REPORT NUMBER: 214P-CAL-23-011

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

Nissan Motor CO., LTD
2023 Nissan Z
2 Door Coupe

NHTSA No: C20235203

PREPARED BY:
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September 5, 2023

FINAL REPORT

PREPARED FOR:
U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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WASHINGTON, D.C. 20590

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Prepared by:  Date: September 5, 2023

Quinn Porzio, Test Engineer

Approved by:  Date: September 5, 2023

Alexander Rudniski, Test Engineer

FINAL REPORT ACCEPTANCE BY OVSC:

_____

Accepted by

Date: _____

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7. Author(s) Quinn Porzio, Test Engineer Alexander Rudniski, Test Engineer	***8. Performing Organization Report No.*** CAL-DOT-2023-011
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225	***10. Work Unit No.***
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12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance 1200 New Jersey Ave., SE Washington, D.C. 20590	***13. Type of Report and Period Covered:*** Final Test Report August 23, 2023 - September 5, 2023
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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 Nissan Z 2 Door Coupe 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 August 23, 2023.

The impact velocity of the vehicle was 30.84 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 -336 mm located at level 3. The test vehicle's occupant performance data is as follows:

Measurement Description	Front Passenger ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	339.679
Maximum Thoracic Rib Deflection	mm	44	20.891
Total Abdominal Force	N	2500	762.990
Pubic Symphysis Force	N	6000	-2411.996

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	***18. Distribution Statement***
Compliance Testing Side Impact Protection Pole Test ES-2re SID-IIs	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 2023 FMVSS 214 Side Impact Protection Compliance Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-17-D-00078. The purpose of this test was to evaluate side impact protection in a 2023 Nissan Z 2 Door Coupe. 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 Nissan Z 2 Door Coupe. The subject vehicle was towed into the rigid pole at an angle of 285^{o} and a velocity of 30.84 km/h. The test was conducted by Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on August 23, 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	339.679
Upper Rib Deflection	mm	44	20.891
Mid Rib Deflection	mm	44	17.705
Lower Rib Deflection	mm	44	19.841
Abdominal Load (front)	N		230.033
Abdominal Load (mid)	N		278.448
Abdominal Load (rear)	N		358.863
Total Abdominal Force	N	2500	762.990
Pubic Symphysis Force	N	6000	-2411.996

SECTION 2

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

DATA SHEET NO. 1
TEST VEHICLE INFORMATION AND OPTIONS

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023

TEST VEHICLE INFORMATION AND OPTIONS

Make	Nissan
Model	Z
Body Style	Coupe
VIN	JN1BZ4BH2PM311797
Body Color	Black
Engine Displacement (L)	3.0
Type / No. Cylinders	V6
Engine Placement	Inline
Transmission Type	Automatic
Transmission Speeds	9 -Speeds
Overdrive	Yes
Final Drive	Rear Wheel Drive
Odometer Reading (mi)	16 Miles

Anti-Lock Brakes (ABS)	Yes
All-Wheel Drive (AWD)	No
Traction Control System (TCS)	Yes
Electric Stability Control (ECS)	Yes
Curtain Airbags	Yes
Torso Airbags – Front Seats	Yes
Torso Airbags – Rear Seats	N/A
Combination/Head Torso Bag	No
Pelvic Airbag – Front Seats	No
Pelvis Airbag – Rear Seats	N/A
Knee Airbag – Driver	No
Knee Airbag – Front Passenger	No
Seat Belt Pretensioners – Front Seats	Yes
Seat Belt Pretensioners – Rear Seats	N/A
Seat Belt Load Limiter – Front Seats	Yes
Seat Belt Load Limiter – Rear Seats	N/A
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	No

DATA FROM CERTIFICATION LABEL

Manufactured By	Nissan Motor CO., LTD
Date of Manufacture	01/23
Vehicle Type	Passenger Car

GVWR (kg)	1910
GVWR Front (kg)	1040
GVWR Rear (kg)	920

VEHICLE SEATING AND WEIGHT CAPACITY DATA

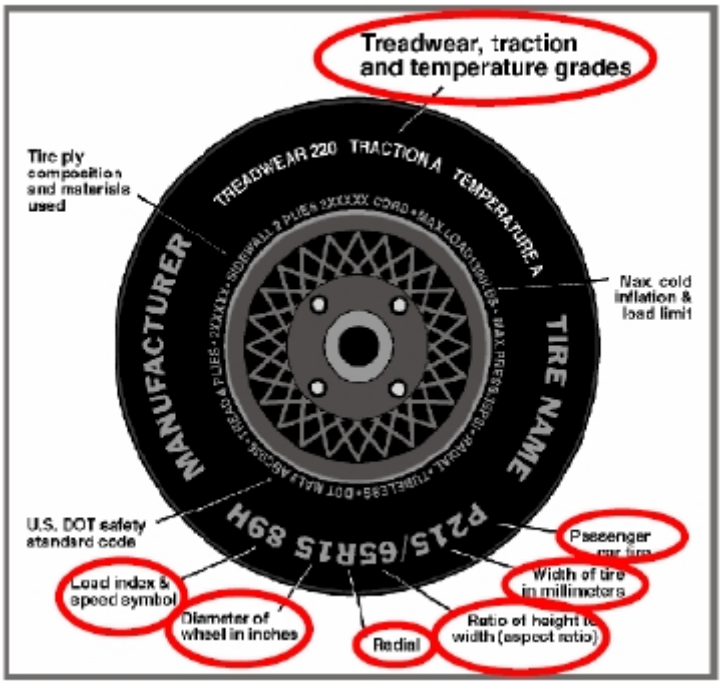
Measured Parameter	Front	Rear	Third	Total
Type of Seats (Bench or Bucket)	Bucket	N/A	N/A	
Designated Seating Capacity (DSC)	2	N/A	N/A	2
Capacity Weight (VCW) (kg)				204
Cargo Weight (RCLW) (kg)				67.92

DATA SHEET NO. 2
VEHICLE TIRE INFORMATION

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023

VEHICLE TIRE INFORMATION

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



TIRE SIDEWALL INFORMATION

Tire Placard	Front	Rear
Recommended Cold Pressure (kPa)	220	200
Recommended Tire Size	255/40R19	275/35R19
Tire Sidewall	**Front**	**Rear**
Maximum Tire Pressure (kPa)	350	350
Tire Size on Vehicle	255/40R19	275/35R19
Tire Manufacturer Model	Bridgestone	Bridgestone
Tire Name	Potenza S007	Potenza S007
Tire Type	Summer	Summer
Tire Width	255	275
Aspect Ratio	40	35
Radial	Yes	Yes
Wheel Diameter	19	19
Load Index / Speed Symbol	96W	96W
Treadwear	240	240
Traction Grade	A	A
Temperature Grades	A	A

DATA SHEET NO. 3
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Nissan Z 2 Door Coupe | NHTSA No.: C20235203
Test Facility: Calspan | Test Date: 08/23/2023

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	240	241	230	227
Tire Placard	kPa	220	220	200	200

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			Fully Loaded			As Tested		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	475	346		484	392		484	395	
Right	kg	458	361		491	424		484	417	
Ratio	%	56.9	43.1		54.4	45.6		54.4	45.6	
Totals	kg	933	707	1640	975	816	1791	968	812	1780

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1640	(A)
Weight of Test Dummy	kg	81	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	67.9	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1788.9	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	As Delivered	Fully Loaded	As Tested
Driver Door Sill Angle	Deg	+0.25	+0.05	+0.20
Front Passenger Sill Angle	Deg	-0.30	-0.10	-0.20
Front Bumper-Line Angle	Deg	-0.30	+0.10	+0.05
Rear Bumper-Line Angle	Deg	-0.20	-0.70	-0.25

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

CALCULATION OF VERTICAL IMPACT REFFERENCE LINE

Measured Parameter	Units	Value
Test Vehicle Wheelbase	mm	2547
Vertical Impact Reference Line Aft of Front Axle	mm	1430

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting/Trim	7
Rear Speaker	4
Tools	4
Ballast (if any)	25

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

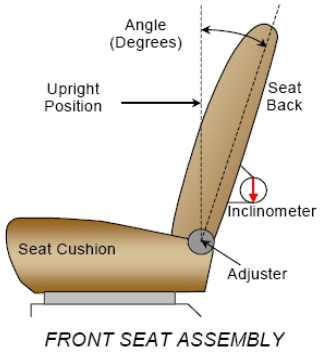
Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023

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	8.9
Front Passenger Seat	Degrees	10.0

**Measurement taken on headrest post*



FRONT SEAT ASSEMBLY

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (º)	SCRP Height Position	SCRP Height (mm)		
			Rearmost	Mid-Fore / Aft	Forward-Most
Driver Seat	16.8	Max	24	44	64
		Mid	13	33	53
		Min	2	22	42
Front Passenger Seat	Fixed	Max			
		Mid			
		Min			

SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Placed in Position #	
	mm	Detents	mm	Detents
Driver Seat	235	Powered	118	Powered
Front Passenger Seat	235	Powered	118	Powered

SEAT BELT ANCHORAGE ADJUSTMENT

Seat	Total # of Positions	Placed in Position #
Front Passenger Seat	Fixed	Fixed

HEAD RESTRAINT ADJUSTMENT

Seat	Total # of Positions	Placed in Position #
Front Passenger Seat	2 (0-1)	Uppermost

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

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023

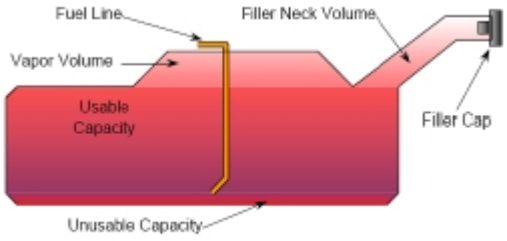
FUEL TANK CAPACITY

Description	Liters
Usable Capacity of (Form No.1)	62
Usable Capacity of (Owner's Manual)	62
92 - 94% of Usable Capacity	57.0 - 58.3
Actual Amount of Solvent Used in Test	57.6

FUEL PUMP

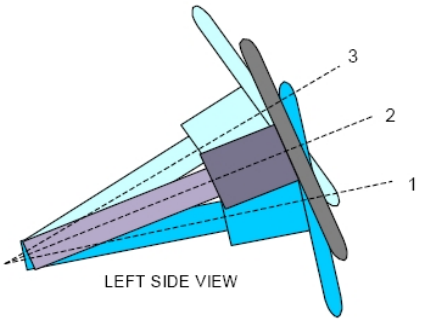
Describe the operation of the fuel pump.

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



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN POSITIONS

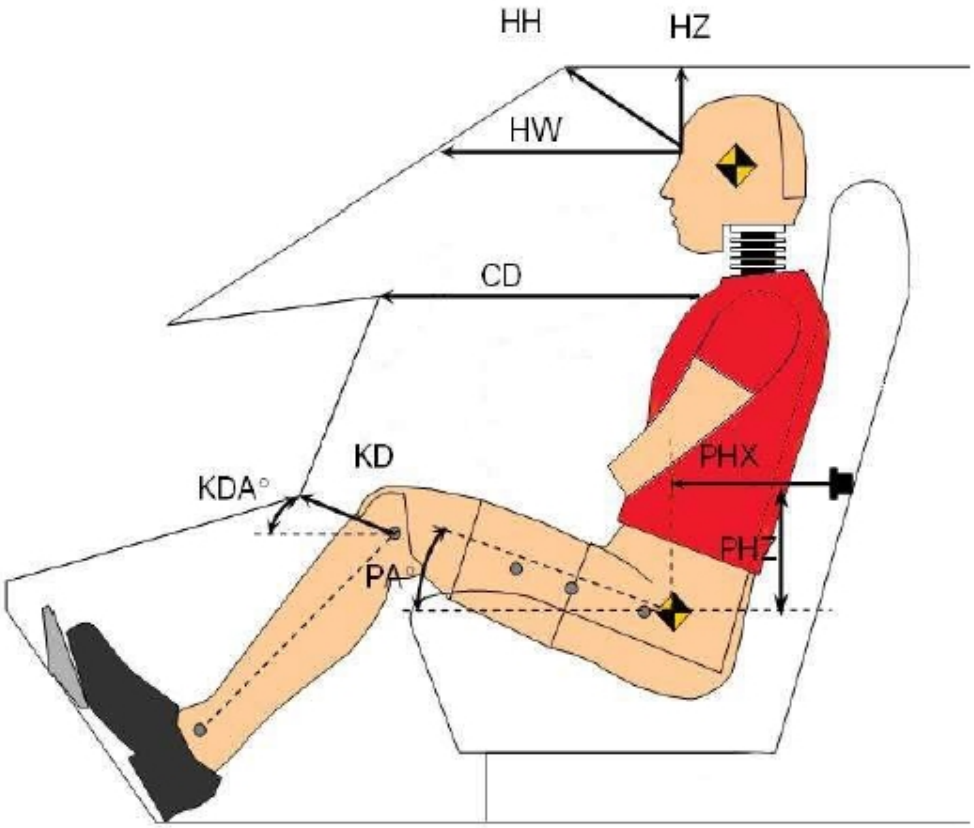


STEERING COLUMN ASSEMBLY

	Degrees	Fore / Aft Position (mm)
Lowermost - Position No. 1	17.2	
Geometric center - Position No. 2	13.8	
Uppermost - Position No. 3	10.4	
Telescoping Steering Wheel Travel		45
Test Position	13.8	22.5

DATA SHEET NO. 6
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023

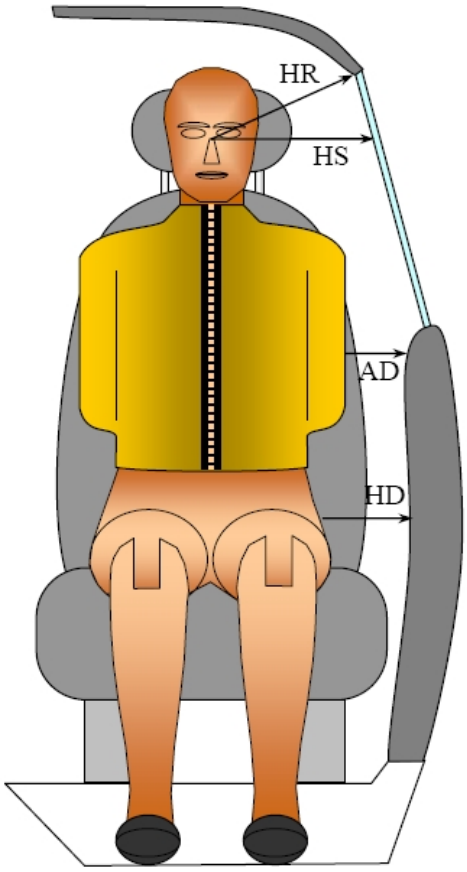


DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Description	Front Passenger	
		Length (mm)	Angle (°)
HH	Head to Header	328	
HW	Head to Windshield	482	
HZ	Head to Roof Liner	135	
NR	Nose to Dash	580	
CD	Chest to Dash	544	
KD(L) / KDA(L)◦	Left Knee to Dash	122	49.7
KD(R) / KDA(R)◦	Right Knee to Dash	136	48.3
PAX◦	Pelvic Tilt Angle (X-Axis)		25.2
PAY◦	Pelvic Tilt Angle (Y-Axis)		0.6
PHX	Hip Point to Striker (X-Axis)	396	
PHZ	Hip Point to Striker (Z-Axis)	176	

DATA SHEET NO. 7
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023



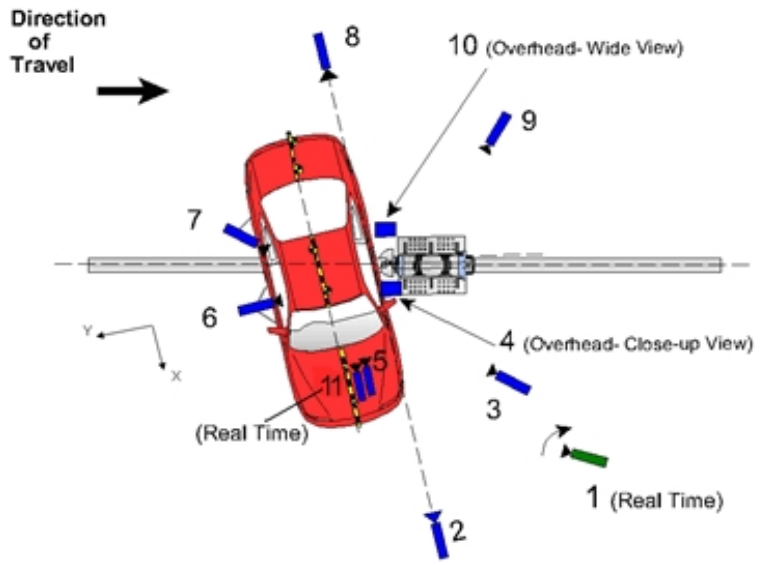
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Front Passenger
HR	Head to Side Header	mm	182
HS	Head to Side Window	mm	316
AD	Arm to Door	mm	48
HD	H-Point to Door	mm	132

DATA SHEET NO. 8
LOCATION OF CAMERAS

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023



CAMERA LOCATIONS AND DATA

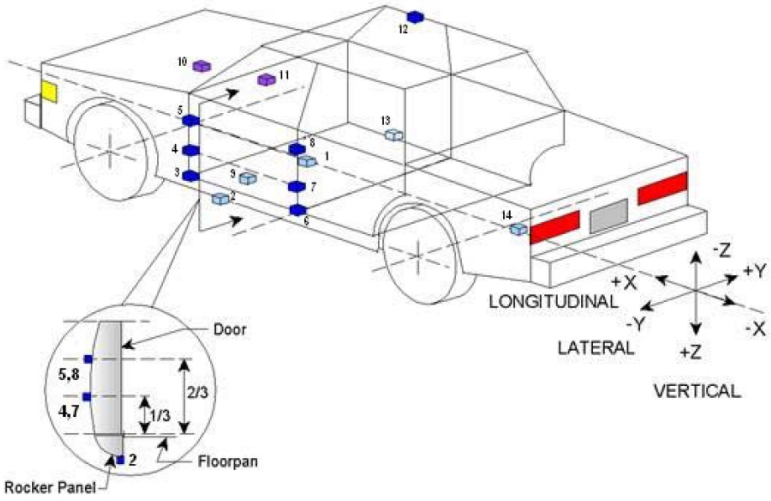
CAMERA LOCATIONS AND DATA

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	30
2	Front ground level - impact view	-568	-7170	-1304	28	1000
3	Impact side 45º - forward pole view	1056	-5654	-1273	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				8	1000
8	Rear ground level - impact view	0	7675	-1374	28	1000
9	Impact side 45º - rearward pole view	3483	5001	-1379	24	1000
10	Overhead wide - view of impact	0	0	-9200	16	1000

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

DATA SHEET NO. 9
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2135	4	471
2	Left Floor Sill	2293	663	730
3	A-Pillar Sill	2766	641	718
4	A-Pillar Low	2818	639	538
5	A-Pillar Mid	2530	649	133
6	B-Pillar Sill	1707	663	732
7	B-Pillar Low	1630	668	530
8	B-Pillar Mid	1522	658	207
9	Seat	2017	562	758
10	Engine	3665	128	312
11	Firewall	2998	-298	254
12	Roof	1418	-565	-176
13	Right Floor Sill	2289	-662	735
14	Rear Deck	863	2	584

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 Nissan Z 2 door Coupe NHTSA No.: C20235203
Test Facility: Calspan Test Date: 08/23/2023

Loc. No	Description	Axes	Units	Positive Direction		Negative Direction	
				Max	Time (ms)	Max	Time (ms)
1	Vehicle CG	X	g	5.79	34.90	-12.78	41.35
	Vehicle CG	Y	g	1.83	191.70	-25.50	33.65
	Vehicle CG	Z	g	12.51	42.35	-8.99	18.05
	Vehicle CG Resultant	N/A	g	26.19	33.85	0.04	-41.60
2	Floor Sill (Left)	Y	g	1.33	152.55	-16.42	32.85
3	A Pillar Sill	Y	g	17.52	24.65	-22.32	20.45
4	A Pillar Low	Y	g	36.90	37.30	-39.54	29.75
5	A Pillar Mid	Y	g	19.75	32.60	-44.11	37.95
6	B Pillar Sill	Y	g	27.90	34.40	-78.83	15.20
7	B Pillar Low	Y	g	39.74	24.40	-51.96	41.30
8	B Pillar Mid	Y	g	102.63	17.85	-122.11	14.30
9	Seat	Y	g	10.22	58.10	-49.96	25.60
10	Engine Top	X	g	5.93	100.20	-11.62	53.95
	Engine Top	Y	g	5.23	26.70	-17.80	56.55
11	Firewall	Y	g	0.76	215.50	-12.94	41.35
12	Roof	Y	g	2.13	252.00	-48.92	37.90
13	Floor Sill (Right)	Y	g	61.10	19.30	-100.21	13.10
14	Rear Deck	X	g	4.23	117.30	-7.78	54.00
	Rear Deck	Y	g	1.54	161.35	-20.84	55.00

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

Test Vehicle: 2023 Nissan Z 2 Door Coupe NHTSA No.: C20235203
Test Facility: Calspan Test Date: 08/23/2023

Dummy Serial No. DG5348

Description	Axes	Positive Direction		Negative Direction	
		MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (g)					
Longitudinal	X	4.04	125.60	-15.97	50.45
Lateral	Y	13.43	85.50	-55.30	49.75
Vertical	Z	12.00	21.80	-4.49	74.30
Resultant	N/A	57.43	49.75		
HIC36 (t1, t2)	N/A	339.68		**t1=**37.50	**t2=**61.60
THORAX DEFLECTION (mm)					
Upper Rib	Y	20.89	52.75	-0.52	86.65
Middle Rib	Y	17.71	60.65	-1.19	83.10
Lower Rib	Y	19.84	49.60	-0.01	-38.50
ABDOMINAL FORCES (N)					
Front	Y	230.03	28.70	-8.60	18.55
Middle	Y	278.45	26.80	-5.11	-48.65
Rear	Y	358.86	53.05	-14.13	105.75
SUM	N/A	762.99	28.85		
PELVIS FORCES (N)					
Pubic Symphysis	Y	17.90	23.90	-2412.00	43.05

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

DATA SHEET NO. 12
POST-TEST OBSERVATIONS

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023

IMPACT POINT DATA

Measured Parameter		Units	Value
Vertical Impact Ref Line	- Aft of Front Axle, Intended Impact Pt	mm	1430
Actual Impact Point	- Aft of Front Axle	mm	1430
Difference		mm	0

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Passenger Seat Dummy (ES2re)
Head Contact	Header, Curtain Airbag & Headrest
Upper Torso Contact	Torso/Pelvic Airbag & Seatback
Lower Torso Contact	Torso/Pelvic Airbag & Seatback
Left Knee Contact	Right Knee
Right Knee Contact	Door Trim

POST-TEST DOOR PERFORMANCE

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

POST-TEST SEAT PERFORMANCE

Description	Struck Side		Non-Struck Side	
	Front	Rear	Front	Rear
Seat Movement Along Seat Track	No	N/A	No	N/A
Seat Disengagement from Floor Pan	No	N/A	No	N/A

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	A-Pillar, B-Pillar & C-Pillar buckled
Sill Separation	None
Windshield Damage	Cracked troughout
Side Window Damage	Shattered and fell out
Other Notable Effects	None

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

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023

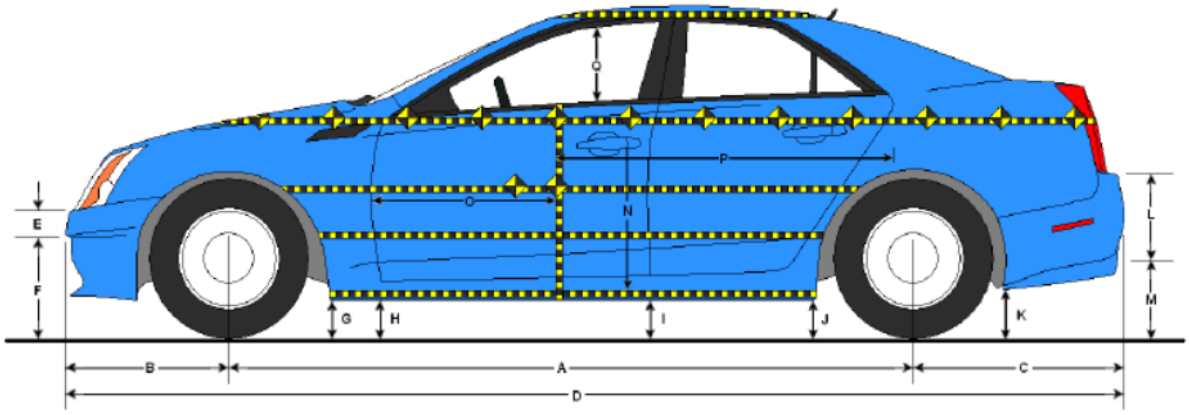
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Front Occupant	
	Mounted	Deployed
Front Airbag	Yes	No
Knee Airbag	No	N/A
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:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023



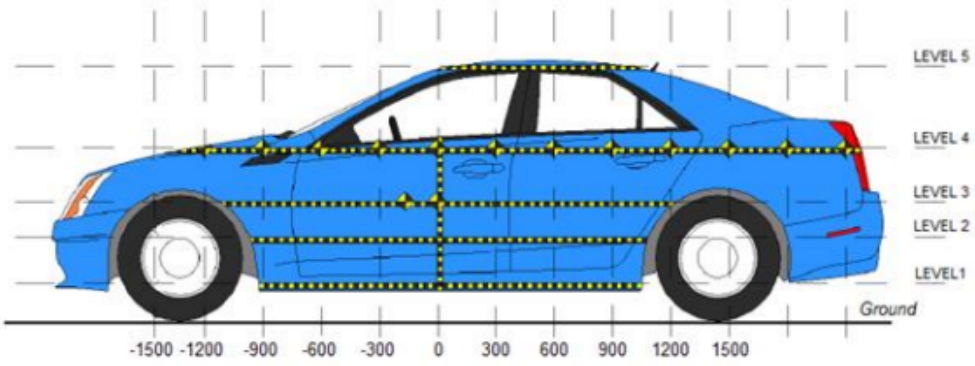
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

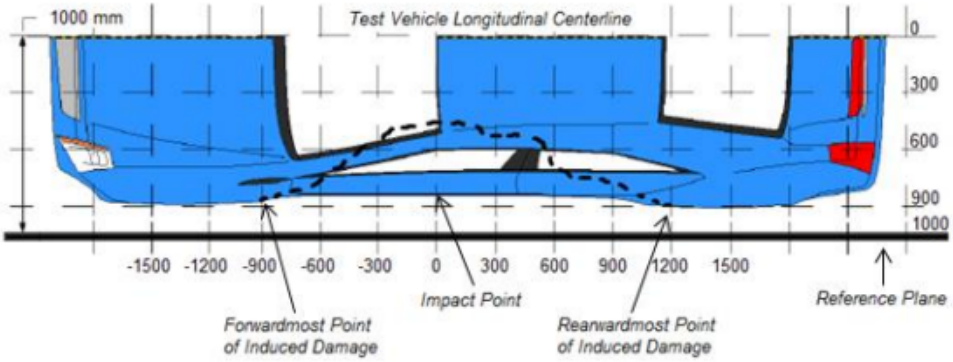
No.	Measurement Description	Pre-Test	Post-Test	Difference
A	Vehicle Wheelbase	2547	2562	15
B	Front Axle to FSOV	943	942	-1
C	Rear Axle to RSOV	888	877	-11
D	Total Vehicle Length at Centerline	4378	4381	3
E	Front Bumper Thickness	85	85	0
F	Front Bumper Bottom to Ground	405	511	106
G	Sill Height at Front Wheel Well	132	123	-9
H	Sill Height at Front Door Leading Edge	137	122	-15
I	Sill Height at B Pillar	146	129	-17
J1	Sill Height at Rear Wheel Well	126	138	12
J2	Pinch Weld Height at Rear Wheel Well	156	165	9
K	Sill Height Aft of Rear Wheel Well	202	182	-20
L	Rear Bumper Thickness	138	138	0
M	Rear Bumper Bottom to Ground	381	375	-6
N	Sill Height to Window Bottom Sill	763	803	40
O	Front Door Leading Edge to Impact CL	718	664	-54
P	Rear Door Trailing Edge to Impact CL	571	465	-106
Q	Front Window Opening	285	260	-26
R	Right Side Length	4258	4204	-54
S	Left Side Length	4255	4257	3
T	Vehicle Width at B-Pillars	1832	1772	-60

DATA SHEET NO. 14
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023



Left Side View



Overhead View

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	295	-288	0
2	Occupant H-Point	mm	461	-325	0
3	Mid-Door	mm	617	-336	0
4	Window Sill	mm	893	-254	0
5	Window Top	mm	1258	-77	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)

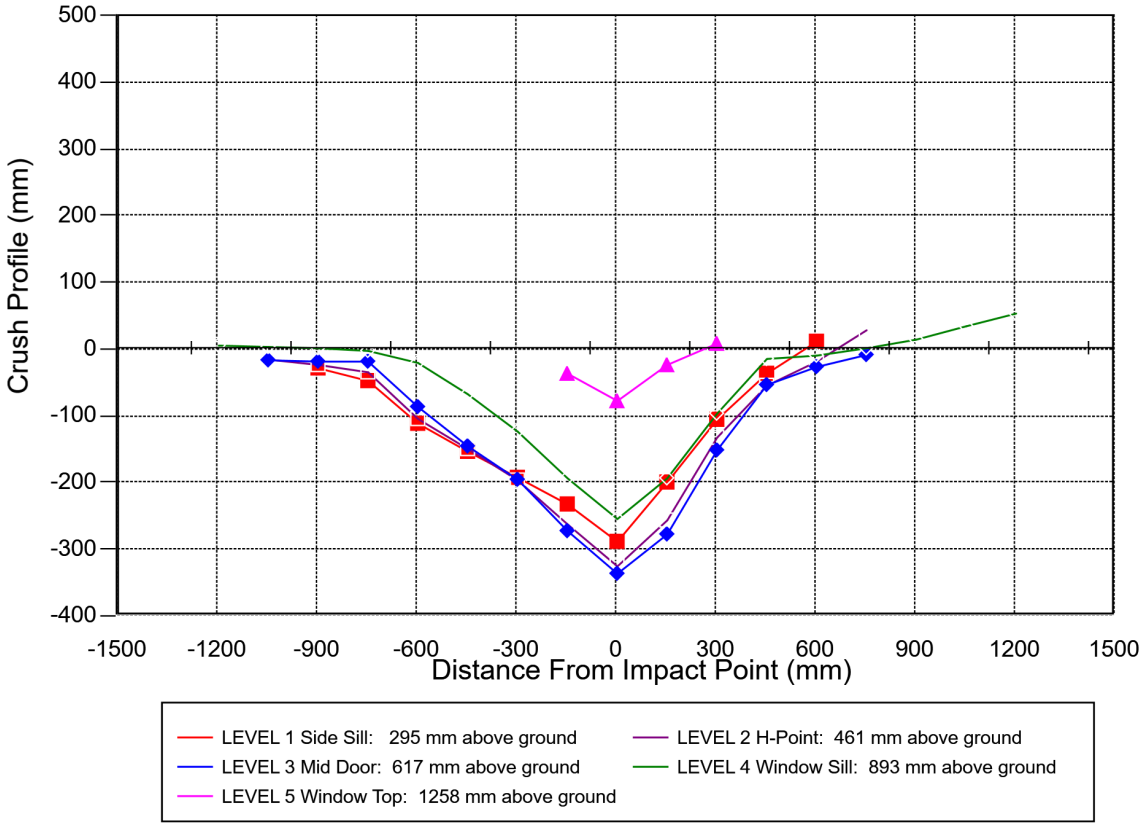
Test Vehicle: 2023 Nissan Z 2 Door Coupe
NHTSA No.: C20235203
Test Facility: Calspan
Test Date: 08/23/2023

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				-758					-764					6	
-1050		-915	-918	-779			-900	-902	-783			-15	-16	4	
-900	-896	-912	-913	-796		-868	-889	-895	-798		-28	-23	-18	2	
-750	-888	-909	-911	-808		-841	-875	-893	-806		-47	-34	-18	-2	
-600	-881	-907	-912	-819		-770	-803	-826	-799		-111	-104	-86	-20	
-450	-876	-904	-912	-825		-723	-755	-767	-758		-153	-149	-145	-67	
-300	-869	-902	-912	-829		-677	-706	-717	-706		-192	-196	-195	-123	
-150	-863	-899	-912	-833	-636	-631	-637	-640	-640	-600	-232	-262	-272	-193	-36
0	-857	-897	-911	-834	-639	-569	-572	-575	-580	-562	-288	-325	-336	-254	-77
150	-853	-895	-911	-834	-632	-654	-639	-634	-641	-609	-199	-256	-277	-193	-23
300	-857	-895	-911	-833	-612	-752	-763	-760	-737	-621	-105	-132	-151	-96	9
450	-879	-905	-913	-827		-843	-851	-860	-813		-36	-54	-53	-14	
600	-899	-917	-921	-819		-911	-899	-895	-810		12	-18	-26	-9	
750		-921	-925	-818			-950	-917	-820			29	-8	2	
900				-834					-849					15	
1050				-850					-885					35	
1200				-845					-899					54	
1350															
1500															

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

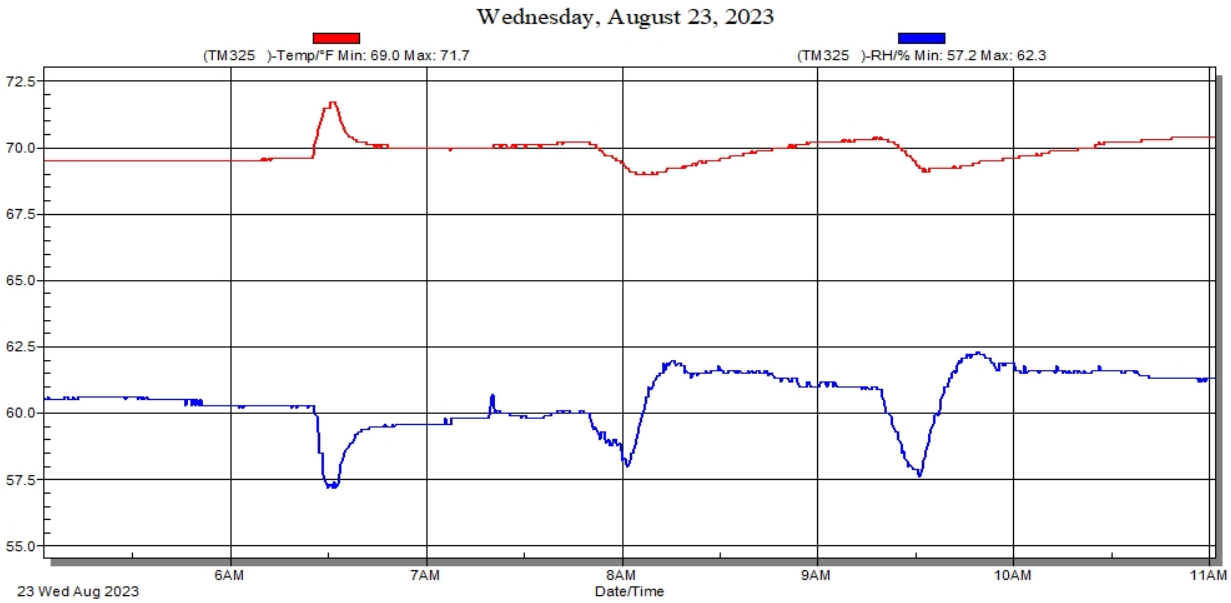
Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023



Vehicle Exterior Crush Measurements - Visual Representation

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

Test Vehicle:	2023 Nissan Z 2 Door Coupe	NHTSA No.:	C20235203
Test Facility:	Calspan	Test Date:	08/23/2023



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

APPENDIX I

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

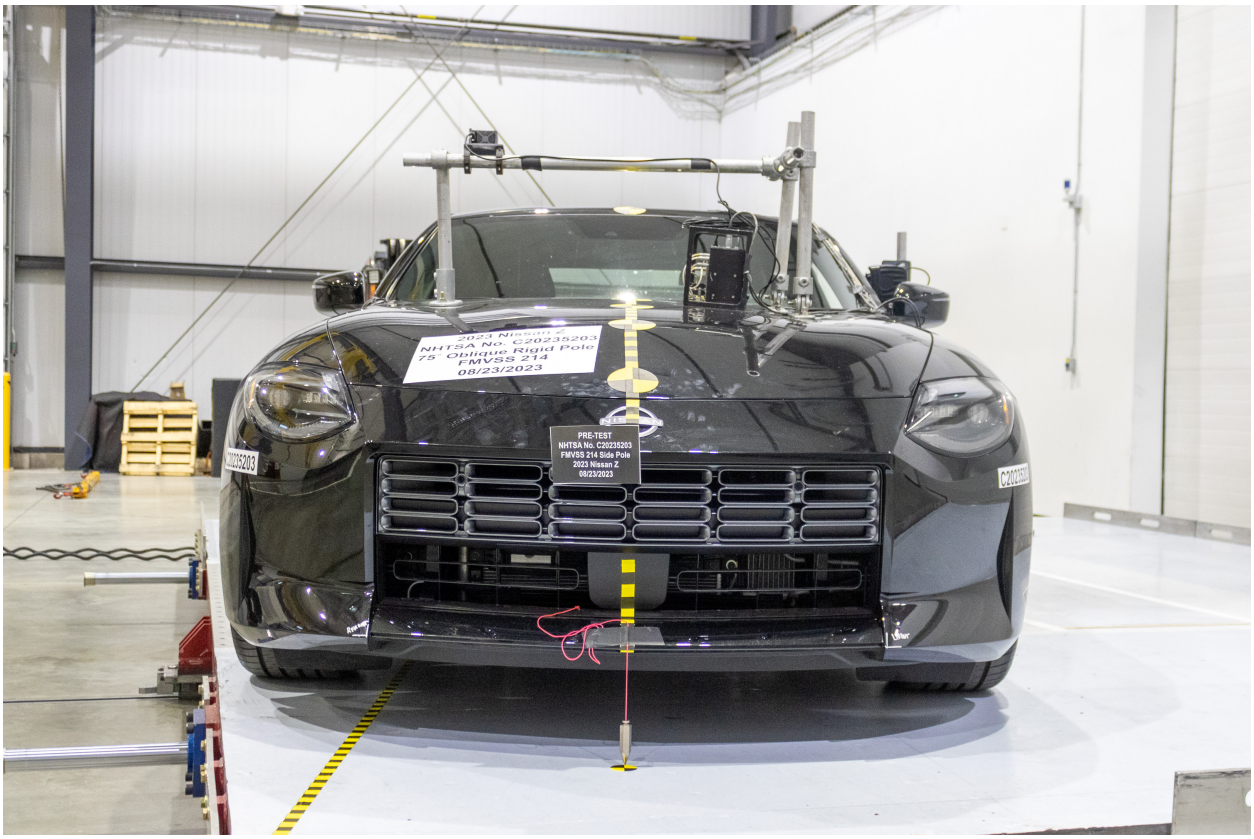


Figure A-1: Pre-Test Frontal View of Test Vehicle

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

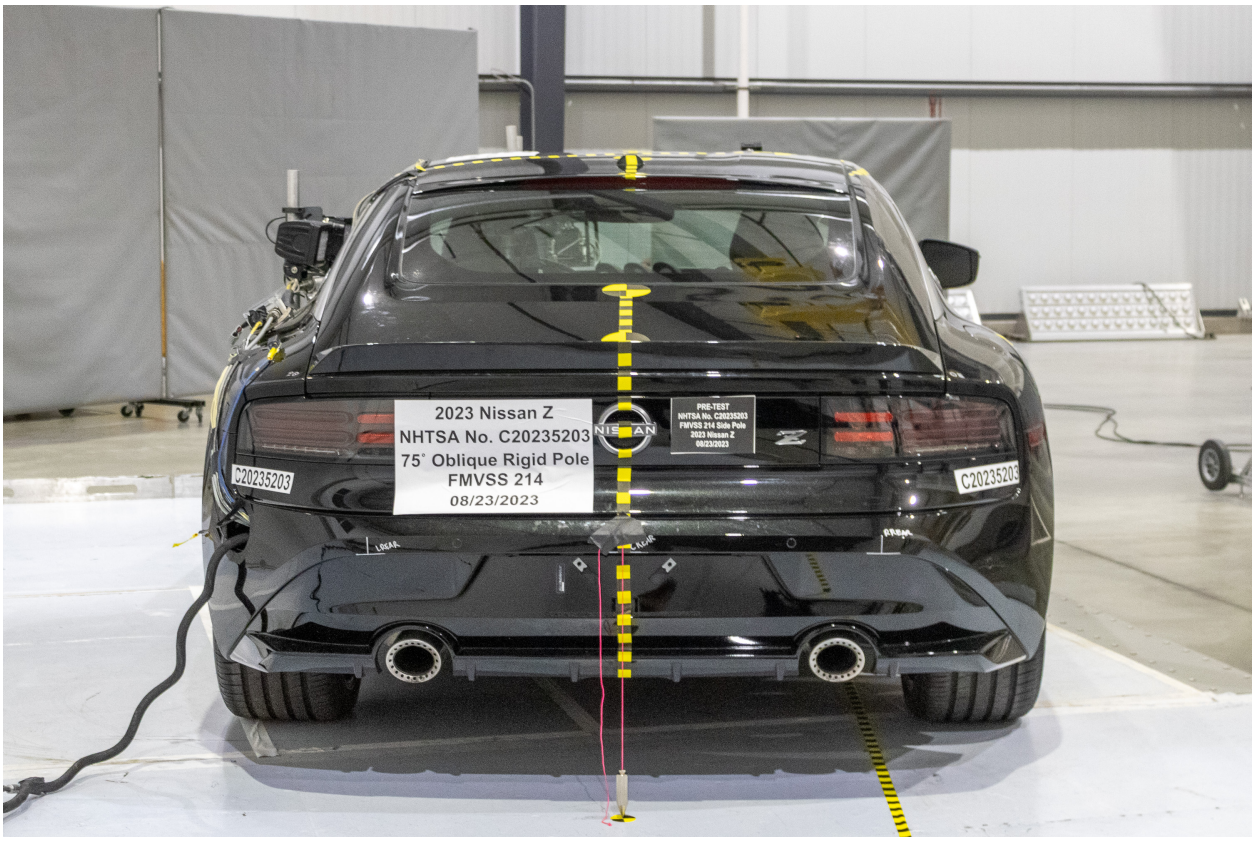


Figure A-3: Pre-Test Rear View of Test Vehicle

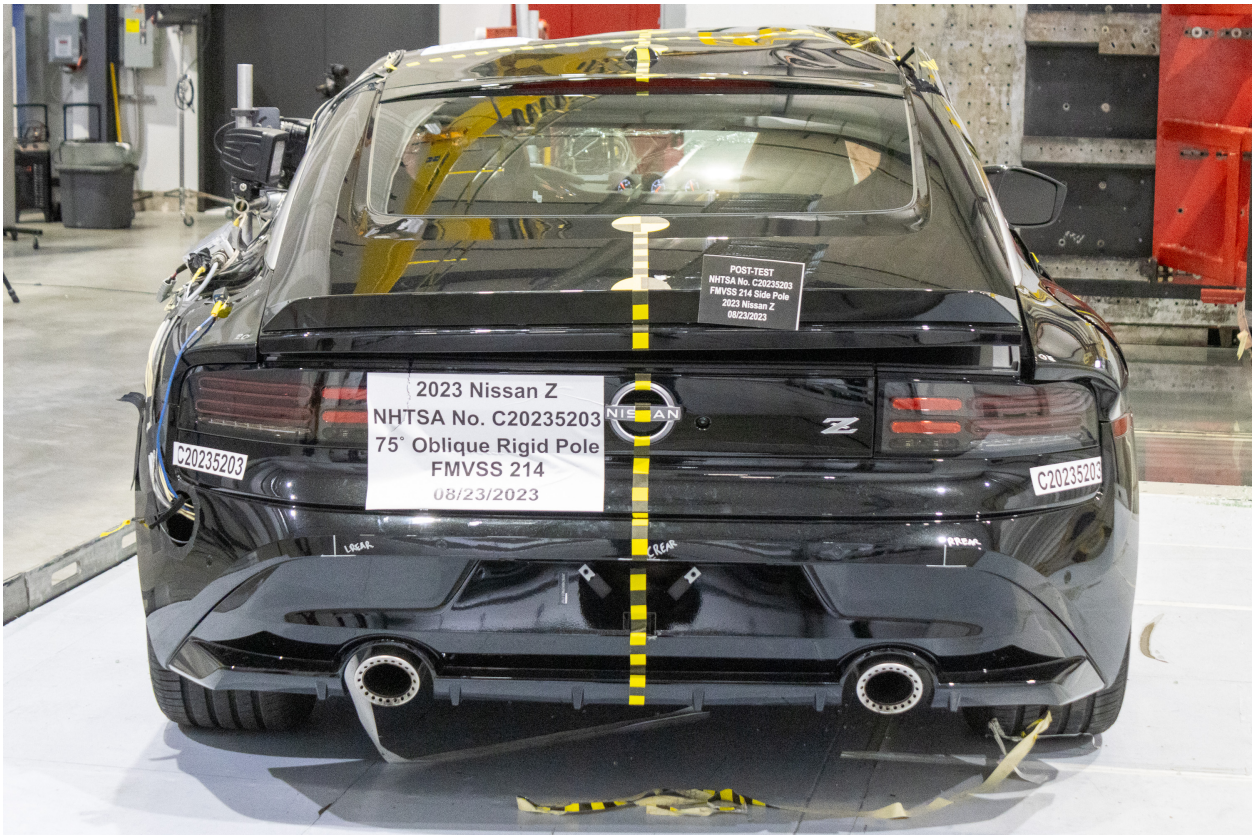


Figure A-4: Post-Test Rear View of Test Vehicle

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

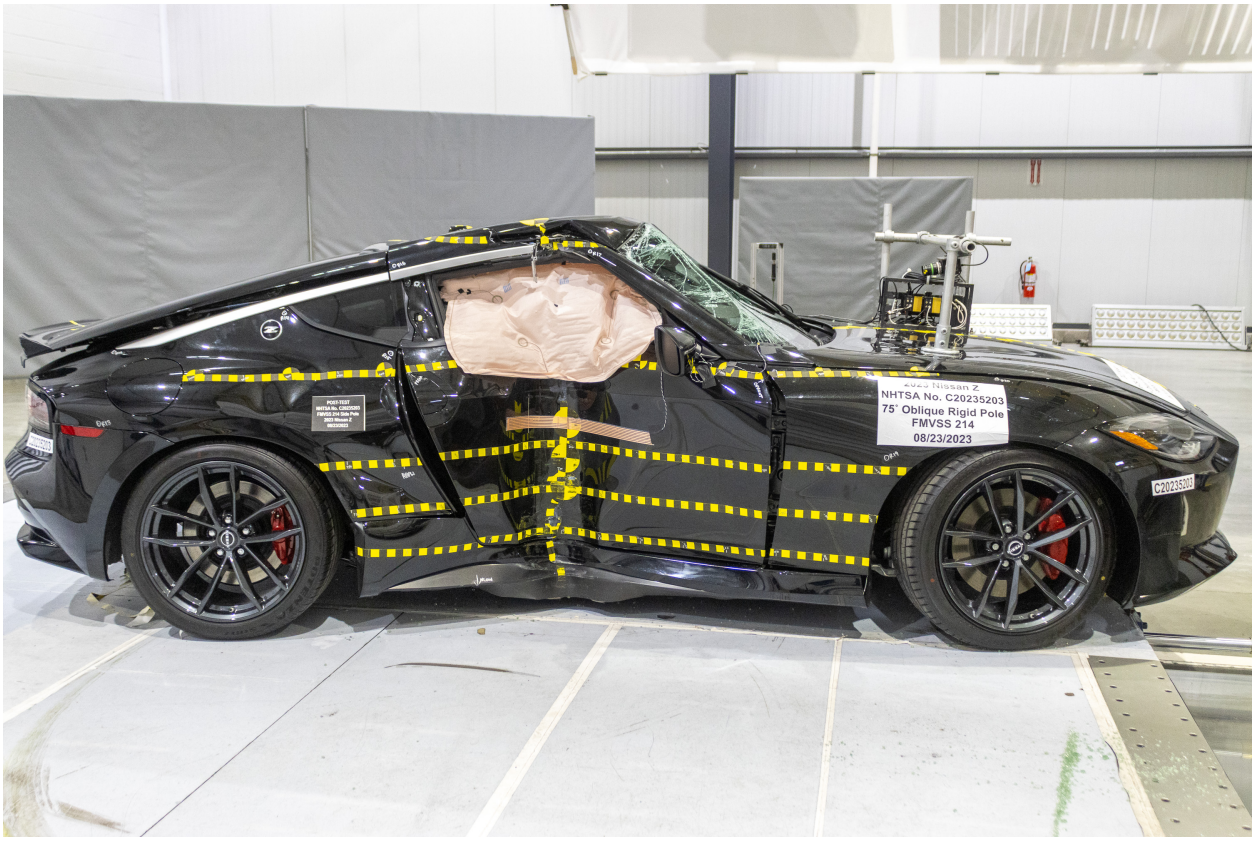


Figure A-6: Post-Test Impacted Side View of Test Vehicle

Figure A-7: Pre-Test Right ¾ Front View of Vehicle and Pole

Figure A-8: Pre-Test Right ¾ Rear View of Vehicle and Pole

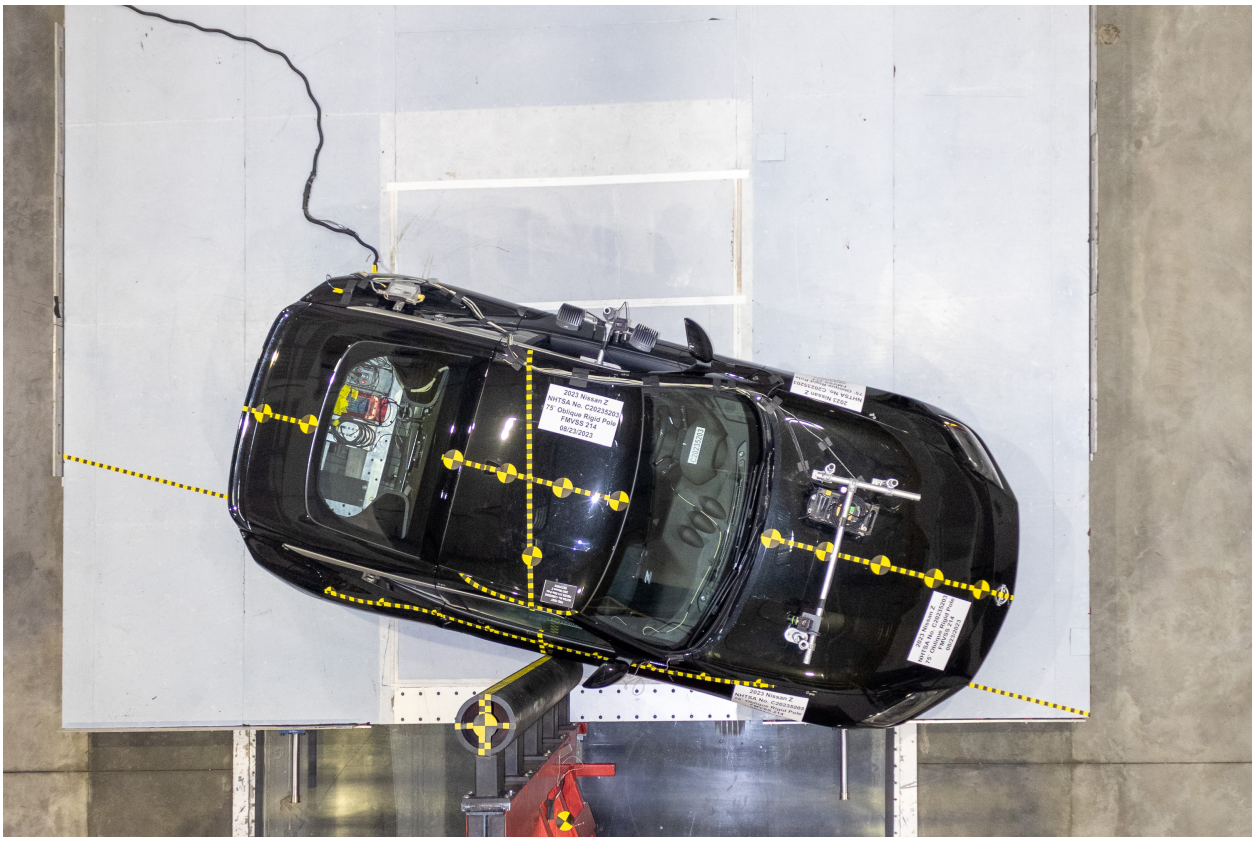


Figure A-9: Pre-Test Overhead View of Test Vehicle

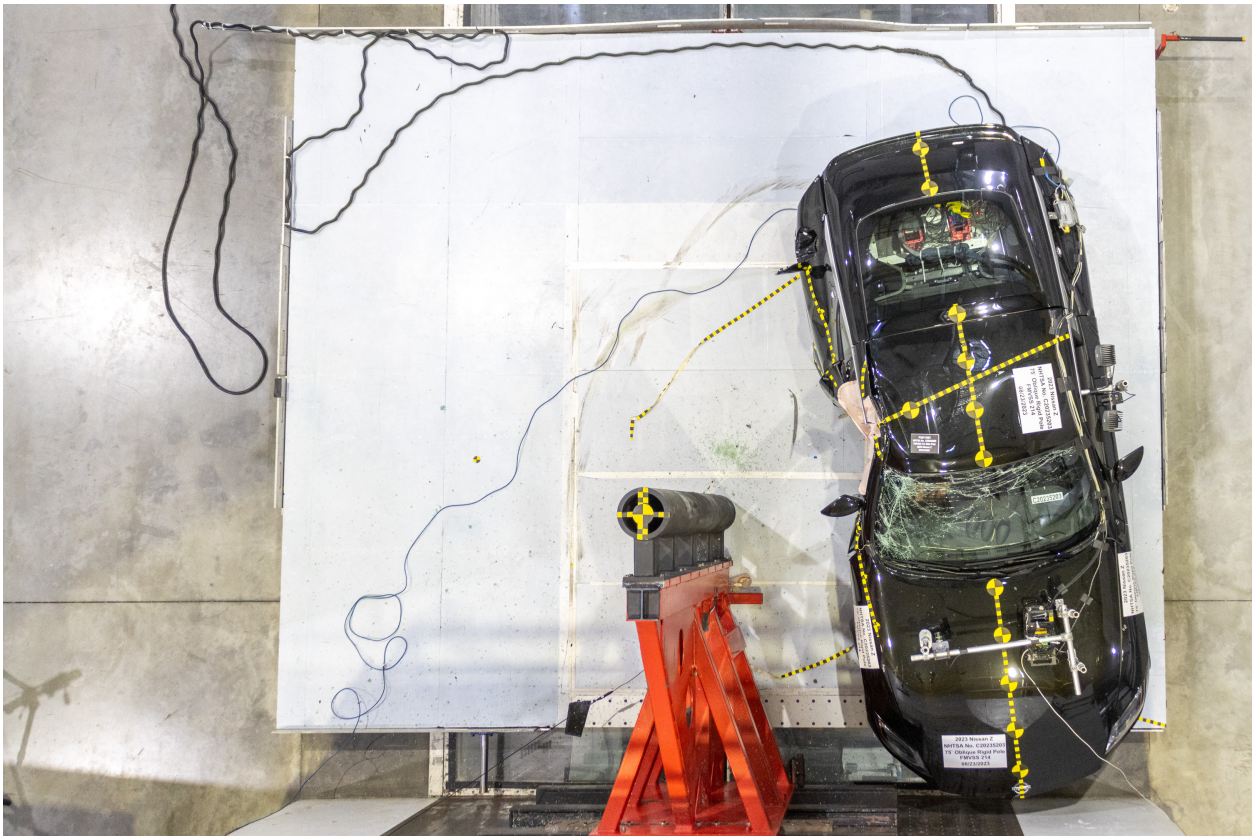


Figure A-10: Post-Test Overhead View of Test Vehicle

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

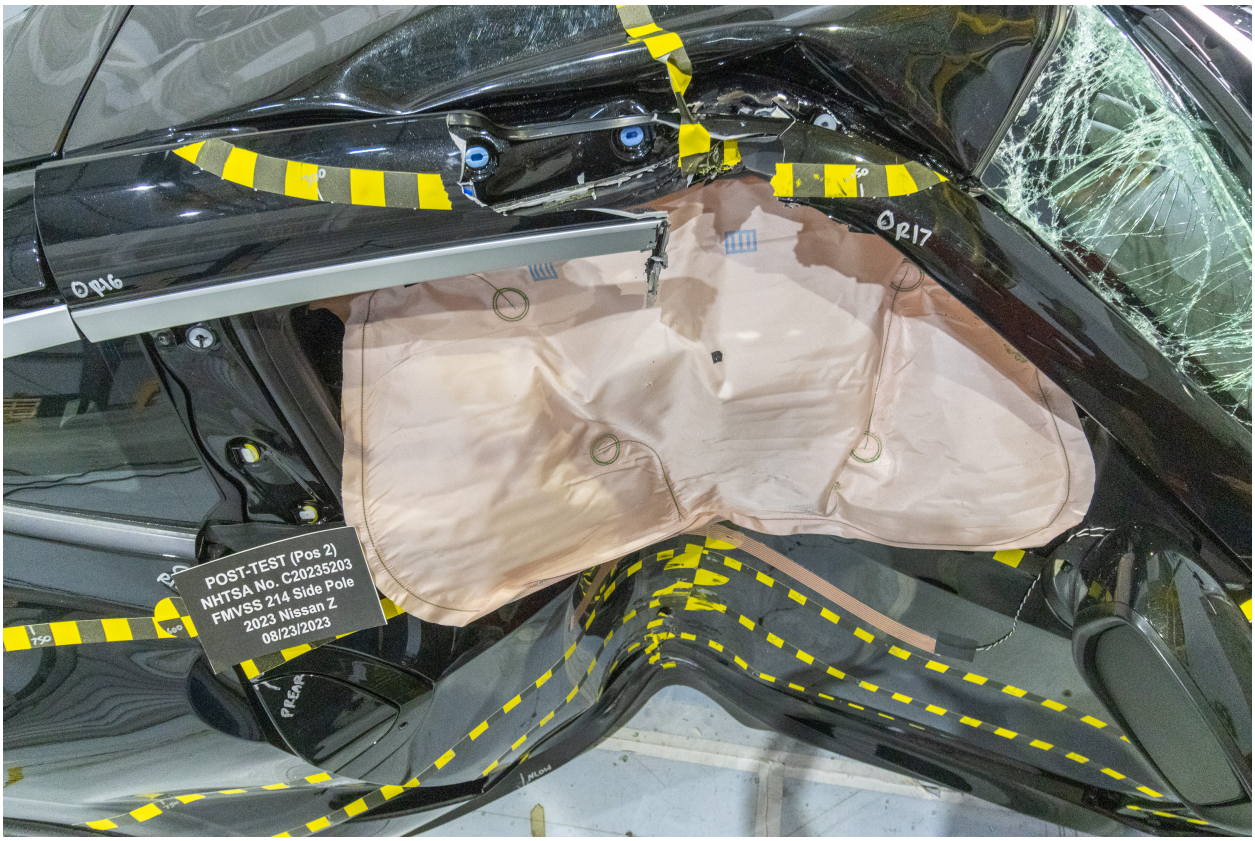


Figure A-17: Post-Test Dummy Shoulder and Door Top View

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

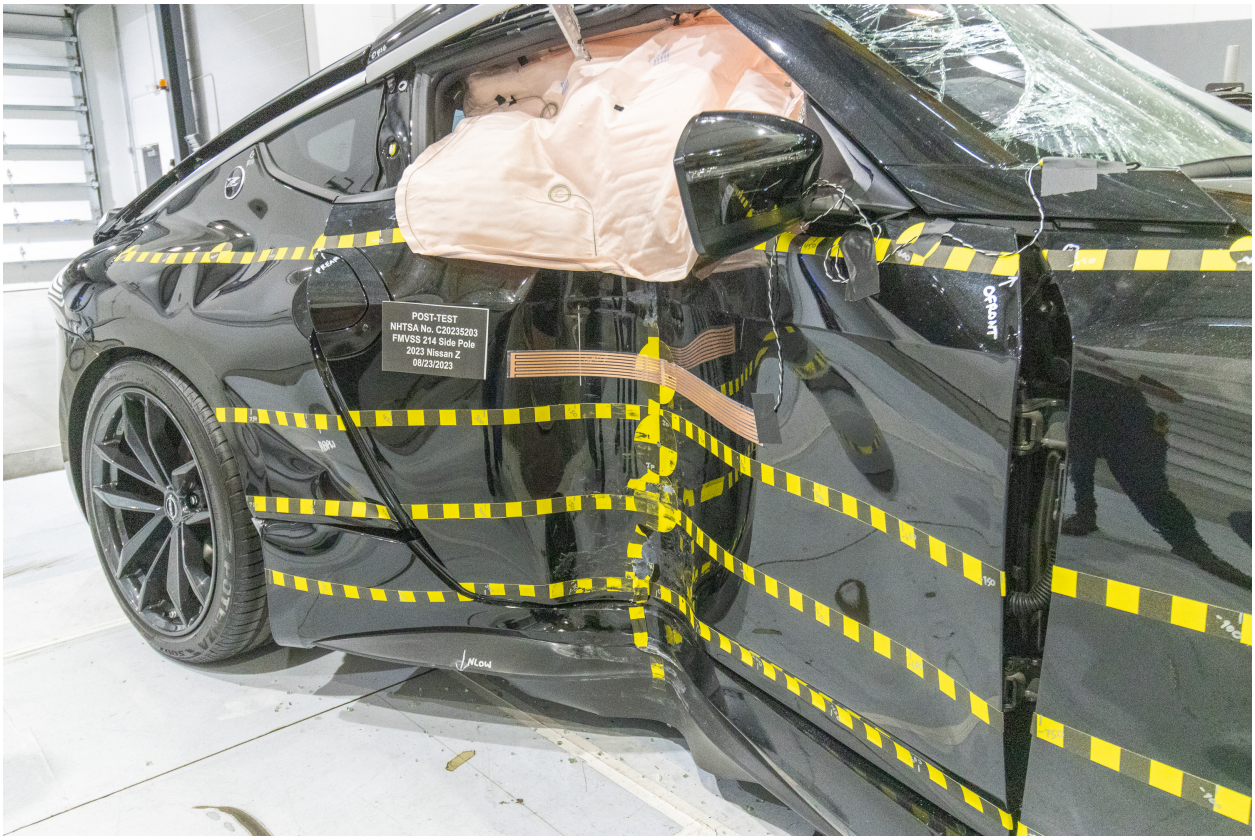


Figure A-22: Post-Test ¾ Front View of Impact Zone

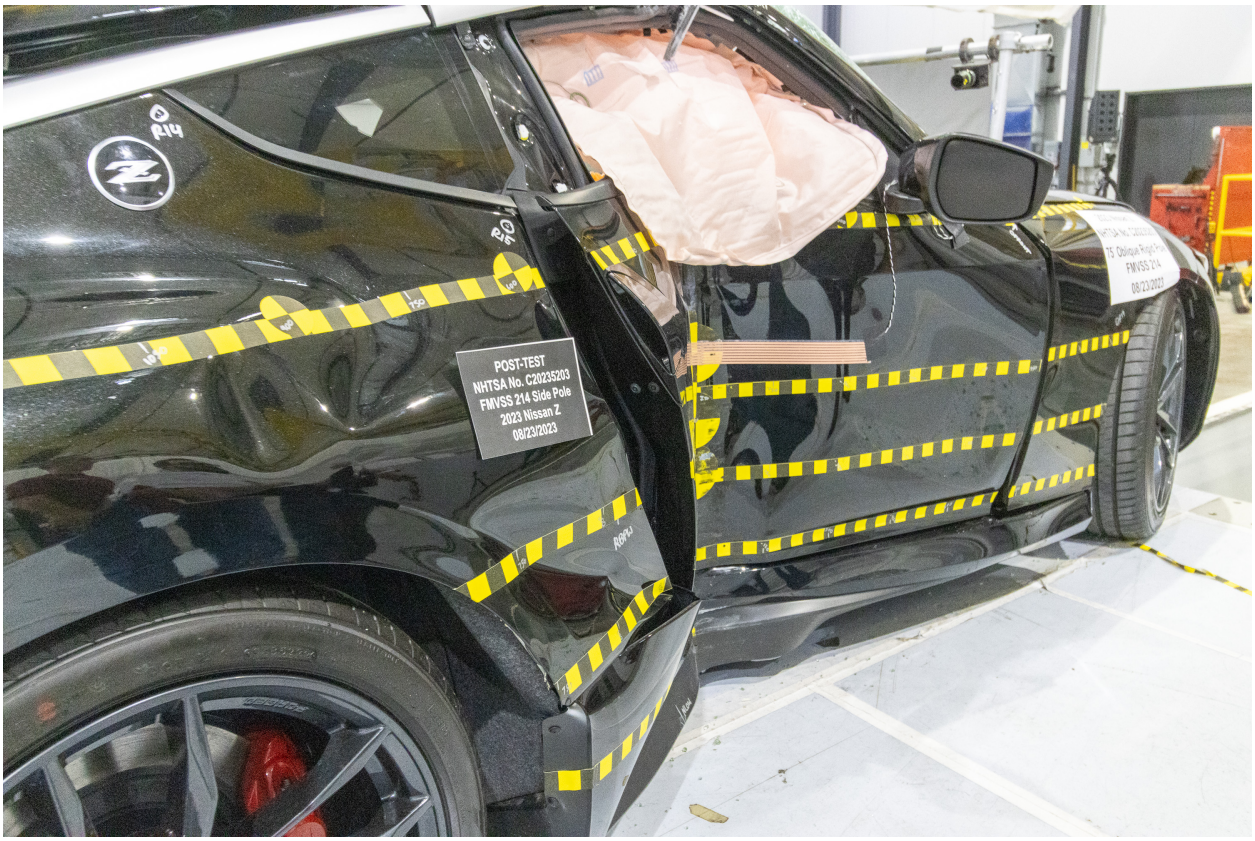


Figure A-23: Post-Test ¾ Rear View of Impact Zone

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

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

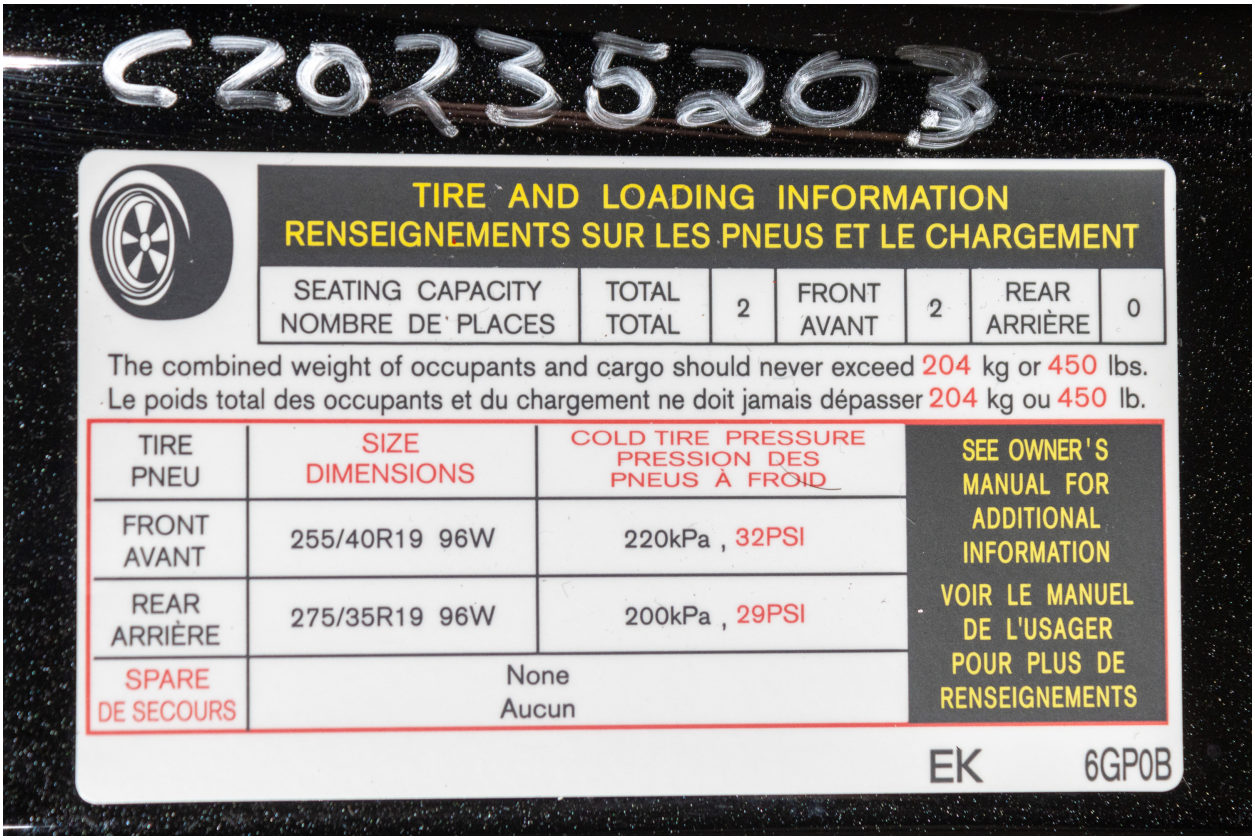
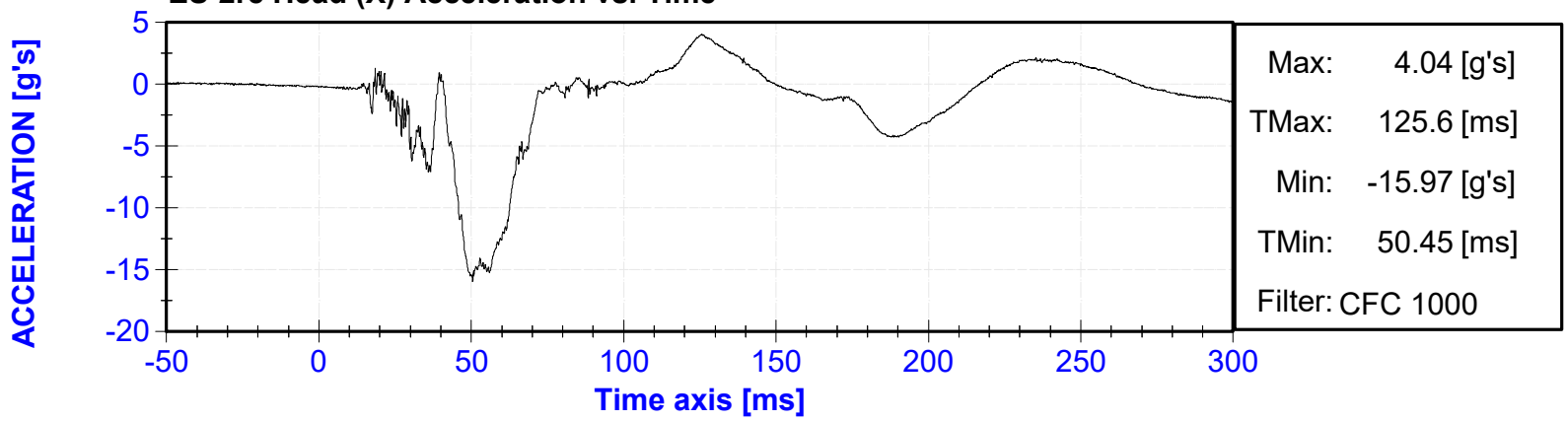


Figure A-26: Close-Up View of Vehicle's Tire Placard Label

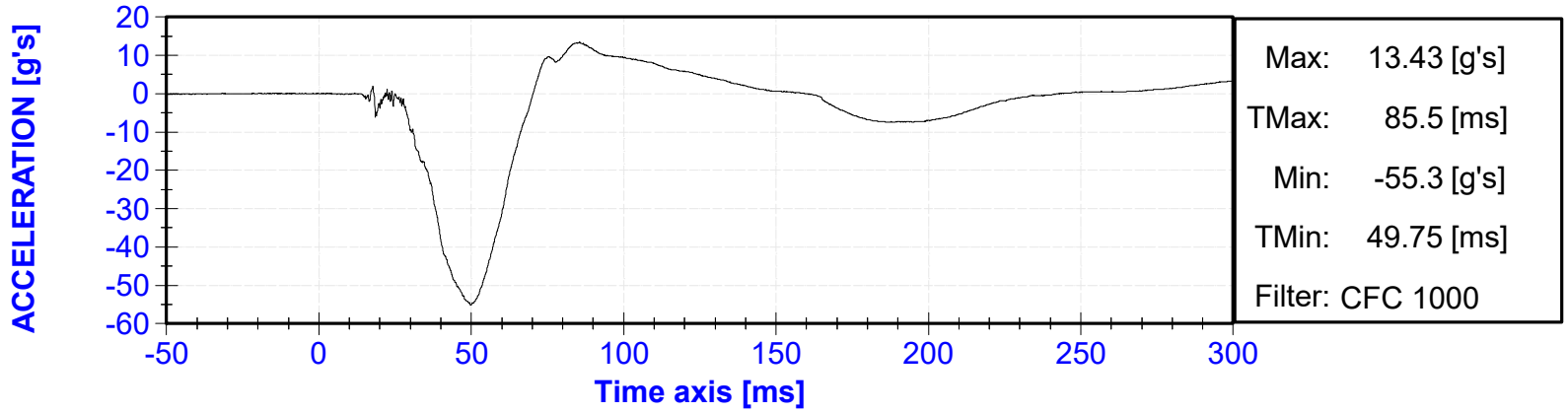
APPENDIX II
ES-2re DUMMY RESPONSE DATA TRACES

Table of Data Plots

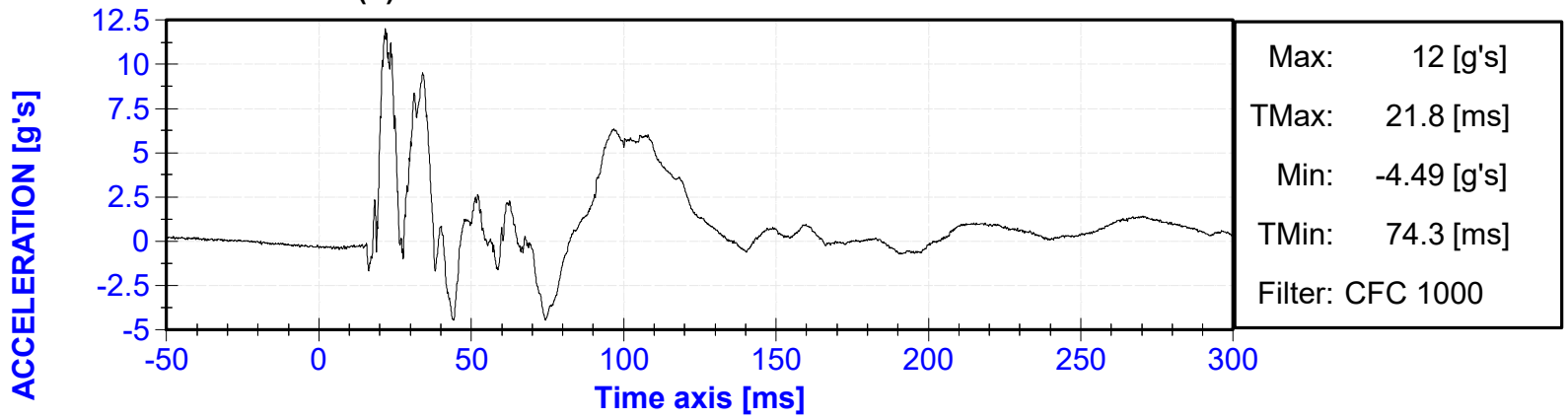
ES-2re Head (X) Acceleration vs. Time



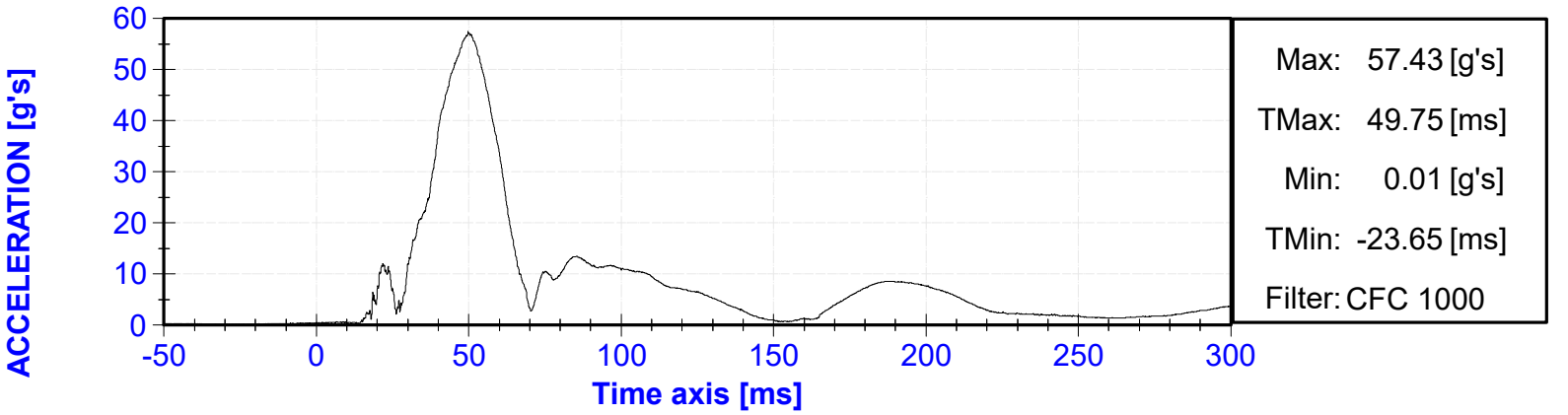
ES-2re Head (Y) Acceleration vs. Time



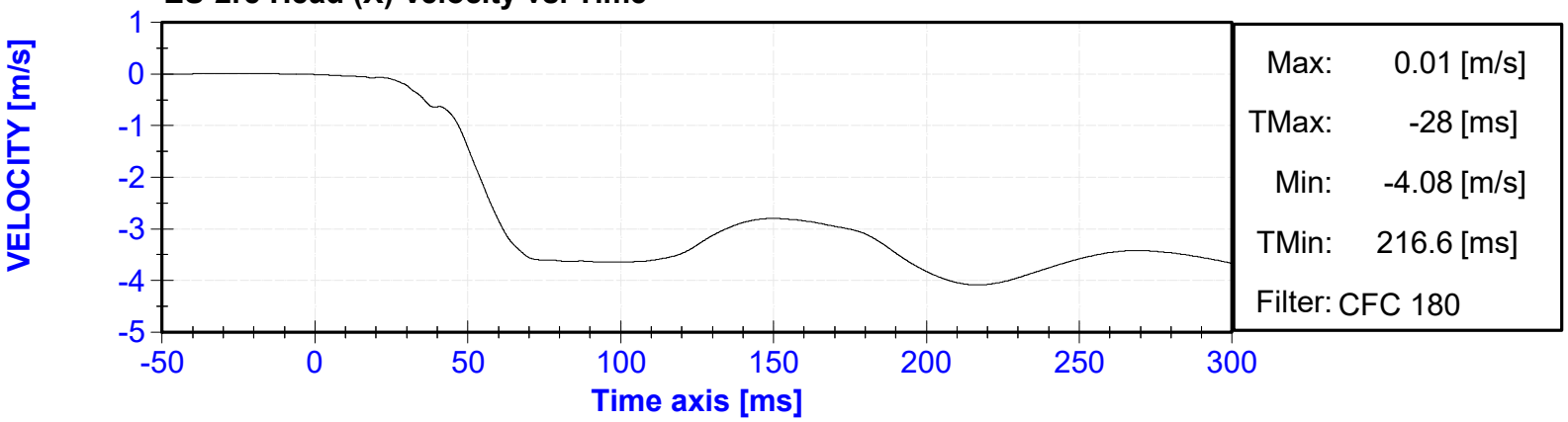
ES-2re Head (Z) Acceleration vs. Time



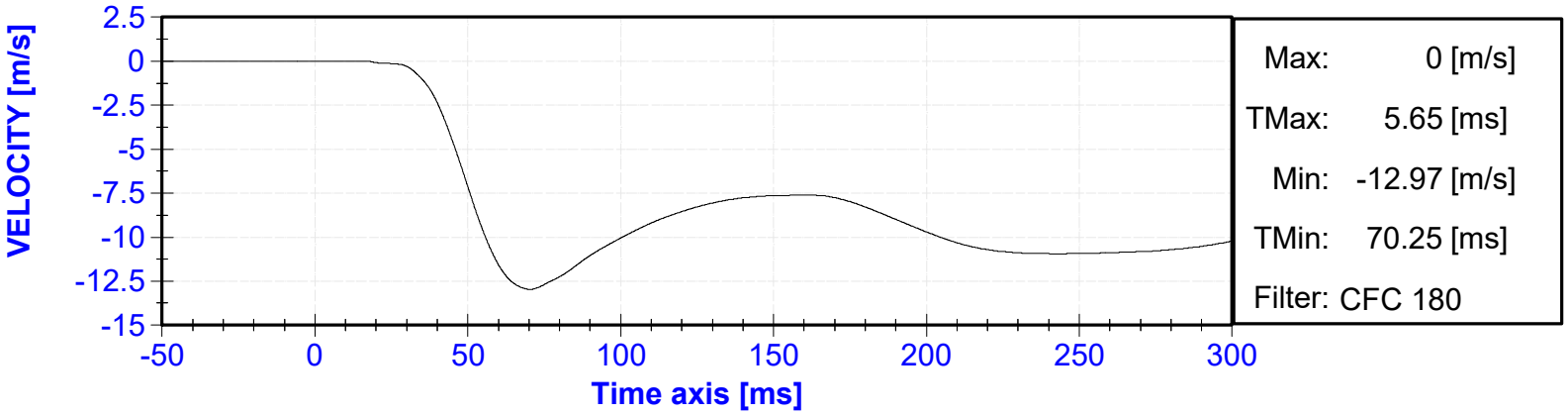
ES-2re Head Resultant Acceleration vs. Time



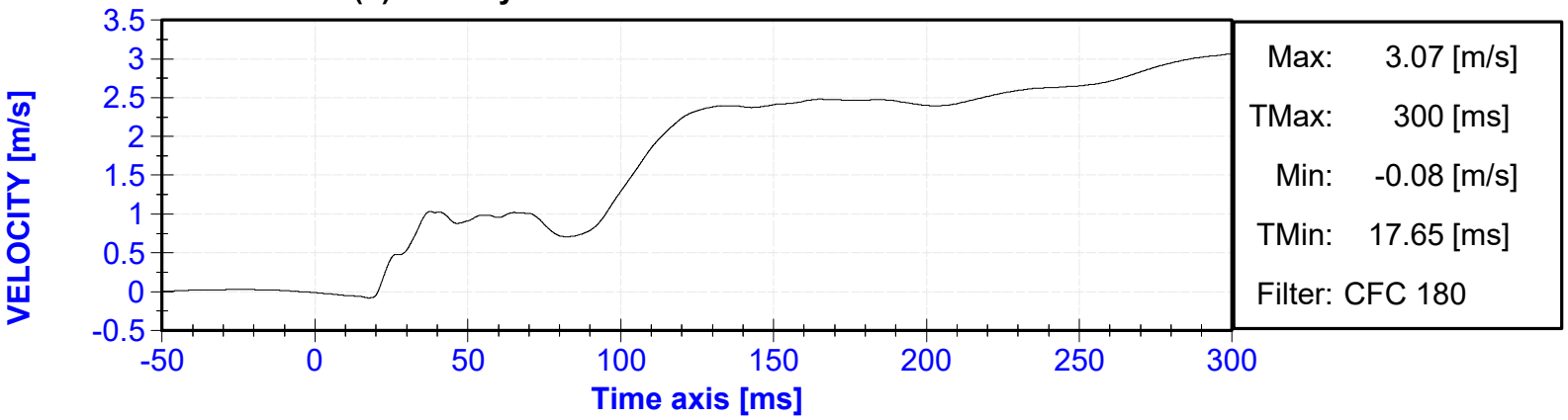
ES-2re Head (X) Velocity vs. Time



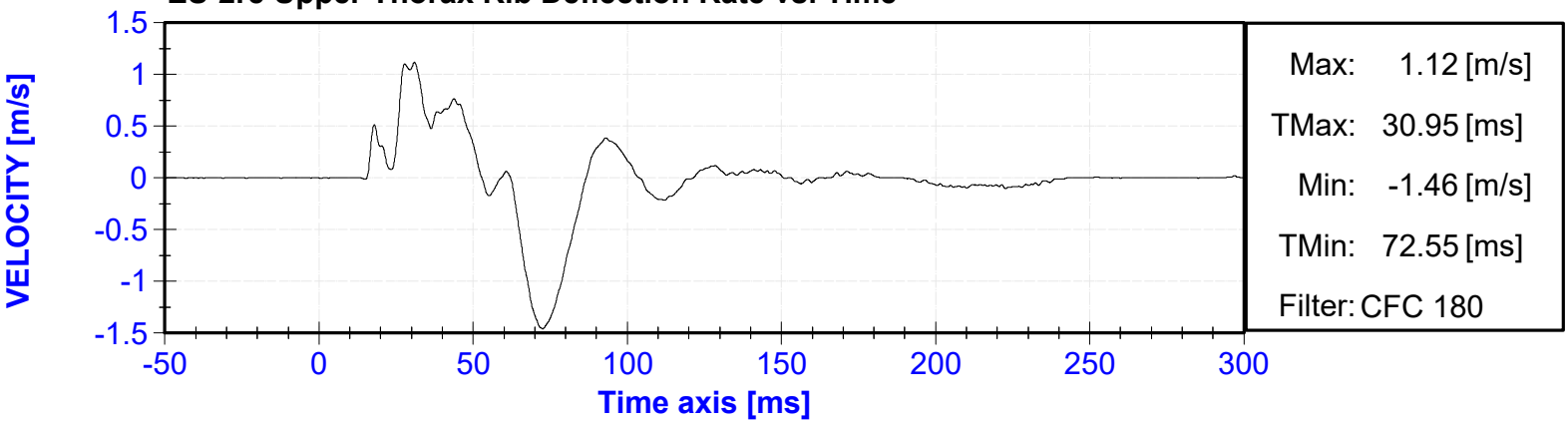
ES-2re Head (Y) Velocity vs. Time



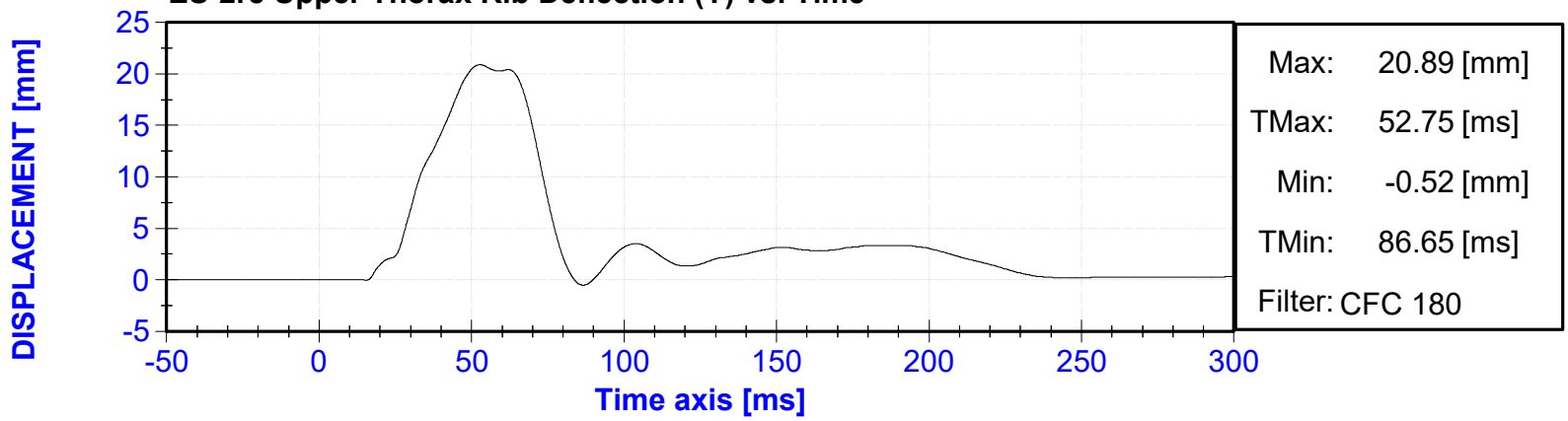
ES-2re Head (Z) Velocity vs. Time



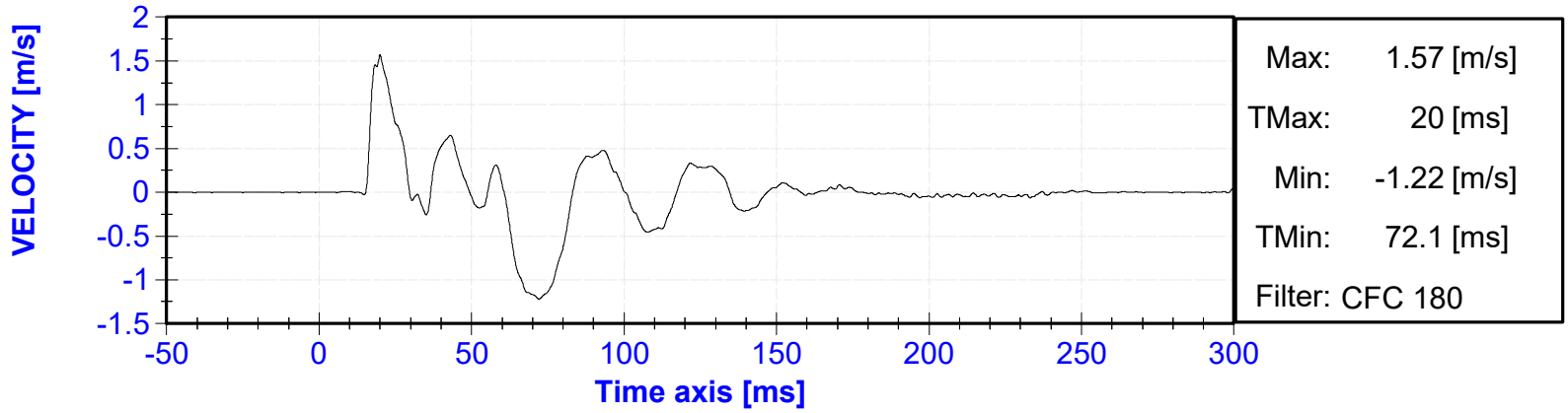
ES-2re Upper Thorax Rib Deflection Rate vs. Time



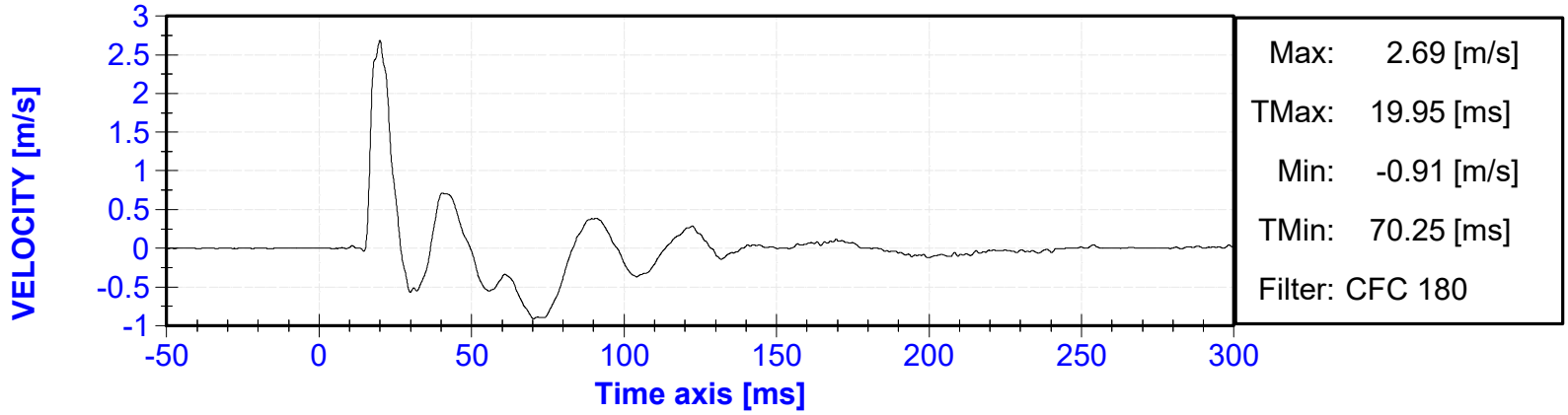
ES-2re Upper Thorax Rib Deflection (Y) vs. Time



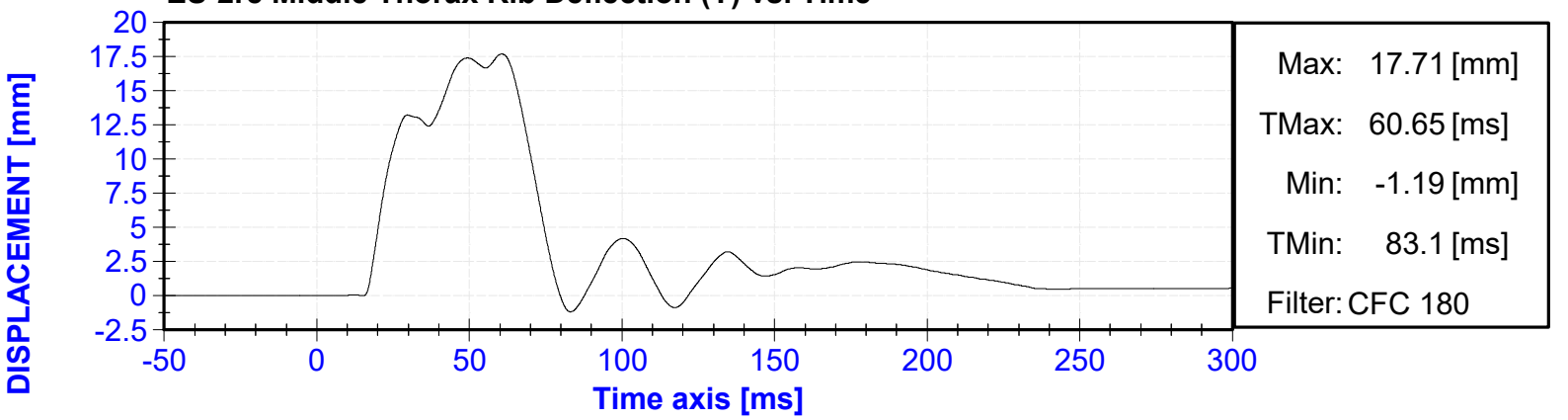
ES-2re Middle Thorax Rib Deflection Rate vs. Time



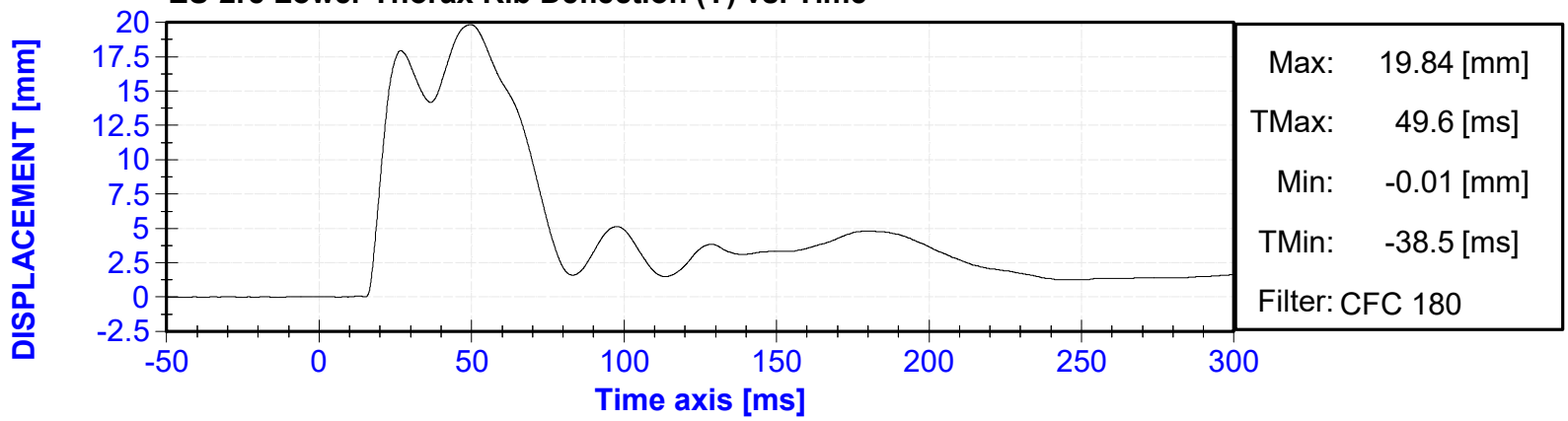
ES-2re Lower Thorax Rib Deflection Rate vs. Time



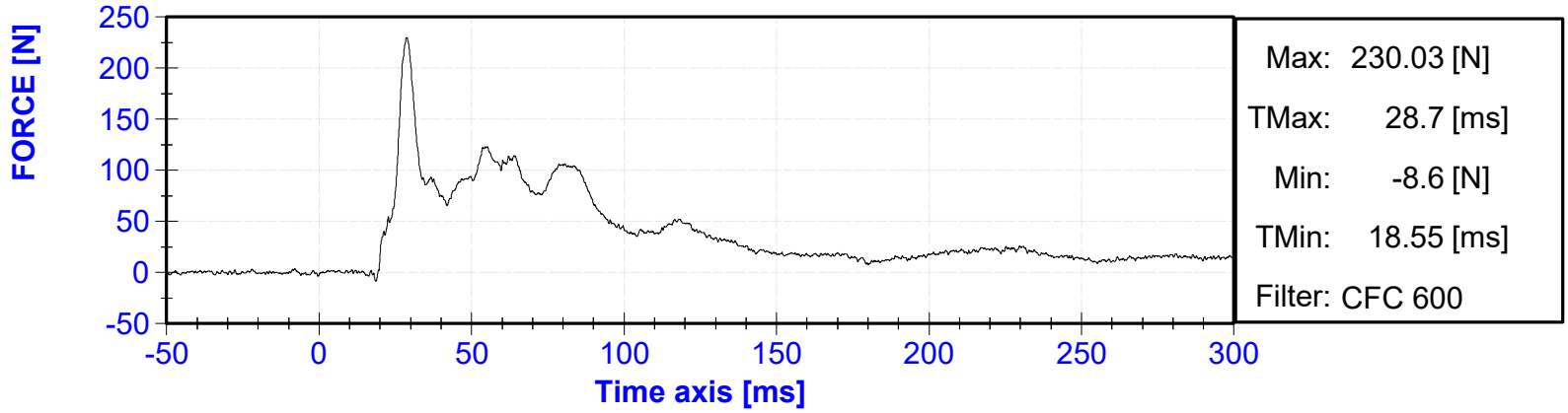
ES-2re Middle Thorax Rib Deflection (Y) vs. Time



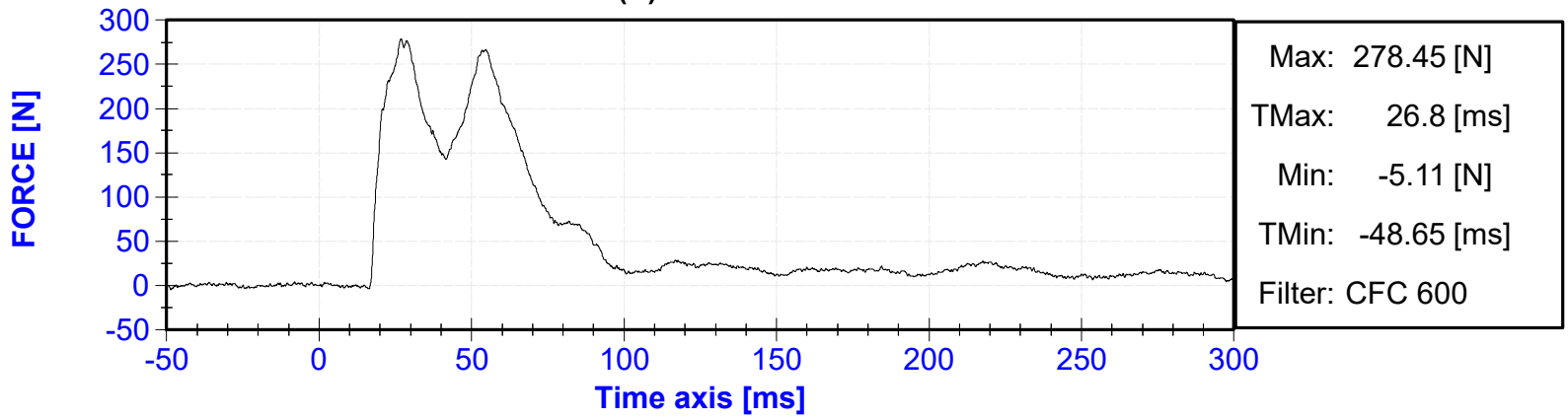
ES-2re Lower Thorax Rib Deflection (Y) vs. Time



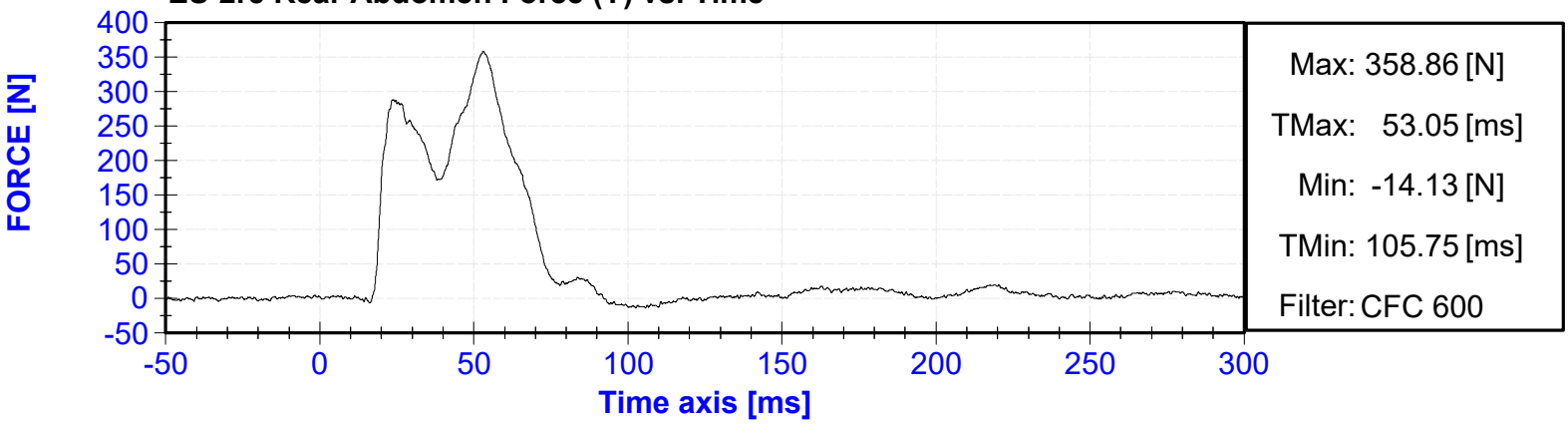
ES-2re Front Abdomen Force (Y) vs. Time

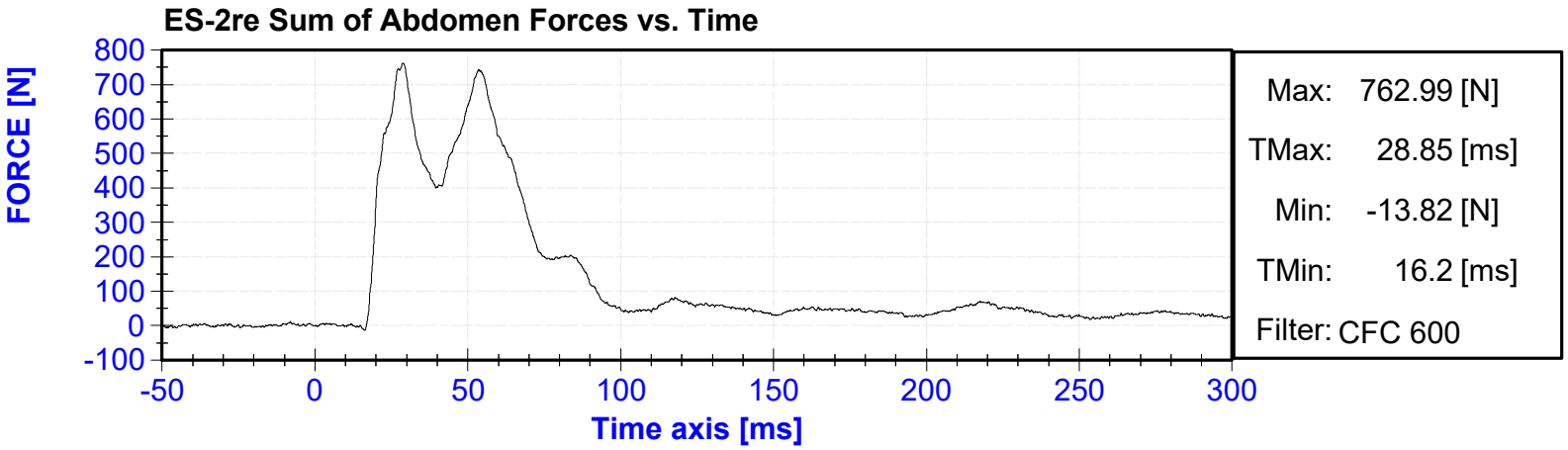


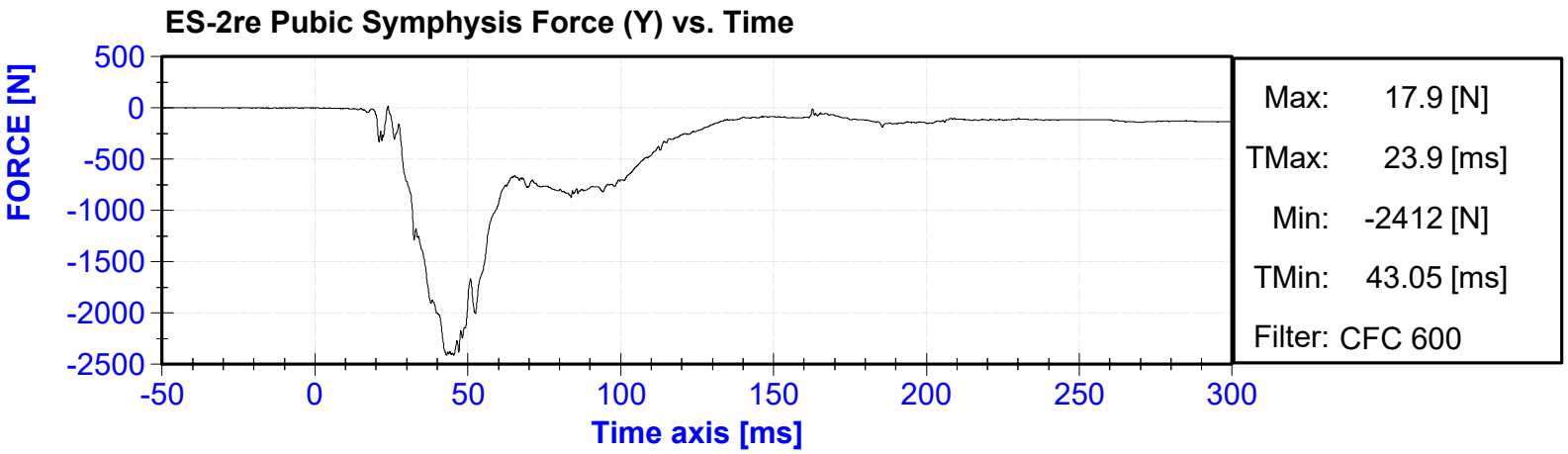
ES-2re Middle Abdomen Force (Y) vs. Time



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




ES-2re Sum of Abdomen Forces vs. Time
FORCE [N]
800
700
600
500
400
300
200
100
0
-100
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 762.99 [N]
TMax: 28.85 [ms]
Min: -13.82 [N]
TMin: 16.2 [ms]
Filter: CFC 600


ES-2re Pubic Symphysis Force (Y) vs. Time
FORCE [N]
500
0
-500
-1000
-1500
-2000
-2500
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 17.9 [N]
TMax: 23.9 [ms]
Min: -2412 [N]
TMin: 43.05 [ms]
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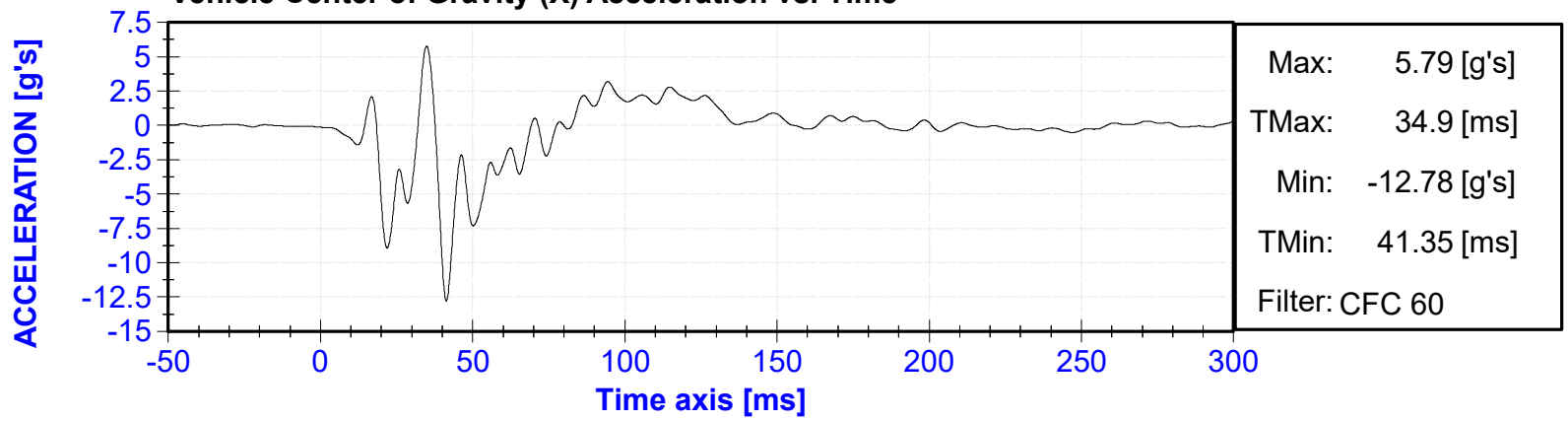
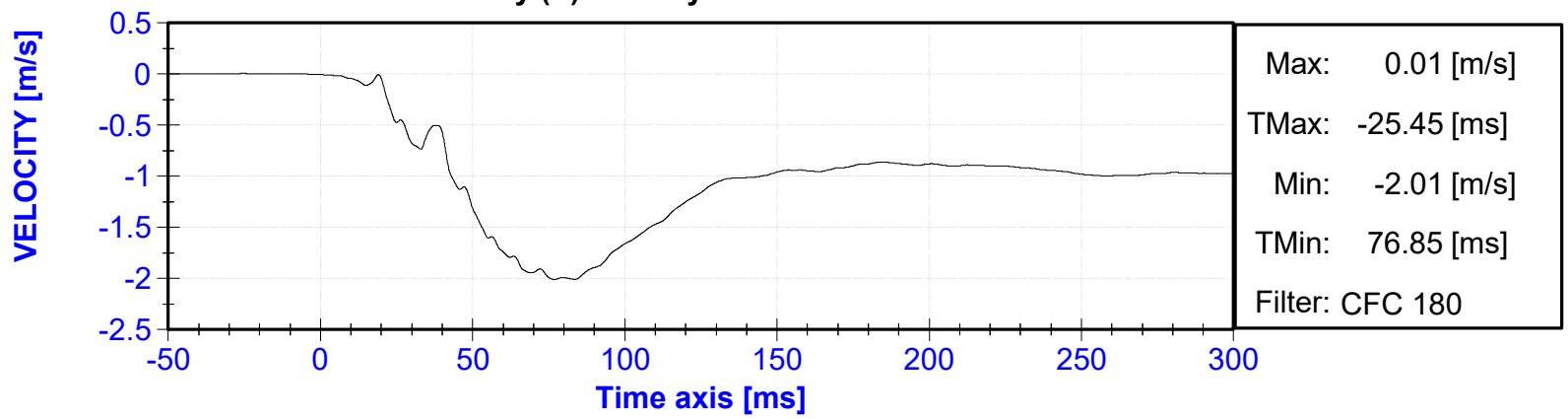
APPENDIX III
VEHICLE ACCELEROMETER RESPONSE DATA

Table of Data Plots

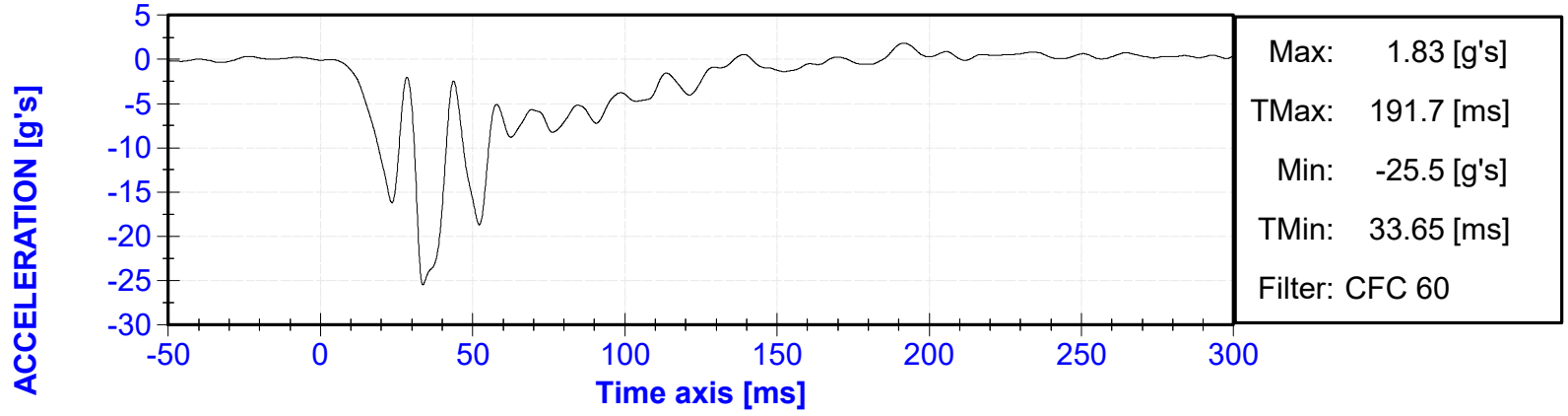
Vehicle Center of Gravity (X) Acceleration vs. Time



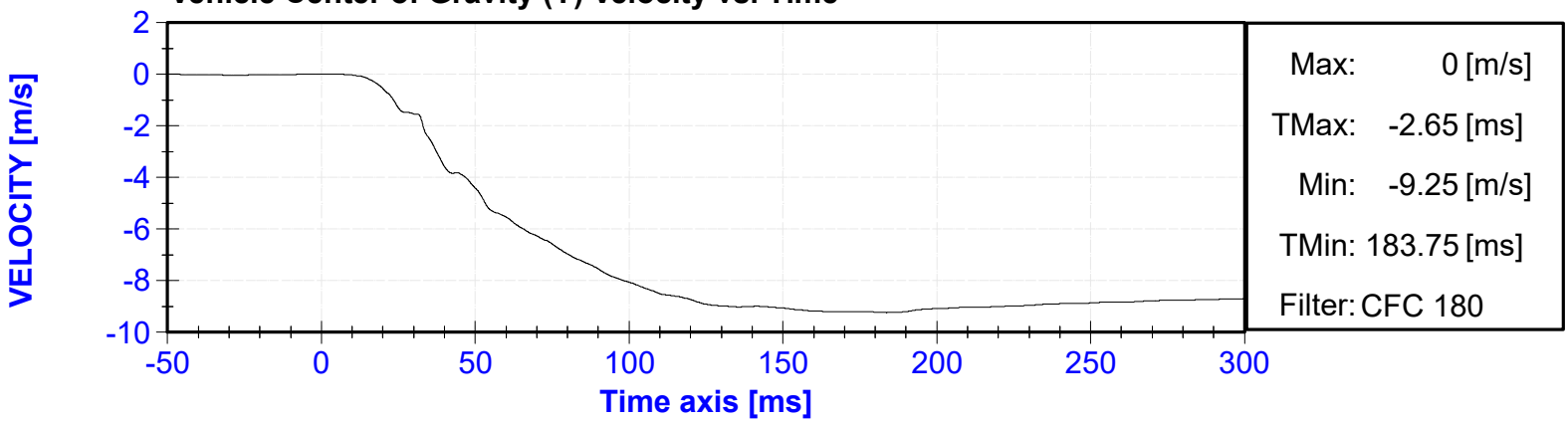
Vehicle Center of Gravity (X) Velocity vs. Time



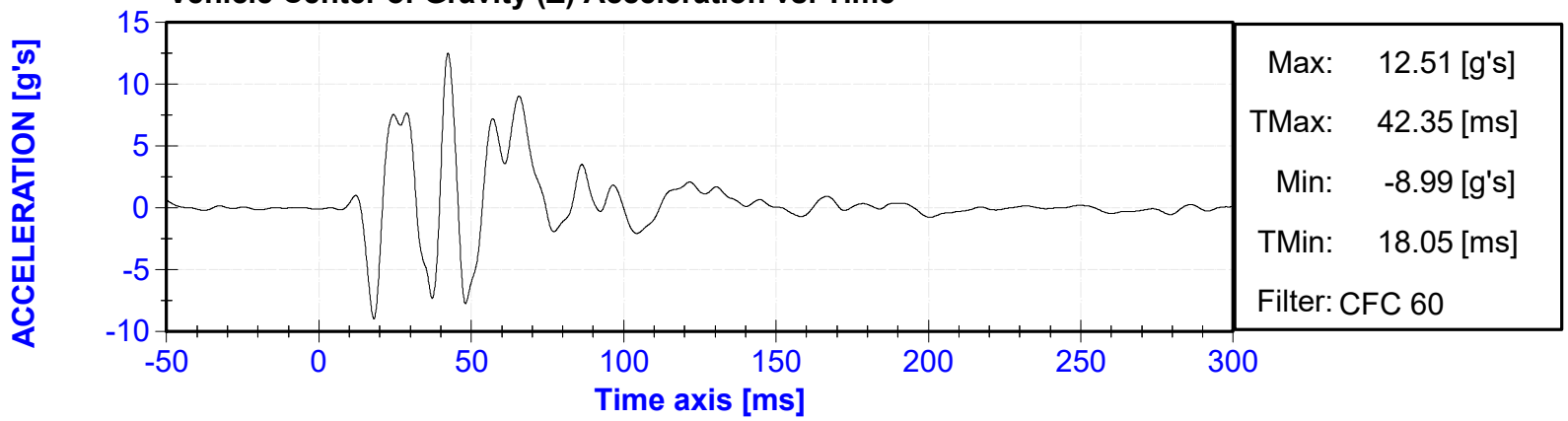
Vehicle Center of Gravity (Y) Acceleration vs. Time



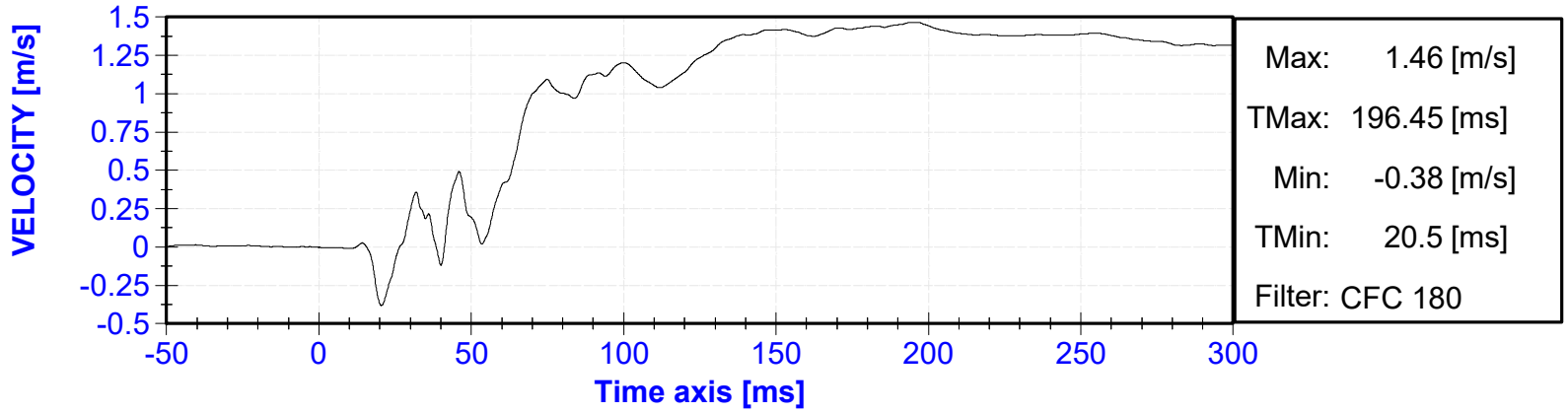
Vehicle Center of Gravity (Y) Velocity vs. Time



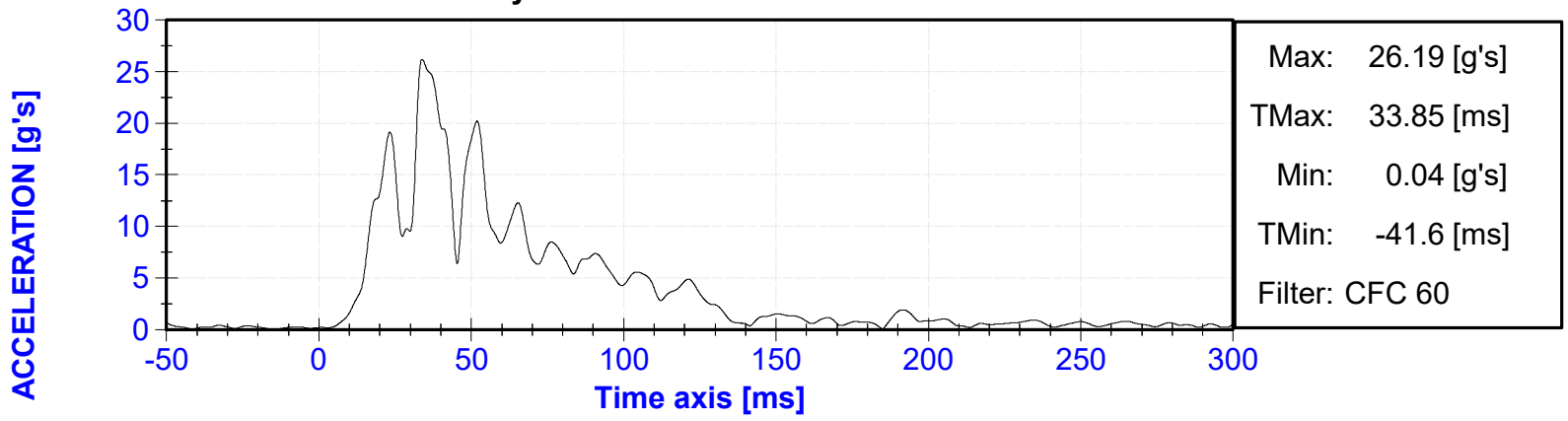
Vehicle Center of Gravity (Z) Acceleration vs. Time



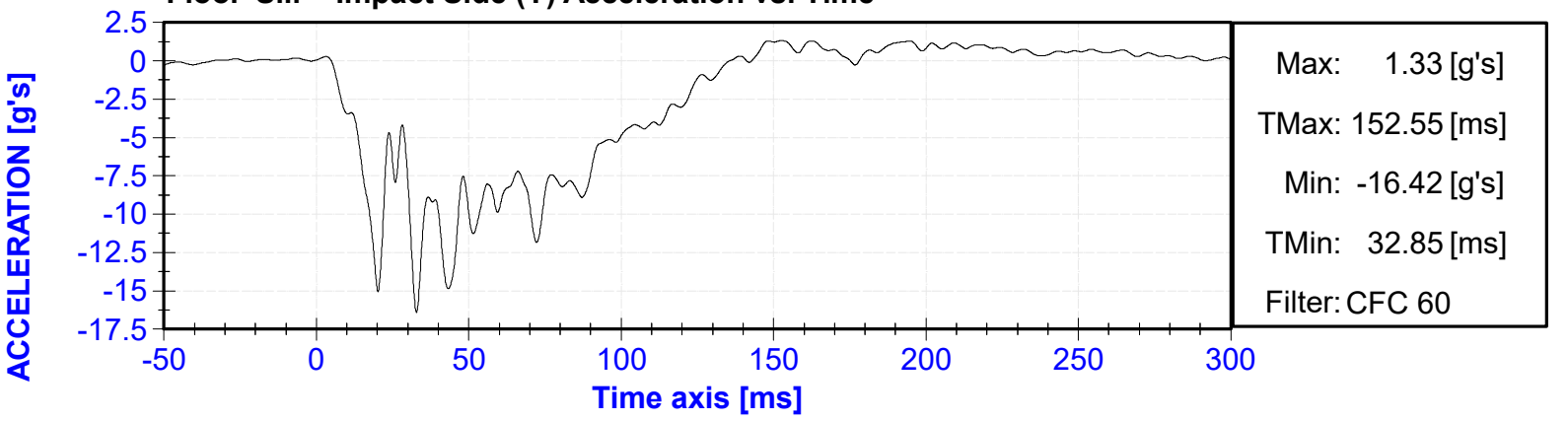
Vehicle Center of Gravity (Z) Velocity vs. Time



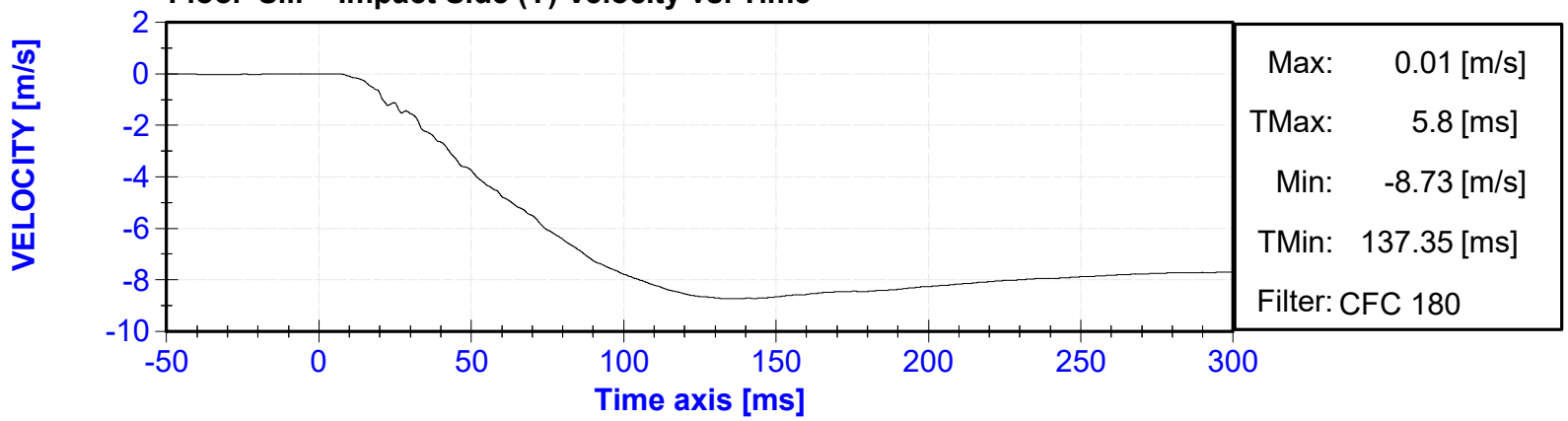
Vehicle Center of Gravity Resultant Acceleration vs. Time



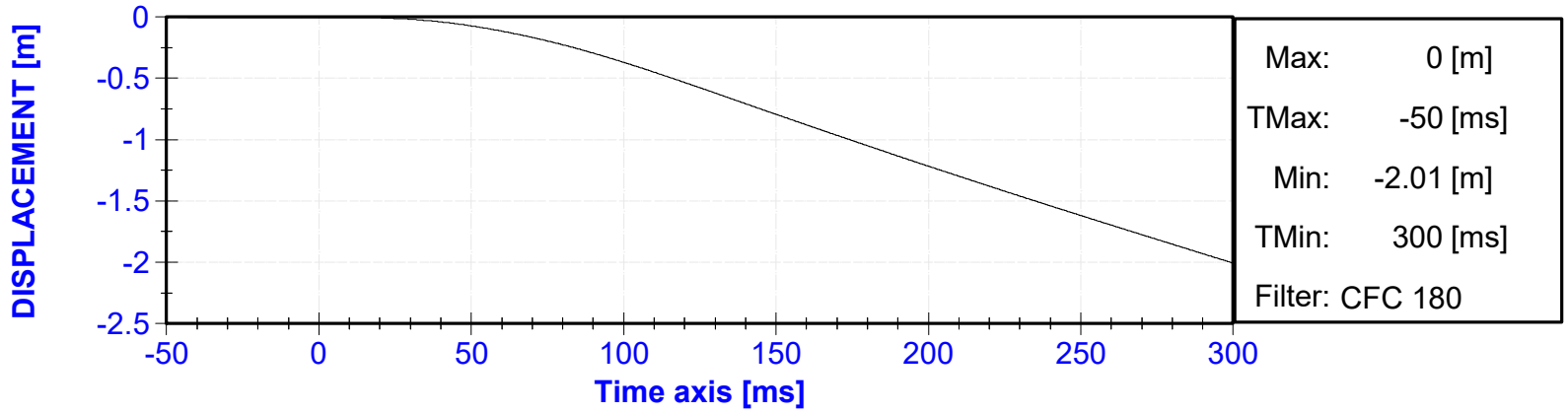
Floor Sill – Impact Side (Y) Acceleration vs. Time



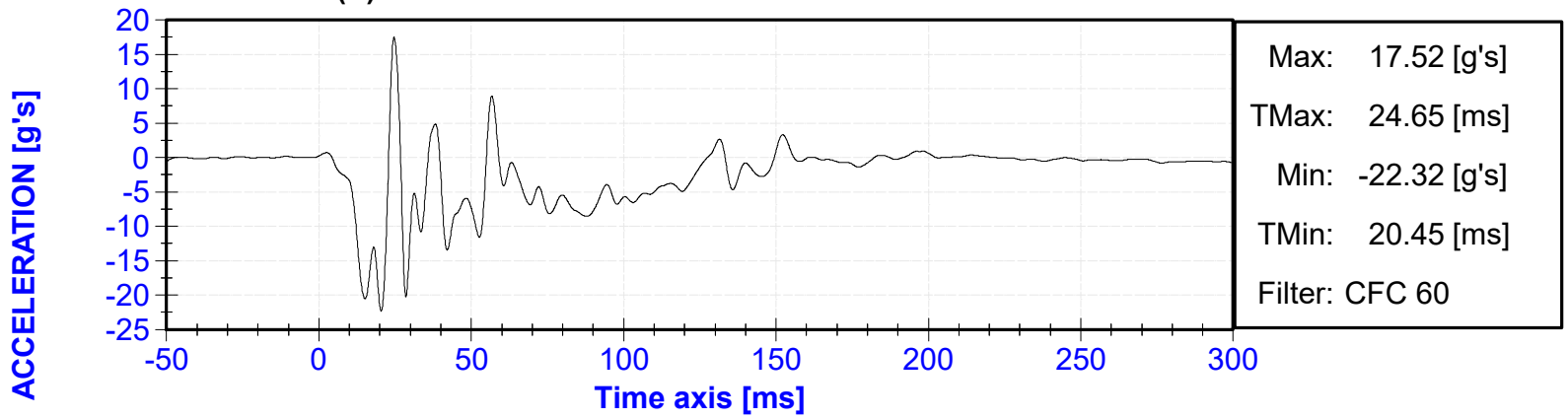
Floor Sill – Impact Side (Y) Velocity vs. Time



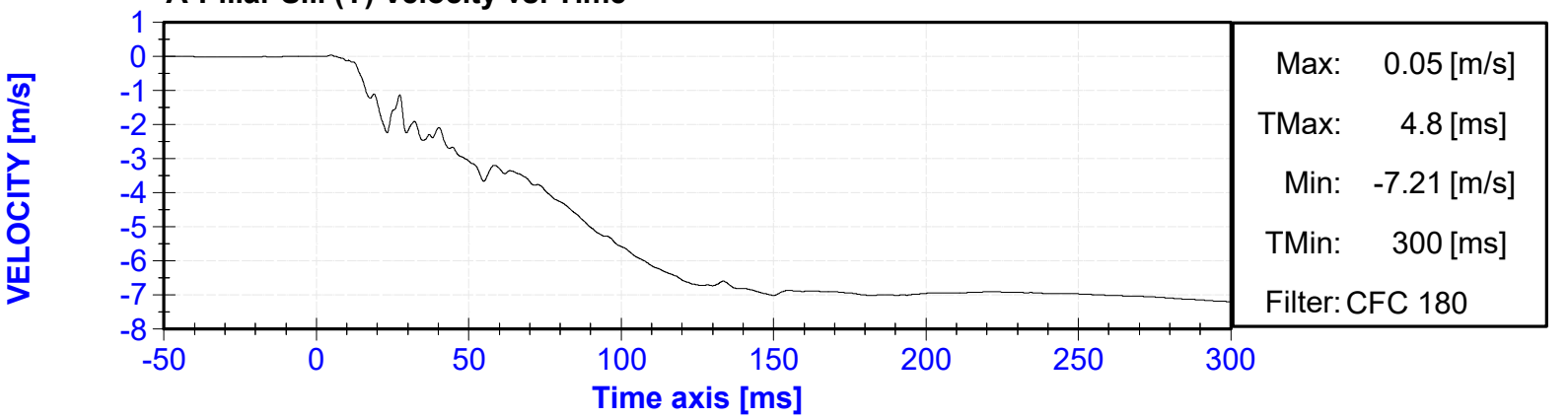
Floor Sill – Impact Side (Y) Displacement vs. Time

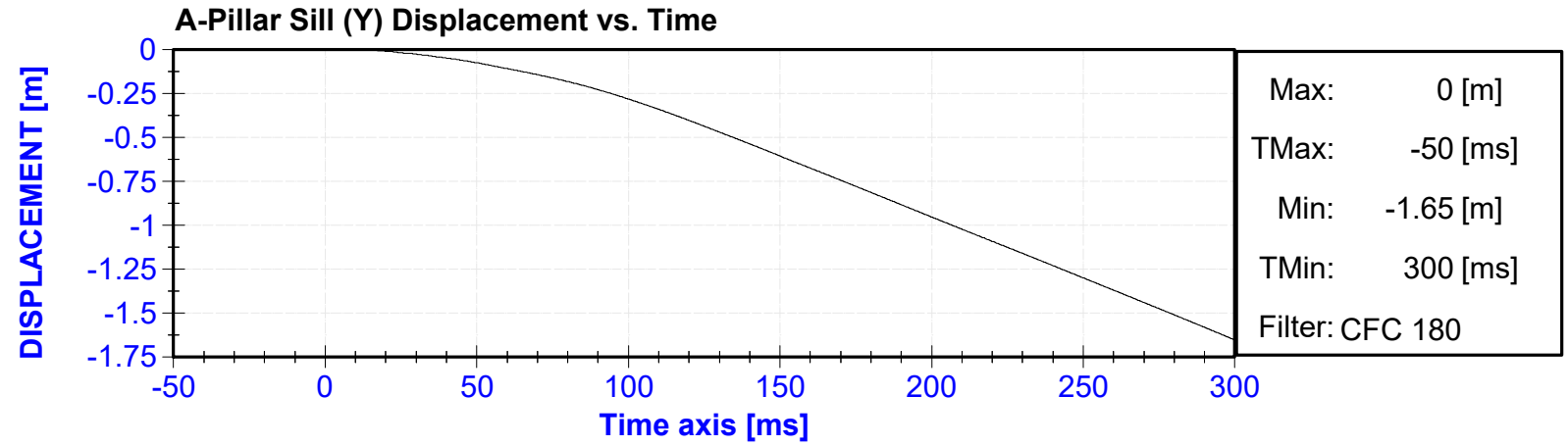


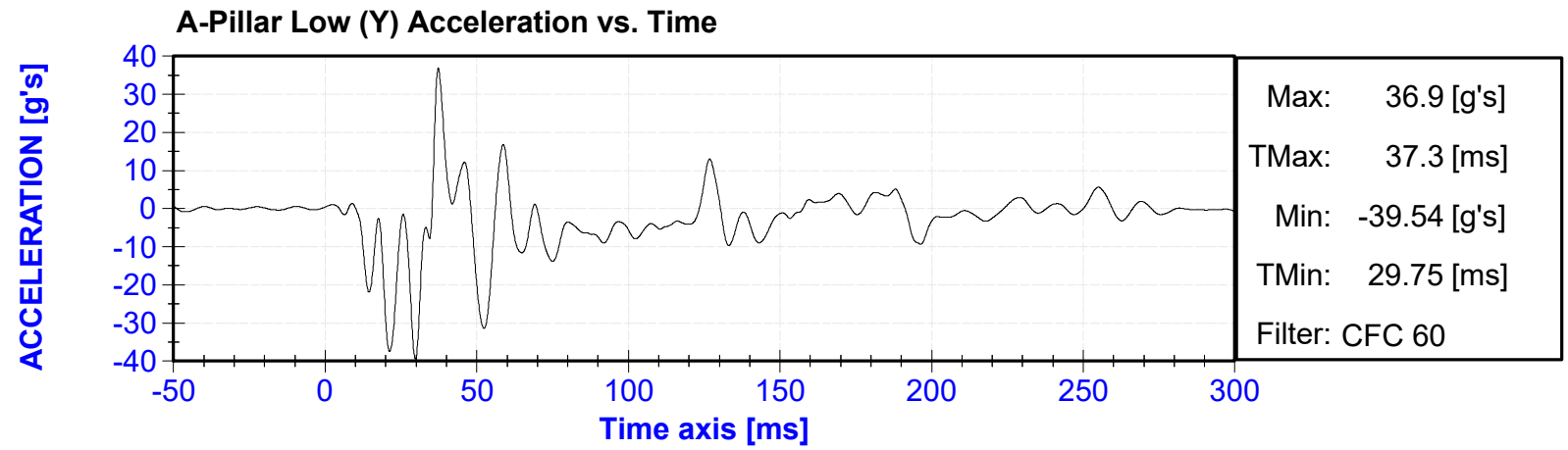
A-Pillar Sill (Y) Acceleration vs. Time

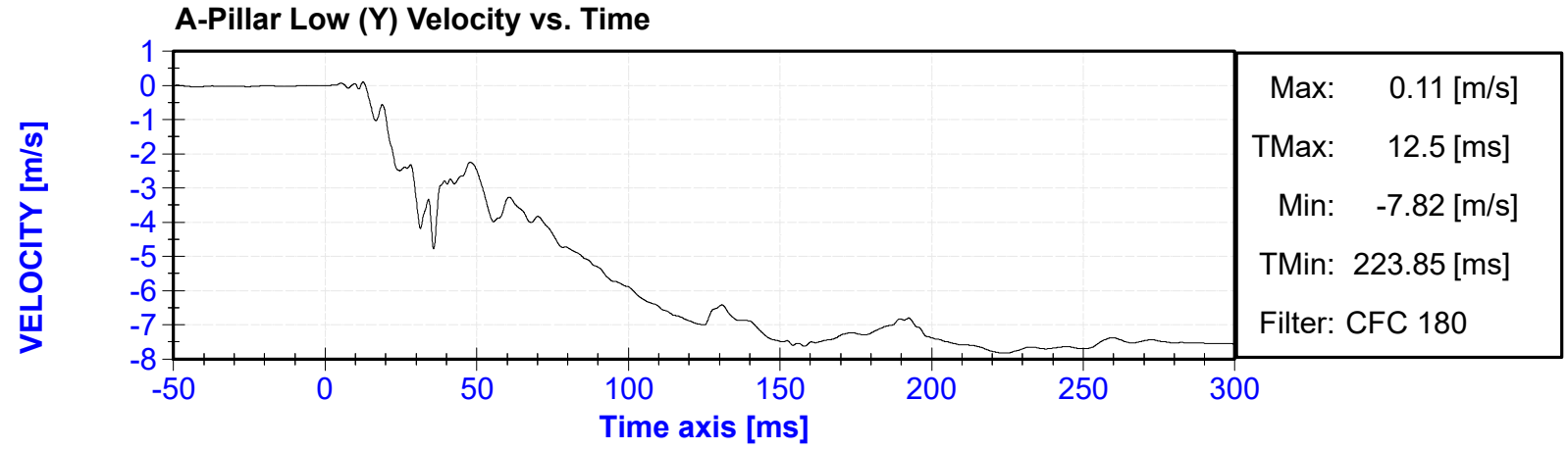


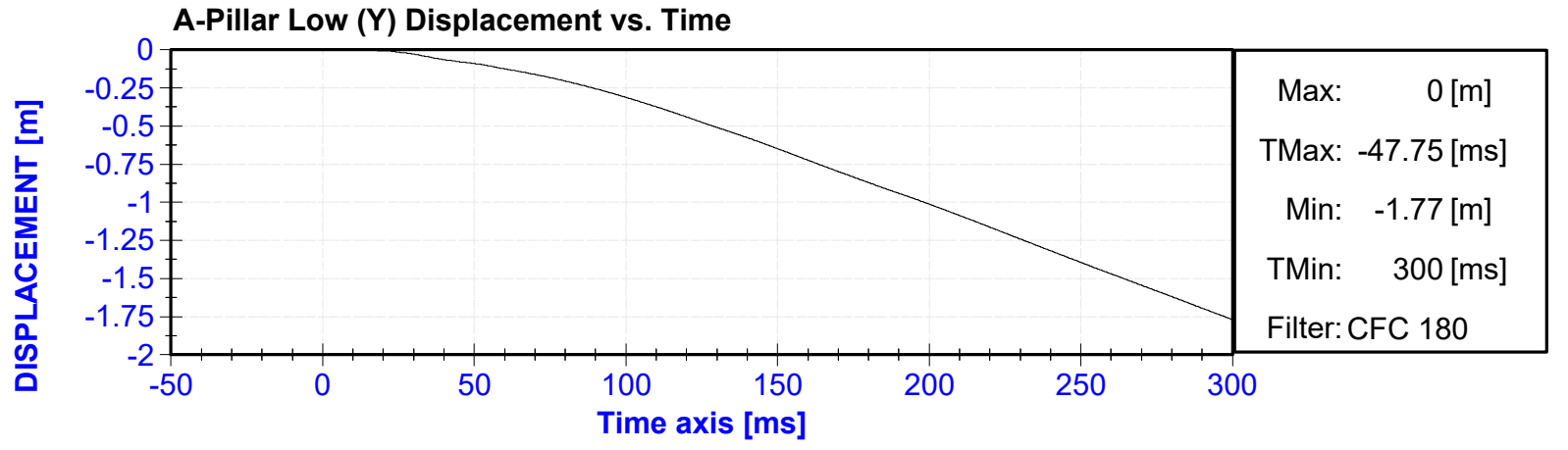
A-Pillar Sill (Y) Velocity vs. Time



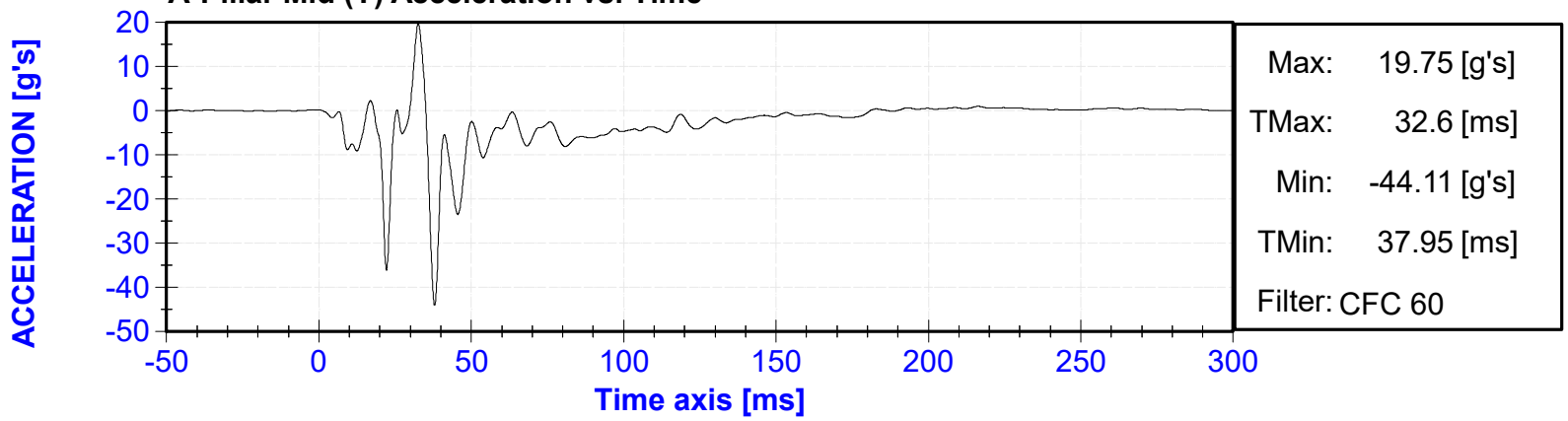

A-Pillar Sill (Y) Displacement vs. Time
DISPLACEMENT [m]
0
-0.25
-0.5
-0.75
-1
-1.25
-1.5
-1.75
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0 [m]
TMax: -50 [ms]
Min: -1.65 [m]
TMin: 300 [ms]
Filter: CFC 180


A-Pillar Low (Y) Acceleration vs. Time
ACCELERATION [g's]
40
30
20
10
0
-10
-20
-30
-40
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 36.9 [g's]
TMax: 37.3 [ms]
Min: -39.54 [g's]
TMin: 29.75 [ms]
Filter: CFC 60

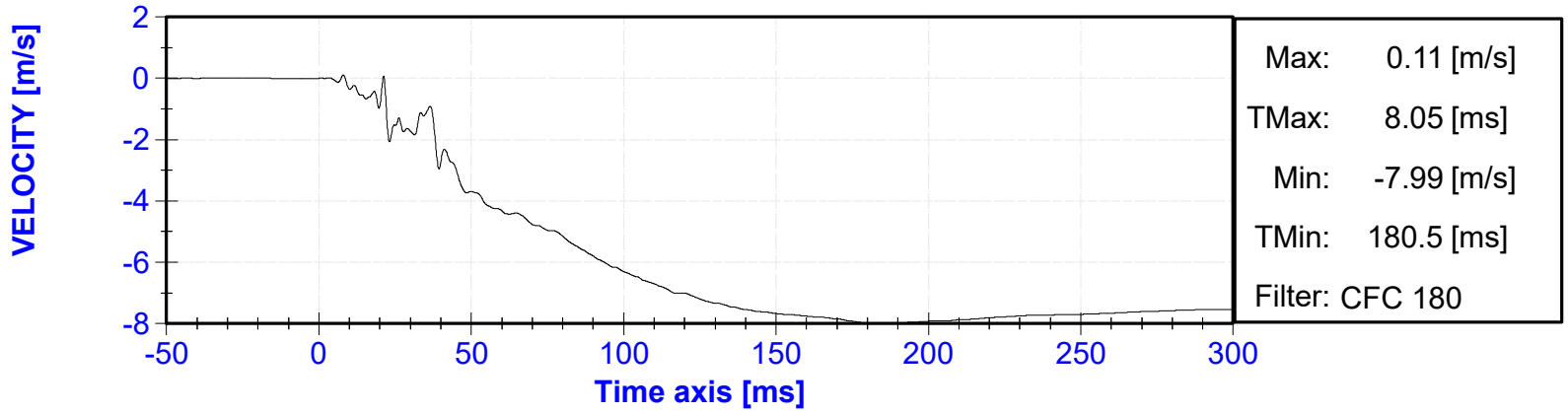

A-Pillar Low (Y) Velocity vs. Time
VELOCITY [m/s]
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0.11 [m/s]
TMax: 12.5 [ms]
Min: -7.82 [m/s]
TMin: 223.85 [ms]
Filter: CFC 180


A-Pillar Low (Y) Displacement vs. Time
DISPLACEMENT [m]
0
-0.25
-0.5
-0.75
-1
-1.25
-1.5
-1.75
-2
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0 [m]
TMax: -47.75 [ms]
Min: -1.77 [m]
TMin: 300 [ms]
Filter: CFC 180

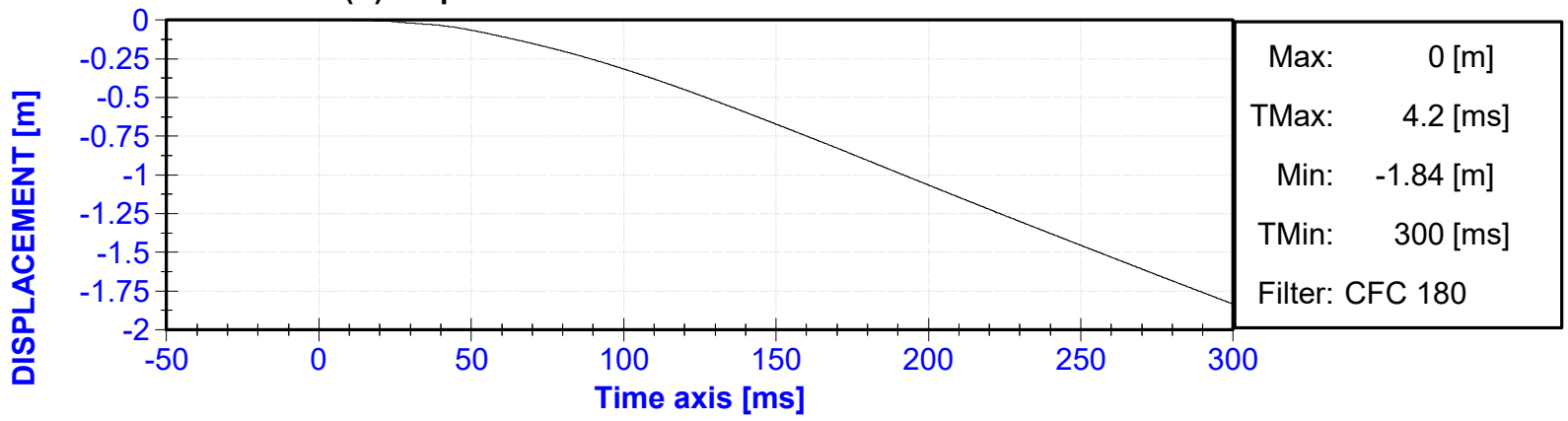
A-Pillar Mid (Y) Acceleration vs. Time



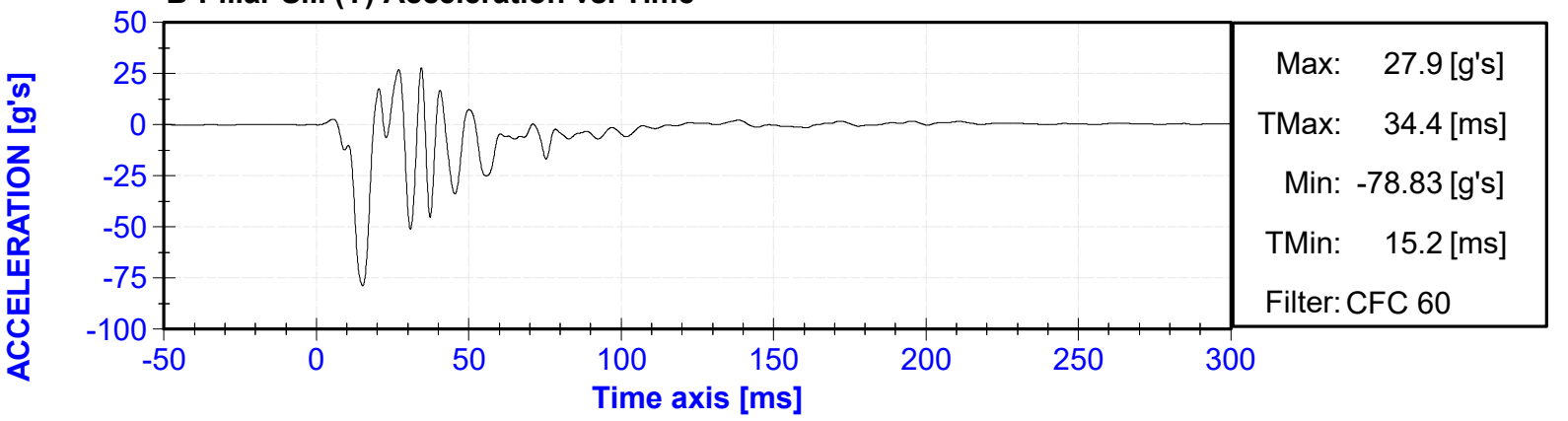
A-Pillar Mid (Y) Velocity vs. Time

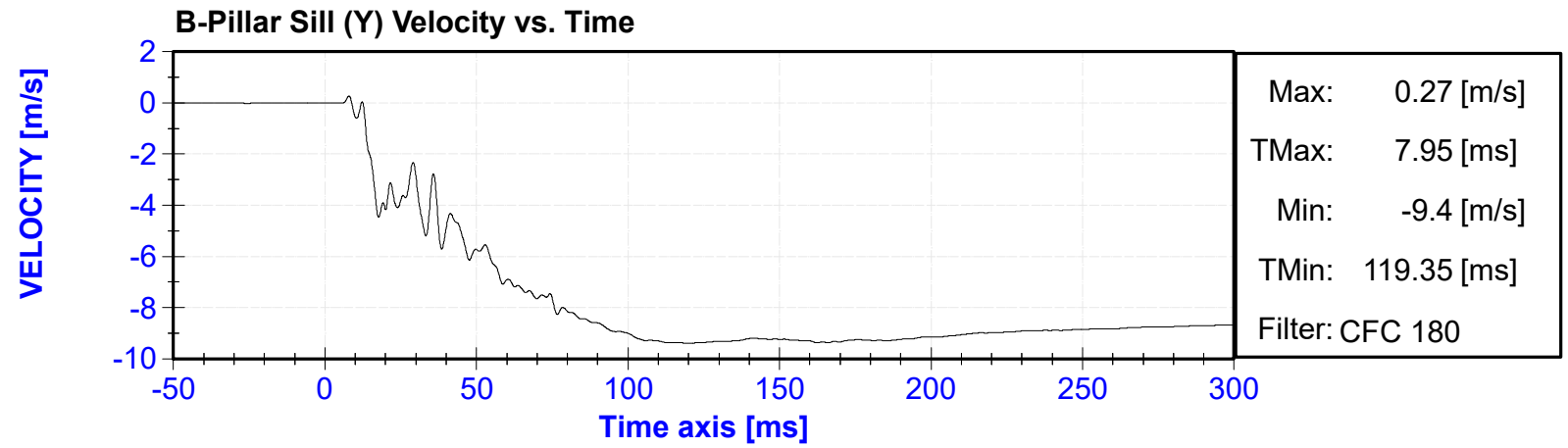


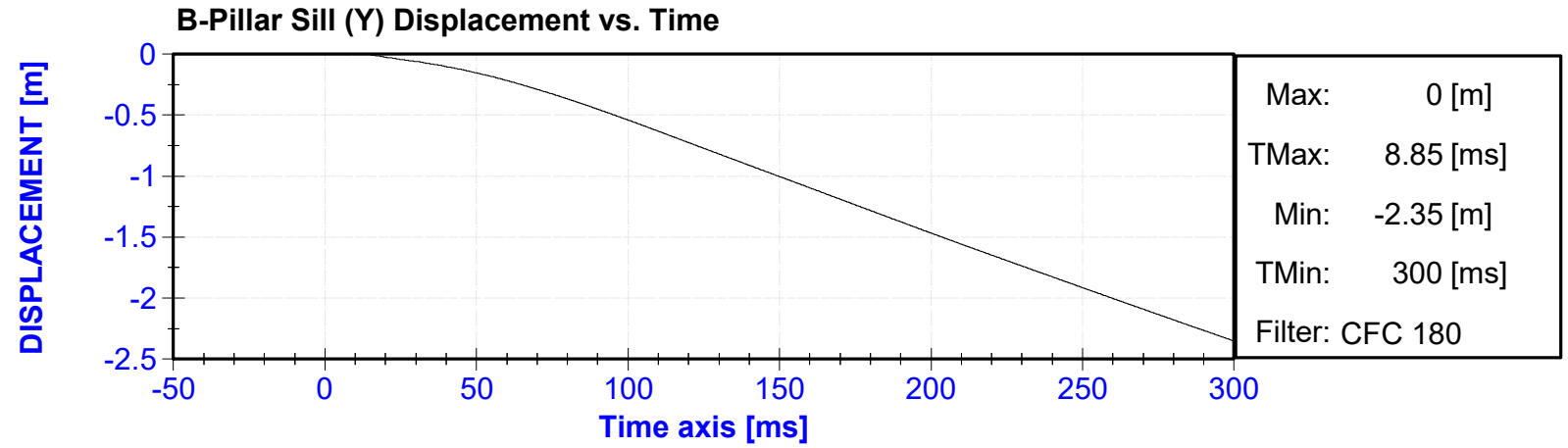
A-Pillar Mid (Y) Displacement vs. Time

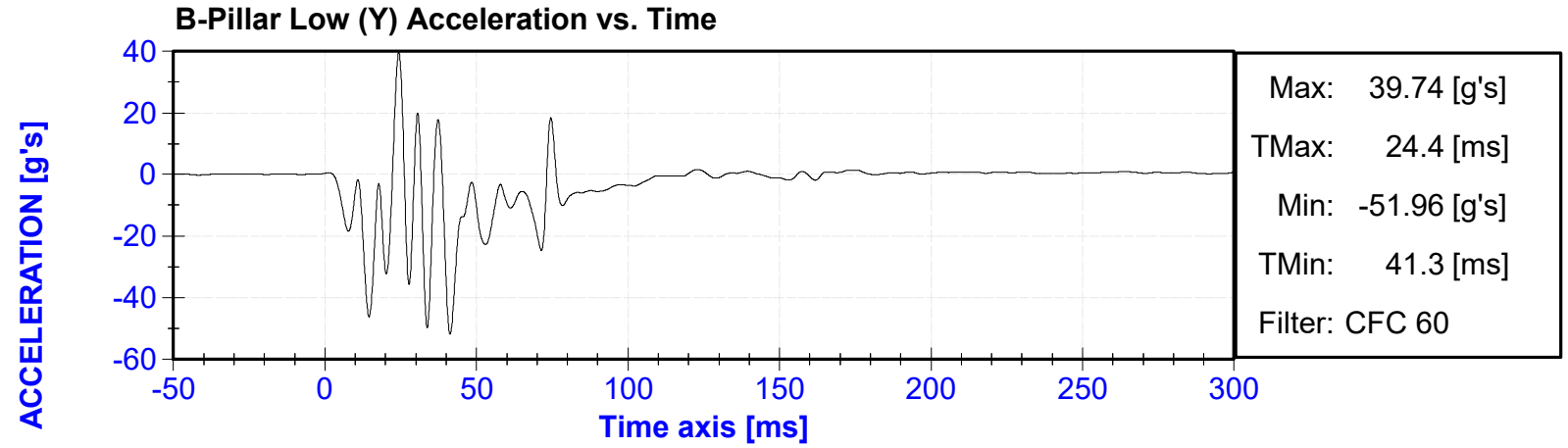


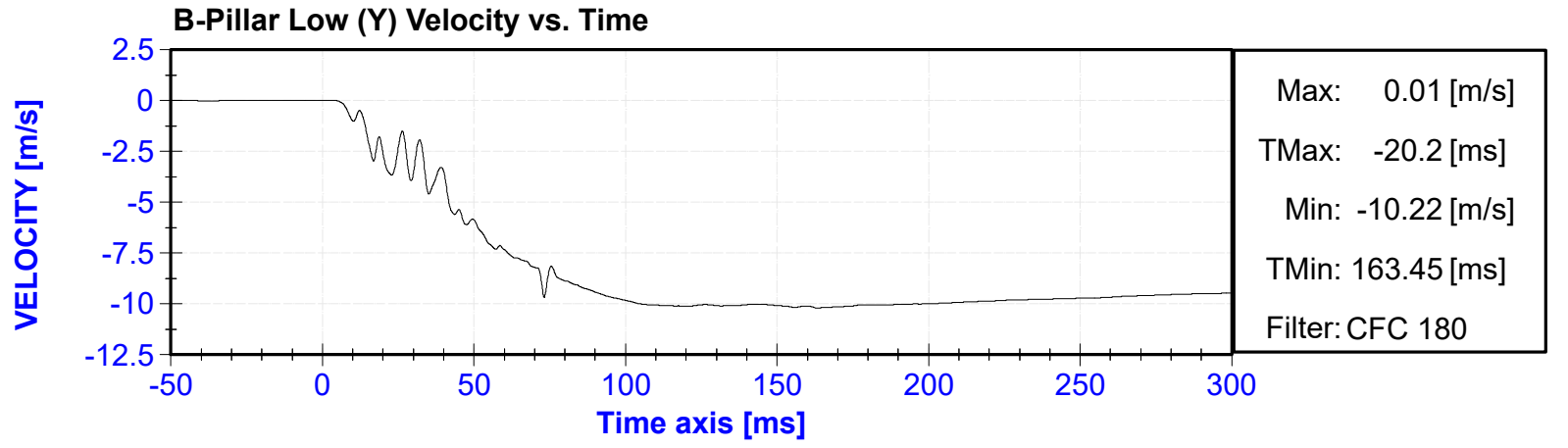
B-Pillar Sill (Y) Acceleration vs. Time



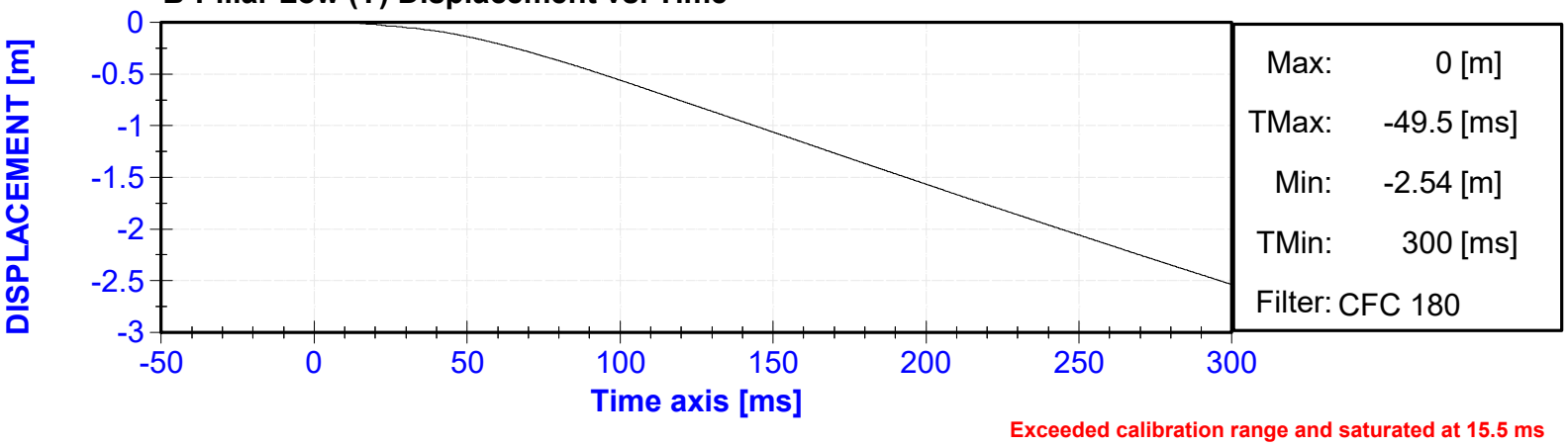

B-Pillar Sill (Y) Velocity vs. Time
VELOCITY [m/s]
2
0
-2
-4
-6
-8
-10
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0.27 [m/s]
TMax: 7.95 [ms]
Min: -9.4 [m/s]
TMin: 119.35 [ms]
Filter: CFC 180


B-Pillar Sill (Y) Displacement vs. Time
DISPLACEMENT [m]
0
-0.5
-1
-1.5
-2
-2.5
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0 [m]
TMax: 8.85 [ms]
Min: -2.35 [m]
TMin: 300 [ms]
Filter: CFC 180


B-Pillar Low (Y) Acceleration vs. Time
ACCELERATION [g's]
40
20
0
-20
-40
-60
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 39.74 [g's]
TMax: 24.4 [ms]
Min: -51.96 [g's]
TMin: 41.3 [ms]
Filter: CFC 60

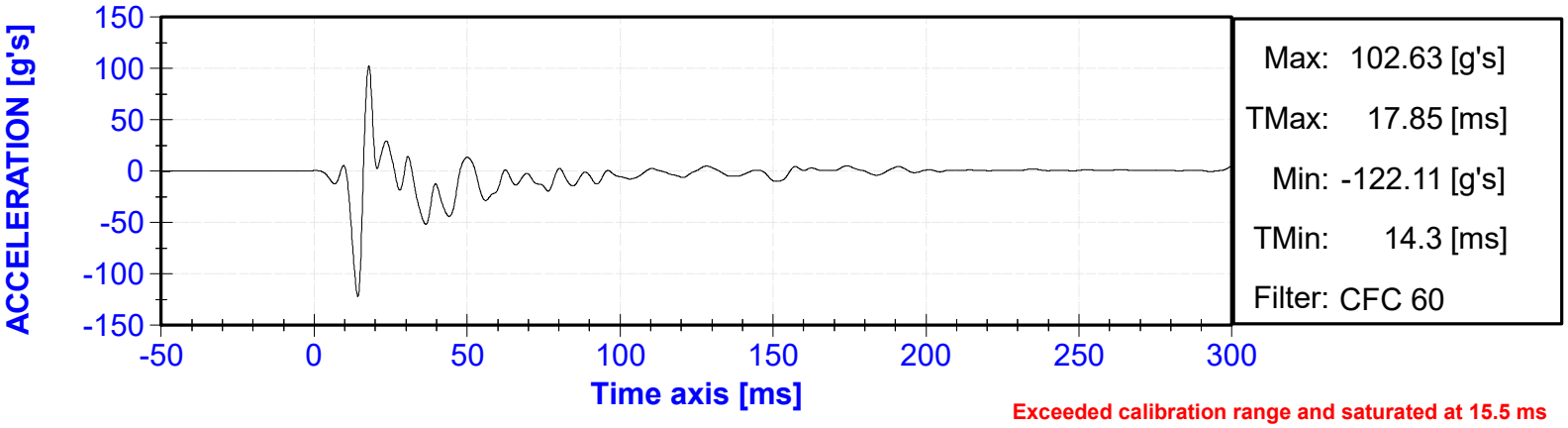

B-Pillar Low (Y) Velocity vs. Time
VELOCITY [m/s]
2.5
0
-2.5
-5
-7.5
-10
-12.5
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0.01 [m/s]
TMax: -20.2 [ms]
Min: -10.22 [m/s]
TMin: 163.45 [ms]
Filter: CFC 180

B-Pillar Low (Y) Displacement vs. Time



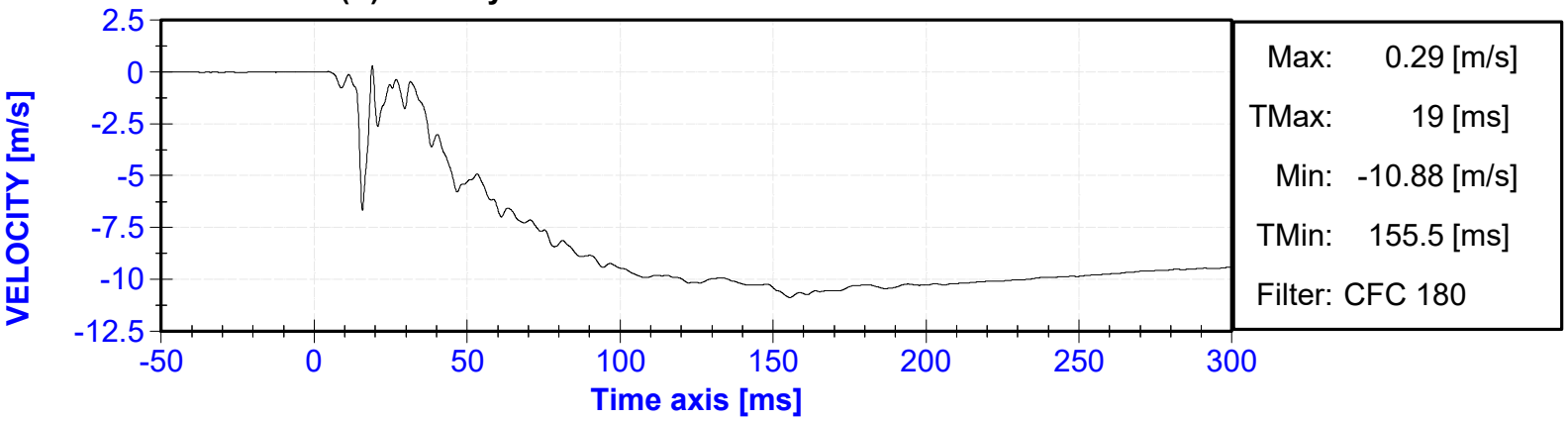
Exceeded calibration range and saturated at 15.5 ms

B-Pillar Mid (Y) Acceleration vs. Time



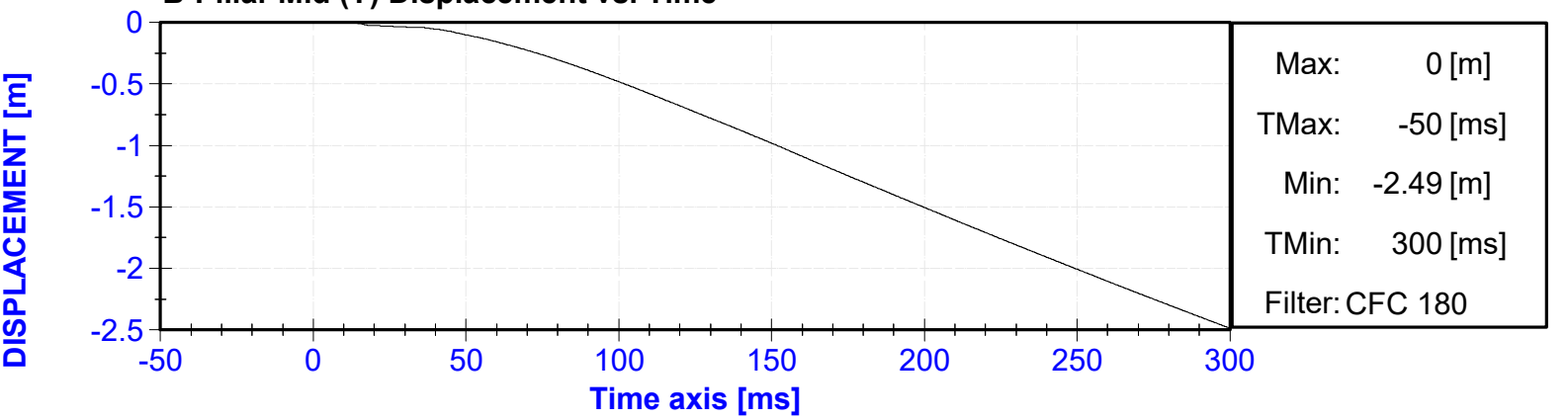
Exceeded calibration range and saturated at 15.5 ms

B-Pillar Mid (Y) Velocity vs. Time

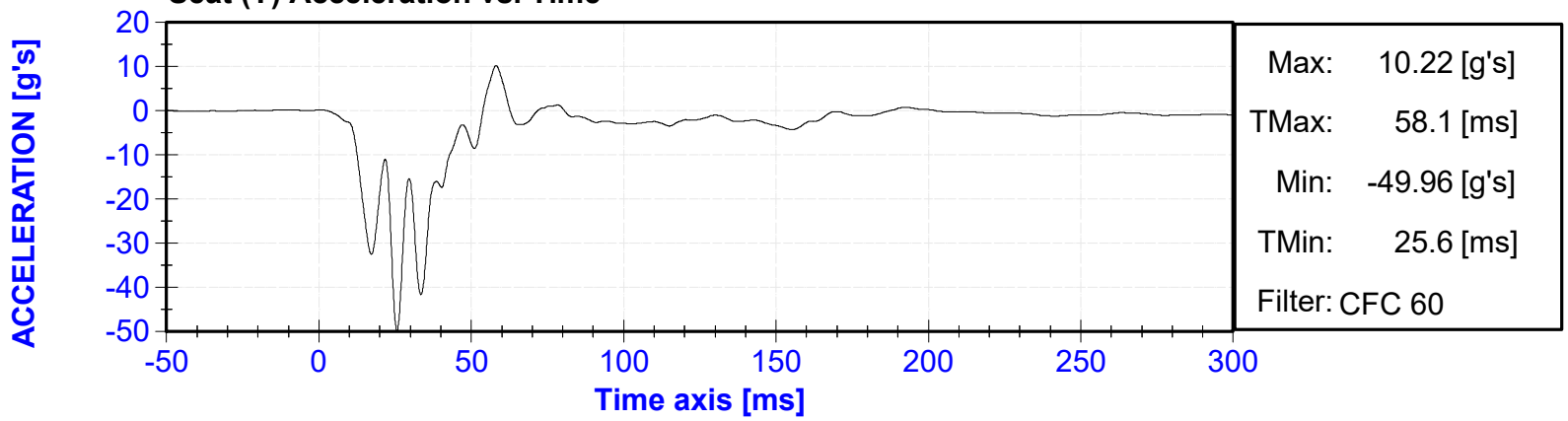


Exceeded calibration range and saturated at 15.5 ms

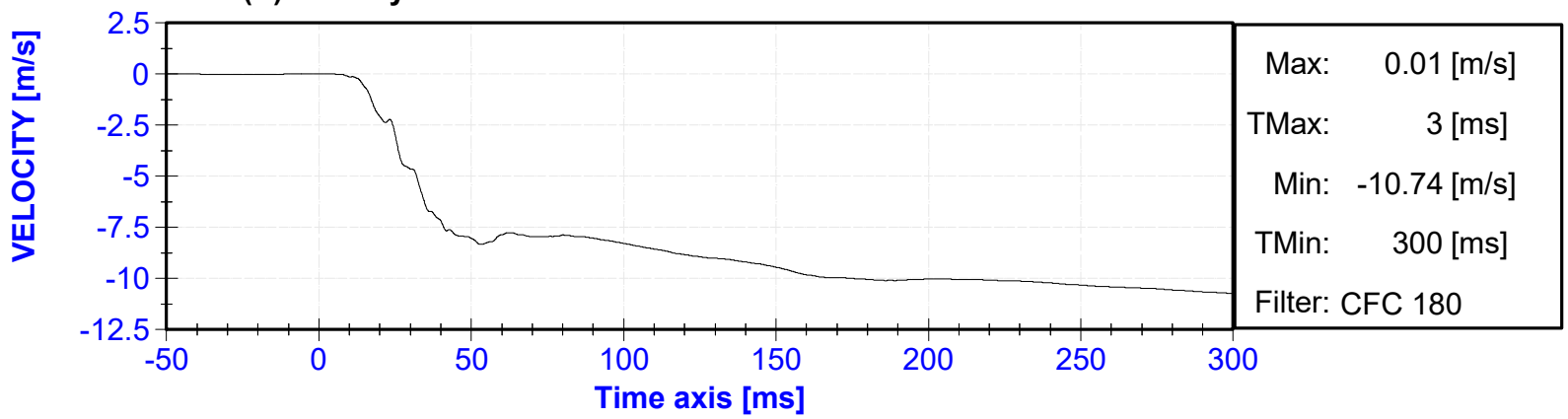
B-Pillar Mid (Y) Displacement vs. Time



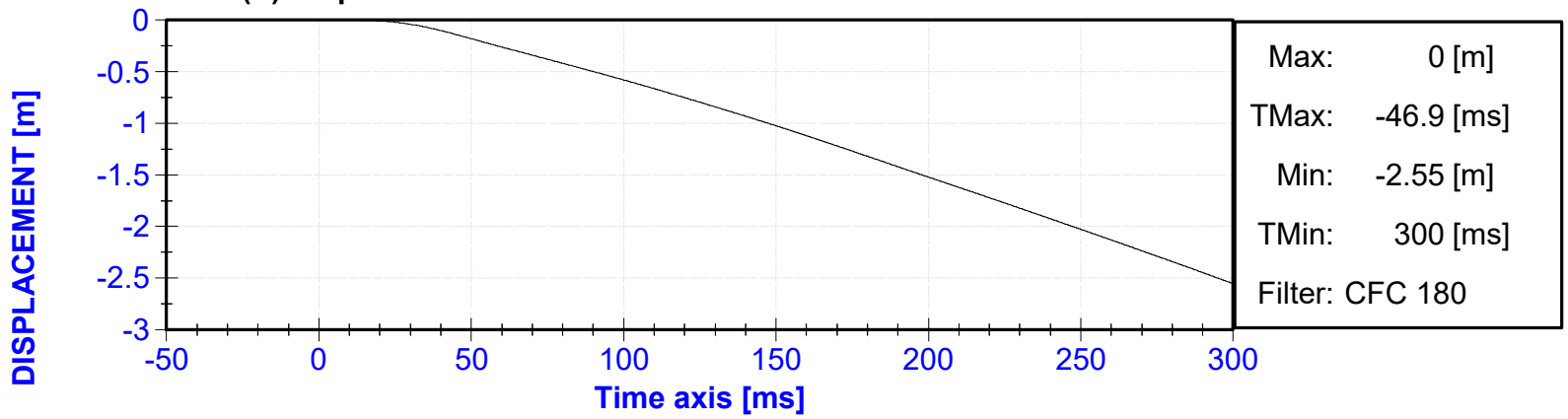
Seat (Y) Acceleration vs. Time



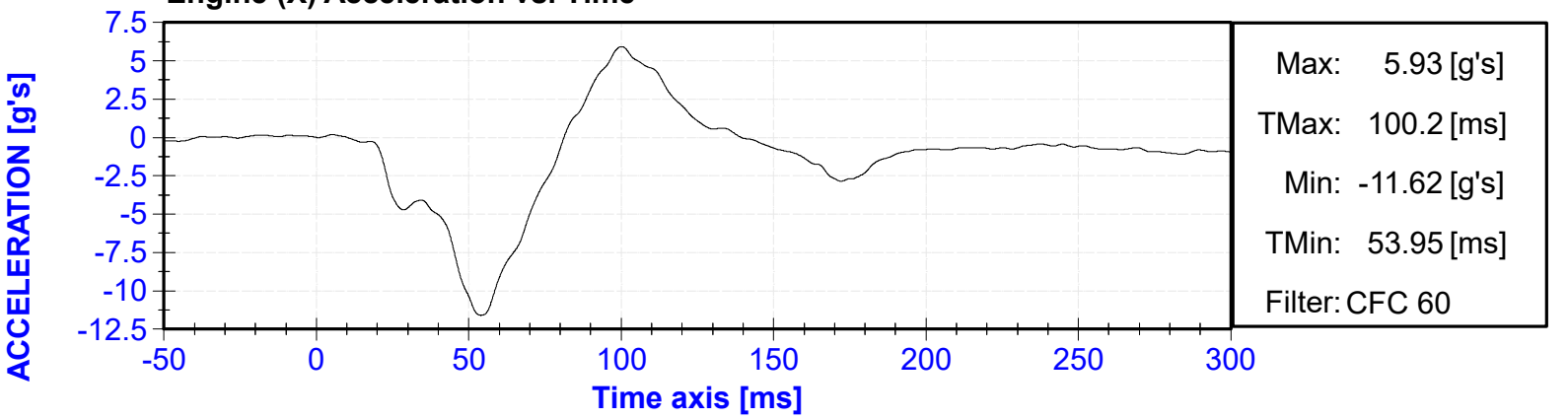
Seat (Y) Velocity vs. Time

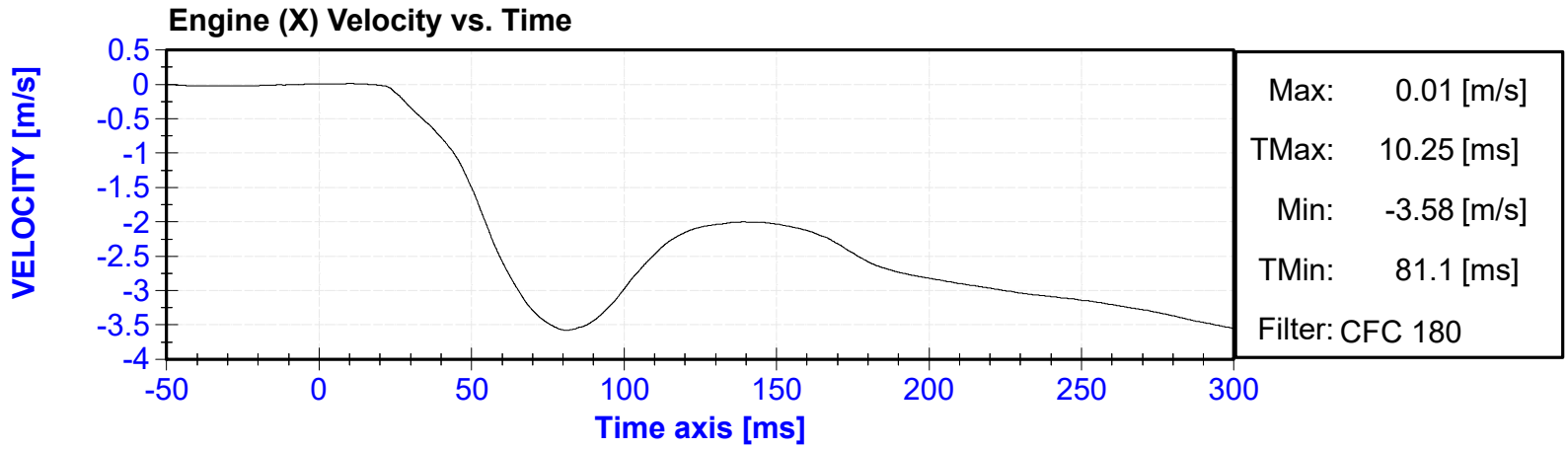


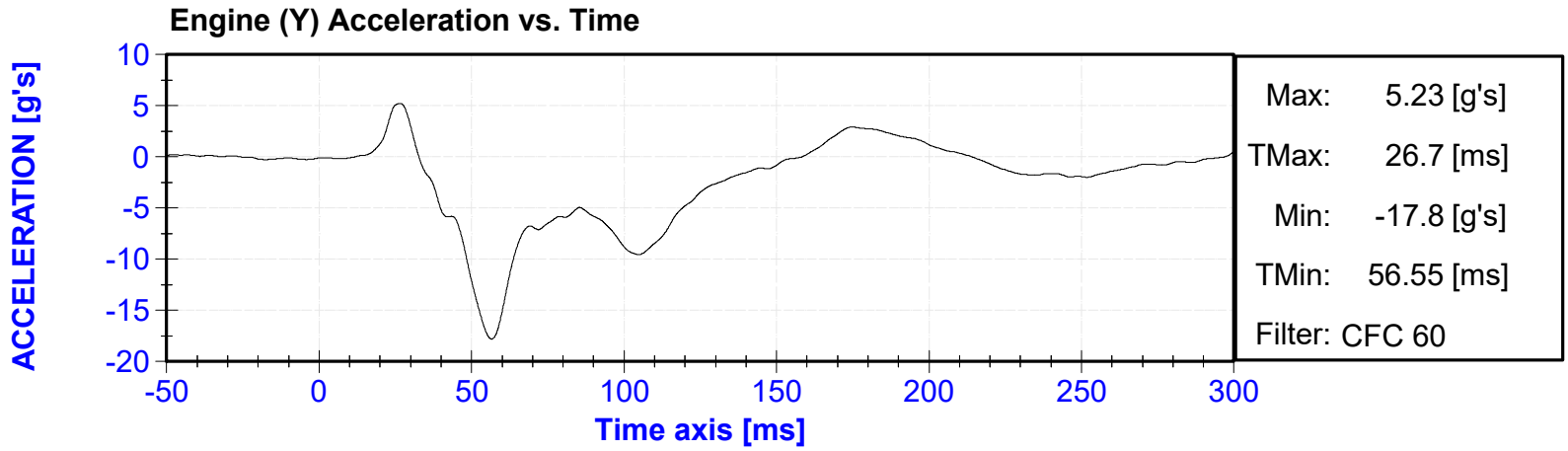
Seat (Y) Displacement vs. Time

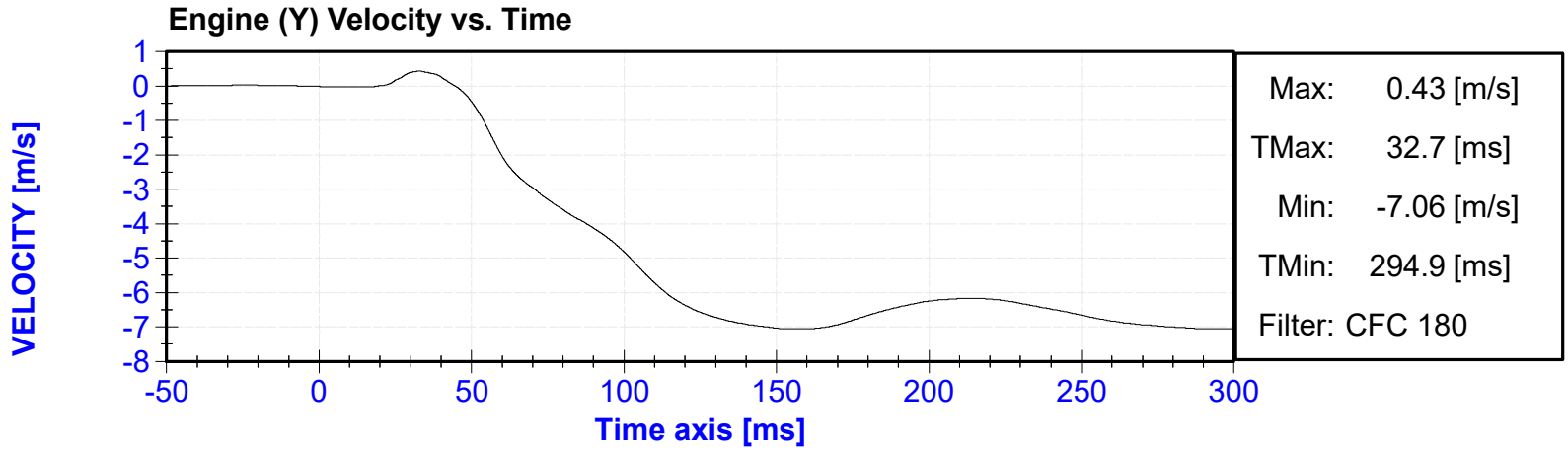


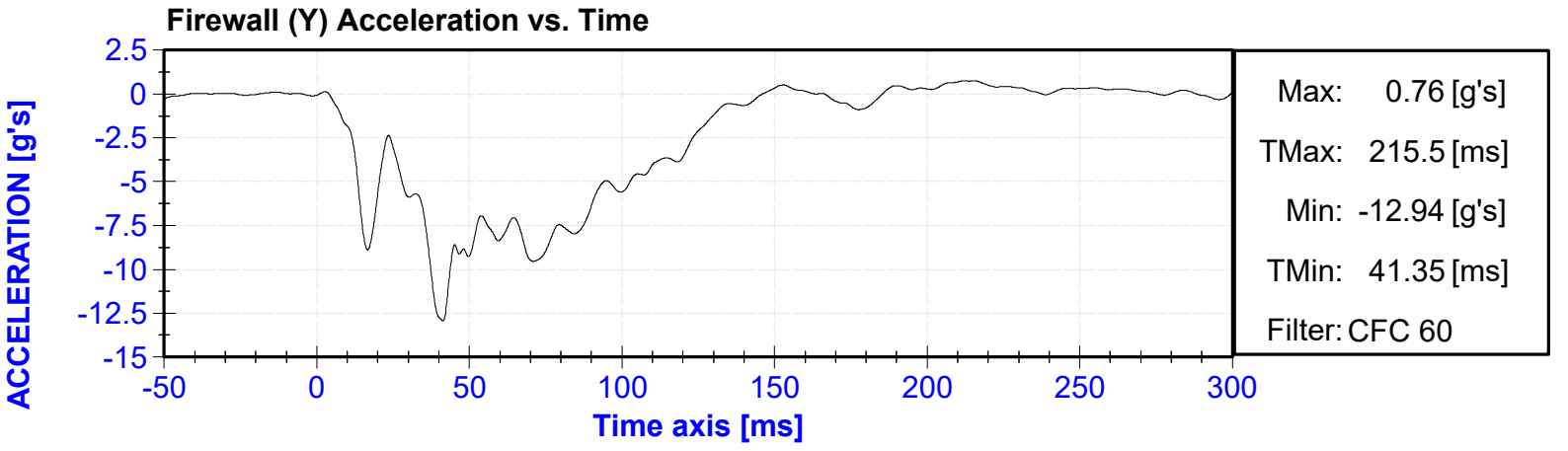
Engine (X) Acceleration vs. Time



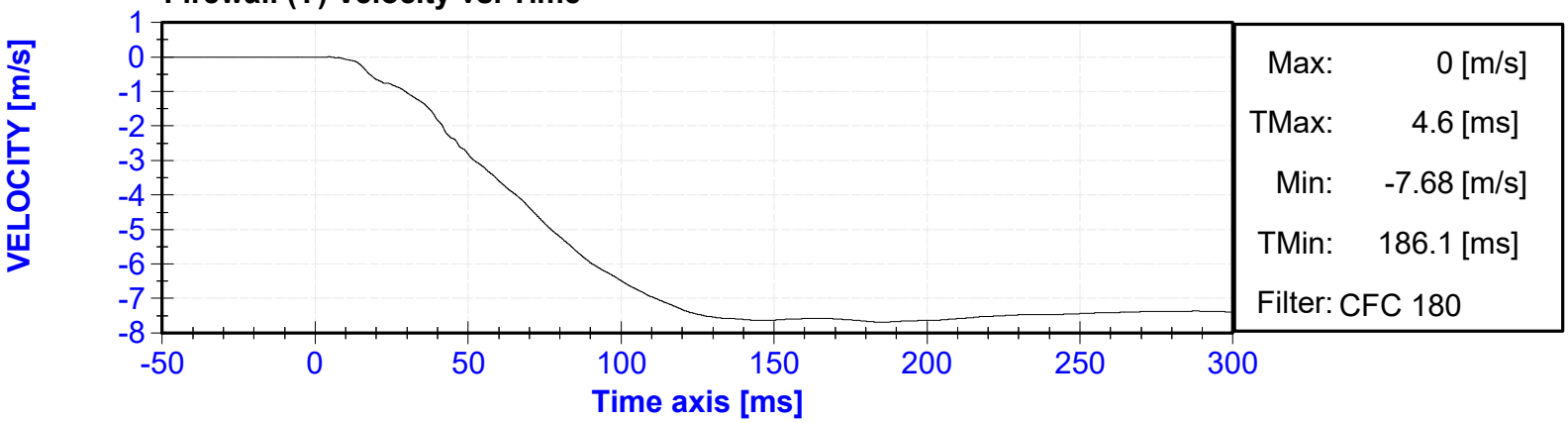

Engine (X) Velocity vs. Time
VELOCITY [m/s]
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0.01 [m/s]
TMax: 10.25 [ms]
Min: -3.58 [m/s]
TMin: 81.1 [ms]
Filter: CFC 180


Engine (Y) Acceleration vs. Time
ACCELERATION [g's]
10
5
0
-5
-10
-15
-20
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 5.23 [g's]
TMax: 26.7 [ms]
Min: -17.8 [g's]
TMin: 56.55 [ms]
Filter: CFC 60

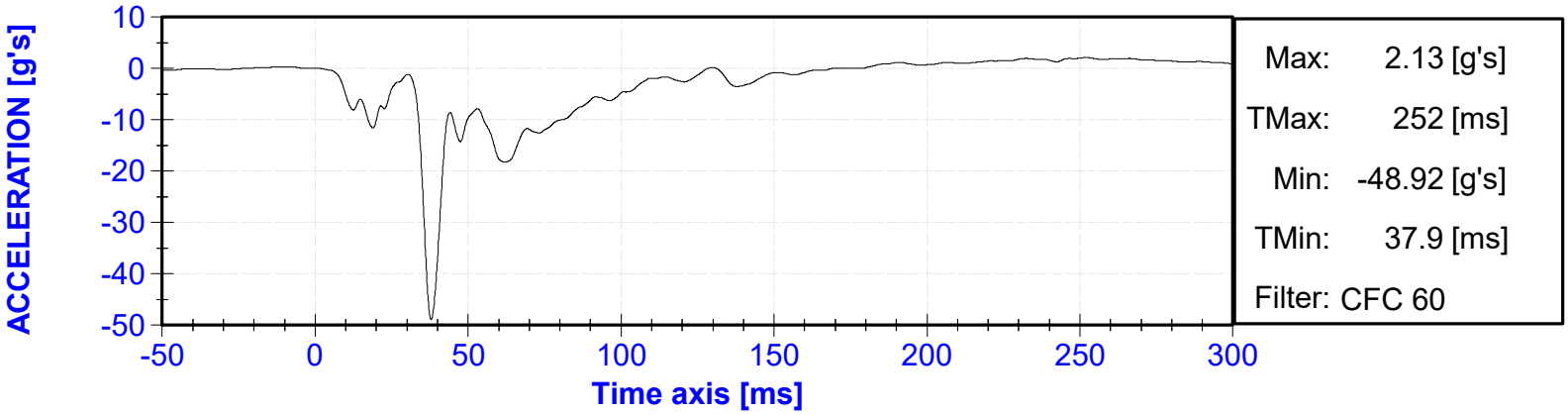

Engine (Y) Velocity vs. Time
VELOCITY [m/s]
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0.43 [m/s]
TMax: 32.7 [ms]
Min: -7.06 [m/s]
TMin: 294.9 [ms]
Filter: CFC 180


Firewall (Y) Acceleration vs. Time
ACCELERATION [g's]
2.5
0
-2.5
-5
-7.5
-10
-12.5
-15
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0.76 [g's]
TMax: 215.5 [ms]
Min: -12.94 [g's]
TMin: 41.35 [ms]
Filter: CFC 60

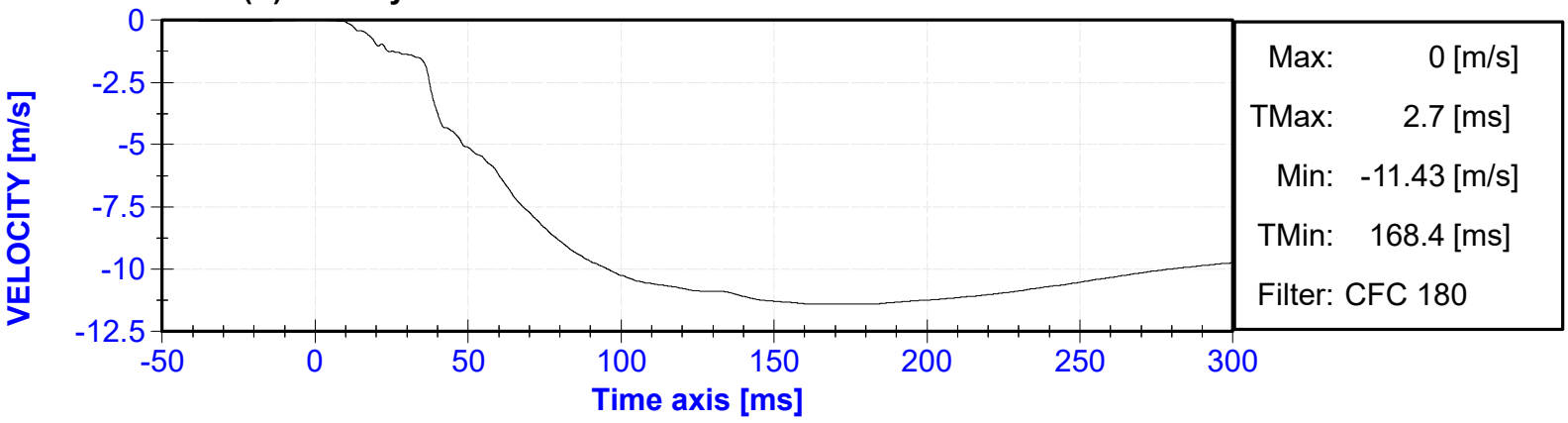
Firewall (Y) Velocity vs. Time



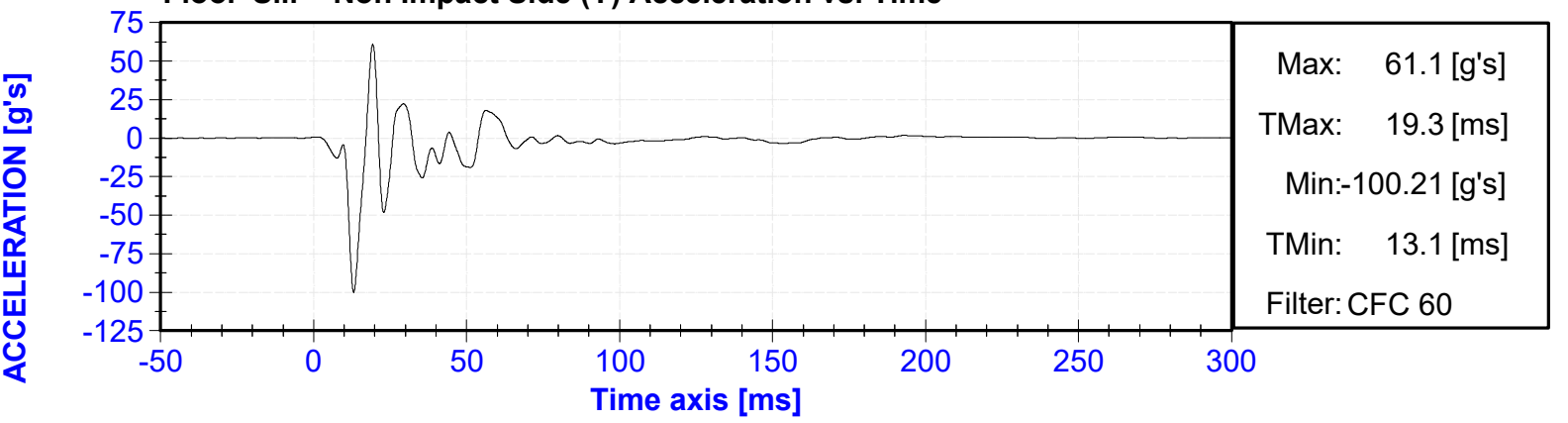
Roof (Y) Acceleration vs. Time



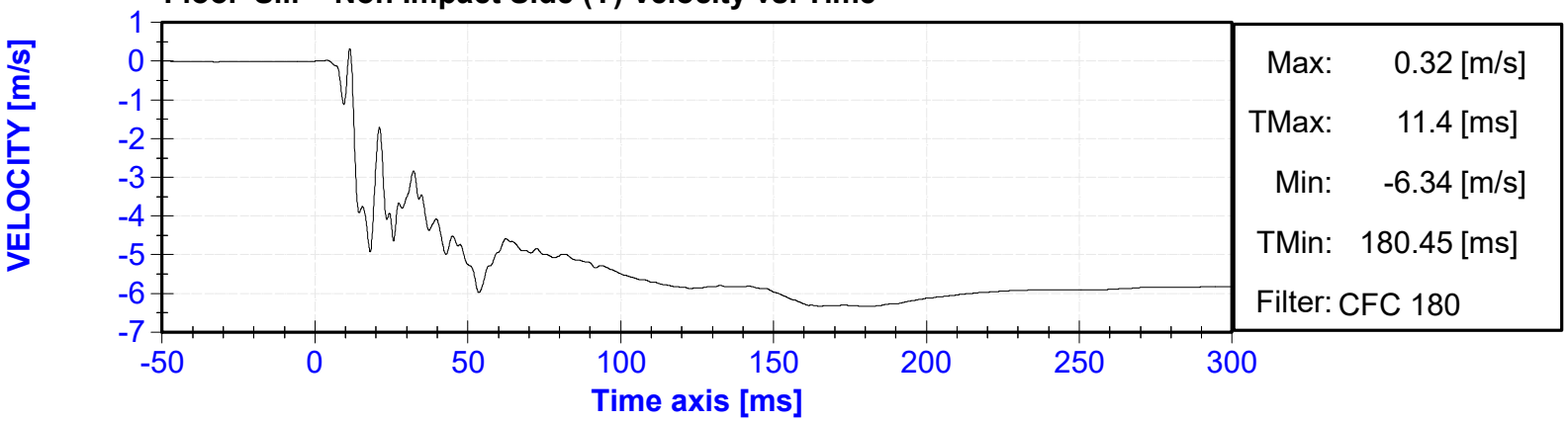
Roof (Y) Velocity vs. Time



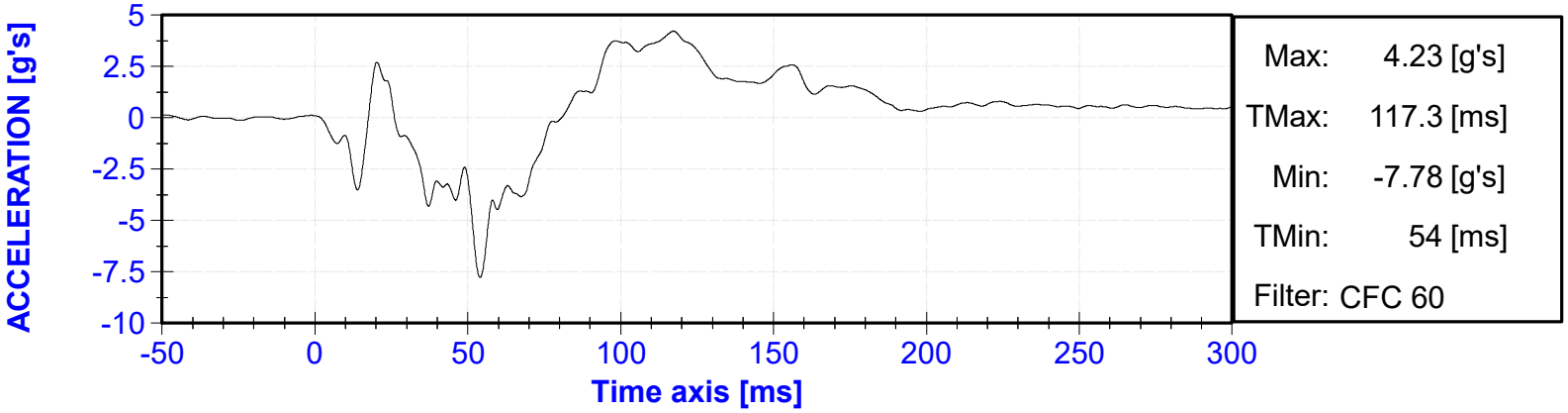
Floor Sill – Non Impact Side (Y) Acceleration vs. Time



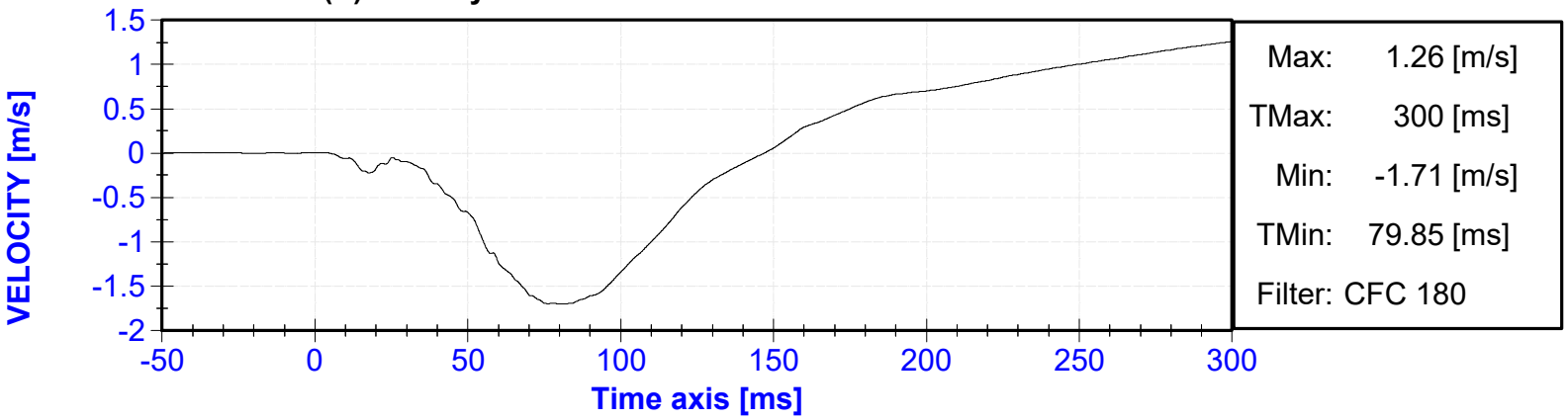
Floor Sill – Non Impact Side (Y) Velocity vs. Time



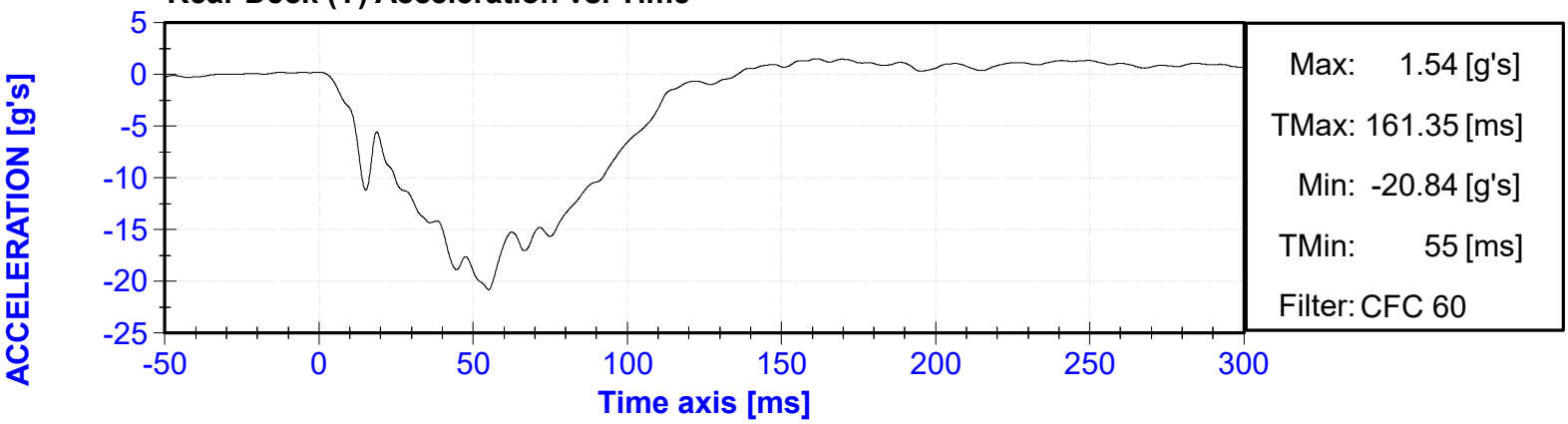
Rear Deck (X) Acceleration vs. Time

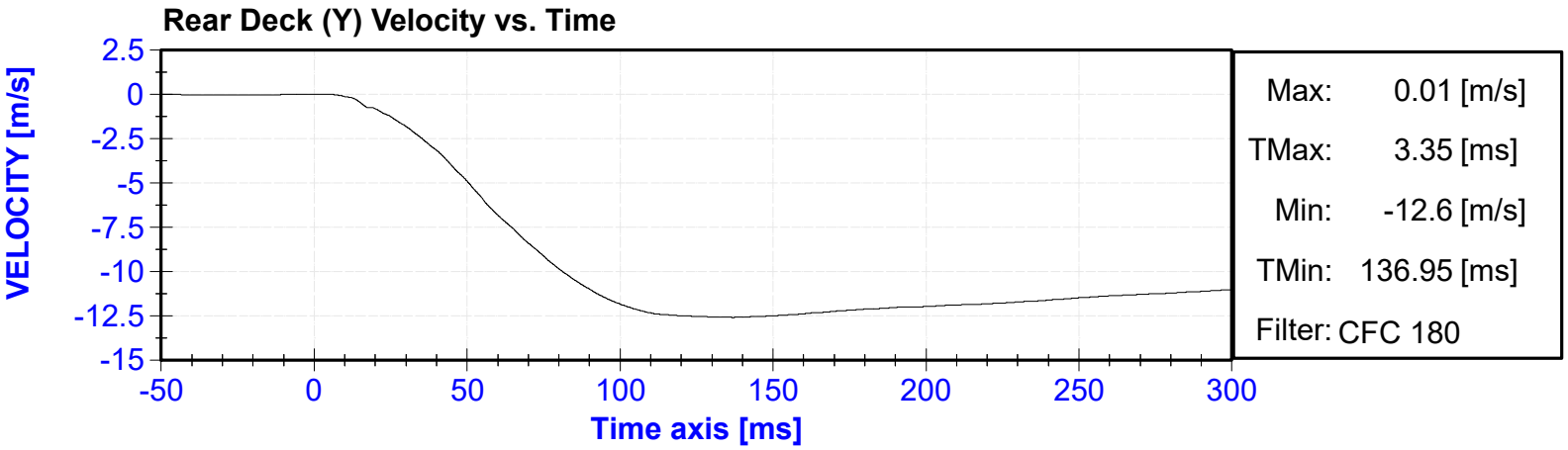


Rear Deck (X) Velocity vs. Time



Rear Deck (Y) Acceleration vs. Time




Rear Deck (Y) Velocity vs. Time
VELOCITY [m/s]
2.5
0
-2.5
-5
-7.5
-10
-12.5
-15
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0.01 [m/s]
TMax: 3.35 [ms]
Min: -12.6 [m/s]
TMin: 136.95 [ms]
Filter: CFC 180

APPENDIX IV

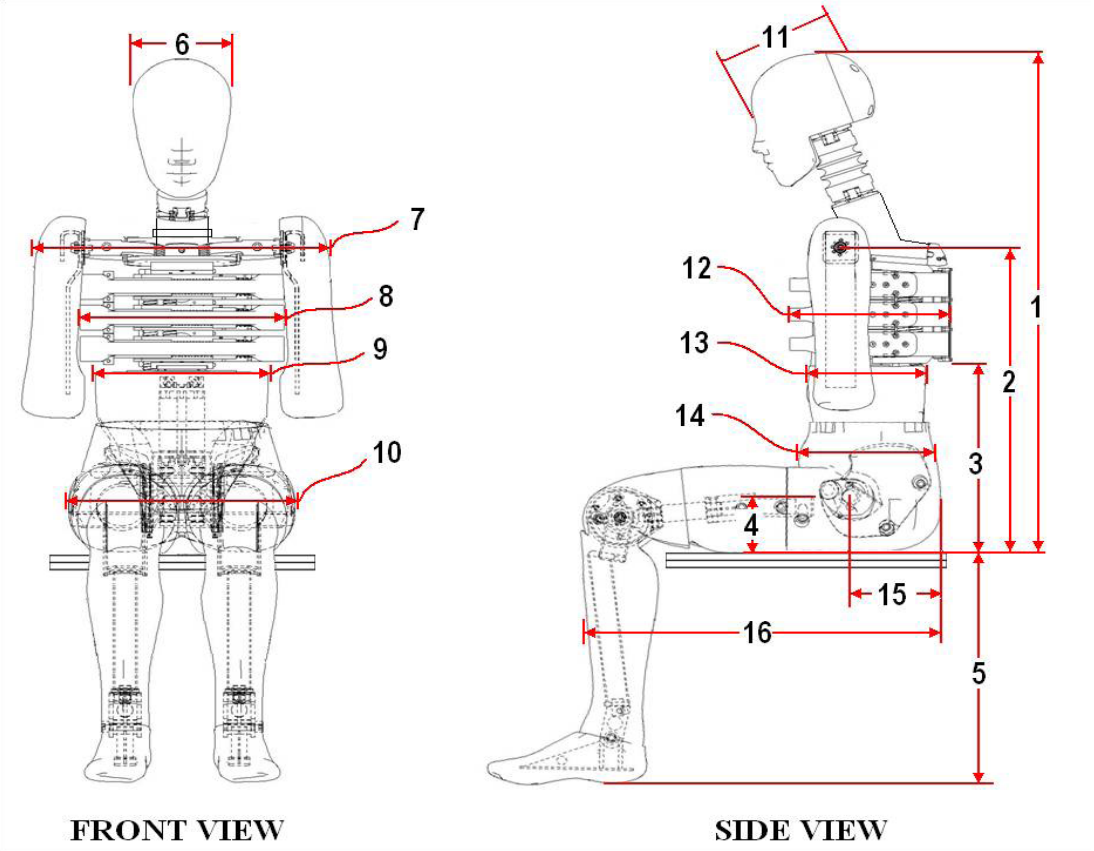
PRE-TEST DUMMY PERFORMANCE CALIBRATION TEST DATA

(Subpart U, ES-2re)

External Measurements - EuroSID-2re

Technician: K. Brogan Date: 08/14/2023

Dummy Serial Number: DG5348



FRONT VIEW SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	914	Pass
2	Seat to Shoulder Joint	558	572	568	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	350	Pass
4	Seat to Hip Joint (center of bolt)	97	103	102	Pass
5	Sole to Seat, Sitting	333	451	410	Pass
6	Head Width	152	158	156	Pass
7	Shoulder/Arm Width	461	479	471	Pass
8	Thorax Width	322	332	325	Pass
9	Abdomen Width	273	287	281	Pass
10	Pelvis Lap Width	359	373	368	Pass
11	Head Depth	196	206	202	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	199	Pass
14	Pelvis Depth	235	245	242	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

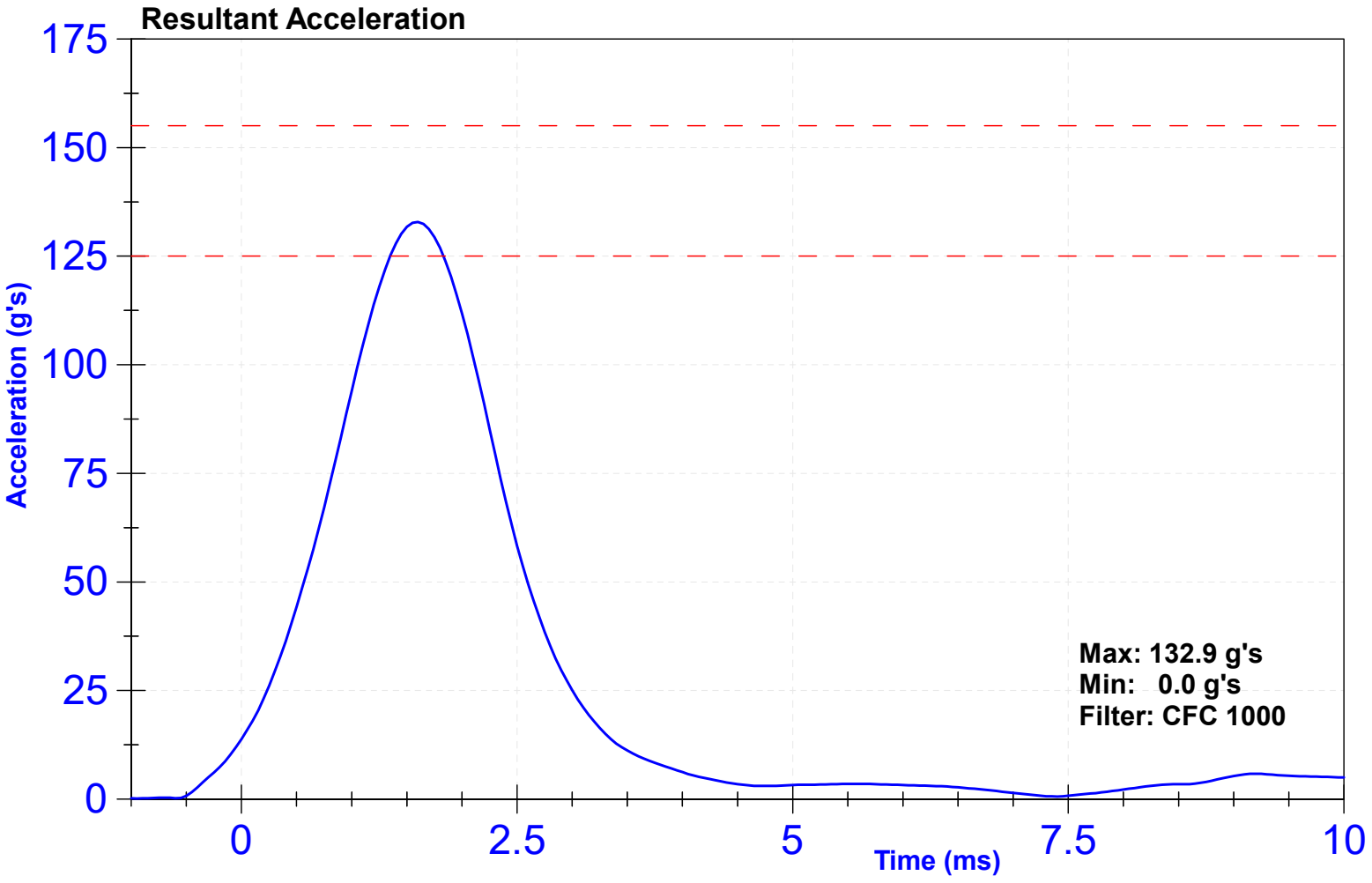
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

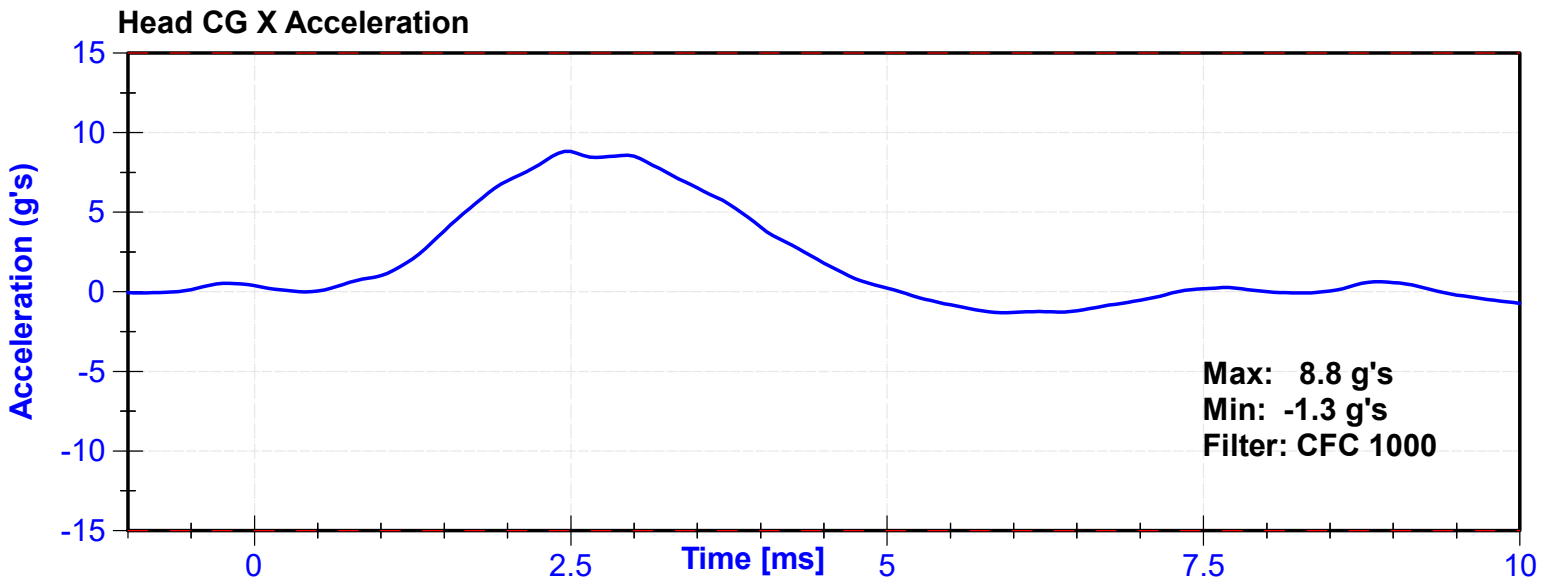
Results

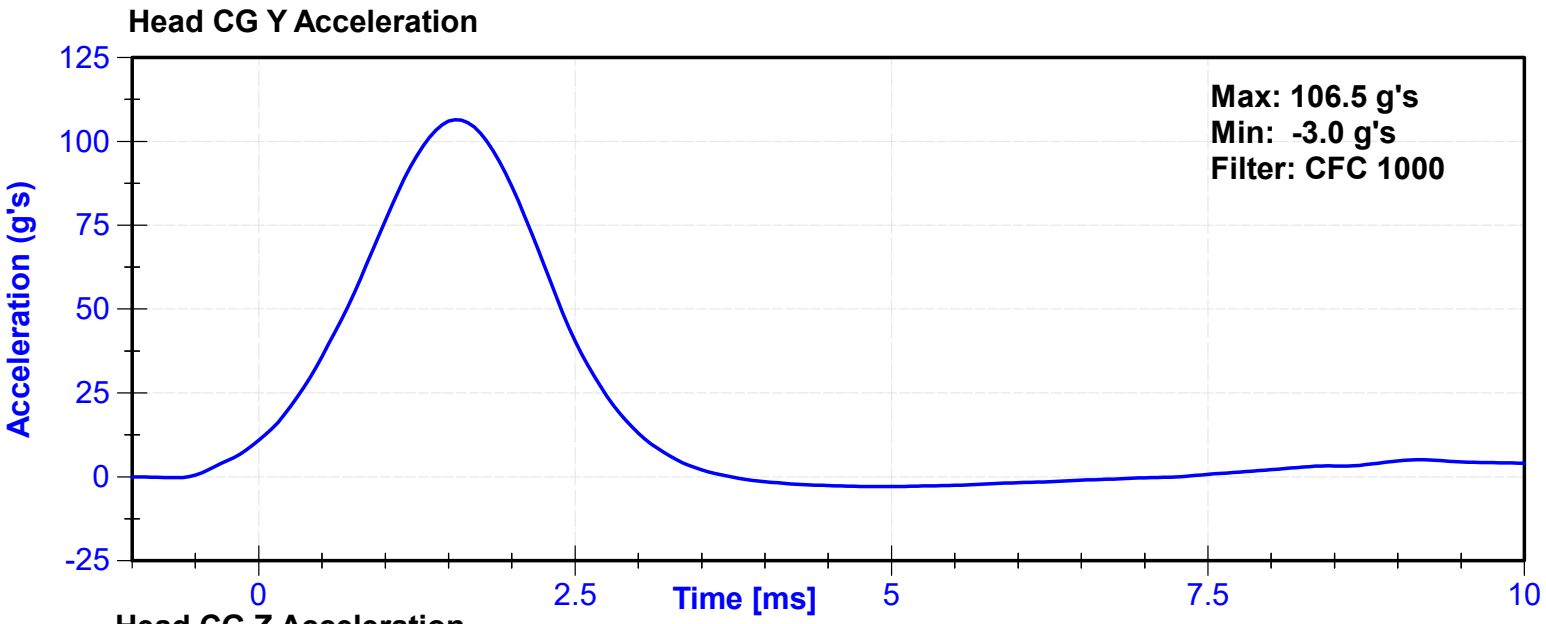
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	59	Pass
Resultant Acceleration	125	155	g's	132.9	Pass
Oscillation	0	15	%	4.39	Pass
Fore-Aft Acceleration	-15	15	g's	8.8	Pass

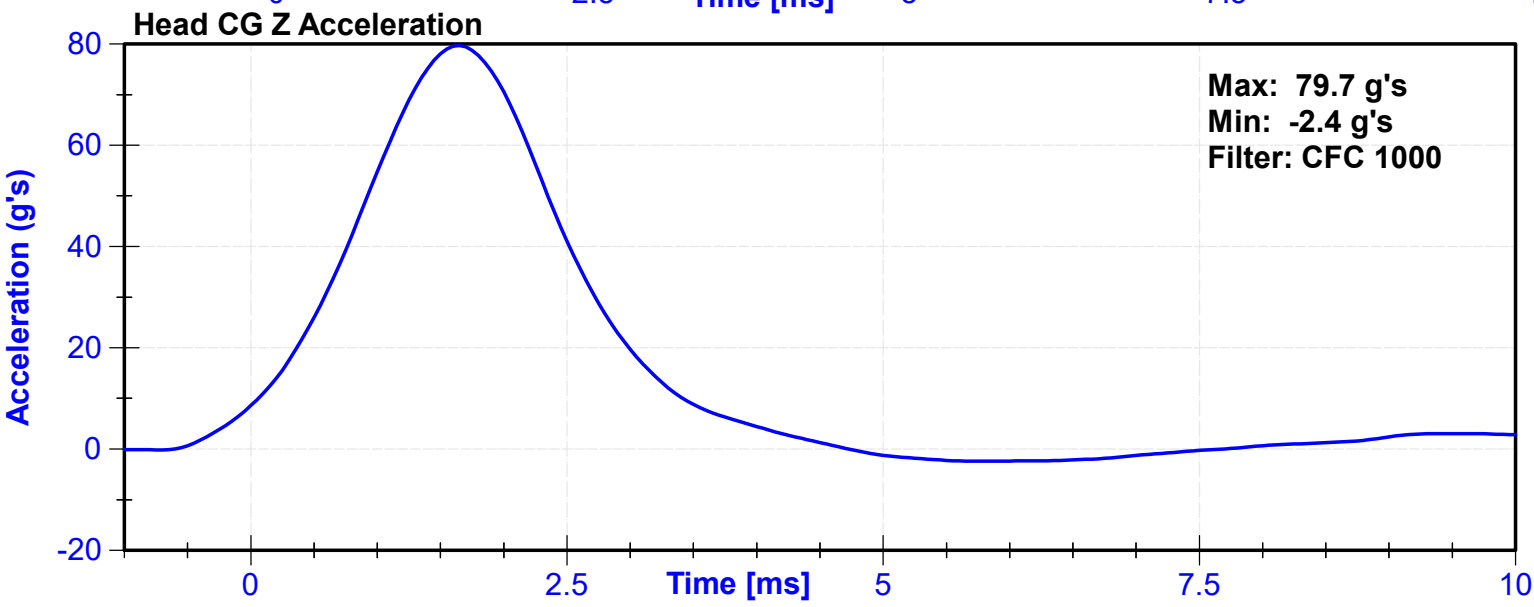
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	18613	6/14/2023	12/11/2023
Y Accelerometer	Endevco	18472	2/28/2023	8/27/2023
Z Accelerometer	Endevco	18663	2/28/2023	8/27/2023




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
Time [ms]
5
7.5
10
Max: 8.8 g's
Min: -1.3 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
Time [ms]
5
7.5
10
Max: 106.5 g's
Min: -3.0 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
80
60
40
20
0
-20
0
2.5
Time [ms]
5
7.5
10
Max: 79.7 g's
Min: -2.4 g's
Filter: CFC 1000

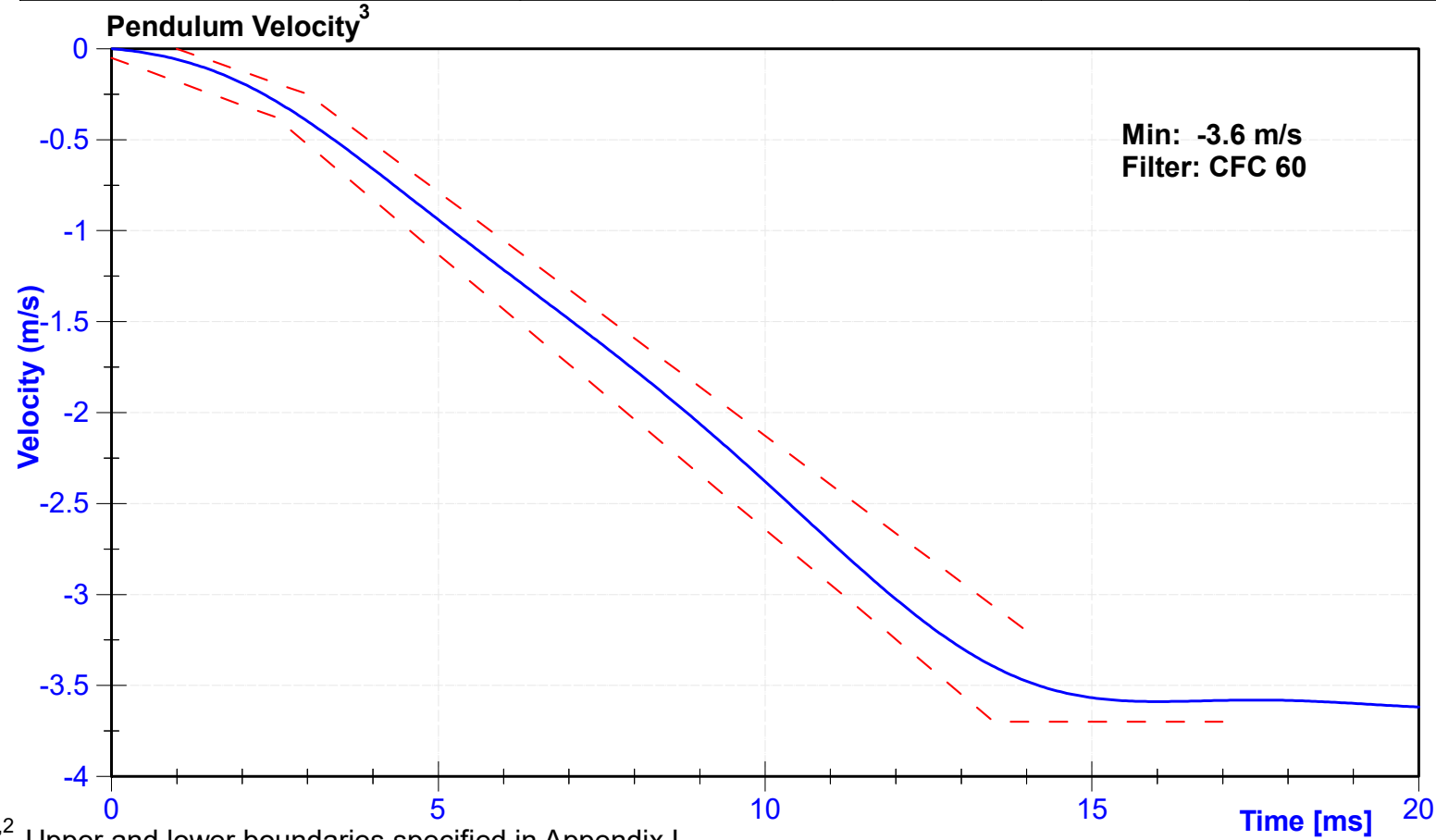
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

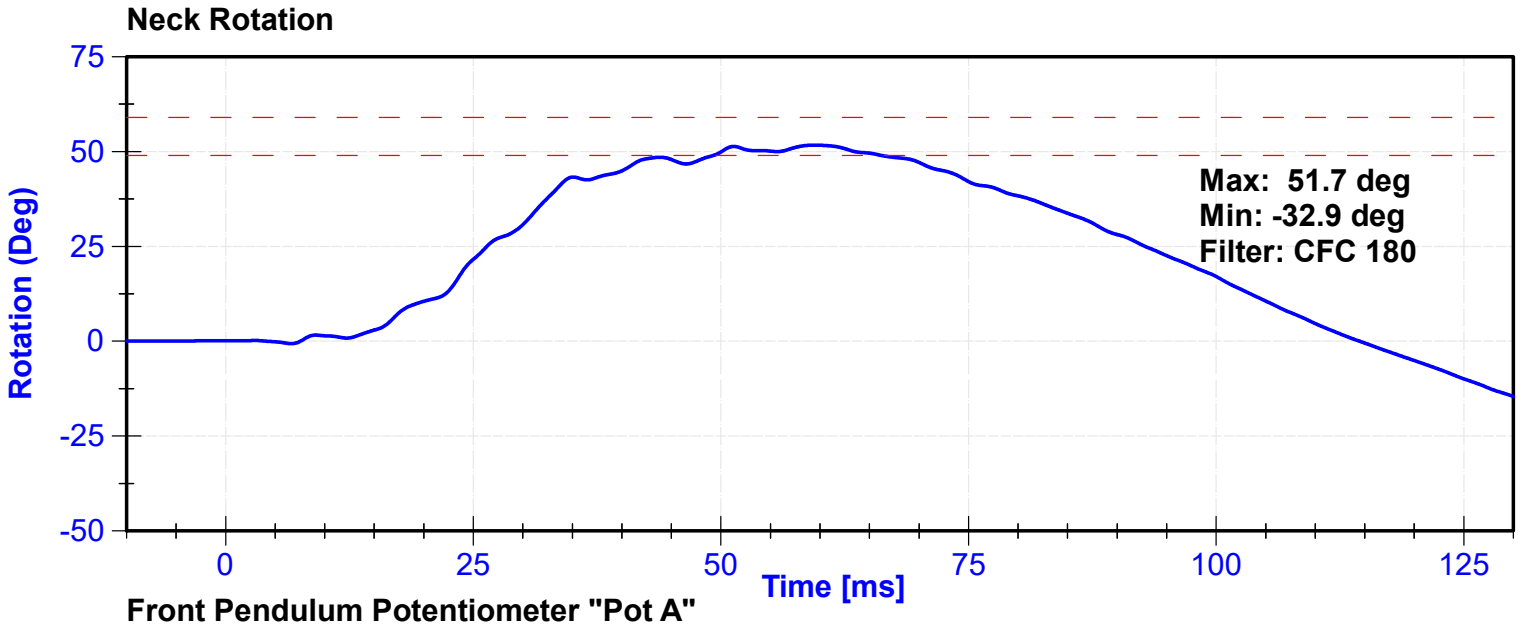
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	55	Pass
Velocity	3.3	3.5	m/s	3.40	Pass
Lateral Neck Rotation	49	59	deg	51.7	Pass
Time at Maximum Rotation	54	66	ms	59.4	Pass
Time of Rotation Decay from Maximum	53	88	ms	55.1	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

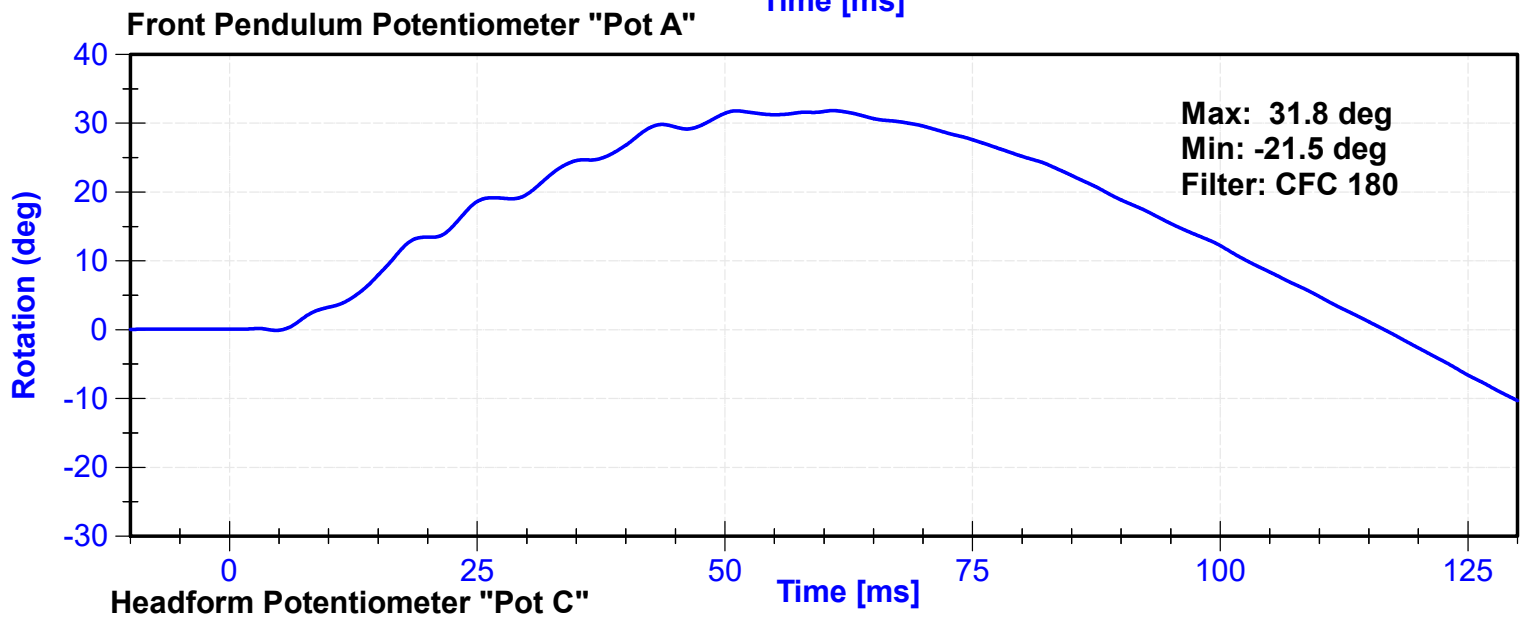
Transducer Calibrations

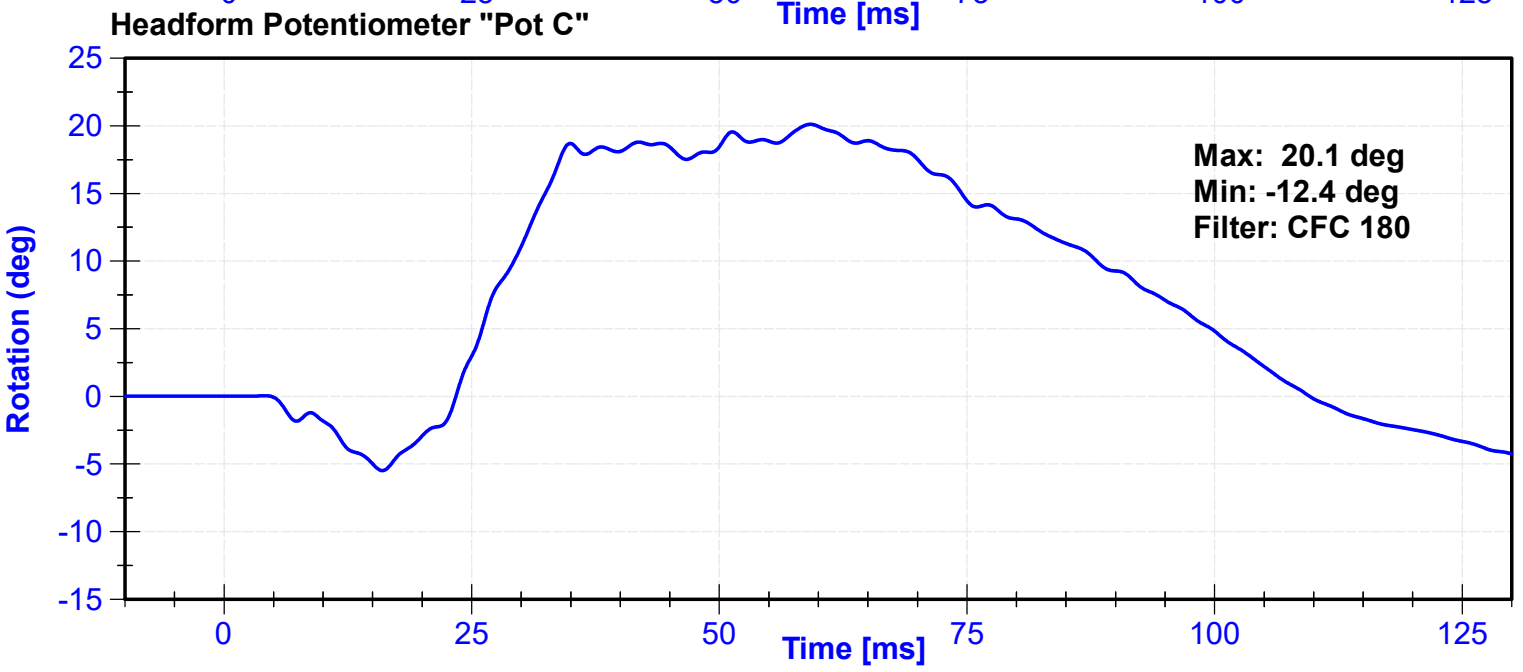
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Front Pendulum Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Headform Potentiometer	Sfernice	095	10/5/2022	10/5/2023



[1,2] Upper and lower boundaries specified in Appendix I


Neck Rotation
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]
Max: 51.7 deg
Min: -32.9 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
40
30
20
10
0
-10
-20
-30
0
25
50
75
100
125
Time [ms]
Max: 31.8 deg
Min: -21.5 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
25
20
15
10
5
0
-5
-10
-15
0
25
50
75
100
125
Time [ms]
Max: 20.1 deg
Min: -12.4 deg
Filter: CFC 180

Appendix I

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

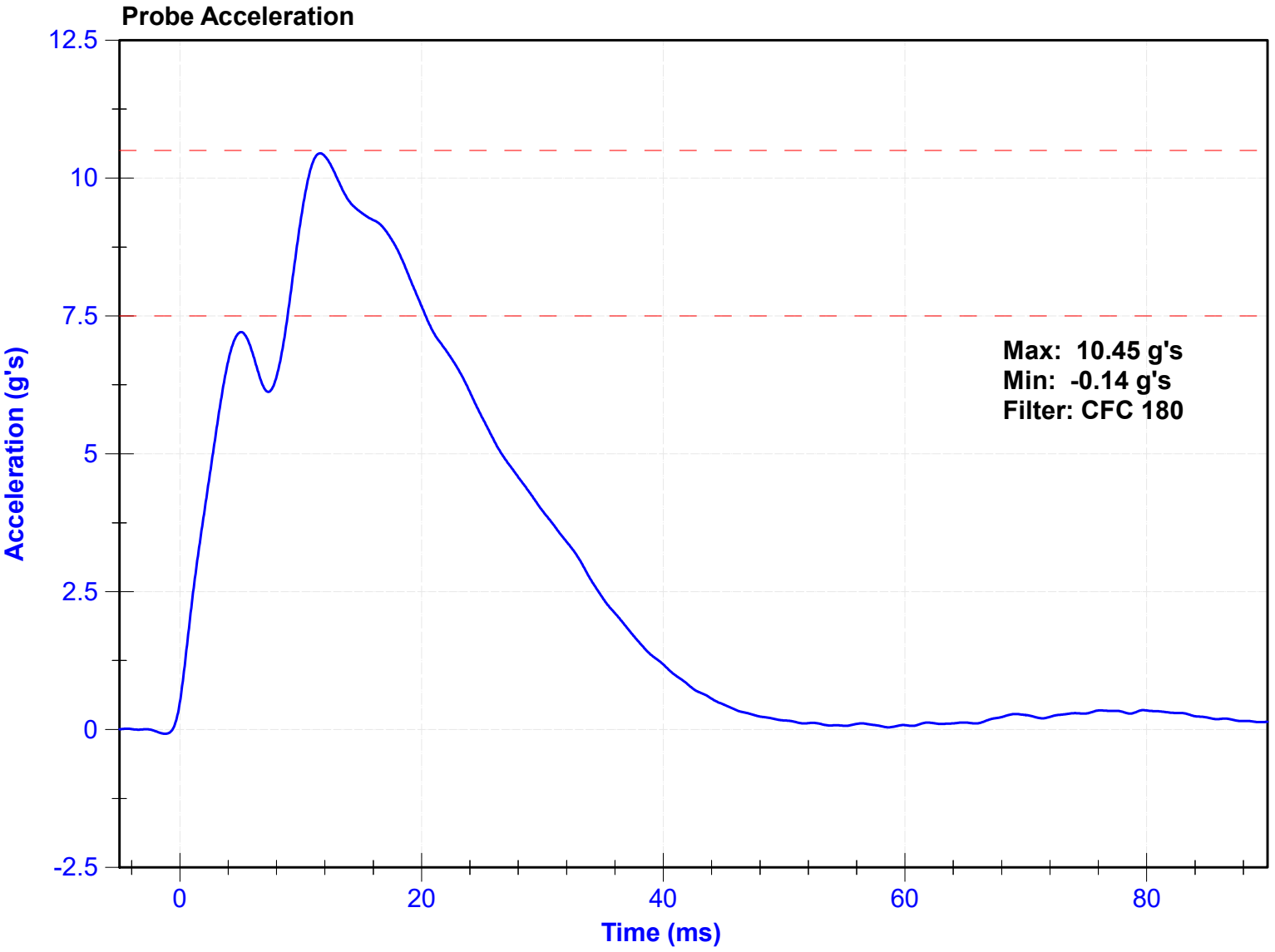
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	47	Pass
Velocity	4.2	4.4	m/s	4.30	Pass
Probe Acceleration	7.5	10.5	g's	10.45	Pass

Transducer Calibrations

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



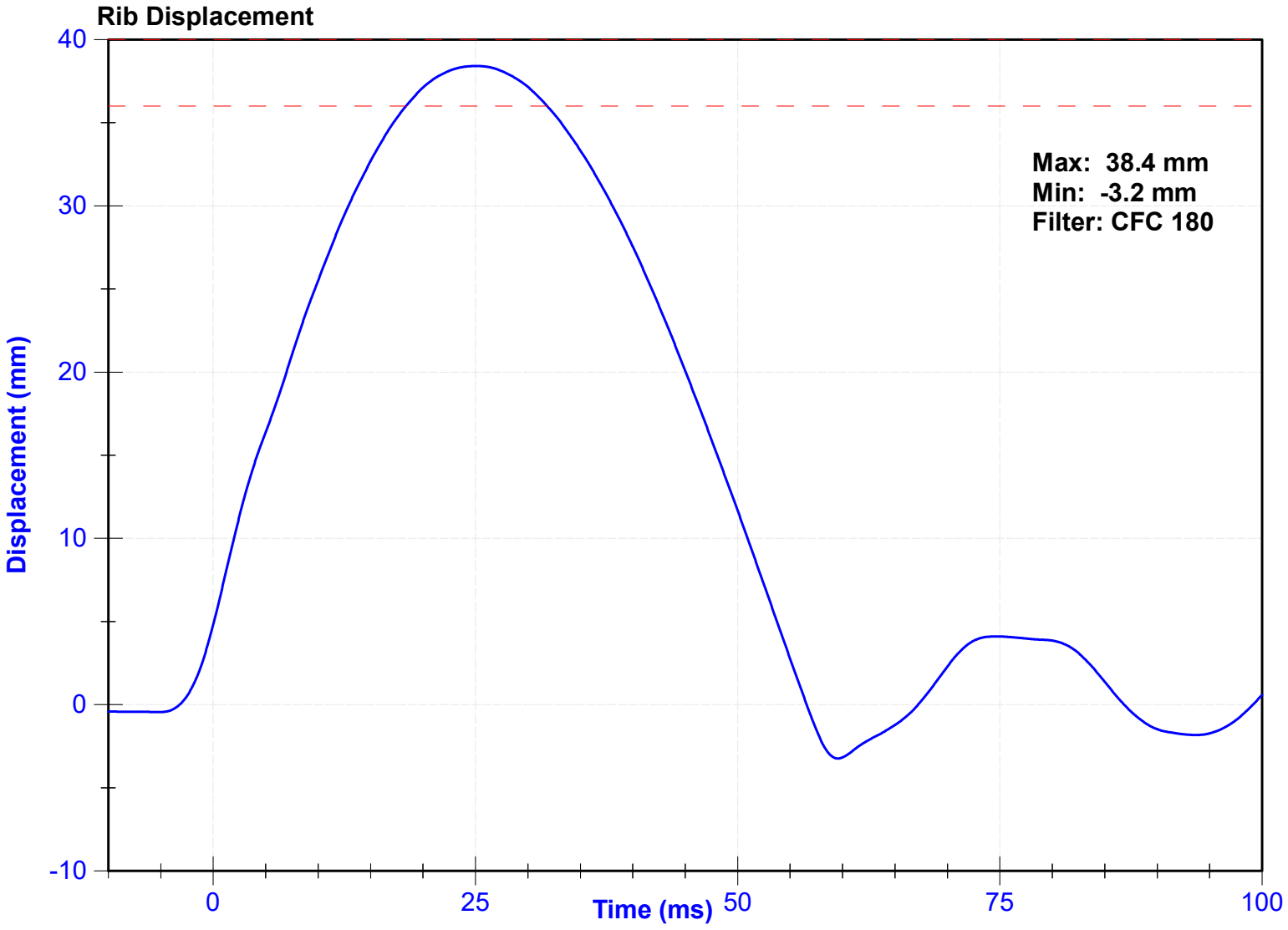
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	59.6	Pass
Rib Displacement	36	40	mm	38.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	268GFE	8/8/2023	2/6/2024



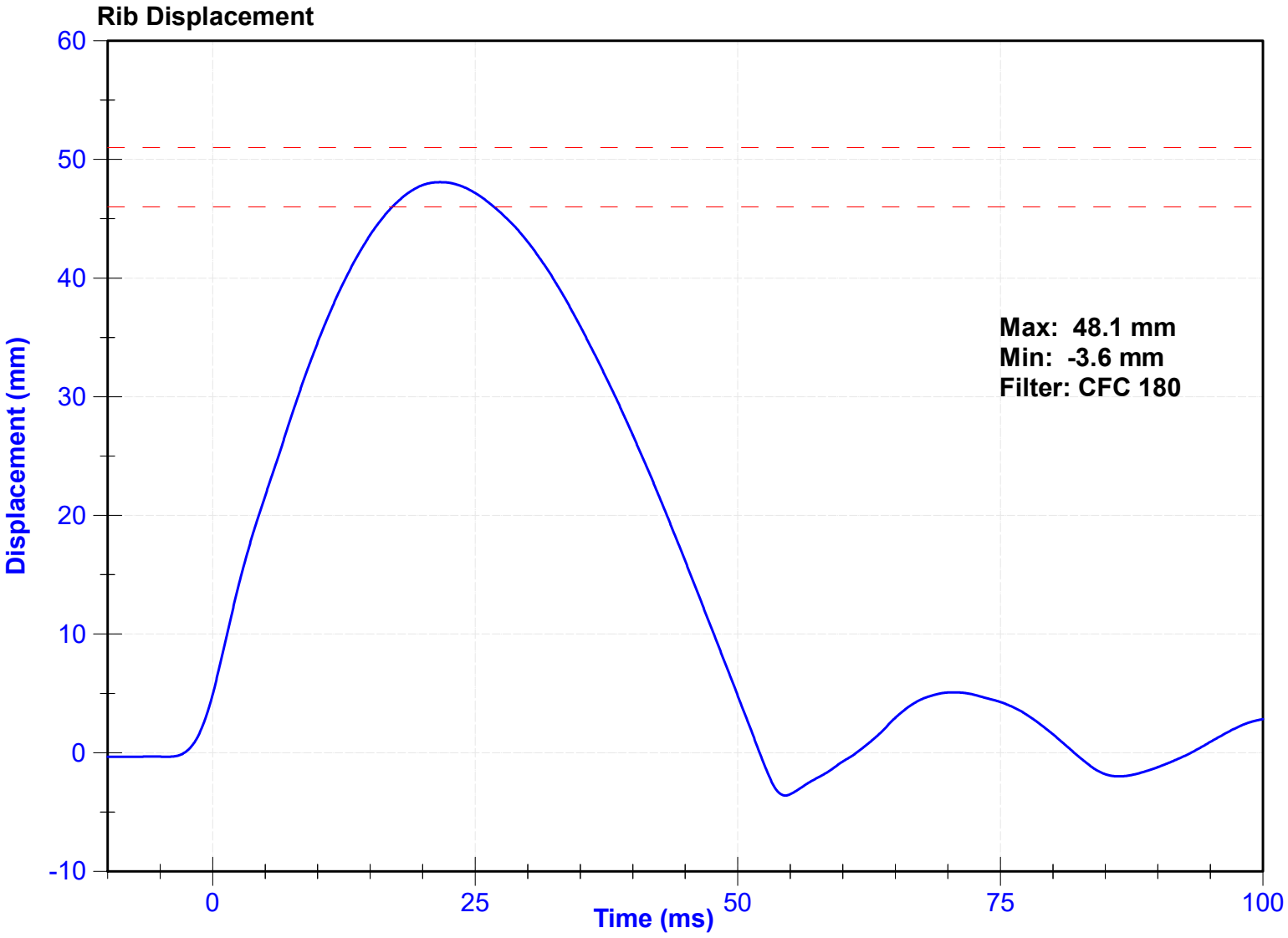
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	59.6	Pass
Rib Displacement	46	51	mm	48.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	268GFE	8/8/2023	2/6/2024



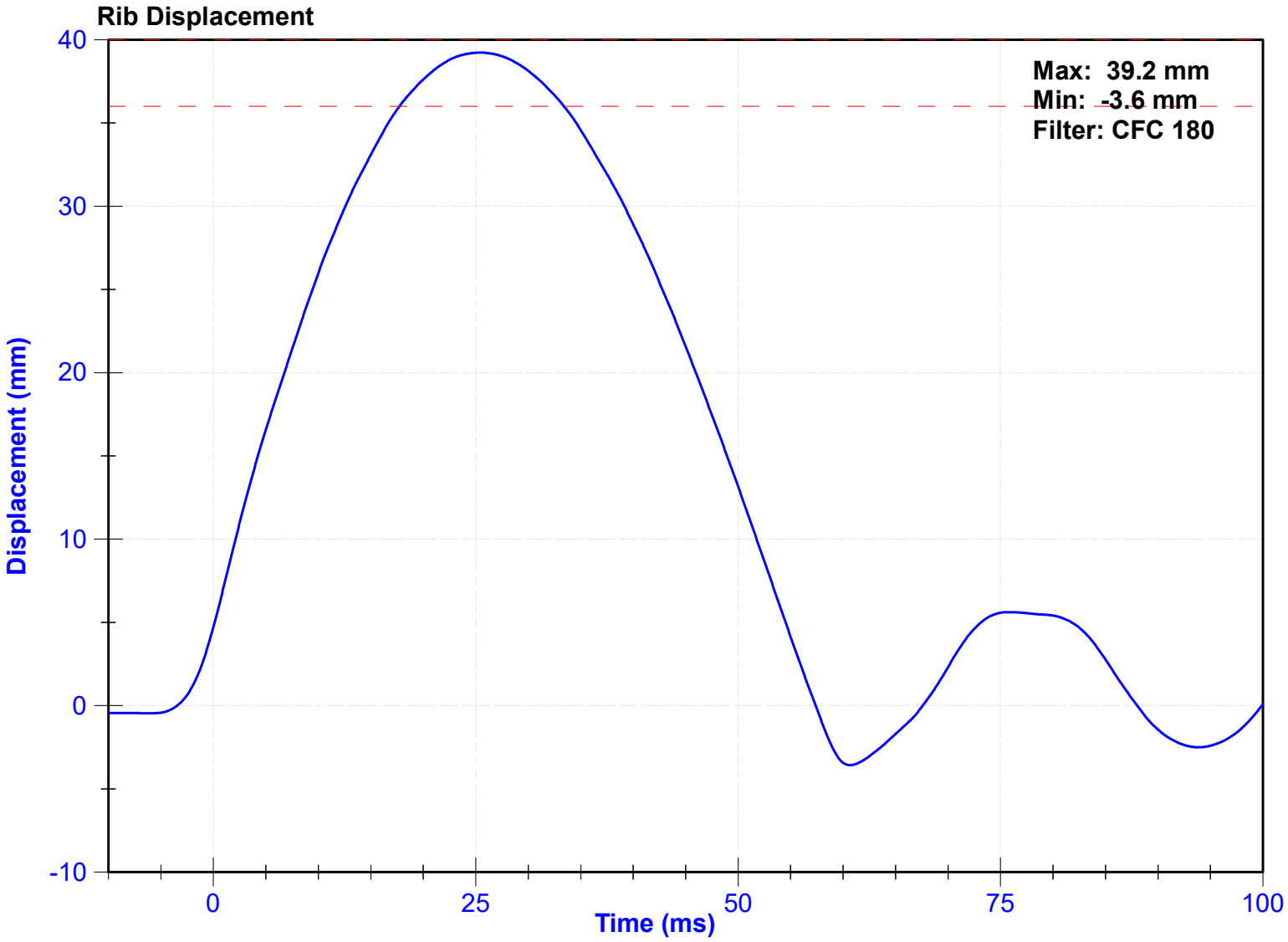
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	55	Pass
Rib Displacement	36	40	mm	39.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	269GFE	8/8/2023	2/6/2024



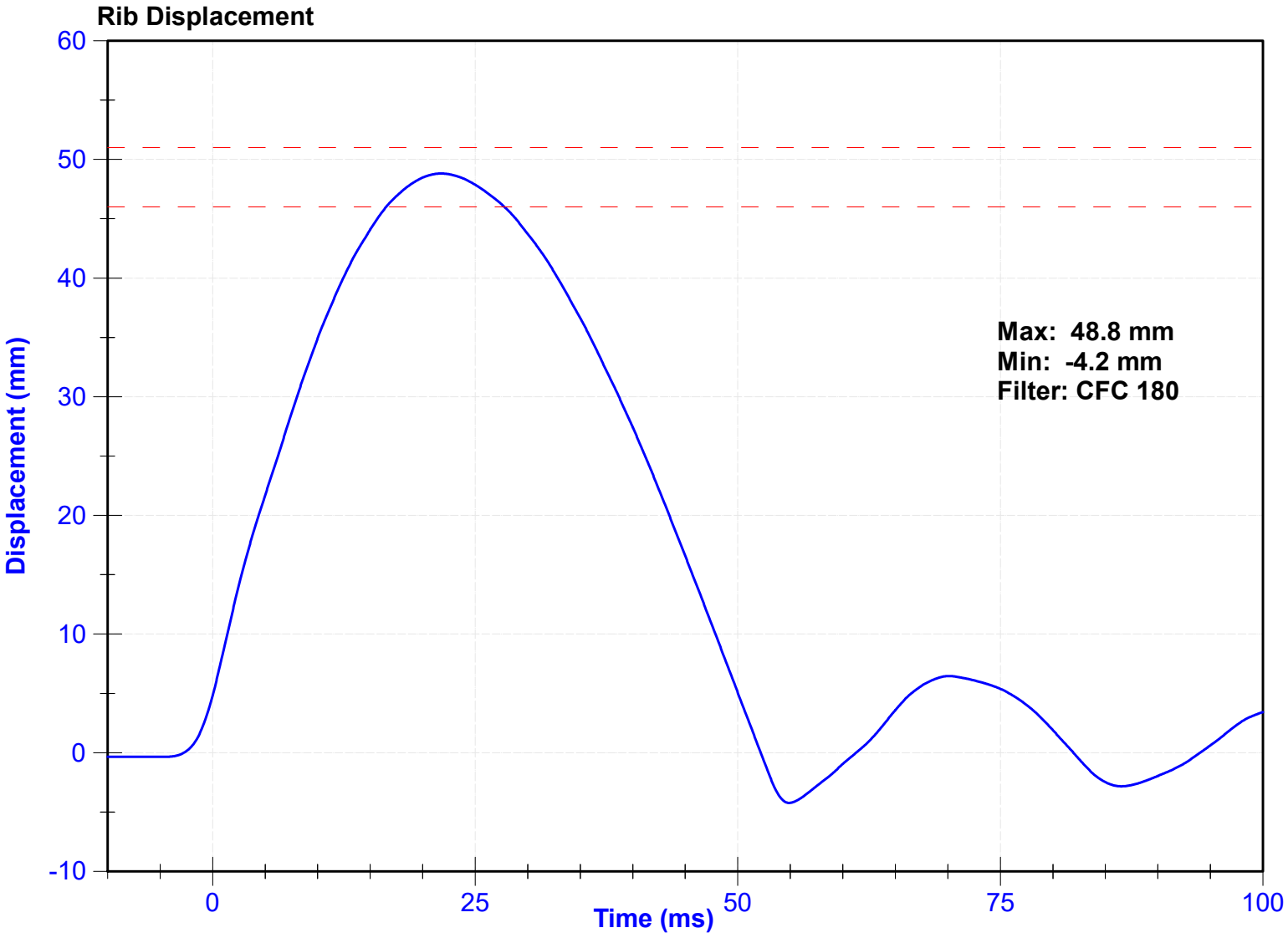
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	55	Pass
Rib Displacement	46	51	mm	48.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	269GFE	8/8/2023	2/6/2024



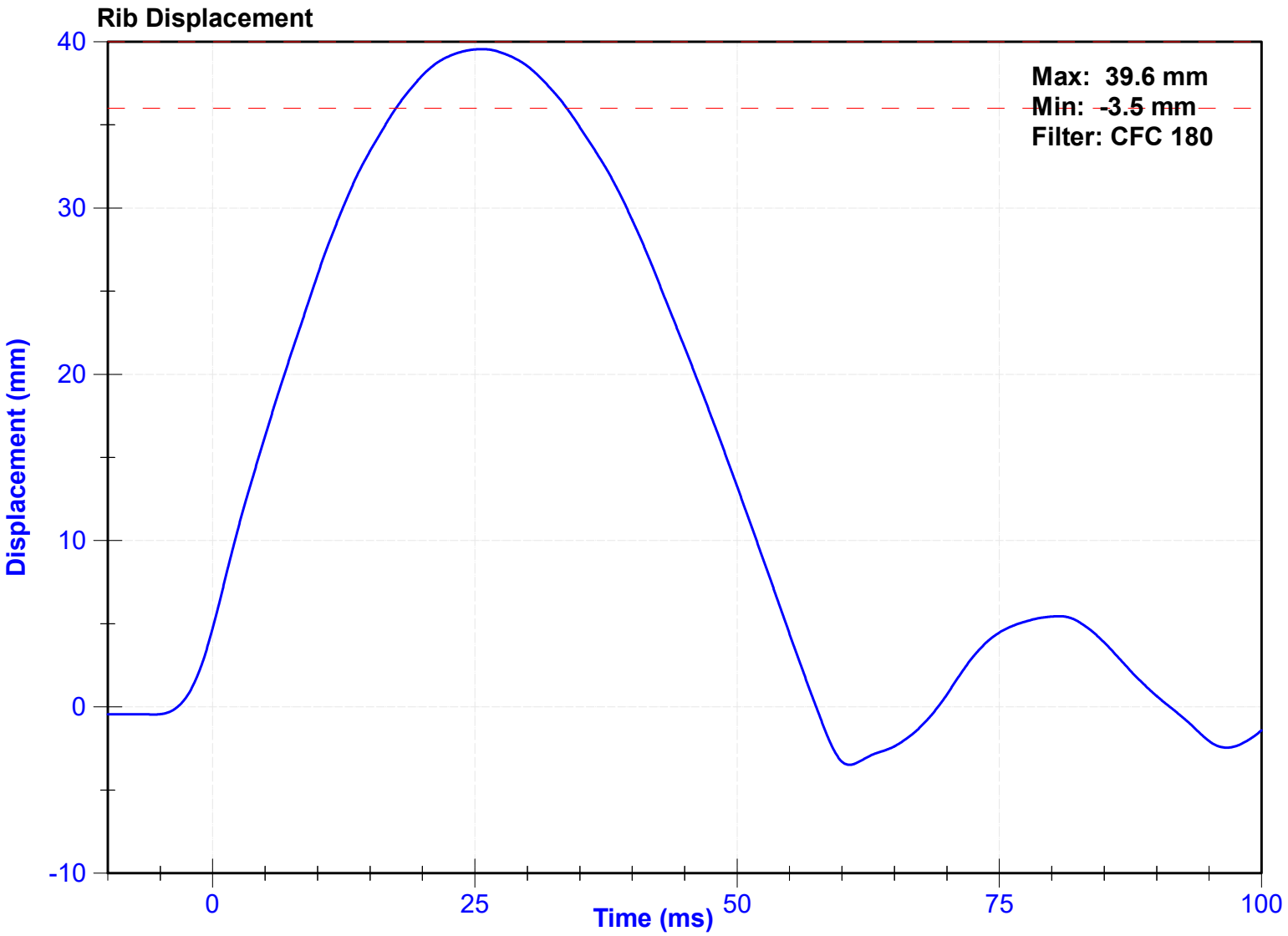
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	55	Pass
Rib Displacement	36	40	mm	39.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	270GFE	8/8/2023	2/6/2024



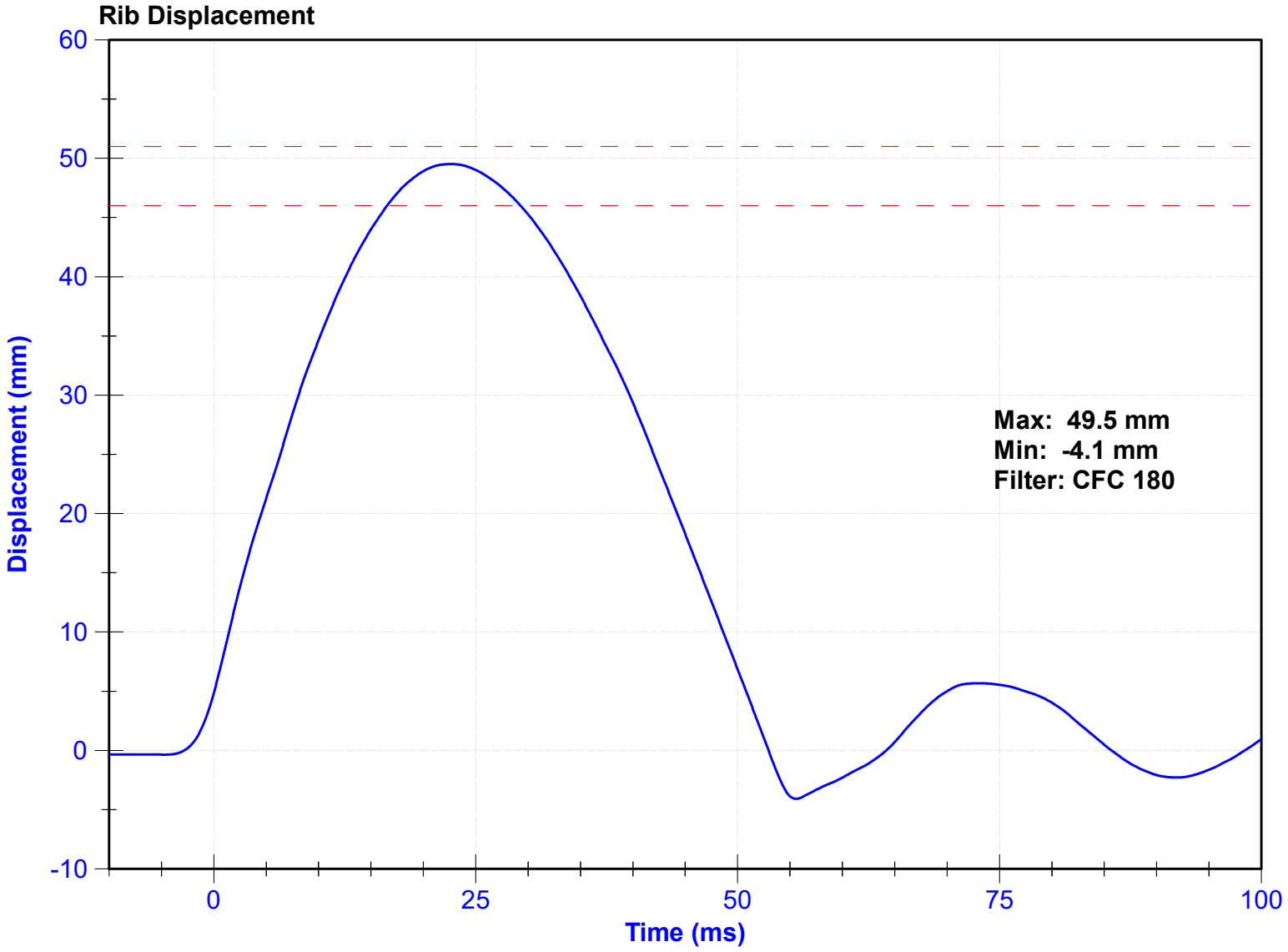
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	55	Pass
Rib Displacement	46	51	mm	49.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	270GFE	8/8/2023	2/6/2024



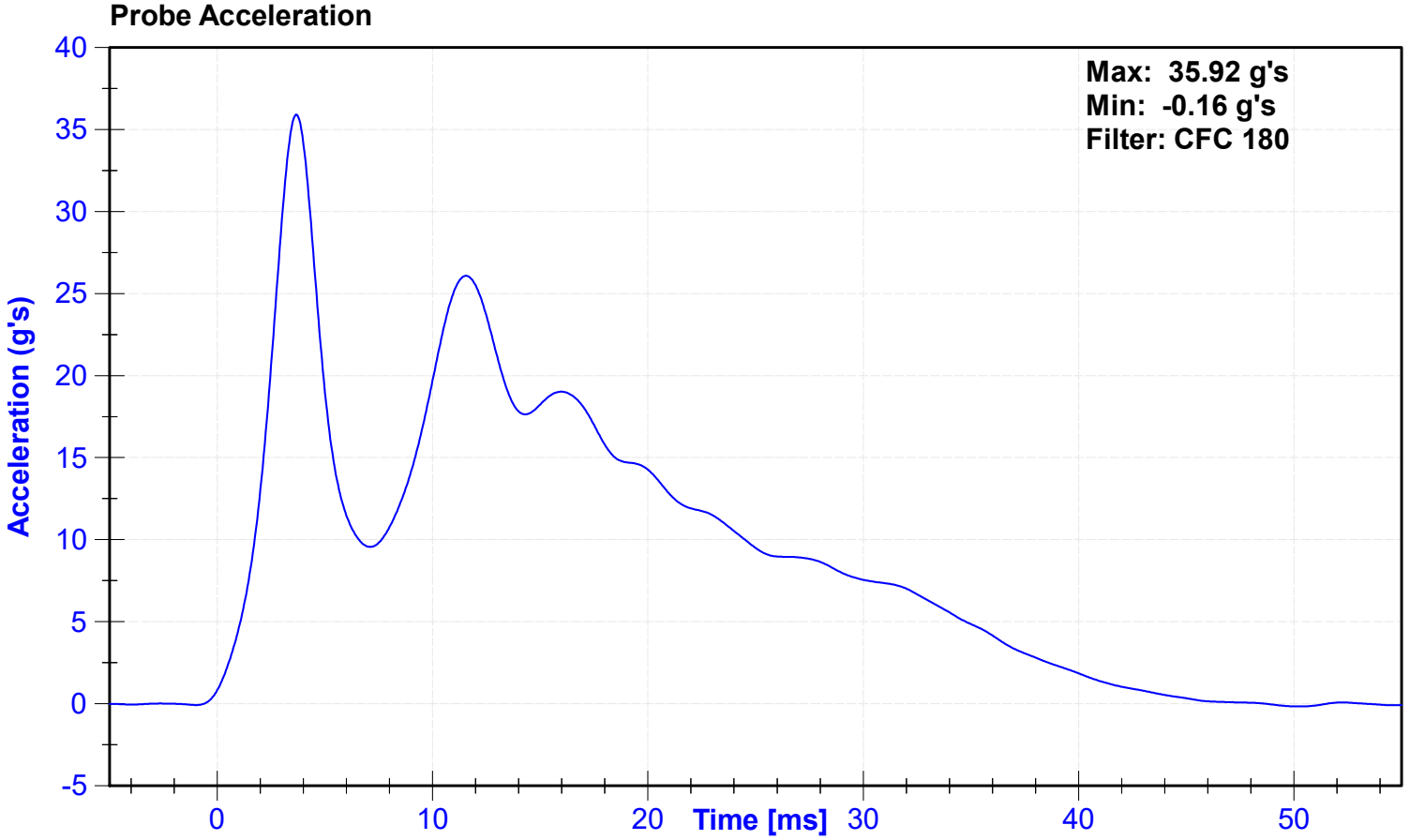
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

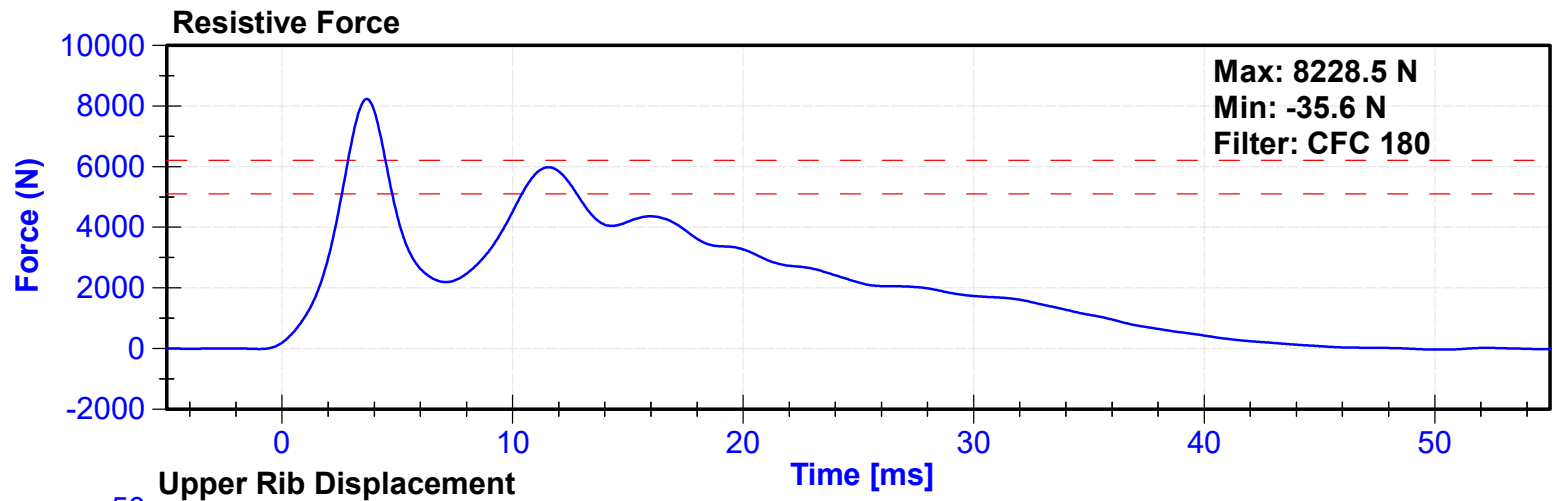
Results

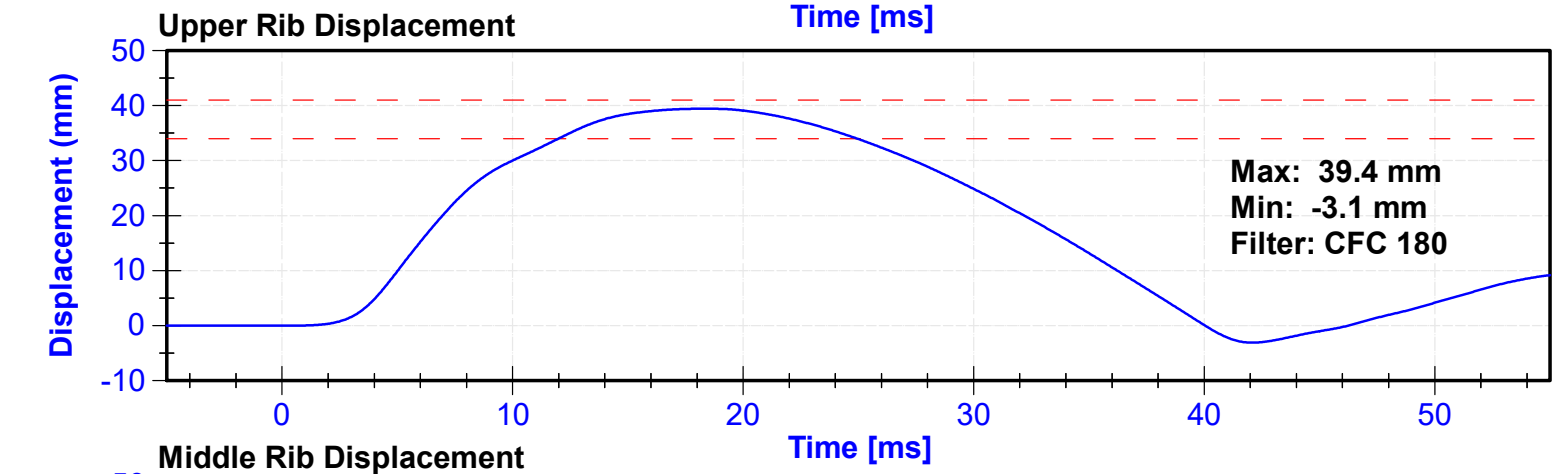
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	47	Pass
Velocity	5.4	5.6	m/s	5.54	Pass
Resistive Force after 6ms	5100	6200	N	5976.3	Pass
Upper Thorax Rib Deflection	34	41	mm	39.4	Pass
Mid Thorax Rib Deflection	37	45	mm	42.5	Pass
Lower Thorax Rib Deflection	37	44	mm	41.6	Pass

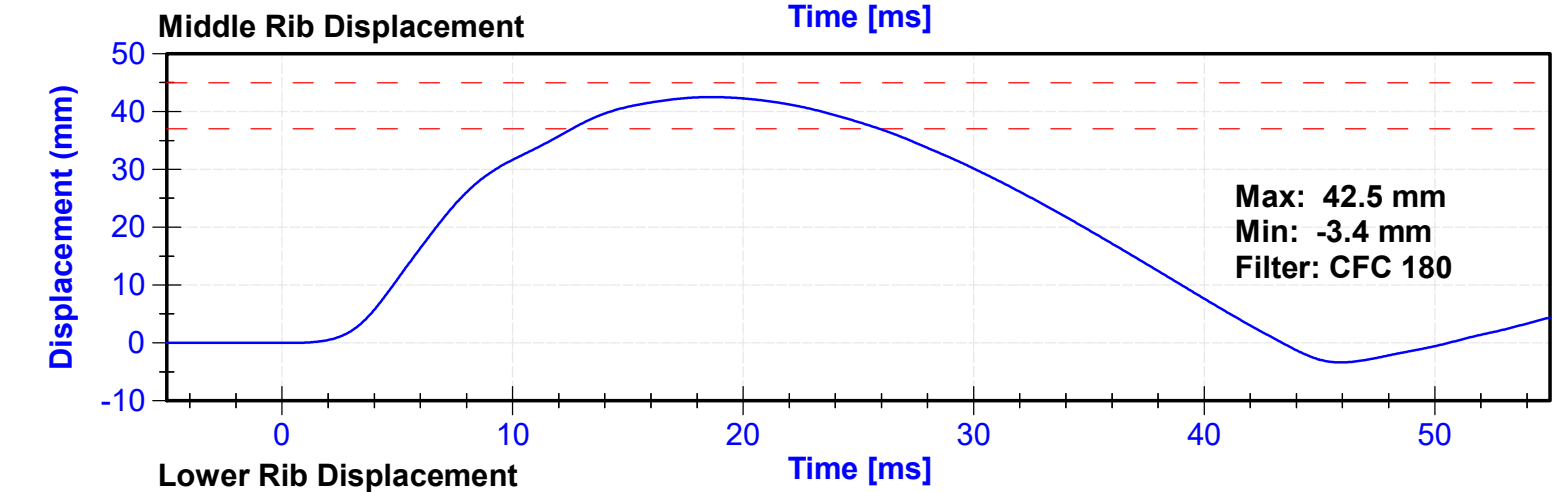
Transducer Calibrations

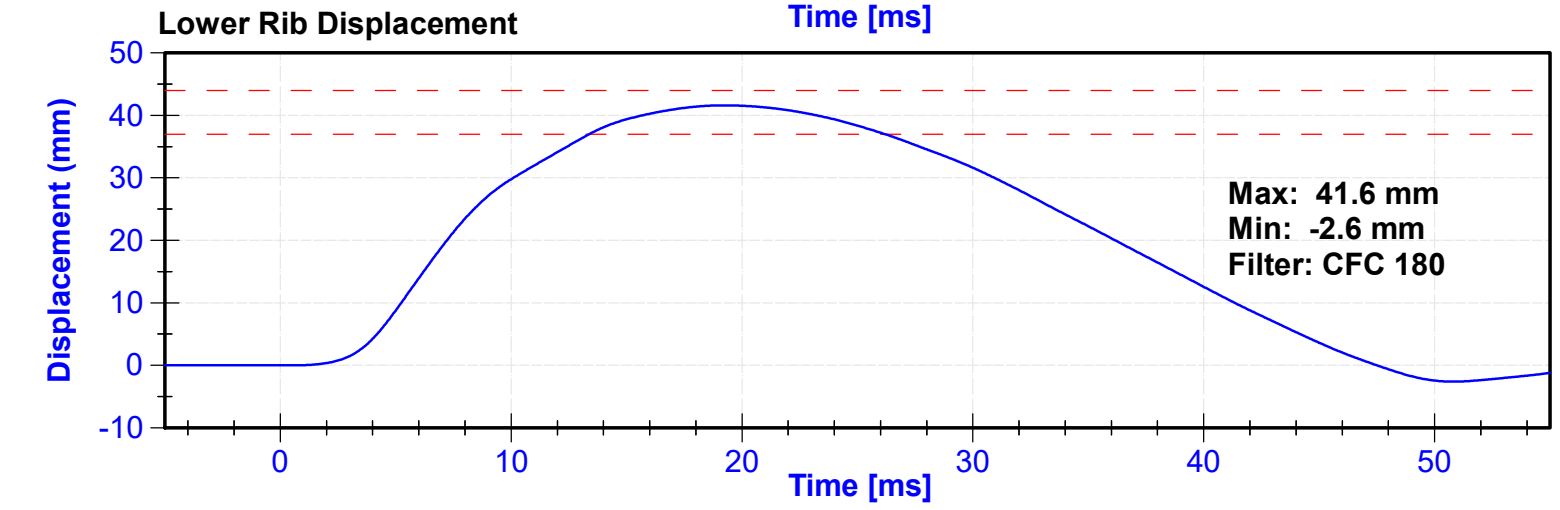
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Thorax Rib Potentiometer	Honeywell	268GFE	8/8/2023	2/6/2024
Middle Thorax Rib Potentiometer	Honeywell	269GFE	8/8/2023	2/6/2024
Lower Thorax Rib Potentiometer	Honeywell	270GFE	8/8/2023	2/6/2024




Resistive Force
Max: 8228.5 N
Min: -35.6 N
Filter: CFC 180
Force (N)
10000
8000
6000
4000
2000
0
-2000
0
10
20
30
40
50
Time [ms]


Upper Rib Displacement
Max: 39.4 mm
Min: -3.1 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Middle Rib Displacement
Max: 42.5 mm
Min: -3.4 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Lower Rib Displacement
Max: 41.6 mm
Min: -2.6 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]

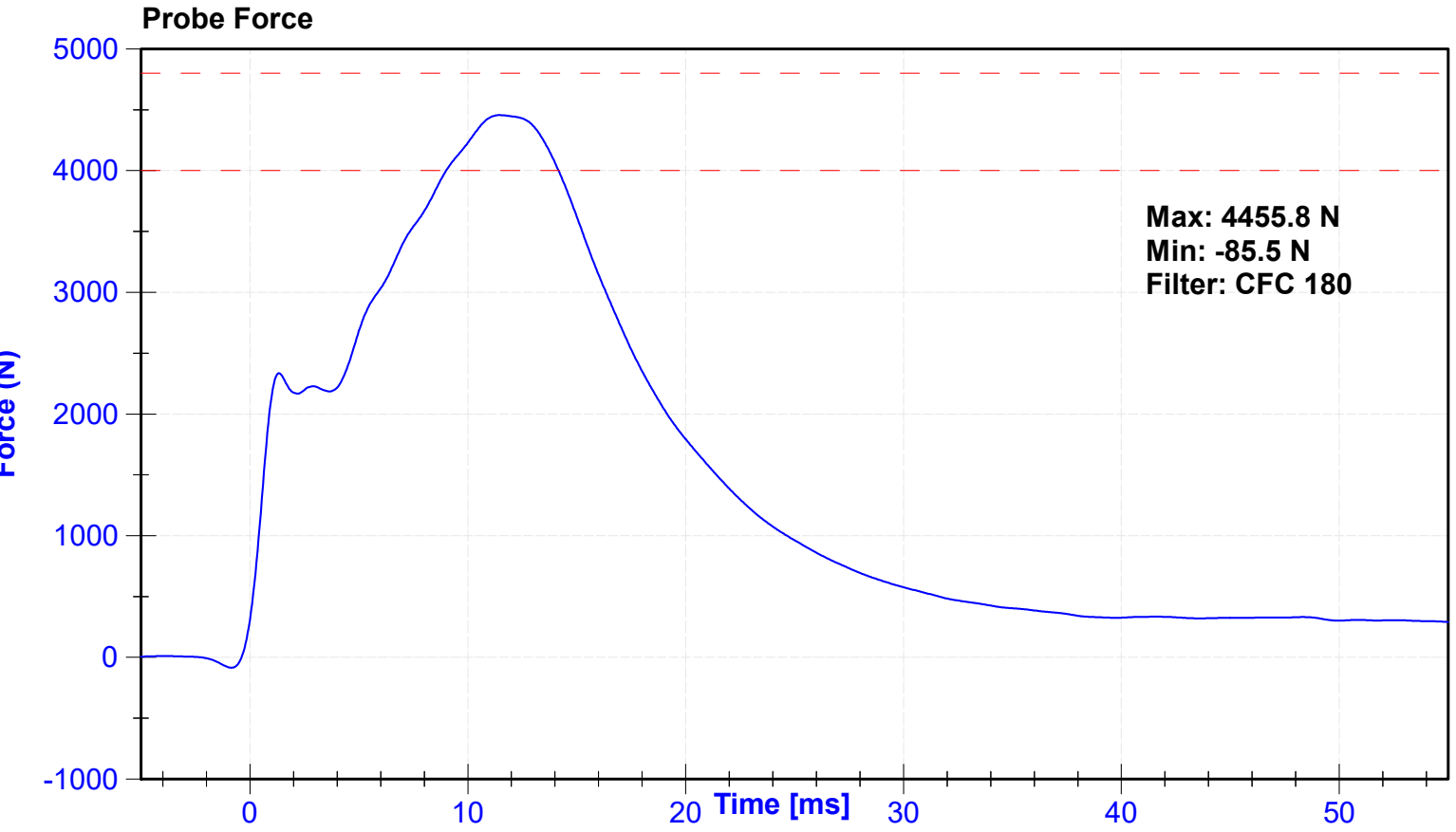
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

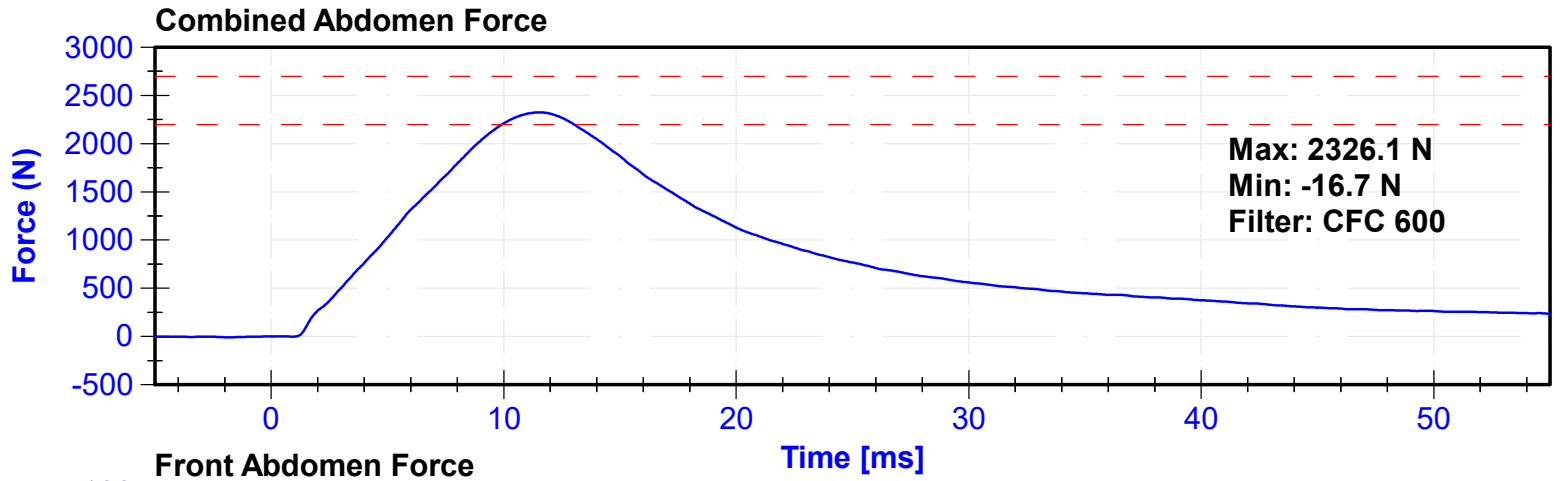
Results

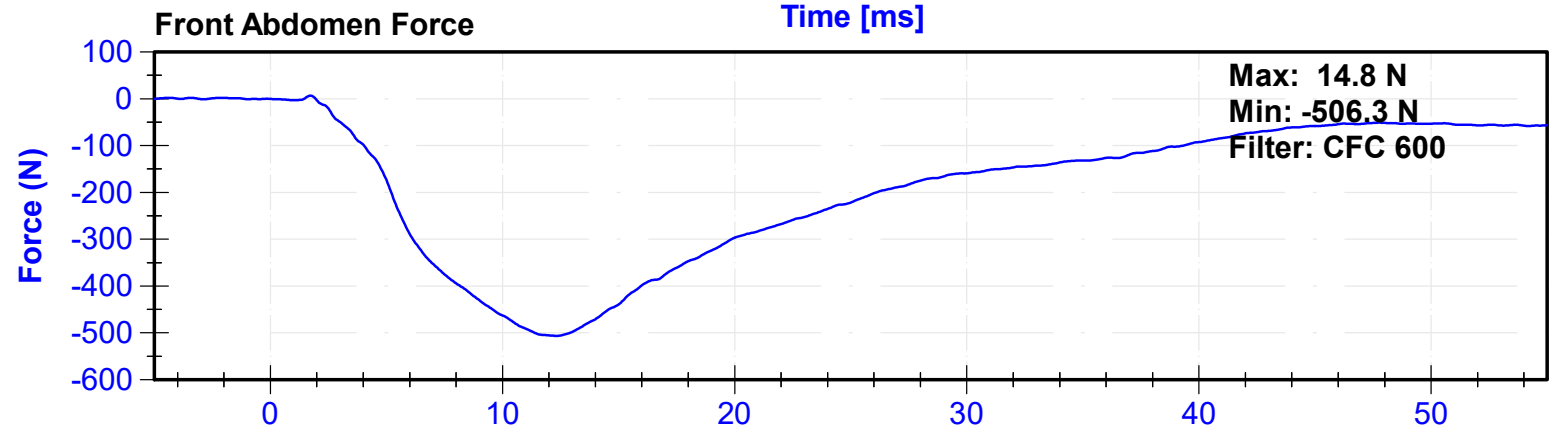
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	47	Pass
Velocity	3.9	4.1	m/s	4.08	Pass
Combined Abdomen Force	2200	2700	N	2326.1	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.55	Pass
Resistive Probe Force	4000	4800	N	4455.8	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.45	Pass

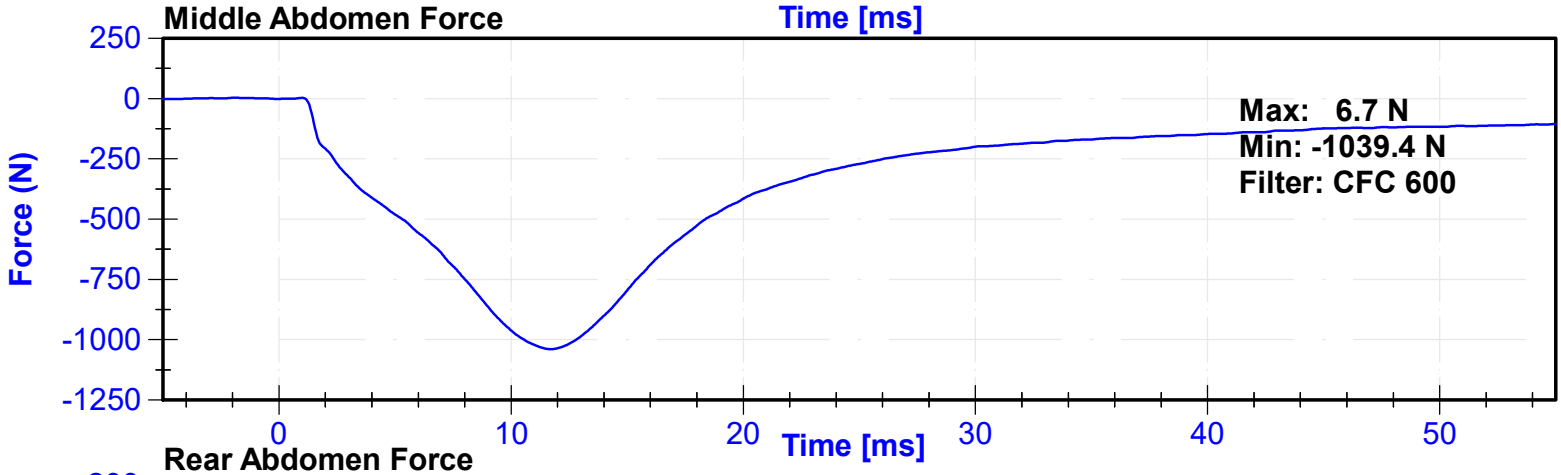
Transducer Calibrations

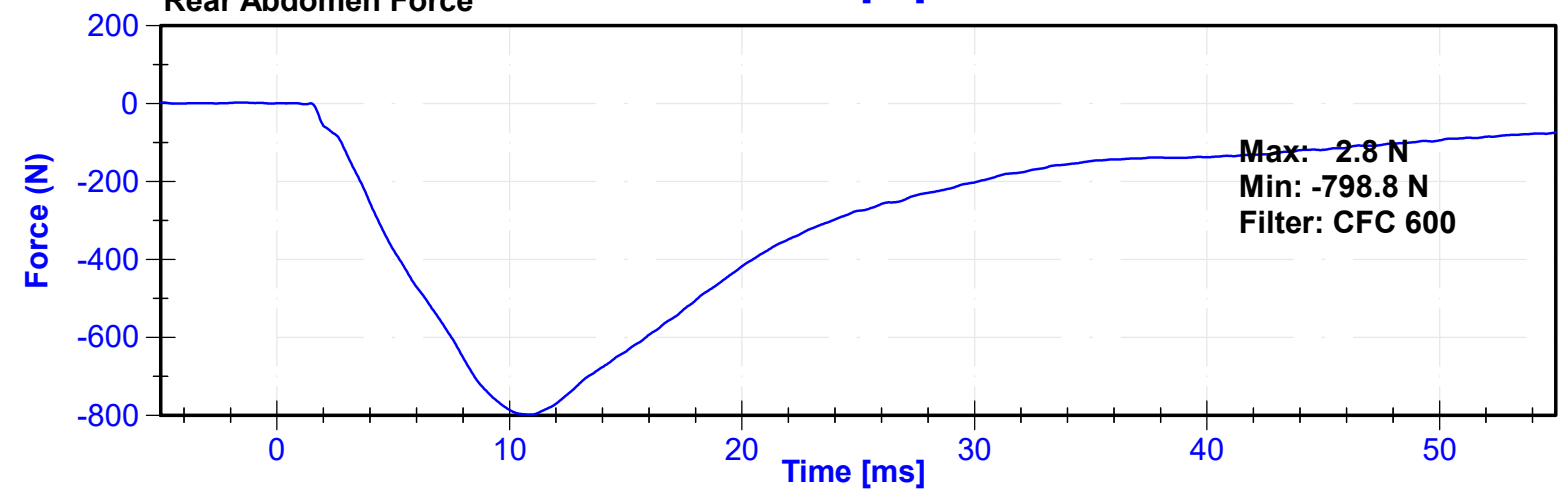
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Front Abdomen Load Cell	Denton	1512	8/15/2023	8/14/2024
Middle Abdomen Load Cell	Denton	1526	8/15/2023	8/14/2024
Rear Abdomen Load Cell	Denton	1516	8/15/2023	8/14/2024




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2326.1 N
Min: -16.7 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 14.8 N
Min: -506.3 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 6.7 N
Min: -1039.4 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 2.8 N
Min: -798.8 N
Filter: CFC 600

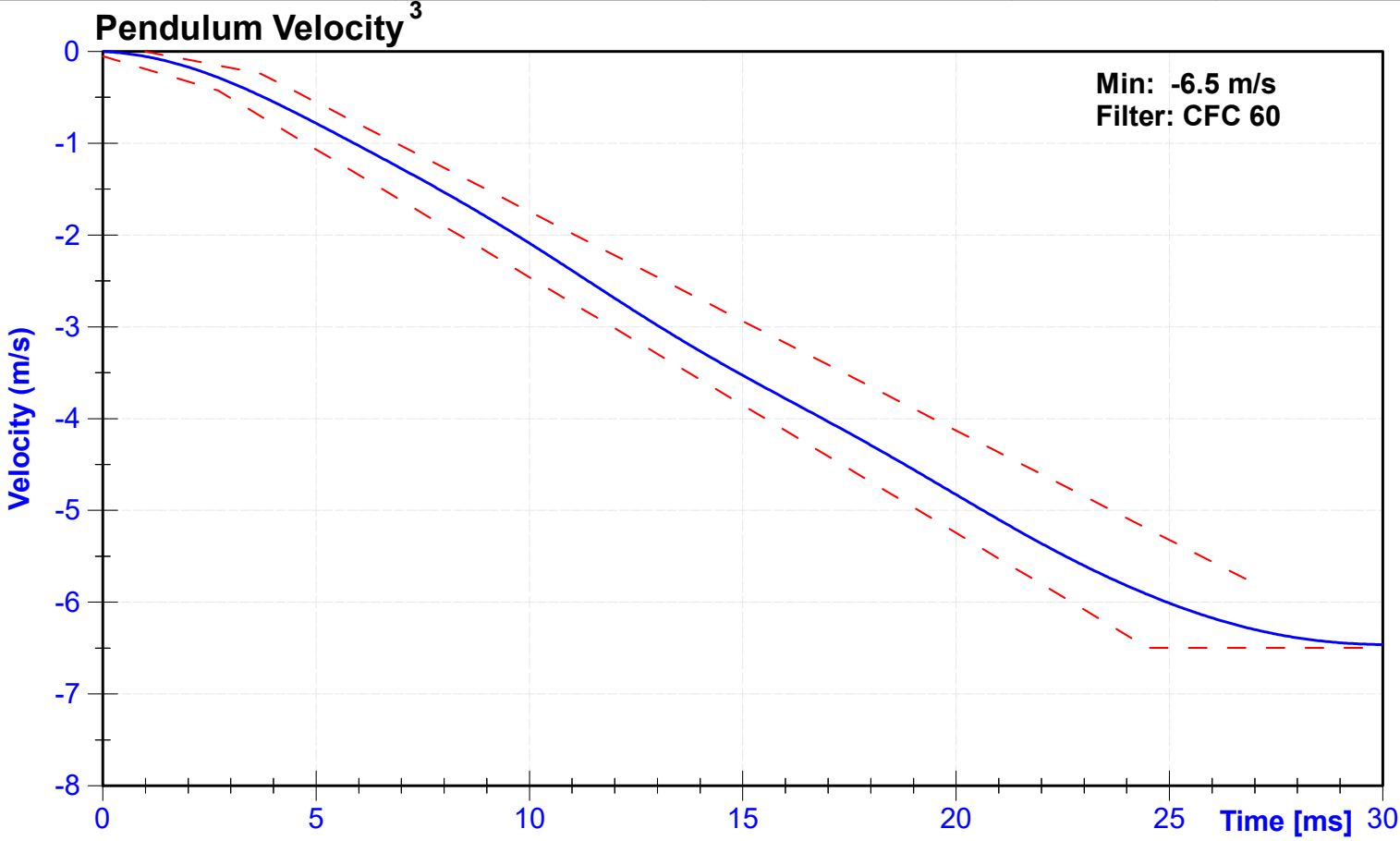
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

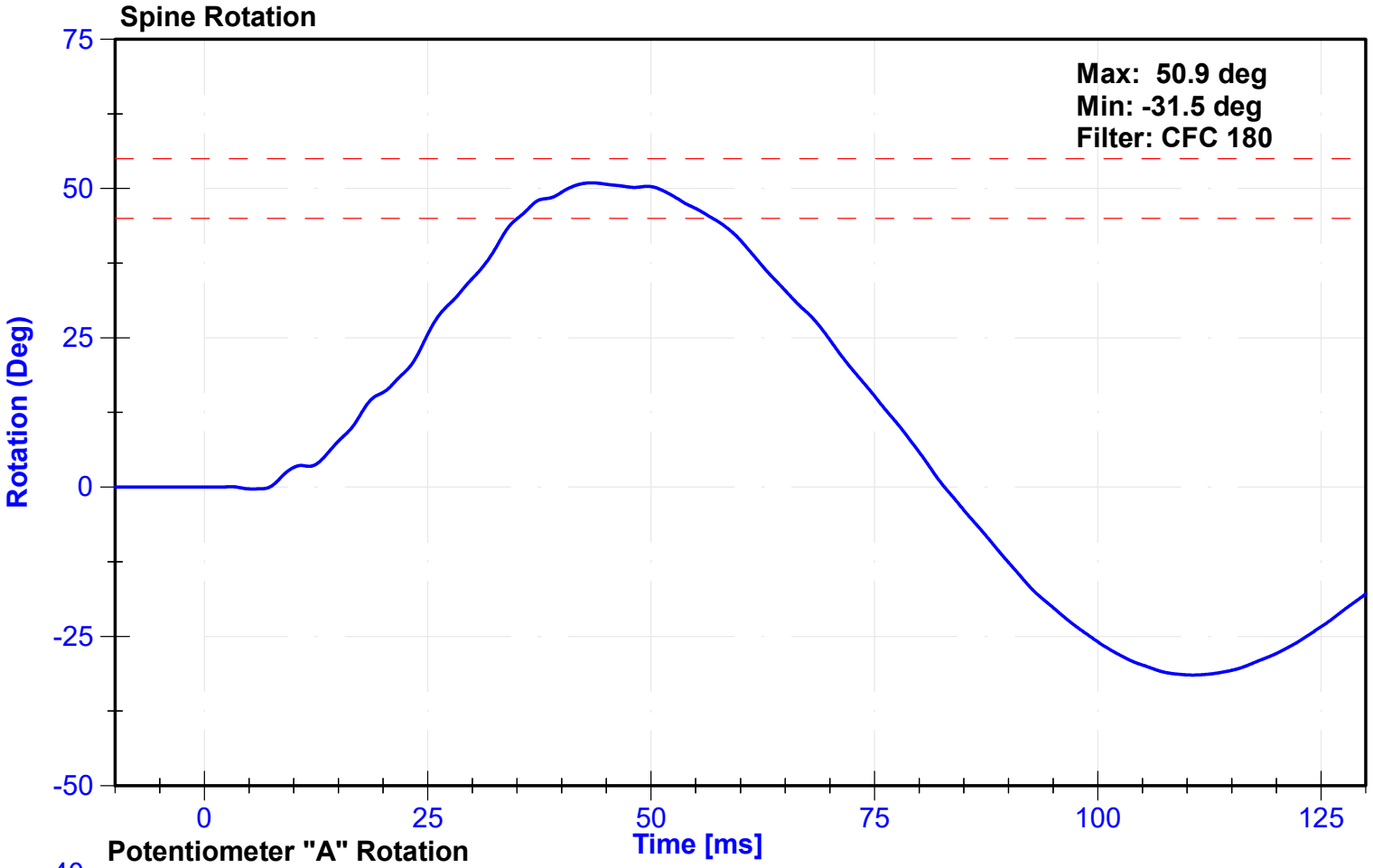
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	55	Pass
Velocity	5.95	6.15	m/s	5.993	Pass
Lateral Spine Rotation	45	55	deg	50.9	Pass
Time at Maximum Rotation	39	53	ms	43.3	Pass
Time of Decay to Zero Degrees	37	57	ms	39.6	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

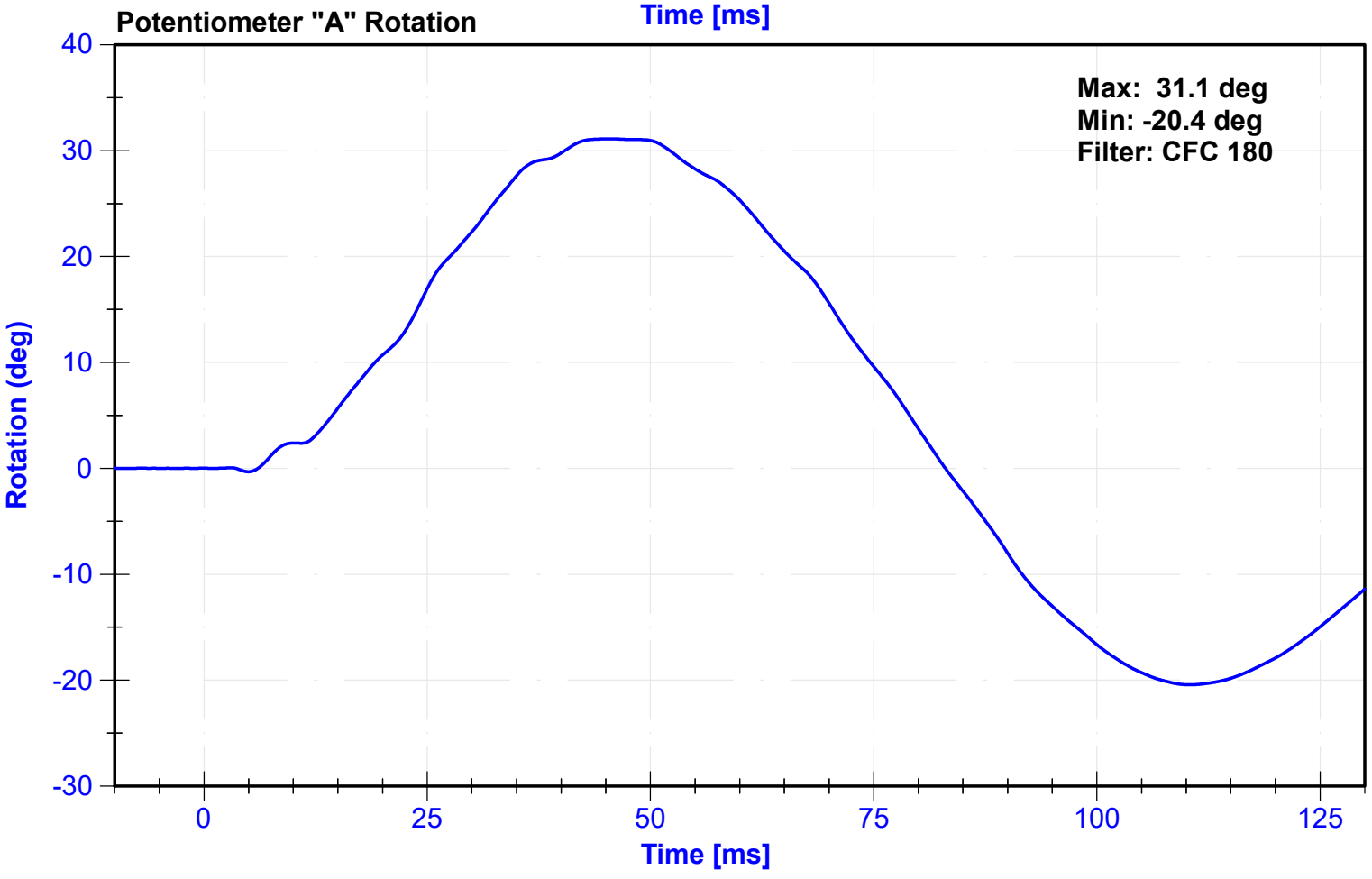
Transducer Calibrations

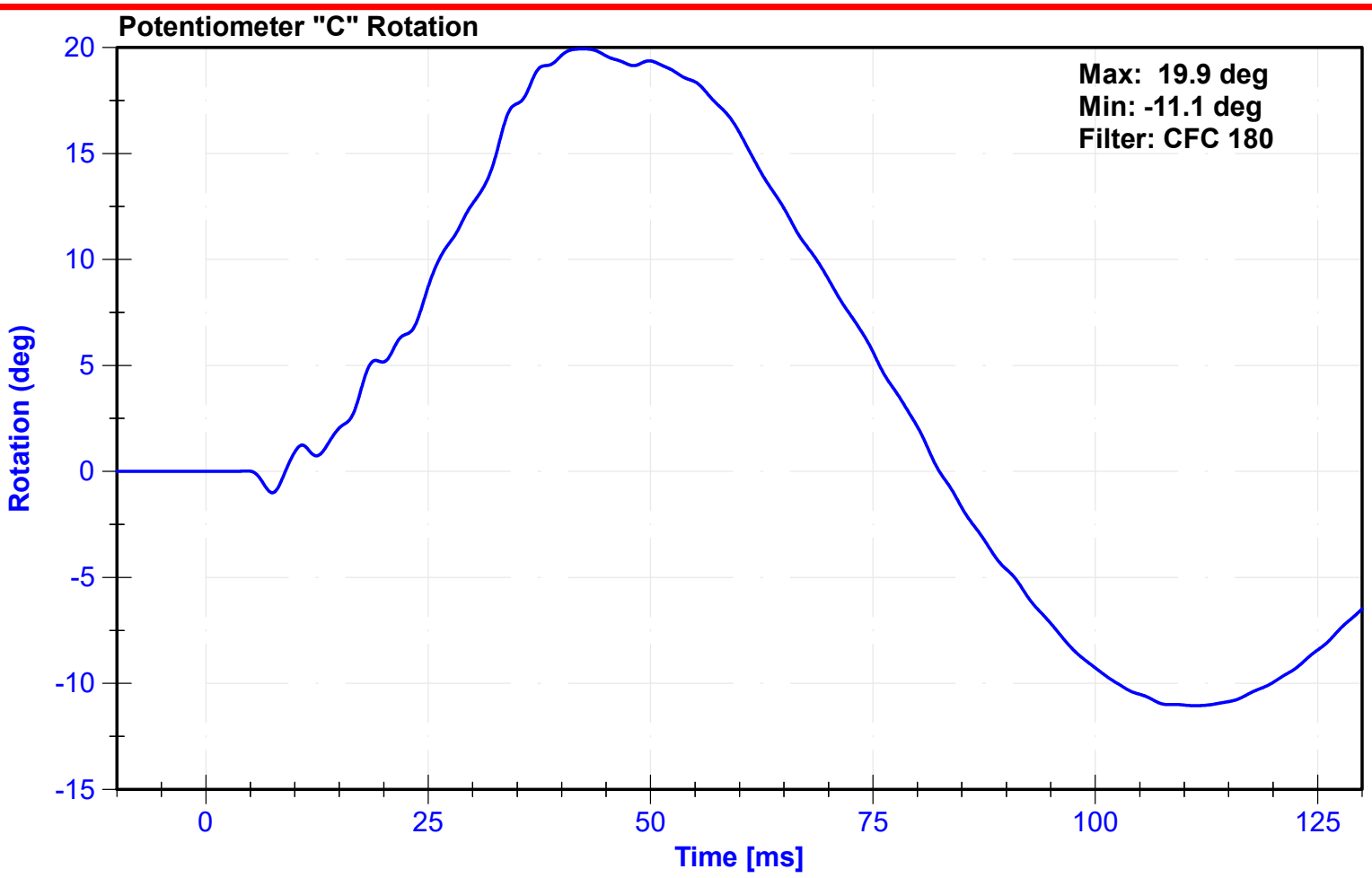
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum "A" Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Condyle "B" Potentiometer	Sfernice	095	10/5/2022	10/5/2023



[1,2] Upper and lower boundaries specified in Appendix I


Spine Rotation
Max: 50.9 deg
Min: -31.5 deg
Filter: CFC 180
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 31.1 deg
Min: -20.4 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
-20
-30
0
25
50
75
100
125
Time [ms]



Appendix I

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

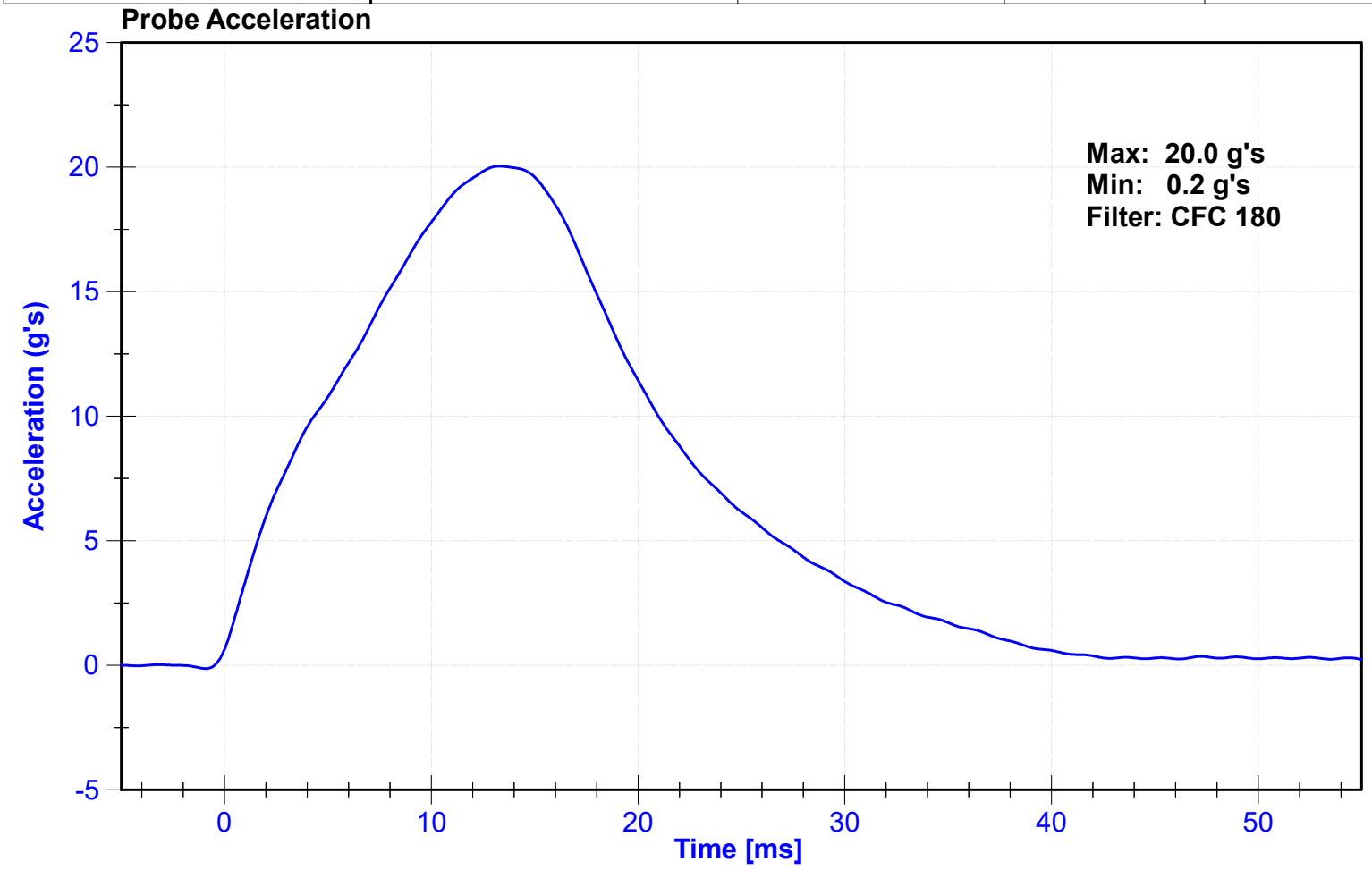
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

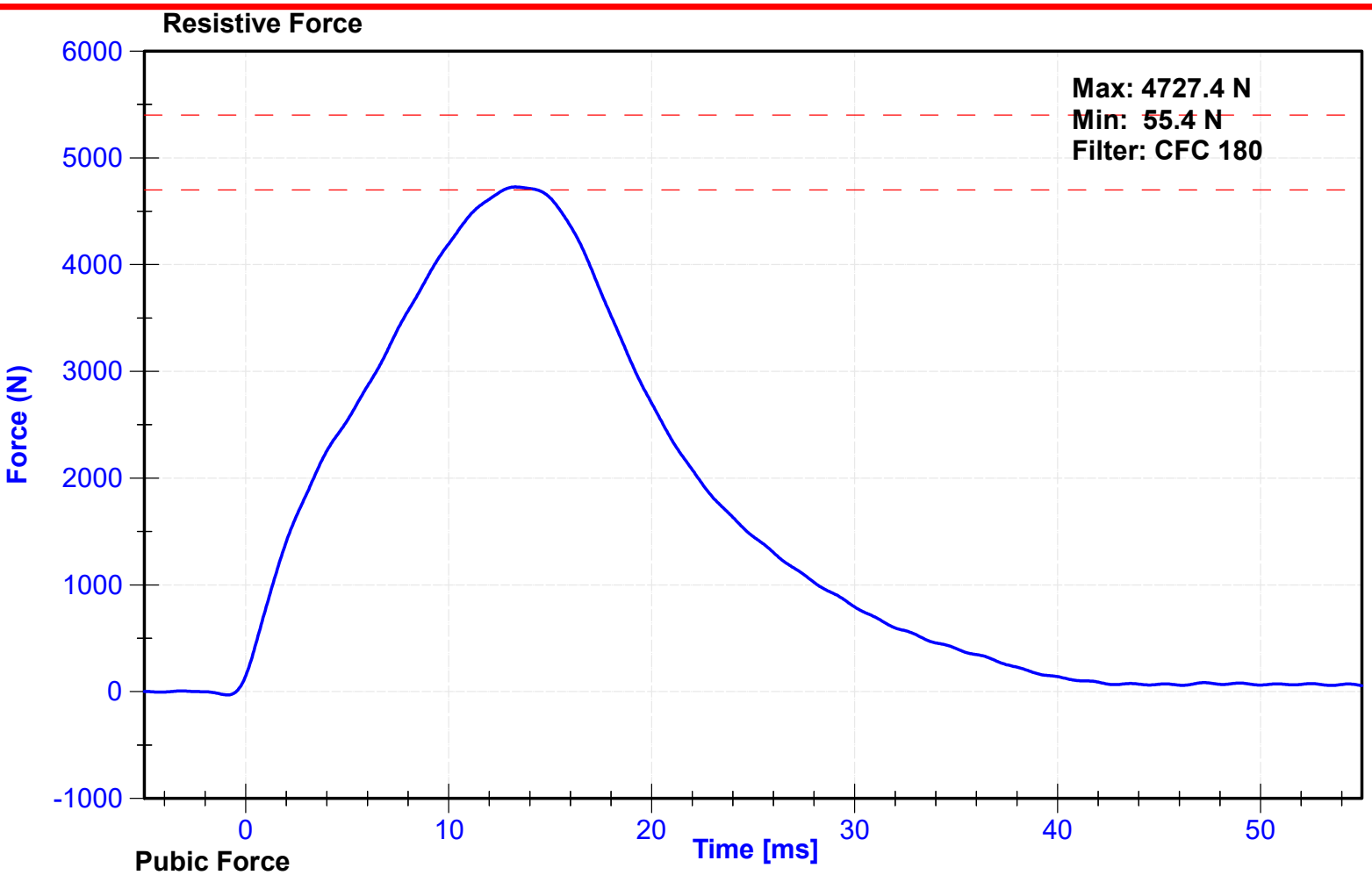
Results

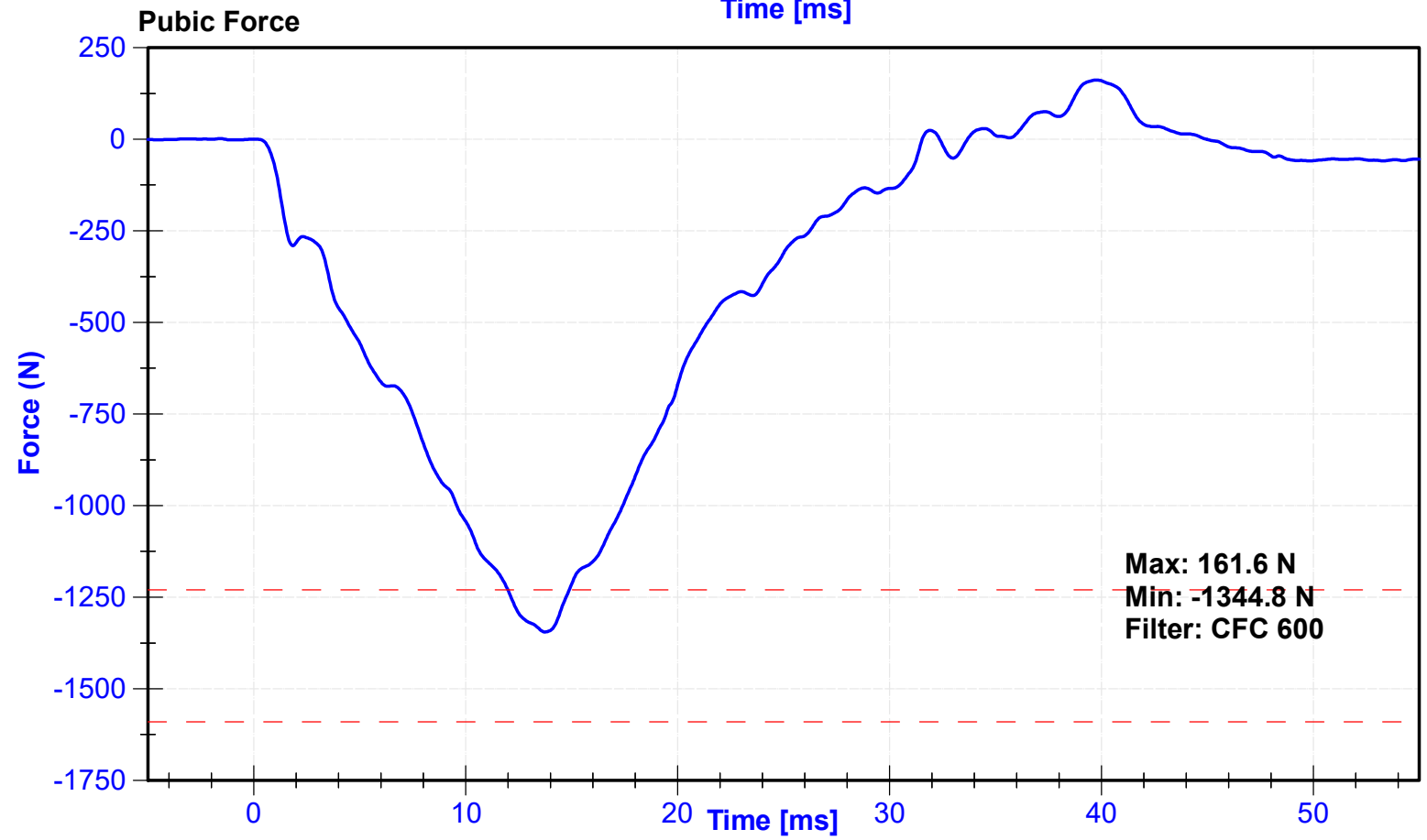
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	47	Pass
Velocity	4.2	4.4	m/s	4.30	Pass
Resistive Force	4700	5400	N	4727.4	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.30	Pass
Pubic Force	-1590	-1230	N	-1344.8	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.75	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pubic Load Cell	Denton	464-FY	8/15/2023	8/14/2024




Resistive Force
Max: 4727.4 N
Min: 55.4 N
Filter: CFC 180
Force (N)
6000
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]

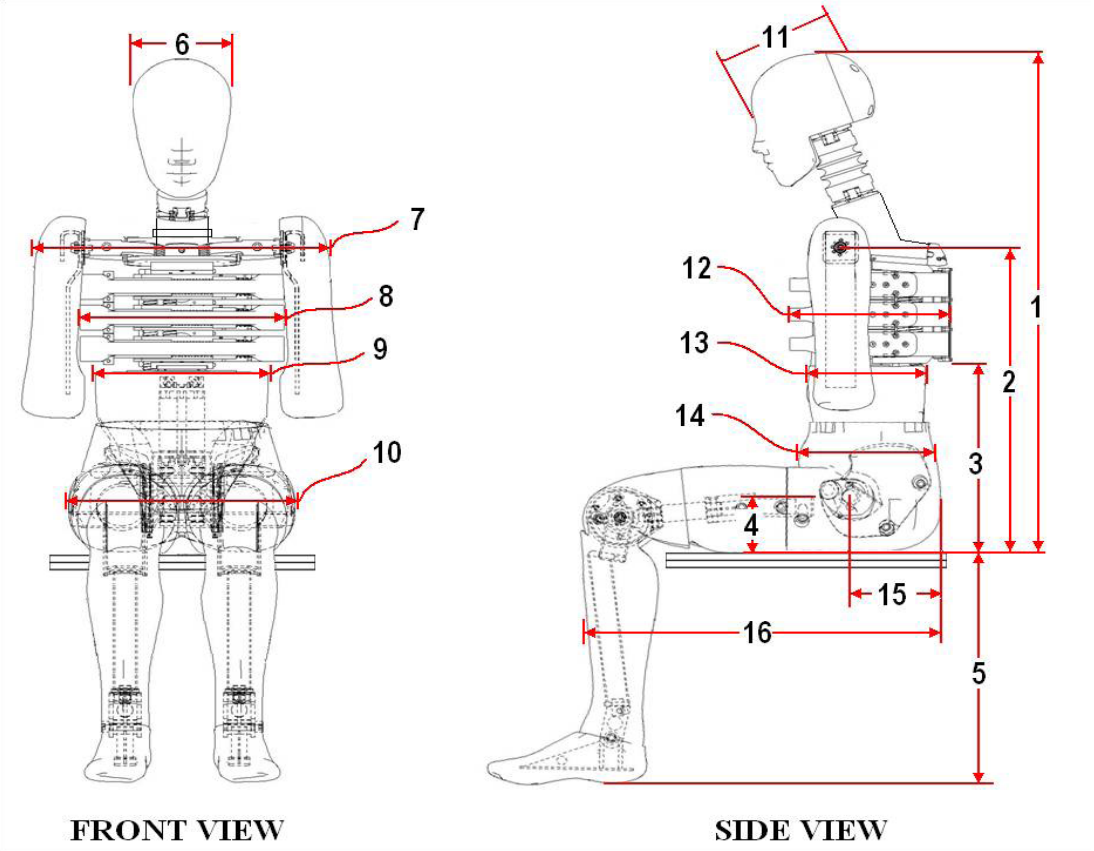

Pubic Force
Max: 161.6 N
Min: -1344.8 N
Filter: CFC 600
Force (N)
250
0
-250
-500
-750
-1000
-1250
-1500
-1750
0
10
20
30
40
50
Time [ms]

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

External Measurements - EuroSID-2re

Technician: K. Brogan Date: 08/24/2023

Dummy Serial Number: DG5348



FRONT VIEW SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	915	Pass
2	Seat to Shoulder Joint	558	572	568	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	350	Pass
4	Seat to Hip Joint (center of bolt)	97	103	102	Pass
5	Sole to Seat, Sitting	333	451	410	Pass
6	Head Width	152	158	156	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	325	Pass
9	Abdomen Width	273	287	281	Pass
10	Pelvis Lap Width	359	373	368	Pass
11	Head Depth	196	206	202	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	200	Pass
14	Pelvis Depth	235	245	242	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

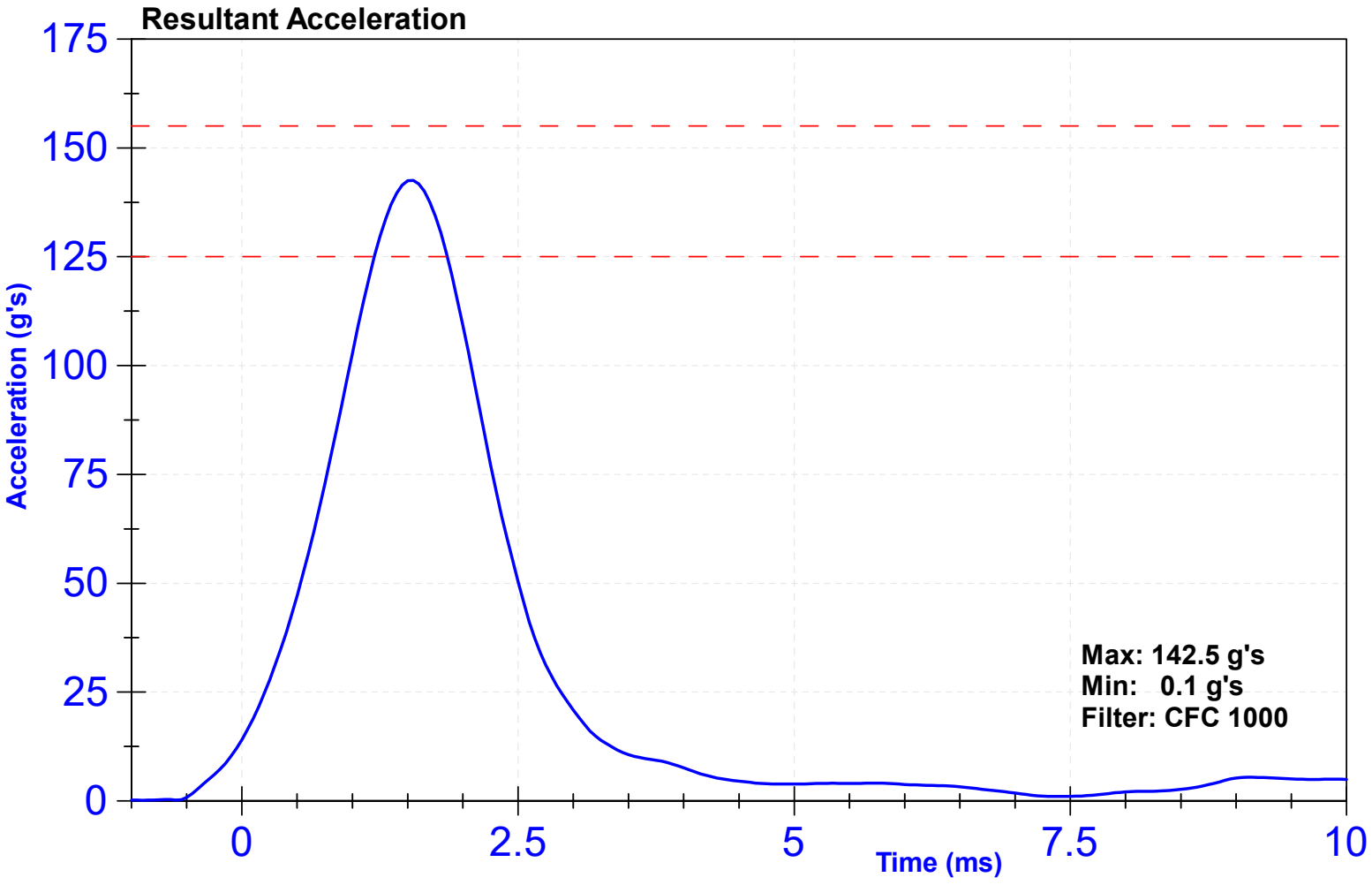
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

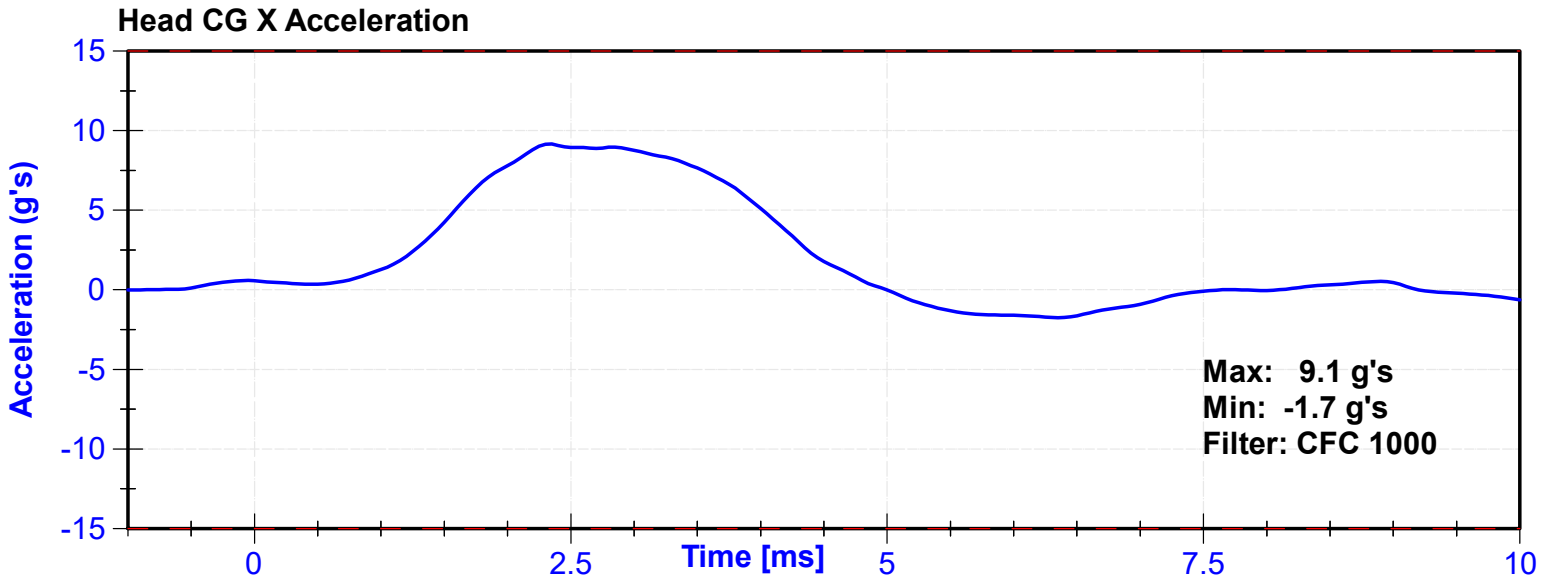
Results

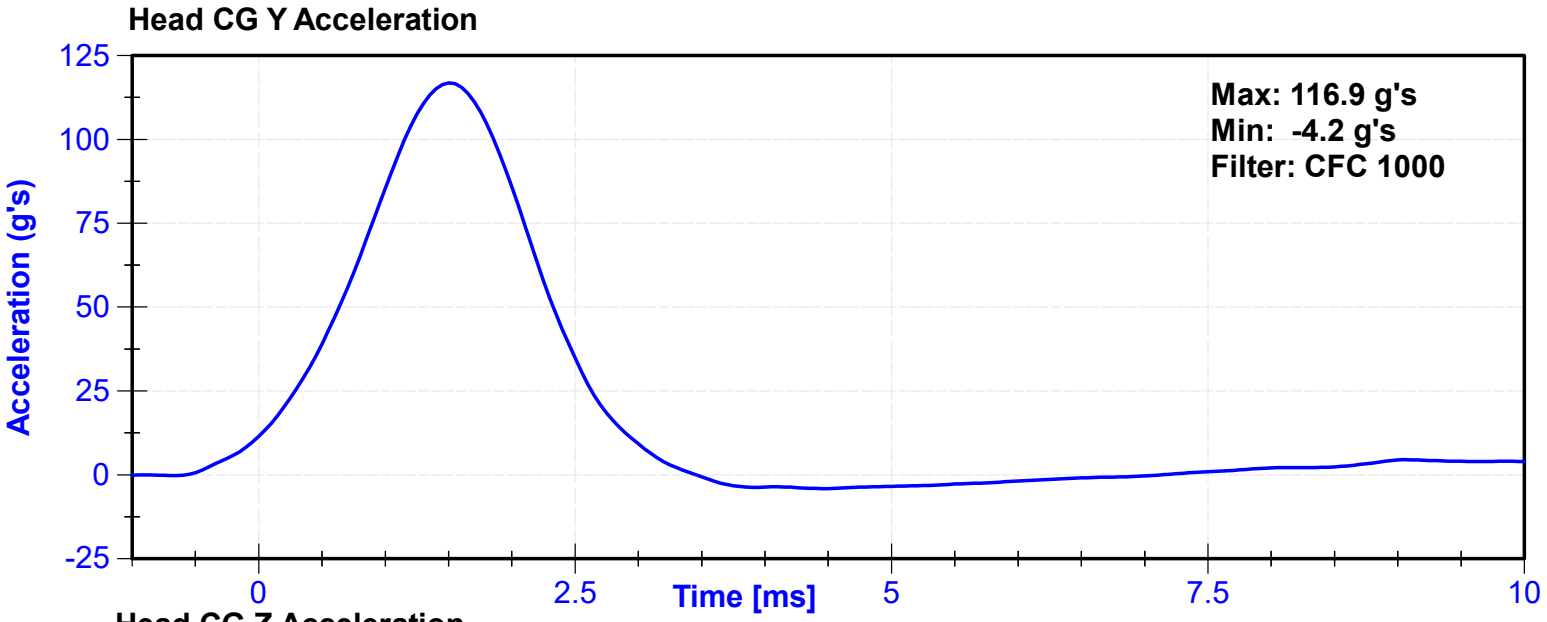
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	61	Pass
Resultant Acceleration	125	155	g's	142.5	Pass
Oscillation	0	15	%	3.82	Pass
Fore-Aft Acceleration	-15	15	g's	9.1	Pass

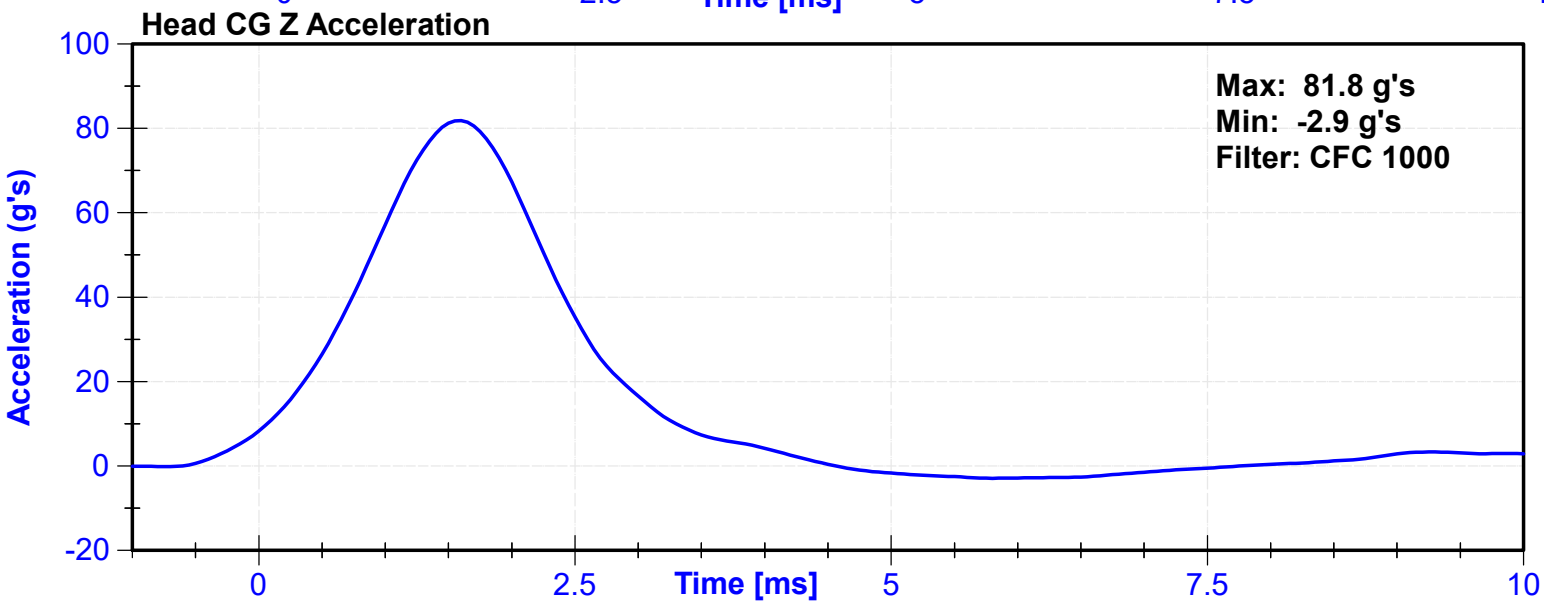
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	18613	6/14/2023	12/11/2023
Y Accelerometer	Endevco	18472	2/28/2023	8/27/2023
Z Accelerometer	Endevco	18663	2/28/2023	8/27/2023




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 9.1 g's
Min: -1.7 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 116.9 g's
Min: -4.2 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]
Max: 81.8 g's
Min: -2.9 g's
Filter: CFC 1000

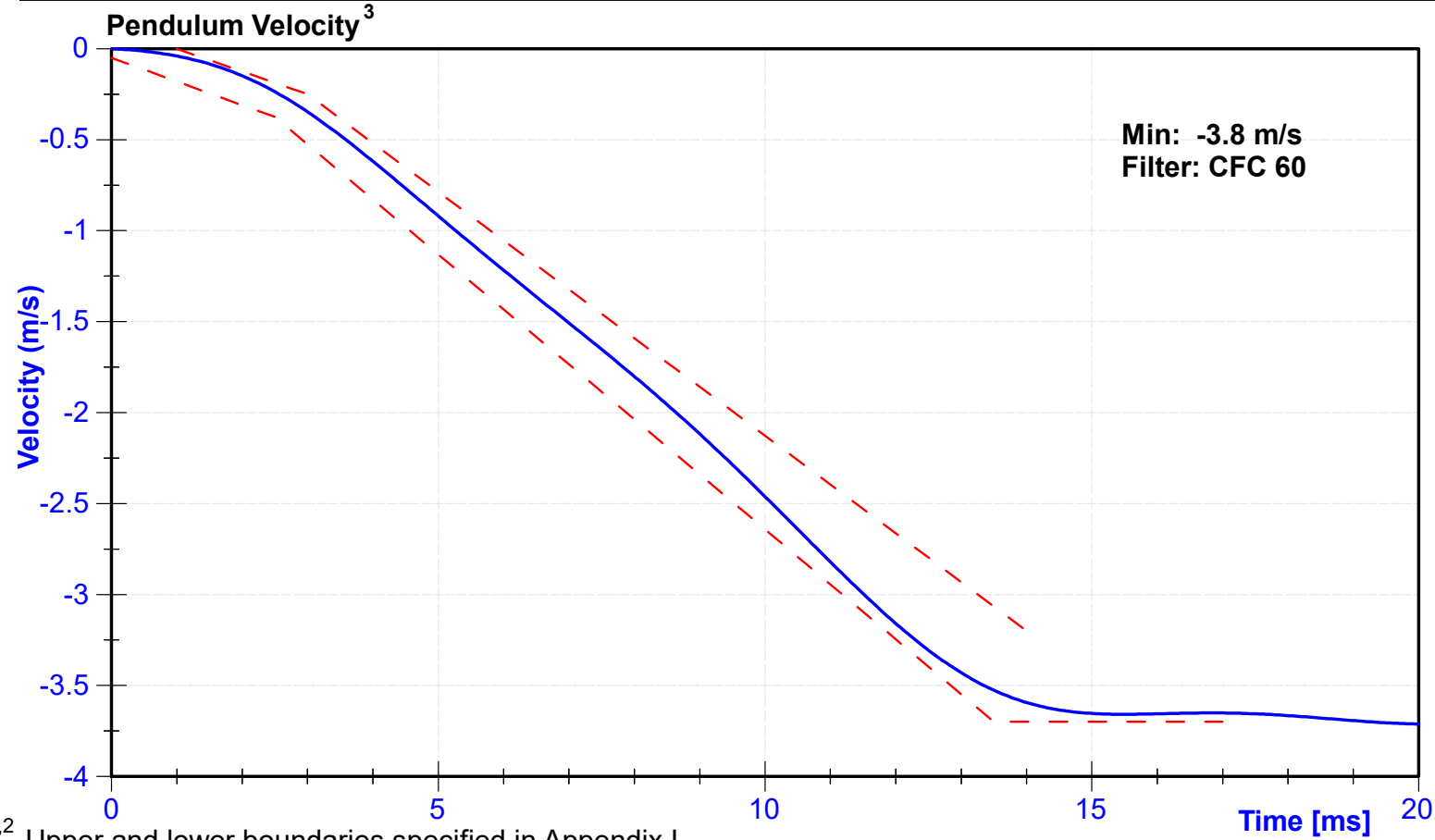
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

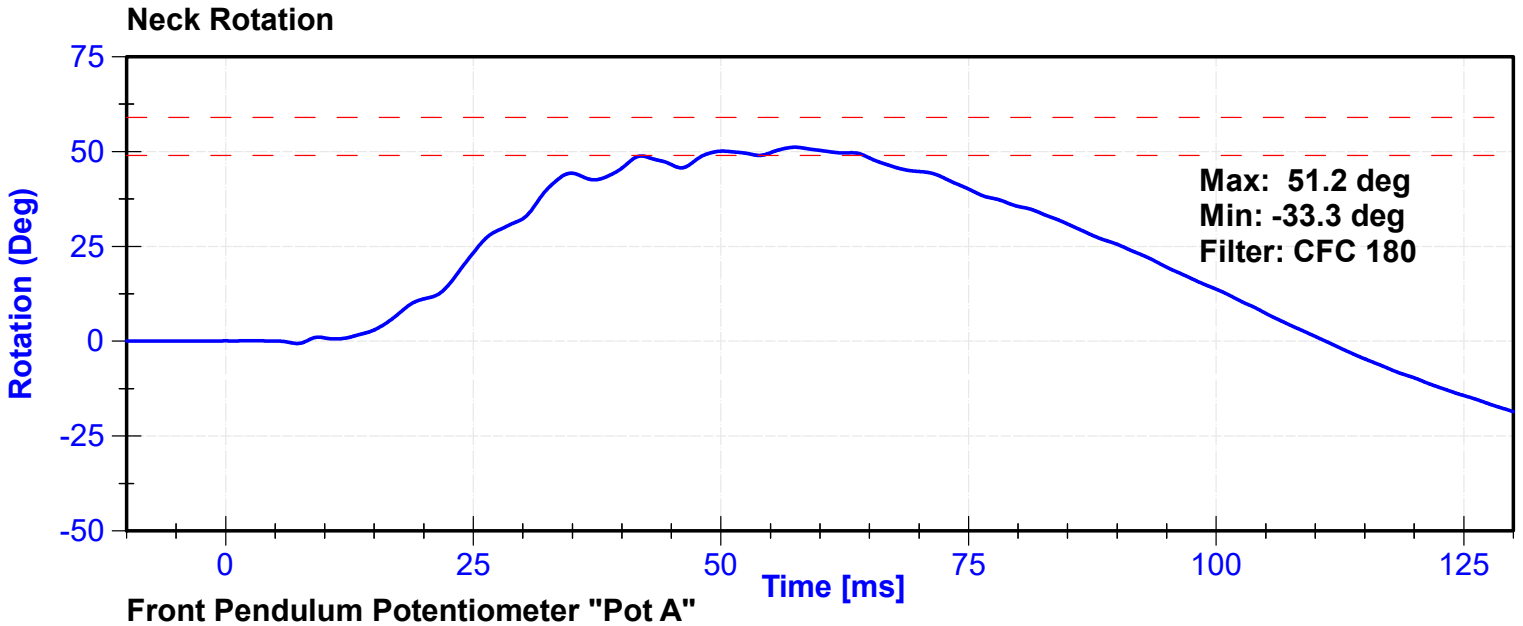
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	46.7	Pass
Velocity	3.3	3.5	m/s	3.42	Pass
Lateral Neck Rotation	49	59	deg	51.2	Pass
Time at Maximum Rotation	54	66	ms	57.5	Pass
Time of Rotation Decay from Maximum	53	88	ms	53.6	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

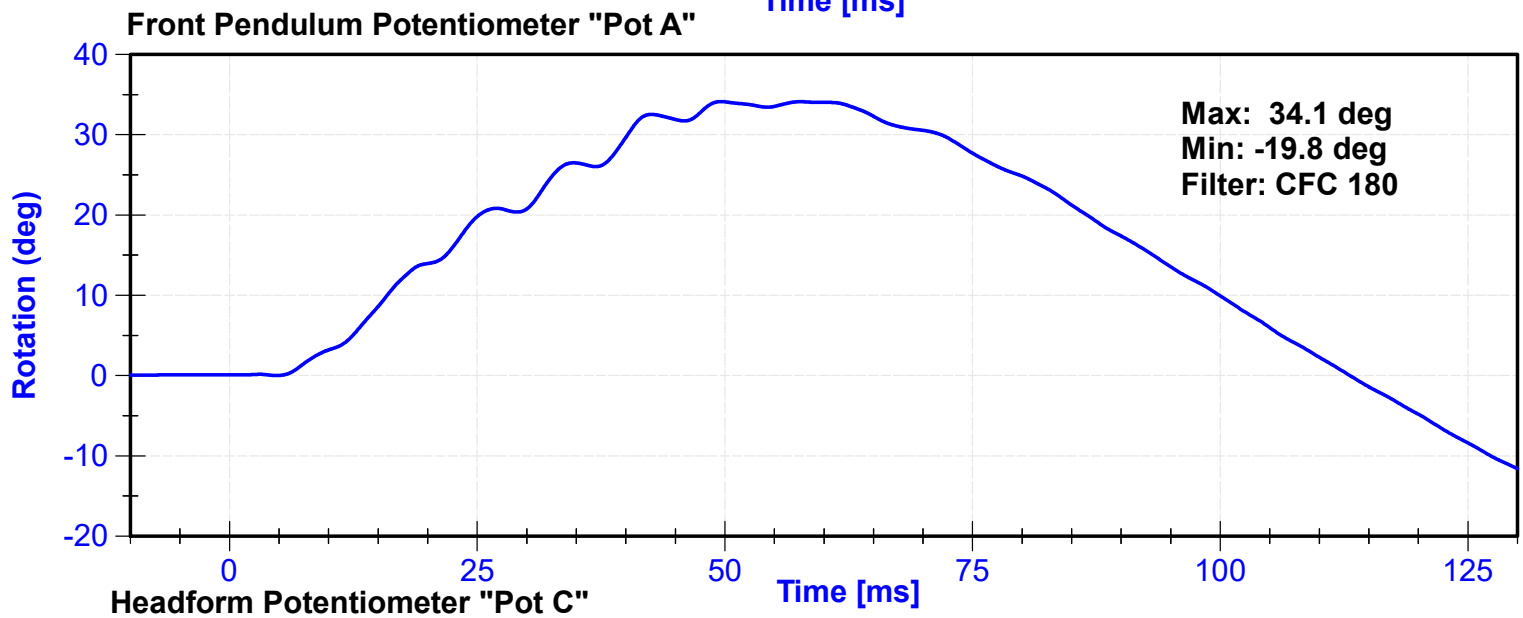
Transducer Calibrations

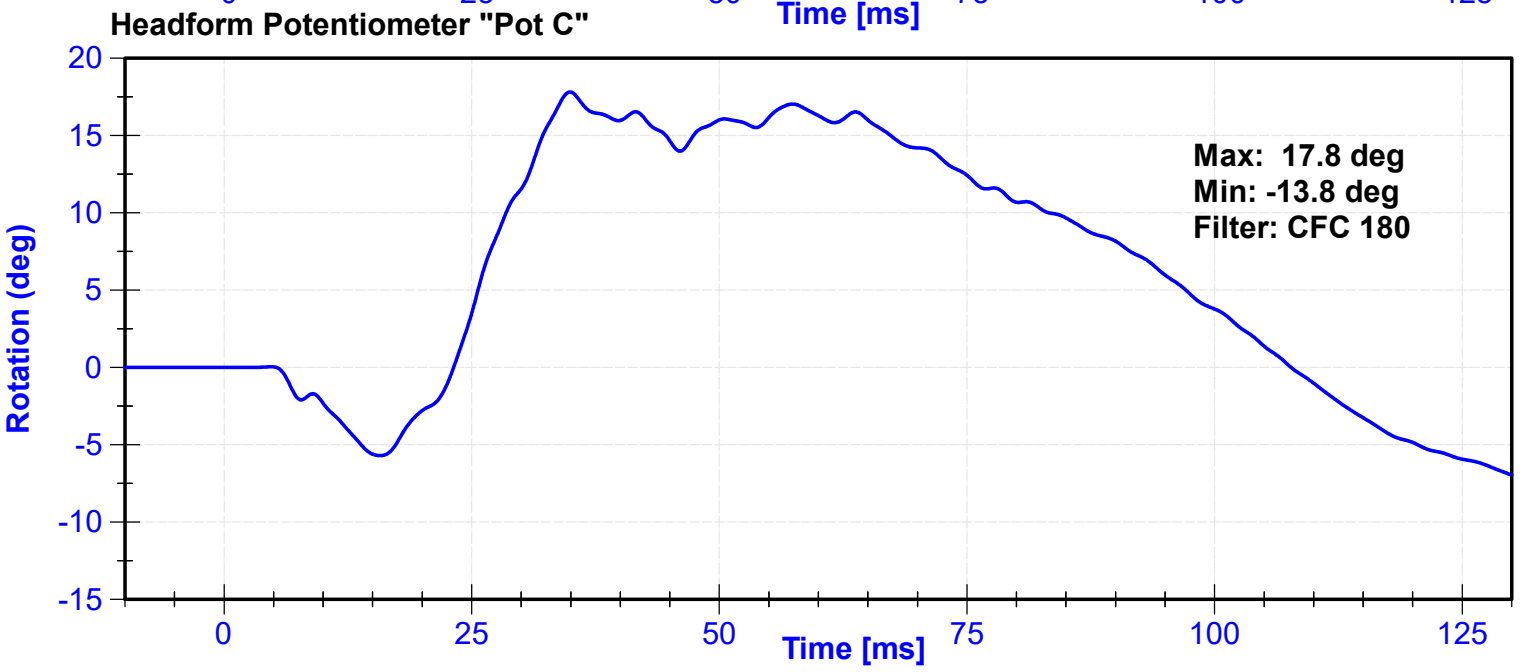
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16650	10/31/2022	10/31/2023
Front Pendulum Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Headform Potentiometer	Sfernice	095	10/5/2022	10/5/2023



[1,2] Upper and lower boundaries specified in Appendix I


Neck Rotation
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]
Max: 51.2 deg
Min: -33.3 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
40
30
20
10
0
-10
-20
0
25
50
75
100
125
Time [ms]
Max: 34.1 deg
Min: -19.8 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
20
15
10
5
0
-5
-10
-15
0
25
50
75
100
125
Time [ms]
Max: 17.8 deg
Min: -13.8 deg
Filter: CFC 180

Appendix I

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

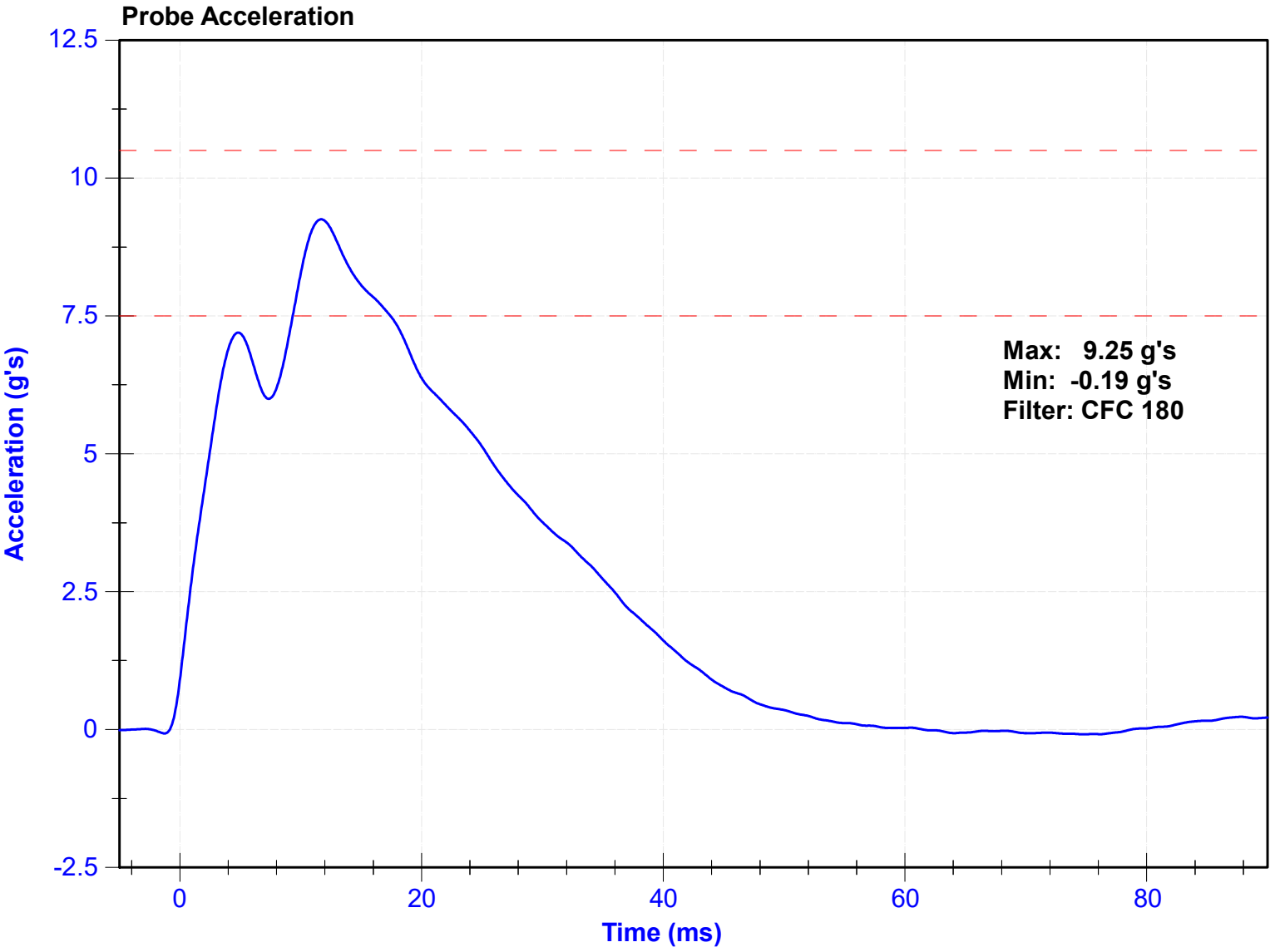
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	54	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	7.5	10.5	g's	9.25	Pass

Transducer Calibrations

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



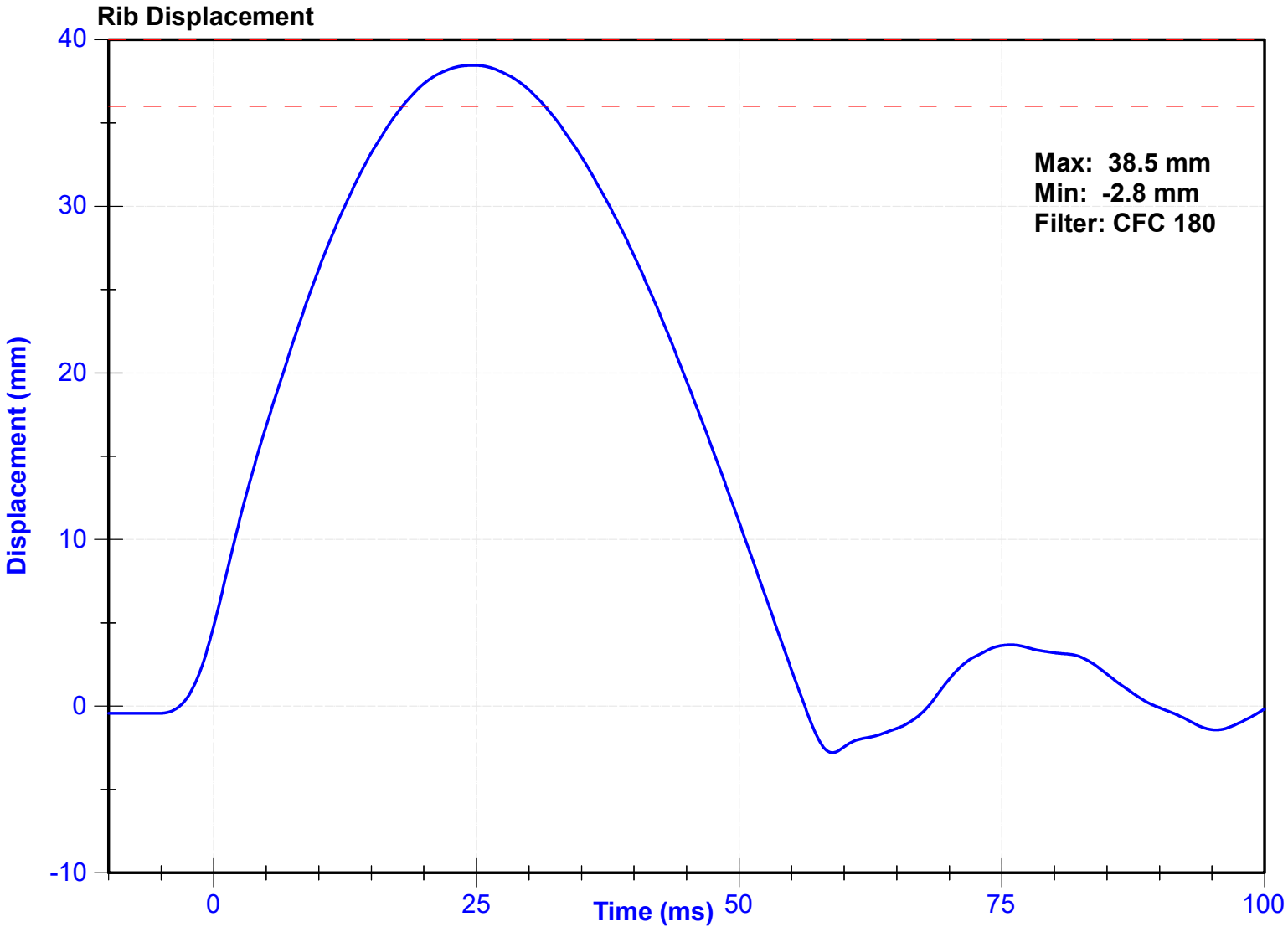
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	61	Pass
Rib Displacement	36	40	mm	38.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	268GFE	8/8/2023	2/6/2024



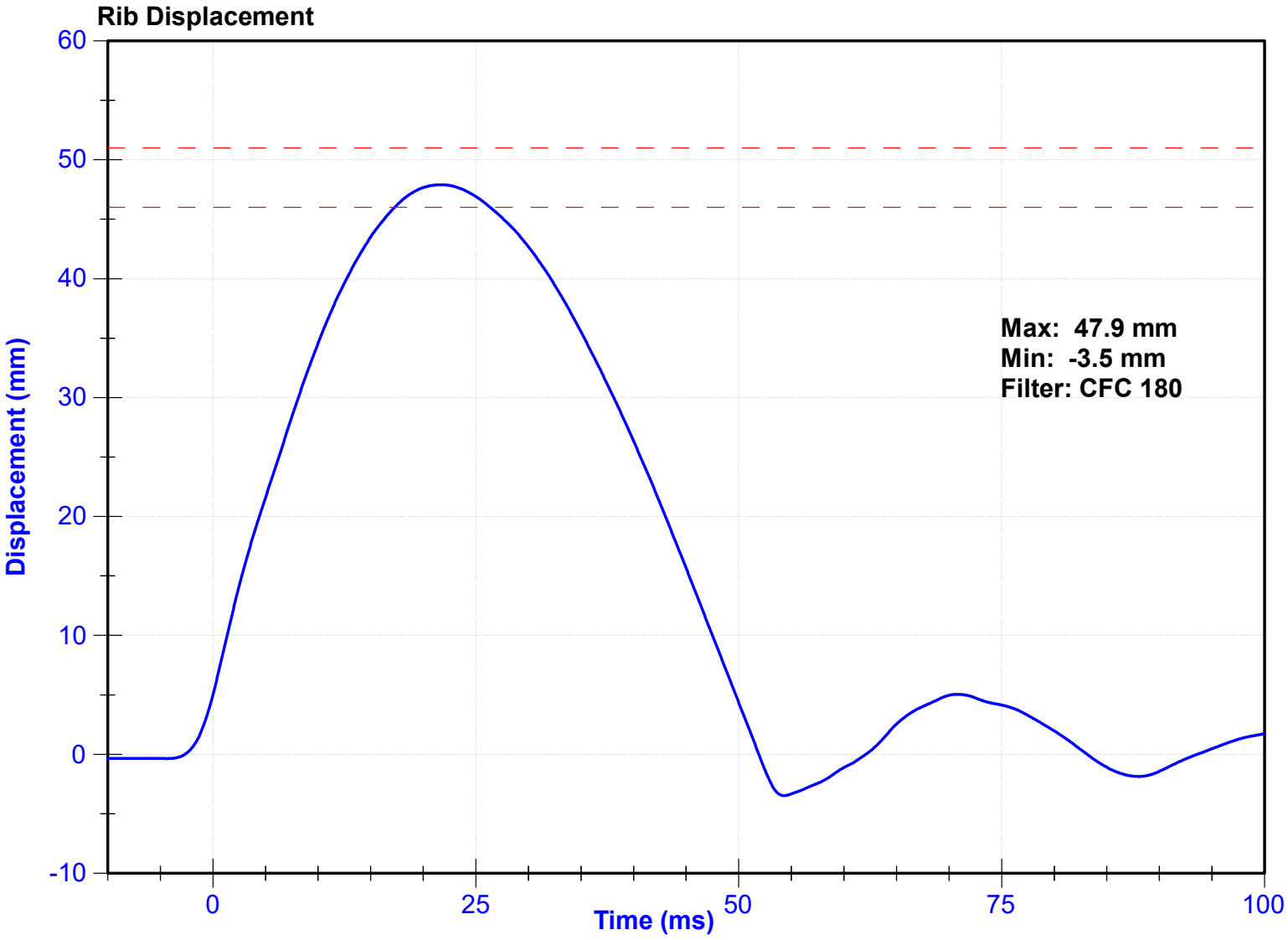
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	61	Pass
Rib Displacement	46	51	mm	47.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	268GFE	8/8/2023	2/6/2024



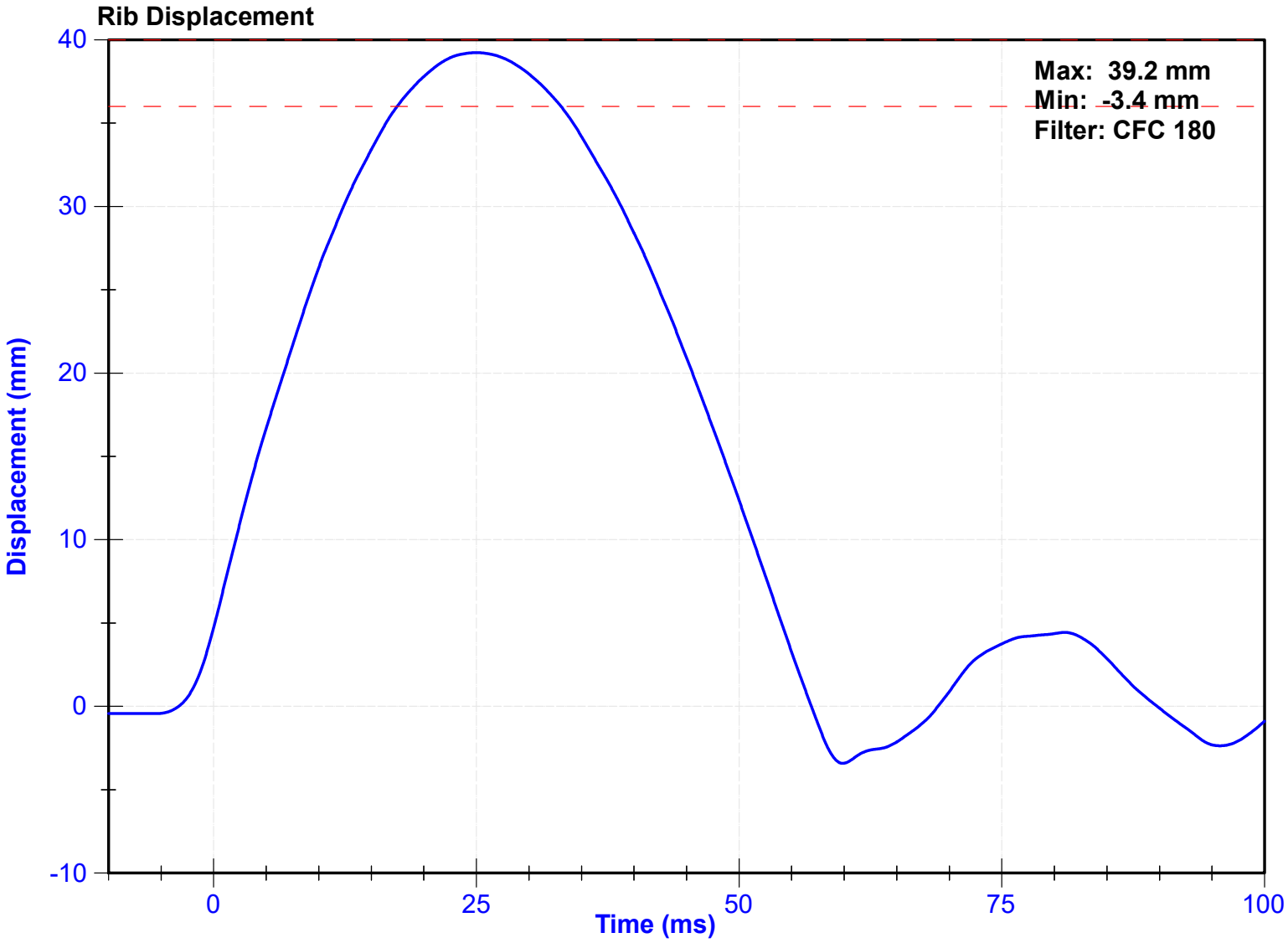
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	61	Pass
Rib Displacement	36	40	mm	39.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	269GFE	8/8/2023	2/6/2024



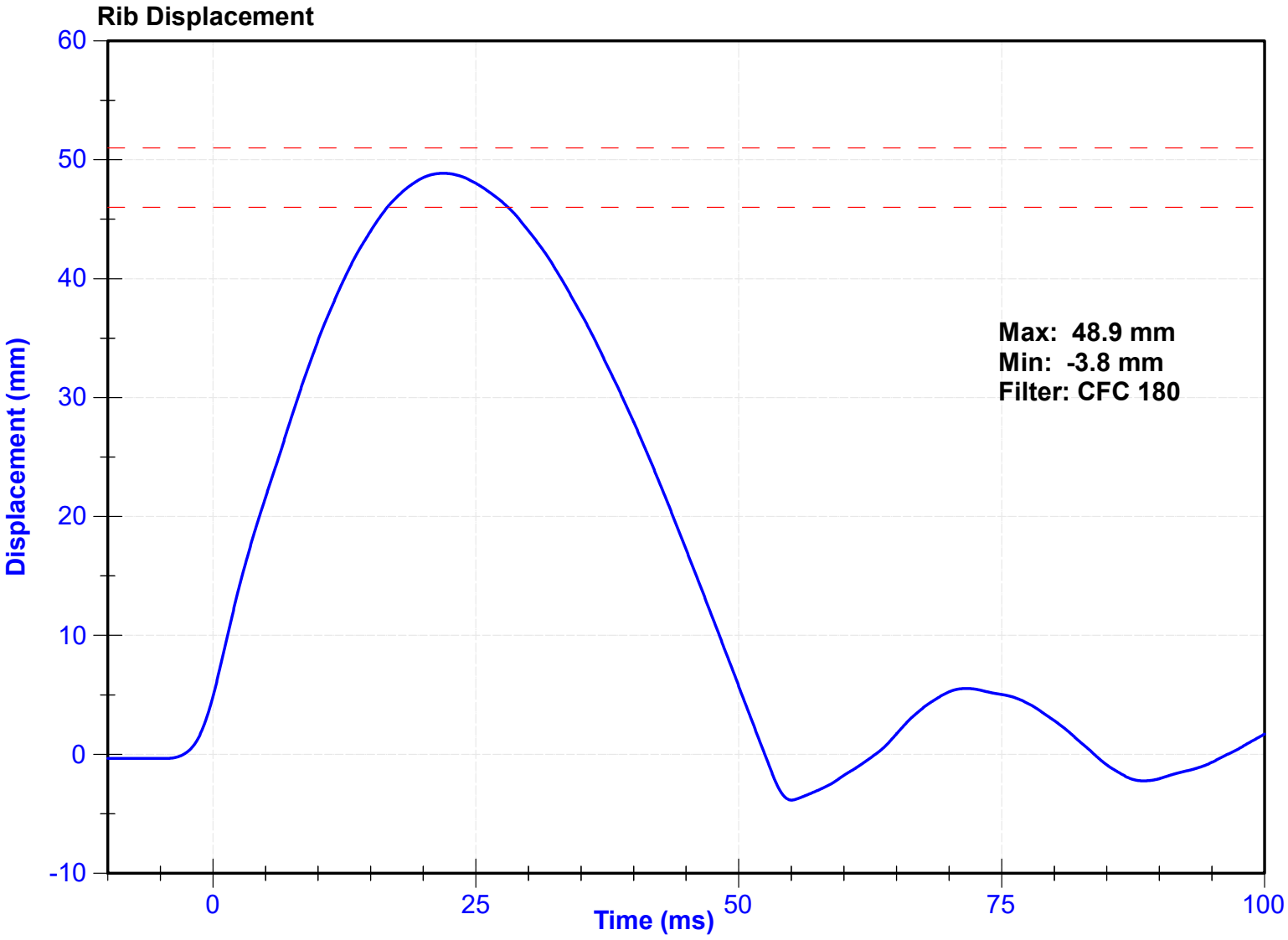
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	61	Pass
Rib Displacement	46	51	mm	48.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	269GFE	8/8/2023	2/6/2024



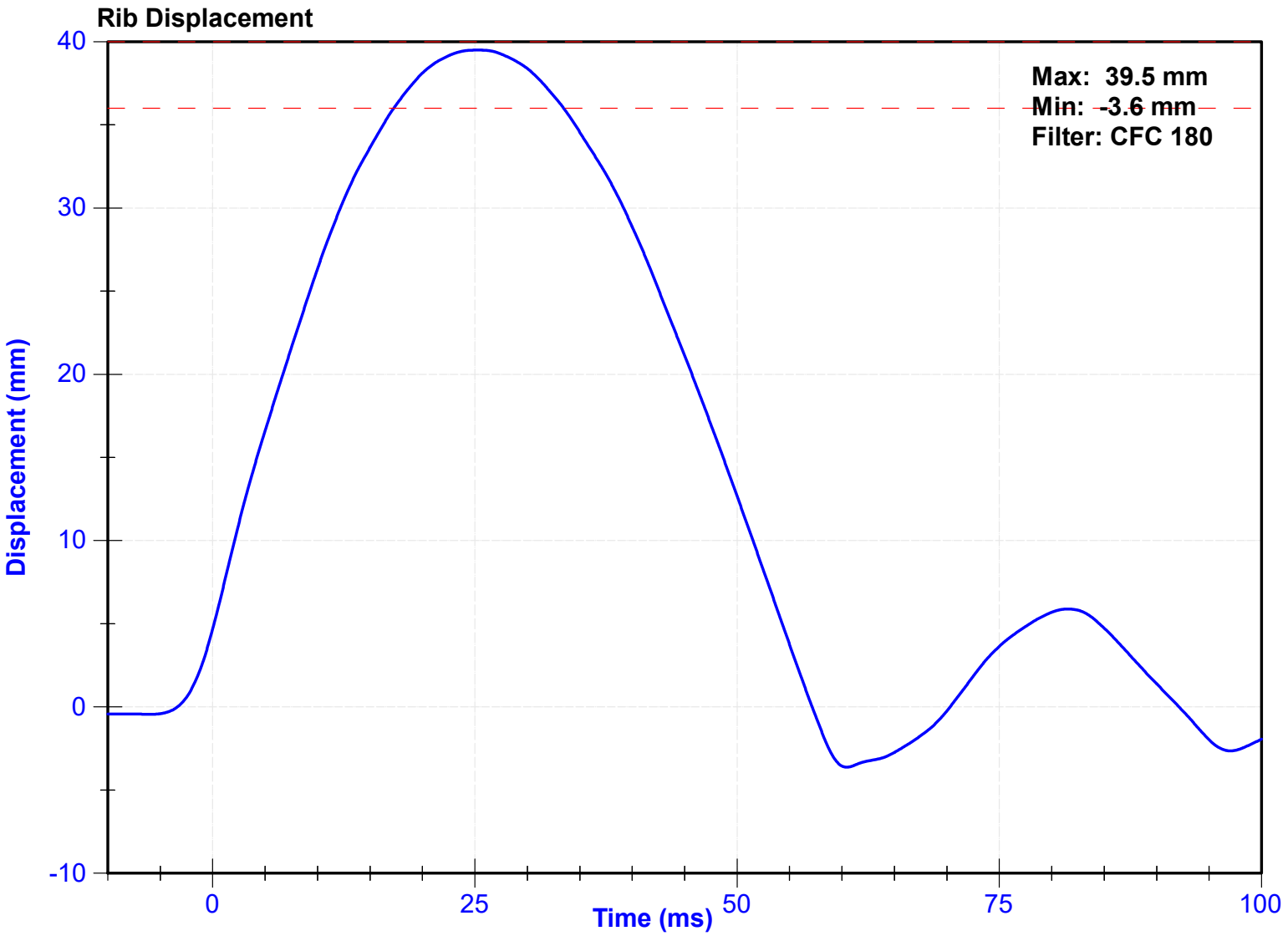
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	61	Pass
Rib Displacement	36	40	mm	39.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	270GFE	8/8/2023	2/6/2024



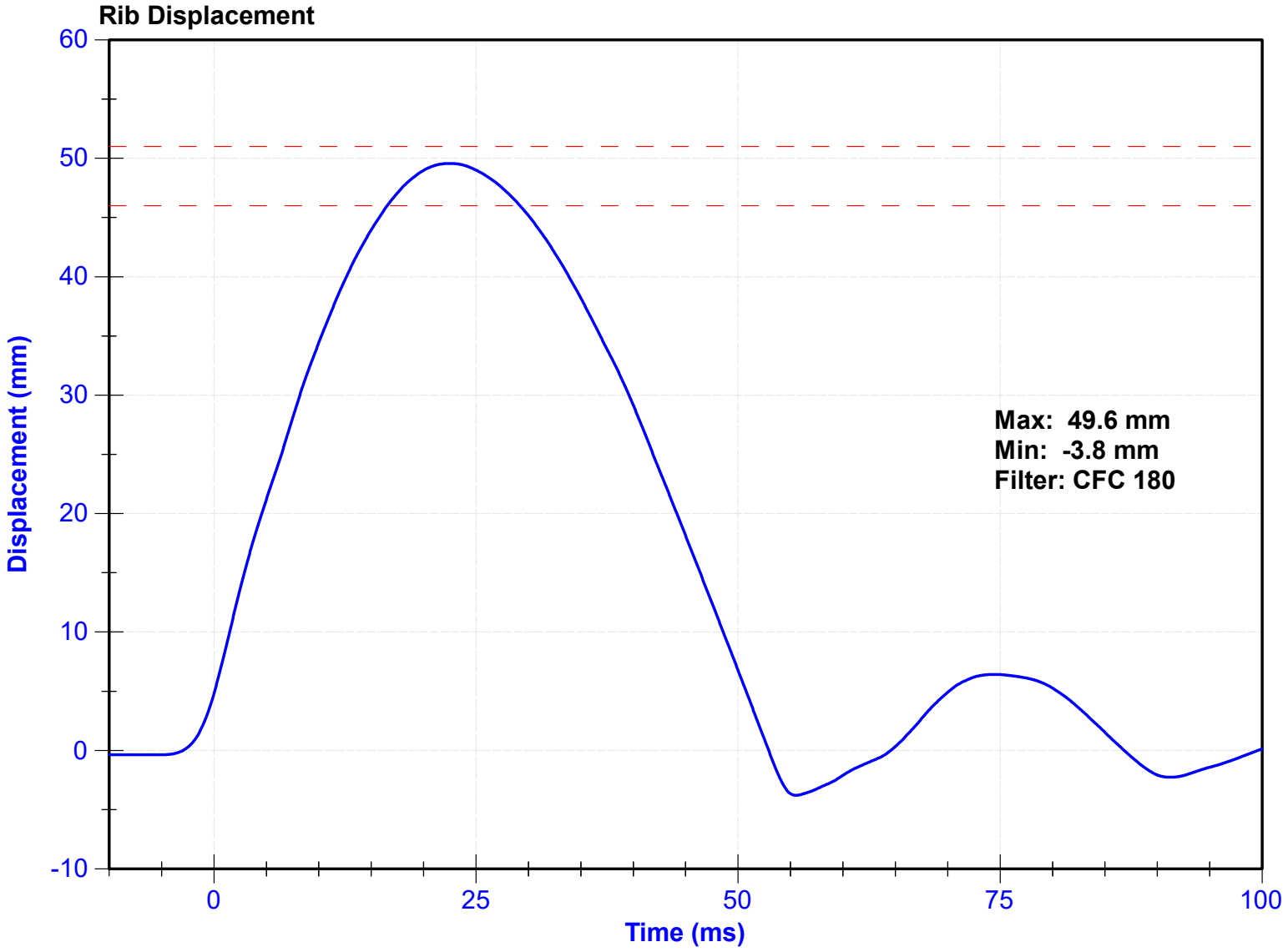
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	61	Pass
Rib Displacement	46	51	mm	49.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	270GFE	8/8/2023	2/6/2024



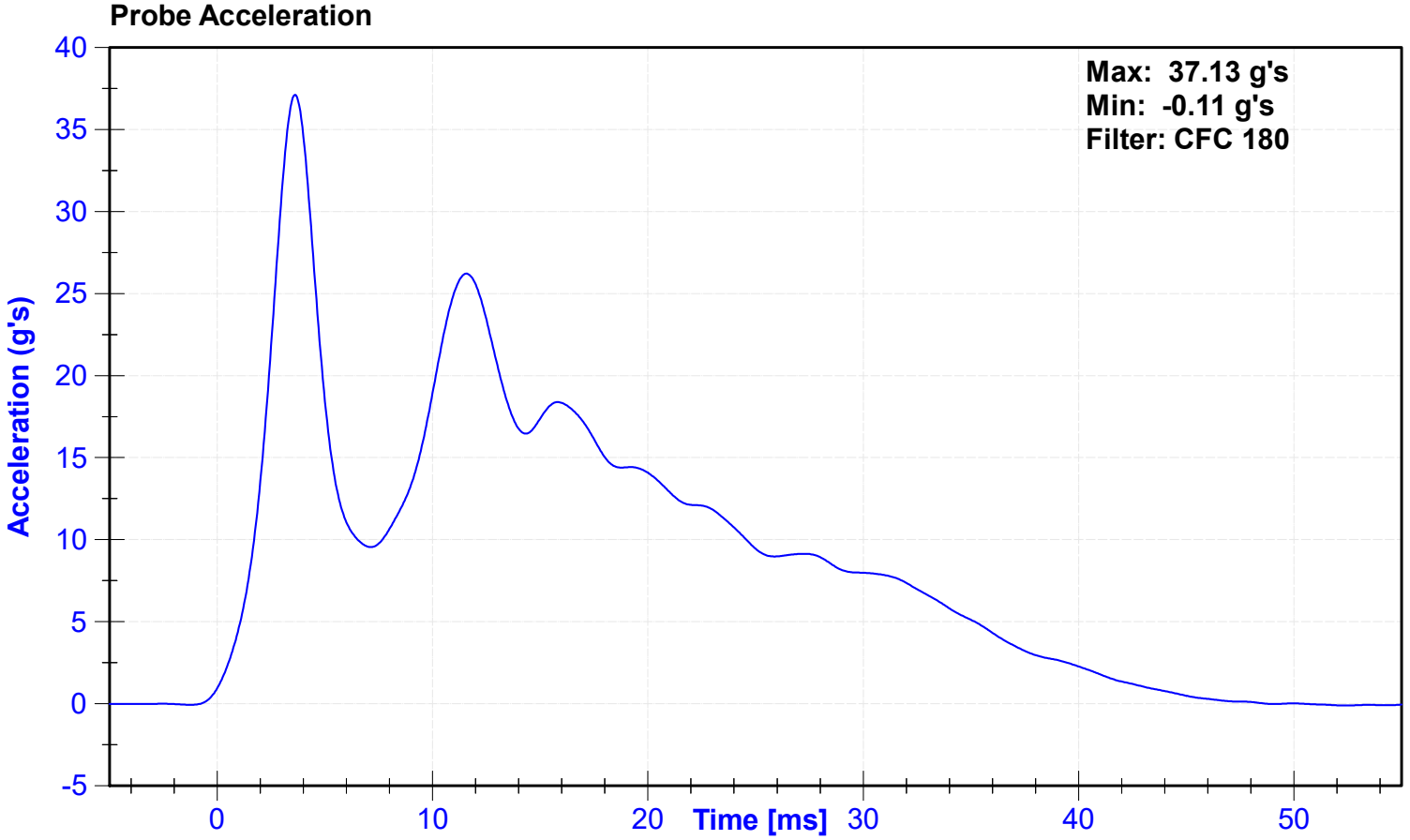
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

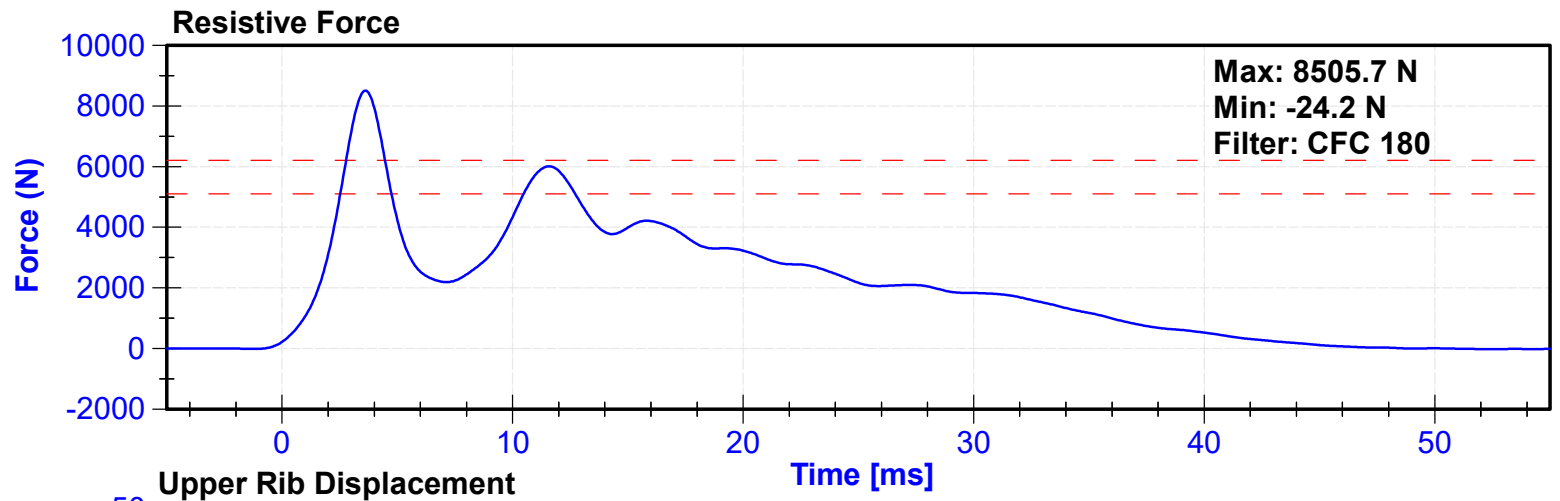
Results

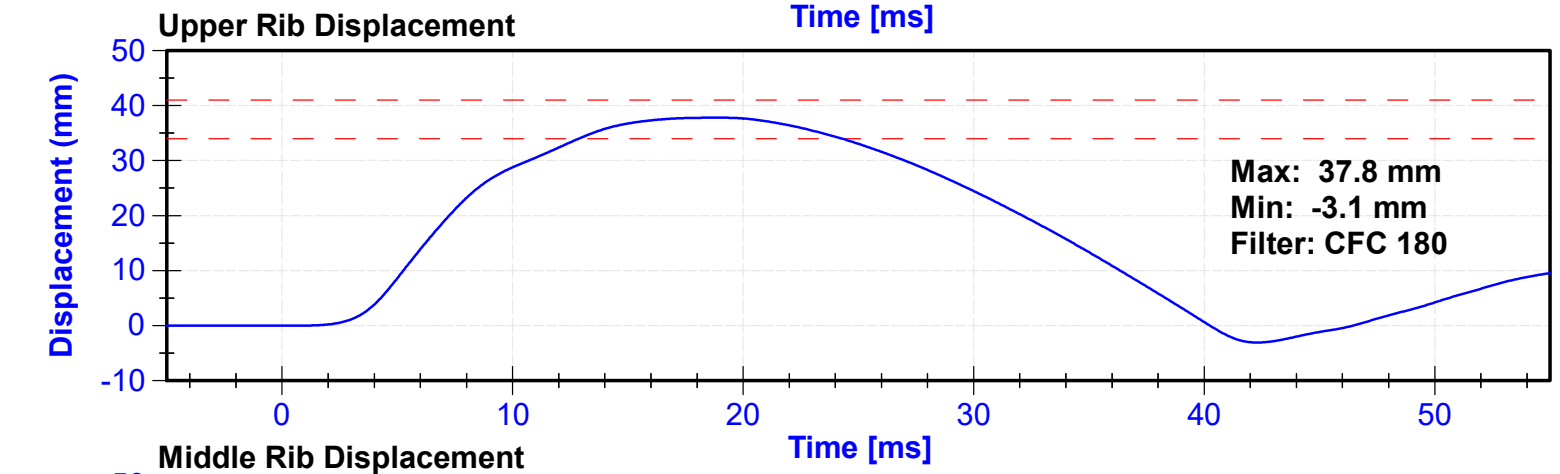
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	54	Pass
Velocity	5.4	5.6	m/s	5.53	Pass
Resistive Force after 6ms	5100	6200	N	6005.7	Pass
Upper Thorax Rib Deflection	34	41	mm	37.8	Pass
Mid Thorax Rib Deflection	37	45	mm	42.5	Pass
Lower Thorax Rib Deflection	37	44	mm	42.4	Pass

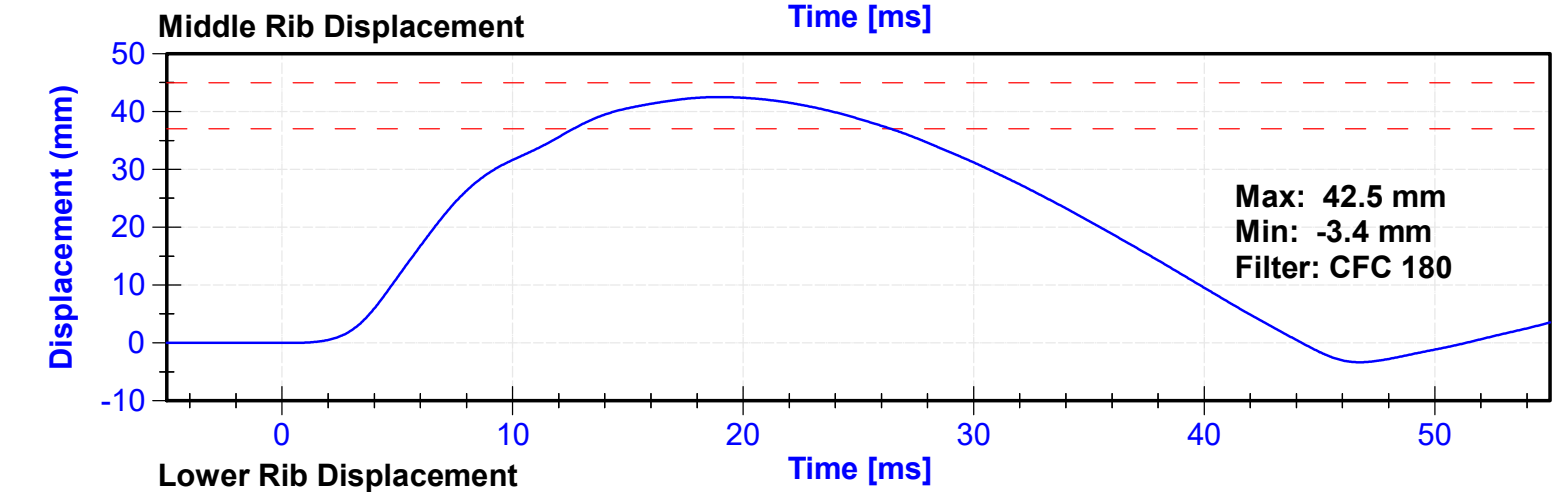
Transducer Calibrations

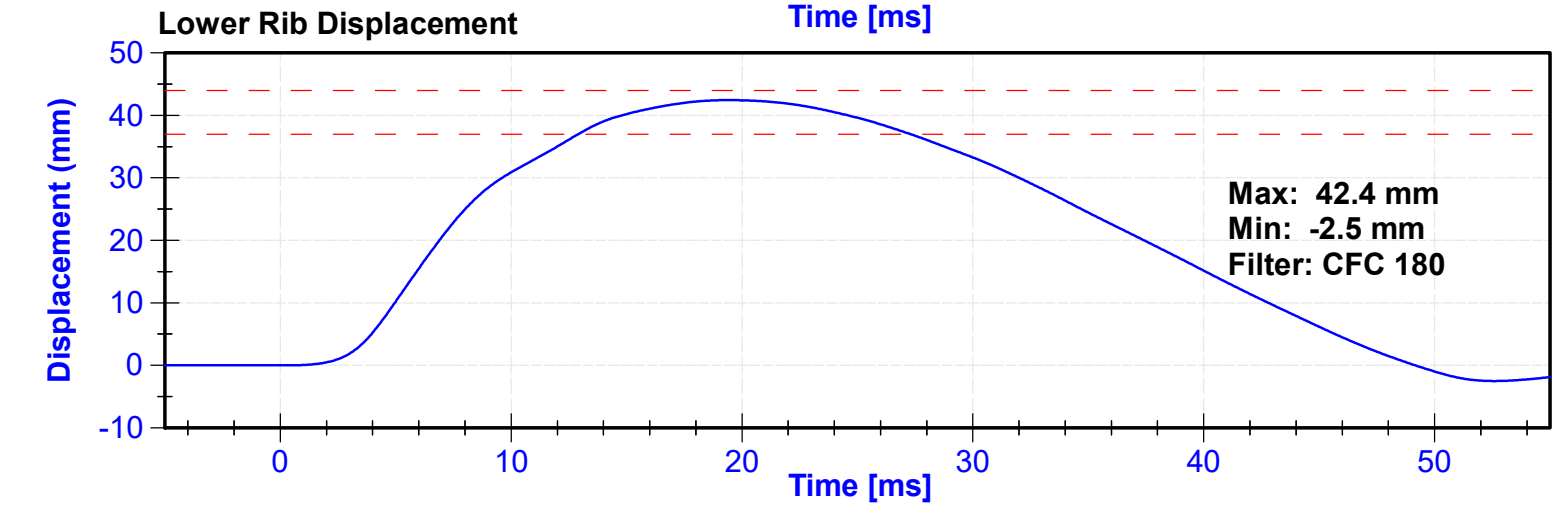
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Upper Thorax Rib Potentiometer	Honeywell	268GFE	8/8/2023	2/6/2024
Middle Thorax Rib Potentiometer	Honeywell	269GFE	8/8/2023	2/6/2024
Lower Thorax Rib Potentiometer	Honeywell	270GFE	8/8/2023	2/6/2024




Resistive Force
Max: 8505.7 N
Min: -24.2 N
Filter: CFC 180
Force (N)
10000
8000
6000
4000
2000
0
-2000
0
10
20
30
40
50
Time [ms]


Upper Rib Displacement
Max: 37.8 mm
Min: -3.1 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Middle Rib Displacement
Max: 42.5 mm
Min: -3.4 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Lower Rib Displacement
Max: 42.4 mm
Min: -2.5 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]

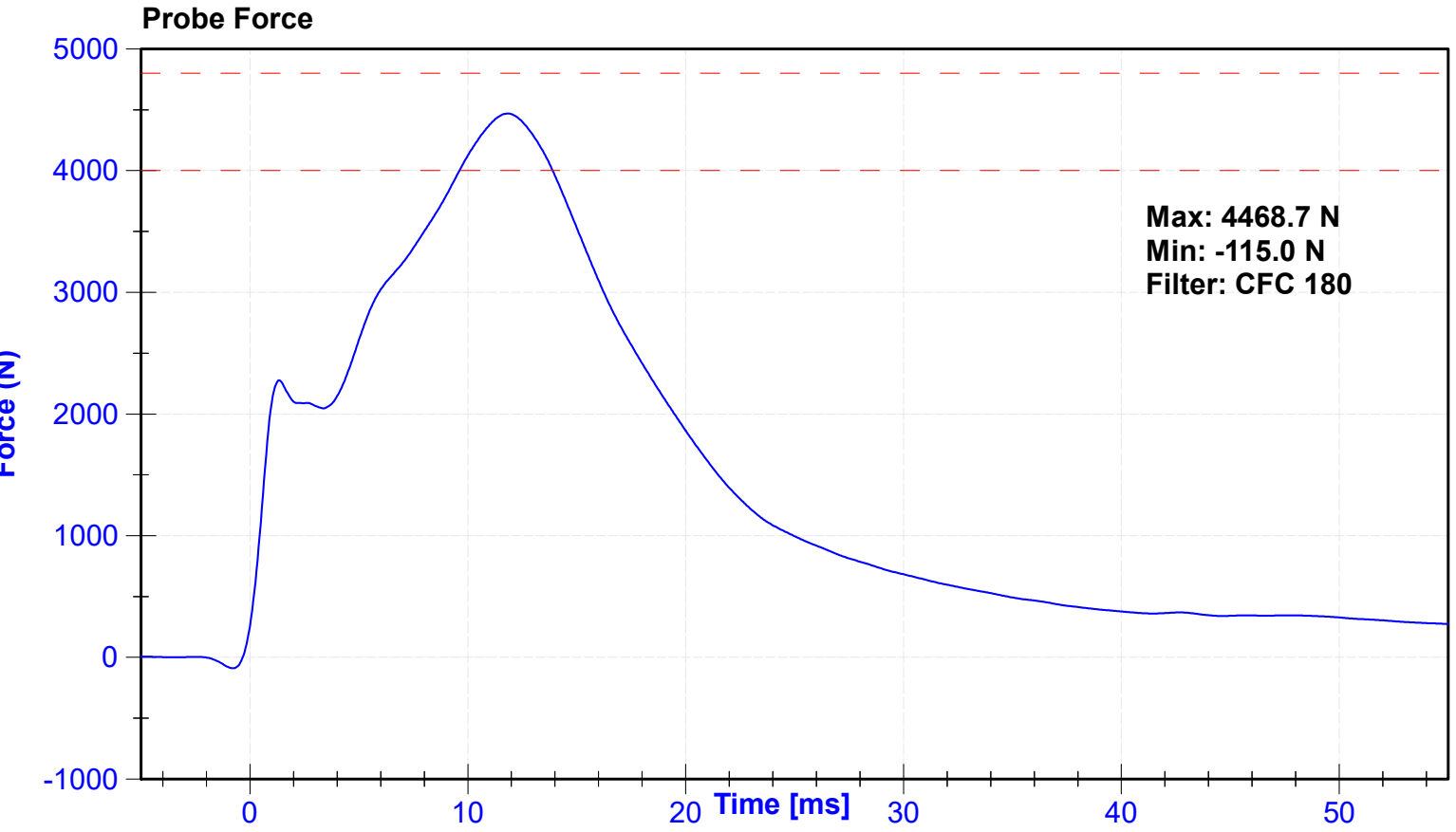
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

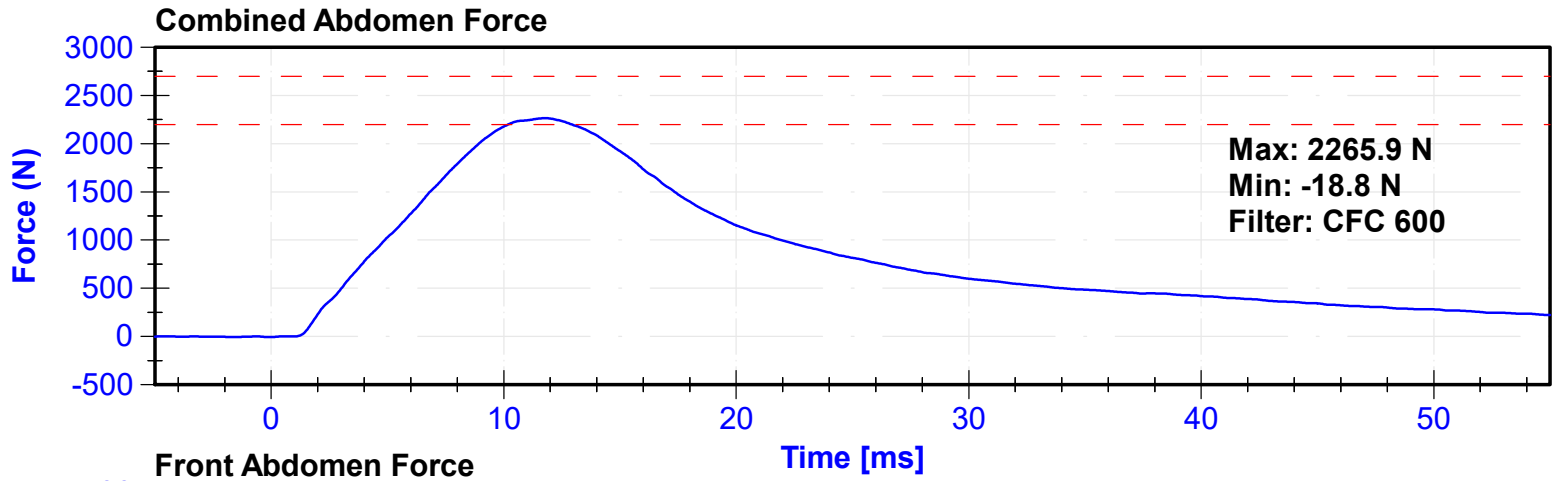
Results

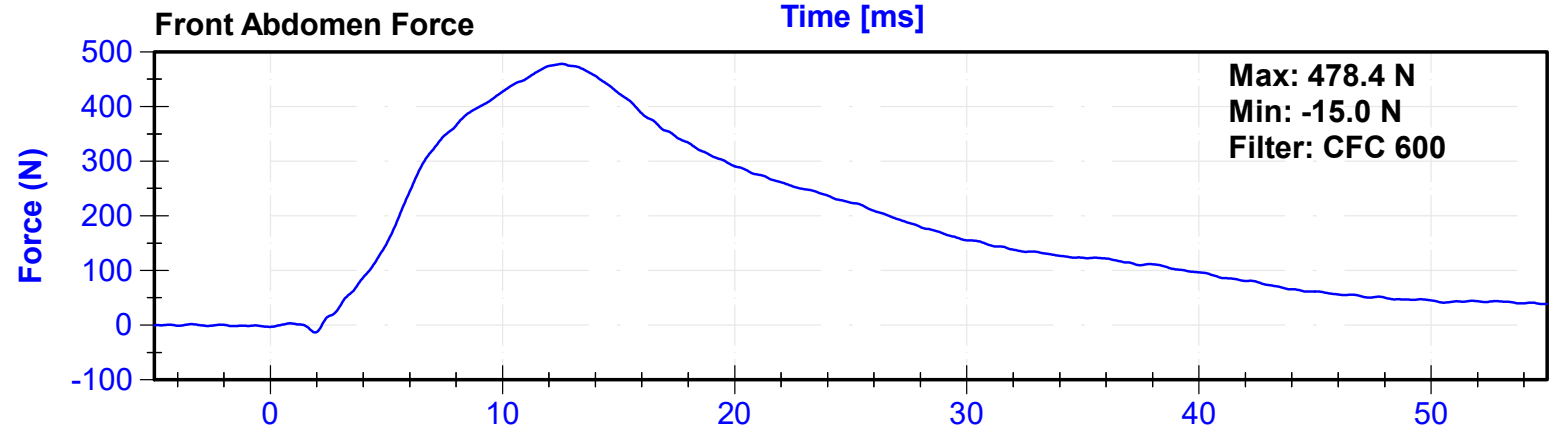
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	54	Pass
Velocity	3.9	4.1	m/s	4.02	Pass
Combined Abdomen Force	2200	2700	N	2265.9	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.75	Pass
Resistive Probe Force	4000	4800	N	4468.7	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.85	Pass

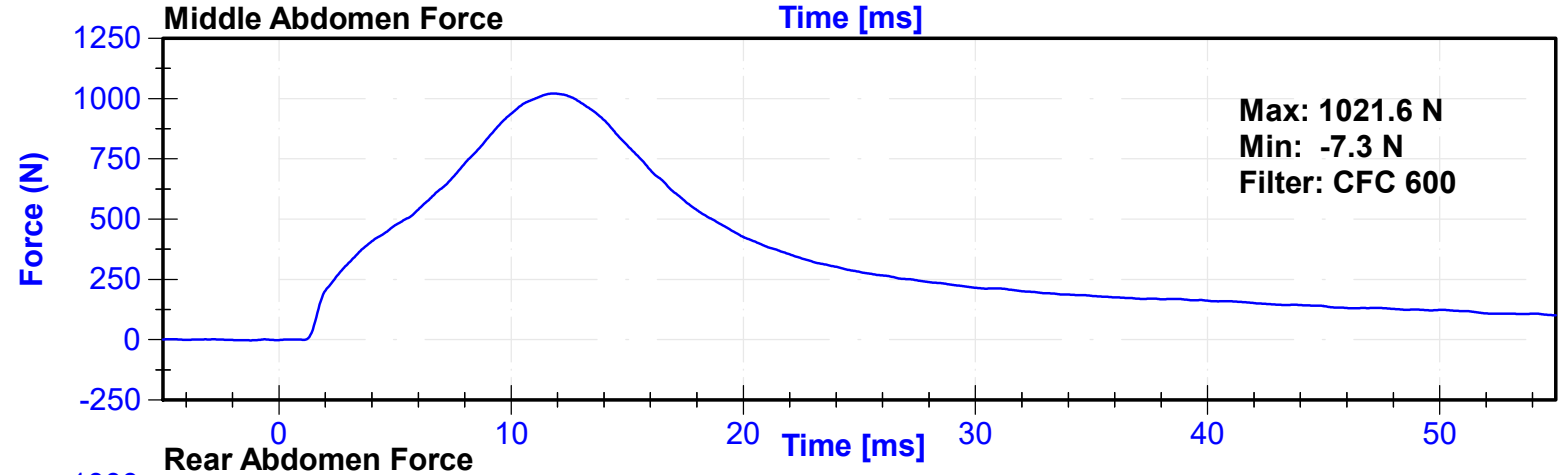
Transducer Calibrations

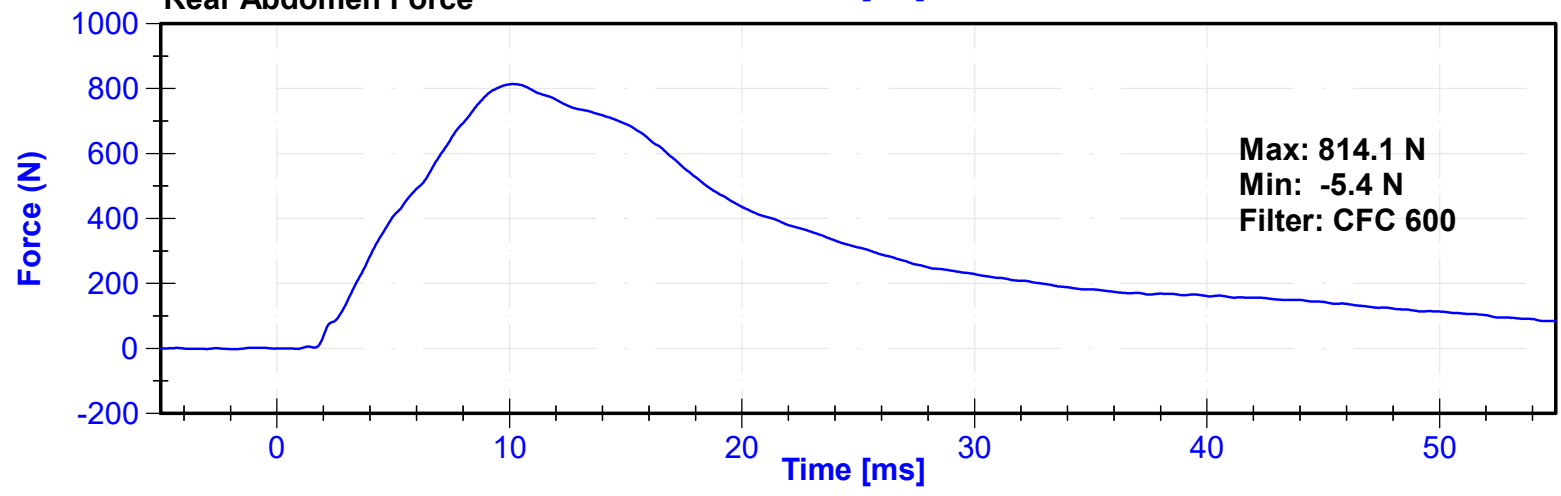
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Front Abdomen Load Cell	Denton	1512	8/15/2023	8/14/2024
Middle Abdomen Load Cell	Denton	1526	8/15/2023	8/14/2024
Rear Abdomen Load Cell	Denton	1516	8/15/2023	8/14/2024




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2265.9 N
Min: -18.8 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 478.4 N
Min: -15.0 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1021.6 N
Min: -7.3 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 814.1 N
Min: -5.4 N
Filter: CFC 600

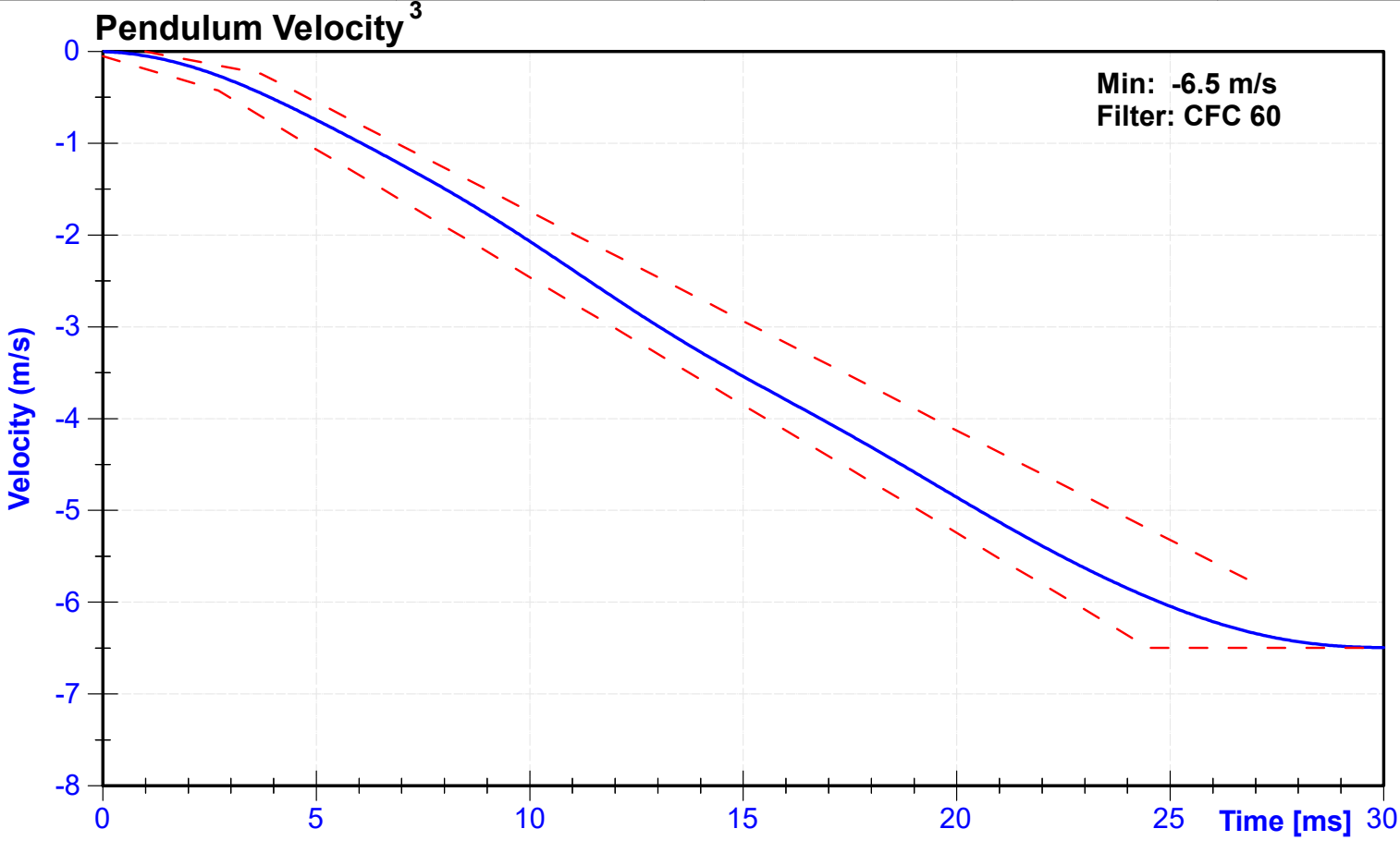
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

Results

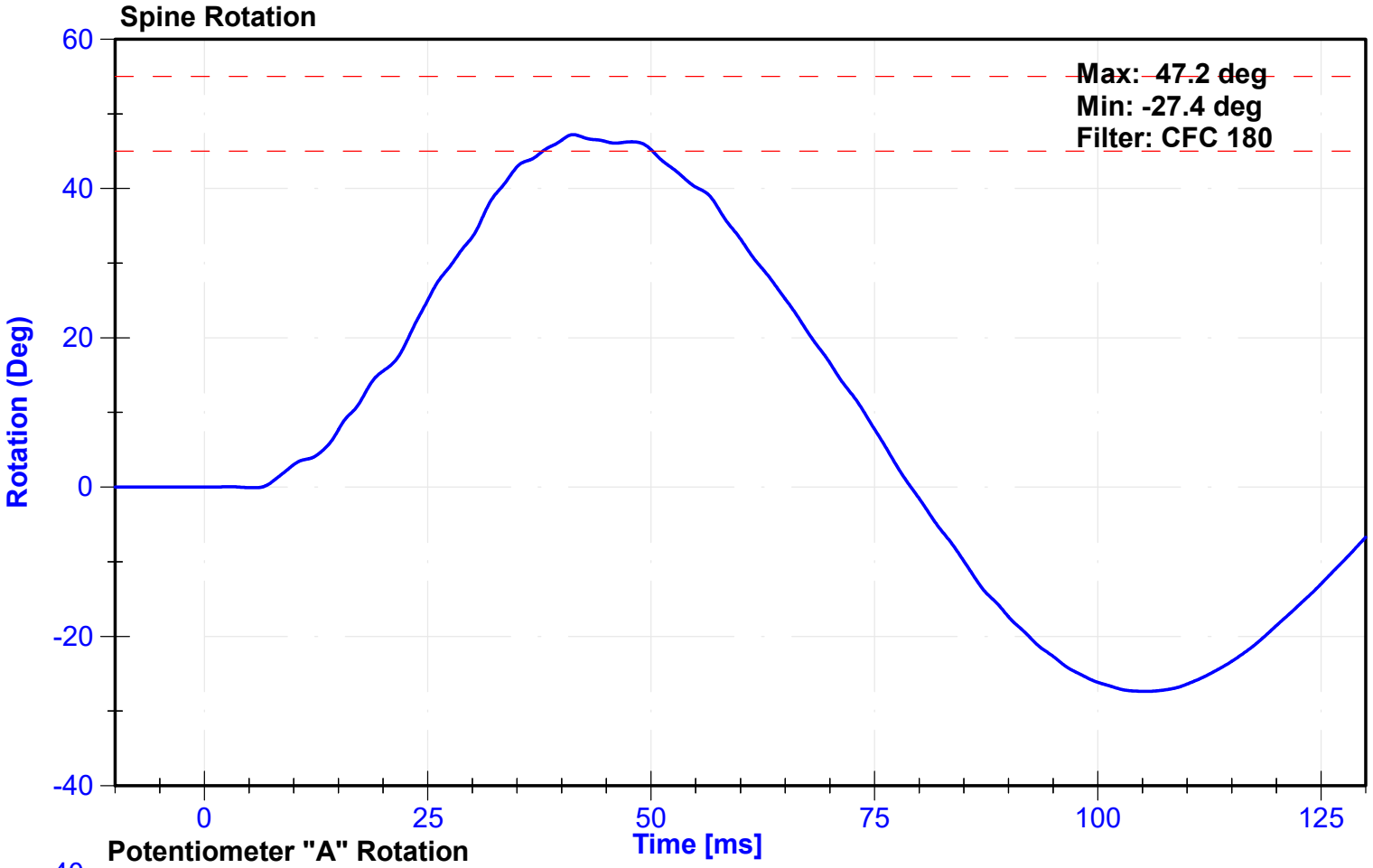
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	46.7	Pass
Velocity	5.95	6.15	m/s	6.016	Pass
Lateral Spine Rotation	45	55	deg	47.2	Pass
Time at Maximum Rotation	39	53	ms	41.3	Pass
Time of Decay to Zero Degrees	37	57	ms	37.8	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

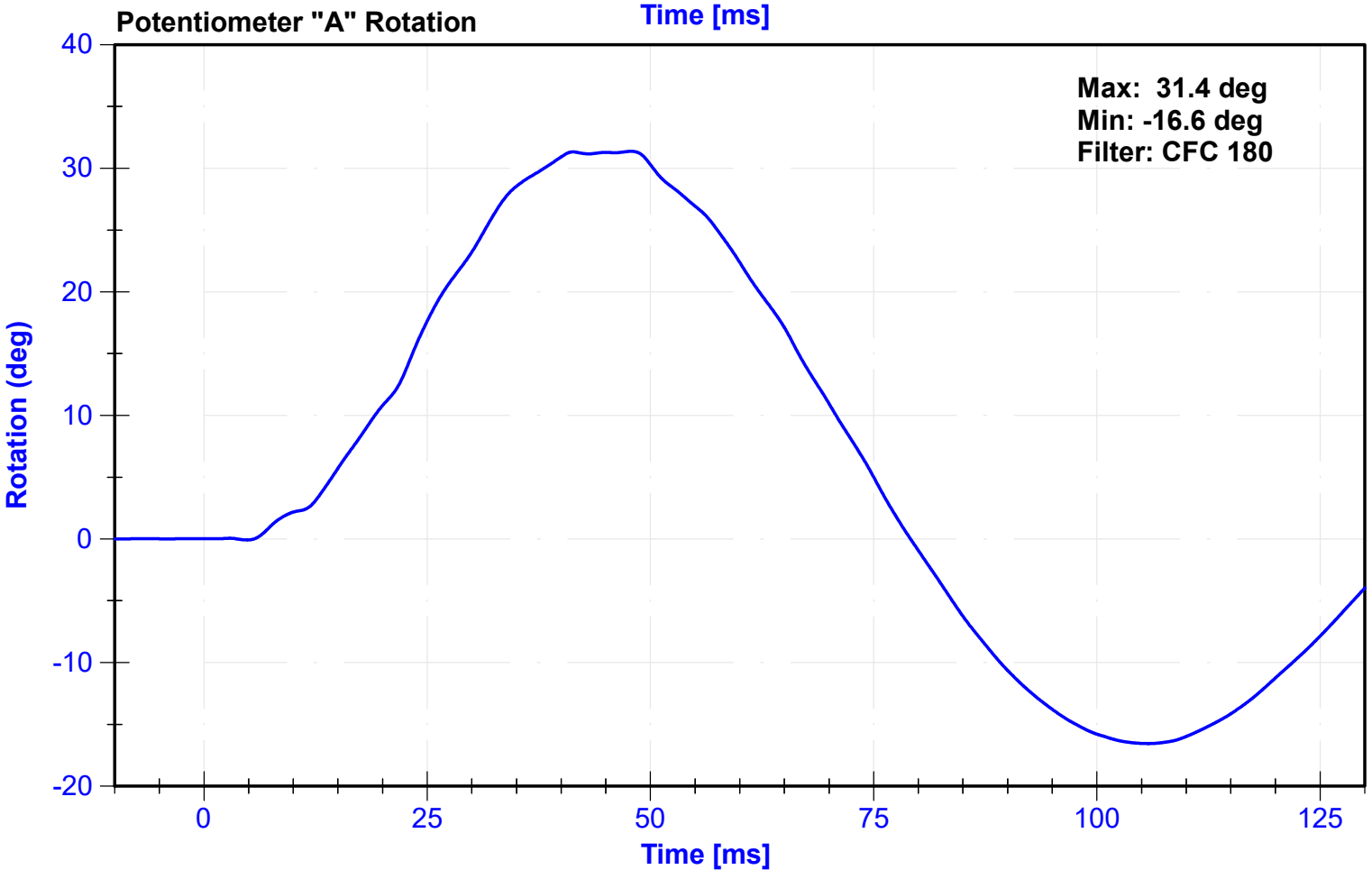
Transducer Calibrations

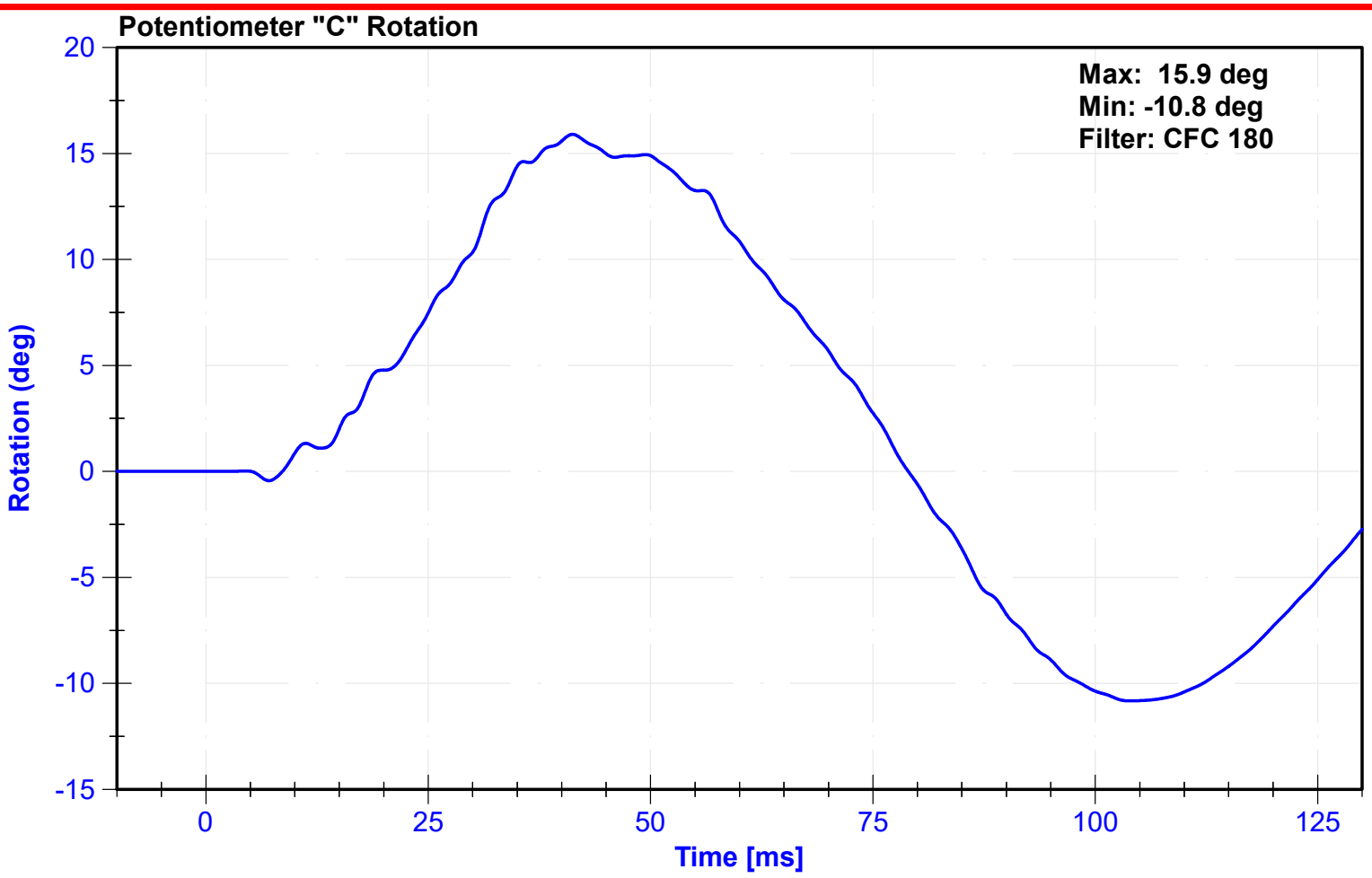
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16650	10/31/2022	10/31/2023
Pendulum "A" Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Condyle "B" Potentiometer	Sfernice	095	10/5/2022	10/5/2023



[1,2] Upper and lower boundaries specified in Appendix I


Spine Rotation
Max: 47.2 deg
Min: -27.4 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 31.4 deg
Min: -16.6 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
-20
0
25
50
75
100
125
Time [ms]



Appendix I

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

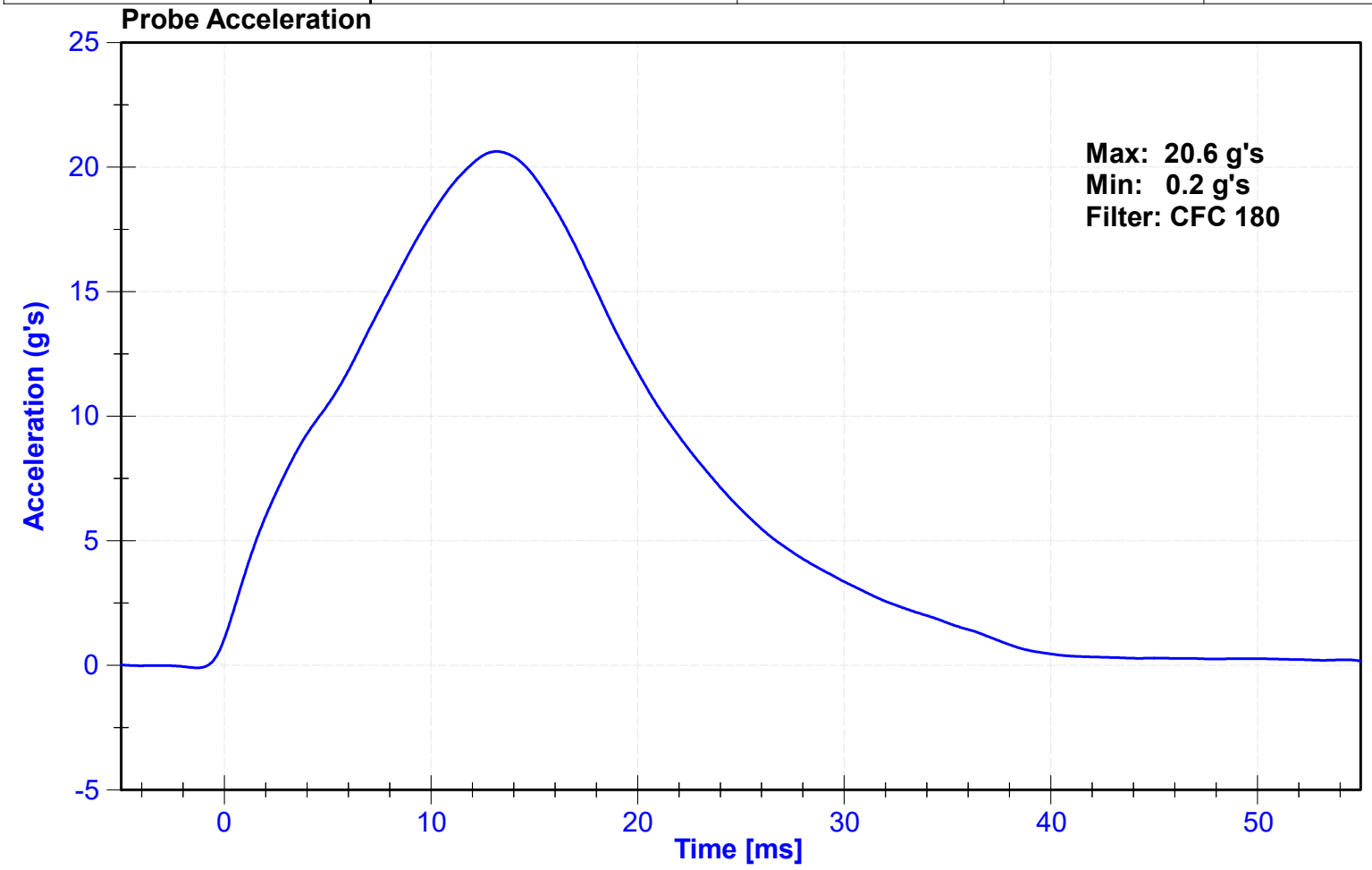
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	C. Mantell

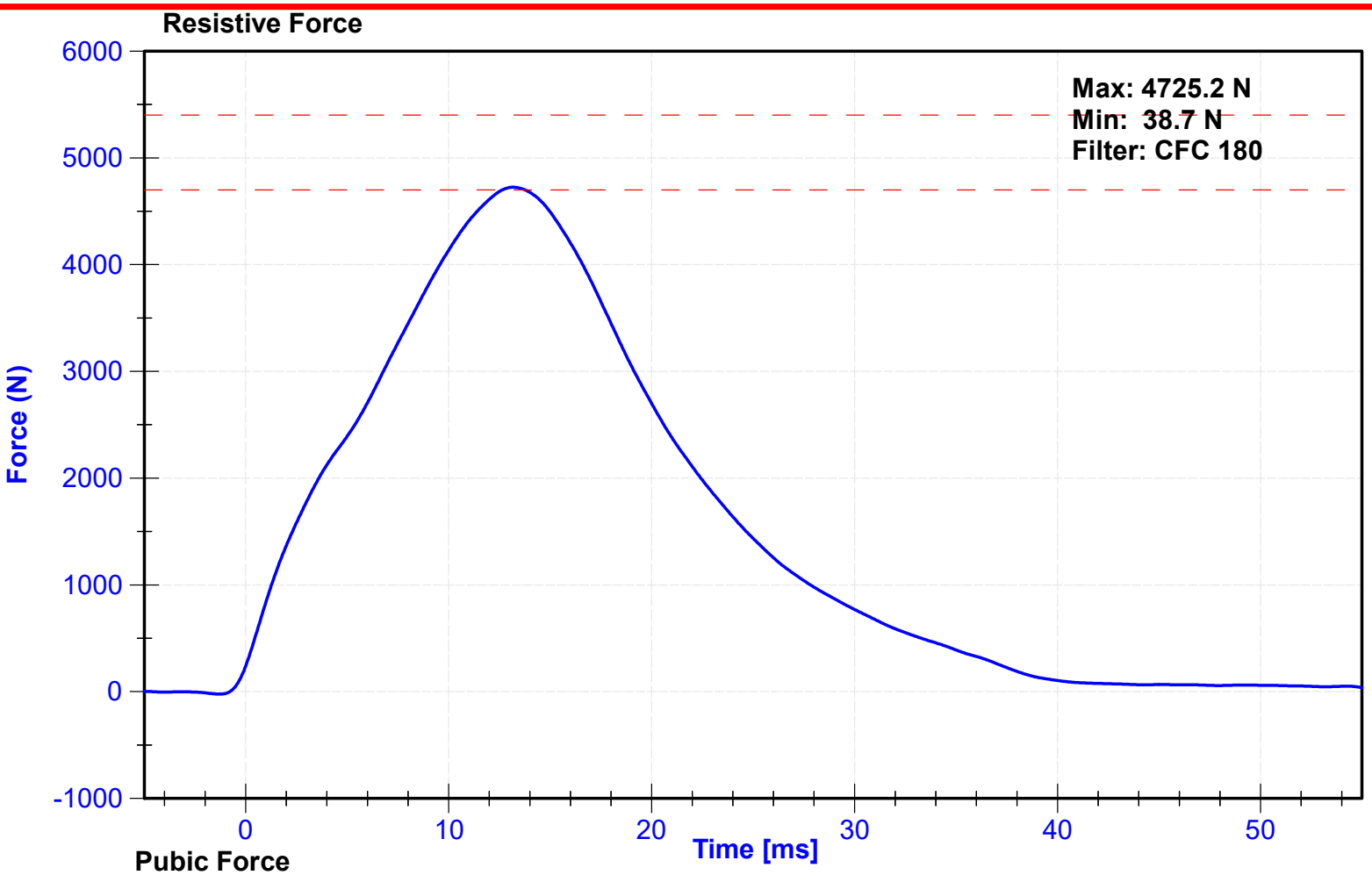
Results

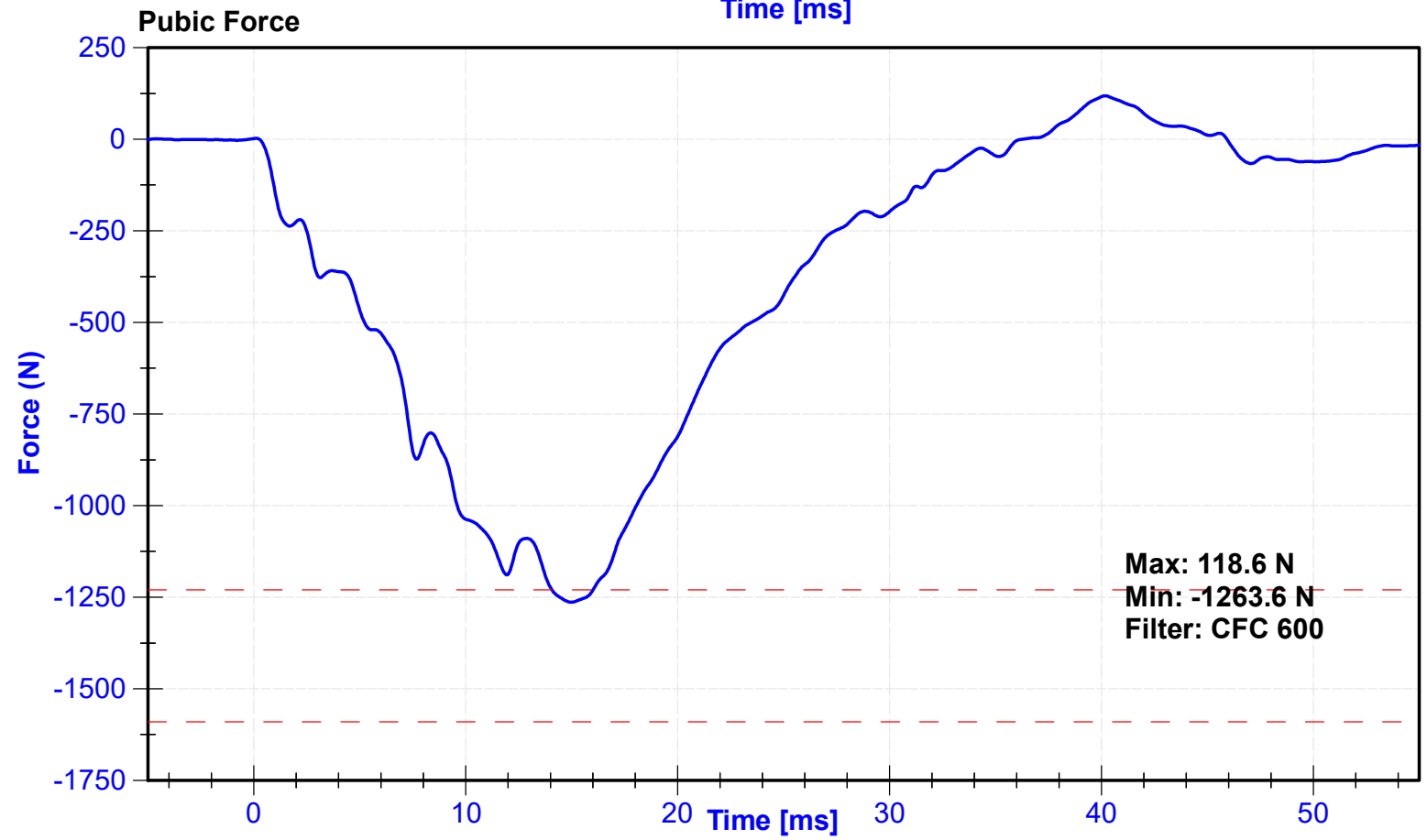
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	54	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Resistive Force	4700	5400	N	4725.2	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.15	Pass
Pubic Force	-1590	-1230	N	-1263.6	Pass
Time at Peak Pubic Force	12.2	17.0	ms	15.00	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Pubic Load Cell	Denton	464-FY	8/15/2023	8/14/2024




Resistive Force
Max: 4725.2 N
Min: 38.7 N
Filter: CFC 180
Force (N)
6000
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]


Pubic Force
Max: 118.6 N
Min: -1263.6 N
Filter: CFC 600
Force (N)
250
0
-250
-500
-750
-1000
-1250
-1500
-1750
0
10
20
30
40
50
Time [ms]

APPENDIX V

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N _DG5348__		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X	18613	Endevco	06/14/2023
		Y	18472	Endevco	02/28/2023
		Z	18663	Endevco	02/28/2023
	Redundant	X	18666	Endevco	02/28/2023
		Y	18664	Endevco	02/28/2023
		Z	18675	Endevco	02/28/2023
Thorax Rib Displacement Potentiometers	Upper	Y	268GFE	Honeywell	08/08/2023
	Middle	Y	269GFE	Honeywell	08/08/2023
	Lower	Y	270GFE	Honeywell	08/08/2023
Abdomen Load Cells	Forward	Y	1512	Denton	08/15/2023
	Middle	Y	1526	Denton	08/15/2023
	Rear	Y	1516	Denton	08/15/2023
Lower Spine Accelerometers (T12)		X	18478	Endevco	02/28/2023
		Y	18573	Endevco	05/02/2023
		Z	18662	Endevco	02/28/2023
Pubic Symphysis Load Cell		Y	464-FY	Denton	08/15/2023

Table 2 – Vehicle Instrumentation

Vehicle Instrumentation		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	A282707	Measurement Specialties	08/14/2023
Vehicle Center of Gravity	Y	A315104	Measurement Specialties	08/14/2023
Vehicle Center of Gravity	Z	A315940	Measurement Specialties	08/14/2023
Left Floor Sill	Y	A374254	Measurement Specialties	05/26/2023
A-Pillar Sill	Y	G22392	Endevco	06/28/2023
A-Pillar Low	Y	A431225	Measurement Specialties	04/10/2023
A-Pillar Mid	Y	A427996	Measurement Specialties	06/16/2023
B-Pillar Sill	Y	G23624	Endevco	04/25/2023
B-Pillar Low	Y	A374248	Measurement Specialties	06/01/2023
B-Pillar Mid	Y	G22432	Endevco	06/26/2023
Driver Seat	Y	G22774	Endevco	08/16/2023
Engine Top	X	A374214	Measurement Specialties	06/16/2023
Engine Top	Y	A413611	Measurement Specialties	06/01/2023
Firewall	Y	A370888	Measurement Specialties	03/06/2023
Right Roof	Y	A428006	Measurement Specialties	08/16/2023
Right Floor Sill	Y	G22107	Endevco	06/16/2023
Rear Floorpan	X	G22389	Endevco	03/22/2023
Rear Floorpan	Y	A428028	Measurement Specialties	03/17/2023