REPORT NUMBER: SINCAP-CAL-24-001

NEW CAR ASSESSMENT PROGRAM (NCAP)
MOVING DEFORMABLE BARRIER SIDE IMPACT TEST

Hyundai Motor Company
2024 Hyundai Tucson Hybrid
5 Door SUV

NHTSA No: O20244203

PREPARED BY:
CALSPAN CORPORATION
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November 7, 2024

FINAL REPORT

PREPARED FOR:
U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
MAIL CODE: NRM-110
1200 NEW JERSEY AVE SE
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Claire Hejaily, Test Engineer

Date: November 7, 2024

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Matthew Pronko, Test Engineer

Date: November 7, 2024

FINAL REPORT ACCEPTANCE BY OCWS:

_____
Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

_____
COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

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	6. Performing Organization Code CAL
7. Author(s) Claire Hejaily, Test Engineer Matthew Pronko, Test Engineer	*8. Performing Organization Report No.* CAL-DOT-2024-001
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15. Supplementary Notes

16. Abstract

A 55/28, (61.90kph / 38.5 mph), 90° Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2024 Hyundai Tucson Hybrid 5 Door SUV in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the generation of consumer information on vehicle side crash protection. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on November 30, 2023.

The impact velocity of the Moving Deformable Barrier (MDB) was 62.25 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 191 mm located at level 2. The test vehicle's occupant performance data is as follows:

Measurement Description	Driver ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	48.334
Maximum Thorax Rib Deflection	mm	44	16.576
Total Abdominal Force	N	2500	569.370
Pubic Symphysis Force	N	6000	1295.865
Lower Spine (T12) Resultant Acceleration	G	82*	23.122

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	78.948
Maximum Thorax Rib Deflection	mm	38*	10.001
Lower Spine (T12) Resultant Acceleration	G	82	46.446
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2495.970
Maximum Abdominal Rib Deflection	mm	45*	20.284

**Proposed IARV*

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*
New Car Assessment Program (NCAP) Side Impact MDB ES-2re SID-IIs	Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave. SE Washington, D.C. 20590

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SECTION 1

TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2024 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number 693JJ920D000016. The purpose of this test is to generate comparative side impact performance in a 2024 Hyundai Tucson Hybrid 5 Door SUV. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure dated March 2020.

SECTION 2
SUMMARY OF TEST RESULTS

A 2024 Hyundai Tucson Hybrid 5 Door SUV was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 62.25 km/h. The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by the Calspan Corporation's Transportation Test Operations Center in Buffalo, New York on November 30, 2023. Pre-test and post-test photographs of the test vehicle, the MDB and the dummies (ES-2re and SID-IIs) are included in this report.

Dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OCWS Side Impact Laboratory Test Procedure, dated March 2020. The side impact event was documented by 9 high-speed and 2 real-time cameras. Camera locations are included in this report.

The Dummies were instrumented in the following manner:

DRIVER ATD (ES-2re)
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

PASSENGER ATD (SID-IIs)
Primary and redundant head CG tri-axial accelerometers
Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers
Abdomen upper rib and lower rib y-axis displacement potentiometers
Lower spine (T12) tri-axial accelerometers
Acetabulum and iliac wing y-axis load cells

Appendix B contains the vehicle and dummy response data. Dummy configuration and performance verification data can be found in Appendix C of this report. Appendix D of this report contains the test equipment and instrumentation calibration data.

DUMMY INJURY VALUES

Measurement Description	Driver ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	48.334
Maximum Thorax Rib Deflection	mm	44	16.576
Total Abdominal Force	N	2500	569.370
Pubic Symphysis Force	N	6000	1295.865
Lower Spine (T12) Resultant Acceleration	G	82*	23.122

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	78.948
Maximum Thorax Rib Deflection	mm	38*	10.001
Lower Spine (T12) Resultant Acceleration	G	82	46.446
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2495.970
Maximum Abdominal Rib Deflection	mm	45*	20.284

*Proposed IARV

SUPPLEMENTAL RESTRAINT INFORMATION

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Front Airbag	Yes	No	No	N/A
Knee Airbag	No	N/A	No	N/A
Side Airbag 1 - Curtain	Yes	Yes	Yes	Yes
Side Airbag 2 - Torso/Pelvis Airbag	Yes	Yes	Yes	Yes
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Yes	No	N/A
Other	N/A	N/A	N/A	N/A

GENERAL COMMENTS:

1. P1 serial number – F033
2. P4 serial number – 300

Data Anomalies:

The following channel was questionable for:

- Left B-Pillar Lower Y Acceleration, Exceeded calibration range and saturated at 11.8 ms
- Left B-Pillar Middle Y Acceleration, Exceeded calibration range and saturated at 11.2 ms

SECTION 3

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

Data Sheet No. 1 - General Test and Vehicle Parameter Data

Data Sheet No. 2 - Seat, Seat Belt, Steering Wheel Adjustment and Fuel Systems Data

Data Sheet No. 3 - Dummy Longitudinal Clearance Dimensions

Data Sheet No. 4 - Dummy Lateral Clearance Dimensions

Data Sheet No. 5 - Camera and Instrumentation Data

Data Sheet No. 6 - Test Vehicle Accelerometer Locations

Data Sheet No. 7- MDB Accelerometer Locations

Data Sheet No. 8 - Post-Test Observations

Data Sheet No. 9 - MDB Summary of Results

Data Sheet No. 10 - Test Vehicle Profile Measurements

Data Sheet No. 11 - Test Vehicle Exterior Crush Measurements

Data Sheet No. 12 - MDB Exterior Static Crush Measurements

Data Sheet No. 13 - Vehicle and MDB Damage Profile Distances

Data Sheet No. 14 - FMVSS No. 301 Static Rollover Results

Data Sheet No. 15 - Dummy / Vehicle Temperature and Humidity Stabilization Data

Data Sheet No. 305-1 - General Test and Parameter Data for Indicant FMVSS No. 305 Testing

Data Sheet No. 305-2 - Pre-Impact Data for Indicant FMVSS No. 305 Testing

Data Sheet No. 305-3 - Pre-Impact Electrical Isolation Measurements and Calculations for Indicant FMVSS No. 305 Testing

Data Sheet No. 305-4 - Post-Impact Data for Indicant FMVSS No. 305 Testing

Data Sheet No. 305-5 - Static Rollover Test Data for Indicant FMVSS No. 305 Testing

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2024 Hyundai Tucson Hybrid 5 Door SUV
NHTSA No.: O20244203
Test Program: NCAP Side MDB Impact Test
Test Date: 11/30/2023

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20244203
Model Year	2024
Make	Hyundai
Model	Tucson Hybrid
Body Style	5 Door SUV
VIN	KM8JECD19RU153780
Body Color	Silver
Odometer Reading (km/mi)	189 mi
Engine Displacement (L)	1.6
Type / No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Auto
Transmission Speeds	6-Speed
Overdrive	Yes
Final Drive	All Wheel Drive
Roof Rack	No
Sunroof / T-Top	Yes
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
Auto-Leveling System	No
Automatic Door Locks (ADL)	Yes
Power Window Auto-Reverse	Yes
Other Optional Feature	N/A
Driver Front Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso / Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	No
Rear Pass. Curtain Airbag	Yes
Rear Pass. Head / Torso Airbag	No
Rear Pass. Torso Airbag	No
Rear Pass. Torso / Pelvis Airbag	Yes
Rear Pass. Pelvis Airbag	No
Driver Seat Belt Pretensioner	Yes
Rear Pass. Seat Belt Pretensioner	No
Driver Load Limiter	Yes
Rear Pass. Load Limiter	No
Other Safety Restraint	N/A

Does owner's manual provide instructions to turn off automatic door locks? No

DATA FROM CERTIFICATION LABEL

Manufactured By	Hyundai Motor Company
Date of Manufacture	AUG/2023
Vehicle Type	MPV

GVWR	2205
GAWR Front	1260
GAWR Rear	1200

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3	N/A	5	
Vehicle Capacity Weight (VCW) (kg)				420	(A)
DSC x 68.04 kg				340	(B)
Cargo Weight (RCLW) (kg)				80	(A-B)

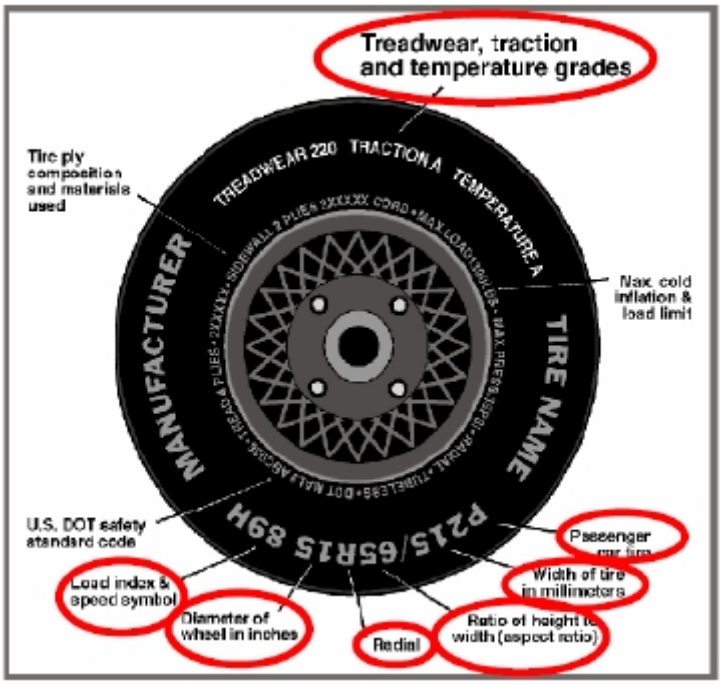
VEHICLE SEAT TYPE

Seating Location	Type Of Seat Pan				Type Of Seat Back		
	Bucket	Bench	Split Bench	Contour	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front	X						X
Rear or Second Row Seat			X			X	
Third Row Seat	N/A	N/A	N/A	N/A	N/A	N/A	N/A

DATA SHEET NO. 1 … (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

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



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	235/55R19	235/55R19
Tire Size on Vehicle	235/55R19	235/55R19
Tire Manufacturer	Michelin	Michelin
Tire Model	Primacy A/S	Primacy A/S
Treadwear	540	540
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Load Index / Speed Symbol	101 V	101 V
Tire Material	Rubber	Rubber
DOT Safety Code Left	0C8F041X2623	0C8F041X2523
DOT Safety Code Right	0C8F041X2623	0C8F041X2423

DATA SHEET NO. 1 … (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2024 Hyundai Tucson Hybrid 5 Door SUV | NHTSA No.: O20244203
Test Program: NCAP Side MDB Impact Test | Test Date: 11/30/2023

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	204	225	227	235
Tire Placard	kPa	240	240	240	240
Owner's Manual	kPa	240	240	240	240
As Tested	kPa	240	240	240	240

MDB TIRE SPECIFICATIONS

	Units	Requirements	LF	RF	LR	RR
Tire Size		P205/75R15	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	kPa	200 ± 21	207	207	207	207

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	517	371		567	444		563	459	
Right	kg	520	352		527	424		526	420	
Ratio	%	58.9	41.1		55.7	44.2		55.3	44.7	
Totals	kg	1037	723	1760	1094	868	1962	1089	879	1968

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1760	(A)
Sum of Actual Weight of 1 ES2re and 1 P572 ATD (SID-IIs)	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	80	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1967	(A+B+C)

Does the measured As Test Vehicle Weight lie within the required weight range

(i.e. Calculated Test Vehicle Target Weight – 4.5 kg to – 9 kg)? [X] **Yes** [ ] **No**

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	Fully Loaded	As Tested	Meets Rqmt***
LF	mm	863	862	Yes
RF	mm	870	862	Yes
RR	mm	888	885	Yes
LR	mm	879	887	Yes
Vehicle CG (Aft of Front Axle)	mm	1232	1221	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	32	25	

****The "As Tested" vehicle attitude measurements must be equal to or within ± 10mm of the "Fully Loaded" vehicle attitude measurements at each wheel well. Indicate "Yes" or "No" for "Meets Requirements".*

Test height adjustable suspension setting, if applicable: N/A

DATA SHEET NO. 1 … (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	6
Rear Speaker	2
Rear Trim	5
Ballast / Equipment Added	19

TEST SURFACE MARKINGS

	Distance from 63° Impact Location Line (mm)
Fore 25 mm target	1141
Aft 25 mm target	1138
Pre-Impact Angle Line	230

Parallel Track Target	X Location (mm)	Y Location (mm)
A	0	0
B	2955	1555
C	2955	3355
D	0	3000

DATA SHEET NO. 2
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and right front passenger's seat should be set to the mid-track, lowest, mid-angle position. The struck-side rear passenger's seat, rear center seat, and non-struck side rear passenger's seats should be set to the rear-most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL(°)		
	Max	Min	Mid
Driver Seat	21.2	12.3	16.8
Front Passenger Seat	21.2	11.9	16.6
Front Center Seat			
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid-Fore / Aft	Forward-Most
Driver Seat	16.8	9	Max	68	73	78
			Mid	36	41	46
			Min	4	9	14
Front Passenger Seat	16.6	10	Max	69	74	80
			Mid	37	42	48
			Min	5	10	16
Front Center Seat*			Max			
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max			
			Mid			
			Min			
Non-Struck Side Rear Seat	Fixed	Fixed	Max			
			Mid			
			Min			
Rear Center Seat*	Fixed	Fixed	Max			
			Mid			
			Min			

**If applicable*

DATA SHEET NO. 2 … (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

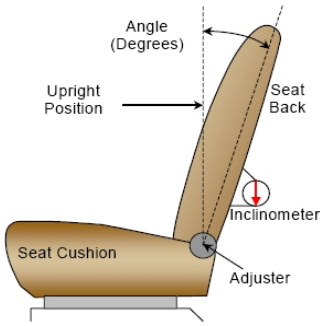
SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forwardmost Position	
	mm	Detents*	mm	Detents*
Driver Seat	240	Power	120	Power
Front Passenger Seat	240	Power	120	Power
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed	Fixed

**if applicable*

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned to the manufacturer's designated design angle. The front center and front passenger's seat backs are positioned in a similar manner as the driver's seat back. The struck side rear seat back is positioned such that the dummy's head is level. The rear center and non-struck side rear outboard seat backs are positioned in a similar manner as the struck-side rear seat back.



FRONT SEAT ASSEMBLY

Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degrees	Detents*
Driver Seat w/ Seated Dummy	47.1	Power	+ 0.4	Power
Front Passenger Seat	46.7	Power	+ 0.4	Power
Front Center Seat*				
Struck Side Rear Seat w/ Seated Dummy	28.5	14 (0-13)	2.5	0
Non-Struck Side Rear Seat	27.9	14 (0-13)	1.9	0
Rear Center Seat*	27.9	14 (0-13)	1.9	0

**if applicable*

DATA SHEET NO. 2 … (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. For this test zero is defined as the uppermost position.

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

HEAD RESTRAINT ADJUSTMENT

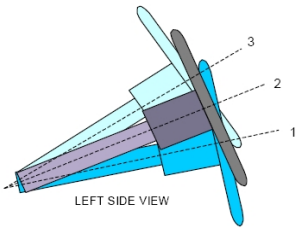
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

Seat	Total # of Positions	Placed in Position #
Driver Seat	6 (0-5)	Uppermost
Rear Seat	3 (0-2)	Lowermost

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.

	Degrees	Fore / Aft Position (mm)
Lowermost - Position No. 1	23.1	
Geometric center - Position No. 2	25.6	
Uppermost - Position No. 3	28.1	
Telescoping Steering Wheel Travel		56
Test Position	25.6	28

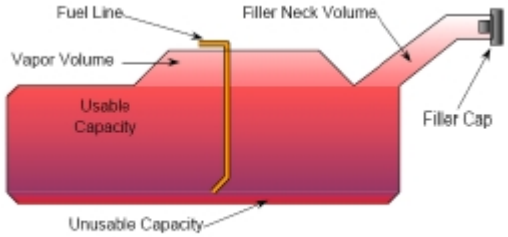


STEERING COLUMN ASSEMBLY

FUEL PUMP

Describe the fuel pump type, details about how it operates, and the location of the fuel filler neck

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



VEHICLE FUEL TANK ASSEMBLY

DATA SHEET NO. 2 … (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

FUEL TANK CAPACITY

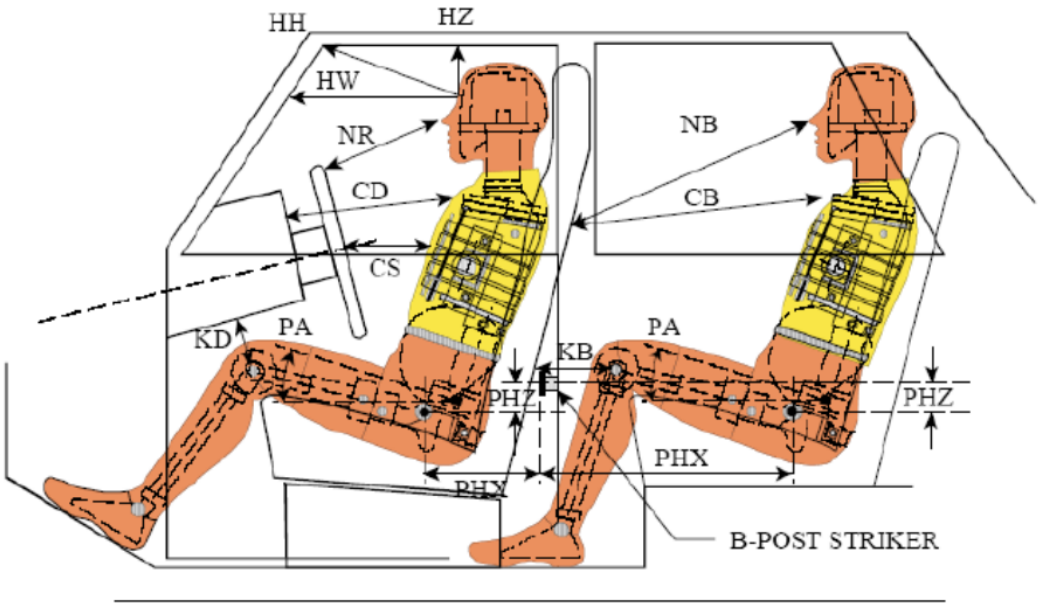
Description	Liters
Usable Capacity of “Standard Tank” (see Form No. 1)	51.86
Usable Capacity of “Optional Tank” (see Form No. 1)	N/A
Usable Capacity of “Standard Tank” (see Owner’s Manual)	51.86
Usable Capacity of “Optional Tank” (see Owner’s Manual)	N/A
93% of Usable Capacity	48.23
Actual Amount of Solvent Used in Test	48.23
1/3 of Usable Capacity	17.29

Is the Actual Amount of Solvent Used in the test equal to 93% ±1% of the Usable Capacity stated in Form No. 1? [X] **Yes** [ ] **No** [ ] **N/A**

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION



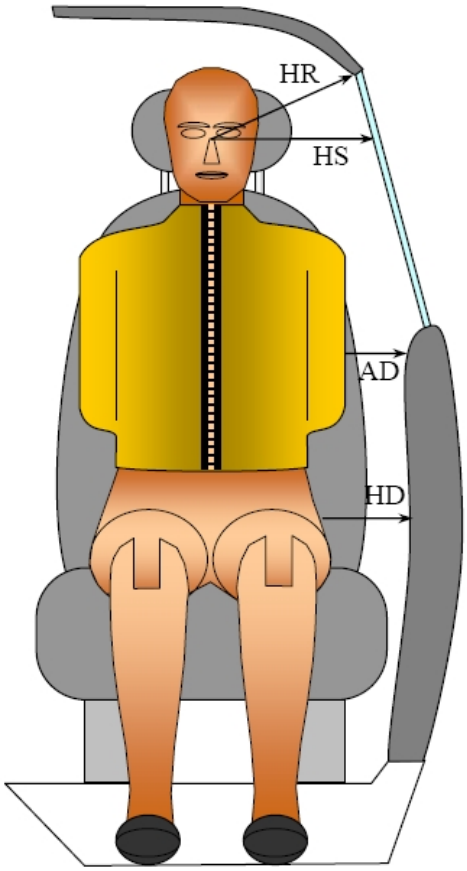
NOTE: 2-DOOR VEHICLE SHOWN. REAR DUMMY PHX & PHZ MEASUREMENTS FOR A 4-DOOR VEHICLE WOULD USE THE C-POST STRIKER AS A REFERENCE POINT

LEFT SIDE VIEW

Driver Code	Pass. Code	Description	Driver (Serial No. F033)		Left Rear Passenger (Serial No. 300)	
			Length (mm)	Angle (°)	Length (mm)	Angle (°)
HH		Header to Header	374			
HW		Header to Windshield	619			
HZ	HZ	Head to Roof Liner	159		300	
NR	NB	Nose to Rim/Seat Back	445		533	
CD	CB	Chest to Dash/Seat Back	685		539	
CS		Chest to Steering Wheel	377			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	202	30.2	324	19.1
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	155	31.9	301	21.0
PAX°	PAX°	Pelvic Tilt Angle X		20.8		19.8
	PAY°	Pelvic Tilt Angle Y				-0.4
PHX	PHX	Hip Point to Striker (X-Axis)	164		261	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	200		264	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023



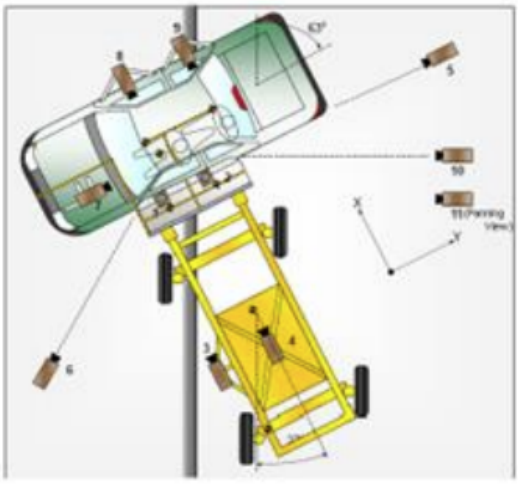
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver (Serial No. F033)	Left Rear Passenger (Serial No. 300)
HR	Head to Side Header	mm	195	272
HS	Head to Side Window	mm	320	374
AD	Arm to Door	mm	94	168
HD	Hip Point to Door	mm	149	193

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2024 Hyundai Tucson Hybrid 5 Door SUV
NHTSA No.: O20244203
Test Program: NCAP Side MDB Impact Test
Test Date: 11/30/2023



CAMERA LOCATIONS AND DATA

No.	Camera View	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Overhead Overall	210	-680	-8380	12.5	1000
2	Overhead Close-up	0	0	-8345	28	1000
3	Left Impact Point (MDB)	-1470	0	-847	25	1000
4	Side Overall (MDB)	-1140	878	-1587	8	1000
5	Rear	0	10715	-1557	24	1000
6	Left Front	-3970	7129	-1556	24	1000
7	Driver Front (OB)				25	1000
8	Driver Side (OB)				12.5	1000
9	Passenger Side (OB)				12.5	1000
10	Real-time Left Rear				Zoom	30
11	Real-time In Run				Zoom	30

Notes: *Reference: Impact Point projected to Ground*
+X = To Front of MDB, +Y = To Right of MDB, +Z = Down
** All measurements accurate to ± 6 mm.*

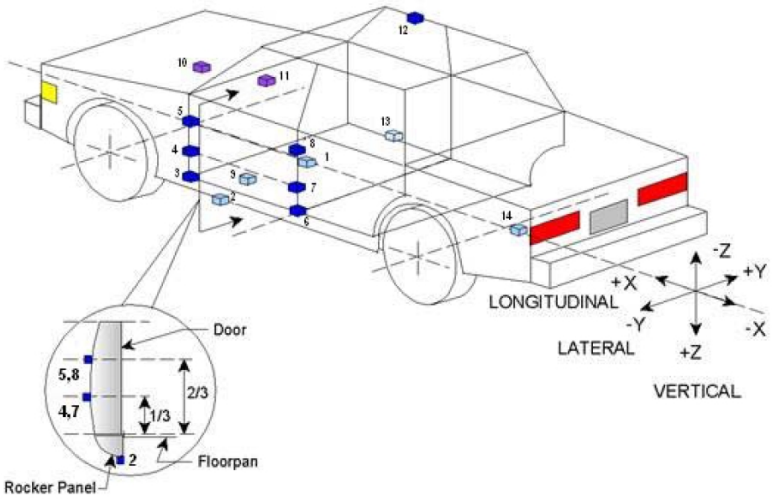
If applicable, explain why camera(s) did not operate as intended: All cameras operated as intended.

INSTRUMENTATION

Description	Number of Channels
Driver Dummy Channels	16
Passenger Dummy Channels	16
Vehicle Structure Accelerometers	23
MDB Accelerometers	7
Total	62

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023



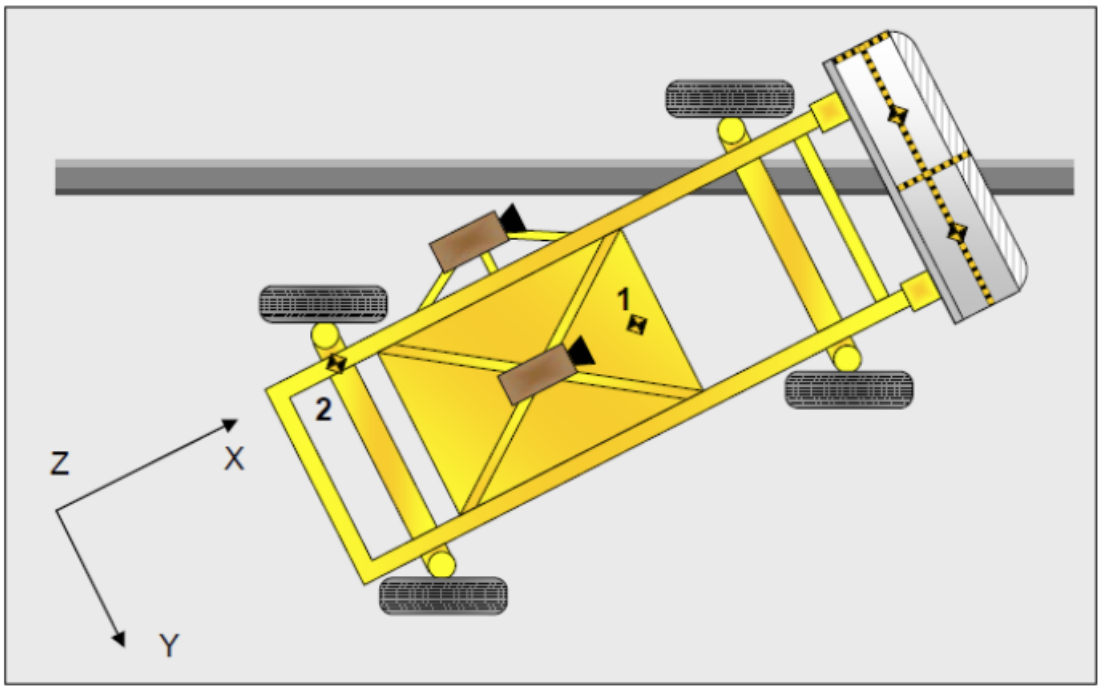
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2521	9	-341
2	Right Sill at Front Seat	2818	665	111
3	Right Sill at Rear Seat	1915	667	97
4	Left Sill at Front Door	2825	-670	108
5	Left Sill at Rear Door	1917	-671	97
6	A-Post Lower	3241	-650	-122
7	A-Post Middle	3161	-658	-625
8	B-Post Lower	2175	-690	-298
9	B-Post Middle	2132	-666	-603
10	Front Seat Track	2503	-570	52
11	Rear Seat Structure	1826	-361	-20
12	Rt. Rear Occ. Compartment	2012	440	191
13	Engine Block	3895	208	-389
14	Rear Above Axle	996	-1	40

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

DATA SHEET NO. 7
MDB ACCELEROMETER LOCATIONS

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023



MDB ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	MDB CG	1859	0	-330
2	MDB Rear	386	-660	-660

Reference: *X – Face of MDB (+forward)*
Y – MDB centerline (+ to right)
Z – Ground plane (+down)

Width between left and right contact switches (mm): 1480

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2024 Hyundai Tucson Hybrid 5 Door SUV
NHTSA No.: O20244203
Test Program: NCAP Side MDB Impact Test
Test Date: 11/30/2023

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Airbag	Curtain Airbag
Top of Head	Curtain Airbag & Side Header	Curtain Airbag
Left Side of Head	Curtain Airbag	Curtain Airbag
Back of Head	Curtain Airbag, Side Header & Head Restraint	Curtain Airbag & Head Restraint
Left Shoulder	Curtain Airbag & Torso/Pelvis Airbag	Torso/Pelvis Airbag, Seat Back & Left Rear Door Trim
Upper Torso	Torso/Pelvis Airbag & Seat Back	Torso/Pelvis Airbag & Seat Back
Lower Torso	Torso/Pelvis Airbag & Seat Back	Torso/Pelvis Airbag & Seat Back
Left Hip	Torso/Pelvis Airbag & Seat Pan	Torso/Pelvis Airbag, Seat Pan & Left Rear Door Trim
Left Knee	Driver Door Trim	Left Rear Door Trim

POST-TEST DOOR PERFORMANCE

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

POST-TEST SEAT PERFORMANCE

Description	Struck Side		Non-Struck Side	
	Front	Rear	Front	Rear
Seat Movement Along Seat Track	No	No	No	No
Seat Disengagement from Floor Pan	No	No	No	No
Seat Back Movement from Initial Position	No	No	No	No
Seat Back Collapse	No	No	No	No

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	B-Pillar Buckled
Sill Separation	None
Windshield Damage	None
Side Window Damage	None
Other Notable Effects	None

DATA SHEET NO. 8 … (CONTINUED)
POST-TEST OBSERVATIONS

Test Vehicle: 2024 Hyundai Tucson Hybrid 5 Door SUV NHTSA No.: O20244203
Test Program: NCAP Side MDB Impact Test Test Date: 11/30/2023

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Front Airbag	Yes	No	No	N/A
Knee Airbag	No	N/A	No	N/A
Side Airbag 1 - Curtain	Yes	Yes	Yes	Yes
Side Airbag 2 - Torso/Pelvis Airbag	Yes	Yes	Yes	Yes
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Yes	No	N/A
Other	N/A	N/A	N/A	N/A

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2762
Vertical Impact Reference Line (Aft of Front Axle - Intended Impact Point)	mm		441
Actual Impact Point (Aft of Frontal Axle)	mm		447
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	-6
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact Point	0

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1250
Overall Length Including Honeycomb Frame	4120
Wheelbase of Framework Carriage	2591
CG Location of Front Axle	1122

MDB WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg	396	291.5	687.5
Right	kg	377.5	301	678.5
Ratio	%	56.6	43.4	100
Totals	kg	773.5	592.5	1366

SPEED AND ANGLE AT IMPACT DATA

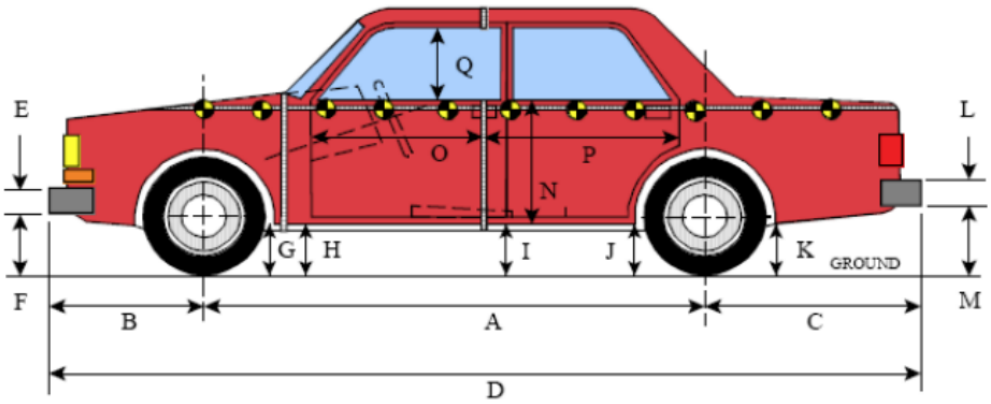
Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.10 to 62.70	62.25
Trap No. 2 Velocity (Redundant)	km/h	61.10 to 62.70	62.24
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.0
MDB Crabbed angle to MDB Forward Line of Motion	degrees	26.0 to 28.0	27.0

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Right	240
B	Top of Bumper	533	700	Left	182
C	Mid-Level	686	800	Left	149
D	Top of Stack	813	800	Left	176

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023



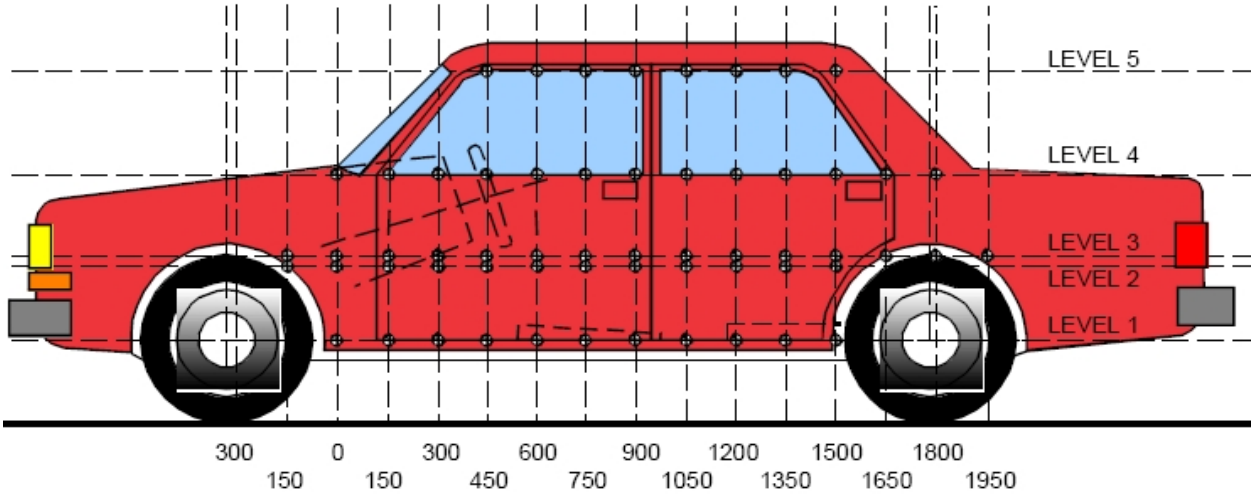
LEFT SIDE VIEW
All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3mm

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code.	Measurement Description	Pre-Test	Post-Test	Change
A	Wheelbase	2762	2765	3
B	Front Axle to FSOV	893	894	1
C	Rear Axle to RSOV	979	975	-4
D2	Total Length at Centerline	4634	4634	0
E	Front Bumper Thickness	108	108	0
F	Front Bumper Bottom to Ground	477	471	-6
G	Sill Height at Front Wheel Well	266	258	-8
H	Sill Height at Front Door Leading Edge	266	259	-7
I	Sill Height at B Pillar	271	262	-9
J1	Sill Height at Rear Wheel Well	273	257	-16
J2	Pinch Weld Height at Rear Wheel Well	263	250	-13
K	Sill Height Aft of Rear Wheel Well	298	291	-7
L	Rear Bumper Thickness	103	103	0
M	Rear Bumper Bottom to Ground	552	544	-8
N	Sill Height to Bottom of Front Window Sill	894	887	-7
O	Front Door Leading Edge to Impact CL	748	743	-5
P	Rear Door Trailing Edge to Impact CL	1403	1360	-43
Q	Front Window Opening	402	404	2
R	Right Side Length	4534	4535	1
S	Left Side Length	4537	4538	1
T	Vehicle Width at B-Pillars	1816	1748	-68
U	Front Wheel Track Width	1616	1618	2
V	Rear Wheel Track Width	1625	1634	9

DATA SHEET NO.11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023



LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	327	91	1650
2	Occupant H-Point	mm	681	191	1800
3	Mid-Door	mm	735	190	1800
4	Window Sill	mm	1098	64	1800
5	Window Top	mm	1589	8	1350

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.11 … (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2024 Hyundai Tucson Hybrid 5 Door SUV
NHTSA No.: O20244203
Test Program: NCAP Side MDB Impact Test
Test Date: 11/30/2023

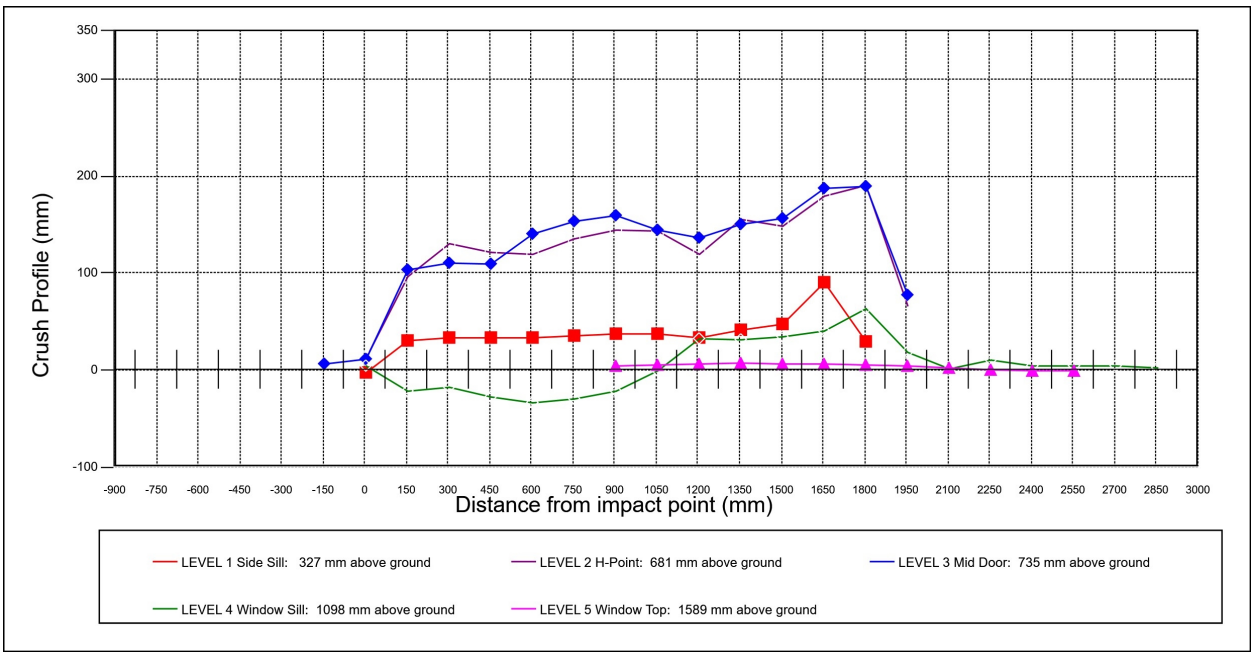
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test					Post-Test					Crush				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900															
-750															
-600															
-450															
-300															
-150			935					928					7		
0	902	933	933	812		904	920	924	807		-2	13	9	5	
150	897	924	925	820		866	827	821	841		31	97	104	-21	
300	890	911	913	821		856	780	802	838		34	131	111	-17	
450	885	906	907	823		851	784	797	850		34	122	110	-27	
600	883	909	910	829		849	789	769	862		34	120	141	-33	
750	883	910	912	834		847	774	758	863		36	136	154	-29	
900	883	910	912	839	625	845	765	752	860	620	38	145	160	-21	5
1050	881	908	911	843	634	843	764	766	843	628	38	144	145	0	6
1200	878	904	908	846	635	844	784	771	813	628	34	120	137	33	7
1350	877	900	905	849	633	835	744	754	817	625	42	156	151	32	8
1500	890	907	906	857	631	842	758	749	822	624	48	149	157	35	7
1650	900	920	919	869	629	809	740	731	828	622	91	180	188	41	7
1800	901	932	932	876	625	871	741	742	812	619	30	191	190	64	6
1950		935	931	872	618		868	853	853	613		67	78	19	5
2100				866	605				864	602				2	3
2250				859	589				848	588				11	1
2400				857	570				852	570				5	0
2550				851	545				846	545				5	0
2700				843					838					5	
2850				812					809					3	
3000															

NOTE: *Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition.*
Vehicle measurements forward of the vertical impact reference line are negative.
The crush profile grid is established prior to test based on an estimated impact point.

DATA SHEET NO.11 … (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

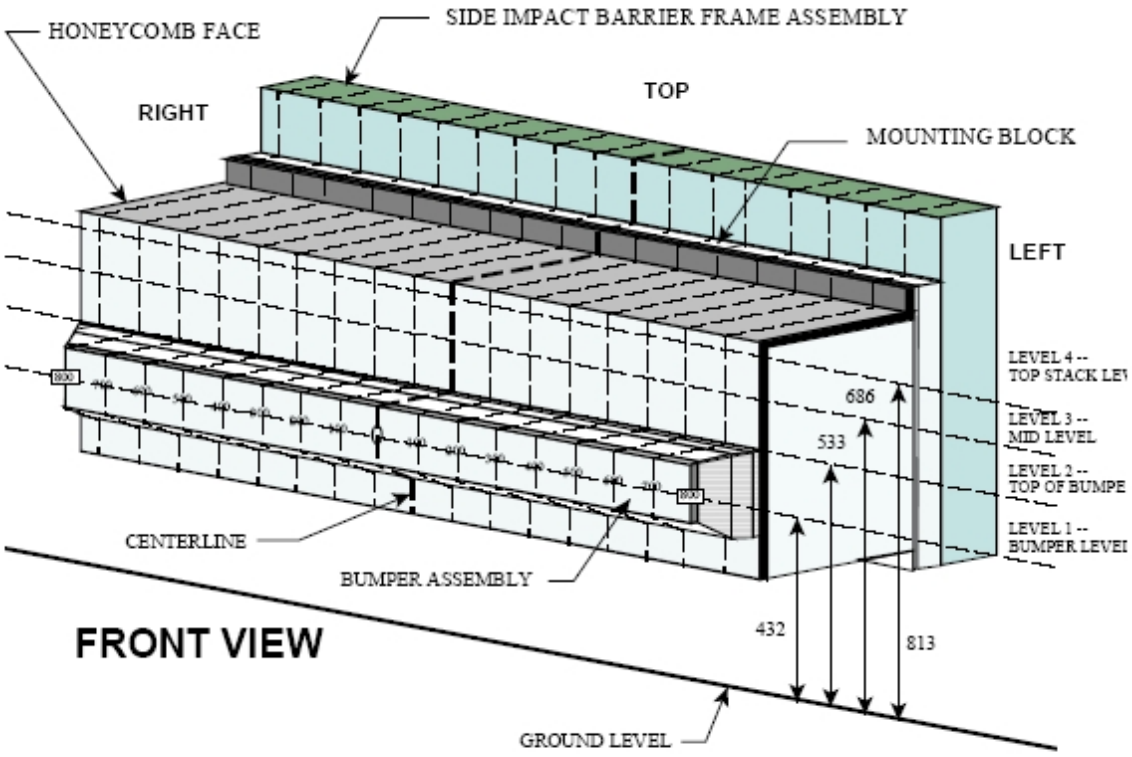
Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023



Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO.12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023



NOTE: Dimensions are shown in millimeters, mm

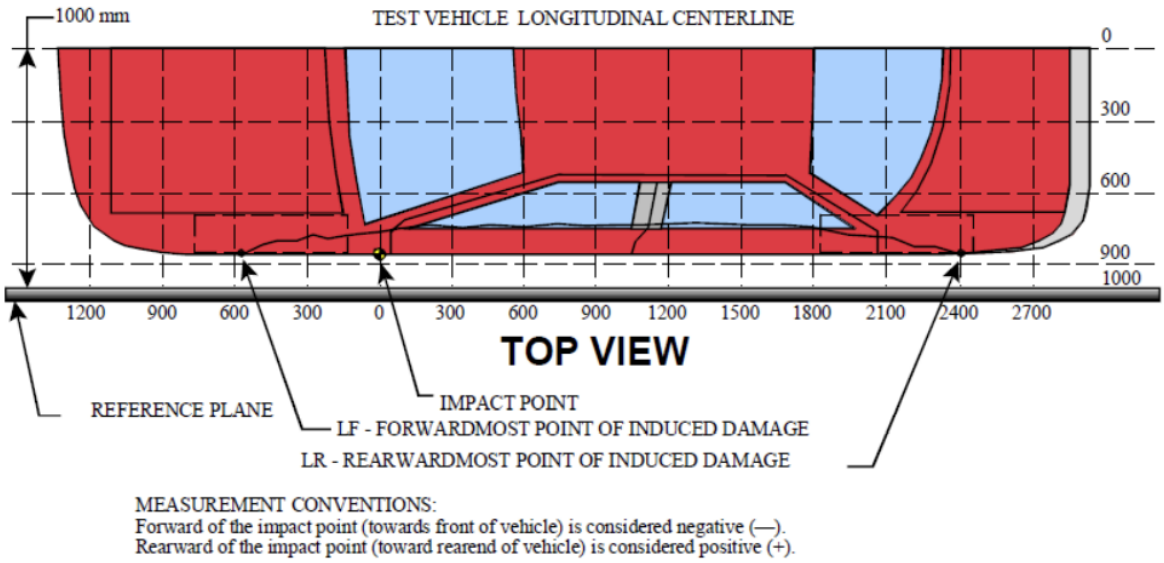
DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center								C/L	Distance Left of Center							
	800	700	600	500	400	300	200	100	0	100	200	300	400	500	600	700	800
1	240	237	237	237	237	237	239	237	237	235	235	235	235	235	235	235	239
2	138	139	140	139	139	141	146	138	135	130	129	129	130	131	131	138	182
3	89	90	95	78	78	106	96	75	70	71	71	74	74	81	89	107	149
4	92	82	80	81	98	96	107	98	87	84	81	96	90	98	116	139	176

DATA SHEET NO.13
VEHICLE AND MDB DAMAGE PROFILE DISTANCE

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

For guidance regarding damage profile distance measurements, please refer to the latest version of the *NHTSA Test Reference Guide, Volume 1: Vehicle Tests.*



MEASUREMENT CONVENTIONS:
Forward of the impact point (towards front of vehicle) is considered negative (—).
Rearward of the impact point (toward rearend of vehicle) is considered positive (+).

VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance From Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	-150	3	72	65	7
2	270	3	194	85	109
3	690	3	238	89	149
4	1110	3	232	90	142
5	1530	3	255	91	164
6	1950	3	147	69	78

MDB DAMAGE PROFILE DISTANCES

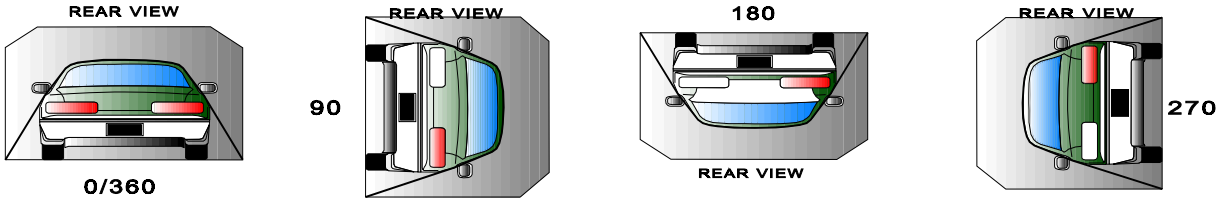
DPD	Distance From Center of MDB (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	800 mm left of center	1	266	505	-239
2	480 mm left of center	1	279	514	-235
3	160 mm left of center	1	279	514	-235
4	160 mm right of center	1	275	513	-238
5	480 mm right of center	1	276	513	-237
6	800 mm right of center	1	261	501	-240

DATA SHEET NO.14
FMVSS NO.301 STATIC ROLLOVER RESULTS

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023
Test Time:	12:47 PM	Temperature:	21.0 °C

A. From impact until vehicle motion ceases: 0 oz
(Maximum allowable is 1 oz.)
B. For the 5-minute period after motion ceases: 0 oz
(Maximum allowable is 5 oz.)
C. For the following 25 minutes: 0 oz
(Maximum allowable is 1 oz.)

D. Spillage Detail: No Spillage Occcured



ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	78	300	378
90° to 180°	74	300	374
180° to 270°	74	300	374
270° to 360°	77	300	377

FMVSS 301 SPILLAGE TABLE

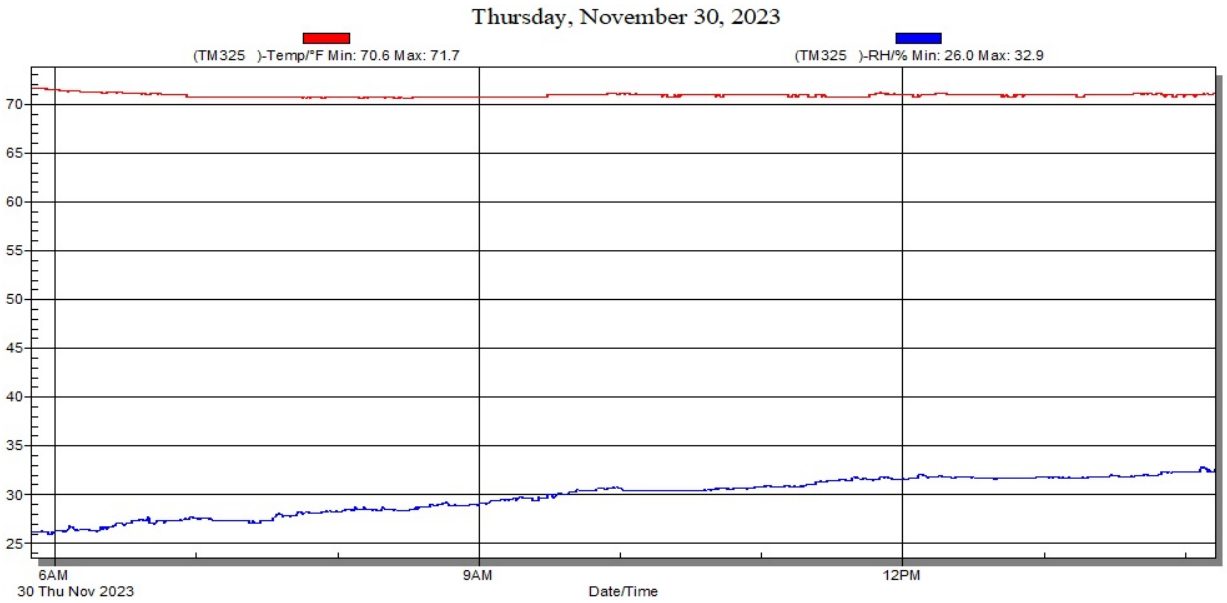
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	No Spillage Occurred
90° to 180°	No Spillage Occurred
180° to 270°	No Spillage Occurred
270° to 360°	No Spillage Occurred

DATA SHEET NO. 15
DUMMY / VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023



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

DATA SHEET NO. 305-1
GENERAL TEST AND VEHICLE PARAMETER DATA FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

ELECTRIC VEHICLE PROPULSION SYSTEM

Measured Parameter	Value
Type of Electric Vehicle (Electric/Gas-Electric Hybrid/Fuel Cell-Electric Hybrid)	Gas-Electric Hybrid
Propulsion Battery Type	Lithium-ion Polymer Battery
Nominal Voltage (Volts)	270
Is this Vehicle equipped with an Automatic Propulsion Battery Disconnect?	Yes
Physical Location of Automatic Propulsion Battery Disconnect, if applicable	Under 2nd Row Seat
Auxiliary Battery Type	N/A

PROPULSION BATTERY SYSTEM DATA (COTR SUPPLIED)

Measured Parameter	Value
Electrolyte Fluid Type	LiPF6 salt, Carbonate solvent
Electrolyte Fluid Specific Gravity	1.23 g/cm3
Electrolyte Fluid Kinematic Viscosity (centistokes)	3.03 mPa s @ 25˚C
Electrolyte Fluid Color	Transparent & Pale Yellow
Propulsion Battery Coolant Type, Color and Specific Gravity (if applicable)	Air Cooled
Location of Battery Modules (Inside or Outside of Passenger Compartment?)	Inside Passenger Compartment

PROPULSION BATTERY STATE OF CHARGE

Measured Parameter	Units	Value
For all battery types: Voltage Range corresponding to **useable energy** of the battery:		
Minimum State of Charge	V	
Maximum State of Charge	V	
95% of Maximum	V	
Test Voltage *	V	
For batteries that are rechargeable ONLY by an energy source on the vehicle: Voltage range corresponding to **useable energy** of the battery:		
Minimum State of Charge	V	180
Maximum State of Charge	V	309.6
95% of Maximum	V	294.12
Test Voltage *	V	257.0

* *For all battery types-No less than 95% of Maximum Operating Voltage; for batteries that are rechargeable ONLY by an energy source on the vehicle-maximum practicable state of charge within normal operating range.*

DATA SHEET NO. 305-2
PRE-IMPACT DATA FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

VEHICLE CHASSIS GROUND PT(S) LOCATION(S) & PROPULSION BATTERY SYSTEM

Measured Parameter	Value
Details of Vehicle Chassis Ground Points & Locations	The ground point is located under the second row seat and is connected to the vehicle chassis.
Details of Propulsion Battery Components	The high voltage battery is located under the second row split bench seat.

DATA SHEET NO. 305-3
PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

VOLTMETER INFORMATION

Measured Parameter	Units	Value
Make & Model		Fluke 1587
Serial No.		51800115
Internal Impedance Value	MΩ	10
Resolution	V	0.001
Last Calibration Date		06/20/2023

NOTES:

- *The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 M Ω*
- *An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.*

PROPULSION BATTERY VOLTAGE, RESISTANCE & ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS

Measured Parameter	Symbol	Units	Value
Normal operating voltage range specified by the manufacturer	V_b	V	180 - 309.6
Propulsion Battery Voltage: (ready to drive position)	V_b	V	257.0
Propulsion Battery to Vehicle Chassis	V_1	V	181.0
Propulsion Battery to Vehicle Chassis	V_2	V	184.0
Propulsion Battery to Vehicle Chassis Across Known Resistor	R_o	Ω	150,600
Propulsion Battery to Vehicle Chassis with R_o installed	V_1'	V	19.8
Propulsion Battery to Vehicle Chassis with R_o installed	V_2'	V	20.1
$R_{i1}= R_o*(1+V_2/V_1)*[(V_1-V_1')/V_1']$	R_{i1}	Ω	2,472,516
$R_{i2}= R_o*(1+V_1/V_2)*[(V_2-V_2')/V_2']$	R_{i2}	Ω	2,436,032
Lesser value of R_{i1} and R_{i2}	R_i	Ω	2,436,032
Electrical Isolation Value (Minimum E.I. Value is 500 Ω/V)	R_i/V_b	Ω/V	9,479

Is the Electrical Isolation Value ≥ 500 Ω/V (Yes/No)? [X] Yes [ ] No (Fail)

NOTES:

- *The measurement shall be made with the propulsion battery connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion motor(s) activated) position.*
- *If the voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.*
- *The known resistance Ro (in Ohms) should be approximately 500 times the nominal operating voltage of the vehicle (in volts) per SAE J1766*
- *If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant*

DATA SHEET NO. 305-4
POST-IMPACT DATA FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2024 Hyundai Tucson Hybrid 5 Door SUV	NHTSA No.:	O20244203
Test Program:	NCAP Side MDB Impact Test	Test Date:	11/30/2023

VOLTMETER INFORMATION

Measured Parameter	Units	Value
Make & Model		Fluke 1587
Serial No.		51800115
Internal Impedance Value	MΩ	10
Calibration Date		06/20/2023

NOTES:

- *The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 M Ω*
- *An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.*

ELECTRICAL ISOLATION MEASUREMENTS & IMPACT CALCULATIONS

Parameter	Value	Units		Value		Value	
V_b =	0.180	V	Time:	2	Minutes	36	Seconds
V_1 =	3.100	V	Time:	1	Minutes	54	Seconds
V_2 =	3.120	Ω	Time:	1	Minutes	33	Seconds
R_o =	150,600	V					
V_1' =	0.110	V	Time:	1	Minutes	12	Seconds
V_2' =	0.110	Ω	Time:	0	Minutes	51	Seconds
R_{i1} =	8,213,574	Ω	Time:	1	Minutes	12	Seconds
R_{i2} =	8,215,511	Ω	Time:	0	Minutes	51	Seconds
R_i =	8,213,574	Ω/V	Time:	1	Minutes	12	Seconds
R_i/V_b =	45,630,967	Ω/V	Time:	1	Minutes	12	Seconds

Is the Electrical Isolation Value ≥ 500 Ω/V (Yes/No)?	X	Yes		No (Fail)

NOTES:

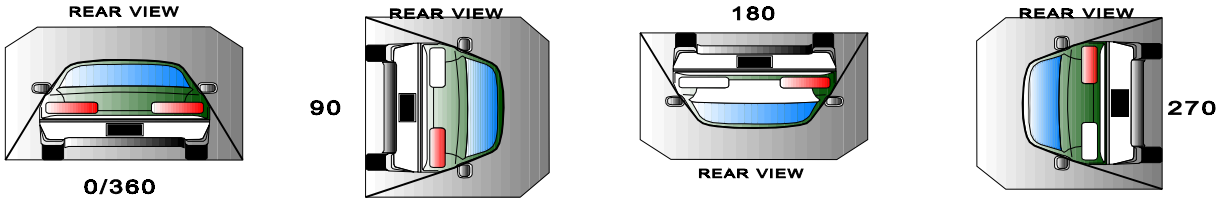
- *R_{i1}= R_o*(1+V_2/V_1)*[(V_1-V_1')/V_1'], R_{i2}= R_o*(1+V_1/V_2)*[(V_2-V_2')/V_2'], R_i = Lesser value of R_{i1} and R_{i2}*
- *If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant*
- *Minimum Electrical Isolation Value is 500 Ω/V*

PROPULSION BATTERY SYSTEM COMPONENTS

Measured Parameter	Comments	Passed	Failed
Propulsion Battery Module movement within the passenger compartment	None	X	
Intrusion of an outside Propulsion Battery Component into the passenger compartment	None	X	
Is propulsion battery electrolyte spillage visible in the passenger compartment?	None	X	

DATA SHEET NO. 305-5
STATIC ROLLOVER TEST DATA FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2024 Hyundai Tucson Hybrid 5 Door SUV
NHTSA No.: O20244203
Test Program: NCAP Side MDB Impact Test
Test Date: 11/30/2023



Rear View

DETERMINATION OF PROPULSION BATTERY ELECTROLYTE COLLECTION TIME PERIOD

Rollover Stage	Rotation Time (spec. 1 -3 min)		FMVSS 301 Hold Time	Total Time		Next Whole Minute Interval
	Minutes	Seconds	Minutes	Minutes	Seconds	Minutes
0° to 90°	1	18	5	6	18	7
90° to 180°	1	14	5	6	14	7
180° to 270°	1	14	5	6	14	7
270° to 360°	1	17	5	6	17	7

ACTUAL TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE

Rollover Stage	Propulsion Battery Electrolyte Spillage	Units	Spillage Location
0° to 90°	0	Liters	No Spillage Occurred
90° to 180°	0	Liters	No Spillage Occurred
180° to 270°	0	Liters	No Spillage Occurred
270° to 360°	0	Liters	No Spillage Occurred
Total Spillage	0	Liters	No Spillage Occurred

** FMVSS 305 Requirements: Maximum allowable propulsion battery electrolyte spillage is **5.0 Liters***

Is the total spillage of propulsion battery electrolyte greater than 5.0 Liters? [ ] Yes (Fail) [X] No

Is propulsion battery electrolyte spillage visible in the passenger compartment? [ ] Yes (Fail) [X] No

VOLTMETER INFORMATION

Measured Parameter	Units	Value
Make & Model		Fluke 1587
Serial No.		51800115
Internal Impedance Value	MΩ	10
Calibration Date		06/20/2023

NOTES:

- *The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 M Ω*
- *An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.*

DATA SHEET NO. 305-5
STATIC ROLLOVER TEST DATA FOR INDICANT FMVSS NO. 305 TESTING (CONT'D)

Test Vehicle: 2024 Hyundai Tucson Hybrid 5 Door SUV NHTSA No.: O20244203
Test Program: NCAP Side MDB Impact Test Test Date: 11/30/2023

ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS

Parameter	Rollover Stage	Value	Units	R_0=150,000Ω	Minutes	Seconds
V_b =	90°	0.0	V	Time:	1	22
	180°	0.0	V		9	14
	270°	0.0	V		14	52
	360°	0.0	V		22	10
V_1 =	90°	0.02	V	Time:	1	42
	180°	0.02	V		9	40
	270°	0.02	V		15	10
	360°	0.02	V		22	36
V_2 =	90°	0.02	V	Time:	1	54
	180°	0.02	V		9	53
	270°	0.02	V		15	19
	360°	0.02	V		22	49
V_1' =	90°	0.0	V	Time:	2	6
	180°	0.0	V		10	6
	270°	0.0	V		15	28
	360°	0.0	V		23	2
V_2' =	90°	0.0	Ω	Time:	2	18
	180°	0.0	Ω		10	19
	270°	0.0	Ω		15	37
	360°	0.0	Ω		23	15
R_{i1} =	90°	Zero Volts	Ω	Time:	2	6
	180°	Zero Volts	Ω		10	6
	270°	Zero Volts	Ω		15	28
	360°	Zero Volts	Ω		23	2
R_{i2} =	90°	Zero Volts	Ω	Time:	2	18
	180°	Zero Volts	Ω		10	19
	270°	Zero Volts	Ω		15	37
	360°	Zero Volts	Ω		23	15
R_i =	90°	Zero Volts	Ω/V	Time:	2	18
	180°	Zero Volts	Ω/V		10	19
	270°	Zero Volts	Ω/V		15	37
	360°	Zero Volts	Ω/V		23	15
R_i/V_b =	90°	Zero Volts	Ω/V	Time:	2	18
	180°	Zero Volts	Ω/V		10	19
	270°	Zero Volts	Ω/V		15	37
	360°	Zero Volts	Ω/V		23	15

Is the Electrical Isolation Value ≥ 500 Ω/V (Yes/No)? [X] Yes [ ] No (Fail)

APPENDIX A

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Figure A-1: As Delivered Right Front ¾ View of Test Vehicle



Figure A-2: As Delivered Left Rear ¾ View of Test Vehicle



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



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



Figure A-5: Pre-Test Left Front ¾ View of Test Vehicle



Figure A-6: Post-Test Left Front ¾ View of Test Vehicle



Figure A-7: Pre-Test Left Side View of Test Vehicle



Figure A-8: Post-Test Left Side View of Test Vehicle



Figure A-9: Pre-Test Left Rear ¾ View of Test Vehicle



Figure A-10: Post-Test Left Rear ¾ View of Test Vehicle



Figure A-11: Pre-Test Rear View of Test Vehicle



Figure A-12: Post-Test Rear Side View of Test Vehicle



Figure A-13: Pre-Test Right Side View of Test Vehicle



Figure A-14: Post-Test Right Side View of Test Vehicle

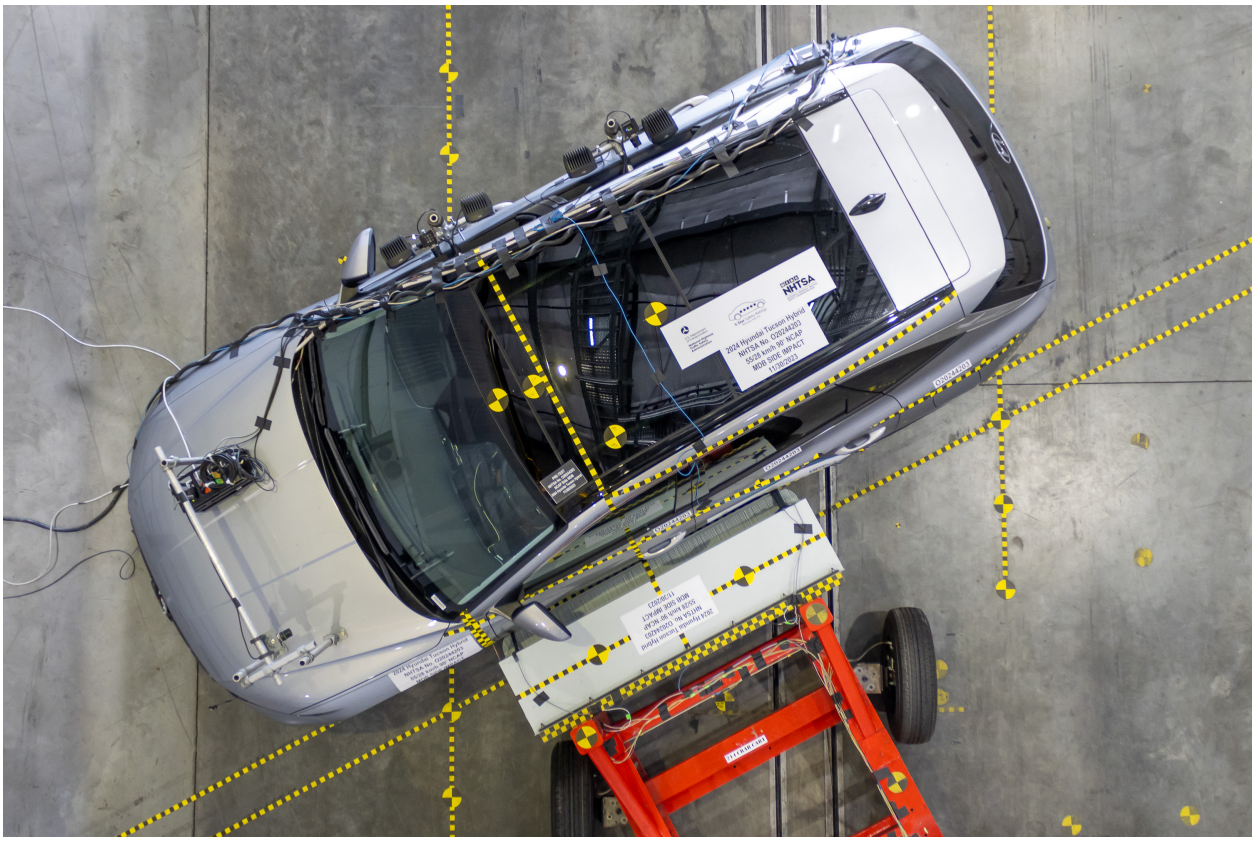


Figure A-15: Pre-Test Overhead View of Test Area

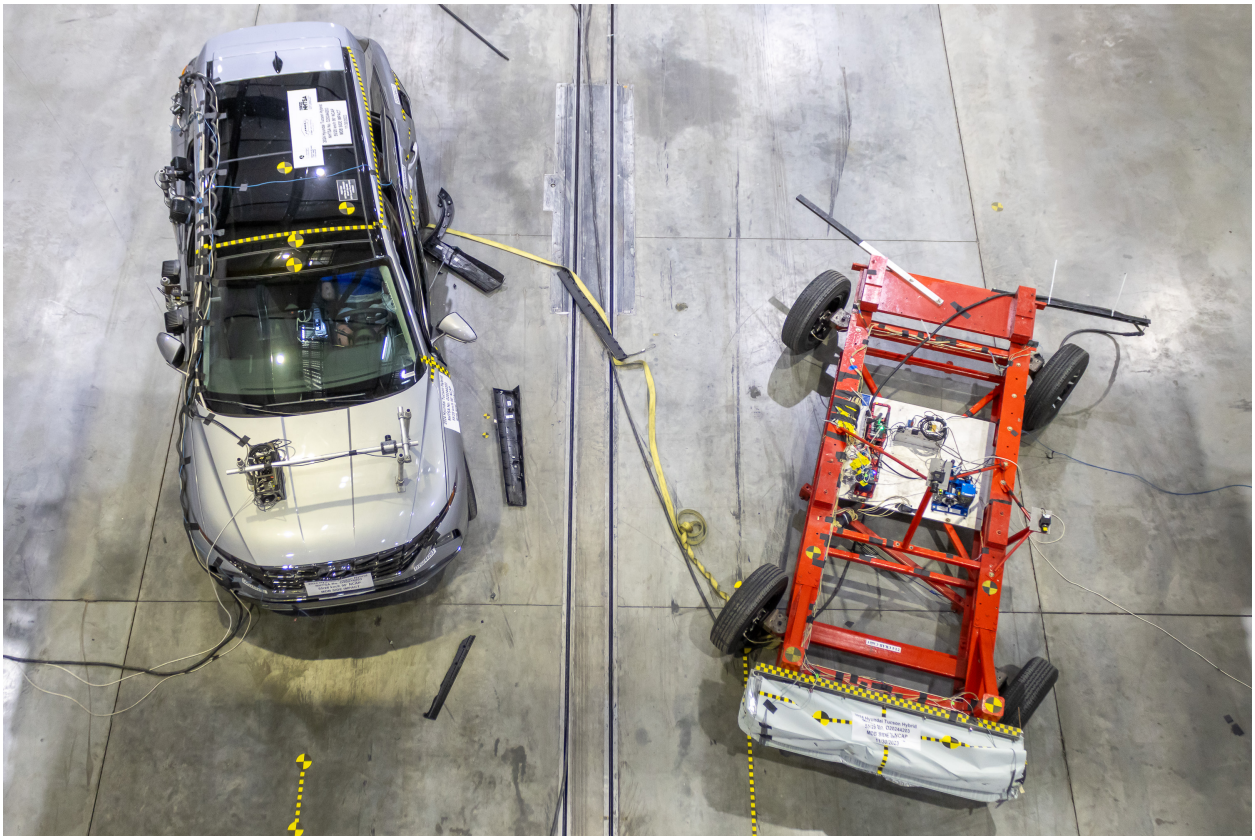


Figure A-16: Post-Test Overhead View of Test Area



Figure A-17: Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle



Figure A-18: Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle



Figure A-19: Pre-Test Close-Up View of Impact Point Target



Figure A-20: Post-Test Close-Up View of Impact Point Target

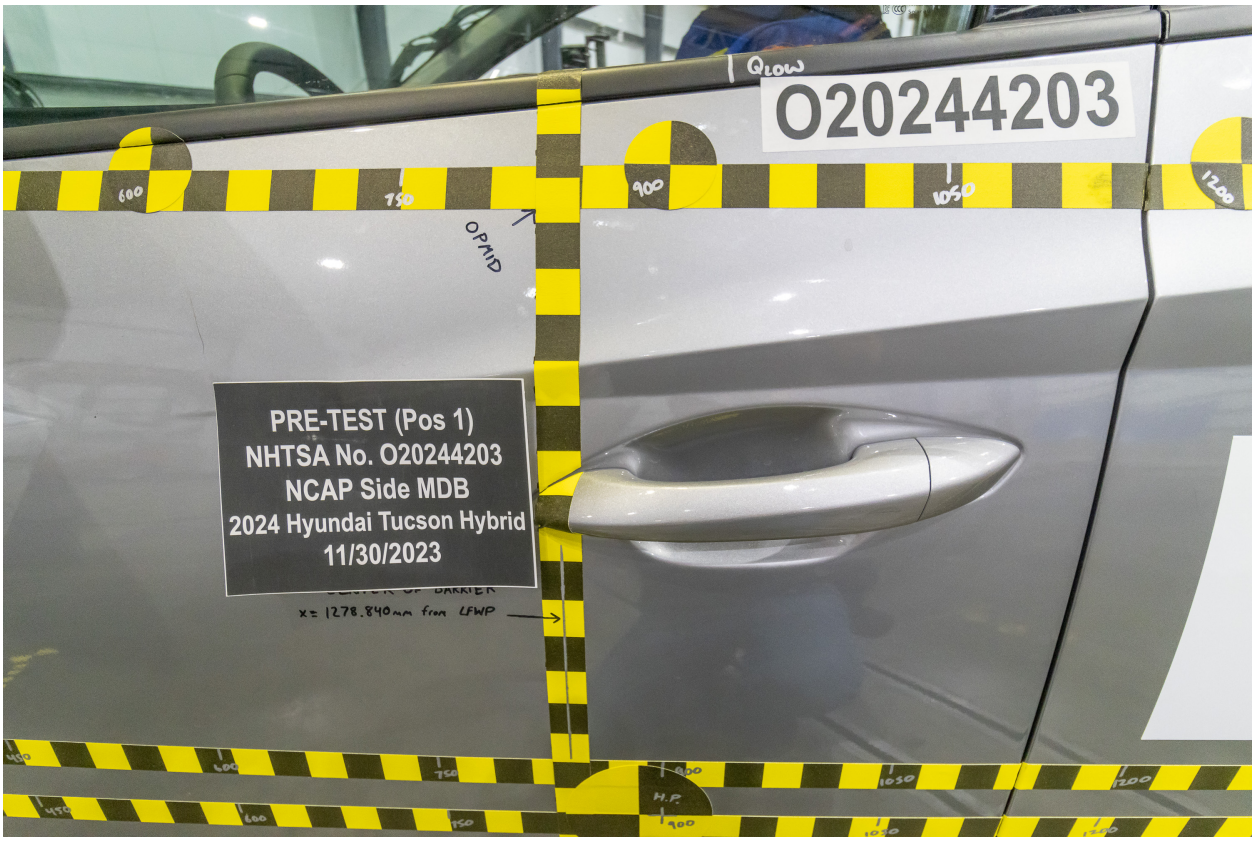


Figure A-21: Pre-Test Left Front Door Latch Close-Up

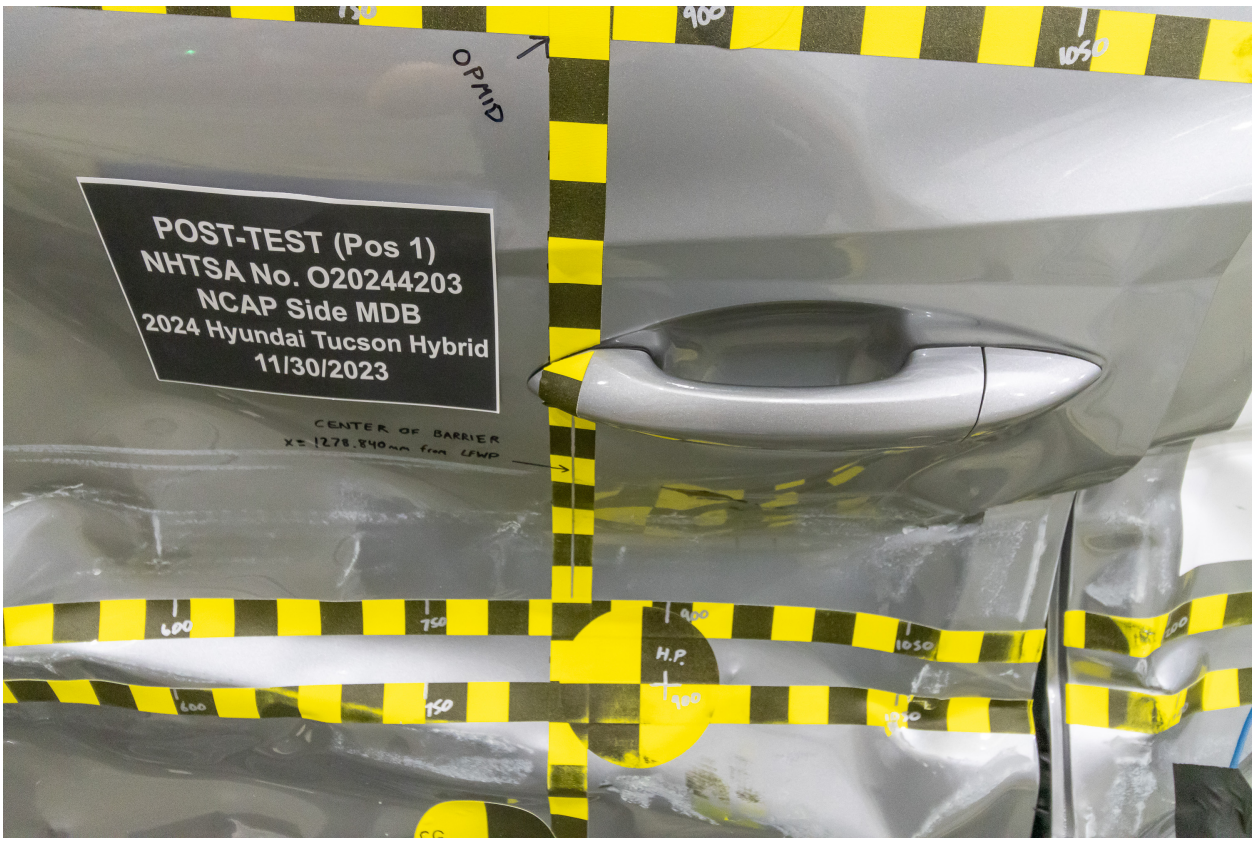


Figure A-22: Post-Test Left Front Door Latch Close-Up



Figure A-23: Pre-Test Left Rear Door Latch Close-Up



Figure A-24: Post-Test Left Rear Door Latch Close-Up



Figure A-25: Pre-Test Front Close-up View of Driver Dummy



Figure A-26: Post-Test Front Close-up View of Driver Dummy



Figure A-27: Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking



Figure A-28: Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View



Figure A-29: Post-Test Left Side View of Driver Dummy Shoulder and Door Top View



Figure A-30: Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning

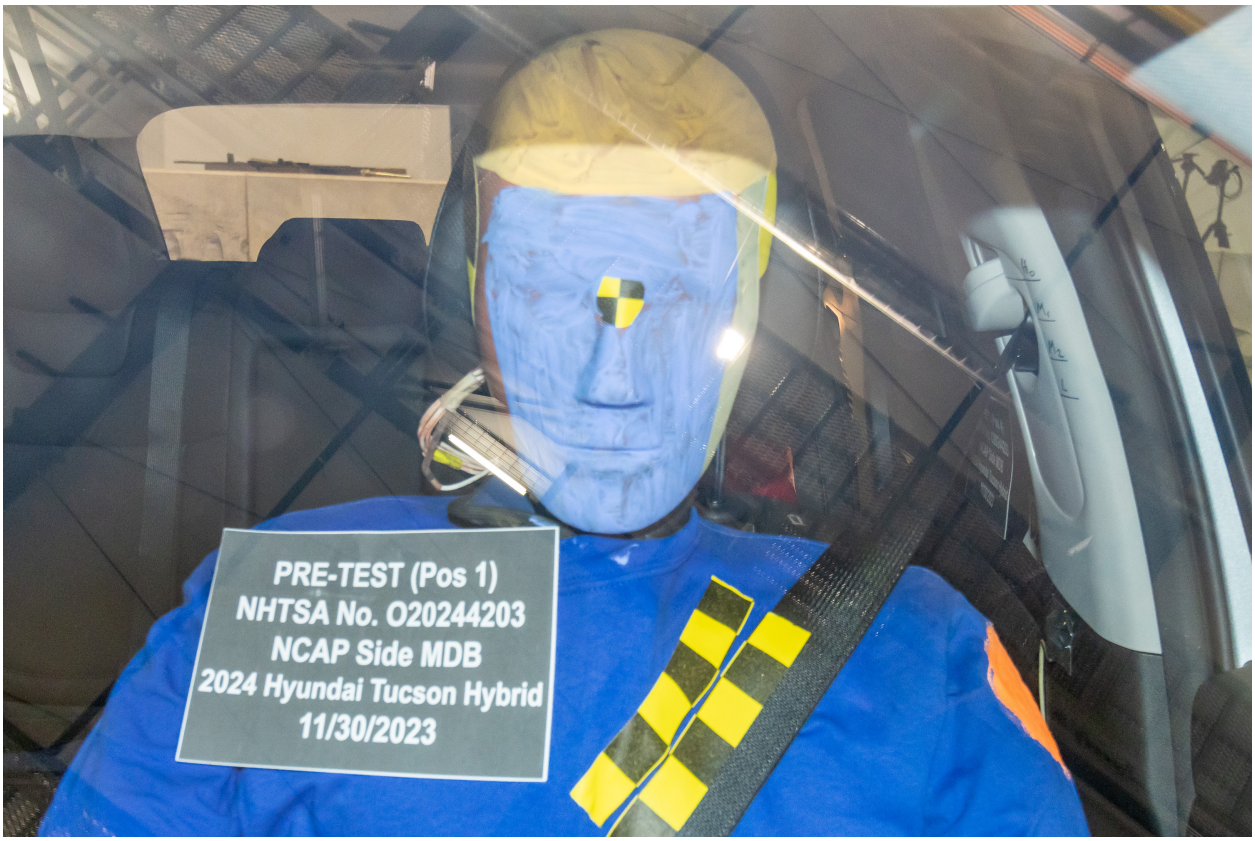


Figure A-31: Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint



Figure A-32: Pre-Test Frontal View of Driver Seat Pan Prior to Dummy Positioning



Figure A-33: Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan



Figure A-34: Pre-Test Placement of Driver Dummy's Feet



Figure A-35: Pre-Test View of Belt Anchorage for Driver Dummy



Figure A-36: Pre-Test Left Side View of Steering Wheel



Figure A-37: View of Disengaged Parking Brake



Figure A-38: Pre-Test View of Parking Brake



Figure A-39: Pre-Test Close-Up Left Side View of Driver Seat Track



Figure A-40: Pre-Test Close-Up Left Side View of Driver Seat Back



Figure A-41: Pre-Test Close-Up View of Driver Seat Back or Head Restraint



Figure A-42: Pre-Test Driver Dummy and Door Clearance View



Figure A-43: Post-Test Driver Dummy and Door Clearance View



Figure A-44: Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment



Figure A-45: Post-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment



Figure A-46: Pre-Test Driver Inner Door Panel View



Figure A-47: Post-Test Driver Inner Door Panel View



Figure A-48: Post-Test Driver Dummy Close-Up Head Contact with Vehicle View



Figure A-49: Post-Test Driver Dummy Close-Up Head Contact with Side Air Bag View



Figure A-50: Post-Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View



Figure A-51: Post-Test Driver Dummy Close-Up Torso Contact with Side Air Bag View



Figure A-52: Post-Test Driver Dummy Close-Up Pelvis Contact View



Figure A-53: Post-Test Driver Dummy Close-Up Pelvis Contact with Side Air Bag View



Figure A-54: Post-Test Driver Dummy Close-Up Knee Contact View



Figure A-55: Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking



Figure A-56: Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View



Figure A-57: Post-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View



Figure A-58: Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning



Figure A-59: Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint



Figure A-60: Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning



Figure A-61: Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan



Figure A-62: Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket



Figure A-63: Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level



Figure A-64: Pre-Test Placement of Rear Passenger Dummy's Feet



Figure A-65: Pre-Test View of Belt Anchorage for Rear Passenger Dummy



Figure A-66: Pre-Test Close-Up Left Side View of Rear Passenger Seat Track



Figure A-67: Pre-Test Close-Up Left Side View of Rear Passenger Seat Back



Figure A-68: Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint



Figure A-69: Pre-Test Rear Passenger Dummy and Door Clearance View



Figure A-70: Post-Test Rear Passenger Dummy and Door Clearance View



Figure A-71: Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment



Figure A-72: Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment



Figure A-73: Pre-Test Rear Passenger Inner Door Panel View



Figure A-74: Post-Test Rear Passenger Inner Door Panel View Showing Rear Passenger Dummy Contact Locations



Figure A-75: Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle View



Figure A-76: Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Air Bag View



Figure A-77: Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View



Figure A-78: Post-Test Rear Passenger Dummy Close-Up Torso Contact with Side Air Bag View



Figure A-79: Post-Test Rear Passenger Dummy Close-Up Pelvis Contact View



Figure A-80: Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Air Bag View



Figure A-81: Post-Test Rear Passenger Dummy Close-Up Knee Contact View



Figure A-82: Pre-Test Fuel Filler Cap



Figure A-83: Post-Test Fuel Filler Cap

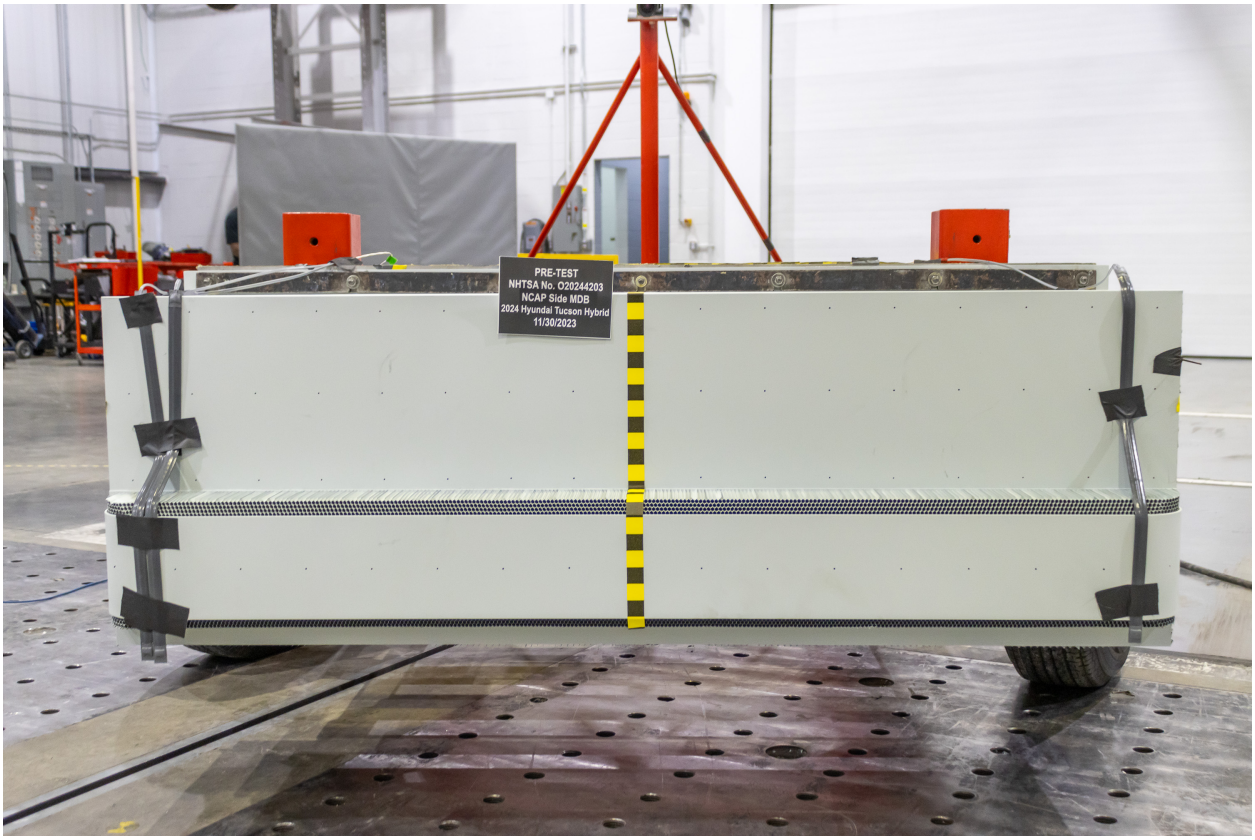


Figure A-84: Pre-Test Front View of MDB Impactor Face



Figure A-85: Post-Test Front View of MDB Impactor Face

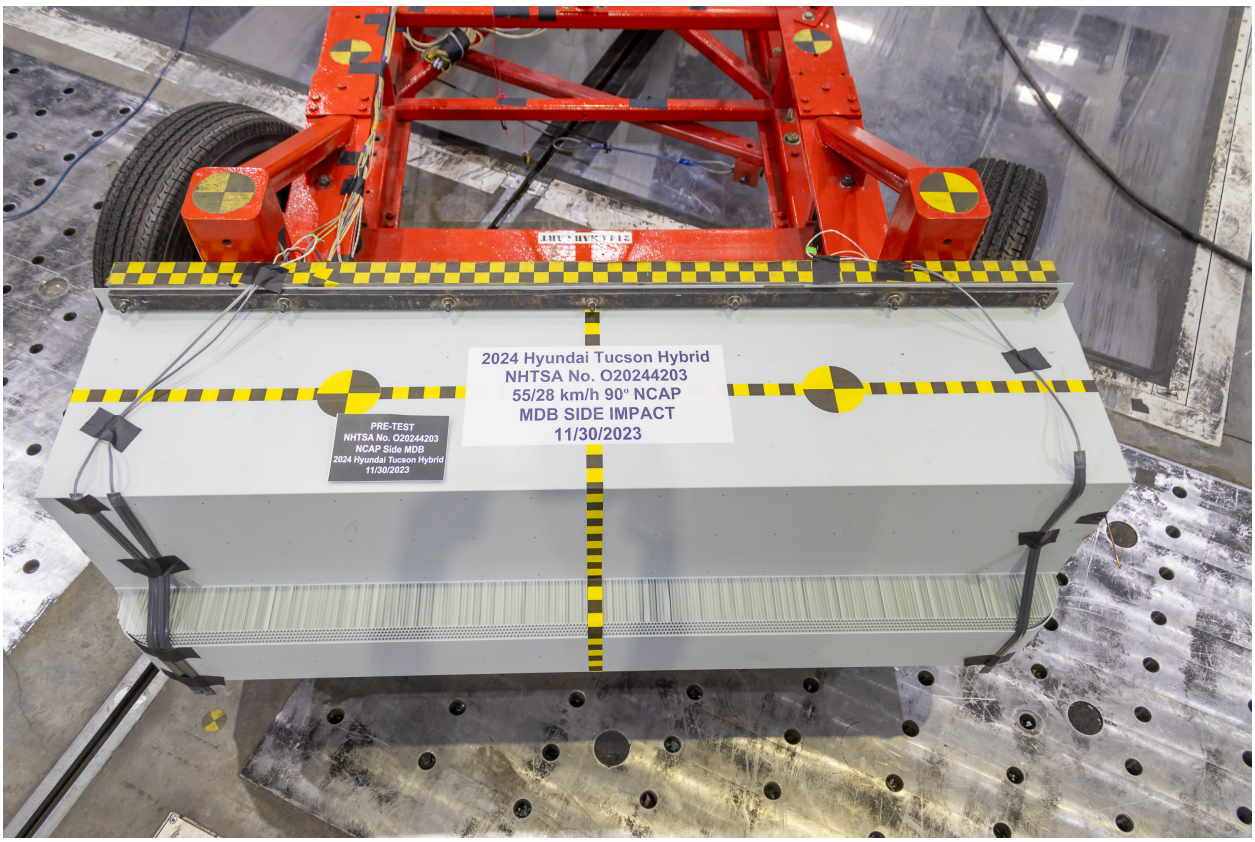


Figure A-86: Pre-Test Top View of MDB Impactor Face



Figure A-87: Post-Test Top View of MDB Impactor Face



Figure A-88: Pre-Test Left Side View of MDB Impactor Face



Figure A-89: Post-Test Left Side View of MDB Impactor Face



Figure A-90: Pre-Test Right Side View of MDB Impactor Face



Figure A-91: Post-Test Right Side View of MDB Impactor Face



Figure A-92: Close-Up View of Vehicle's Certification Label



Figure A-93: Close-Up View of Vehicle's Tire Information Placard or Label

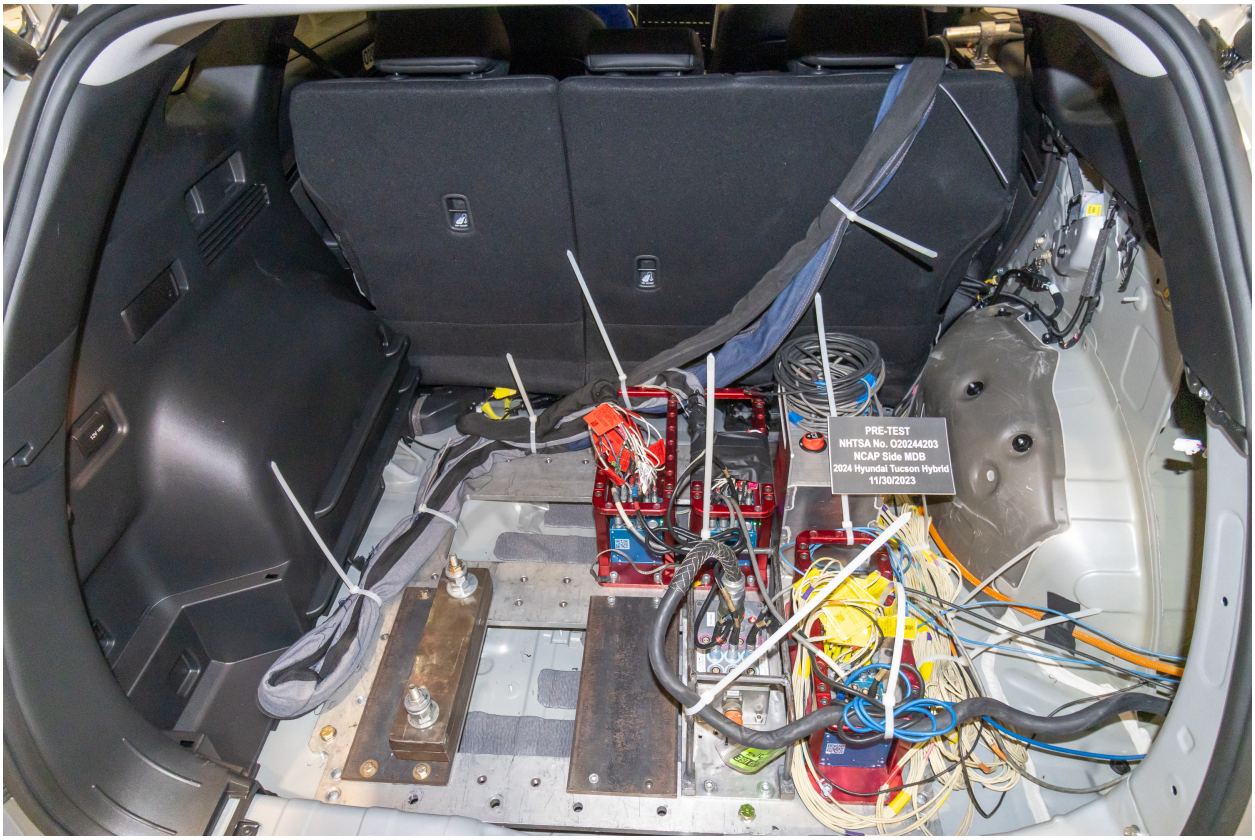


Figure A-94: Pre-Test Ballast View



Figure A-95: Post-Test Primary and Redundant Speed Trap Read-Out

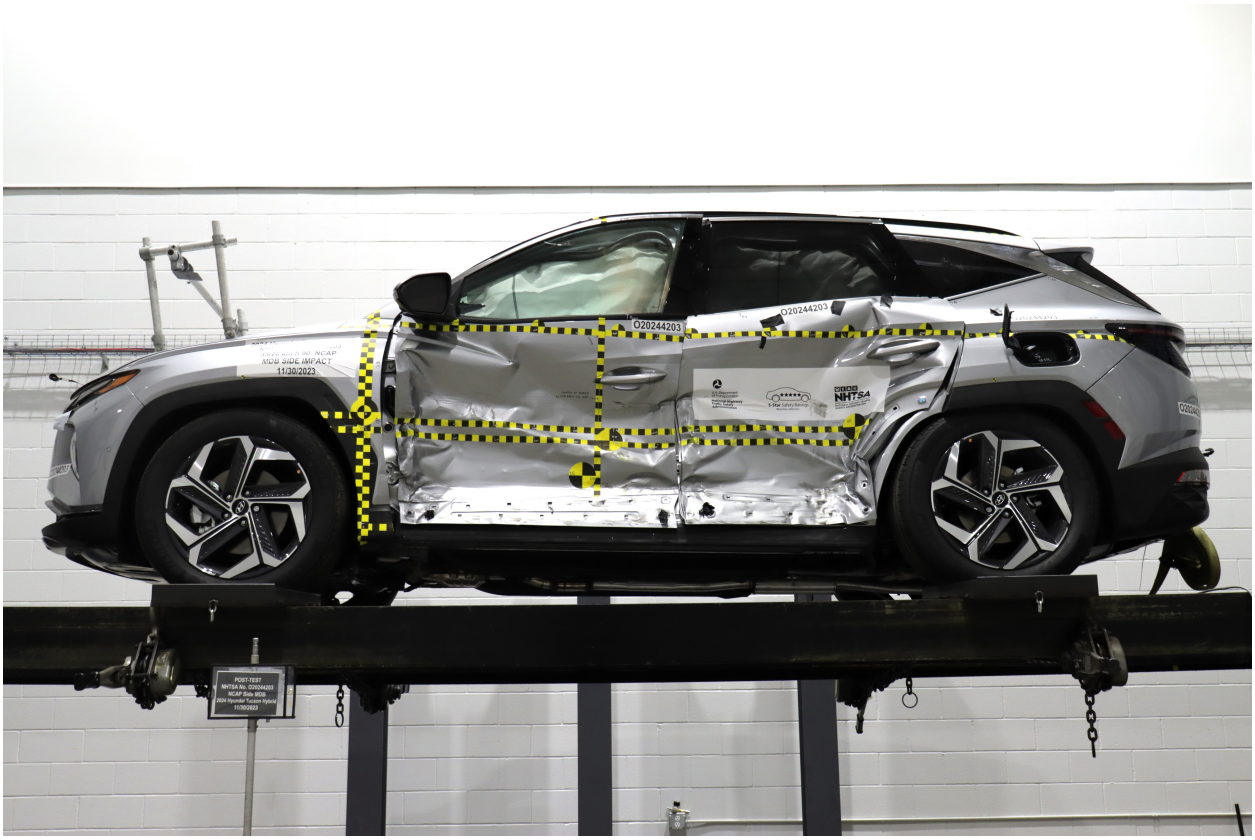


Figure A-96: FMVSS No. 301 Static Rollover 0 Degrees

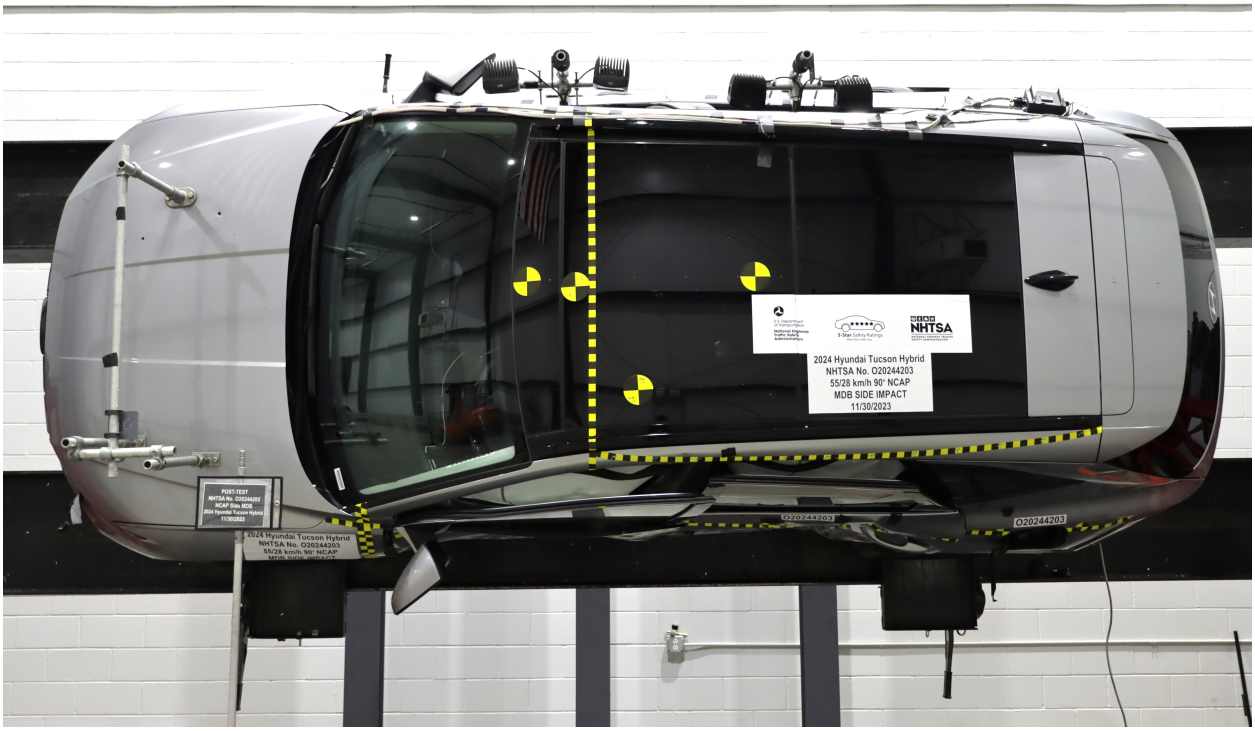


Figure A-97: FMVSS No. 301 Static Rollover 90 Degrees

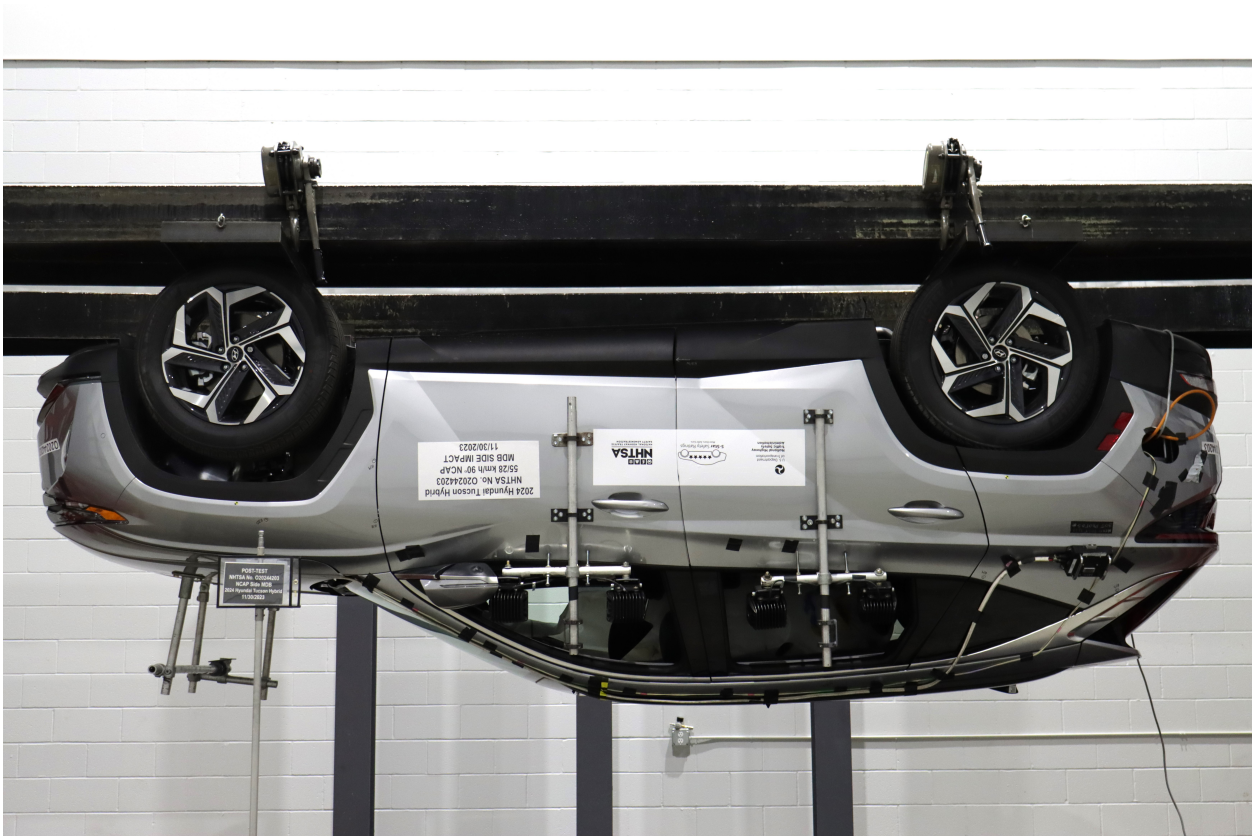


Figure A-98: FMVSS No. 301 Static Rollover 180 Degrees

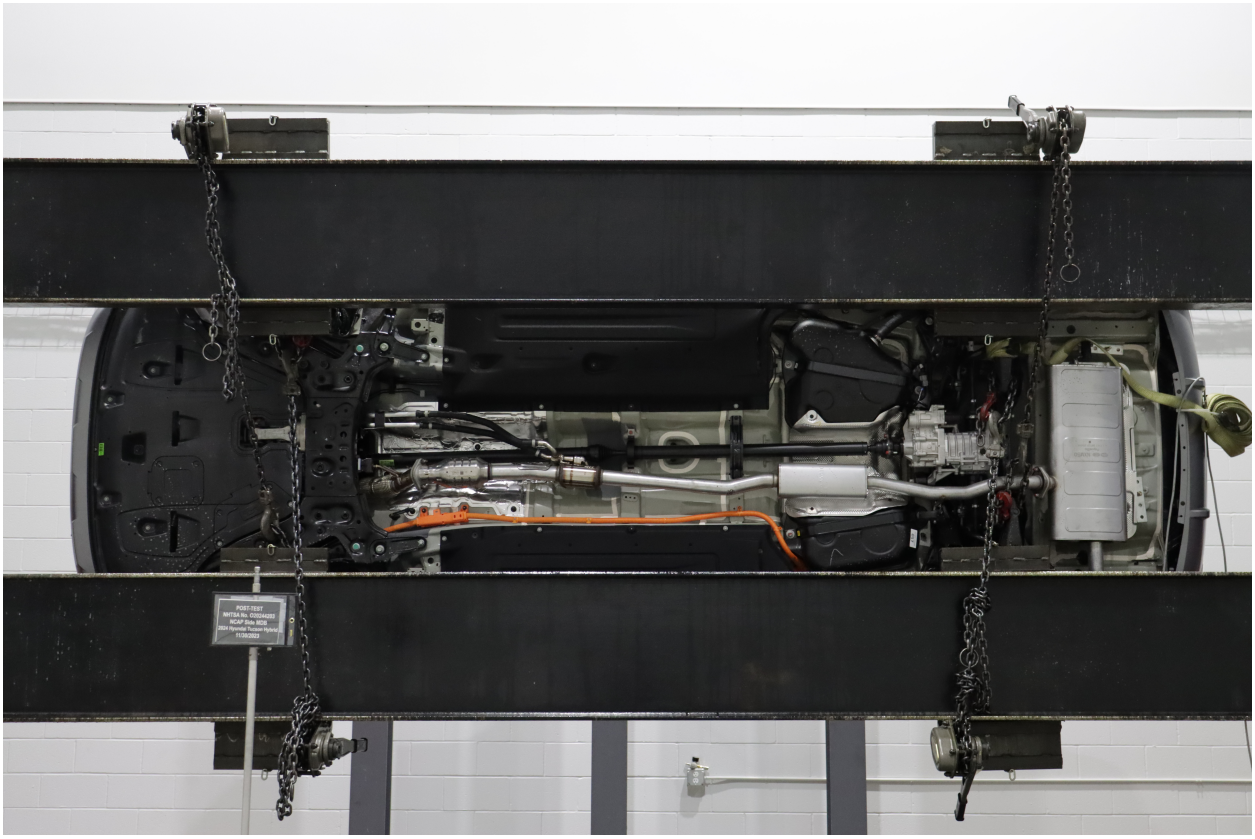


Figure A-99: FMVSS No. 301 Static Rollover 270 Degrees

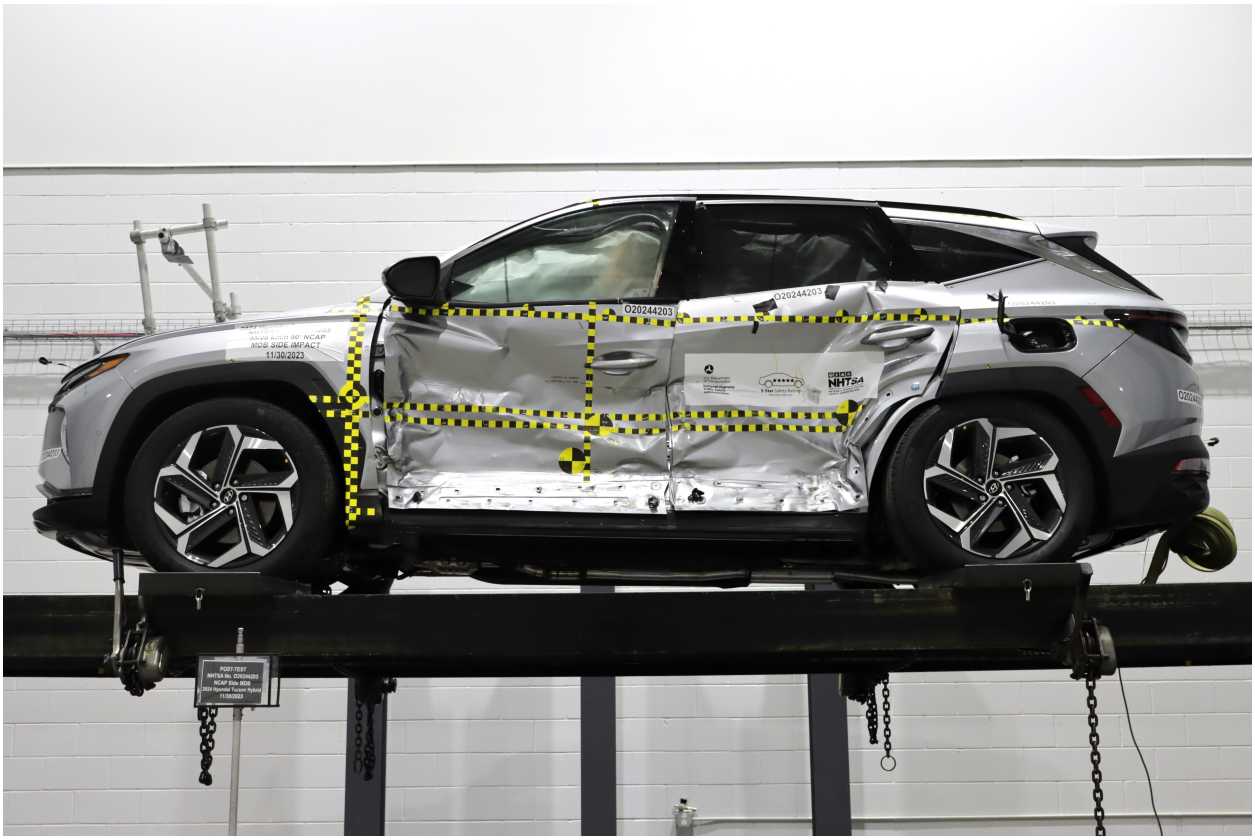
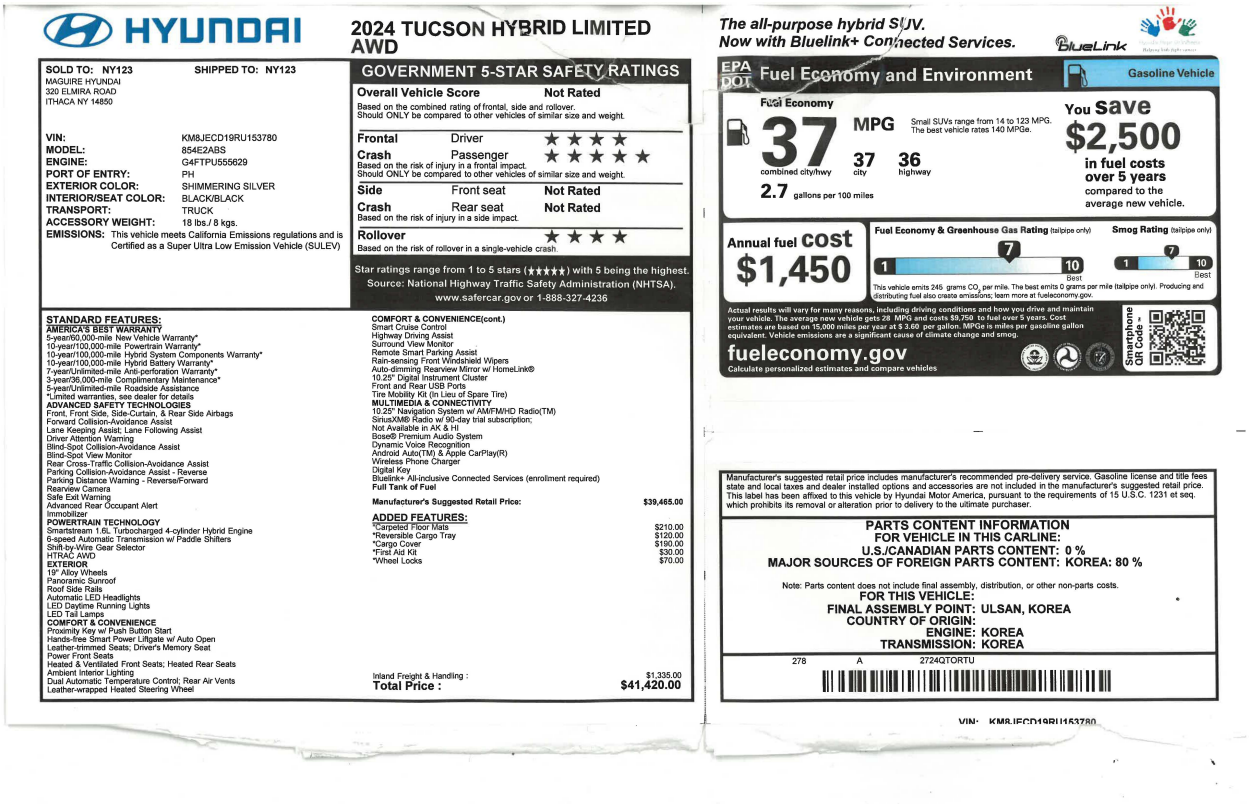


Figure A-100: FMVSS No. 301 Static Rollover 360 Degrees



Figure A-101: Impact Event



HYUNDAI

2024 TUCSON HYBRID LIMITED AWD

SOLD TO: NY123 SHIPPED TO: NY123
MAGUIRE HYUNDAI
320 ELMIRA ROAD
ITHACA NY 14850

VIN: KM8JECD19RU153780
MODEL: 854E2ABS
ENGINE: G4FTPU555629
PORT OF ENTRY: PH
EXTERIOR COLOR: SHIMMERING SILVER
INTERIOR/SEAT COLOR: BLACK/BLACK
TRANSPORT: TRUCK
ACCESSORY WEIGHT: 18 lbs./ 8 kgs.
EMISSIONS: This vehicle meets California Emissions regulations and is Certified as a Super Ultra Low Emission Vehicle (SULEV)

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score: Not Rated
Based on the combined rating of frontal, side and rollover.
Should ONLY be compared to other vehicles of similar size and weight.

Frontal Crash: Driver ★★★★ Passenger ★★★★★
Based on the risk of injury in a frontal impact.
Should ONLY be compared to other vehicles of similar size and weight.

Side Crash: Front seat Not Rated; Rear seat Not Rated
Based on the risk of injury in a side impact.

Rollover: ★★★★
Based on the risk of rollover in a single-vehicle crash.

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.
Source: National Highway Traffic Safety Administration (NHTSA).
www.safercar.gov or 1-888-327-4236

STANDARD FEATURES:
AMERICA'S BEST WARRANTY
5-year/60,000-mile New Vehicle Warranty*
10-year/100,000-mile Powertrain Warranty*
10-year/100,000-mile Hybrid System Components Warranty*
10-year/100,000-mile Hybrid Battery Warranty*
7-year/Unlimited-mile Anti-perforation Warranty*
3-year/36,000-mile Complimentary Maintenance*
5-year/Unlimited-mile Roadside Assistance
*Limited warranties, see dealer for details
ADVANCED SAFETY TECHNOLOGIES
Front, Front Side, Side-Curtain, & Rear Side Airbags
Forward Collision-Avoidance Assist
Lane Keeping Assist; Lane Following Assist
Driver Attention Warning
Blind-Spot Collision-Avoidance Assist
Blind-Spot View Monitor
Rear Cross-Traffic Collision-Avoidance Assist
Parking Collision-Avoidance Assist - Reverse
Parking Distance Warning - Reverse/Forward
Rearview Camera
Safe Exit Warning
Advanced Rear Occupant Alert
Immobilizer
POWERTRAIN TECHNOLOGY
Smartstream 1.6L Turbocharged 4-cylinder Hybrid Engine
6-speed Automatic Transmission w/ Paddle Shifters
Shift-by-Wire Gear Selector
HTRAC AWD
EXTERIOR
19" Alloy Wheels
Panoramic Sunroof
Roof Side Rails
Automatic LED Headlights
LED Daytime Running Lights
LED Tail Lamps
COMFORT & CONVENIENCE
Proximity Key w/ Push Button Start
Hands-free Smart Power Liftgate w/ Auto Open
Leather-trimmed Seats; Driver's Memory Seat
Power Front Seats
Heated & Ventilated Front Seats; Heated Rear Seats
Ambient Interior Lighting
Dual Automatic Temperature Control; Rear Air Vents
Leather-wrapped Heated Steering Wheel

COMFORT & CONVENIENCE(cont.)
Smart Cruise Control
Highway Driving Assist
Surround View Monitor
Remote Smart Parking Assist
Rain-sensing Front Windshield Wipers
Auto-dimming Rearview Mirror w/ HomeLink®
10.25" Digital Instrument Cluster
Front and Rear USB Ports
Tire Mobility Kit (in Lieu of Spare Tire)
MULTIMEDIA & CONNECTIVITY
10.25" Navigation System w/ AM/FM/HD Radio(TM)
SiriusXM® Radio w/ 90-day trial subscription;
Not Available in AK & HI
Bose® Premium Audio System
Dynamic Voice Recognition
Android Auto(TM) & Apple CarPlay(R)
Wireless Phone Charger
Digital Key
Bluelink+ All-inclusive Connected Services (enrollment required)
Full Tank of Fuel

Manufacturer's Suggested Retail Price: $39,465.00

ADDED FEATURES:
*Carpeted Floor Mats $210.00
*Reversible Cargo Tray $120.00
*Cargo Cover $190.00
*First Aid Kit $30.00
*Wheel Locks $70.00

Inland Freight & Handling : $1,335.00
Total Price : $41,420.00

The all-purpose hybrid SUV.
Now with Bluelink+ Connected Services.
BlueLink

EPA DOT Fuel Economy and Environment — Gasoline Vehicle

Fuel Economy
37 MPG combined city/hwy
37 city 36 highway
2.7 gallons per 100 miles
Small SUVs range from 14 to 123 MPG.
The best vehicle rates 140 MPGe.

You save $2,500 in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost $1,450

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 7 (1 Worst, 10 Best)
Smog Rating (tailpipe only): 7 (1 Worst, 10 Best)
This vehicle emits 246 grams CO_2 per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fueleconomy.gov.

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 28 MPG and costs $9,750 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $ 3.60 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fueleconomy.gov
Calculate personalized estimates and compare vehicles

Smartphone QR Code

Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. Gasoline license and title fees state and local taxes and dealer installed options and accessories are not included in the manufacturer's suggested retail price. This label has been affixed to this vehicle by Hyundai Motor America, pursuant to the requirements of 15 U.S.C. 1231 et seq. which prohibits its removal or alteration prior to delivery to the ultimate purchaser.

PARTS CONTENT INFORMATION
FOR VEHICLE IN THIS CARLINE:
U.S./CANADIAN PARTS CONTENT: 0 %
MAJOR SOURCES OF FOREIGN PARTS CONTENT: KOREA: 80 %

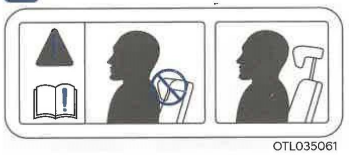
Note: Parts content does not include final assembly, distribution, or other non-parts costs.
FOR THIS VEHICLE:
FINAL ASSEMBLY POINT: ULSAN, KOREA
COUNTRY OF ORIGIN:
ENGINE: KOREA
TRANSMISSION: KOREA

278 A 2724QTORTU

VIN: KM8JECD19RU153780

Figure A-102: Monroney Label

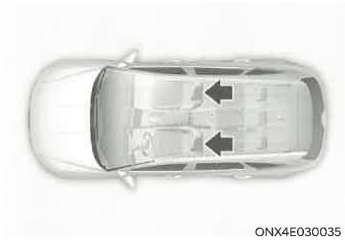
WARNING



OTL035061

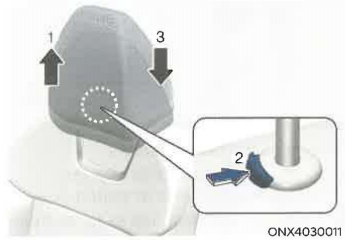
When passengers are sitting on the rear seats, always raise the head restraints above the lowest stored position.

Front seat head restraints



ONX4E030035

The driver's and front passenger's seats are equipped with adjustable head restraint for the passengers safety and comfort.



ONX4030011

Adjusting the height up and down

To raise the head restraint:

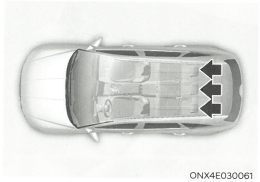
1. Pull it up to the desired position ①.

To lower the head restraint:

1. Press and hold the release button ② on the head restraint support.
2. Lower the head restraint to the desired position ③.

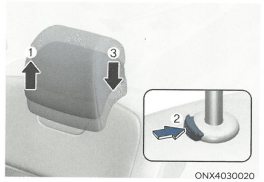
Figure A-103: Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

Rear seat head restraint



ONX4E030061

The rear seats are equipped with head restraint in all the seating positions for the passenger's safety and comfort.



ONX4030020

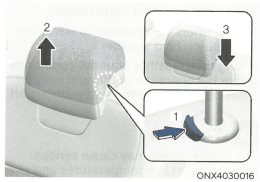
Adjusting the height up and down

To raise the head restraint:

1. Pull it up to the desired position ①.

To lower the head restraint:

1. Press and hold the release button ② on the head restraint support.
2. Lower the head restraint to the desired position ③.



ONX4030016

Removal/Reinstallation

To remove the head restraint:

1. Raise the head restraint as far as it can go.
2. Press the head restraint release button ① while pulling up the head restraint ②.

To reinstall the head restraint:

1. Put the head restraint poles into the holes ③ while pressing the release button ①.
2. Adjust the head restraint to the appropriate height.

Figure A-104: Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

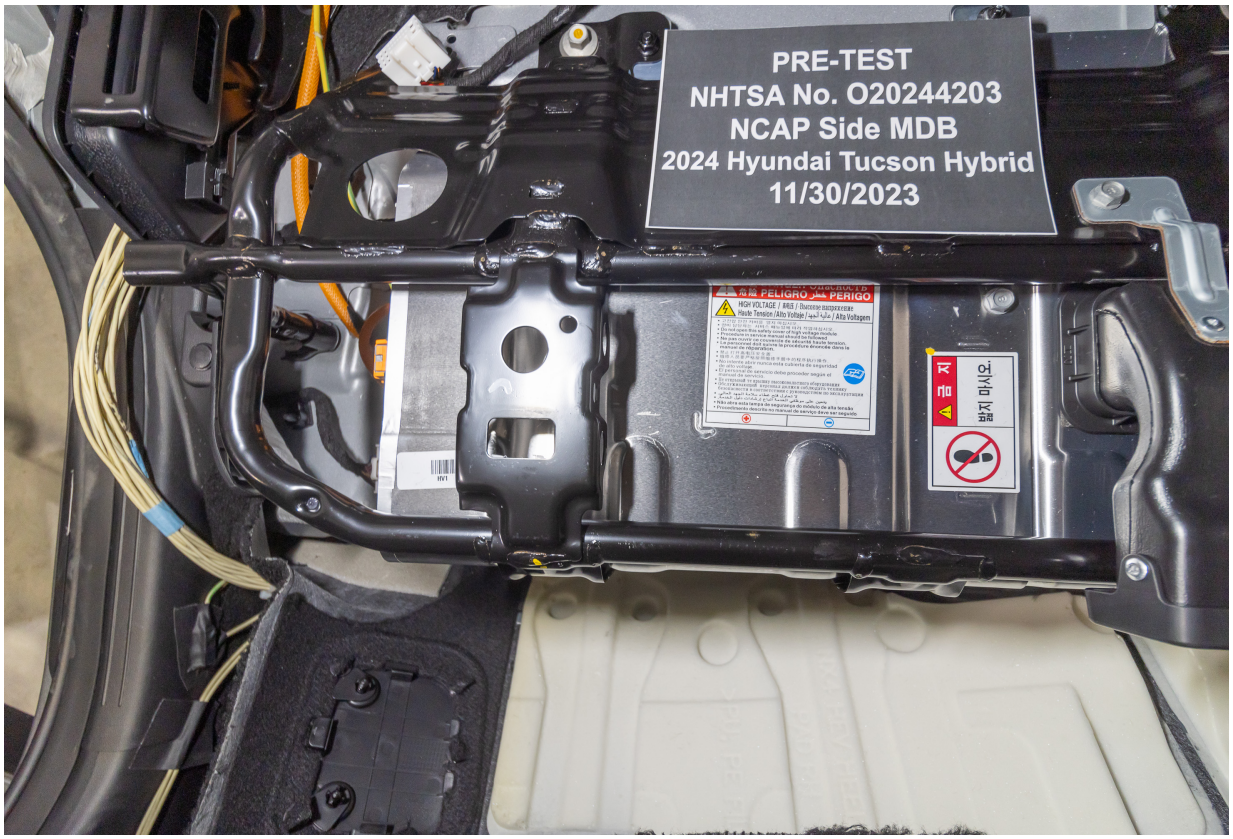


Figure 305-1: Auxiliary Power Module Warning Label

Photo Not Applicable

Figure 305-2: Power Inverter Warning Label



Figure 305-3 First Responder Warning Label

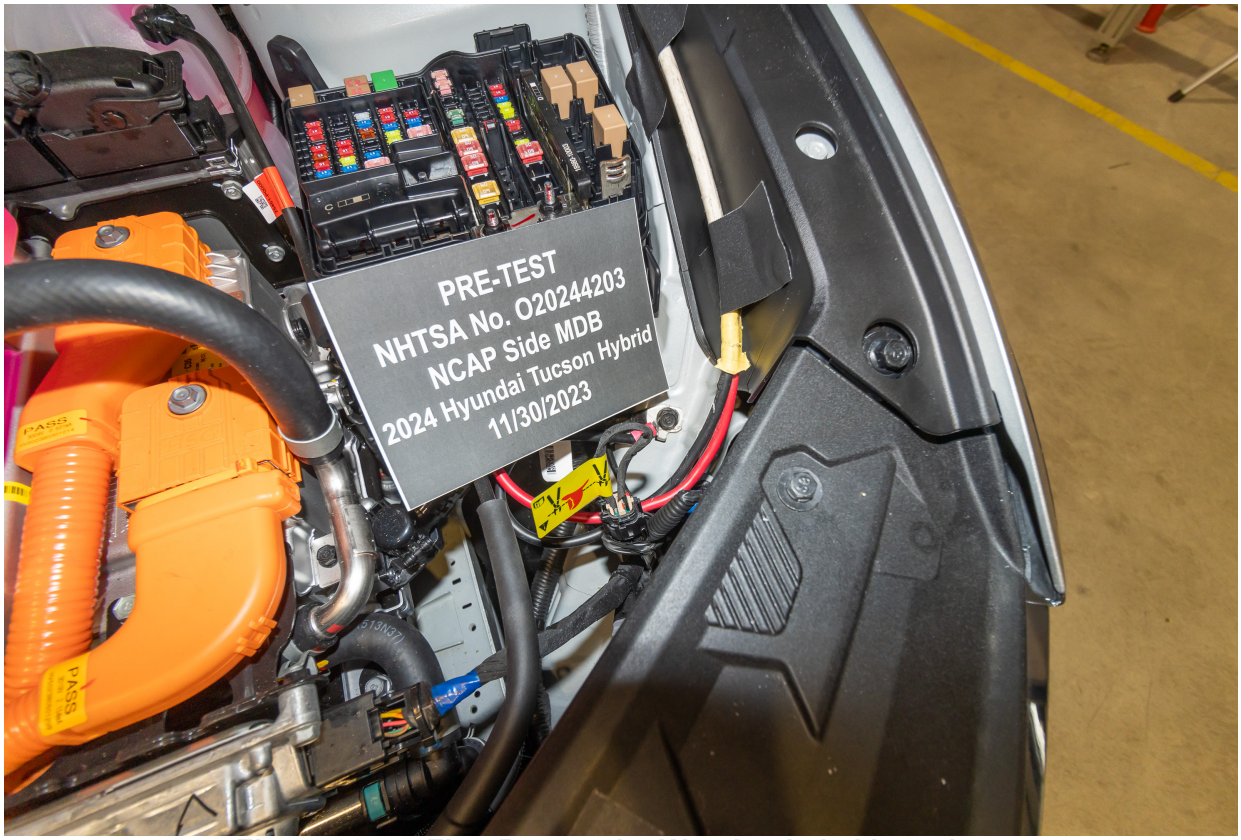


Figure 305-4: First Responder Warning Label Location

Photo Not Applicable

Figure 305-5: Other Vehicle Label(s) Related to Electrical Propulsion System

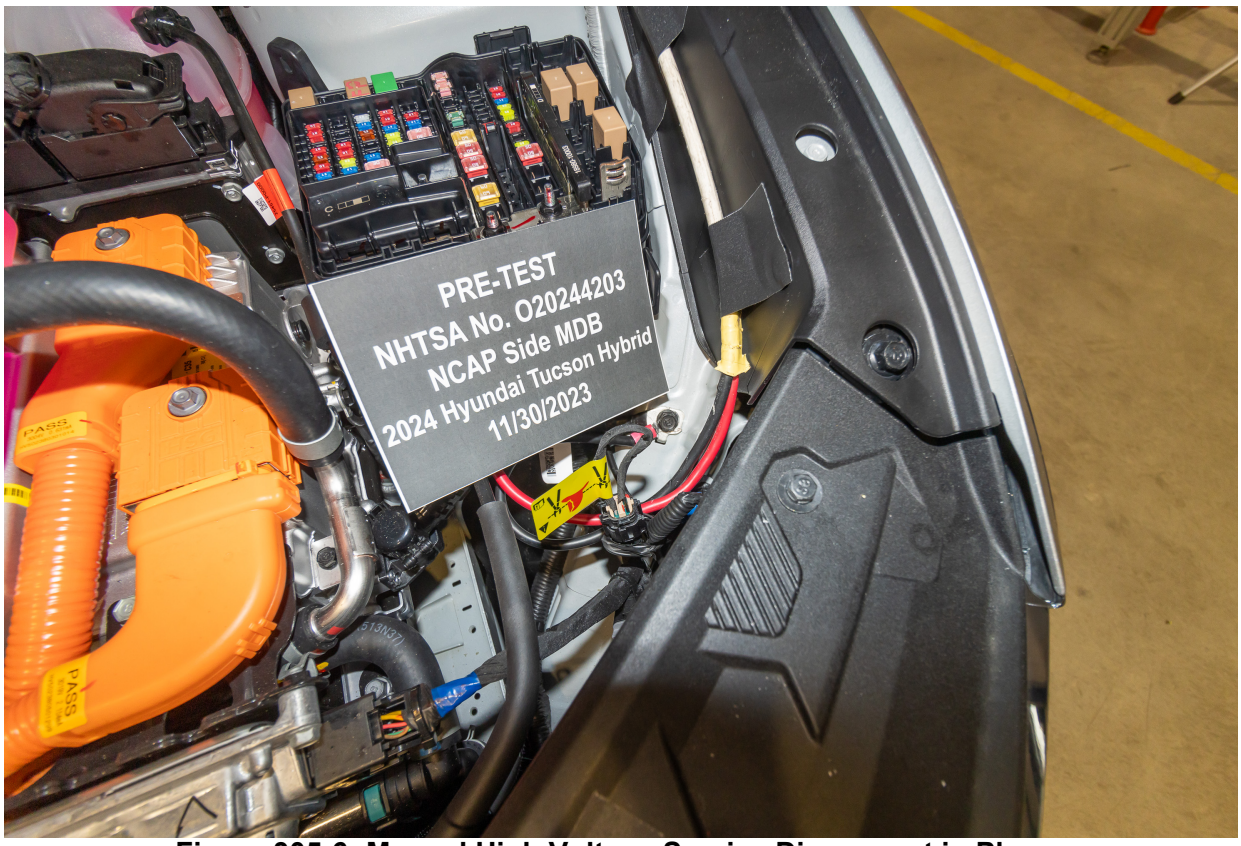


Figure 305-6: Manual High Voltage Service Disconnect in Place



Figure 305-7: Manual High Voltage Service Disconnect Removed (Plug)



Figure 305-8: Manual High Voltage Service Disconnect Removed (Location where removed)

Photo Not Applicable

Figure 305-9: Pre-Impact View of Propulsion Battery



Figure 305-10: Post-Impact Front View of Propulsion Battery



Figure 305-11: Post-Impact Rear View of Propulsion Battery (if any part of it is visible)



Figure 305-12: Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

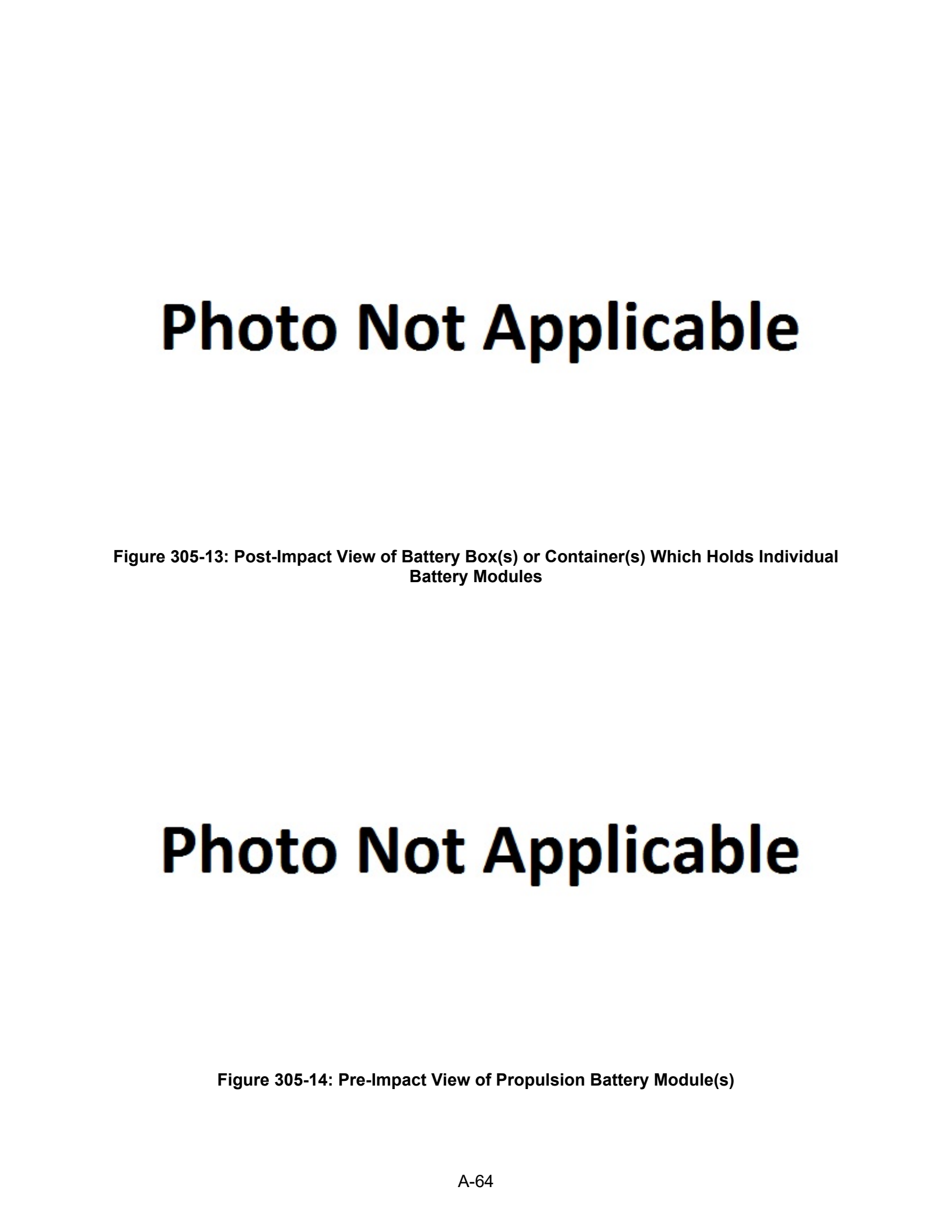


Figure 305-13: Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

Figure 305-14: Pre-Impact View of Propulsion Battery Module(s)

Photo Not Applicable

Figure 305-15: Post-Impact View of Propulsion Battery Module(s)

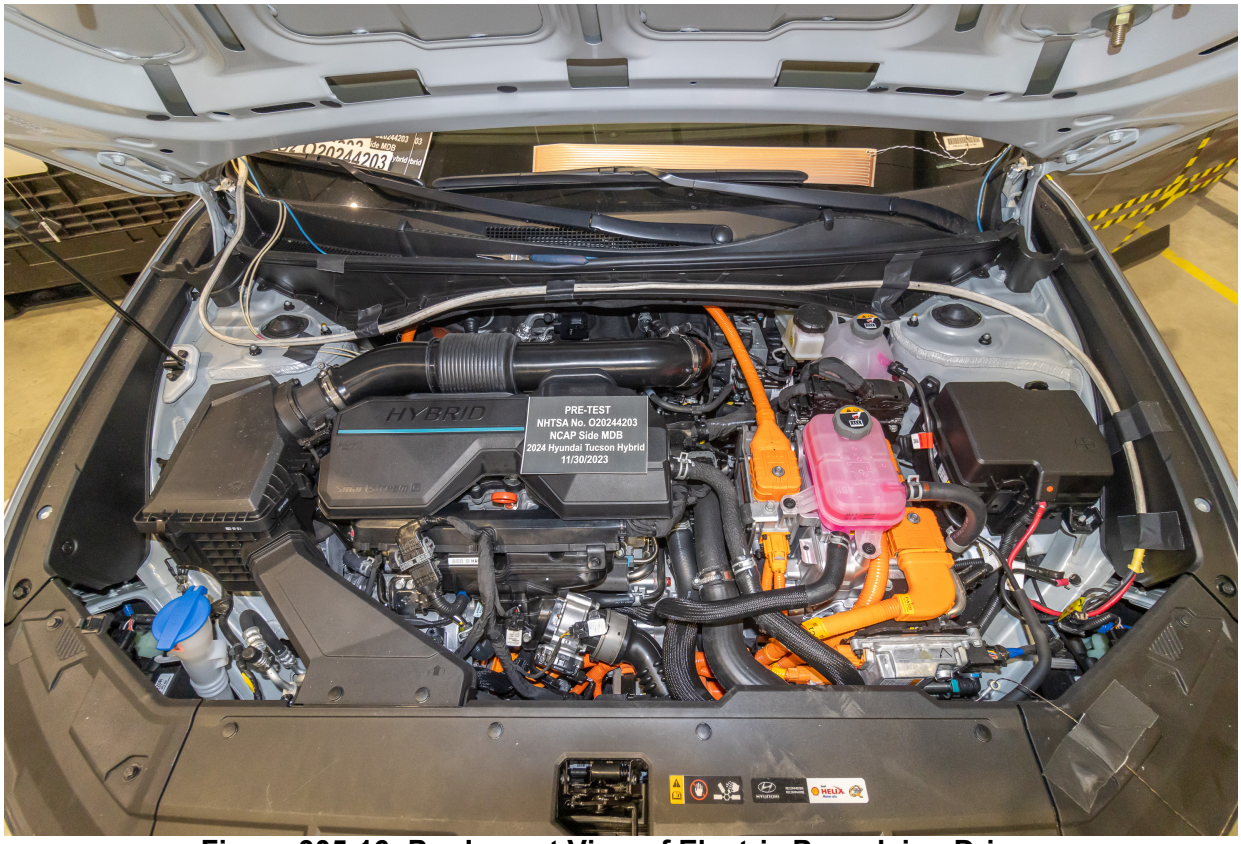


Figure 305-16: Pre-Impact View of Electric Propulsion Drive



Figure 305-17: Post-Impact View of Electric Propulsion Drive

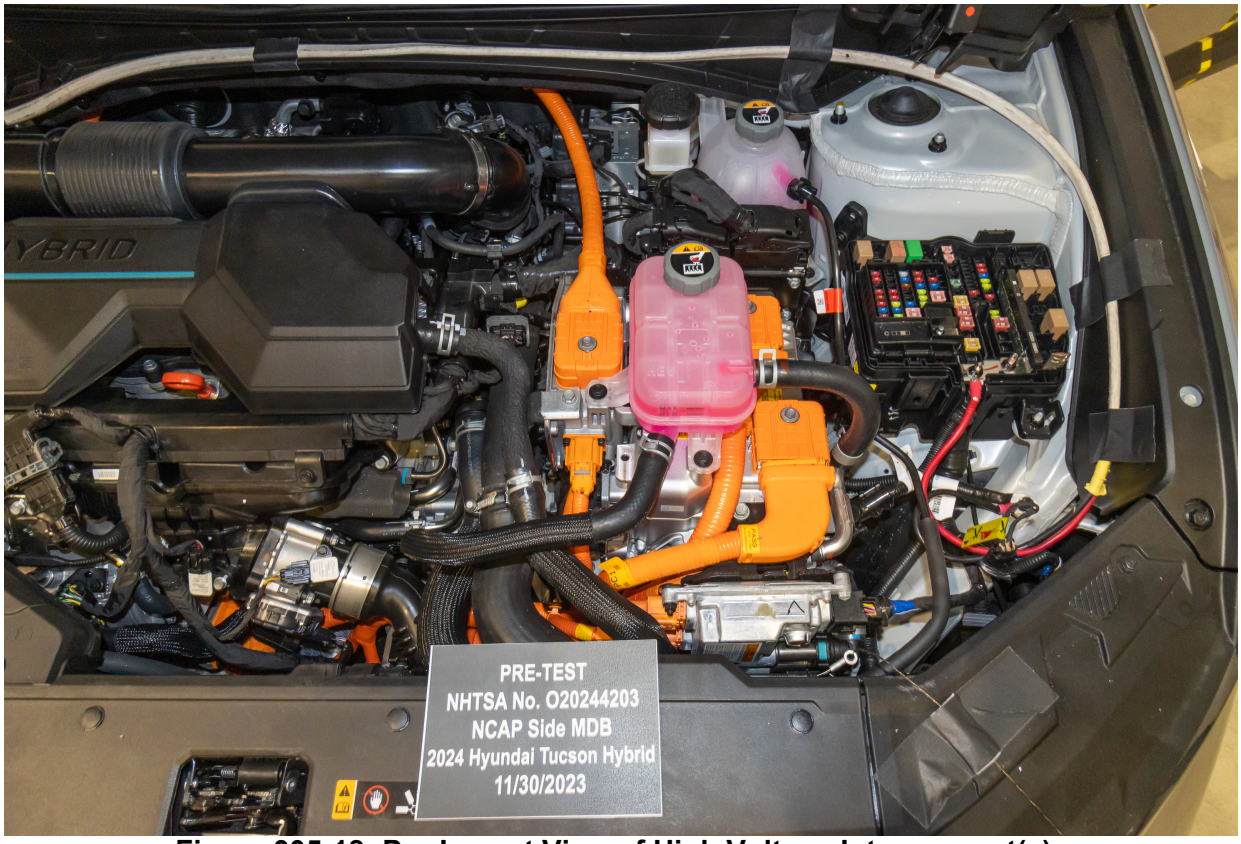


Figure 305-18: Pre-Impact View of High Voltage Interconnect(s)



Figure 305-19: Pre-Impact View Propulsion Venting System(s)

Photo Not Applicable

Figure 305-20: Pre-Impact View of Other Visible Electric Propulsion Components

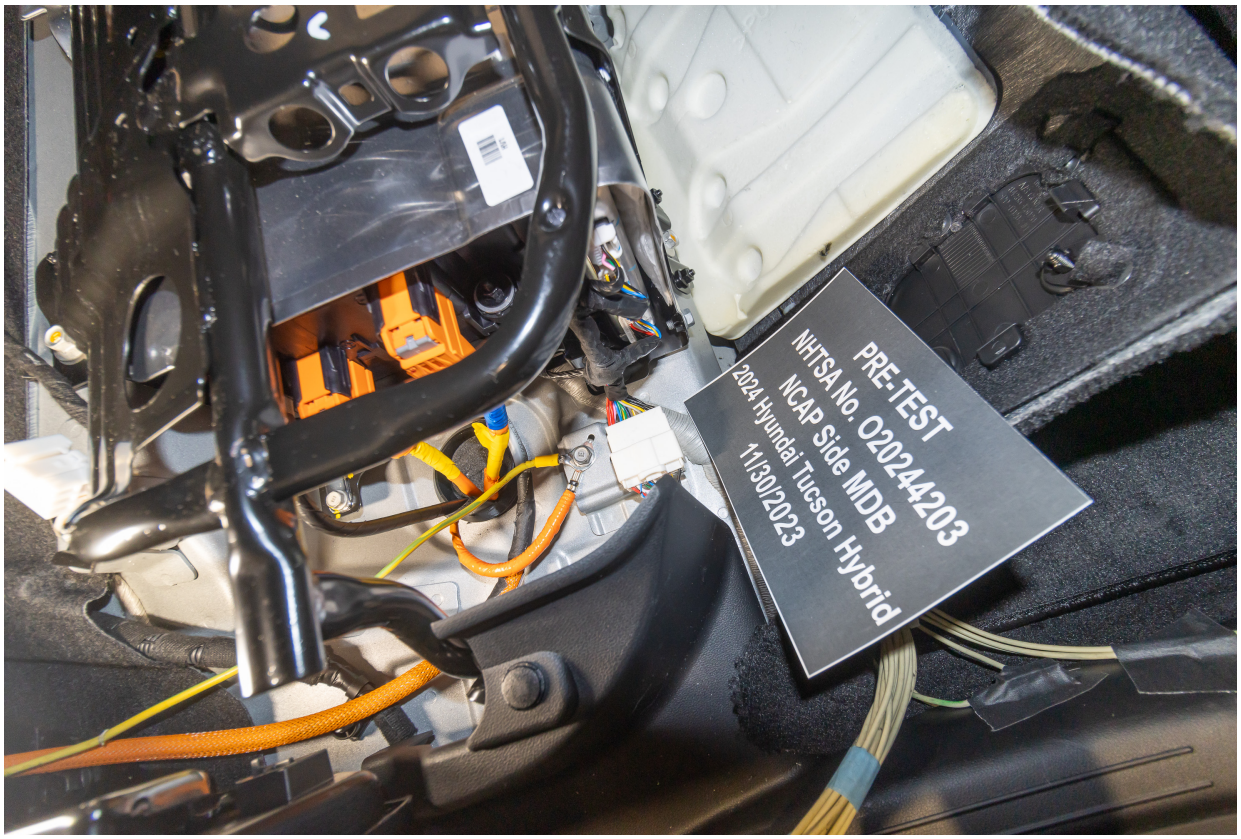


Figure 305-21: Pre-Impact View of Ground Lead Attached

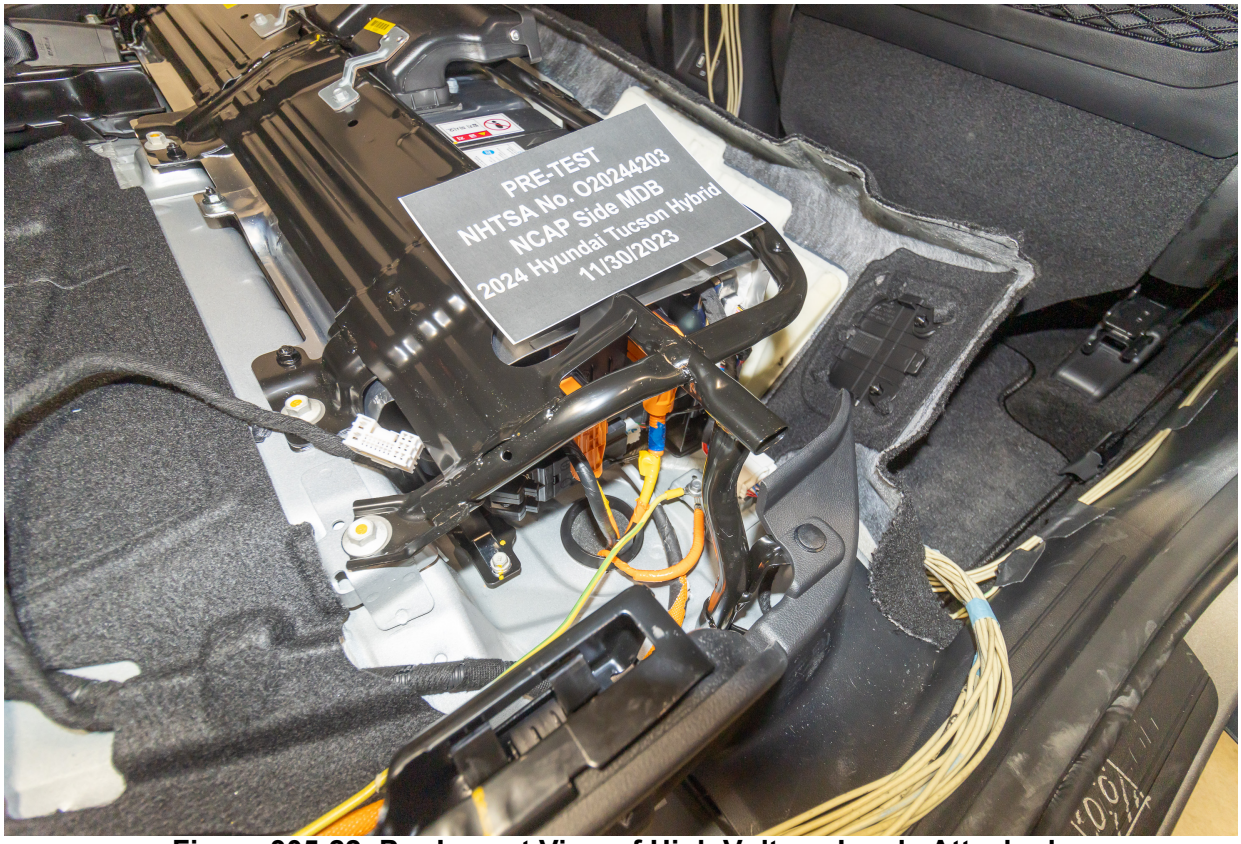


Figure 305-22: Pre-Impact View of High Voltage Leads Attached



Figure 305-23: Pre-Impact Close-Up View of High Voltage Leads Attached

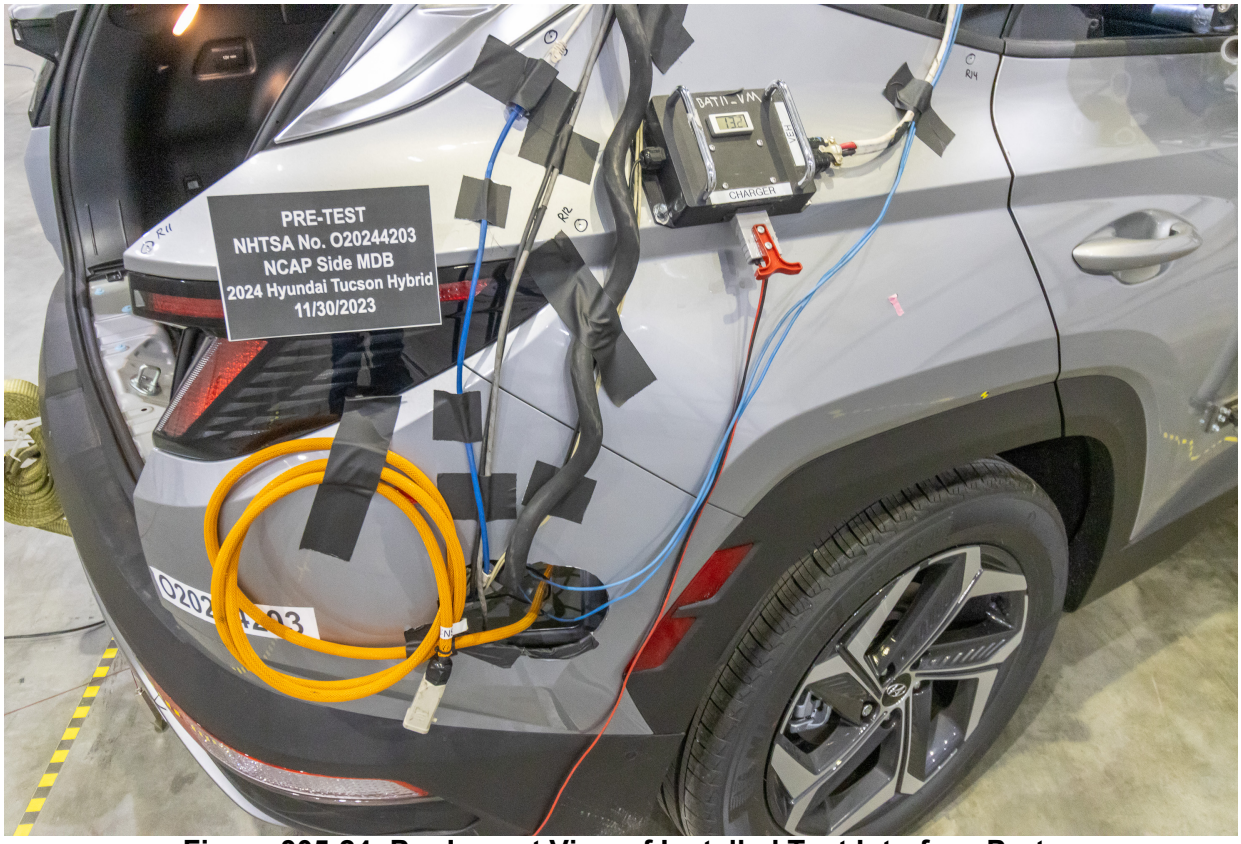


Figure 305-24: Pre-Impact View of Installed Test Interface Port



Figure 305-25: Post-Impact View of Installed Test Interface Port

Photo Not Applicable

Figure 305-26: Pre-Impact View of Other Test Devices

Photo Not Applicable

Figure 305-27: Post-Impact View of Other Test Devices

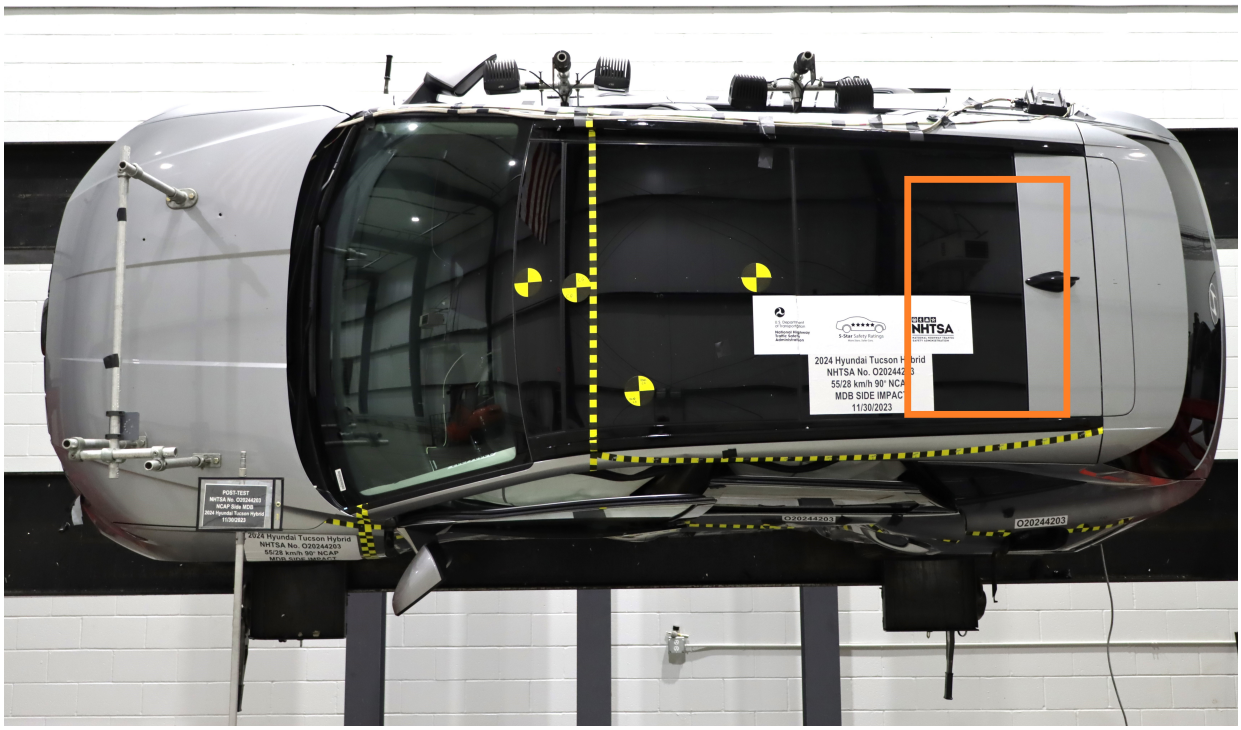


Figure 305-28: FMVSS No. 305 Static Rollover 90 Degrees

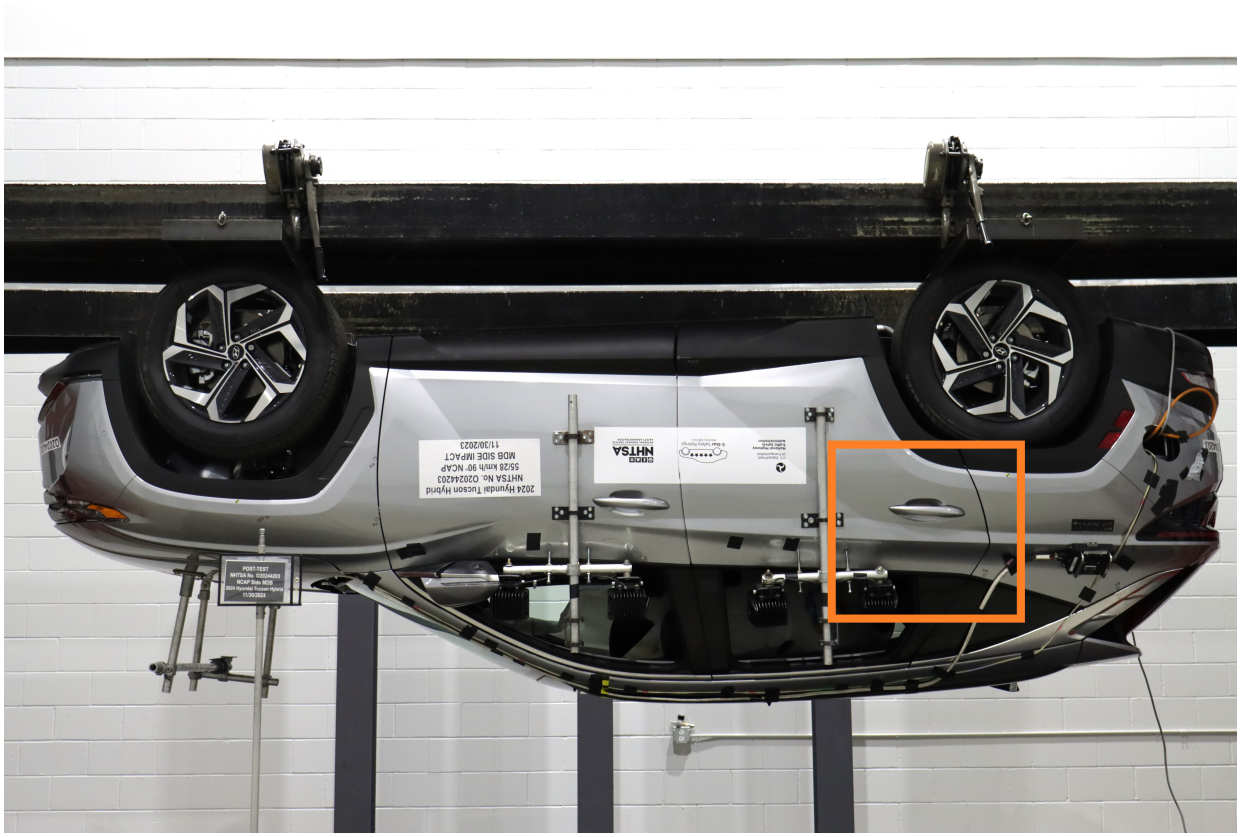


Figure 305-29: FMVSS No. 305 Static Rollover 180 Degrees

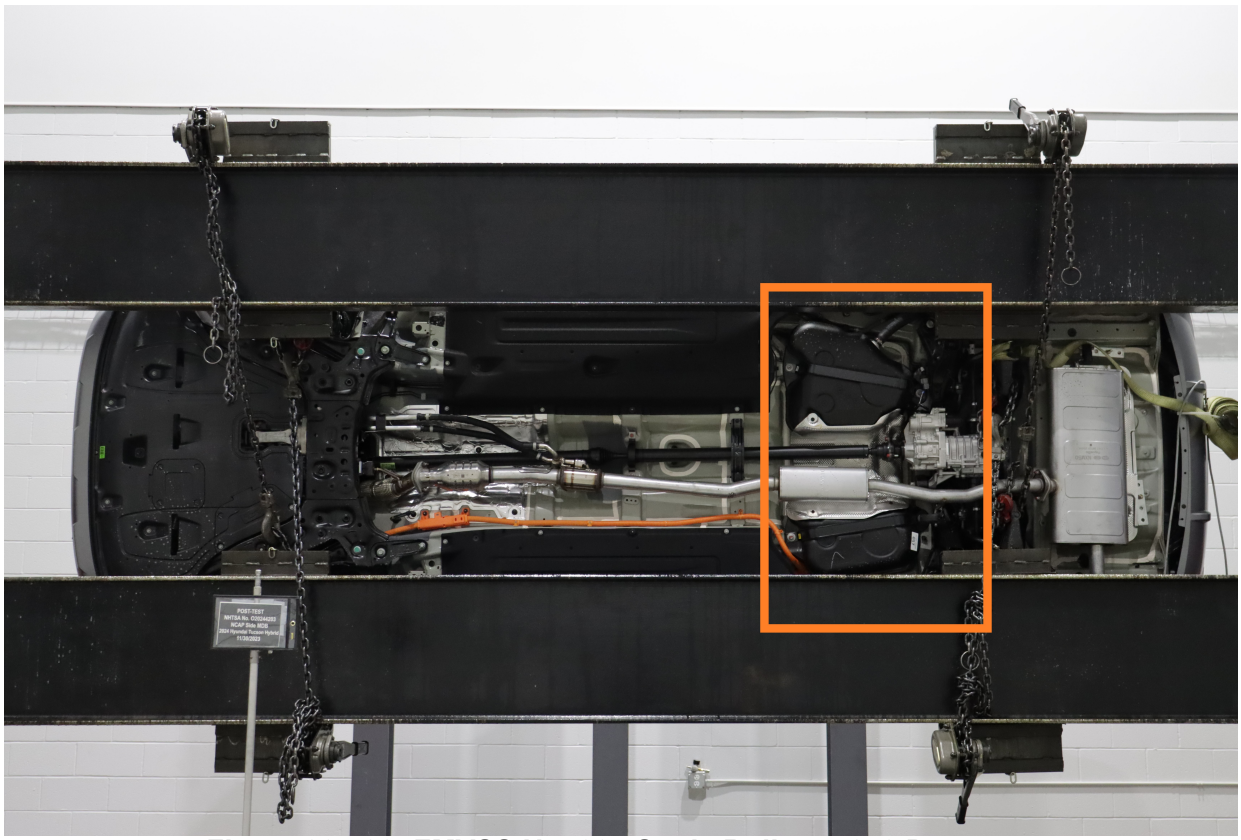


Figure 305-30: FMVSS No. 305 Static Rollover 270 Degrees

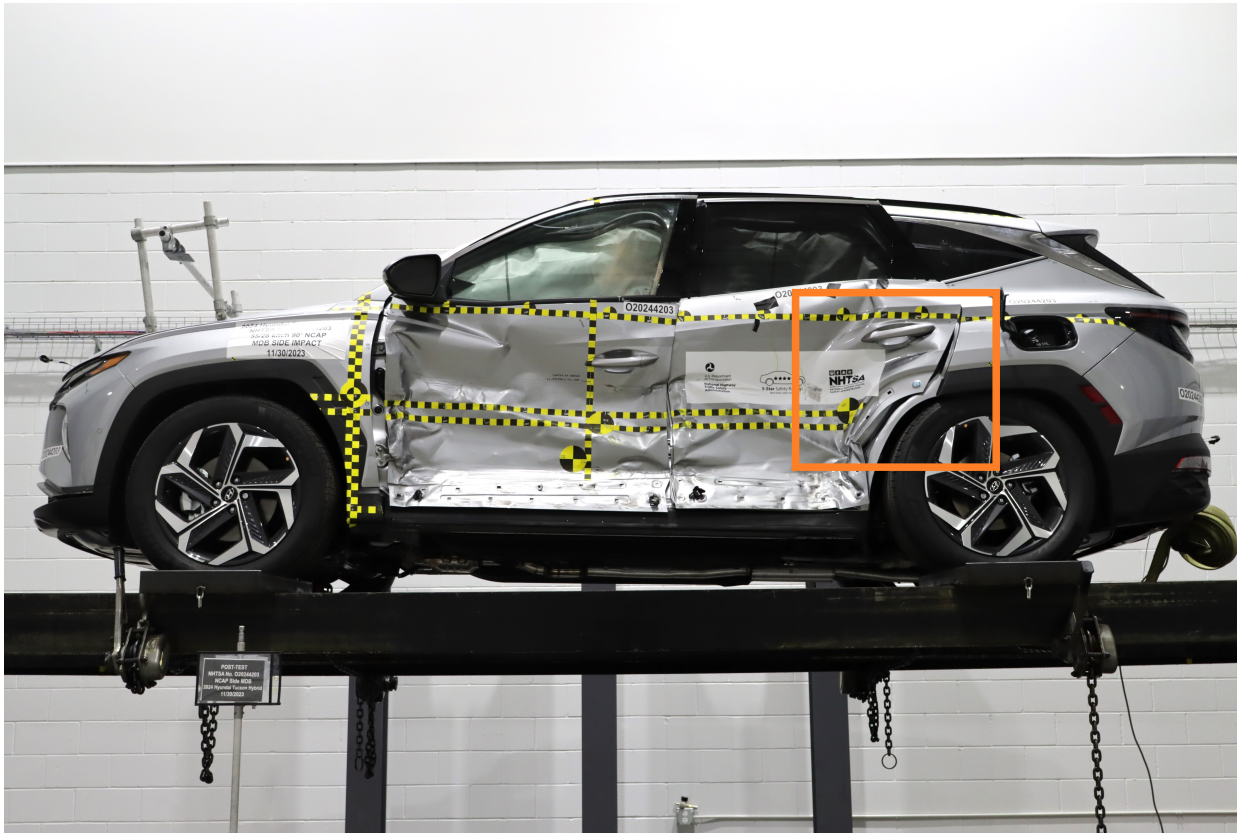


Figure 305-31: FMVSS No. 305 Static Rollover 360 Degrees



Figure 305-32: Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery



Figure 305-33: Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

Photo Not Applicable

Figure 305-34: Post-Impact Propulsion Battery System Mounting and-or Intrusion Failure(s)



Figure 305-35: Post-Impact View of Battery Component Intrusion (if applicable)

Figure 305-36: Post-Impact View of Battery Module Movement or Retention Loss (if applicable)

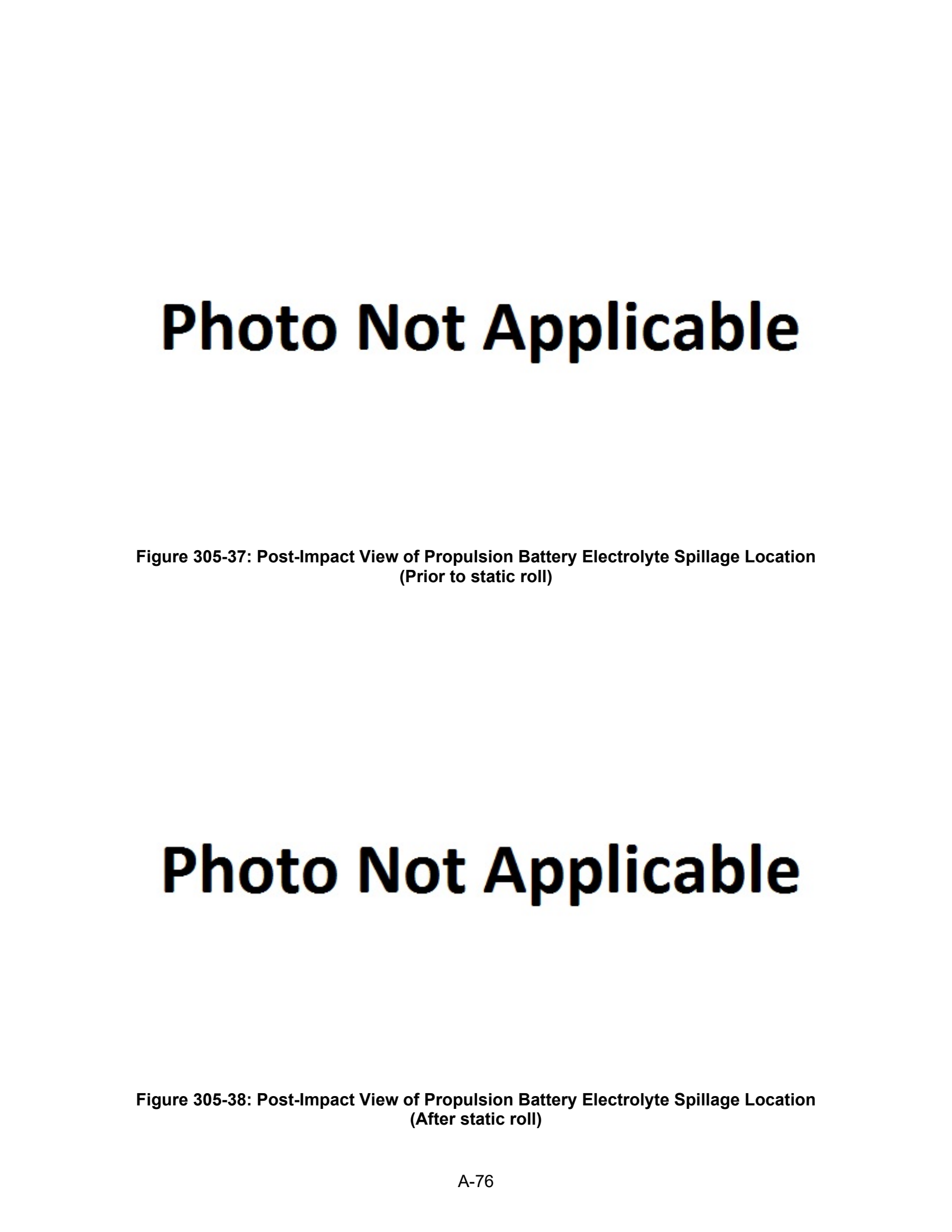


Figure 305-37: Post-Impact View of Propulsion Battery Electrolyte Spillage Location (Prior to static roll)

Figure 305-38: Post-Impact View of Propulsion Battery Electrolyte Spillage Location (After static roll)

APPENDIX B
VEHICLE AND DUMMY RESPONSE DATA TRACES

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Driver Dummy Instrumentation Plots

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The following additional dummy and vehicle response data can be obtained from the Research and Development section of the NHTSA website. The website can be found at www.NHTSA.gov

Additional Driver & Passenger Dummy Instrumentation Data

Driver Lower Spine T12 Acceleration (X)
Driver Lower Spine T12 Acceleration (Y)
Driver Lower Spine T12 Acceleration (Z)
Passenger Upper Thorax Rib Deflection (Y)
Passenger Middle Thorax Rib Deflection (Y)
Passenger Lower Thorax Rib Deflection (Y)
Passenger Upper Abdomen Rib Deflection (Y)
Passenger Lower Abdomen Rib Deflection (Y)
Driver Head Acceleration Redundant (X)
Driver Head Acceleration Redundant (Y)
Driver Head Acceleration Redundant (Z)
Passenger Head Acceleration Redundant (X)
Passenger Head Acceleration Redundant (Y)
Passenger Head Acceleration Redundant (Z)

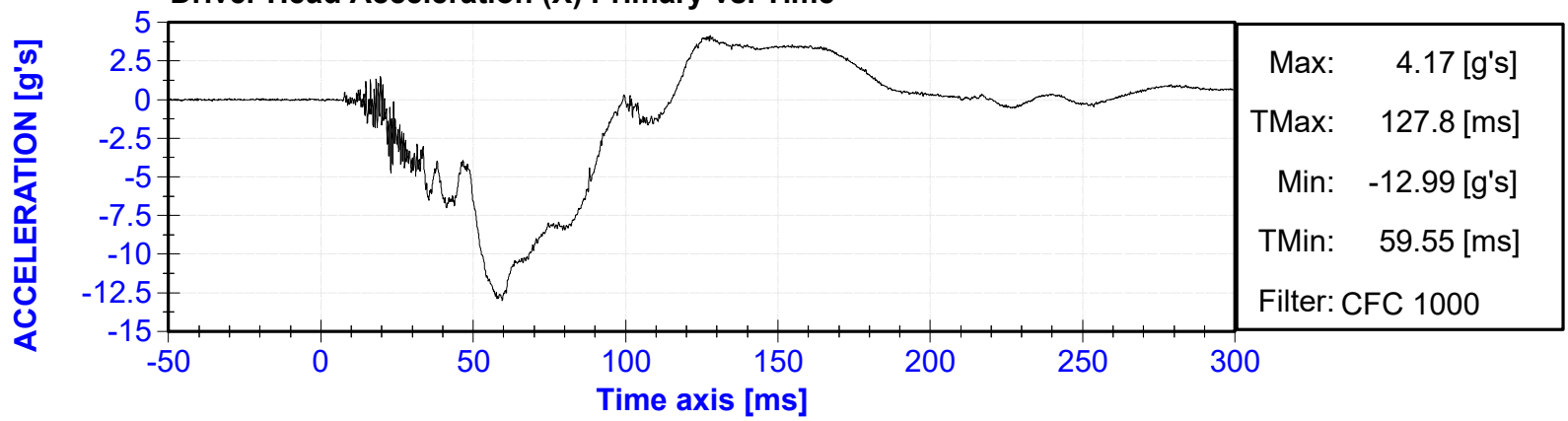
Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)
Vehicle Center of Gravity Acceleration (Y)
Vehicle Center of Gravity Acceleration (Z)
Right Side Sill at Front Seat Acceleration (X)
Right Side Sill at Front Seat Acceleration (Y)
Right Side Sill at Front Seat Acceleration (Z)
Right Side Sill at Rear Seat Acceleration (X)
Right Side Sill at Rear Seat Acceleration (Y)
Right Side Sill at Rear Seat Acceleration (Z)
Left Side Sill at Front Seat Acceleration (Y)
Left Side Sill at Rear Seat Acceleration (Y)
Lower A-Post Acceleration (Y)
Middle A-Post Acceleration (Y)
Lower B-Post Acceleration (Y)
Middle B-Post Acceleration (Y)
Front Seat Track Acceleration (Y)
Rear Seat Structure Acceleration (Y)
Right Rear Occupant Compartment Acceleration (Y)
Engine Block (X)
Engine Block (Y)
Rear Floorpan Above Axle Acceleration (X)
Rear Floorpan Above Axle Acceleration (Y)
Rear Floorpan Above Axle Acceleration (Z)

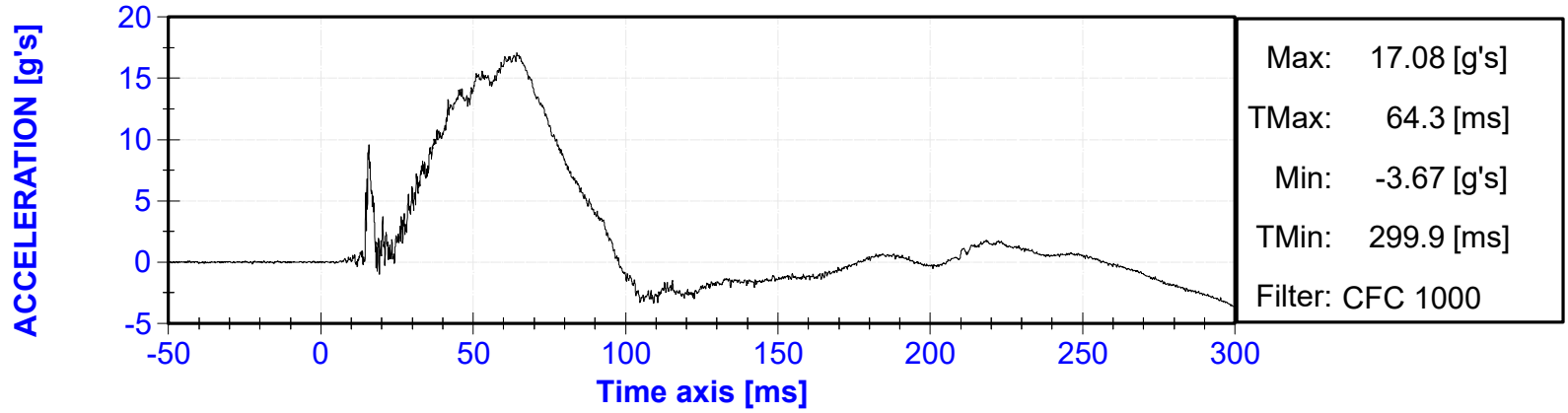
MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)
MDB Center of Gravity Acceleration (Y)
MDB Center of Gravity Acceleration (Z)
MDB Rear Acceleration (X)
MDB Rear Acceleration (Y)
Left MDB Contact Switch
Right MDB Contact Switch

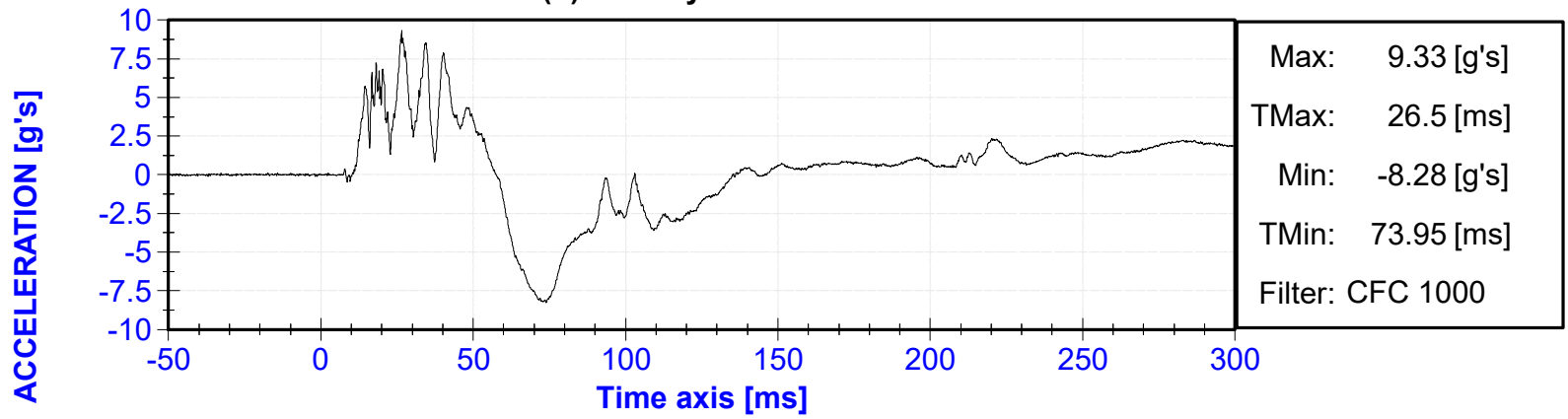
Driver Head Acceleration (X) Primary vs. Time



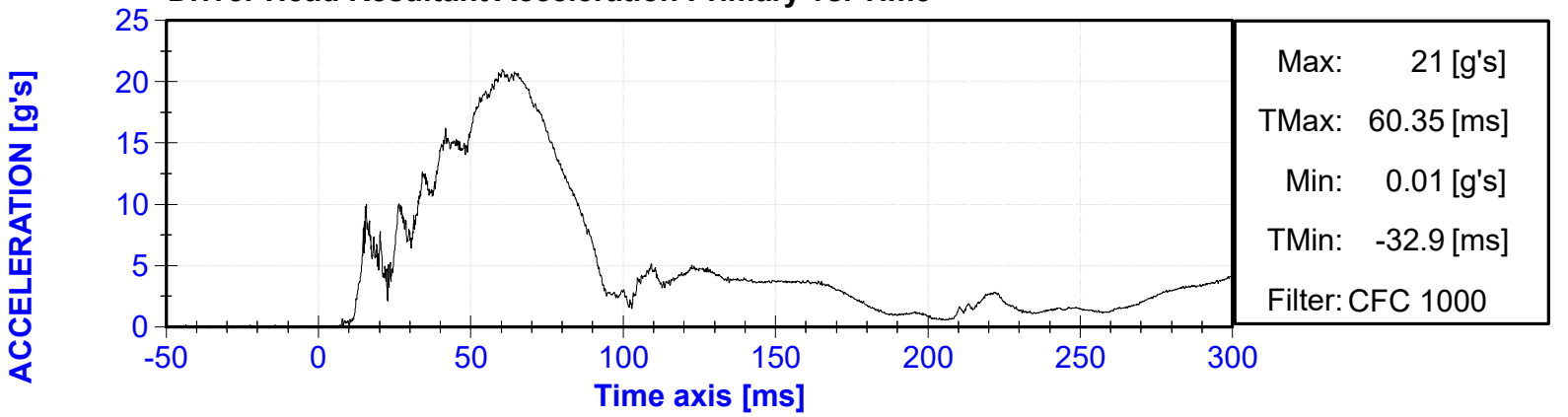
Driver Head Acceleration (Y) Primary vs. Time



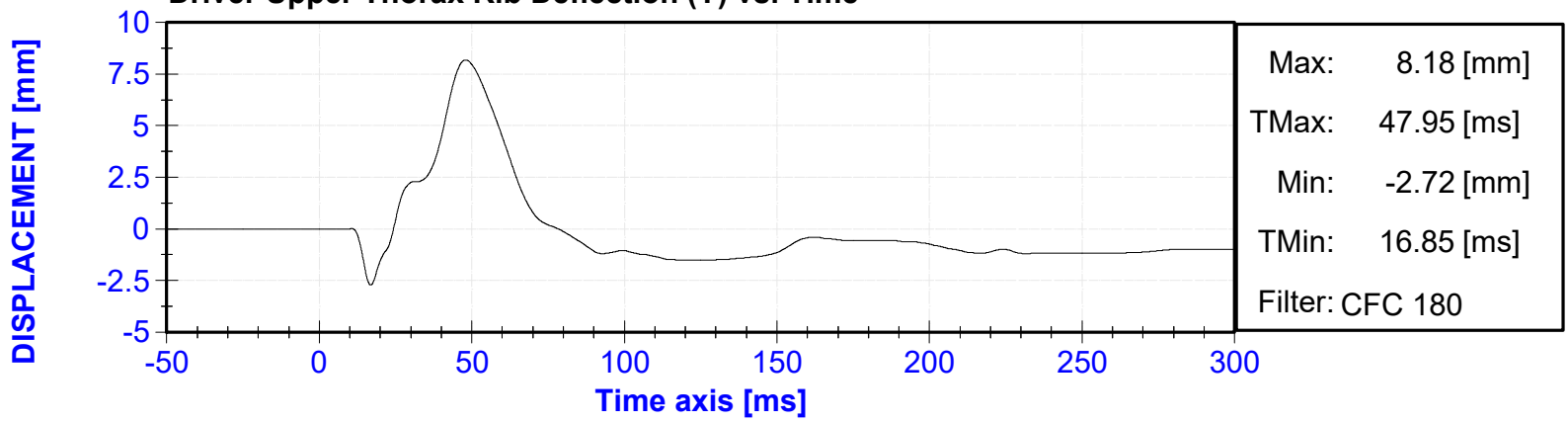
Driver Head Acceleration (Z) Primary vs. Time



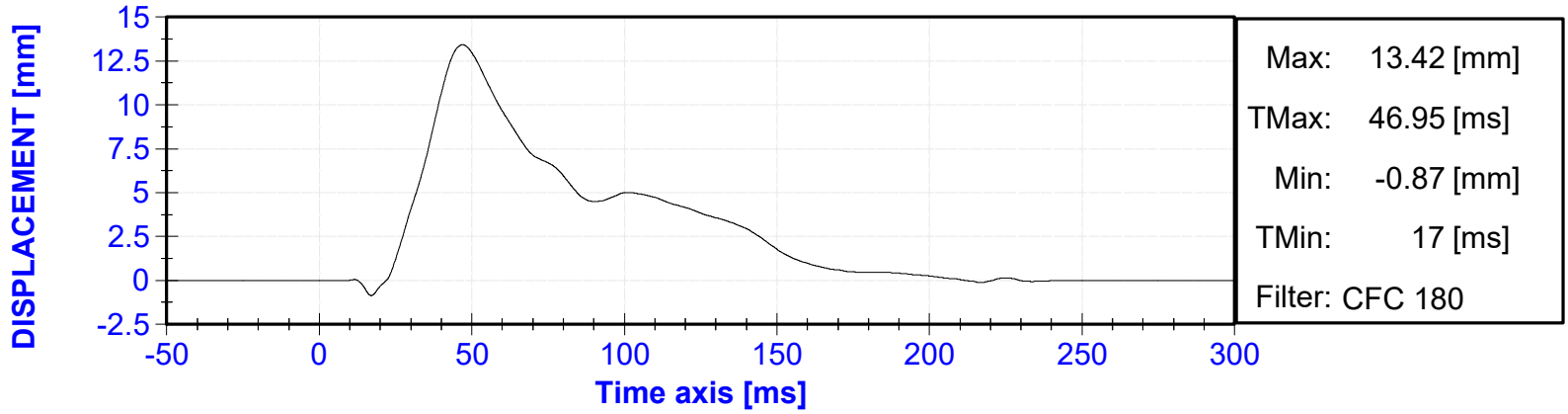
Driver Head Resultant Acceleration Primary vs. Time



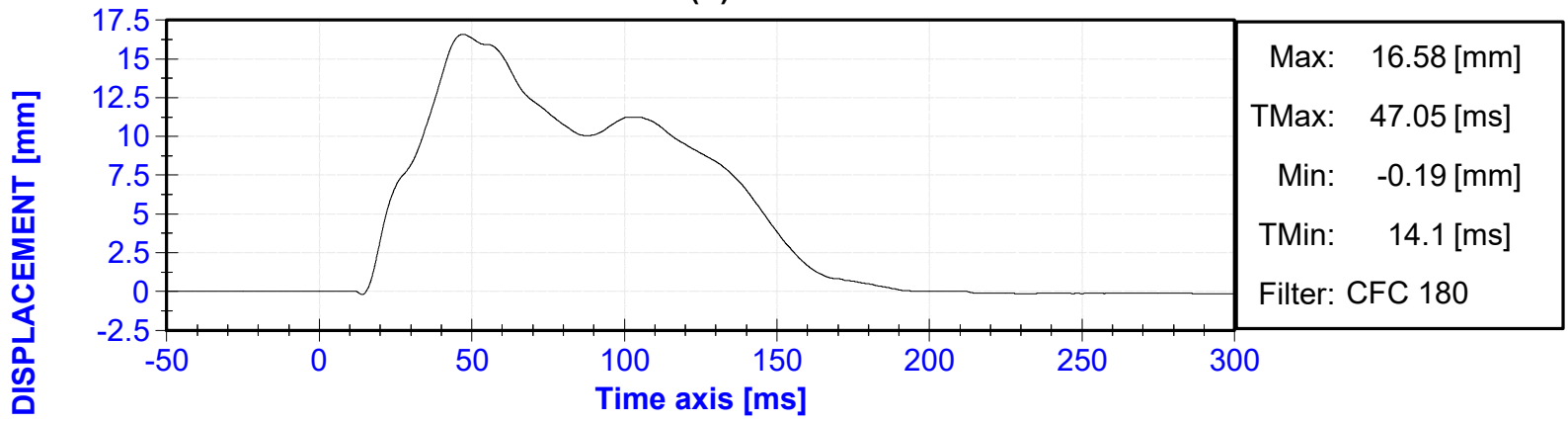
Driver Upper Thorax Rib Deflection (Y) vs. Time



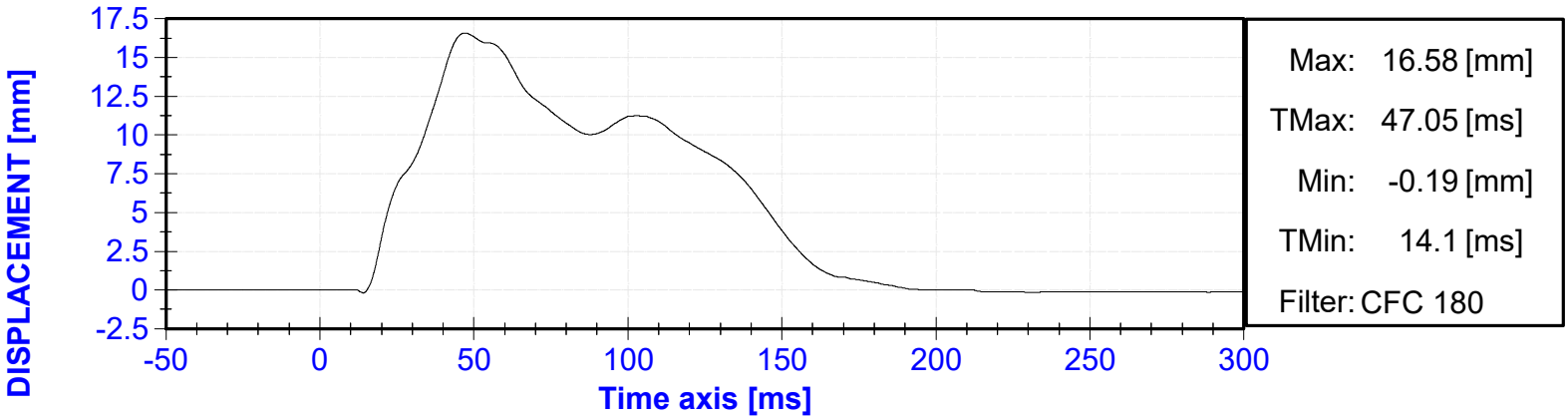
Driver Middle Thorax Rib Deflection (Y) vs. Time



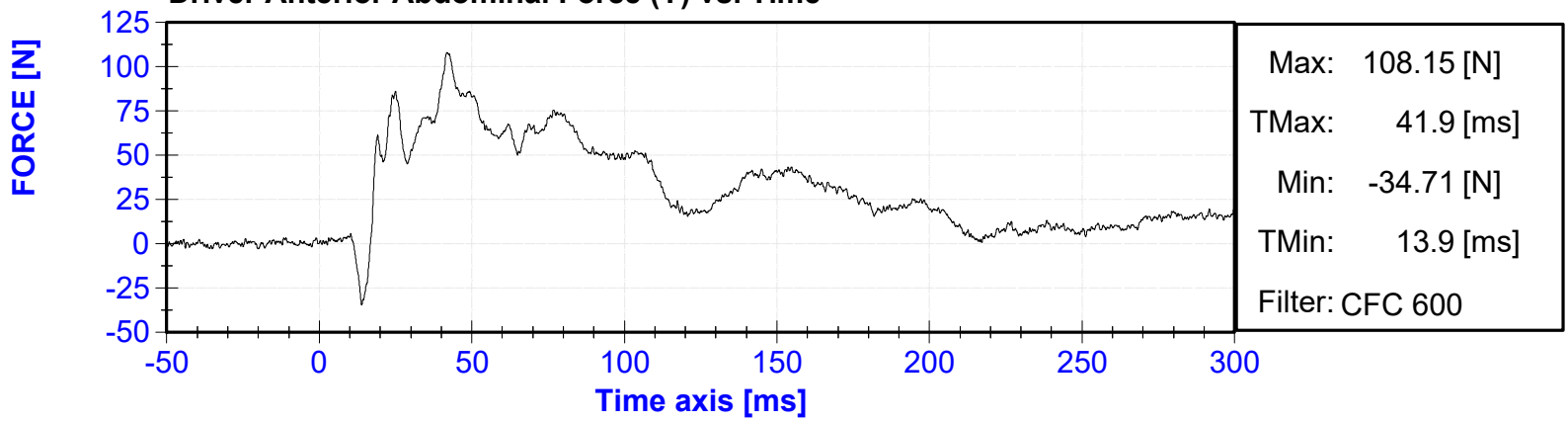
Driver Lower Thorax Rib Deflection (Y) vs. Time



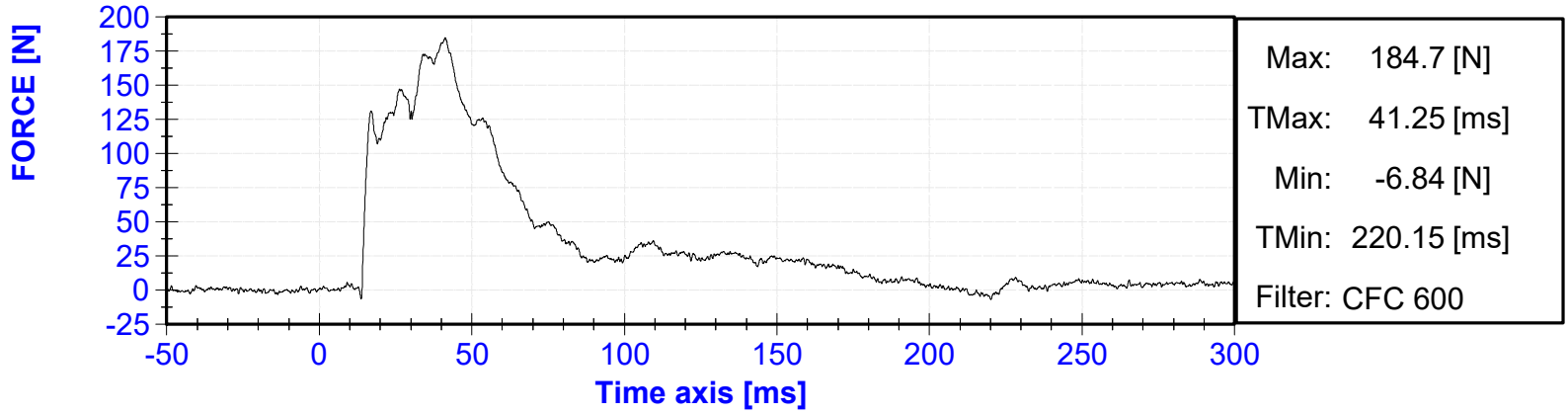
Driver Thorax Rib Deflection Maximum vs. Time



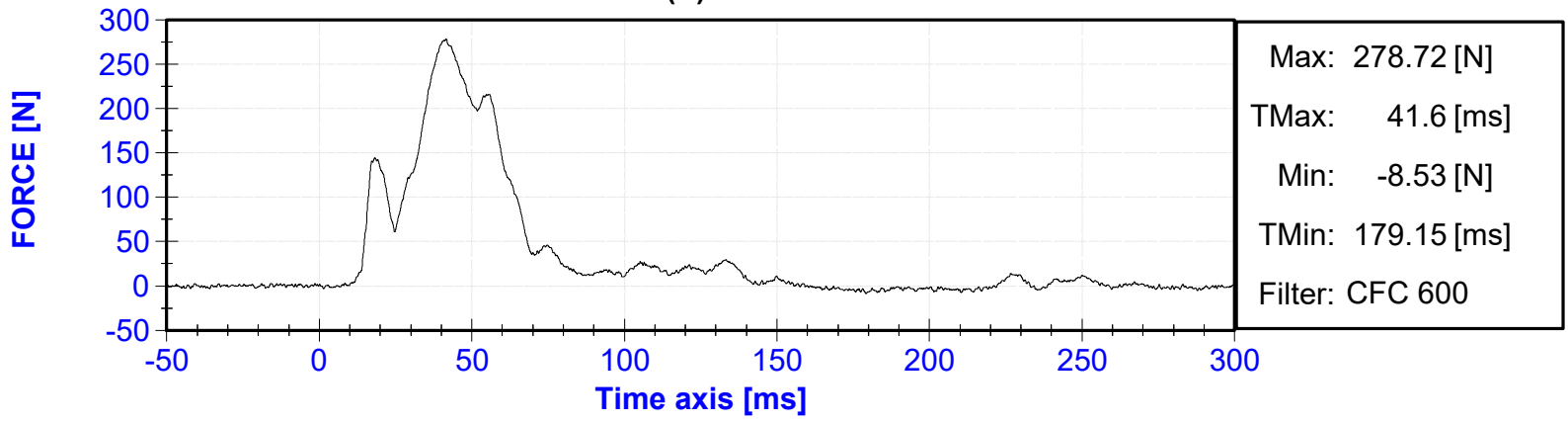
Driver Anterior Abdominal Force (Y) vs. Time



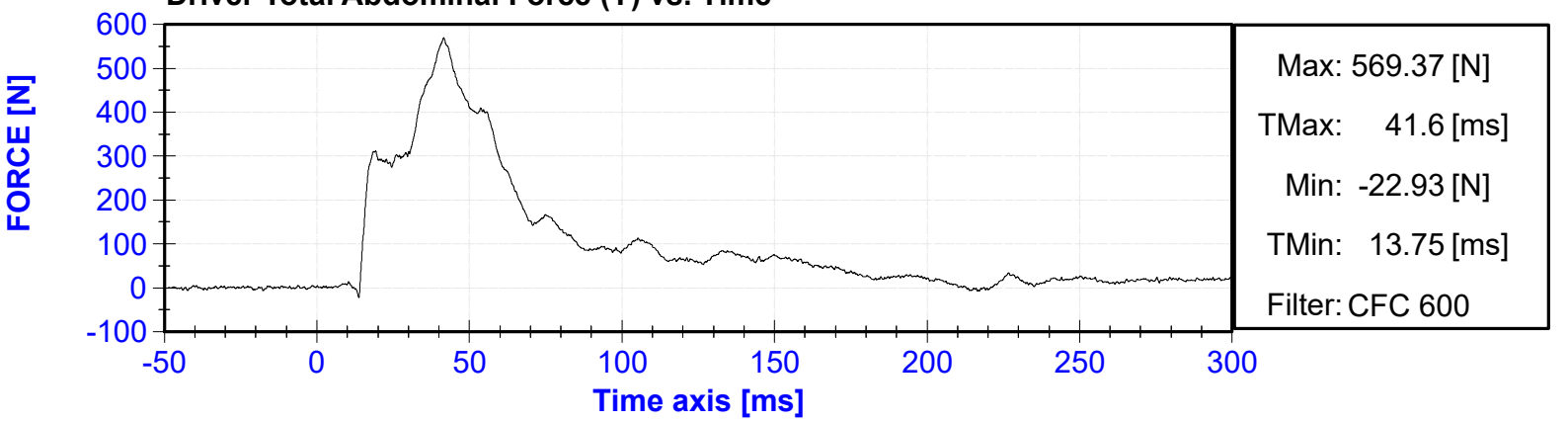
Driver Middle Abdominal Force (Y) vs. Time



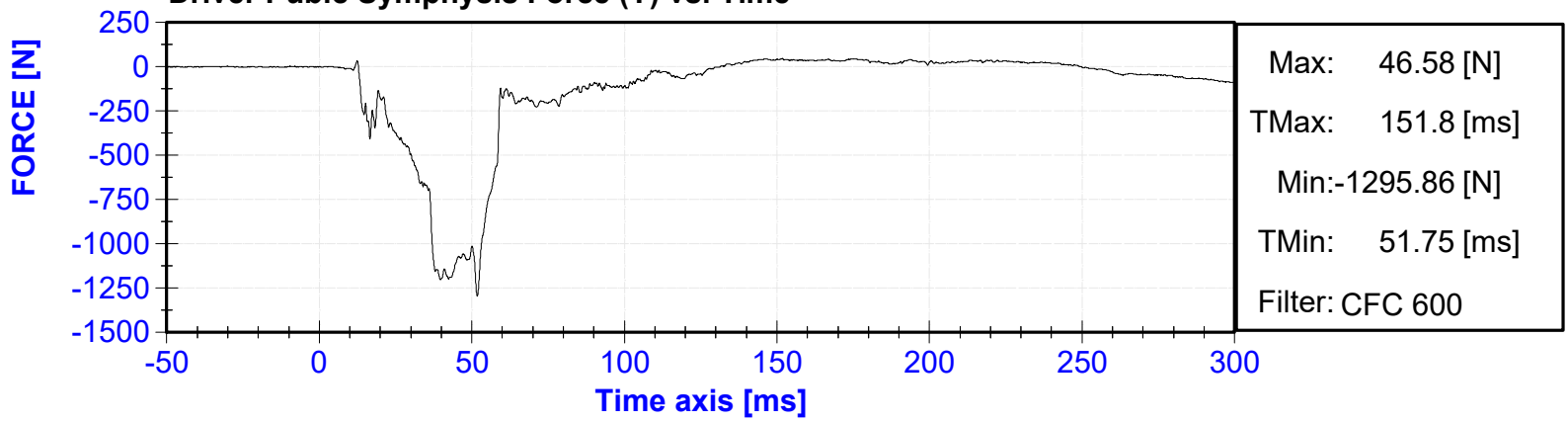
Driver Posterior Abdominal Force (Y) vs. Time



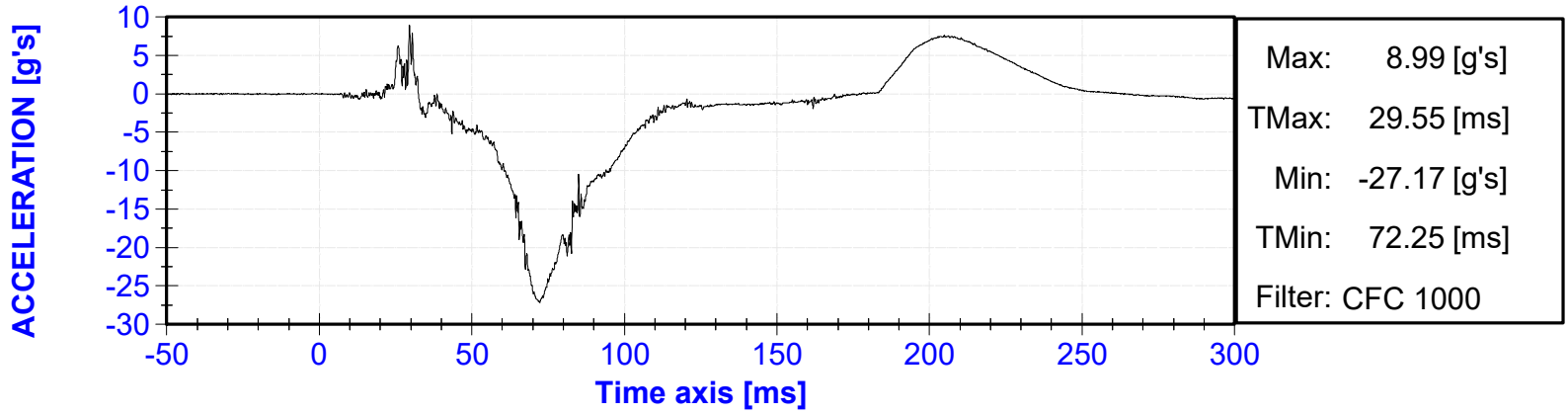
Driver Total Abdominal Force (Y) vs. Time



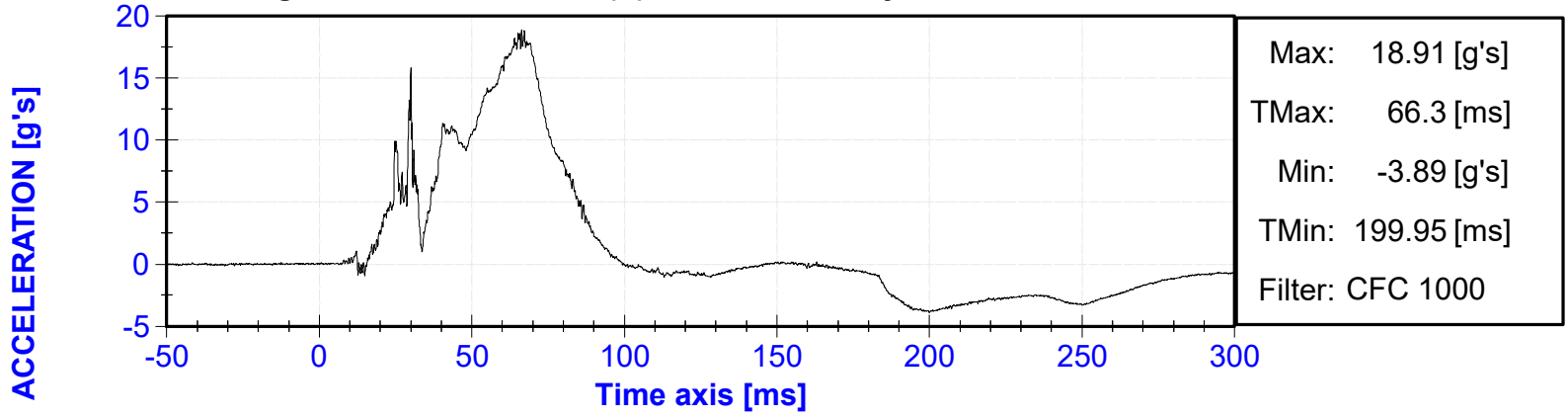
Driver Pubic Symphysis Force (Y) vs. Time



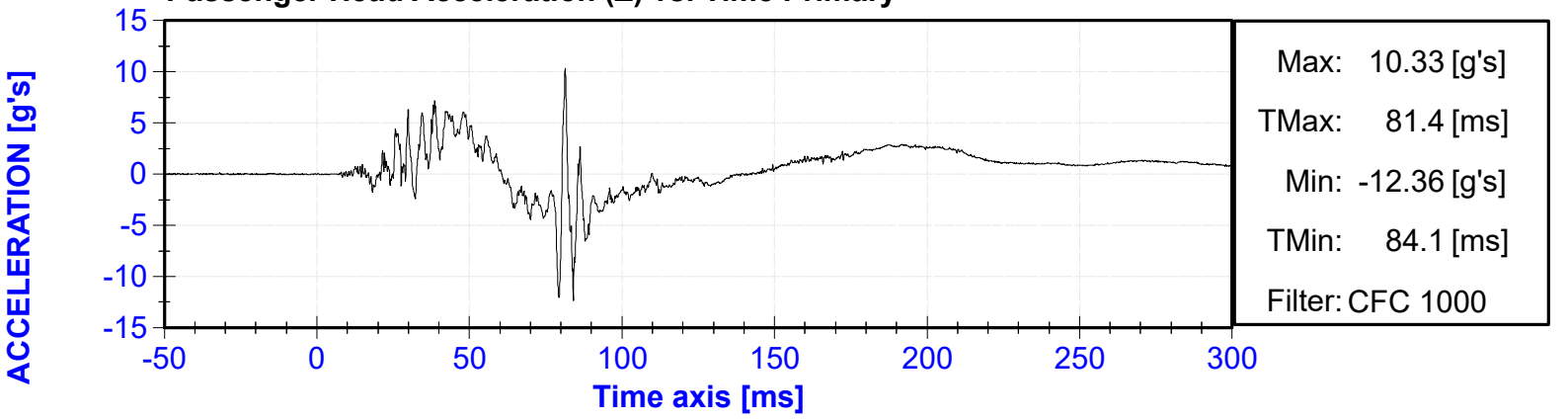
Passenger Head Acceleration (X) vs. Time Primary



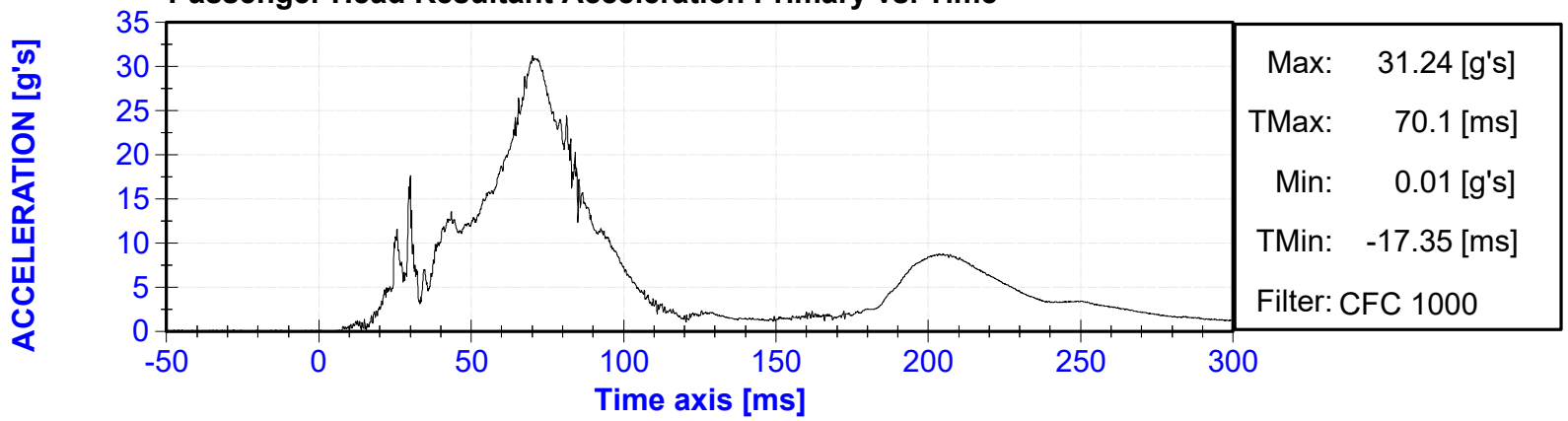
Passenger Head Acceleration (Y) vs. Time Primary



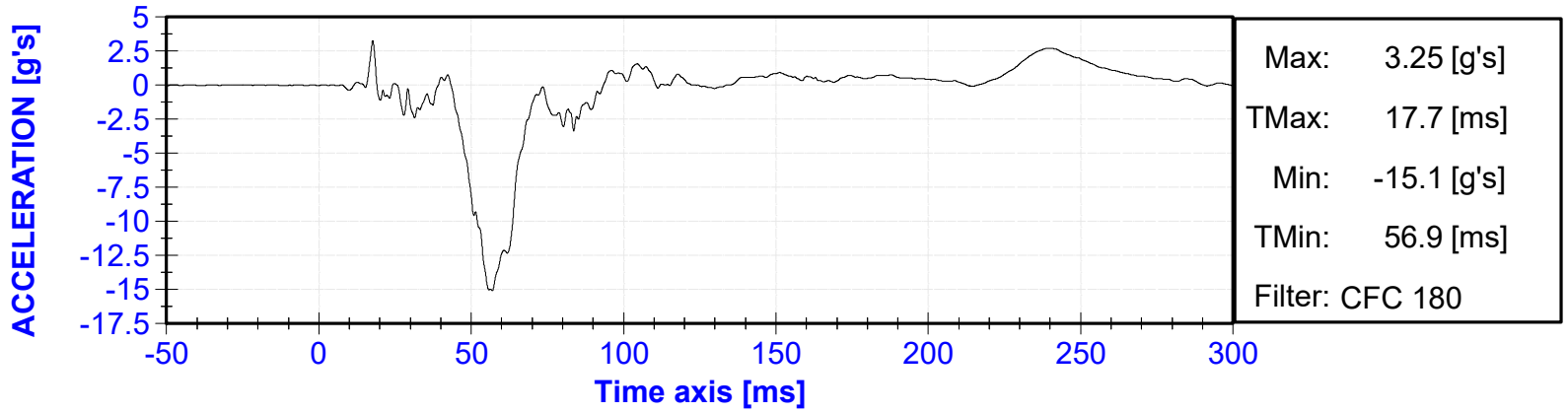
Passenger Head Acceleration (Z) vs. Time Primary



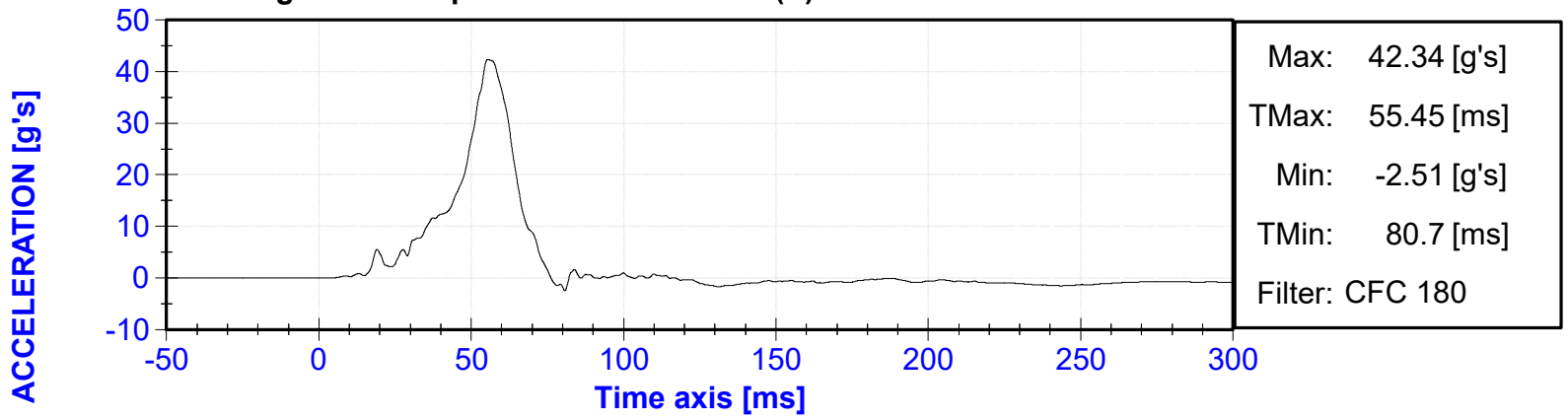
Passenger Head Resultant Acceleration Primary vs. Time



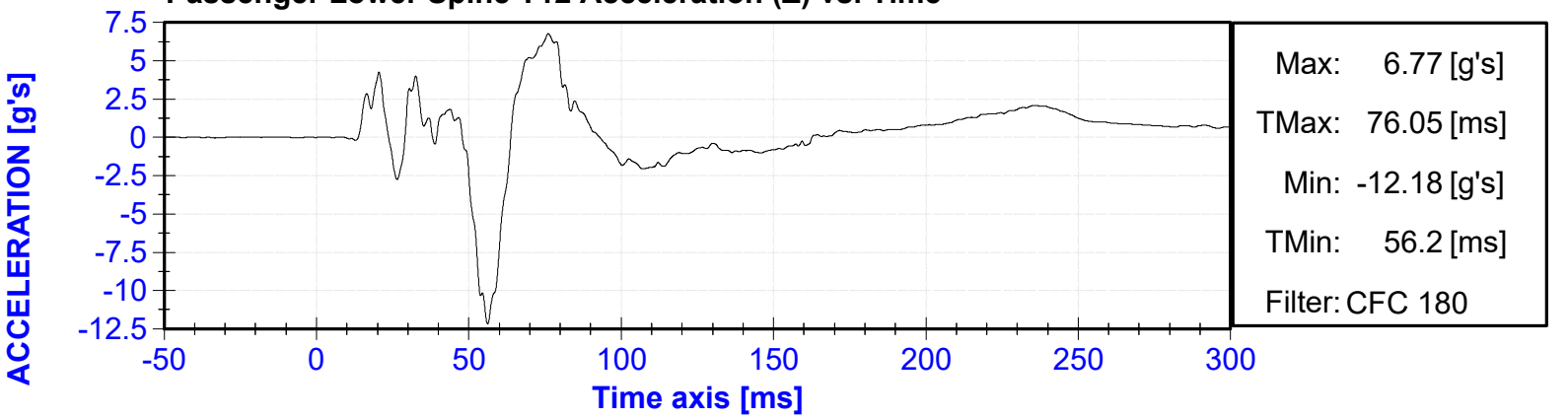
Passenger Lower Spine T12 Acceleration (X) vs. Time



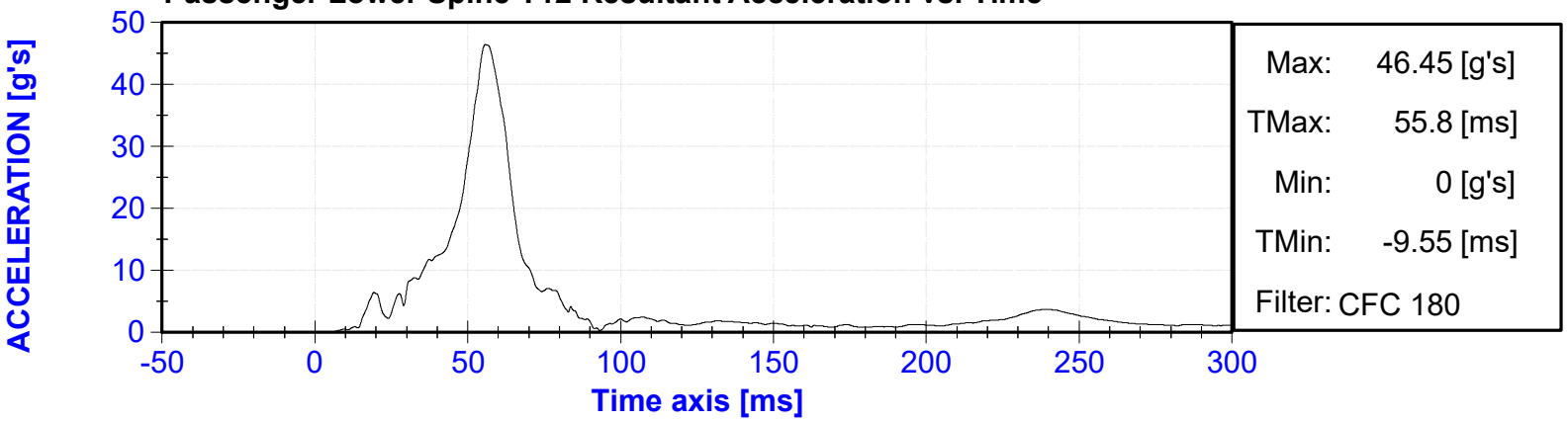
Passenger Lower Spine T12 Acceleration (Y) vs. Time



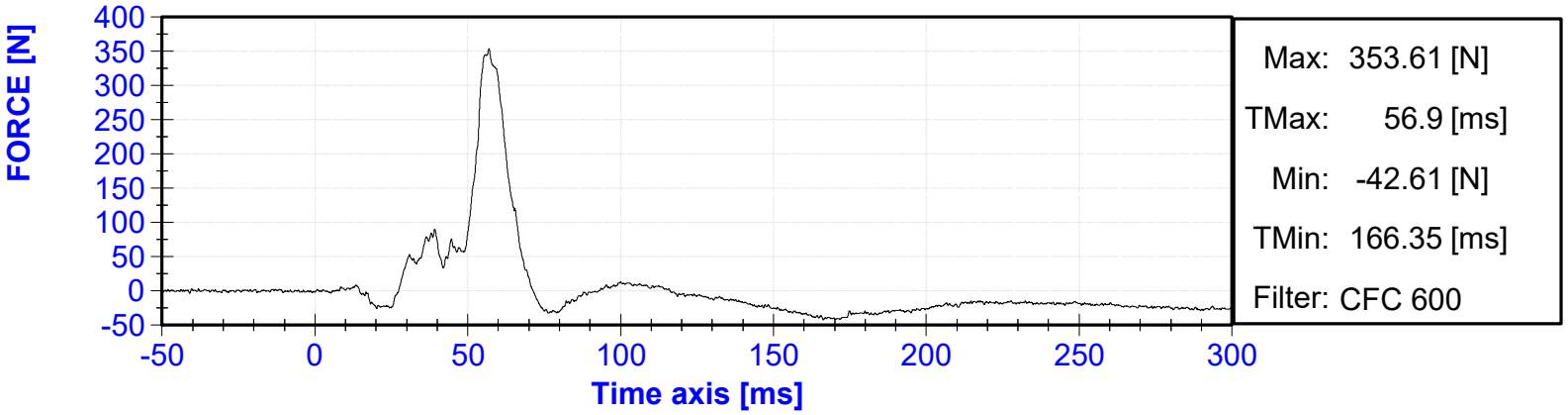
Passenger Lower Spine T12 Acceleration (Z) vs. Time



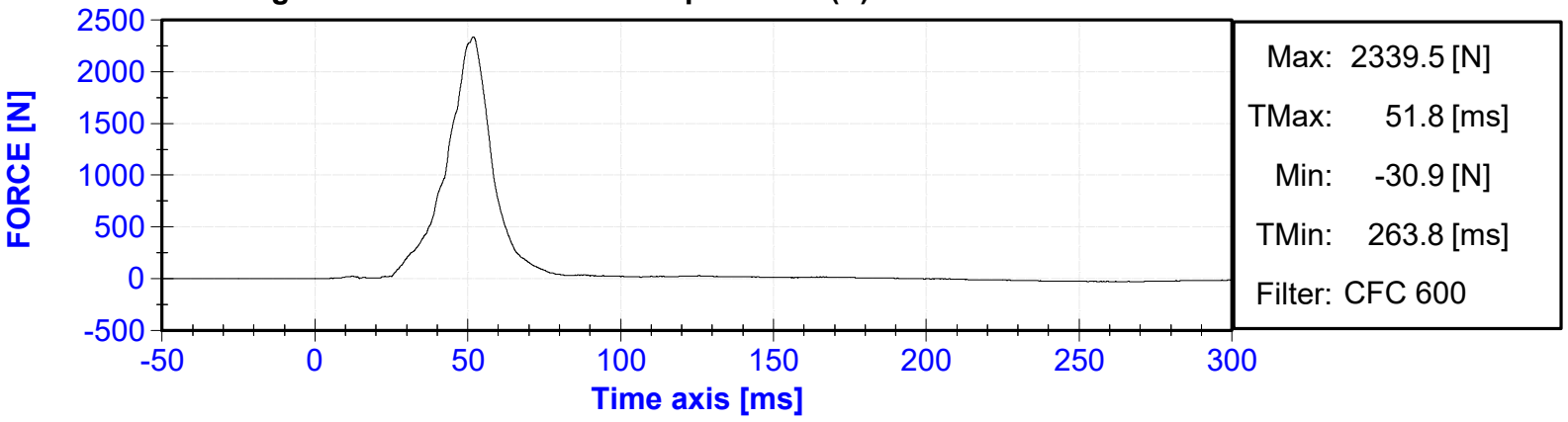
Passenger Lower Spine T12 Resultant Acceleration vs. Time



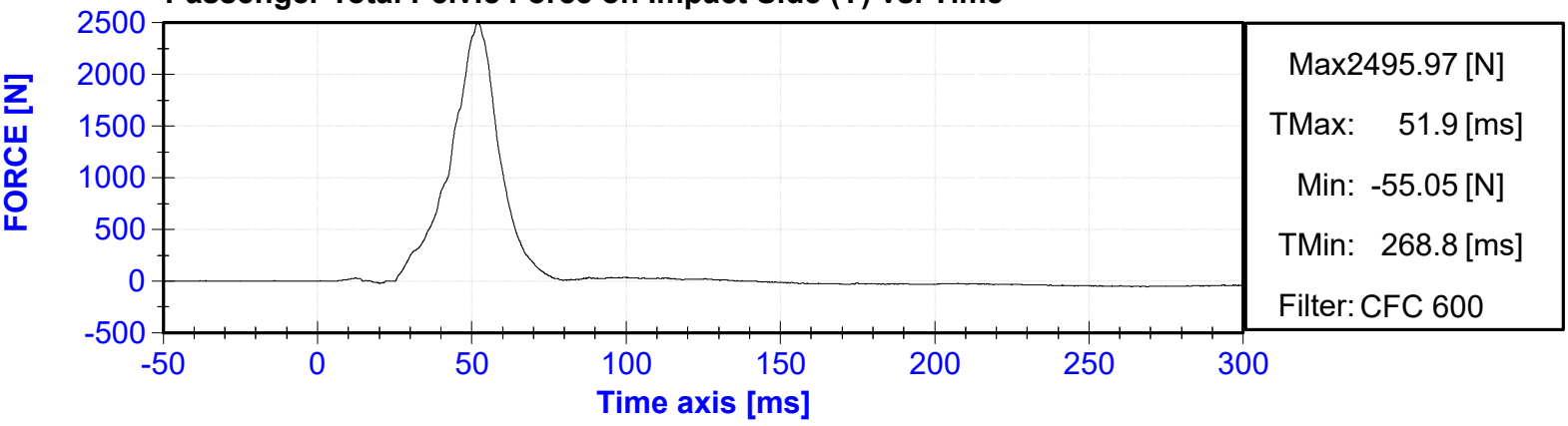
Passenger Iliac Force on Impact Side (Y) vs. Time



Passenger Acetabulum Force on Impact Side (Y) vs. Time



Passenger Total Pelvic Force on Impact Side (Y) vs. Time



APPENDIX C

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

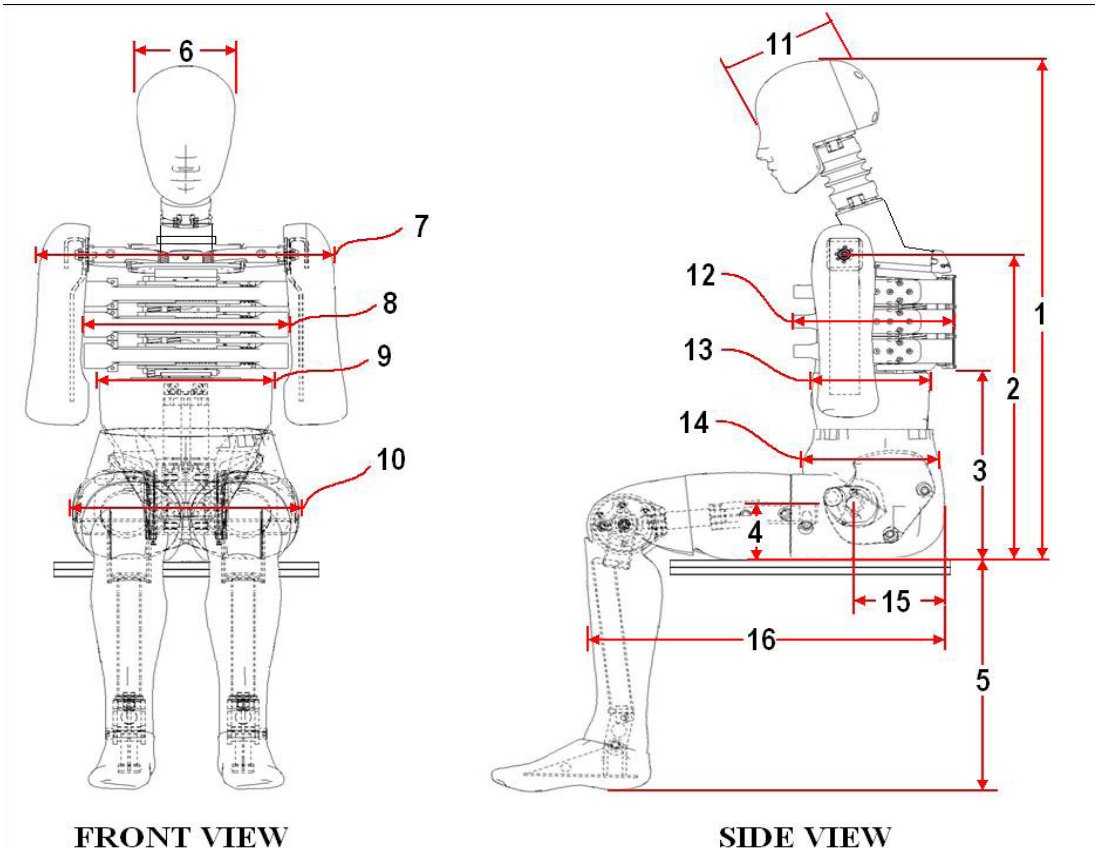
SERIAL NO:F033

(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - EuroSID-2re

Technician: K. Brogan Date: 11/28/2023

Dummy Serial Number: F033



FRONT VIEW SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	912	Pass
2	Seat to Shoulder Joint	558	572	567	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	353	Pass
4	Seat to Hip Joint (center of bolt)	97	103	99	Pass
5	Sole to Seat, Sitting	333	451	424	Pass
6	Head Width	152	158	155	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	280	Pass
10	Pelvis Lap Width	359	373	367	Pass
11	Head Depth	196	206	201	Pass
12	Thorax Depth	262	272	267	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	241	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	156	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

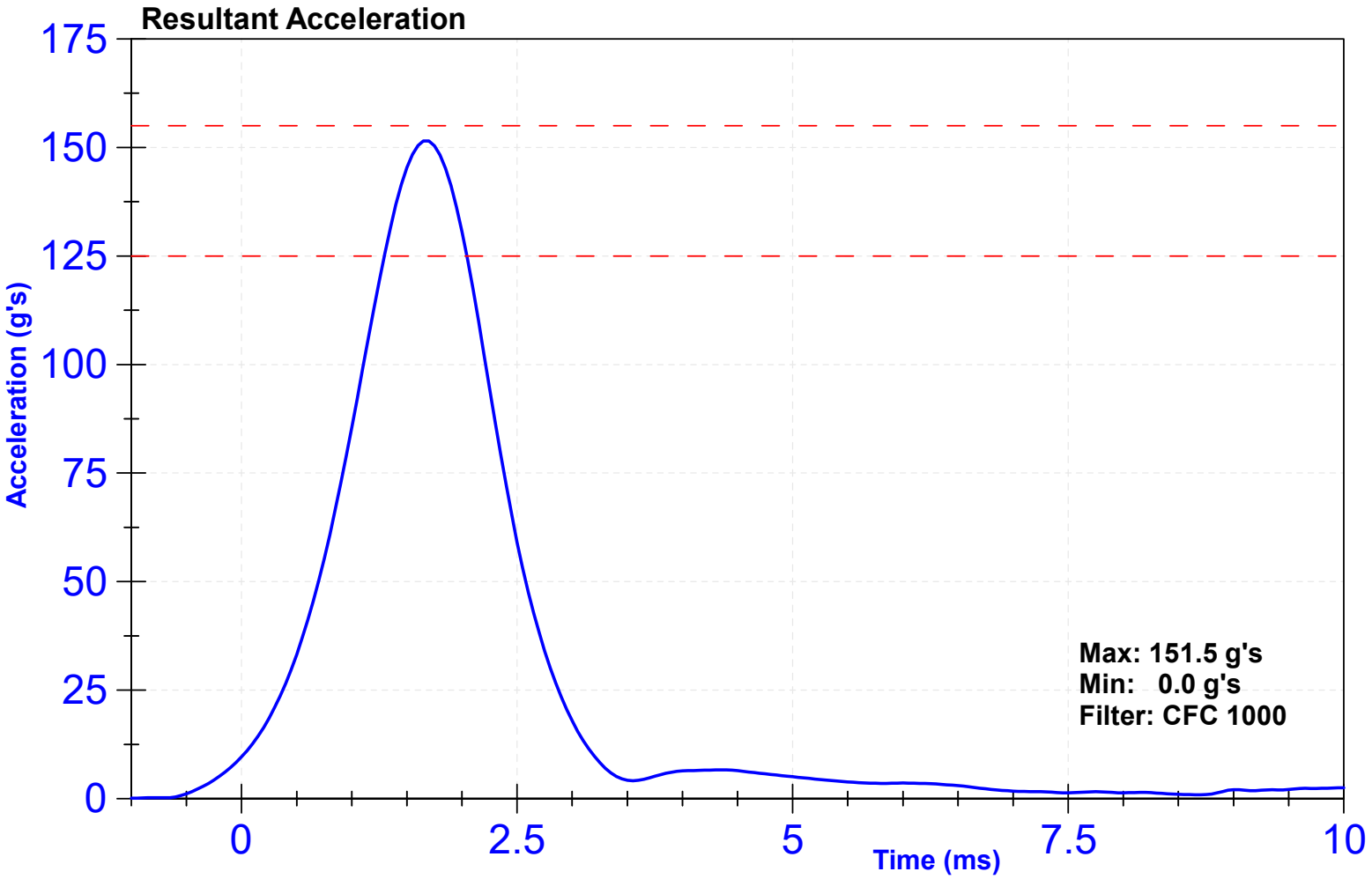
ATD Manufacturer	FTSS	Test Technician	J. Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

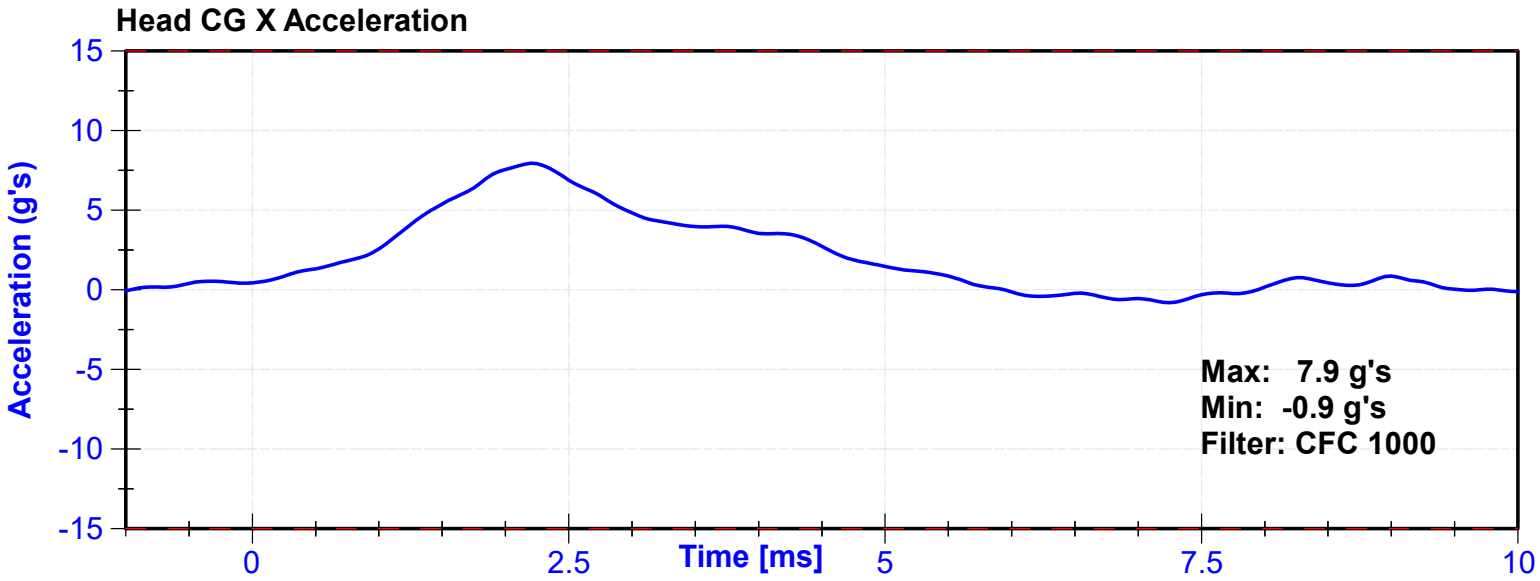
Results

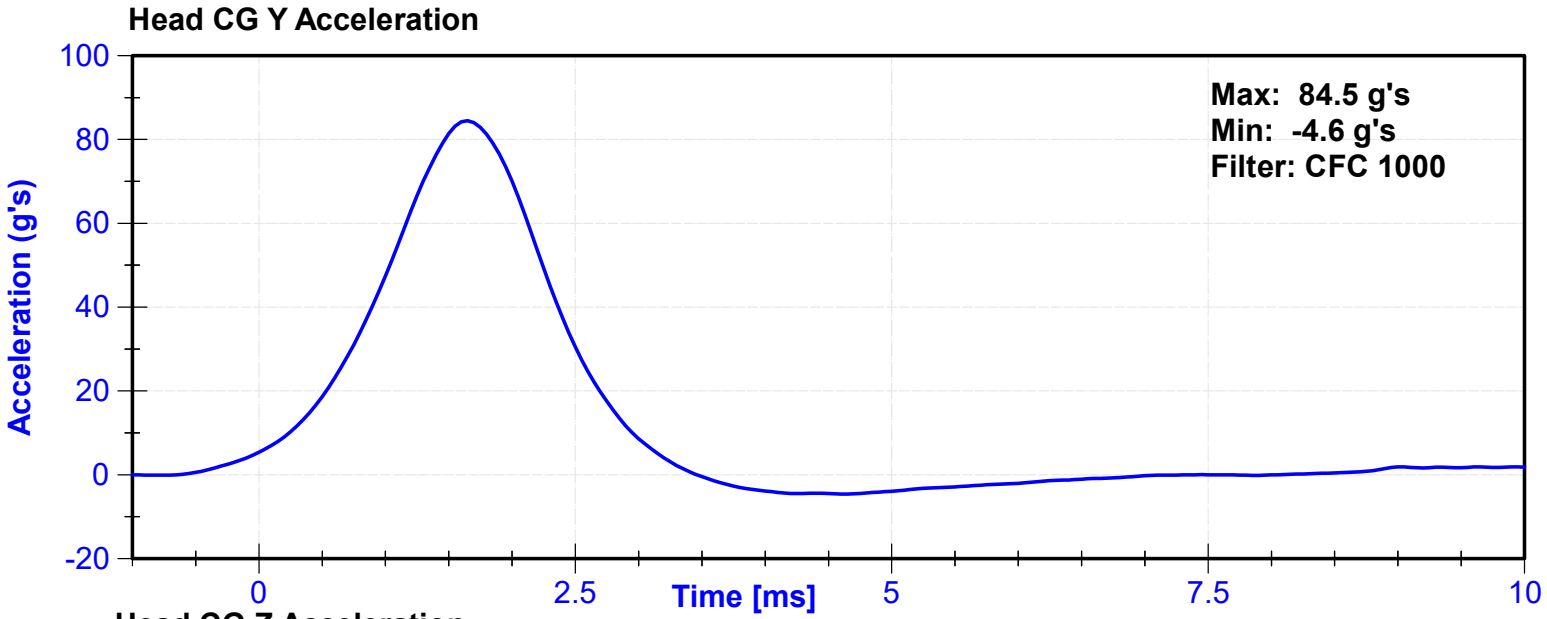
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	48	Pass
Resultant Acceleration	125	155	g's	151.5	Pass
Oscillation	0	15	%	4.37	Pass
Fore-Aft Acceleration	-15	15	g's	7.9	Pass

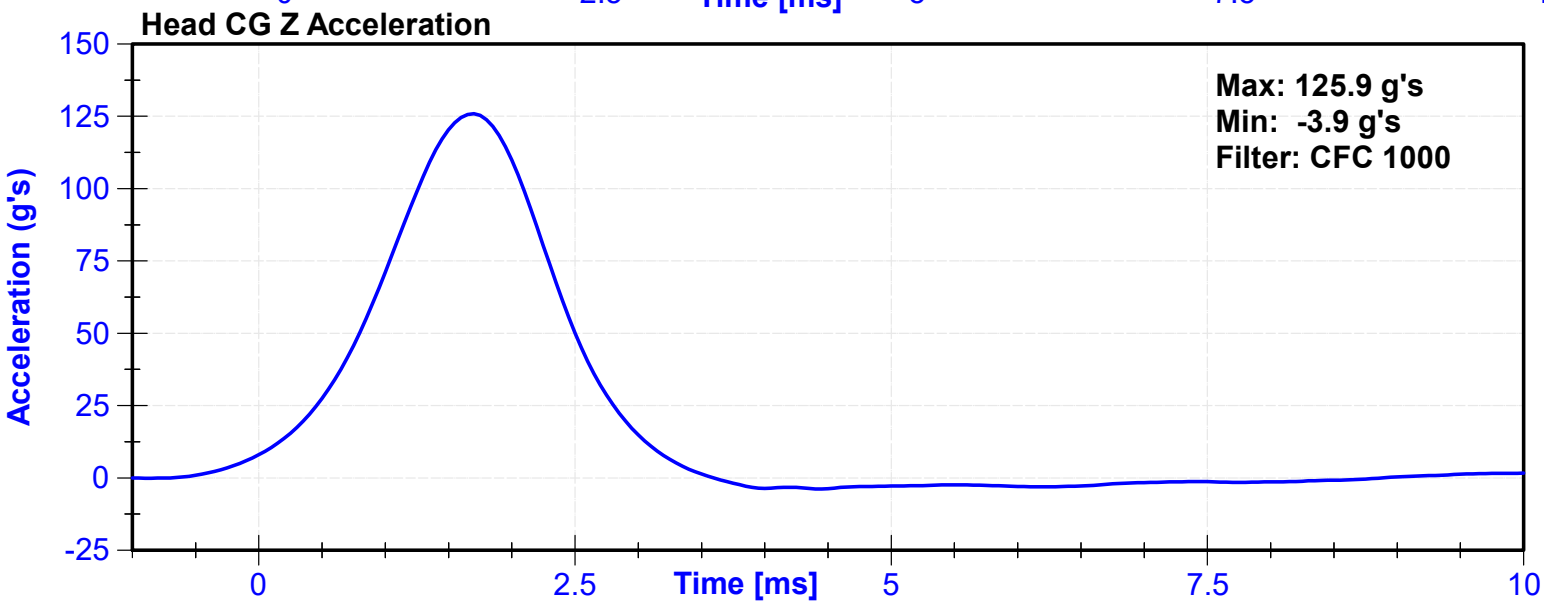
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Measurement Specialties	MS26716	8/29/2023	2/25/2024
Y Accelerometer	Measurement Specialties	MS26106	10/10/2023	4/7/2024
Z Accelerometer	Measurement Specialties	A255567	8/29/2023	2/25/2024




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
Time [ms]
5
7.5
10
Max: 7.9 g's
Min: -0.9 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
Time [ms]
5
7.5
10
Max: 84.5 g's
Min: -4.6 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
150
125
100
75
50
25
0
-25
0
2.5
Time [ms]
5
7.5
10
Max: 125.9 g's
Min: -3.9 g's
Filter: CFC 1000

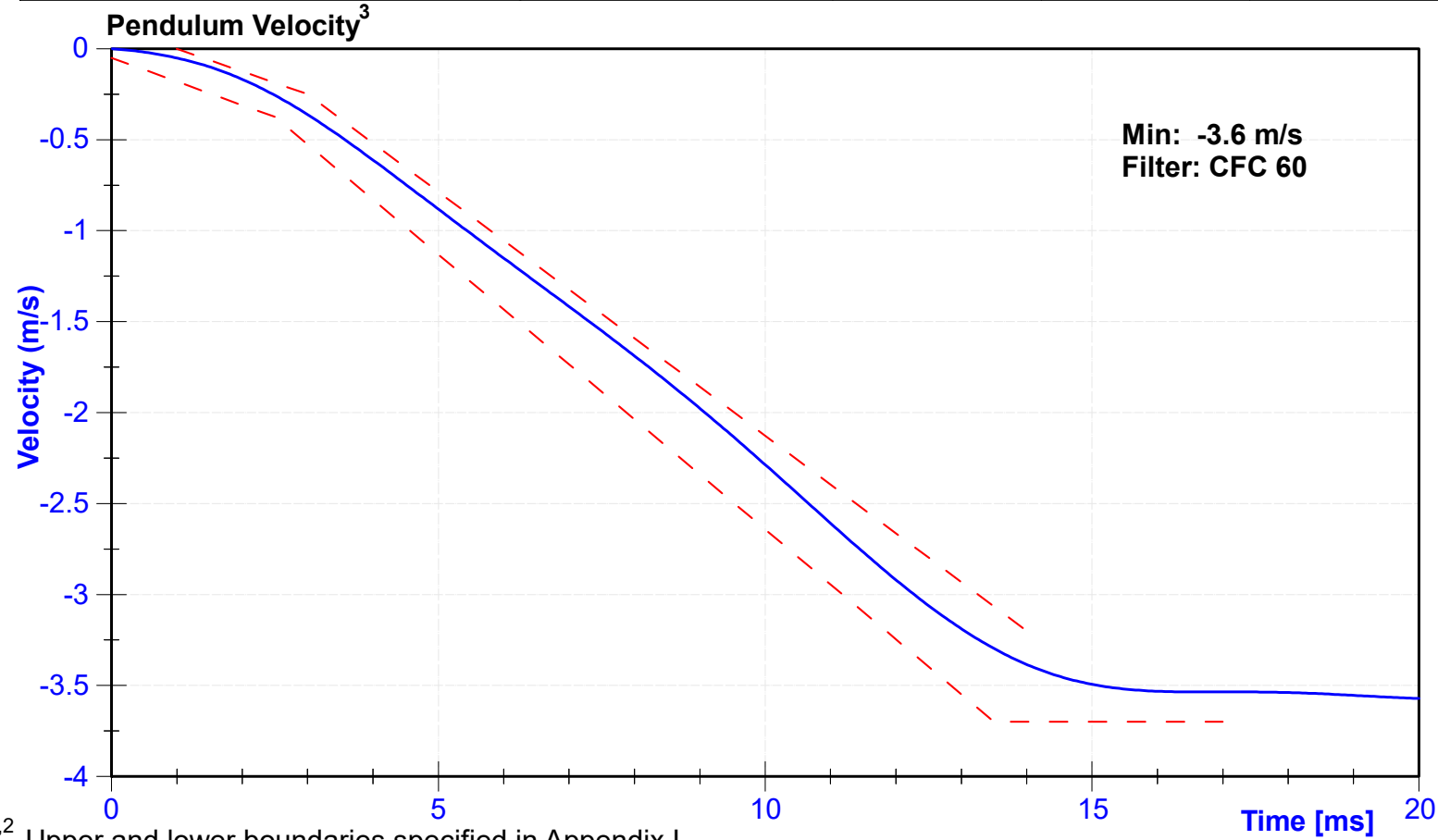
ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

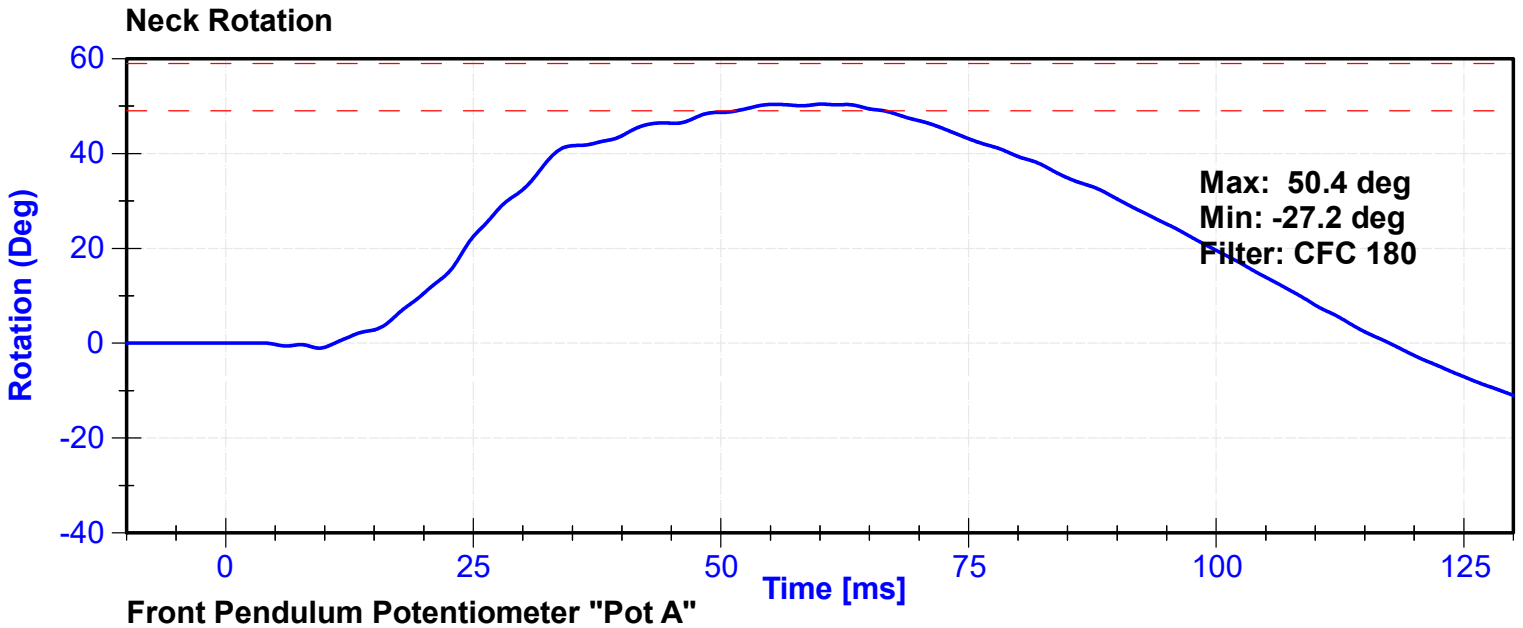
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	33	Pass
Velocity	3.3	3.5	m/s	3.34	Pass
Lateral Neck Rotation	49	59	deg	50.4	Pass
Time at Maximum Rotation	54	66	ms	60.2	Pass
Time of Rotation Decay from Maximum	53	88	ms	57.4	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

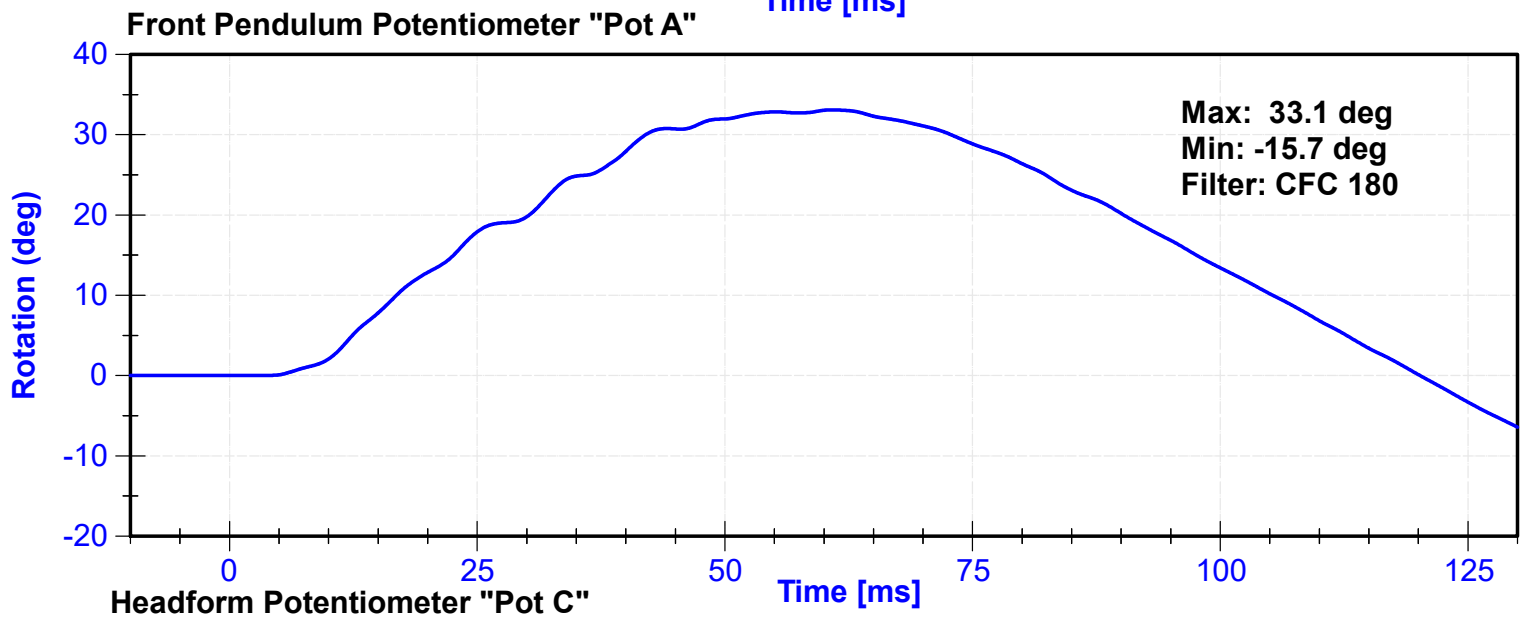
Transducer Calibrations

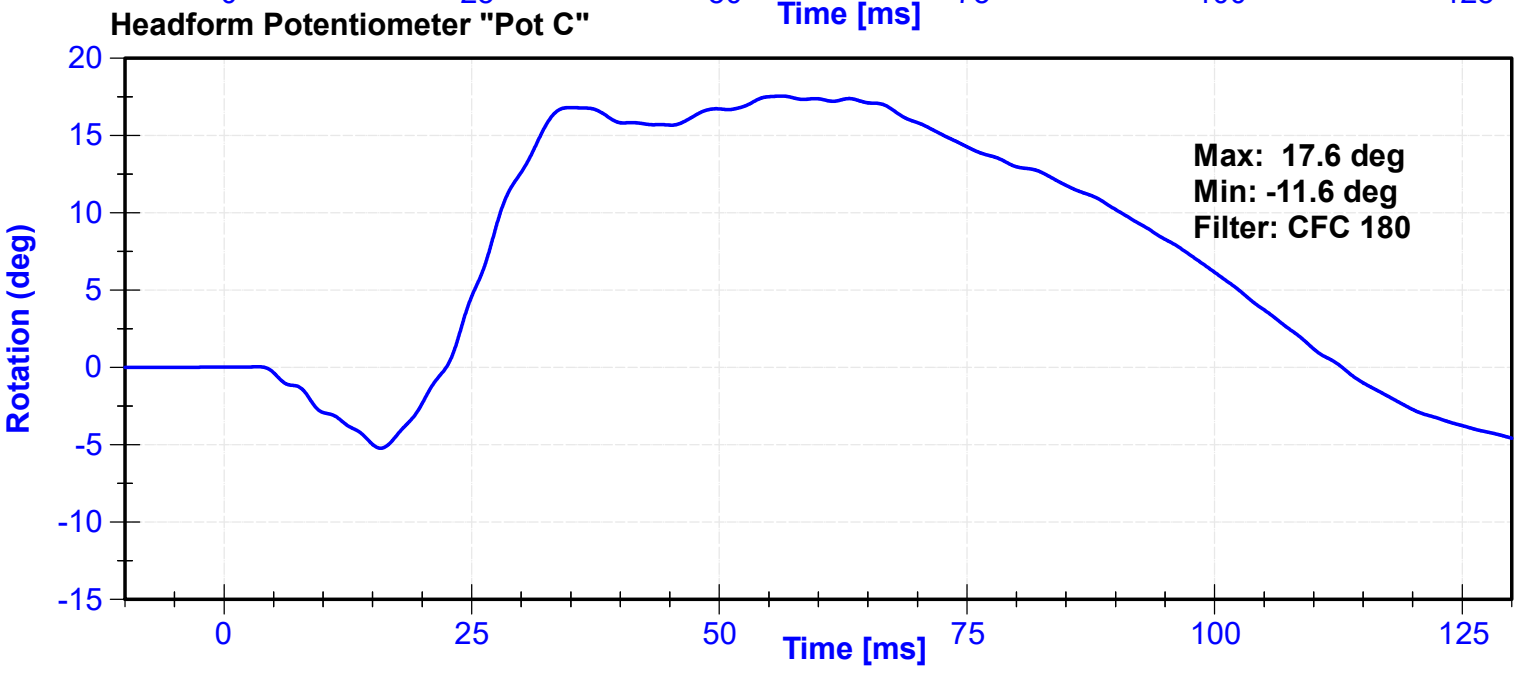
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/31/2023	4/28/2024
Front Pendulum Potentiometer	Sfernice	094	9/29/2023	9/28/2024
Headform Potentiometer	Sfernice	095	9/29/2023	9/28/2024



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


Neck Rotation
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]
Max: 50.4 deg
Min: -27.2 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: 33.1 deg
Min: -15.7 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: 17.6 deg
Min: -11.6 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

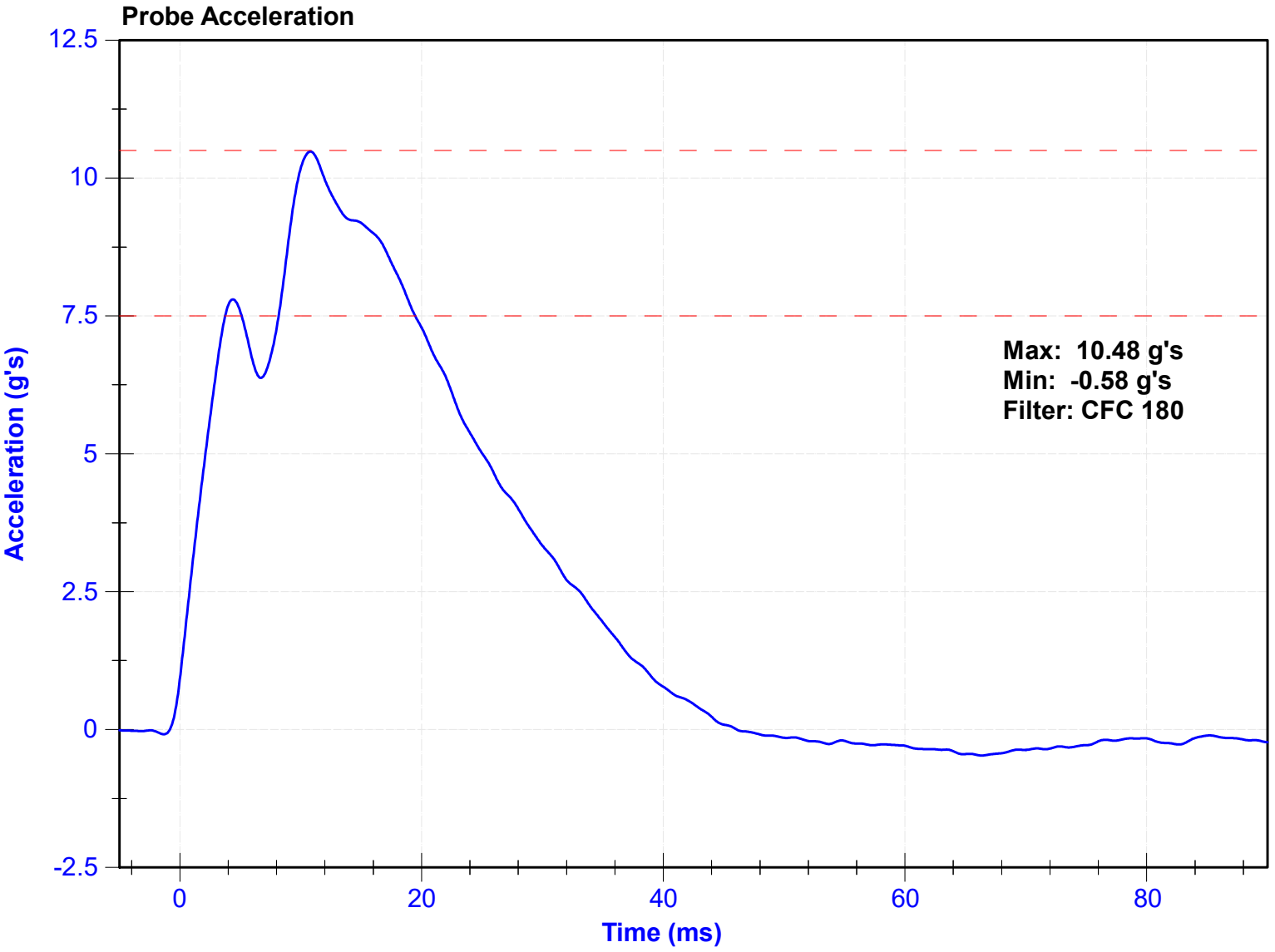
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	59.4	Pass
Velocity	4.2	4.4	m/s	4.26	Pass
Probe Acceleration	7.5	10.5	g's	10.48	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18587	11/20/2023	5/18/2024



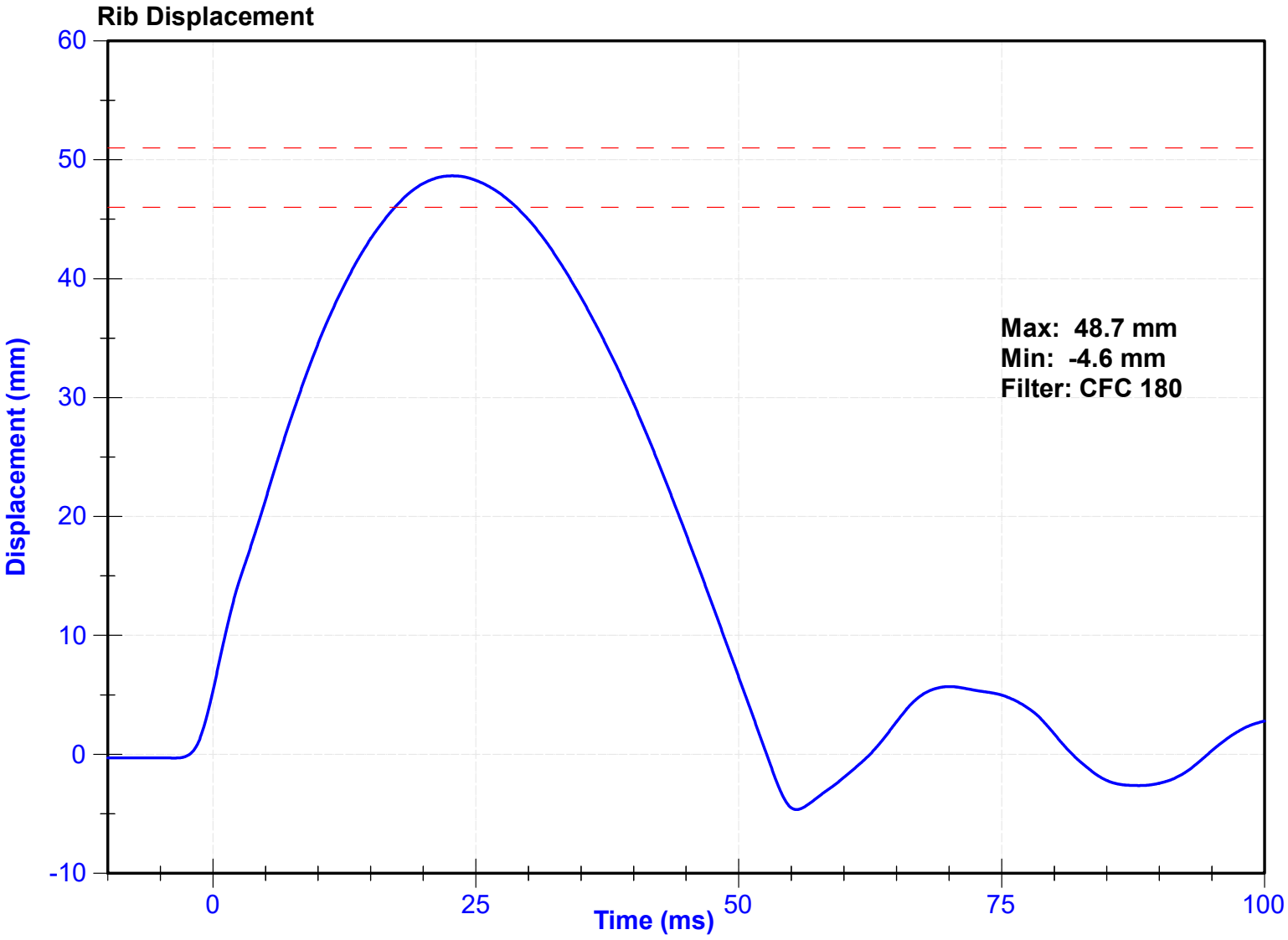
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C.Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	46	51	mm	48.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	179GFE	11/17/2023	5/17/2024



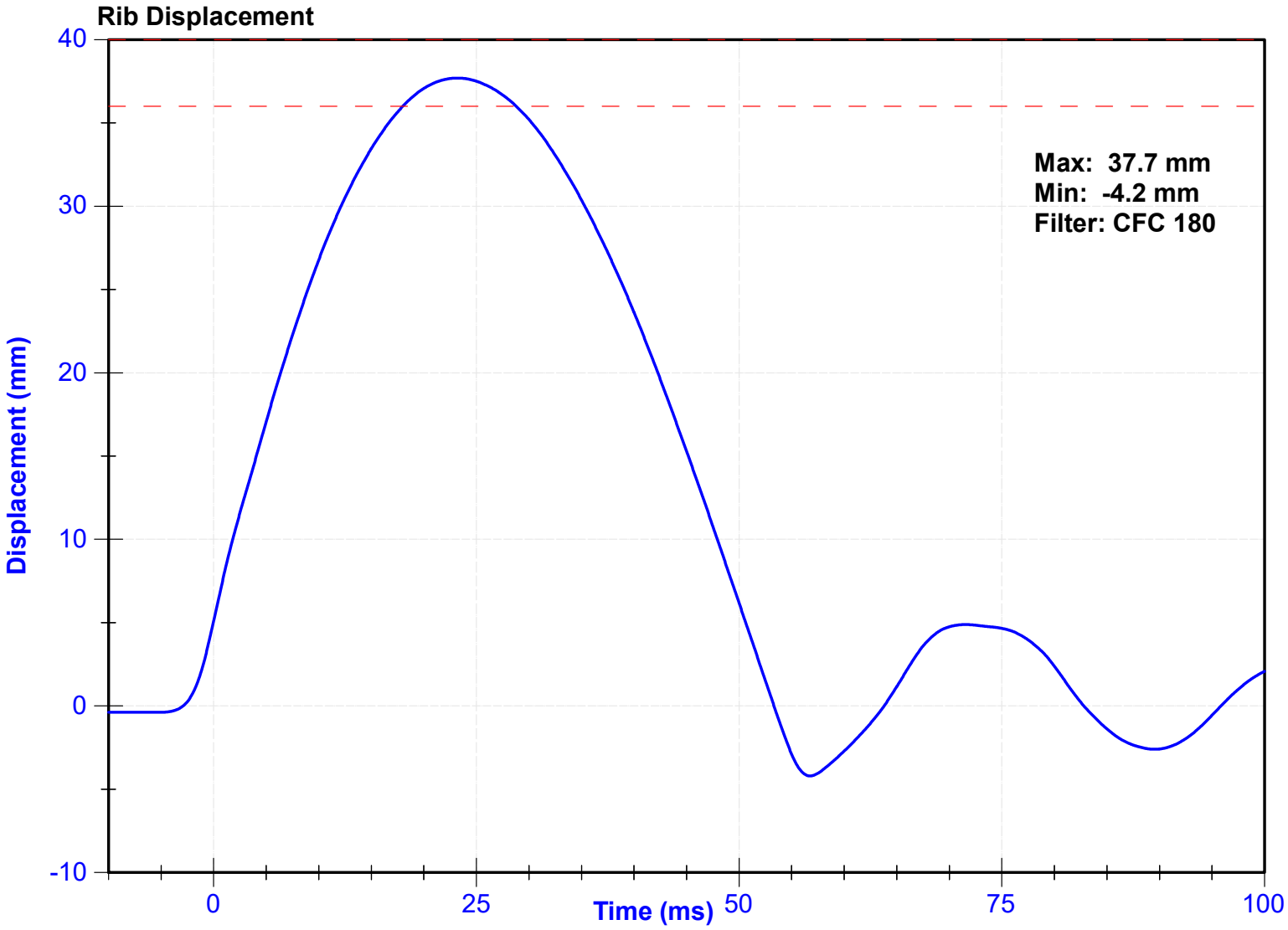
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C.Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	36	40	mm	37.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	179GFE	11/17/2023	5/17/2024



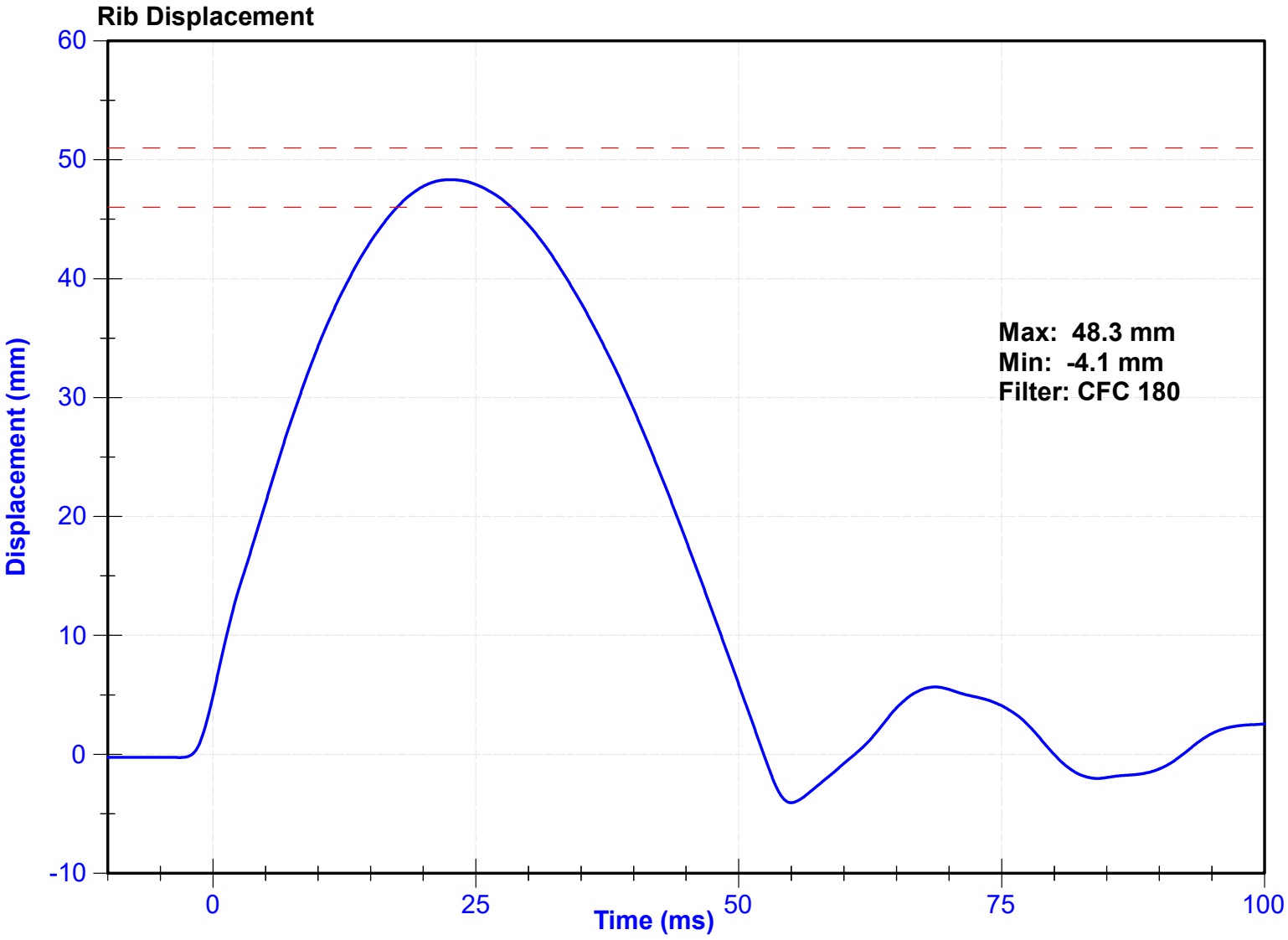
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C.Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	46	51	mm	48.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	185GFE	11/17/2023	5/17/2024



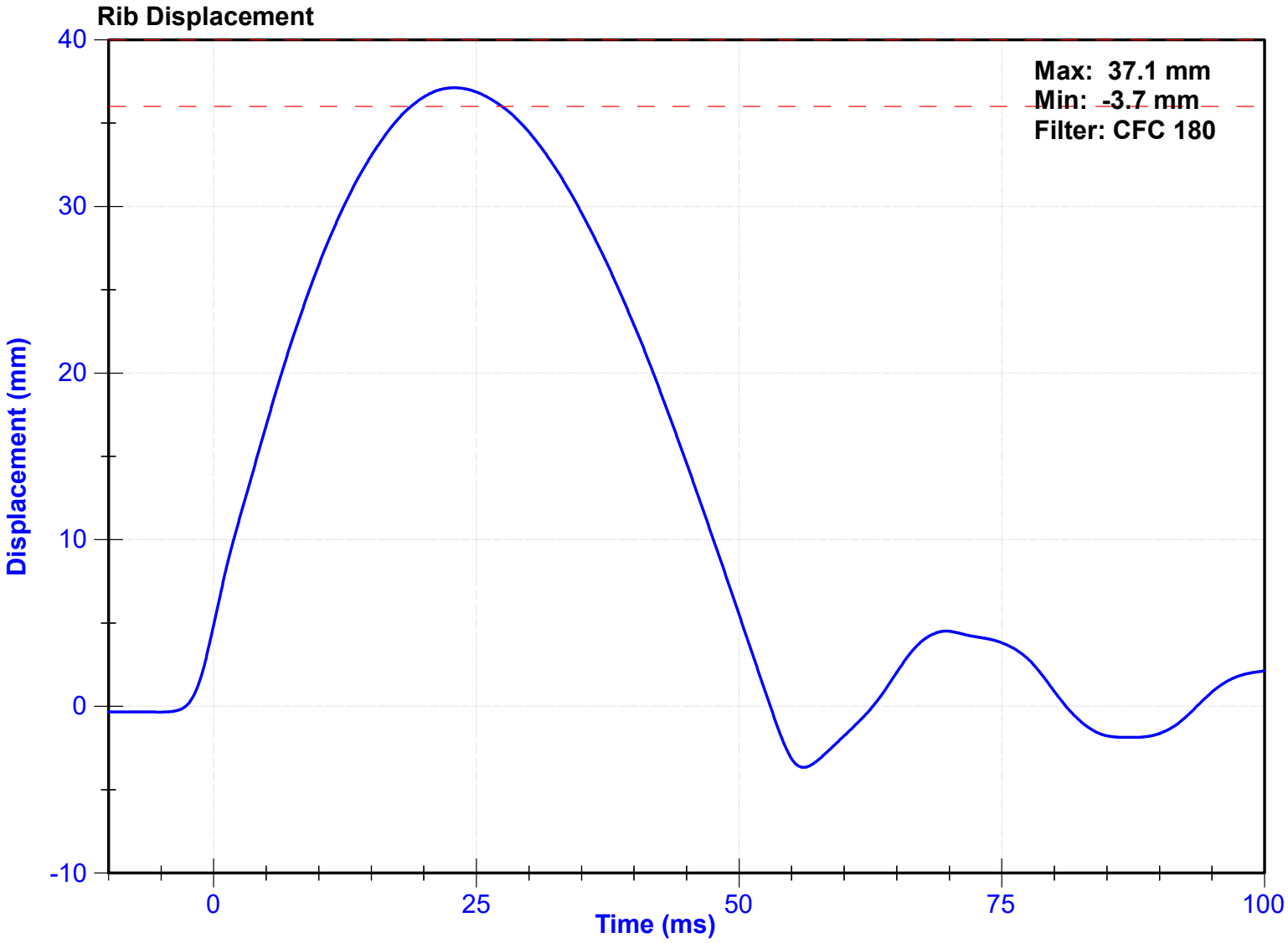
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C.Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	36	40	mm	37.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	185GFE	11/17/2023	5/17/2024



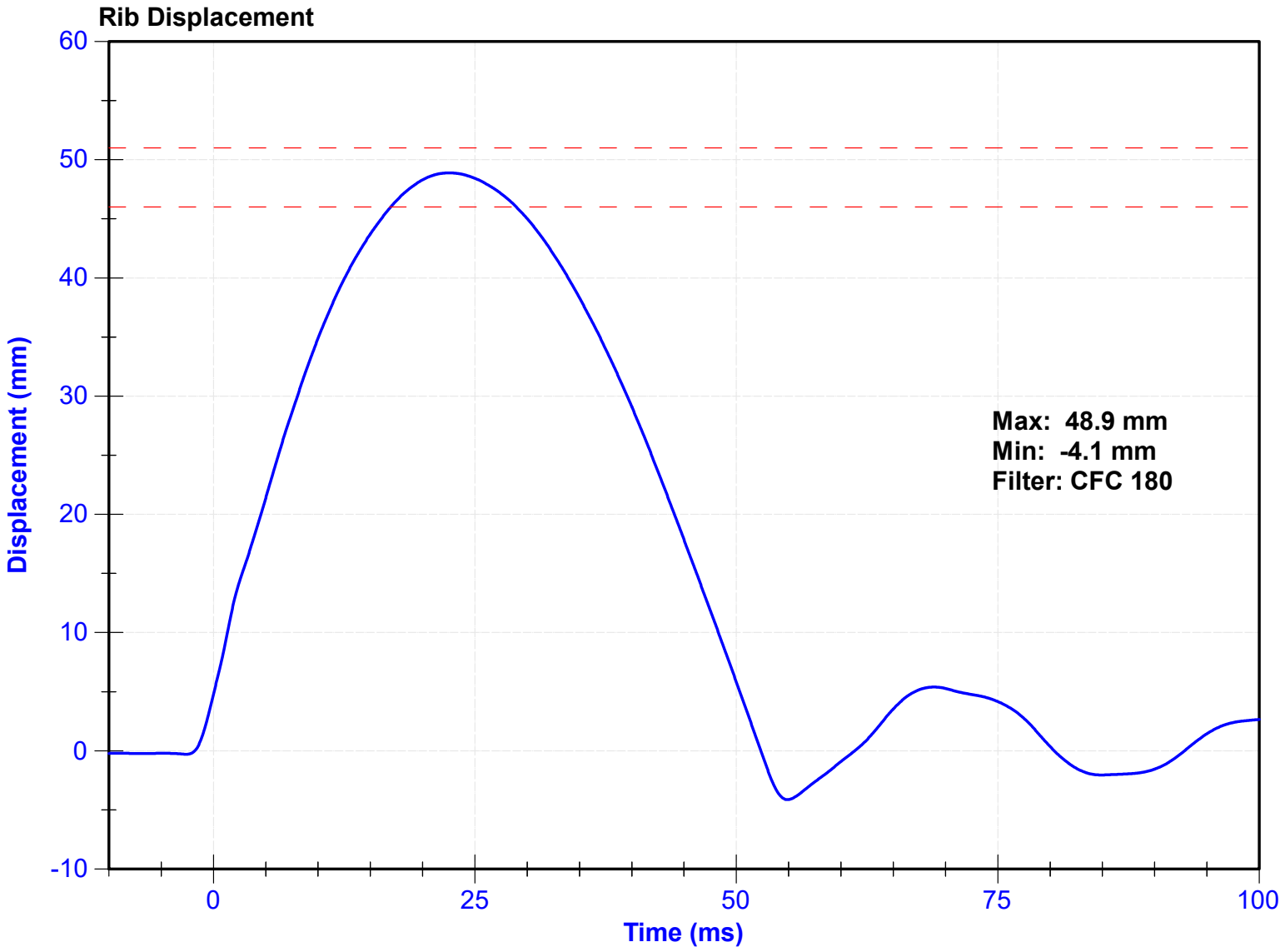
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C.Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	46	51	mm	48.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	178GFE	11/17/2023	5/17/2024



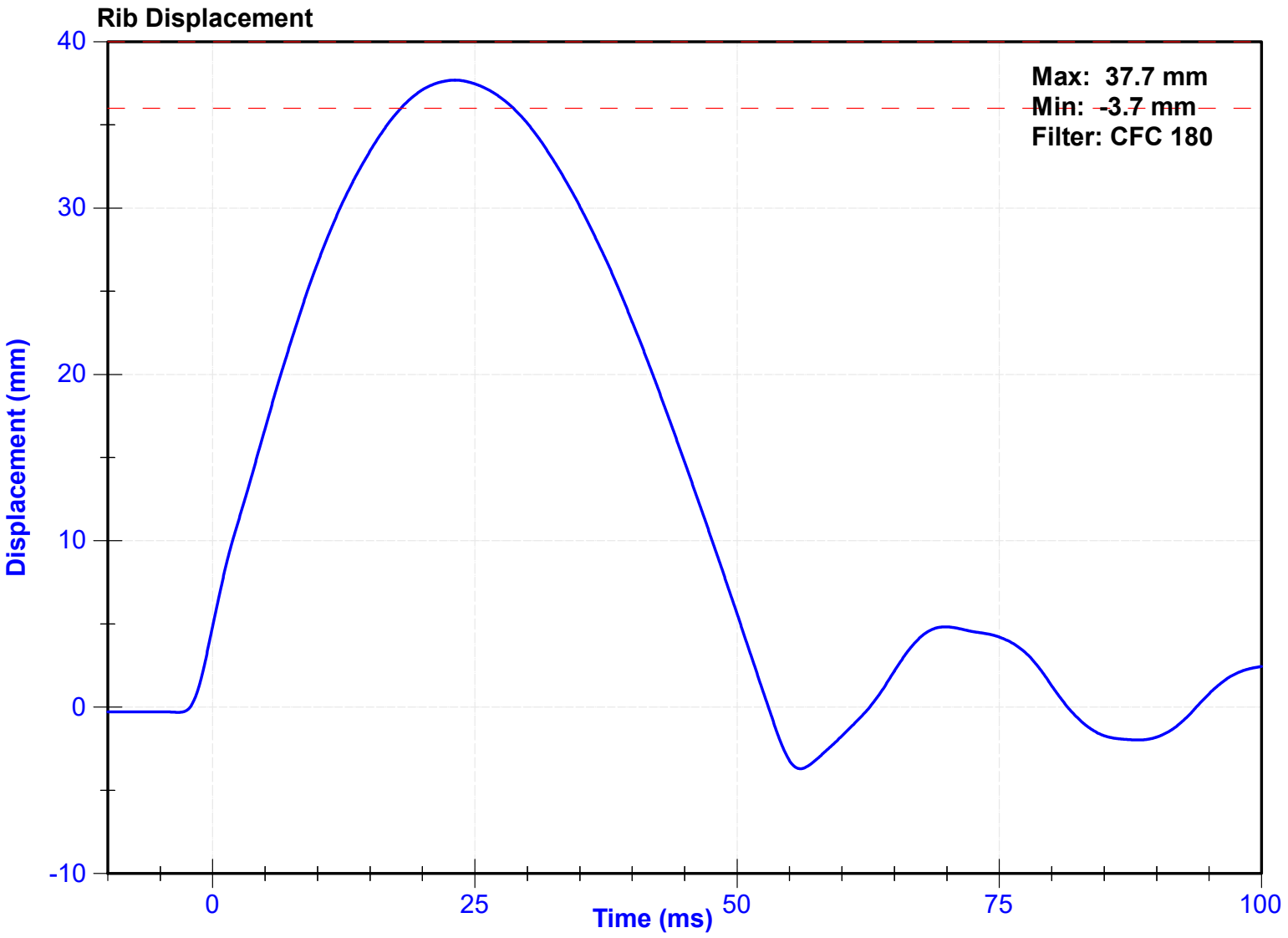
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C.Mantel

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	36	40	mm	37.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	178GFE	11/17/2023	5/17/2024



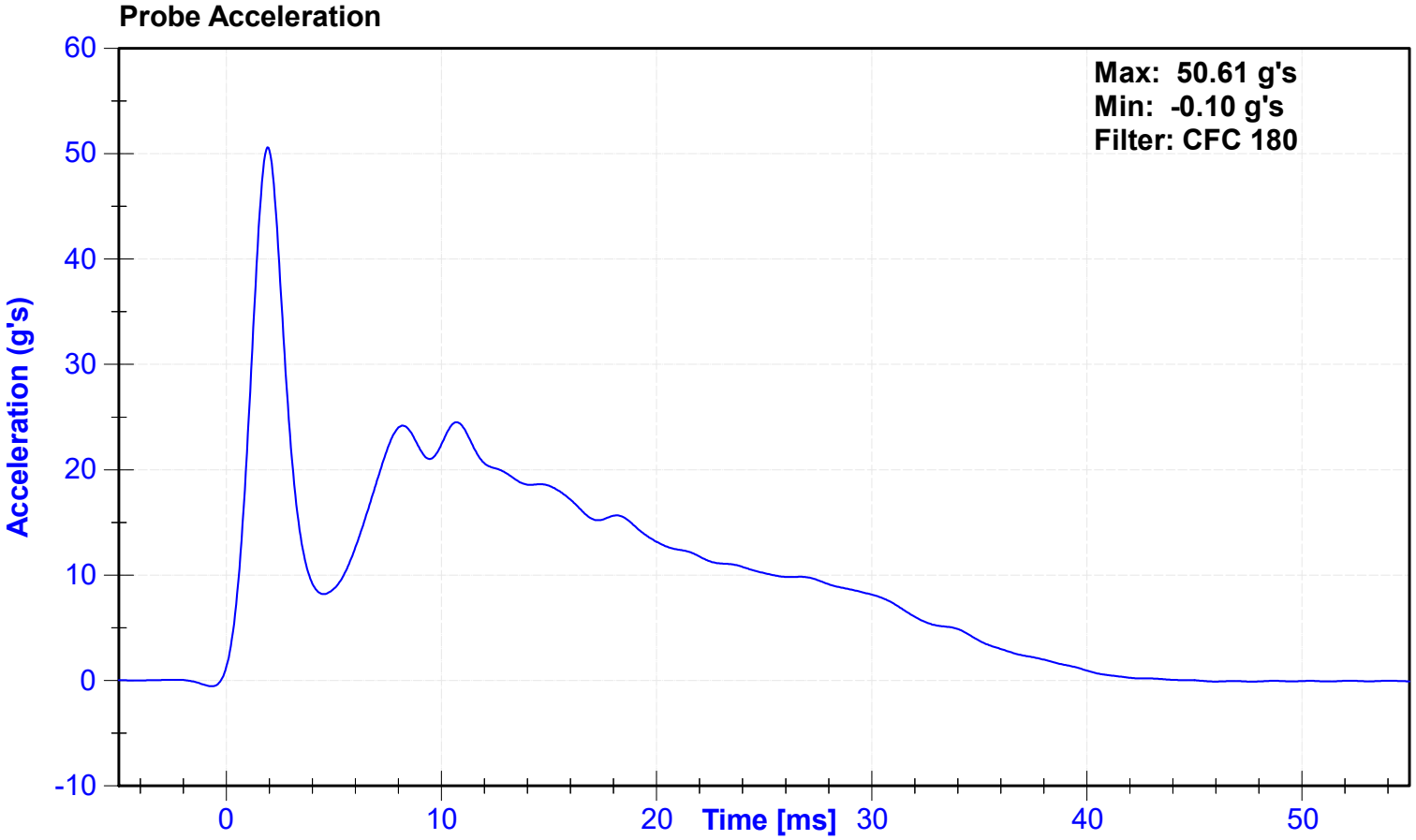
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

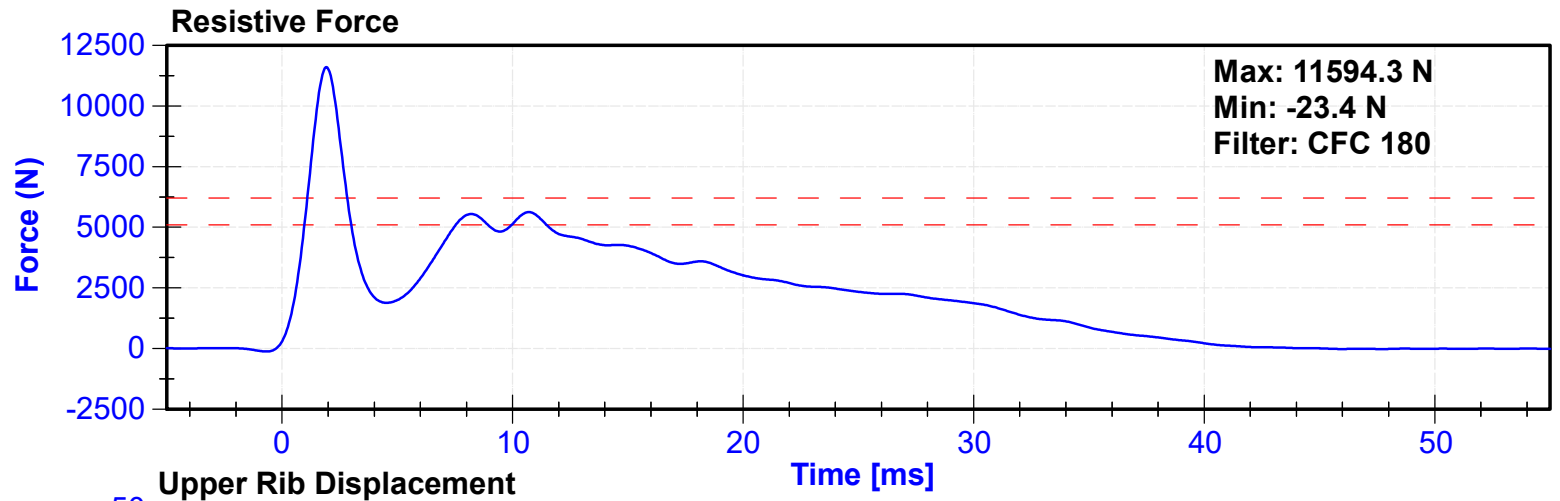
Results

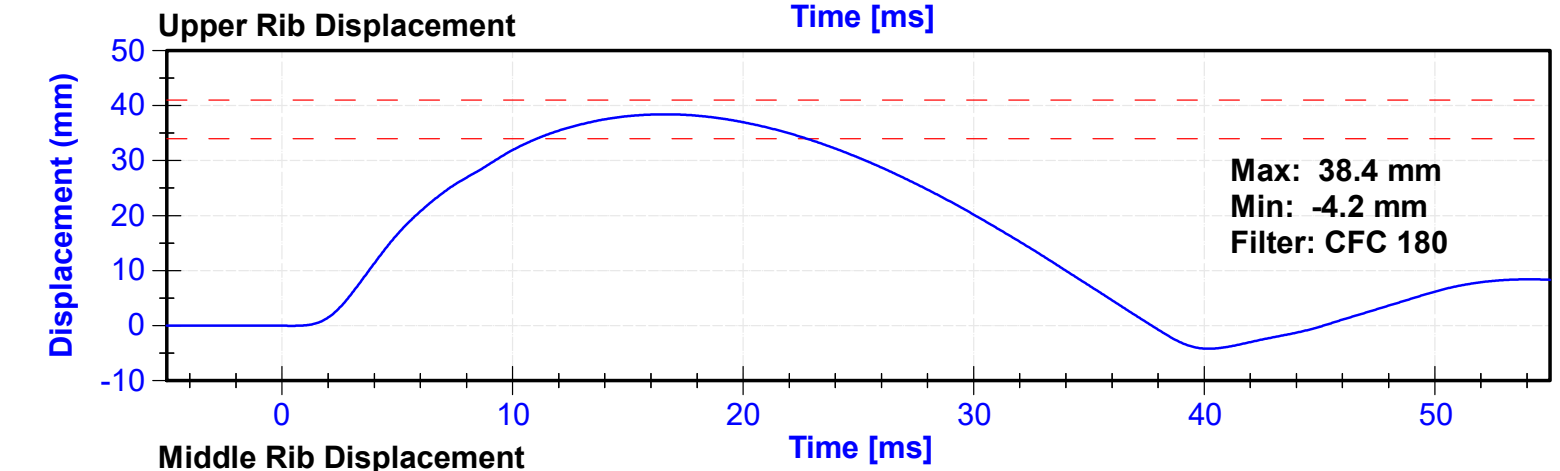
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	59.4	Pass
Velocity	5.4	5.6	m/s	5.54	Pass
Resistive Force after 6ms	5100	6200	N	5619.0	Pass
Upper Thorax Rib Deflection	34	41	mm	38.4	Pass
Mid Thorax Rib Deflection	37	45	mm	42.0	Pass
Lower Thorax Rib Deflection	37	44	mm	40.2	Pass

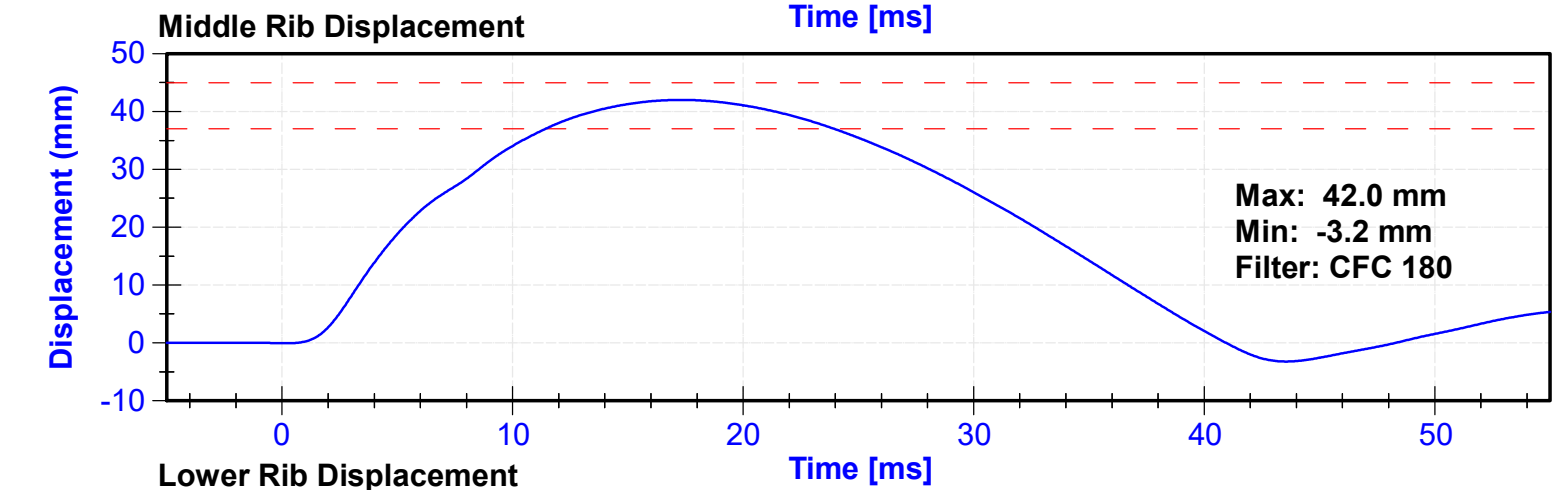
Transducer Calibrations

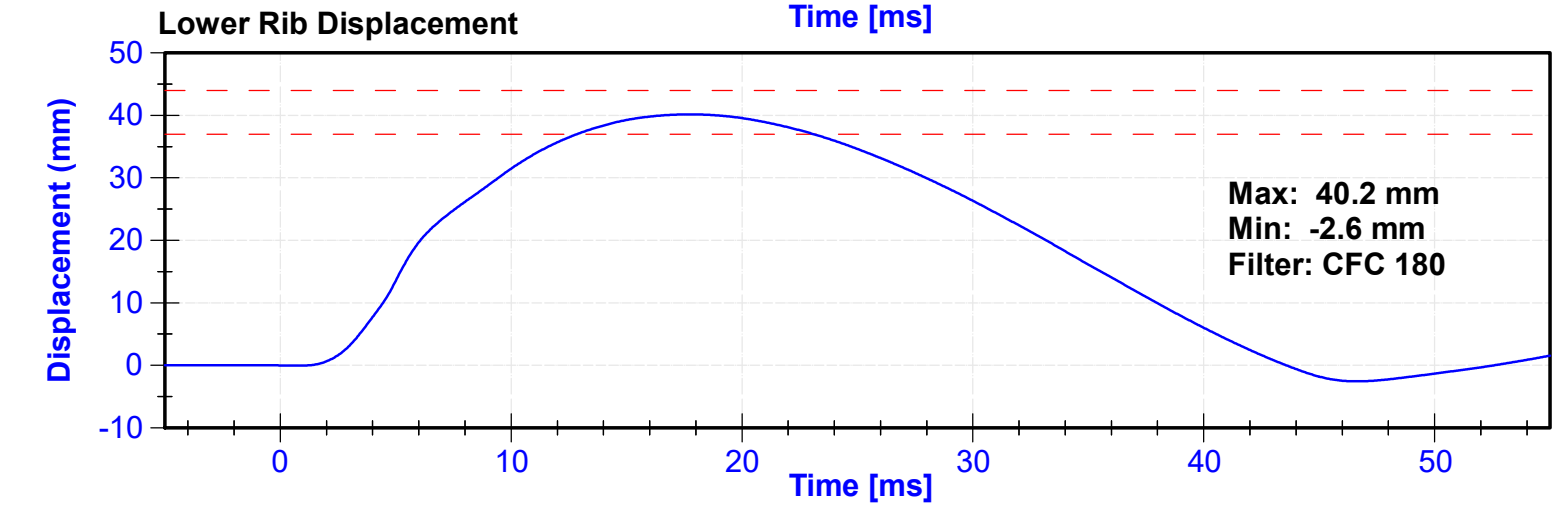
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Upper Thorax Rib Potentiometer	Honeywell	179GFE	11/17/2023	5/17/2024
Middle Thorax Rib Potentiometer	Honeywell	185GFE	11/17/2023	5/17/2024
Lower Thorax Rib Potentiometer	Honeywell	178GFE	11/17/2023	5/17/2024




Resistive Force
Max: 11594.3 N
Min: -23.4 N
Filter: CFC 180
Force (N)
12500
10000
7500
5000
2500
0
-2500
0
10
20
30
40
50
Time [ms]


Upper Rib Displacement
Max: 38.4 mm
Min: -4.2 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: 42.0 mm
Min: -3.2 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: 40.2 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]

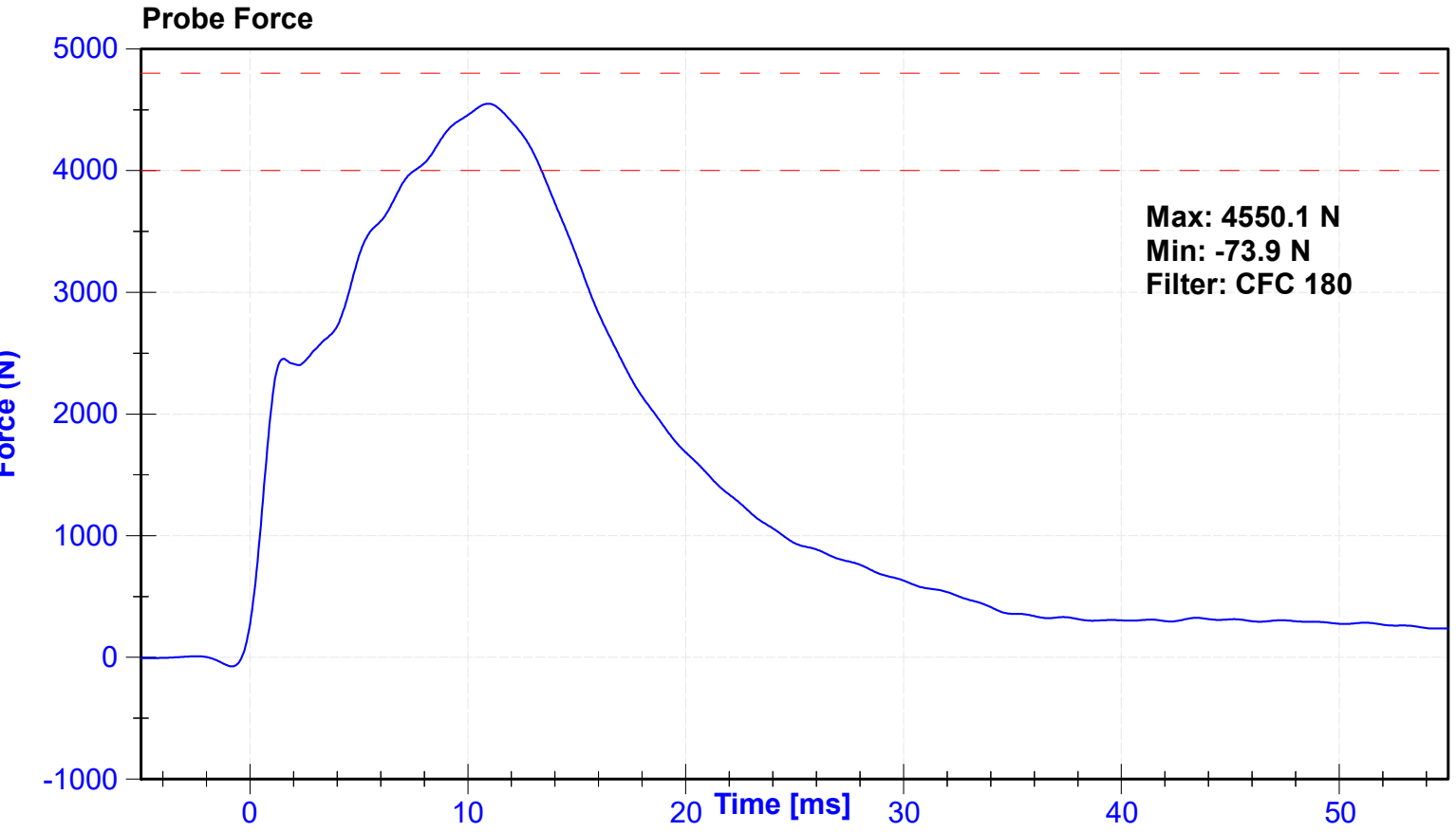
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

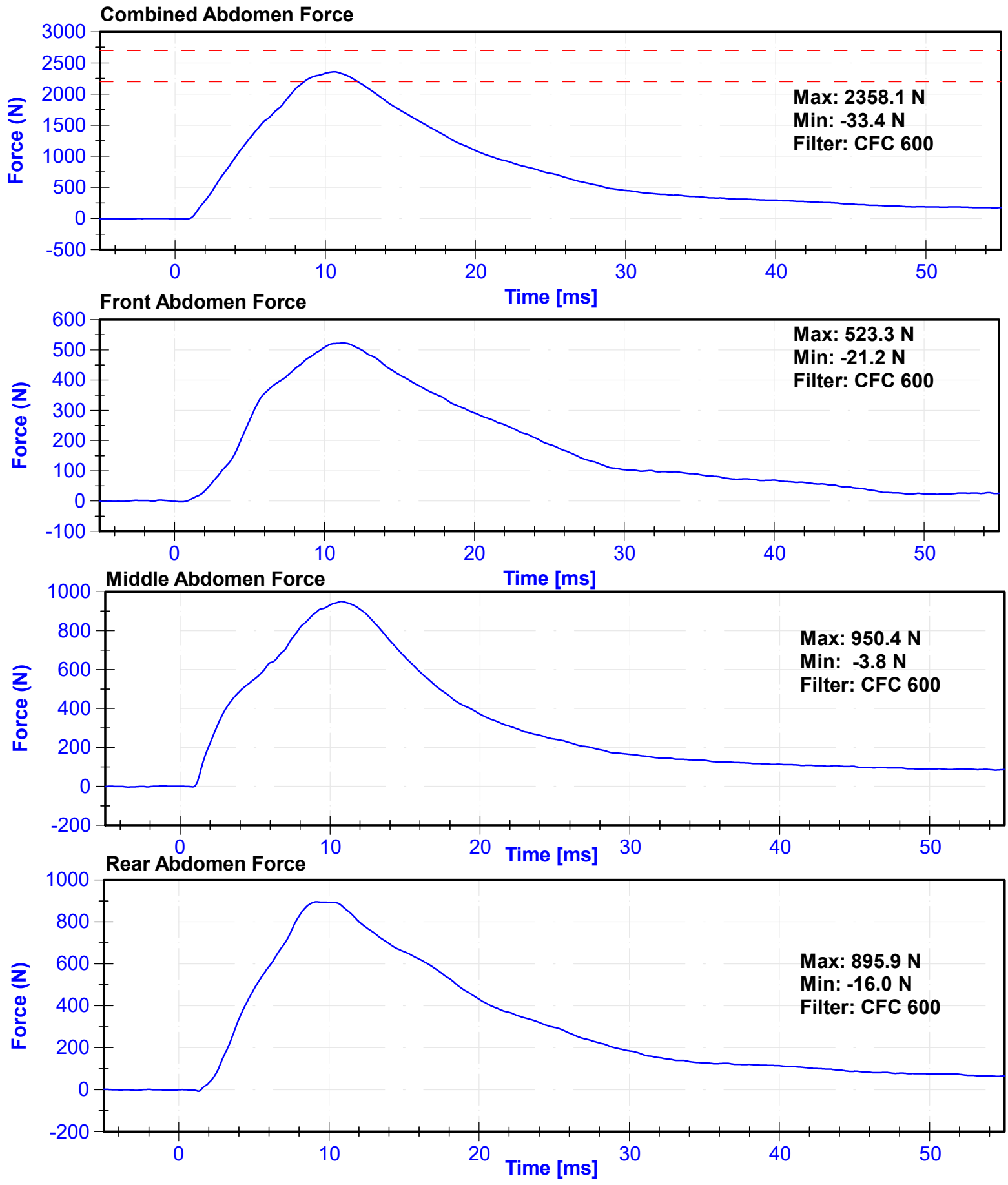
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	59.4	Pass
Velocity	3.9	4.1	m/s	4.02	Pass
Combined Abdomen Force	2200	2700	N	2358.1	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.60	Pass
Resistive Probe Force	4000	4800	N	4550.1	Pass
Time at Peak Resistive Force	10.6	13.0	ms	10.95	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Front Abdomen Load Cell	Denton	DM5846	5/18/2023	5/17/2024
Middle Abdomen Load Cell	Denton	1529	5/18/2023	5/17/2024
Rear Abdomen Load Cell	Denton	1533	5/18/2023	5/17/2024




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2358.1 N
Min: -33.4 N
Filter: CFC 600
Front Abdomen Force
Force (N)
Time [ms]
Max: 523.3 N
Min: -21.2 N
Filter: CFC 600
Middle Abdomen Force
Force (N)
Time [ms]
Max: 950.4 N
Min: -3.8 N
Filter: CFC 600
Rear Abdomen Force
Force (N)
Time [ms]
Max: 895.9 N
Min: -16.0 N
Filter: CFC 600

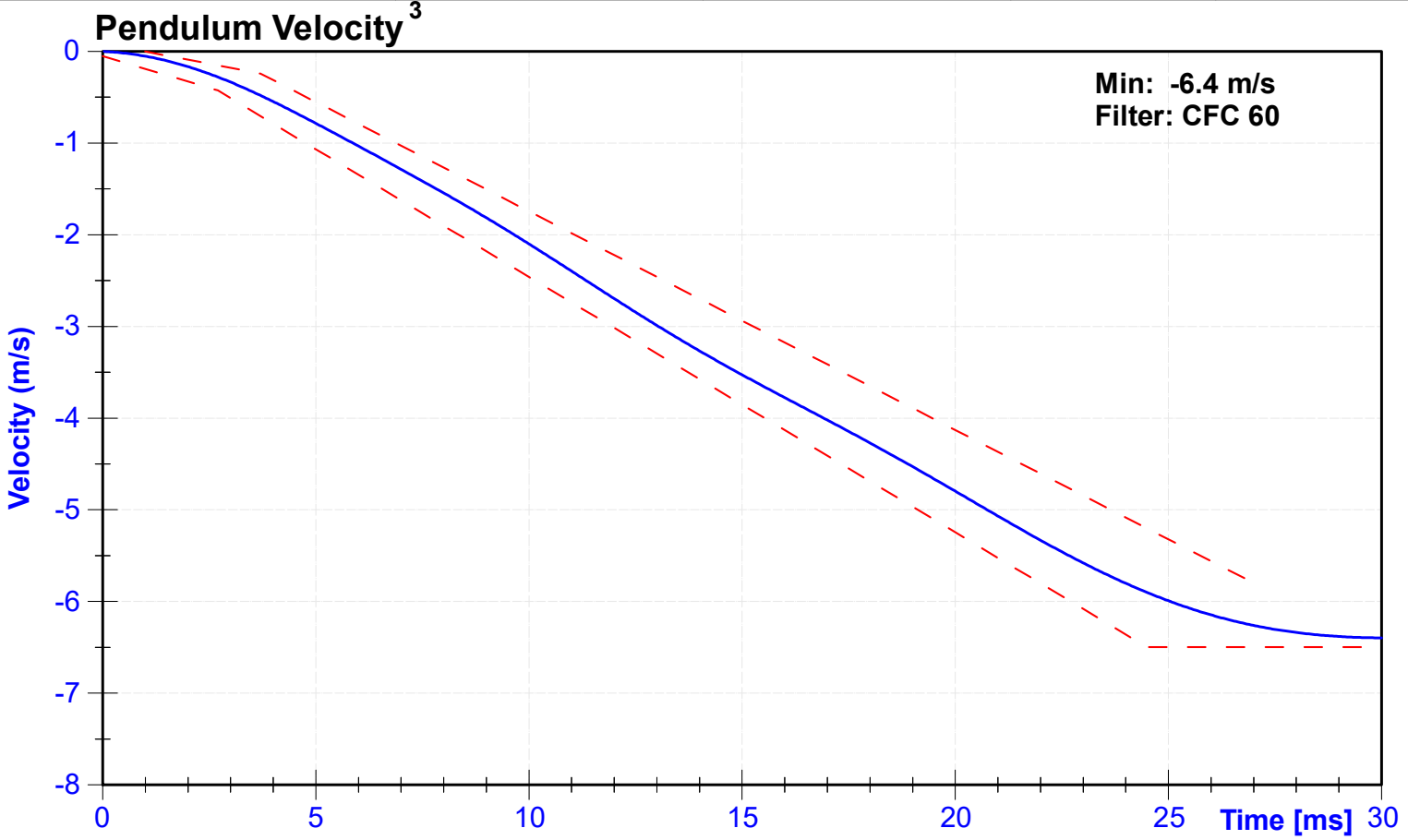
ATD Manufacturer	FTSS	Test Technician	J. Rios
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

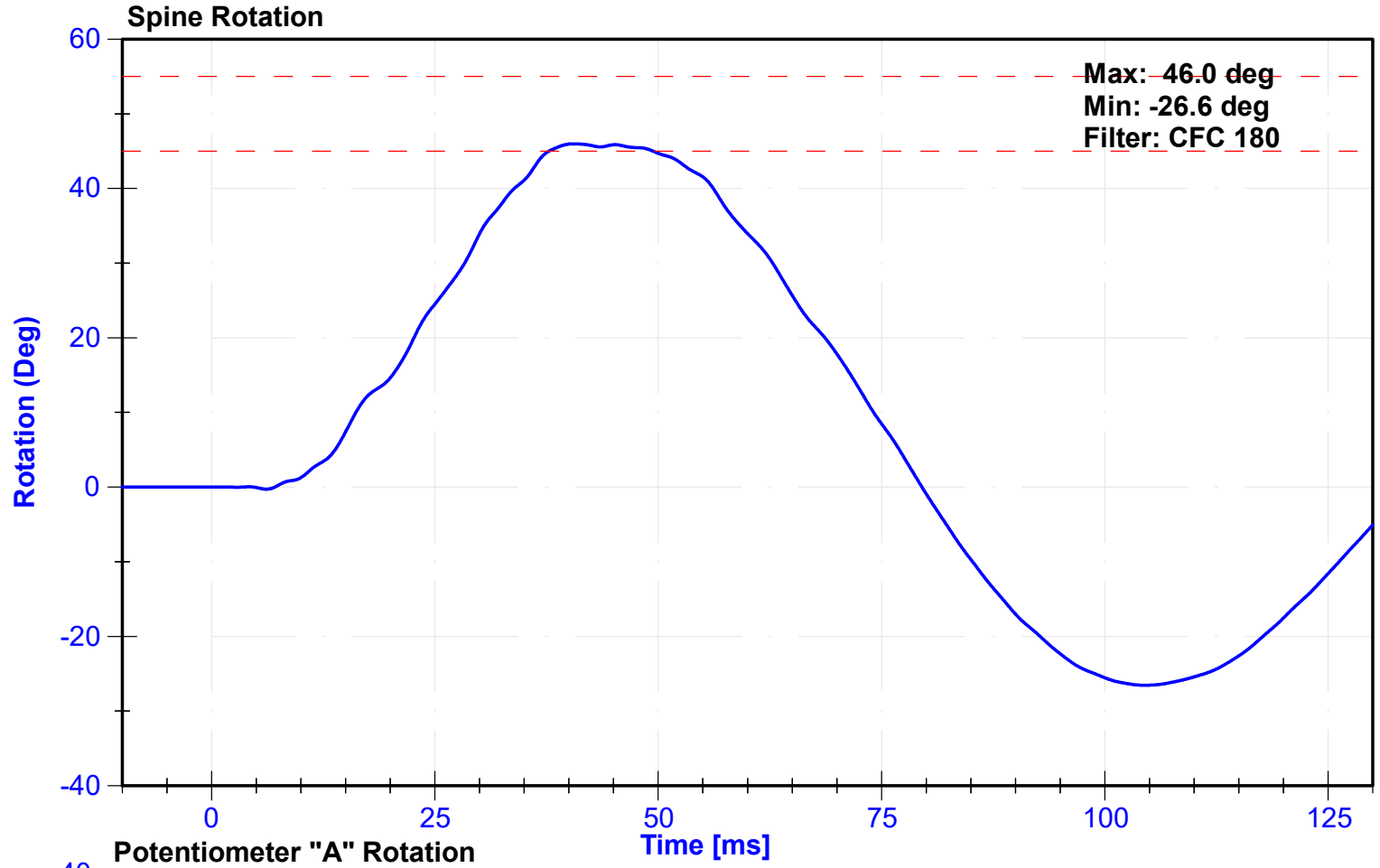
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	33	Pass
Velocity	5.95	6.15	m/s	6.002	Pass
Lateral Spine Rotation	45	55	deg	46.0	Pass
Time at Maximum Rotation	39	53	ms	40.5	Pass
Time of Decay to Zero Degrees	37	57	ms	39.1	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

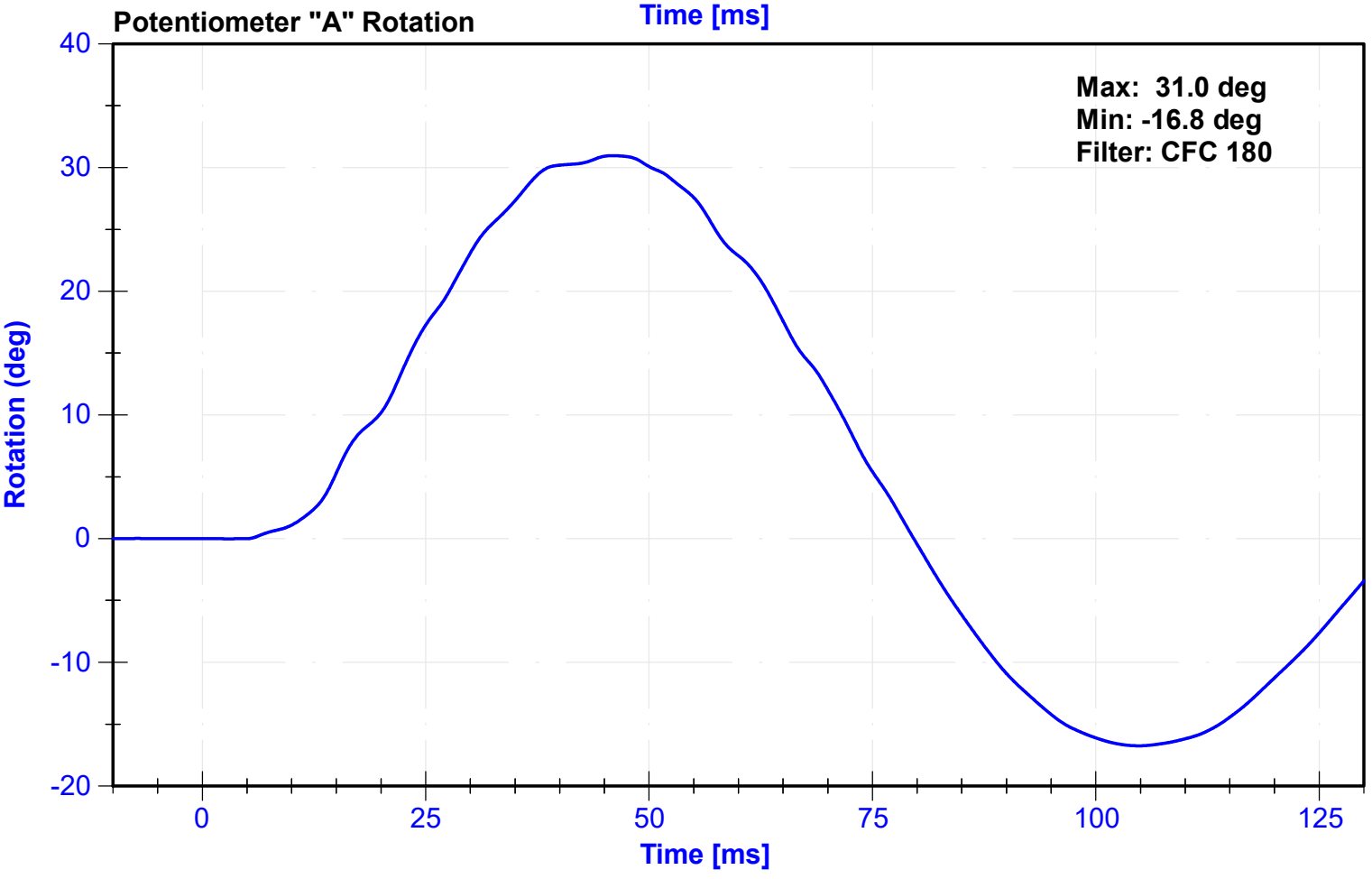
Transducer Calibrations

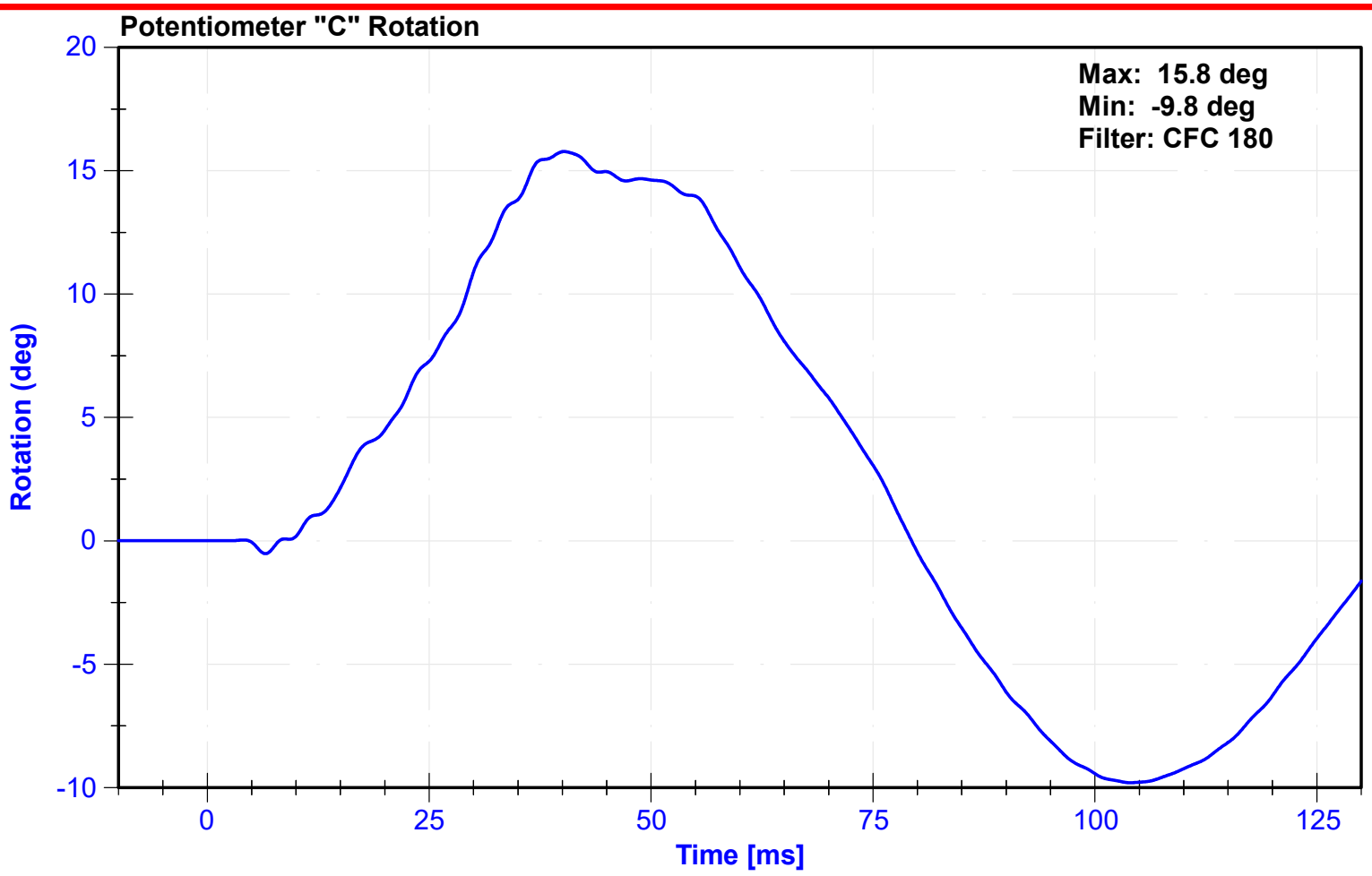
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/31/2023	4/28/2024
Pendulum "A" Potentiometer	Sfernice	094	9/29/2023	9/28/2024
Condyle "B" Potentiometer	Sfernice	095	9/29/2023	9/28/2024



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


Spine Rotation
Max: 46.0 deg
Min: -26.6 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 31.0 deg
Min: -16.8 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

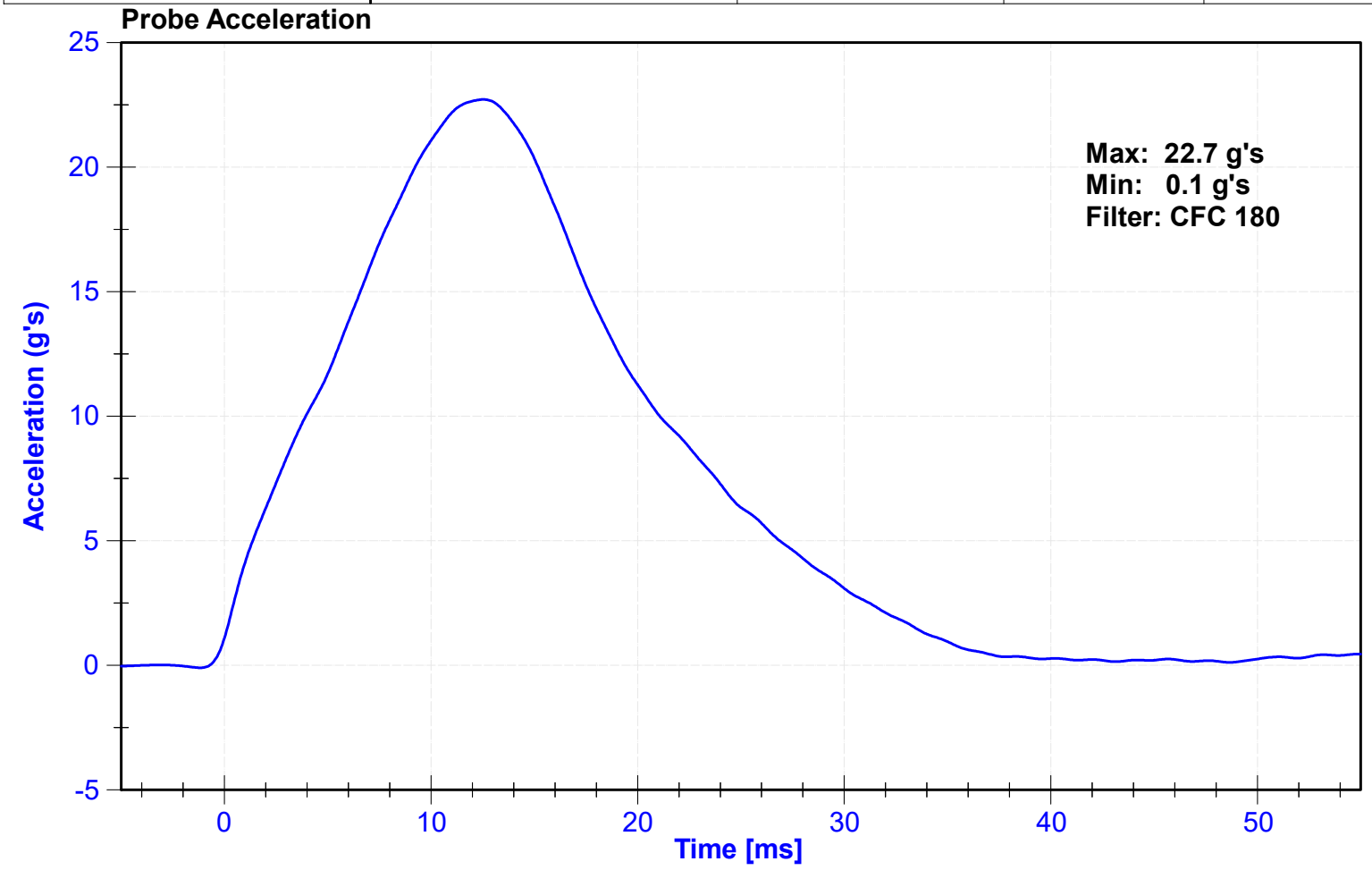
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

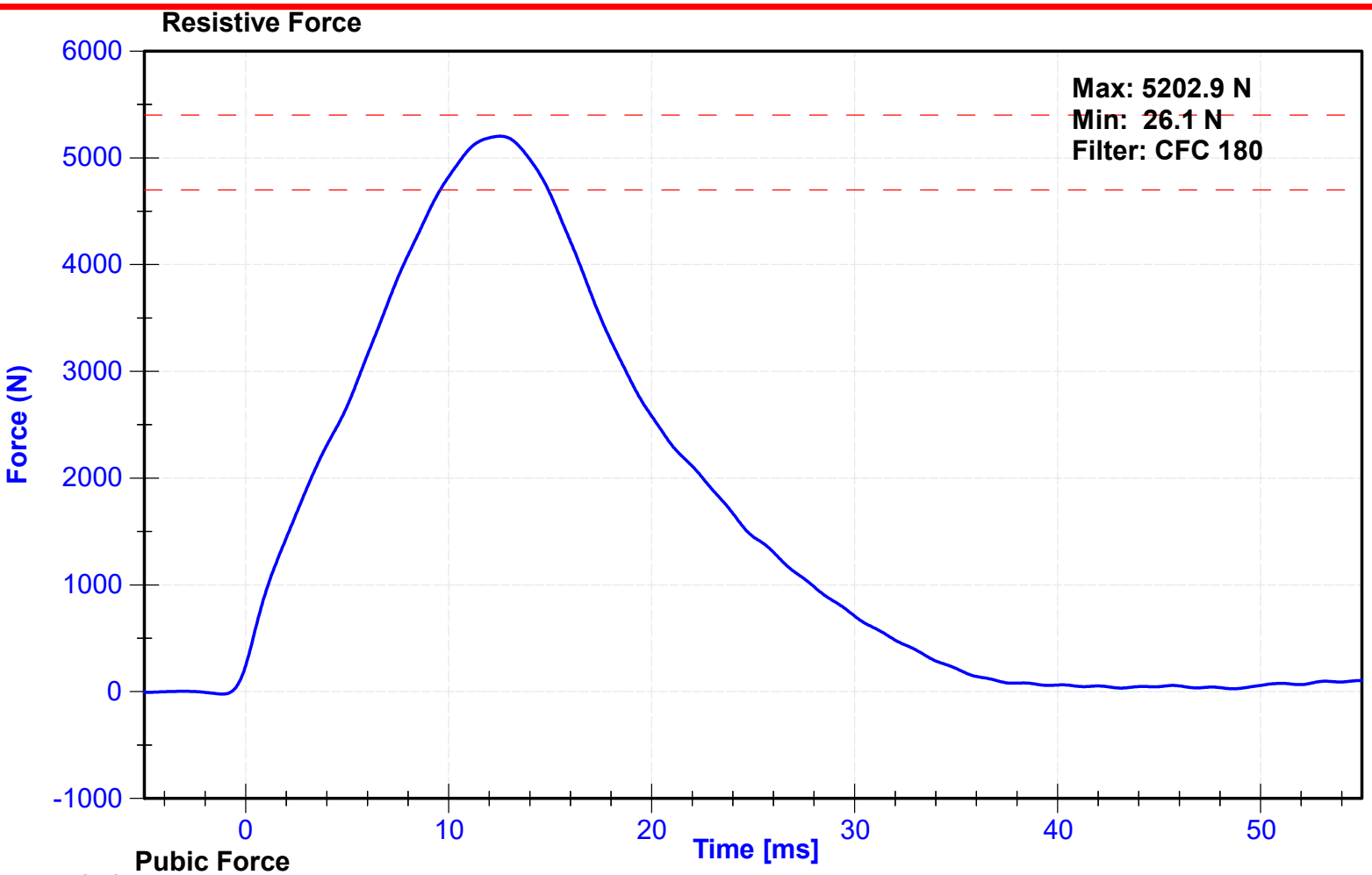
Results

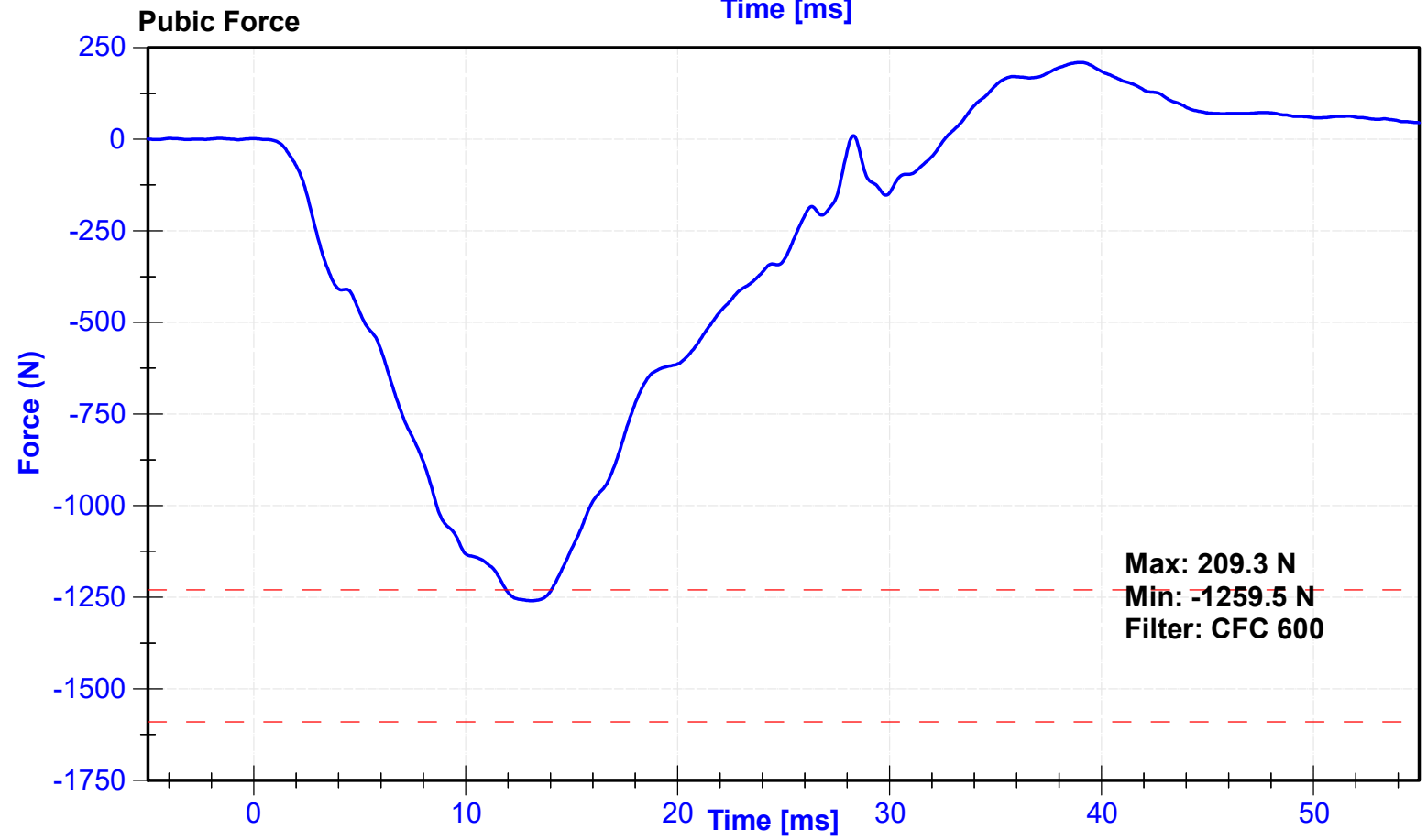
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	59.4	Pass
Velocity	4.2	4.4	m/s	4.32	Pass
Resistive Force	4700	5400	N	5202.9	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.50	Pass
Pubic Force	-1590	-1230	N	-1259.5	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.10	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Pubic Load Cell	Denton	459-FY	6/20/2023	6/19/2024




Resistive Force
Max: 5202.9 N
Min: 26.1 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: 209.3 N
Min: -1259.5 N
Filter: CFC 600
Force (N)
250
0
-250
-500
-750
-1000
-1250
-1500
-1750
0
10
20
30
40
50
Time [ms]

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE – PASSENGER ATD

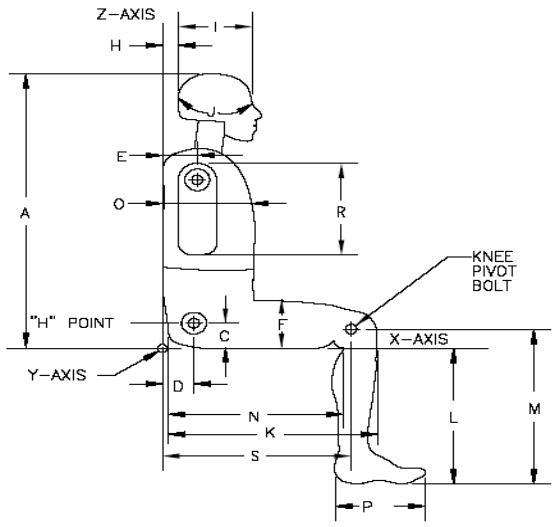
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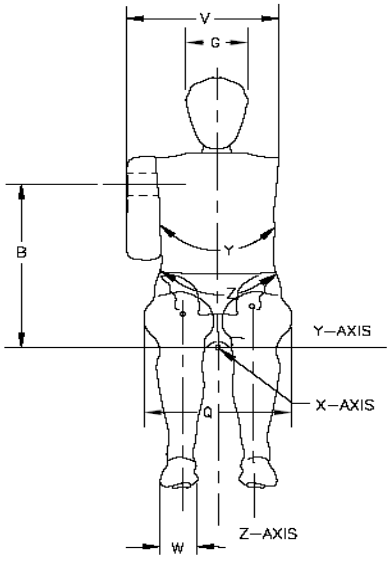
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: K. Brogan Date: 11/28/2023

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	781	Pass
B	Shoulder Pivot Height	437	453	444	Pass
C	H-point Height	79	89	84	Pass
D	H-point from seatback	141	151	144	Pass
E	Shoulder Pivot from Backline	97	107	100	Pass
F	Thigh Clearance	119	135	124	Pass
G	Head Breadth	140	148	142	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	180	Pass
J	Head Circumference	541	551	546	Pass
K	Buttock to Knee Length	514	540	529	Pass
L	Popliteal Height	343	369	357	Pass
M	Knee Pivot to floor height	392	409	401	Pass
N	Buttock Popliteal Length	416	442	433	Pass
O	Chest Depth w/o jacket	195	211	198	Pass
P	Foot Length	216	232	221	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	317	Pass
R	Arm Length	249	259	253	Pass
S	Knee Joint to seatback	477	493	482	Pass
V	Shoulder Width	341	357	350	Pass
W	Foot Width	78	94	85	Pass
Y	Chest Circumference w/jacket	851	881	876	Pass
Z	Waist Circumference	761	791	777	Pass

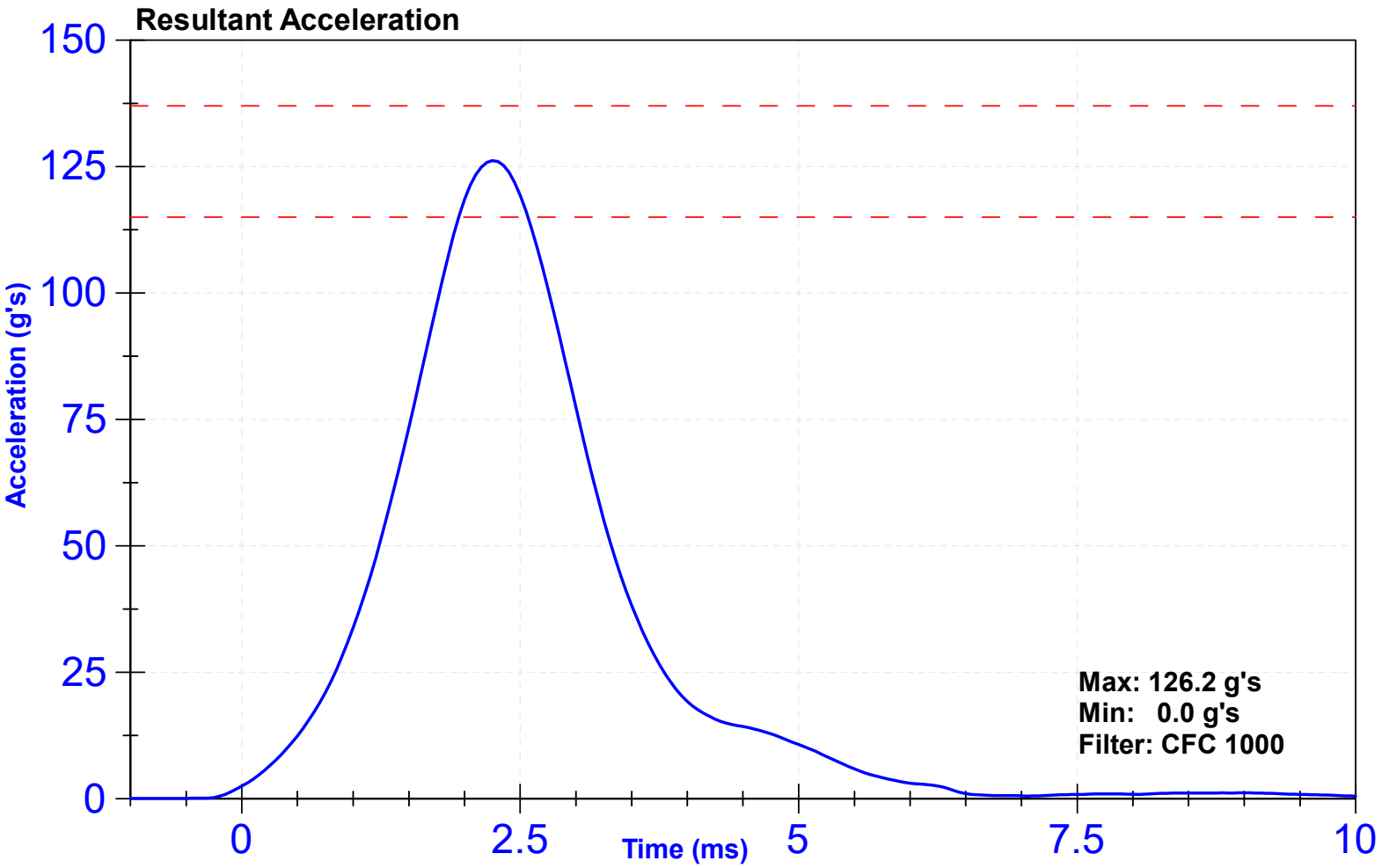
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

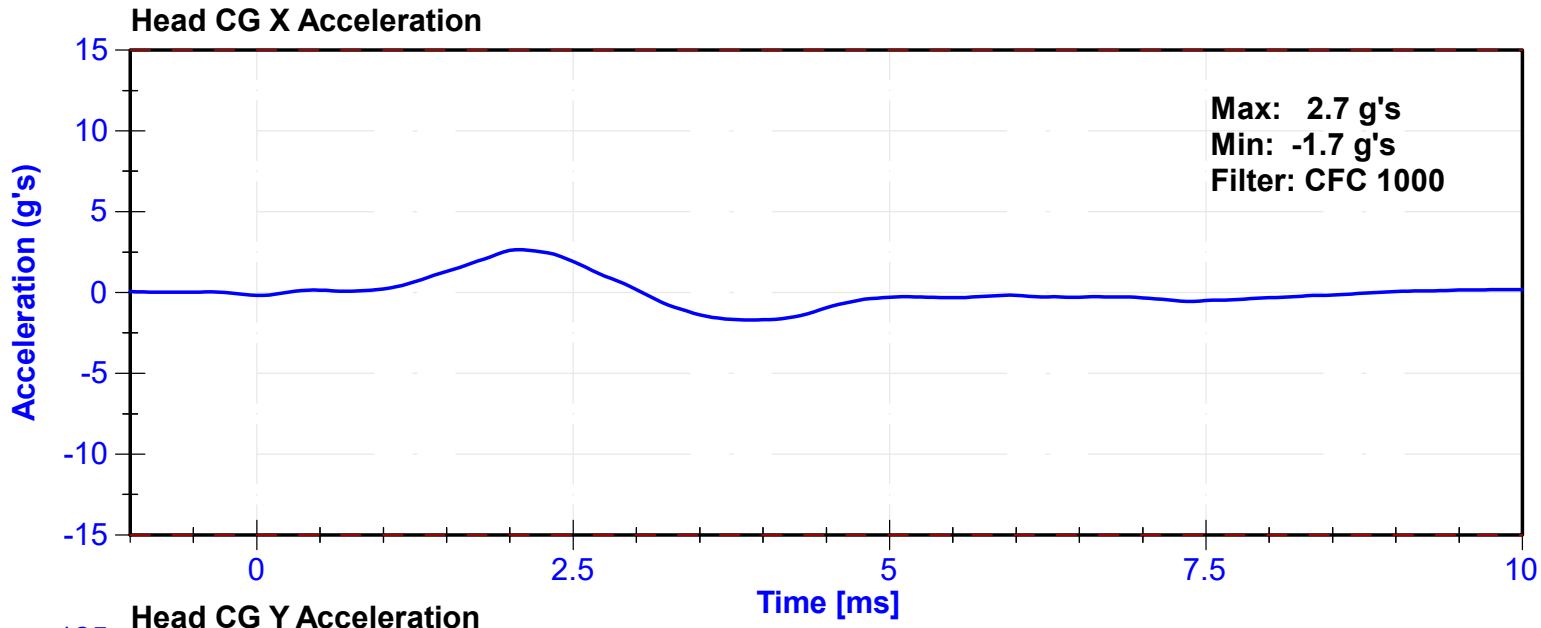
Results

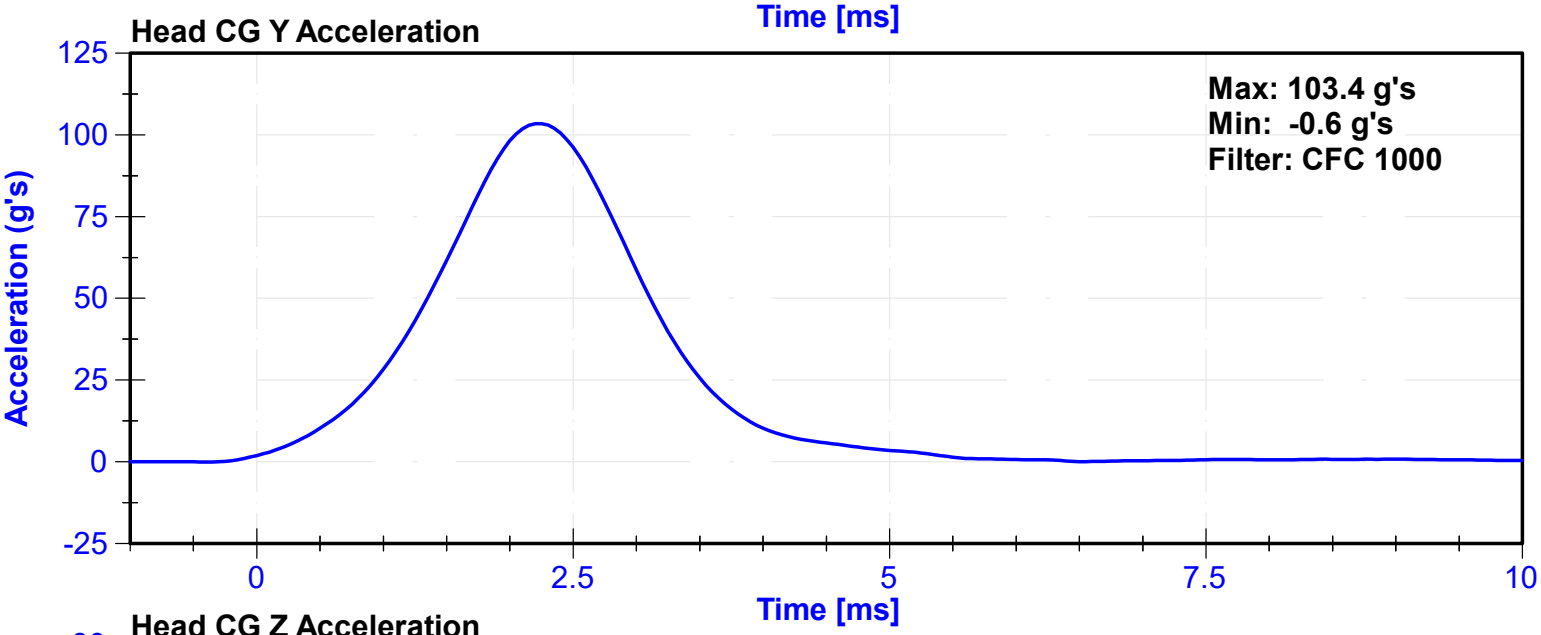
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	20	Pass
Resultant Acceleration	115	137	g's	126.2	Pass
Oscillation	0	15	%	0.8	Pass
Fore-Aft Acceleration	-15	15	g's	2.7	Pass

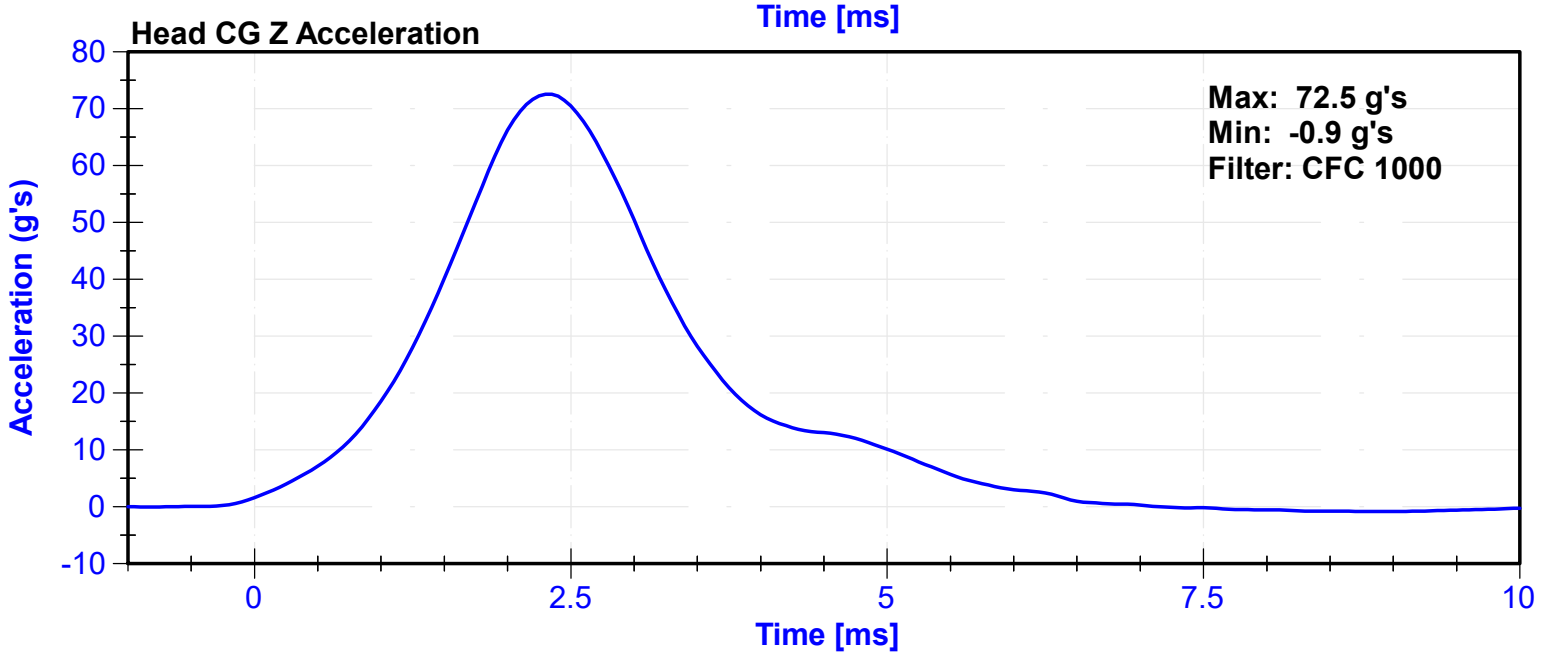
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibratio Date	Calibratio Due Date
X Accelerometer	Endevco	P59018	11/15/2023	5/13/2024
Y Accelerometer	Endevco	P79189	11/15/2023	5/13/2024
Z Accelerometer	Endevco	P79587	11/15/2023	5/13/2024




Head CG X Acceleration
Max: 2.7 g's
Min: -1.7 g's
Filter: CFC 1000
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]


Head CG Y Acceleration
Max: 103.4 g's
Min: -0.6 g's
Filter: CFC 1000
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]


Head CG Z Acceleration
Max: 72.5 g's
Min: -0.9 g's
Filter: CFC 1000
Acceleration (g's)
80
70
60
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]

ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

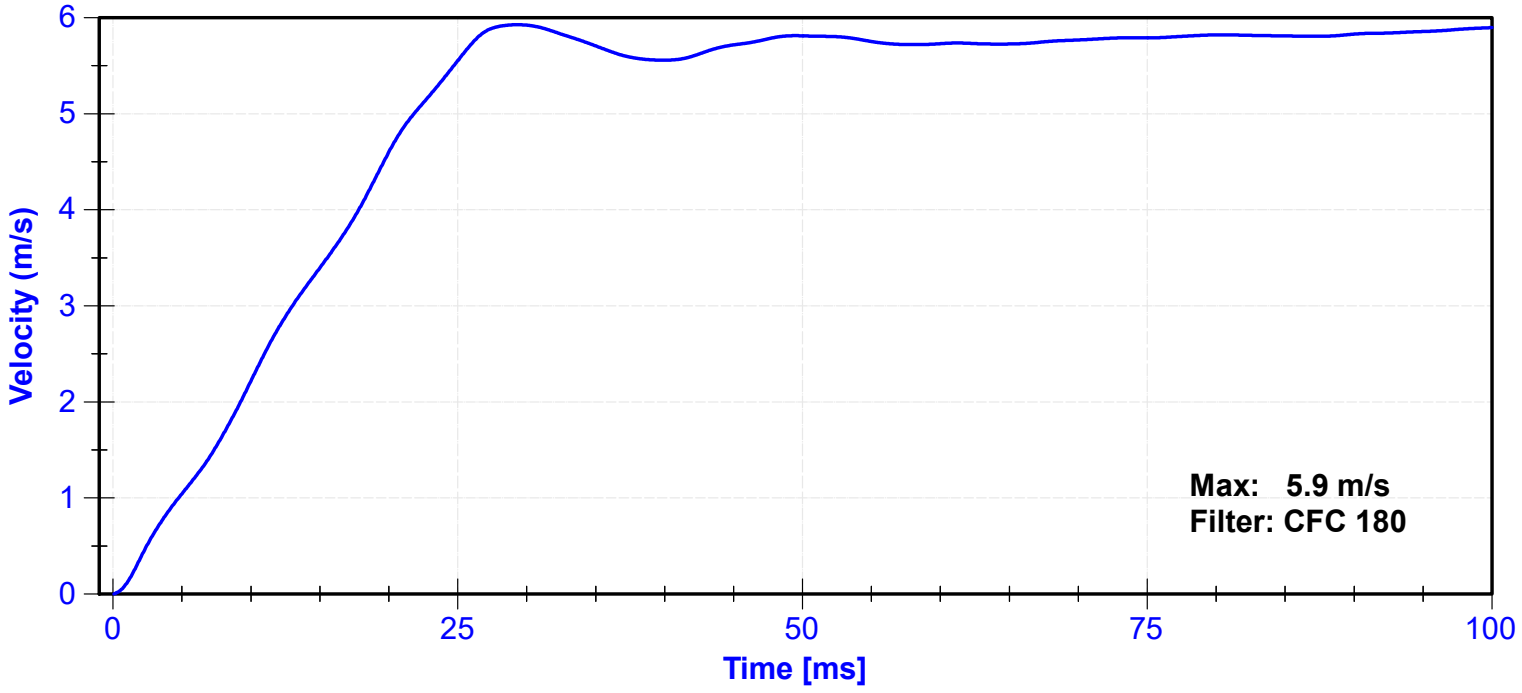
Results

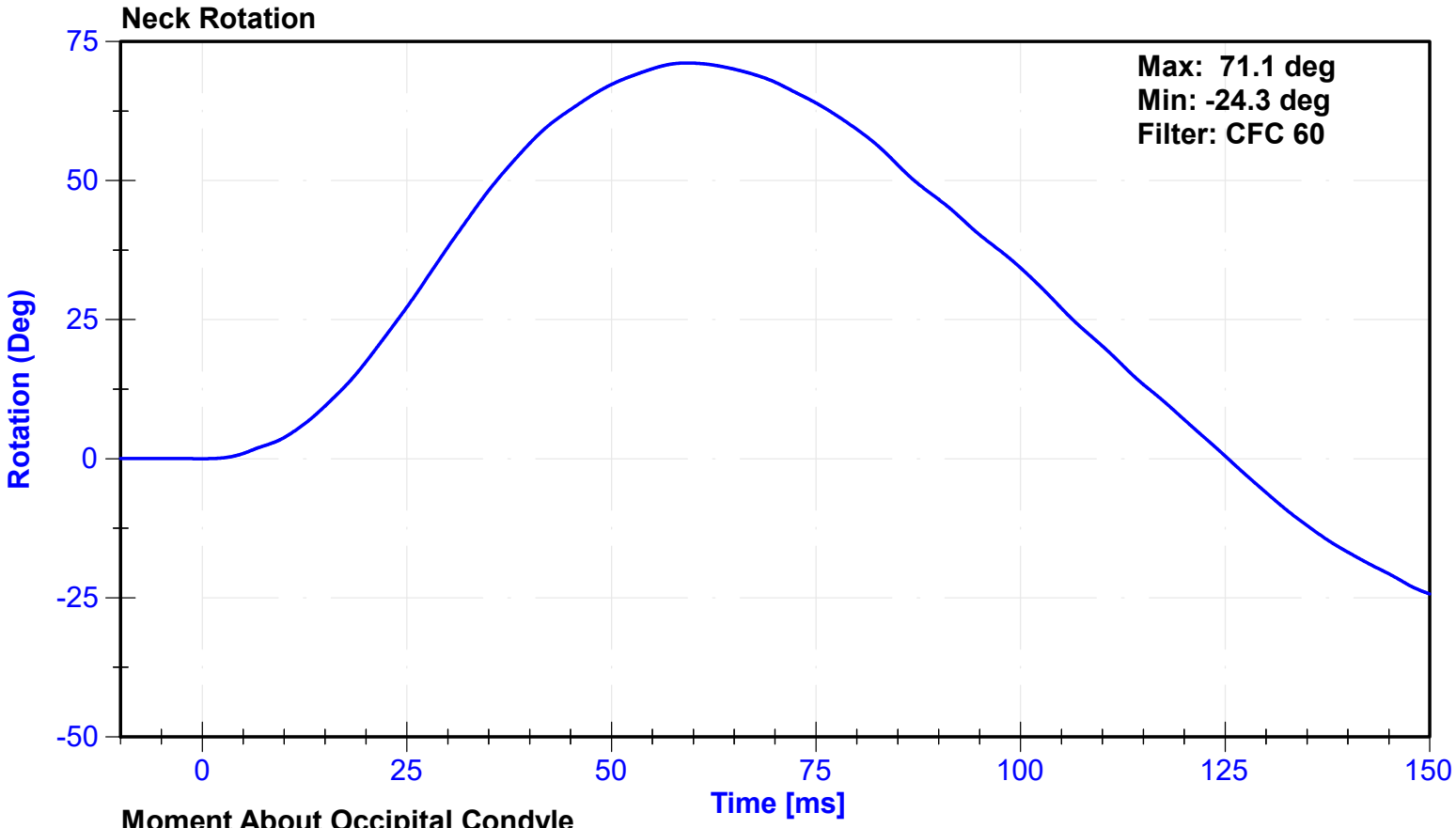
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	20	Pass
Velocity	5.51	5.63	m/s	5.516	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.22	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.40	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.60	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.55	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.93	Pass
Neck Rotation	71	81	deg	71.1	Pass
Time at Maximum Rotation	50	70	ms	59.2	Pass
Moment about the OC	36	44	Nm	42.0	Pass
Moment Decay to 0 Nm	102	126	ms	111.5	Pass

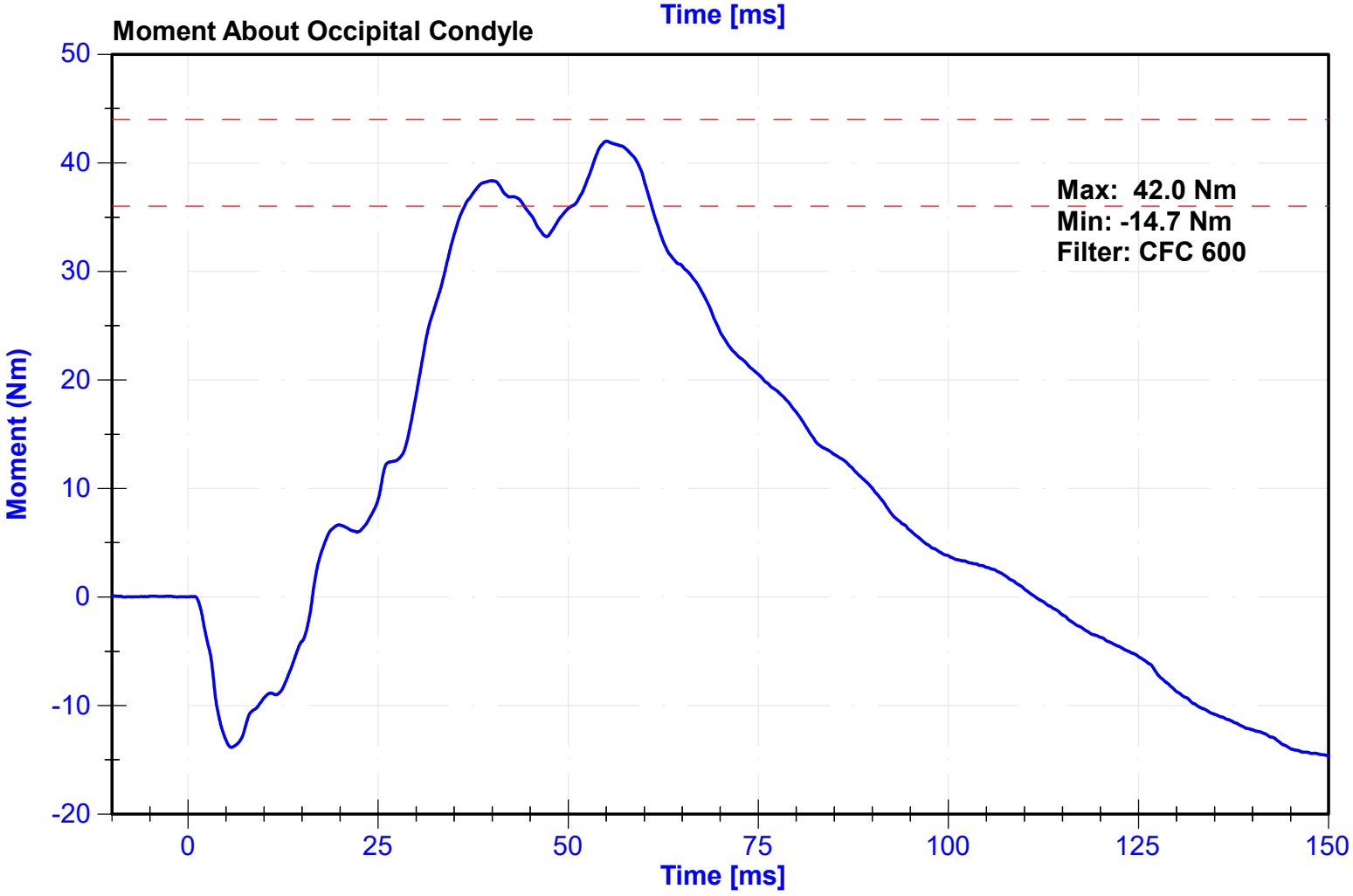
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	7231C-750	10/31/2023	4/28/2024
Pendulum Potentiometer	Servo	4961	10/2/2023	10/1/2024
Condyle Potentiometer	Servo	DS185	10/2/2023	10/1/2024
Upper Neck Load Cell	Denton	1716ATF_2184-FY	5/18/2023	5/17/2024

Pendulum Impulse




Neck Rotation
Max: 71.1 deg
Min: -24.3 deg
Filter: CFC 60
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 42.0 Nm
Min: -14.7 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

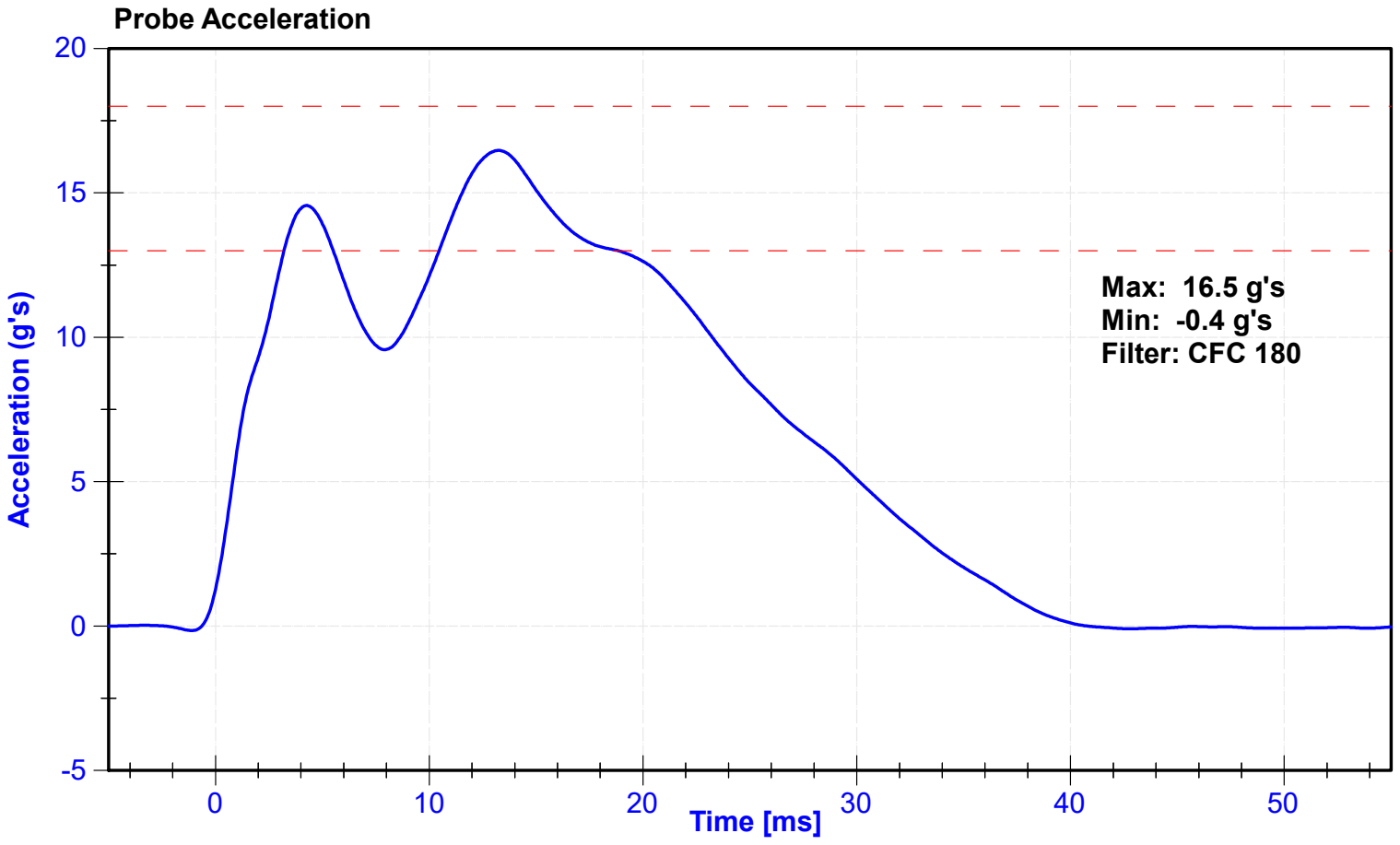
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

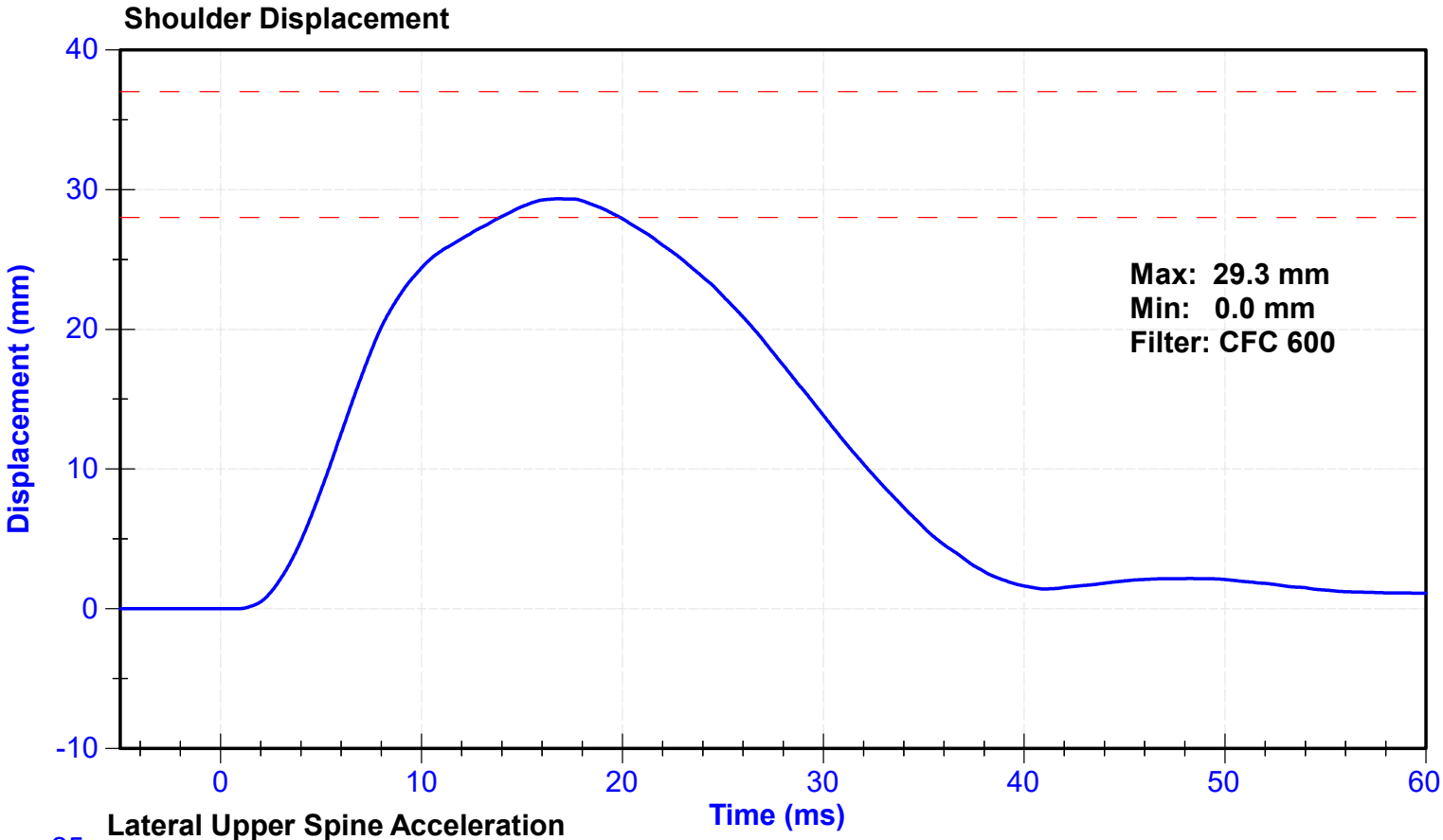
Results

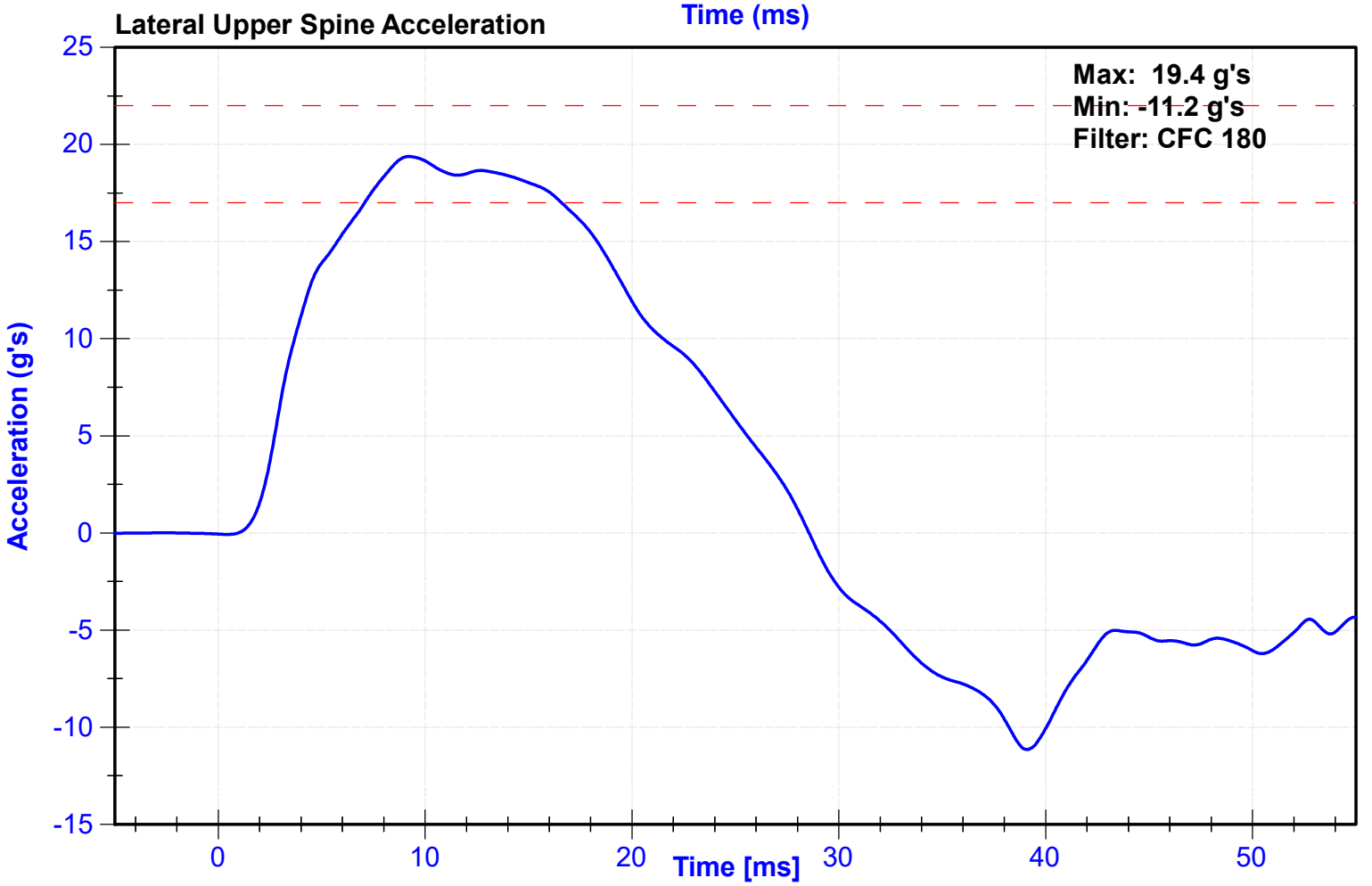
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	65	Pass
Velocity	4.2	4.4	m/s	4.32	Pass
Probe Acceleration	13	18	g's	16.5	Pass
Shoulder Deflection	28	37	mm	29.3	Pass
Lateral Upper Spine Acceleration	17	22	g's	19.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Shoulder Potentiometer	Servo	053GFE	11/17/2023	5/17/2024
Upper Spine Y Accelerometer	Endevco	T20880	11/16/2023	5/14/2024




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 29.3 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 19.4 g's
Min: -11.2 g's
Filter: CFC 180

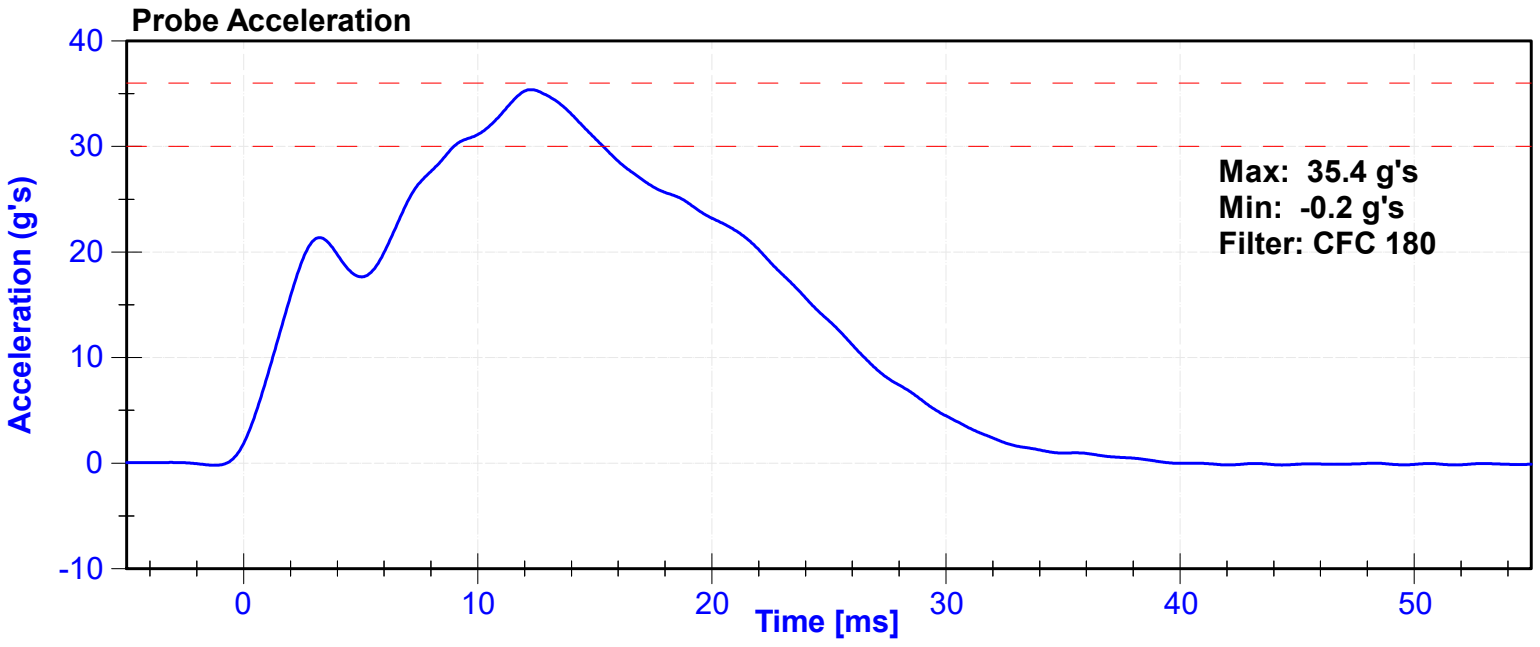
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

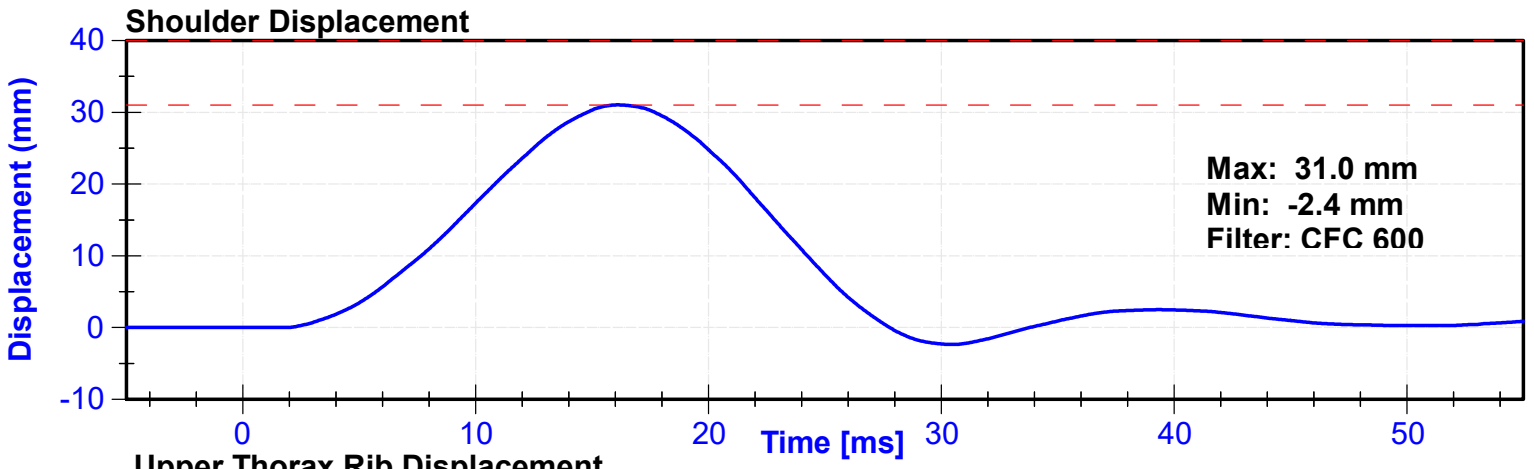
Results

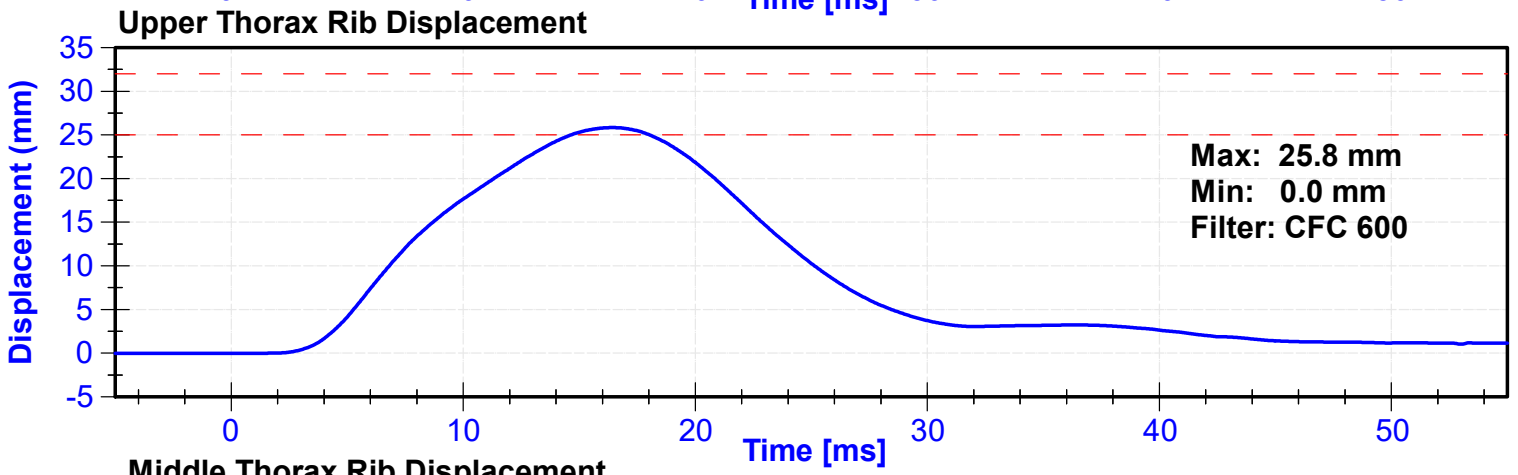
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	20	Pass
Velocity	6.6	6.8	m/s	6.62	Pass
Probe Acceleration after 5 ms	30	36	g's	35.4	Pass
Lateral Upper Spine Acceleration	34	43	g's	35.9	Pass
Lateral Lower Spine Acceleration	29	37	g's	31.4	Pass
Shoulder Deflection	31	40	mm	31.0	Pass
Upper Thorax Rib Deflection	25	32	mm	25.8	Pass
Mid Thorax Rib Deflection	30	36	mm	30.9	Pass
Lower Thorax Rib Deflection	32	38	mm	34.3	Pass

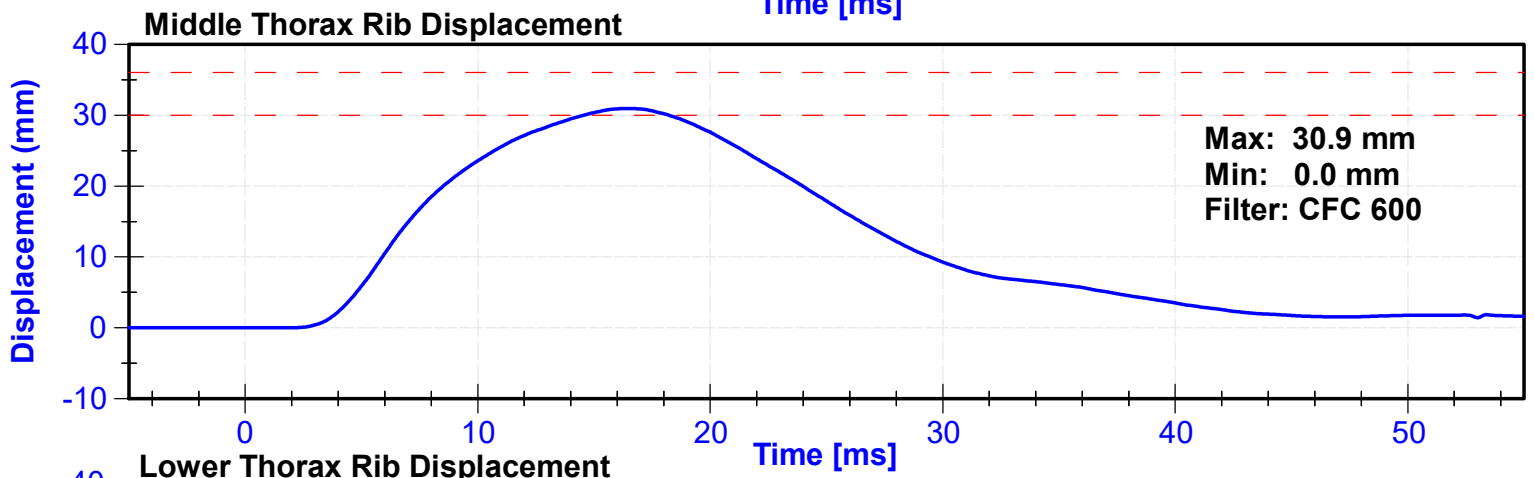
Transducer Calibrations

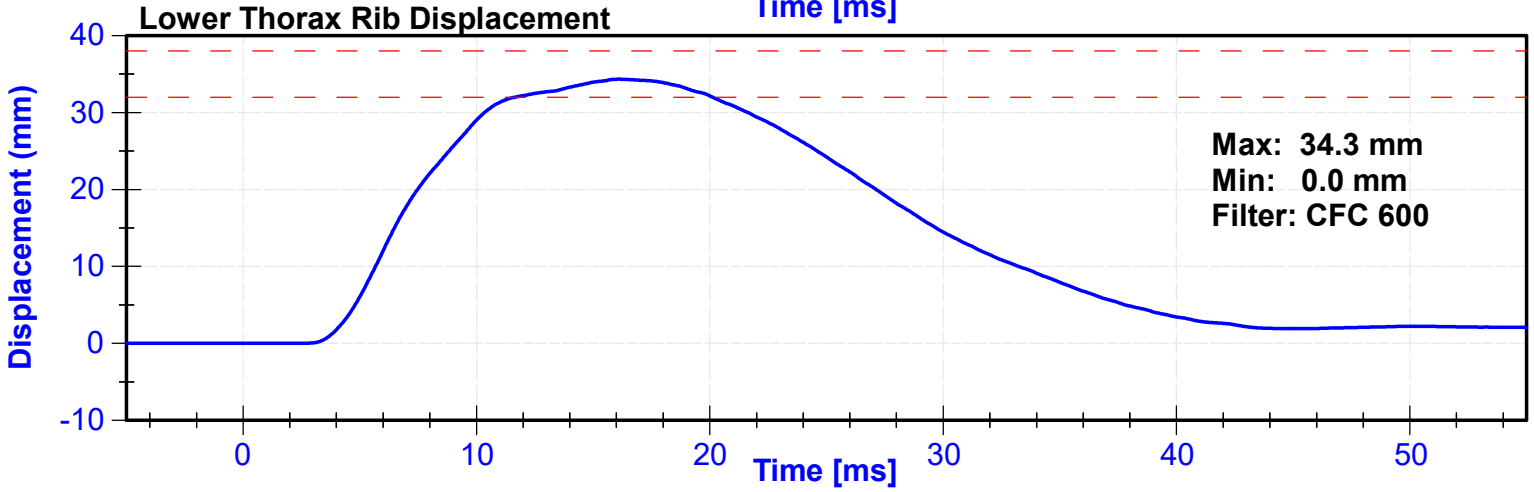
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Upper Spine T1 Y Accelerometer	Endevco	T20880	11/16/2023	5/14/2024
Upper Spine T12 Y Accelerometer	Endevco	P52071	11/16/2023	5/14/2024
Shoulder Potentiometer	Servo	053GFE	11/17/2023	5/17/2024
Upper Thorax Rib Potentiometer	Servo	2316GFE	11/17/2023	5/17/2024
Middle Thorax Rib Potentiometer	Servo	307GFE	11/17/2023	5/17/2024
Lower Thorax Rib Potentiometer	Servo	1156GFE	11/17/2023	5/17/2024

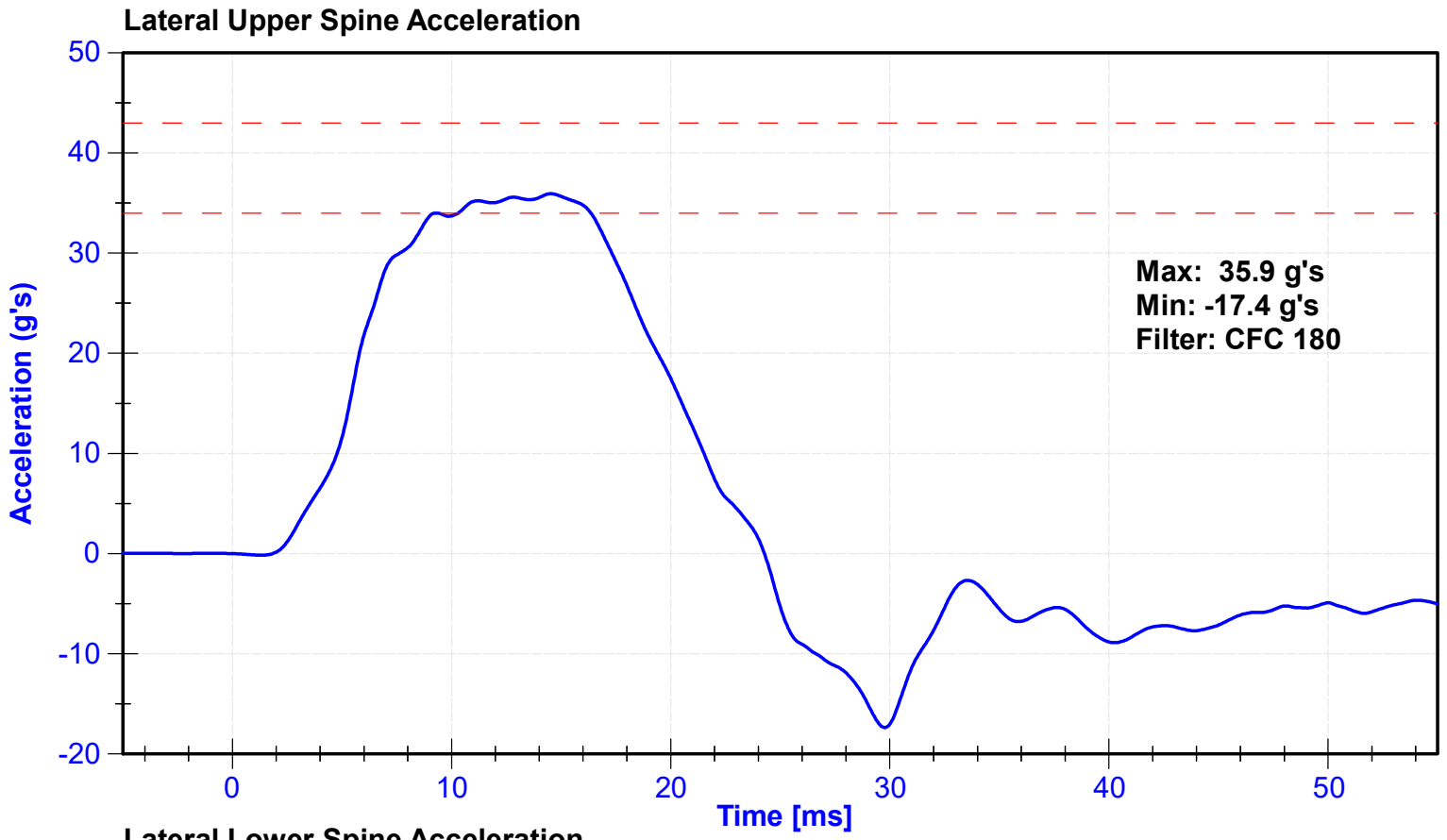


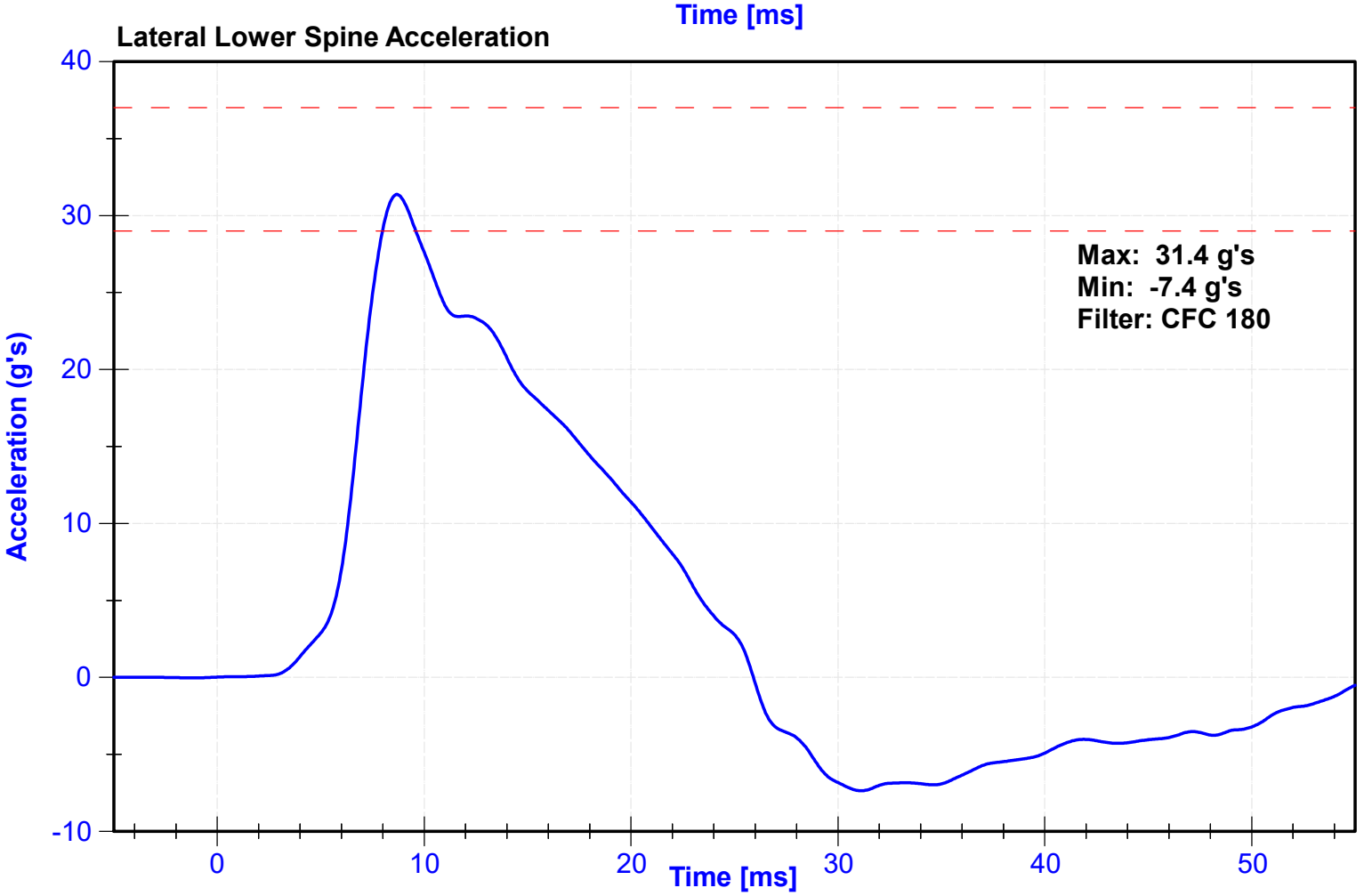

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 31.0 mm
Min: -2.4 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 25.8 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 30.9 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 34.3 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 35.9 g's
Min: -17.4 g's
Filter: CFC 180


Lateral Lower Spine Acceleration
Acceleration (g's)
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 31.4 g's
Min: -7.4 g's
Filter: CFC 180

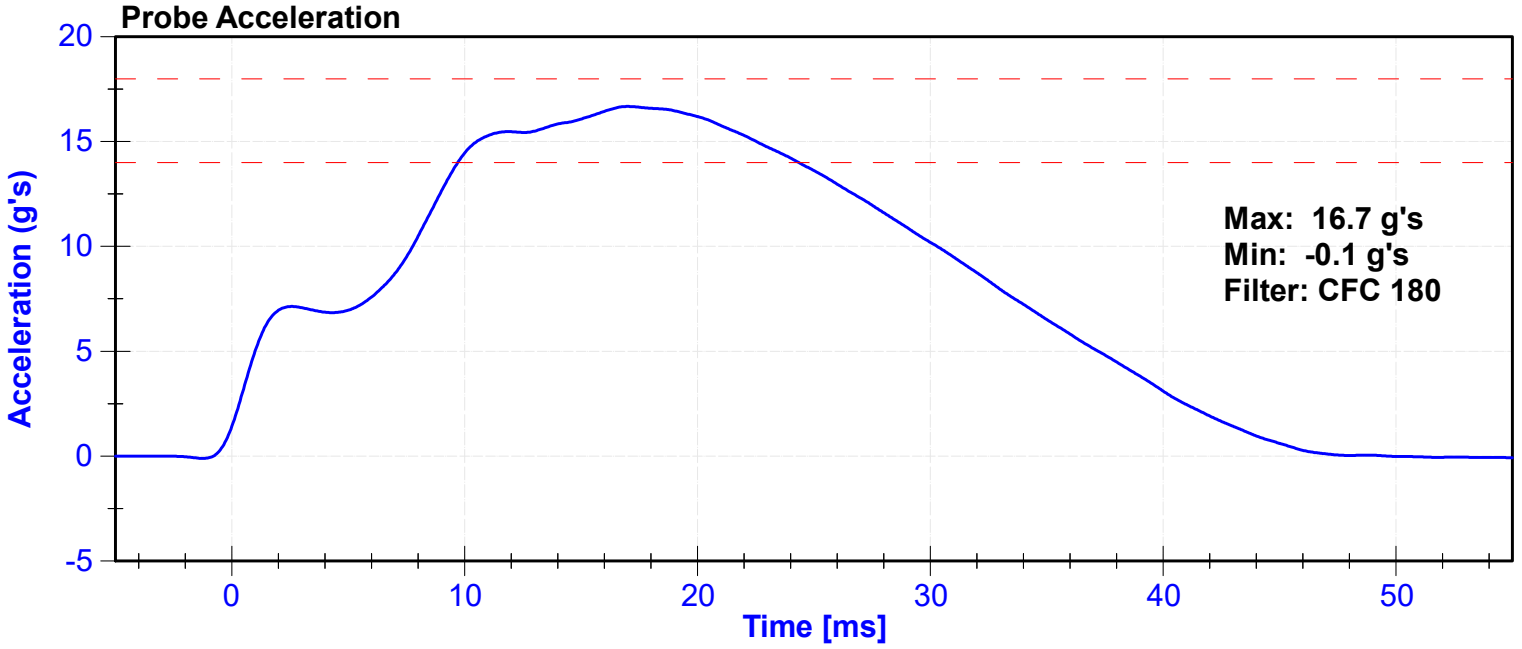
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

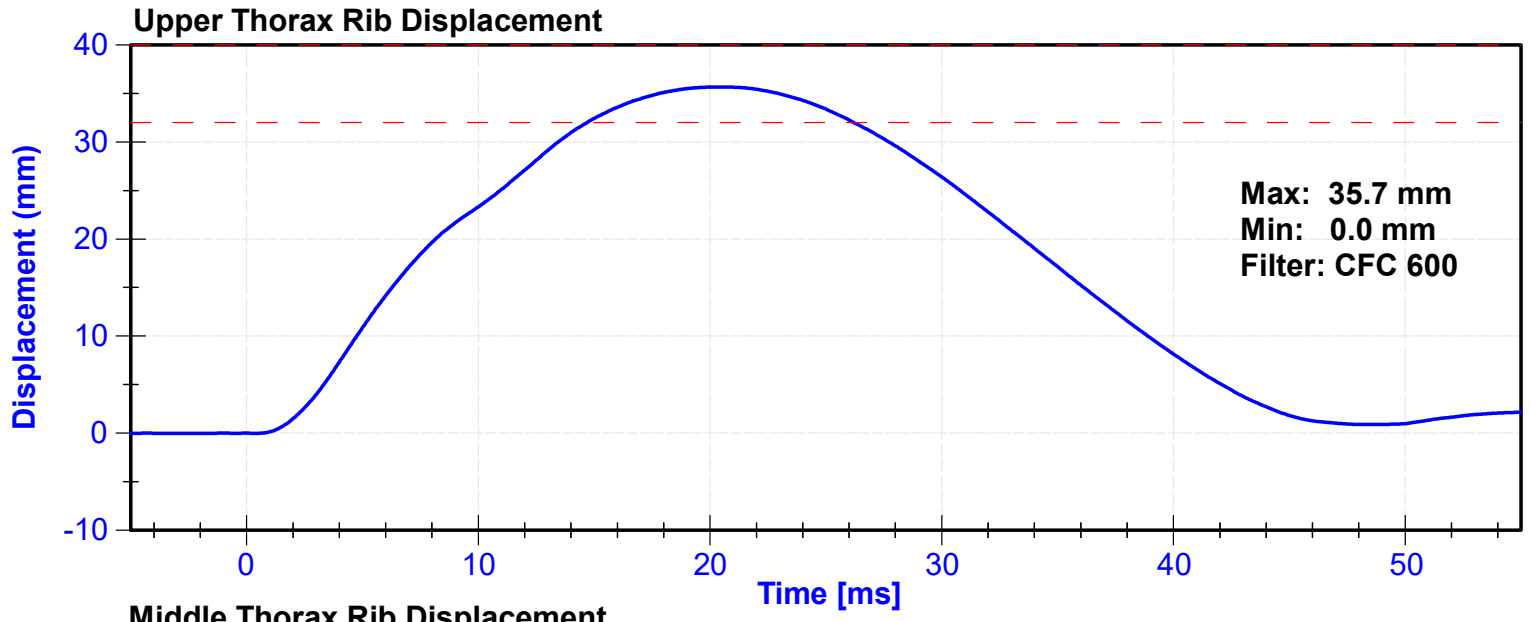
Results

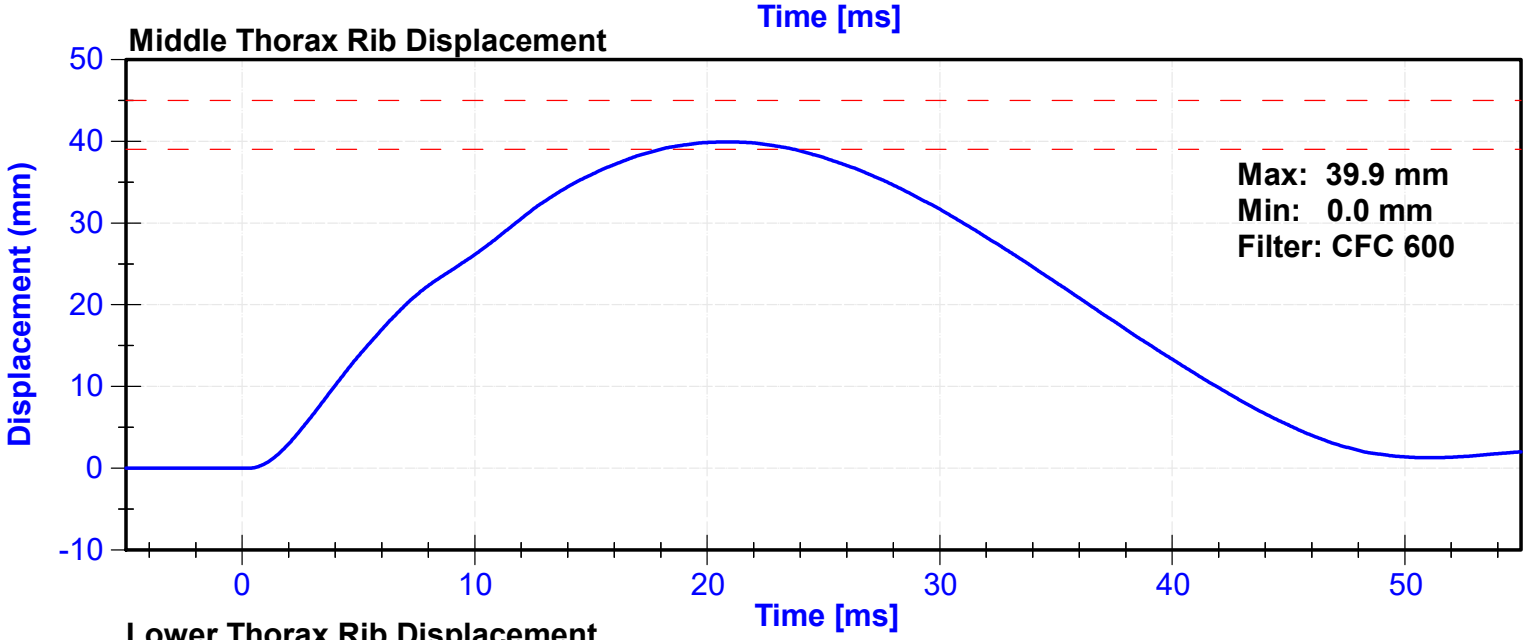
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	20	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	14	18	g's	16.7	Pass
Lateral Upper Spine Acceleration	13	17	g's	15.3	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.4	Pass
Upper Thorax Rib Deflection	32	40	mm	35.7	Pass
Middle Thorax Rib Deflection	39	45	mm	39.9	Pass
Lower Thorax Rib Deflection	35	43	mm	37.3	Pass

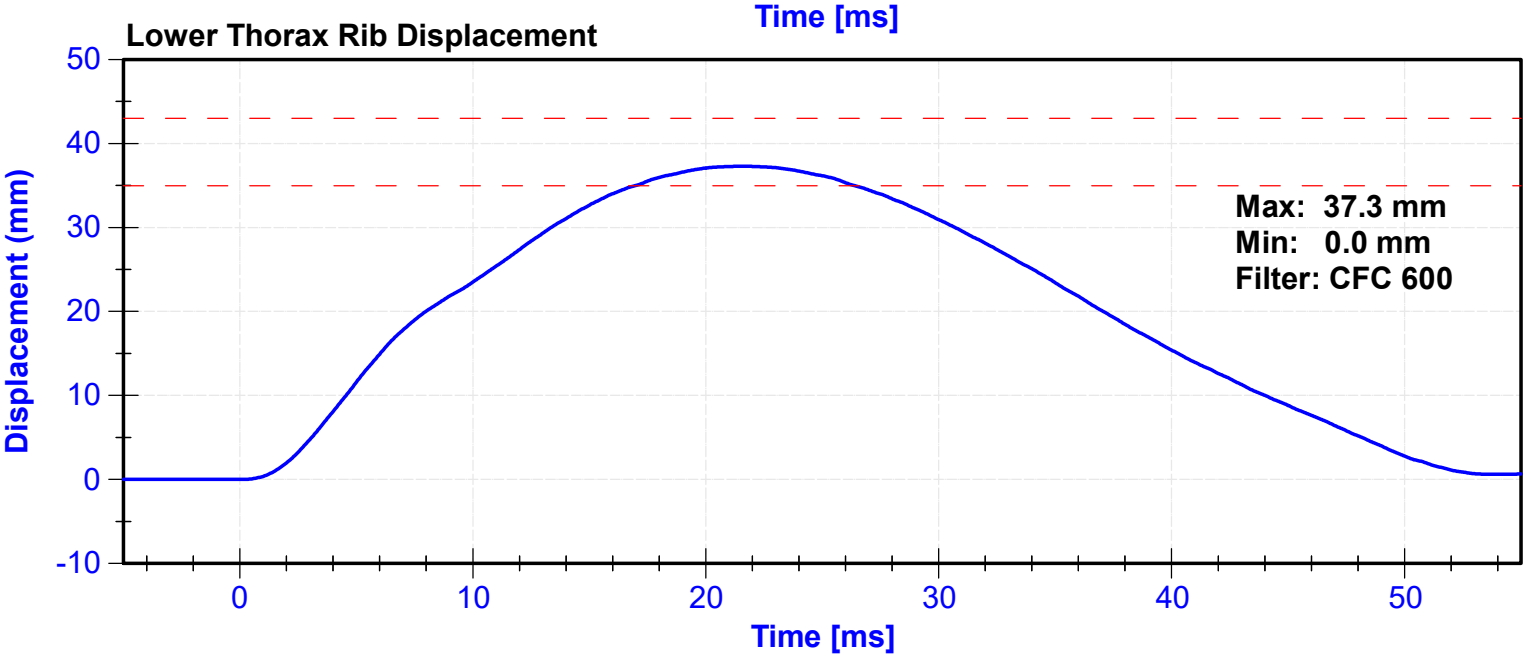
Transducer Calibrations

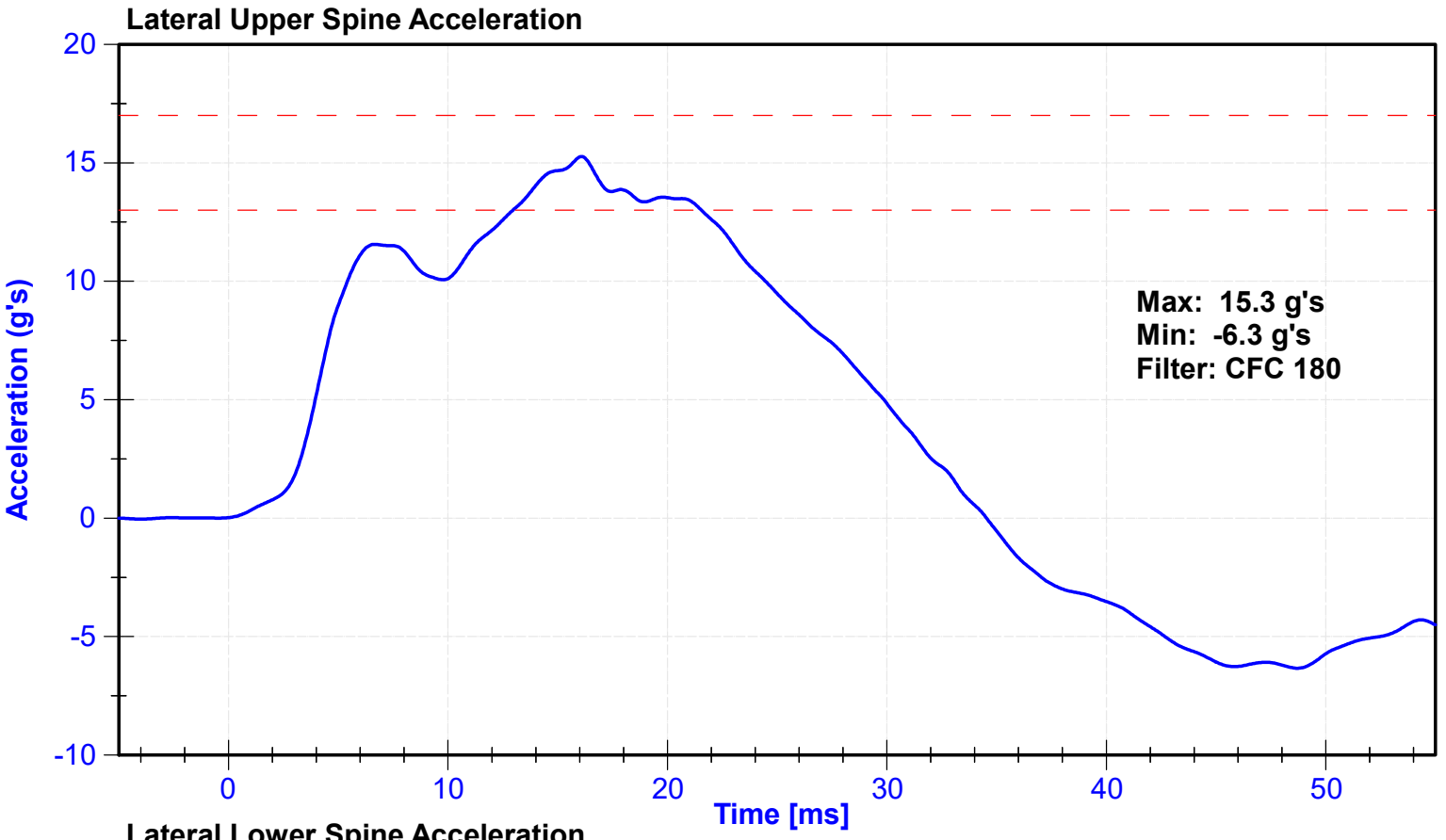
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Upper Spine Y Accelerometer	Endevco	T20880	11/16/2023	5/14/2024
Lower Spine Y Accelerometer	Endevco	P52071	11/16/2023	5/14/2024
Upper Thorax Rib Potentiometer	Servo	2316GFE	11/17/2023	5/17/2024
Middle Thorax Rib Potentiometer	Servo	307GFE	11/17/2023	5/17/2024
Lower Thorax Rib Potentiometer	Servo	1156GFE	11/17/2023	5/17/2024

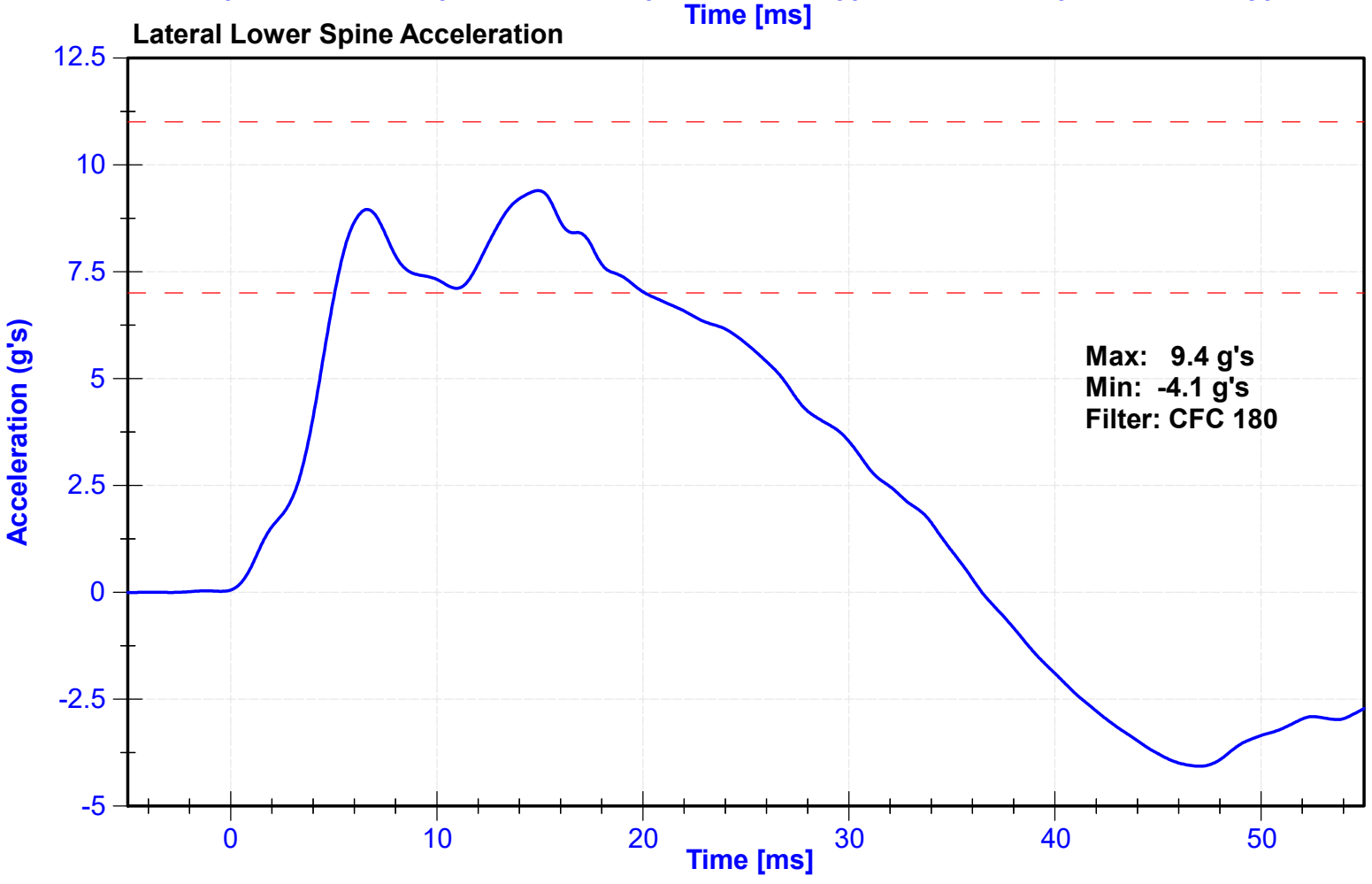



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 35.7 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 39.9 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.3 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
20
15
10
5
0
-5
-10
0
10
20
30
40
50
Time [ms]
Max: 15.3 g's
Min: -6.3 g's
Filter: CFC 180


Lateral Lower Spine Acceleration
Acceleration (g's)
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50
Time [ms]
Max: 9.4 g's
Min: -4.1 g's
Filter: CFC 180

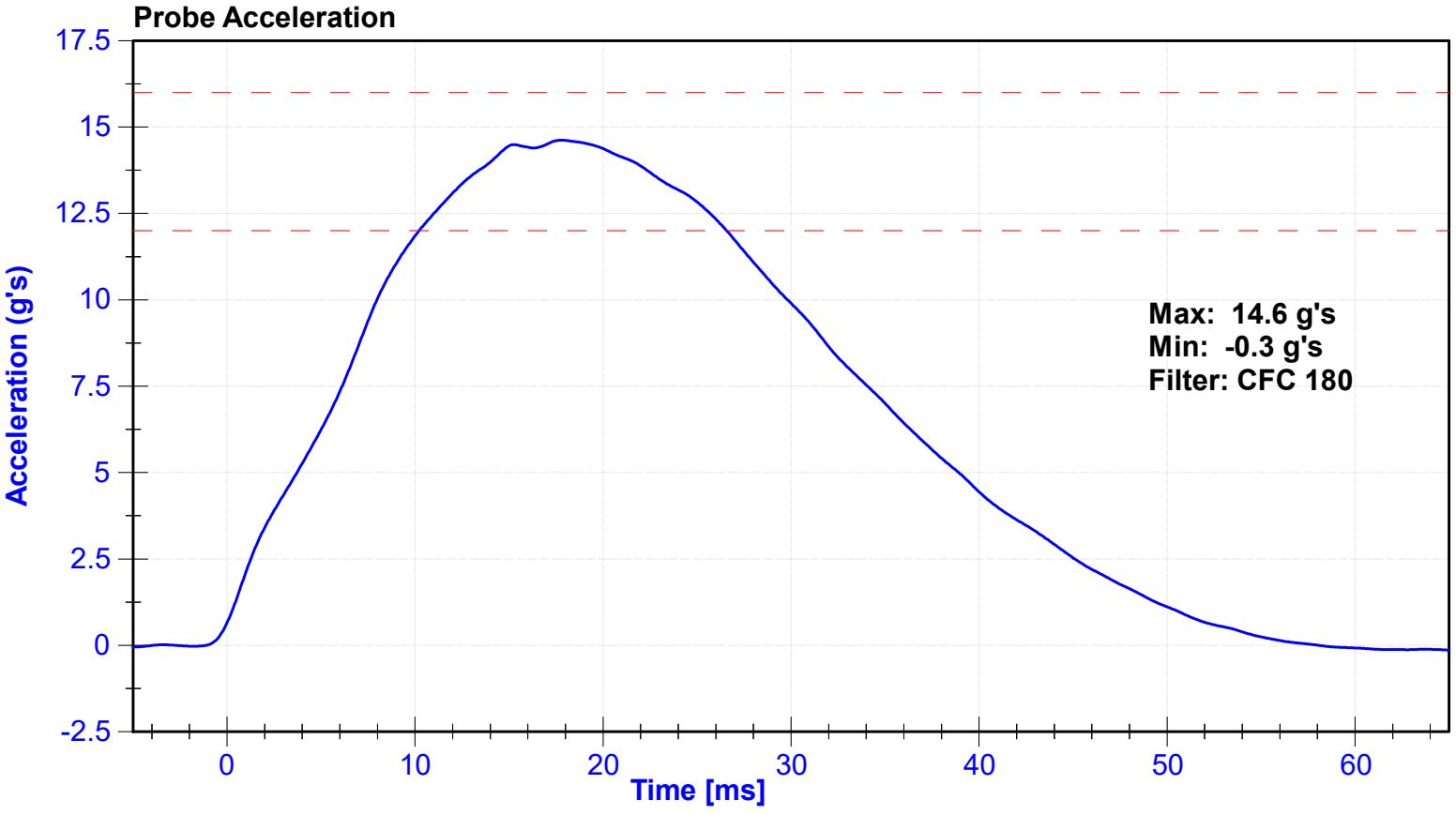
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

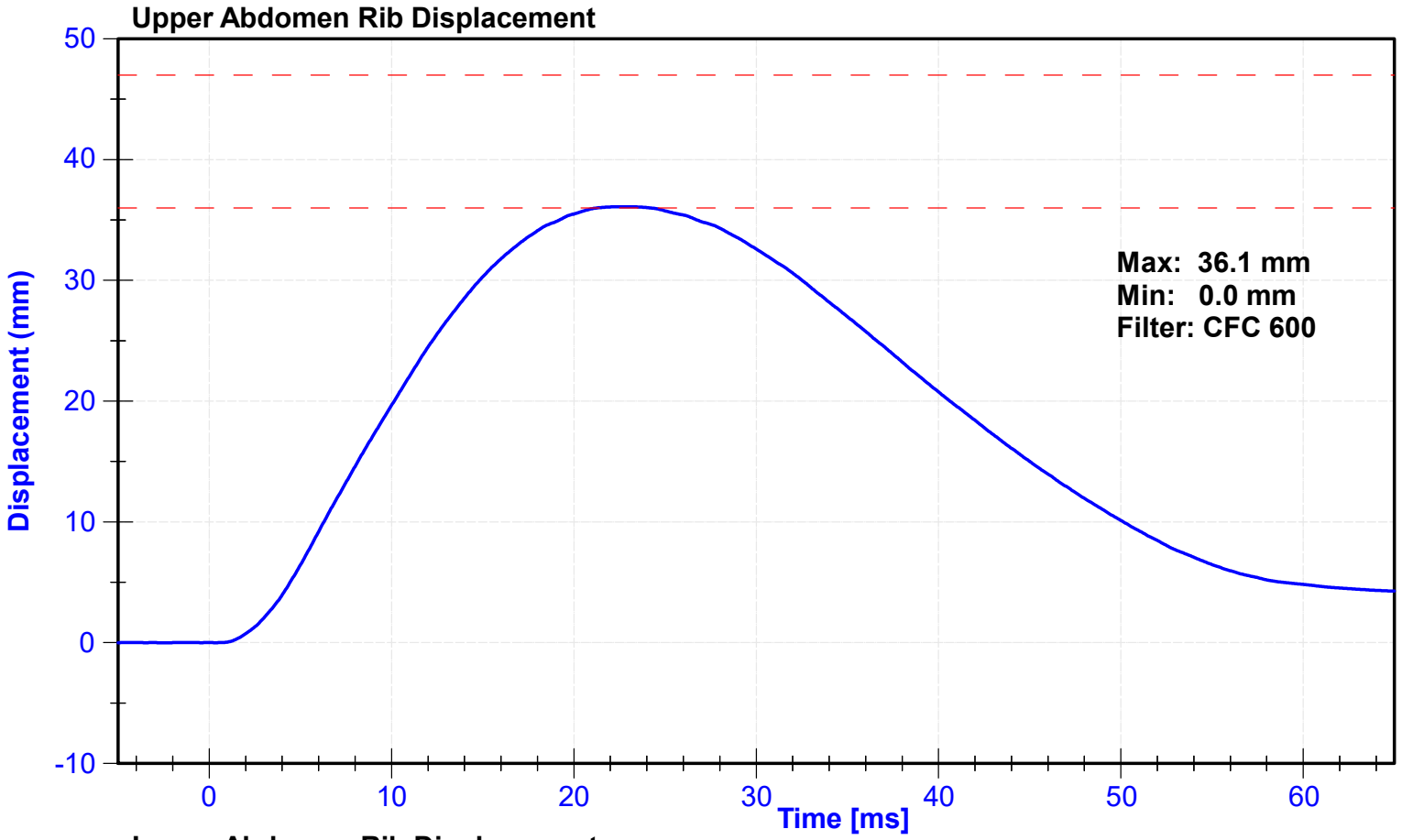
Results

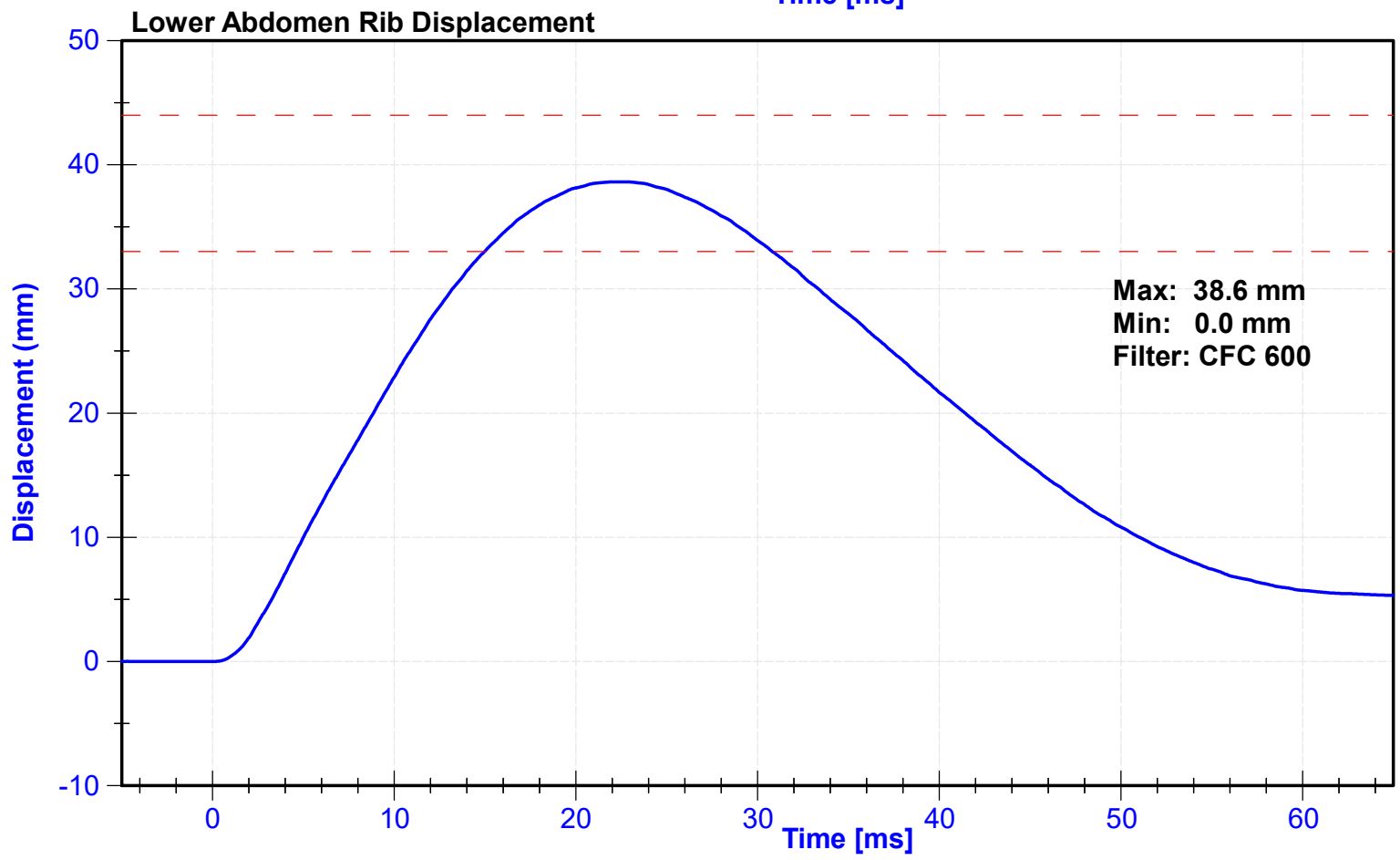
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	20	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	12	16	g's	14.6	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.4	Pass
Upper Abdomen Rib Deflection	36	47	mm	36.1	Pass
Lower Abdomen Rib Deflection	33	44	mm	38.6	Pass

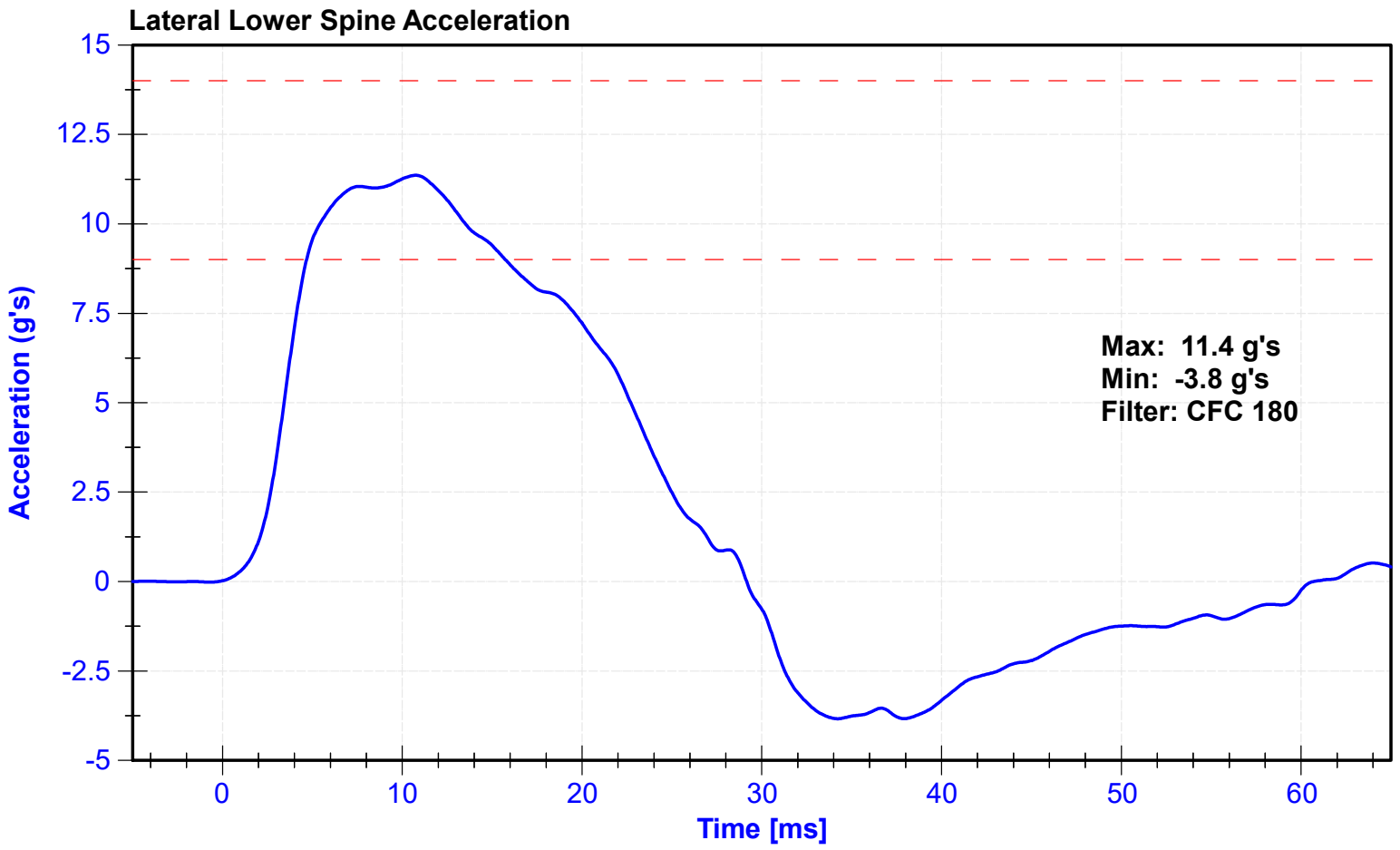
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Lower Spine Y Accelerometer	Endevco	P52071	11/16/2023	5/14/2024
Upper Abdomen Rib Potentiometer	Servo	060GFE	11/21/2023	5/21/2024
Lower Abdomen Rib Potentiometer	Servo	308GFE	11/17/2023	5/17/2024




Upper Abdomen Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
60
Time [ms]
Max: 36.1 mm
Min: 0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
60
Time [ms]
Max: 38.6 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Lower Spine Acceleration
Acceleration (g's)
15
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50
60
Time [ms]
Max: 11.4 g's
Min: -3.8 g's
Filter: CFC 180

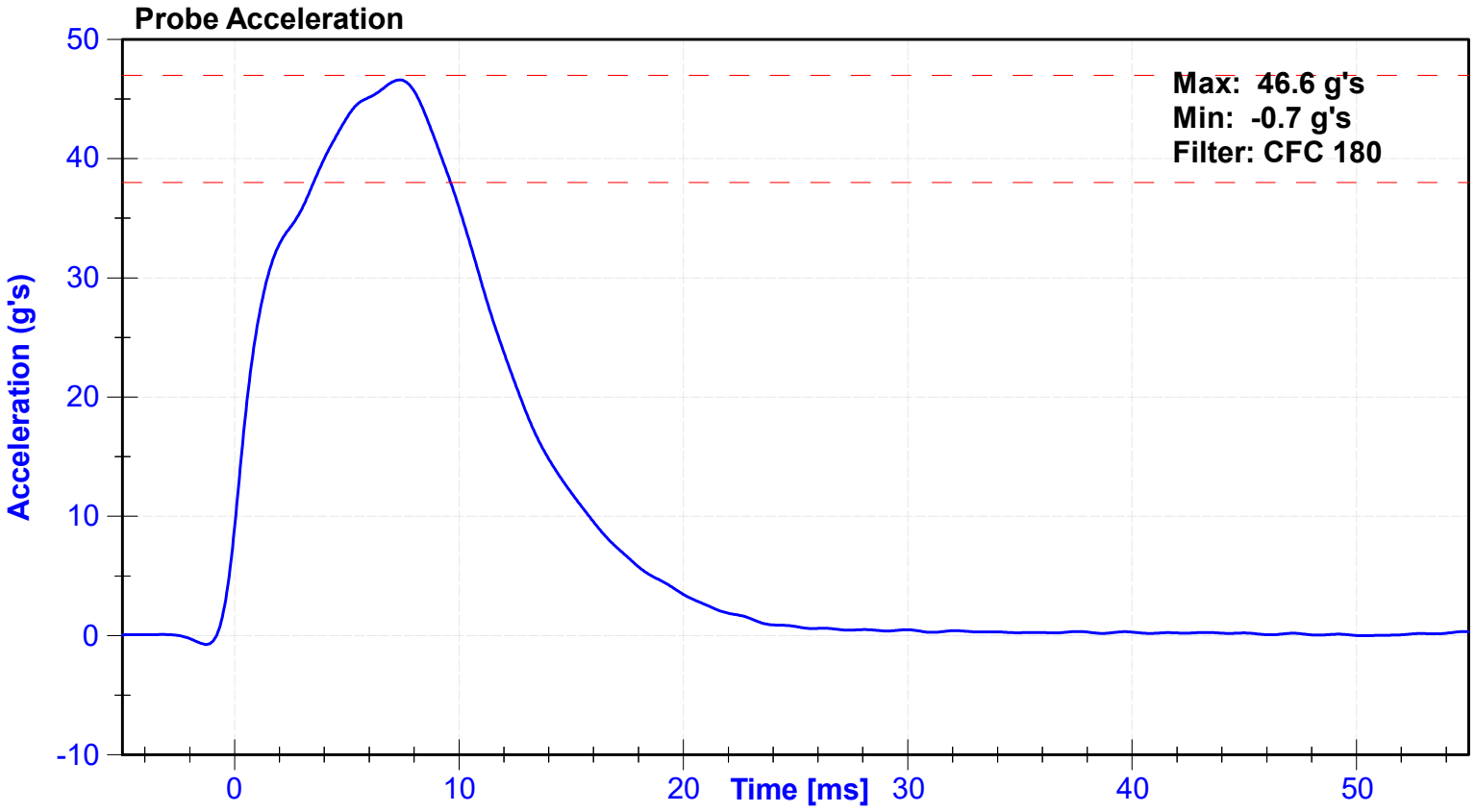
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

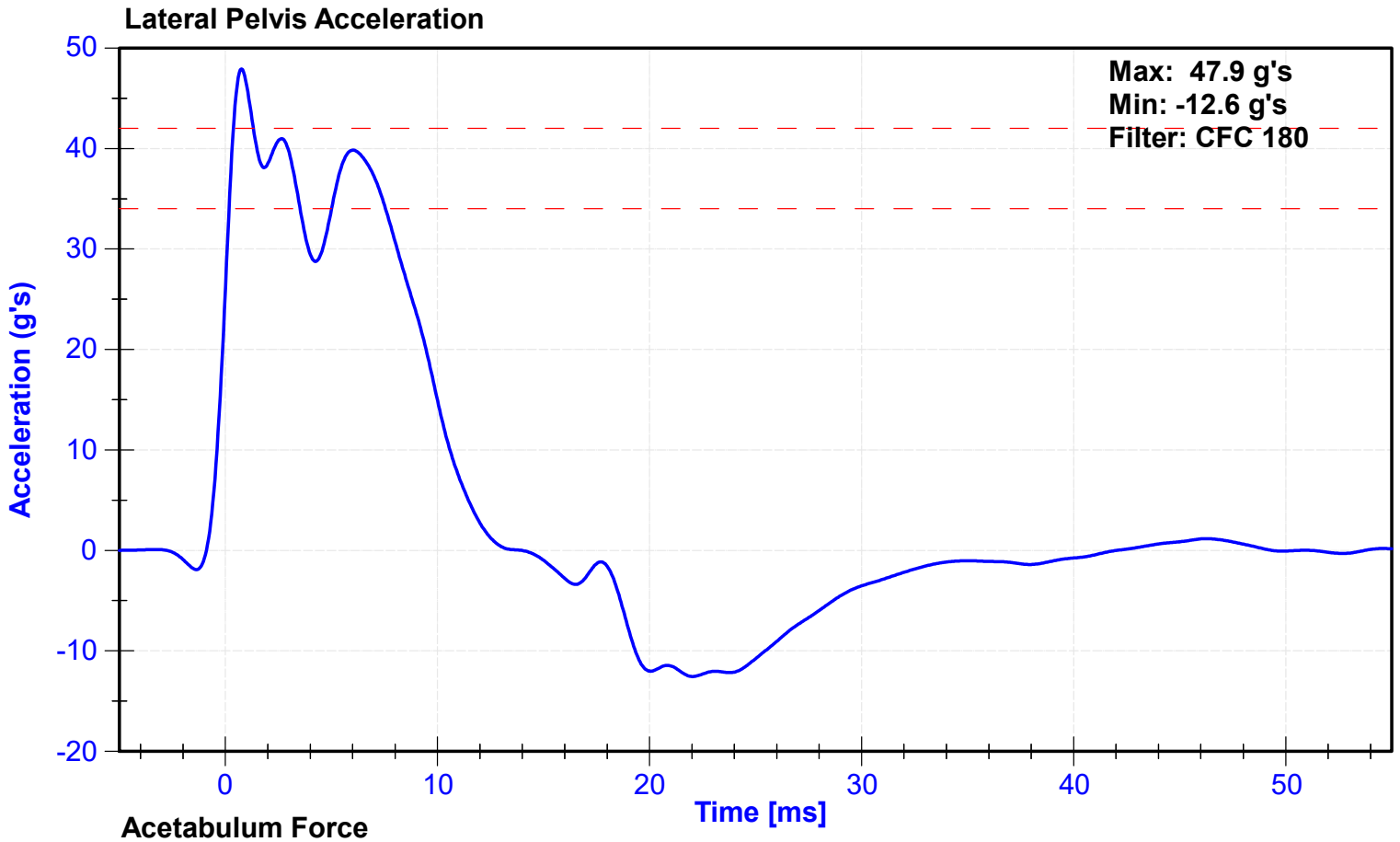
Results

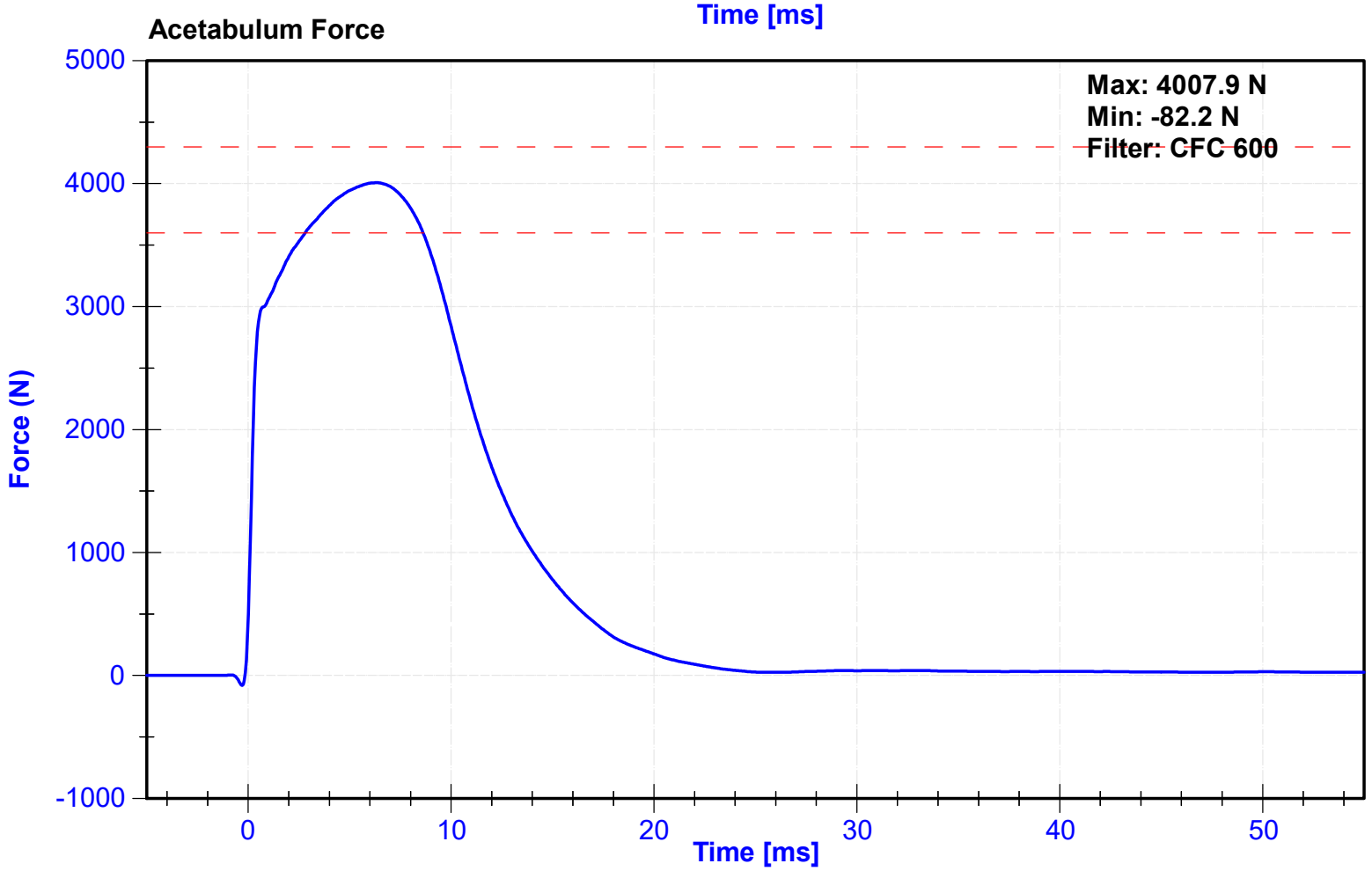
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	20	Pass
Velocity	6.6	6.8	m/s	6.63	Pass
Probe Acceleration	38	47	g's	46.6	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	39.8	Pass
Acetabulum Force	3600	4300	N	4007.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Pelvis Y Accelerometer	Endevco	P51731	11/15/2023	5/13/2024
Acetabulum Load Cell	Denton	267-FY	9/11/2023	9/10/2024
Certification Plug	SACO			N/A
Crash Test Plug	SACO			N/A




Lateral Pelvis Acceleration
Max: 47.9 g's
Min: -12.6 g's
Filter: CFC 180
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]


Acetabulum Force
Max: 4007.9 N
Min: -82.2 N
Filter: CFC 600
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]

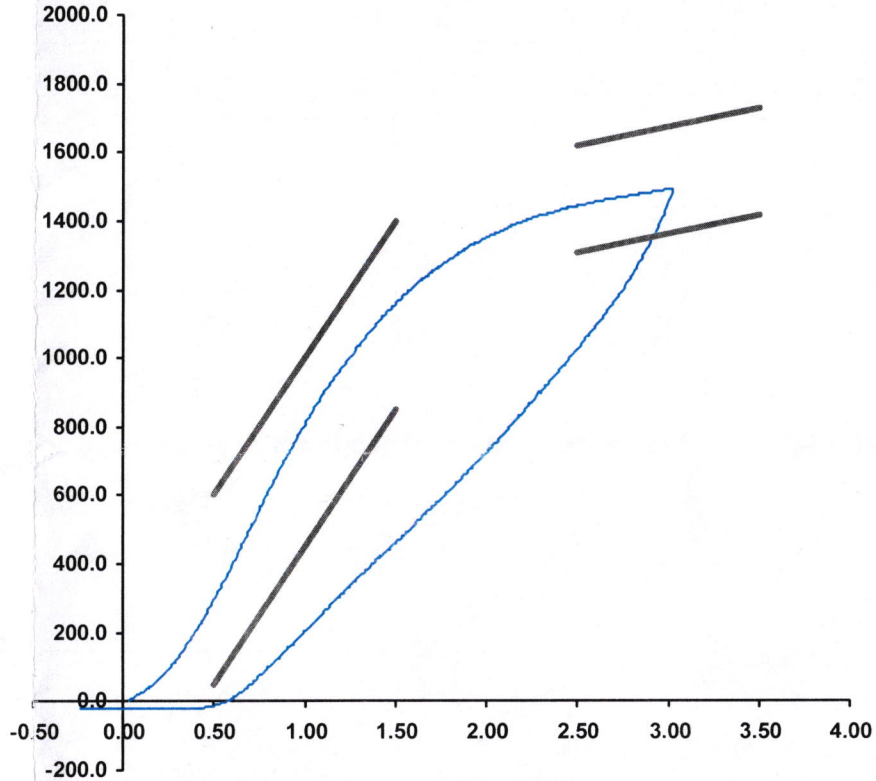
certification
11/27/23

SID-IIs Pelvis Plug Certification Test

Plug S/N 16385
Test Number 22952
Report Number 23010
Test Date 5/20/2022 2:39:16 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	303	50	600
Force @ 1.5 mm (N)	1,161	850	1,400
Force @ 2.5 mm (N)	1,444	1,306	1,618
Force @ 3.0 mm (N)	1,491	1,361	1,673

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

(-44)

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 20-May-22
SACO Research

By : DC Date : 5/20/2022

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

300 8/8/23

SID-IIs Pelvis Plug Certification Test

Plug S/N 16471 CRASH - IMPACT

Test Number 23040

Report Number 23098

Test Date 5/23/2022 1:22:16 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	340	50	600
Force @ 1.5 mm (N)	1,004	850	1,400
Force @ 2.5 mm (N)	1,353	1,306	1,618
Force @ 3.0 mm (N)	1,465	1,361	1,673

Testing Machine STM-20 5965542

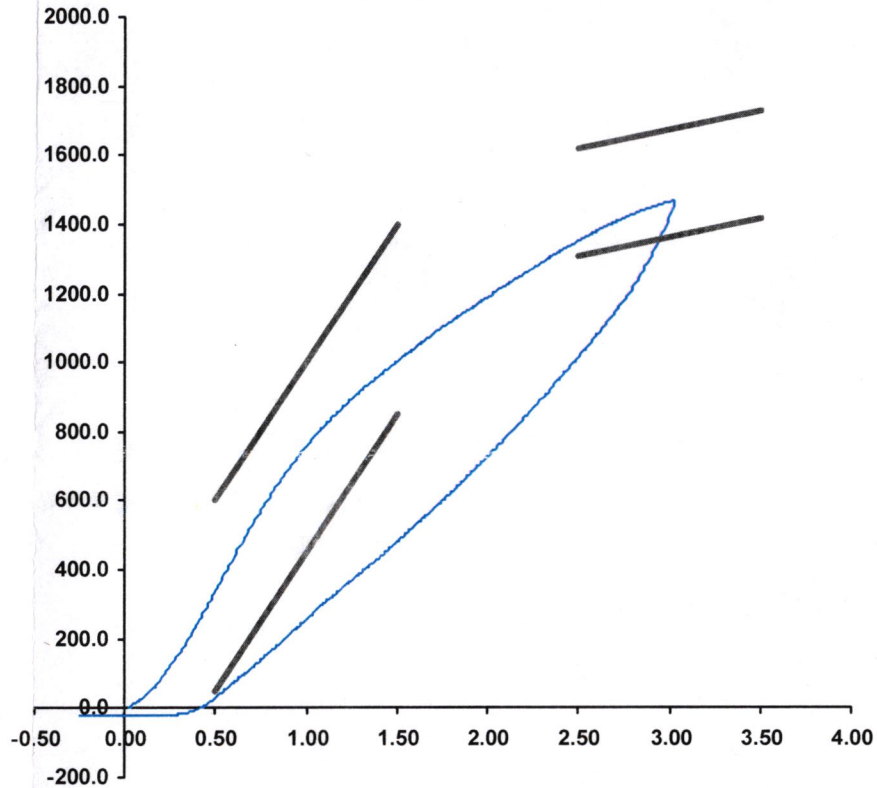
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7

Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 23-May-22

SACO Research

By : _____ Date : 5/23/2022

SACO RESEARCH

3008/8/23

SID-IIs Pelvis Plug Certification Test

Plug S/N 16549 CRASH - NON IMPACT

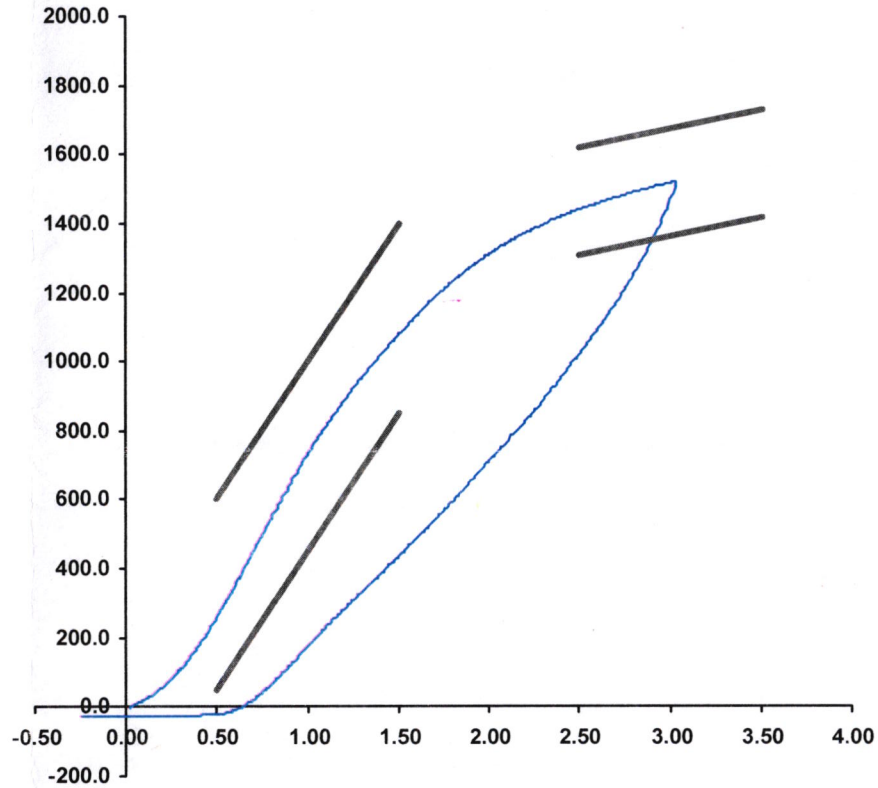
Test Number 23333

Report Number 23390

Test Date 7/15/2022 9:22:48 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	266	50	600
Force @ 1.5 mm (N)	1,079	850	1,400
Force @ 2.5 mm (N)	1,441	1,306	1,618
Force @ 3.0 mm (N)	1,517	1,361	1,673

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542

Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7

Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 15-Jul-22

SACO Research

By : DC Date : 7/15/22

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

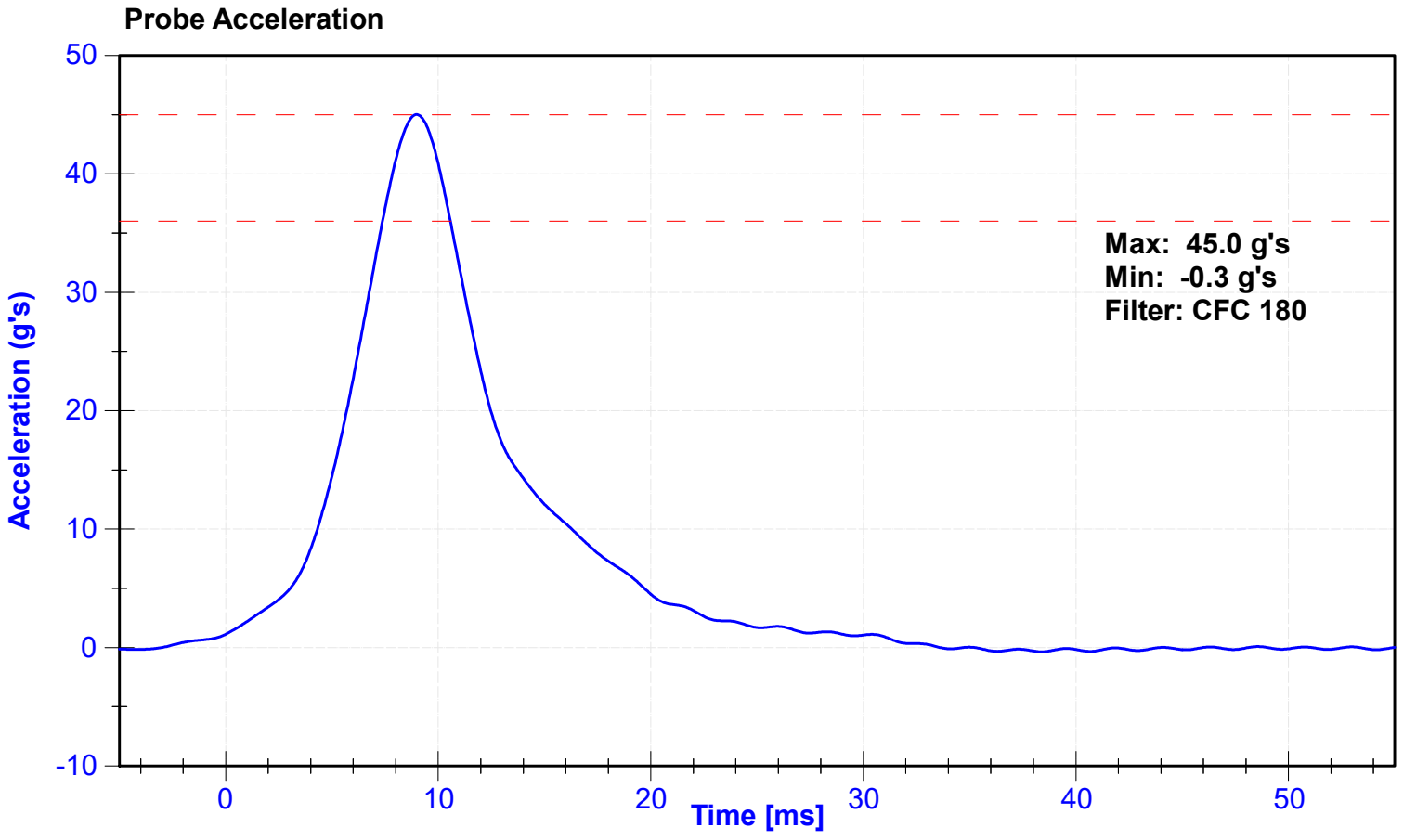
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

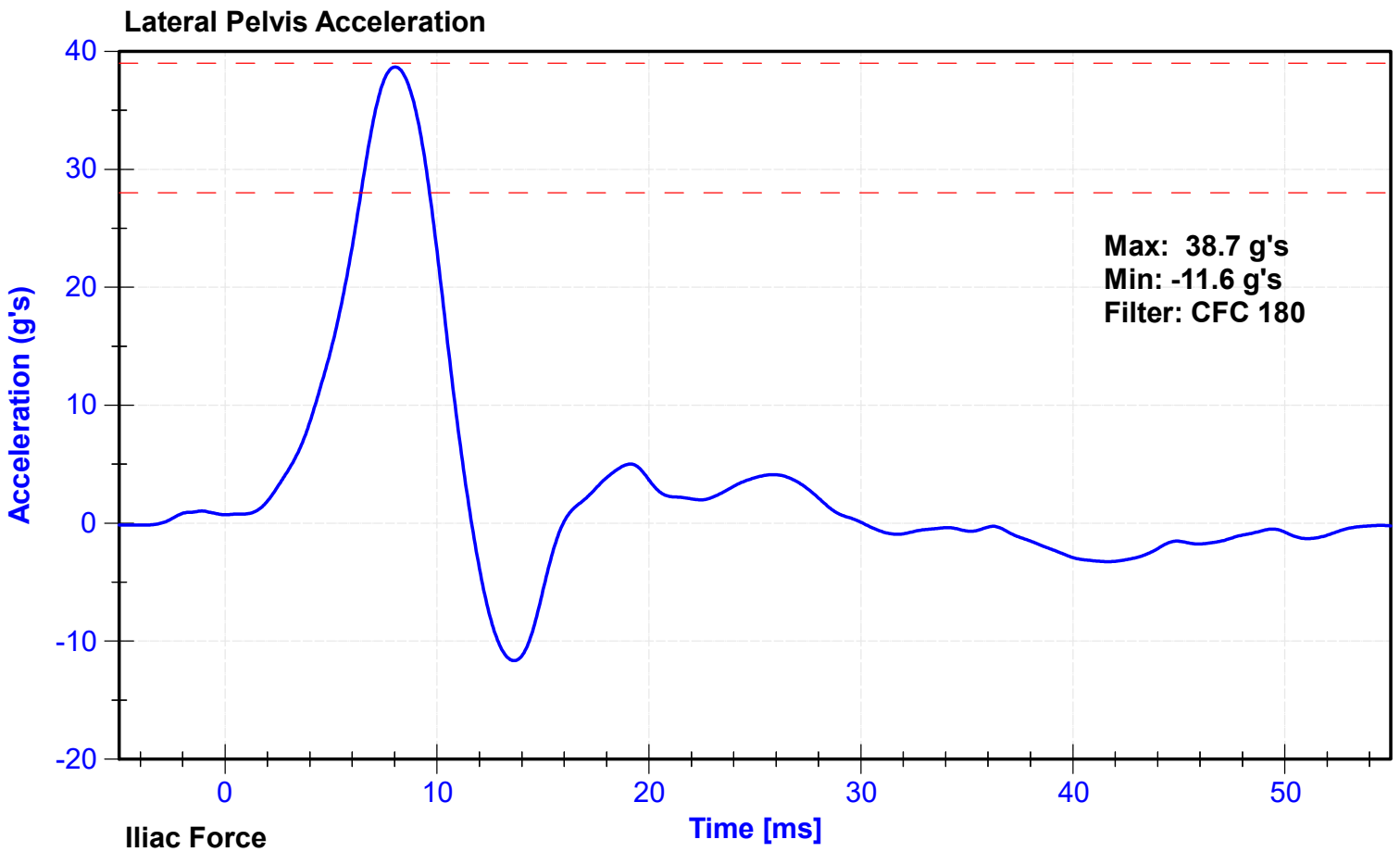
Results

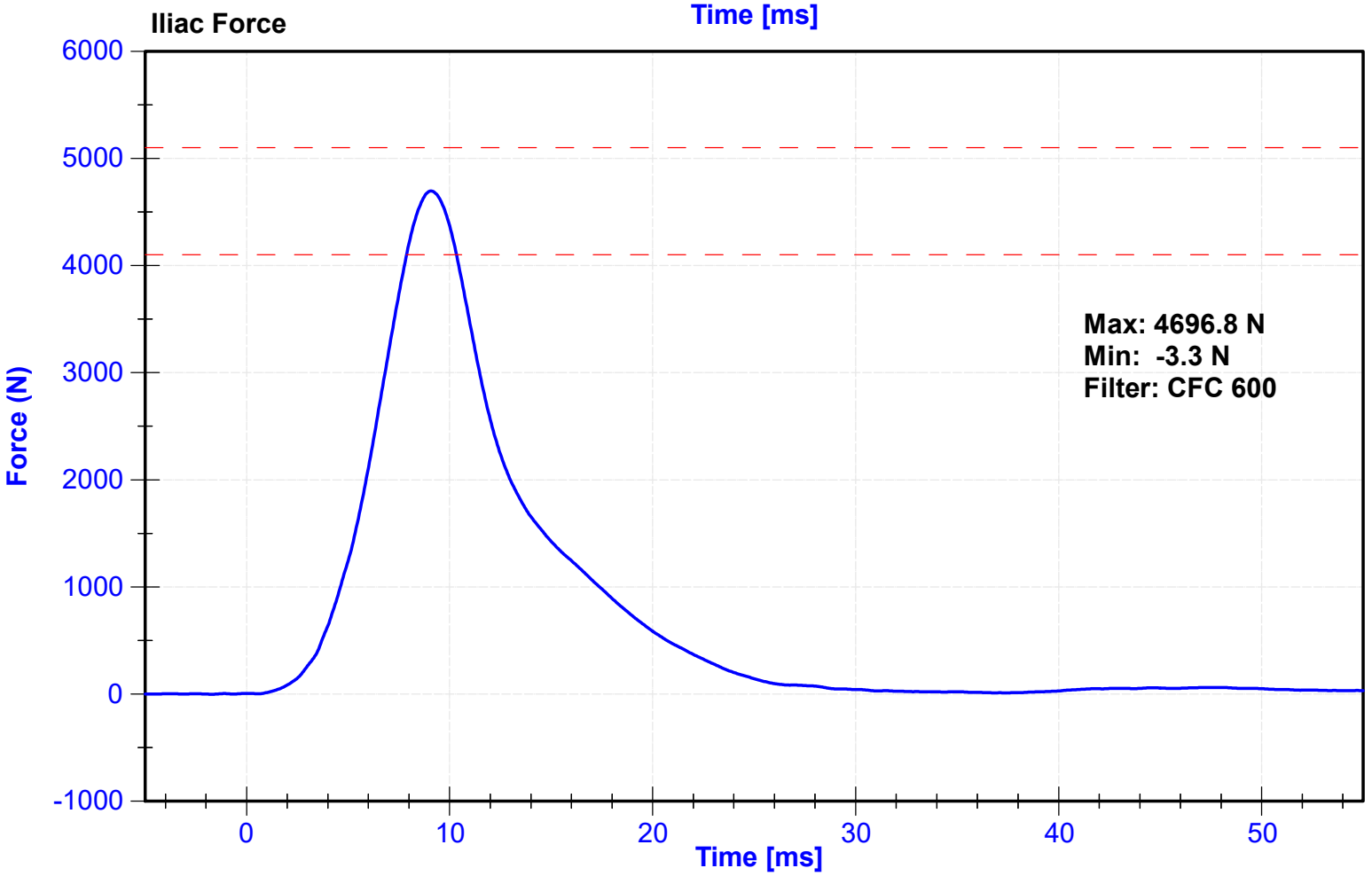
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	20	Pass
Velocity	4.2	4.4	m/s	4.27	Pass
Probe Acceleration	36	45	g's	45.0	Pass
Lateral Pelvis Acceleration	28	39	g's	38.7	Pass
Iliac Force	4100	5100	N	4696.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Pelvis Y Accelerometer	Endevco	P51731	11/15/2023	5/13/2024
Iliac Load Cell	Denton	321	9/11/2023	9/10/2024




Lateral Pelvis Acceleration
Acceleration (g's)
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 38.7 g's
Min: -11.6 g's
Filter: CFC 180


Iliac Force
Force (N)
6000
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 4696.8 N
Min: -3.3 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

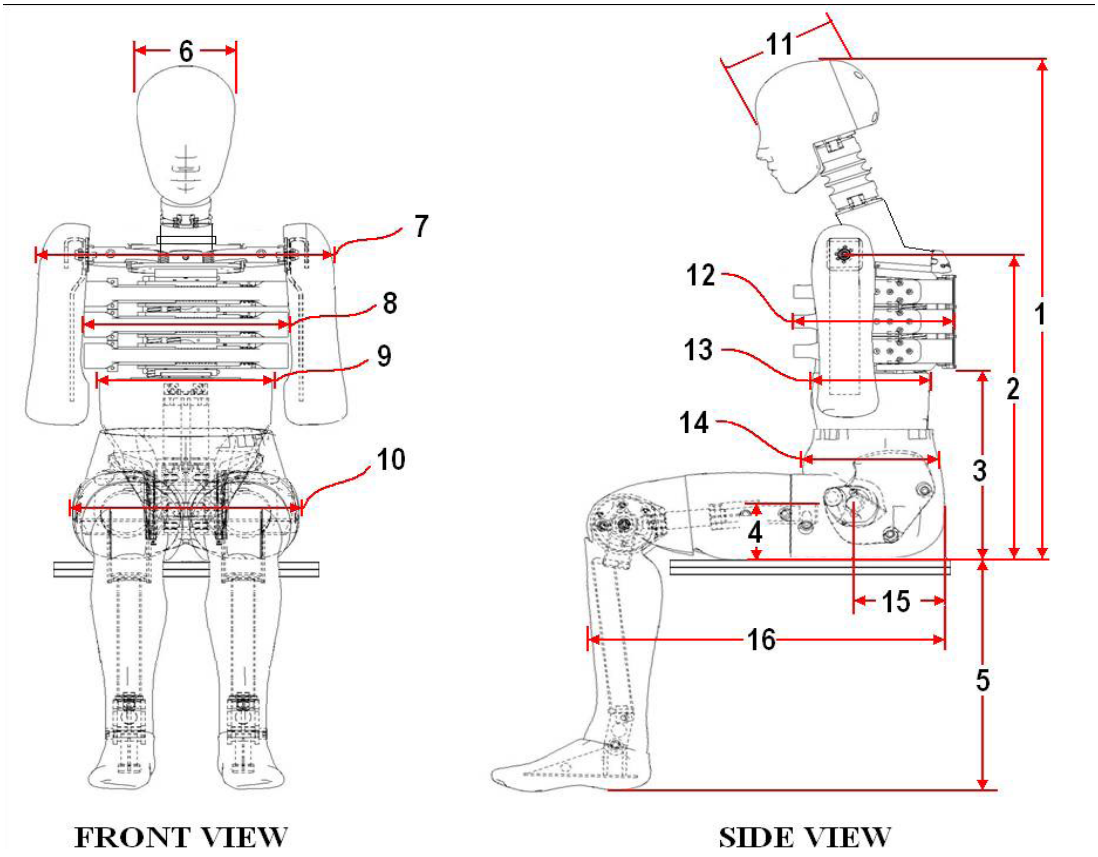
SERIAL NO:F033

(CONFIGURED FOR LEFT SIDE It

External Measurements - EuroSID-2re

Technician: K. Brogan Date: 12/06/2023

Dummy Serial Number: F033



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	567	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	99	Pass
5	Sole to Seat, Sitting	333	451	425	Pass
6	Head Width	152	158	156	Pass
7	Shoulder/Arm Width	461	479	471	Pass
8	Thorax Width	322	332	329	Pass
9	Abdomen Width	273	287	281	Pass
10	Pelvis Lap Width	359	373	369	Pass
11	Head Depth	196	206	200	Pass
12	Thorax Depth	262	272	266	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	240	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

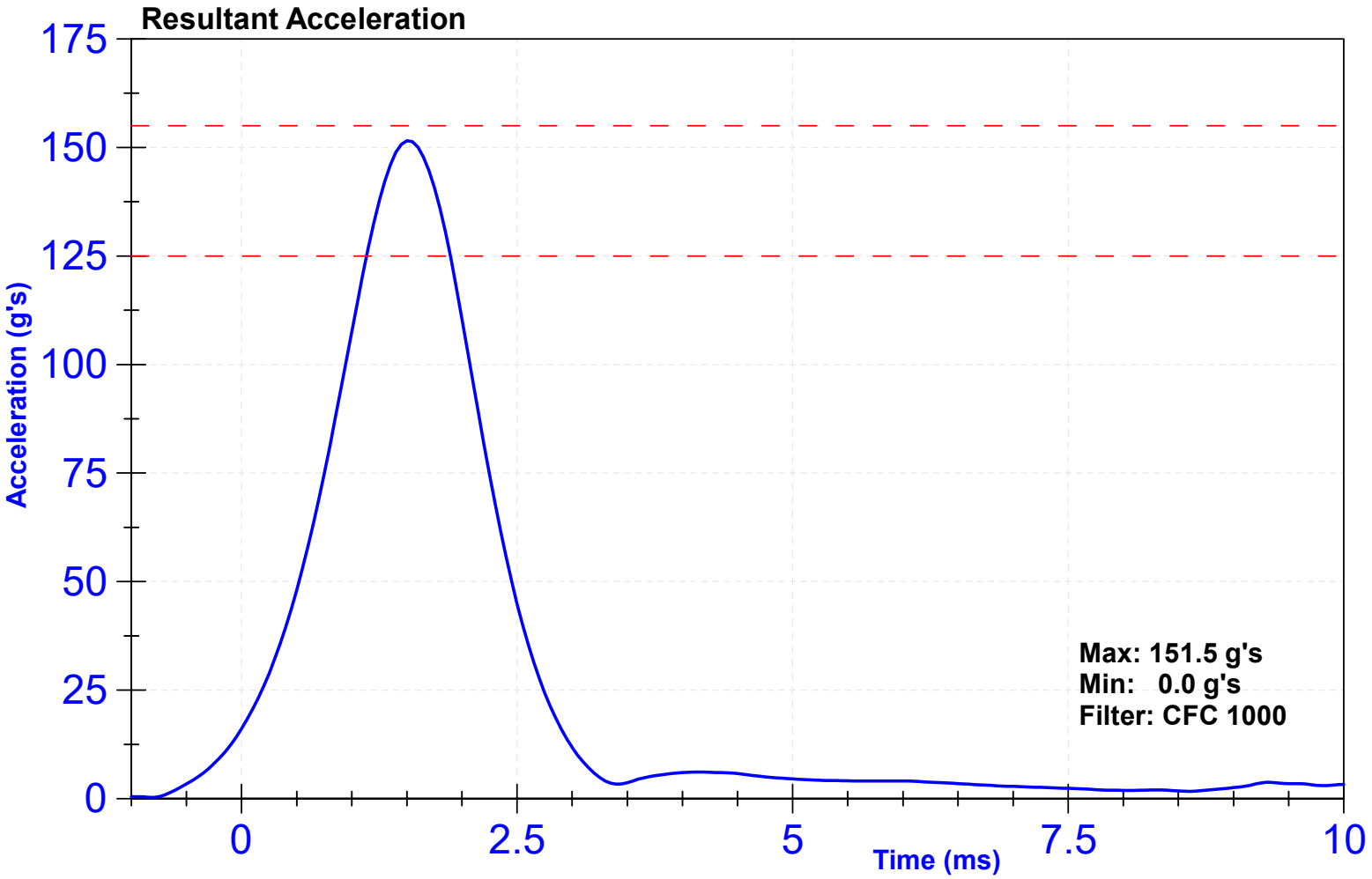
ATD Manufacturer	FTSS	Test Technician	J. Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

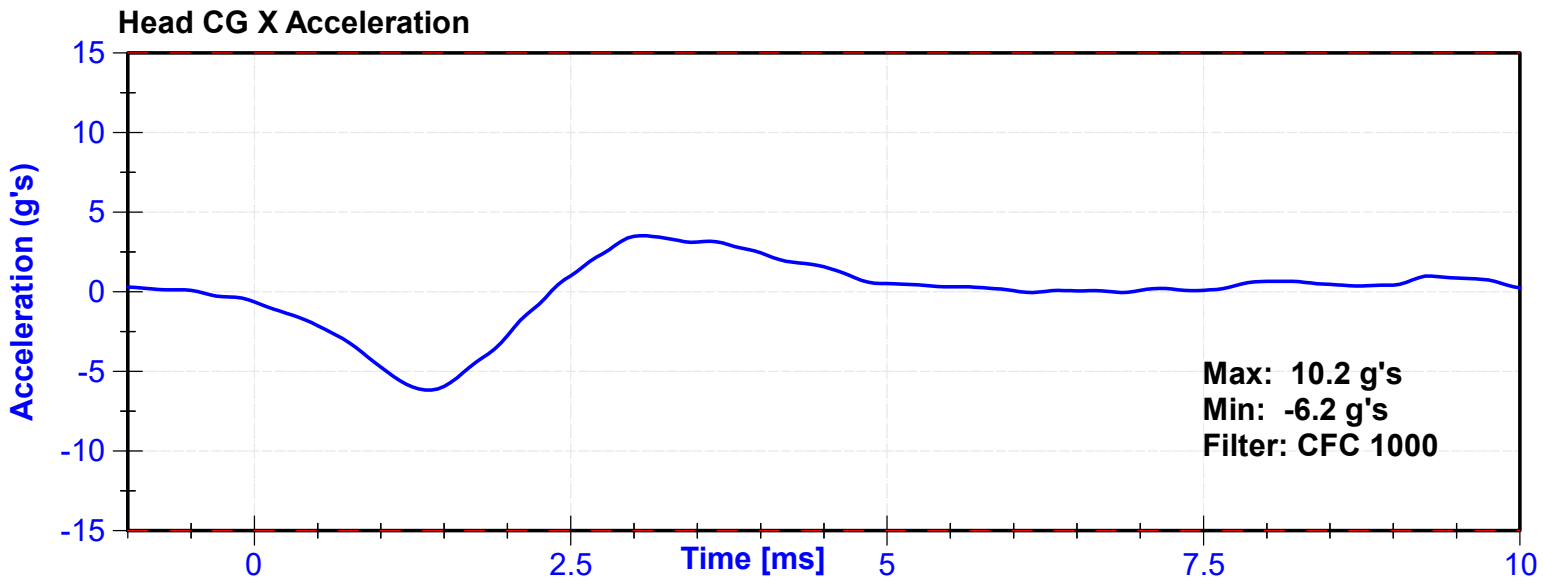
Results

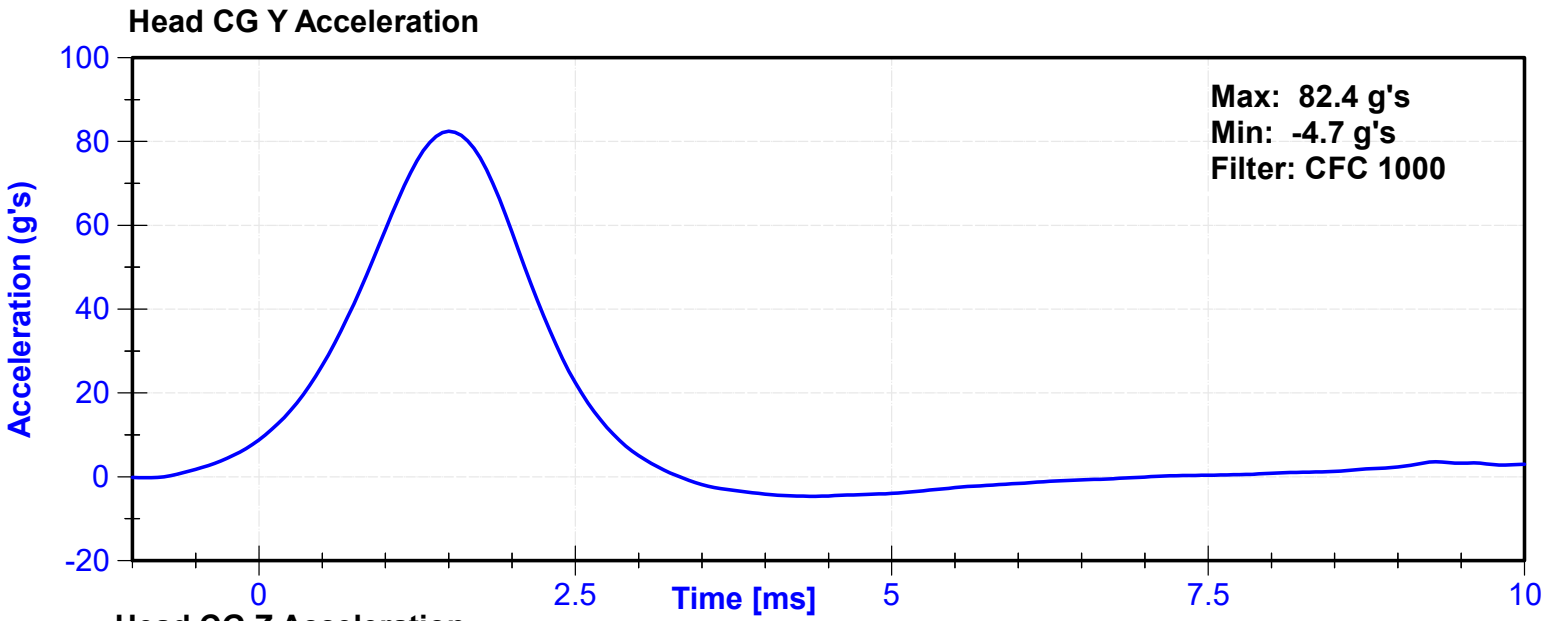
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	48	Pass
Resultant Acceleration	125	155	g's	151.5	Pass
Oscillation	0	15	%	6.98	Pass
Fore-Aft Acceleration	-15	15	g's	10.2	Pass

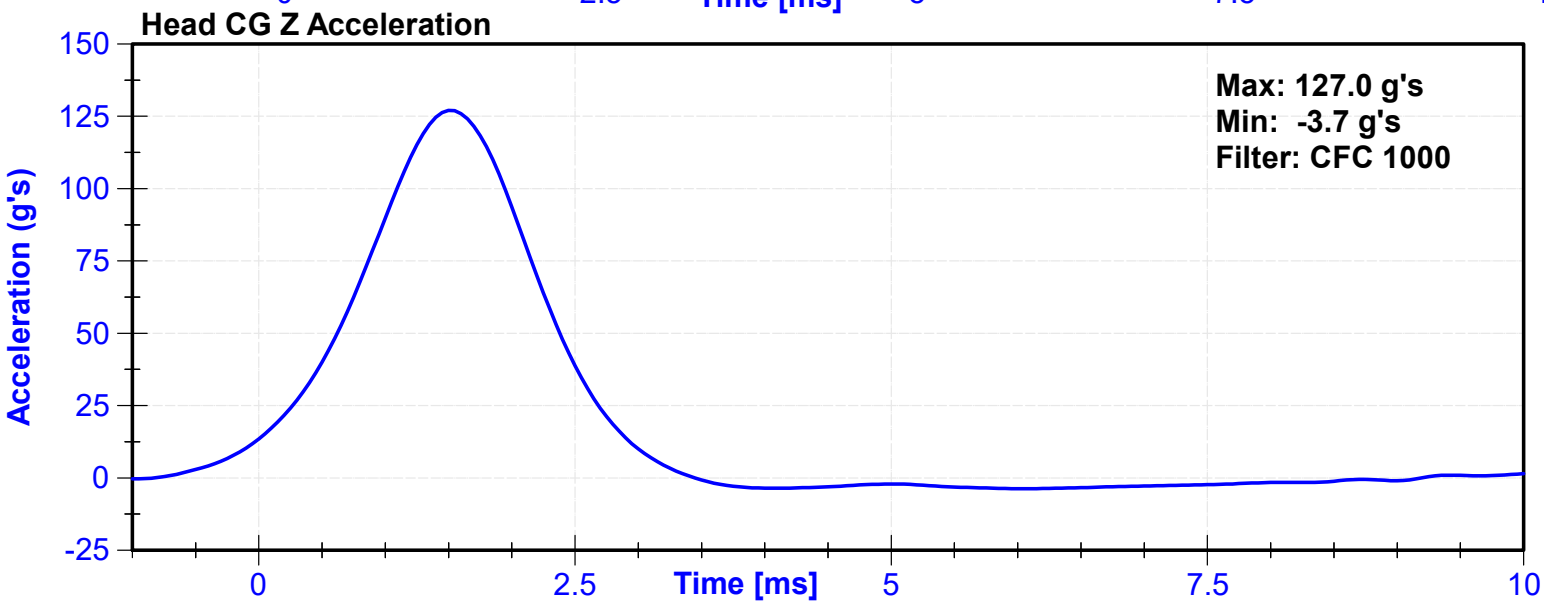
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Measurement Specialties	MS26716	8/29/2023	2/25/2024
Y Accelerometer	Measurement Specialties	MS26106	10/10/2023	4/7/2024
Z Accelerometer	Measurement Specialties	A255567	8/29/2023	2/25/2024




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
Time [ms]
5
7.5
10
Max: 10.2 g's
Min: -6.2 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
Time [ms]
5
7.5
10
Max: 82.4 g's
Min: -4.7 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
150
125
100
75
50
25
0
-25
0
2.5
Time [ms]
5
7.5
10
Max: 127.0 g's
Min: -3.7 g's
Filter: CFC 1000

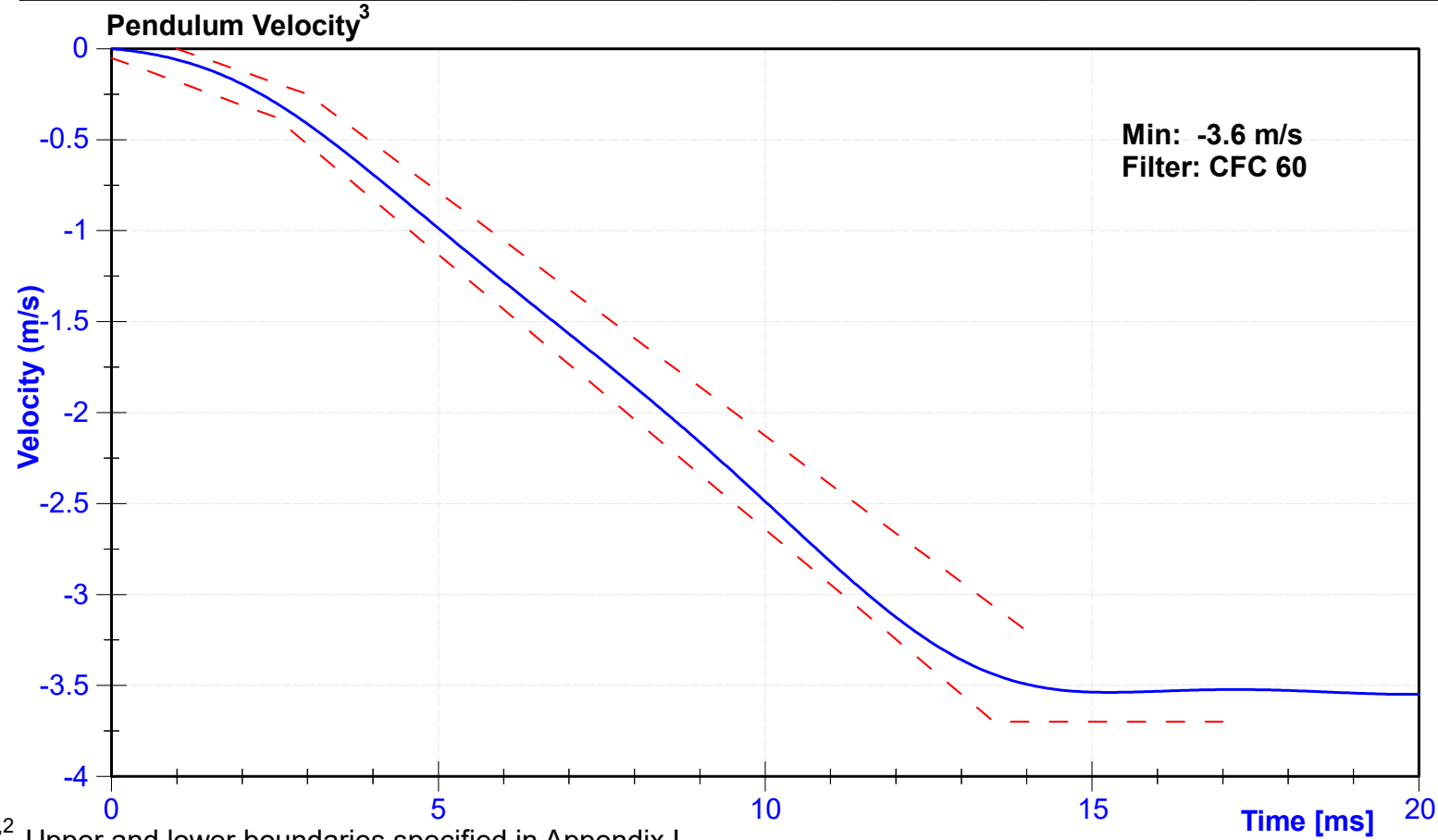
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

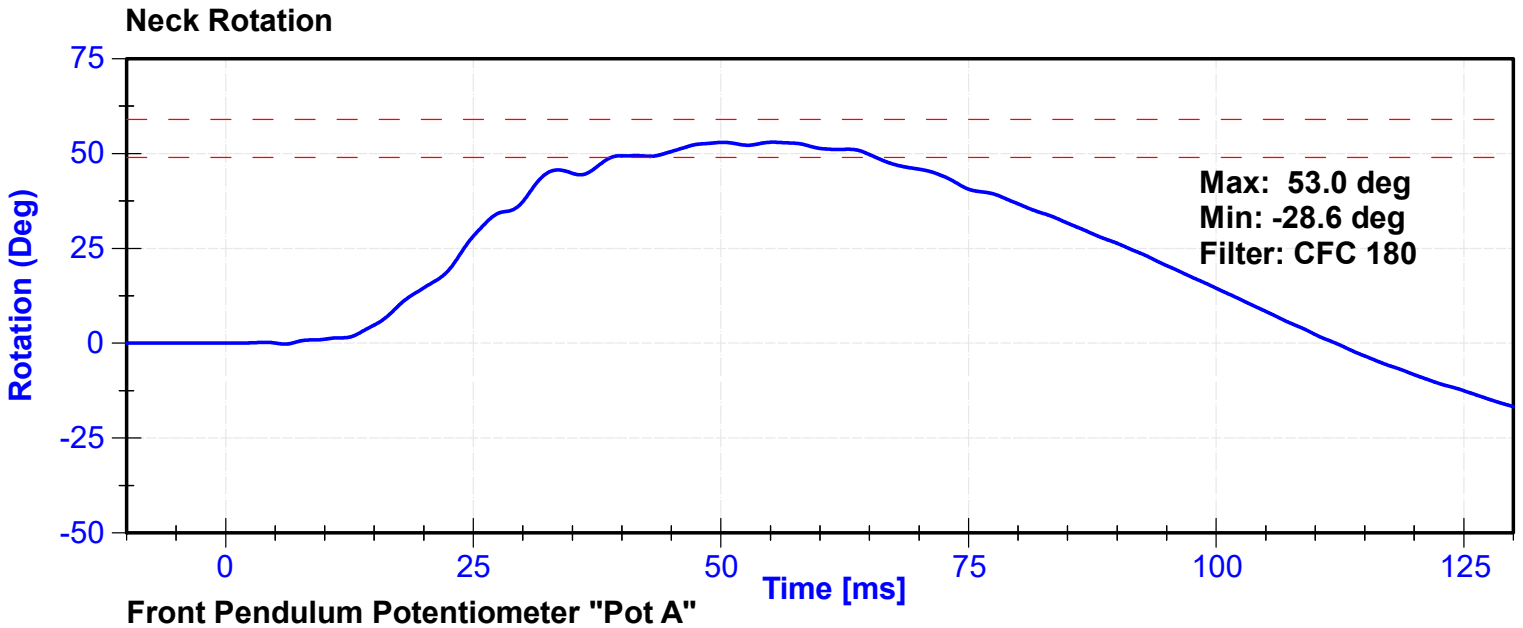
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.0	Pass
Humidity	10	70	%	34	Pass
Velocity	3.3	3.5	m/s	3.33	Pass
Lateral Neck Rotation	49	59	deg	53.0	Pass
Time at Maximum Rotation	54	66	ms	55.3	Pass
Time of Rotation Decay from Maximum	53	88	ms	56.8	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

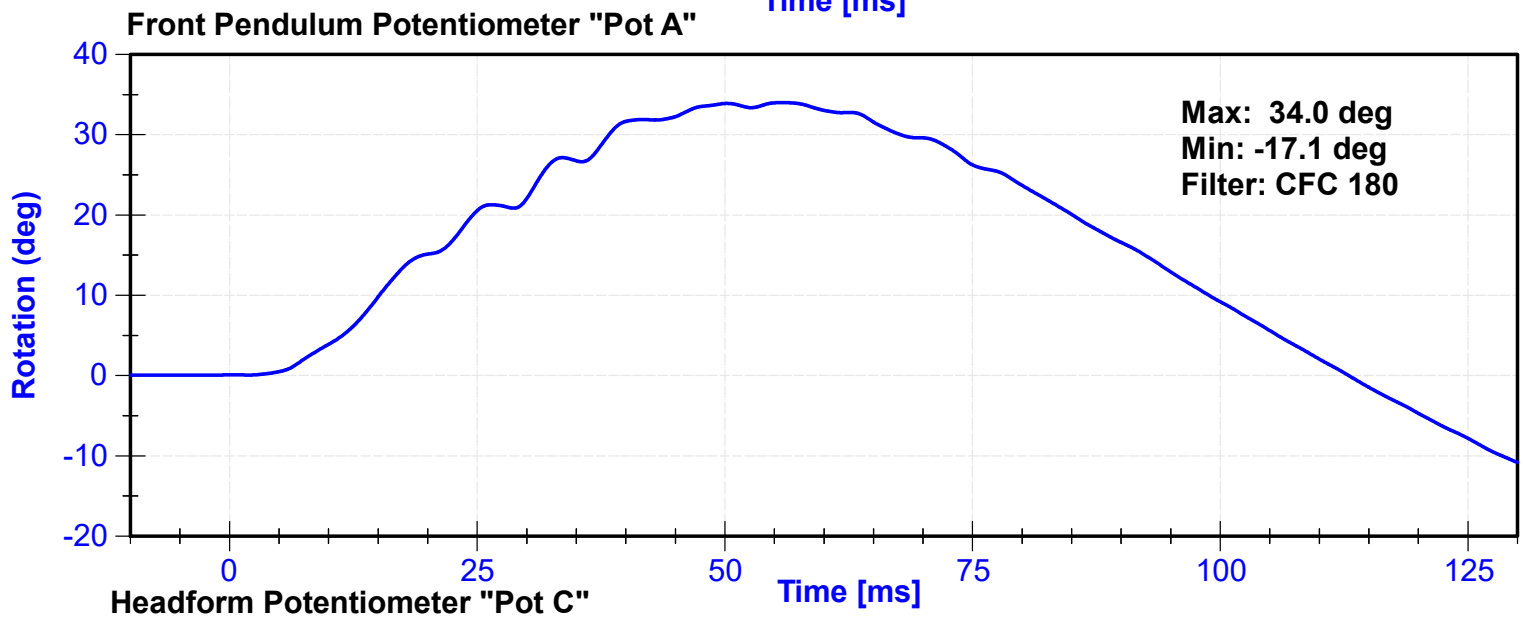
Transducer Calibrations

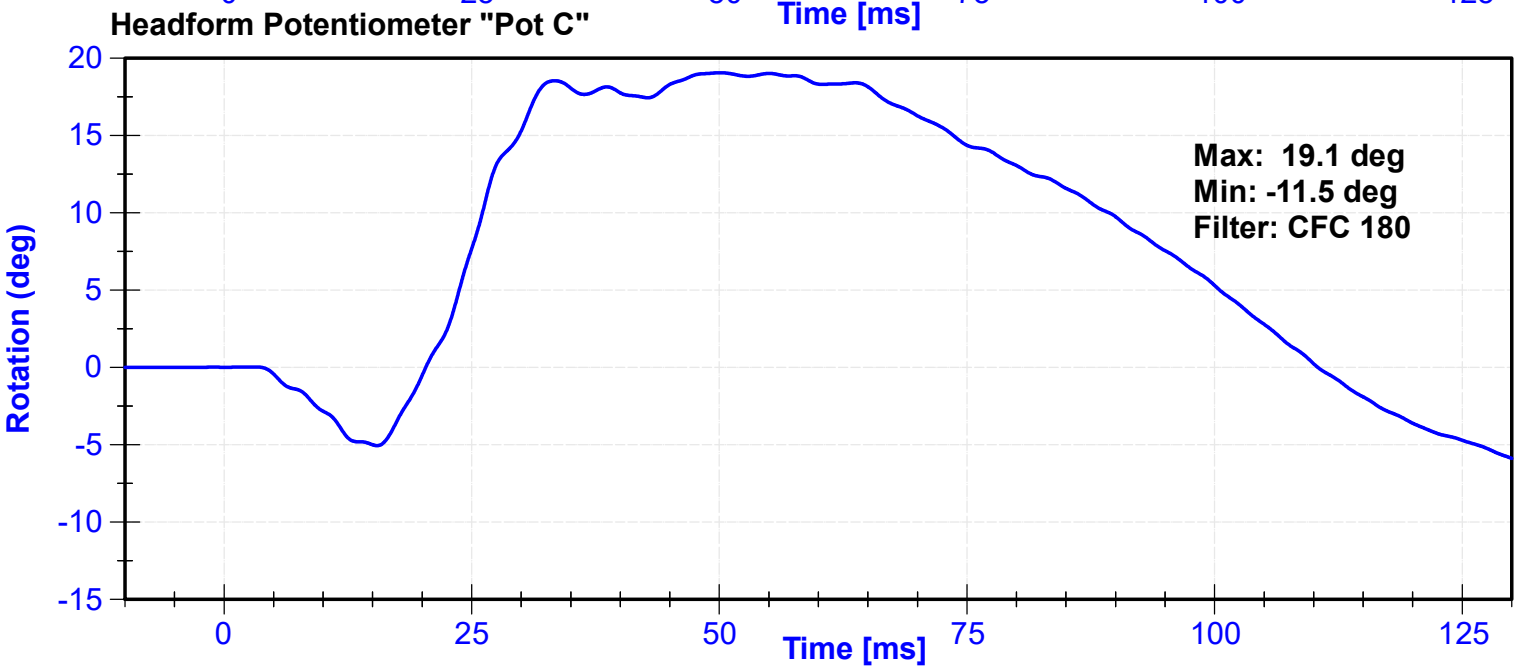
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/31/2023	4/28/2024
Front Pendulum Potentiometer	Sfernice	2247	12/5/2023	12/4/2024
Headform Potentiometer	Sfernice	095	9/29/2023	9/28/2024



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


Neck Rotation
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]
Max: 53.0 deg
Min: -28.6 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: 34.0 deg
Min: -17.1 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: 19.1 deg
Min: -11.5 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

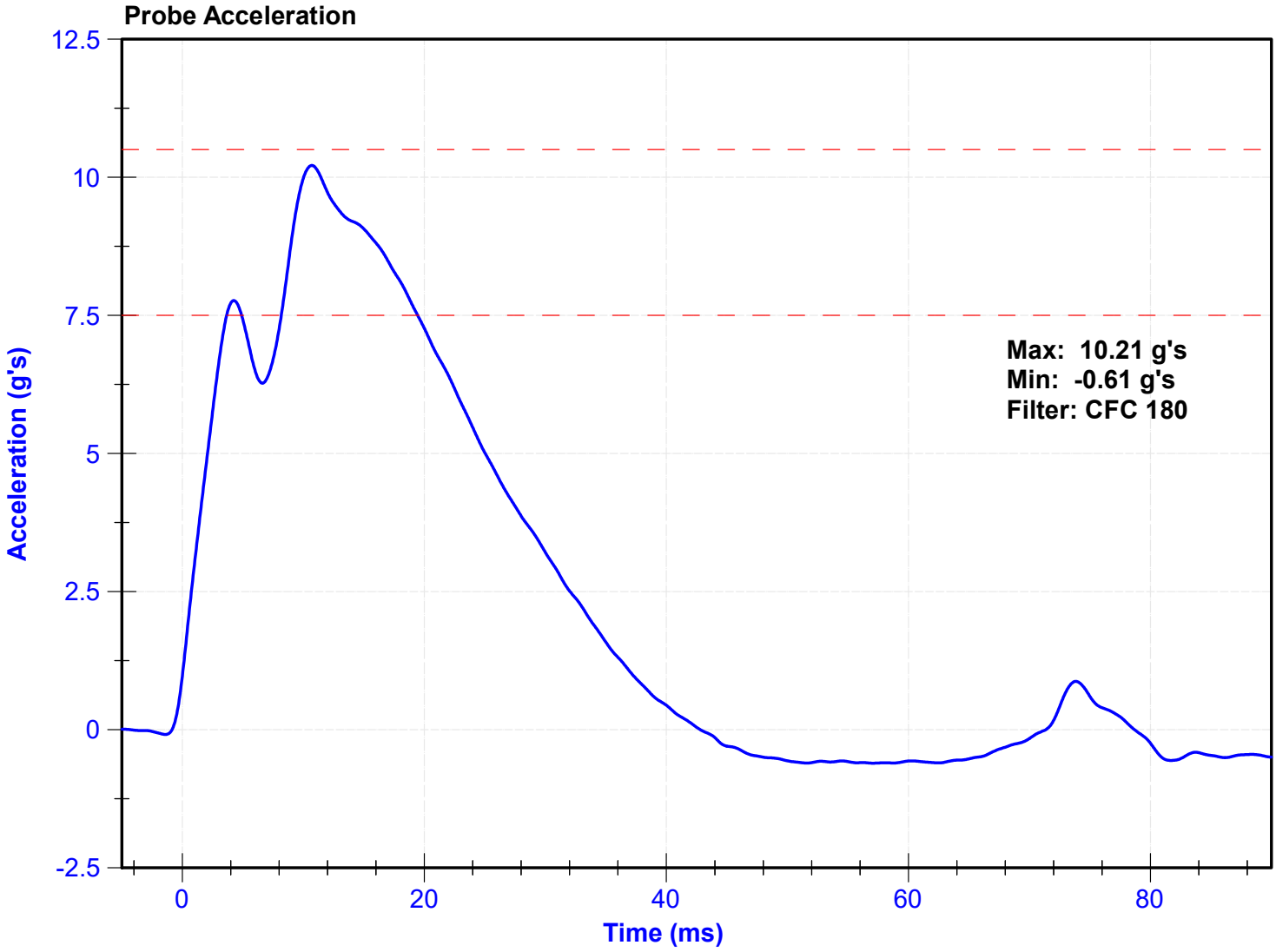
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	59.4	Pass
Velocity	4.2	4.4	m/s	4.30	Pass
Probe Acceleration	7.5	10.5	g's	10.21	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18587	11/20/2023	5/18/2024



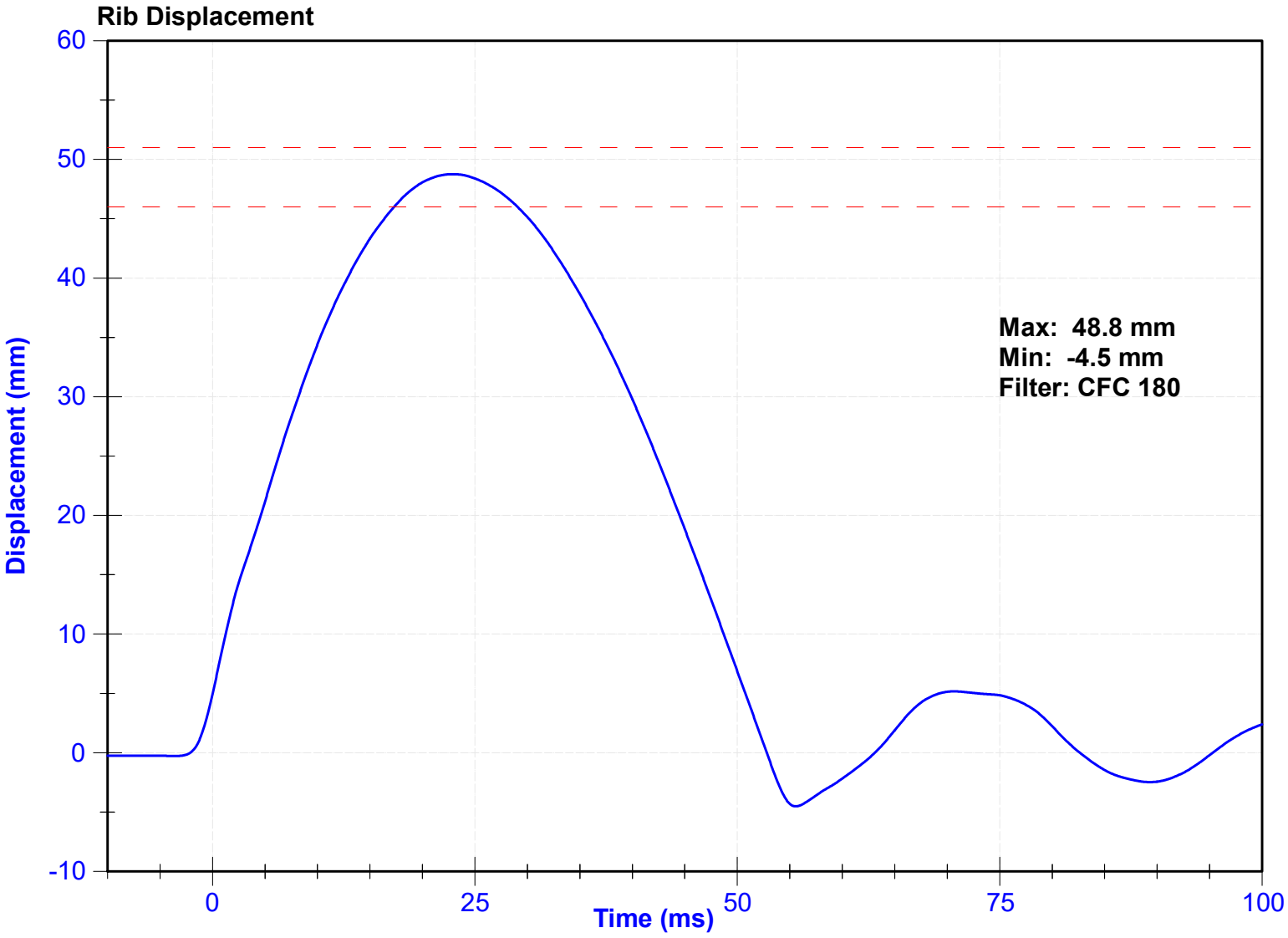
ATD Manufacturer	FTSS	Test Technician	J. Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	48.3	Pass
Rib Displacement	46	51	mm	48.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	179GFE	11/17/2023	5/17/2024



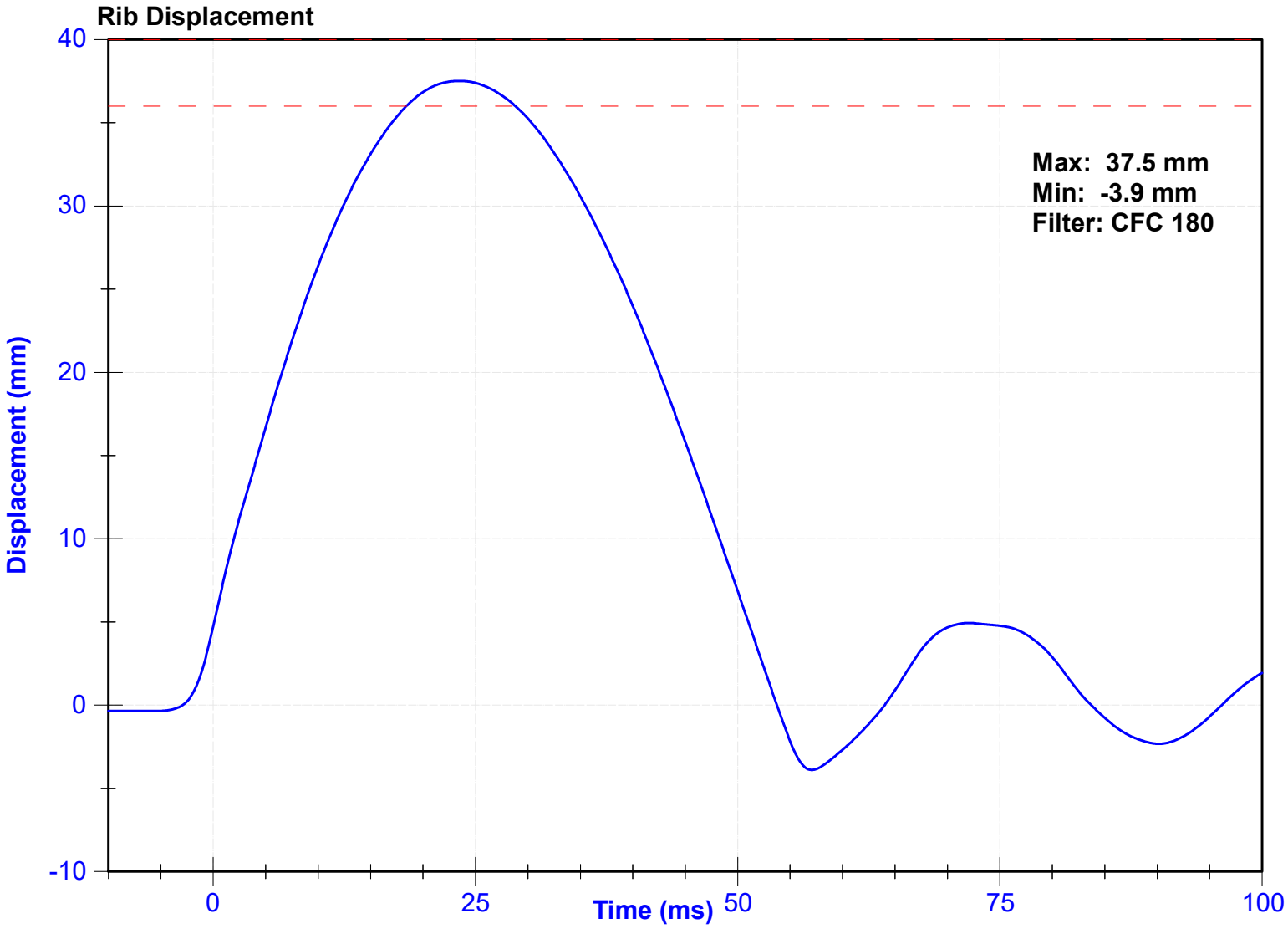
ATD Manufacturer	FTSS	Test Technician	J. Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	48.3	Pass
Rib Displacement	36	40	mm	37.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	179GFE	11/17/2023	5/17/2024



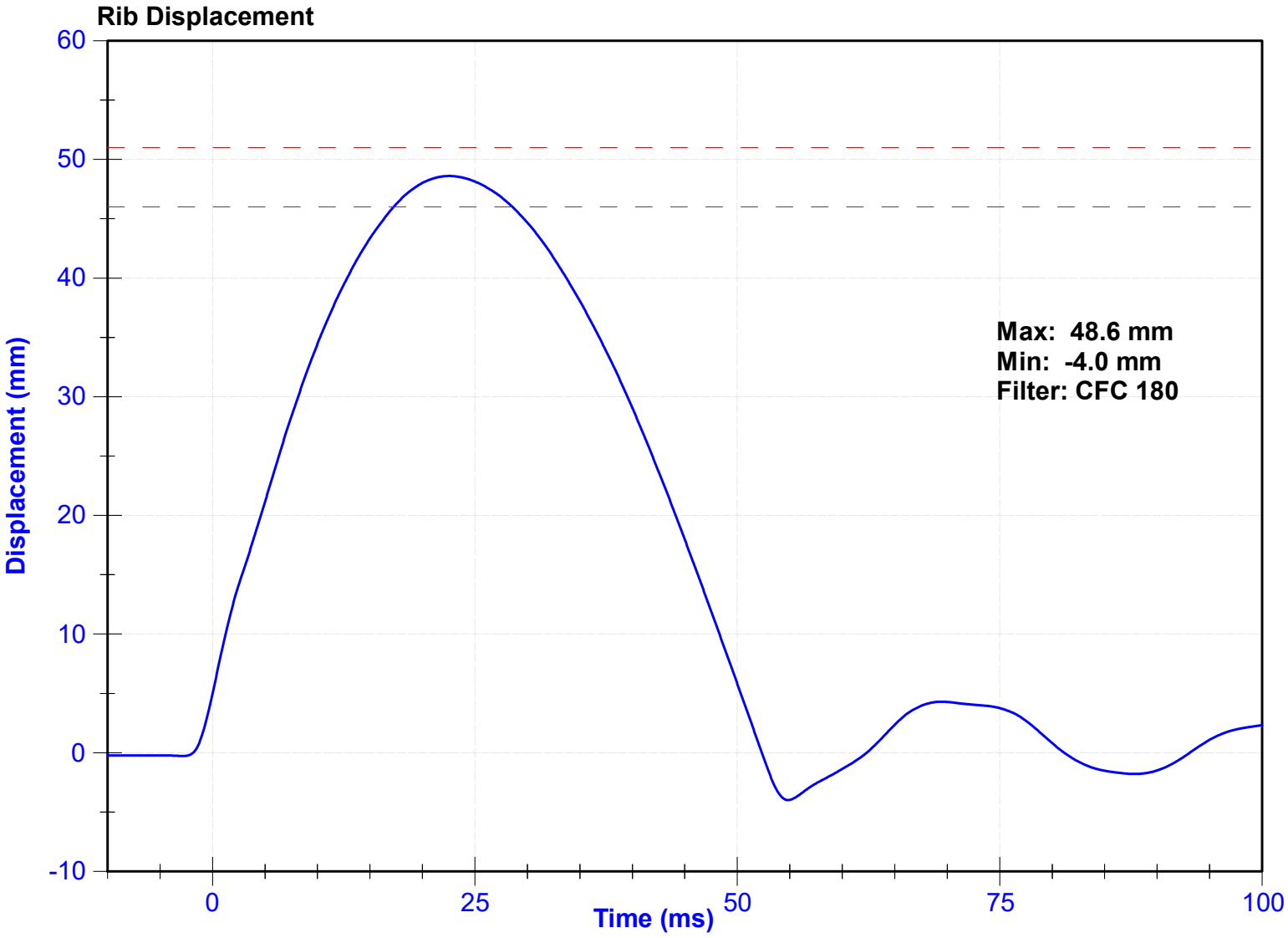
ATD Manufacturer	FTSS	Test Technician	J. Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	48.3	Pass
Rib Displacement	46	51	mm	48.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	185GFE	11/17/2023	5/17/2024



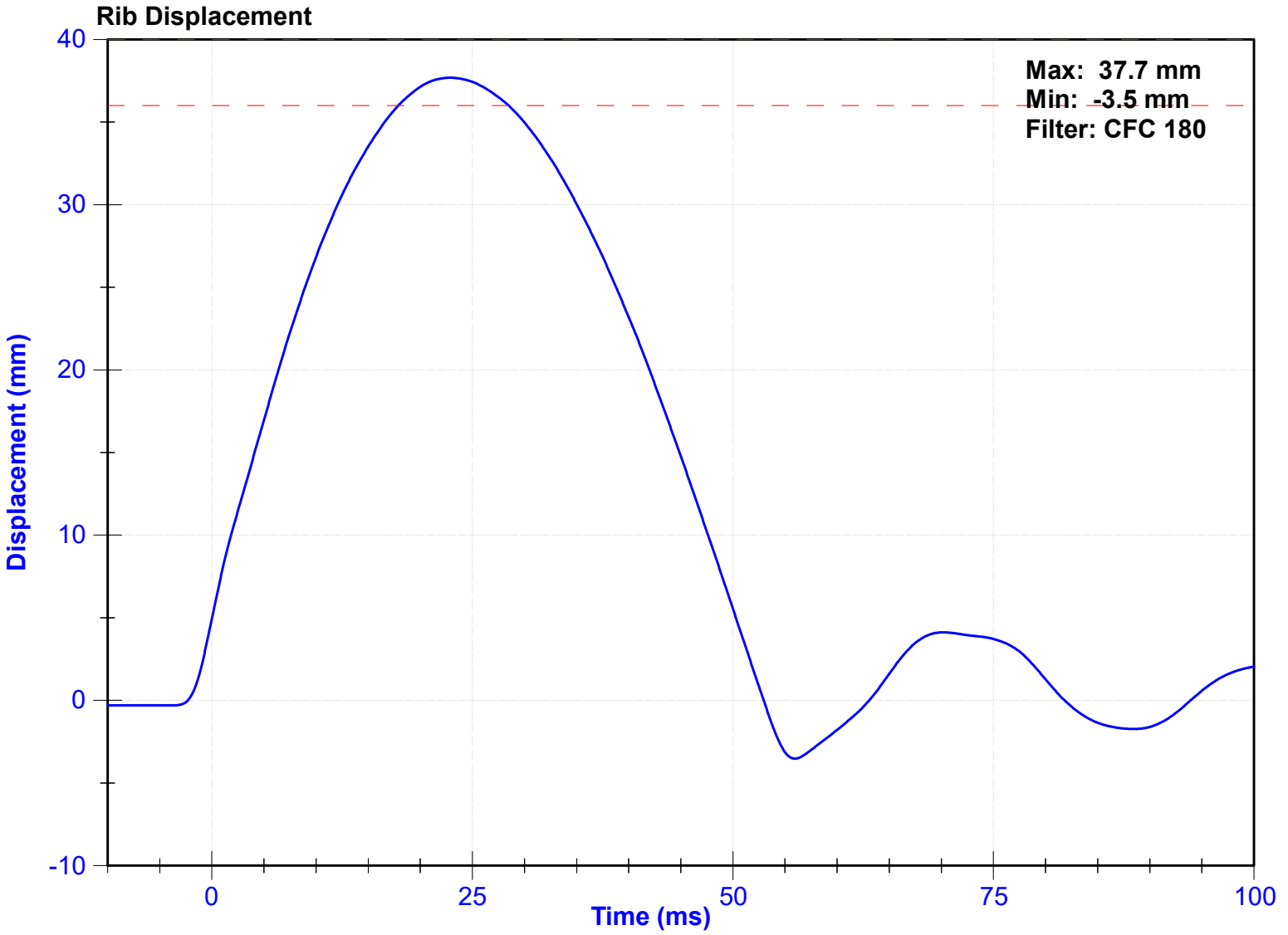
ATD Manufacturer	FTSS	Test Technician	J. Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	48.3	Pass
Rib Displacement	36	40	mm	37.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	185GFE	11/17/2023	5/17/2024



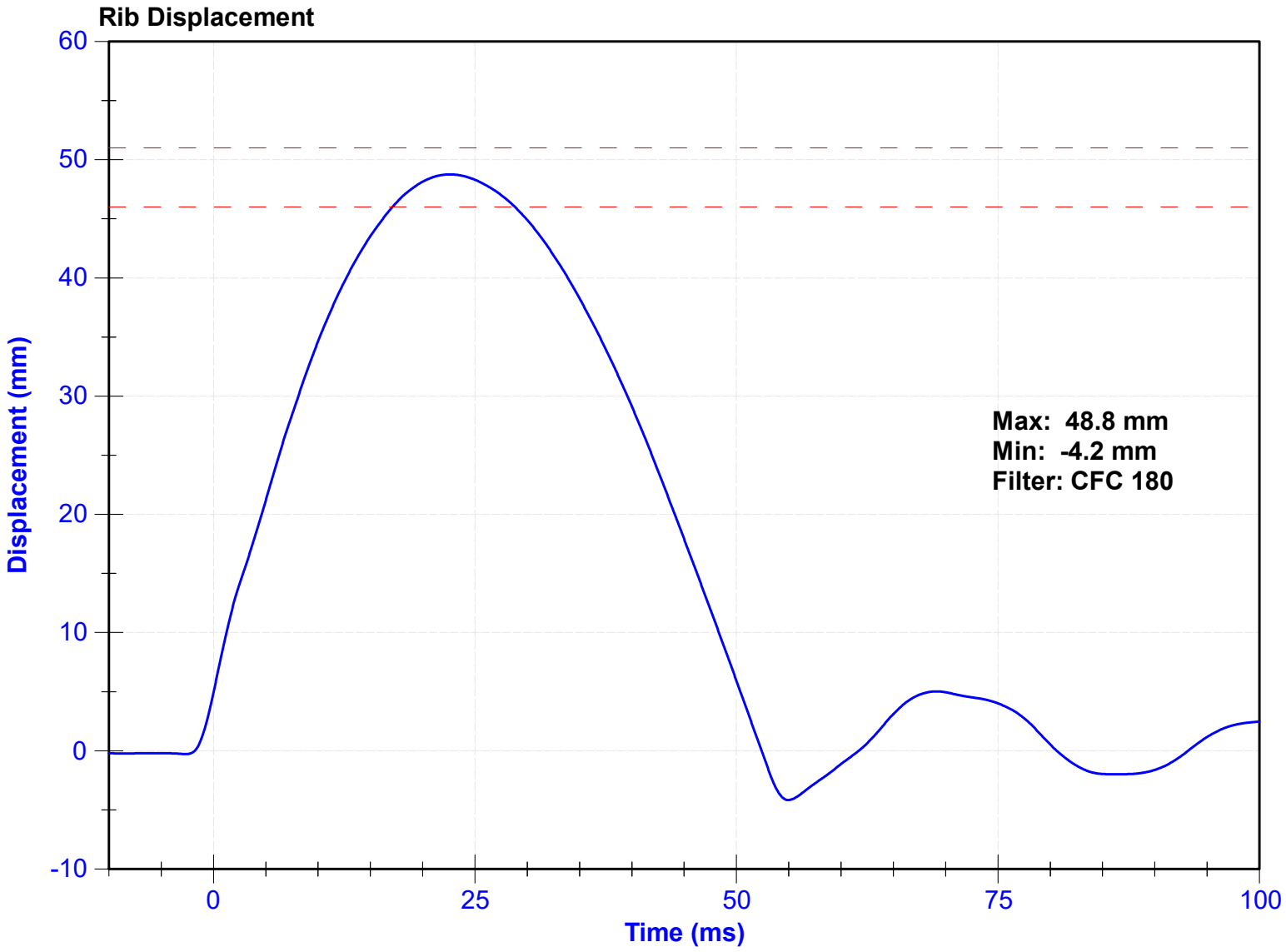
ATD Manufacturer	FTSS	Test Technician	J. Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	48.3	Pass
Rib Displacement	46	51	mm	48.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	178GFE	11/17/2023	5/17/2024



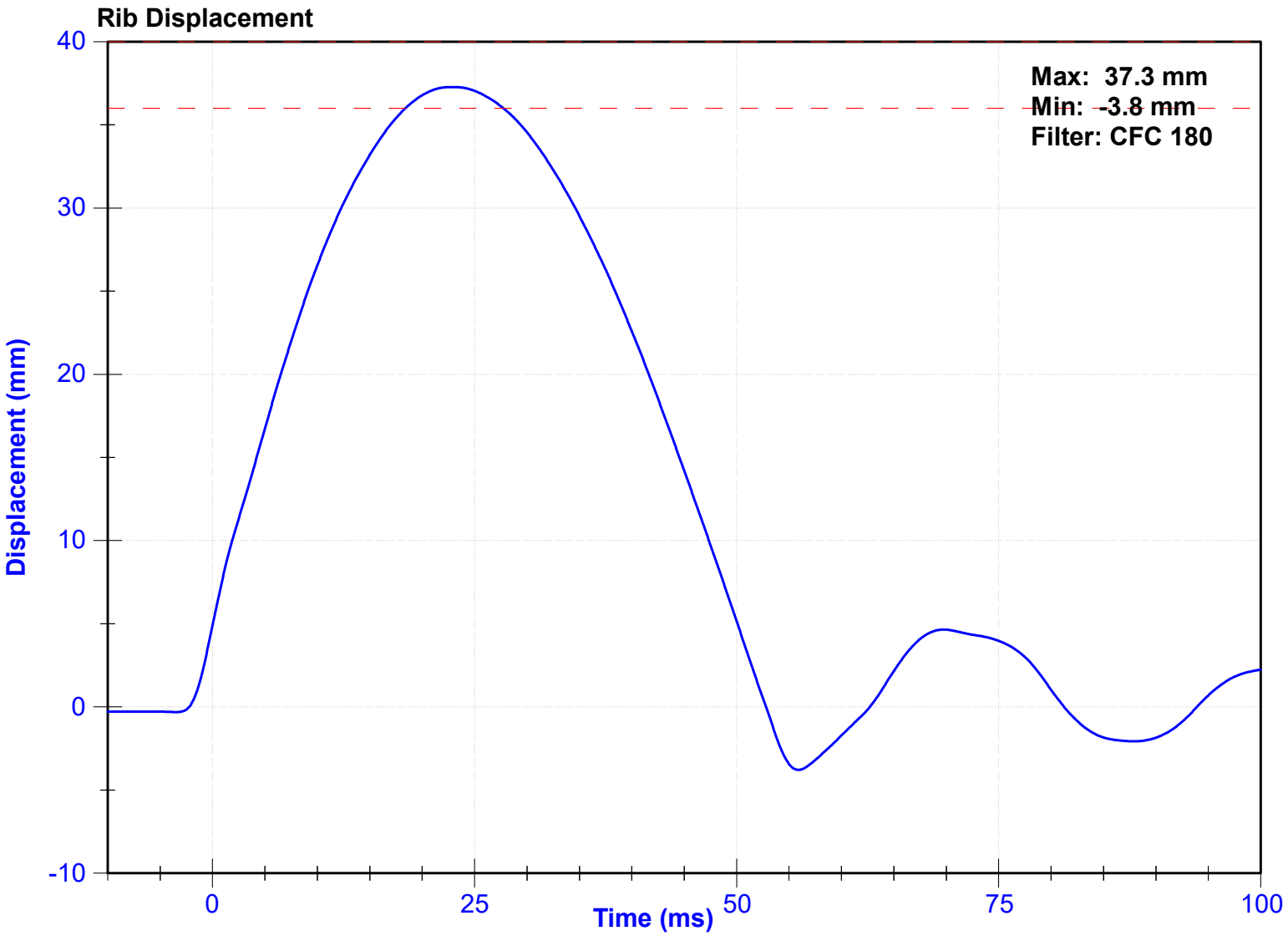
ATD Manufacturer	FTSS	Test Technician	J. Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	48.3	Pass
Rib Displacement	36	40	mm	37.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	178GFE	11/17/2023	5/17/2024



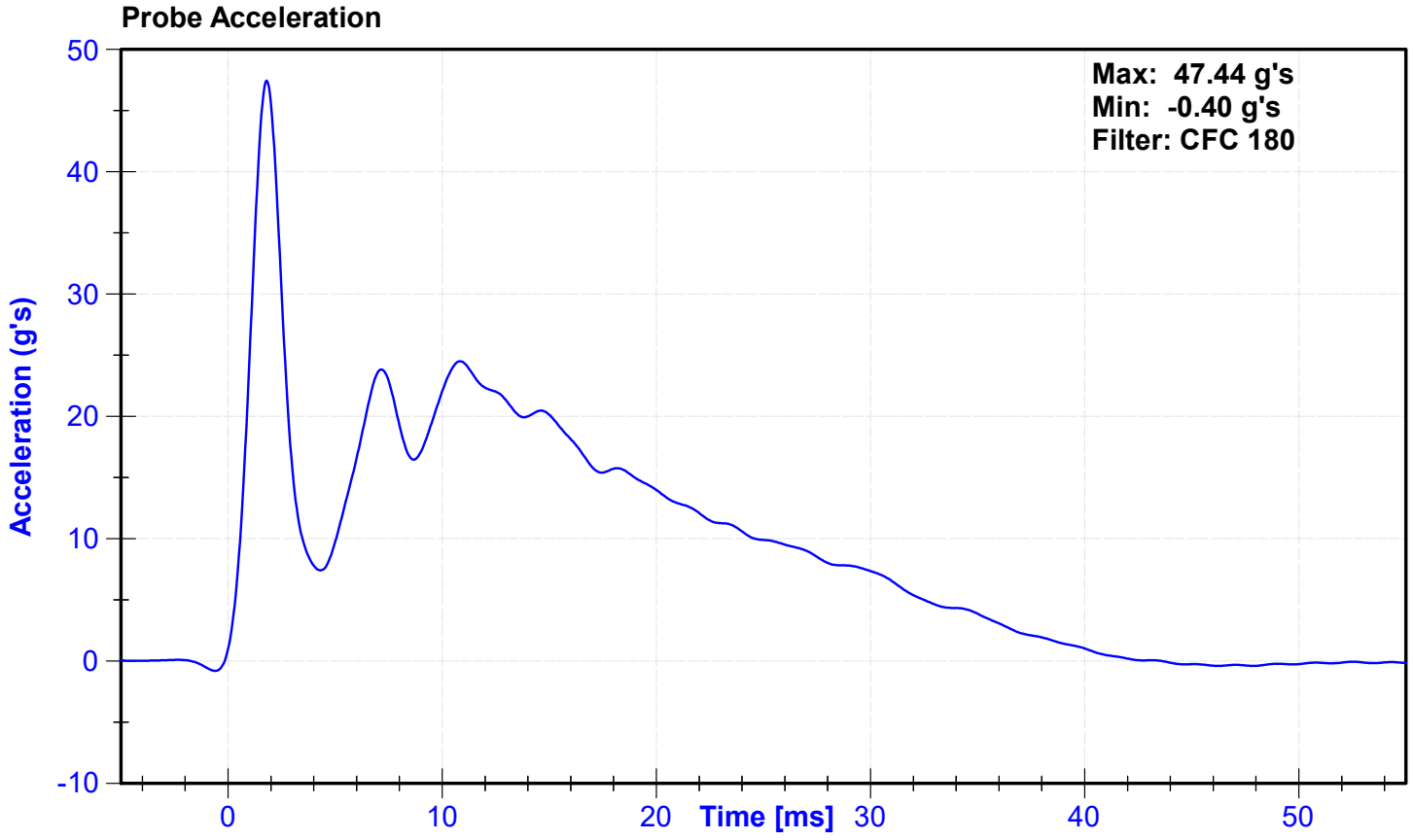
ATD Manufacturer	FTSS	Test Technician	J. Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

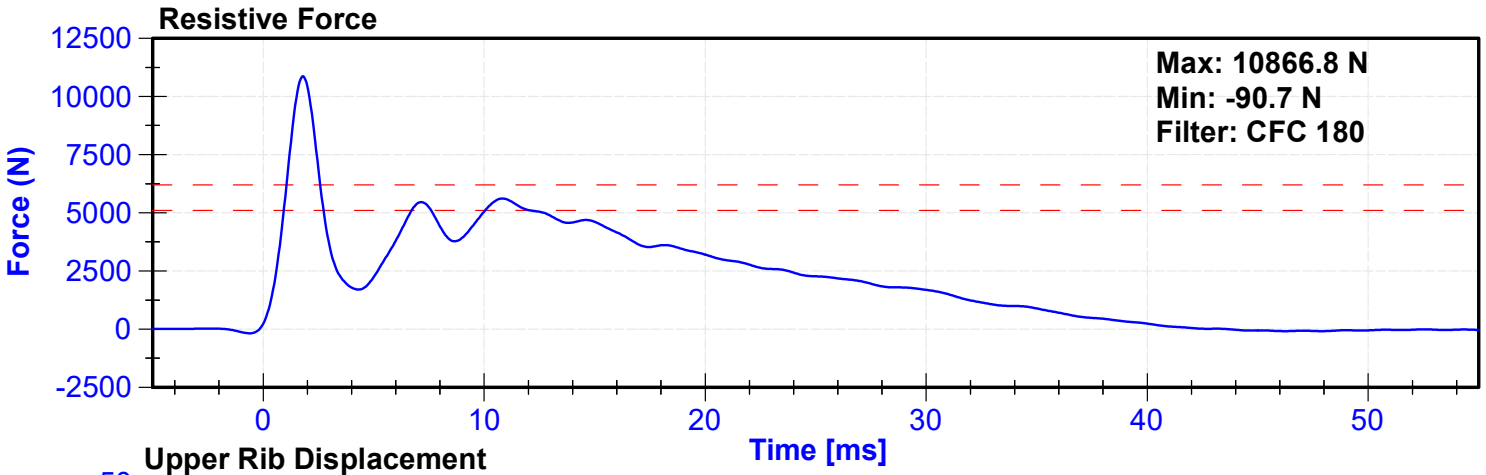
Results

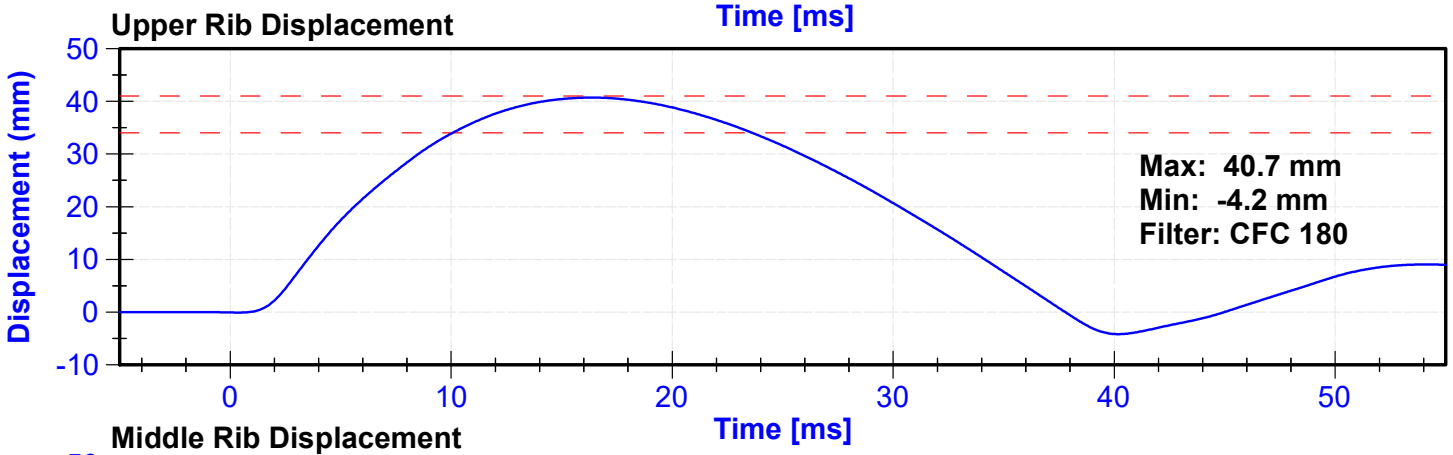
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	59.4	Pass
Velocity	5.4	5.6	m/s	5.53	Pass
Resistive Force after 6ms	5100	6200	N	5613.8	Pass
Upper Thorax Rib Deflection	34	41	mm	40.7	Pass
Mid Thorax Rib Deflection	37	45	mm	42.9	Pass
Lower Thorax Rib Deflection	37	44	mm	40.8	Pass

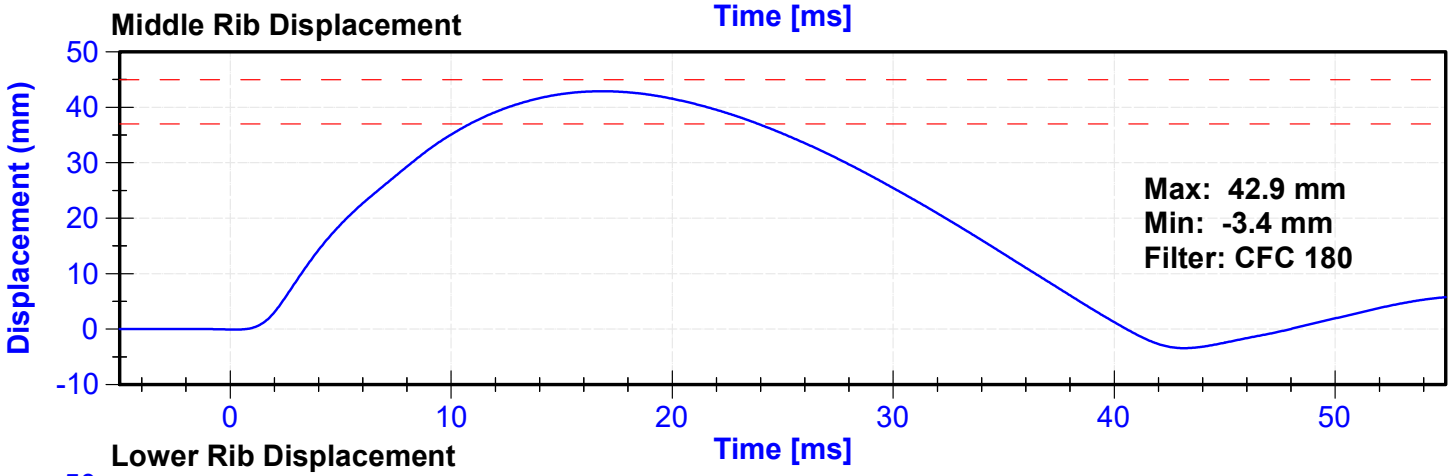
Transducer Calibrations

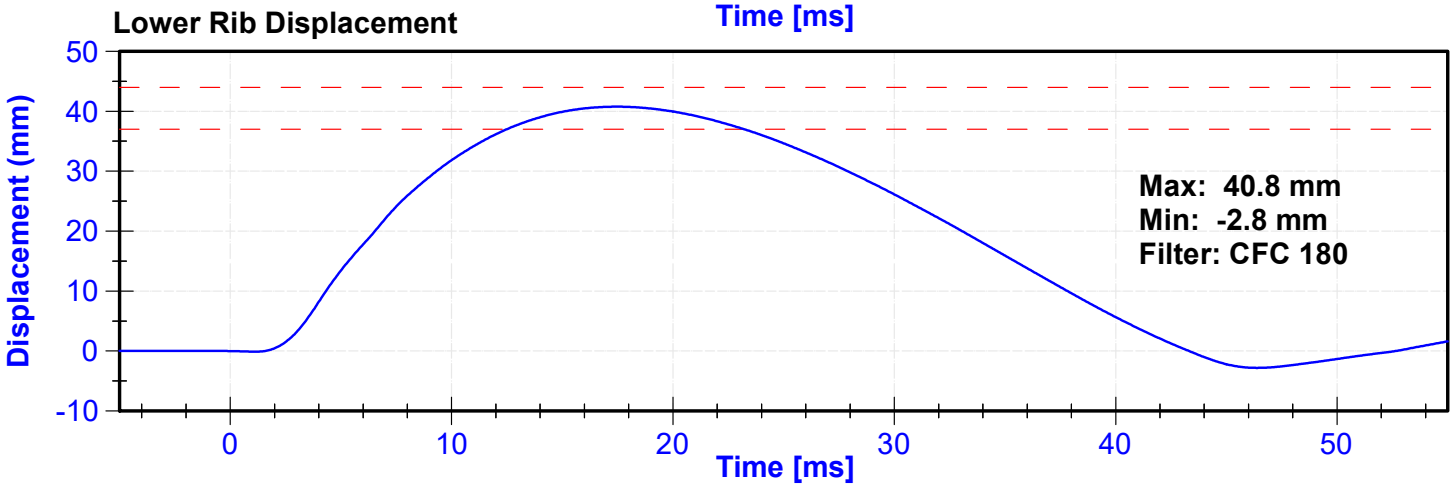
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Upper Thorax Rib Potentiometer	Honeywell	179GFE	11/17/2023	5/17/2024
Middle Thorax Rib Potentiometer	Honeywell	185GFE	11/17/2023	5/17/2024
Lower Thorax Rib Potentiometer	Honeywell	178GFE	11/17/2023	5/17/2024




Resistive Force
Force (N)
12500
10000
7500
5000
2500
0
-2500
0
10
20
30
40
50
Time [ms]
Max: 10866.8 N
Min: -90.7 N
Filter: CFC 180


Upper Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 40.7 mm
Min: -4.2 mm
Filter: CFC 180


Middle Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 42.9 mm
Min: -3.4 mm
Filter: CFC 180


Lower Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 40.8 mm
Min: -2.8 mm
Filter: CFC 180

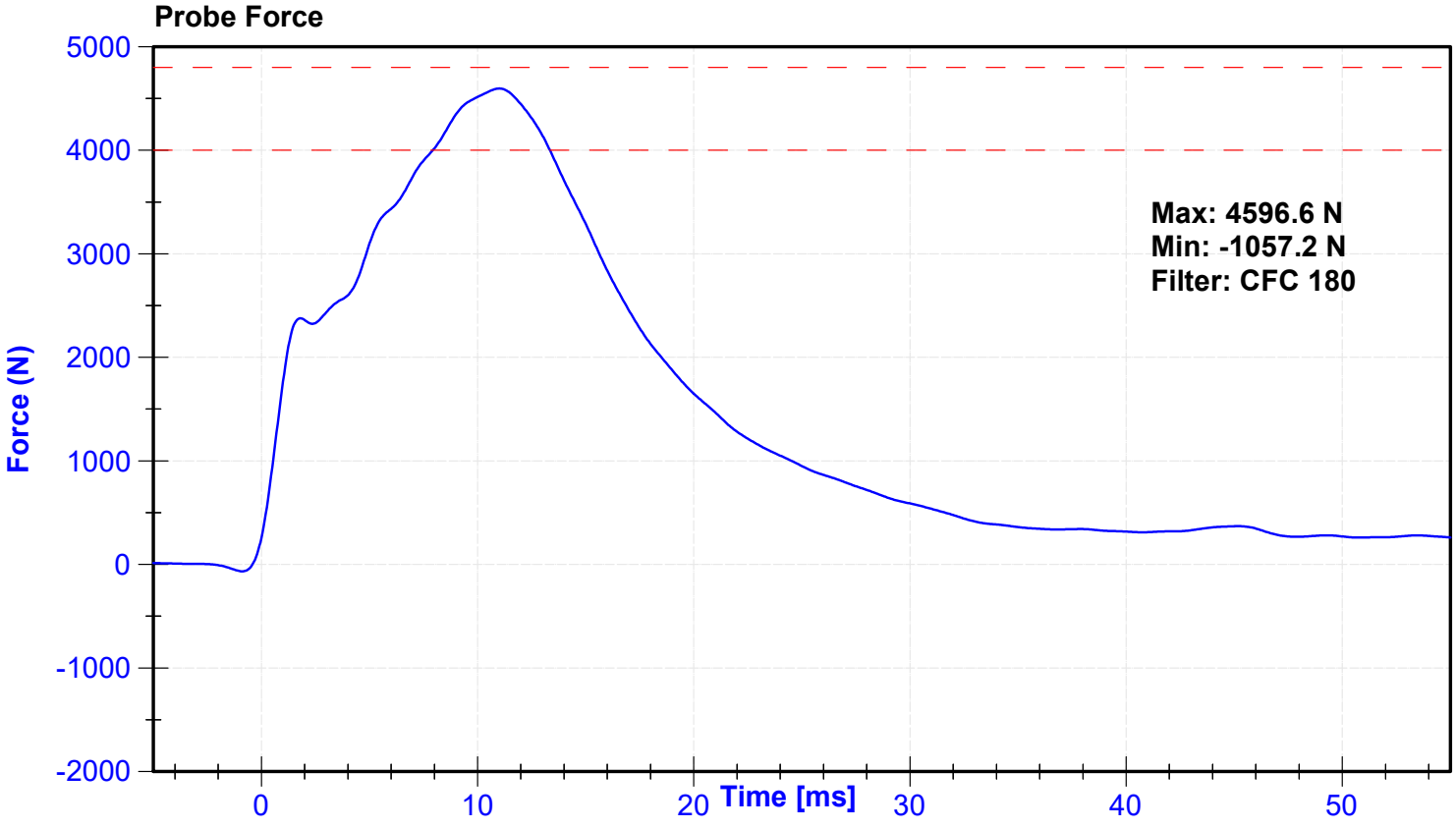
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

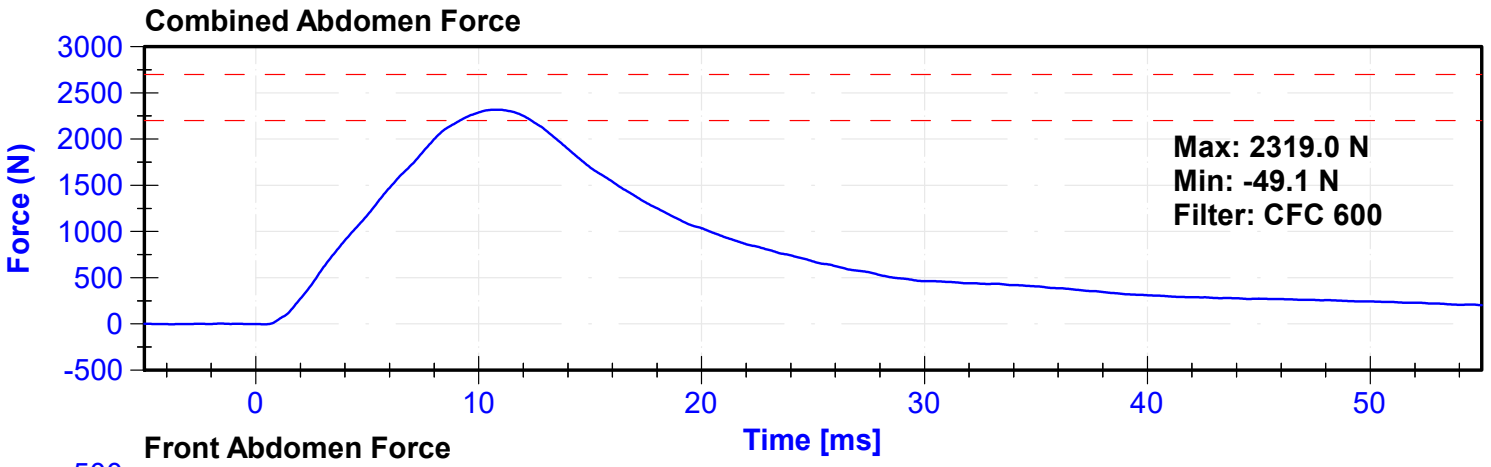
Results

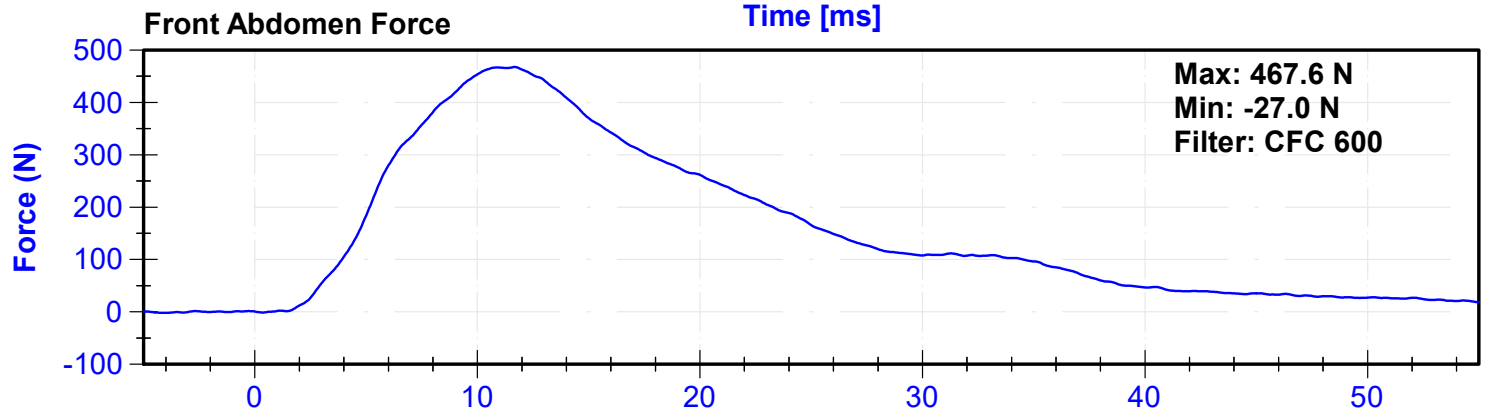
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	59.4	Pass
Velocity	3.9	4.1	m/s	4.04	Pass
Combined Abdomen Force	2200	2700	N	2319.0	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.85	Pass
Resistive Probe Force	4000	4800	N	4596.6	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.00	Pass

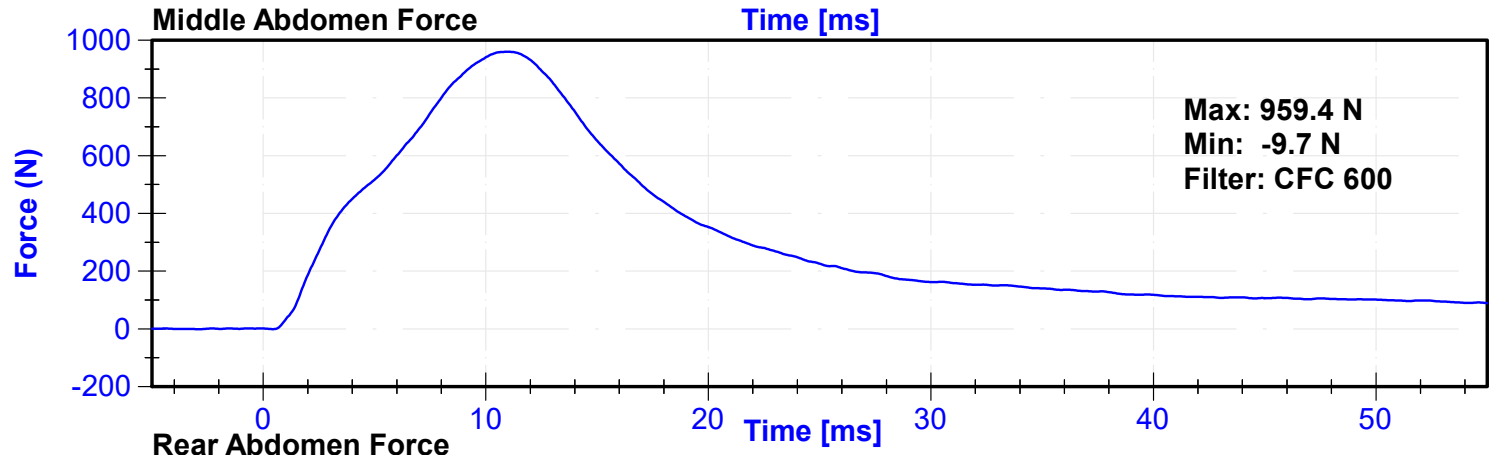
Transducer Calibrations

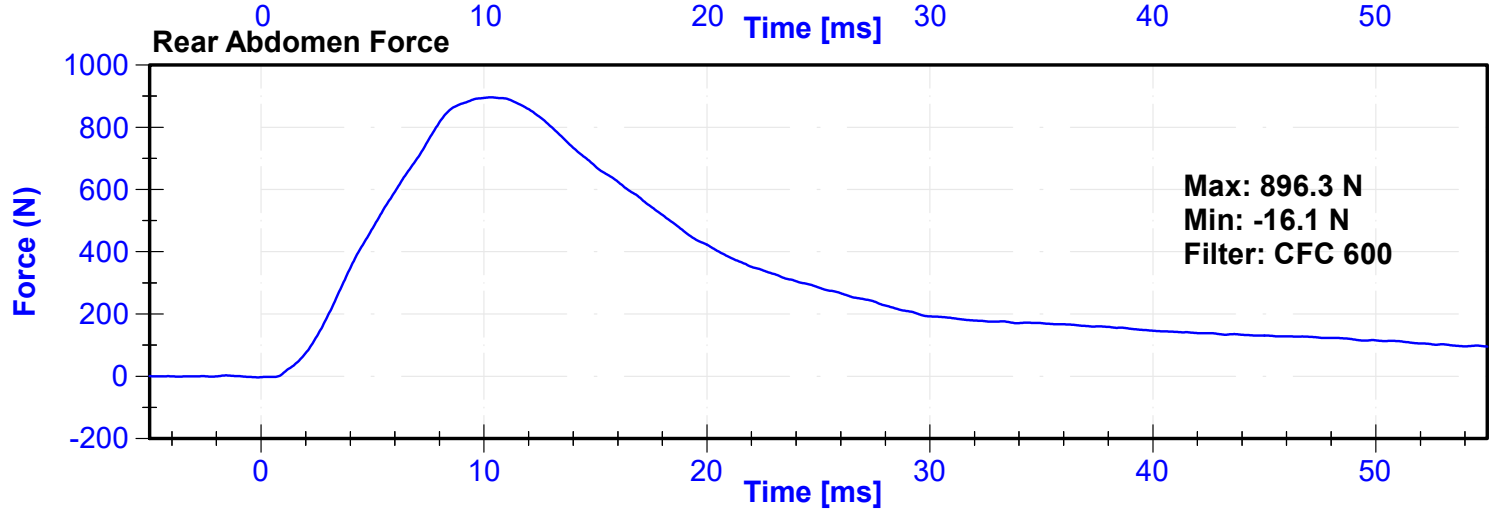
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Front Abdomen Load Cell	Denton	DM5846	5/18/2023	5/17/2024
Middle Abdomen Load Cell	Denton	1529	5/18/2023	5/17/2024
Rear Abdomen Load Cell	Denton	1533	5/18/2023	5/17/2024




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2319.0 N
Min: -49.1 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 467.6 N
Min: -27.0 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 959.4 N
Min: -9.7 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 896.3 N
Min: -16.1 N
Filter: CFC 600

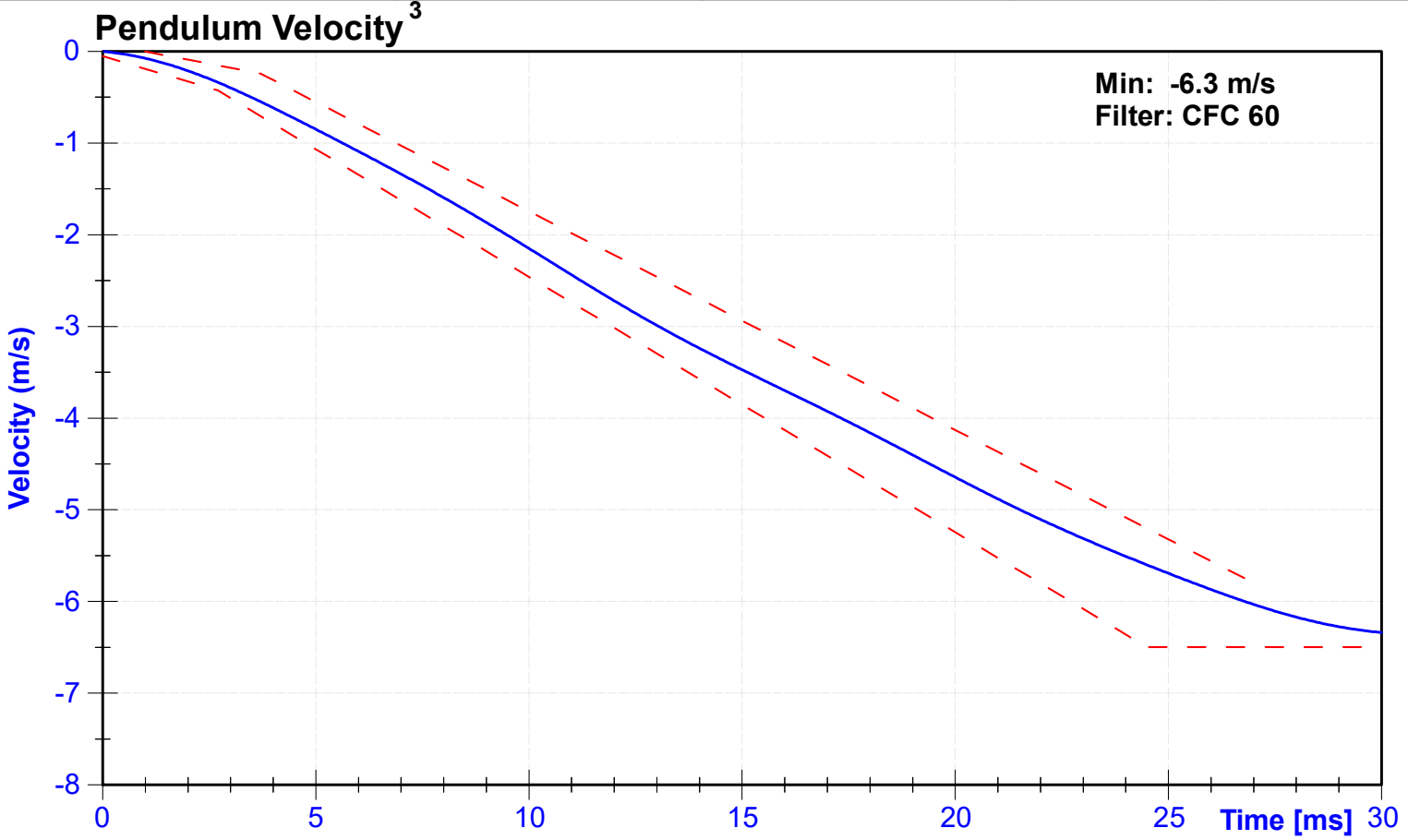
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

Results

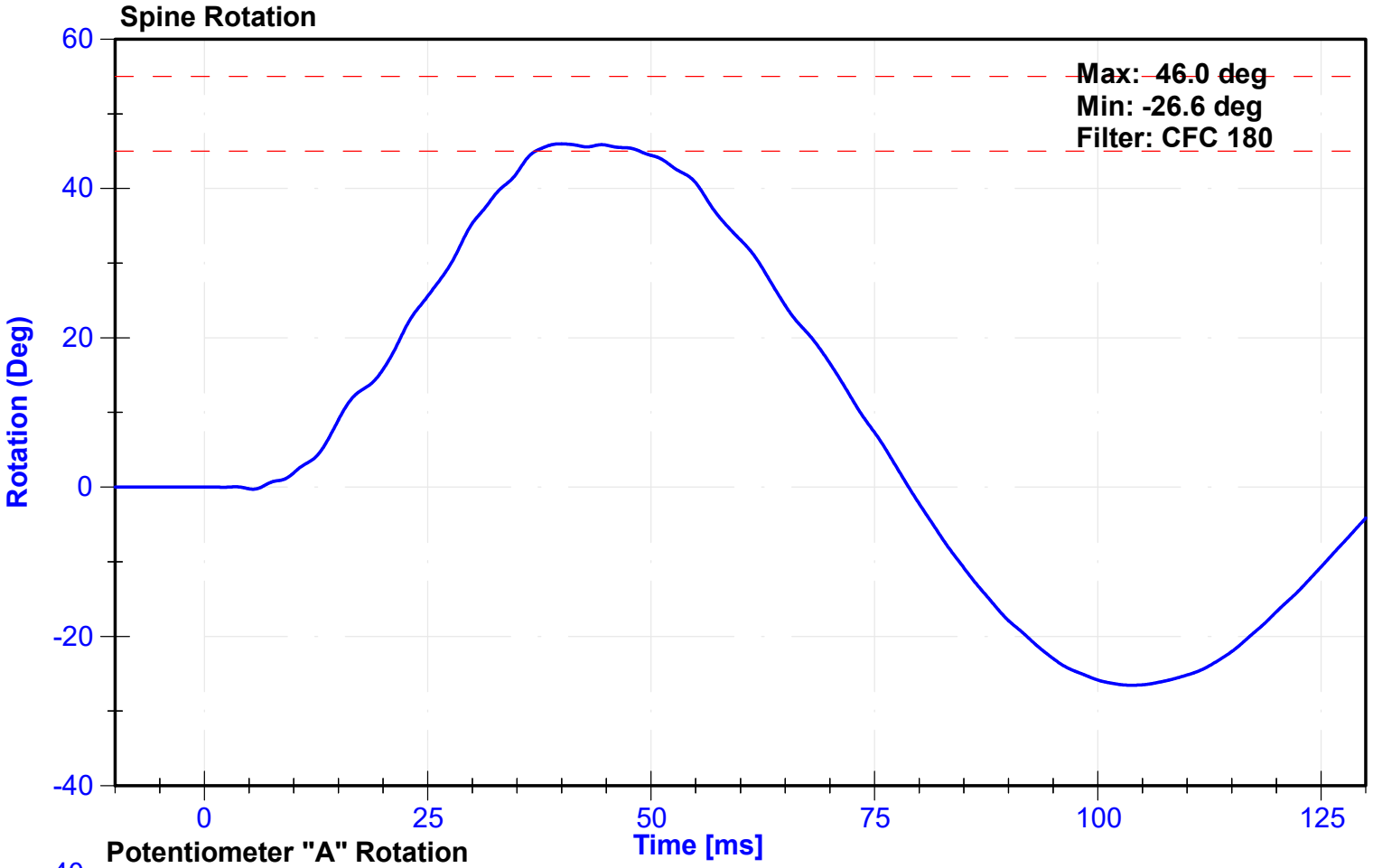
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.0	Pass
Humidity	10	70	%	34	Pass
Velocity	5.95	6.15	m/s	5.997	Pass
Lateral Spine Rotation	45	55	deg	46.0	Pass
Time at Maximum Rotation	39	53	ms	39.8	Pass
Time of Decay to Zero Degrees	37	57	ms	39.0	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

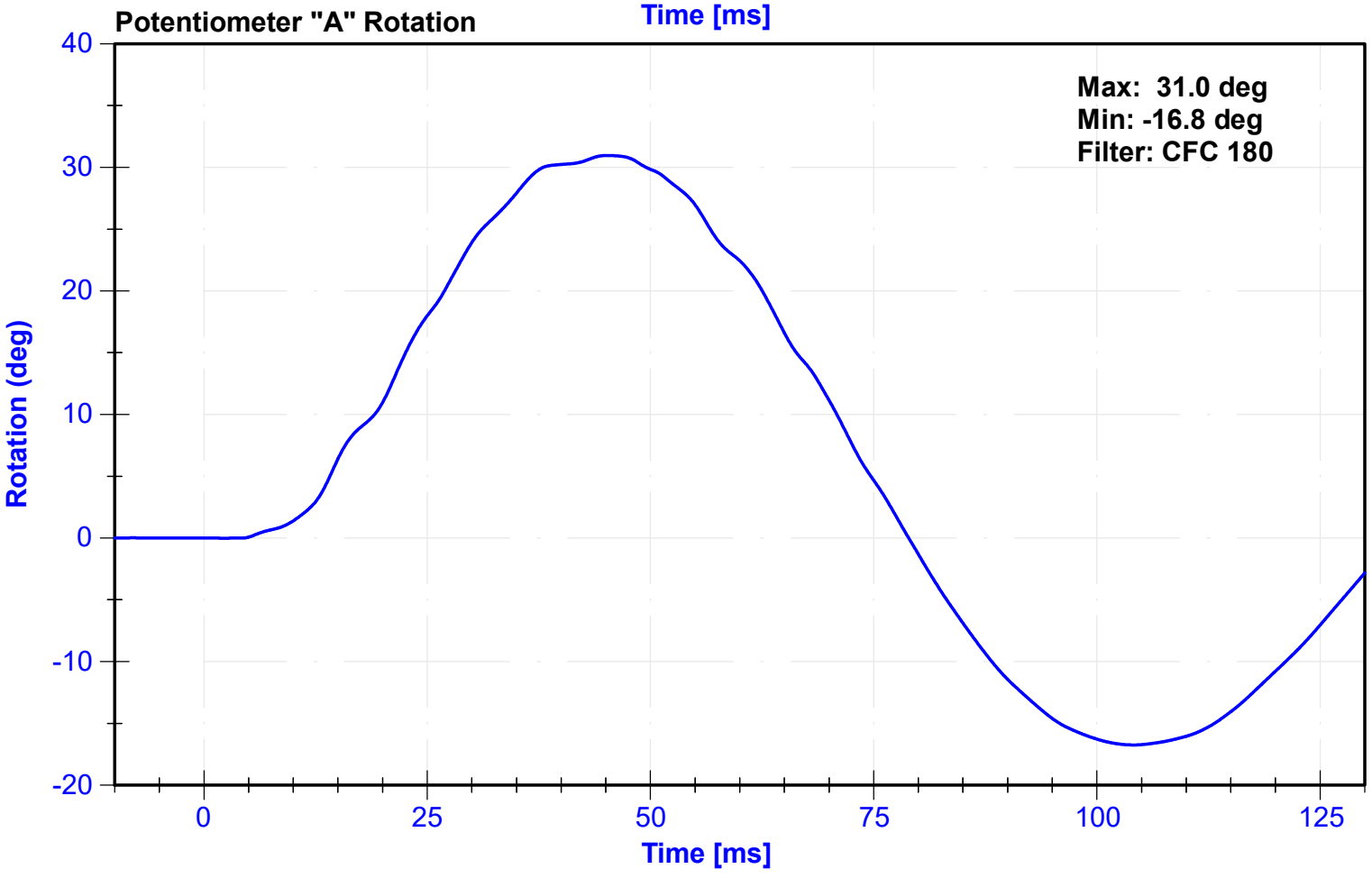
Transducer Calibrations

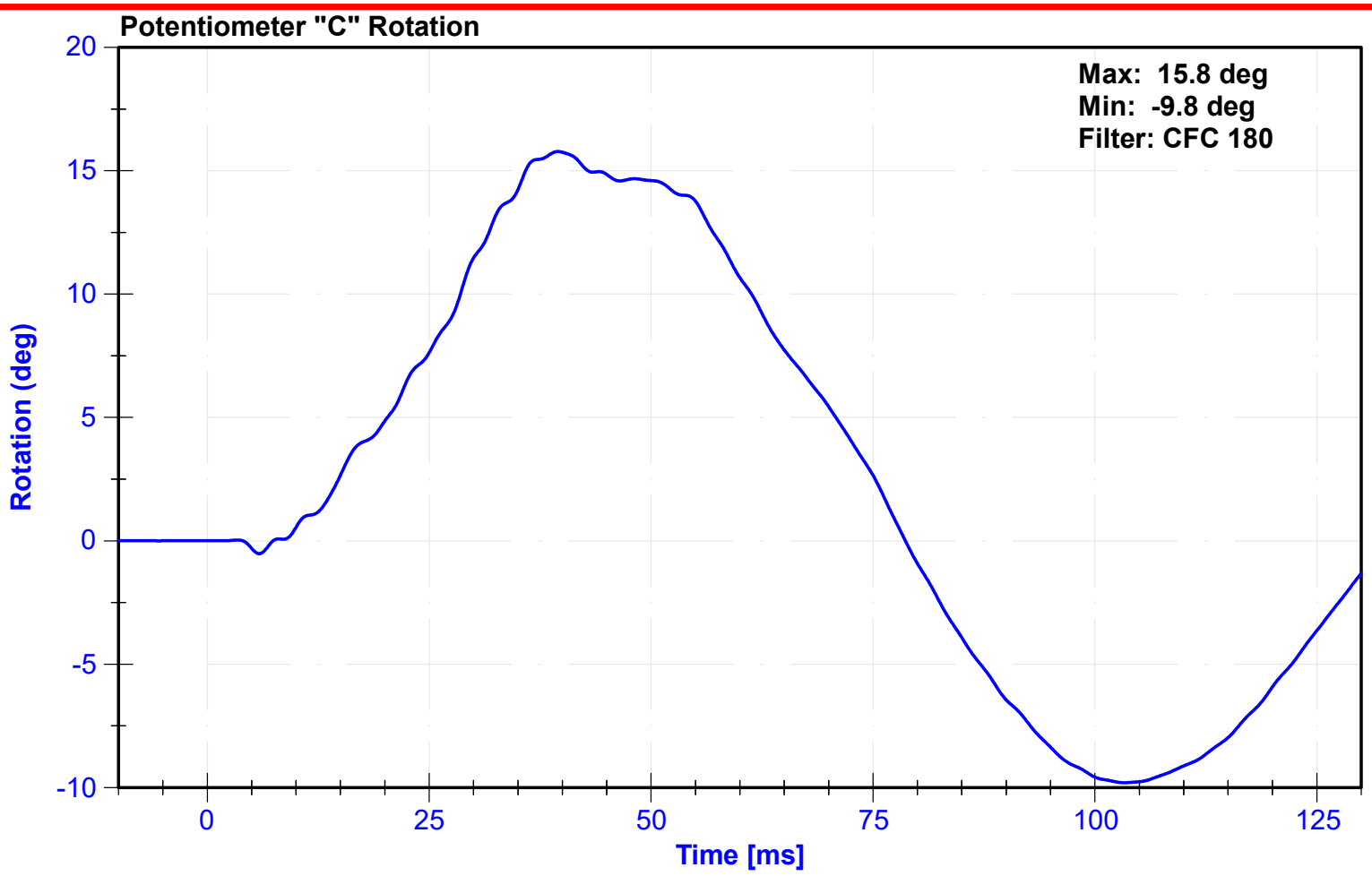
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/31/2023	4/28/2024
Pendulum "A" Potentiometer	Sfernice	094	9/29/2023	9/28/2024
Condyle "B" Potentiometer	Sfernice	095	9/29/2023	9/28/2024



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


Spine Rotation
Max: 46.0 deg
Min: -26.6 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 31.0 deg
Min: -16.8 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

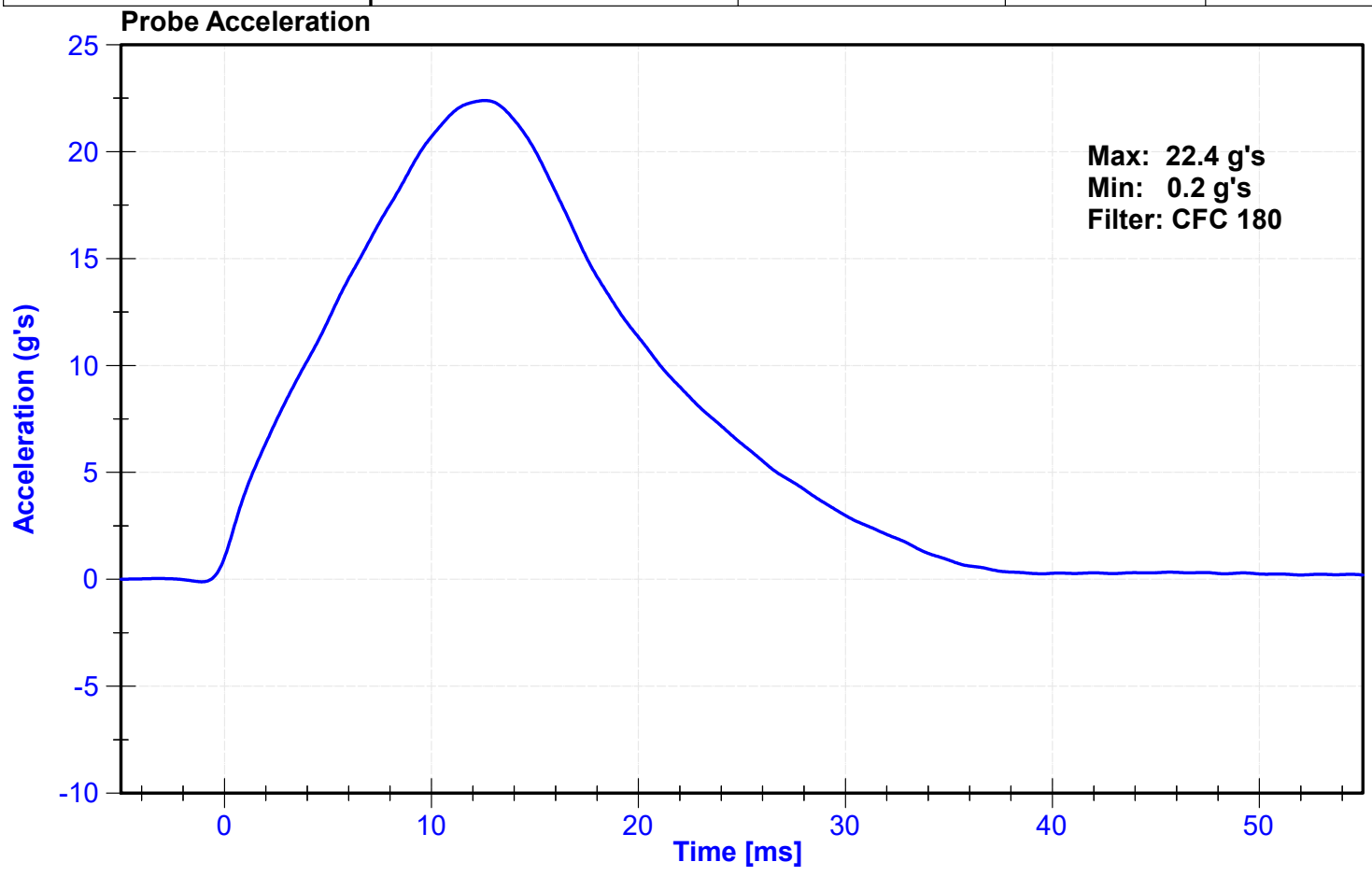
ATD Manufacturer	FTSS	Test Technician	J.Kinderman
ATD Serial Number	F033	Laboratory Supervisor	C. Mantell

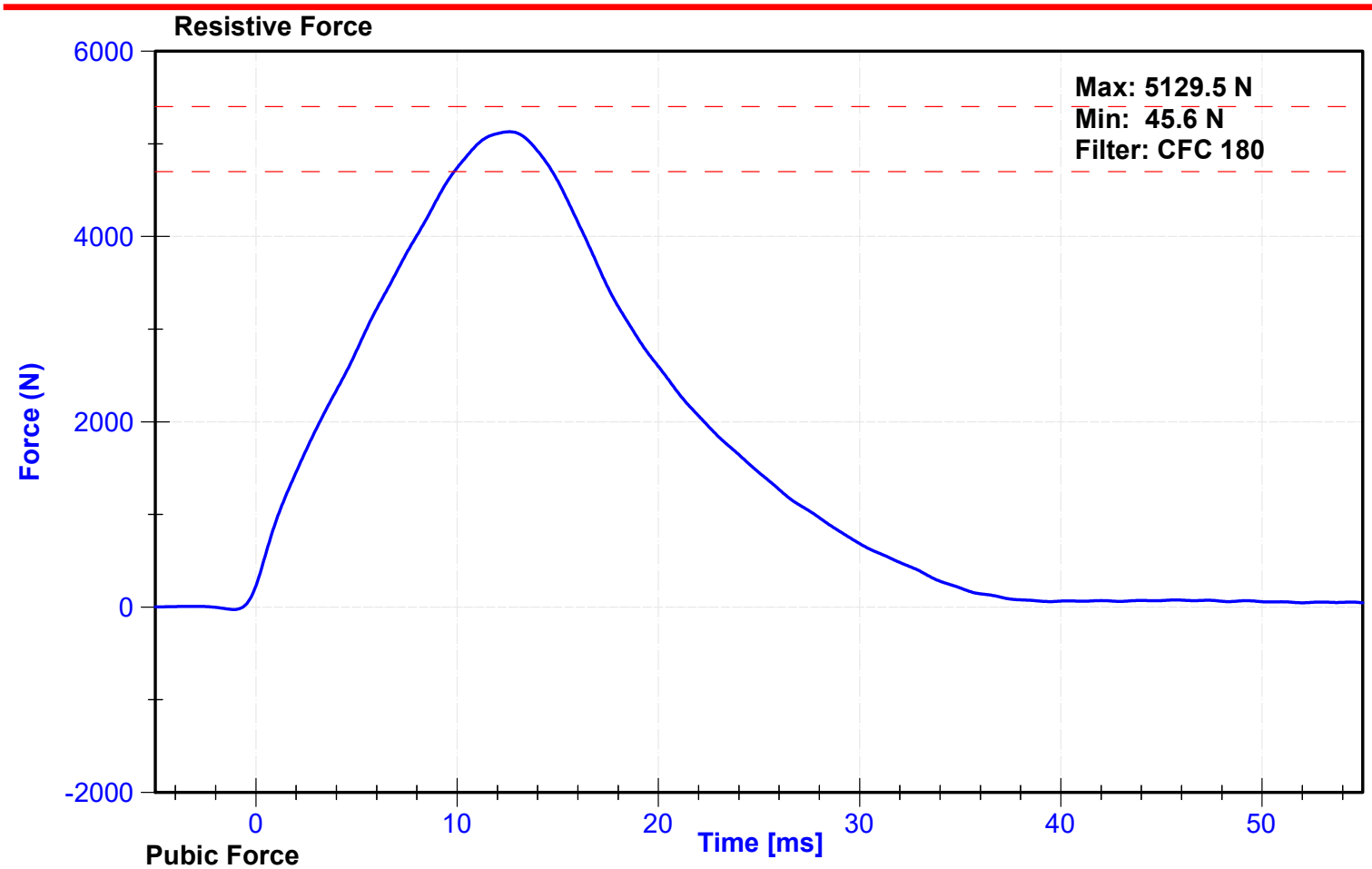
Results

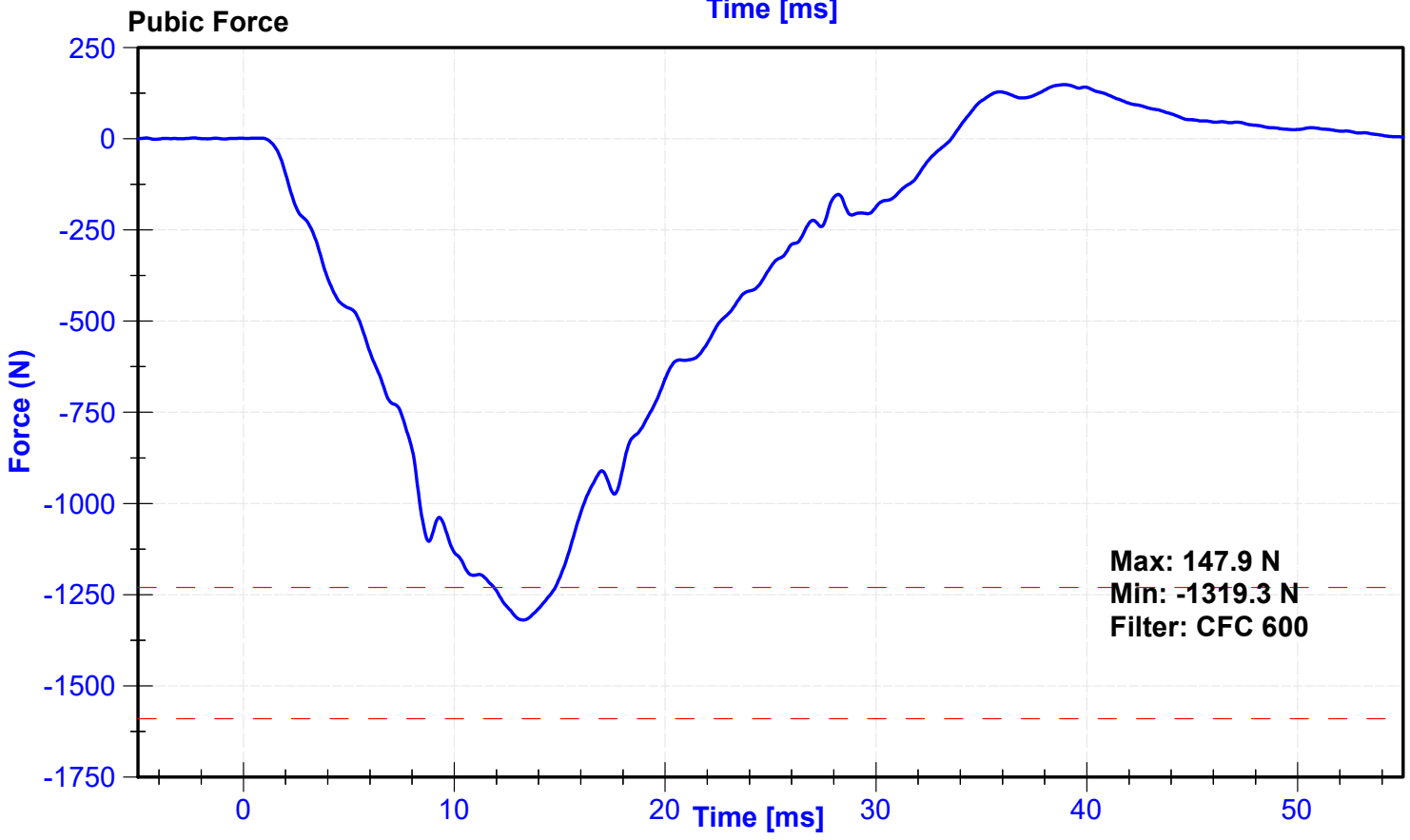
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	59.4	Pass
Velocity	4.2	4.4	m/s	4.30	Pass
Resistive Force	4700	5400	N	5129.5	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.60	Pass
Pubic Force	-1590	-1230	N	-1319.3	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.25	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Pubic Load Cell	Denton	459-FY	6/20/2023	6/19/2024




Resistive Force
Max: 5129.5 N
Min: 45.6 N
Filter: CFC 180
Force (N)
6000
4000
2000
0
-2000
0
10
20
30
40
50
Time [ms]


Pubic Force
Max: 147.9 N
Min: -1319.3 N
Filter: CFC 600
Force (N)
250
0
-250
-500
-750
-1000
-1250
-1500
-1750
0
10
20
30
40
50
Time [ms]

CALIBRATION TEST RESULTS

POST-TEST

SID-IIS 5TH PERCENTILE FEMALE – PASSENGER ATD

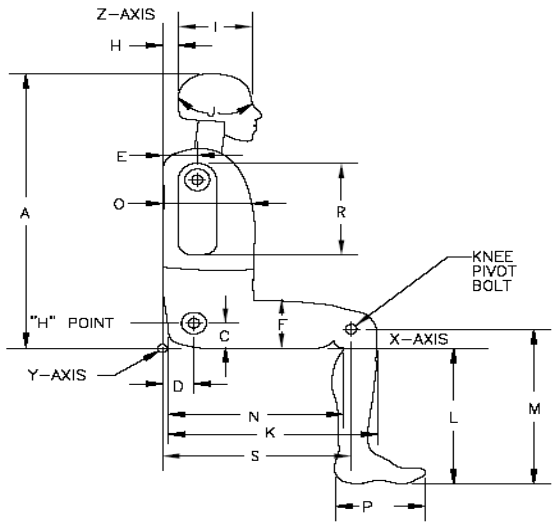
SERIAL NO:300

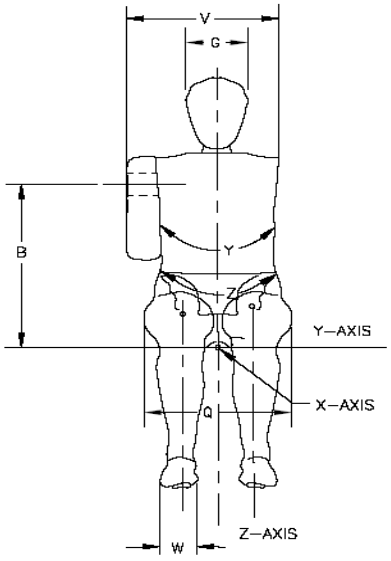
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: K. Brogan Date: 12/05/2023

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	782	Pass
B	Shoulder Pivot Height	437	453	444	Pass
C	H-point Height	79	89	83	Pass
D	H-point from seatback	141	151	144	Pass
E	Shoulder Pivot from Backline	97	107	98	Pass
F	Thigh Clearance	119	135	124	Pass
G	Head Breadth	140	148	143	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	181	Pass
J	Head Circumference	541	551	546	Pass
K	Buttock to Knee Length	514	540	530	Pass
L	Popliteal Height	343	369	357	Pass
M	Knee Pivot to floor height	392	409	402	Pass
N	Buttock Popliteal Length	416	442	433	Pass
O	Chest Depth w/o jacket	195	211	199	Pass
P	Foot Length	216	232	221	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	319	Pass
R	Arm Length	249	259	253	Pass
S	Knee Joint to seatback	477	493	483	Pass
V	Shoulder Width	341	357	350	Pass
W	Foot Width	78	94	86	Pass
Y	Chest Circumference w/jacket	851	881	876	Pass
Z	Waist Circumference	761	791	778	Pass

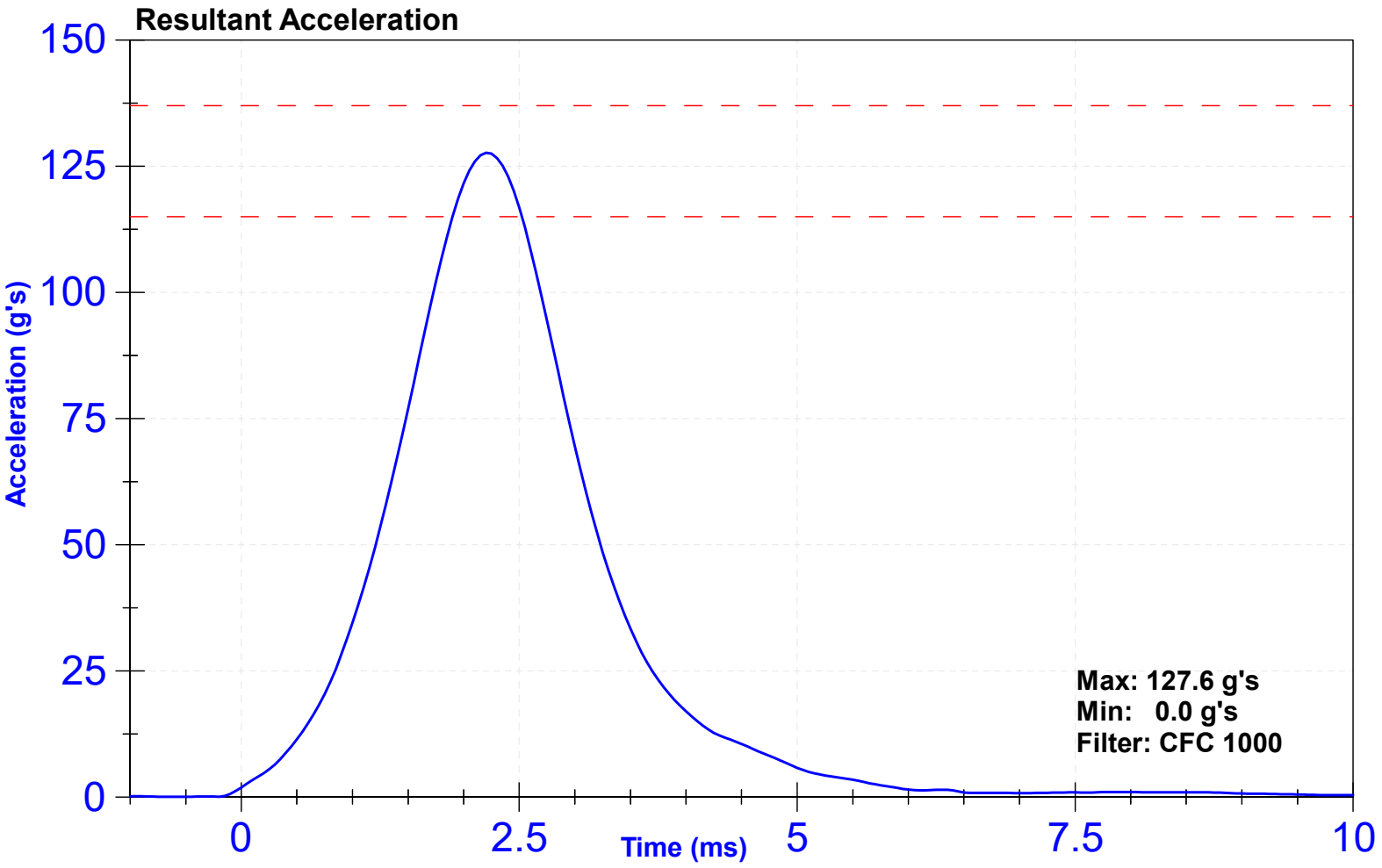
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

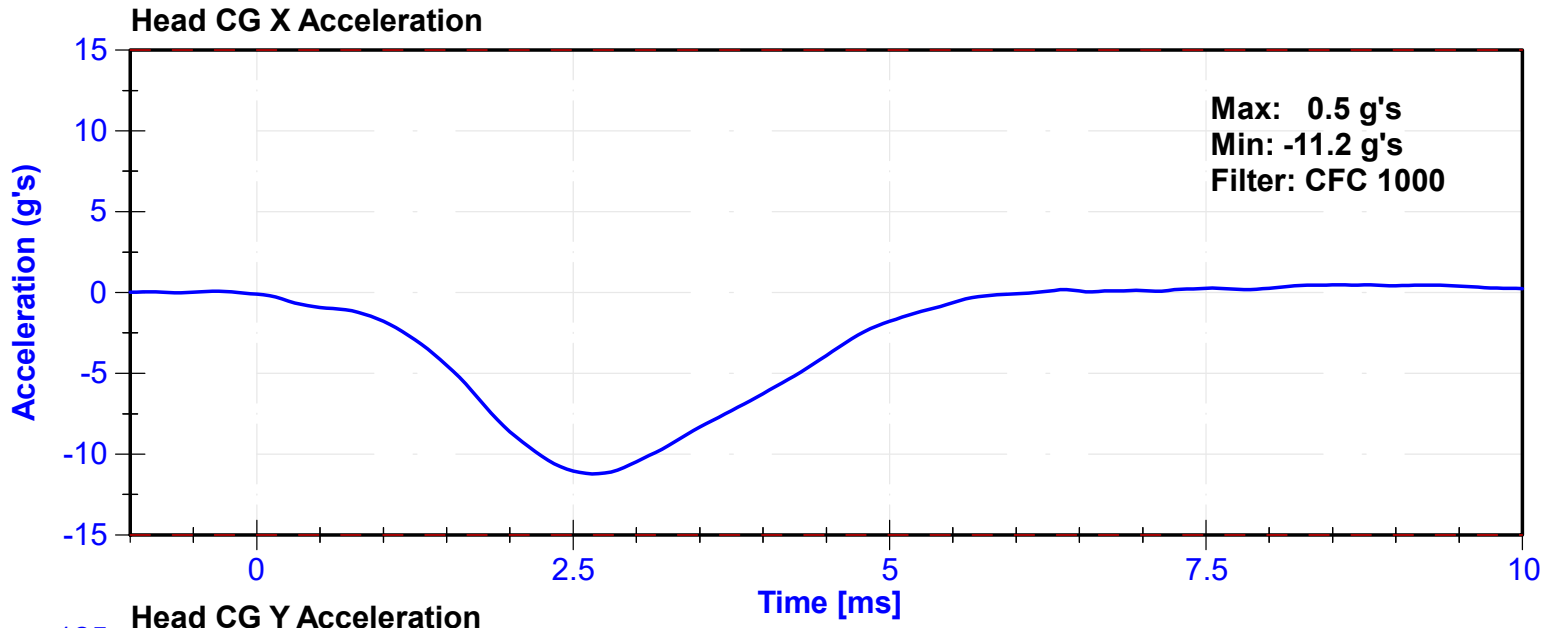
Results

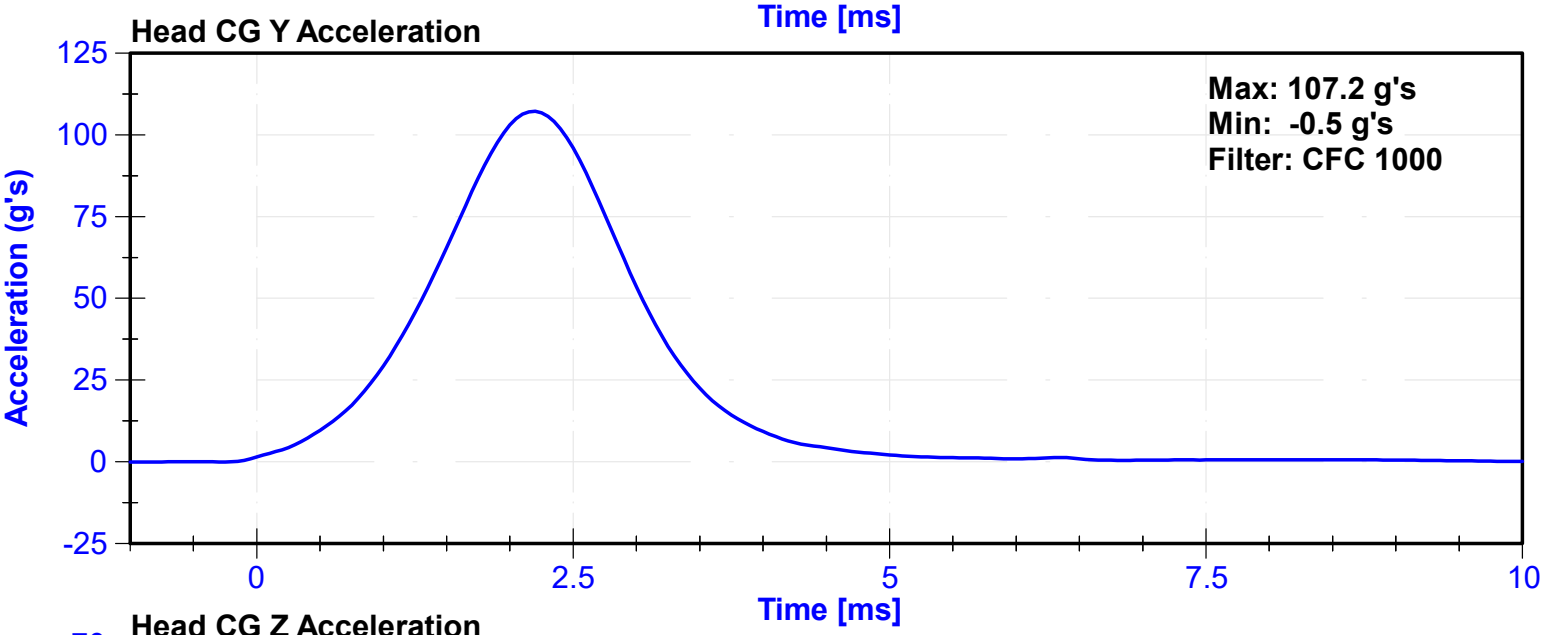
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.0	Pass
Humidity	10	70	%	18	Pass
Resultant Acceleration	115	137	g's	127.6	Pass
Oscillation	0	15	%	1.1	Pass
Fore-Aft Acceleration	-15	15	g's	-11.2	Pass

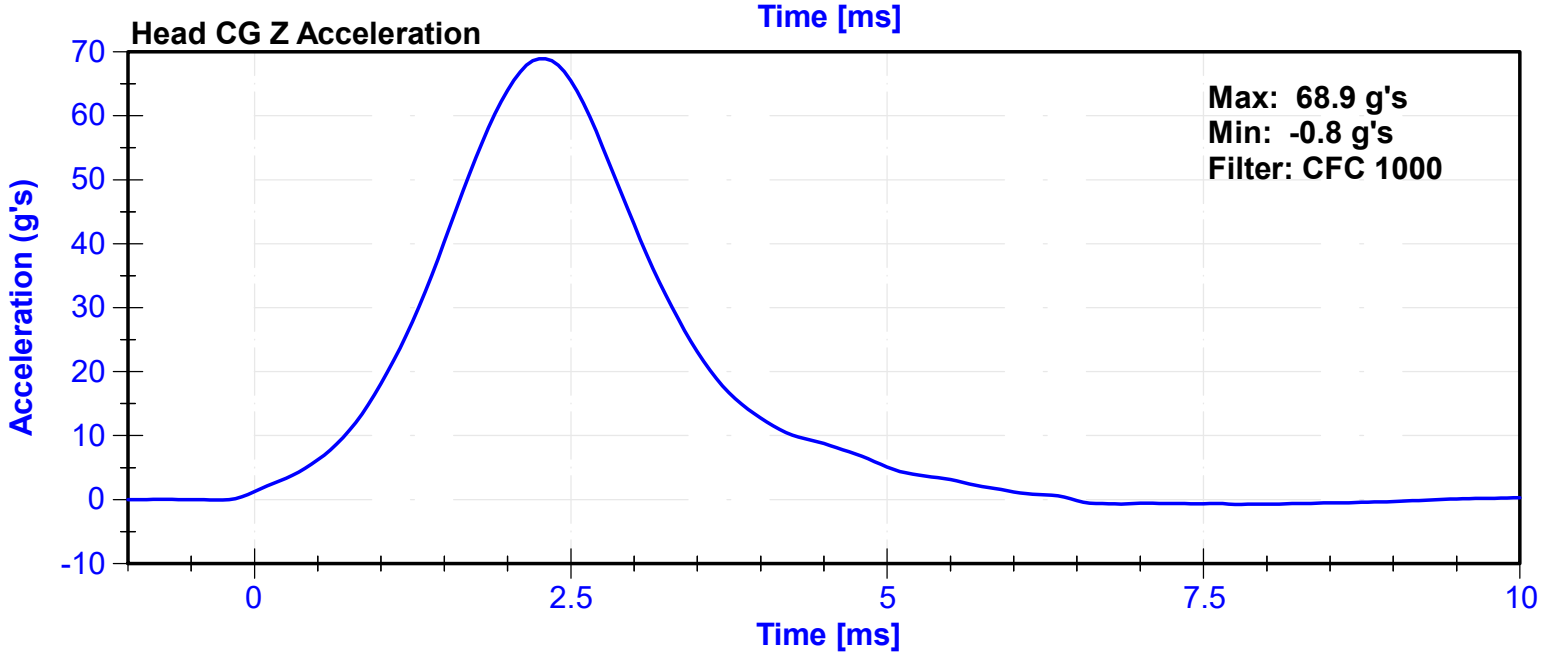
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibratio Date	Calibratio Due Date
X Accelerometer	Endevco	P59018	11/15/2023	5/13/2024
Y Accelerometer	Endevco	P79189	11/15/2023	5/13/2024
Z Accelerometer	Endevco	P79587	11/15/2023	5/13/2024




Head CG X Acceleration
Max: 0.5 g's
Min: -11.2 g's
Filter: CFC 1000
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]


Head CG Y Acceleration
Max: 107.2 g's
Min: -0.5 g's
Filter: CFC 1000
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]


Head CG Z Acceleration
Max: 68.9 g's
Min: -0.8 g's
Filter: CFC 1000
Acceleration (g's)
70
60
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]

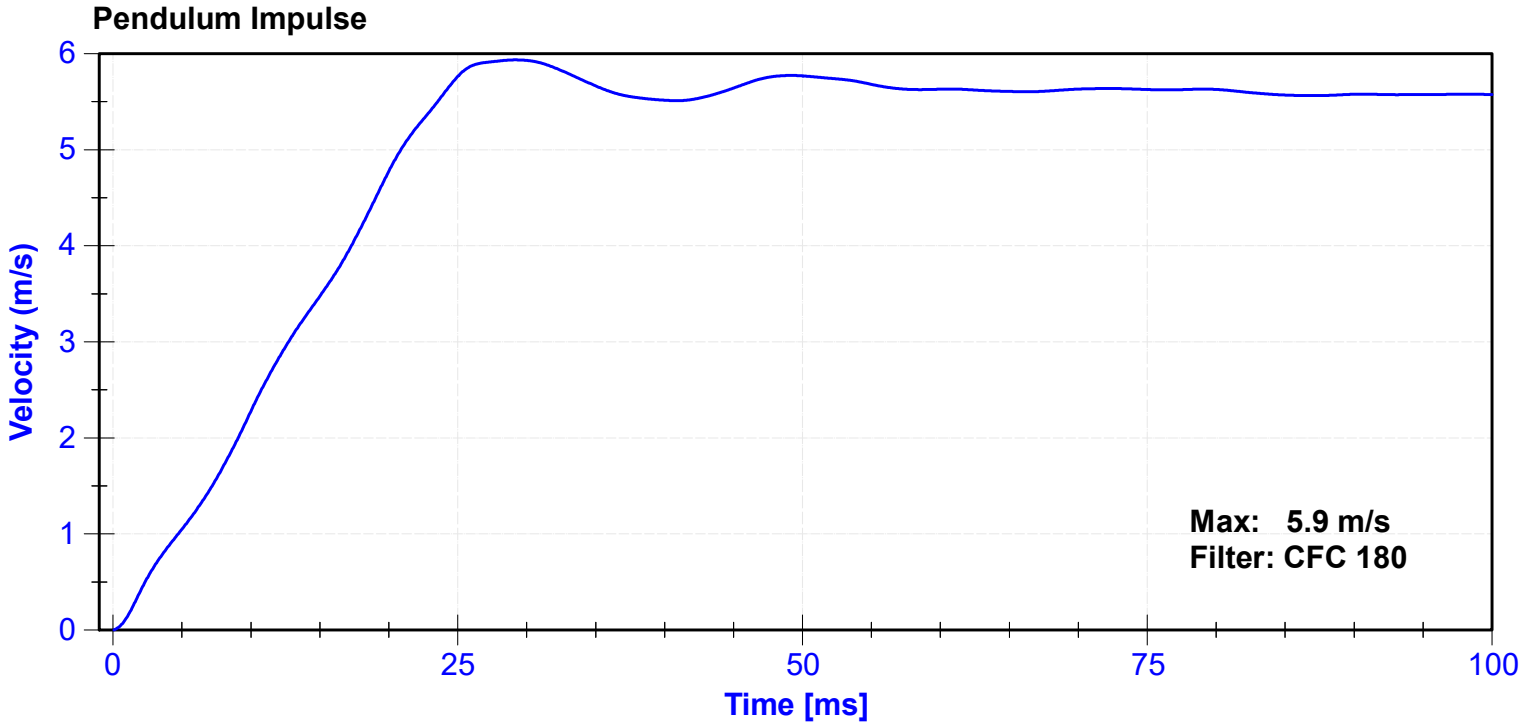
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

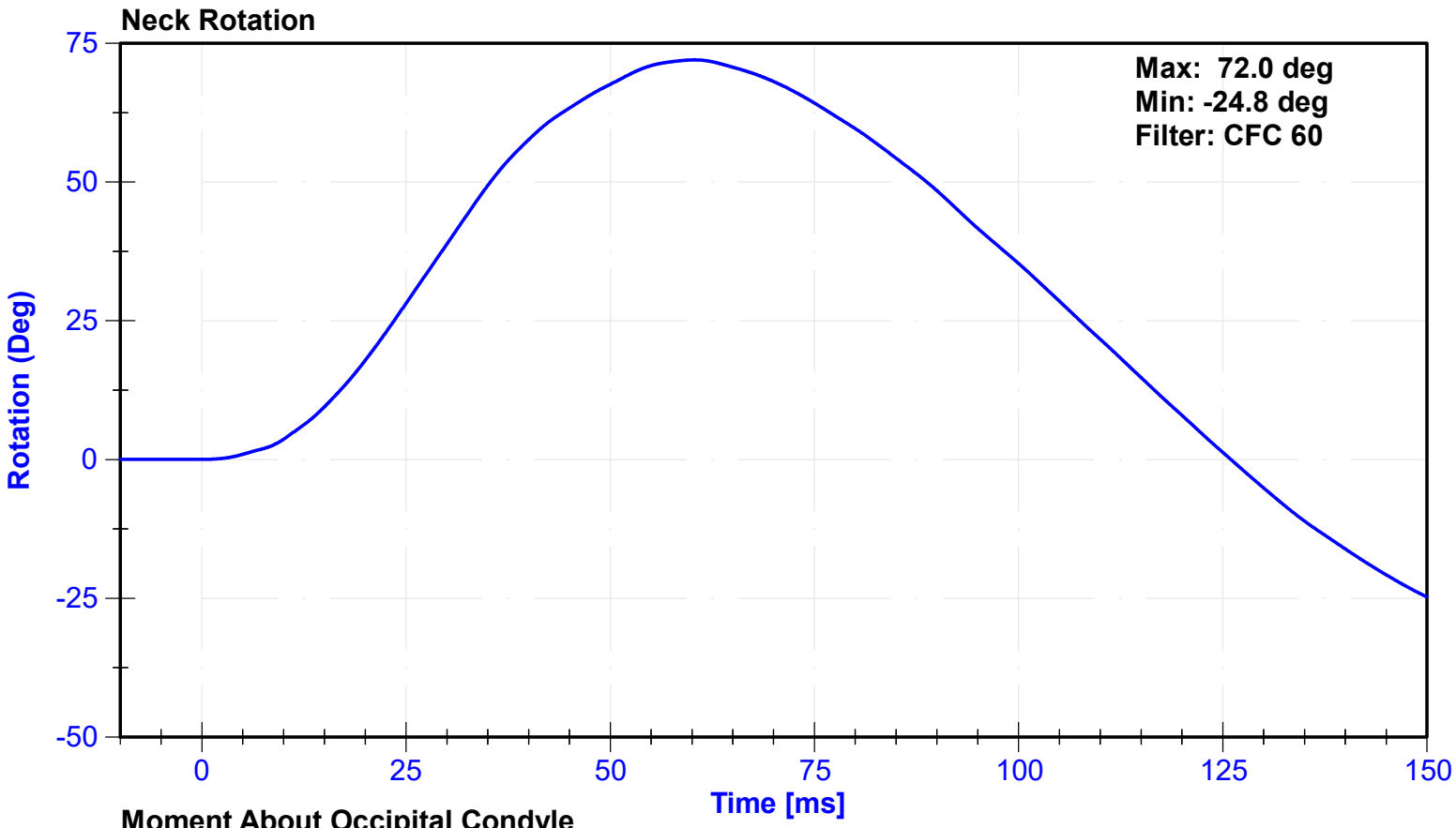
Results

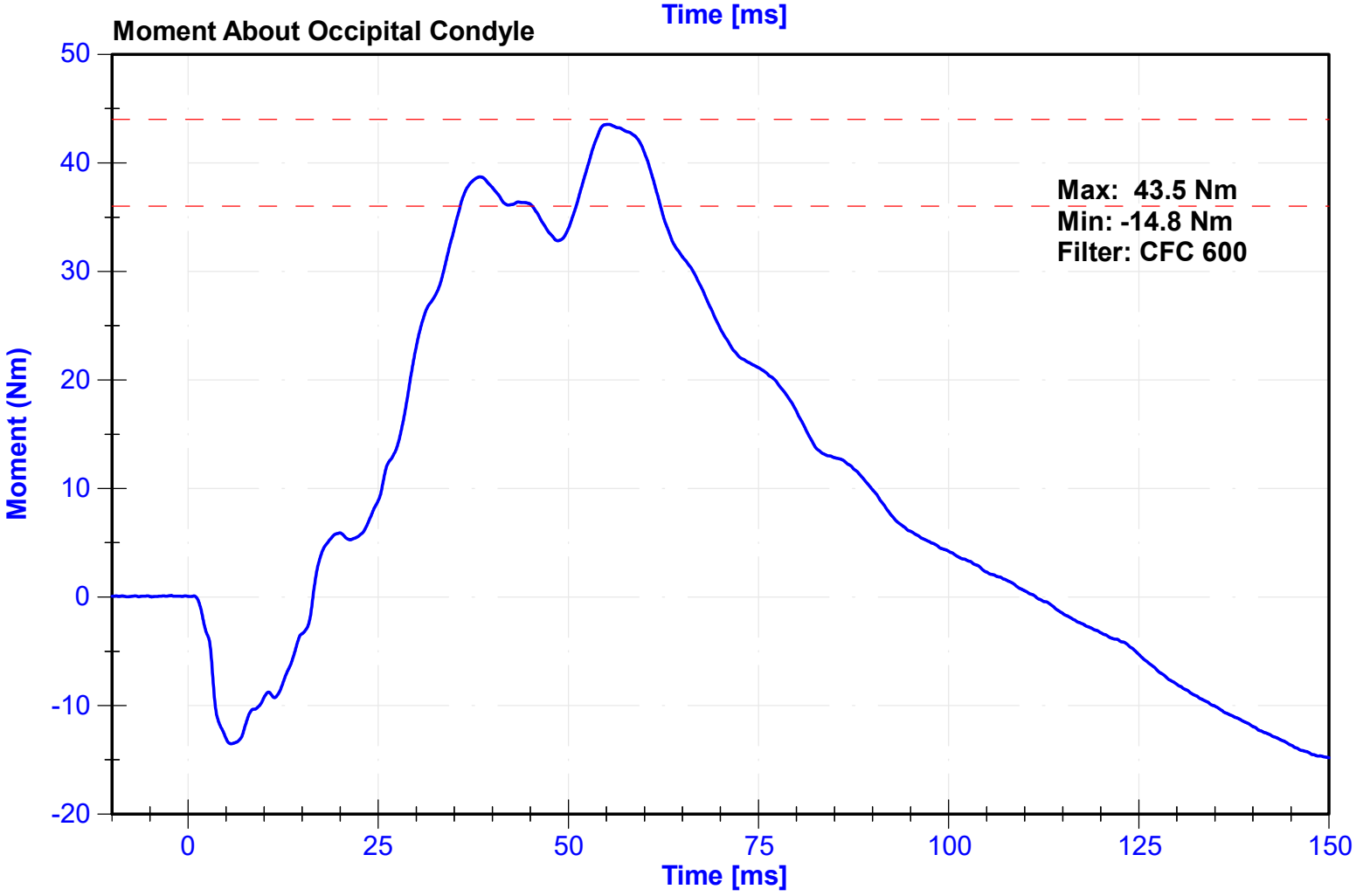
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	29	Pass
Velocity	5.51	5.63	m/s	5.538	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.28	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.48	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.78	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.76	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.93	Pass
Neck Rotation	71	81	deg	72.0	Pass
Time at Maximum Rotation	50	70	ms	60.3	Pass
Moment about the OC	36	44	Nm	43.5	Pass
Moment Decay to 0 Nm	102	126	ms	111.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	7231C-750	10/31/2023	4/28/2024
Pendulum Potentiometer	Servo	4961	10/2/2023	10/1/2024
Condyle Potentiometer	Servo	DS185	10/2/2023	10/1/2024
Upper Neck Load Cell	Denton	1716ATF_2184-FY	5/18/2023	5/17/2024




Neck Rotation
Max: 72.0 deg
Min: -24.8 deg
Filter: CFC 60
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 43.5 Nm
Min: -14.8 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

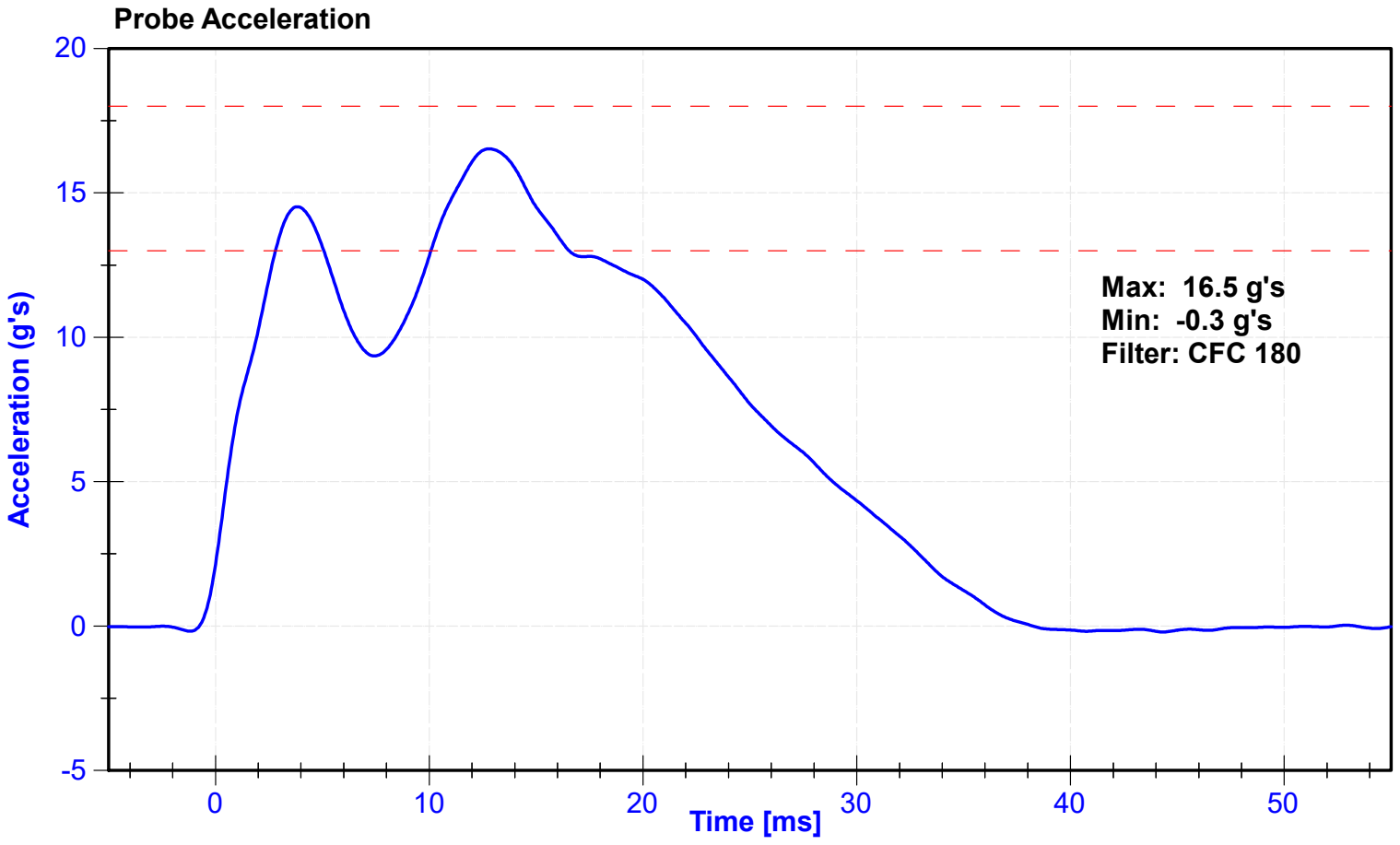
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

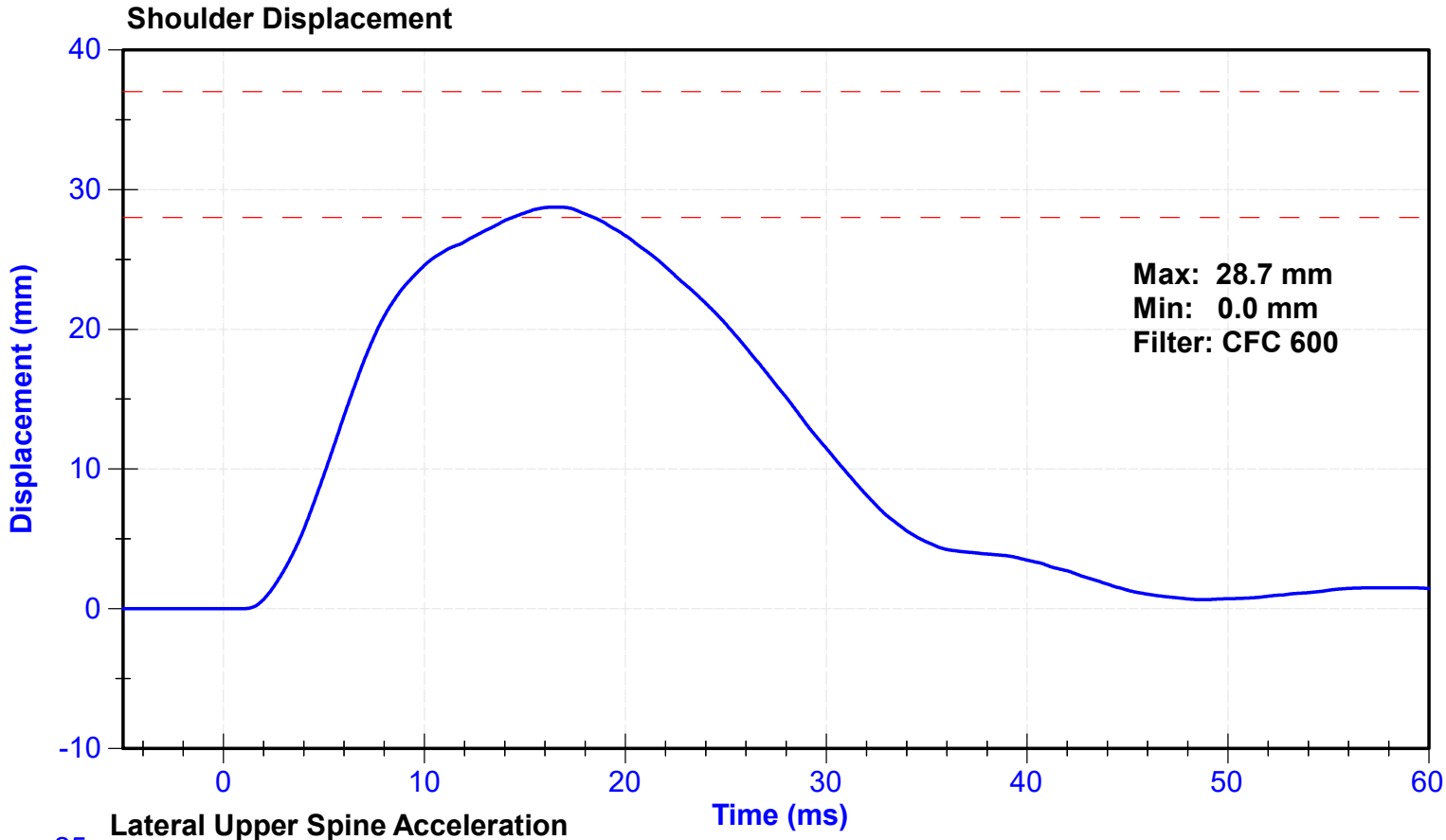
Results

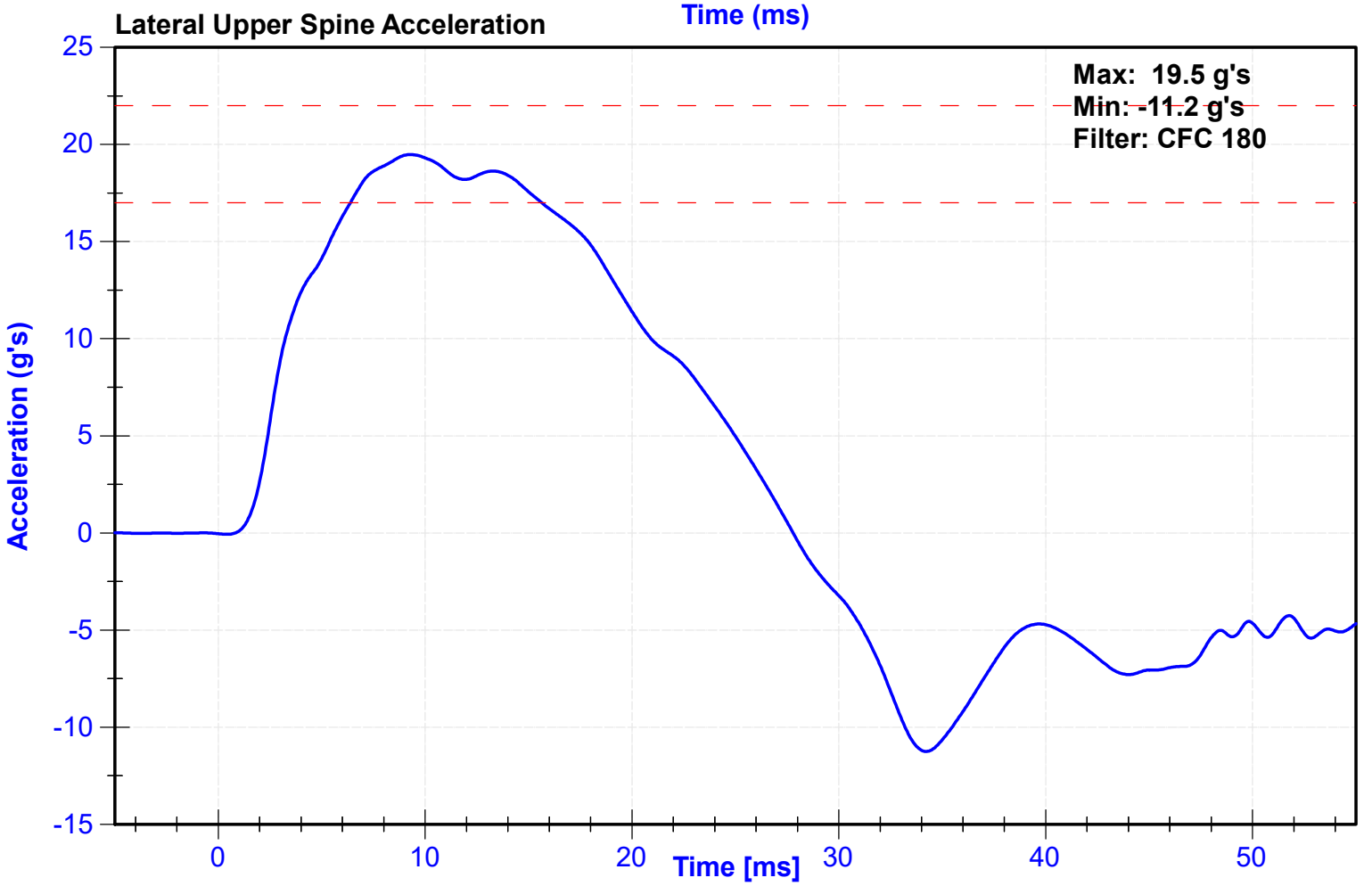
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	29	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	13	18	g's	16.5	Pass
Shoulder Deflection	28	37	mm	28.7	Pass
Lateral Upper Spine Acceleration	17	22	g's	19.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Shoulder Potentiometer	Servo	053GFE	11/17/2023	5/17/2024
Upper Spine Y Accelerometer	Endevco	T20880	11/16/2023	5/14/2024




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 28.7 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 19.5 g's
Min: -11.2 g's
Filter: CFC 180

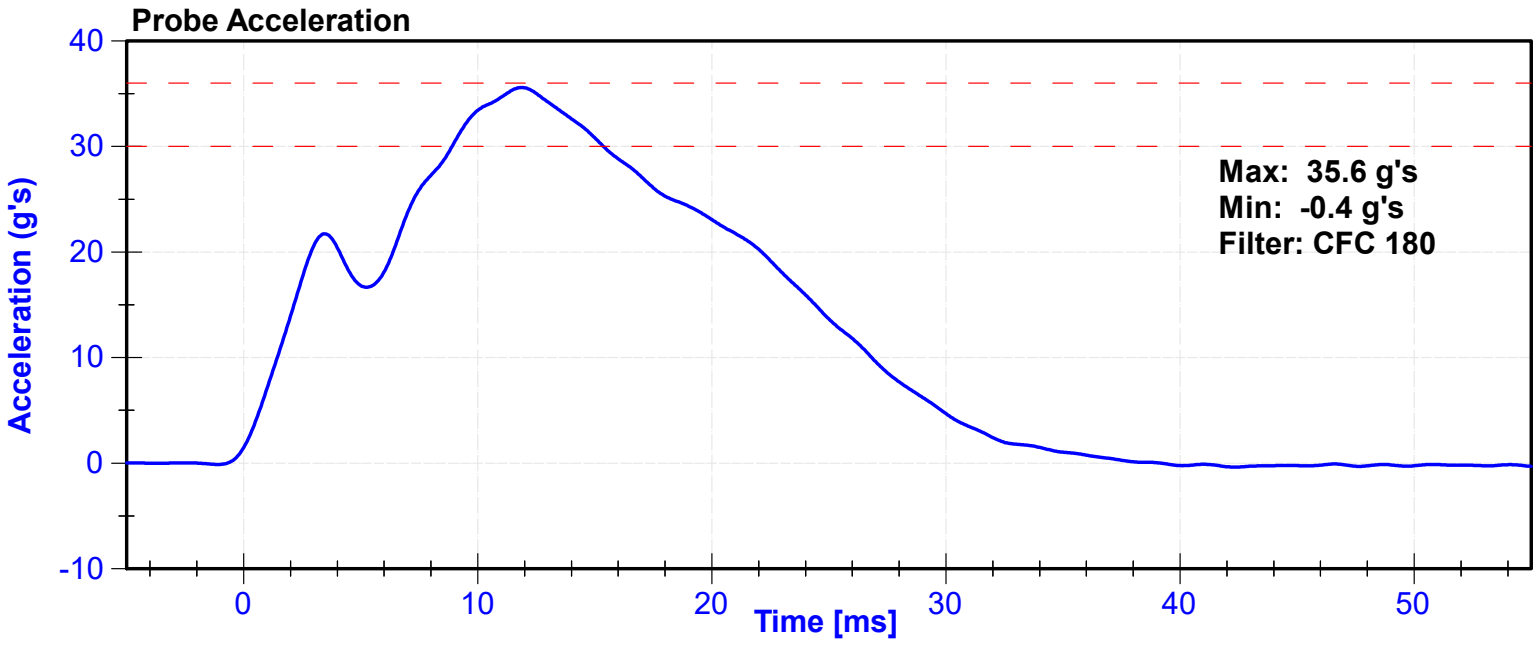
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

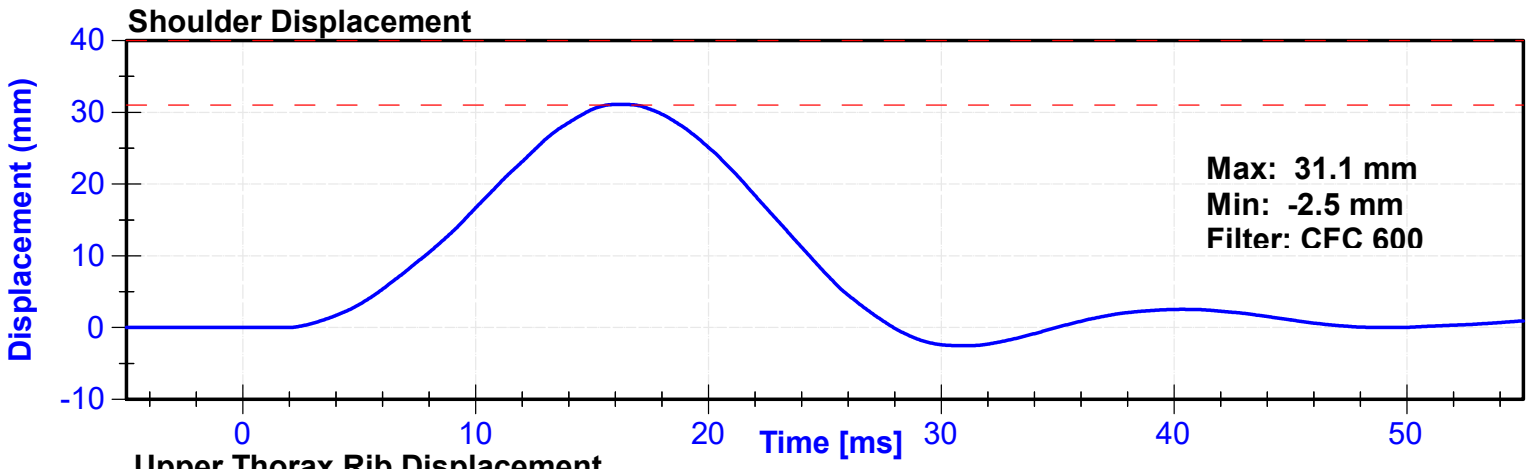
Results

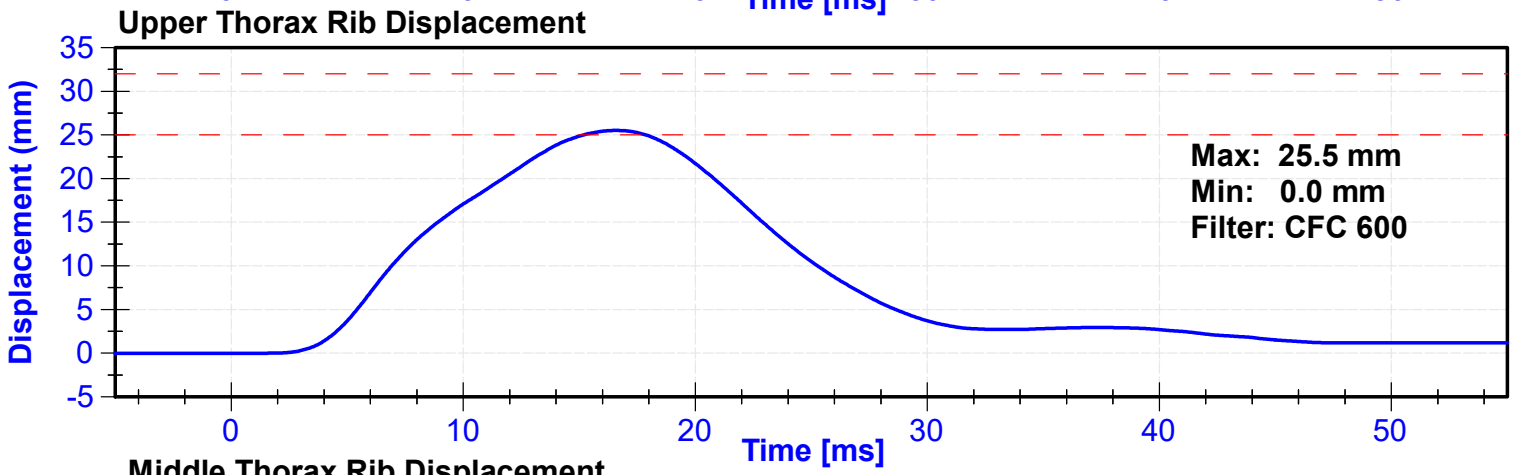
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.0	Pass
Humidity	10	70	%	24	Pass
Velocity	6.6	6.8	m/s	6.63	Pass
Probe Acceleration after 5 ms	30	36	g's	35.6	Pass
Lateral Upper Spine Acceleration	34	43	g's	34.8	Pass
Lateral Lower Spine Acceleration	29	37	g's	29.5	Pass
Shoulder Deflection	31	40	mm	31.1	Pass
Upper Thorax Rib Deflection	25	32	mm	25.5	Pass
Mid Thorax Rib Deflection	30	36	mm	30.0	Pass
Lower Thorax Rib Deflection	32	38	mm	32.7	Pass

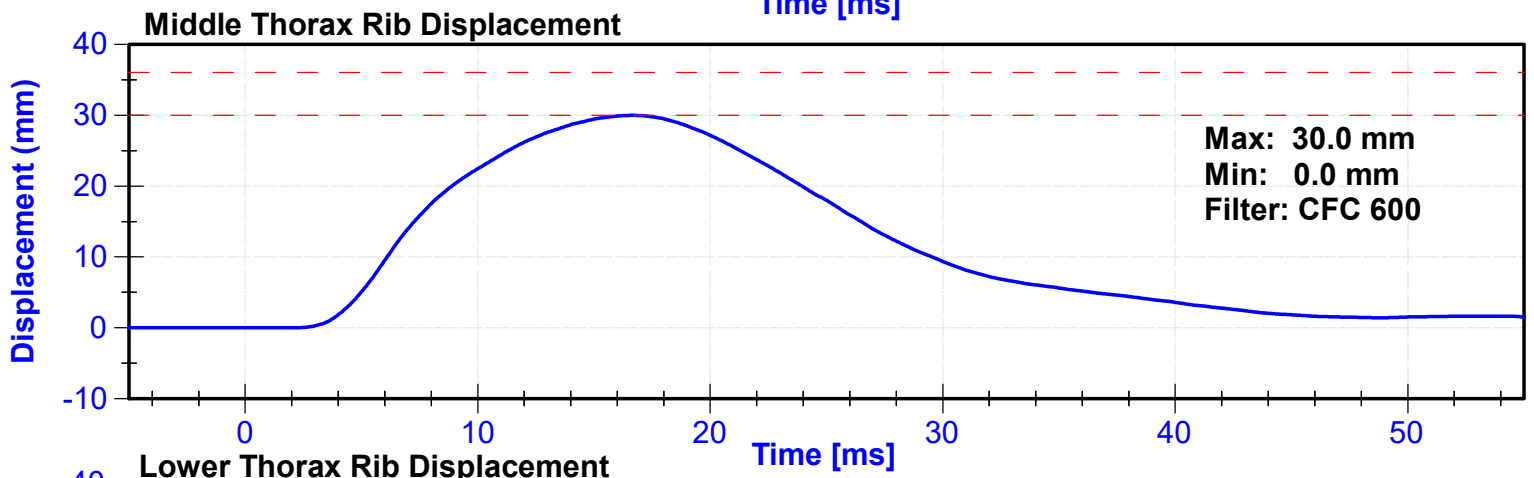
Transducer Calibrations

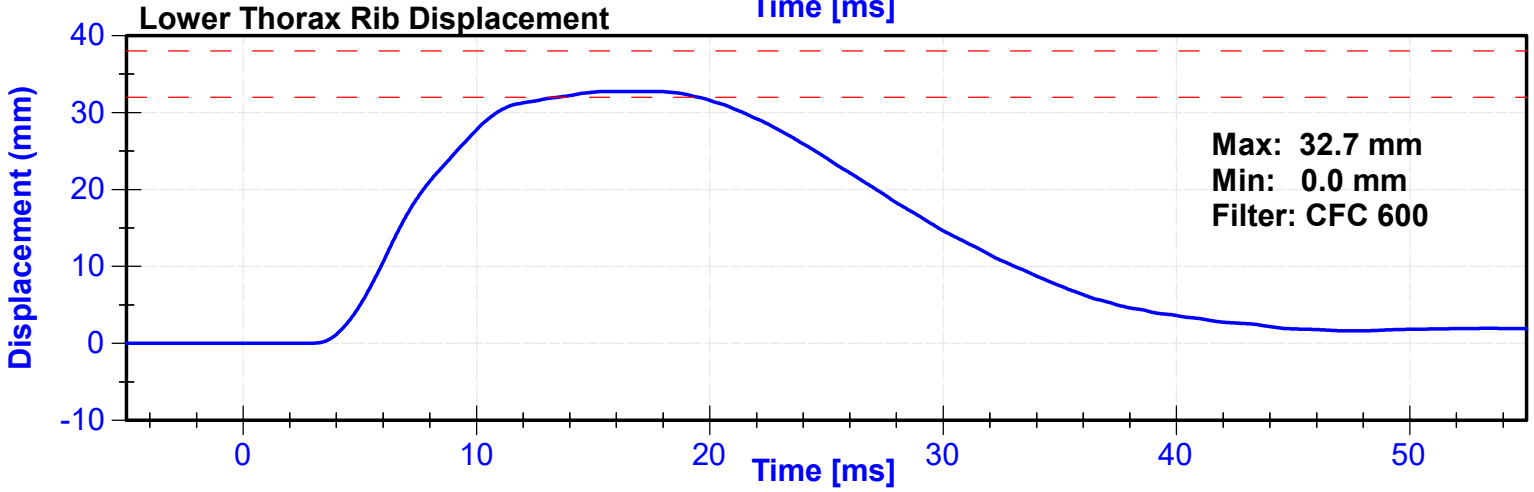
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Upper Spine T1 Y Accelerometer	Endevco	T20880	11/16/2023	5/14/2024
Upper Spine T12 Y Accelerometer	Endevco	P52071	11/16/2023	5/14/2024
Shoulder Potentiometer	Servo	053GFE	11/17/2023	5/17/2024
Upper Thorax Rib Potentiometer	Servo	2316GFE	11/17/2023	5/17/2024
Middle Thorax Rib Potentiometer	Servo	307GFE	11/17/2023	5/17/2024
Lower Thorax Rib Potentiometer	Servo	1156GFE	11/17/2023	5/17/2024

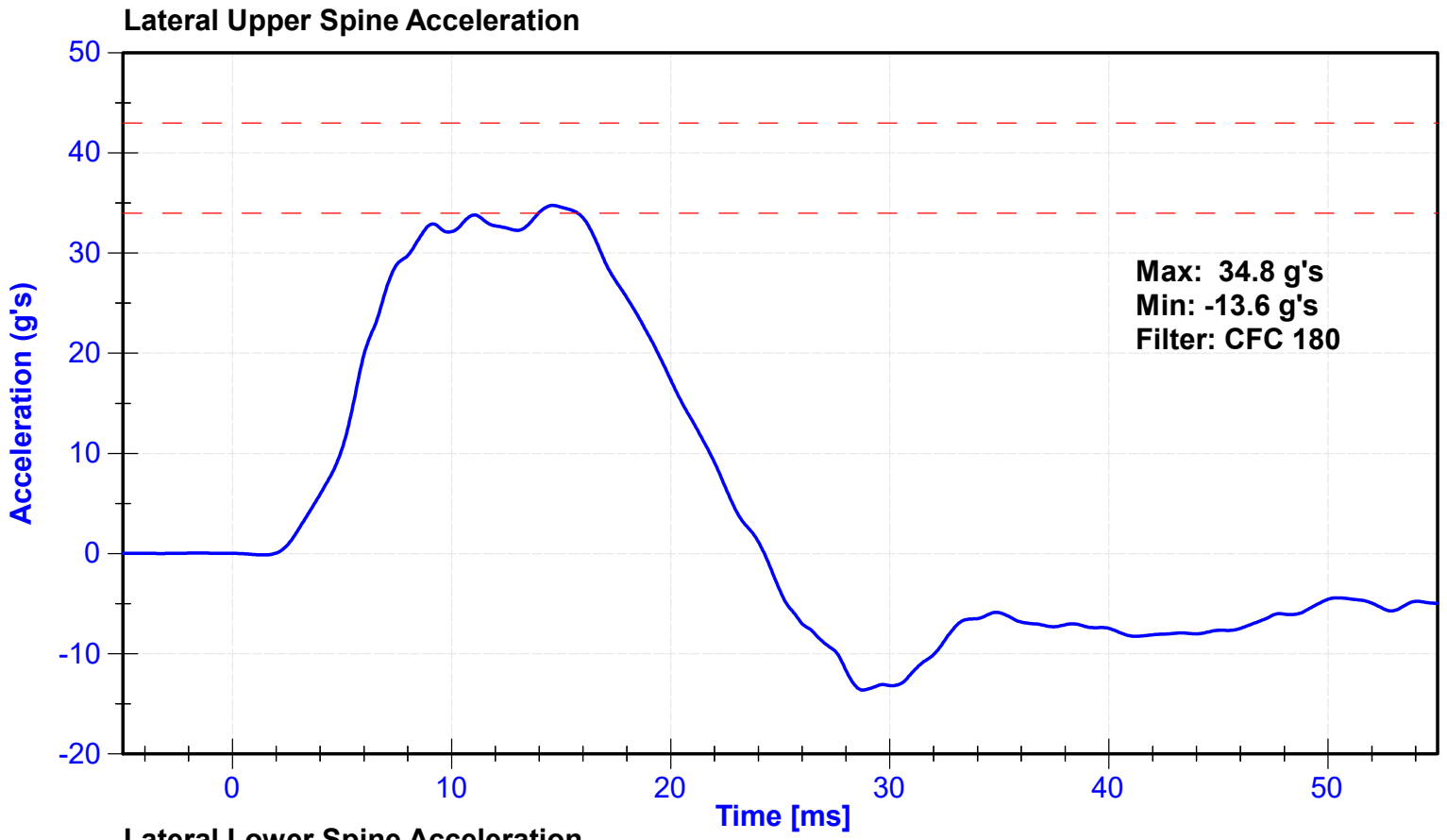


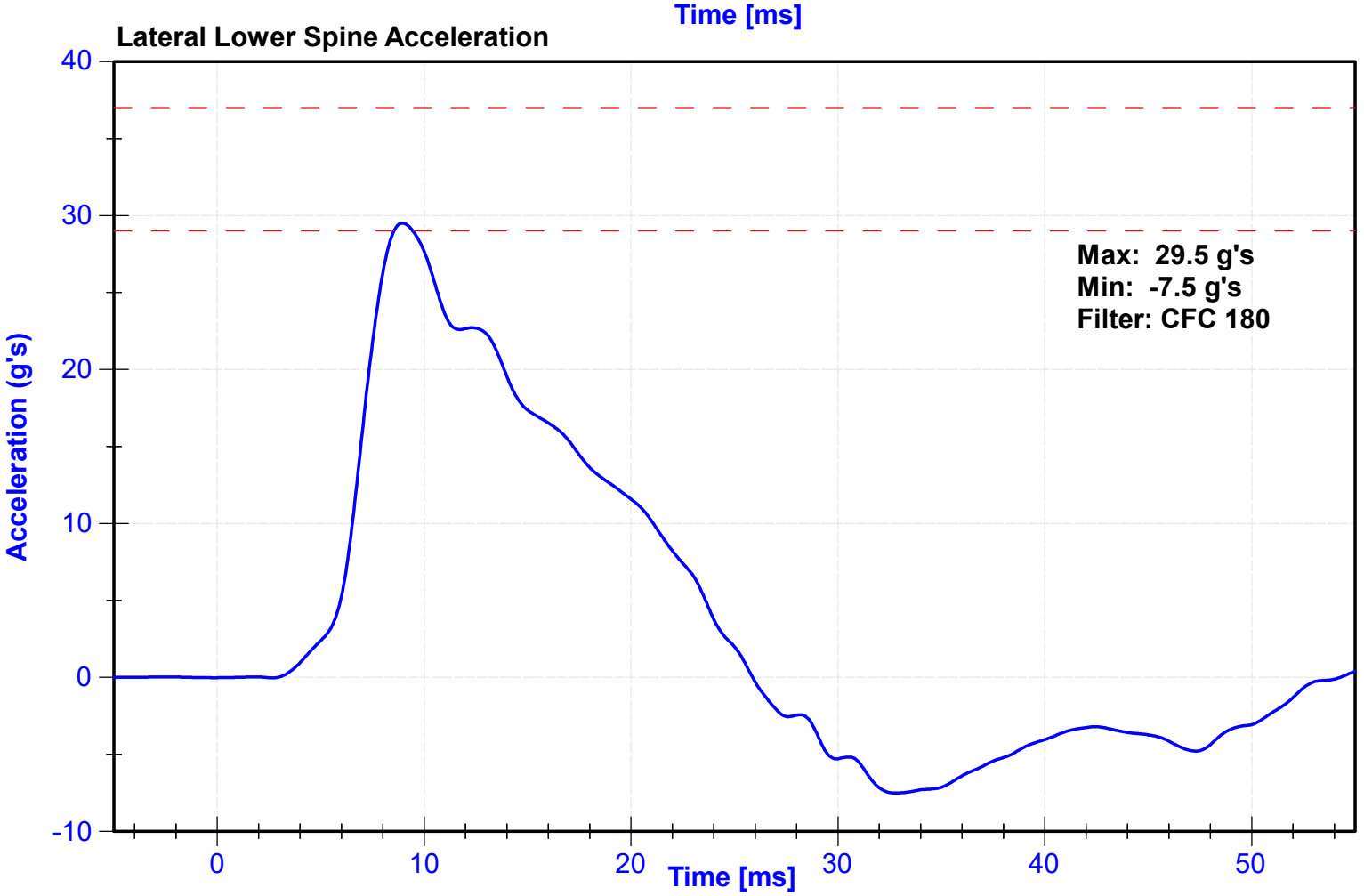

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 31.1 mm
Min: -2.5 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 25.5 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 30.0 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 32.7 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 34.8 g's
Min: -13.6 g's
Filter: CFC 180


Lateral Lower Spine Acceleration
Acceleration (g's)
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 29.5 g's
Min: -7.5 g's
Filter: CFC 180

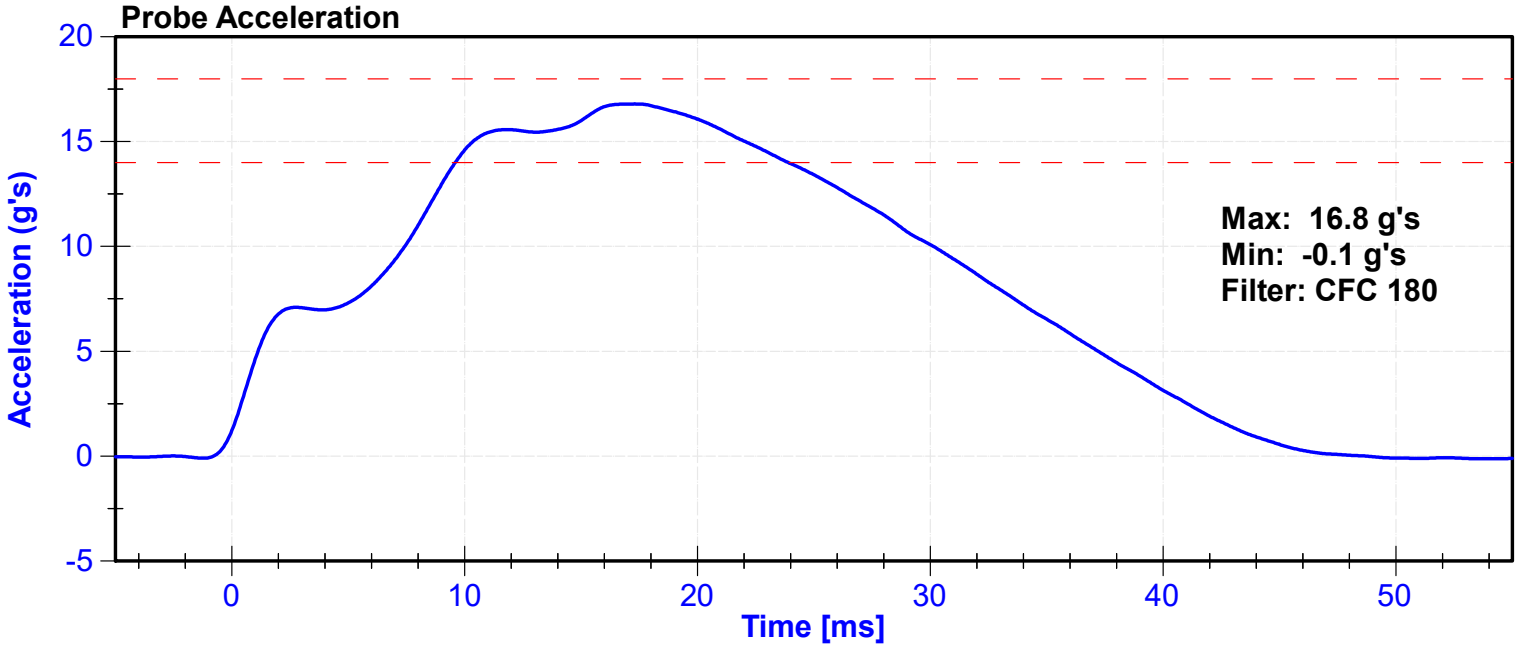
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

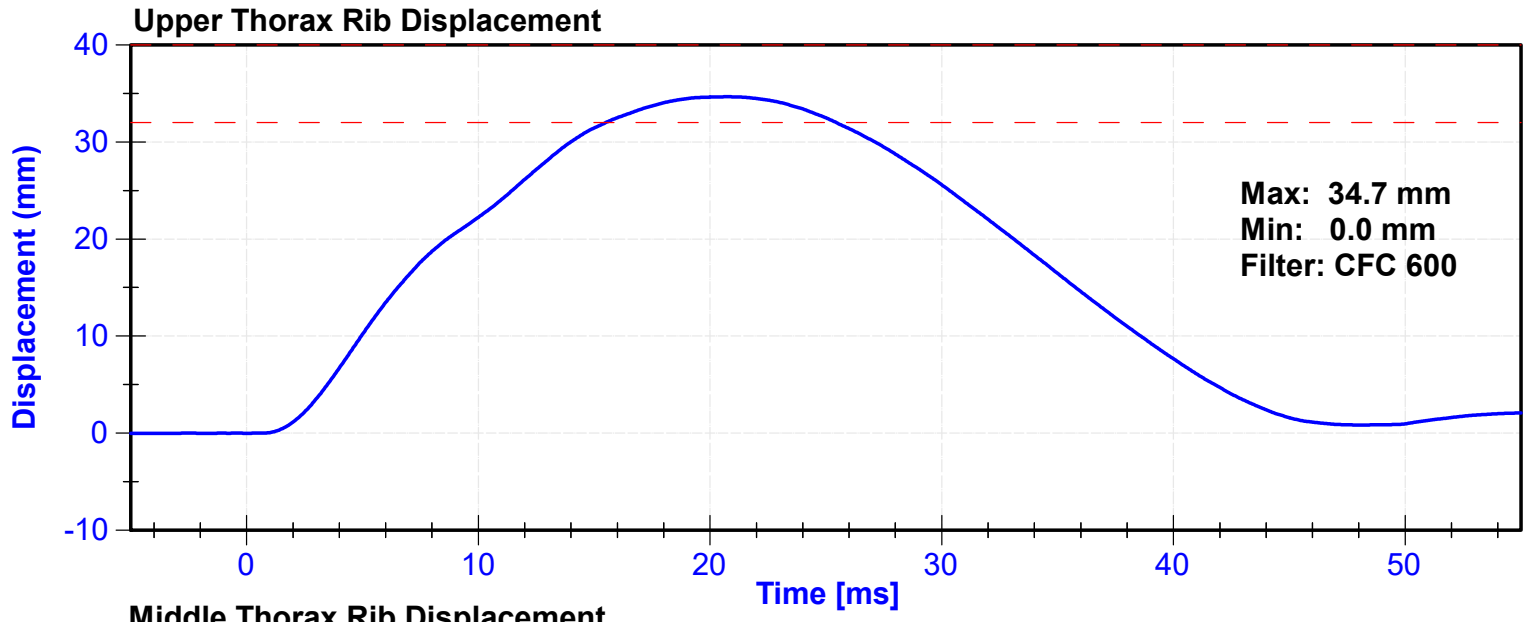
Results

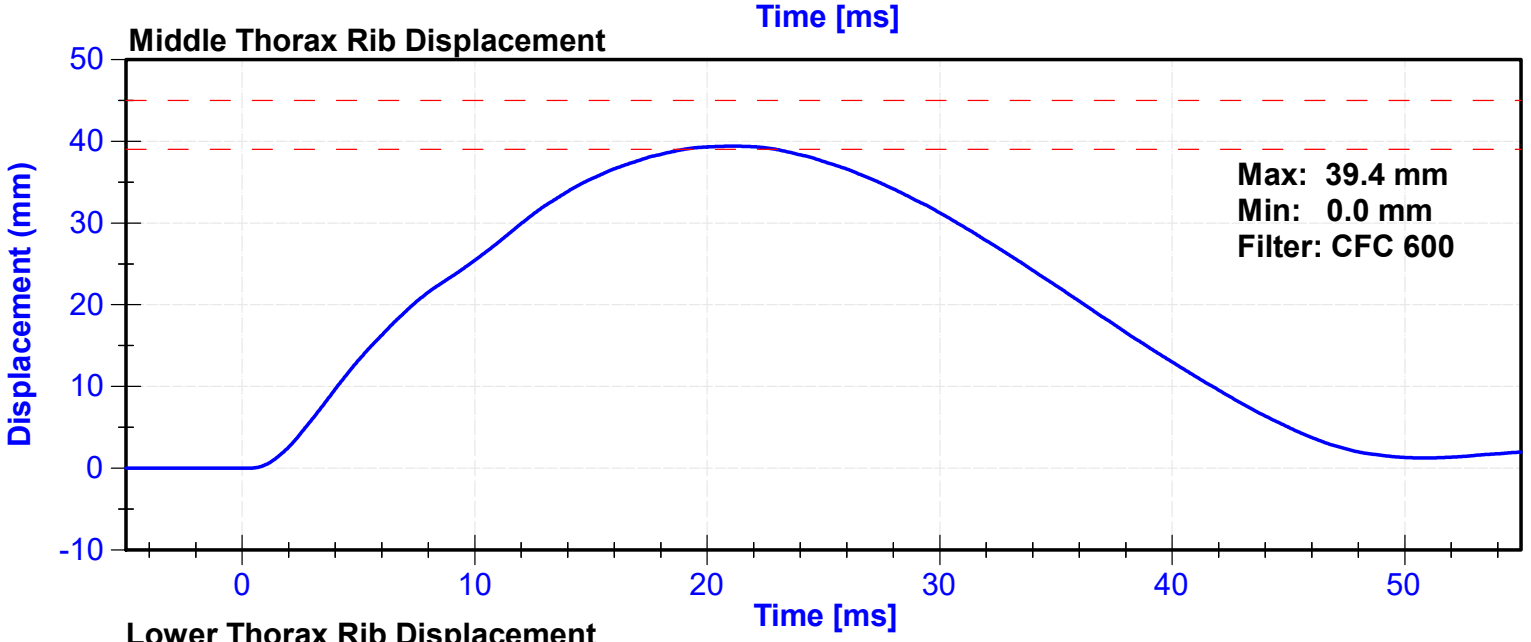
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.0	Pass
Humidity	10	70	%	24	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	14	18	g's	16.8	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.9	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.2	Pass
Upper Thorax Rib Deflection	32	40	mm	34.7	Pass
Middle Thorax Rib Deflection	39	45	mm	39.4	Pass
Lower Thorax Rib Deflection	35	43	mm	37.3	Pass

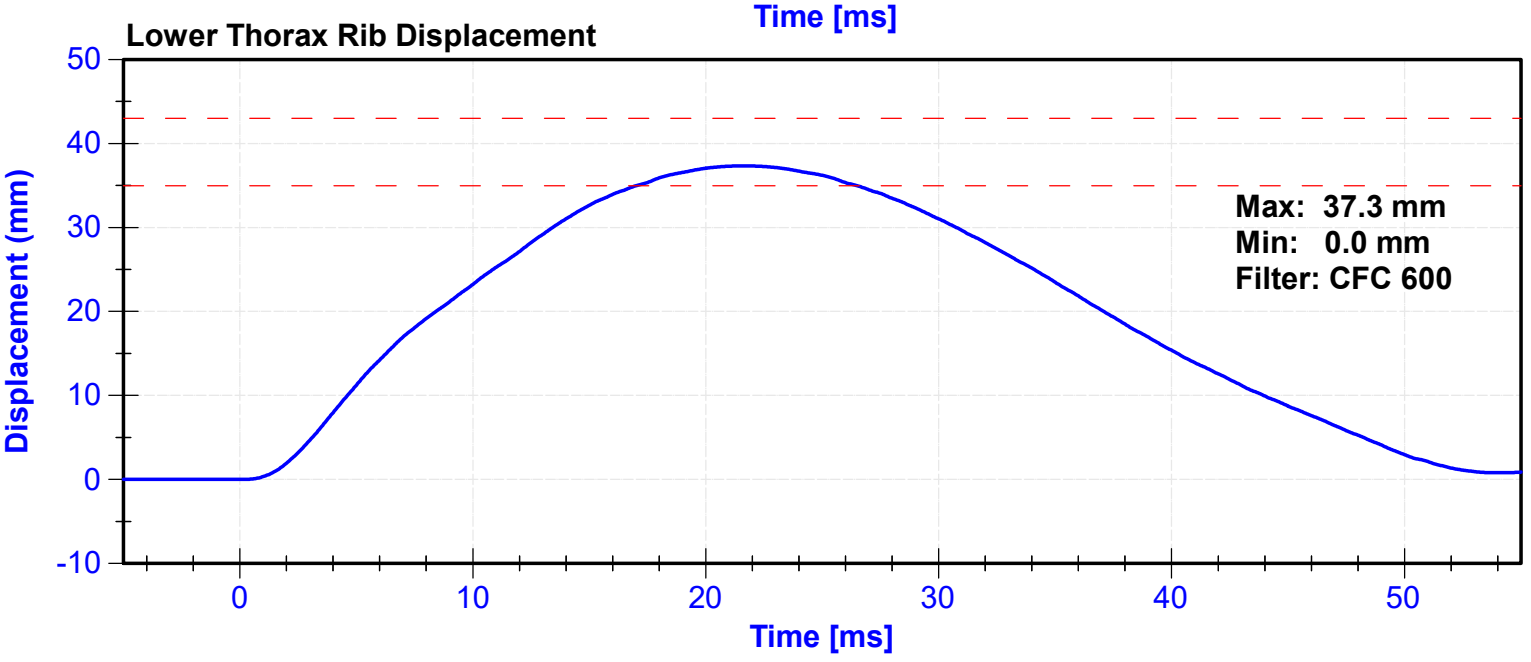
Transducer Calibrations

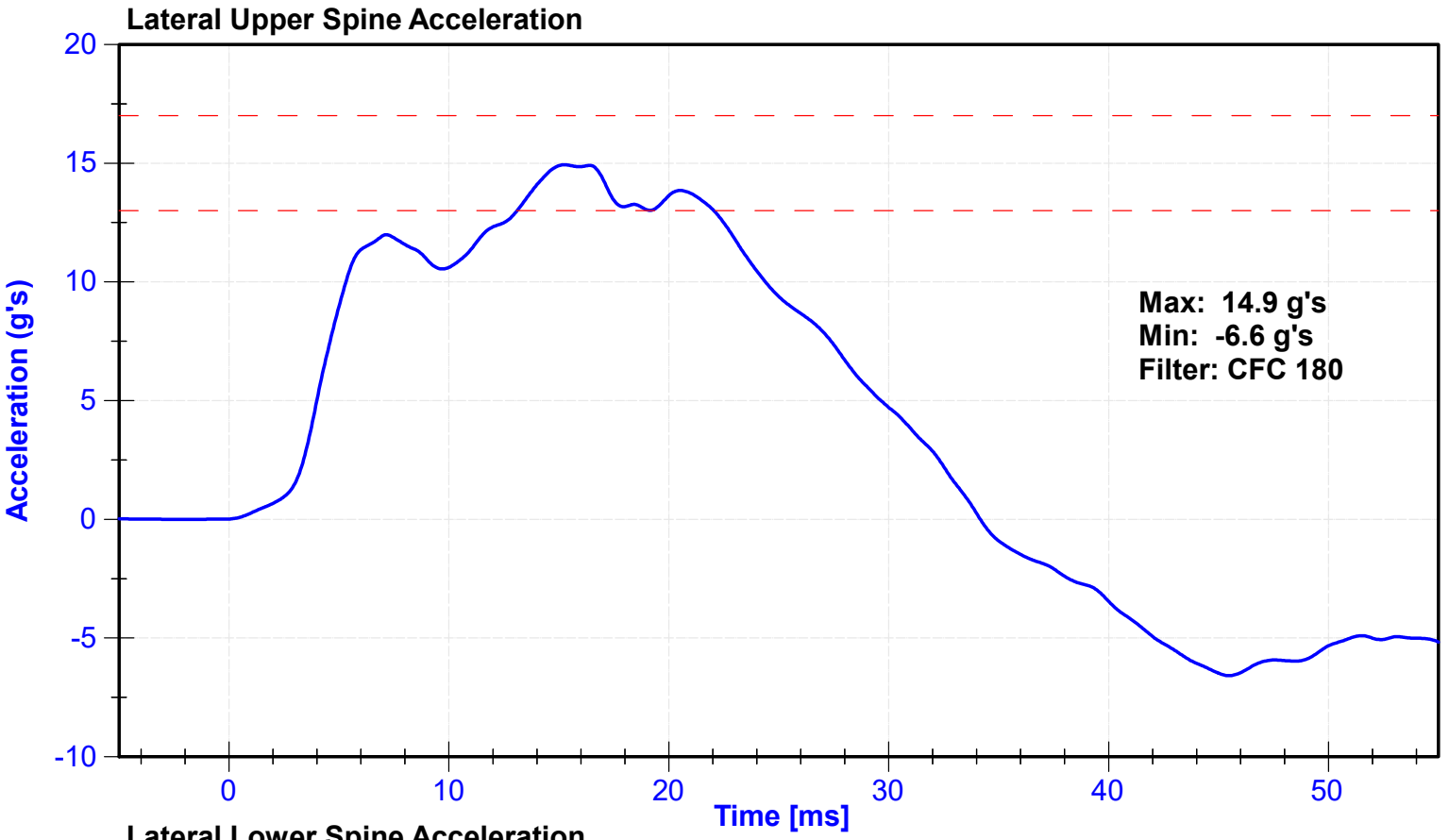
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Upper Spine Y Accelerometer	Endevco	T20880	11/16/2023	5/14/2024
Lower Spine Y Accelerometer	Endevco	P52071	11/16/2023	5/14/2024
Upper Thorax Rib Potentiometer	Servo	2316GFE	11/17/2023	5/17/2024
Middle Thorax Rib Potentiometer	Servo	307GFE	11/17/2023	5/17/2024
Lower Thorax Rib Potentiometer	Servo	1156GFE	11/17/2023	5/17/2024

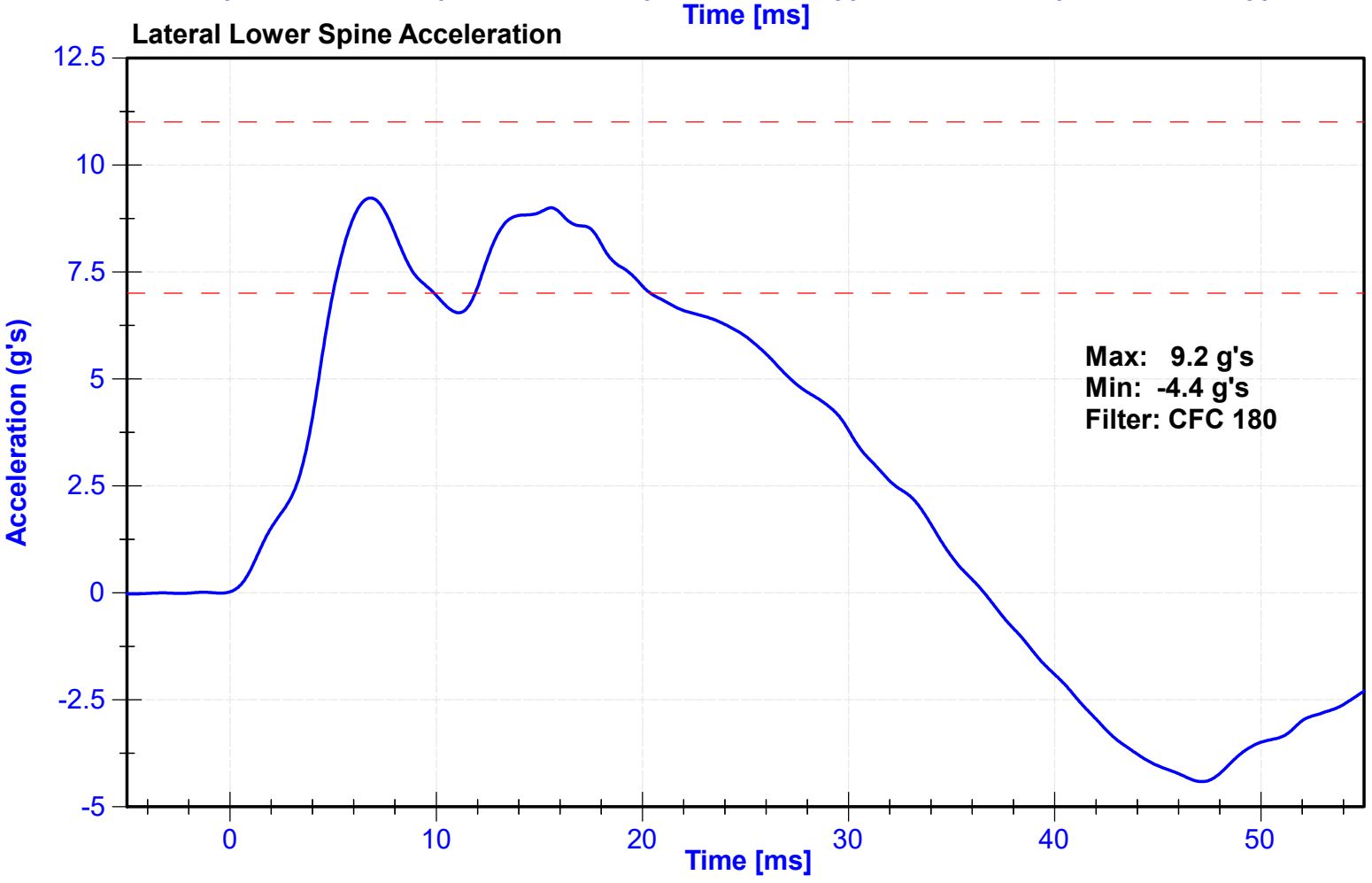



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 34.7 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 39.4 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.3 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 14.9 g's
Min: -6.6 g's
Filter: CFC 180


Lateral Lower Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 9.2 g's
Min: -4.4 g's
Filter: CFC 180

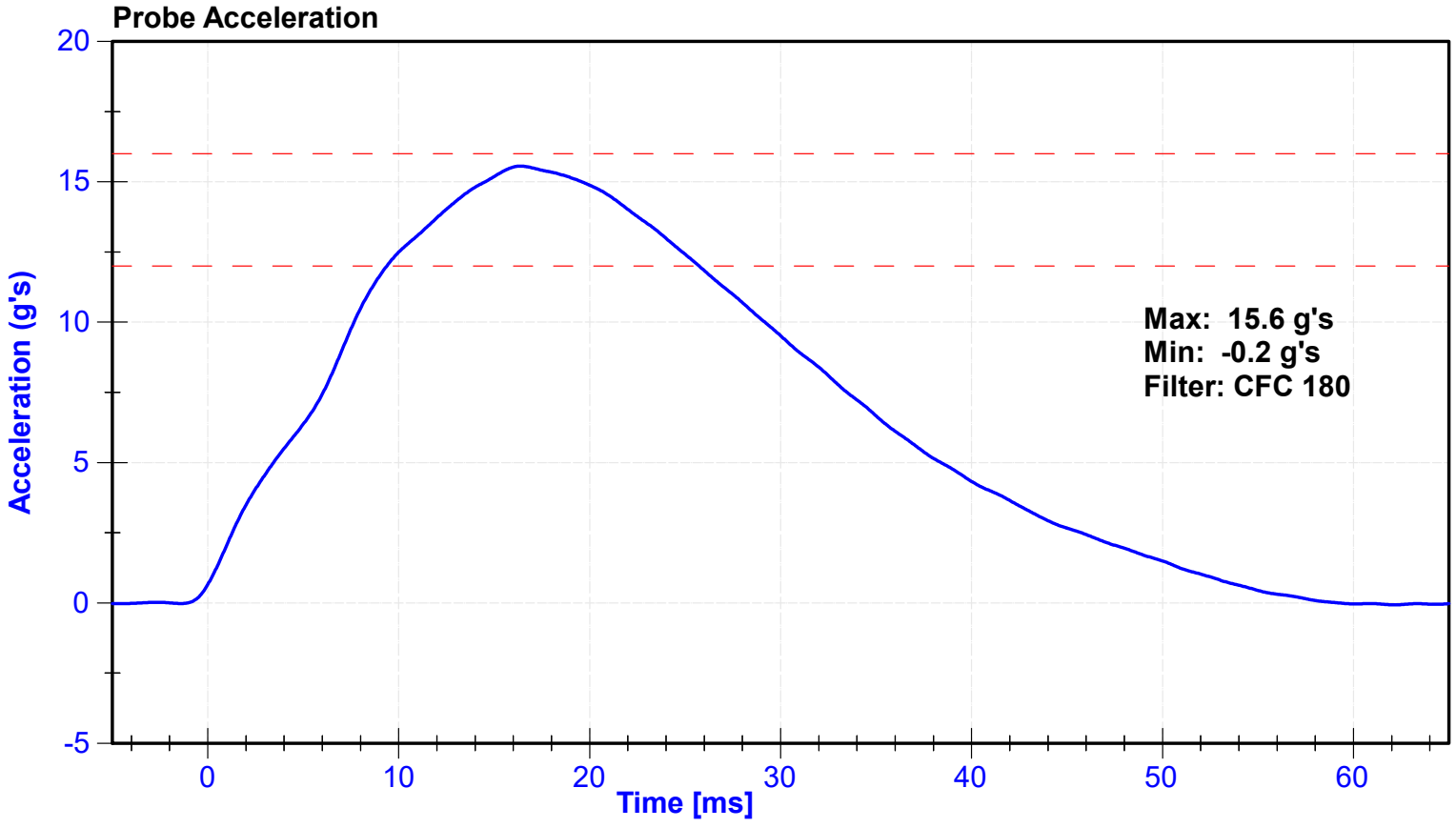
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

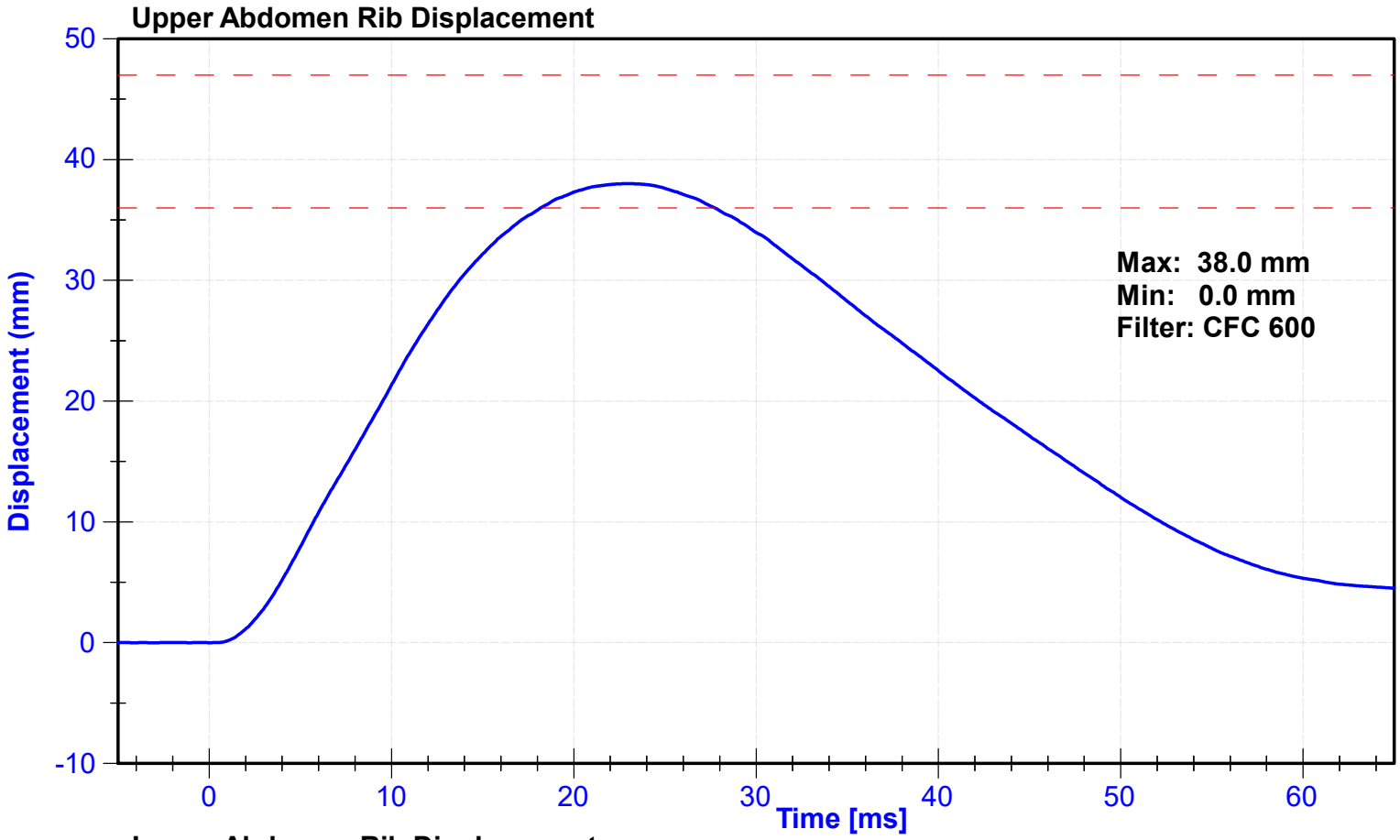
Results

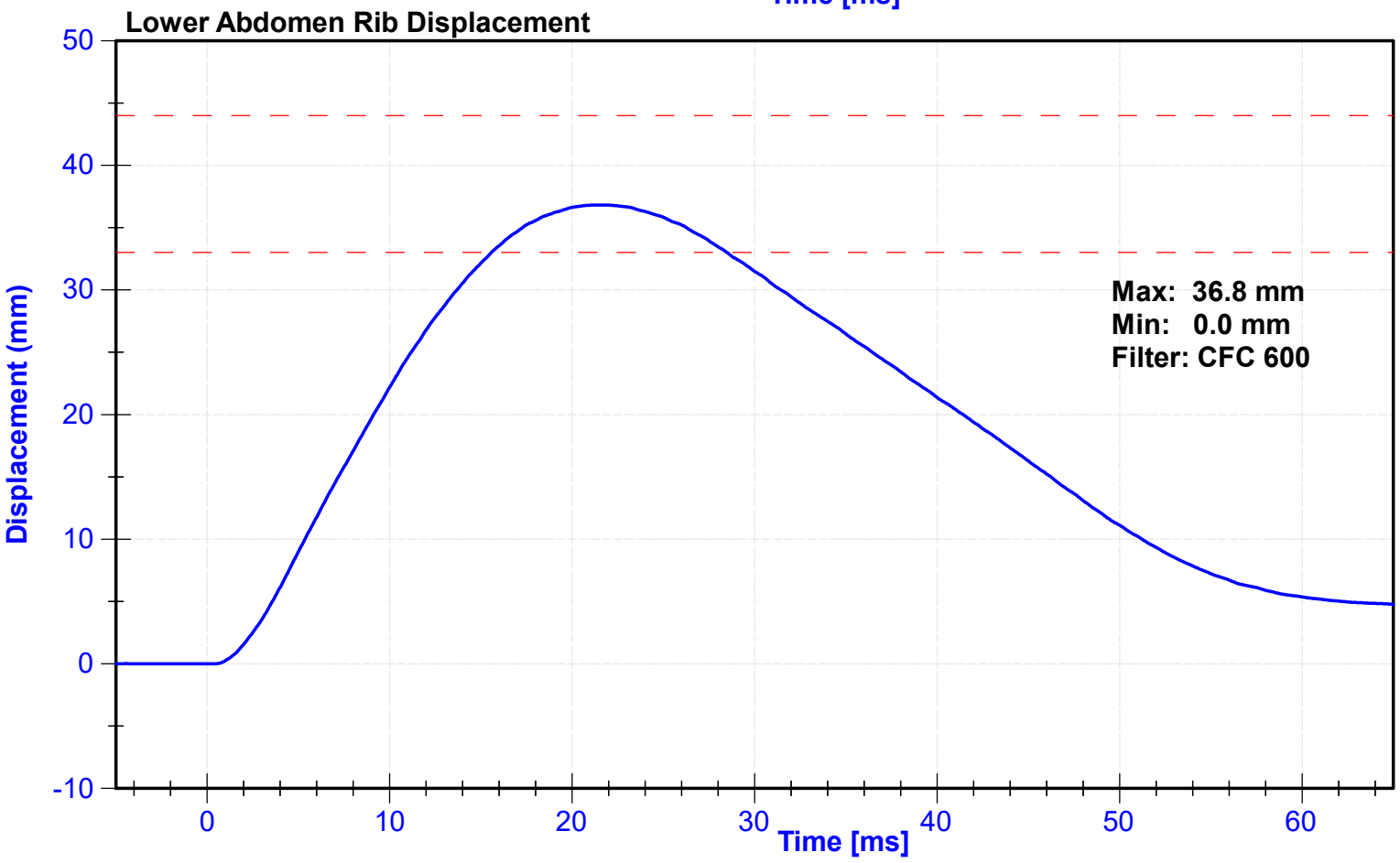
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.0	Pass
Humidity	10	70	%	24	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	12	16	g's	15.6	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.5	Pass
Upper Abdomen Rib Deflection	36	47	mm	38.0	Pass
Lower Abdomen Rib Deflection	33	44	mm	36.8	Pass

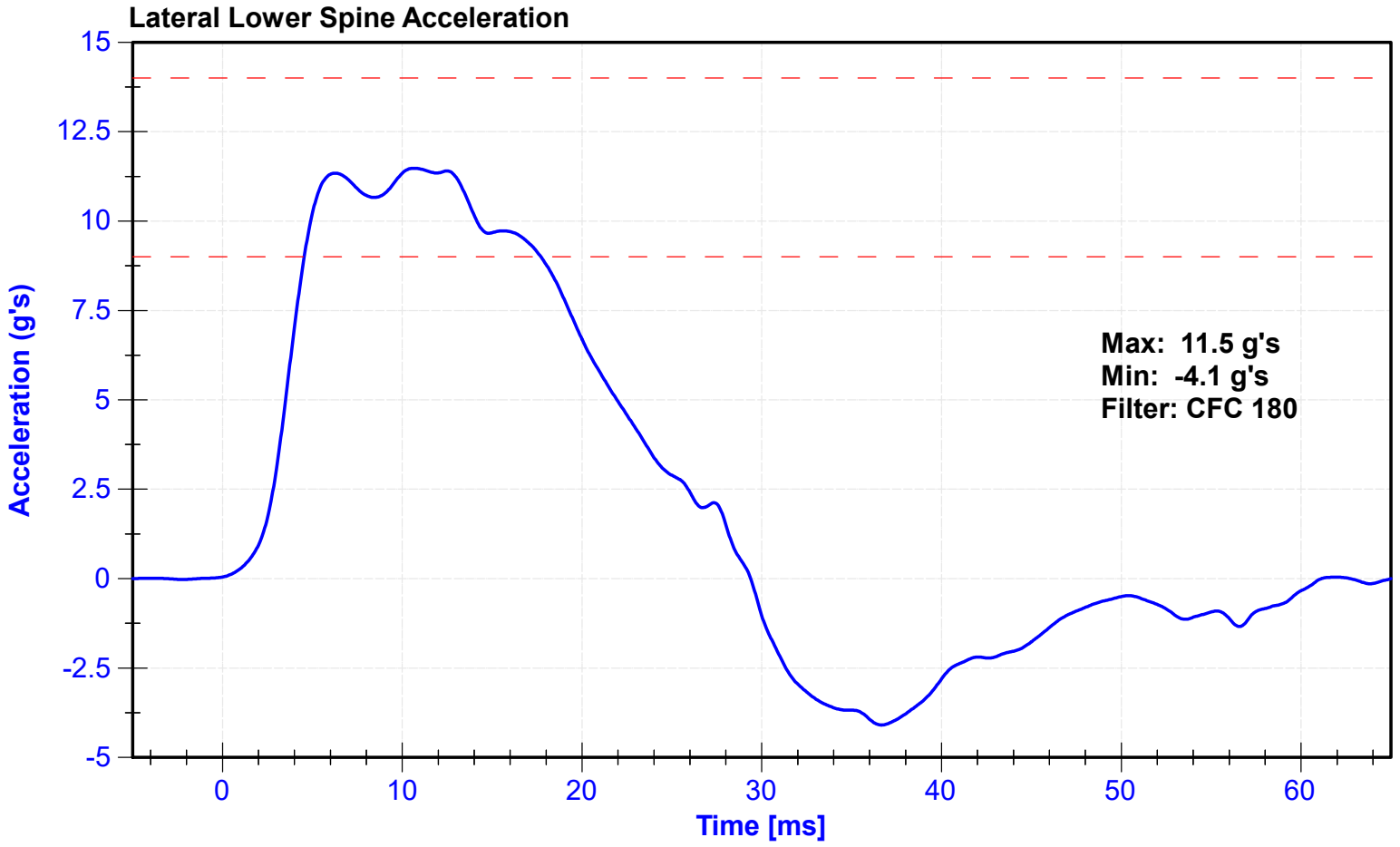
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Lower Spine Y Accelerometer	Endevco	P52071	11/16/2023	5/14/2024
Upper Abdomen Rib Potentiometer	Servo	060GFE	11/21/2023	5/21/2024
Lower Abdomen Rib Potentiometer	Servo	308GFE	11/17/2023	5/17/2024




Upper Abdomen Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
60
Time [ms]
Max: 38.0 mm
Min: 0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
60
Time [ms]
Max: 36.8 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Lower Spine Acceleration
Acceleration (g's)
15
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50
60
Time [ms]
Max: 11.5 g's
Min: -4.1 g's
Filter: CFC 180

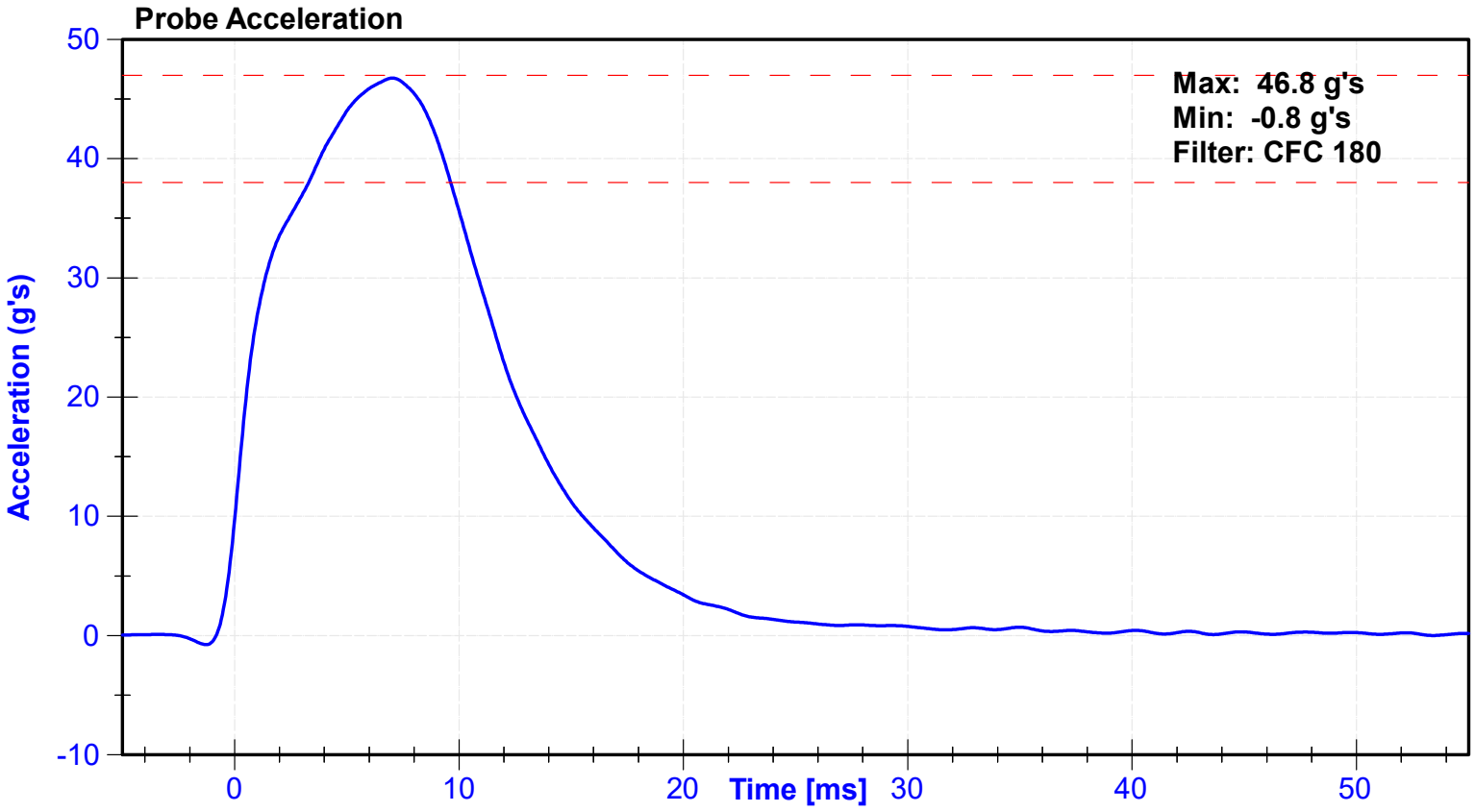
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

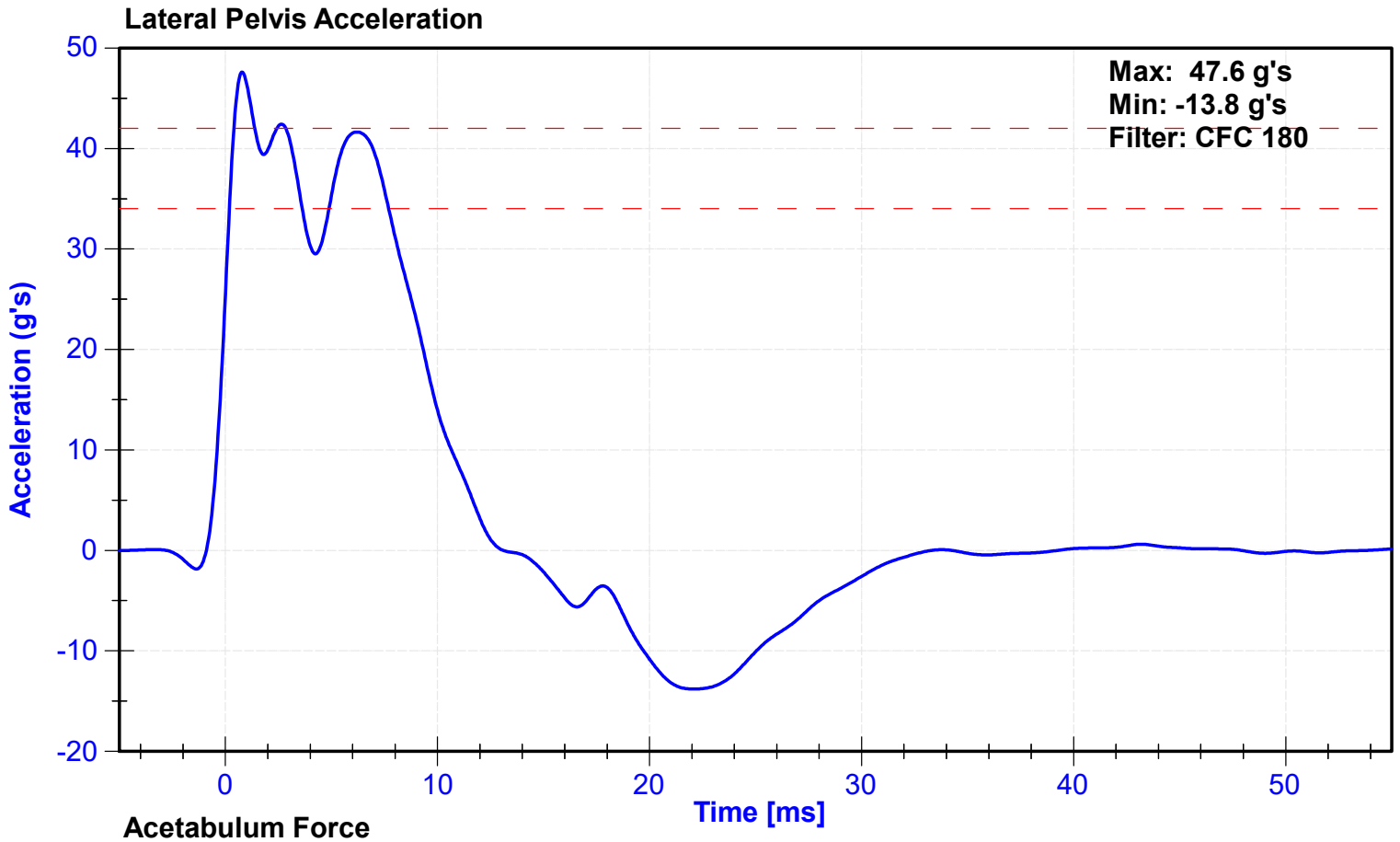
Results

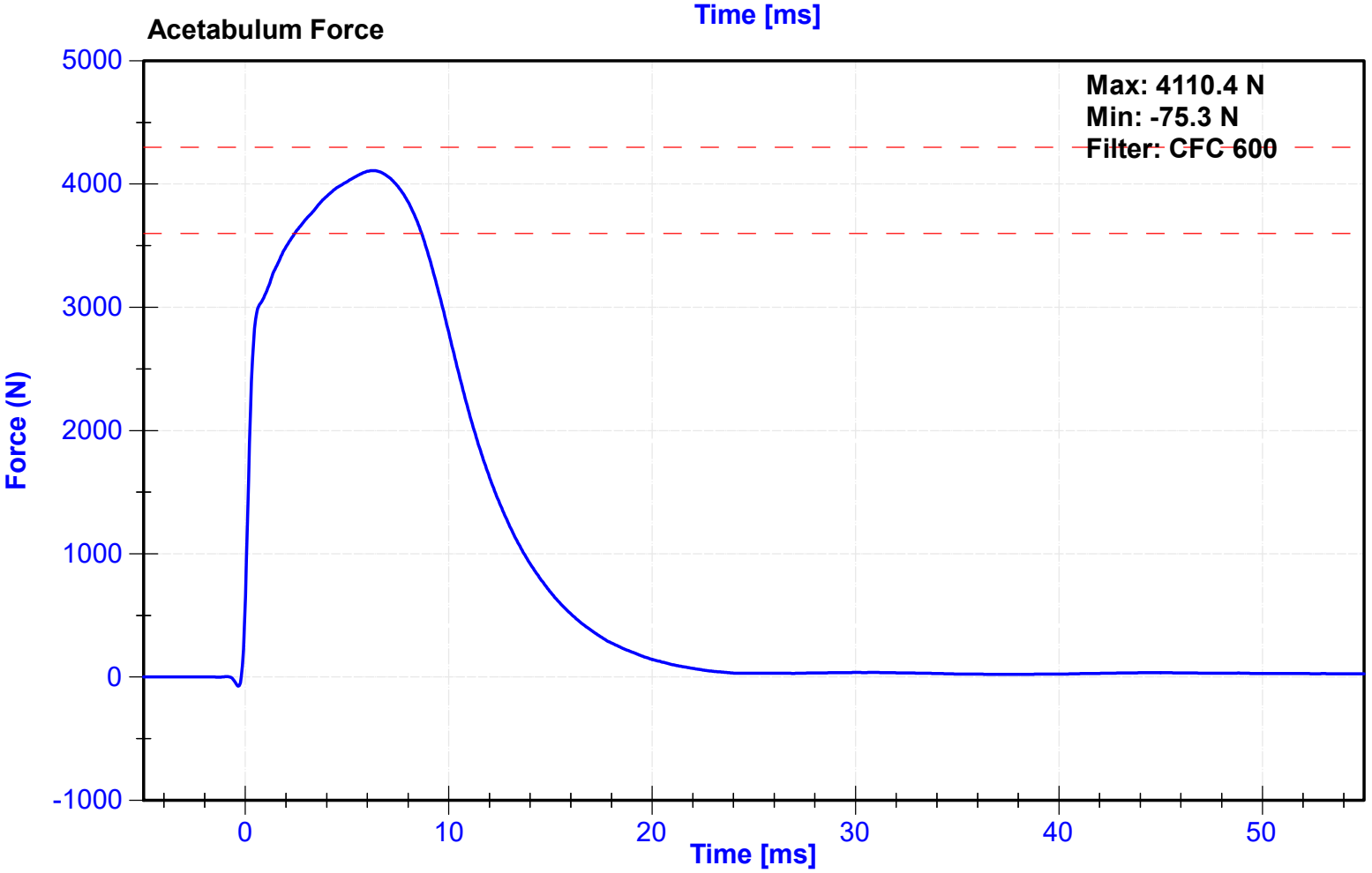
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.0	Pass
Humidity	10	70	%	24	Pass
Velocity	6.6	6.8	m/s	6.64	Pass
Probe Acceleration	38	47	g's	46.8	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.6	Pass
Acetabulum Force	3600	4300	N	4110.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Pelvis Y Accelerometer	Endevco	P51731	11/15/2023	5/13/2024
Acetabulum Load Cell	Denton	267-FY	9/11/2023	9/10/2024
Certification Plug	SACO			N/A
Crash Test Plug	SACO			N/A




Lateral Pelvis Acceleration
Max: 47.6 g's
Min: -13.8 g's
Filter: CFC 180
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]


Acetabulum Force
Max: 4110.4 N
Min: -75.3 N
Filter: CFC 600
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]

SACO RESEARCH

certification
12/5/23

SID-IIs Pelvis Plug Certification Test

Plug S/N 16372
Test Number 22939
Report Number 22996
Test Date 5/20/2022 2:03:36 PM

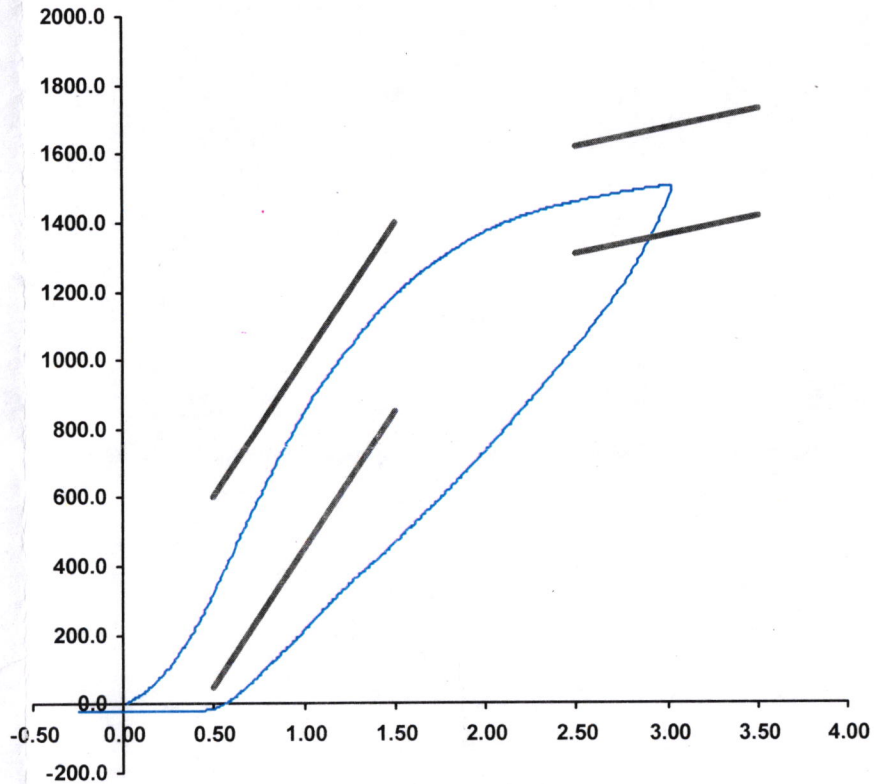
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	325	50	600
Force @ 1.5 mm (N)	1,187	850	1,400
Force @ 2.5 mm (N)	1,458	1,306	1,618
Force @ 3.0 mm (N)	1,504	1,361	1,673

Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 20-May-22
SACO Research

By : DC Date : 5/20/2022

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

SACO RESEARCH

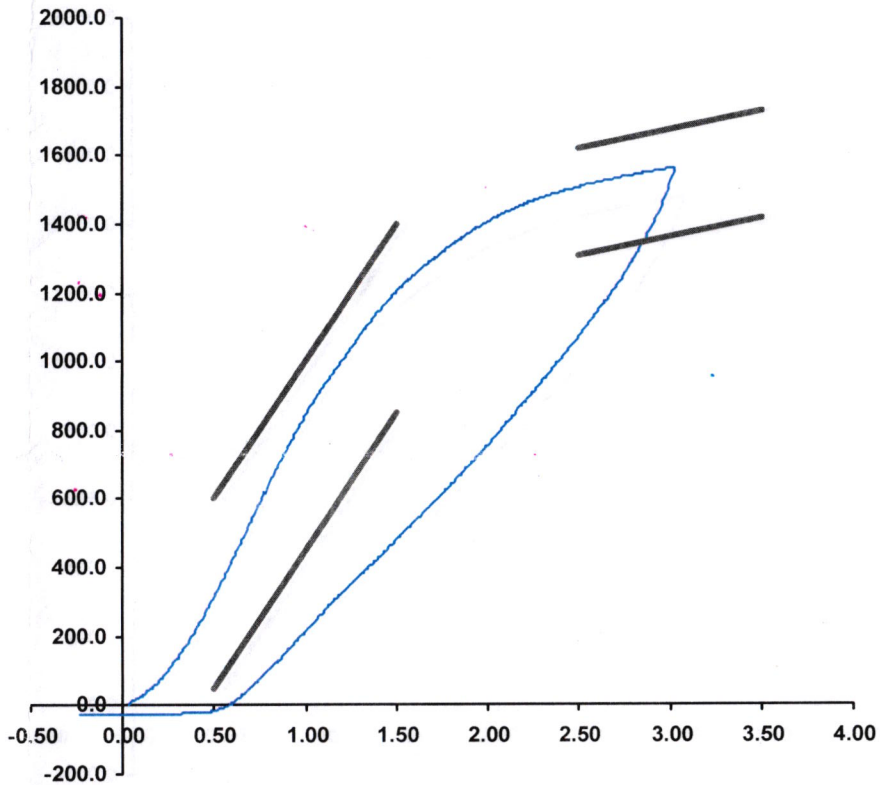
300 CRASH IMPACT

SID-IIs Pelvis Plug Certification Test

Plug S/N 16335
Test Number 22902
Report Number 22959
Test Date 5/20/2022 11:44:17 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	318	50	600
Force @ 1.5 mm (N)	1,203	850	1,400
Force @ 2.5 mm (N)	1,506	1,306	1,618
Force @ 3.0 mm (N)	1,561	1,361	1,673

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 20-May-22
SACO Research

By : DC Date : 5/20/2022

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

C-90

SACO RESEARCH

300 NON-IMPACT

SID-IIs Pelvis Plug Certification Test

Plug S/N 16448
Test Number 23017
Report Number 23075
Test Date 5/23/2022 12:21:08 PM

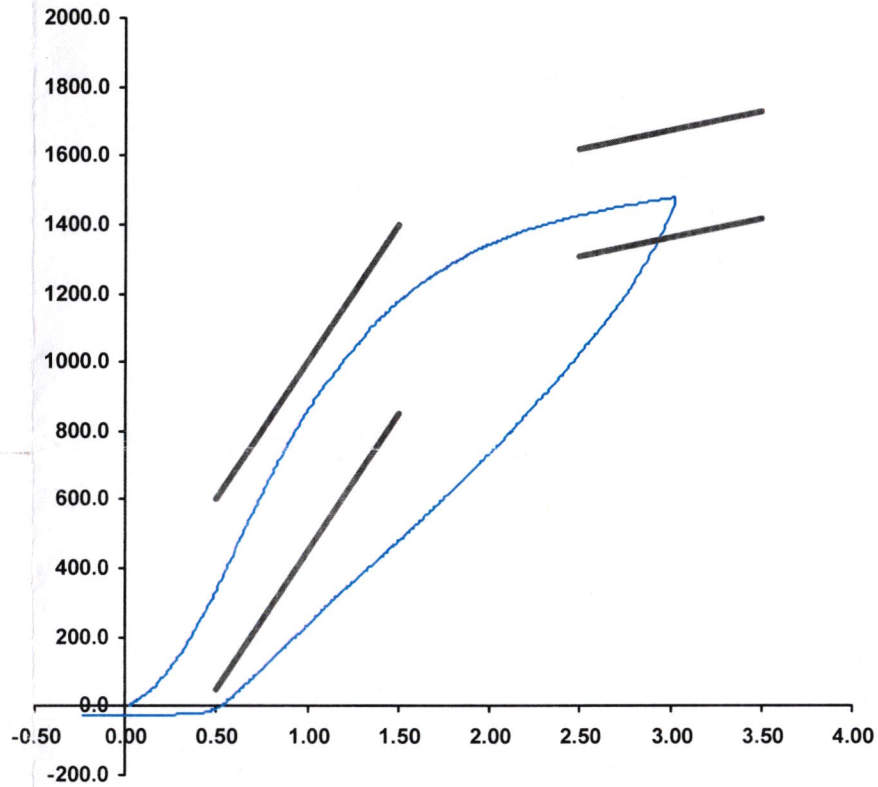
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	340	50	600
Force @ 1.5 mm (N)	1,175	850	1,400
Force @ 2.5 mm (N)	1,428	1,306	1,618
Force @ 3.0 mm (N)	1,477	1,361	1,673

Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 23-May-22
SACO Research

By : DC Date : 5/23/2022

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

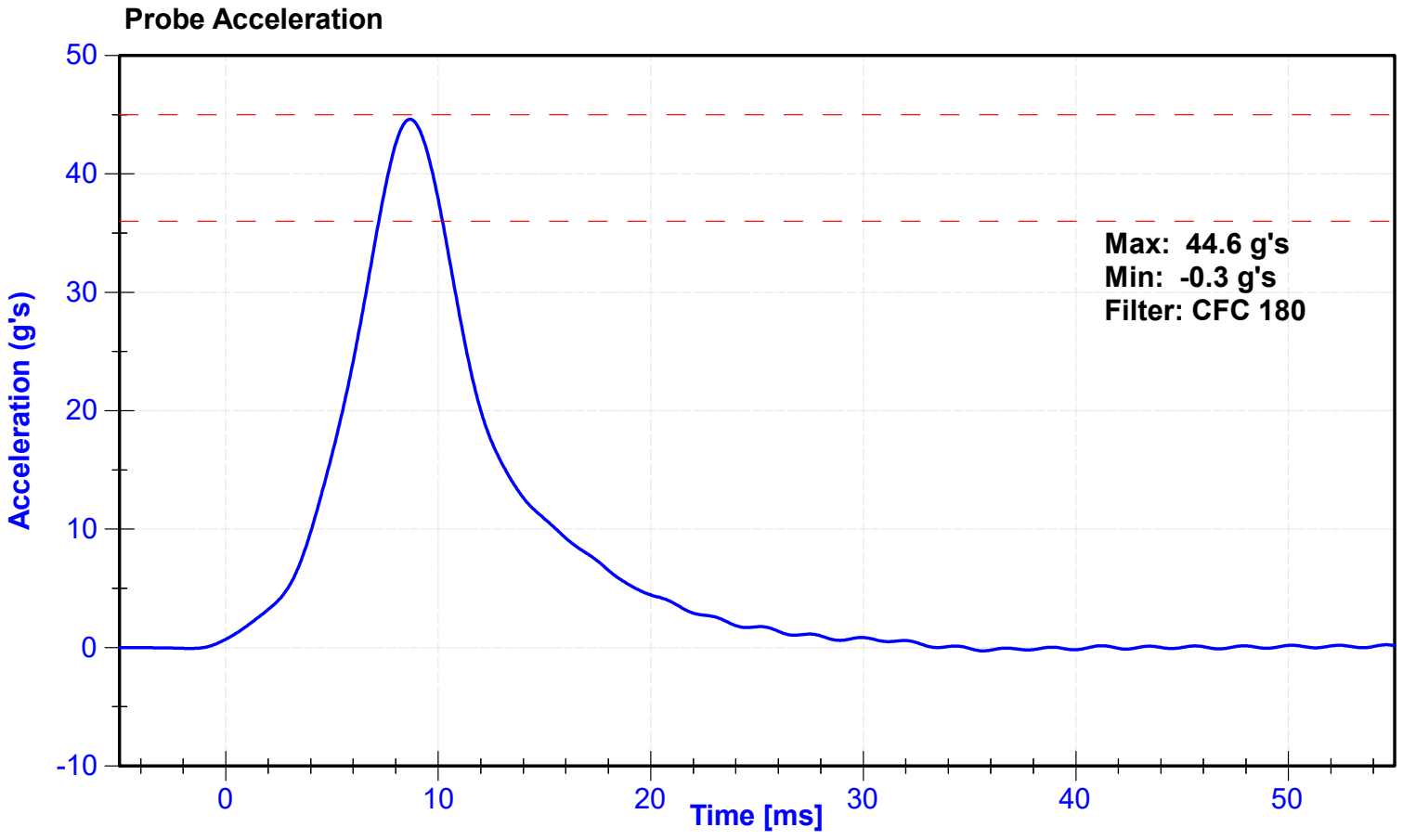
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	300	Laboratory Supervisor	C. Mantell

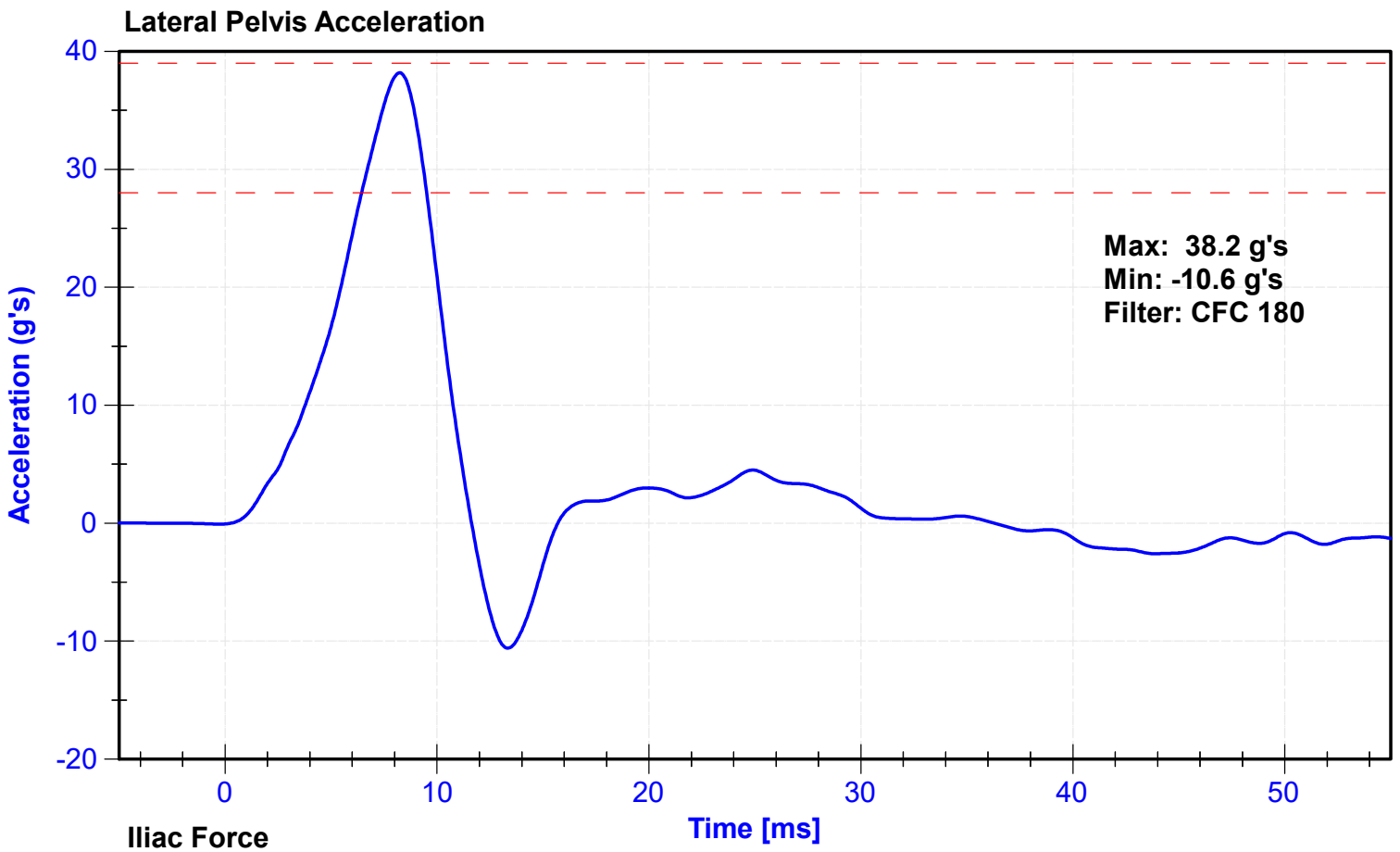
Results

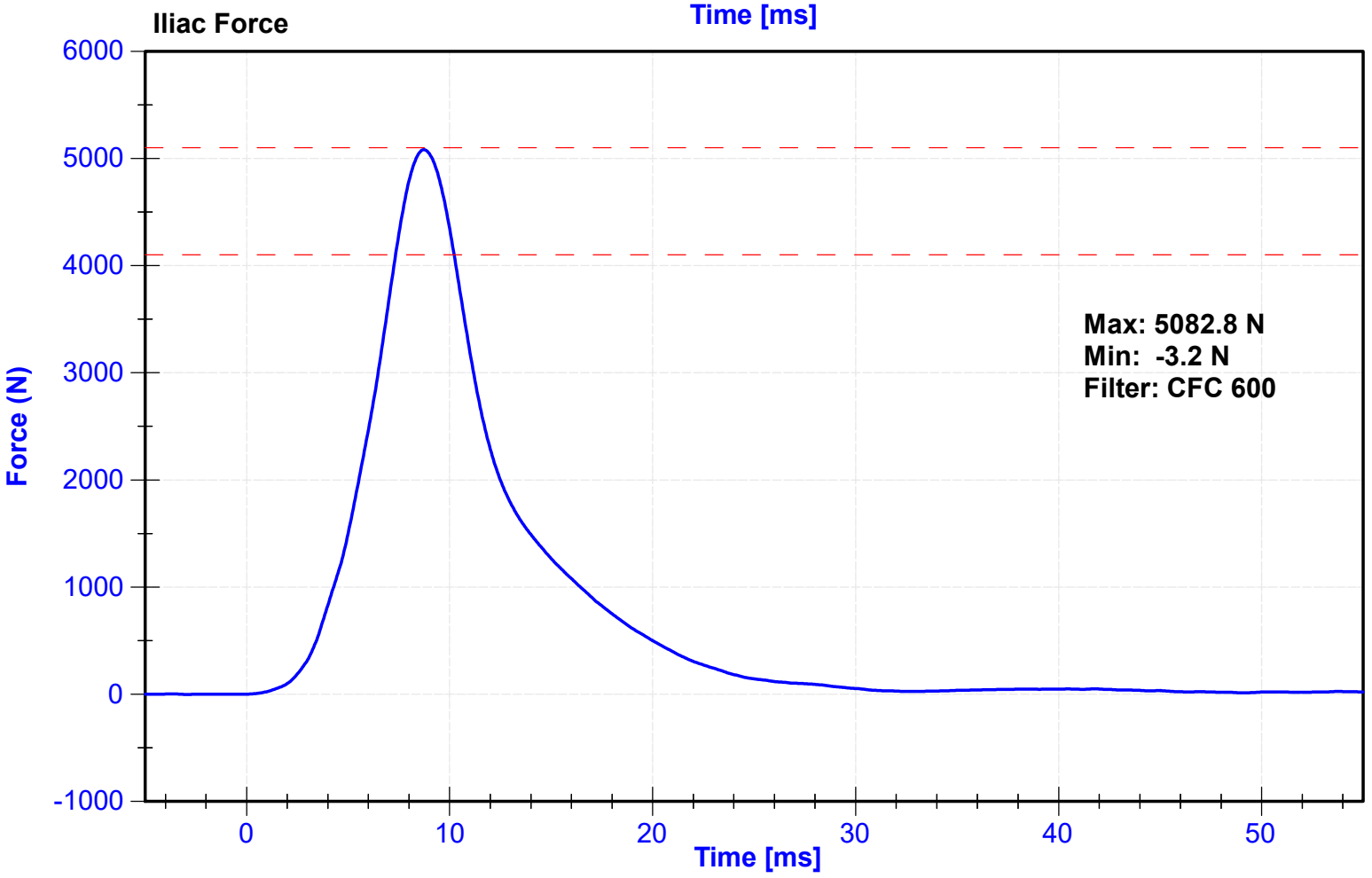
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.0	Pass
Humidity	10	70	%	24	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	36	45	g's	44.6	Pass
Lateral Pelvis Acceleration	28	39	g's	38.2	Pass
Iliac Force	4100	5100	N	5082.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18587	11/20/2023	5/18/2024
Pelvis Y Accelerometer	Endevco	P51731	11/15/2023	5/13/2024
Iliac Load Cell	Denton	321	9/11/2023	9/10/2024




Lateral Pelvis Acceleration
Acceleration (g's)
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 38.2 g's
Min: -10.6 g's
Filter: CFC 180


Iliac Force
Force (N)
6000
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 5082.8 N
Min: -3.2 N
Filter: CFC 600

APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

TABLE 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N _F033__		
			Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers	Primary	X	P63861	Endevco	11/16/2023
		Y	P49216	Endevco	11/16/2023
		Z	P51303	Endevco	11/16/2023
	Redundant	X	P58868	Endevco	11/16/2023
		Y	P59020	Endevco	11/16/2023
		Z	P52132	Endevco	11/16/2023
Thorax Rib Displacement Potentiometers	Upper	Y	179GFE	Honeywell	11/17/2023
	Middle	Y	185GFE	Honeywell	11/17/2023
	Lower	Y	178GFE	Honeywell	11/17/2023
Abdomen Load Cells	Forward	Y	DM5846	Denton	05/18/2023
	Middle	Y	1529	Denton	05/18/2023
	Rear	Y	1533	Denton	05/24/2023
Lower Spine Accelerometers (T12)		X	P58997	Endevco	11/16/2023
		Y	T21243	Endevco	11/16/2023
		Z	P52033	Endevco	11/16/2023
Pubic Symphysis Load Cell		Y	459-FY	Denton	06/20/2023

TABLE 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N __300__		
				Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers		Primary	X	P59018	Endevco	11/15/2023
			Y	P79189	Endevco	11/15/2023
			Z	P79587	Endevco	11/15/2023
		Redundant	X	P68057	Endevco	11/15/2023
			Y	P58986	Endevco	11/15/2023
			Z	P52025	Endevco	11/15/2023
Displacement Potentiometers	Thoracic Rib	Upper	Y	2316GFE	Servo	11/17/2023
		Middle	Y	307GFE	Servo	11/17/2023
		Lower	Y	1156GFE	Servo	11/17/2023
	Abdominal Rib	Upper	Y	060GFE	Servo	11/21/2023
		Lower	Y	308GFE	Servo	11/17/2023
Lower Spine Accelerometers (T12)			X	P64003	Endevco	11/16/2023
			Y	P52071	Endevco	11/16/2023
			Z	P17283	Endevco	11/16/2023
Acetabulum Load Cell			Y	267-FY	Denton	09/11/2023
Iliac Wing Load Cell			Y	321	Denton	09/11/2023
Pelvis Plug (struck side)				16471	SACO	05/23/2022
Pelvis Plug (non-struck side)				16549	SACO	07/15/2022

TABLE 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	G22713	Endevco	09/12/2023
	Vehicle Center of Gravity	Y	G22785	Endevco	09/09/2023
	Vehicle Center of Gravity	Z	G23433	Endevco	09/26/2023
2	Right Sill at Front Seat	X	G22724	Endevco	10/13/2023
	Right Sill at Front Seat	Y	G22728	Endevco	10/13/2023
	Right Sill at Front Seat	Z	G22730	Endevco	10/13/2023
3	Right Sill at Rear Seat	X	G22436	Endevco	08/30/2023
	Right Sill at Rear Seat	Y	G22773	Endevco	09/27/2023
	Right Sill at Rear Seat	Z	G23624	Endevco	09/26/2023
4	Left Sill at Front Door	Y	G22749	Endevco	08/11/2023
5	Left Sill at Rear Door	Y	G22736	Endevco	09/13/2023
6	Left A-Post Lower	Y	G22913	Endevco	08/11/2023
7	Left A-Post Middle	Y	G22671	Endevco	10/04/2023
8	Left B-Post Lower	Y	A405571	Measurement Specialties	10/06/2023
9	Left B-Post Middle	Y	A431198	Measurement Specialties	10/25/2023
10	Front Seat Track	Y	G22395	Endevco	10/12/2023
11	Rear Seat Track or Structure	Y	G22780	Endevco	06/26/2023
12	Right Rear Occ. Compartment	Y	A370922	Measurement Specialties	08/14/2023
13	Engine Block	X	A431204	Measurement Specialties	09/30/2023
	Engine Block	Y	A431207	Measurement Specialties	09/30/2023
14	Rear Floorpan Above Axle	X	A352419	Measurement Specialties	09/16/2023
	Rear Floorpan Above Axle	Y	A352424	Measurement Specialties	09/16/2023
	Rear Floorpan Above Axle	Z	A352425	Measurement Specialties	09/16/2023

TABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	G22717	Endevco	08/15/2023
MDB Center of Gravity	Y	G22737	Endevco	08/15/2023
MDB Center of Gravity	Z	G22738	Endevco	08/15/2023
Left Frame at Rear Axle Centerline	X	A284318	Measurement Specialties	10/12/2023
Left Frame at Rear Axle Centerline	Y	A374216	Measurement Specialties	10/12/2023