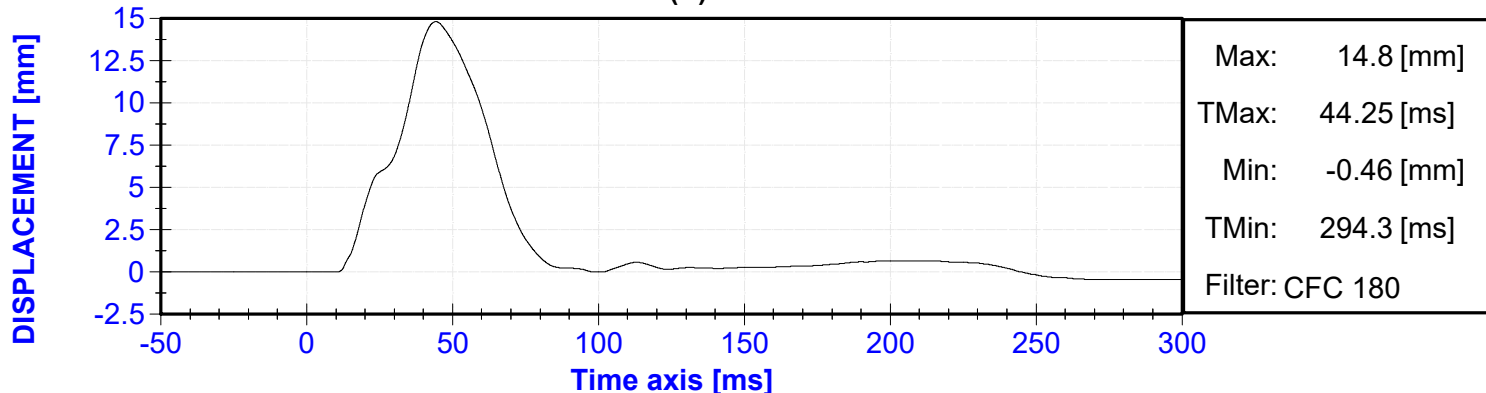
ES-2re Head Resultant Acceleration vs. Time



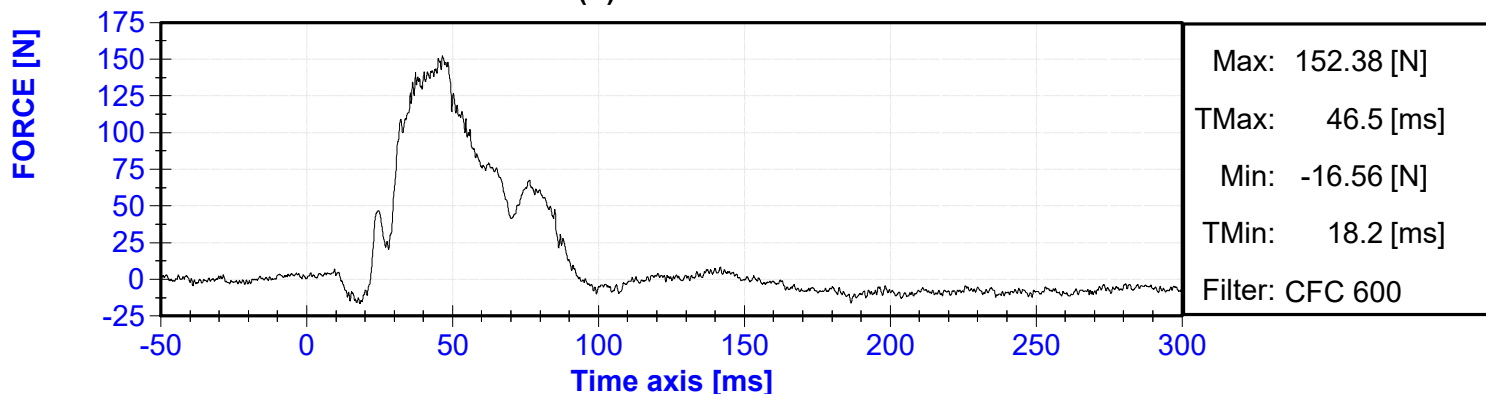




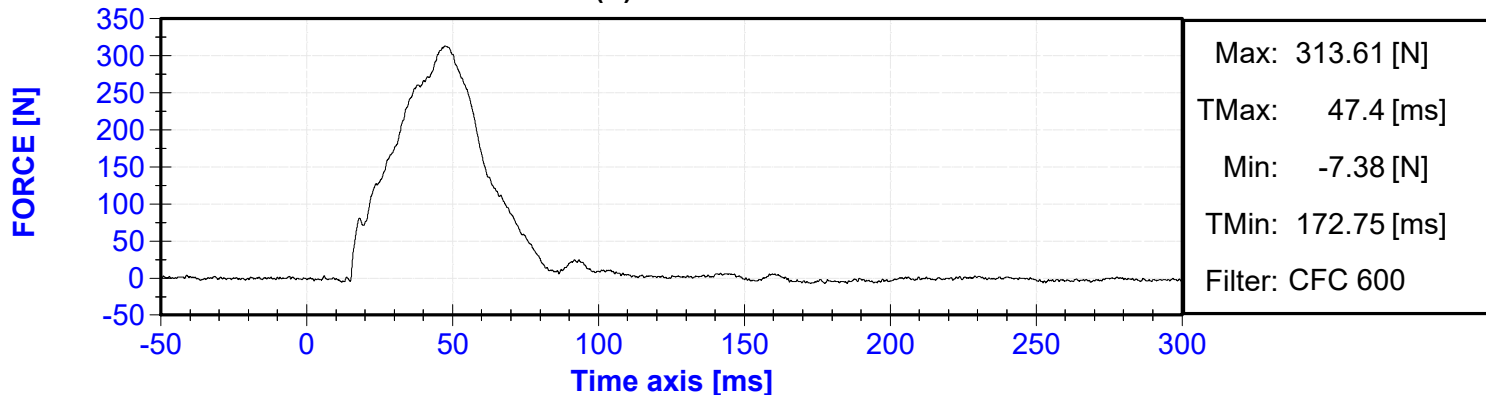
ES-2re Lower Thorax Rib Deflection (Y) vs. Time



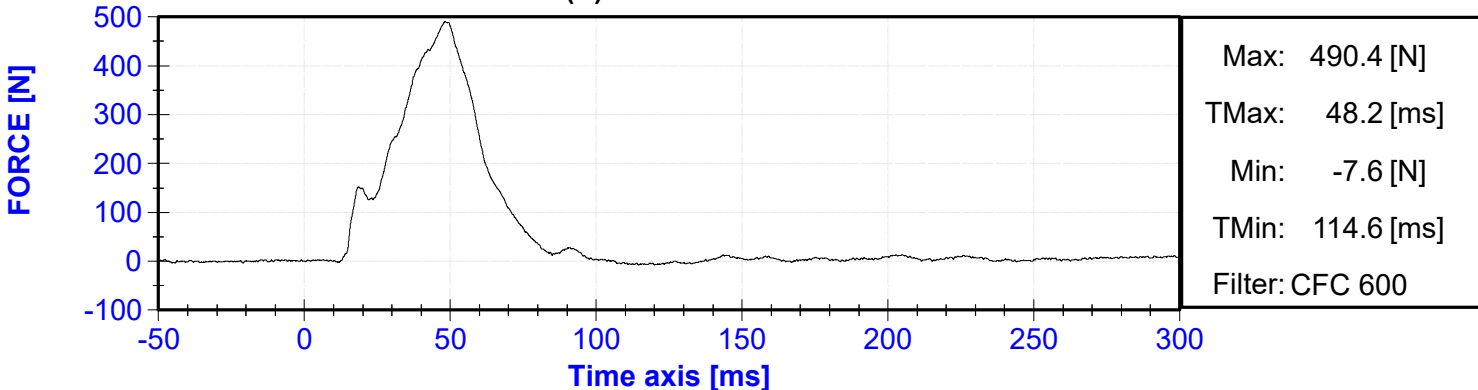
ES-2re Front Abdomen Force (Y) vs. Time

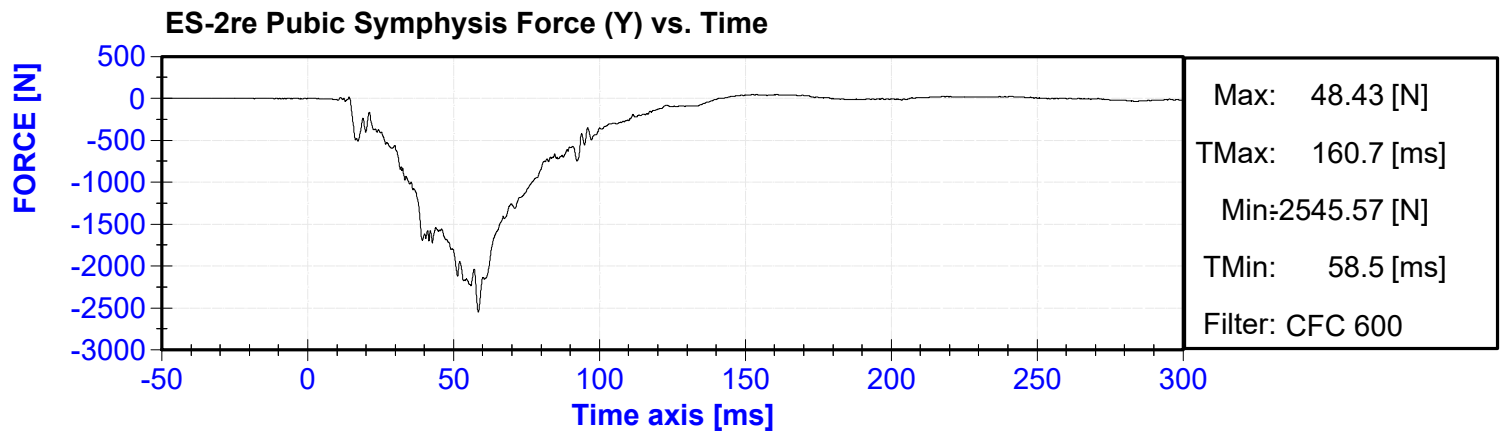
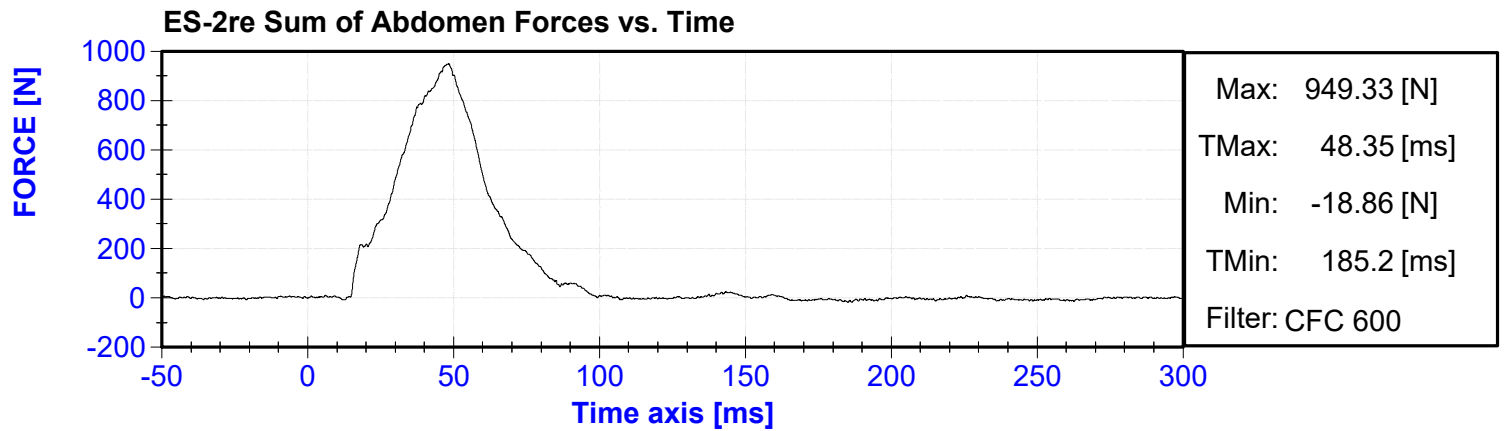


ES-2re Middle Abdomen Force (Y) vs. Time



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



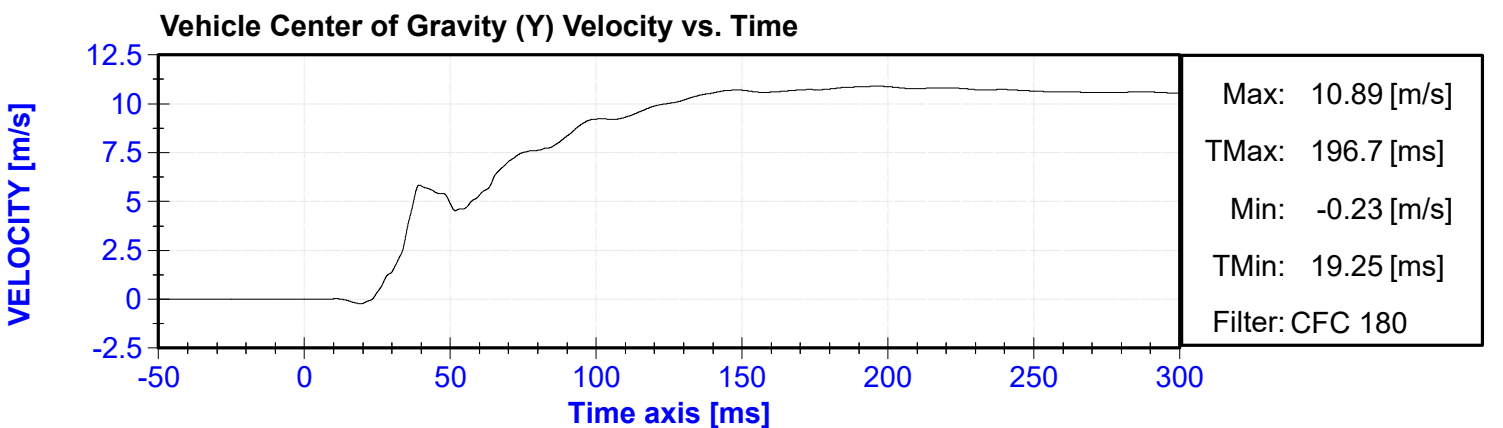
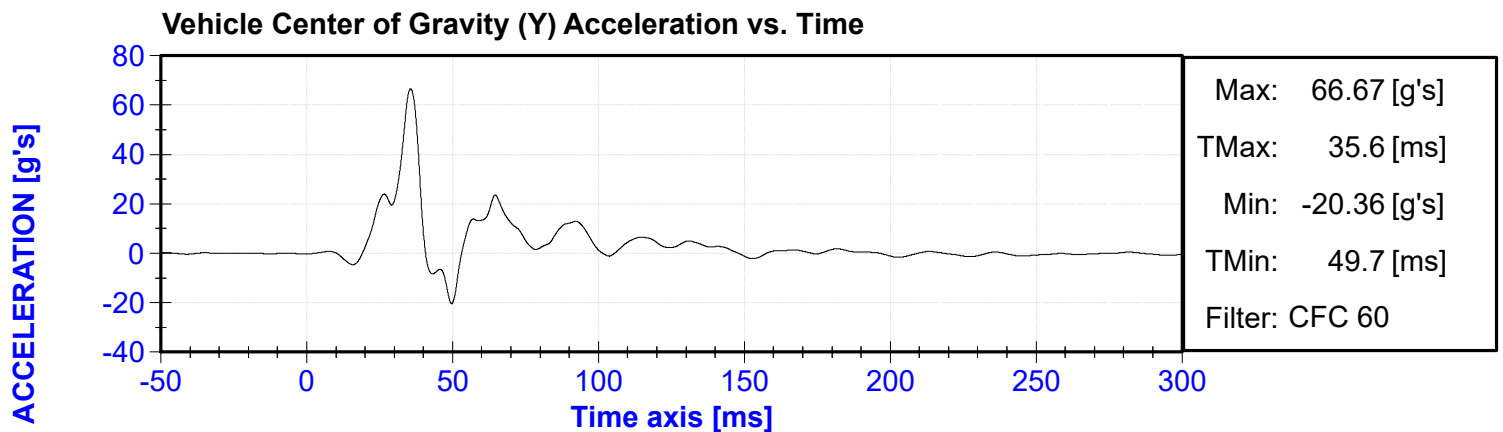
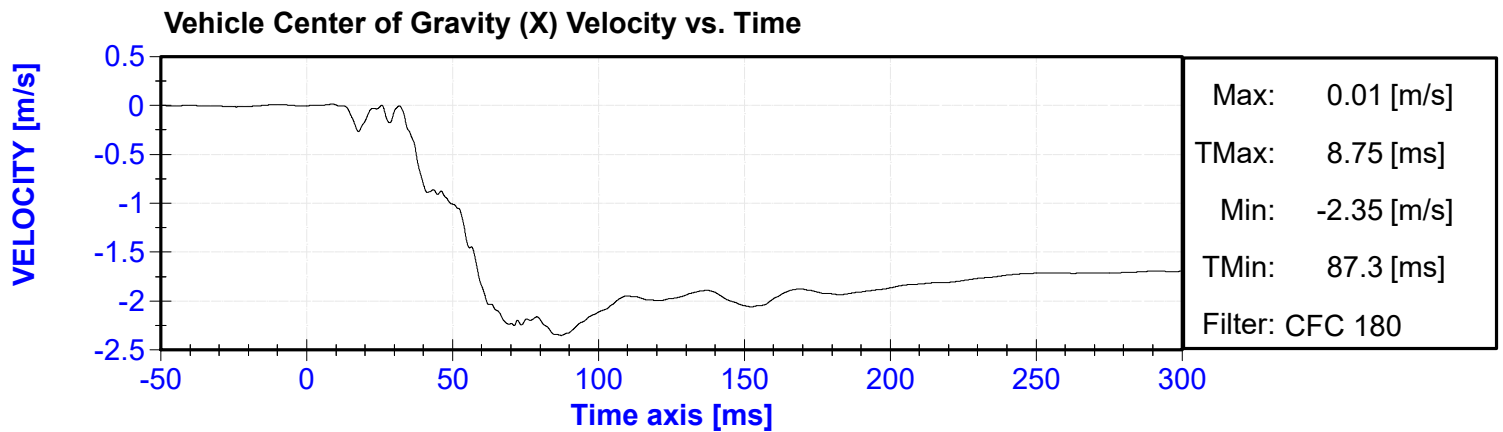
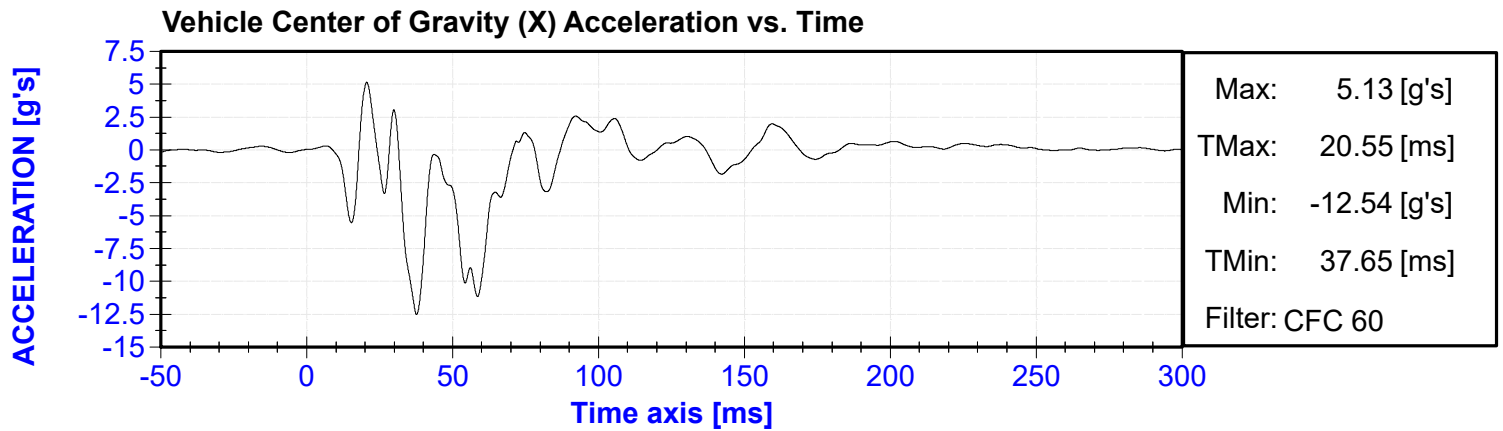


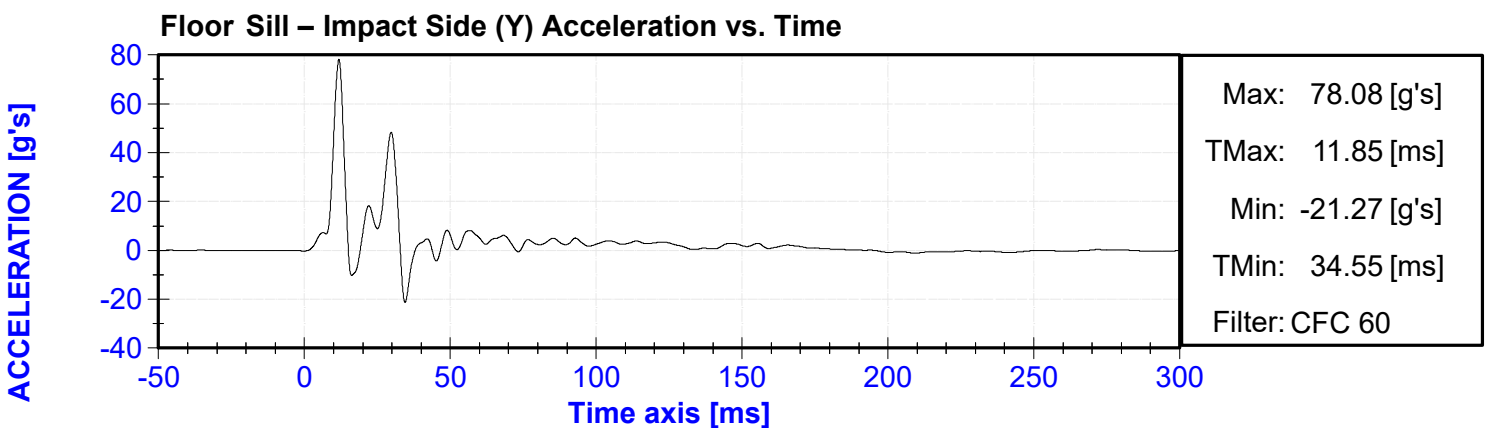
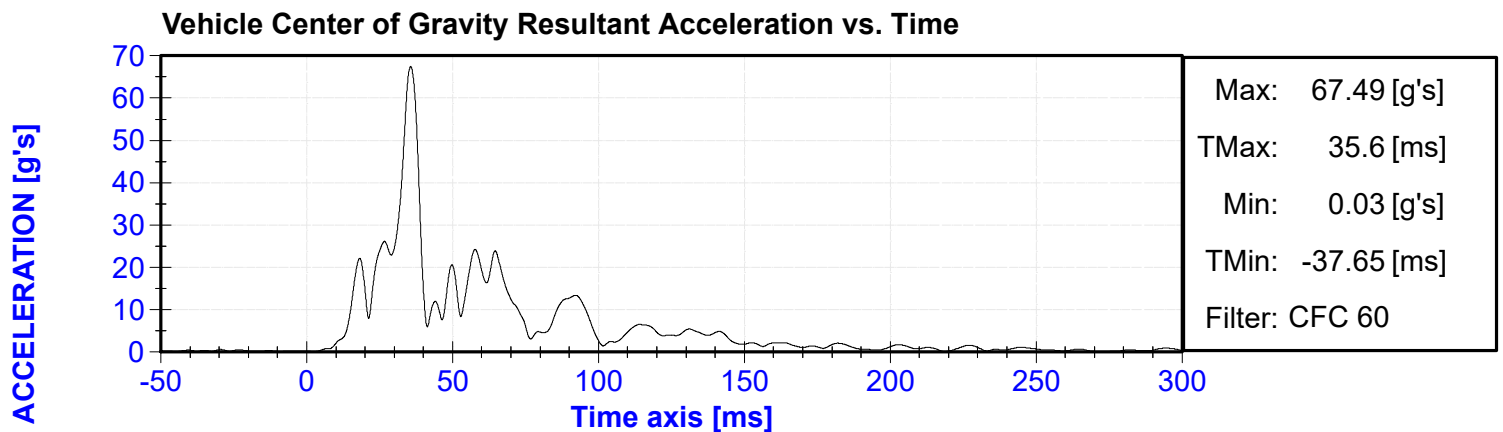
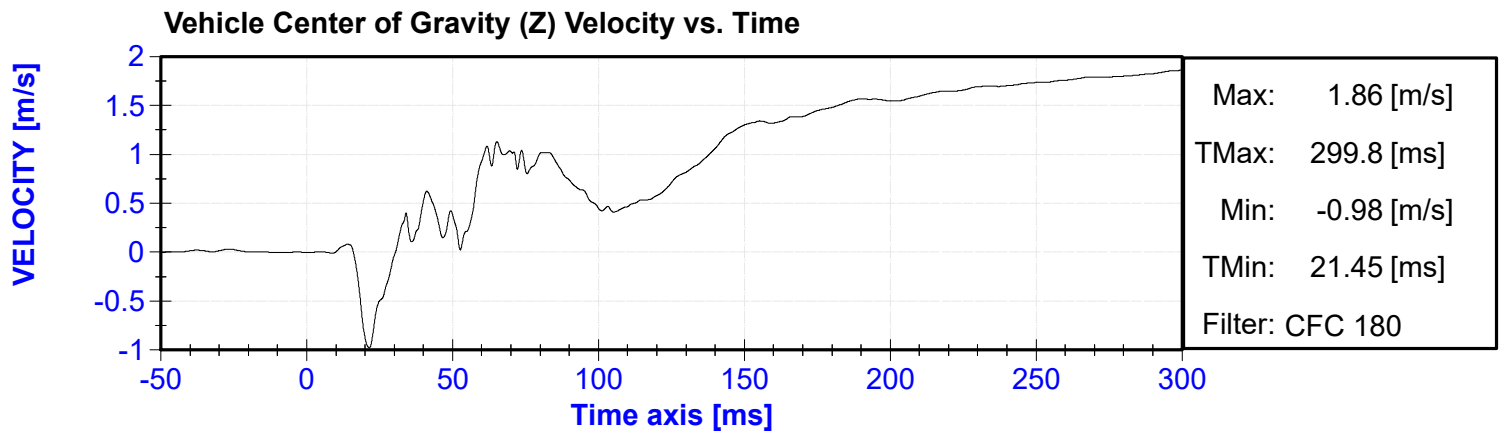
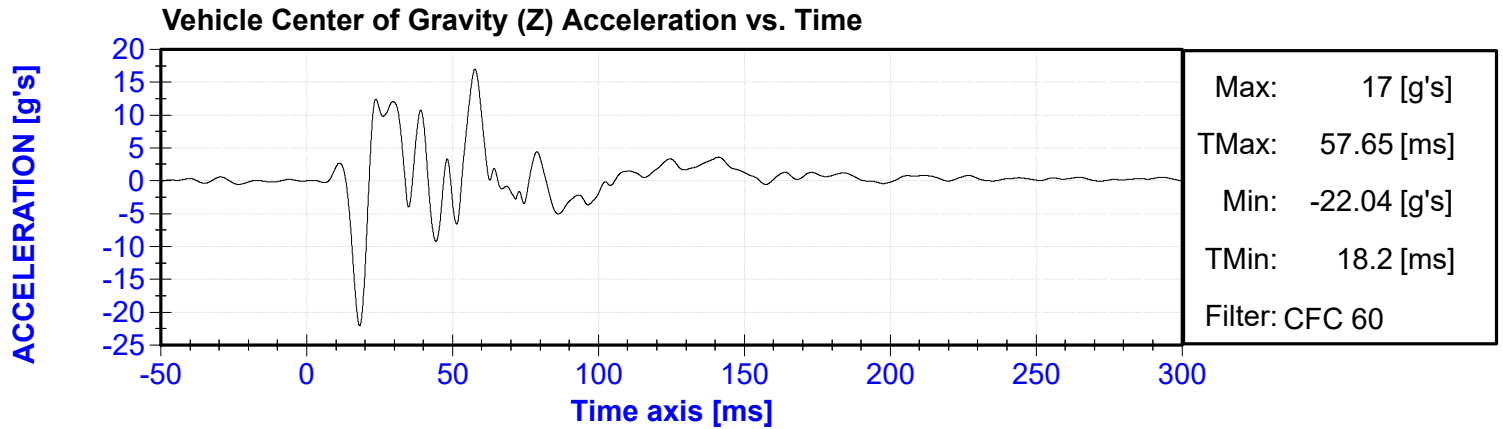
APPENDIX III

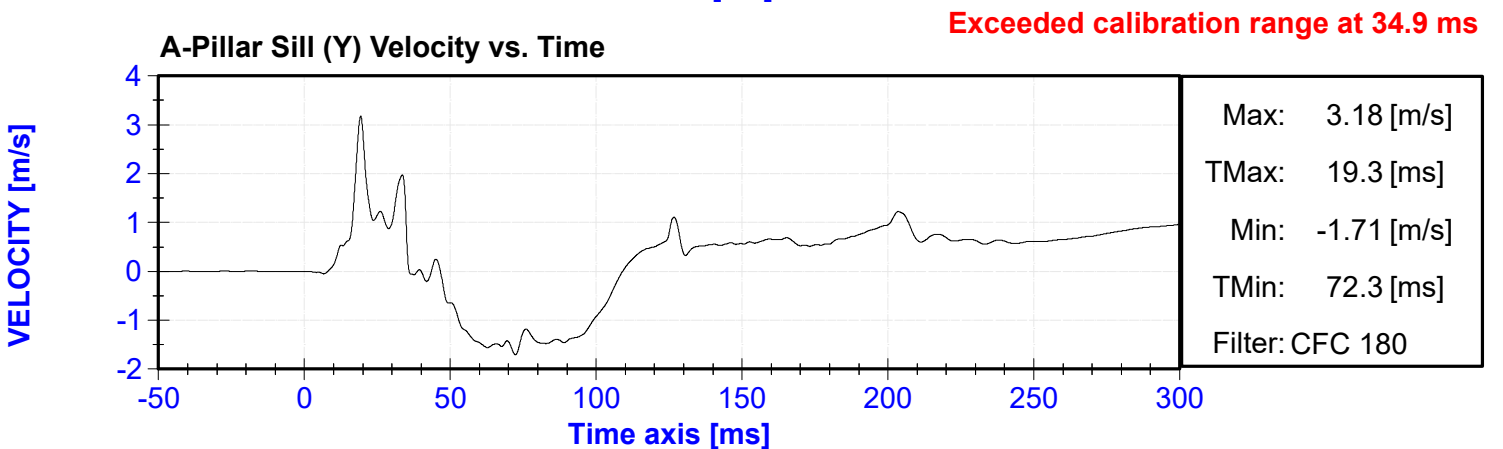
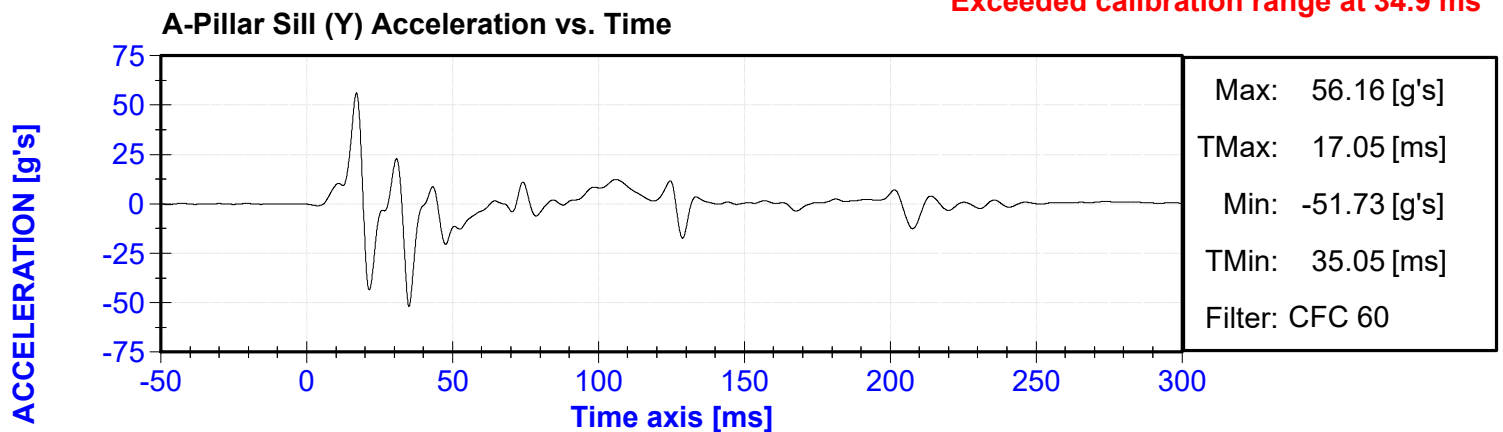
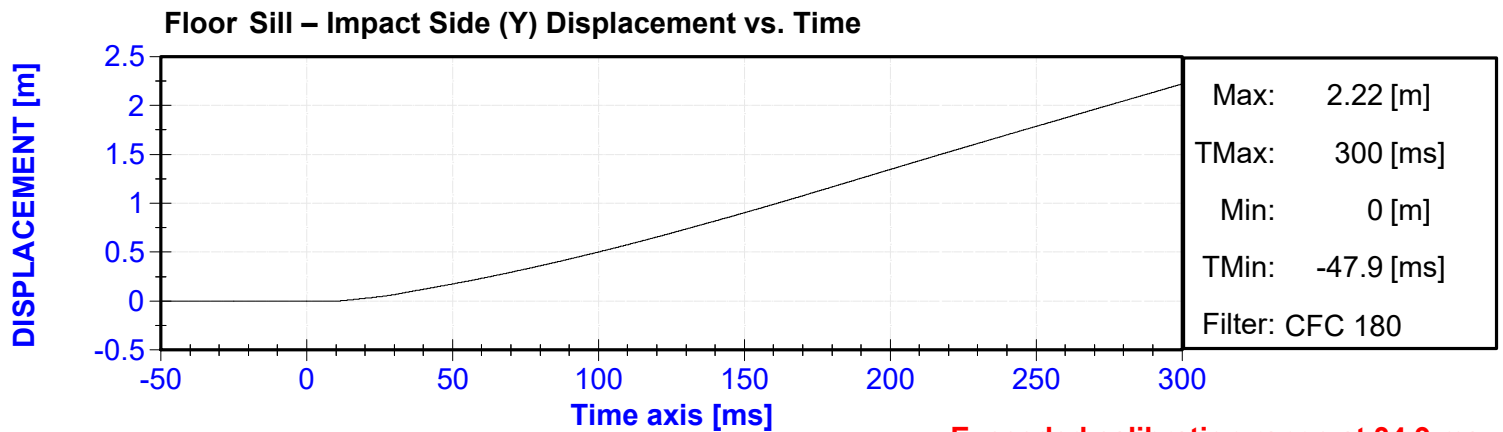
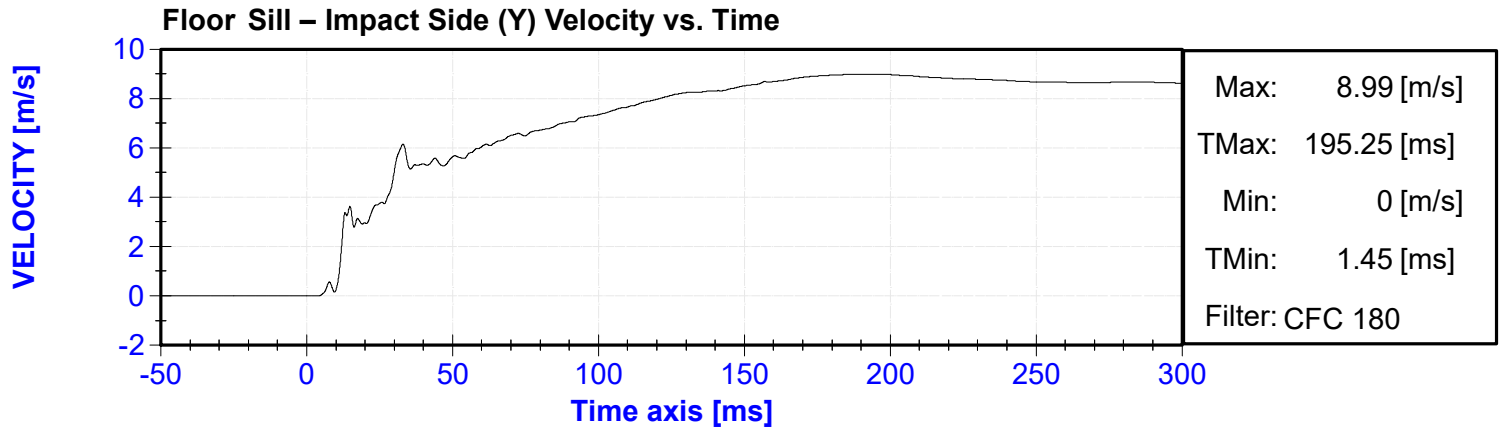
VEHICLE ACCELEROMETER RESPONSE DATA

Table of Data Plots

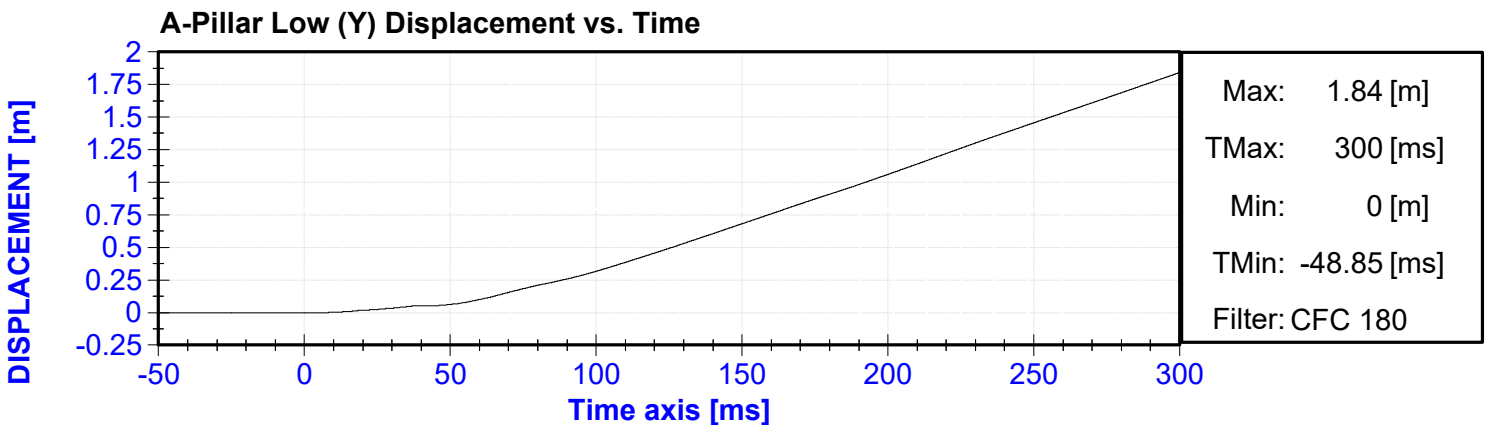
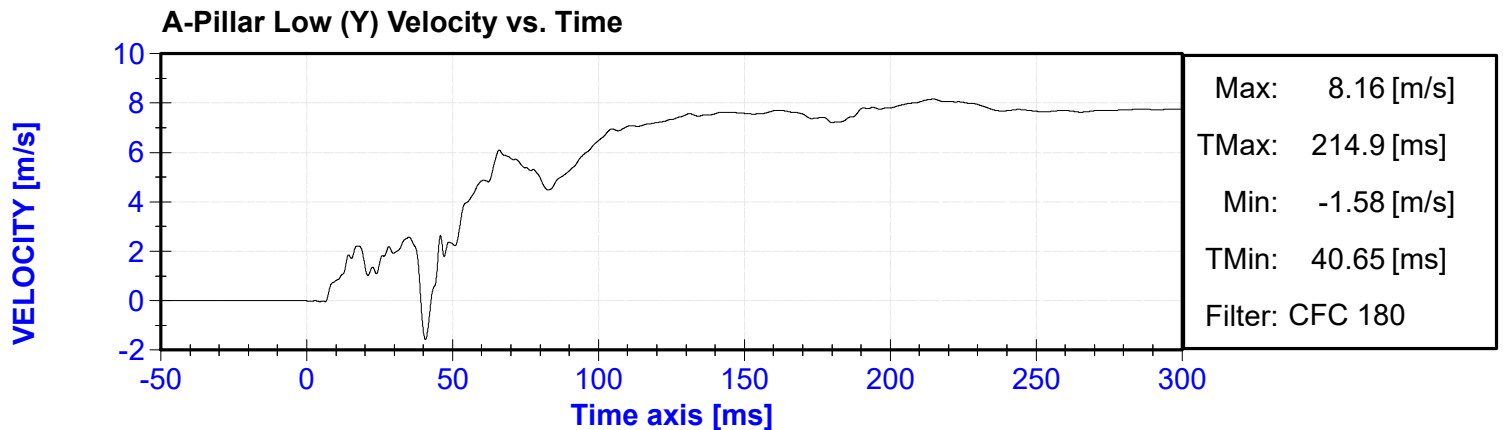
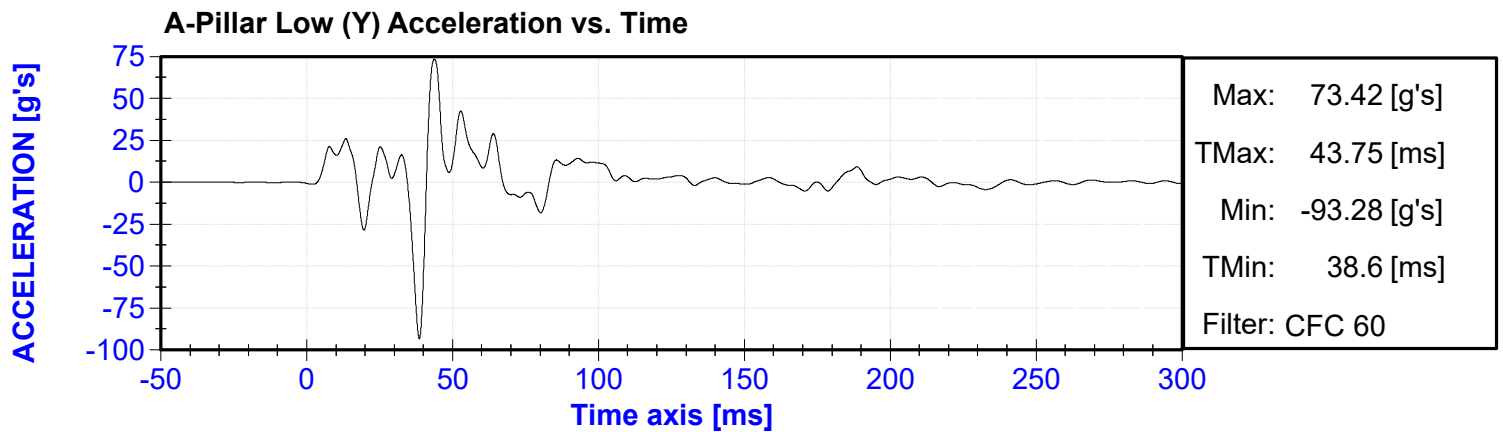
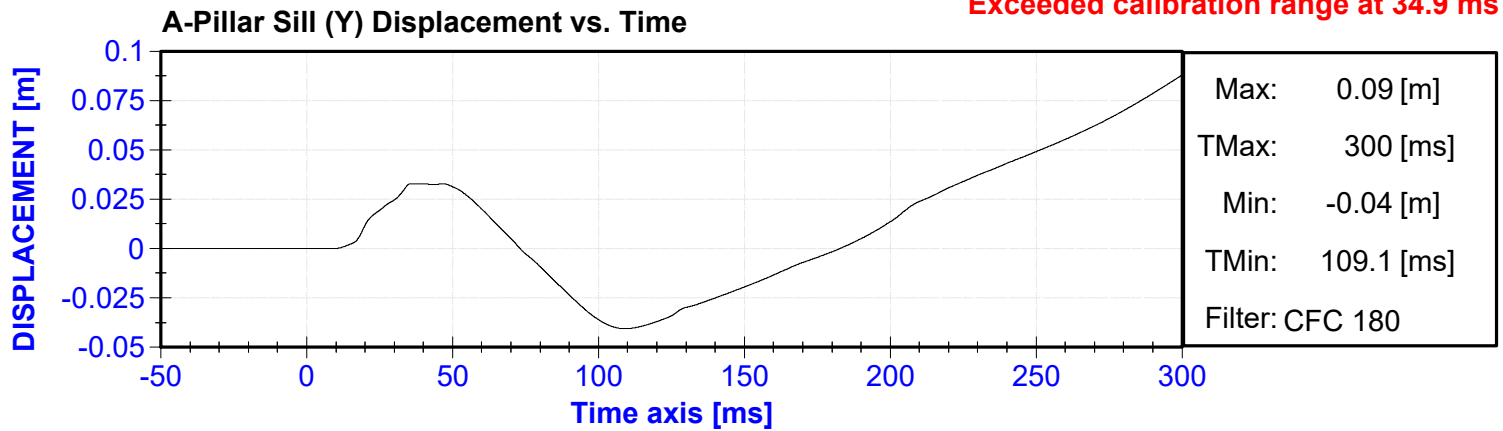
No.	Description	Page
1	Vehicle Center of Gravity (X) Acceleration vs. Time	III-3
2	Vehicle Center of Gravity (X) Velocity vs. Time	III-3
3	Vehicle Center of Gravity (Y) Acceleration vs. Time	III-3
4	Vehicle Center of Gravity (Y) Velocity vs. Time	III-3
5	Vehicle Center of Gravity (Z) Acceleration vs. Time	III-4
6	Vehicle Center of Gravity (Z) Velocity vs. Time	III-4
7	Vehicle Center of Gravity Resultant Acceleration vs. Time	III-4
8	Floor Sill – Impact Side (Y) Acceleration vs. Time	III-4
9	Floor Sill – Impact Side (Y) Velocity vs. Time	III-5
10	Floor Sill – Impact Side (Y) Displacement vs. Time	III-5
11	A-Pillar Sill (Y) Acceleration vs. Time	III-5
12	A-Pillar Sill (Y) Velocity vs. Time	III-5
13	A-Pillar Sill (Y) Displacement vs. Time	III-6
14	A-Pillar Low (Y) Acceleration vs. Time	III-6
15	A-Pillar Low (Y) Velocity vs. Time	III-6
16	A-Pillar Low (Y) Displacement vs. Time	III-6
17	A-Pillar Mid (Y) Acceleration vs. Time	III-7
18	A-Pillar Mid (Y) Velocity vs. Time	III-7
19	A-Pillar Mid (Y) Displacement vs. Time	III-7
20	B-Pillar Sill (Y) Acceleration vs. Time	III-7
21	B-Pillar Sill (Y) Velocity vs. Time	III-8
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
33	Engine (X) Velocity vs. Time	III-11
34	Engine (Y) Acceleration vs. Time	III-11
35	Engine (Y) Velocity vs. Time	III-11
36	Firewall (Y) Acceleration vs. Time	III-11
37	Firewall (Y) Velocity vs. Time	III-12
38	Roof (Y) Acceleration vs. Time	III-12
39	Roof (Y) Velocity vs. Time	III-12
40	Floor Sill – Non Impact Side (Y) Acceleration vs. Time	III-12
41	Floor Sill – Non Impact Side (Y) Velocity vs. Time	III-13
42	Rear Deck (X) Acceleration vs. Time	III-13
43	Rear Deck (X) Velocity vs. Time	III-13
44	Rear Deck (Y) Acceleration vs. Time	III-13
45	Rear Deck (Y) Velocity vs. Time	III-14







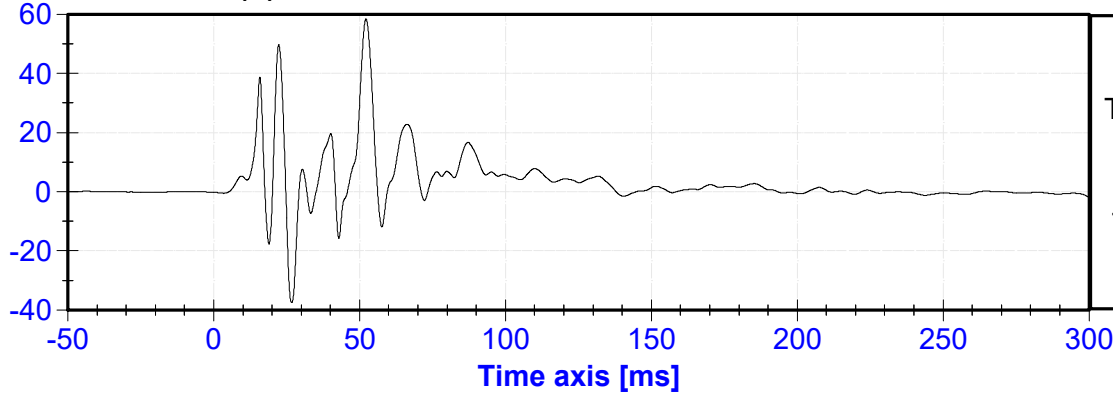
Exceeded calibration range at 34.9 ms



ACCELERATION [g's]

A-Pillar Mid (Y) Acceleration vs. Time

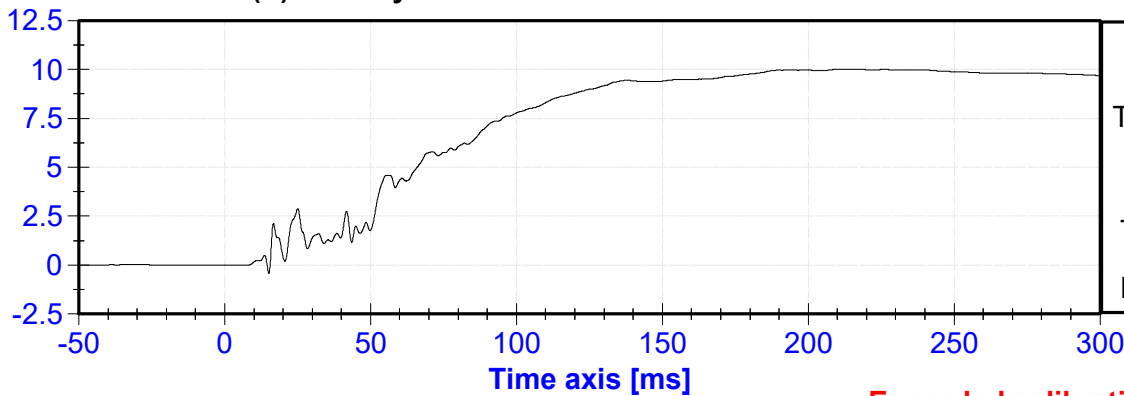
Exceeded calibration range at 15.9 ms



VELOCITY [m/s]

A-Pillar Mid (Y) Velocity vs. Time

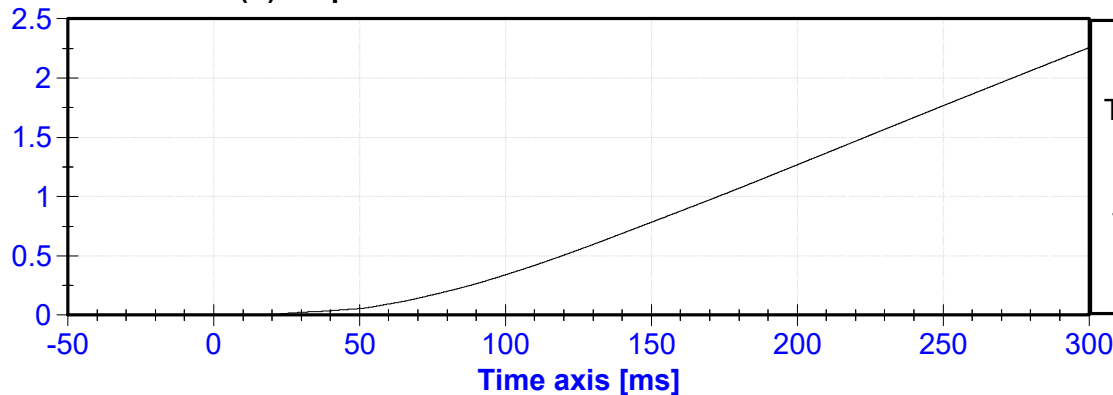
Exceeded calibration range at 15.9 ms



DISPLACEMENT [m]

A-Pillar Mid (Y) Displacement vs. Time

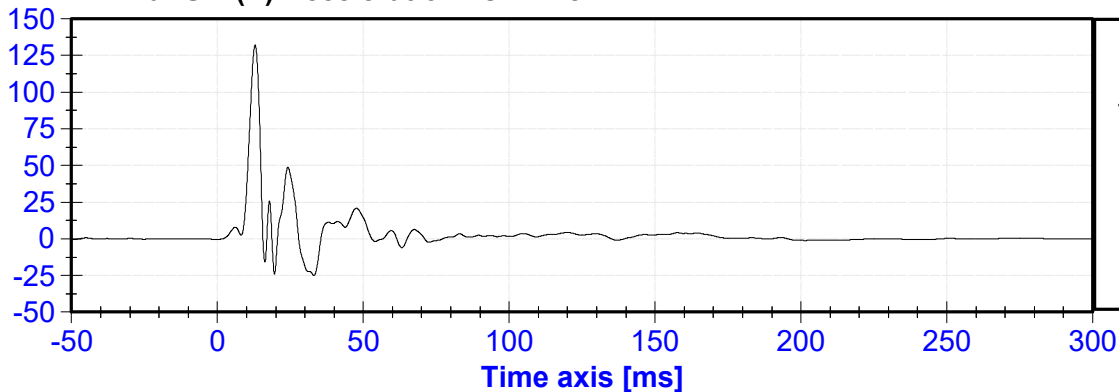
Exceeded calibration range at 15.9 ms

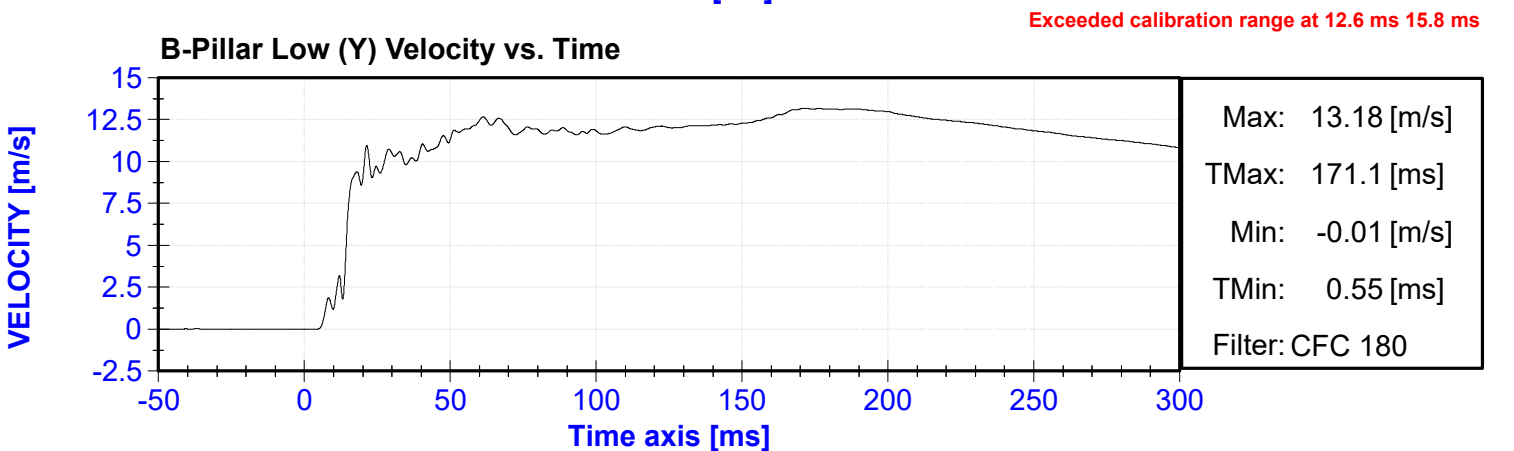
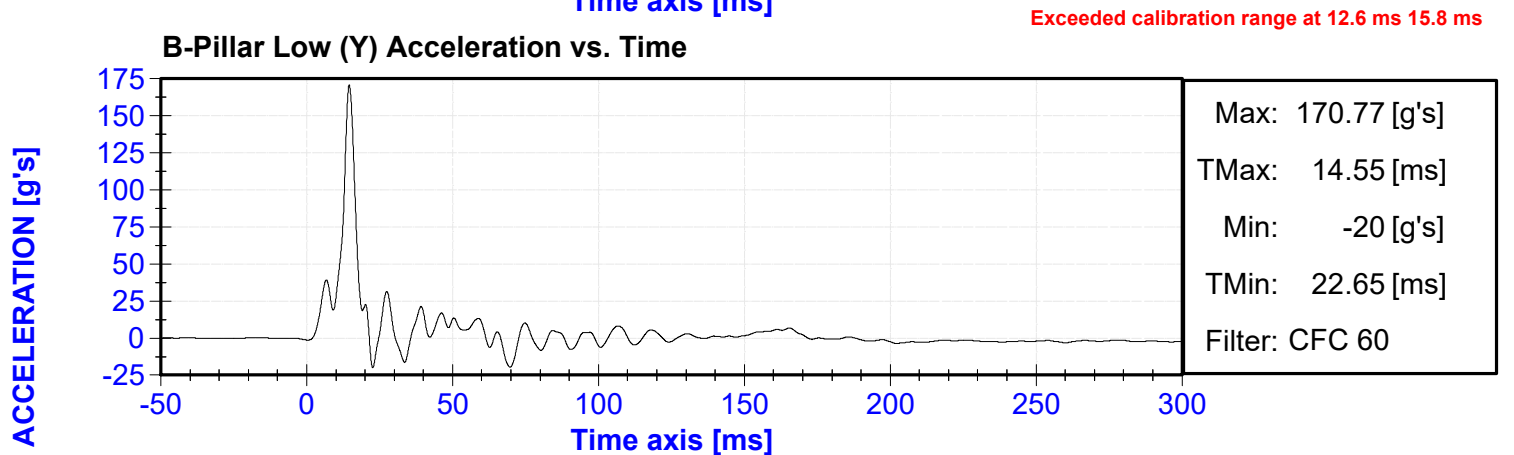
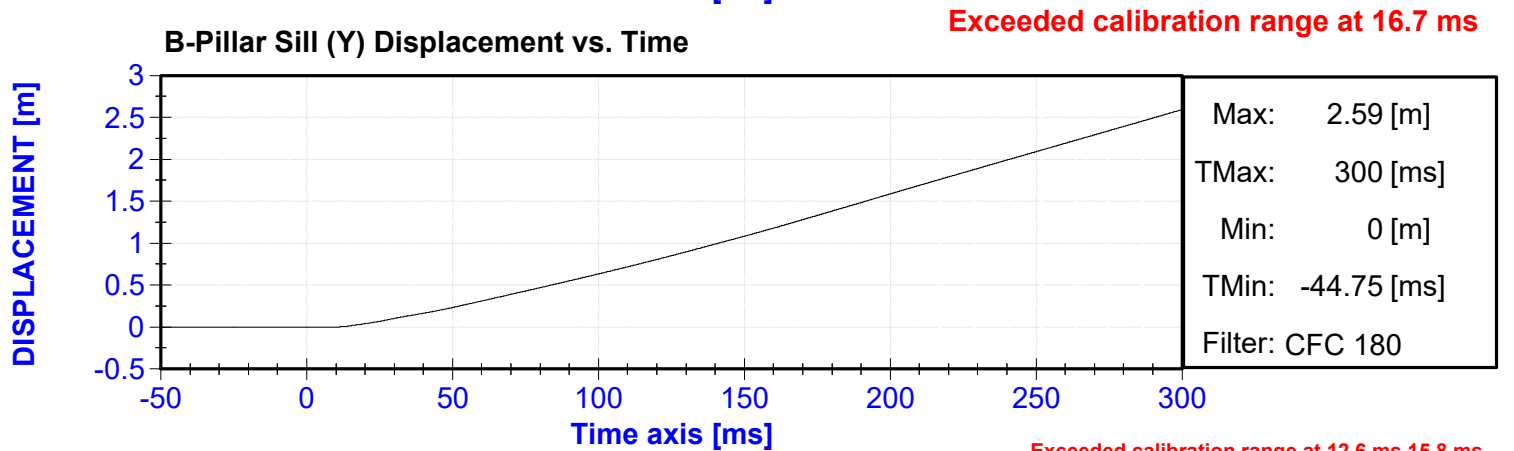
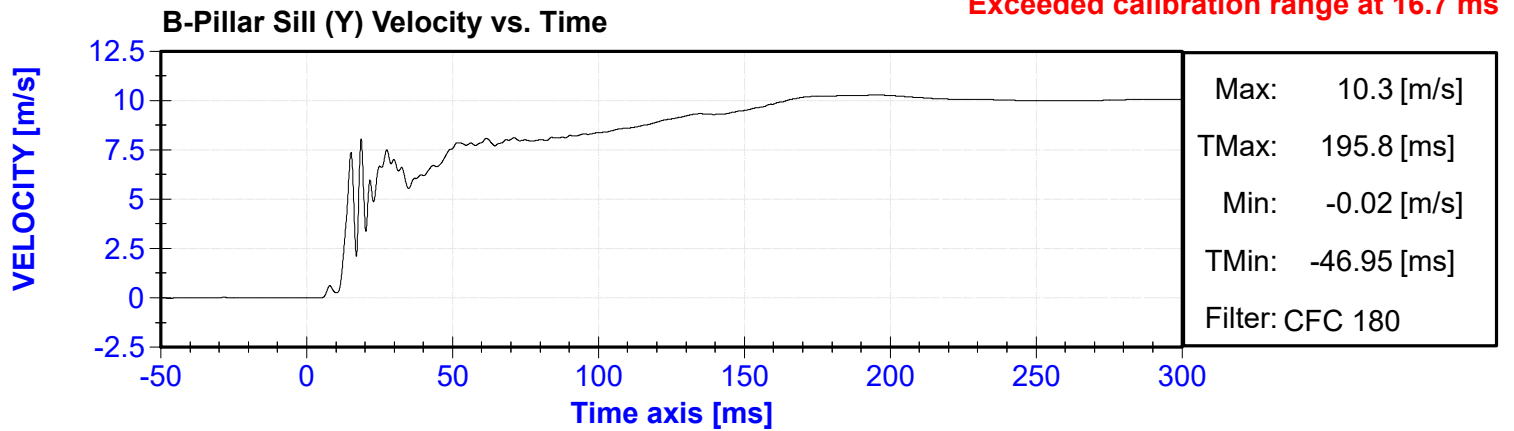


ACCELERATION [g's]

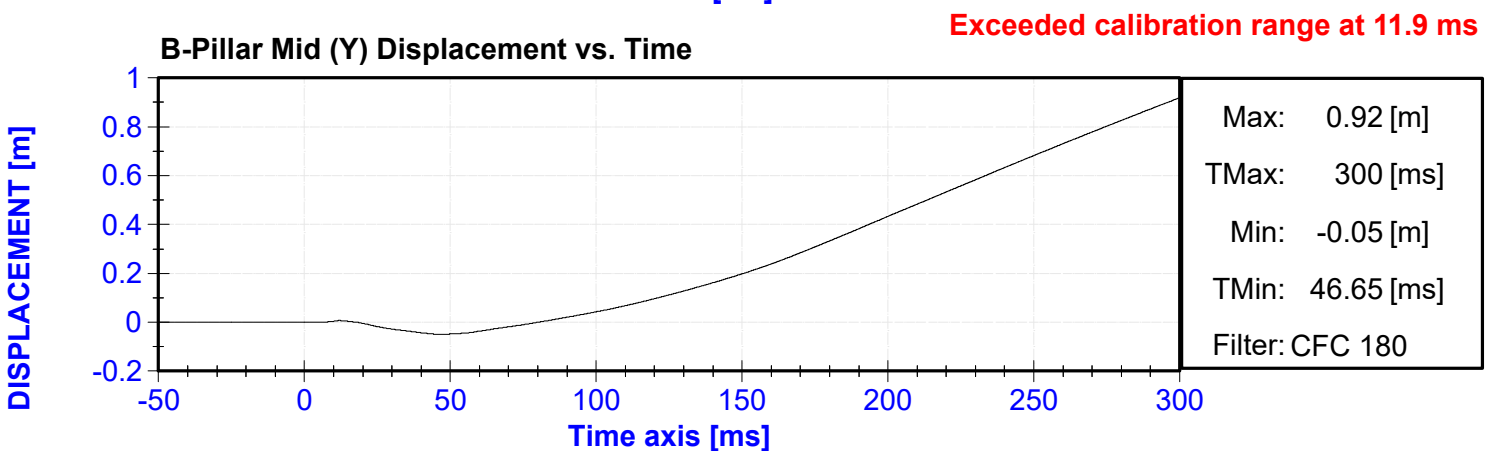
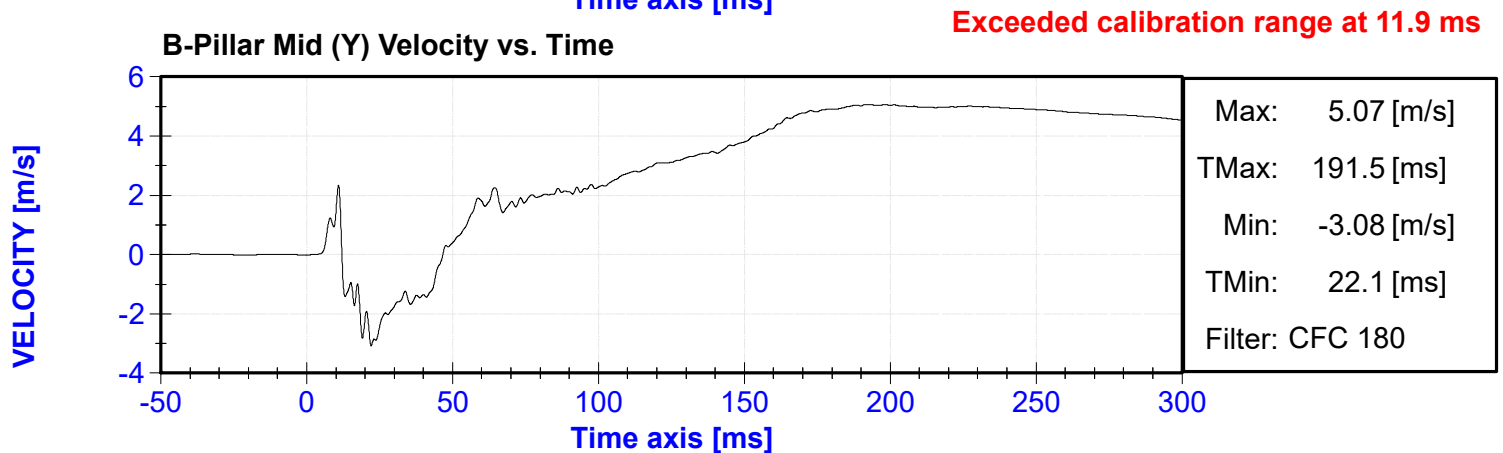
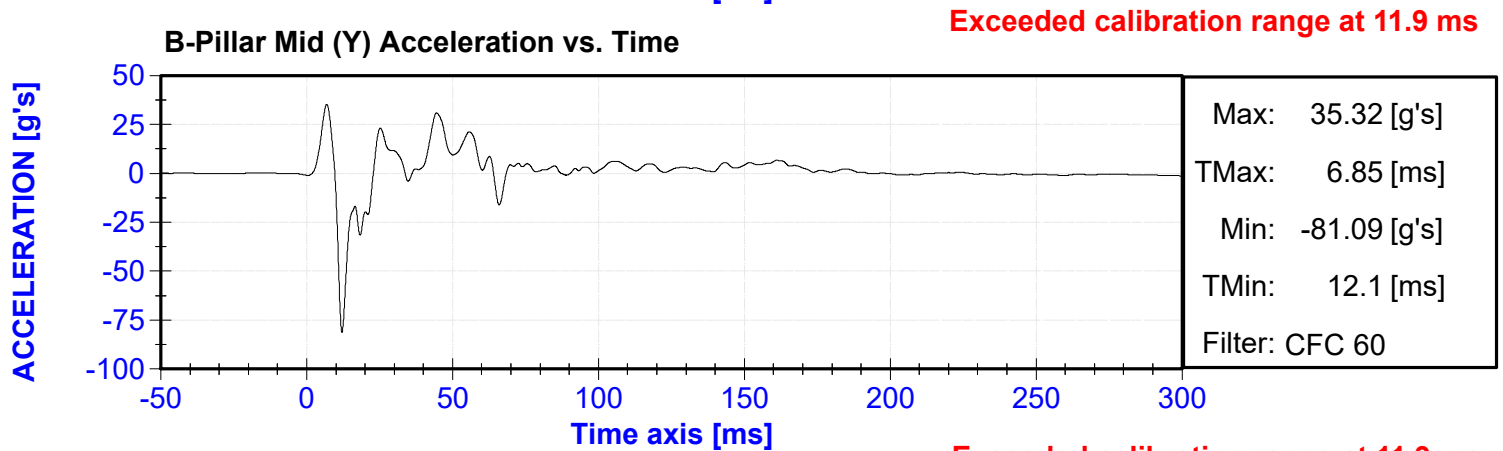
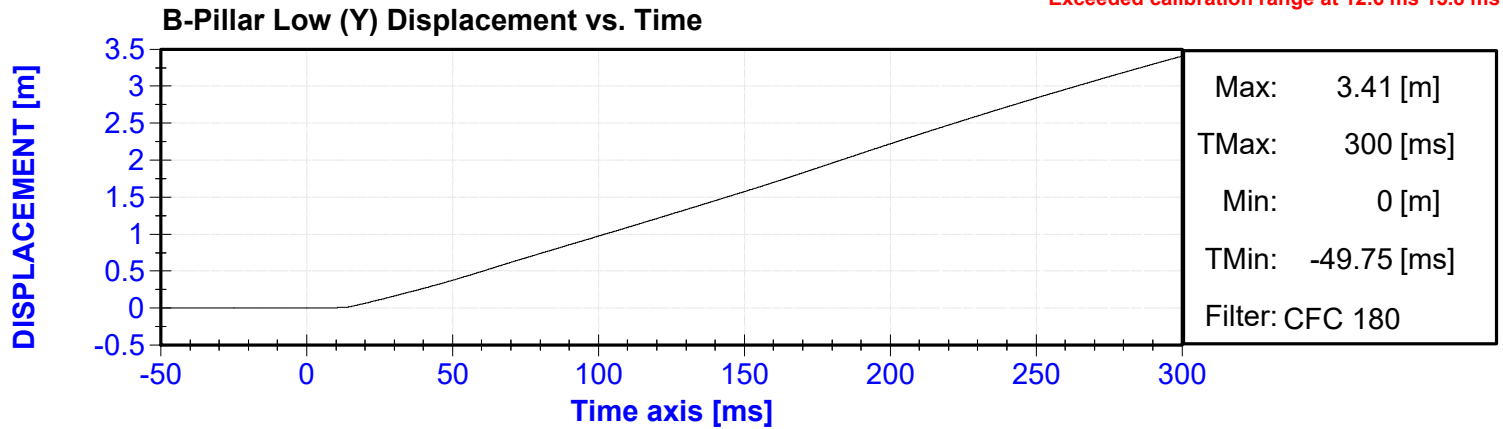
B-Pillar Sill (Y) Acceleration vs. Time

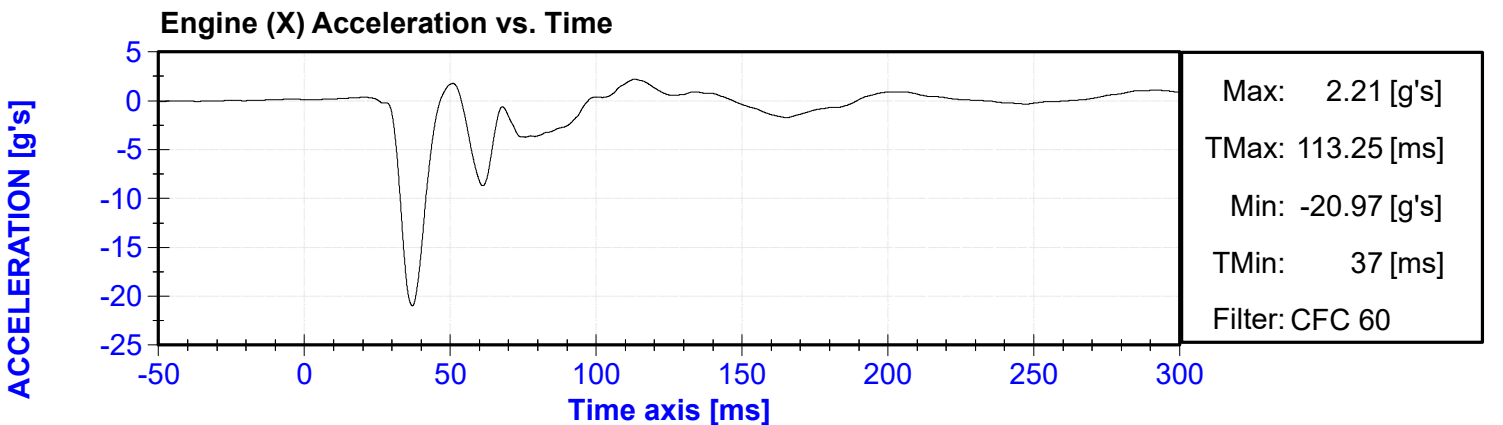
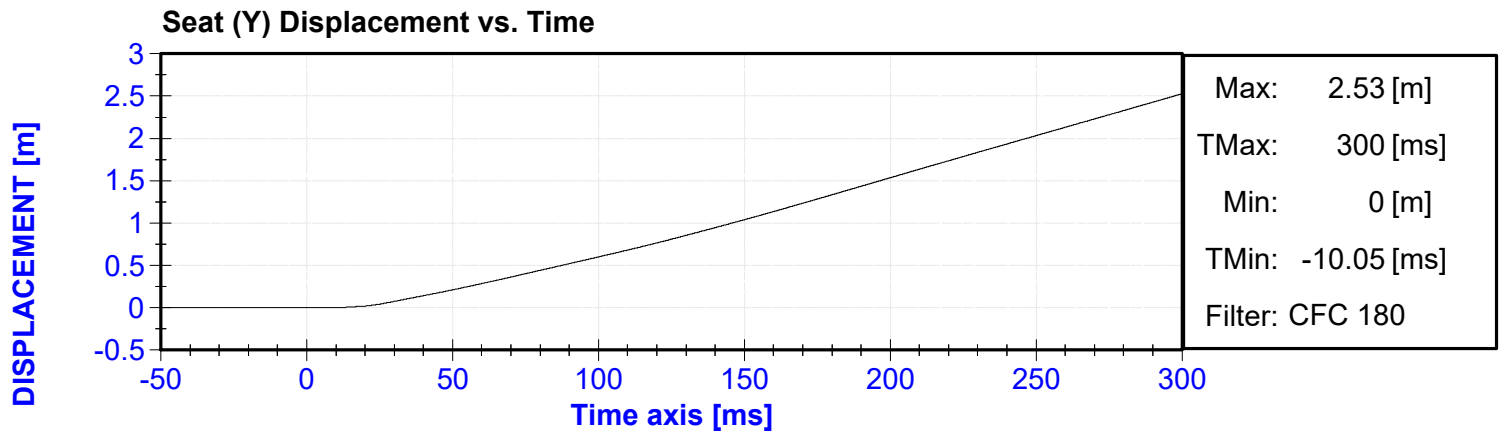
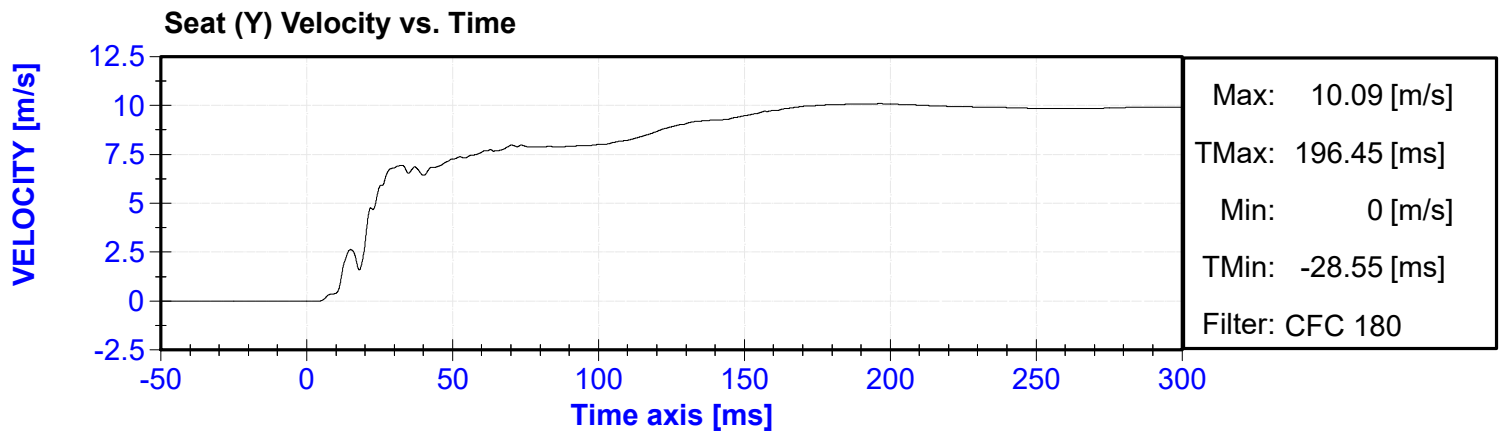
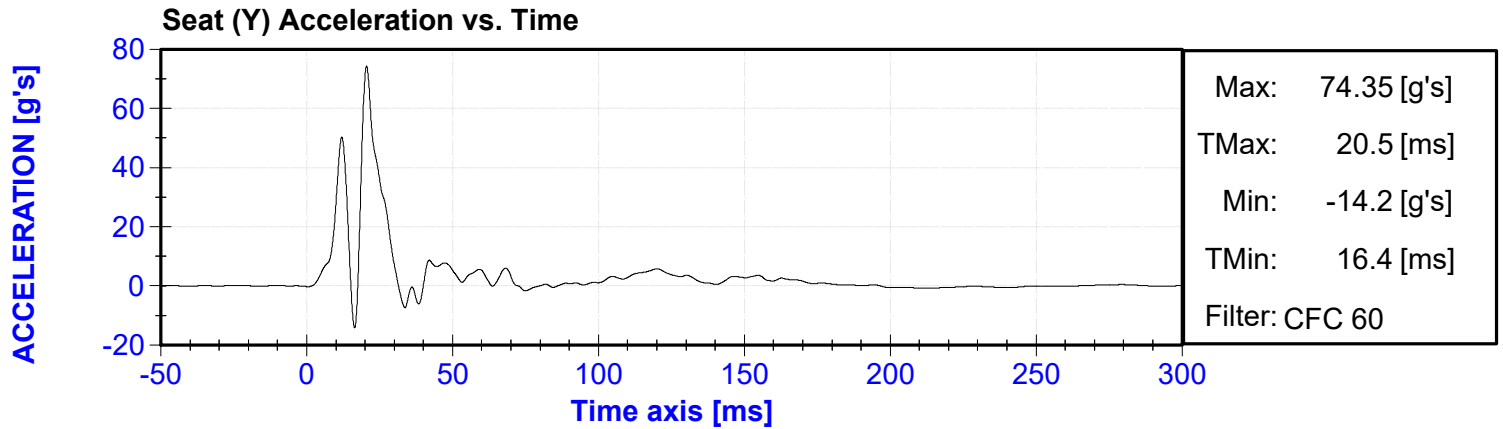
Exceeded calibration range at 16.7 ms

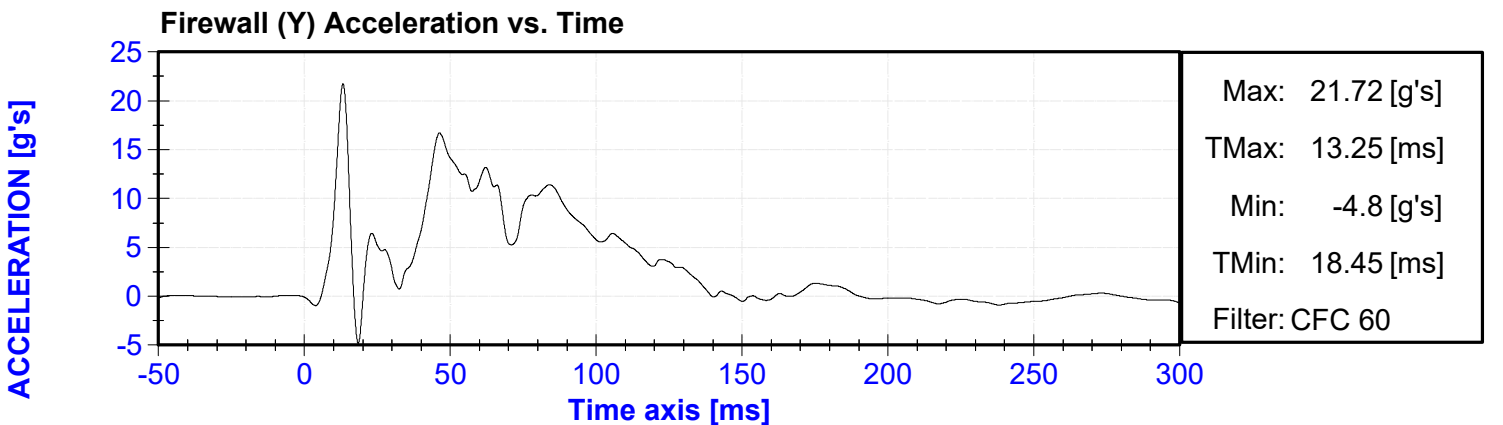
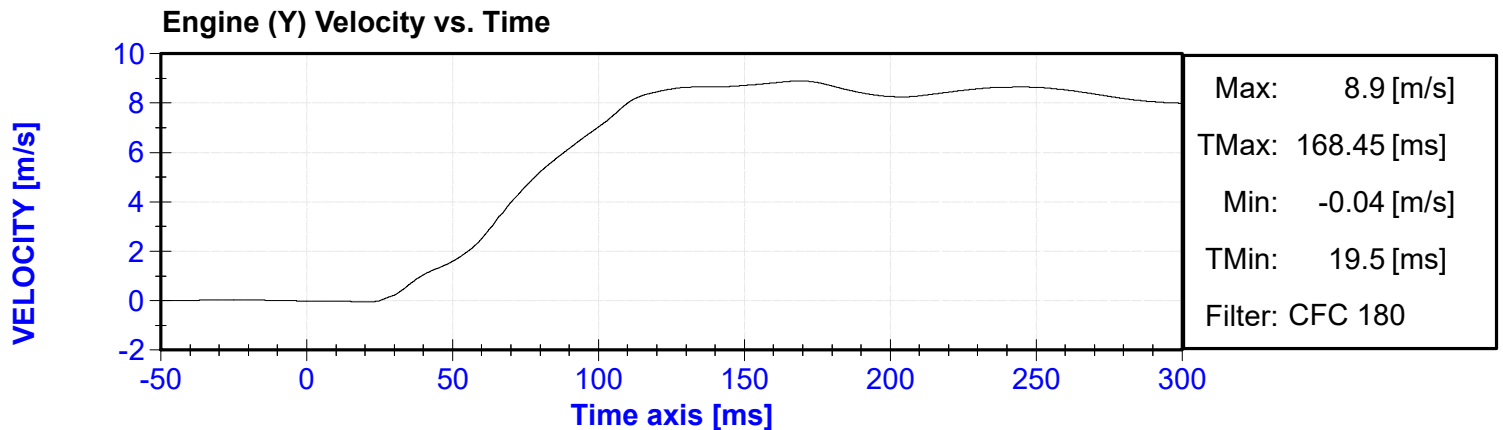
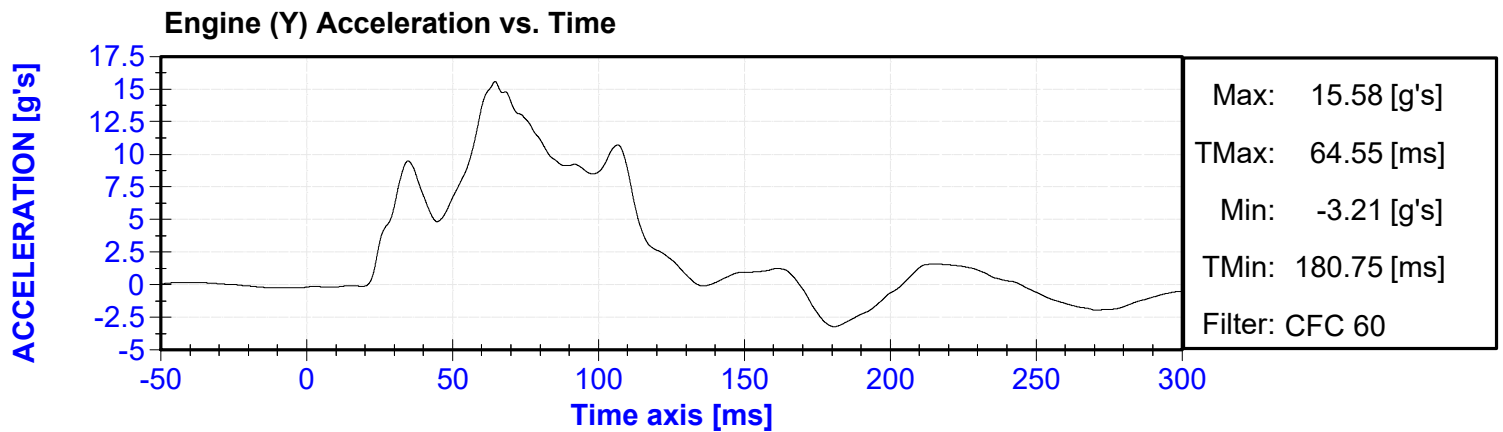
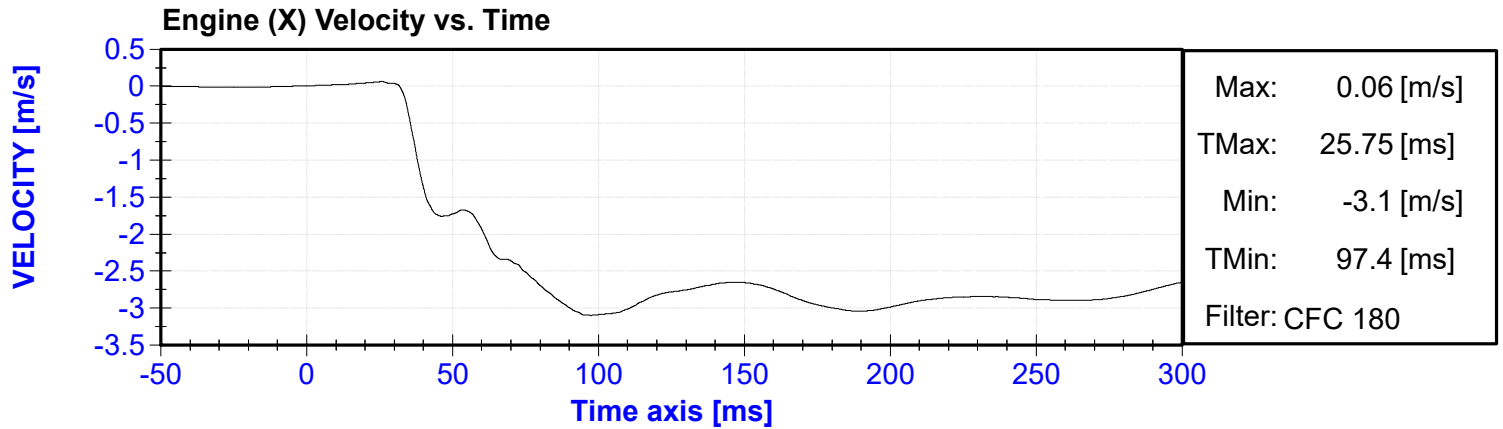




Exceeded calibration range at 12.6 ms 15.8 ms

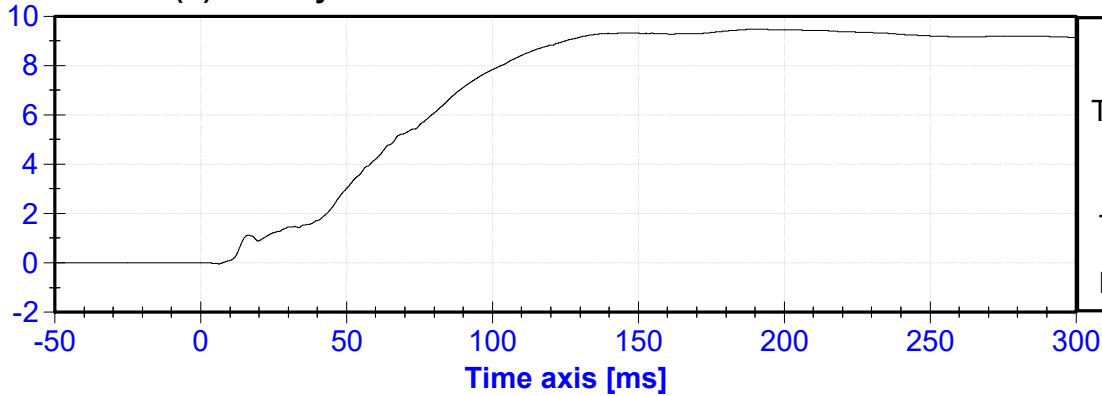






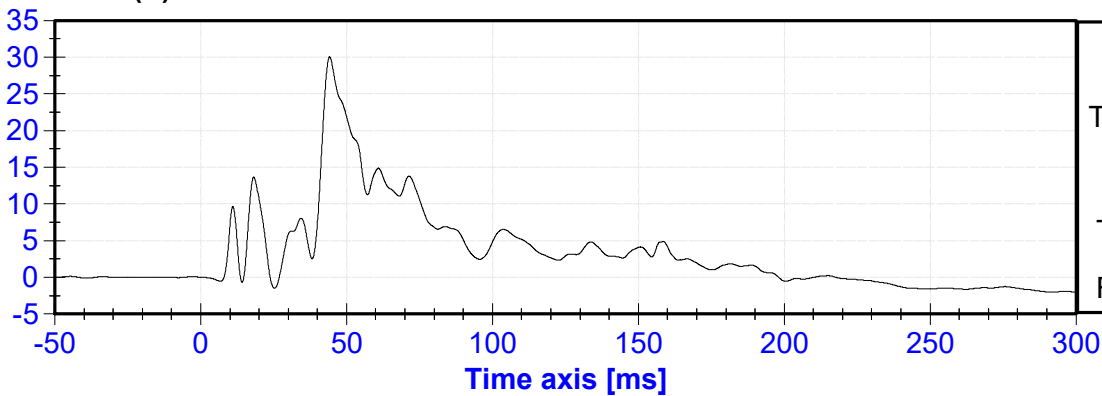
VELOCITY [m/s]

Firewall (Y) Velocity vs. Time



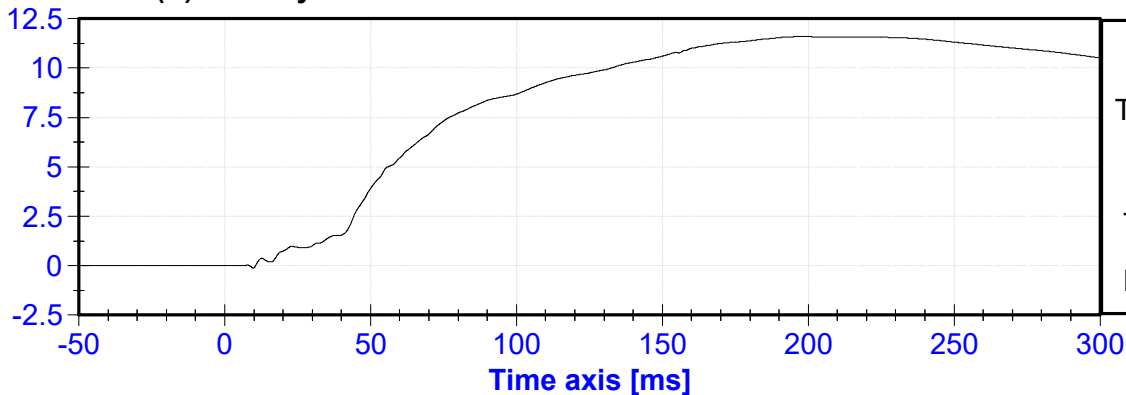
ACCELERATION [g's]

Roof (Y) Acceleration vs. Time



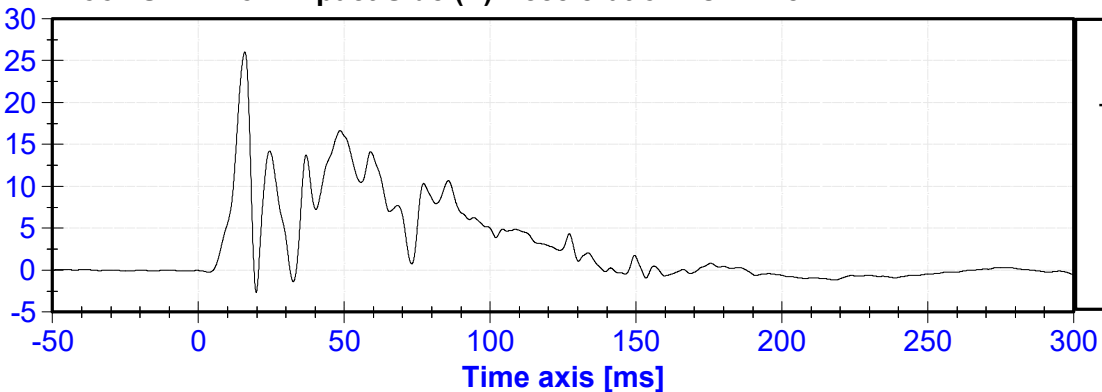
VELOCITY [m/s]

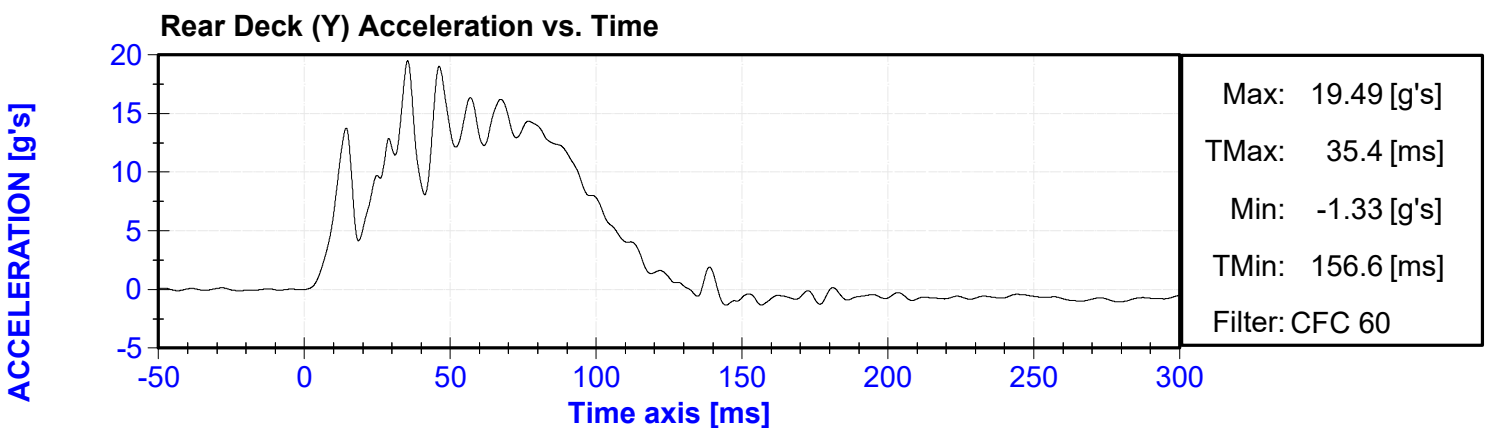
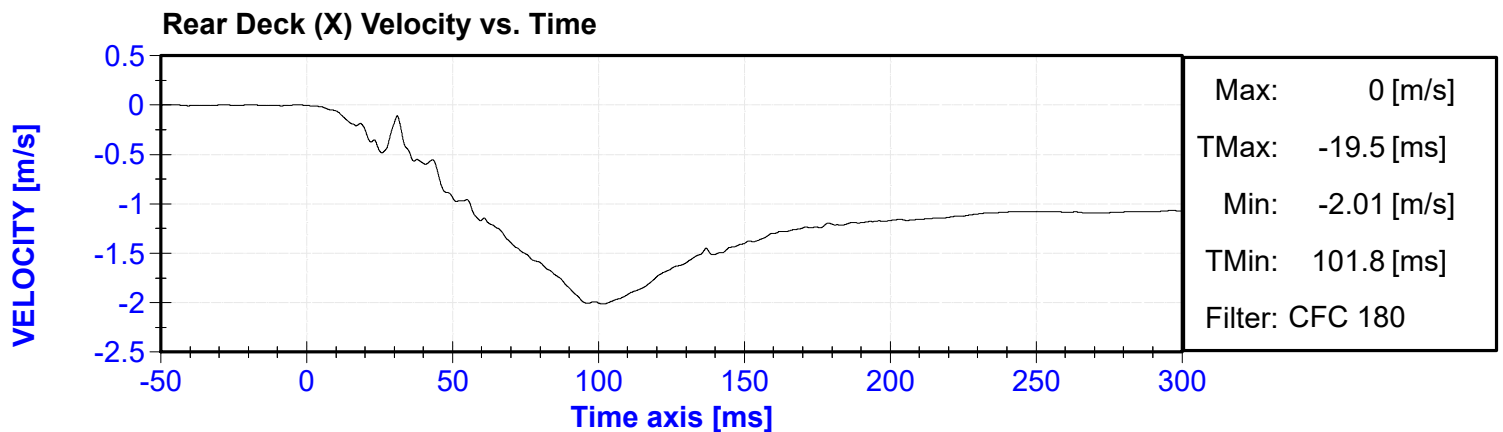
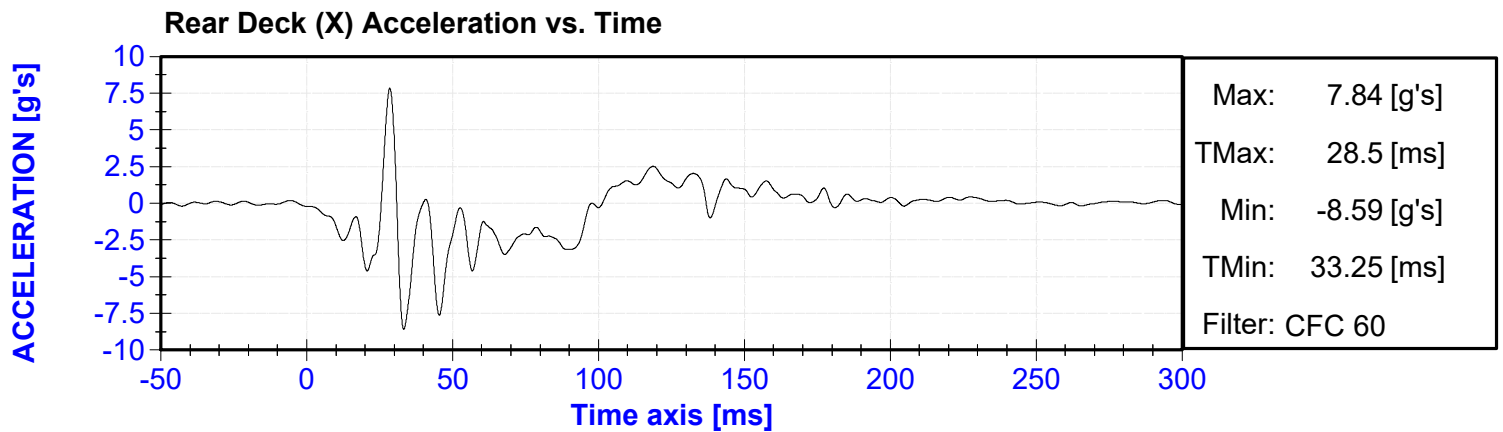
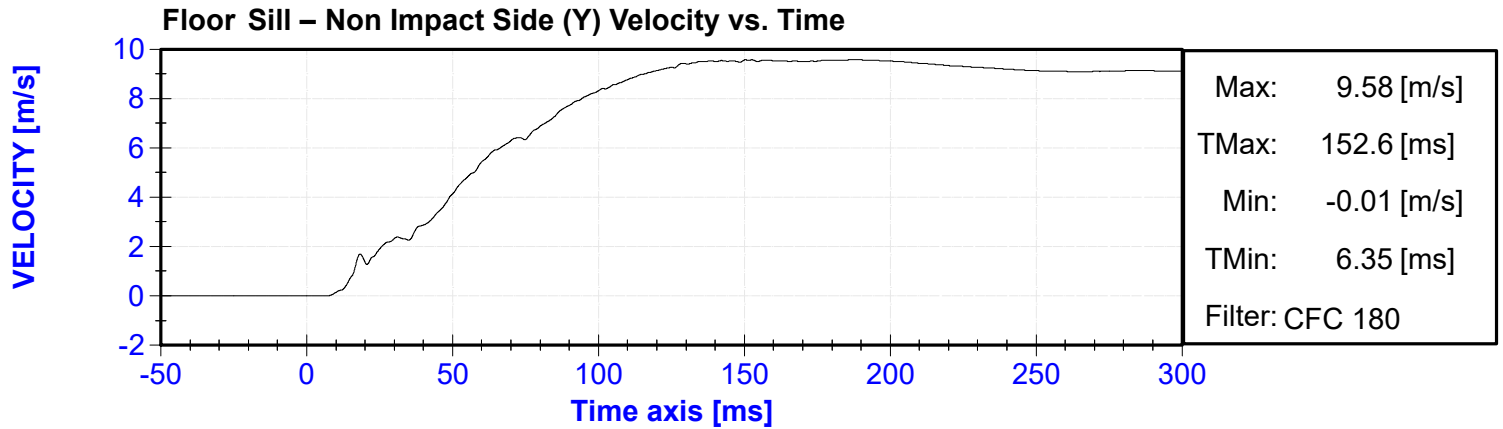
Roof (Y) Velocity vs. Time

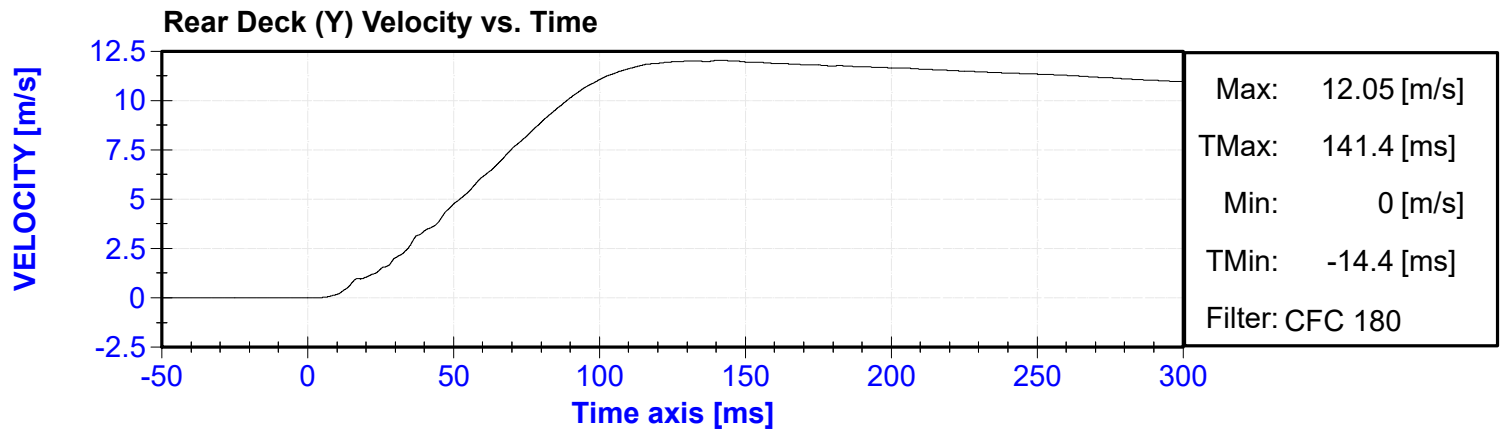


ACCELERATION [g's]

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







APPENDIX IV

PRE-TEST DUMMY PERFORMANCE CALIBRATION TEST DATA

(Subpart U, ES-2re)

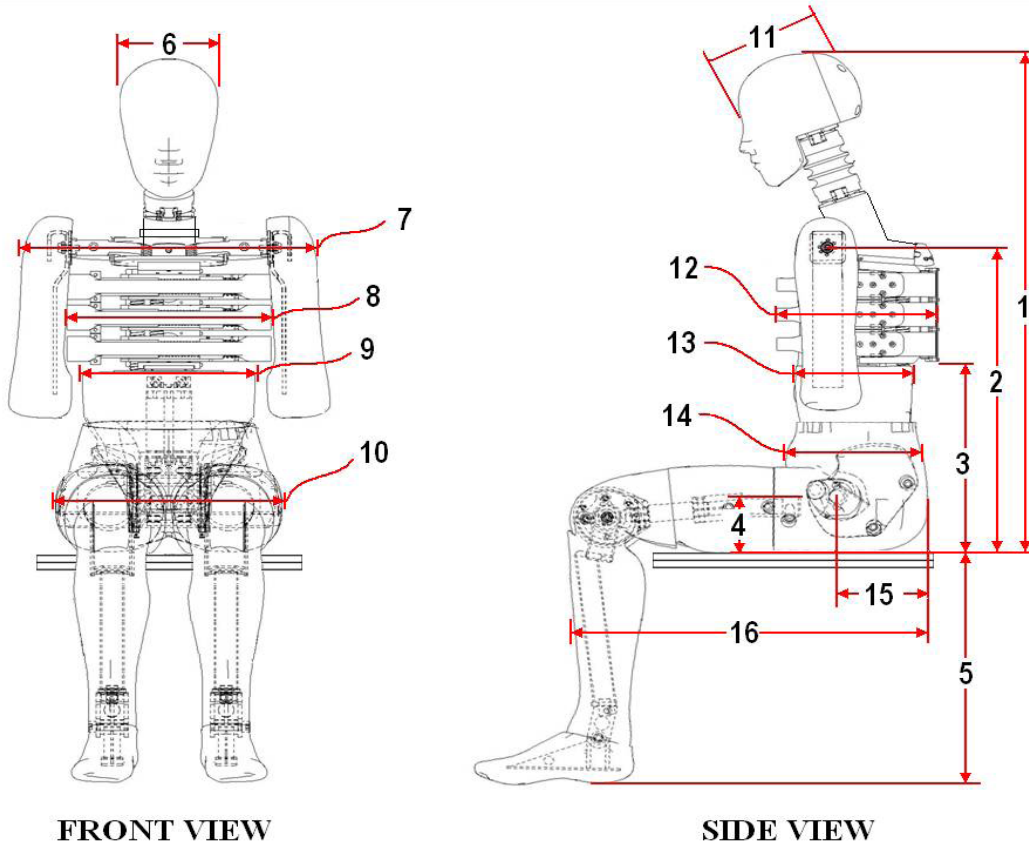


External Measurements - EuroSID-2re

Technician: T. Roseman

Date: 3/1/2024

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	562	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	354	Pass
4	Seat to Hip Joint (center of bolt)	97	103	101	Pass
5	Sole to Seat, Sitting	333	451	421	Pass
6	Head Width	152	158	153	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	362	Pass
11	Head Depth	196	206	199	Pass
12	Thorax Depth	262	272	265	Pass
13	Abdomen Depth	194	204	197	Pass
14	Pelvis Depth	235	245	238	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	602	Pass

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

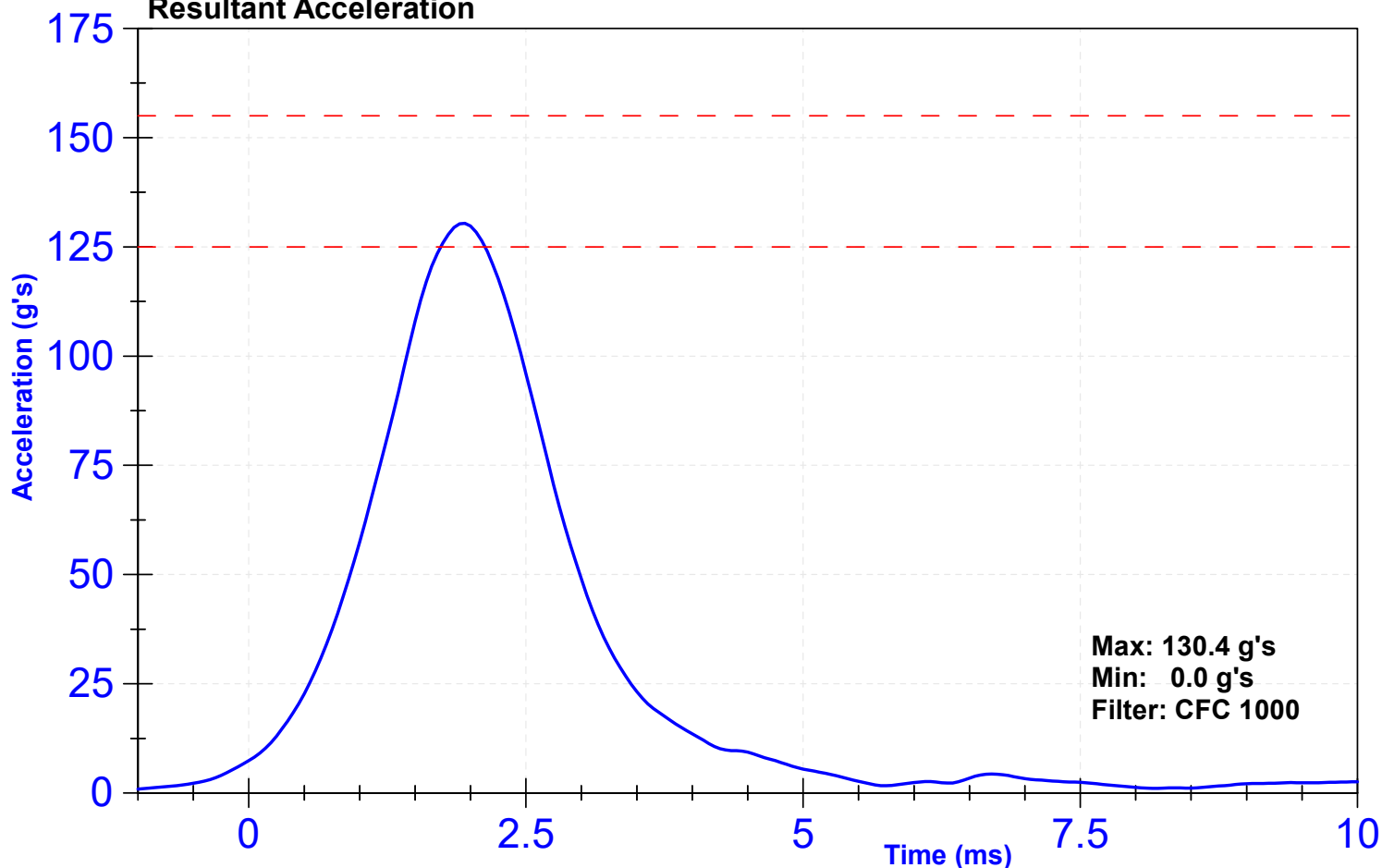
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	17.7	Pass
Resultant Acceleration	125	155	g's	130.4	Pass
Oscillation	0	15	%	3.30	Pass
Fore-Aft Acceleration	-15	15	g's	10.3	Pass

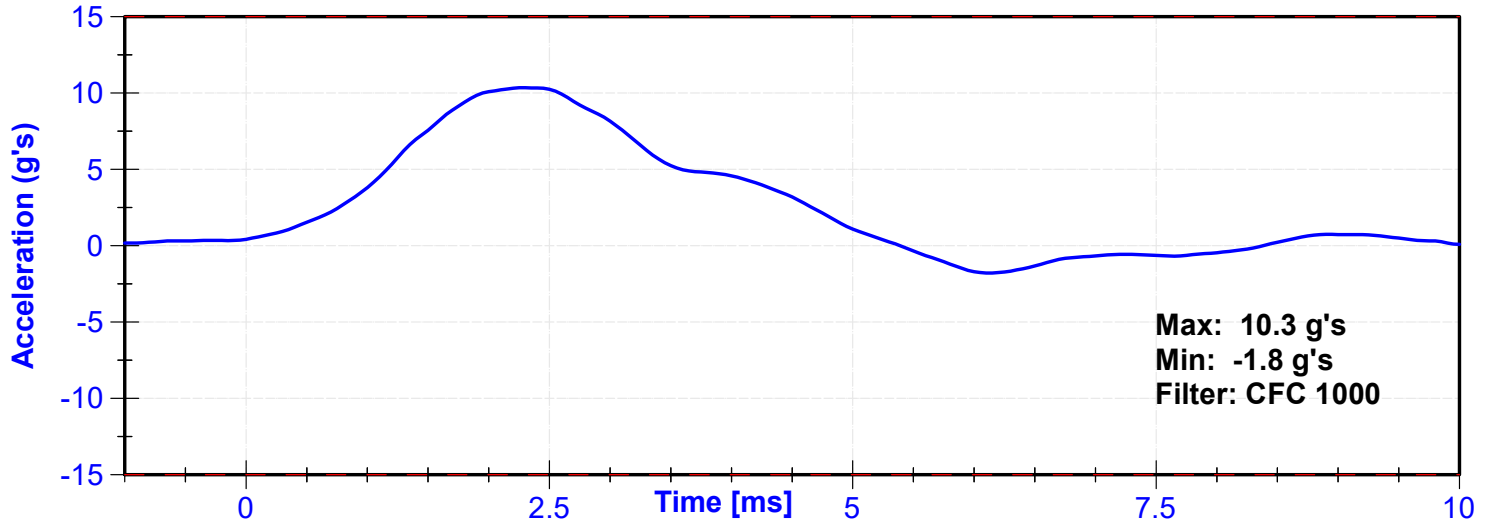
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	T21724	2/1/2024	7/30/2024
Y Accelerometer	Endevco	T22281	2/1/2024	7/30/2024
Z Accelerometer	Endevco	T26050	2/1/2024	7/30/2024

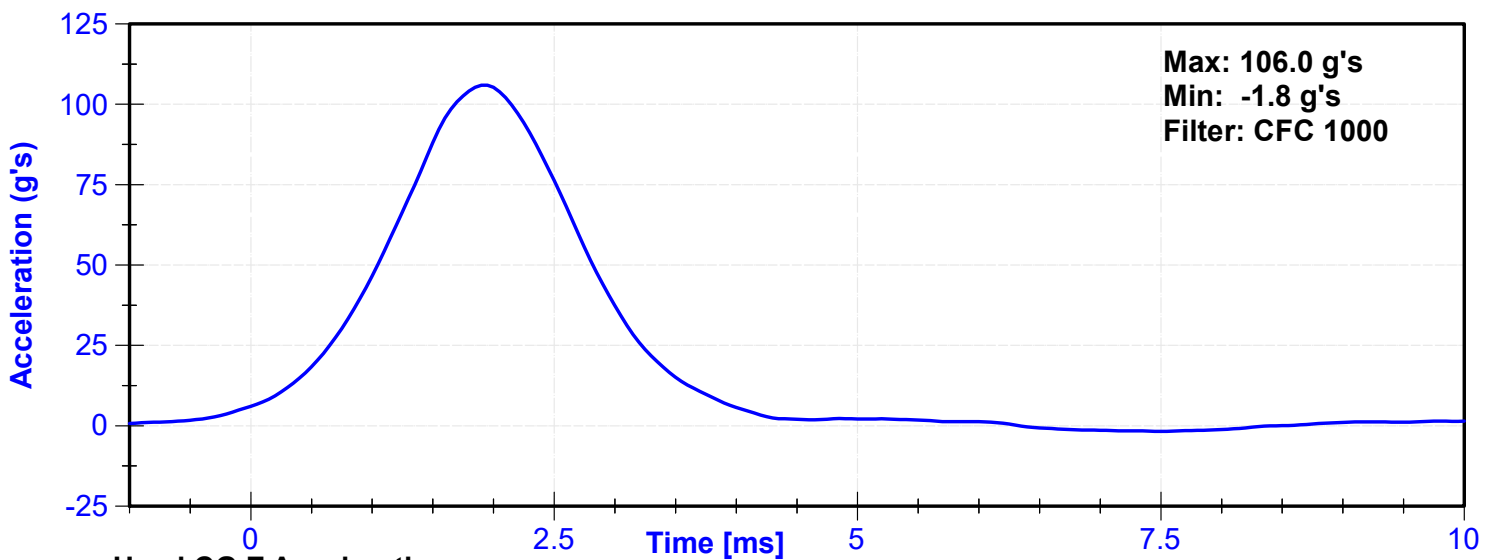
Resultant Acceleration



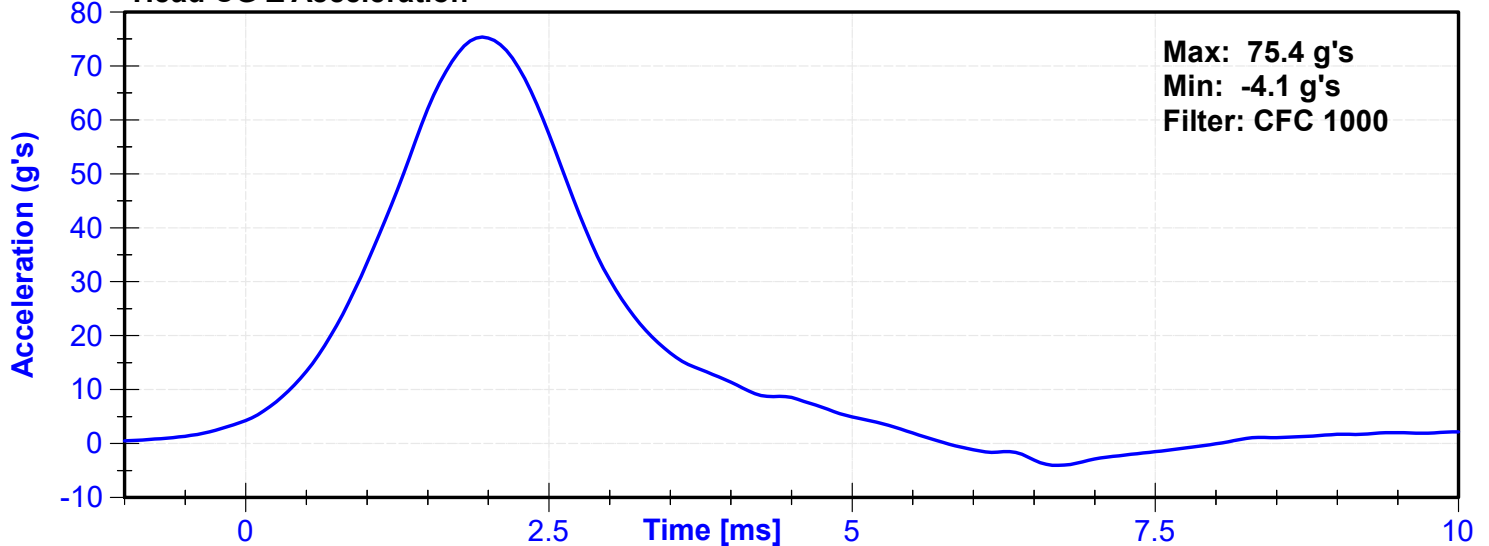
Head CG X Acceleration



Head CG Y Acceleration



Head CG Z Acceleration



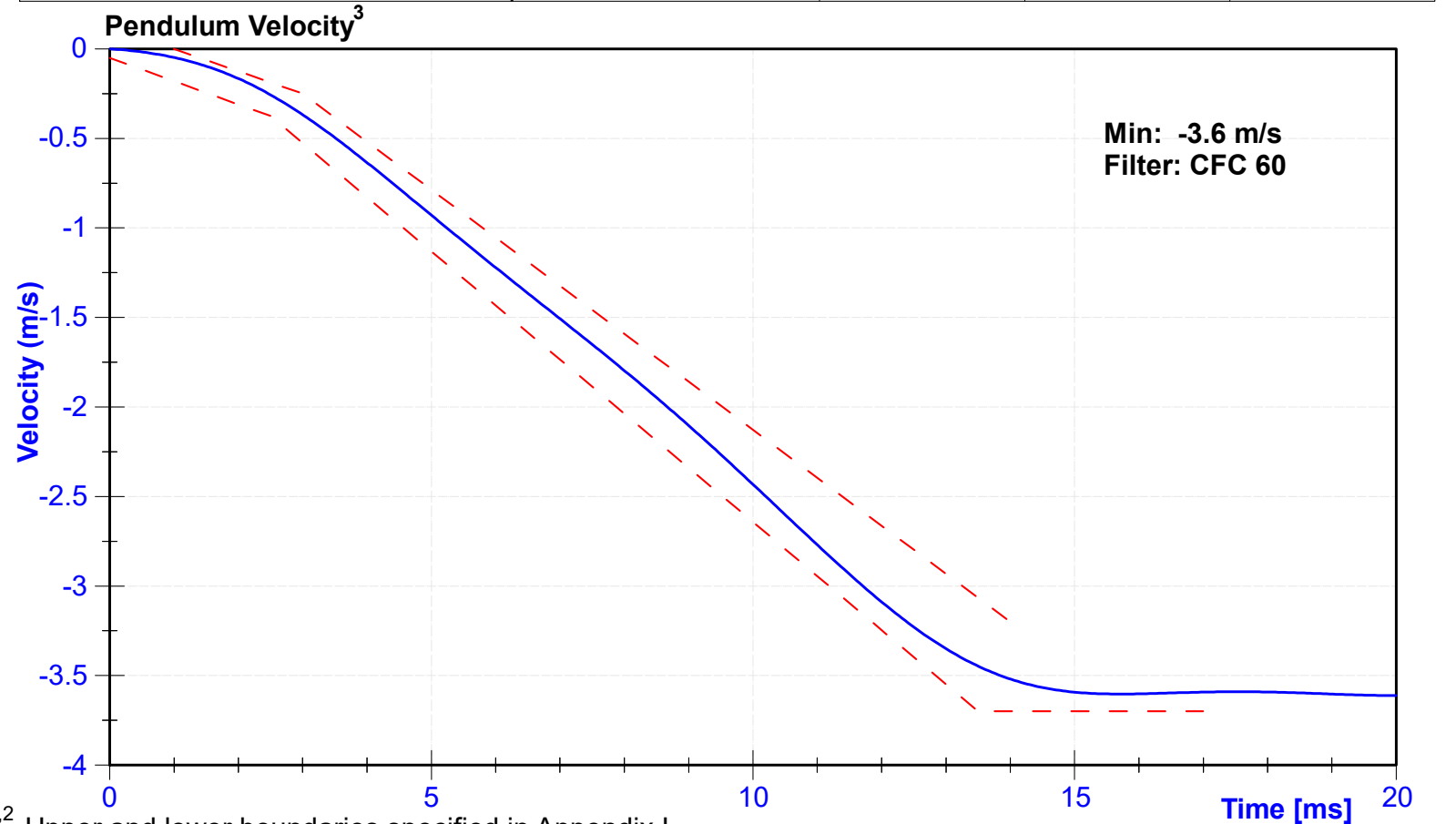
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

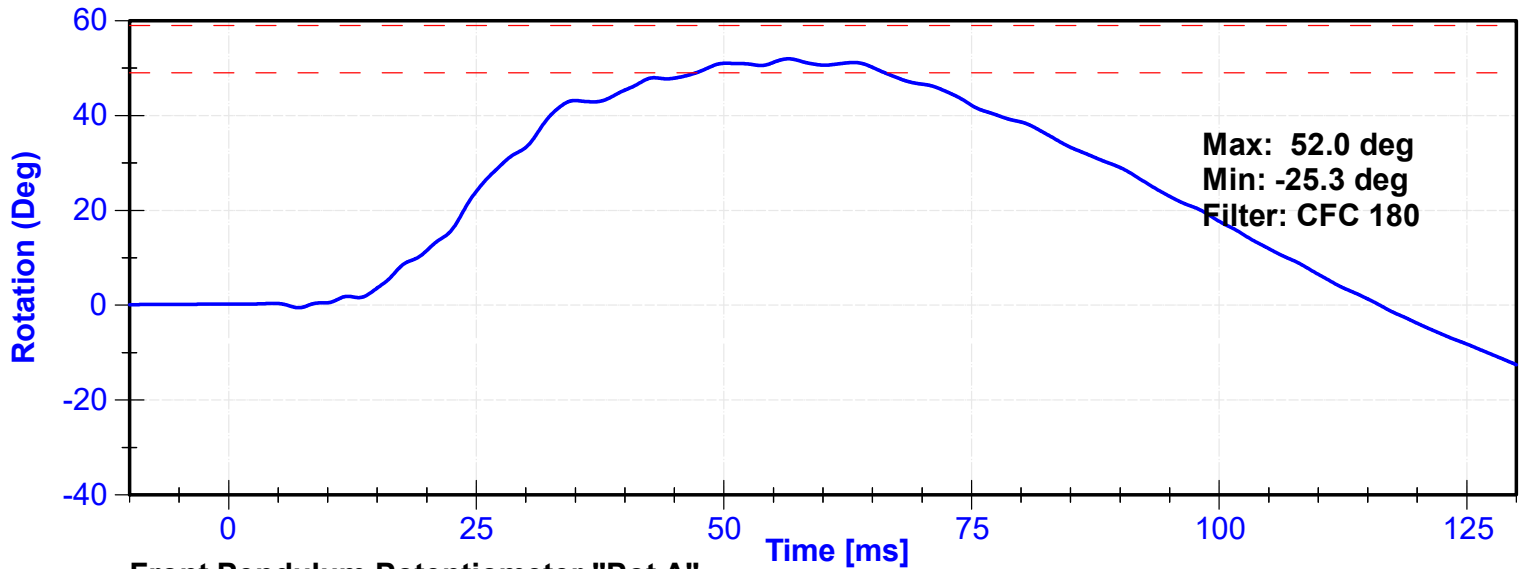
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	18	Pass
Velocity	3.3	3.5	m/s	3.41	Pass
Lateral Neck Rotation	49	59	deg	52.0	Pass
Time at Maximum Rotation	54	66	ms	56.5	Pass
Time of Rotation Decay from Maximum	53	88	ms	59.7	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

Transducer Calibrations

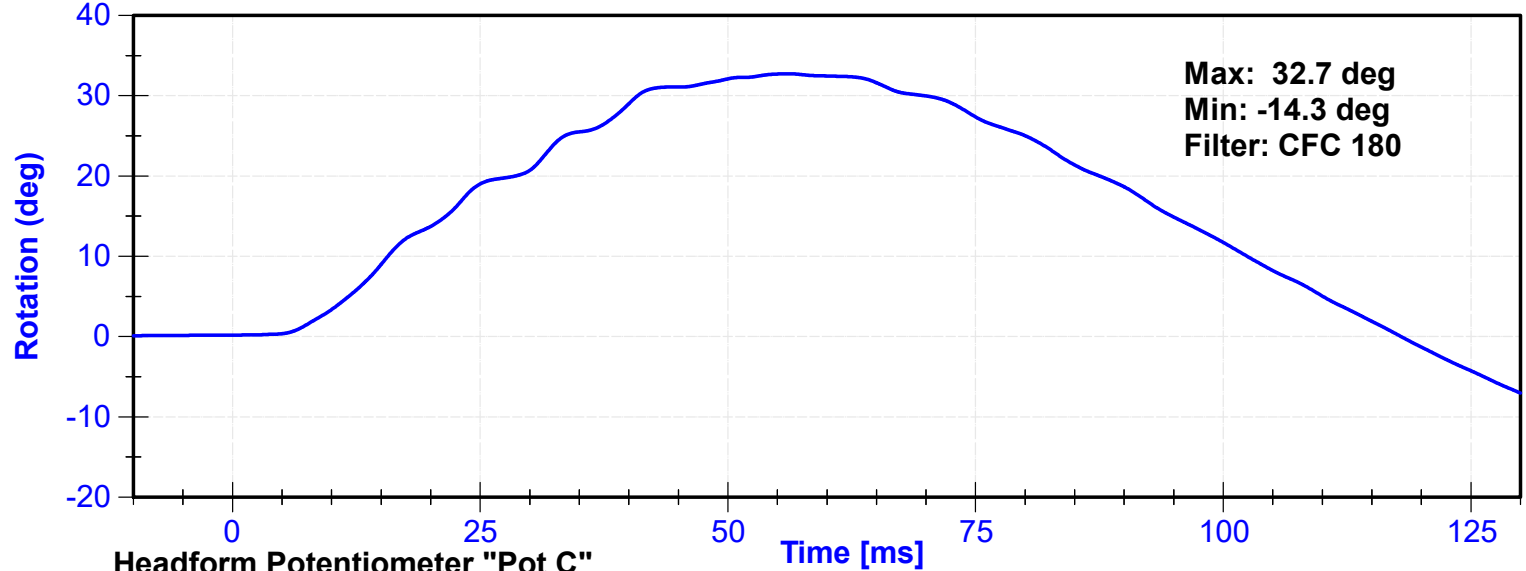
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/31/2023	4/28/2024
Front Pendulum Potentiometer	Sfernice	2247	12/5/2023	12/4/2024
Headform Potentiometer	Sfernice	095	9/29/2023	9/28/2024



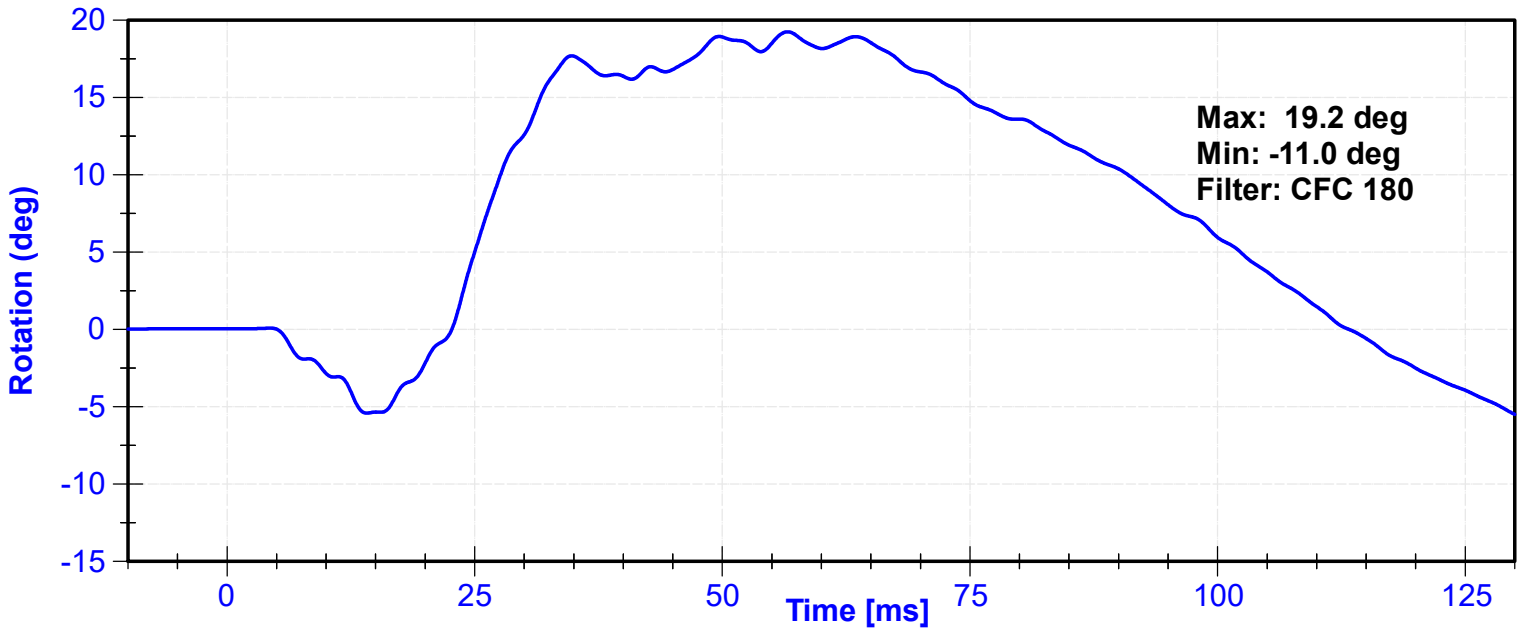
Neck Rotation



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

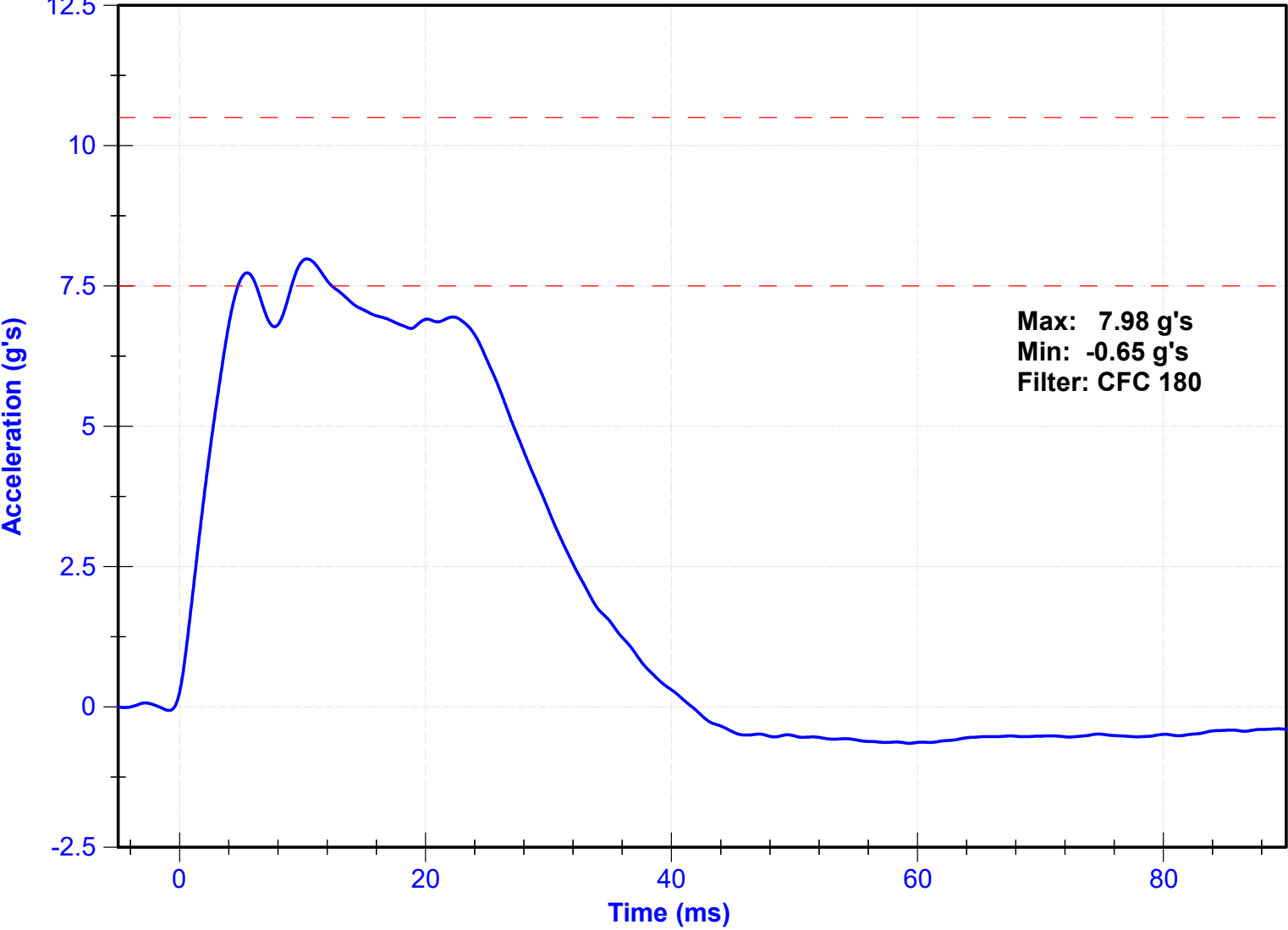
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	29	Pass
Velocity	4.2	4.4	m/s	4.33	Pass
Probe Acceleration	7.5	10.5	g's	7.98	Pass

Transducer Calibrations

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

Probe Acceleration



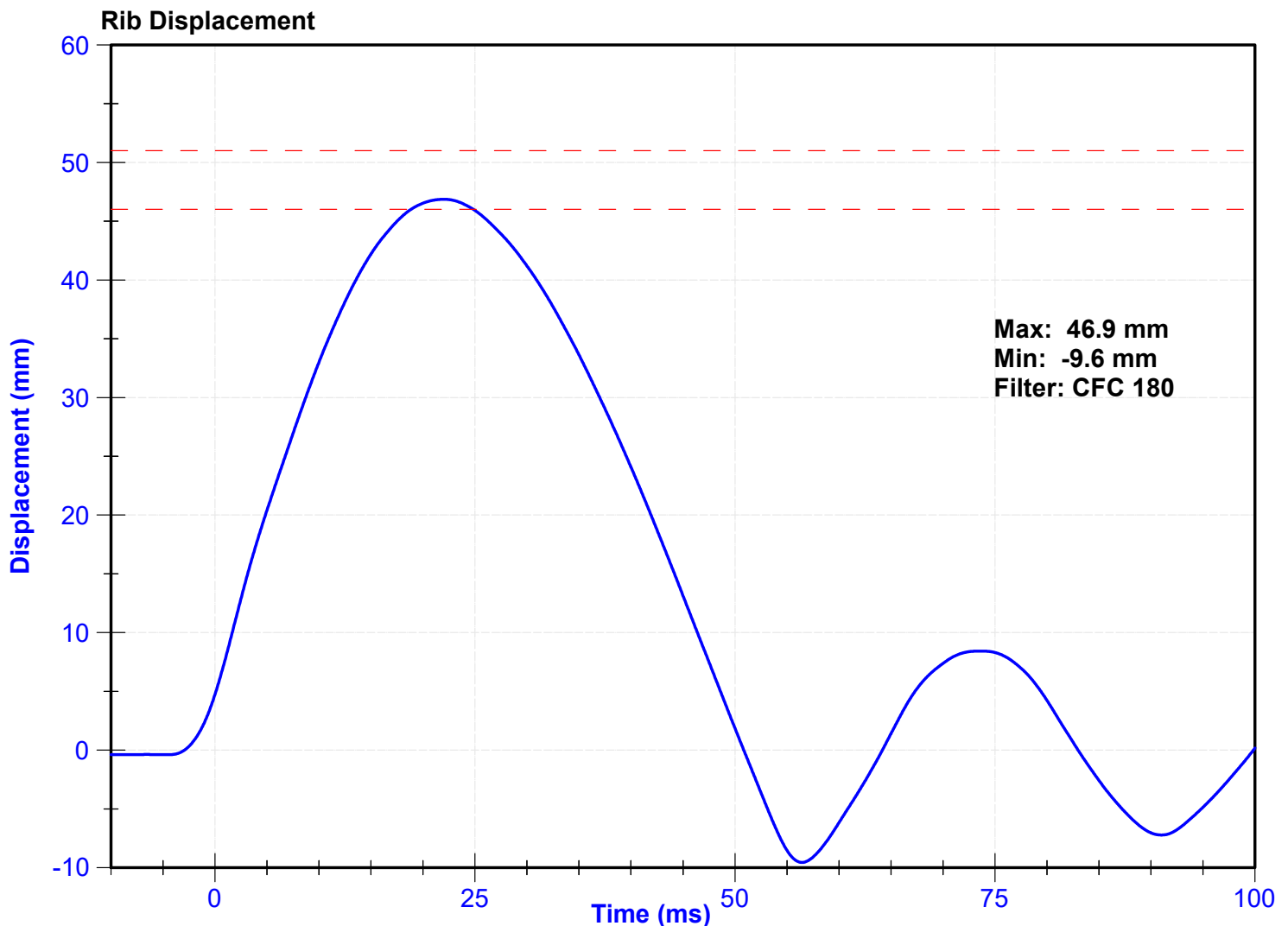
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	17.7	Pass
Rib Displacement	46	51	mm	46.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-01	1/31/2024	7/31/2024



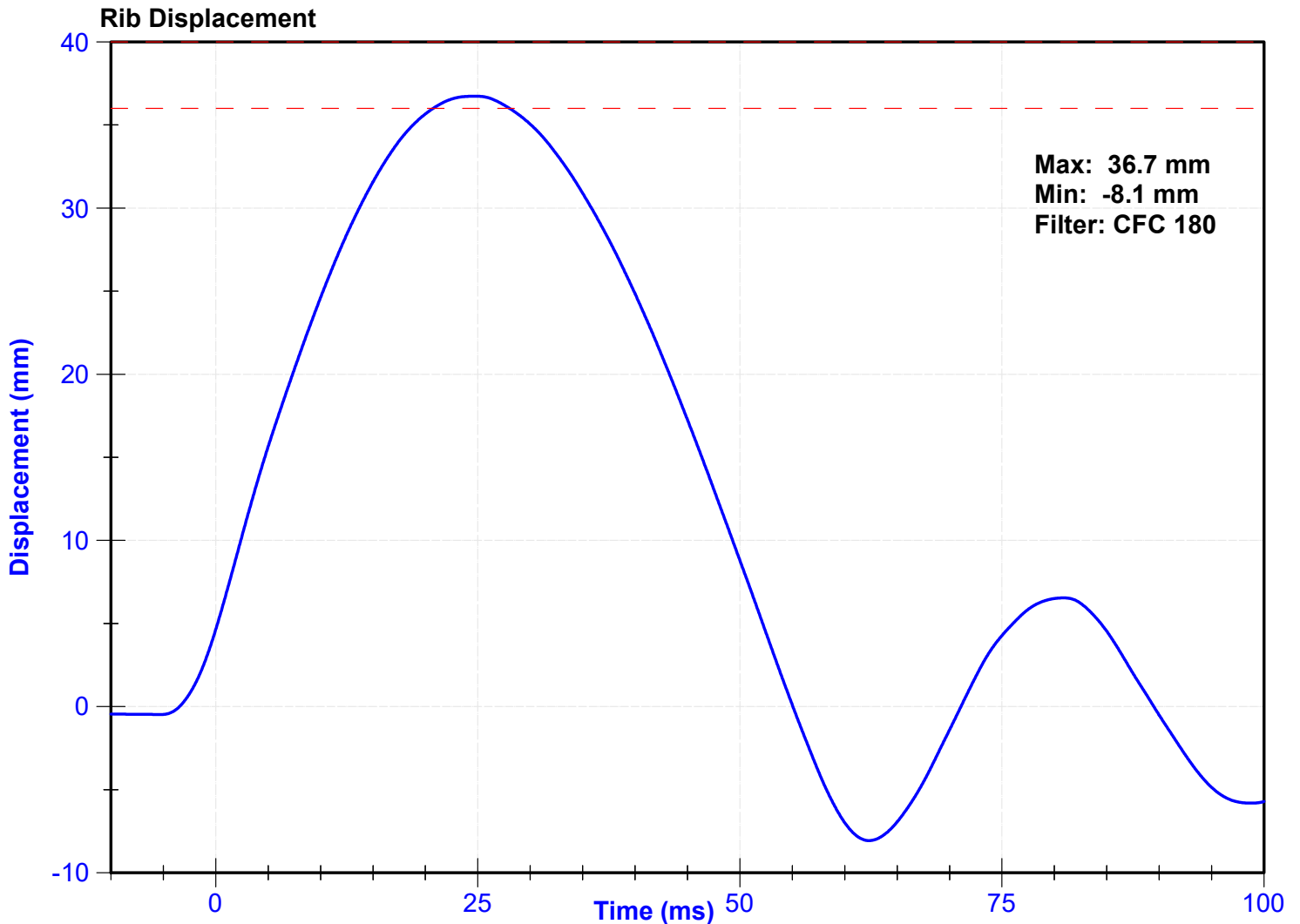
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	17.7	Pass
Rib Displacement	36	40	mm	36.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-01	1/31/2024	7/31/2024



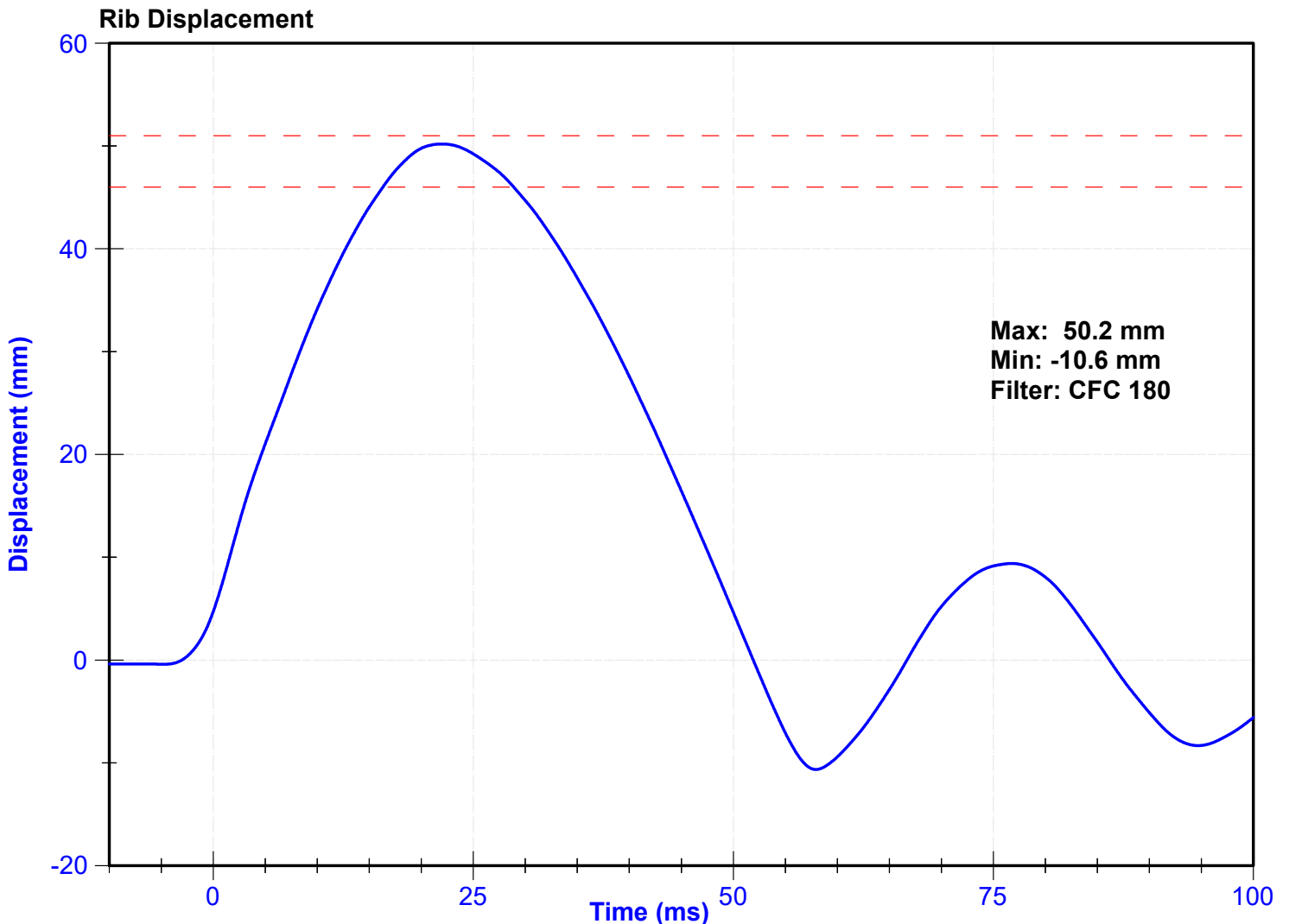
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	17.7	Pass
Rib Displacement	46	51	mm	50.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	807	1/31/2024	7/31/2024



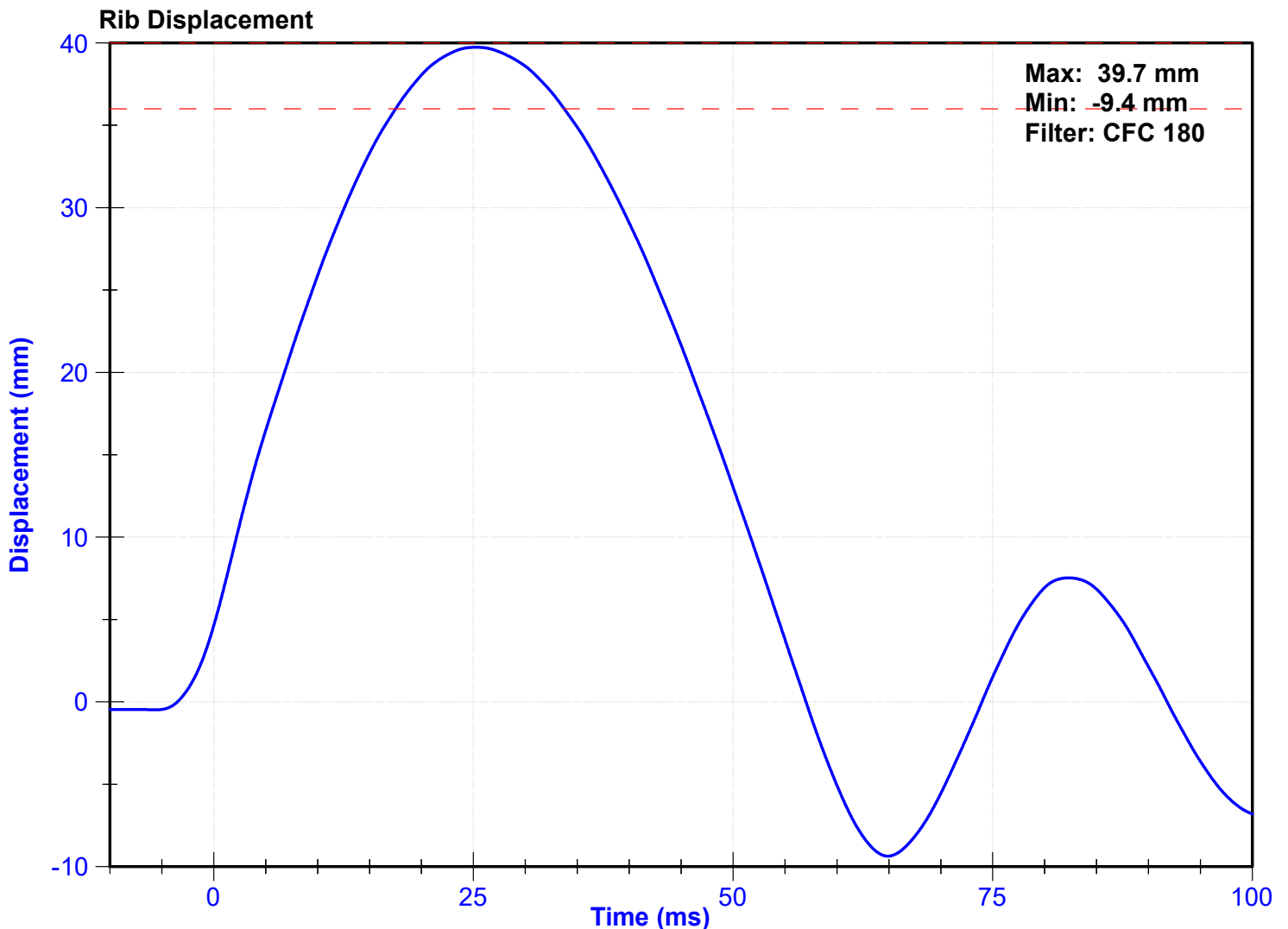
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	17.7	Pass
Rib Displacement	36	40	mm	39.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	807	1/31/2024	7/31/2024



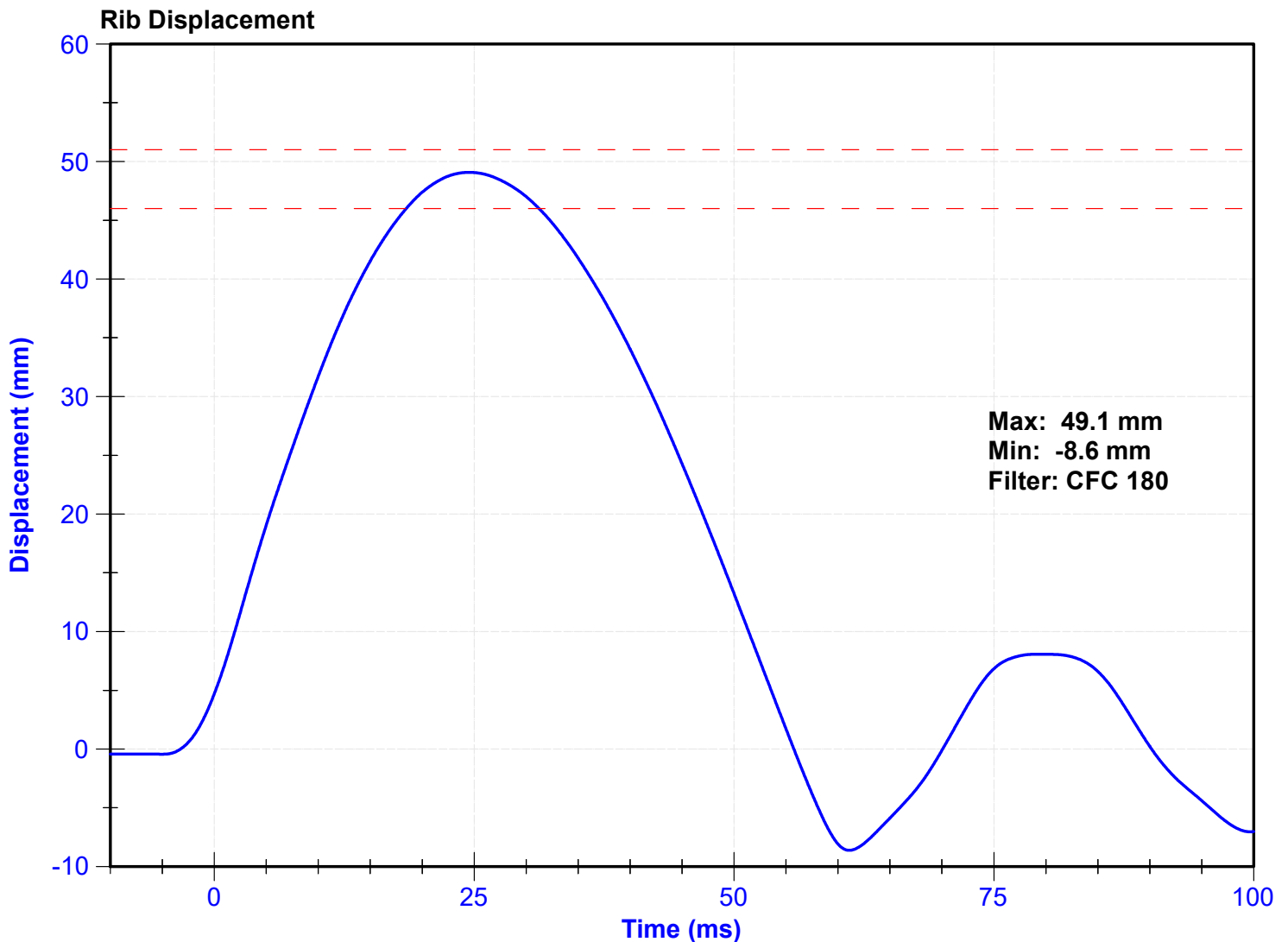
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	17.7	Pass
Rib Displacement	46	51	mm	49.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-03	1/31/2024	7/31/2024



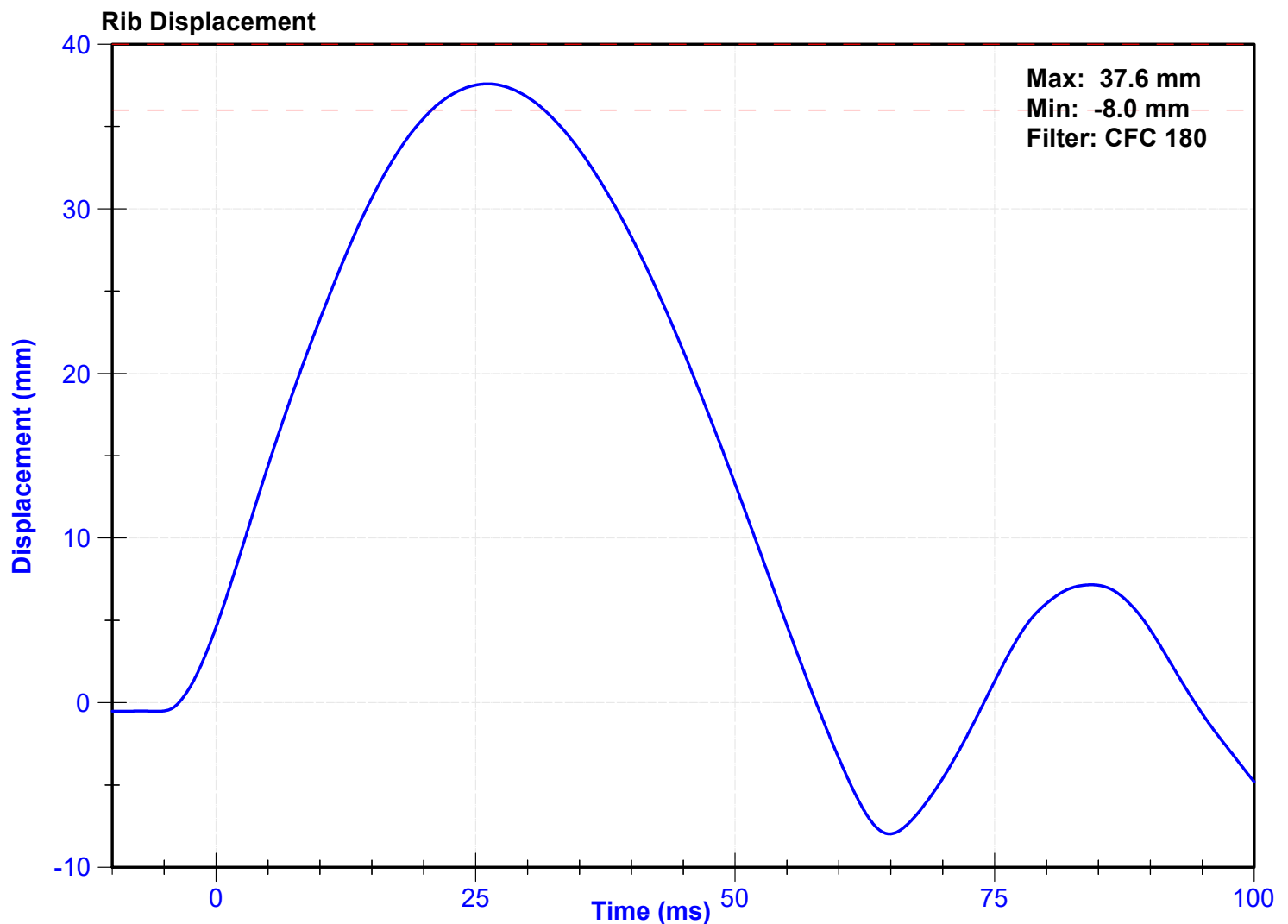
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	17.7	Pass
Rib Displacement	36	40	mm	37.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-03	1/31/2024	7/31/2024



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

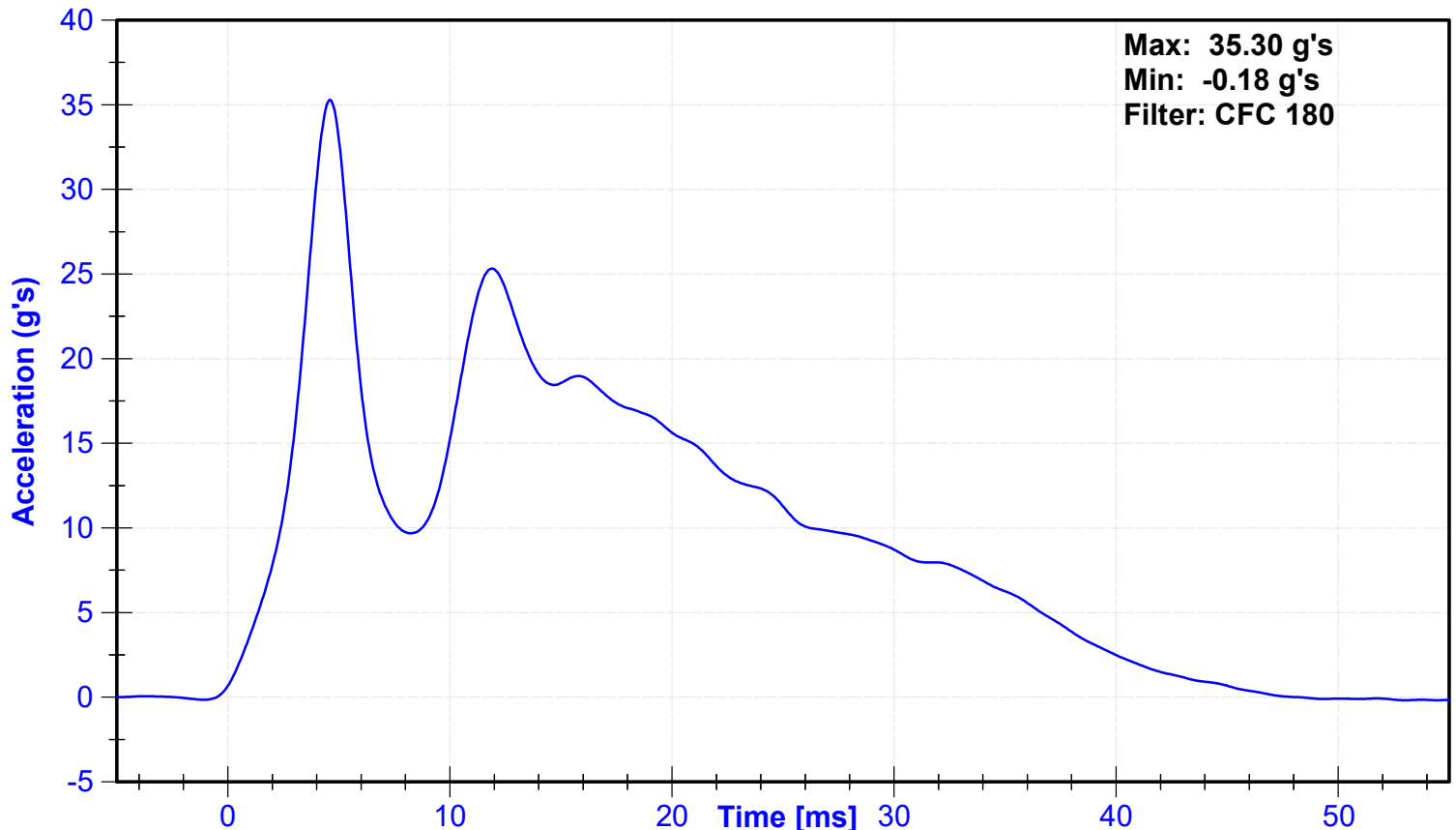
Results

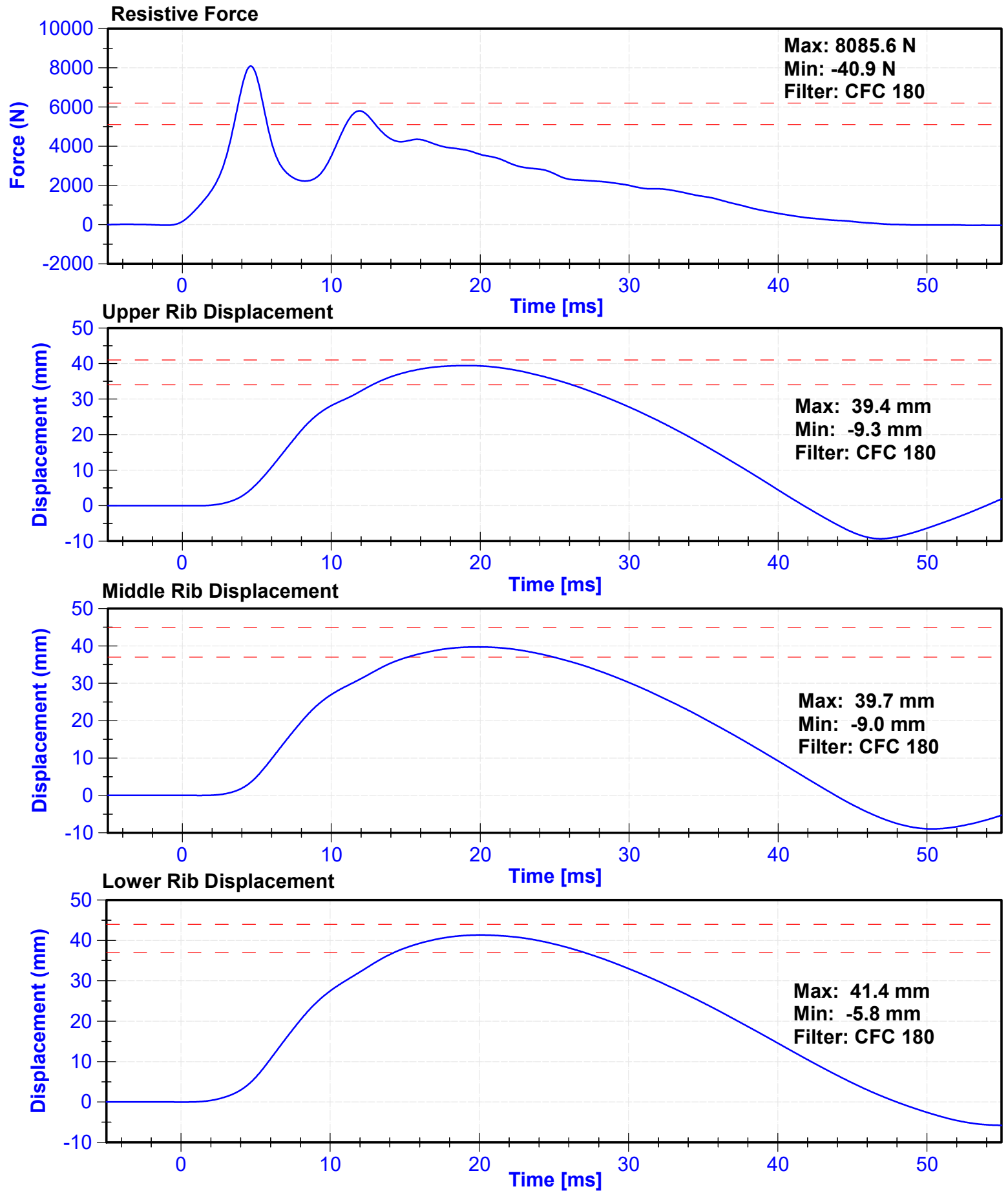
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	29	Pass
Velocity	5.4	5.6	m/s	5.53	Pass
Resistive Force after 6ms	5100	6200	N	5799.7	Pass
Upper Thorax Rib Deflection	34	41	mm	39.4	Pass
Mid Thorax Rib Deflection	37	45	mm	39.7	Pass
Lower Thorax Rib Deflection	37	44	mm	41.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18587	11/20/2023	11/19/2024
Upper Thorax Rib Potentiometer	Honeywell	0552-01	1/31/2024	7/31/2024
Middle Thorax Rib Potentiometer	Honeywell	807	1/31/2024	7/31/2024
Lower Thorax Rib Potentiometer	Honeywell	0552-03	1/31/2024	7/31/2024

Probe Acceleration





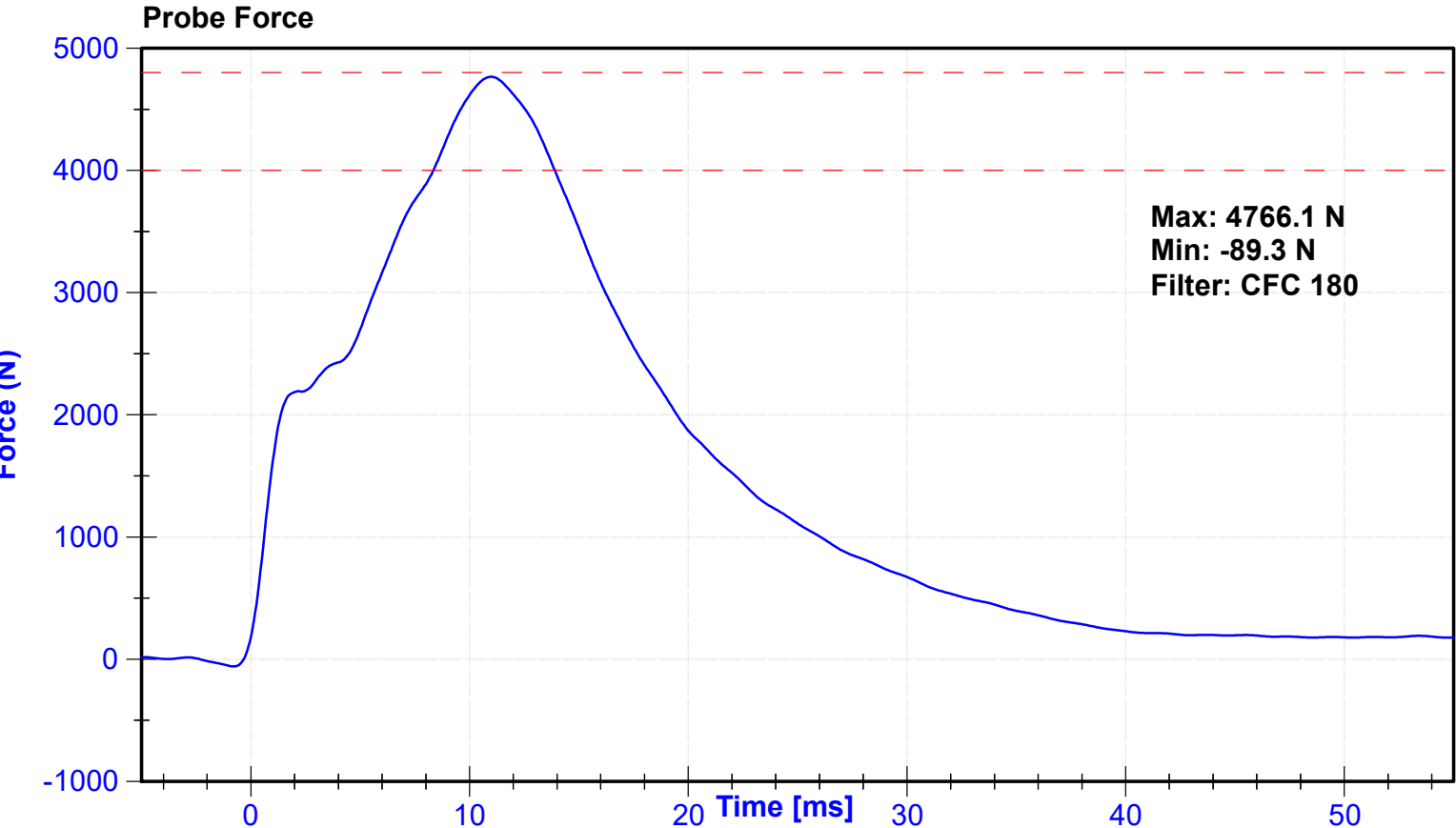
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

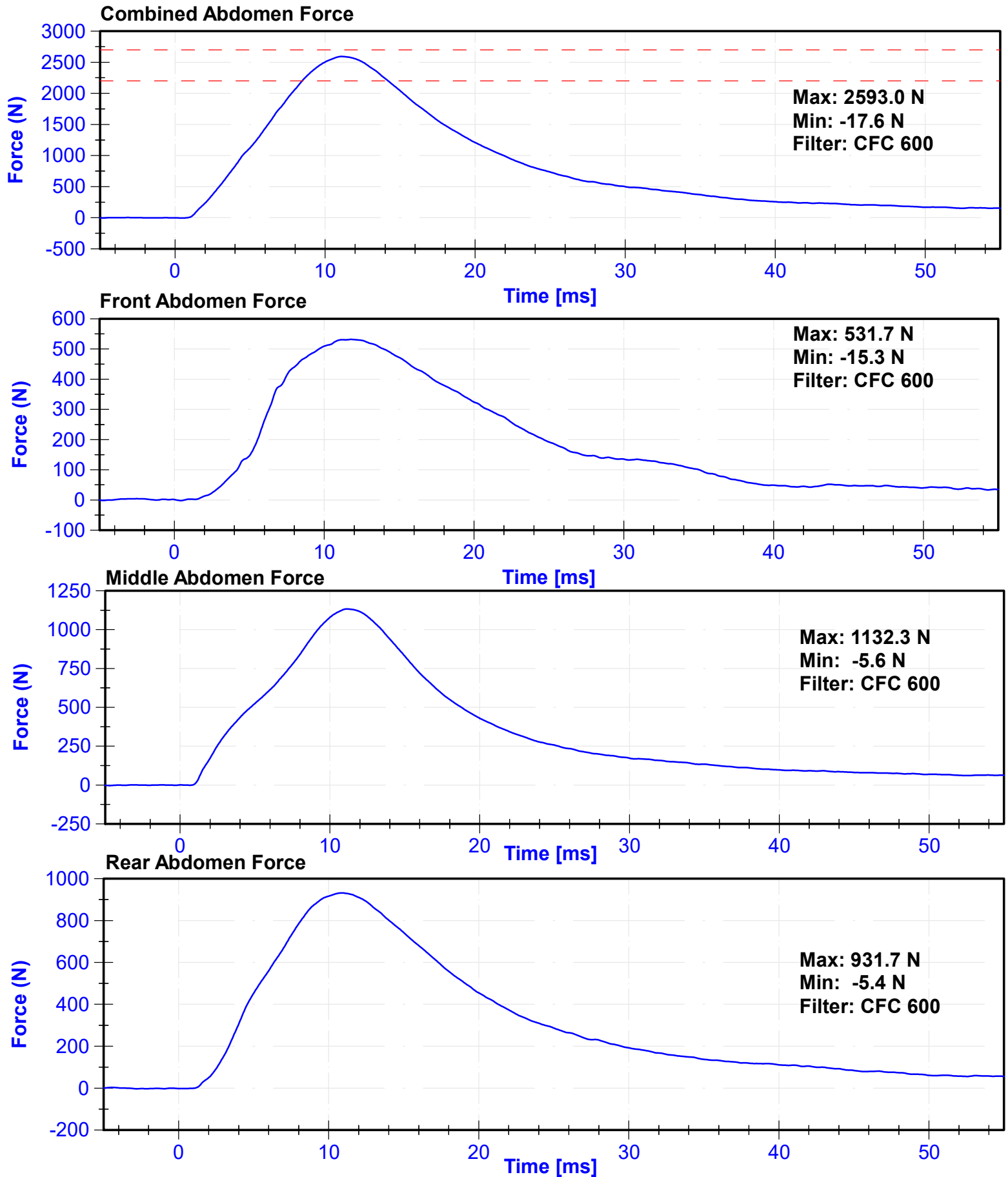
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	29	Pass
Velocity	3.9	4.1	m/s	3.97	Pass
Combined Abdomen Force	2200	2700	N	2593.0	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.10	Pass
Resistive Probe Force	4000	4800	N	4766.1	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.00	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	11/19/2024
Front Abdomen Load Cell	Denton	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





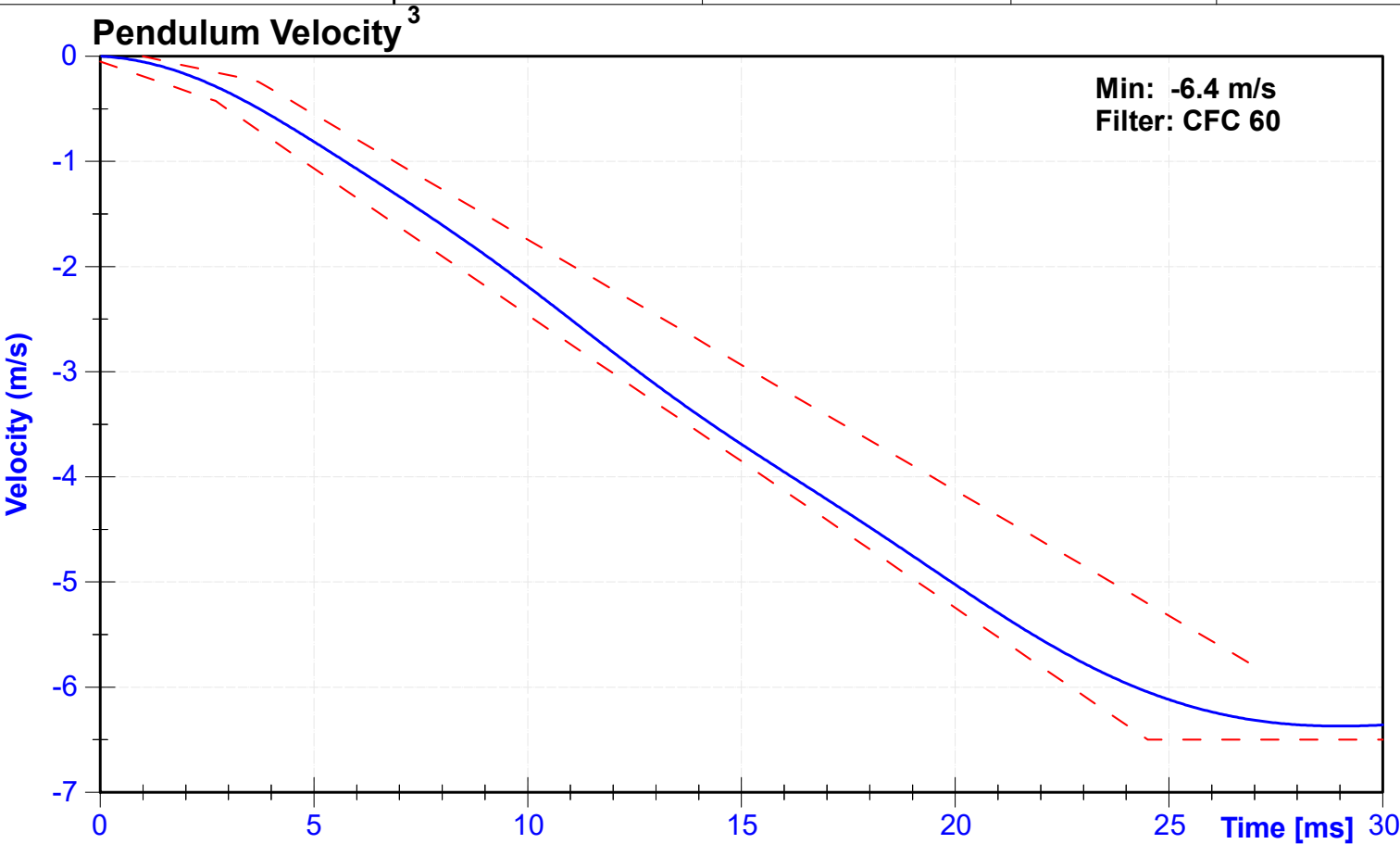
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

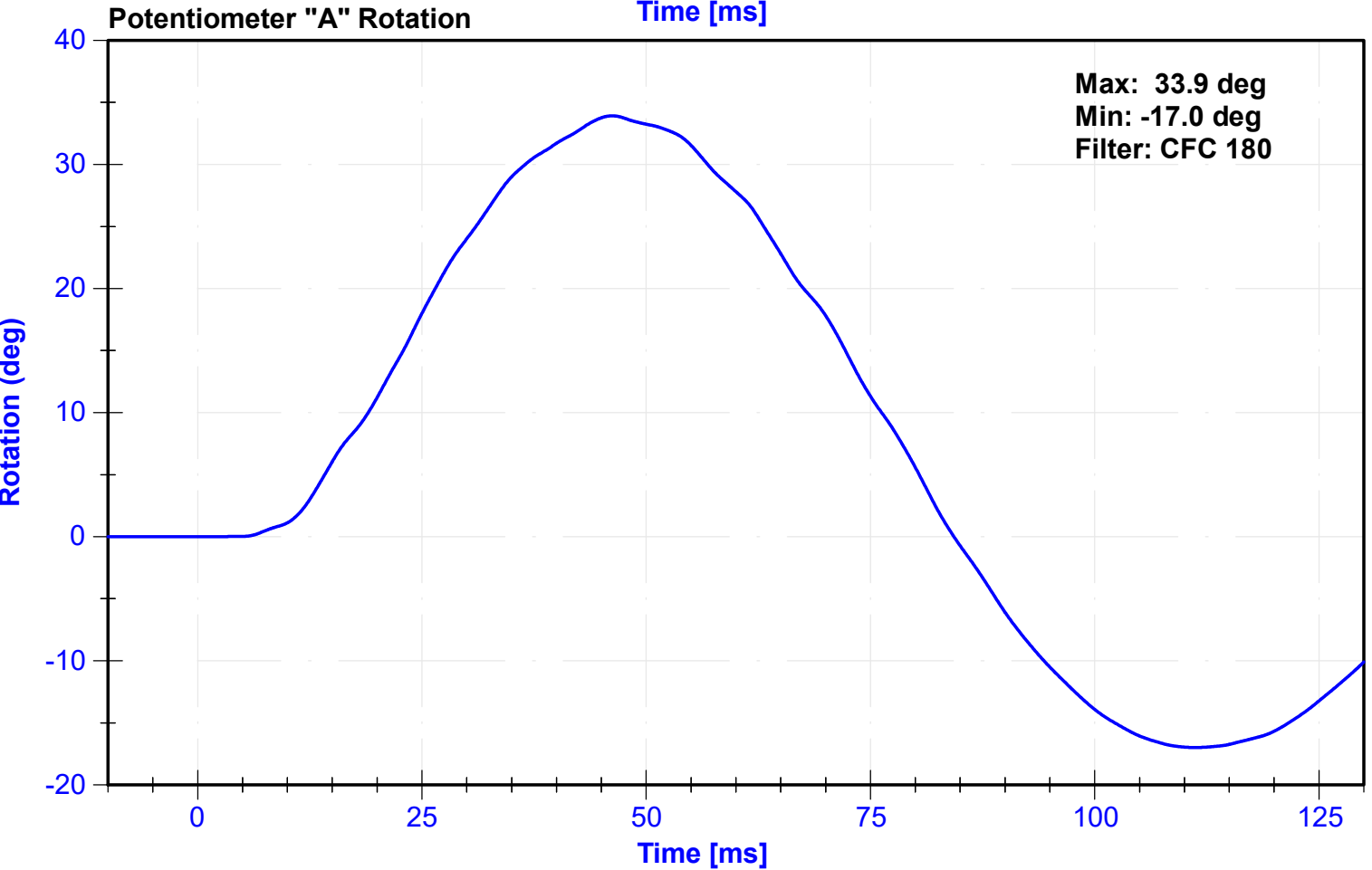
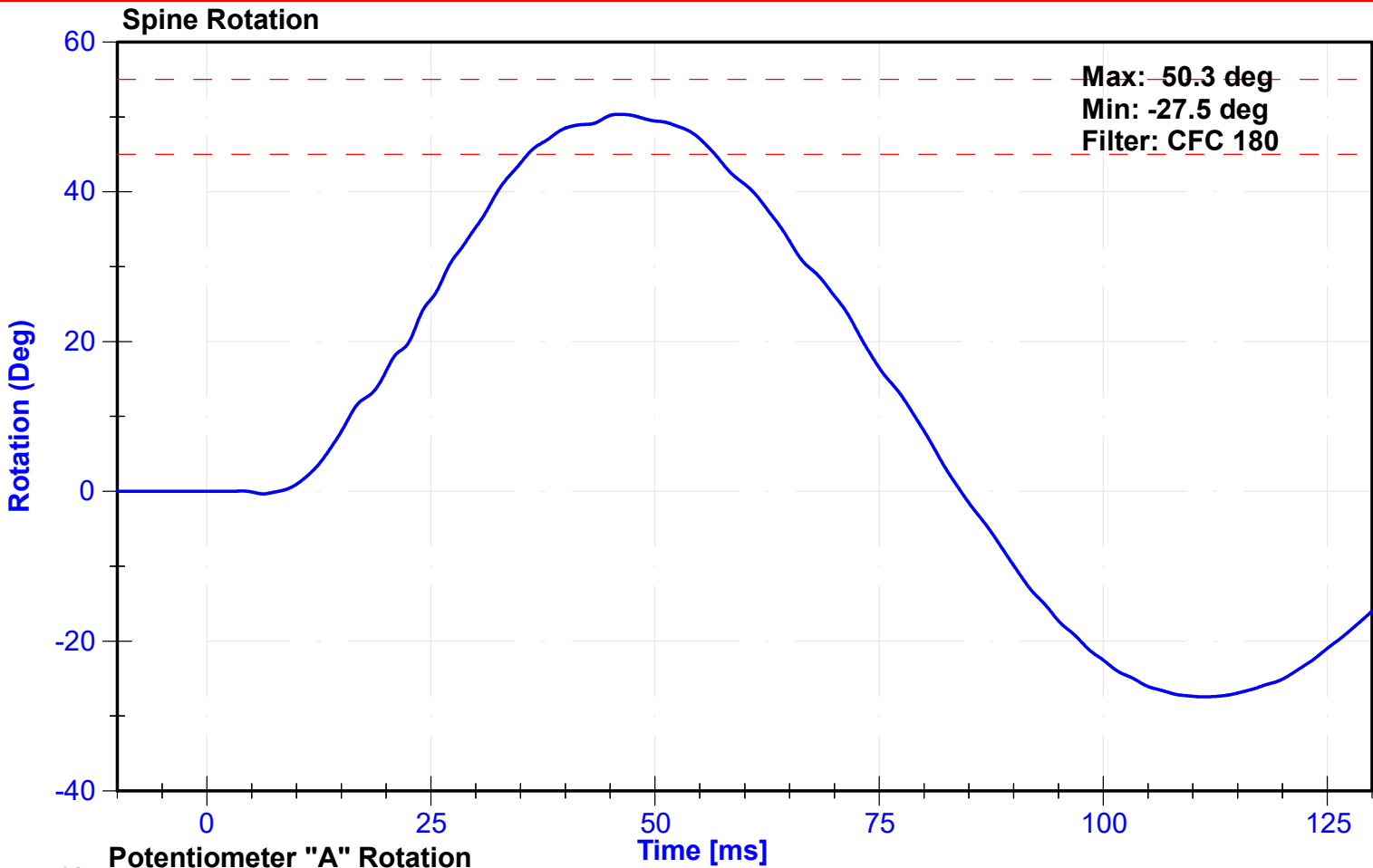
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	18	Pass
Velocity	5.95	6.15	m/s	5.975	Pass
Lateral Spine Rotation	45	55	deg	50.3	Pass
Time at Maximum Rotation	39	53	ms	45.9	Pass
Time of Decay to Zero Degrees	37	57	ms	38.2	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

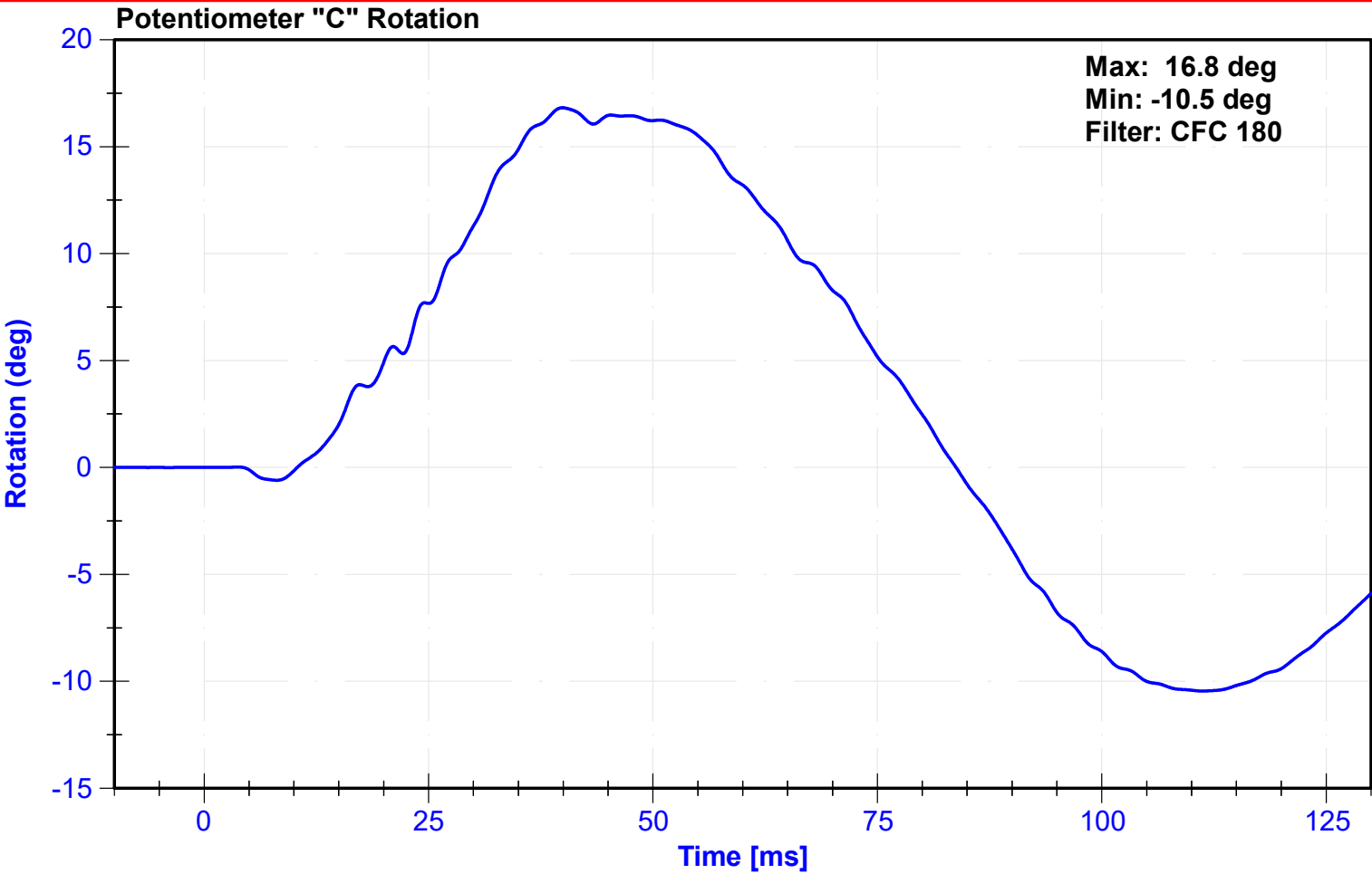
Transducer Calibrations

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



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





Appendix I

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

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

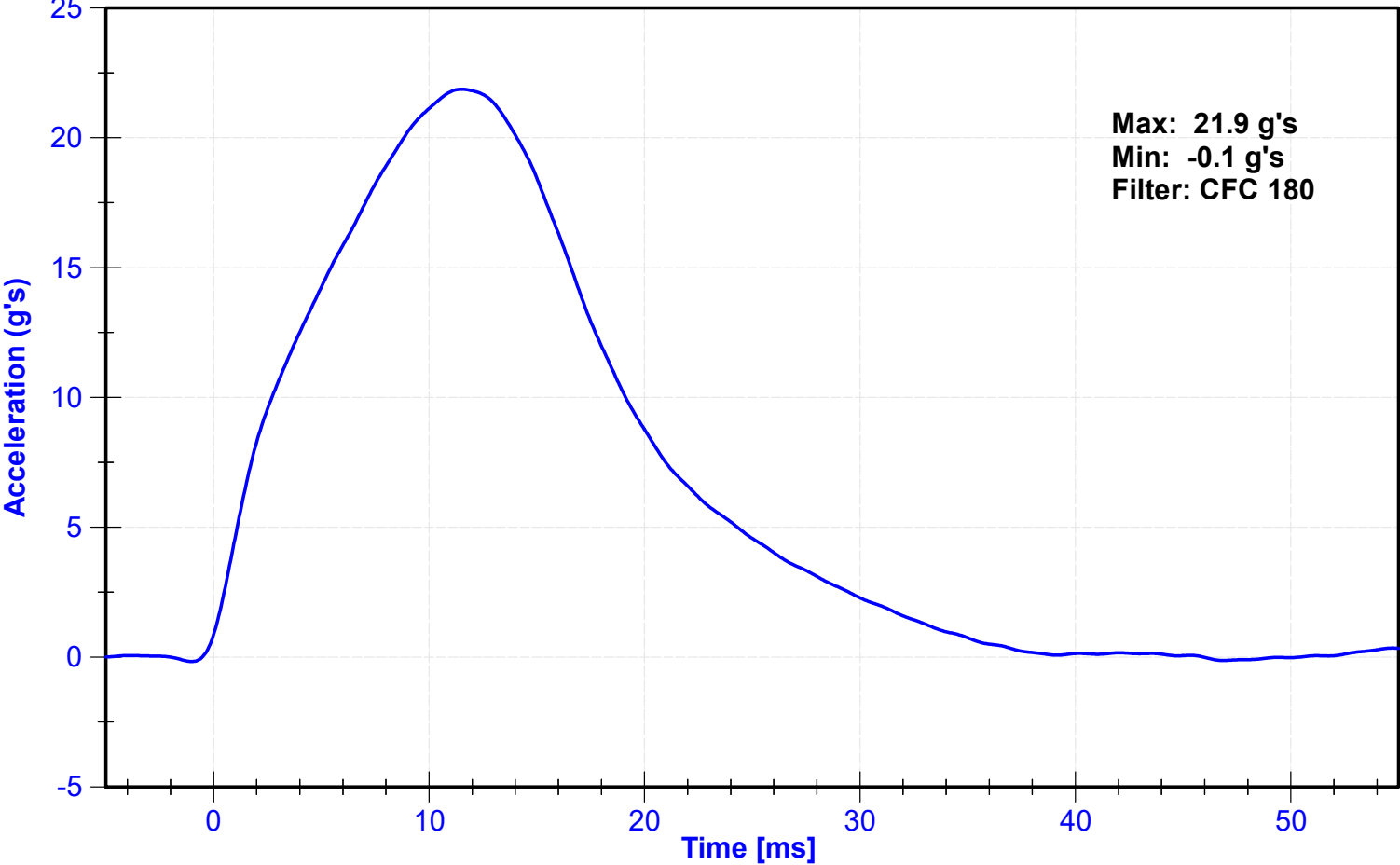
Results

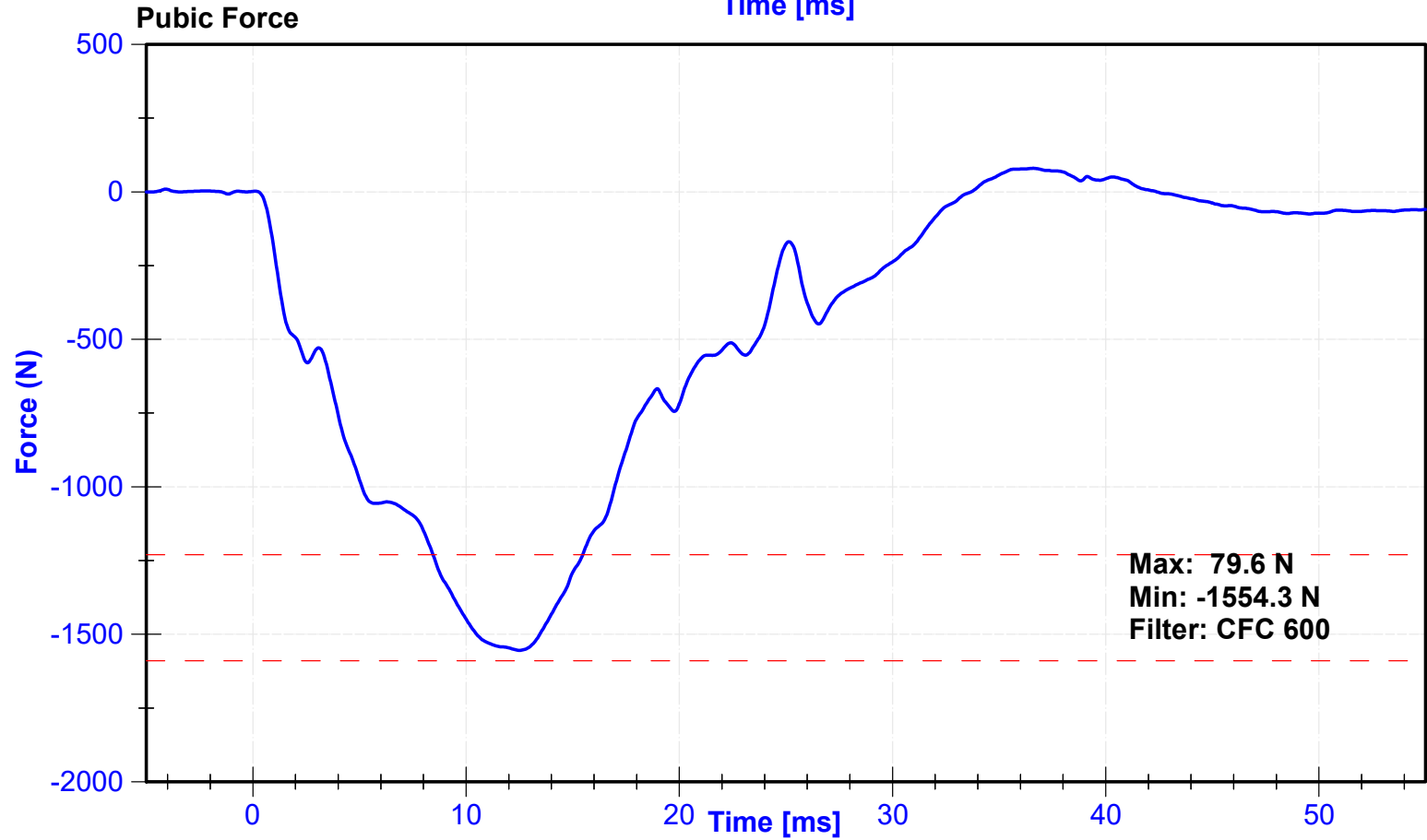
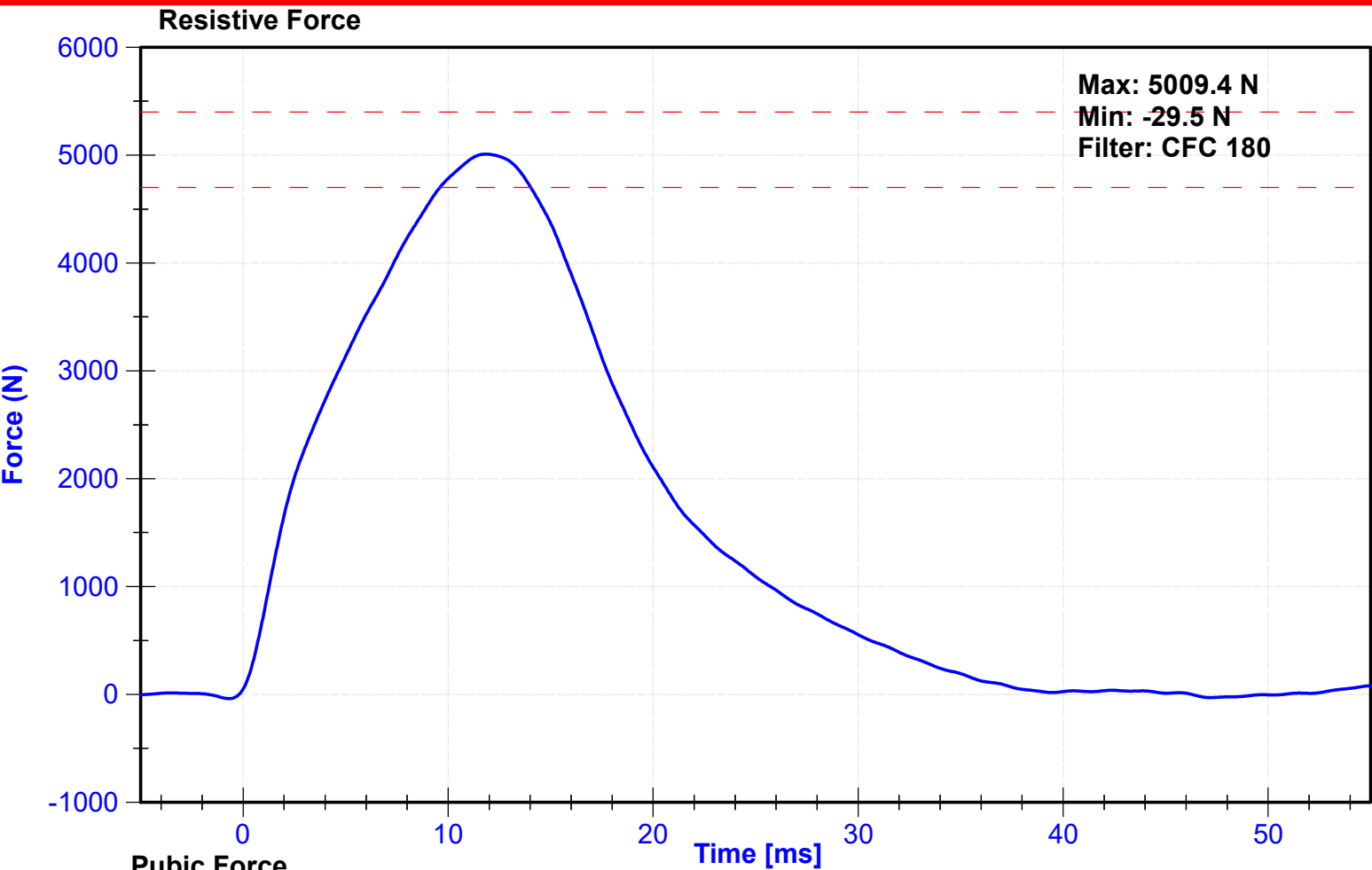
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	29	Pass
Velocity	4.2	4.4	m/s	4.36	Pass
Resistive Force	4700	5400	N	5009.4	Pass
Time at Peak Resistive Force	11.8	16.1	ms	11.82	Pass
Pubic Force	-1590	-1230	N	-1554.3	Pass
Time at Peak Pubic Force	12.2	17.0	ms	12.50	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	11/19/2024
Pubic Load Cell	Denton	456-FY	8/8/2023	8/7/2024

Probe Acceleration





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

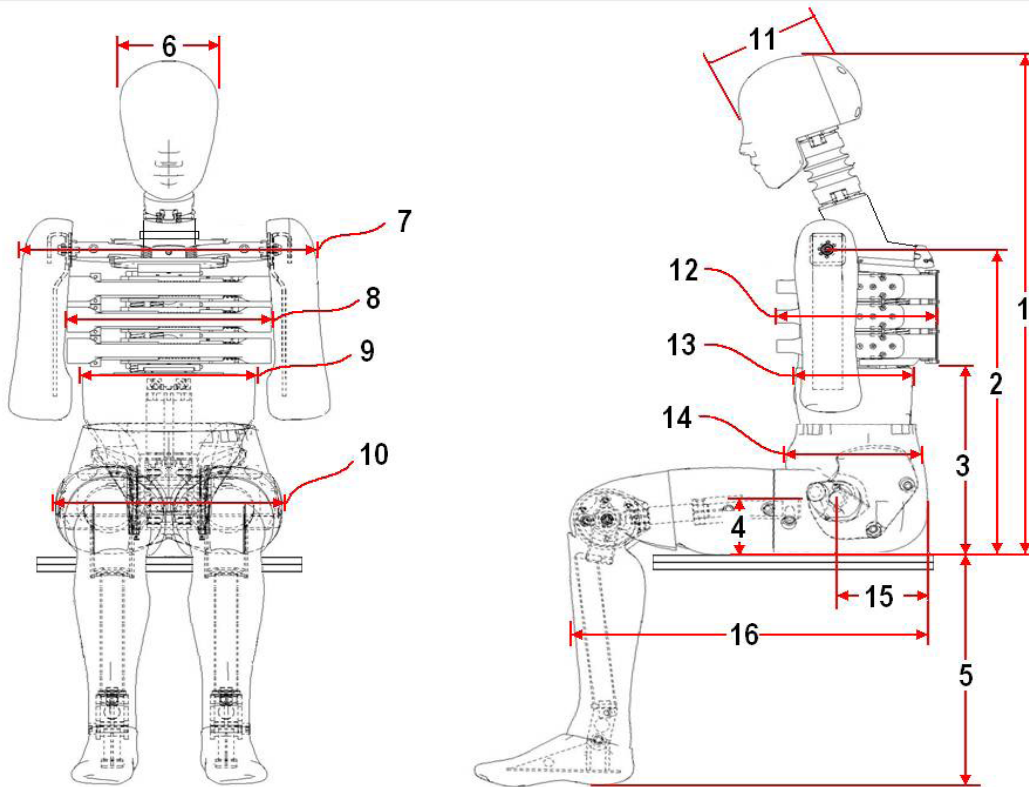


External Measurements - EuroSID-2re

Technician: T. Roseman

Date: 3/20/2024

Dummy Serial Number: D037



FRONT VIEW

SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	910	Pass
2	Seat to Shoulder Joint	558	572	562	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	421	Pass
6	Head Width	152	158	153	Pass
7	Shoulder/Arm Width	461	479	474	Pass
8	Thorax Width	322	332	330	Pass
9	Abdomen Width	273	287	285	Pass
10	Pelvis Lap Width	359	373	362	Pass
11	Head Depth	196	206	199	Pass
12	Thorax Depth	262	272	265	Pass
13	Abdomen Depth	194	204	198	Pass
14	Pelvis Depth	235	245	238	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	605	Pass

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

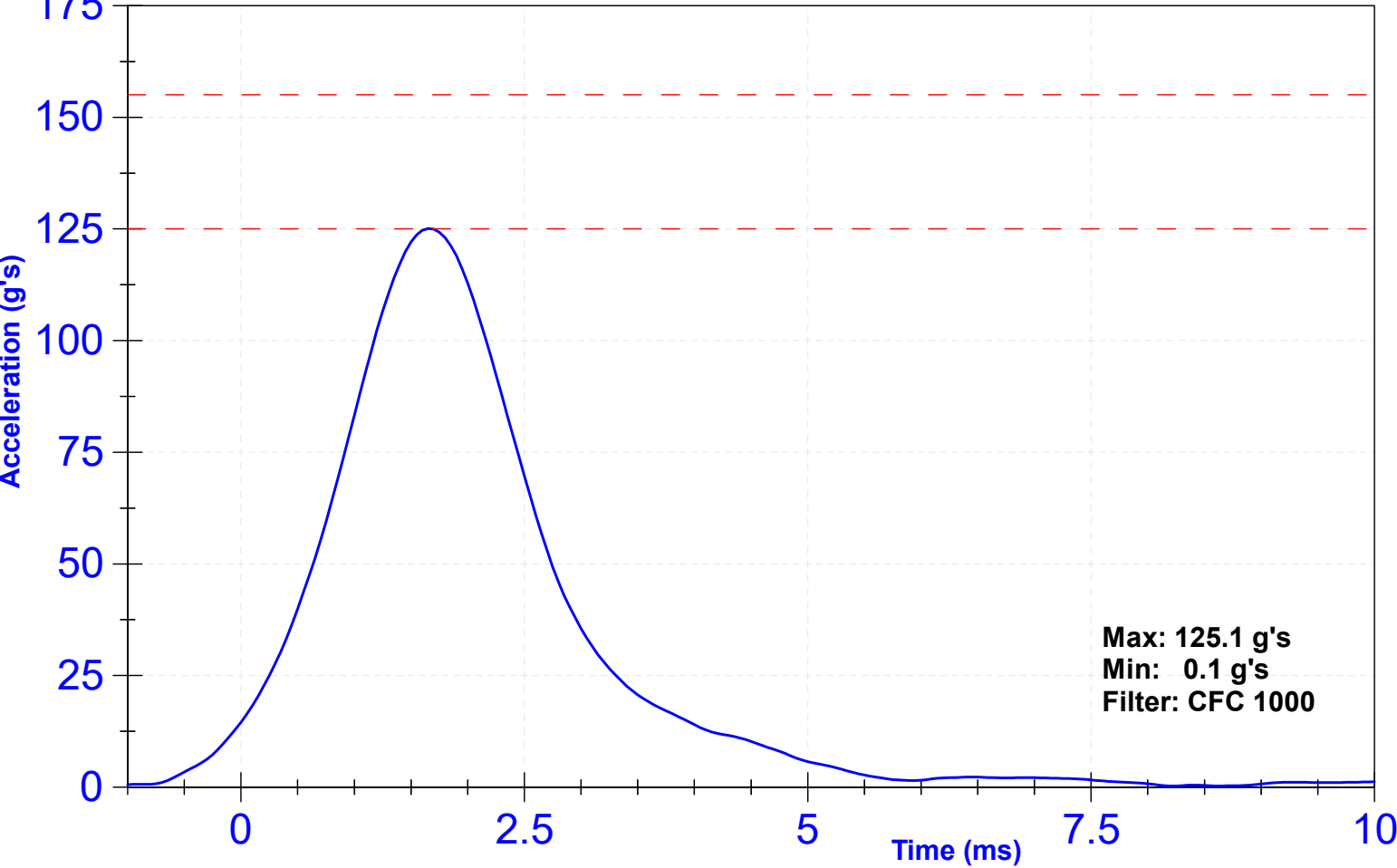
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	22	Pass
Resultant Acceleration	125	155	g's	125.1	Pass
Oscillation	0	15	%	1.82	Pass
Fore-Aft Acceleration	-15	15	g's	8.1	Pass

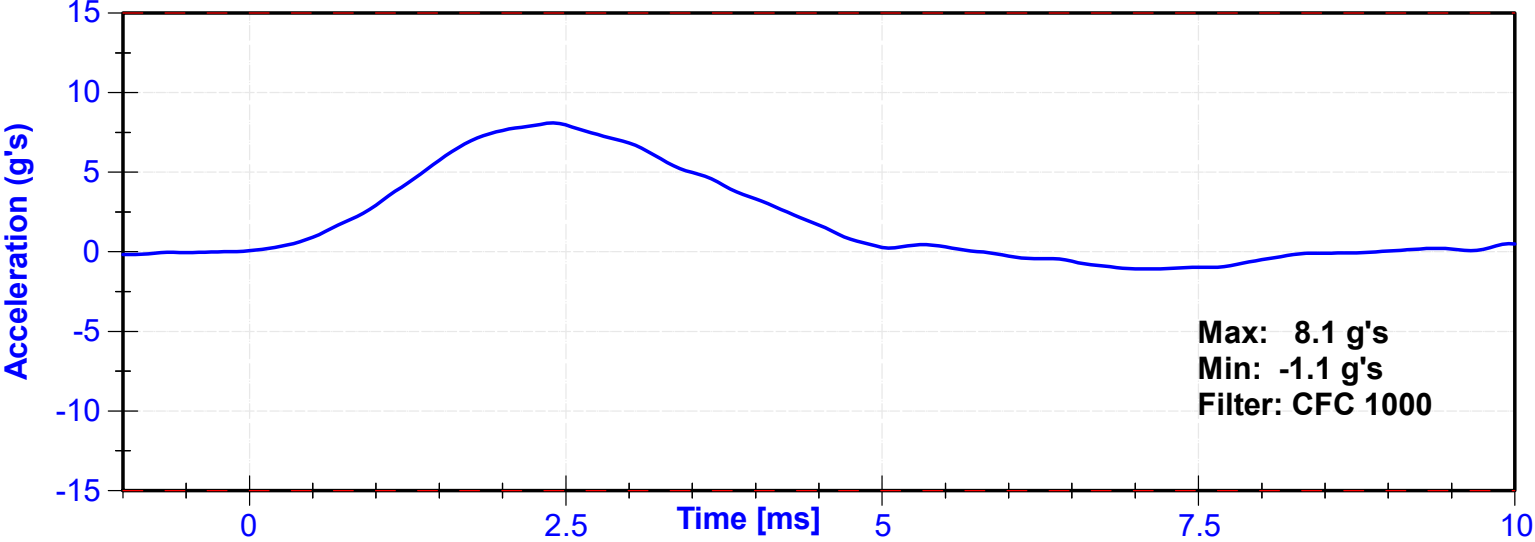
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	T21724	2/1/2024	7/30/2024
Y Accelerometer	Endevco	T22281	2/1/2024	7/30/2024
Z Accelerometer	Endevco	T26050	2/1/2024	7/30/2024

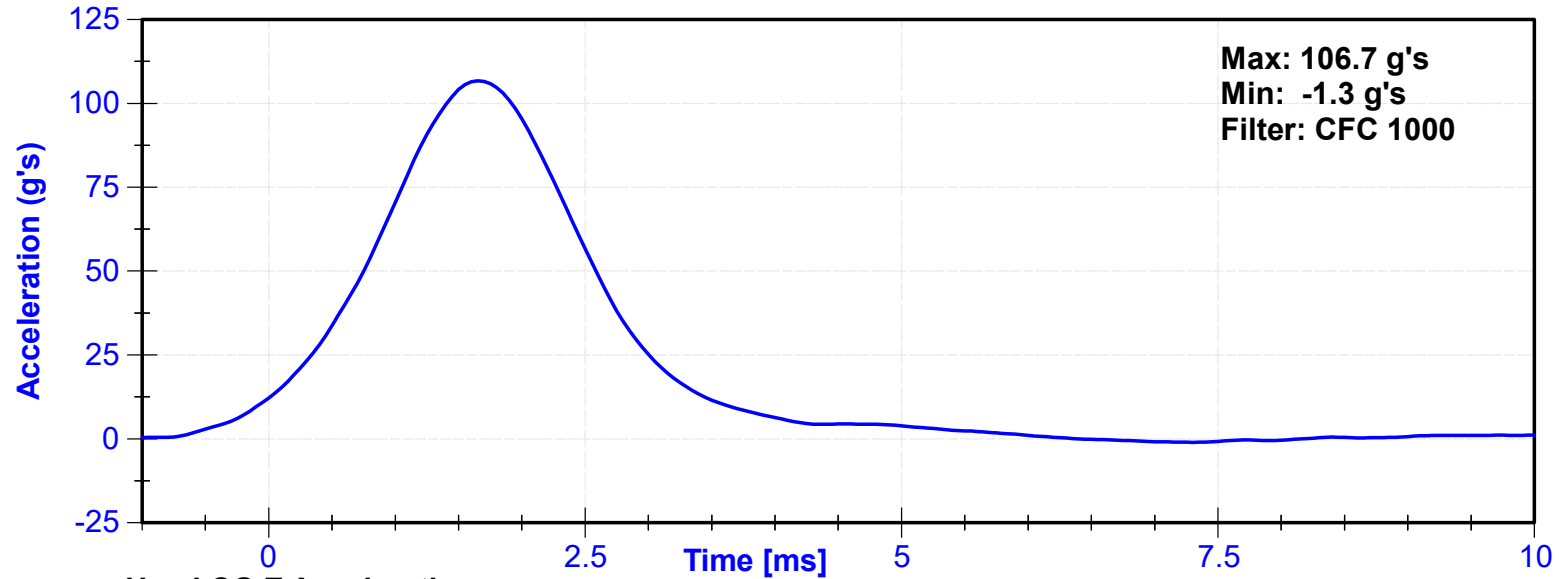
Resultant Acceleration



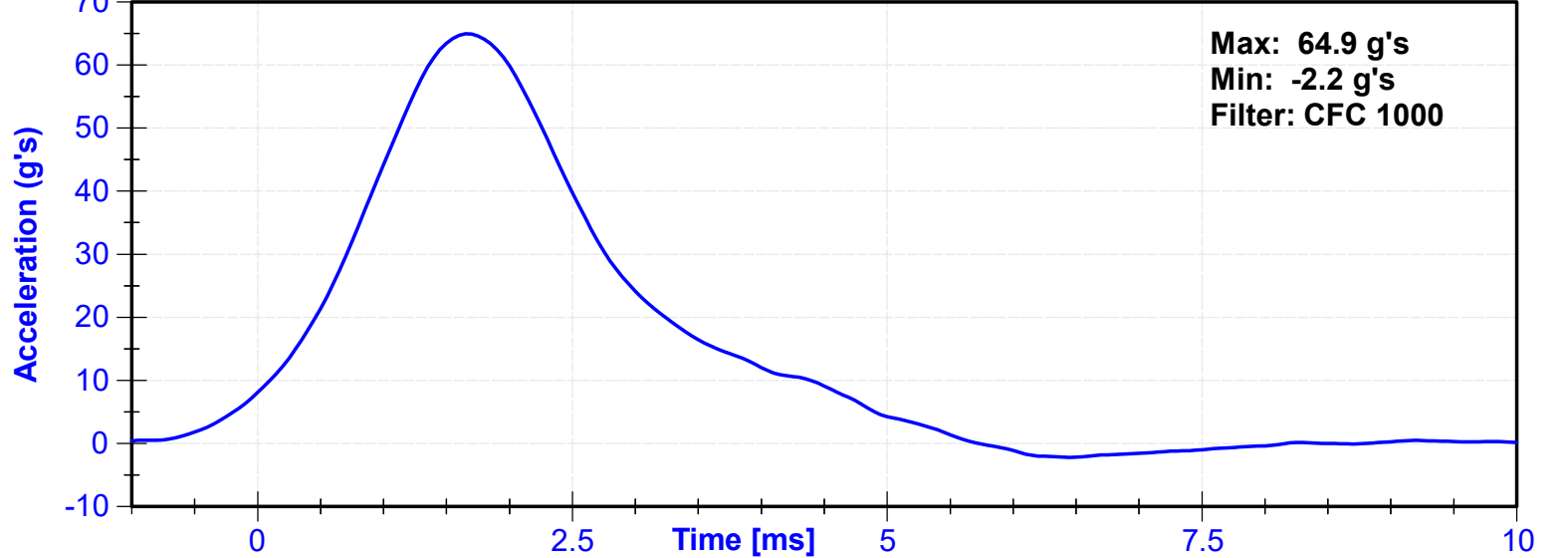
Head CG X Acceleration



Head CG Y Acceleration



Head CG Z Acceleration



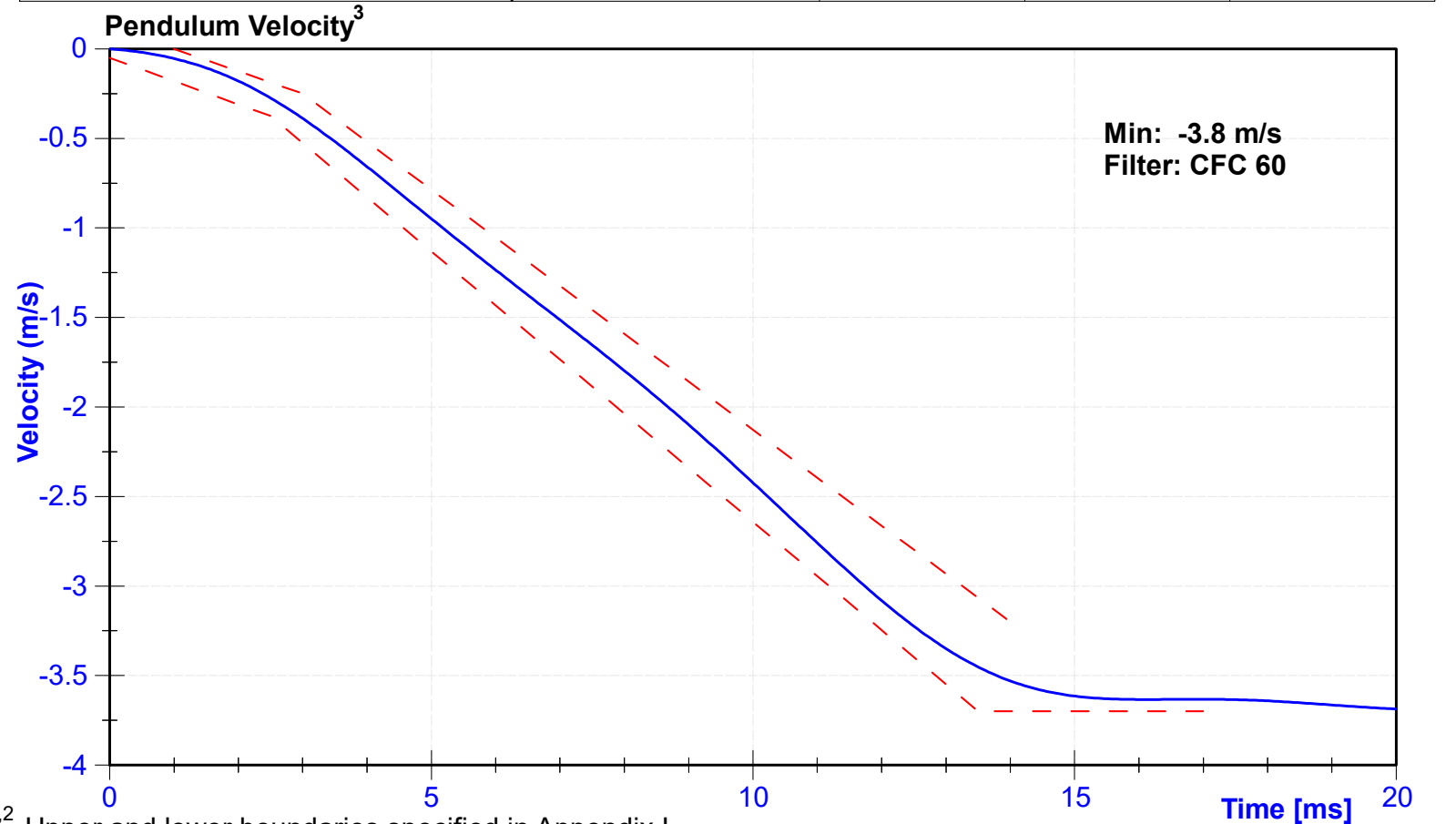
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	17	Pass
Velocity	3.3	3.5	m/s	3.42	Pass
Lateral Neck Rotation	49	59	deg	53.7	Pass
Time at Maximum Rotation	54	66	ms	57.6	Pass
Time of Rotation Decay from Maximum	53	88	ms	59.4	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

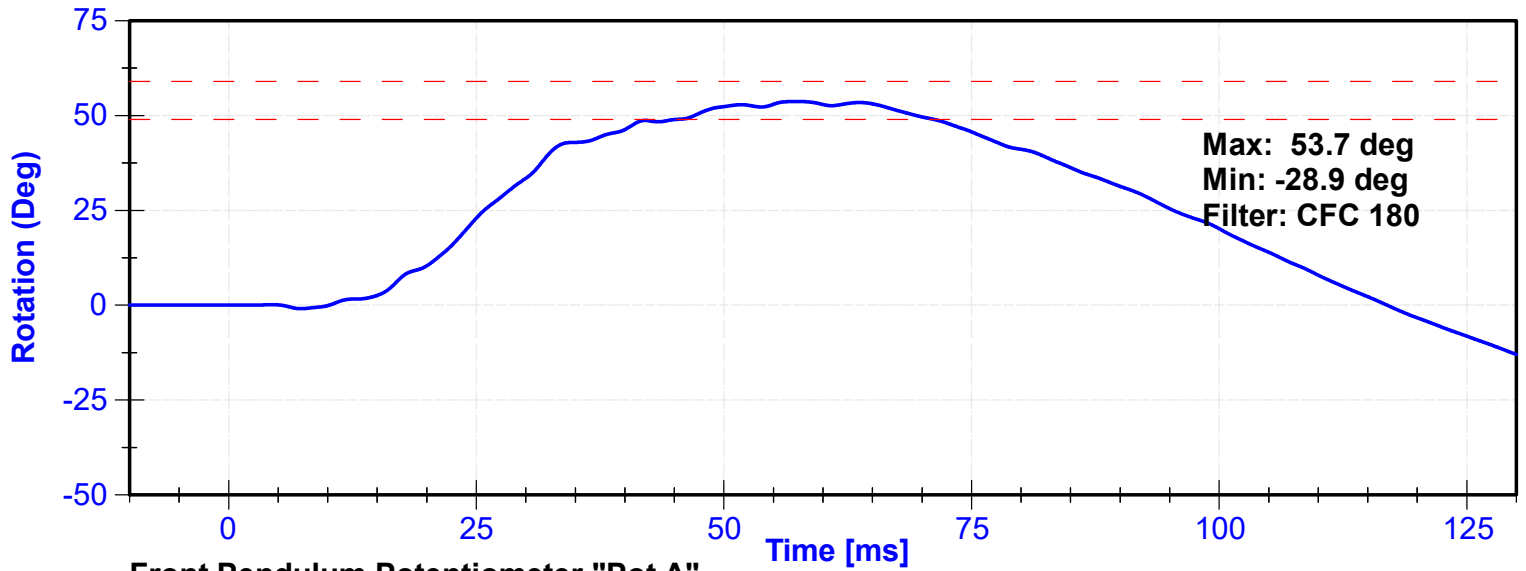
Transducer Calibrations

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

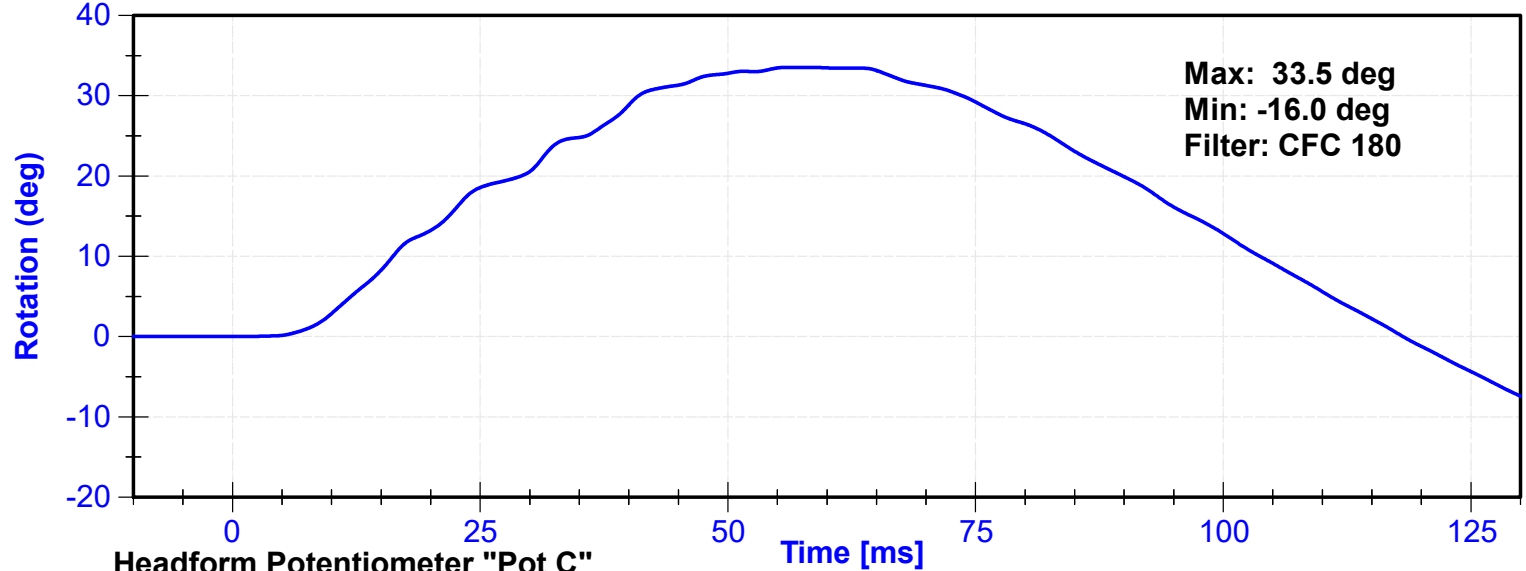


^{1,2} Upper and lower boundaries specified in Appendix I

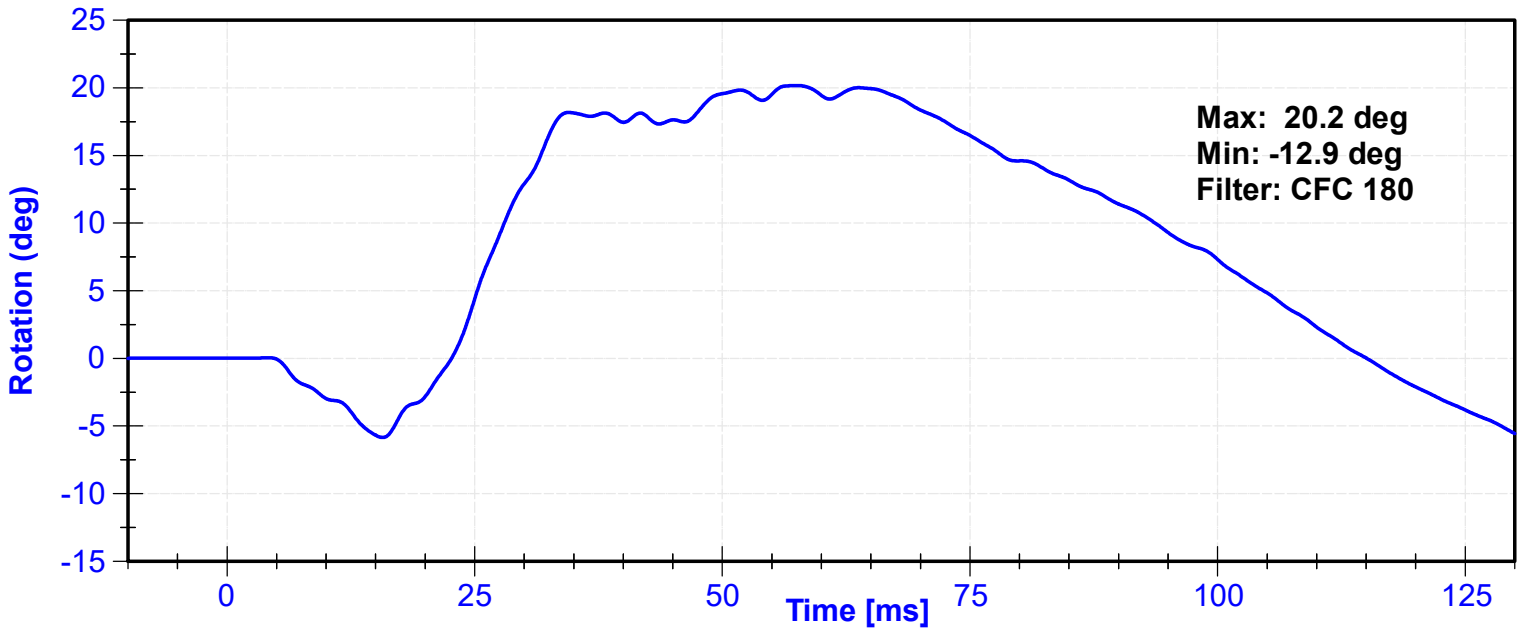
Neck Rotation



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	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

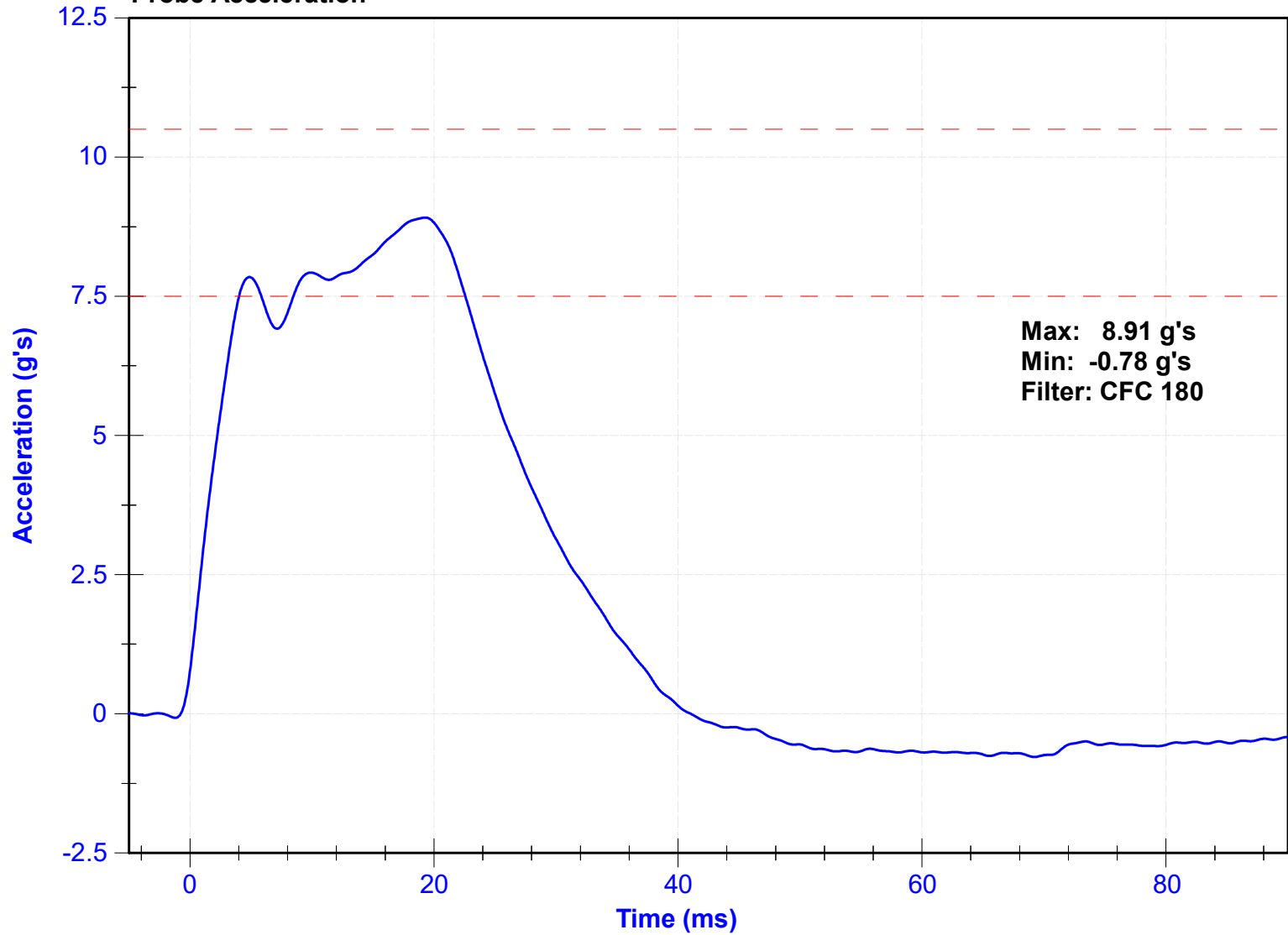
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	18	Pass
Velocity	4.2	4.4	m/s	4.27	Pass
Probe Acceleration	7.5	10.5	g's	8.91	Pass

Transducer Calibrations

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

Probe Acceleration



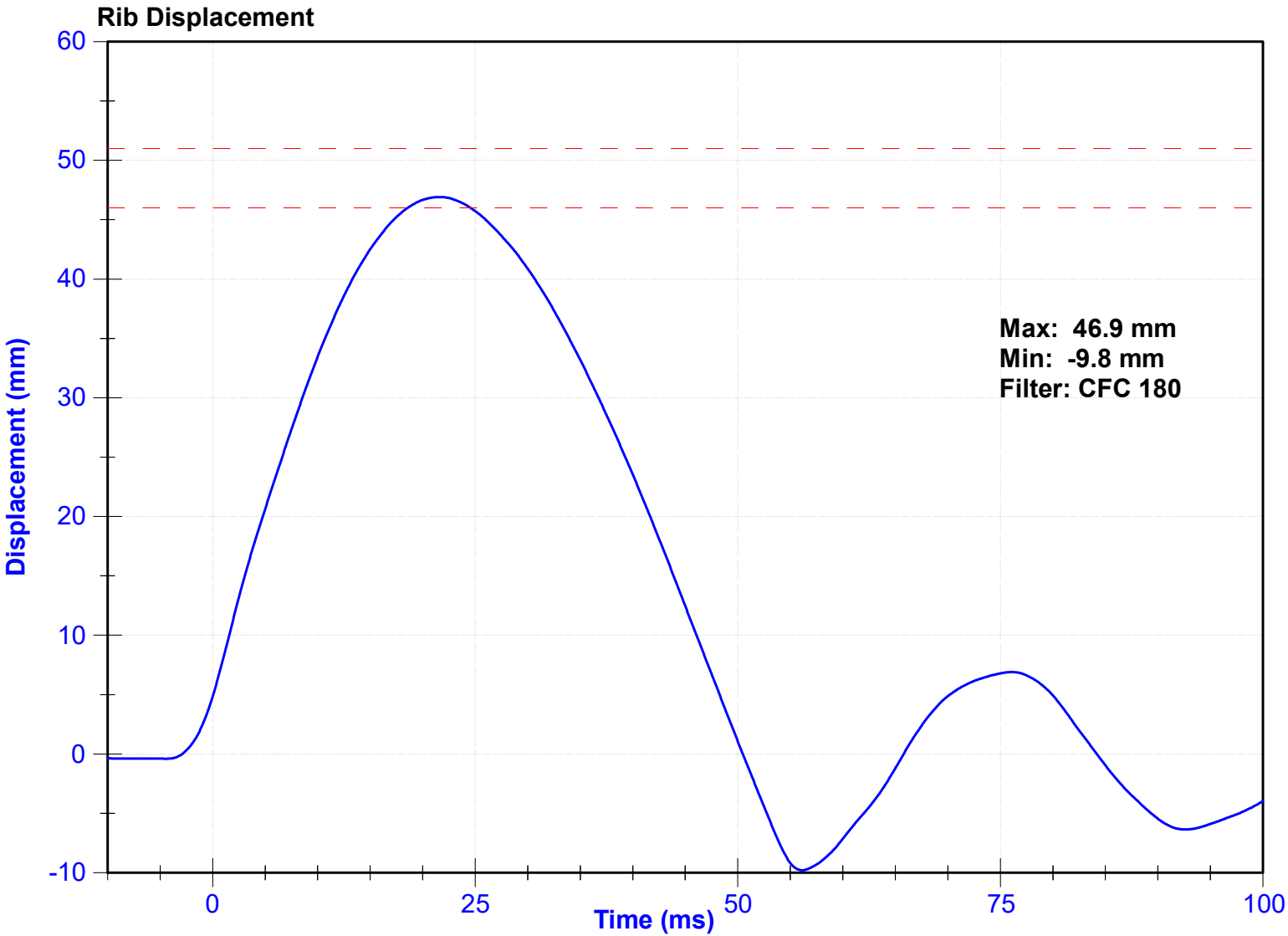
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	22	Pass
Rib Displacement	46	51	mm	46.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-01	1/31/2024	7/31/2024



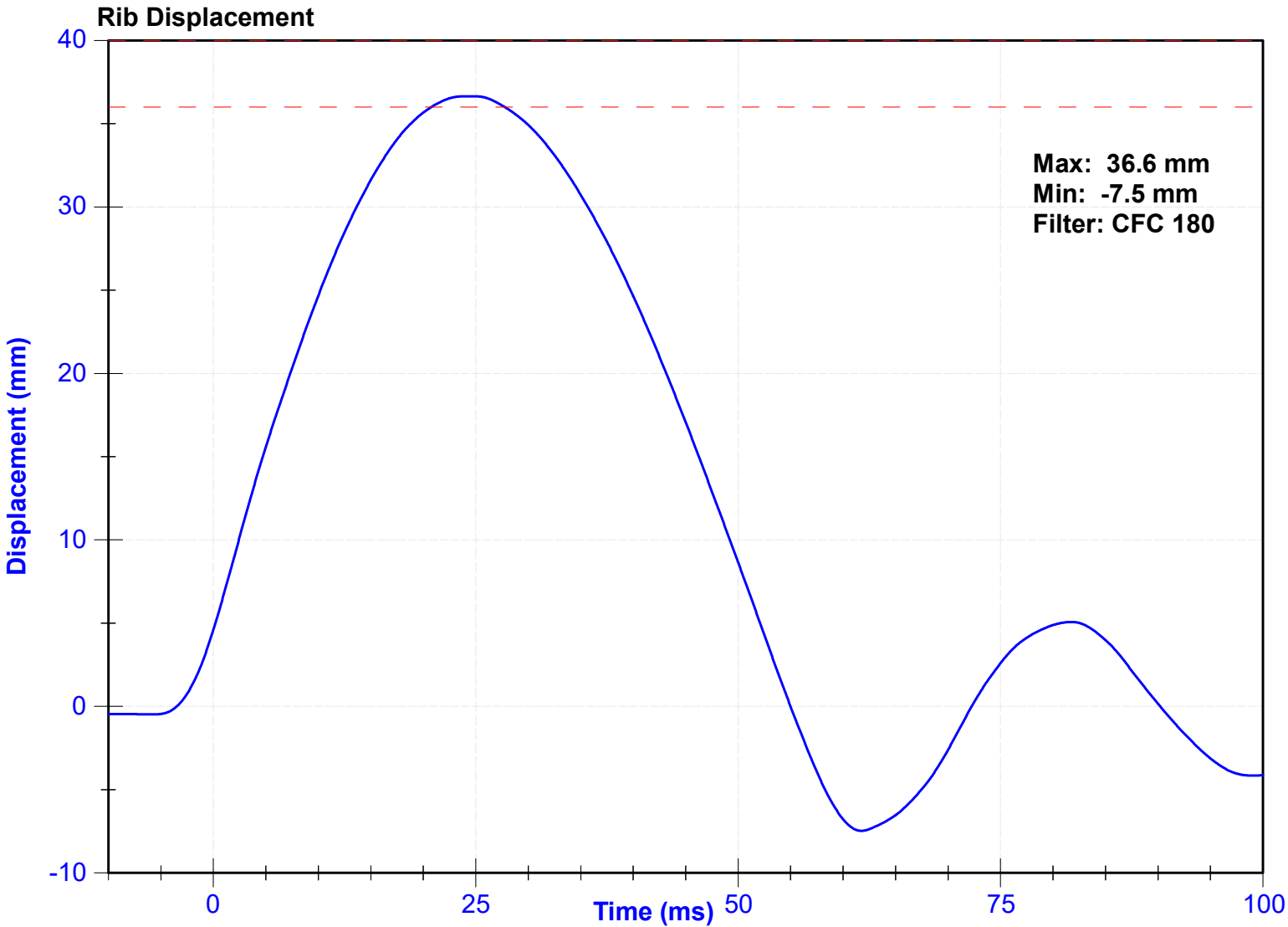
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	22	Pass
Rib Displacement	36	40	mm	36.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-01	1/31/2024	7/31/2024



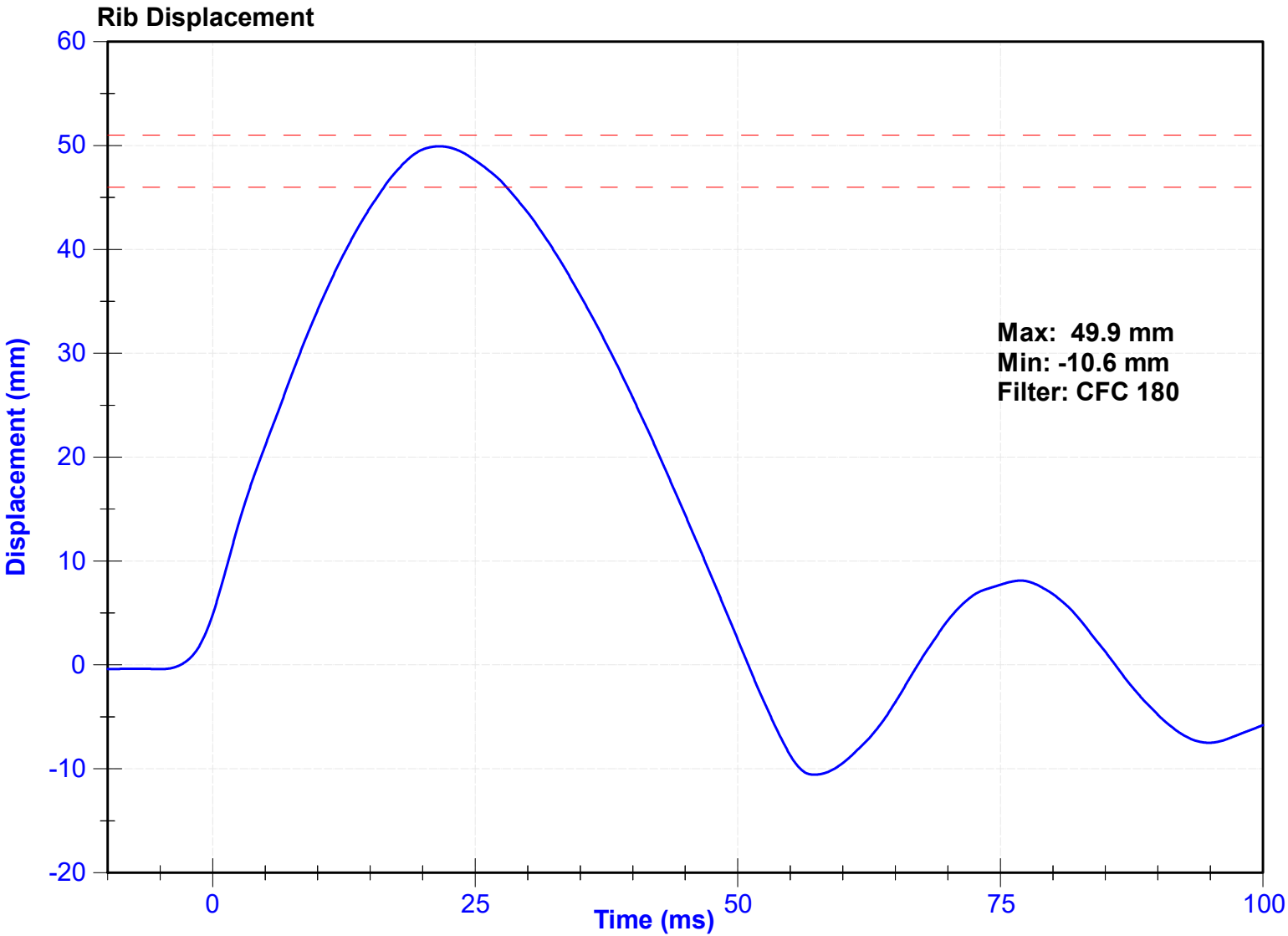
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	22	Pass
Rib Displacement	46	51	mm	49.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	807	1/31/2024	7/31/2024



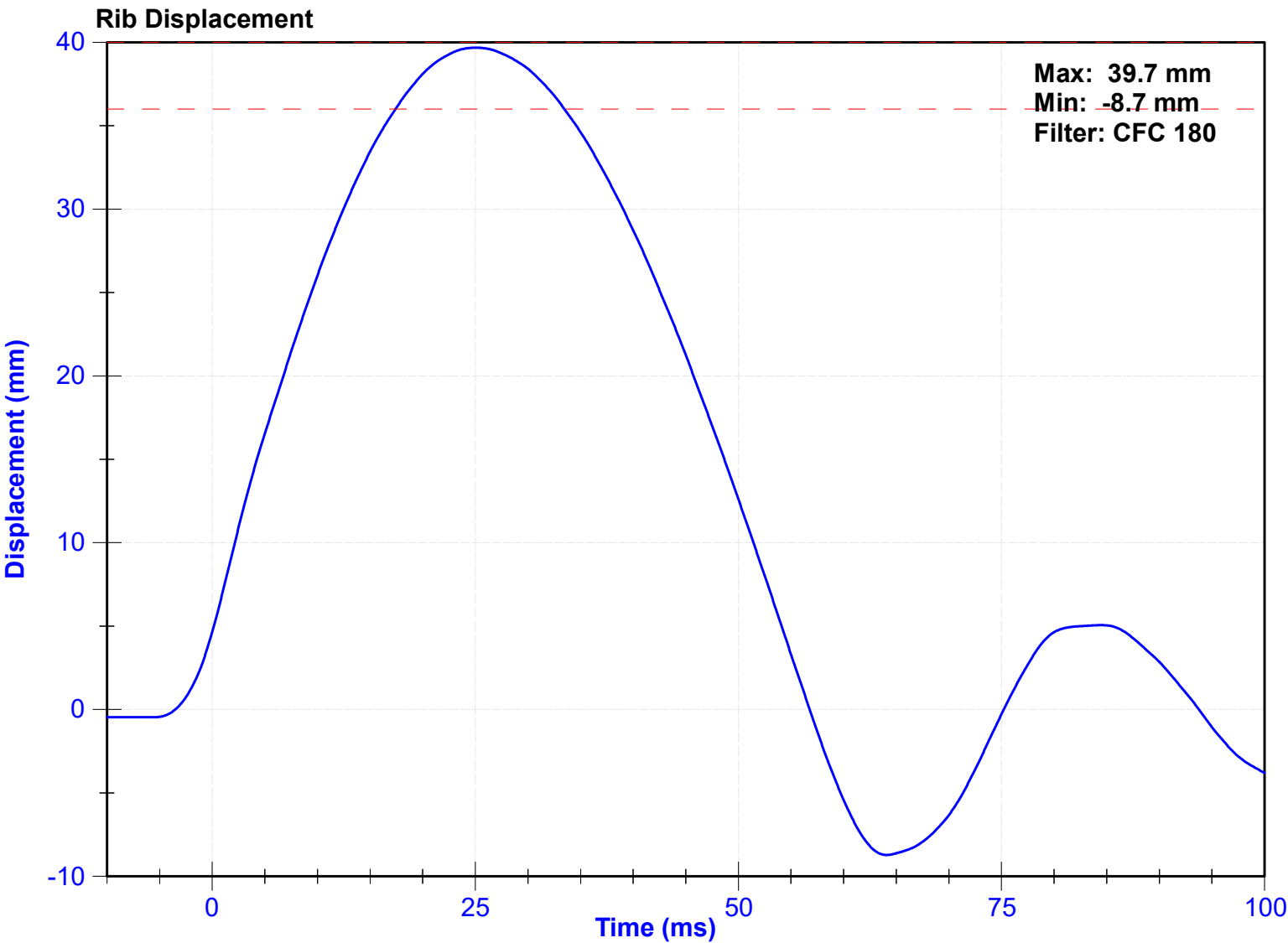
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	22	Pass
Rib Displacement	36	40	mm	39.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	807	1/31/2024	7/31/2024



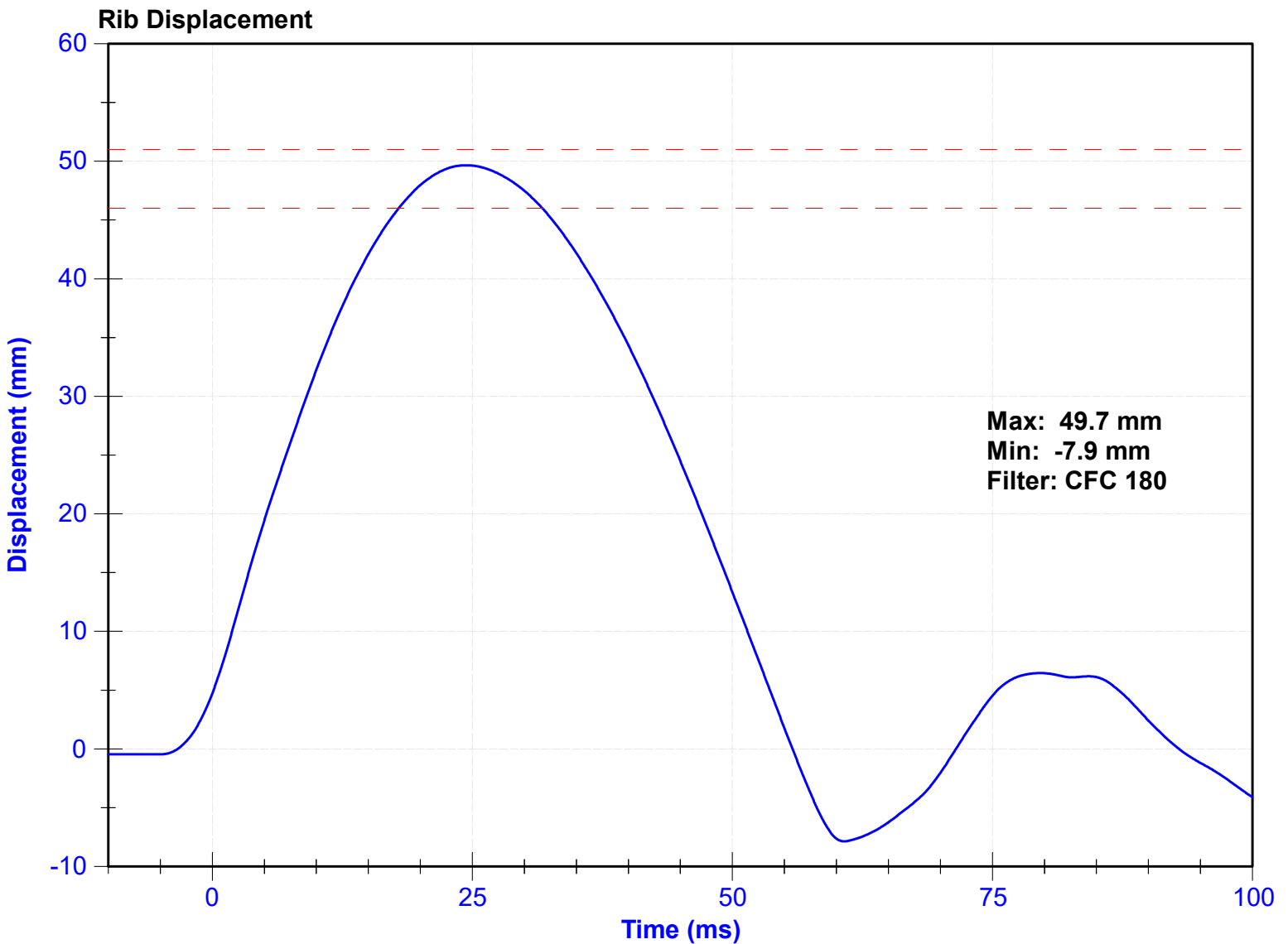
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	22	Pass
Rib Displacement	46	51	mm	49.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-03	1/31/2024	7/31/2024



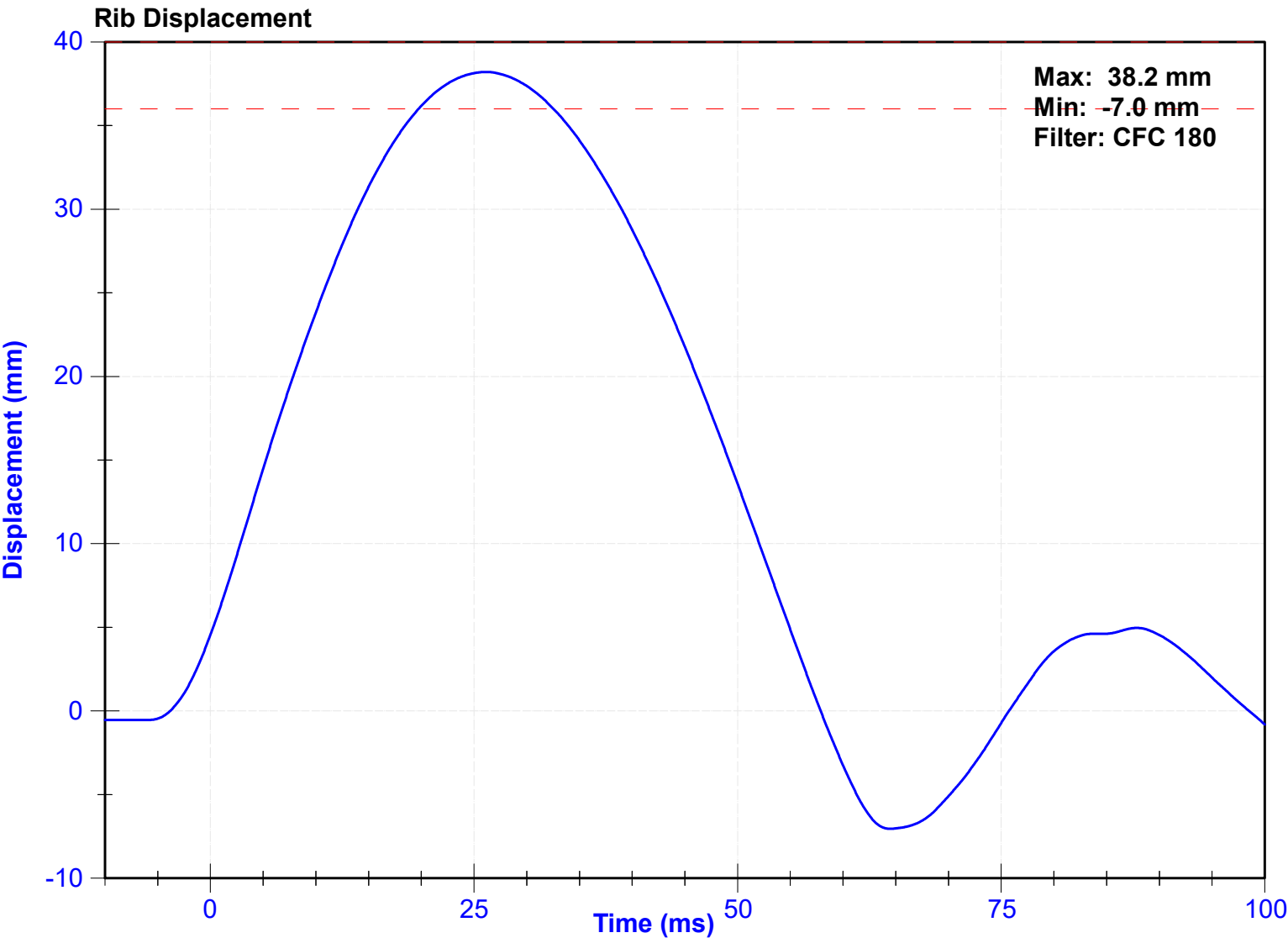
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	22	Pass
Rib Displacement	36	40	mm	38.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	0552-03	1/31/2024	7/31/2024



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

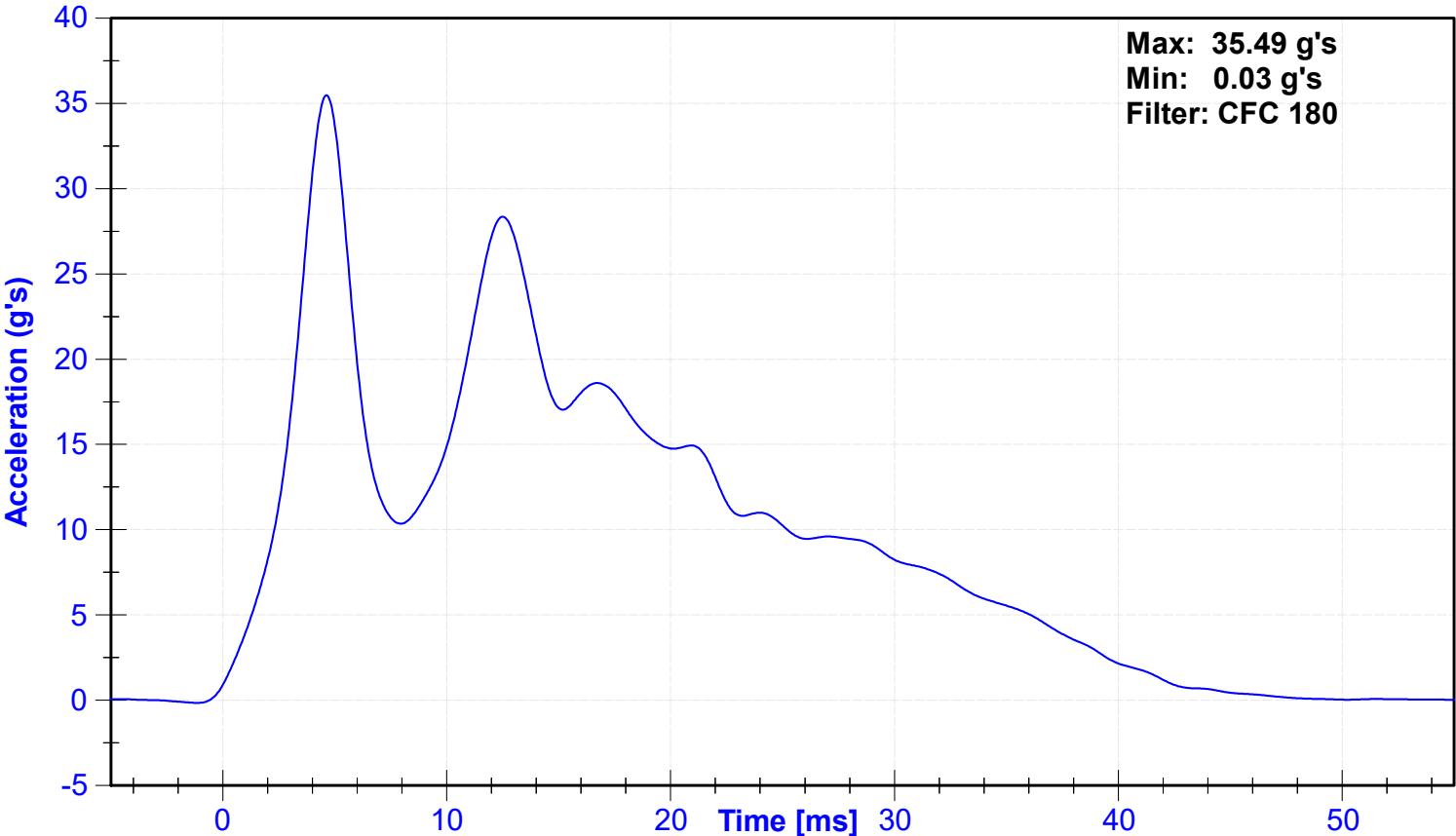
Results

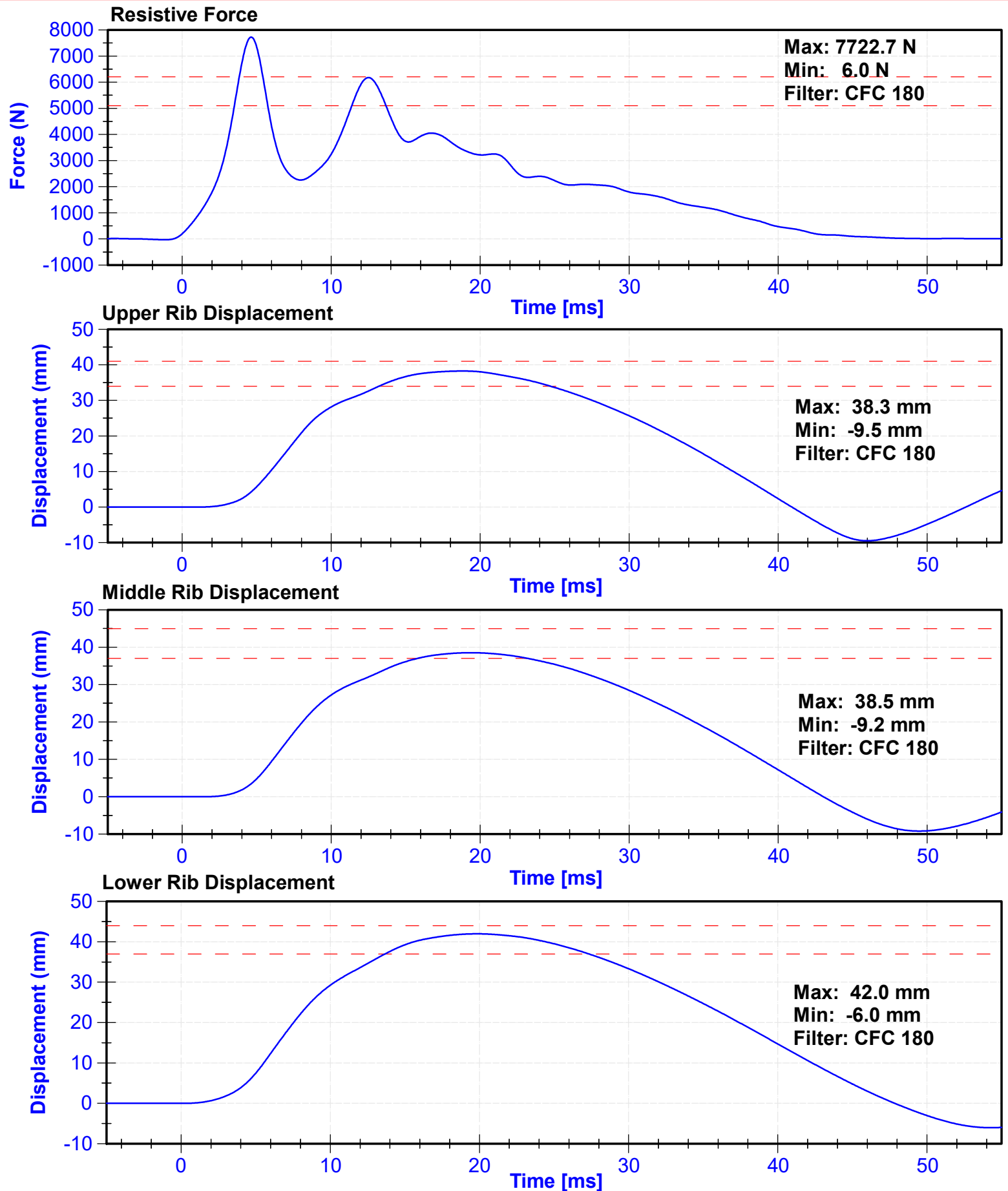
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	18	Pass
Velocity	5.4	5.6	m/s	5.52	Pass
Resistive Force after 6ms	5100	6200	N	6172.6	Pass
Upper Thorax Rib Deflection	34	41	mm	38.3	Pass
Mid Thorax Rib Deflection	37	45	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	18587	11/20/2023	11/19/2024
Upper Thorax Rib Potentiometer	Honeywell	0552-01	1/31/2024	7/31/2024
Middle Thorax Rib Potentiometer	Honeywell	807	1/31/2024	7/31/2024
Lower Thorax Rib Potentiometer	Honeywell	0552-03	1/31/2024	7/31/2024

Probe Acceleration





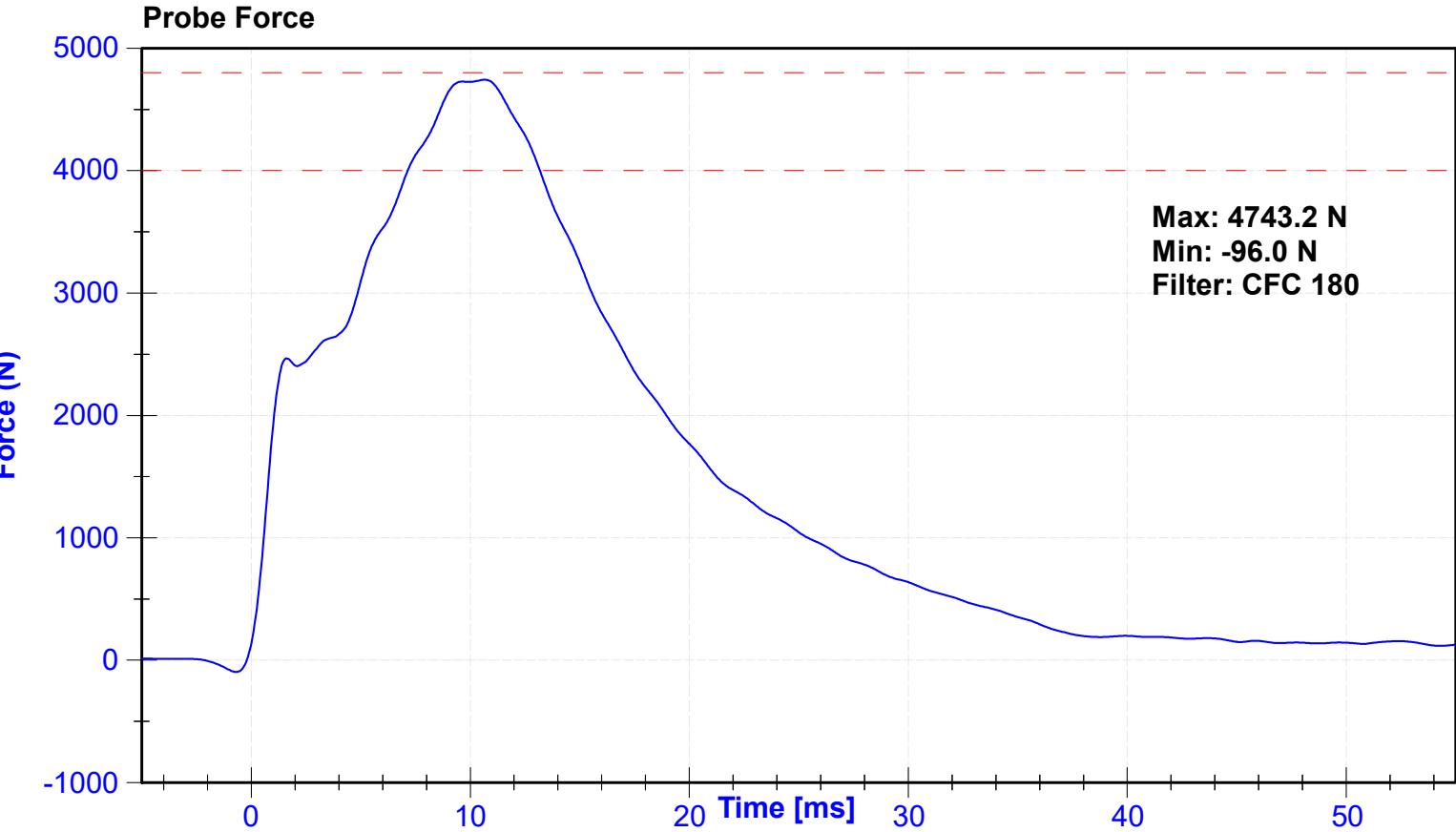
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

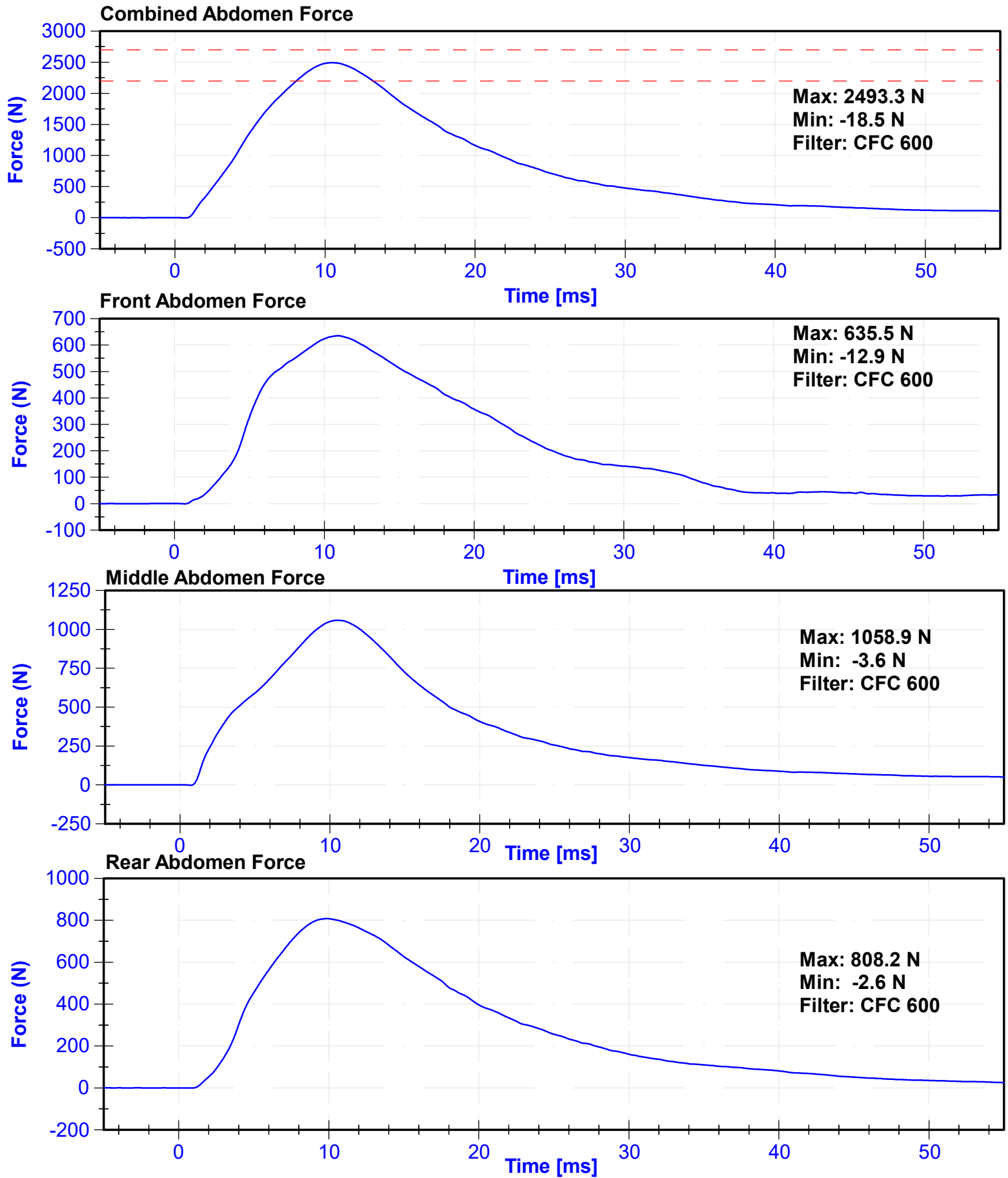
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	18	Pass
Velocity	3.9	4.1	m/s	4.02	Pass
Combined Abdomen Force	2200	2700	N	2493.3	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.45	Pass
Resistive Probe Force	4000	4800	N	4743.2	Pass
Time at Peak Resistive Force	10.6	13.0	ms	10.65	Pass

Transducer Calibrations

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





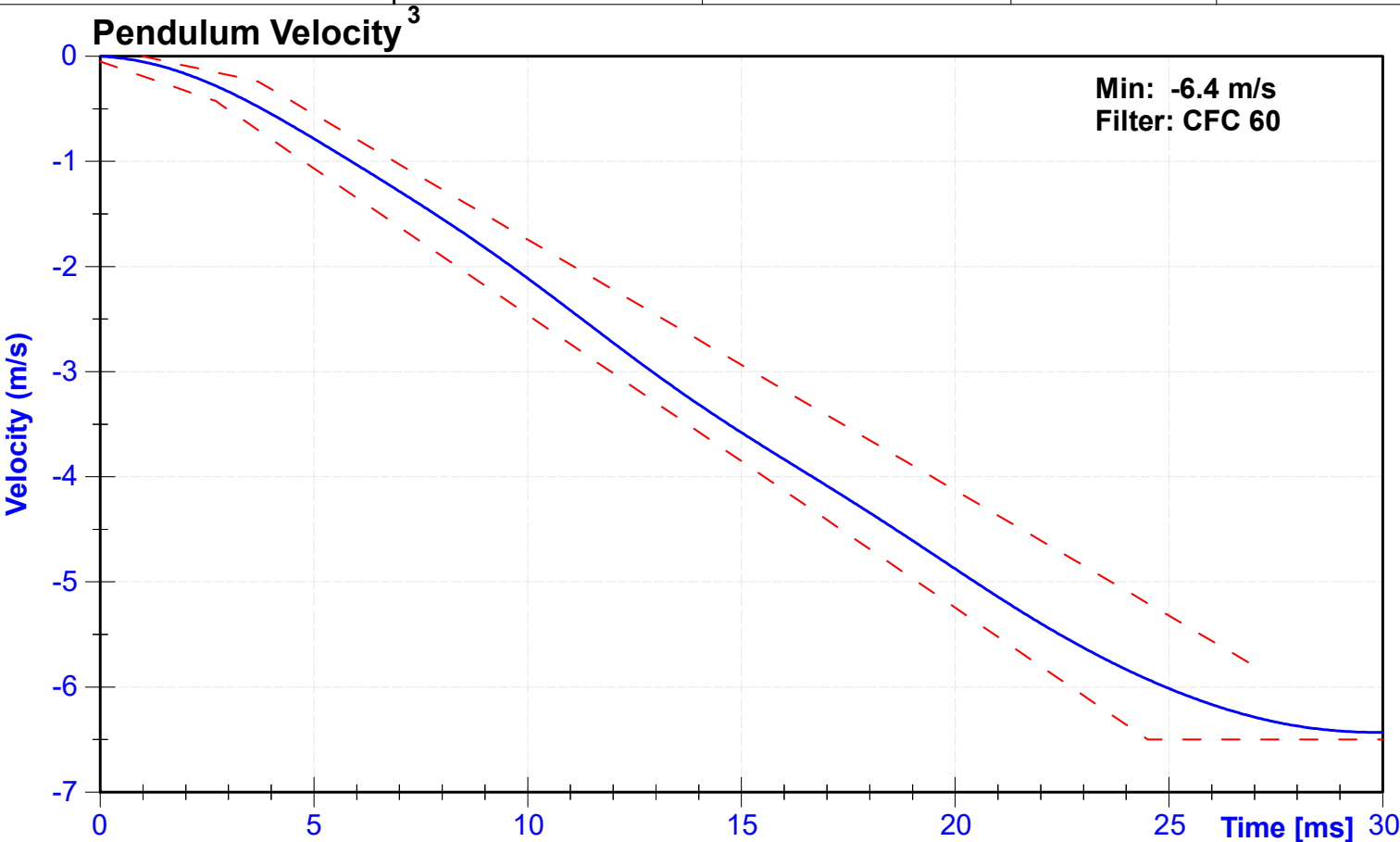
ATD Manufacturer	Denton	Test Technician	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

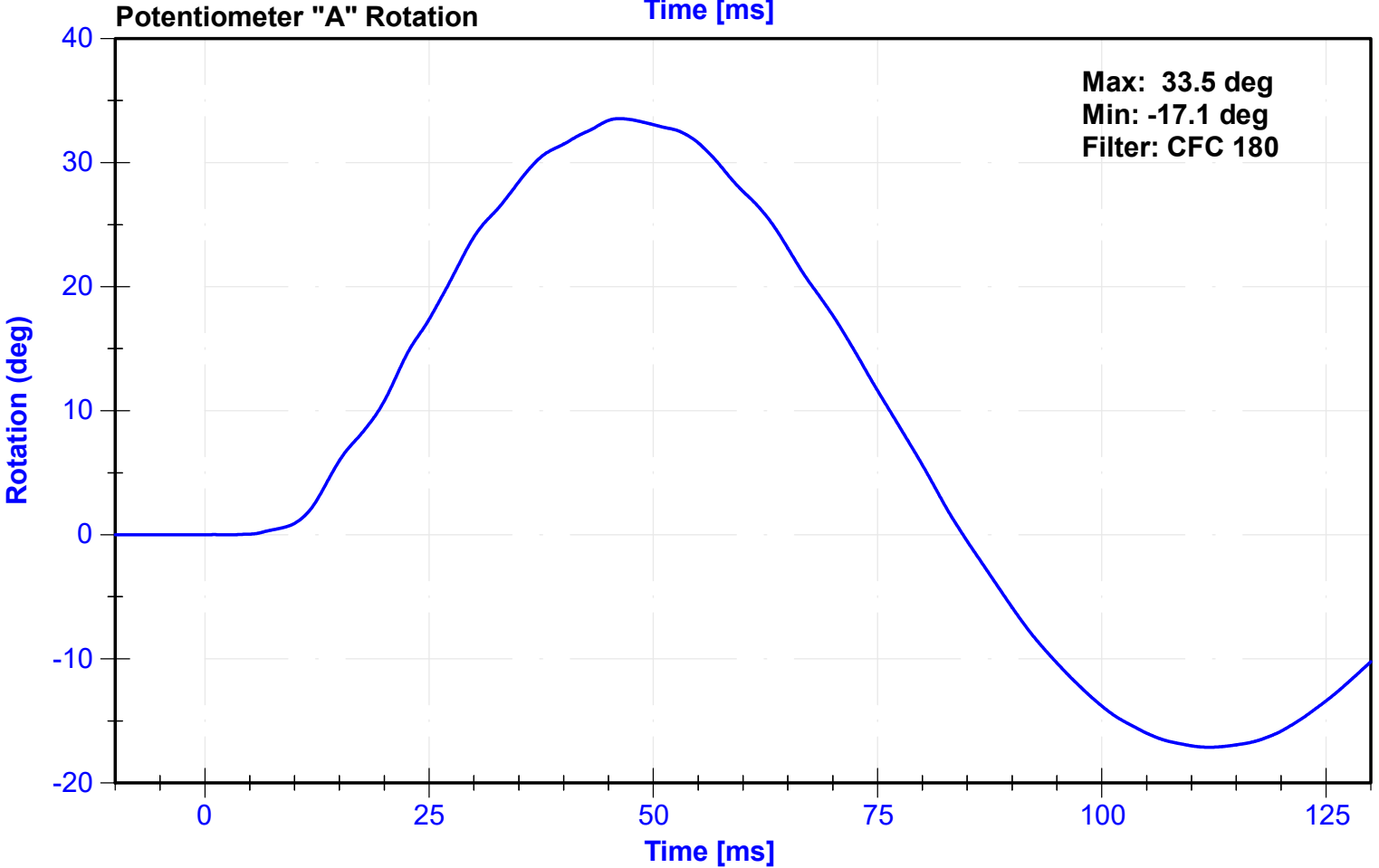
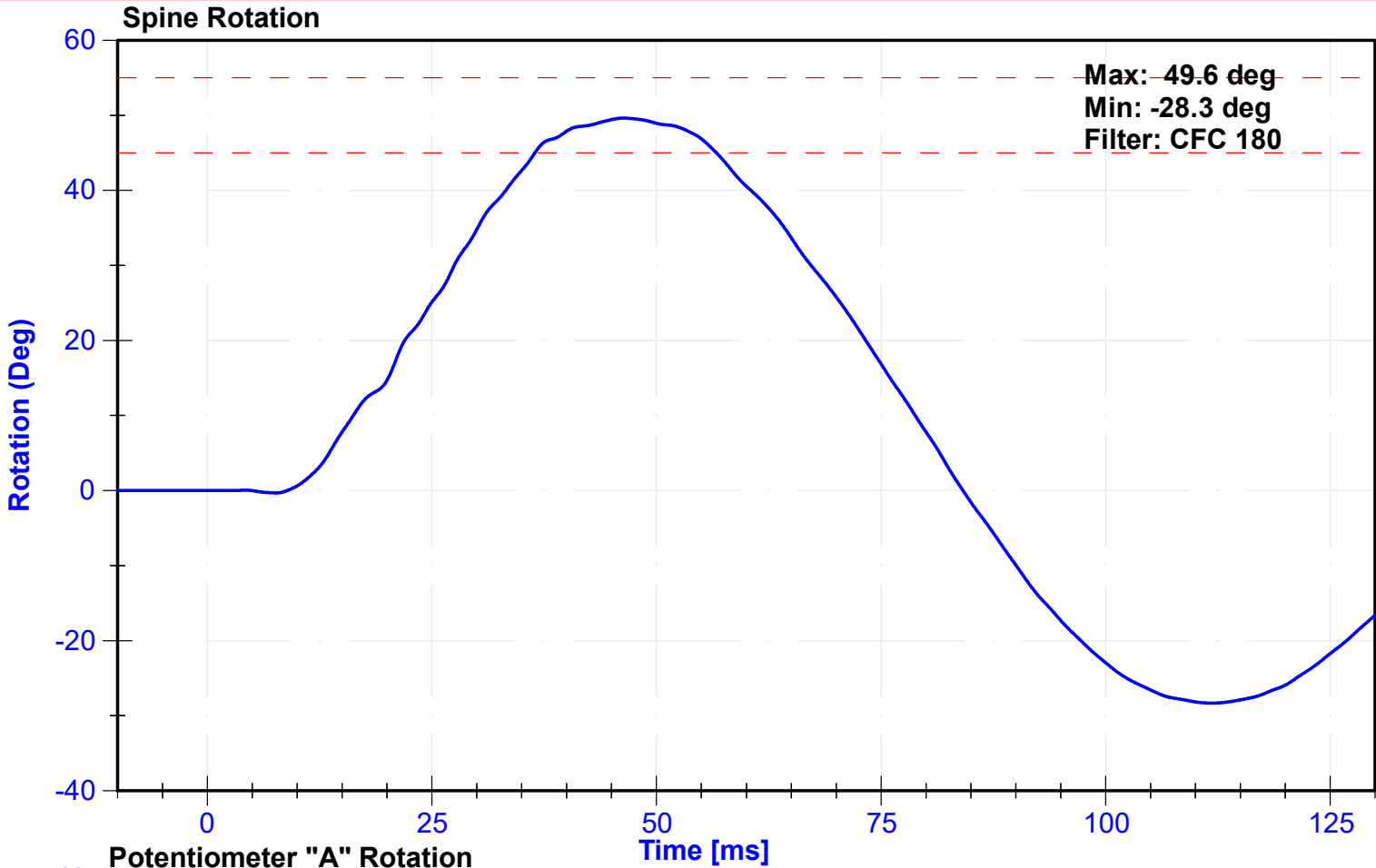
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	17	Pass
Velocity	5.95	6.15	m/s	6.009	Pass
Lateral Spine Rotation	45	55	deg	49.6	Pass
Time at Maximum Rotation	39	53	ms	46.3	Pass
Time of Decay to Zero Degrees	37	57	ms	37.8	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

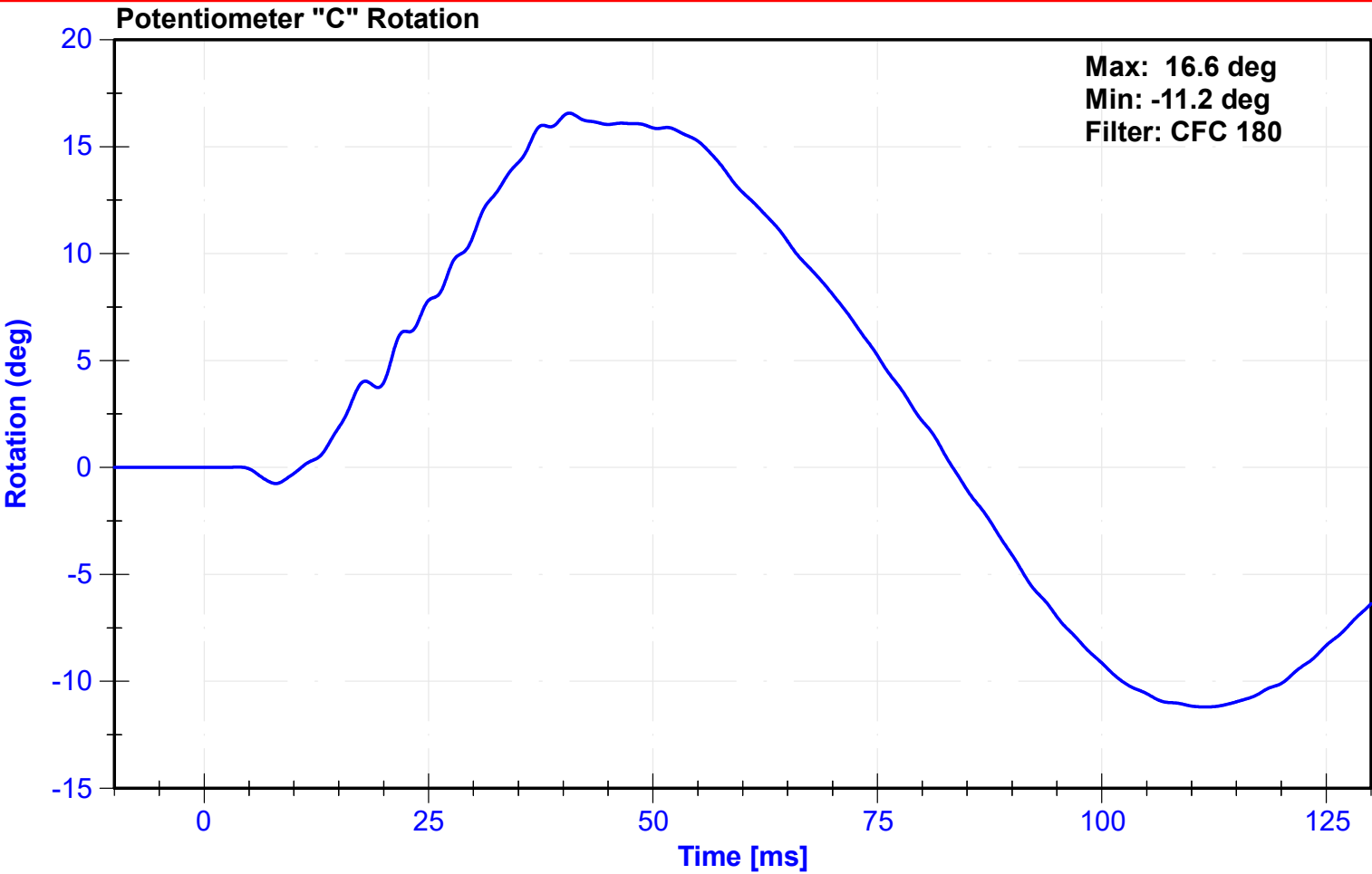
Transducer Calibrations

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



^{1,2} Upper and lower boundaries specified in Appendix I
IV-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	D. Sakona
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

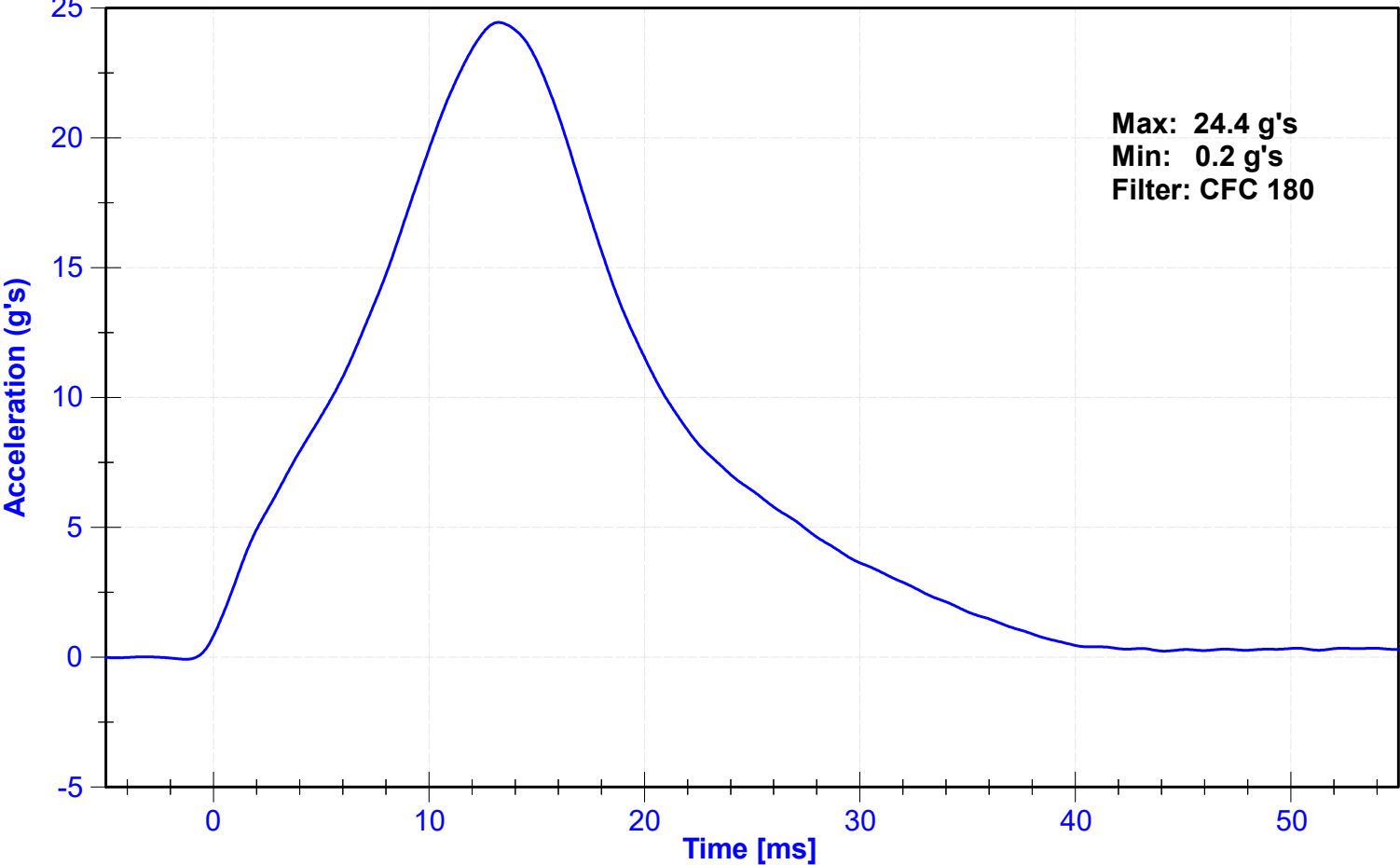
Results

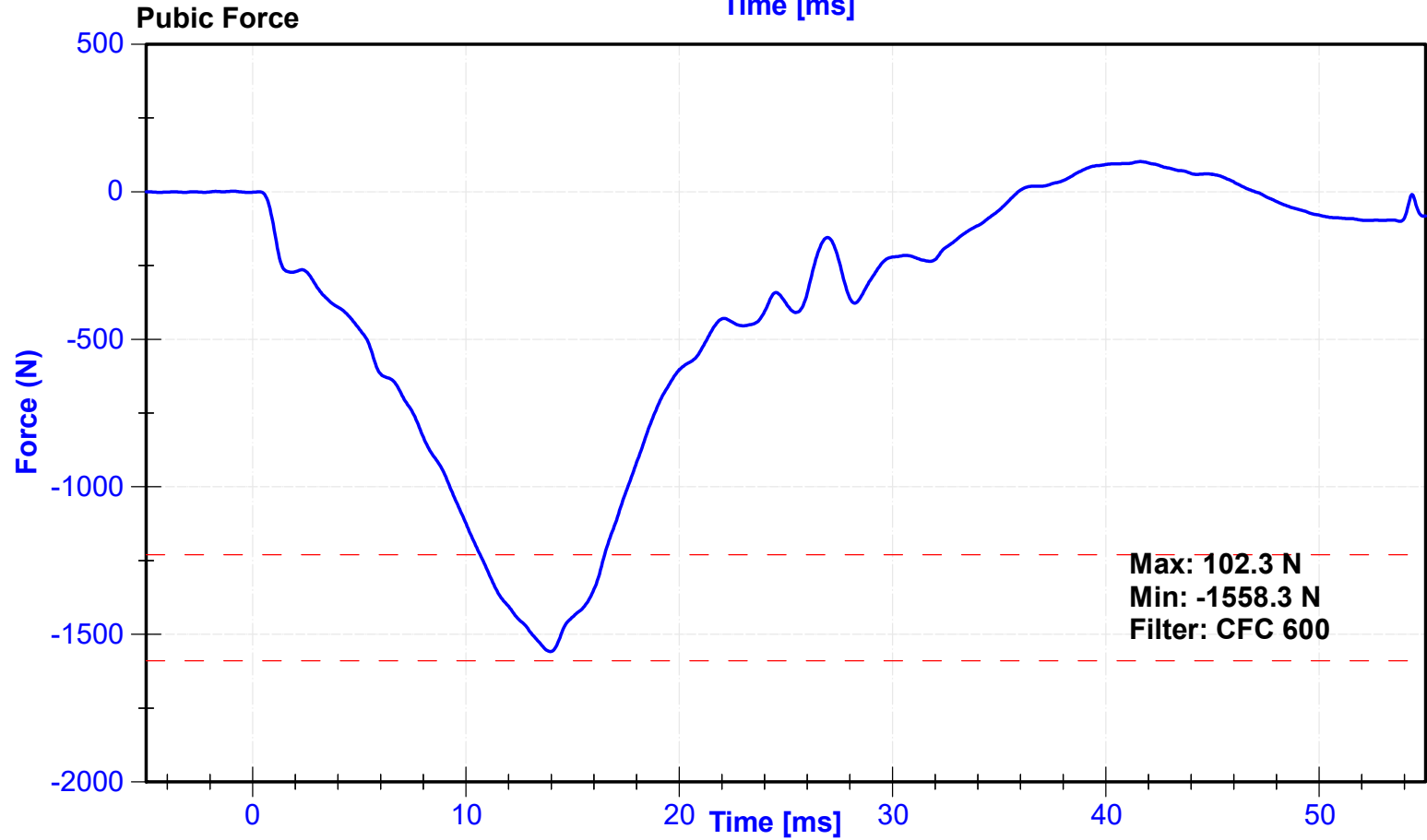
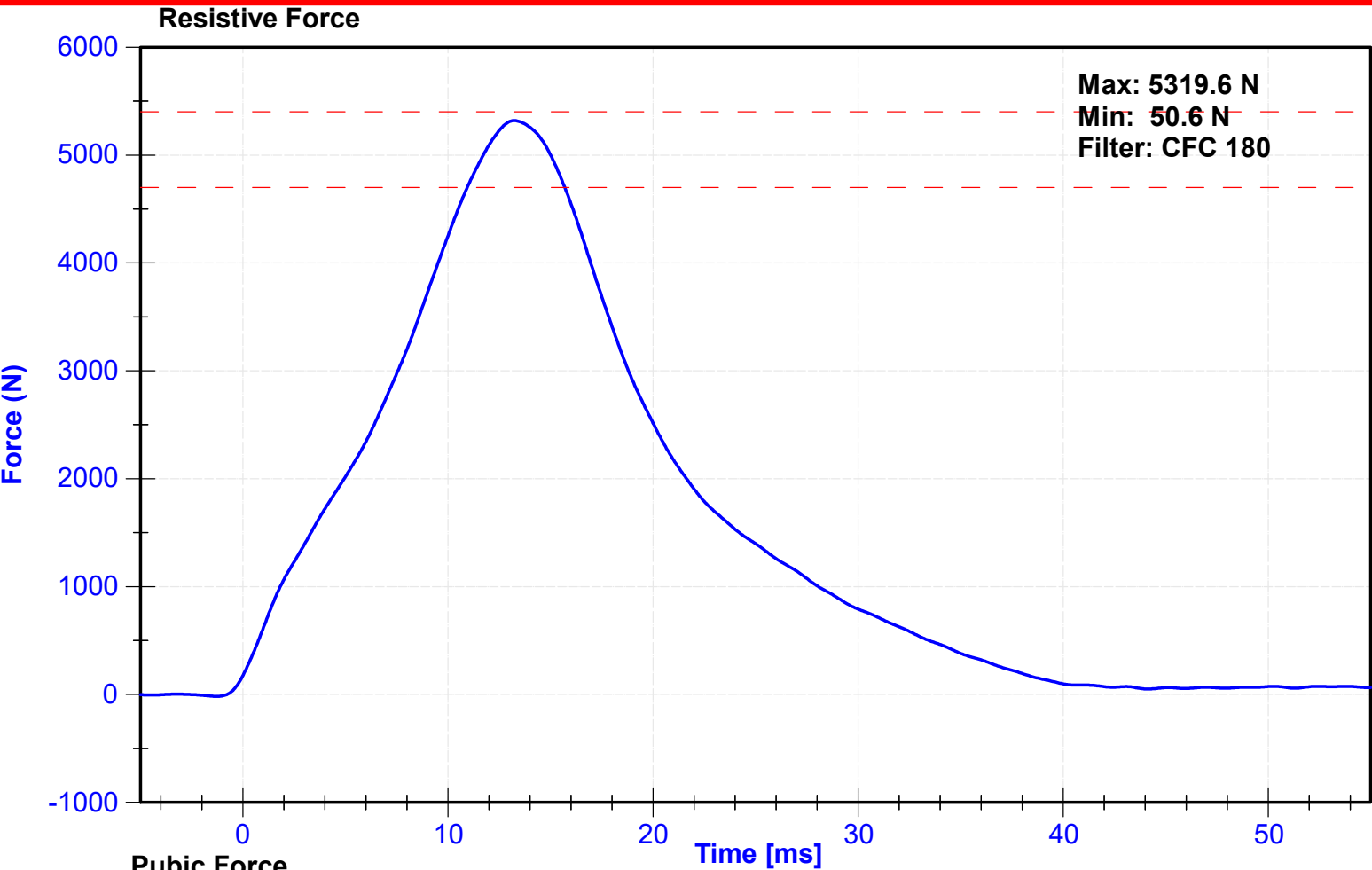
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.9	Pass
Humidity	10	70	%	18	Pass
Velocity	4.2	4.4	m/s	4.27	Pass
Resistive Force	4700	5400	N	5319.6	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.25	Pass
Pubic Force	-1590	-1230	N	-1558.3	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.95	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	11/19/2024
Pubic Load Cell	Denton	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	02/01/2024
		Y	T22281	Endevco	02/01/2024
		Z	T26050	Endevco	02/01/2024
	Redundant	X	T21682	Endevco	02/01/2024
		Y	T25989	Endevco	02/01/2024
		Z	T25864	Endevco	02/01/2024
Thorax Rib Displacement Potentiometers	Upper	Y	0552-01	Honeywell	01/31/2024
	Middle	Y	807	Honeywell	01/31/2024
	Lower	Y	0552-03	Honeywell	01/31/2024
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	02/01/2024
		Y	18722	Endevco	12/29/2023
		Z	18720	Endevco	12/29/2023
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	G23876	Endevco	01/26/2024
Vehicle Center of Gravity	Y	G24634	Endevco	11/30/2023
Vehicle Center of Gravity	Z	G24022	Endevco	01/26/2024
Left Floor Sill	Y	G24639	Endevco	11/29/2023
A-Pillar Sill	Y	G24961	Endevco	01/09/2024
A-Pillar Low	Y	G24955	Endevco	01/10/2024
A-Pillar Mid	Y	G24957	Endevco	01/09/2024
B-Pillar Sill	Y	G24953	Endevco	01/09/2024
B-Pillar Low	Y	G24637	Endevco	11/29/2023
B-Pillar Mid	Y	G24952	Endevco	01/09/2024
Driver Seat	Y	G24640	Endevco	11/29/2023
Engine Top	X	G22718	Endevco	12/08/2023
Engine Top	Y	G22746	Endevco	12/08/2023
Firewall	Y	G24636	Endevco	11/30/2023
Right Roof	Y	G24958	Endevco	01/09/2024
Right Floor Sill	Y	G24959	Endevco	01/10/2024
Rear Floorpan	X	G22639	Endevco	12/07/2023
Rear Floorpan	Y	G22918	Endevco	12/07/2023