REPORT NUMBER: R&D-KAR-20-011

VEHICLE TO RIGID BARRIER CRASH TEST IN SUPPORT OF NHTSA'S FRONTAL RESEARCH CRASH TEST PROGRAM LEFT SIDE 30° FRONTAL RIGID BARRIER IMPACT

MAZDA MOTOR CORPORATION

2020 MAZDA CX-5 AWD 5-DOOR MPV

NHTSA No: R20205416

PREPARED BY:

APPLUS IDIADA KARCO ENGINEERING, LLC.

9270 HOLLY ROAD

ADELANTO, CA 92301

JUNE 11, 2021

FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

VEHICLE SAFETY RESEARCH

1200 NEW JERSEY AVE, SE, ROOM W46-446

WASHINGTON, D.C. 20590

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Prepared By: _____

Mr. Neeraj N. Patel, Project Engineer
Applus IDIADA KARCO Engineering, LLC.

Reviewed By: _____

Mr. Steven D. Matsusaka, Engineering Manager
Applus IDIADA KARCO Engineering, LLC.

Approved By: _____

Mr. Michael L. Dunlap, Director of Operations
KARCO Engineering, LLC.

Approval Date: June 11, 2021

FINAL REPORT ACCEPTANCE BY VEHICLE SAFETY RESEARCH,
OFFICE OF STRUCTURAL AND RESTRAINTS RESEARCH DIVISION:

_____

TOM, Vehicle Crash Testing
NHTSA, Office of Structures and Restraints Research

Date: _____

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15. Supplementary Notes

16. Abstract

A 40.0 km/h Left Side 30° Frontal Rigid Barrier Impact Test was conducted on a 2020 Mazda CX-5 5-door MPV in accordance with Contract DTNH22-14-D-00360L, Task Order #693JJ918F000199. The test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at the Applus IDIADA KARCO Engineering, LLC. facility in Adelanto, California on May 21, 2021.

The impact velocity of the vehicle was 39.68 km/h and the ambient temperature at the test vehicle at the time of impact was 30.0°C. The vehicle's post-test maximum crush was 438 mm measured to left of the vehicle's centerline. The test vehicle's performance was as follows:

Measurement Description	Units	Driver THOR	Passenger Hybrid III
		Result	Result
Head Injury Criteria (HIC_{15})		93.0	87.8
Brain Injury Criteria (BrIC)		0.7	
Nij			0.7
Peak Neck Tension	N	1015.4	866.3
Peak Neck Compression	N	-2621.4	-3243.9
Peak Chest Deflection	mm	35.1	-5.8
Peak Abdomen Deflection	mm	-28.7	
Peak Resultant Acetabulum Force	N	2685.8	
Peak Femur Force	N	-4279.8	-4675.8
Peak Tibia Index		0.5	

17. Key Words	18. Distribution Statement
30° Frontal Rigid Barrier Impact Frontal Research Crash Test THOR Hybrid III	Copies of this report are available from: National Highway Traffic Safety Administration Technical Reference Division 1200 New Jersey Ave., SE Washington, D.C. 20590

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SECTION 1

TEST PURPOSE AND PROCEDURE

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

This 40.0 km/h (24.8 mph) Left Side 30° Frontal Rigid Barrier Impact Test is part of the Frontal Research Crash Test Program outlined in Contract No. DTNH22-14-D-00360L, Task Order #693JJ918F000199. The purpose of this test is to obtain vehicle crashworthiness and occupant restraint system performance data for research purposes.

This test was conducted in accordance with the instructions set forth for a 40.0 km/h Left Side 30° Frontal Rigid Barrier Impact, outlined in Contract No. DTNH22-14-D-00360L, Task Order #693JJ918F000199. Data indicant of Federal Motor Vehicle Safety Standard FMVSS 208 - Occupant Crash Protection, FMVSS 212 – Windshield Mounting, FMVSS 219 (partial) – Windshield Zone Intrusion, and FMVSS 301 – Fuel System Integrity was obtained, in addition to the data required by Contract No. DTNH22-14-D-00360L, Task Order #693JJ918F000199.

SECTION 2

SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

A 40.0 km/h Left Side 30° Frontal Rigid Barrier Impact Test was conducted on a 2020 Mazda CX-5 AWD 5-Door MPV. The test was performed at Applus IDIADA KARCO Engineering, LLC. on May 21, 2021.

The test was documented by one (1) real-time and eighteen (18) high-speed video cameras. Camera No. 16 failed during impact and did not record the test. Pre-and post-test photographs of the test vehicle and test setup were taken using a digital still camera. Photographic documentation of the test is presented in Appendix A of this report.

One (1) 50th percentile adult male THOR anthropomorphic test device (ATD) (Serial No. EG2595) was seated in the left front seating position (P1 – Driver) and one 50th percentile adult male Hybrid III ATD (Serial No. 168) was seated in the right front passenger seating position (P3 - Passenger). The driver was positioned according to instructions specified in the THOR 50th Percentile Male Dummy Seating & Positioning Procedures: Driver Position. The passenger was positioned according to instructions specified in FMVSS 208 Appendix F, Dummy Positioning Procedures for Driver and Passenger Test Dummy Conforming to Subpart E of Part 572.

Both ATD's are unbelted.

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416
Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

One hundred ninety (190) channels of data from the two (2) ATD's and the test vehicle were collected using Diversified Technical Systems, Inc. data acquisition systems. Appendix B contains dummy data plots, as well as vehicle response data plots.

The windshield was broken during impact but there was no separation recorded. There was no intrusion into the protected zone of the windshield during any portion of the impact event. The maximum static crush of the vehicle was 438 mm measured to the left of the vehicle's centerline.

All four vehicle doors remained closed and latched during the test. All doors remained operational after the impact event.

Structural observations include the following:

- The front end including the bumper, grill, and hood were crushed, with the damage concentrated on the left side
- The windshield was broken due to impact with the rigid barrier and contact with the driver ATD head.

The driver ATD's visible contact points were:

- Head contacted the frontal airbag, A-pillar trim, and windshield
- Torso contacted the frontal airbag
- Left leg contacted the knee bolster
- Right leg contacted the knee bolster

The right front passenger ATD's visible contact points were:

- Head contacted the frontal airbag, rear view mirror, and windshield
- Torso contacted the frontal airbag
- Left leg contacted the knee bolster
- Right leg contacted the knee bolster

SECTION 2 … (CONTINUED)

SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

PRIMARY IMPACT DATA

Measured Parameter	Units	Value
Vehicle Test Weight	kg	1772.5
Vehicle Maximum Static Crush	mm	438
Number of Data Channels		190
Number of Real-Time Cameras		1
Number of High-Speed Cameras		18

DUMMY CONTACTS

Description	Driver	Picture Ref.	Passenger	Picture Ref.
Dummy Type	THOR, S/N: EG2595		Hybrid III, S/N: 168	
Head Contact	Frontal airbag, A-pillar trim, and windshield	A-89, A-91a, A-91b	Frontal airbag, rear view mirror, and windshield	A-93, A-134
Upper Torso Contact	Frontal airbag	A-89	Frontal airbag	A-134
Lower Torso Contact	Frontal airbag	A-89	Frontal airbag	A-134
Left Leg Contact	Knee bolster	A-91c	Knee bolster	A-125
Right Leg Contact	Knee bolster	A-91c	Knee bolster	A-125

SECTION 2 … (CONTINUED)

SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

DATA ANOMALIES

Channel Description	Explanation
P1TH ACETABULUM RIGHT X FORCE	No data collected, Known channel failure
P2H3 HEAD AYR	Questionable data excursion From 133-150MS during head impact to windshield
P2H3 HEAD AZR	Questionable data excursion From 133-145MS during head impact to windshield

SECTION 2 … (CONTINUED)

SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

Driver, THOR S/N EG2595					
LOCATION	**DESCRIPTION**	**UNIT**	**SOURCE**	**MAX**	**MIN**
Head	HIC 15ms		Compute	93.0	
	Brain Injury Criteria (BrIC)		Compute	0.723	
	Head Rotational Velocity X	Deg/s	60	672.4	-255.1
	Head Rotational Velocity Y	Deg/s	60	555.4	-1730.1
	Head Rotational Velocity Z	Deg/s	60	607.5	-1111.8
Neck	Upper Neck Z-axis Force	N	1000	1015.4	-2621.4
	Upper Neck Y-axis Moment	Nm	600	0.6	-22.4
Chest	Upper Left Resultant Chest Deflection	mm	Compute	29.3	
	Upper Right Resultant Chest Deflection	mm	Compute	35.1	
	Lower Left Resultant Chest Deflection	mm	Compute	22.9	
	Lower Right Resultant Chest Deflection	mm	Compute	17.6	
Abdomen	Lower Left X-axis Deflection	mm	Compute	2.8	-28.7
	Lower Right X-axis Deflection	mm	Compute	2.8	-1.4
Acetabulum	Left Acetabulum Resultant Force	N	Compute	2685.8	
	Right Acetabulum Resultant Force	N	Compute	1149.9	
Femur	Left Femur Force, FZ	N	600	173.3	-4279.8
	Right Femur Force, FZ	N	600	288.5	-3024.4
Tibia	Left Upper Tibia, FZ	N	600	4.2	-882.8
	Left Upper Tibia Index		Compute	0.477	
	Right Upper Tibia, FZ	N	600	782.1	-780.1
	Right Upper Tibia Index		Compute	0.299	
	Left Lower Tibia, FZ	N	600	197.2	-1696.1
	Left Lower Tibia Index		Compute	0.167	
	Right Lower Tibia, FZ	N	600	540.9	-1076.9
	Right Lower Tibia Index		Compute	0.196	
Ankle	Left Ankle Rotation, RX	Deg	180	31.4	-15.0
	Left Ankle Rotation, RY	Deg	180	21.7	-15.5
	Left Ankle Dorsiflexion Moment, MY	Nm	Compute	14.6	-91.4
	Left Ankle In/Eversion Moment, MX	Nm	Compute	30.4	-13.7
	Right Ankle Rotation, RX	Deg	180	16.1	-24.1
	Right Ankle Rotation, RY	Deg	180	1.3	-13.1
	Right Ankle Dorsiflexion Moment, MY	Nm	Compute	39.6	-44.4
	Right Ankle In/Eversion Moment, MX	Nm	Compute	19.6	-48.3

Anomalies:

P1TH ACETABULUM Right X FORCE, P2H3 Head AYR, P2H3 Head AZR

SECTION 2 … (CONTINUED)

SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

	Passenger, Hybrid III 50th Percentile Male S/N 168				
Injury Reading	**Units**	**Limit**	**Value**	**t^1**	**t^2**
HIC 15		700	87.791	116.2	131.2
Nij		1	0.739	123.7	***NCF***
Upper Neck Force Z (Tension)	N	4170	866.266	76.8	
Upper Neck Force Z (Compression)	N	4000	-3243.855	123.8	
Upper Neck Moment Y (Flexion)	Nm	310	88.165	123.2	
Upper Neck Moment Y (Extension)	Nm	135	-27.695	159.0	
Chest Deflection	mm	63	-5.818	111.8	
3 ms Chest Clip	g	60	23.964	119.4	122.4
Femur Force, Left	N	10000	-4675.779	79.6	
Femur Force, Right	N	10000	-4087.223	93.6	

SECTION 3

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

CONVERSION FACTORS

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	miles/hr	km/hr	1.609344
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.574
Pressure	Tire Pressures	lbf/in^2	kPa	6.895
Temperature	General Use	^oF	^oC	=(Tf -32)/1.8
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf-ft	N•m	1.355

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	R20205416
Model Year	2020
Make	Mazda
Model	CX-5
Body Style	5-Door MPV
VIN	JM3KFBBM3L0854558
Body Color	Jet Black Mica
Odometer Reading (km / mi)	142 / 88
Engine Displacement (L)	2.5
Type / No. of Cylinders	Inline 4-Cylinder
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	6
Overdrive	Yes
Final Drive	AWD
Roof Rack	No
Sunroof / T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADLs)	Yes

Traction Control System	Yes
Power Steering	Yes
Power Window Auto-Reverse	Yes
Driver Frontal Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	No
Front Pass. Frontal Airbag	Yes
Front Pass. Curtain Airbag	Yes
Front Pass. Head/Torso Airbag	No
Front Pass. Torso Airbag	No
Front Pass. Torso/Pelvis Airbag	Yes
Front Pass. Pelvis Airbag	No
Front Pass. Knee Airbag	No
Driver Seat Belt Pretensioner	Yes
Driver Load Limiter	Yes
Front Pass. Seat Belt Pretensioner	Yes
Front Pass. Load Limiter	Yes
Other Safety Restraint	Yes

Does Owner's Manual provide instructions to turn off automatic door locks?	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Mazda Motor Corporation
Date of Manufacture	Jul-20

GVWR (kg)	2143
GAWR Front (kg)	1100
GAWR Rear (kg)	1043

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

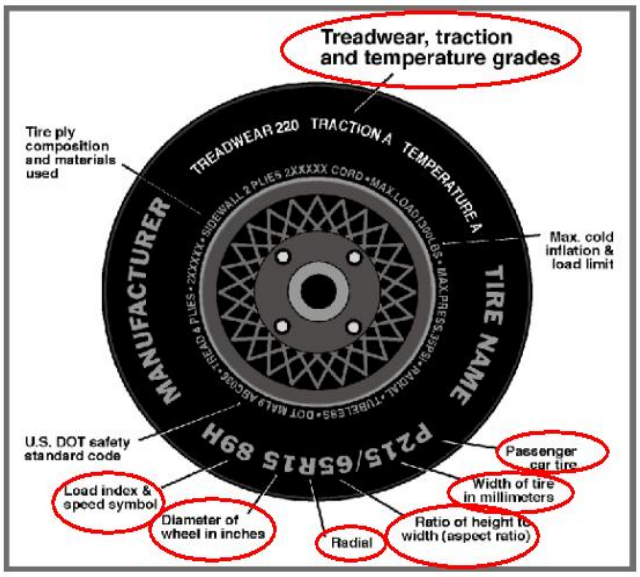
Measured Parameter	Front	Rear	Third	Total	
Type of Seats	Bucket	Bench			
Designated Seating Capacity	2	3		5	
Capacity Weight (VCW) (kg)				385.0	*A*
DSC x 68.04 (kg)				340.2	*B*
Cargo Weight (RCLW) (kg)				44.8	*A-B*

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21



Measured Parameter	Front	Rear
Max. Tire Pressure (kpa)	300	300
Cold Pressure (kPa)	230	230
Recommended Tire Size	P225/65R17	P225/65R17
Tire Size on Vehicle	P225/65R17	P225/65R17
Tire Manufacturer	Yokohama	Yokohama
Tire Model	Geolander G91	Geolander G91
Treadware	280	280
Traction Grade	B	B
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Nylon	2 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	100H	100H
Tire Material	Polyester, Steel, Nylon	Polyester, Steel, Nylon
DOT Safety Code Left	FDF5-PC52 720	FDF5-PC52 720
DOT Safety Code Right	FDF5-PC52 720	FDF5-PC52 720

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

TEST VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)*		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	468.5	345.0		512.5	383.0	
Right	kg	469.0	327.0		499.5	377.5	
Ratio	%	58.2%	41.8%	100.0%	57.1%	42.9%	100.0%
Total	kg	937.5	672.0	1609.5	1012.0	760.5	1772.5

*Vehicle as tested mass was reduced at the request of NHTSA. The vehicle is an AWD model being in comparison with FWD models.

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1609.5	A
Weight of THOR-50M and AM50	kg	164.0	B
Rated Cargo/Luggage Weight (RCLW)	kg	44.8	C
Calculated Vehicle Target Weight (TVTW)	kg	1818.3	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	875	880	905	910	1118
As Tested	mm	860	860	895	902	1149
Post-Test	mm	905	850	882	890	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2678
Total Vehicle Length at Left Side	mm	4308
Total Vehicle Length at Centerline	mm	4560
Total Vehicle Length at Right Side	mm	4299
Weight of Ballast/Equipment in Cargo Area	kg	80.7
Weight of Vehicle Components Removed	kg	93.5
Amount of Stoddard Solvent in Fuel Tank	L	52.10

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

Taillights (1.5 kg), spare tire & tools (18.5 kg), trunk trim (3.0 kg), underbody covers (2.5 kg), rear bumper fascia (4.5 kg), rear wheel wall trim (1.0 kg), rear seat cushion (6.5 kg), rear seatbacks (16.0 kg), rear hatch door (30.5 kg), rear bumper (9.5 kg).

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

TARGET VEHICLE STRUCTURAL MEASUREMENTS

No.	Description	Units	Pre-Test
1	Total Length	mm	4560
2	Total Width	mm	1836
3*	Bumper Top Height	mm	599
4*	Bumper Bottom Height	mm	434
5*	Longitudinal Member Top Height	mm	599
6	Distance Between Longitudinal Members	mm	903
7	Longitudinal Member Width	mm	87
8*	Engine Top Height	mm	930
9*	Engine Bottom Height	mm	219
10	Engine and Gearbox Width	mm	634
11	Front Bumper to Engine Distance	mm	489
12*	Front Shock Absorber Fixing Height	mm	1020
13*	Bonnet Leading Edge Height	mm	900
14	Front Shock Absorber Fixing Width	mm	586
15	Front Bumper to Front Axle Distance	mm	944
16	Front Axle to A-Pillar Distance	mm	605
17	A-Pillar to B-Pillar Distance	mm	984
18	B-Pillar to Rear Axle Distance	mm	1083
19	B-Pillar to C-Pillar Distance	mm	994
20*	Roof Sill Bottom Height	mm	1555
21*	Roof Sill Top Height	mm	1665
22*	Floor Sill Bottom Height	mm	330
23*	Floor Sill Top Height	mm	420

*Note: Height measurements are in reference to the ground.

DATA SHEET NO. 2

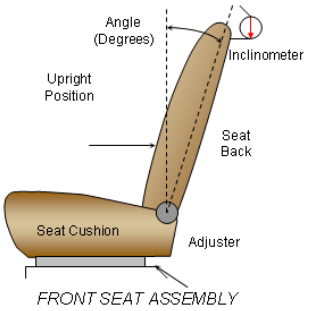
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

NOMINAL DESIGN RIDING POSITION

The driver seat back was initially set to the manufacturer's designated angle listed in FORM 208 but was moved forward per THOR seating procedure to level the head. The passenger seat back was set to the manufacturer's designated angle listed in FORM 208 but was moved rearward to level the head.



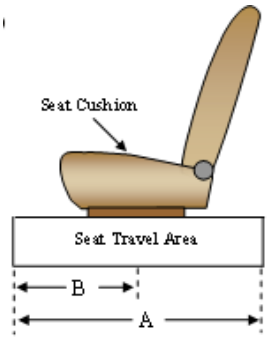
SEAT BACK ANGLE

Seating Position	Unit	FORM 208 Position	After ATD Positioning
Driver Seat Back Angle	Degrees	6.2	5.6
Passenger Seat Back Angle	Degrees	6.2	9.9

*Neck load cell was installed in passenger ATD. Neck bracket could not be adjusted, therefore the seat back was reclined in order to level the passenger ATD head.

SEAT FORE / AFT POSITIONING

The passenger seat travel is measured from the forward most position to the rear most position with the seat cushion set at mid angle. The passenger seat was initially positioned 25 mm rearward of mid-track before being moved as far forward as possible where the ATD did not contact any interior panels, up to mid-track. The driver seat travel is measured from the forward most possible position to the rear most possible position. The driver seat is set to the middle of the fore-aft travel.



SEAT FORE/AFT POSITIONS

Seating Position	Total Fore/Aft Travel (mm)	Placed in Position (mm)
Driver Seat	258	129
Passenger Seat	260	130

SEAT BELT UPPER ANCHORAGE

The seat belt upper anchorage is positioned to the manufacturer's design position for a 50th percentile adult male ATD for the driver and passenger. Position "H" is the uppermost position, followed by position "M1" and "M2." Position "L" is the lowermost position.

SEAT BELT UPPER ANCHORAGES

Seating Position	Total No. of Positions	Placed in Position
Driver Seat	4	H
Passenger Seat	4	H

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

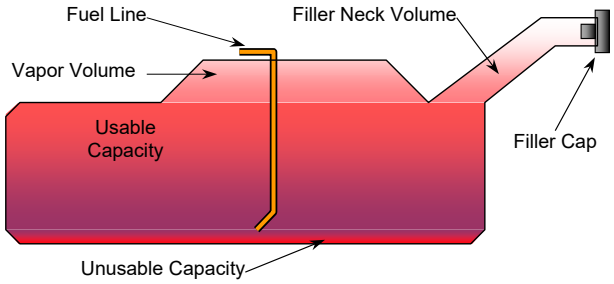
Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank"	57.92
Usable Capacity of "Optional Tank"	
93% of Usable Capacity	53.87
Actual Amount of Stoddard Solvent Used	57.92
1/3 of Usable Capacity	19.31

FUEL PUMP

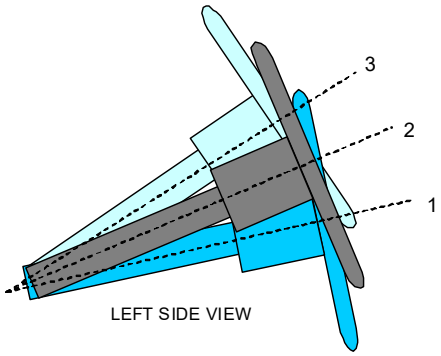
Fuel was evacuated according to the specifications provided by the manufacturer in Form 208. The electric fuel pump operates when the starter or engine is activated.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. A digital inclinometer is used to measure a plate which is placed across the rim of the steering wheel for angular measurements. A tape measure is used to measure telescoping steering wheel travel.



STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITIONING

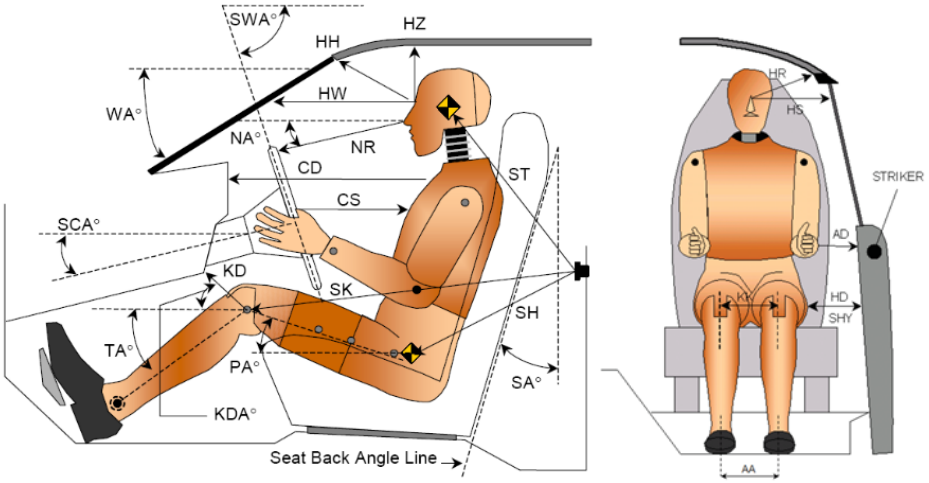
	Degrees	Fore-Aft Position (mm)
Lowermost Position, No. 1	22.7	110
Geometric Center Position, No. 2	25.2	132
Uppermost Position, No. 3	27.7	154
Telescoping Steering Wheel Travel		44
Test Position	25.2	132

DATA SHEET NO. 3

DUMMY CLEARANCE DIMENSIONS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21



LEFT SIDE VIEW

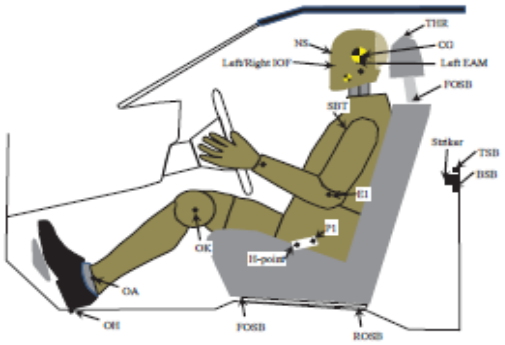
Code	Measurement Description	Driver S/N# EG2595		Passenger S/N# 168	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
HZ	Nasion to Roof (Z Distance)	208		211	
HH	Nasion to Header (3D Distance)	390		347	
HW	Nasion to Windshield Point 1 Inside (X Distance)	753		745	
NR	Tip of Nose to Top of Steering Wheel (3D Distance)	504			
CD	Chest Point 1 to Dash Point 1 (3D Distance)	587		502	
CS	Chest Point 2 to Center of Steering Wheel (X Distance)	337			
CBS	Chest Point 3 to Bottom of Steering Wheel (X Distance)	206			
IKD	Inboard Knee to Dash Point 3 (3D Distance)			142	
OKD	Outboard Knee to Dash Point 2 (3D Distance)	103		146	
HR	Nasion to Side Header (3D Distance)	332		234	
HS	Nasion to Side Window Distance (Y Distance)	347		361	
AD	Elbow to Door (Y Distance)	148		62	
HD	H-Point to Door (Y Distance)			158	
HLHL	Inboard Heel to Outboard Heel (Y Distance)	333		206	
KK	Inboard Knee to Outboard Knee (Y Distance)			185	
SH	Striker to H-Point (3D Distance)	338		318	
HRA	Head Restraint Post Angle		5.6		9.9
	H-Point Tool Angle		17.3		
	Torso Angle		20.1		16
	Windshield Angle		61.4		62
	Head Angle (X)		-0.3		0
	Head Angle (Y)		0.0		
	T1 Angle (X)				
	T1 Angle (Y)				
	T6 Angle (X)		-0.9		
	T6 Angle (Y)		17.6		
	T12 Angle (X)				
	T12 Angle (Y)				
	Pelvis Angle (X)		-0.9		29
	Pelvis Angle (Y)		33.6		

DATA SHEET NO. 4

DUMMY CMM MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21



Description	Units	Driver S/N# EG2595			Passenger S/N# 168		
		X	Y	Z	X	Y	Z
Center of Upper Striker Bolt	mm	2028	-796	-344	2032	795	-344
Center of Lower Striker Bolt	mm	2034	-797	-308	2039	797	-309
Center of Striker Bar	mm	2061	-798	-333	2066	797	-334
Front Outboard Seat Bolt	mm	2557	-613	58	2561	608	56
Rear Outboard Seat Bolt	mm	2116	-609	108	2120	607	108
Center of Steering Wheel Hub	mm	2559	-370	-545			
Outer Head Restraint Post	mm	1856	-455	-681	1847	451	-680
Right Head CG	mm	2063	-286	-825	2121	438	-820
Left Head CG	mm	2066	-445	-825	2120	287	-819
Right EAM	mm	2073	-290	-799			
Left EAM	mm	2073	-442	-800			
Nasion	mm	2149	-367	-842	2206	360	-823
Right IOF	mm	2155	-333	-803	2195	395	-806
Left IOF	mm	2151	-397	-802	2195	330	-814
Tip of Nose	mm	2151	-366	-801	2229	367	-781
Tip of Chin	mm	2155	-366	-705	2204	361	-703
Chest Point 1	mm	2201	-366	-581	2244	365	-583
Chest Point 2	mm	2222	-367	-545			
Chest Point 3	mm	2309	-367	-388			
Shoulder Point 1	mm	2056	-574	-593	2117	549	-553
Shoulder Point 2	mm	2133	-555	-569			
Elbow	mm	2315	-616	-366	2246	627	-339
Center of H-Point Tool	mm						
H-Point on H-Point Tool	mm	2300	-610	-185	2303	653	-179
H-Point on ATD Skin	mm	2298	-571	-185	2303	542	-179
Outboard Knee	mm	2689	-577	-342	2685	503	-291
Inboard Knee	mm				2679	318	-284
Outboard Ankle	mm	2942	-590	-8	2970	534	25
Inboard Ankle	mm	2972	-255	-7	2987	315	13
Outboard Heel	mm	2966	-565	126	2947	493	128
Inboard Heel	mm	2963	-232	132	2977	289	122

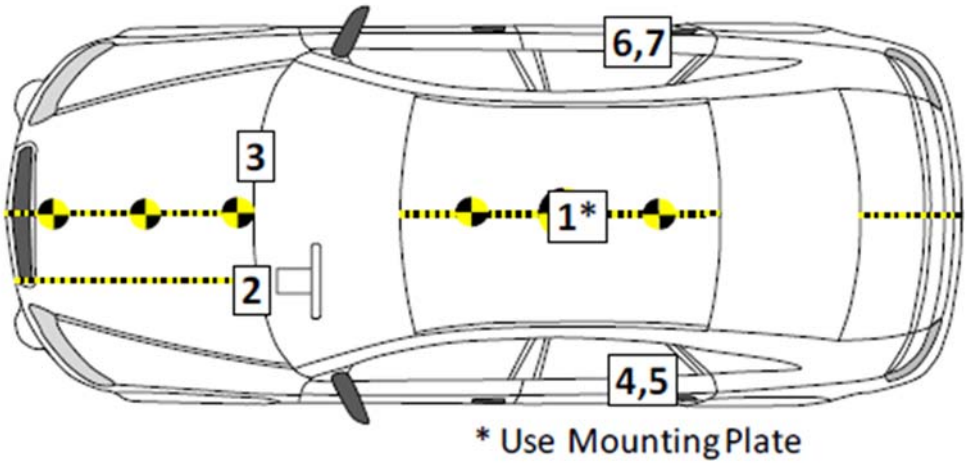
Reference Point:
+X – From the rear of the vehicle to the front of the vehicle
+Y – From the left side of the vehicle to the right side of the vehicle
+Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 5

VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS RELATIVE TO VCS

No.	Instrumentation Location	Axes	Units	Coordinates (mm)		
				X	Y	Z
1	Vehicle CG (Acceleration and Angular Rate)	x, y, z	g, °/s	1806	6	42
2	Driver Floor Pan	x, y, z	°/s	3288	-401	9
3	Passenger Floor Pan	x, y, z	g	3225	393	55
4	Door Sill LR	x, y	g	1608	-713	142
5	Door Sill LR Redundant	x, y	g	1585	-713	143
6	Door Sill RR	x, y	g	1611	707	143
7	Door Sill RR Redundant	x, y	g	1586	711	143

Reference Point:

+X – From the rear of the vehicle to the front of the vehicle

+Y – From the left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

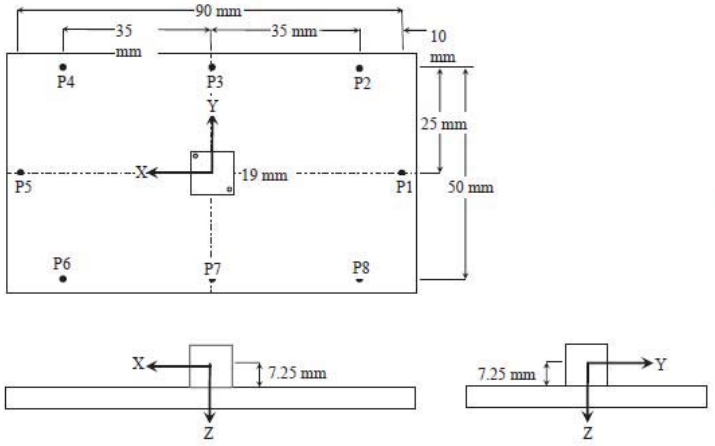
DATA SHEET NO. 5 … (CONTINUED)

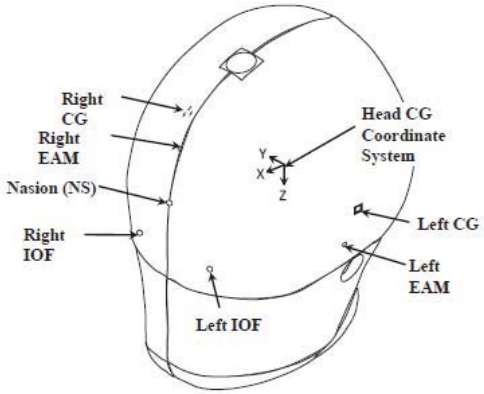
VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

ANGULAR RATE SENSOR MOUNTING PLATE & THOR HEAD POINT DEFINITIONS





CG ARS MOUNTING PLATE - VEHICLE COORDINATE SYSTEM

No.	Description	Units	X	Y	Z
P1	Plate Point 1	mm	1860	8	48
P2	Plate Point 2	mm	1850	-19	52
P3	Plate Point 3	mm	1816	-19	60
P4	Plate Point 4	mm	1781	-20	61
P5	Plate Point 5	mm	1769	5	60
P6	Plate Point 6	mm	1780	30	57
P7	Plate Point 7	mm	1815	30	52
P8	Plate Point 8	mm	1851	31	47

PASSENGER HEAD POINTS IN RELATION TO HEAD CG COORDINATE SYSTEM

Description	Units	x	y	z
Left CG	mm	67	-41	47
Left EAM	mm	74	-36	74
Left IOF	mm	154	5	72
Right IOF	mm	156	66	75
Nasion	mm	157	37	37
Right EAM	mm	73	108	72
Right CG	mm	66	113	44

DATA SHEET NO. 5 … (CONTINUED)

VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

Location No.	Description	Axes	Units	Positive Direction		Negative Direction	
				Max	Time (ms)	Min	Time (ms)
1	Vehicle CG	x	g	12.8	28.6	-27.0	79.2
		y	g	11.6	52.2	-6.9	20.8
		z	g	30.0	47.6	-29.3	26.0
	Vehicle CG Rotation	x	°/s	75.4	25.1	101.1	46.4
		y	°/s	138.0	27.6	-145.7	49.3
		z	°/s	12.4	52.4	-68.6	299.8
2	Driver Floor Pan	x	g	12.4	17.9	-18.2	14.4
		y	g	16.7	50.3	-8.9	17.5
		z	g	19.4	76.1	-3.9	28.0
3	Passenger Floor Pan	x	g	5.0	25.5	-16.4	77.4
		y	g	15.9	50.6	-3.1	16.1
		z	g	22.2	78.5	-5.6	28.6
4	Door Sill LR	x	g	4.4	27.6	-25.0	76.6
		y	g	11.4	52.4	-4.3	20.6
5	Door Sill LR Redundant	x	g	4.6	27.6	-23.3	76.6
		y	g	11.6	52.5	-3.2	20.6
6	Door Sill RR	x	g	3.4	27.3	-26.7	79.0
		y	g	9.7	51.8	-4.4	20.6
7	Door Sill RR Redundant	x	g	3.6	27.3	-26.7	79.0
		y	g	10.0	51.9	-4.6	20.7

Note: See Appendix B for all vehicle data plots

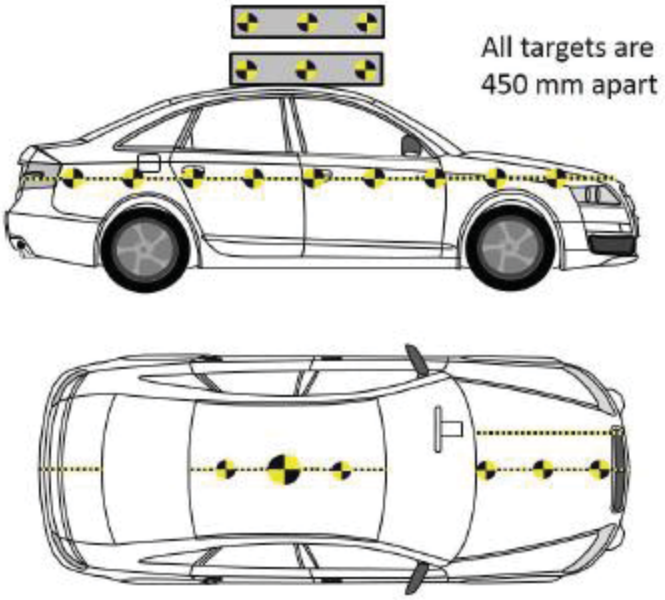
DATA SHEET NO. 6

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

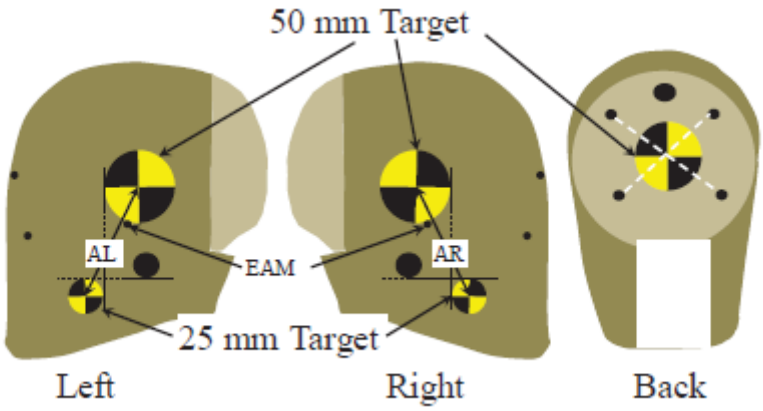
Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

VEHICLE TARGETS



ATD HEAD TARGETS



Driver

Target	Units	Measurement
AL	mm	97
AR	mm	98

DATA SHEET NO. 7

TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Sensors	117
Passenger Dummy Sensors	43
Vehicle Structure Sensors	30
Total	190

CAMERA COVERAGE

Type of Camera	Number of Cameras Collected
High-Speed Vehicle Onboard	4
High-Speed Off-Board	14
Real-Time Panning	1
Total	19

DATA SHEET NO. 8

POST TEST OBSERVATIONS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

TEST DUMMY INFORMATION AND CONTACT

Description	Driver	Passenger
Dummy Type/Serial No.	THOR-50M / EG2595	Hybrid III / 168
Lower Leg Type	LX	
Lower Leg Serial No.		
Head Contact	Frontal airbag, A-pillar trim, windshield	Frontal airbag, windshield. Rear view mirror
Upper Torso Contact	Frontal airbag	Frontal airbag
Lower Torso Contact	Frontal airbag	Frontal airbag
Left Knee Contact	Knee bolster	Knee bolster
Right Knee Contact	Knee bolster	Knee bolster

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked / Unlocked Doors	Unlocked	Unlocked
Front Door Opening	Remained closed and latched, operational	Remained closed and latched, operational
Rear Door Opening	Remained closed and latched, operational	Remained closed and latched, operational
Seat Track Shift (mm)		
Seat Back Failure	None	None
Glazing Damage	Broken	

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	Good
Windshield Damage	Broken
Window Damage	None
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver		Passenger	
	Installed	Operated	Installed	Operated
Front Airbag	Yes	Yes	Yes	Yes
Side Airbag 1 (Curtain)	Yes	Yes	Yes	No
Side Airbag 2 (Torso/Pelvis)	Yes	Yes	Yes	No
Knee Airbag	No		No	
Seat Belt Pretensioner	Yes	No	Yes	No
Seat Belt Load Limiter	Yes	No	Yes	No

DATA SHEET NO. 9

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4560	4503	-57
2	Rear Surface of Vehicle to Front of Engine	4071	4038	-33
3	RSOV to Firewall	3505	3511	6
4	RSOV to Upper Leading Edge of Right Door	3056	3056	0
5	RSOV to Upper Leading Edge of Left Door	3050	3050	0
6	RSOV to Lower Leading Edge of Right Door	3087	3085	-1
7	RSOV to Lower Leading Edge of Left Door	3080	3078	-3
8	RSOV to Upper Trailing Edge of Right Door	1941	1940	-1
9	RSOV to Upper Trailing Edge of Left Door	1936	1933	-3
10	RSOV to Lower Trailing Edge of Right Door	2073	2073	0
11	RSOV to Lower Trailing Edge of Left Door	2067	2066	-1
12	RSOV to Bottom of A-Pillar, Right Side	3017	3017	0
13	RSOV to Bottom of A-Pillar, Left Side	3011	3011	0
14	RSOV to Firewall, Right Side	3632	3633	0
15	RSOV to Firewall, Left Side	3626	3617	-9
16	RSOV to Steering Column	2559	2591	32
17	Center of Steering Column to A-Pillar	452	421	-32
18	Center of Steering Column to Headliner	477	448	-30
19	RSOV to Right Side of Front Bumper	4299	4308	8
20	RSOV to Left Side of Front Bumper	4308	3870	-438
21	Length of Engine Block	500	495	-5
RD	RSOV to Right Side of Dash Panel	2777	2780	3
CD	RSOV to Center of Dash Panel	2745	2753	8
LD	RSOV to Left Side of Dash Panel	2774	2776	3

All measurements in millimeters.

DATA SHEET NO. 10

ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

VEHICLE INFORMATION

VIN: JM3KFBBM3L0854558 Wheelbase (mm): 2678

Vehicle Size Category: 5-door MPV Test Weight (kg): 1772.5

ACCELEROMETER DATA

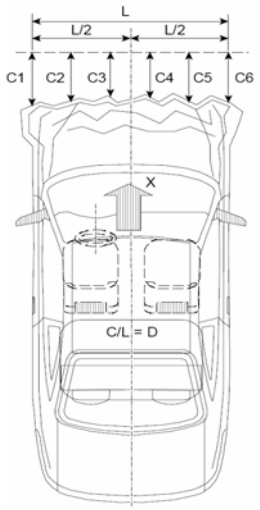
Accelerometer Locations: Vehicle CG_x

Cal. Procedure/Interval: Vibration Test / 6 months

Integration Algorithm: NHTSA Standard

Linearity: Good

Impact Velocity (km/h): 39.68



CRUSH PROFILE

Collision Deformation Classification: 12FDEW2

Midpoint of Damage: 752.8

Damage Region Length (mm): 1505.6

Impact Mode: Left Side 30° Frontal

Crush Measurements

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush Zone 1 at Left Side	mm	4308	3870	-438
C2	Crush Zone 2 at Left Side	mm	4453	4149	-303
C3	Crush Zone 3 at Left Side	mm	4512	4410	-102
C4	Crush Zone 4 at Right Side	mm	4513	4484	-30
C5	Crush Zone 5 at Right Side	mm	4450	4469	19
C6	Crush Zone 6 at Right Side	mm	4299	4308	9
L	C1 to C6	mm	1506		

DATA SHEET NO. 11

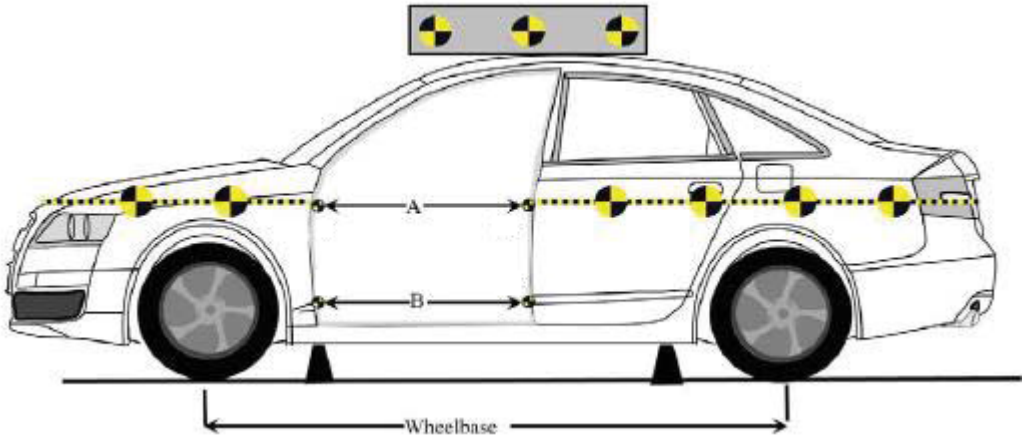
VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Driver Side Upper	mm	871	873	-2
B	Driver Side Lower	mm	731	729	2
D	Passenger Side Upper	mm	871	873	-1
E	Passenger Side Lower	mm	734	732	2



DATA SHEET NO. 11 … (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

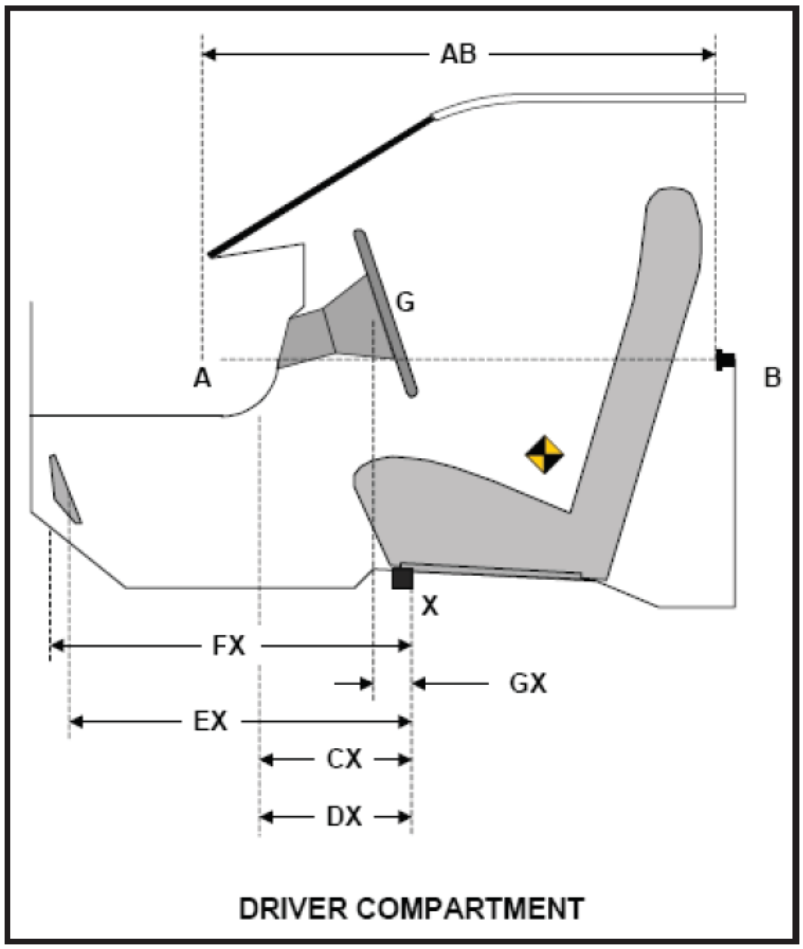
Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	867	859	8
CX	Left Knee Bolster to X	mm	284	274	10
DX	Right Knee Bolster to X	mm	262	296	-34
EX	Brake Pedal to X	mm	514	517	-3
FX	Footrest to X	mm	659	665	-6
GX	Center of Steering Column Wheel Hub to X	mm	3	32	-30

X = Front of Seat Track (Stationary)



DRIVER COMPARTMENT

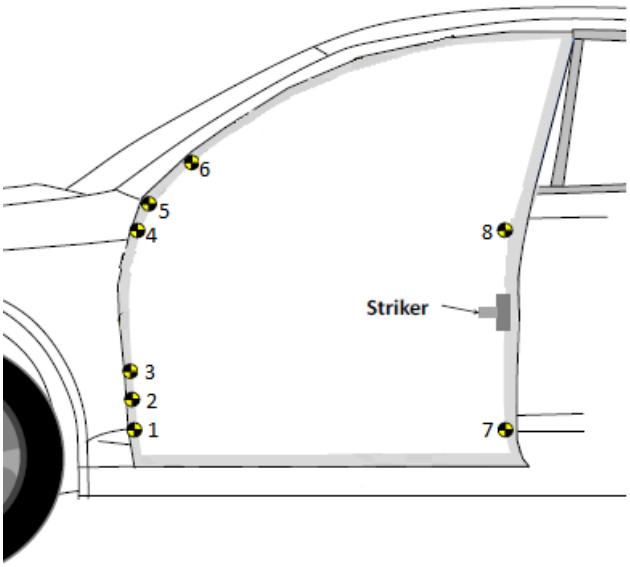
DATA SHEET NO. 11 … (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

DRIVER SIDE DOOR SILL INTRUSIONS



+X – From the rear of the vehicle to the front of the vehicle
+Y – From the left side of the vehicle to the right side of the vehicle
+Z – From the top of the vehicle to the bottom of the vehicle

Point	Pre-Test			Post-Test			Difference		
	x	y	z	x	y	z	x	y	z
1	2956	-758	-32	2954	-757	-29	-2	1	3
2	2965	-753	-107	2965	-752	-105	0	1	2
3	2955	-749	-184	2955	-749	-184	0	1	0
4	2915	-750	-482	2916	-750	-481	1	0	1
5	2903	-754	-560	2903	-754	-551	0	0	9
6	2875	-757	-634	2877	-757	-633	2	0	1
7	2225	-760	-26	2225	-759	-26	0	1	1
8	2044	-743	-478	2042	-743	-478	-2	0	0

All measurements in millimeters.

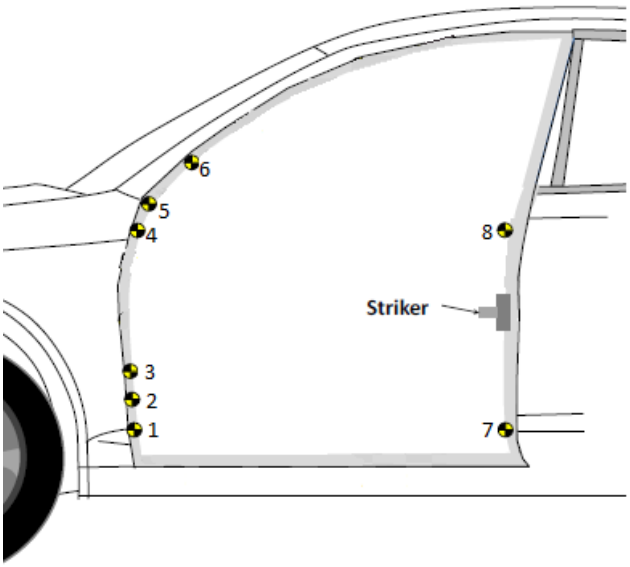
DATA SHEET NO. 11 … (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

PASSENGER SIDE DOOR SILL INTRUSIONS



+X – From the rear of the vehicle to the front of the vehicle
+Y – From the left side of the vehicle to the right side of the vehicle
+Z – From the top of the vehicle to the bottom of the vehicle

Point	Pre-Test			Post-Test			Difference		
	x	y	z	x	y	z	x	y	z
1	2961	750	-33	2960	751	-31	-1	1	2
2	2967	744	-111	2967	745	-109	-1	1	2
3	2962	740	-183	2962	741	-180	0	1	3
4	2919	742	-487	2919	743	-485	1	0	2
5	2907	746	-559	2907	747	-560	-1	0	0
6	2880	748	-638	2882	749	-635	2	0	3
7	2227	756	-28	2228	757	-27	1	1	1
8	2047	740	-476	2047	741	-475	-1	1	2

All measurements in millimeters.

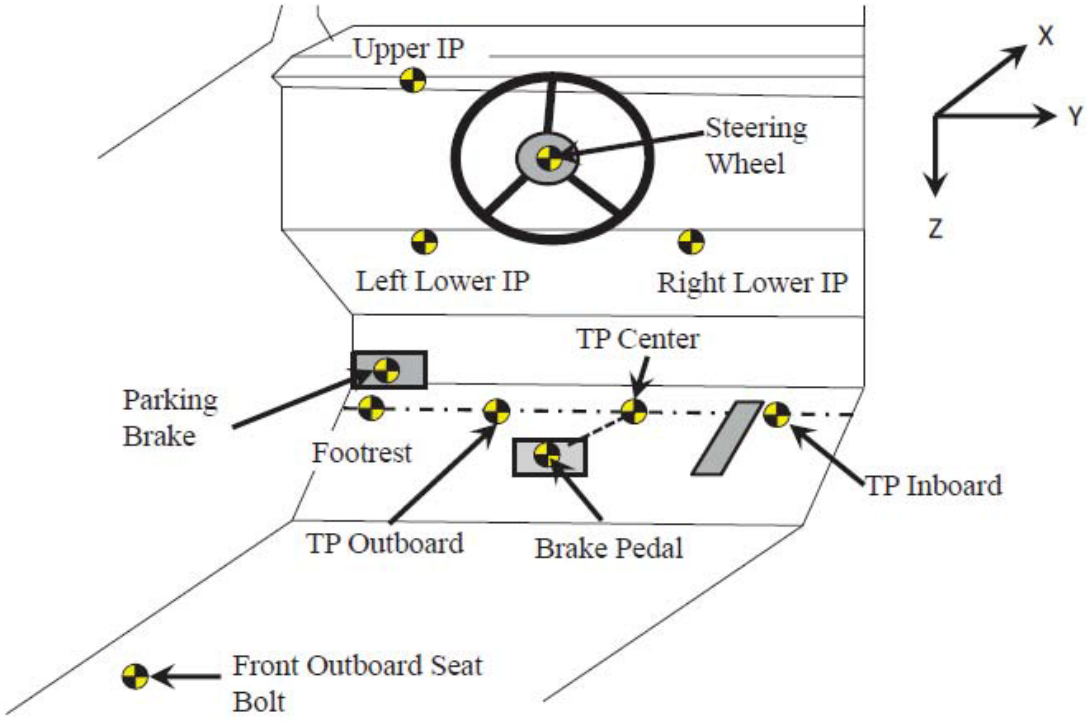
DATA SHEET NO. 11 … (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

DRIVER FLOOR PAN MEASUREMENTS



Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	x	y	z	x	y	z	x	y	z
TP Inboard	3354	-183	-51	3356	-180	-52	2	3	0
TP Center	3342	-340	-35	3344	-342	-39	2	-2	-4
TP Outboard	3306	-484	-36	3303	-482	-35	-3	2	1
TP Footrest	3221	-582	-35	3222	-581	-34	1	1	1
Brake Pedal	3076	-331	-35	3074	-342	-38	-2	-10	-3
Left Lower IP	2845	-520	-318	2851	-521	-317	6	-1	1
Right Lower IP	2824	-220	-318	2836	-221	-321	12	-1	-3
Upper IP	2752	-520	-452	2757	-520	-455	5	0	-2
Steering Wheel	2559	-372	-546	2591	-369	-570	32	3	-24
Front Outboard Bolt	2557	-613	58	2557	-612	59	0	1	2
Emergency Brake									

Reference point:
+X – From the rear of the vehicle to the front of the vehicle
+Y – From the left side of the vehicle to the right side of the vehicle
+Z – From the top of the vehicle to the bottom of the vehicle

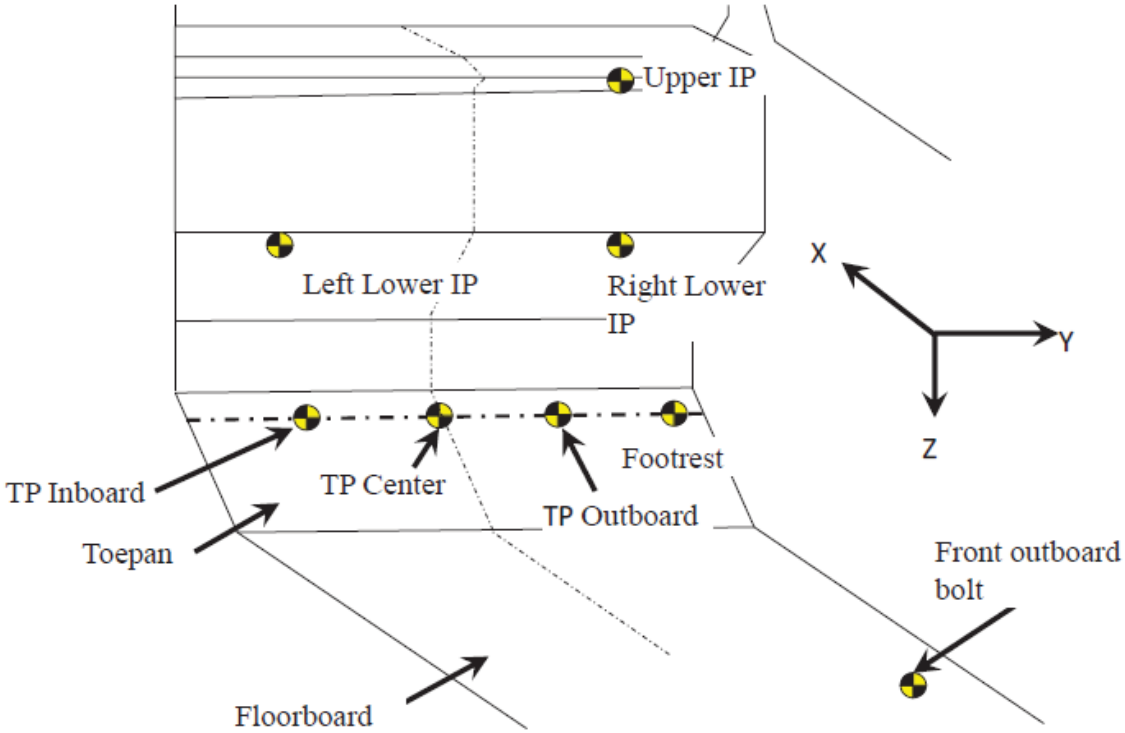
DATA SHEET NO. 11 … (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

PASSENGER FLOOR PAN MEASUREMENTS



Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	x	y	z	x	y	z	x	y	z
TP Inboard	3325	210	-39	3326	212	-36	1	2	3
TP Center	3342	364	-34	3344	369	-33	2	5	1
TP Outboard	3257	512	-36	3257	514	-32	0	1	4
TP Footrest	3204	612	-35	3205	614	-35	0	2	0
Left Lower IP	2816	213	-318	2831	215	-321	15	2	-3
Right Lower IP	2848	512	-320	2853	513	-319	5	0	1
Upper IP	2746	512	-473	2753	512	-472	8	0	1
Front Outboard Seat Bolt	2561	608	56	2561	607	58	0	-1	2

Reference point:
+X – From the rear of the vehicle to the front of the vehicle
+Y – From the left side of the vehicle to the right side of the vehicle
+Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 12

SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

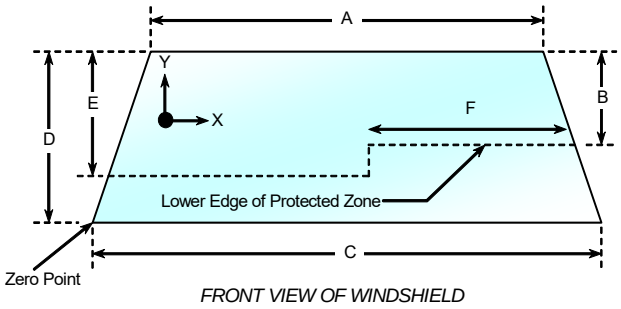
Windshield Mounting Details: Windshield glass is secured to the vehicle frame with plastic molding and rubber cement.

The standard requires that the post-test retention measurement be a minimum of 75% of the pre-test total periphery measurement for vehicles not equipped with occupant passive restraints and 50% for each side of the windshield for vehicles which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21.1 °C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2158	2158	100.0%
Right Side	2158	2158	100.0%
Total	4316	4316	100.0%



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	618
B	mm	760
C	mm	780
D	mm	618
E	mm	760
F	mm	780

AREAS OF PROTECTED ZONE FAILURES

A. Provide Coordinates of the area that the protected zone was penetrated more than 0.25 inches by a vehicle component other than one that is normally in contact with the windshield.

X	Y

B. Provide Coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.

X	Y

DATA SHEET NO. 12 … (CONTINUED)

SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 30 °C Test Time: 12:16 PM

Stoddard Solvent Spillage Measurements

A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)

B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)

C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)

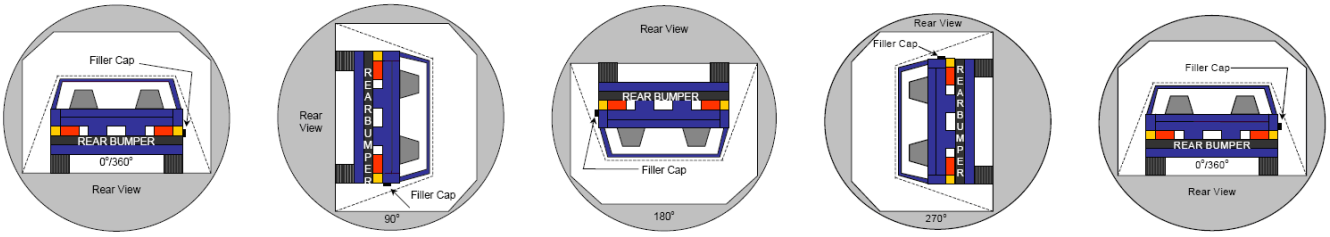
D. Spillage: There was no Stoddard solvent spillage.

DATA SHEET NO. 13

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV NHTSA No. R20205416

Test Program: Left Side 30° Frontal Rigid Barrier Impact Test Date: 05/21/21



0° TO 90° 90° TO 180° 180° TO 270° 270° TO 360°

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard solvent spillage: There was no Stoddard solvent spillage.

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	84	300	384
90° To 180°	88	300	388
180° To 270°	88	300	388
270° To 360°	88	300	388

FMVSS 301 SPILLAGE TABLE

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

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° To 90°	
90° To 180°	
180° To 270°	
270° To 360°	

APPENDIX A

PHOTOGRAPHS

FIGURE 1. Test Vehicle Certification Label

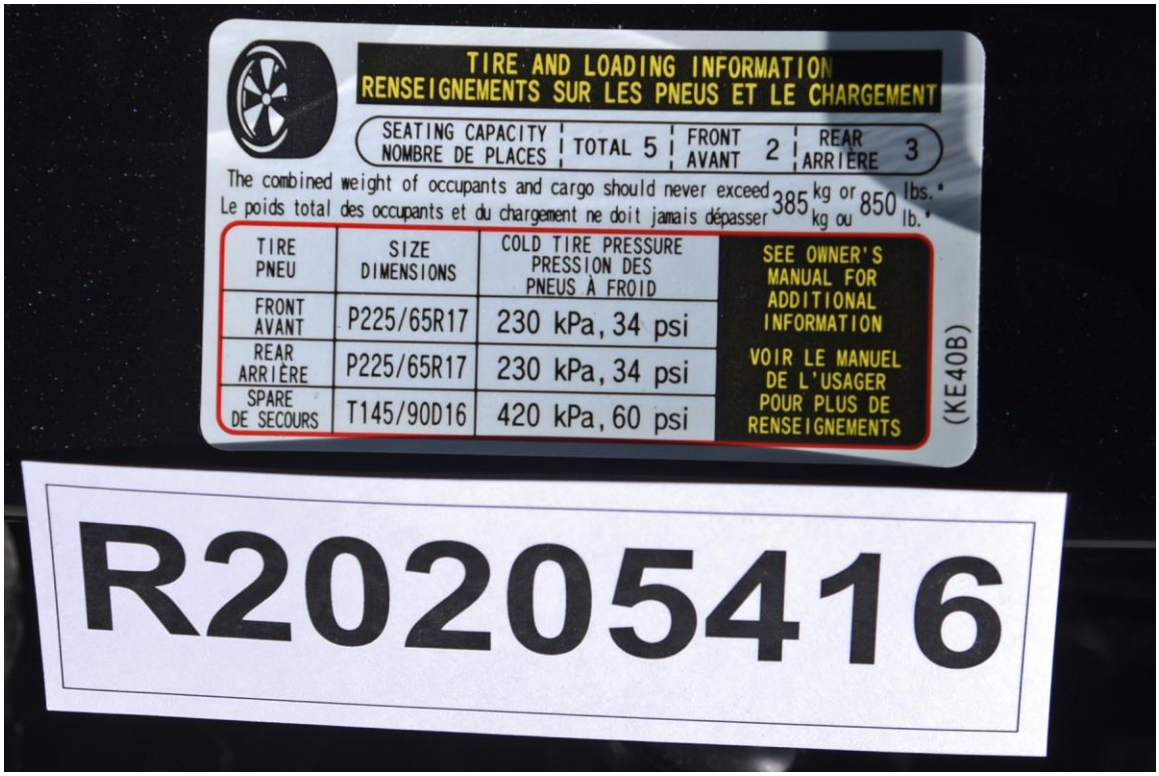


FIGURE 2. Test Vehicle Tire Placard

FIGURE 3. Right Front ¾ View, As Received

FIGURE 4. Left Rear ¾ View, As Received

FIGURE 5. Pre-Test Front View of Test Vehicle

FIGURE 6. Post-Test Front View of Test Vehicle

FIGURE 7. Pre-Test Left View of Test Vehicle

FIGURE 8. Post-Test Left View of Test Vehicle

FIGURE 9. Pre-Test Right View of Test Vehicle

FIGURE 10. Post-Test Right View of Test Vehicle

FIGURE 11. Pre-Test Left Front ¾ View of Test Vehicle

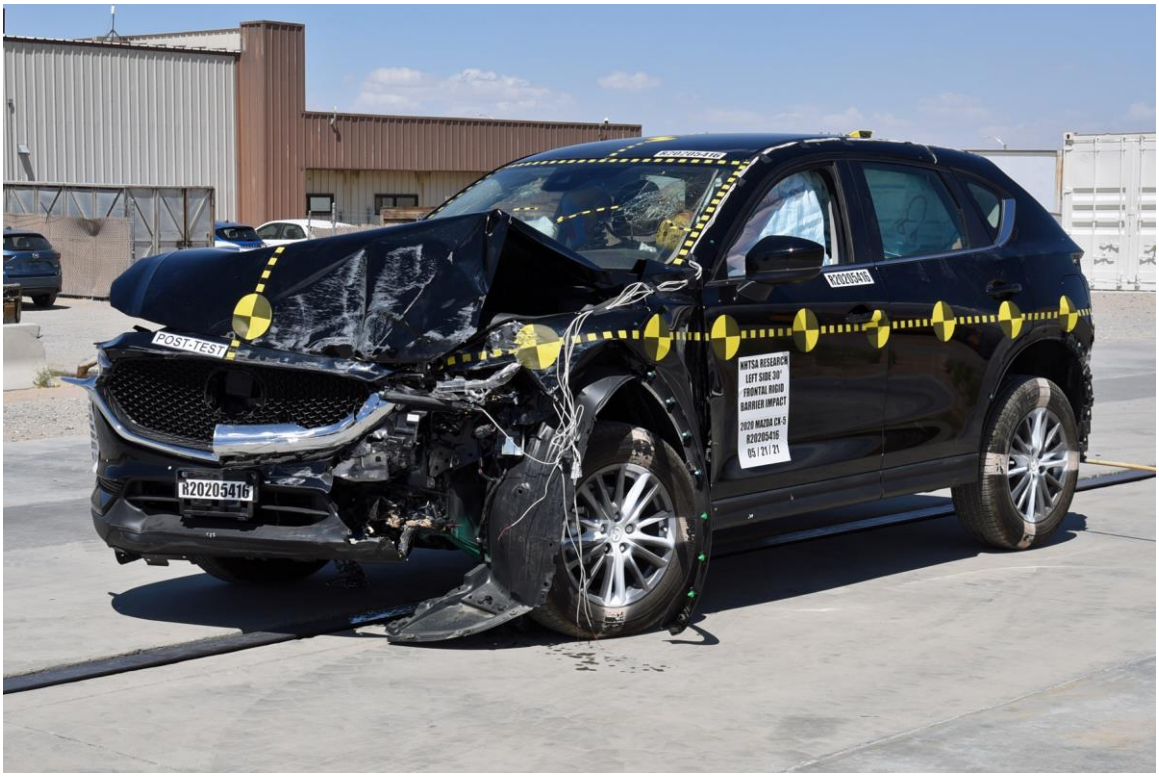


FIGURE 12. Post-Test Left Front ¾ View of Test Vehicle

FIGURE 13. Pre-Test Right Front ¾ View of Test Vehicle

FIGURE 14. Post-Test Right Front ¾ View of Test Vehicle

FIGURE 15. Pre-Test Right Rear ¾ View of Test Vehicle

FIGURE 16. Post-Test Right Rear ¾ View of Test Vehicle

FIGURE 17. Pre-Test Rear View of Test Vehicle

FIGURE 18. Post-Test Rear View of Test Vehicle

FIGURE 19. Pre-Test Left Rear ¾ View of Test Vehicle

FIGURE 20. Post-Test Left Rear ¾ View of Test Vehicle

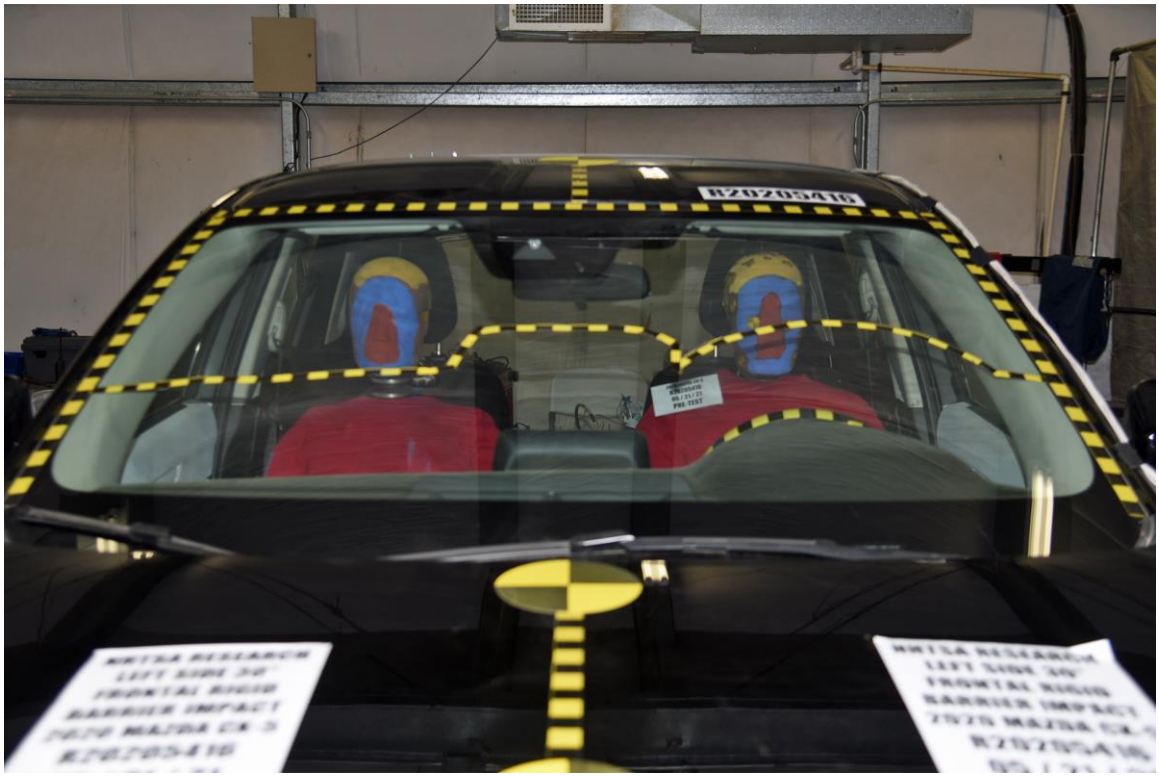


FIGURE 21. Pre-Test Windshield View

FIGURE 22. Post-Test Windshield View

FIGURE 23. Pre-Test Engine Compartment View

Photograph Not Available

FIGURE 24. Post-Test Engine Compartment View

FIGURE 25. Pre-Test Fuel Filler Cap View

FIGURE 26. Post-Test Fuel Filler Cap View

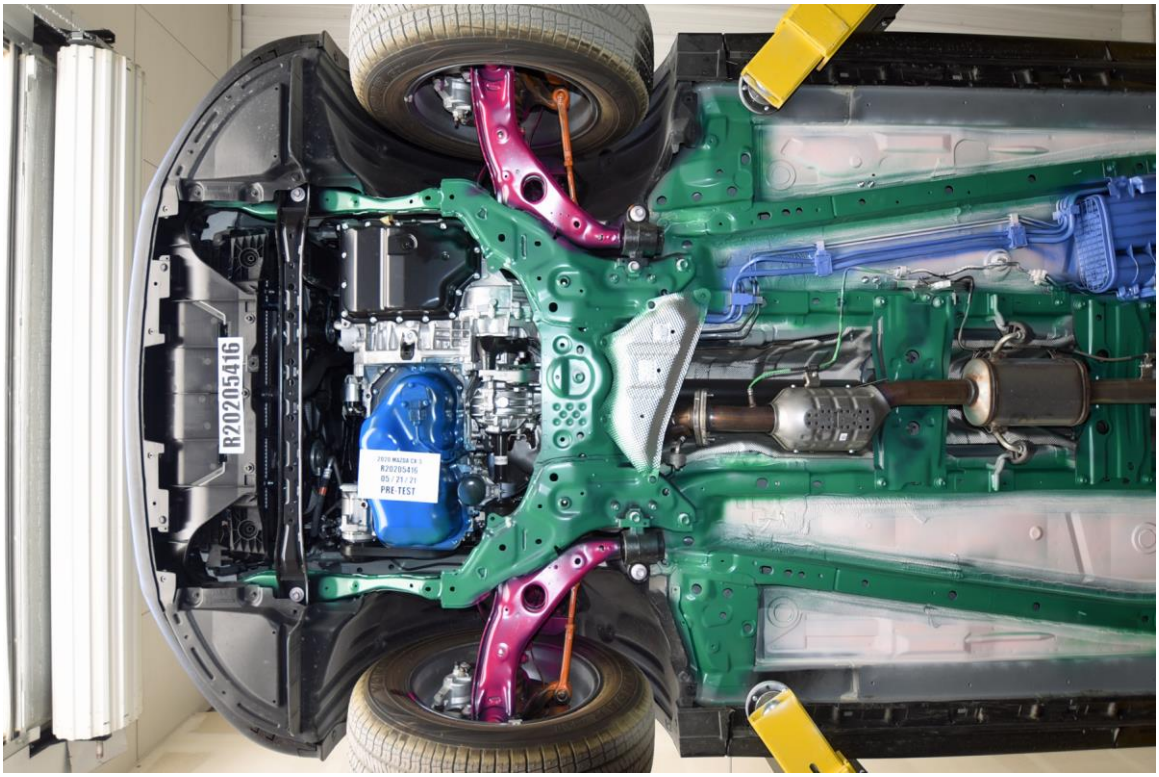


FIGURE 27. Pre-Test Front Underbody View

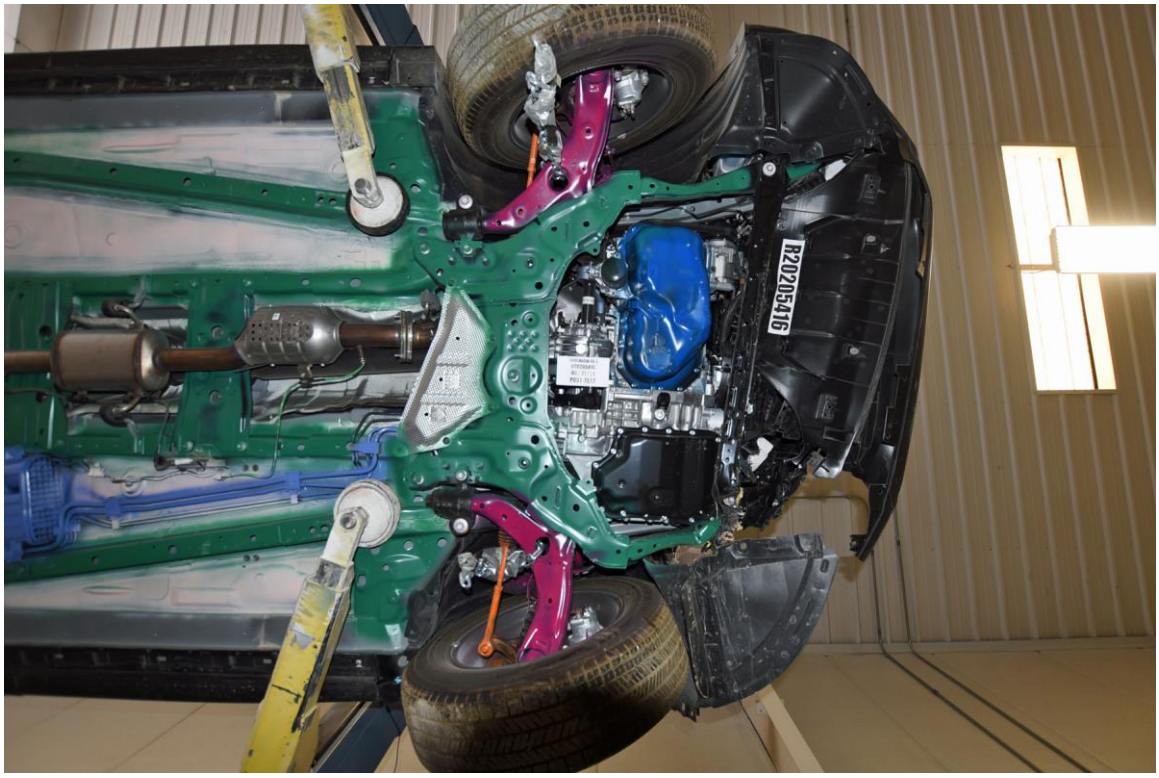


FIGURE 28. Post-Test Front Underbody View

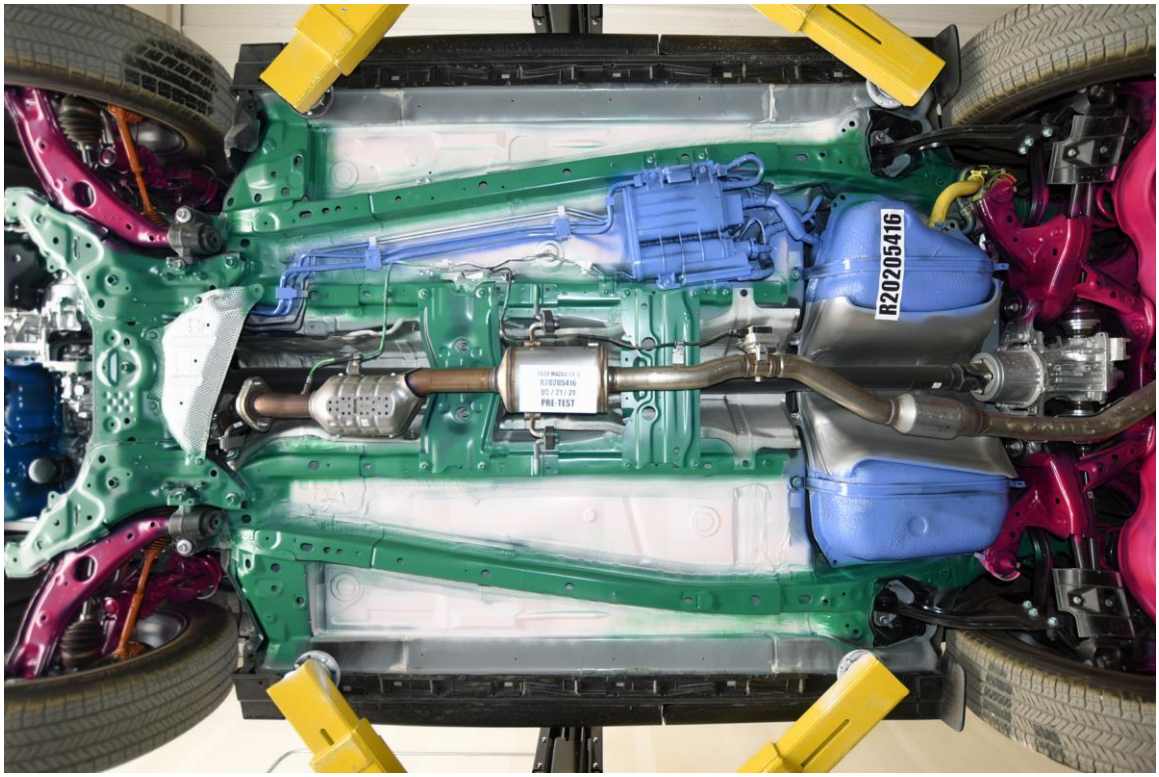


FIGURE 29. Pre-Test Mid Underbody View

FIGURE 30. Post-Test Mid Underbody View

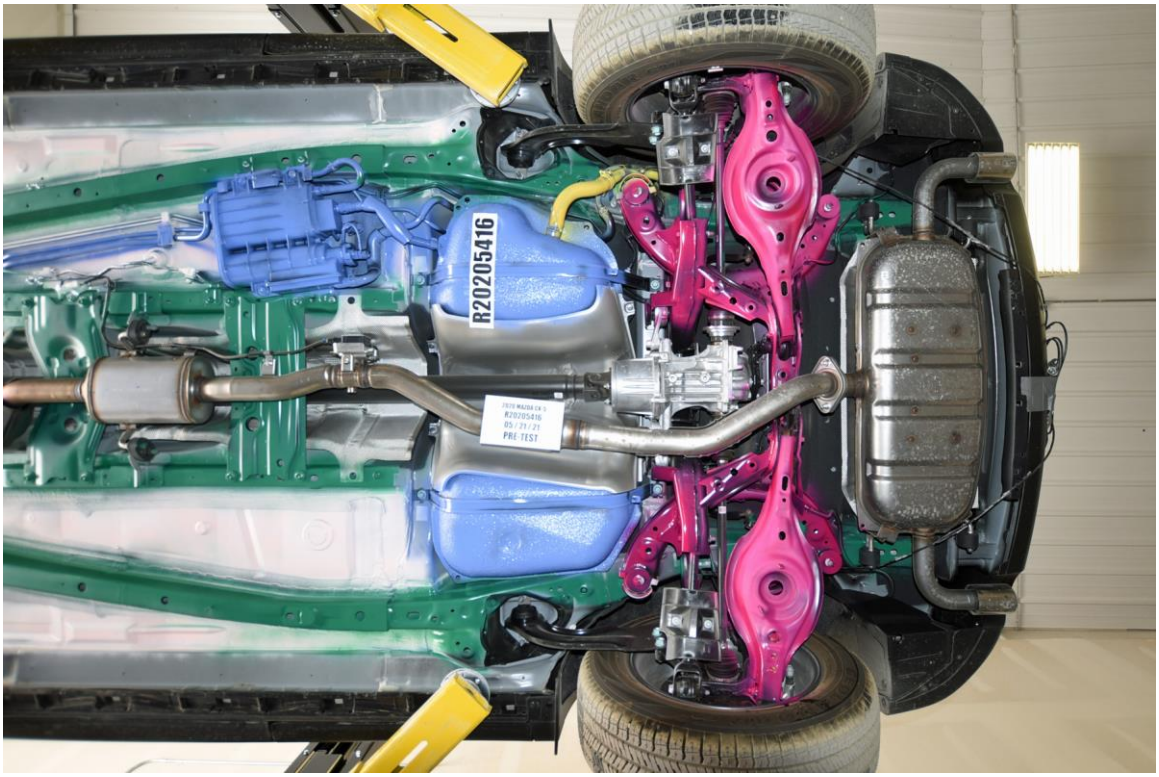


FIGURE 31. Pre-Test Rear Underbody View

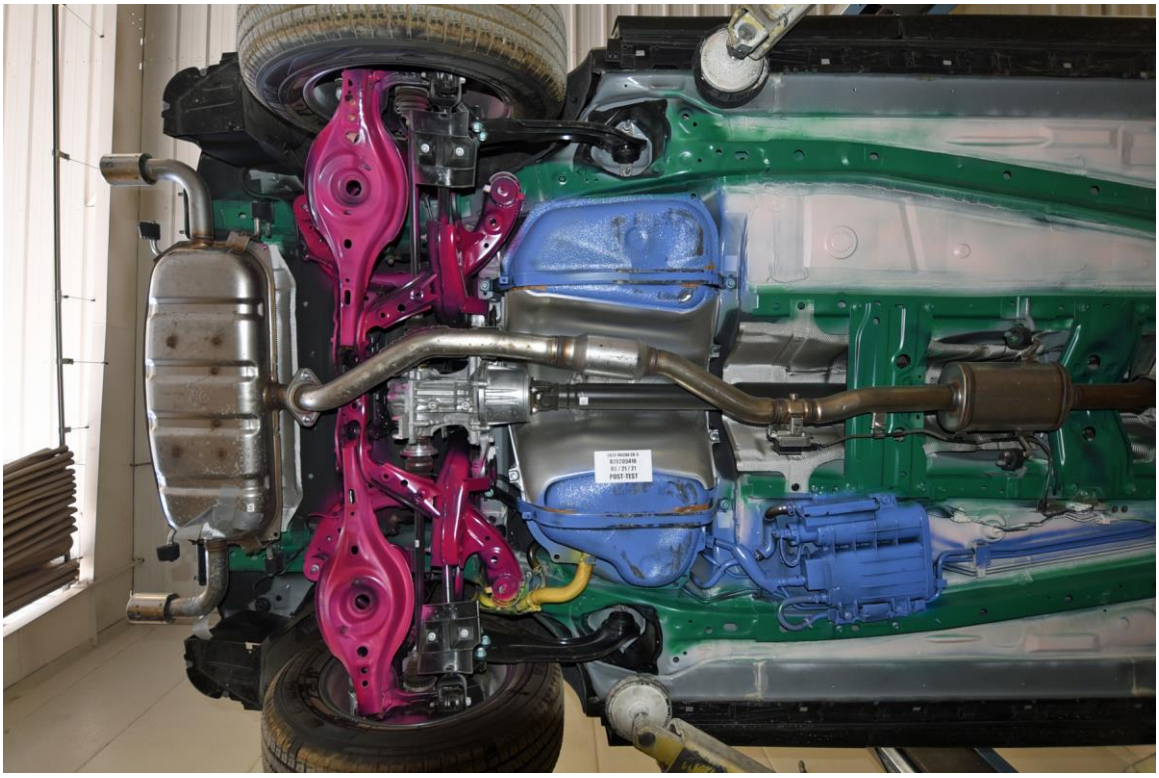


FIGURE 32. Post-Test Rear Underbody View

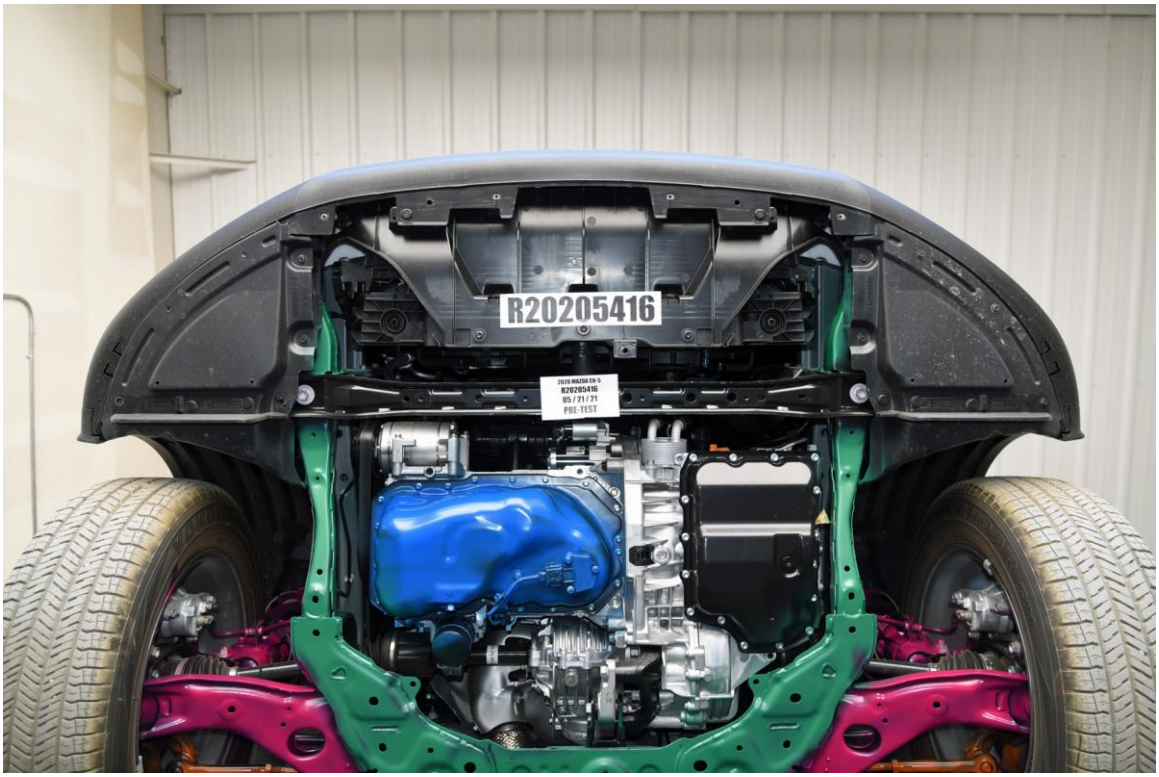


FIGURE 33. Pre-Test Bumper to Rail Attachments and Crush Initiators

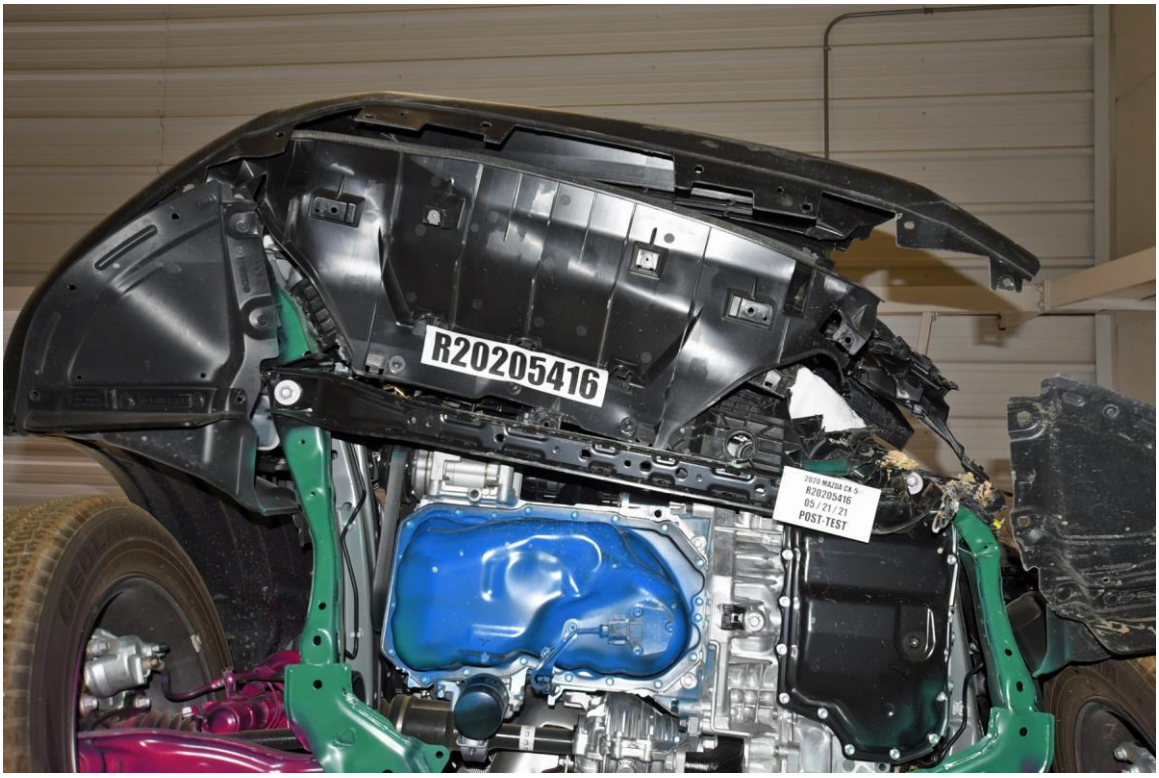


FIGURE 34. Post-Test Bumper to Rail Attachments and Crush Initiators

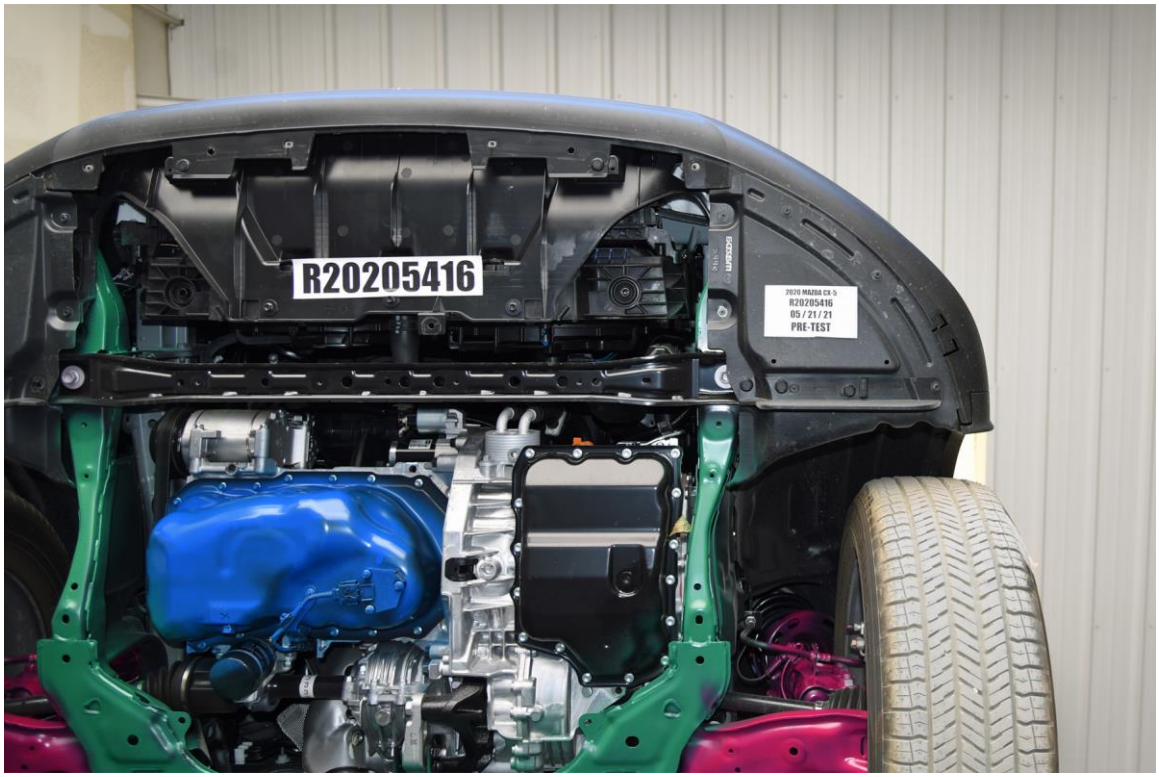


FIGURE 35. Pre-Test Driver Side Bumper to Rail Attachments and Crush Initiators

FIGURE 36. Post-Test Driver Side Bumper to Rail Attachments and Crush Initiators

FIGURE 37. Pre-Test Passenger Side Bumper to Rail Attachments and Crush Initiators

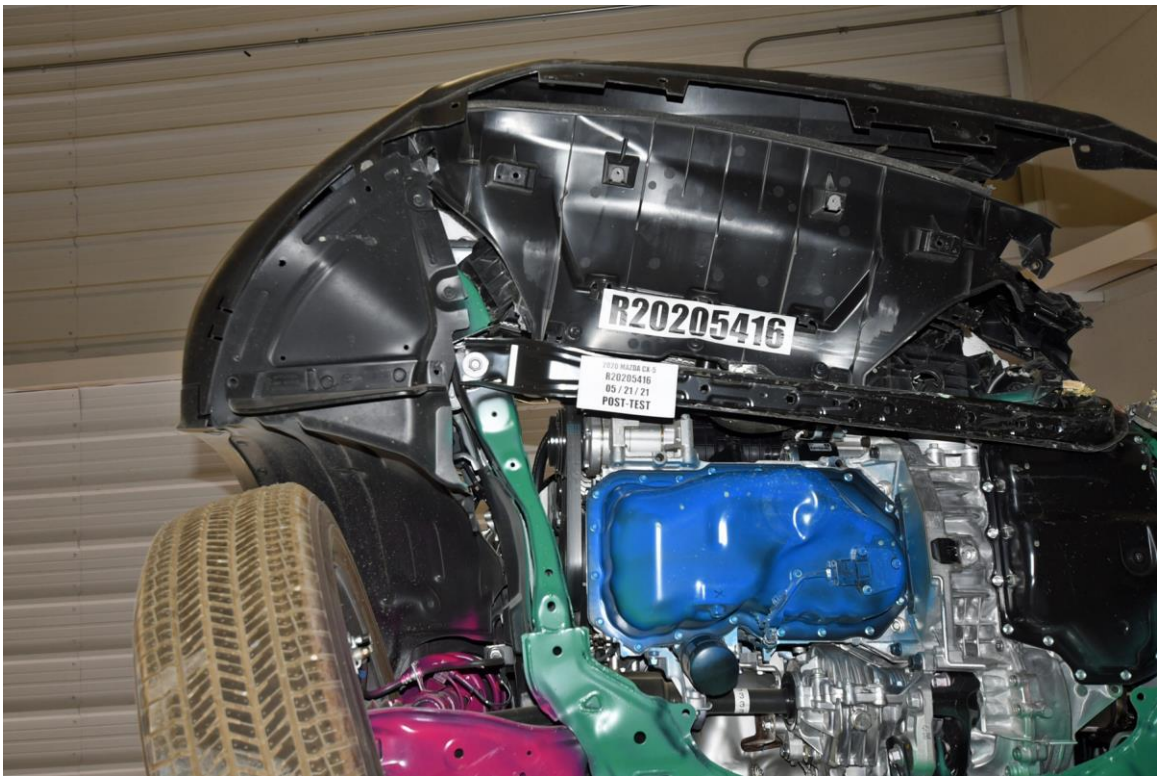


FIGURE 38. Post-Test Passenger Side Bumper to Rail Attachments and Crush Initiators

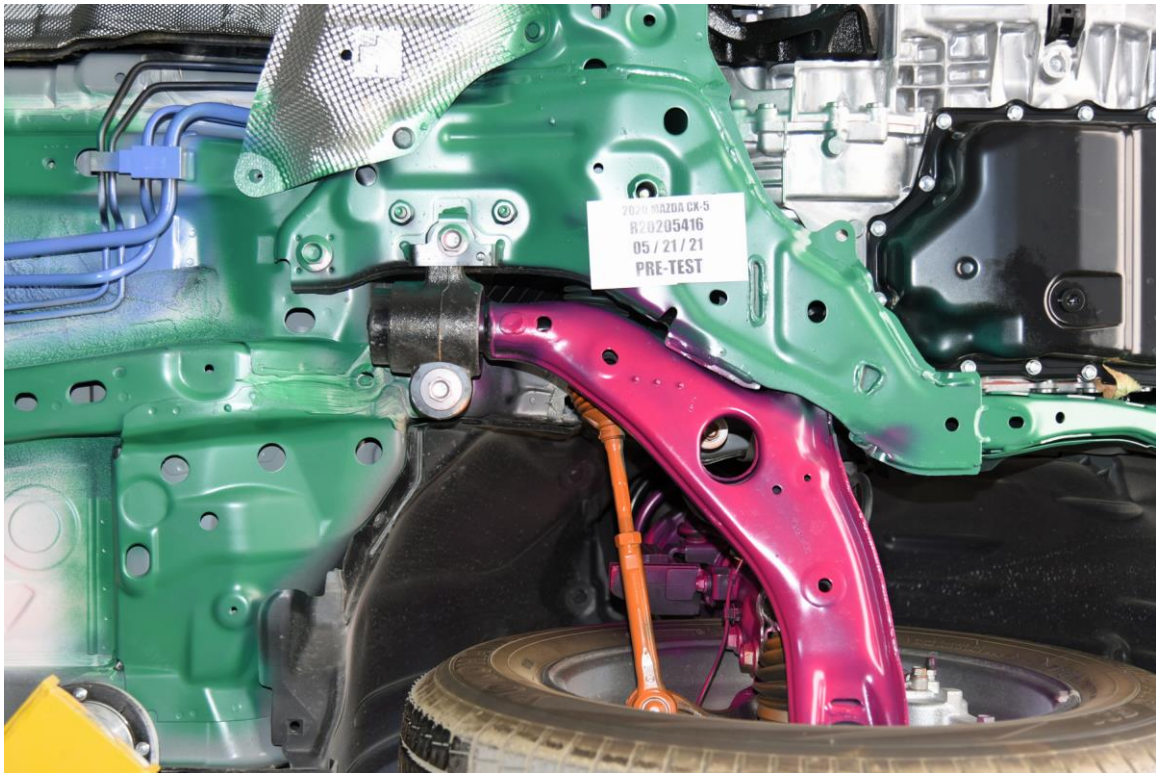


FIGURE 39. Pre-Test Driver Side Rocker

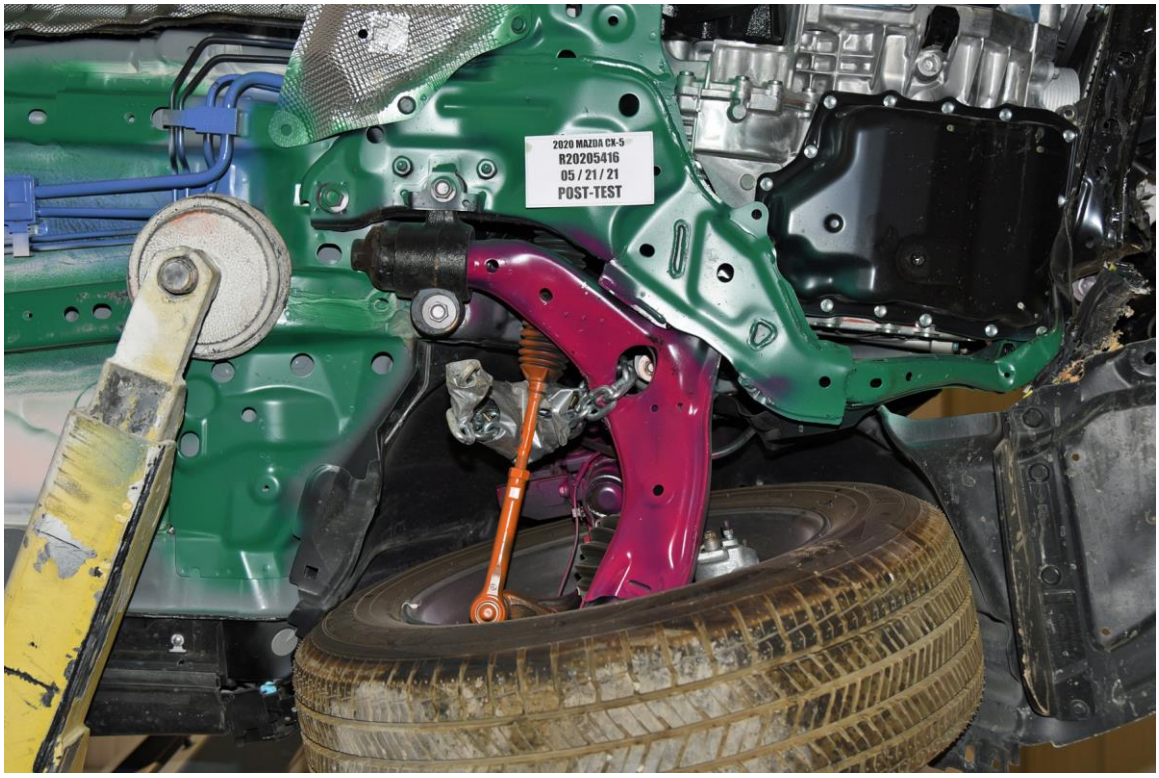


FIGURE 40. Post-Test Driver Side Rocker

FIGURE 41. Pre-Test Passenger Side Rocker

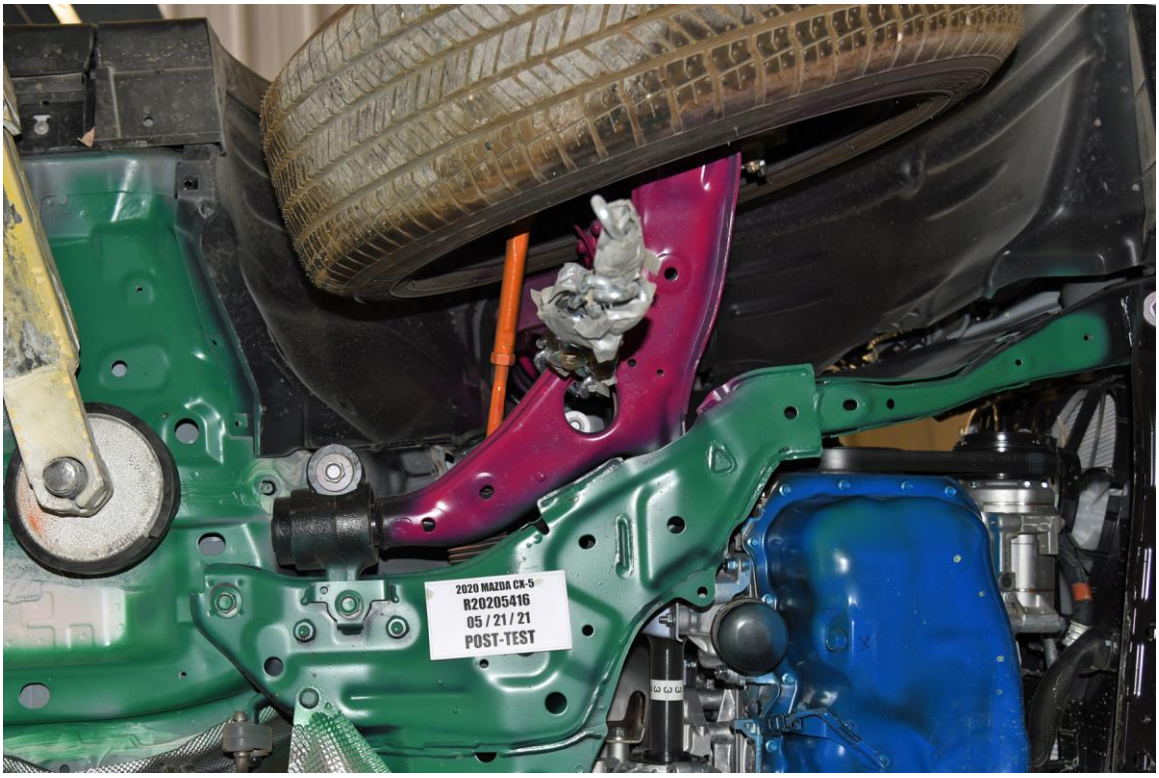


FIGURE 42. Post-Test Passenger Side Rocker

FIGURE 43. Pre-Test Driver Front Windshield View

FIGURE 44. Post-Test Driver Front Windshield View

FIGURE 45. Pre-Test Driver Side Front Window View

FIGURE 46. Post-Test Driver Side Front Window View

FIGURE 47. Pre-Test View of Driver Door Clearance

FIGURE 48. Post-Test View of Driver Door Clearance

FIGURE 49. Pre-Test Left Side View of Driver and Interior

FIGURE 50. Post-Test Left Side View of Driver and Interior

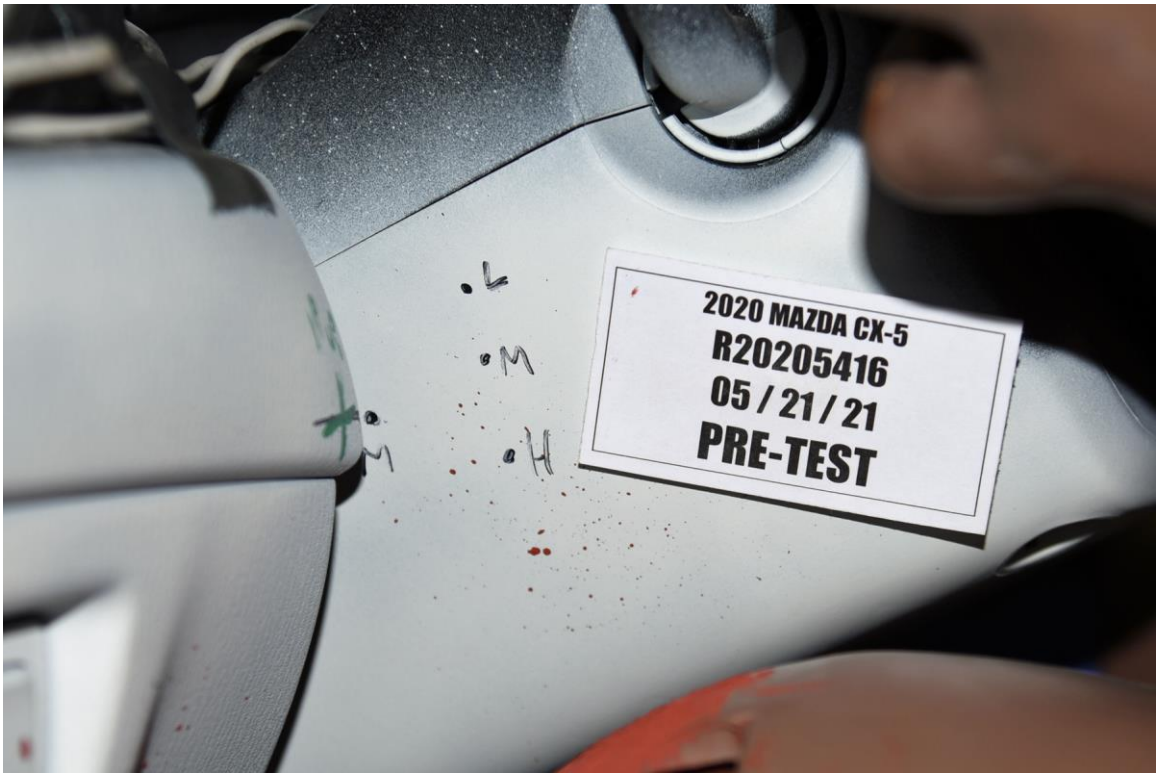


FIGURE 51. Pre-Test Left Side View of Steering Wheel Position

FIGURE 52. Post-Test Left Side View of Steering Wheel Position

FIGURE 53. Pre-Test Overhead View of Driver Thighs on Seat

FIGURE 54. Post-Test Overhead View of Driver Thighs on Seat

FIGURE 55. Pre-Test View of Driver Abdomen

FIGURE 56. Post-Test View of Driver Abdomen

FIGURE 57. Pre-Test Right Side View of Driver and Interior

FIGURE 58. Post-Test Right Side View of Driver and Interior

FIGURE 59. Pre-Test View of Driver Left Knee and Bolster

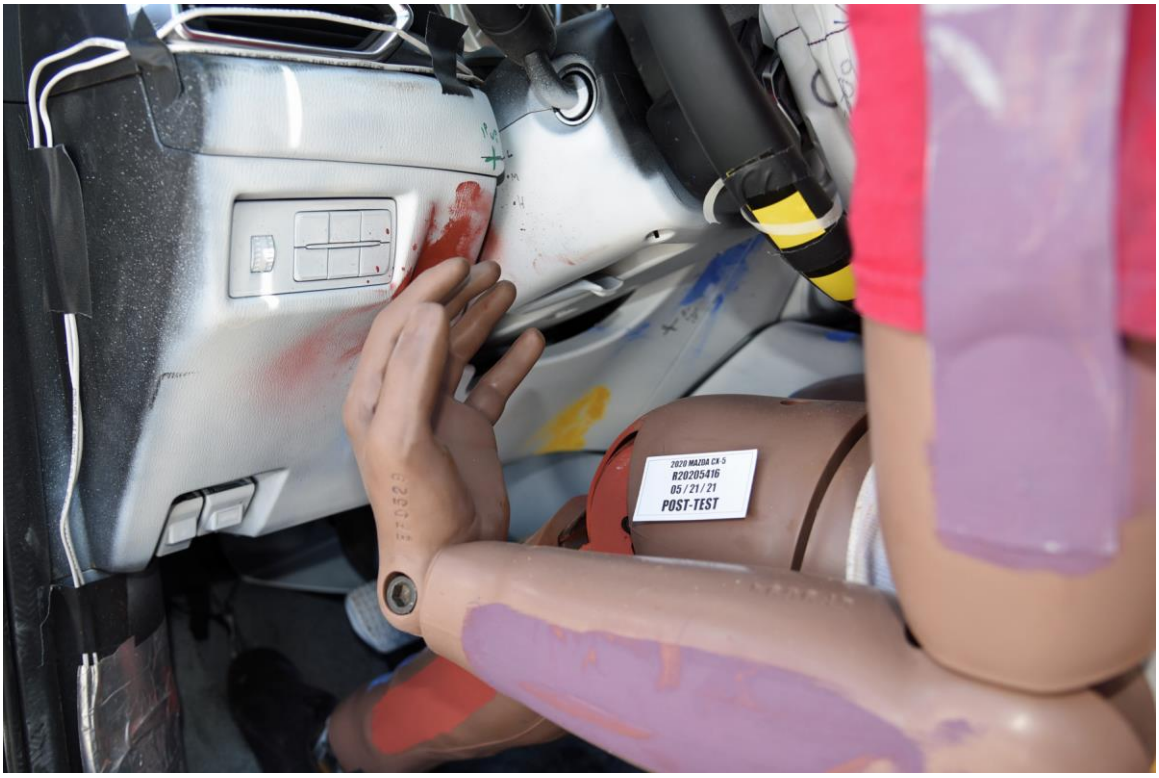


FIGURE 60. Post-Test View of Driver Left Knee and Bolster

FIGURE 61. Pre-Test View of Driver Right Knee and Bolster

FIGURE 62. Post-Test View of Driver Right Knee and Bolster

FIGURE 63. Pre-Test View of the Driver Left Leg

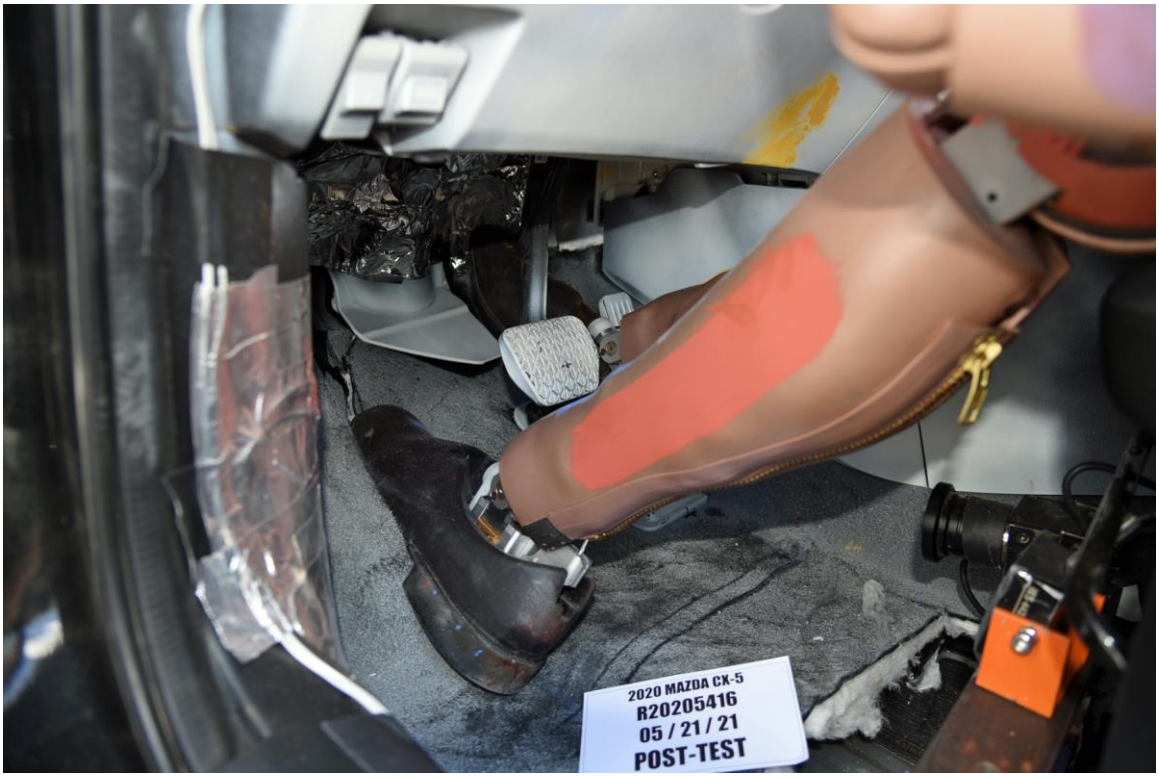


FIGURE 64. Post-Test View of the Driver Left Leg

FIGURE 65. Pre-Test View of the Driver Feet

FIGURE 66. Post-Test View of the Driver Feet

FIGURE 67. Pre-Test Driver Adjustable D-Ring

FIGURE 68. Post-Test Driver Adjustable D-Ring

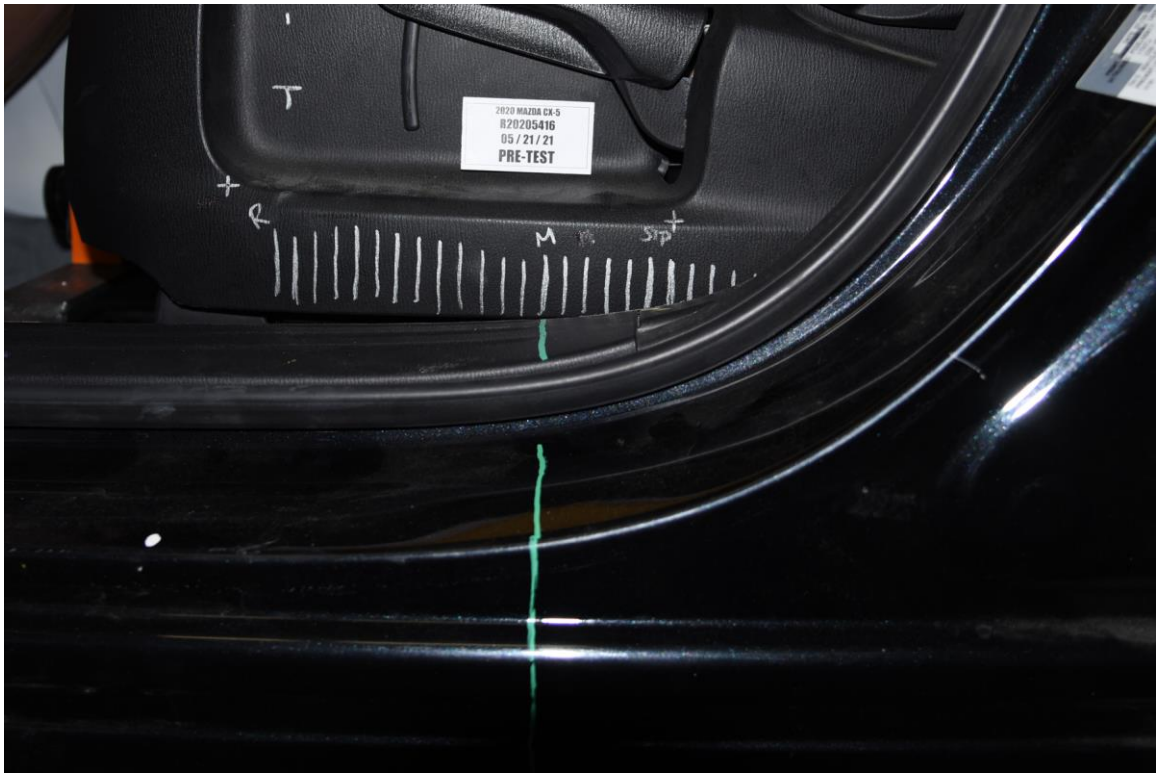


FIGURE 69. Pre-Test Driver Seat Fore-Aft Markings

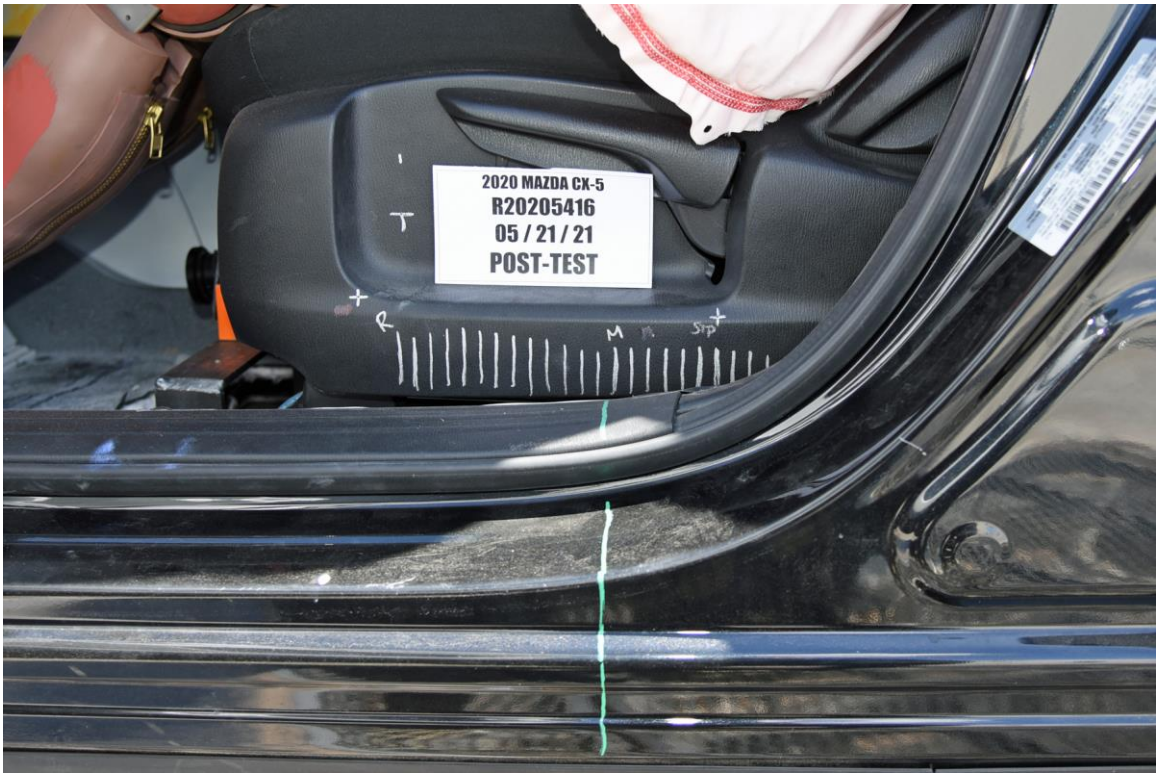


FIGURE 70. Post-Test Driver Seat Fore-Aft Markings

FIGURE 71. Pre-Test Driver Seat Back Markings

FIGURE 72. Post-Test Driver Seat Back Markings

FIGURE 73. Pre-Test Close-Up View of Driver Door Latch

FIGURE 74. Post-Test Close-Up View of Driver Door Latch

FIGURE 75. Pre-Test Driver Inner Door Panel

FIGURE 76. Post-Test Driver Inner Door Panel

FIGURE 77. Pre-Test Left Side View of Driver Knee Bolster

FIGURE 78. Post-Test Left Side View of Driver Knee Bolster

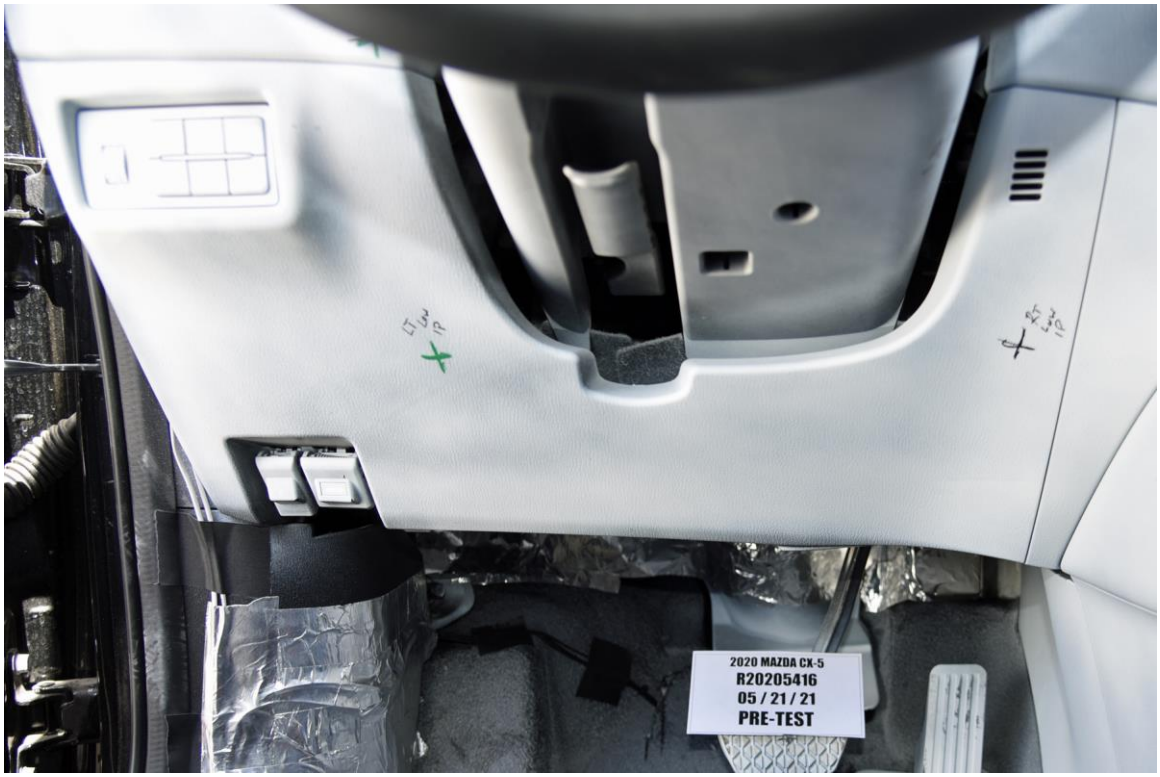


FIGURE 79. Pre-Test Overall View of Driver Knee Bolster

FIGURE 80. Post-Test Overall View of Driver Knee Bolster

FIGURE 81. Pre-Test Right Side View of Driver Knee Bolster

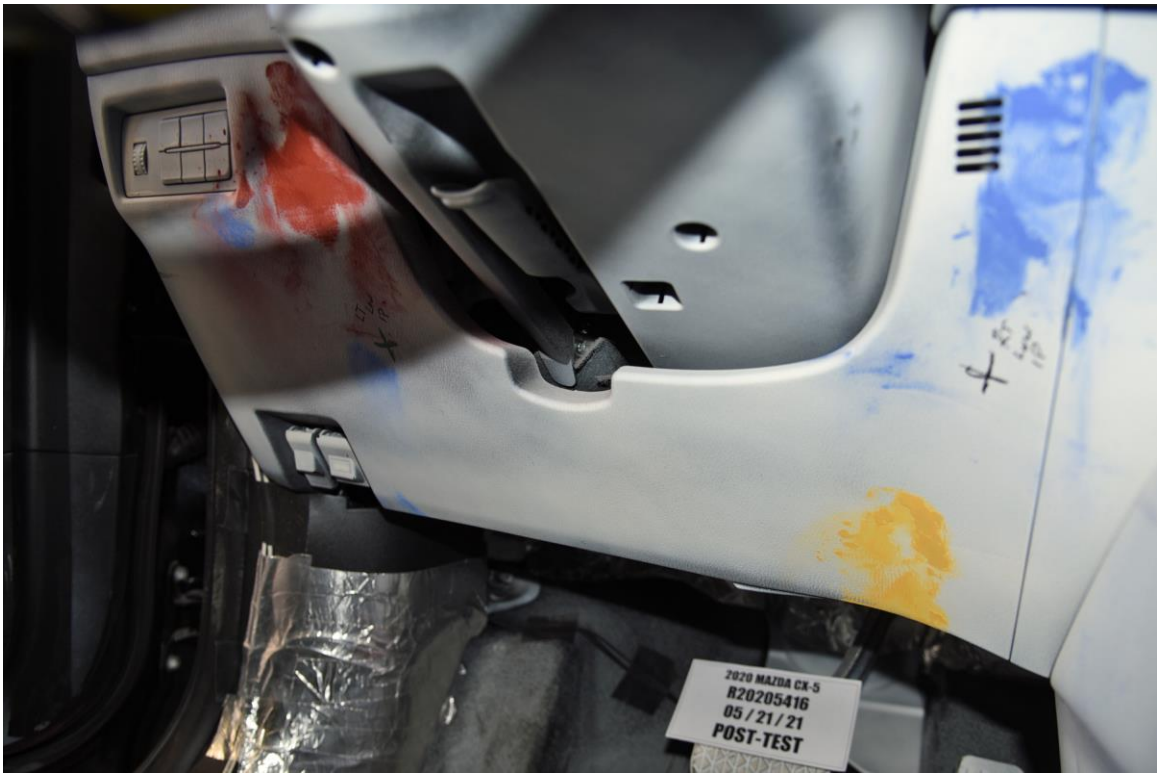


FIGURE 82. Post-Test Right Side View of Driver Knee Bolster

FIGURE 83. Pre-Test View of Driver Floor Pan from Outside of Vehicle

FIGURE 84. Post-Test View of Driver Floor Pan from Outside of Vehicle

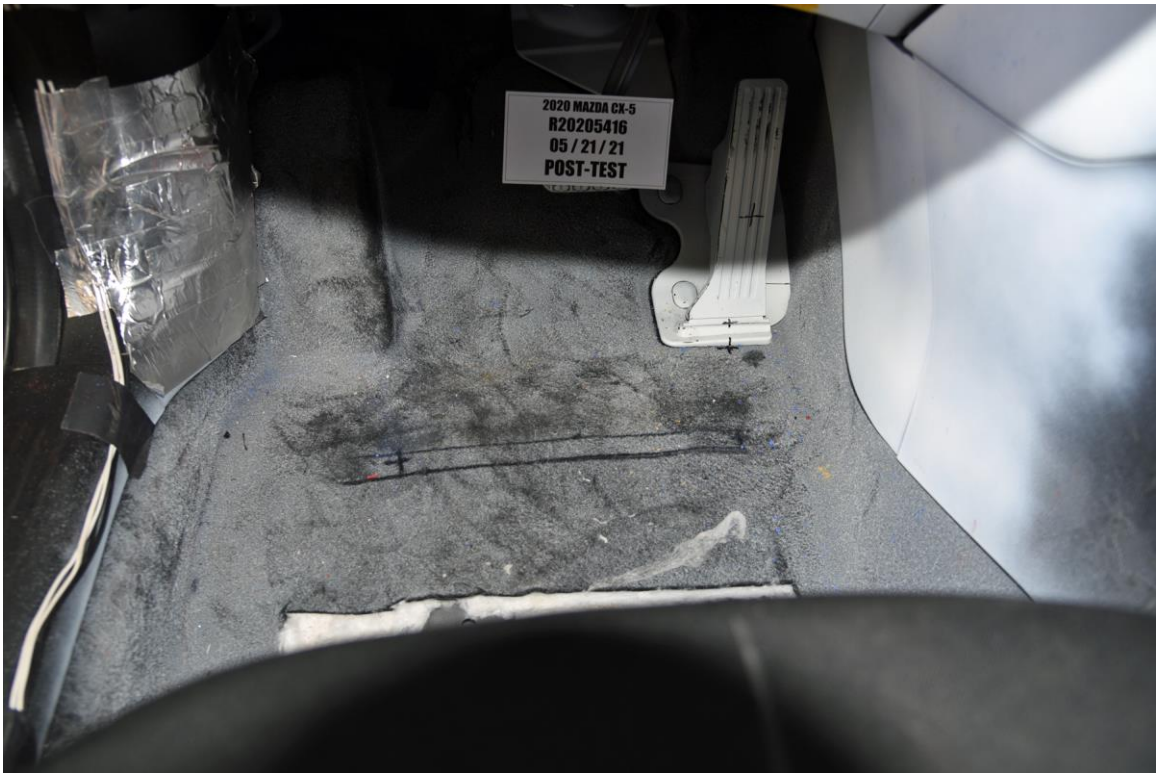


FIGURE 85. Pre-Test View of Driver Floor Pan from Top of Seat

FIGURE 86. Post-Test View of Driver Floor Pan from Top of Seat

FIGURE 87. Pre-Test View of Driver Floor Pan from Center of Vehicle

FIGURE 88. Post-Test View of Driver Floor Pan from Center of Vehicle

FIGURE 89. Post-Test Driver Dummy Contact with Front Airbag

FIGURE 90. Post-Test Driver Dummy Contact with Side Airbag

Photograph Not Applicable

FIGURE 91. Post-Test Driver Dummy Contact with Knee Airbag

FIGURE 91a. Post-Test Driver Dummy Contact with Windshield

FIGURE 91b. Post-Test Driver Dummy Contact with Headliner and A-Pillar

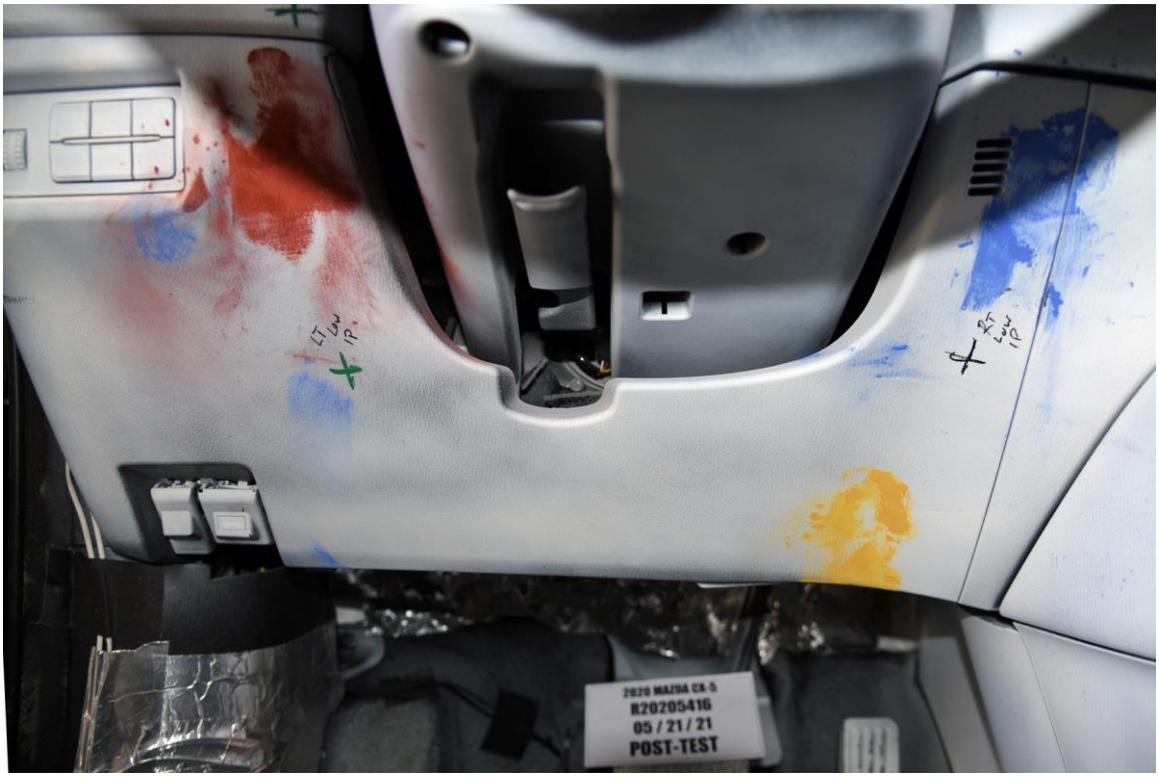


FIGURE 91c. Post-Test Driver Dummy Contact with Knee Bolster

FIGURE 92. Pre-Test Passenger Front Windshield View

FIGURE 93. Post-Test Passenger Front Windshield View

FIGURE 94. Pre-Test Passenger Side Front Window View

FIGURE 95. Post-Test Passenger Side Front Window View

FIGURE 96. Pre-Test View of Passenger Door Clearance

FIGURE 97. Post-Test View of Passenger Door Clearance

FIGURE 98. Pre-Test Right Side View of Passenger and Interior

FIGURE 99. Post-Test Right Side View of Passenger and Interior

FIGURE 100. Pre-Test Overhead View of Passenger Thighs on Seat

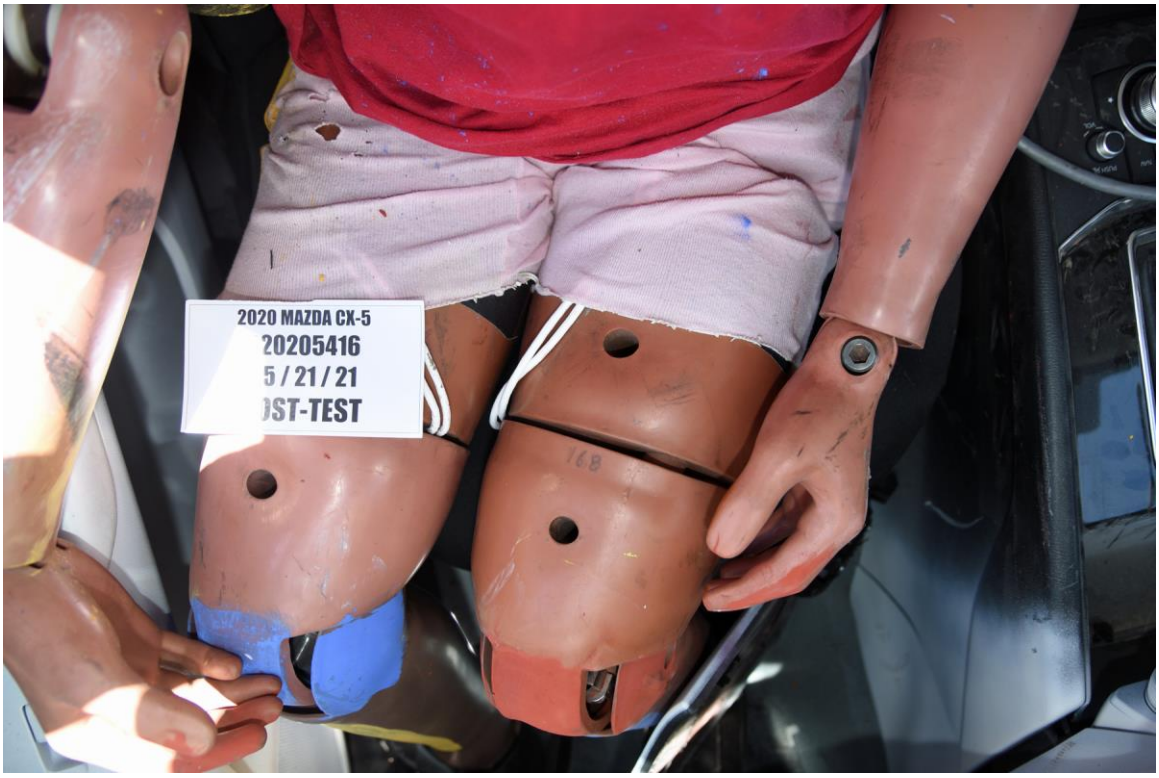


FIGURE 101. Post-Test Overhead View of Passenger Thighs on Seat

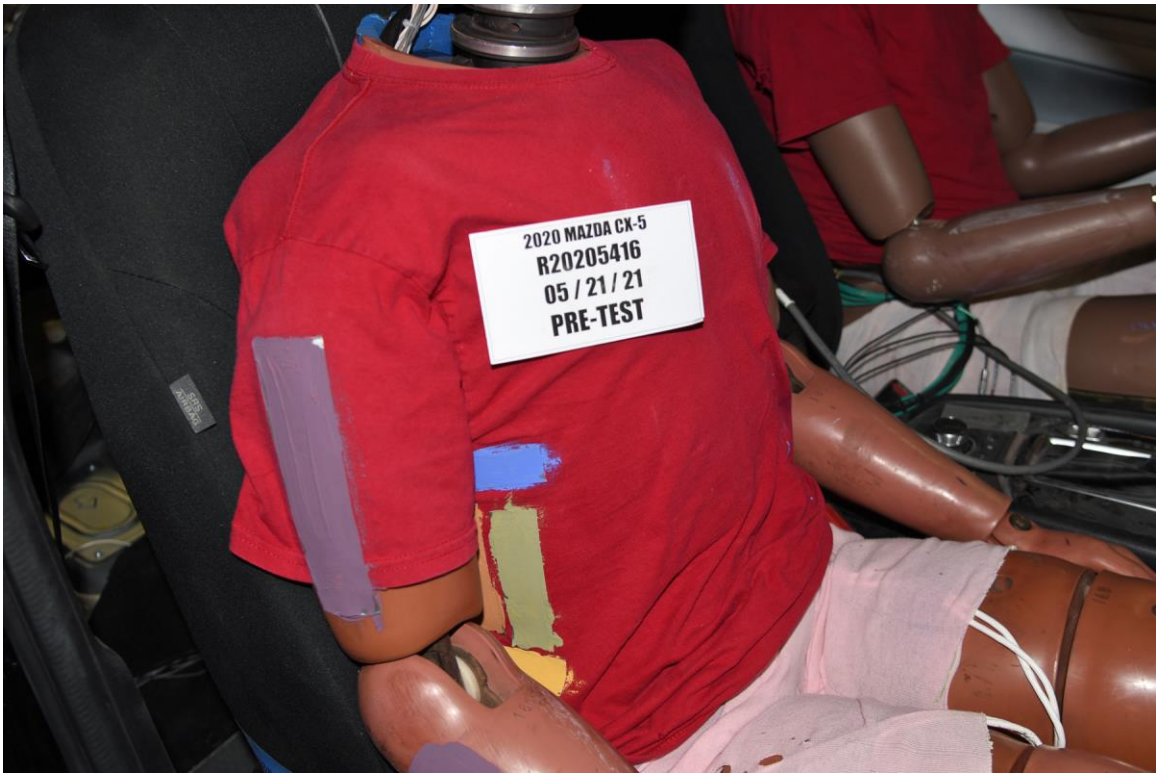


FIGURE 102. Pre-Test View of Passenger Abdomen

FIGURE 103. Post-Test View of Passenger Abdomen

FIGURE 104. Pre-Test Left Side Passenger and Interior View

FIGURE 105. Post-Test Left Side Passenger and Interior View

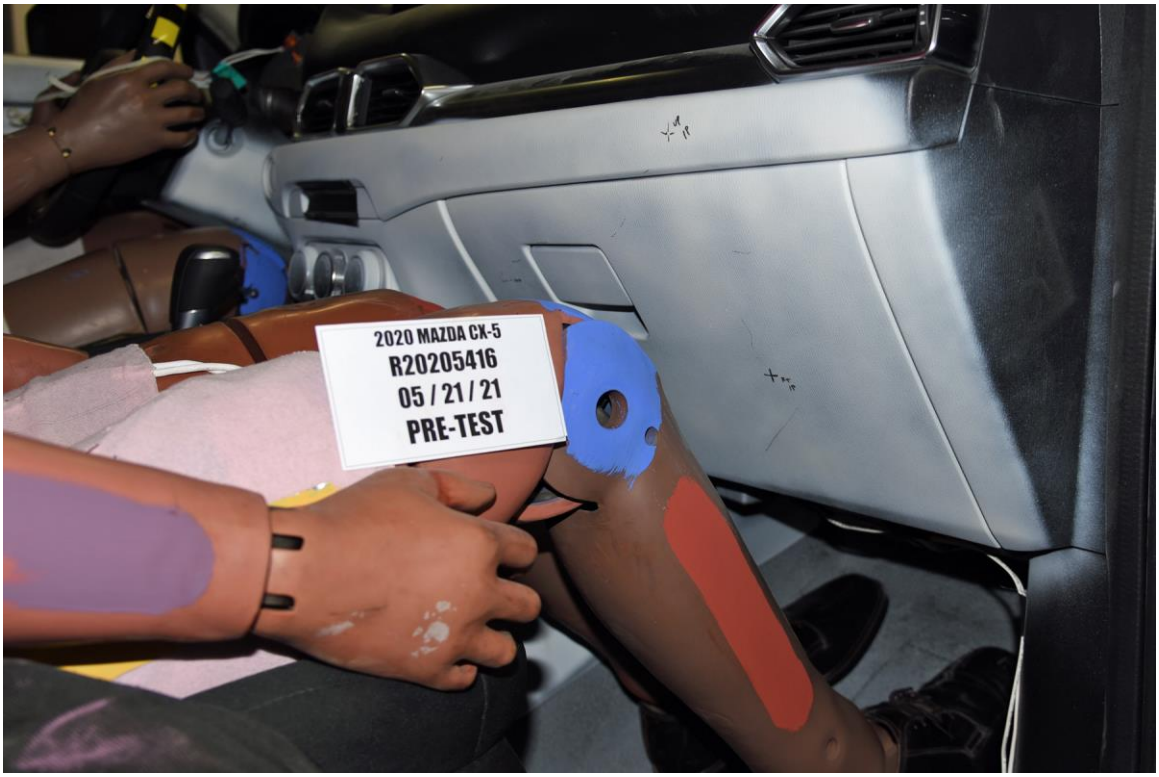


FIGURE 106. Pre-Test View of Passenger Right Knee and Bolster

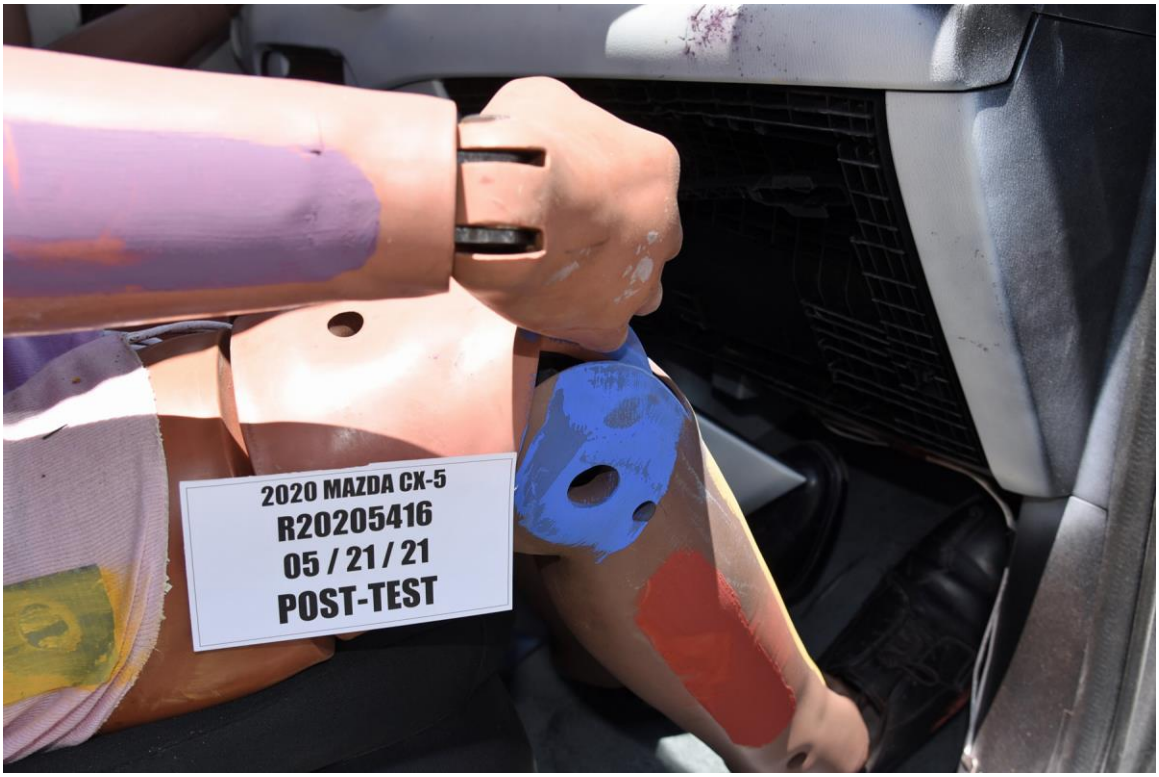


FIGURE 107. Post-Test View of Passenger Right Knee and Bolster

FIGURE 108. Pre-Test View of Passenger Left Knee and Bolster

FIGURE 109. Post-Test View of Passenger Left Knee and Bolster

FIGURE 110. Pre-Test View of the Passenger Feet

FIGURE 111. Post-Test View of the Passenger Feet

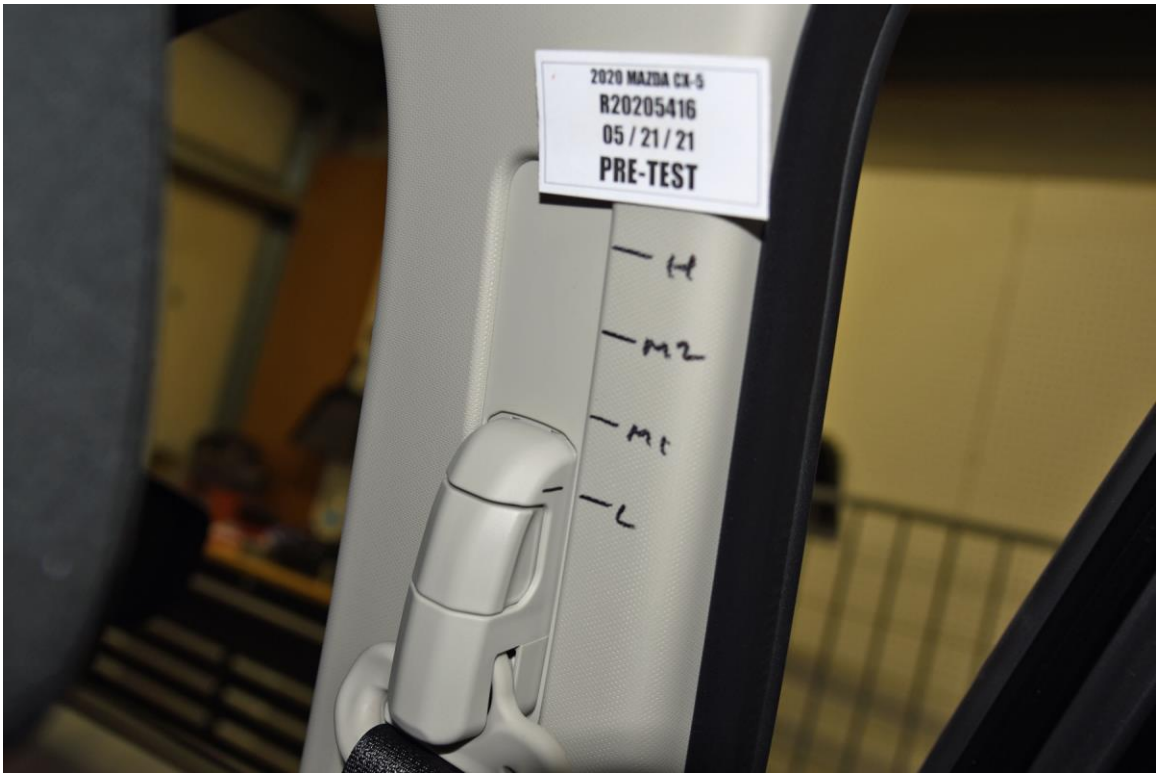


FIGURE 112. Pre-Test Passenger Adjustable D-Ring

FIGURE 113. Post-Test Passenger Adjustable D-Ring

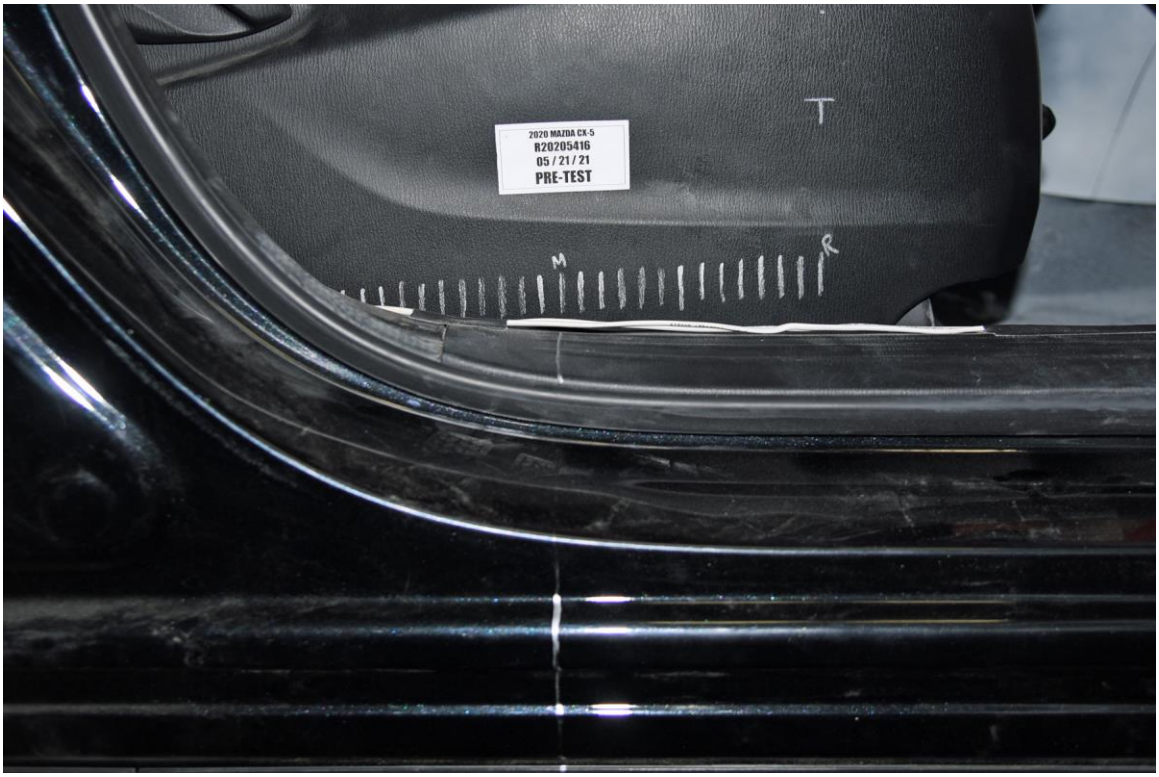


FIGURE 114. Pre-Test Right Front Passenger Seat Fore-Aft Markings

FIGURE 115. Post-Test Right Front Passenger Seat Fore-Aft Markings

FIGURE 116. Pre-Test Passenger Seat Back Markings

FIGURE 117. Post-Test Passenger Seat Back Markings

FIGURE 118. Pre-Test Close-up View of Passenger Door Latch

FIGURE 119. Post-Test Close-up View of Passenger Door Latch

FIGURE 120. Pre-Test Passenger Inner Door Panel

FIGURE 121. Post-Test Passenger Inner Door Panel

FIGURE 122. Pre-Test Right Side View of Passenger Knee Bolster

FIGURE 123. Post-Test Right Side View of Passenger Knee Bolster

FIGURE 124. Pre-Test Center View of Passenger Knee Bolster

FIGURE 125. Post-Test Center View of Passenger Knee Bolster

FIGURE 126. Pre-Test Left Side View of Passenger Knee Bolster

FIGURE 127. Post-Test Left Side View of Passenger Knee Bolster

FIGURE 128. Pre-Test View of Passenger Floor Pan from Outside of Vehicle

FIGURE 129. Post-Test View of Passenger Floor Pan from Outside of Vehicle

FIGURE 130. Pre-Test View of Passenger Floor Pan from Top of Front Seat

FIGURE 131. Post-Test View of Passenger Floor Pan from Top of Front Seat

FIGURE 132. Pre-Test View of Passenger Floor Pan from Center of Vehicle

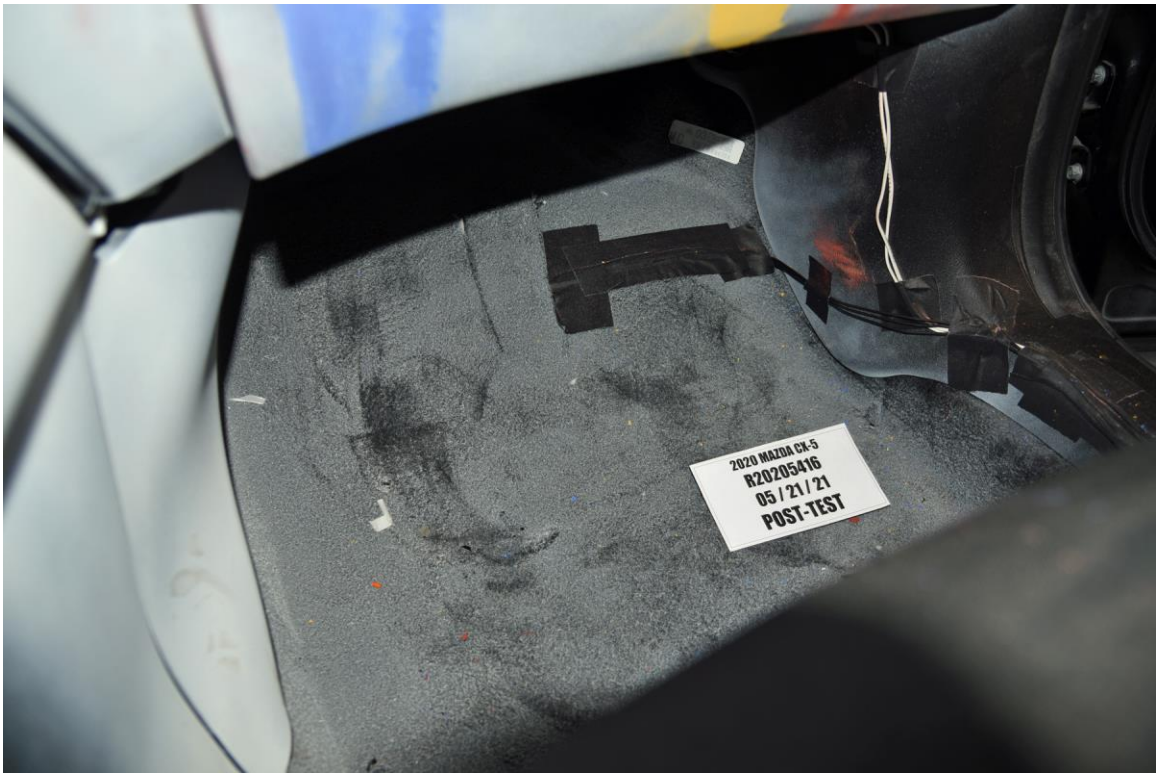


FIGURE 133. Post-Test View of Passenger Floor Pan from Center of Vehicle

FIGURE 134. Post-Test Passenger Dummy Contact with Front Airbag

Photograph Not Applicable

FIGURE 135. Post-Test Passenger Dummy Contact with Side Airbag

Photograph Not Applicable

FIGURE 136. Post-Test Passenger Dummy Contact with Knee Airbag

FIGURE 136a. Post-Test Passenger Dummy Contact with Knee Bolster

Photograph Not Applicable

No Stoddard Solvent Spillage

FIGURE 138. Post-Test Stoddard Solvent Spillage Location View

FIGURE 139. Post-Test Speed Trap Read-Out

FIGURE 140. Vehicle at 0° on Static Rollover Device

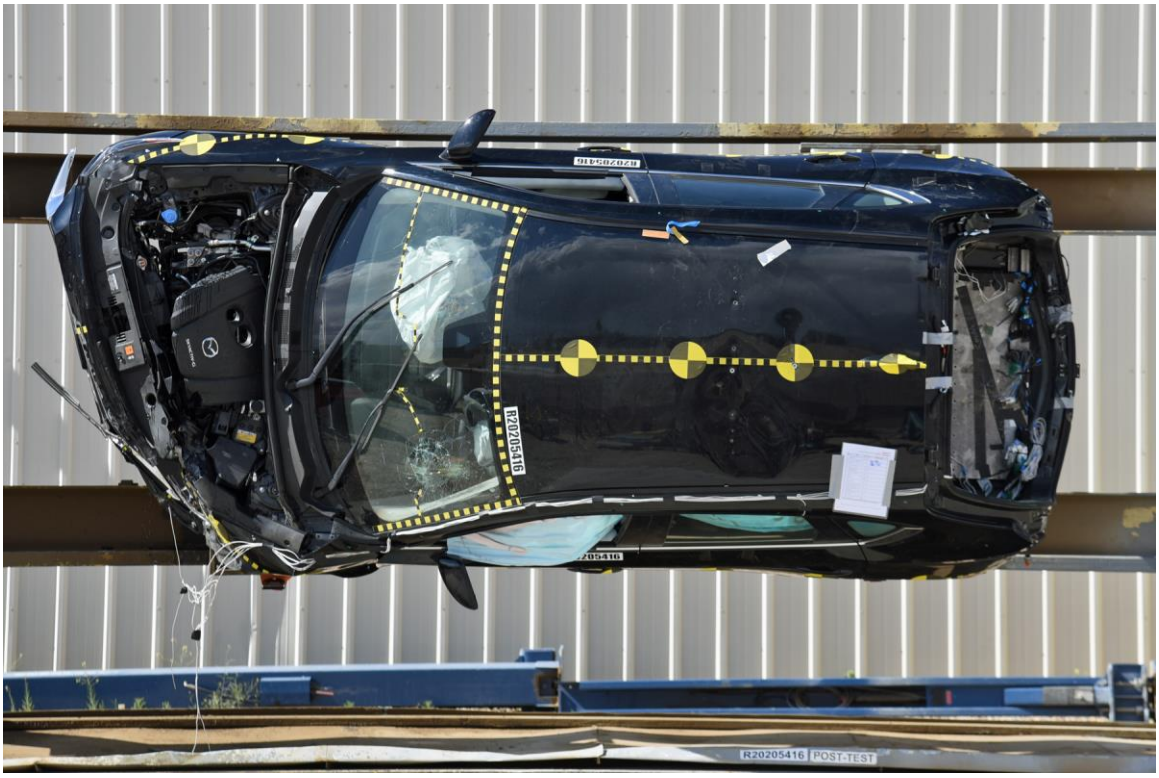


FIGURE 141. Vehicle at 90° on Static Rollover Device

FIGURE 142. Vehicle at 180° on Static Rollover Device

FIGURE 143. Vehicle at 270° on Static Rollover Device

FIGURE 144. Vehicle at 360° on Static Rollover Device

FIGURE 145. Frontal Impact Event

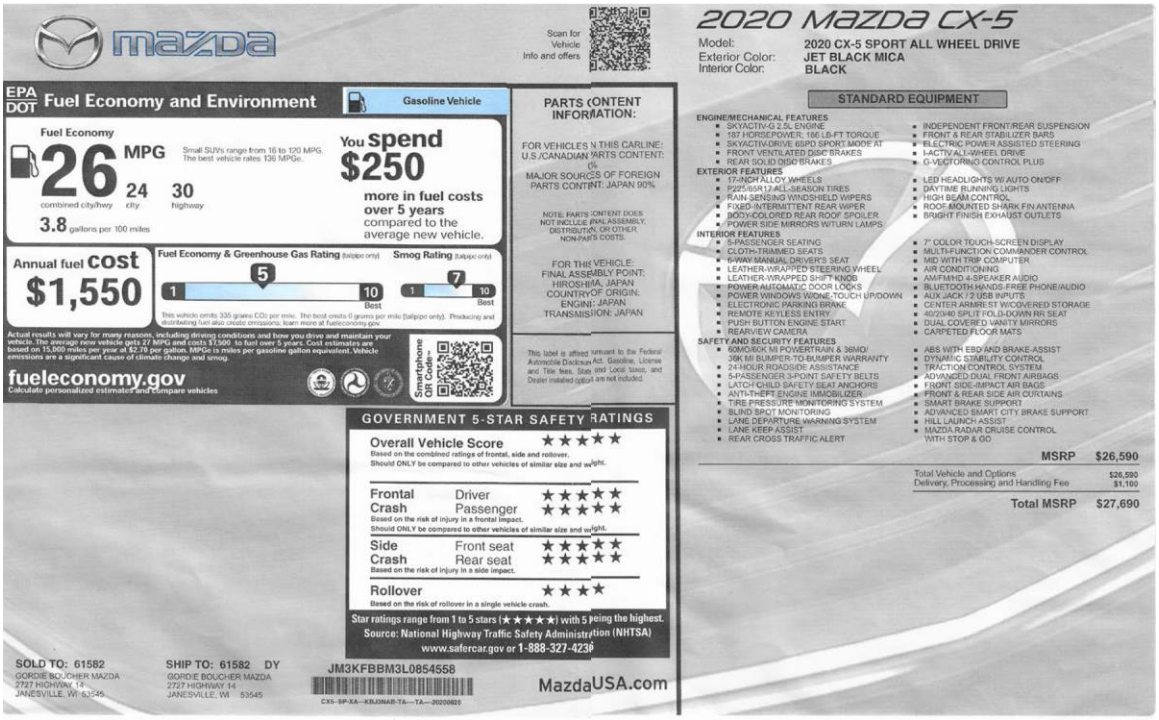


FIGURE 146. Monroney Label Photograph

APPENDIX B

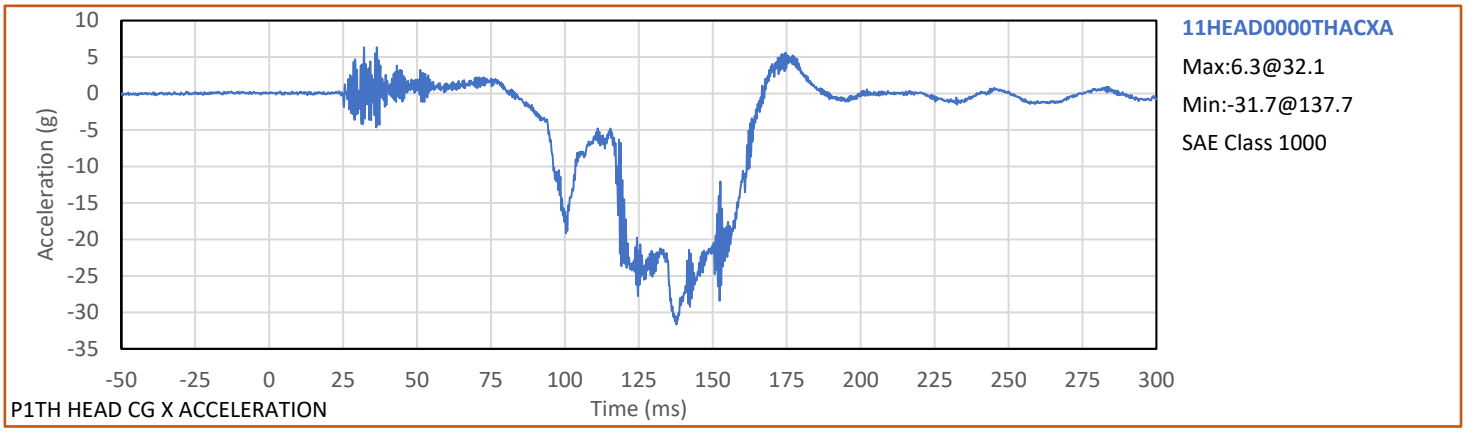
VEHICLE AND DUMMY RESPONSE DATA TRACES

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV

Test Program: Left Side 30° Frontal Rigid Barrier Impact

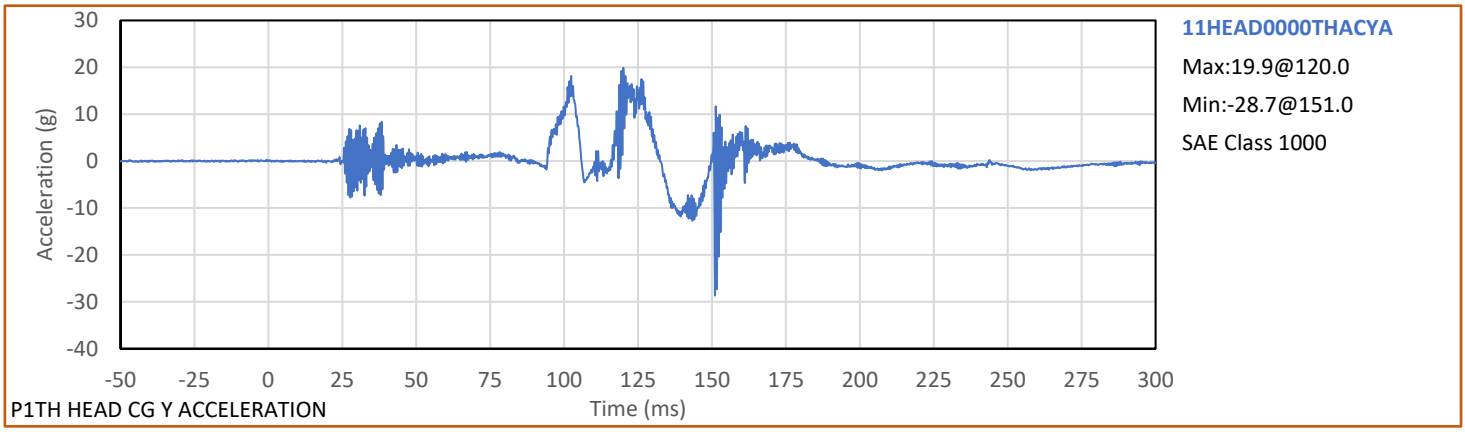
NHTSA No.: R20205416

Test Date: 5/21/2021



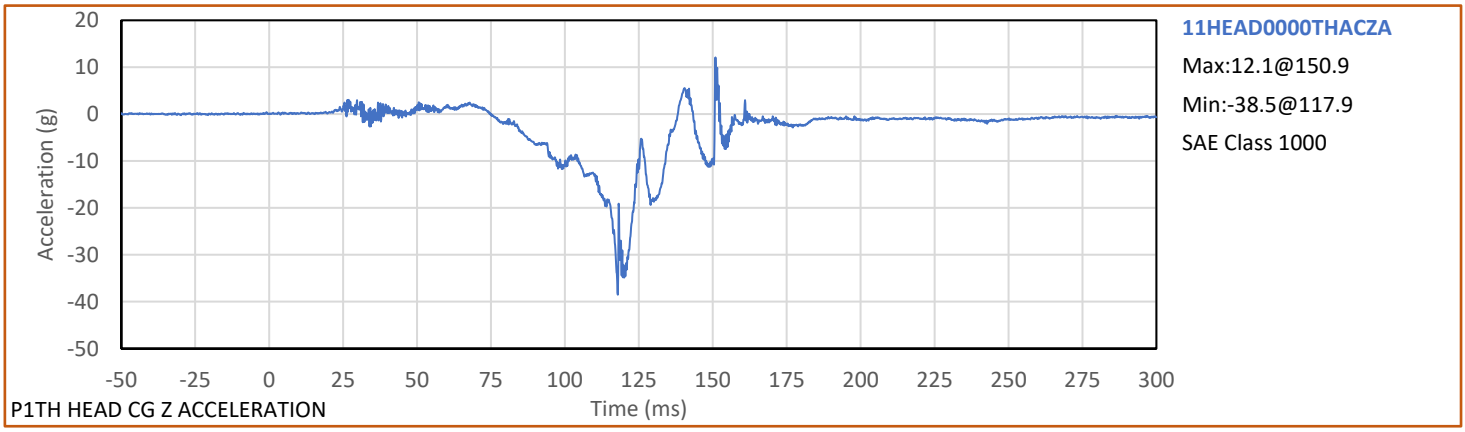
P1TH HEAD CG X ACCELERATION

11HEAD0000THACXA
Max:6.3@32.1
Min:-31.7@137.7
SAE Class 1000



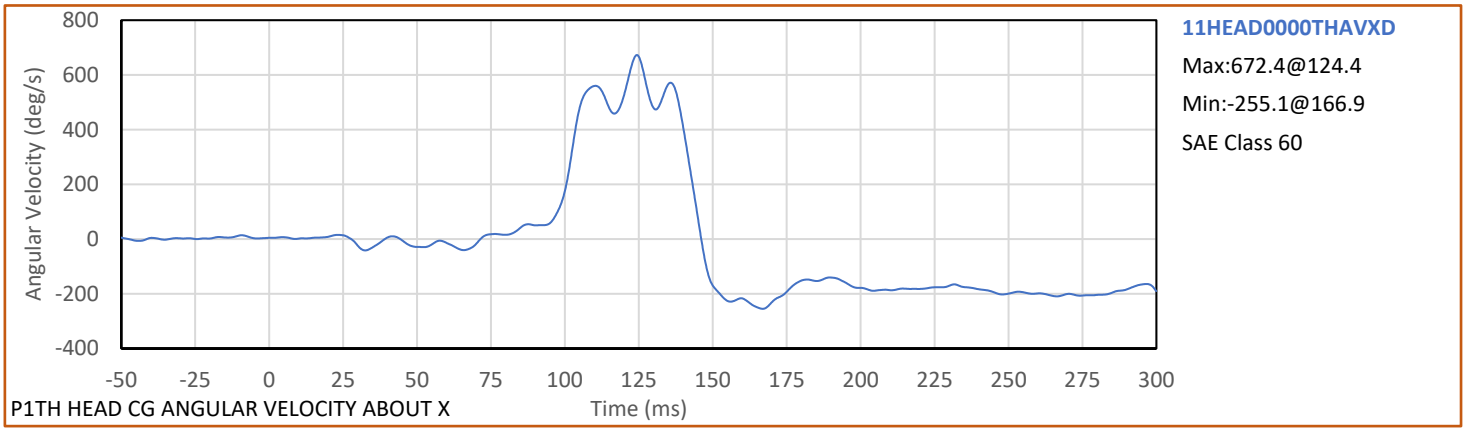
P1TH HEAD CG Y ACCELERATION

11HEAD0000THACYA
Max:19.9@120.0
Min:-28.7@151.0
SAE Class 1000



P1TH HEAD CG Z ACCELERATION

11HEAD0000THACZA
Max:12.1@150.9
Min:-38.5@117.9
SAE Class 1000



P1TH HEAD CG ANGULAR VELOCITY ABOUT X

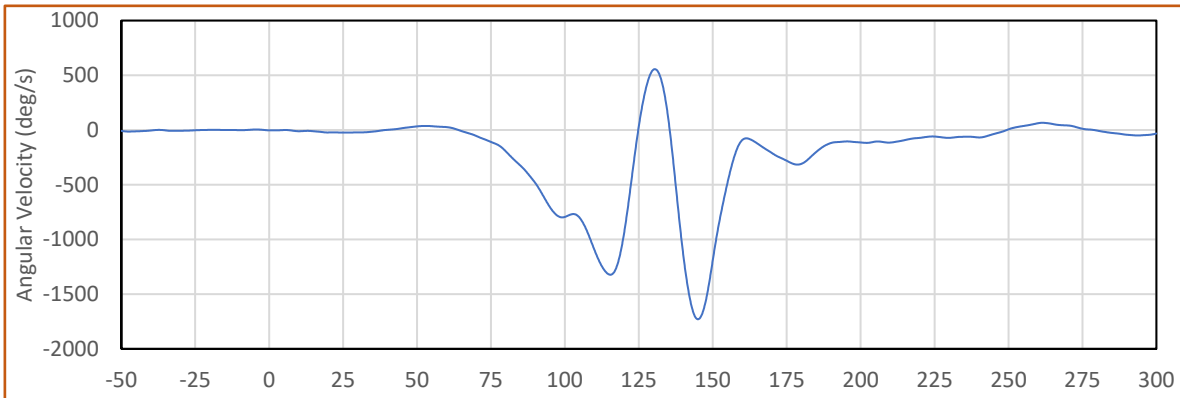
11HEAD0000THAVXD
Max:672.4@124.4
Min:-255.1@166.9
SAE Class 60

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV

Test Program: Left Side 30° Frontal Rigid Barrier Impact

NHTSA No.: R20205416

Test Date: 5/21/2021



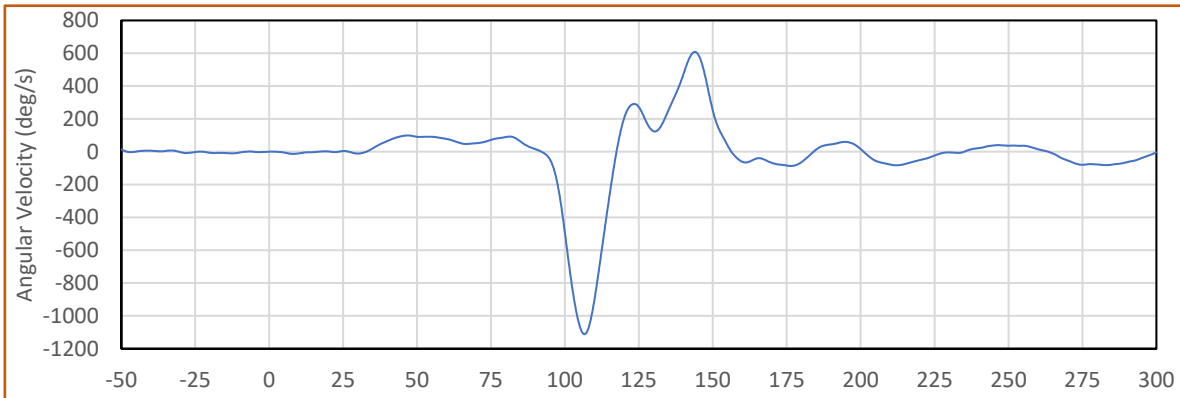
11HEAD0000THAVYD

Max:555.4@130.4

Min:-1730.1@145.0

SAE Class 60

P1TH HEAD CG ANGULAR VELOCITY ABOUT Y



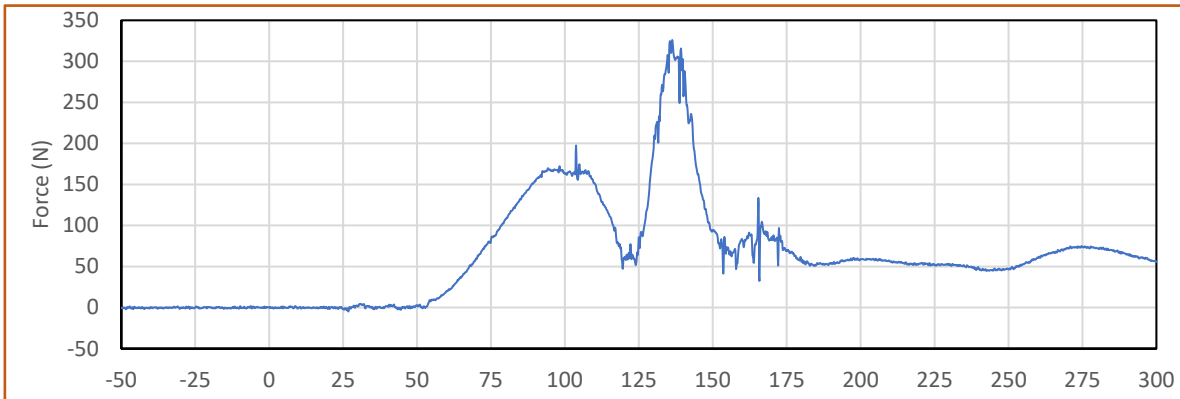
11HEAD0000THAVZD

Max:607.5@144.0

Min:-1111.8@106.6

SAE Class 60

P1TH HEAD CG ANGULAR VELOCITY ABOUT Z



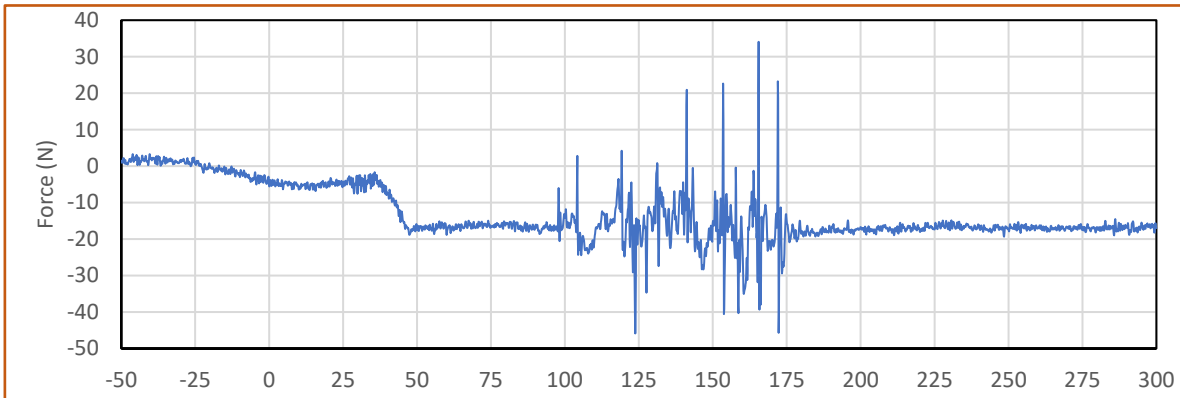
11NECKFR00THFOZA

Max:326.0@136.3

Min:-4.8@26.8

SAE Class 1000

P1TH FRONT NECK SPRING TOWER LOAD CELL



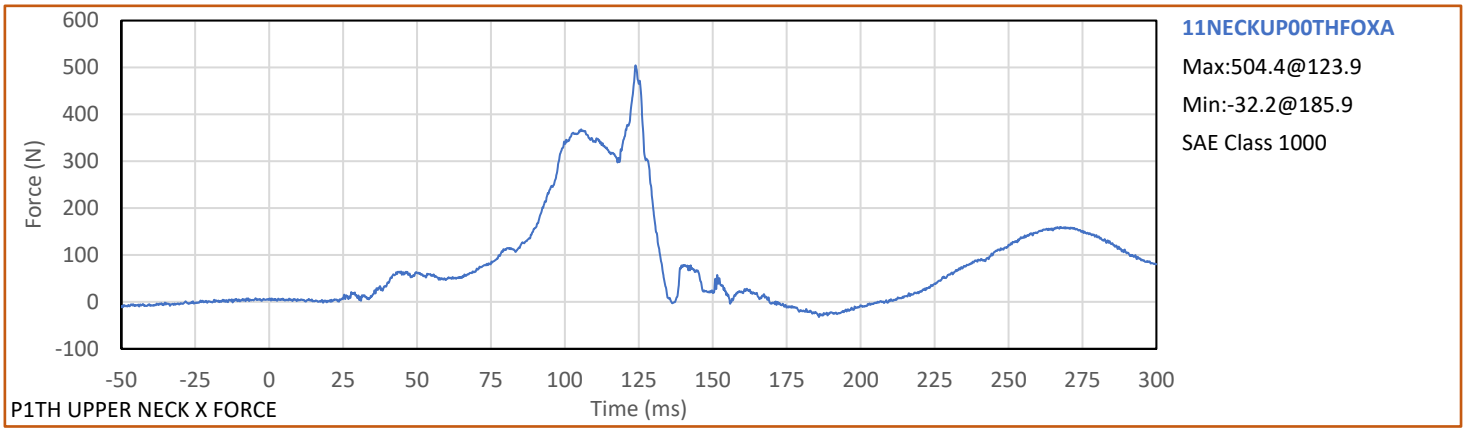
11NECKRE00THFOZA

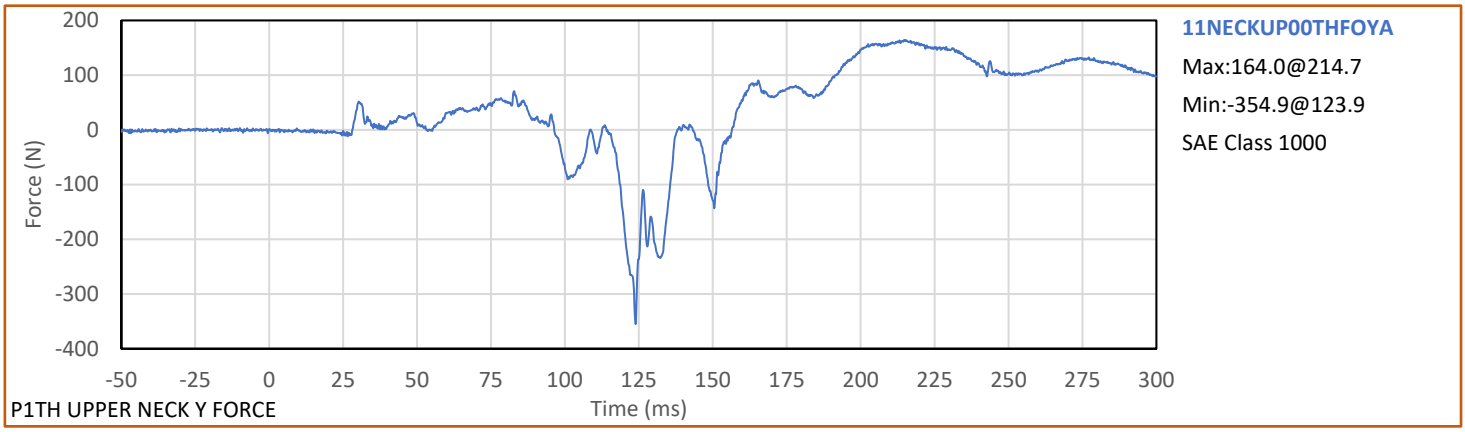
Max:34.1@165.5

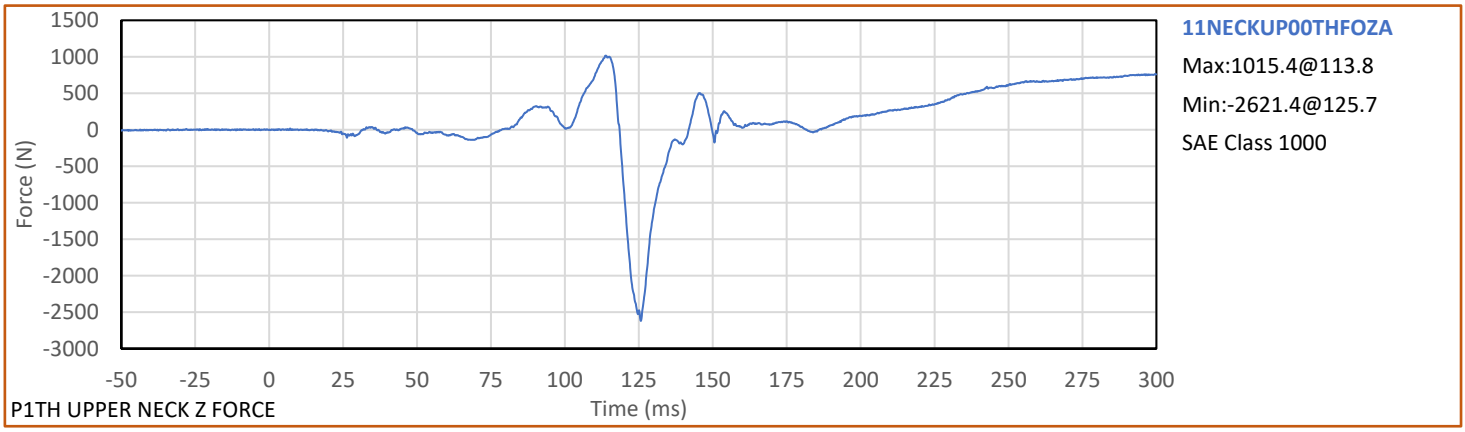
Min:-45.9@123.8

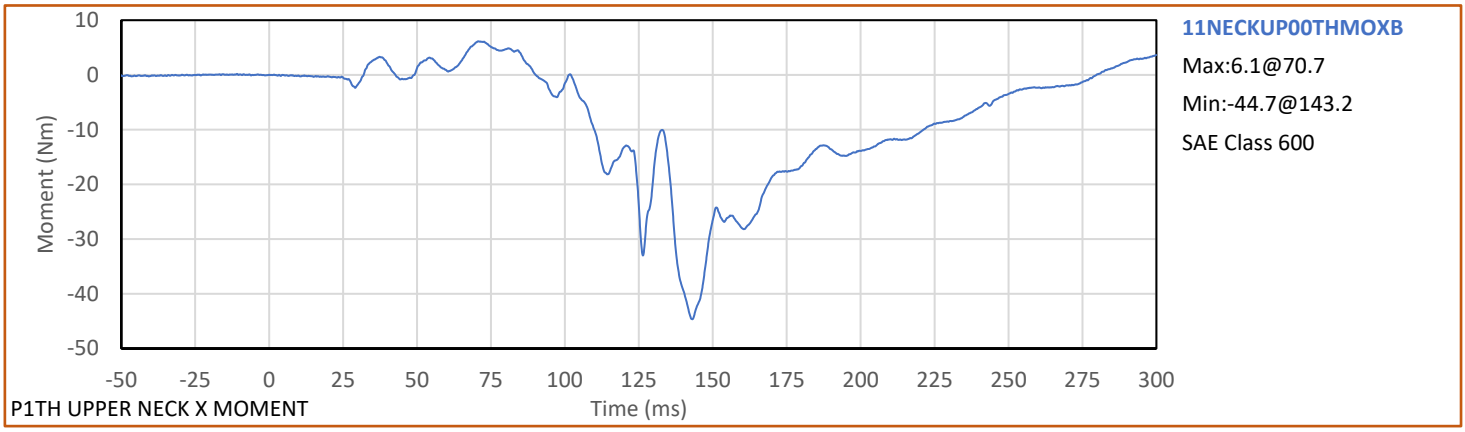
SAE Class 1000

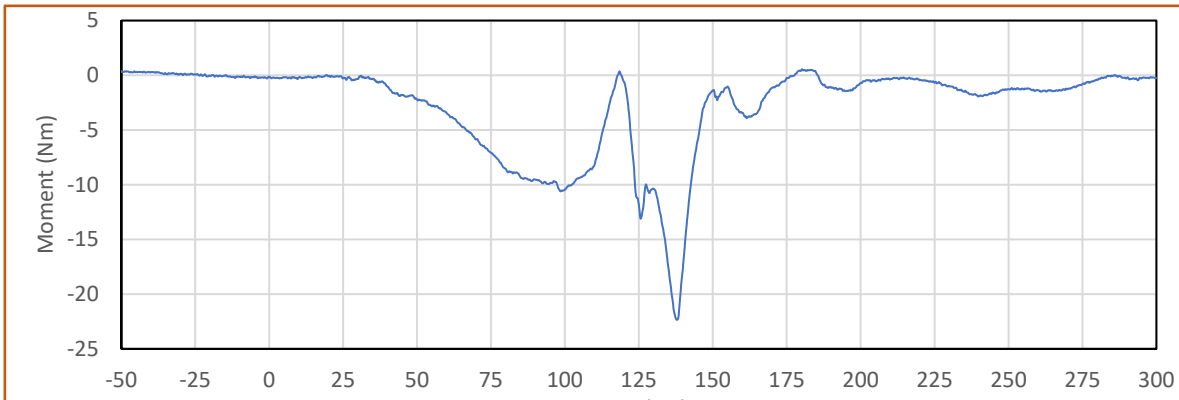
P1TH REAR NECK SPRING TOWER LOAD CELL


Force (N)
Time (ms)
P1TH UPPER NECK X FORCE
11NECKUP00THFOXA
Max:504.4@123.9
Min:-32.2@185.9
SAE Class 1000


Force (N)
Time (ms)
P1TH UPPER NECK Y FORCE
11NECKUP00THFOYA
Max:164.0@214.7
Min:-354.9@123.9
SAE Class 1000


Force (N)
Time (ms)
P1TH UPPER NECK Z FORCE
11NECKUP00THFOZA
Max:1015.4@113.8
Min:-2621.4@125.7
SAE Class 1000


Moment (Nm)
Time (ms)
P1TH UPPER NECK X MOMENT
11NECKUP00THMOXB
Max:6.1@70.7
Min:-44.7@143.2
SAE Class 600

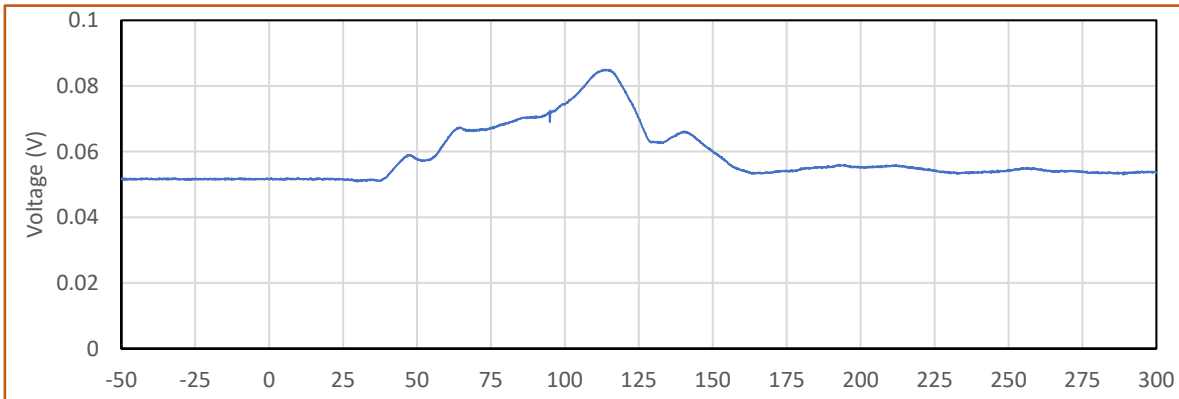


P1TH UPPER NECK Y MOMENT

11NECKUP00THMOYB
Max:0.6@180.2
Min:-22.4@137.9
SAE Class 600

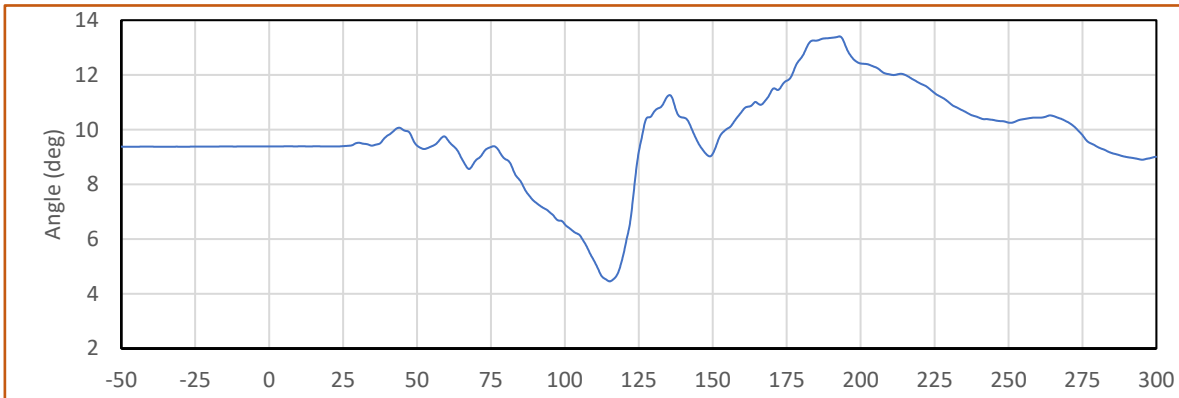
P1TH UPPER NECK Z MOMENT

11NECKUP00THMOZB
Max:21.2@114.3
Min:-1.0@58.9
SAE Class 600



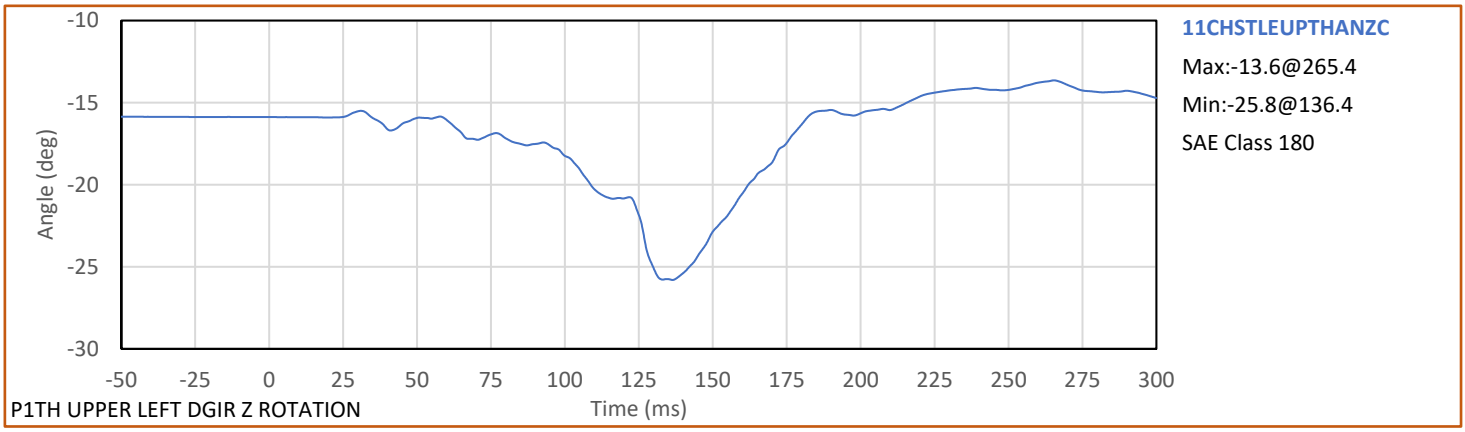
P1TH UPPER LEFT DGIR X DISPLACEMENT

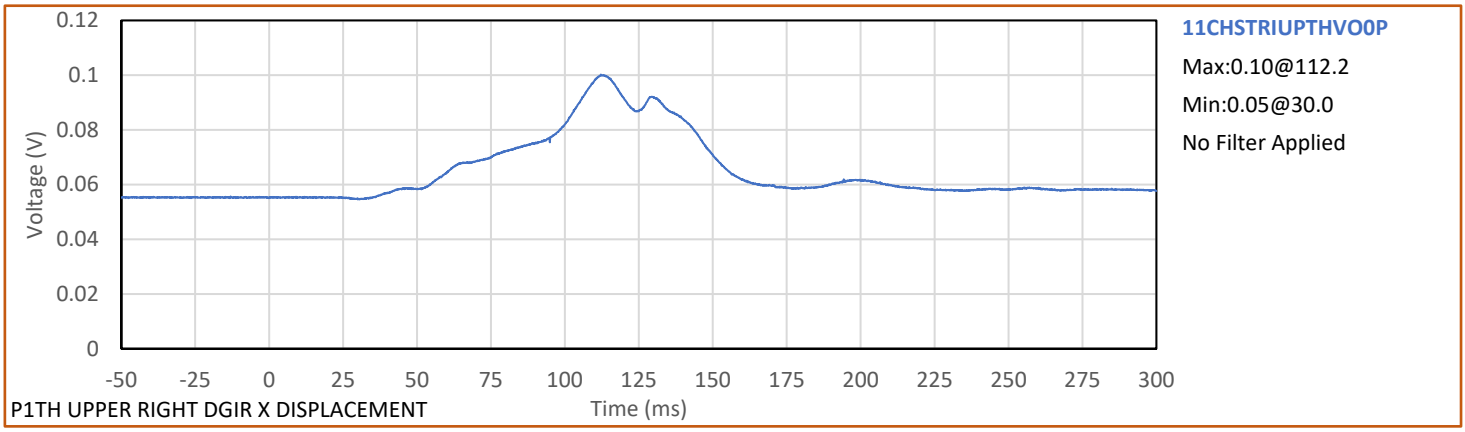
11CHSTLEUPTHVO0P
Max:0.08@113.6
Min:0.05@29.7
No Filter Applied

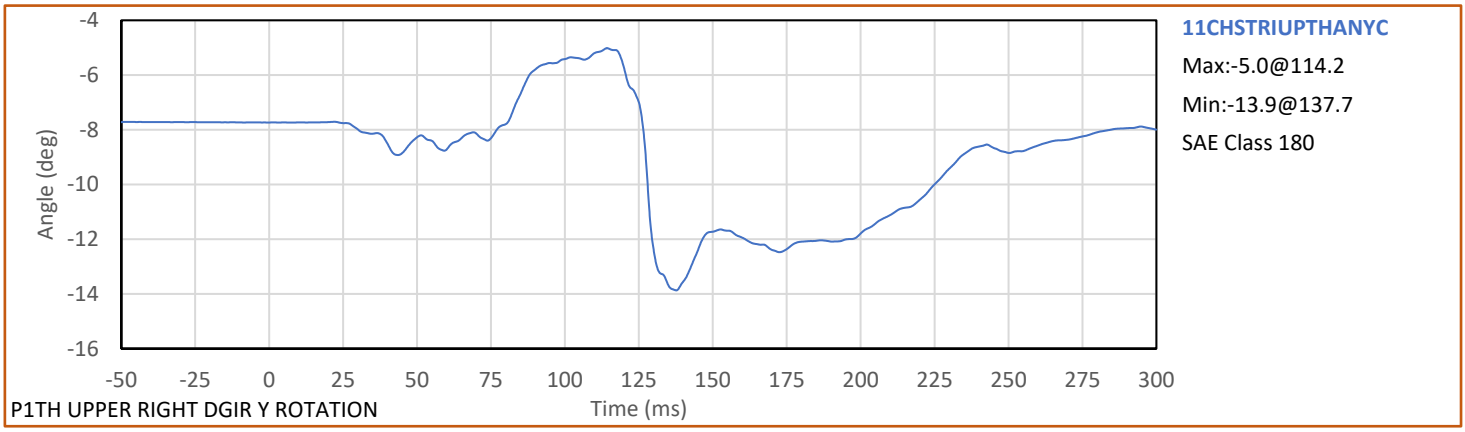


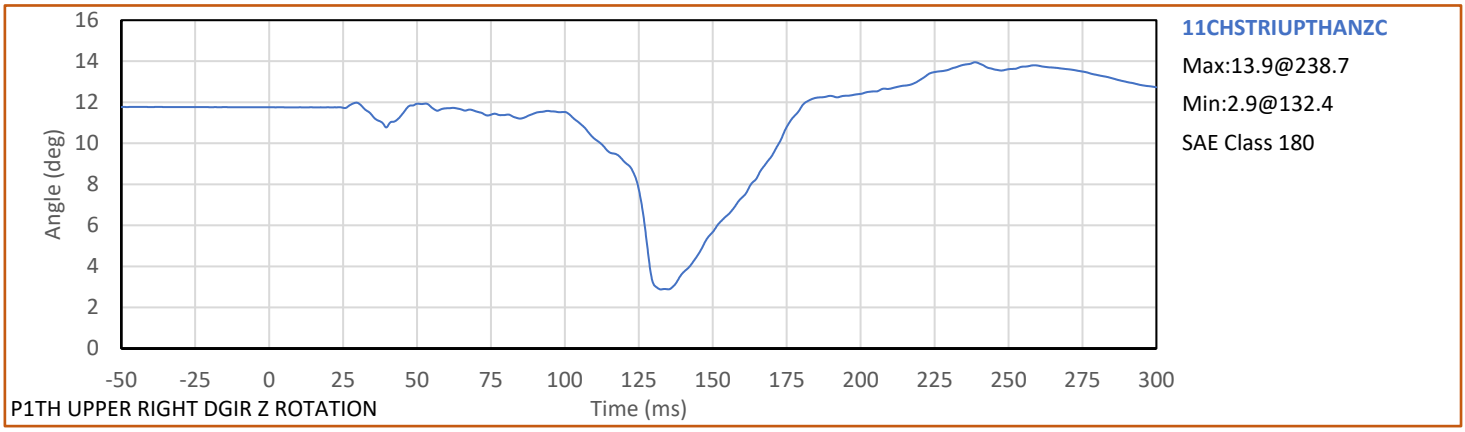
P1TH UPPER LEFT DGIR Y ROTATION

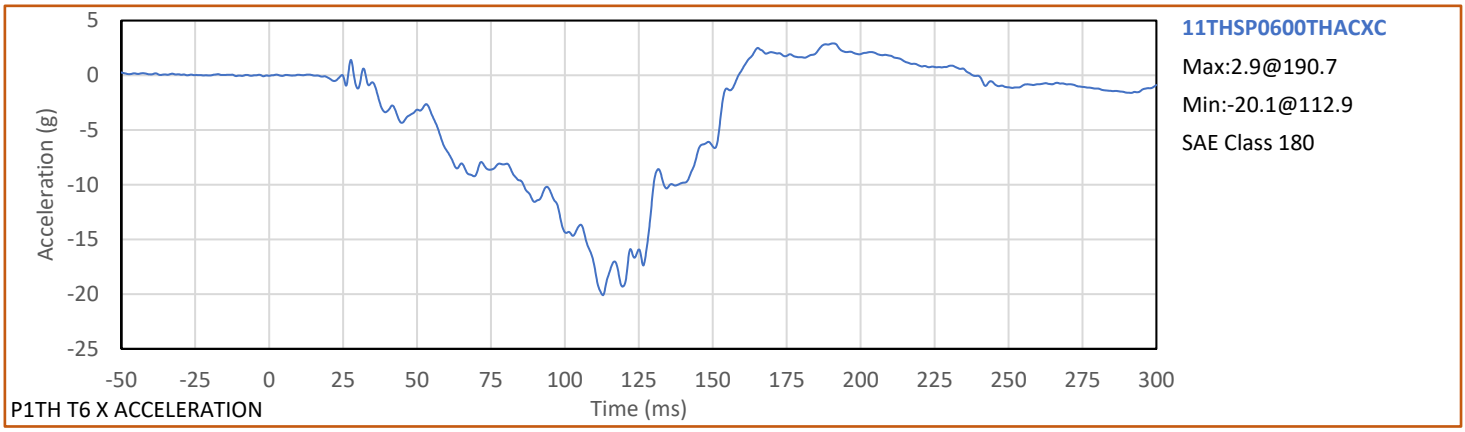
11CHSTLEUPTHANYC
Max:13.4@192.9
Min:4.5@115.2
SAE Class 180

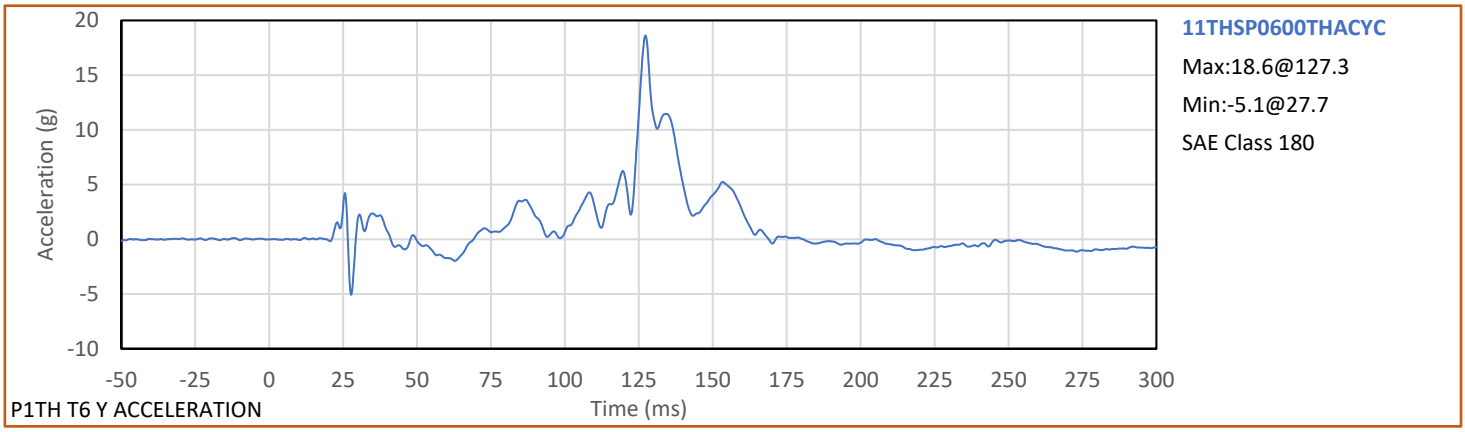

Angle (deg)
Time (ms)
P1TH UPPER LEFT DGIR Z ROTATION
11CHSTLEUPTHANZC
Max:-13.6@265.4
Min:-25.8@136.4
SAE Class 180

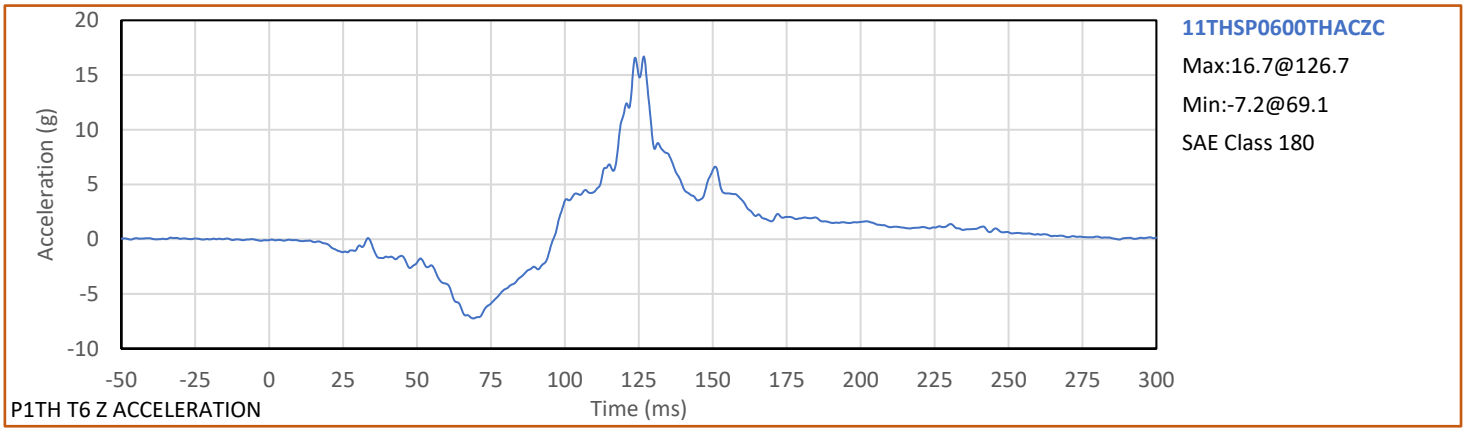

Voltage (V)
Time (ms)
P1TH UPPER RIGHT DGIR X DISPLACEMENT
11CHSTRIUPTHVO0P
Max:0.10@112.2
Min:0.05@30.0
No Filter Applied

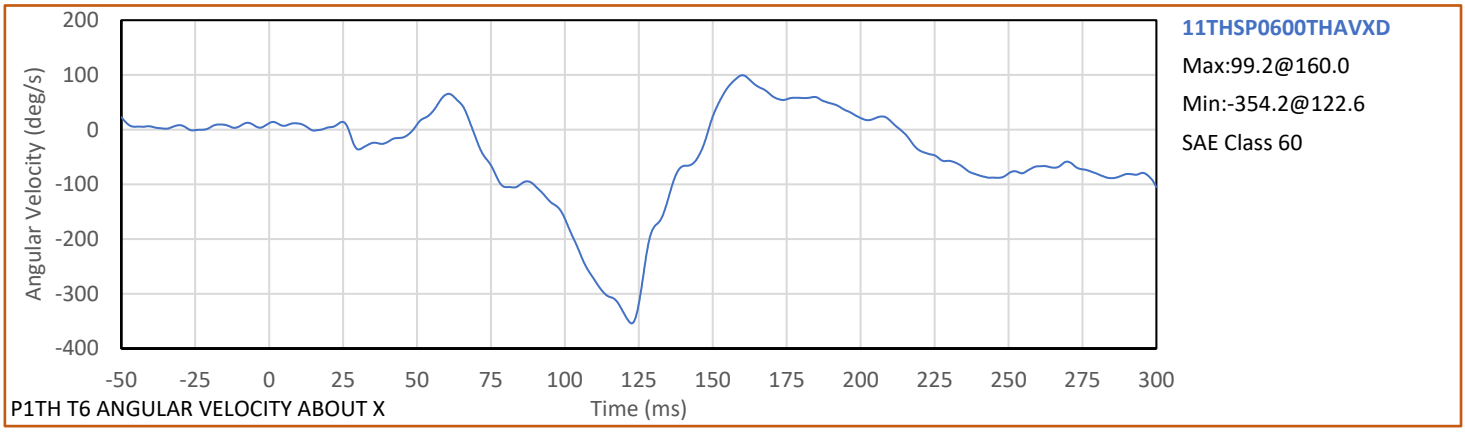

Angle (deg)
Time (ms)
P1TH UPPER RIGHT DGIR Y ROTATION
11CHSTRIUPTHANYC
Max:-5.0@114.2
Min:-13.9@137.7
SAE Class 180


Angle (deg)
Time (ms)
P1TH UPPER RIGHT DGIR Z ROTATION
11CHSTRIUPTHANZC
Max:13.9@238.7
Min:2.9@132.4
SAE Class 180


11THSP0600THACXC
Max:2.9@190.7
Min:-20.1@112.9
SAE Class 180
Acceleration (g)
Time (ms)
P1TH T6 X ACCELERATION


11THSP0600THACYC
Max:18.6@127.3
Min:-5.1@27.7
SAE Class 180
Acceleration (g)
Time (ms)
P1TH T6 Y ACCELERATION


11THSP0600THACZC
Max:16.7@126.7
Min:-7.2@69.1
SAE Class 180
Acceleration (g)
Time (ms)
P1TH T6 Z ACCELERATION

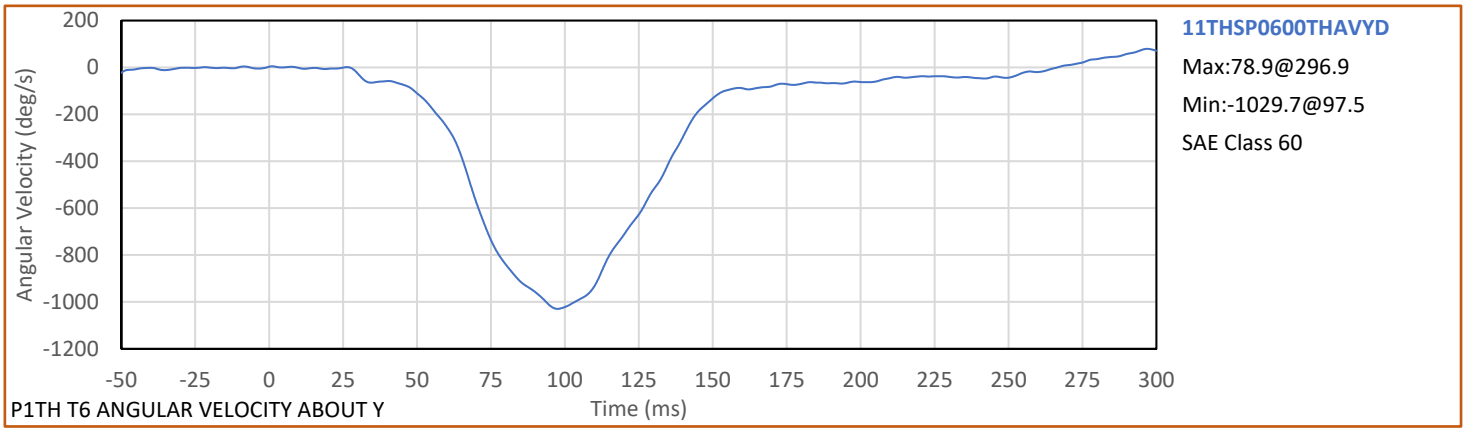

11THSP0600THAVXD
Max:99.2@160.0
Min:-354.2@122.6
SAE Class 60
Angular Velocity (deg/s)
Time (ms)
P1TH T6 ANGULAR VELOCITY ABOUT X

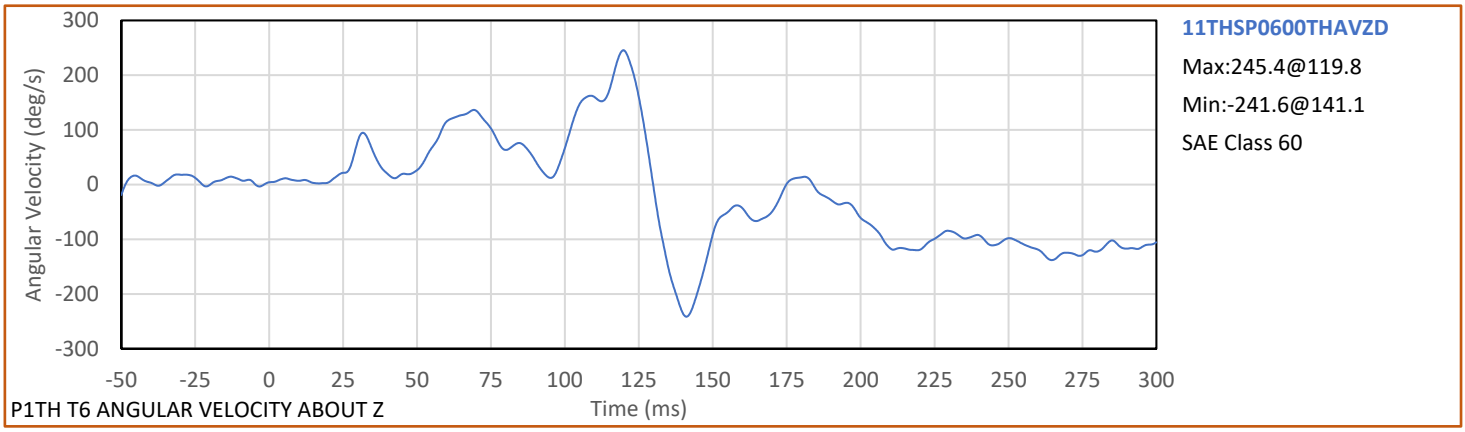
Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV

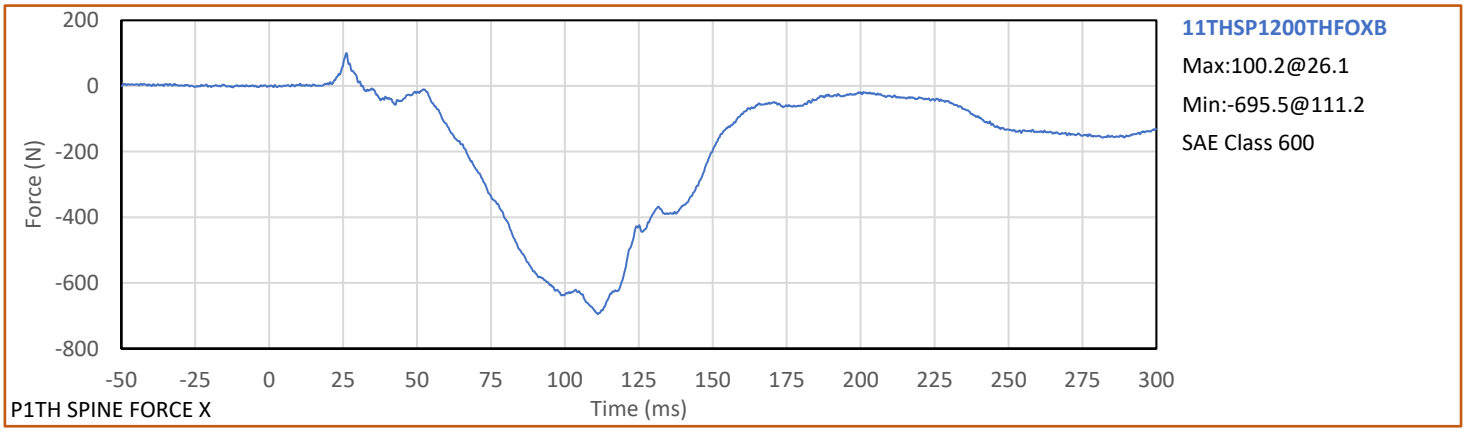
Test Program: Left Side 30° Frontal Rigid Barrier Impact

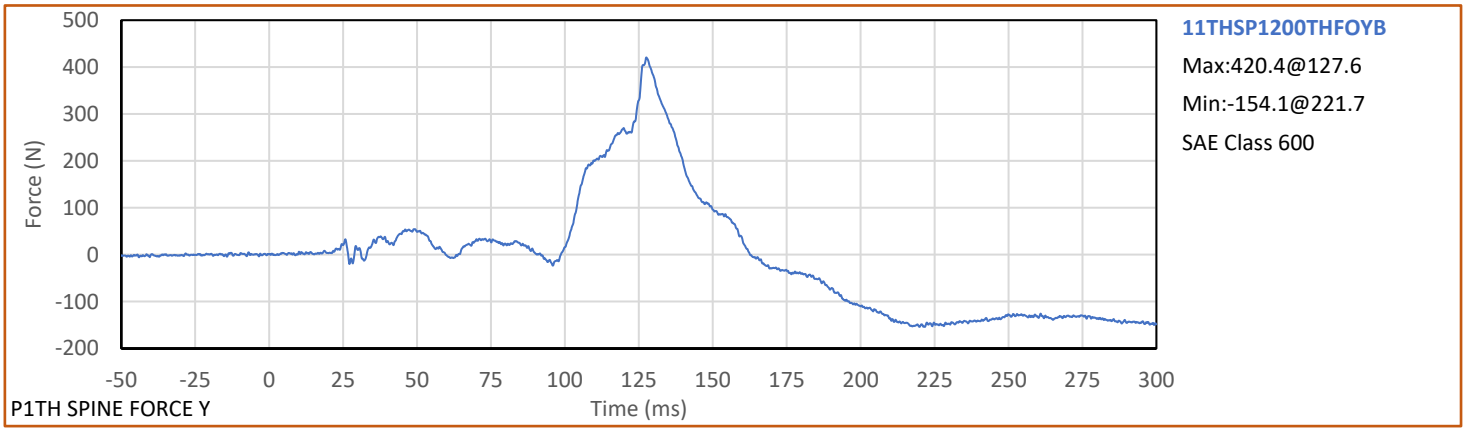
NHTSA No.: R20205416

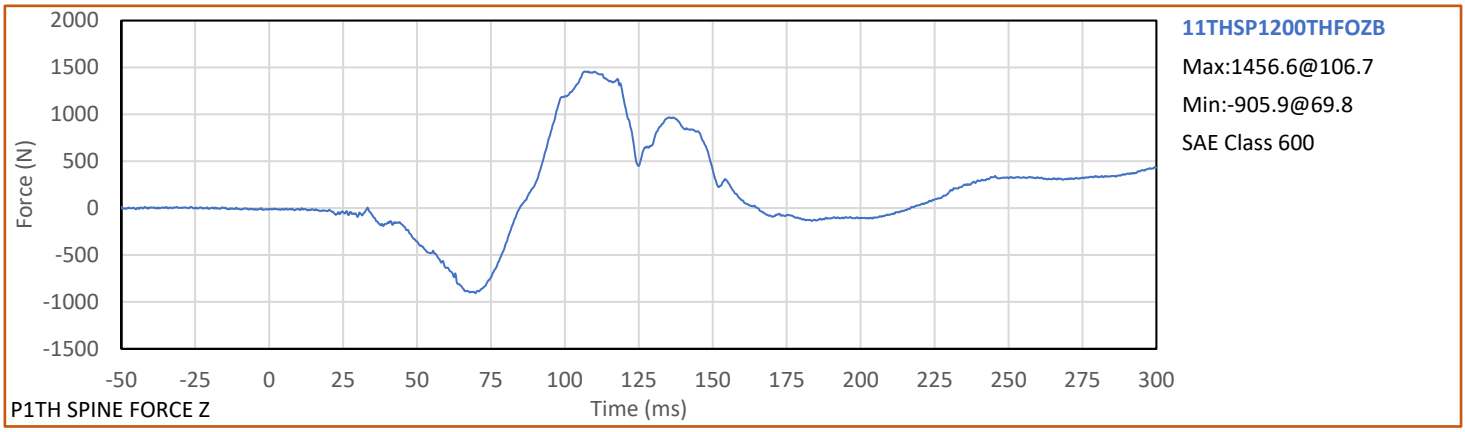
Test Date: 5/21/2021

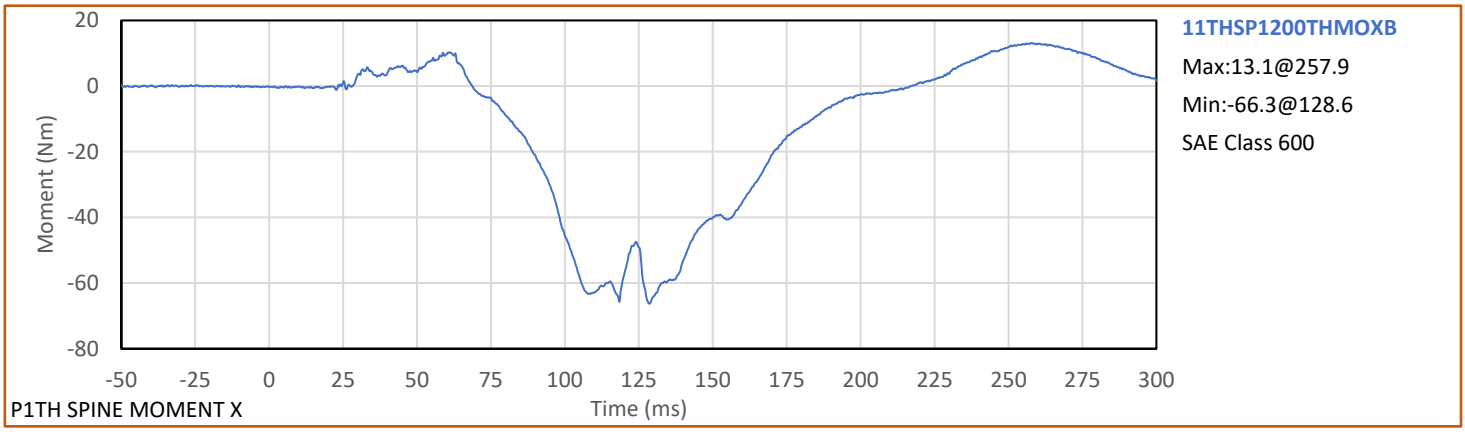


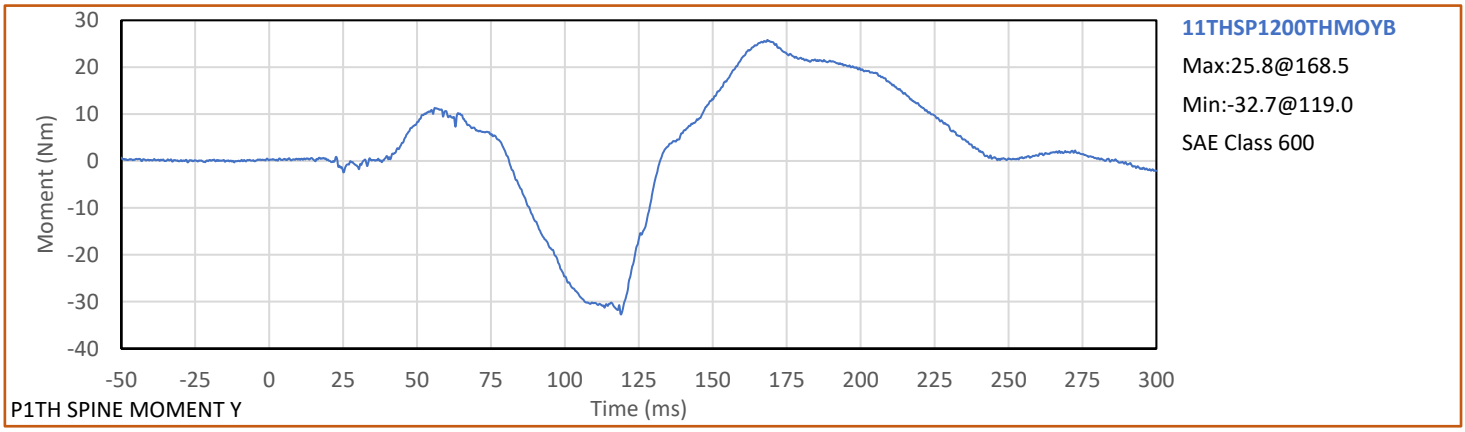


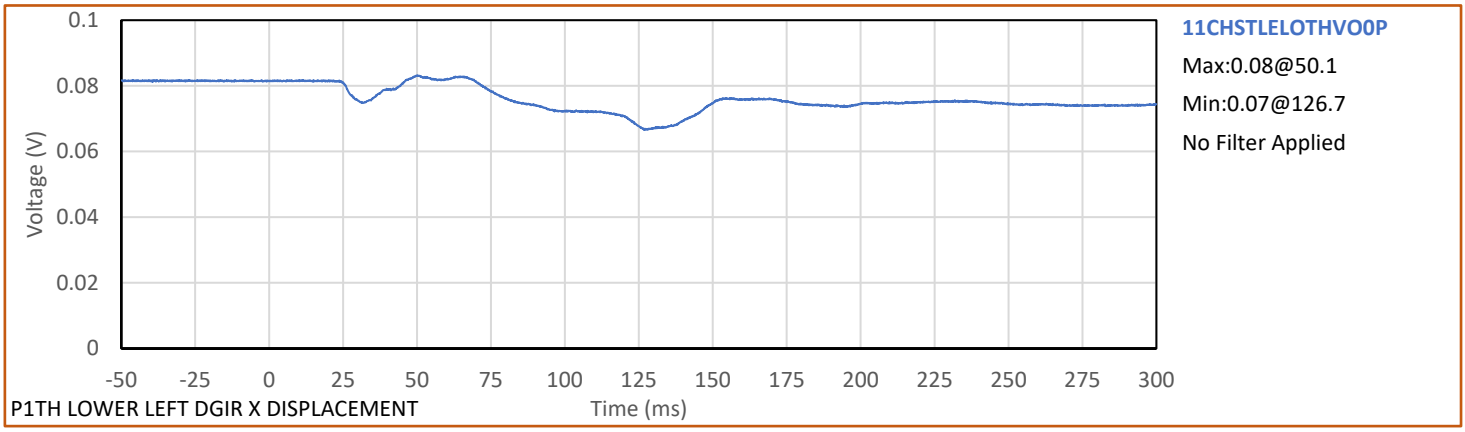





Force (N)
Time (ms)
11THSP1200THFOZB
Max:1456.6@106.7
Min:-905.9@69.8
SAE Class 600
P1TH SPINE FORCE Z

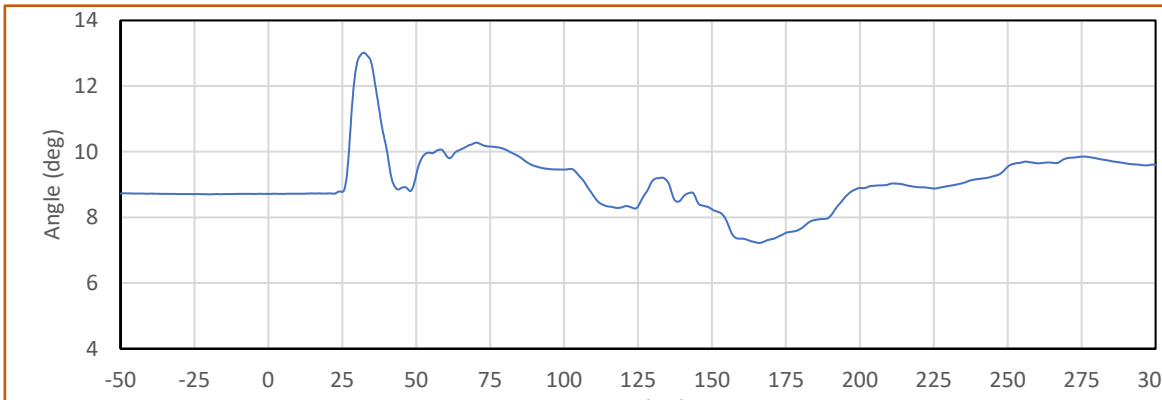

Moment (Nm)
Time (ms)
11THSP1200THMOXB
Max:13.1@257.9
Min:-66.3@128.6
SAE Class 600
P1TH SPINE MOMENT X


Moment (Nm)
Time (ms)
11THSP1200THMOYB
Max:25.8@168.5
Min:-32.7@119.0
SAE Class 600
P1TH SPINE MOMENT Y


Voltage (V)
Time (ms)
11CHSTLELOTHVO0P
Max:0.08@50.1
Min:0.07@126.7
No Filter Applied
P1TH LOWER LEFT DGIR X DISPLACEMENT

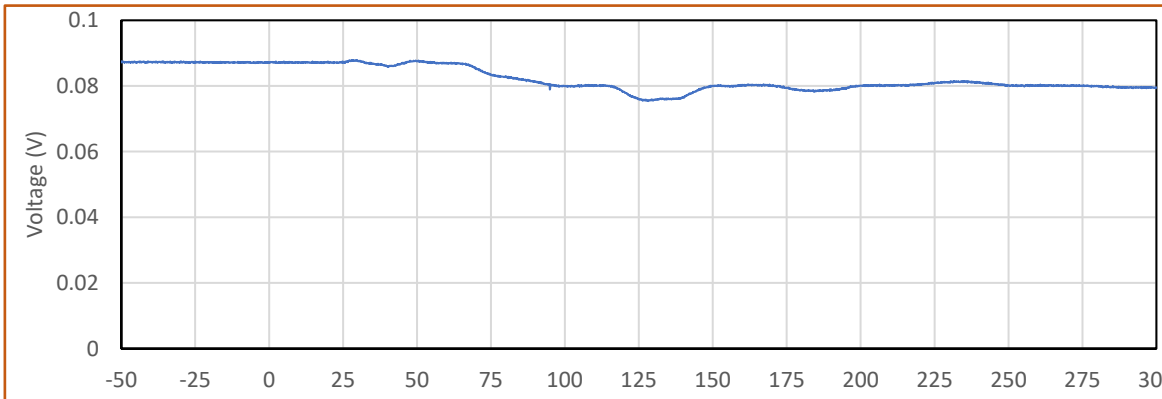
P1TH LOWER LEFT DGIR Y ROTATION

11CHSTLELOTHANYC
Max:-0.3@137.4
Min:-10.0@28.7
SAE Class 180



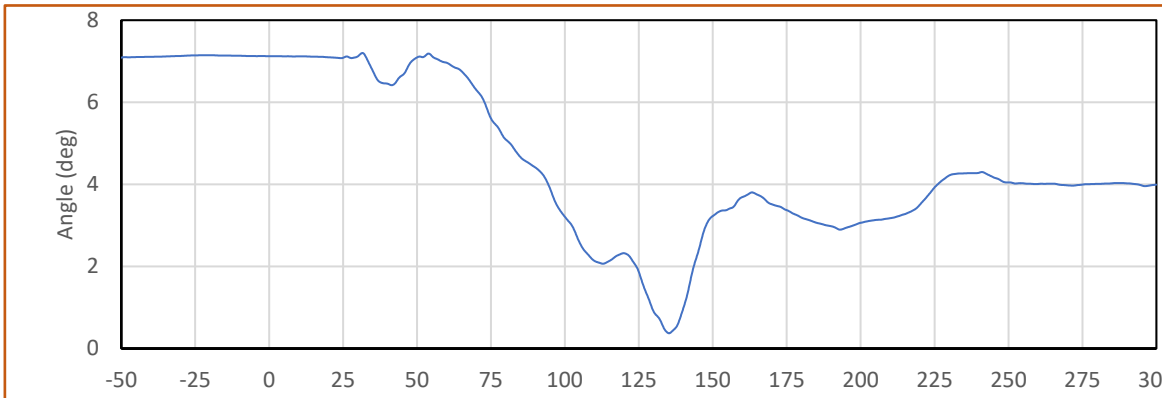
P1TH LOWER LEFT DGIR Z ROTATION

11CHSTLELOTHANZC
Max:13.0@32.3
Min:7.2@166.0
SAE Class 180



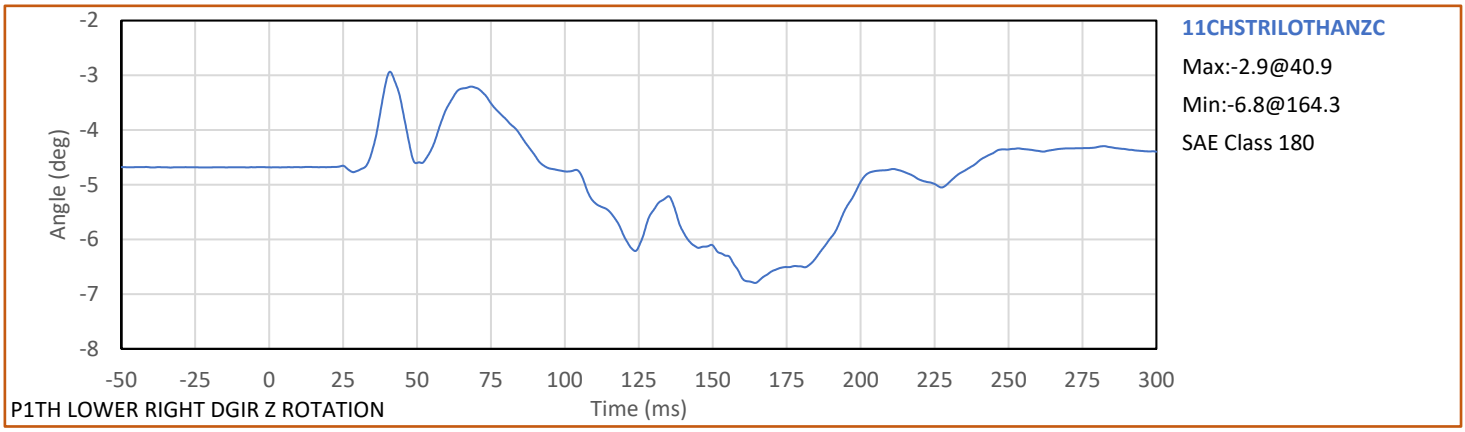
P1TH LOWER RIGHT DGIR X DISPLACEMENT

11CHSTRILOTHVO0P
Max:0.09@28.1
Min:0.08@128.2
No Filter Applied



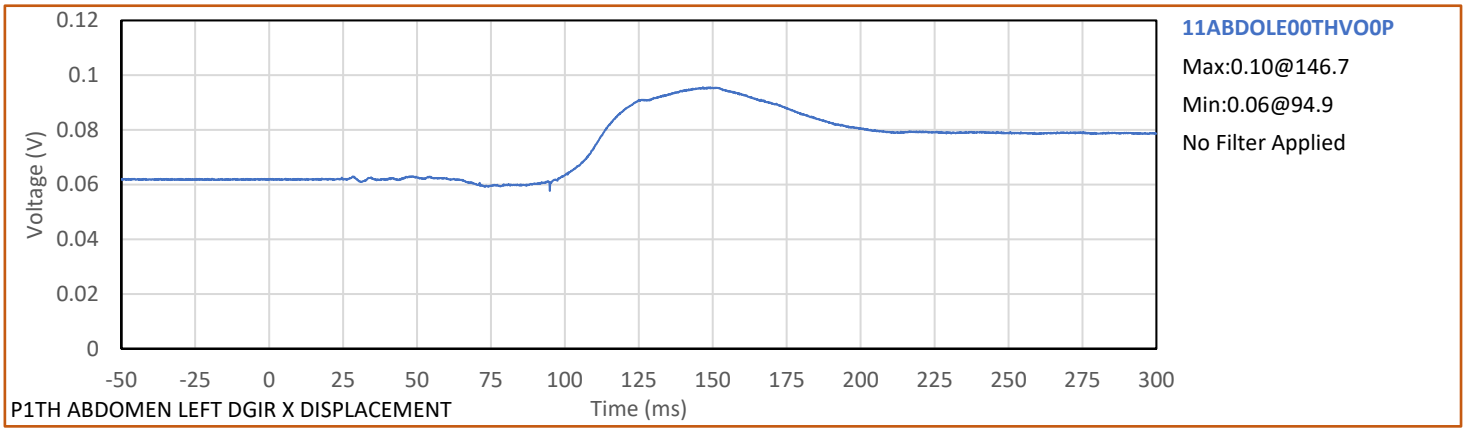
P1TH LOWER RIGHT DGIR Y ROTATION

11CHSTRILOTHANYC
Max:7.2@31.6
Min:0.4@135.2
SAE Class 180



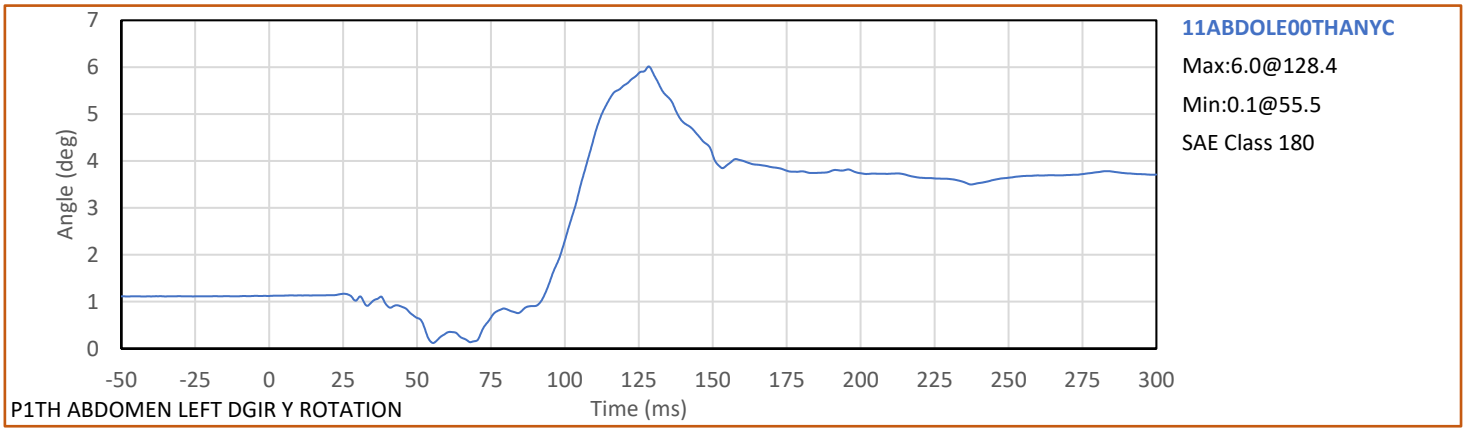
11CHSTRILOTHANZC
Max:-2.9@40.9
Min:-6.8@164.3
SAE Class 180

P1TH LOWER RIGHT DGIR Z ROTATION



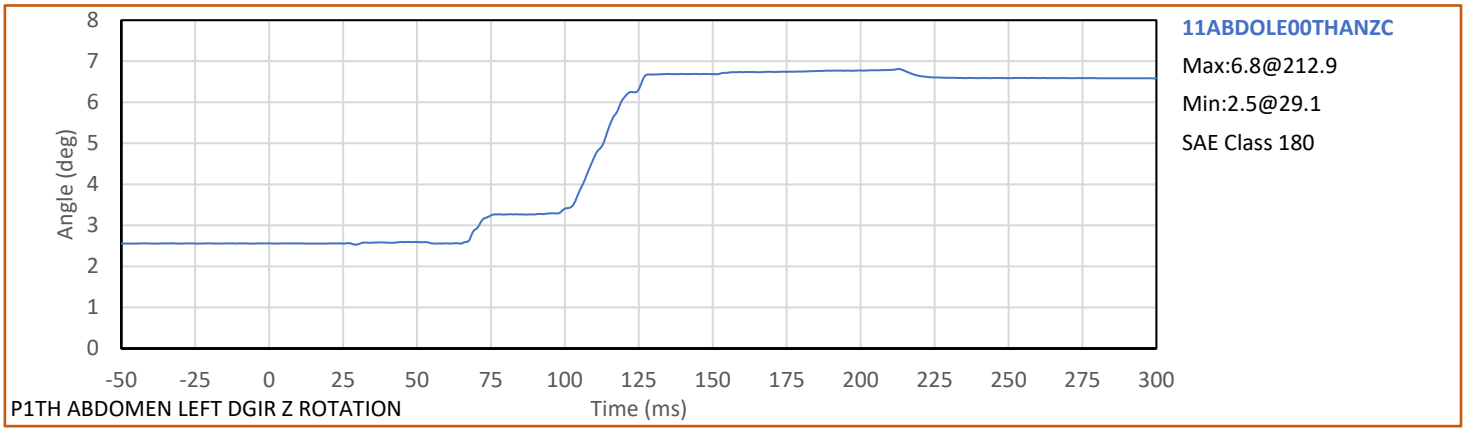
11ABDOLE00THVO0P
Max:0.10@146.7
Min:0.06@94.9
No Filter Applied

P1TH ABDOMEN LEFT DGIR X DISPLACEMENT



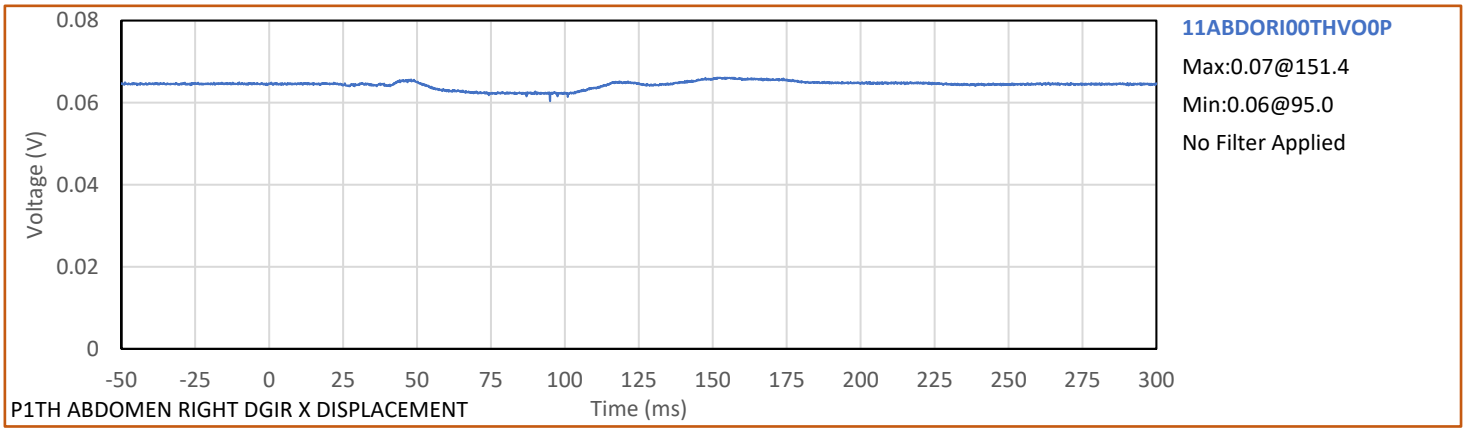
11ABDOLE00THANYC
Max:6.0@128.4
Min:0.1@55.5
SAE Class 180

P1TH ABDOMEN LEFT DGIR Y ROTATION



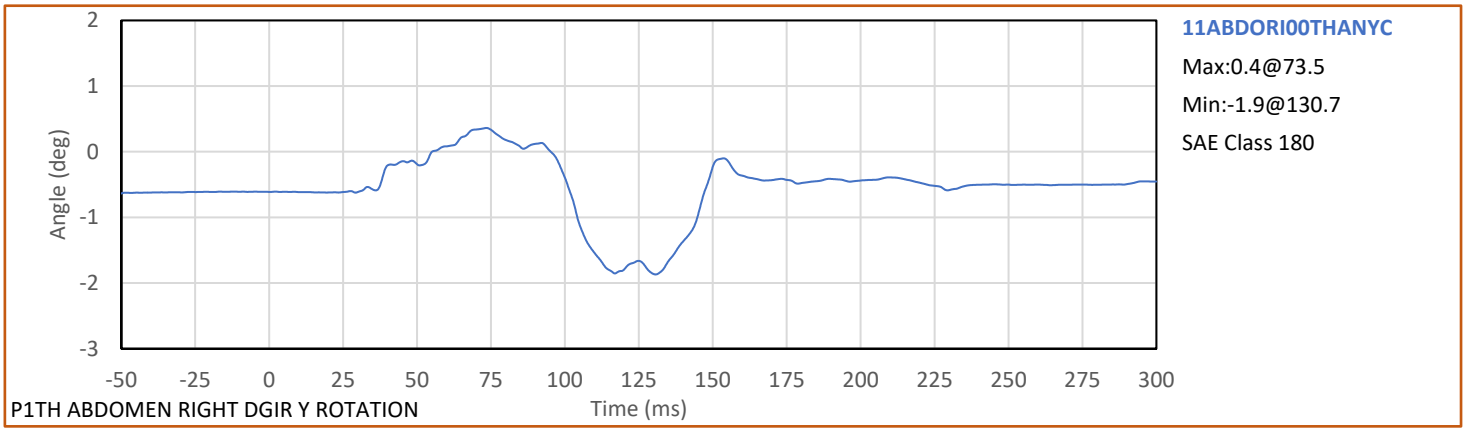
11ABDOLE00THANZC
Max:6.8@212.9
Min:2.5@29.1
SAE Class 180

P1TH ABDOMEN LEFT DGIR Z ROTATION



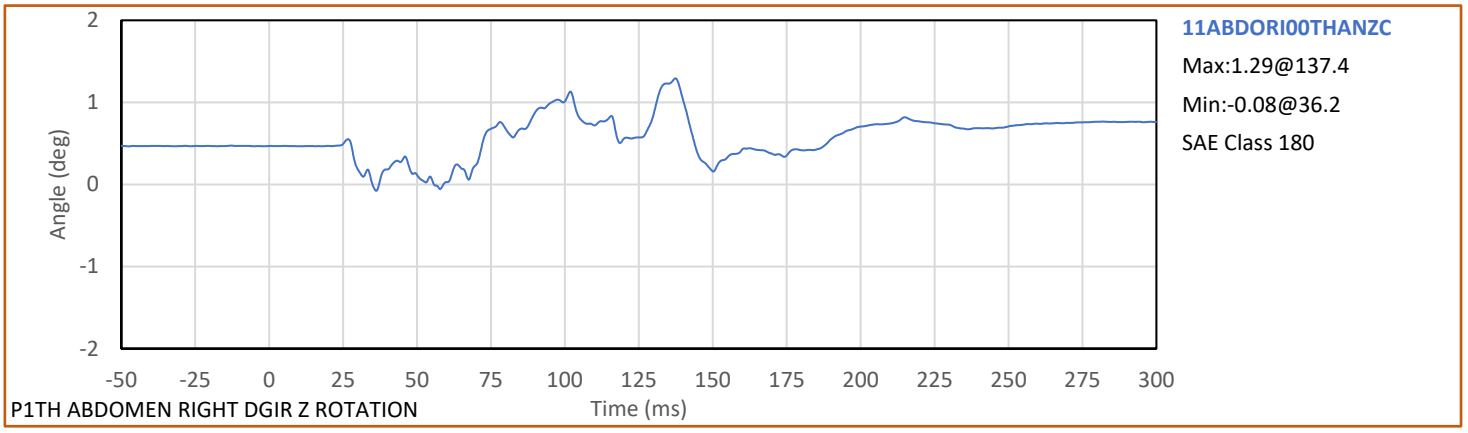
P1TH ABDOMEN RIGHT DGIR X DISPLACEMENT

11ABDORI00THVO0P
Max:0.07@151.4
Min:0.06@95.0
No Filter Applied



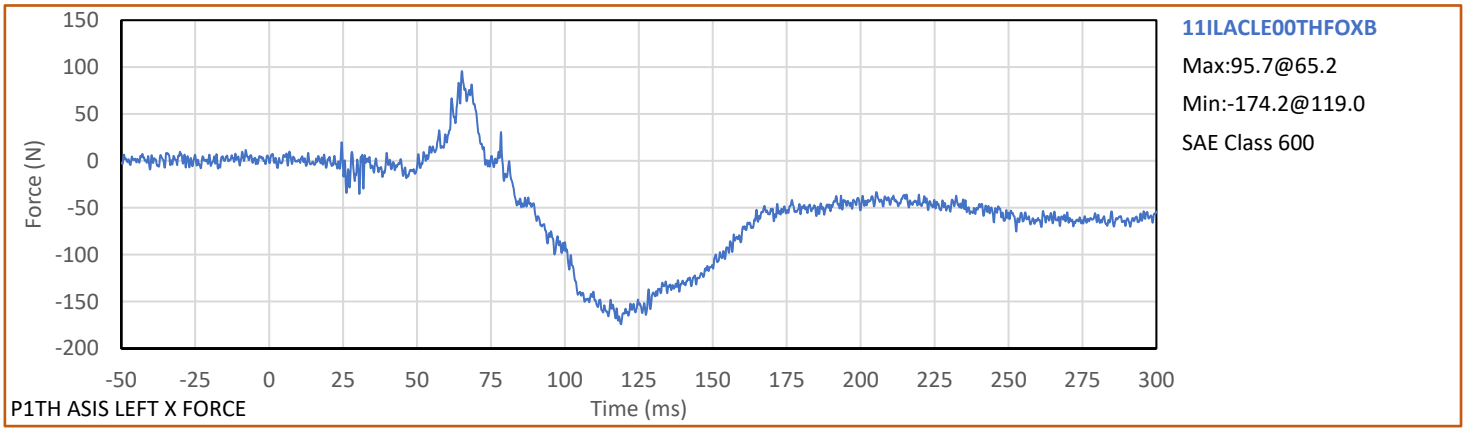
P1TH ABDOMEN RIGHT DGIR Y ROTATION

11ABDORI00THANYC
Max:0.4@73.5
Min:-1.9@130.7
SAE Class 180



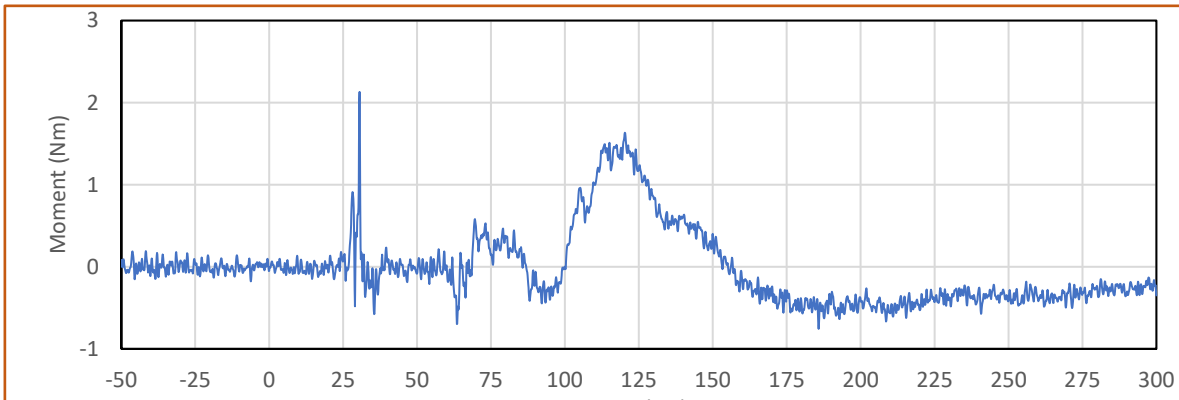
P1TH ABDOMEN RIGHT DGIR Z ROTATION

11ABDORI00THANZC
Max:1.29@137.4
Min:-0.08@36.2
SAE Class 180

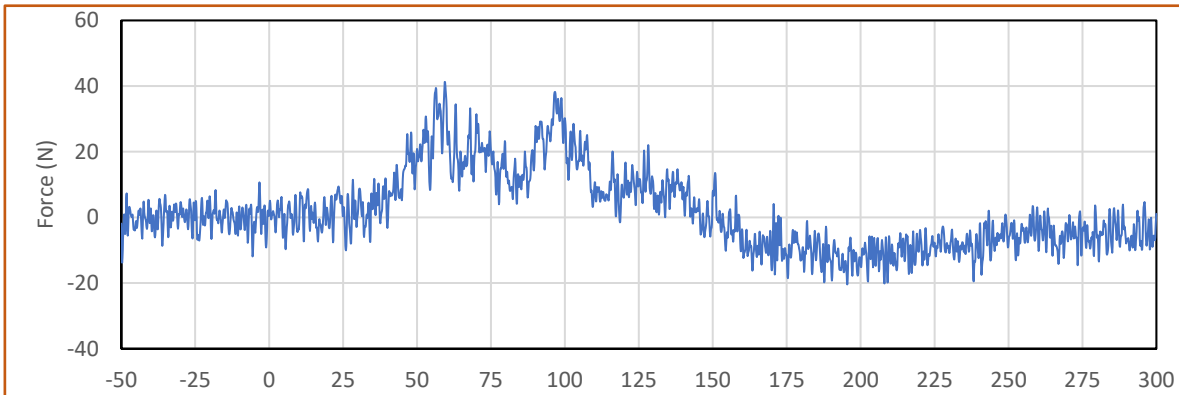


P1TH ASIS LEFT X FORCE

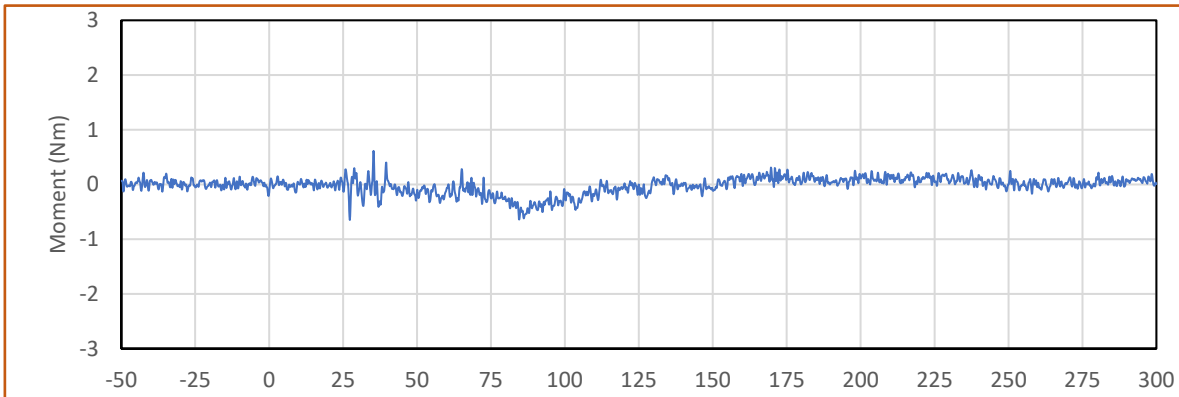
11ILACLE00THFOXB
Max:95.7@65.2
Min:-174.2@119.0
SAE Class 600



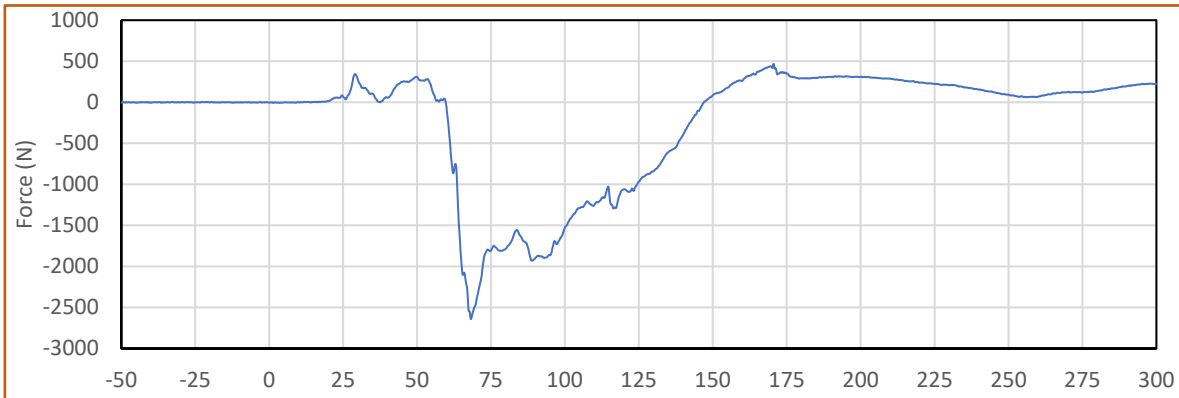
11ILACLE00THMOYB
Max:2.1@30.6
Min:-0.8@185.8
SAE Class 600



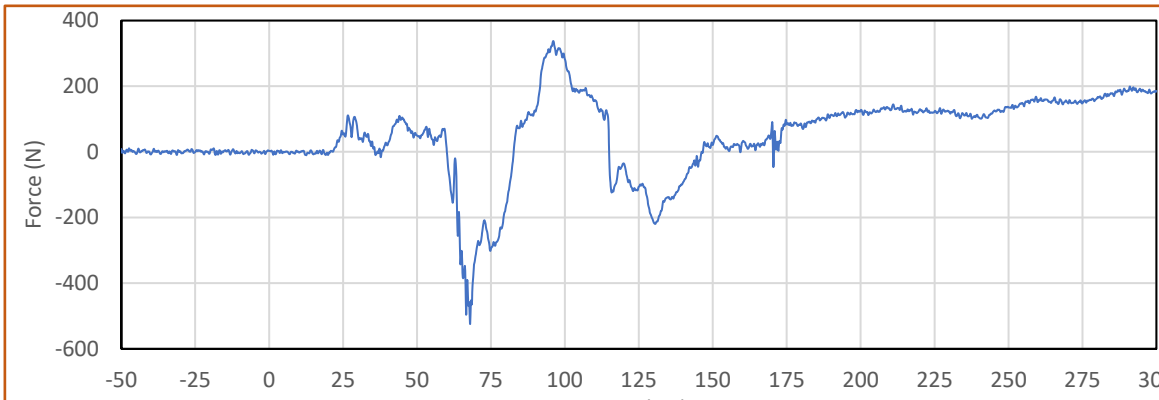
11ILACRI00THFOXB
Max:41.3@59.4
Min:-20.4@195.5
SAE Class 600



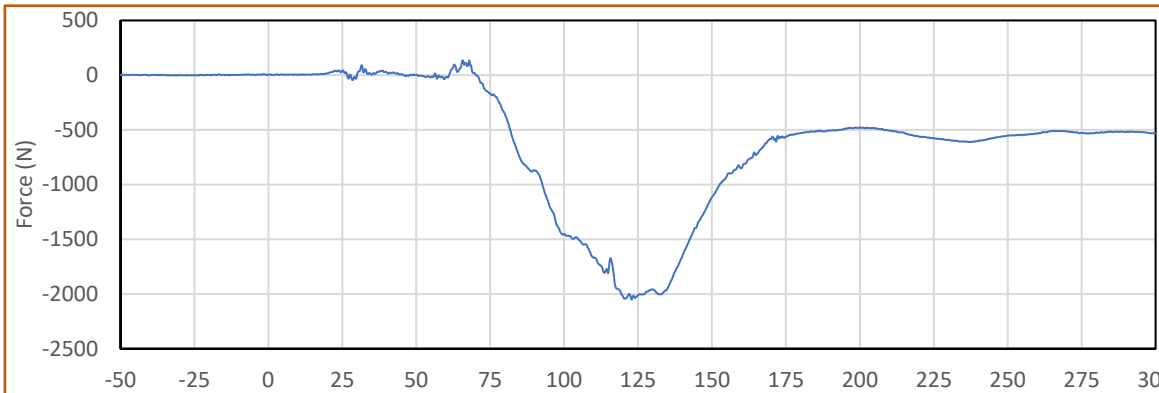
11ILACRI00THMOYB
Max:0.61@35.3
Min:-0.65@27.3
SAE Class 600



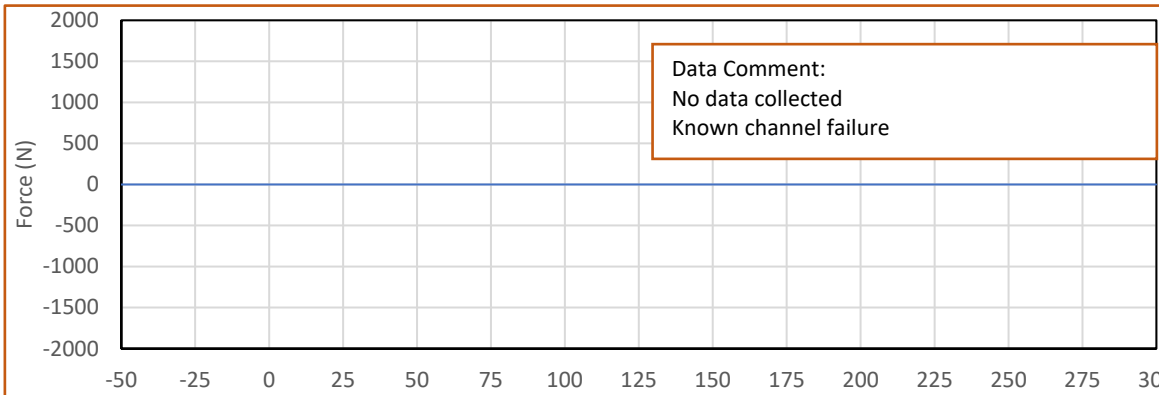
11ACTBLE00THFOXB
Max:467.4@170.6
Min:-2643.4@68.2
SAE Class 600



11ACTBLE00THFOYB
Max:337.5@96.1
Min:-524.5@68.0
SAE Class 600

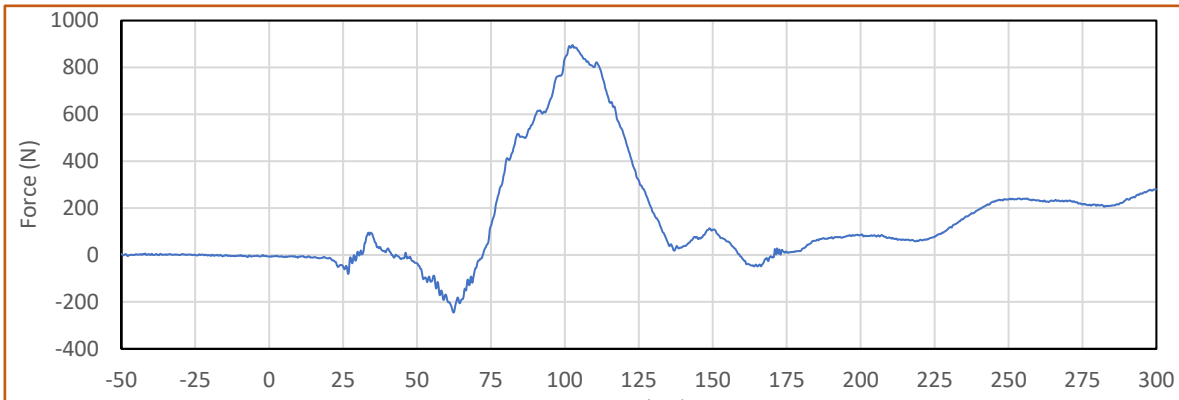


11ACTBLE00THFOZB
Max:136.2@65.7
Min:-2050.5@122.8
SAE Class 600



11ACTBRI00THFOXB
Max:0.00@0.1
Min:0.00@0.1
SAE Class 600

11ACTBRI00THFOYB
Max:803.3@97.3
Min:-117.1@256.9
SAE Class 600

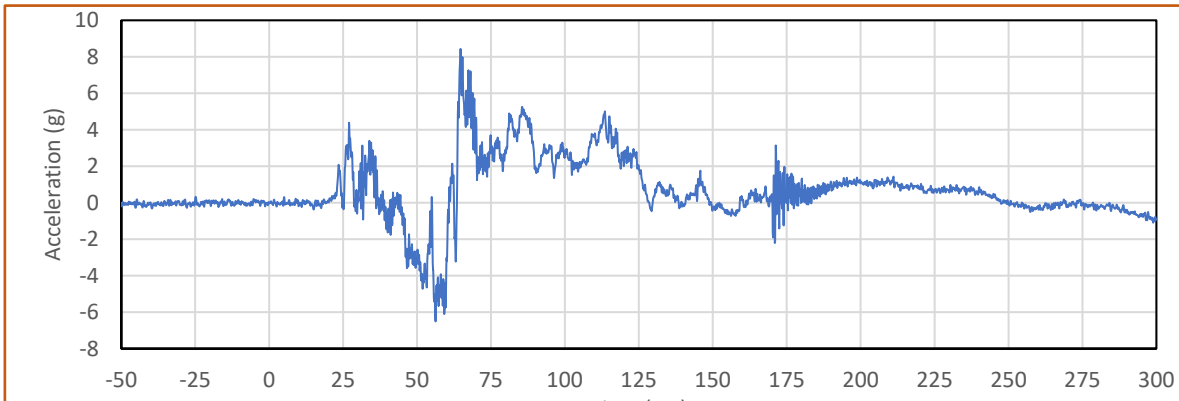


P1TH ACETABULUM RIGHT Z FORCE

11ACTBRI00THFOZB
Max:895.5@102.6
Min:-245.3@62.4
SAE Class 600

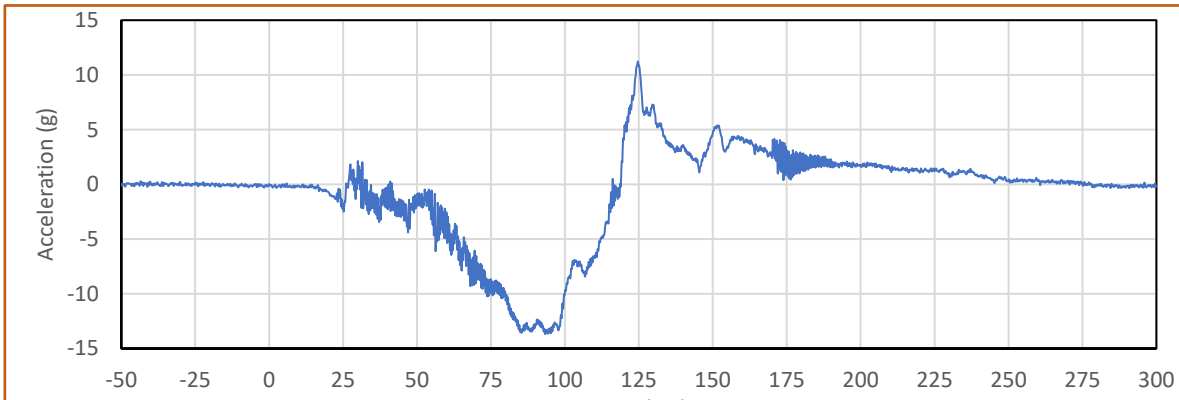
P1TH PELVIS X ACCELERATION

11PELV0000THACXA
Max:5.2@170.6
Min:-32.8@68.3
SAE Class 1000



P1TH PELVIS Y ACCELERATION

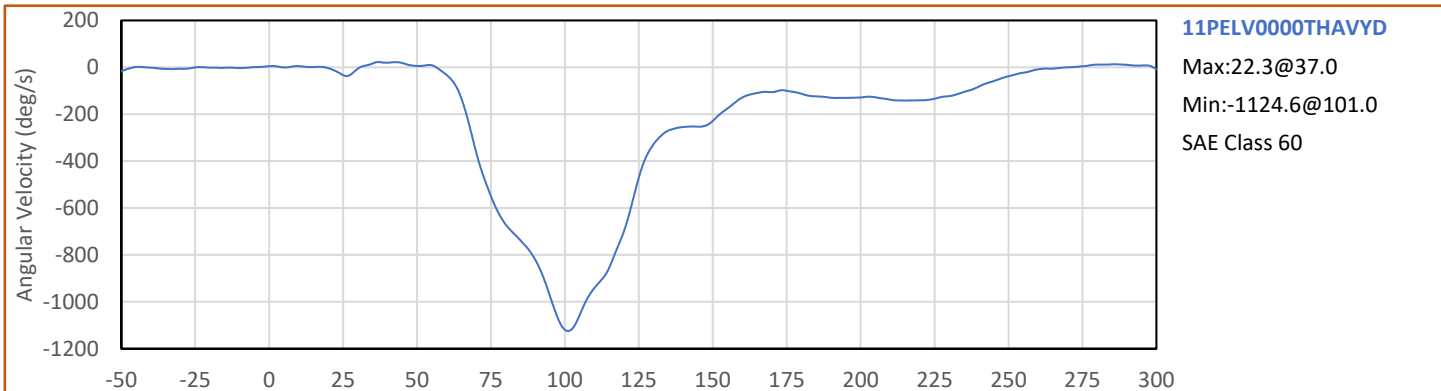
11PELV0000THACYA
Max:8.4@64.8
Min:-6.5@56.3
SAE Class 1000



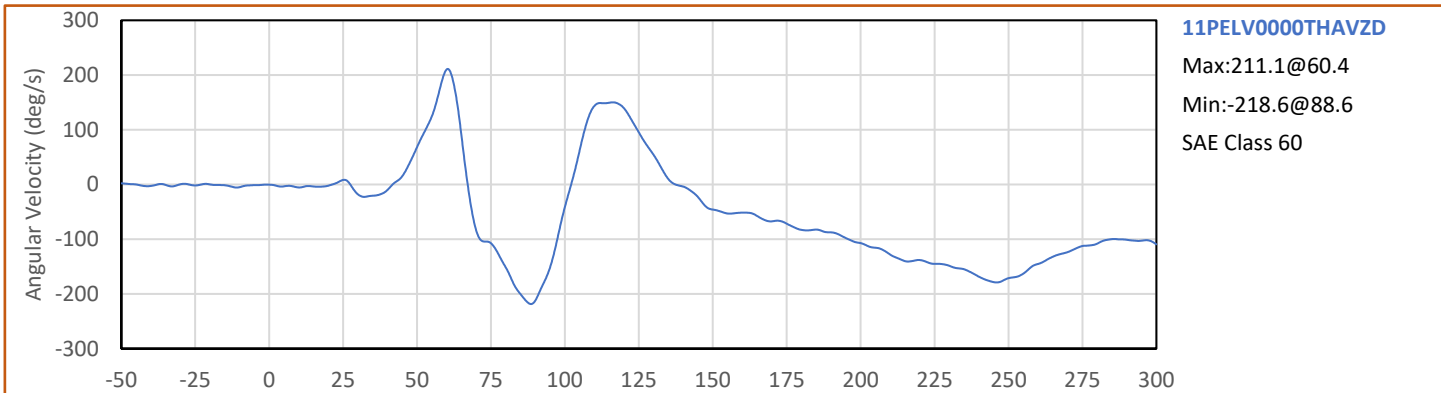
P1TH PELVIS Z ACCELERATION

11PELV0000THACZA
Max:11.2@124.7
Min:-13.7@93.3
SAE Class 1000

P1TH PELVIS ANGULAR VELOCITY ABOUT X

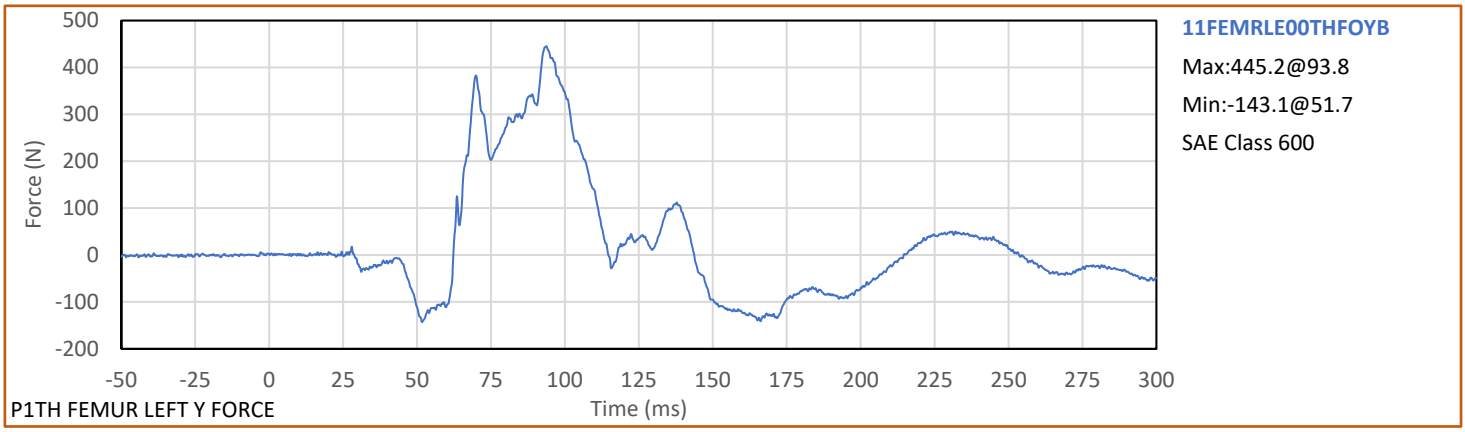


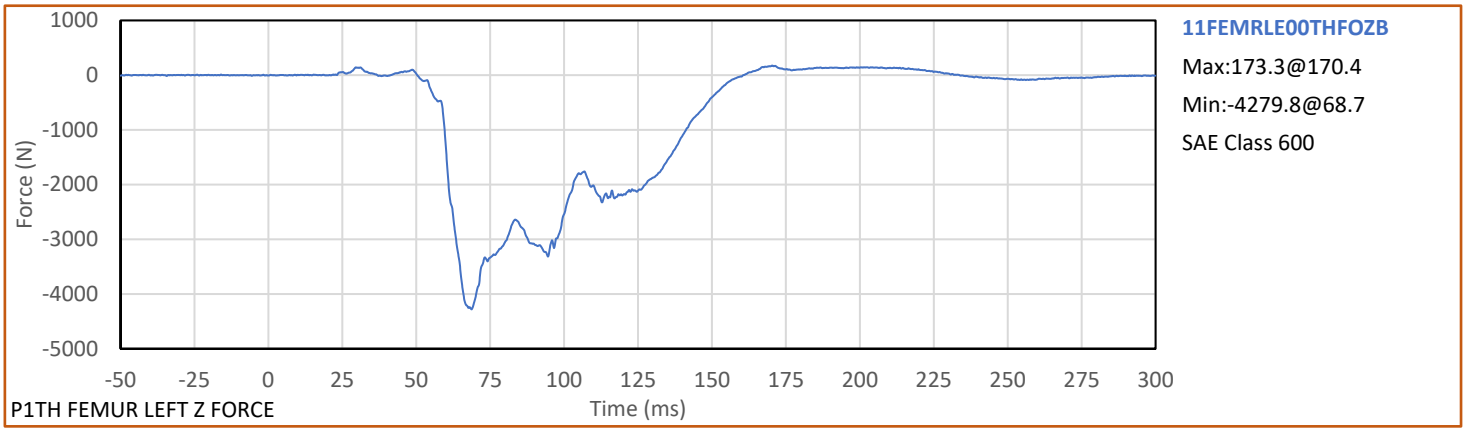
P1TH PELVIS ANGULAR VELOCITY ABOUT Y

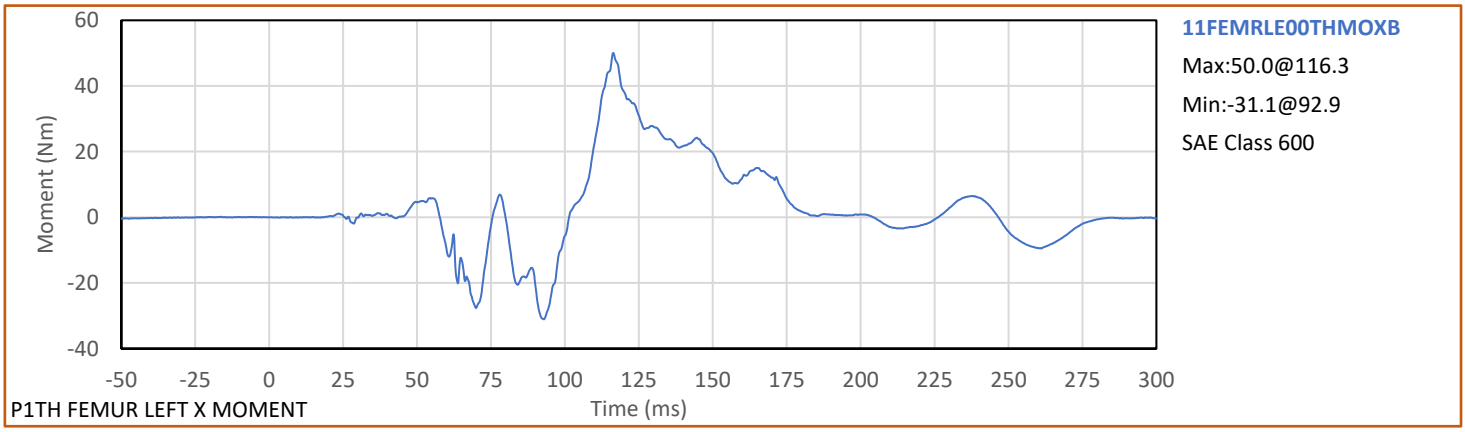


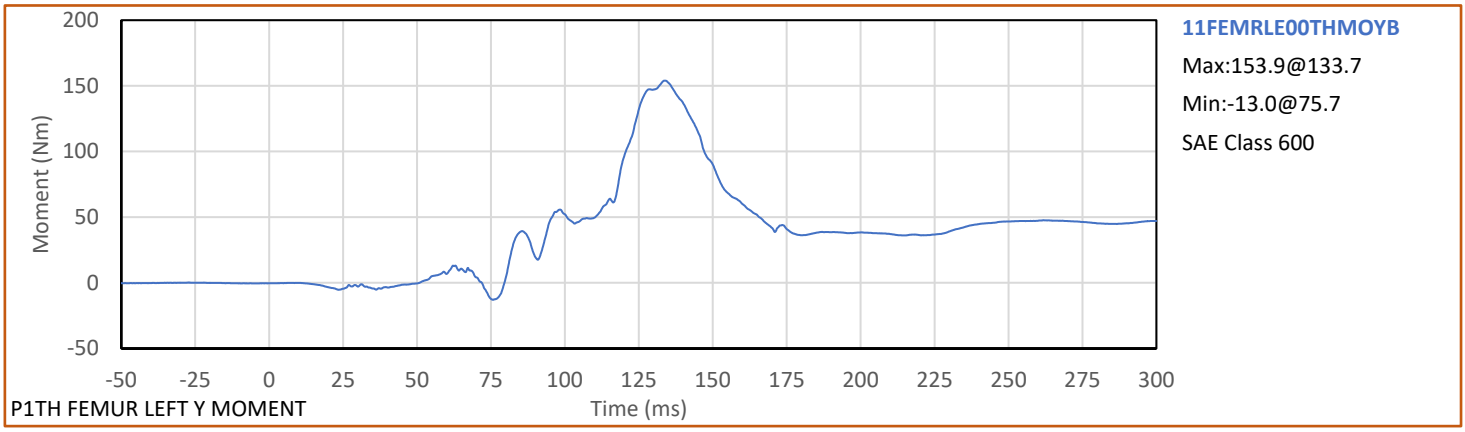
P1TH PELVIS ANGULAR VELOCITY ABOUT Z

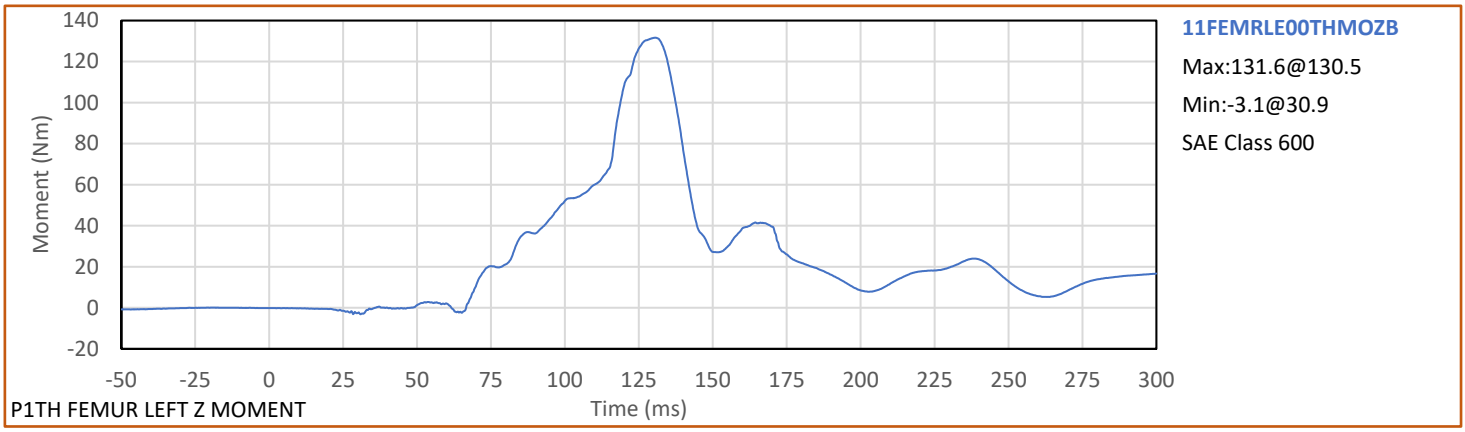
P1TH FEMUR LEFT X FORCE

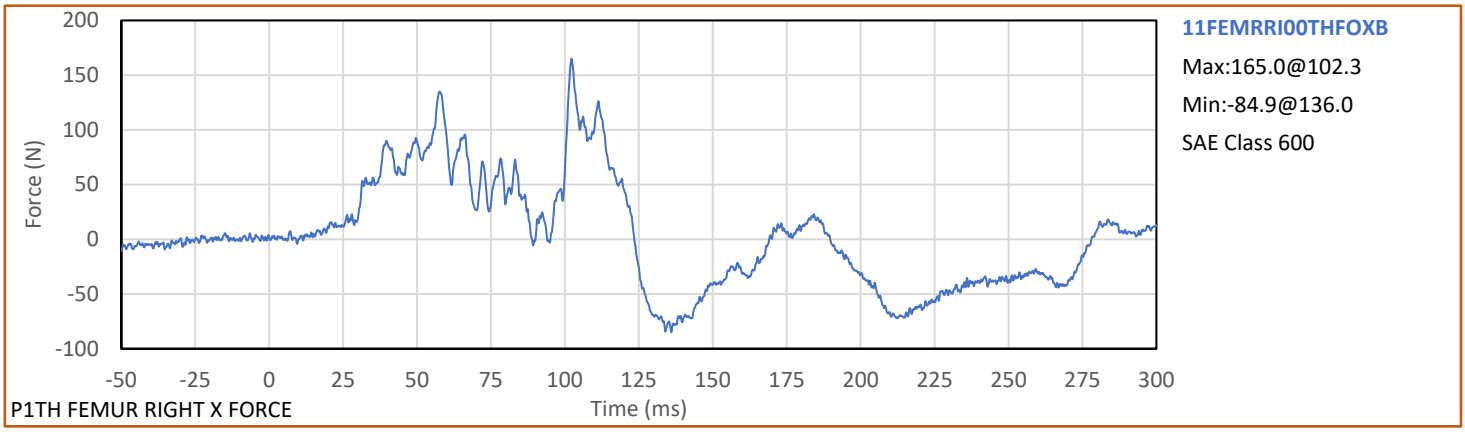

Force (N)
Time (ms)
P1TH FEMUR LEFT Y FORCE
11FEMRLE00THFOYB
Max:445.2@93.8
Min:-143.1@51.7
SAE Class 600

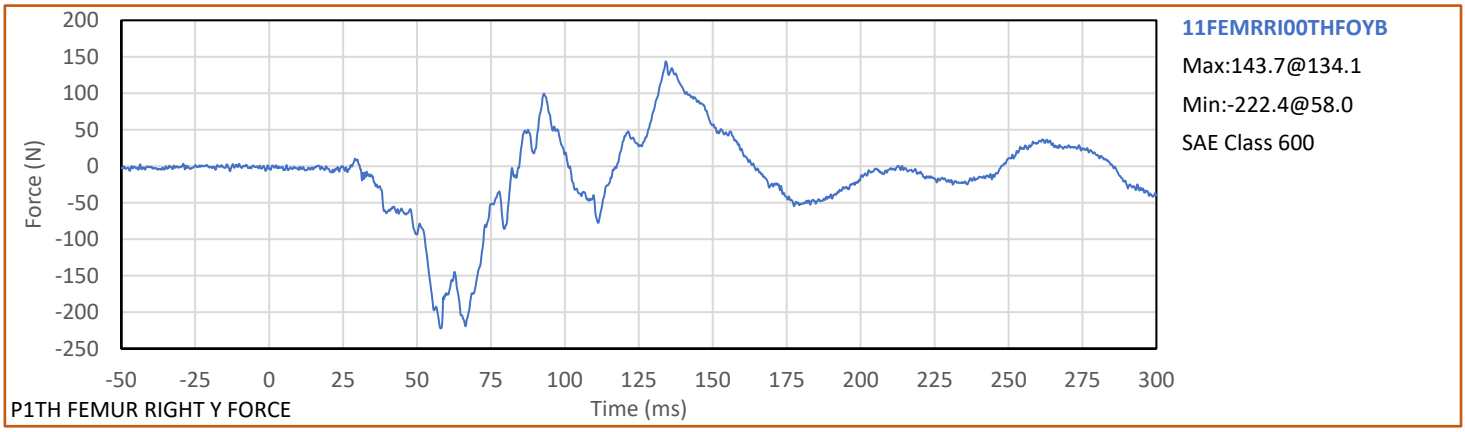

Force (N)
Time (ms)
P1TH FEMUR LEFT Z FORCE
11FEMRLE00THFOZB
Max:173.3@170.4
Min:-4279.8@68.7
SAE Class 600

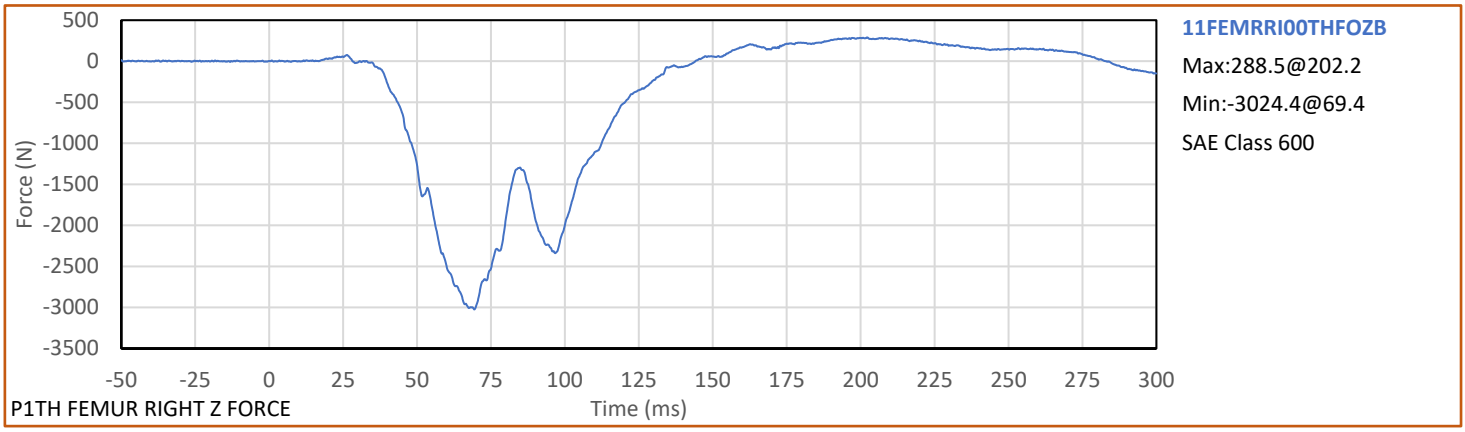

Moment (Nm)
Time (ms)
P1TH FEMUR LEFT X MOMENT
11FEMRLE00THMOXB
Max:50.0@116.3
Min:-31.1@92.9
SAE Class 600


Moment (Nm)
Time (ms)
P1TH FEMUR LEFT Y MOMENT
11FEMRLE00THMOYB
Max:153.9@133.7
Min:-13.0@75.7
SAE Class 600


Moment (Nm)
Time (ms)
P1TH FEMUR LEFT Z MOMENT
11FEMRLE00THMOZB
Max:131.6@130.5
Min:-3.1@30.9
SAE Class 600


Force (N)
Time (ms)
P1TH FEMUR RIGHT X FORCE
11FEMRRI00THFOXB
Max:165.0@102.3
Min:-84.9@136.0
SAE Class 600


Force (N)
Time (ms)
P1TH FEMUR RIGHT Y FORCE
11FEMRRI00THFOYB
Max:143.7@134.1
Min:-222.4@58.0
SAE Class 600

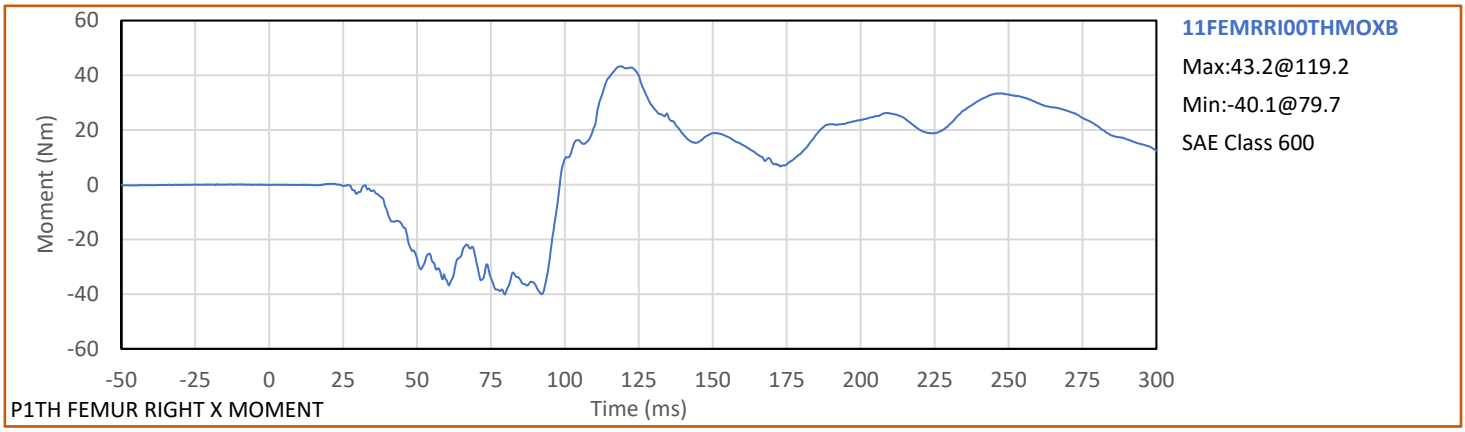

Force (N)
Time (ms)
P1TH FEMUR RIGHT Z FORCE
11FEMRRI00THFOZB
Max:288.5@202.2
Min:-3024.4@69.4
SAE Class 600

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV

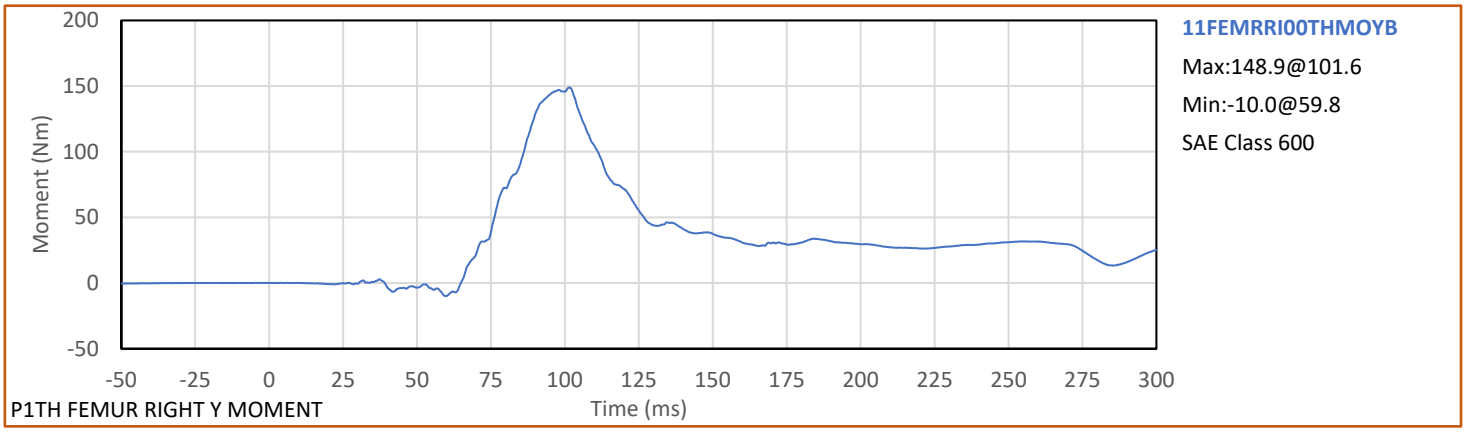
Test Program: Left Side 30° Frontal Rigid Barrier Impact

NHTSA No.: R20205416

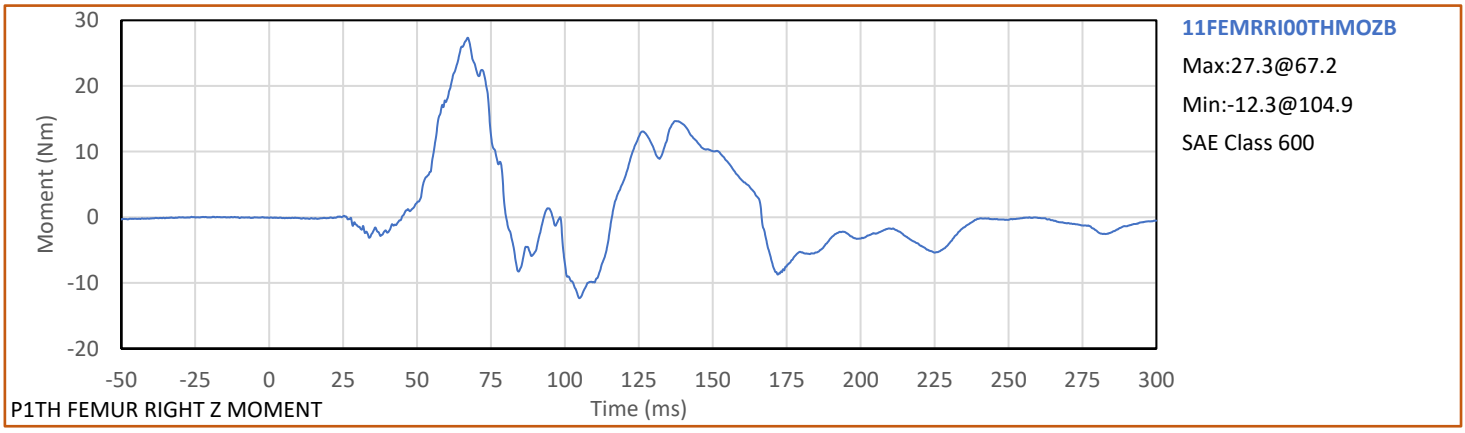
Test Date: 5/21/2021



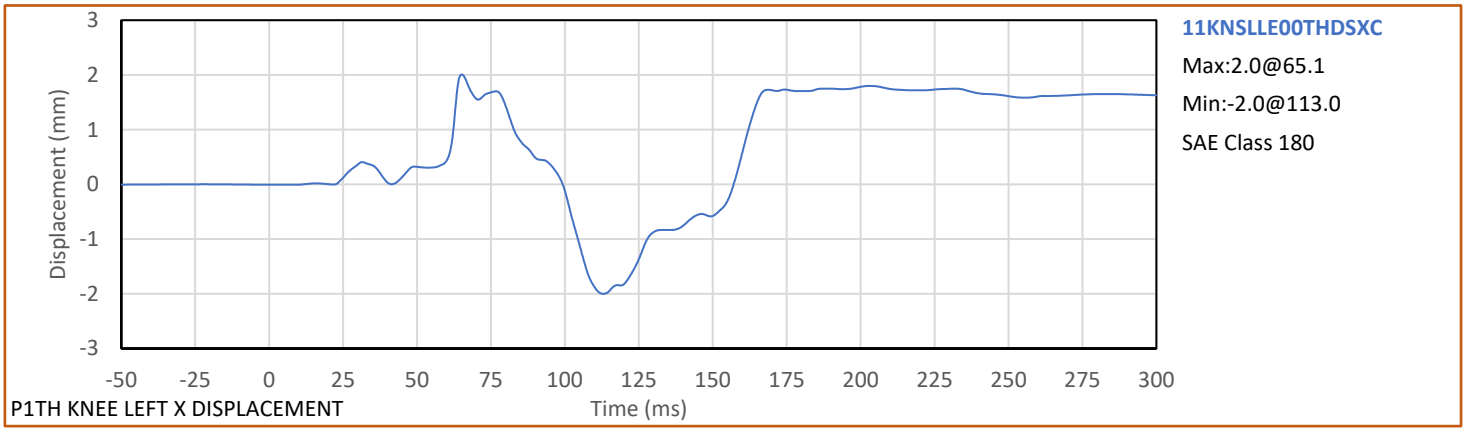
P1TH FEMUR RIGHT X MOMENT



P1TH FEMUR RIGHT Y MOMENT



P1TH FEMUR RIGHT Z MOMENT



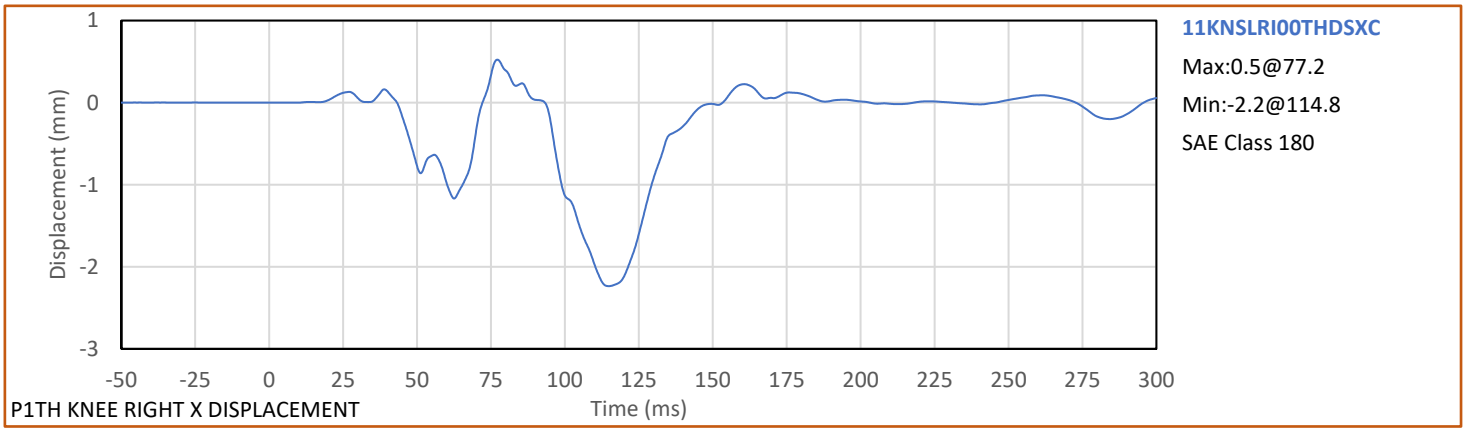
P1TH KNEE LEFT X DISPLACEMENT

Test Vehicle: 2020 Mazda CX-5 AWD 5-Door MPV

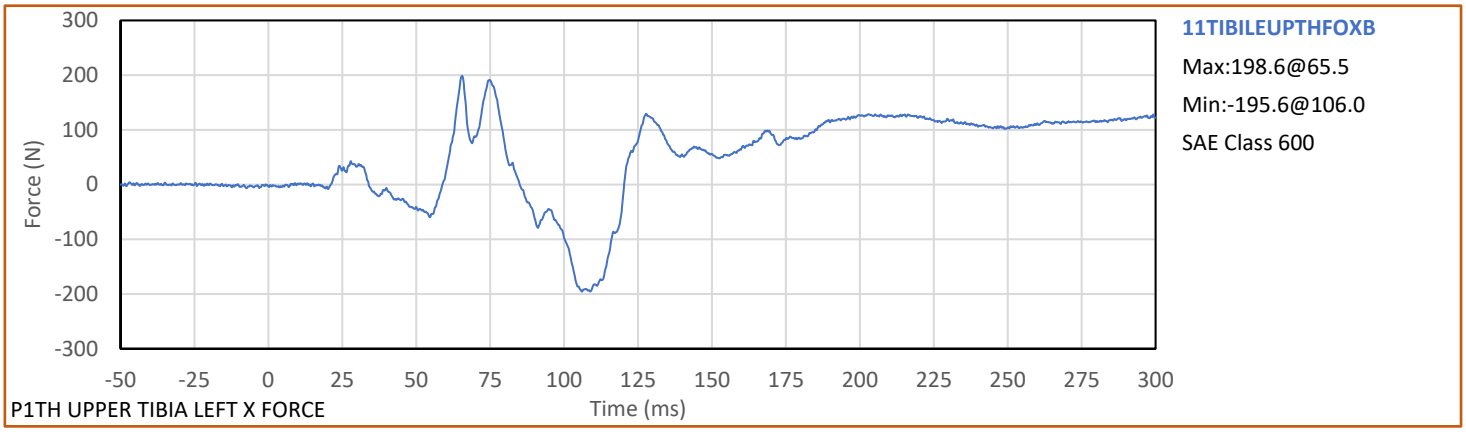
Test Program: Left Side 30° Frontal Rigid Barrier Impact

NHTSA No.: R20205416

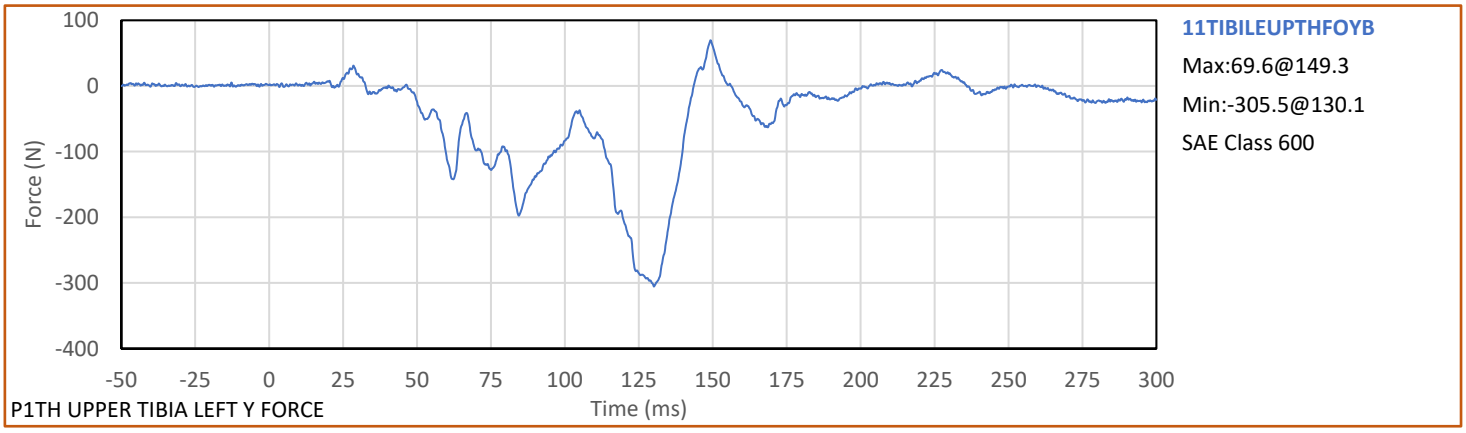
Test Date: 5/21/2021



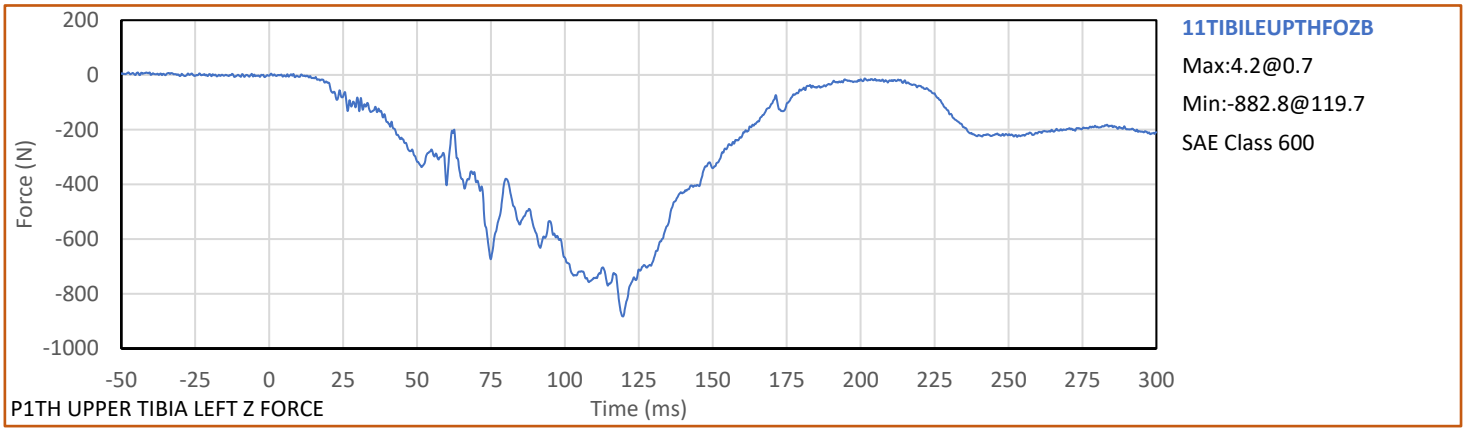
P1TH KNEE RIGHT X DISPLACEMENT



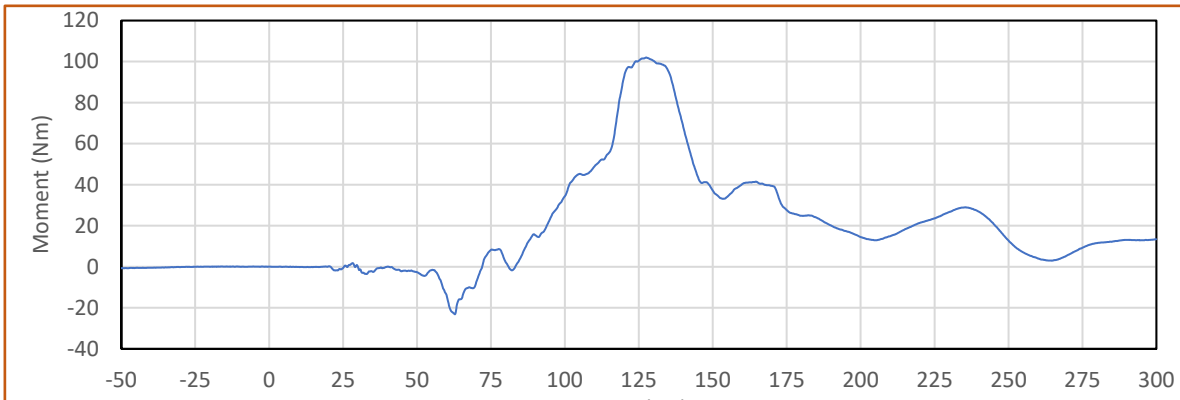
P1TH UPPER TIBIA LEFT X FORCE



P1TH UPPER TIBIA LEFT Y FORCE

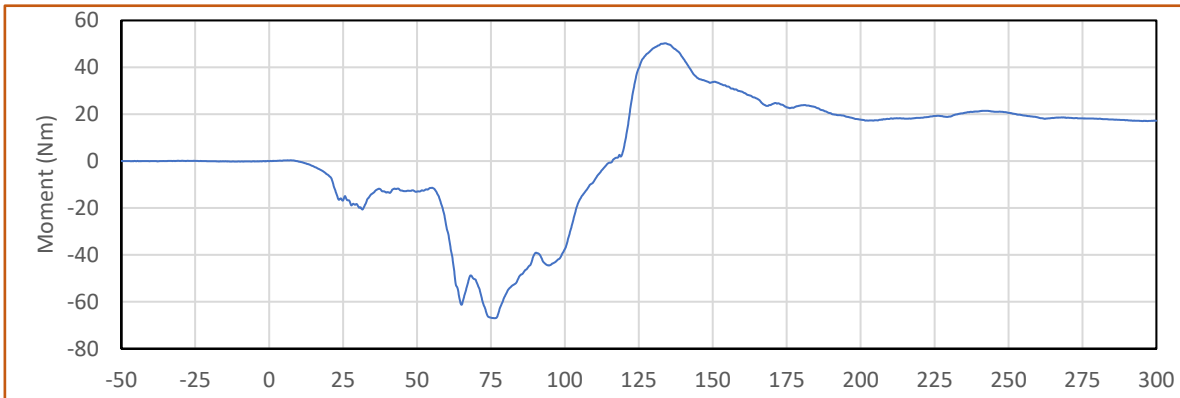


P1TH UPPER TIBIA LEFT Z FORCE



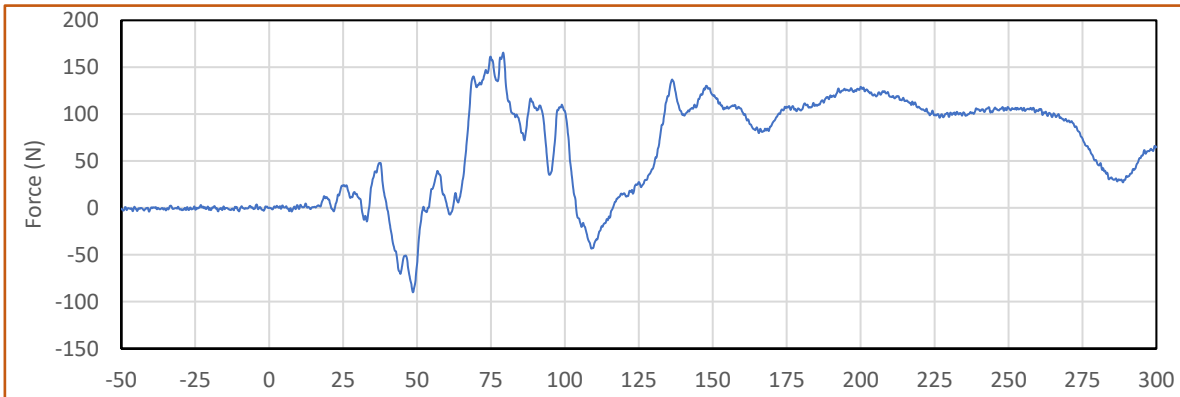
P1TH UPPER TIBIA LEFT X MOMENT

11TIBILEUPTHMOXB
Max:102.0@127.5
Min:-23.2@62.8
SAE Class 600



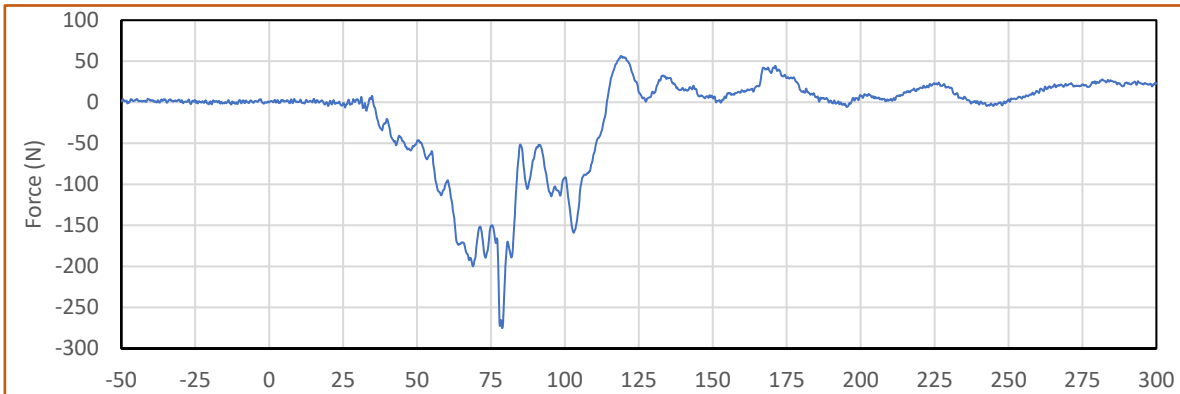
P1TH UPPER TIBIA LEFT Y MOMENT

11TIBILEUPTHMOYB
Max:50.2@134.0
Min:-67.0@76.2
SAE Class 600



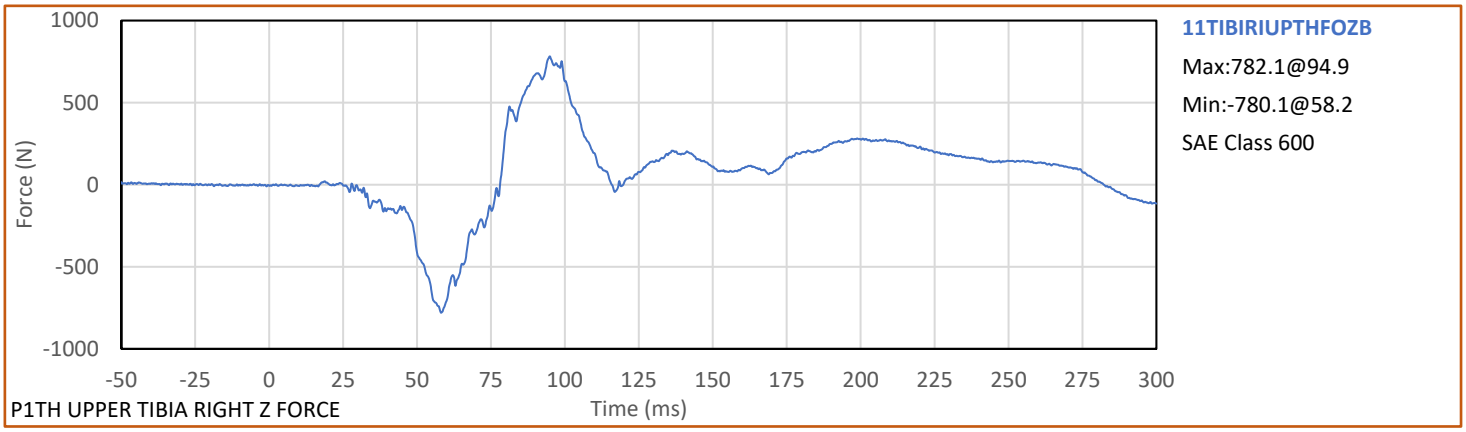
P1TH UPPER TIBIA RIGHT X FORCE

11TIBIRIUPTHFOXB
Max:165.6@79.1
Min:-90.0@48.6
SAE Class 600



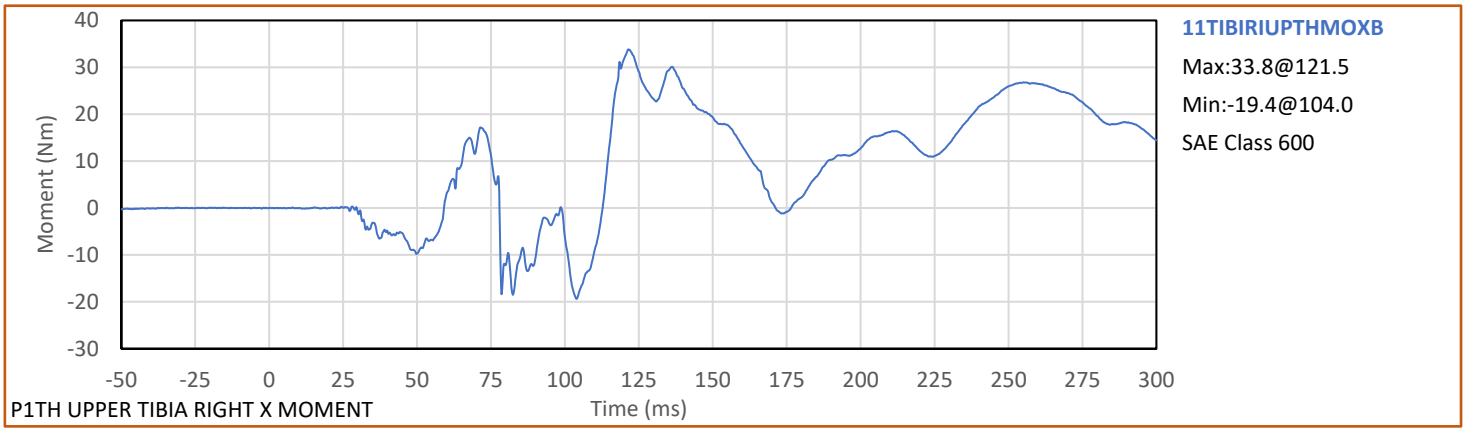
P1TH UPPER TIBIA RIGHT Y FORCE

11TIBIRIUPTHFOYB
Max:56.4@119.0
Min:-275.3@78.8
SAE Class 600



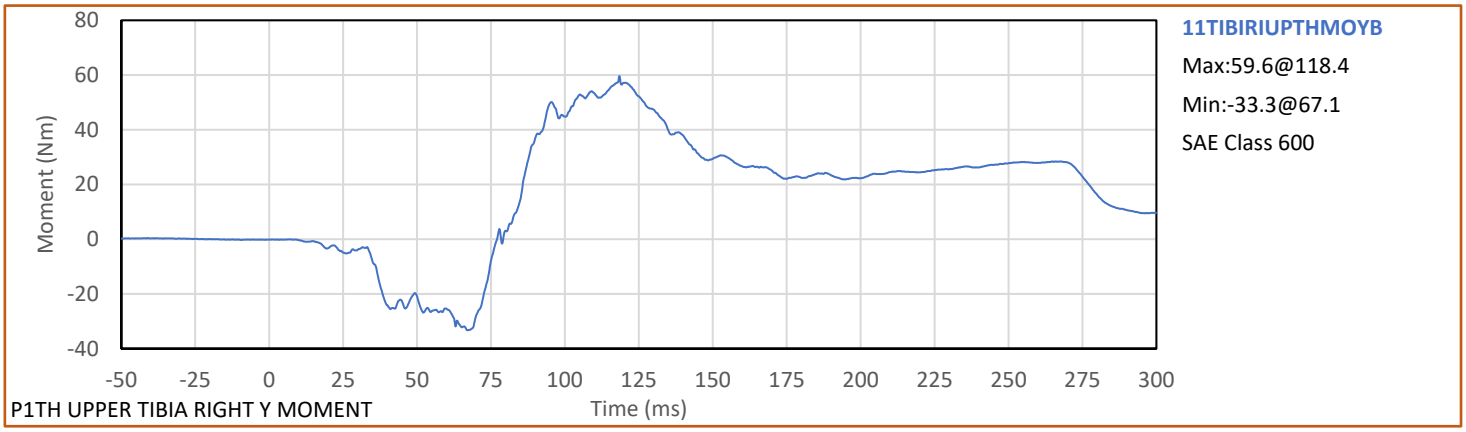
P1TH UPPER TIBIA RIGHT Z FORCE

11TIBIRIUPTHFOZB
Max:782.1@94.9
Min:-780.1@58.2
SAE Class 600



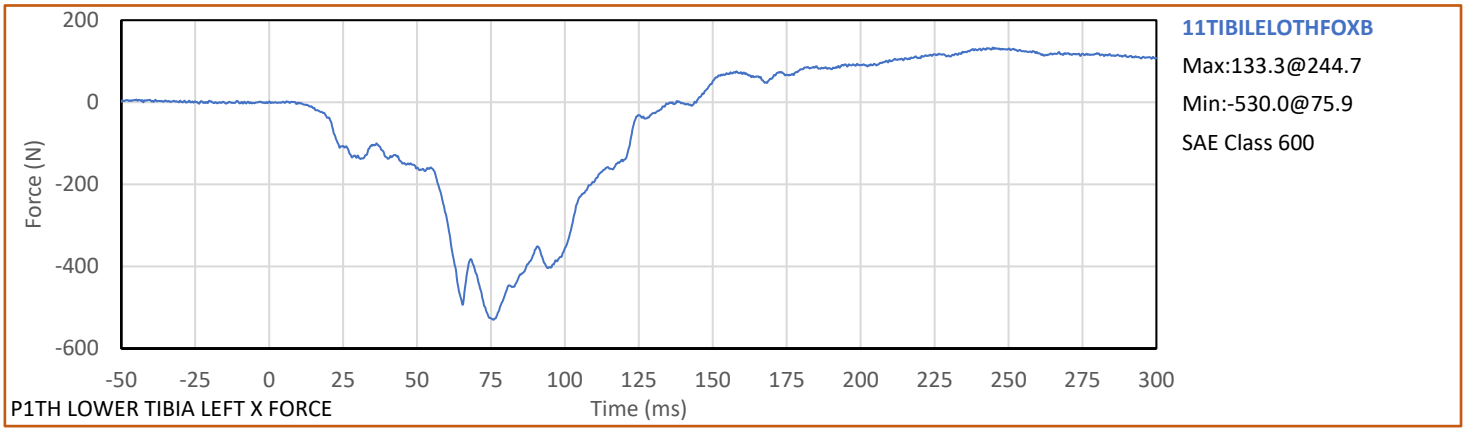
P1TH UPPER TIBIA RIGHT X MOMENT

11TIBIRIUPTHMOXB
Max:33.8@121.5
Min:-19.4@104.0
SAE Class 600



P1TH UPPER TIBIA RIGHT Y MOMENT

11TIBIRIUPTHMOYB
Max:59.6@118.4
Min:-33.3@67.1
SAE Class 600



P1TH LOWER TIBIA LEFT X FORCE

11TIBILELOTHFOXB
Max:133.3@244.7
Min:-530.0@75.9
SAE Class 600

P1TH LOWER TIBIA LEFT Y FORCE

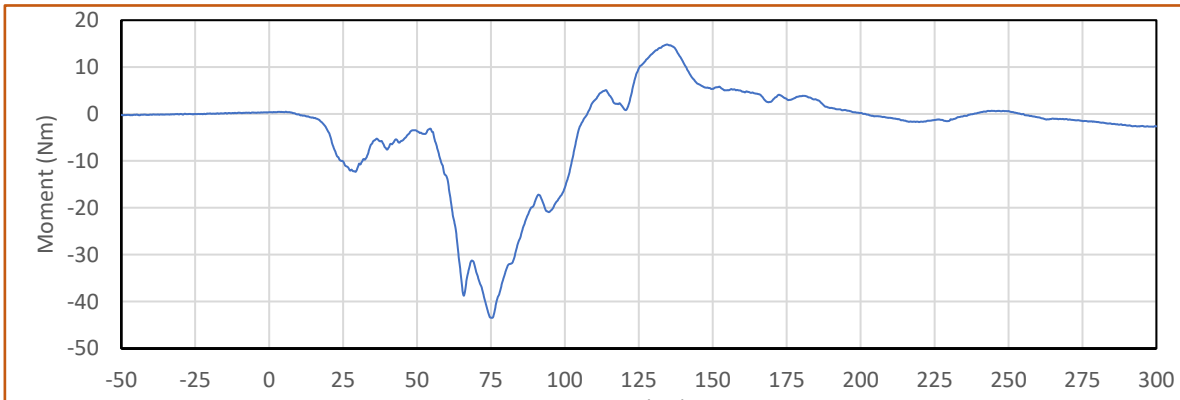
11TIBILELOTHFOYB
Max:138.1@62.0
Min:-310.4@126.3
SAE Class 600

P1TH LOWER TIBIA LEFT Z FORCE

11TIBILELOTHFOZB
Max:197.2@201.8
Min:-1696.1@103.5
SAE Class 600

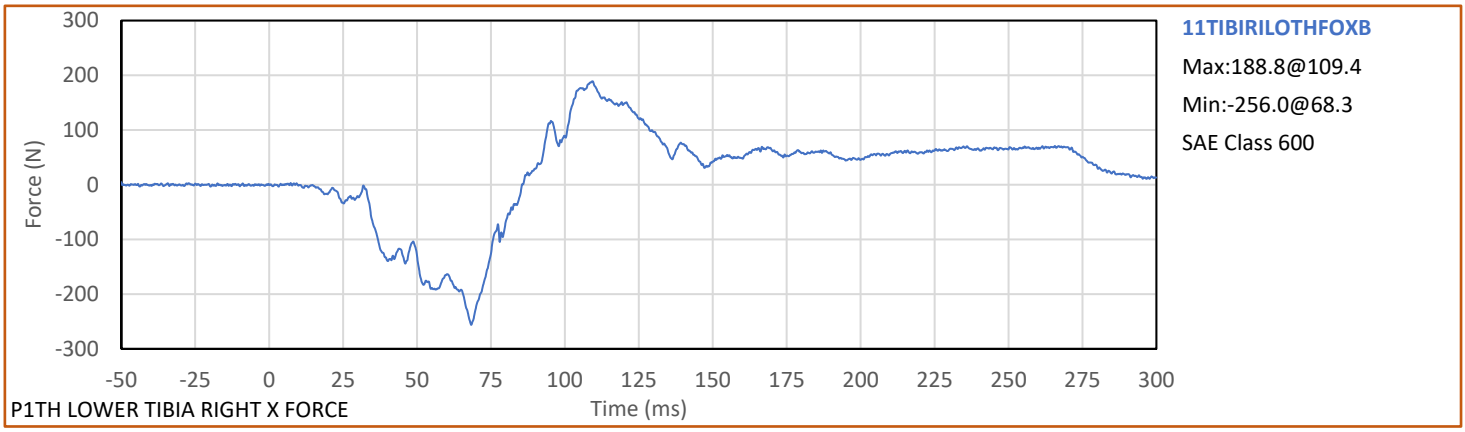
P1TH LOWER TIBIA LEFT X MOMENT

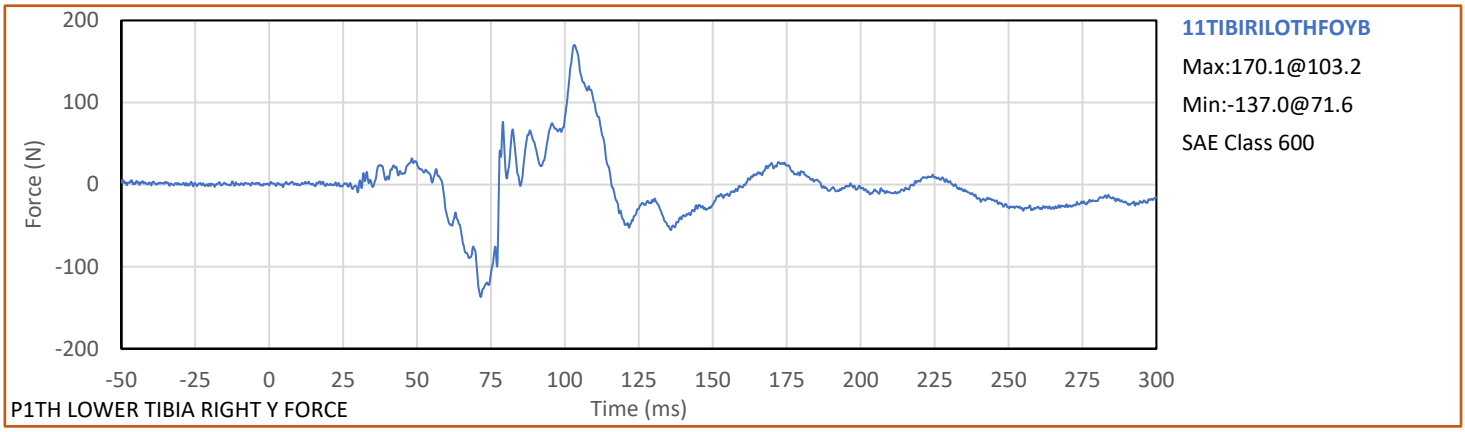
11TIBILELOTHMOXB
Max:38.6@148.9
Min:-19.4@62.2
SAE Class 600

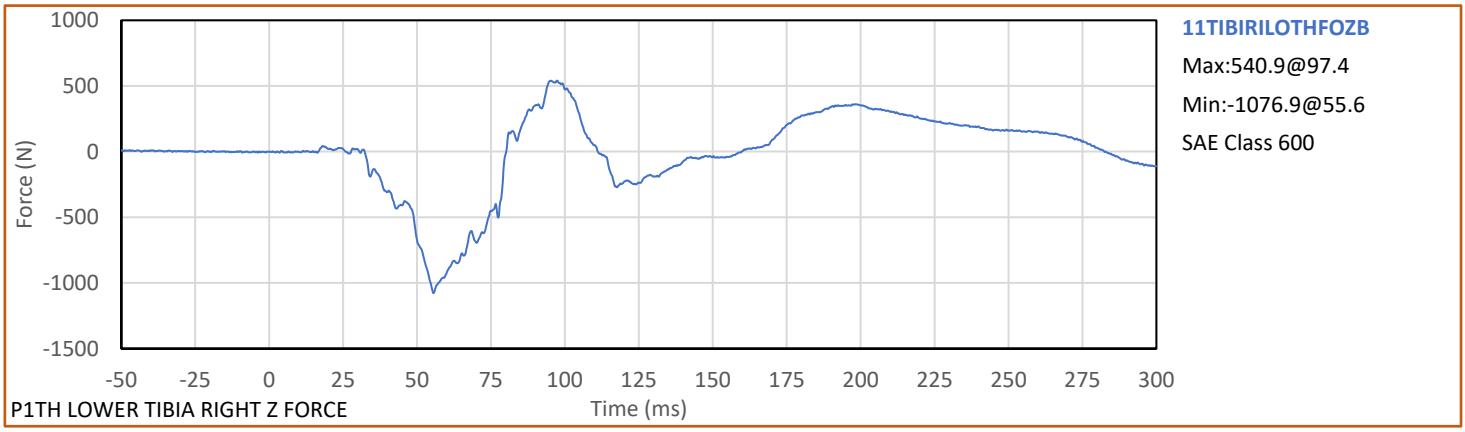


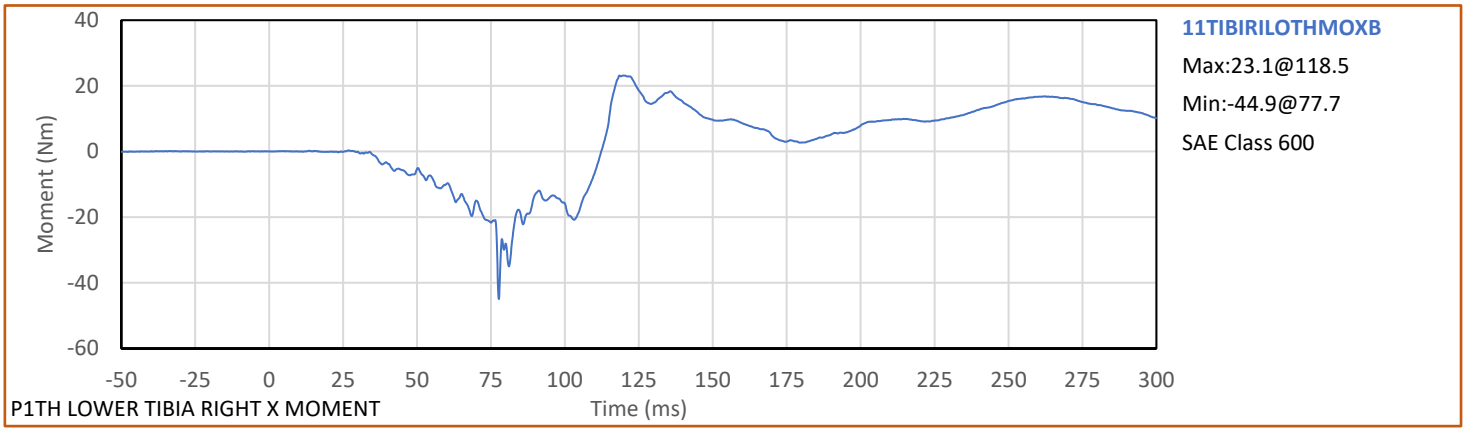
P1TH LOWER TIBIA LEFT Y MOMENT

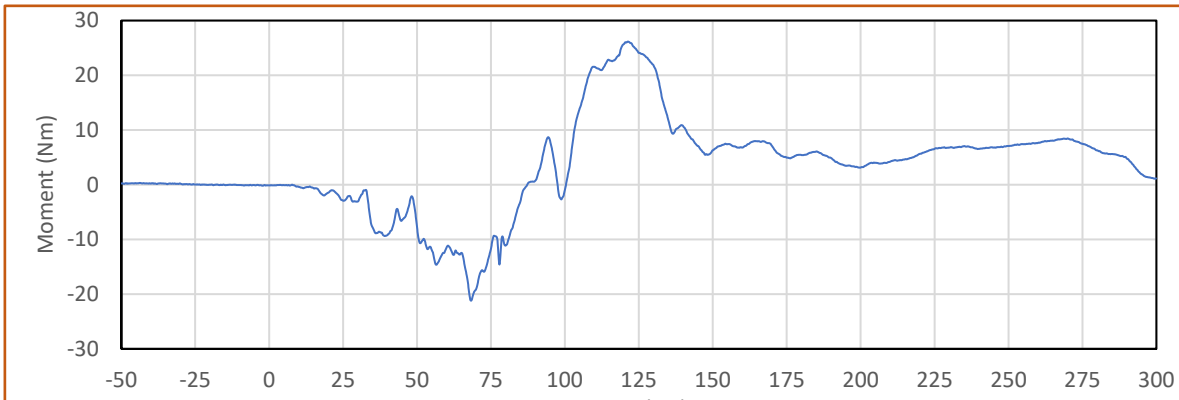
11TIBILELOTHMOYB
Max:14.8@134.5
Min:-43.5@75.4
SAE Class 600


Force (N)
Time (ms)
P1TH LOWER TIBIA RIGHT X FORCE
11TIBIRILOTHFOXB
Max:188.8@109.4
Min:-256.0@68.3
SAE Class 600


Force (N)
Time (ms)
P1TH LOWER TIBIA RIGHT Y FORCE
11TIBIRILOTHFOYB
Max:170.1@103.2
Min:-137.0@71.6
SAE Class 600

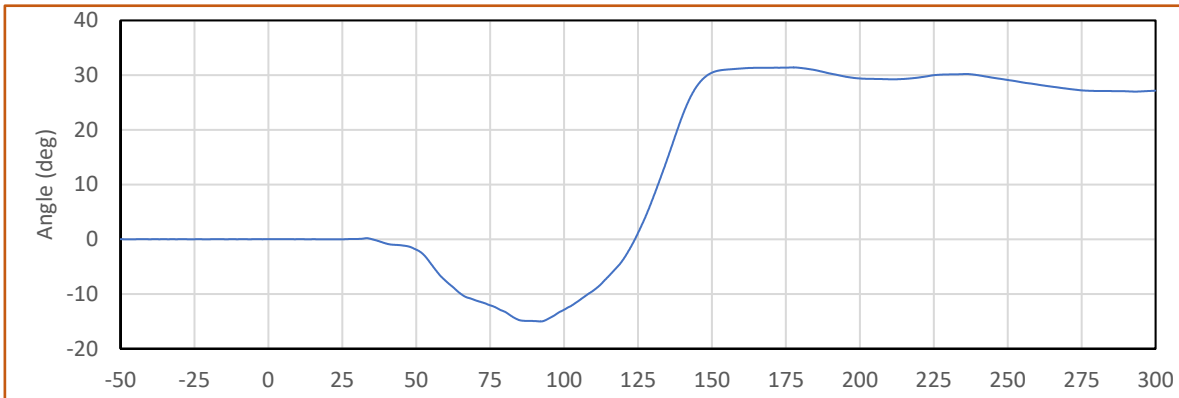

Force (N)
Time (ms)
P1TH LOWER TIBIA RIGHT Z FORCE
11TIBIRILOTHFOZB
Max:540.9@97.4
Min:-1076.9@55.6
SAE Class 600


Moment (Nm)
Time (ms)
P1TH LOWER TIBIA RIGHT X MOMENT
11TIBIRILOTHMOXB
Max:23.1@118.5
Min:-44.9@77.7
SAE Class 600



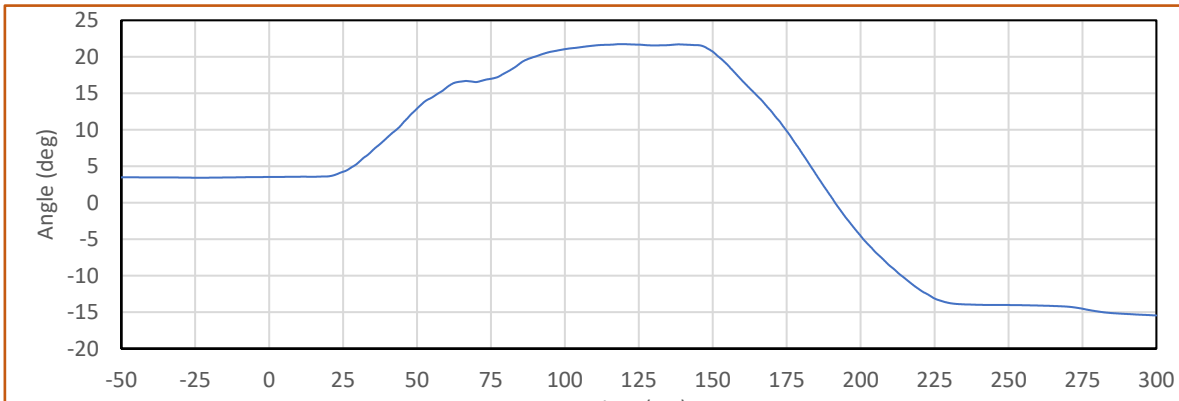
P1TH LOWER TIBIA RIGHT Y MOMENT

11TIBIRILOTHMOYB
Max:26.2@121.4
Min:-21.2@68.3
SAE Class 600



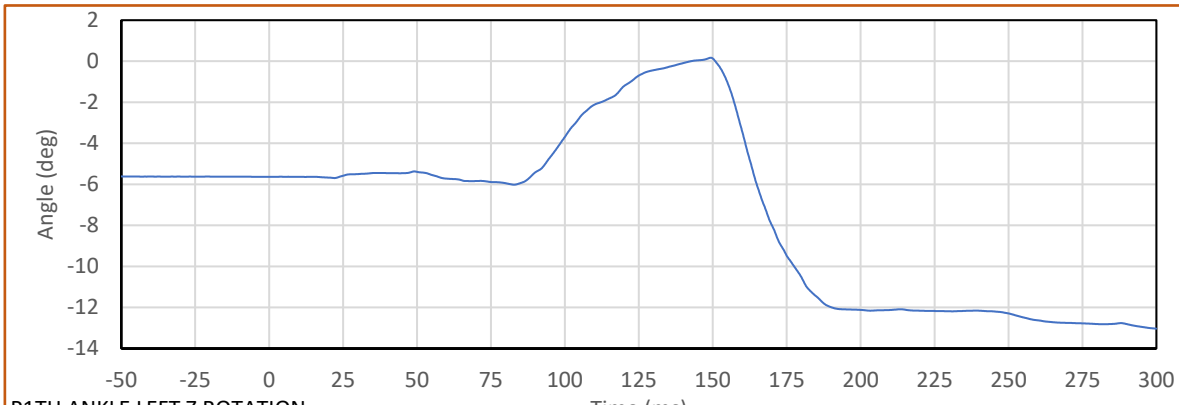
P1TH ANKLE LEFT X ROTATION

11ANKLLE00THANXC
Max:31.4@177.6
Min:-15.0@92.0
SAE Class 180



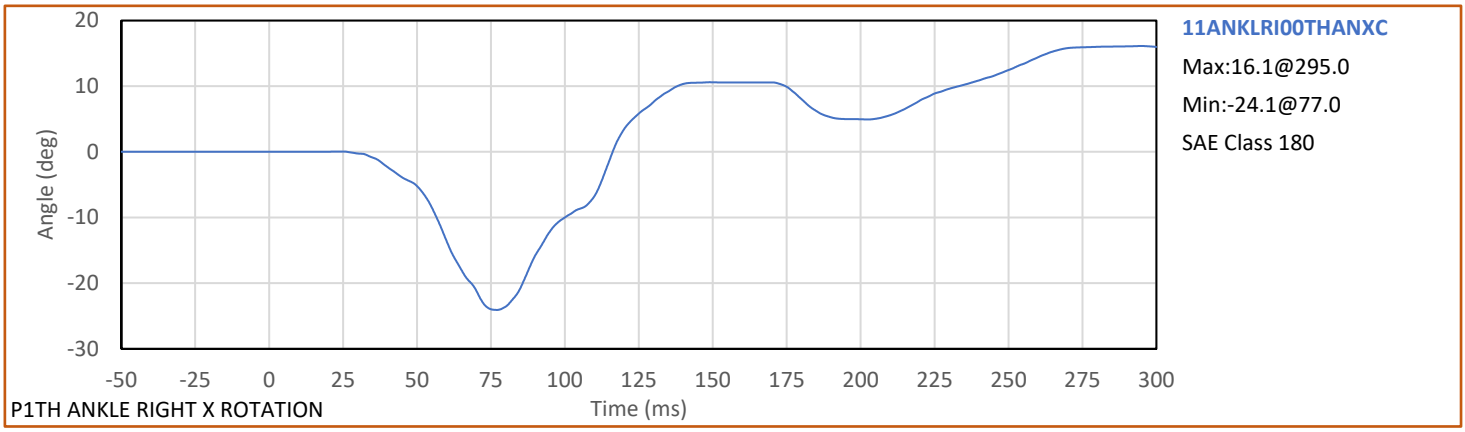
P1TH ANKLE LEFT Y ROTATION

11ANKLLE00THANYC
Max:21.7@118.7
Min:-15.5@299.8
SAE Class 180

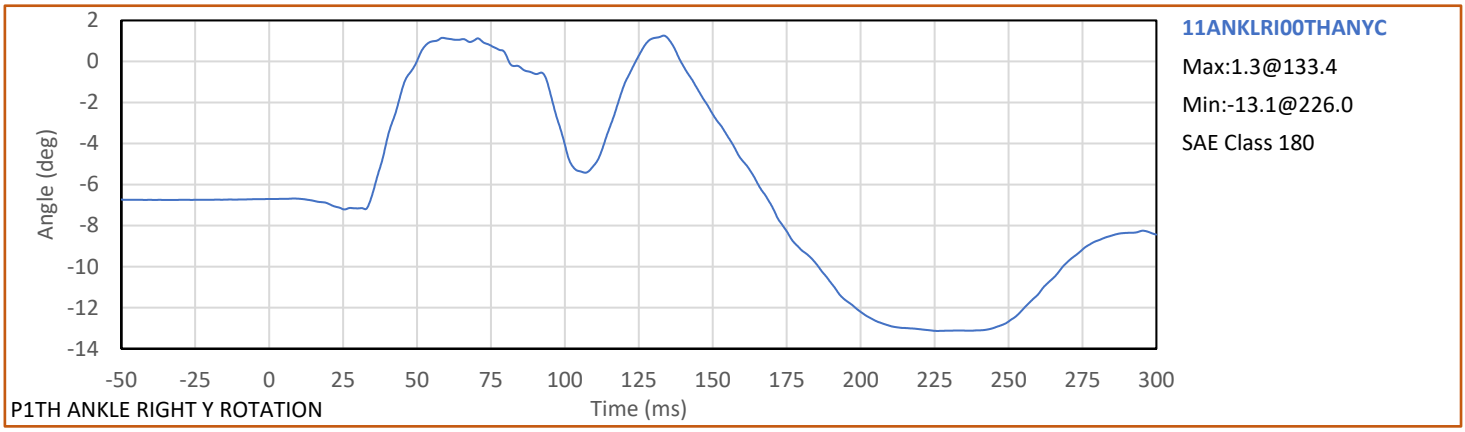


P1TH ANKLE LEFT Z ROTATION

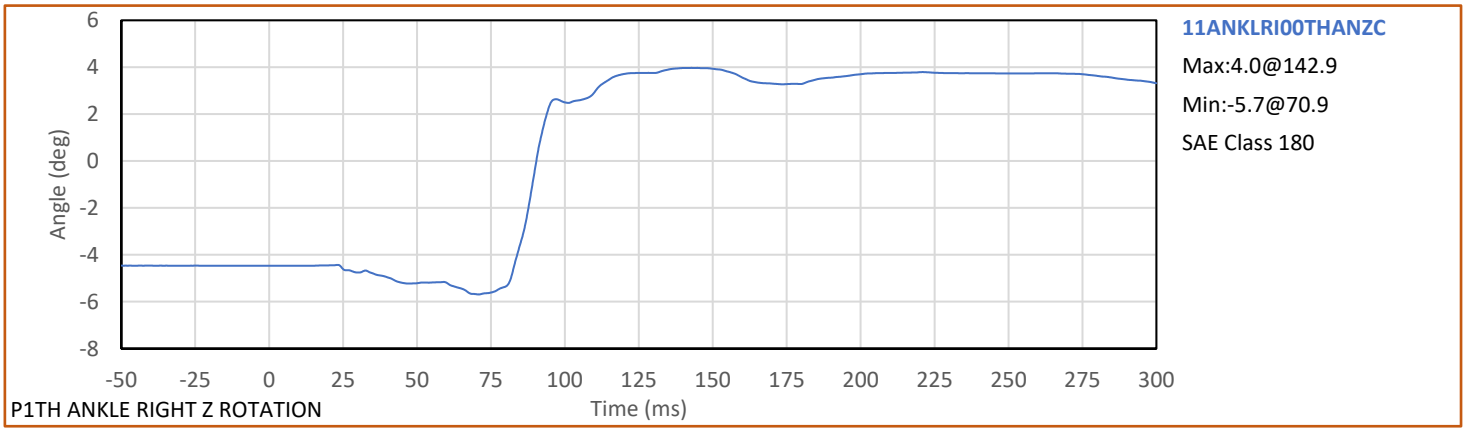
11ANKLLE00THANZC
Max:0.2@149.3
Min:-13.0@299.8
SAE Class 180



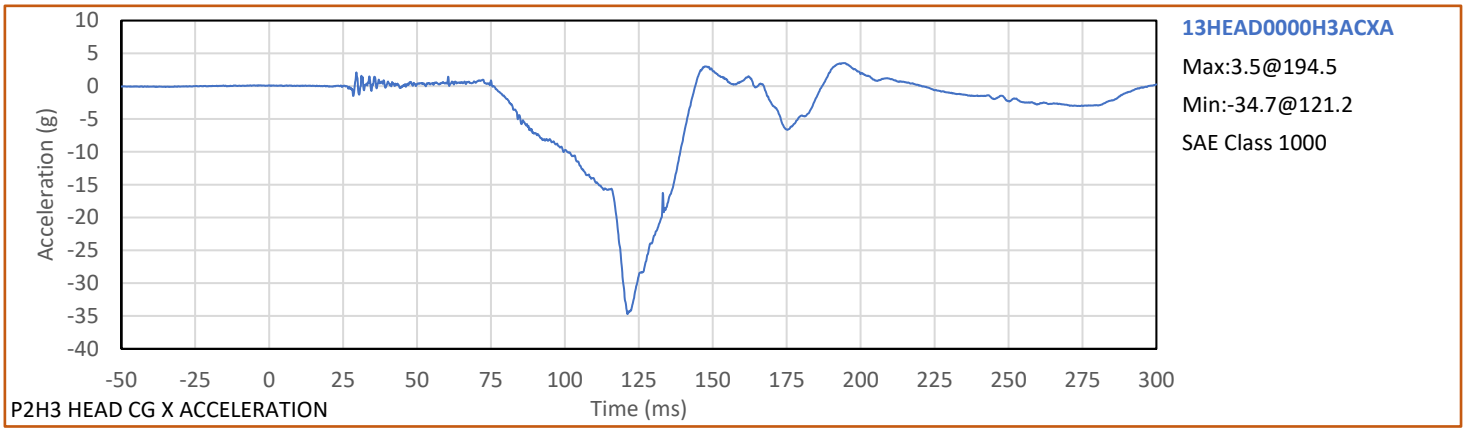
P1TH ANKLE RIGHT X ROTATION

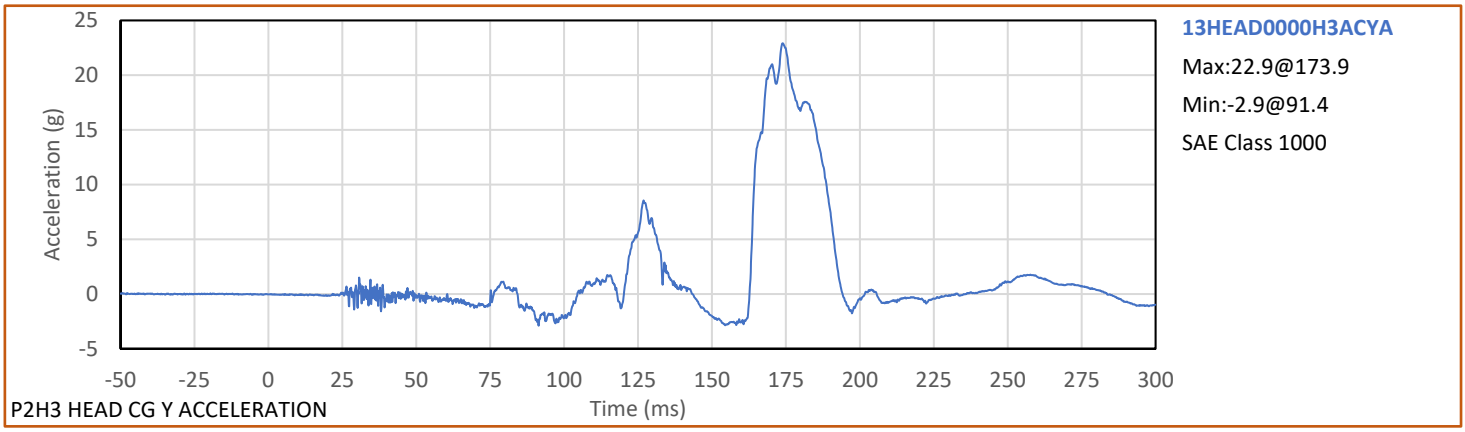


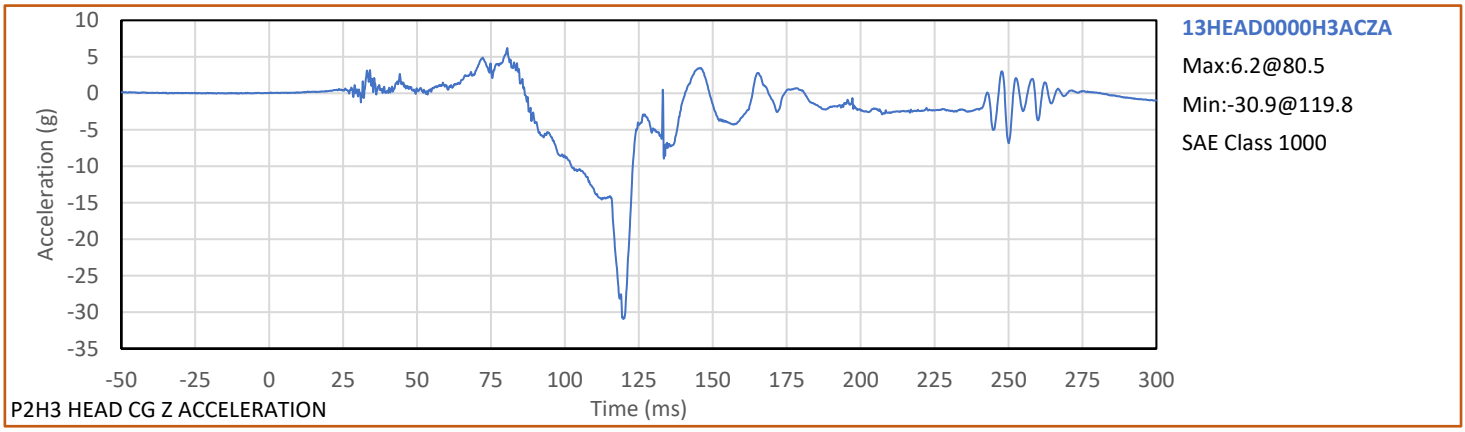
P1TH ANKLE RIGHT Y ROTATION

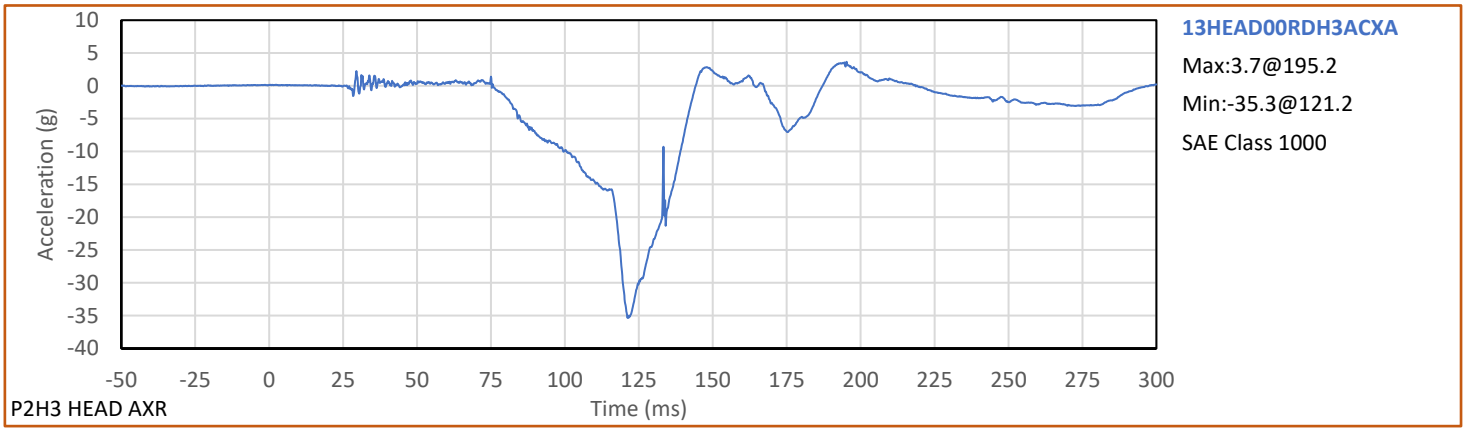


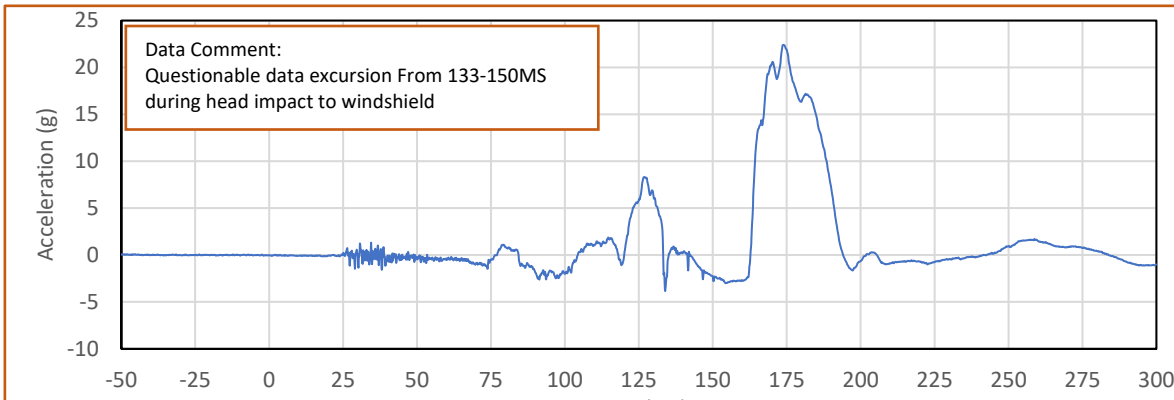
P1TH ANKLE RIGHT Z ROTATION


Acceleration (g)
Time (ms)
P2H3 HEAD CG X ACCELERATION
13HEAD0000H3ACXA
Max:3.5@194.5
Min:-34.7@121.2
SAE Class 1000


Acceleration (g)
Time (ms)
P2H3 HEAD CG Y ACCELERATION
13HEAD0000H3ACYA
Max:22.9@173.9
Min:-2.9@91.4
SAE Class 1000

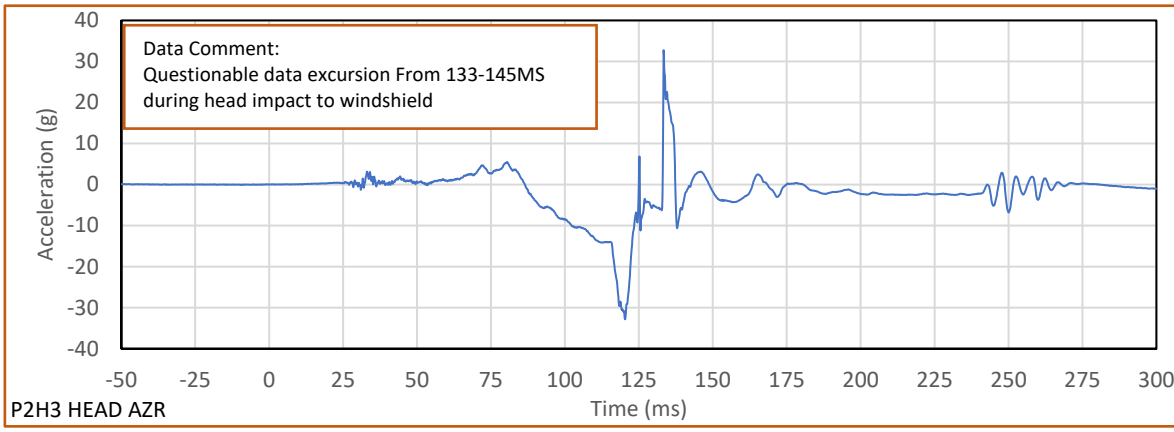

Acceleration (g)
Time (ms)
P2H3 HEAD CG Z ACCELERATION
13HEAD0000H3ACZA
Max:6.2@80.5
Min:-30.9@119.8
SAE Class 1000


Acceleration (g)
Time (ms)
P2H3 HEAD AXR
13HEAD00RDH3ACXA
Max:3.7@195.2
Min:-35.3@121.2
SAE Class 1000



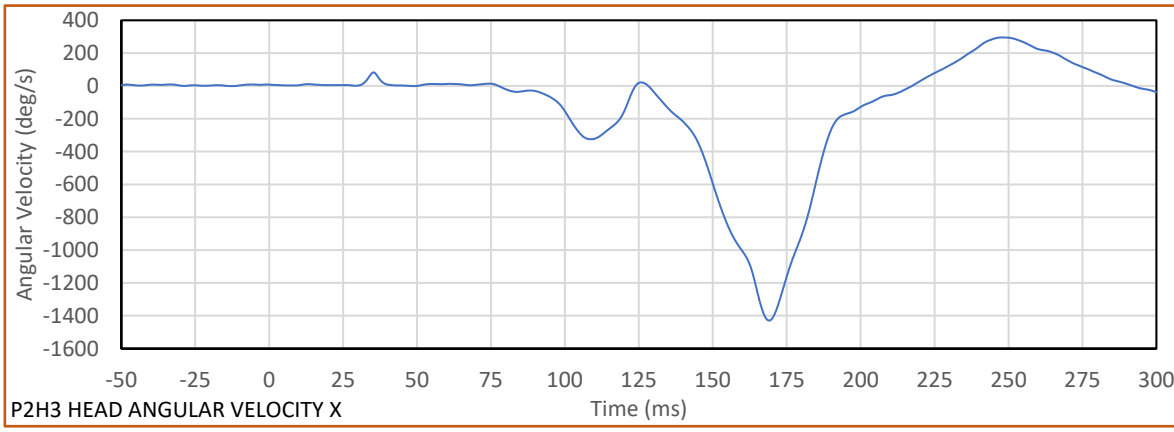
13HEAD00RDH3ACYA
Max:22.4@173.9
Min:-3.9@133.9
SAE Class 1000

P2H3 HEAD AYR



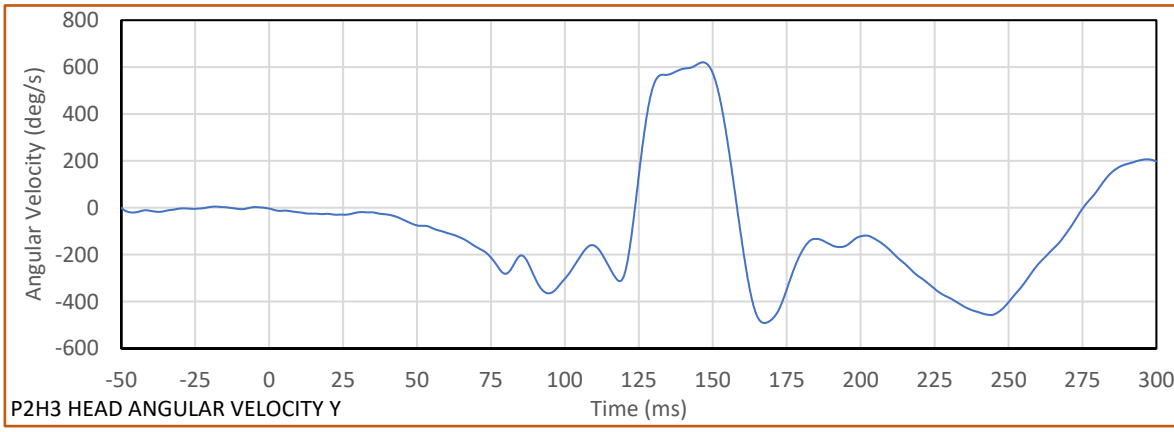
13HEAD00RDH3ACZA
Max:32.7@133.4
Min:-32.8@120.4
SAE Class 1000

P2H3 HEAD AZR



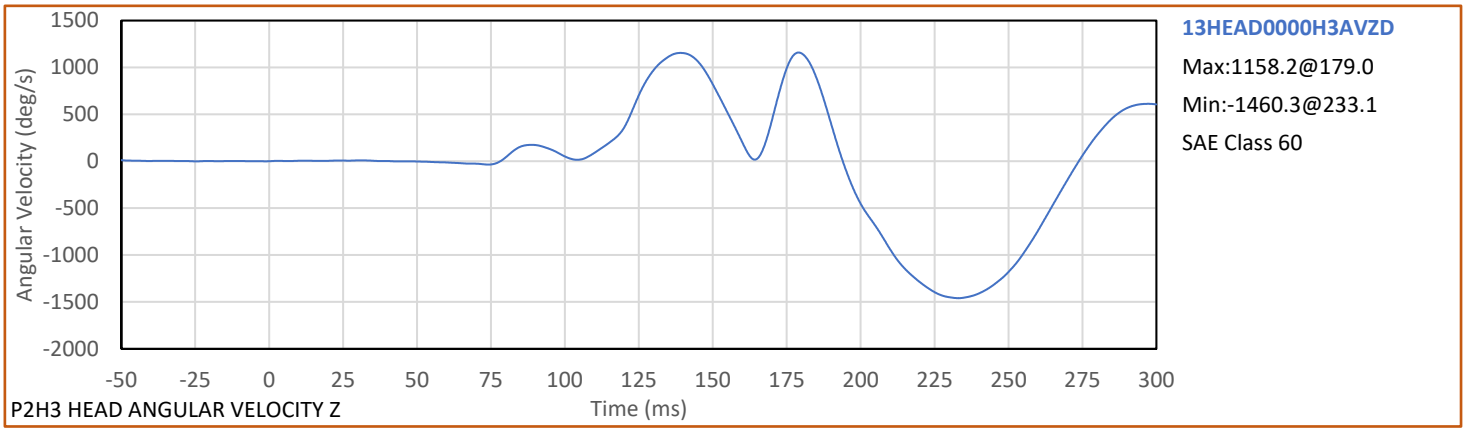
13HEAD0000H3AVXD
Max:295.1@247.8
Min:-1429.3@169.1
SAE Class 60

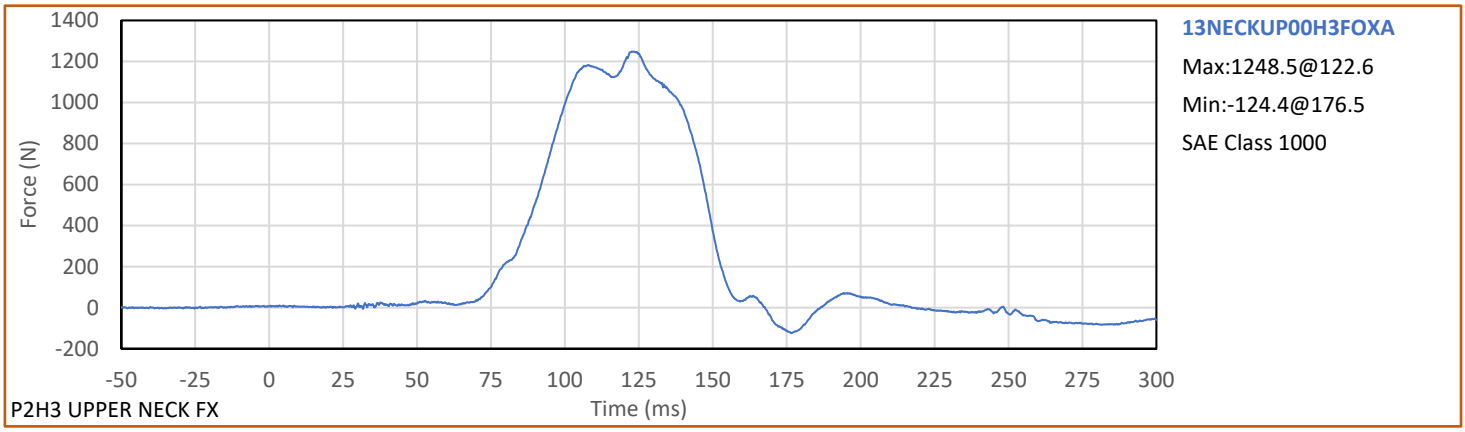
P2H3 HEAD ANGULAR VELOCITY X

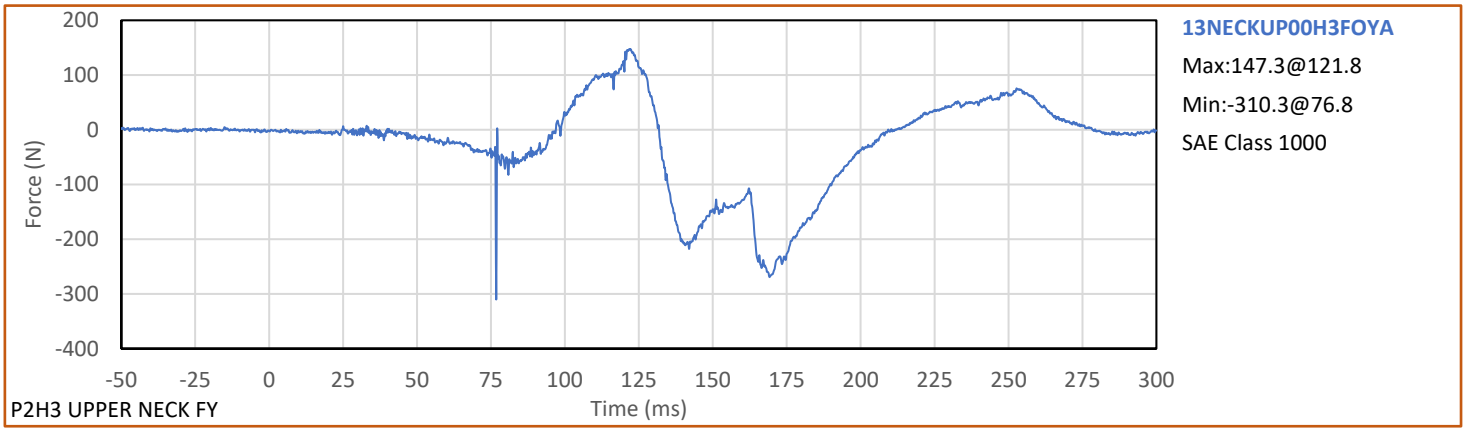


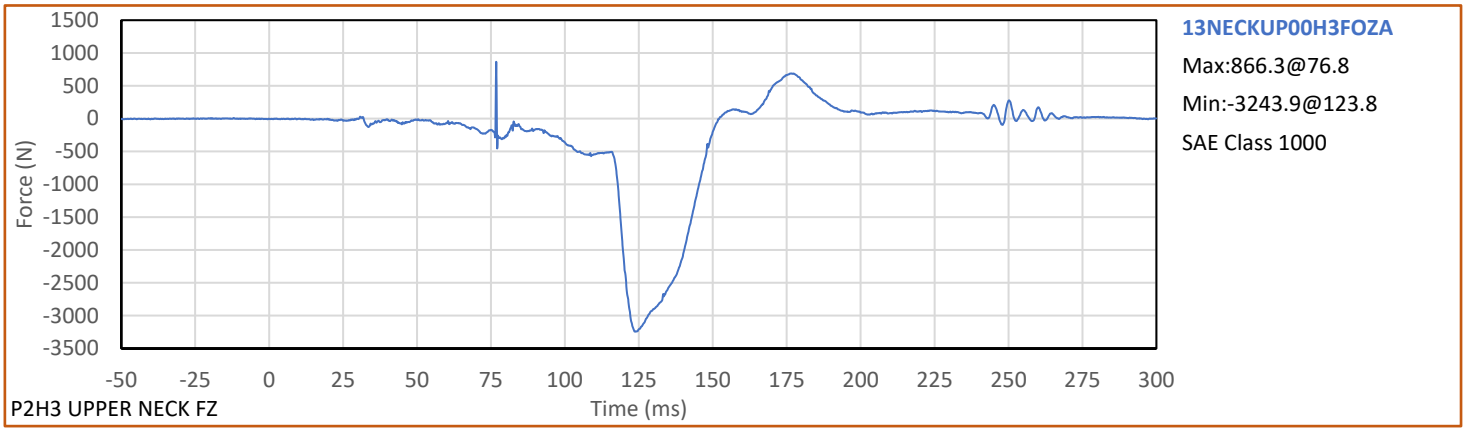
13HEAD0000H3AVYD
Max:620.1@146.7
Min:-491.6@167.5
SAE Class 60

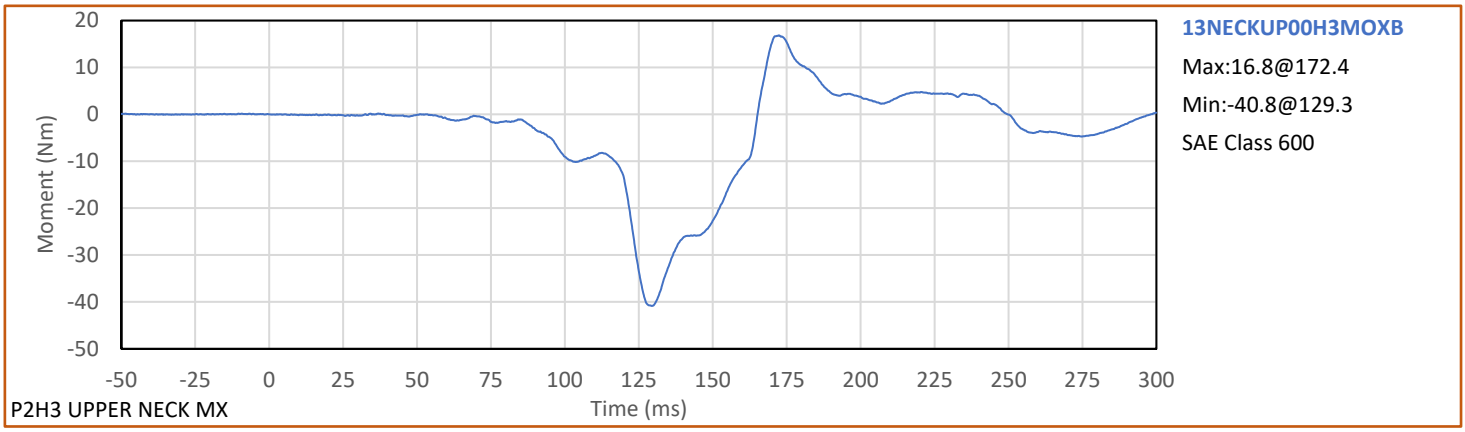
P2H3 HEAD ANGULAR VELOCITY Y


Angular Velocity (deg/s)
Time (ms)
13HEAD0000H3AVZD
Max:1158.2@179.0
Min:-1460.3@233.1
SAE Class 60
P2H3 HEAD ANGULAR VELOCITY Z

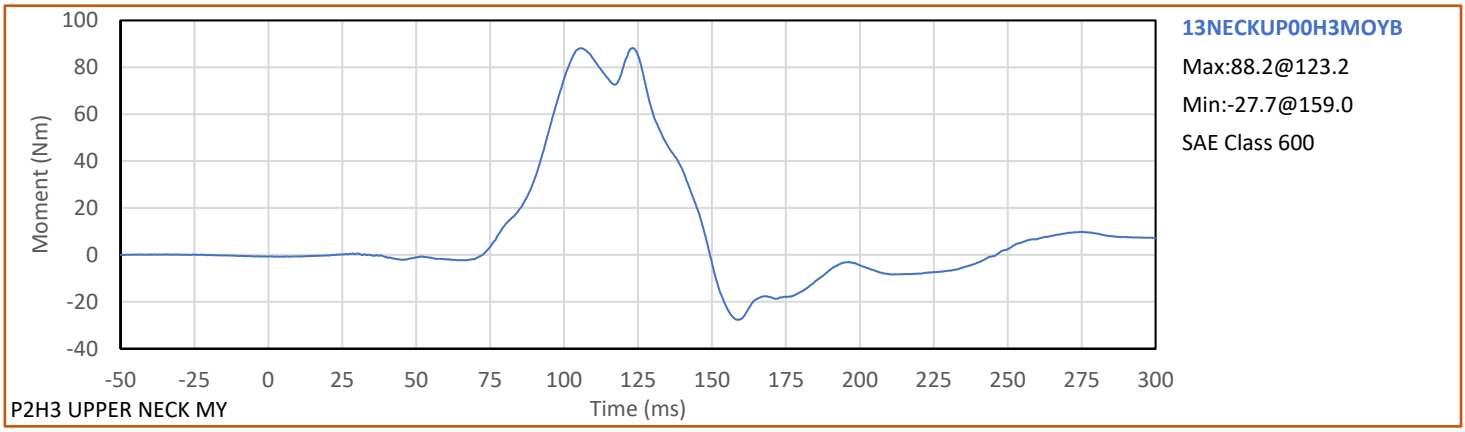

Force (N)
Time (ms)
13NECKUP00H3FOXA
Max:1248.5@122.6
Min:-124.4@176.5
SAE Class 1000
P2H3 UPPER NECK FX


Force (N)
Time (ms)
13NECKUP00H3FOYA
Max:147.3@121.8
Min:-310.3@76.8
SAE Class 1000
P2H3 UPPER NECK FY

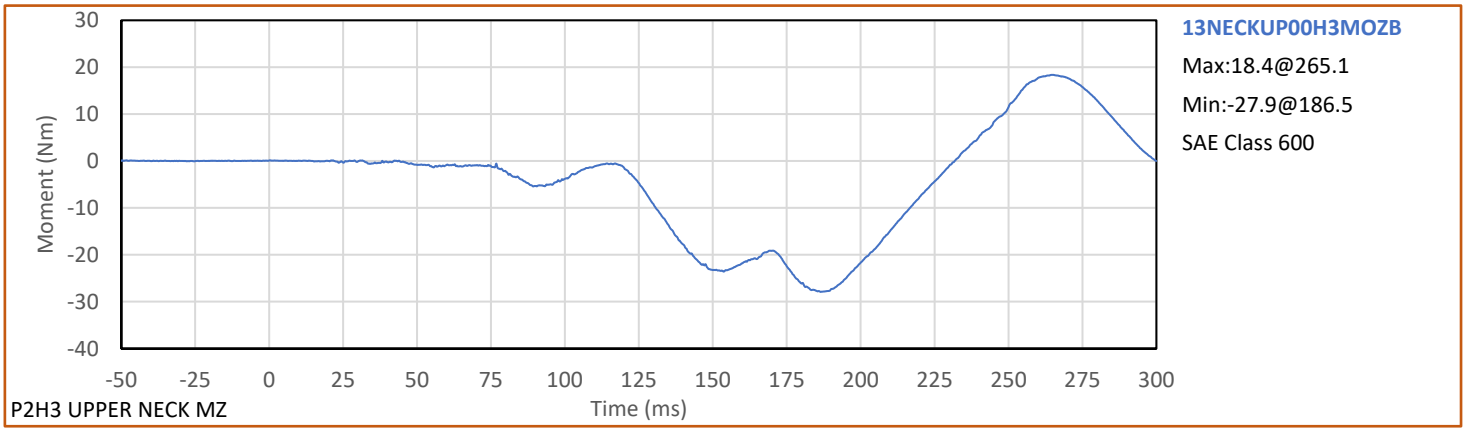

Force (N)
Time (ms)
13NECKUP00H3FOZA
Max:866.3@76.8
Min:-3243.9@123.8
SAE Class 1000
P2H3 UPPER NECK FZ



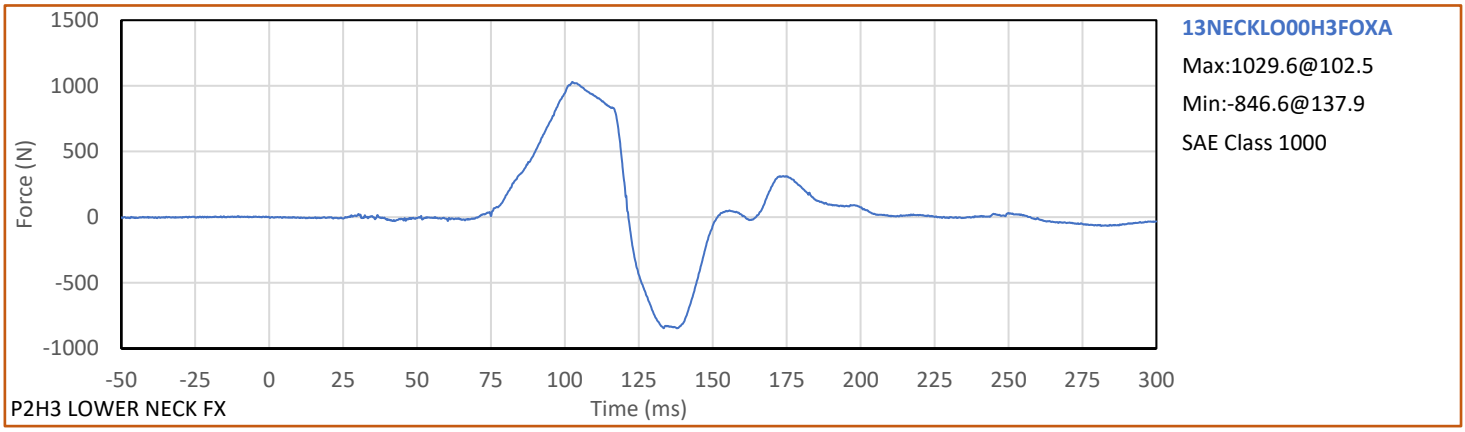
13NECKUP00H3MOXB
Max:16.8@172.4
Min:-40.8@129.3
SAE Class 600



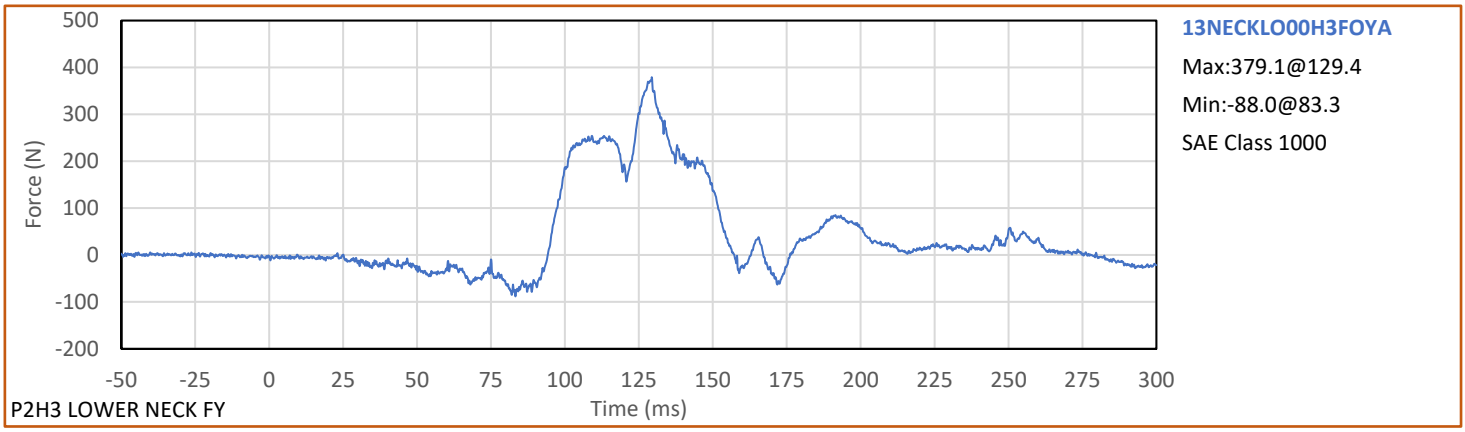
13NECKUP00H3MOYB
Max:88.2@123.2
Min:-27.7@159.0
SAE Class 600

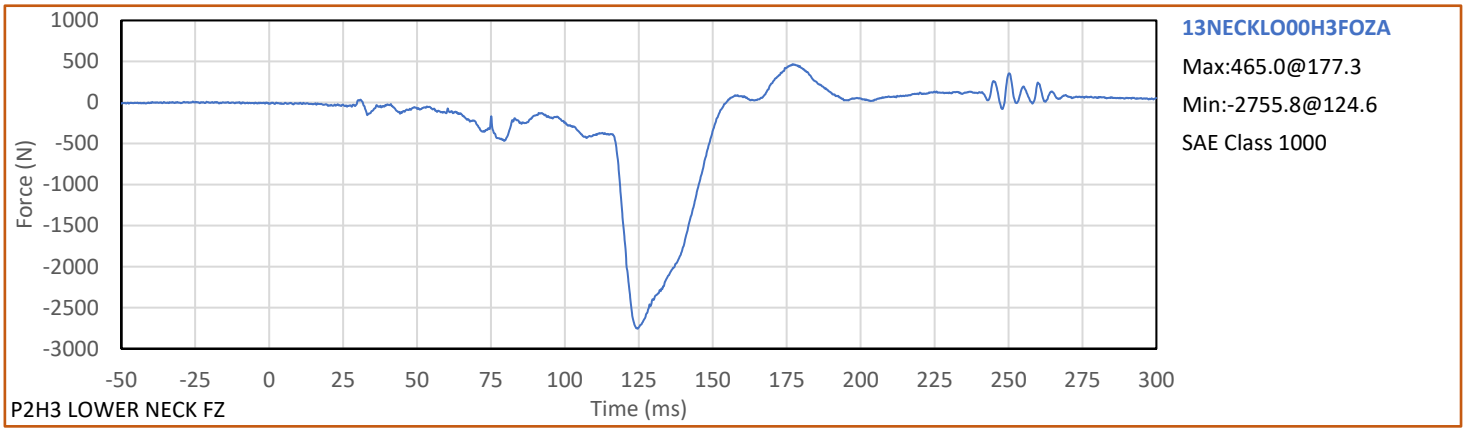


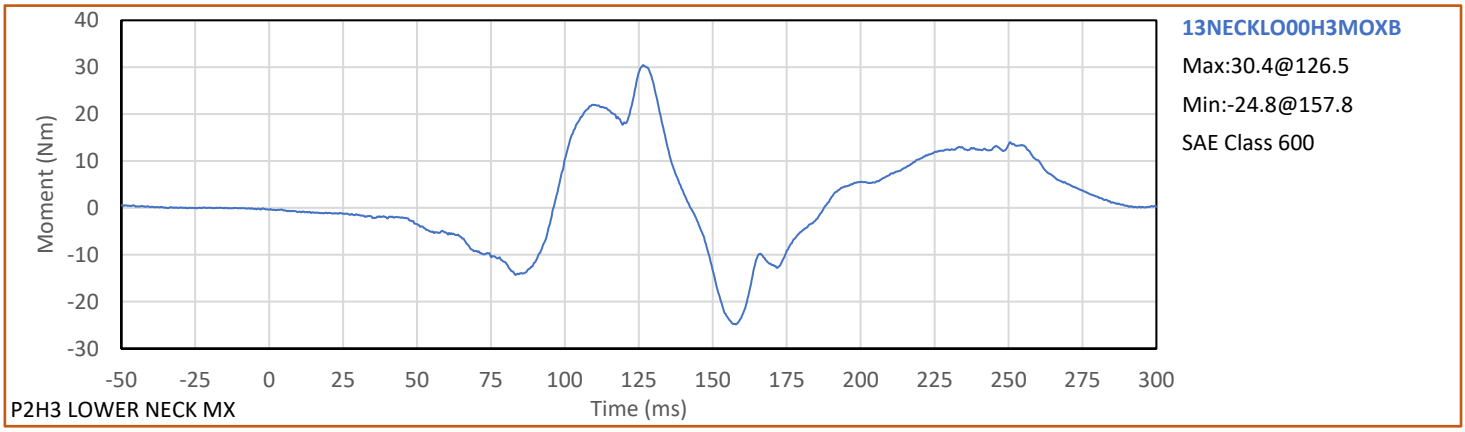
13NECKUP00H3MOZB
Max:18.4@265.1
Min:-27.9@186.5
SAE Class 600

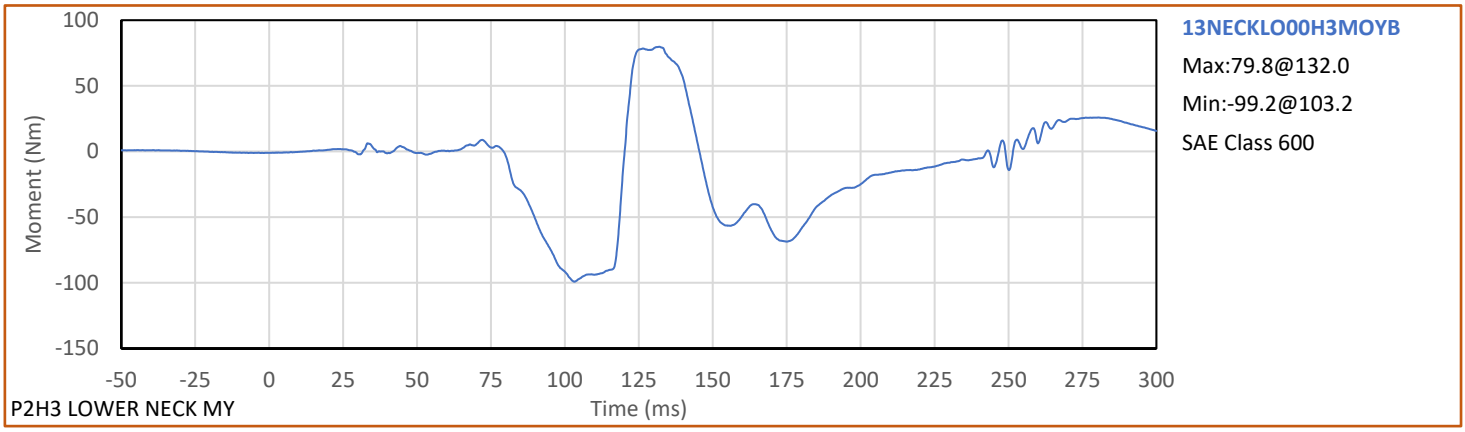


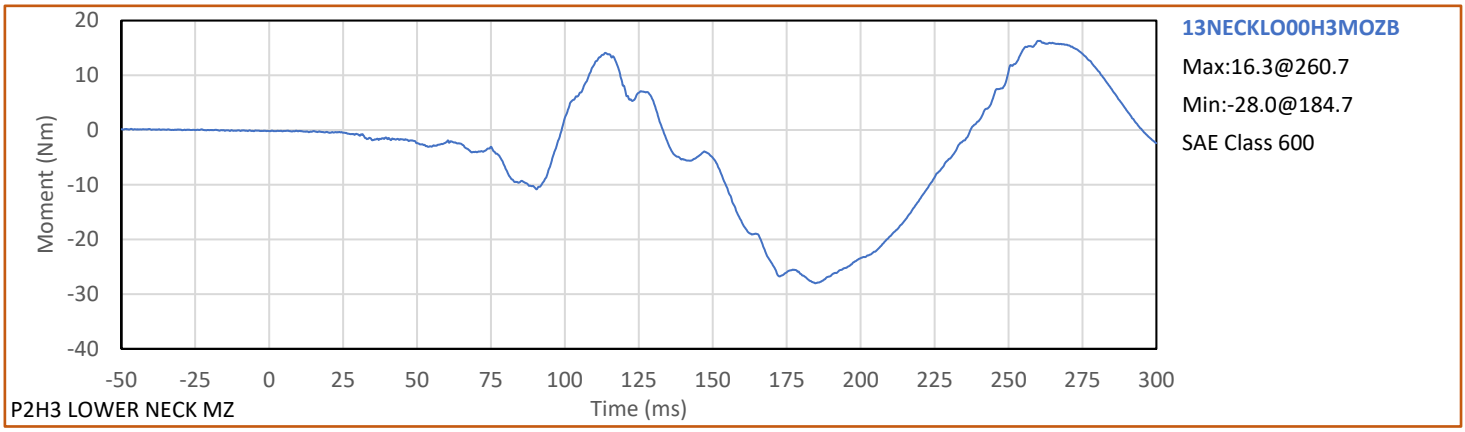
13NECKLO00H3FOXA
Max:1029.6@102.5
Min:-846.6@137.9
SAE Class 1000

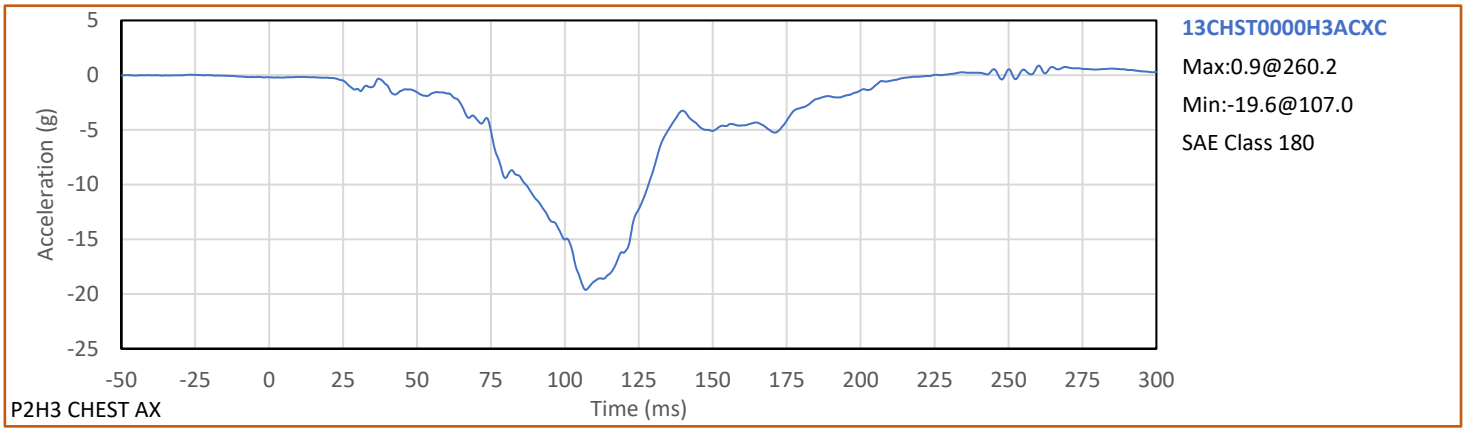

Force (N)
Time (ms)
P2H3 LOWER NECK FY
13NECKLO00H3FOYA
Max:379.1@129.4
Min:-88.0@83.3
SAE Class 1000

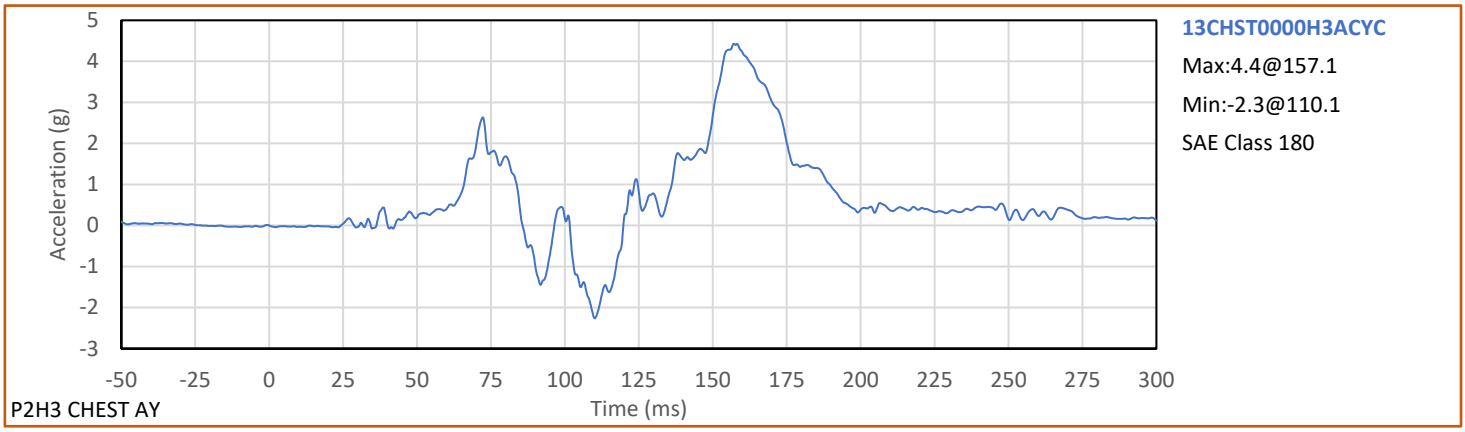

Force (N)
Time (ms)
P2H3 LOWER NECK FZ
13NECKLO00H3FOZA
Max:465.0@177.3
Min:-2755.8@124.6
SAE Class 1000

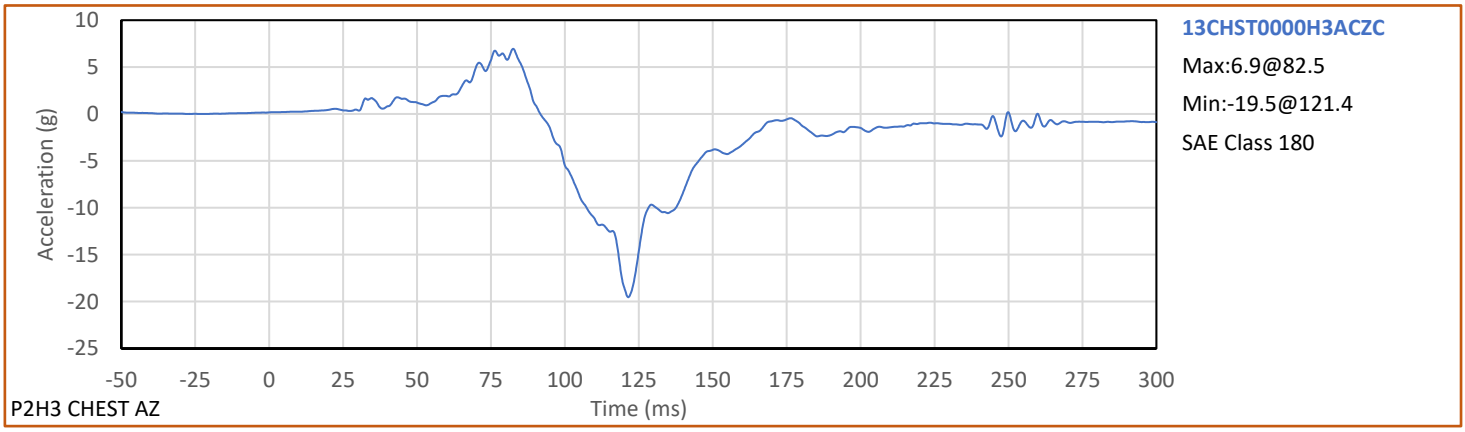

Moment (Nm)
Time (ms)
P2H3 LOWER NECK MX
13NECKLO00H3MOXB
Max:30.4@126.5
Min:-24.8@157.8
SAE Class 600

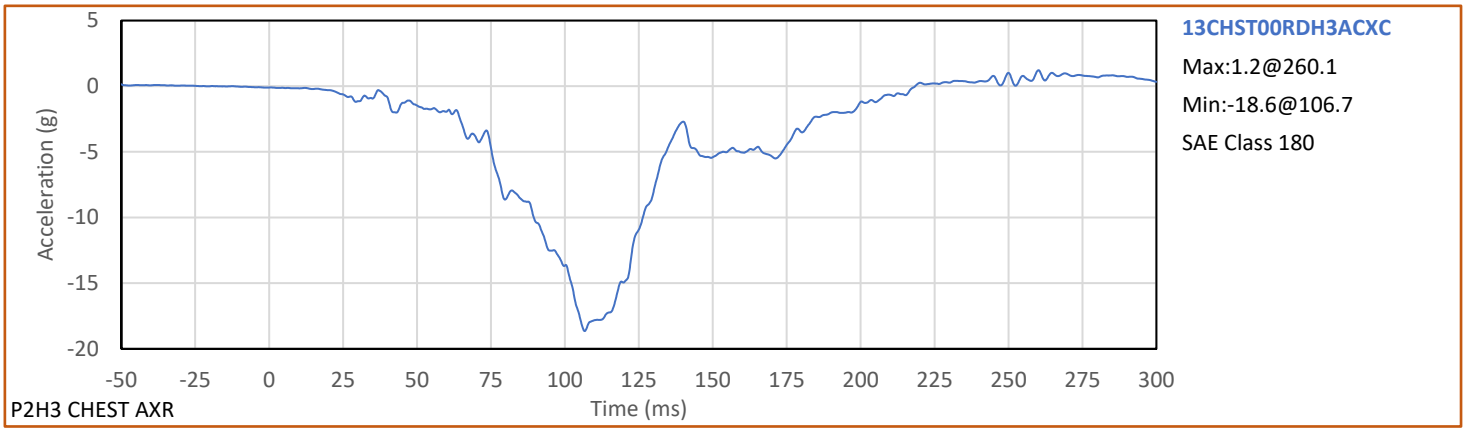

Moment (Nm)
Time (ms)
P2H3 LOWER NECK MY
13NECKLO00H3MOYB
Max:79.8@132.0
Min:-99.2@103.2
SAE Class 600

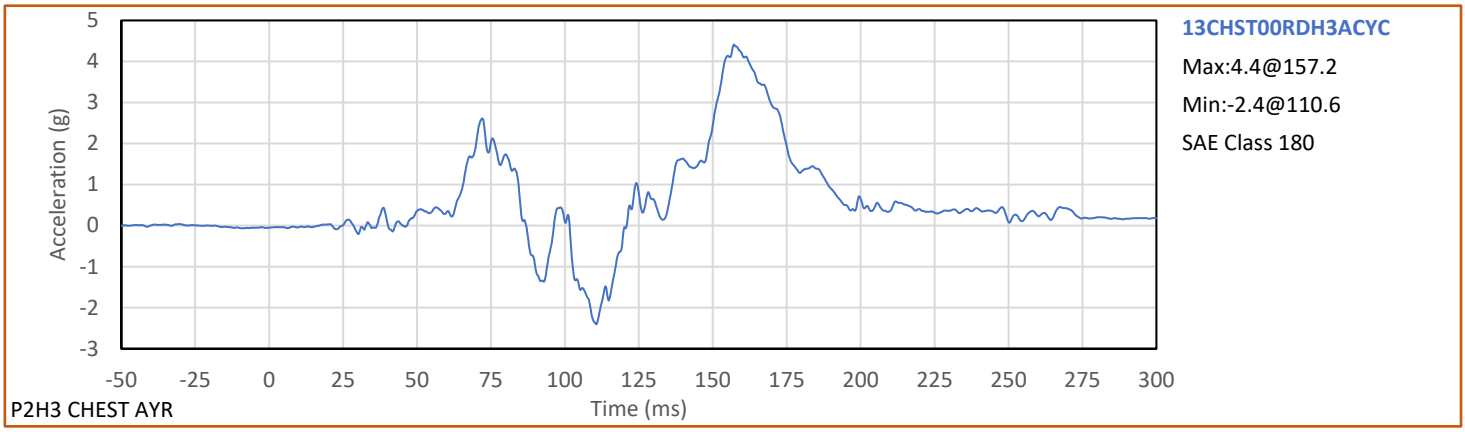

Moment (Nm)
Time (ms)
P2H3 LOWER NECK MZ
13NECKLO00H3MOZB
Max:16.3@260.7
Min:-28.0@184.7
SAE Class 600

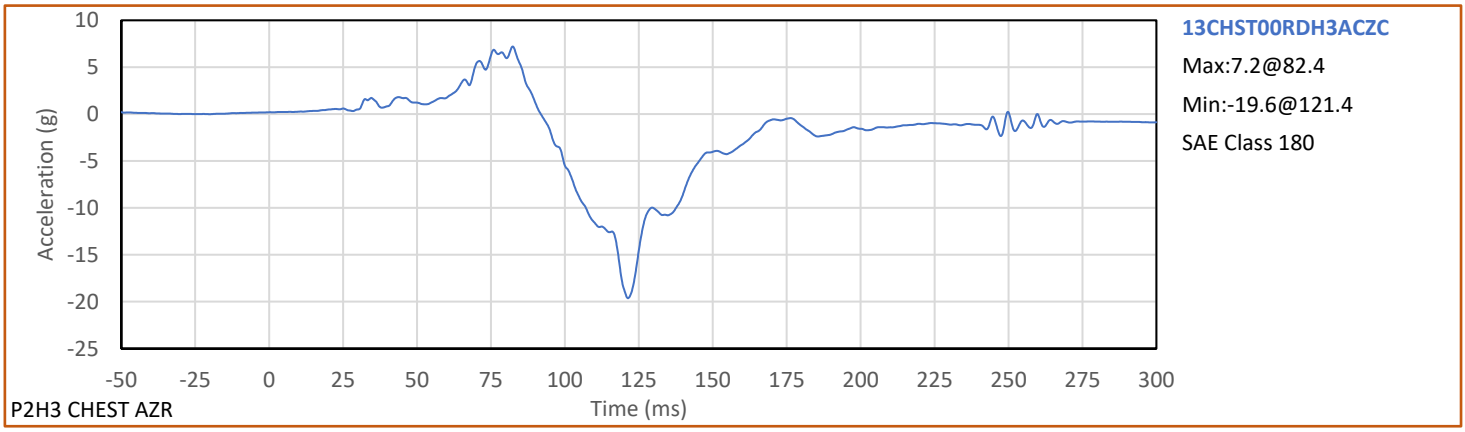

Acceleration (g)
Time (ms)
P2H3 CHEST AX
13CHST0000H3ACXC
Max:0.9@260.2
Min:-19.6@107.0
SAE Class 180

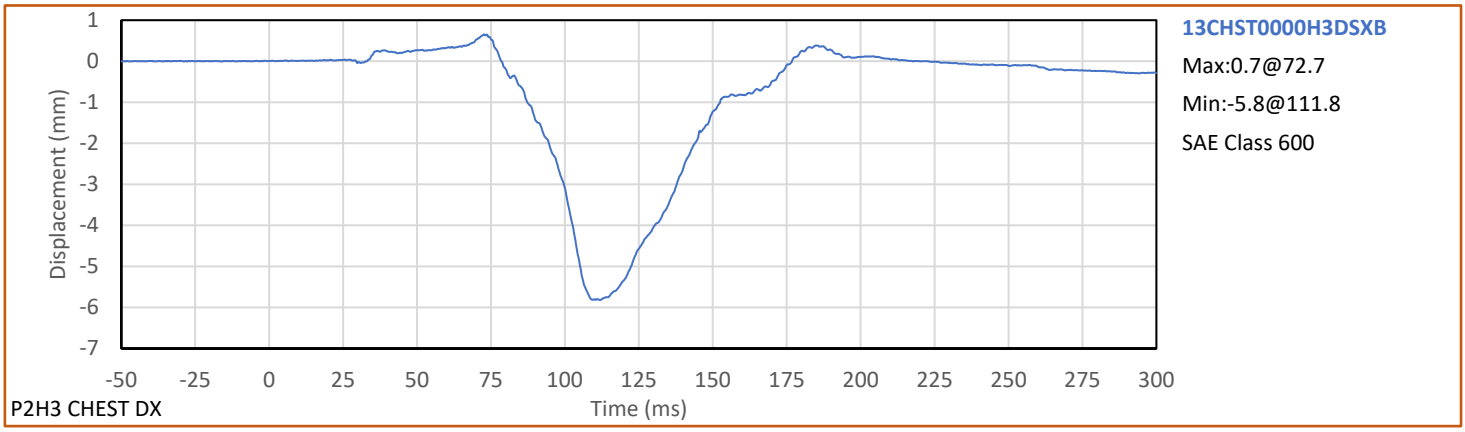

Acceleration (g)
Time (ms)
P2H3 CHEST AY
13CHST0000H3ACYC
Max:4.4@157.1
Min:-2.3@110.1
SAE Class 180

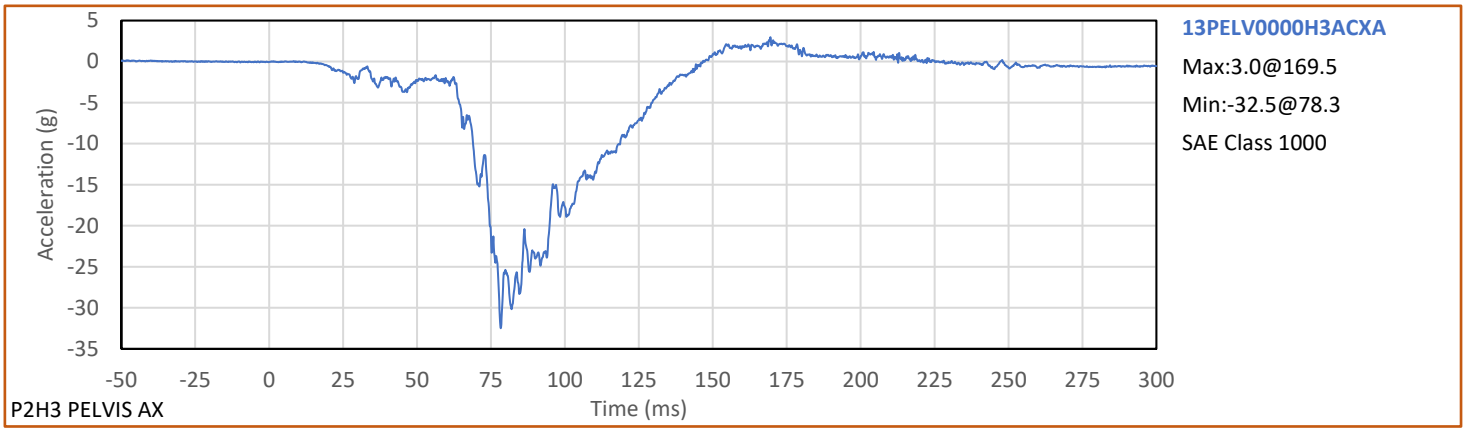

Acceleration (g)
Time (ms)
P2H3 CHEST AZ
13CHST0000H3ACZC
Max:6.9@82.5
Min:-19.5@121.4
SAE Class 180

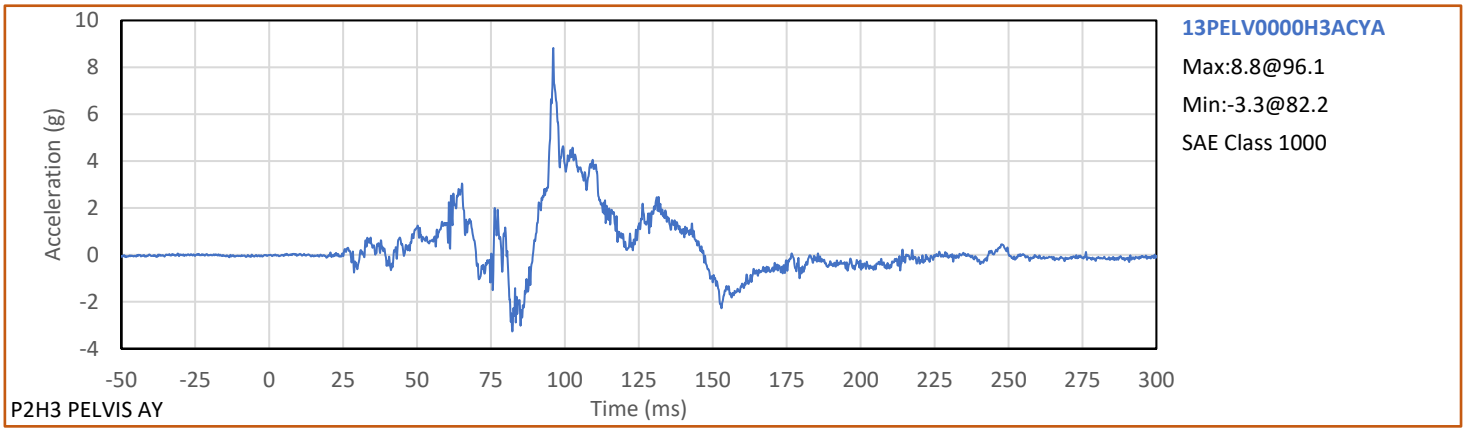

13CHST00RDH3ACXC
Max:1.2@260.1
Min:-18.6@106.7
SAE Class 180
Acceleration (g)
Time (ms)
P2H3 CHEST AXR

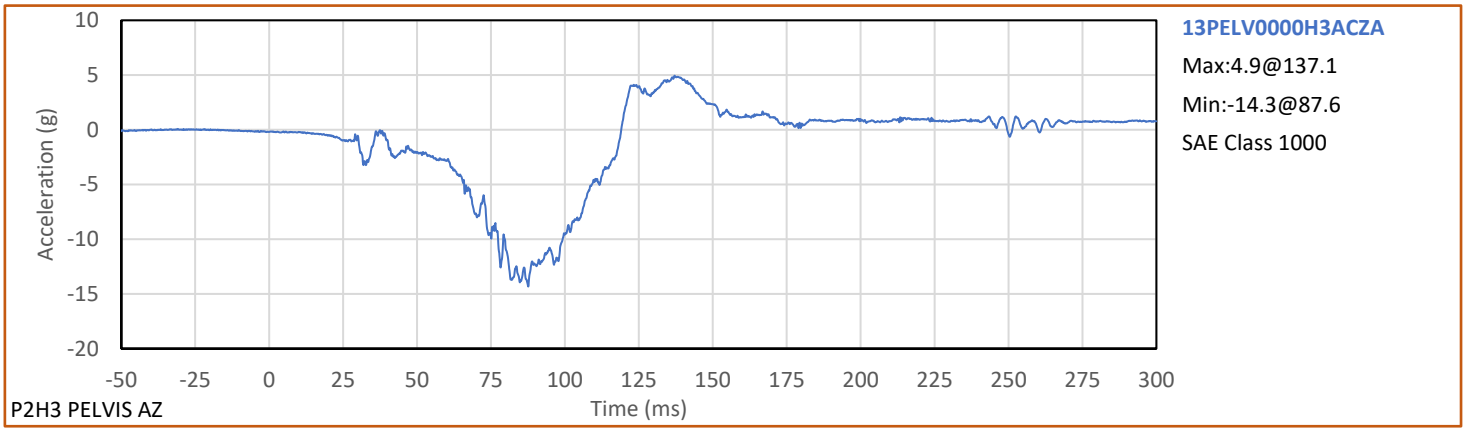

13CHST00RDH3ACYC
Max:4.4@157.2
Min:-2.4@110.6
SAE Class 180
Acceleration (g)
Time (ms)
P2H3 CHEST AYR

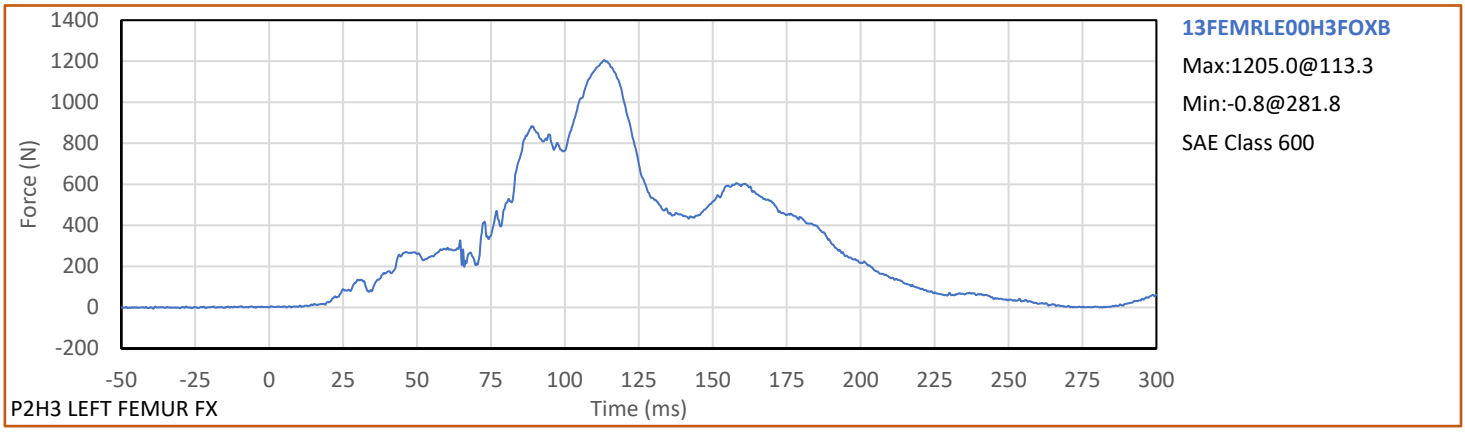

13CHST00RDH3ACZC
Max:7.2@82.4
Min:-19.6@121.4
SAE Class 180
Acceleration (g)
Time (ms)
P2H3 CHEST AZR

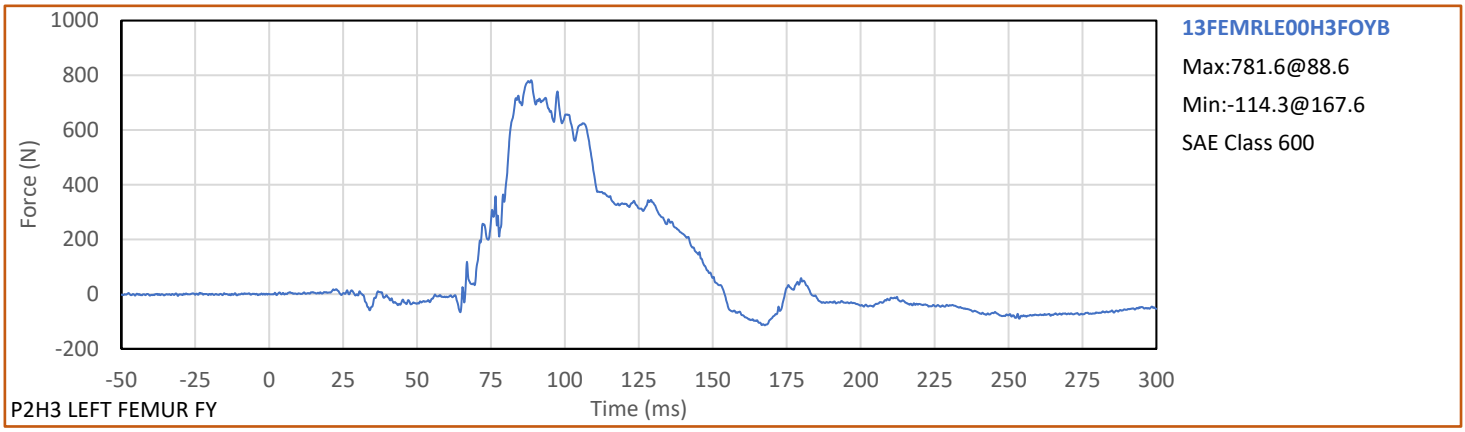

13CHST0000H3DSXB
Max:0.7@72.7
Min:-5.8@111.8
SAE Class 600
Displacement (mm)
Time (ms)
P2H3 CHEST DX

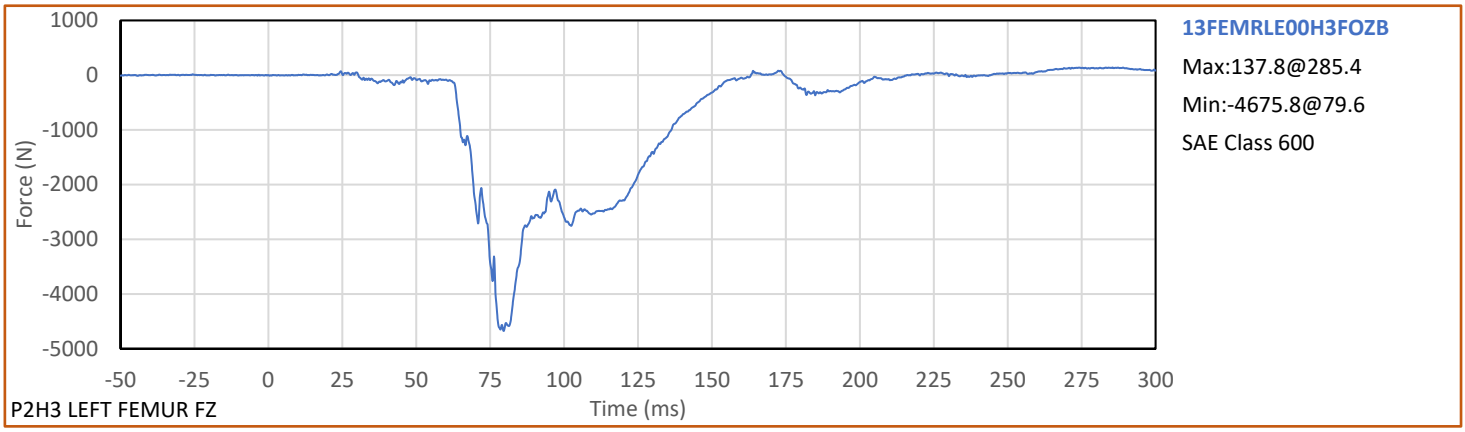

Acceleration (g)
Time (ms)
P2H3 PELVIS AX
13PELV0000H3ACXA
Max:3.0@169.5
Min:-32.5@78.3
SAE Class 1000

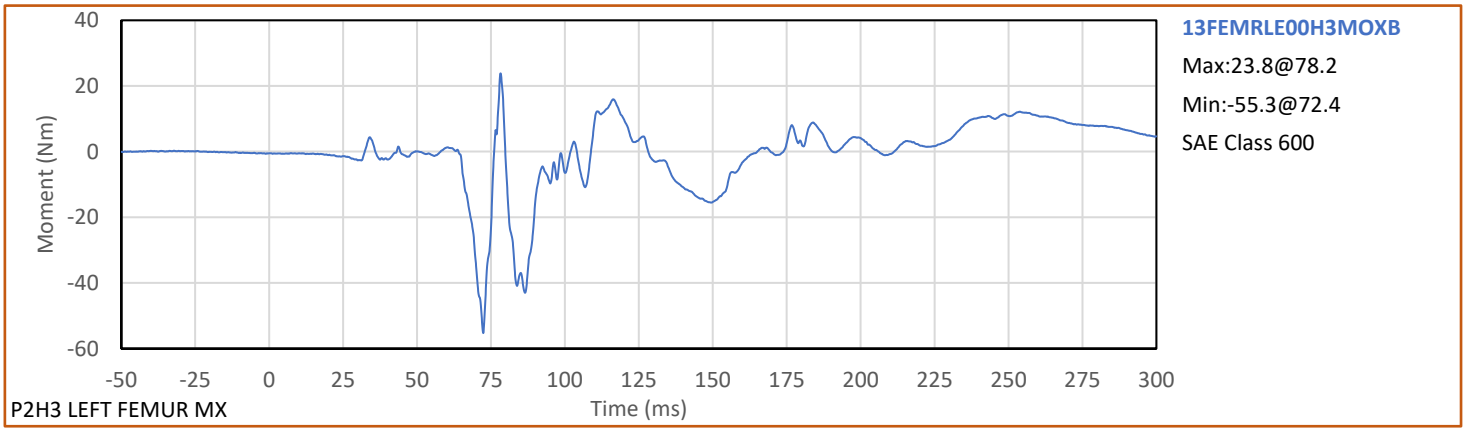

Acceleration (g)
Time (ms)
P2H3 PELVIS AY
13PELV0000H3ACYA
Max:8.8@96.1
Min:-3.3@82.2
SAE Class 1000

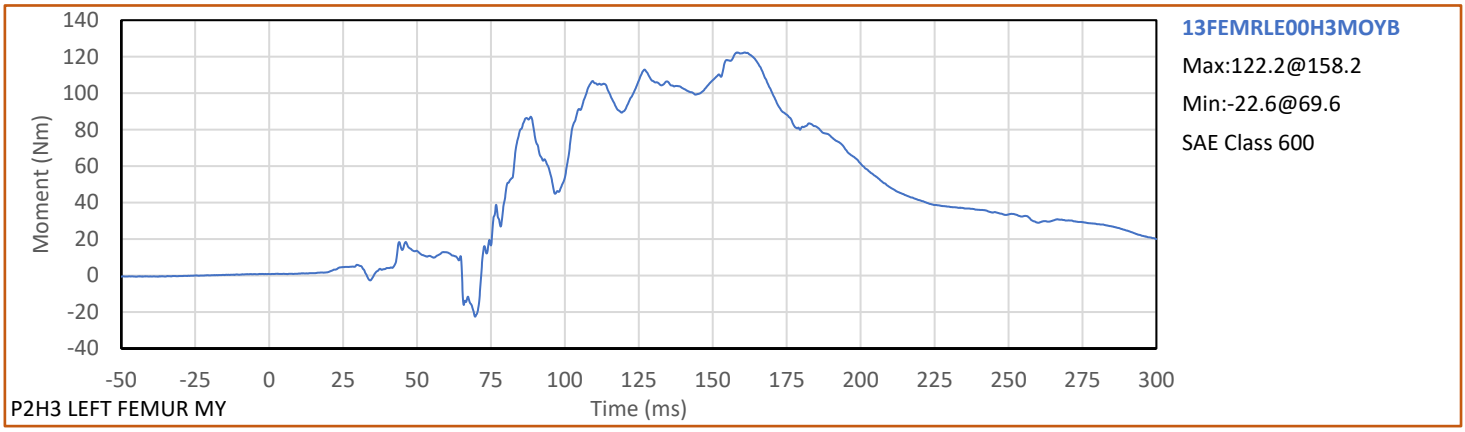

Acceleration (g)
Time (ms)
P2H3 PELVIS AZ
13PELV0000H3ACZA
Max:4.9@137.1
Min:-14.3@87.6
SAE Class 1000

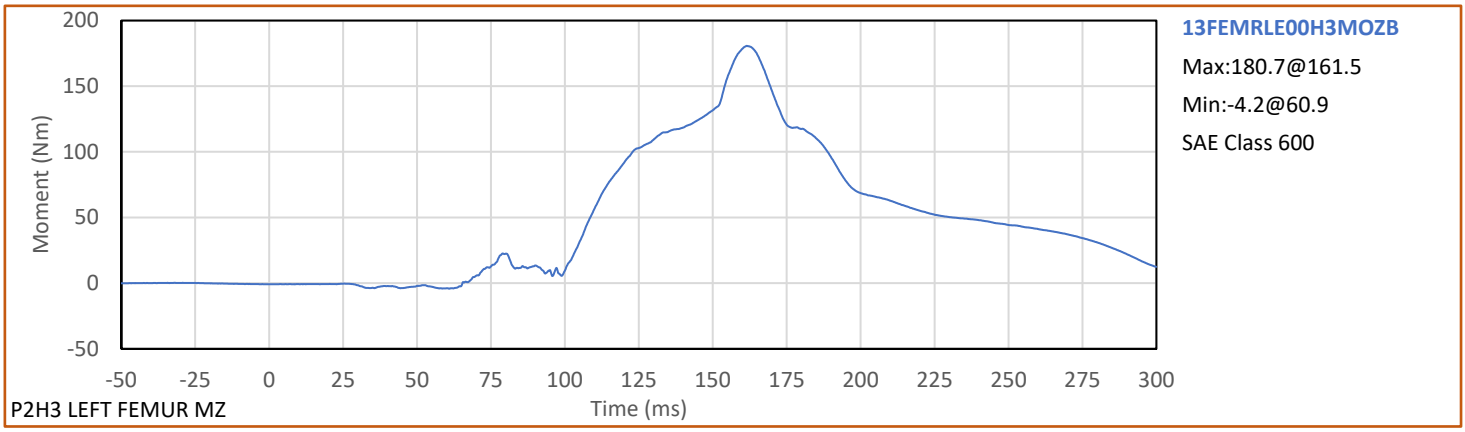

Force (N)
Time (ms)
P2H3 LEFT FEMUR FX
13FEMRLE00H3FOXB
Max:1205.0@113.3
Min:-0.8@281.8
SAE Class 600

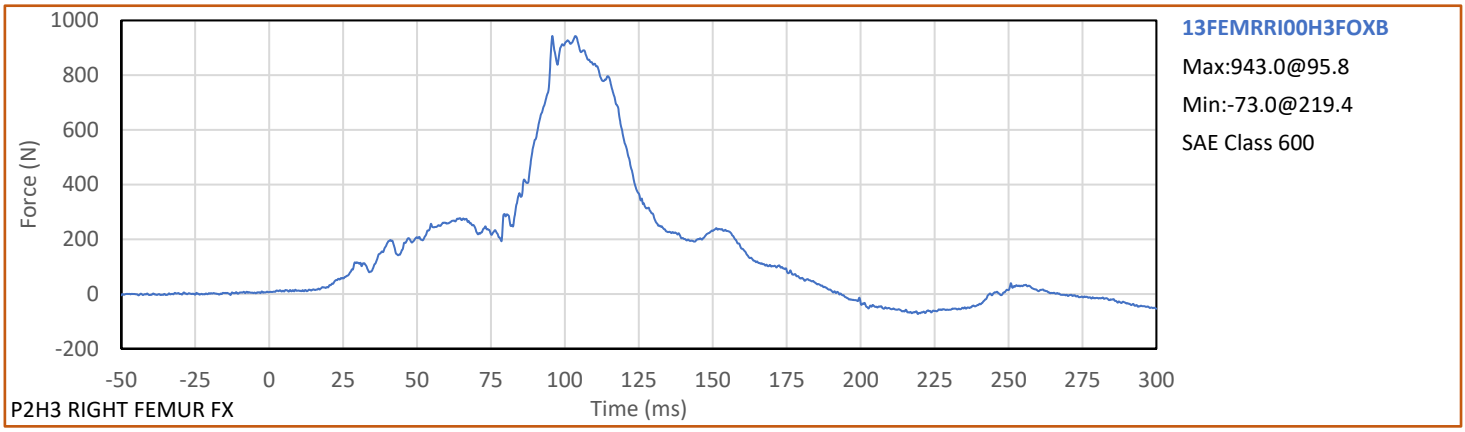

Force (N)
Time (ms)
P2H3 LEFT FEMUR FY
13FEMRLE00H3FOYB
Max:781.6@88.6
Min:-114.3@167.6
SAE Class 600

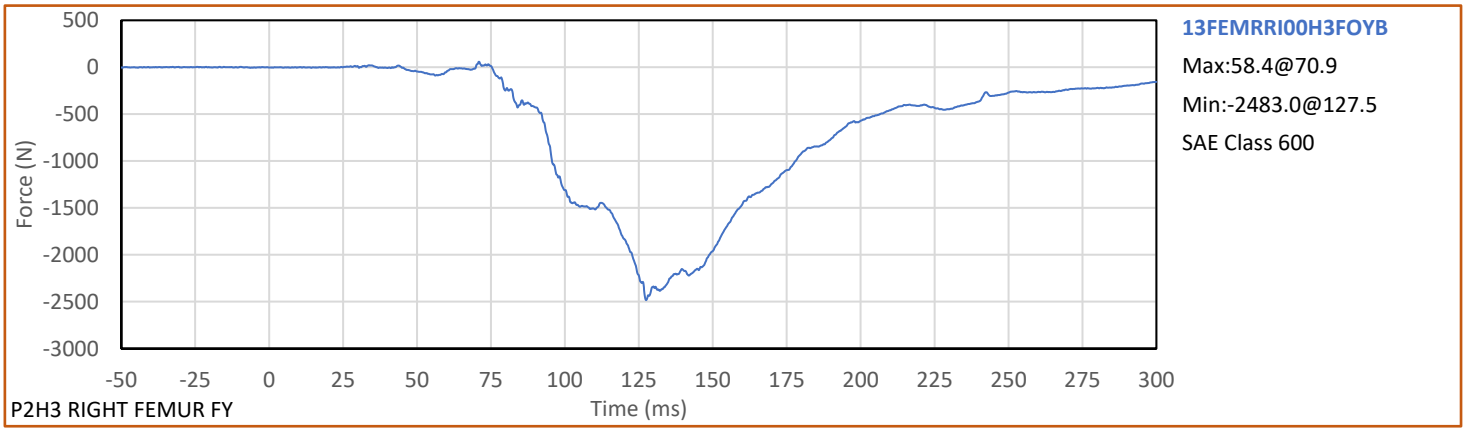

Force (N)
Time (ms)
P2H3 LEFT FEMUR FZ
13FEMRLE00H3FOZB
Max:137.8@285.4
Min:-4675.8@79.6
SAE Class 600

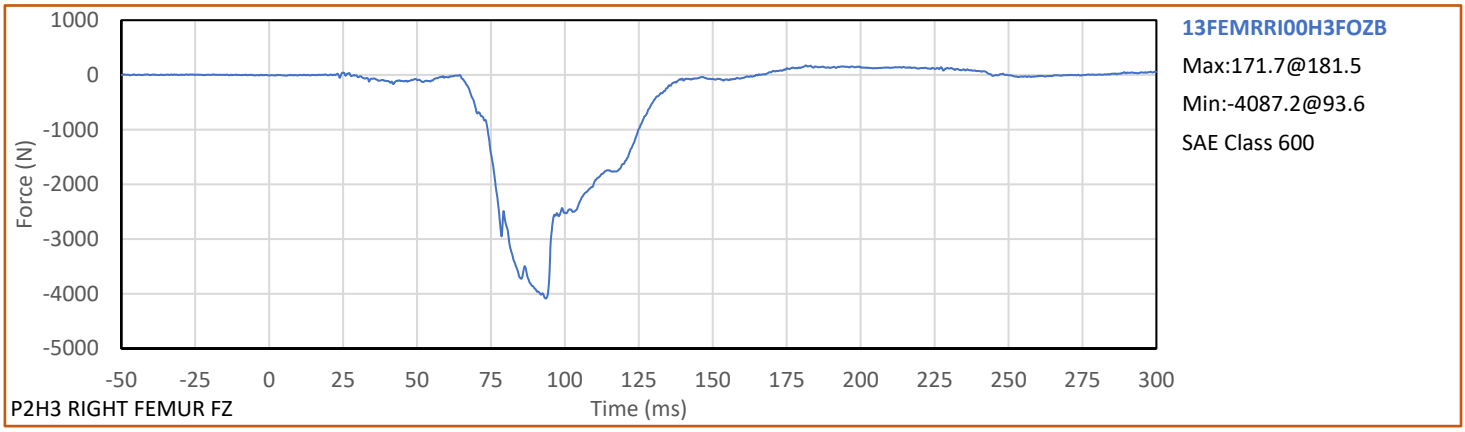

Moment (Nm)
Time (ms)
P2H3 LEFT FEMUR MX
13FEMRLE00H3MOXB
Max:23.8@78.2
Min:-55.3@72.4
SAE Class 600

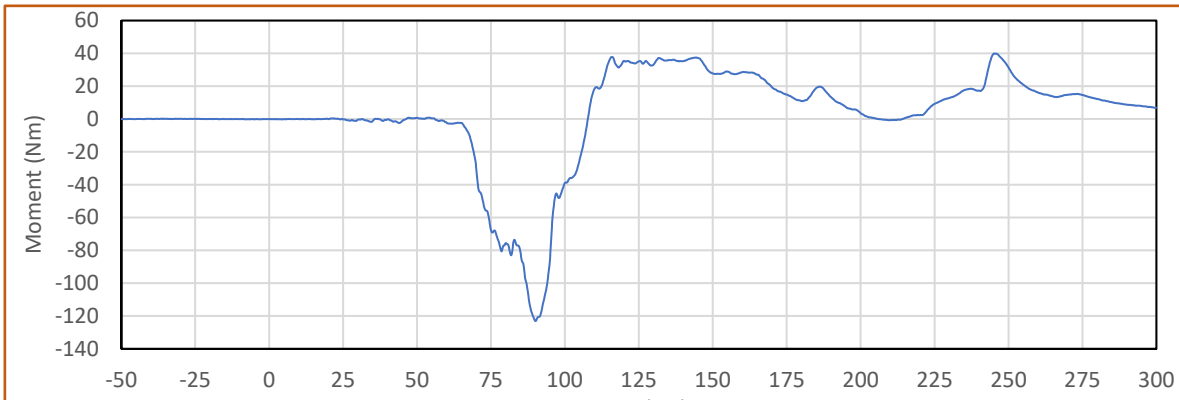

Moment (Nm)
Time (ms)
P2H3 LEFT FEMUR MY
13FEMRLE00H3MOYB
Max:122.2@158.2
Min:-22.6@69.6
SAE Class 600


Moment (Nm)
Time (ms)
P2H3 LEFT FEMUR MZ
13FEMRLE00H3MOZB
Max:180.7@161.5
Min:-4.2@60.9
SAE Class 600

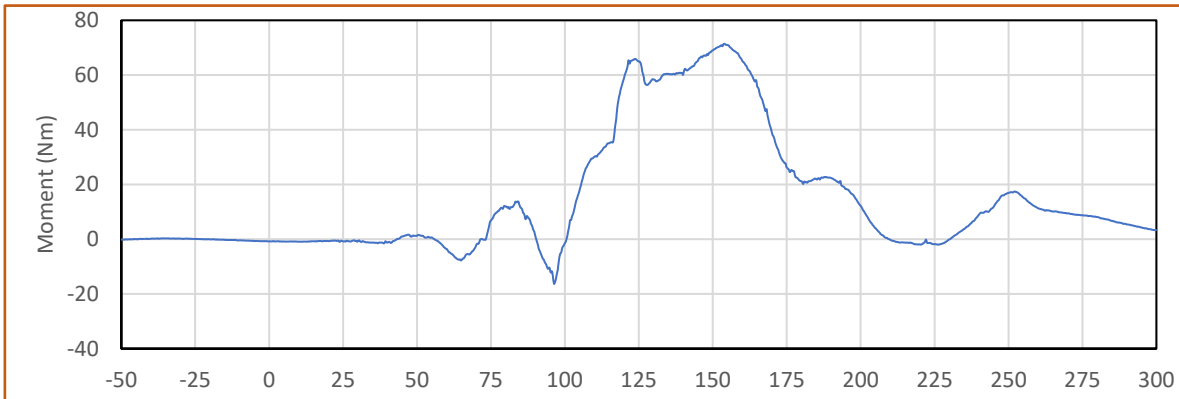

Force (N)
Time (ms)
P2H3 RIGHT FEMUR FX
13FEMRRI00H3FOXB
Max:943.0@95.8
Min:-73.0@219.4
SAE Class 600

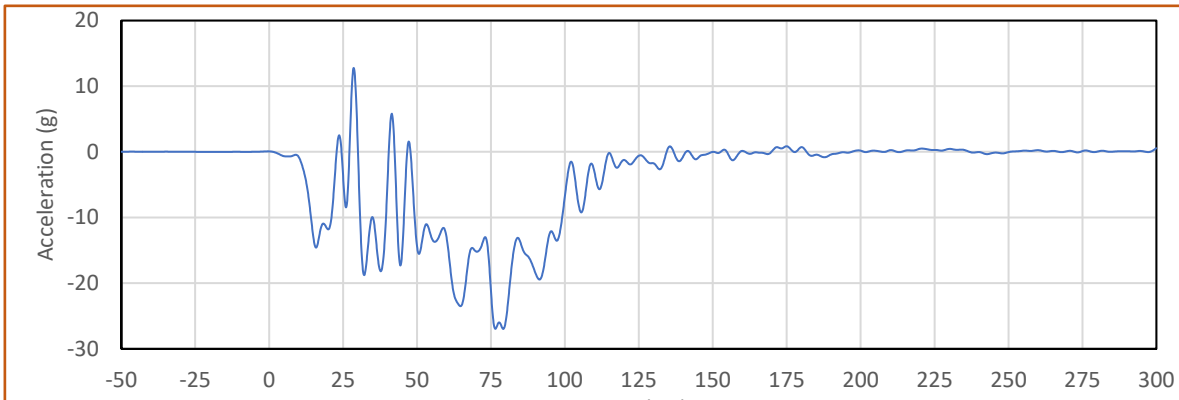

Force (N)
Time (ms)
P2H3 RIGHT FEMUR FY
13FEMRRI00H3FOYB
Max:58.4@70.9
Min:-2483.0@127.5
SAE Class 600


Force (N)
Time (ms)
P2H3 RIGHT FEMUR FZ
13FEMRRI00H3FOZB
Max:171.7@181.5
Min:-4087.2@93.6
SAE Class 600

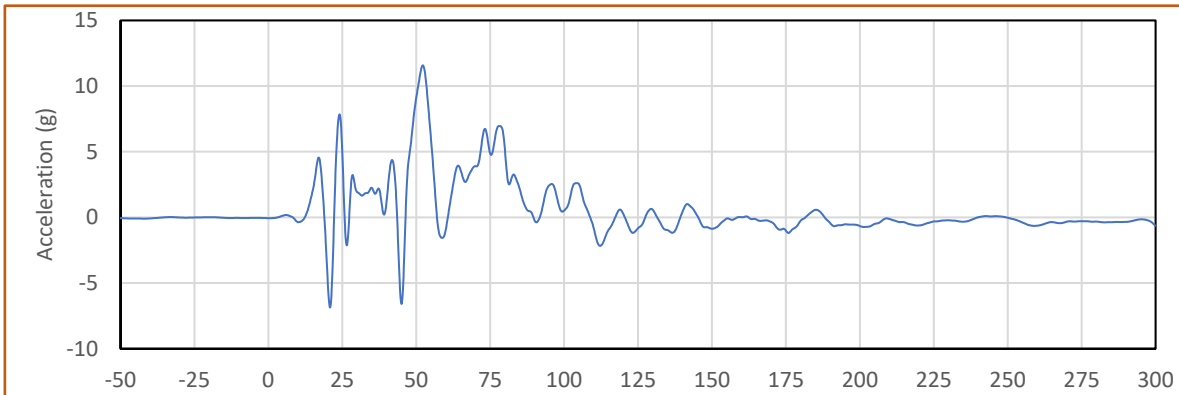

Moment (Nm)
Time (ms)
P2H3 RIGHT FEMUR MX
13FEMRRI00H3MOXB
Max:39.9@245.2
Min:-123.1@90.1
SAE Class 600


Moment (Nm)
Time (ms)
P2H3 RIGHT FEMUR MY
13FEMRRI00H3MOYB
Max:150.3@114.2
Min:-22.5@275.3
SAE Class 600

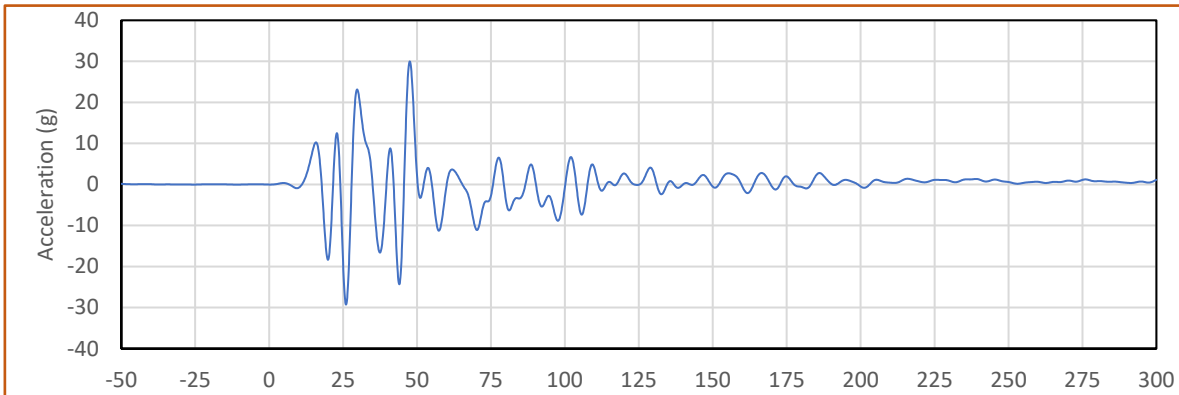

Moment (Nm)
Time (ms)
P2H3 RIGHT FEMUR MZ
13FEMRRI00H3MOZB
Max:71.4@153.9
Min:-16.4@96.4
SAE Class 600



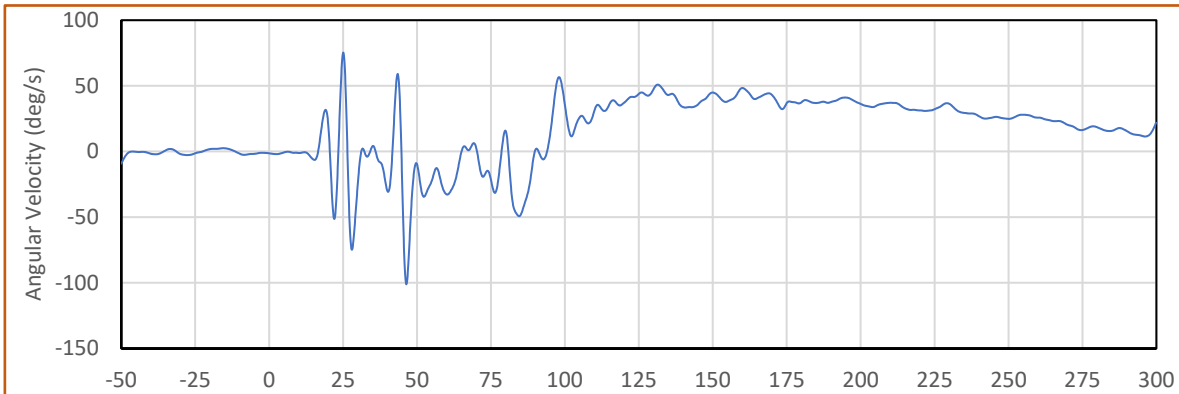
15TUNNCGLO00ACXD
Max:12.8@28.6
Min:-27.0@79.2
SAE Class 60



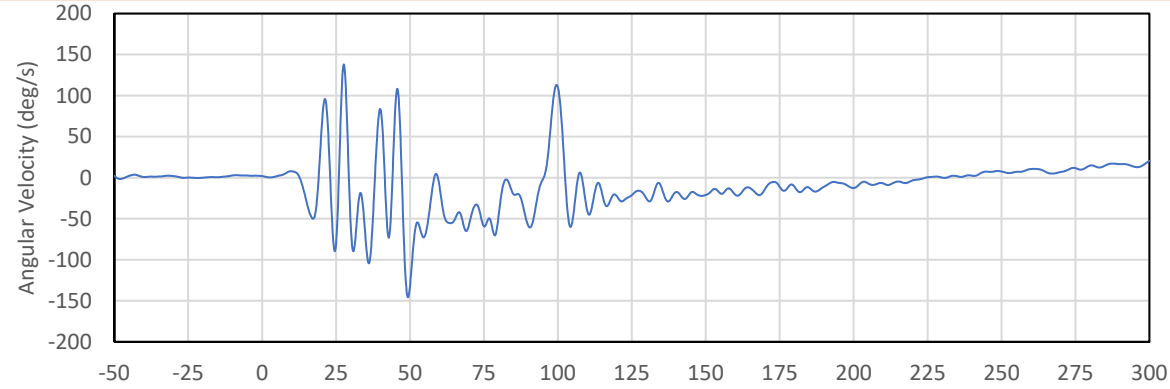
15TUNNCGLO00ACYD
Max:11.6@52.2
Min:-6.9@20.8
SAE Class 60



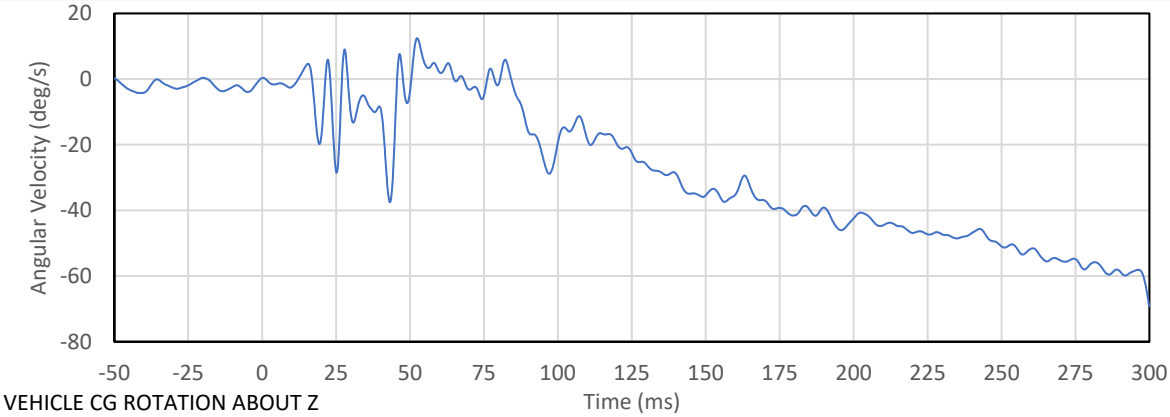
15TUNNCGLO00ACZD
Max:30.0@47.6
Min:-29.3@26.0
SAE Class 60



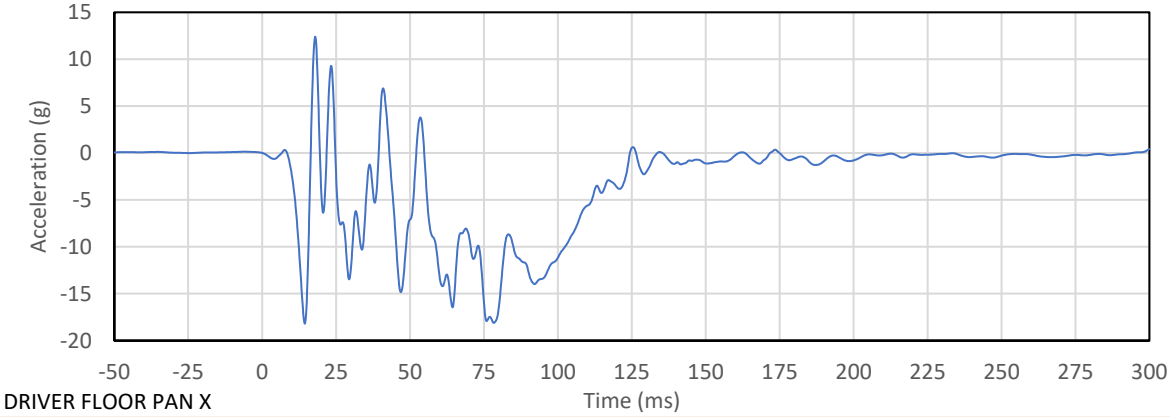
15TUNNCGLO00AVXD
Max:75.4@25.1
Min:-101.1@46.4
SAE Class 60



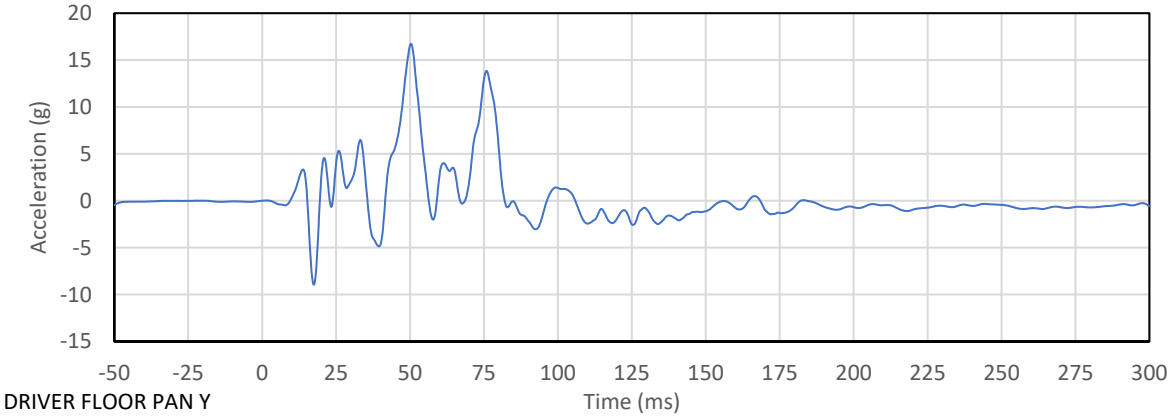
15TUNNCGLO00AVYD
Max:138.0@27.6
Min:-145.7@49.3
SAE Class 60



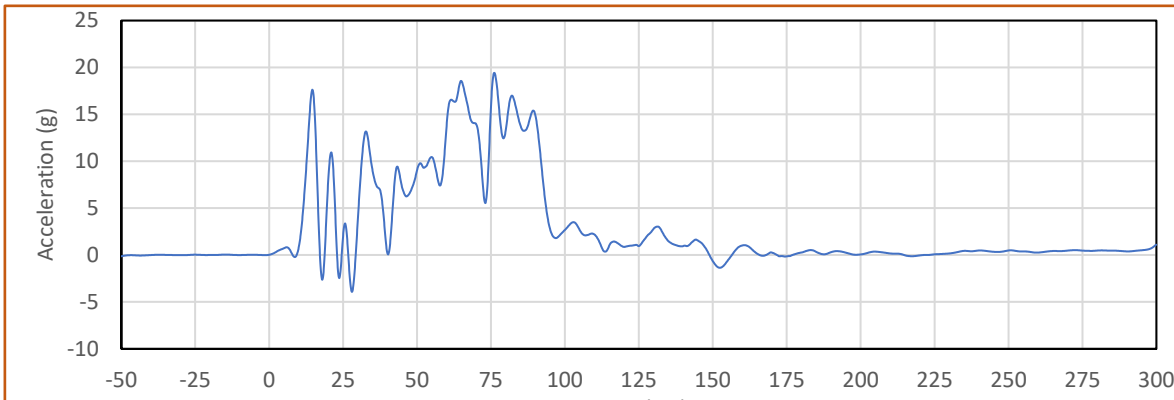
15TUNNCGLO00AVZD
Max:12.4@52.4
Min:-68.6@299.8
SAE Class 60



11FOWE000000ACXD
Max:12.4@17.9
Min:-18.2@14.4
SAE Class 60

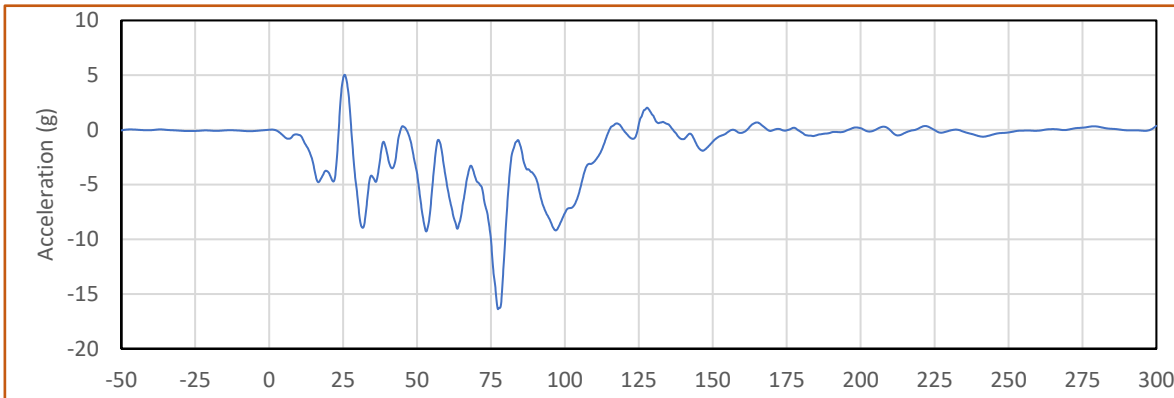


11FOWE000000ACYD
Max:16.7@50.3
Min:-8.9@17.5
SAE Class 60



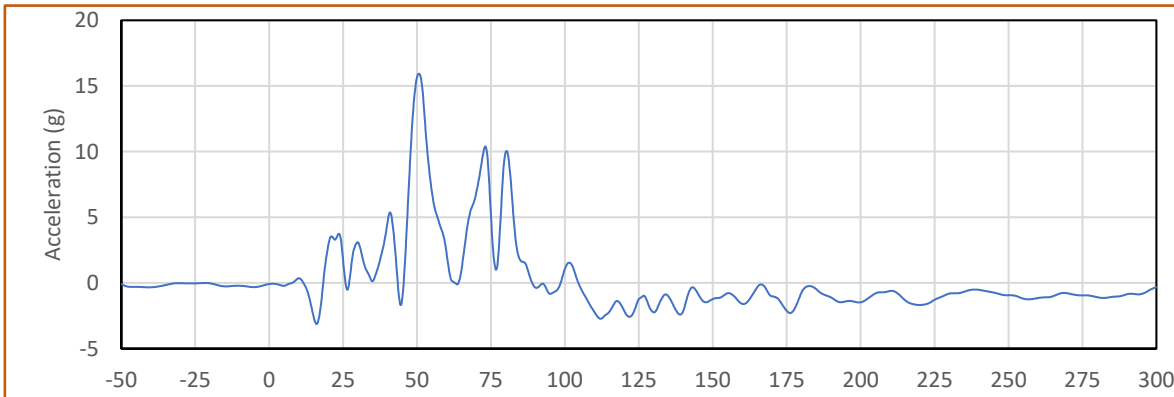
DRIVER FLOOR PAN Z

11FOWE000000ACZD
Max:19.4@76.1
Min:-3.9@28.0
SAE Class 60



PASSENGER FLOOR PAN X

13FOWE000000ACXD
Max:5.0@25.5
Min:-16.4@77.4
SAE Class 60

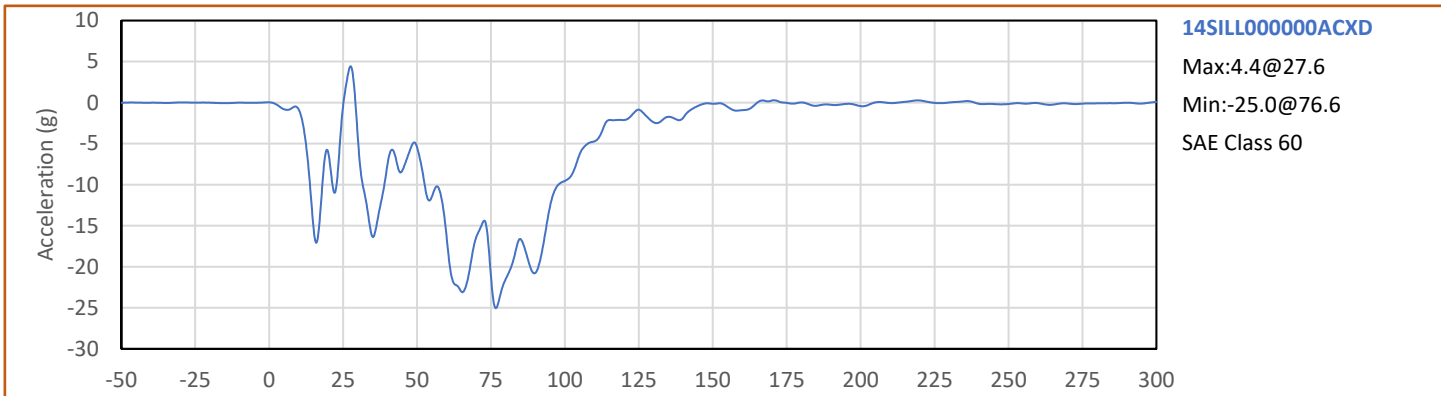


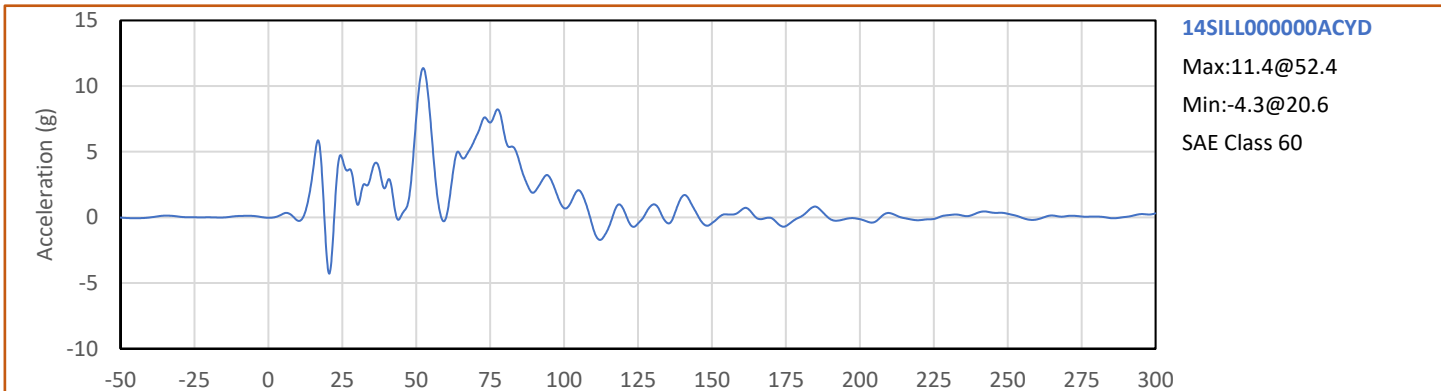
PASSENGER FLOOR PAN Y

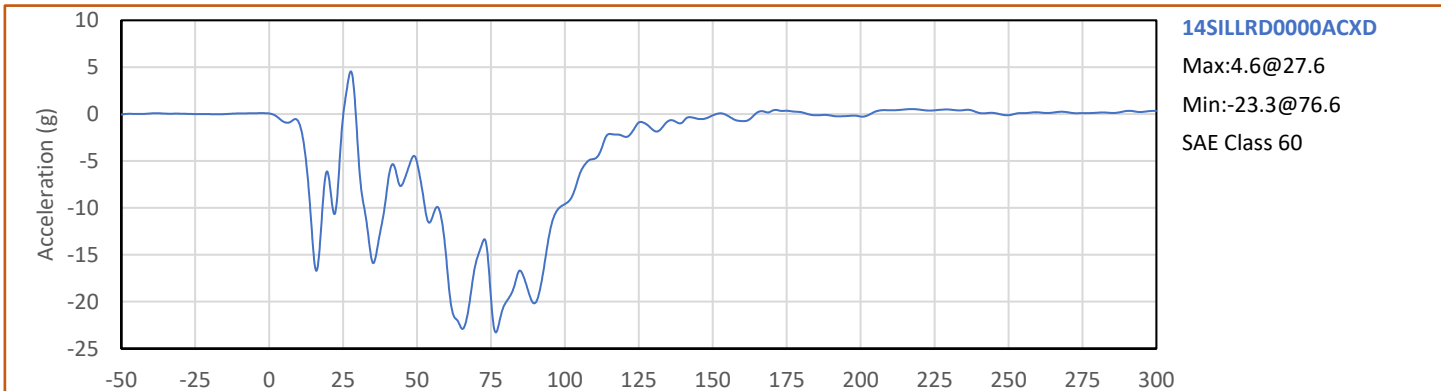
13FOWE000000ACYD
Max:15.9@50.6
Min:-3.1@16.1
SAE Class 60

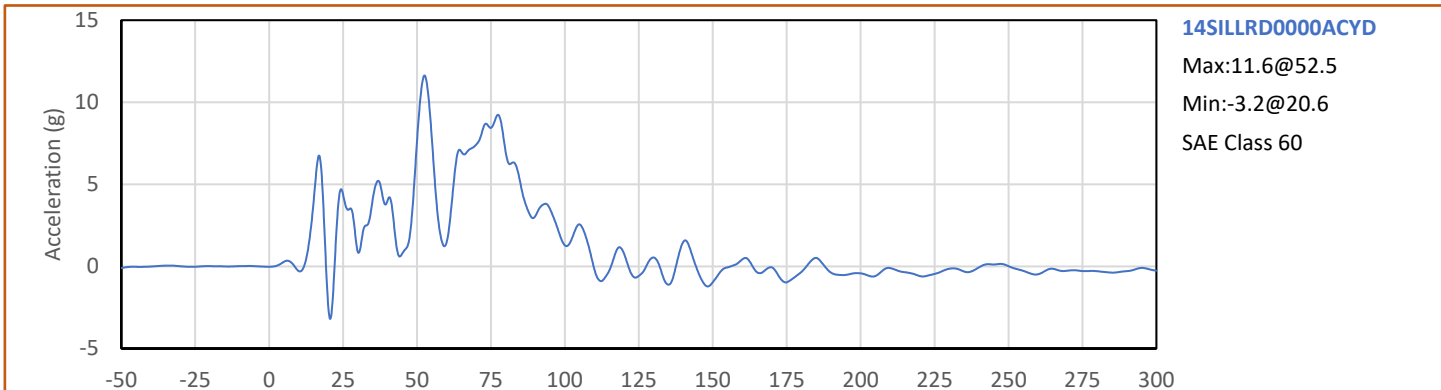
PASSENGER FLOOR PAN Z

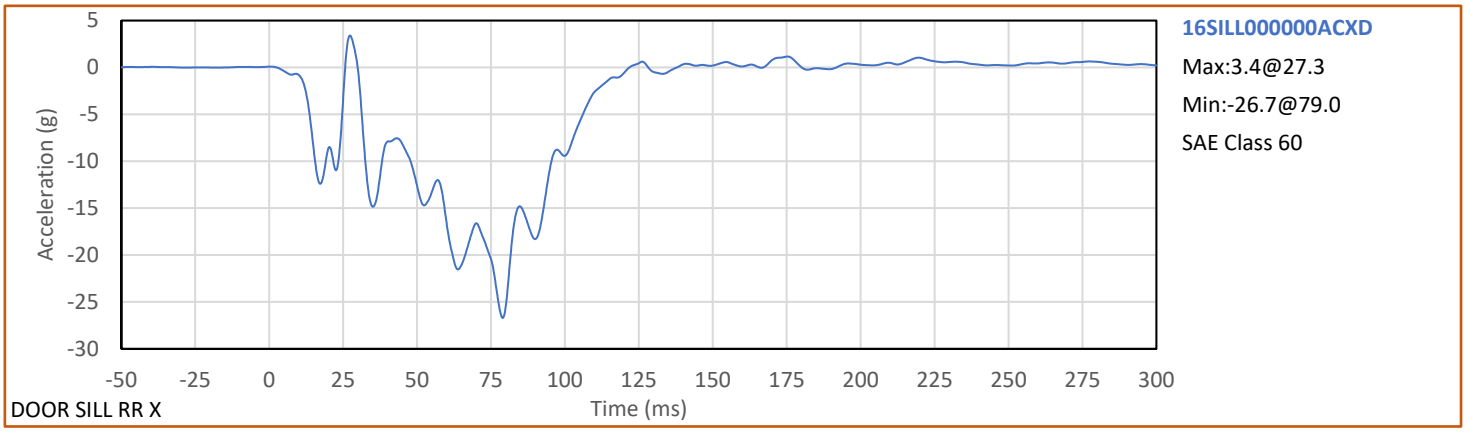
13FOWE000000ACZD
Max:22.2@78.5
Min:-5.6@28.6
SAE Class 60

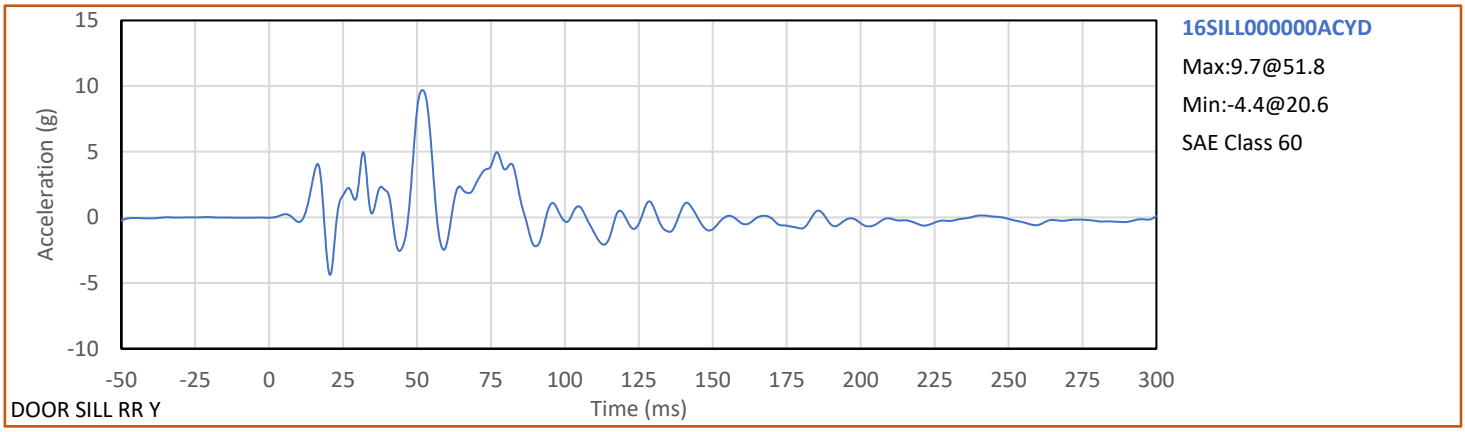

14SILL000000ACXD
Max:4.4@27.6
Min:-25.0@76.6
SAE Class 60
Acceleration (g)
Time (ms)
DOOR SILL LR X

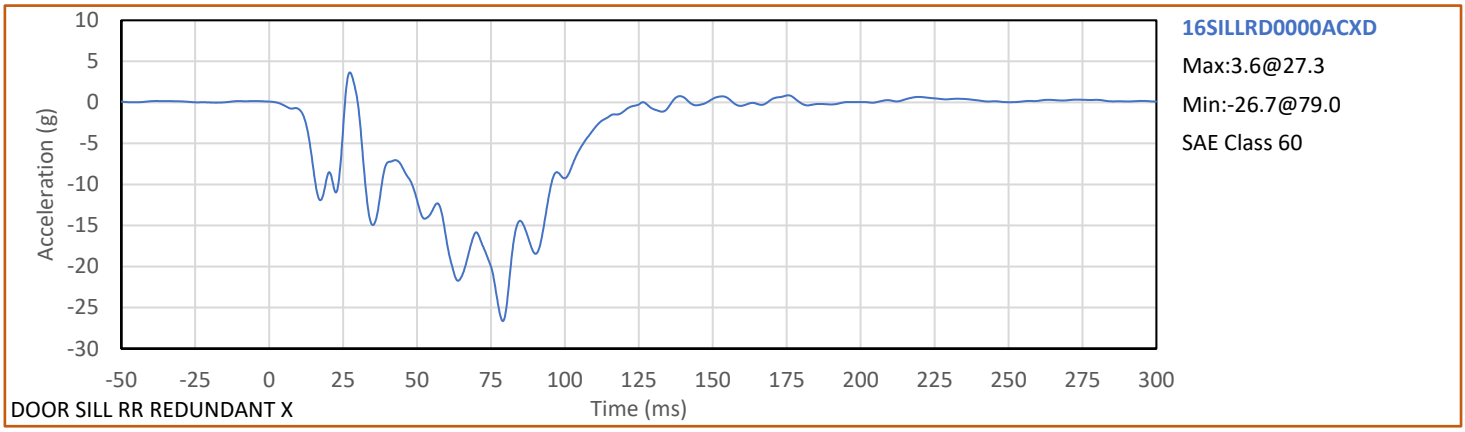

14SILL000000ACYD
Max:11.4@52.4
Min:-4.3@20.6
SAE Class 60
Acceleration (g)
Time (ms)
DOOR SILL LR Y

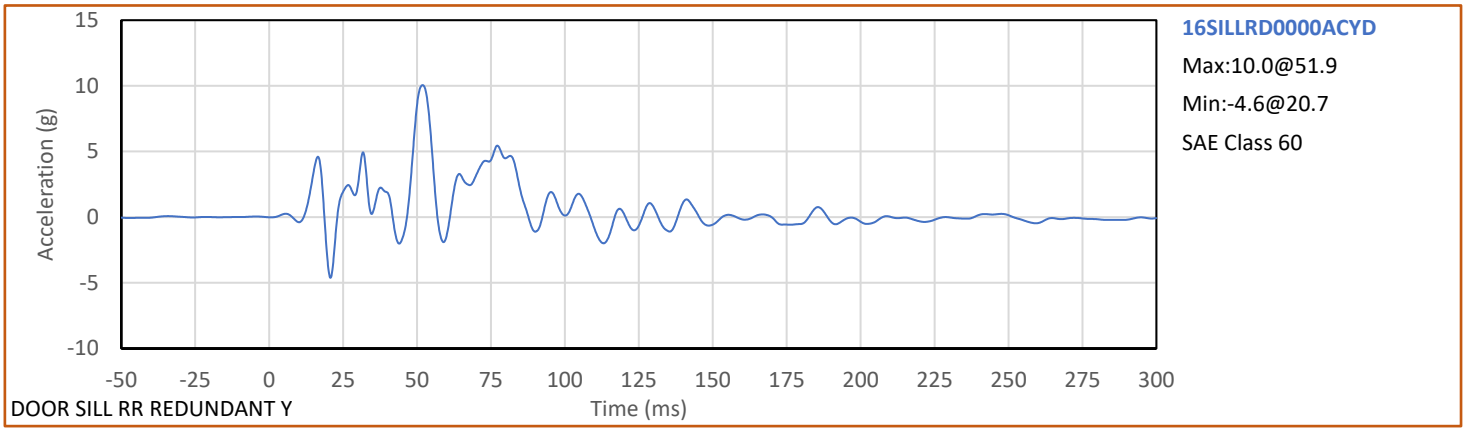

14SILLRD0000ACXD
Max:4.6@27.6
Min:-23.3@76.6
SAE Class 60
Acceleration (g)
Time (ms)
DOOR SILL LR REDUNDANT X

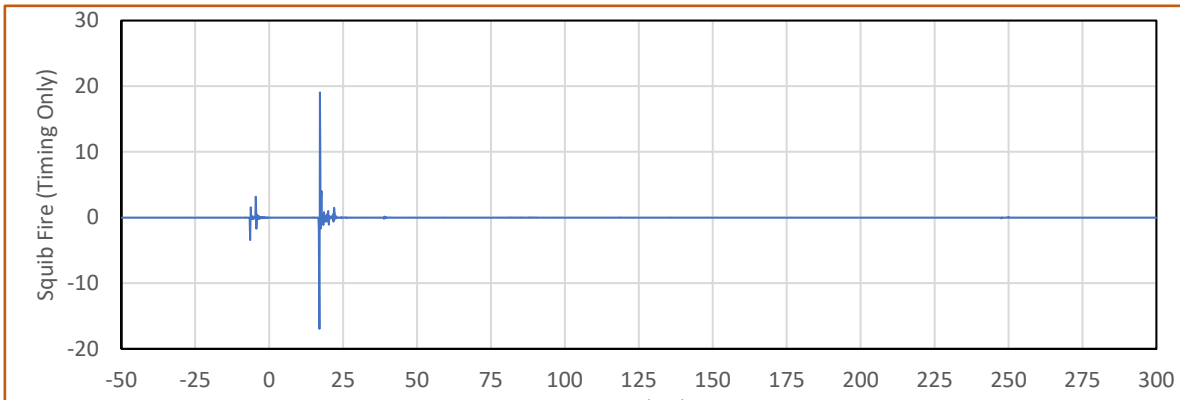

14SILLRD0000ACYD
Max:11.6@52.5
Min:-3.2@20.6
SAE Class 60
Acceleration (g)
Time (ms)
DOOR SILL LR REDUNDANT Y


Acceleration (g)
Time (ms)
DOOR SILL RR X
16SILL000000ACXD
Max:3.4@27.3
Min:-26.7@79.0
SAE Class 60


Acceleration (g)
Time (ms)
DOOR SILL RR Y
16SILL000000ACYD
Max:9.7@51.8
Min:-4.4@20.6
SAE Class 60

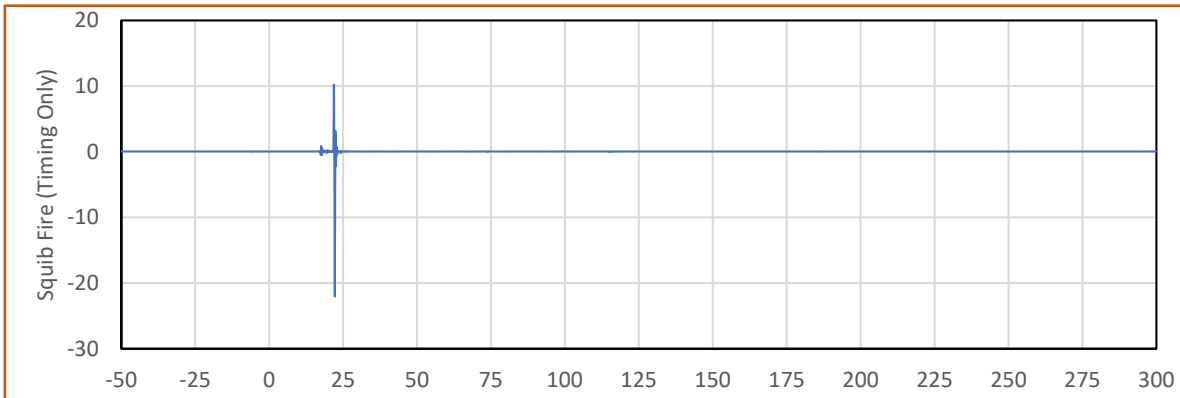

Acceleration (g)
Time (ms)
DOOR SILL RR REDUNDANT X
16SILLRD0000ACXD
Max:3.6@27.3
Min:-26.7@79.0
SAE Class 60


Acceleration (g)
Time (ms)
DOOR SILL RR REDUNDANT Y
16SILLRD0000ACYD
Max:10.0@51.9
Min:-4.6@20.7
SAE Class 60



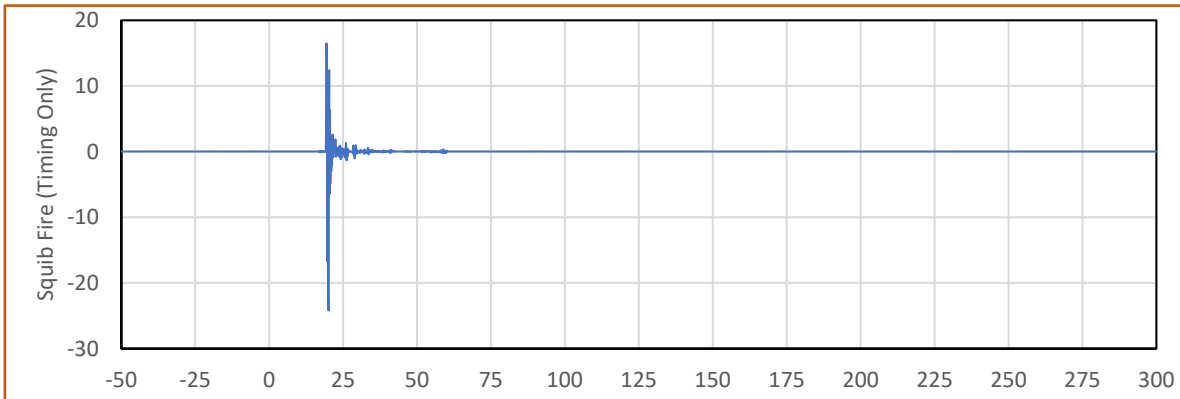
11STWL0100AFCU0P
Max:19.1@17.2
Min:-16.9@17.0
No Filter Applied

DRIVER SW AIRBAG STAGE , - TIME TO FIRE - 16.8 MS.



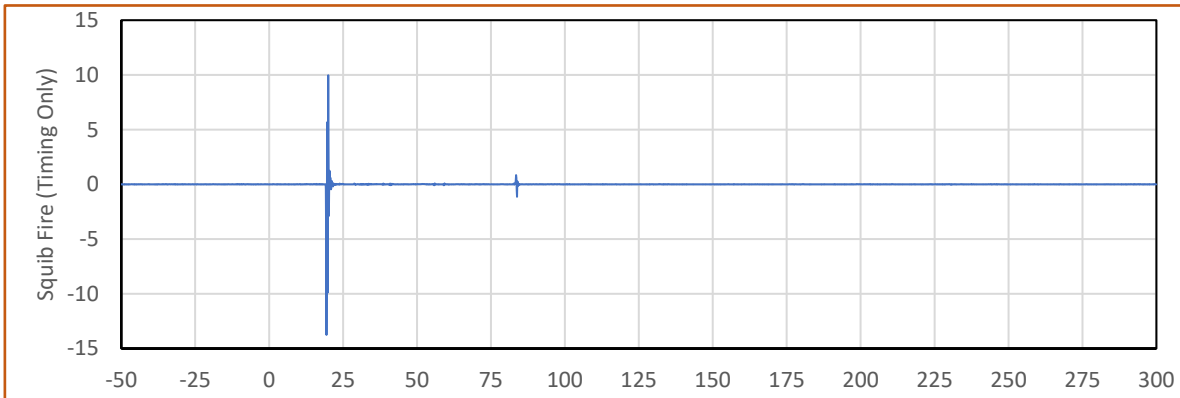
11STWL0200AFCU0P
Max:10.2@21.9
Min:-22.1@22.2
No Filter Applied

DRIVER SW AIRBAG STAGE 2, - TIME TO FIRE - 21.8 MS.



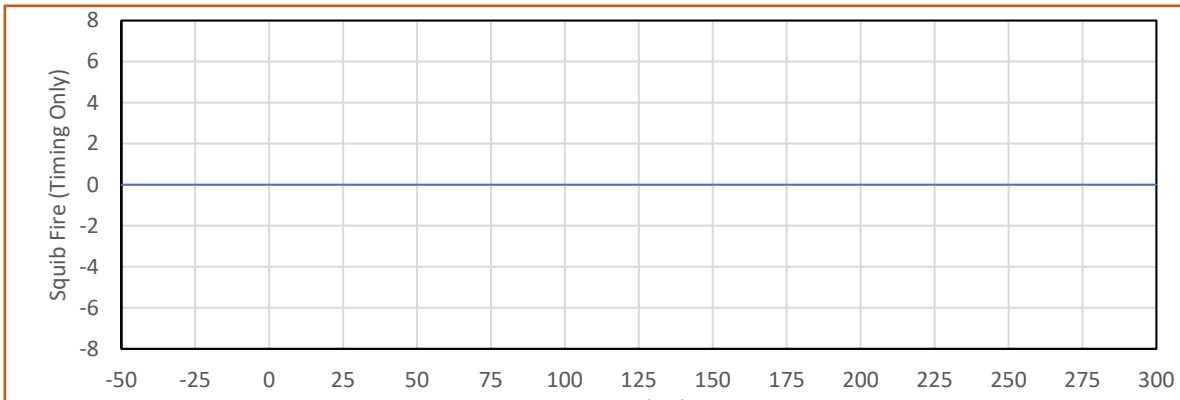
11ROFR0000AHCU0P
Max:16.5@19.4
Min:-24.2@20.1
No Filter Applied

DRIVER CURTAIN AIRBAG, - TIME TO FIRE - 19.3 MS.



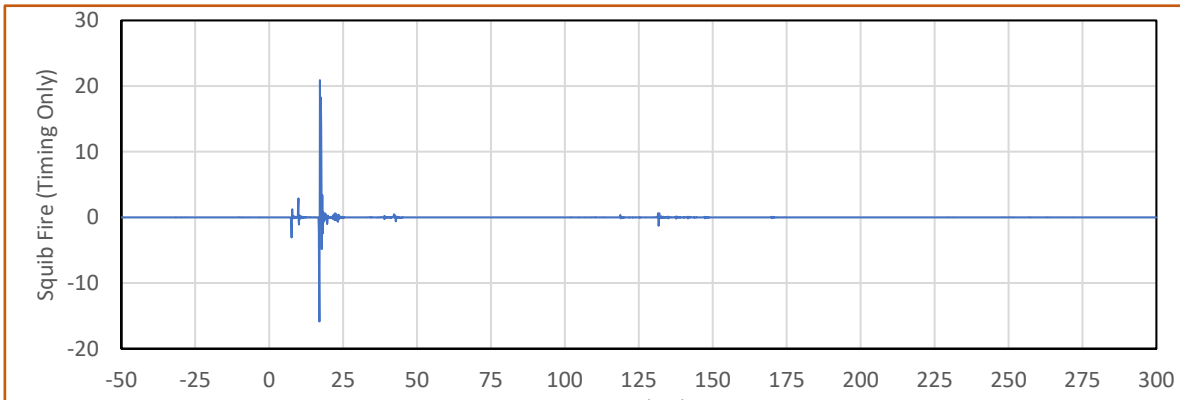
11SEBA0000ASCU0P
Max:10.0@20.0
Min:-13.8@19.4
No Filter Applied

DRIVER SEAT AIRBAG, - TIME TO FIRE - 19.3 MS.



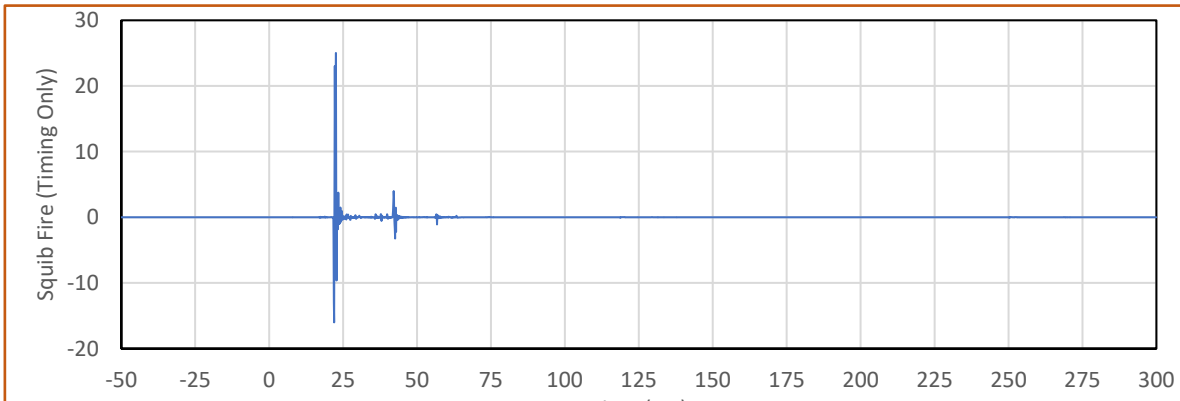
11AIRB0100ASCU0P
Max:0.00@0.1
Min:0.00@0.1
No Filter Applied

DRIVER KNEE AIRBAG, - NOT INSTALLED



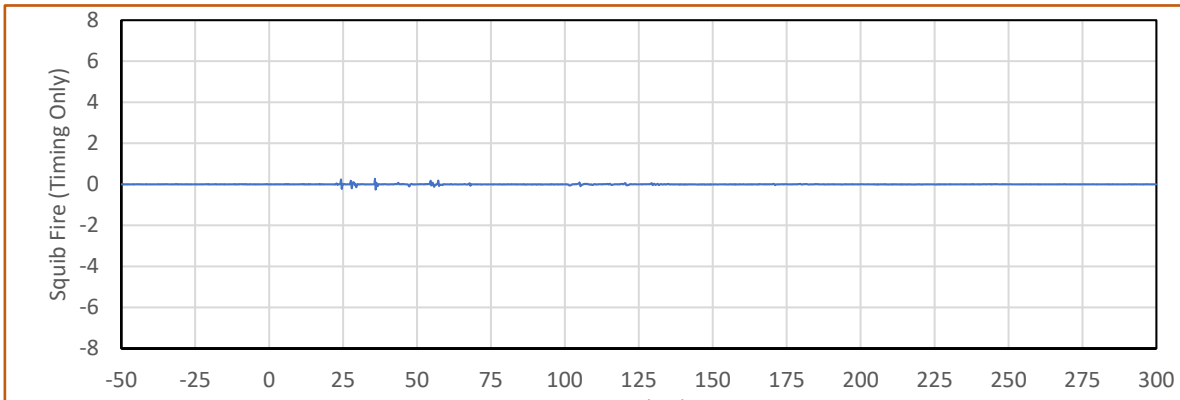
13DASH0100AFCU0P
Max:20.9@17.2
Min:-15.8@17.0
No Filter Applied

PASSENGER AIRBAG STAGE 1, - TIME TO FIRE - 16.8 MS.



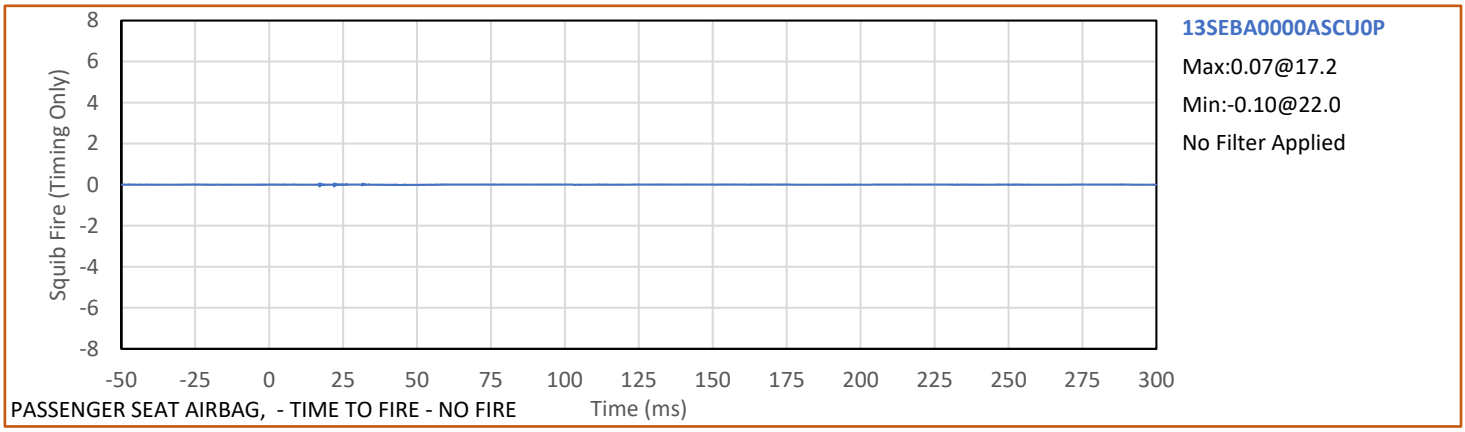
13DASH0200AFCU0P
Max:25.0@22.6
Min:-16.0@22.0
No Filter Applied

PASSENGER AIRBAG STAGE 2, - TIME TO FIRE - 21.8 MS.

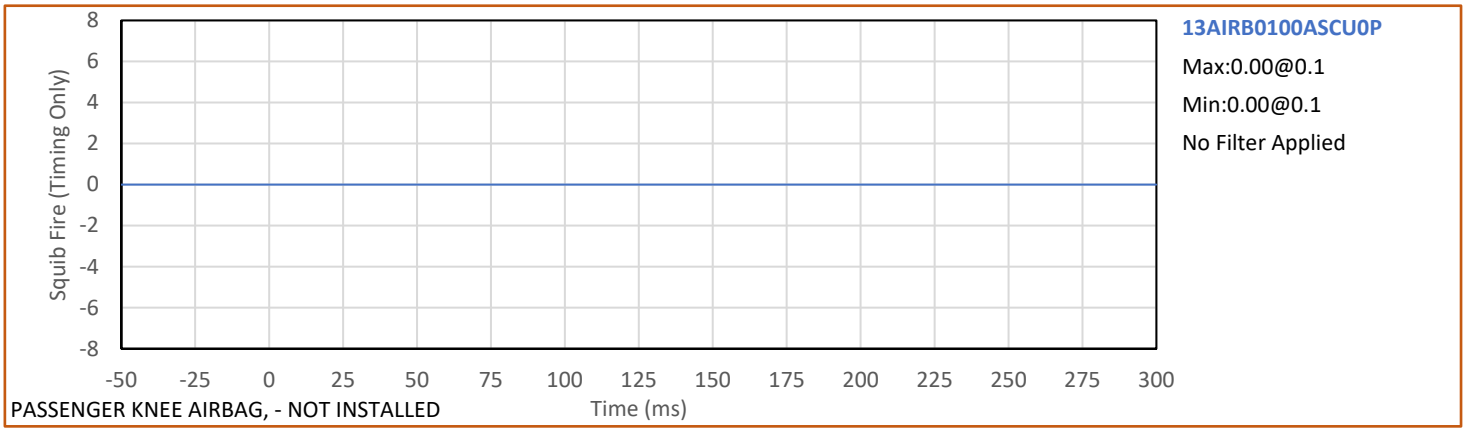


13ROFR0000AHCU0P
Max:0.27@35.8
Min:-0.26@36.0
No Filter Applied

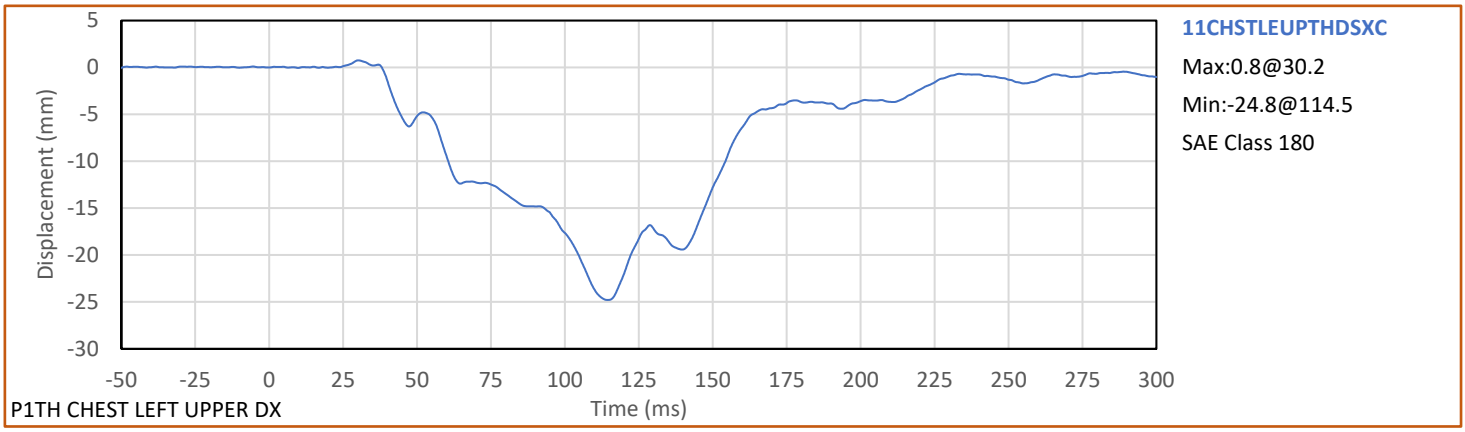
PASSENGER CURTAIN AIRBAG, - TIME TO FIRE - NO FIRE

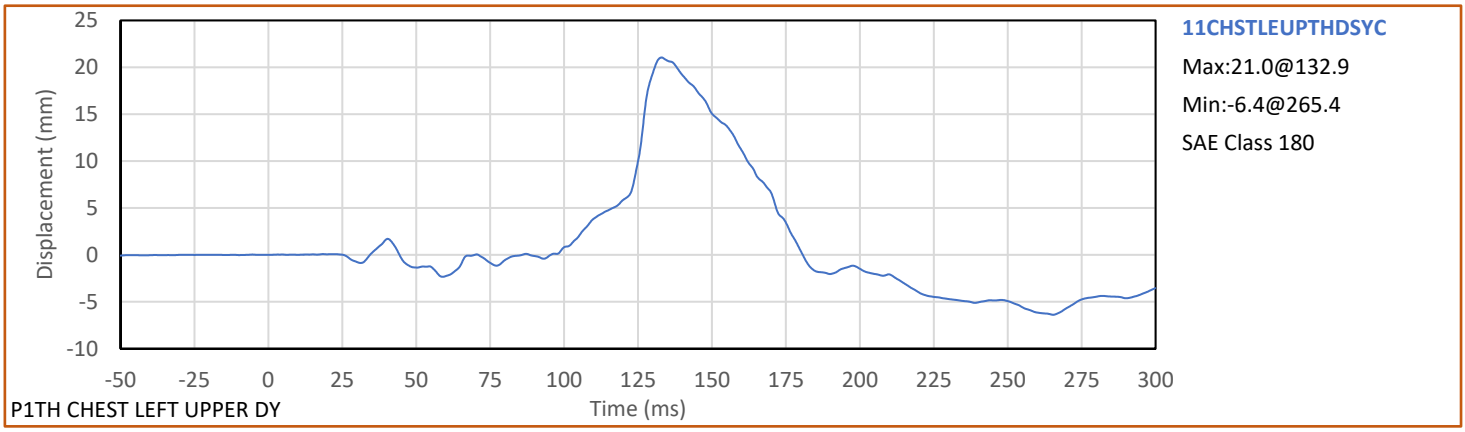


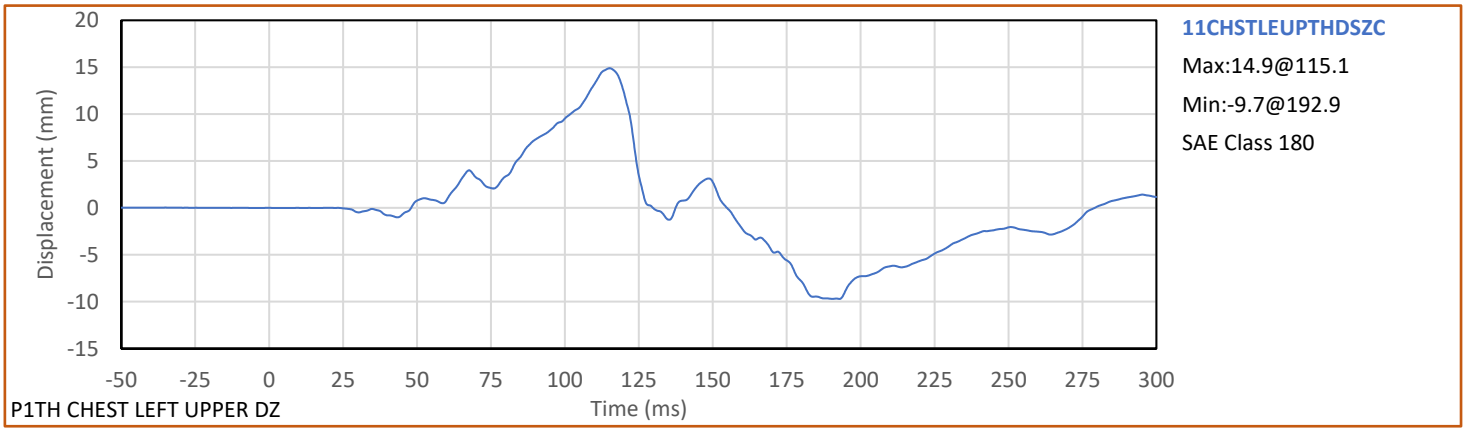
PASSENGER SEAT AIRBAG, - TIME TO FIRE - NO FIRE

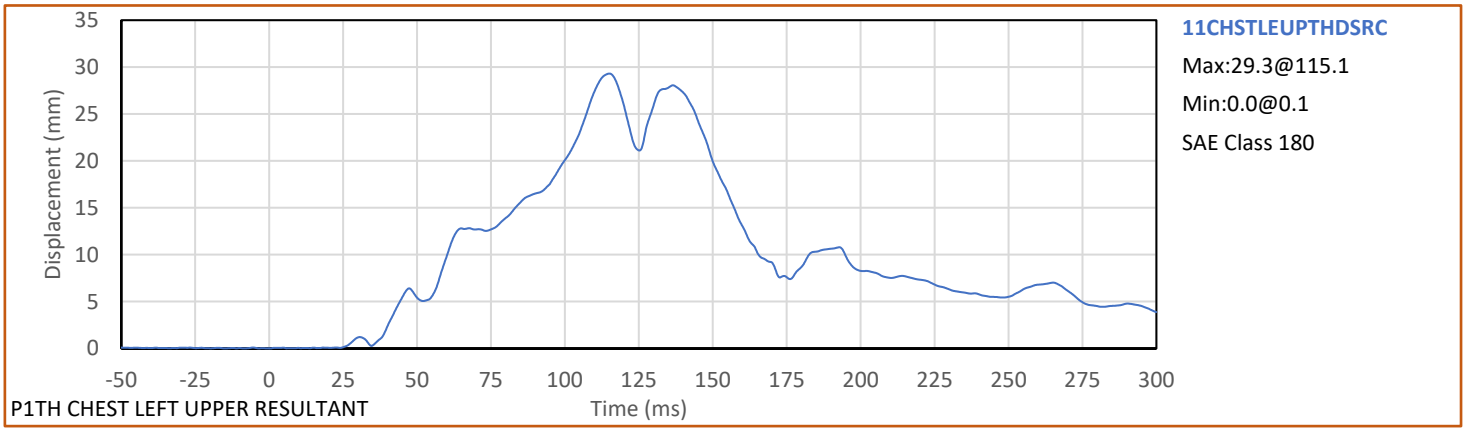


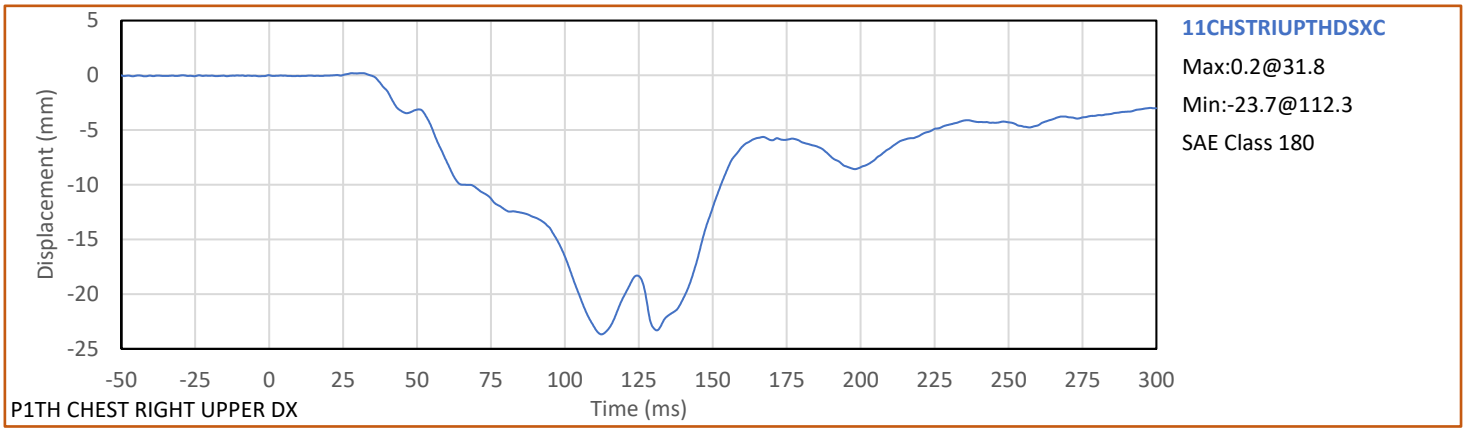
PASSENGER KNEE AIRBAG, - NOT INSTALLED

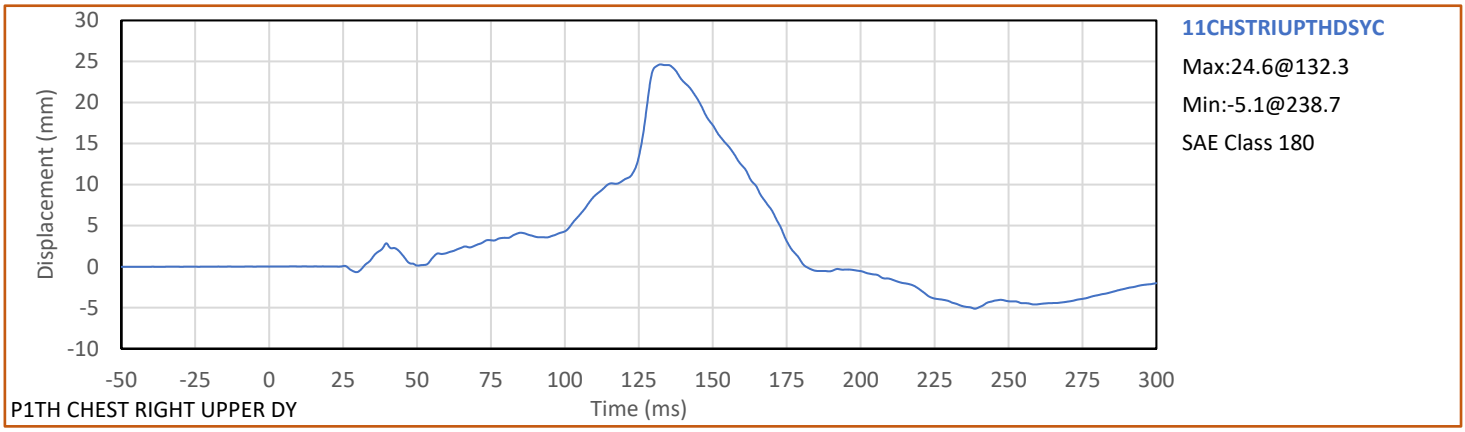

Displacement (mm)
Time (ms)
11CHSTLEUPTHDSXC
Max:0.8@30.2
Min:-24.8@114.5
SAE Class 180
P1TH CHEST LEFT UPPER DX

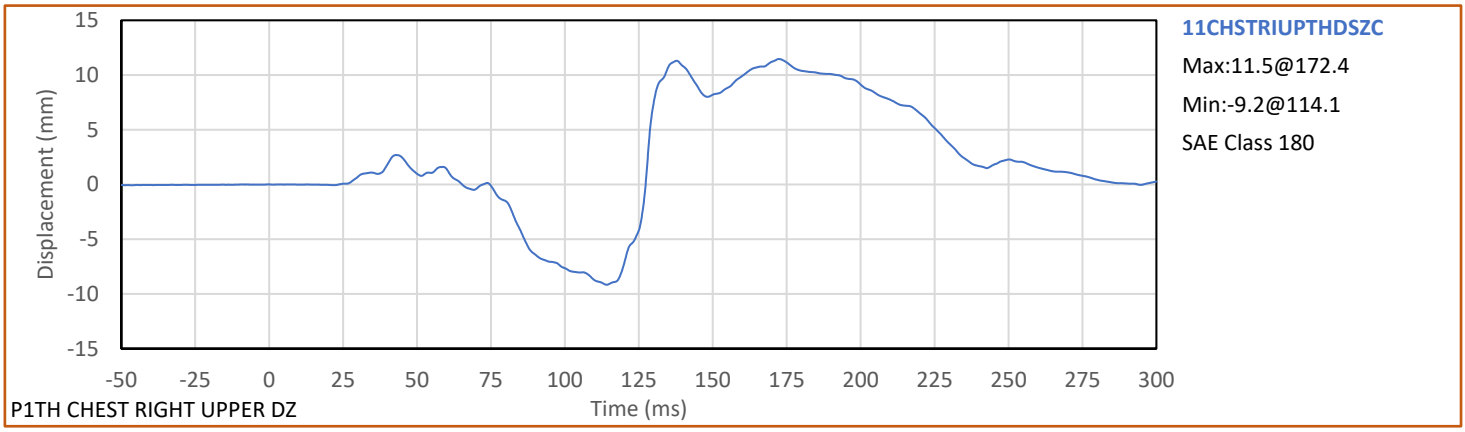

Displacement (mm)
Time (ms)
11CHSTLEUPTHDSYC
Max:21.0@132.9
Min:-6.4@265.4
SAE Class 180
P1TH CHEST LEFT UPPER DY

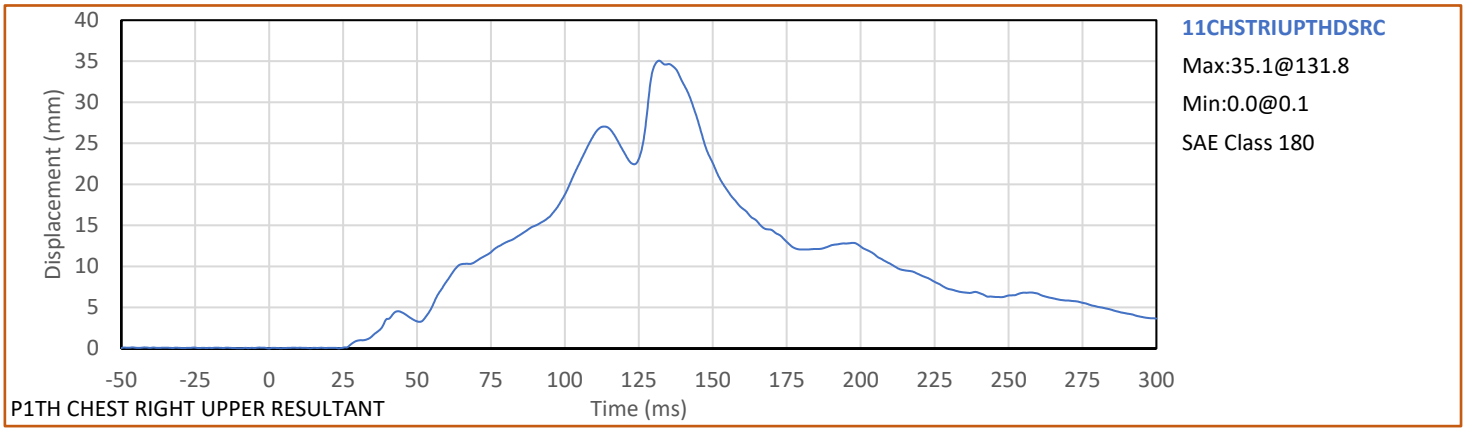

Displacement (mm)
Time (ms)
11CHSTLEUPTHDSZC
Max:14.9@115.1
Min:-9.7@192.9
SAE Class 180
P1TH CHEST LEFT UPPER DZ

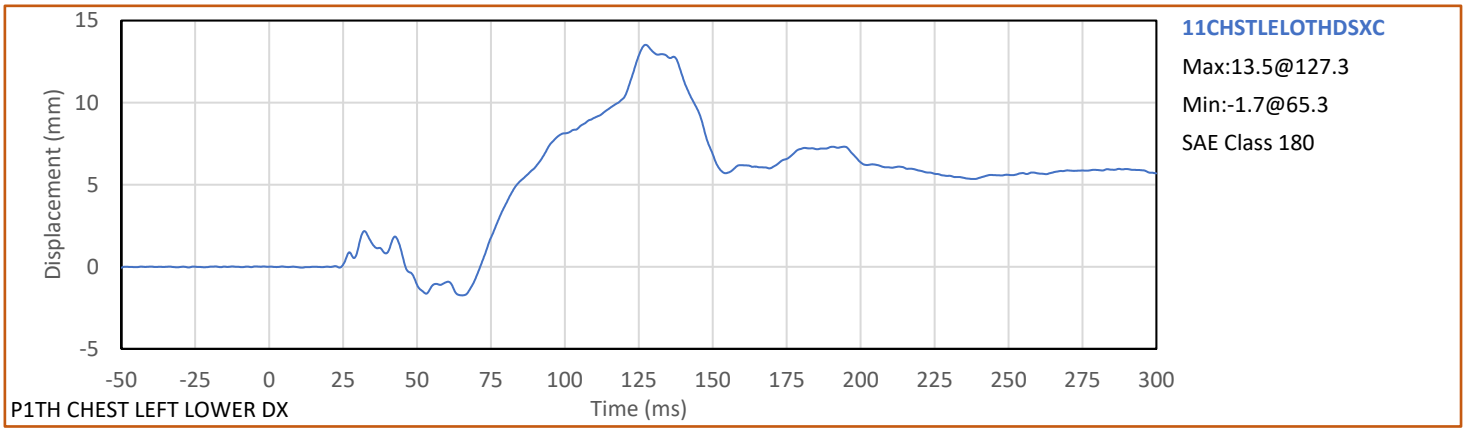

Displacement (mm)
Time (ms)
11CHSTLEUPTHDSRC
Max:29.3@115.1
Min:0.0@0.1
SAE Class 180
P1TH CHEST LEFT UPPER RESULTANT

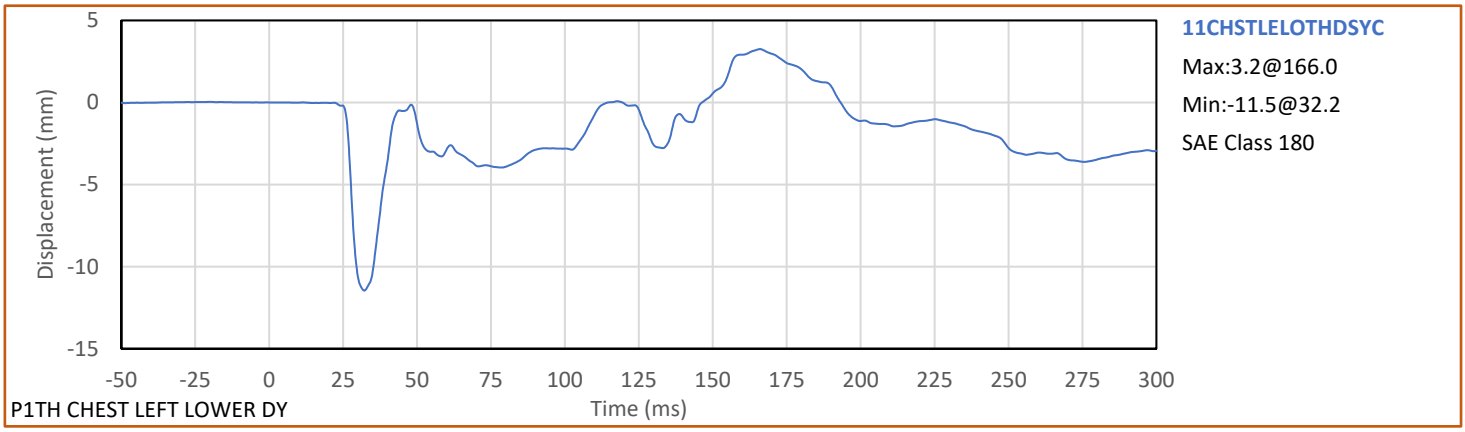

Displacement (mm)
Time (ms)
11CHSTRIUPTHDSXC
Max:0.2@31.8
Min:-23.7@112.3
SAE Class 180
P1TH CHEST RIGHT UPPER DX

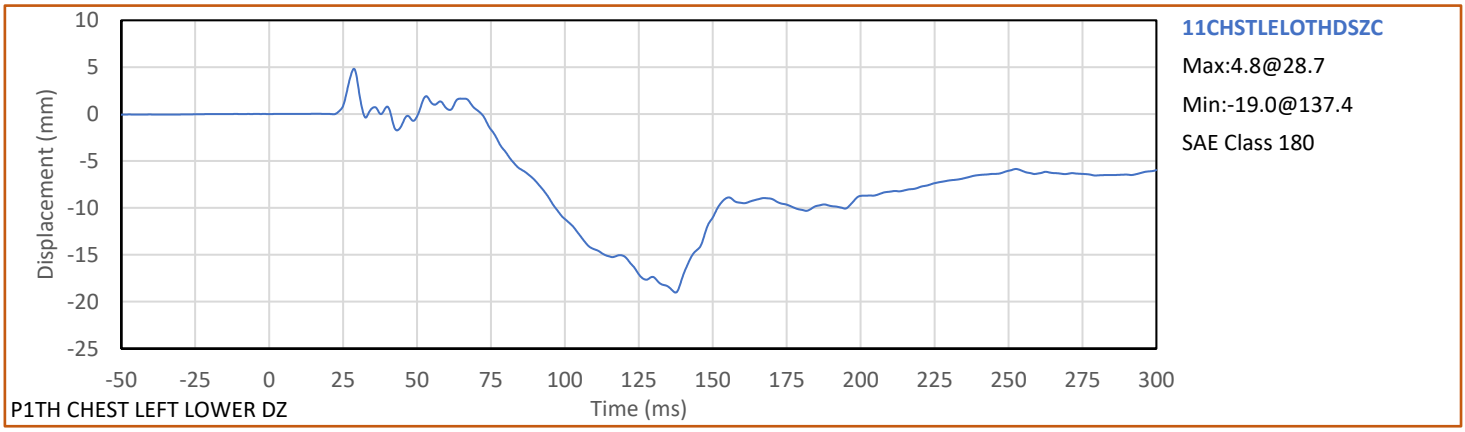

Displacement (mm)
Time (ms)
11CHSTRIUPTHDSYC
Max:24.6@132.3
Min:-5.1@238.7
SAE Class 180
P1TH CHEST RIGHT UPPER DY

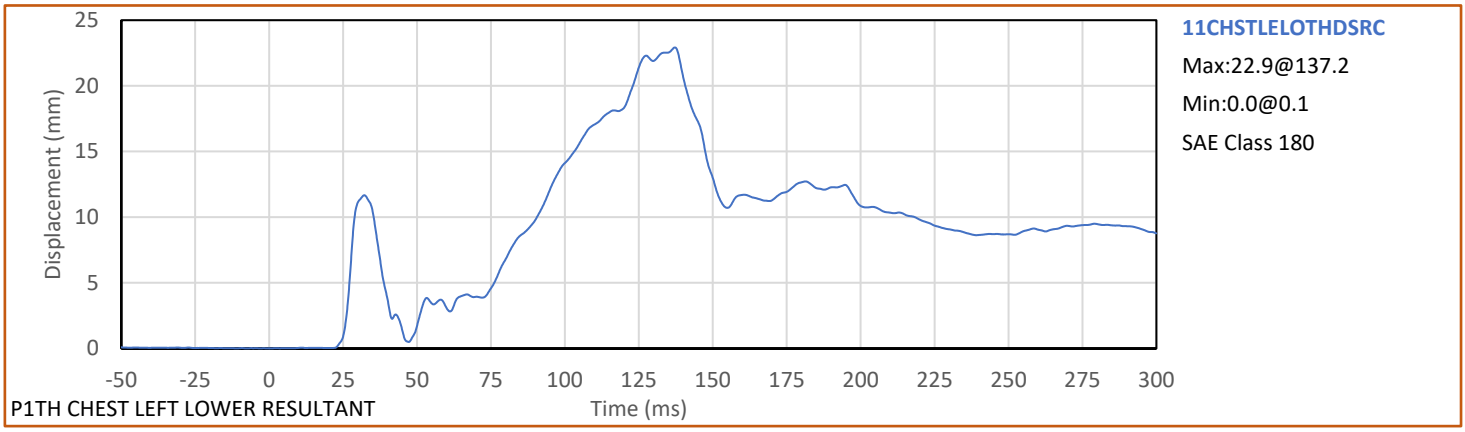

Displacement (mm)
Time (ms)
11CHSTRIUPTHDSZC
Max:11.5@172.4
Min:-9.2@114.1
SAE Class 180
P1TH CHEST RIGHT UPPER DZ

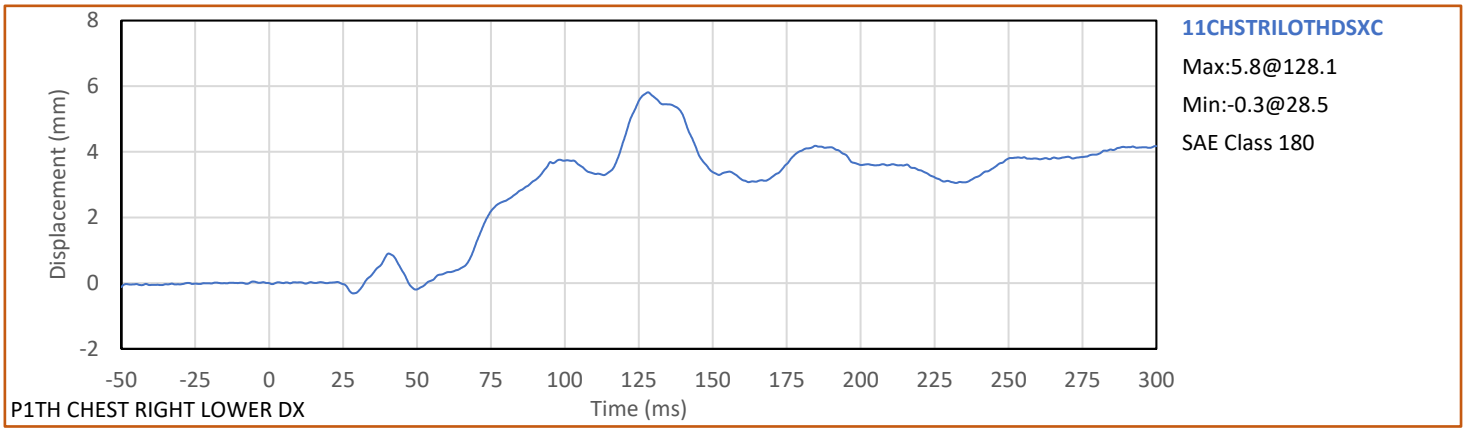

Displacement (mm)
Time (ms)
11CHSTRIUPTHDSRC
Max:35.1@131.8
Min:0.0@0.1
SAE Class 180
P1TH CHEST RIGHT UPPER RESULTANT

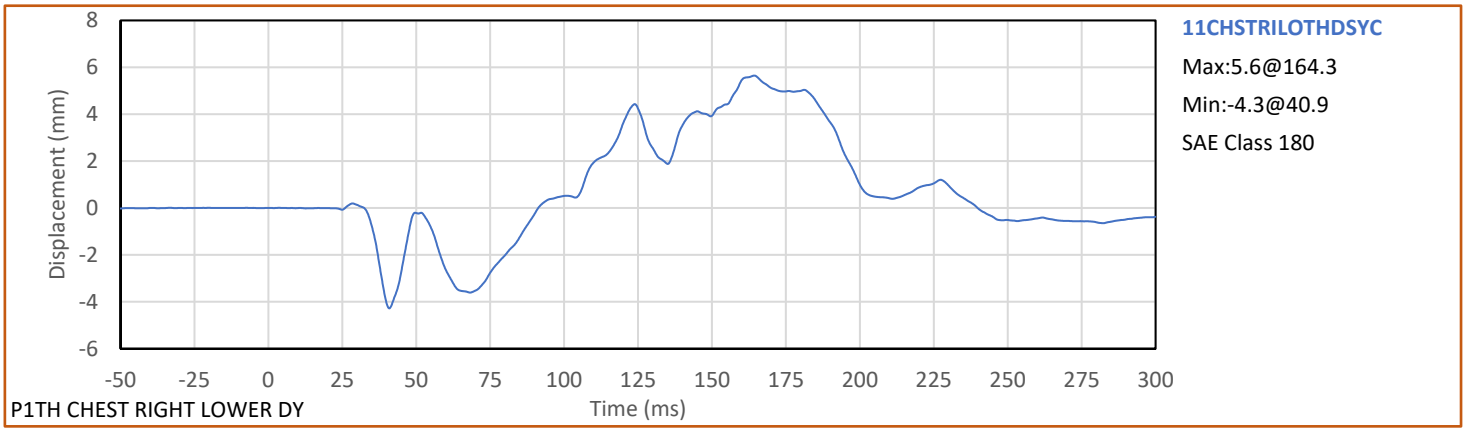

Displacement (mm)
Time (ms)
P1TH CHEST LEFT LOWER DX
11CHSTLELOTHDSXC
Max:13.5@127.3
Min:-1.7@65.3
SAE Class 180

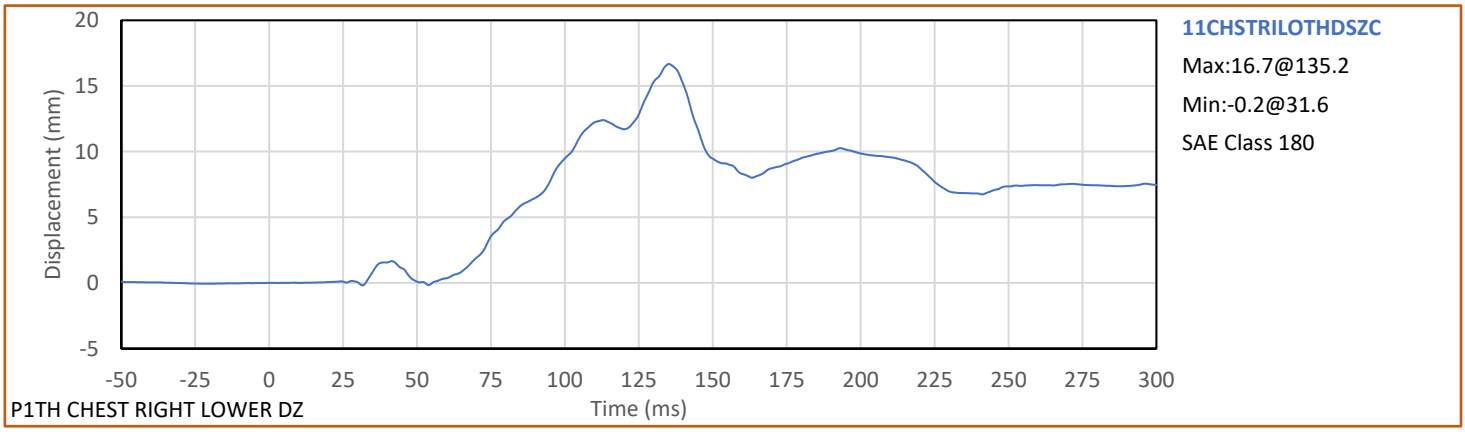

Displacement (mm)
Time (ms)
P1TH CHEST LEFT LOWER DY
11CHSTLELOTHDSYC
Max:3.2@166.0
Min:-11.5@32.2
SAE Class 180

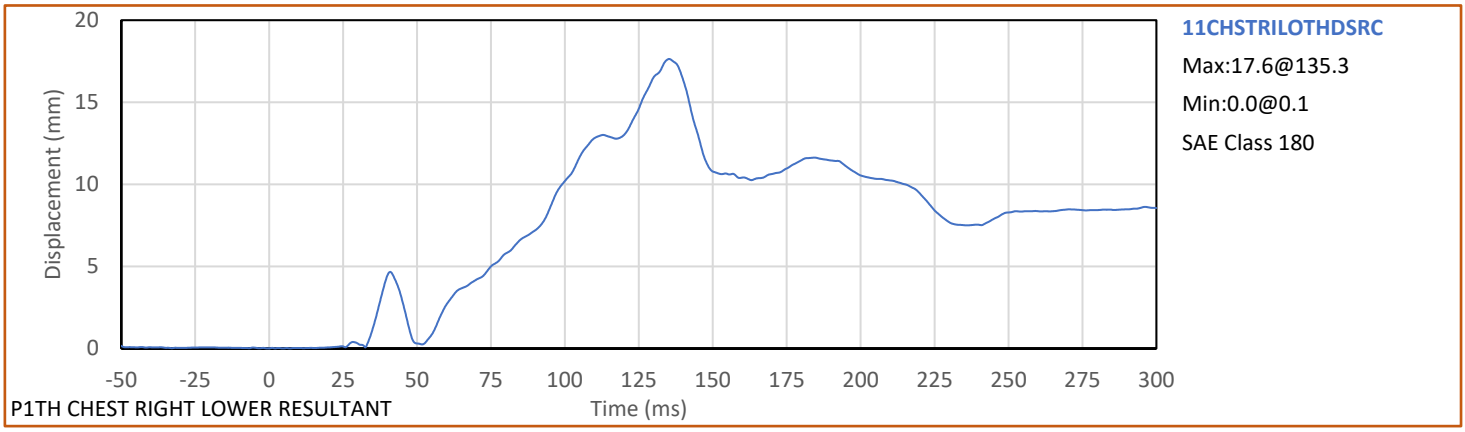

Displacement (mm)
Time (ms)
P1TH CHEST LEFT LOWER DZ
11CHSTLELOTHDSZC
Max:4.8@28.7
Min:-19.0@137.4
SAE Class 180

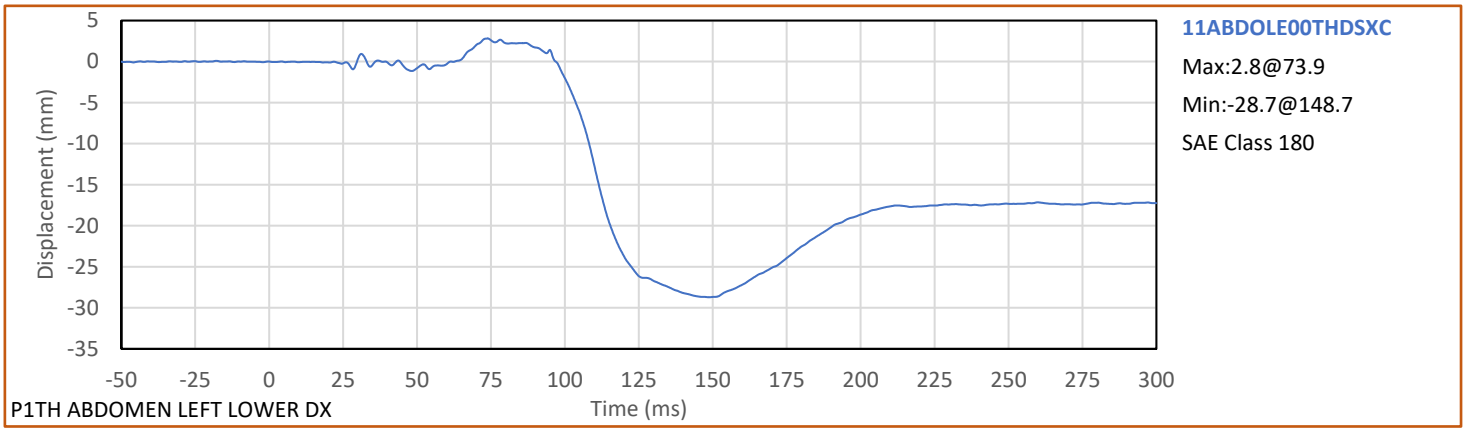

Displacement (mm)
Time (ms)
P1TH CHEST LEFT LOWER RESULTANT
11CHSTLELOTHDSRC
Max:22.9@137.2
Min:0.0@0.1
SAE Class 180

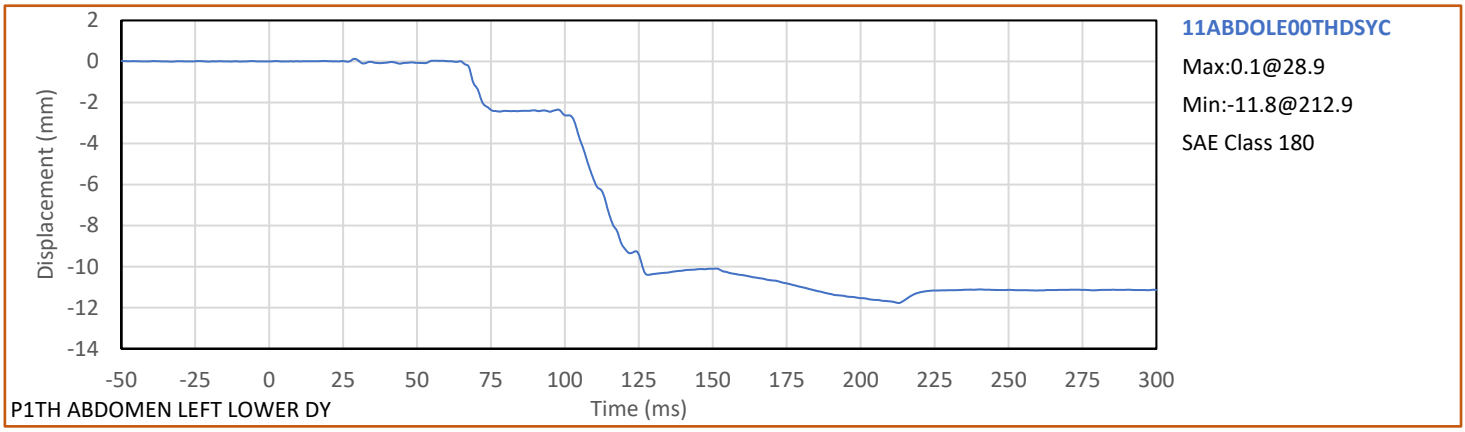

Displacement (mm)
Time (ms)
11CHSTRILOTHDSXC
Max:5.8@128.1
Min:-0.3@28.5
SAE Class 180
P1TH CHEST RIGHT LOWER DX

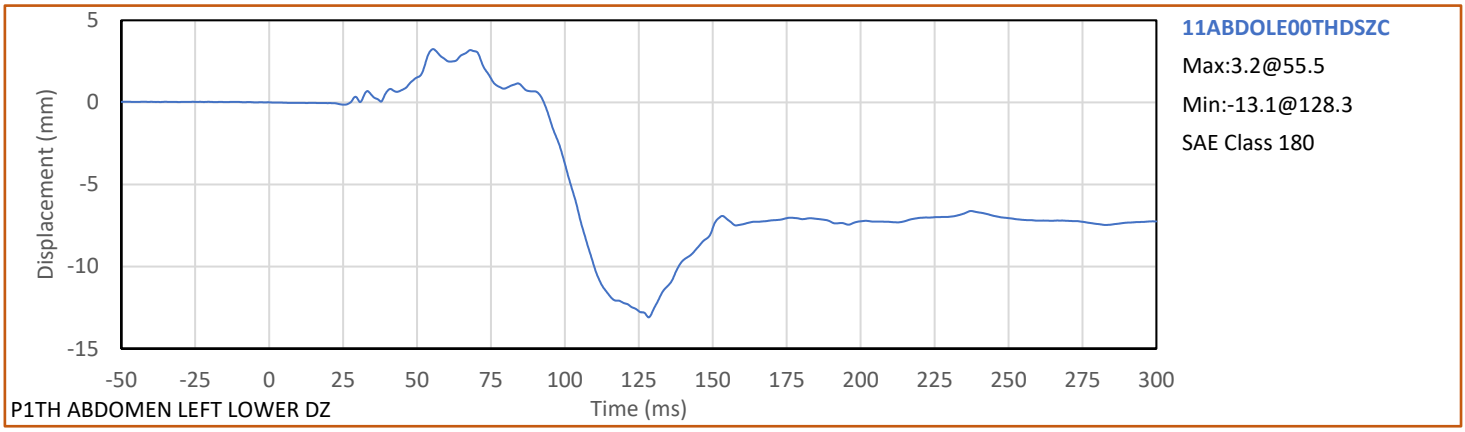

Displacement (mm)
Time (ms)
11CHSTRILOTHDSYC
Max:5.6@164.3
Min:-4.3@40.9
SAE Class 180
P1TH CHEST RIGHT LOWER DY

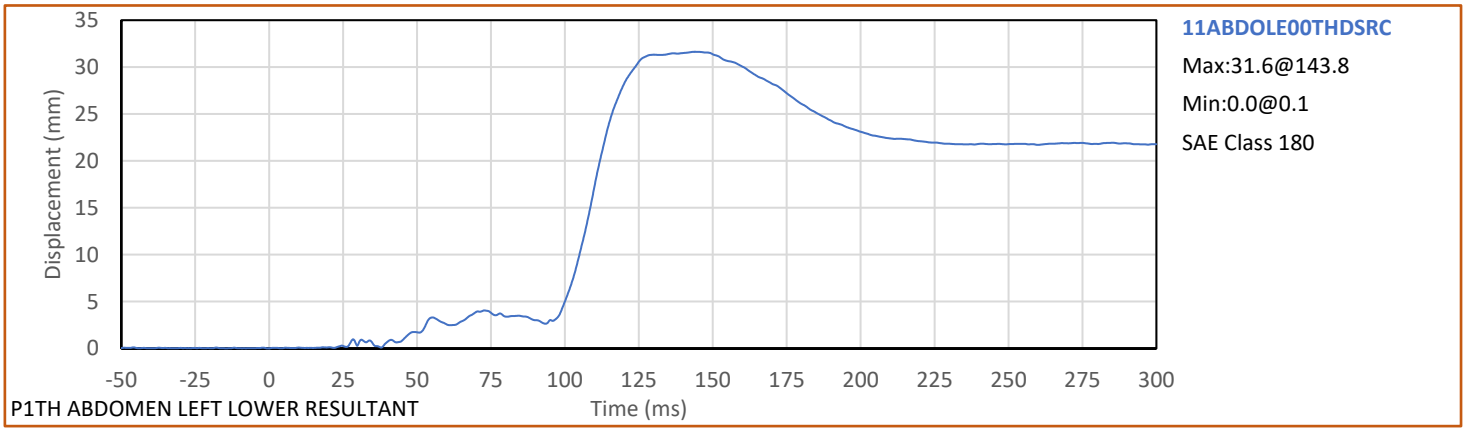

Displacement (mm)
Time (ms)
11CHSTRILOTHDSZC
Max:16.7@135.2
Min:-0.2@31.6
SAE Class 180
P1TH CHEST RIGHT LOWER DZ

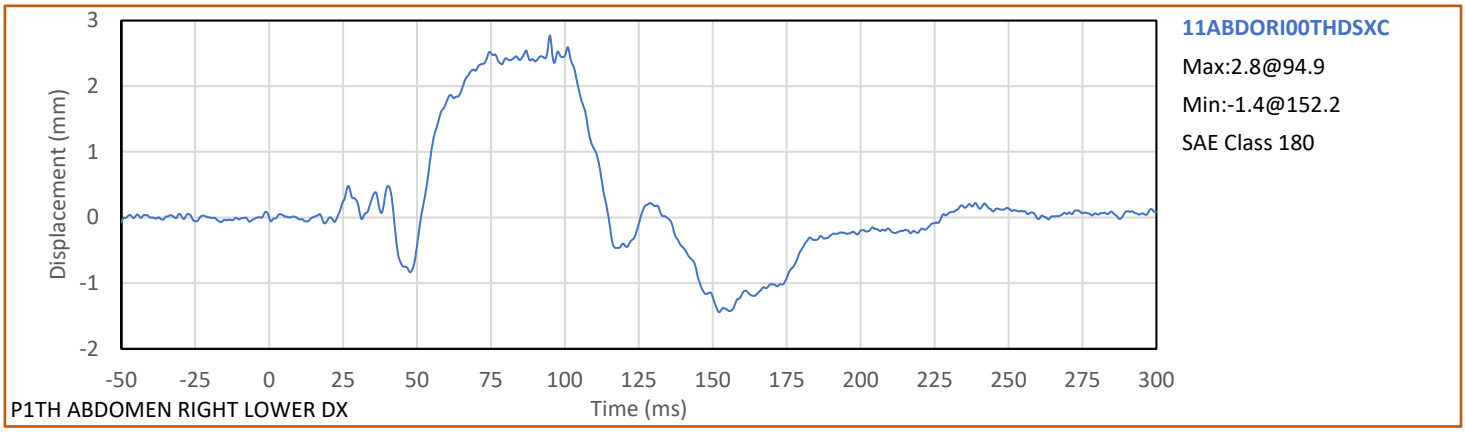

Displacement (mm)
Time (ms)
11CHSTRILOTHDSRC
Max:17.6@135.3
Min:0.0@0.1
SAE Class 180
P1TH CHEST RIGHT LOWER RESULTANT

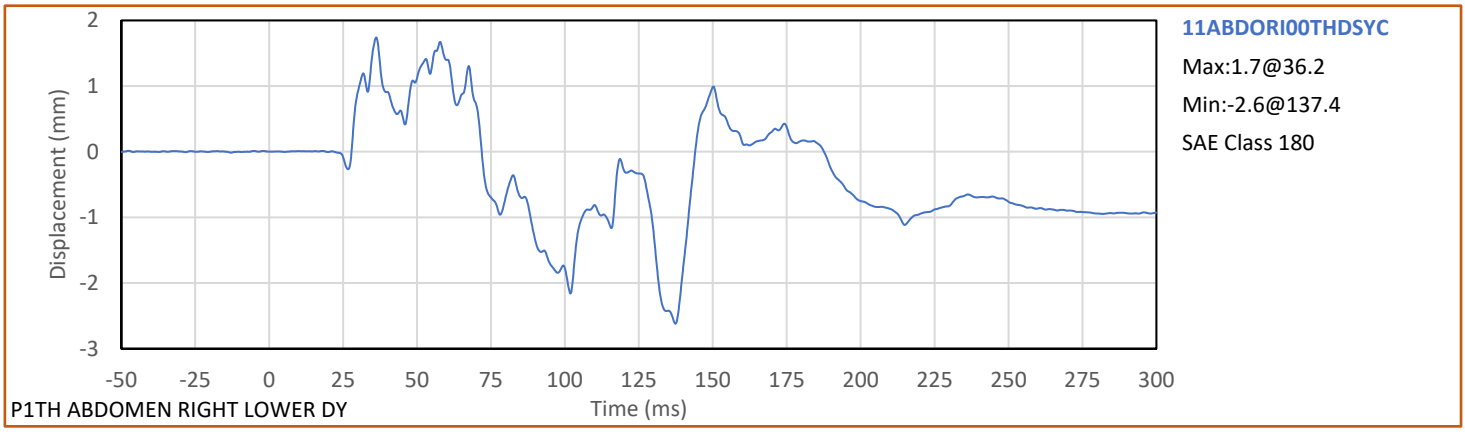

Displacement (mm)
Time (ms)
P1TH ABDOMEN LEFT LOWER DX
11ABDOLE00THDSXC
Max:2.8@73.9
Min:-28.7@148.7
SAE Class 180

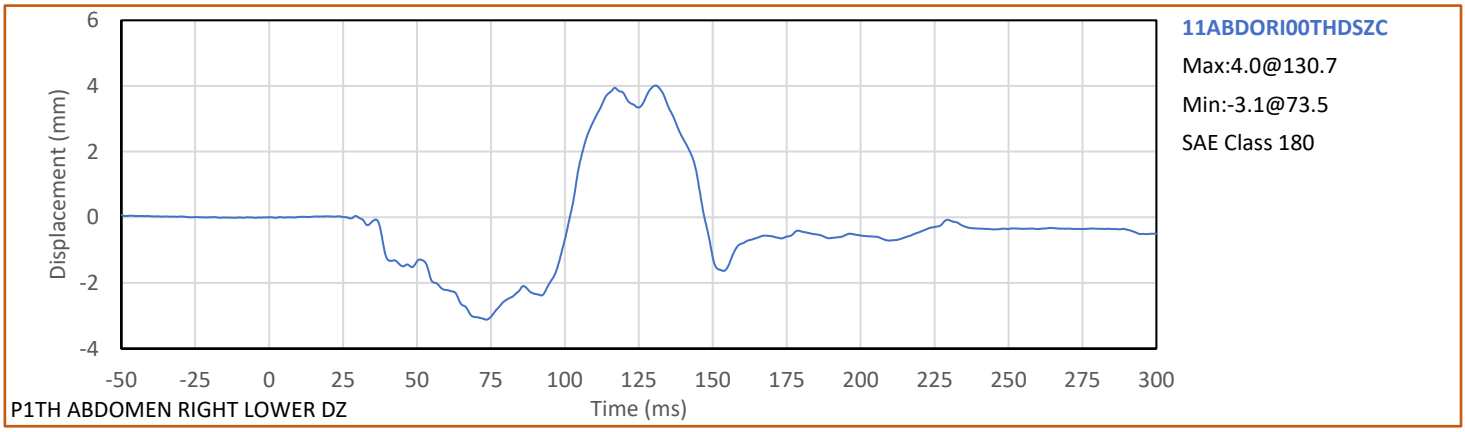

Displacement (mm)
Time (ms)
P1TH ABDOMEN LEFT LOWER DY
11ABDOLE00THDSYC
Max:0.1@28.9
Min:-11.8@212.9
SAE Class 180

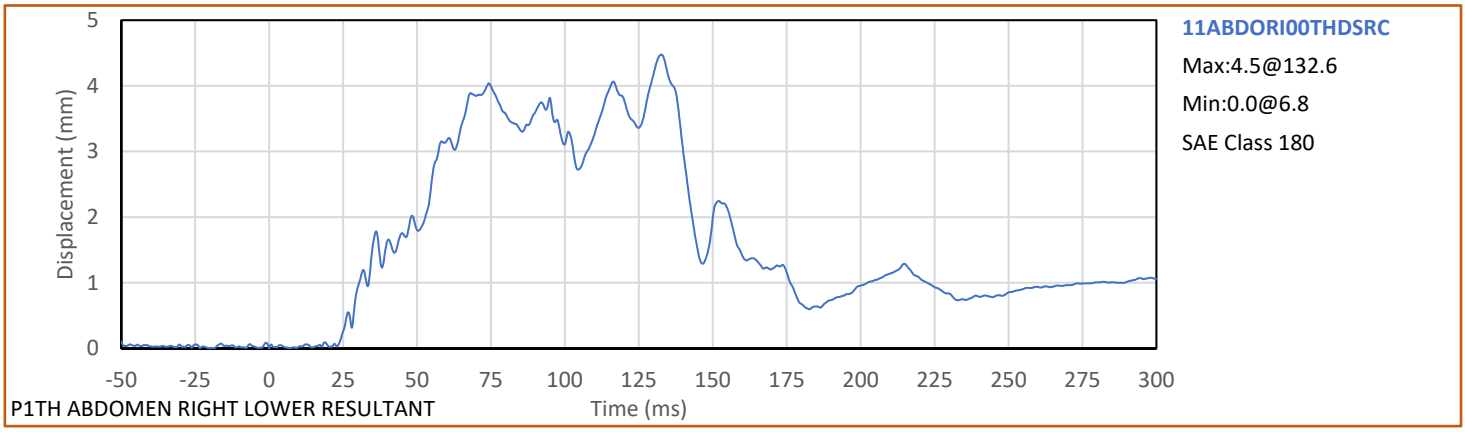

Displacement (mm)
Time (ms)
P1TH ABDOMEN LEFT LOWER DZ
11ABDOLE00THDSZC
Max:3.2@55.5
Min:-13.1@128.3
SAE Class 180


Displacement (mm)
Time (ms)
P1TH ABDOMEN LEFT LOWER RESULTANT
11ABDOLE00THDSRC
Max:31.6@143.8
Min:0.0@0.1
SAE Class 180


Displacement (mm)
Time (ms)
P1TH ABDOMEN RIGHT LOWER DX
11ABDORI00THDSXC
Max:2.8@94.9
Min:-1.4@152.2
SAE Class 180


Displacement (mm)
Time (ms)
P1TH ABDOMEN RIGHT LOWER DY
11ABDORI00THDSYC
Max:1.7@36.2
Min:-2.6@137.4
SAE Class 180


Displacement (mm)
Time (ms)
P1TH ABDOMEN RIGHT LOWER DZ
11ABDORI00THDSZC
Max:4.0@130.7
Min:-3.1@73.5
SAE Class 180


Displacement (mm)
Time (ms)
P1TH ABDOMEN RIGHT LOWER RESULTANT
11ABDORI00THDSRC
Max:4.5@132.6
Min:0.0@6.8
SAE Class 180

APPENDIX C

ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

THOR-50M 50TH PERCENTILE MALE ATD

PRE-TEST QUALIFICATION (PARTIAL)

APPENDIX C
ATD Configuration and Performance Verification Data
THOR-50M 50th Percentile Male ATD
Pre-Test Qualification (Full) S/N: EG2595

Applus IDIADA KARCO

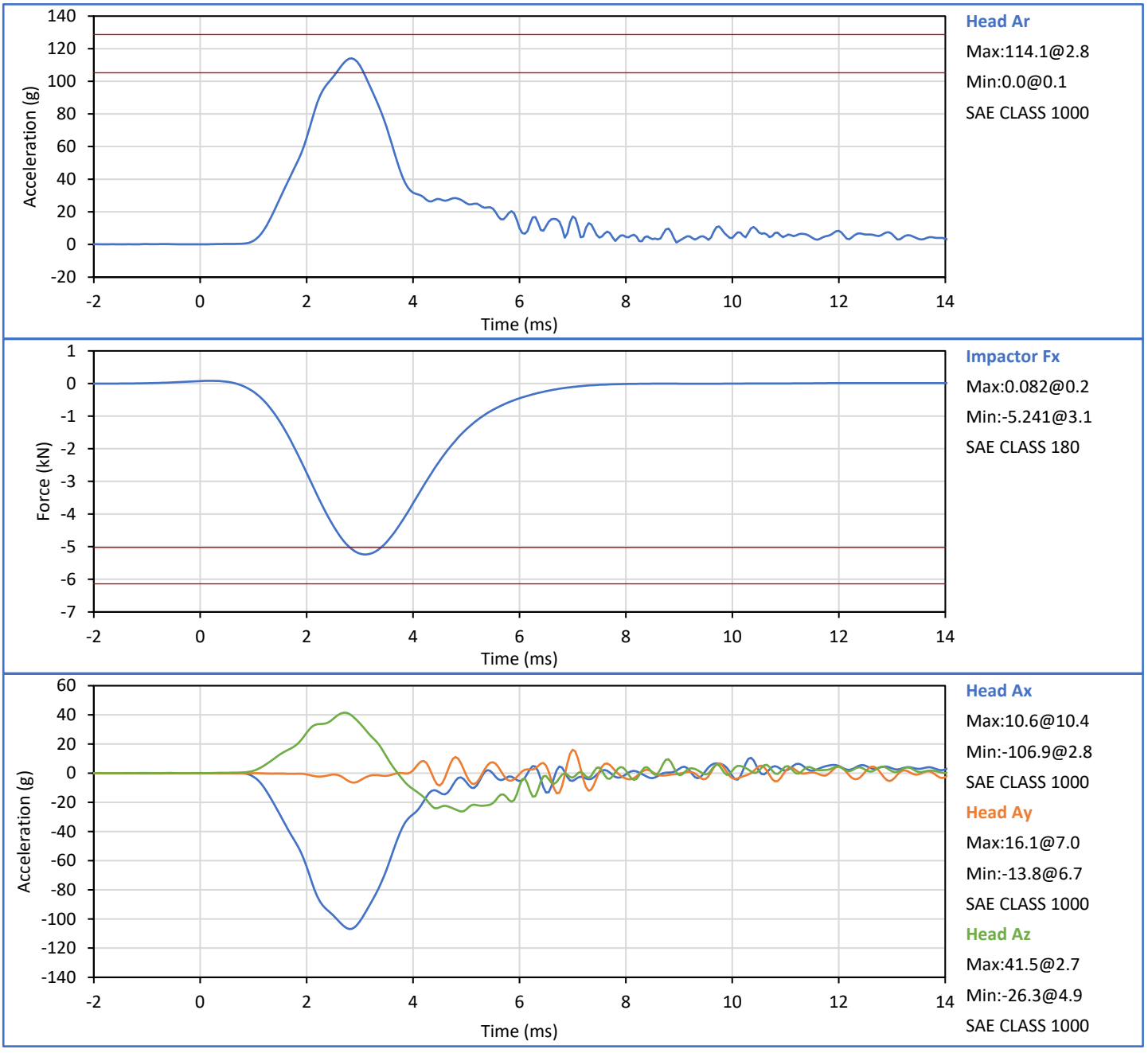
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Head Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	30	Pass
Velocity	m/s	1.95	2.05	2.02	Pass
Peak Impactor Force	kN	-6.138	-5.022	-5.241	Pass
Peak Head Resultant Acceleration	g	105.3	128.7	114.1	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P .Puzzuto

Applus IDIADA KARCO

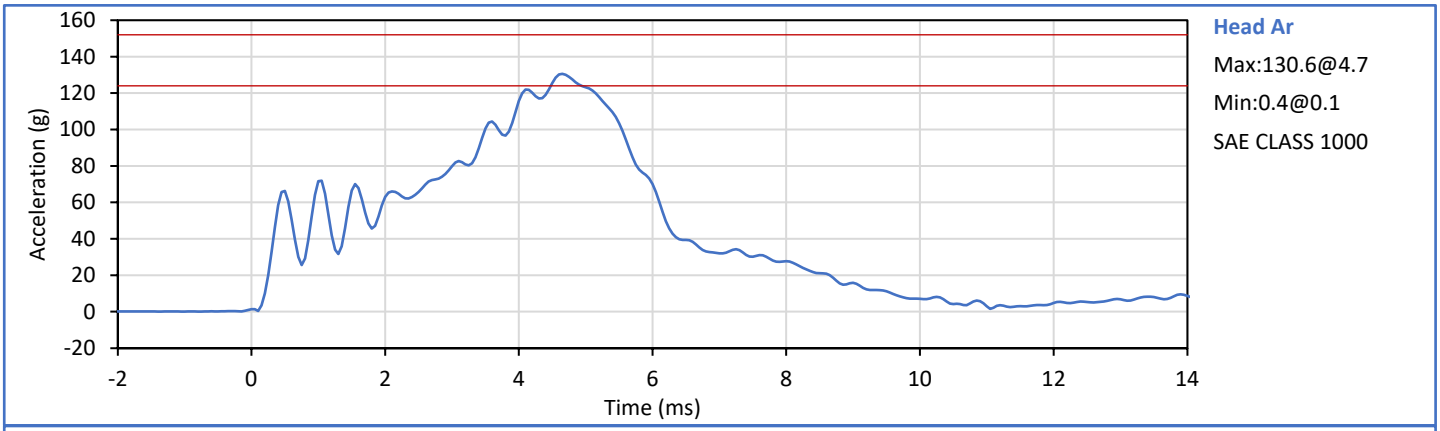
Pre-Test Qualification (Full)

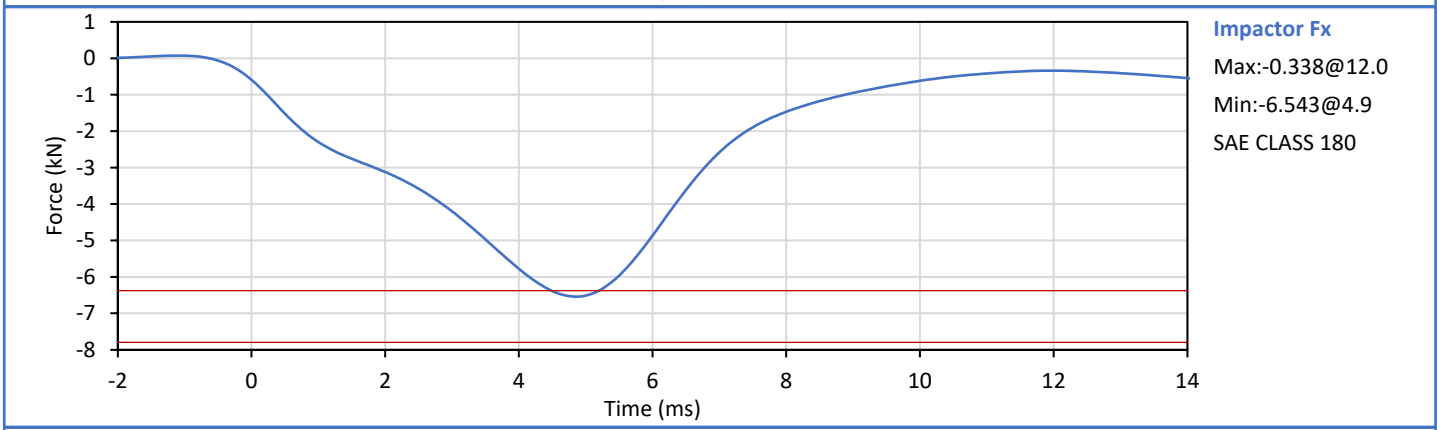
THOR-50M 50th Percentile Male ATD
Face Qualification

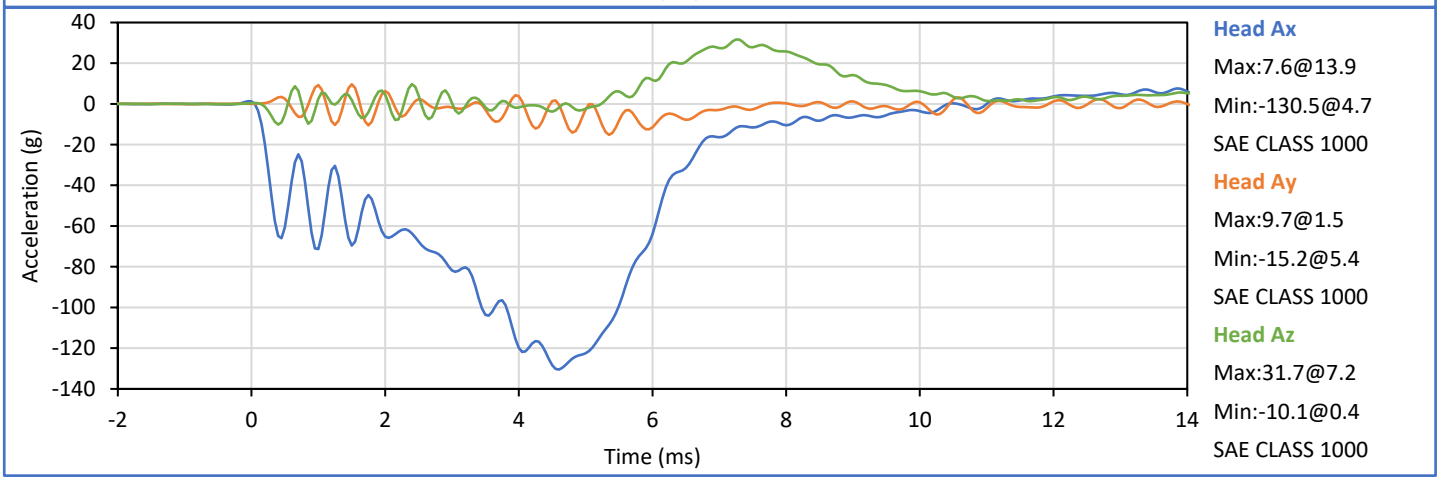
ATD Serial No.: EG2595

Test Date: 2021-05-20

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	26	Pass
Velocity	m/s	6.68	6.78	6.78	Pass
Peak Impactor Force	kN	-7.796	-6.378	-6.543	Pass
Peak Head Resultant Acceleration	g	124.0	152.0	130.6	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass







Technician: J. Hernandez

Approved By: P .Puzzuto

Applus IDIADA KARCO

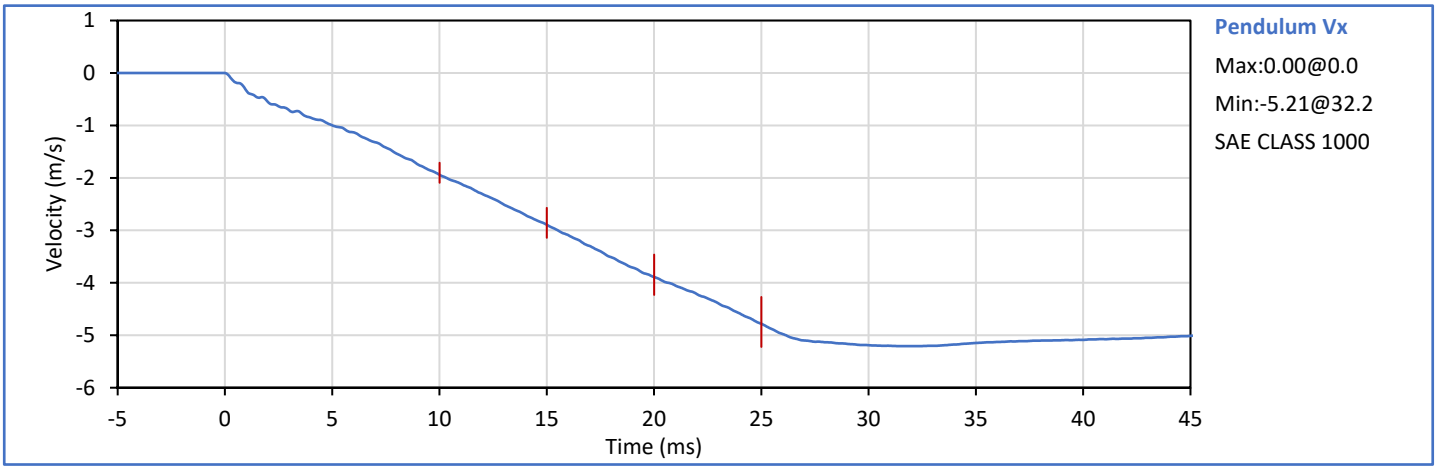
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Neck Torsion (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	31	Pass
Pendulum Velocity	m/s	4.95	5.05	5.02	Pass
Pendulum Velocity at 10 ms	m/s	-2.09	-1.71	-1.94	Pass
Pendulum Velocity at 15 ms	m/s	-3.14	-2.57	-2.89	Pass
Pendulum Velocity at 20 ms	m/s	-4.23	-3.46	-3.89	Pass
Pendulum Velocity at 25 ms	m/s	-5.22	-4.27	-4.78	Pass
Peak Upper Neck Mz	Nm	37.3	45.6	39.0	Pass
Peak Head Wz	deg/s	-1529	-1251	-1397	Pass
Peak Neck Fixture Rotation	deg	-52.7	-43.1	-46.1	Pass
NHTSA 2019-05 Corridor			Overall Test Results		Pass



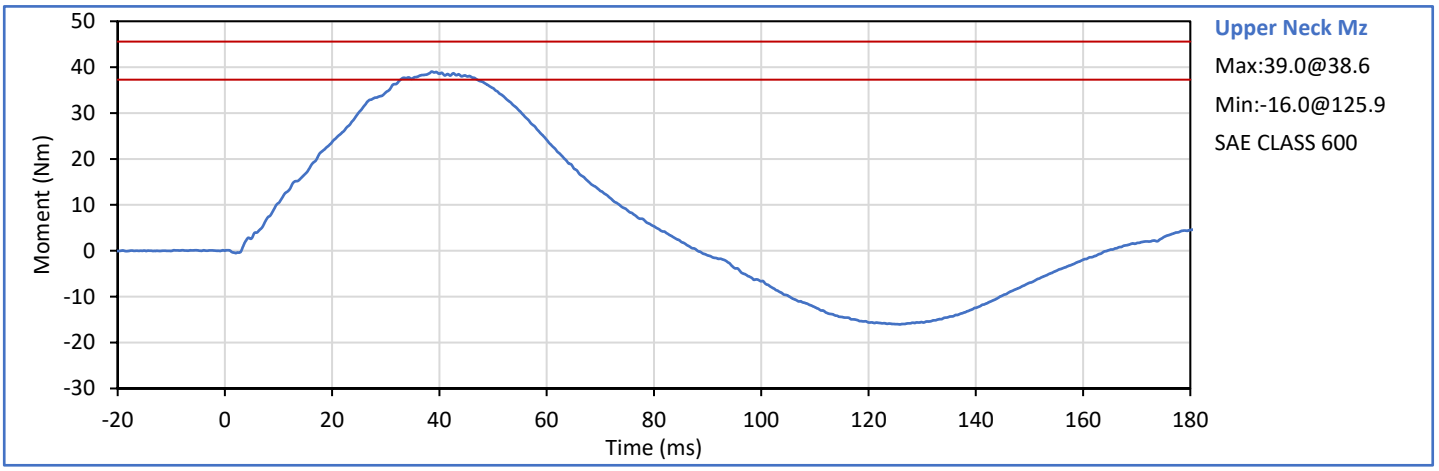
Applus IDIADA KARCO

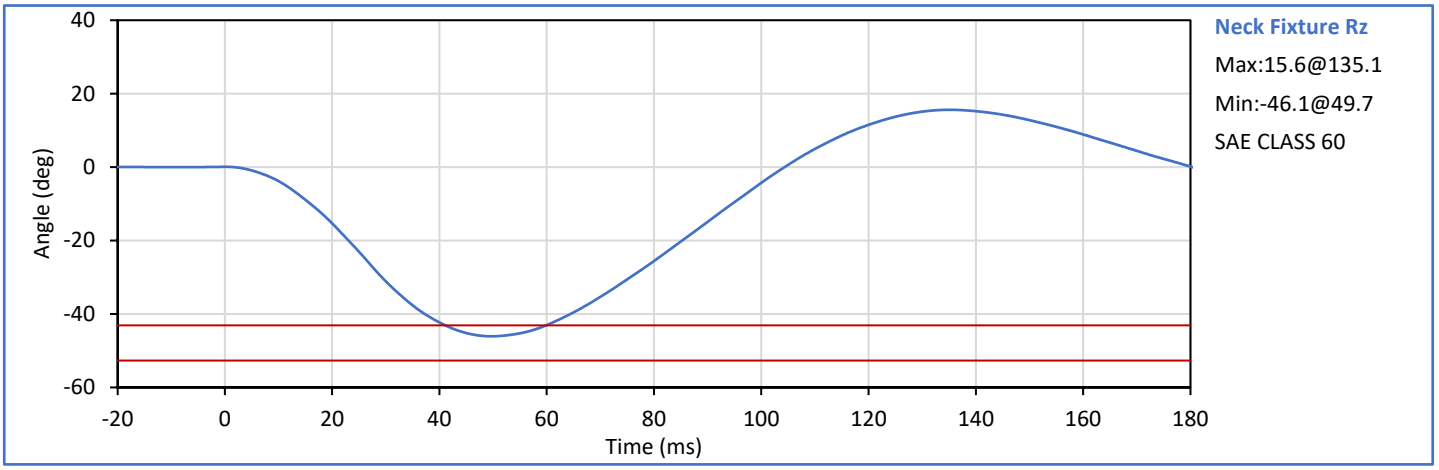
Pre-Test Qualification (Full)

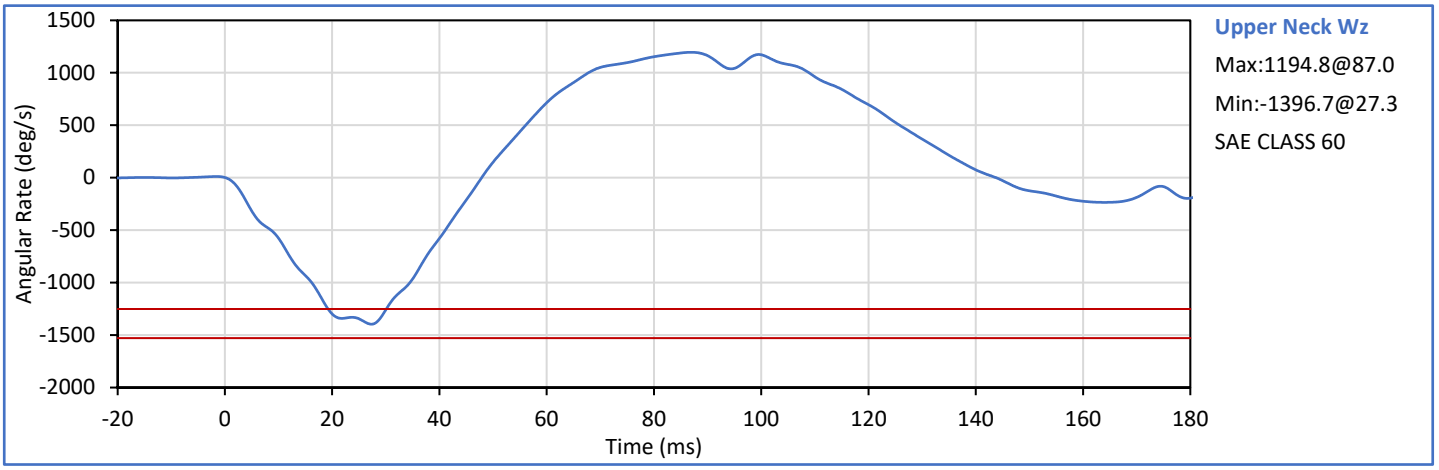
THOR-50M 50th Percentile Male ATD
Neck Torsion (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

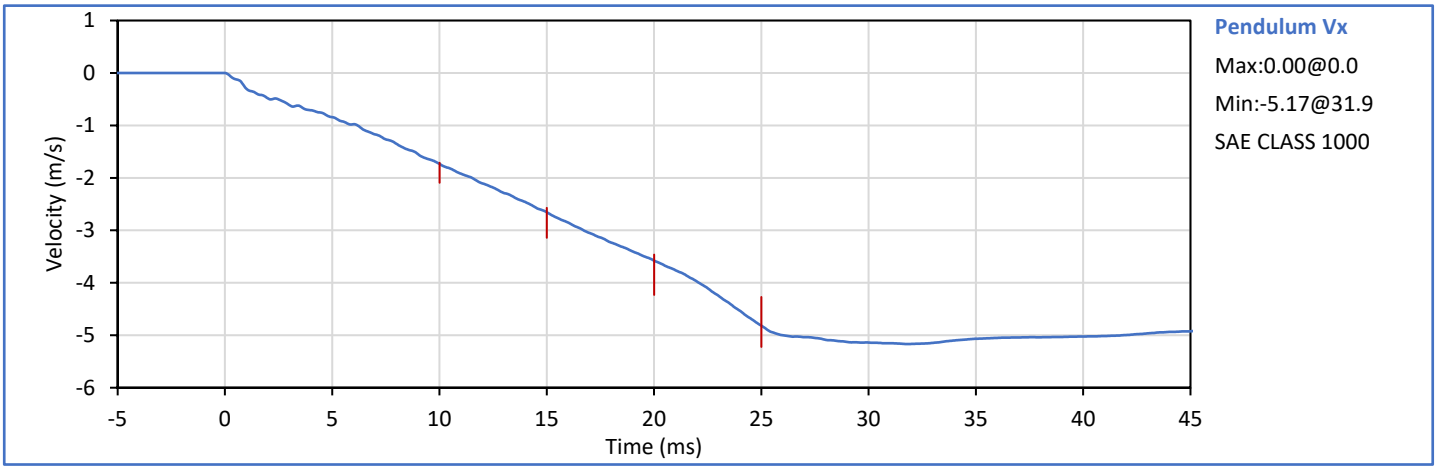
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Neck Torsion (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	35	Pass
Pendulum Velocity	m/s	4.95	5.05	5.03	Pass
Pendulum Velocity at 10 ms	m/s	-2.09	-1.71	-1.73	Pass
Pendulum Velocity at 15 ms	m/s	-3.14	-2.57	-2.65	Pass
Pendulum Velocity at 20 ms	m/s	-4.23	-3.46	-3.58	Pass
Pendulum Velocity at 25 ms	m/s	-5.22	-4.27	-4.82	Pass
Peak Upper Neck Mz	Nm	-45.6	-37.3	-38.6	Pass
Peak Head Wz	deg/s	1251	1529	1492	Pass
Peak Neck Fixture Rotation	deg	43.1	52.7	46.7	Pass
NHTSA 2019-05 Corridor			Overall Test Results		Pass



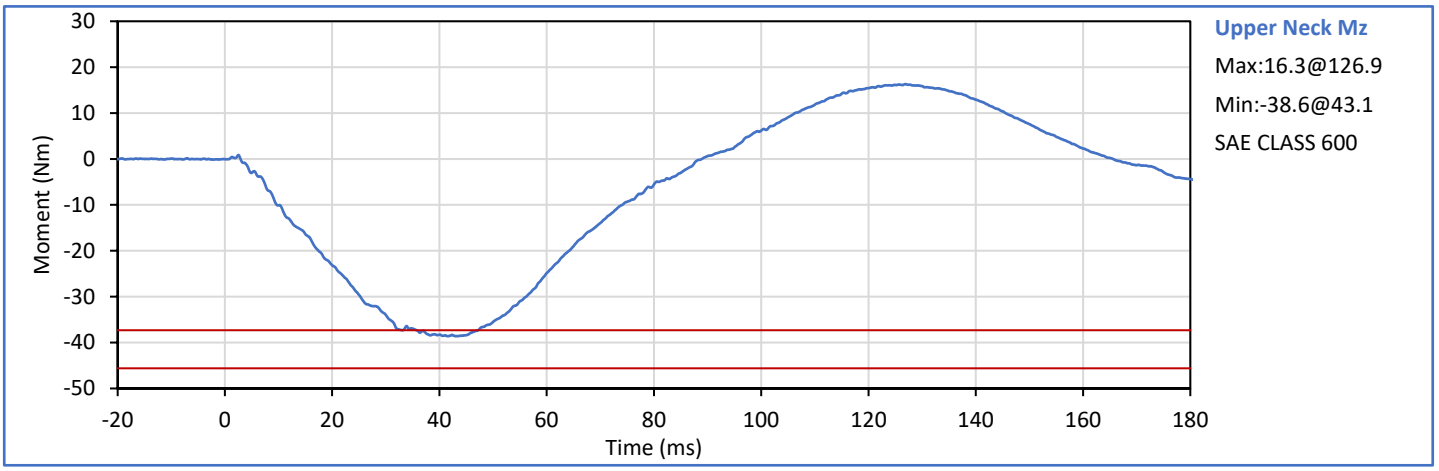
Applus IDIADA KARCO

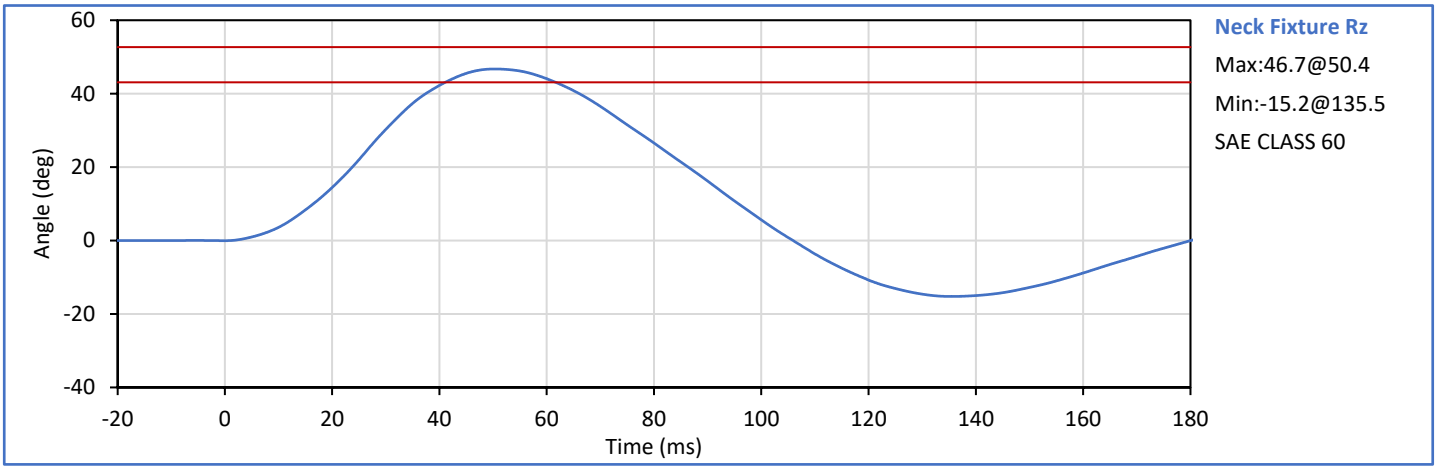
Pre-Test Qualification (Full)

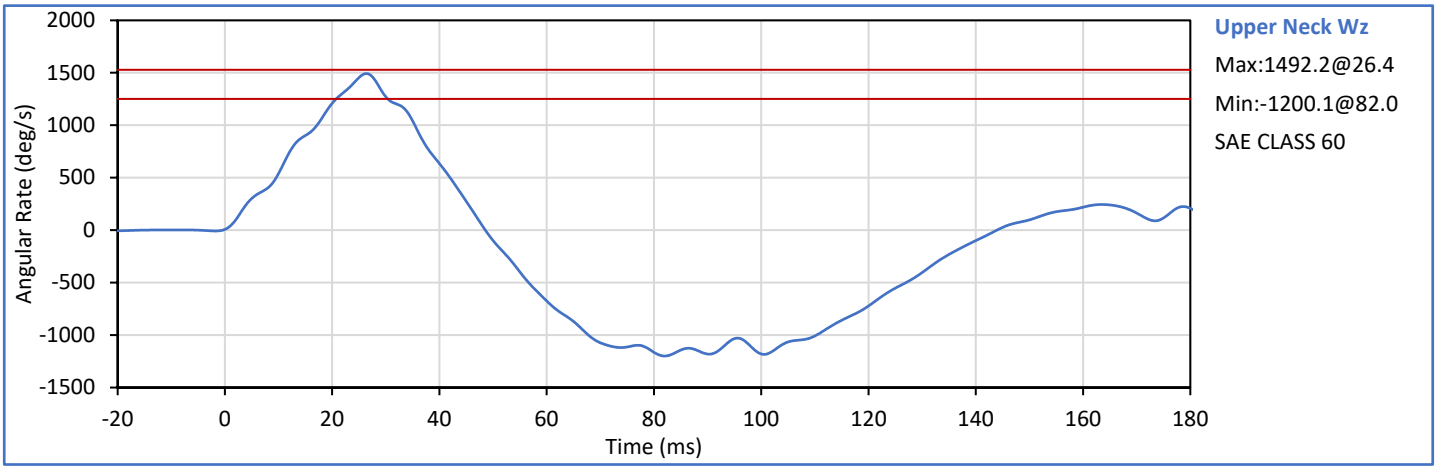
THOR-50M 50th Percentile Male ATD
Neck Torsion (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

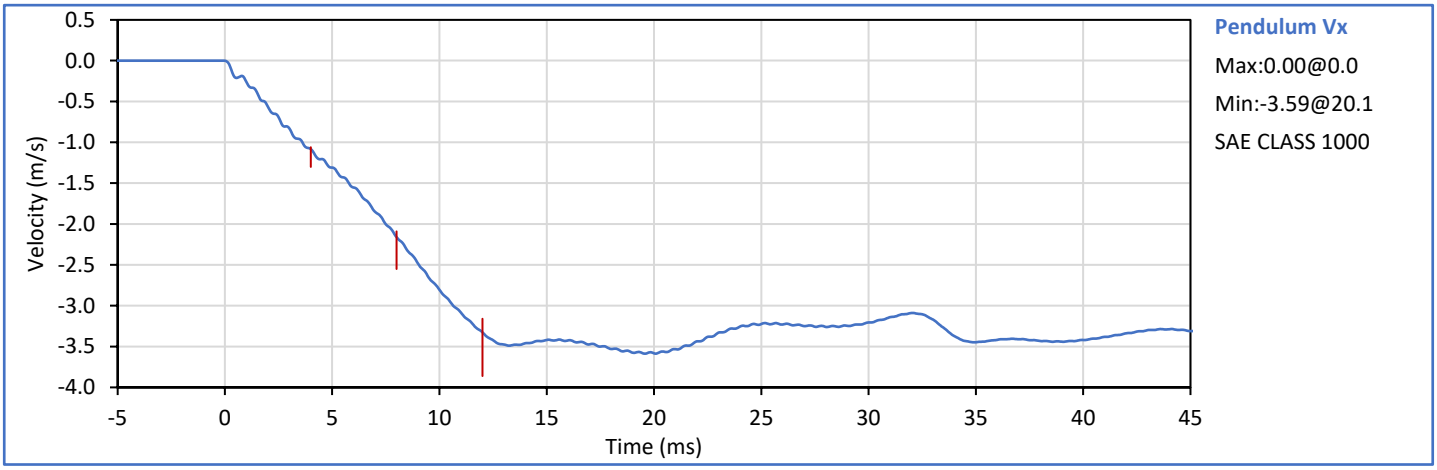
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Neck Lateral Flexion (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Humidity	%	10	70	34	Pass
Pendulum Velocity	m/s	3.35	3.45	3.45	Pass
Pendulum Velocity at 4 ms	m/s	-1.30	-1.06	-1.08	Pass
Pendulum Velocity at 8 ms	m/s	-2.55	-2.09	-2.16	Pass
Pendulum Velocity at 12 ms	m/s	-3.86	-3.16	-3.32	Pass
Peak Upper Neck Mx after 40 ms	Nm	44.8	54.7	46.4	Pass
Peak Head Wx	deg/s	-1498	-1226	-1322	Pass
Peak Head Relative Rotation	deg	-45.9	-37.6	-41.6	Pass
NHTSA 2019-05 Corridor			Overall Test Results		Pass



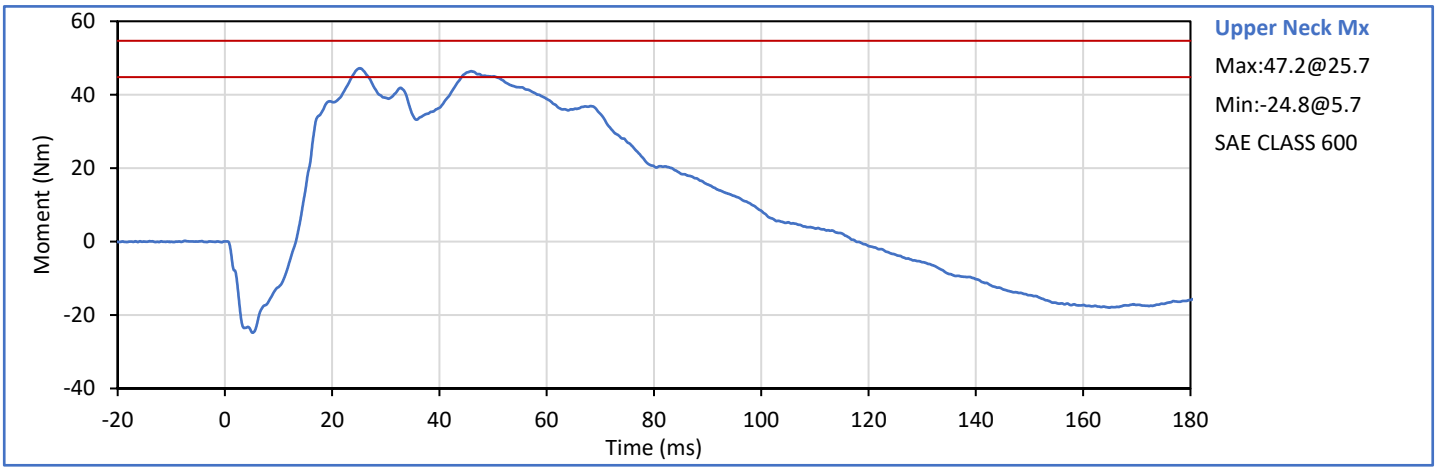
Applus IDIADA KARCO

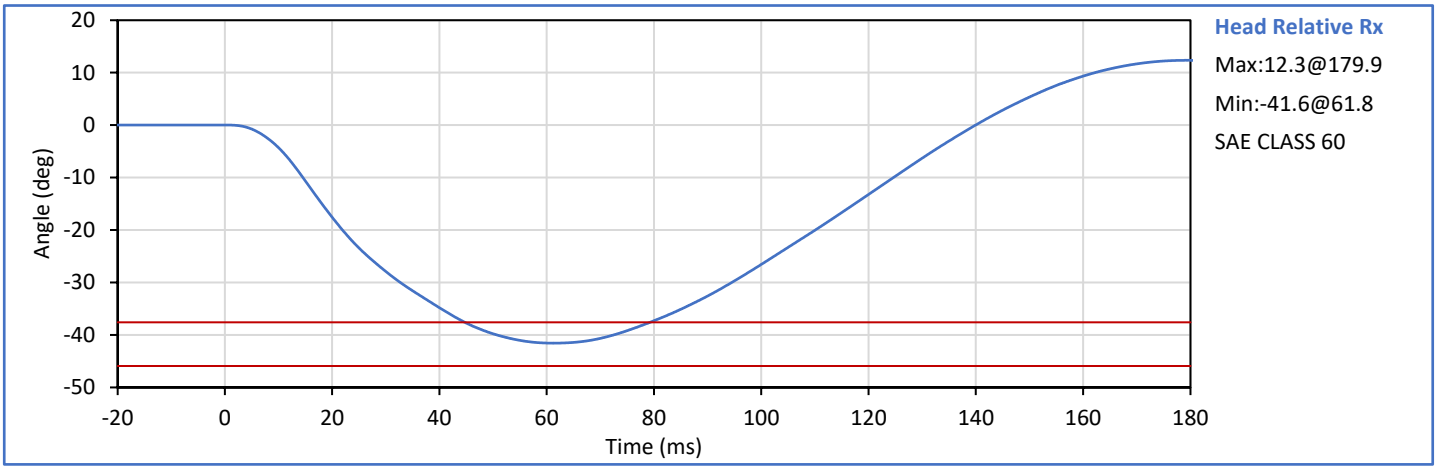
Pre-Test Qualification (Full)

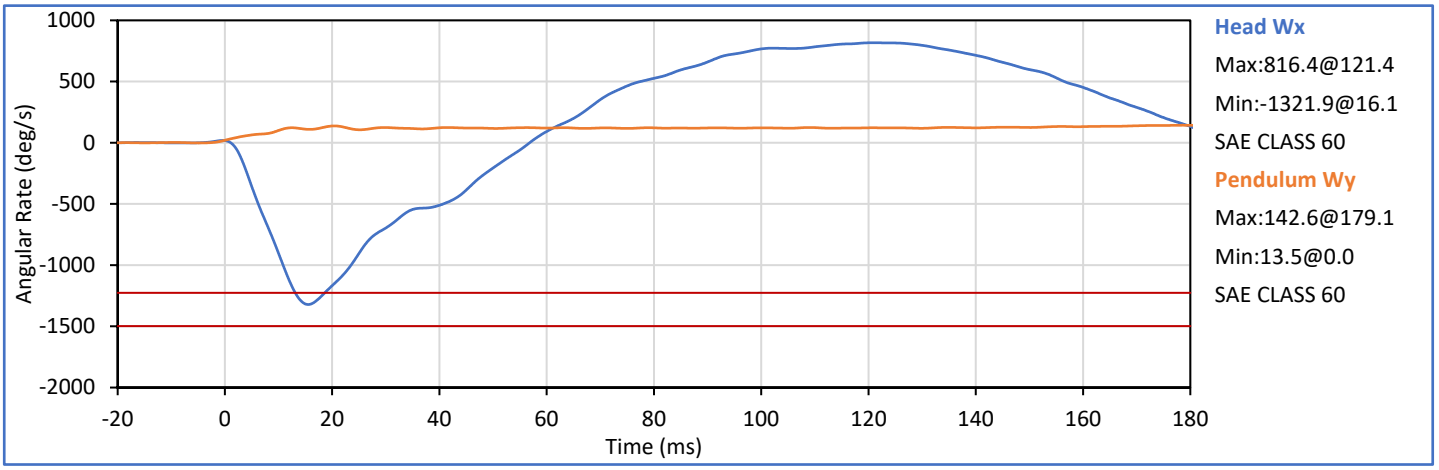
THOR-50M 50th Percentile Male ATD
Neck Lateral Flexion (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

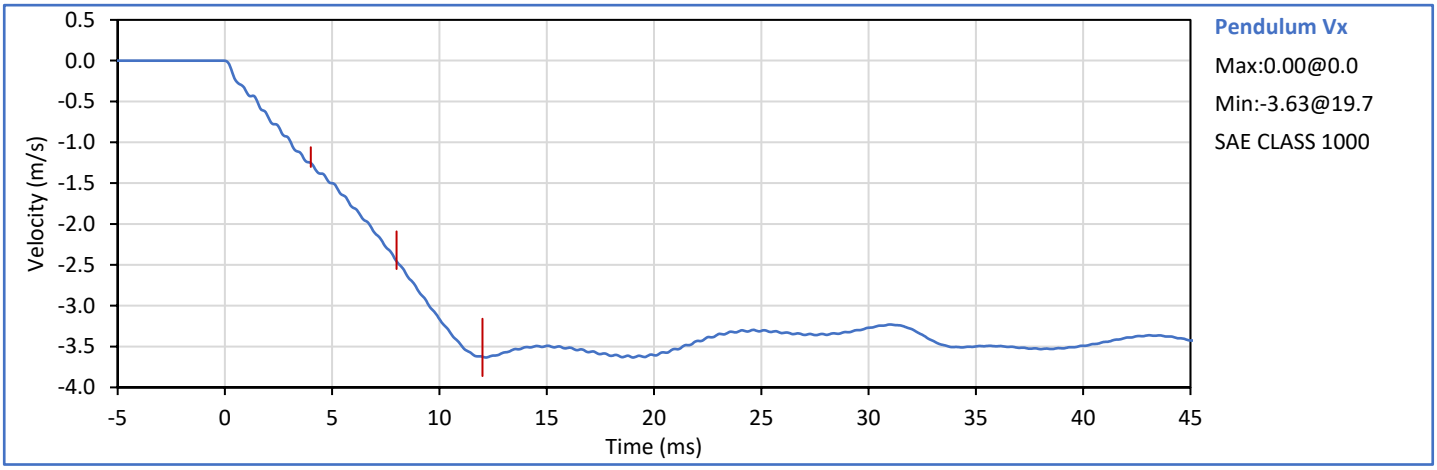
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Neck Lateral Flexion (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Humidity	%	10	70	28	Pass
Pendulum Velocity	m/s	3.35	3.45	3.45	Pass
Pendulum Velocity at 4 ms	m/s	-1.30	-1.06	-1.25	Pass
Pendulum Velocity at 8 ms	m/s	-2.55	-2.09	-2.46	Pass
Pendulum Velocity at 12 ms	m/s	-3.86	-3.16	-3.62	Pass
Peak Upper Neck Mx after 40 ms	Nm	-54.7	-44.8	-44.9	Pass
Peak Head Wx	deg/s	1226	1498	1387	Pass
Peak Head Relative Rotation	deg	37.6	45.9	43.3	Pass
NHTSA 2019-05 Corridor			Overall Test Results		Pass



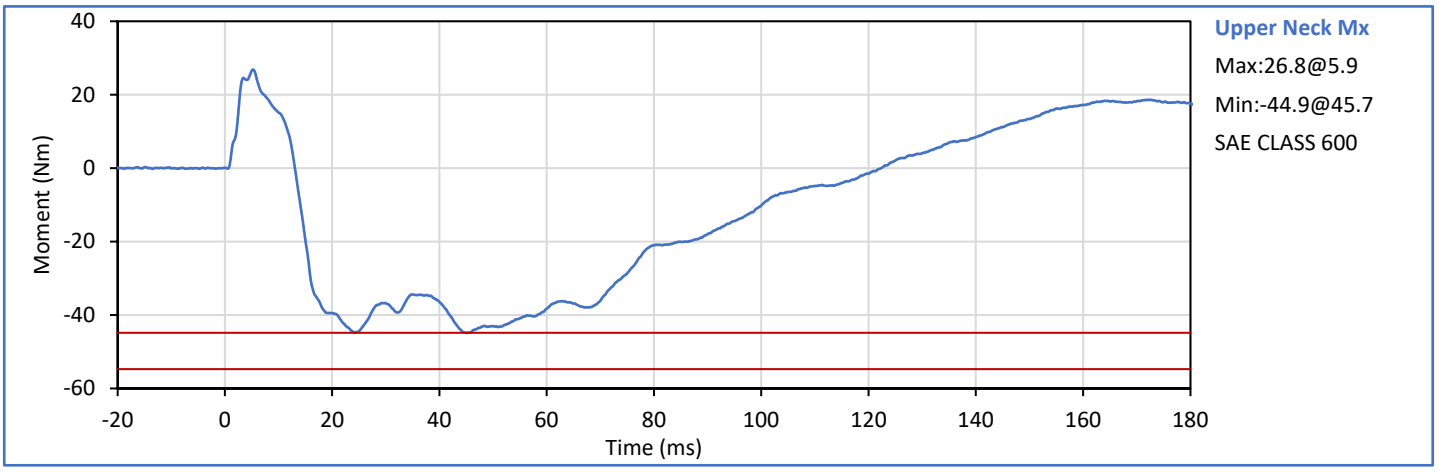
Applus IDIADA KARCO

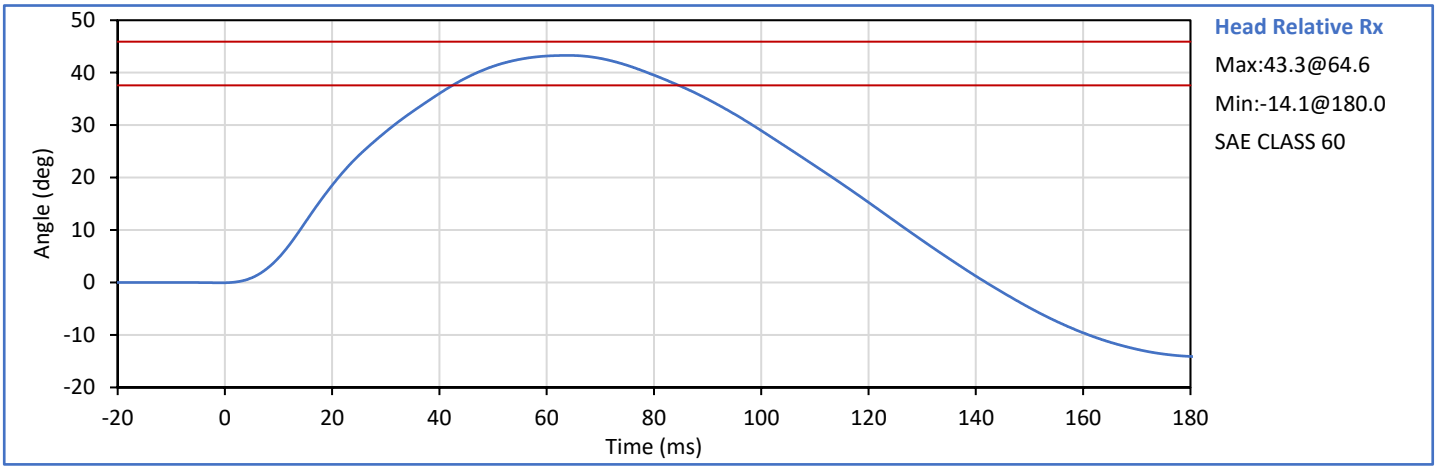
Pre-Test Qualification (Full)

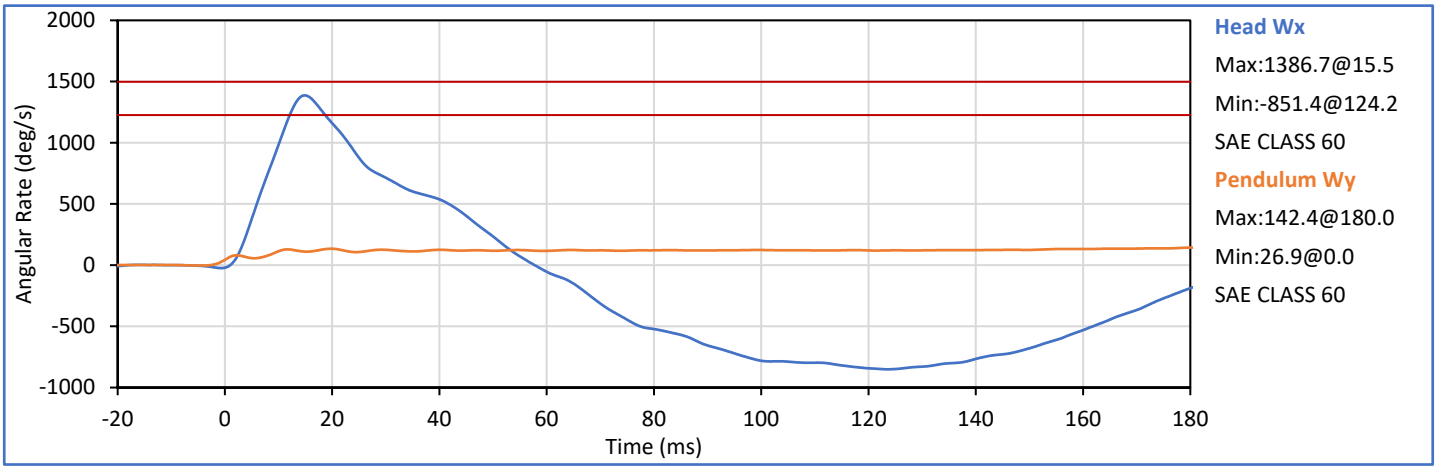
THOR-50M 50th Percentile Male ATD
Neck Lateral Flexion (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

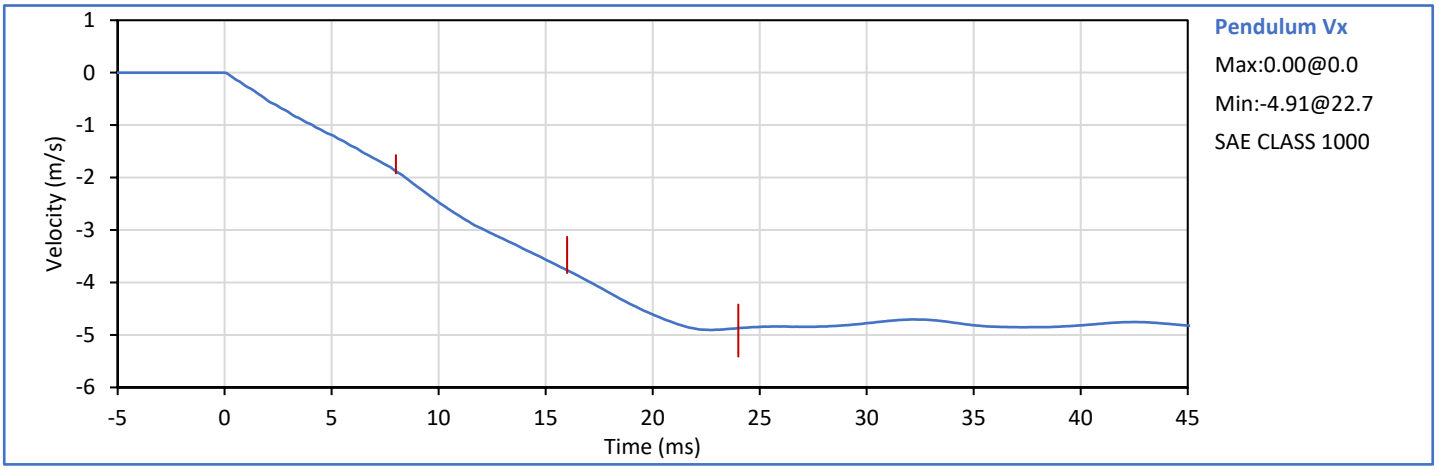
Pre-Test Qualification (Full)

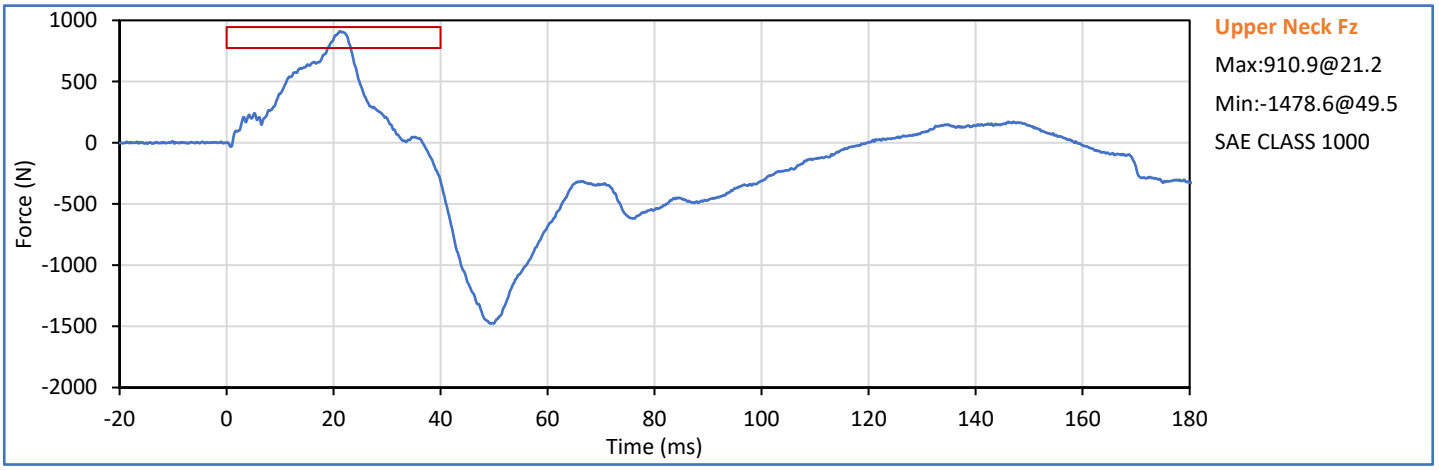
THOR-50M 50th Percentile Male ATD
Neck Flexion Front Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	34	Pass
Pendulum Velocity	m/s	4.95	5.05	4.96	Pass
Pendulum Velocity at 8 ms	m/s	-1.92	-1.57	-1.88	Pass
Pendulum Velocity at 16 ms	m/s	-3.82	-3.13	-3.77	Pass
Pendulum Velocity at 24 ms	m/s	-5.41	-4.42	-4.87	Pass
Peak Upper Neck My	Nm	27.9	34.1	34.0	Pass
Peak Upper Neck Fz (before 40ms)	N	774	946	911	Pass
Peak Head Wy	deg/s	-2172	-1777	-2006	Pass
Peak Head Relative Rotation	deg	-71.0	-58.1	-59.4	Pass
NHTSA 2019-05 Corridor			Overall Test Results		Pass





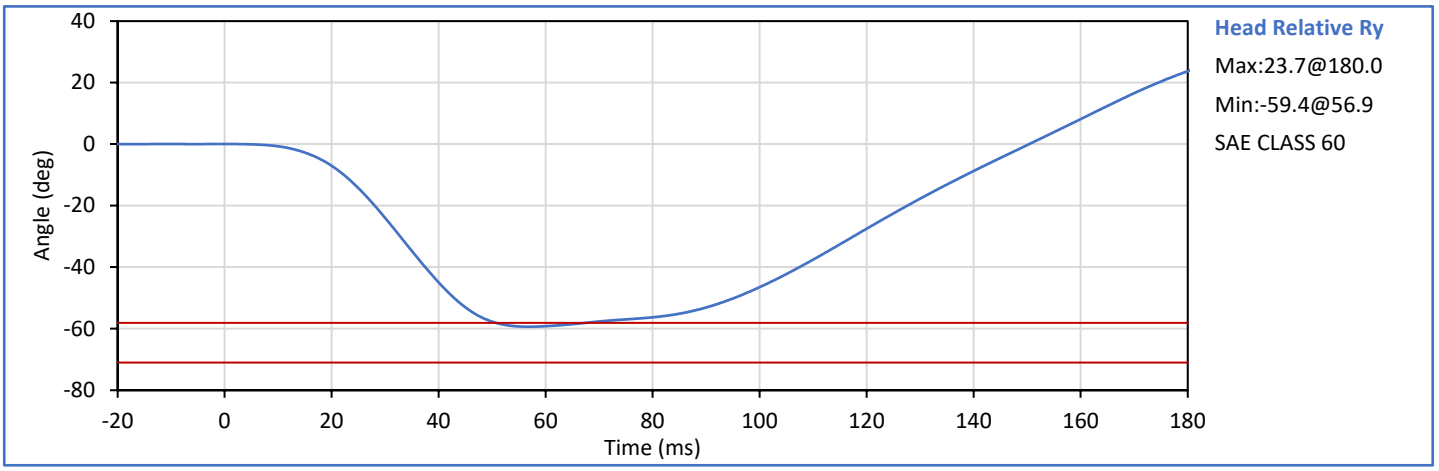
Applus IDIADA KARCO

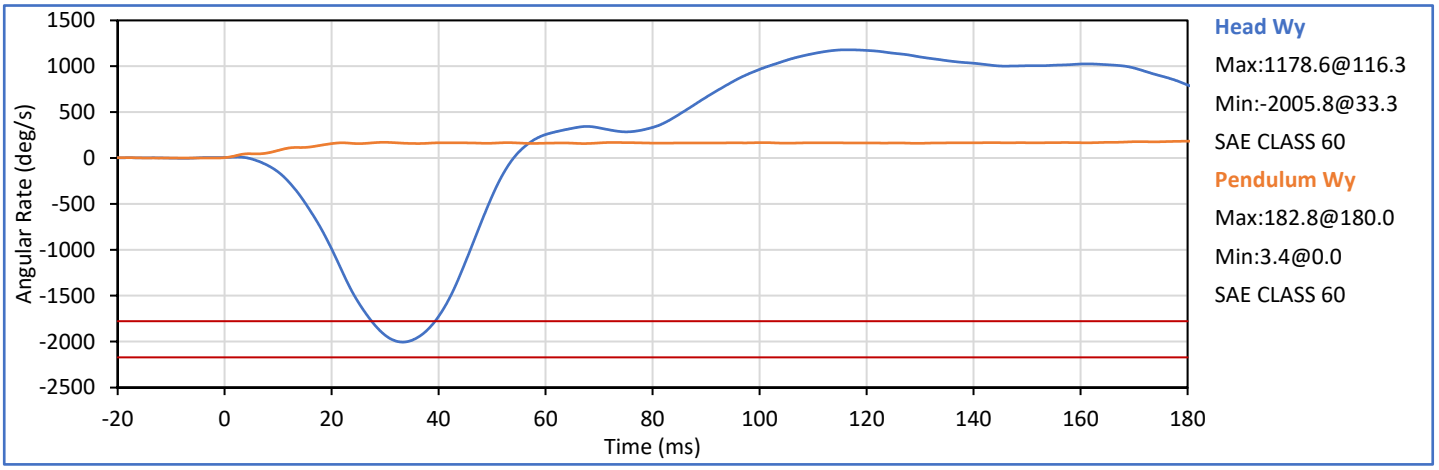
Pre-Test Qualification (Full)

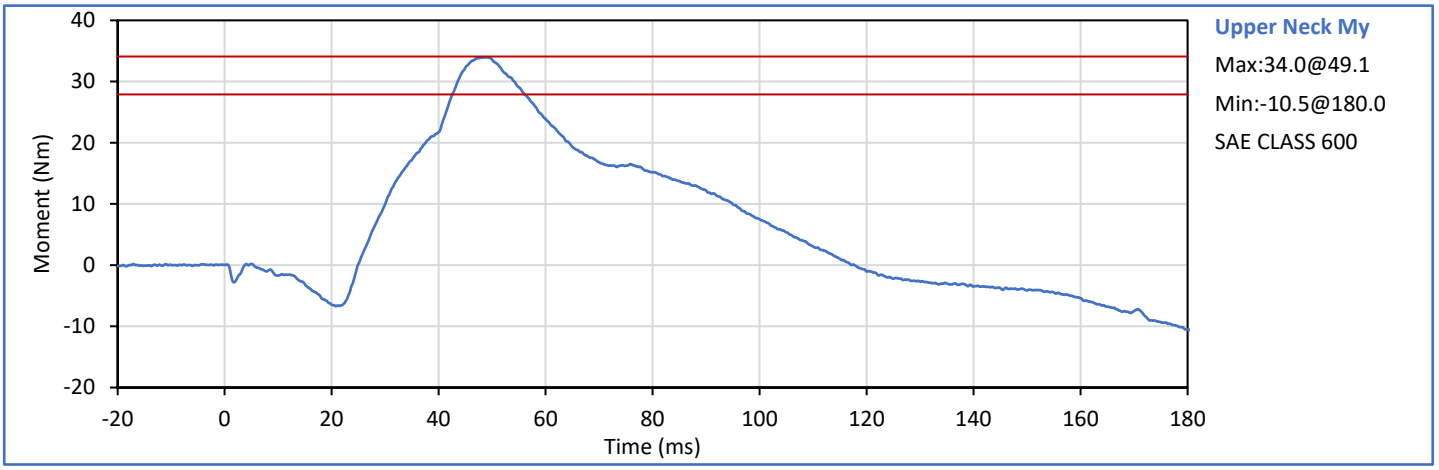
THOR-50M 50th Percentile Male ATD
Neck Flexion Front Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

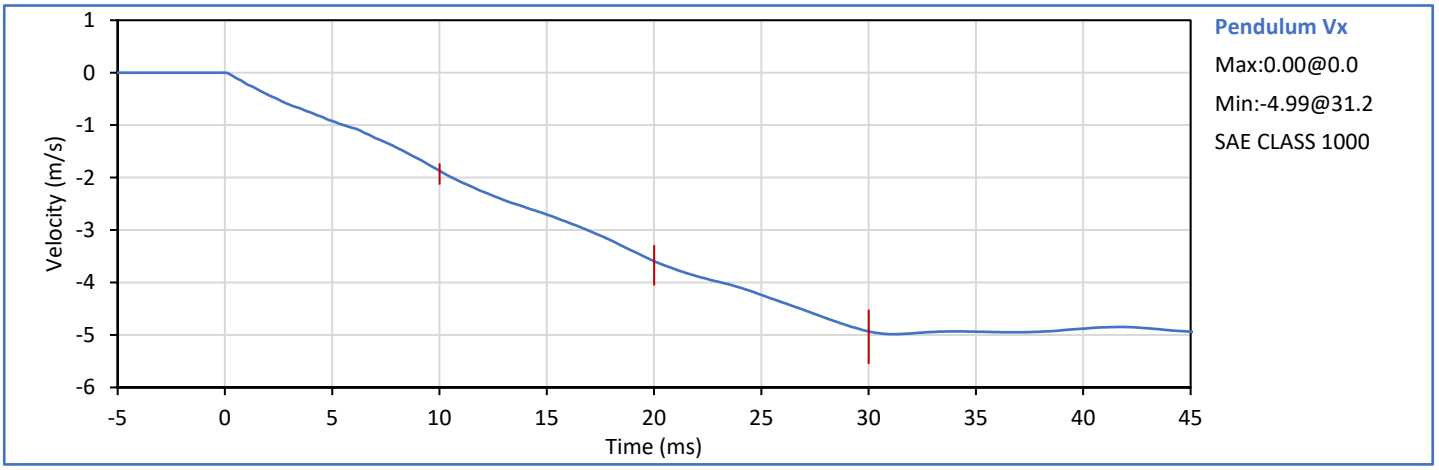
Pre-Test Qualification (Full)

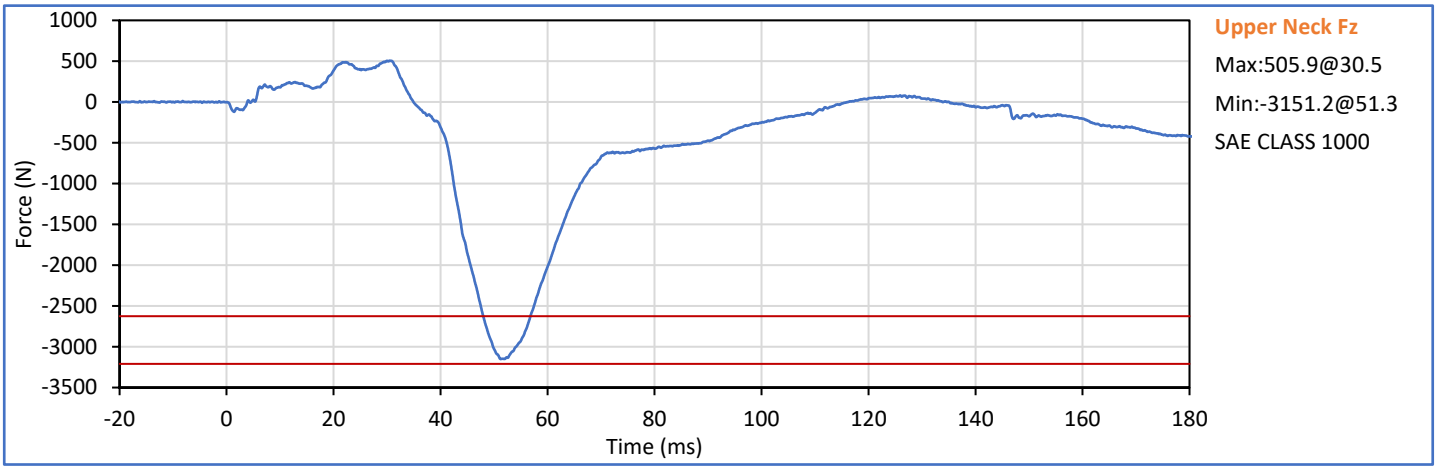
THOR-50M 50th Percentile Male ATD
Neck Extension Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	26	Pass
Pendulum Velocity	m/s	4.95	5.05	4.96	Pass
Pendulum Velocity at 10 ms	m/s	-2.12	-1.74	-1.88	Pass
Pendulum Velocity at 20 ms	m/s	-4.04	-3.30	-3.60	Pass
Pendulum Velocity at 30 ms	m/s	-5.54	-4.53	-4.94	Pass
Peak Upper Neck My	Nm	-25.3	-20.7	-24.0	Pass
Peak Upper Neck Fz	N	-3210	-2626	-3151	Pass
Peak Head Wy	deg/s	1855	2267	2152	Pass
Peak Head Relative Rotation	deg	58.5	71.5	62.1	Pass
NHTSA 2019-05 Corridor			Overall Test Results		Pass





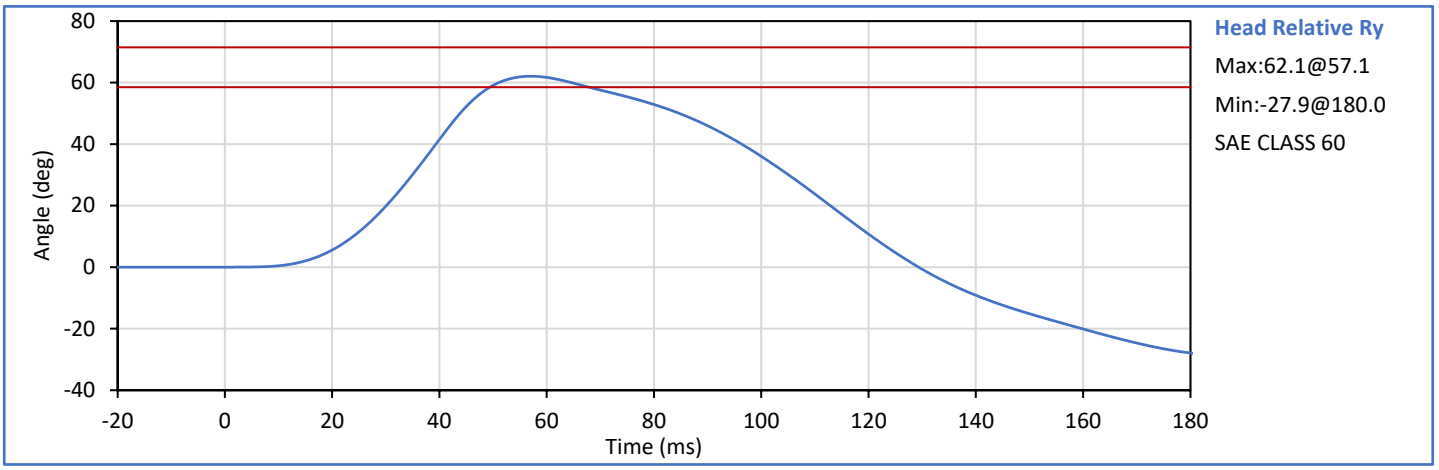
Applus IDIADA KARCO

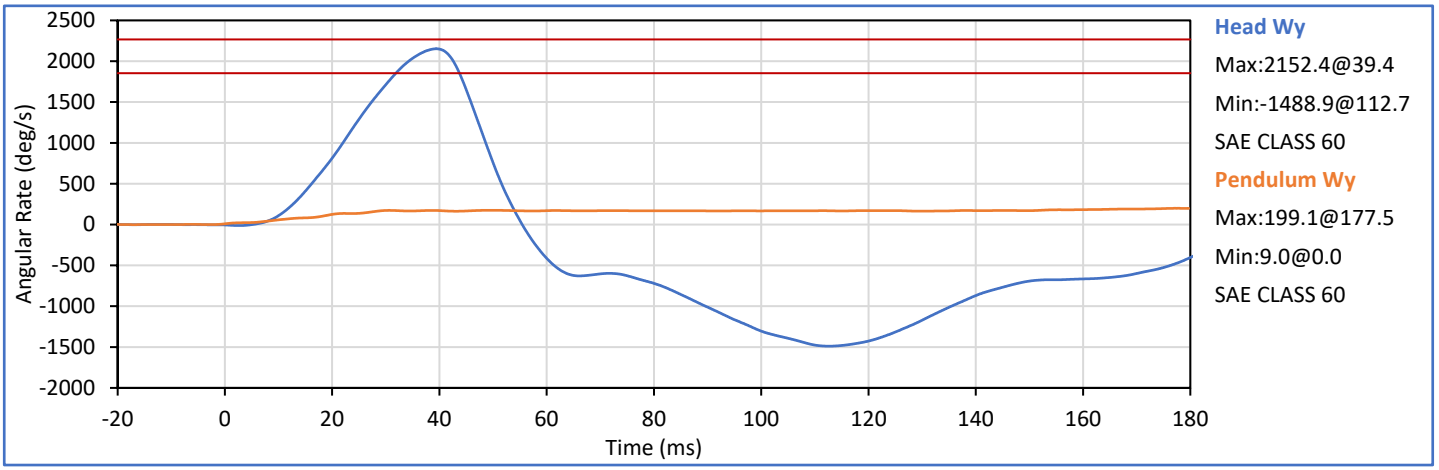
Pre-Test Qualification (Full)

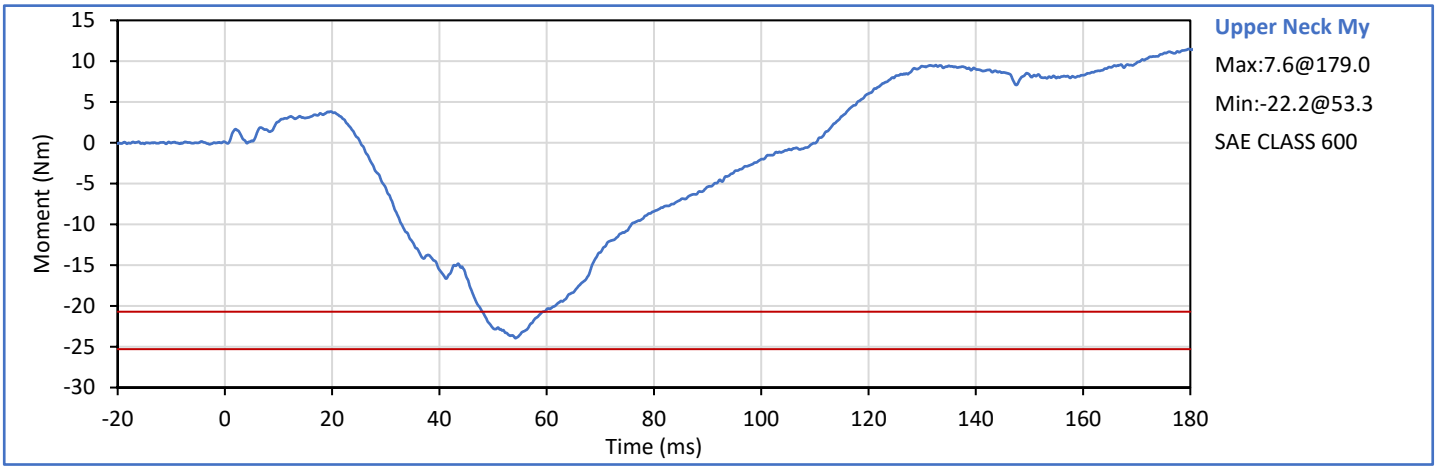
THOR-50M 50th Percentile Male ATD
Neck Extension Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-18







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

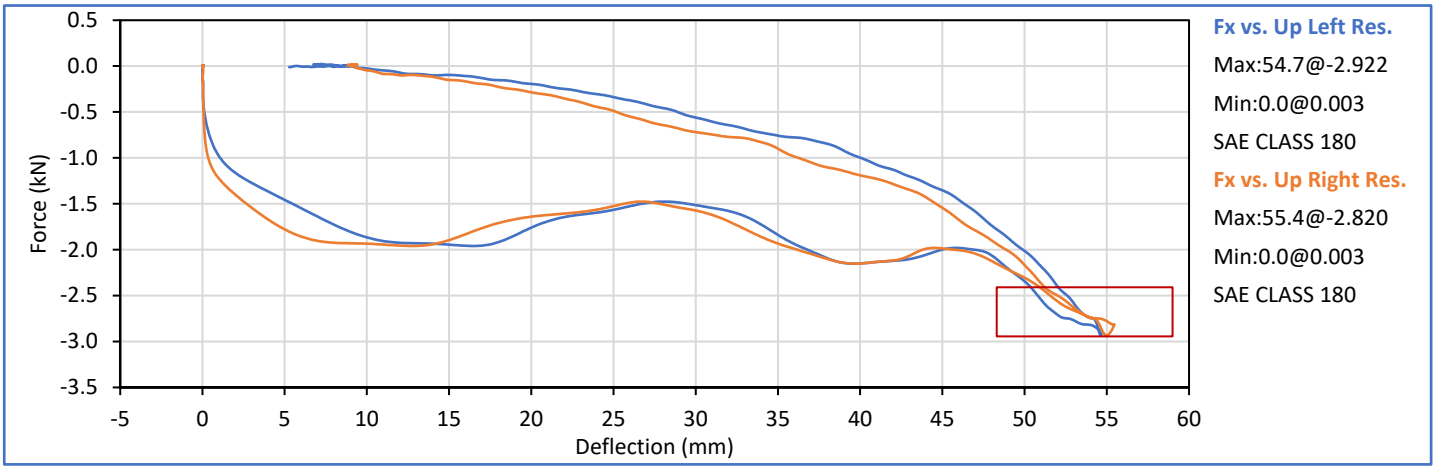
Pre-Test Qualification (Full)

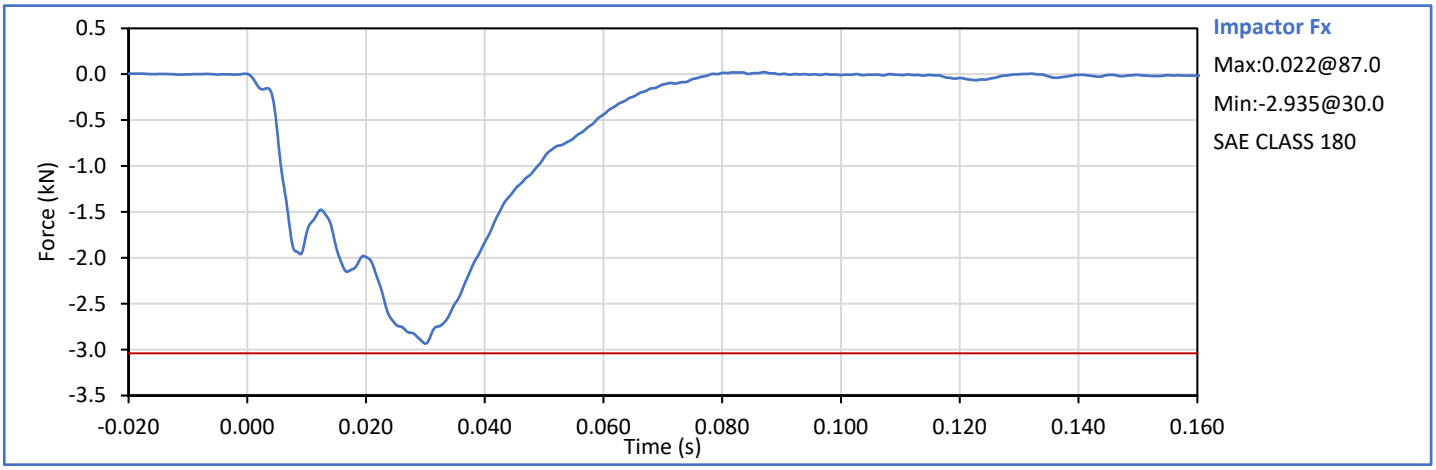
THOR-50M 50th Percentile Male ATD
Thorax Impact (Upper)

ATD Serial No.: EG2595

Test Date: 2021-05-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	25	Pass
Probe Velocity	m/s	4.25	4.35	4.30	Pass
Peak Probe Force	kN	-3.039		-2.935	Pass
Peak Upper Left Deflection Res.	mm	48.3	59.0	54.7	Pass
Peak Upper Right Deflection Res.	mm			55.4	Pass
Absolute Difference L/R Defl. Res.	mm	0.0	5.0	0.8	Pass
Force at Peak Upper Left Res.	mm	-2.944	-2.409	-2.922	Pass
Force at Peak Upper Right Res.	mm			-2.820	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass



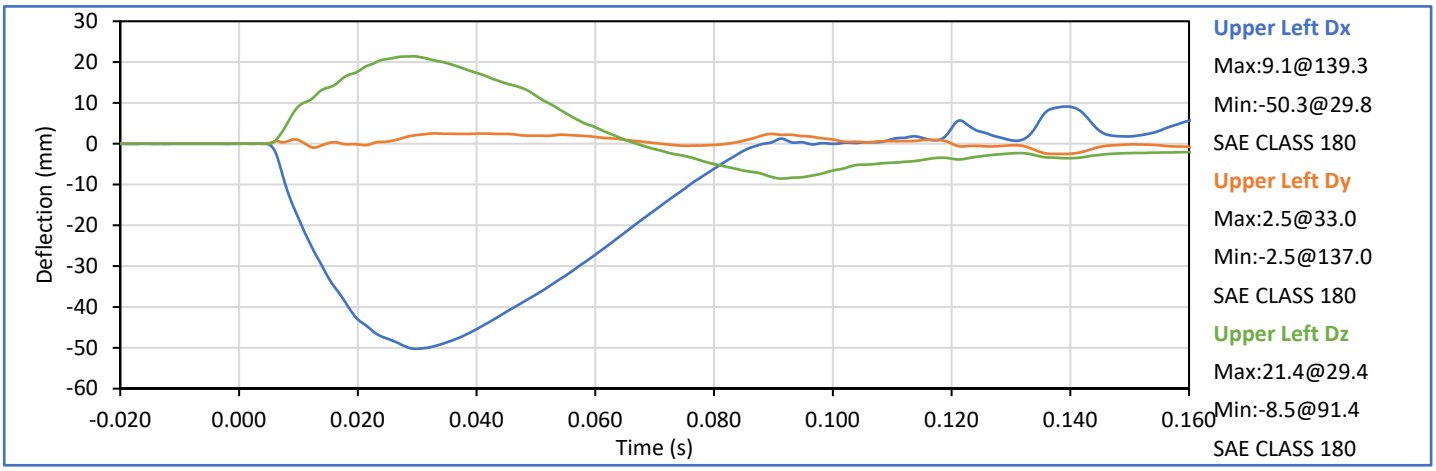


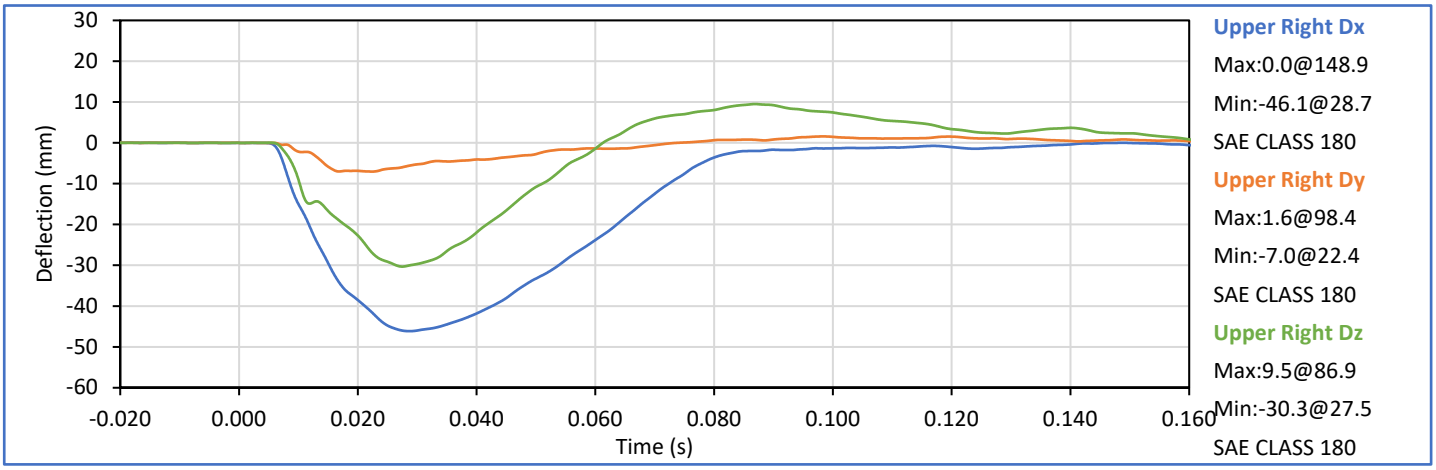
Technician: J. Hernandez

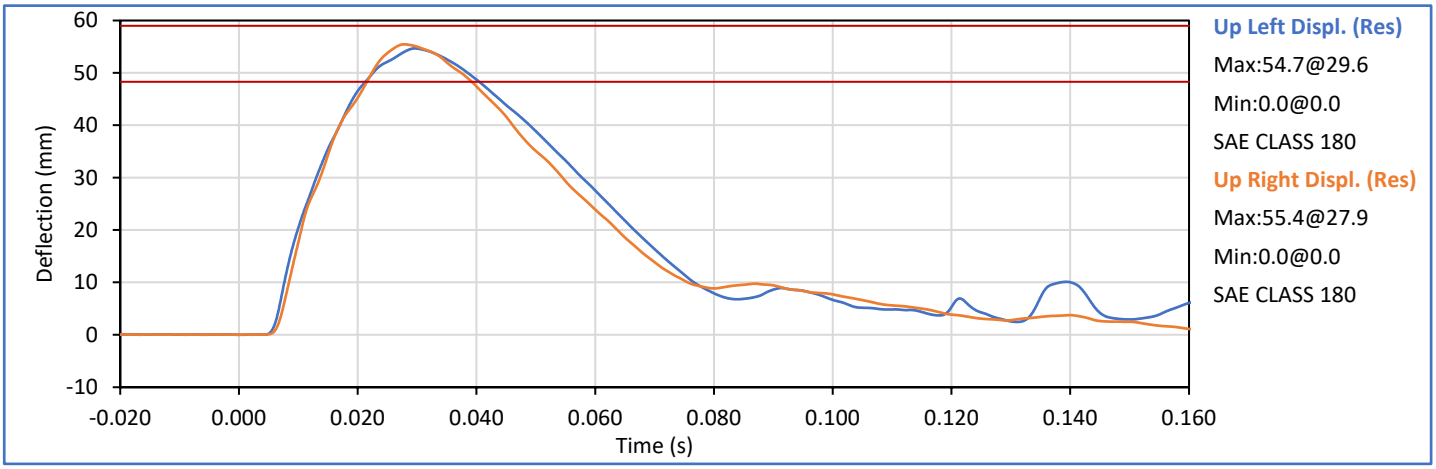
Approved By: P. Puzzuto

ATD Serial No.: EG2595

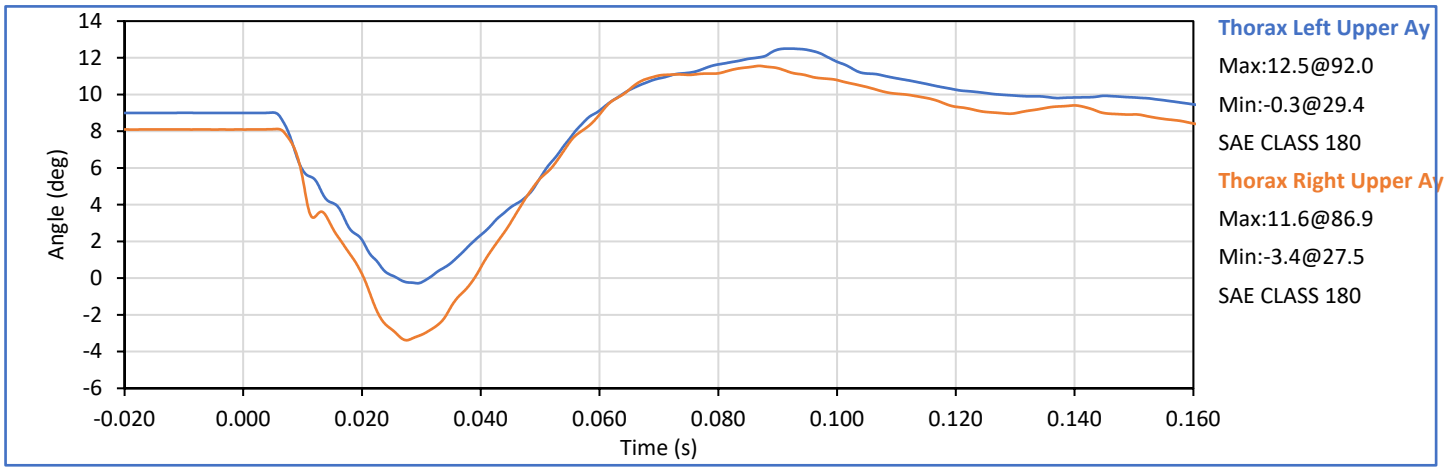
Test Date: 2021-05-19

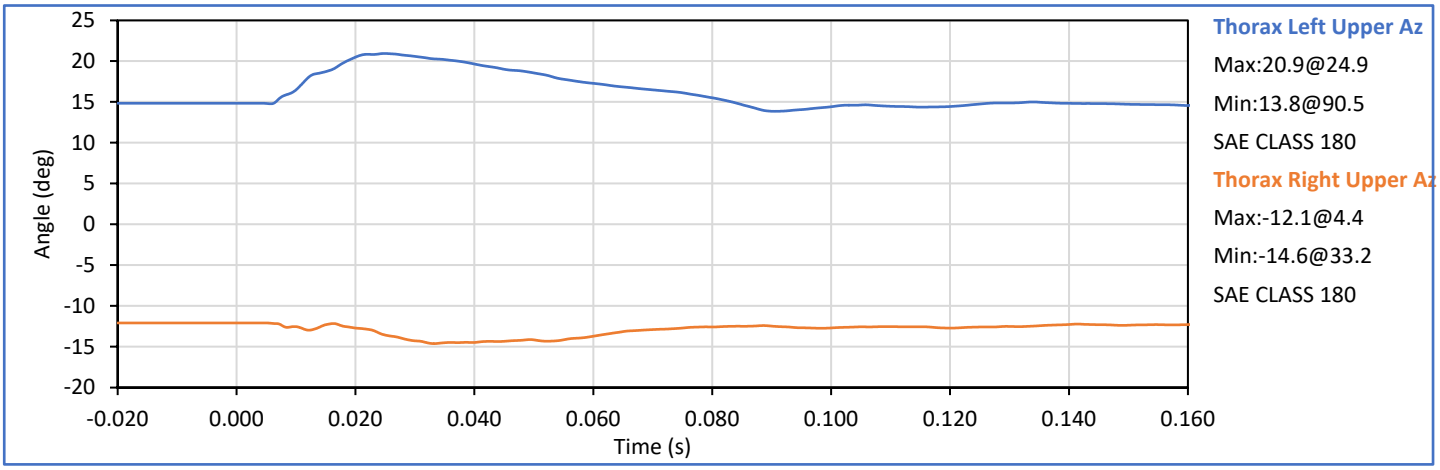






ATD Serial No.: EG2595 Test Date: 2021-05-19





Applus IDIADA KARCO

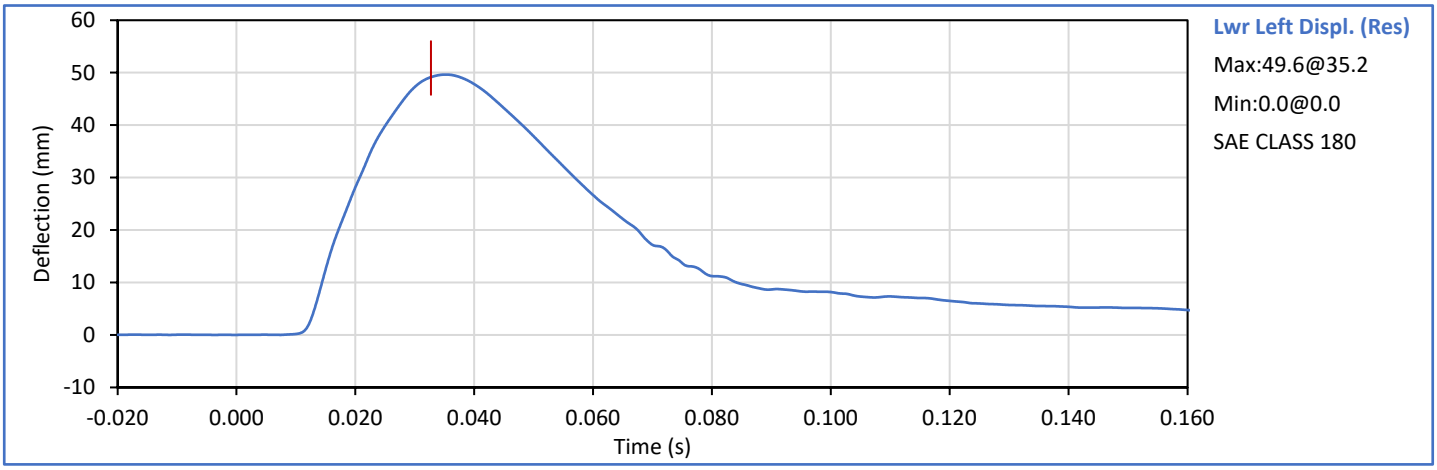
Pre-Test Qualification (Full)

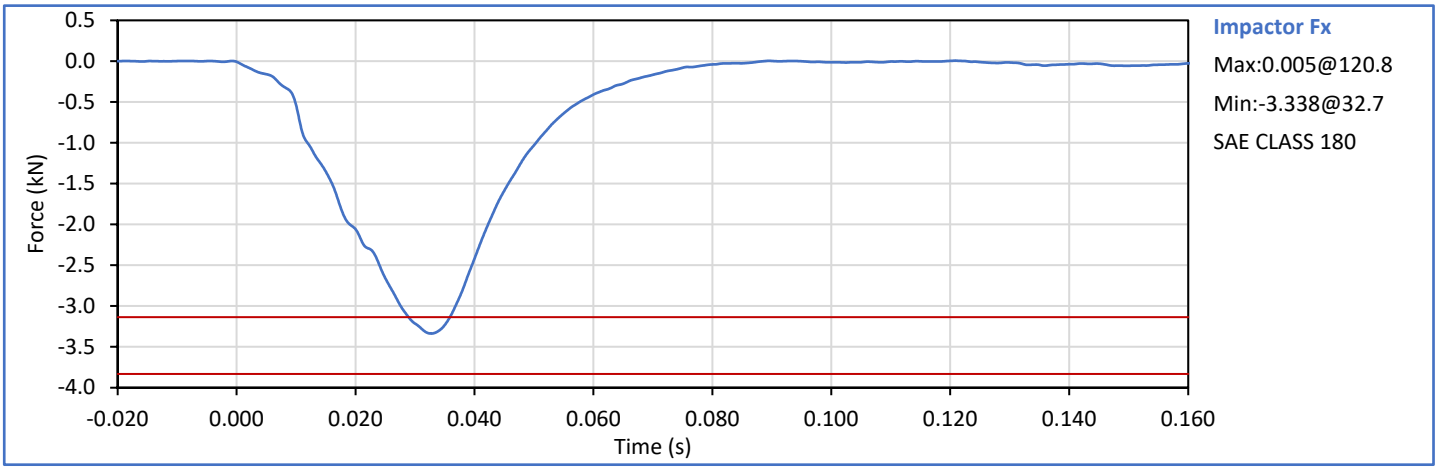
THOR-50M 50th Percentile Male ATD
Thorax Impact (Lower Left)

ATD Serial No.: EG2595

Test Date: 2021-05-20

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	22.2	Pass
Laboratory Relative Humidity	%	10	70	24	Pass
Probe Velocity	m/s	4.25	4.35	4.33	Pass
Peak Probe Force	kN	-3.832	-3.136	-3.338	Pass
Lower Left Defl. Res. at Peak Fx	mm	45.8	56.0	49.1	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

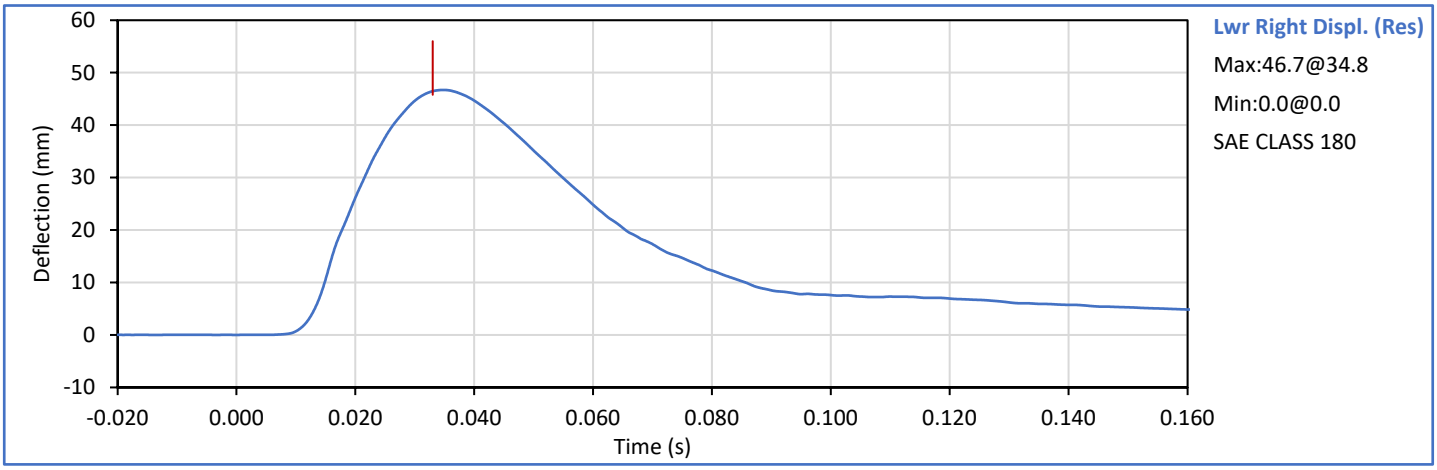
Pre-Test Qualification (Full)

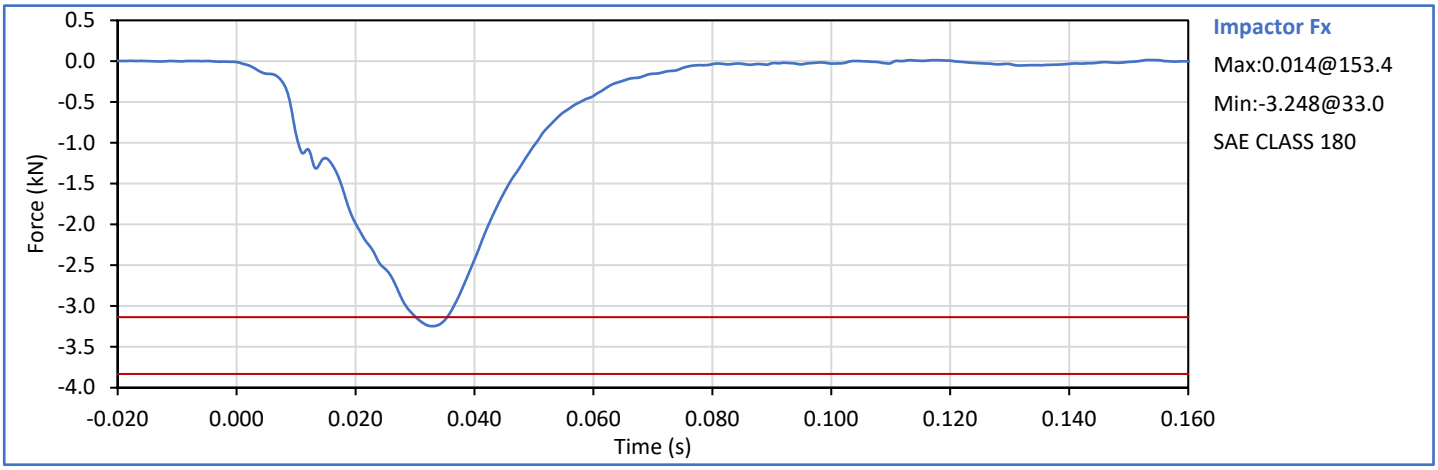
THOR-50M 50th Percentile Male ATD
Thorax Impact (Lower Right)

ATD Serial No.: EG2595

Test Date: 2021-05-20

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	26	Pass
Probe Velocity	m/s	4.25	4.35	4.32	Pass
Peak Probe Force	kN	-3.832	-3.136	-3.248	Pass
Lower Left Defl. Res. at Peak Fx	mm	45.8	56.0	46.4	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

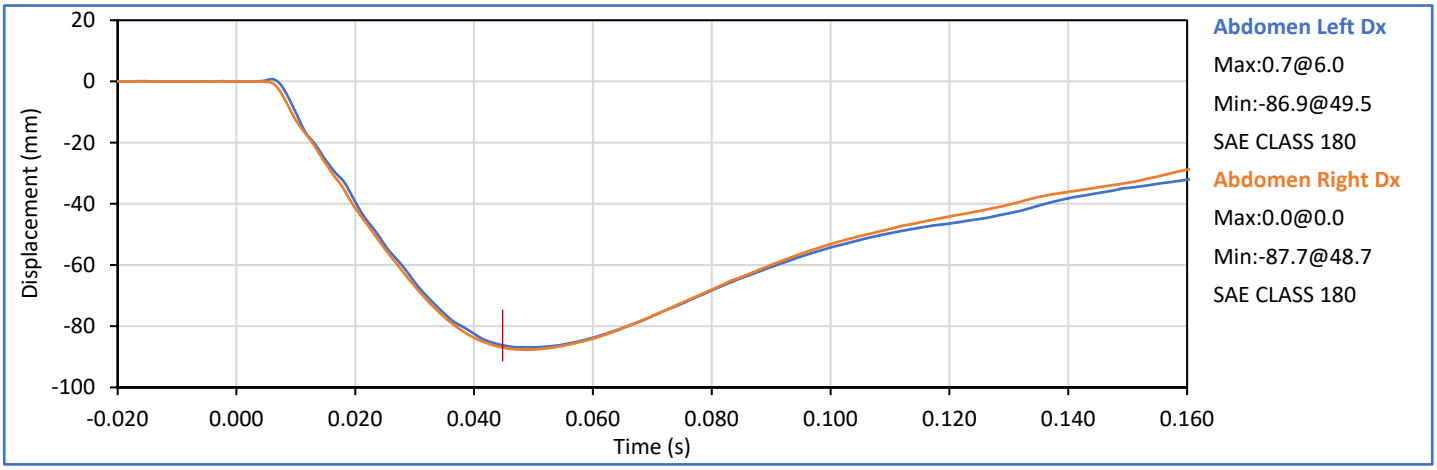
Pre-Test Qualification (Full)

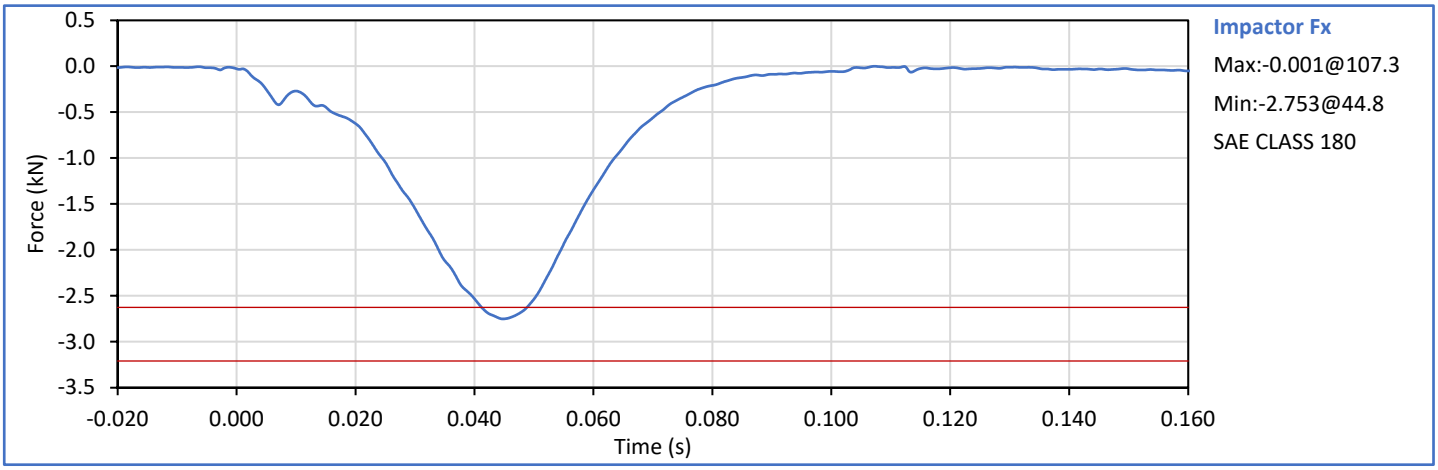
THOR-50M 50th Percentile Male ATD
Abdomen Qualificaion

ATD Serial No.: EG2595

Test Date: 2021-05-20

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	34	Pass
Probe Velocity	m/sec	3.25	3.35	3.32	Pass
Peak Probe Force	kN	-3.210	-2.626	-2.753	Pass
Lower Left Dx at Time of Peak Force	mm	-91.3	-74.7	-86.2	Pass
Lower Right Dx at Time of Peak Force	mm			-87.0	Pass
Absolute Difference of Left/Right Dx	mm	0.0	8.0	0.7	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

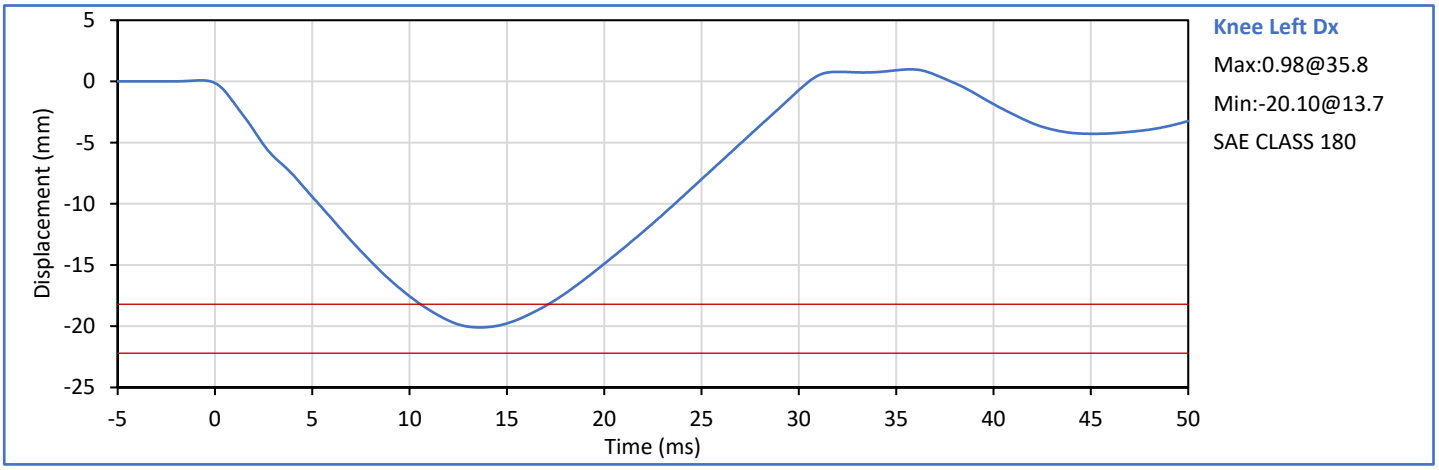
Pre-Test Qualification (Full)

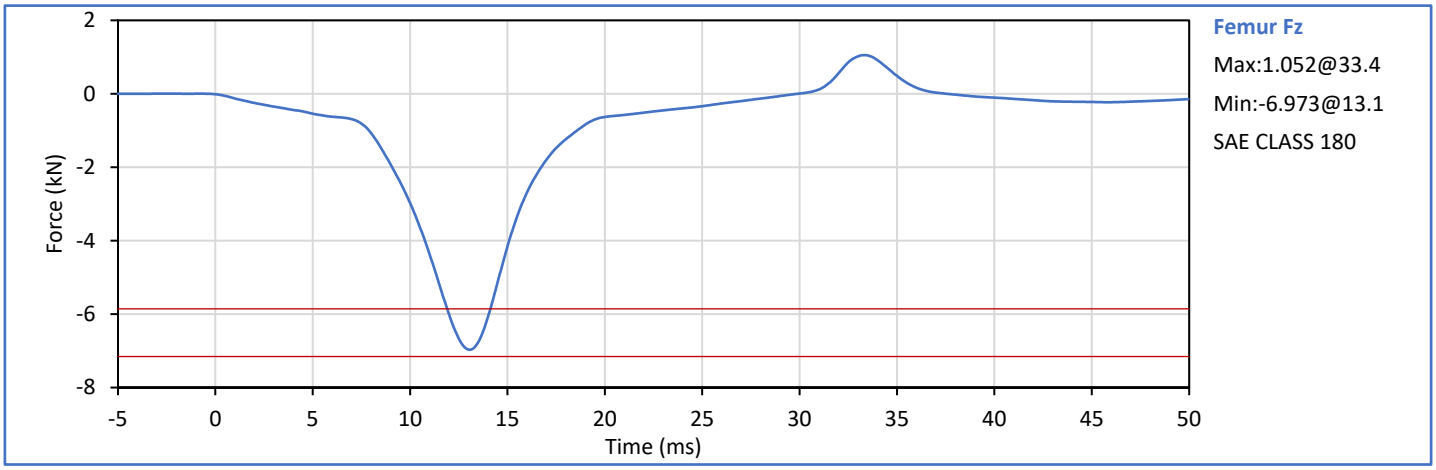
THOR-50M 50th Percentile Male ATD
Knee (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-13

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	31	Pass
Pendulum Velocity	m/s	2.15	2.25	2.22	Pass
Peak Femur Fz	kN	-7.156	-5.855	-6.973	Pass
Knee Dx at Peak Femur Fz	mm	-22.20	-18.20	-20.05	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

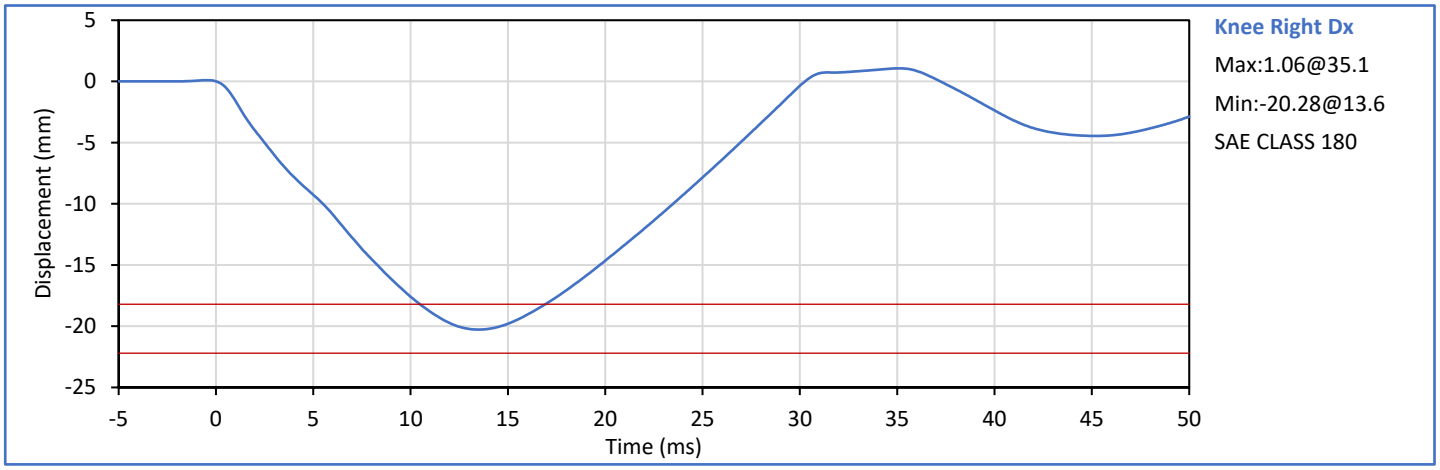
Pre-Test Qualification (Full)

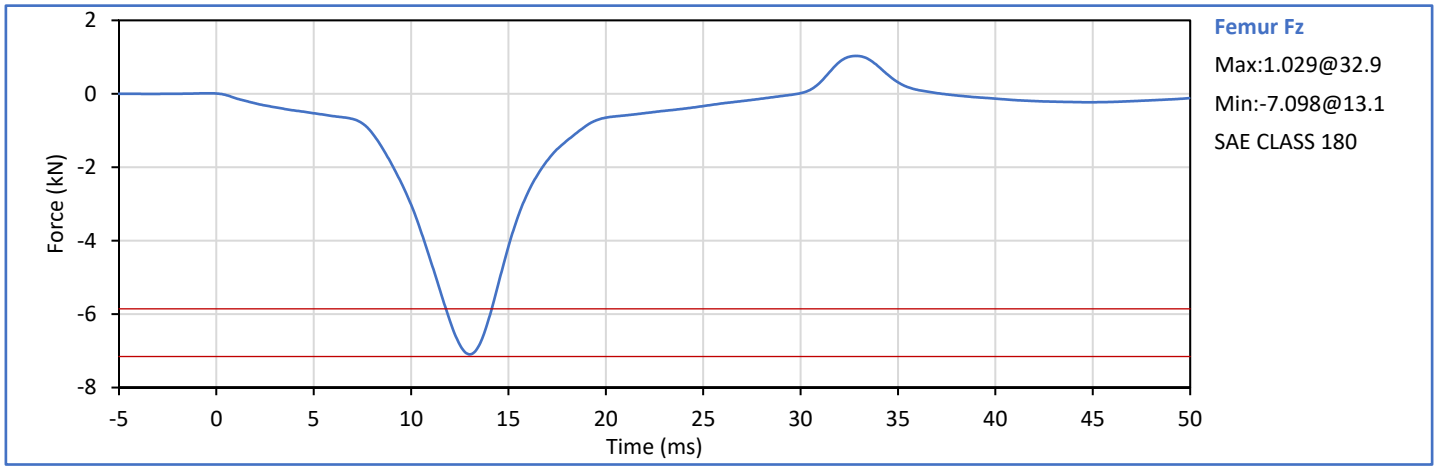
THOR-50M 50th Percentile Male ATD
Knee (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-13

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	2.15	2.25	2.23	Pass
Peak Femur Fz	kN	-7.156	-5.855	-7.098	Pass
Knee Dx at Peak Femur Fz	mm	-22.20	-18.20	-20.23	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

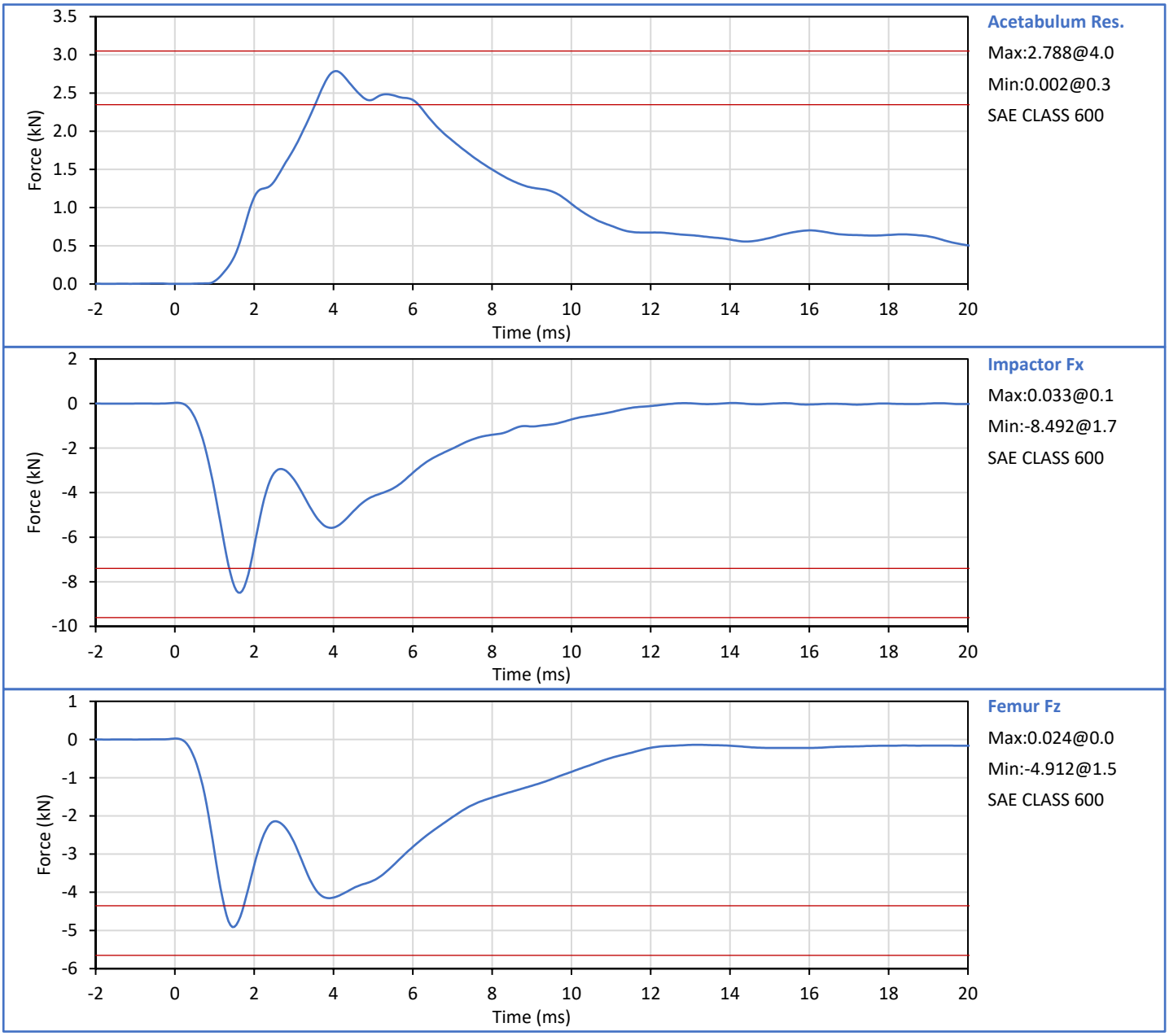
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Upper Leg (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-13

Tested Parameter	Units	Spec. Low[1]	Spec. High[1]	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	32	Pass
Pendulum Velocity	m/s	3.25	3.35	3.34	Pass
Peak Impactor Force	kN	-9.605	-7.395	-8.492	Pass
Peak Femur Fz	kN	-5.650	-4.350	-4.912	Pass
Acetabulum Force Resultant	kN	2.349	3.051	2.788	Pass
NHTSA Corridor 2020-03 (Preliminary Corridor)			Overall Test Results		Pass



J. Hernandez

P. Puzzuto

Applus IDIADA KARCO

Pre-Test Qualification (Full)

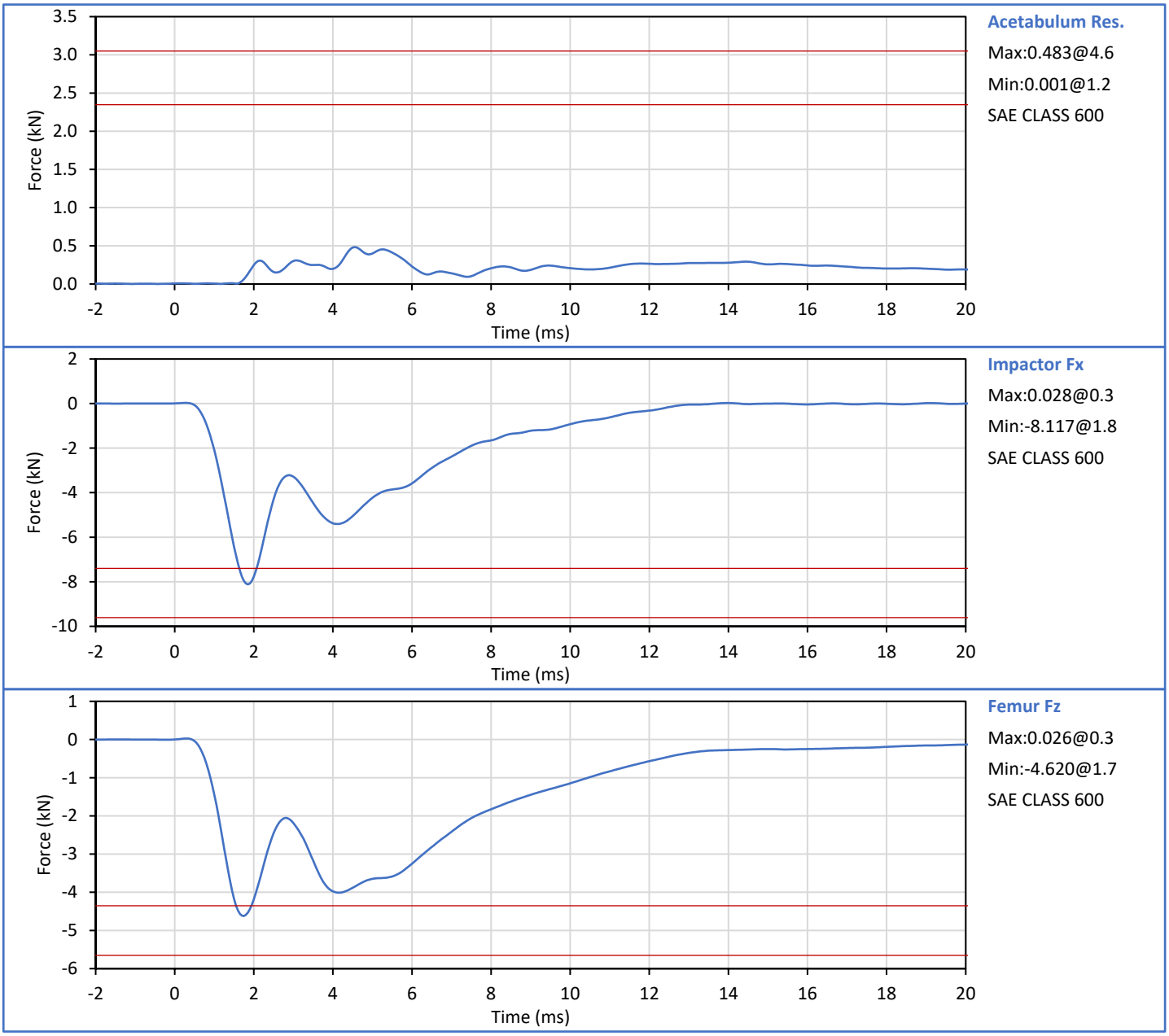
THOR-50M 50th Percentile Male ATD
Upper Leg (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-13

Tested Parameter	Units	Spec. Low[1]	Spec. High[1]	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	32	Pass
Pendulum Velocity	m/s	3.25	3.35	3.34	Pass
Peak Impactor Force	kN	-9.605	-7.395	-8.117	Pass
Peak Femur Fz	kN	-5.650	-4.350	-4.620	Pass
Acetabulum Force Resultant	kN	2.349	3.051	0.483	**Fail** *
NHTSA Corridor 2020-03 (Preliminary Corridor)			Overall Test Results		**Fail**

* Acetablum Load Cell Fx is not functioning



J. Hernandez

P. Puzzuto

Applus IDIADA KARCO

Pre-Test Qualification (Full)

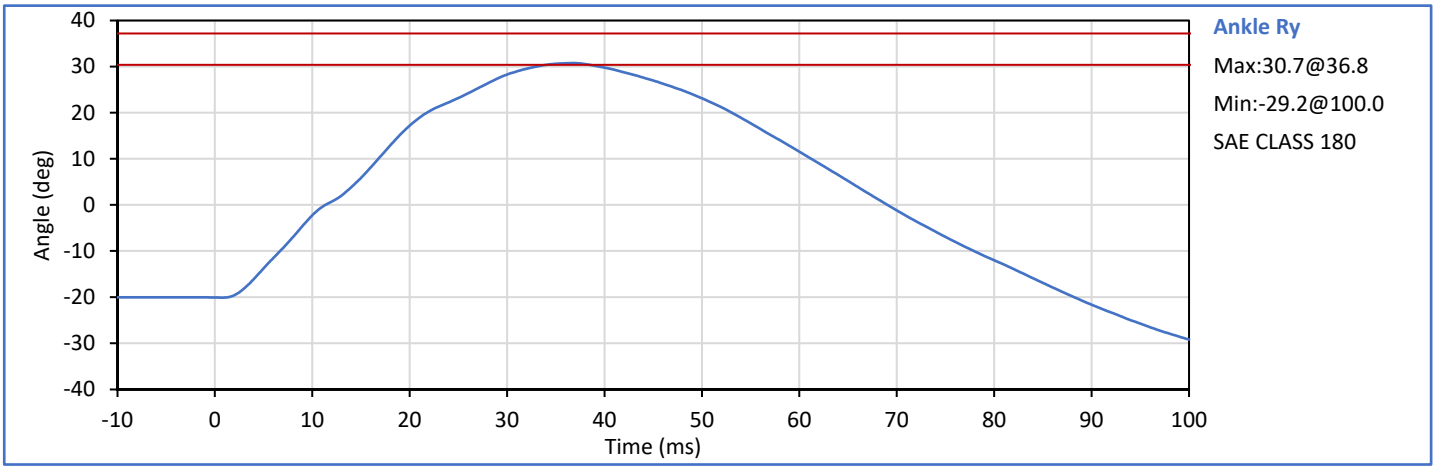
THOR-50M 50th Percentile Male ATD
Ball of Foot (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-17

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	32	Pass
Pendulum Velocity	m/s	4.95	5.05	5.03	Pass
Peak Ankle Ry	deg	30.4	37.2	30.7	Pass
Peak Ankle Resistive Moment	Nm	49.8	60.8	50.1	Pass
Peak Lower Tibia Fz	kN	-3.487	-2.853	-3.155	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass

x



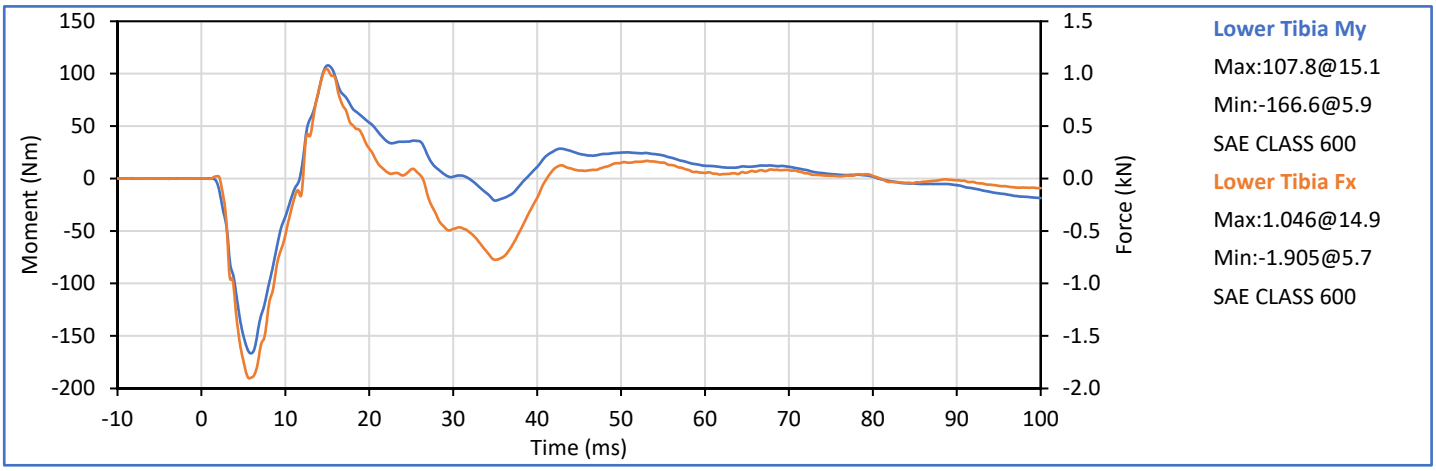
Applus IDIADA KARCO

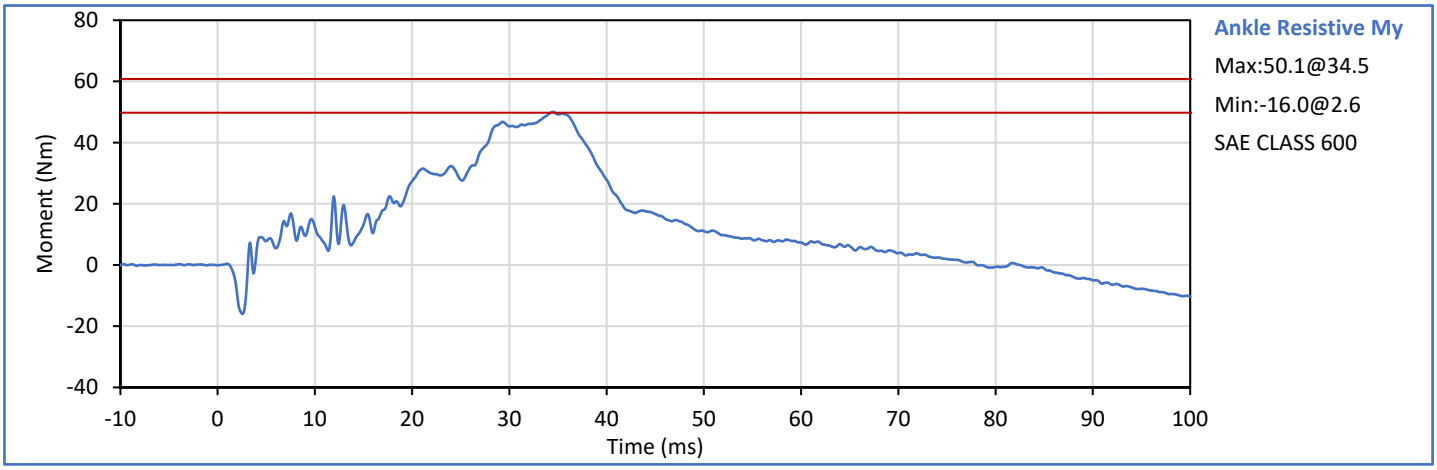
Pre-Test Qualification (Full)

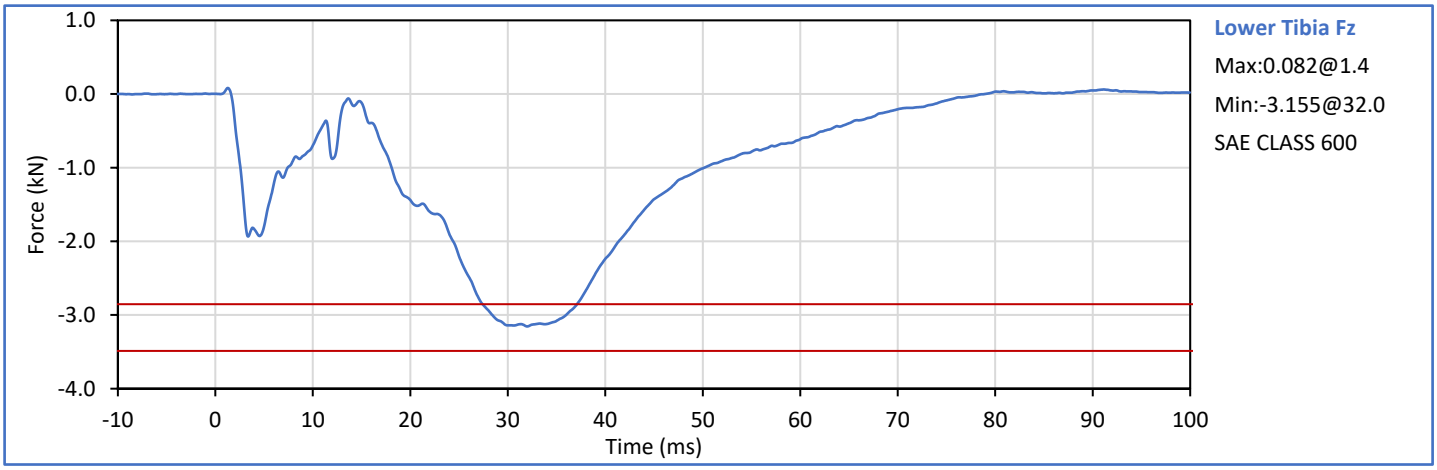
THOR-50M 50th Percentile Male ATD
Ball of Foot (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-17







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

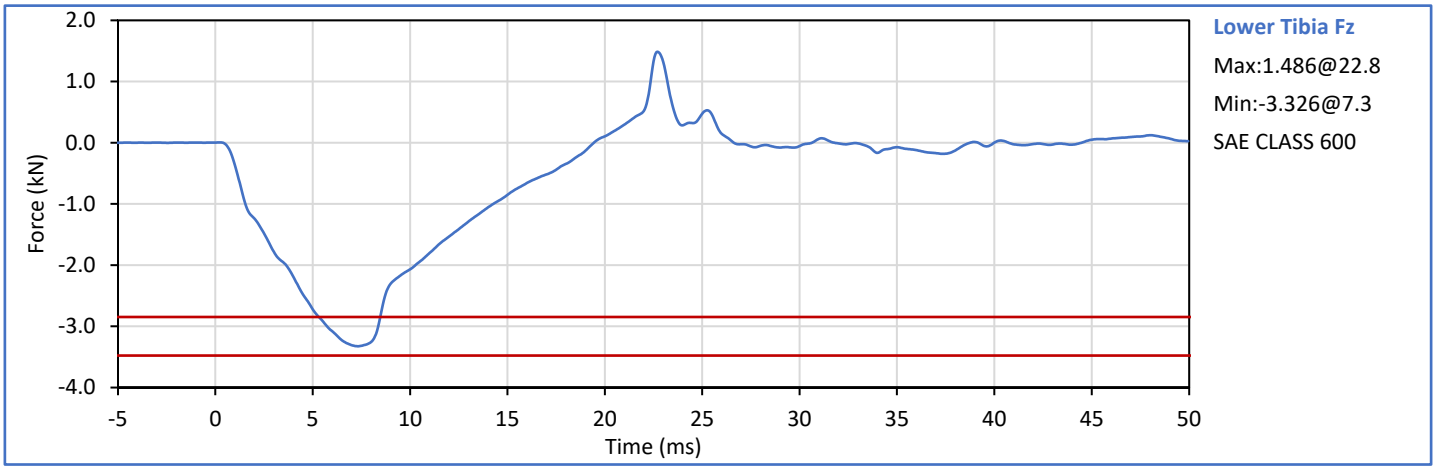
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Heel of Foot (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-17

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	40	Pass
Pendulum Velocity	m/s	3.95	4.05	4.01	Pass
Peak Lower Tibia Fz	kN	-3.478	-2.846	-3.326	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

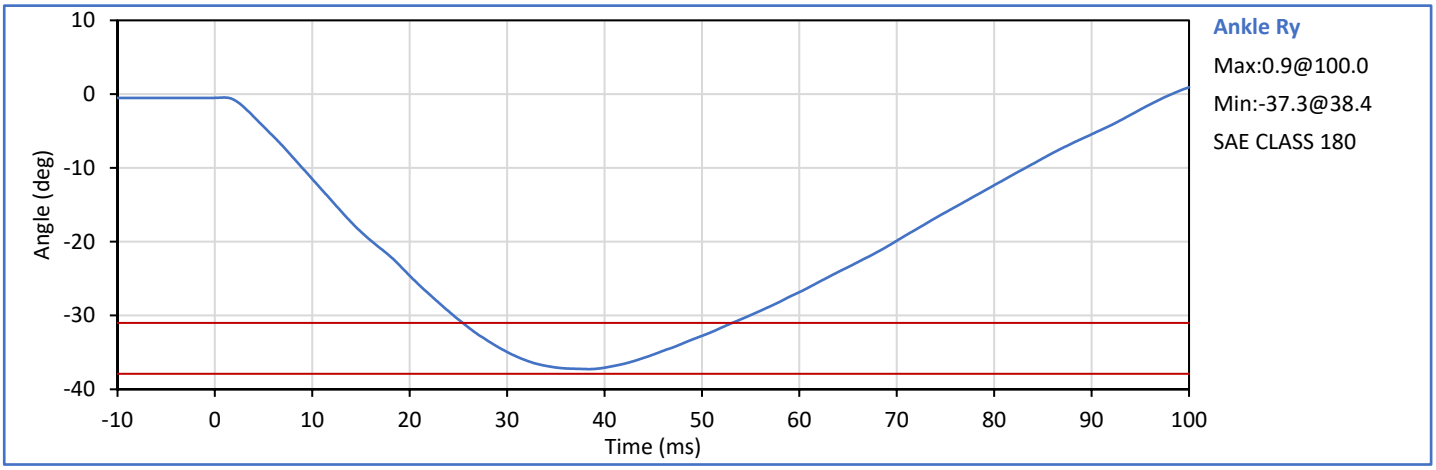
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Ankle Inversion (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-14

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	32	Pass
Pendulum Velocity	m/s	1.95	2.05	2.02	Pass
Peak Ankle Rx	deg	-37.9	-31.0	-37.3	Pass
Peak Ankle Resistive Mx	Nm	-43.0	-35.2	-40.8	Pass
Peak Lower Tibia Fz	kN	-0.555	-0.454	-0.547	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass



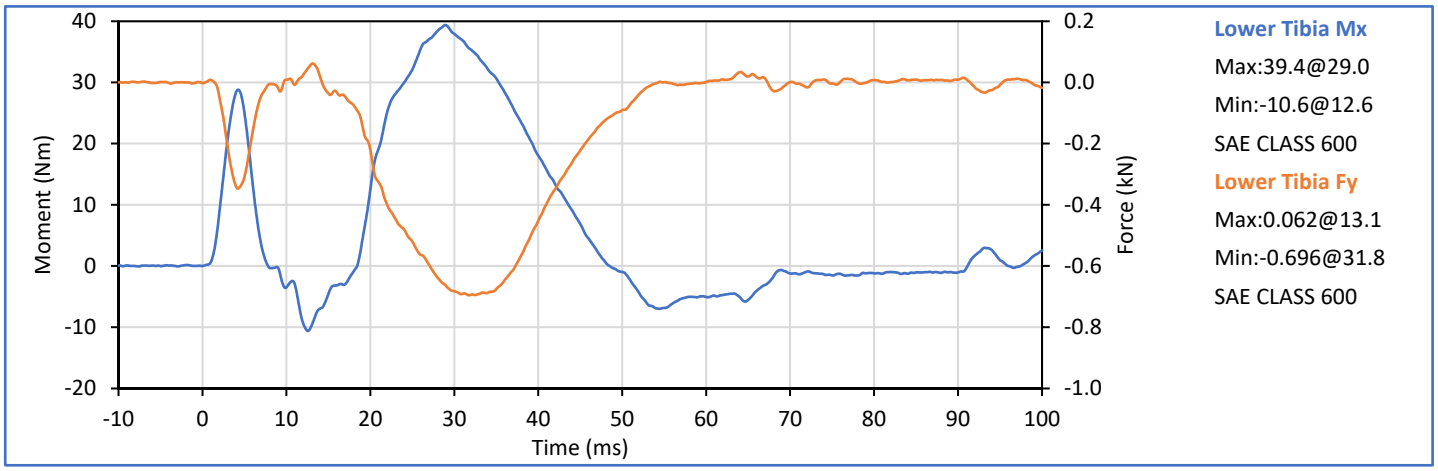
Applus IDIADA KARCO

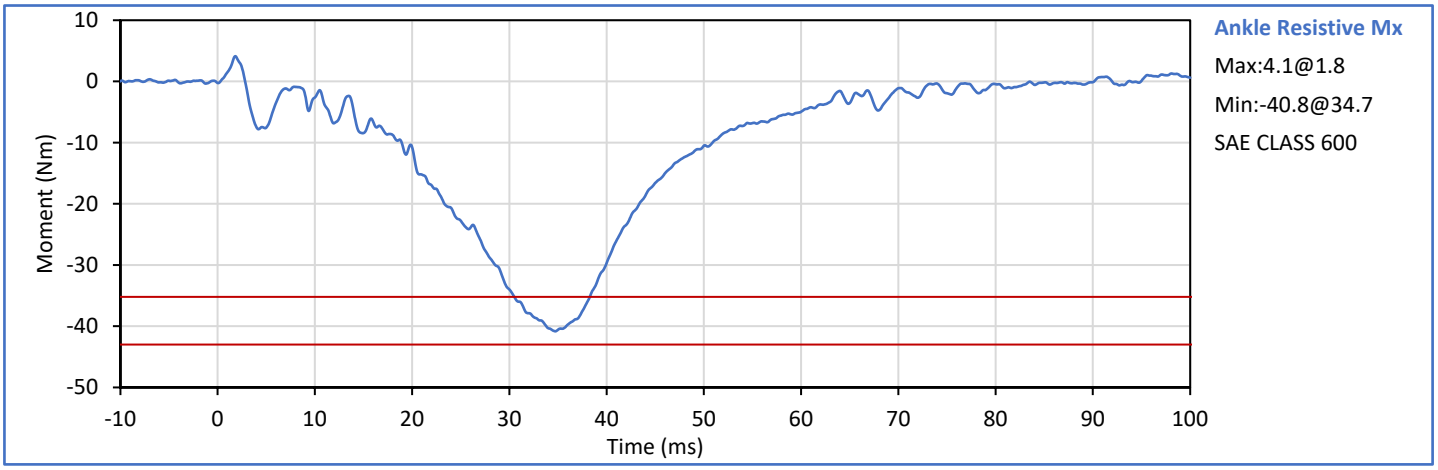
Pre-Test Qualification (Full)

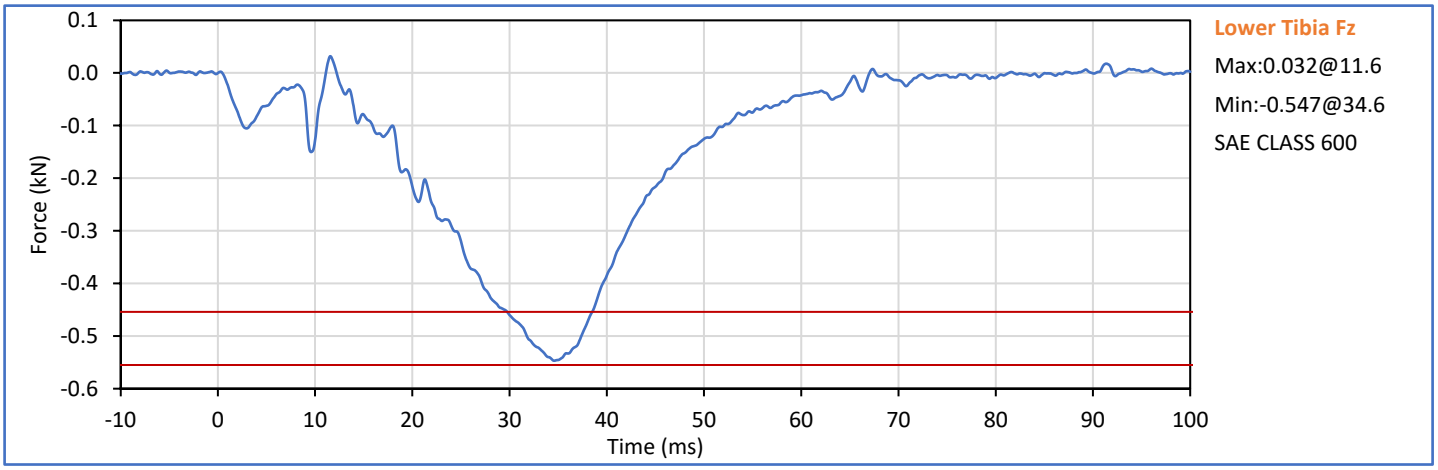
THOR-50M 50th Percentile Male ATD
Ankle Inversion (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-14







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

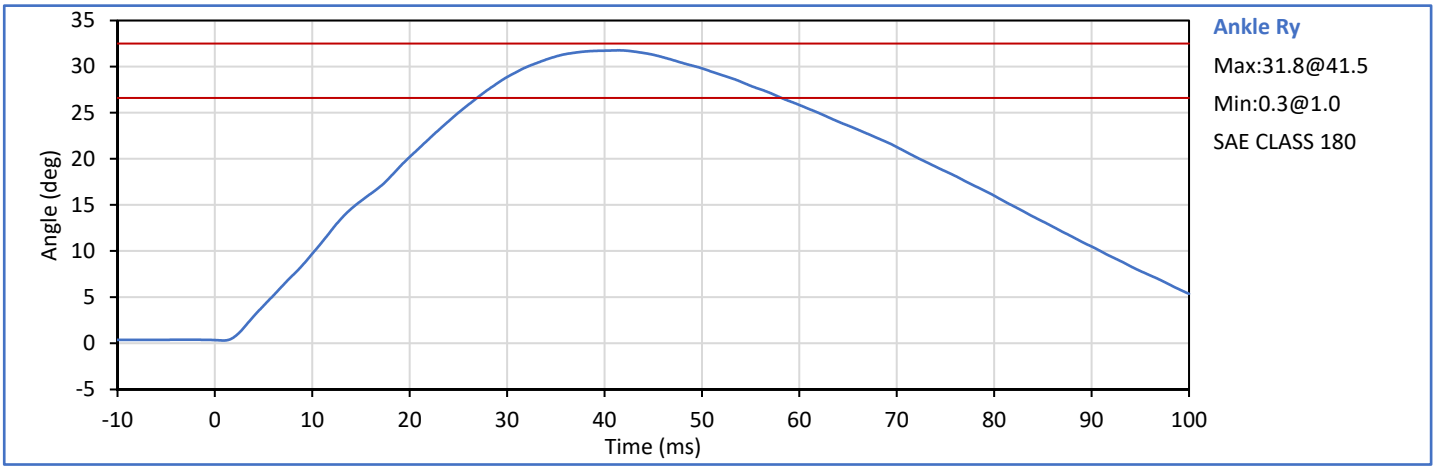
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Ankle Eversion (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-14

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	32	Pass
Pendulum Velocity	m/s	1.95	2.05	1.99	Pass
Peak Ankle Rx	deg	26.6	32.5	31.8	Pass
Peak Ankle Resistive Mx	Nm	38.7	47.3	40.0	Pass
Peak Lower Tibia Fz	kN	-0.629	-0.514	-0.589	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass



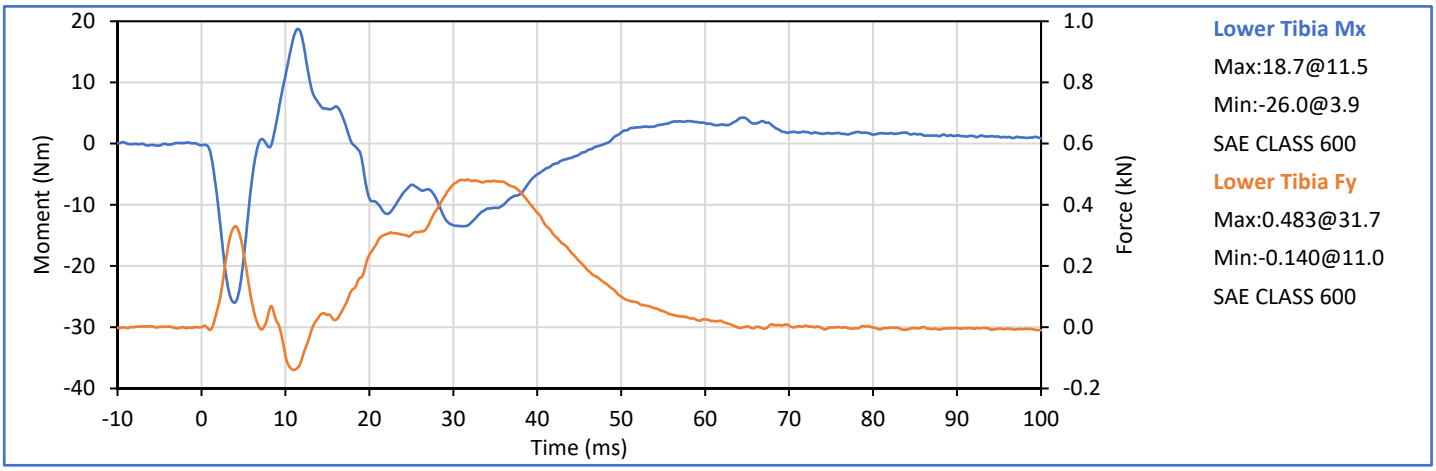
Applus IDIADA KARCO

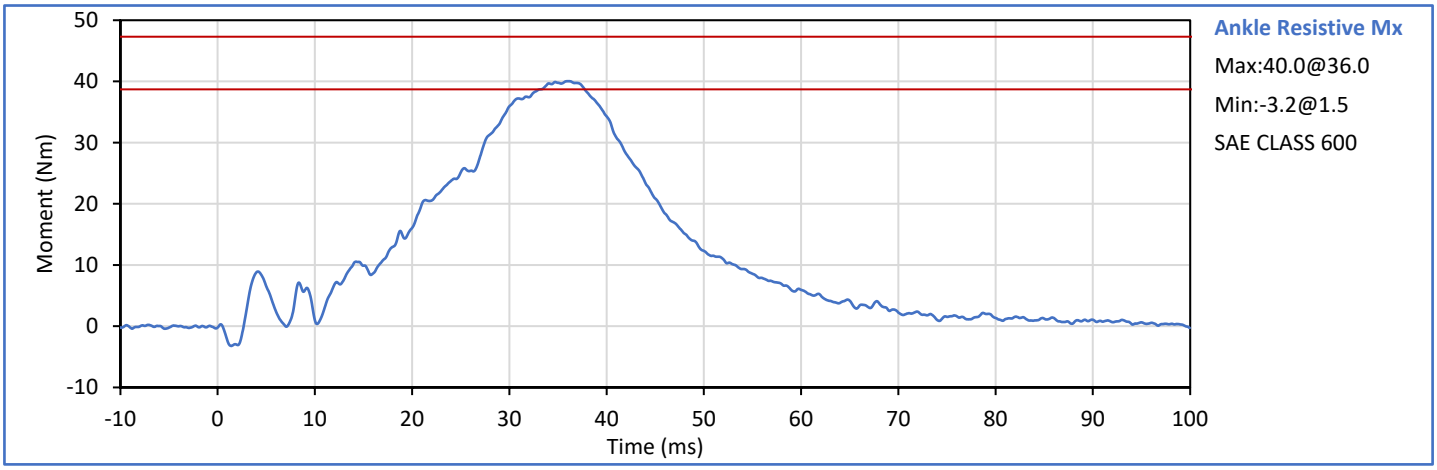
Pre-Test Qualification (Full)

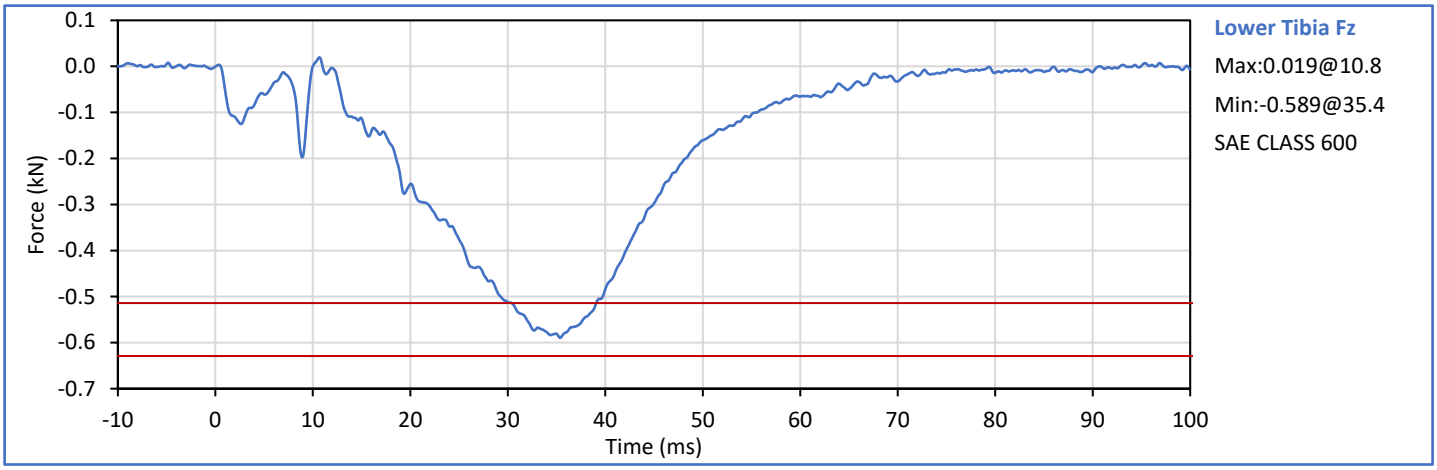
THOR-50M 50th Percentile Male ATD
Ankle Eversion (Left) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-14







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

Pre-Test Qualification (Full)

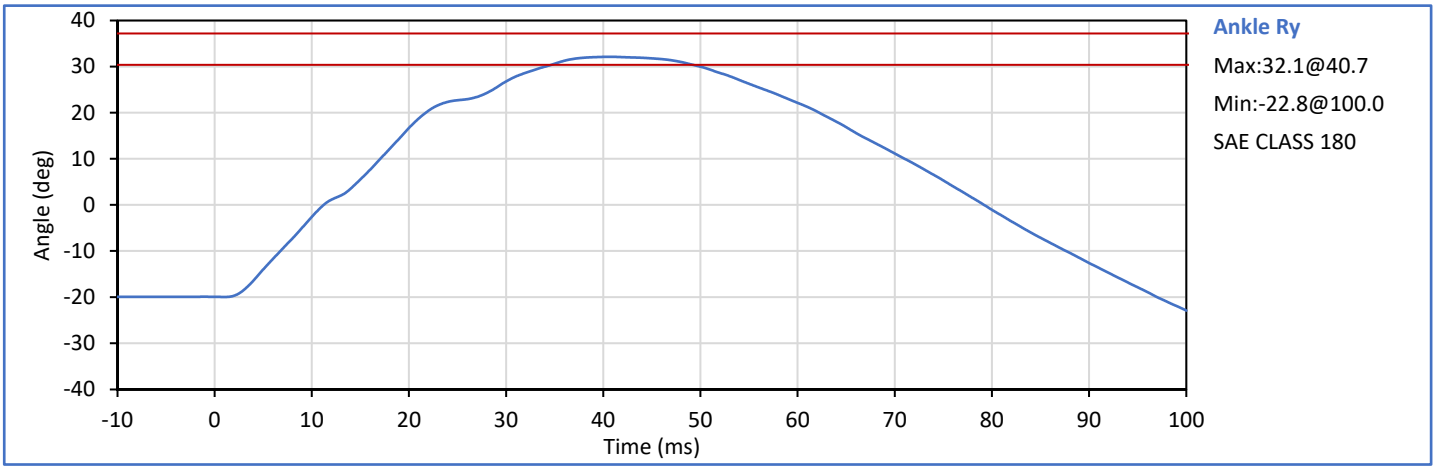
THOR-50M 50th Percentile Male ATD
Ball of Foot (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-17

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	25	Pass
Pendulum Velocity	m/s	4.95	5.05	5.01	Pass
Peak Ankle Ry	deg	30.4	37.2	32.1	Pass
Peak Ankle Resistive Moment	Nm	49.8	60.8	60.1	Pass
Peak Lower Tibia Fz	kN	-3.487	-2.853	-3.119	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass

x



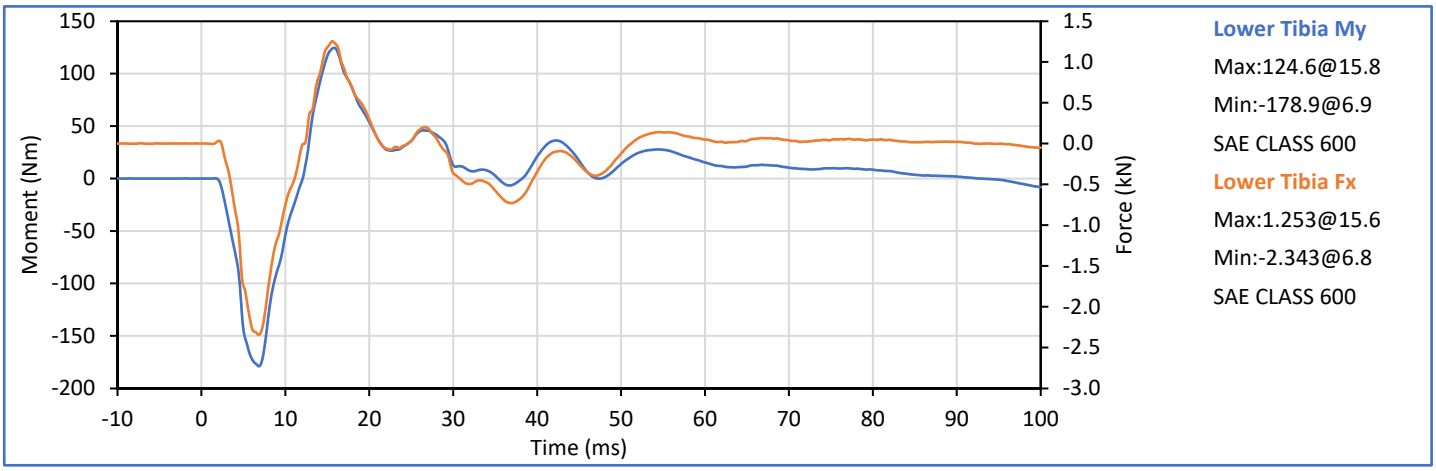
Applus IDIADA KARCO

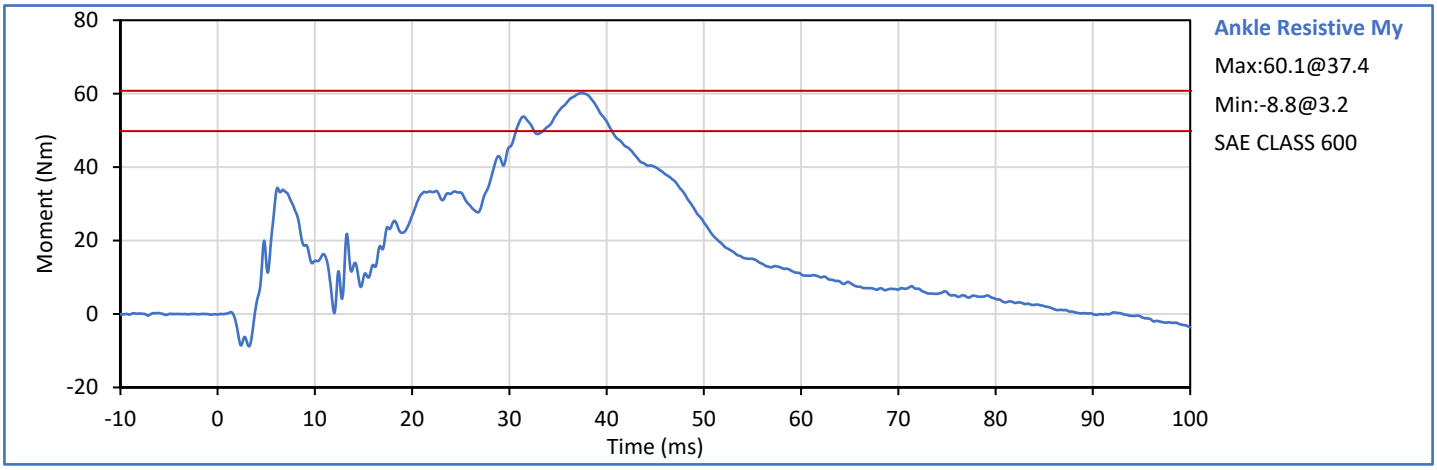
Pre-Test Qualification (Full)

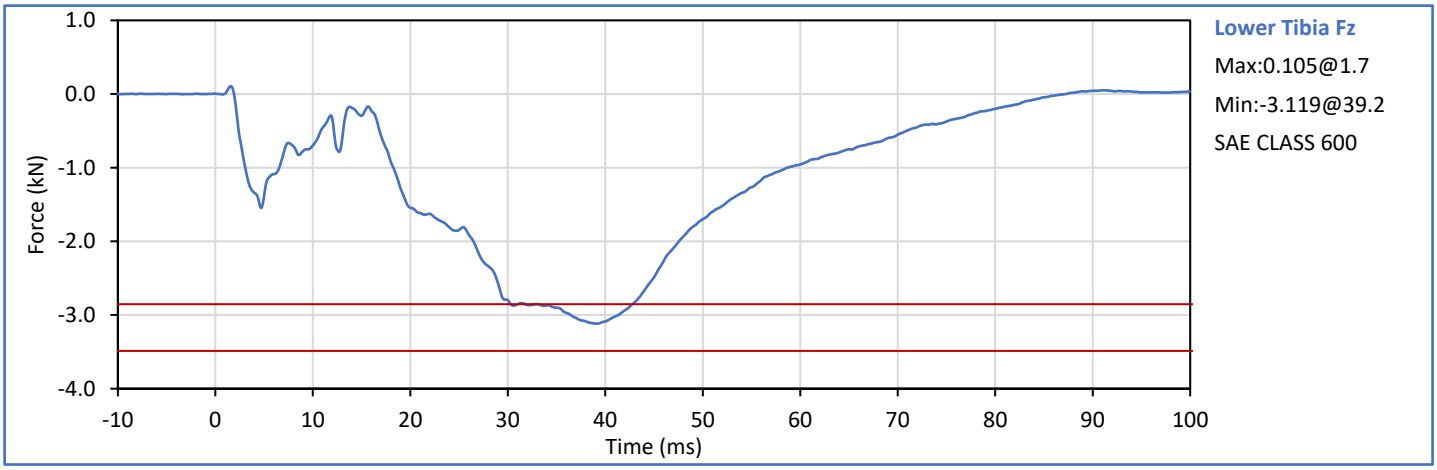
THOR-50M 50th Percentile Male ATD
Ball of Foot (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-17







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

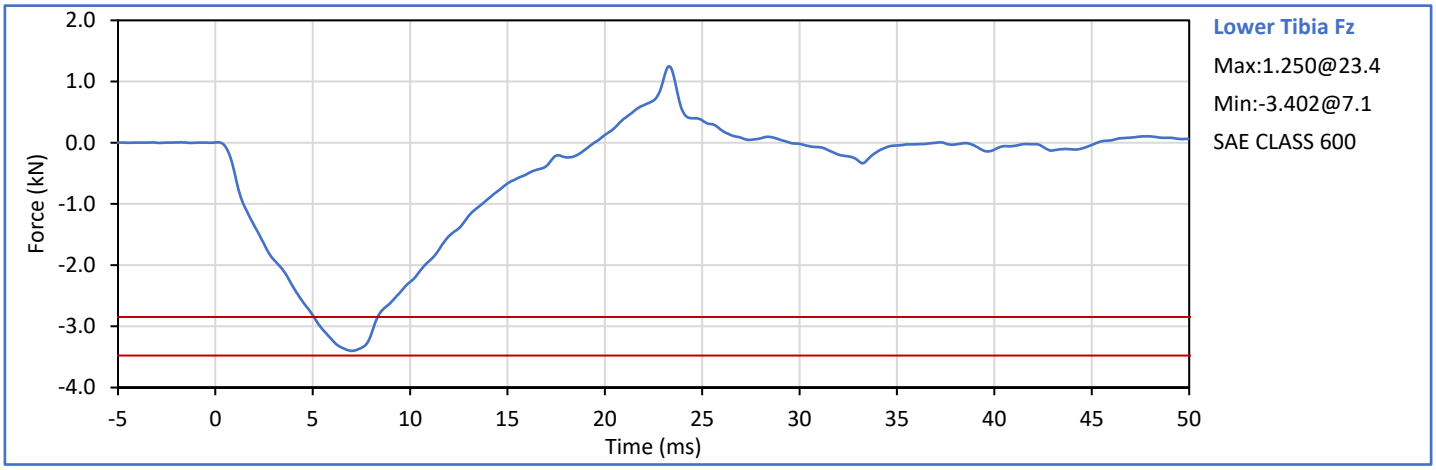
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Heel of Foot (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-17

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	40	Pass
Pendulum Velocity	m/s	3.95	4.05	4.01	Pass
Peak Lower Tibia Fz	kN	-3.478	-2.846	-3.402	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

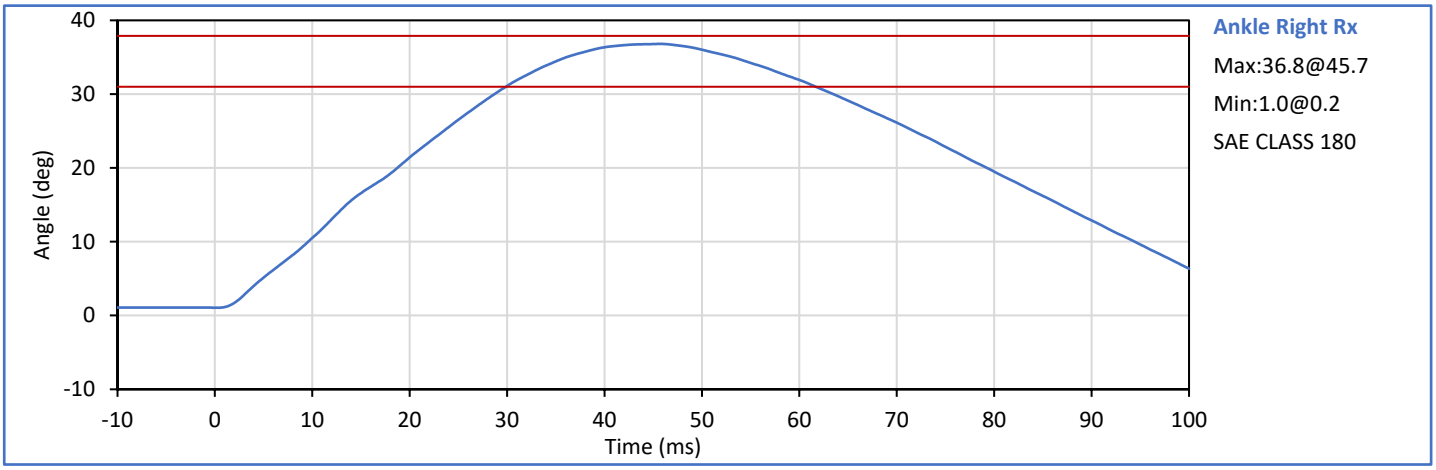
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Ankle Inversion (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-17

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	24	Pass
Pendulum Velocity	m/s	1.95	2.05	1.98	Pass
Peak Ankle Rx	deg	31.0	37.9	36.8	Pass
Peak Ankle Resistive Mx	Nm	35.2	43.0	40.4	Pass
Peak Lower Tibia Fz	kN	-0.555	-0.454	-0.552	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass



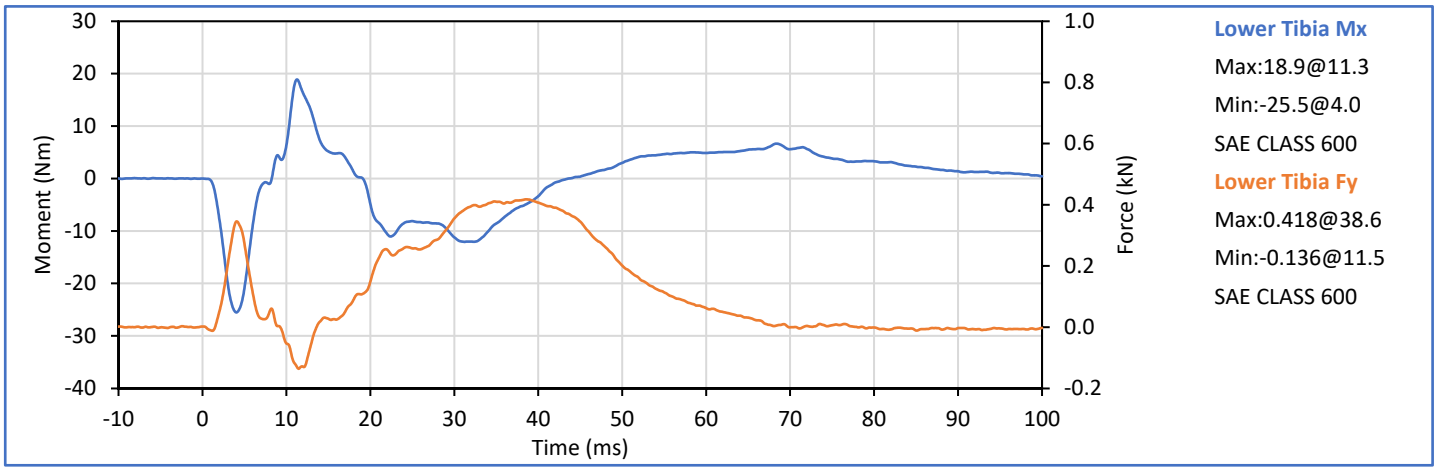
Applus IDIADA KARCO

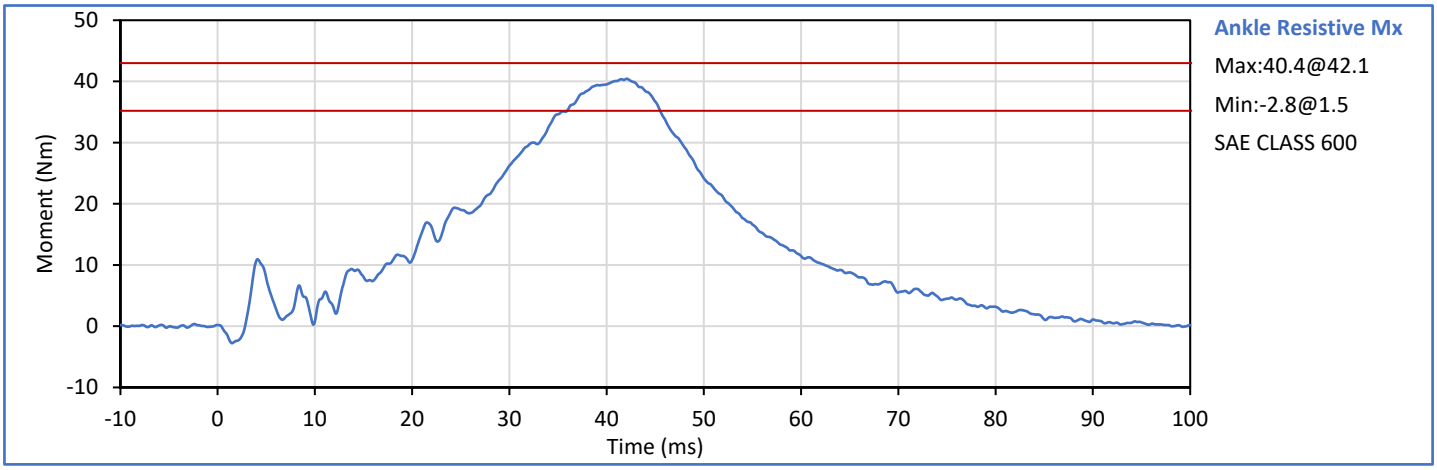
Pre-Test Qualification (Full)

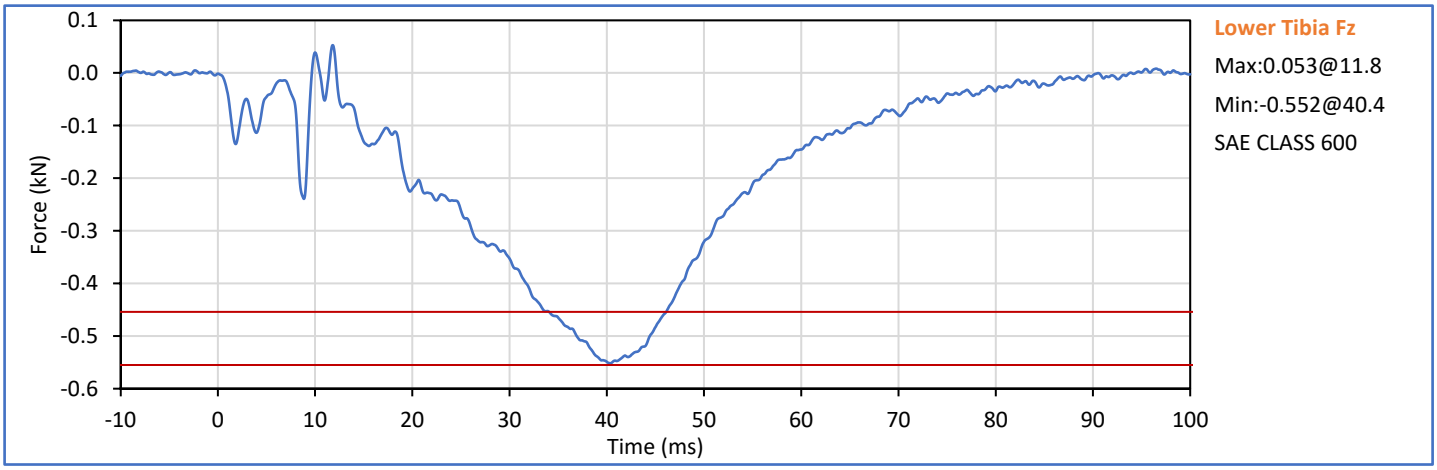
THOR-50M 50th Percentile Male ATD
Ankle Inversion (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-17







Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

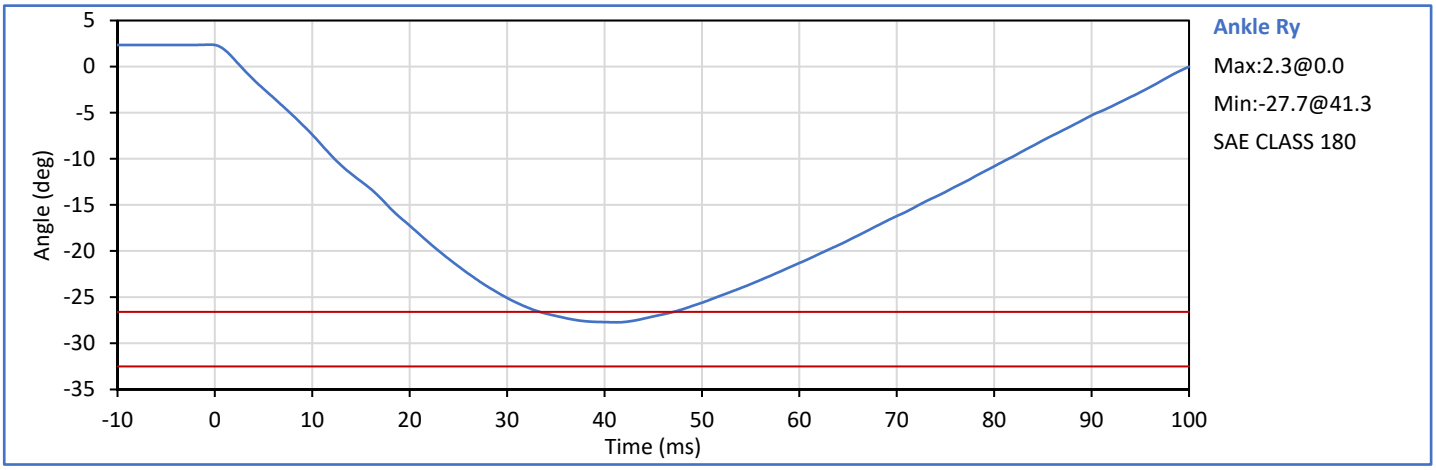
Pre-Test Qualification (Full)

THOR-50M 50th Percentile Male ATD
Ankle Eversion (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-17

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	26	Pass
Pendulum Velocity	m/s	1.95	2.05	2.03	Pass
Peak Ankle Rx	deg	-32.5	-26.6	-27.7	Pass
Peak Ankle Resistive Mx	Nm	38.7	47.3	39.3	Pass
Peak Lower Tibia Fz	kN	-0.629	-0.514	-0.551	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass



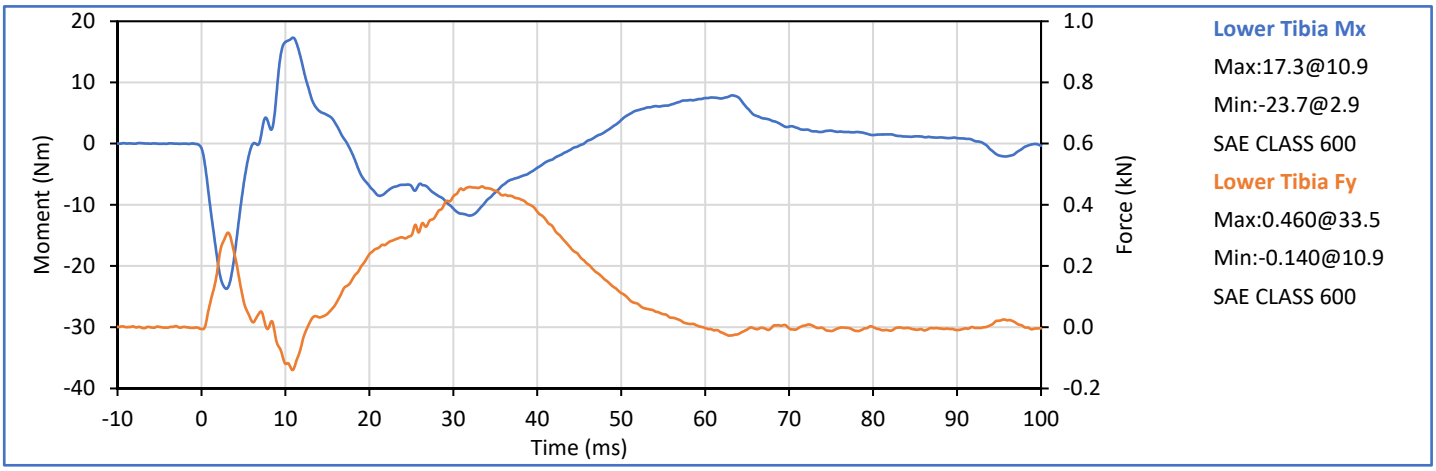
Applus IDIADA KARCO

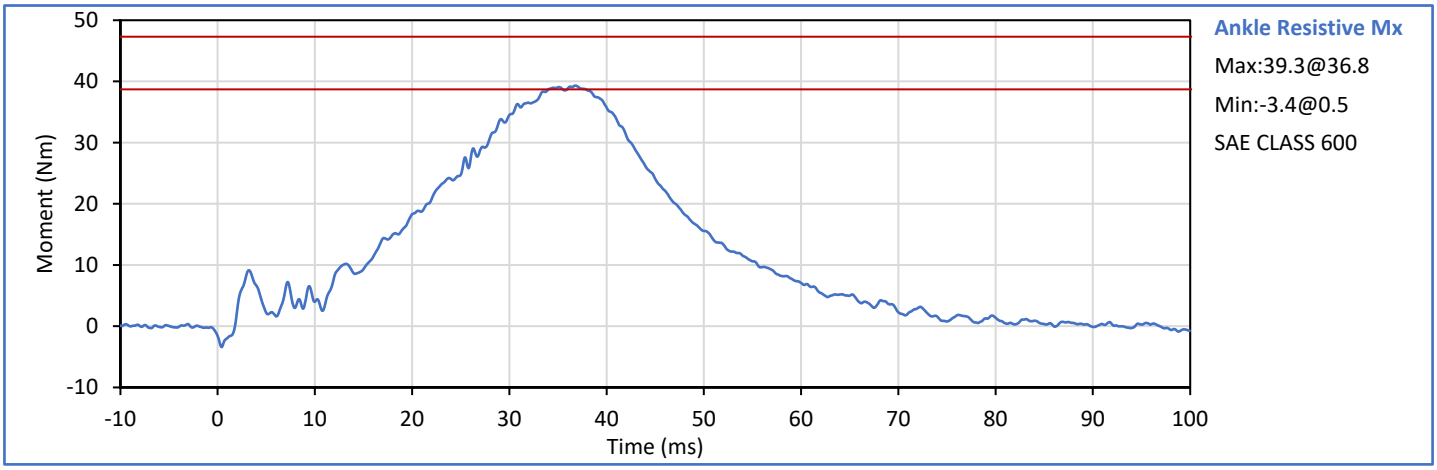
Pre-Test Qualification (Full)

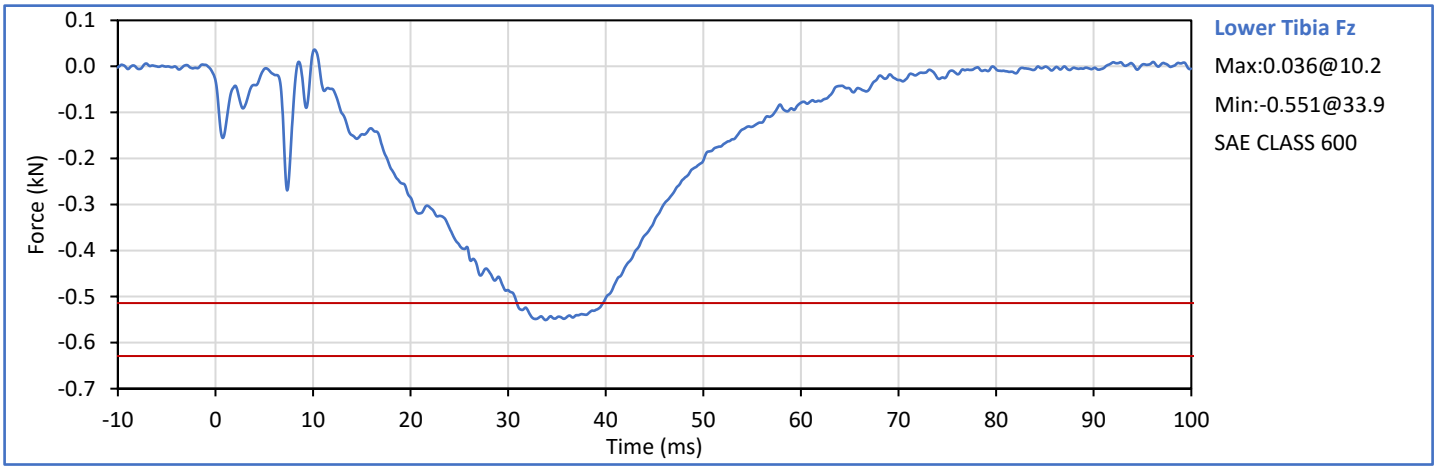
THOR-50M 50th Percentile Male ATD
Ankle Eversion (Right) Qualification

ATD Serial No.: EG2595

Test Date: 2021-05-17







Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX C
ATD Qualification and Performance Verification
Hybrid III 50th Percentile Male ATD
Pre-Test Qualification (Full) S/N: 168

Applus IDIADA KARCO

Pre-Test Qualification (Full)

Hybrid III 50th Percentile Male ATD
ATD Damage Checklist

ATD Serial No.: 168

Test Date: 2021-05-10

Dummy Item	Inspect for	Comments	Damage	OK
Entire ATD	Perform general cleaning			✓
Outer Skin	Gashes, rips, cracks			✓
Head	Ballast secure			✓
	General appearance			✓
Neck bracket	Upper neck firmly attached to lower bracket			✓
Neck	Broken or cracked rubber			✓
	Looseness at the condyle joint			✓
Nodding block	Cracked or out of position			✓
Lumbar Spine	Broken or cracked rubber			✓
Ribs	Broken or bent ribs			✓
	Broken or bent rib supports			✓
	Damping material separated or cracked			✓
	Rubber bumpers in place			✓
Chest Displ.	Bent shaft			✓
Assembly	Slider arm riding in track			✓
Sensors	Check cables for cuts, tears			✓
	Check for damaged insulation			✓
Accelerometer	Head mounting secure			✓
Mounting	Chest mounting secure			✓
Knees	Skin condition			✓
	Insert (do not remove)			✓
	Casting			✓
Limbs	Normal movement and adjustment			✓
Knee Sliders	Wires intact			✓
	Rubber returned to "resting" position			✓
Pelvis	Broken			✓
Other	Describe below as needed			✓

Describe any repairs or replacement of parts or other findings:

No Problems Found

Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

Pre-Test Qualification (Full)

Hybrid III 50th Percentile Male ATD
External Measurements

ATD Serial No.: 168

Test Date: 2021-05-10

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Relative Humidity	%	10	70	26	Pass
A - Total sitting height	mm	879	889	887	Pass
B - Shoulder pivot height	mm	505	521	517	Pass
C - 'H' point height	mm	84	89	87	Pass
D - 'H' point location from backline	mm	135	140	139	Pass
E - Shoulder pivot from backline	mm	84	94	91	Pass
F - Thigh clearance	mm	140	155	151	Pass
G - Back of elbow to wrist pivot	mm	290	305	297	Pass
H - Head back to backline	mm	41	46	46	Pass
I - Shoulder to elbow length	mm	330	345	343	Pass
J - Elbow rest height	mm	190	211	204	Pass
K - Buttock to knee length	mm	579	604	589	Pass
L - Popliteal length	mm	429	455	440	Pass
M - Knee pivot height	mm	485	500	495	Pass
N - Buttock popliteal length	mm	452	477	464	Pass
O - Chest depth without jacket	mm	213	229	220	Pass
P - Foot length	mm	251	267	258	Pass
V - Shoulder breadth	mm	422	437	431	Pass
W - Foot breadth	mm	91	107	103	Pass
Y - Chest circum. (w/chest jacket)	mm	970	1001	980	Pass
Z - Waist circum.	mm	836	866	851	Pass
AA - Location for chest circum.	mm	429	434	432	Pass
BB - Location for waist circum.	mm	226	231	228	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

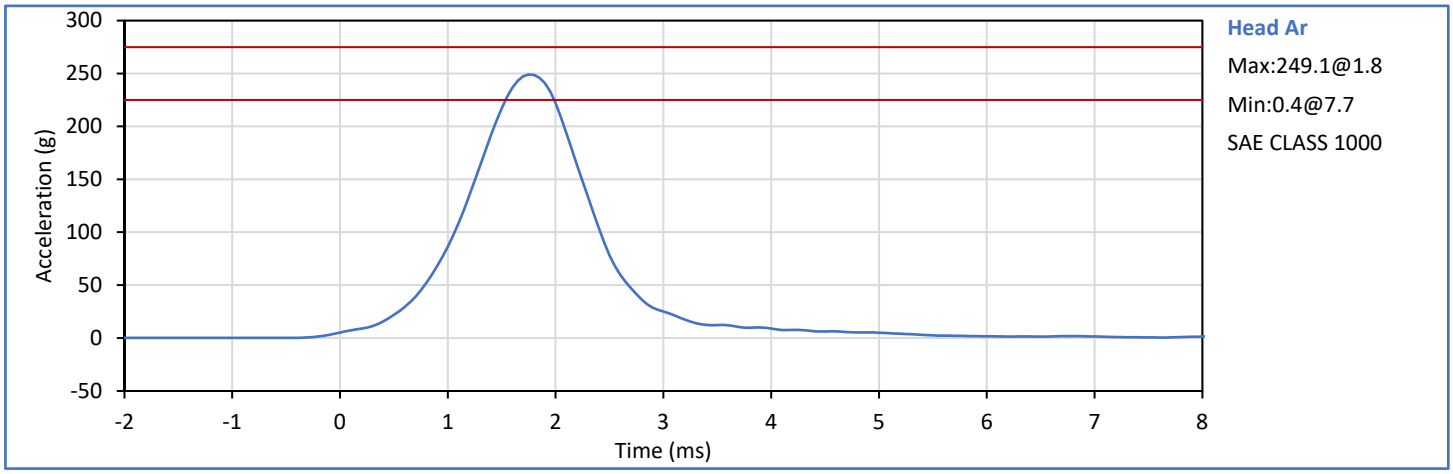
Pre-Test Qualification (Full)

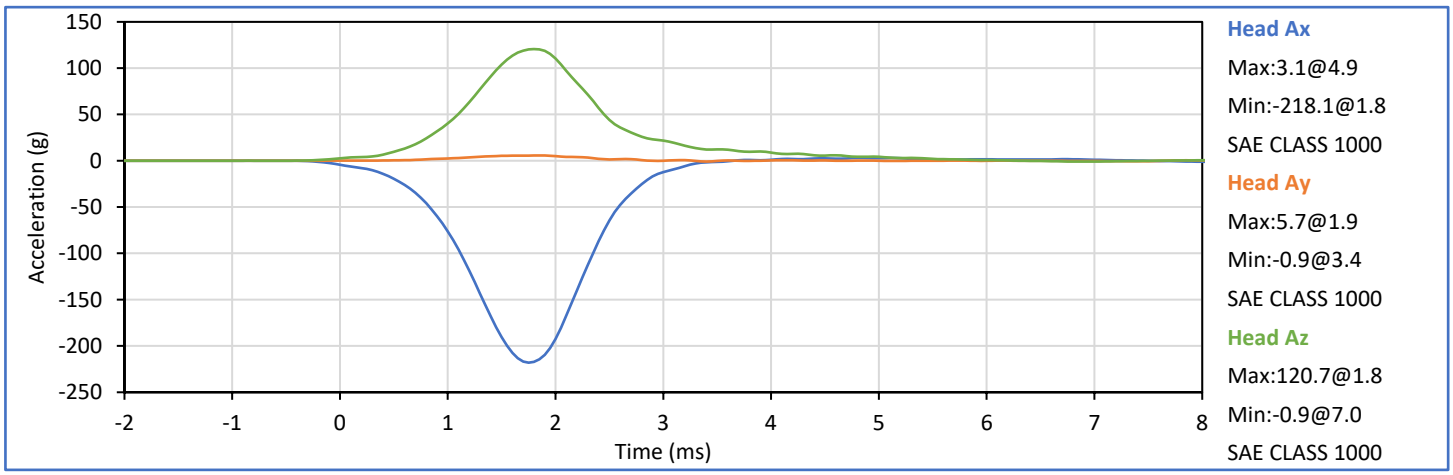
Hybrid III 50th Percentile Male ATD
Head Drop

ATD Serial No.: 168

Test Date: 2021-05-10

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.1	Pass
Laboratory Relative Humidity	%	10	70	29	Pass
Peak Resultant Acceleration	g	225.0	275.0	249.1	Pass
Peak Lateral Acceleration	g	-15.0	15.0	5.7	Pass
Oscillations After Main Pulse	%	0.0	10.0	0.8	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

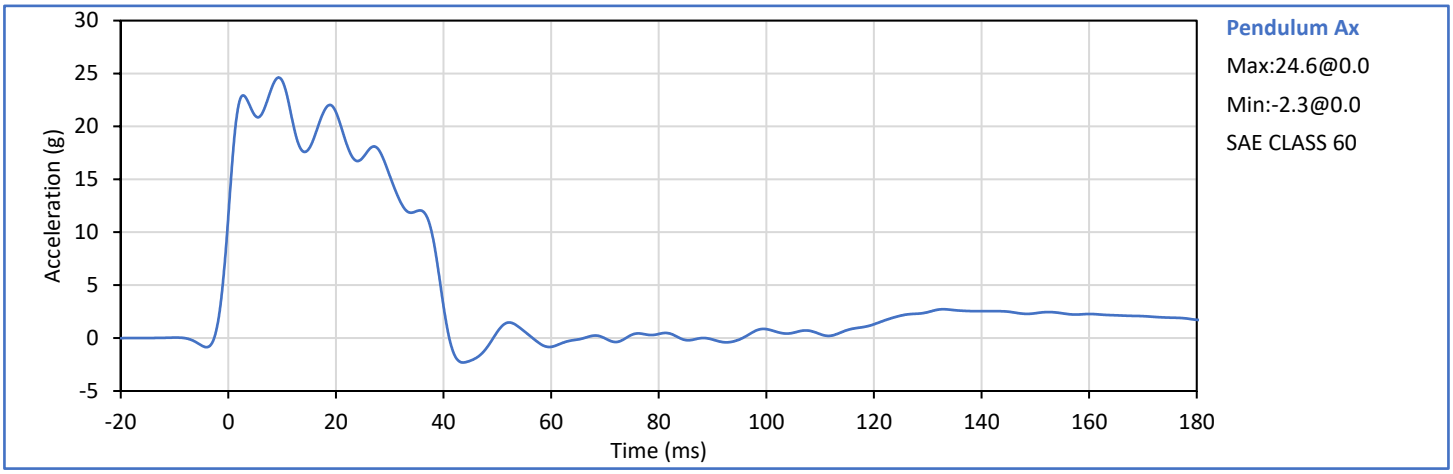
Pre-Test Qualification (Full)

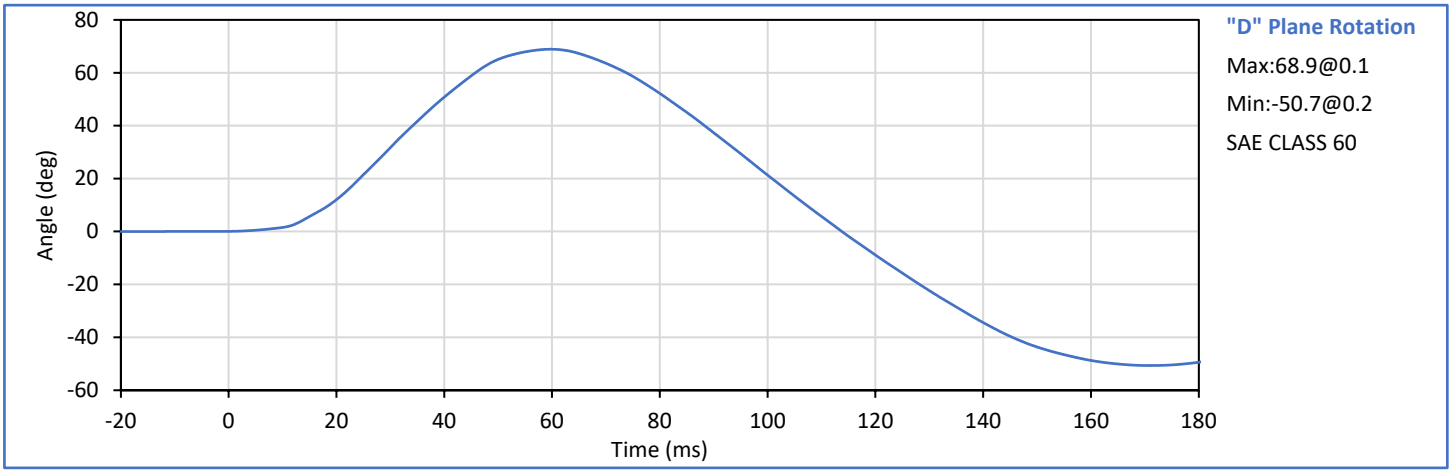
Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 168

Test Date: 2021-05-10

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	6.89	7.13	6.98	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	24.3	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	21.3	Pass
Pendulum Deceleration at 30 ms	g	12.5	18.5	15.3	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	29.0	15.3	Pass
Deceleration Decay to Cross 5 g	ms	34.0	42.0	39.4	Pass
"D" Plane Rotation peak	deg	64.0	78.0	68.9	Pass
	ms	57.0	64.0	59.8	Pass
"D" Plane Rotation Decay To Zero	ms	113.0	128.0	113.8	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	98.9	Pass
	ms	47.0	58.0	50.4	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	101.9	Pass
			Overall Test Results		Pass



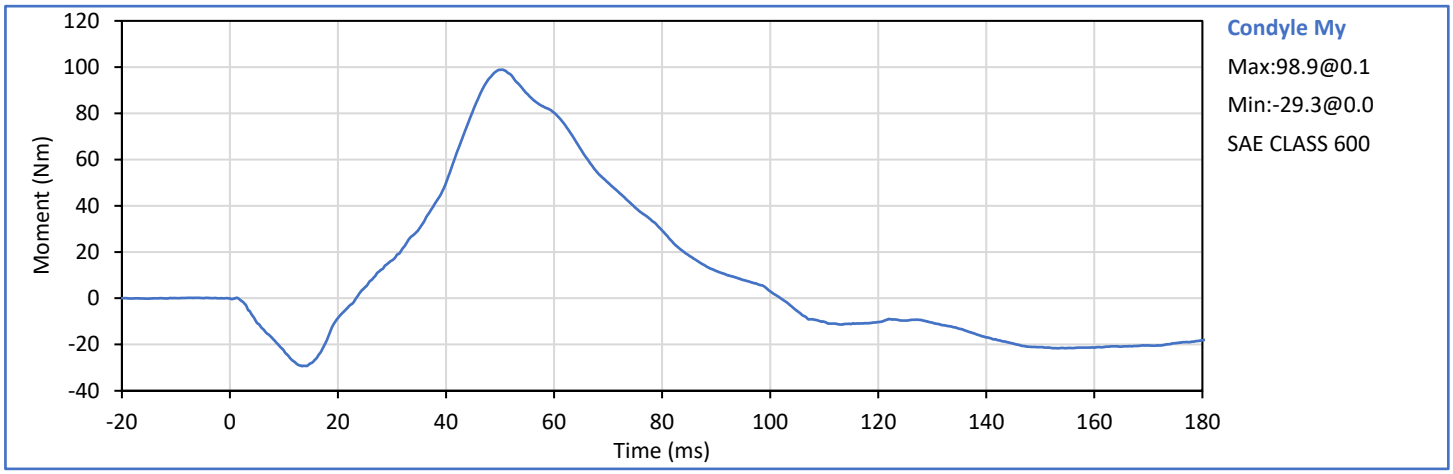


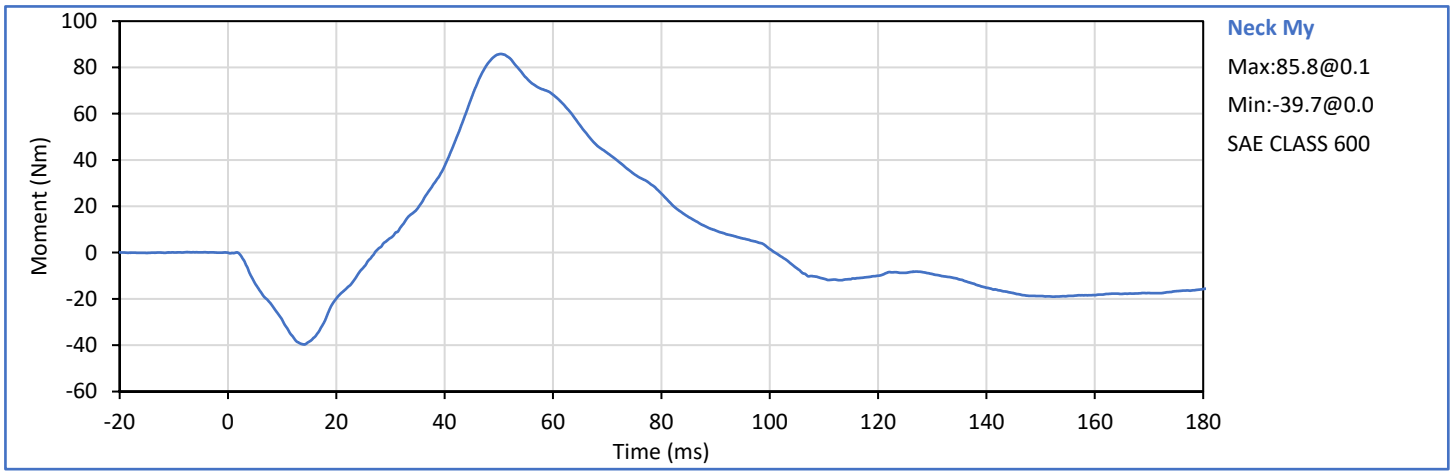
Technician: J. Hernandez

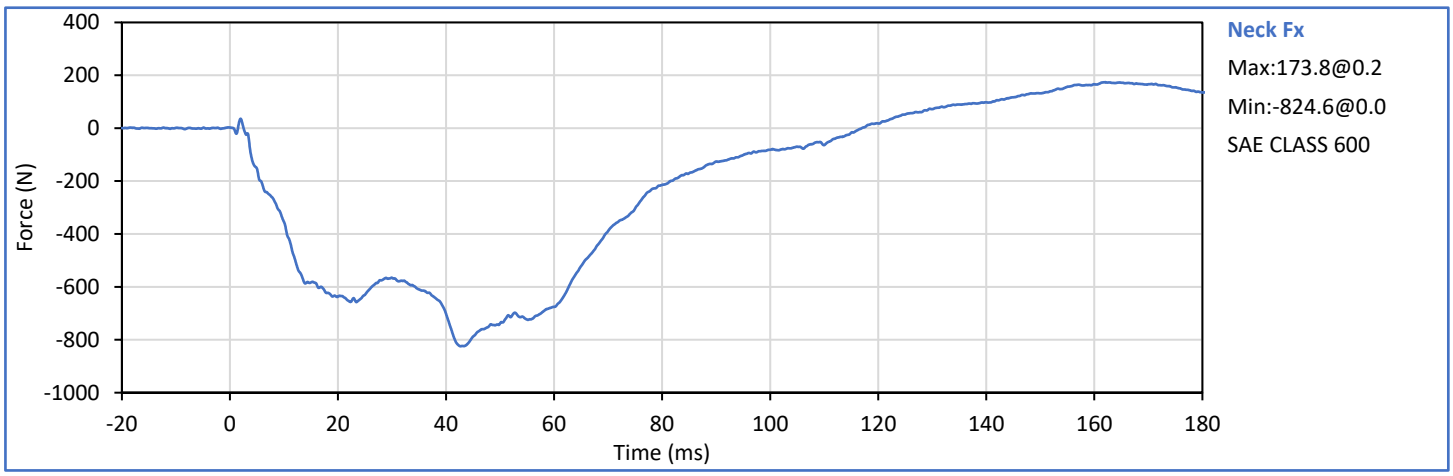
Approved By: P. Puzzuto

ATD Serial No.: 168

Test Date: 2021-05-10







Applus IDIADA KARCO

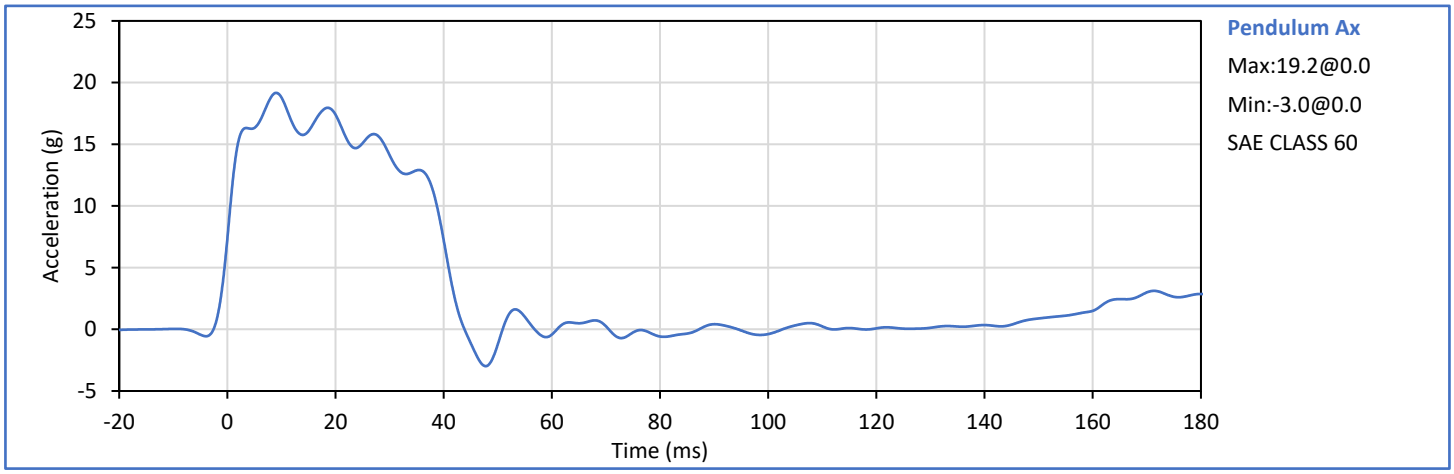
Pre-Test Qualification (Full)

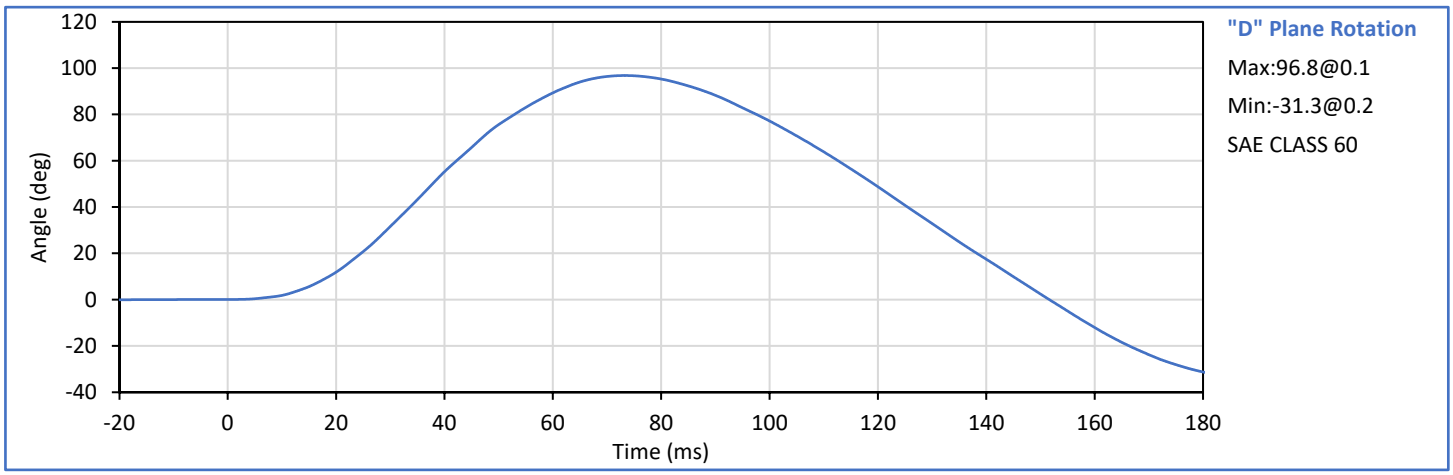
Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 168

Test Date: 2021-05-10

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	5.94	6.19	6.01	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	18.8	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	17.4	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	14.1	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	22.0	14.1	Pass
Deceleration Decay to Cross 5 g	ms	38.0	46.0	40.9	Pass
"D" Plane Rotation peak	deg	81.0	106.0	96.8	Pass
	ms	72.0	82.0	73.3	Pass
"D" Plane Rotation Decay To Zero	ms	147.0	174.0	151.7	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-69.7	Pass
	ms	65.0	79.0	69.2	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	136.4	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

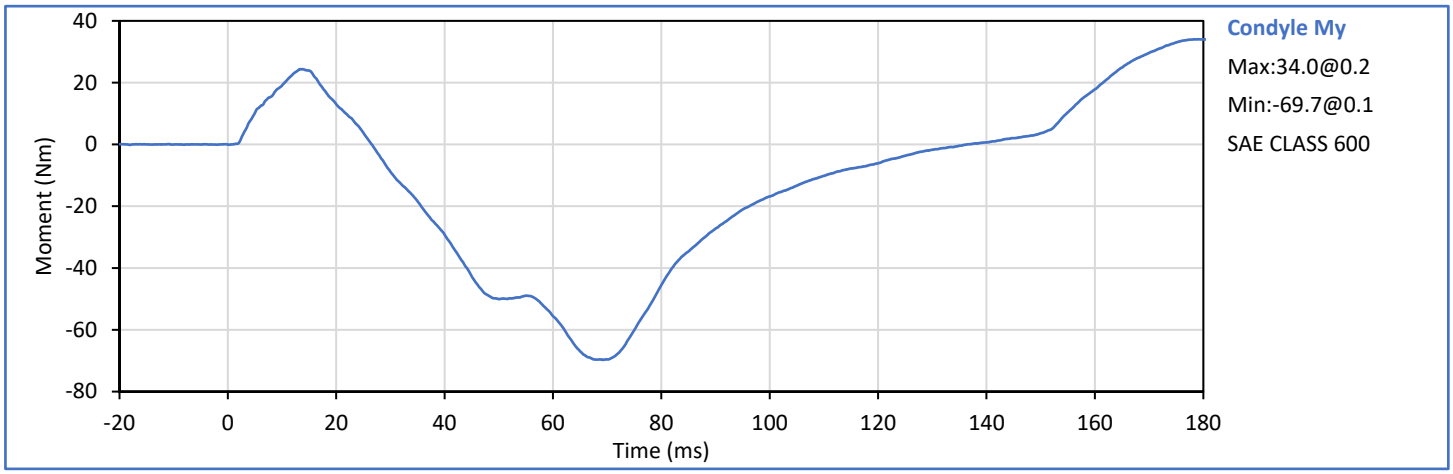
Approved By: P. Puzzuto

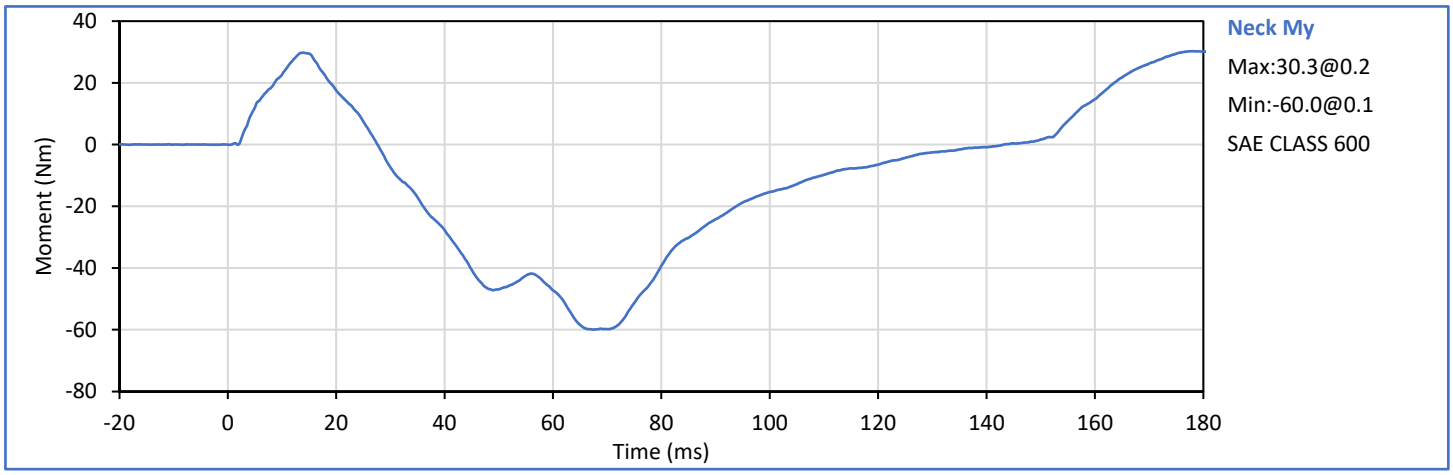
C-44

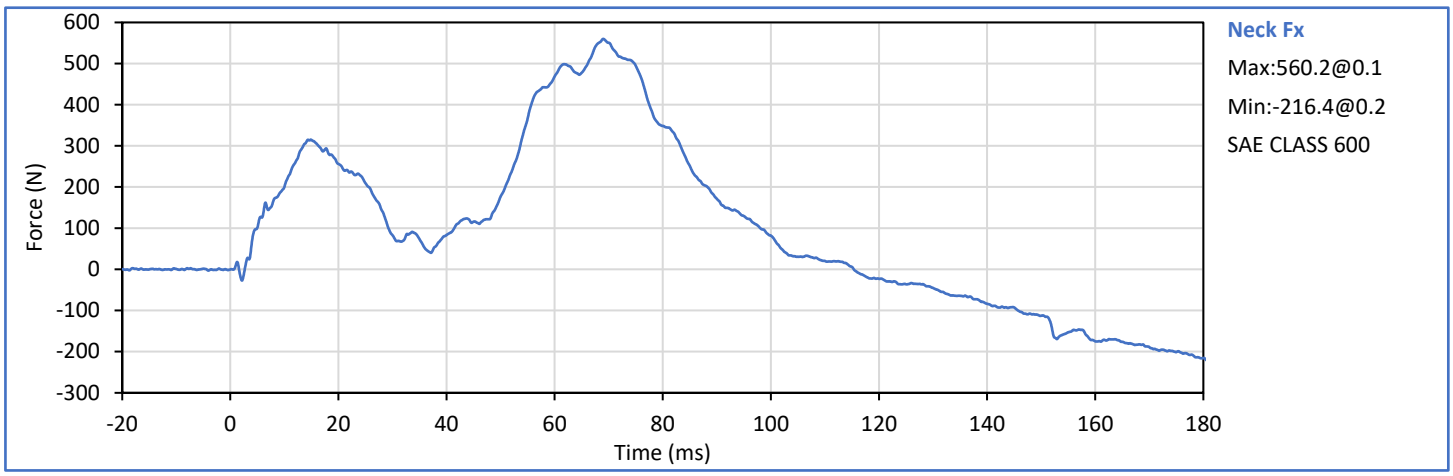
TR-P41129-01-NC

ATD Serial No.: 168

Test Date: 2021-05-10







Applus IDIADA KARCO

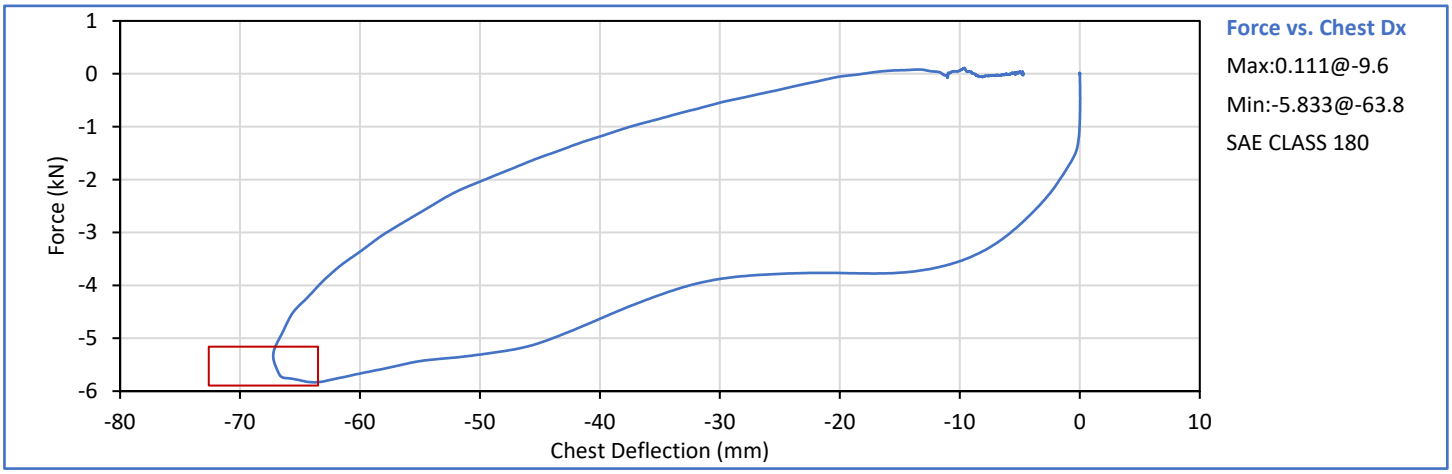
Pre-Test Qualification (Full)

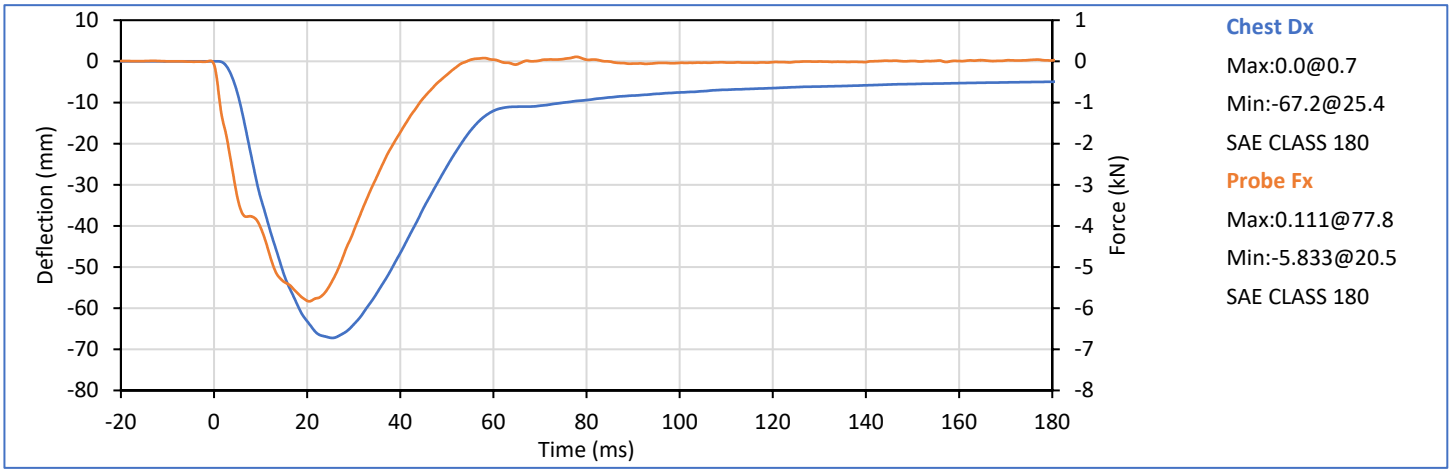
Hybrid III 50th Percentile Male ATD
Thorax Impact

ATD Serial No.: 168

Test Date: 2021-05-13

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	31	Pass
Probe Velocity	m/s	6.58	6.82	6.68	Pass
Peak Chest Deflection	mm	-72.6	-63.5	-67.2	Pass
Peak Probe Force	kN	-5.893	-5.159	-5.833	Pass
Internal Hysterisis	%	69.0	85.0	71.3	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

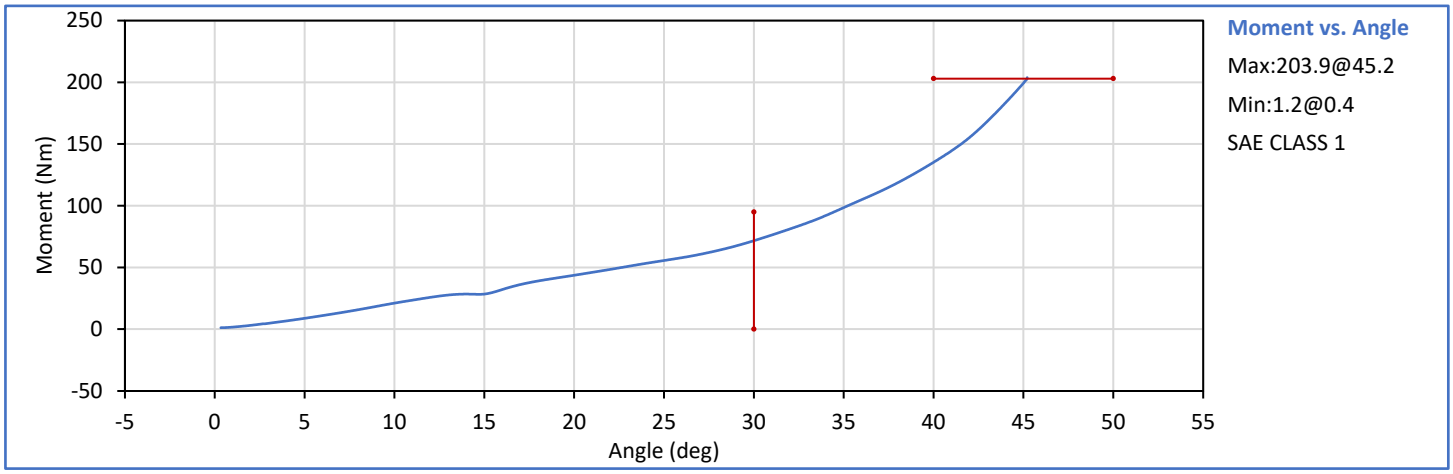
Pre-Test Qualification (Full)

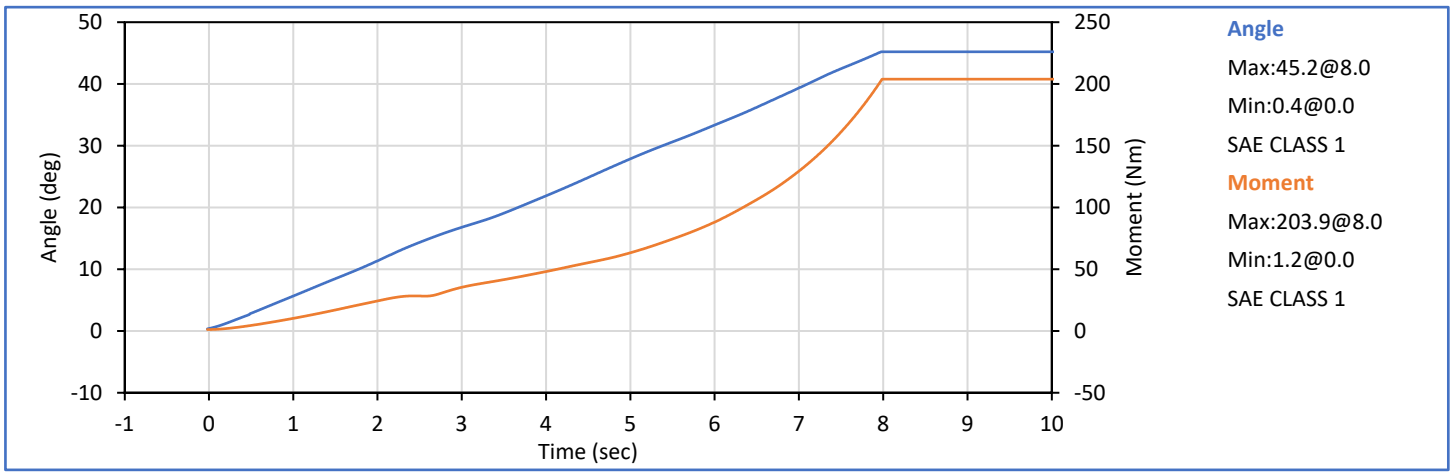
Hybrid III 50th Percentile Male ATD
Hip Range of Motion (Left)

ATD Serial No.: 168

Test Date: 2021-05-17

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.7	Pass
Laboratory Relative Humidity	%	10	70	35	Pass
Left Hip Rotation Rate	deg/s	5.0	10.0	5.6	Pass
Left Femur Torque at 30°	Nm	0.0	95.0	71.6	Pass
Left Hip Rotation at 203 Nm	deg	40.0	50.0	45.2	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

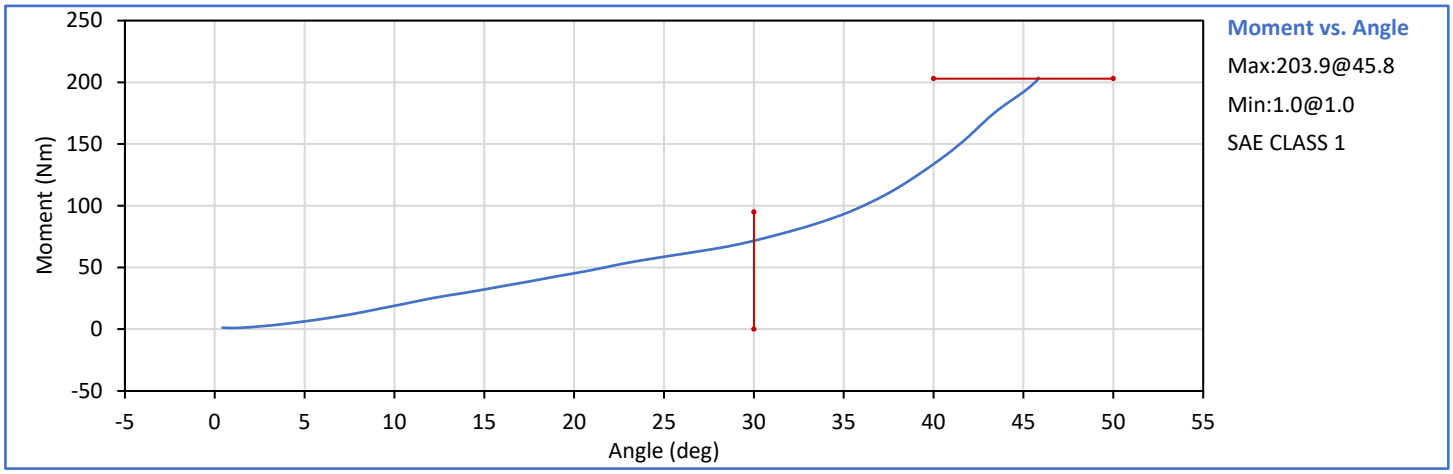
Pre-Test Qualification (Full)

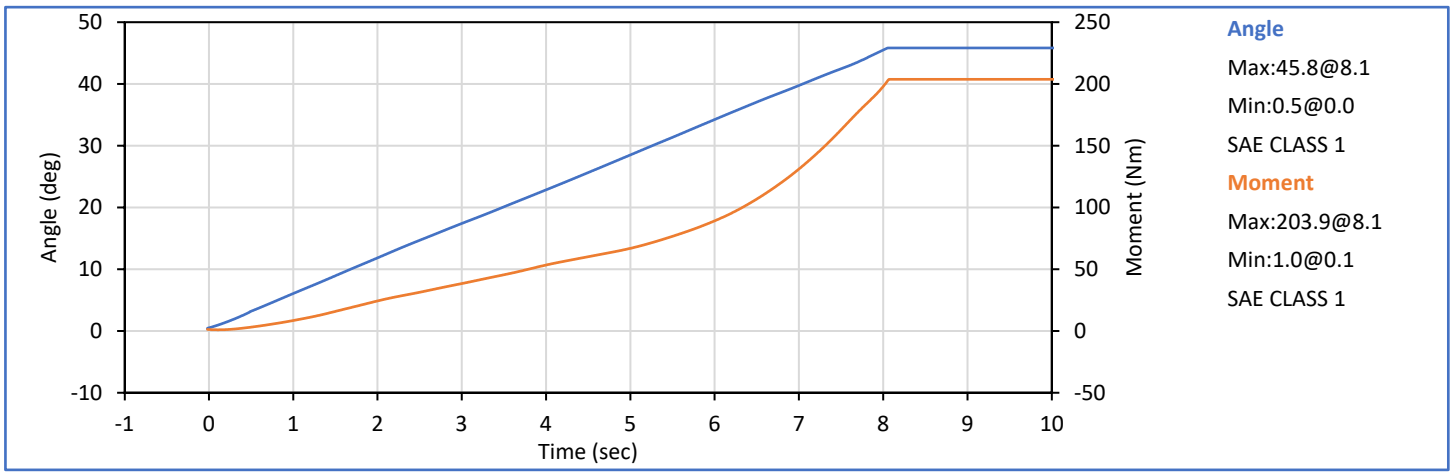
Hybrid III 50th Percentile Male ATD
Hip Range of Motion (Right)

ATD Serial No.: 168

Test Date: 2021-05-17

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.1	Pass
Laboratory Relative Humidity	%	10	70	29	Pass
Right Hip Rotation Rate	deg/s	5.0	10.0	5.6	Pass
Right Femur Torque at 30°	Nm	0.0	95.0	71.6	Pass
Right Hip Rotation at 203 Nm	deg	40.0	50.0	45.8	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA KARCO

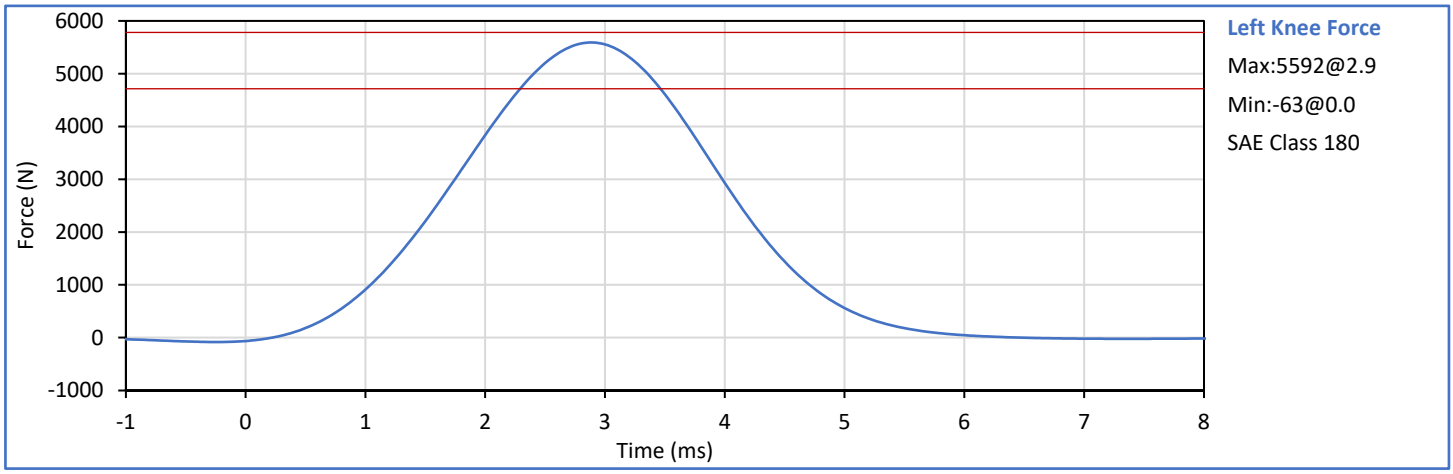
Pre-Test Qualification (Full)

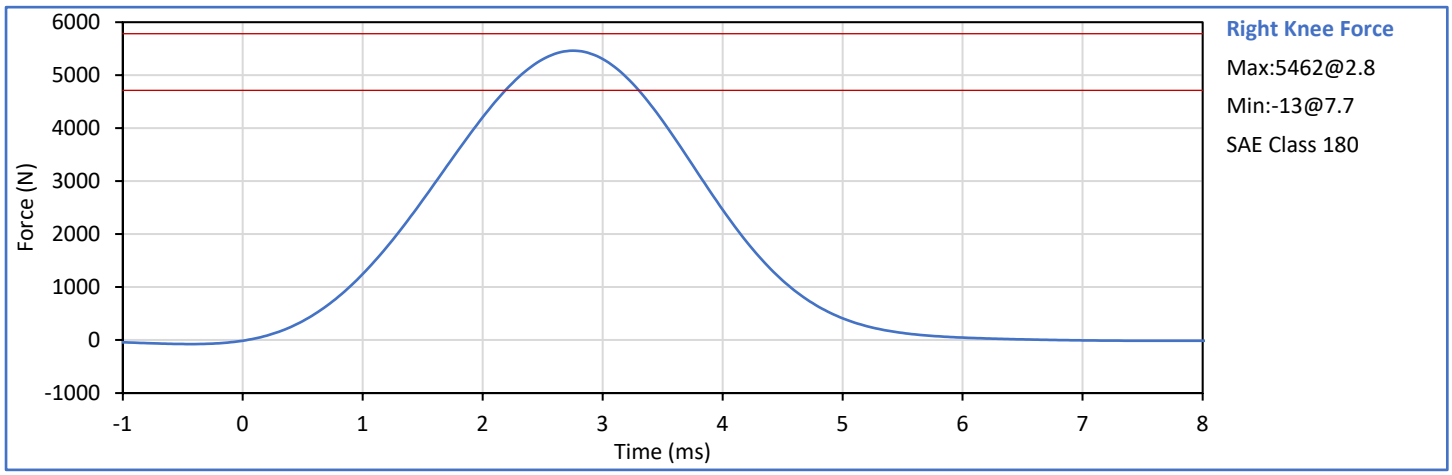
Hybrid III 50th Percentile Male ATD
Knee Impact (Left/Right)

ATD Serial No.: 168

Test Date: 2021-04-06

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	20.6	Pass
	Laboratory Relative Humidity	%	10	70	30	Pass
Left Knee	Probe Velocity	m/s	2.070	2.130	2.110	Pass
	Peak Resistive Force	N	4715	5782	5592	Pass
Right Knee	Probe Velocity	m/s	2.070	2.130	2.110	Pass
	Peak Resistive Force	N	4715	5782	5462	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX D

ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

THOR-50M 50TH PERCENTILE MALE ATD

POST-TEST QUALIFICATION (FULL)

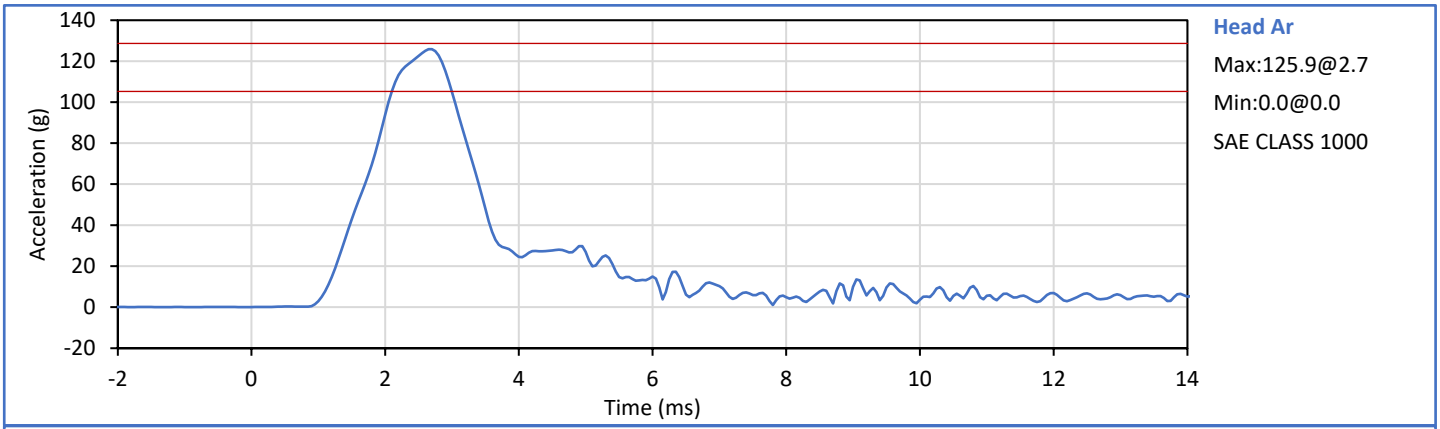
APPENDIX D
ATD Configuration and Performance Verification Data
THOR-50M 50th Percentile Male ATD
Post-Test Qualification (Partial) S/N: EG2595

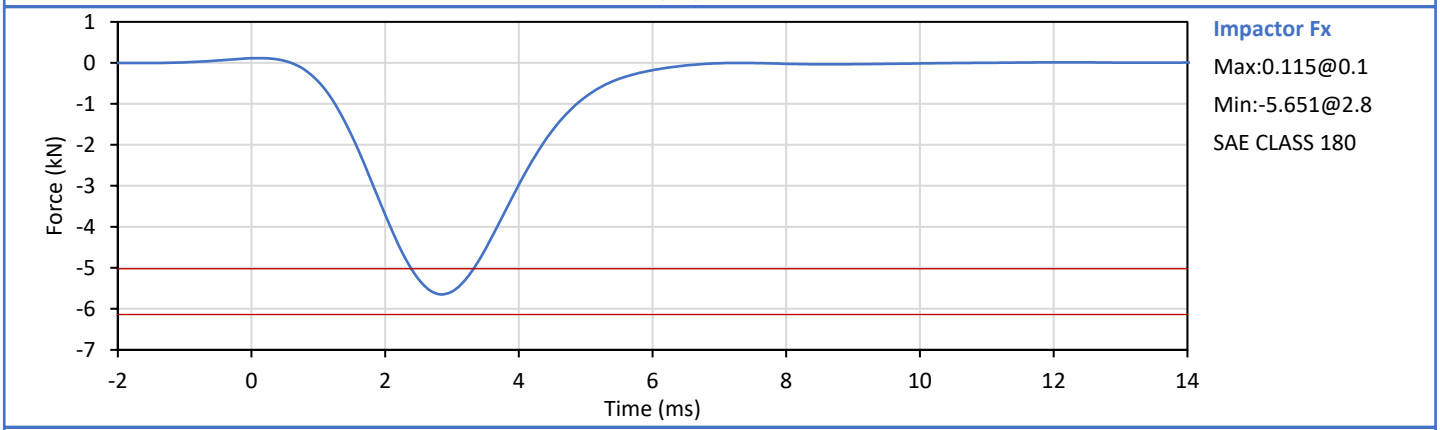
Applus IDIADA KARCO

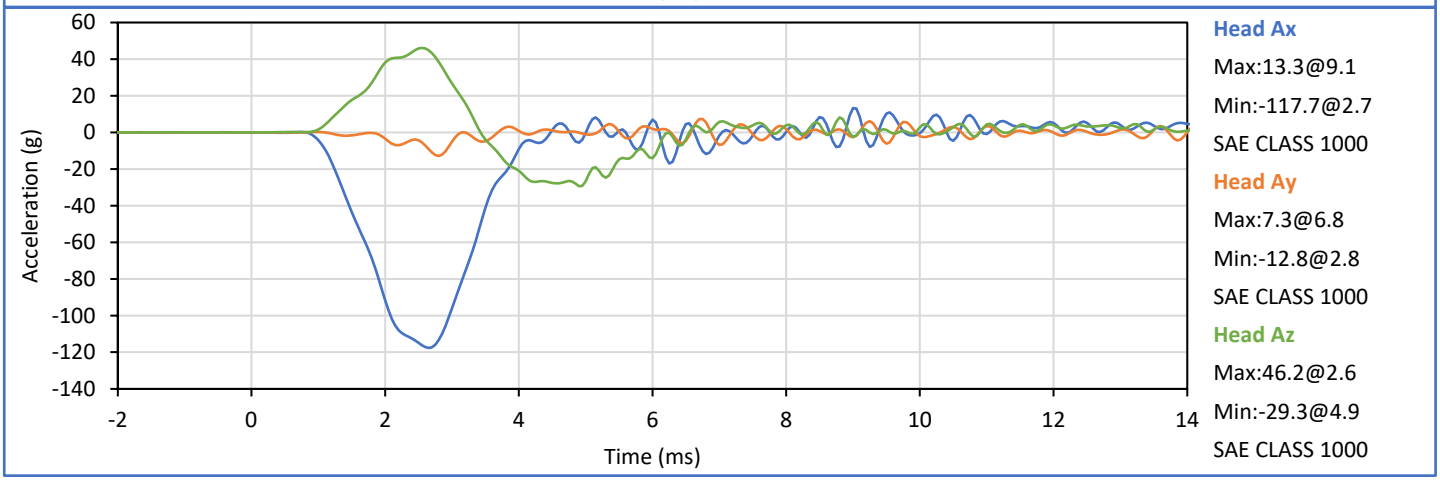
Post-Test Qualification (Partial) **THOR-50M 50th Percentile Male ATD Head Qualification**

ATD Serial No.: EG2595 Test Date: 2021-05-28

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	28	Pass
Velocity	m/s	1.95	2.05	1.97	Pass
Peak Impactor Force	kN	-6.138	-5.022	-5.651	Pass
Peak Head Resultant Acceleration	g	105.3	128.7	125.9	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass







Technician: J. Hernandez

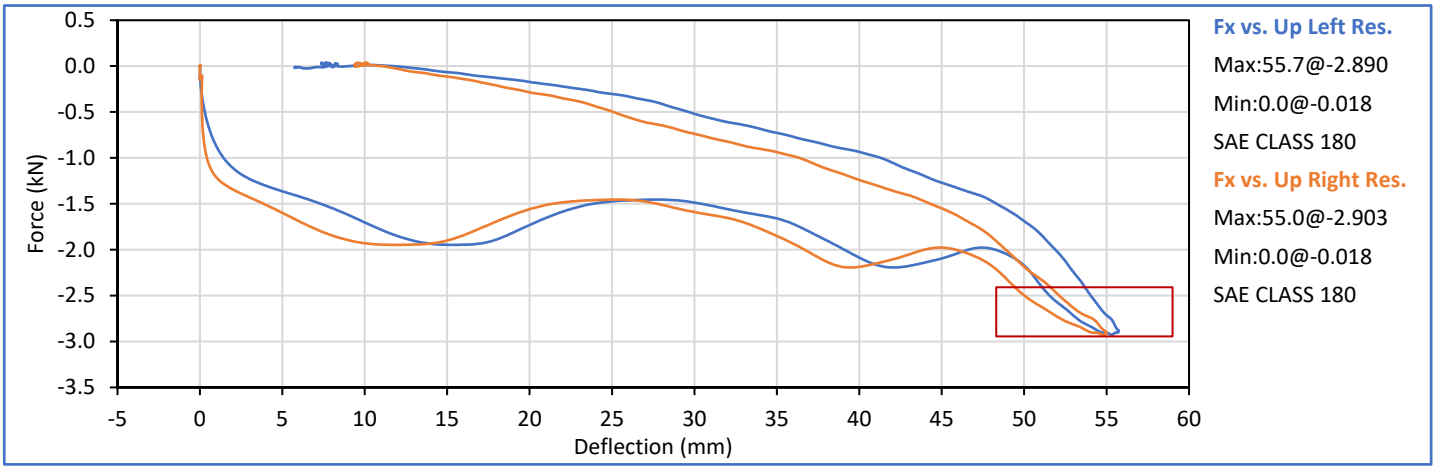
Approved By: P .Puzzuto

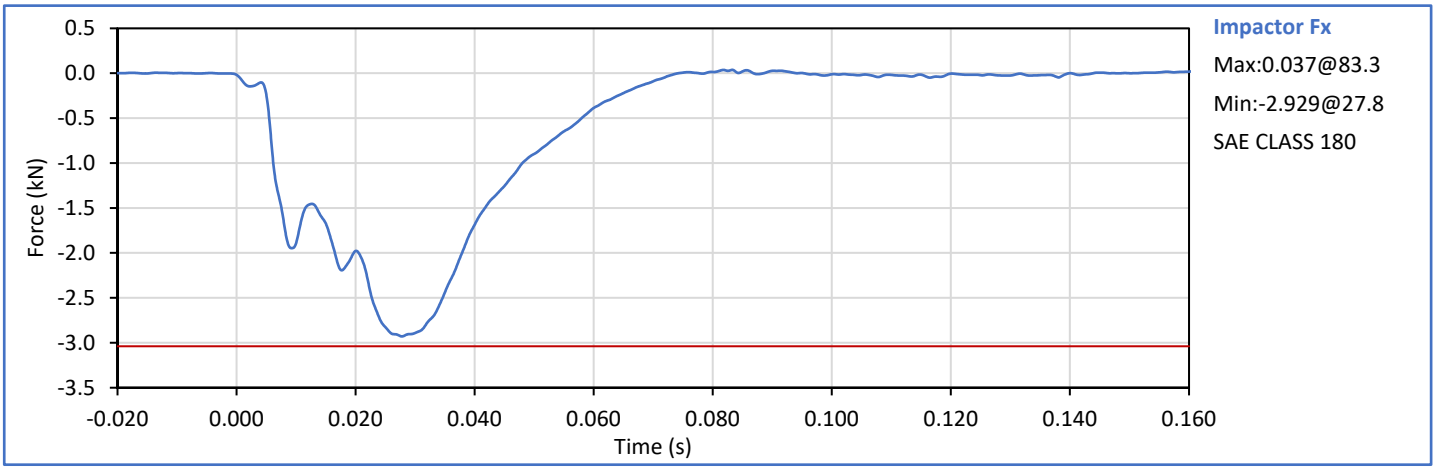
Applus IDIADA KARCO

Post-Test Qualification (Partial) **THOR-50M 50th Percentile Male ATD**
Thorax Impact (Upper)

ATD Serial No.: EG2595 Test Date: 2021-05-28

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	28	Pass
Probe Velocity	m/s	4.25	4.35	4.30	Pass
Peak Probe Force	kN	-3.039		-2.929	Pass
Peak Upper Left Deflection Res.	mm	48.3	59.0	55.7	Pass
Peak Upper Right Deflection Res.	mm			55.0	Pass
Absolute Difference L/R Defl. Res.	mm	0.0	5.0	0.7	Pass
Force at Peak Upper Left Res.	mm	-2.944	-2.409	-2.890	Pass
Force at Peak Upper Right Res.	mm			-2.903	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass

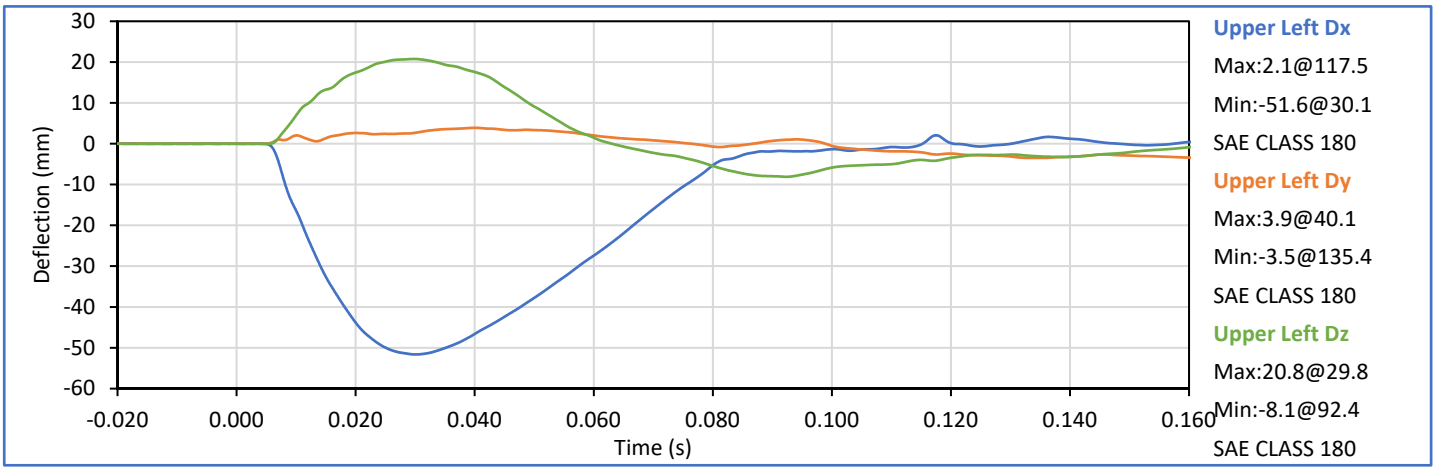


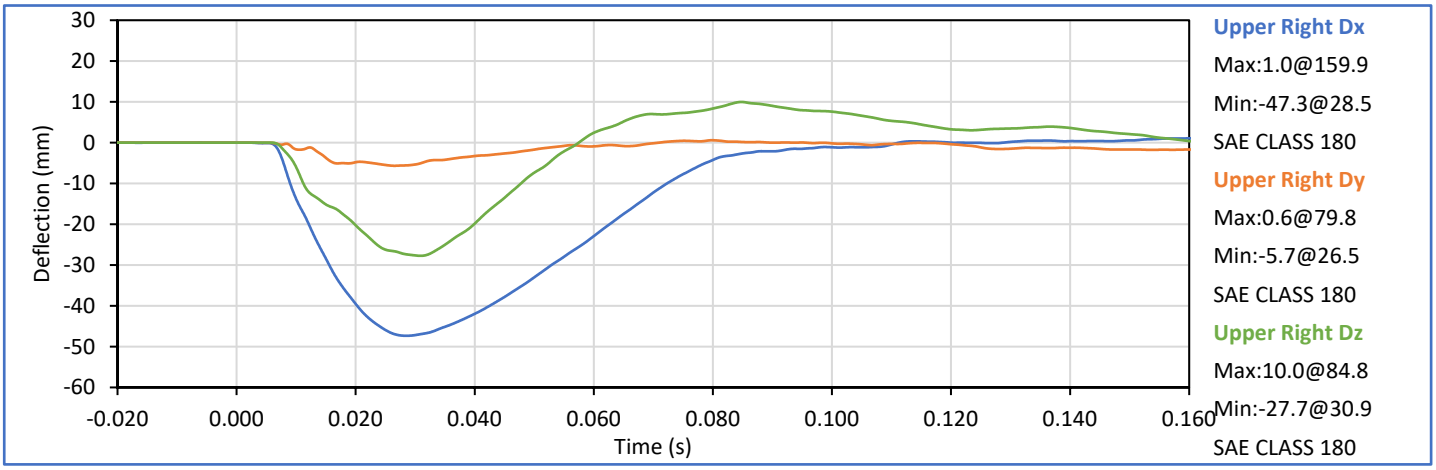


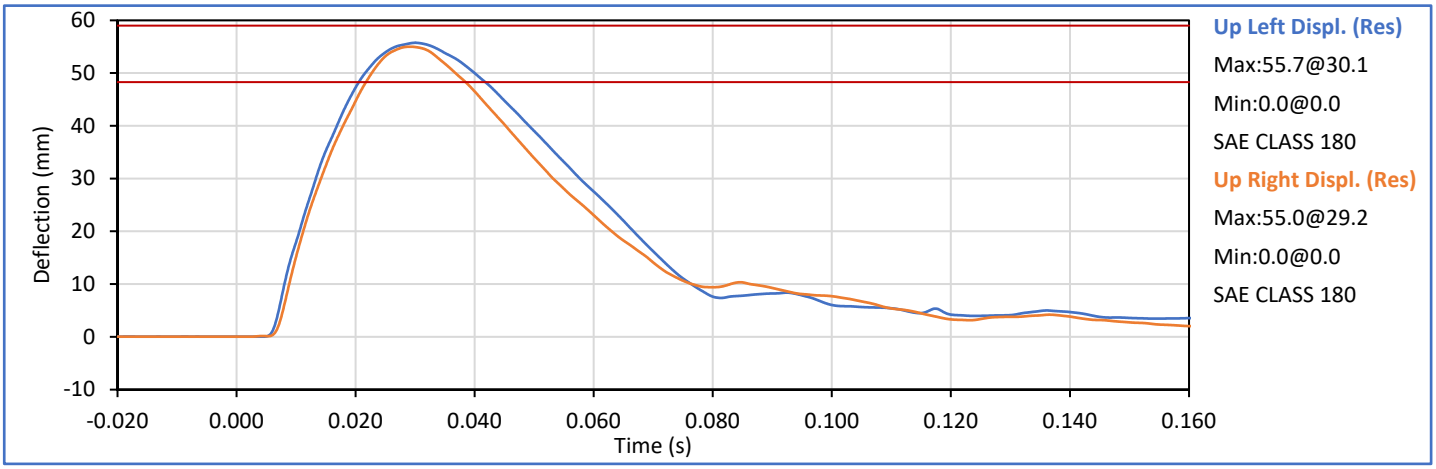
Technician: J. Hernandez

Approved By: P. Puzzuto

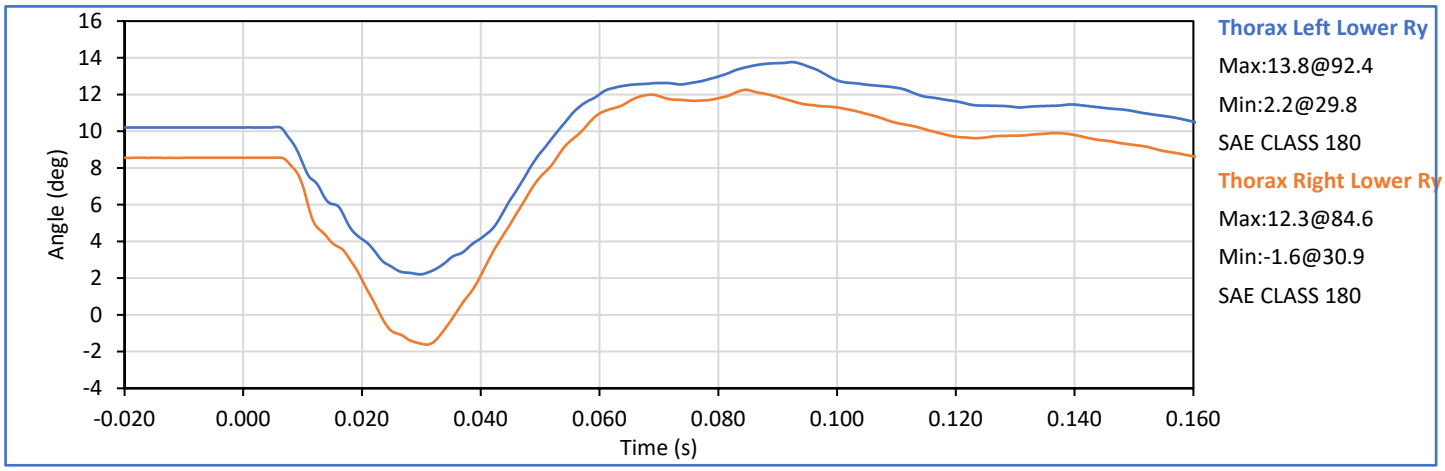
ATD Serial No.: EG2595 Test Date: 2021-05-28

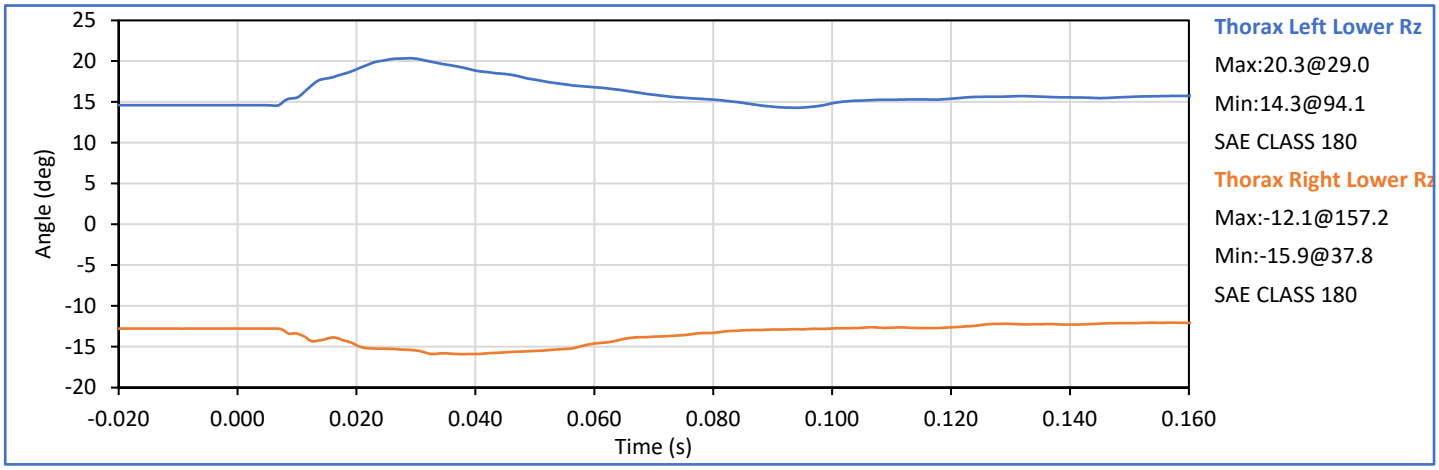






ATD Serial No.: EG2595 Test Date: 2021-05-28



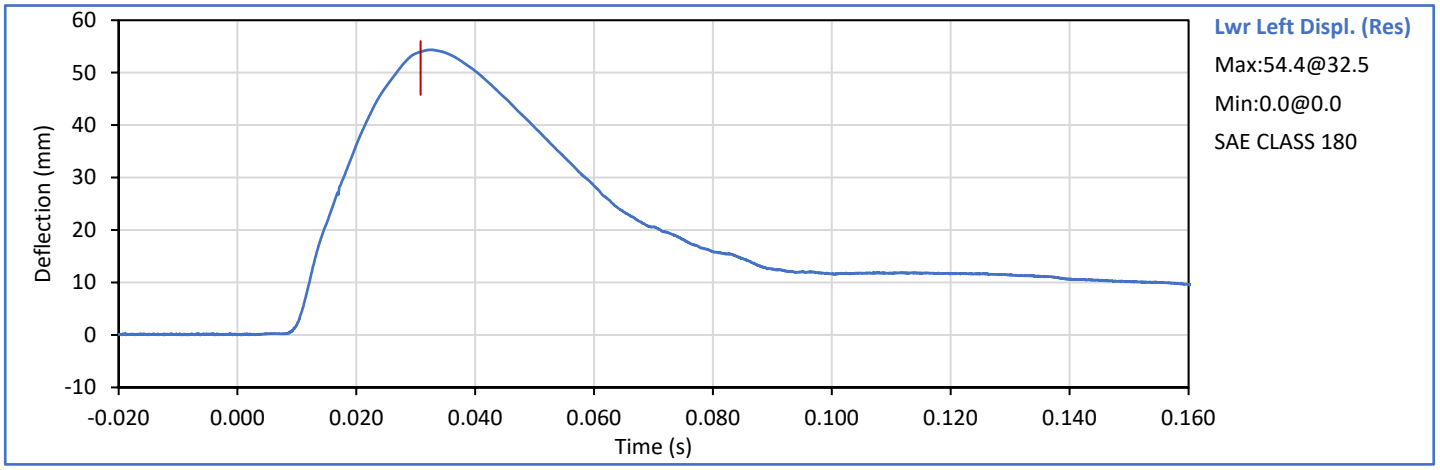


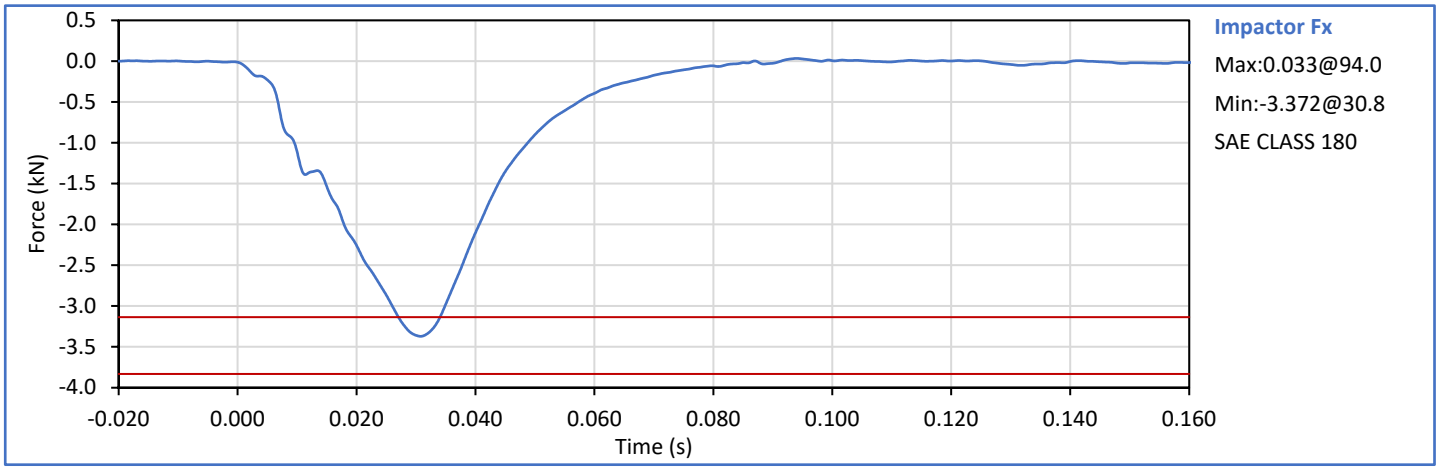
Applus IDIADA KARCO

Post-Test Qualification (Partial) **THOR-50M 50th Percentile Male ATD**
Thorax Impact (Lower Left)

ATD Serial No.: EG2595 Test Date: 2021-05-28

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	27	Pass
Probe Velocity	m/s	4.25	4.35	4.34	Pass
Peak Probe Force	kN	-3.832	-3.136	-3.372	Pass
Lower Left Defl. Res. at Peak Fx	mm	45.8	56.0	54.0	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass





Technician: J. Hernandez

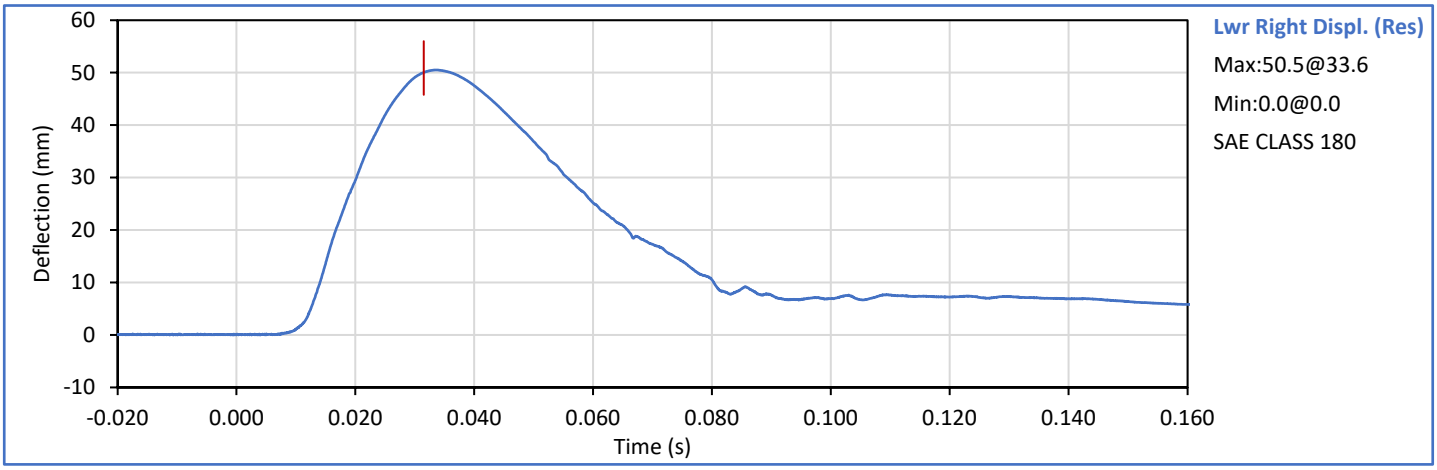
Approved By: P. Puzzuto

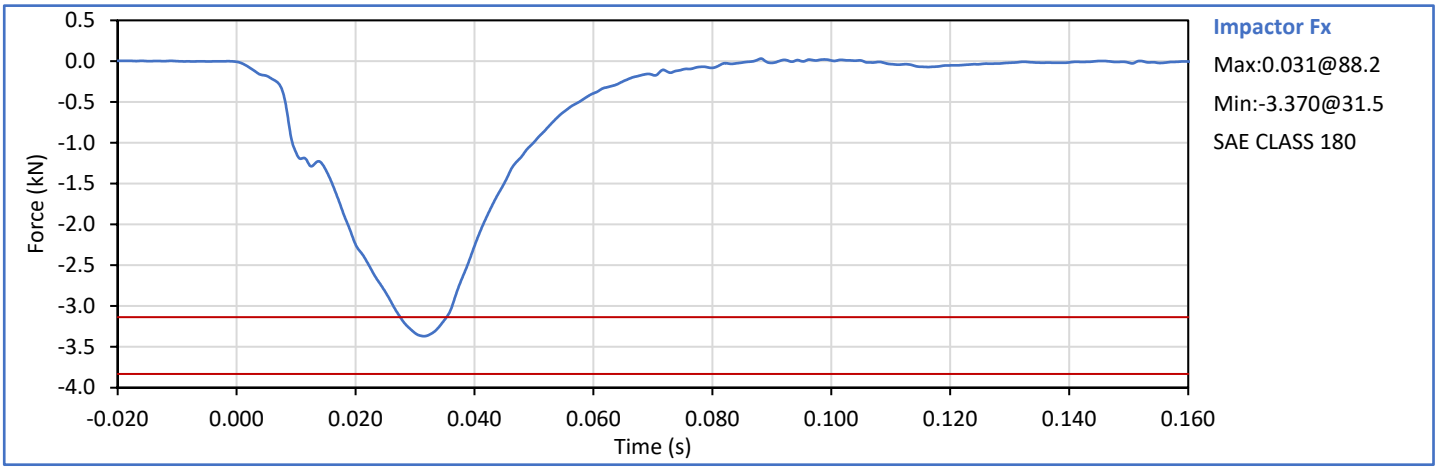
Applus IDIADA KARCO

Post-Test Qualification (Partial) **THOR-50M 50th Percentile Male ATD**
Thorax Impact (Lower Right)

ATD Serial No.: EG2595 Test Date: 2021-05-28

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	27	Pass
Probe Velocity	m/s	4.25	4.35	4.34	Pass
Peak Probe Force	kN	-3.832	-3.136	-3.370	Pass
Lower Left Defl. Res. at Peak Fx	mm	45.8	56.0	50.0	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass





Technician: J. Hernandez

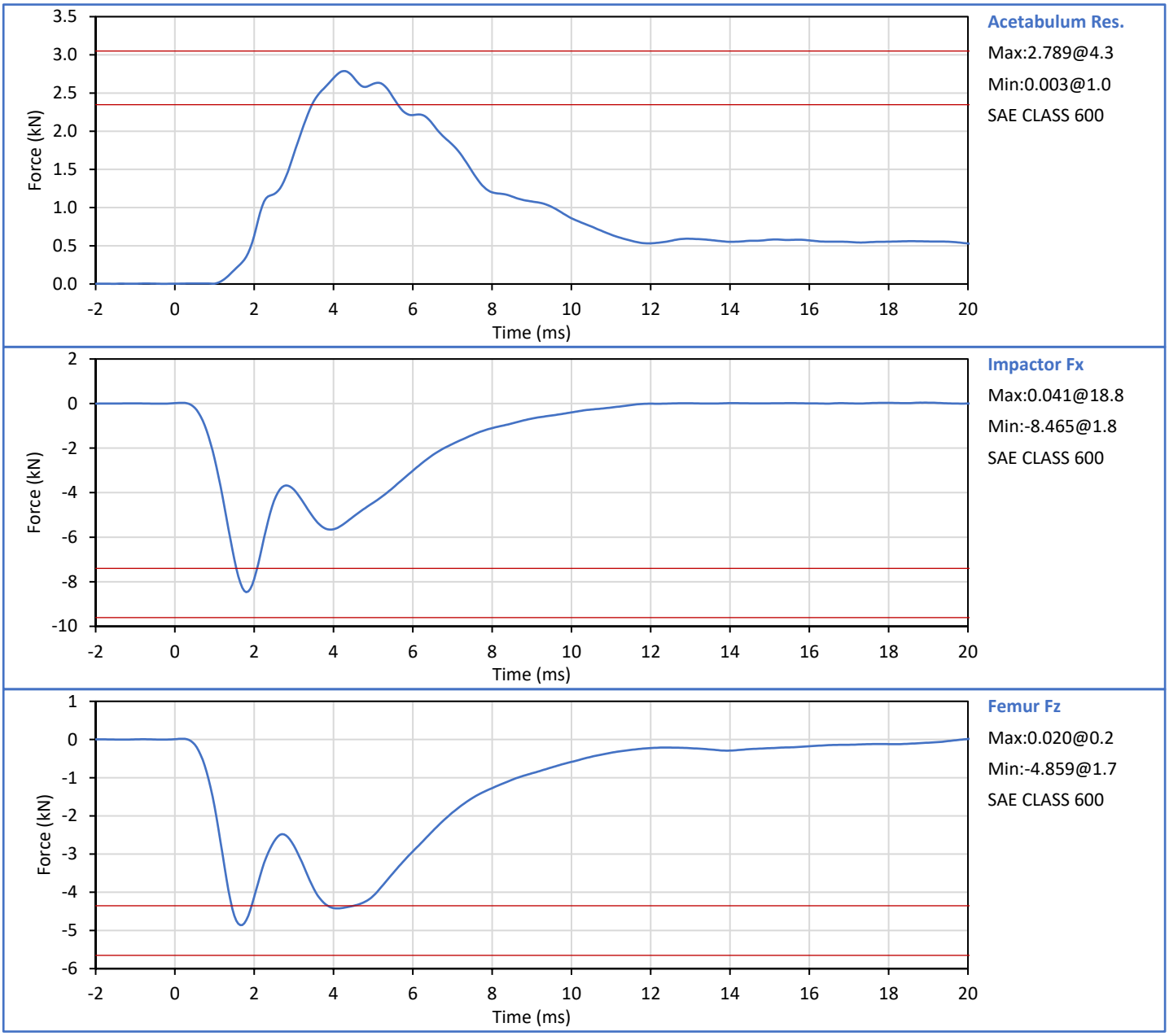
Approved By: P. Puzzuto

Applus IDIADA KARCO

Post-Test Qualification (Partial) **THOR-50M 50th Percentile Male ATD**
Upper Leg (Left) Qualification

ATD Serial No.: EG2595 Test Date: 2021-06-01

Tested Parameter	Units	Spec. Low[1]	Spec. High[1]	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Humidity	%	10	70	34	Pass
Pendulum Velocity	m/s	3.25	3.35	3.32	Pass
Peak Impactor Force	kN	-9.605	-7.395	-8.465	Pass
Peak Femur Fz	kN	-5.650	-4.350	-4.859	Pass
Acetabulum Force Resultant	kN	2.349	3.051	2.789	Pass
NHTSA Corridor 2020-03 (Preliminary Corridor)			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

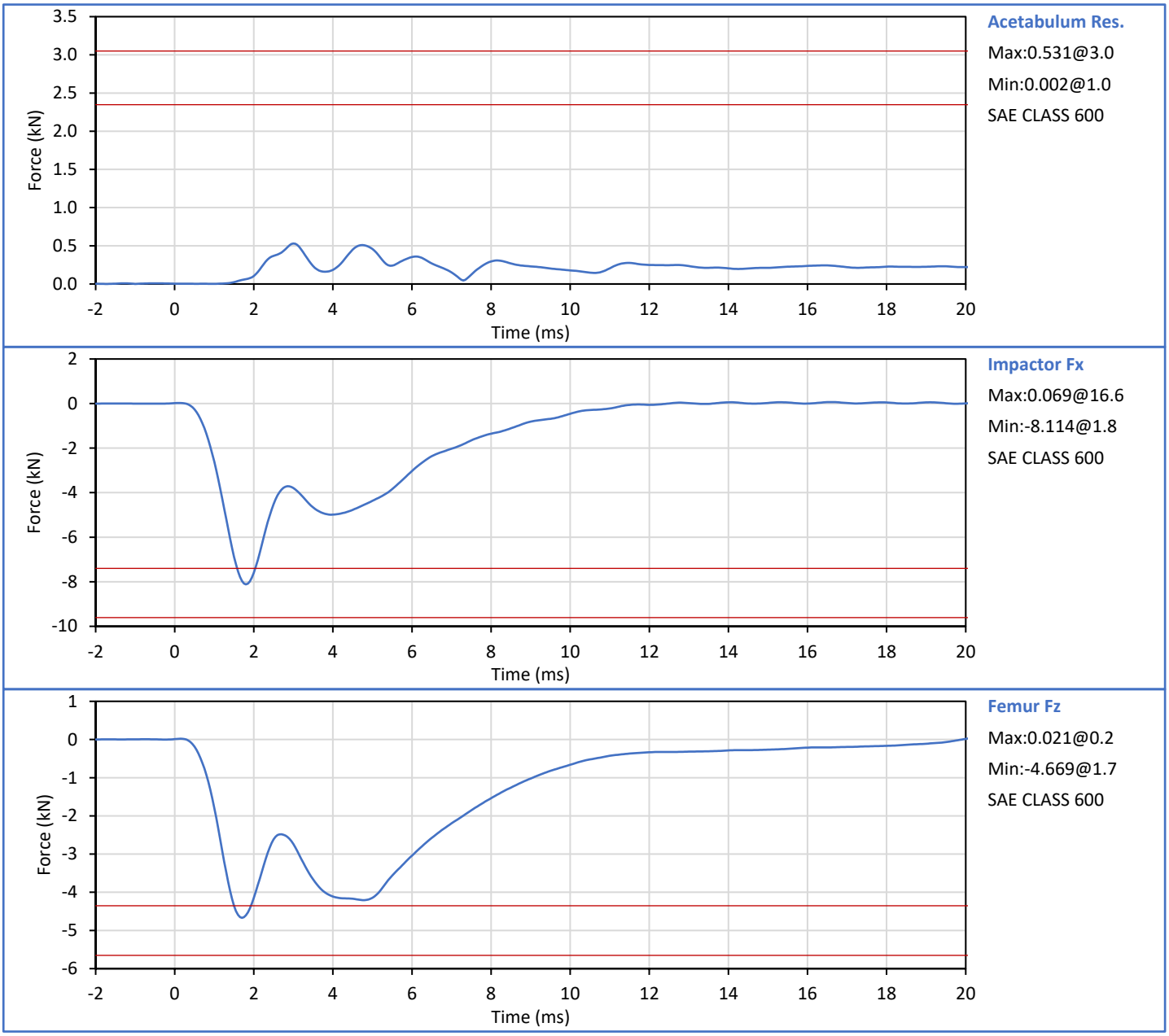
Applus IDIADA KARCO

Post-Test Qualification (Partial) **THOR-50M 50th Percentile Male ATD**
Upper Leg (Right) Qualification

ATD Serial No.: EG2595 Test Date: 2021-06-01

Tested Parameter	Units	Spec. Low[1]	Spec. High[1]	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Humidity	%	10	70	34	Pass
Pendulum Velocity	m/s	3.25	3.35	3.30	Pass
Peak Impactor Force	kN	-9.605	-7.395	-8.114	Pass
Peak Femur Fz	kN	-5.650	-4.350	-4.669	Pass
Acetabulum Force Resultant	kN	2.349	3.051	0.531	**Fail** *
NHTSA Corridor 2020-03 (Preliminary Corridor)			Overall Test Results		**Fail**

* Acetablum Load Cell Fx is not functioning



Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX D
ATD Qualification and Performance Verification
Hybrid III 50th Percentile Male ATD
Post-Test Qualification (Partial) S/N: 168

Applus IDIADA KARCO

Post-Test Qualification (Partial)

Hybrid III 50th Percentile Male ATD
ATD Damage Checklist

ATD Serial No.: 168

Test Date: 2021-05-26

Dummy Item	Inspect for	Comments	Damage	OK
Entire ATD	Perform general cleaning			✓
Outer Skin	Gashes, rips, cracks			✓
Head	Ballast secure			✓
	General appearance			✓
Neck bracket	Upper neck firmly attached to lower bracket			✓
Neck	Broken or cracked rubber			✓
	Looseness at the condyle joint			✓
Nodding block	Cracked or out of position			✓
Lumbar Spine	Broken or cracked rubber			✓
Ribs	Broken or bent ribs			✓
	Broken or bent rib supports			✓
	Damping material separated or cracked			✓
	Rubber bumpers in place			✓
Chest Displ.	Bent shaft			✓
Assembly	Slider arm riding in track			✓
Sensors	Check cables for cuts, tears			✓
	Check for damaged insulation			✓
Accelerometer	Head mounting secure			✓
Mounting	Chest mounting secure			✓
Knees	Skin condition			✓
	Insert (do not remove)			✓
	Casting			✓
Limbs	Normal movement and adjustment			✓
Knee Sliders	Wires intact			✓
	Rubber returned to "resting" position			✓
Pelvis	Broken			✓
Other	Describe below as needed			✓

Describe any repairs or replacement of parts or other findings:

No Problems Found

Due to data excursions in the Head Redundant Ay and Head Redundant Az, sensors and cabling was checked to ensure accelerometers are properly secured and cabling is properly strain relieved; no issues found.

Technician: J. Hernandez

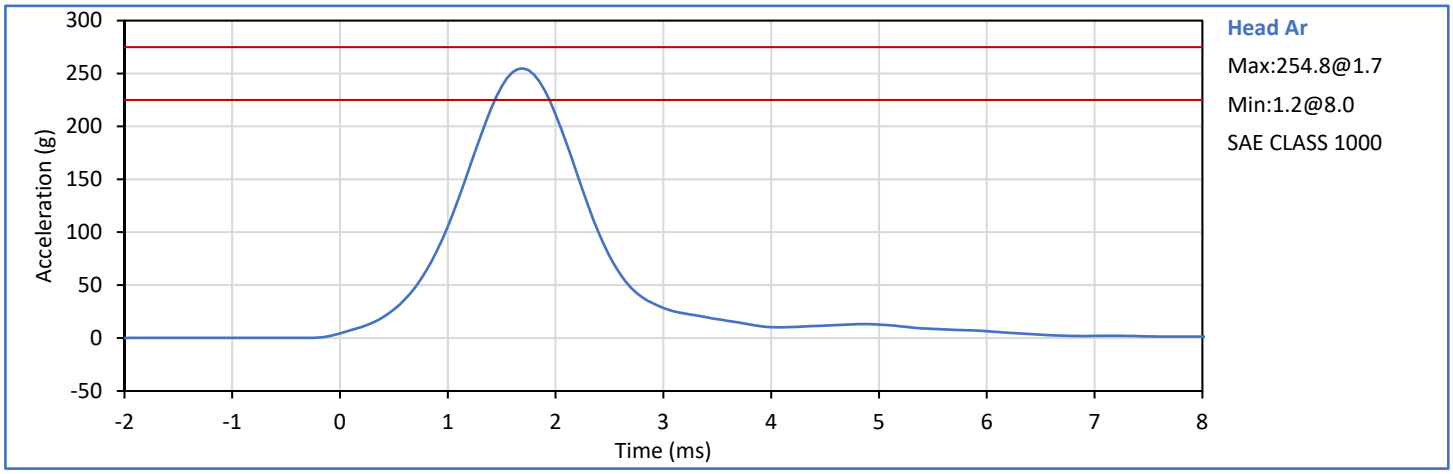
Approved By: P. Puzzuto

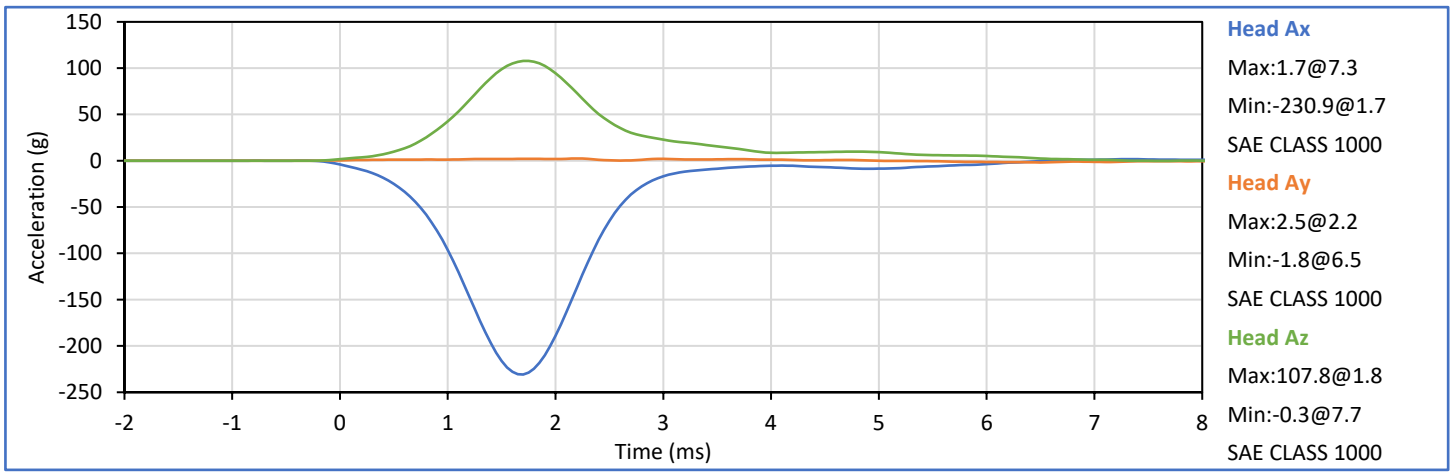
Applus IDIADA KARCO

Post-Test Qualification (Partial) **Hybrid III 50th Percentile Male ATD**
Head Drop

ATD Serial No.: 168 Test Date: 2021-05-26

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.7	Pass
Laboratory Relative Humidity	%	10	70	30	Pass
Peak Resultant Acceleration	g	225.0	275.0	254.8	Pass
Peak Lateral Acceleration	g	-15.0	15.0	2.5	Pass
Oscillations After Main Pulse	%	0.0	10.0	3.0	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

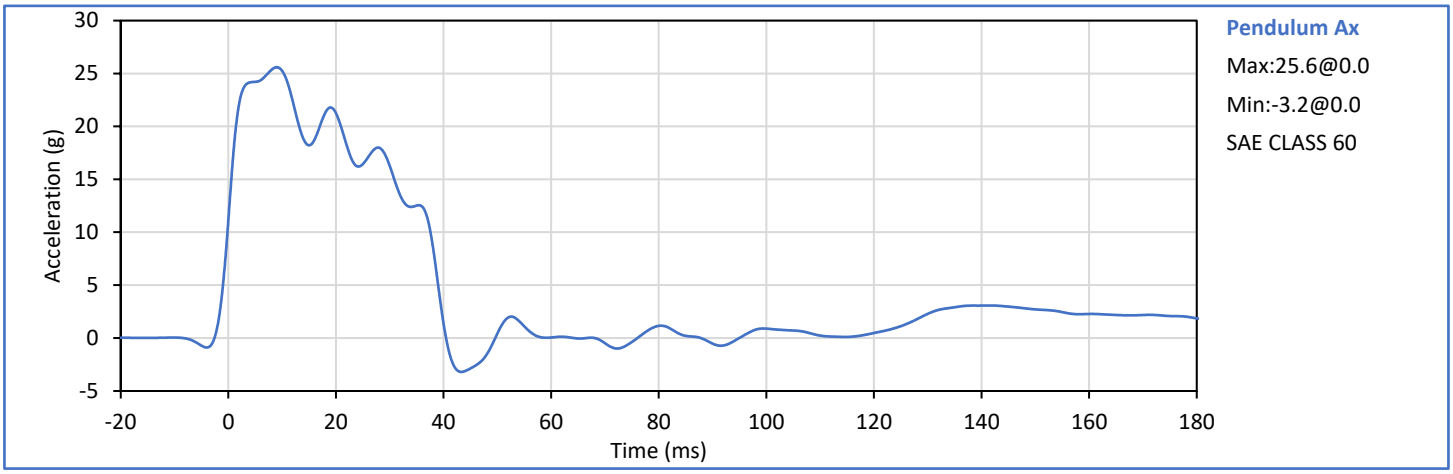
Approved By: P. Puzzuto

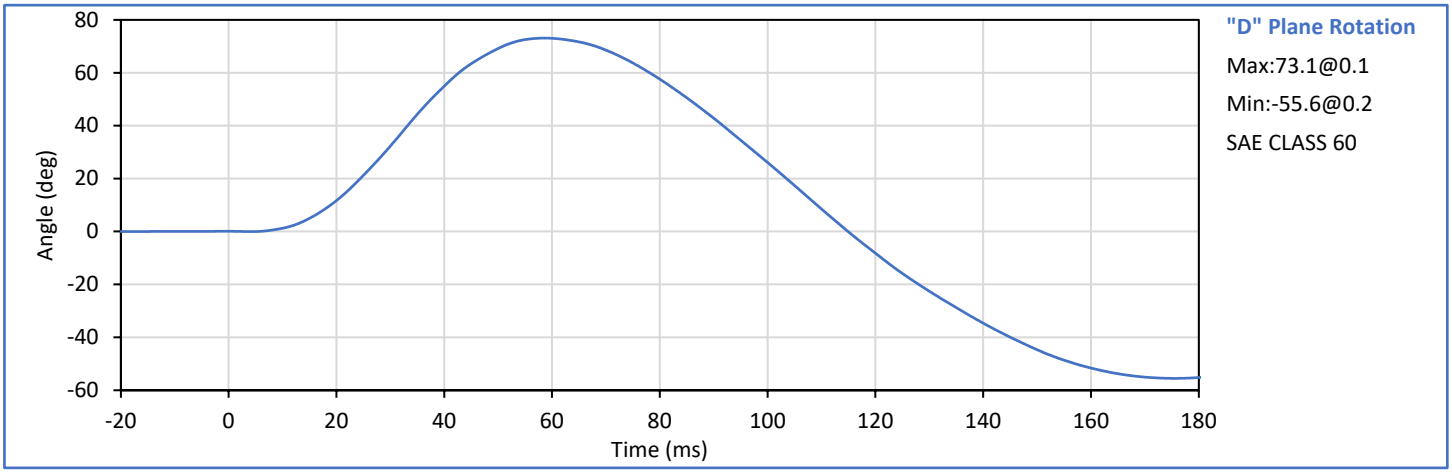
Applus IDIADA KARCO

Post-Test Qualification (Partial) **Hybrid III 50th Percentile Male ATD**
Neck Flexion Test

ATD Serial No.: 168 Test Date: 2021-05-27

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	6.89	7.13	7.03	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	25.2	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	21.3	Pass
Pendulum Deceleration at 30 ms	g	12.5	18.5	16.3	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	29.0	16.3	Pass
Deceleration Decay to Cross 5 g	ms	34.0	42.0	39.0	Pass
"D" Plane Rotation peak	deg	64.0	78.0	73.1	Pass
	ms	57.0	64.0	58.7	Pass
"D" Plane Rotation Decay To Zero	ms	113.0	128.0	115.0	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	93.0	Pass
	ms	47.0	58.0	51.4	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	105.9	Pass
			Overall Test Results		Pass

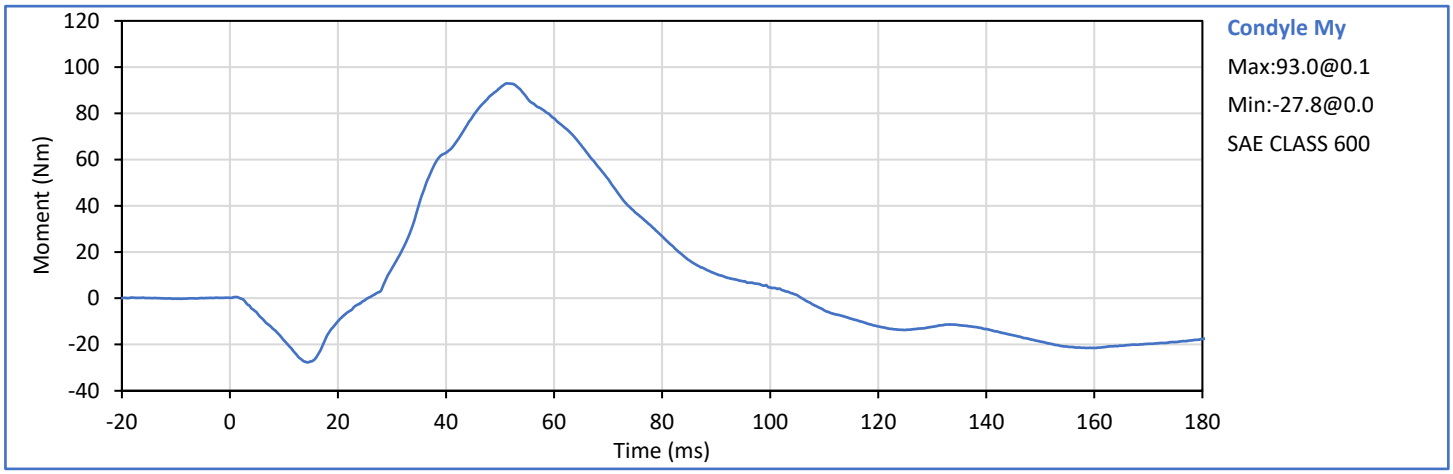


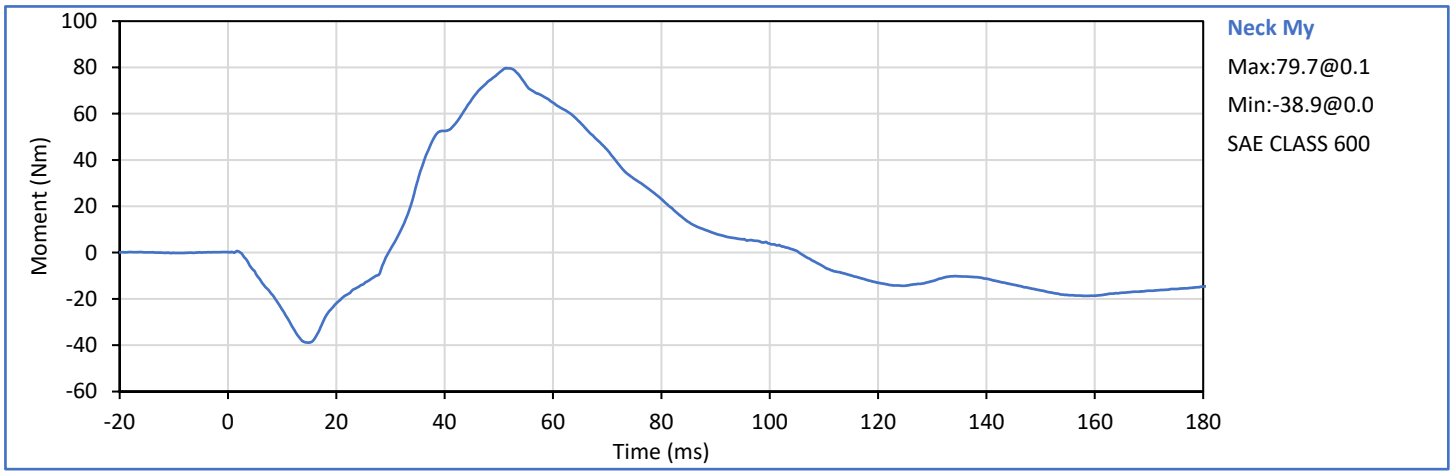


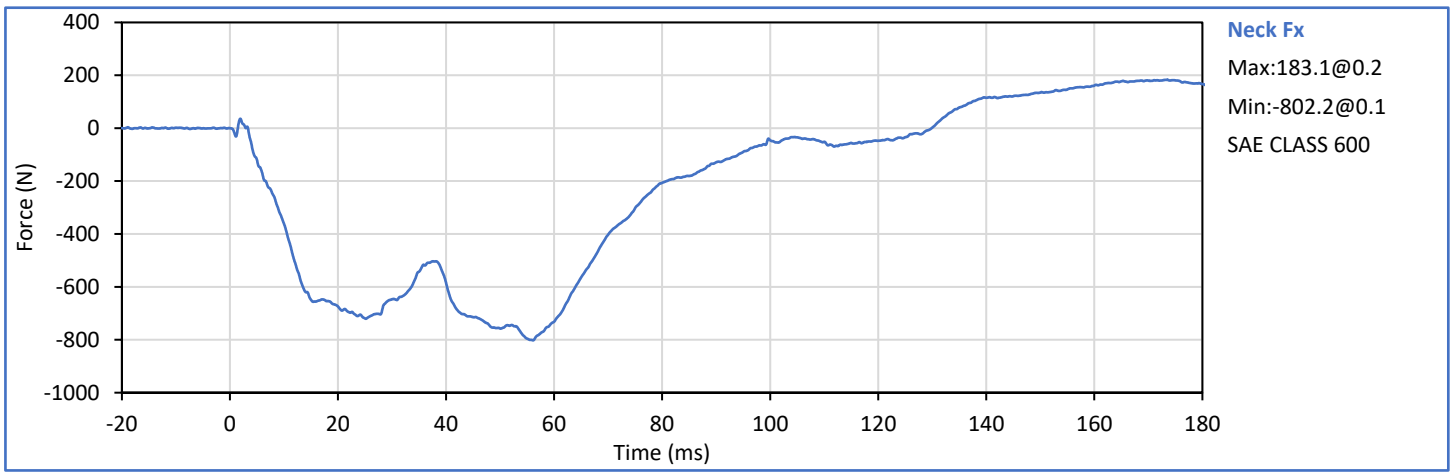
Technician: J. Hernandez

Approved By: P. Puzzuto

ATD Serial No.: 168 Test Date: 2021-05-27





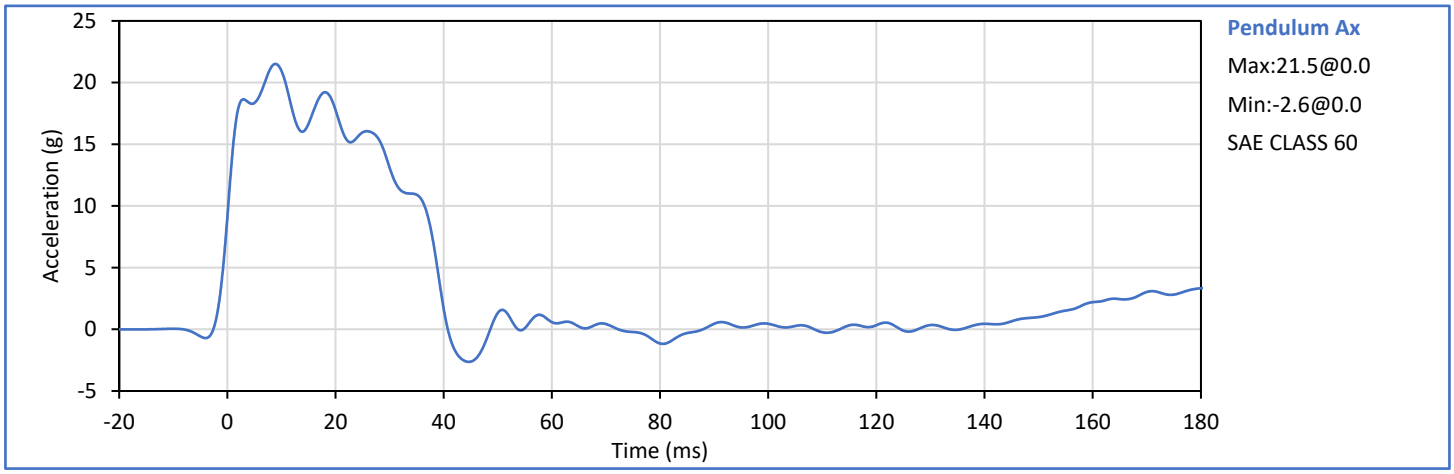


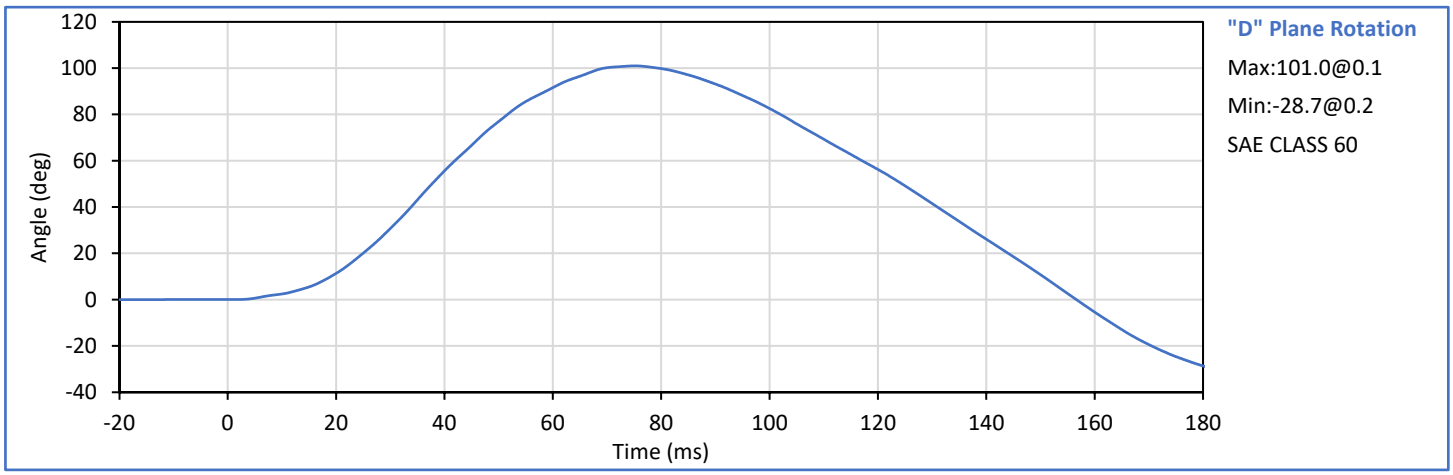
Applus IDIADA KARCO

Post-Test Qualification (Partial) **Hybrid III 50th Percentile Male ATD**
Neck Extension Test

ATD Serial No.: 168 Test Date: 2021-05-27

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	28	Pass
Pendulum Velocity	m/s	5.94	6.19	6.16	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	21.0	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	17.8	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	13.1	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	22.0	13.1	Pass
Deceleration Decay to Cross 5 g	ms	38.0	46.0	38.8	Pass
"D" Plane Rotation peak	deg	81.0	106.0	101.0	Pass
	ms	72.0	82.0	75.2	Pass
"D" Plane Rotation Decay To Zero	ms	147.0	174.0	156.7	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-71.8	Pass
	ms	65.0	79.0	70.4	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	144.4	Pass
			Overall Test Results		Pass

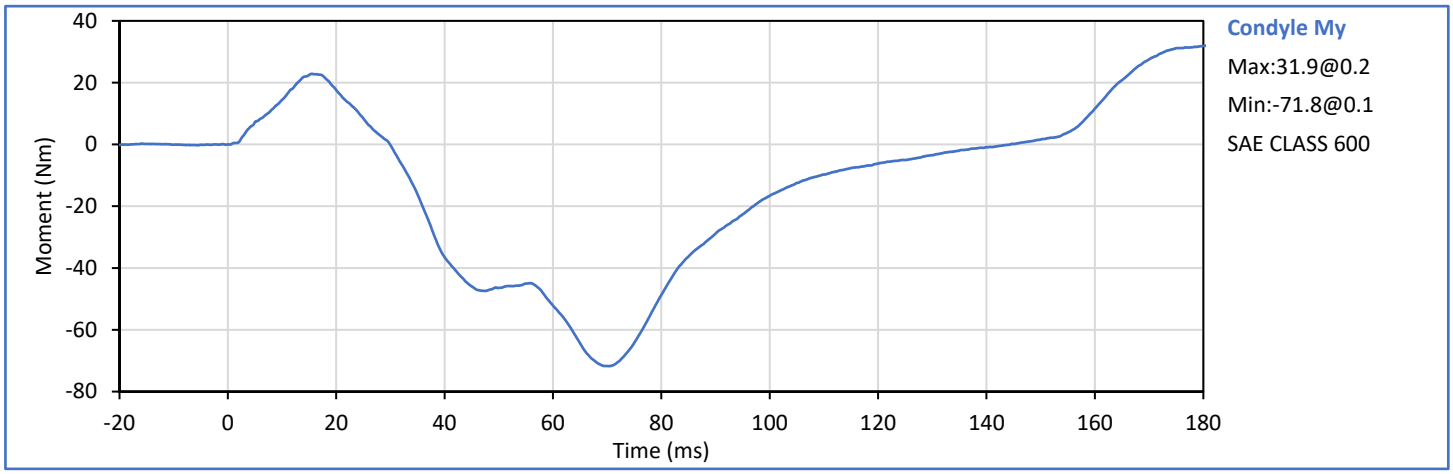


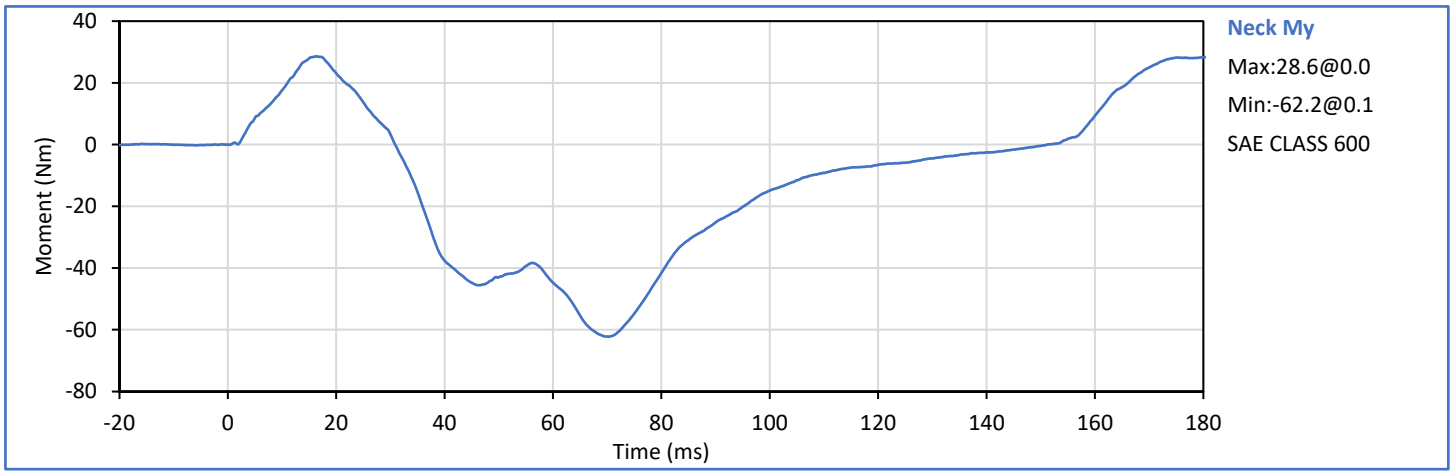


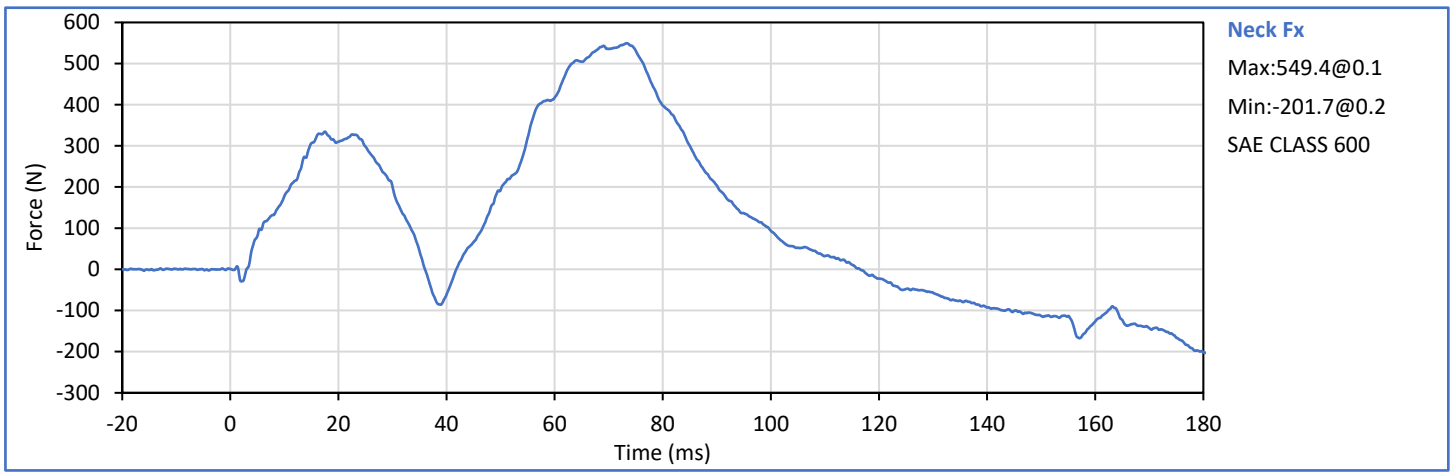
Technician: J. Hernandez

Approved By: P. Puzzuto

ATD Serial No.: 168 Test Date: 2021-05-27





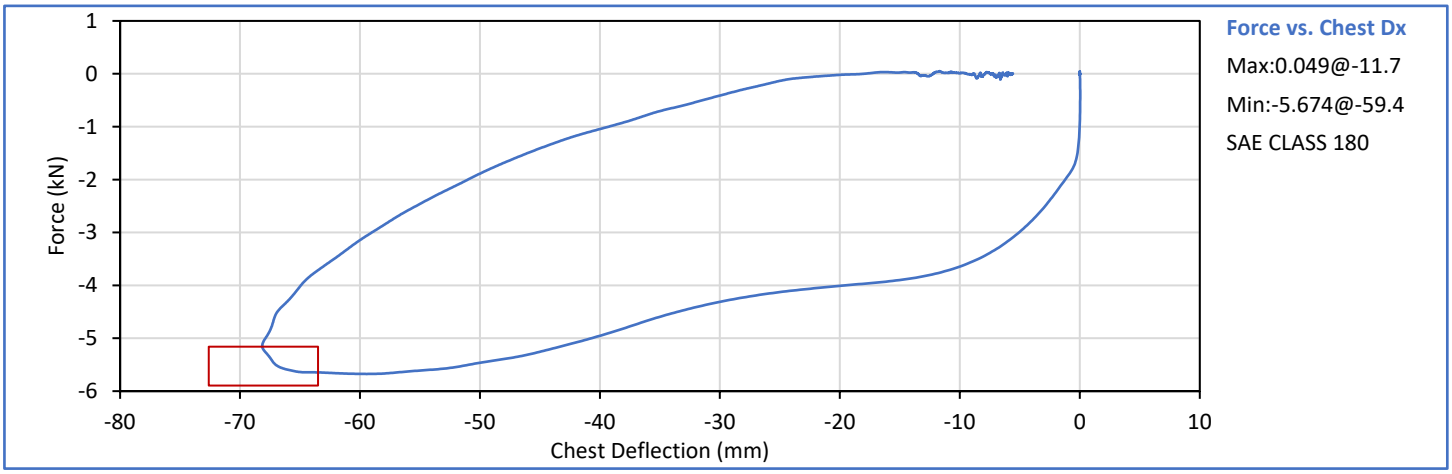


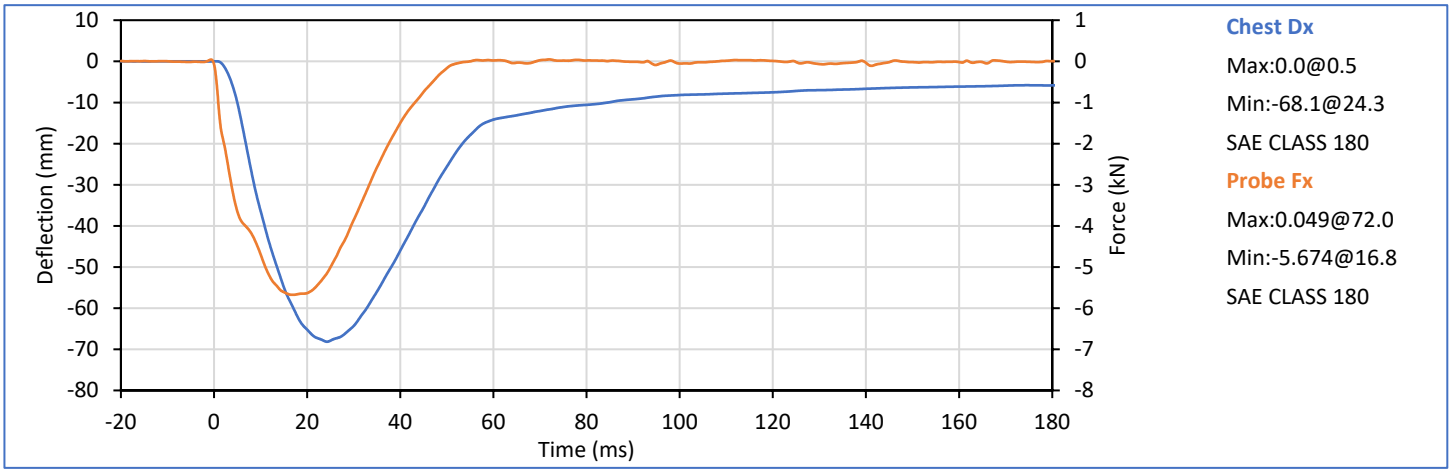
Applus IDIADA KARCO

Post-Test Qualification (Partial) **Hybrid III 50th Percentile Male ATD Thorax Impact**

ATD Serial No.: 168 Test Date: 2021-06-01

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	32	Pass
Probe Velocity	m/s	6.58	6.82	6.71	Pass
Peak Chest Deflection	mm	-72.6	-63.5	-68.1	Pass
Peak Probe Force	kN	-5.893	-5.159	-5.674	Pass
Internal Hysterisis	%	69.0	85.0	74.1	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX E

THOR-50M 50TH PERCENTILE MALE ATD

PHYSICAL INSPECTION, PRE-TEST

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Physical Inspection, Pre-Test

ATD Serial No.: EG2595 Inspection Date: 2021-05-12

Overall Conditon/Functionality	Note
Known errors in data channels (no data, clipping, unexpected drops): Serial Number: DL9552-FX Right Acetabulum Force X bad channel. Serial Number: DW9502 Occipital Condyle Potentiometer not wired. Pre-test calibration notes: Lower thorax cert at bottom of displacement corridor. Overall passing results in final cert. S/N: DL9552-FX Right Acetabulum Force X bad channel, no data will be recorded during testing* S/N: DW9502 Occipital Condyle Potentiometer, no data will be recorded during testing***	
Physical evidence of damage: *Right acetabulum force X was received with bad channel. It was investigated why it was not working and was determined it was not fixable without replacing the loadcell. NHTSA approved running tests without recording this channel. **Occipital Condyle Potentiometer was not wired when received and was required to be recorded. NHTSA approved running the tests without recording this channel.	
Anecdotal evidence of damage:	
Equipment delivered to Borrower: THOR-50M S/N EG2595 with DTS SLICE6 Internal DAS Laptop DTS MiniDistributor with cables and PSU	

Technician: J. Hernandez

Approved By: P .Puzzuto

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Physical Inspection, Pre-Test

ATD Serial No.: EG2595 Inspection Date: 2021-05-12

HEAD – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Rear head cap mounts securely to head:	
✓	Head skin fits securely over skull	
✓	Head skin shows no sign of tears or damage	
✓	Interior components of skull (ballast, sensor mounts, sensors) securely attached:	
✓	Head securely mounted to OC joint:	
✓	Other:	

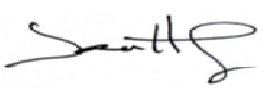
Neck – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Neck cables slide freely through holes in neck plates:	
✓	Head can rotate about occipital condyle joint freely until the bump stops are engaged:	
✓	Neck cables show no sign of fraying, broken strands, or kinking	
✓	No evidence of de-bonding between neck pucks and plates. If failure, indicate which interface (i.e.: where plate/puck 1 attach to upper neck load cell):	
✓	No evidence of de-bonding or permanent compression in neck soft stop assemblies:	
✓	Neck securely attached to upper neck load cell:	
✓	Neck securely attached to lower neck load cell	
✓	Neck pitch change joint mechanism mating teeth are engaged	
✓	Other:	

JACKET – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Rib stiffeners show no sign of permanent deformation:	
✓	No evidence of tears or holes in jacket fabric, velcro, or zippers:	
✓	Other:	

LEFT SHOULDER/ARM – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Urethane shoulder pads show no evidence of contact:	
✓	Clavicle securely attached to sternum and shoulder:	
✓	No evidence of debonding, tearing, or permanent compression of posterior soft stops	
✓	Other:	

RIGHT SHOULDER/ARM – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Urethane shoulder pads show no evidence of contact:	
✓	Clavicle securely attached to sternum and shoulder:	
✓	No evidence of debonding, tearing, or permanent compression of posterior soft stops	
✓	Other:	

Spine – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	No evidence of de-bonding between thoracic spine flex joint and metal plates:	
✓	No evidence of de-bonding between lumbar spine flex joint and metal plates:	
✓	Lumbar spine pitch change joint mechanism mating teeth are engaged:	
✓	Other:	

Technician:  Approved By: 

J. Hernandez P .Puzzuto

Applus IDIADA
KARCO

THOR-50M 50th Percentile Male ATD
Physical Inspection, Pre-Test

ATD Serial No.: EG2595 Inspection Date: 2021-05-12

THORAX – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	No evidence of contact at top, bottom, or interior faces of rib damping material:	
✓	No evidence of debonding between rib damping material and ribs:	
✓	IR-TRACC tubes securely attached to anterior ribs	
✓	IR-TRACC tubes securely attached to double gimbals, spine:	
✓	Urethane bib is securely attached to ribs with no sign of tearing or washer penetration:	
✓	Ribs securely attached to posterior spine:	
✓	Rib stiffeners show no evidence of bending (no gaps between ribs and stiffeners):	
✓	Other:	

ABDOMEN – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	No evidence of tearing, cuts, or broken stitches in upper abdomen bag and zipper:	
✓	Upper abdomen insert securely attached to spine:	
✓	Upper abdomen insert shows no evidence of permanent set:	
✓	No evidence of tearing, cuts, or broken stitches in lower abdomen bag and zipper:	
✓	Lower abdomen insert securely attached to spine:	
✓	Lower abdomen insert shows no evidence of permanent set:	
✓	Other:	

Pelvis – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Pelvis flesh fits securely over pelvis bones:	
✓	H-point tool fits securely into hole on both sides of pelvis:	
✓	ASIS load cells are secured to the iliac bones and iliac bones are firmly attached to the pelvis	
✓	The iliac bones are free from cracks or fractures	
✓	If welds are present in the iliac bones, the welds are continuous and devoid of cracks	
✓	Other:	

Technician: J. Hernandez

Approved By: P .Puzzuto

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Physical Inspection, Pre-Test

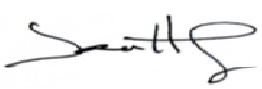
ATD Serial No.: EG2595 Inspection Date: 2021-05-12

	LEFT FEMUR – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture	Note
✓	Acetabular load cells firmly attached:	
✓	Femur load cell firmly attached:	
✓	No evidence of deformation of knee slider bump stop:	
✓	No cuts, tears, or scuffing of knee flesh:	
✓	Other:	

	RIGHT FEMUR – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture	Note
✓	Acetabular load cells firmly attached:	
✓	Femur load cell firmly attached:	
✓	No evidence of deformation of knee slider bump stop:	
✓	No cuts, tears, or scuffing of knee flesh:	
✓	Other:	

	LEFT LOWER EXTREMITY (LX) – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture	Note
✓	Rotational potentiometers in ankle securely attached:	
✓	Achilles tendon provides resistance to dorsiflexion:	
✓	No evidence of debonding, tearing, or permanent compression of ankle soft stops:	
✓	No cuts, tears, or scuffing of leg flesh	
✓	Other:	

	RIGHT LOWER EXTREMITY (LX) – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture	Note
✓	Rotational potentiometers in ankle securely attached:	
✓	Achilles tendon provides resistance to dorsiflexion:	
✓	No evidence of debonding, tearing, or permanent compression of ankle soft stops:	
✓	No cuts, tears, or scuffing of leg flesh	
✓	Other:	

Technician:  Approved By: 

J. Hernandez P .Puzzuto

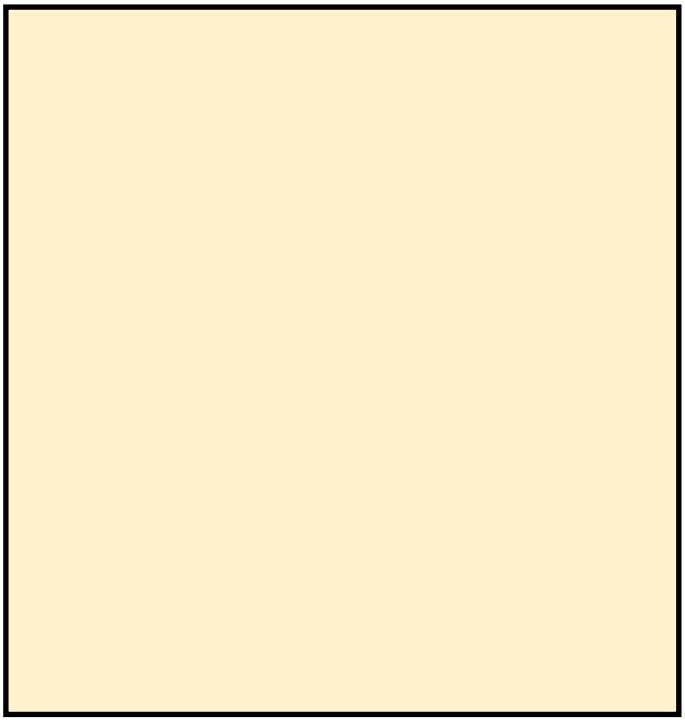
Applus IDIADA KARCO

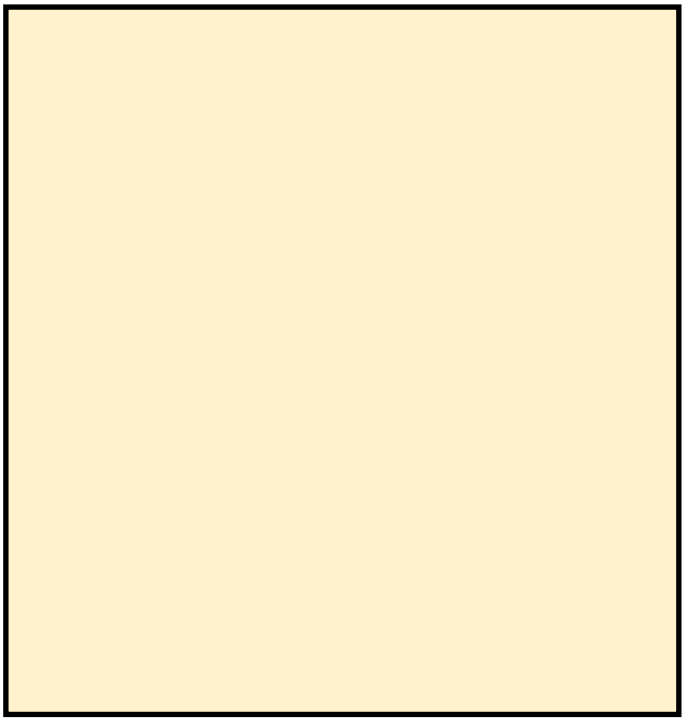
THOR-50M 50th Percentile Male ATD
Physical Inspection, Pre-Test

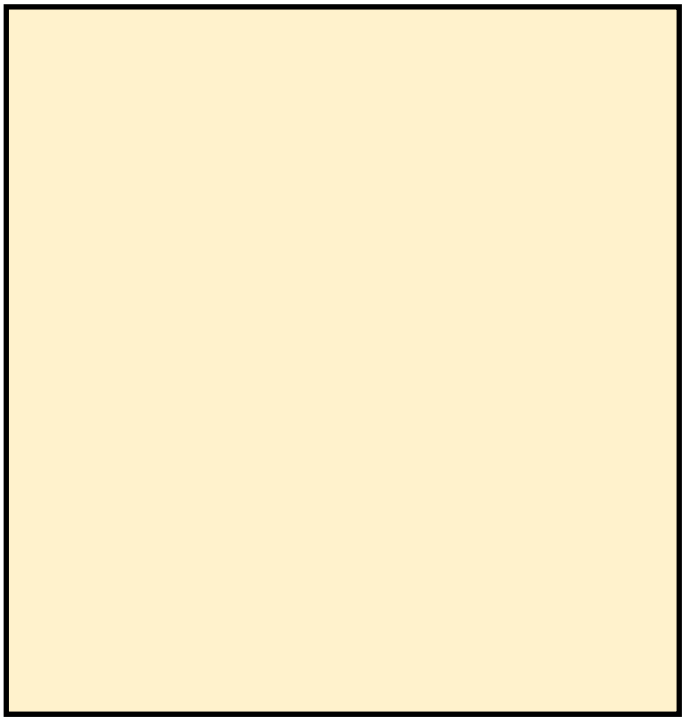
ATD Serial No.: EG2595

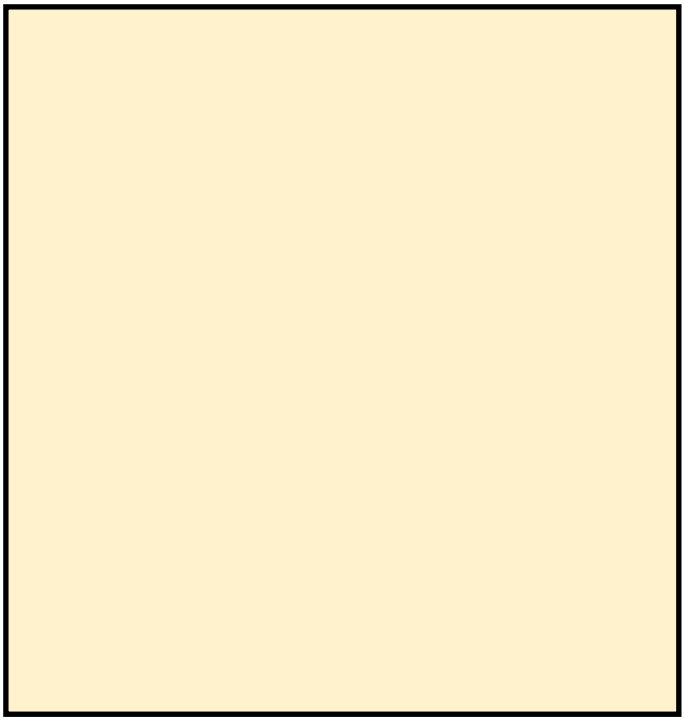
Inspection Date: 2021-05-12

Damage and Discrepancy Details









Technician: J. Hernandez

Approved By: P .Puzzuto

APPENDIX F

THOR-50M 50TH PERCENTILE MALE ATD

PHYSICAL INSPECTION, POST-TEST

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Physical Inspection, Post-Test

ATD Serial No.: EG2595 Inspection Date: 2021-05-24

Overall Conditon/Functionality	Note
Known errors in data channels (no data, clipping, unexpected drops): Serial Number: DL9552-FX Right Acetabulum Force X bad channel. Serial Number: DW9502 Occipital Condyle Potentiometer not wired. Serial Number: DL9552-FX Right Acetabulum Force X bad channel, no data recorded during the test* Serial Number: DW9502 Occipital Condyle Potentiometer, no data recorded during the test**	
Physical evidence of damage: *Right acetabulum force X was received with bad channel. It was investigated why it was not working and was determined it was not fixable without replacing the loadcell. NHTSA approved running the test without recording this channel. **Occipital Condyle Potentiometer was not wired when received and was required to be recorded. NHTSA approved running the test without recording this channel.	
Anecdotal evidence of damage:	
Equipment delivered to Borrower: THOR-50M S/N EG2595 with DTS SLICE6 Internal DAS Laptop DTS MiniDistributor with cables and PSU	

Technician: J. Hernandez

Approved By: P .Puzzuto

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Physical Inspection, Post-Test

ATD Serial No.: EG2595 Inspection Date: 2021-05-24

HEAD – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Rear head cap mounts securely to head:	
✓	Head skin fits securely over skull	
✓	Head skin shows no sign of tears or damage	
✓	Interior components of skull (ballast, sensor mounts, sensors) securely attached:	
✓	Head securely mounted to OC joint:	
×	Other:	See Details Page

Neck – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Neck cables slide freely through holes in neck plates:	
✓	Head can rotate about occipital condyle joint freely until the bump stops are engaged:	
✓	Neck cables show no sign of fraying, broken strands, or kinking	
✓	No evidence of de-bonding between neck pucks and plates. If failure, indicate which interface (i.e.: where plate/puck 1 attach to upper neck load cell):	
✓	No evidence of de-bonding or permanent compression in neck soft stop assemblies:	
✓	Neck securely attached to upper neck load cell:	
✓	Neck securely attached to lower neck load cell	
✓	Neck pitch change joint mechanism mating teeth are engaged	
✓	Other:	

JACKET – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Rib stiffeners show no sign of permanent deformation:	
✓	No evidence of tears or holes in jacket fabric, velcro, or zippers:	
✓	Other:	

LEFT SHOULDER/ARM – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Urethane shoulder pads show no evidence of contact:	
✓	Clavicle securely attached to sternum and shoulder:	
✓	No evidence of debonding, tearing, or permanent compression of posterior soft stops	
✓	Other:	

RIGHT SHOULDER/ARM – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Urethane shoulder pads show no evidence of contact:	
✓	Clavicle securely attached to sternum and shoulder:	
✓	No evidence of debonding, tearing, or permanent compression of posterior soft stops	
✓	Other:	

Spine – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	No evidence of de-bonding between thoracic spine flex joint and metal plates:	
✓	No evidence of de-bonding between lumbar spine flex joint and metal plates:	
✓	Lumbar spine pitch change joint mechanism mating teeth are engaged:	
✓	Other:	

Technician: J. Hernandez

Approved By: P .Puzzuto

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Physical Inspection, Post-Test

ATD Serial No.: EG2595 Inspection Date: 2021-05-24

	THORAX – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture	Note
✓	No evidence of contact at top, bottom, or interior faces of rib damping material:	
✓	No evidence of debonding between rib damping material and ribs:	
✓	IR-TRACC tubes securely attached to anterior ribs	
✓	IR-TRACC tubes securely attached to double gimbals, spine:	
✓	Urethane bib is securely attached to ribs with no sign of tearing or washer penetration:	
✓	Ribs securely attached to posterior spine:	
✓	Rib stiffeners show no evidence of bending (no gaps between ribs and stiffeners):	
✓	Other:	

	ABDOMEN – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture	Note
✓	No evidence of tearing, cuts, or broken stitches in upper abdomen bag and zipper:	
✓	Upper abdomen insert securely attached to spine:	
✓	Upper abdomen insert shows no evidence of permanent set:	
✓	No evidence of tearing, cuts, or broken stitches in lower abdomen bag and zipper:	
✓	Lower abdomen insert securely attached to spine:	
✓	Lower abdomen insert shows no evidence of permanent set:	
✓	Other:	

	Pelvis – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture	Note
✓	Pelvis flesh fits securely over pelvis bones:	
✓	H-point tool fits securely into hole on both sides of pelvis:	
✓	ASIS load cells are secured to the iliac bones and iliac bones are firmly attached to the pelvis	
✓	The iliac bones are free from cracks or fractures	
✓	If welds are present in the iliac bones, the welds are continuous and devoid of cracks	
✓	Other:	

Technician: J. Hernandez

Approved By: P .Puzzuto

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Physical Inspection, Post-Test

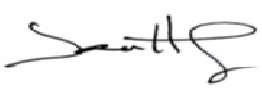
ATD Serial No.: EG2595 Inspection Date: 2021-05-24

LEFT FEMUR – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Acetabular load cells firmly attached:	
✓	Femur load cell firmly attached:	
✓	No evidence of deformation of knee slider bump stop:	
✓	No cuts, tears, or scuffing of knee flesh:	
✓	Other:	

RIGHT FEMUR – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Acetabular load cells firmly attached:	
✓	Femur load cell firmly attached:	
✓	No evidence of deformation of knee slider bump stop:	
✓	No cuts, tears, or scuffing of knee flesh:	
✓	Other:	

LEFT LOWER EXTREMITY (LX) – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Rotational potentiometers in ankle securely attached:	
✓	Achilles tendon provides resistance to dorsiflexion:	
✓	No evidence of debonding, tearing, or permanent compression of ankle soft stops:	
✓	No cuts, tears, or scuffing of leg flesh	
✓	Other:	

RIGHT LOWER EXTREMITY (LX) – Pass(✓)/Fail(×). If Fail, explain reason and/or attach picture		Note
✓	Rotational potentiometers in ankle securely attached:	
✓	Achilles tendon provides resistance to dorsiflexion:	
✓	No evidence of debonding, tearing, or permanent compression of ankle soft stops:	
✓	No cuts, tears, or scuffing of leg flesh	
✓	Other:	

Technician:  Approved By: 

J. Hernandez P .Puzzuto

ATD Serial No.: EG2595 Inspection Date: 2021-05-24

Damage and Discrepancy Details

Cuts in Face Foam

Cut on top of face.

Additional Notes:
None

APPENDIX G
THOR-50M 50TH PERCENTILE MALE ATD
SENSOR POLARITIES

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Sensor Polarities

ATD S/N: EG2595 Date: 5/10/2021

Note 1: Some polarities may appear counter to the specified wiring. The use of wired adapters may influence polarities

Note 2: Highlighted SAE polarity shows a deviation from SAE standard or an expected negative polarity to the mechanical input

Segment	Instrument	Axis	ISO Code	Motion	J211	Actual	Invert
Head and Neck	Head Accelerometers Primary	Ax	HEAD0000THACXP	Impact back of head	+	-	Yes
		Ay	HEAD0000THACYP	Impact left of head	+	+	No
		Az	HEAD0000THACZP	Impact top of head	+	+	No
	Head Accelerometers Redundant	Ax	HEADRD00THACXP	Impact back of head	+	NA	NA
		Ay	HEADRD00THACYP	Impact left of head	+	NA	NA
		Az	HEADRD00THACZP	Impact top of head	+	NA	NA
	Head ARS	ωx	HEAD0000THAVXP	Rotate right ear toward right shoulder	+	-	Yes
		ωy	HEAD0000THAVYP	Rotate chin away from sternum	+	+	No
		ωz	HEAD0000THAVZP	Rotate chin toward right shoulder	+	-	Yes
	Front Neck Spring	Fz	NECKFR00THFOZP	Rotate head rearward	+	+	No
	Rear Neck Spring	Fz	NECKRE00THFOZP	Rotate chin toward chest	+	+	No
	O.C. Rotary Pot	Ry	NECKUP00THANYP	Rotate chin toward chest	+	NA	NA
	Upper Neck Load	Fx	NECKUP00THFOXP	Move head rear, chest forward	+	+	No
		Fy	NECKUP00THFOYP	Move head left, chest right	+	+	No
		Fz	NECKUP00THFOZP	Move head up, chest down	+	+	No
		Mx	NECKUP00THMOXP	Rotate left ear toward left shoulder	+	+	No
		My	NECKUP00THMOYP	Rotate chin toward sternum	+	+	No
		Mz	NECKUP00THMOZP	Rotate chin toward left shoulder	+	+	No
	Lower Neck Load	Fx	NECKLO00THFOXP	Move head rear, chest forward	+	NA	NA
		Fy	NECKLO00THFOYP	Move head left, chest right	+	NA	NA
		Fz	NECKLO00THFOZP	Move head up, chest down	+	NA	NA
		Mx	NECKLO00THMOXP	Rotate left ear toward left shoulder	+	NA	Yes
		My	NECKLO00THMOYP	Rotate chin toward sternum	+	NA	Yes
		Mz	NECKLO00THMOZP	Rotate chin toward left shoulder	+	NA	Yes
	Face Loads	Fx	NA	Hold back of head, push face rearward	-	NA	NA

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD

Sensor Polarities

ATD S/N: EG2595 Date: 5/10/2021

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Segment	Instrument	Axis	ISO Code	Motion	J211	Actual	Invert
Spine and Thorax	T1 Accelerometer	Ax	THSP0100THACXP	Impact back of T1Spine	+	NA	NA
		Ay	THSP0100THACYP	Impact left of T1Spine	+	NA	NA
		Az	THSP0100THACZP	Impact top of Spine	+	NA	NA
	T1 ARS	ωx	THSP0100THAVXP	Rotate spine sideways to the right	+	NA	NA
		ωy	THSP0100THAVYP	Rotate spine rearward	+	NA	NA
		ωz	THSP0100THAVZP	Left shoulder forward, right shoulder aft	+	NA	NA
	Mid Sternum Accelerometer	Ax	STRN0000THACXP	Rotate dummy back (face up)	+	NA	NA
	T6 Accelerometer (Chest CG)	Ax	THSP0600THACXP	Impact back of T6 Spine	+	-	Yes
		Ay	THSP0600THACYP	Impact left of T6 Spine	+	+	No
		Az	THSP0600THACZP	Impact top of Spine	+	-	Yes
	T6 ARS	ωx	THSP0600THAVXP	Right shoulder down	+	-	Yes
		ωy	THSP0600THAVYP	Shoulders back	+	+	No
		ωz	THSP0600THAVZP	Left shoulder forward, right shoulder back	+	-	Yes
	T12 (Thoracic Spine) Accelerometer	Ax	THSP1200THACXP	Impact back of T12 Spine	+	NA	NA
		Ay	THSP1200THACYP	Impact left of T12 Spine	+	NA	NA
		Az	THSP1200THACZP	Impact top of Spine	+	NA	NA
	T12 (Thoracic Spine) ARS	ωx	THSP1200THAVXP	Impact back of T12 Spine	+	NA	NA
		ωy	THSP1200THAVYP	Impact left of T12 Spine	+	NA	NA
		ωz	THSP1200THAVZP	Impact top of Spine	+	NA	NA
	T12 (Thoracic Spine) Load	Fx	THSP1200THFOXP	Move chest rear, pelvis forward	+	+	No
		Fy	THSP1200THFOYP	Move chest left, pelvis right	+	+	No
		Fz	THSP1200THFOZP	Move chest up, pelvis down	+	+	No
		Mx	THSP1200THMOXP	Rotate left shoulder toward left hip	+	+	No
		My	THSP1200THMOYP	Rotate sternum towards front of legs	+	+	No
	Left Clavicle (Medial) Load	Fx	NA	Pull clavicle forward away from spine	+	NA	NA
		Fz	NA	Push clavicle down towards pelvis	+	NA	NA
	Left Clavicle (Lateral) Load	Fx	NA	Push clavicle forward away from spine	+	NA	NA
		Fz	NA	Push clavicle down towards pelvis	+	NA	NA
	Right Clavicle (Medial) Load	Fx	NA	Push clavicle forward away from spine	+	NA	NA
		Fz	NA	Push clavicle down towards pelvis	+	NA	NA
	Right Clavicle (Lateral) Load	Fx	NA	Push clavicle forward away from spine	+	NA	NA
		Fz	NA	Push clavicle down towards pelvis	+	NA	NA
Abdomen	Upper Abdomen Accel,	Ax	NA	Impact back of Spine	+	NA	NA

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Sensor Polarities

ATD S/N: EG2595 Date: 5/10/2021

Note 1: Some polarities may appear counter to the specified wiring. The use of wired adapters may influence polarities

Note 2: Highlighted SAE polarity shows a deviation from SAE standard or an expected negative polarity to the mechanical input

Segment	Instrument	Axis	ISO Code	Motion	J211	Actual	Invert
Pelvis	Left ASIS Load	Fx	ILACLE00THFOXP	Push in towards back of pelvis	-	-	No
	(Anterior Superior Iliac Spine)	My	ILACLE00THMOYP	Push top of ASIS towards back of pelvis	+	+	No
	Right ASIS Load	Fx	ILACRI00THFOXP	Push in towards back of pelvis	-	-	No
	(Anterior Superior Iliac Spine)	My	ILACRI00THMOYP	Push top of ASIS towards back of pelvis	+	+	No
	Left Acetabular Load	Fx	ACTBLE00THFOXP	Move femur forward, pelvis rear	+	-	Yes
		Fy	ACTBLE00THFOYP	Move femur right, pelvis left	+	+	No
		Fz	ACTBLE00THFOZP	Move femur down, pelvis up	+	+	No
	Right Acetabular Load	Fx	ACTBRI00THFOXP	Move femur forward, pelvis rear	+	+	No
		Fy	ACTBRI00THFOYP	Move femur right, pelvis left	+	-	Yes
		Fz	ACTBRI00THFOZP	Move femur down, pelvis up	+	-	Yes
	Pelvis CG Accelerometer	Ax	PELV0000THACXP	Impact back of Pelvis	+	-	Yes
		Ay	PELV0000THACYP	Impact left of Pelvis	+	+	No
		Az	PELV0000THACZP	Impact top of Spine	+	+	No
	Pelvis CG ARS	ωx	PELV0000THAVXP	Right shoulder down	+	-	Yes
		ωy	PELV0000THAVYP	Shoulders back, legs up	+	+	No
		ωz	PELV0000THAVZP	Twist pelvis, body, and legs right	+	+	No
Femurs	Left Femur Load	Fx	FEMRLE00THFOXP	Move knee upward, upper femur down	+	+	No
		Fy	FEMRLE00THFOYP	Move knee right, upper femur left	+	+	No
		Fz	FEMRLE00THFOZP	Move knee forward, femur rear	+	+	No
		Mx	FEMRLE00THMOXP	Rotate knee left, hold upper femur	+	+	No
		My	FEMRLE00THMOYP	Rotate knee up, hold upper femur	+	+	No
		Mz	FEMRLE00THMOZP	Rotate tibia left, hold pelvis	+	+	No
	Right Femur Load	Fx	FEMRRI00THFOXP	Move knee upward, upper femur down	+	+	No
		Fy	FEMRRI00THFOYP	Move knee right, upper femur left	+	+	No
		Fz	FEMRRI00THFOZP	Move knee forward, femur rear	+	+	No
		Mx	FEMRRI00THMOXP	Rotate knee left, hold upper femur	+	+	No
		My	FEMRRI00THMOYP	Rotate knee up, hold upper femur	+	+	No
		Mz	FEMRRI00THMOZP	Rotate tibia left, hold pelvis	+	+	No

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Sensor Polarities

ATD S/N: EG2595 Date: 5/10/2021

Note 1: Some polarities may appear counter to the specified wiring. The use of wired adapters may influence polarities

Note 2: Highlighted SAE polarity shows a deviation from SAE standard or an expected negative polarity to the mechanical input

Segment	Instrument	Axis	ISO Code	Motion	J211	Actual	Invert
Lower Extremity Left	Knee Shear Displacement	Dx	KNSLLE00THDSXP	Hold femur, move tibia forward	+	+	No
	Upper Tibia Load	Fx	TIBILEUPTHFOXP	Move tibia forward, knee rearward	+	+	No
		Fy	TIBILEUPTHFOYP	Move ankle right, knee left	+	+	No
		Fz	TIBILEUPTHFOZP	Move ankle down, knee up	+	+	No
		Mx	TIBILEUPTHMOXP	Impact left of Tibia	+	+	No
		My	TIBILEUPTHMOYP	Impact front of Tibia	+	+	No
	Lower Tibia Load	Fx	TIBILELOTHFOXP	Move ankle forward, knee rearward	+	+	No
		Fy	TIBILELOTHFOYP	Move ankle right, knee left	+	+	No
		Fz	TIBILELOTHFOZP	Move ankle down, knee up	+	+	No
		Mx	TIBILELOTHMOXP	Impact left of Tibia	+	+	No
		My	TIBILELOTHMOYP	Impact front of Tibia	+	+	No
	Tibia Accelerometer	Ax	TIBILE00THACXP	Impact back of Tibia	+	NA	NA
		Ay	TIBILE00THACYP	Impact left of Tibia	+	NA	NA
	Achilles Load	Fz	ANKLLE00THFO0P	Rotate foot forward	+	NA	NA
	Ankle Rotation	Rx	ANKLLE00THANXP	Hold tibia, rotate foot leftward	+	+	No
		Ry	ANKLLE00THANYP	Hold tibia, push toe upward	+	-	Yes
		Rz	ANKLLE00THANZP	From top, hold tibia, rotate foot CCW	+	-	Yes
	Foot Acceleration	Ax	FOOTLE00THACXP	Impact back of Foot	+	NA	NA
		Ay	FOOTLE00THACYP	Impact left of Foot	+	NA	NA
		Az	FOOTLE00THACZP	Impact top of Foot	+	NA	NA

Applus IDIADA KARCO

THOR-50M 50th Percentile Male ATD
Sensor Polarities

ATD S/N: EG2595 Date: 5/10/2021

Note 1: Some polarities may appear counter to the specified wiring. The use of wired adapters may influence polarities

Note 2: Highlighted SAE polarity shows a deviation from SAE standard or an expected negative polarity to the mechanical input

Segment	Instrument	Axis	ISO Code	Motion	J211	Actual	Invert
Lower Extremity Right	Knee Shear Displacement	Dx	KNSLRI00THDSXP	Hold femur, move tibia forward	+	+	No
	Upper Tibia Load	Fx	TIBIRIUPTHFOXP	Move tibia forward, knee rearward	+	+	No
		Fy	TIBIRIUPTHFOYP	Move ankle right, knee left	+	+	No
		Fz	TIBIRIUPTHFOZP	Move ankle down, knee up	+	+	No
		Mx	TIBIRIUPTHMOXP	Impact left of Tibia	+	+	No
		My	TIBIRIUPTHMOYP	Impact front of Tibia	+	+	No
	Lower Tibia Load	Fx	TIBIRILOTHFOXP	Move ankle forward, knee rearward	+	+	No
		Fy	TIBIRILOTHFOYP	Move ankle right, knee left	+	+	No
		Fz	TIBIRILOTHFOZP	Move ankle down, knee up	+	+	No
		Mx	TIBIRILOTHMOXP	Impact left of Tibia	+	+	No
		My	TIBIRILOTHMOYP	Impact front of Tibia	+	+	No
	Tibia Accelerometer	Ax	TIBIRI00THACXP	Impact back of Tibia	+	NA	NA
		Ay	TIBIRI00THACYP	Impact left of Tibia	+	NA	NA
	Achilles Load	Fz	ANKLRI00THFO0P	Rotate foot forward	+	NA	NA
	Ankle Rotation	Rx	ANKLRI00THANXP	Hold tibia, rotate foot leftward	+	+	No
		Ry	ANKLRI00THANYP	Hold tibia, push toe upward	+	-	Yes
		Rz	ANKLRI00THANZP	From top, hold tibia, rotate foot CCW	+	-	Yes
	Foot Acceleration	Ax	FOOTRI00THACXP	Impact back of Foot	+	NA	NA
		Ay	FOOTRI00THACYP	Impact left of Foot	+	NA	NA
		Az	FOOTRI00THACZP	Impact top of Foot	+	NA	NA

THOR-50M 50th Percentile Male ATD
Sensor Polarities

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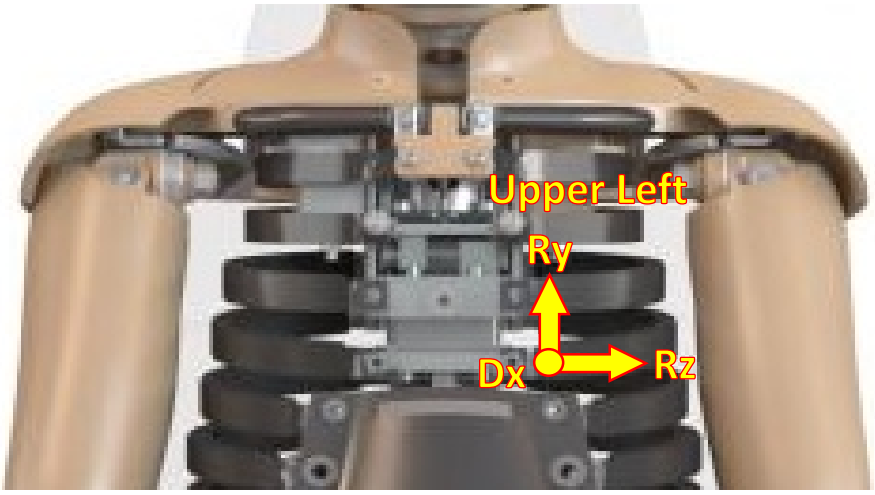
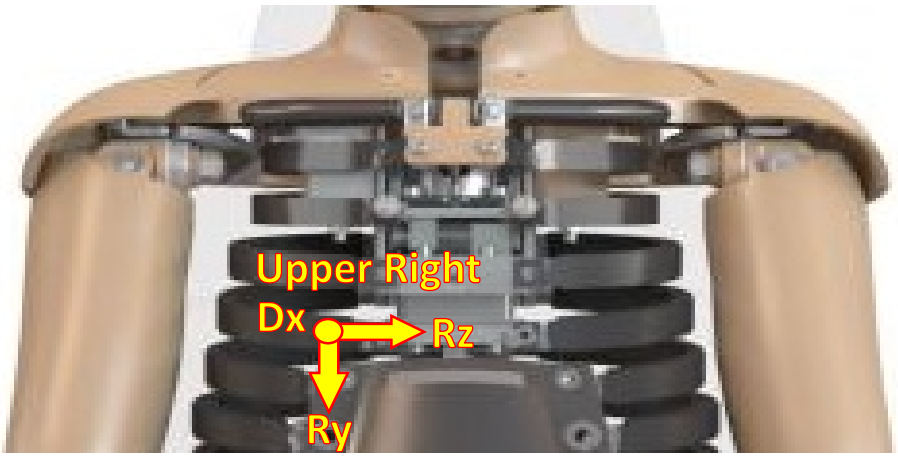
Note 2: Highlighted SAE polarity shows a deviation from SAE standard or an expected negative polarity to the mechanical input

Segment	Instrument	Axis	ISO Code	Motion	J211	Actual	Invert
Thorax Upper Left	IRTRACC Raw Voltage	Dx (V)	CHSTLEUPTHVO0P	Push Inward	+	+	No
	Rotation Pitch	Ry	CHSTLEUPTHANYP	Push upward	+	+	No
	Rotation Yaw	Rz	CHSTLEUPTHANZP	Push leftward	+	+	No
Thorax Upper Right	IRTRACC Raw Voltage	Dx (V)	CHSTRIUPTHVO0P	Push Inward	+	+	No
	Rotation Pitch	Ry	CHSTRIUPTHANYP	Push downward	+	+	No
	Rotation Yaw	Rz	CHSTRIUPTHANZP	Push leftward	+	+	No





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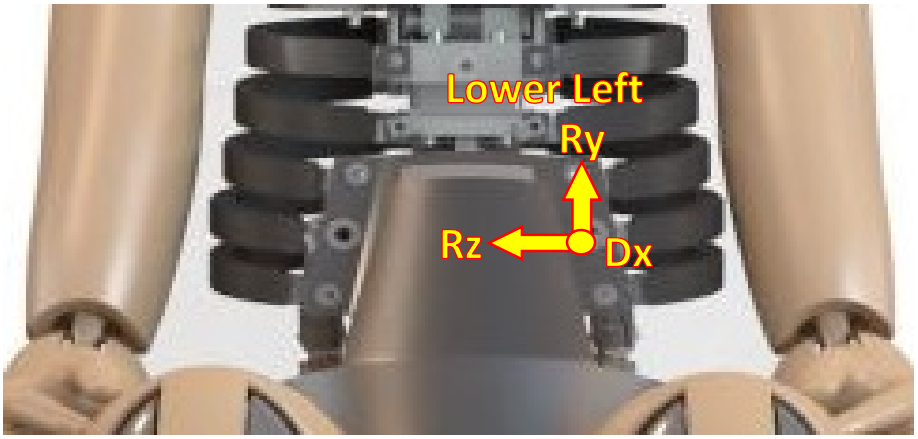
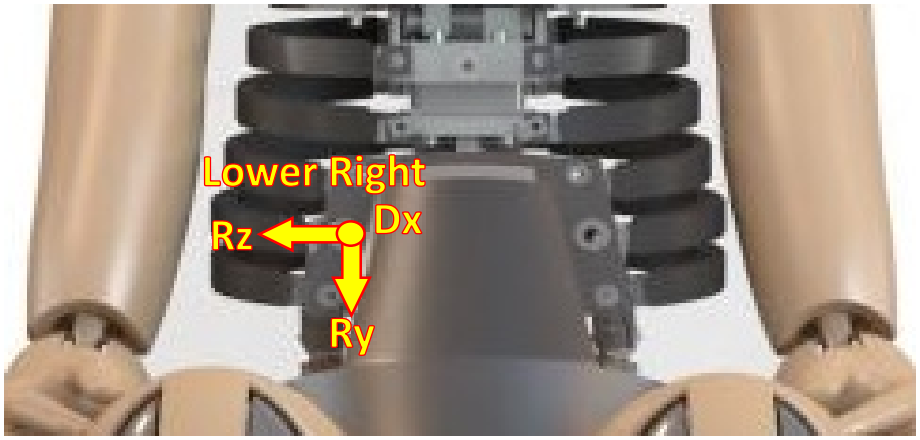
Segment	Instrument	Axis	ISO Code	Motion	J211	Actual	Invert
Thorax Lower Left	IRTRACC Raw Voltage	Dx (V)	CHSTLELOTHVO0P	Push Inward	+	+	No
	Rotation Pitch	Ry	CHSTLELOTHANYP	Push upward	+	+	No
	Rotation Yaw	Rz	CHSTLELOTHANZP	Push rightward	+	+	No
Thorax Lower Right	IRTRACC Raw Voltage	Dx (V)	CHSTRILOTHVO0P	Push Inward	+	+	No
	Rotation Pitch	Ry	CHSTRILOTHANYP	Push downward	+	+	No
	Rotation Yaw	Rz	CHSTRILOTHANZP	Push rightward	+	+	No





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Sensor Polarities

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Segment	Instrument	Axis	ISO Code	Motion	J211	Actual	Invert
Abdomen Left	IRTRACC Raw Voltage	Dx (V)	ABDOLE00THVO0P	Push Inward	+	+	No
	Rotation Pitch	Ry	ABDOLE00THANYP	Push upward	+	+	No
	Rotation Yaw	Rz	ABDOLE00THANZP	Push rightward	+	+	No
Abdomen Right	IRTRACC Raw Voltage	Dx (V)	ABDORI00THVO0P	Push Inward	+	+	No
	Rotation Pitch	Ry	ABDORI00THANYP	Push downward	+	+	No
	Rotation Yaw	Rz	ABDORI00THANZP	Push rightward	+	+	No