REPORT NUMBER: 214D-CAL-23-005

SAFETY COMPLIANCE TESTING FOR FMVSS 214
SIDE IMPACT PROTECTION

Toyota Motor Corporation
2023 Toyota Prius
5 Door Hatchback

NHTSA No: C20235102

PREPARED BY:
CALSPAN CORPORATION
P.O. BOX 400
BUFFALO, NEW YORK 14225

July 11, 2023

FINAL REPORT

PREPARED FOR:
U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVE. S.E.
WEST Bldg. (NEF-240)
WASHINGTON, D.C. 20590

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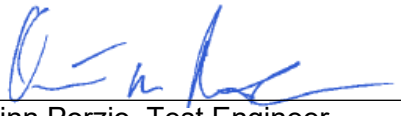
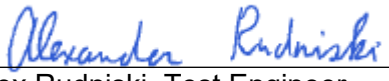
Prepared by:  Date: July 11, 2023

Quinn Porzio, Test Engineer

Approved by:  Date: July 11, 2023

Alex Rudniski, Test Engineer

FINAL REPORT ACCEPTANCE BY OVSC:

_____

Accepted by

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

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7. Author(s) Quinn Porzio, Test Engineer Alex Rudniski, Test Engineer		***8. Performing Organization Report No.*** CAL-DOT-2023-005
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225		***10. Work Unit No.*** ***11. Contract or Grant No.*** DTNH22-17-D00078
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15. Supplementary Notes

16. Abstract

A 48/24 kph 90° Impact (Moving Deformable Barrier) Compliance Tests was conducted on the subject 2023 Toyota Prius 5 Door Hatchback in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-214D-09 for the determination of FMVSS No. 214 Side Impact Protection compliance. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on June 27, 2023.

The impact velocity of the Moving Deformable Barrier (MDB) was 52.87 kph, and the ambient temperature at the struck (driver side) of the target vehicle at the time of impact was 21°C. The target vehicle post-test maximum crush was 141 mm located at level 3. The test vehicle's occupant performance data is as follows:

Measurement Description	Driver ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	91.112
Maximum Thoracic Rib Deflection	mm	44	16.231
Total Abdominal Force	N	2500	333.108
Pubic Symphysis Force	N	6000	995.036

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	294.018
Lower Spine Resultant Acceleration	G	82	45.320
Maximum Thoracic Rib Deflection	mm	38	16.454
Maximum Abdominal Rib Deflection	mm	45	19.626

The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.

17. Key Words Compliance Testing Side Impact Protection MDB ES-2re SID-IIs	***18. Distribution Statement*** Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services (TIS) Room E12-100 East Bldg. 1200 New Jersey Ave. Washington, D.C. 20590 Telephone No. (202) 366-2588

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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This moving deformable barrier side impact test was conducted as part of the MY 2023 214 Side Impact Protection Compliance Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-17-D00078. The purpose of this test was to evaluate side impact protection in a 2023 Toyota Prius 5 Door Hatchback. The side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure, TP-214D-09 dated September 2012.

SUMMARY

A 2023 Toyota Prius 5 Door Hatchback was impacted on the left 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 52.87 kph. 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 June 27, 2023. Pre-test and post-test photographs of the test vehicle, the MDB and the dummies are included in this report.

Test dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OVSC Test Procedure, dated September 2012. The side impact event was documented by 9 cameras. Camera locations and other pertinent camera information are included in this report.

The ES2re male dummy was instrumented with triaxial accelerometer packs located in the head, three rib displacement transducers located in the chest, three load cells located in the abdomen and a load cell located in the pubic symphysis.

The SID-IIs female dummy was instrumented with triaxial accelerometer packs located in the head and the spine and load cells located in the pubic symphysis and acetabulum. A summary of each dummy's configuration and performance verification test data has been included in this report along with the dummy response traces.

Injury readings for the dummies were recorded as follows:

INJURY READINGS

ES-2re Injury Criteria	Units	Max. Allowable IARV	Measured Value	Pass/Fail
Head Injury Criteria (HIC36)		1000	91.112	Pass
Upper Rib Deflection	mm	44	16.231	Pass
Mid Rib Deflection	mm	44	12.780	Pass
Lower Rib Deflection	mm	44	15.241	Pass
Abdominal Load (front)	N		23.709	
Abdominal Load (mid)	N		127.360	
Abdominal Load (rear)	N		198.778	
Total Abdominal Force	N	2500	333.108	Pass
Pubic Symphysis Force	N	6000	995.036	Pass

INJURY READINGS

SIDIIs Injury Criteria	Units	Max. Allowable IARV	Measured Value	Pass/Fail
Head Injury Criteria (HIC36)		1000	294.018	Pass
Lower Spine Resultant Acceleration	G	82	45.320	Pass
Acetabulum Force	N		1819.502	
Iliac Force	N		1332.505	
Sum of Acetabular and Iliac	N	5525	3026.085	Pass

SECTION 2

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

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DATA SHEET NO. 1
TEST VEHICLE INFORMATION AND OPTIONS

Test Vehicle: 2023 Toyota Prius 5 Door Hatchback
NHTSA No.: C20235102
Test Facility: Calspan
Test Date: 06/27/2023

TEST VEHICLE INFORMATION AND OPTIONS

Make	Toyota
Model	Prius
Body Style	Five Door Hatchback
VIN	JTDACAAU2P3002361
Body Color	Gray
Engine Displacement (L)	2.0
Type / No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	CVT
Overdrive	Yes
Final Drive	Front Wheel Drive
Odometer Reading	13 miles

Anti-Lock Brakes (ABS)	Yes
All-Wheel Drive (AWD)	No
Traction Control System (TCS)	Yes
Electric Stability Control (ECS)	Yes
Curtain Airbags	Yes
Torso Airbags – Front Seats	Yes
Torso Airbags – Rear Seats	Yes
Combination/Head Torso Bag	No
Pelvic Airbag – Front Seats	No
Pelvis Airbag – Rear Seats	No
Knee Airbag – Driver	No
Knee Airbag – Front Passenger	No
Seat Belt Pretensioners – Front Seats	Yes
Seat Belt Pretensioners – Rear Seats	Yes
Seat Belt Load Limiter – Front Seats	Yes
Seat Belt Load Limiter – Rear Seats	Yes
Tire Pressure Monitoring System (TPMS)	Yes
Tilt Steering Wheel	Yes
Automatic Door Locks (ADL)	Yes
Power Window Auto-reverse	Yes
Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Corporation
Date of Manufacture	02/23
Vehicle Type	Passenger Car

GVWR (kg)	1880
GVWR Front (kg)	1064
GVWR Rear (kg)	1030

VEHICLE SEATING AND WEIGHT CAPACITY DATA

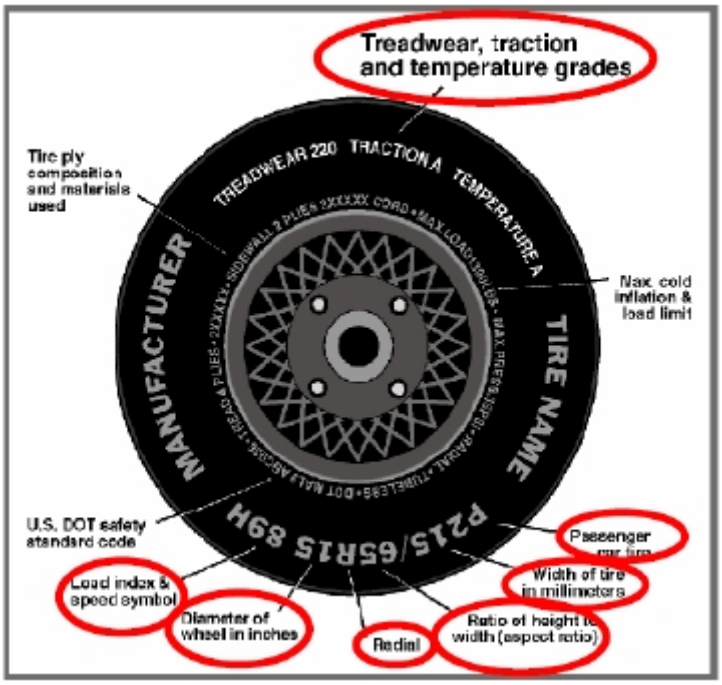
Measured Parameter	Front	Rear	Third	Total
Type of Seats (Bench or Bucket)	Bucket	Bench	N/A	
Designated Seating Capacity (DSC)	2	3	N/A	5
Capacity Weight (VCW) (kg)				390

DATA SHEET NO. 1 … (CONTINUED)
VEHICLE TIRE INFORMATION

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023

VEHICLE TIRE INFORMATION

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



TIRE SIDEWALL INFORMATION

Tire Placard	Front	Rear
Recommended Cold Pressure (kPa)	250	240
Recommended Tire Size	190/60R17	190/60R17
Tire Sidewall	**Front**	**Rear**
Maximum Tire Pressure (kPa)	300	300
Tire Size on Vehicle	190/60R17	190/60R17
Tire Manufacturer Model	Bridgestone	Bridgestone
Tire Name	Ecopia EP422 Plus	Ecopia EP422 Plus
Tire Type	All Season	All Season
Tire Width	190	190
Aspect Ratio	60	60
Radial	Yes	Yes
Wheel Diameter	17	17
Load Index / Speed Symbol	90H	90H
Treadwear	600	600
Traction Grade	A	A
Temperature Grades	A	A

DATA SHEET NO. 2
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Toyota Prius 5 Door Hatchback NHTSA No.: C20235102
Test Facility: Calspan Test Date: 06/27/2023

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	276	271	276	274
Tire Placard	kPa	250	250	240	240

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			Fully Loaded			As Tested		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	414	304		453	385		487	334	
Right	kg	433	259		447	302		432	323	
Ratio	%	60.0	40.0		56.7	43.3		58.3	41.7	
Totals	kg	847	563	1410	900	687	1587	919	657	1576

TARGET TEST WEIGHT (TVTW) CALCULATION

Measured Parameter	Units	Value	
As Delivered Weight (UVW)	kg	1410.0	(A)
Weight of 2 P572 ATDs	kg	131.0	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	43.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1584.8	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

Wheel Opening Location	Distance (grd to ref. point above wheel opening in mm)		Difference (mm)	Meets Requirement***
	Fully Loaded	As Tested		
Left Front	761	759	2	Yes
Right Front	774	768	6	Yes
Left Rear	745	751	6	Yes
Right Rear	765	760	5	Yes

****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".*

MDB IMPACT POINT DATA

Measured Parameter	Distance (mm)	Met Requirement
Test Vehicle Wheelbase	2751	
Target Vertical Impact Reference Line Aft of Front Axle	437	Yes
Actual Impact Point Location (fore-aft, above - below)	+2 / -10	Yes

Note: Fore or above the target impact point is positive (+). Aft or below the target impact point is negative (-)

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

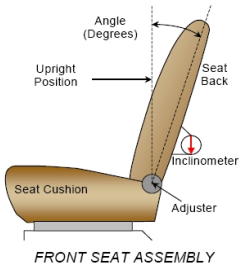
Component Description	Weight (kg)
Trunk Carpeting	8
Jack	2
Right Rear Airbag	1
Rear Bumper Facia & Beam	15
Center & Right Rear Tail Lights	3
Ballast (if any)	0

DATA SHEET NO. 3
SEAT AND SEAT BELT ANCHORAGE ADJUSTMENT DATA

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023

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	46.4	27 (0-26)	+3.6	5
Front Passenger Seat	49.1	27 (0-26)	+5.3	5

***Measured on seat back per Form 1**

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 passengers' seats should be set to the rear-most, lowest, mid-angle position

Seat	As Tested SCRL Angle (Mid) (º)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid-Fore / Aft	Forward-Most
Driver Seat	18.8	27	Max	-	-	-
			Mid	-	-	-
			Min	16	27	38
Front Passenger Seat	18.7	25	Max	-	-	-
			Mid	-	-	-
			Min	14	25	35

SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forward most Position	
	mm	Detents*	mm	Detents*
Driver Seat	260	27 (0-26)	130	13
Front Passenger Seat	260	27 (0-26)	130	13
Rear Passenger Seat	Fixed	Fixed	Fixed	Fixed

SEAT BELT ANCHORAGE ADJUSTMENT

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

HEAD RESTRAINT ADJUSTMENT

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

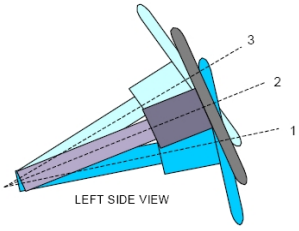
DATA SHEET NO. 4
FUEL SYSTEMS AND STEERING WHEEL POSITION DATA

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023

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	17.9	
Geometric center - Position No. 2	19.9	
Uppermost - Position No. 3	21.9	
Telescoping Steering Wheel Travel		50
Test Position	19.9	25

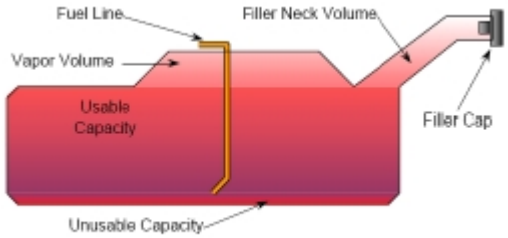


STEERING COLUMN ASSEMBLY

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.



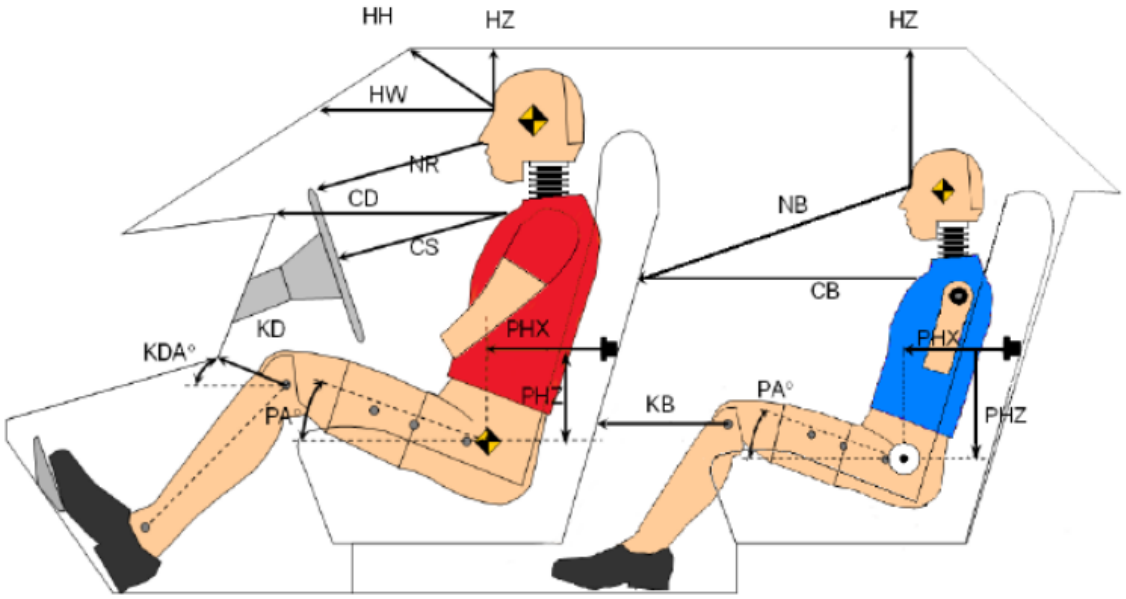
VEHICLE FUEL TANK ASSEMBLY

FUEL TANK CAPACITY

Description	Liters
Usable Capacity of - Form No.1	43.0
Usable Capacity of - Owner's Manual	43.0
93% of Usable Capacity	39.99
Actual Amount of Solvent Used in Test	39.9

DATA SHEET NO. 5
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023

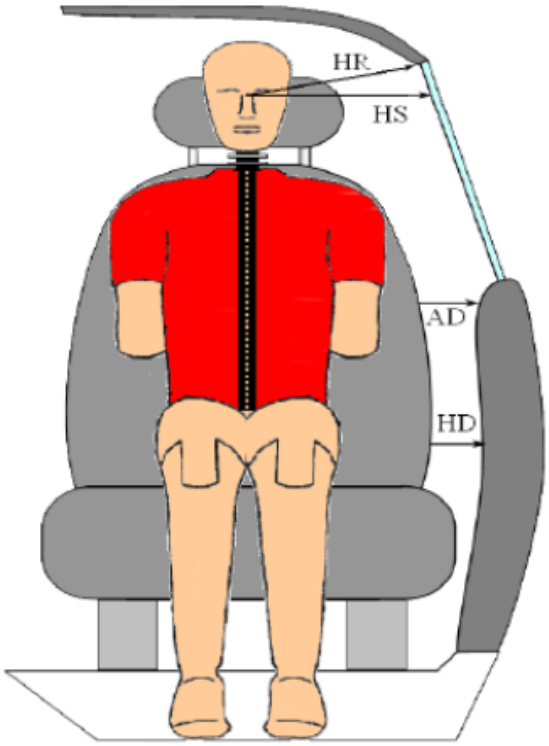


DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Code	Pass. Code	Description	ES2-re		SID-IIs	
			Length (mm)	Angle	Length (mm)	Angle
HH		Head to Header	373			
HW		Head to Windshield	608			
HZ	HZ	Head to Roof Liner	129		236	
NR	NB	Nose to Rim/Seatback	430		612	
CD	CB	Chest to Dash/Seatback	580		606	
CS		Chest to Steering Wheel	360			
KD(L) / KDA(L)°	KB(L) / KBA(L)°	Left Knee to Dash/Seatback	199	37.4	317	11.7
KD(R) / KDA(R)°	KB(R) / KBA(R)°	Right Knee to Dash/Seatback	126	60.5	314	16.3
PA°	PA°	Pelvic Tilt Angle (X-Axis)		25.0		25.5
PHX	PHX	Hip Point to Striker (X-Axis)	200		336	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	224		370	

DATA SHEET NO. 6
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023



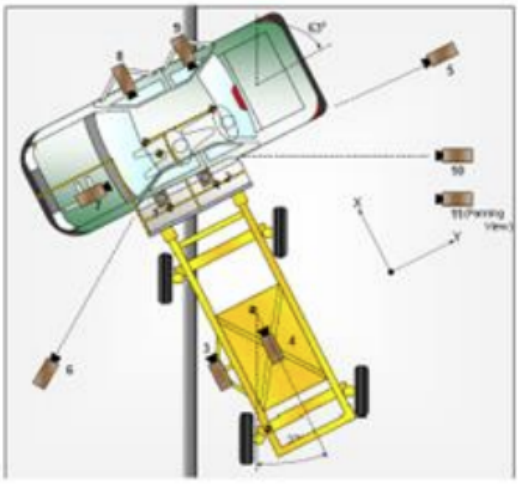
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Front Occupant	Rear Occupant
HR	Head to Side Header	mm	160	175
HS	Head to Side Window	mm	335	363
AD	Arm to Door	mm	85	136
HD	Hip Point to Door	mm	183	187

DATA SHEET NO. 7
LOCATION OF CAMERAS

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023



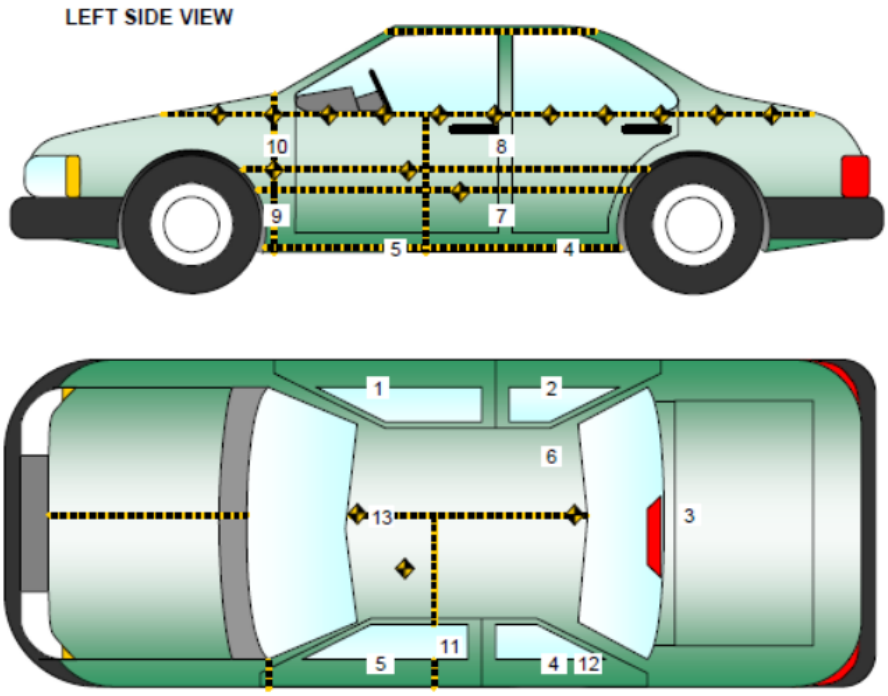
CAMERA LOCATIONS AND DATA

No.	Camera View	Location (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	0	-893	-9220	12.5	1000
2	Overhead Close-up	0	0	-9220	25	1000
3	Impact Point Close-up				25	1000
4	Centerline of Impact (MDB)				8	1000
5	Right Side View	443	7821	-1641	28	1000
6	Left Side View	-3514	-5853	-1563	24	1000
7	Front Seat Occupant-Frontal View (OB)				25	1000
8	Front Seat Occupant-Side View (OB)				12.5	1000
9	Rear Passenger-Side View (OB)				12.5	1000
10	Real-time Coverage				Zoom	30

Notes: *Reference: Impact Point projected to Ground*
+X = To Front of MDB, +Y = To Right of MDB, +Z = Down

DATA SHEET NO. 8
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Left (or Rt.) Sill at Front Seat	2806	669	196
2	Left (or Rt.) Sill at Rear Seat	1814	663	202
3	Rear Floorpan Above Axle	584	74	98
4	Left (or Rt.) Sill at Front Door	1831	-655	209
5	Left (or Rt.) Sill at Rear Door	2770	-666	202
6	Left (or Rt.) Rear Occ. Compartment	2059	399	323
7	Left (or Rt.) B-Post Lower	2102	-656	99
8	Left (or Rt.) B-Post Middle	2021	-639	-315
9	Left (or Rt.) A-Post Lower	3171	-602	76
10	Left (or Rt.) A-Post Middle	3146	-628	-437
11	Front Seat Track	2296	-576	262
12	Rear Seat Track or Structure	1792	-339	168
13	Vehicle CG	1996	1	255

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

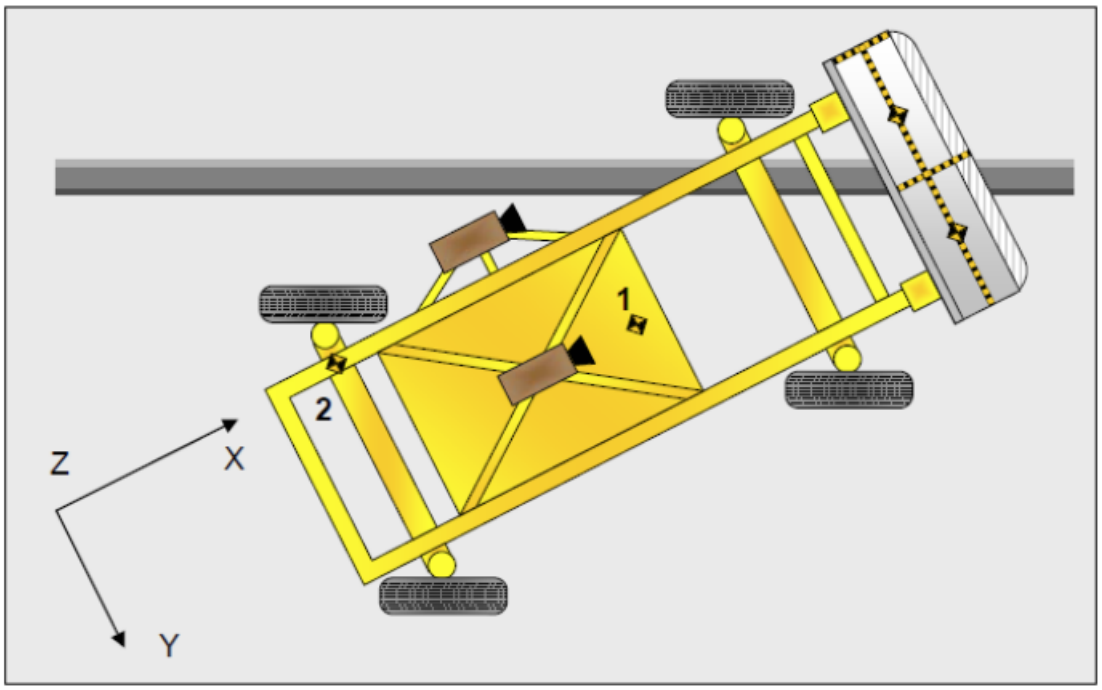
DATA SHEET NO. 9
TEST VEHICLE ACCELEROMETER DATA SUMMARY

Test Vehicle: 2023 Toyota Prius 5 Door Hatchback NHTSA No.: C20235102
Test Facility: Calspan Test Date: 06/27/2023

Loc. No	Description	Axes	Units	Peak Values (g's)			
				Max	Time (ms)	Min	Time (ms)
1	Left (or Rt.) Sill at Front Seat	X	g	13.64	25.40	-7.12	14.60
	Left (or Rt.) Sill at Front Seat	Y	g	28.30	31.25	-3.95	74.70
	Left (or Rt.) Sill at Front Seat	Z	g	8.00	23.00	-20.57	12.30
	Left (or Rt.) Sill at Front Seat Resultant	N/A	g	29.32	19.10	0.01	-35.65
2	Left (or Rt.) Sill at Rear Seat	X	g	8.73	25.80	-11.25	12.65
	Left (or Rt.) Sill at Rear Seat	Y	g	45.45	8.35	-16.92	14.05
	Left (or Rt.) Sill at Rear Seat	Z	g	5.09	31.55	-9.51	14.20
	Left (or Rt.) Sill at Rear Seat Resultant	N/A	g	45.78	8.30	0.01	-14.75
3	Rear Floor Pan Above Axle	X	g	7.45	49.20	-8.45	7.60
	Rear Floor Pan Above Axle	Y	g	27.68	21.45	-2.54	85.10
	Rear Floor Pan Above Axle	Z	g	28.88	9.80	-40.95	18.05
	Rear Floor Pan Above Axle Resultant	N/A	g	49.20	18.15	0.06	-33.10
4	Left (or Rt.) Sill at Rear Door	Y	g	192.53	5.75	-80.44	10.20
5	Left (or Rt.) Sill at Front Door	Y	g	98.31	3.65	-43.26	15.30
6	Left (or Rt.) Rear Occ. Compartment	Y	g	31.72	6.75	-2.87	91.00
7	Left (or Rt.) B-Post Lower	Y	g	173.76	5.45	-48.61	10.00
8	Left (or Rt.) B-Post Middle	Y	g	142.25	10.00	-106.58	13.40
9	Left (or Rt.) A-Post Lower	Y	g	42.55	8.05	-28.53	70.85
10	Left (or Rt.) A-Post Middle	Y	g	40.17	20.70	-46.04	28.65
11	Front Seat Track	Y	g	38.57	5.20	-2.08	94.25
12	Rear Seat Track or Structure	Y	g	34.06	8.80	-2.69	90.65
13	Vehicle CG	X	g	2.02	16.40	-9.04	10.40
	Vehicle CG	Y	g	33.92	6.20	-2.63	89.65
	Vehicle CG	Z	g	25.75	7.65	-12.11	50.10
	Vehicle CG Resultant	N/A	g	39.50	7.15	0.01	-15.25

DATA SHEET NO. 10
MDB ACCELEROMETER LOCATIONS DATA SUMMARY

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023



MDB ACCELEROMETER LOCATIONS

Loc No.	Description	Axes	Units	Peak Values (g's)			
				Max	Time (ms)	Min	Time (ms)
1	MDB CG	X	g	1.63	78.65	-20.60	32.25
		Y	g	3.02	57.50	-9.57	40.60
		Z	g	12.72	53.10	-10.67	71.25
		Resultant		22.28	33.80	22.28	-24.45
2	MDB Rear	Y	g	2.35	82.60	-22.17	36.70
		Z	g	5.05	34.25	-3.93	52.30

DATA SHEET NO. 11
MDB SUMMARY OF RESULTS

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023

MDB SPECIFICATIONS

Measurement Description	Requirement	Value
Overall Width of Framework Carriage	1241- 1261	1250
Overall Length Including Honeycomb Frame	4140 - 3990	4120
Wheelbase of Framework Carriage	2566 -2616	2600
CG Location of Front Axle		1120
MDB Front Axle Weight		764
MDB Rear Axle Weight		594
MDB Total Weight	1356.5 - 1365.5	1358

SPEED AND ANGLE AT IMPACT DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	52.10 to 53.70	52.87
Trap No. 2 Velocity (Redundant)	km/h	52.10 to 53.70	52.87
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0

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	Left	187
B	Top of Bumper	533	800	Right	92
C	Mid-Level	686	200	Right	68
D	Top of Stack	813	200	Right	86

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	+2
Vertical Offset (- down / + up)	mm	+/- 50 of Intended Impact Point	-10

DATA SHEET NO. 12
DUMMY INJURY RESPONSE DATA
(Subpart U, ES-2re)

Test Vehicle: 2023 Toyota Prius 5 Door Hatchback NHTSA No.: C20235102
Test Facility: Calspan Test Date: 06/27/2023

Dummy Serial No. D037

Description	Axes	Positive Direction		Negative Direction	
		MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (g)					
Longitudinal	X	8.36	179.85	-15.28	57.70
Lateral	Y	27.94	49.75	-5.28	276.75
Vertical	Z	7.74	14.55	-7.55	59.55
Resultant	N/A	30.93	52.30		
HIC36 (t1, t2)	N/A	91.11		**t1 =** 30.30	**t2 =** 63.35
THORAX DEFLECTION (mm)					
Upper Rib	Y	16.23	43.40	-1.77	79.95
Middle Rib	Y	12.78	35.05	-3.65	76.90
Lower Rib	Y	15.24	54.75	-0.60	77.65
ABDOMINAL FORCES (N)					
Front	Y	23.71	63.05	-20.72	12.10
Middle	Y	127.36	37.40	-6.60	11.85
Rear	Y	198.78	38.90	-4.43	9.70
SUM	N/A	333.11	37.55		
PELVIS FORCES (N)					
Pubic Symphysis	Y	34.85	160.45	-995.04	45.25

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

DATA SHEET NO. 13
DUMMY INJURY RESPONSE DATA
(Subpart V, SIDIIs)

Test Vehicle: 2023 Toyota Prius 5 Door Hatchback NHTSA No.: C20235102
Test Facility: Calspan Test Date: 06/27/2023

Dummy Serial No. 261

Description	Axes	Positive Direction		Negative Direction	
		MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (g)					
Longitudinal	X	6.49	105.35	-13.86	56.65
Lateral	Y	50.01	55.35	-8.25	106.45
Vertical	Z	7.63	41.00	-14.10	59.55
Resultant	N/A	52.99	55.35		
HIC36 (t1, t2)	N/A	294.02		**t1 =** 38.55	**t2 =** 65.45
LOWER SPINE (g)					
Longitudinal	X	7.06	50.20	-11.88	29.60
Lateral	Y	44.04	47.65	-5.64	14.95
Vertical	Z	5.22	79.35	-11.23	50.85
Resultant	N/A	45.32	47.70	0.00	-12.60
PELVIS FORCES (N)					
Acetabular	Y	1819.50	41.20	-102.64	189.00
Iliac	Y	1332.50	45.10	-83.84	19.85

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

DATA SHEET NO. 14
POST-TEST OBSERVATIONS

Test Vehicle: 2023 Toyota Prius 5 Door Hatchback NHTSA No.: C20235102
Test Facility: Calspan Test Date: 06/27/2023

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Occupant	Rear Occupant
Face Contact	Curtain Airbag & Side Header	None
Top of Head Contact	Side Header	Curtain Airbag & Side Header & Headrest
Left Side of Head Contact	Curtain Airbag & Side Header	Curtain Airbag
Back of Head Contact	Curtain Airbag, Head restraint & Side Header	Curtain Airbag, Head restraint & Center Headrest
Left Shoulder Contact	Curtain Airbag, Torso/Pelvis Airbag & B-Pillar trim	Seatback, Torso/Pelvis Airbag & Passenger Door Trim
Upper Torso Contact	Seatback & Torso/Pelvis Airbag	Seatback & Torso/Pelvis Airbag
Lower Torso Contact	Seatback & Torso/Pelvis Airbag	Seatback & Torso/Pelvis Airbag
Left Knee Contact	Driver Door trim	Passenger Door Trim
Left Hip Contact	Torso/Pelvis Airbag & Seat pan	Torso/Pelvis Airbag

POST-TEST DOOR PERFORMANCE

Description	Front	Rear
Left Side Doors	Jammed Shut	Jammed Shut
Right Side Doors	Remained closed and operational	Remained closed and operational
Hatch and Other Doors	N/A	Remained closed and operational
Seat Movement	None	None
Seatback Failure	No	No

*Note: Description for door opening must be specific with the following three categories: Remained closed and operational, opened/unlatched during the crash, or jammed shut. Sometimes the door is jammed and unlatched. If the door cannot be opened, then note the door as jammed shut. If open, measurement must be taken for the width of the door opening (mm).

POST-TEST STRUCTURAL OBSERVATIONS

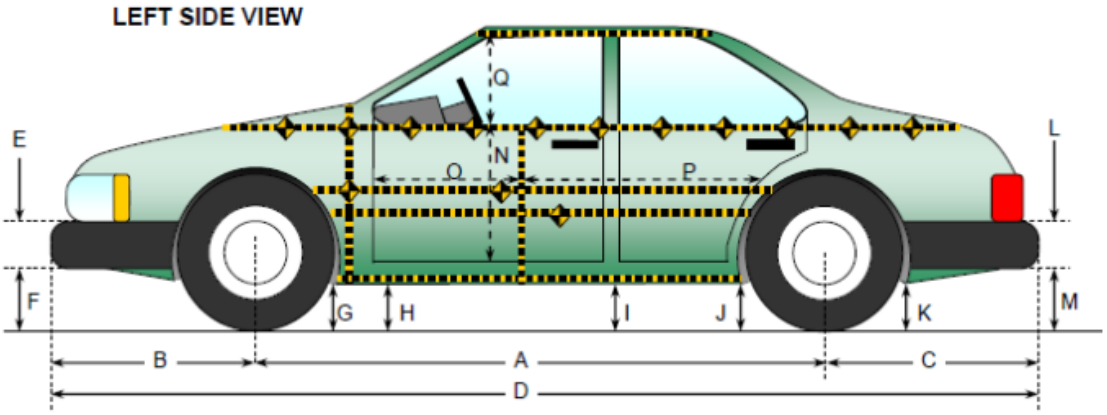
Critical Areas of Performance	Observations and Conclusions
Pillar Performance	B-Pillar & C-Pillar buckled
Sill Separation	None
Windshield Damage	None
Side Window Damage	Driver window shattered during impact
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Front Occupant		Rear Occupant	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	No		
Side Torso/Pelvis Airbag	Yes	Yes	Yes	Yes
Head Airbag	No	N/A	No	N/A
Curtain Airbag	Yes	Yes	Yes	Yes
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Other	N/A	N/A	N/A	N/A

DATA SHEET NO. 15
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023

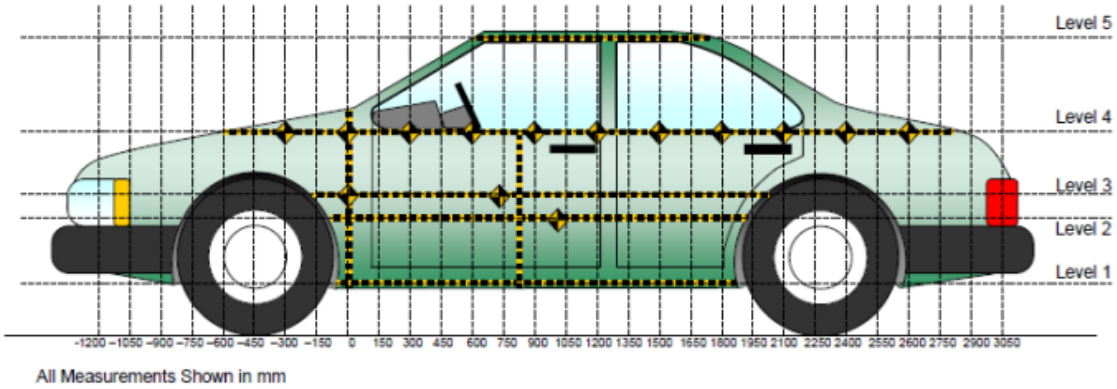


VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code.	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2751	2758	7
B	Front Axle to FSOV	977	974	-3
C	Rear Axle to RSOV	867	863	-4
D	Total Vehicle Length at Centerline	4597	4595	-2
E	Front Bumper Thickness	160	160	0
F	Front Bumper Bottom to Ground	417	414	-3
G	Sill Height at Front Wheel Well	162	163	1
H	Sill Height at Front Door Leading Edge	162	166	4
I	Sill Height at B Pillar	171	182	11
J1	Sill Height at Rear Wheel Well	161	173	12
J2	Pinch Weld Height at Rear Wheel Well	178	179	1
K	Sill Height Aft of Rear Wheel Well	366	380	14
L	Rear Bumper Thickness	195	195	0
M	Rear Bumper Bottom to Ground	392	406	14
N	Sill Height to Window Bottom of Front Window Sill	789	780	-9
O	Front Door Leading Edge to Impact CL	776	757	-20
P	Rear Door Trailing Edge to Impact CL	1437	1407	-30
Q	Front Window Opening	353	350	-3
R	Right Side Length	4479	4477	-2
S	Left Side Length	4476	4471	-5
T	Vehicle Width at B-Pillars	1760	1653	-107

DATA SHEET NO.16
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023



All Measurements Shown in mm

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	282	45	1650
2	Occupant H-Point	mm	493	139	1350
3	Mid-Door	mm	601	141	750
4	Window Sill	mm	904	93	1800
5	Window Top	mm	1338	5	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.17
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2023 Toyota Prius 5 Door Hatchback
NHTSA No.: C20235102
Test Facility: Calspan
Test Date: 06/27/2023

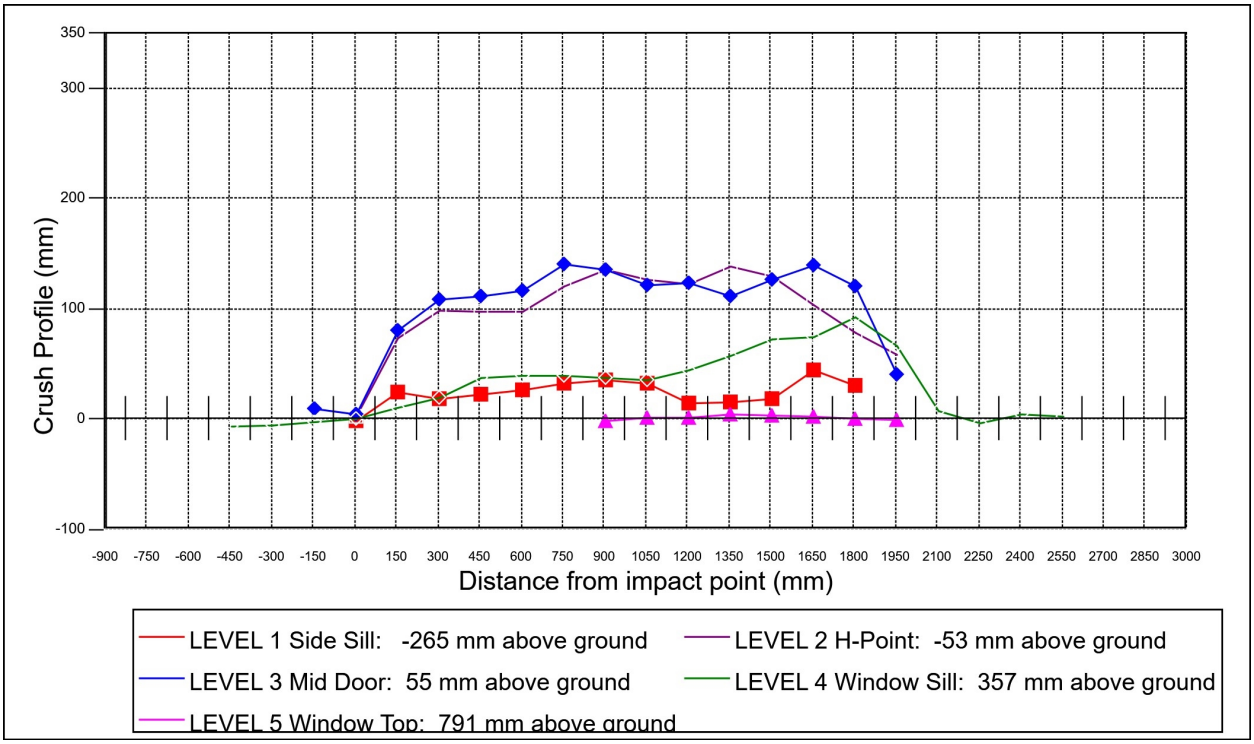
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900															
-750															
-600															
-450				805					811					-6	
-300				824					829					-5	
-150			891	832				881	834				10	-2	
0	872	885	885	836		873	882	887	835		-1	3	-2	1	
150	864	885	890	834		839	811	809	823		25	74	81	11	
300	861	883	890	820		842	784	781	800		19	99	109	20	
450	861	882	889	837		838	784	777	799		23	98	112	38	
600	861	881	888	849		834	783	771	809		27	98	117	40	
750	860	879	886	853		827	758	745	813		33	121	141	40	
900	859	876	884	855	611	823	740	748	817	612	36	136	136	38	-1
1050	850	873	880	856	627	817	746	758	820	625	33	127	122	36	2
1200	837	867	875	855	623	822	744	751	810	621	15	123	124	45	2
1350	832	865	873	853	617	816	726	761	795	612	16	139	112	58	5
1500	837	867	872	849	611	818	737	745	776	607	19	130	127	73	4
1650	849	873	876	844	603	804	769	736	769	600	45	104	140	75	3
1800	867	884	885	841	593	836	805	764	748	592	31	79	121	93	1
1950		886	890	837	554		827	849	770	554		59	41	67	0
2100				834					826					8	
2250				835					838					-3	
2400				835					830					5	
2550				827					824					3	
2700															
2850															
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 the test based on an estimated impact point. The final distance from impact is determined after the final dummy positioning and the pole is aligned with the center of gravity of the dummy's head.*

DATA SHEET NO.17
TEST VEHICLE EXTERIOR CRUSH PROFILES (CONTINUED)

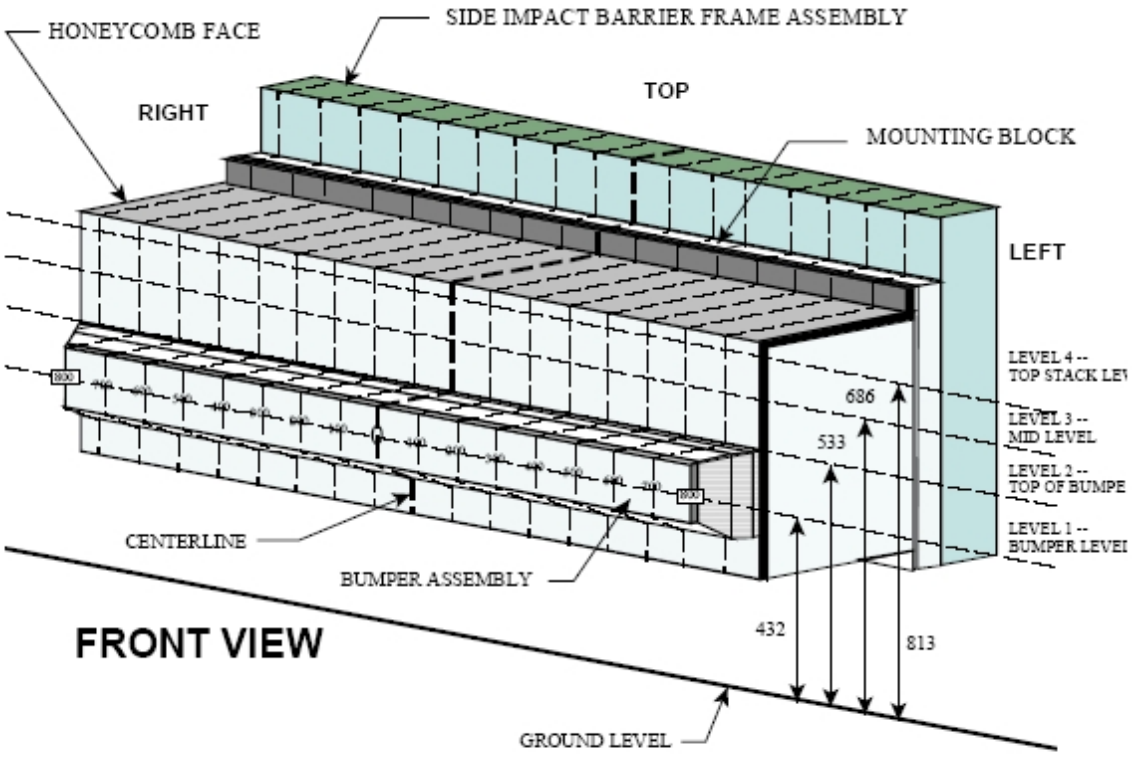
Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023



Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO.18
EXTERIOR STATIC CRUSH FOR IMPACT FACE

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023



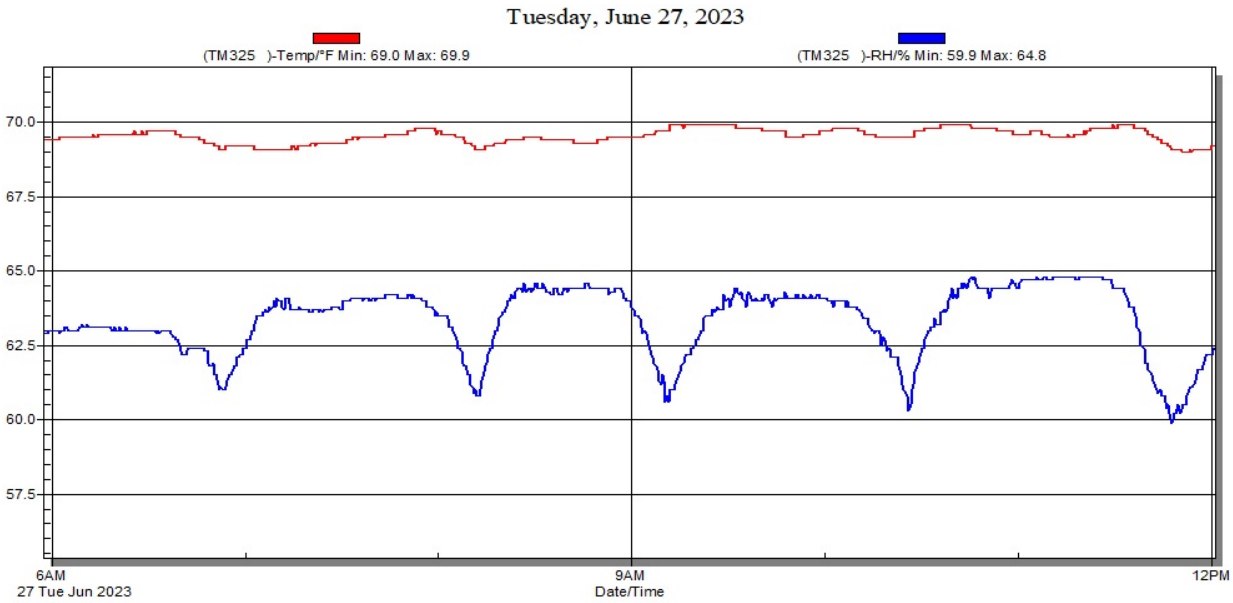
NOTE: Dimensions are shown in millimeters, mm

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	148	143	138	138	138	139	139	140	140	140	139	139	138	138	138	143	148
2	92	91	91	89	89	88	86	75	63	75	86	88	89	89	91	91	92
3	11	6	13	19	25	32	68	38	18	38	68	32	25	19	13	6	11
4	5	3	12	22	35	71	86	66	46	66	86	71	35	22	12	3	5

DATA SHEET NO. 19
DUMMY / VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle:	2023 Toyota Prius 5 Door Hatchback	NHTSA No.:	C20235102
Test Facility:	Calspan	Test Date:	06/27/2023



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

APPENDIX I

PHOTOGRAPHS

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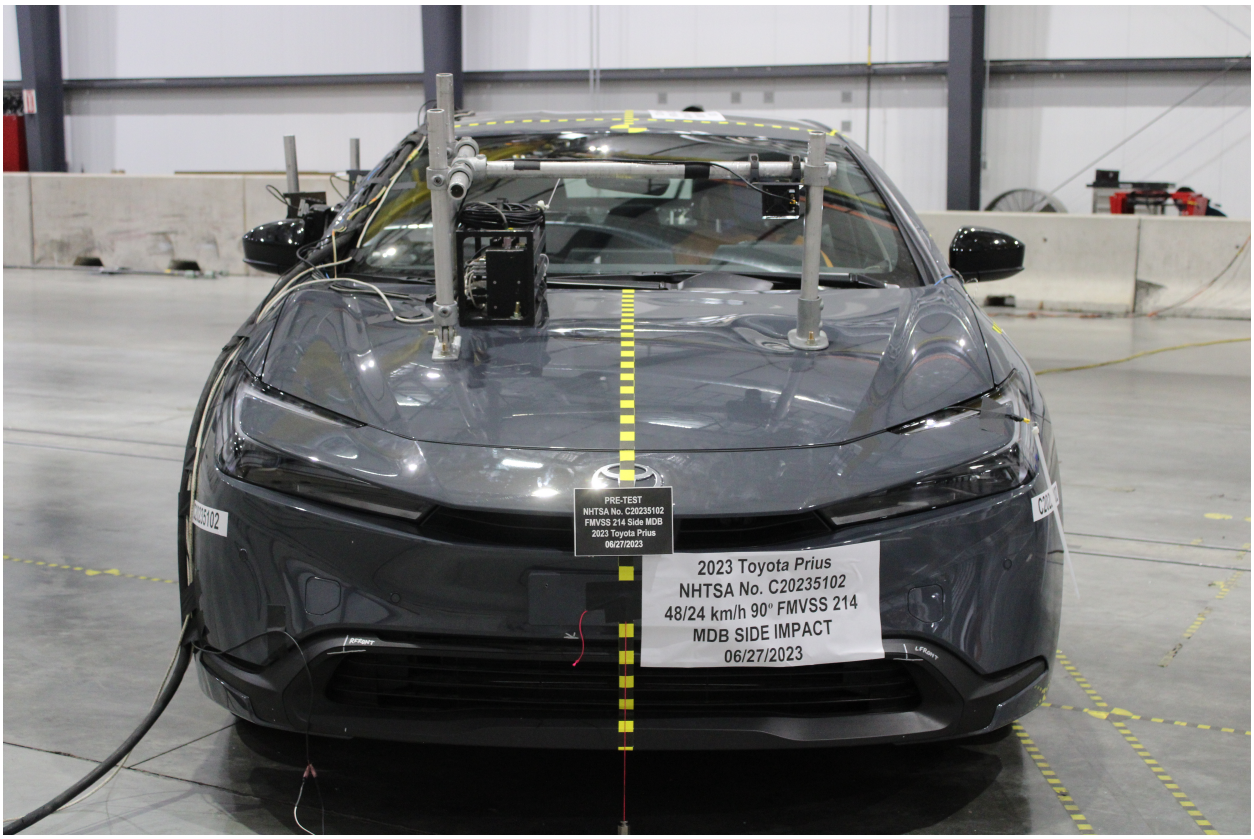

Figure A-1: Pre-Test Frontal View of Test Vehicle

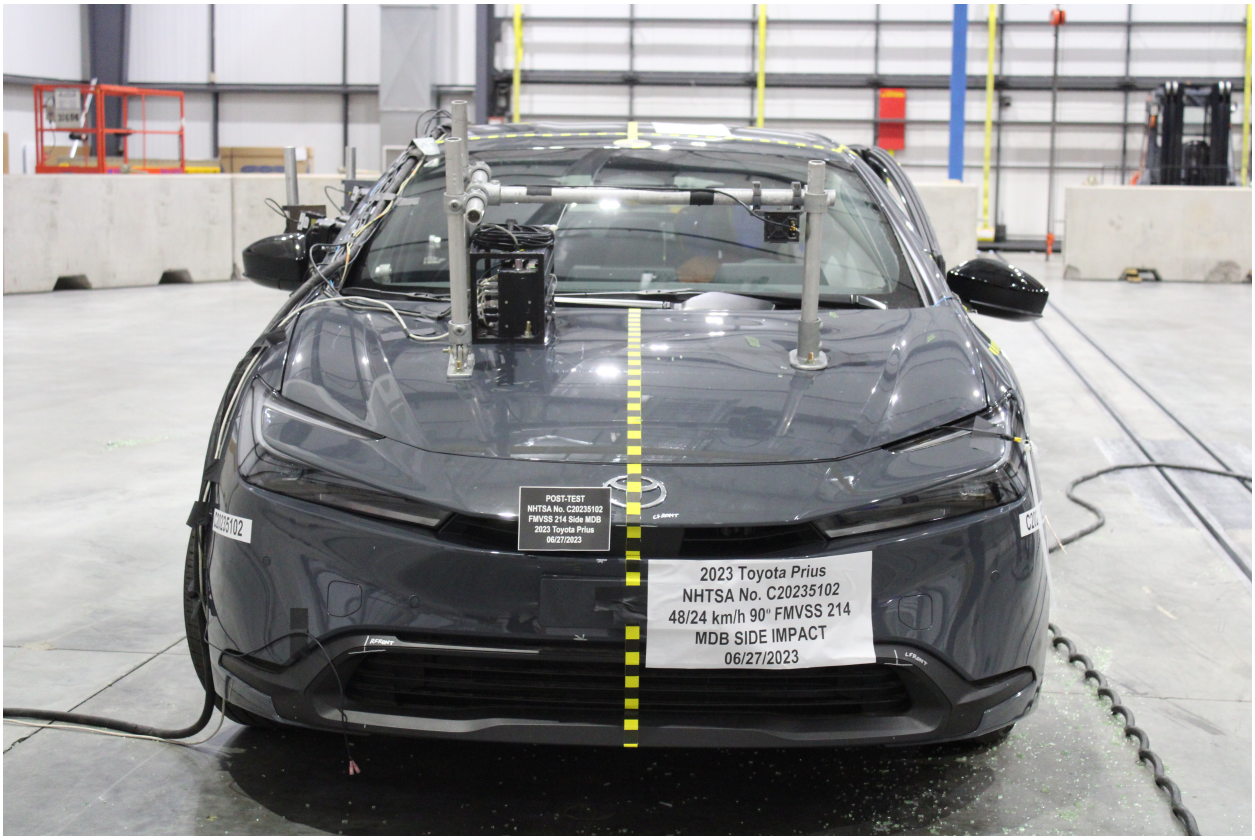

Figure A-2: Post-Test Frontal View of Test Vehicle



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



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

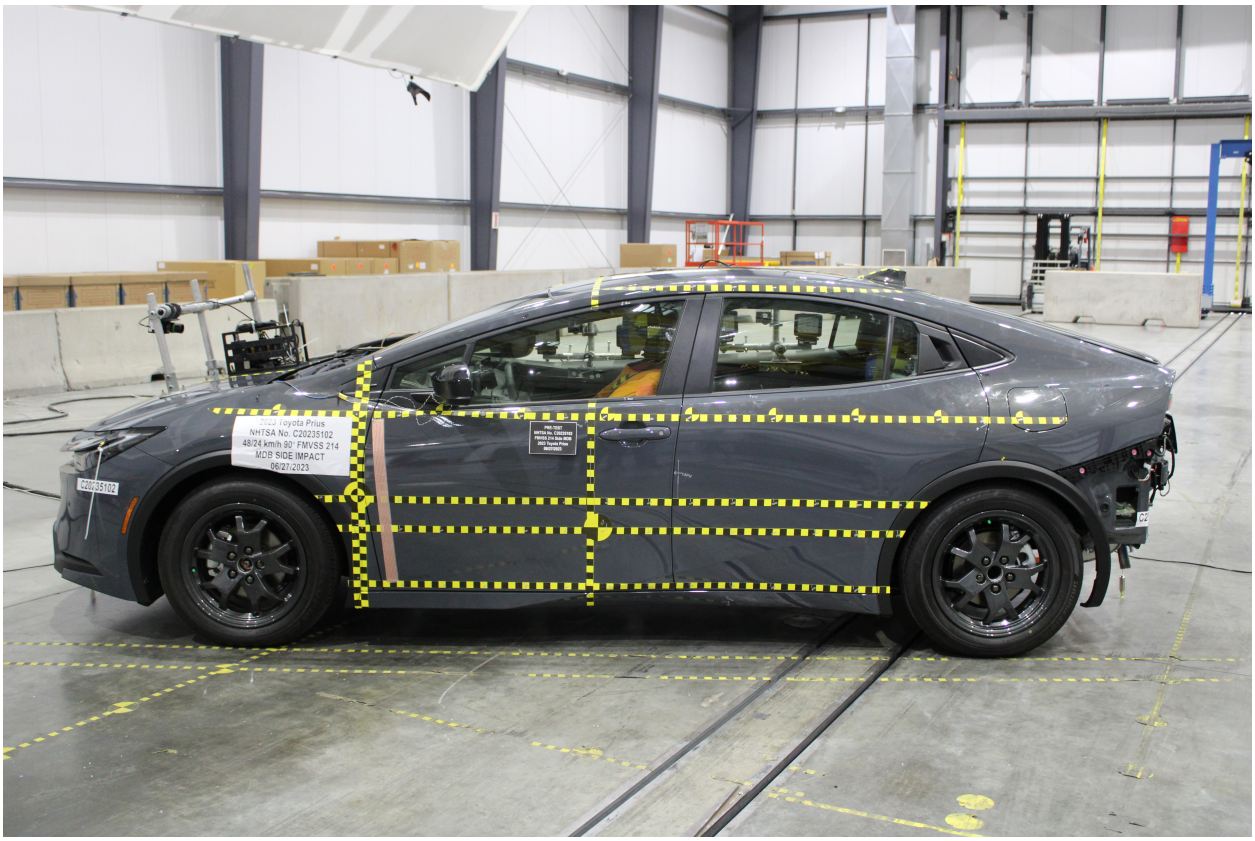

Figure A-5: Pre-Test Impacted Side View of Test Vehicle



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

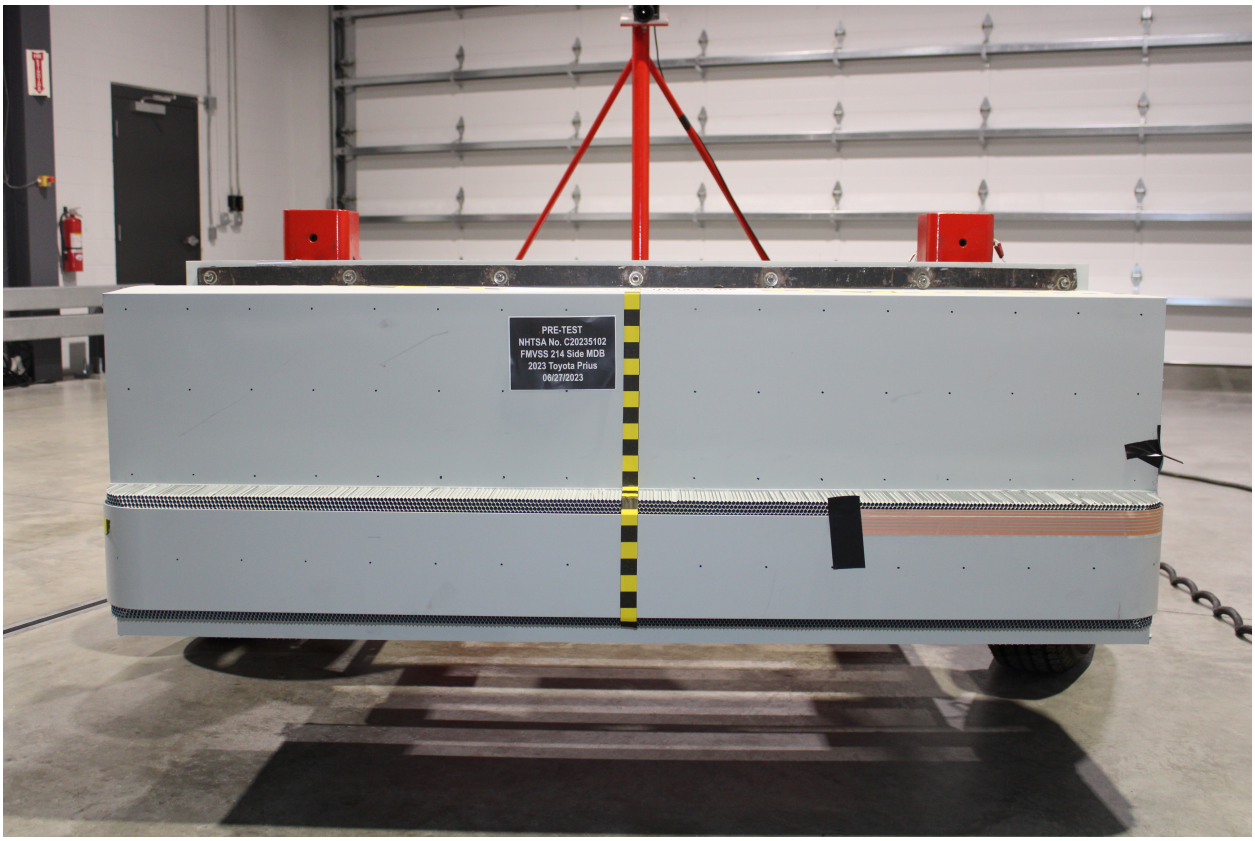

Figure A-7: Pre-Test Frontal View of Impactor Face

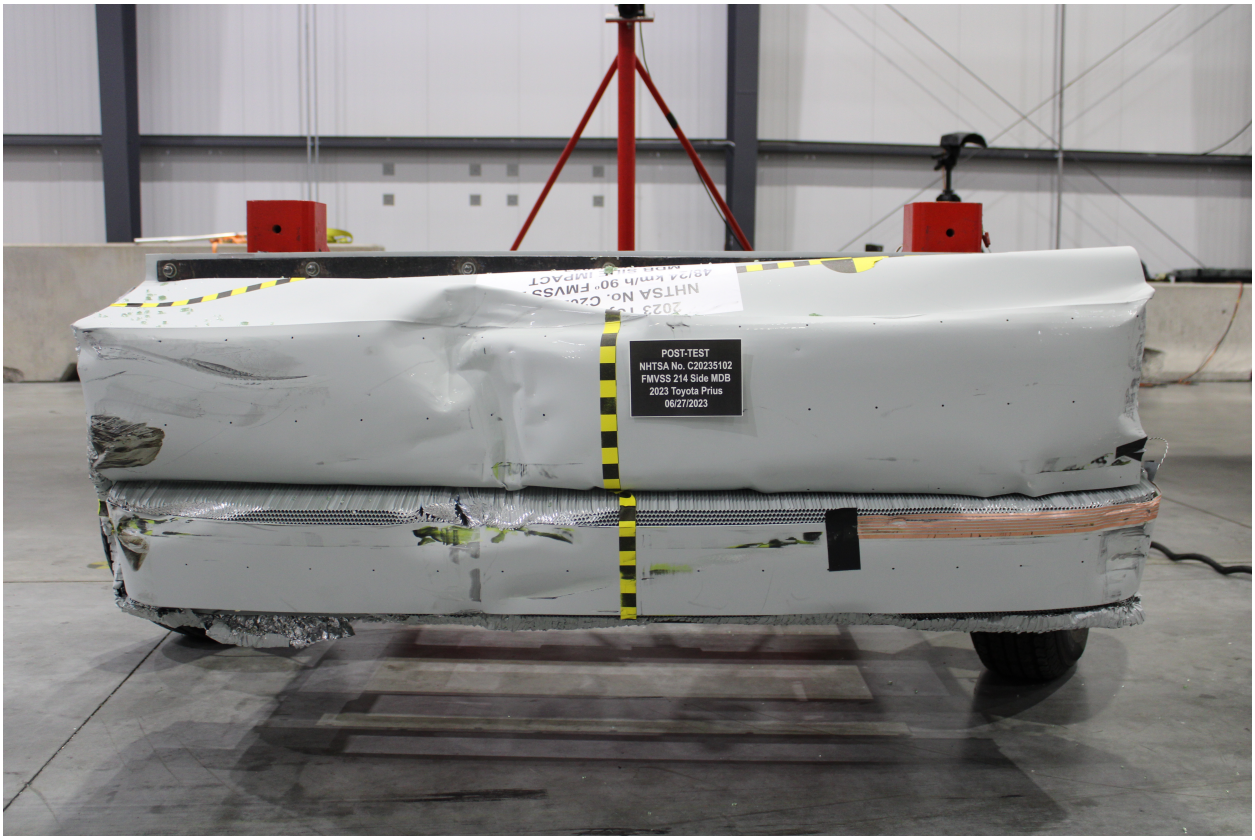

Figure A-8: Post-Test Frontal View of Impactor Face



Figure A-9: Pre-Test Left Side View of Impactor Face



Figure A-10: Post-Test Left Side View of Impactor Face



Figure A-11: Pre-Test Right Side View of Impactor Face



Figure A-12: Post-Test Right Side View of Impactor Face



Figure A-13: Pre-Test Top View of Impactor Face



Figure A-14: Post-Test Top View of Impactor Face

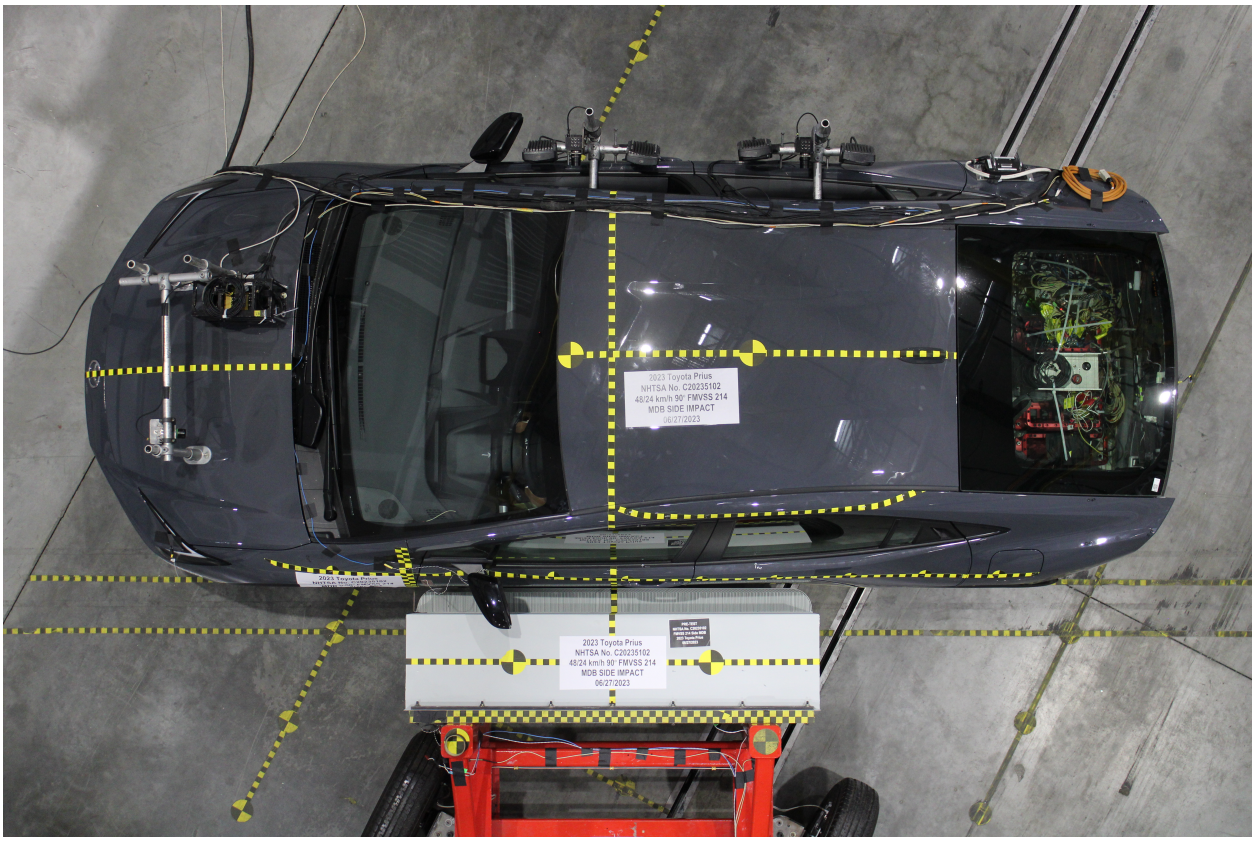

Figure A-15: Pre-Test Overhead View of MDB Positioned Against Impact Side of Test Vehicle at Impact Location

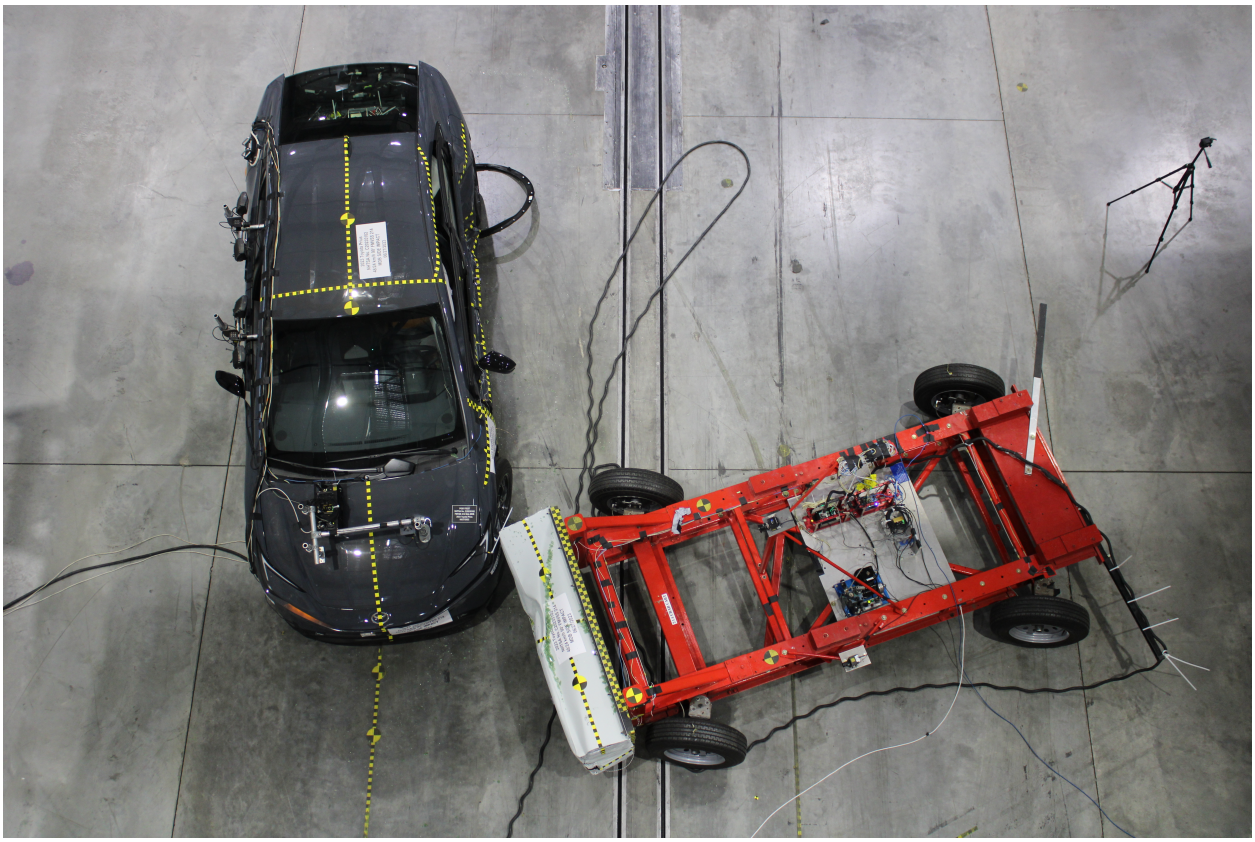

Figure A-16: Post-Test Overhead View of the MDB and Test Vehicle



Figure A-17: Pre-Test Front ES2-re in Final Seating Position (Door Open)



Figure A-18: Pre-Test Front ES2-re in Final Seating Position (Door Closed)



Figure A-19: Pre-Test Front ES2-re - Opposite Side View



Figure A-20: Post-Test Front ES2-re - Opposite Side View



Figure A-21: Pre-Test Rear SID in Final Seating Position (Door Open)



Figure A-22: Pre-Test Rear SID in Final Seating Position (Door Closed)



Figure A-23: Pre-Test Rear SID - Opposite Side View



Figure A-24: Post-Test Rear SID - Opposite Side View

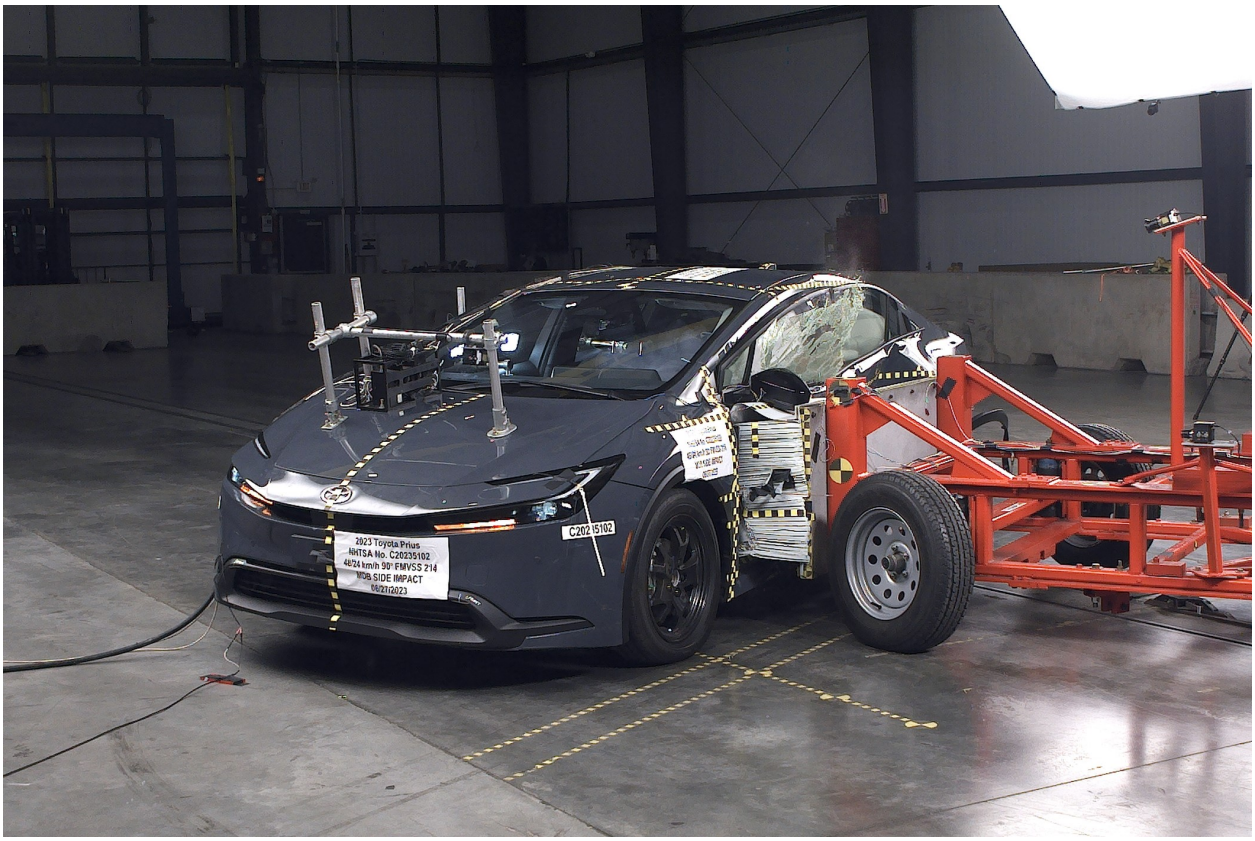

Figure A-25: T (0) - Impact Event



Figure A-26: Post-Test Close-up View of Impact Point Target

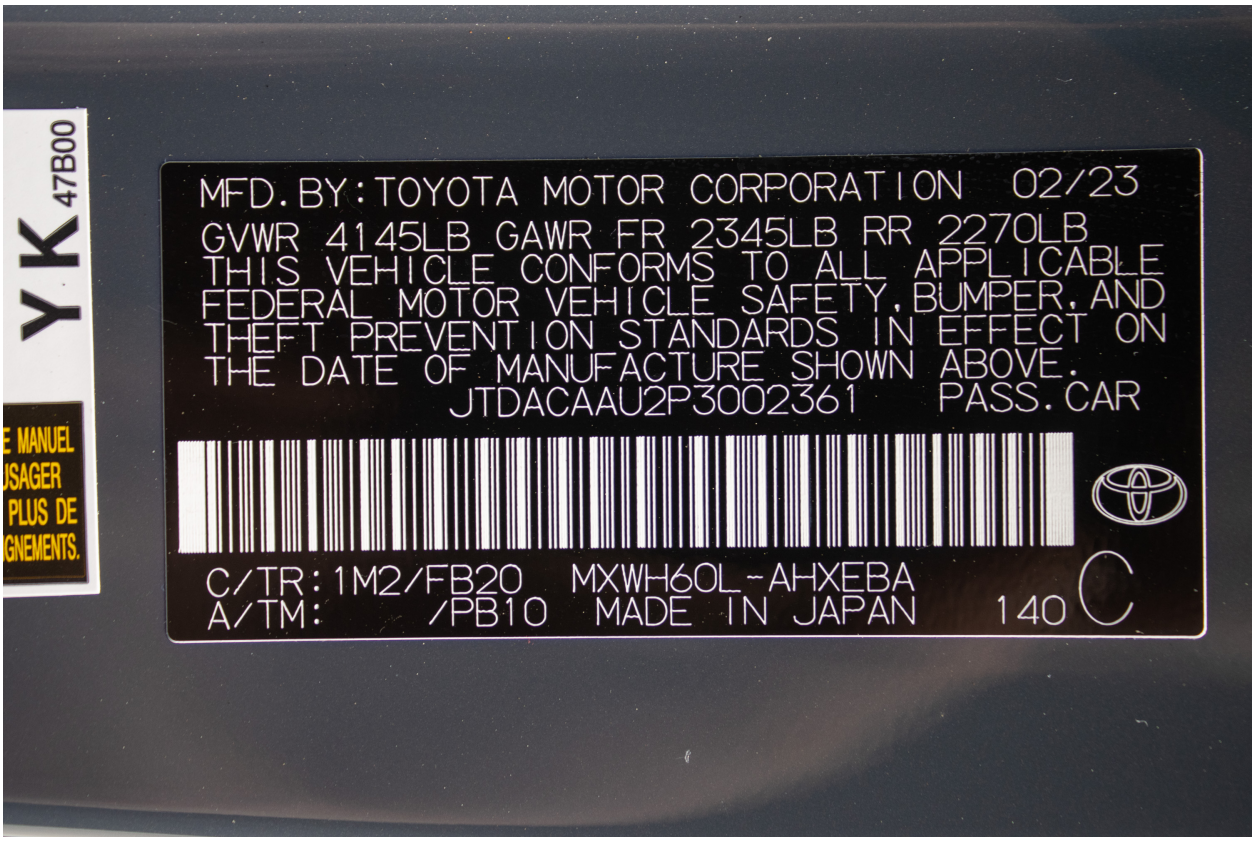

Figure A-27: Close-up View of Vehicle's Certification Label



Figure A-28: Post-Test Front Seat Occupant Area Showing Head & Torso Contact Regions



Figure A-29: Post-Test Rear Seat Occupant Area Showing Head & Torso Contact Regions

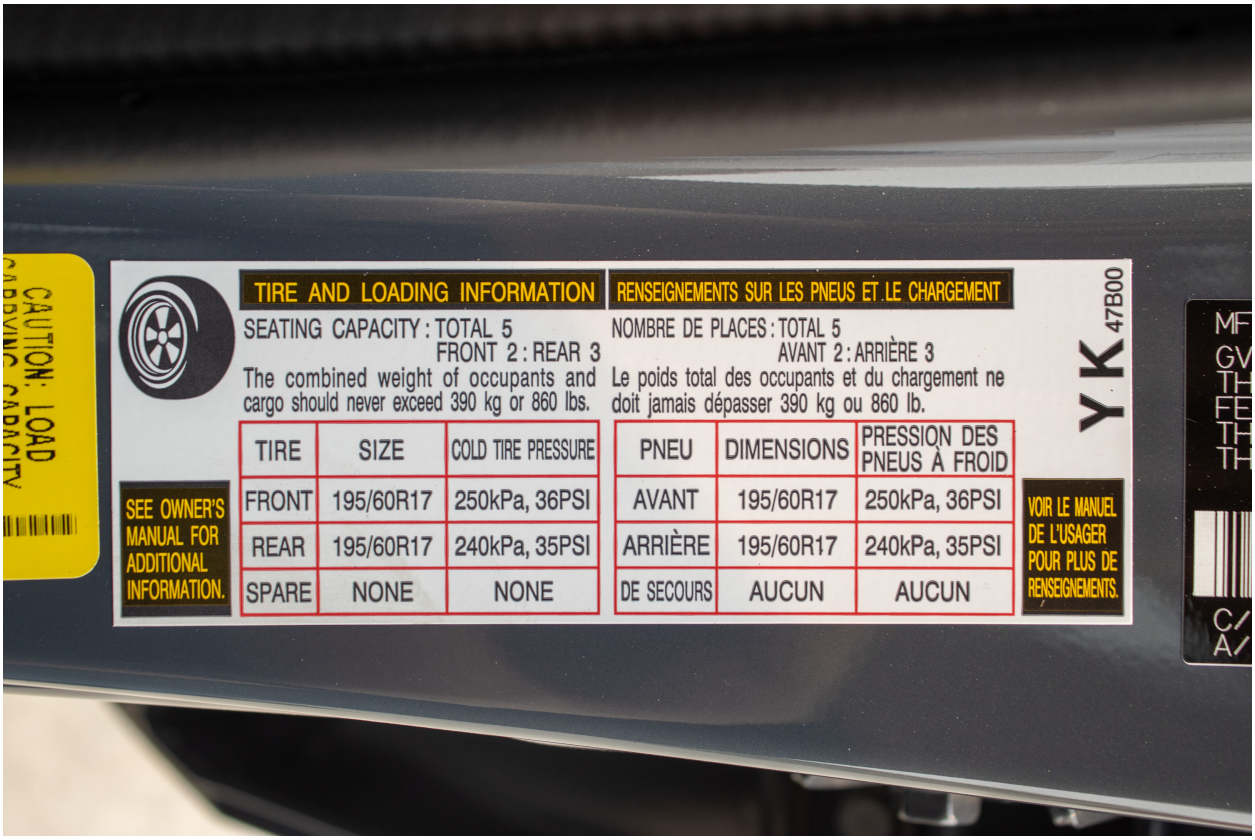

Figure A-30: Close-up View of Vehicle's Tire Placard

APPENDIX II
ES-2re DUMMY RESPONSE DATA TRACES

Table of Data Plots

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1	ES-2re Head (X) Acceleration vs. Time	II-3
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9	ES-2re Upper Thorax Rib Deflection (Y) vs. Time	II-5
10	ES-2re Middle Thorax Rib Deflection Rate vs. Time	II-5
11	ES-2re Middle Thorax Rib Deflection (Y) vs. Time	II-5
12	ES-2re Lower Thorax Rib Deflection Rate vs. Time	II-5
13	ES-2re Lower Thorax Rib Deflection (Y) vs. Time	II-6
14	ES-2re Front Abdomen Force (Y) vs. Time	II-6
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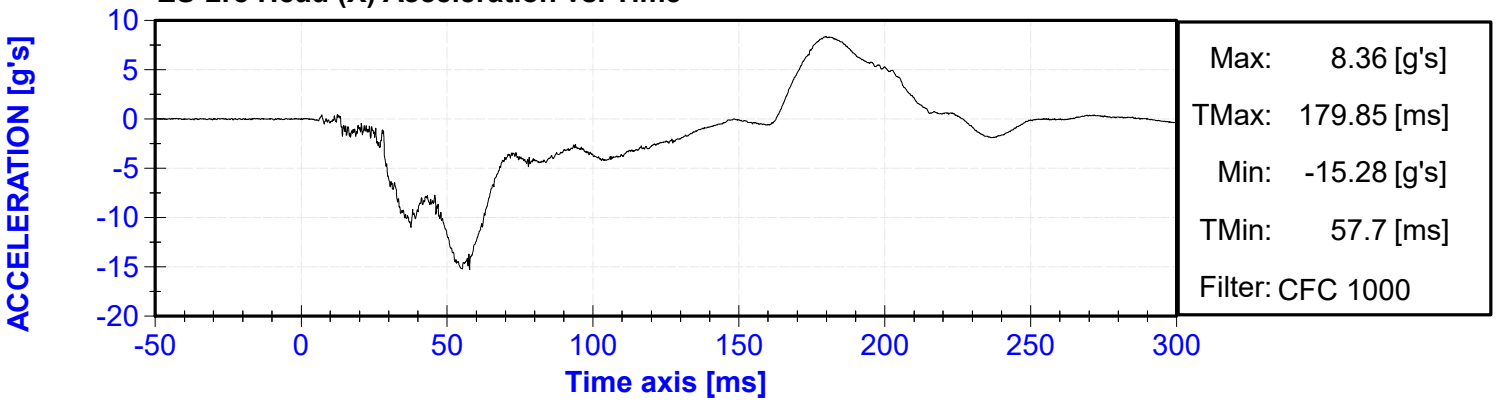
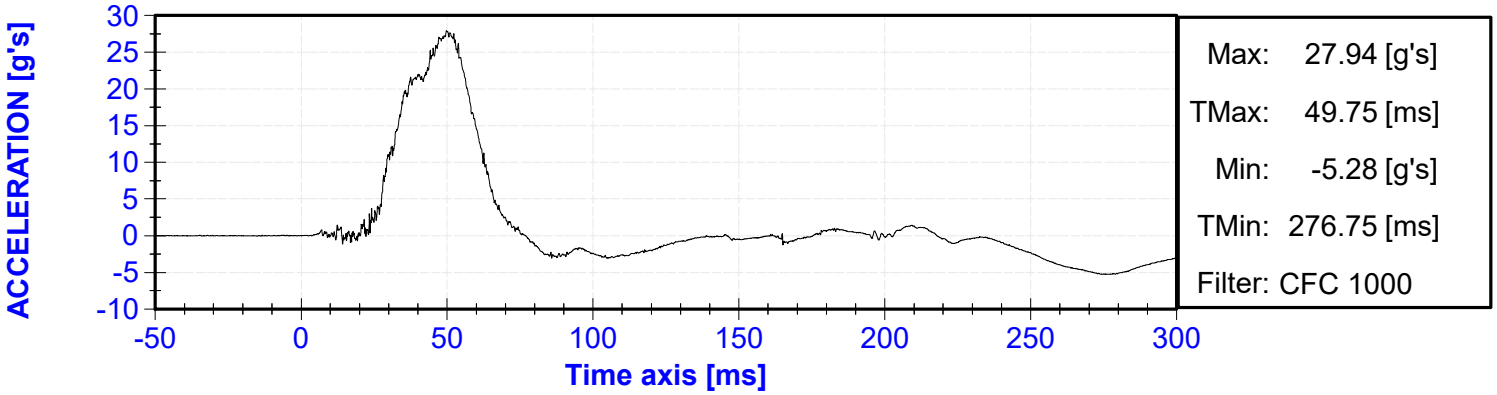
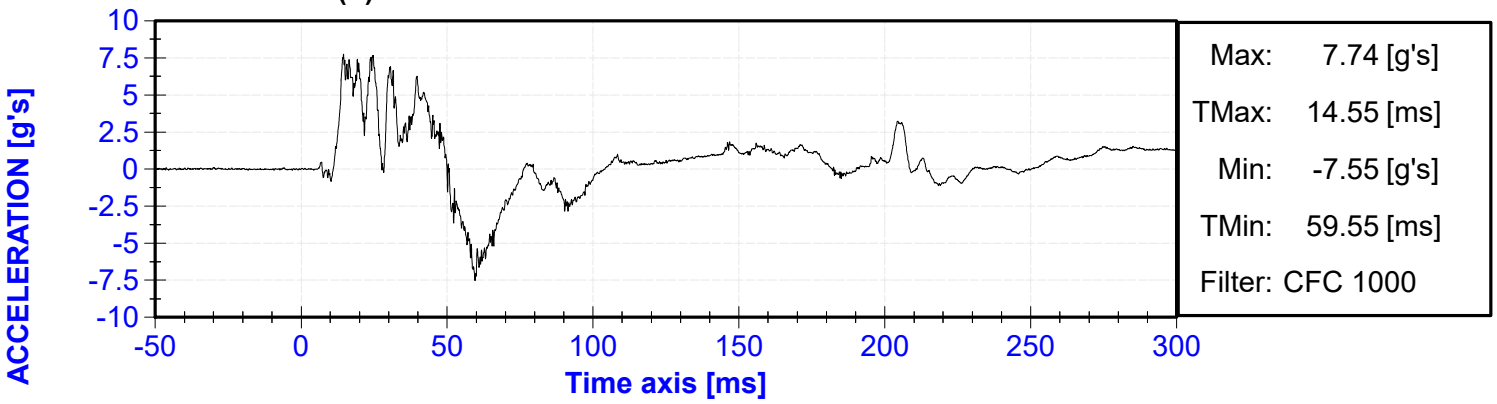
ES-2re Head (X) Acceleration vs. Time



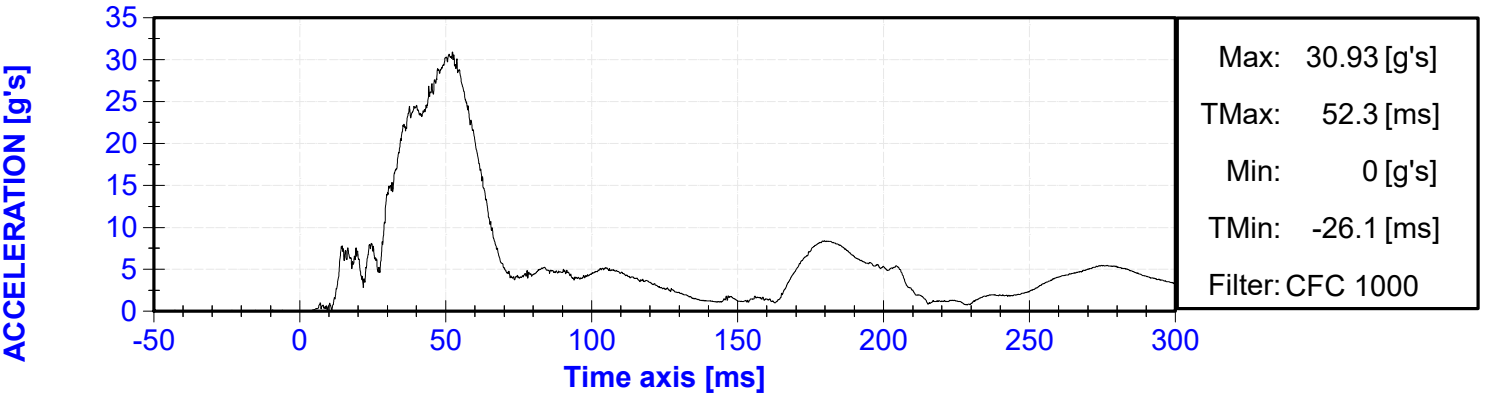
ES-2re Head (Y) Acceleration vs. Time



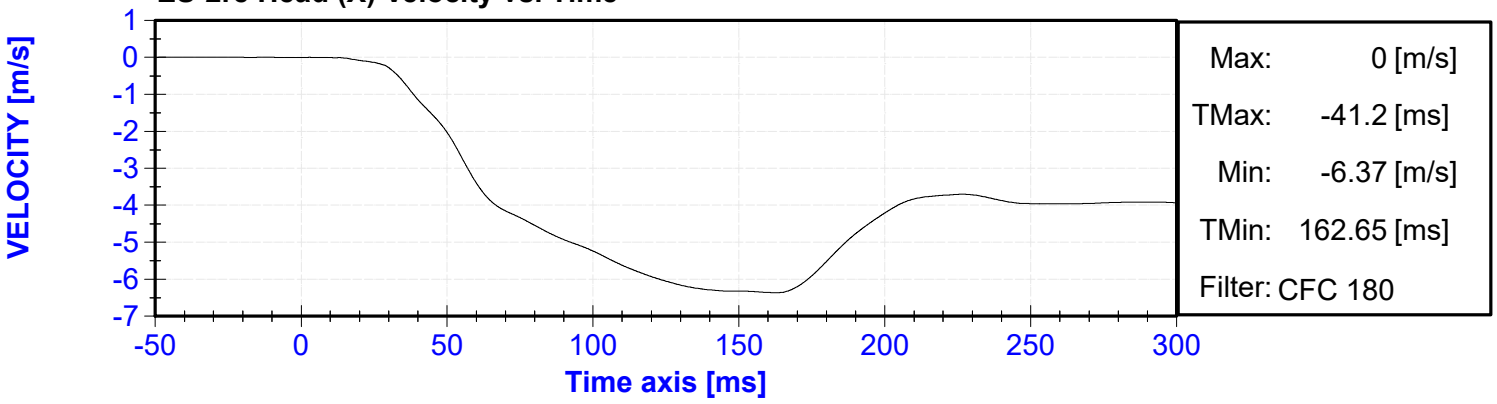
ES-2re Head (Z) Acceleration vs. Time



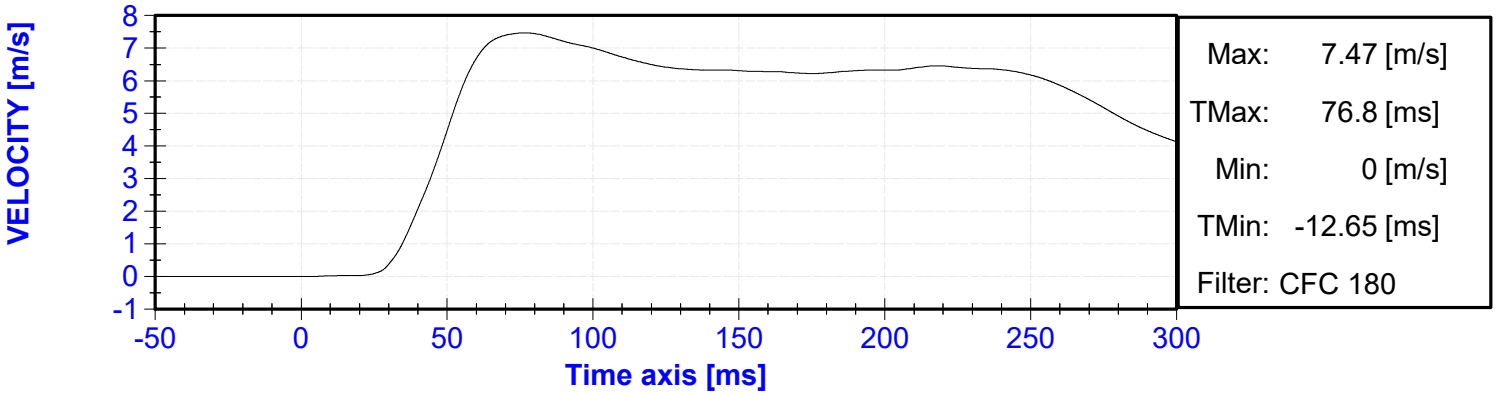
ES-2re Head Resultant Acceleration vs. Time



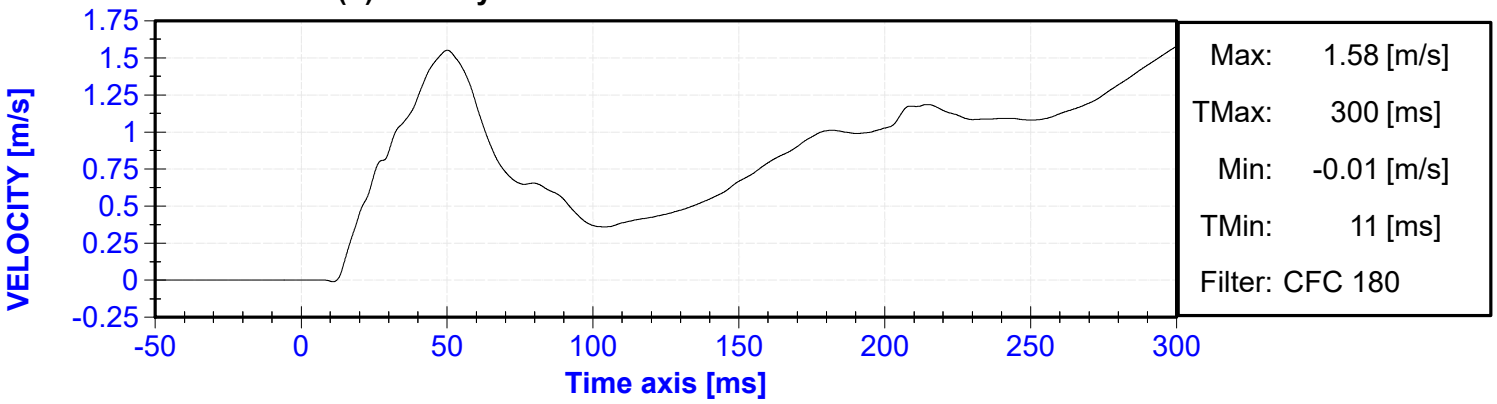
ES-2re Head (X) Velocity vs. Time



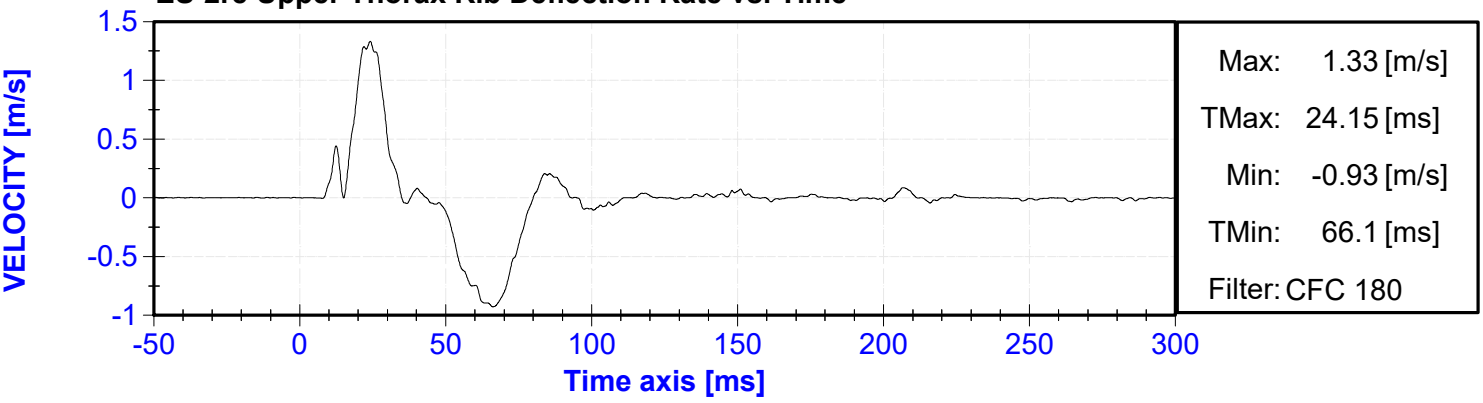
ES-2re Head (Y) Velocity vs. Time



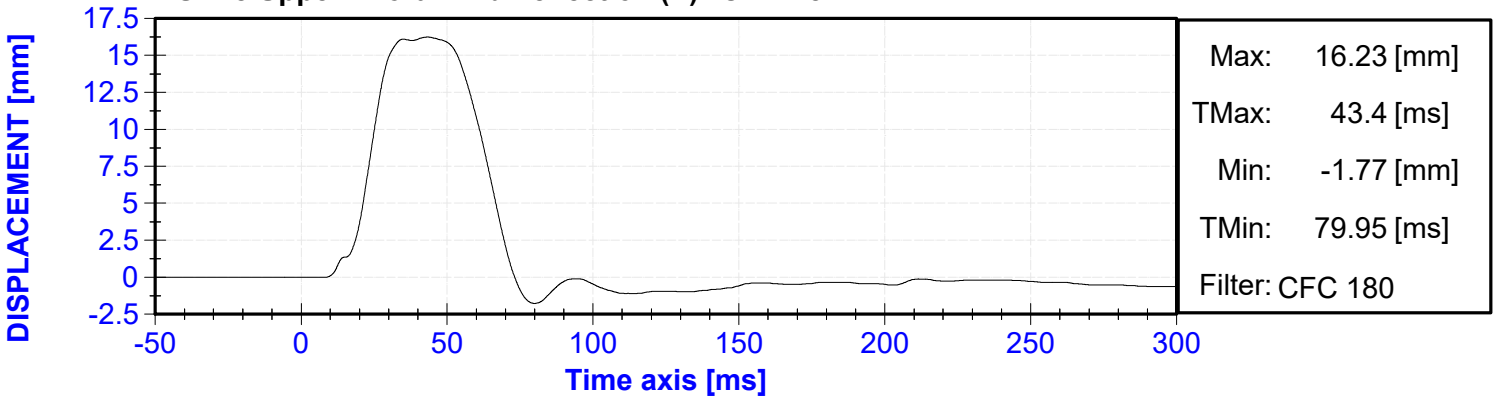
ES-2re Head (Z) Velocity vs. Time



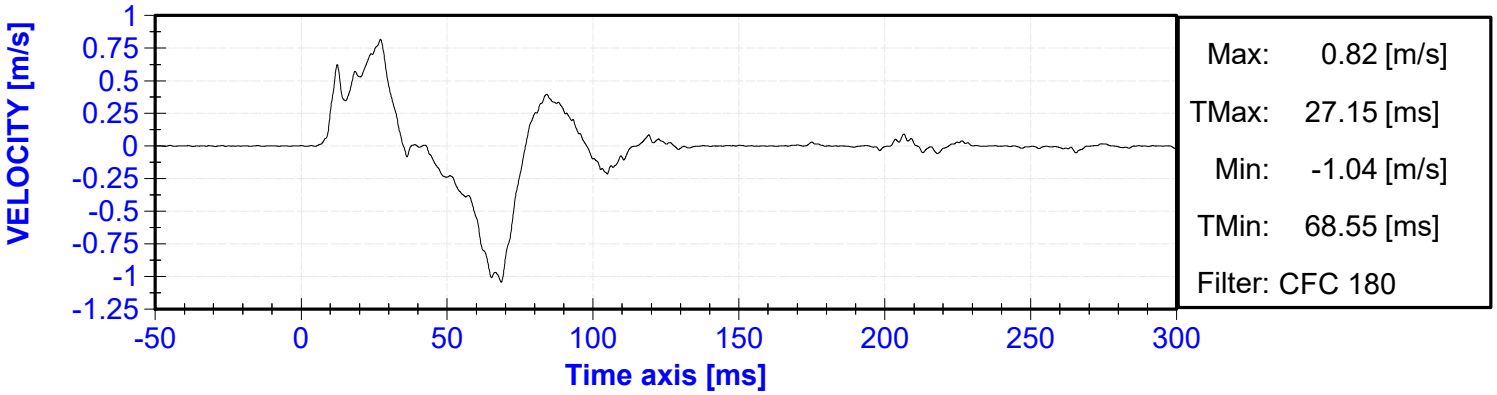
ES-2re Upper Thorax Rib Deflection Rate vs. Time



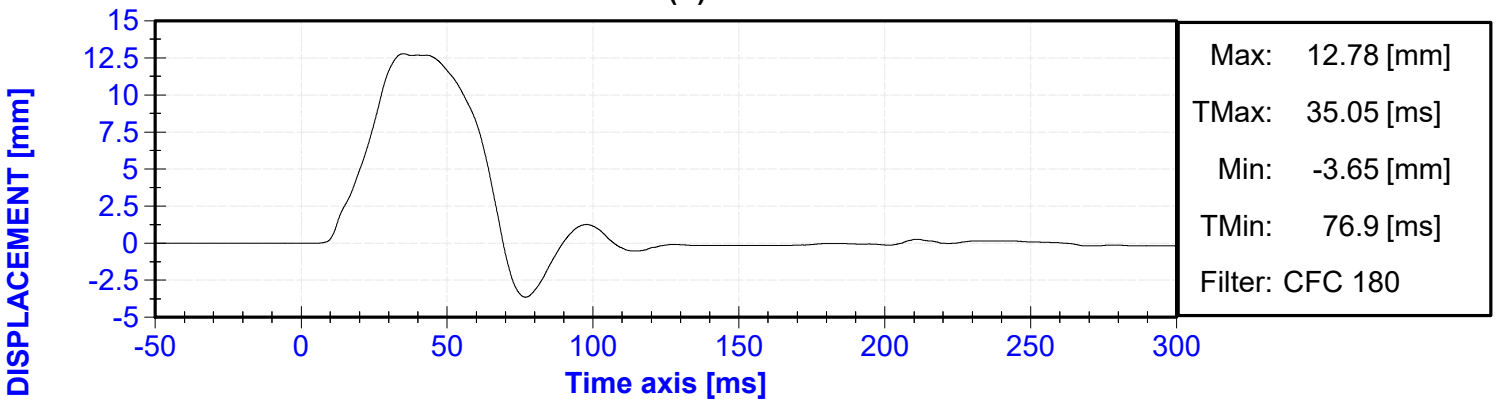
ES-2re Upper Thorax Rib Deflection (Y) vs. Time



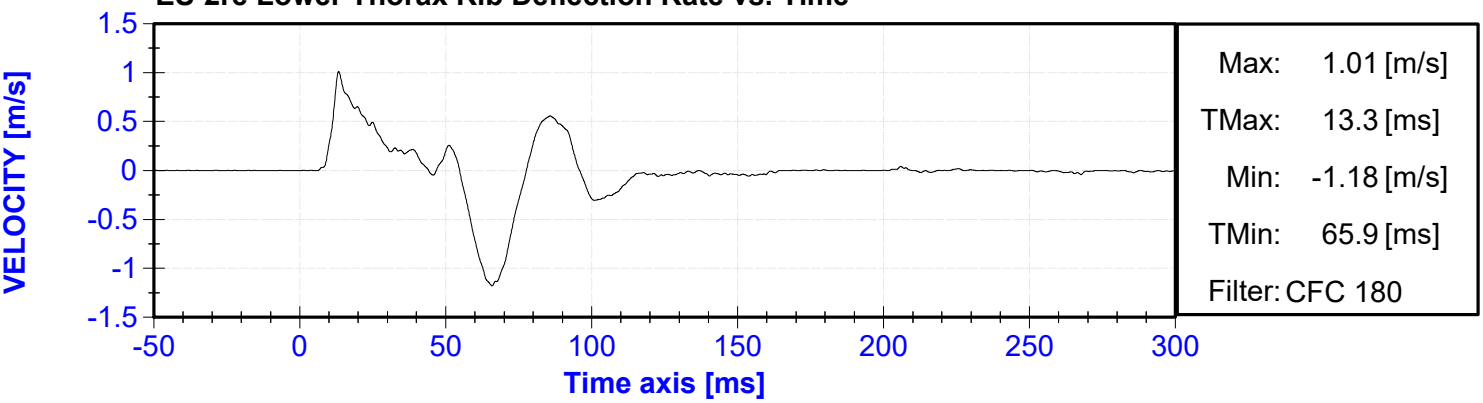
ES-2re Middle Thorax Rib Deflection Rate vs. Time



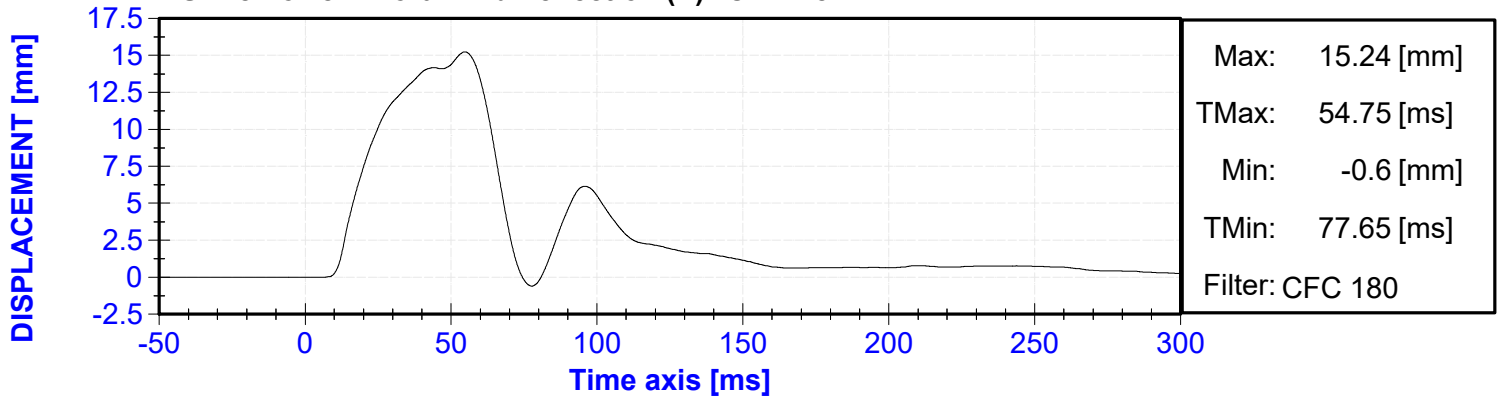
ES-2re Middle Thorax Rib Deflection (Y) vs. Time



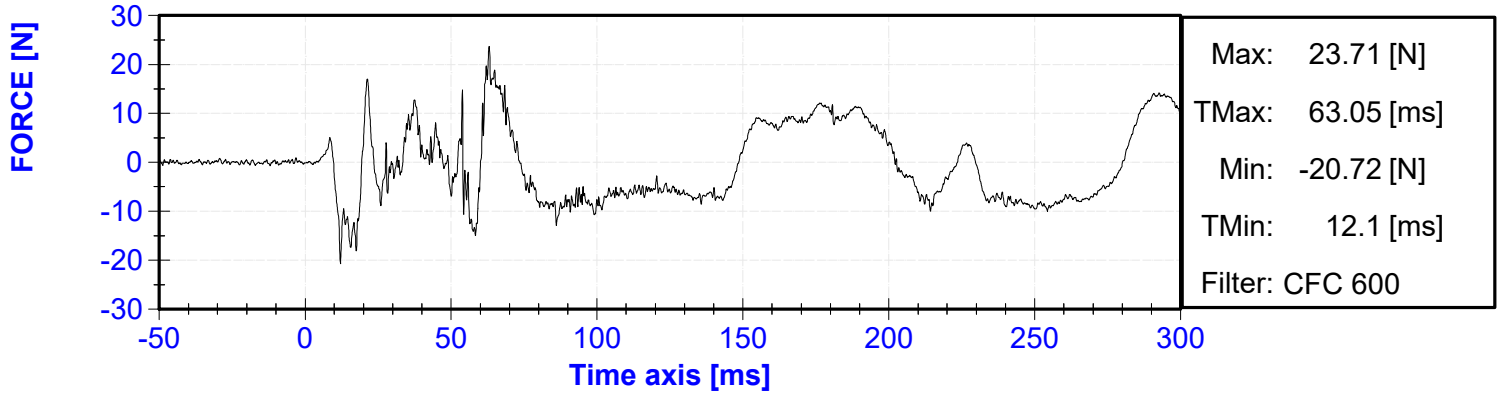
ES-2re Lower Thorax Rib Deflection Rate vs. Time



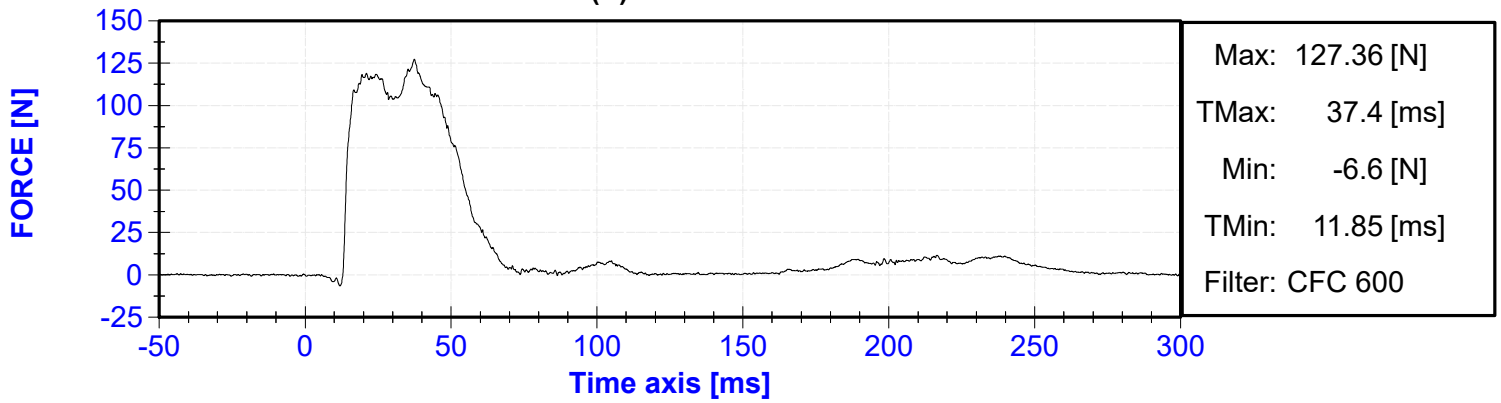
ES-2re Lower Thorax Rib Deflection (Y) vs. Time



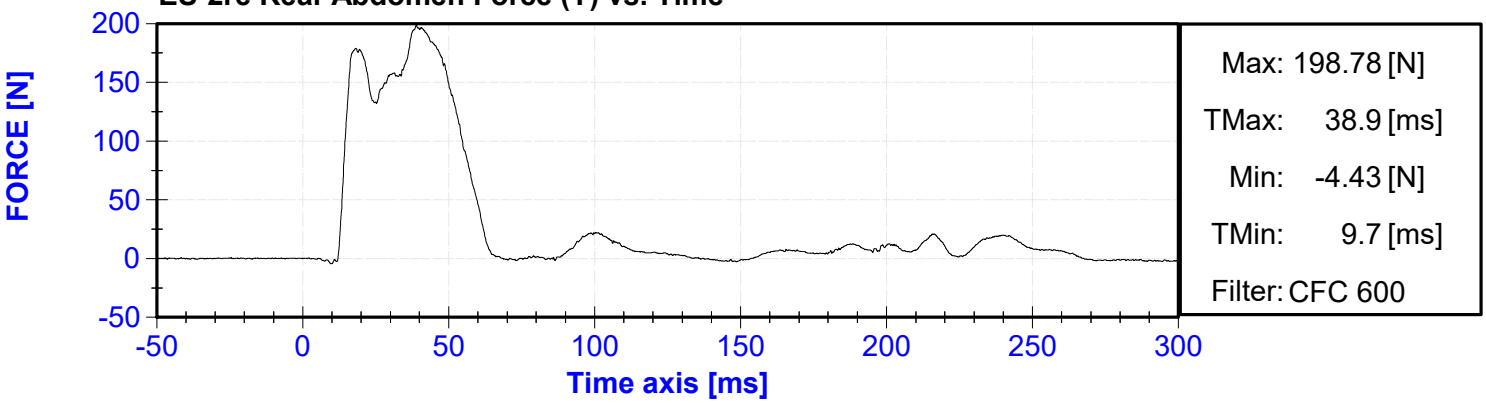
ES-2re Front Abdomen Force (Y) vs. Time



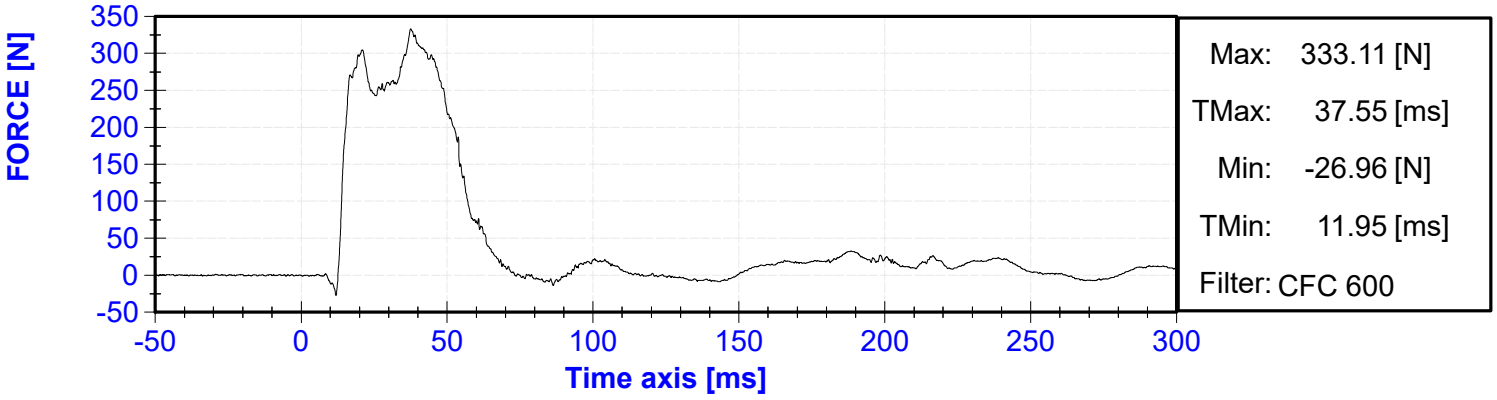
ES-2re Middle Abdomen Force (Y) vs. Time



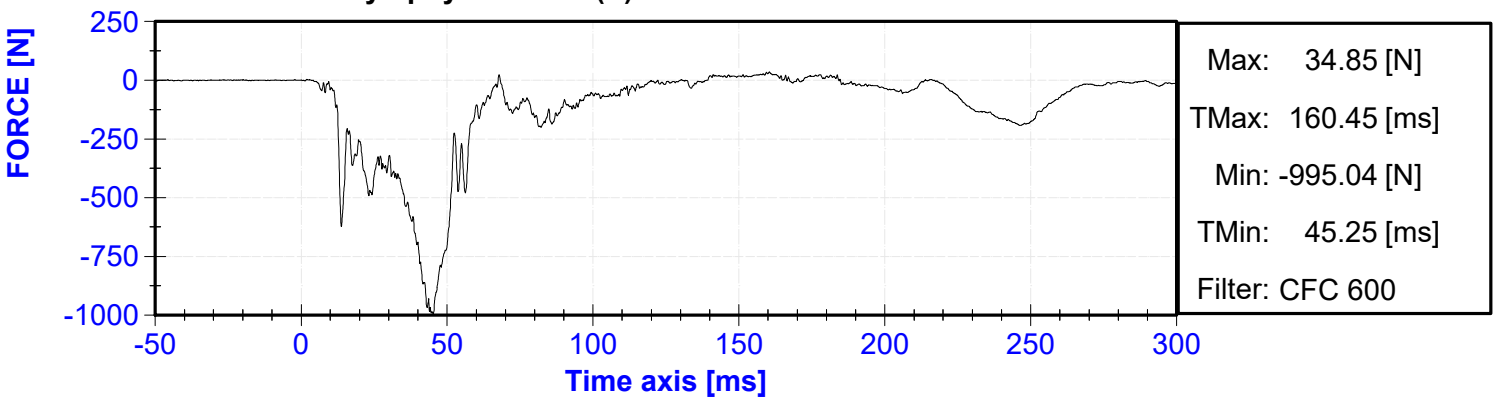
ES-2re Rear Abdomen Force (Y) vs. Time



ES-2re Sum of Abdomen Forces vs. Time



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



APPENDIX III
SID-IIs DUMMY RESPONSE DATA TRACES

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11	SID-IIs Lower Spine Resultant Acceleration vs. Time	III-5
12	SID-IIs Lower Spine X Velocity vs. Time	III-5
13	SID-IIs Lower Spine Y Velocity vs. Time	III-6
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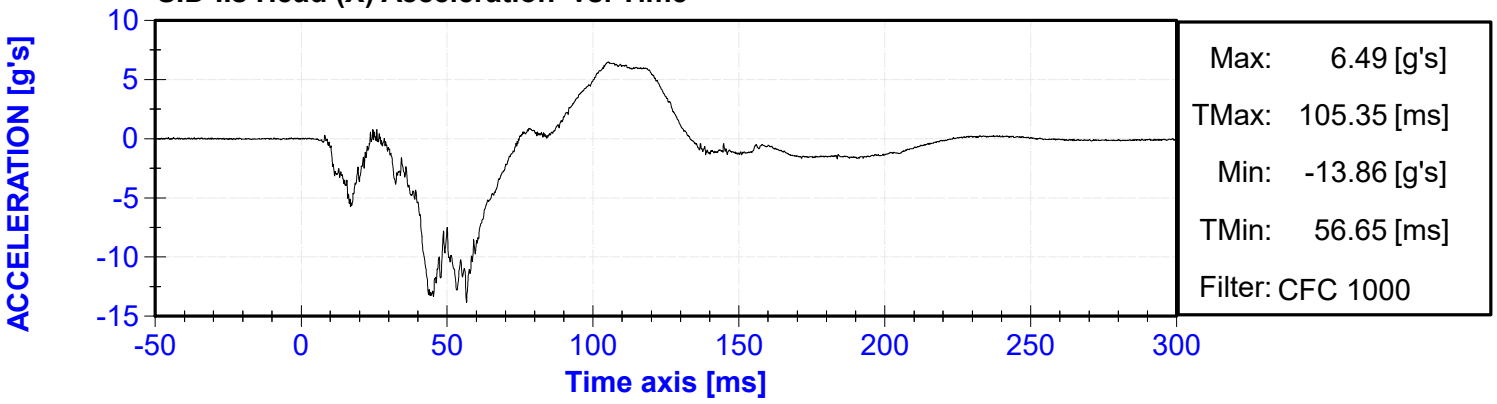
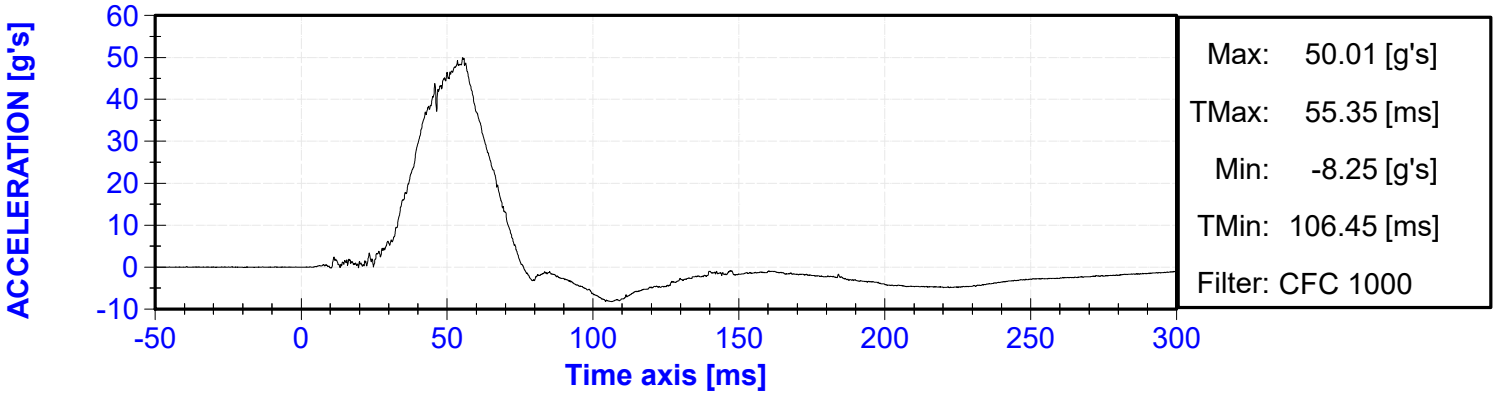
15	SID-IIs Acetabulum Force vs. Time	III-6
16	SID-IIs Iliac Force vs. Time	III-6
17	SID-IIs Sum of Iliac and Acetabulum Forces vs. Time	III-7

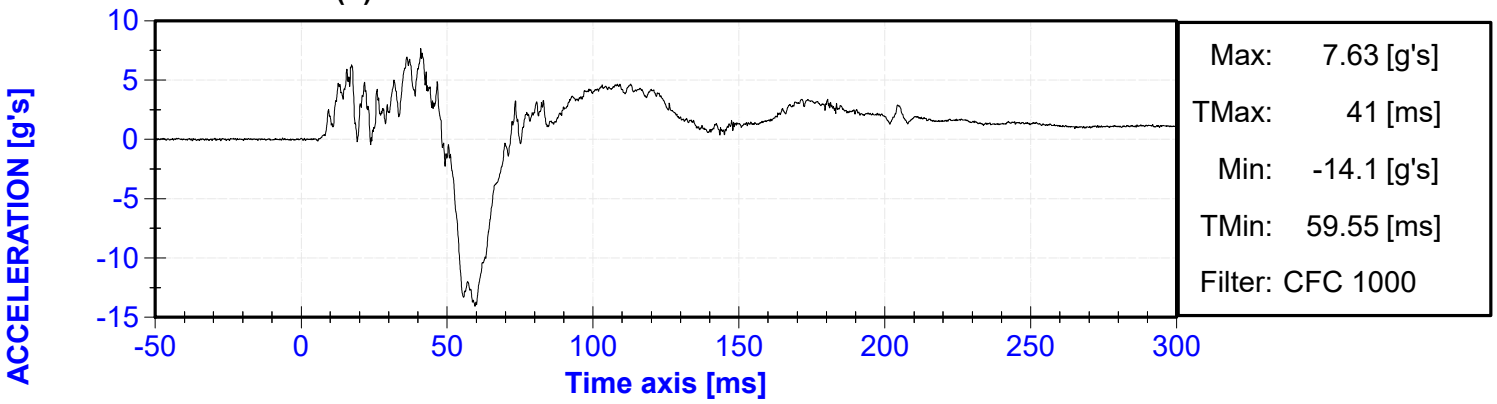
SID-IIs Head (X) Acceleration vs. Time



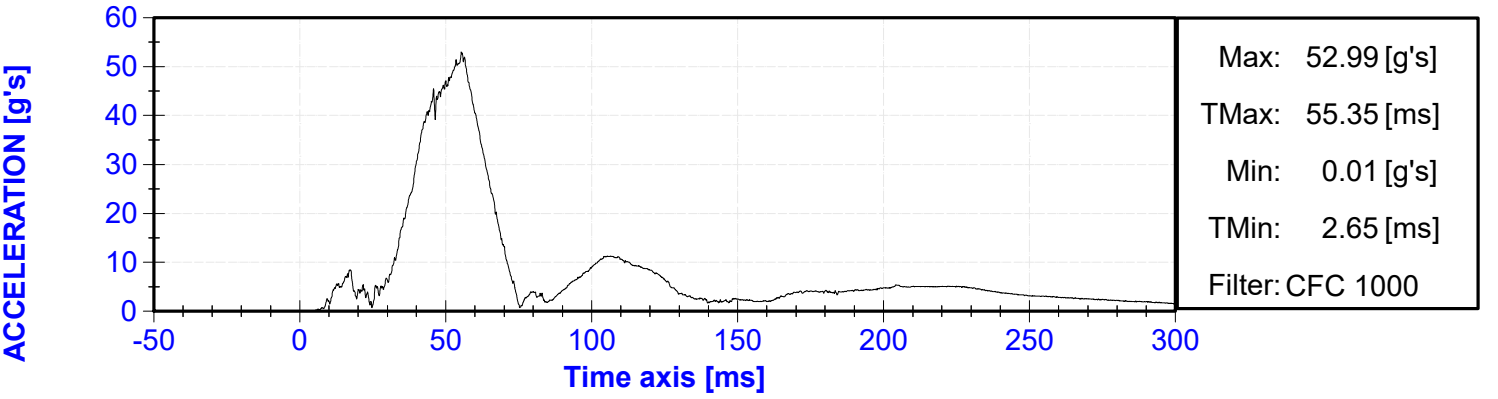
SID-IIs Head (Y) Acceleration vs. Time



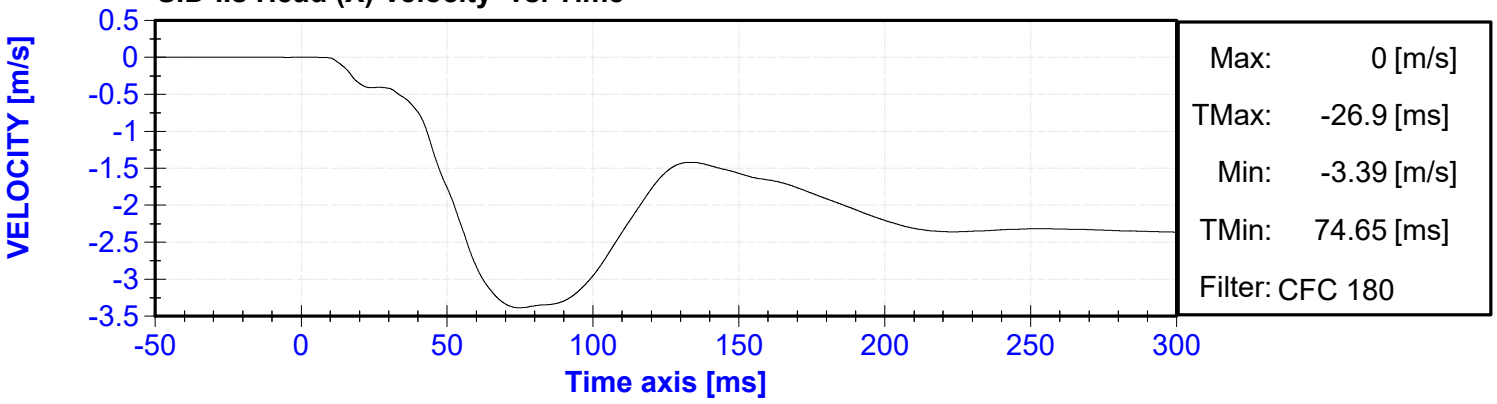
SID-IIs Head (Z) Acceleration vs. Time



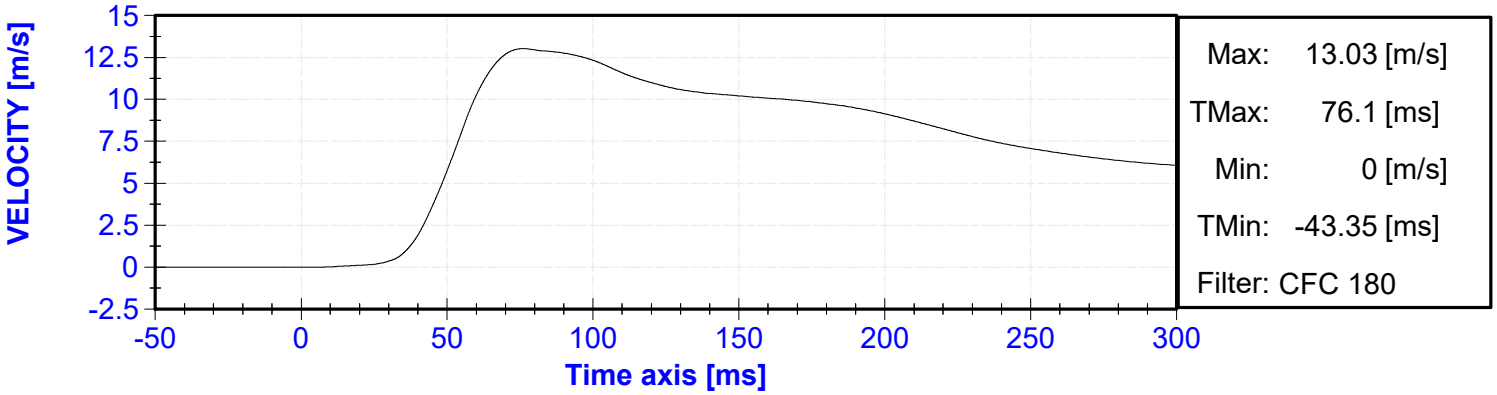
SID-IIs Head ResultantAcceleration vs. Time



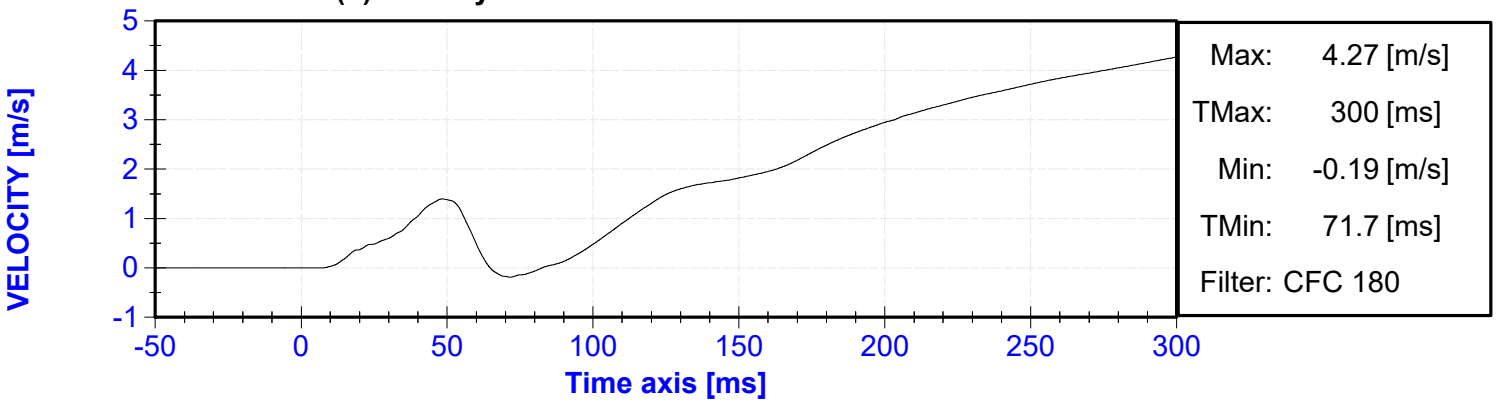
SID-IIs Head (X) Velocity vs. Time



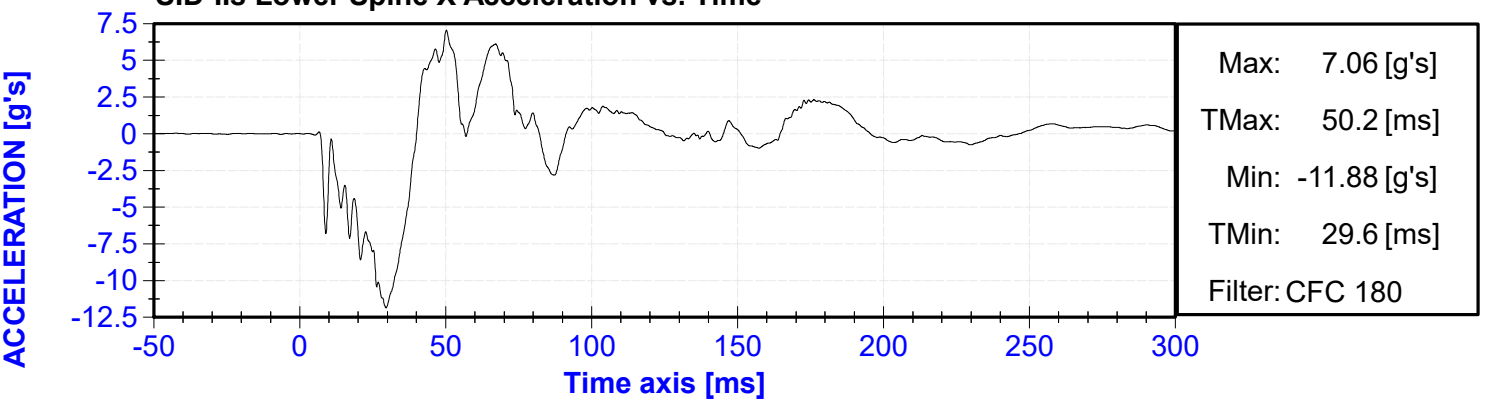
SID-IIs Head (Y) Velocity vs. Time



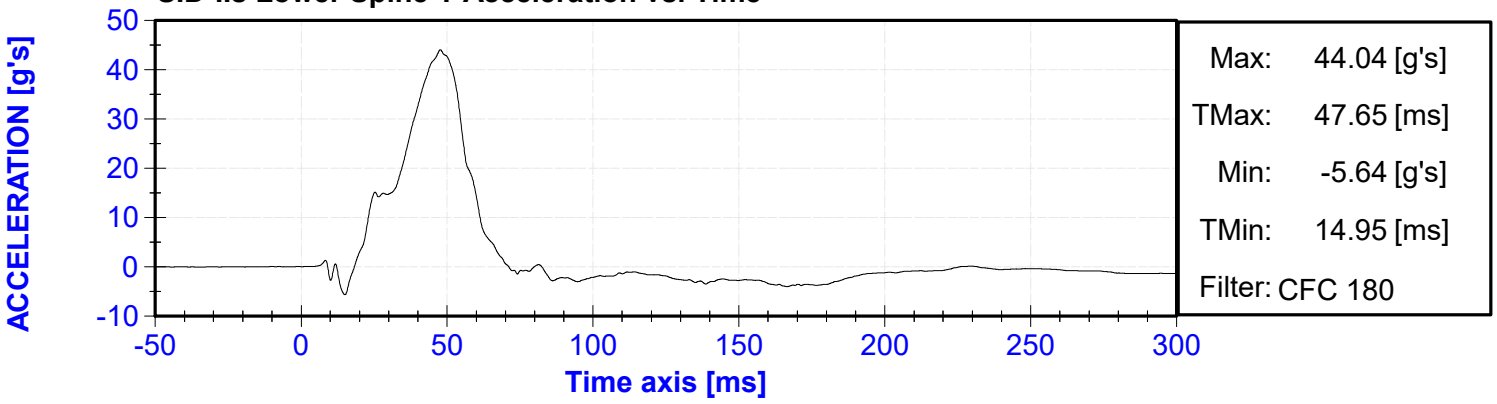
SID-IIs Head (Z) Velocity vs. Time



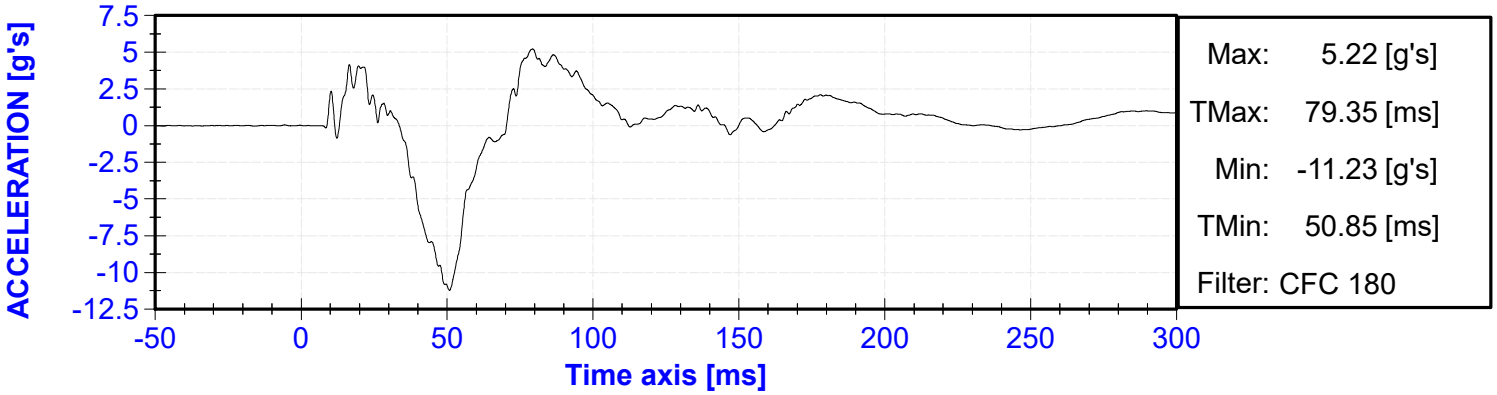
SID-IIs Lower Spine X Acceleration vs. Time



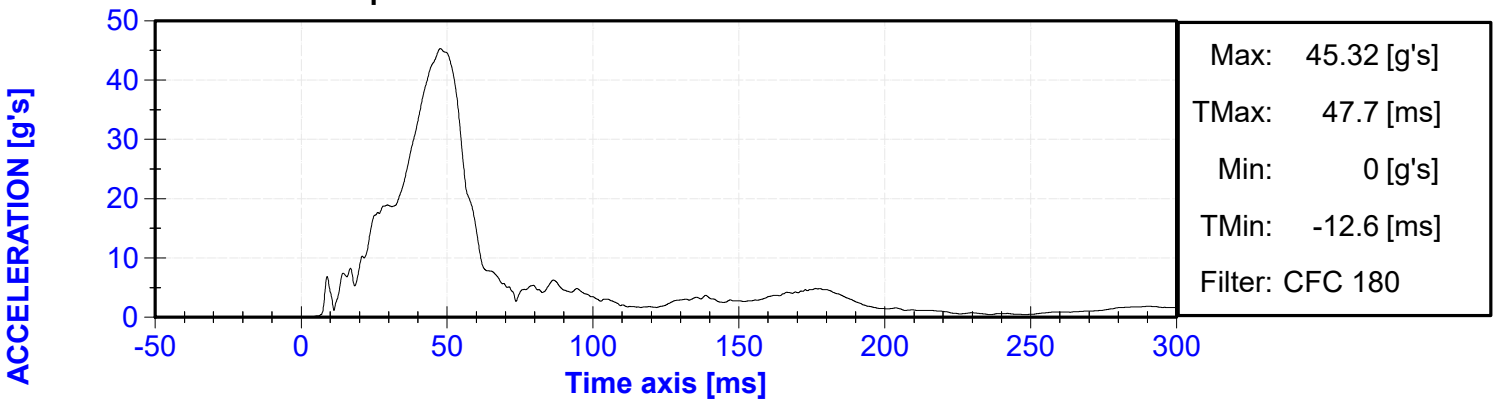
SID-IIs Lower Spine Y Acceleration vs. Time



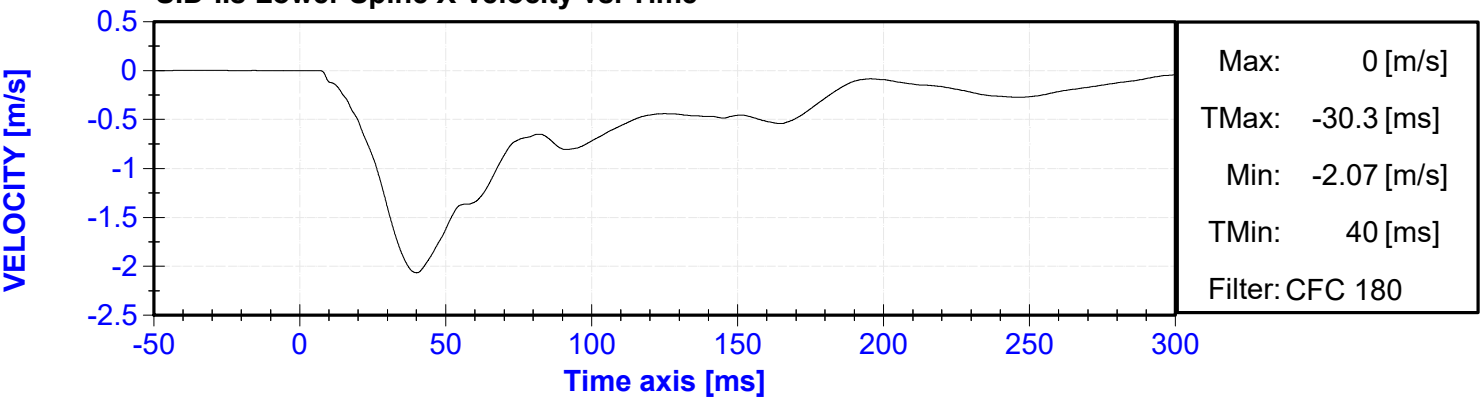
SID-IIs Lower Spine Z Acceleration vs. Time



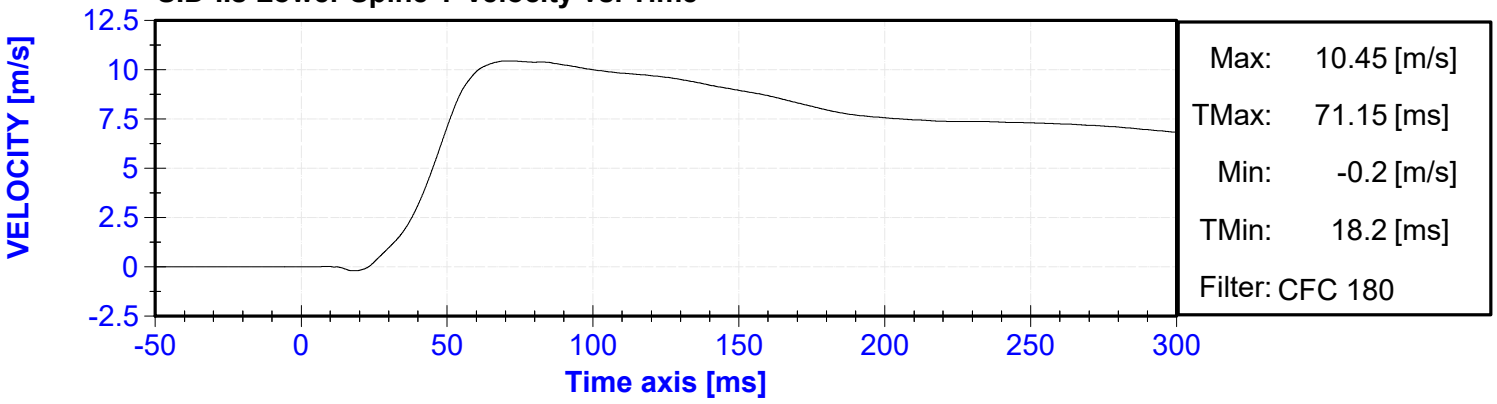
SID-IIs Lower Spine Resultant Acceleration vs. Time



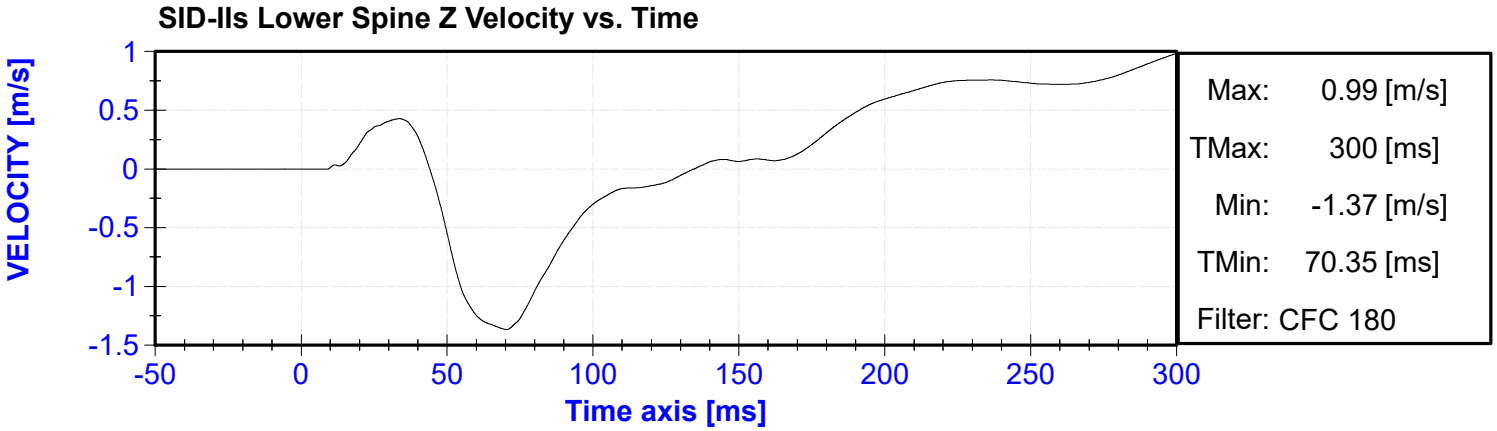
SID-IIs Lower Spine X Velocity vs. Time



SID-IIs Lower Spine Y Velocity vs. Time



SID-IIs Lower Spine Z Velocity vs. Time



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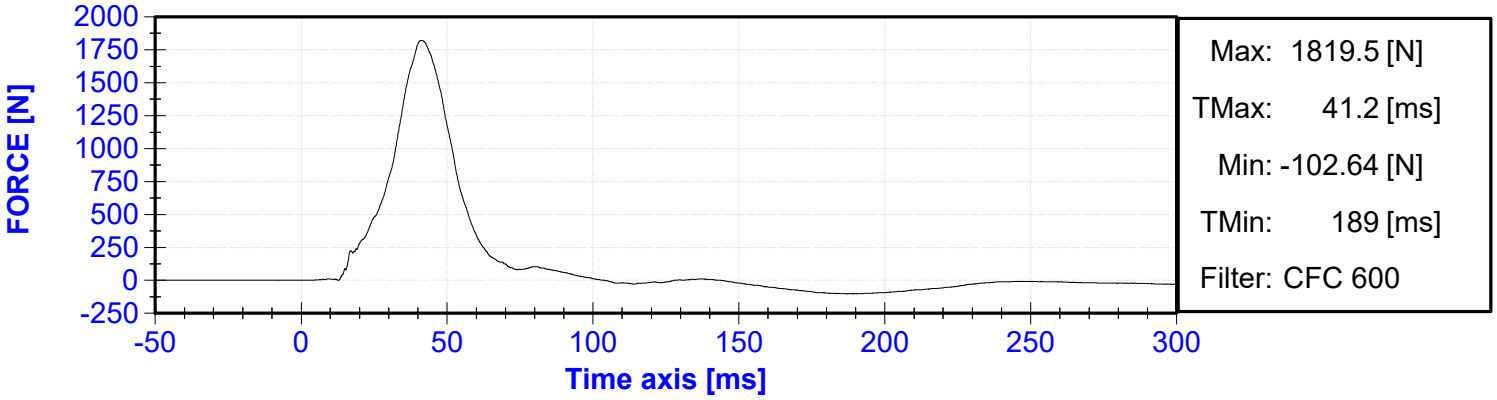
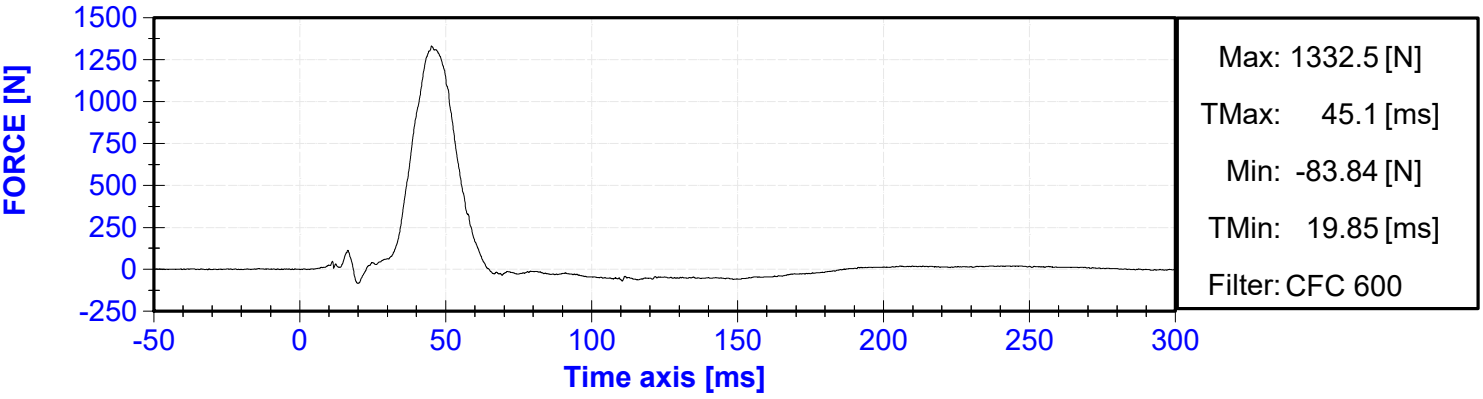
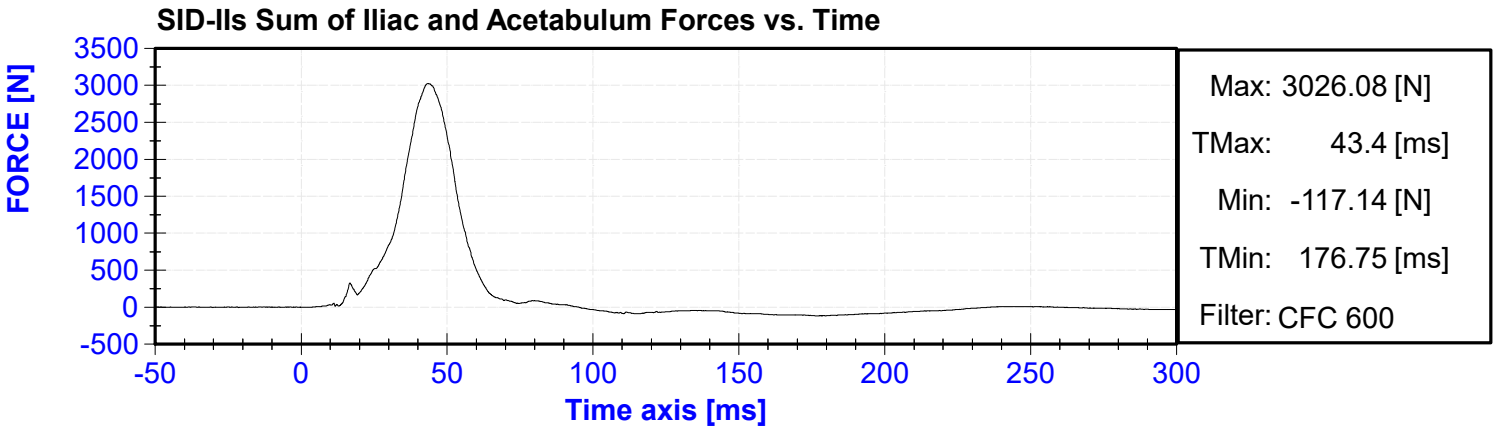


SID-IIs Iliac Force vs. Time




SID-IIs Sum of Iliac and Acetabulum Forces vs. Time
FORCE [N]
3500
3000
2500
2000
1500
1000
500
0
-500
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 3026.08 [N]
TMax: 43.4 [ms]
Min: -117.14 [N]
TMin: 176.75 [ms]
Filter: CFC 600

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VEHICLE AND MDB ACCELEROMETER RESPONSE DATA

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33	Left A-Post Lower(Y) Velocity vs. Time	IV-12
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56	MDB Rear (Y) Acceleration vs. Time	IV-17
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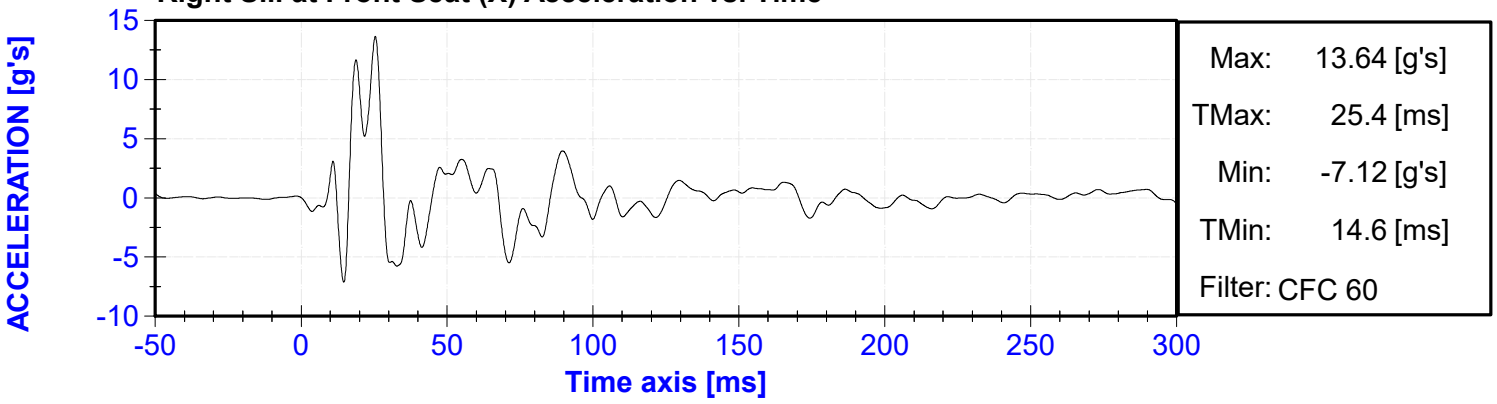
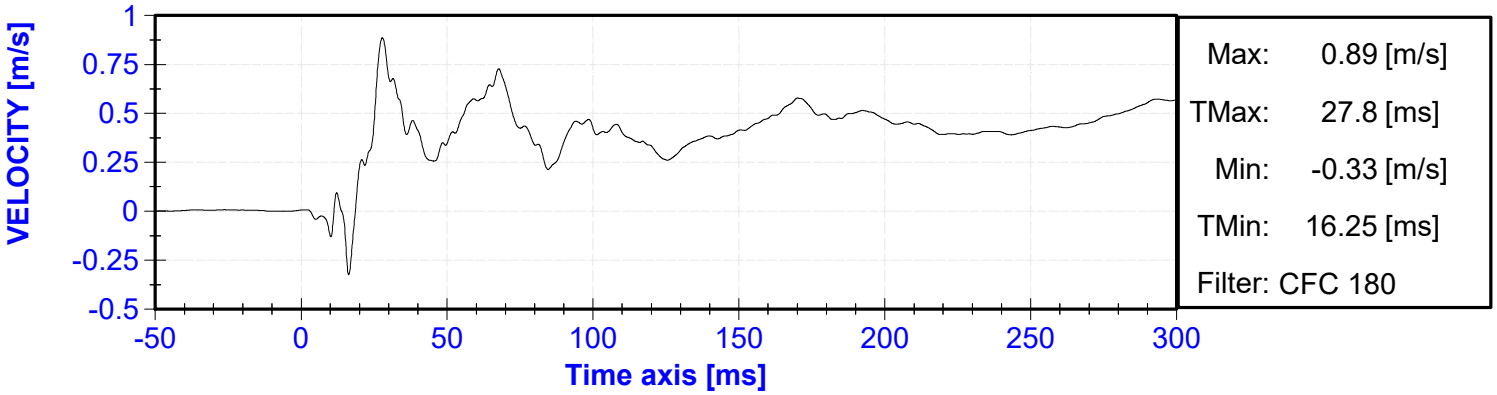
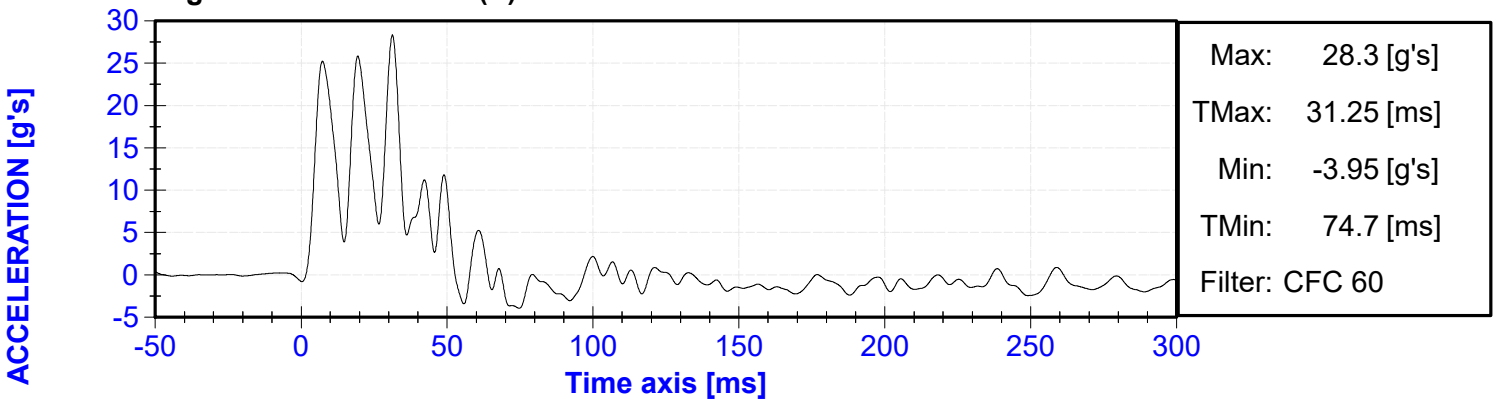
Right Sill at Front Seat (X) Acceleration vs. Time



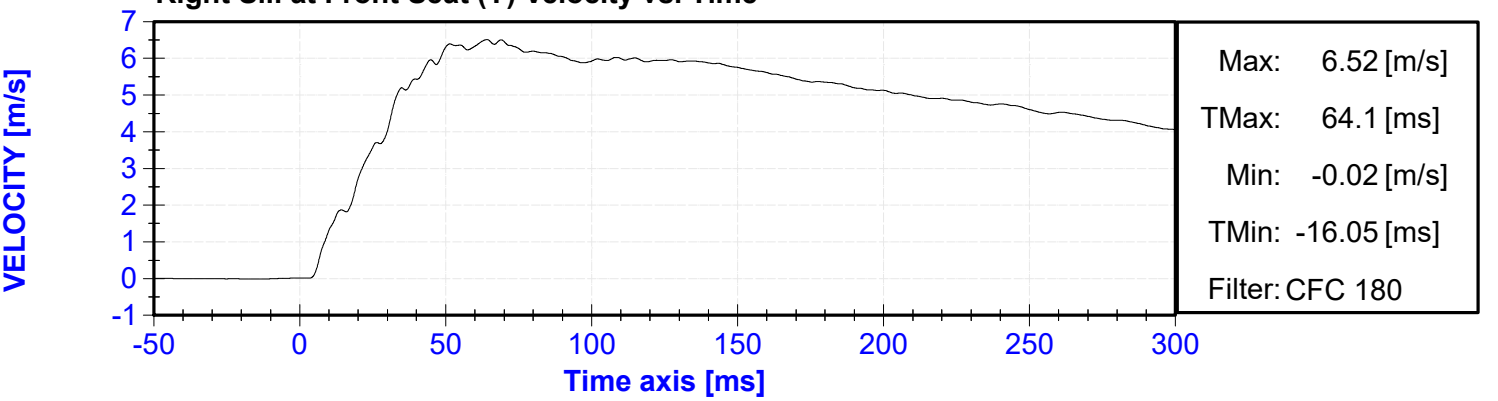
Right Sill at Front Seat (X) Velocity vs. Time



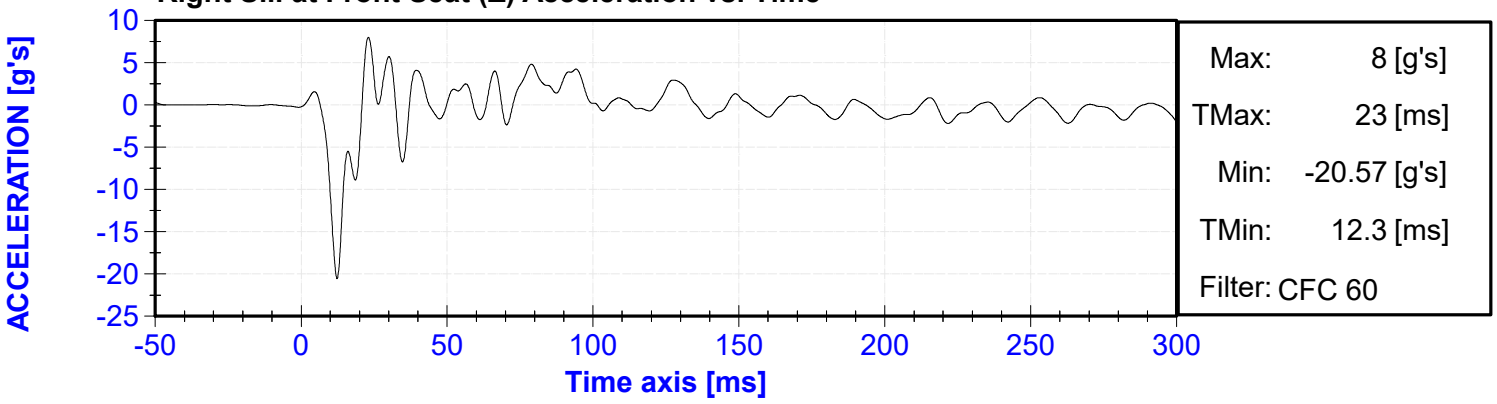
Right Sill at Front Seat (Y) Acceleration vs. Time



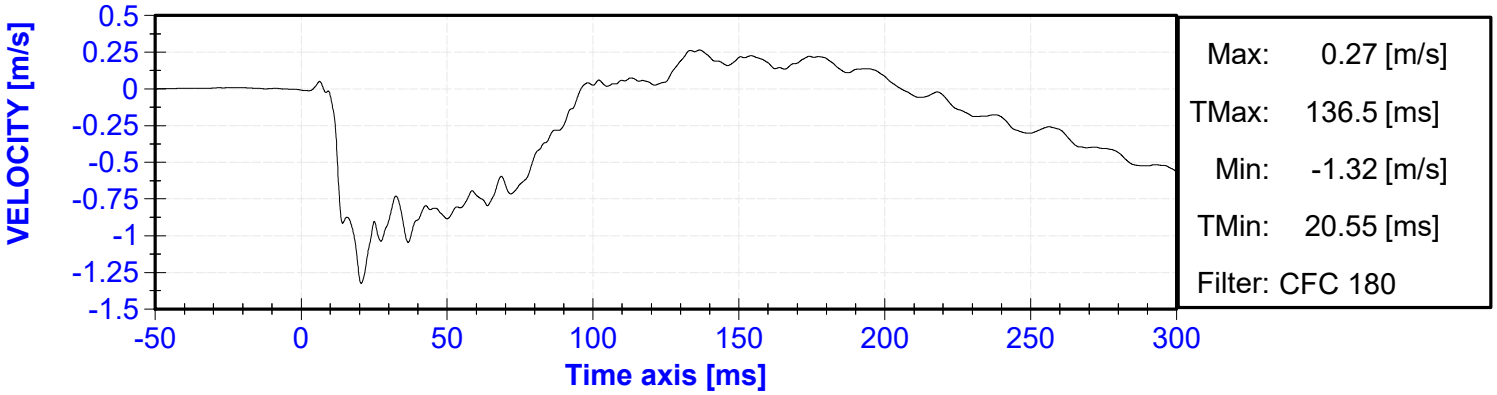
Right Sill at Front Seat (Y) Velocity vs. Time



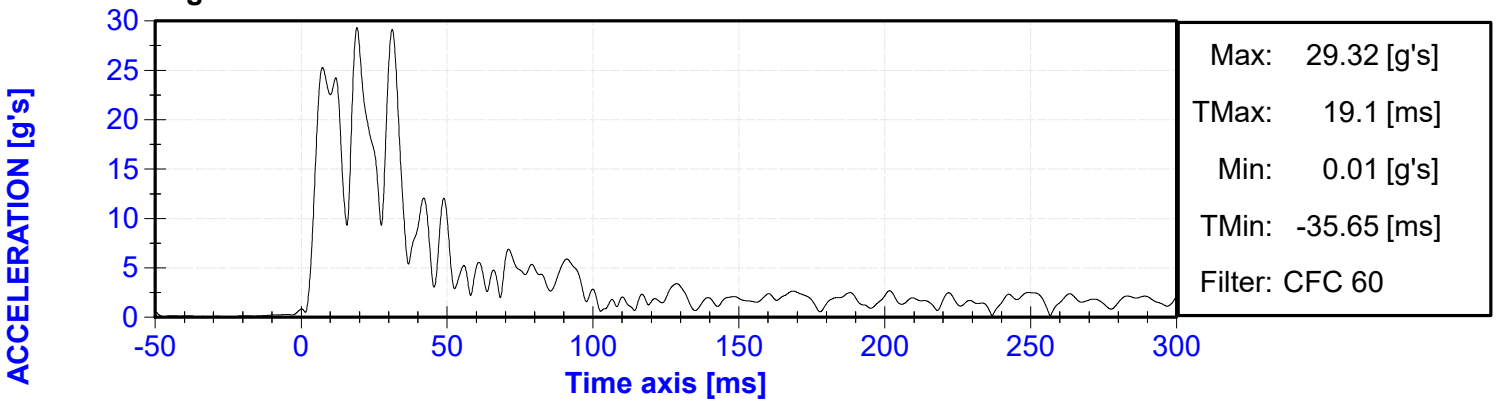
Right Sill at Front Seat (Z) Acceleration vs. Time



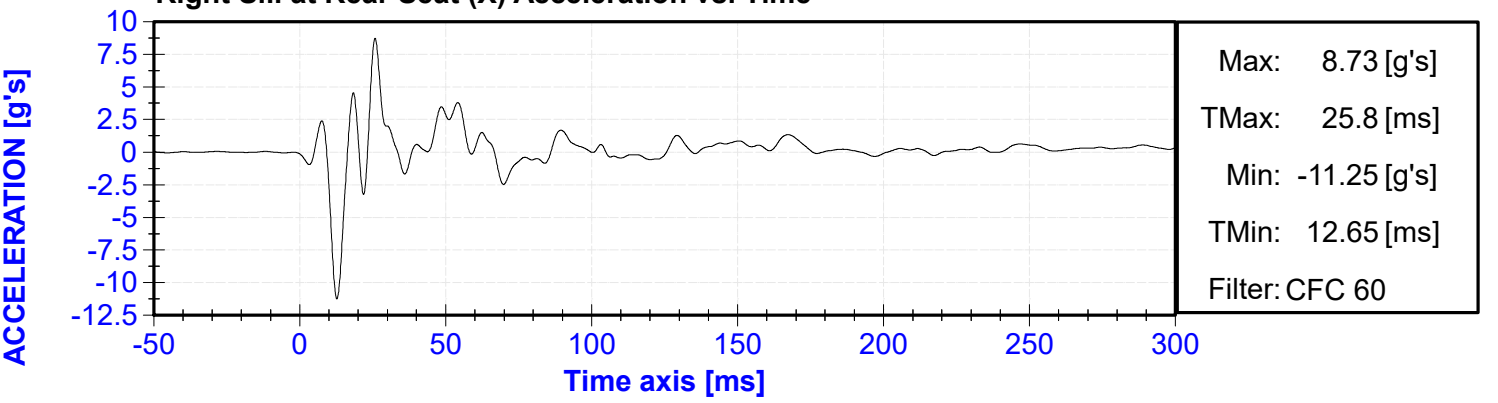
Right Sill at Front Seat (Z) Velocity vs. Time



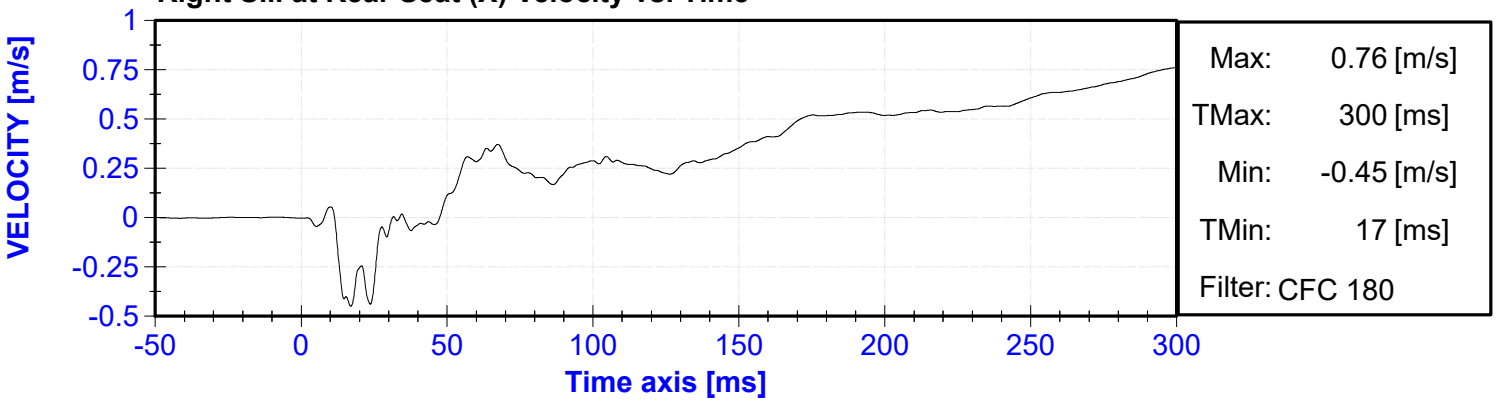
Right Sill at Front Seat Resultant vs. Time



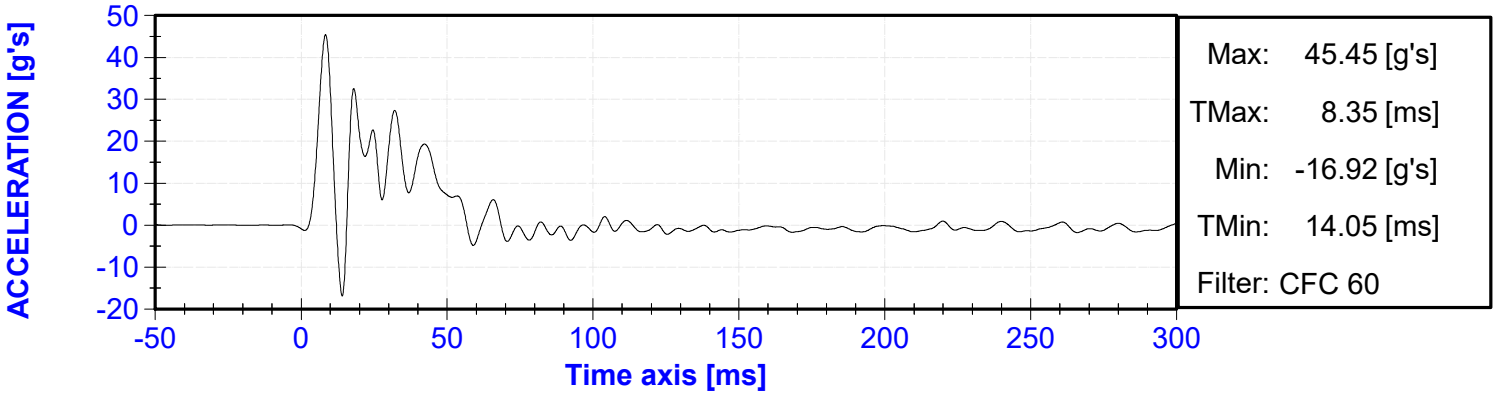
Right Sill at Rear Seat (X) Acceleration vs. Time



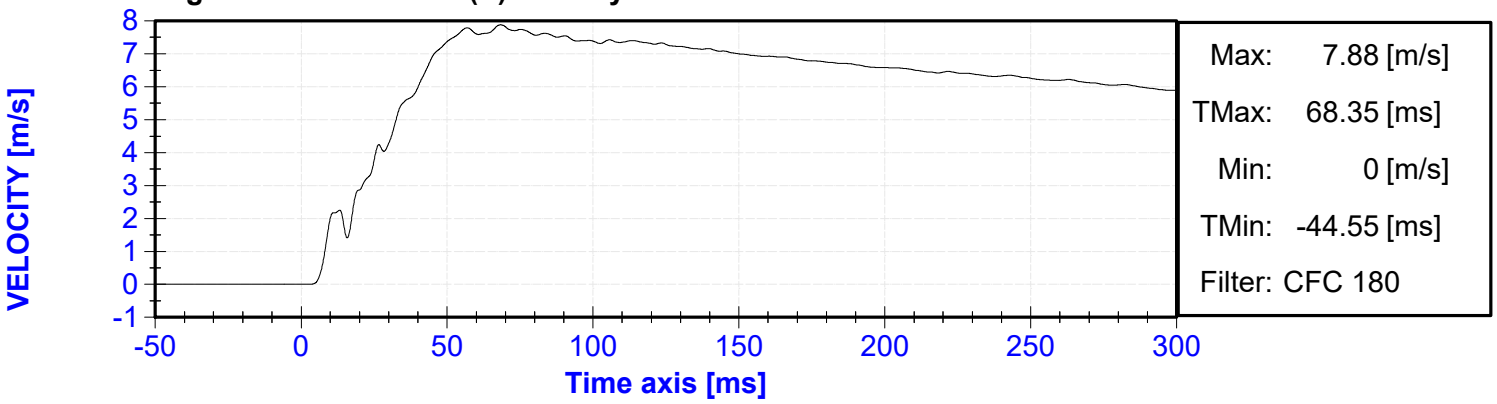
Right Sill at Rear Seat (X) Velocity vs. Time



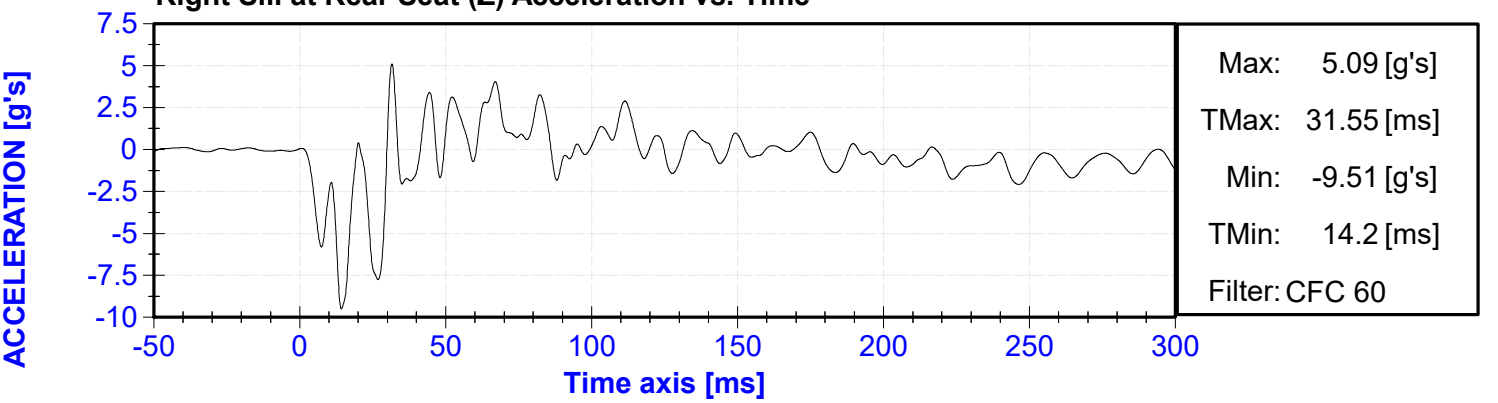
Right Sill at Rear Seat (Y) Acceleration vs. Time



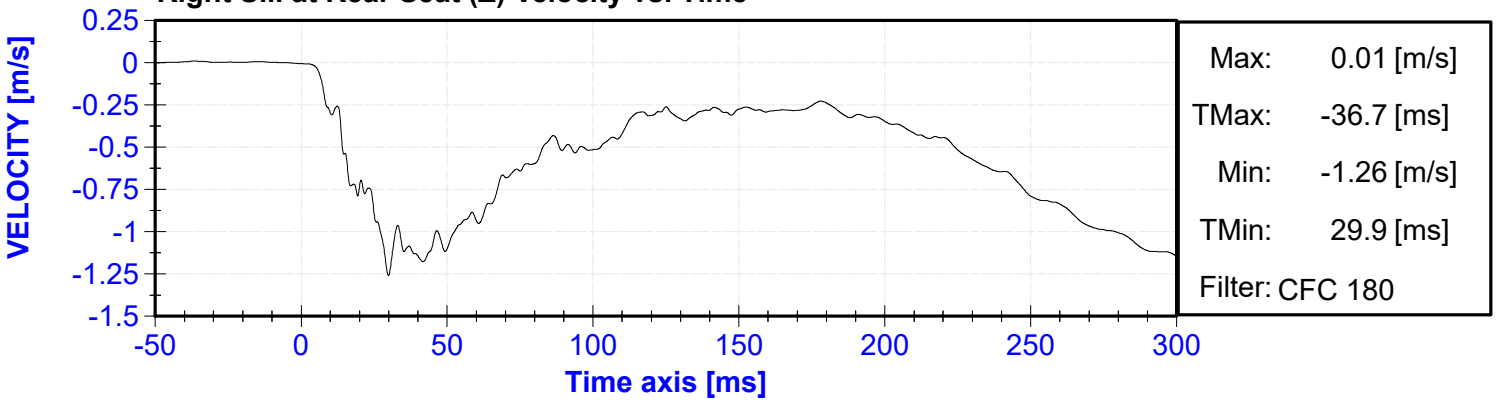
Right Sill at Rear Seat (Y) Velocity vs. Time



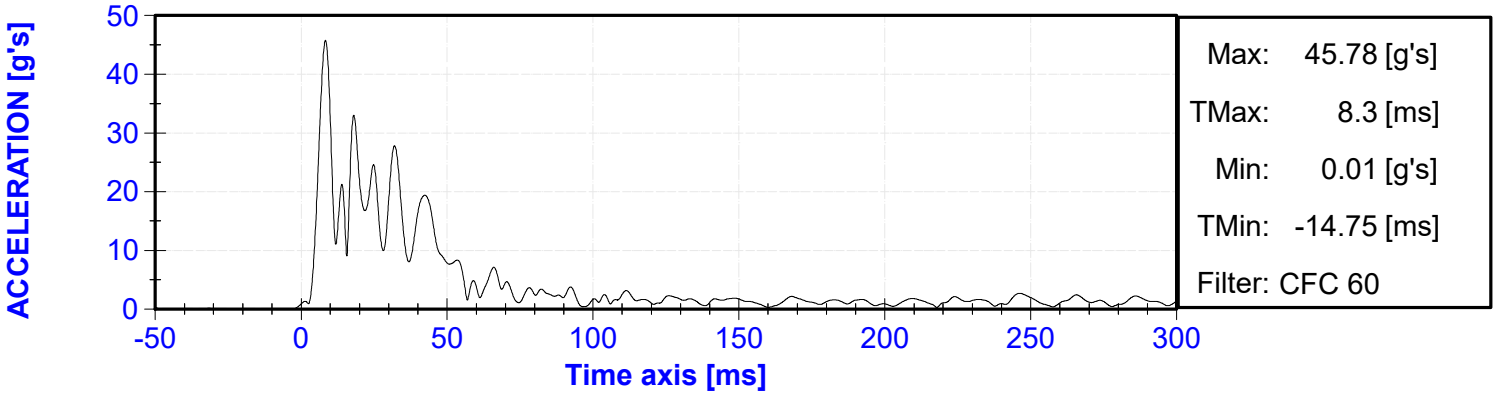
Right Sill at Rear Seat (Z) Acceleration vs. Time



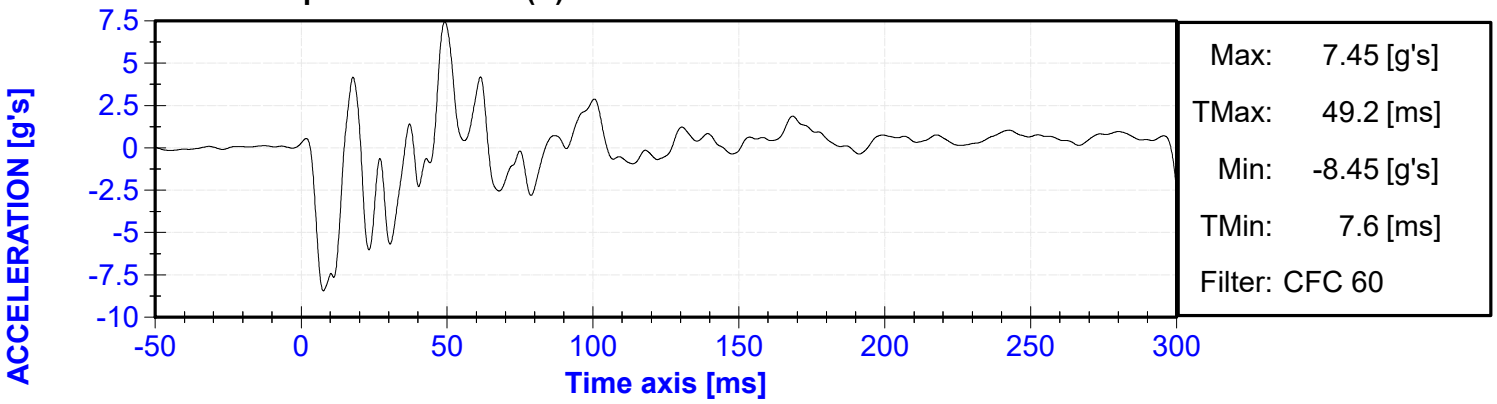
Right Sill at Rear Seat (Z) Velocity vs. Time



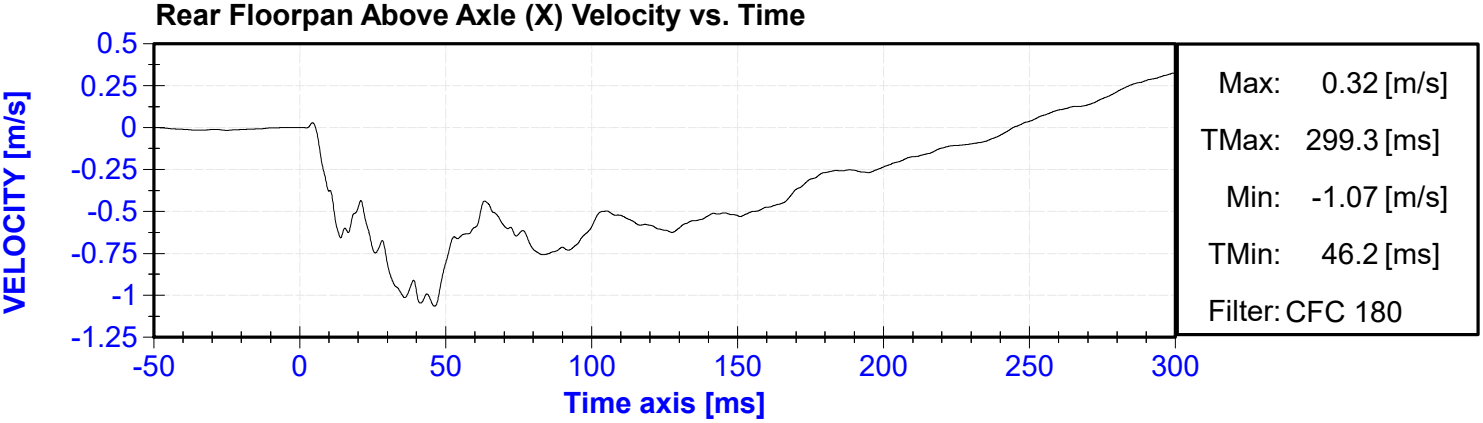
Right Sill at Rear Seat Resultant Acceleration vs. Time



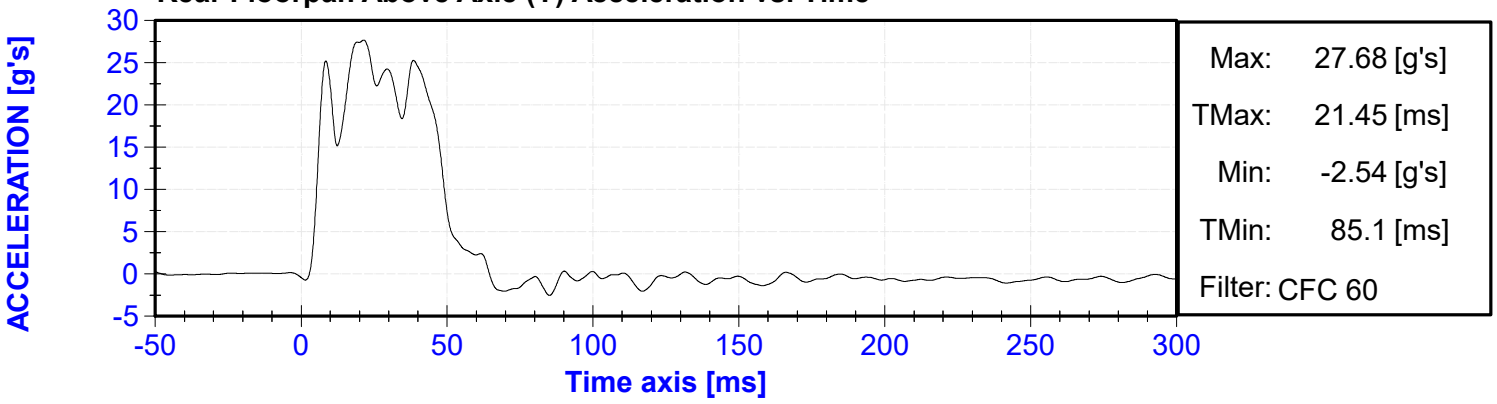
Rear Floorpan Above Axle (X) Acceleration vs. Time



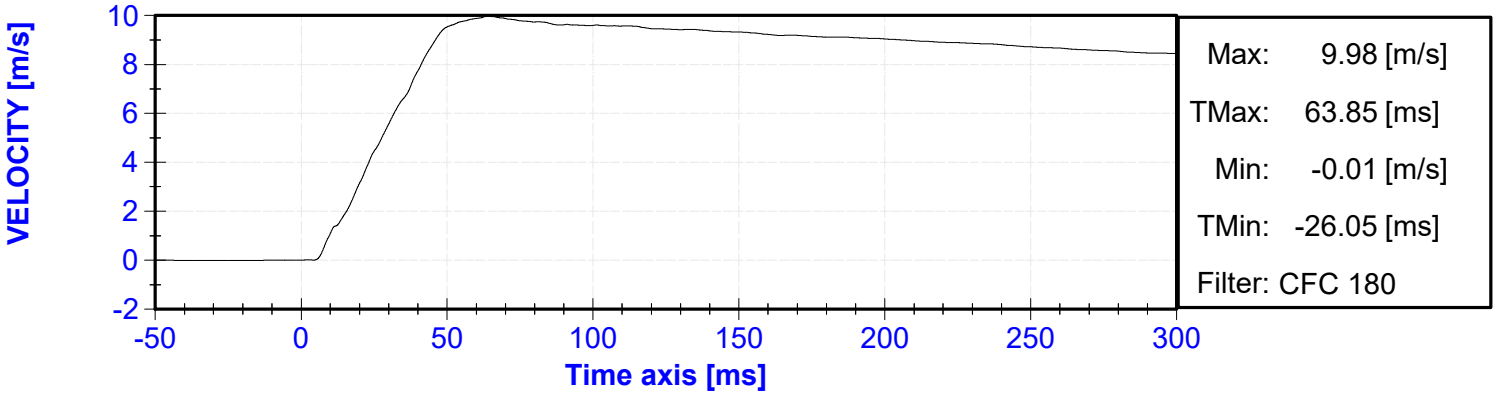
Rear Floorpan Above Axle (X) Velocity vs. Time



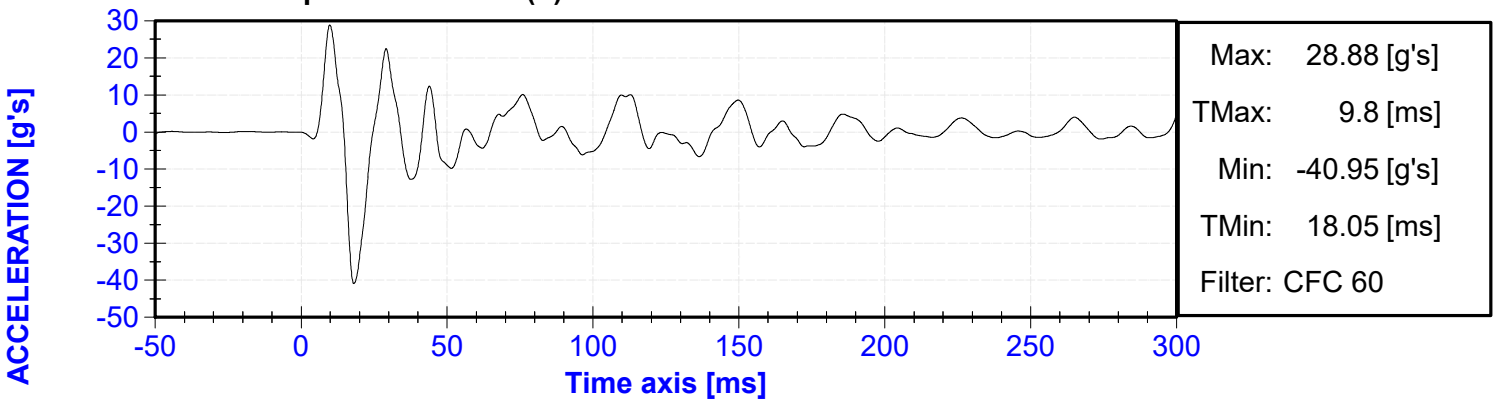
Rear Floorpan Above Axle (Y) Acceleration vs. Time



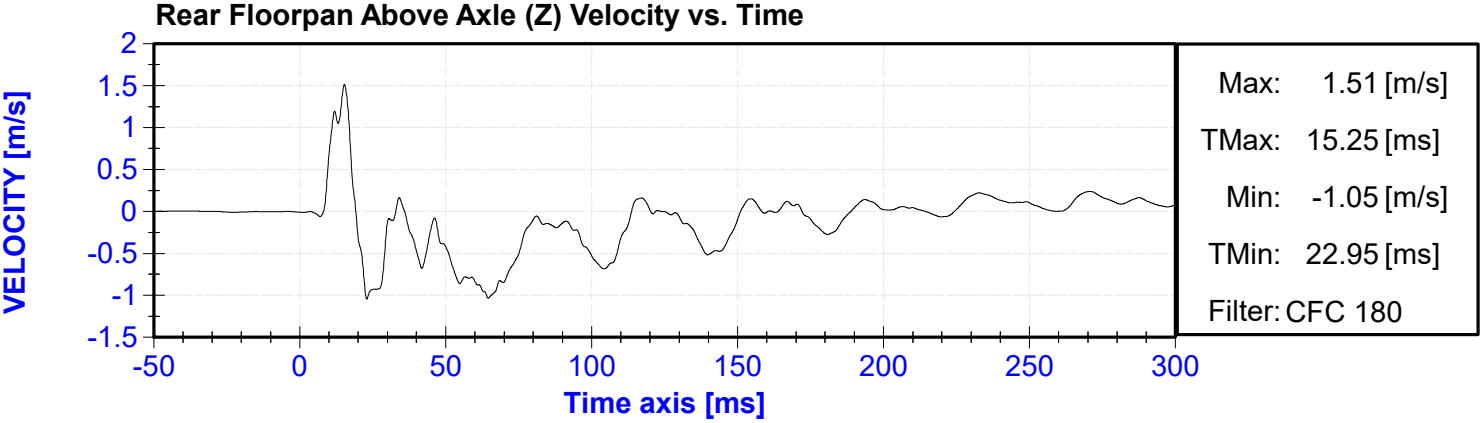
Rear Floorpan Above Axle (Y) Velocity vs. Time



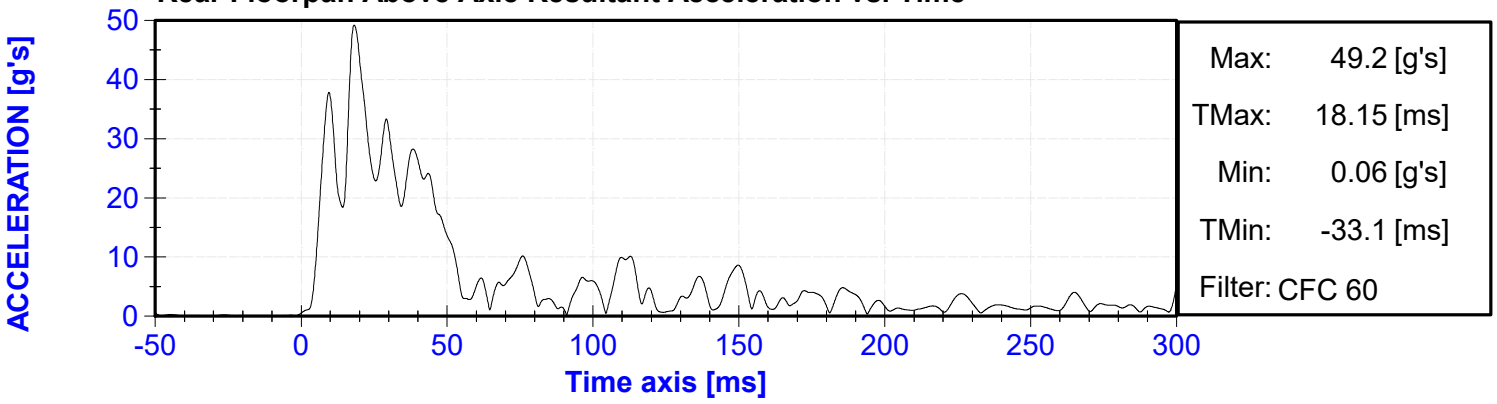
Rear Floorpan Above Axle (Z) Acceleration vs. Time



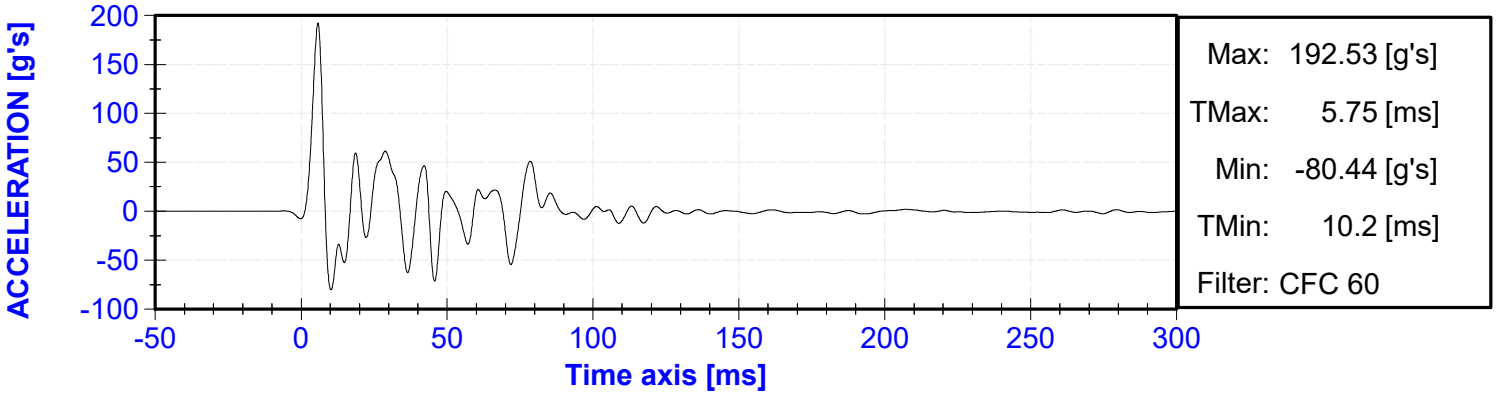
Rear Floorpan Above Axle (Z) Velocity vs. Time



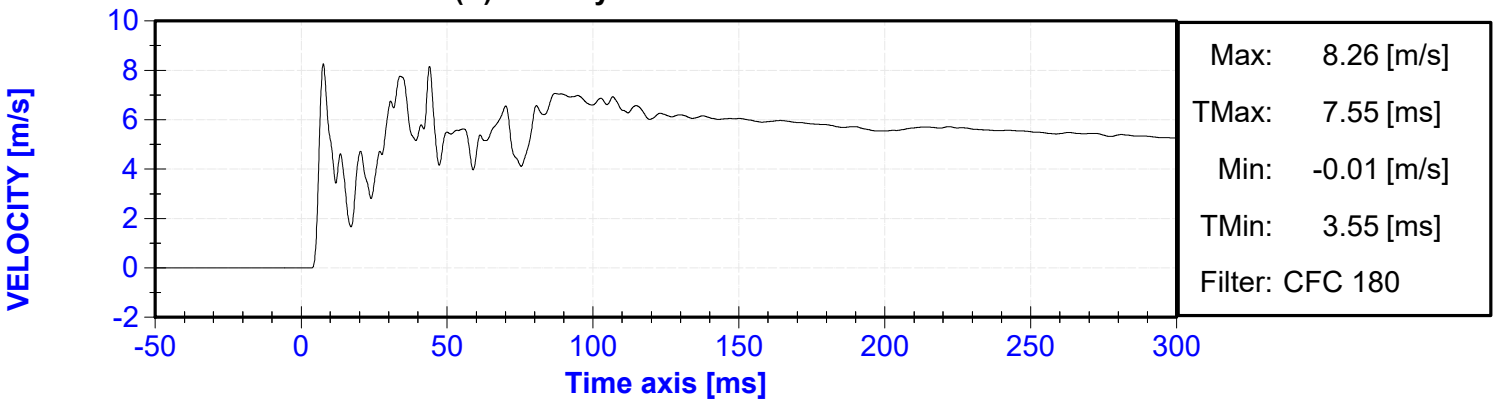
Rear Floorpan Above Axle Resultant Acceleration vs. Time



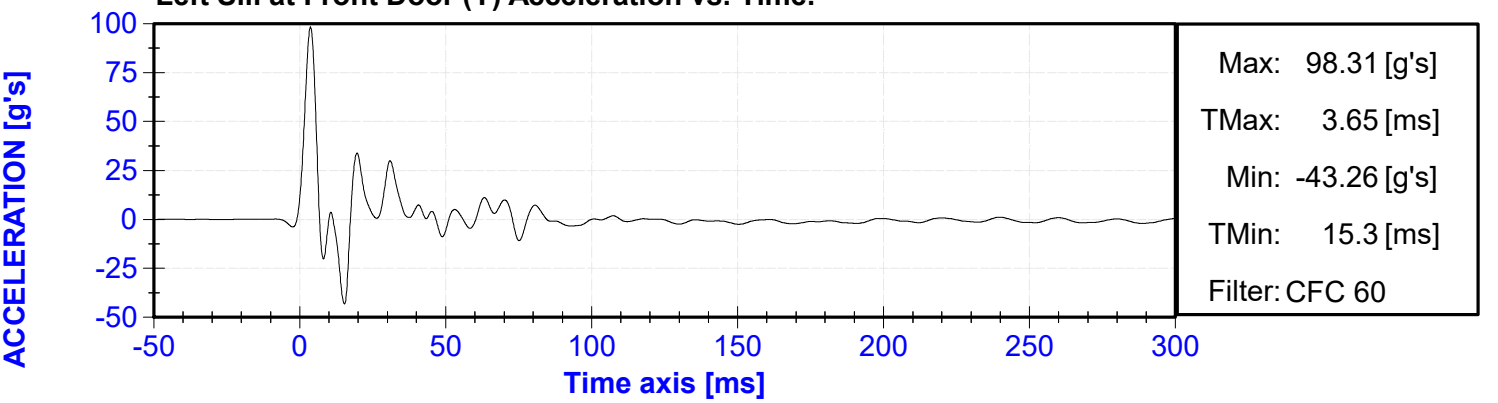
Left Sill at Rear Door (Y) Acceleration vs. Time



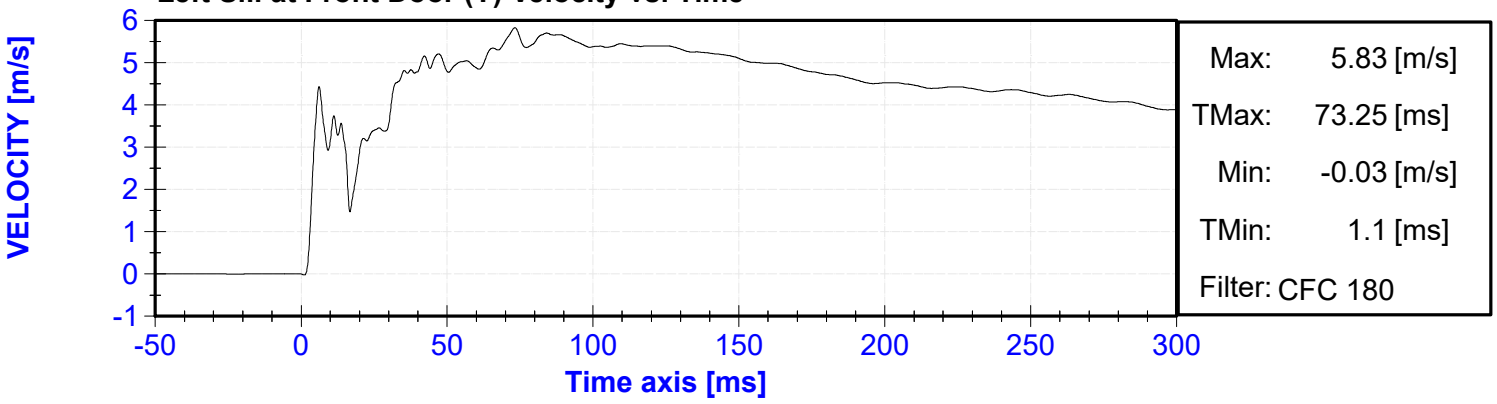
Left Sill at Rear Door (Y) Velocity vs. Time



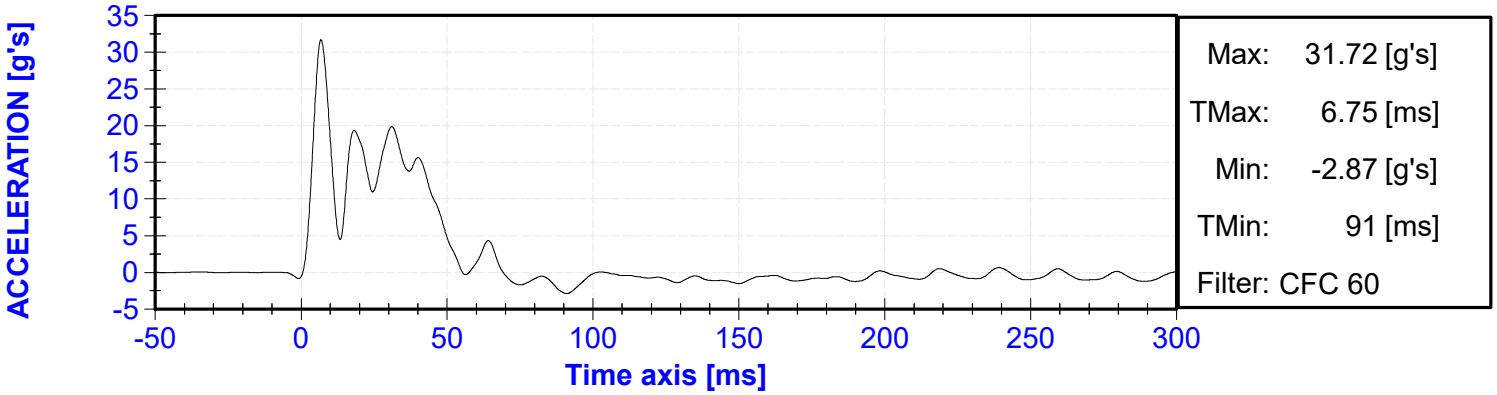
Left Sill at Front Door (Y) Acceleration vs. Time.



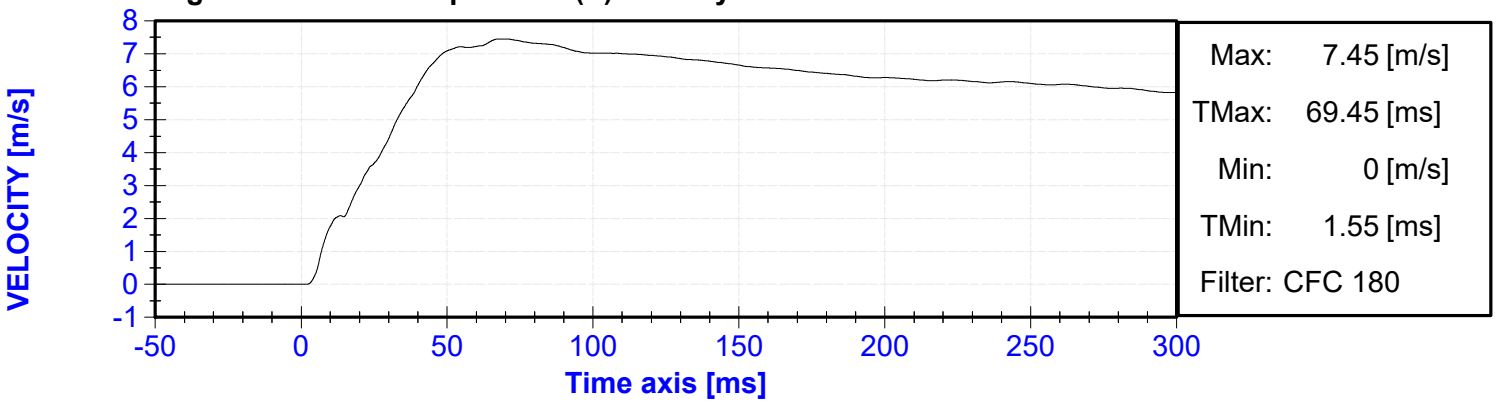
Left Sill at Front Door (Y) Velocity vs. Time



Right Rear Occ. Compartment(Y) Acceleration vs. Time

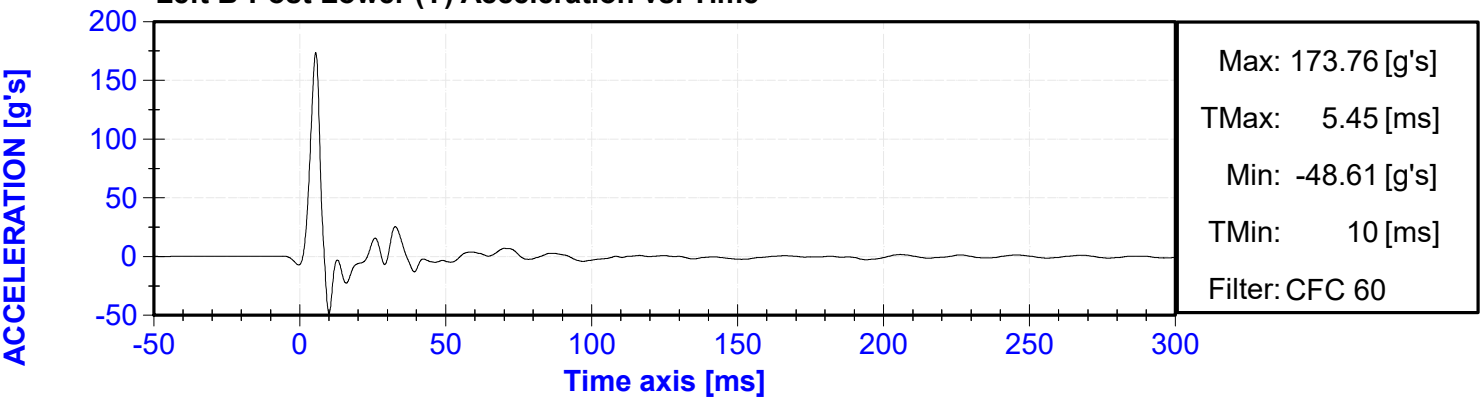


Right Rear Occ. Compartment(Y) Velocity vs. Time



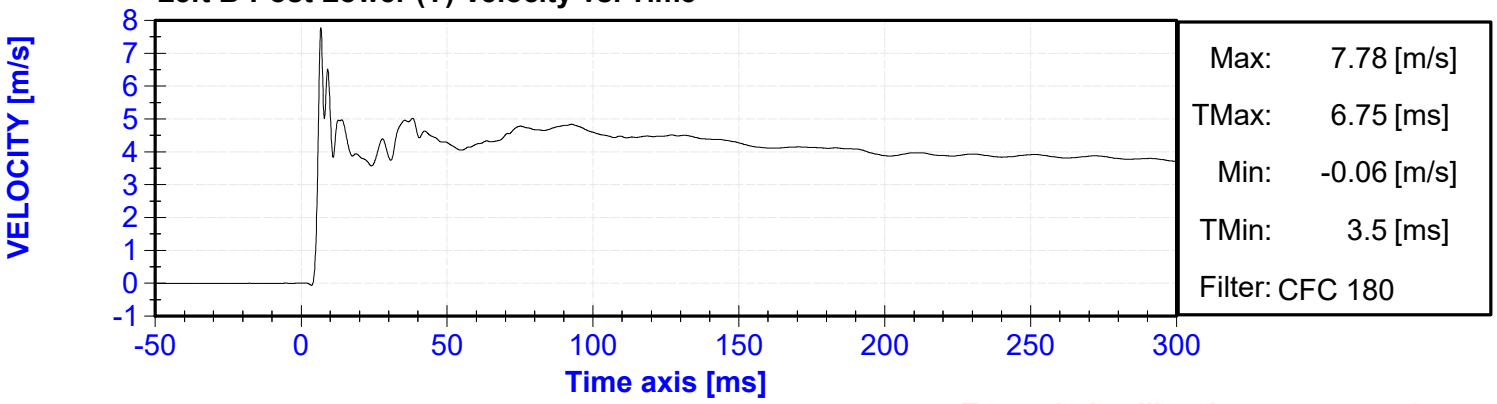
Questionable data spike at 7.2 ms

Left B-Post Lower (Y) Acceleration vs. Time



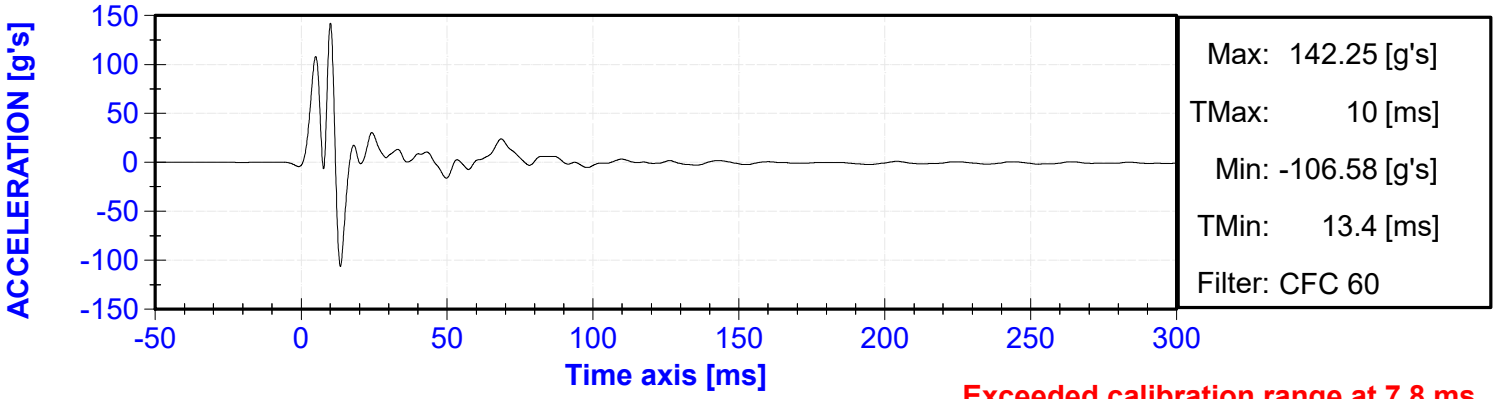
Questionable data spike at 7.2 ms

Left B-Post Lower (Y) Velocity vs. Time



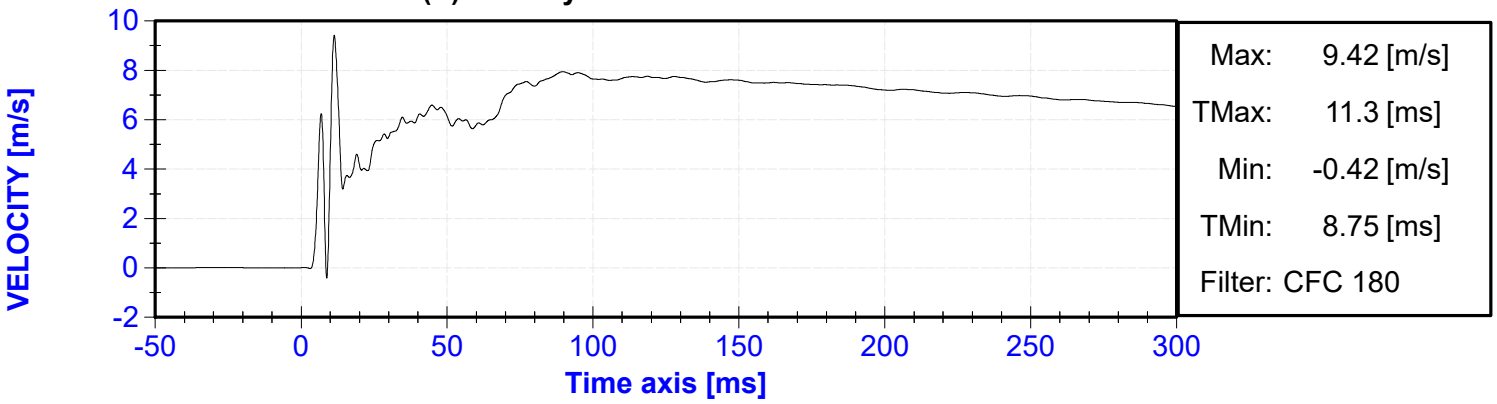
Exceeded calibration range at 7.8 ms

Left B-Post Middle (Y) Acceleration vs. Time

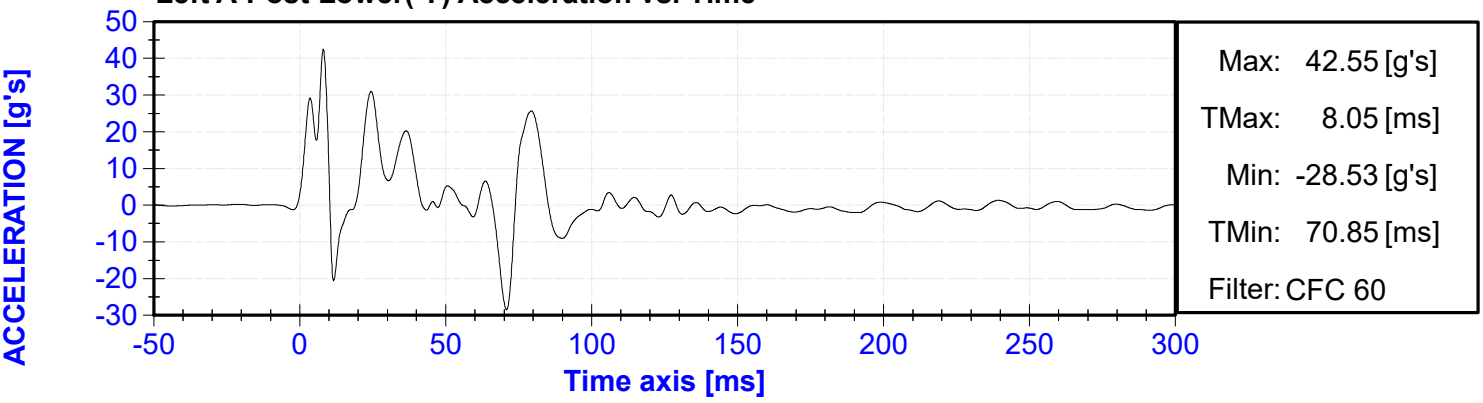


Exceeded calibration range at 7.8 ms

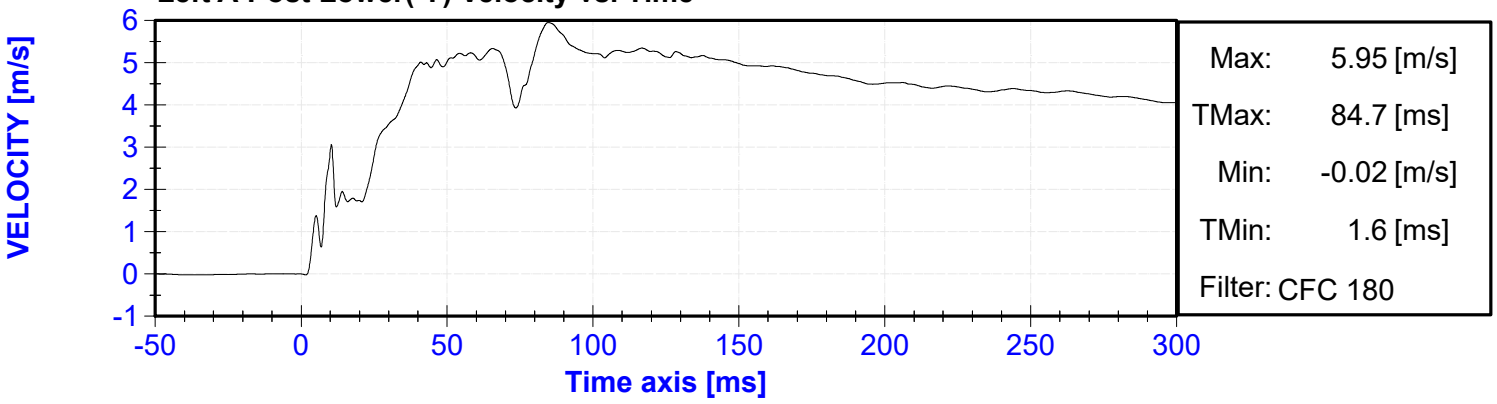
Left B-Post Middle (Y) Velocity vs. Time



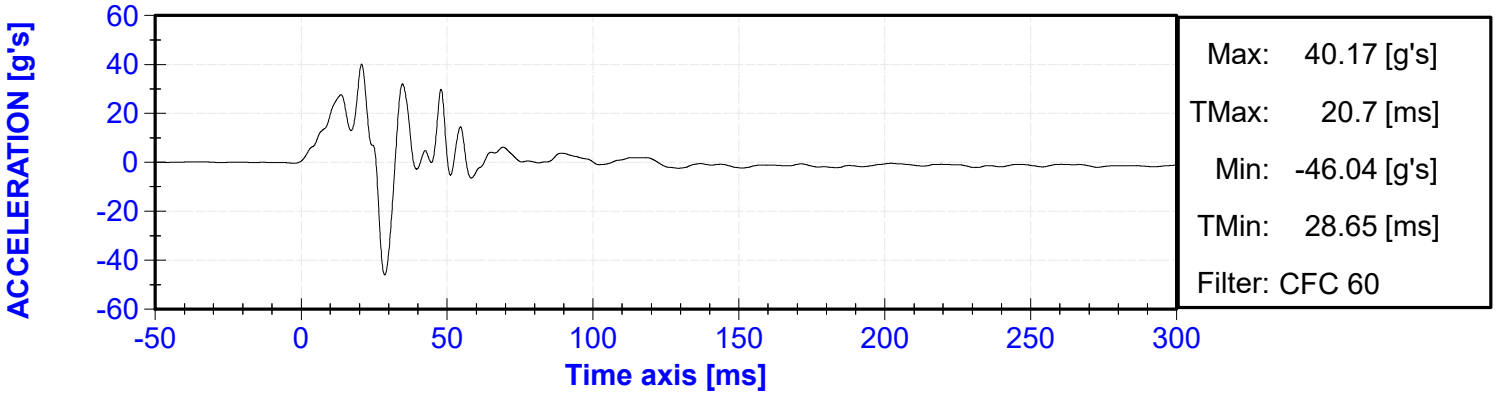
Left A-Post Lower(Y) Acceleration vs. Time



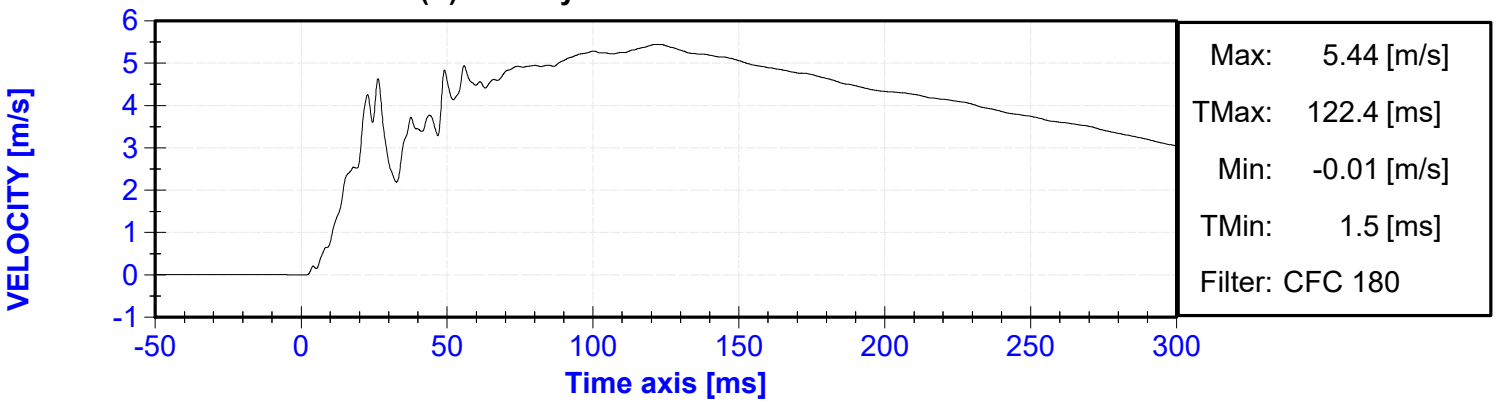
Left A-Post Lower(Y) Velocity vs. Time



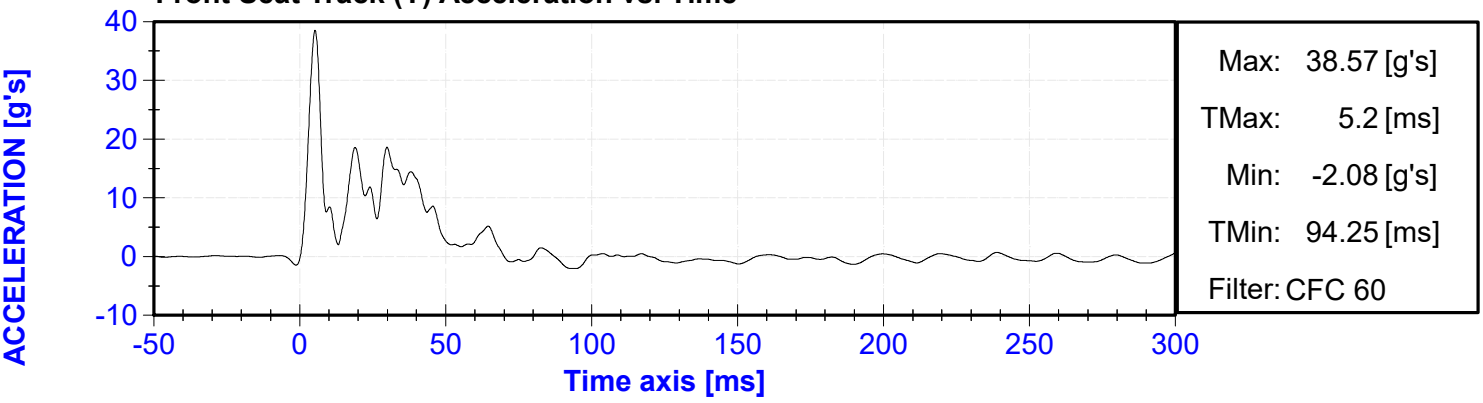
Left A-Post Middle (Y) Acceleration vs. Time



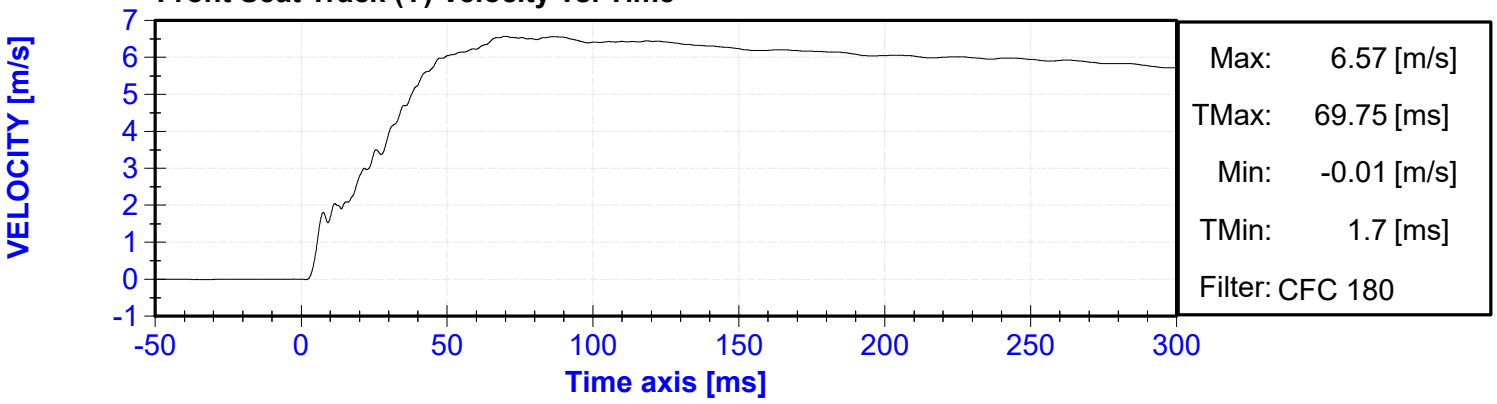
Left A-Post Middle (Y) Velocity vs. Time



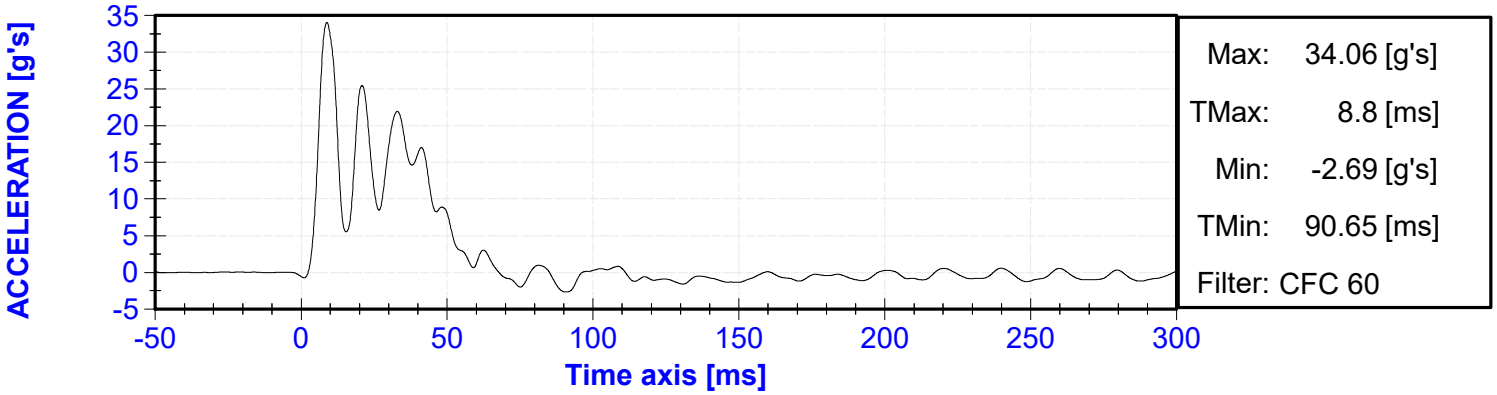
Front Seat Track (Y) Acceleration vs. Time



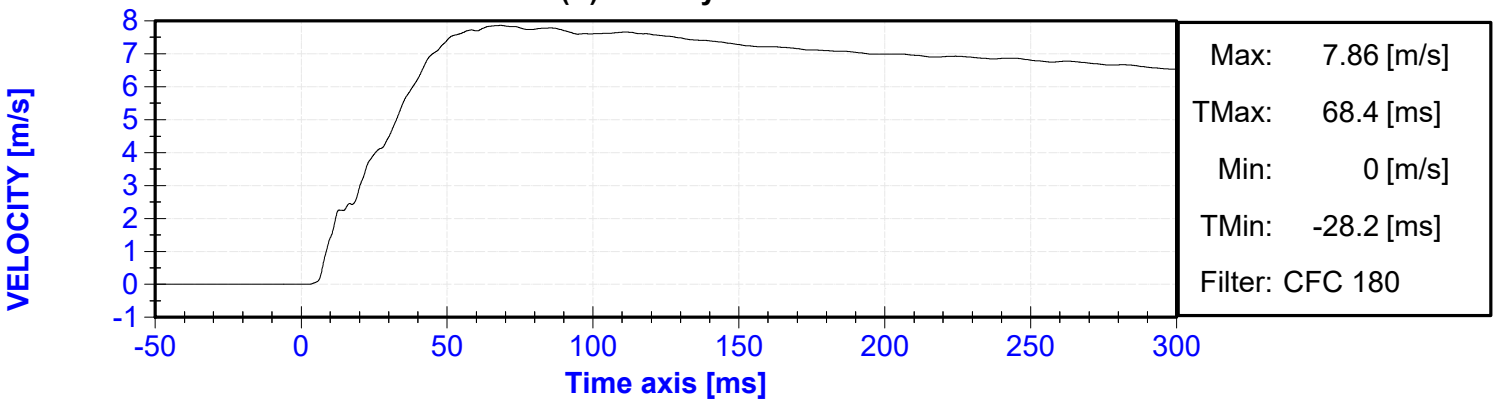
Front Seat Track (Y) Velocity vs. Time



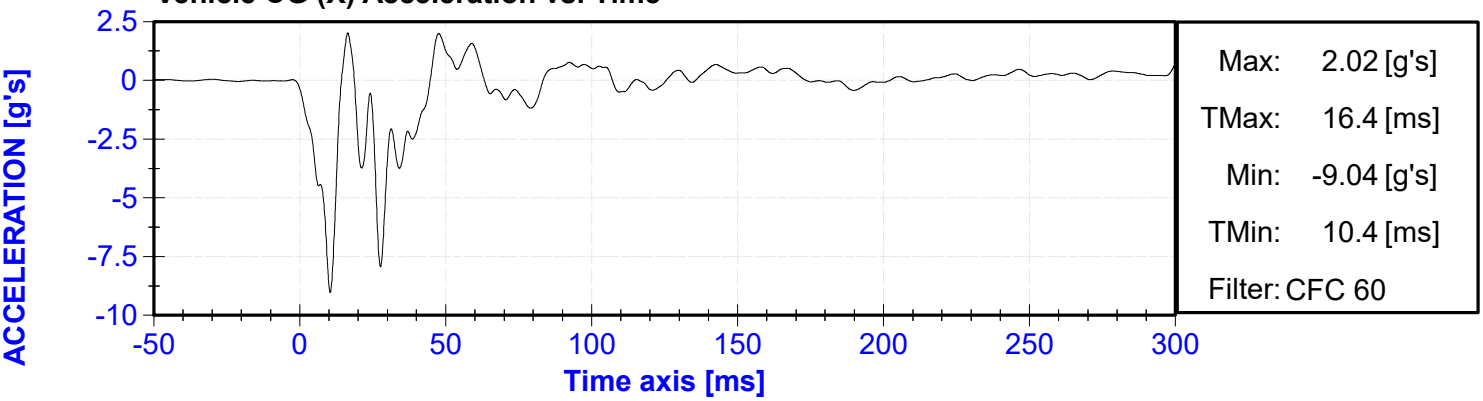
Rear Seat Track or Structure (Y) Acceleration vs. Time



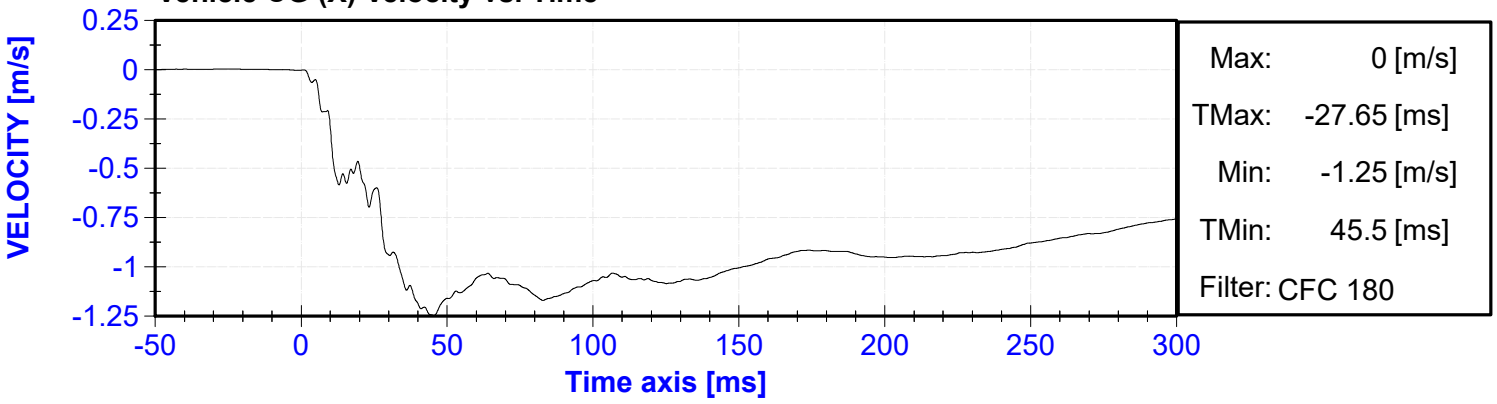
Rear Seat Track or Structure (Y) Velocity vs. Time



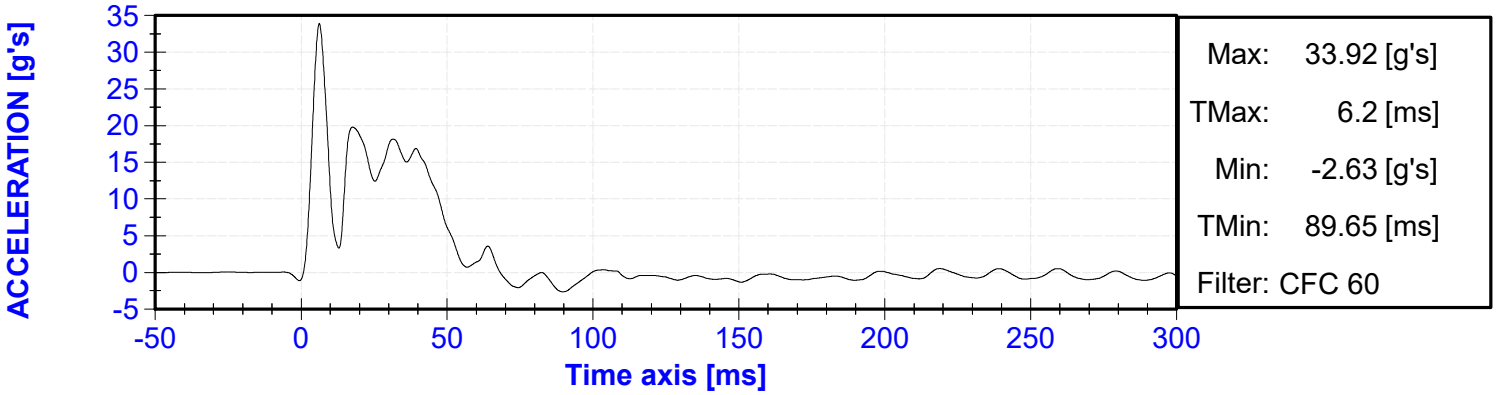
Vehicle CG (X) Acceleration vs. Time



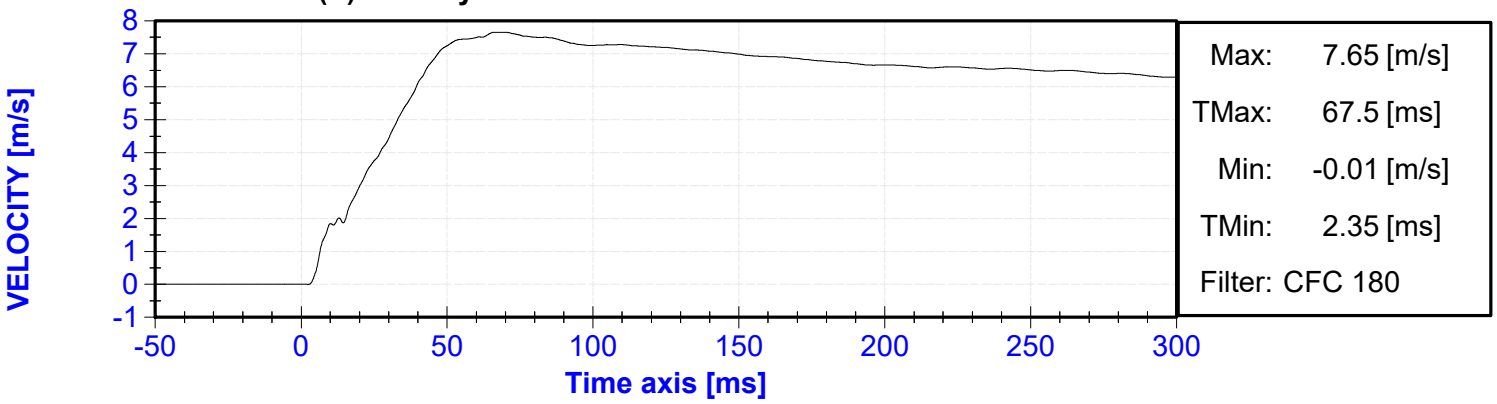
Vehicle CG (X) Velocity vs. Time



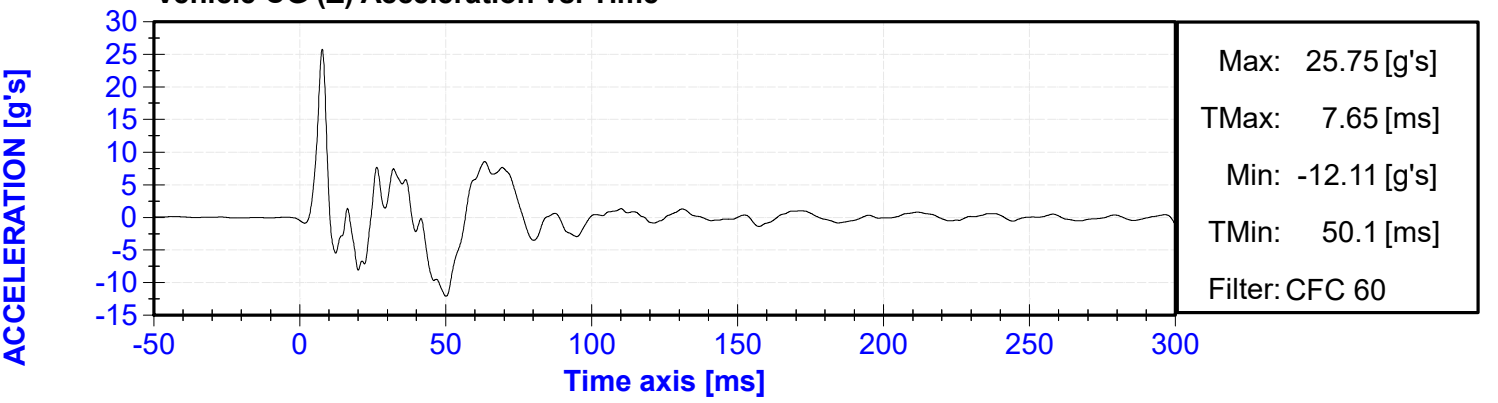
Vehicle CG (Y) Acceleration vs. Time



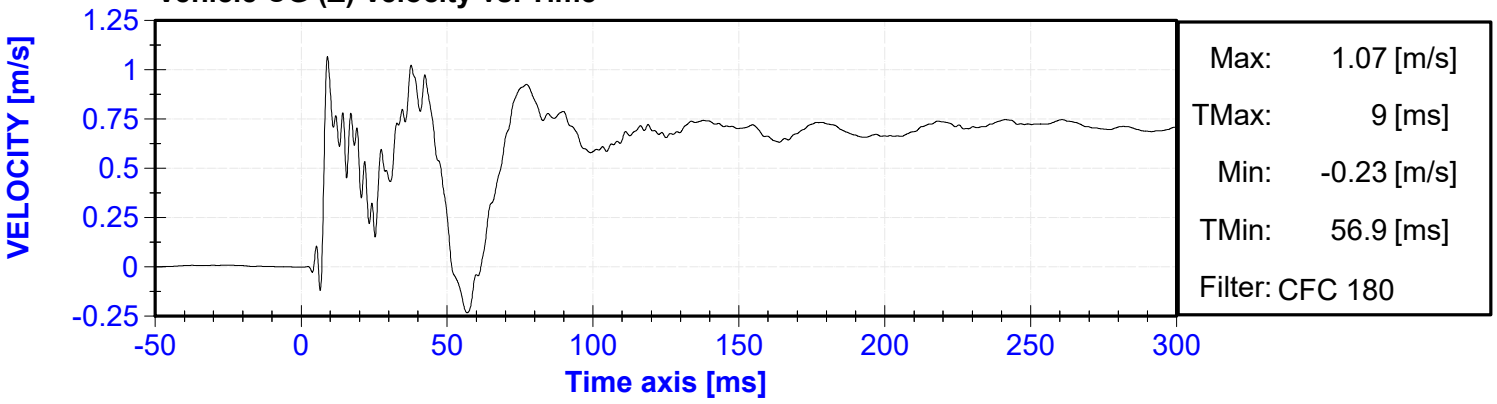
Vehicle CG (Y) Velocity vs. Time



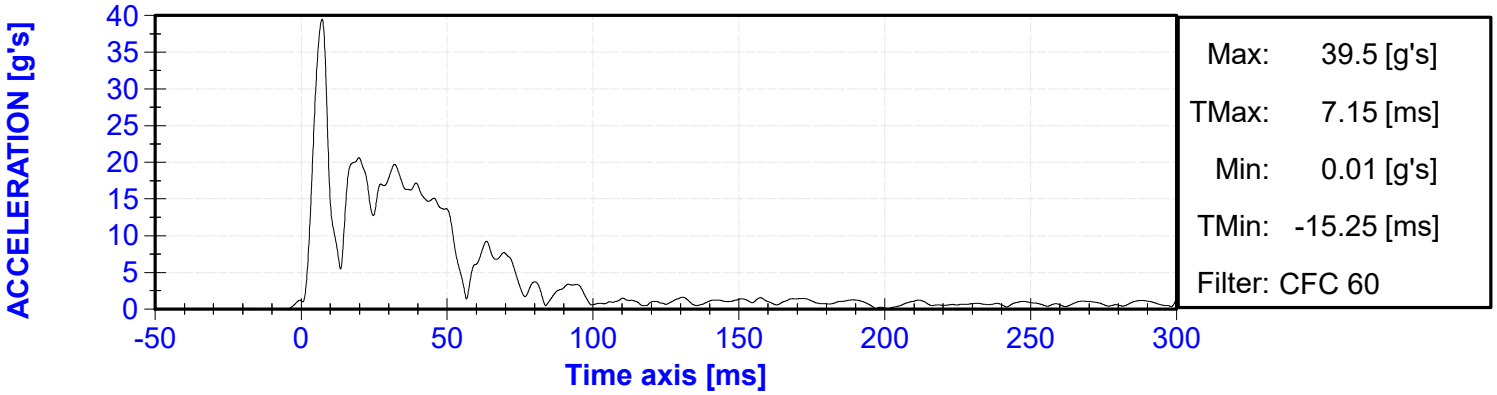
Vehicle CG (Z) Acceleration vs. Time



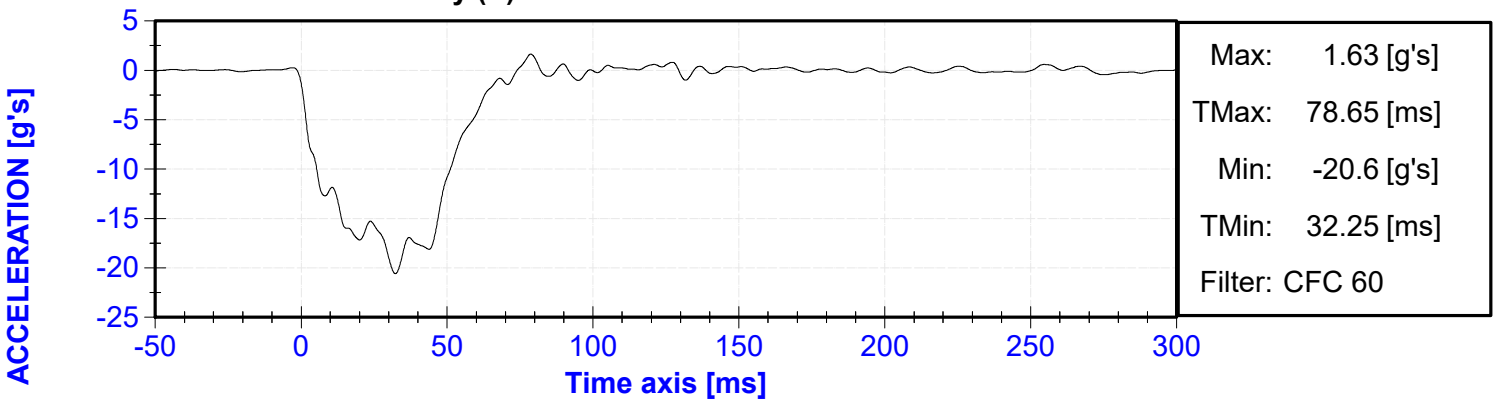
Vehicle CG (Z) Velocity vs. Time



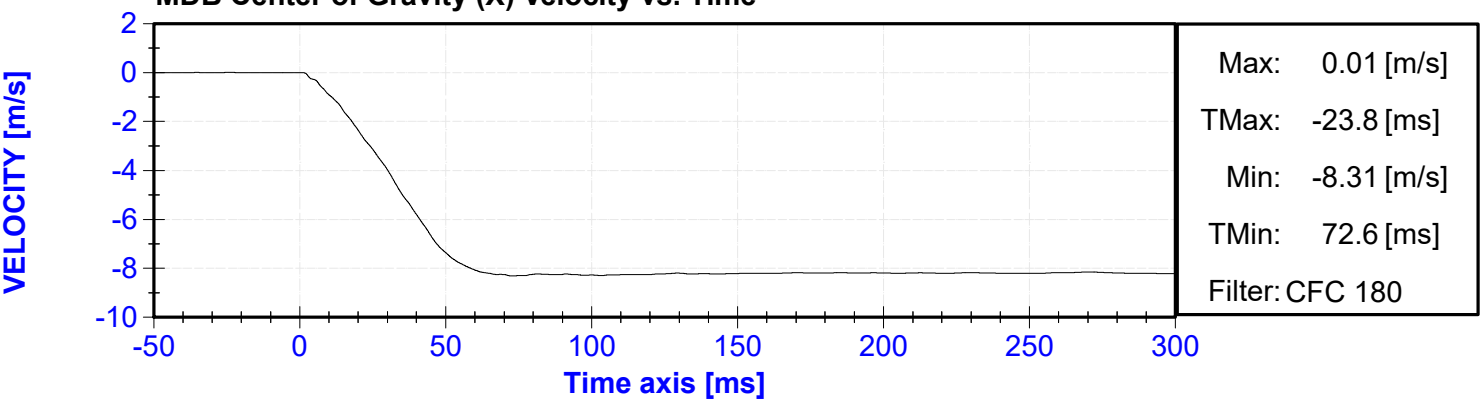
Vehicle CG Resultant Acceleration vs. Time



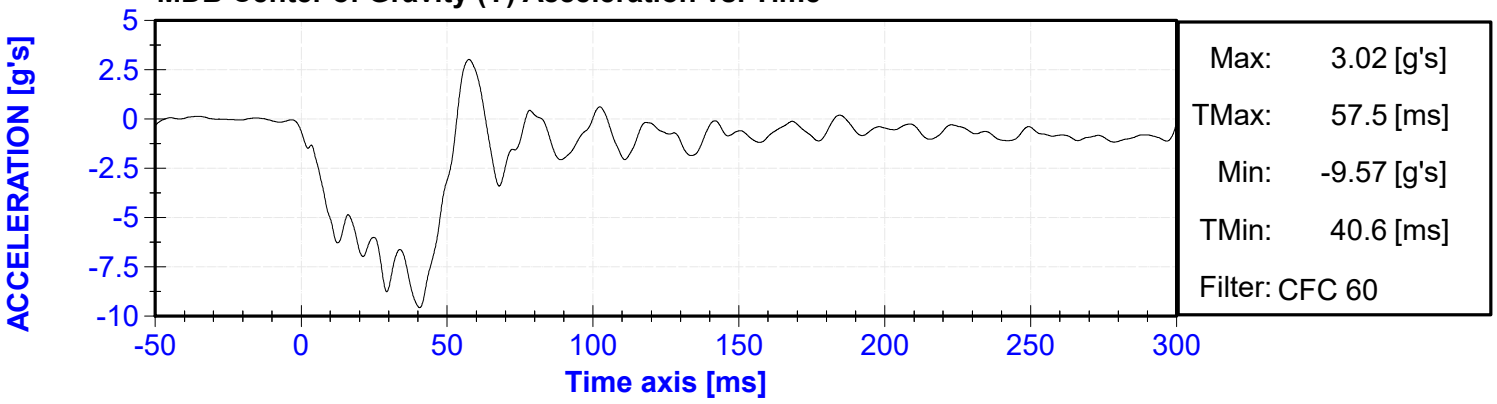
MDB Center of Gravity (X) Acceleration vs. Time



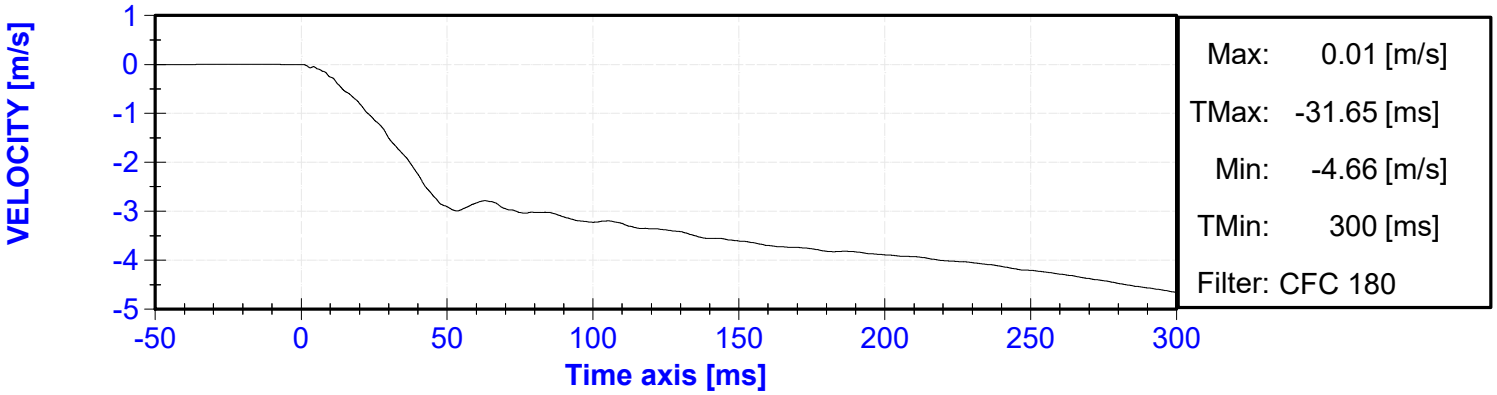
MDB Center of Gravity (X) Velocity vs. Time



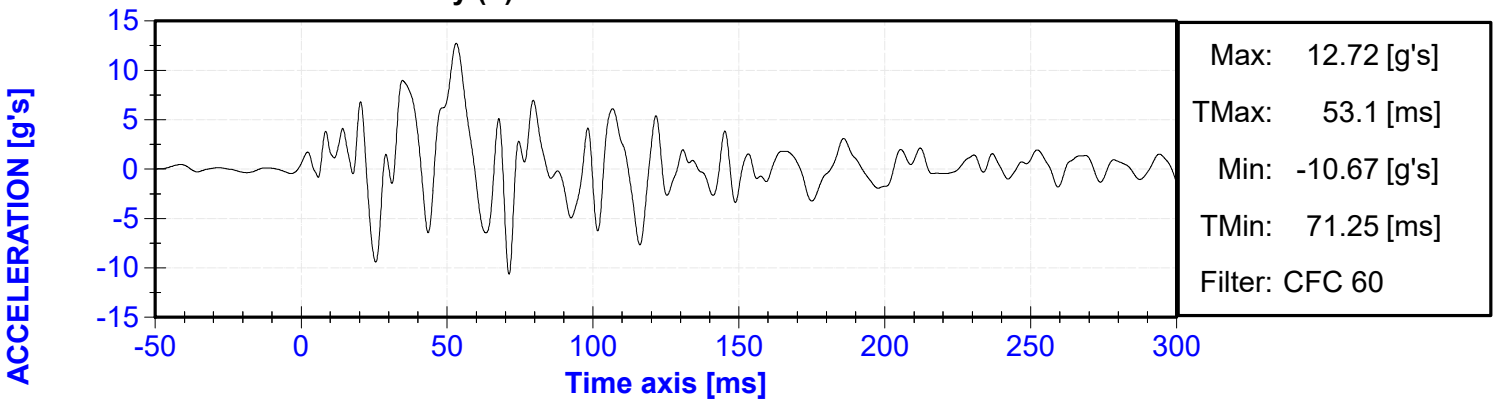
MDB Center of Gravity (Y) Acceleration vs. Time



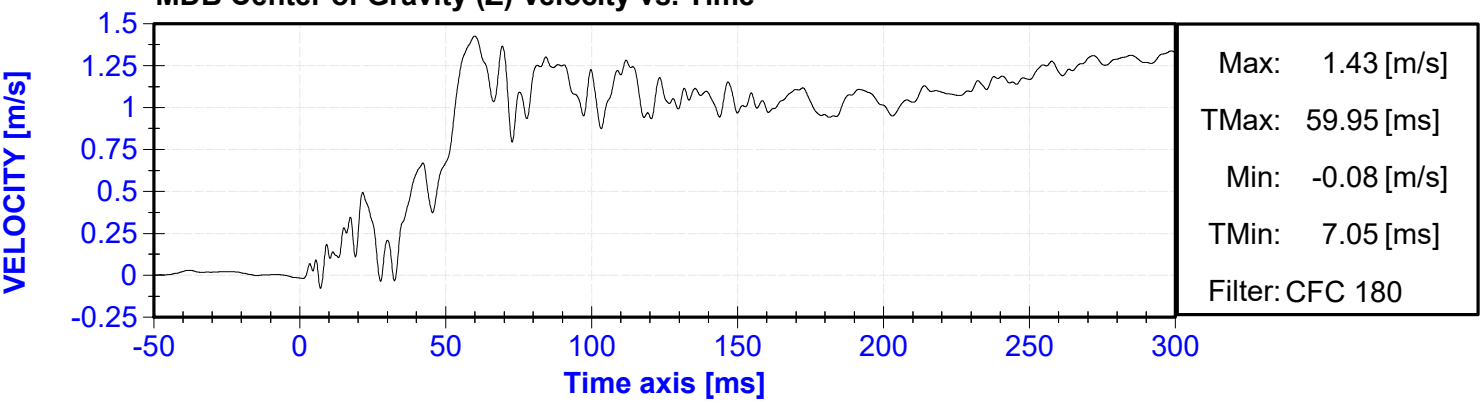
MDB Center of Gravity (Y) Velocity vs. Time



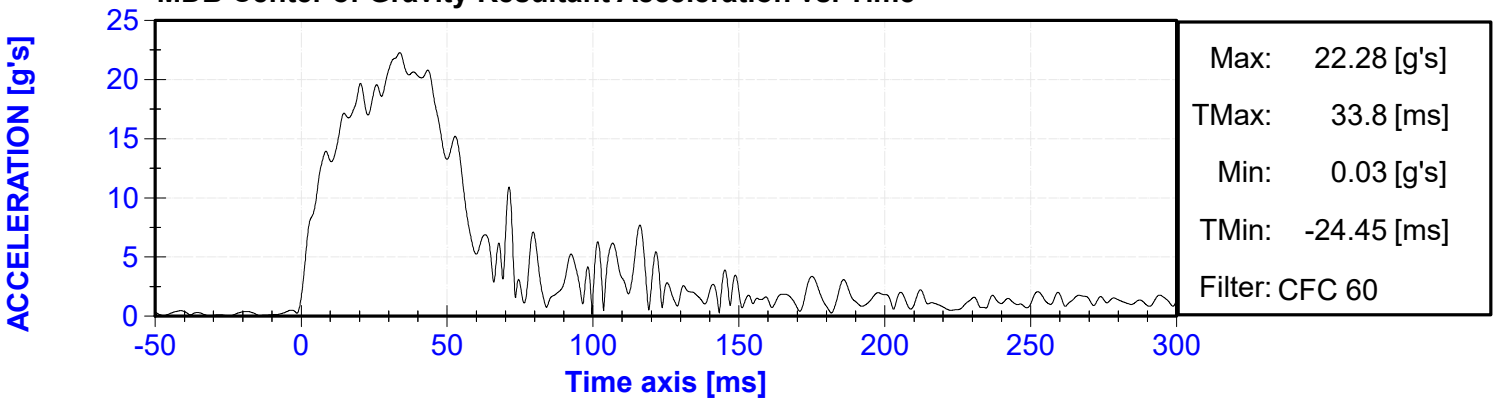
MDB Center of Gravity (Z) Acceleration vs. Time



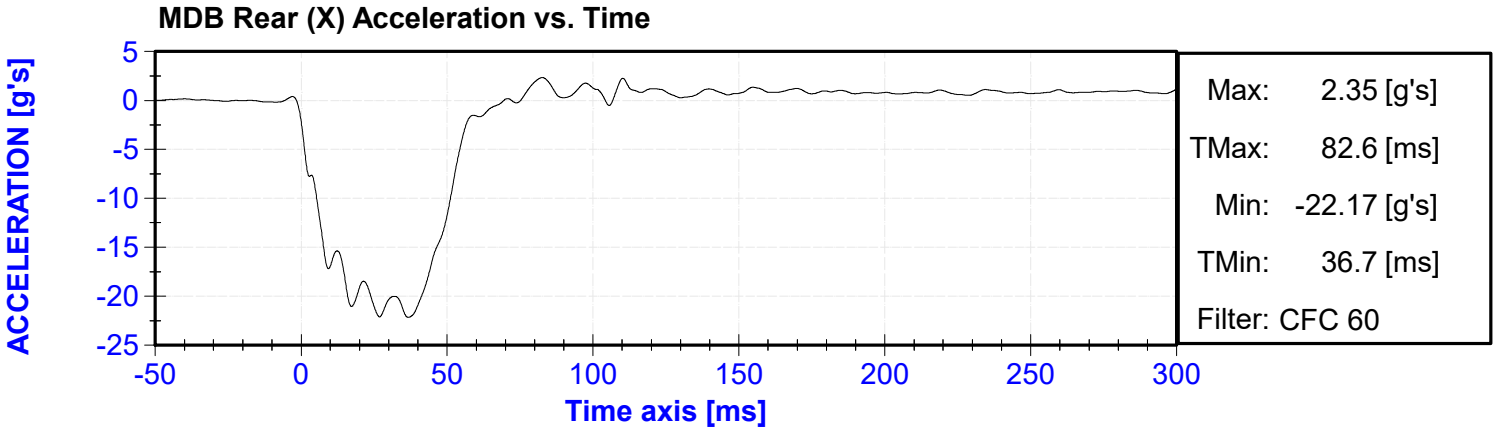
MDB Center of Gravity (Z) Velocity vs. Time



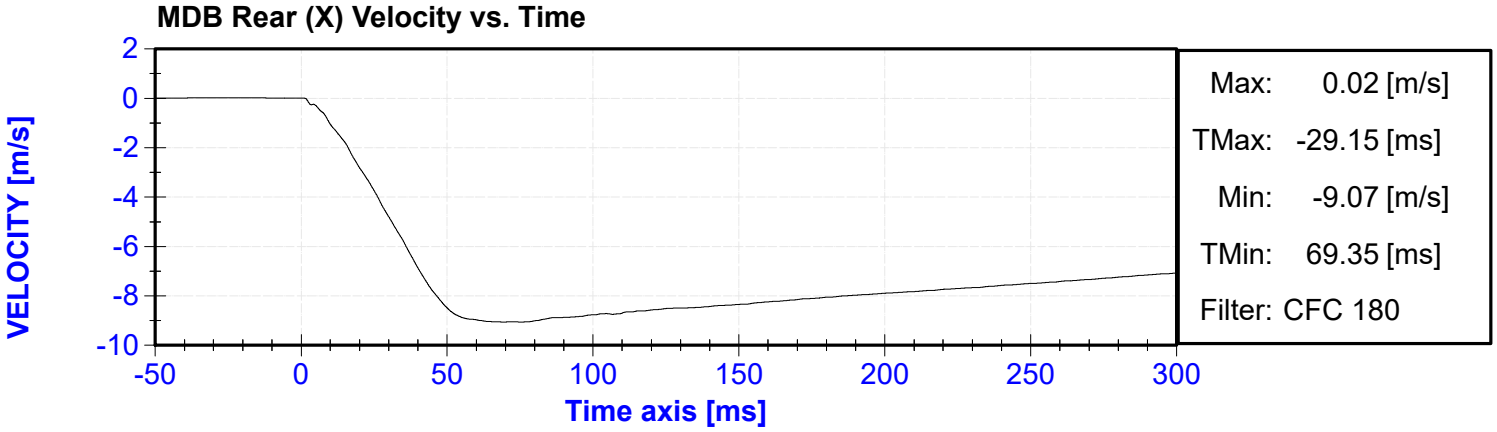
MDB Center of Gravity Resultant Acceleration vs. Time



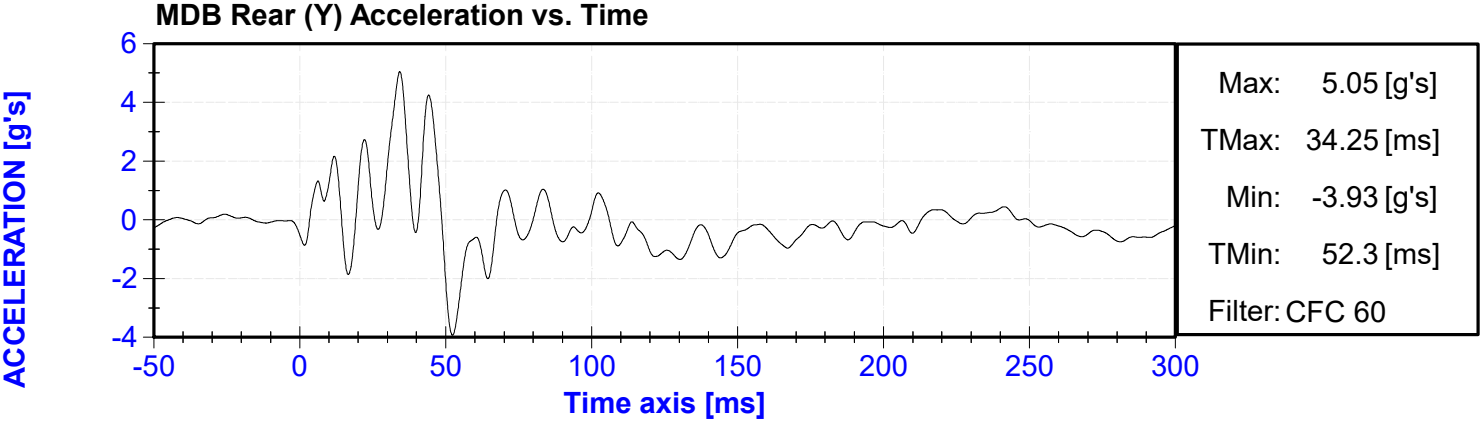
MDB Rear (X) Acceleration vs. Time

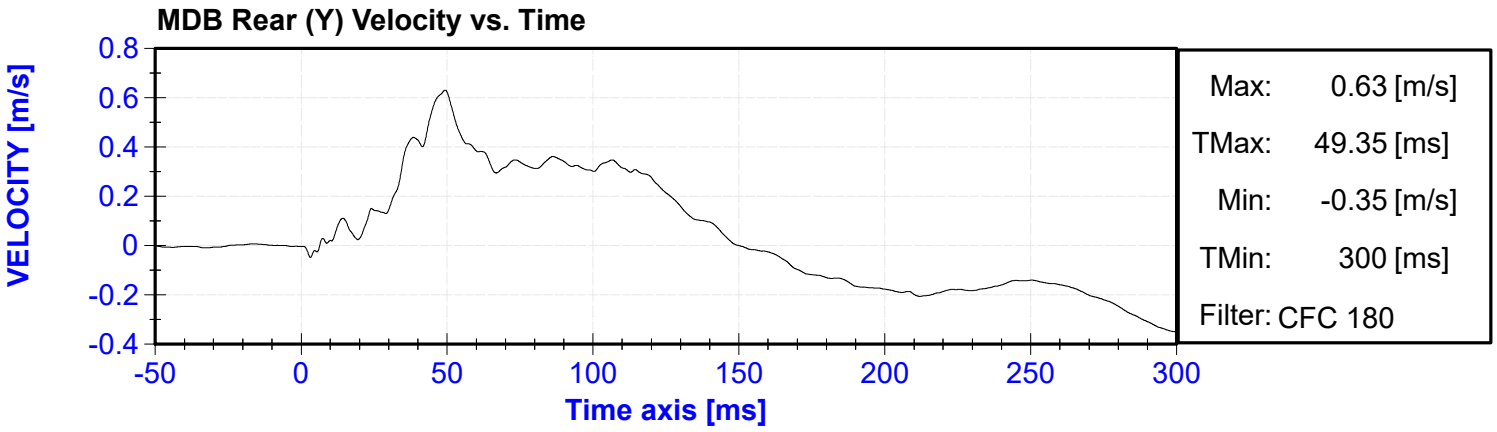


MDB Rear (X) Velocity vs. Time



MDB Rear (Y) Acceleration vs. Time




MDB Rear (Y) Velocity vs. Time
VELOCITY [m/s]
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-50
0
50
100
150
200
250
300
Time axis [ms]
Max: 0.63 [m/s]
TMax: 49.35 [ms]
Min: -0.35 [m/s]
TMin: 300 [ms]
Filter: CFC 180

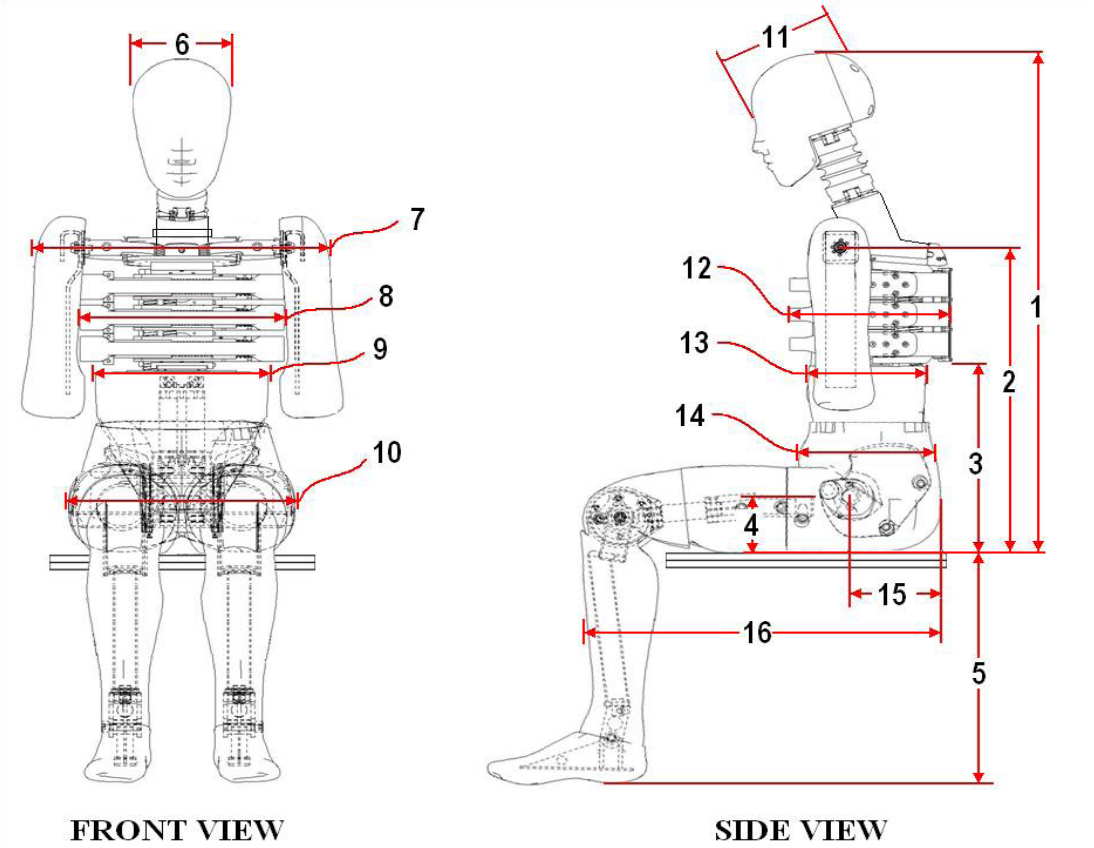
APPENDIX V

PRE-TEST
ES-2re PERFORMANCE CALIBRATION TEST DATA

External Measurements - EuroSID-2re

Technician: K. Brogan Date: 06/22/2023

Dummy Serial Number: D037



FRONT VIEW SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	913	Pass
2	Seat to Shoulder Joint	558	572	564	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	100	Pass
5	Sole to Seat, Sitting	333	451	421	Pass
6	Head Width	152	158	155	Pass
7	Shoulder/Arm Width	461	479	471	Pass
8	Thorax Width	322	332	329	Pass
9	Abdomen Width	273	287	280	Pass
10	Pelvis Lap Width	359	373	363	Pass
11	Head Depth	196	206	199	Pass
12	Thorax Depth	262	272	266	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	154	Pass
16	Back of Buttocks to Front Knee	597	615	605	Pass

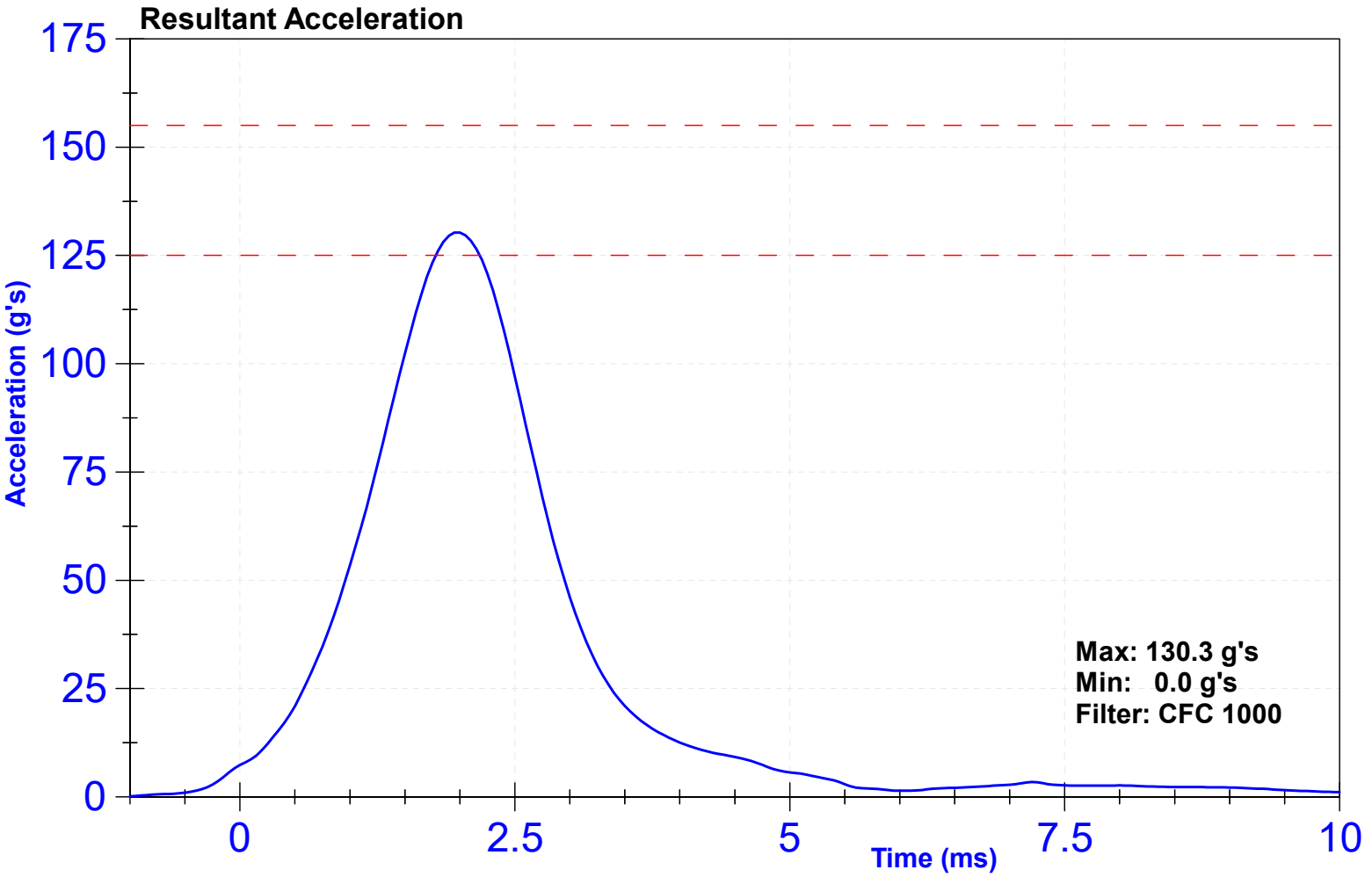
ATD Manufacturer	Denton	Test Technician	C. Mantell
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

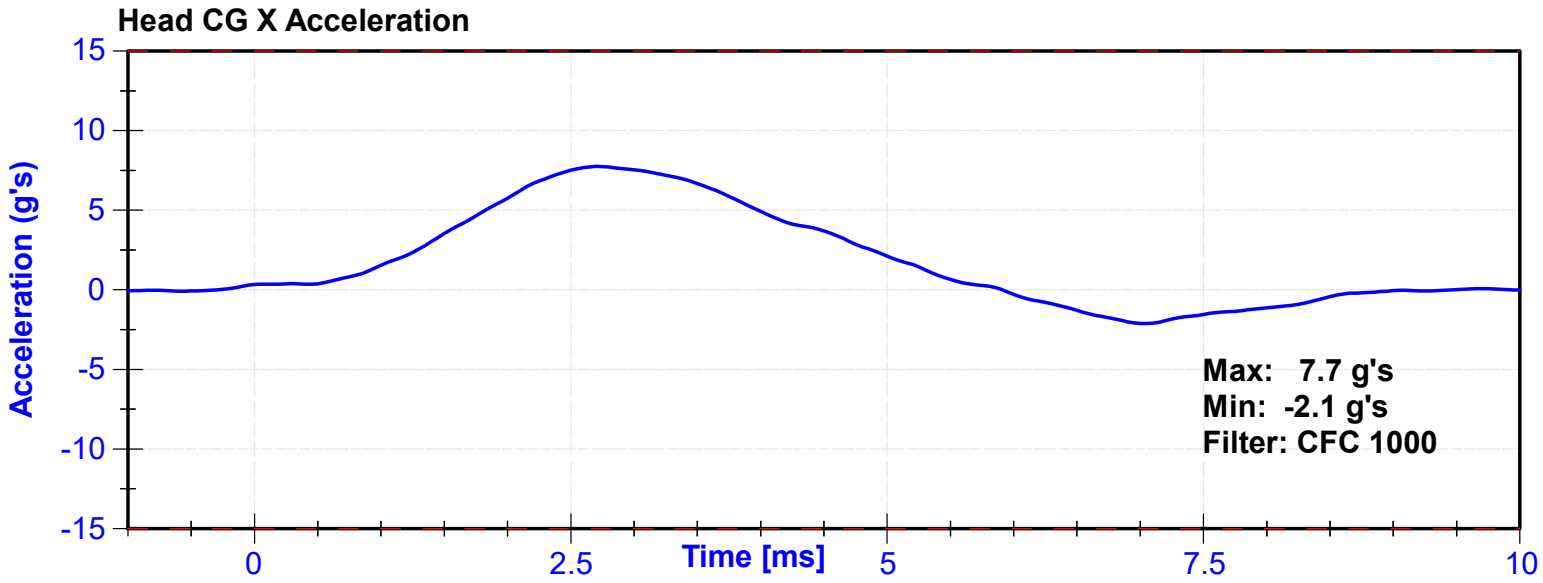
Results

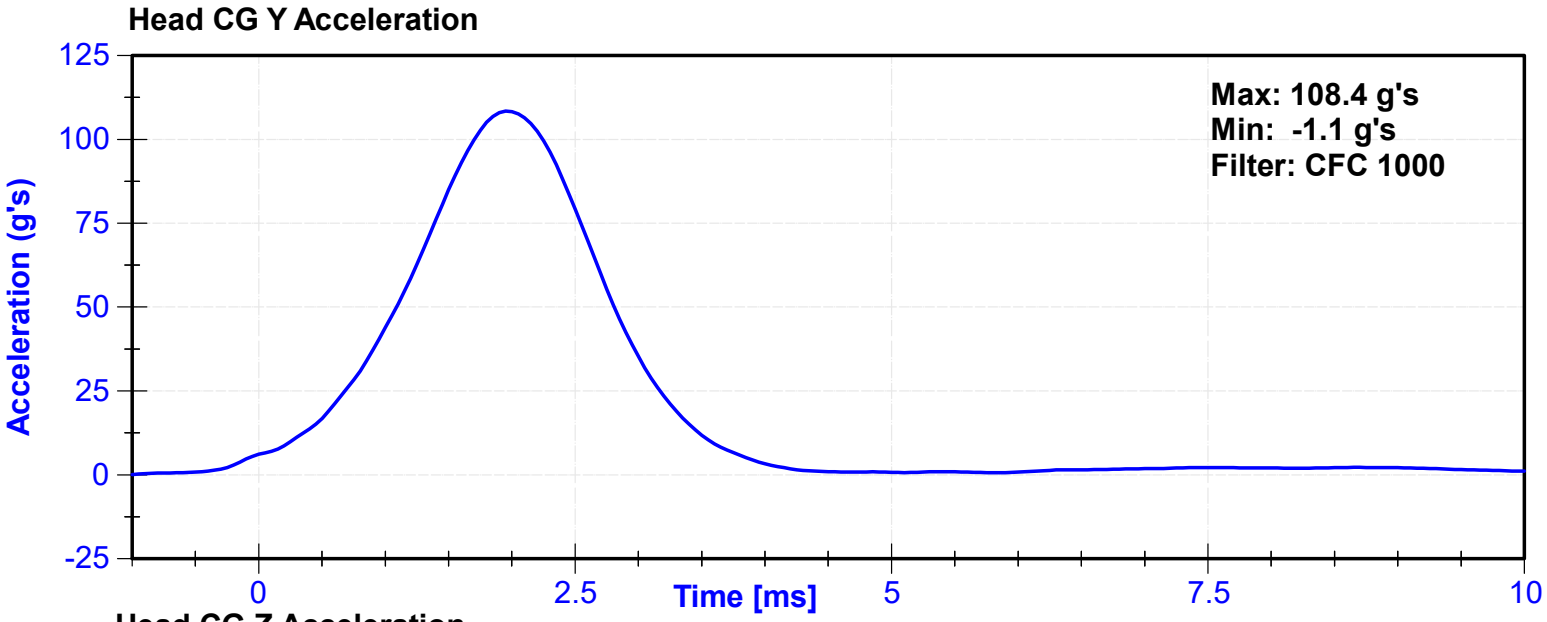
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	51.0	Pass
Resultant Acceleration	125	155	g's	130.3	Pass
Oscillation	0	15	%	2.64	Pass
Fore-Aft Acceleration	-15	15	g's	7.7	Pass

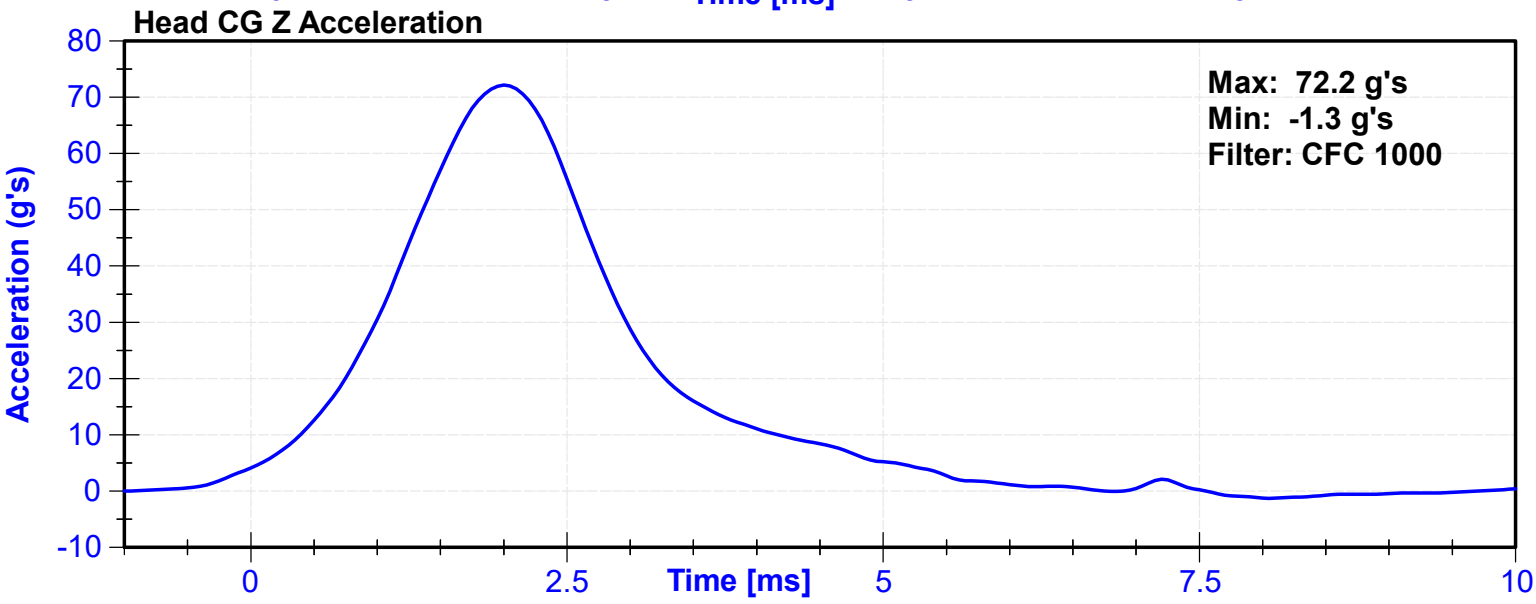
Transducer Calibrations

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




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
Time [ms]
5
7.5
10
Max: 7.7 g's
Min: -2.1 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
Time [ms]
5
7.5
10
Max: 108.4 g's
Min: -1.1 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
80
70
60
50
40
30
20
10
0
-10
0
2.5
Time [ms]
5
7.5
10
Max: 72.2 g's
Min: -1.3 g's
Filter: CFC 1000

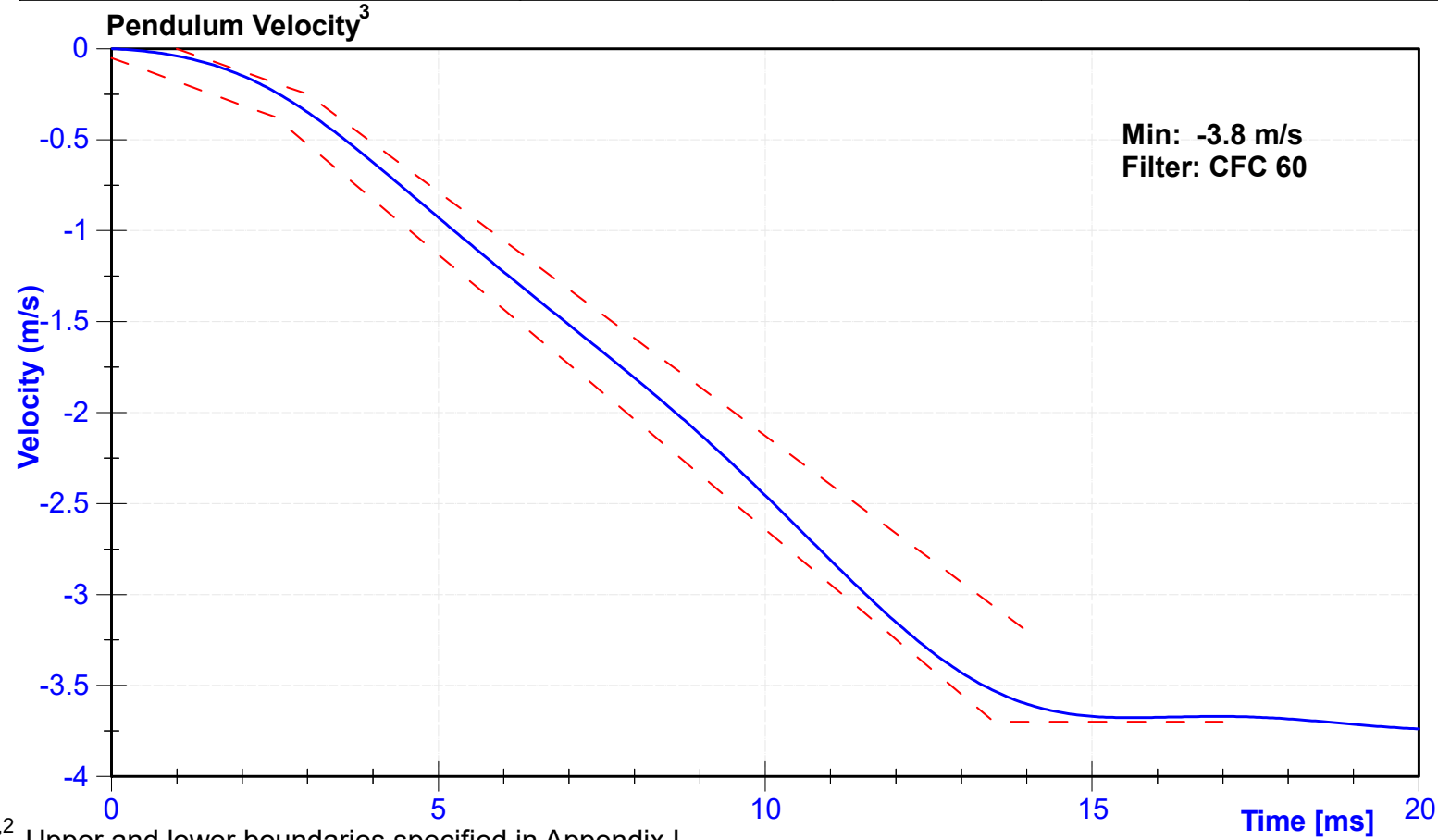
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

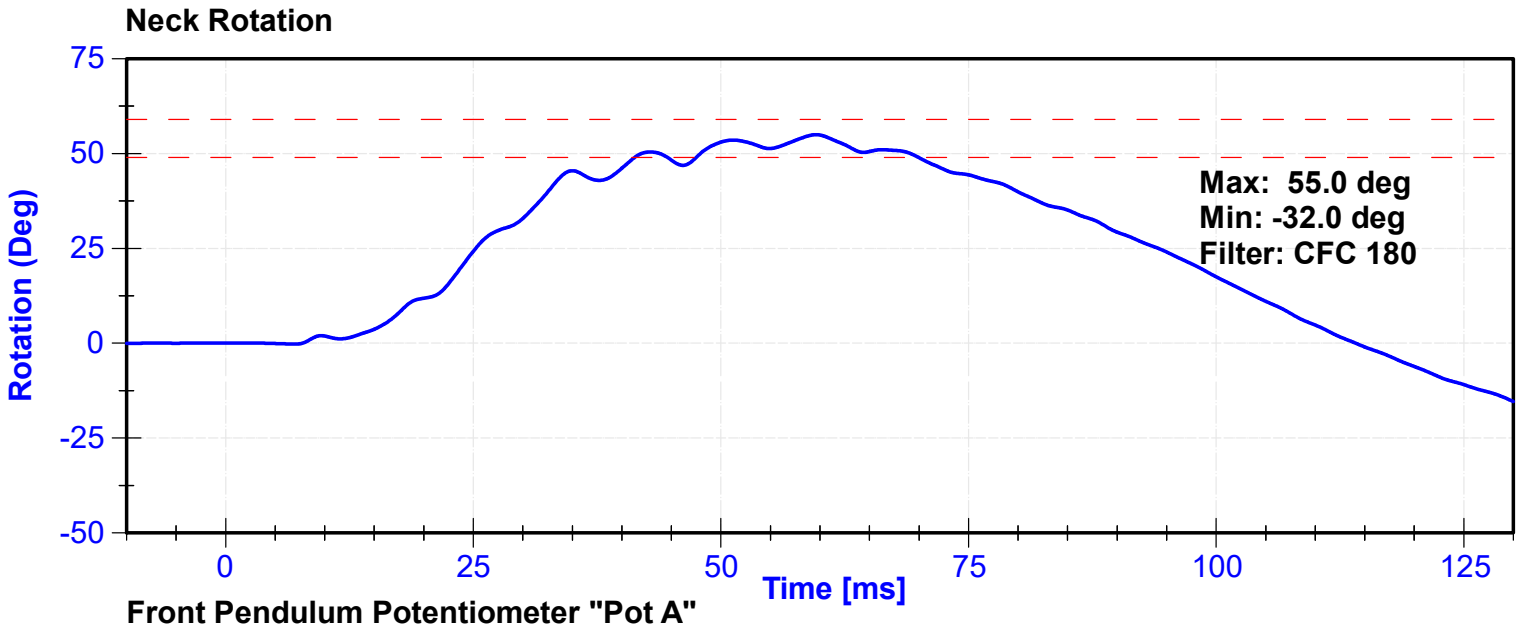
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	51.0	Pass
Velocity	3.3	3.5	m/s	3.45	Pass
Lateral Neck Rotation	49	59	deg	55.0	Pass
Time at Maximum Rotation	54	66	ms	59.6	Pass
Time of Rotation Decay from Maximum	53	88	ms	54.5	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

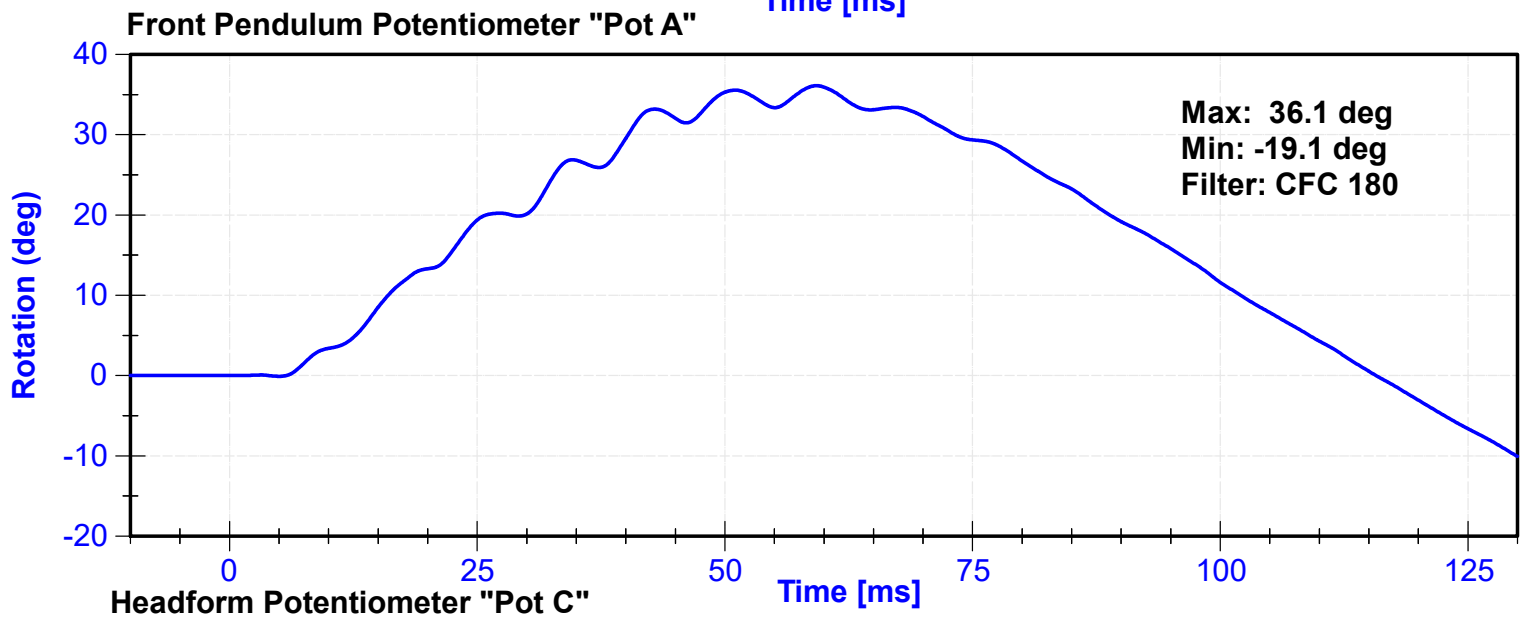
Transducer Calibrations

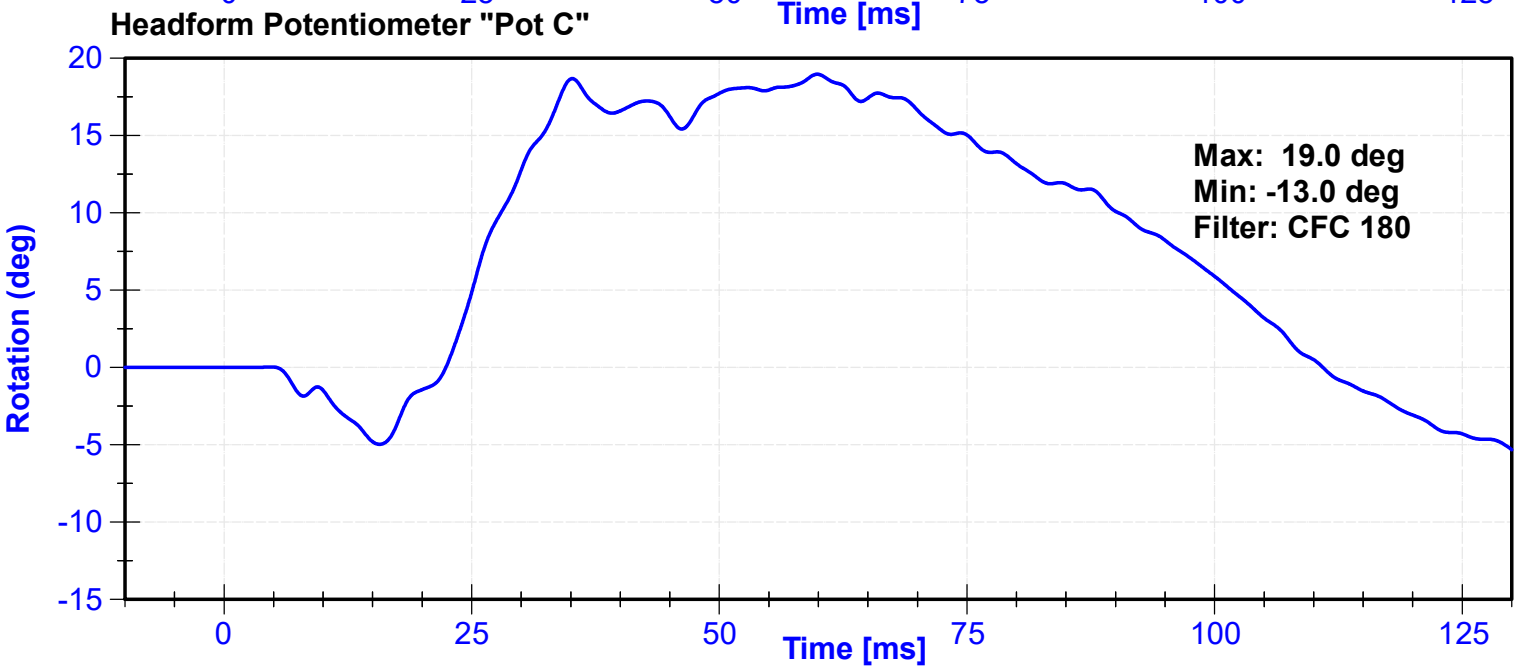
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16650	10/31/2022	10/31/2023
Front Pendulum Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Headform Potentiometer	Sfernice	095	10/5/2022	10/5/2023



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


Neck Rotation
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]
Max: 55.0 deg
Min: -32.0 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: 36.1 deg
Min: -19.1 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: 19.0 deg
Min: -13.0 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

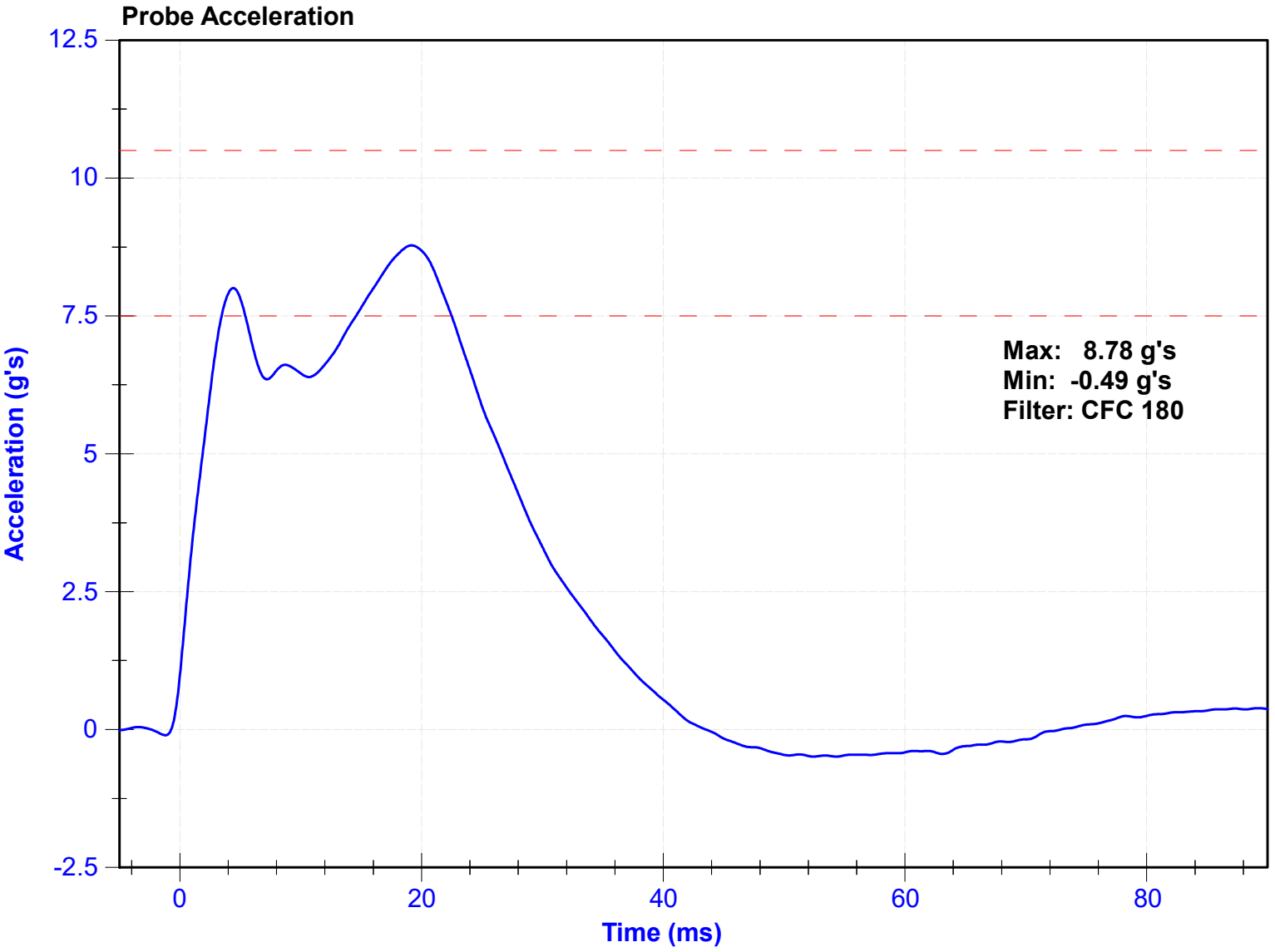
ATD Manufacturer	Denton	Test Technician	C. Mantell
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	66.1	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	7.5	10.5	g's	8.78	Pass

Transducer Calibrations

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



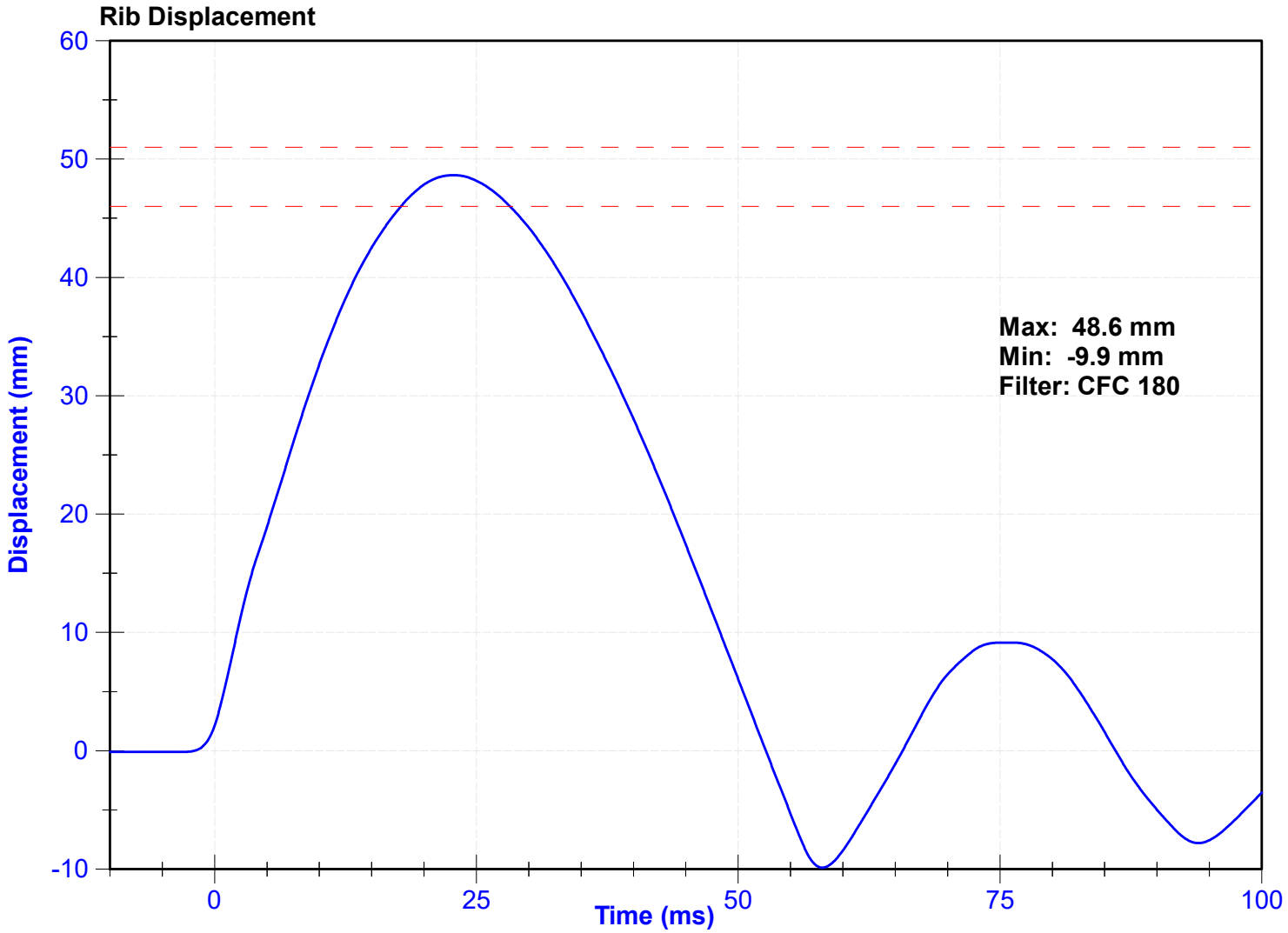
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	51.0	Pass
Rib Displacement	46	51	mm	48.6	Pass

Transducer Calibrations

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



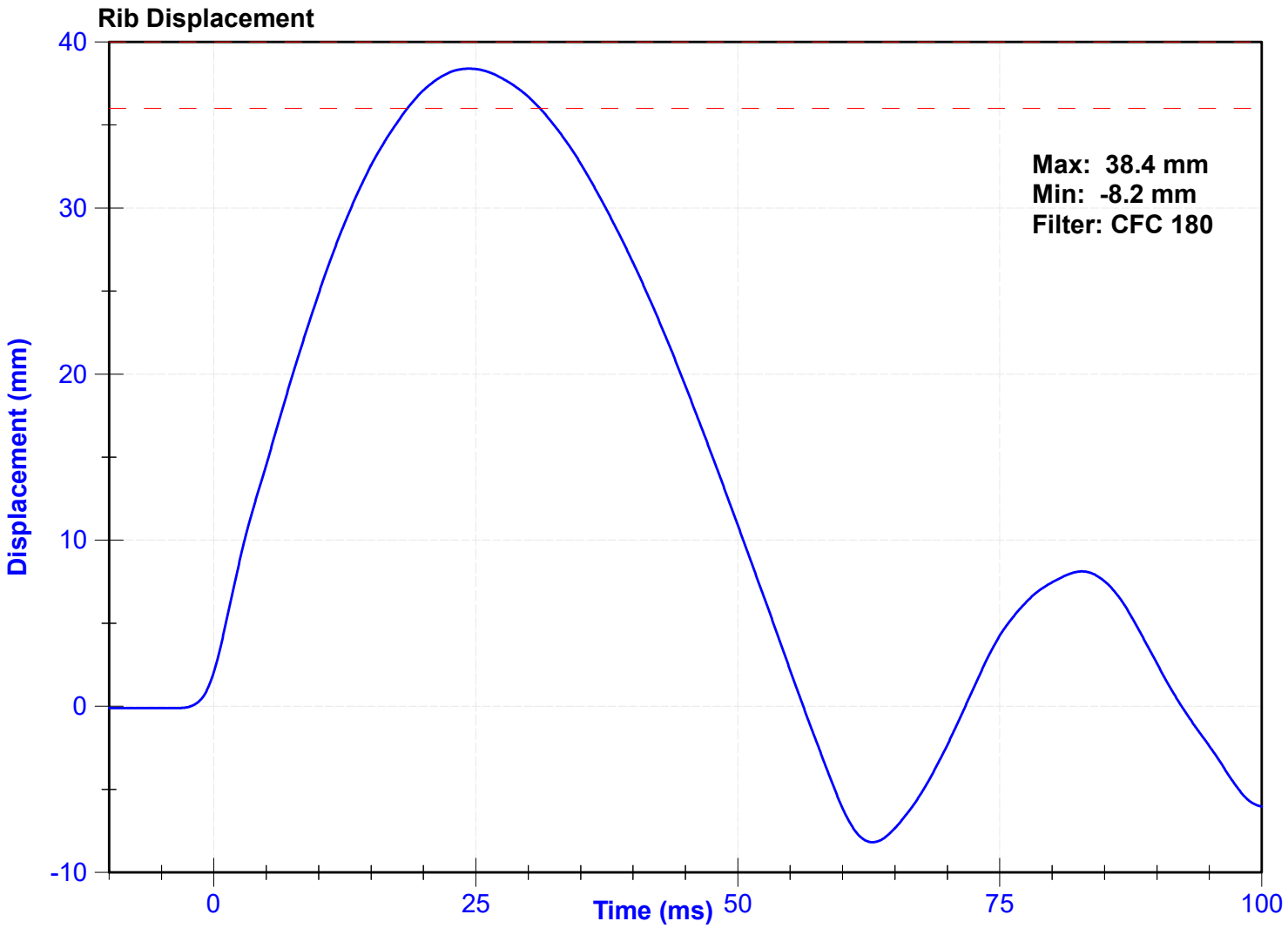
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	51.0	Pass
Rib Displacement	36	40	mm	38.4	Pass

Transducer Calibrations

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



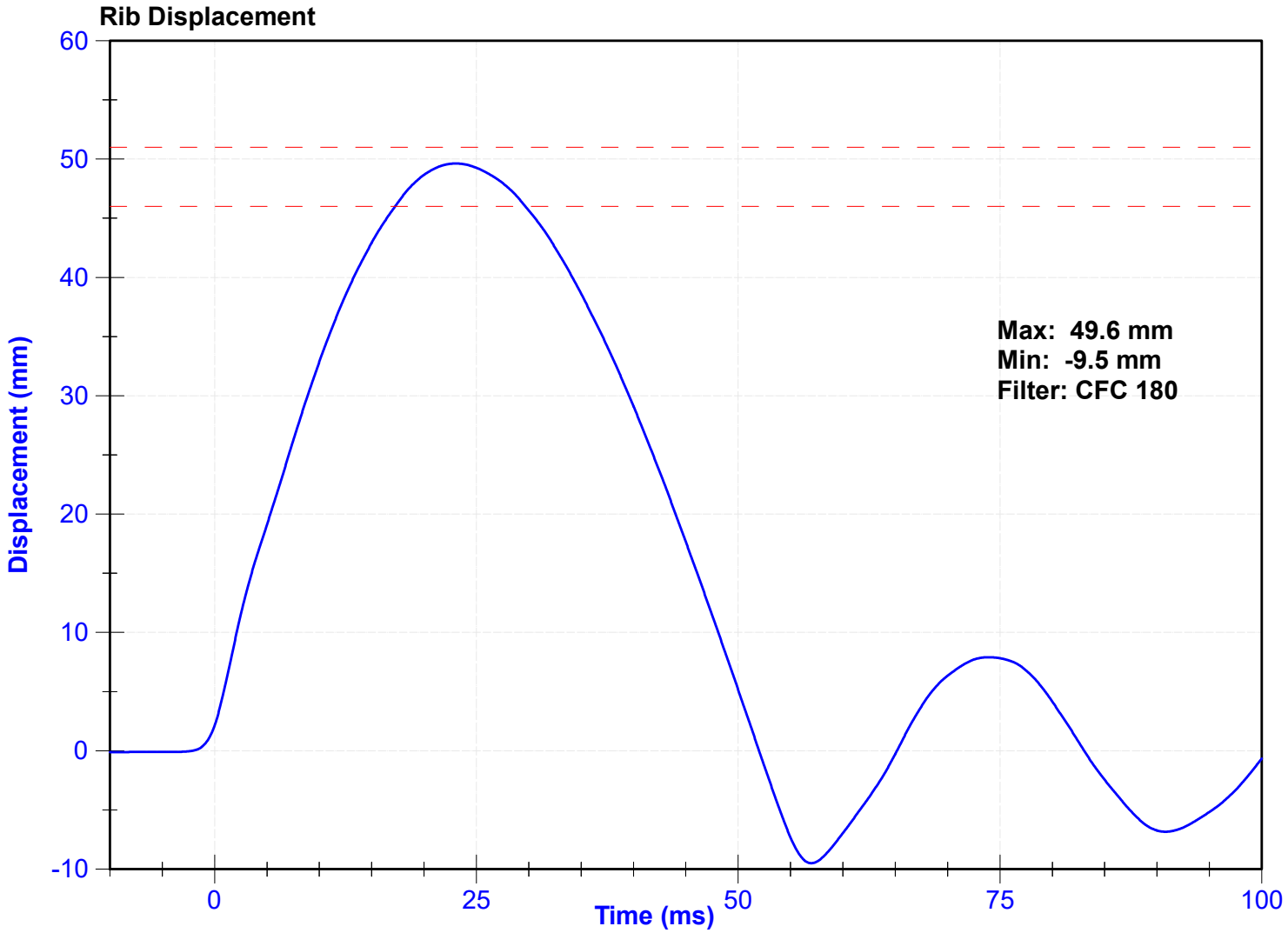
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	51.0	Pass
Rib Displacement	46	51	mm	49.6	Pass

Transducer Calibrations

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



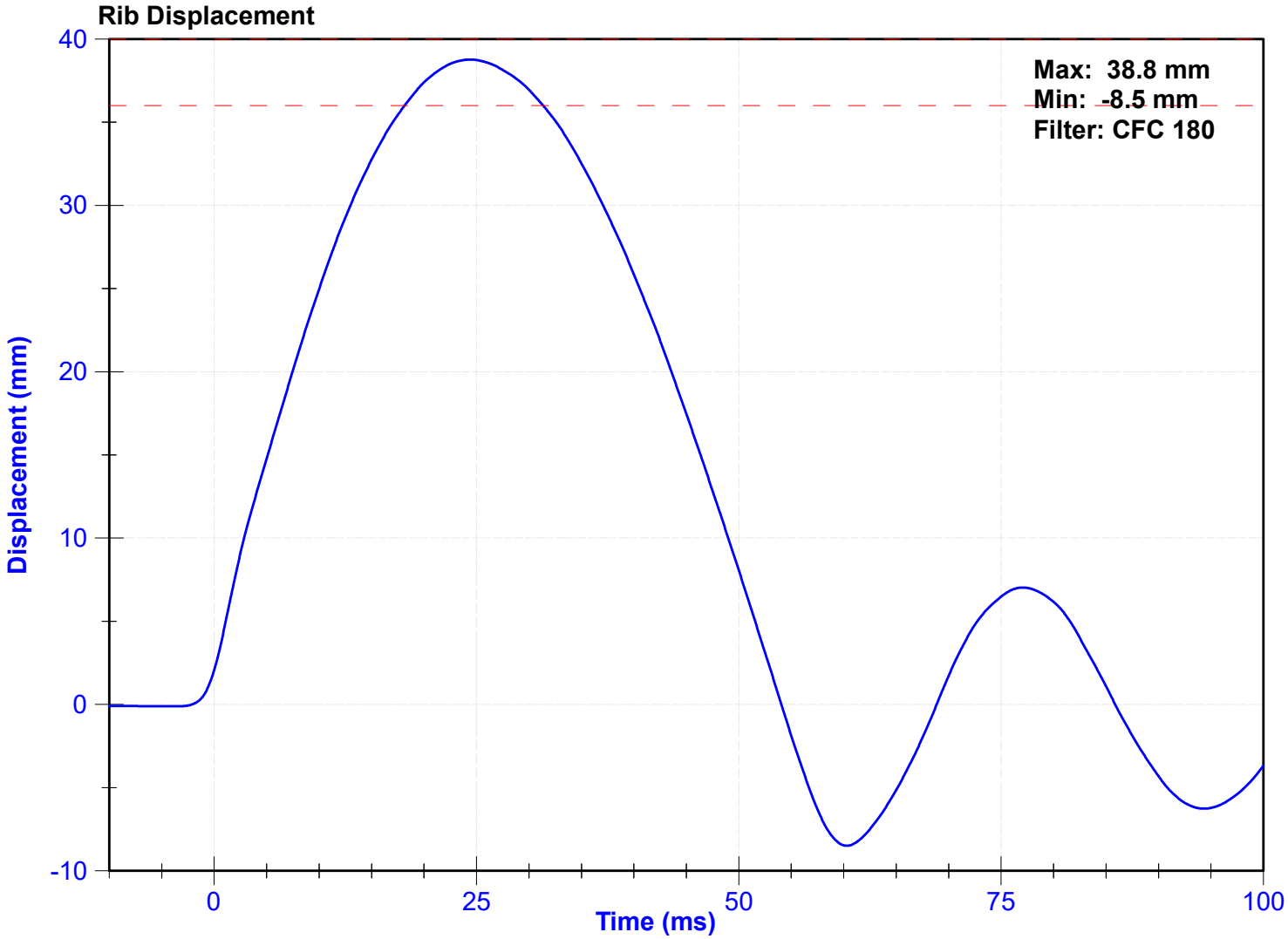
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	51.0	Pass
Rib Displacement	36	40	mm	38.8	Pass

Transducer Calibrations

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



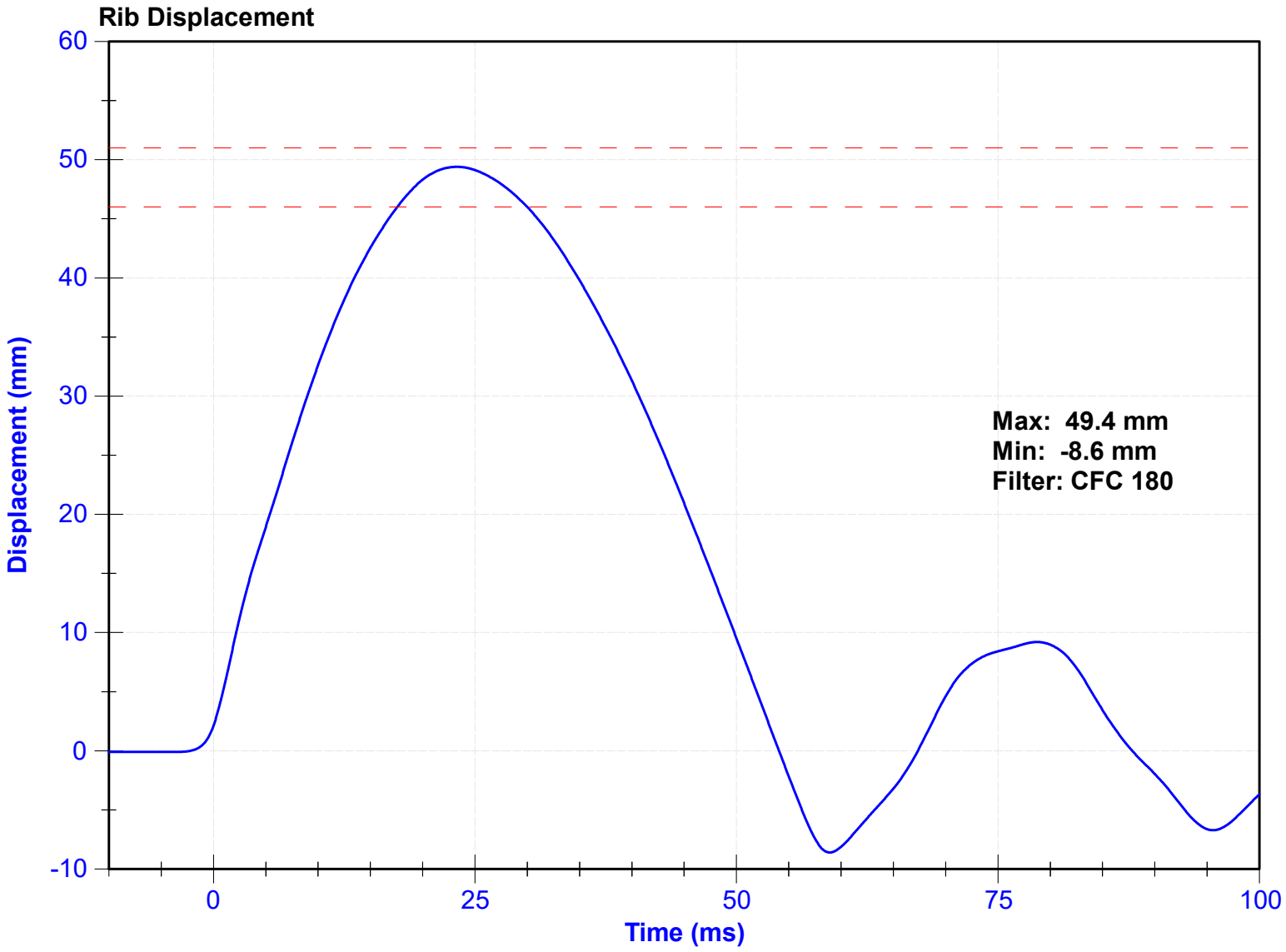
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	51.0	Pass
Rib Displacement	46	51	mm	49.4	Pass

Transducer Calibrations

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



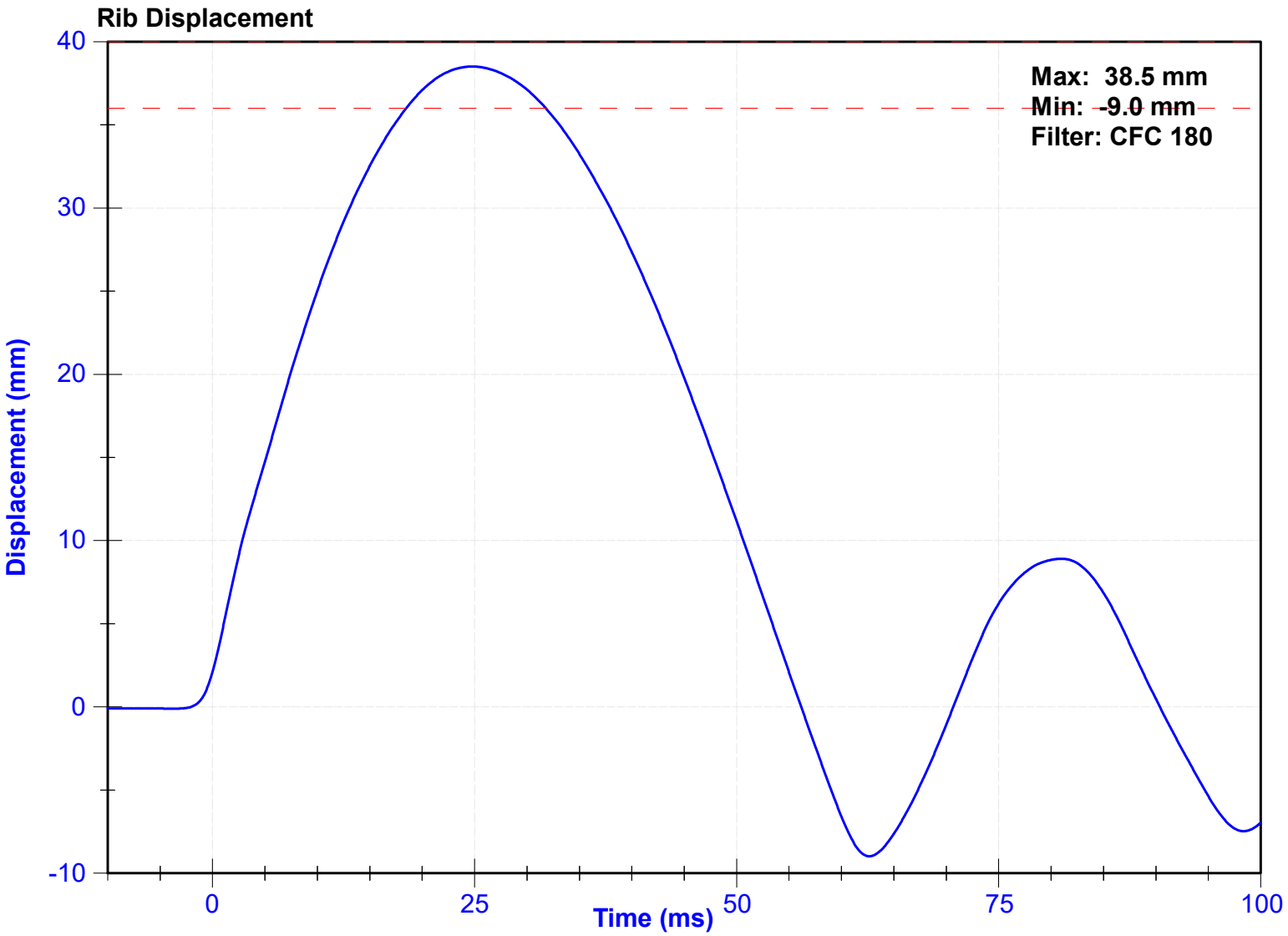
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	51.0	Pass
Rib Displacement	36	40	mm	38.5	Pass

Transducer Calibrations

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



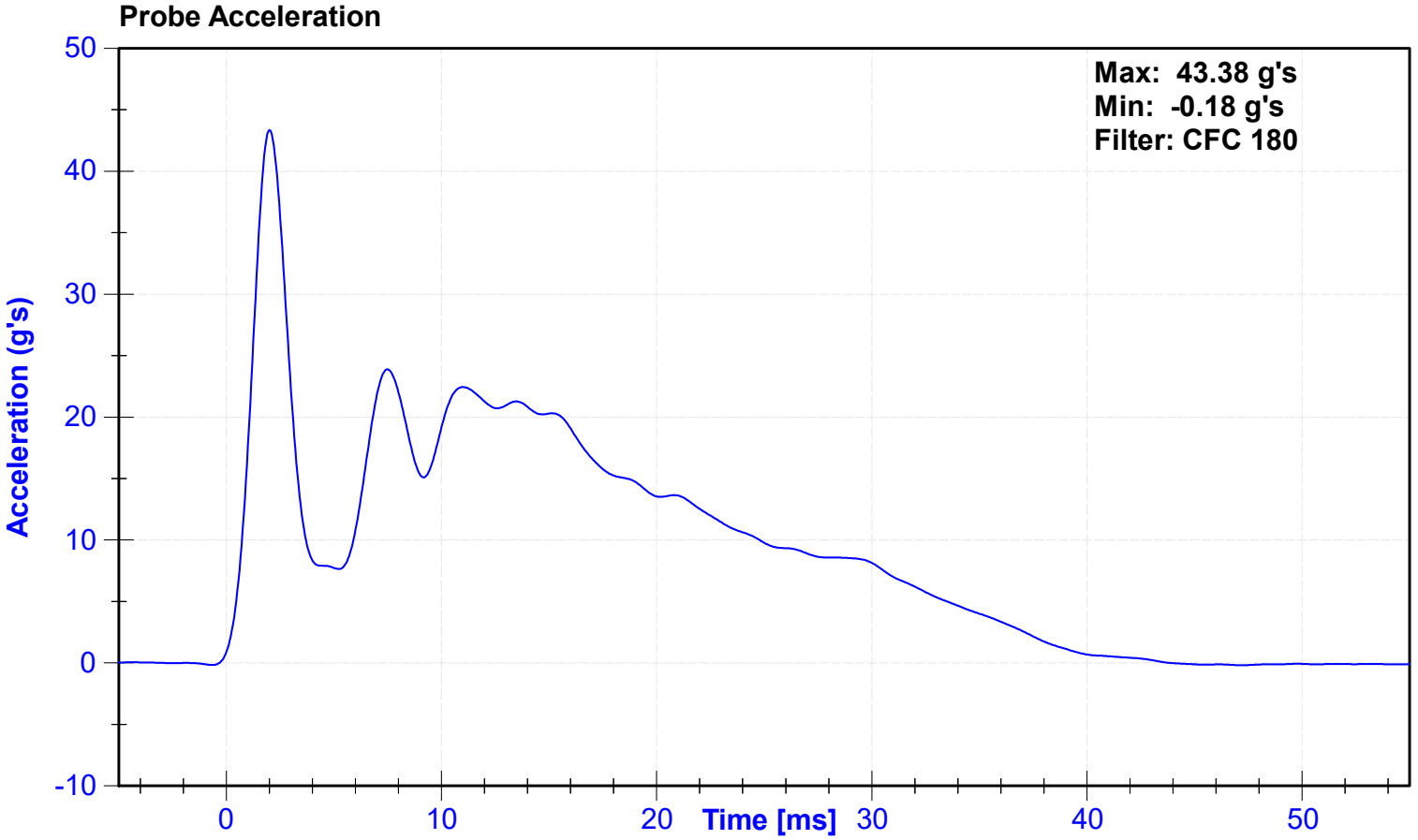
ATD Manufacturer	Denton	Test Technician	C. Mantell
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

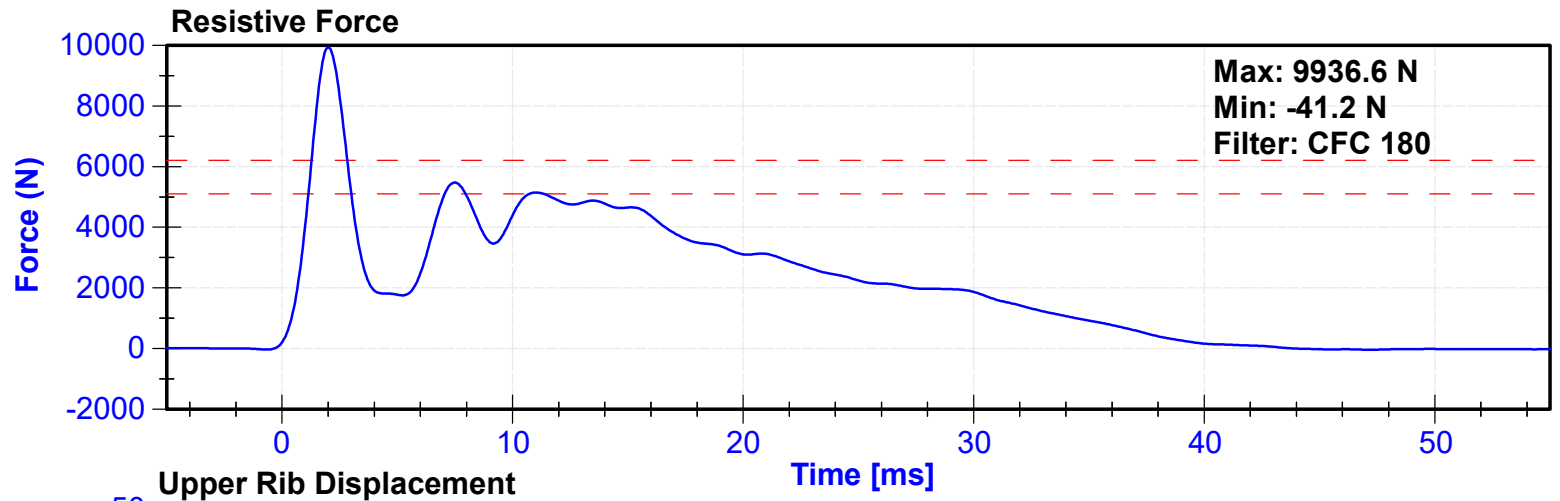
Results

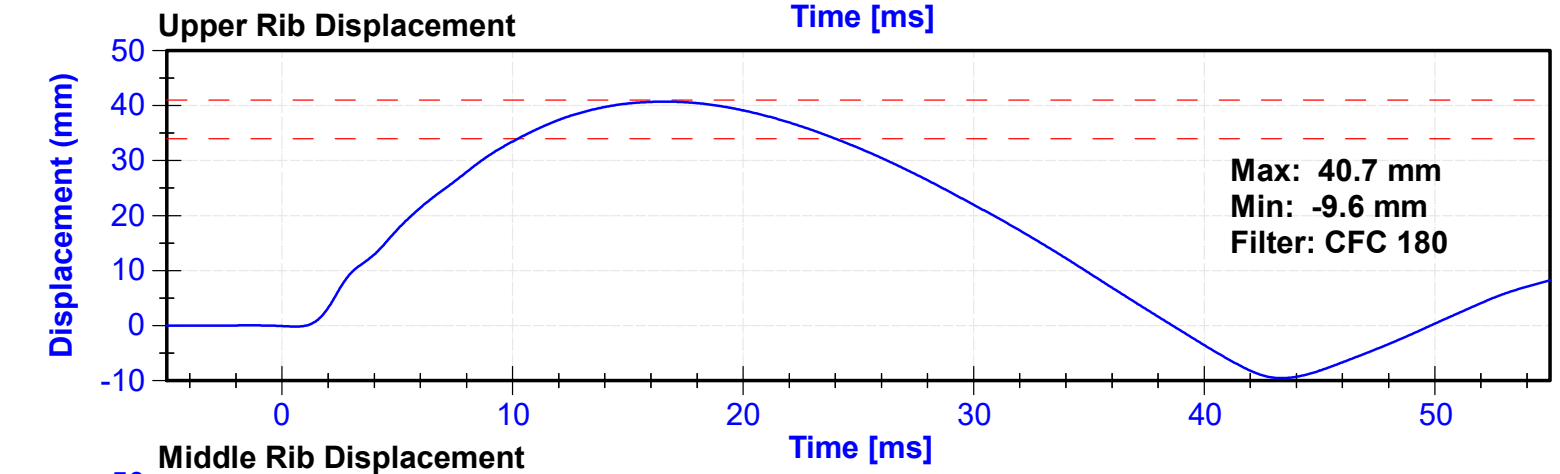
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	66.1	Pass
Velocity	5.4	5.6	m/s	5.54	Pass
Resistive Force after 6ms	5100	6200	N	5472.8	Pass
Upper Thorax Rib Deflection	34	41	mm	40.7	Pass
Mid Thorax Rib Deflection	37	45	mm	42.8	Pass
Lower Thorax Rib Deflection	37	44	mm	41.4	Pass

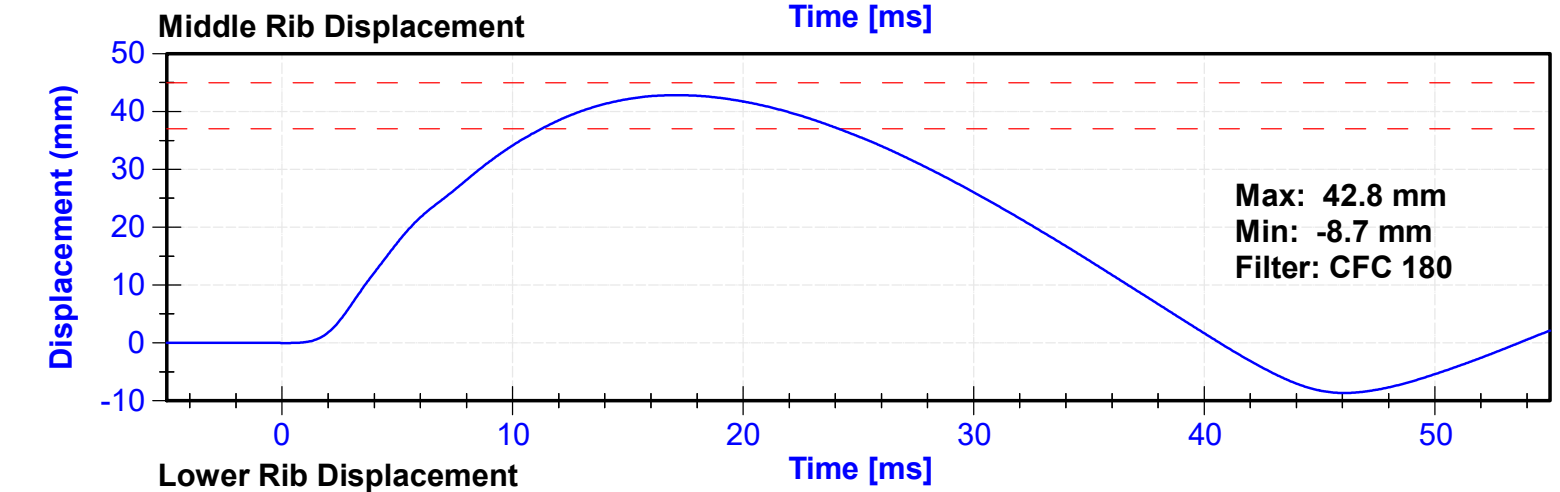
Transducer Calibrations

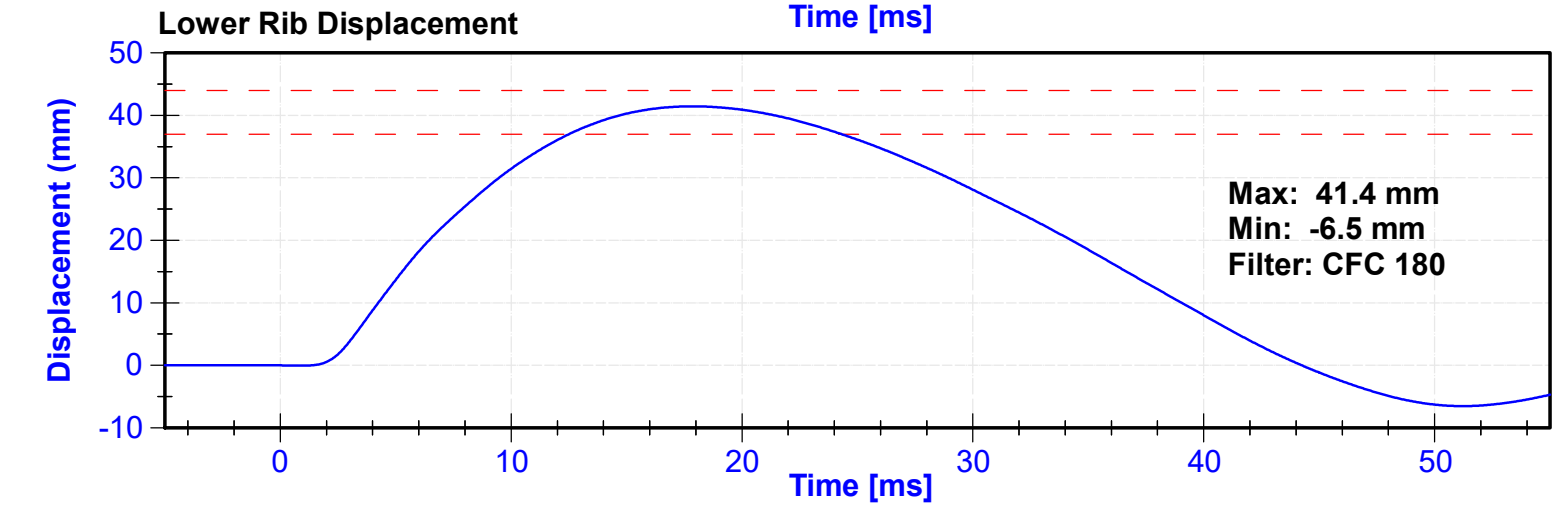
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Upper Thorax Rib Potentiometer	Honeywell	DS-0552-01	2/27/2023	8/28/2023
Middle Thorax Rib Potentiometer	Honeywell	DS-807	2/27/2023	8/28/2023
Lower Thorax Rib Potentiometer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




Resistive Force
Max: 9936.6 N
Min: -41.2 N
Filter: CFC 180
Force (N)
10000
8000
6000
4000
2000
0
-2000
0
10
20
30
40
50
Time [ms]


Upper Rib Displacement
Max: 40.7 mm
Min: -9.6 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: 42.8 mm
Min: -8.7 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Lower Rib Displacement
Max: 41.4 mm
Min: -6.5 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]

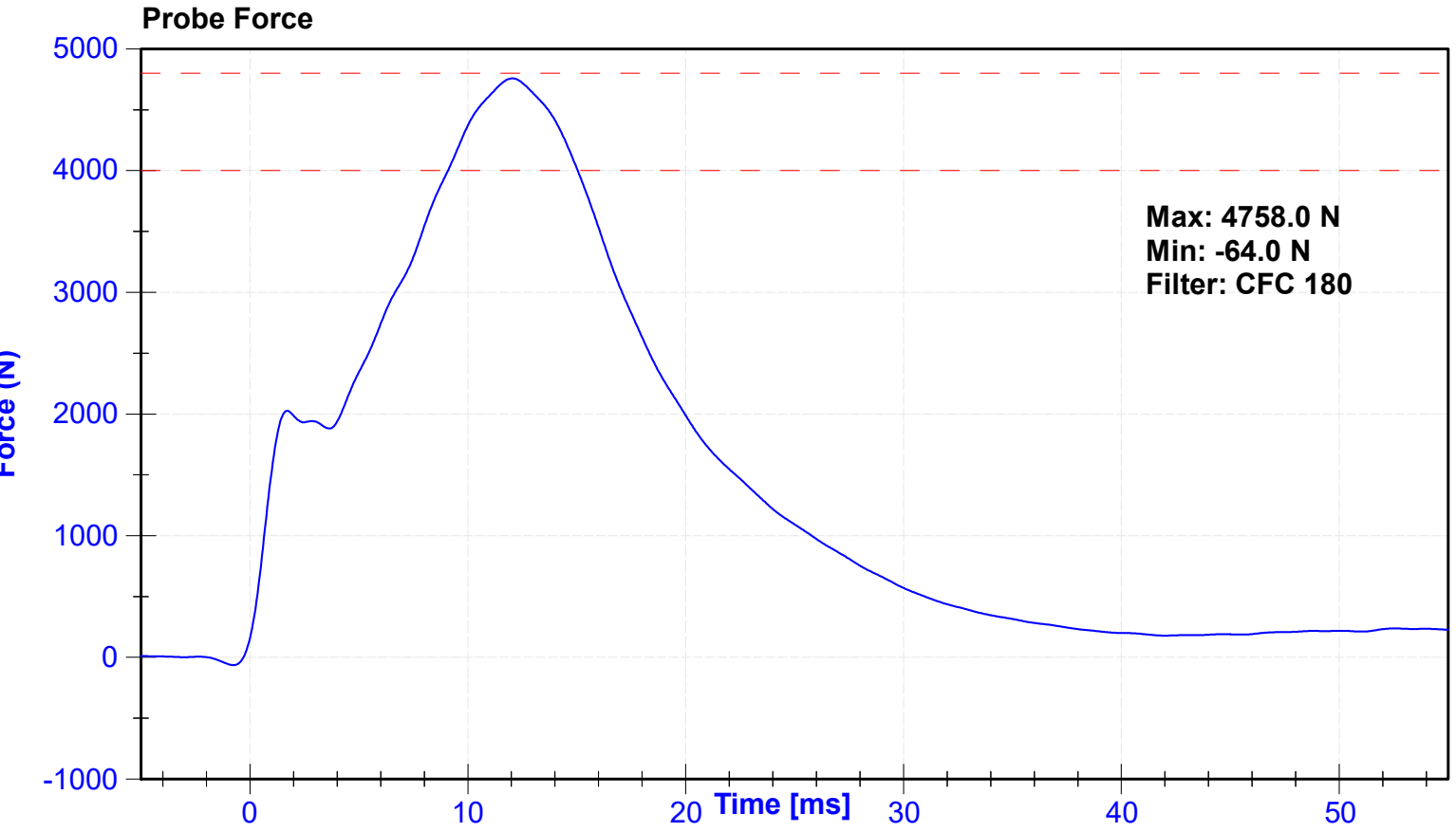
ATD Manufacturer	Denton	Test Technician	C. Mantell
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

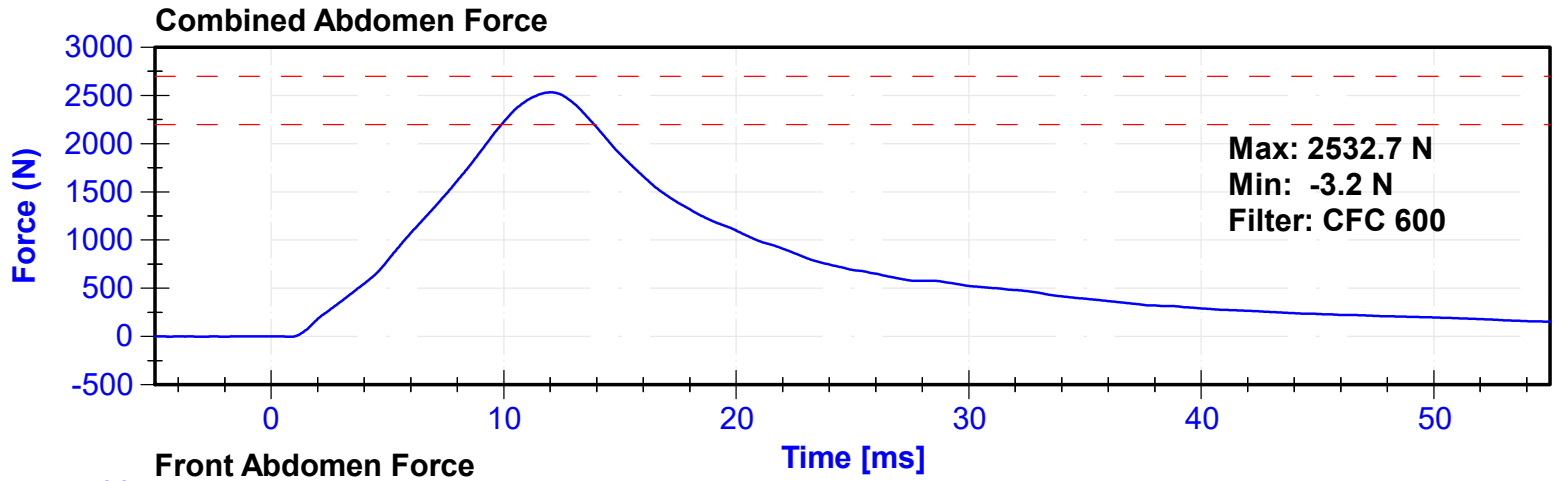
Results

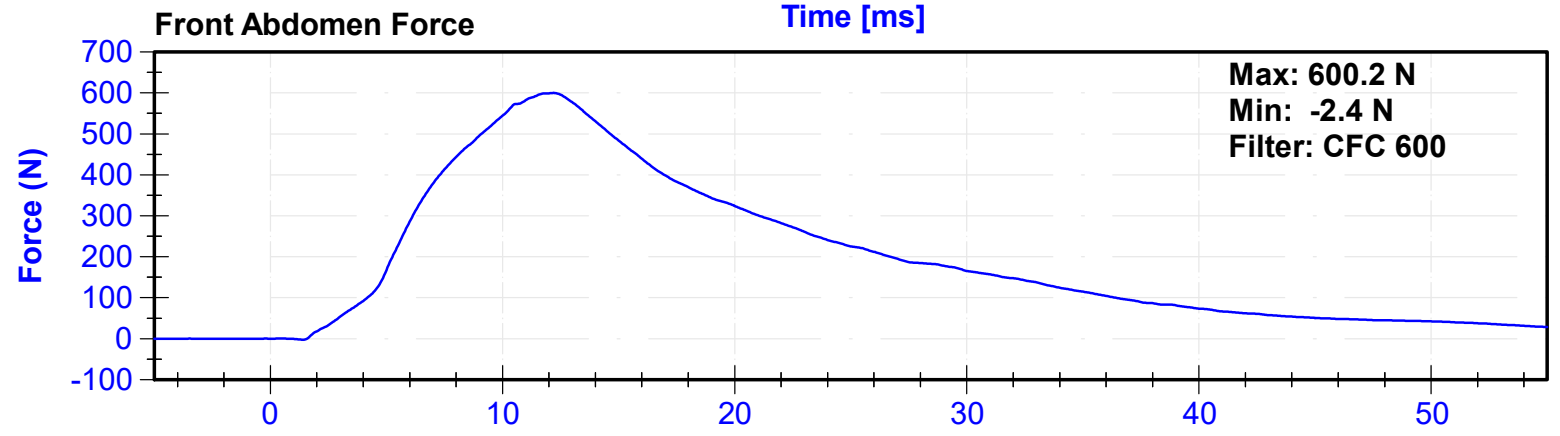
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	66.1	Pass
Velocity	3.9	4.1	m/s	4.02	Pass
Combined Abdomen Force	2200	2700	N	2532.7	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	12.05	Pass
Resistive Probe Force	4000	4800	N	4758.0	Pass
Time at Peak Resistive Force	10.6	13.0	ms	12.05	Pass

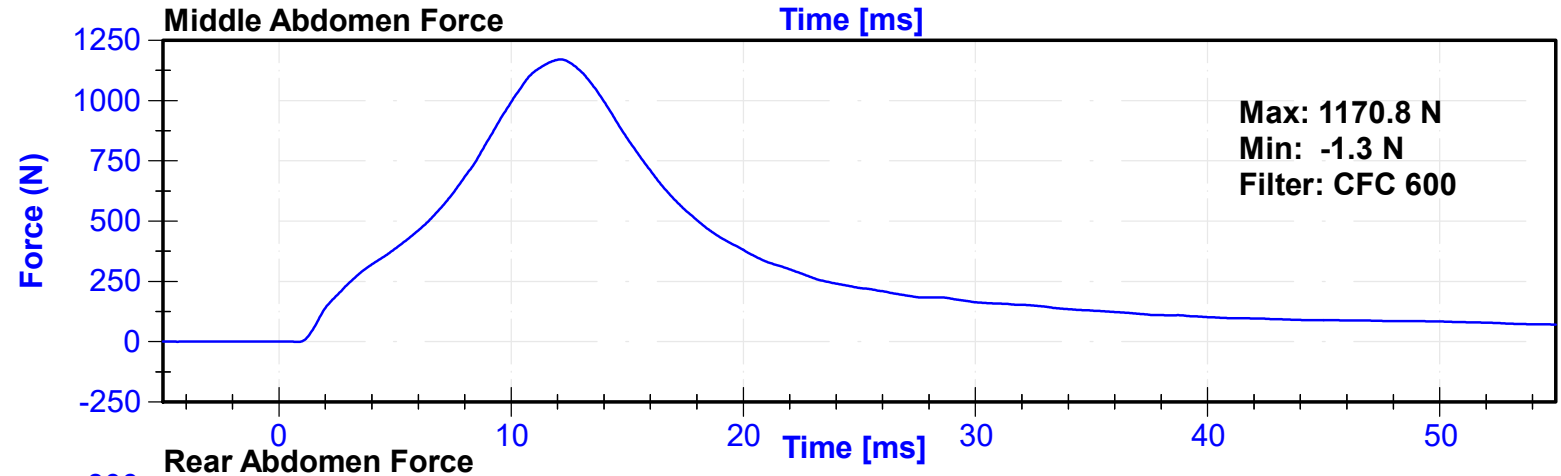
Transducer Calibrations

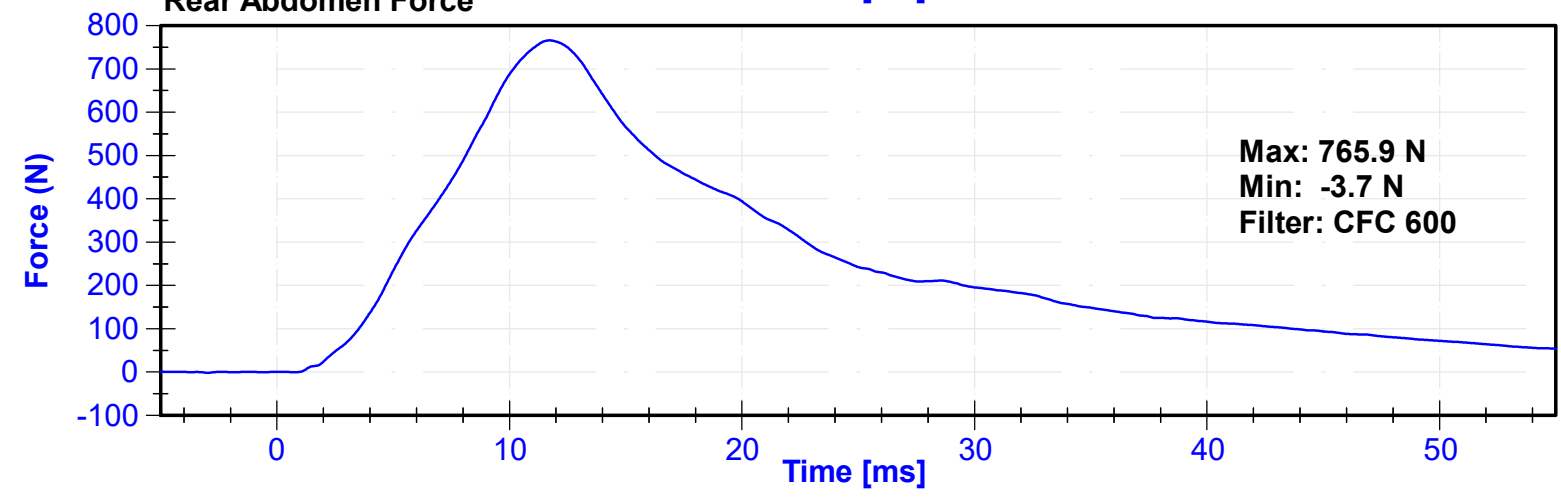
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Front Abdomen Load Cell	Denton	1440	8/12/2022	8/12/2023
Middle Abdomen Load Cell	Denton	1525	8/12/2022	8/12/2023
Rear Abdomen Load Cell	Denton	1528	8/12/2022	8/12/2023




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2532.7 N
Min: -3.2 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 600.2 N
Min: -2.4 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1170.8 N
Min: -1.3 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 765.9 N
Min: -3.7 N
Filter: CFC 600

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

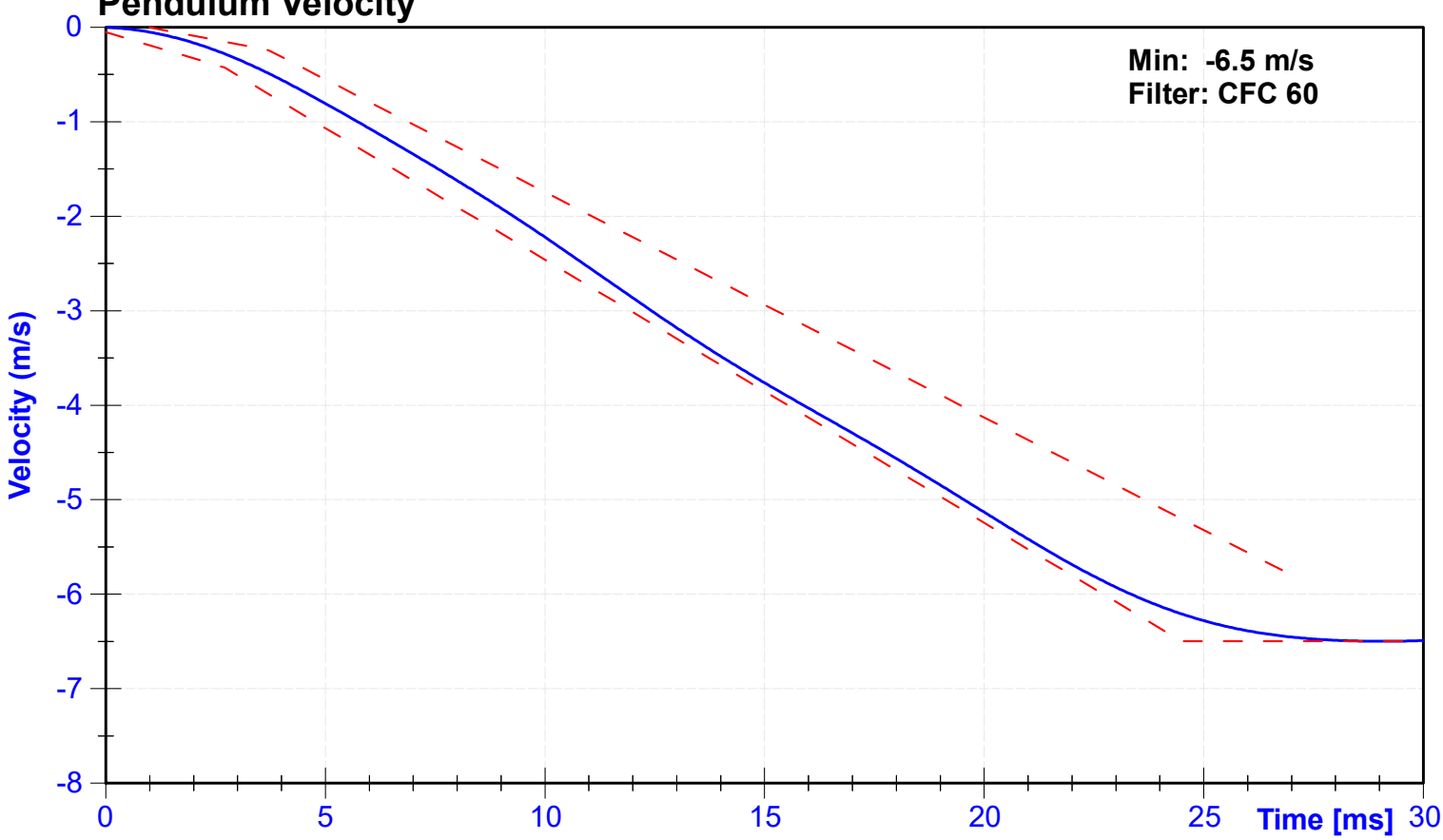
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	69.9	Pass
Velocity	5.95	6.15	m/s	6.062	Pass
Lateral Spine Rotation	45	55	deg	52.4	Pass
Time at Maximum Rotation	39	53	ms	47.0	Pass
Time of Decay to Zero Degrees	37	57	ms	39.7	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

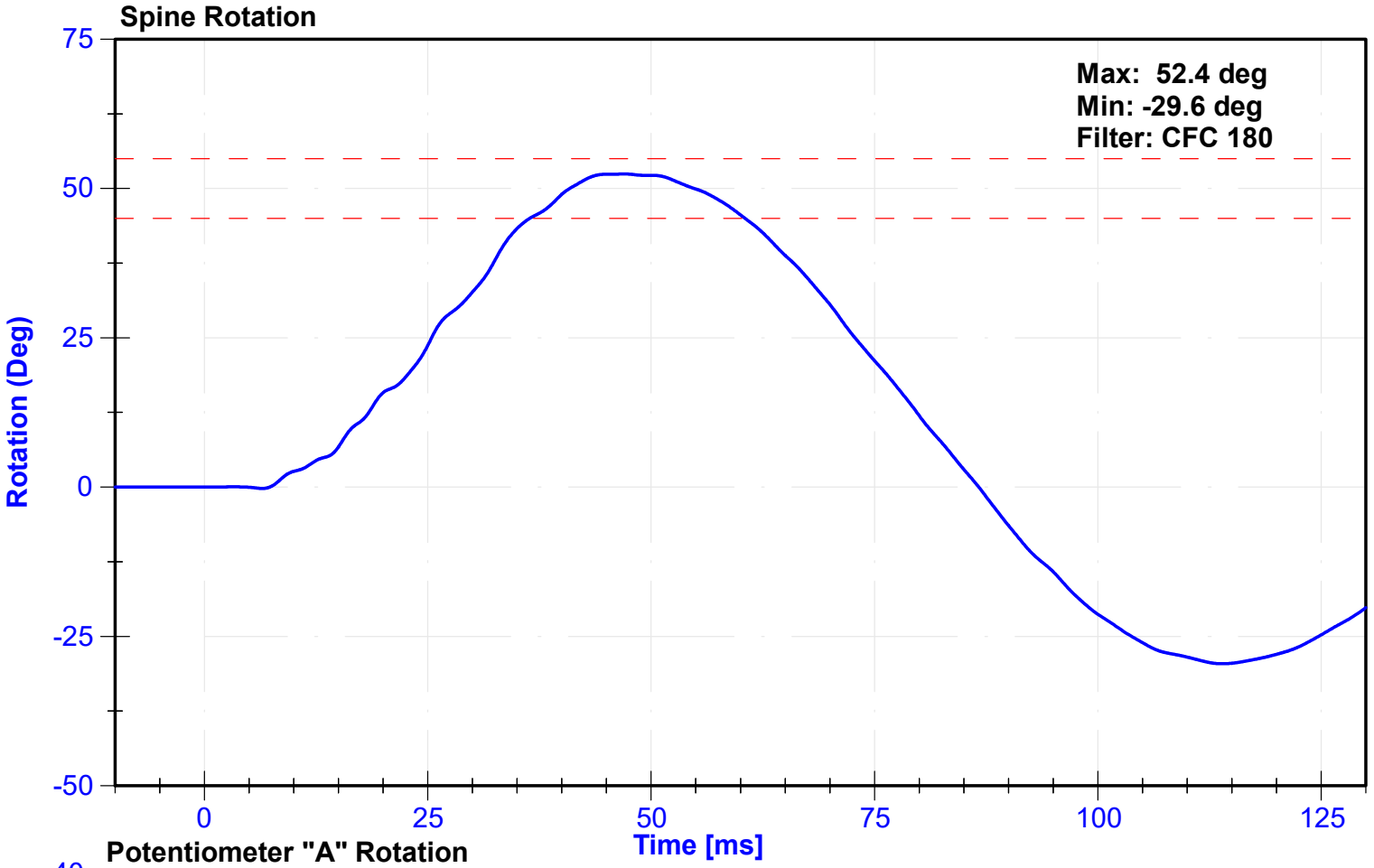
Transducer Calibrations

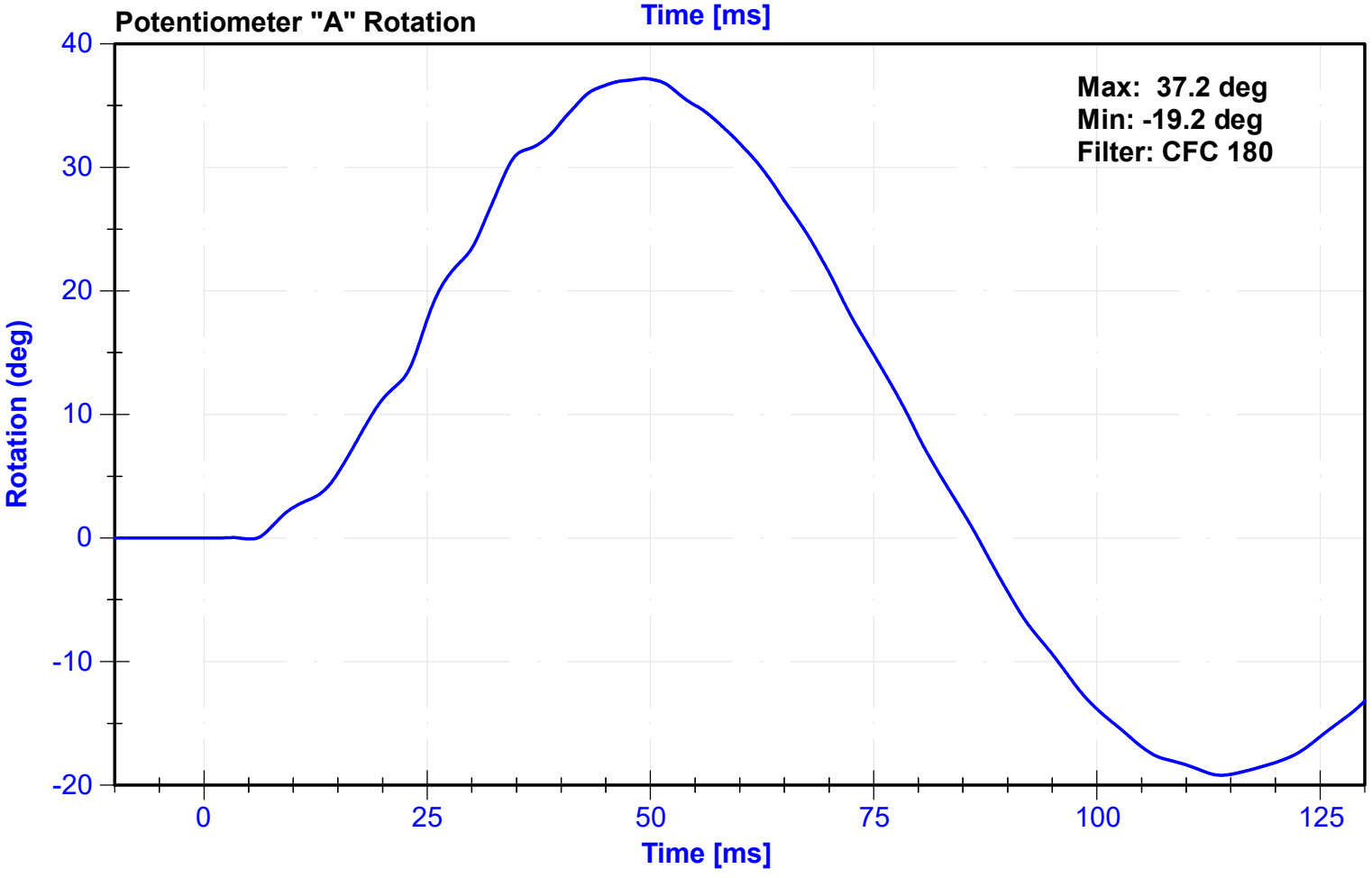
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum "A" Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Condyle "B" Potentiometer	Sfernice	095	10/5/2022	10/5/2023

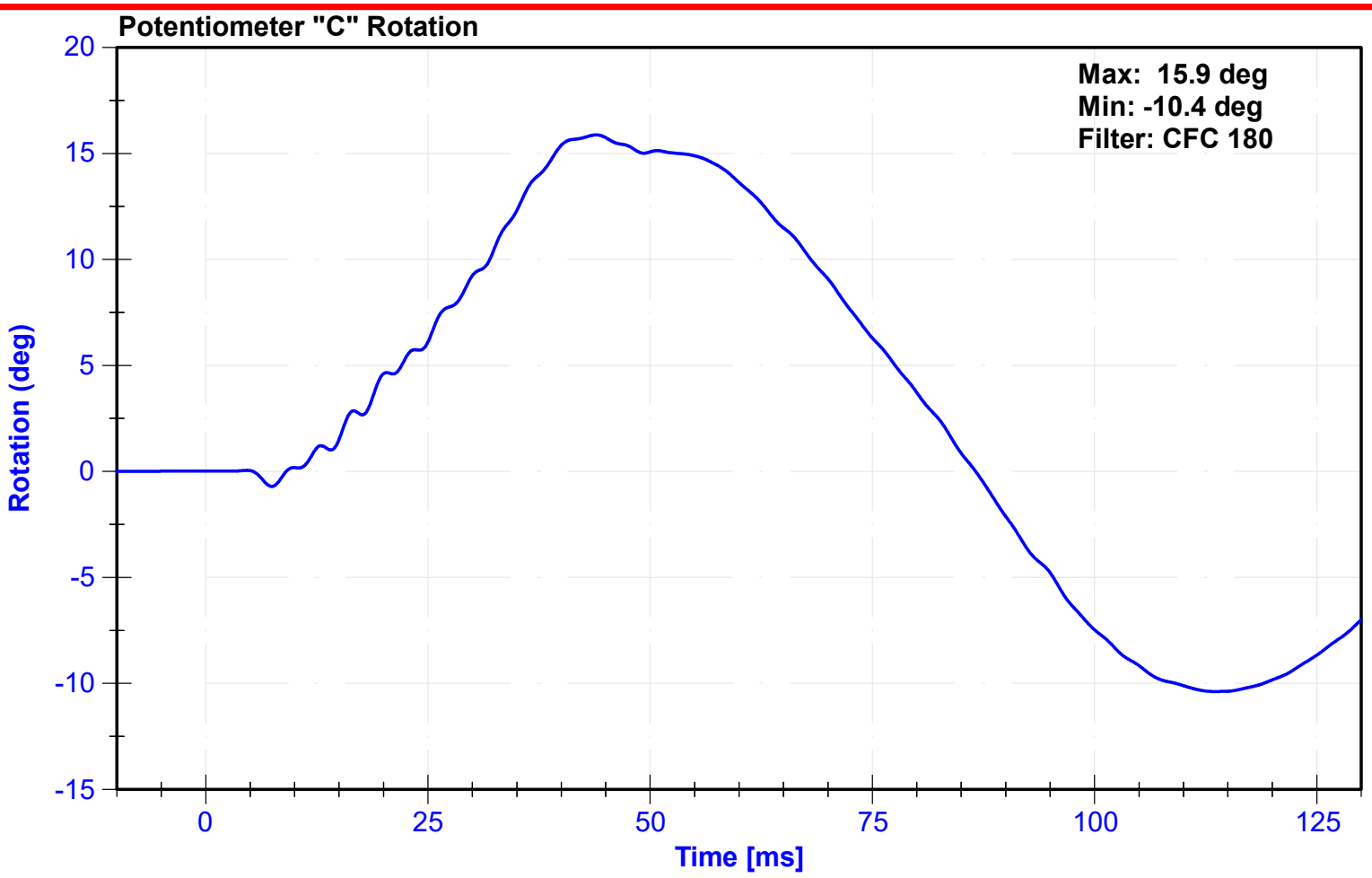
Pendulum Velocity[3]



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


Spine Rotation
Max: 52.4 deg
Min: -29.6 deg
Filter: CFC 180
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 37.2 deg
Min: -19.2 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

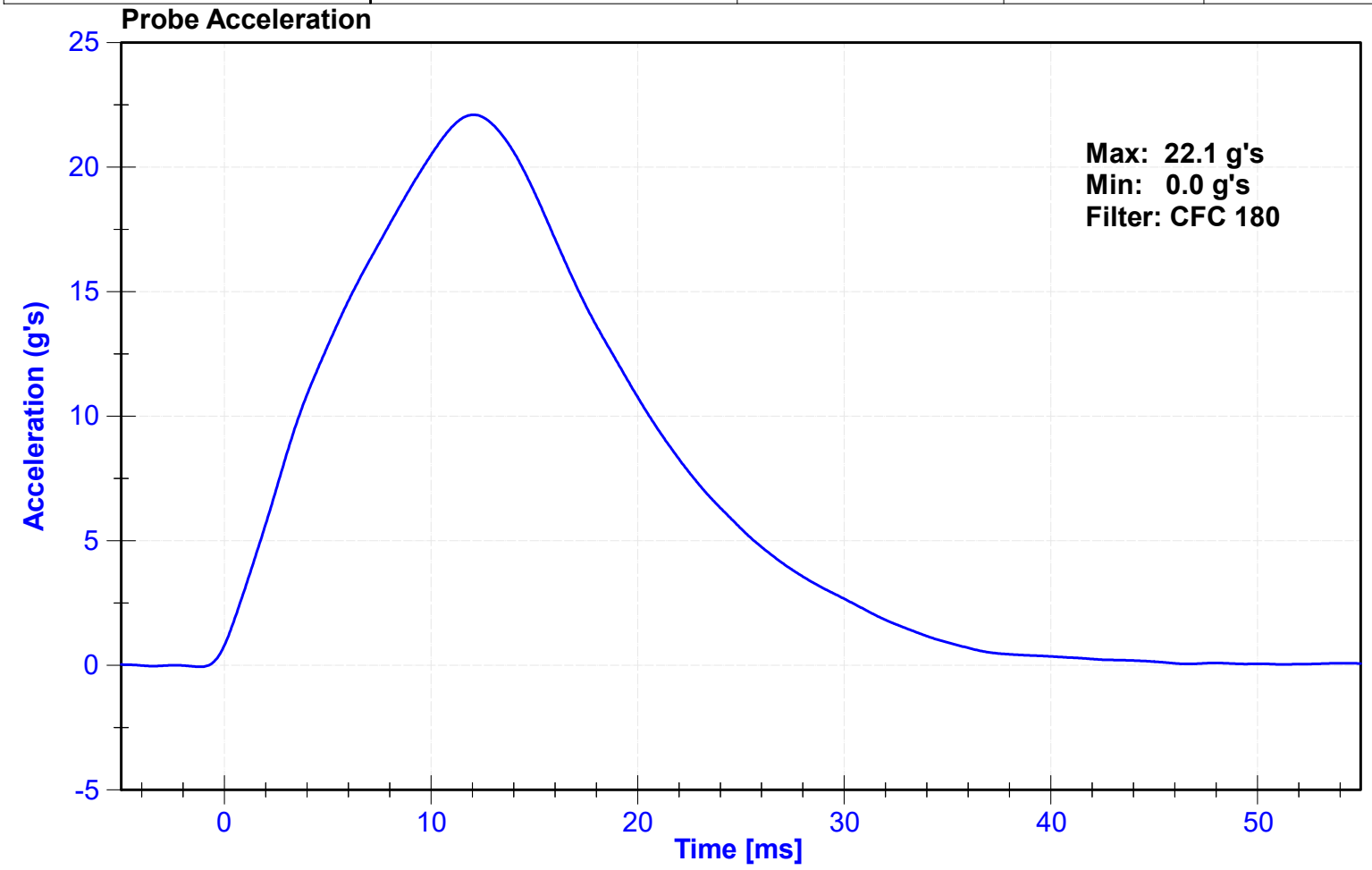
ATD Manufacturer	Denton	Test Technician	C. Mantell
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

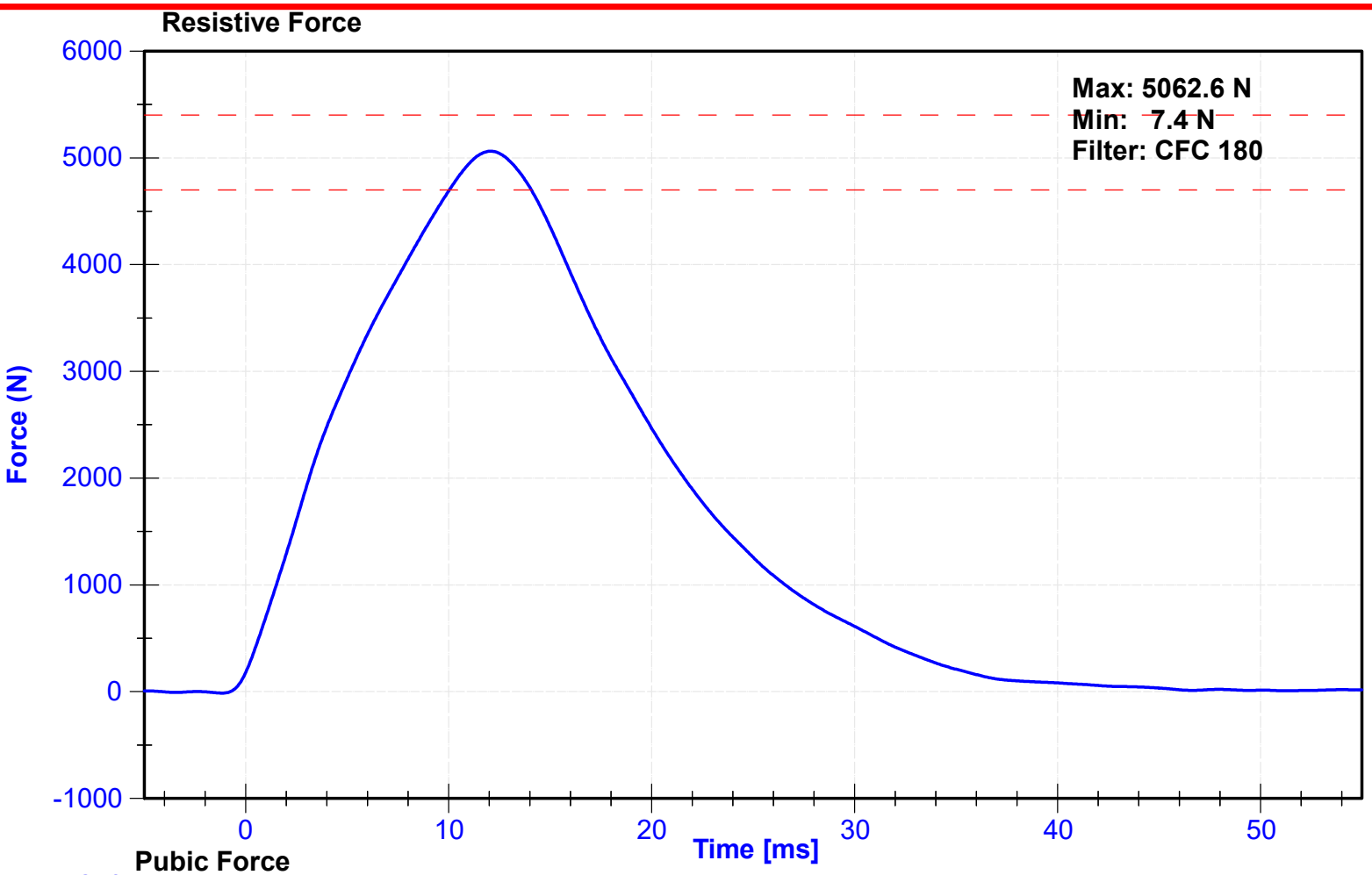
Results

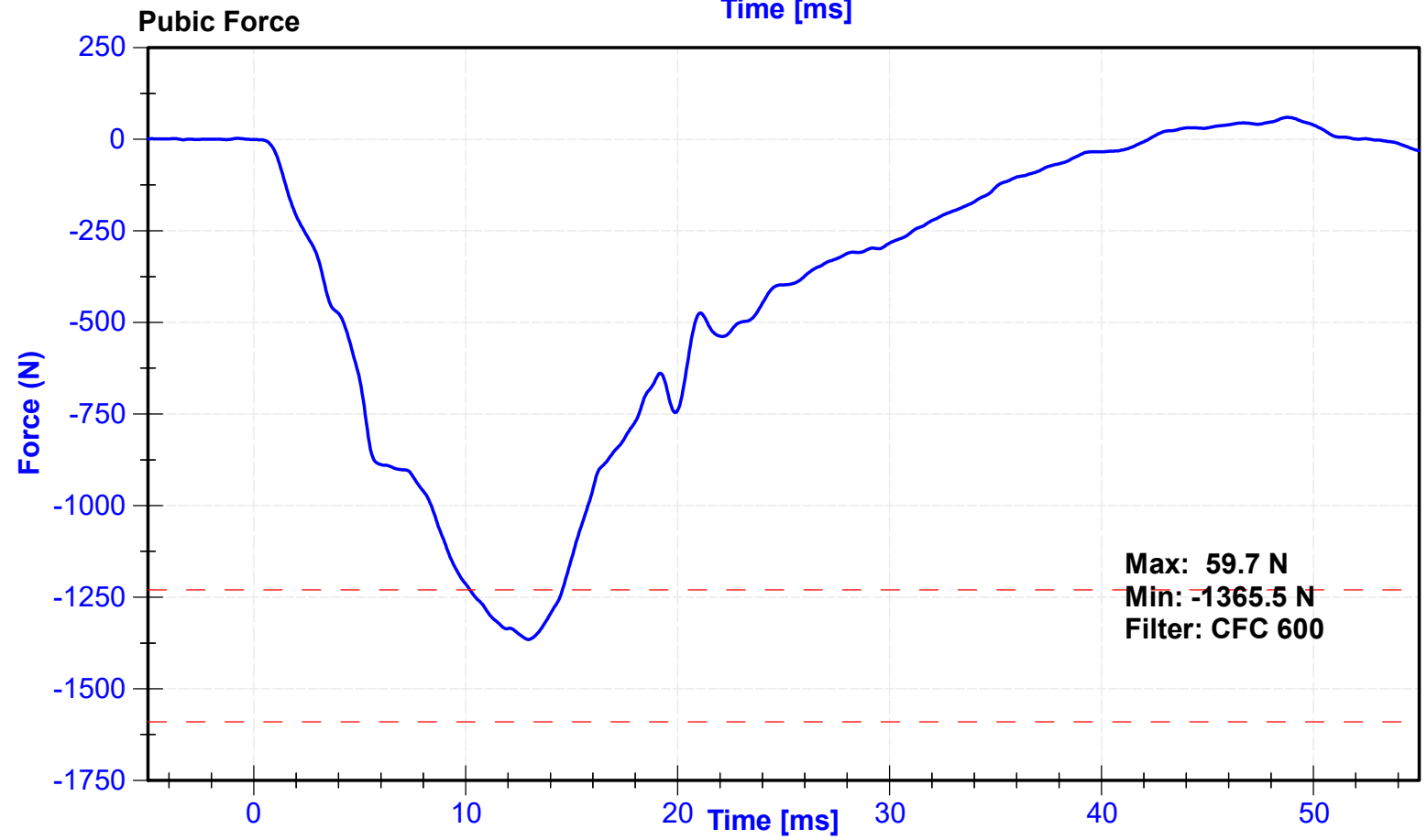
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	66.1	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Resistive Force	4700	5400	N	5062.6	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.05	Pass
Pubic Force	-1590	-1230	N	-1365.5	Pass
Time at Peak Pubic Force	12.2	17.0	ms	12.95	Pass

Transducer Calibrations

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




Resistive Force
Max: 5062.6 N
Min: 7.4 N
Filter: CFC 180
Force (N)
6000
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]

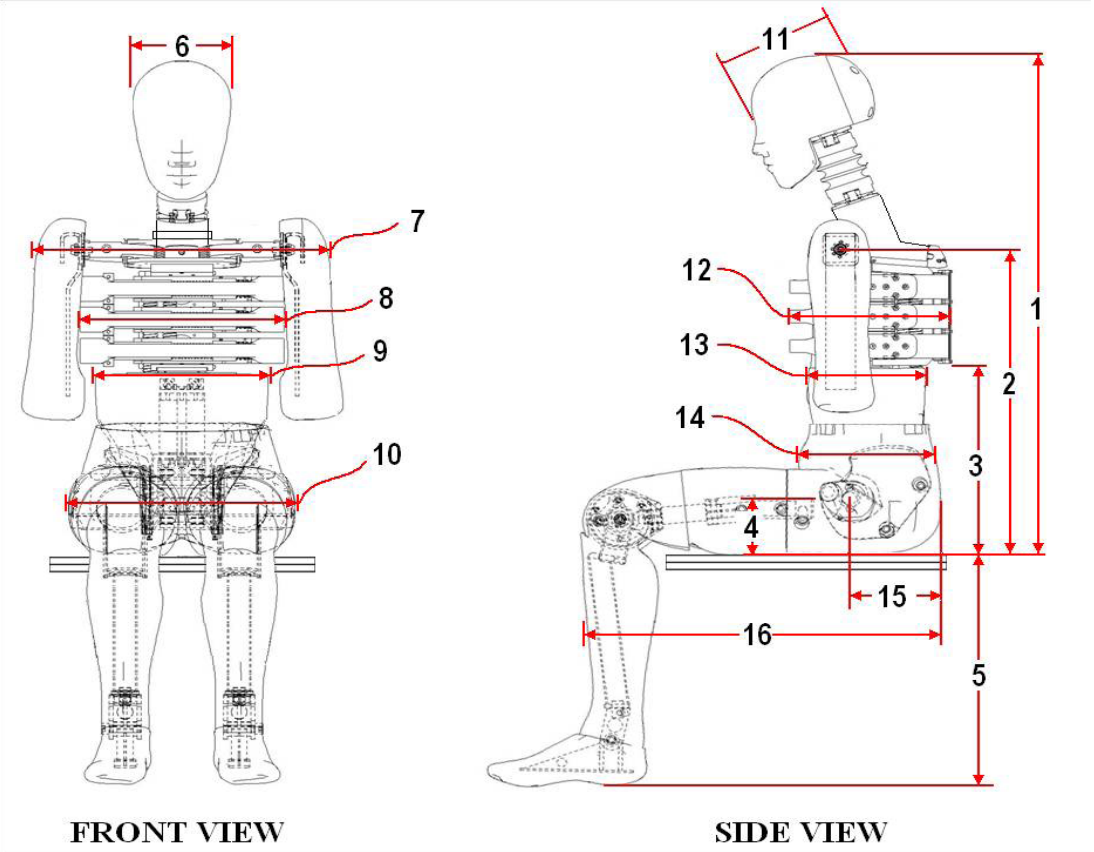

Pubic Force
Max: 59.7 N
Min: -1365.5 N
Filter: CFC 600
Force (N)
250
0
-250
-500
-750
-1000
-1250
-1500
-1750
0
10
20
30
40
50
Time [ms]

POST-TEST
ES-2re PERFORMANCE CALIBRATION TEST DATA

External Measurements - EuroSID-2re

Technician: K. Brogan Date: 06/29/2023

Dummy Serial Number: D037



FRONT VIEW SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	911	Pass
2	Seat to Shoulder Joint	558	572	564	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	353	Pass
4	Seat to Hip Joint (center of bolt)	97	103	101	Pass
5	Sole to Seat, Sitting	333	451	422	Pass
6	Head Width	152	158	155	Pass
7	Shoulder/Arm Width	461	479	470	Pass
8	Thorax Width	322	332	329	Pass
9	Abdomen Width	273	287	281	Pass
10	Pelvis Lap Width	359	373	364	Pass
11	Head Depth	196	206	200	Pass
12	Thorax Depth	262	272	266	Pass
13	Abdomen Depth	194	204	198	Pass
14	Pelvis Depth	235	245	241	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	154	Pass
16	Back of Buttocks to Front Knee	597	615	604	Pass

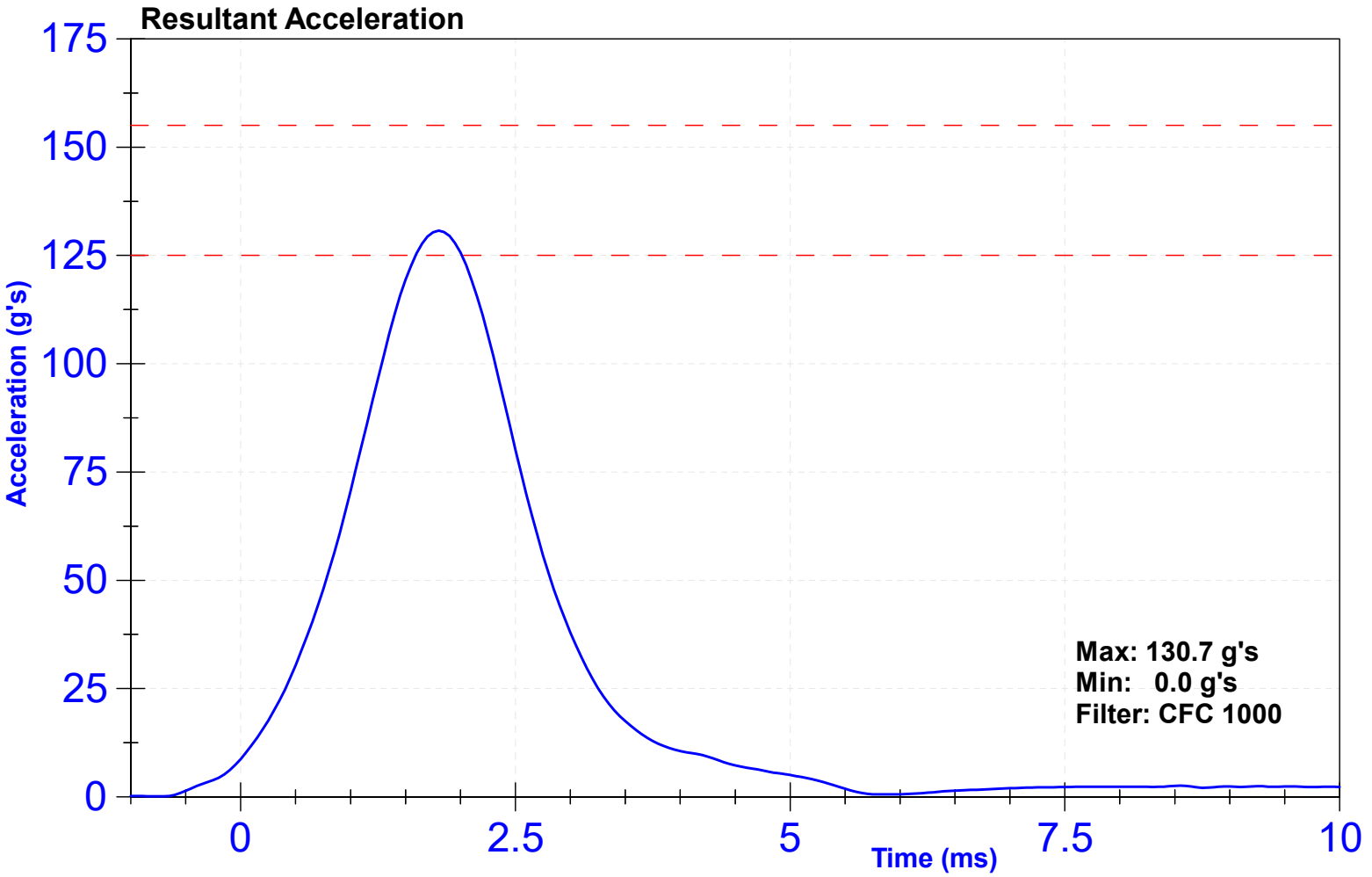
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

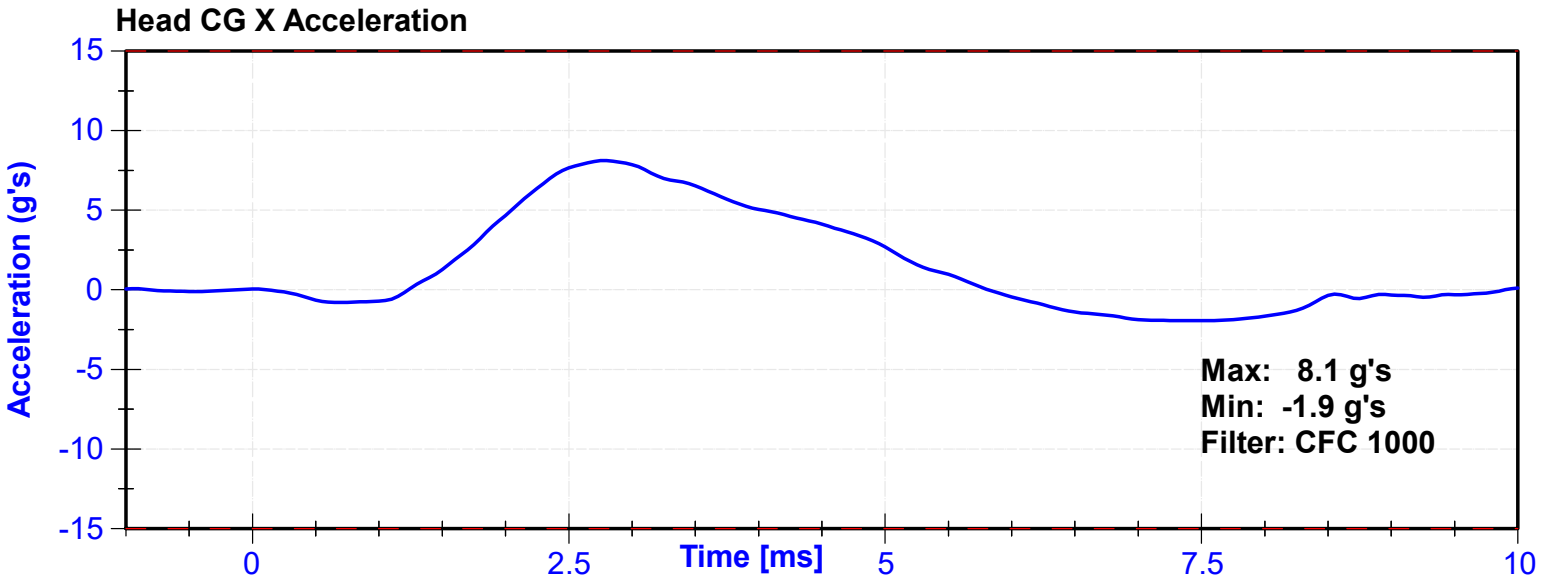
Results

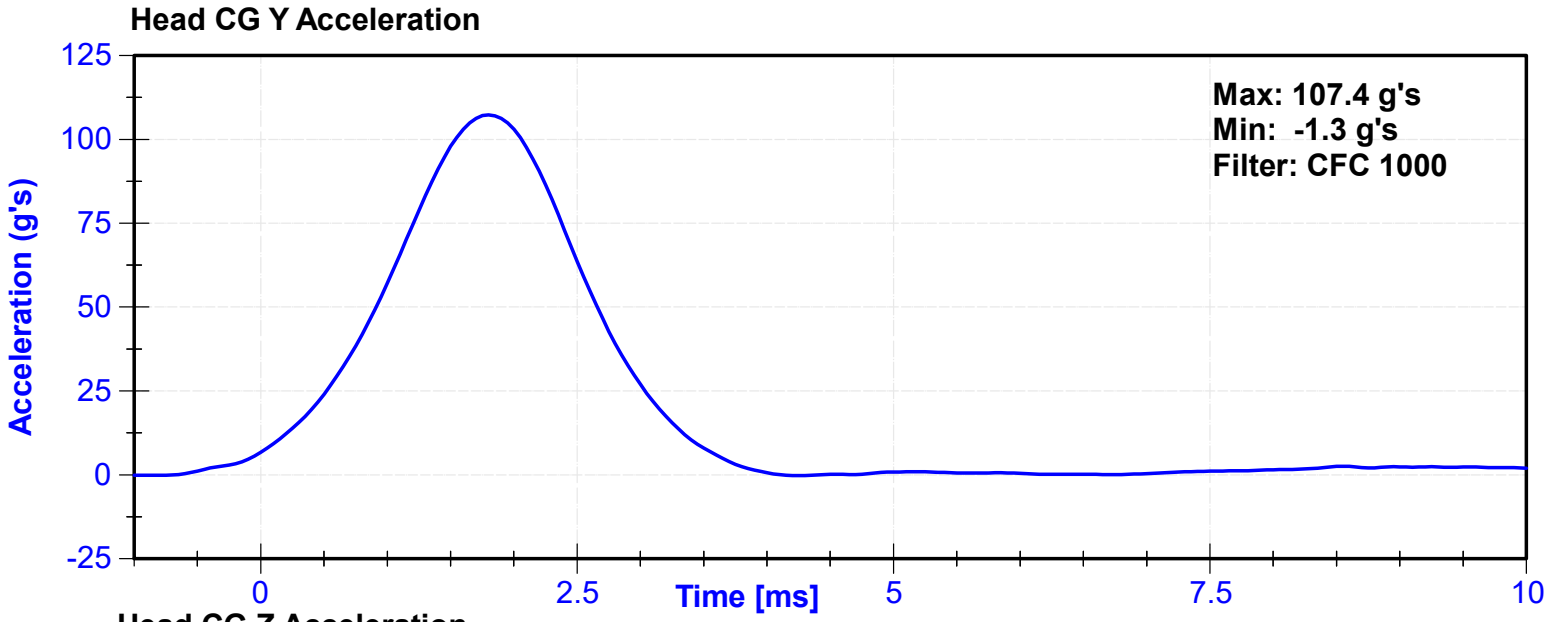
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	48	Pass
Resultant Acceleration	125	155	g's	130.7	Pass
Oscillation	0	15	%	1.97	Pass
Fore-Aft Acceleration	-15	15	g's	8.1	Pass

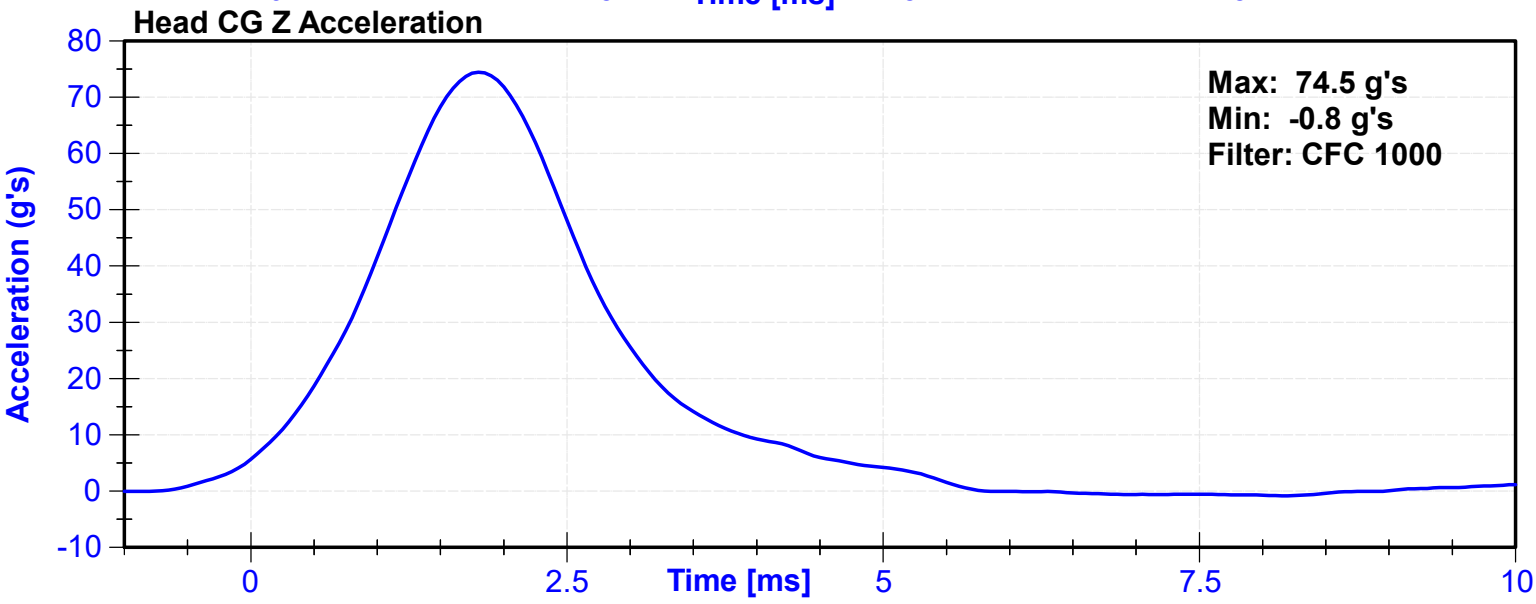
Transducer Calibrations

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




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 8.1 g's
Min: -1.9 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 107.4 g's
Min: -1.3 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
80
70
60
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]
Max: 74.5 g's
Min: -0.8 g's
Filter: CFC 1000

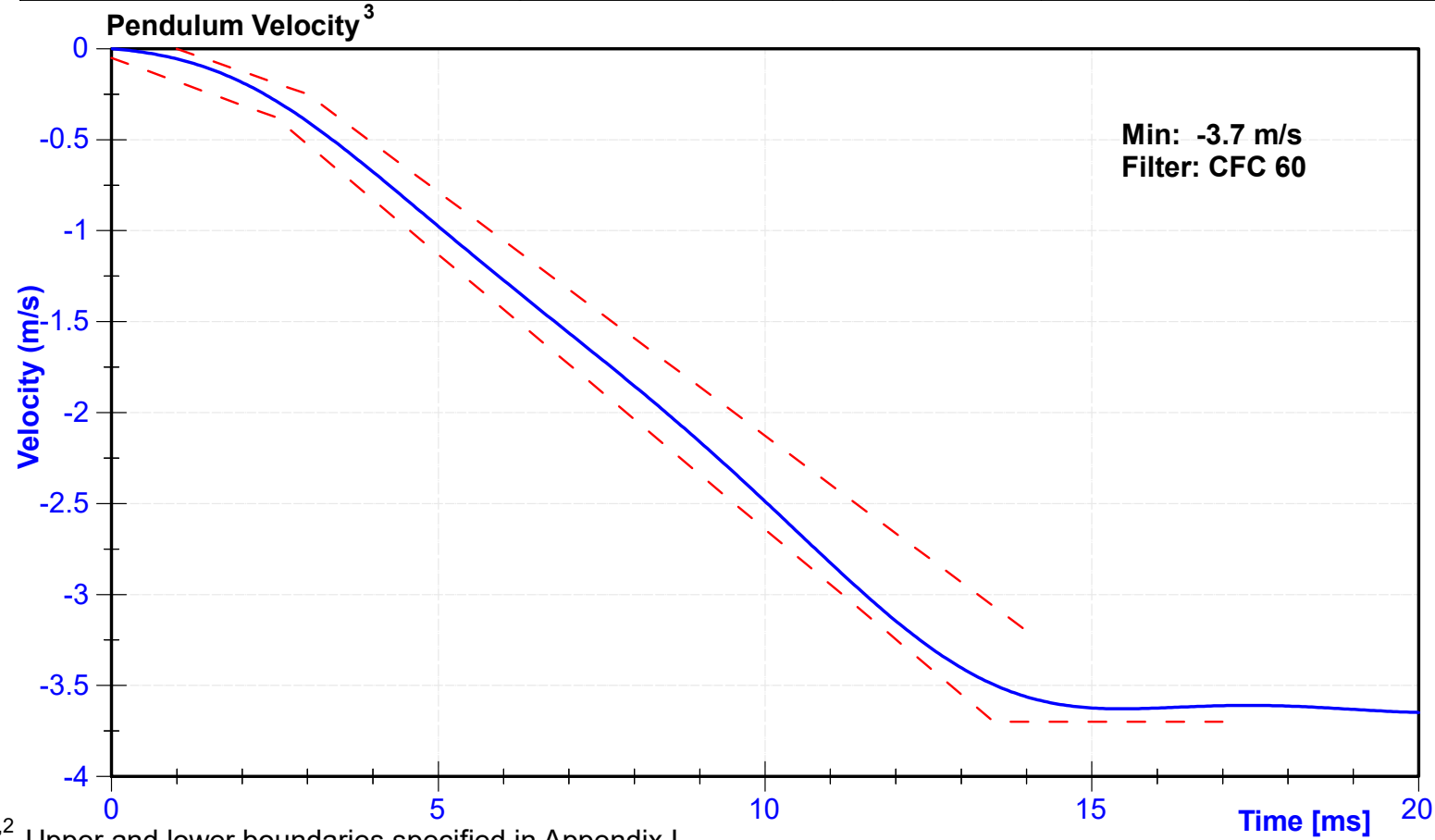
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

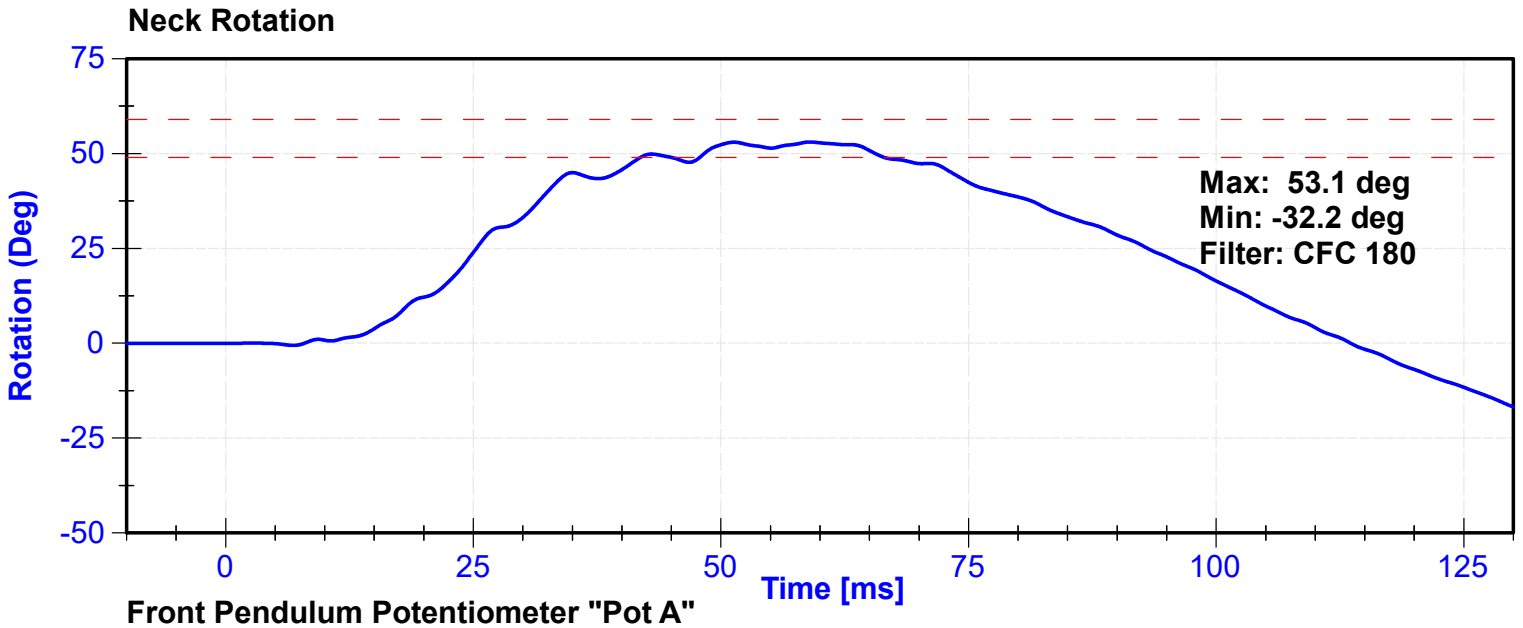
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	54.3	Pass
Velocity	3.3	3.5	m/s	3.42	Pass
Lateral Neck Rotation	49	59	deg	53.1	Pass
Time at Maximum Rotation	54	66	ms	59.0	Pass
Time of Rotation Decay from Maximum	53	88	ms	54.6	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

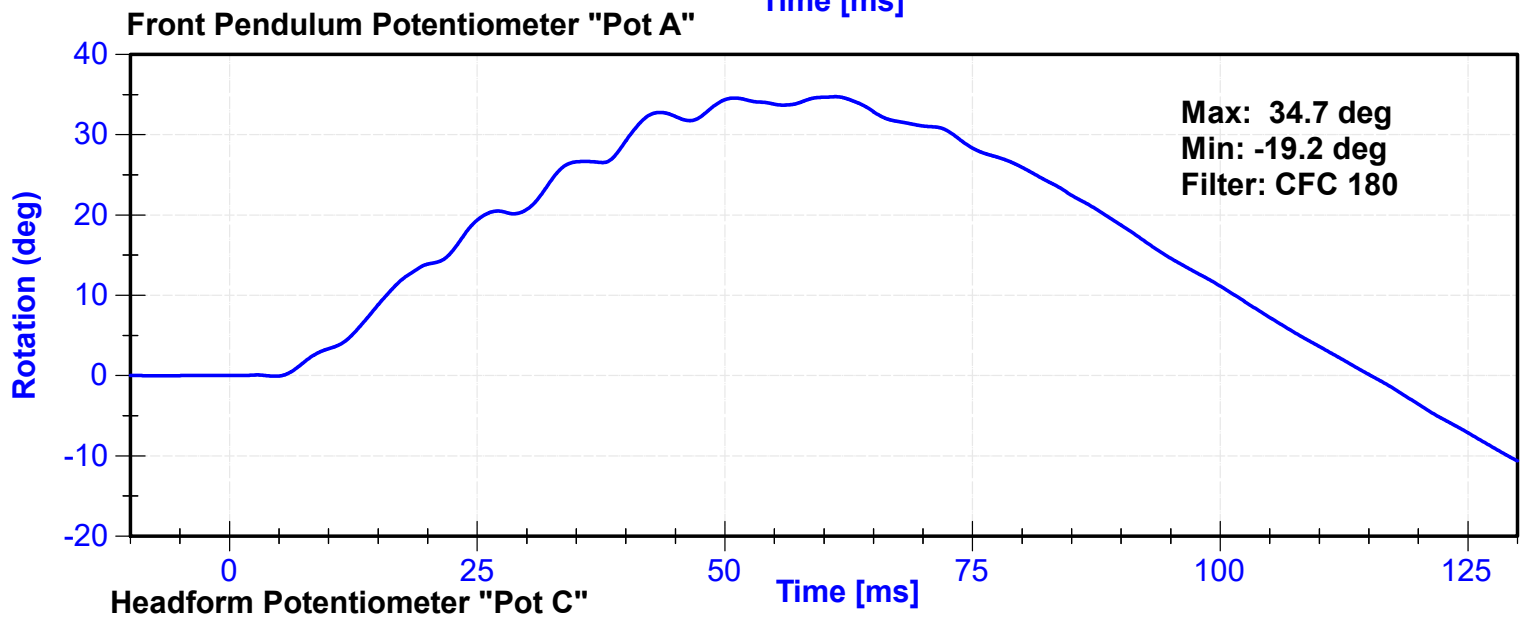
Transducer Calibrations

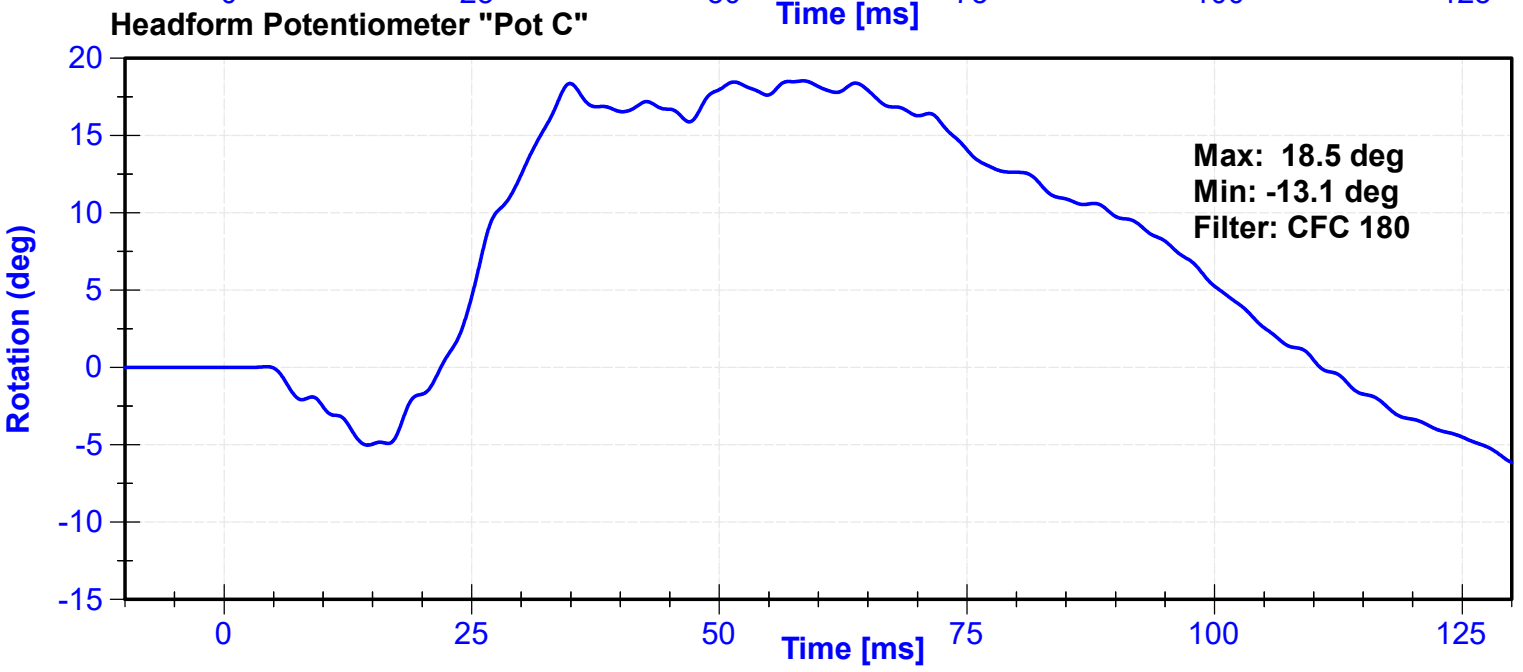
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Front Pendulum Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Headform Potentiometer	Sfernice	095	10/5/2022	10/5/2023



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


Neck Rotation
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]
Max: 53.1 deg
Min: -32.2 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: 34.7 deg
Min: -19.2 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: 18.5 deg
Min: -13.1 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

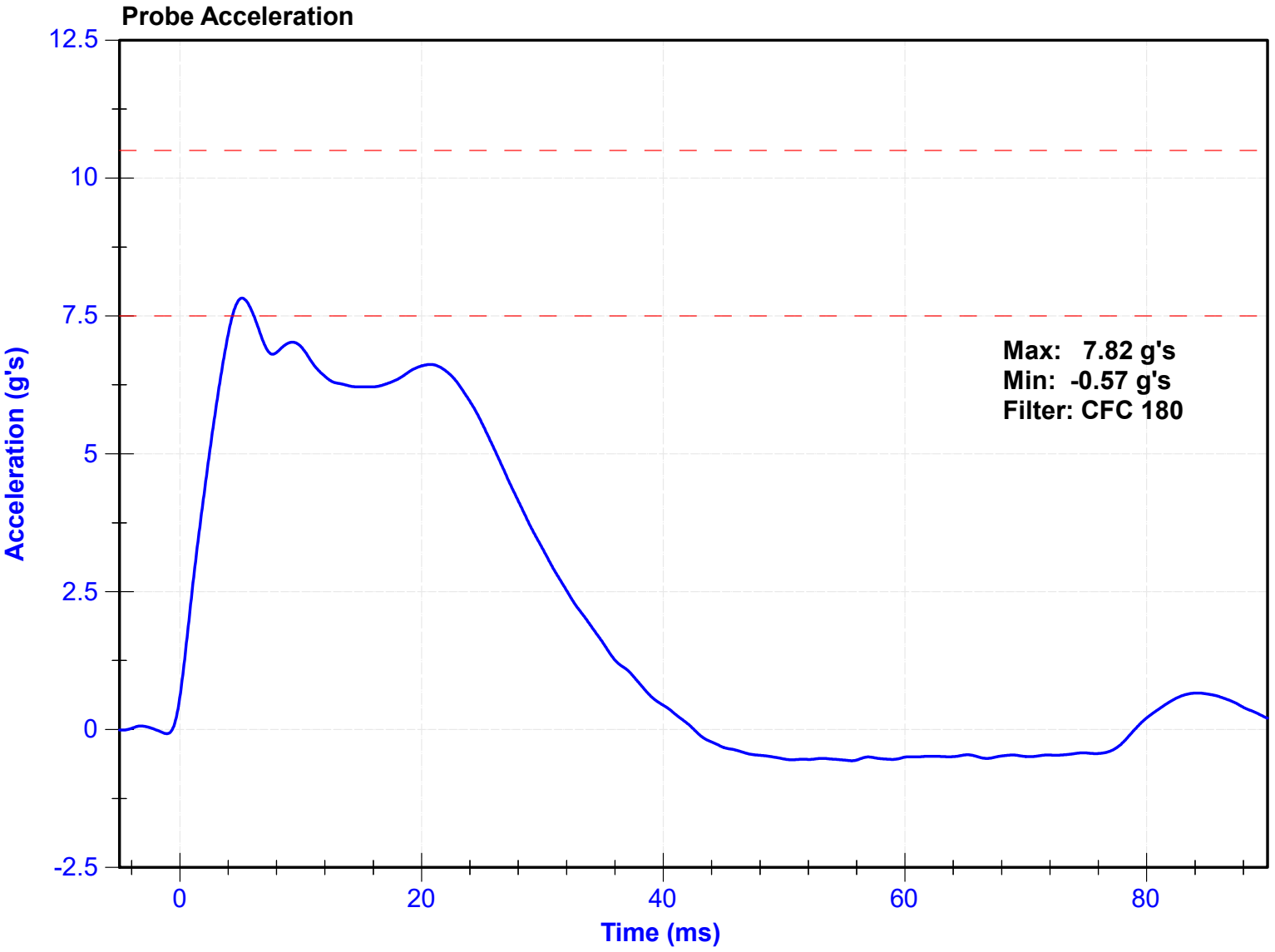
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	47.3	Pass
Velocity	4.2	4.4	m/s	4.32	Pass
Probe Acceleration	7.5	10.5	g's	7.82	Pass

Transducer Calibrations

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



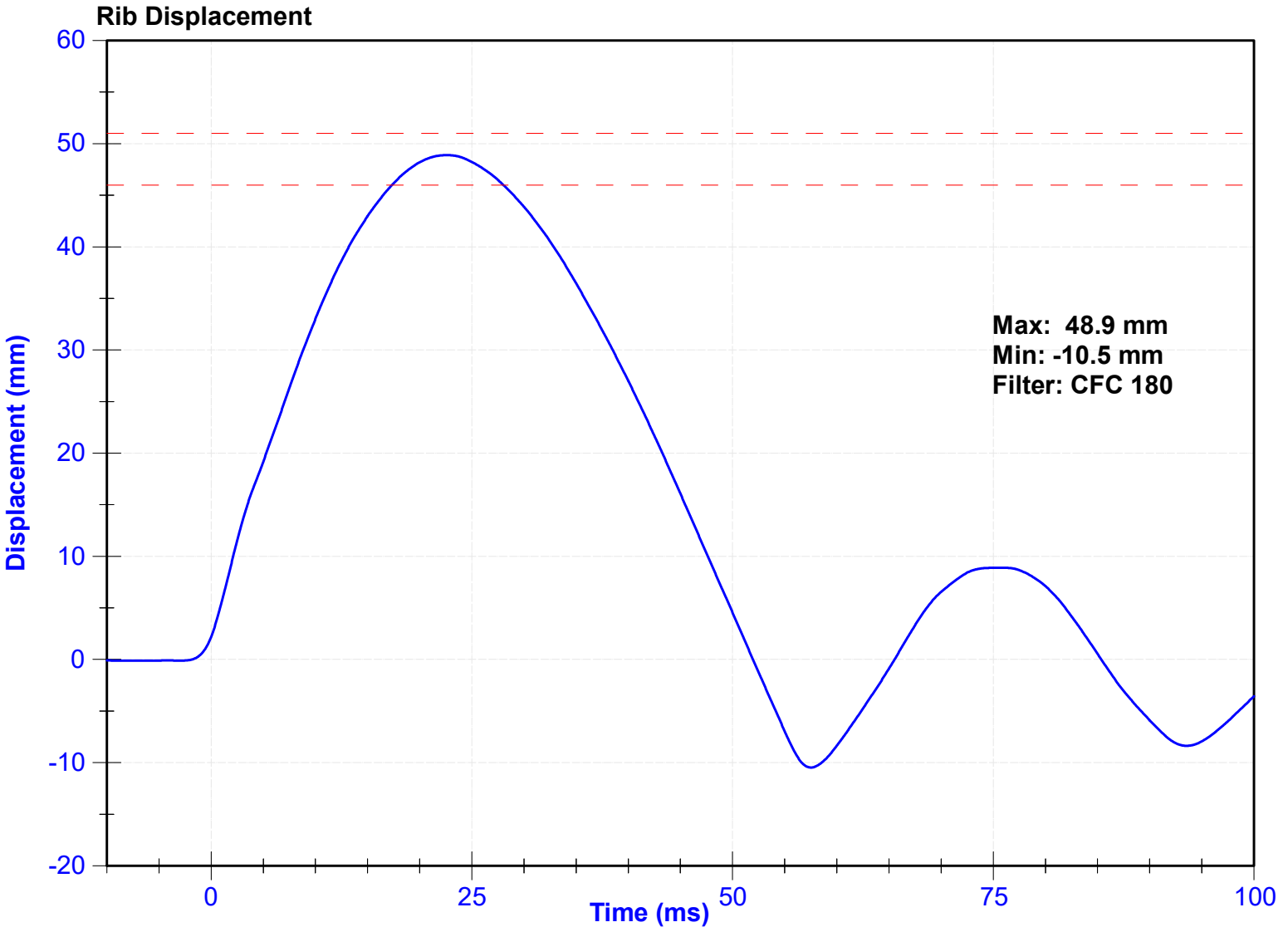
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	46	51	mm	48.9	Pass

Transducer Calibrations

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



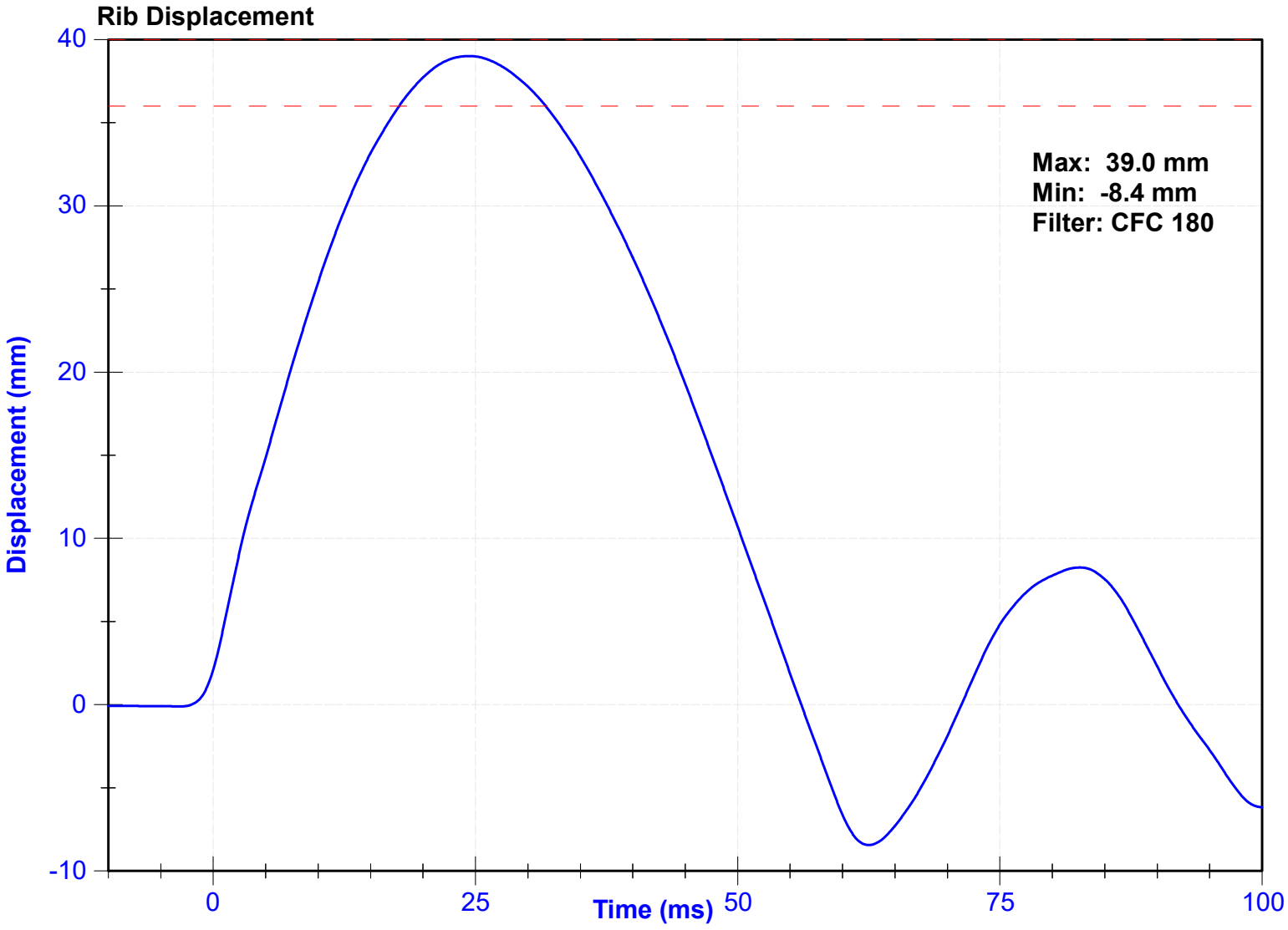
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	36	40	mm	39.0	Pass

Transducer Calibrations

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



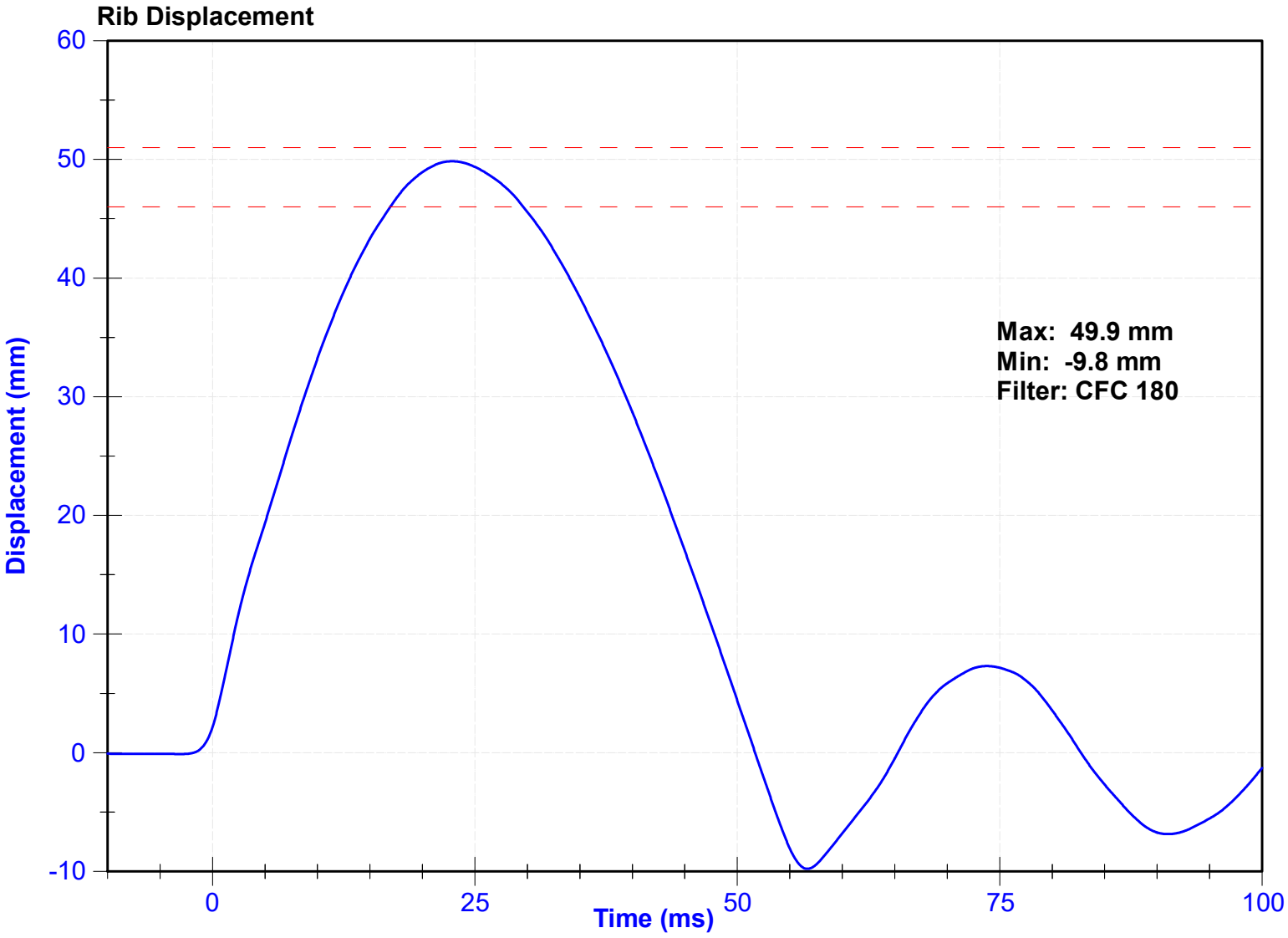
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	46	51	mm	49.9	Pass

Transducer Calibrations

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



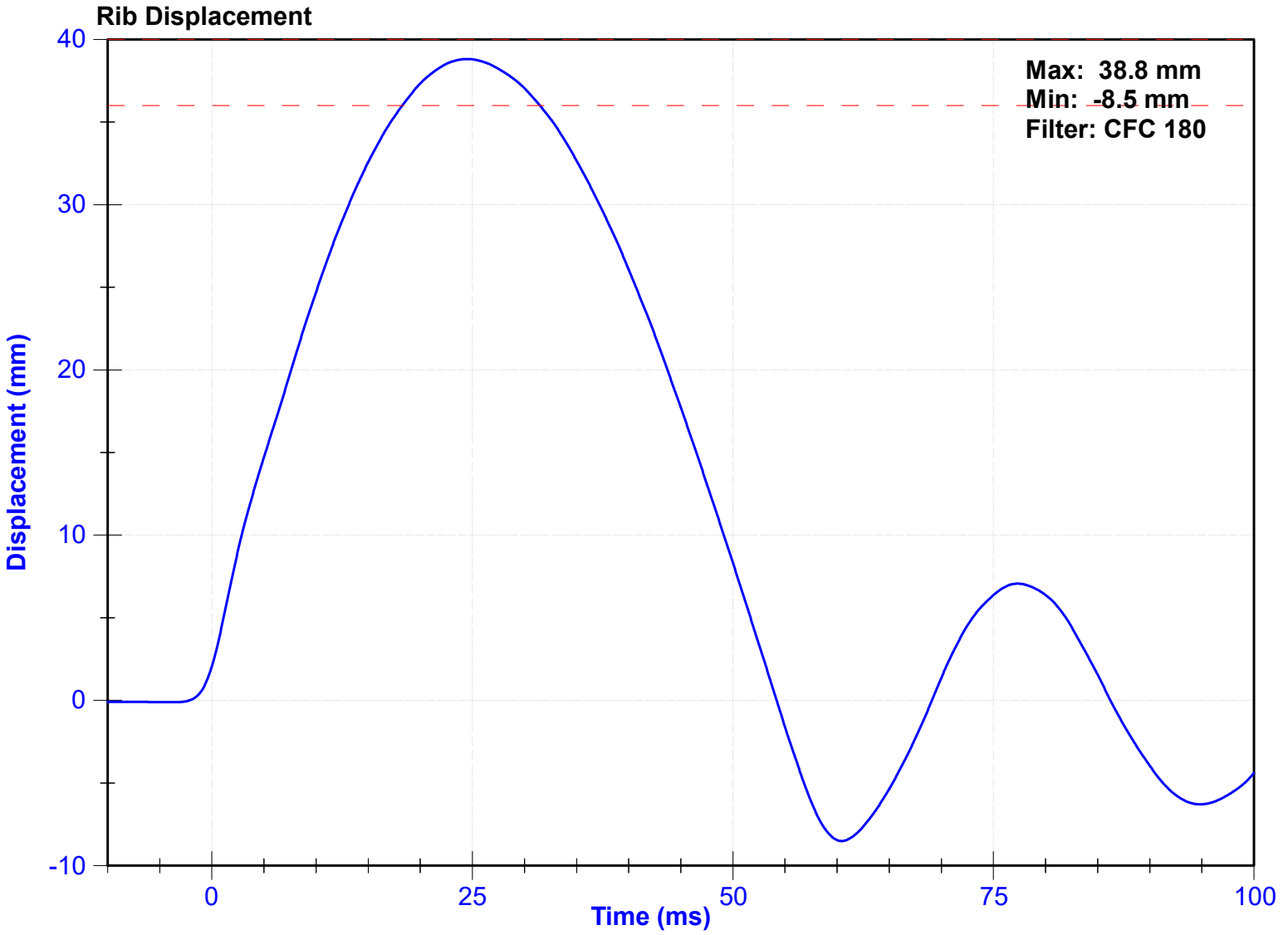
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	36	40	mm	38.8	Pass

Transducer Calibrations

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



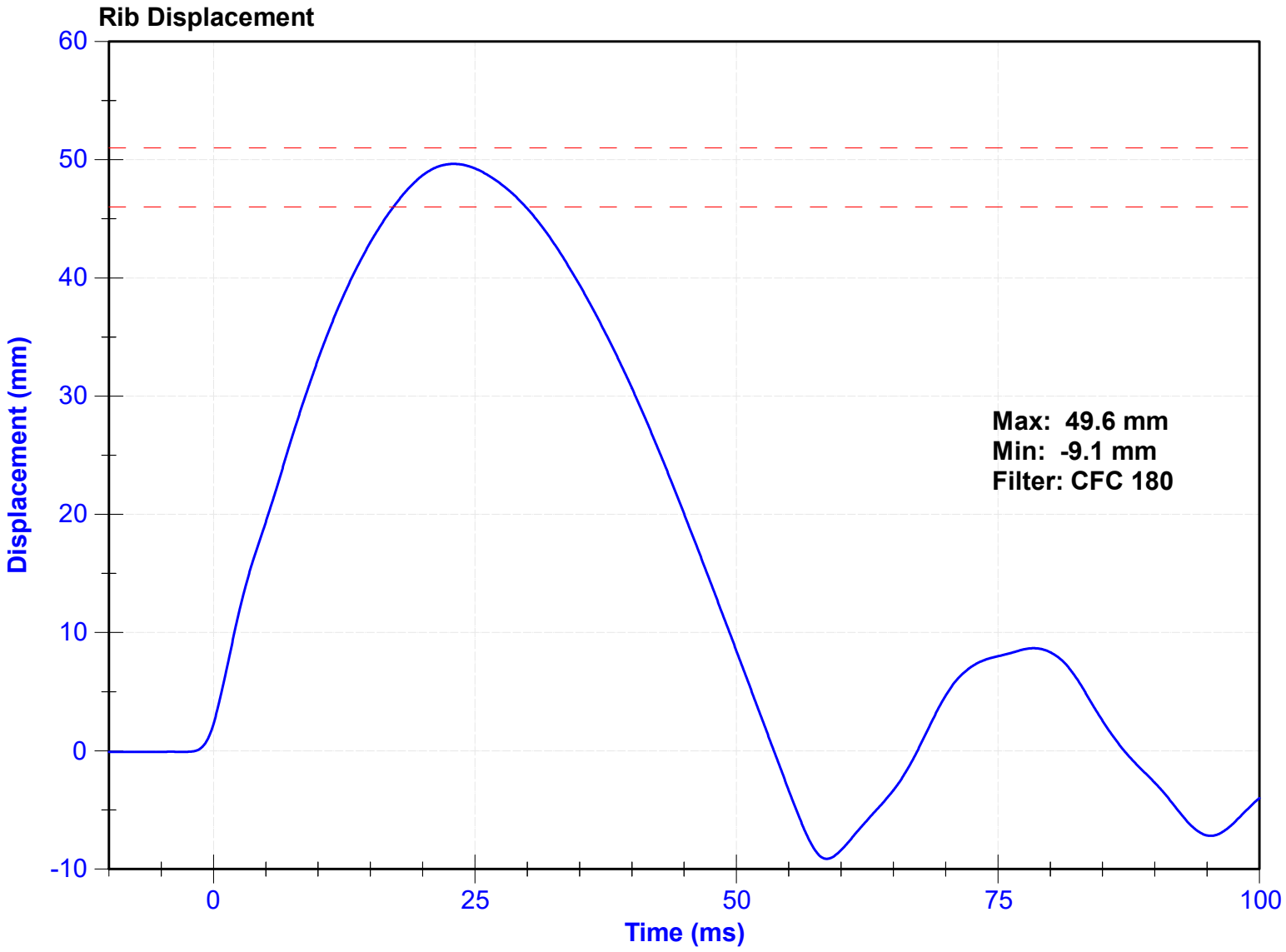
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	46	51	mm	49.6	Pass

Transducer Calibrations

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



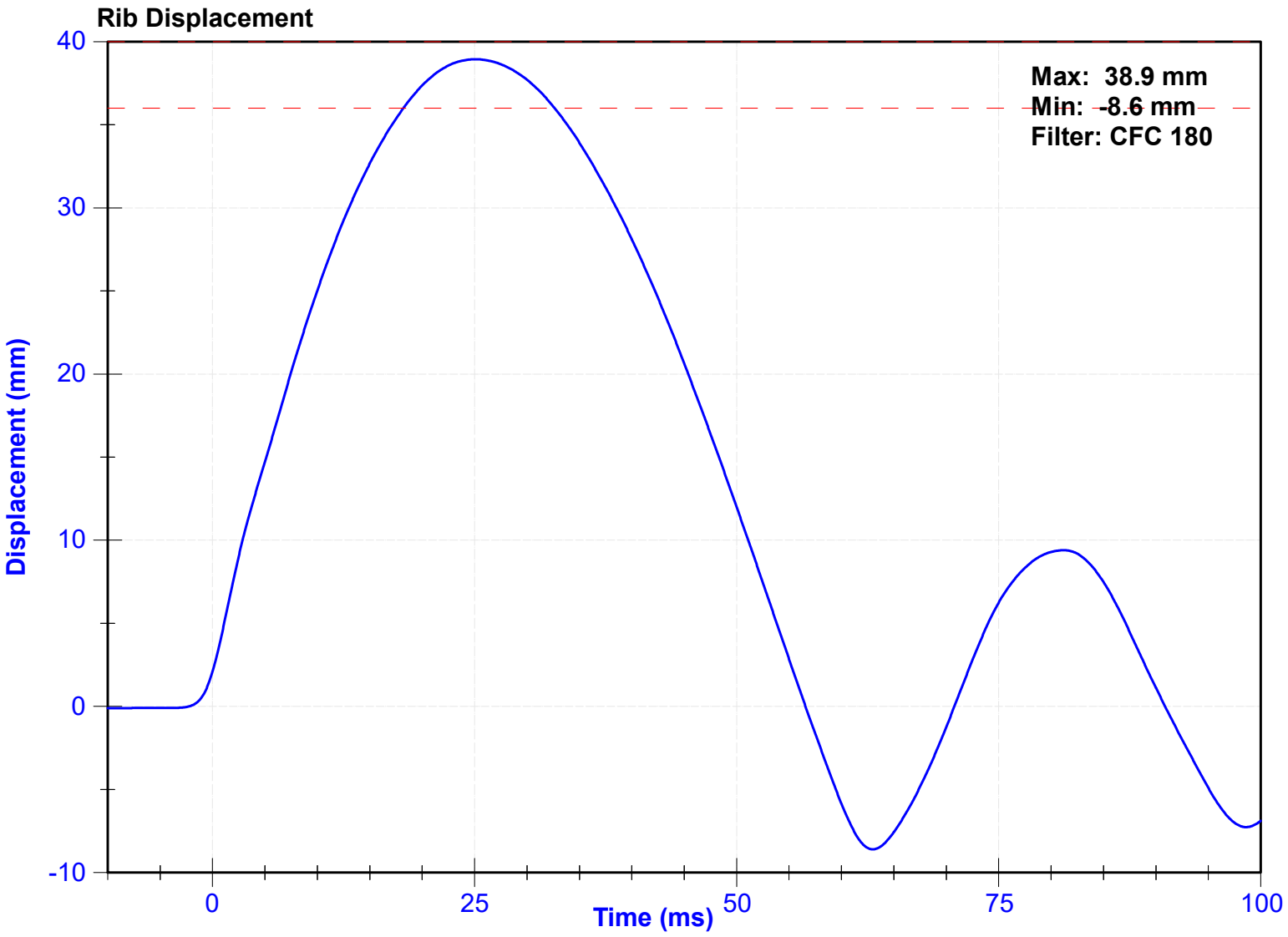
ATD Manufacturer	Denton	Test Technician	O.Vail
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	48	Pass
Rib Displacement	36	40	mm	38.9	Pass

Transducer Calibrations

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



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

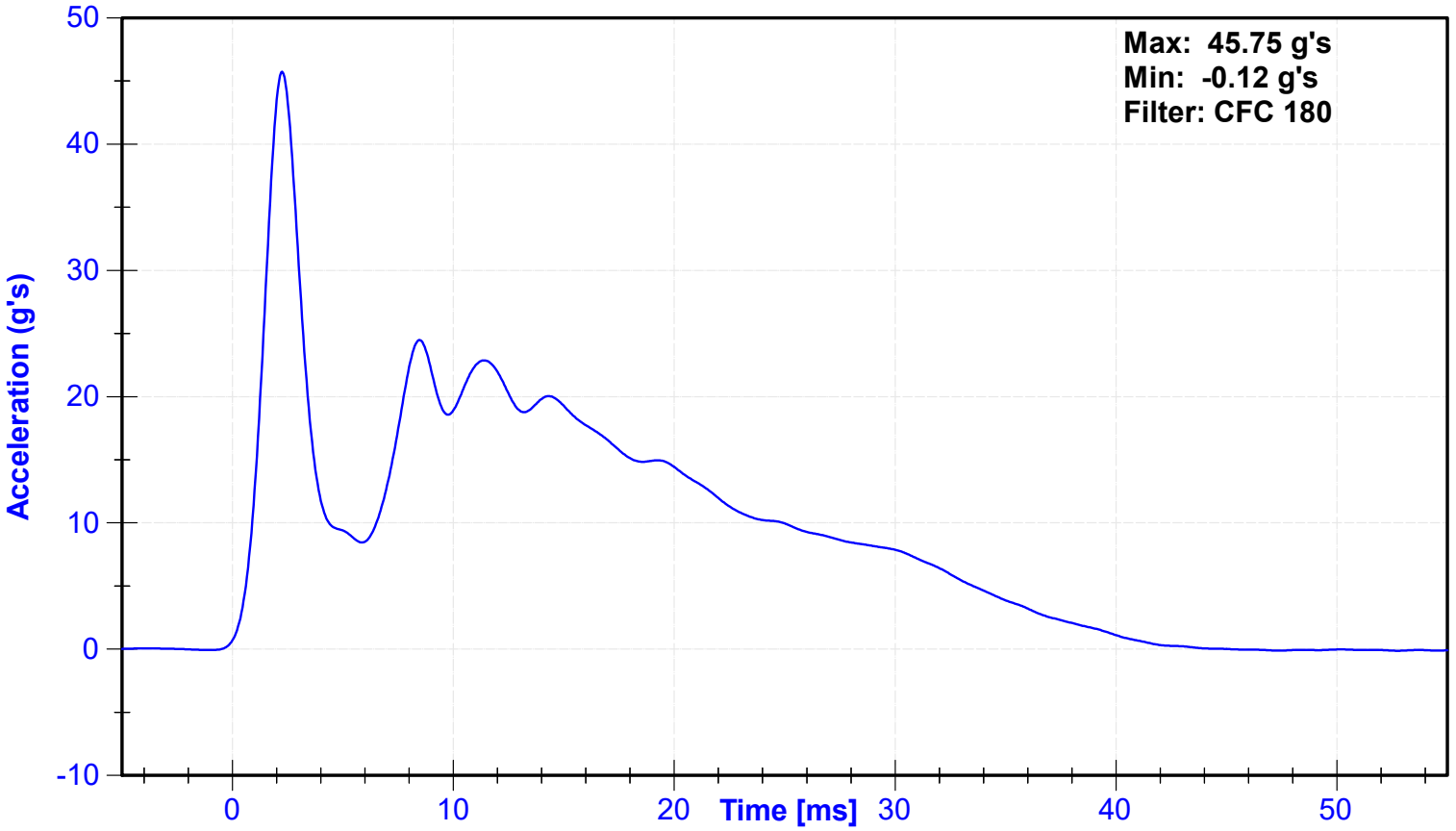
Results

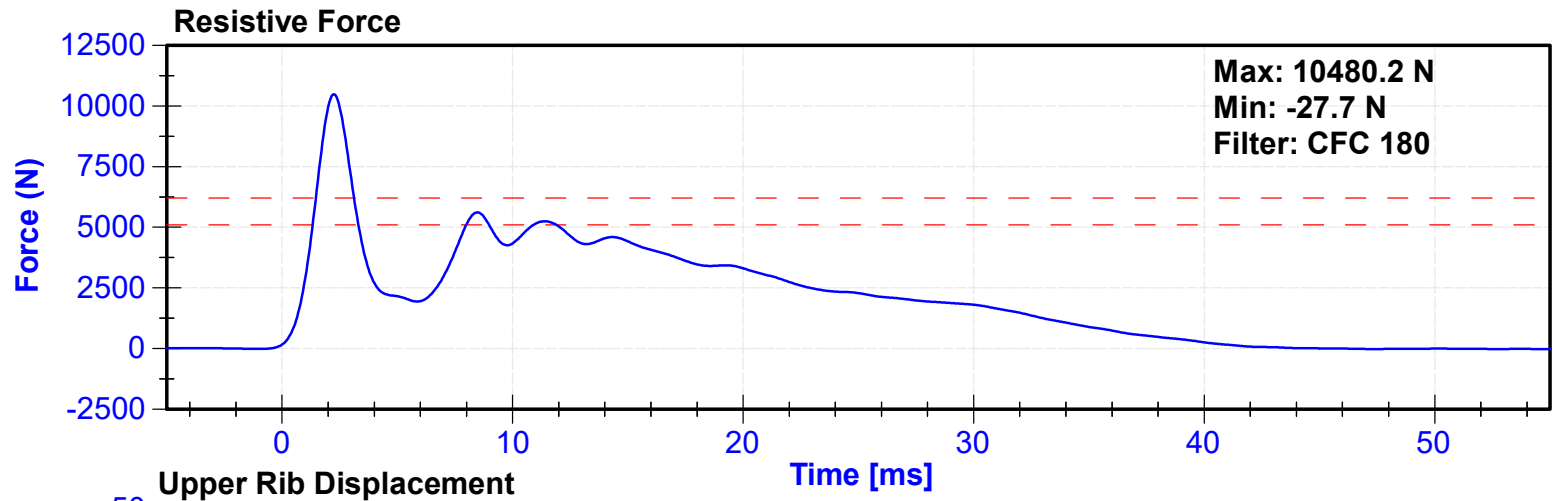
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	47.3	Pass
Velocity	5.4	5.6	m/s	5.53	Pass
Resistive Force after 6ms	5100	6200	N	5610.3	Pass
Upper Thorax Rib Deflection	34	41	mm	40.9	Pass
Mid Thorax Rib Deflection	37	45	mm	42.0	Pass
Lower Thorax Rib Deflection	37	44	mm	41.2	Pass

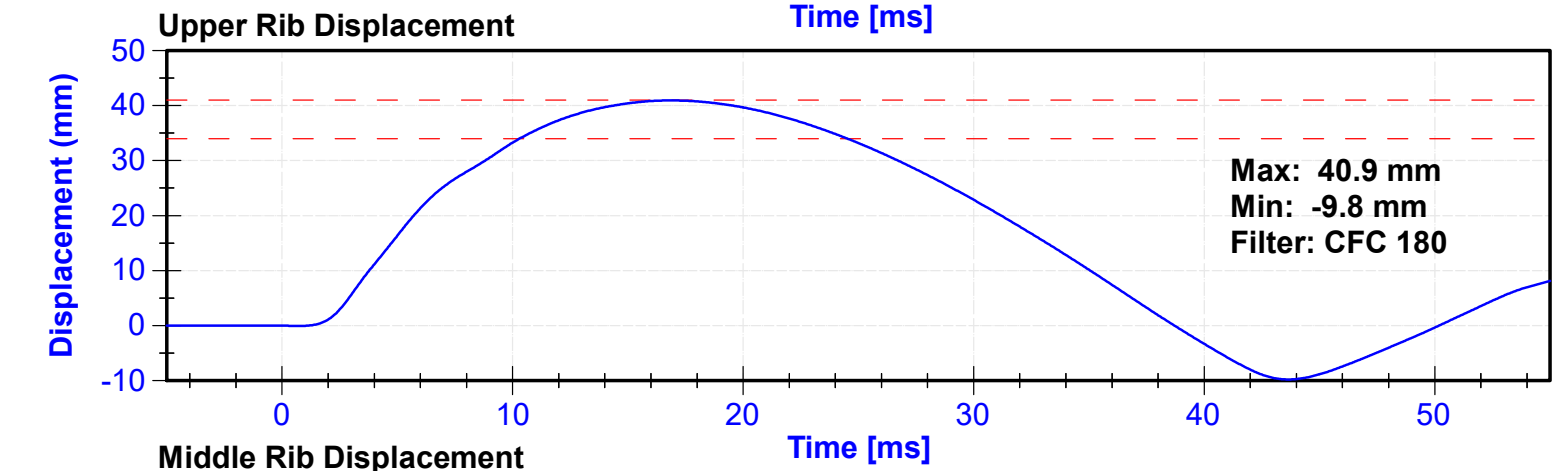
Transducer Calibrations

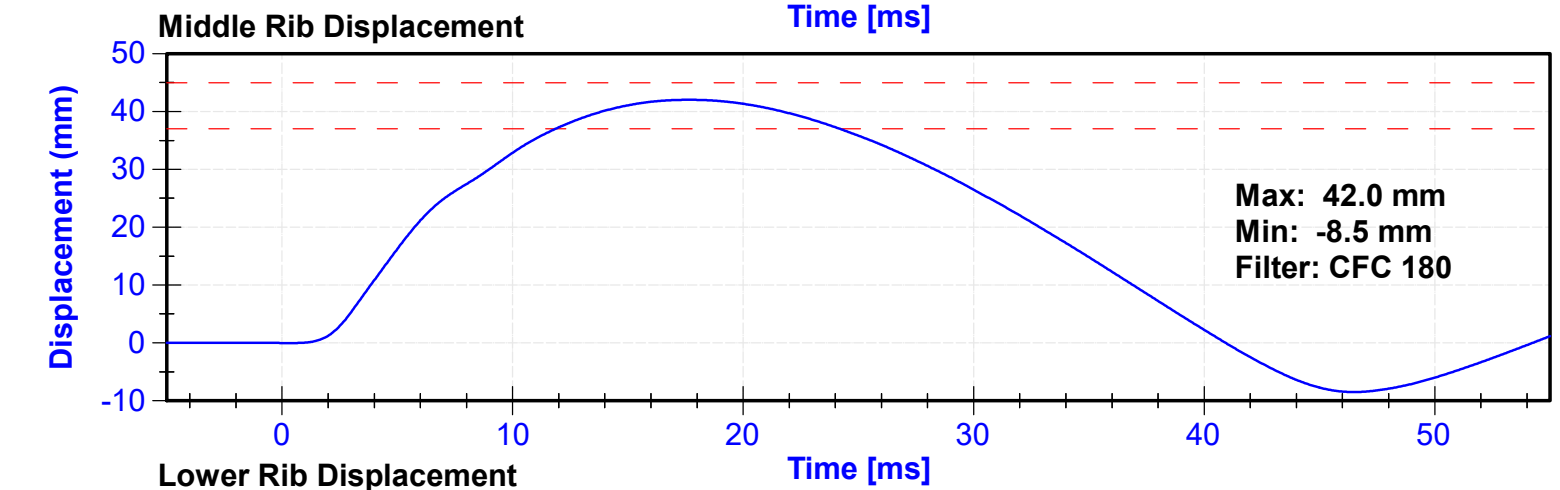
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Upper Thorax Rib Potentiometer	Honeywell	DS-0552-01	2/27/2023	8/28/2023
Middle Thorax Rib Potentiometer	Honeywell	DS-807	2/27/2023	8/28/2023
Lower Thorax Rib Potentiometer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

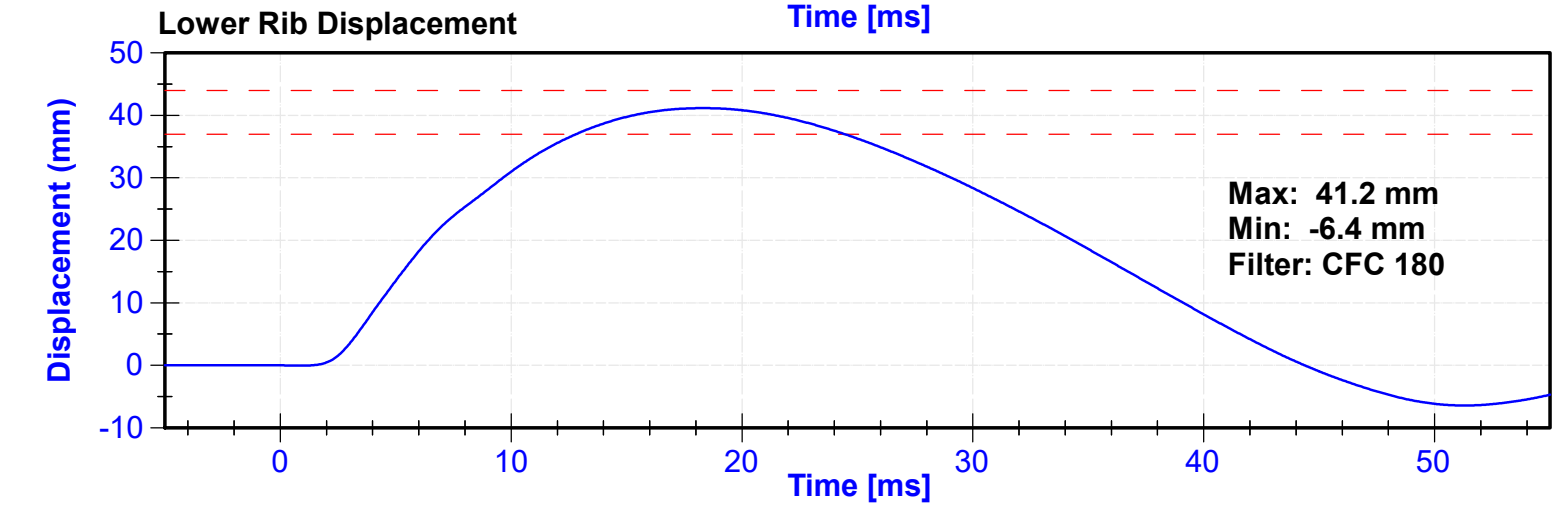
Probe Acceleration




Resistive Force
Max: 10480.2 N
Min: -27.7 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: 40.9 mm
Min: -9.8 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: -8.5 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Lower Rib Displacement
Max: 41.2 mm
Min: -6.4 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]

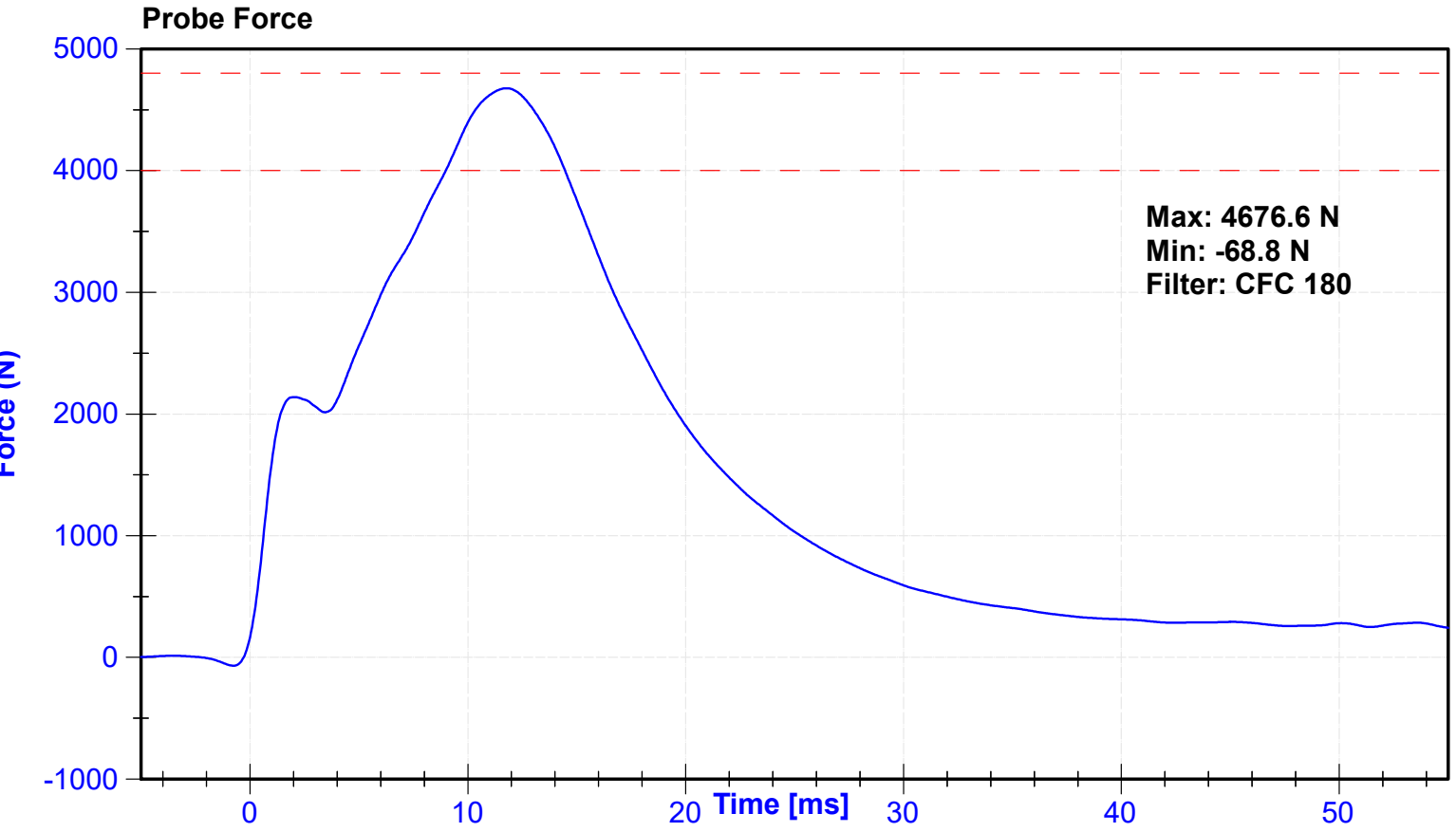
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

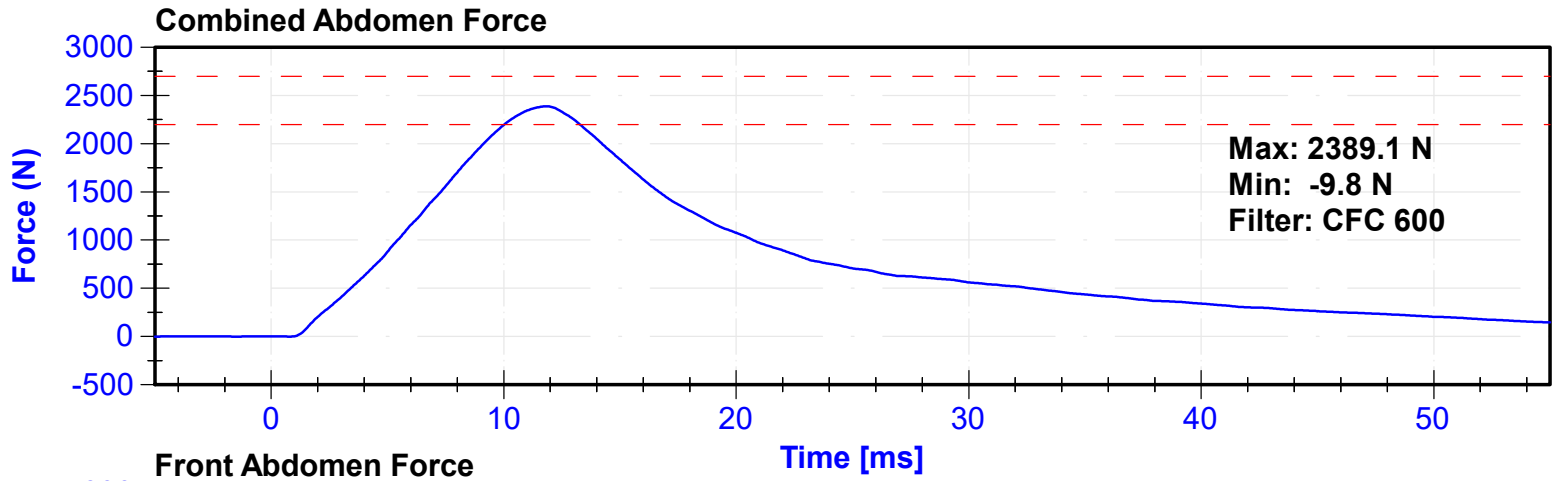
Results

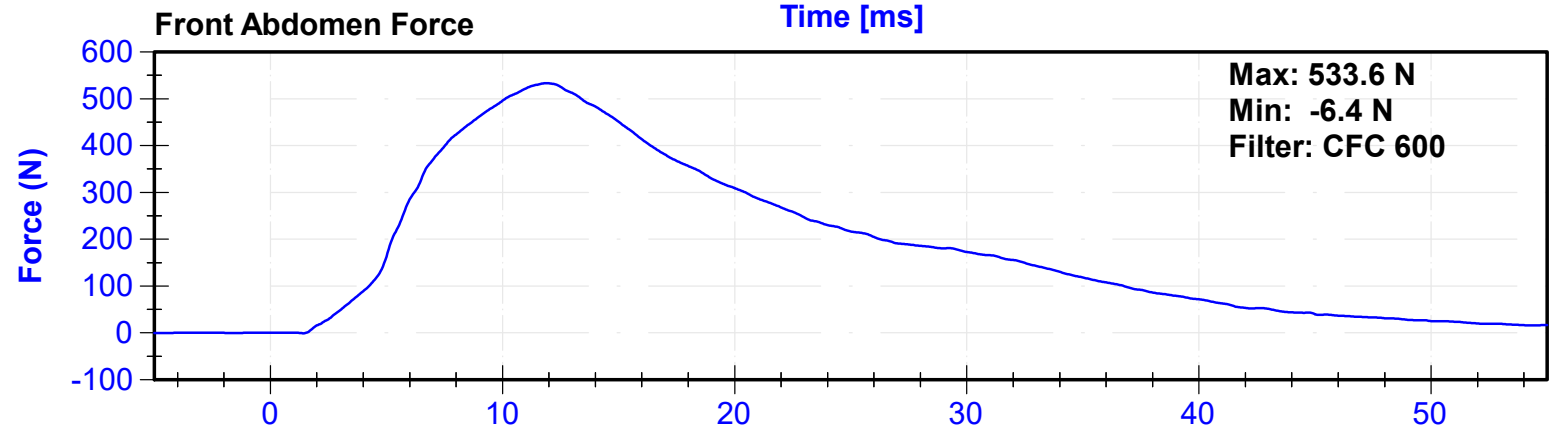
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	47.3	Pass
Velocity	3.9	4.1	m/s	4.03	Pass
Combined Abdomen Force	2200	2700	N	2389.1	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.85	Pass
Resistive Probe Force	4000	4800	N	4676.6	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.80	Pass

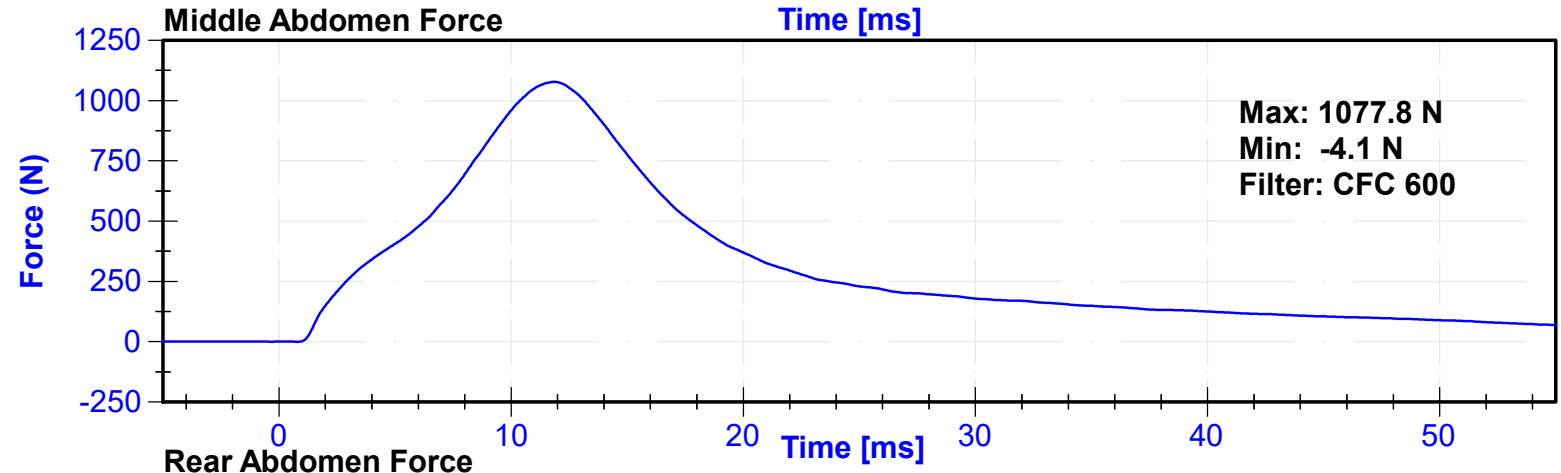
Transducer Calibrations

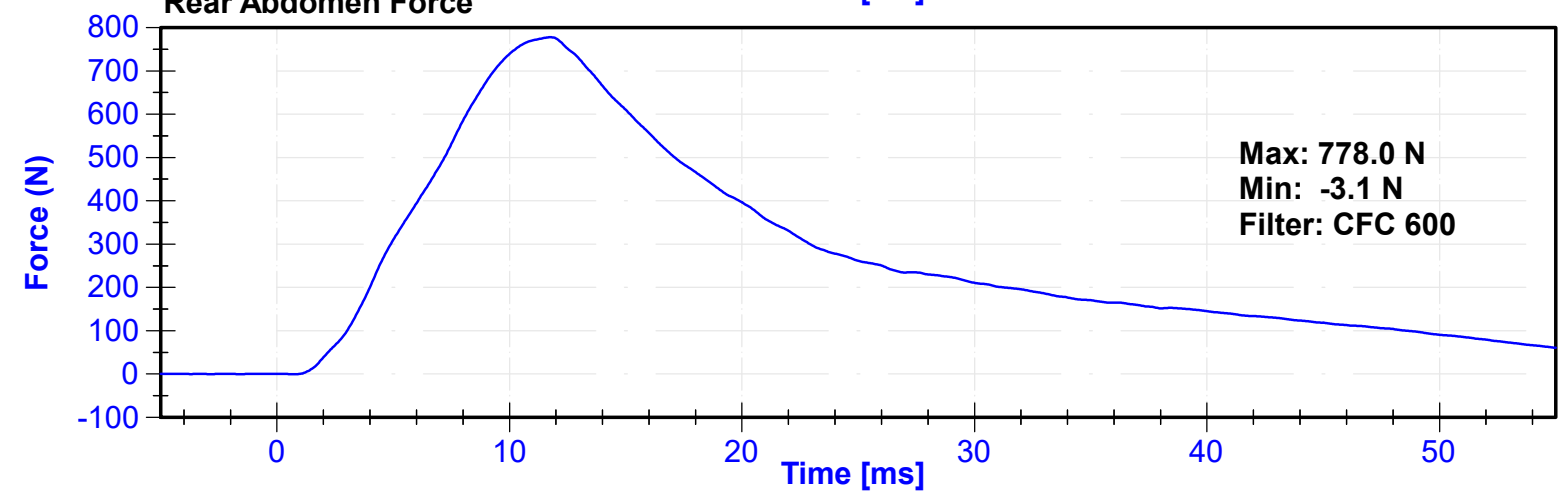
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	18546	11/19/2022	11/18/2023
Front Abdomen Load Cell	Denton	1440	8/12/2022	8/12/2023
Middle Abdomen Load Cell	Denton	1525	8/12/2022	8/12/2023
Rear Abdomen Load Cell	Denton	1528	8/12/2022	8/12/2023




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2389.1 N
Min: -9.8 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 533.6 N
Min: -6.4 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1077.8 N
Min: -4.1 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 778.0 N
Min: -3.1 N
Filter: CFC 600

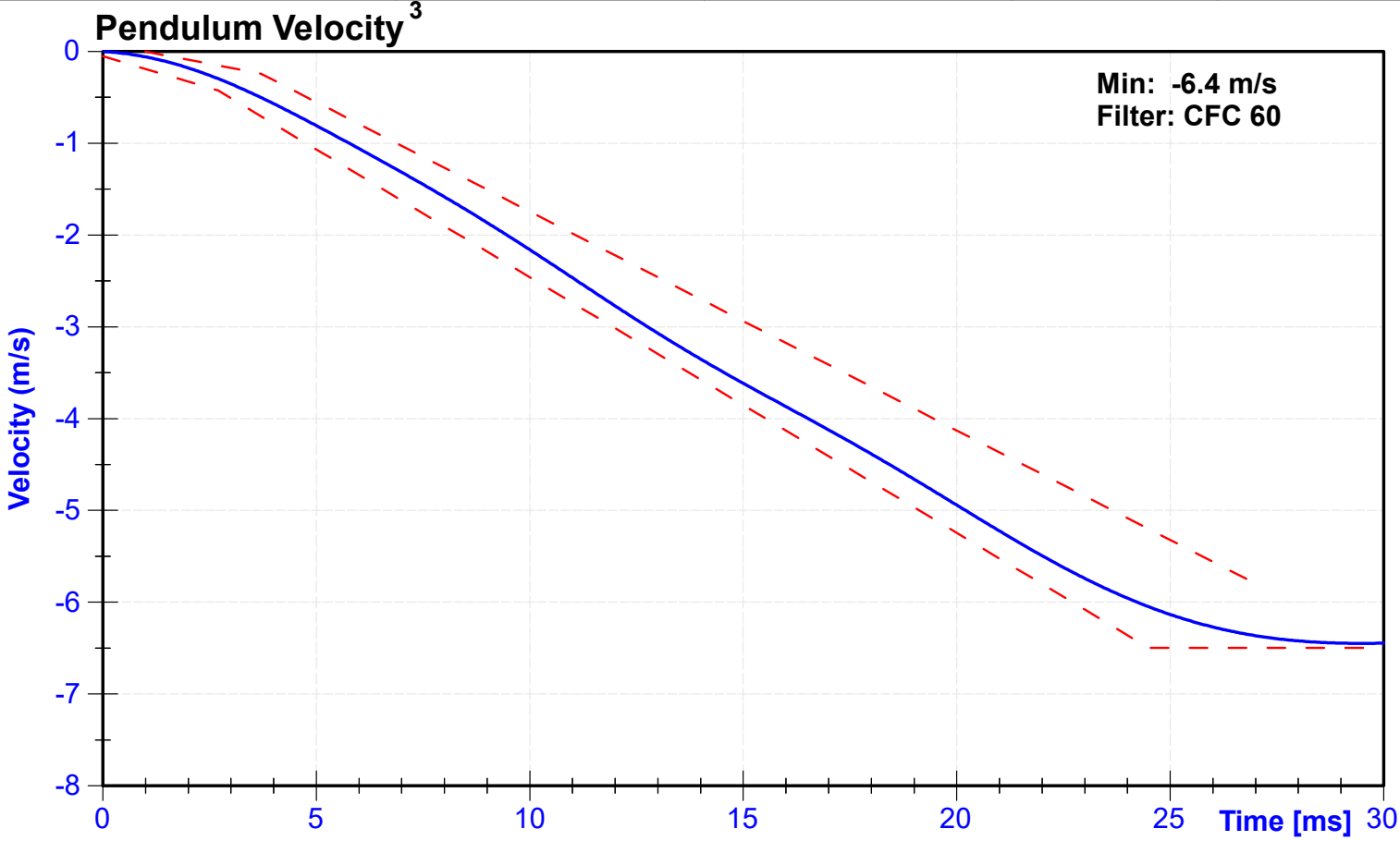
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

Results

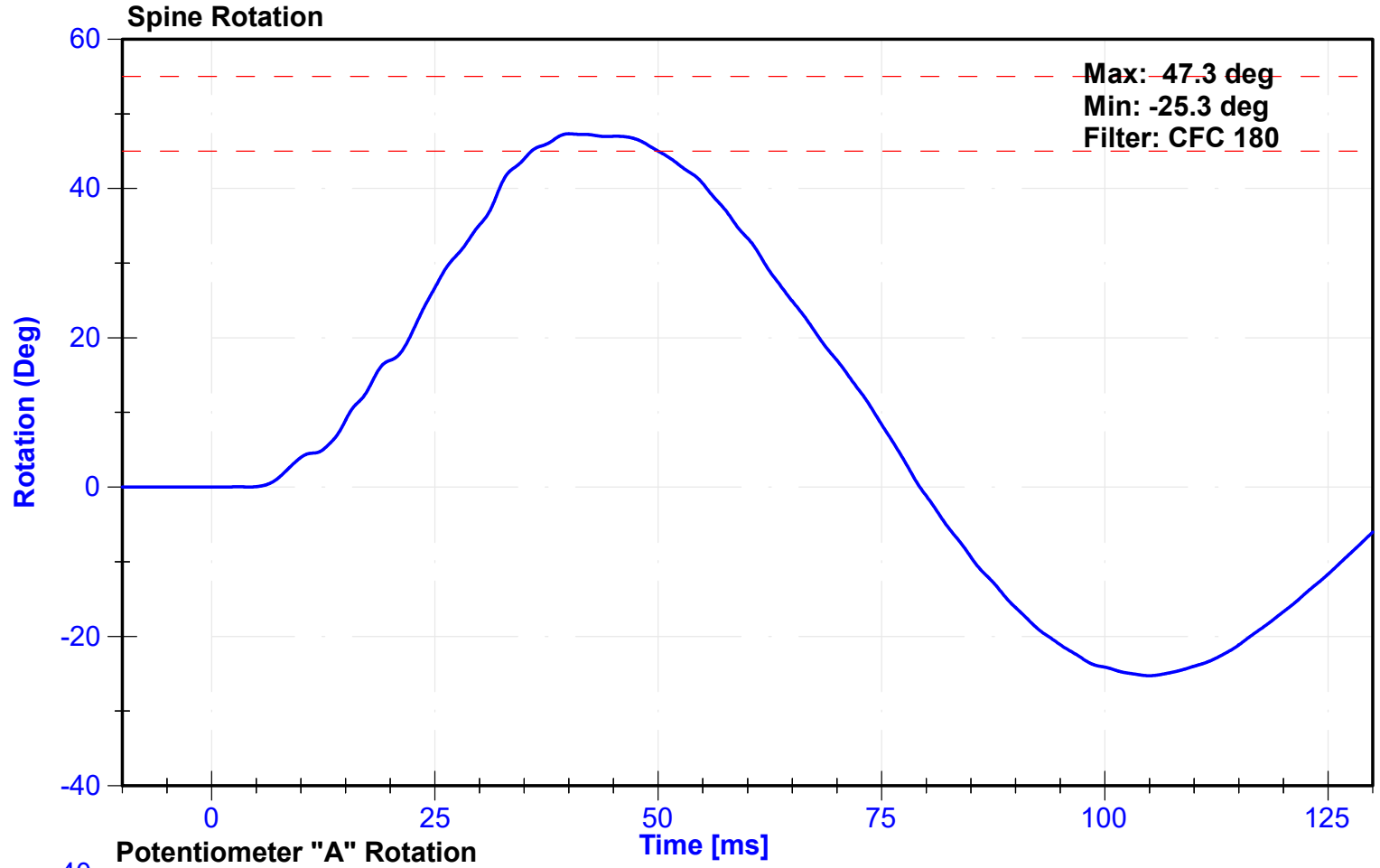
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	54.3	Pass
Velocity	5.95	6.15	m/s	6.060	Pass
Lateral Spine Rotation	45	55	deg	47.3	Pass
Time at Maximum Rotation	39	53	ms	40.0	Pass
Time of Decay to Zero Degrees	37	57	ms	39.3	Pass
Pendulum Velocity Overall Corridor	Lower Boundary[1]	Upper Boundary[2]	m/s	See Plot[3]	Pass

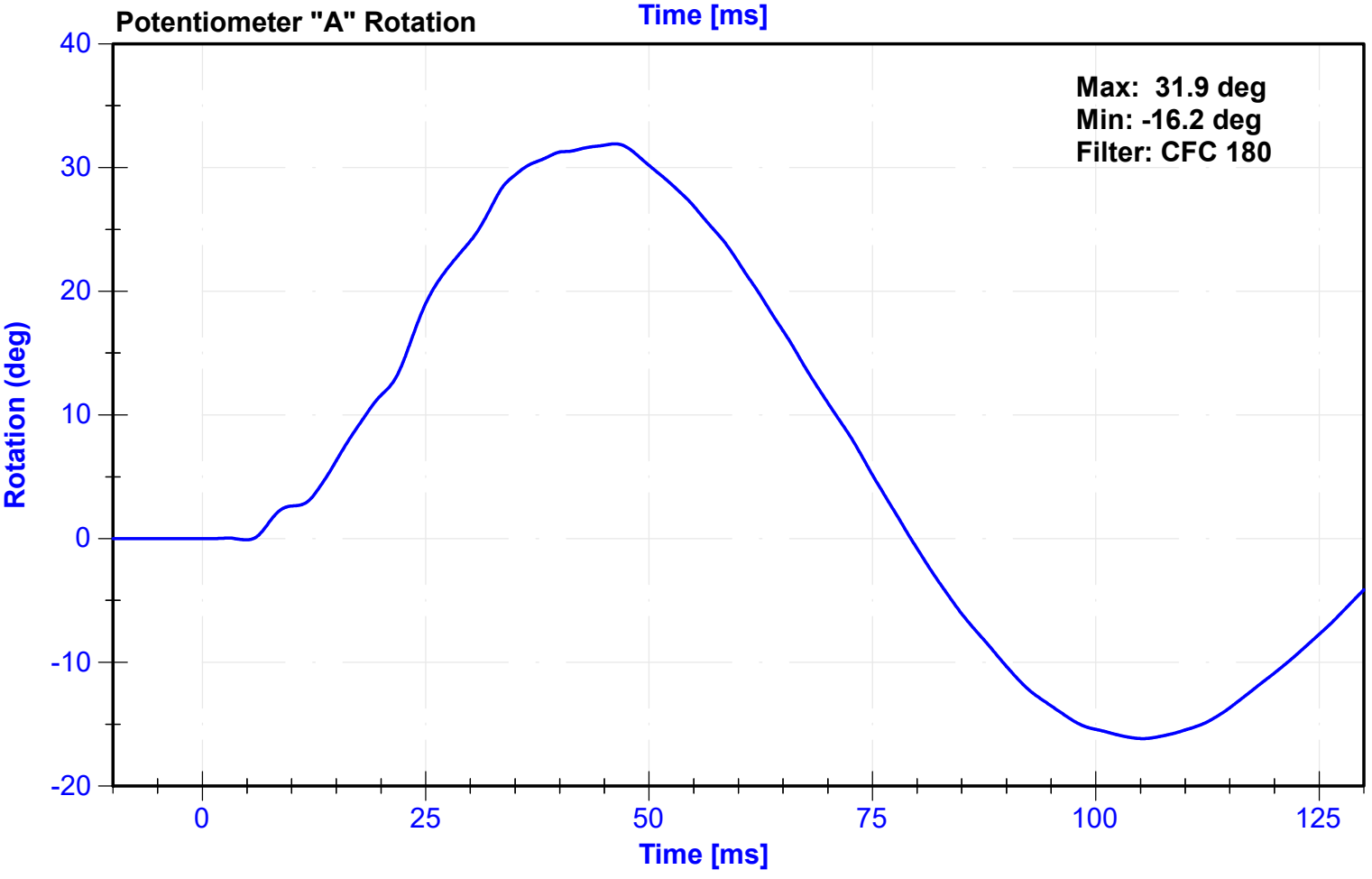
Transducer Calibrations

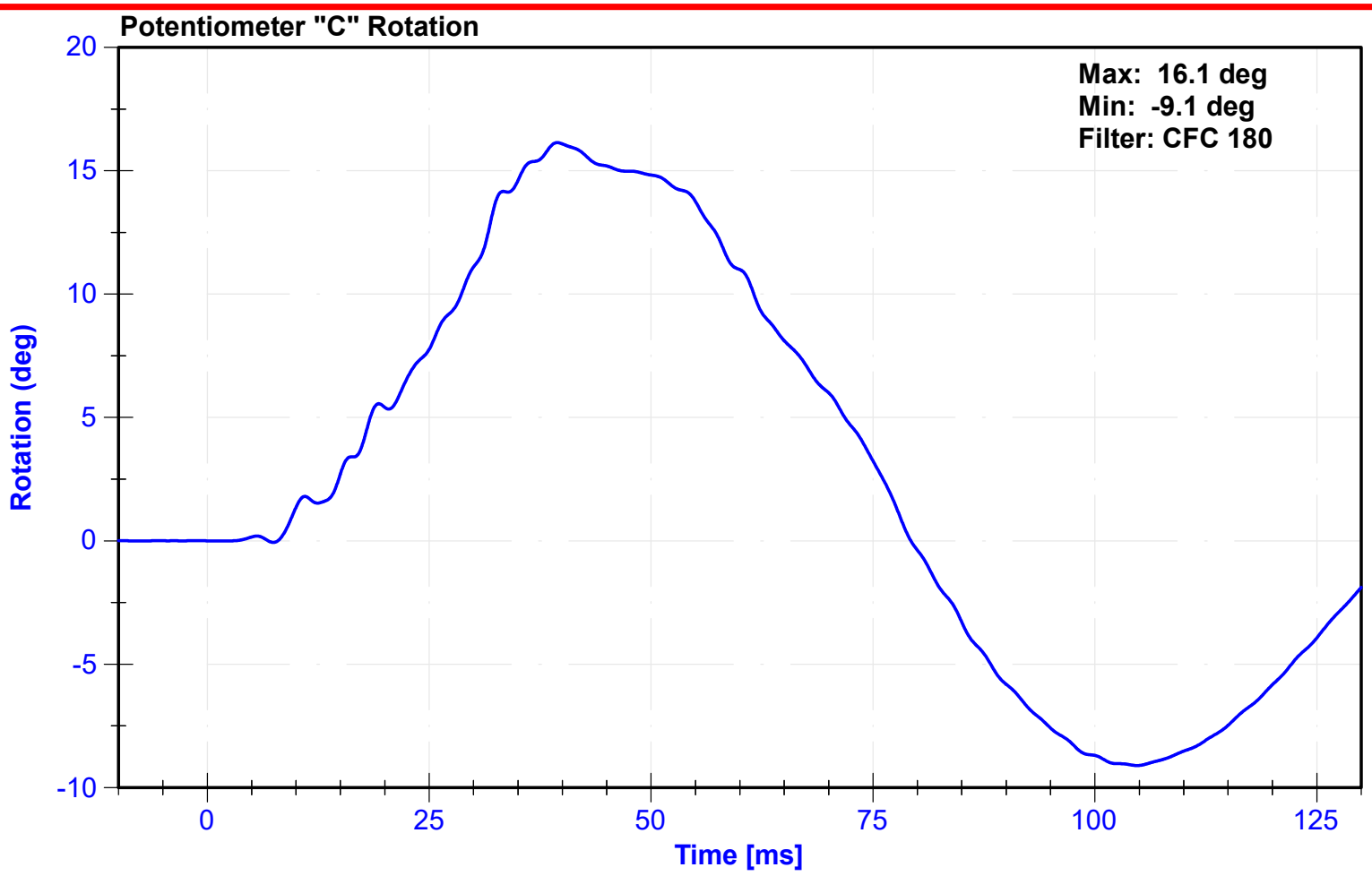
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum "A" Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Condyle "B" Potentiometer	Sfernice	095	10/5/2022	10/5/2023



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


Spine Rotation
Max: 47.3 deg
Min: -25.3 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 31.9 deg
Min: -16.2 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

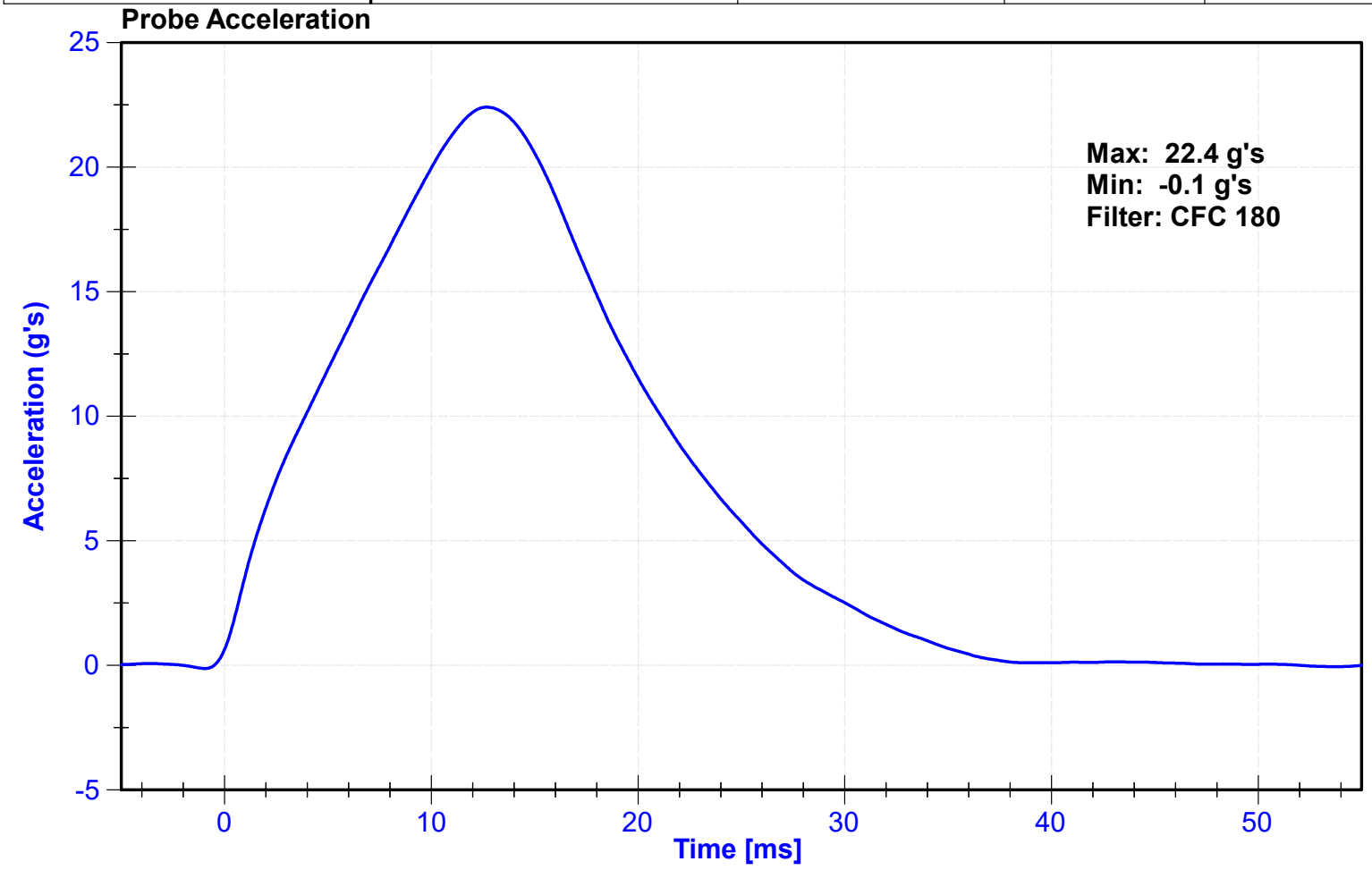
ATD Manufacturer	Denton	Test Technician	T. Roseman
ATD Serial Number	D037	Laboratory Supervisor	C. Mantell

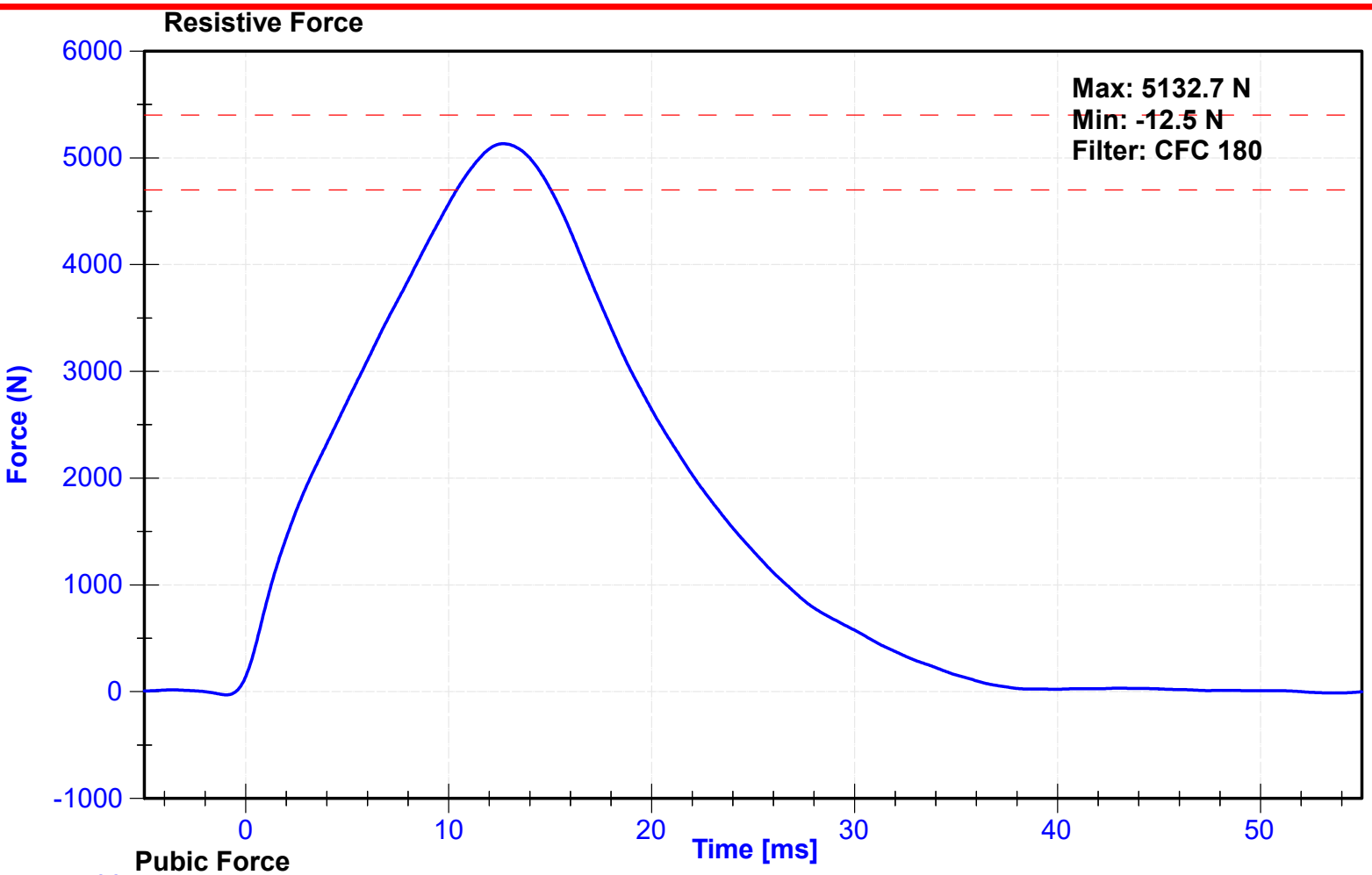
Results

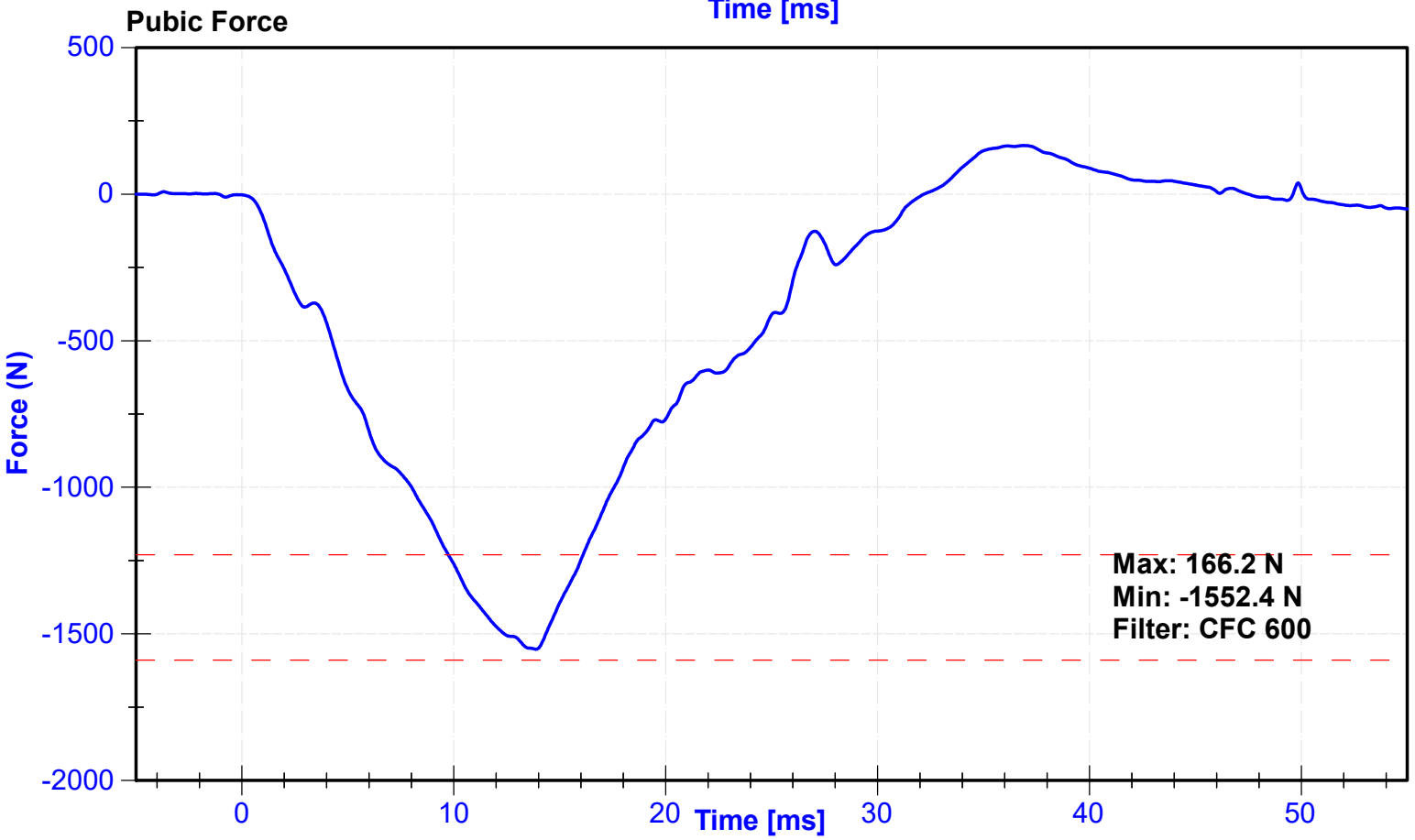
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	47.3	Pass
Velocity	4.2	4.4	m/s	4.30	Pass
Resistive Force	4700	5400	N	5132.7	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.70	Pass
Pubic Force	-1590	-1230	N	-1552.4	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.85	Pass

Transducer Calibrations

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




Resistive Force
Max: 5132.7 N
Min: -12.5 N
Filter: CFC 180
Force (N)
6000
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]

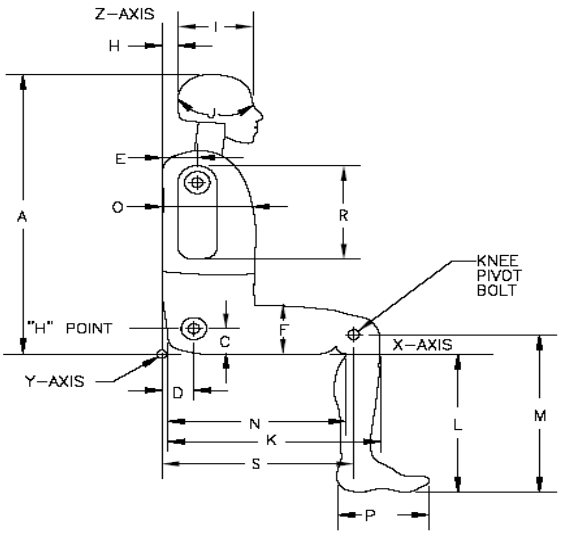

Pubic Force
Max: 166.2 N
Min: -1552.4 N
Filter: CFC 600
Force (N)
500
0
-500
-1000
-1500
-2000
0
10
20
30
40
50
Time [ms]

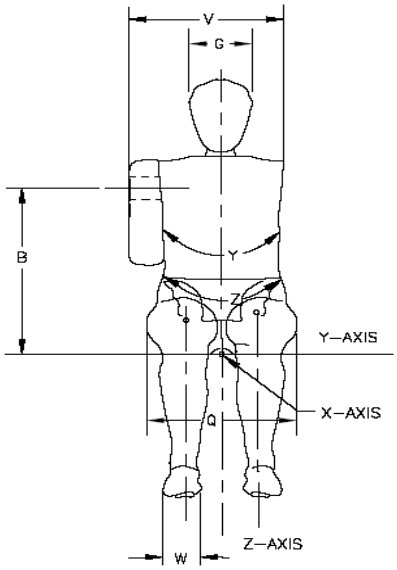
APPENDIX VI
SID-IIs PERFOMANCE CALIBRATION TEST DATA

External Measurements - SID-IIs

Technician: K. Brogan Date: 06/26/2023

Dummy Serial Number: 261





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	781	Pass
B	Shoulder Pivot Height	437	453	445	Pass
C	H-point Height	79	89	82	Pass
D	H-point from seatback	141	151	147	Pass
E	Shoulder Pivot from Backline	97	107	104	Pass
F	Thigh Clearance	119	135	128	Pass
G	Head Breadth	140	148	145	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	180	Pass
J	Head Circumference	541	551	549	Pass
K	Buttock to Knee Length	514	540	531	Pass
L	Popliteal Height	343	369	354	Pass
M	Knee Pivot to floor height	392	409	400	Pass
N	Buttock Popliteal Length	416	442	432	Pass
O	Chest Depth w/o jacket	195	211	206	Pass
P	Foot Length	216	232	223	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	319	Pass
R	Arm Length	249	259	254	Pass
S	Knee Joint to seatback	477	493	483	Pass
V	Shoulder Width	341	357	350	Pass
W	Foot Width	78	94	84	Pass
Y	Chest Circumference w/jacket	851	881	871	Pass
Z	Waist Circumference	761	791	774	Pass

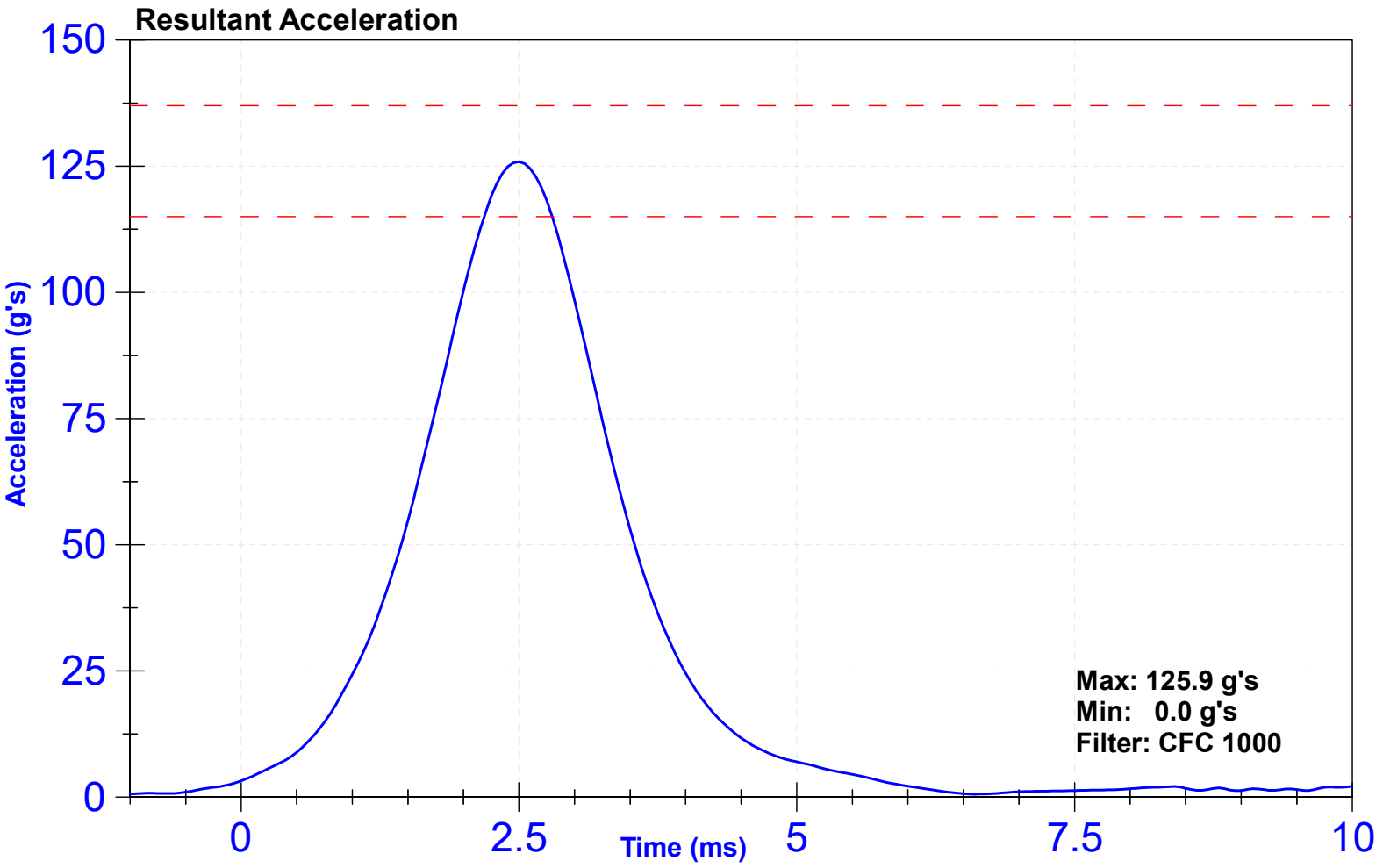
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	261	Laboratory Supervisor	C .Mantell

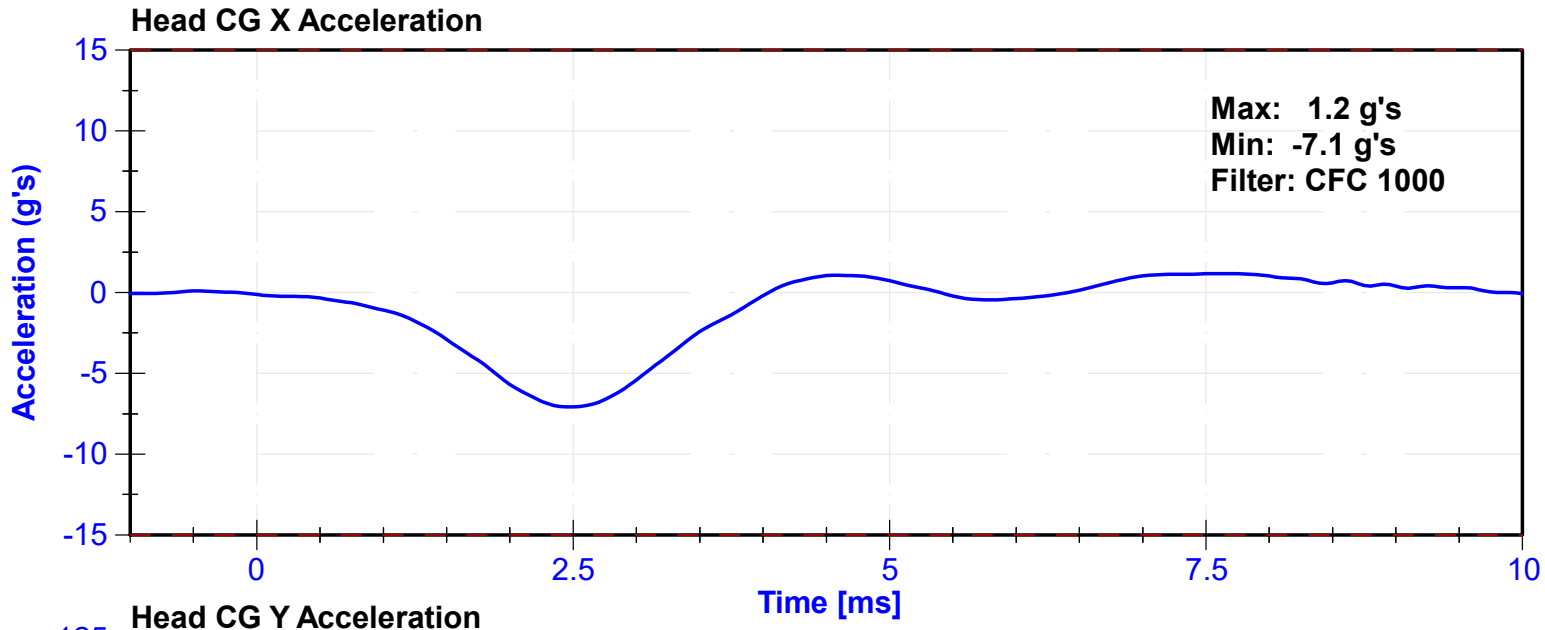
Results

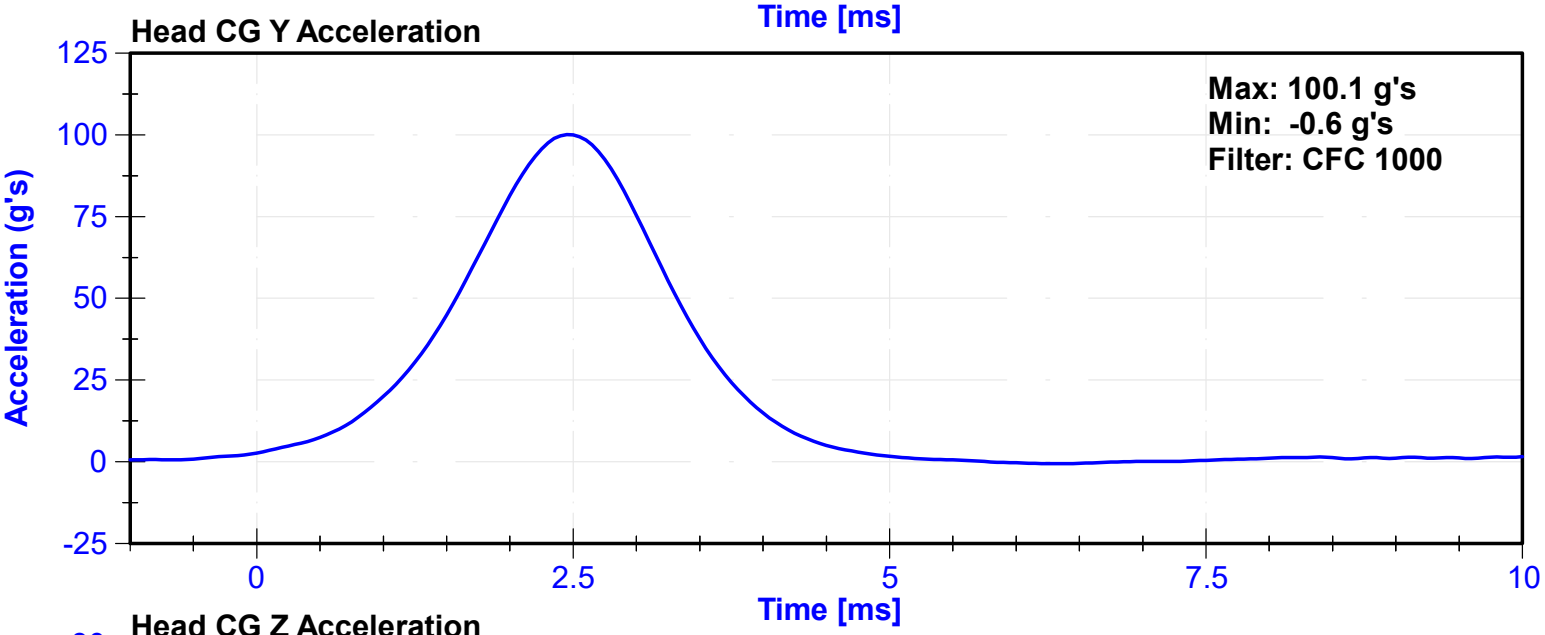
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	61.2	Pass
Resultant Acceleration	115	137	g's	125.9	Pass
Oscillation	0	15	%	1.8	Pass
Fore-Aft Acceleration	-15	15	g's	-7.1	Pass

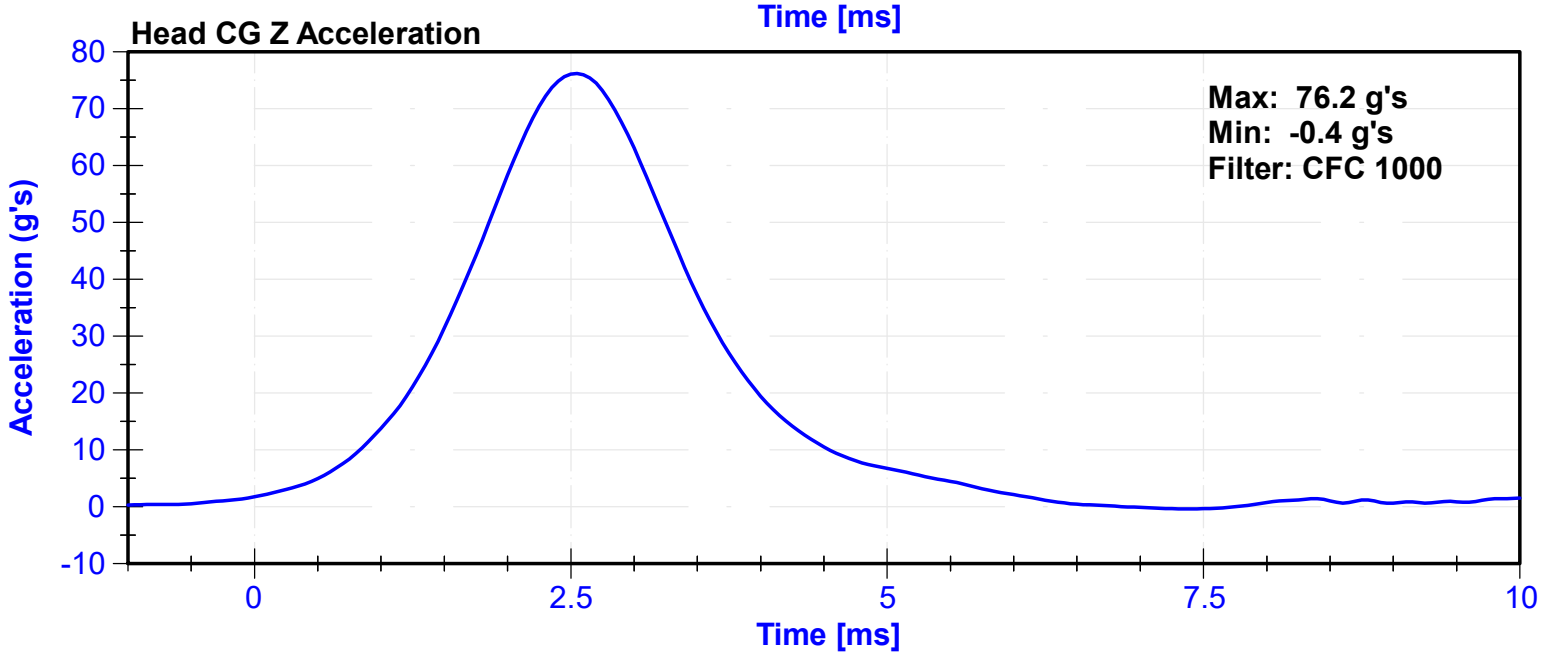
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibratio Date	Calibratio Due Date
X Accelerometer	Endevco	P68067	6/22/2023	12/19/2023
Y Accelerometer	Endevco	P18567	6/22/2023	12/19/2023
Z Accelerometer	Endevco	P49163	6/22/2023	12/19/2023




Head CG X Acceleration
Max: 1.2 g's
Min: -7.1 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: 100.1 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: 76.2 g's
Min: -0.4 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	T. Roseman
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

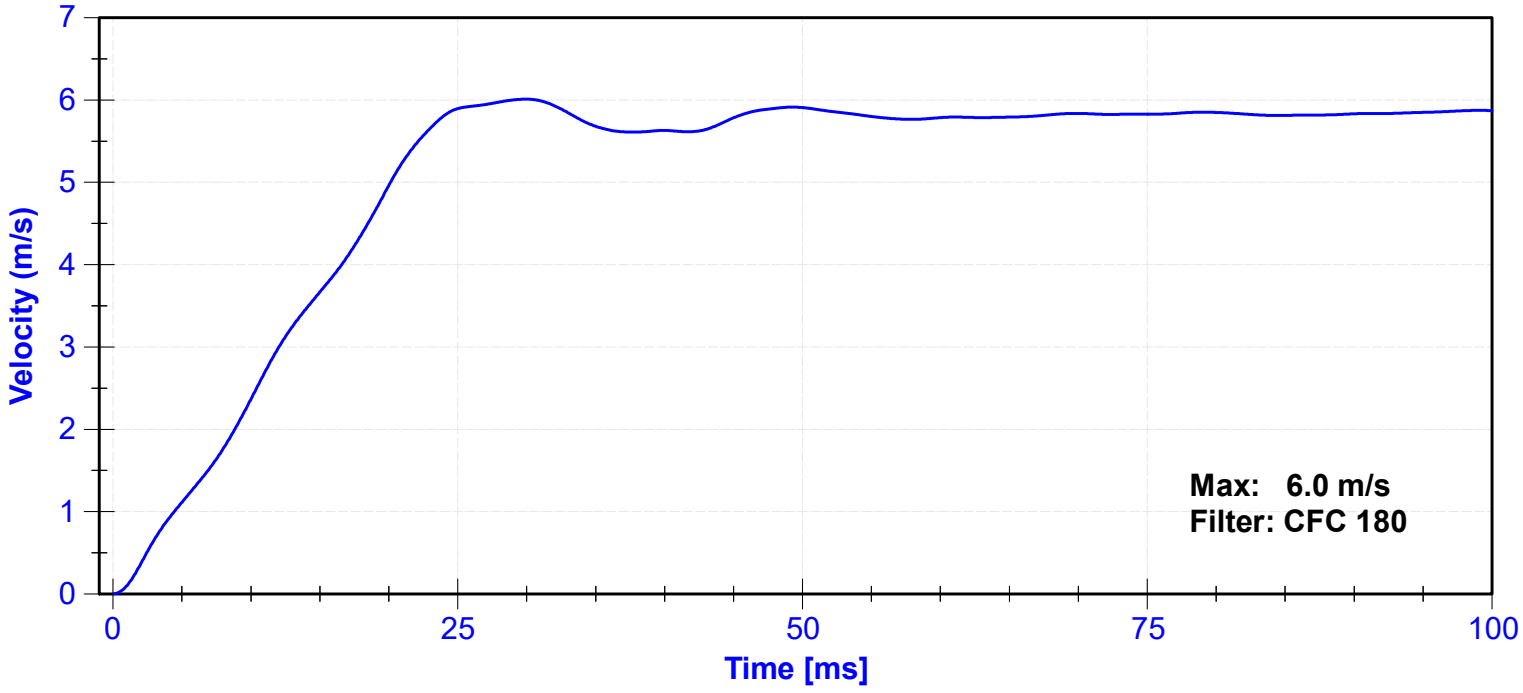
Results

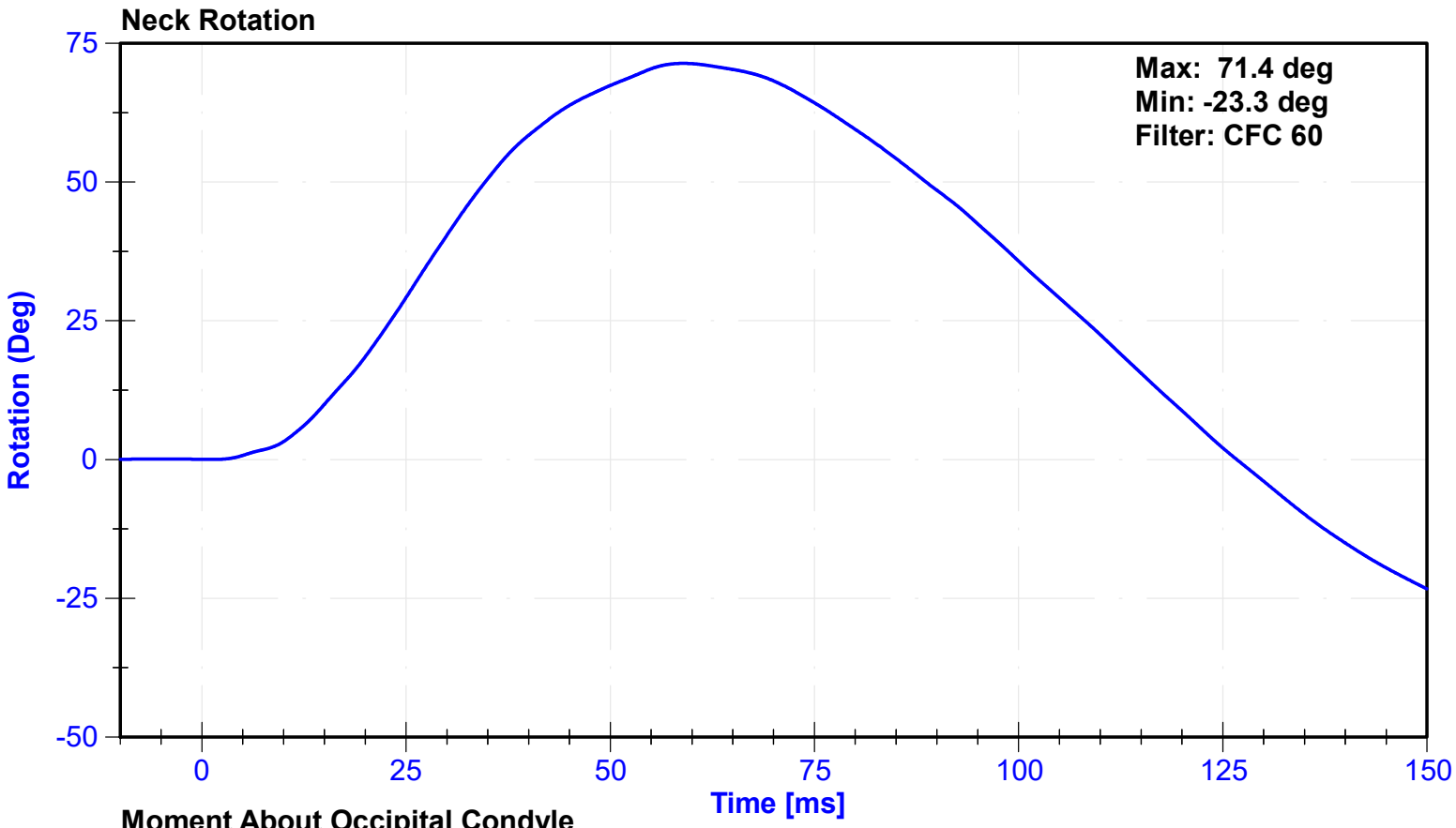
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	51.5	Pass
Velocity	5.51	5.63	m/s	5.535	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.37	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.67	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.96	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.89	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	6.01	Pass
Neck Rotation	71	81	deg	71.4	Pass
Time at Maximum Rotation	50	70	ms	58.9	Pass
Moment about the OC	36	44	Nm	42.5	Pass
Moment Decay to 0 Nm	102	126	ms	111.6	Pass

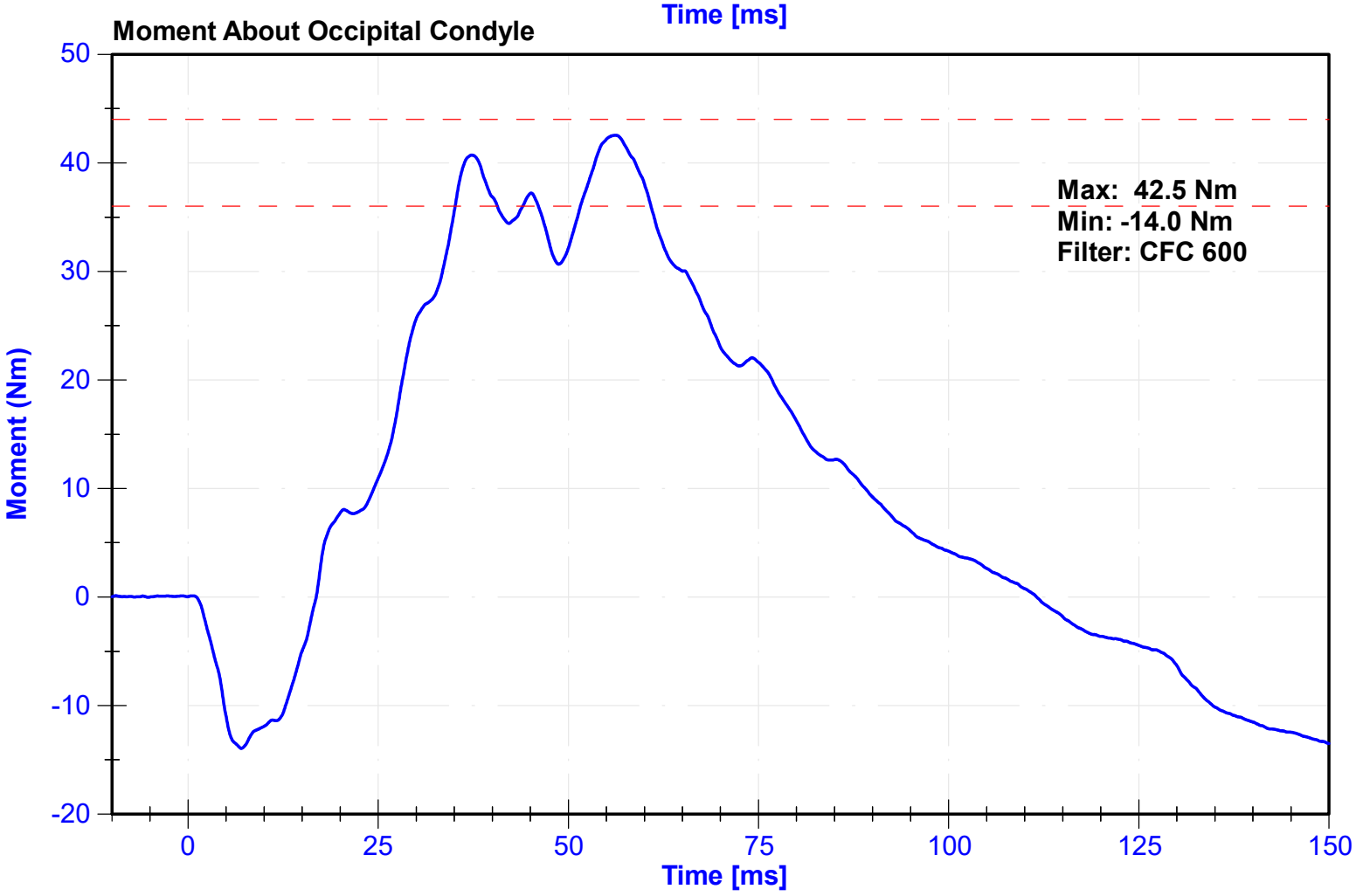
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	7231C-750	10/26/2022	10/26/2023
Pendulum Potentiometer	Servo	4961	11/11/2022	11/11/2023
Condyle Potentiometer	Servo	DS185	11/11/2022	11/11/2023
Upper Neck Load Cell	Denton	1716ATF_2184-FY	5/18/2023	5/17/2024

Pendulum Impulse




Neck Rotation
Max: 71.4 deg
Min: -23.3 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: 42.5 Nm
Min: -14.0 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

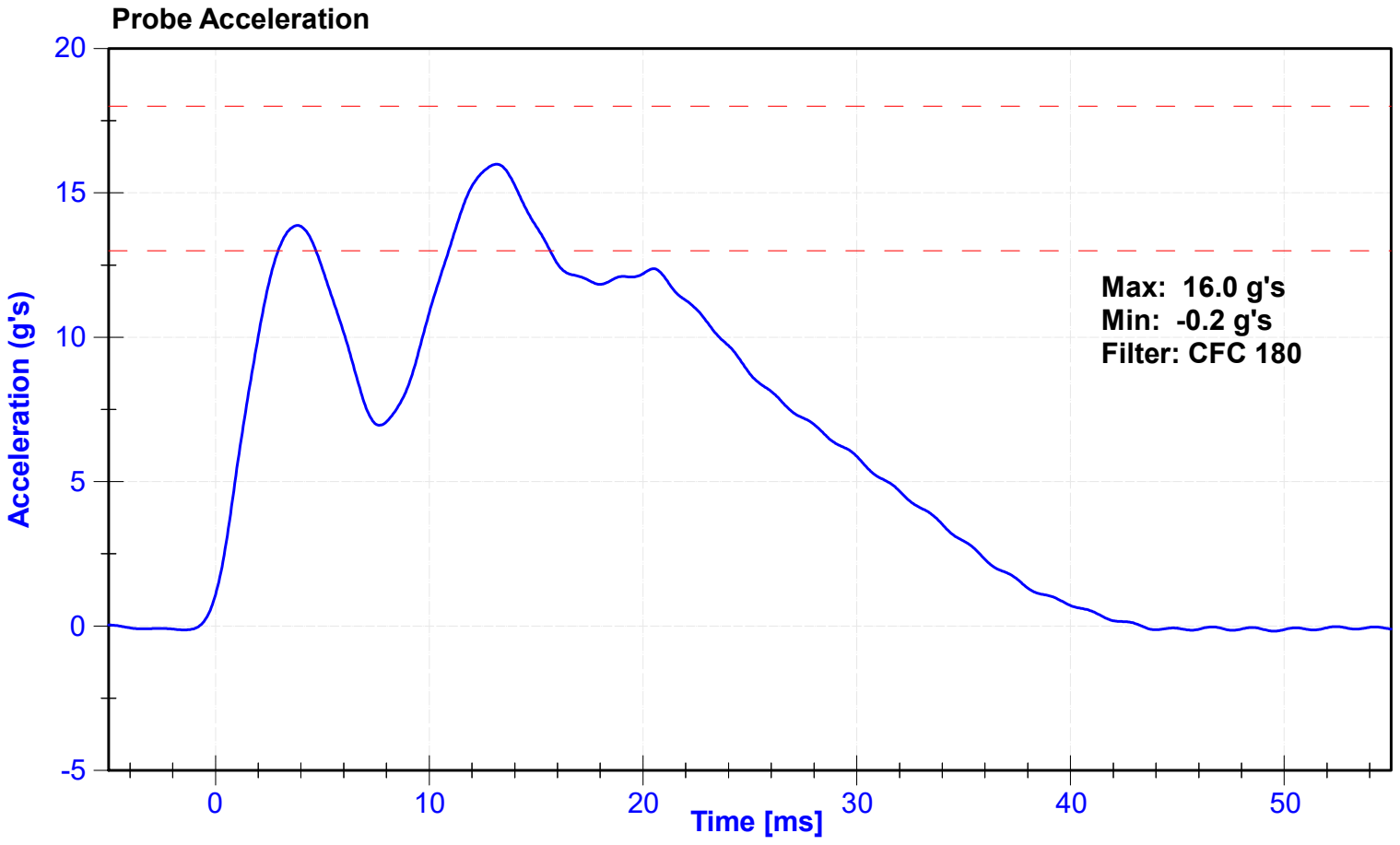
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

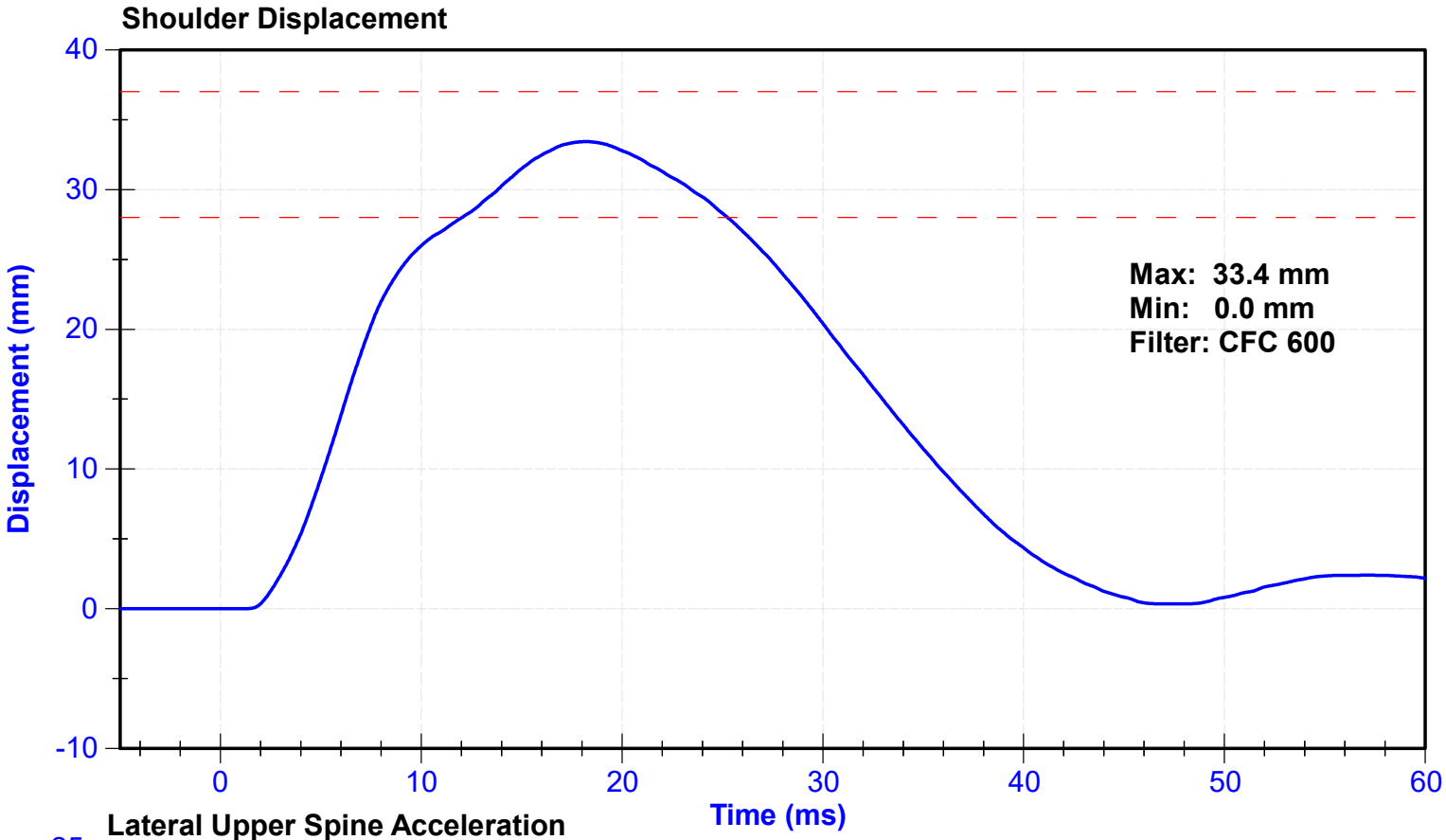
Results

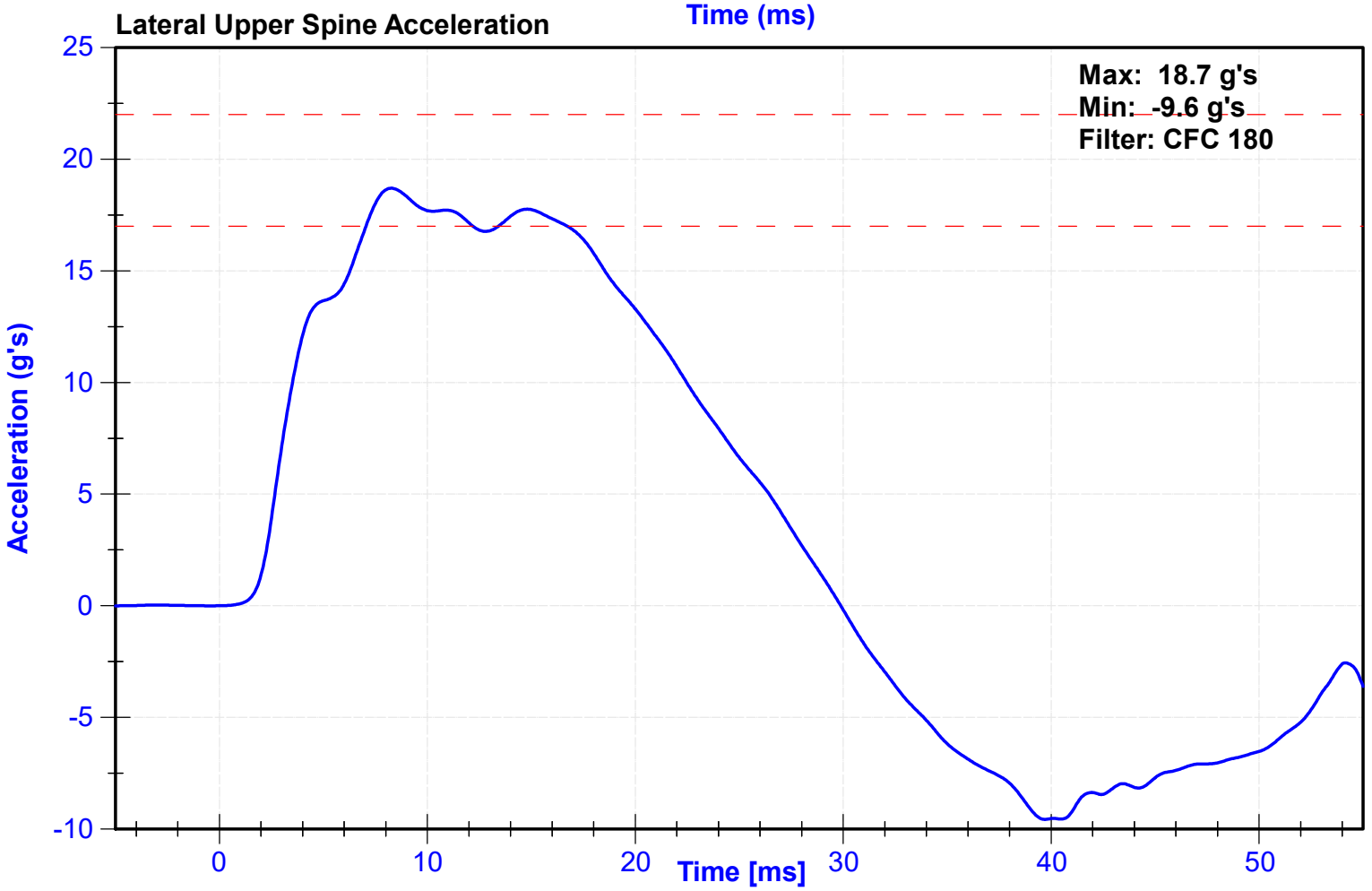
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	61.3	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	13	18	g's	16.0	Pass
Shoulder Deflection	28	37	mm	33.4	Pass
Lateral Upper Spine Acceleration	17	22	g's	18.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Shoulder Potentiometer	Servo	572GFE	6/22/2023	12/21/2023
Upper Spine Y Accelerometer	Endevco	P94678	6/22/2023	12/19/2023




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 33.4 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 18.7 g's
Min: -9.6 g's
Filter: CFC 180

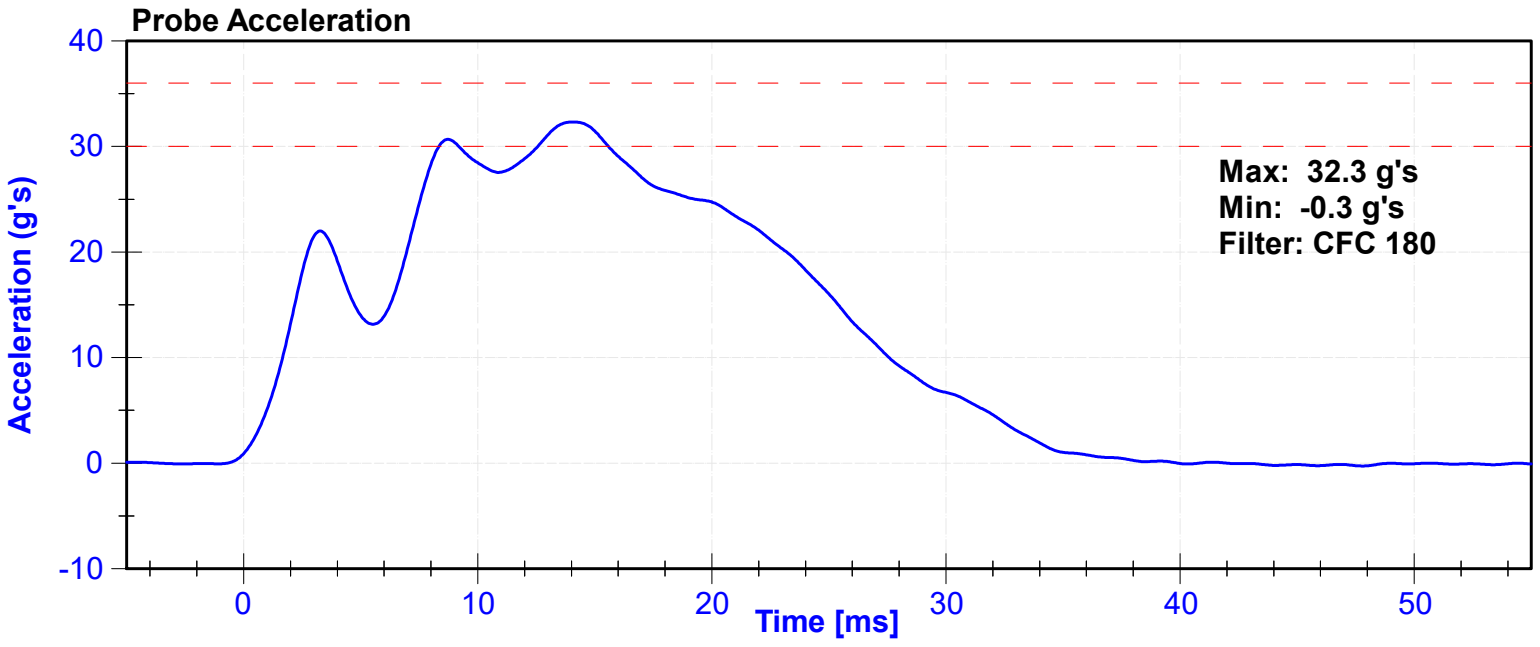
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

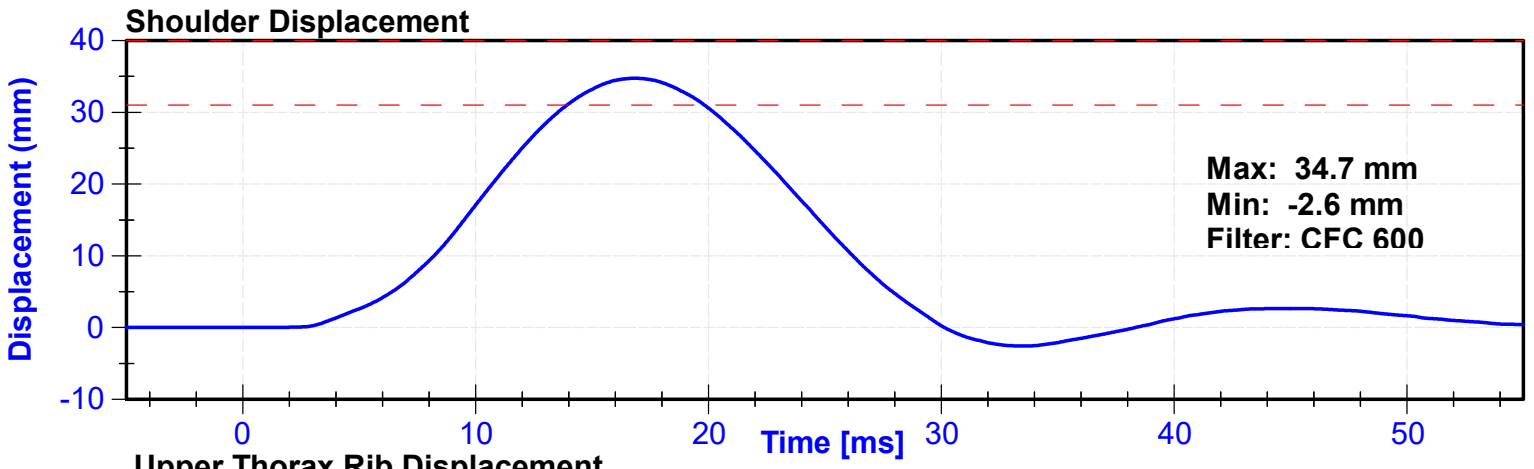
Results

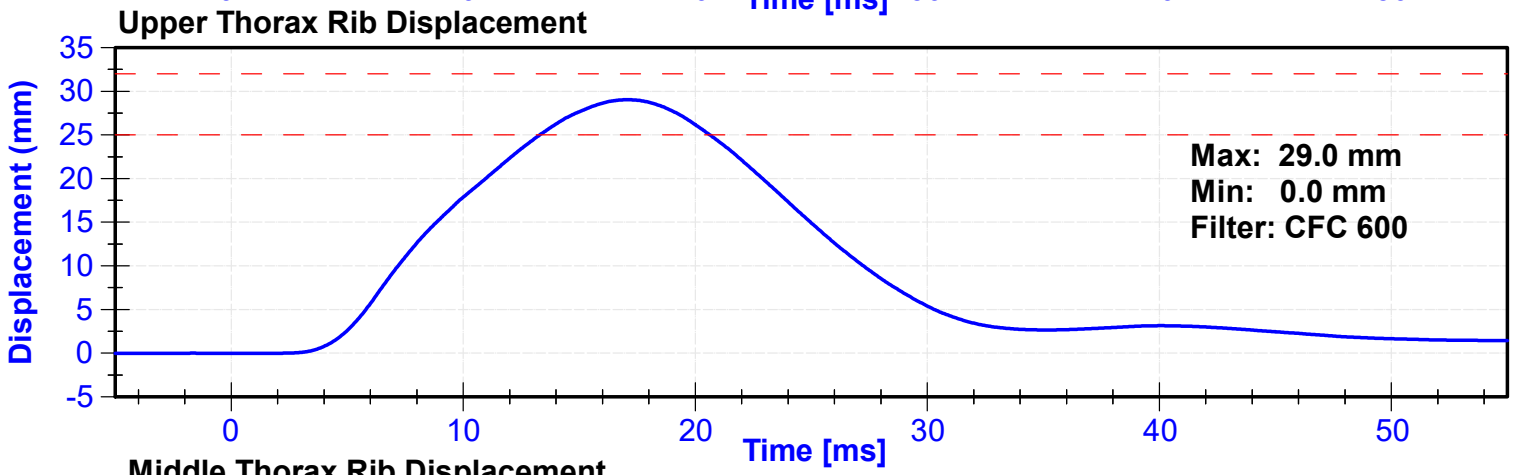
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	61.3	Pass
Velocity	6.6	6.8	m/s	6.67	Pass
Probe Acceleration after 5 ms	30	36	g's	32.3	Pass
Lateral Upper Spine Acceleration	34	43	g's	37.1	Pass
Lateral Lower Spine Acceleration	29	37	g's	29.7	Pass
Shoulder Deflection	31	40	mm	34.7	Pass
Upper Thorax Rib Deflection	25	32	mm	29.0	Pass
Mid Thorax Rib Deflection	30	36	mm	33.5	Pass
Lower Thorax Rib Deflection	32	38	mm	36.4	Pass

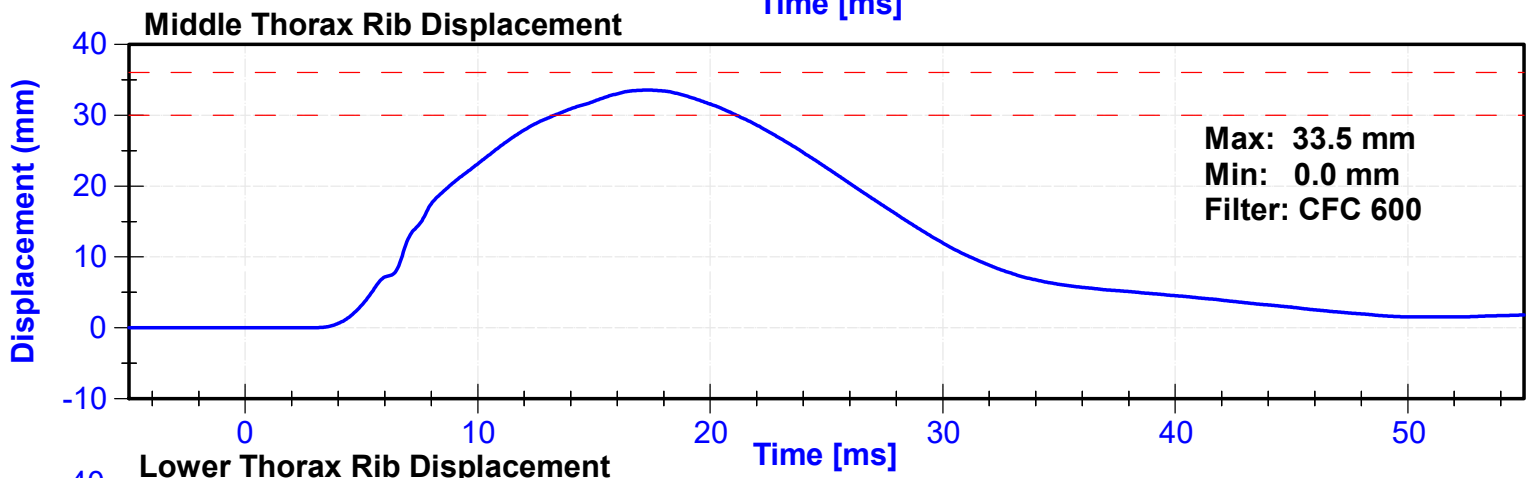
Transducer Calibrations

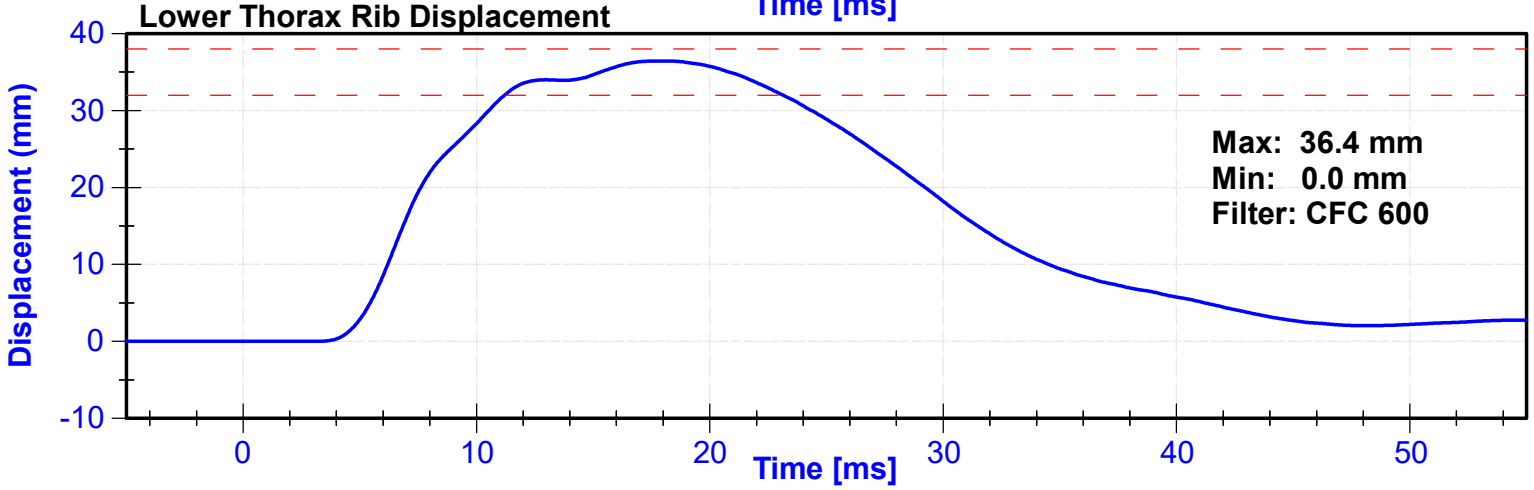
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Spine T1 Y Accelerometer	Endevco	P94678	6/22/2023	12/19/2023
Upper Spine T12 Y Accelerometer	Endevco	P58744	6/22/2023	12/19/2023
Shoulder Potentiometer	Servo	572GFE	6/22/2023	12/21/2023
Upper Thorax Rib Potentiometer	Servo	062GFE	6/22/2023	12/21/2023
Middle Thorax Rib Potentiometer	Servo	528GFE	6/22/2023	12/21/2023
Lower Thorax Rib Potentiometer	Servo	513GFE	6/22/2023	12/21/2023

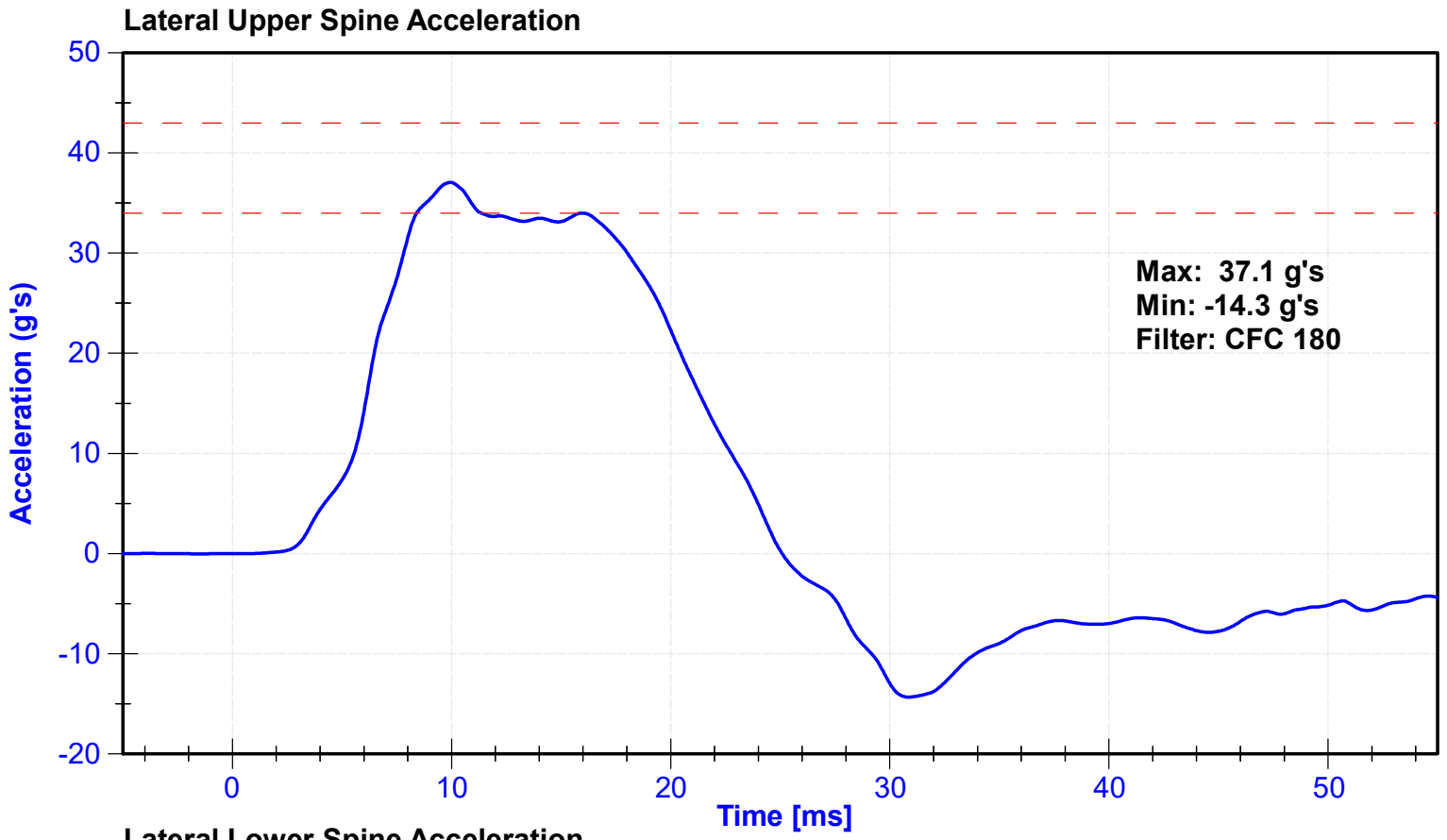


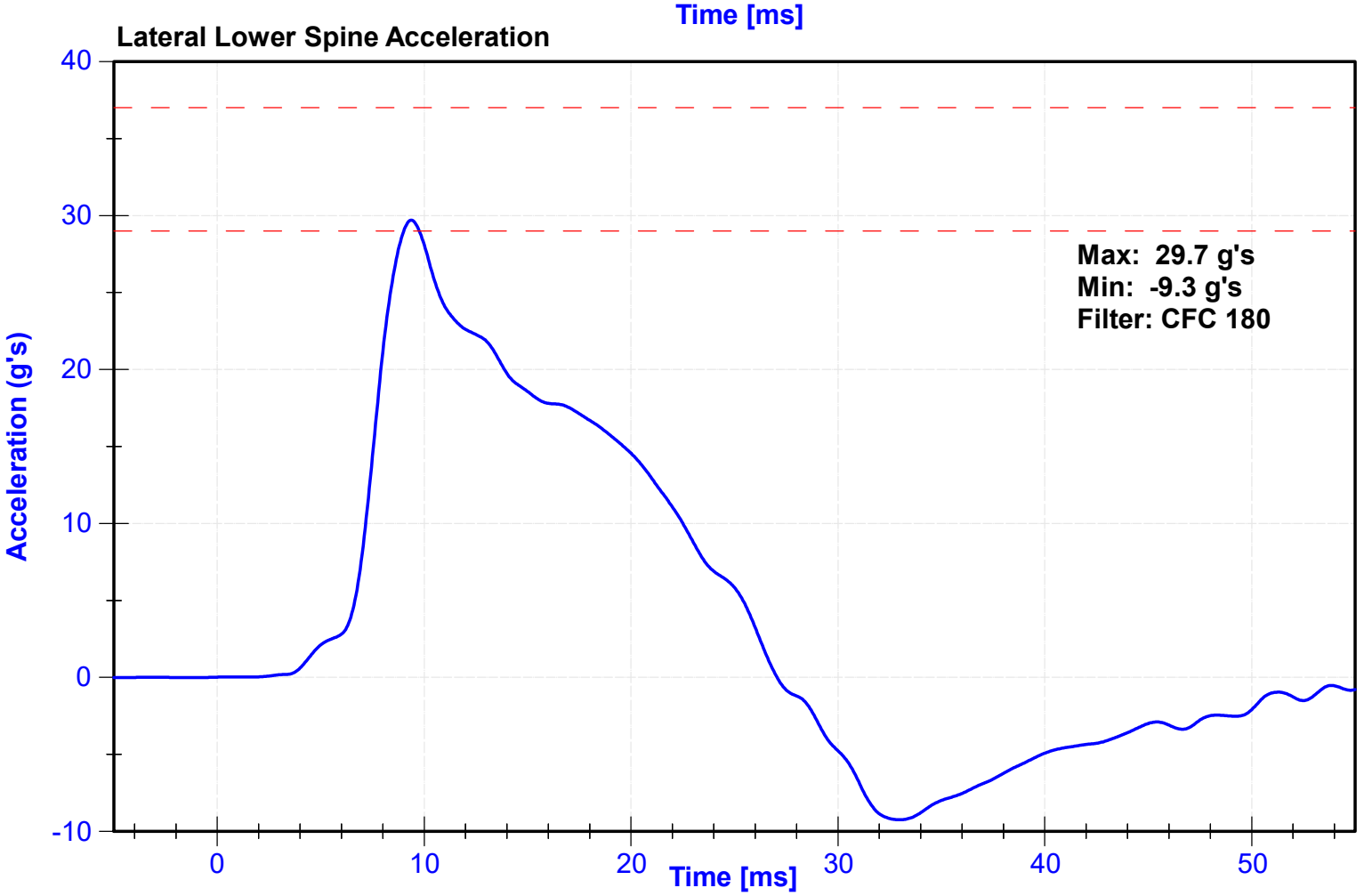

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 34.7 mm
Min: -2.6 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 29.0 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 33.5 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 36.4 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 37.1 g's
Min: -14.3 g's
Filter: CFC 180


Lateral Lower Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 29.7 g's
Min: -9.3 g's
Filter: CFC 180

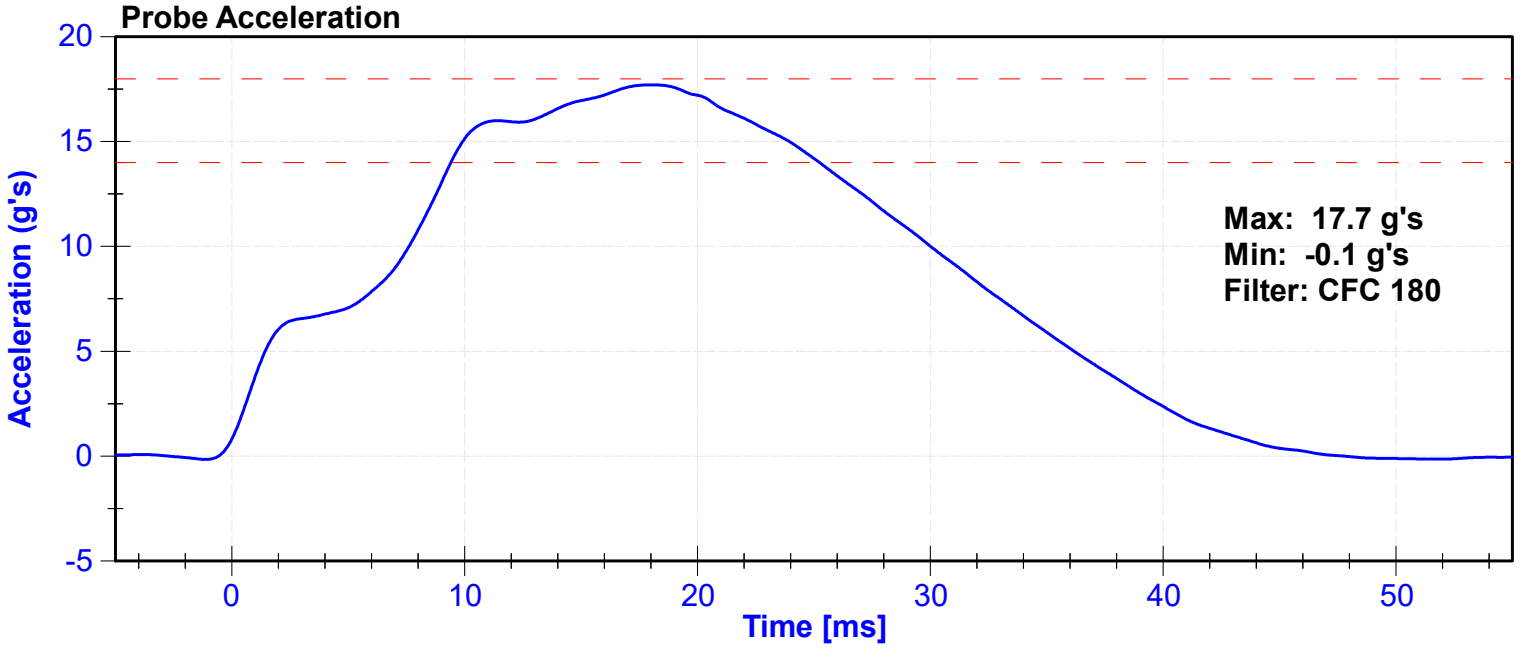
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

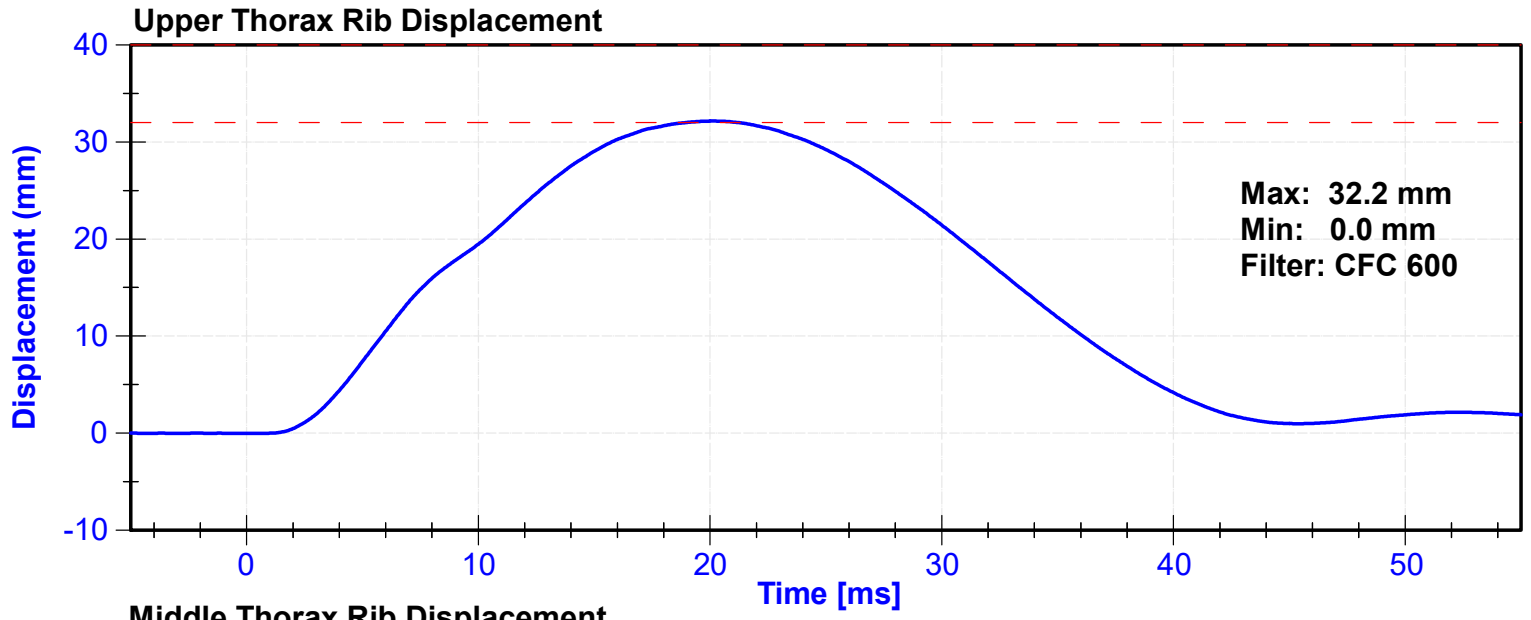
Results

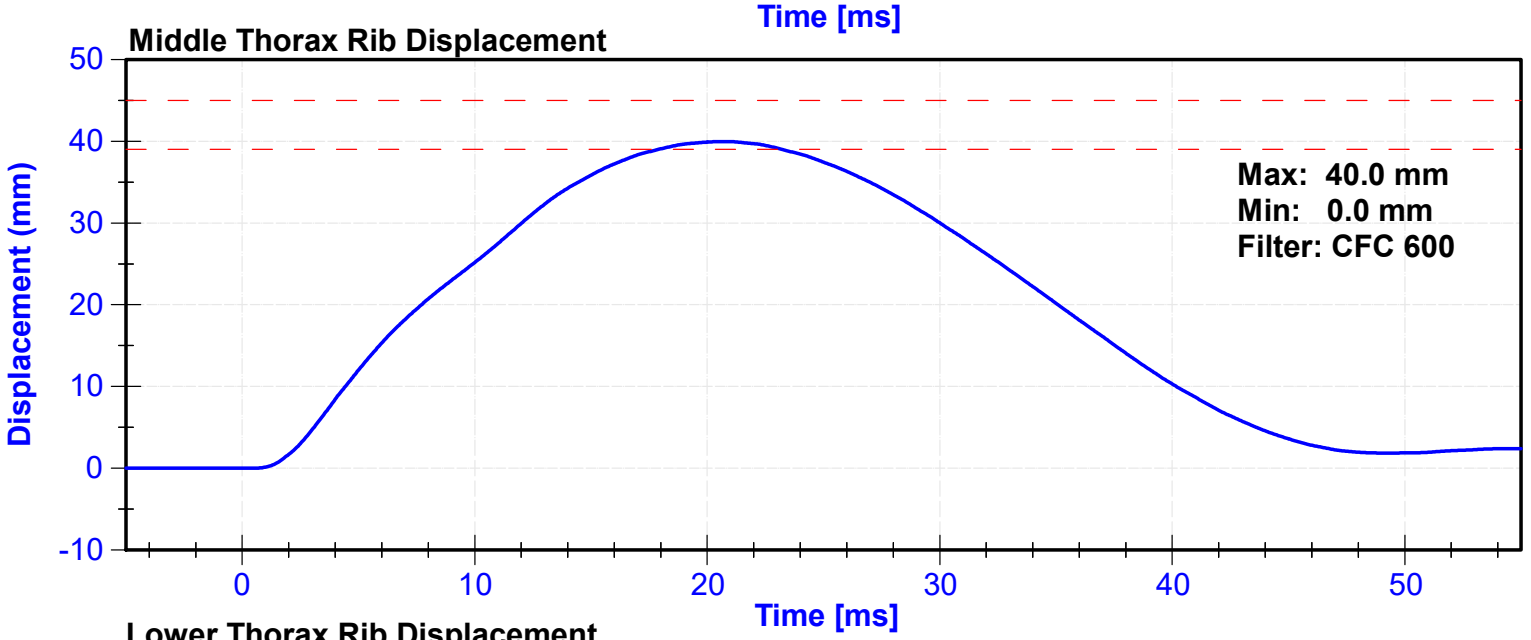
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	61.3	Pass
Velocity	4.2	4.4	m/s	4.33	Pass
Probe Acceleration	14	18	g's	17.7	Pass
Lateral Upper Spine Acceleration	13	17	g's	16.0	Pass
Lateral Lower Spine Acceleration	7	11	g's	10.8	Pass
Upper Thorax Rib Deflection	32	40	mm	32.2	Pass
Middle Thorax Rib Deflection	39	45	mm	40.0	Pass
Lower Thorax Rib Deflection	35	43	mm	40.2	Pass

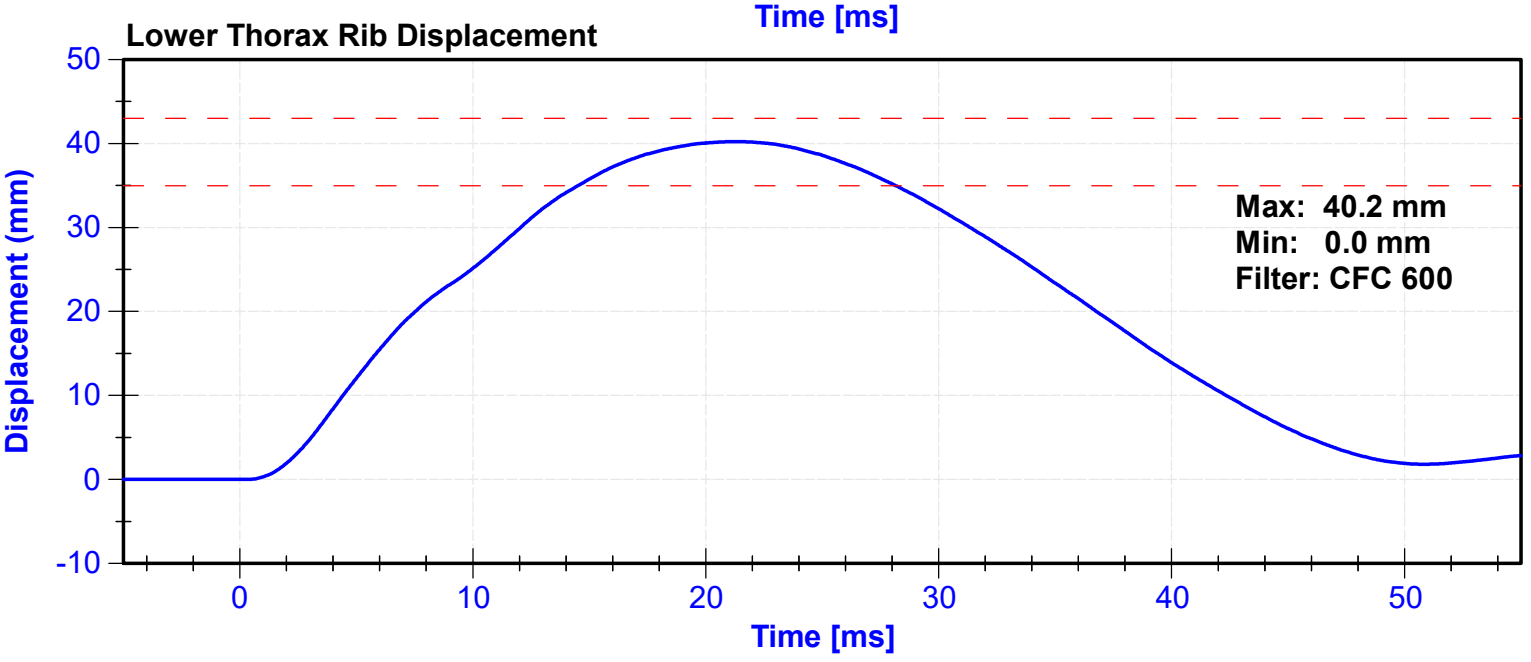
Transducer Calibrations

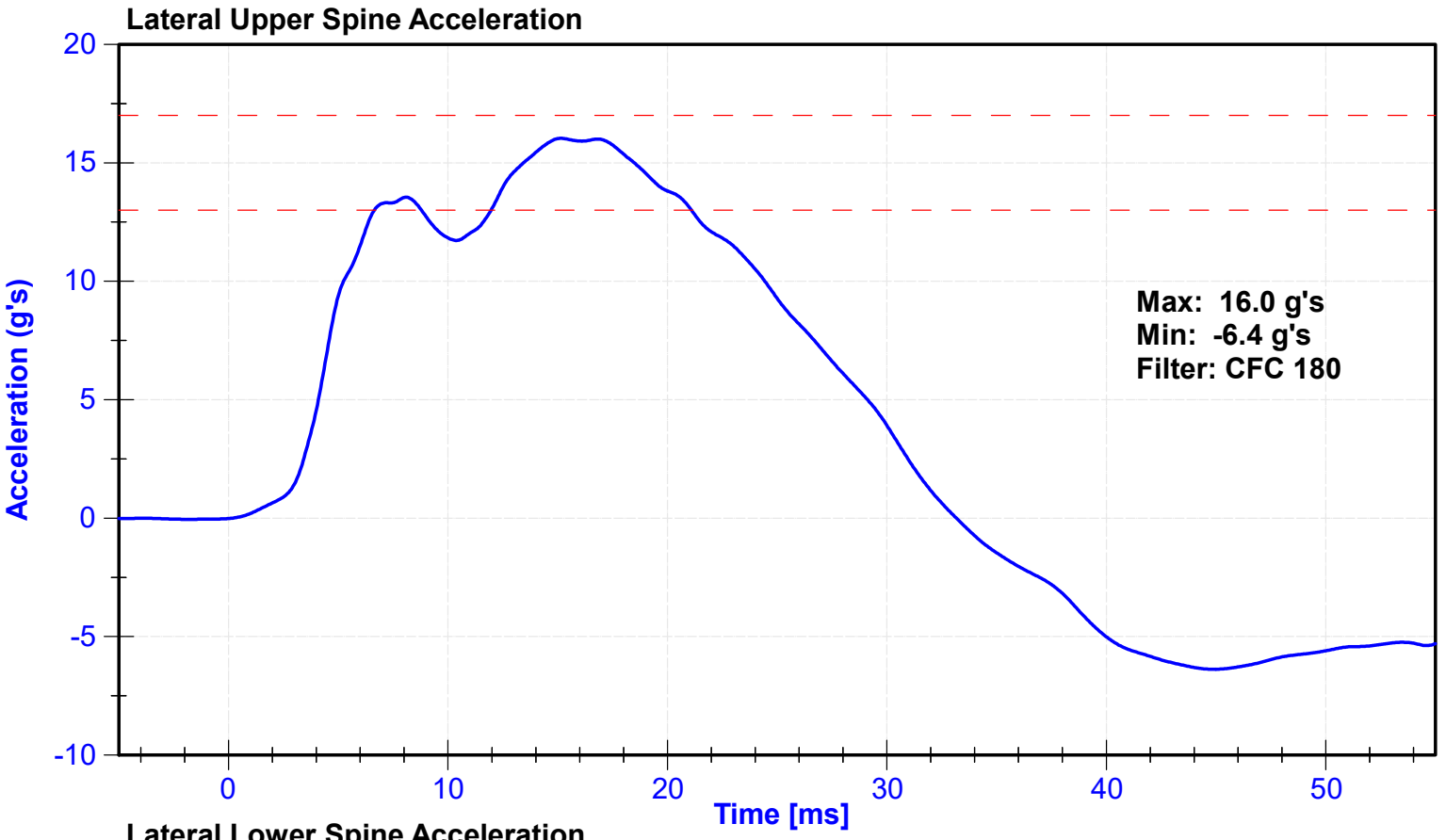
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Spine Y Accelerometer	Endevco	P94678	6/22/2023	12/19/2023
Lower Spine Y Accelerometer	Endevco	P58744	6/22/2023	12/19/2023
Upper Thorax Rib Potentiometer	Servo	062GFE	6/22/2023	12/21/2023
Middle Thorax Rib Potentiometer	Servo	528GFE	6/22/2023	12/21/2023
Lower Thorax Rib Potentiometer	Servo	513GFE	6/22/2023	12/21/2023

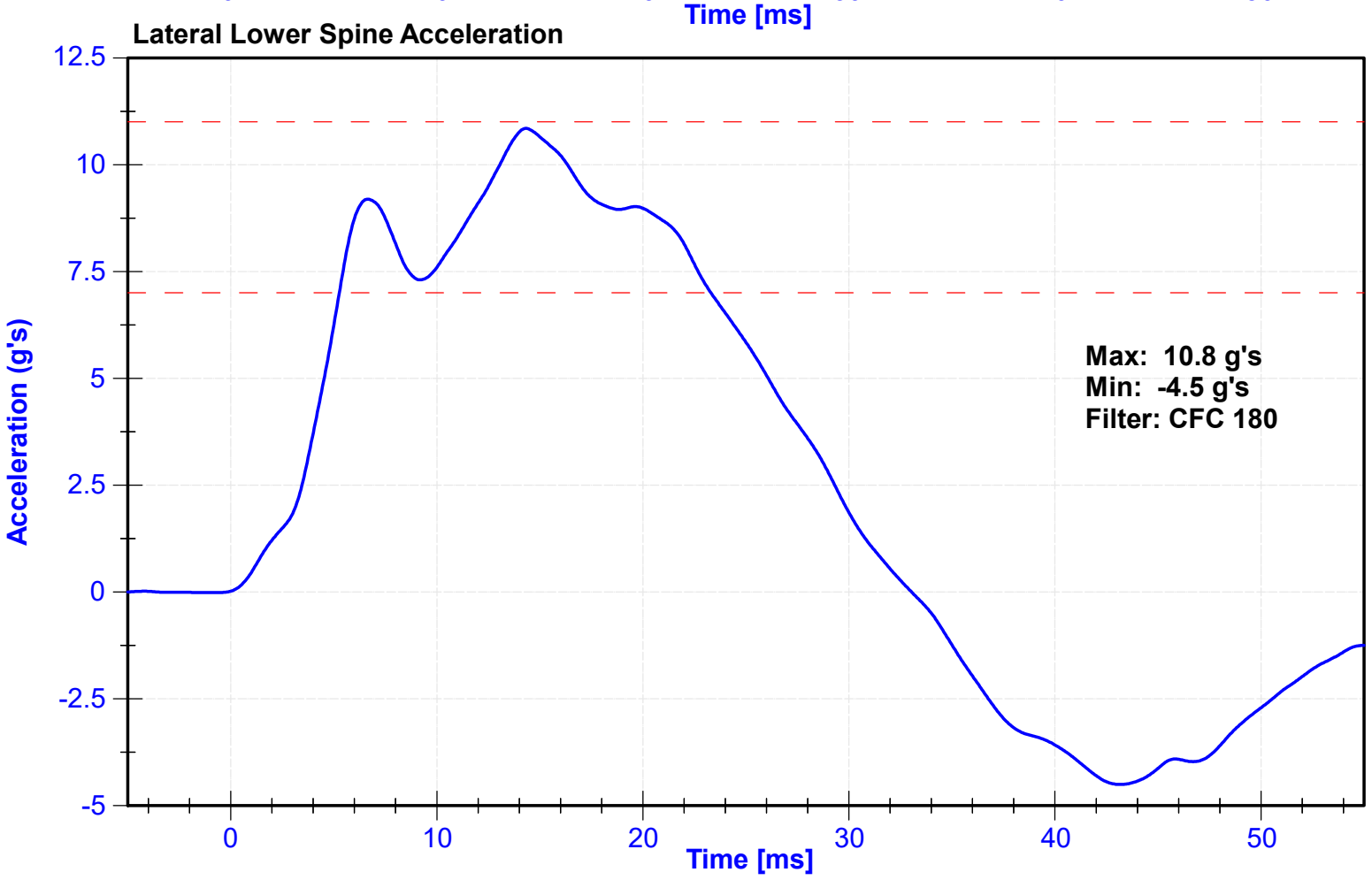



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 32.2 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.0 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.2 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: 16.0 g's
Min: -6.4 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: 10.8 g's
Min: -4.5 g's
Filter: CFC 180

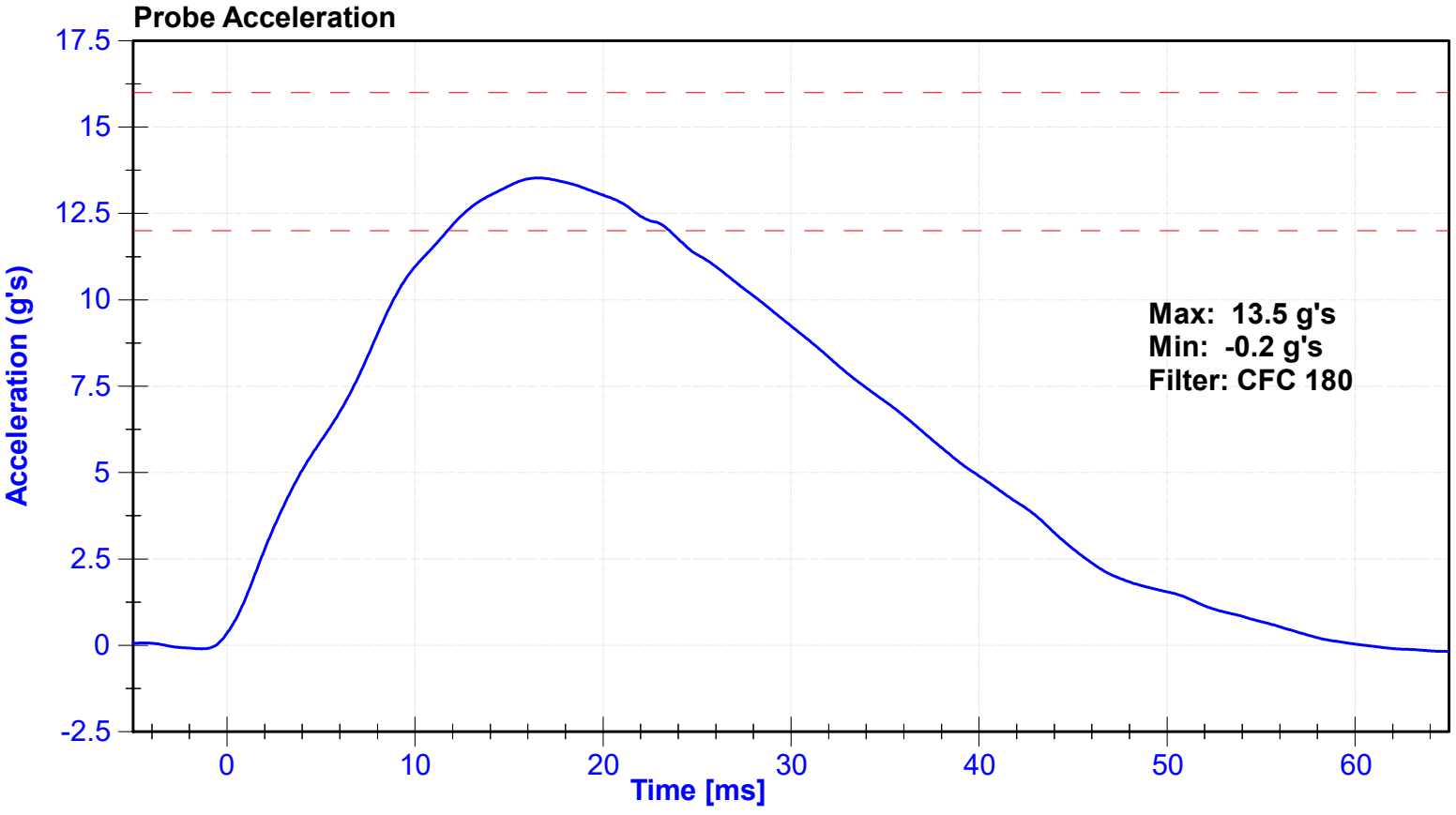
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

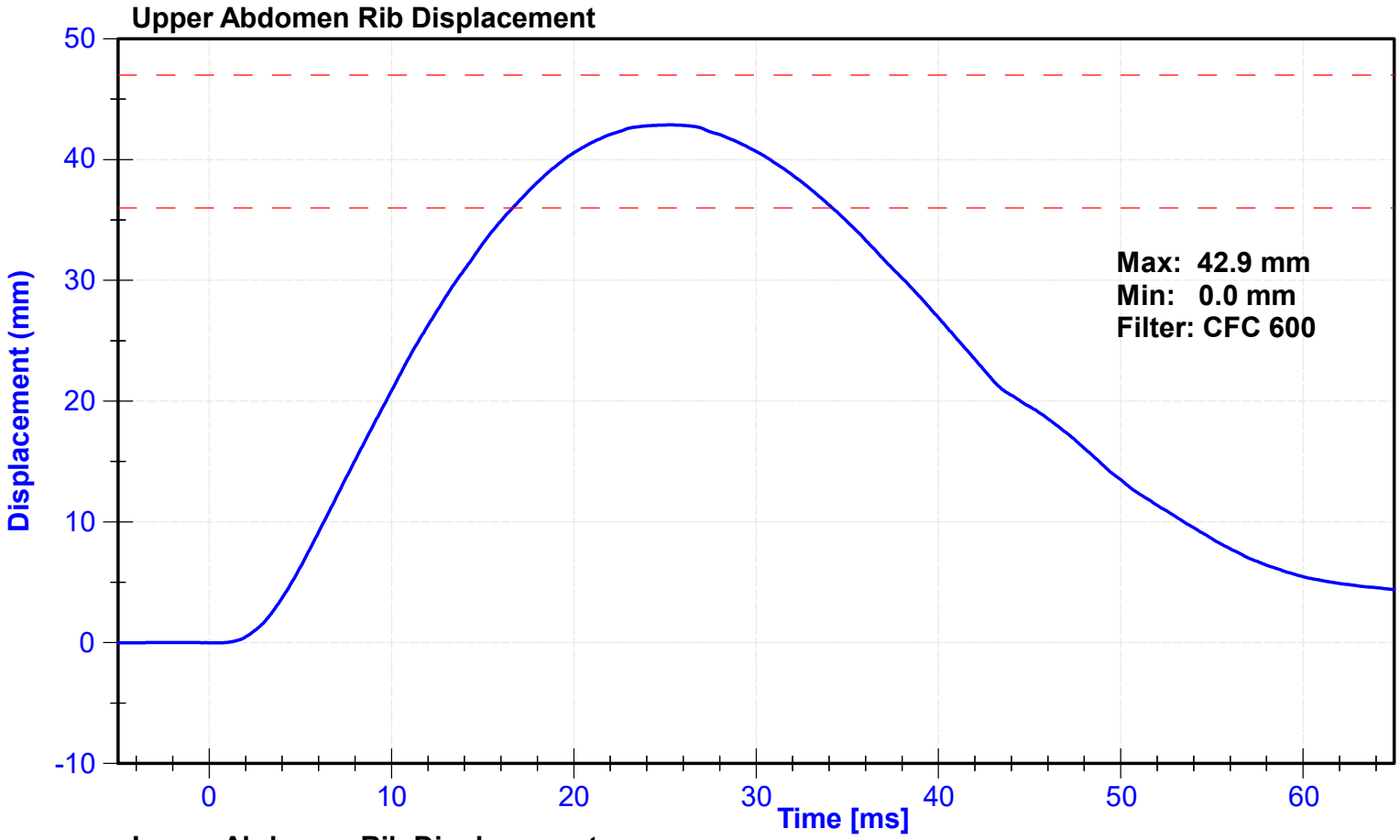
Results

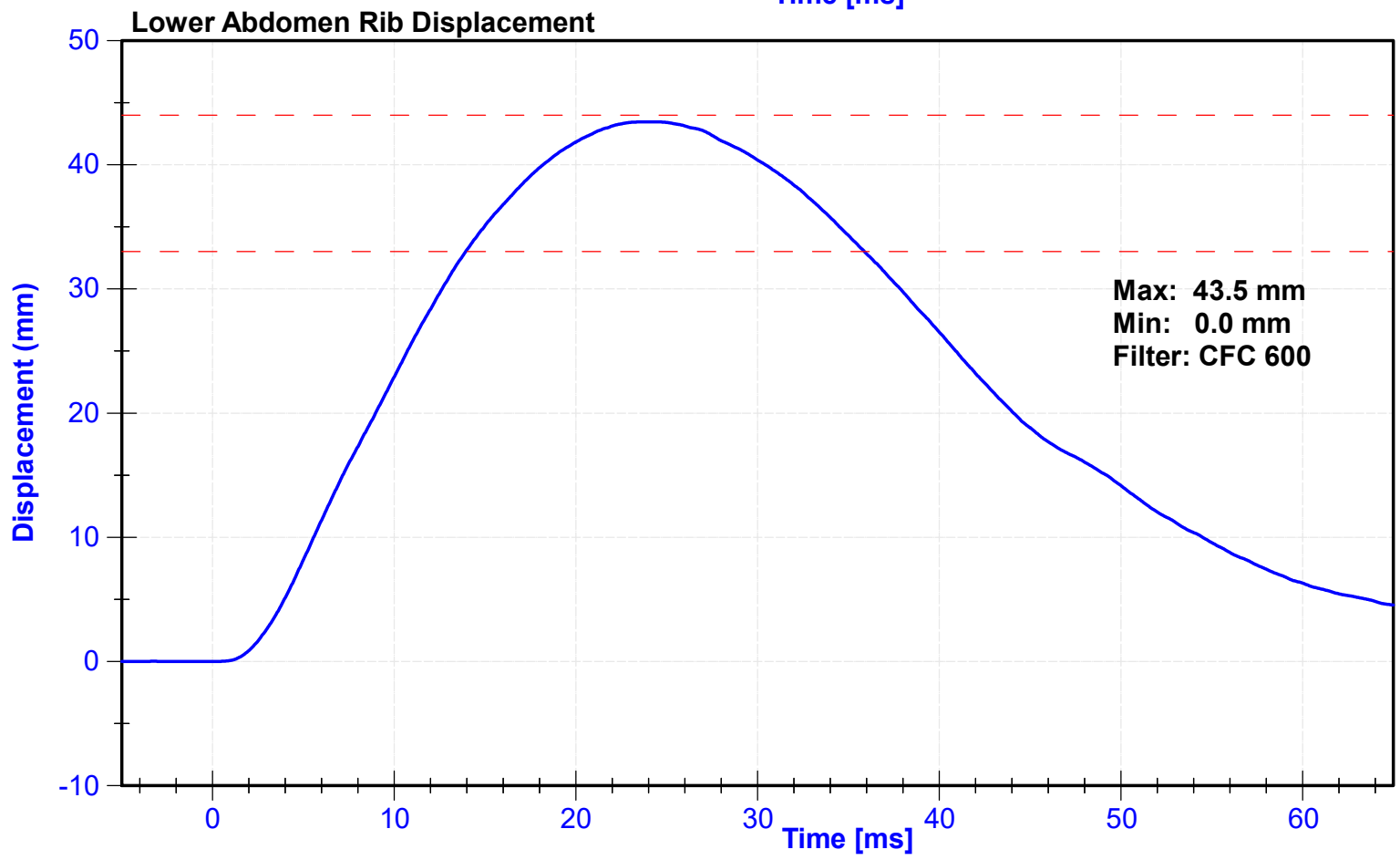
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	61.3	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	12	16	g's	13.5	Pass
Lateral Lower Spine Acceleration	9	14	g's	9.8	Pass
Upper Abdomen Rib Deflection	36	47	mm	42.9	Pass
Lower Abdomen Rib Deflection	33	44	mm	43.5	Pass

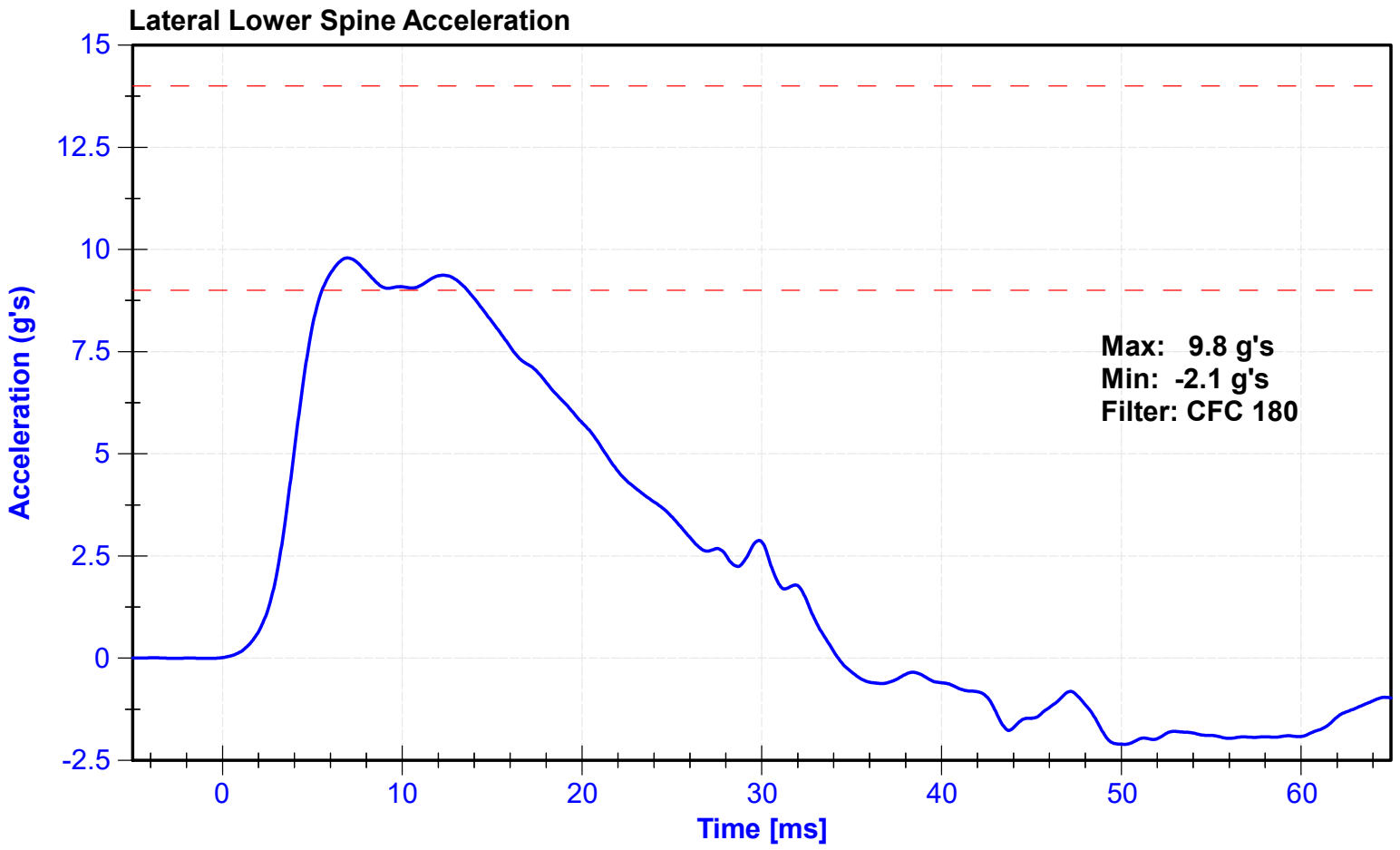
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Lower Spine Y Accelerometer	Endevco	P58744	6/22/2023	12/19/2023
Upper Abdomen Rib Potentiometer	Servo	342GFE	6/22/2023	12/21/2023
Lower Abdomen Rib Potentiometer	Servo	512GFE	6/22/2023	12/21/2023




Upper Abdomen Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
60
Time [ms]
Max: 42.9 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: 43.5 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
0
10
20
30
40
50
60
Time [ms]
Max: 9.8 g's
Min: -2.1 g's
Filter: CFC 180

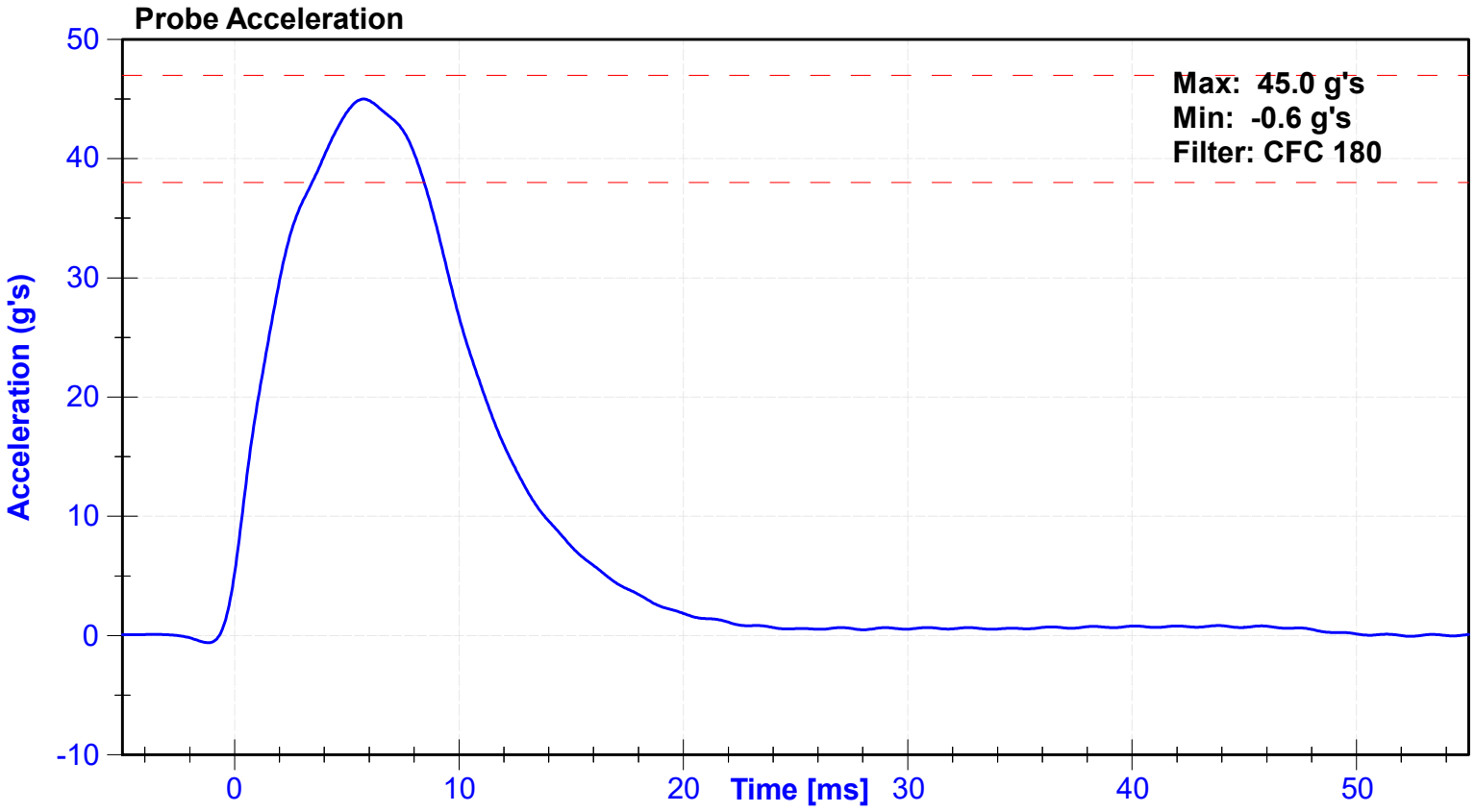
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

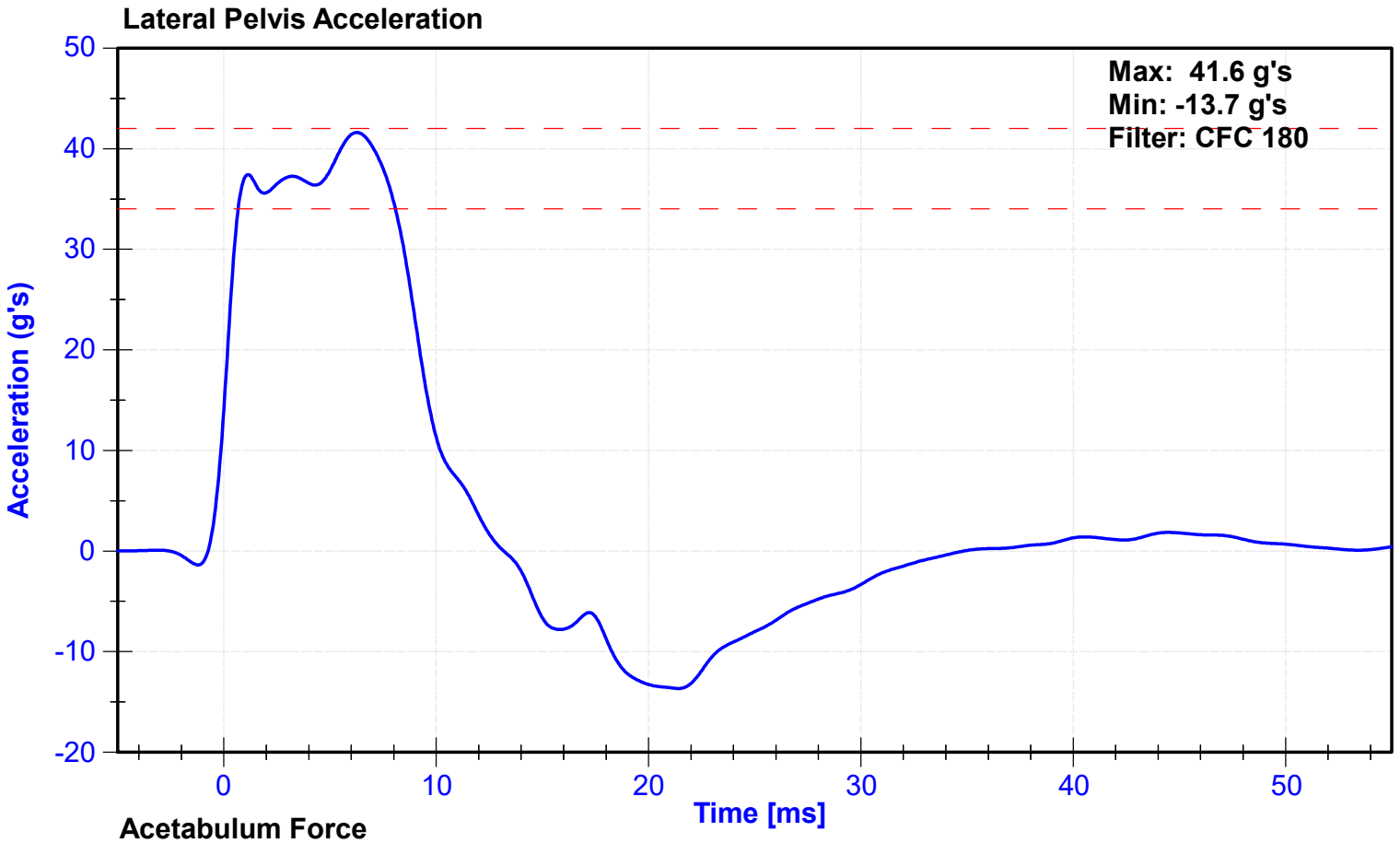
Results

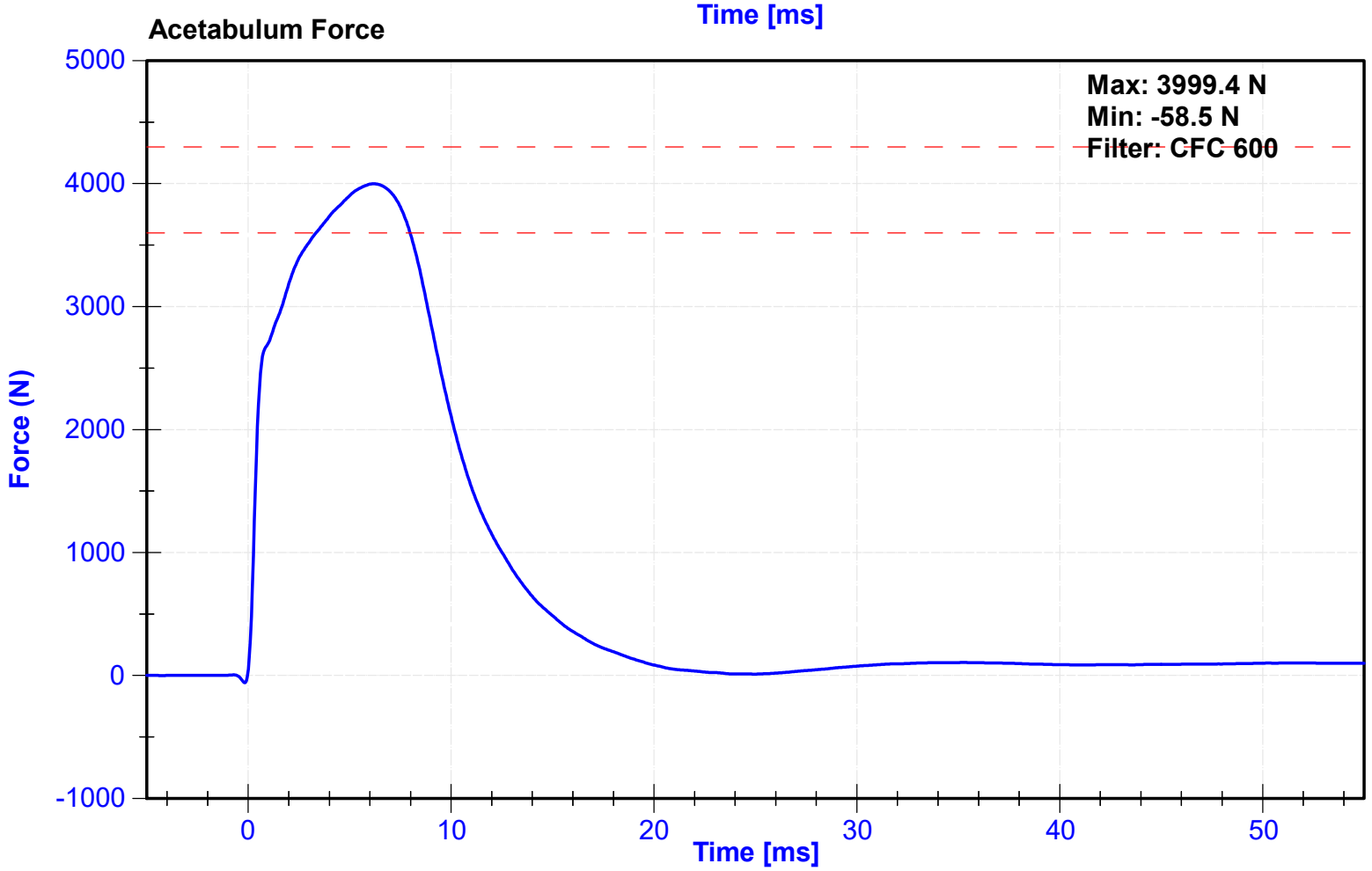
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	61.3	Pass
Velocity	6.6	6.8	m/s	6.69	Pass
Probe Acceleration	38	47	g's	45.0	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.6	Pass
Acetabulum Force	3600	4300	N	3999.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pelvis Y Accelerometer	Endevco	P18688	6/22/2023	12/19/2023
Acetabulum Load Cell	FTSS	236	8/23/2022	8/23/2023
Certification Plug	SACO			N/A
Crash Test Plug	SACO			N/A




Lateral Pelvis Acceleration
Max: 41.6 g's
Min: -13.7 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: 3999.4 N
Min: -58.5 N
Filter: CFC 600
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]

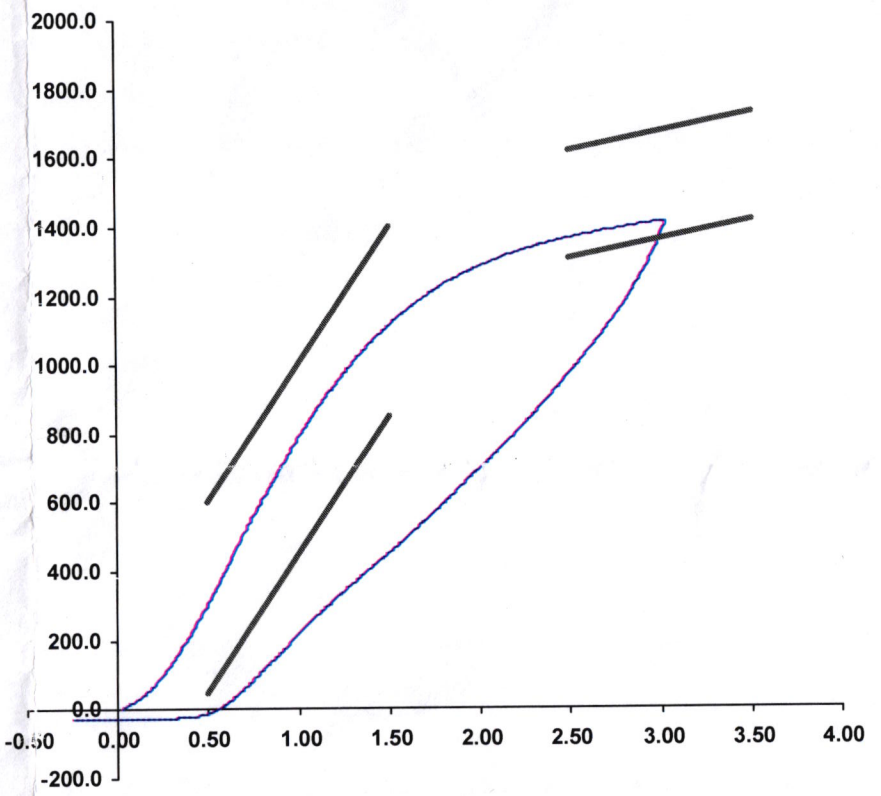
261 CERT
6/26/2023

SID-IIs Pelvis Plug Certification Test

Plug S/N 15037
Test Number 17618
Report Number 17665
Test Date 2/5/2021 10:26:35 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	314	50	600
Force @ 1.5 mm (N)	1,113	850	1,400
Force @ 2.5 mm (N)	1,366	1,306	1,618
Force @ 3.0 mm (N)	1,413	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 05-Feb-21
SACO Research

By : DC Date : 2/5/2021

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

SACO RESEARCH

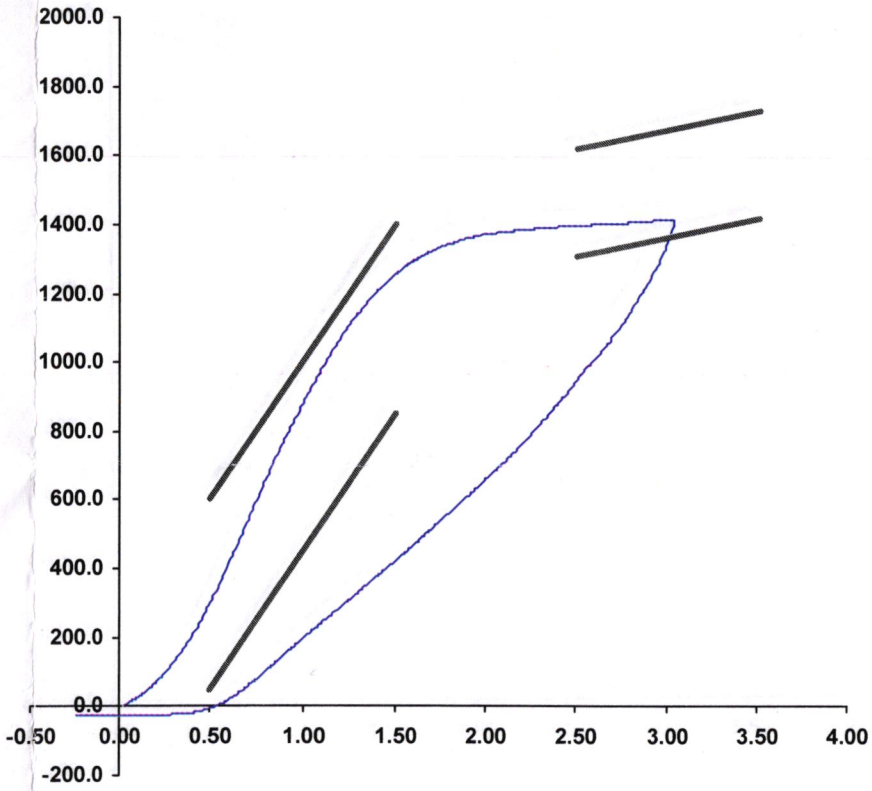
261 CRASH
6-26-2023

SID-IIs Pelvis Plug Certification Test

Force (-N) vs Extension (-mm)

Plug S/N 14207
Test Number 14347
Report Number 14391
Test Date 7/3/2020 8:48:42 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	308.57	50.00	600.00
Force @ 1.5 mm (N)	1,252.61	850.00	1,400.00
Force @ 2.5 mm (N)	1,394.14	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,410.09	1,361.00	1,673.00



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

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

Notes:

Operator

Part Number 180-4450

Template No 107 03-Jul-20
SACO Research

By : DC Date : 7/3/2020

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

SACO RESEARCH

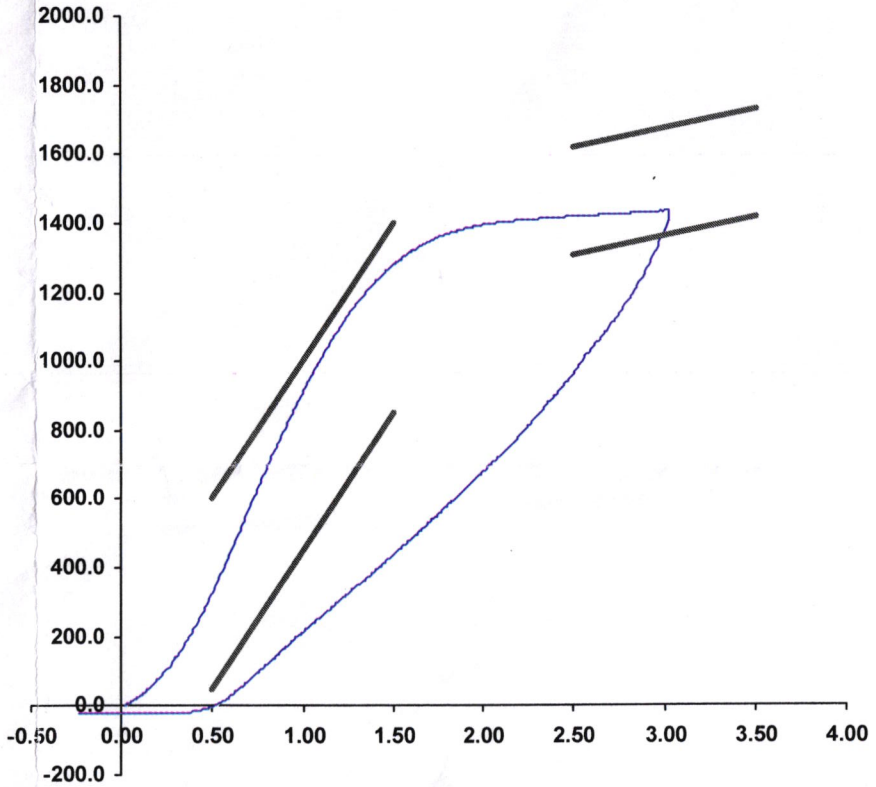
261 NON-IMPACT
6-26-2023

SID-IIs Pelvis Plug Certification Test

Plug S/N 14225
Test Number 14365
Report Number 14409
Test Date 7/3/2020 9:16:19 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	326.15	50.00	600.00
Force @ 1.5 mm (N)	1,276.33	850.00	1,400.00
Force @ 2.5 mm (N)	1,415.14	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,431.81	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



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

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

Notes:

Operator

Part Number 180-4450

Template No 107 03-Jul-20
SACO Research

By : DC Date : 7/3/2020

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

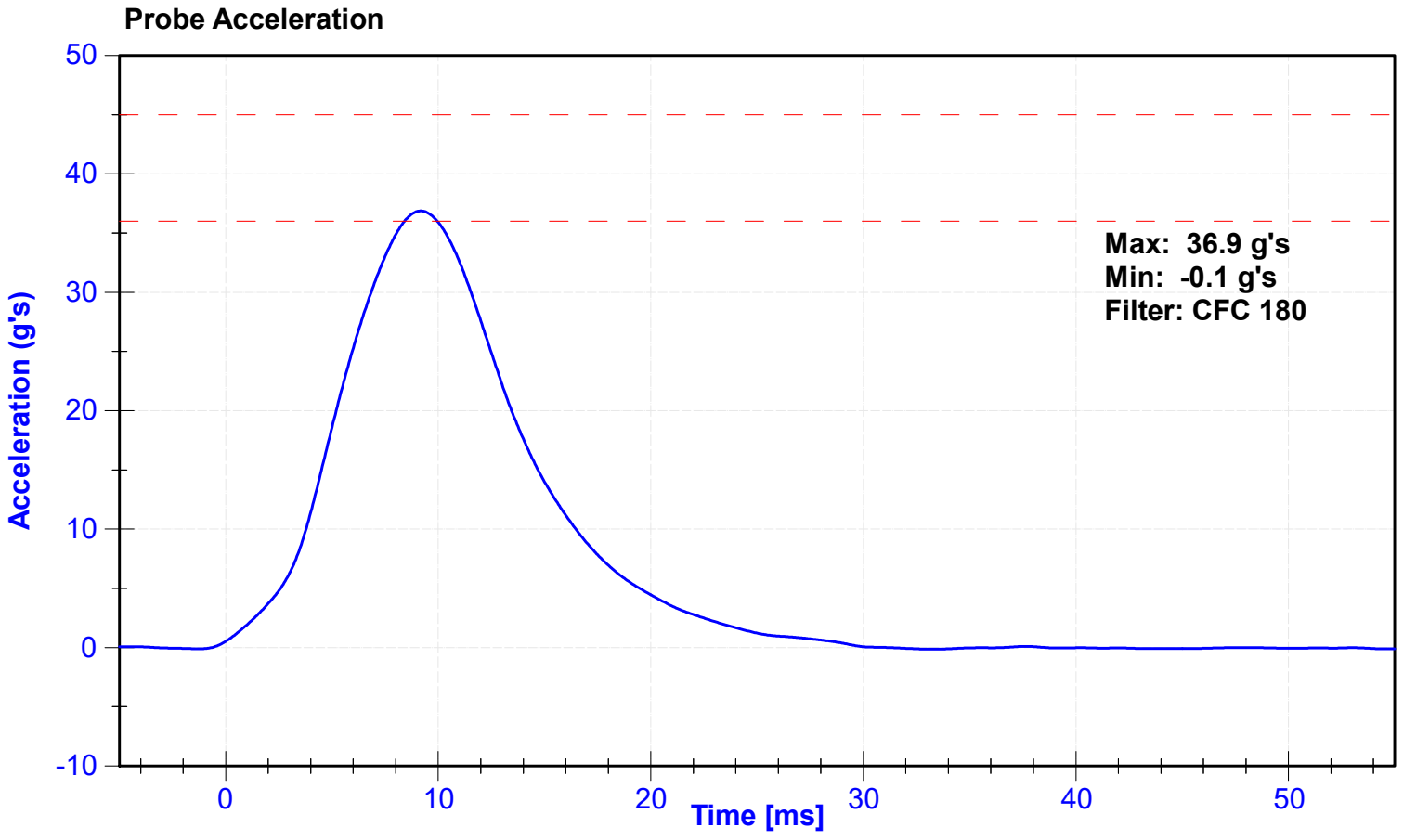
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

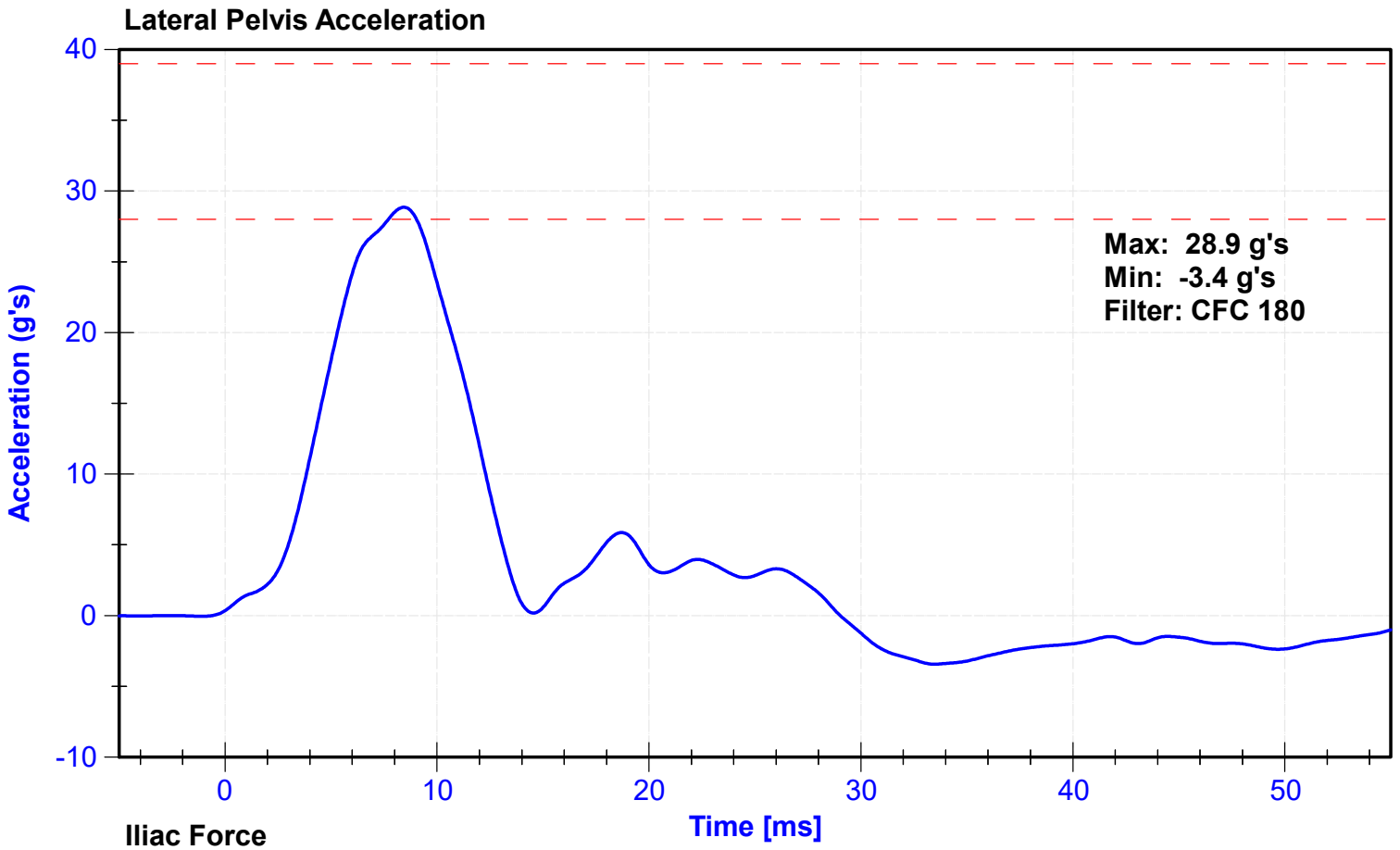
Results

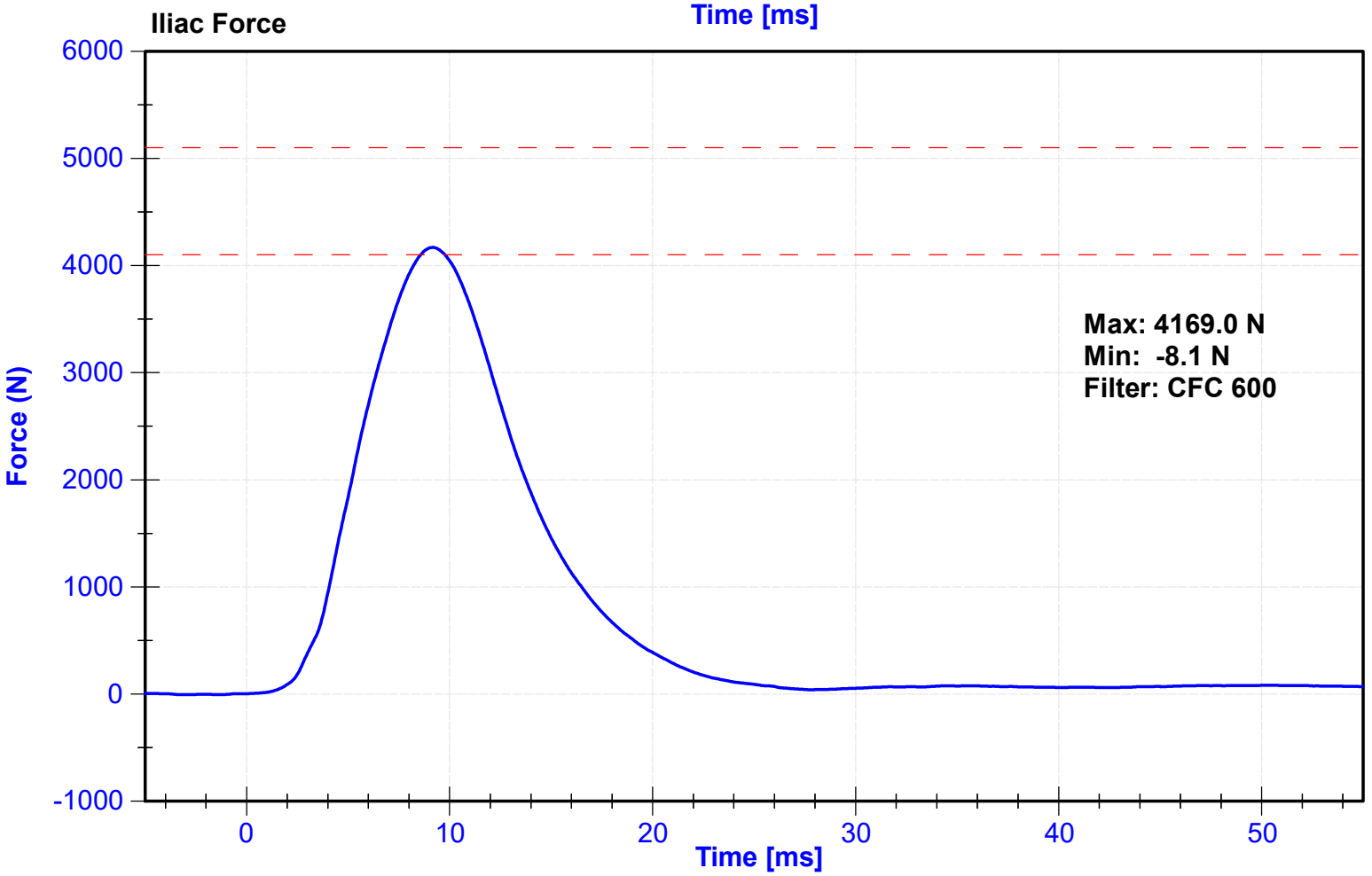
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	61.3	Pass
Velocity	4.2	4.4	m/s	4.33	Pass
Probe Acceleration	36	45	g's	36.9	Pass
Lateral Pelvis Acceleration	28	39	g's	28.9	Pass
Iliac Force	4100	5100	N	4169.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pelvis Y Accelerometer	Endevco	P18688	6/22/2023	12/19/2023
Iliac Load Cell	Denton	279-FY	8/11/2022	8/11/2023




Lateral Pelvis Acceleration
Acceleration (g's)
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 28.9 g's
Min: -3.4 g's
Filter: CFC 180

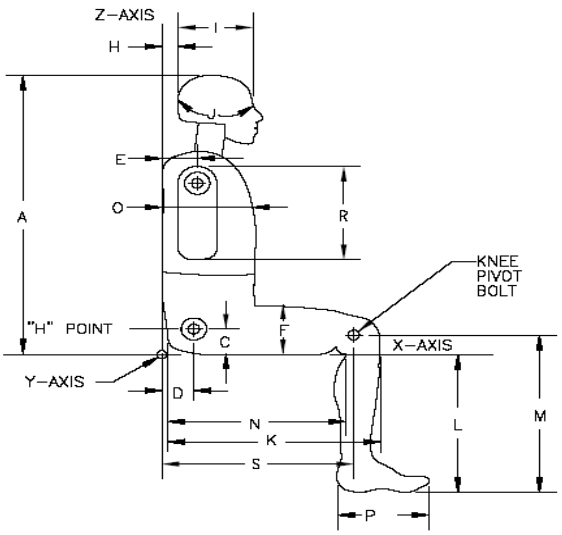

Iliac Force
Force (N)
6000
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 4169.0 N
Min: -8.1 N
Filter: CFC 600

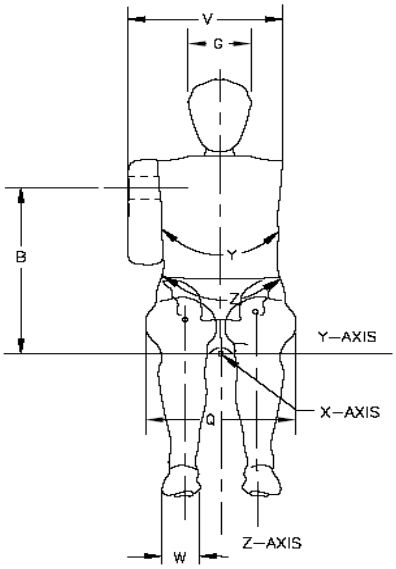
POST-TEST
SID-IIs PERFORMANCE CALIBRATION TEST DATA

External Measurements - SID-IIs

Technician: K. Brogan Date: 06/29/2023

Dummy Serial Number: 261





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	780	Pass
B	Shoulder Pivot Height	437	453	445	Pass
C	H-point Height	79	89	82	Pass
D	H-point from seatback	141	151	146	Pass
E	Shoulder Pivot from Backline	97	107	104	Pass
F	Thigh Clearance	119	135	128	Pass
G	Head Breadth	140	148	144	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	180	Pass
J	Head Circumference	541	551	548	Pass
K	Buttock to Knee Length	514	540	531	Pass
L	Popliteal Height	343	369	354	Pass
M	Knee Pivot to floor height	392	409	400	Pass
N	Buttock Popliteal Length	416	442	431	Pass
O	Chest Depth w/o jacket	195	211	206	Pass
P	Foot Length	216	232	223	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	318	Pass
R	Arm Length	249	259	254	Pass
S	Knee Joint to seatback	477	493	483	Pass
V	Shoulder Width	341	357	349	Pass
W	Foot Width	78	94	84	Pass
Y	Chest Circumference w/jacket	851	881	871	Pass
Z	Waist Circumference	761	791	775	Pass

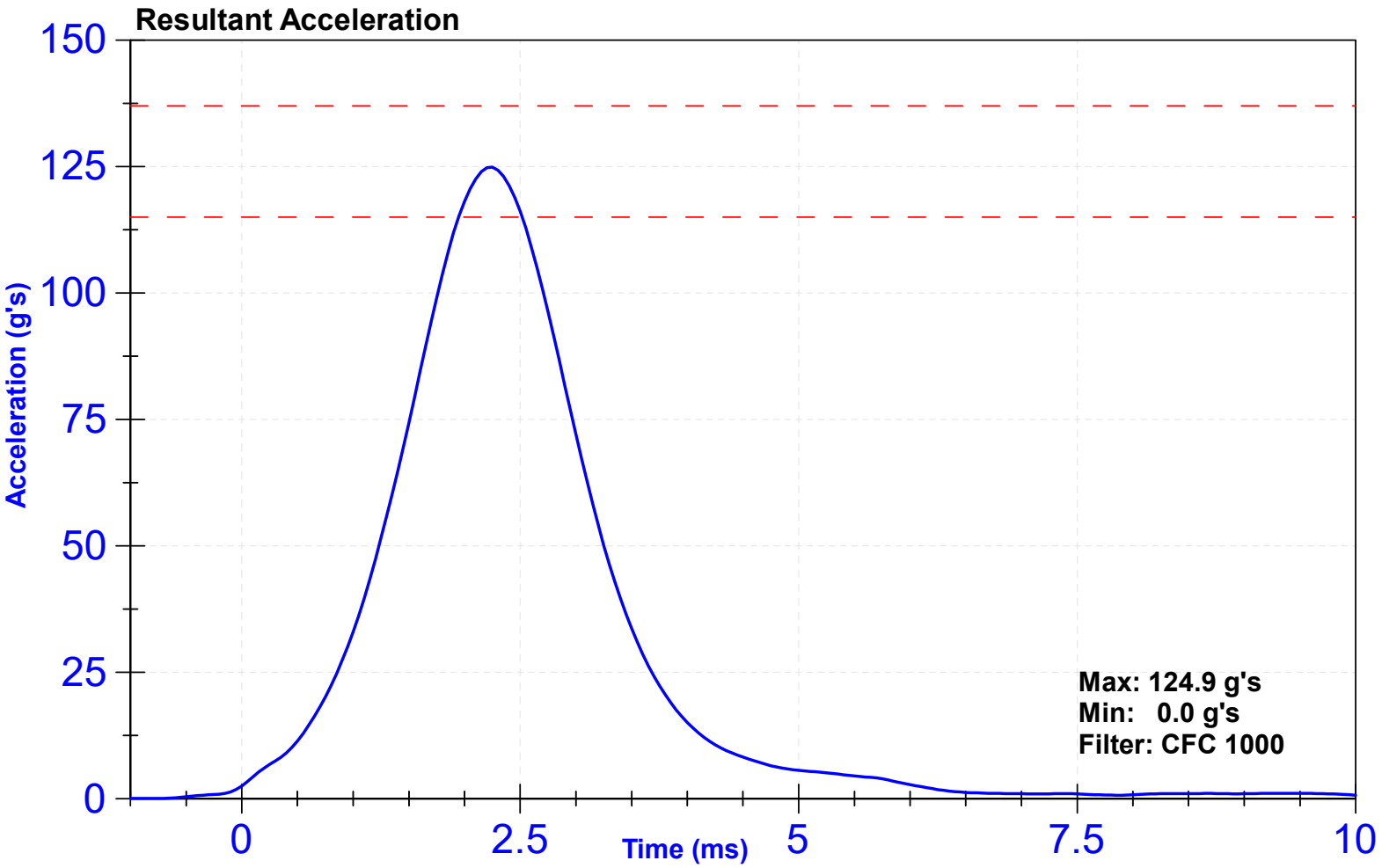
ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	261	Laboratory Supervisor	C .Mantell

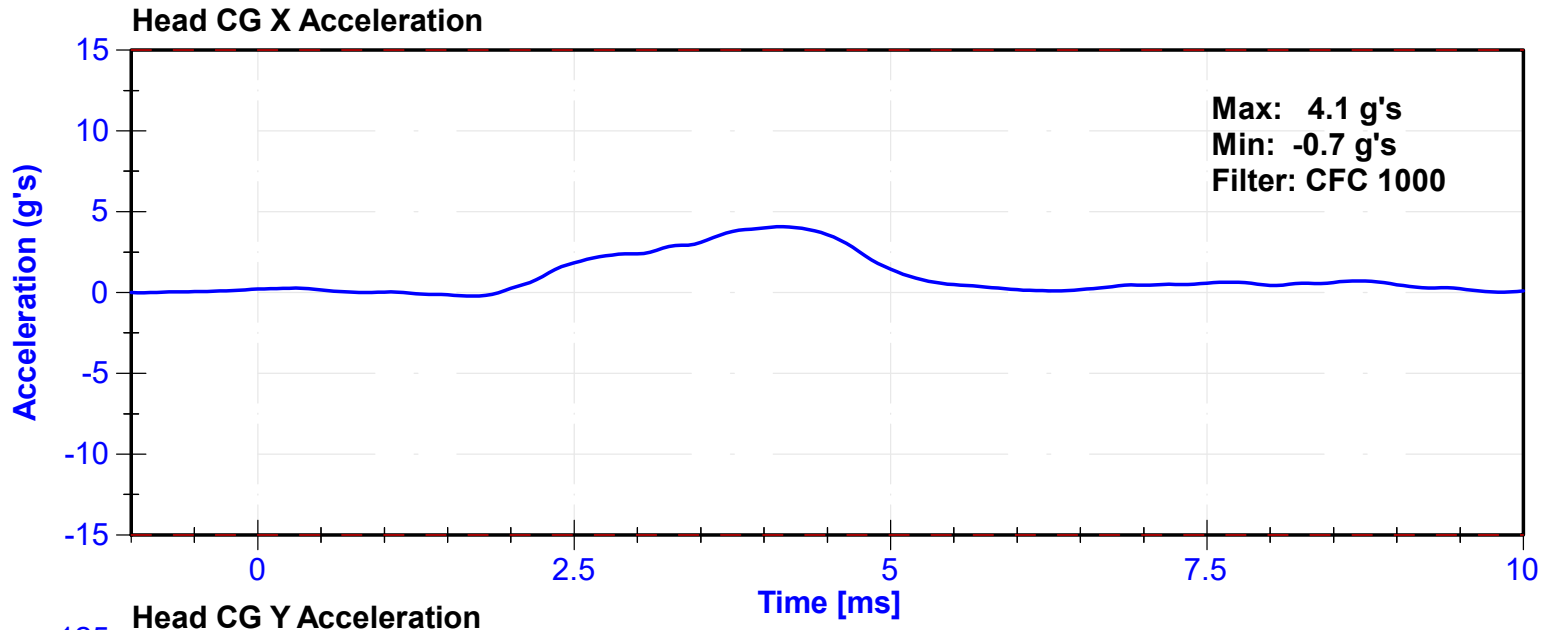
Results

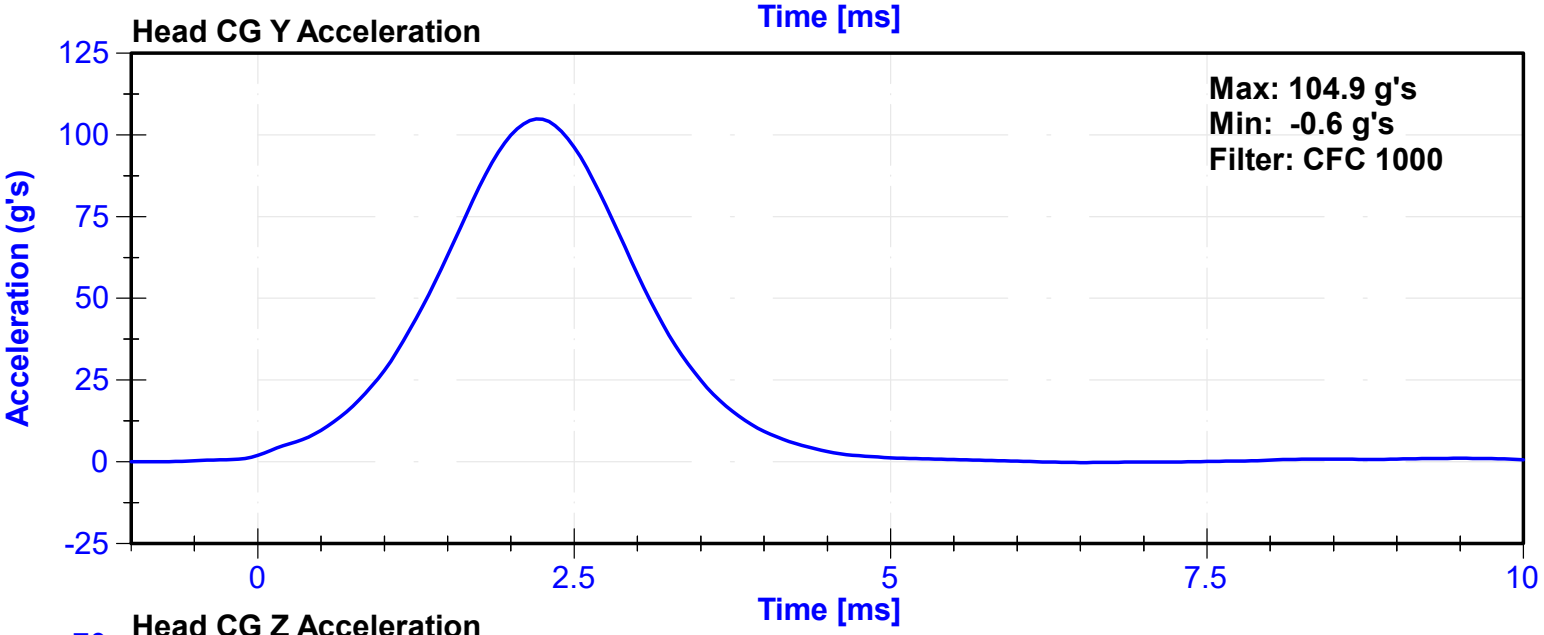
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	47.3	Pass
Resultant Acceleration	115	137	g's	124.9	Pass
Oscillation	0	15	%	0.8	Pass
Fore-Aft Acceleration	-15	15	g's	4.1	Pass

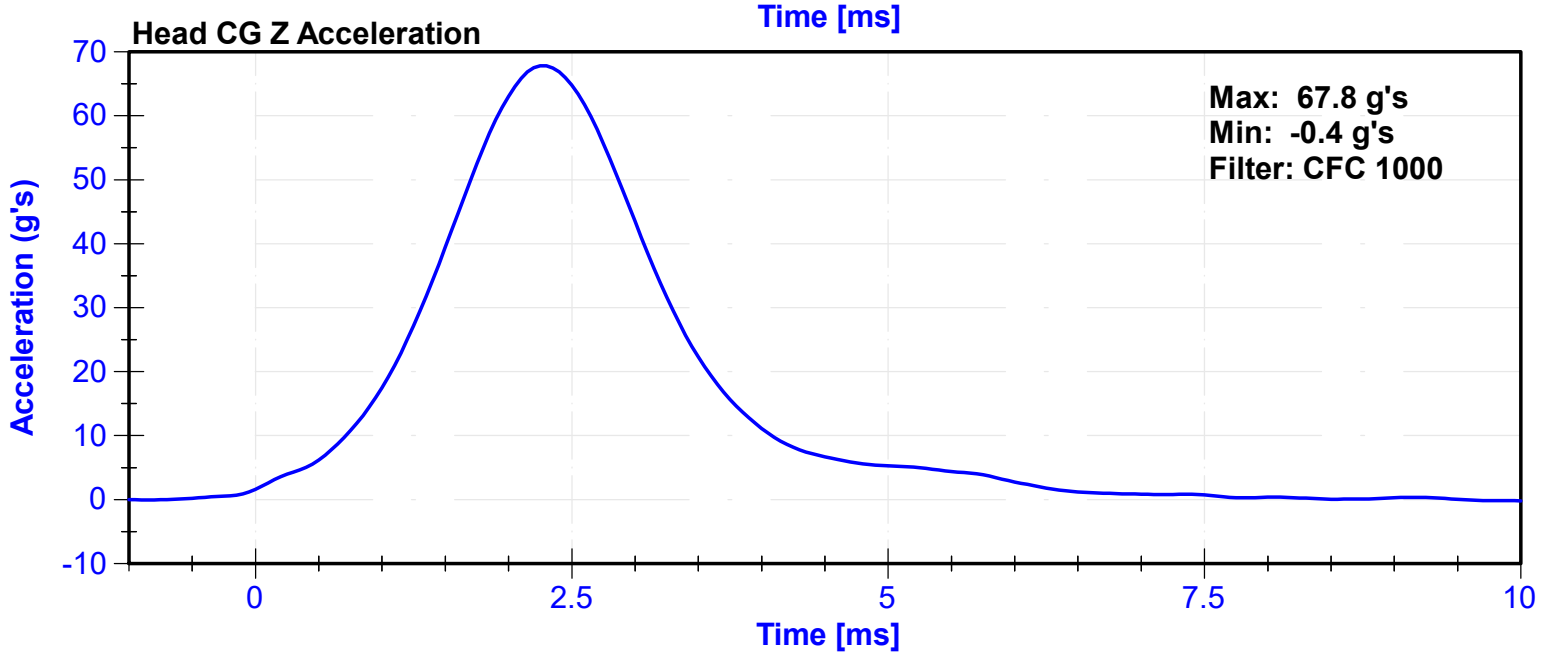
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibratio Date	Calibratio Due Date
X Accelerometer	Endevco	P68067	6/22/2023	12/19/2023
Y Accelerometer	Endevco	P18567	6/22/2023	12/19/2023
Z Accelerometer	Endevco	P49163	6/22/2023	12/19/2023




Head CG X Acceleration
Max: 4.1 g's
Min: -0.7 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Y Acceleration
Max: 104.9 g's
Min: -0.6 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Z Acceleration
Max: 67.8 g's
Min: -0.4 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]

ATD Manufacturer	FTSS	Test Technician	T. Roseman
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

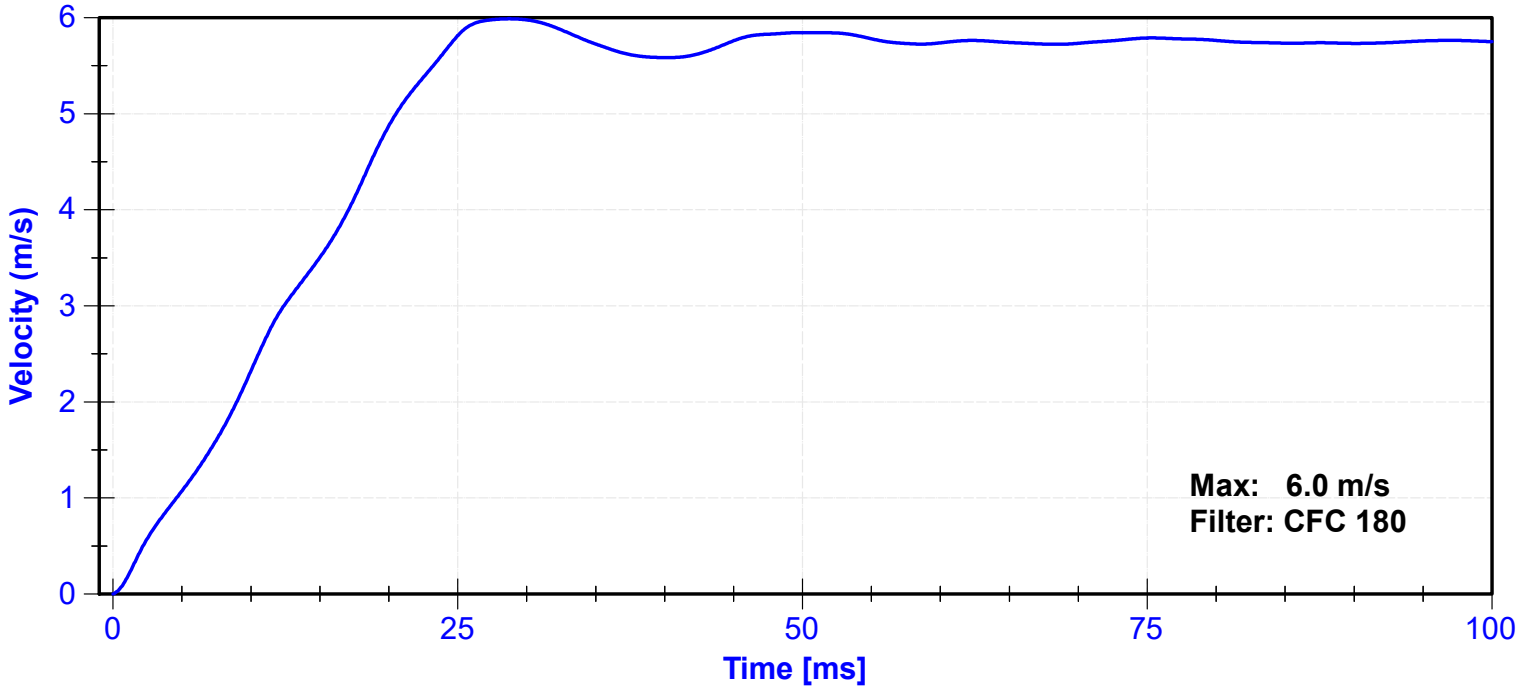
Results

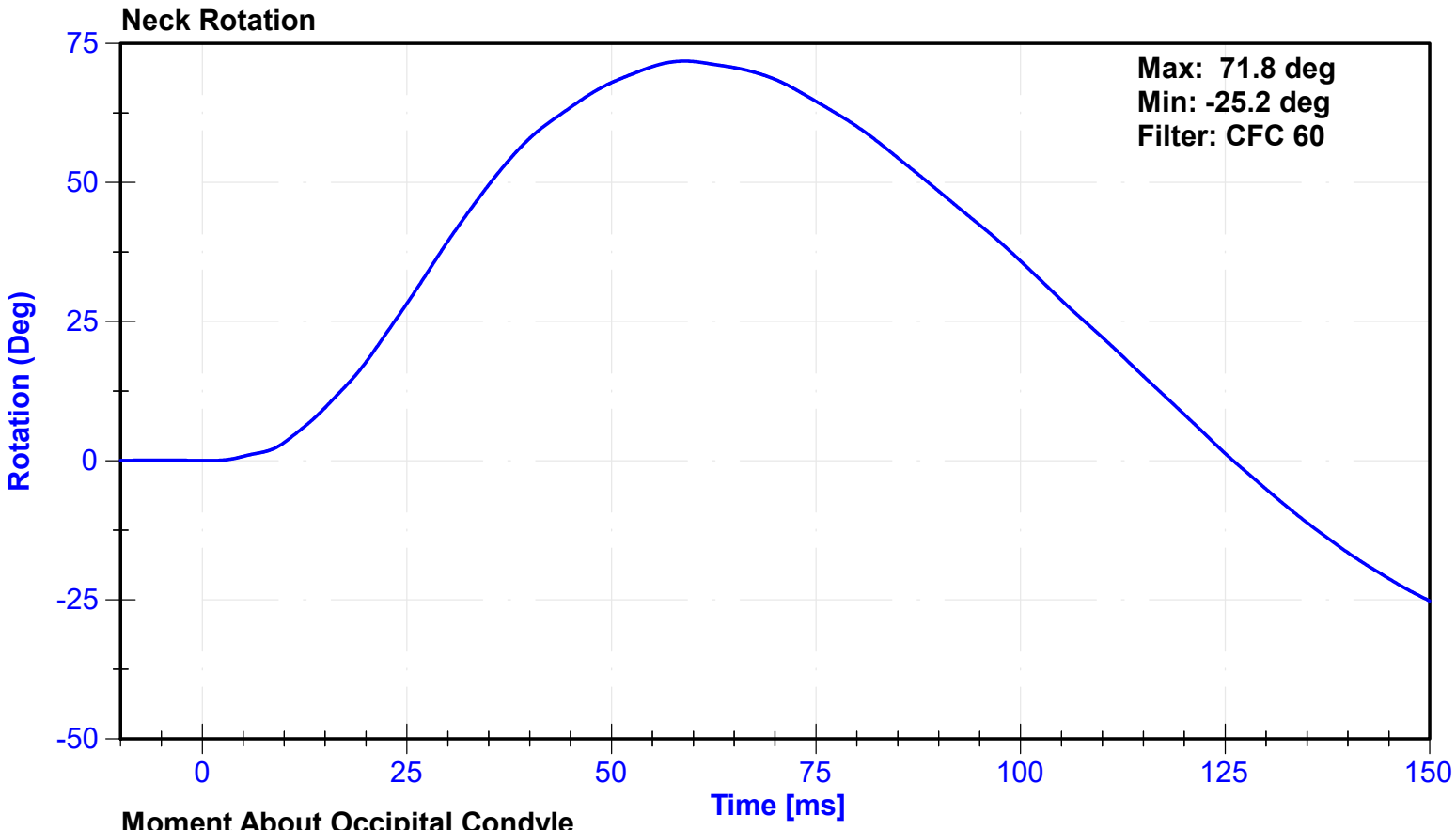
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.1	Pass
Humidity	10	70	%	47.3	Pass
Velocity	5.51	5.63	m/s	5.574	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.32	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.50	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.87	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.81	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.99	Pass
Neck Rotation	71	81	deg	71.8	Pass
Time at Maximum Rotation	50	70	ms	59.0	Pass
Moment about the OC	36	44	Nm	42.3	Pass
Moment Decay to 0 Nm	102	126	ms	110.9	Pass

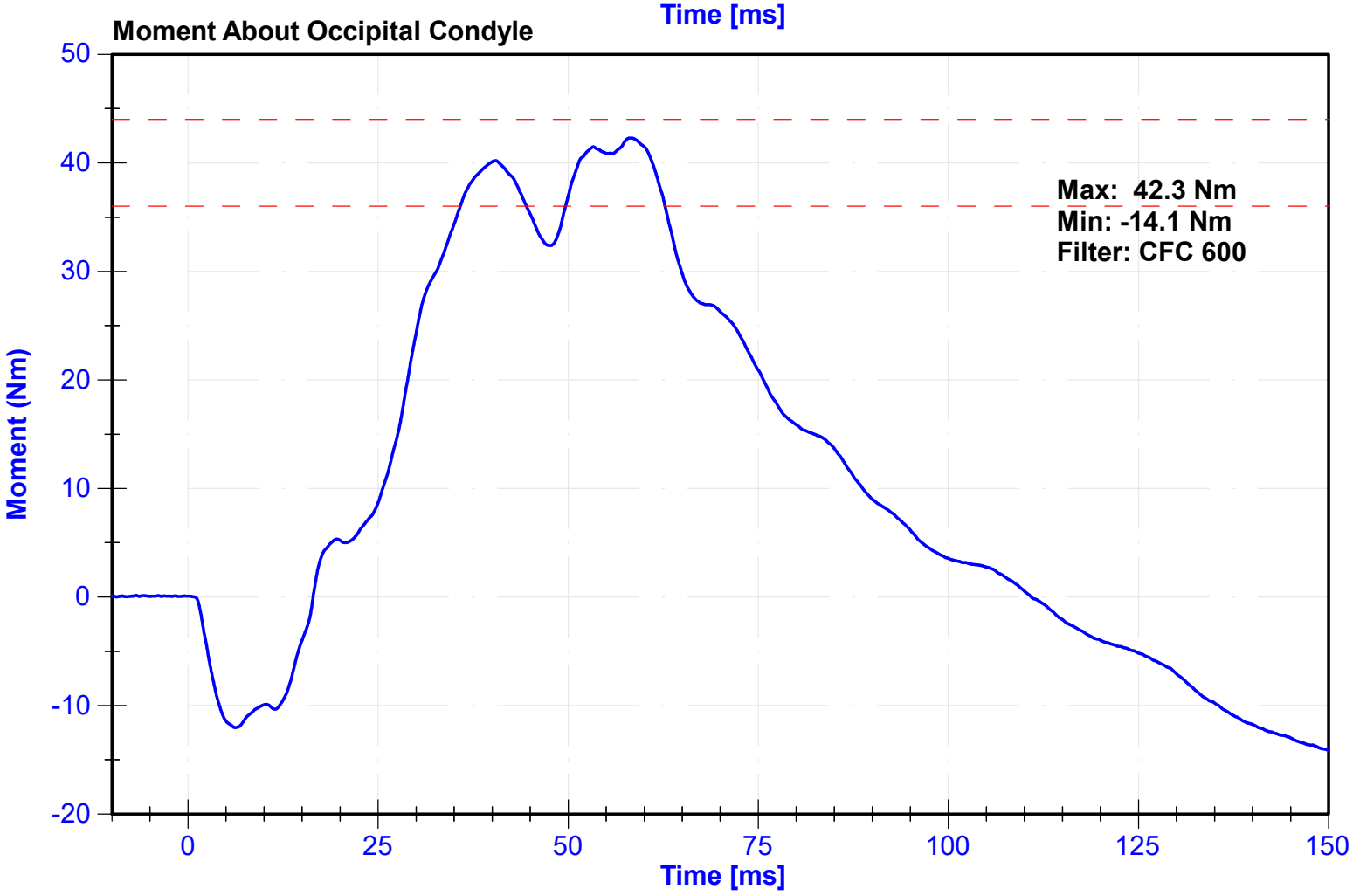
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	7231C-750	10/31/2022	10/31/2023
Pendulum Potentiometer	Servo	4961	11/11/2022	11/11/2023
Condyle Potentiometer	Servo	DS185	11/11/2022	11/11/2023
Upper Neck Load Cell	Denton	1716ATF_2184-FY	5/18/2023	5/17/2024

Pendulum Impulse




Neck Rotation
Max: 71.8 deg
Min: -25.2 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: 42.3 Nm
Min: -14.1 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

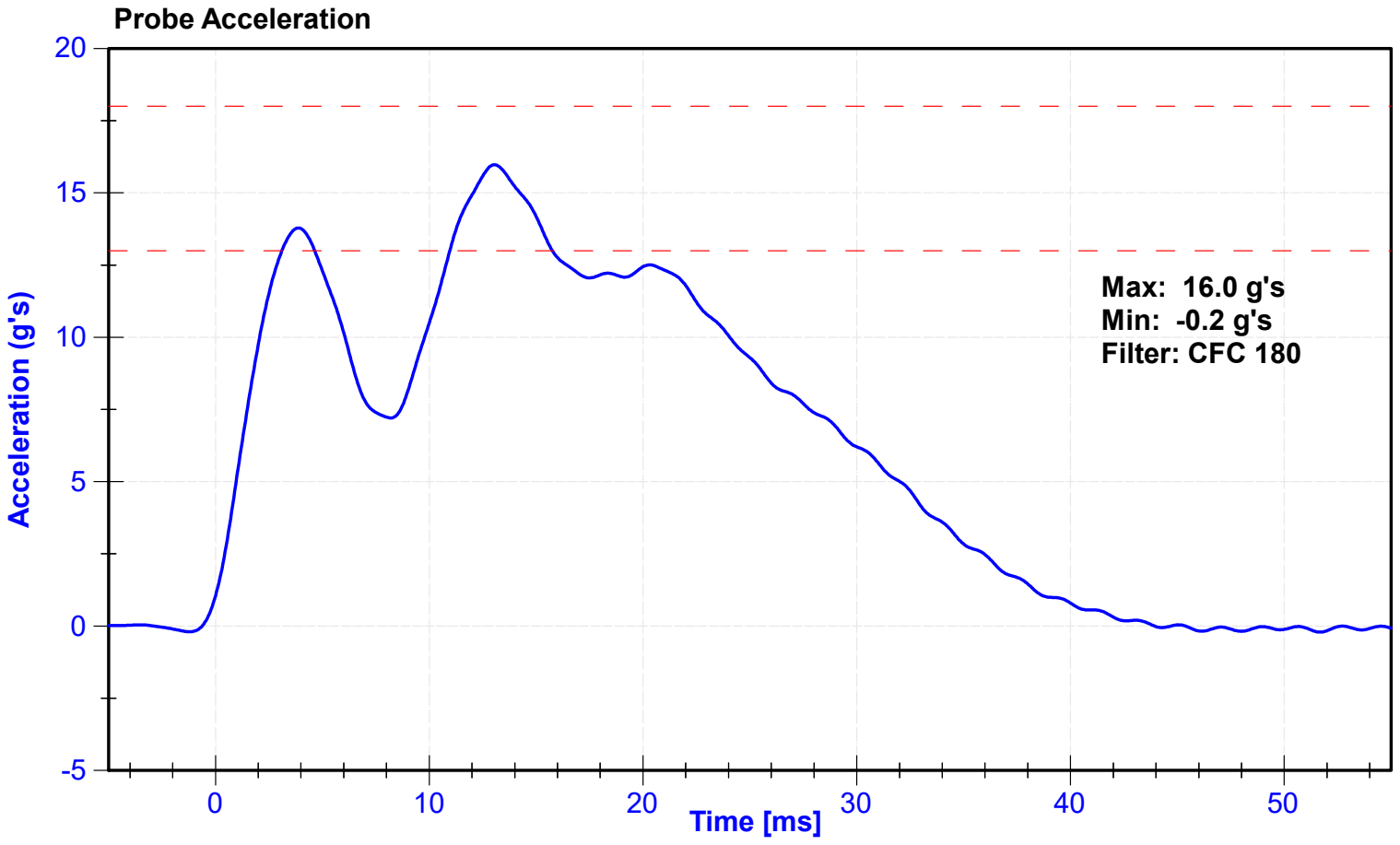
ATD Manufacturer	FTSS	Test Technician	S. Phillips
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

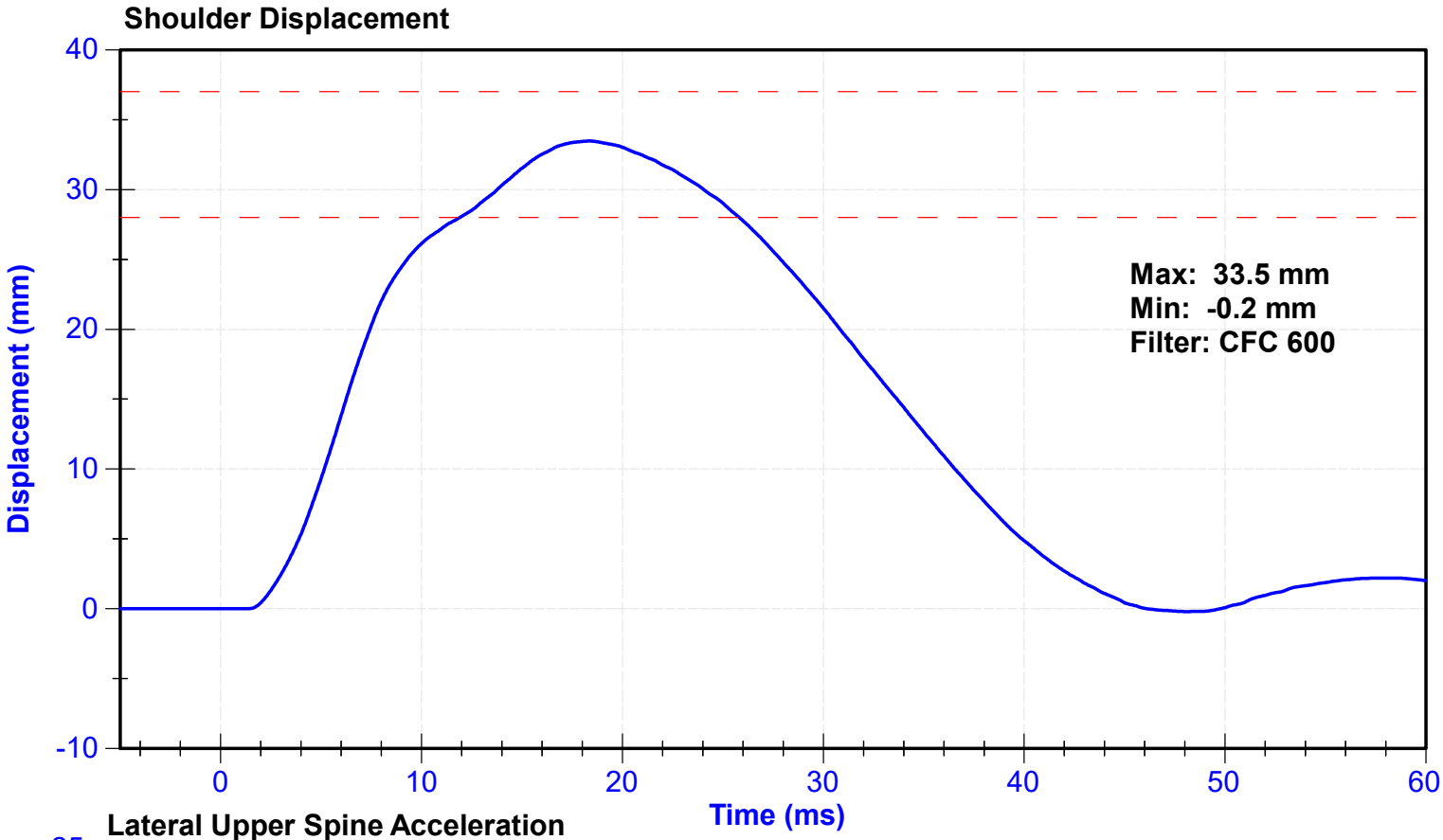
Results

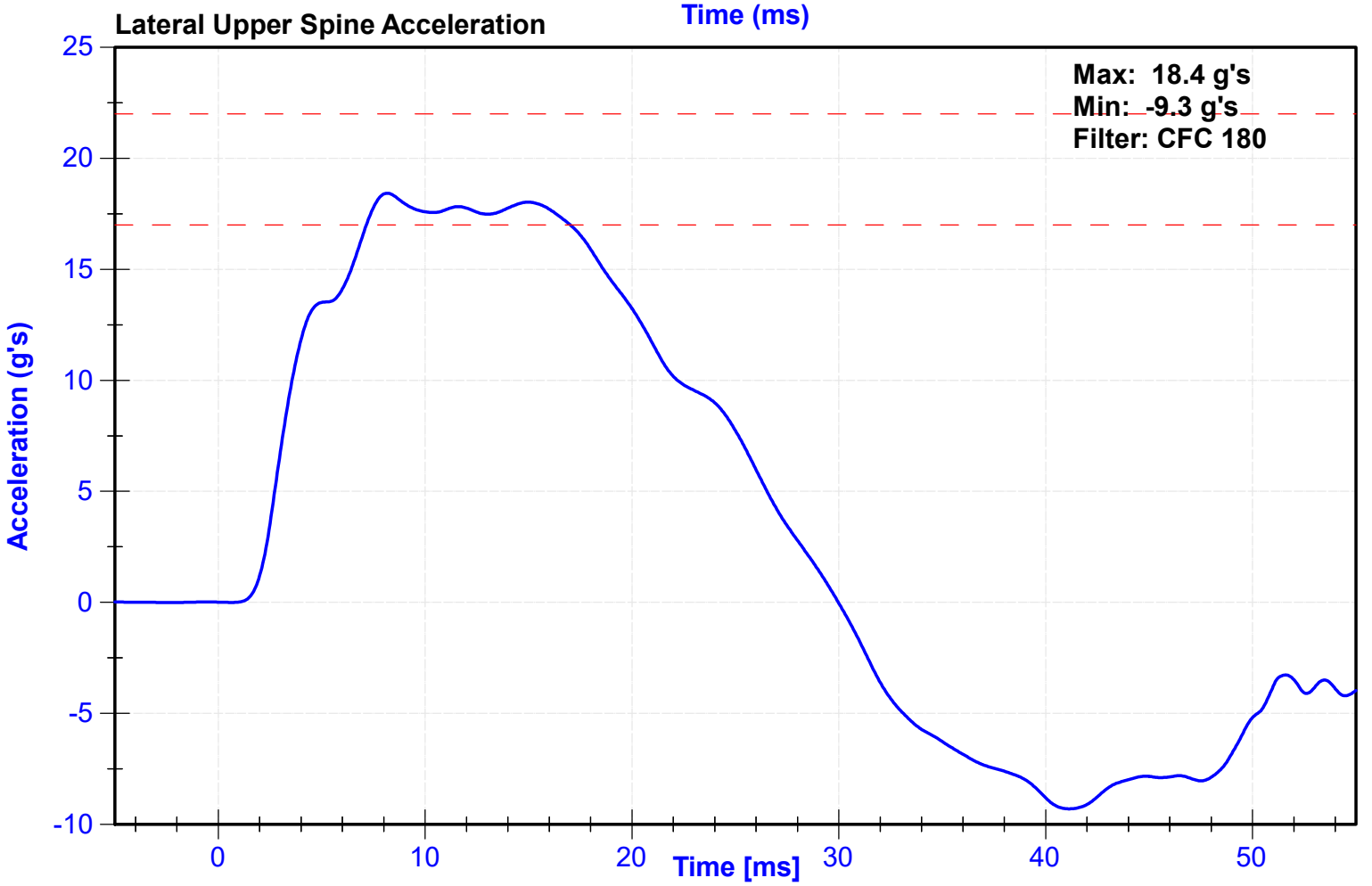
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	56	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	13	18	g's	16.0	Pass
Shoulder Deflection	28	37	mm	33.5	Pass
Lateral Upper Spine Acceleration	17	22	g's	18.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Shoulder Potentiometer	Servo	572GFE	6/22/2023	12/21/2023
Upper Spine Y Accelerometer	Endevco	P94678	6/22/2023	12/19/2023




Shoulder Displacement
Displacement (mm)
40
30
20
10
0
-10
0
10
20
30
40
50
60
Time (ms)
Max: 33.5 mm
Min: -0.2 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
25
20
15
10
5
0
-5
-10
0
10
20
30
40
50
Time [ms]
Max: 18.4 g's
Min: -9.3 g's
Filter: CFC 180

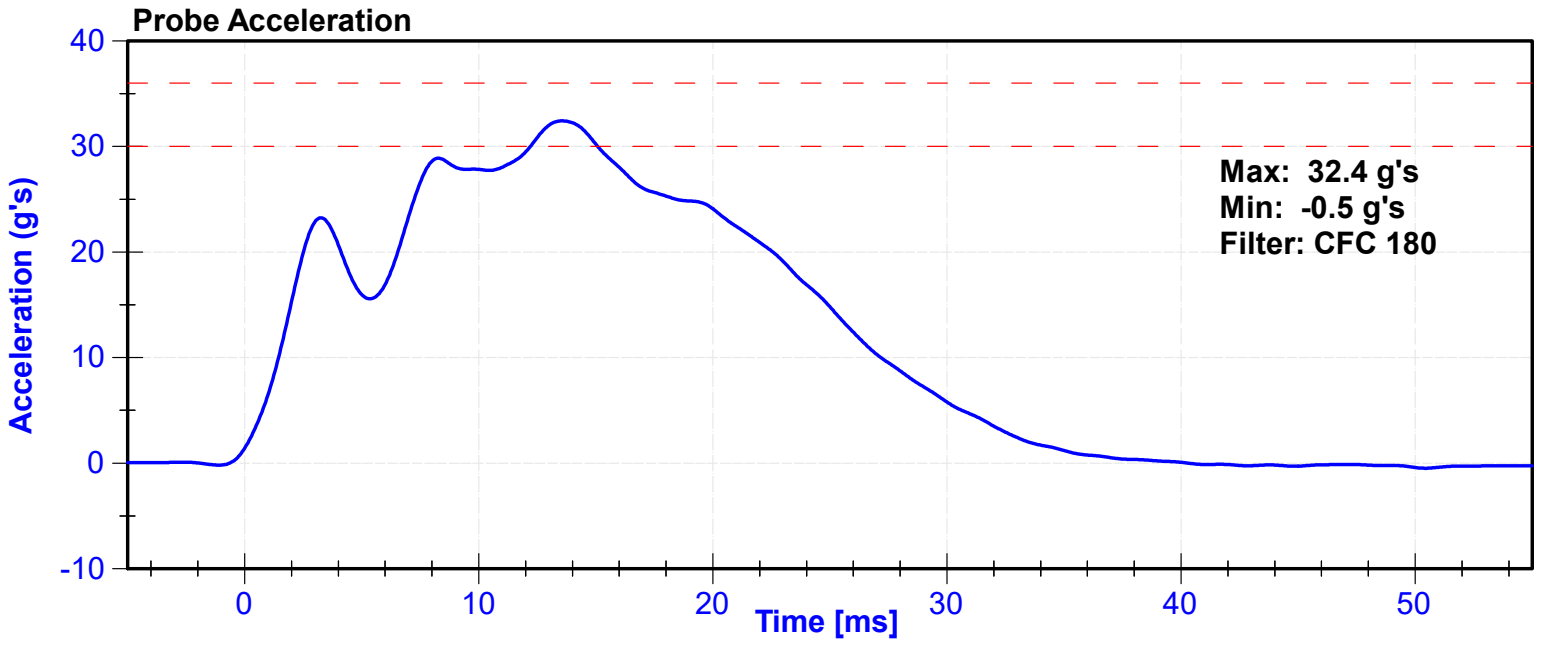
ATD Manufacturer	FTSS	Test Technician	S. Phillips
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

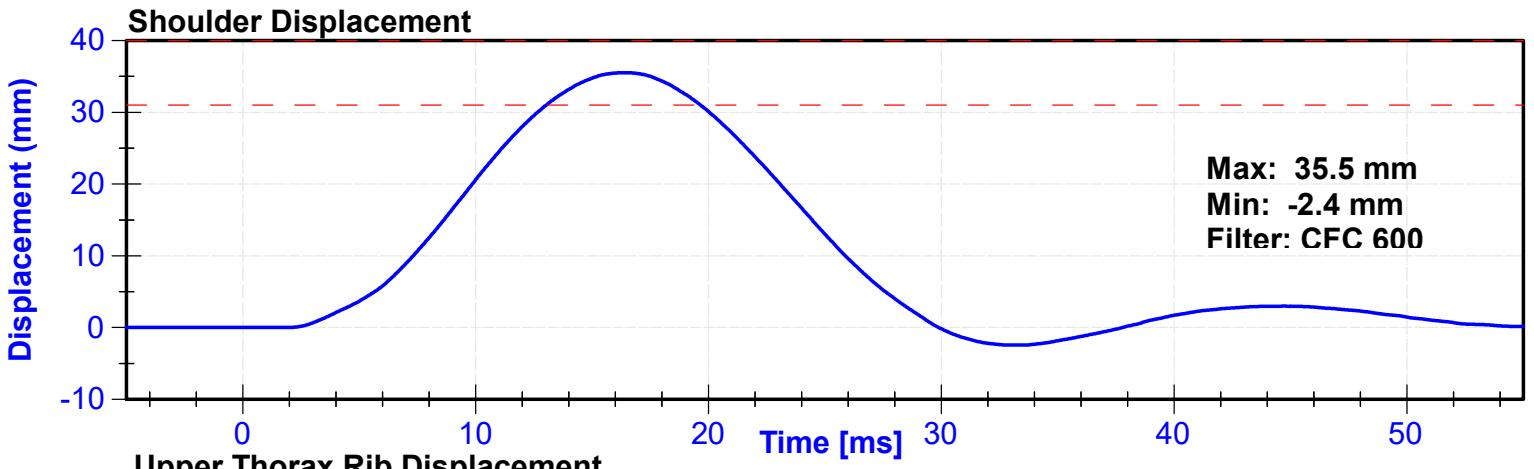
Results

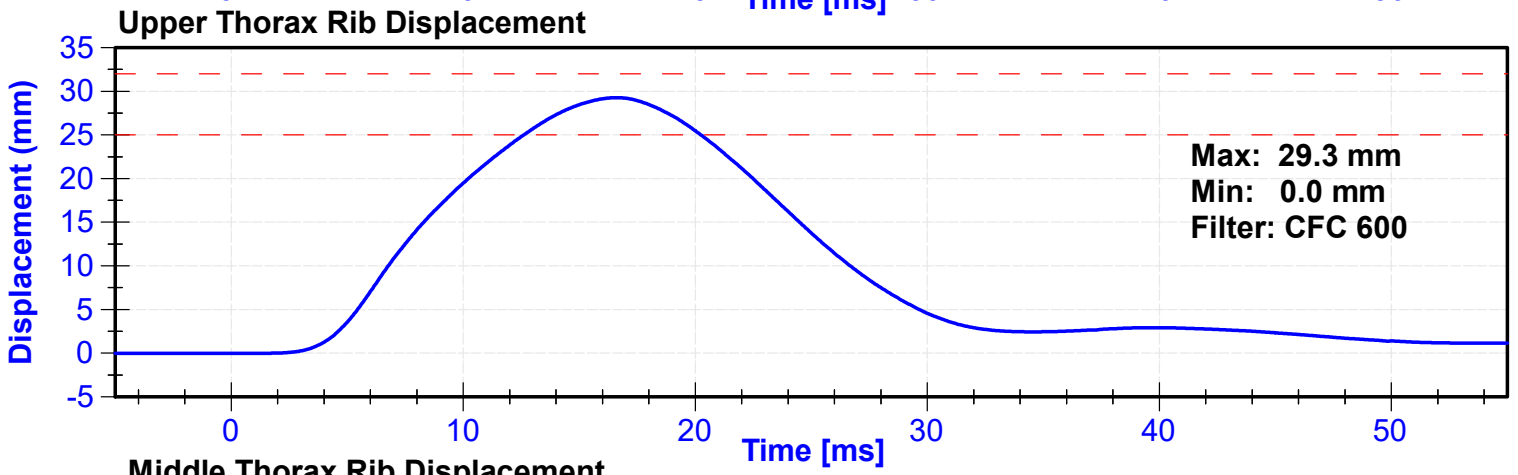
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	56	Pass
Velocity	6.6	6.8	m/s	6.67	Pass
Probe Acceleration after 5 ms	30	36	g's	32.4	Pass
Lateral Upper Spine Acceleration	34	43	g's	37.3	Pass
Lateral Lower Spine Acceleration	29	37	g's	30.5	Pass
Shoulder Deflection	31	40	mm	35.5	Pass
Upper Thorax Rib Deflection	25	32	mm	29.3	Pass
Mid Thorax Rib Deflection	30	36	mm	33.2	Pass
Lower Thorax Rib Deflection	32	38	mm	35.8	Pass

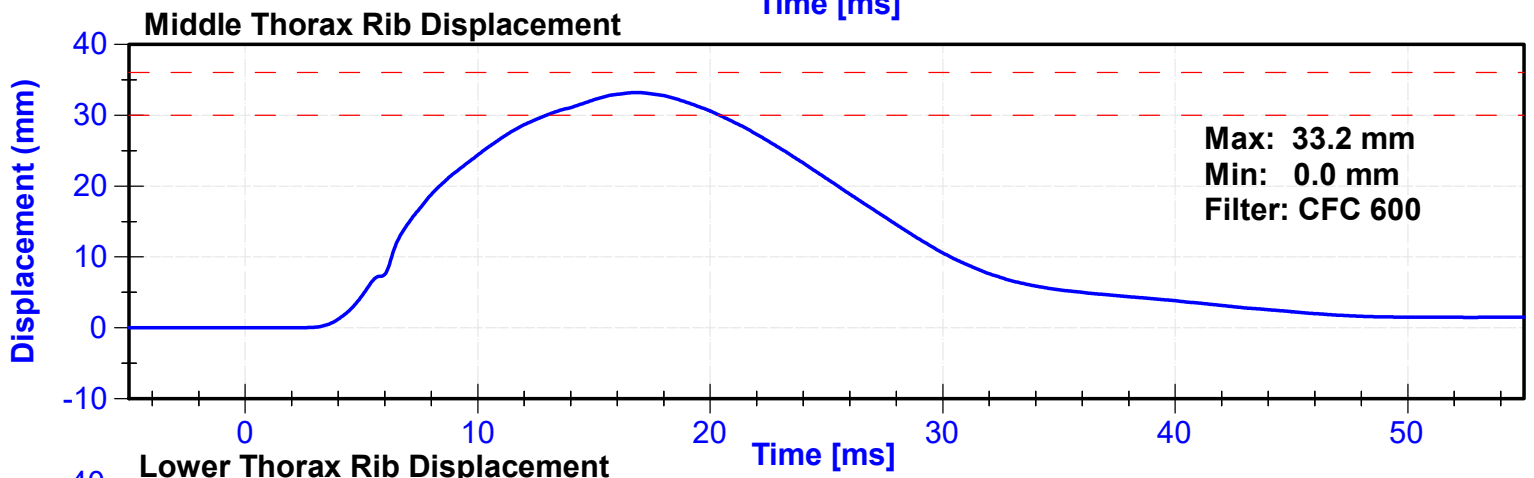
Transducer Calibrations

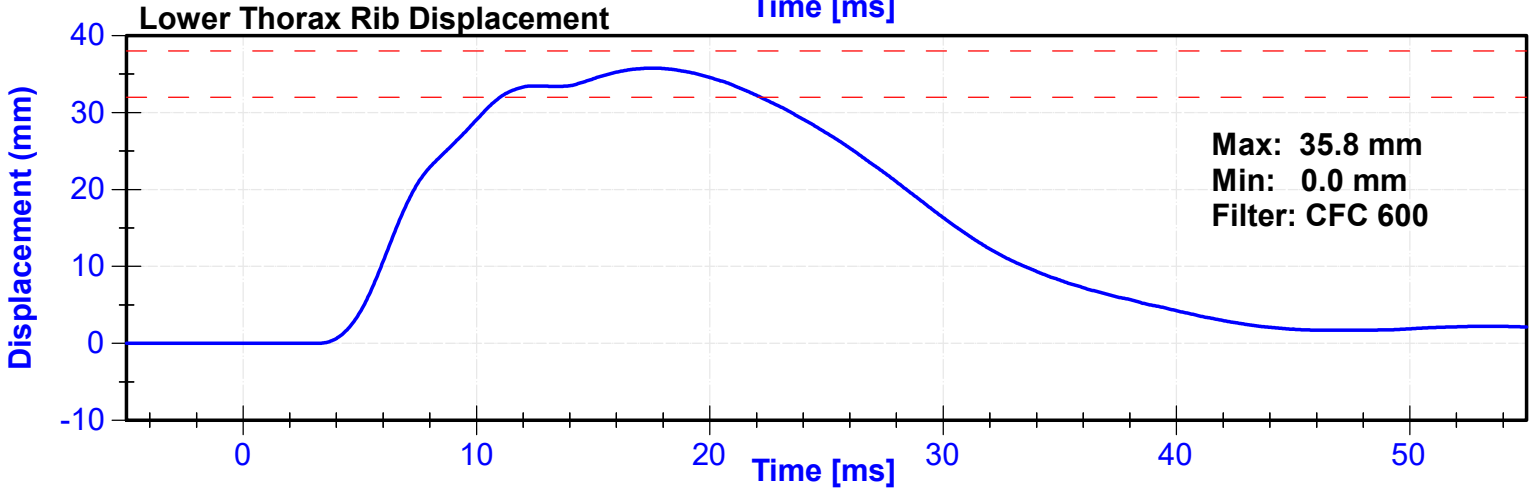
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Spine T1 Y Accelerometer	Endevco	P94678	6/22/2023	12/19/2023
Upper Spine T12 Y Accelerometer	Endevco	P58744	6/22/2023	12/19/2023
Shoulder Potentiometer	Servo	572GFE	6/22/2023	12/21/2023
Upper Thorax Rib Potentiometer	Servo	062GFE	6/22/2023	12/21/2023
Middle Thorax Rib Potentiometer	Servo	528GFE	6/22/2023	12/21/2023
Lower Thorax Rib Potentiometer	Servo	513GFE	6/22/2023	12/21/2023

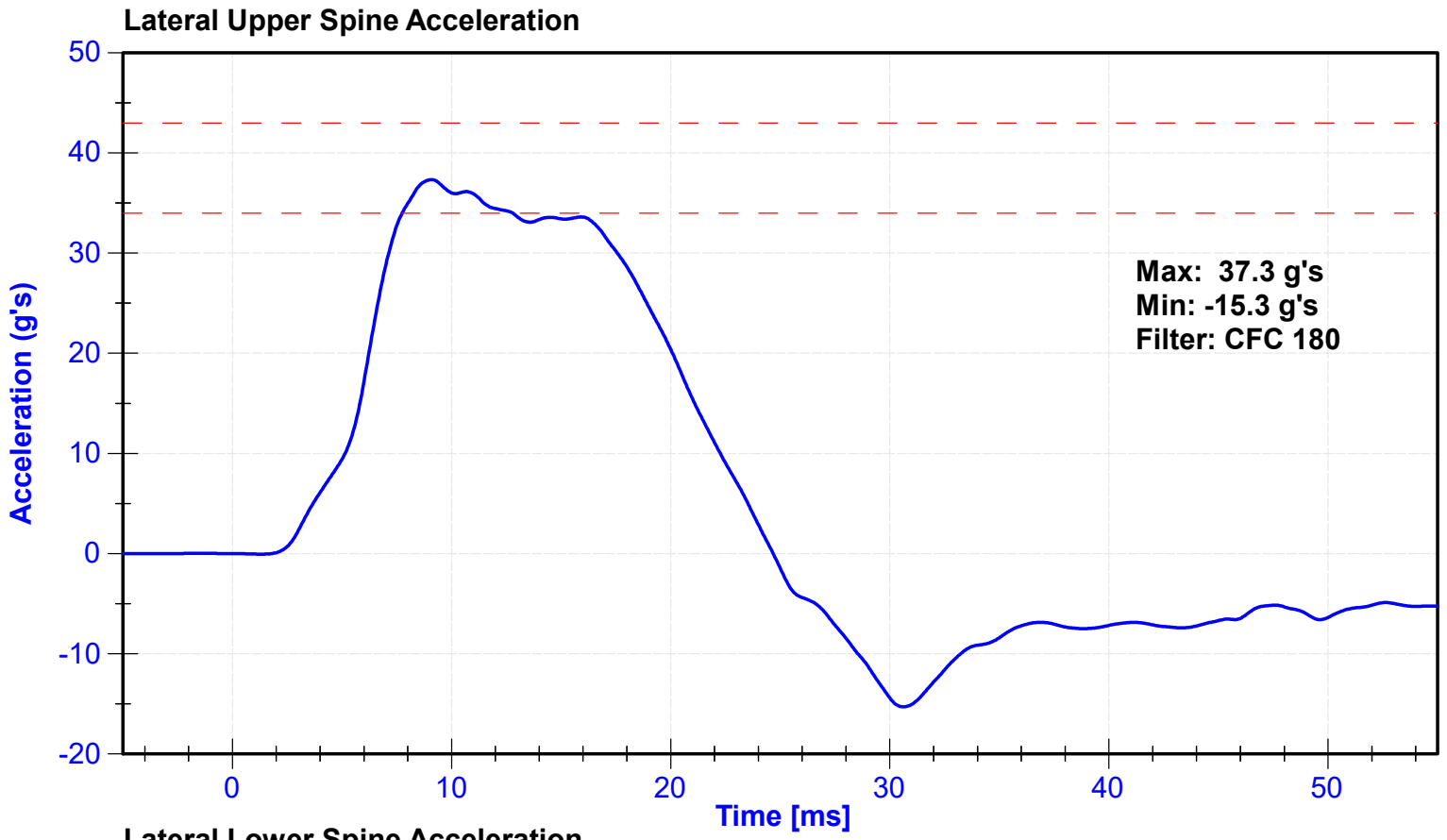


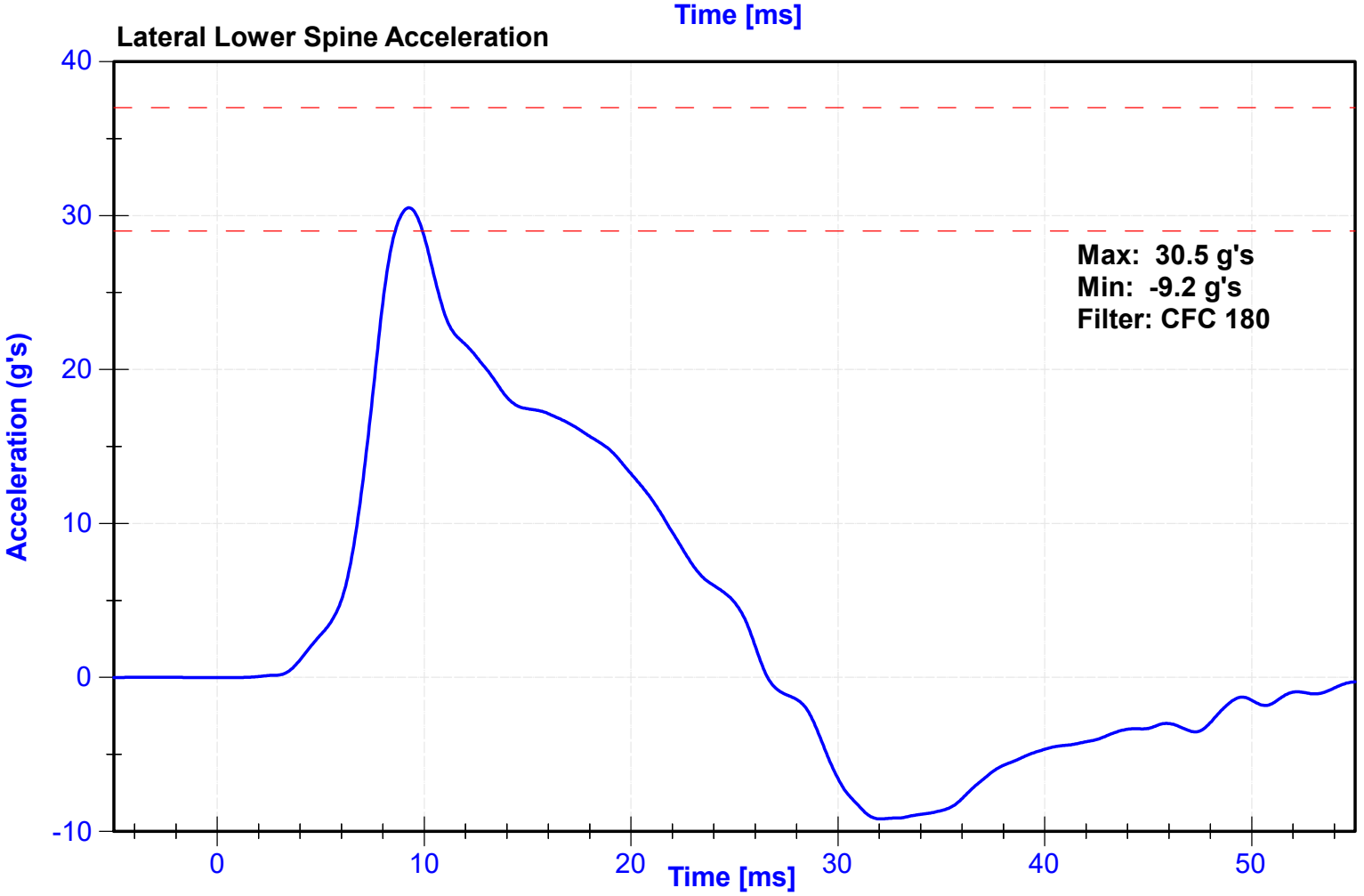

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 35.5 mm
Min: -2.4 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 29.3 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 33.2 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 35.8 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 37.3 g's
Min: -15.3 g's
Filter: CFC 180


Lateral Lower Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 30.5 g's
Min: -9.2 g's
Filter: CFC 180

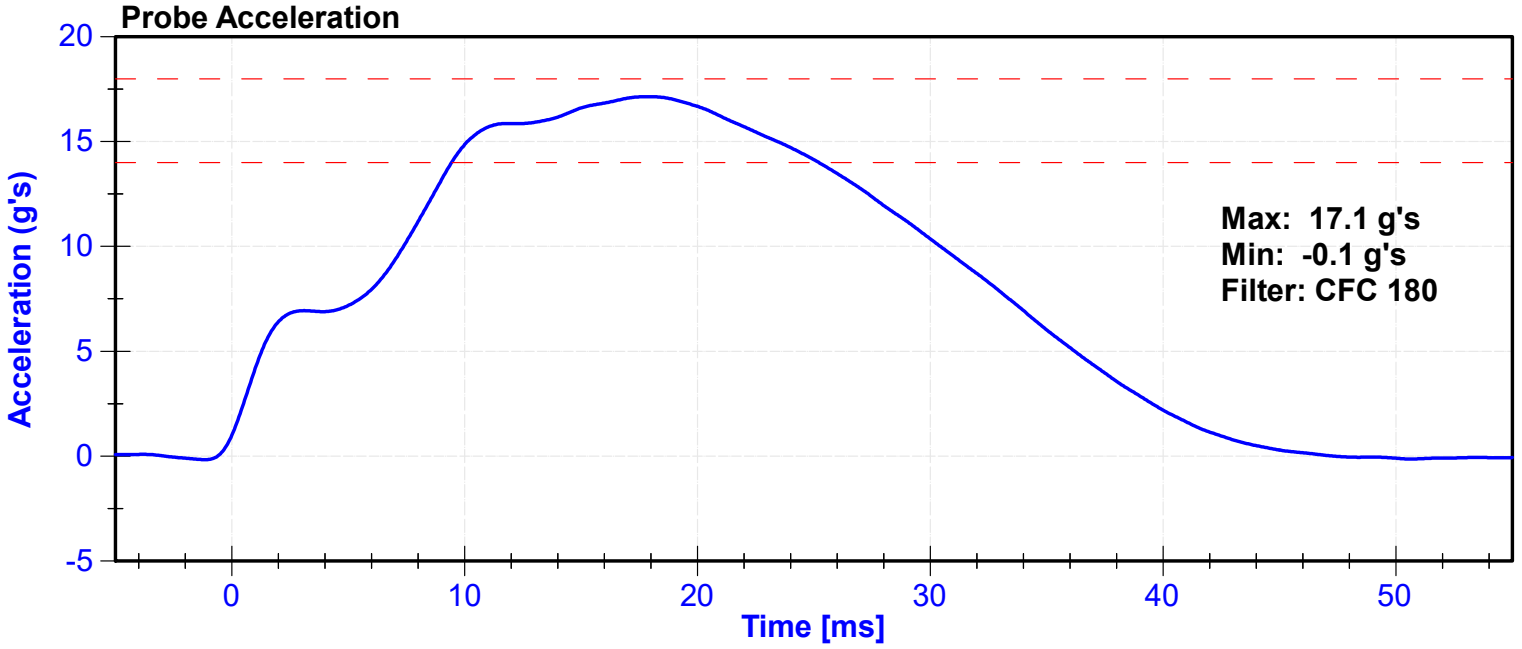
ATD Manufacturer	FTSS	Test Technician	S. Phillips
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

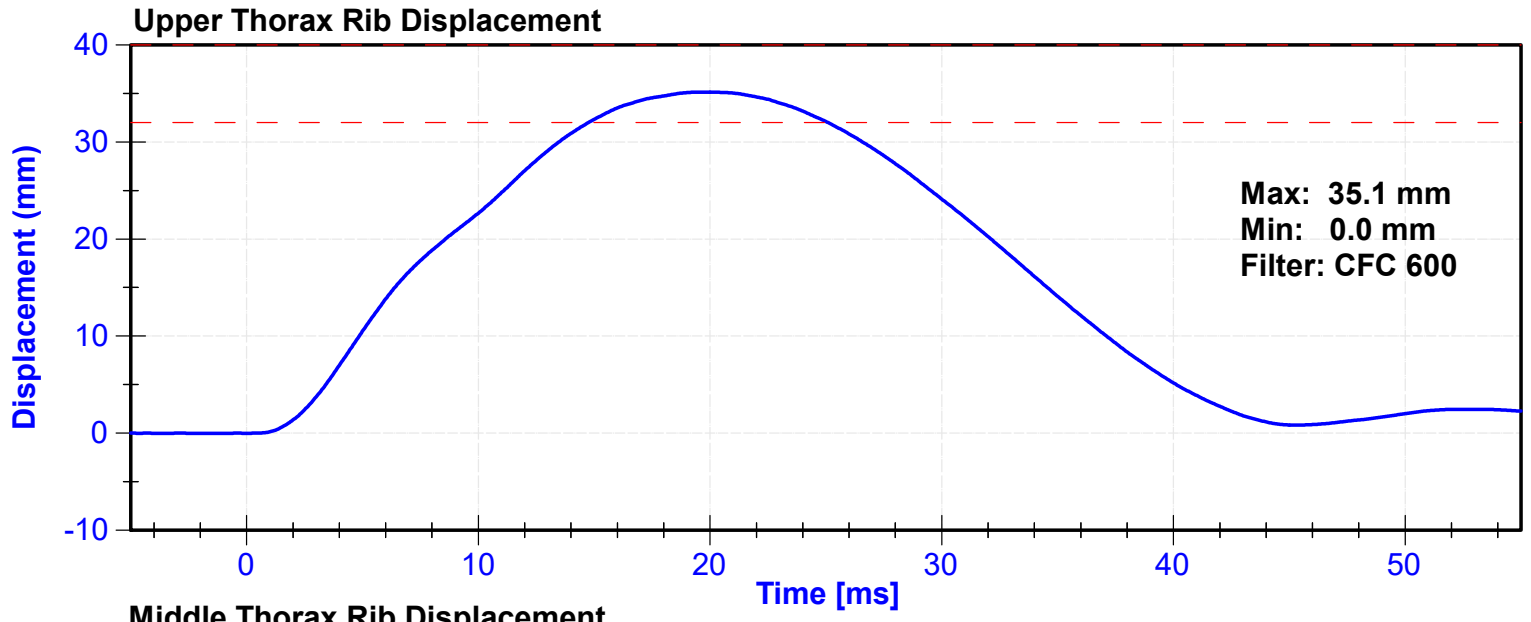
Results

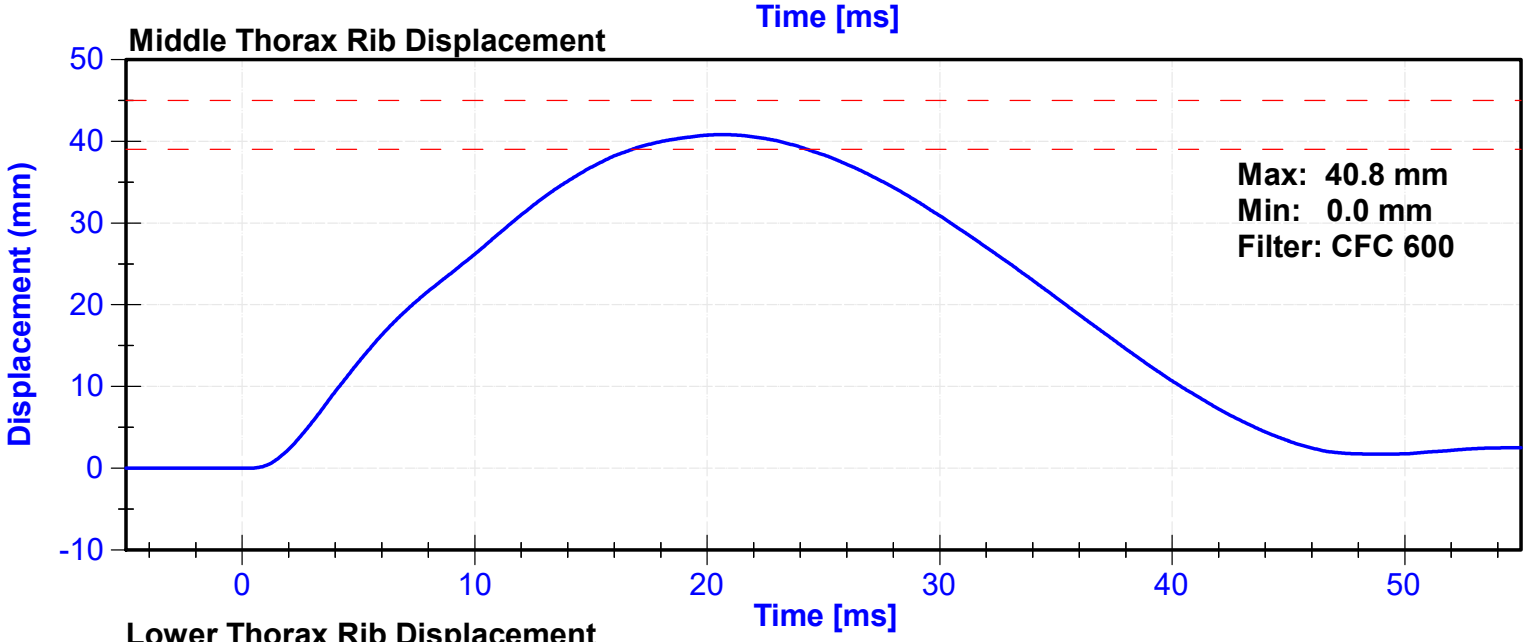
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	59	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	14	18	g's	17.1	Pass
Lateral Upper Spine Acceleration	13	17	g's	16.1	Pass
Lateral Lower Spine Acceleration	7	11	g's	10.0	Pass
Upper Thorax Rib Deflection	32	40	mm	35.1	Pass
Middle Thorax Rib Deflection	39	45	mm	40.8	Pass
Lower Thorax Rib Deflection	35	43	mm	37.9	Pass

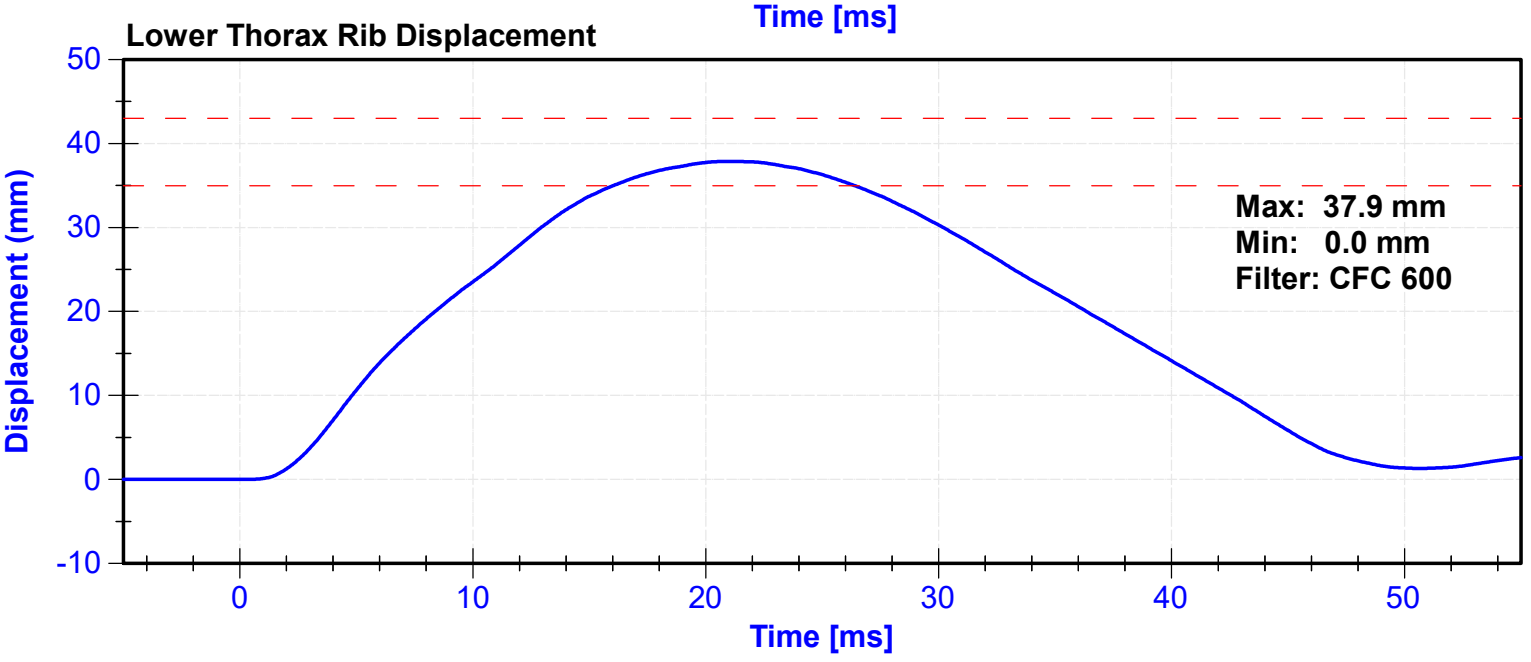
Transducer Calibrations

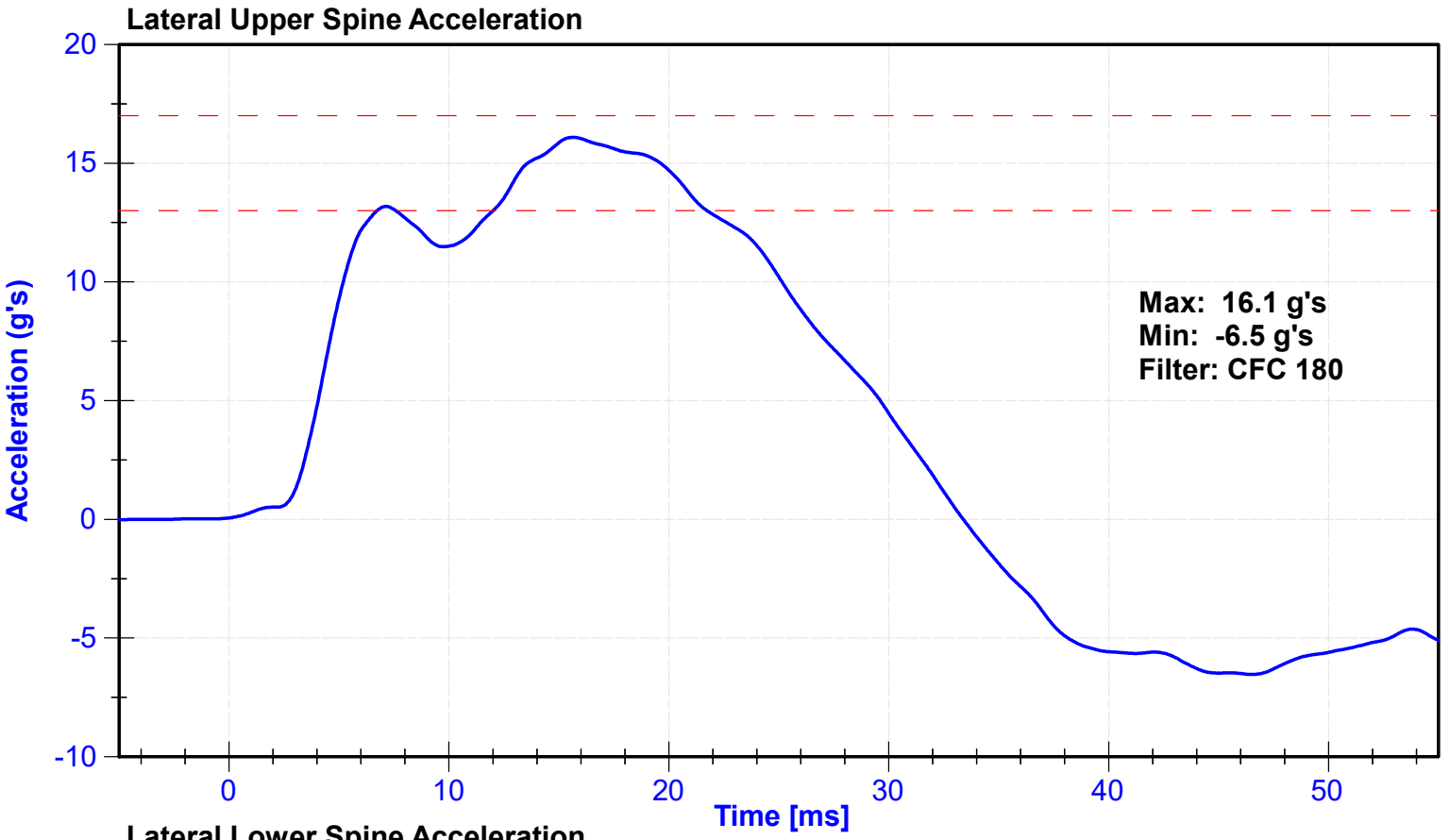
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Spine Y Accelerometer	Endevco	P94678	6/22/2023	12/19/2023
Lower Spine Y Accelerometer	Endevco	P58744	6/22/2023	12/19/2023
Upper Thorax Rib Potentiometer	Servo	062GFE	6/22/2023	12/21/2023
Middle Thorax Rib Potentiometer	Servo	528GFE	6/22/2023	12/21/2023
Lower Thorax Rib Potentiometer	Servo	513GFE	6/22/2023	12/21/2023

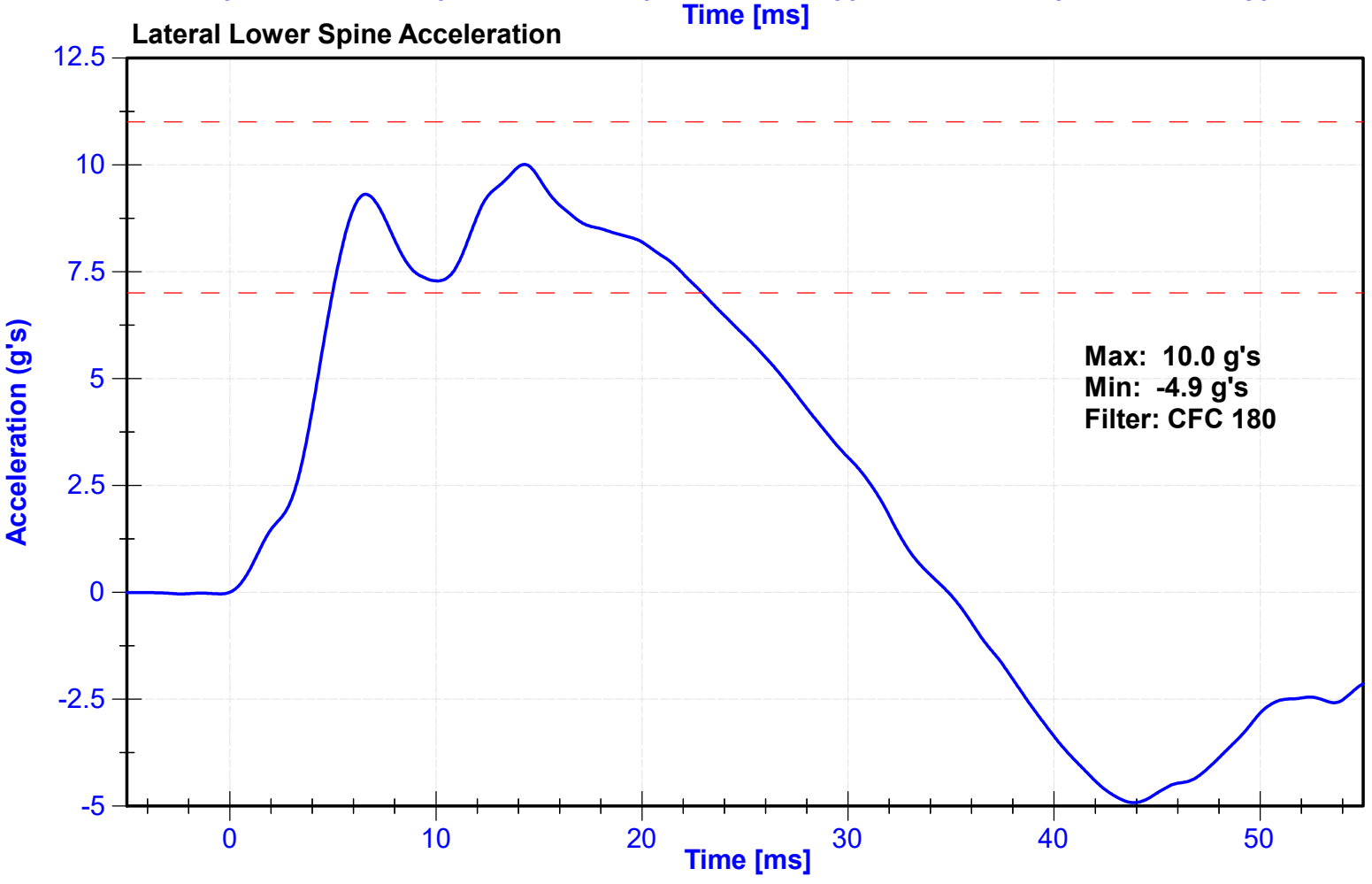



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 35.1 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.8 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.9 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: 16.1 g's
Min: -6.5 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: 10.0 g's
Min: -4.9 g's
Filter: CFC 180

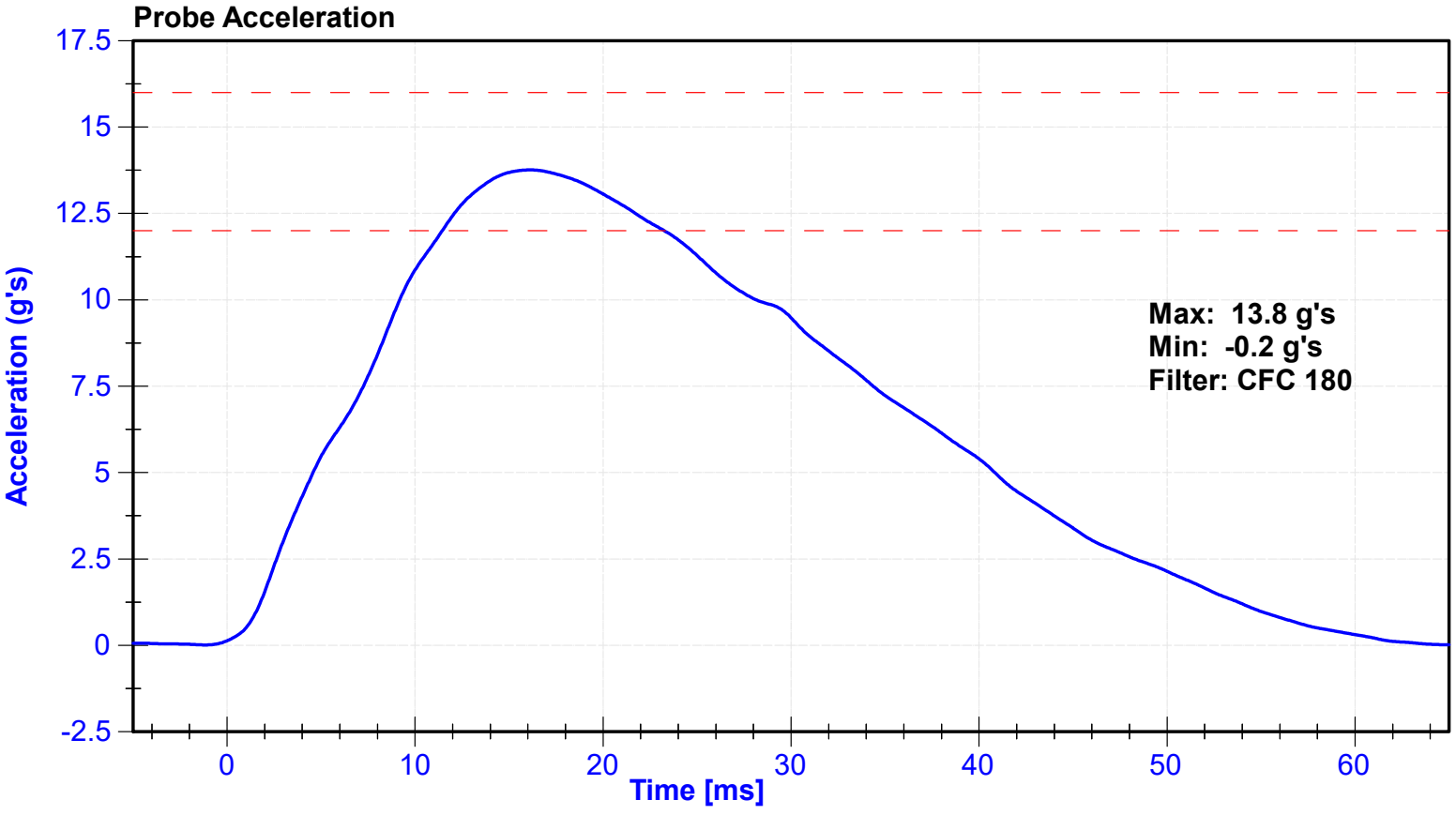
ATD Manufacturer	FTSS	Test Technician	S. Phillips
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

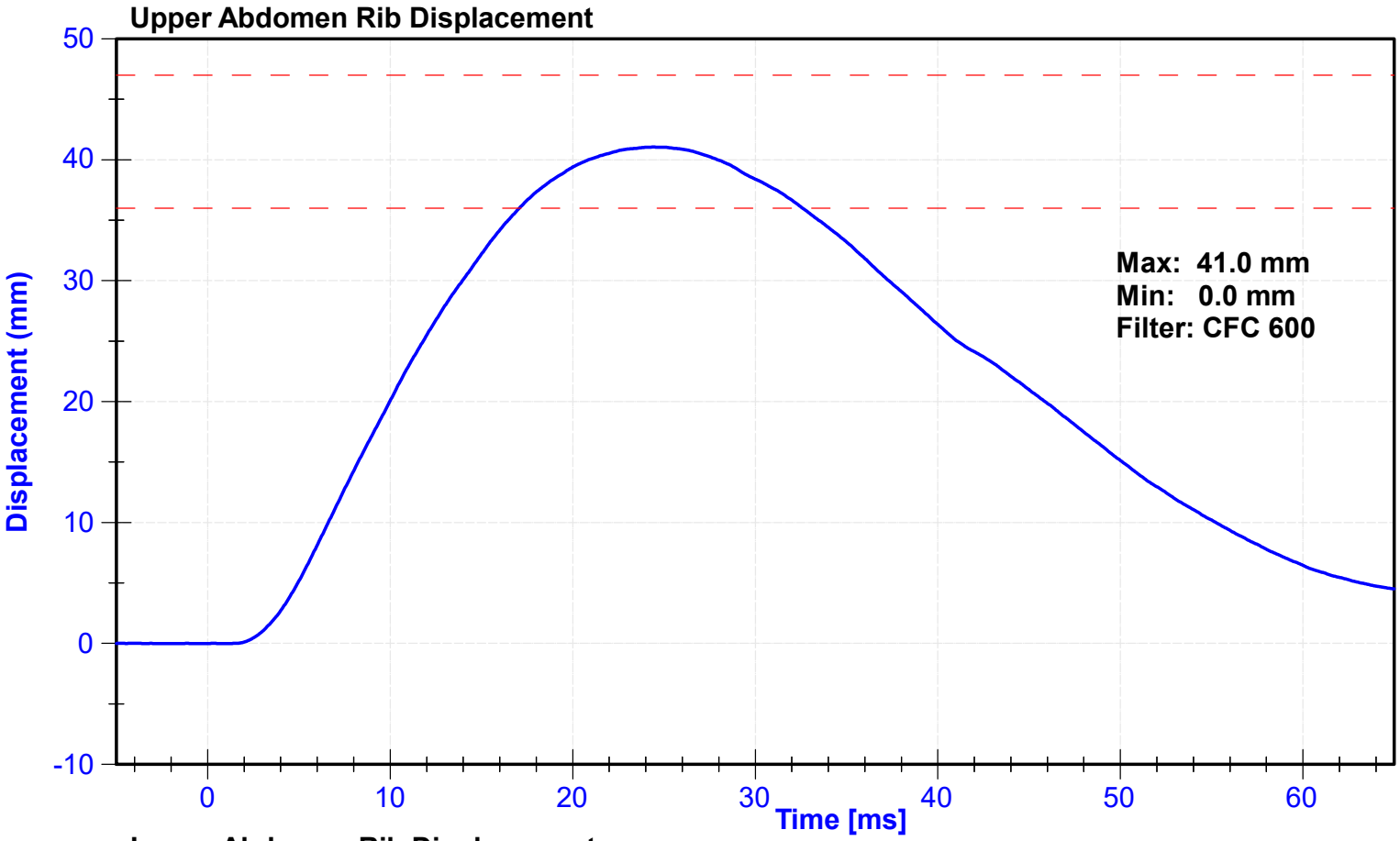
Results

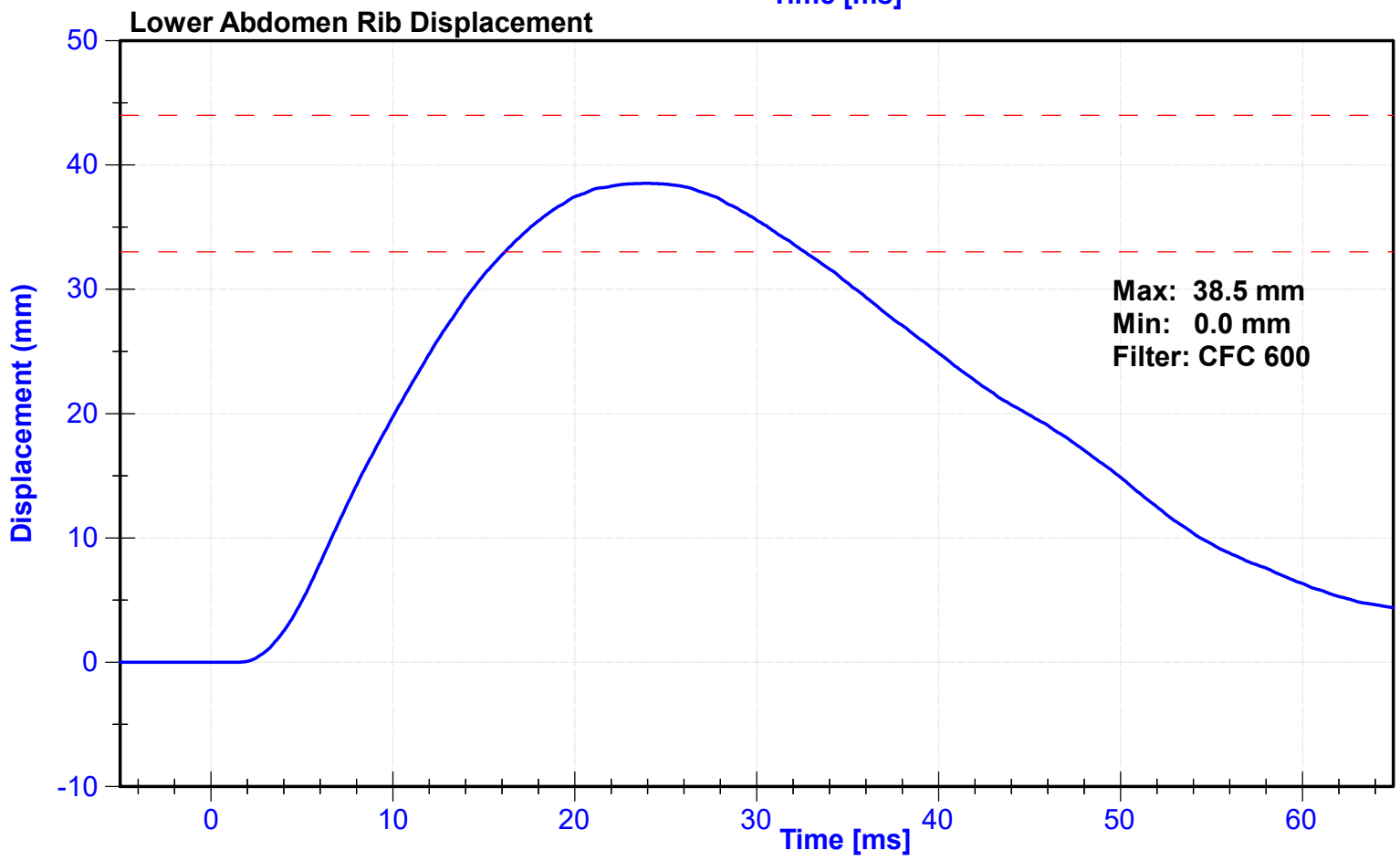
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.2	Pass
Humidity	10	70	%	49.3	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	12	16	g's	13.8	Pass
Lateral Lower Spine Acceleration	9	14	g's	10.1	Pass
Upper Abdomen Rib Deflection	36	47	mm	41.0	Pass
Lower Abdomen Rib Deflection	33	44	mm	38.5	Pass

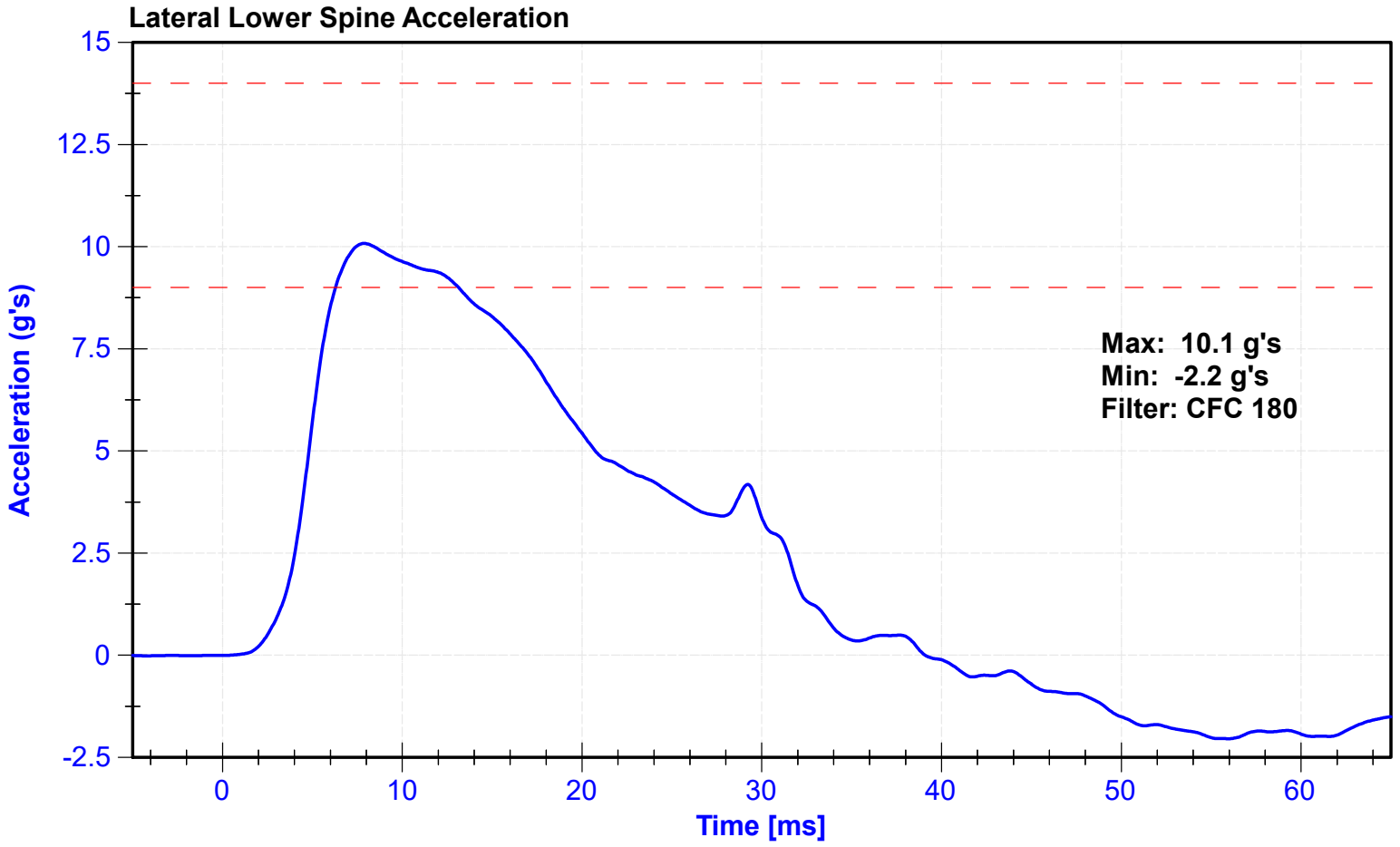
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Lower Spine Y Accelerometer	Endevco	P58744	6/22/2023	12/19/2023
Upper Abdomen Rib Potentiometer	Servo	342GFE	6/22/2023	12/21/2023
Lower Abdomen Rib Potentiometer	Servo	512GFE	6/22/2023	12/21/2023




Upper Abdomen Rib Displacement
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
60
Time [ms]
Max: 41.0 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: 38.5 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
0
10
20
30
40
50
60
Time [ms]
Max: 10.1 g's
Min: -2.2 g's
Filter: CFC 180

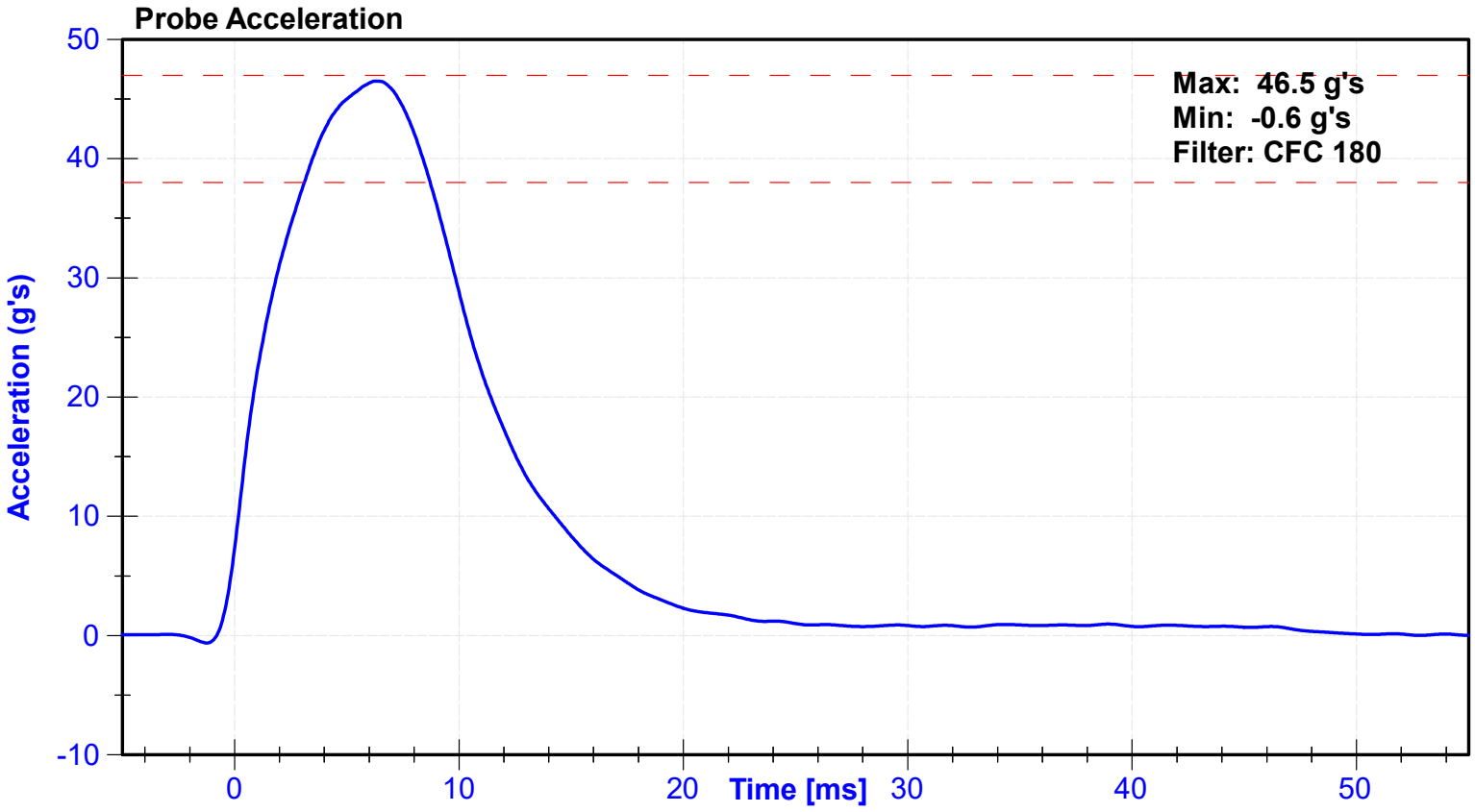
ATD Manufacturer	FTSS	Test Technician	S. Phillips
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

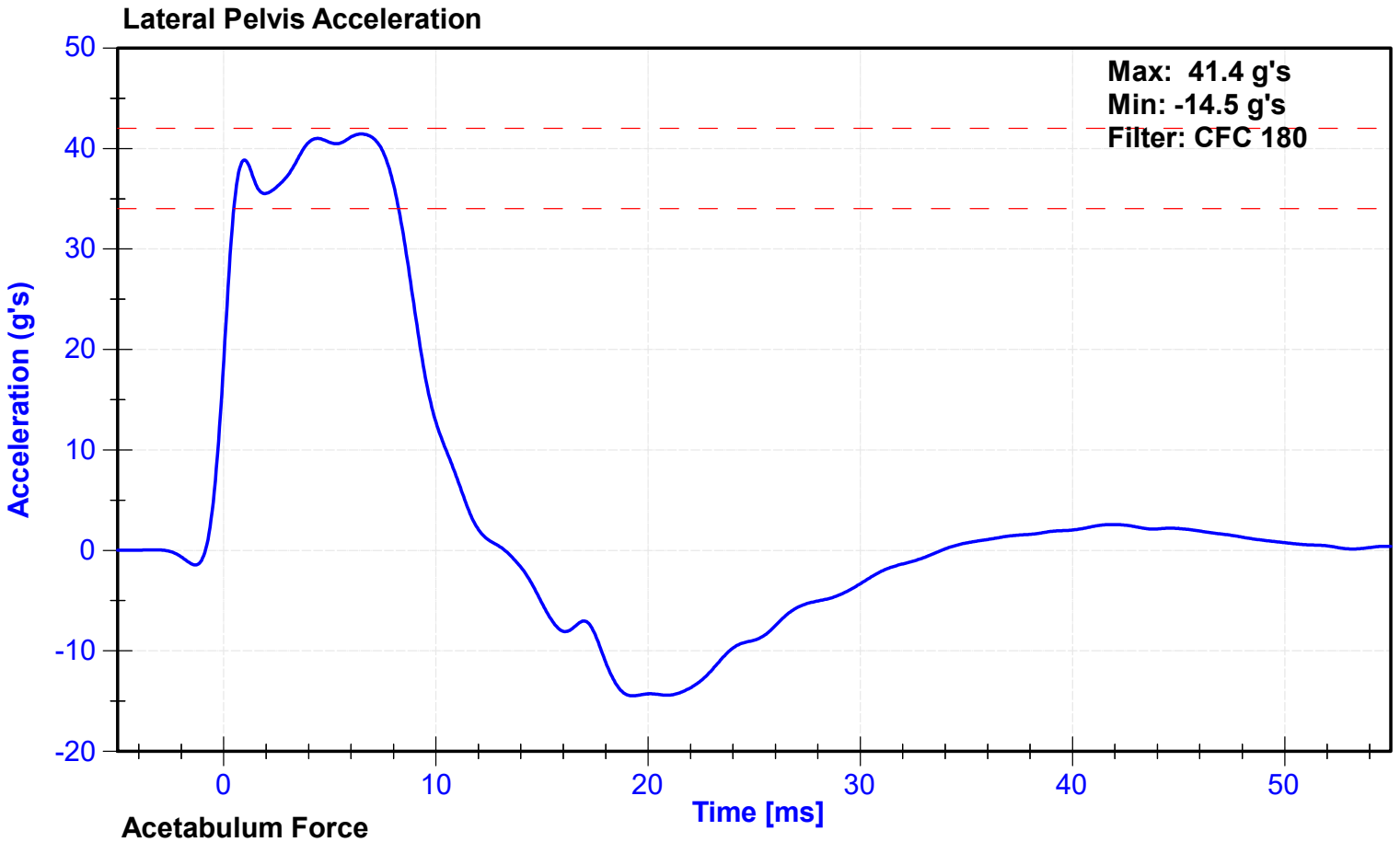
Results

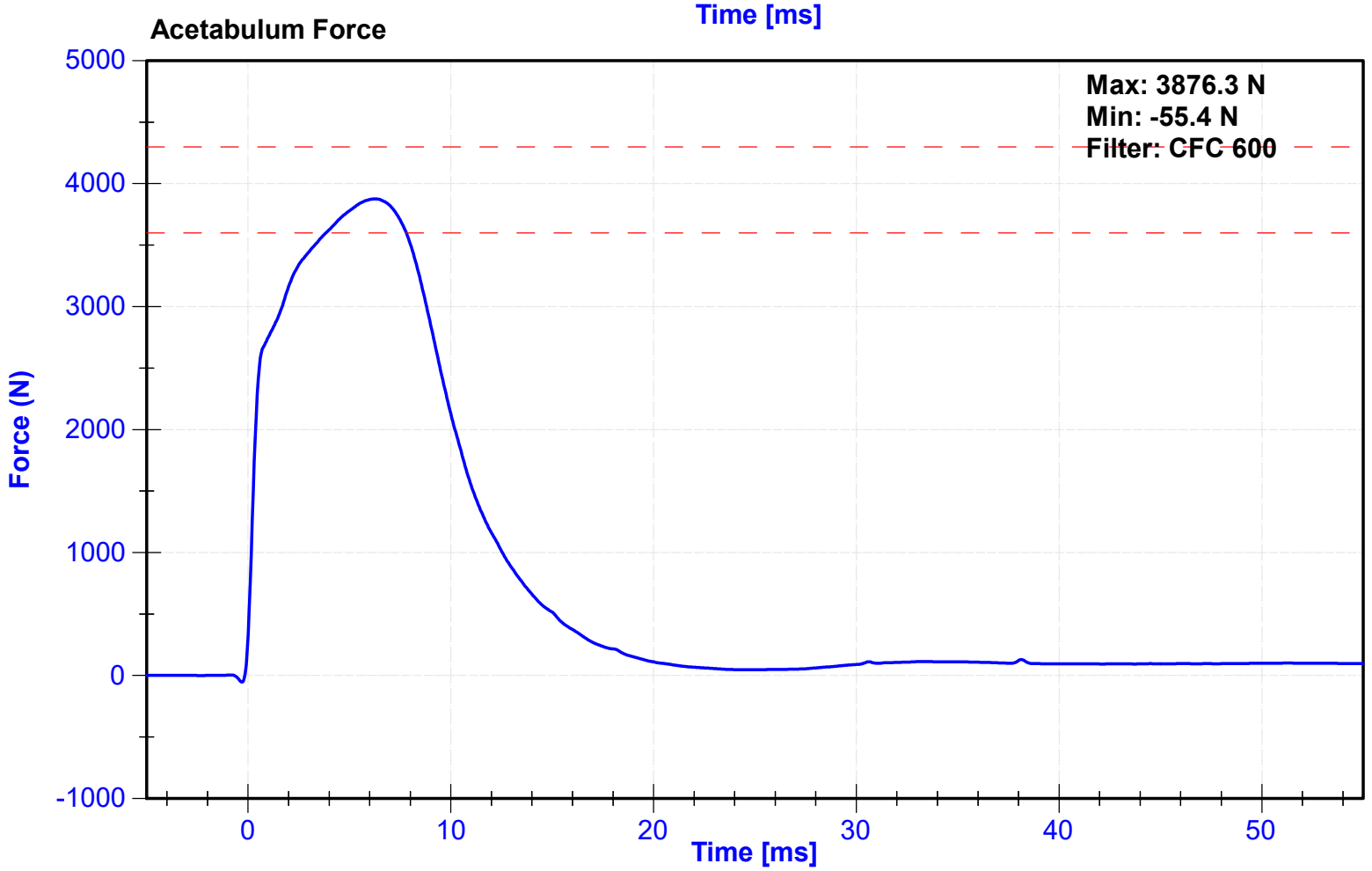
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.2	Pass
Humidity	10	70	%	49	Pass
Velocity	6.6	6.8	m/s	6.63	Pass
Probe Acceleration	38	47	g's	46.5	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.4	Pass
Acetabulum Force	3600	4300	N	3876.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pelvis Y Accelerometer	Endevco	P18688	6/22/2023	12/19/2023
Acetabulum Load Cell	FTSS	236	8/23/2022	8/23/2023
Certification Plug	SACO			N/A
Crash Test Plug	SACO			N/A




Lateral Pelvis Acceleration
Max: 41.4 g's
Min: -14.5 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: 3876.3 N
Min: -55.4 N
Filter: CFC 600
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]

CERTIFICATION
6-29-23

SID-IIs Pelvis Plug Certification Test

Plug S/N 15007
Test Number 17588
Report Number 17635
Test Date 2/5/2021 8:58:03 AM

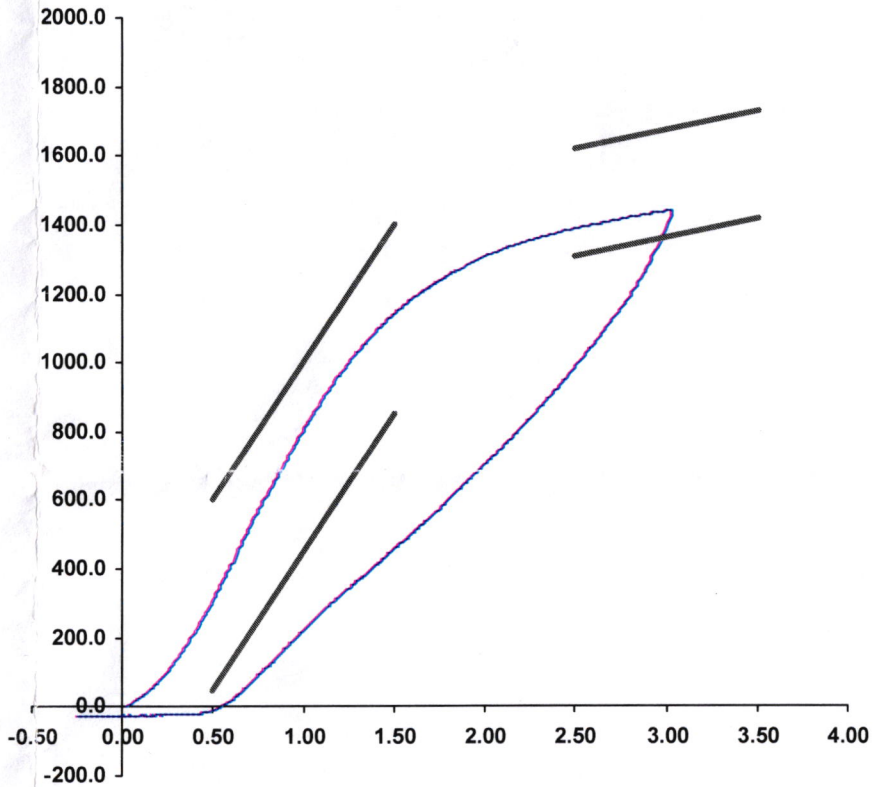
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	312	50	600
Force @ 1.5 mm (N)	1,141	850	1,400
Force @ 2.5 mm (N)	1,388	1,306	1,618
Force @ 3.0 mm (N)	1,438	1,361	1,673

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 05-Feb-21
SACO Research

By : DC Date : 2/5/2021

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

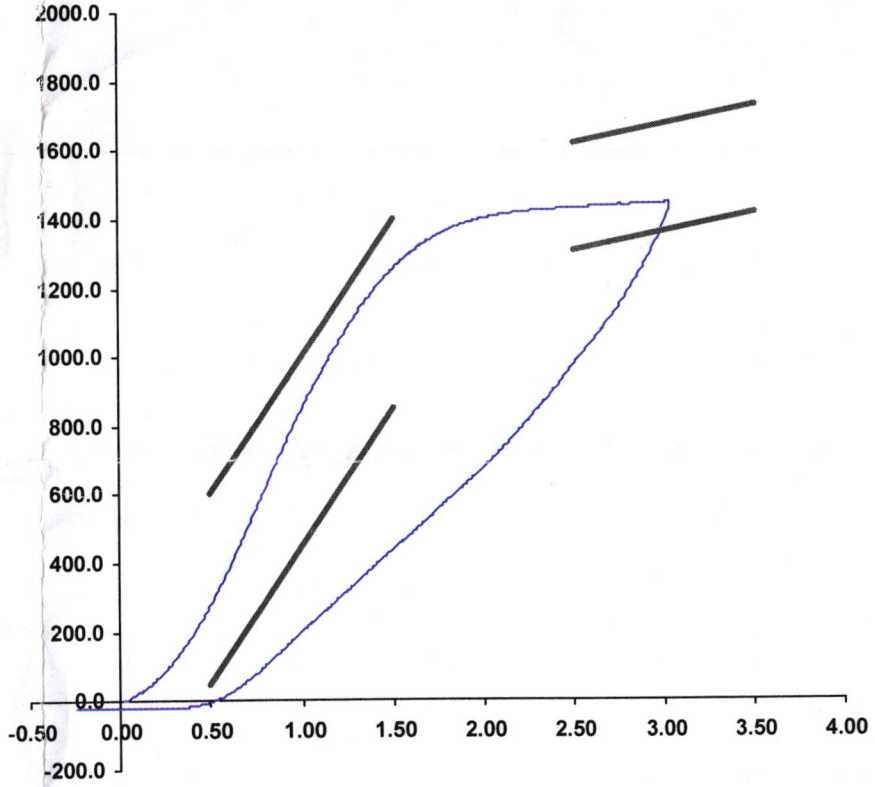
Non-Impact
6-29-2023

SID-IIs Pelvis Plug Certification Test

Plug S/N 14194
Test Number 14334
Report Number 14378
Test Date 7/3/2020 8:32:29 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	287.73	50.00	600.00
Force @ 1.5 mm (N)	1,252.09	850.00	1,400.00
Force @ 2.5 mm (N)	1,428.66	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,442.58	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



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

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

Notes:

V4-45

Operator

Part Number 180-4450

Template No 107 03-Jul-20
SACO Research

By : DC Date : 7/3/2020

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

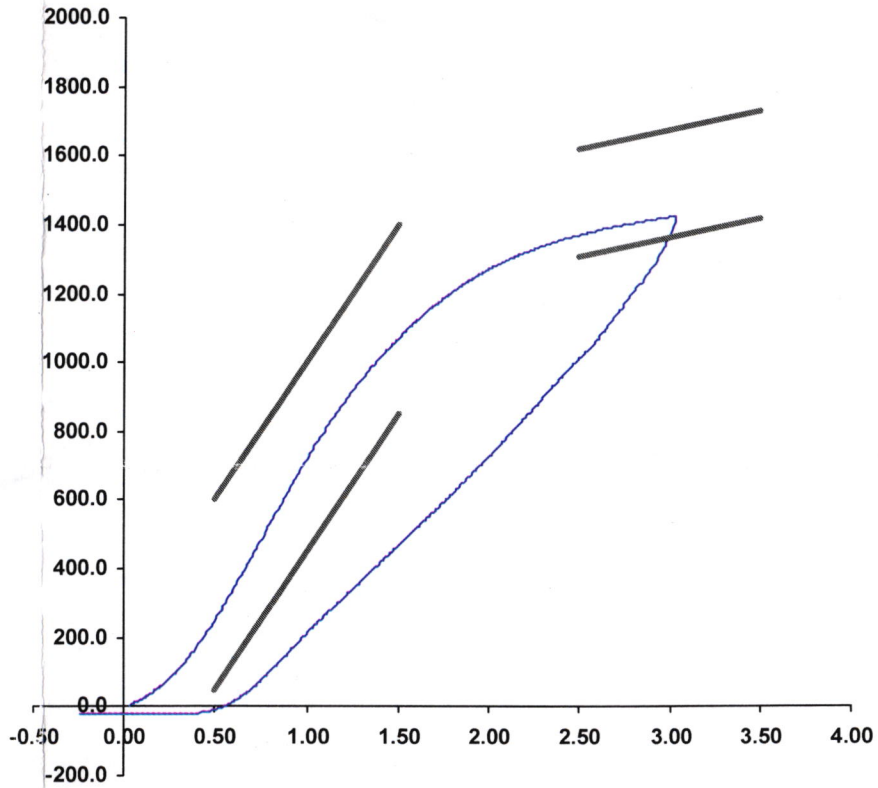
IMPACT
6-29-2023

SID-IIs Pelvis Plug Certification Test

Plug S/N 13799
Test Number 13233
Report Number 13278
Test Date 5/8/2020 11:25:10 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	255.10	50.00	600.00
Force @ 1.5 mm (N)	1,067.14	850.00	1,400.00
Force @ 2.5 mm (N)	1,368.54	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,420.90	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000
Preload Value (-N) 22.24
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 08-May-20
SACO Research

By : DC Date : 5/8/2020

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

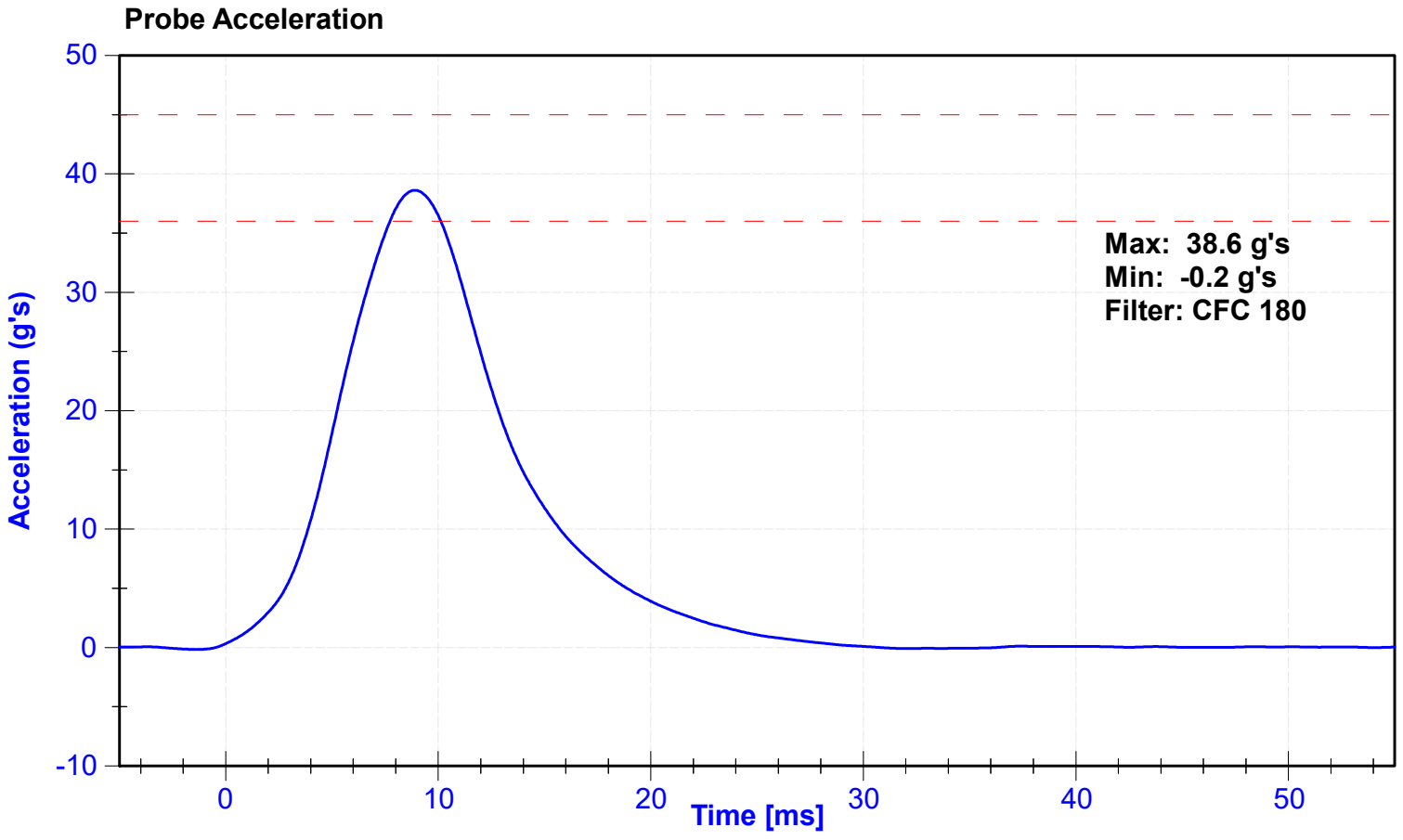
ATD Manufacturer	FTSS	Test Technician	S. Phillips
ATD Serial Number	261	Laboratory Supervisor	C. Mantell

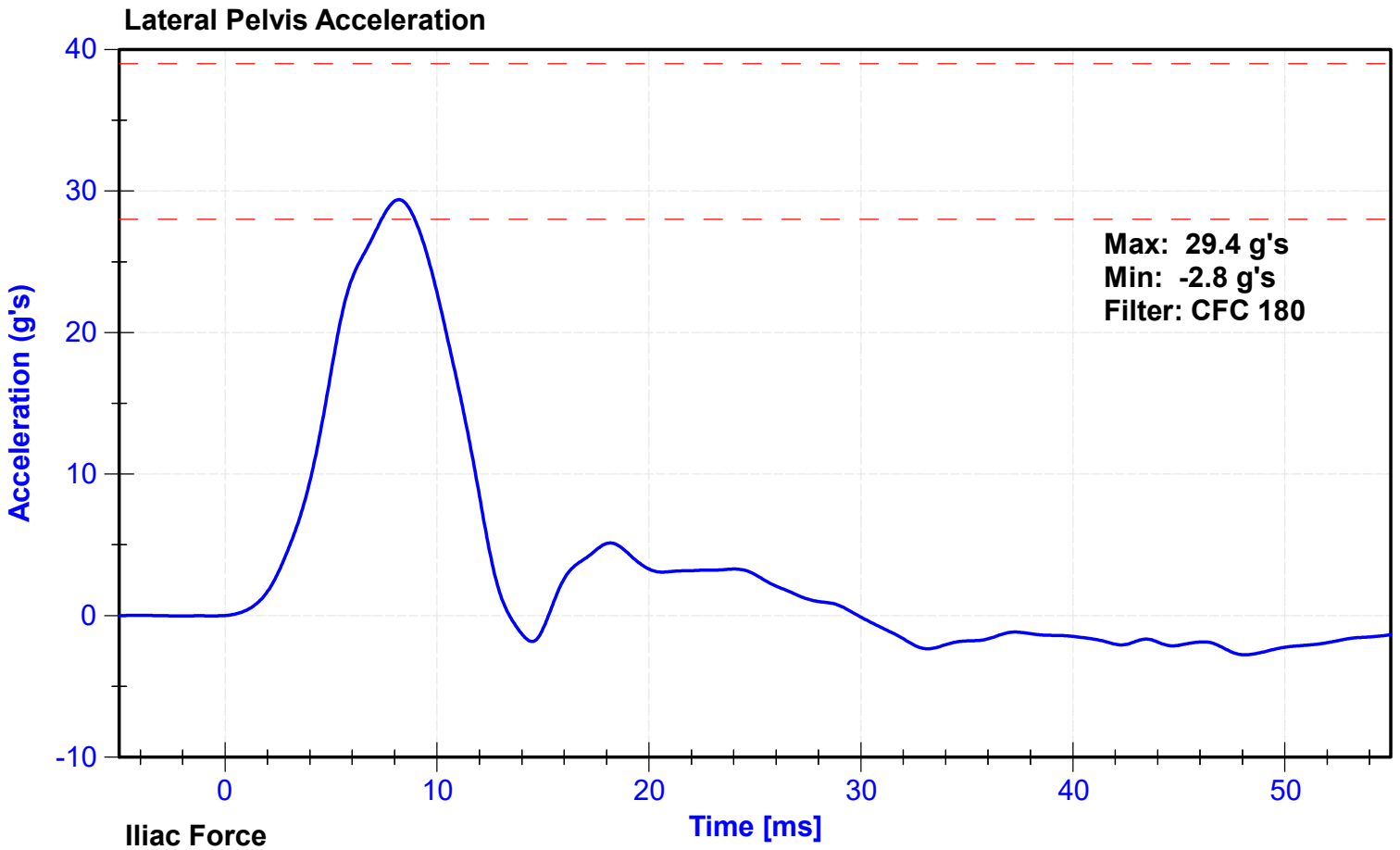
Results

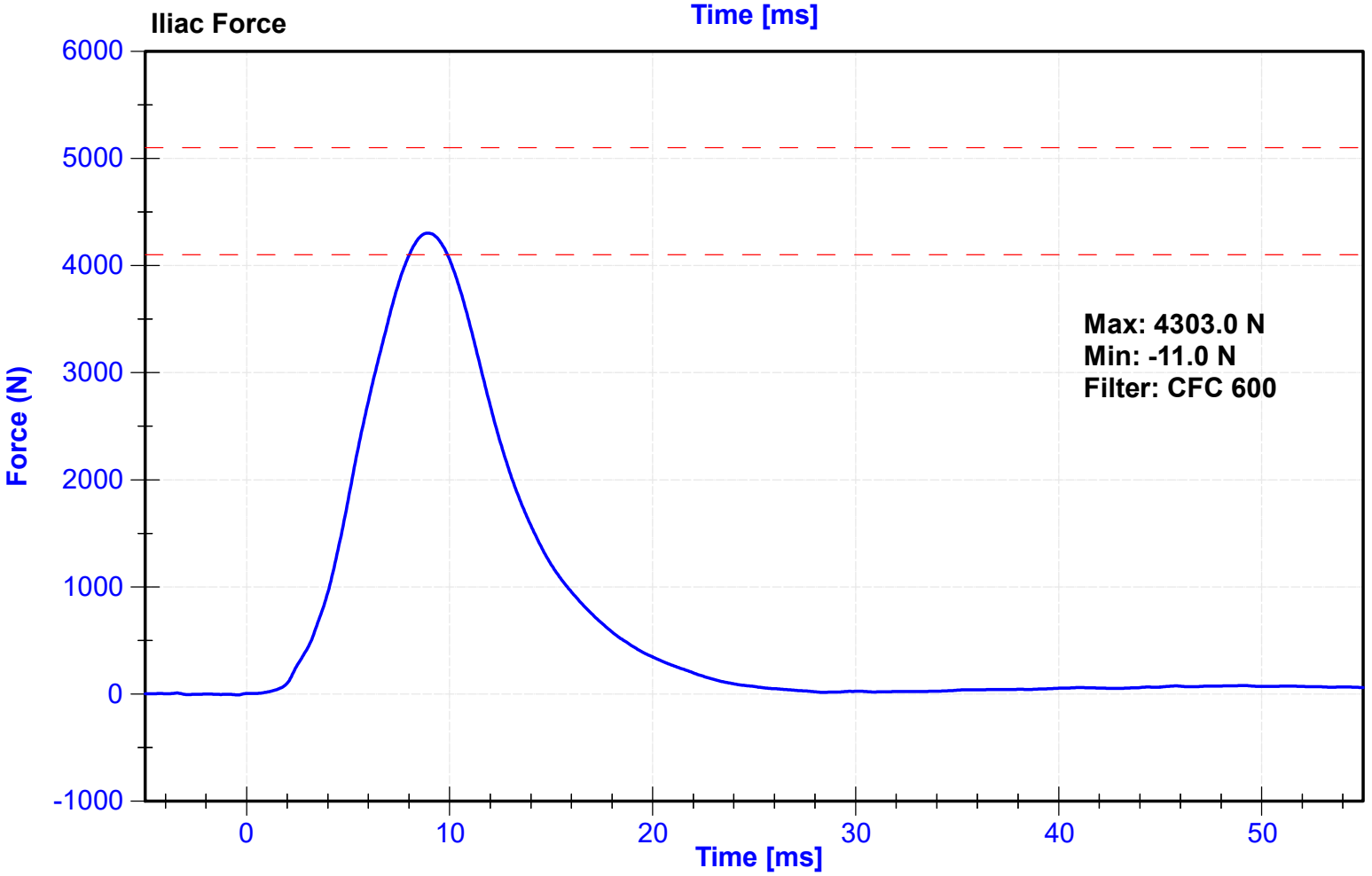
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.2	Pass
Humidity	10	70	%	49	Pass
Velocity	4.2	4.4	m/s	4.29	Pass
Probe Acceleration	36	45	g's	38.6	Pass
Lateral Pelvis Acceleration	28	39	g's	29.4	Pass
Iliac Force	4100	5100	N	4303.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pelvis Y Accelerometer	Endevco	P18688	6/22/2023	12/19/2023
Iliac Load Cell	Denton	279-FY	8/11/2022	8/11/2023




Lateral Pelvis Acceleration
Acceleration (g's)
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 29.4 g's
Min: -2.8 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: 4303.0 N
Min: -11.0 N
Filter: CFC 600

APPENDIX VII

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

TABLE 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N _D037__		
			Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers	Primary	X	T21724	Endevco	2/27/2023
		Y	T22281	Endevco	2/27/2023
		Z	T26050	Endevco	2/27/2023
	Redundant	X	T21682	Endevco	2/27/2023
		Y	T25989	Endevco	2/27/2023
		Z	T25864	Endevco	2/27/2023
Thorax Rib Displacement Potentiometers	Upper	Y	DS-0552-01	Honeywell	2/27/2023
	Middle	Y	DS-807	Honeywell	2/27/2023
	Lower	Y	DS-0552-03	Honeywell	2/27/2023
Abdomen Load Cells	Forward	Y	1440	Denton	8/12/2022
	Middle	Y	1525	Denton	8/12/2022
	Rear	Y	1528	Denton	8/12/2022
Lower Spine Accelerometers (T12)		X	P71278	Endevco	2/27/2023
		Y	P71276	Endevco	2/27/2023
		Z	T23573	Endevco	2/27/2023
Pubic Symphysis Load Cell		Y	3096JFL-456-FY	Denton	8/12/2022

TABLE 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N __261__		
				Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers		Primary	X	P68067	Endevco	6/22/2023
			Y	P18567	Endevco	6/22/2023
			Z	P49163	Endevco	6/22/2023
		Redundant	X	T26041	Endevco	6/22/2023
			Y	T22409	Endevco	6/22/2023
			Z	T26086	Endevco	6/22/2023
Displacement Potentiometers	Thoracic Rib	Upper	Y	062GFE	Servo	6/22/2023
		Middle	Y	528GFE	Servo	6/22/2023
		Lower	Y	513GFE	Servo	6/22/2023
	Abdominal Rib	Upper	Y	342GFE	Servo	6/22/2023
		Lower	Y	512GFE	Servo	6/22/2023
Lower Spine Accelerometers (T12)			X	T22340	Endevco	6/22/2023
			Y	P58744	Endevco	6/22/2023
			Z	T22124	Endevco	6/22/2023
Acetabulum Load Cell			Y	236	FTSS	8/23/2022
Iliac Wing Load Cell			Y	279-FY	Denton	8/11/2022
Pelvis Plug (struck side)				14207	Saco	7/03/2020
Pelvis Plug (non-struck side)				14225	Saco	7/03/2020

TABLE 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	G22796	Endevco	2/6/2023
	Vehicle Center of Gravity	Y	G22818	Endevco	2/4/2023
	Vehicle Center of Gravity	Z	G22828	Endevco	2/4/2023
2	Right Sill at Front Seat	X	A315832	Measurement Specialties	4/11/2023
	Right Sill at Front Seat	Y	A315871	Measurement Specialties	4/11/2023
	Right Sill at Front Seat	Z	A315935	Measurement Specialties	4/11/2023
3	Right Sill at Rear Seat	X	G21412	Endevco	3/22/2023
	Right Sill at Rear Seat	Y	G22233	Endevco	3/22/2023
	Right Sill at Rear Seat	Z	A398644	Measurement Specialties	3/22/2023
4	Left Sill at Front Door	Y	G22830	Endevco	2/4/2023
5	Left Sill at Rear Door	Y	A405580	Measurement Specialties	3/21/2023
6	Left A-Post Lower	Y	A301868	Measurement Specialties	2/27/2023
7	Left A-Post Middle	Y	A431379	Measurement Specialties	5/26/2023
8	Left B-Post Lower	Y	G22655	Endevco	3/22/2023
9	Left B-Post Middle	Y	A413564	Measurement Specialties	6/17/2023
10	Front Seat Track	Y	A396628	Measurement Specialties	6/17/2023
11	Rear Seat Track or Structure	Y	G23419	Endevco	4/24/2023
12	Right Rear Occ. Compartment	Y	G23424	Endevco	4/24/2023
13	Engine Block	X	A280971	Measurement Specialties	4/5/2023
	Engine Block	Y	A396614	Measurement Specialties	4/5/2023
14	Rear Floorpan Above Axle	X	A315740	Measurement Specialties	2/24/2023
	Rear Floorpan Above Axle	Y	A315853	Measurement Specialties	2/24/2023
	Rear Floorpan Above Axle	Z	A374311	Measurement Specialties	2/24/2023

vTABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
Vehicle CG Acceleration vs. Time	X	A352316	Measurement Specialties	5/10/2023
Vehicle CG Acceleration vs. Time	Y	A400754	Measurement Specialties	5/10/2023
Vehicle CG Velocity vs. Time	Y	Calculated	Measurement Specialties	5/10/2023
Vehicle CG Acceleration vs. Time	Z	A405578	Measurement Specialties	5/10/2023
Vehicle CG Velocity vs. Time	Z	Calculated	Measurement Specialties	5/10/2023
Vehicle CG Resultant Acceleration vs. Time	R	Calculated	Measurement Specialties	5/10/2023

APPENDIX VIII

CHECK SHEETS

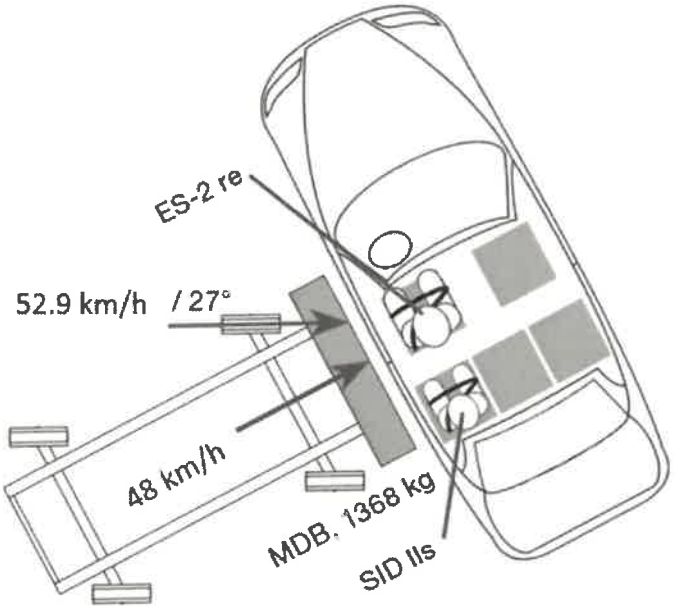
Federal Motor Vehicle Safety Standards

Work Instructions: FMVSS 214

Side Impact Moving Deformable Barrier Test

W/305 Roll

Work Instructions Aligned with U.S. D.O.T. National Highway Traffic Safety Administration's Laboratory Test Procedure for FMVSS 214:
Side Impact Moving Deformable Barrier



Customer:

JCRSH-00006 – HV Battery!

Cal # 5687

C

C20235102

VIN: JTDACAAU2P3002361

DTNH-22-17D-00078

Lead Test Engineer: Matthew Pronko

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Section 1

Project Set-up

Instruction: Insert Engineer's Checklist, Customer's Statement of Work or Test Request after this tab.

- [ ] Inserted Completed Engineer's Checklist.
- [ ] Inserted Customer's SOW / Test Request.
- [x] Inserted Copy of the Form 1.

Section 2

Vehicle Inspection

Instruction: Complete the checked task:

[X] Fully Complete the Following Section.

[ ] The Following Section Does Not Need to be Completed.

Incoming Vehicle Checklist:

Performed by:	SJuico	Date:	06/26/23

Complete the following fields:

Dealer	Jerry's Toyota
Date vehicle arrived:	06/05/23
Model Year	2023
Make	Toyota
Model	Prius

Verify the following and place a checkmark in the appropriate box. Any variances must be reported to the Technical Director within 2 working days of the vehicle's arrival:

Yes	No	
X		All options listed on the 'window sticker' are present on the test vehicle.
X		Tires and wheel rims are the same as listed.
X		There are no dents or other interior or exterior flaws.
X		The vehicle has been properly prepared and is in running condition.
X		The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys.
X		Proper fuel filler cap is supplied on the test vehicle.
X		Spare tire, jack, lug wrench and tool kit (if applicable) is located in the vehicle cargo area.
X		The odometer reflects that the vehicle has been driven less than or equal to 200 miles.
X		The VIN (vehicle identification number) matches the number supplied by NHTSA.
X		Vehicle is equipped / matches description provided by NHTSA.
X		Vehicle warning lights (i.e. check engine, SRS, etc.) are not illuminated.
X		Floor mats come with vehicle (front and rear). Verify with window sticker.
X		Is vehicle a hybrid or full electric vehicle that requires FMVSS 305?

Vehicle Condition Checklist:

Performed by: STuco Date: 06/26/23

Complete the following fields:

Make	Toyota
Model	Prius
Body Style	5Dr. Hatchback
Vin	JTDACAAU2P3002361
Body Color	Light Blue
Engine Disp (liters)	2.0
Number of Cylinders	I4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	> CVT 1-Spd
Overdrive	yes
Final Drive	FWD
Odometer Reading	13mi.

Anti-lock Brakes (ABS)	Yes
All-Wheel Drive (AWD)	No
Traction Control System (TCS)	Yes
Electronic Stability Control (ECS)	Yes
Side Curtain Airbags	Yes
Torso Airbag – Front Seats	Yes
Torso Airbag – Rear Seats	Yes
Combination/Head Torso Bag	No
Pelvic Airbag – Front Seats	No
Pelvic Airbag – Rear Seats	No
Knee Airbag – Driver	No
Knee Airbag – Front Passenger	No
Seat Belt Pretensioners – Front Seats	Yes
Seat Belt Pretensioners – Rear Seats	Yes
Seat Belt Load Limiters – Front Seats	Yes
Seat Belt Load Limiters – Rear Seats	Yes
Tire Pressure Monitoring System (TPMS)	Yes
Tilt Steering Wheel	Yes
Automatic Door Locks (ADL)	Yes
Power Window Auto-reverse	Yes
Power Seats	No

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

p. 108, 538-543

[1] These items are in addition to the Form 1 Report of Vehicle Condition and are required for The Data Sheet No. 1 General Test and Vehicle Parameters.

Tinted Glass	No
Power Brakes	Yes
Front Disc	Yes
Rear Disc	Yes
Bucket Seats	Yes
Air Conditioning	Yes

(Am/FM) CD	Yes
Power Windows	Yes
Other	No

Take the following photographs (Refer to the sample photo set if necessary):

Initial:

JH Close-up view of Vehicle's Tire Placard Label (No. 30)

JH Close up view of Vehicle's Certification Label (No. 27)

JH Front View

JH Left Front ¾ View

JH Left Side View

JH Left Rear ¾ View

JH Rear View

JH Right Rear ¾ View

JH Right Side View

JH Right Front ¾ View

JH Monroney Label

General Vehicle Data:

Performed by: S.Tuico Date: 06/26/23

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

Data from Certification Label

Manufactured By	Toyota Motor Corporation		GVWR	1880 kg
Date of Manufacture	02/23		GAWR Front	1064 kg
Vehicle Type	Passenger Car		GAWR Rear	1030 kg

Vehicle Seating and Weight Capacity Data

	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	3	N/A	5
Vehicle Capacity Weight (VCW)				(A) 390 kg
DSC x 68.04 kg				(B) 340.2 kg
Load Reduction				(C) 6 kg
Rated Cargo and Luggage Weight (RCLW)				(A-B-C) 43 kg

Vehicle Seat Type (Check one of the following)

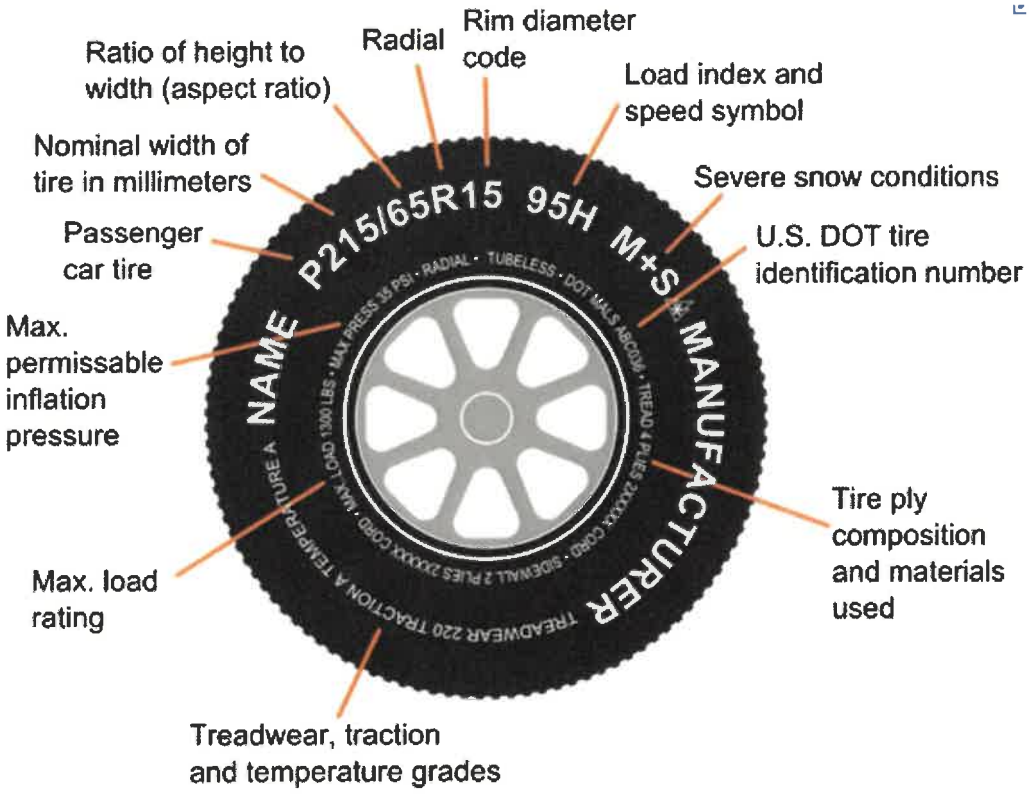
	Type of Seat Pan				Type of Seat Back		
Seating Location	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable w/Lever	Adjustable w/Knob
Front Seat	X					X	
Rear or Second Row Seat		X			X		
Third Row Seat	N/A						

Please list other pertinent Optional Equipment below:

None

Tire Placard Information	Front	Rear
Recommended Cold Tire Pressure (kPa)	250	240
Recommended Tire Size	190/60R17	190/60R17

Tire Sidewall Information	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Tire Size on Vehicle	190/60R17	190/60R17
Tire Manufacturer Model	Bridgestone	Bridgestone
Tire Name	Ecopia EP422 plus	Ecopia EP422 PLUS
Tire Type	All Season	All Season
Tire Width	190	190
Aspect Ratio	60	60
Radial	Yes	Yes
Wheel Diameter	17	17
Load Index/Speed Symbol	90H	90H
Tread Wear	600	600
Traction Grade	A	A
Temperature Grade	A	A


Ratio of height to width (aspect ratio)
Radial
Rim diameter code
Load index and speed symbol
Nominal width of tire in millimeters
Severe snow conditions
Passenger car tire
U.S. DOT tire identification number
Max. permissable inflation pressure
Tire ply composition and materials used
Max. load rating
Treadwear, traction and temperature grades
P215/65R15 95H M+S
NAME
MANUFACTURER
TREADWEAR 220 TRACTION A TEMPERATURE A
MAX. LOAD 1300 LBS · MAX PRESS 35 PSI · RADIAL · TUBELESS · DOT MALS ABCDM · TREAD 4 PLIES ZXXXXX CORD · SIDEWALL 2 PLIES ZXXXXX CORD

Section 3

Attitudes, Weights, Mechanical Prep & Electrical Connections

Weight - As Delivered Condition:

Performed by: Gretchen M Date: 6-20-23

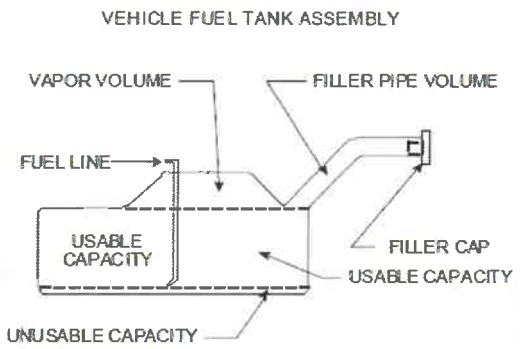
Initial:

GM Drain the fuel from the fuel tank.

GM Run engine until all fuel remaining in the fuel delivery system is used and engine stops.

GM Describe the fuel pump type, details about how it operates and the location of the fuel filler neck in the space provided below.

Electronic fuel pump
filler neck on left side of car



	Yes	No	
GM			Is the vehicle equipped with an electric fuel pump?
GM			If yes, does the pump normally operate when the vehicle's electrical system is activated?

Initial:

GM Record the usable fuel tank capacity of both standard and optional (if applicable) fuel tanks in the space provided below as stated in the supplied FORM1.

GM Record the fuel tank capacity of both standard and optional (if applicable) fuel tanks as supplied in the owner's manual in the space provided below.

GM Calculate 1/3 of the usable capacity of the tank(s) (as supplied on Form 1) and record the calculated value in the space provided below.

GM Calculate 93% of the usable capacity of the fuel tank(s) and record the calculated value in the space provided below.

GM Using gasoline, fill the fuel tank to 100% of the usable capacity as supplied on Form 1.

GM Record the amount of fuel added for the "As Delivered" weight condition in the space provided below.

Note: Stoddard solvent shall be free of debris. It is considered debris-free only if upon filtering with a 10 micron filter, no solid debris is retained on the filter media or in any conduit, container or vessel upstream from the filter paper (e.g. debris is not allowed to be present in the funnel, pump or container).

Fuel Tank Capacity Data

Usable Capacity of "Standard Tank" (see Form No. 1)	11.4gal/43	liters
Usable Capacity of "Optional Tank" (see Form No. 1)	—	liters
Usable Capacity of Standard Tank (see Owner's Manual)	11.4gal/43	liters
Usable Capacity of Optional Tank (see Owner's Manual)	—	liters
1/3 of Usable Capacity	14.3	liters
93% of Usable Capacity	10.57/39.9	liters
Gasoline to Achieve 100% of Capacity (As Delivered)	—	liters

QP

Initial:

GM Crank the engine to fill the fuel delivery system with gasoline

GM Fill the coolant system to capacity.

GM Fill the engine with motor oil to the maximum mark on the dip stick.

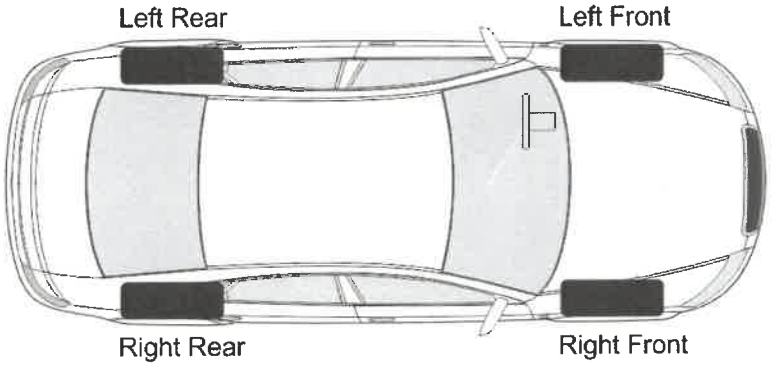
GM Fill the transmission with transmission fluid to full capacity.

GM Fill the brake reservoir with brake fluid to its normal level.

GM Fill the windshield washer reservoir to capacity.

GM Inflate the tires to the cold tire pressure indicated on the tire placard. If no tire placard is available, inflate the tires to the recommended pressure in the owner's manual and record the pressure for each tire in the space provided below.

	Units	LF	RF	LR	RR
As Delivered	kpa	276	271	276	274
Tire Placard	kpa	250	250	240	240
Owner's Manual	kpa	250	250	240	240
Tire Pressure Gage Unique Identifier:				—	



Initial: GM

Weigh the vehicle at each wheel and add the weights together to determine the "As Delivered" (or "Unloaded Vehicle") weight.

GM

Record the weight measurements and Weight Scale's Unique Identifier in the space provided below.

		As Delivered (UVW)		
	Units	Front Axle	Rear Axle	Total
Left	kg	414	304	W_{Left} = 718
Right	kg	433	259	W_{Right} = 692
Ratio	%	60%	40%	
Totals	kg	W_F = 847	W_R = 563	1410
Weight Scale Unique Identifier:			400323	

Initial: GM

Calculate the Rated Cargo and Luggage Weight (RCLW) and record this value in the space provided below. For trucks, MPV's or Buses - **If the RCLW calculated is greater than 136 kg, use 136 kg as the RCLW.**

GM

Calculate the Test Vehicle Target Weight by adding the "As Delivered" weight, the RCLW, and the weight of the fully instrumented dummies in the space provided below.

Rated Cargo and Luggage Weight Calculation	Units	Value	
Vehicle Capacity Weight (VCW - From Vehicle Placard)	kg	390	(A)
Reduced Load Capacity (if Applicable)	kg	6	(B)
Designated Seating Capacity (DSC - From Vehicle Placard)		5	(C)
Rated Cargo and Luggage Weight (RCLW)	kg	43.8	(C x 68.04 kg) – (A-B)
Is the RCLW > 136 kg? If yes use 136 kg as RCLW	kg	–	
Target Test Weight Calculation	Units	Value	
Total As Delivered Weight (UVW = Unloaded Vehicle Wgt.)	kg	1410	(A)
Actual Weight of 1 – ES-2re ATD & 1 – SID-IIs ATD **(Ask ATD Lab for specific ATD Weight)**	kg	131	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	43.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1584.8	(A+B+C)
Target Test Weight (min):	kg	1575.8	(A+B+C) – 9.0 kg
Target Test Weight (max):	kg	1580.3	(A+B+C) – 4.5 kg

Attitude - As Delivered Condition:

Performed by: Gretchen M Date: 6-20-23

Note: Do not lift the vehicle off the ground until the attitude measurements have been taken.

Initial:

GM With the vehicle in the "As Delivered" weight condition, place it on a flat, level surface.

GM Place transmission in neutral. Note: If the vehicle has an Auto-Leveling, the ignition must be set to the "on" position. If the vehicle is equipped with a self-adjusting hydraulic system, contact the COTR for further guidance on attitude measurements.

GM Exercise the suspension by rolling the vehicle forward and rearward approximately 4 to 6 feet. Repeat this step three to four additional times.

GM Mark a point on each vehicle body above the center of each wheel.

GM Measure the perpendicular distance from the level surface to the four (4) points marked on the vehicle and record each.

Vehicle Attitudes	Units	LF	RF	LR	RR
As Delivered	mm	776	778	779	780
Tape Measure Unique Identifier:			—		

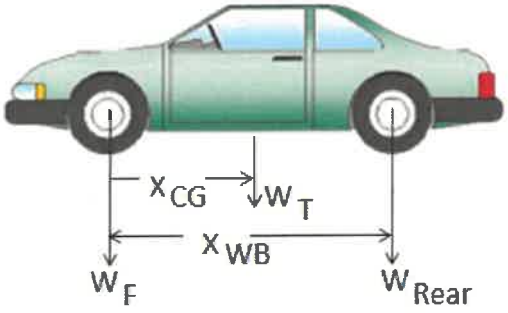
CG - As Delivered Condition:

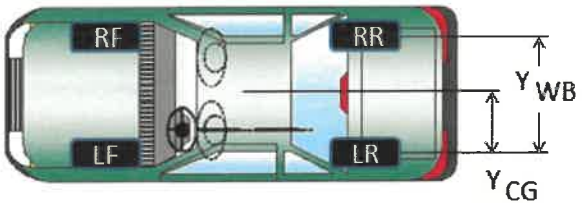
Performed by: AR Date: 6/26/23

Initial: AR

Measure and record the vehicle distances and copy the weights from the previous section in the space provided below in order to calculate the vehicle CG aft of the front axle.

Center of Gravity Calculation:





$$X_{CG} = \frac{X_{WB} \times W_{Rear}}{W_{Total}}$$ (From Front Axle)

$$Y_{CG} = \frac{Y_{WB} \times W_{Right}}{W_{Total}}$$ (From Left Wheel Centerline)

$$X_{CG} = \frac{X_{WB} \times W_{Rear}}{W_{Total}}$$

1098 mm = (2751 mm × 563 kg) / 1410 kg

$$Y_{CG} = \frac{Y_{WB} \times W_{Right}}{W_{Total}}$$

783 mm / 2 = 768

(1565 mm × 692 kg) / 1410 kg

Test Vehicle Center of Gravity (CG)	Units	As Delivered	
Vehicle CG (Aft of Front Axle)	mm	1098	X_{CG}
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	-15	Y_{CG}

Weight – Fully Loaded Condition:

Performed by: Gretchen M. Date: 6/20/23

Initial:

GM With the vehicle in the "As Delivered" weight condition, load the vehicle with the ballast equal to the RCLW placed in the luggage or load carrying/cargo area. Center the load over the longitudinal centerline of the vehicle.

GM Place the weight of the fully instrumented test dummy (with clothes and shoes) into the appropriate seating positions. **(Ask ATD Lab for specific ATD Weight)**

GM Reference weight: Driver 178.6 lbs.

GM Reference weight: Rear Passenger 110.2 lbs.

GM Weigh the vehicle at each wheel and add the weights together to determine the "Fully Loaded" weight. Record the weight measurements in the space provided below.

		Fully Loaded		
	Units	Front Axle	Rear Axle	Total
Left	kg	453	385	W_{Left} = 838
Right	kg	447	302	W_{Right} = 749
Ratio	%	56.7%	43.3%	
Totals	kg	W_F = 900	W_R = 687	1587
Weight Scales Unique Identifier:			400323	

GP

Attitude - Fully Loaded Condition:

Performed by: Gretchen M Date: 6-20-23

Initial:

GM With the vehicle in the "Fully Loaded" weight condition, place it on a flat, level surface.

Note: If the vehicle has an Auto-Leveling, the ignition must be set to the "on" position. If the vehicle is equipped with a self-adjusting hydraulic system, contact the COTR for further guidance on attitude measurements.

GM Exercise the suspension by rolling the vehicle forward and rearward approximately 4 to 6 feet. Repeat this step three to four additional times.

GM Measure the perpendicular distance from the level surface to the four (4) points previously marked on the vehicle and record each in the space provided below.

GM Record the Unique Identifier of the inclinometer used to complete these measurements in the space provided below.

Vehicle Attitudes	Units	LF	RF	LR	RR
Fully Loaded	mm	761	774	745	765
Tape Measure Unique Identifier:			—		

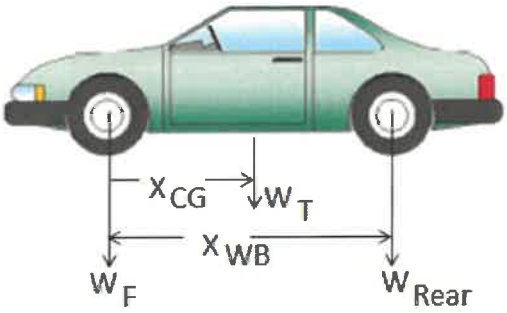
CG - Fully Loaded Condition:

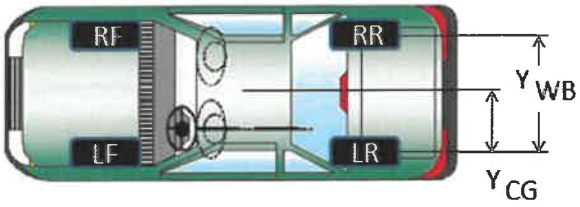
Performed by: AR Date: 6/26/23

Initial: AR

Measure and record the vehicle distances and copy the weights from the previous section in the space provided below in order to calculate the vehicle CG aft of the front axle and left (+) / right (-) from the longitudinal centerline.

Center of Gravity Calculation:





$$X_{CG} = \frac{X_{WB} \times W_{Rear}}{W_{Total}}$$ (From Front Axle)

$$Y_{CG} = \frac{Y_{WB} \times W_{Right}}{W_{Total}}$$ (From Left Wheel Centerline)

X_{CG} = X_{WB} X W_{Rear}

1191 mm = 2751 mm X 687 kg / 1587 kg

W_{Total}

Y_{CG} = Y_{WB} X W_{Right}

783 mm / 2 = 739

1565 mm X (749 kg / 1587 kg)

W_{Total}

Test Vehicle Center of Gravity (CG)	Units	As Delivered	
Vehicle CG (Aft of Front Axle)	mm	1191	X_{CG}
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	-44	Y_{CG}

Drain Fuel and Paint Vehicle:

Performed by: Gretchen M Date: 6-20-23

Initial:

GM Remove the ballast weight (RCLW) from the cargo area.

GM Drain the fuel tank. Use caution when draining the fuel. Do not damage or remove any fuel system components.

GM Using purple dyed Stoddard solvent fill the tank to 93 % (±1%) of the usable capacity as supplied on Form 1 found in a previous section.

GM Record this amount of Stoddard solvent in the space provided below along with the Unique Identifier of the meter used to conduct this task.

GM Record this amount on the inside of the fuel filler lid.

Actual Amount of Solvent Used in Test	10.5GAL/39.9 liters (2P)
Pump Meter Unique Identifier	—

Yes	No	
GM		Is the Actual Amount of Solvent Used in the test equal to 93% ± 1% of the Usable Capacity stated in on Form No. 1?

Initial:

GM Disable all side airbags on the non-struck side of the vehicle per manufacturer's instructions. If manufacturer will be here for the test confirm that the manufacturer has disabled these airbags prior to conducting the test.

N/A Disable vehicle Daytime Running Lights (if equipped).

GM Remove horn fuse.

N/A Tape off interior airbag covers, instrument cluster, transmission gear selector, and airbag cut-off switch (if equipped).

GM Paint vehicle interior surfaces such as the instrument panel, A-post trim panels, door trim panels, console, etc., with flat white paint. Note: Do not paint points marked on dash if they are present before painting. Note: The air bag indicator light on the dash shall NOT be painted so as to be visible prior to testing. Also be sure not to paint over passenger air bag indicator light.

GM Black out mirrors.

GM Place driver and passenger front windows in the fully open position. Place all other windows and vents in the fully closed position unless otherwise specified by the COTR.

GM Adjustable cowl tops or other adjustable panels in front of the windshield should be placed in the position used under normal operation during inclement weather.

N/A Evacuate refrigerant.

N/A Tap brakes for abort.

GM Drain the engine oil *

GM Drain the transmission fluid *

N/A Drain the transfer case (4WD) *

GM Drain the engine coolant *

GM Drain the windshield washer fluid *

N/A Drain the power steering fluid *

AR Connect 305 monitoring and make sure engineer takes required 305 photos

AR Install 305 tow hook to rear of vehicle

*Note: Ensure that no fluids are leaking from the vehicle after being drained. Seal any leaks before vehicle is transported to the test track.

Mechanical Preparation:

Performed by: Gretchen M Date: 6-23-23

Initial: GM

Remove trunk carpeting, spare tire and jack (in trunk). Note: Per the NHTSA procedure, the spare tire, rear radio speakers, interior door trim and windows on the non-struck side, outboard mirrors on non-struck side taillights and rear bumper can be removed – IF NECESSARY. Refer to the Form 1 for a list of components that the manufacturer will allowed to be removed from the vehicle.

Equipment that is no longer on the test vehicle:

Description	Weight		Description	Weight	
Trunk carpeting	8	kg	—	—	kg
Spare tire	—	kg	—	—	kg
Jack	2	kg	—	—	kg
Rear speaker	—	kg	—	—	kg
Tail light	—	kg	—	—	kg
Right Rear Air Bag	1	kg	—	—	kg

Weight Scale Unique Identifier: —

Explanation for equipment removal:

N/A

Initial:		Description	Qty.
GM	1	**Trunk Release**	1
		NOT FOR REAR. Cut trunk release cable inside of vehicle and route outside to rear deck lid.	
GM	2	**Hood Release**	1
		NOT FOR FRONTAL. Cut hood release cable near fender and tape to bumper.	
GM	3	**Instrumentation Plate**	1
		Install instrumentation plate in trunk. Note location of all fuel components and use caution when drilling holes.	
N/A	4	**Abort Package**	0
		Install abort package on instrumentation plate leading to rear brakes. Verify no leaks.	
N/A	5	**Roof Camera Mount**	0
		Interior T-Bar, stay clear of side curtain air bags when drilling.	
GM	6	**Side Door Camera Mount**	2
GM	7	**Hood Camera Mount**	1
N/A	8	**Toe Pan Camera Mount**	0
		Place seat in test position. Install toe pan camera in corresponding footwell area as far back as possible. Check for fuel lines before drilling.	
GM	9	**LED Light**	3
		On the camera mount, attach (2) LED lights to either side of each camera (2 in total).	
N/A	10	**Remote Battery and Cable**	0
		Route remote battery cable over the vehicle on the non-struck side to the monitor box. Not needed for AGM type battery.	

GM	11	**Battery Monitor Box**	1
		Mount the battery monitor box to the right rear corner / non-struck corner.	
SB	12	**Umbilical Hangar**	1
		Attach the umbilical hanger to rear quarter panel on same side as umbilical	
N/A	13	**Air Bag Monitor**	0
		As per test request, connect inductive pickup to corresponding airbag positive (+) wire.	
N/A	14	**Overhead Target Bar**	0
		Refer to Vehicle Targeting section	
GM	15	**Trigger**	2
		Tape (2) triggers centered on the front hood and run cables to the truck / cargo area. Leave 2 feet of cable slack on hood.	
N/A	16	**Flash Unit**	0
		Attach flash units.	
TB	17	**LED Light Box**	1
		Mount one LED Light box to the instrumentation plate.	
TB	18	**Camera Network Box**	1
		Mount on instrumentation plate or rear floor pan depending on camera placement. Only 1 cable per camera, no extensions.	
TB	19	**Breakout Box / Hub**	1
		Mount Breakout Box hub to instrumentation plate.	
14c	20	**DAU (KI/MINI)**	3
		Mount (3) DAUs to the instrumentation plate.	

N/A	21	**Wireless Antenna**	1
		Mount (1) wireless antenna within the trunk / cargo compartment.	
N/A	22	**Speed Trap Bar**	0
		Fasten speed trap bar to rear bumper of vehicle, opposite side of umbilical. (395 mm minimum height)	
TB	23	**25ft Camera Cable**	3
TB	24	**IDT Camera**	3
		Mount (2) IDT cameras to the onboard camera mounts.	
N/A	25	**GoPro Camera**	0
N/A	26	**Seat Belt Displacement Sensor**	0
		Screw displacement sensor bracket to corresponding pillar in line with seat belt at thorax height as per dummy placement	
N/A	27	**Seat Belt Load Cell**	0
		(See Form 1) - Place (2) seat belt load cells on the front driver's seat. Place (2) seat belt load cells on the front passenger seat.	

Onboard Camera Installation:

Performed by: MP Date: 6/26/23

MP Install Camera Hub with Power & Trigger Cables

MP Install On-Board Camera's & Cables to Mounts

MP Check to make sure all required camera views are met. If not readjust camera mounts until all required views are met. (See photo references below)

MP Verify the Battery is fully charged

MP Install On-Board Lights Battery Box & ensure all light cables reach the box. If they do not install extension cables.

MP Tie down all wiring related to the cameras and lights

MP Pin all onboard cameras & camera bars to stabilize images during the impact.

High speed camera and light mounts photo reference:

High speed camera (1000 fps): Camera #7 – Onboard Dummy Front View and two LED lights to capture the following field of view:



High speed camera (1000 fps): Camera #8 –Onboard Dummy Side View and two LED lights to capture the following field of view:



High speed camera (1000 fps): Camera #9 – Onboard Dummy Rear Passenger Side View and two LED lights to capture the following field of view:



Section 4

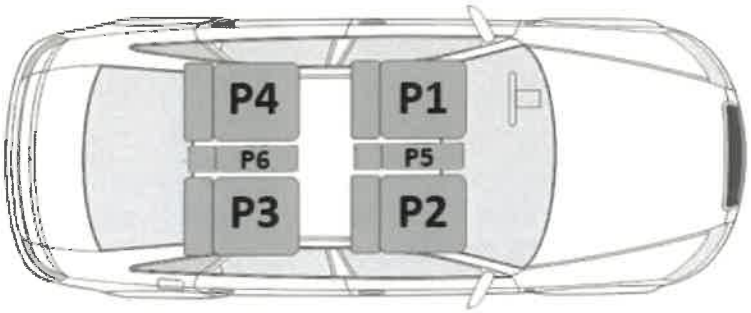
Seat Positioning, Seat Setting, H-Point & Targeting

1st Row Seat Positioning – Reference Marks:

Performed by:	Kyle Glavk	Date:	6-23-23

Tape Measure Unique Identifier:	400602
Inclinometer Unique Identifier:	401036

Instructions: In this section there are three sets of check marks. The first row corresponds with the front driver seat (P1), the second row corresponds with the front center seat (P5) and the third row corresponds with the front passenger seat (P2).



Setting the Seats - Driver, Front Center, and Front Passenger Seats
Set the driver, front center (if applicable), and front passenger seats accordingly:

Initial Settings ----------

Initial:

HAG 1. **Determine the Seat Type**

Visually inspect the front seats to determine its type (i.e., bucket or bench).

Driver Seat:	Bench_____	Bucket ✓
Front Outboard Passenger Seat:	Bench_____	Bucket ✓
Front Center Seat:	Bench N/A	Bucket N/A

P1	P5	P2
N/A	N/A	N/A

2. **Position lumbar supports**
Position the seat's adjustable lumbar supports to the lowest, retracted or deflated adjustment positions.

✓ N/A, No lumbar adjustment

N/A N/A N/A

3. **Position additional supports**
Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position.

✓ N/A, No additional support adjustment

N/A N/A

4. **Position leg supports**
Position an additional leg support system in its rearmost position.

✓ N/A, No additional support adjustment

MAG

5.2.1. **Position head restraint**
Using any adjustment of the head restraint, position it to its highest position.

MAG

5.2.2. Using any adjustment of the head restraint, position it to the full forward position. If it rotates, rotate it such that the head restraint extends as far forward as possible. Record the position of the head restraint in the space below.

N/A – The test vehicle is equipped with automatically adjusting head restraints or there is no head restraint adjustment.

Head Restraint Adjustment	Total # of Positions	Placed in Position #
Driver Seat	$H_0 - 3$	H_0

MAG N/A

6. **Mark the longitudinal centerline of the seat**

MAG

6.1 Driver's seat:
If adjustable, place the seat back in its most vertical (upright) position. For bucket seats, locate and **mark** for reference the intersection of a vertical longitudinal plane that passes through the SgRP and the seat cushion upper surface, seat back and head restraint. For bench seats, draw a line along the intersection of a vertical longitudinal plane that passes through the centerline of the steering wheel and the seat cushion upper surface, seat back and head restraint.

MAG MAG

7. **Mark the range of seat travel**
Prior to marking the seat, move the seat through its full range of motion using all available controls. Separately, operate each control to determine whether it moves the seat and/or seat cushion primarily in the fore-aft or up-down directions.

Seat Fore/Aft Positioning	Total Fore/Aft Travel	Placed in Position #
Driver	(260) $F_0 - 26$	(130) M_{13}
Front Passenger Seat	(260) $F_0 - 26$	(130) M_{13}

Front Center Seat	N/A	N/A

7.1 Mark a point (seat cushion reference point - **SCRP**) on the side of the seat cushion that is between 150 mm and 250 mm from the front edge of the seat cushion. For seat cushions that move up and down independently from the seat housing, mark the point on the side of the cushion in an area that will not be obscured by the seat housing when the seat cushion is at its lowest height position.

7.2 Draw a horizontal line (seat cushion reference line - **SCRL**) through the **SCRP**.

7.3 Use only the controls that primarily move the seat in the fore-aft direction to move the **SCRP** to the rearmost position.

7.4 If the seat cushion adjusts fore-aft, independent of the seat back, use only the controls that primarily move the seat cushion in the fore-aft direction to move the **SCRP** to the rearmost position.

✓ *N/A* No independent fore-aft seat cushion adjustment

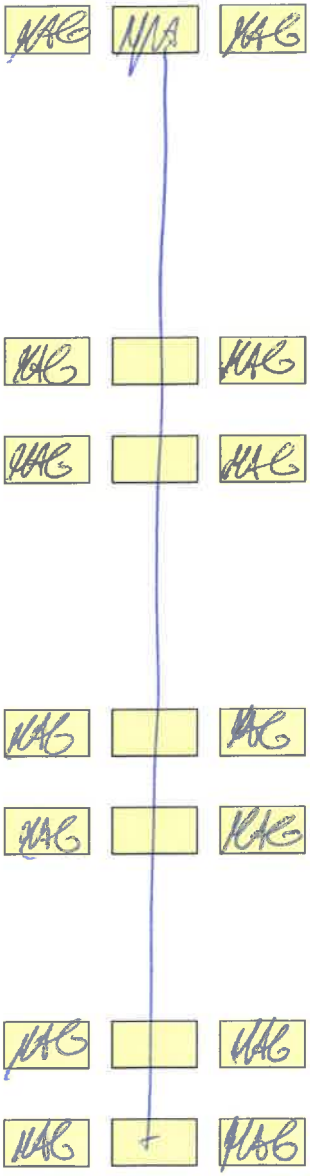
7.5 Use any part of any control, other than the parts just used for fore-aft positioning, to determine the range of angles of the **SCRL** and to set the **SCRL** at mid-angle. Record the maximum, minimum and midangles in the table below;

SCRL°	Max	Min	Mid
Driver Seat	21.4	16.1	18.8
Front Passenger Seat	21.4	16.0	18.7
Front Center Seat	N/A	N/A	N/A

7.6 If the seat and/or seat cushion height is adjustable, use any part of any control other than the parts which primarily move the seat or seat cushion fore-aft, to put the **SCRP** in its lowest position with the **SCRL** angle at the mid-angle found in 7.5.

✓ *N/A* No independent fore-aft seat cushion adjustment

7.7 Use only the controls that primarily move the seat in the fore-aft direction to verify the seat is in the rearmost position.



7.8 Use only the controls that primarily move the seat in the fore-aft direction to **mark** the fore-aft seat positions. **Mark** each position so that there is a visual indication when the seat is at a particular position. For manual seats, move the seat forward one detent at a time and **mark** each detent. For power seats, **mark** only the rearmost, middle, and foremost positions. Label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost.

7.9 Use only the controls that primarily move the seat in the fore-aft direction to move the **SCRP** to the rearmost position.

7.10 Use any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, to find the maximum, minimum, and middle height of the **SCRP** with the **SCRL** at the mid-angle determined in 7.5 by measuring from the **SCRP** to a reference point on the floor pan or sill. Record the maximum, minimum and middle heights on the table below.

✓ *N/A* No independent fore-aft seat cushion adjustment

7.11 Use only the controls that primarily move the seat and/or seat cushion in the fore-aft direction to place the **SCRP** at the mid-fore-aft position.

7.12 Use any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, to find the maximum, minimum, and middle height of the **SCRP** with the **SCRL** at the mid-angle determined in 7.5 by measuring from the **SCRP** to a reference point on the floor pan or sill. Record the maximum, minimum and middle heights on the table below.

7.13 Use only the controls that primarily move the seat in the fore-aft direction to place the **SCRP** at the full forward position.

7.14 Use any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, to find and visually **mark** the maximum, minimum, and middle height of the **SCRP** with the **SCRL** at the midangle determined in 7.5 by measuring from the **SCRP** to a reference point on the floor pan or sill. Record the maximum, minimum and middle heights and SCRL mid-angle on the table below.

Seat	SCRL Mid-Angle (7.5)	SCRP Height Position	SCRP Height (mm)		
			Rearmost (7.10)	Mid-fore/aft (7.12)	Full forward (7.14)
Driver Seat	18.8	Max	N/A	N/A	N/A
		Mid	N/A	N/A	N/A
		Min	16	27	38
Front Passenger Seat	18.7	Max	N/A	N/A	N/A
		Mid	N/A	N/A	N/A
		Min	14	25	35
Front Center Seat	N/A	Max	N/A	N/A	N/A
		Mid			
		Min			

N/A N/A N/A

8. For adjustable seat backs, position the seat back at the foremost stop. Mark each position of adjustment from the foremost to rearmost stops so that there is a visual indication when the seat back is at a particular position.

For manually adjustable seat backs (with detents), move the seat back rearward one detent at a time and mark each detent. Label the rearmost, middle, and foremost positions with the measured detent. If no middle detent exists, label the next most-rearward detent to the middle position.

For power seat backs (no detents), move the seat back rearward one degree at a time and mark each angle. Angles should be measured at the location on the seat (head restraint, seat back, plastic trim, etc.) as indicated by the manufacturer on Form No. 1. Label the rearmost, middle, and foremost positions with the measured angle.

Record the range of angles in degrees and detents in the space provided below. Visually mark and label for future reference the rear seat back angle, if adjustable, as provided by the manufacturer on Form No. 1 for the 50th percentile (ES-2re) male dummy in a Side MDB test.

Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents *	Degree	Detent *
Driver Seat w/ Seated Dummy	46.4	F_o -26	+3.6	5
Front Passenger Seat	49.1	F_o -26	+5.3	5
Front Center Seat	N/A	N/A	N/A	N/A

HAC N/A HAC 8. **Mark the seat belt upper anchorage positions**
Mark for reference each vertical position of a manually adjustable seat belt upper anchorage.

Mark and label each position with the following: H for highest, M"X" for mid-positions (where "X" stands for 1, 2, 3, etc. and 1 is used for the highest mid-position), and L for lowest.

☐ *N/A* No independent fore-aft seat cushion adjustment

HAC 9. **Mark the steering wheel position**
Is the steering wheel adjustable up and down and/or in and out?

☑ Yes, go to 9.1

☐ No - Check Sheet completed.

HAC 9.1 Find and **mark** for future reference each up and down position. Label three of the positions with the following: H for highest, M for mid-position (if there is no mid-position, label the next lowest adjustment position), and L for lowest.

☐ N/A steering wheel is not adjustable up and down

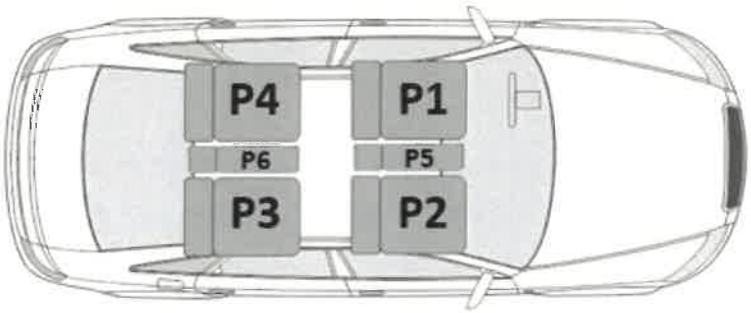
HAC 9.2 Find and **mark** for future reference each -in- and -out- position. Label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the next rearmost adjustment position), and R for rearmost.

2nd Row Seat Positioning – Reference Marks:

Performed by:	Kyle Glaab	Date:	6-23-23

Tape Measure Unique Identifier:	400602
Inclinometer Unique Identifier:	401036

Instructions: In this section there are three sets of check marks. The first row corresponds with the rear struck side seat (left rear seat P4), the second row corresponds with the rear center seat (P6) and the third row corresponds with the rear outboard passenger seat (P3).



Setting the Seats - Driver, Front Center, and Front Passenger Seats
Set the driver, front center (if applicable), and front passenger seats accordingly:

Initial Settings ----------

Initial:
HAG 1. **Determine the Seat Type**

Visually inspect the front seats to determine its type (i.e., bucket or bench).

Struck Side Rear Passenger Seat:	Bench ✓	Bucket
Non-Struck Side Passenger Seat:	Bench ✓	Bucket
Rear Center Seat:	Bench ✓	Bucket

P4	P6	P3
N/A	N/A	N/A

2. **Position lumbar supports**
Position the seat's adjustable lumbar supports to the lowest, retracted or deflated adjustment positions.

✓ N/A, No lumbar adjustment

P4 P6 P3

N/A N/A N/A

3. **Position additional supports**
Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position.

✓ N/A, No additional support adjustment

N/A N/A N/A

4. **Position leg supports**
Position an additional leg support system in its rearmost position.

✓ N/A, No additional support adjustment

FIXED FIXED FIXED

5.2.1. **Position head restraint**

Does the adjustable head restraint have a non-use position as defined by FMVSS No. 202a?

Yes - Set the head restraint to the lowest position using the procedure described by the manufacturer. Record position in table below. Go to step 6.

✓ No – go to step 5.1.2

Head Restraint Adjustment	Total # of Positions	Placed in Position #
Rear Passenger Seat	FIXED	FIXED

5.1.2. Using any adjustment of the head restraint, position it to its lowest position.

5.1.3 Using any adjustment of the head restraint, position it to the full forward position. If it rotates, rotate it such that the head restraint extends as far forward as possible.

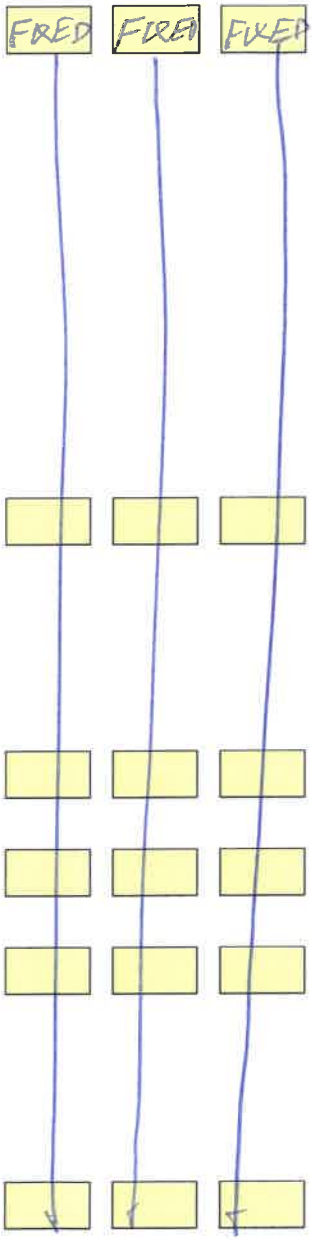
✓ N/A – The test vehicle is equipped with automatically adjusting head restraints or there is no head restraint adjustment.

N/A N/A N/A

6. **Mark the longitudinal centerline of the seat**

N/A

6.1 Driver's seat:
If adjustable, place the seat back in its most vertical (upright) position. For bucket seats, locate and **mark** for reference the intersection of a vertical longitudinal plane that passes through the SgRP and the seat cushion upper surface, seat back and head restraint. For bench seats, draw a line along the intersection of a vertical longitudinal plane that passes through the centerline of the steering wheel and the seat cushion upper surface, seat back and head restraint.



7. **Mark the range of seat travel**

Prior to marking the seat, move the seat through its full range of motion using all available controls. Separately, operate each control to determine whether it moves the seat and/or seat cushion primarily in the fore-aft or up-down directions.

Seat Fore/Aft Positioning	Total Fore/Aft Travel	Placed in Position #
Struck Side Rear Seat	FIXED	FIXED
Non-Struck Side Rear Seat	↓	↓
Rear Center Seat	↓	↓

7.1 Mark a point (seat cushion reference point - **SCRP**) on the side of the seat cushion that is between 150 mm and 250 mm from the front edge of the seat cushion. For seat cushions that move up and down independently from the seat housing, mark the point on the side of the cushion in an area that will not be obscured by the seat housing when the seat cushion is at its lowest height position.

7.2 Draw a horizontal line (seat cushion reference line - **SCRL**) through the **SCRP**.

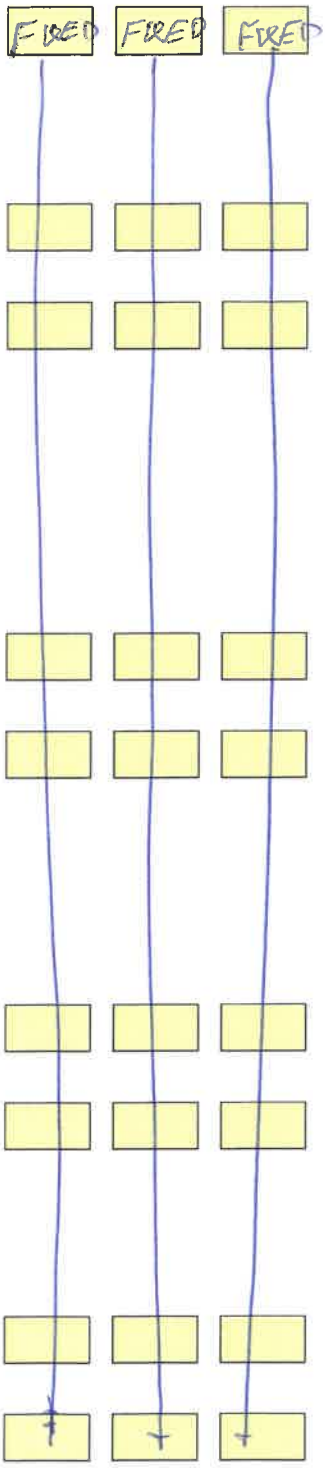
7.3 Use only the controls that primarily move the seat in the fore-aft direction to move the **SCRP** to the rearmost position.

7.4 If the seat cushion adjusts fore-aft, independent of the seat back, use only the controls that primarily move the seat cushion in the fore-aft direction to move the **SCRP** to the rearmost position.

☐ *N/A* No independent fore-aft seat cushion adjustment

7.5 Use any part of any control, other than the parts just used for fore-aft positioning, to determine the range of angles of the **SCRL** and to set the **SCRL** at mid-angle. Record the maximum, minimum and midangles in the table below;

SCRL°	Max	Min	Mid
Struck Side Rear Seat	N/A	N/A	N/A
Non-Struck Side Rear Seat	↓	↓	↓
Rear Center Seat	↓	↓	↓



7.6 If the seat and/or seat cushion height is adjustable, use any part of any control other than the parts which primarily move the seat or seat cushion fore-aft, to put the **SCRP** in its lowest position with the **SCRL** angle at the mid-angle found in 7.5.

☐ *N/A* No independent fore-aft seat cushion adjustment

7.7 Use only the controls that primarily move the seat in the fore-aft direction to verify the seat is in the rearmost position.

7.8 Use only the controls that primarily move the seat in the fore-aft direction to **mark** the fore-aft seat positions. **Mark** each position so that there is a visual indication when the seat is at a particular position. For manual seats, move the seat forward one detent at a time and **mark** each detent. For power seats, **mark** only the rearmost, middle, and foremost positions. Label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost.

7.9 Use only the controls that primarily move the seat in the fore-aft direction to move the **SCRP** to the rearmost position.

7.10 Use any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, to find the maximum, minimum, and middle height of the **SCRP** with the **SCRL** at the mid-angle determined in 7.5 by measuring from the **SCRP** to a reference point on the floor pan or sill. Record the maximum, minimum and middle heights on the table below.

☐ *N/A* No independent fore-aft seat cushion adjustment

7.11 Use only the controls that primarily move the seat and/or seat cushion in the fore-aft direction to place the **SCRP** at the mid-fore-aft position.

7.12 Use any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, to find the maximum, minimum, and middle height of the **SCRP** with the **SCRL** at the mid-angle determined in 7.5 by measuring from the **SCRP** to a reference point on the floor pan or sill. Record the maximum, minimum and middle heights on the table below.

7.13 Use only the controls that primarily move the seat in the fore-aft direction to place the **SCRP** at the full forward position.

7.14 Use any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, to find and visually **mark** the maximum, minimum, and middle height of the **SCRP** with the **SCRL** at the midangle determined in 7.5 by measuring from the **SCRP** to a reference point on the floor pan or sill. Record the maximum, minimum and middle heights and SCRL mid-angle on the table below.

Seat	SCRL Mid-Angle (7.5)	SCRP Height Position	SCRP Height (mm) Rearmost (7.10)	Mid-fore/aft (7.12)	Full forward (7.14)
Struck Side Rear Seat	N/A	Max	N/A	N/A	N/A
		Mid			
		Min			
Non-Struck Side Rear Seat		Max			
		Mid			
		Min			
Rear Center Seat		Max			
		Mid			
		Min			

FIXED FIXED FIXED

8. For adjustable seat backs, position the seat back at the foremost stop. Mark each position of adjustment from the foremost to rearmost stops so that there is a visual indication when the seat back is at a particular position.

For manually adjustable seat backs (with detents), move the seat back rearward one detent at a time and mark each detent. Label the rearmost, middle, and foremost positions with the measured detent. If no middle detent exists, label the next most-rearward detent to the middle position.

For power seat backs (no detents), move the seat back rearward one degree at a time and mark each angle. Angles should be measured at the location on the seat (head restraint, seat back, plastic trim, etc.) as indicated by the manufacturer on Form No. 1. Label the rearmost, middle, and foremost positions with the measured angle.

Record the range of angles in degrees and detents in the space provided below. Visually mark and label for future reference the rear seat back angle, if adjustable, as provided by the manufacturer on Form No. 1 for the 5th percentile (SID-IIs) female dummy in a Side MDB test.

Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents *	Degree	Detent *
Struck Side Rear Seat	FIXED	FIXED	FIXED	FIXED
Non-Struck Side Rear Seat	↓	↓	↓	↓
Rear Center Seat	↓	↓	↓	↓

N/A N/A N/A

9. **Mark the seat belt upper anchorage positions**
Mark for reference each vertical position of a manually adjustable seat belt upper anchorage.

Mark and label each position with the following: H for highest, M"X" for mid-positions (where "X" stands for 1, 2, 3, etc. and 1 is used for the highest mid-position), and L for lowest.

☑ *N/A* No independent fore-aft seat cushion adjustment

BAC 10. **Mark the steering wheel position**
Is the steering wheel adjustable up and down and/or in and out?

☑ Yes, go to 9.1

☐ No - Check Sheet completed.

BAC 10.1 Find and **mark** for future reference each up and down position. Label three of the positions with the following: H for highest, M for mid-position (if there is no mid-position, label the next lowest adjustment position), and L for lowest.

☐ N/A steering wheel is not adjustable up and down

BAC 10.2 Find and **mark** for future reference each -in- and -out- position. Label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the next rearmost adjustment position), and R for rearmost.

H-Point Left Front Seat (Position 1):

Performed by: Kyle Glaub Date: 6-23-23

Initial:

HAG Place a piece of muslin cloth over seat area.

HAG Place H-point machine in center of seat. Note: If vehicle is a bench seat, then the center is aligned with the center of the steering column. For the passenger seat, the center is found by placing the machine the same distance outboard from the vehicle centerline as for the driver seat. If the seat is a bucket, place the H-point machine on the seat centerline.

HAG Attach leg assemblies. T-bar parallel to ground and perpendicular to vehicle centerline. T-bar set at 15.8, legs set at 16.3 for 50th percentile.

HAG Position right driver's foot on un-depressed accelerator pedal. Insert pin in right foot to ensure angle is not less than 87 degrees. Sole on pedal and heel as far forward as possible. Left knee is placed same distance from H-point machine centerline as right knee.

HAG Position knees 254 mm apart. Place feet as far forward as possible.

HAG Apply lower leg and thigh weights.

HAG Tilt back pan forward. Pull T-bar forward then release to allow machine to slide back into seat.

HAG Apply a 22 pound rearward load at the intersection of hip angle and T-bar. Apply load twice.

HAG Return back plane to seat back.

HAG Prevent H-point machine from sliding forward for the rest of the procedure.

HAG Install buttock and torso weights.

HAG Move back plane forward and rock 3 times over a 10 degree arc.

HAG Lift each leg and allow it to fall into place. Make sure seat pan is level (i.e. no roll) and return back pan to seat back.

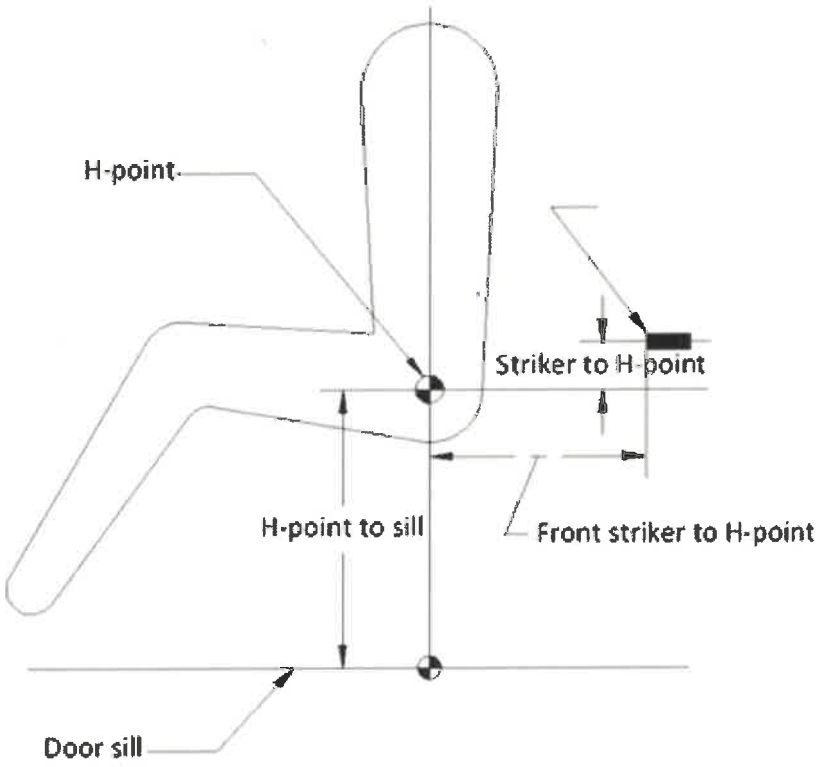
HAG Apply force to the back pan to either: (1) Increase hip angle 3 degrees. (2) Maximum of 15 pounds.

HAG Record H-Point Machine Torso Angle in the space provided below.

HAG Record H-Point Machine Hip Point location in the space provided below.

HAG Place H-point target sticker on outside of vehicle door.

H-Point Machine Torso Angle	22.0	degrees
H-Point Machine Hip Angle	94.5	degrees
Seatback Angle (Headrest Post)	+3.8	degrees
Hip Point: X (fore/aft of striker)	200.0	mm
Z (above/below striker)	234.5	mm



1st Row Seat Positioning – Setting Seats

Performed by:	Kyle Glaub	Date:	6-23-23

Tape Measure Unique Identifier:	400602
Inclinometer Unique Identifier:	401036

Instructions: In this section there are three sets of check marks. The first row corresponds with the front driver seat (P1), the second row corresponds with the front center seat (P5) and the third row corresponds with the front passenger seat (P2).

Setting the Seats - Driver, Front Center, and Front Passenger Seats
Set the driver, front center (if applicable), and front passenger seats accordingly:

Initial:

P1	P5	P2
MAG	N/A	MAG
MAG		MAG
MAG		MAG
MAG		MAG
MAG	-	MAG

1. **Set the seat for a (ES-2re) test dummy**
Using the reference marks on the seat, set the seat in the mid fore-aft, lowest height at mid seat cushion angle position as follows;

1.1 Using the control that primarily moves the seat fore and aft, move the **SCRP** to the mid-travel (i.e., mid-fore aft) position.

1.2 If the seat or seat cushion height is adjustable, other than by the controls that primarily move the seat or seat cushion fore and aft set the height of the **SCRP** to the minimum height, with the **SCRL** set as closely as possible to the mid-angle.

1.3 Set the seat back angle at the manufacturer's nominal design riding position for a 50th percentile adult male in the manner specified by the manufacturer. If the position is not specified, set the seat back at the first detent rearward of 25° from vertical.

Seat Back Angle + 3.6 °

☐ *N/A* The seat back does not adjust.

Using any adjustment of the head restraint, position it to its highest position. Using any adjustment of the head restraint, position it to the full forward position.

2nd Row Seat Positioning – Setting Seats

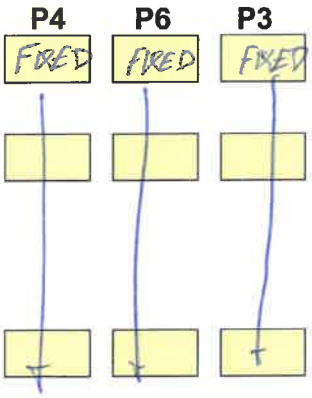
Performed by:	Kyle Glaub	Date:	6-23-23

Tape Measure Unique Identifier:	400602
Inclinometer Unique Identifier:	401036

Instructions: In this section there are three sets of check marks. The first row corresponds with the rear struck side seat (left rear seat P4), the second row corresponds with the rear center seat (P6) and the third row corresponds with the rear outboard passenger seat (P3).

Setting the Seats - Rear Struck Side Seat, Rear Center, and Rear Outboard Seats
Using the reference marks determined in the previous section, set the seats accordingly for a SID-IIs ATD:

Initial:



Set the seat at rearmost fore/aft position, lowest height at mid-angle.

1.1 Using the control that primarily moves the seat fore and aft, move the **SCRP** to the rearmost position.

1.2 If the seat or seat cushion height is adjustable, other than by the controls that primarily move the seat or seat cushion fore and aft, set the height of the **SCRP** to the lowest height, with the **SCRL** set as closely as possible to the mid-angle.

✓ N/A The seat is not adjustable.

1.3 Fully recline the seat back

✓ *N/A* The seat back does not adjust.

Setting Steering Wheel & Seat Belt Adjustment

Performed by:	Kyle Glaub	Date:	6-23-23

Tape Measure Unique Identifier:	400602
Inclinometer Unique Identifier:	401036

Setting Steering Wheel, Seat Belt Anchorages, Belt Guides, etc.

Steering Wheel Adjustment - If the steering wheel is adjustable up and down and/or in and out complete the following steps to set the final steering wheel location:

Initial:

MAG 11. **Set the steering wheel to the mid-position**

Use the markings to position the steering wheel hub at the geometric center of full range of driving positions including any telescoping positions or if applicable, the next lowest detent position. Complete the following table

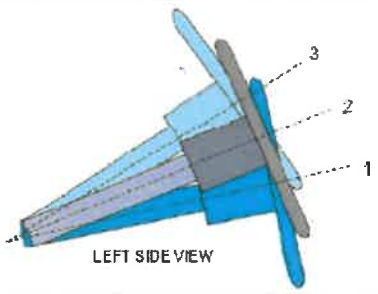
☐ *N/A* steering wheel does not adjust.

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	17.9	
Geometric Center, Position No. 2	19.9	
Uppermost, Position No. 3	21.9	
Telescoping Steering Wheel Travel		50
Test Position	19.9	25

Reference distance from ceiling to center of steering wheel. Mark point in ceiling.	400	mm
Reference distance from front of dash to steering wheel. Mark points on dash and steering wheel.	190	mm



Adjustable Seat Belt Anchorages

Initial:

HAG

Place adjustable seat belt anchorages in the nominal adjustment position in accordance with the manufacturer's data on Form No. 1 for a 50th percentile (ES-2re) male adult occupant and a 5th percentile (SID-IIs) female adult occupant.

Note the position of the seat belt anchorages in the space provided below.

	Total # of Positions	Placed in Position #
Driver Seat	$H_o - 3$	H_o
Rear Passenger Seat	FIXED	FIXED

N/A

Seat Belt Guides: Usage of seat belt guides should be set in accordance with instructions included in the vehicle owner's manual or in Form No. 1.

Photographic Tape & Measurements

Performed by: Kyle Glaub Date: 6-23-23

Initial:

MAG Align the left edge of 25 mm (1 inch) wide yellow/black checkerboard tape along the vertical impact reference line as defined below. Reference illustrations can be found on the next page.

For passenger vehicles

Test Vehicle Wheelbase Length	Vertical Impact Reference Line Location
Less than or equal to 2,896 mm	940 mm +/- 5 mm forward of wheelbase centerline
Greater than 2,896 mm	508 mm +/- 5 mm rearward of front axle centerline

For multipurpose vehicles, sport utility vehicles, light trucks and vans:

Test Vehicle Wheelbase Length	Vertical Impact Reference Line Location
Less than or equal to 2,489 mm	305 mm +/- 5 mm rearward of front axle centerline
Greater than 2,489 mm but less than 2,896 mm	940 mm +/- 5 mm forward of wheelbase centerline
Greater than 2,896 mm	508 mm +/- 5 mm rearward of front axle centerline

Note: For different wheelbase versions of the same model vehicle, the vertical impact reference line may be determined by the following procedure:

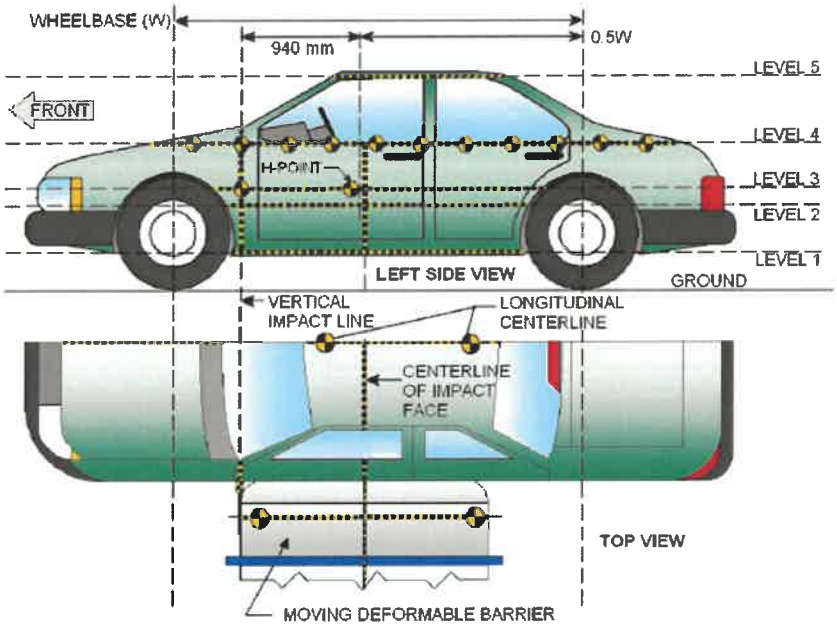
- Select the shortest wheelbase version of the same model and locate the vertical impact reference line as described above.
- Measure the distance between the SgRP and the vertical impact reference line.
- Maintain the same distance between the seating reference point and the vertical impact reference line for the version being tested as that distance between the seating reference point and vertical impact reference line for the shortest wheelbase version.

MAG Measure the distance from the front axle to the edge of the tape used to denote the vertical impact reference line and record the measurement in the space provided below.

Impact Point Location:	Units	Value
Vehicle Wheel Base	mm	~~2753.136~~ 2753.1
Wheelbase Midpoint	mm	1376.568
Vertical Impact Reference Line Location (Taken from above table) *If Wheel Base is greater than 2,896 mm than use 508 mm*	mm	940
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm	436.568

KAG Place 25 mm (1 inch) wide yellow/black checkerboard tape shall be placed on the vehicle such that when the barrier is properly aligned with the test for impact, the tape coincides with the vertical centerline of the barrier's impact face. See below figures.

The tape should be extended across the roof of the vehicle (90˚ angle to the test vehicle longitudinal centerline) to provide a reference for the overhead camera coverage.



KAG Affix 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at LEVEL 1 – Top of side sill: Affix tape along the door sill from the front to the rear wheel-wells.

KAG Affix 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at LEVEL 2 – Occupant Hip Point: Project the location of the driver dummy's hip point laterally through the door to its exterior panel. Affix tape to the side body panels so that the tape intersects the hip point.

KAG Affix 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at LEVEL 3 – Mid-door: Measure the height of the front door body panel at two different locations that are at least 600 mm apart. Take the average of the two measurements. Mark this point on the exterior door panel. Affix tape to the side body panels so that the tape intersects this point.

KAG Affix 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at LEVEL 4 – Window sill: Affix tape just below the front door window sill.

KAG Affix 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at LEVEL 5 – Top of window: Affix tape just above the top of the front door window.

Note: The following measurements should be taken along the vertical impact reference line. Vehicle measurements forward of the vertical impact reference line are negative. All measurements are in millimeters (mm). Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition. The crush profile grid is established prior to the test based on an estimated impact point.

Affix Targets to the Struck side of the Test Vehicle

Initial:

MAG Place a 50 mm (2 inch) diameter target on the vehicle at mid-door height and along the left edge of the vertical impact reference line. The tip of the welding rod will be located in the center of the target.

MAG Affix targets, labeled appropriately (if applicable) to the front door or side panel to denote the hip pivot center of the test driver dummy. Use a 100 mm (4 inch) diameter target and label with "HP".

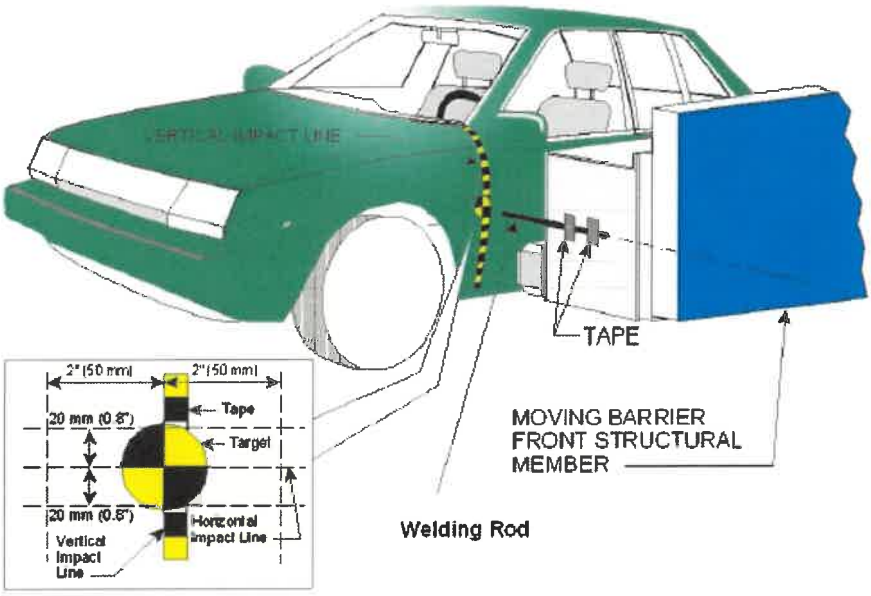
MAG Affix targets, labeled appropriately (if applicable), along LEVEL 4, window sill tape line, at every 300 mm. Use 50 mm (2 inch) diameter targets.

MAG Affix 25 mm (1 inch) wide checkerboard tape on the hood and roof along the longitudinal centerline of the entire vehicle (excluding glazing surfaces).

MAG Affix two (4-inch) diameter targets approximately 700mm apart on the roof's longitudinal centerline.

If the vehicle has a sunroof, no not affix any targets to any glazing. Maximize the distance between the targets assuring that the targets only lie on the roof's body panel.

Roof Target Dia. 100 mm Distance between target centers: 700 mm



Pre-Test Measurements:

Performed by: Kyle Glab Date: 6-23-23

Instructions: Read through the following instruction PRIOR to measuring the following locations using the FARO arm.

Vehicle Coordinate System:

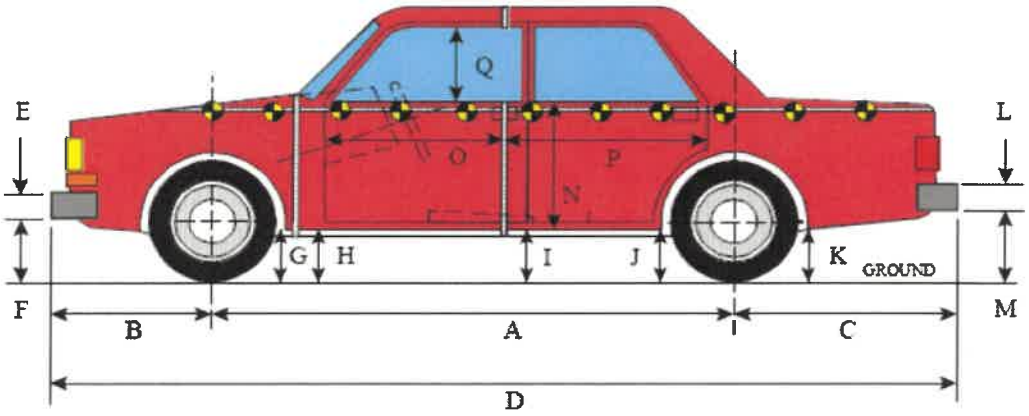
X – Rear Surface of Vehicle (+ forward)
Y – Vehicle Centerline (+ to right)
Z – Ground Plane (+ down)

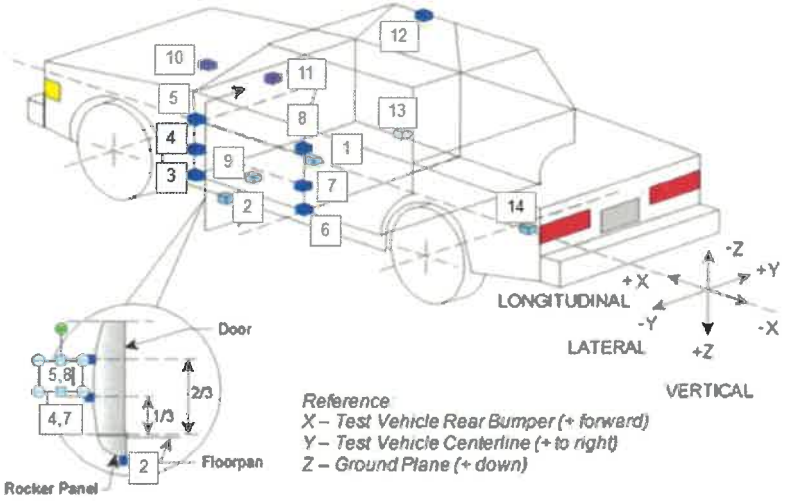
Exterior Vehicle Measurements:

FARO Unique Identifier: 16105

Initial:

MAG Review the below illustrations.





Vehicle Floor Pan Measurements / P1 Floor Pan / Interior ----------
Initial:
HAG P1 STRIKER – Center of P1 Striker Bolt

Vehicle Floor Pan Measurements / P2 Floor Pan / Interior ----------
Initial:
HAG P2 STRIKER – Center of P2 Striker Bolt

Crush Measurements (Previously Taken in Vehicle & Photographic Targets Section)----------

Initial:
HAG C1 - Vehicle Crush Measurement #1 – Sill Top
HAG C2 - Vehicle Crush Measurement #2 – Occupant Hip Point
HAG C3 - Vehicle Crush Measurement #3 – Mid Door
HAG C4 - Vehicle Crush Measurement #4 – Window Sill
HAG C5 - Vehicle Crush Measurement #5 – Window Top

Accelerometer Measurements----------

Initial:
HAG ACC 1 – Right Front Sill
HAG ACC 2 – Right Rear Sill
HAG ACC 3 – Rear Floor Pan
HAG ACC 4 – Left Rear Sill
HAG ACC 5 – Left Front Sill
HAG ACC 6 – Right Rear Occupant Compartment
HAG ACC 7 – Left B-Pillar Low
HAG ACC 8 – Left B-Pillar Mid
HAG ACC 9 – Left A-Pillar Low
HAG ACC 10 – Left A-Pillar Middle
HAG ACC 11 – Front Seat Track
HAG ACC 12 – Rear Seat Track
HAG ACC 13 – Vehicle CG

Initial:

Confirm vehicle is in the "As Tested" configuration.

Establish a fixed reference plane that is perpendicular to the vehicle's longitudinal centerline.

Ground Plane Reference Points ----------

Initial:

Gplane - Ground Plane Reference Points Left, Front, Right and Rear.

Wheelbase / Vehicle Length ----------

Initial:

LFW - Left Front Wheel.

LRW - Left Rear Wheel.

RFW - Right Front Wheel.

RRW - Right Rear Wheel.

RFRONT - Right Front (X19)

CFRONT - Center of Front (X1)

LFRONT - Left Front (X20)

RREAR - Right Rear

CREAR - Center of Rear

LREAR - Left Rear

NUP - N Upper Point

NLOW - N Lower Point

OFRNT - O Front Point

OPMID - O Rear Point / P Front Point

PREAR - P Rear Point

QUP - Front Window Opening – Take uppermost point on front window to obtain window vertical distance measurement

QLOW – Front Window Opening – Take lowermost point on front window to obtain window vertical distance movement

RBPW - Right B Pillar Point *(Taken at vertical tangency point)*

LBPW - Left B Pillar Point *(Taken at vertical tangency point)*

Hand Measurements----------

Initial:

QA	Hand measure	E	Front Bumper Thickness - *(The vertical height of the front bumper fascia)*	160 mm
QA	Hand measure	F	Front Bumper Bottom to Ground - *(Vertical distance from ground to the bottom of the front bumper fascia)*	417 mm
QA	Hand measure	G	Sill Height at Front Wheel Well - *(Vertical distance from ground to the sill at the front wheel well opening)*	162 mm
QA	Hand measure	H	Sill Height at Front Door Leading Edge -*(Vertical distance from ground to the sill at the front door seam)*	162 mm
QA	Hand measure	I	Sill Height at B-Pillar - *(Vertical distance from ground to the sill in line with the front door striker or B-pillar if no striker exists)*	171 mm
QA	Hand measure	J1	Sill Height at Rear Wheel Well - *(Vertical distance from ground to the sill at the rear wheel well opening)*	161 mm
QA	Hand measure	J2	Pinch Weld Height at Rear Wheel Well - *(Vertical distance from ground to the pinch weld at the rear wheel well opening)*	178 mm
QA	Hand measure	K	Sill Height Aft of Rear Wheel Well - *(Vertical distance from ground to the vehicle sheet body at the rear of the rear tire's wheel well)*	366 mm
QA	Hand measure	L	Thickness or height of rear bumper at center.	195 mm
QA	Hand measure	M	Distance from bottom of bumper to ground at center.	392 mm
Tape Measure Unique Identifier Used to conduct measurements				—

$R_{wb} = 1565$

Initial:
KAG Record the following information below (needed to generate the QuickLook).

Wheelbase Left Side	2753.136 mm
Wheelbase Right Side	2748.634 mm
Vehicle Width at B-Pillar	1759.849 mm
Vehicle Length Left Side	4475.685 mm
Vehicle Length Center	4597.099 mm
Vehicle Length Right Side	4479.214 mm

Section 5

Vehicle Instrumentation

Instrumentation Installation:

Performed by: Collin Browning Date: 6/27/23

Note: It is the Technician's responsibility to verify that all instrumentation and associated wiring is in good working condition and calibrated.

Initial:

CB Review the customer's test request or statement of work for the list of desired instrumentation.

CB Create Calspan Excel channel request.

CB Generate photo placards.

CB Verify that the placards match the desired instrumentation list.

CB Print and cut out photo placards.

CB Acquire instrumentation, verify functionality, that it has been calibrated and that its calibration has not expired or is within two weeks of needing to be calibrated.

CB Install instrumentation in the following locations using two-face tape, hot melt or screws as appropriate. Use single accelerometers that have been pre-assembled as dual or tri-packs as appropriate). Then take a close-up photo of the installed instrumentation and corresponding photo placard followed by an overall photo. See Figure 5 below for vehicle accelerometer locations.

Install	Photo Close	Photo Overall	
✓	✓	✓	*Right Sill @ Front Seat* – Triaxial accelerometer mounted on the opposite side to the impacted side sill at the front seat to provide Ax, Ay and Az data: ACC 1 – Location 1.
✓	✓	✓	*Right Sill @ Rear Seat* – Triaxial accelerometer mounted on the opposite side to the impacted side sill at the rear seat to provide Ax, Ay and Az data: ACC 2 – Location 2.
✓	✓	✓	*Rear Floor Pan Above Axle* – Triaxial accelerometer mounted on the rear floor pan above the axle to provide Ax, Ay and Az data: ACC 3 - Location 3.
✓	✓	✓	*Left Sill @ Rear Door* – Uniaxial accelerometer mounted on the impacted side sill in line longitudinally with the center of the widest portion of the front door and located under the sill inward of pinch welds to provide Ay data: ACC 4 – Location 4.
✓	✓	✓	*Left Sill @ Front Door* – Uniaxial accelerometer mounted on the impacted side sill in line longitudinally with the center of the widest portion of the rear door and located under the sill inward of pinch welds to provide Ay data: ACC 5 – Location 5.

Right Rear Occupant Compartment – Uniaxial accelerometer mounted in the rear occupant compartment to provide Ay data: ACC 6 – Location 6.

Left B-Post Lower – Uniaxial accelerometer mounted on the impacted lower B-Pillar (located 1/3 the distance from the floor to the bottom of the door's window opening) to provide Ay data: ACC 7 – Location 7.

Left B-Post Middle – Uniaxial accelerometer mounted on the impacted middle A-Pillar (located 2/3 the distance from the floor to the bottom of the doors window opening) to provide Ay data: ACC 8 – Location 8.

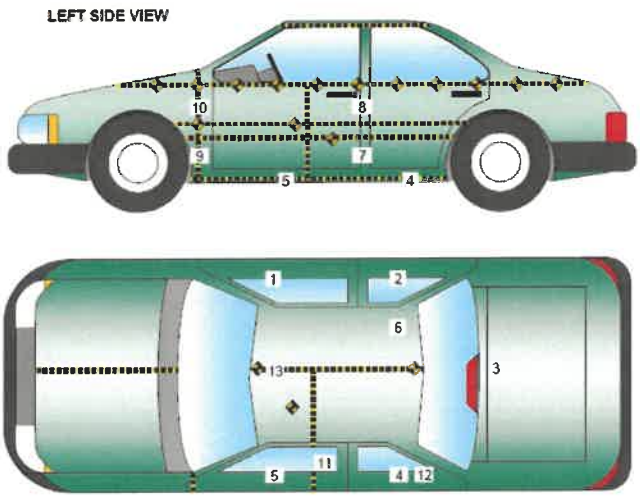
Left A-Post Lower – Uniaxial accelerometer mounted on the impacted lower A-Pillar (located 1/3 the distance from the floor to the bottom of the doors window opening) to provide Ay data: ACC 9 – Location 9.

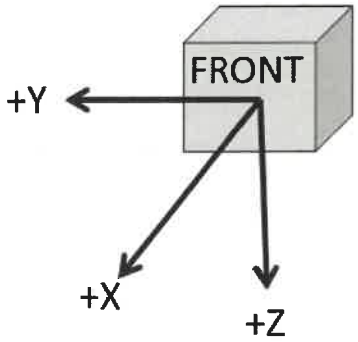
Left A-Post Middle – Uniaxial accelerometer mounted on the impacted middle A-Pillar (located 2/3 the distance from the floor to the bottom of the doors window opening) to provide Ay data: ACC 10 – Location 10.

Front Seat Track – Uniaxial accelerometer mounted on the front seat track nearest the impacted door and approximately aligned with the driver hip point to provide Ay data: ACC 11 – Location 11.

Rear Seat Track or Structure – Uniaxial accelerometer mounted on the rear seat structure (if easily accessible) nearest the impacted door and approximately aligned with the dummy's hip pivot point to provide Ay data: ACC 12 – Location 12.

Vehicle CG – One triaxial accelerometer mounted to the floorpan at the longitudinal and lateral location of the vehicle CG to measure accelerations in the x, y, and z directions: ACC 13 - Location 13.





Onboard Test Equipment Installation:

Performed by: FINLEY Date: 6/27/23

Note: It is the Technician's responsibility to verify that all instrumentation and associated wiring is in good working condition and calibrated. Verify that all DAU's calibration has not expired. This section MUST be completed prior to installation to prevent unnecessary delays.

Initial:

AF Inspect cables for damage prior to installation.

✓ When installing any instrumentation cables, leave slack for strain relief.

- ✓ Connect 4 DAU's in series with crash link cables, starting with breakout box.
- ✓ Plug in all accelerometer LEMO connectors into DAU's, ensuring a tight fit. Verify lock engaged.
- ✓ Plug in battery monitor cable, ensuring a tight fit. Verify lock engaged.
- ✓ Connect 2 trigger BNC connectors into breakout box.
- ✓ Connect WIFI to Ki-Hub interface.
- ✓ Connect abort to breakout box power wire.
- MP Connect LED light LEMO connector to battery box.
- MP Connect trigger 1 port to camera in port using corresponding cable.

✓ Check functionality of SRS light.

Section 6

Verification of Vehicle, ATD & Facility Readiness

Instruction: Insert ATD and Facility checklists after this tab.

AR Inserted ATD Checklist.

_____ Inserted Facility Checklist.

_____ Inserted MDB Checklist.

Weight – As Tested Condition:

Performed by: Steve B. Date: 6/26/23

Initial:

SB Load the appropriate dummies (with umbilical cord) into the appropriate seating position.
(Ask ATD Lab for specific ATD Weight)

X Reference weight: Driver 178.6 lbs.

X Reference weight: Left Rear Passenger 110.2 lbs.

SB Weigh the vehicle at each wheel and add the weights to determine the "As Tested" weight.

SB Record the weight measurements and scale unique identifier in the space provided below.

SB Verify that the "As Tested" weight is within the Target Test Weight (min) and Target Test Weight (max) determined in the Weight – As Delivered section.

Note: Adjust the weight of the test vehicle by either adding ballast or removing vehicle components in accordance with the manufacturer's data provided by the COTR on Form No. 1. If the calculated Test Vehicle Target Weight is exceeded immediately contact the Technical Director.

SB Record the weight of any added ballast in the space provided on the next page.

SB Record any vehicle components that were removed and their associated total weight in the space provided on the next page.

SB Check to make sure the "As Tested" weight is similar to the "Fully Loaded" weight distribution

SB Record the Unique Identifier of the weight scales used to weigh the vehicle in the box below.

Weight Scales Unique Identifier: 400323

		As Tested		
	Units	Front Axle	Rear Axle	Total
Left	kg	487	334	W_{Left} = 821
Right	kg	432	323	W_{Right} = 755
Ratio	%	58.3%	41.7%	
Totals	kg	W_F = 919	W_R = 657	1576

QP

Target Test Weight Minimum	1575.8	kg
Target Test Weight Maximum	1580.3	kg

Weight of ballast added to meet TVTW

Description	Weight
Ballast	0 kg

Yes	No	
X		Does the measured As Tested Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Weight -4.5 kg to -9.0 kg)?

If no, indicate in the space provided below the equipment that was removed and its associated weight to meet this requirement.

Equipment that was removed to meet test weight:

Rear Bumper Facia
Rear Bumper Beam
RR tail light + Center tail light

Explanation for equipment removal: [2]

N/A

Vehicle components removed to meet TVTW

Description	Weight
Rear Bumper Facia	8 kg
Rear Bumper Beam	7 kg
RR tail light + Center tail light	3 kg

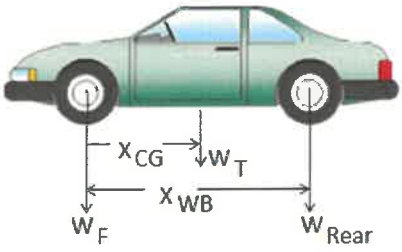
CG – As Tested Condition:

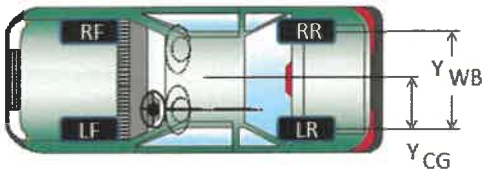
Performed by:	AR	Date:	6/26/23

Initial: AR

Measure and record the vehicle distances and copy the weights from the previous section in the space provided below in order to calculate the vehicle CG aft of the front axle and left (+) / right (-) from the longitudinal centerline.

Center of Gravity Calculation:





$$X_{CG} = \frac{X_{WB} \times W_{Rear}}{W_{Total}}$$ (From Front Axle)

$$Y_{CG} = \frac{Y_{WB} \times W_{Right}}{W_{Total}}$$ (From Left Wheel Centerline)

X_{CG} = X_{WB} X W_{Rear} / W_{Total}

1147 mm = 2751 mm X 657 kg / 1576 kg

Y_{CG} = Y_{WB} X W_{Right} / W_{Total}

783 mm / 2 = 750 = 1565 mm (X 755 kg) / 1576 kg

Test Vehicle Center of Gravity (CG)	Units	As Tested	
Vehicle CG (Aft of Front Axle)	mm	1147	X_{CG}
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	-33	Y_{CG}

Vehicle Verification:

Engineer's Name:	AR QP	Date:	6/26/23

Complete the following steps before transporting the vehicle to the Crash Hall.

Initial:

QP Review and verify that all prior sections of this workbook have been completed.

AR Review all Pre-Test photos for content, field of view, clarity and exposure.

AR Conduct a visual inspection of the vehicle to verify that it has been properly prepared. Note: For OEM's verify that the vehicle reflects the customer's statement of work or test request.

AR Verify that the SRS light is not illuminated.

AR Verify Non-struck side airbags have been disabled.

QP Verify battery voltage is sufficient without charger – Wait 1 minute.

QP 12 Volt or HEV State of Charge

QP Verify that the vehicle has the proper instrumentation.

QP Verify that ATD is ready and have the proper instrumentation. Verify tilt sensor is installed in ES-2re.

QP ~~AR~~ Electric vehicle SOC check. – ~~Battery~~ 217 volts Approved by NHTSA & OEM

AR Verify that placards have been placed on vehicle and contain up-to-date information.

AR Affix large placards to vehicle.

AR Verify that small photograph placards are in test binder with vehicle.

Install Honeycomb

Performed by:	DB & CH	Date:	6/26

Instructions: Read through the following instruction PRIOR to measuring the following locations. See reference images on next page.

Exterior MDB Measurements:

The maximum static crush of the MDB's honeycomb face shall be measured pre-test in the longitudinal direction at the following vertical installation height locations (see **Figure 14 Below**):

(1) Center of Bumper Level = **432 mm** above ground level

(2) Top of Bumper Level = **533 mm** above ground level

(3) Mid Level = **686 mm** above ground level

(4) Top-Stack Level = **813 mm** above ground level

Pre-test measurements are taken (from a reference plane perpendicular to and 1,000 mm from the MDB's longitudinal centerline) across the barrier face at 100 mm intervals at each of the four levels specified.

Initial:

DB Take Level 1 measurements every 100 mm (i.e. L1 800ROC to L1 800LOC) – Center of Bumper Level

DB Take Level 2 measurements every 100 mm (i.e. L2 800ROC to L2 800LOC) – Top of Bumper Level

DB Take Level 3 measurements every 100 mm (i.e. L3 800ROC to L3 800LOC) – Mid Level

DB Take Level 4 measurements every 100 mm (i.e. L4 800ROC to L4 800LOC) – Top-Stack Level

MDB Photographic Targets and Tape:

Performed by: DB Date: 6/26

See reference images on next page.

Initial:

DB Place 25 mm (1 inch) wide yellow/black checkerboard tape along the top of the honeycomb barrier face centerline.

DB Place 25 mm (1 inch) wide yellow/black checkerboard tape along front of the honeycomb barrier face centerline.

DB Place 25 mm (1 inch) wide yellow/black checkerboard tape along the top of the left edge of the honeycomb barrier face, to align with the vertical impact reference line of the test vehicle.

DB Place 25 mm (1 inch) wide yellow/black checkerboard tape along the front of the left edge of the honeycomb barrier face, to align with the vertical impact reference line of the test vehicle.

DB Place two [102 mm diameter (4")] targets on top of the barrier face 400 mm from the barrier centerline.

DB Verify [102 mm diameter (4")] photographic target on the MDB at the rear cross member accelerometer location on the left side of the frame.

DB Verify CG marker and other known location markers are visible and labeled on the MDB in the overhead view.

Align Vehicle & MDB

Performed by: AR & QP Date: 6/27

Initial:

AR Transport vehicle to South Crash Hall and attach battery charger.

AR Place placards on vehicle.

QP Verify that vehicle's tire pressures match the tire pressures listed on the tire placard. If a tire is low, add air and notify Test Engineer.

Tire Pressures	Units	LF	RF	LR	RR
As Tested	kpa	250	250	240	240

Initial:

AR Position vehicle on the side impact pad along 27 degree line and align with MDB.

Note: When the MDB is properly positioned such that it is contacting the vehicle at the initial point of contact along struck side of the vehicle, strike a plane perpendicular to the ground that is coincident with the MDB impact face and is parallel to the vehicle's longitudinal centerline. Accordingly, this plane should form an angle of 63 degrees (± 0.5 degrees) with the direction of forward motion of the MDB.

AR Mark the floor at this location. This line should extend past the front and rear of the vehicle when it is properly positioned.

AR Hold vehicle in place with parking brake.

AR Place automatic transmission in NEUTRAL, manual in SECOND gear

AR Check if vehicle attitudes fall into test range. (If attitude is lower than fully loaded condition, vehicle wheels may need to be momentarily lifted off ground)

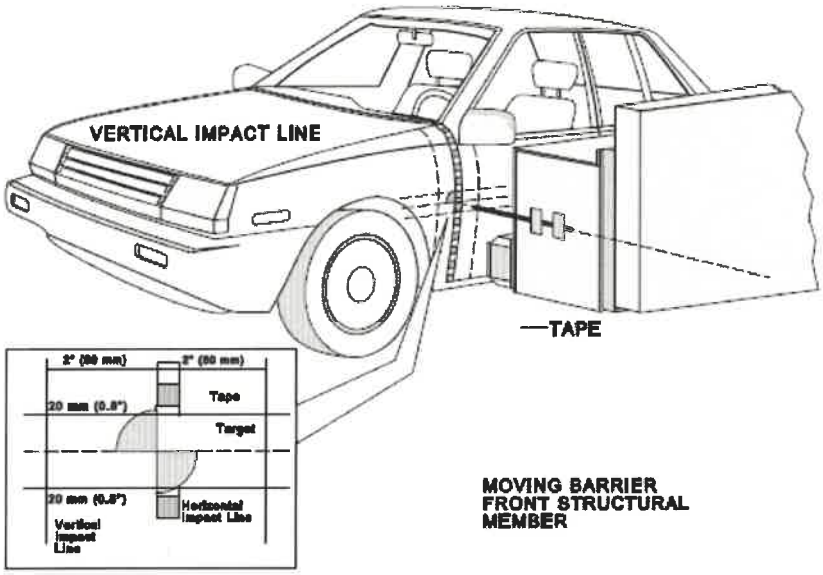
AR Attach plumb bobs to center of front and rear vehicle bumpers.

AR Mark cement beneath vehicle plumb bobs

AR Re-attach battery charger to vehicle.

AR Attach sharpened welding rod along the left side vertical surface of the honeycomb barrier in the horizontal plane level with the mid-door of the test vehicle (Level 3 target). Welding rod shall be positioned and attached with duct tape so as to contact the test vehicle body sheet metal during pre-test setup when MDB is positioned against the side of the test vehicle. The tip should be located in the center of the target.

Continued on next page.



Initial:

GP Place inch tape on barrier sides at H-point level

GP Measure and record the vertical height of level 3 impact targets

Left Side: 490 mm

GP Check speed trap and barrier release distance

EB Locate camera trigger on floor

GP Confirm welding rod will not contact trigger first.

N/A Inspect and take the necessary steps so that the Crash Hall is neat, clean, and arranged in an orderly manner.

Section 7

High Speed Camera Set-Up

Camera Set-up:

Performed by:	MP	Date:	6/26/23

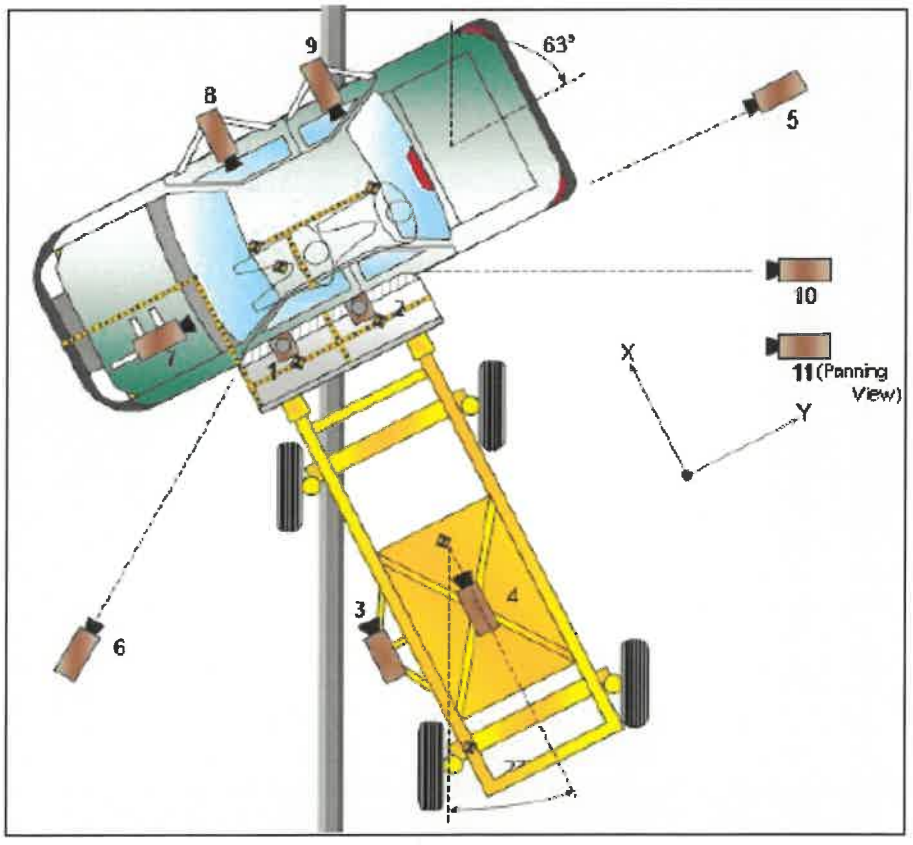
General Requirements:
High-speed digital cameras that operate at a minimum speed of 1000 frames per second (fps) for at least 10 ms before the vehicle contacts the barrier and for at least 300 ms after the vehicle contacts the barrier.

Glare or lights showing on any glass area (closed windows or vents) must be minimized so that views of the dummies during the test are visible for video analysis.

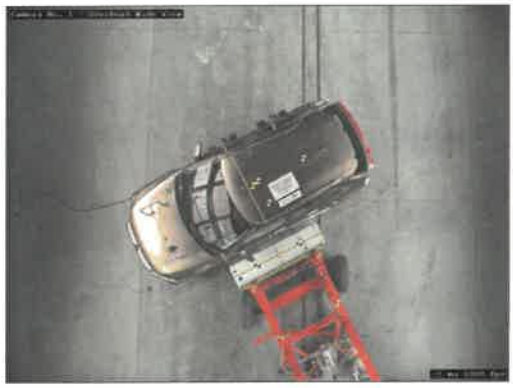
A time zero (T(0)) impact event marker (flash or strobe unit) to indicate when the test vehicle contacts the barrier must be present in each high speed video camera view.

The test laboratory's name or logo shall not appear in any high-speed videos. Note that for the real time, the test laboratory's name shall only appear in the documentary real-time video as part of the title frame.

Locate the following cameras and set field of view:



Camera 1: Overhead Wide View: High-Speed overhead camera to view target vehicle dynamics and positioned directly above the impact plane between the target vehicle and the MDB.



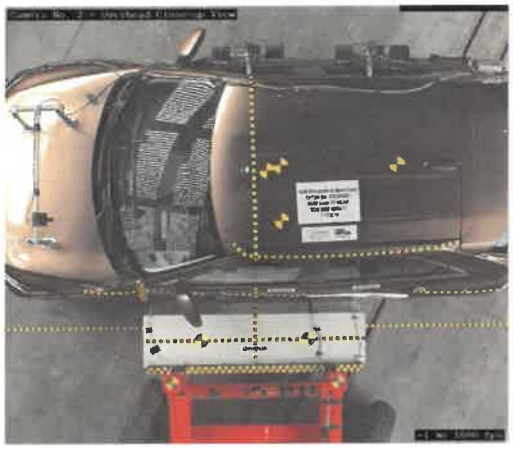
MP Establish field of view (FOV); start w/ **12.5** mm lens.

Confirm placards & strobe are in FOV.

Focus camera

Record Camera's Unique Identifier:
10 - 1018 - 1022

Camera 2: Overhead Close-Up View: A high-speed overhead camera to provide close-up view of the impact plane (should include view of photograph targets on centerline of test vehicle and photograph targets on top of MDB barrier face) and positioned adjacent to Camera No.1.



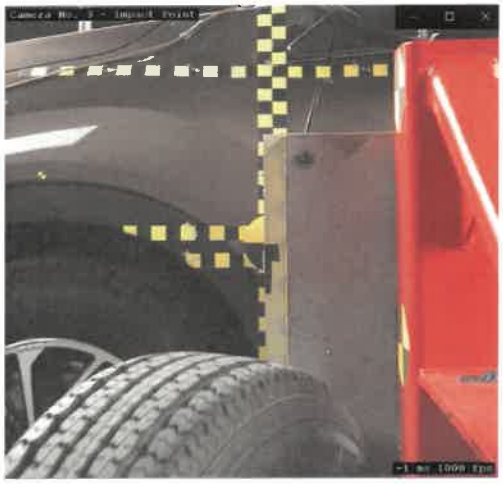
MP Establish field of view (FOV); start w/ **24** mm lens.

Confirm placards & strobe are in FOV.

Focus camera

Record Camera's Unique Identifier:
10 - 1018 - 1009

Camera 3: Impact Point: A high-speed digital camera positioned along the impactor's face left vertical edge to cover target vehicle impact point during side impact event. The initial contact between the tip of the welding rod and test vehicle
Shall be recorded by Camera No. 3.



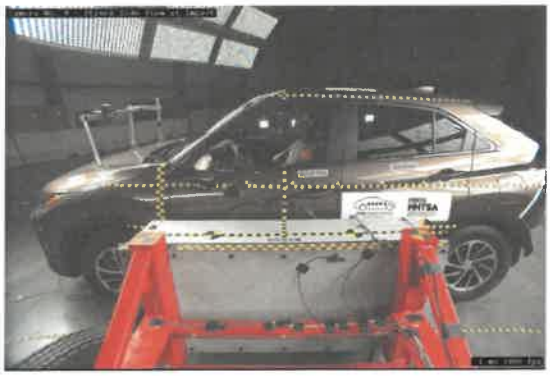
MP Establish field of view (FOV); start w/ **25** mm lens.

Confirm placards & strobe are in FOV.

Focus camera

Record Camera's Unique Identifier:
10 - 1018 - 0942

Camera 4: Struck-Side View at Impact: A high-speed digital camera, positioned on MDB's centerline to view struck side of test vehicle during the side impact event.



MP Establish field of view (FOV); start w/ **8** mm lens.

Confirm placards & strobe are in FOV.

Focus camera

✓ Record Camera's Unique Identifier:

10 - 1018 - 1023

Camera 5: Rear Impact View of Struck Side: A high-speed right side view camera to cover both the MDB and the target vehicle during the side impact event.



MP Establish field of view (FOV); start w/ **28** mm lens.

Confirm placards & strobe are in FOV.

Focus camera

✓ Record Camera's Unique Identifier:

10 - 1018 - 1002

Camera 6: Front Oblique Impact View of Struck Side: A high-speed left side view camera to cover the motion of the target vehicle after impact.



MP Establish field of view (FOV); start w/ **24** mm lens.

Confirm placards & strobe are in FOV.

Focus camera

✓ Record Camera's Unique Identifier:

10 - 1018 - 0995

Camera 7: Driver Dummy Front View (Onboard): A high-speed camera to provide front view of the front dummy through the vehicles windshield from above the engine compartment. (Should be sufficiently raised above the hood structure and positioned such that it shows not only curtain air bag deployment in relation to the dummy's head, but also torso air bag deployment in relation to the dummy's chest, if applicable.)



- [MP] Establish field of view (FOV); start w/ **25** mm lens.
- [ ] Confirm placards & strobe are in FOV.
- [ ] Focus camera
- [ ] Record Camera's Unique Identifier: 10 - 1018 - 0993
- [✓] Verify all mounts and piping have been pinned and secured.

Camera 8: Driver Dummy Side View (Onboard): A high-speed camera to view across the test vehicle's occupant compartment to record the lateral motion of the front dummy during and after side impact.



- [MP] Establish field of view (FOV); start w/ **12.5** mm lens.
- [ ] Confirm placards & strobe are in FOV.
- [ ] Focus camera
- [ ] Record Camera's Unique Identifier: 10 - 1018 - 1016
- [ ] Verify all mounts and piping have been pinned and secured.

Camera 9: Rear Passenger Dummy Side View (Onboard): A high-speed camera to view across the test vehicle's occupant compartment to record the lateral motion of the rear dummy during and after side impact.



MP Establish field of view (FOV); start w/ **12.5** mm lens.

Confirm placards & strobe are in FOV.

Focus camera

Record Camera's Unique Identifier: 10 - 1018 - 1010

V Verify all mounts and piping have been pinned and secured.

Camera 11: Real-Time Pan View of Impact: Real-time (24-30 fps) camera to provide the following pre-test, test, and post-test coverage.



MP Establish field of view (FOV).

Confirm placards & strobe are in FOV.

Focus camera (Focus on ATD's and not placards)

Record Camera's Unique Identifier: Insta 360

Camera Location - Data Sheet:

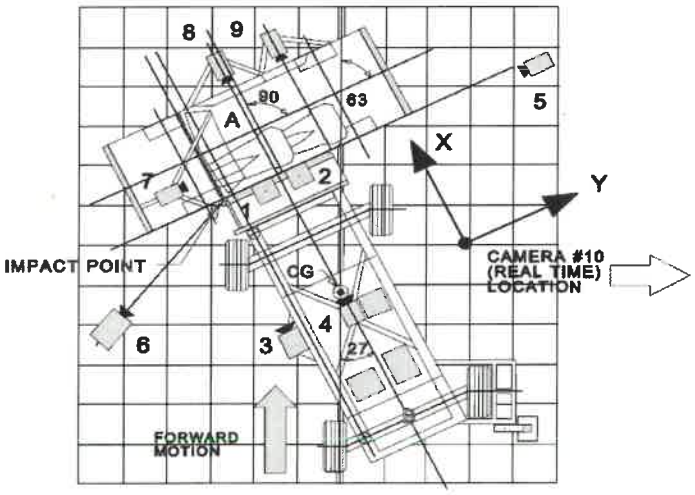
Performed by: MP Date: 6/26/23

Camera Locations:

No.	Camera View	Location X (mm)	Location Y (mm)	Location Z (mm)	Lens (mm)	Operating Frame Rate
1	Overhead Overall	0	-843	-9220	12.5	1000
2	Overhead Close-Up	0	0	-9220	25	1000
3	Impact Point Close-up (MDB)				25	1000
4	Centerline of Impact (MDB)				8	1000
5	Right Side View	443	7821	-1641	28	1000
6	Left Side View	-3514	-5853	-1563	24	1000
7	Front Seat Occupant – Frontal View (OB)				25	1000
8	Front Seat Occupant – Side View (OB)				12.5	1000
9	Rear Passenger – Side View (OB)				12.5	1000
10	Real Time Coverage				VAR.	30
	Measuring Device Unique Identifier:			Fluke 416 D		

*COORDINATES

Specifically, the X and Y coordinates shall reference the designated impact point on the target vehicle's struck side and the Z coordinate shall reference the ground (+X = forward of impact, +Y = right of impact, +Z = Down). The coordinate system shall be aligned with the test vehicle's struck side.



Camera Control Software

Performed by: MP Date: 6/26/23

Instructions: Verify the following software settings and functions are correct

Initial:

MP Appropriate software exposure settings (determined during exposure setup with overhead lights on)

MP Color balance and check corrections (performed during exposure setup with overhead lights on)

MP Pre and post-trigger recorded frames – minimum 10 pre-trigger, 300 post-trigger

MP Record mode is 'circular', trigger configuration is 'SWC'

MP Trigger checks are performed and all cameras trigger properly

MP Auto download is activated and set to download to correct file path on control PC

MP After all configuration settings are set, camera configuration is saved

MP Download to SD card on camera

Section
8

Test Set-up & Execution

Data Acquisition Software Setup:

Performed by: FINLEY Date: 6/27/23

Initial:

AF Verify signals from critical channels are operational and reasonable BEFORE installing ATD.

Yes	No	
✓		Verify firing of airbag(s) with customer, or monitoring and confirm timing pretensions.

✓ Load the Crash Test Plan.

✓ Verify Test Plan has been reviewed by process engineer and customer.

Process Engineer Approval: SP Date: 6/24/23

✓ Place copy of Test Plan after this page for reference.

✓ Verify dummies are attached to data acquisition boxes and are grounded.

✓ Verify crash link cables are installed.

✓ Verify communication cables are attached to the vehicle.

✓ Verify wireless box is communicating with DAU's

✓ Verify KT interface shows 30-36 volts at the vehicle.

Record Vehicle 1 Voltage 30 Record Vehicle 2 Voltage: –

✓ Verify KT data channels CAC's and polarities.

✓ Add the ES-2re, SID-IIs, Vehicle, and Mobile Deformable Barrier assemblies to the Signals tab.

✓ Verify vehicle is communicating with DAU's.

✓ Verify mobile deformable barrier is communicating with DAU's.

✓ Select Auto-ID from the Signals tab and verify there are no transducers identified.

✓ Perform electrical check on Signals tab and verify there are no errors.
Record Number of Channels: 72

✓ Perform electrical check on Samplers tab and verify there are no errors.

✓ Record Vehicle DAU Serial Numbers: 253

✓ Record Mobile Deformable Barrier DAU Serial Number:

✓ Perform electrical check on Triggers tab to test the trigger and verify there are no errors.

✓ Tie down umbilicals and verify adequate cable slack.

Pre-Test Photos & Video Prior to Seating:

Performed by:	AR / TB	Date:	6/27/23

Note: Clear and properly focused digital still photographs in .jpg format with a minimum dots-per-inch (DPI) of 180 shall be taken. A vehicle information placard placed parallel with the camera, identifying the test vehicle model as well as the barrier and NHTSA number, along with an indication of whether the photo was taken pre-test shall appear in each photograph and be legible. All photographs must be in landscape view / orientation. Glare or light from any illuminated or reflective surface shall be minimized while taking photographs. Reference sample photo set.

Initial: **Video of MDB:**

TB Overhead View of MDB

Initial: **Photos of Vehicle against Barrier:**

AR No. 15 – Pretest Overhead View of MDB Positioned Against Impact Side of Test Vehicle at Impact Location.

AR Move MDB back from vehicle and then take below photos and real time video.

Initial: **Photos of MDB:**

AR No. 7 – Pretest Frontal View of Impactor Face

AR No. 13 – Pretest Top View of Impactor Face

AR No. 9 – Pretest Left Side View of Impactor Face

AR No. 11 – Pretest Right Side View of Impactor Face

Initial: **Video of MDB**

TB Left side view of MDB

TB Right side view of MDB

TB Front view of MDB

Initial: **Vehicle Surrounds**

AR No. 1 – Pretest Frontal View of Test Vehicle

AR No. 5 – Pretest Impacted Side View of Test Vehicle

AR No. 3 – Pretest Rear View of Test Vehicle

Initial:

Move MDB to start position, attach tow and abort cables and check onboard abort.

Positioning ES-2re Male in Driver Position

Performed by: AR Date: 6/27/23

Initial:

AR 7. **Place the test dummy in the seat**

AR 7.1 Move the seat and seat back rearward as necessary to get the test dummy in the seat.

AR 7.2 Position the test dummy in the seat such that its plane of symmetry (i.e., mid-sagittal plane) is coincident with the longitudinal centerline marking on the seat cushion, seat back and head restraint.

AR 7.3 Bend the upper torso forward and then lay it back against the seat back. Push the shoulders of the dummy fully rearward.

AR 7.4 Remove the foam blocks from the pelvis flesh.

AR 7.5 Position the dummy so that it sits square and level in the seat.

AR 7.6 Repeat steps 1 thru 1.3 within "1st Row Seat Positioning – Setting Seats" to set the seat at the mid-fore aft position

AR 7.7 Maneuver the dummy's pelvis until the M3 hole on its back plate is within a circle with a radius of 10 mm round the H-point location (x,z) determined by the H-point machine.

AR 7.8 Position the pelvis of the dummy such that a horizontal (lateral) line passing through the dummy's hip pivot center is perpendicular to the longitudinal center plane of the seat.

AR 7.9 Measure the angle using the tilt angle sensor installed in the test dummy. Verify that the line through the dummy's hip pivot center is horizontal with a maximum inclination of ± 2°.

AR 7.10 Is the pelvis tilt angle within spec. ± 2°?

X Yes - Record the tilt angle and measure and record the X and Z location of the dummy's hip pivot center on the chart below;

Dummy hip pivot center location	
Tilt Angle	-0.5 °
X(fore/aft) of striker	~~201~~ 200 (mm)
Z(above/below) striker	~~225~~ 224(mm)

___ No, go back to step 7.2 and repeat steps to re-adjust the position of the test dummy.

___ Proper position cannot be achieved, contact COTR immediately.

AR 7.11.1 **Foot Placement - For test dummy placed in driver seating position**

AR 7.11.2 Without inducing pelvis or torso movement, place the right foot of the dummy on the un-pressed accelerator pedal with the heel resting as far forward as possible on the floor pan.

AR 7.11.3 Set the left foot perpendicular to the lower leg with the heel resting on the floor pan in the same lateral line as the right heel.

AR 7.11.4 If possible within these constraints, place the thighs of the dummy in contact with the seat cushion.

AR 7.12 **Arm Placement**
Place the dummy's upper arms such that the angle between the projection of the arm centerline on the mid-sagittal plane of the dummy and the torso reference line is 40°±5°.

AR 8. **Seatbelt Placement**
Place the seatbelt around the test dummy and fasten latch.

A Belt in Cabling / umbilical's

AR Affix targets, labeled appropriately (if applicable) to the front door or side panel to denote the hip pivot center of the test driver and rear passenger dummy. Use a 100 mm (4 inch) diameter target and label with "HP".

Positioning SID-IIs in Rear Left Position:

Performed by:	QP	Date:	6/27

Initial:

N/A 1. **Set the seat at rearmost fore/aft position, lowest height at mid-angle** — Fixed

N/A 1.1 Using the control that primarily moves the seat fore and aft, move the **SCRP** to the rearmost position. — Fixed

QP 1.2 If the seat or seat cushion height is adjustable, other than by the controls that primarily move the seat or seat cushion fore and aft, set the height of the **SCRP** to the lowest height, with the **SCRL** set as closely as possible to the mid-angle.

QP N/A The seat is not adjustable.

QP 1.3 Fully recline the seat back

QP *N/A* The seat back does not adjust.

QP **3. Place the test dummy in the seat**
Position the dummy in the seat such that the midsagittal plane is coincident with the longitudinal centerline markings on the seat cushion, seat back and head restraint. Place the dummy in the seat with the legs at an angle of 120° to the thighs. The calves should not be touching the seat cushion.

QP 4. Hold down the dummy's thighs and push rearward on the upper torso to maximize the pelvic angle.

QP 5. Set the angle between the legs and the thighs to 120°.

QP 6. Set the transverse distance between the centers of the front of the knees at 160 to 170 mm. (6.3 to 6.7 inches). Center the knee separation with respect to the longitudinal centerline markings of the seat cushion

QP Record Knee Separation 165

QP 7. Push rearward on the dummy's knees until the pelvis contacts the seat back, or the backs of the calves contact the seat cushion, whichever occurs first.

Pelvis contacted seat back.

QP Calves contacted seat cushion.

QP 8. Gently rock the upper torso ± 5° arc (approximately 51 mm (2 inches)) side-to-side three times.

QP 9. If needed, extend the legs until the feet do not contact the floor pan. The thighs should be resting on the seat cushion.

QP 10. With the feet perpendicular to the legs, place the heels on the floor pan. If a heel will not contact the floor pan, place it as close to the floor pan as possible.

QP 11. For vehicles without adjustable seat backs, adjust the lower neck bracket to level the head as much as possible. For vehicles with adjustable seat backs, while holding the thighs in place, rotate the seat back forward until the transverse instrumentation platform of the head is level to within ± 0.5°, making sure that the pelvis does not interfere with the seat bight.

QP 12. If it is not possible to orient the head level within ± 0.5° minimize the angle.

QP 13. Measure and set the dummy's pelvic angle using the pelvic angle gauge. The angle is set to 20.0 °± 2.5°. If this is not possible, adjust the pelvic angle as close to 20.0 ° as possible while keeping the transverse instrumentation platform of the head as level as possible.

14. Passenger foot positioning

N/A 14.1 Place the passenger's feet flat on the floor pan.

QP 14.2 If the either foot does not contact the floor pan, place the foot parallel to the floor and place the leg as perpendicular to the thigh as possible.

QP 15. **Passenger arm/hand positioning**
Place the rear dummy's upper arm such that the angle between the projection of the arm centerline on the midsagittal plane of the dummy and the thoracic spine centerline is 45°± 5°.

QP 16. **Seatbelt Placement**
Place the seatbelt around the test dummy and fasten latch.

QP Belt in cabling / umbilicals

Dummy Measurement:

Performed by: AR & QP Date: 6/27

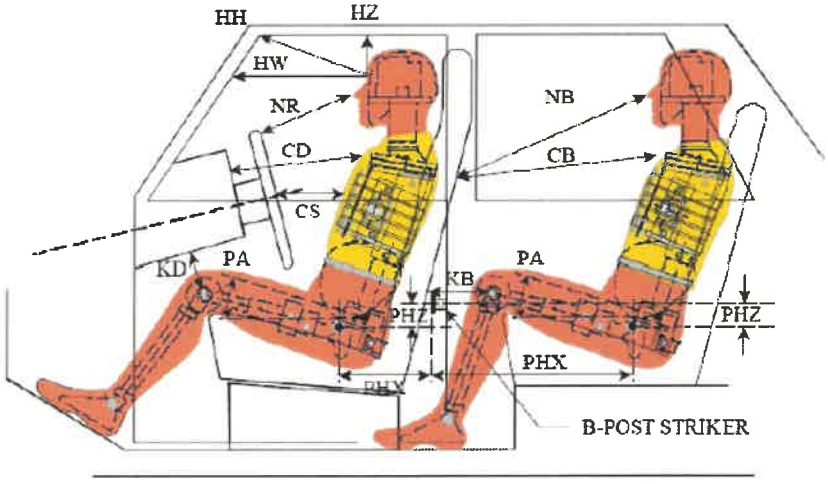
Initial:

AR Once the dummy is properly positioned, and the seat belt has been fastened over the dummy's chest, align a 150 mm (6-inch) segment of yellow/red checkerboard tape with the outboard edge of the shoulder belt portion of the seat belt such that it will be visible in Camera View No. 11.

AR Place a second 150 mm (6-inch) segment of yellow/red checkerboard tape on the dummy's chest such that it is aligned with the first segment that was placed along the outboard edge of the shoulder belt. The two checkerboard tape segments should be cut and positioned such that the colors for each square-inch section alternate on either side of the edge of the shoulder belt.

AR QP Record the final position of the dummy after it is seated in the test vehicle by taking the measurements indicated on the next page (accurate to ± 3 mm).

Tape Measure Unique Identifier: —



LEFT SIDE VIEW

HH HEAD TO HEADER – Measure the distance from the point where the dummy's nose meets his forehead (between the eyes) to the furthest point forward on the header.

HW HEAD TO WINDSHIELD – Measure the distance from the point where the dummy's nose meets his forehead (between the eyes) to a point on the windshield directly in front of it. Use a level or plumb-bob.

HZ HEAD TO ROOF LINER – Measure the distance from the point where the dummy's nose meets his forehead (between the eyes) to the point on the roof directly above it. Use a level or plumb-bob.

NR NOSE TO RIM – Measure the distance from the tip of the dummy's nose to the closest point on the top of the steering wheel rim.

CD CHEST TO DASHBOARD – Place a tape measure on the tip of the dummy's chin and rotate 125 mm of it downward toward the dummy to the point of contact on the transverse center of the dummy's chest. Mark this point with a 25 mm (1 inch) diameter target. Measure the distance from this point to the closest point on the dashboard either between the upper part of the steering wheel between the hub and the rim, or measure to the dashboard placing the tape measure above the rim, whichever is a shorter measurement.

CS CHEST TO STEERING WHEEL – Measure the distance from the center of the steering wheel hub to the dummy's chest. Use a level. Mark this location on the dummy's chest with a 25 mm (1 inch) diameter target.

KDL/KDR LEFT AND RIGHT KNEES TO DASHBOARD – Measure the distance from the center of the knee pivot bolt's outer surface to the closest point forward acquired by swinging the tape measure in continually larger arcs until it contacts the dashboard.

KDAL/KDAR KNEE TO DASHBOARD ANGLE – Using the line representing the length measurement of the knee to the dashboard above, measure the angle between that line and the horizontal.

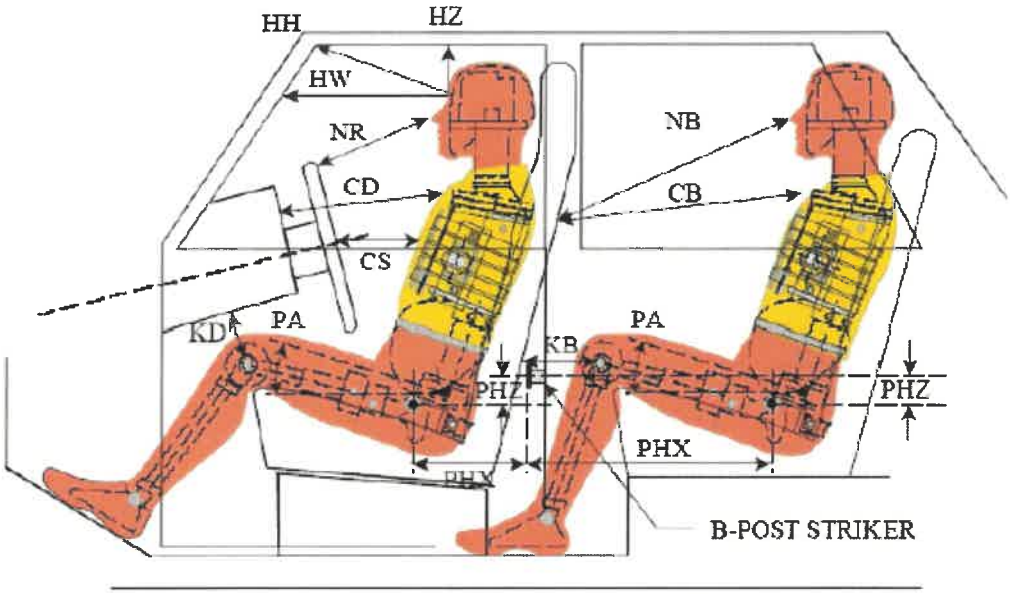
PAX PELVIC TILT ANGLE (X) – Measure by inserting the pelvic angle gauge into the Hip Point gauging hole (actual pivot center of the dummy's torso and thighs) on the dummy and taking this angle with respect to the horizontal. Alternatively, record the pelvic tilt angle X measured by tilt sensors installed in the test dummy.

PAY PELVIC TILT ANGLE (Y) – Measure by inserting the pelvic angle gauge into the Hip Point gauging hole (actual pivot center of the dummy's torso and thighs) on the dummy and taking this angle with respect to the vertical. Alternatively, record the pelvic tilt angle Y measured by tilt sensors installed in the test dummy.

PHX HIP POINT TO STRIKER (X) – Locate a point on the front door striker and project this point (with a level) vertically downward. Measure the distance horizontally from the pivot center of the dummy's torso and thigh to the point it intersects with the level.

PHZ HIP POINT TO STRIKER (Z) – Locate a point on the front door striker and project this point (preferably, with a level) horizontally toward the pivot center of the dummy's torso and thigh. Measure the distance vertically from the pivot center of the dummy's torso and thigh to the point it intersects with the level.

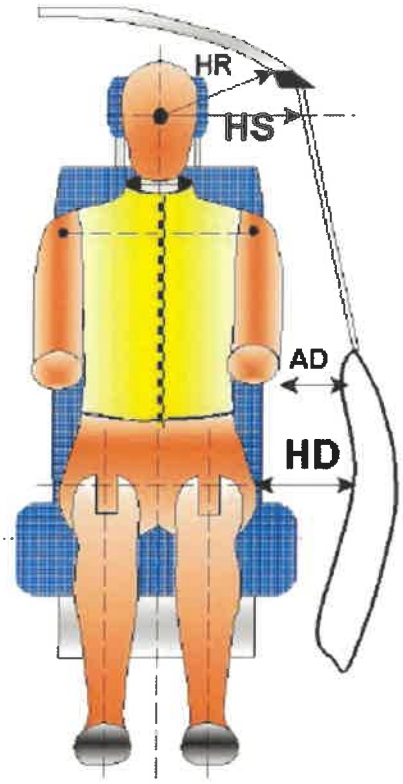
Note: The B-pillar striker will be used as the reference point for PHX & PHZ measurements.



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

Code	Measurement Description	ATD Driver Unique Identifier: D037		ATD Passenger Unique Identifier: 261	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
HH	Header to Header	373			
HW	Head to Windshield	608			
HZ	Head to Roof Liner	129		236	
NR	Nose to Rim / Seatback	430		612	
CD	Chest to Dashboard / Seatback	580		606	
CS	Chest to Steering Wheel	360			
KDL/KDAL°	Left Knee to Dash / Seatback	199	37.4°	317	11.7°
KDR/KDAR°	Right Knee to Dash / Seatback	126	60.5°	314	16.3°
PAX°	Pelvic Tilt Angle (X-axis)		25.0°		0.1°
PAY°	Pelvic Tilt Angle (Y-Axis)				25.5°
PHX	Hip Point to Striker (X-Axis)	200		336	
PHZ	Hip Point to Striker (Z-axis)	224		370	



Code	Measurement Location	Units	Driver	Rear Passenger
HR	Head to Side Header	mm	160	175
HS	Head to Side Window	mm	335	363
AD	Arm to Door	mm	85	136
HD	Hip Point to Door	mm	183	187

HR HEAD TO SIDE HEADER – Measure the shortest distance from the point where the dummy's nose meets his forehead (between the eyes) to the side edge of the header just above the window frame, directly adjacent to the dummy.

HS HEAD TO SIDE WINDOW – Measure the distance horizontally from the point where the dummy's nose meets his forehead (between the eyes) to the outside of the side window. In order to take this measurement, roll the window down to the exact height that allows a level measurement. Use a level.

AD ARM TO DOOR – Measure the distance from the center of the bottom of the outboard arm segment where it meets the driver or passenger dummy's torso to the closest point on the door.

HD HIP POINT TO DOOR – Project a point horizontally from the pivot center of the dummy's torso and thigh, outward to the edge of the pelvis plug. Measure the distance horizontally from this point to the closest point on the door panel. Use a level.

Inch Tape, Cables & Chalking:

Performed by: QP&AR&AF Date: 6/27

Initial:

AR Check cable routing. Take precaution to ensure that cable bundle is routed over the front seat armrest/console such that it allows sufficient slack and does not preclude or restrict dummy movement during impact. Duct tape may be used to secure the cable bundle to the front seat armrest/console to prevent cable damage, and to permanently set the necessary amount of slack.

AF Belt in cabling / umbilical's.

AF Zip tie down cabling in trunk.

AR&QR Place inch tape on the dummy chest and shoulder belt in order to show the belt pretensioner deploy during the impact event.

AR&QR Chalk ATD(s)

Parts of the anthropomorphic testing devices shall be coated with colored chalk/water solutions to show contact points with the vehicle's interior, with their own components (such as head to knee contact), and with each other. The chalk/water solution shall be applied after final dummy positioning.

Note: Face chalk should extend below the chin.

Dummy Part	Driver
Face (Do not paint sides)	Blue
Top of Head (Stop painting at skull cap)	Yellow
Outer Side of Head	Green
Back of Head (skull cap)	Red
Outer Shoulder	Orange
Outer Hip	Red



Dummy Part	Color
Face	
Top of Head	
Side of Head	
Back of Head	
Shoulder	
Hip	

Attitude - As Tested Condition:

Performed by: QP Date: 6/27

Initial:

QP With the vehicle in the "As Tested" weight condition, place it on a flat, level surface.

Note: If the vehicle has an Auto-Leveling, the ignition must be set to the "on" position. If the vehicle is equipped with a self-adjusting hydraulic system, contact the COTR for further guidance on attitude measurements.

QP Verify that the "As Tested" vehicle attitude measurements are equal to or between the "As Delivered" and "Fully Loaded" vehicle attitude measurements. If any "As Tested" attitude measurements do not meet this requirement, adjust the load by shifting ballast, instrumentation, and/or cameras. If, after repeating these steps, any of the "As Tested" attitude measurements do not meet the requirement, contact the Technical Director.

Note: The "As Tested" vehicle attitude measurements **shall be taken within an hour of impact** to ensure the proper attitude is met.

Test Vehicle Attitudes and CG	Units	Fully Loaded	As Tested	Meets Requirements *** Yes	No
Left Front	mm	761	759	X	
Right Front	mm	774	768	X	
Right Rear	mm	765	760	X	
Left Rear	mm	745	751	X	
Vehicle CG (Aft of Front Axle)	mm	1147			
Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline)	mm	-33			

*** The "As Tested" vehicle attitude measurements must be equal to or within +/- 10 mm of the "Fully Loaded" vehicle attitude measurements at each wheel well.

Pre-Test Photos:

Performed by: AR Date: 6/27/23

Note: Clear and properly focused digital still photographs in .jpg format with a minimum dots-per-inch (DPI) of 180 shall be taken. A vehicle information placard placed parallel with the camera, identifying the test vehicle model as well as the barrier and NHTSA number, along with an indication of whether the photo was taken pre-test shall appear in each photograph and be legible. All photographs must be in landscape view / orientation. Glare or light from any illuminated or reflective surface shall be minimized while taking photographs. Reference sample photo set!

Initial:	Photos With Driver Positioned in Vehicle
AR	No. 17 – Pretest Front SID in Final Seating Position (Door Open)
AR	No. 18 – Pretest Front SID in Final Seating Position (Door Closed)
AR	No. 19 – Pretest Front SID – Opposite Side View
AR	No. *21 – Pretest Rear SID in Final Seating Position (Door Open)
AR	No. 22. – Pretest Rear SID in Final Seating Position (Door Closed)
AR	No. 23. – Pretest Rear SID – Opposite Side View

* - Applies to vehicles with 4 or more side doors

Pre-Test Video:

Performed by: TB Date: 6/27/2023

A real-time camera (24-30 fps) shall be used to document the pre-test and post-test condition of the test vehicle in addition to the pre-test and post-test positions of the test dummies, including, but not limited to, the placement of the lap and shoulder belts. Particular attention must be exercised to fully document the proper closing of all vehicle doors, including any rear hatchback or tailgate.

Initial:	**Videos of Vehicle**
TB	Impact side view of vehicle
TB	Rear view of vehicle
TB	Non-impact side view of vehicle
TB	Front view of vehicle
TB	View of gas cap being attached to filler pipe

Initial:	**Videos of Dummy Position** (including, placement of lap and shoulder belt on the dummy)
TB	Side View of ES-2re in front seat (struck-side door open)
TB	Side view of SID-IIs in rear seat (struck-side door open)
TB	Side view of ES-2re in front seat (doors closed)
TB	Side view of SID-IIs in rear seat (doors closed)

Review Post-Test Assignments with Staff:

Performed by: QP Date: 6/27

Initial:

QP Review with the Staff their post-impact order of events and assignments.

While the Test Engineer is taking post-test photos, the following personnel need to be completing the following tasks. During this time, please make sure customers are staying in the observation room and that each one of you stay clear in order not to be photographed. Furthermore, no instrumentation or equipment shall be removed from the test vehicle at this time. Assignments are as follows:

- Camera Personnel – Need to be downloading high speed video and verifying that acceptable video was captured by all cameras.
- Data Personnel – Need to download all instrumentation data and identify questionable and lost channels.
- Facility Personnel – Need to have equipment in hand to capture any Stoddard leaks.

Once the Test Engineer has informed the Staff that post-test photos have been taken. Assignments are as follows:

- Camera Personnel – Check and document any type of equipment damage. If video was lost or is of poor quality, inspect equipment and identify root cause. Please document all findings.
- Data Personnel – For any questionable and lost channels, inspect cabling and instrumentation to identify root cause. Please document findings.
- Facility Personnel – Clean up impact area.

Verify Vehicle & Set-Up / Go / No-Go:

Performed by: QR & AR Date: 6/27

Initial:

- QR Perform FMVSS 305 High Voltage Isolation Check
- QR Review workbook for completeness
- QR Remove head level from ATD
- QR Verify plumb bobs have been removed from vehicle
- QR Verify Non-struck side airbags have been disabled
- N/A Seat Belt Guides – Usage of seat belt guides should be in accords with instructions included in the vehicle owner's manual or in Form No. 1.
- N/A Adjustable Armrests – Place any adjustable armrest in the retracted position.
- N/A Accelerator Pedal – If the vehicle has an adjustable accelerator pedal, adjust it to the full forward position.
- QR Doors – Place all doors (including a hatchback or tailgate) in the fully closed and latched position. Check instrument panel telltales just prior to the test to ensure that all doors and hatches are closed. ***In all instances, all side doors should be unlocked pre-test.***
- QR Door Locks – Verify that the locks on *all side doors* are unlocked.
- N/A Floor Mats - If the vehicle is equipped with optional all-weather (rubber) floor mats, remove them from prior to test. If the vehicle is equipped with carpeted floor mats, or if all-weather floor mats are standard equipment, place them in their proper locations prior to test.
- QR Windows - Verify that the driver and passenger front windows are in the fully closed position. Verify that all other windows and vents in the fully closed position unless otherwise specified by the COTR.
- QR Transmission Engagement:
  1. Manual Transmission – Place manual transmissions in neutral.
  2. Automatic Transmission – Place automatic transmissions in neutral.
- QR Parking Brake Engagement – Engage the parking brake.
- QR Verify speed traps are reset. (Primary and Secondary)
- QR Confirm fuel collectors are ready at the barrier.
- N/A Escort customer to Observation Room – explain to them that they need to stay in the Observation Room until the Test Engineer comes to get them (at minimum, until after the post-test photos have been taken).

QP Verify tow skate attached to tow hooks (visual inspection).

QP Disconnect battery charger. Verify vehicle battery power is sufficient without charger on (wait 1 minute then should have at least 12.75 volts and stable).

TB Turn real time cameras on.

TB Verify cameras are Armed and ready.

QP Ignition Switch –
Place the key in the ignition and switch it to the "ON" position and have SRS light observed by visitor. Check to ensure that the "Airbag Readiness Indicator" shows the airbag system as being functional. If it is a PUSH start vehicle, test must be conducted in 5 min from "Key on".

QP If there is any delay over 5 minutes, verify SRS light is still OK.

QP Verify tow operator has completed their checklist.

QP Verify impact speed.

Initial:

✓ Trigger Check

✓ Abort Check.

✓ Speed Trap Check

✓ Verify Speed Trap Location

✓ Safety Check

✓ Reviewed all sections of this binder for completeness.

✓ Facility Ready for Test

X **READY** for test Date: 6/27

○ **NOT READY** to be tested

○ Corrections made now **READY** for test Date:

○ **NOT READY** for test

OEM Inspection of Set-up:

Performed by: N/A Date: 6/27

Initial:

N/A Setup real time cameras on both sides of vehicle [Lens must be pointed toward ATD].

Turn on cameras and start recording.

Get OEM and notify them that they have 35 minutes to inspect dummy positioning.

✓ Escort OEM to conference room immediately after dummy positioning inspection.

Tow System & DAS Checklist:

Tow Engineer's Name:	SP	Today's Date:	6/27
DAS Engineer's Name:	AF	Today's Date:	6/27

Reference VERF Drive Operation Steps:

Please place copy of associated documentation following this page.

Reference VERF DAS Operation Steps:

Please place copy of associated documentation following this page.

Note Speed Requirement: 52.9 kph ± 0.8 kph

Impact Speed:

Performed by: QP Date: 6/27

Initial:

QP Perform FMVSS 305 High Voltage Isolation Check

QP Remind the DAS operator to look over the Quick Look to determine whether data is near its limits or not. If yes, the operator should look at the traces (i.e. spike or wave form). If a redundant exists, the redundant data should be reviewed to determine whether its traces are the same or different. If it is determined that something is not right with the primary, the operator should use the redundant in the Quick Look and to include a note in the comments section that the redundant was used.

QP Immediately after impact, record the time of impact in the space provided below.

AR Photograph speed trap read-out and record values in the space provided below.

Time of Impact:

11:32

Vehicle Speed Trap Readout (Primary):

52.87 kph Primary

52.87 kph Redundant

Trap Location (from barrier) closest mm

Speed Trap Unique Identifier: 400A52

Vehicle Speed Trap Readout (Secondary):

53.10 kph Primary

53.09 kph Redundant

Trap Location (from barrier) Furthest mm

Speed Trap Unique Identifier: 400643

Impact Location:

Performed by: QP Date: 6/27

Initial:

QP With the vehicle in the "As Tested" weight condition, place it on a flat, level surface.

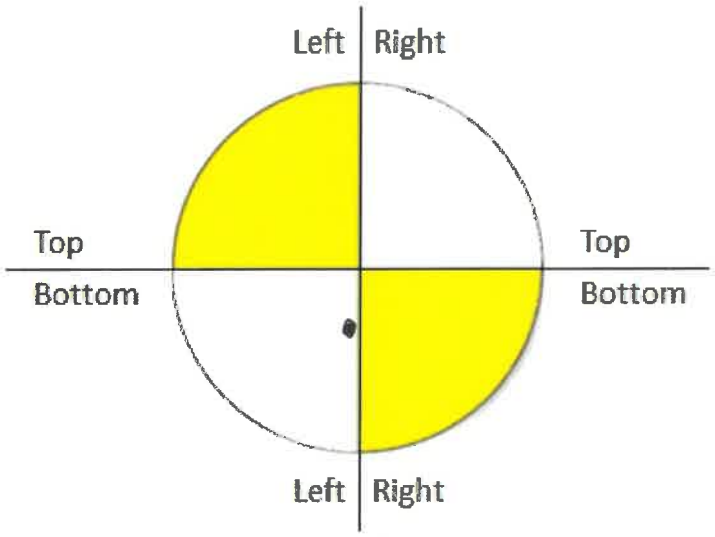
Impact Location: VHP 435

~~438~~ ~~439~~ mm Actual impact point (aft of front axle)

2 mm to Right / Left (Circle One) – must be within ± 50 mm (+ Forward / - Rearward)

-10 mm Up / Down (Circle One) – must be within ± 20 mm (+ Up / - Down)

Looking at the impacted target, draw / indicate the location of the impact on this illustration:



+/- 50 mm Horizontal ("+" = Forward, "–" = Rearward)
+/- 20 mm Vertical ("+" = Down, "–" = Up)

Post-Test Observations – Vehicle As Is

Performed by: QP Date: 6/27

Instructions: Please completely fill in the below tables. If unsure, take additional photographs and please include any observations. Be as descriptive as possible.

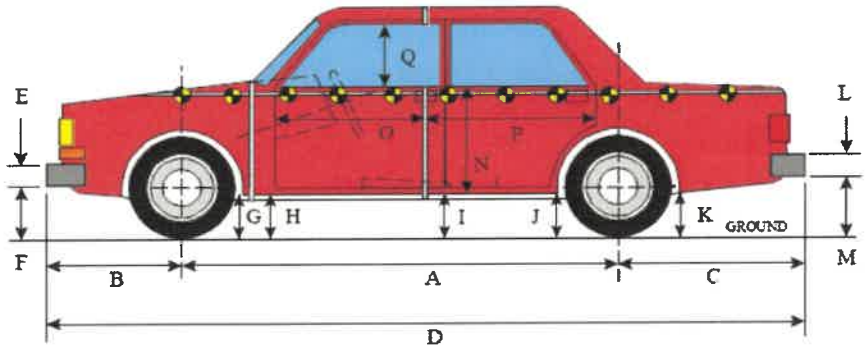
Dummy Contact Location	Driver	Rear Passenger
Face Contact	Curtain AB + Side header	None
Top of Head Contact	Side Header	Curtain AB + Side header
Left Side of Head Contact	Curtain + Side Header	Curtain AB
Back of Head Contact	Curtain AB + Side header	Headrest, Curtain AB Center Headrest
Left Shoulder Contact	Curtain AB, Torso/Pelvis AB B-Pillar	Curtain AB, Torso/Pelvis AB Seatback
Upper Torso Contact	Seatback + Torso/pelvis AB	Seatback + Torso/pelvis AB
Lower Torso Contact	Seatback + Torso/pelvis AB	Seatback + Torso/pelvis AB
Left Knee Contact	Door Trim	Door Trim
Left Hip Contact	seat pan + Torso/pelvis AB	Torso/pelvis AB

Supplemental Restraint System	Struck Side Driver		Non-Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal airbag	Yes	NO		
Knee airbag	NO	N/A		
Side airbag 1 – Curtain Airbag	Yes	Yes	Yes	Yes
Side airbag 2 – Torso Airbag	NO	N/A	NO	N/A
Side airbag 3 – Torso / Pelvis Airbag	Yes	Yes	Yes	Yes
Seat belt pretensioner	Yes	Yes	Yes	Yes
Seat belt load limiter	Yes	Yes	Yes	Yes
Other – Seat Cushion Airbag	N/A	N/A	N/A	N/A

Post-Test Hand Measurements

Performed by: GP Date: 6/27

Note: All measurements must be taken in the As Tested Condition (Fully loaded with instrumentation & ATD)



Initial:

GP	Hand measure	E	Front Bumper Thickness - *(The vertical height of the front bumper fascia)*	160 mm
GP	Hand measure	F	Front Bumper Bottom to Ground - *(Vertical distance from ground to the bottom of the front bumper fascia)*	414 mm
GP	Hand measure	G	Sill Height at Front Wheel Well - *(Vertical distance from ground to the sill at the front wheel well opening)*	163 mm
GP	Hand measure	H	Sill Height at Front Door Leading Edge -*(Vertical distance from ground to the sill at the front door seam)*	166 mm
GP	Hand measure	I	Sill Height at B-Pillar - *(Vertical distance from ground to the sill in line with the front door striker or B-pillar if no striker exists)*	182 mm
GP	Hand measure	J1	Sill Height at Rear Wheel Well - *(Vertical distance from ground to the sill at the rear wheel well opening)*	173 mm
GP	Hand measure	J2	Pinch Weld Height at Rear Wheel Well - *(Vertical distance from ground to the pinch weld at the rear wheel well opening)*	179 mm
GP	Hand measure	K	Sill Height Aft of Rear Wheel Well - *(Vertical distance from ground to the vehicle sheet body at the rear of the rear tire's wheel well)*	380 mm
GP	Hand measure	L	Thickness or height of rear bumper at center.	195 mm
GP	Hand measure	M	Distance from bottom of bumper to ground at center.	406 mm

Tape Measure Unique Identifier Used to conduct measurements —

Post-Test Photos – Vehicle As Is:

Performed by: AR Date: 6/27/23

Note: Clear and properly focused digital still photographs in .jpg format with a minimum dots-per-inch (DPI) of 180 shall be taken. A vehicle information placard placed parallel with the camera, identifying the test vehicle model as well as the MDB and NHTSA number, along with an indication of whether the photo was taken post-test shall appear in each photograph and be legible. All photographs must be in landscape view / orientation. Glare or light from any illuminated or reflective surface shall be minimized while taking photographs.

Initial:	Vehicle
AR	No. 2 – Post test Frontal View of Test Vehicle
AR	No. 6 – Post test Impacted Side View of Test Vehicle
AR	No. 4 – Post test Rear View of Test Vehicle
AR	No. 16 – Post test Overhead View of the MDB and Test Vehicle
TB	No. 25 – Post-Test T(0) – Impact Event
AR	No. 26 – Post test Close-up View of Impact Point Target

Initial:	Photos of MDB
AR	No. 8 – Post test Frontal View of Impactor Face
AR	No. 14 – Post test Top View of Impactor Face
AR	No. 10 – Post test Left Side View of Impactor Face
AR	No. 12 – Post test Right Side View of Impactor Face

Initial:	With Dummy's Positioned in Vehicle
AR	No. 20 – Post test Front SID – Opposite Side View
AR	No. 24 – Post test Rear SID – Opposite Side View

Post-Test Video:

Performed by: MP Date: 6/27/23

A real-time camera (24-30 fps) shall be used to document the pre-test and post-test condition of the test vehicle in addition to the pre-test and post-test positions of the test dummies, including, but not limited to, the placement of the lap and shoulder belts. Particular attention must be exercised to fully document the proper closing of all vehicle doors, including any rear hatchback or tailgate.

Initial:	MDB
MP	View of MDB and vehicle – front of vehicle
MP	View of MDB and vehicle – rear of vehicle
MP	View of MDB and vehicle – ¼ front
MP	View of MDB and vehicle – ¼ rear
MP	View of MDB and vehicle – parallel to impact door

Initial:	Vehicle
MP	View of impact point – close-up
MP	View of impacted side (vehicle removed)
MP	View of front of car
MP	View of rear of car
TB	View of inside front door (dummy removed)
TB	View of inside rear door (dummy removed)
N/A	Any other vehicle anomalies if applicable

Initial:	Test Dummies
MP	View of front ES-2re – parallel to impact door
MP	View of rear SID-IIs – parallel to impact door
MP	View of front ES-2re – thru opposite window
MP	View of rear SID-IIs – thru opposite window

Post-Test Photos:

Performed by: AR Date: 6/27/23

Note: Clear and properly focused digital still photographs in .jpg format with a minimum dots-per-inch (DPI) of 180 shall be taken. A vehicle information placard placed parallel with the camera, identifying the test vehicle model as well as the barrier and NHTSA number, along with an indication of whether the photo was taken pre-test shall appear in each photograph and be legible. All photographs must be in landscape view / orientation. Glare or light from any illuminated or reflective surface shall be minimized while taking photographs. Reference sample photo set!

Initial: **Photos With Dummy's Not in Vehicle**

AR No. 28 – Post test Front Seat Occupant Area showing head and torso contact regions (Test dummy removed)

AR No. 29 – Post test Rear Seat Occupant Area showing head and torso contact regions (Test dummy removed)

Post-Test Observations – Doors Open:

Performed by: QP Date: 6/27

Instructions: Please completely fill in the below tables. If unsure, take additional photographs and please include any observations and be descriptive as possible.

Doors
For each door, note whether: the door remained closed and operational, whether the door totally separated from the vehicle at the hinges or latches, the door disengaged from the latched position, the latch separated from the striker, the hinge components separated from each other, the latch or hinge systems pulled out of their anchorages, or the door was jammed shut. All applicable conditions should be noted. Video analysis should also be used to verify whether any door, including the rear hatch, opened during the impact event.

Initial:

QP Inspect the door at the striker, if the door is open at the striker post, take measurements of the door opening at the location and record it in the space provided below.

QP If there is a failure with any door, door component, or door opening, notify the Data Processing Engineer to include such information on the Quick Look Report.

Instructions: For the next two tables, indicate "Yes", "No" or "N/A"

Post Test Door Performance	Struck Side		Non-Struck Side		Rear Hatch / Other Door
	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
Latch separated from striker	No	No	No	No	No
Jammed shut	Yes	Yes	No	No	No
If door opened at striker, record width of opening at striker (mm)	N/A	N/A	N/A	N/A	N/A

Seat Movement and Structural Observations

In the space provided below, note any seat or seat back movement or disengagement. Also, note any structural observations pertaining to the pillars, sill, window, and windshield. In particular, describe the amount of deformation to the struck-side pillars and struck side sill. Note whether there was damage to the front windshield area and if so, where the damage occurred. A similar assessment should be made for the side windows. Any other notable effects from the impact should also be indicated.

Instructions: For the next two tables, indicate "Yes", "No" or "N/A"

Post Test Seat Performance	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	Observations and Conclusions
Pillar performance	B & C Pillar Buckled
Sill separation	None
Windshield damage	None
Side window damage	Driver shattered & fellout / Rear Pass. None
Other notable effects	None

Post-Test Data Checklist:

Performed by: QP Date: 6/27

Initial:

QP Confirm video has been downloaded.

QP Confirm data has been downloaded.

QP Download ATD / vehicle temperature data.

QP Read and review Questionable Data Channel list.

PAS Remind staff not to remove equipment from vehicle until questionable channel list / questionable channels have been inspected.

Inspect questionable instrumentation/cabling before removal from vehicle, take photos, and document damage.

Tag damaged equipment and remove from service.

Authorize equipment to be removed.

Critical Results:

Performed by: QP Date: 6/27

The following deliverables were met:

QP Impact speed within 52.9 km/h ± 0.8 km/h (32.9 mph ± 0.5 mph).

QP Impact angle within 27˚ ± 1˚

QP Impact point within ± 50 mm (Horizontal offset from the vertical impact line)

Driver ATD (ES-2re) Dummy Injury Data:

QP Head – Head Injury Criterion (HIC) (36) may not exceed 1000.

QP Maximum Thoracic Rib Deflection – The sum of thoracic rib deflection may not exceed 44 mm.

QP Total Abdominal Force – The sum of abdominal forces may not exceed 2,500 N (562 lbf.).

QP Pubic Symphysis Force – The sum of pubic symphysis forces may not exceed 6,000 N (1349 lbf.).

QP Notify customer if injury criteria limit is exceeded.

(Reference Table)

ES-2re Injury Criteria	Max. Allowable IARV
	Units
HIC	1000
Upper Rib Deflection (mm)	
Mid. Rib Deflection (mm)	44 mm
Lower Rib Deflection (mm)	
Abdominal Load (front) (N)	
Abdominal Load (mid) (N)	
Abdominal Load (rear) (N)	
Sum of Abdominal Forces (N)	2.5 kN
Pubic Symphysis (N)	6 kN

Passenger ATD (SID-IIs) Dummy Injury Data:

Head – Head Injury Criterion (HIC) (36) may not exceed 1000.

Lower Spine – The resultant spine acceleration may not exceed 82 g.

Pelvis – The sum of the acetabular and iliac pelvic forces may not exceed 5,525 N (1,242 lbf.).

Notify customer if injury criteria limit is exceeded.

(Reference Table)

SIDIIs Injury Criteria	Max. Allowable IARV
HIC	1000
Max. Spine Acceleration (g)	82
Acetabular (N)	
Iliac (N)	
Sum of Acetabular and Iliac (N)	5525

** Proposed IARV*

Door Opening Criteria:

N/A Any side door that is struck by the mdb shall not separate totally from the vehicle.

N/A Any door (including a rear hatchback or tailgate) that is not struck by the MDB must meet the following requirements:

- The door shall not disengage from the latched position.
- The latch shall not separate from the striker, and the hinge components shall not separate from each other or from their attachment to the vehicle.
- Neither the latch nor the hinge systems of the door shall pull out of their anchorages.

Notify Customer – Test Executed:

Performed by:	QP	Date:	6/27

Informed COTR that test was conducted:

Initial:			
	Via e-mail	Date:	6/27
	Via voice mail message		
X	Via live conversation		

TOM Comments:

N/A

Conversions:

SI* (MODERN METRIC) CONVERSION FACTORS				
Table of APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME	Note: Volumes greater than 1000 L shall be shown in m^3	
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE	Temperature is in exact degrees	
°F	Fahrenheit	5 × (F-32) ÷ 9 or (F-32) ÷ 1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		Force and Pressure or Stress		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

Revision History:

Revision Level:	Revision Date:	Comments:
R00	7/7/2017	Initial Issue as Work Instruction Test Template.
R01	11/21/2019	Complete Rewrite.
R02	11/11/2022	Relocated various sections and procedures to better align with work flow. • Added to Quality System, Security provisions added • Removed duplicate and not applicable steps/procedures • Increased details within various steps & procedures to improve clarity

Approved:

Ed Dutton

Edward Dutton, Crash Operations Manager Date: 11/26/19

FMVSS 305 Static Rollover:

Technician's Name: QR Date: 6/27

Checklist

QP Remove test dummies and de-power systems. Note: Test should occur 30 minutes after impact. If there is an indication of a test failure the Rollover will **NOT** be conducted.

QP Keep the test vehicle under constant observation for Stoddard or leakage during the transition between impact and static rollover tests.

N/A Note: If any of the following occurs, contact the Technical Expert for direction:

- There is an indication of a test anomaly or door opening;
- The vehicle exceeds any of the injury criteria stipulated by FMVSS No. 214 during the
- side impact pole test;
- The vehicle exceeds maximum allowable solvent/electrolytes requirements in accords with FMVSS No. 301/305 post-impact;

DB To avoid damage to the underbody of the test vehicle when moving the vehicle to the static rollover device, ensure that the forklift is only permitted to make contact with the body sills of the vehicle. Accordingly, it may be necessary to place a stabilizer block made of rubber, wood, or polypropylene between the body sills and the forks of the forklift. This is particularly important for electric vehicles in order to avoid electric shock.

DB Carefully secure the test vehicle on the static rollover device so as not to cause any damage to fuel system components or fuel lines.

QP Note: The test vehicle should be rotated on the Static Rollover Device to each successive increment of 90° through 360° at a uniform rate, with a full 90° of rotation taking place in any time interval from 1 to 3 minutes. After reaching each 90° increment the vehicle is held in that position for 5 minutes.

Open 305 Isolation excel sheet to document all measurements and monitor that vehicle remains safe on the roll over fixture.

TB Take real time video, View of static rollover – 0 degrees

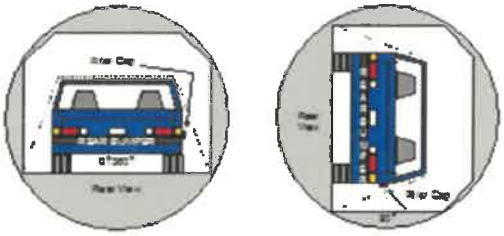
TB Take photograph, FMVSS No. 301 Static Rollover 0 Degrees. Reference sample photo set!

Checklist

QP Begin rotating the vehicle clockwise for the first 90° increment. Record the time rotation start and stop times in the space provided below.

Solvent Collection Time Table

Increment	Rotation Start HR:MIN:SEC	Rotation Stop HR:MIN:SEC	Rotation Time (Seconds)
0° to 90°	1:50:24	1:51:34	71



0° TO 90°

Checklist

QP Hold the vehicle in this position for 5 minutes after rotation ends.

TB Take real time video, View of static rollover – 90 degrees

TB Take photograph – FMVSS No. 301 Static Rollover 90 Degrees. Reference sample photo set !

QP Record Isolation Measurements in the table at the end of this section.

N/A Collect Stoddard solvent spillage, if any, from the onset of rotation or the time rotation began up to 5 minutes thereafter and record in the table provided below. Note: If there is an indication of a test failure during any 90° increment of the rollover test, Immediately contact the Technical Expert for further instruction.

Spillage & Location

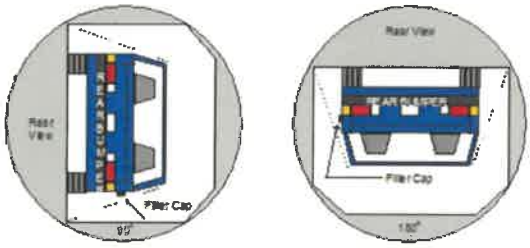
Test Phase	First 5 Minutes	Spillage Location
0° to 90°	0	None

Checklist

QP Begin rotating the vehicle clockwise to the 180° increment. Record the time rotation begins in the space provided below.

Solvent Collection Time Table

Increment	Rotation Start HR:MIN:SEC	Rotation Stop HR:MIN:SEC	Rotation Time (Seconds)
90° to 180°	158:35	1:59:39	64



90° TO 180°

Checklist

N/A Change collection containers. Record any spillage that occurs during the 6th minute after the onset of rotation or when rotation began and record in the table provided below.

N/A If required, change collection containers. Record any spillage that occurs during the 7th minute after the onset of rotation or when rotation began and record in the table provided below.

N/A If required, change collection containers. Record any spillage that occurs during the 8th minute after the onset of rotation or when rotation began and record in the table provided below.

FMVSS 301 Spillage Table

Test Phase	Sixth Minute	Seventh Minute	Eighth Minute
90° to 180°	0	0	–

Checklist

QP Record the time rotation ends in the space provided above.

QP Hold the vehicle in this position for 5 minutes after rotation ends.

TB Take real time video, View of static rollover – 180 degrees

TB Take photograph - FMVSS No. 301 Static Rollover 180 Degrees. Reference sample photo set!

QP Record Isolation Measurements into isolation excel sheet to verify vehicle safety

QP Collect Stoddard solvent spillage, if any, from the onset of rotation or the time rotation began up to 5 minutes thereafter. Note: If there is an indication of a test failure during any 90° increment of the rollover test, Immediately contact the Technical Expert for further instruction.

Spillage & Location

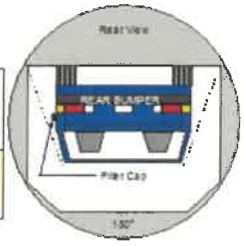
Test Phase	First 5 Minutes	Spillage Location
90° to 180°	0	None

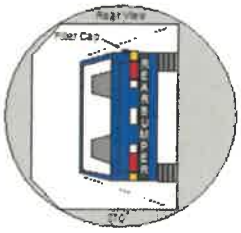
Checklist

Begin rotating the vehicle clock wise to the 270° increment. Record the time rotation begins in the space provided below.

Solvent Collection Time Table

Increment	Rotation Start HR:MIN:SEC	Rotation Stop HR:MIN:SEC	Rotation Time (Seconds)
180° to 270°	2:06:15	2:07:21	66





180° TO 270°

Checklist

N/A Change collection containers. Record any spillage that occurs during the 6th minute after the onset of rotation or when rotation began and record in the table provided below.

N/A If required, change collection containers. Record any spillage that occurs during the 7th minute after the onset of rotation or when rotation began and record in the table provided below.

N/A If required, change collection containers. Record any spillage that occurs during the 8th minute after the onset of rotation or when rotation began and record in the table provided below.

FMVSS 301 Spillage Table

Test Phase	Sixth Minute	Seventh Minute	Eighth Minute
180° to 270°	0	0	—

Checklist

Record the time rotation ends in the space provided above.

Hold the vehicle in this position for 5 minutes after rotation ends.

Take real time video, View of static rollover – 270 degrees

Take photograph – FMVSS No. 301 Static Rollover 270 Degrees. Reference sample photo set!

Record Isolation Measurements into isolation excel sheet to verify vehicle safety

N/A Collect Stoddard solvent spillage, if any, from the onset of rotation or the time rotation began up to 5 minutes thereafter. Note: If there is an indication of a test failure during any 90° increment of the rollover test, Immediately contact the Technical Expert for further instruction.

Spillage & Location

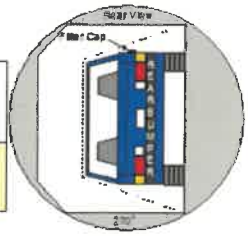
Test Phase	First 5 Minutes	Spillage Location
180° to 270°	0	None

Checklist

N/A Begin rotating the vehicle clock wise to the 360° increment. Record the time rotation begins in the space provided below.

Solvent Collection Time Table

Increment	Rotation Start HR:MIN:SEC	Rotation Stop HR:MIN:SEC	Rotation Time (Seconds)
270° to 360°	2:13:31	2:14:39	68





270° TO 360°

Checklist

N/A Change collection containers. Record any spillage that occurs during the 6th minute after the onset of rotation or when rotation began and record in the table provided below.

N/A If required, change collection containers. Record any spillage that occurs during the 7th minute after the onset of rotation or when rotation began and record in the table provided below.

N/A If required, change collection containers. Record any spillage that occurs during the 8th minute after the onset of rotation or when rotation began and record in the table provided below.

FMVSS 301 Spillage Table

Test Phase	Sixth Minute	Seventh Minute	Eighth Minute
270° to 360°	0	0	—

Checklist

QP Record the time rotation ends in the space provided above.

QP Hold the vehicle in this position for 5 minutes after rotation ends.

TB Take real time video, View of static rollover – 360 degrees.

TP Take photograph – FMVSS No. 301 Static Rollover 270 Degrees. Reference sample photo set!

QP Record Isolation Measurements into isolation excel sheet to verify vehicle safety

QP Collect Stoddard solvent spillage, if any, from the onset of rotation or the time rotation began up to 5 minutes thereafter. Note: If there is an indication of a test failure during any 90° increment of the rollover test, Immediately contact the Technical Expert for further instruction.

Spillage & Location

Test Phase	First 5 Minutes	Spillage Location
270° to 360°	0	None

Note: PASS OR FAIL CRITERIA - Stoddard solvent spillage, from the onset of rotational motion, shall not exceed a total of 142 grams for the first 5 minutes of testing at each successive 90° increment. For the re78maining testing period, at each increment of 90°, solvent spillage during any 1-minute interval shall not exceed 28 grams.

Conversions:

SI* (MODERN METRIC) CONVERSION FACTORS				
Table of APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME	Note: Volumes greater than 1000 L shall be shown in m^3	
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE	Temperature is in exact degrees	
°F	Fahrenheit	5 × (F-32) ÷ 9 or (F-32) ÷ 1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		Force and Pressure or Stress		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

Revision History:

Revision Level:	Revision Date	Comments:
R00	6/13/2007	Initial issued work instruction
R01	11/19/2008	Change approver from M. Kilgallon to J. Dunlop. Change document number from WI-VERF-305-0001 to WI-VERF-305-011 for better identification
R02	7/19/13	Updated work instruction with new format and to follow NHTSA 305 Procedure dated September 11, 2008.
R03	04/10/18	Added high voltage safety procedures
R04	1/14/21	Added Pre and Post Test Checklists and Customer Checklist, updated TSAX security signage

Approved: Ed Dutton Date: 1/14/21

Ed Dutton, Crash Operations Manager