REPORT NUMBER: NCAP-KAR-21-015

NEW CAR ASSESSMENT PROGRAM (NCAP)

FRONTAL BARRIER IMPACT TEST

VOLKSWAGEN AG

2021 VOLKSWAGEN ID.4 5-DOOR SUV

NHTSA NUMBER: M20215800

PREPARED BY:

APPLUS+ IDIADA KARCO ENGINEERING, LLC.

9270 HOLLY ROAD

ADELANTO, CA 92301

OCTOBER 25, 2021

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

OFFICE OF CRASHWORTHINESS STANDARDS

MAIL CODE: NRM-100

1200 NEW JERSEY AVE, SE, ROOM W43-410

WASHINGTON, DC 20590

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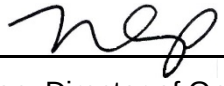
Prepared By: 

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

Reviewed By: 

Mr. Amjad A. Jadallah, Project Manager
Applus+ IDIADA KARCO Engineering, LLC.

Approved By: 

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

Approval Date: October 25, 2021

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date:

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

Date:

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NCAP-KAR-21-015		

4. Title and Subtitle	5. Report Date
Final Report of New Car Assessment Program Frontal Impact Testing and FMVSS No. 305 indicant testing of a 2021 Volkswagen ID.4 5-Door SUV NHTSA No. M20215800	October 25, 2021
	6. Performing Organization Code KAR
7. Authors Mr. Neeraj N. Patel, Project Engineer, Applus+ IDIADA KARCO Mr. Amjad A. Jadallah, Project Manager, Applus+ IDIADA KARCO	**8. Performing Organization Report No.** TR-P41221-01-NC
9. Performing Organization Name and Address Applus+ IDIADA KARCO Engineering, LLC. 9270 Holly Rd. Adelanto, CA 92301	**10. Work Unit No.** **11. Contract or Grant No.** 693JJ919D000004
12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-100) 1200 New Jersey Ave., SE, Room W43-410 Washington, D.C. 20590	**13. Type of Report and Period Covered** Final Test Report, September 28, 2021- October 25, 2021 **14. Sponsoring Agency Code** NRM-100

15. Supplementary Notes

16. Abstract

A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2021 Volkswagen ID.4 5-Door SUV in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. The test was conducted at the Applus+ IDIADA KARCO Engineering, LLC. facility in Adelanto, California on September 28, 2021.

The impact velocity of the vehicle was 56.40 km/h and the ambient temperature at the barrier face at the time of impact was 23.9°C. The target vehicle's post-test maximum crush was 655 mm at the vehicle's centerline. The test vehicle's performance is as follows:

Measurement Description	Units	Driver ATD		Passenger ATD	
		Threshold	Result	Threshold	Result
Head Injury Criteria (HIC_{15})	N/A	700	169.4	700	118.3
Maximum Chest Compression	mm	63	-23	52	-15
Nij	N/A	1	0.18	1	0.54
Neck Tension	N	4170	839.8	2620	668.0
Neck Compression	N	4000	-36.1	2520	-404.0
Left Femur Force	N	10000	-174.3	6800	-22.8
Right Femur Force	N	10000	-172.3	6800	-90.8

17. Key Words	18. Distribution Statement
56.3 km/h (35 mph) Full Frontal Rigid Barrier Impact Test New Car Assessment Program (NCAP)	National Highway Traffic Safety Administration Technical Information Services Division 1200 New Jersey Ave, SE Washington, DC 20590

19. Security Classification of this report	20. Security Classification of this page	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	175	

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SECTION 1
PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program, sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number 693JJ919D000004. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards Laboratory Procedure dated May 2018 for NCAP Full Frontal Rigid Barrier Impact Testing.

SUMMARY

A load cell barrier, consisting of 176 load cells, was impacted by a 2021 Volkswagen ID.4 5-Door SUV at a velocity of 56.40 km/h. The test was performed at Applus+ IDIADA KARCO Engineering, LLC. on September 28, 2021. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A of this report.

One (1) real-time cameras and sixteen (16) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in Data Sheet 6 of this report.

One Part HIII 50th percentile male anthropomorphic test device (ATD) was placed in the driver seating position and one Part HIII 5th percentile female ATD was placed in the right-front passenger seating position according to dummy placement instructions specified in the Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck force transducers, right / left femur load cells, and lower leg instrumentation.

The driver (position 1) ATD (Serial No. 360) and the right-front passenger (position 2) ATD (Serial No. DH1644) were qualified prior to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 106 channels of dummy and vehicle response data were recorded on an on-board data acquisition system. Appendix B contains the dummy response data traces. Appendix D contains a complete list of instrumentation used for dummies and the vehicle.

There was 100 percent windshield retention and intrusion into the protected zone of the windshield during the event. There was no Stoddard solvent leakage after the event or during any phase of the static rollover.

The maximum static crush of the test vehicle was 655 mm at the vehicle's centerline. Both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: the driver ATD's head contacted the frontal airbag and headrest. The upper and lower torso contacted the frontal airbag. There was no knee contact.

The passenger's visible contact points were as follows: the passenger ATD's head contacted the frontal airbag and headrest. The upper and lower torso contacted the frontal airbag. There was no knee contact.

The occupant data is summarized below:

ATD Position	HIC_{15}	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (g)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50th Male)	169.4	0.18	839.8	-36.1	30	-23	-174.3	-172.3
Passenger (5th Female)	118.3	0.54	668.0	-404.0	29	-15	-22.8	-90.8

GENERAL COMMENTS:

- Driver Lap Belt Force, not installed
- Passenger Lap Belt Force, not installed
- Driver Left Foot Aft Ax, channel failed, no data
- Engine Bottom Ax, channel failed at 21.7 ms

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

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: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	M20215800	Traction Control System	Yes
Model Year	2021	Power Steering	Yes
Make	Volkswagen	Power Window Auto-Reverse	Yes
Model	ID.4	Driver Frontal Airbag	Yes
Body Style	5-Door SUV	Driver Curtain Airbag	Yes
VIN	WVGRMPE22MP034867	Driver Head/Torso Airbag	No
Body Color	Moonstone Gray	Driver Torso Airbag	No
Odometer Reading (km / mi)	92 / 57	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	N/A	Driver Pelvis Airbag	No
Type / No. of Cylinders	Electric	Driver Knee Airbag	No
Engine Placement	N/A	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	1	Front Pass. Head/Torso Airbag	No
Overdrive	No	Front Pass. Torso Airbag	No
Final Drive	RWD	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	Yes	Front Pass. Pelvis Airbag	No
Sunroof / T-Top	No	Front Pass. Knee Airbag	No
Running Boards	No	Driver Seat Belt Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	Yes	Front Pass. Seat Belt Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Other Safety Restraint	N/A

Does Owner's Manual provide instructions to turn off automatic door locks?	No

DATA FROM CERTIFICATION LABEL

Manufactured By	Volkswagen AG	GVWR (kg)	2560
		GAWR Front (kg)	1130
Date of Manufacture	Apr-21	GAWR Rear (kg)	1480

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

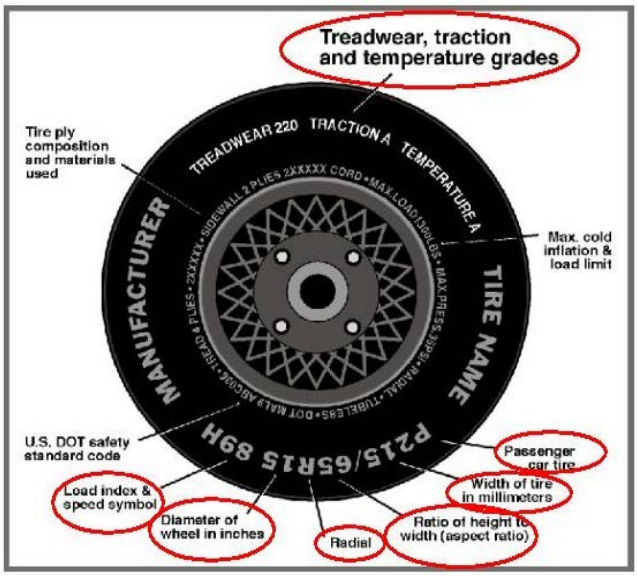
Measured Parameter	Front	Rear	Third	Total	
Type of Seats	Bucket	Split Bench			
Designated Seating Capacity	2	3		5	
Capacity Weight (VCW) (kg)				430.0	*A*
DSC x 68.04 (kg)				340.2	*B*
Cargo Weight (RCLW) (kg)				89.8	*A-B*

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	340	340
Cold Pressure (kPa)	290	290
Recommended Tire Size	P235/55 R19	P255/50 R19
Tire Size on Vehicle	P235/55 R19	P255/50 R19
Tire Manufacturer	Hankook	Hankook
Tire Model	Kinergy AS X EV	Kinergy AS X EV
Treadwear	500	500
Traction	A	A
Temperature Grades	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	105T	107T
Tire Material	Polyester, Steel, Nylon	Polyester, Steel, Nylon
DOT Safety Code Left	15M98 9U H0 5120	15M7F 9U H0 5020
DOT Safety Code Right	15M98 9U H0 5120	15M7F 9U H0 5020

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

TEST VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	494.0	550.0		577.0	595.0	
Right	kg	496.0	542.5		548.0	585.0	
Ratio	%	47.5%	52.5%	100.0%	48.8%	51.2%	100.0%
Total	kg	990.0	1092.5	2082.5	1125.0	1180.0	2305.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	2082.5	A
Weight of 1 P572E ATD & 1 P572O ATD	kg	141.0	B
Rated Cargo/Luggage Weight (RCLW)	kg	89.8	C
Calculated Vehicle Target Weight (TVTW)	kg	2313.3	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	867	865	870	872	1453
As Tested	mm	855	853	854	855	1418
Post-Test	mm	977	936	861	855	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheelbase	mm	2769
Total Vehicle Length at Left Side	mm	4033
Total Vehicle Length at Centerline	mm	4581
Total Vehicle Length at Right Side	mm	4032
Weight of Ballast in Cargo Area	kg	87.0
Weight of Vehicle Components Removed	kg	5.5
Amount of Stoddard Solvent in Fuel Tank	L	

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

Rear Trim (3.0 kg), Taillights (2.5 kg)

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

TARGET VEHICLE STRUCTURAL MEASUREMENTS

No.	Description	Pre-Test
1	Total Length	4581
2	Total Width	1848
3	Bumper Top Height	763
4	Bumper Bottom Height	466
5	Longitudinal Member Top Height	587
6	Distance Between Longitudinal Members	774
7	Longitudinal Member Width	75
8	Engine Top Height	
9	Engine Bottom Height	
10	Engine and Gearbox Width	
11	Front Bumper to Engine Distance	
12	Front Shock Absorber Fixing Height	976
13	Bonnet Leading Edge Height	954
14	Front Shock Absorber Fixing Width	1120
15	Front Bumper to Front Axle Distance	851
16	Front Axle to A-Pillar Distance	362
17	A-Pillar to B-Pillar Distance	1302
18	B-Pillar to Rear Axle Distance	1105
19	B-Pillar to C-Pillar Distance	999
20	Roof Sill Bottom Height	1544
21	Roof Sill Top Height	1592
22	Floor Sill Bottom Height	267
23	Floor Sill Top Height	428

All measurements in millimeters.

DATA SHEET NO. 2

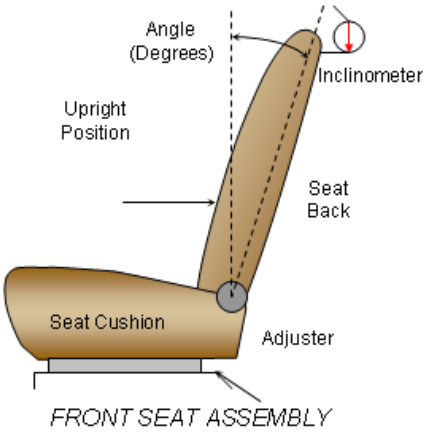
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

NOMINAL DESIGN RIDING POSITION

The procedure for the driver is as follows: the seat back is set to the manufacturer's designated angle. The procedure for the passenger is as follows: the seat back is set to position the transverse instrumentation platform of the dummy's head at 0° ± 0.5°. Seat back angle is measured at the back of the headrest post.

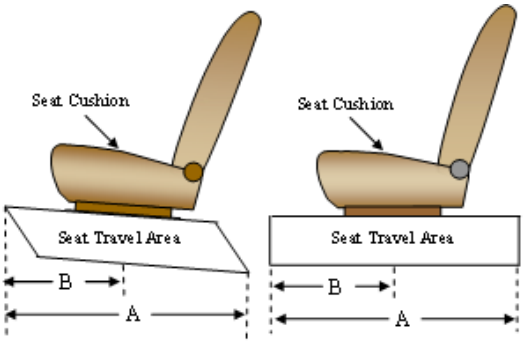


SEAT BACK ANGLE

Seating Position	Degrees
Driver Seat Back Angle	16.0
Passenger Seat Back Angle	17.4

SEAT FORE / AFT POSITIONING

The total seat travel is measured from the forward most possible position to the rear most possible position. The driver's seat is set to the middle of the fore-aft travel. The passenger's seat is set to the forward most position where the ATD will not contact any interior panels.



SEAT FORE/AFT POSITIONS

Seating Position	Total Fore-Aft Travel	Placed in Position
Driver Seat	312 mm	152 mm
Passenger Seat	248 mm	0 mm

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 a 5th percentile adult female ATD for the passenger. Position "L" is the lowermost position, followed by position "M1". Position "H" is the uppermost position.

SEAT BELT UPPER ANCHORAGES

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

DATA SHEET NO. 2 … (CONTINUED)

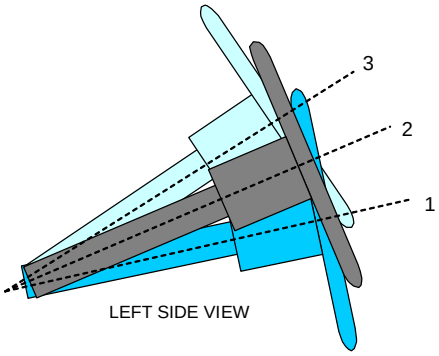
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

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.



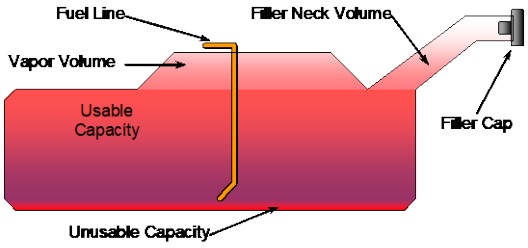
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITIONING

	Degrees	Fore-Aft Position (mm)
Lowermost Position, No. 1	19.1	125
Geometric Center Position, No. 2	21.9	154
Uppermost Position, No. 3	24.7	182
Telescoping Steering Wheel Travel		57
Test Position	21.9	154

FUEL PUMP

The vehicle is an electric vehicle and is not equipped with a fuel tank or fuel pump.



VEHICLE FUEL TANK ASSEMBLY

FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	
Usable Capacity of "Optional Tank" (see Form No. 1)	
Usable Capacity of "Standard Tank" (see Owner's Manual)	
Usable Capacity of "Optional Tank" (see Owner's Manual)	
93% of Usable Capacity	
Actual amount of Solvent Used in Test	
1/3 of Usable Capacity	

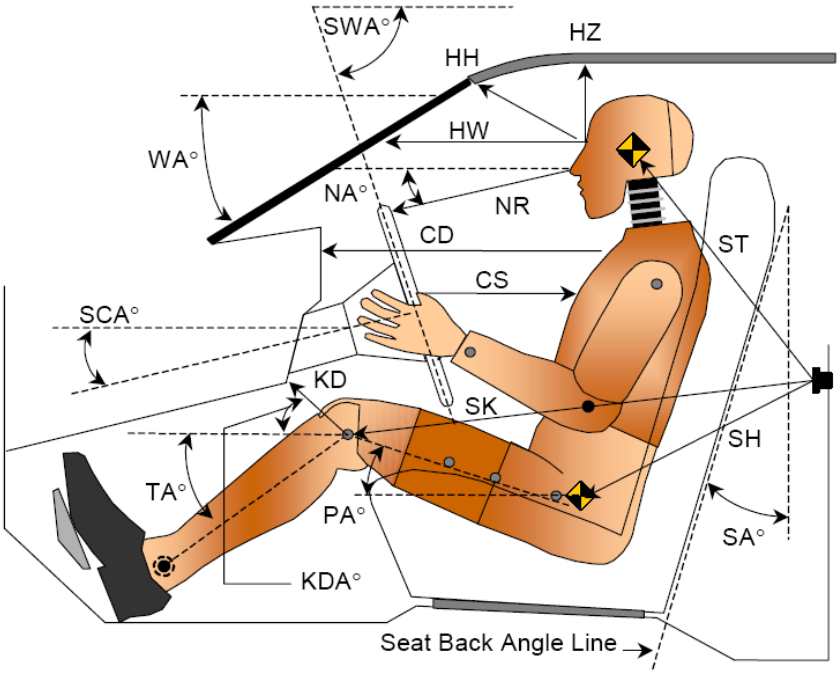
Is the Actual Amount of Solvent Used in the test equal to 93% ± 1% of the Usable Capacity stated in the Form No. 1? ☐ **Yes** ☐ **No**

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21



LEFT SIDE VIEW

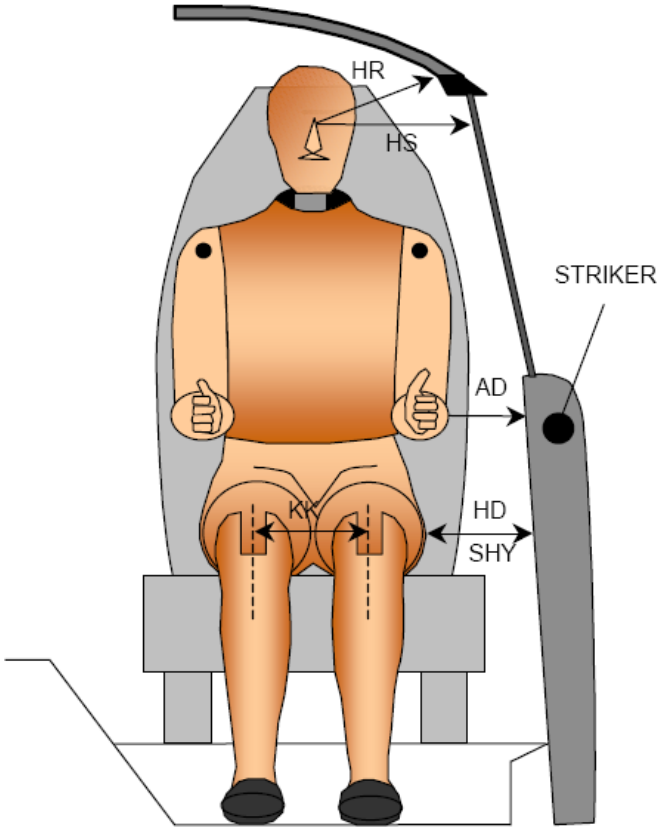
Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		23.2		
SWA°	Steering Wheel Angle		69.9		
SCA°	Steering Column Angle		22.3		
SA°	Seat Back Angle (On Headrest Post)		16.0		16.9
HZ	Head to Roof	243	90.0	256	90.0
HH	Head to Header	391	23.4	370	43.4
HW	Head to Windshield	802	0.0	805	0.0
NR	Nose to Rim	374	8.9	455	22.2
CD	Chest to Dash	525	10.6	410	9.2
CS	Chest to Steering Hub	313	0.0		
RA	Rim to Abdomen	211	0.0		
KDL	Left Knee to Dash	215	26.8	147	45.7
KDR	Right Knee to Dash	206	35.8	166	43.1
PA°	Pelvic Angle		229.0		21.1
TA°	Tibia Angle		40.3		
SK	Striker to Knee	595	10.5	655	10.5
ST	Striker to Head	414	-74.7	387	-64.2
SH	Striker to H-Point	32	51.8	383	34.5

DATA SHEET NO. 4

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21



Code	Description	Driver (mm)	Passenger (mm)
AD	Arm to Door	92	96
HD	H-Point to Door	143	185
HR	Head to Side Header	255	300
HS	Head to Side Window	340	398
KK	Knee to Knee	320	170
SHY	Striker to H-Point (Y-Direction)	264	289
AA	Ankle to Ankle	300	150

DATA SHEET NO. 5

SEAT BELT POSITIONING DATA

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

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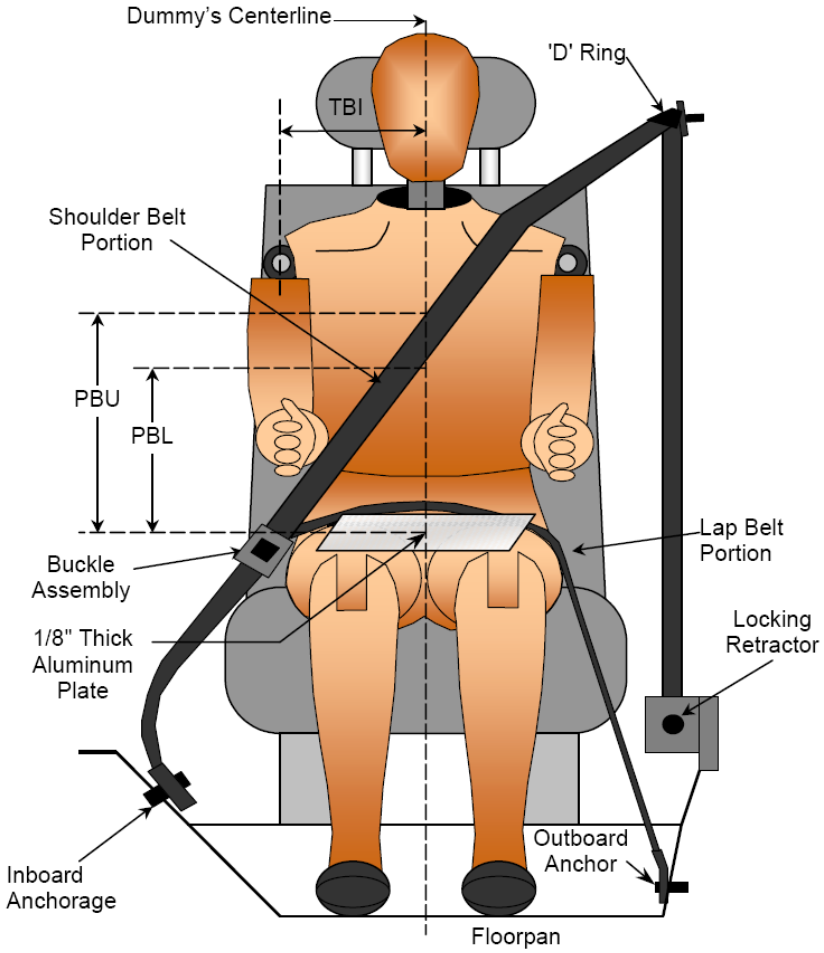


FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Code	Measurement Description	Units	Driver	Passenger
PBU	Top Surface of Aluminum Plate to Belt Upper Edge	mm	296	265
PBL	Top Surface of Aluminum Plate to Belt Lower Edge	mm	211	185

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as Measured on ATD	mm	901	930
Lap Belt Length as Measured on ATD	mm	598	590
Remainder of Belt on Reel	mm	1078	1035
Total Belt Length for Continuous Webbing Systems	mm	2577	2555

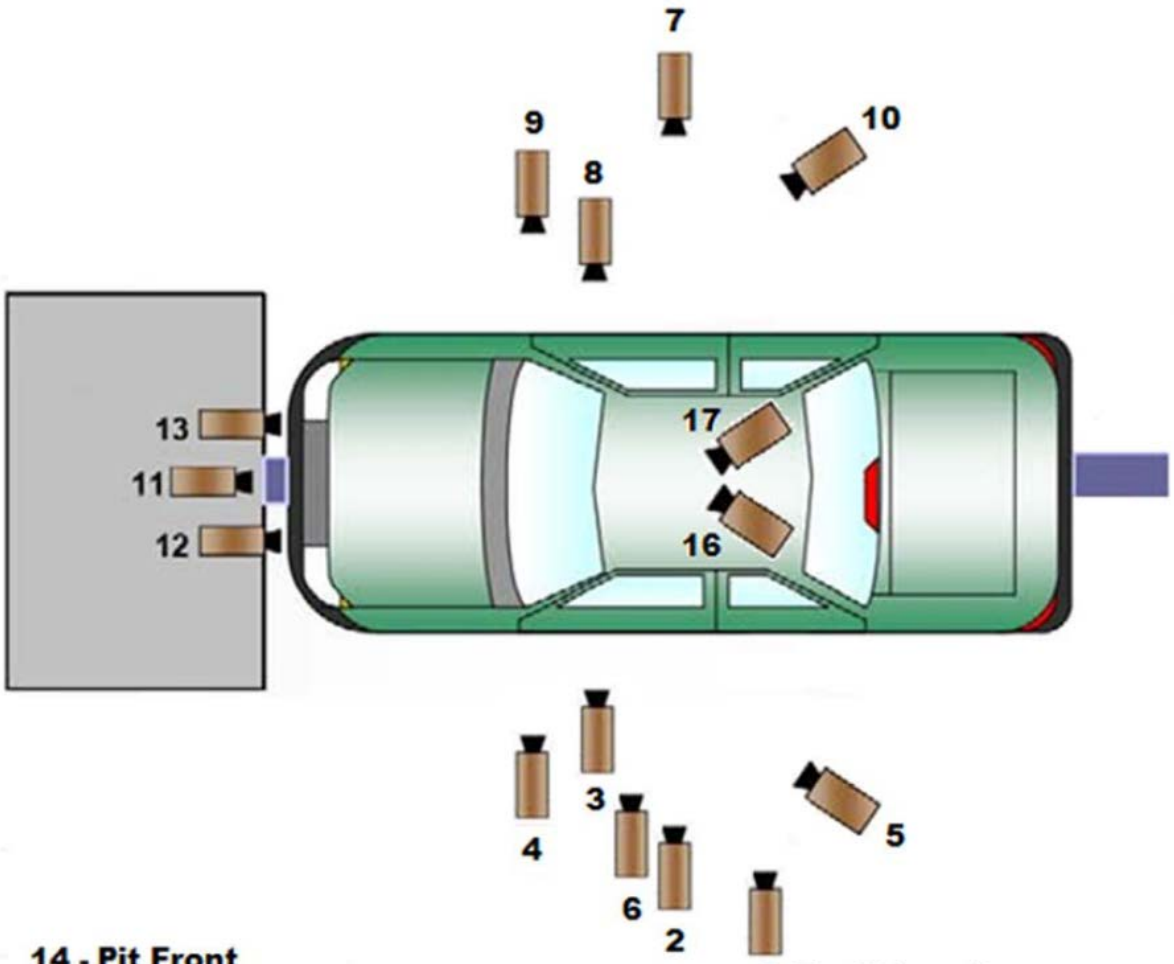
DATA SHEET NO. 6

HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

CAMERA POSITIONS FOR FRONTAL IMPACTS



***Camera locations are approximate and not to scale*

DATA SHEET NO. 6 … (CONTINUED)

HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

CAMERA LOCATIONS

No.	Description	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall	-11412	-8150	-1484		30
2	Left Overall	-2456	-7975	-1025	20	1000
3	Driver Close-Up	-2590	-7950	-1371	50	1000
4	Left Front Half	-1701	-6197	-1701	35	1000
5	Left Angle	-6696	-10308	-3211	105	1000
6	Steering Column	-1966	-10412	-3688	35	1000
7	Right Overall	-2336	7569	-1012	20	1000
8	Passenger Close-Up	-1733	7581	-1408	50	1000
9	Right Front Half	-1600	8214	-1811	35	1000
10	Right Angle	-6217	9516	-4830	85	1000
11	Windshield	-354	0	-5749	28	1000
12	Driver Windshield	297	-366	-2460	24	1000
13	Passenger Windshield	297	366	-2460	24	1000
14	Pit Front	-756	0	1495	21	1000
15	Pit Rear	-3398	0	1495	15	1000
16	Driver Onboard	-1396	197	1460	6	1000
17	Passenger Onboard	-1375	-258	1458	6	1000

Coordinates: +X = forward impact plane

+Y = right of monorail center

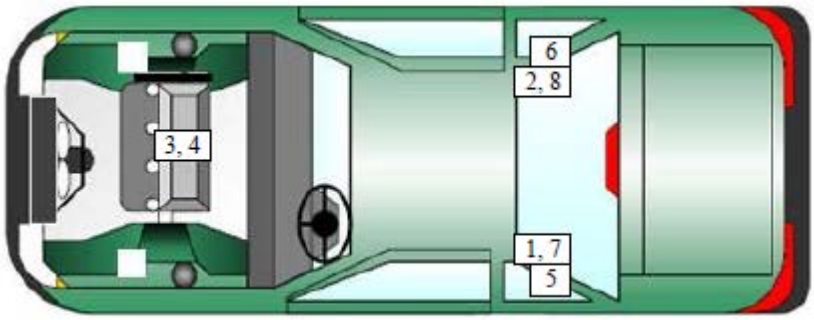
+Z = into ground

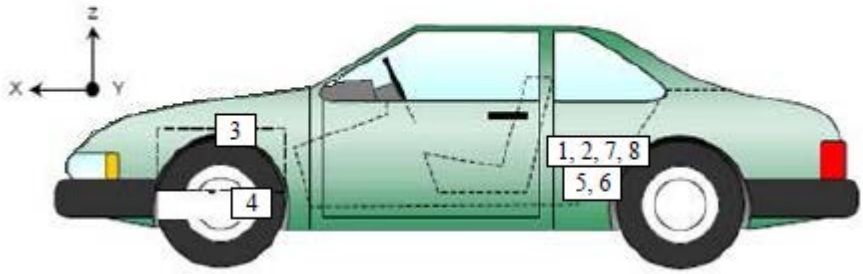
DATA SHEET NO. 7

VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Description	Location		
		X	Y	Z
1	Left Rear Accelerometer X-Direction	2210	-910	530
2	Right Rear Accelerometer X-Direction	2215	915	540
3	Engine Top X	4510	0	900
4	Engine Bottom X	4120	0	330
5	Left Rear Accelerometer Z-Direction	2210	-910	530
6	Right Rear Accelerometer Z-Direction	2215	915	540
7	Left Rear Accelerometer X-Direction Redundant	2210	-910	530
8	Right Rear Accelerometer X-Direction Redundant	2215	915	540

Reference Points: X – Rear Surface of Vehicle (+ forward)

Y – Vehicle Centerline (+ to right)

Z – Ground Plane (+ up)

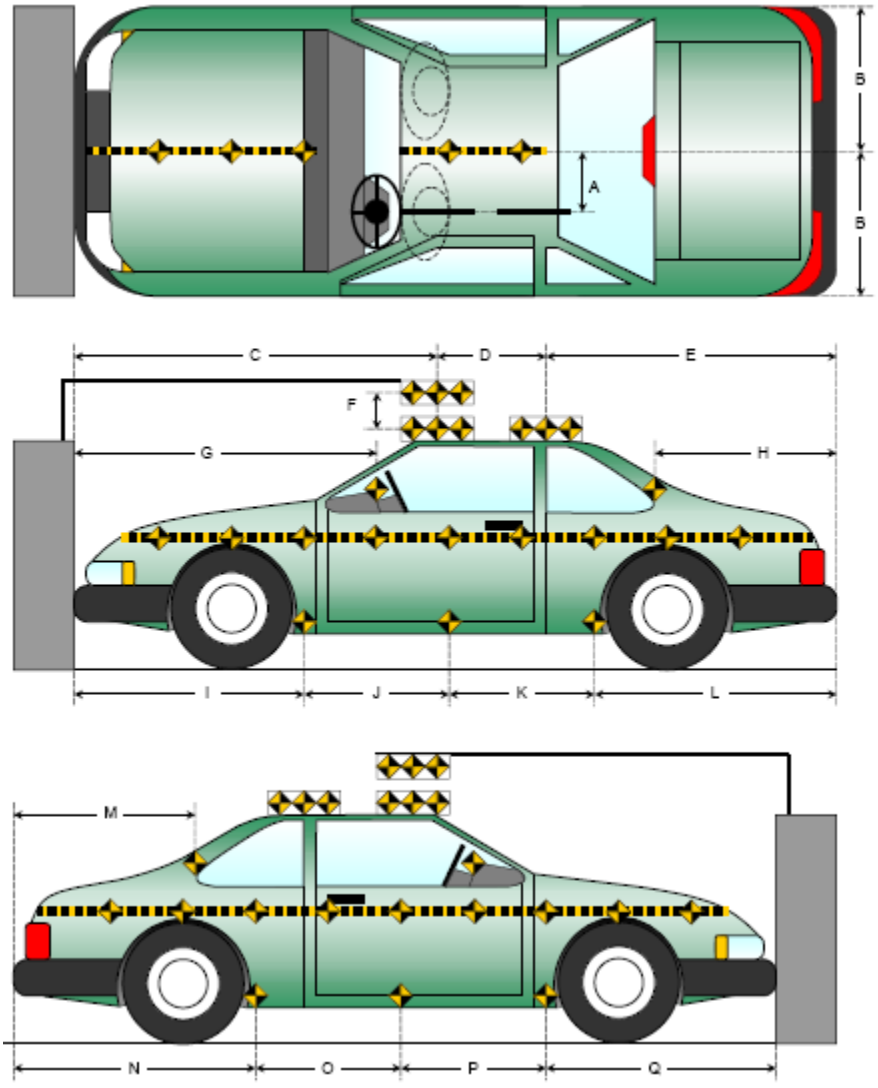
DATA SHEET NO. 8

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

Item	Value
A	367
B	902
C	2148
D	608
E	1825
F	638
G	1669
H	753
I	1440
J	813
K	819
L	1509
M	753
N	1509
O	819
P	813
Q	1440



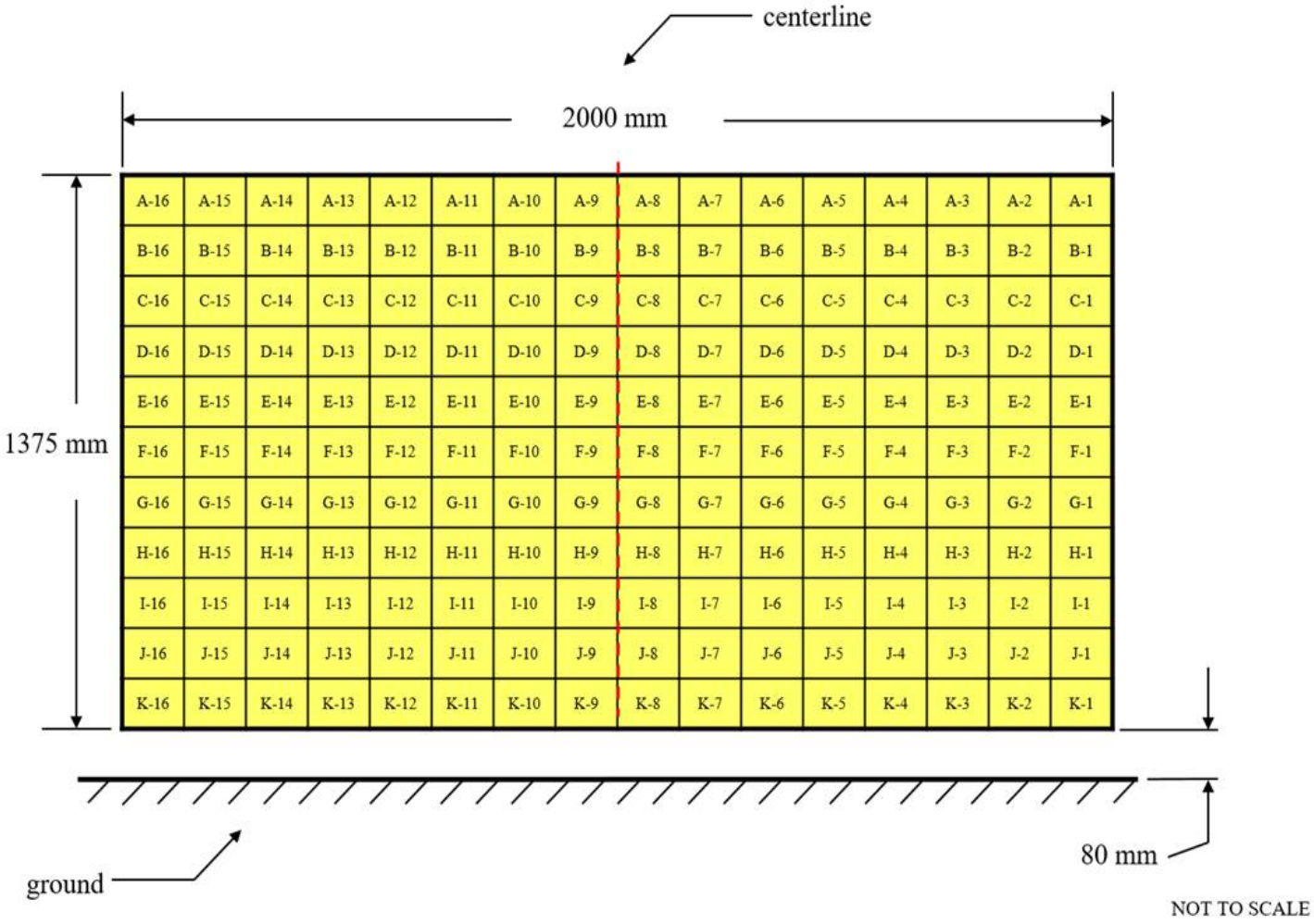
All measurements in millimeters.

DATA SHEET NO. 9

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21



DATA SHEET NO. 10

TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

INSTRUMENTATION

Driver Dummy Accelerometers	49
Passenger Dummy Accelerometers	49
Vehicle Structure Accelerometers	8
Load Cell Barrier	176
Total	282

CAMERA COVERAGE

High-Speed Vehicle On Board	2
High-Speed Off Board	14
Real Time	1
Total	17

DATA SHEET NO. 11

POST-TEST OBSERVATIONS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type/Serial No.	HIII 50th Percentile Male ATD / 360	HIII 5th Percentile Female ATD / DH1644
Head Contact	Frontal Airbag, Headrest	Frontal Airbag, Headrest
Upper Torso Contact	Frontal Airbag	Frontal Airbag
Lower Torso Contact	Frontal Airbag	Frontal Airbag
Left Knee Contact	None	None
Right Knee Contact	None	None

DOOR OPENING, TRUNK OPENING, AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked / Unlocked Doors	Locked	Locked
Front Door Opening	Remained closed, latched, and operational	Remained closed, latched, and operational
Rear Door Opening	Remained closed, latched, and operational	Remained closed, latched, and operational
Trunk/Hatch/Tailgate Opening	None	
Seat Track Shift (mm)	0	0
Seat Back Movement from Initial Position	None	None

OTHER VEHICLE POST-TEST OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1409
Center	mm	1274
Right Side	mm	1239
Average	mm	1307

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

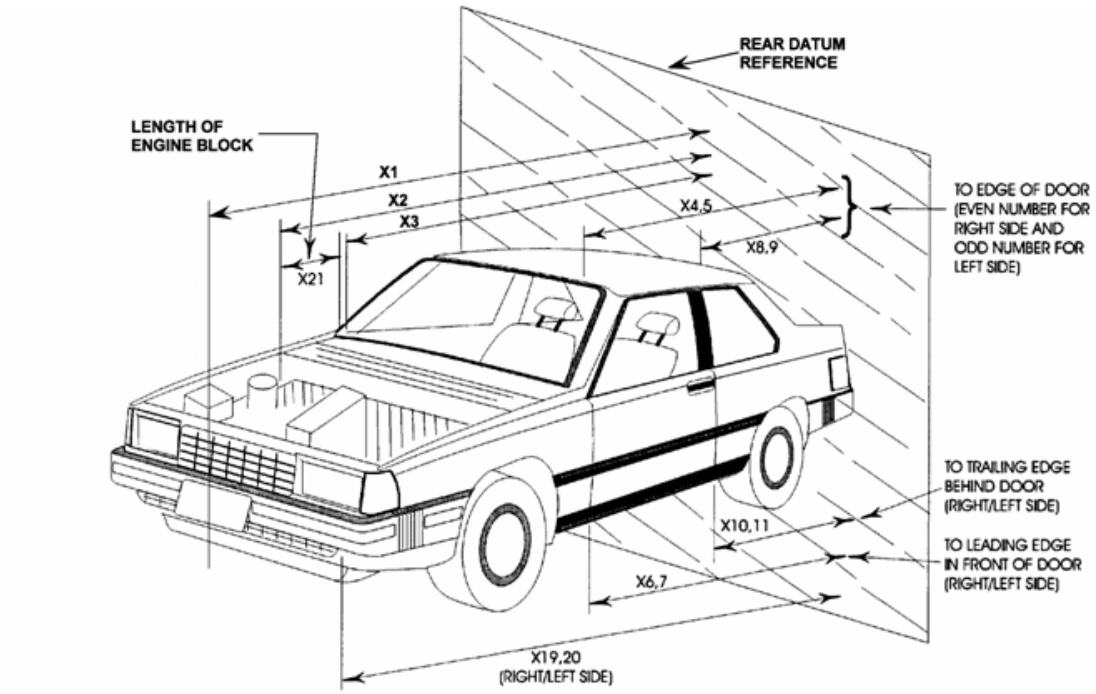
Restraint Type	Driver		Passenger	
	Installed	Operated	Installed	Operated
Front Airbag	Yes	Yes	Yes	Yes
Side Airbag 1 (Curtain)	Yes	Yes	Yes	Yes
Side Airbag 2 (Torso/Pelvis)	Yes	No	Yes	No
Knee Airbag	No		No	
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Yes	Yes	Yes

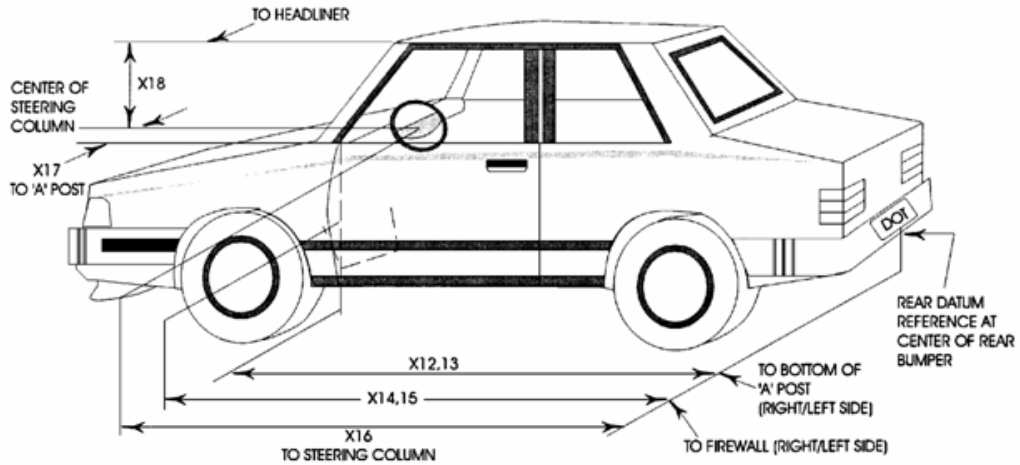
DATA SHEET NO. 12

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21





DATA SHEET NO. 12 … (CONTINUED)

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4581	3926	-655
2	Rear Surface of Vehicle to Front of Engine	3937	3906	-31
3	RSOV to Firewall	3667	3690	23
4	RSOV to Upper Leading Edge of Right Door	3222	3223	1
5	RSOV to Upper Leading Edge of Left Door	3222	3222	0
6	RSOV to Lower Leading Edge of Right Door	3202	3202	0
7	RSOV to Lower Leading Edge of Left Door	3203	3202	-1
8	RSOV to Upper Trailing Edge of Right Door	2065	2064	-1
9	RSOV to Upper Trailing Edge of Left Door	2065	2065	0
10	RSOV to Lower Trailing Edge of Right Door	2116	2116	0
11	RSOV to Lower Trailing Edge of Left Door	2117	2114	-3
12	RSOV to Bottom of A-Pillar, Right Side	3358	3360	2
13	RSOV to Bottom of A-Pillar, Left Side	3368	3368	0
14	RSOV to Firewall, Right Side	3694	3695	1
15	RSOV to Firewall, Left Side	3695	3690	-5
16	RSOV to Steering Column	2703	2769	66
17	Center of Steering Column to A-Pillar	456	373	-83
18	Center of Steering Column to Headliner	711	785	74
19	RSOV to Right Side of Front Bumper	4032	3873	-159
20	RSOV to Left Side of Front Bumper	4033	3785	-248
21	Length of Engine Block			
RD	RSOV to Right Side of Dash Panel	2897	2900	3
CD	RSOV to Center of Dash Panel	2886	2891	5
LD	RSOV to Left Side of Dash Panel	2898	2900	2

All measurements in millimeters.

DATA SHEET NO. 13

ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

VEHICLE INFORMATION

VIN: WVGRMPE22MP034867 Wheelbase (mm): 2769

Vehicle Size Category: Passenger Car Test Weight (kg): 2305.0

ACCELEROMETER DATA

Accelerometer Locations: Left Rear Crossmember

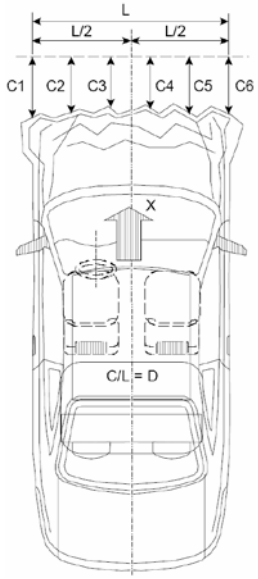
Cal. Procedure/Interval: Vibration Test / 6 months

Integration Algorithm: NHTSA Standard Linearity: Good

Impact Velocity (km/h): 56.40

Velocity Change (km/h): 69.7

Time of Separation (msec): 82.5



CRUSH PROFILE

Collision Deformation Classification: 12FDEW3

Midpoint of Damage: Vehicle Centerline

Damage Region Length (mm): 1431

Impact Mode: Full Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush Zone 1 at Left Side	mm	4396	3909	487
C2	Crush Zone 2 at Left Side	mm	4524	3925	599
C3	Crush Zone 3 at Left Side	mm	4564	3918	646
C4	Crush Zone 4 at Right Side	mm	4566	3926	640
C5	Crush Zone 5 at Right Side	mm	4527	3931	596
C6	Crush Zone 6 at Right Side	mm	4405	3906	499
L	C1 to C6	mm	1431		

DATA SHEET NO. 14

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

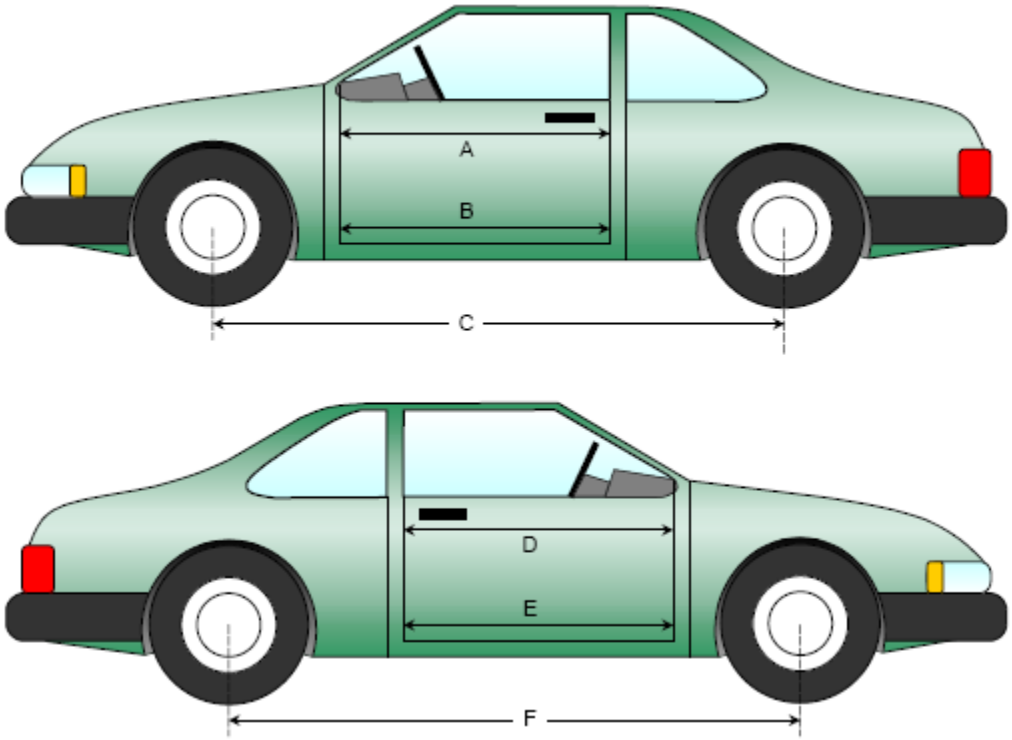
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1001	1001	0
B	Left Side Lower	mm	896	896	0
D	Right Side Upper	mm	1001	1001	0
E	Right Side Lower	mm	896	896	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2769	2643	126
F	Right Side Wheelbase	mm	2769	2659	110



DATA SHEET NO. 14 … (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

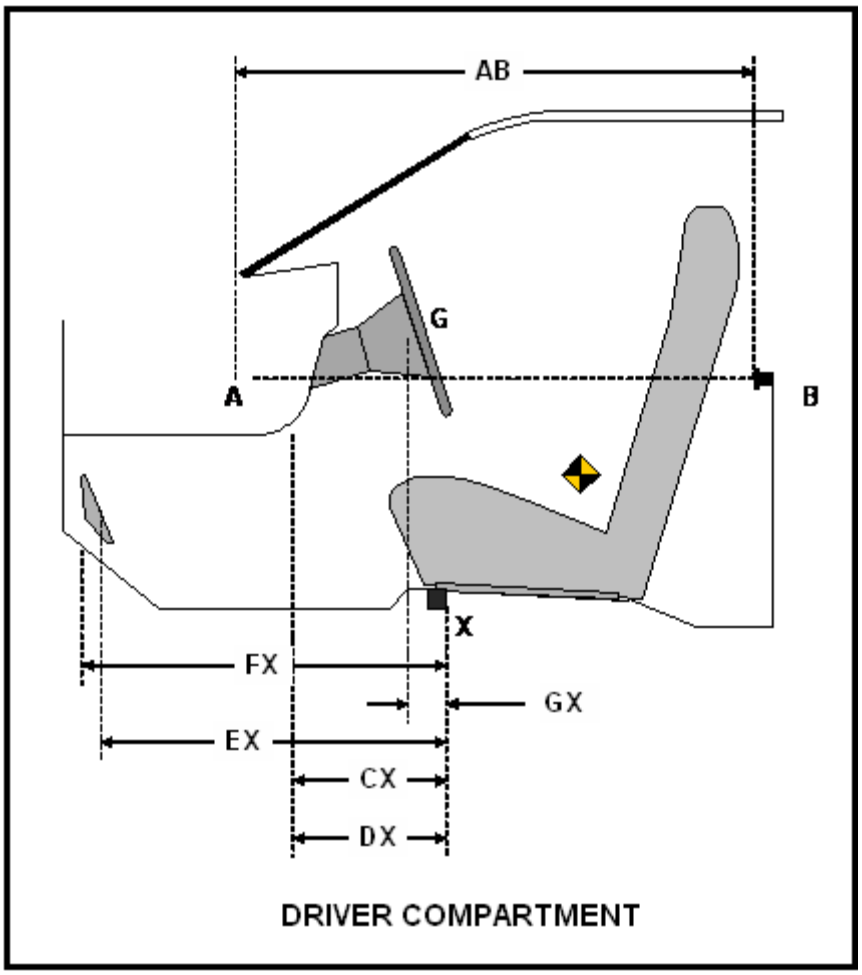
Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	982	977	5
CX	Left Knee Bolster to X	mm	348	348	0
DX	Right Knee Bolster to X	mm	347	342	5
EX	Brake Pedal to X	mm	106	106	0
FX	Foot Rest to X	mm	622	619	3
GX	Center of Steering Wheel Hub to X	mm	284	358	-74

X = Front of Seat Track (Stationary)



DATA SHEET NO. 15

SUMMARY OF INDICANT FMVSS 212 AND 219 (PARTIAL) DATA

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

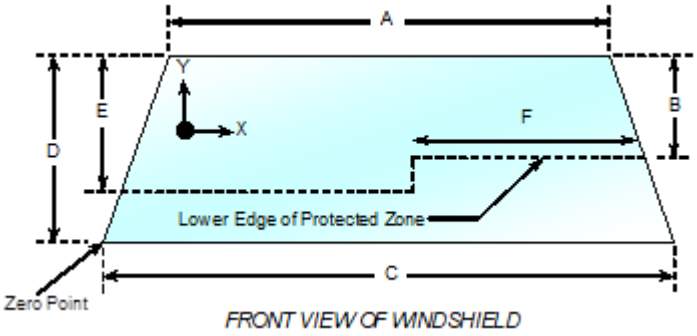
Windshield Mounting Details: Windshield glass is secured to the vehicle frame with rubber molding and rubber cement.

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: 21.6° C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2350	2350	100.0%
Right Side	2350	2350	100.0%
Total	4700	4700	100.0%



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1240
B	mm	515
C	mm	1460
D	mm	1000
E	mm	545
F	mm	500

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. 16

FMVSS 301 BARRIER IMPACT AND STATIC ROLLOVER RESULTS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 23.9°C Test Time: 3:54 PM

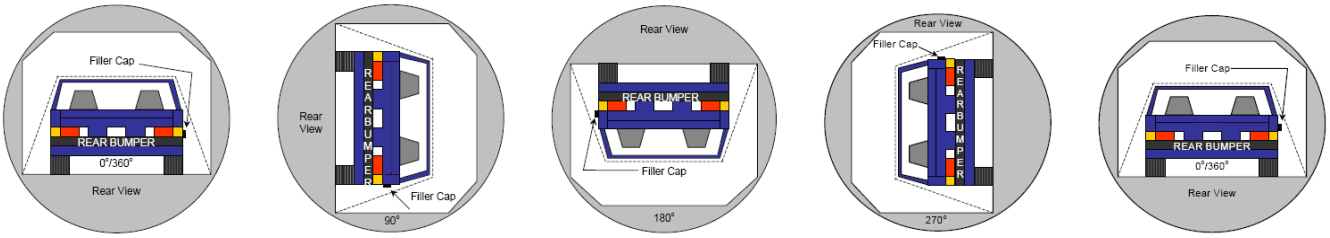
Stoddard Solvent Spillage Measurements

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

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

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

D. Spillage: N/A



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: N/A

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	84	300	384
90° To 180°	87	300	387
180° To 270°	82	300	382
270° To 360°	82	300	382

DATA SHEET NO. 16 … (CONTINUED)

FMVSS 301 BARRIER IMPACT AND STATIC ROLLOVER RESULTS

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

FMVSS 301 SPILLAGE TABLE

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

SOLVENT SPILLAGE LOCATION TABLE

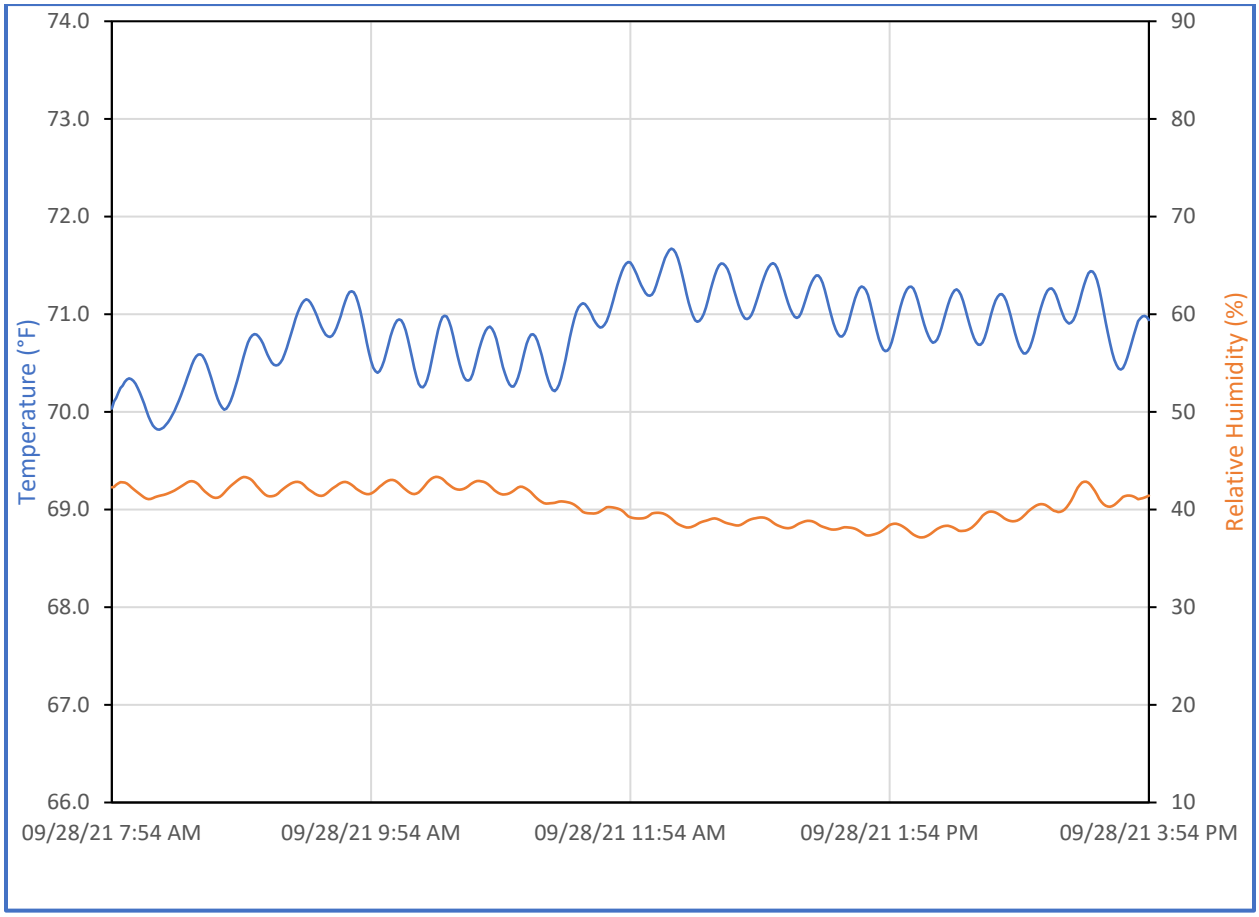
Test Phase	Spillage Location
0° To 90°	
90° To 180°	
180° To 270°	
270° To 360°	

DATA SHEET NO. 17

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21



DATA SHEET NO. 305-1

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

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

TEST VEHICLE INFORMATION

NHTSA Number	M20215800
Model Year	2021
Make	Volkswagen
Model	ID.4
Body Style	5-Door SUV
Body Color	Moonstone Gray
Odometer Reading (km / mi)	92 / 57

DATA FROM VEHICLE'S CERTIFICATION LABEL

Manufactured By	Volkswagen AG
Date of Manufacture	Apr-21
VIN	WVGRMPE22MP034867
GVWR (kg)	2560

ELECTRIC VEHICLE PROPULSION SYSTEM

Type of Electrical Vehicle	Electric
Propulsion Battery Type	Lithium-Ion
Nominal Voltage (V)	352
Automatic Propulsion Battery Disconnect	Yes
Physical Location of Automatic Propulsion Battery Disconnect	Internal to HV Battery
Auxiliary Battery Type	12 Volt Lithium-Ion

PROPULSION BATTERY SYSTEM DATA

Electrolyte Fluid Type	LiPF6 + EC + EMC
Electrolyte Fluid Specific Gravity (g/cc)	1.29
Electrolyte Fluid Kinematic Viscosity (mm^2/s)	3.19
Electrolyte Fluid Color	Clear and colorless
Propulsion Battery Coolant Type	G12evo
Propulsion Battery Coolant Color	Pink (Magenta)
Propulsion Battery Coolant Specific Gravity	

LOCATION OF BATTERY MODULES

Location	Outside Passenger Compartment

DATA SHEET NO. 305-1…(CONTINUED)

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

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

For all battery types:

Description	Volts
Minimum Operating Voltage	240.0
Maximum Operating Voltage	408.0
95% of Maximum Operating Voltage	387.6
Test Voltage (no less than 95% of Maximum)*	392.6

For batteries that are rechargeable ONLY by an energy source on the vehicle:

Description	Volts
Minimum Operating Voltage	
Maximum Operating Voltage	
Test Voltage (Maximum practicable state of charge within normal operating range)	

DATA SHEET NO. 305-2

PRE-IMPACT DATA FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

VEHICLE CHASSIS GROUND POINT(S) LOCATION(S)

DETAILS OF VEHICLE CHASSIS GROUND POINT(S) AND LOCATION(S):

The FMVSS 305 ground terminal is located in the trunk compartment of the vehicle.

PROPULSION BATTERY SYSTEM

DETAILS OF PROPULSION BATTERY COMPONENTS:

The FMVSS 305 connections for high voltage battery positive and negative are located under the front passenger dashboard.

DATA SHEET NO. 305-3

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

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

VOLTMETER INFORMATION

Make	Fluke
Model	87V MAX
Serial No.	50790043
Internal Impedence Value	50 MΩ
Resolution	0.001

HV BATTERY ELECTRICAL ISOLATION DATA

Code	Units	Threshold	Pre-Test
V_b	V		392.60
V_1	V		176.20
V_2	V		183.40
R_o	Ω		220,100
V_1'	V		20.02
V_2'	V		22.13
R_{i1}	Ω		3,504,251
R_{i2}	Ω		3,144,941
R_i	Ω		3,144,941
R_i/V_b	Ω/V	500	8,011

Is the Measured Electrical Isolation Value ≥ 500 Ω/V?	Yes

DATA SHEET NO. 305-4

POST-IMPACT DATA FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

VOLTMETER INFORMATION

Make	Fluke
Model	87V MAX
Serial No.	50790043
Internal Impedence Value	50 MΩ
Resolution	0.001

HV BATTERY ELECTRICAL ISOLATION DATA

Code	Units	Threshold	Post-Test
V_b	V		0.002
V_1	V		0.004
V_2	V		0.004
R_o	Ω		220,100
V_1'	V		0.000
V_2'	V		0.000
R_{i1}	Ω		*Zero Volts
R_{i2}	Ω		*Zero Volts
R_i	Ω		*Zero Volts
R_i/V_b	Ω/V	500	*Zero Volts

* ”Zero Volts” is considered as being compliant.

Is the Measured Electrical Isolation Value ≥ 500 Ω/V?	Yes

PROPULSION BATTERY SYSTEM COMPONENTS

Has the propulsion battery module moved within the passenger compartment?

No

Describe any movement: There was no movement of the propulsion battery within the passenger compartment.

Has an outside propulsion battery component intruded into the passenger compartment?

No

Describe any intrusion: There was no intrusion of the outside propulsion battery into the passenger compartment.

Is there propulsion battery electrolyte spillage visible in the passenger compartment?

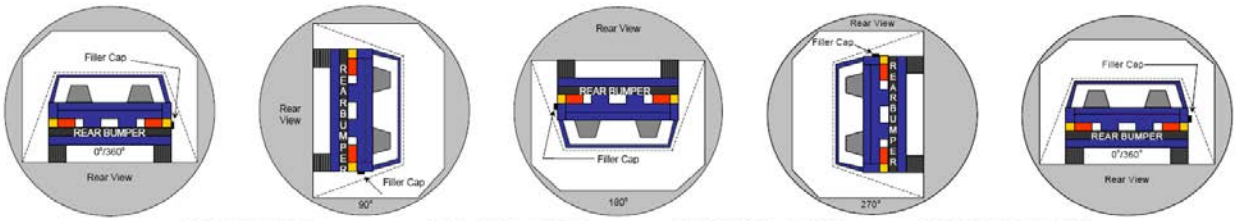
No

DATA SHEET NO. 305-5

STATIC ROLLOVER TEST DATA FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21



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

PROPULSION BATTERY ELECTROLYTE COLLECTION TIME PERIOD

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	84	300	384
90° To 180°	87	300	387
180° To 270°	82	300	382
270° To 360°	82	300	382

TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE

NOTE: The maximum allowable Propulsion Battery Electrolyte Spillage is 5.0 Liters.

Test Phase	Propulsion Battery Electrolyte Spillage (L)	Spillage Location
0° To 90°	0.0	N/A
90° To 180°	0.0	N/A
180° To 270°	0.0	N/A
270° To 360°	0.0	N/A

Is the Total Propulsion Battery Electrolyte Spillage Greater Than 5.0 Liters?	No spillage occurred
Is the Propulsion Battery Electrolyte Spillage Visible in the Passenger Compartment?	N/A

DATA SHEET NO. 305-5

STATIC ROLLOVER TEST DATA FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Volkswagen ID.4 5-Door SUV NHTSA No.: M20215800

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 09/28/21

VOLTMETER INFORMATION

Make	Fluke
Model	87V MAX
Serial No.	50790043
Internal Impedence Value	50 MΩ
Nominal Propulsion Battery Voltage (Vb)	0.001

HV BATTERY ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS

Code	Units	Threshold	0°	90°	180°	270°	360°
V_b	V		0.000	0.000	0.000	0.000	0.000
V_1	V		0.004	0.006	0.029	0.016	0.015
V_2	V		0.001	0.001	0.000	0.007	0.003
R_o	Ω		220,100	220,100	220,100	220,100	220,100
V_1'	V		0.000	0.000	0.008	0.000	0.000
V_2'	V		0.000	0.000	0.000	0.000	0.000
R_{i1}	Ω		*Zero Volts	*Zero Volts	577,763	*Zero Volts	*Zero Volts
R_{i2}	Ω		*Zero Volts	*Zero Volts	*Zero Volts	*Zero Volts	*Zero Volts
R_i	Ω		*Zero Volts	*Zero Volts	*Zero Volts	*Zero Volts	*Zero Volts
R_i/V_b	Ω/V	500	*Zero Volts	*Zero Volts	*Zero Volts	*Zero Volts	*Zero Volts

* ”Zero Volts” is considered as being compliant.

Is the Measured Electrical Isolation Value ≥ 500 Ω/V?	Yes

APPENDIX A
PHOTOGRAPHIC DOCUMENTATION

TABLE OF PHOTOGRAPHS

TABLE OF PHOTOGRAPHS … (CONTINUED)

TABLE OF PHOTOGRAPHS … (CONTINUED)

TABLE OF PHOTOGRAPHS … (CONTINUED)

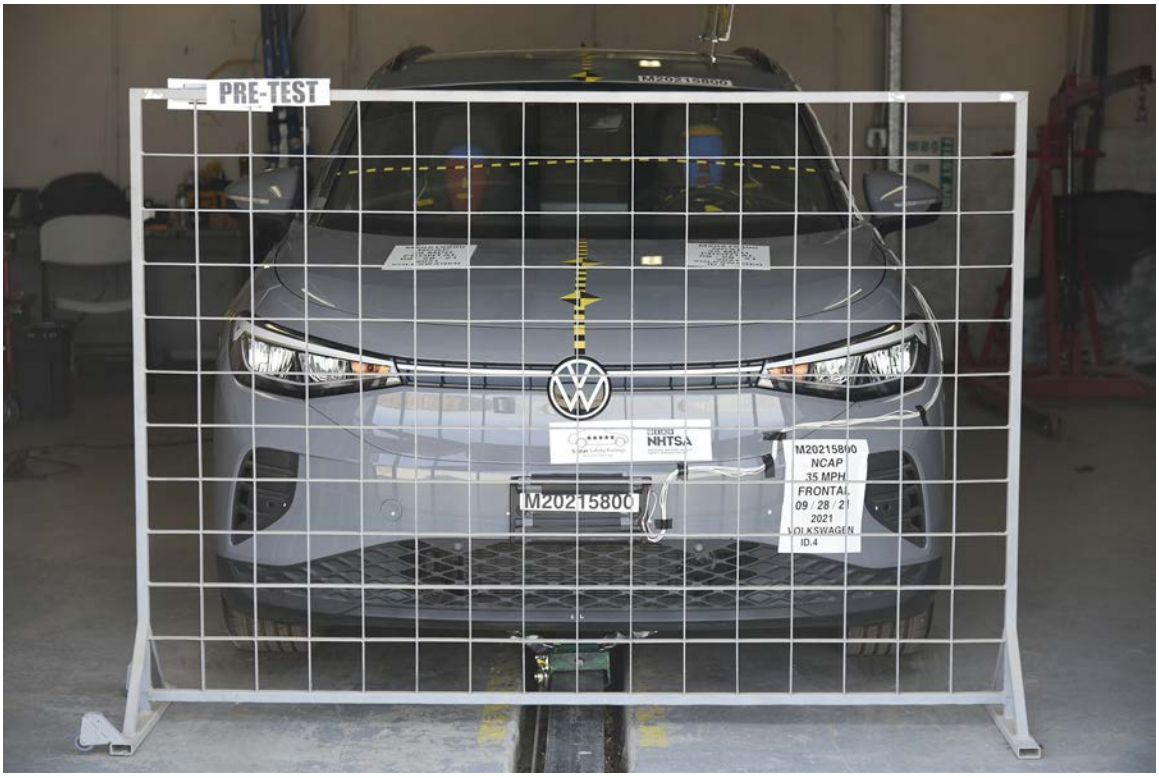


FIGURE 1. Load Cell Location

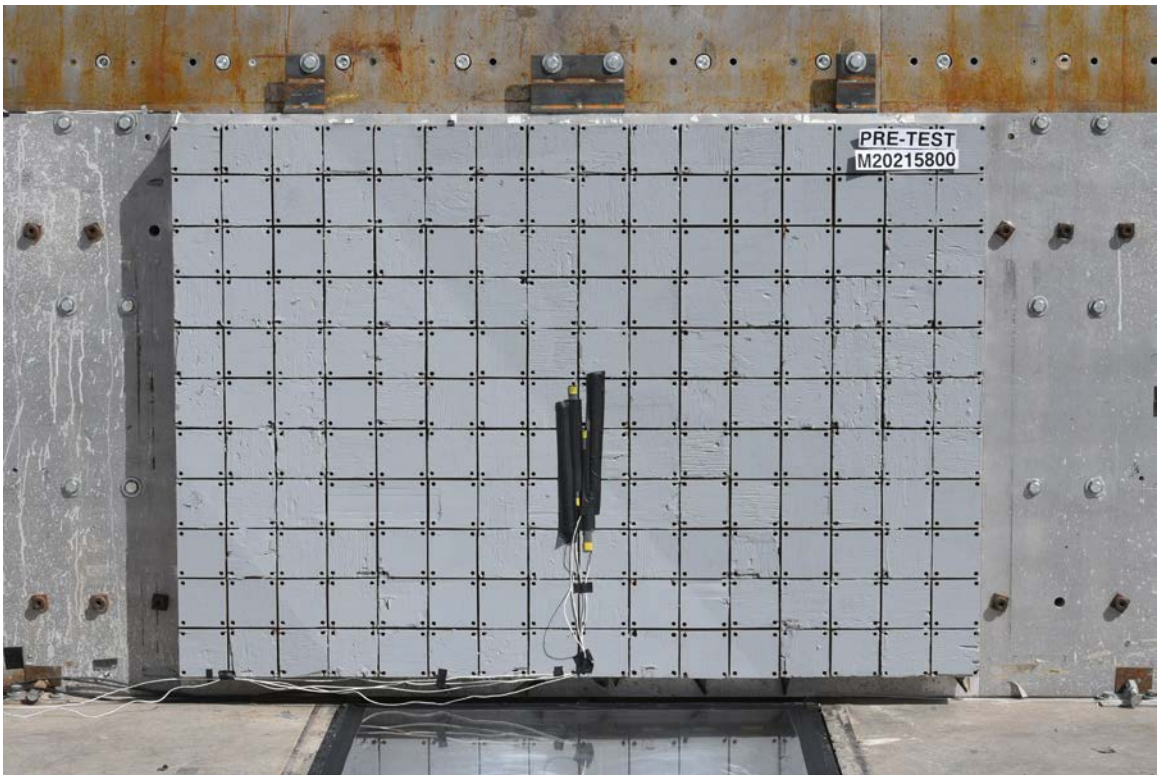


FIGURE 2. Pre-Test Load Cell Wall

FIGURE 3. Post-Test Load Cell Wall

FIGURE 4. Manufacturer's Label

FIGURE 5. Tire Placard

FIGURE 6. 2021 Volkswagen ID.4 Frontal as Delivered

FIGURE 7. Left Rear ¾ View, as Received

FIGURE 8. Pre-Test Front View of Test Vehicle

FIGURE 9. Post-Test Front View of Test Vehicle

FIGURE 10. Pre-Test Left View of Test Vehicle

FIGURE 11. Post-Test Left View of Test Vehicle

FIGURE 12. Pre-Test Right View of Test Vehicle

FIGURE 13. Post-Test Right View of Test Vehicle

FIGURE 14. Pre-Test Right Front ¾ View

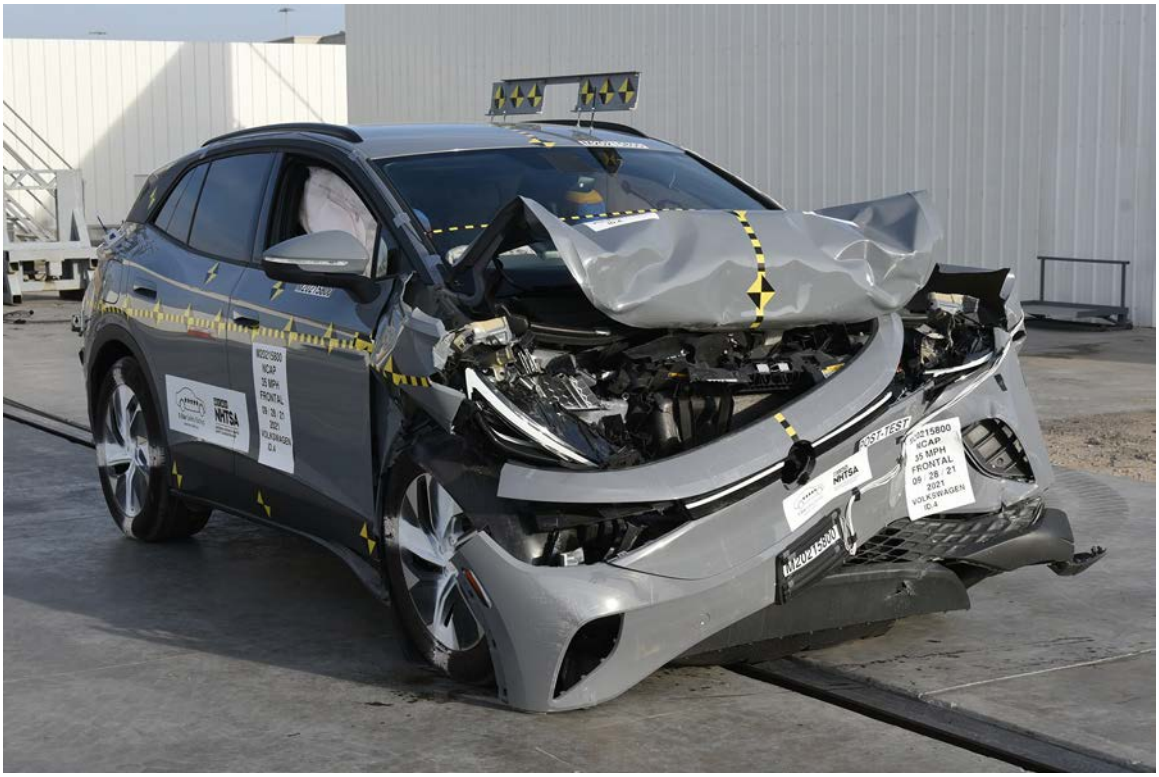


FIGURE 15. Post-Test Right Front ¾ View

FIGURE 16. Pre-Test Left Rear ¾ View

FIGURE 17. Post-Test Left Rear ¾ View

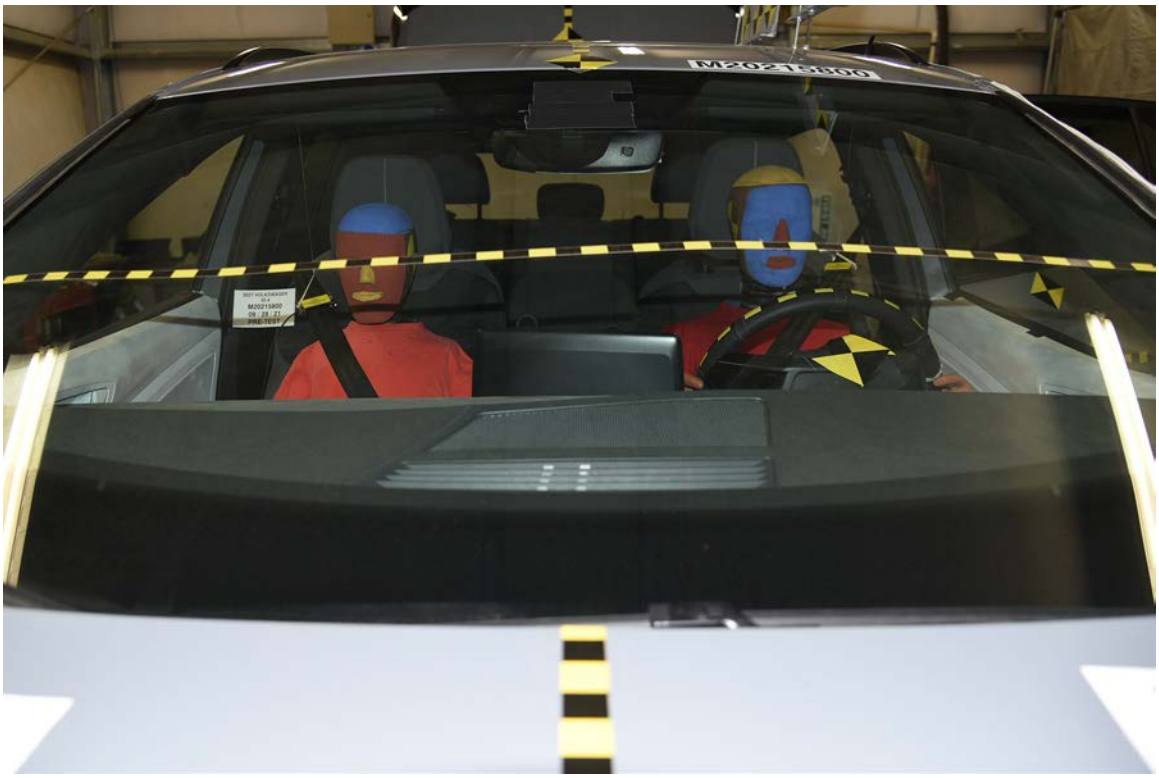


FIGURE 18. Pre-Test Windshield View

FIGURE 19. Post-Test Windshield View

FIGURE 20. Pre-Test Engine Compartment View

FIGURE 21. Post-Test Engine Compartment View

FIGURE 22. Pre-Test Fuel Filler Cap View

FIGURE 23. Post-Test Fuel Filler Cap View

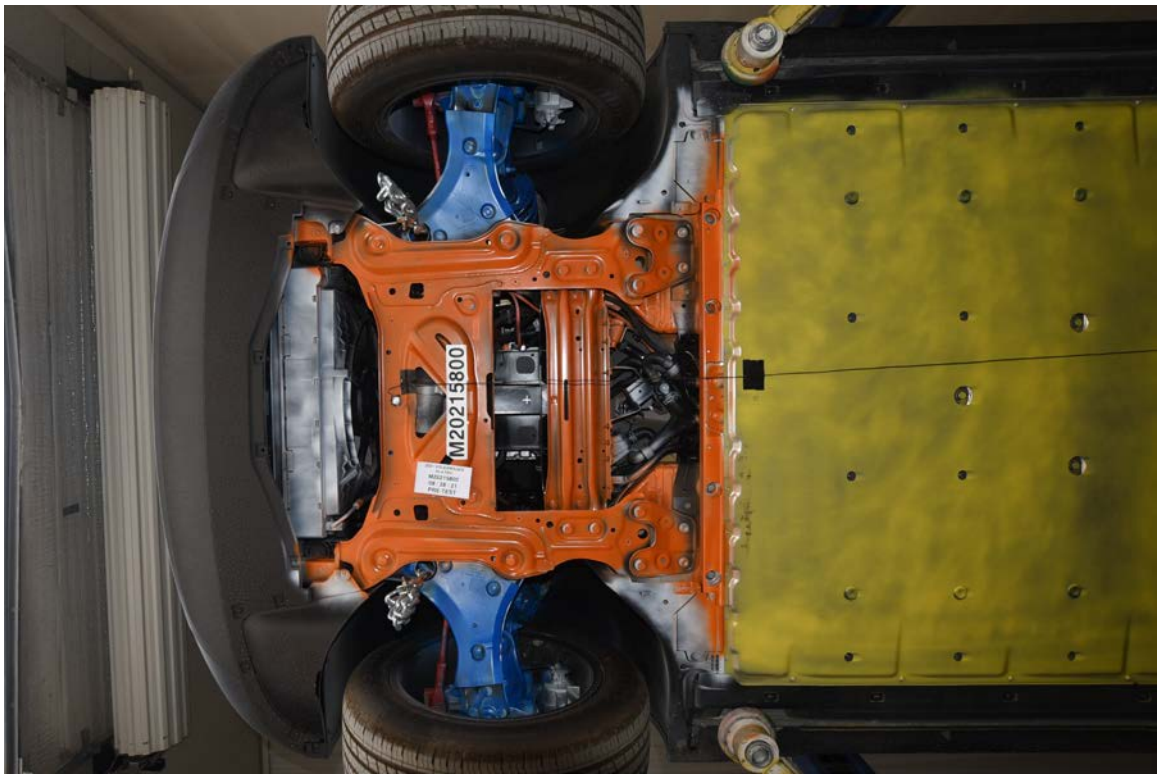


FIGURE 24. Pre-Test Front Underbody View

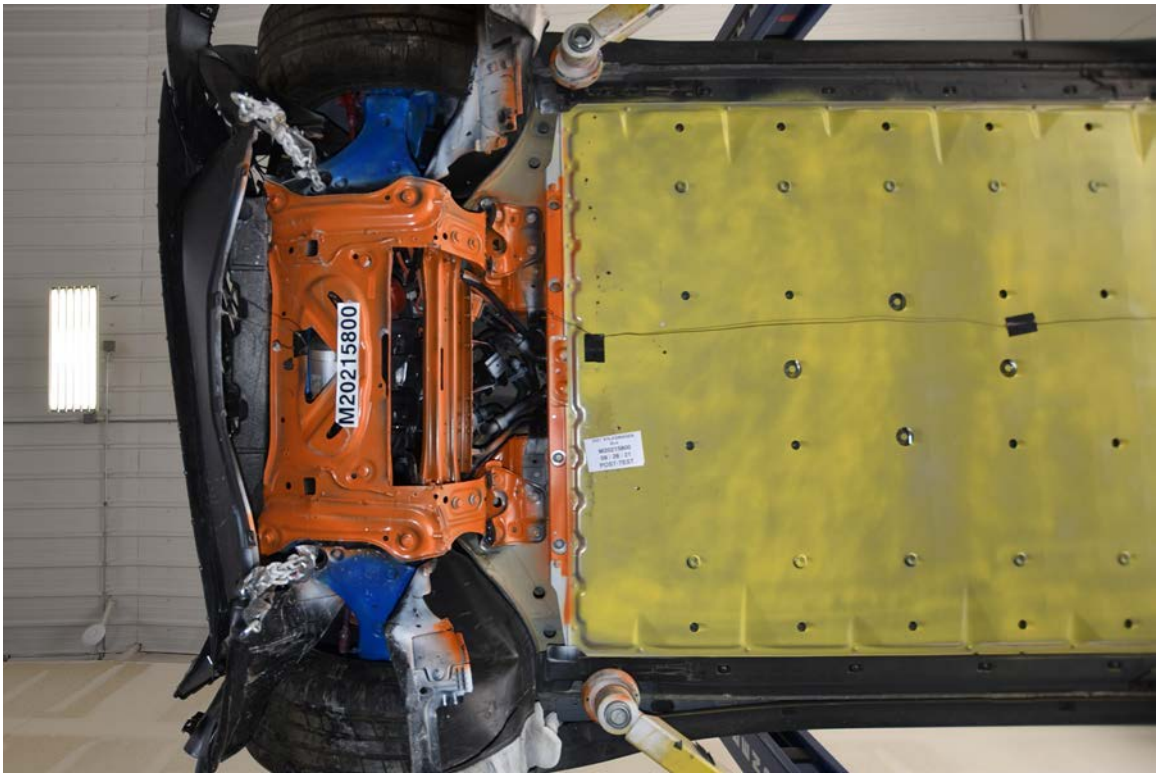


FIGURE 25. Post-Test Front Underbody View

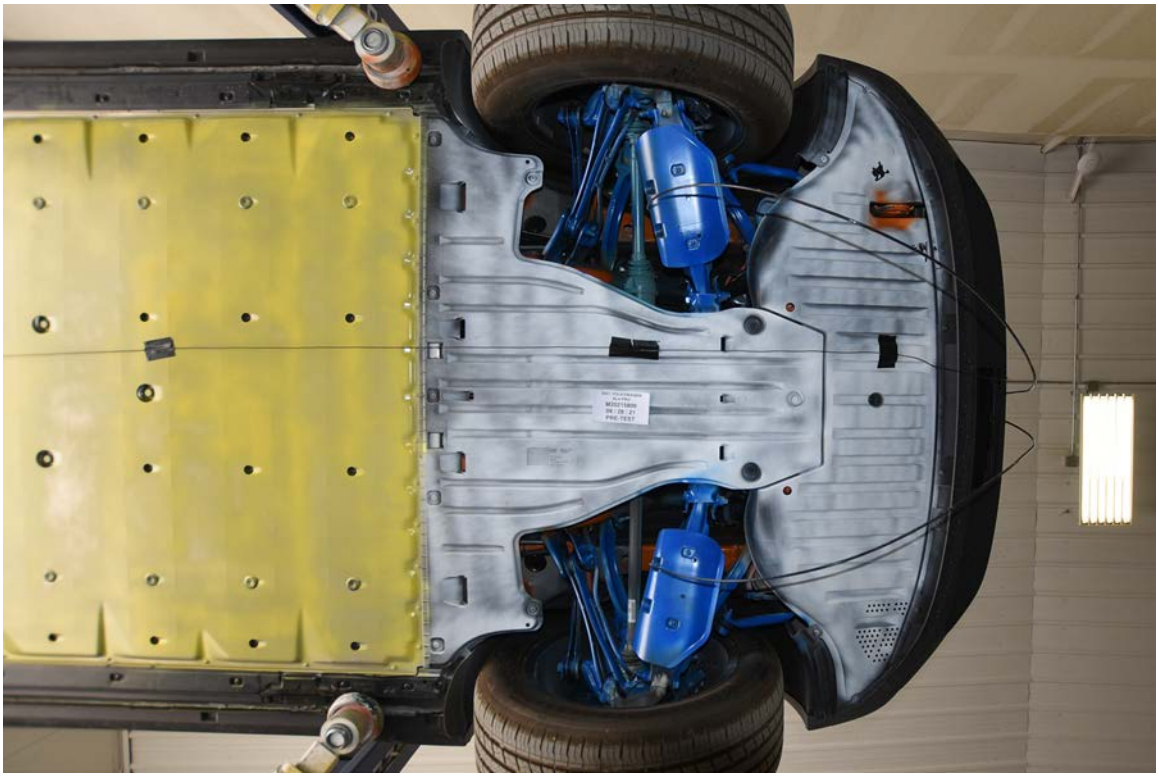


FIGURE 26. Pre-Test Rear Underbody View

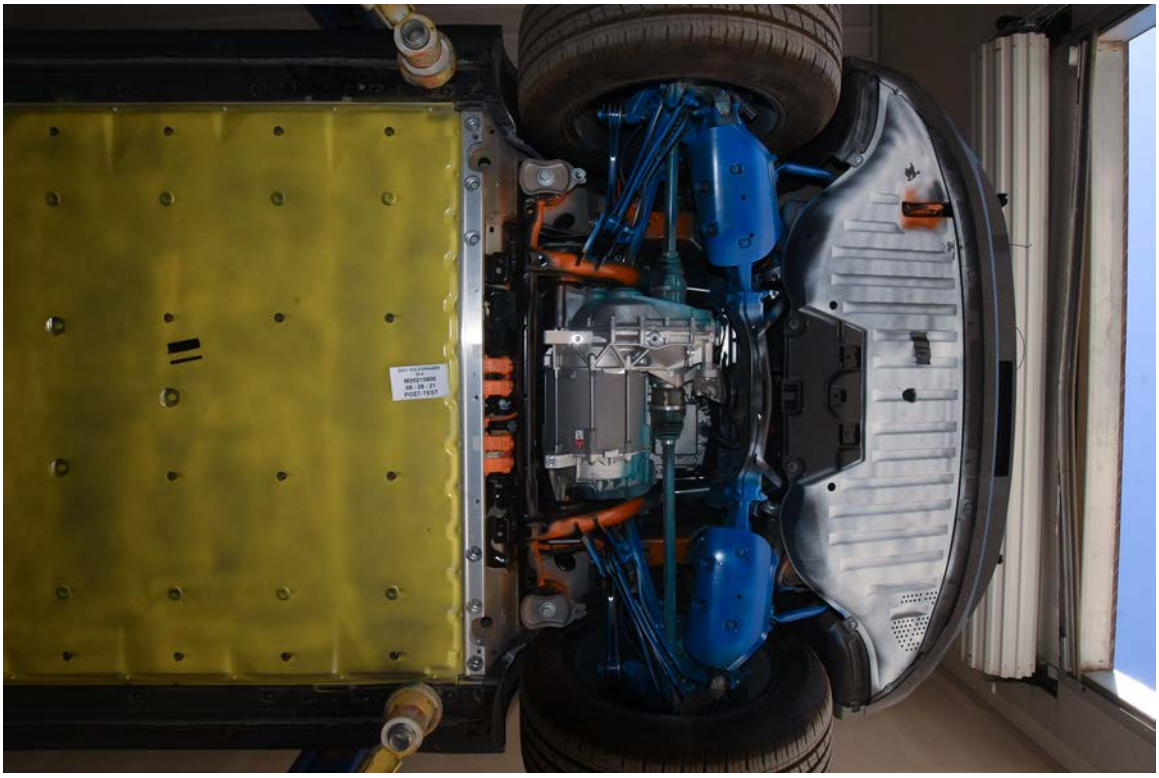


FIGURE 27. Post-Test Rear Underbody View

FIGURE 28. Pre-Test Dummy Cable Routing

FIGURE 29. Post-Test Dummy Cable Routing

FIGURE 30. Pre-Test Driver Dummy Front View

FIGURE 31. Post-Test Driver Dummy Front View

FIGURE 32. Pre-Test Driver Dummy Window View

FIGURE 33. Post-Test Driver Dummy Window View

FIGURE 34. Pre-Test Driver Dummy and Vehicle Interior View

FIGURE 35. Post-Test Driver Dummy and Vehicle Interior View

FIGURE 36. Pre-Test Driver's Seat Fore-Aft Markings

FIGURE 37. Post-Test Driver's Seat Fore-Aft Markings

FIGURE 38. Pre-Test View of Belt Anchorage for Driver Dummy

FIGURE 39. Post-Test View of Belt Anchorage for Driver Dummy

FIGURE 40. Pre-Test View of Belt Buckle and Latch Plate for Driver Dummy

FIGURE 41. Post-Test View of Belt Buckle and Latch Plate for Driver Dummy

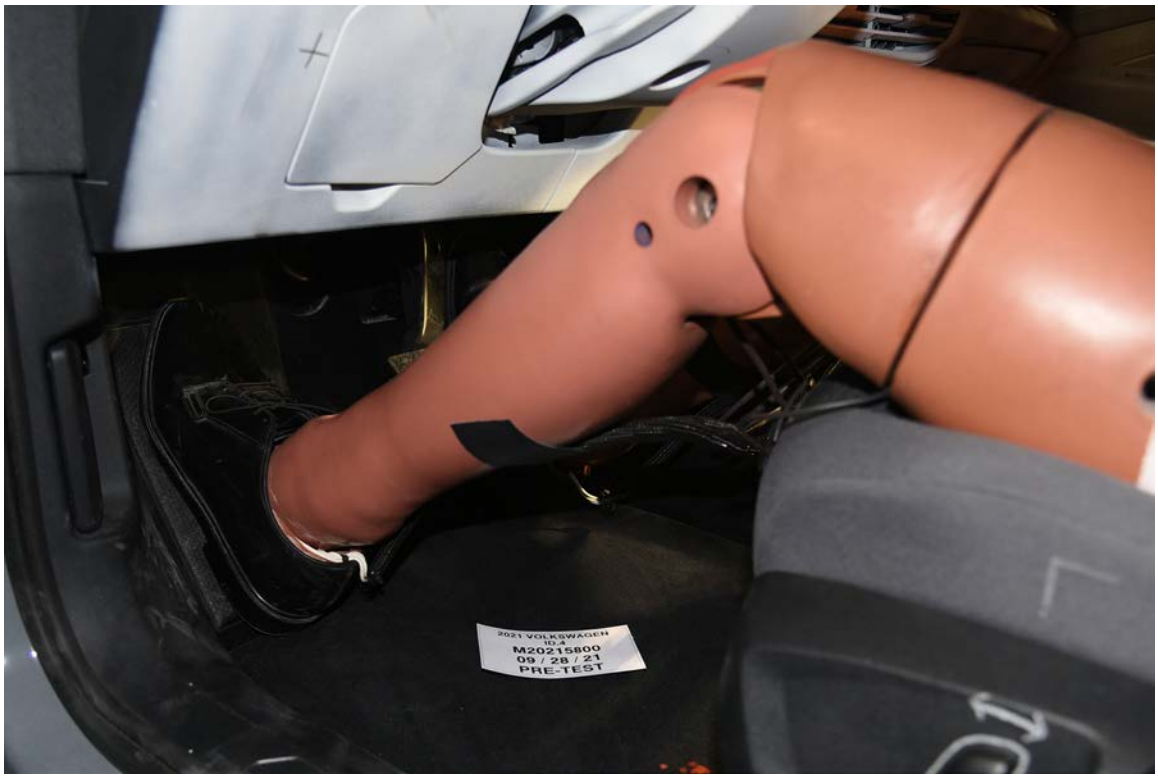


FIGURE 42. Pre-Test Driver Dummy Feet

FIGURE 43. Post-Test Driver Dummy Feet

FIGURE 44. Pre-Test Driver's Side Knee Bolster

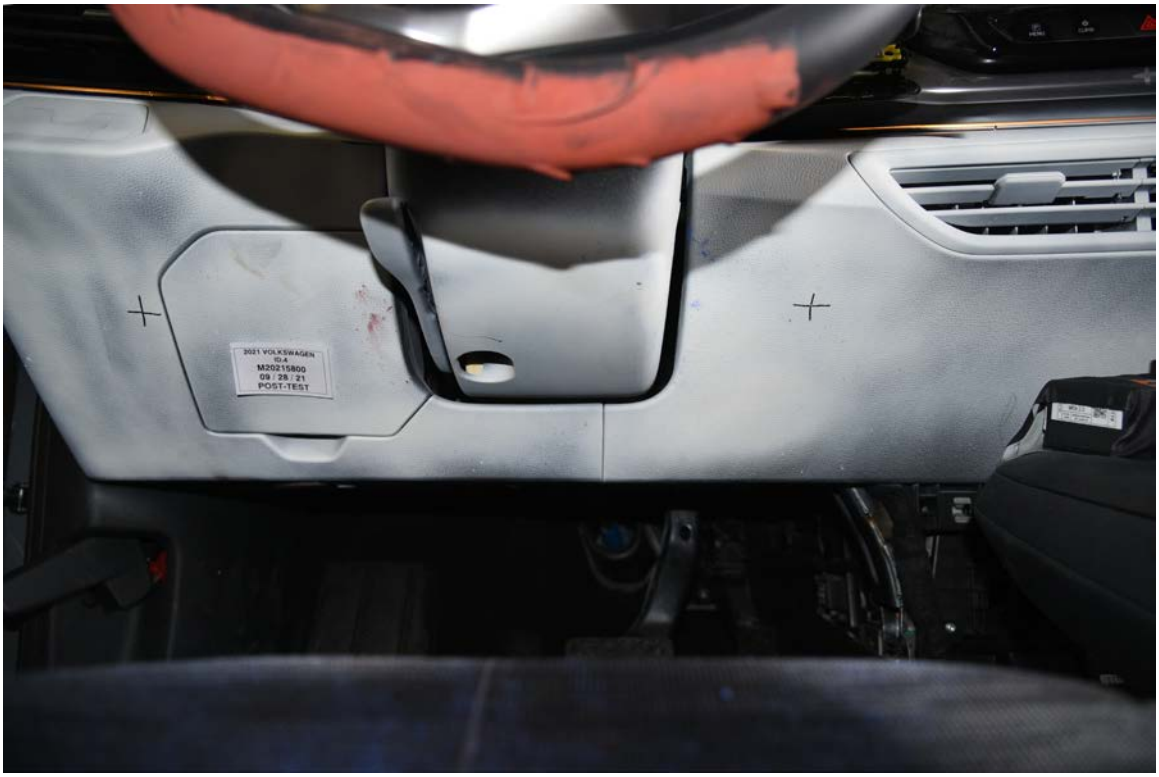


FIGURE 45. Post-Test Driver's Side Knee Bolster

FIGURE 46. Pre-Test Driver's Side Floorpan

FIGURE 47. Post-Test Driver's Side Floorpan

FIGURE 48. Post-Test Driver Dummy Face

FIGURE 49. Post-Test Driver Dummy Contact with Airbag

FIGURE 50. Post-Test Driver Dummy Contact with Headrest

Photograph Not Applicable

FIGURE 50a. Post-Test Driver Dummy Contact with Knee Airbag

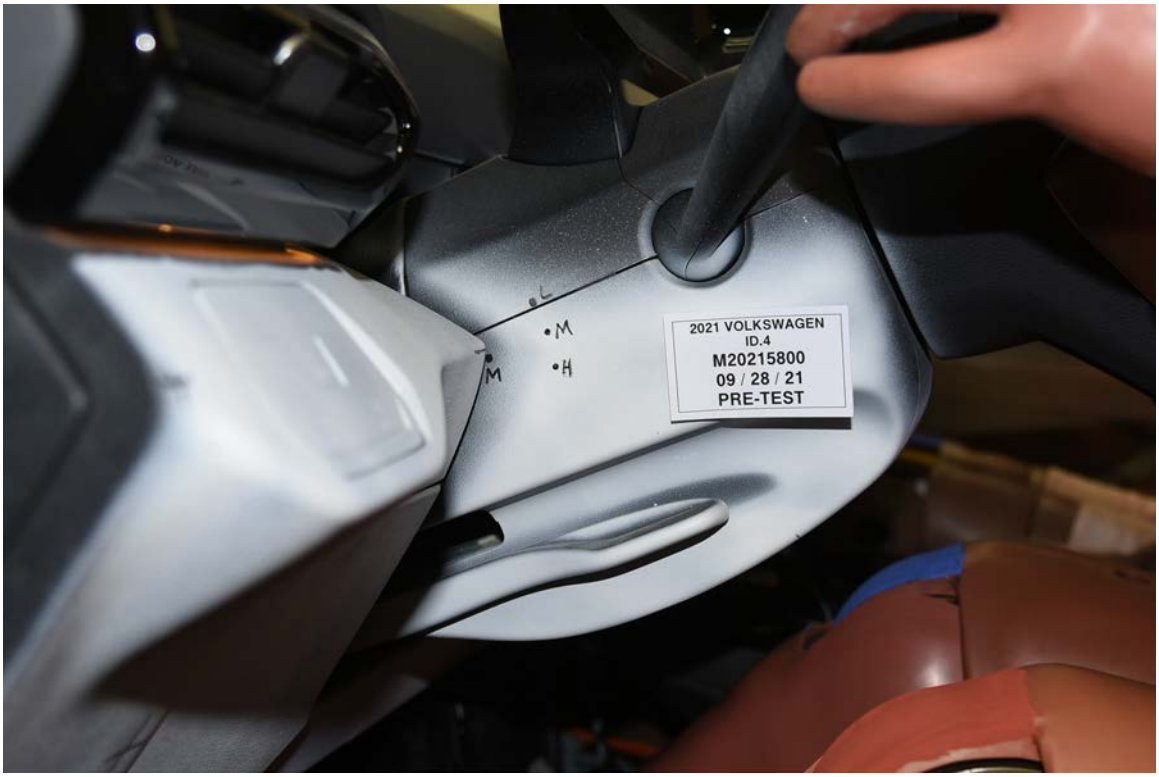


FIGURE 51. Pre-Test View of the Steering Wheel

FIGURE 52. Post-Test View of the Steering Wheel

FIGURE 53. Pre-Test Passenger Dummy Front View

FIGURE 54. Post-Test Passenger Dummy Front View

FIGURE 55. Pre-Test Passenger Dummy Window View

FIGURE 56. Post-Test Passenger Dummy Window View

FIGURE 57. Pre-Test Passenger Dummy and Vehicle Interior View

FIGURE 58. Post-Test Passenger Dummy and Vehicle Interior View

FIGURE 59. Pre-Test Passenger's Seat Fore-Aft Markings

FIGURE 60. Post-Test Passenger's Seat Fore-Aft Markings

FIGURE 61. Pre-Test View of Belt Anchorage for Passenger Dummy

FIGURE 62. Post-Test View of Belt Anchorage for Passenger Dummy

FIGURE 63. Pre-Test View of Belt Buckle and Latch Plate for Passenger Dummy

FIGURE 64. Post-Test View of Belt Buckle and Latch Plate for Passenger Dummy

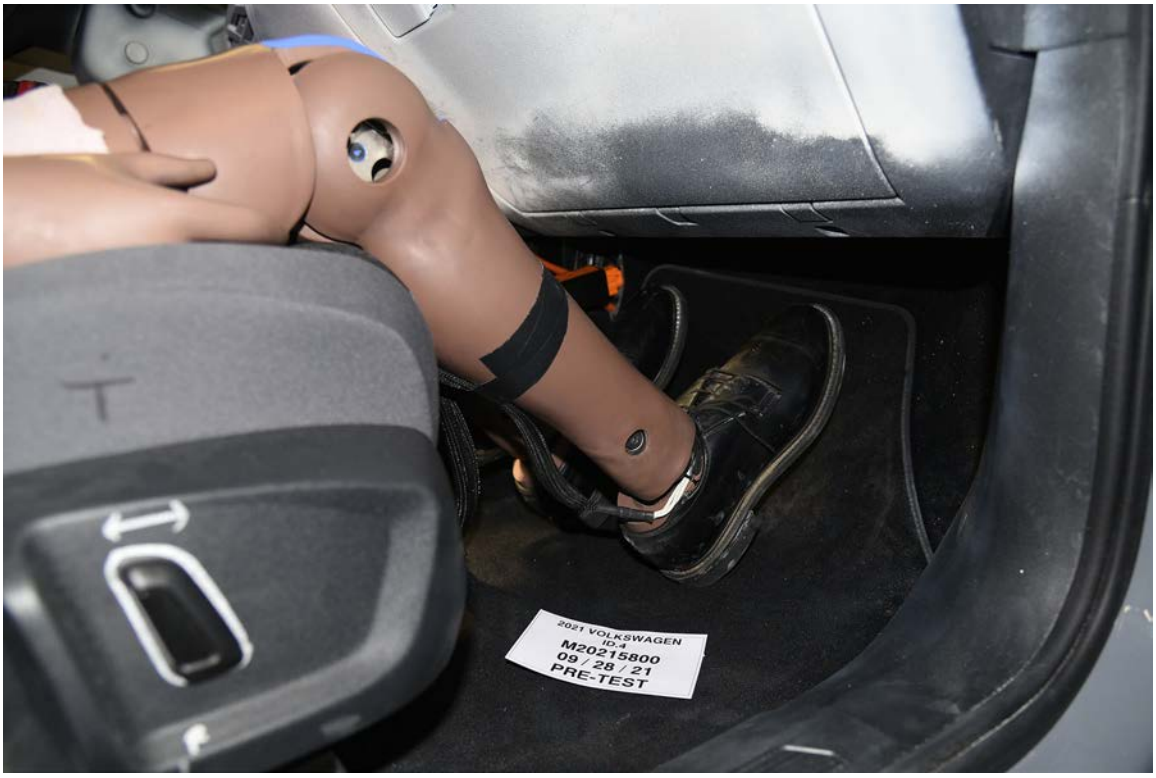


FIGURE 65. Pre-Test Passenger Dummy Feet

FIGURE 66. Post-Test Passenger Dummy Feet

FIGURE 67. Pre-Test Passenger's Side Knee Bolster

FIGURE 68. Post-Test Passenger's Side Knee Bolster

FIGURE 69. Pre-Test Passenger's Side Floorpan

FIGURE 70. Post-Test Passenger's Side Floorpan

FIGURE 71. Post-Test Passenger Dummy Face

FIGURE 72. Post-Test Passenger Dummy Contact with Airbag

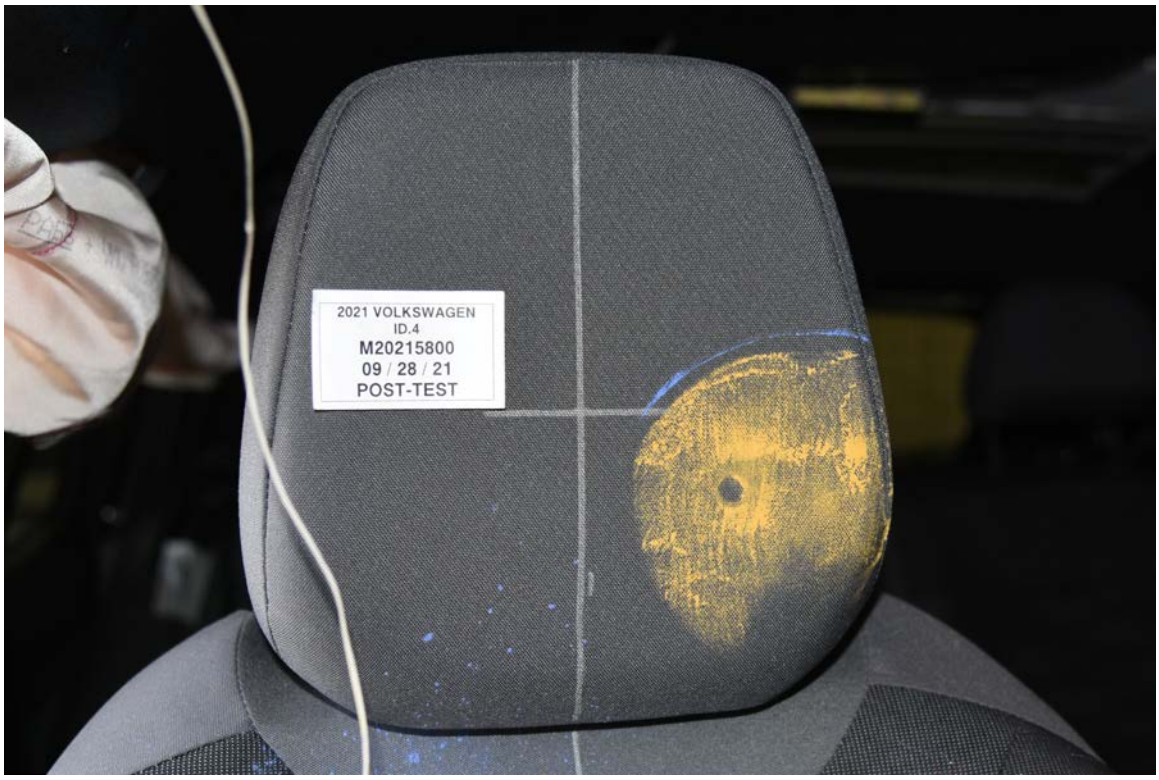


FIGURE 73. Post-Test Passenger Dummy Contact with Headrest

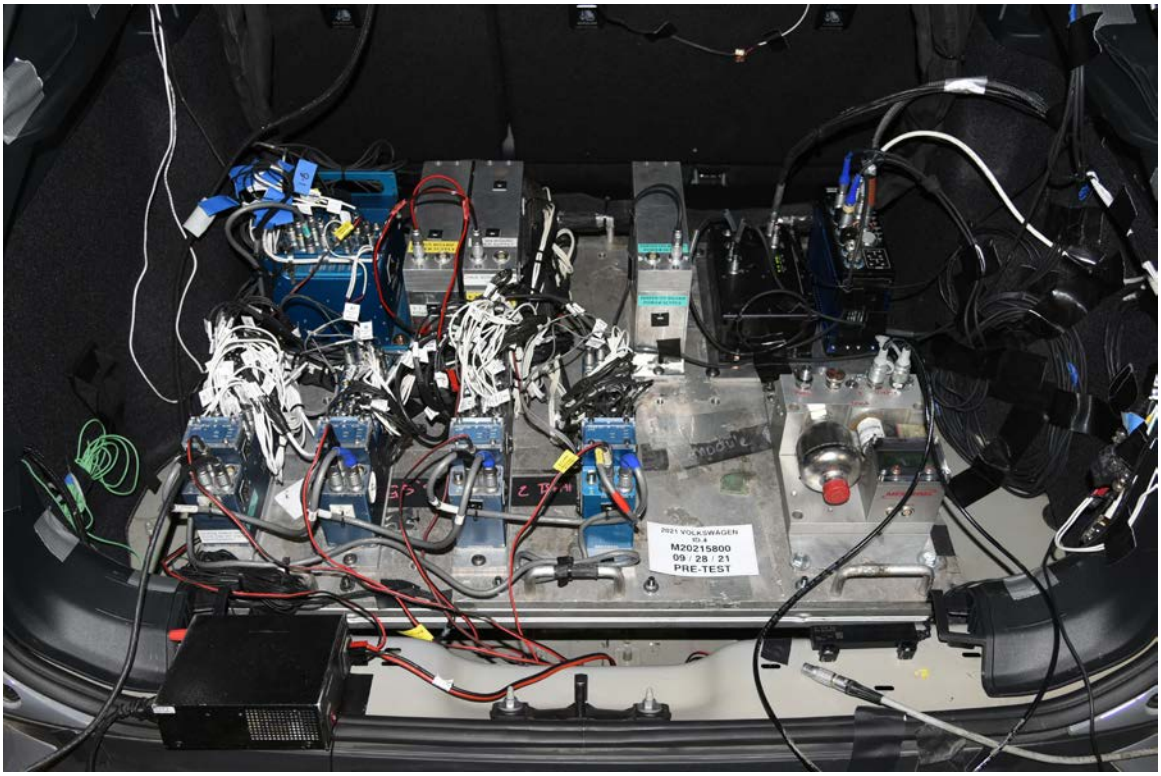


FIGURE 74. Photograph of Ballast Installed in Vehicle

Photograph Not Applicable

FIGURE 75. Post-Test Stoddard Solvent Spillage Location View

FIGURE 76. Post-Test Speed Trap Read-Out

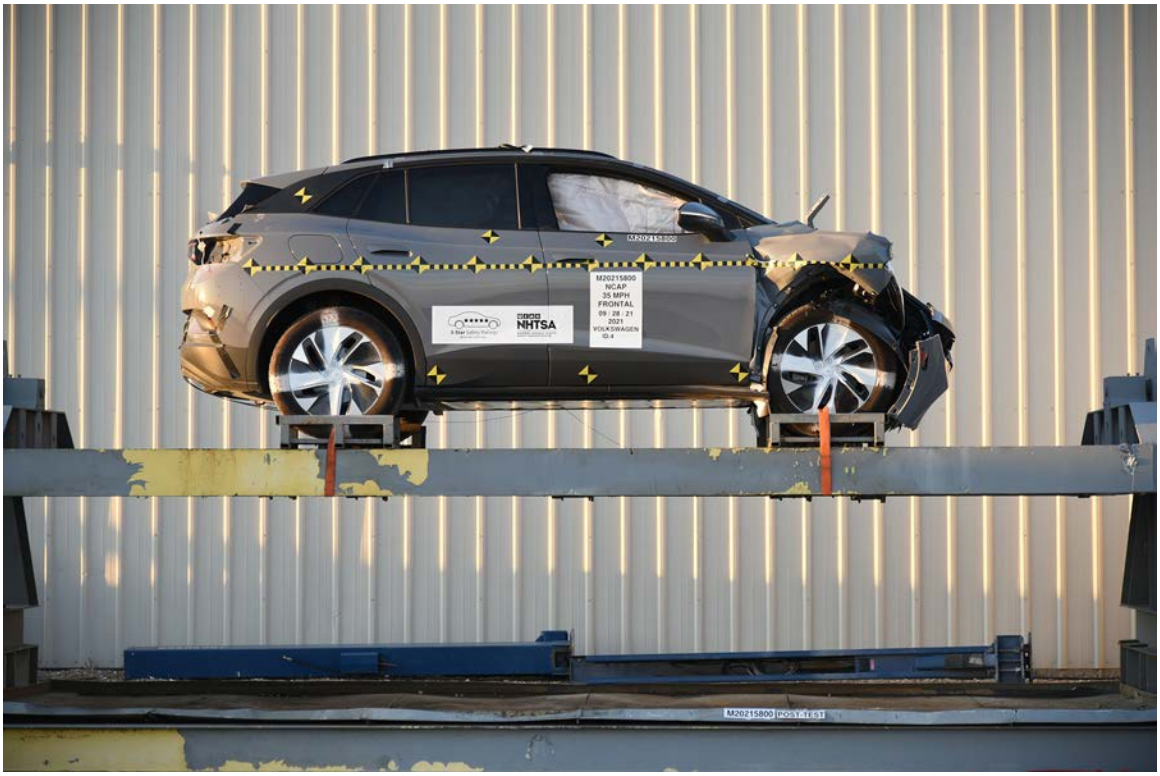


FIGURE 77. Vehicle at 0° on Static Rollover Device

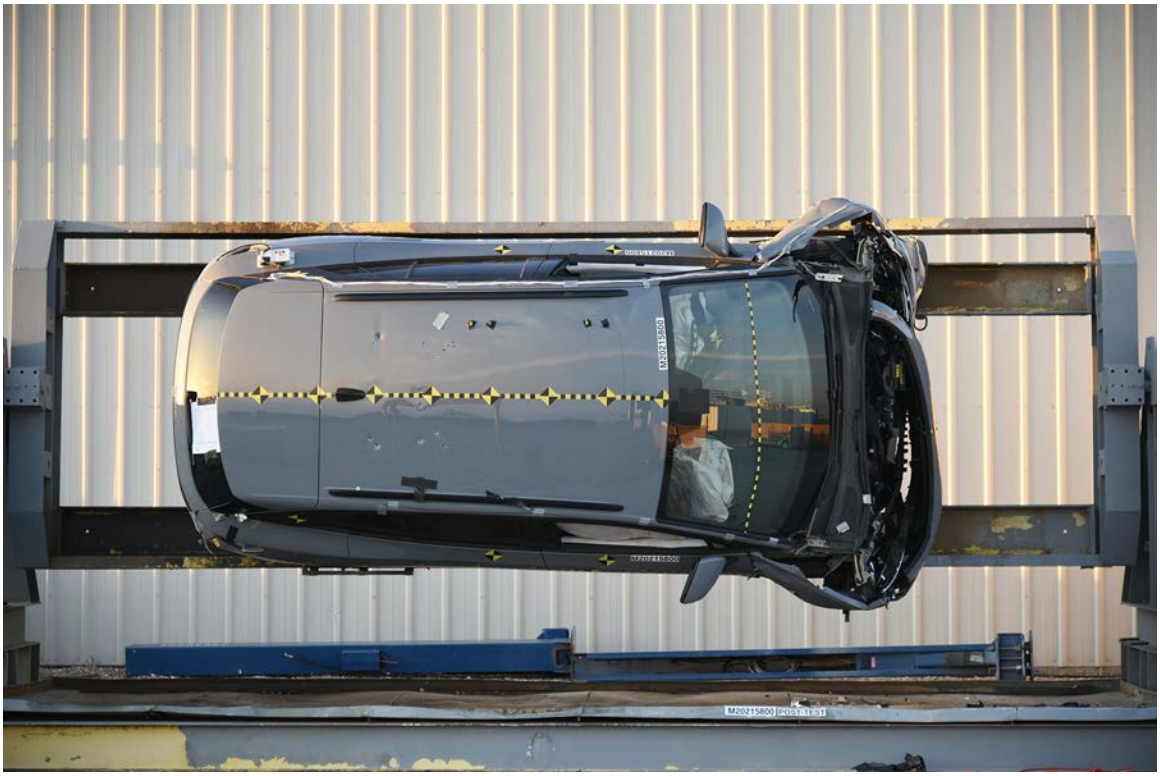


FIGURE 78. Vehicle at 90° on Static Rollover Device

FIGURE 79. Vehicle at 180° on Static Rollover Device

FIGURE 80. Vehicle at 270° on Static Rollover Device

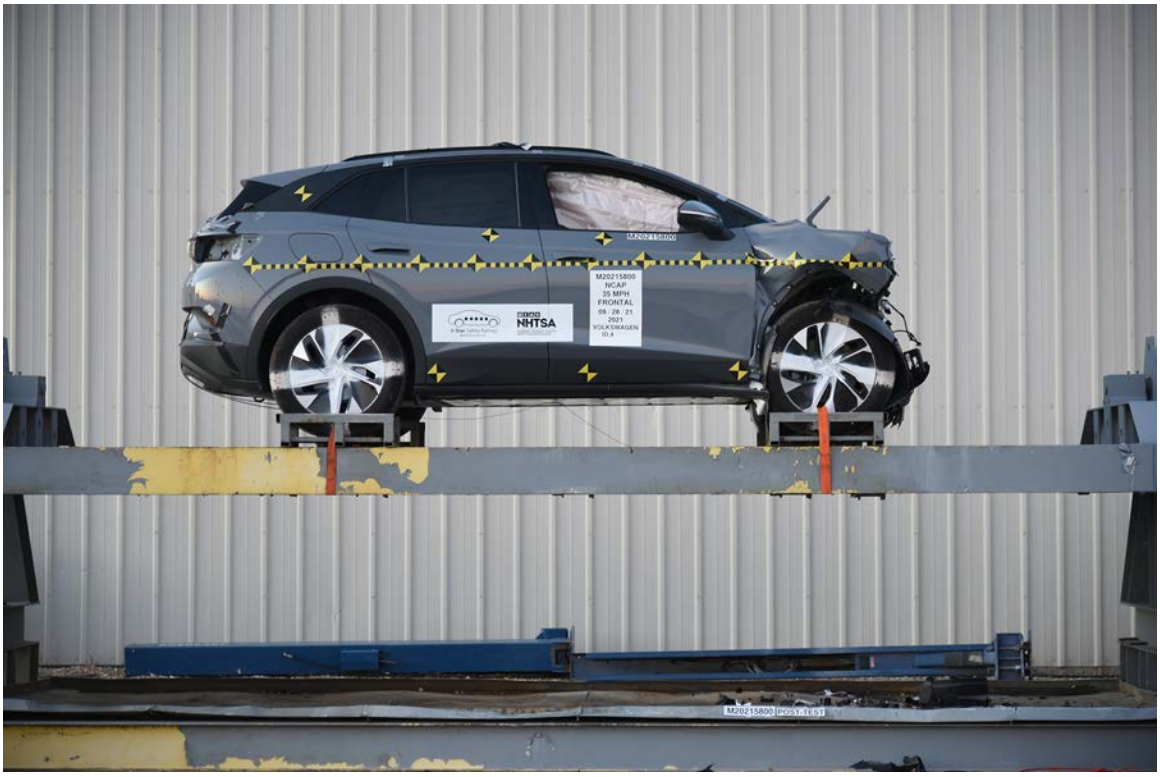


FIGURE 81. Vehicle at 360° on Static Rollover Device

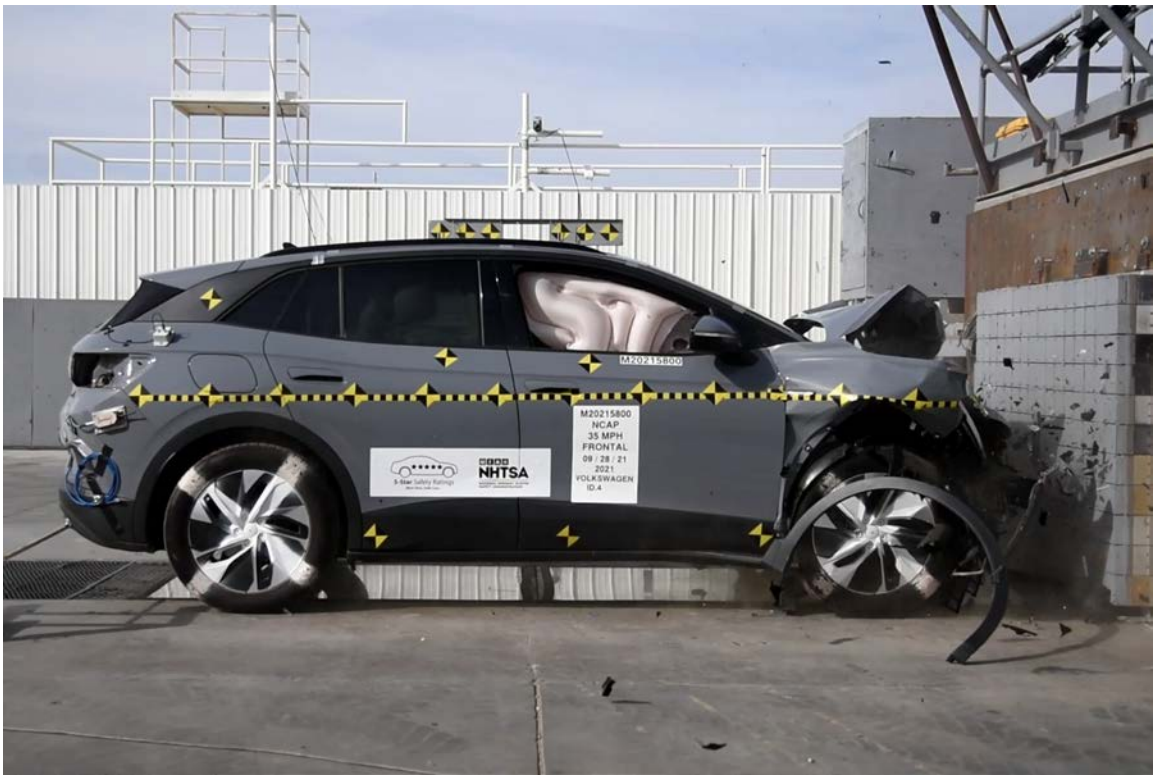


FIGURE 82. 2021 Volkswagen ID.4 Frontal Impact Event

FIGURE 83. Monroney Label Photograph

FIGURE 305-01. Auxiliary Power Module Warning Label

FIGURE 305-01a. Auxiliary Power Module Warning Label

FIGURE 305-02. Power Inverter Warning Label

FIGURE 305-03. First Responder Warning Label

FIGURE 305-04 First Responder Warning Location

Photograph Not Applicable

No Other Vehicle Label Related to Electric Propulsion System

FIGURE 305-05. Other Vehicle Label(s) Related to Electrical Propulsion System

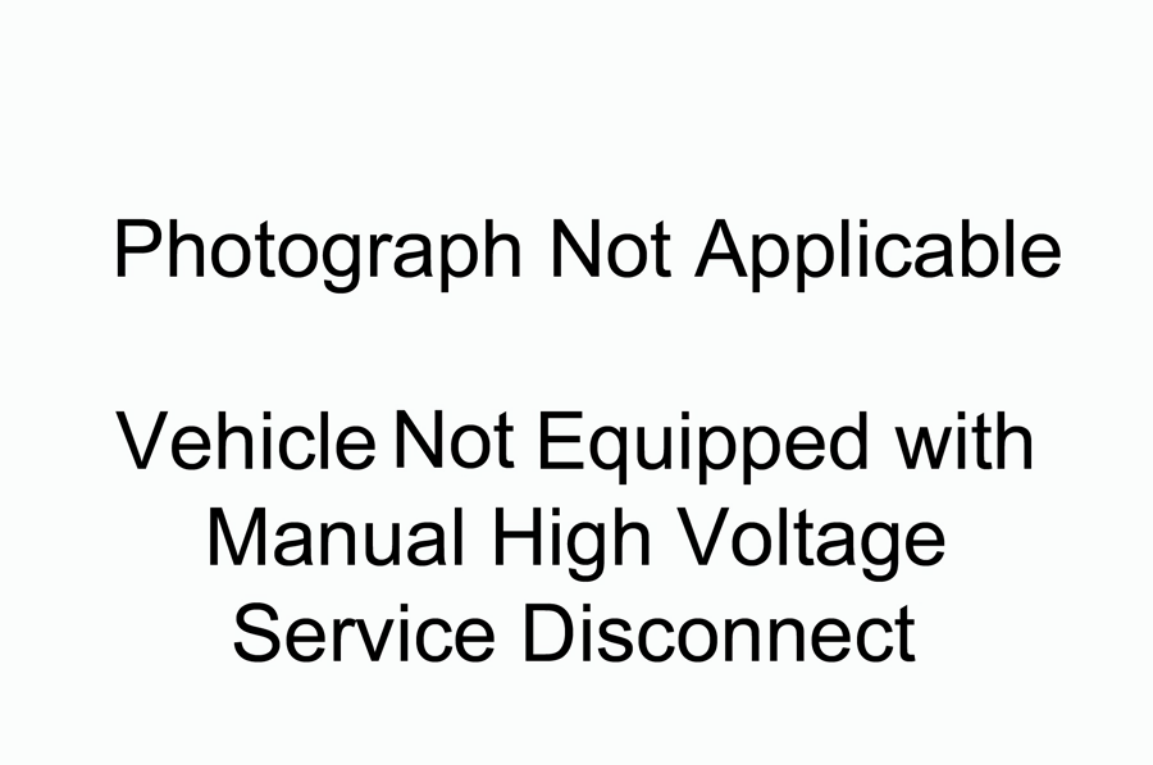


FIGURE 305-06. Manual High Voltage Service Disconnect in Place

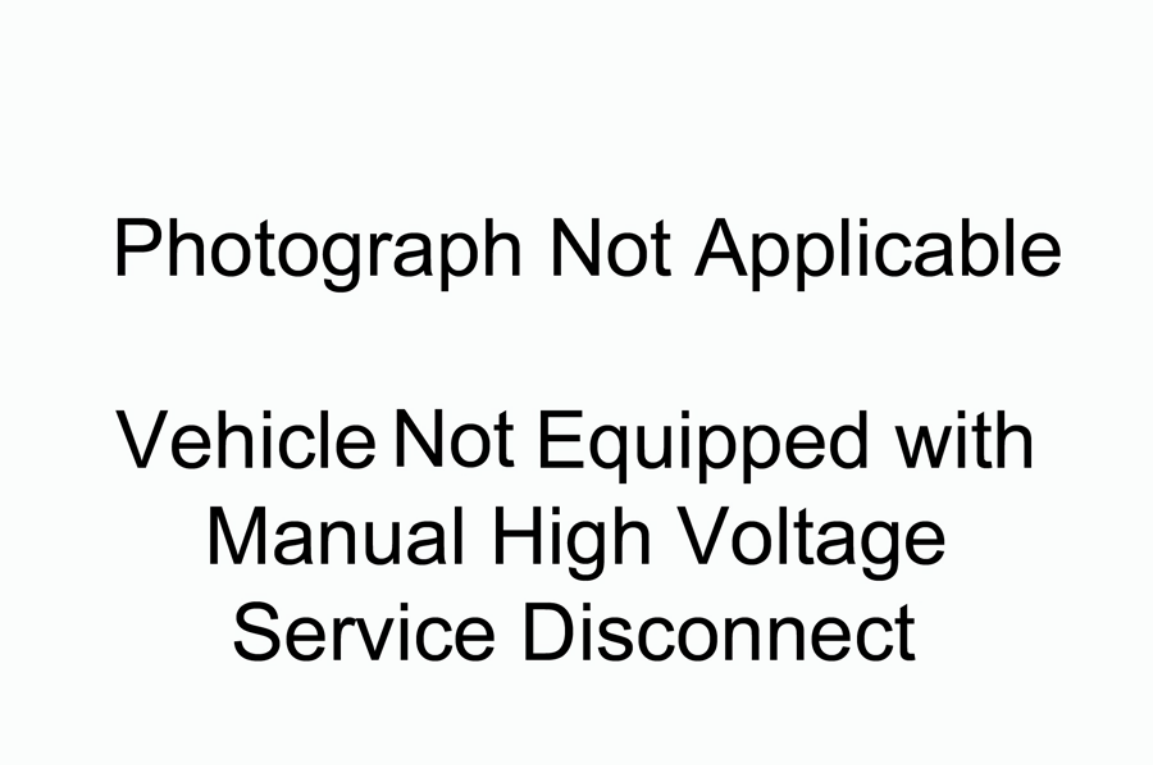


FIGURE 305-07. Manual High Voltage Service Disconnect Removed

Photograph Not Applicable

Vehicle Not Equipped with Manual High Voltage Service Disconnect

FIGURE 305-08. Manual High Voltage Service Disconnect Removed

FIGURE 305-09. Pre-Impact View of Propulsion Battery

FIGURE 305-09a. Pre-Impact View of Propulsion Battery

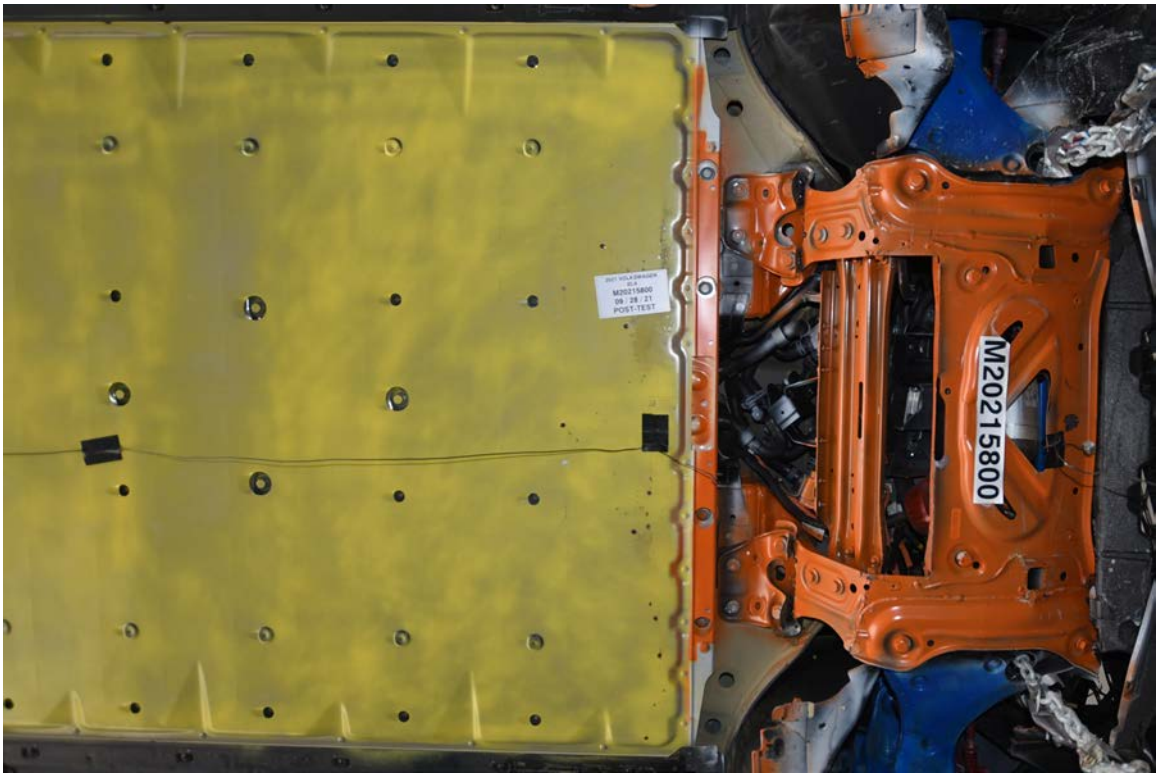


FIGURE 305-010. Post-Impact Front View of Propulsion Battery

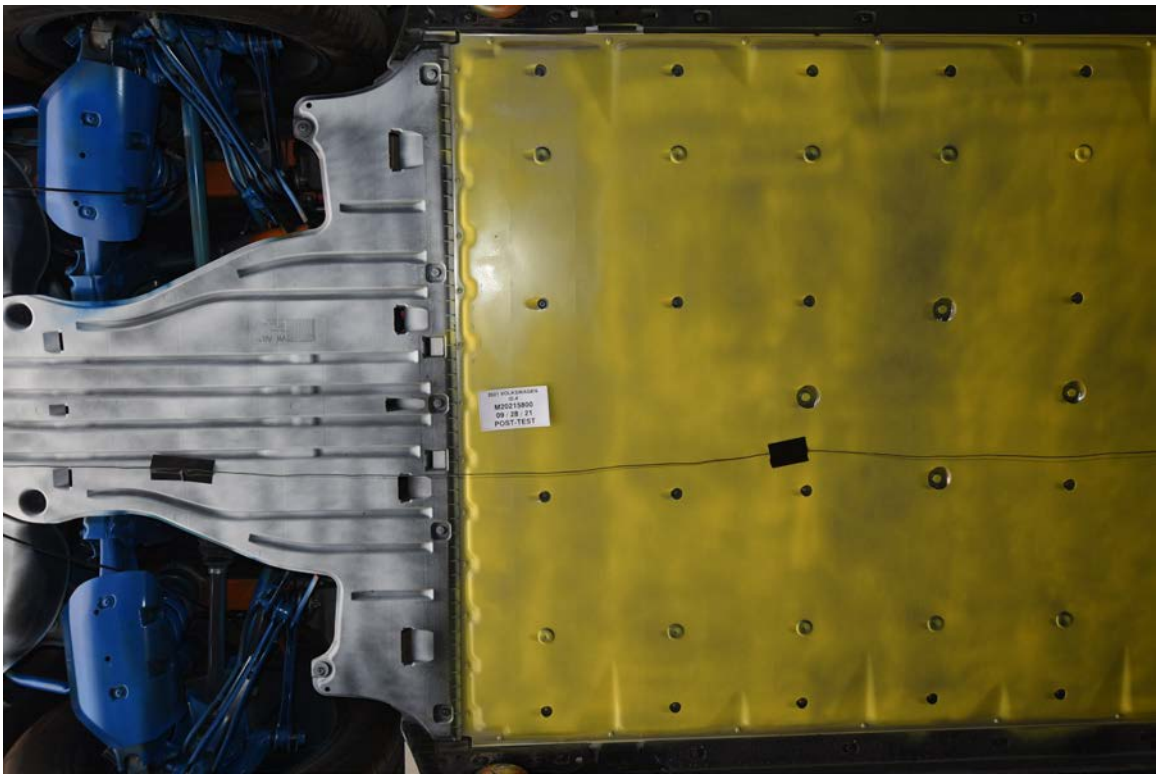


FIGURE 305-011. Post-Impact Rear View of Propulsion Battery

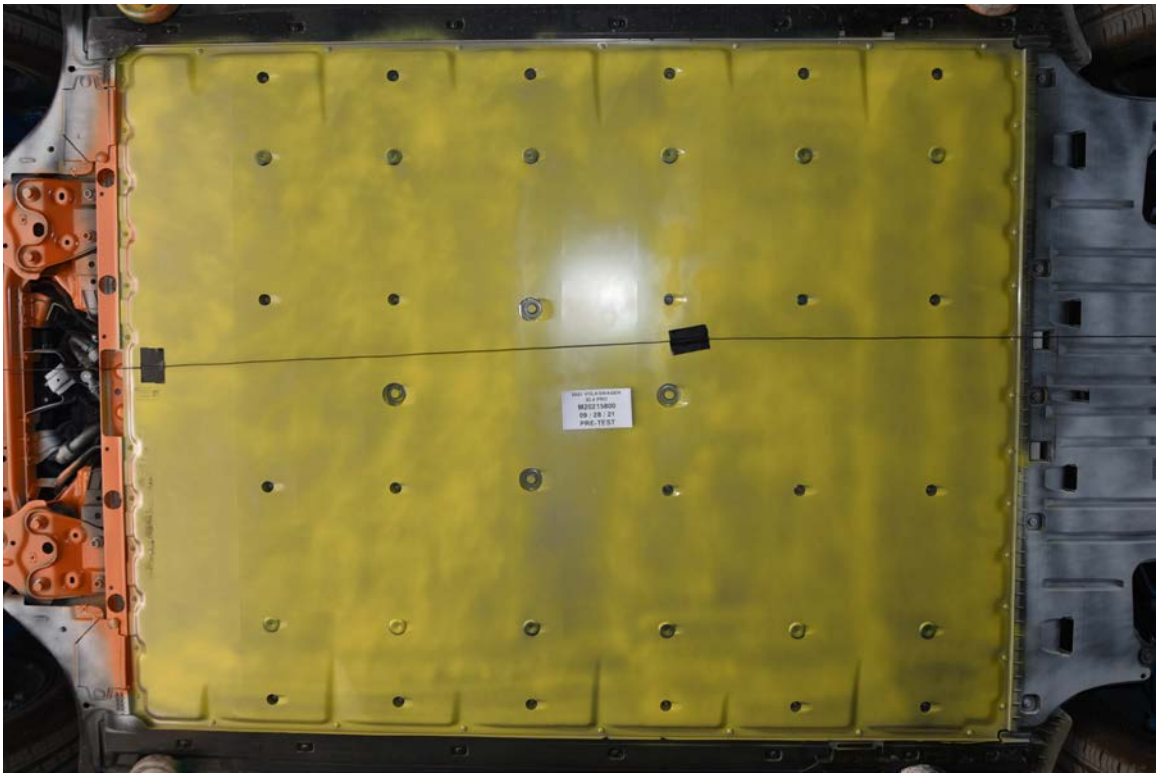


FIGURE 305-012. Pre-Impact View of Battery Box(s) or Container(s)
Which Holds Individual Battery Modules

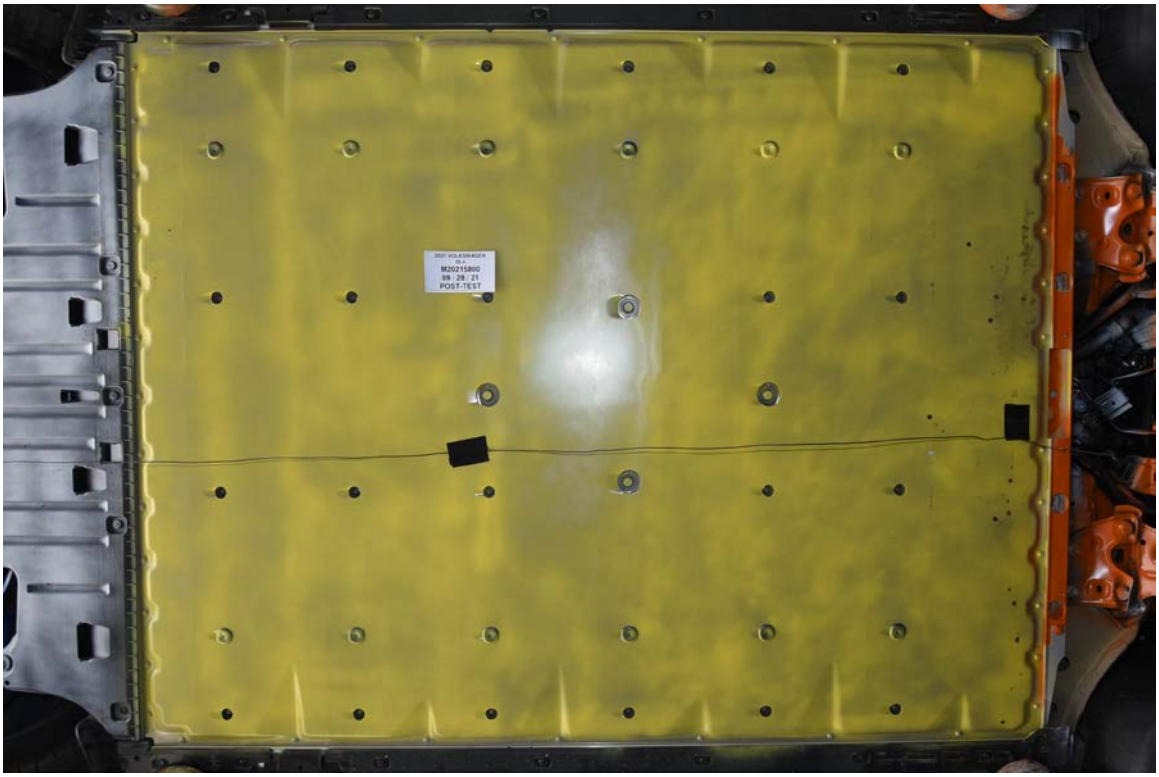


FIGURE 305-013. Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

Photograph Not Applicable

Battery Not Removed From Vehicle

FIGURE 305-014. Pre-Impact View of Propulsion Battery Module(s)

Photograph Not Applicable

Battery Not Removed
From Vehicle

FIGURE 305-015. Post-Impact View of Propulsion Battery Module(s)

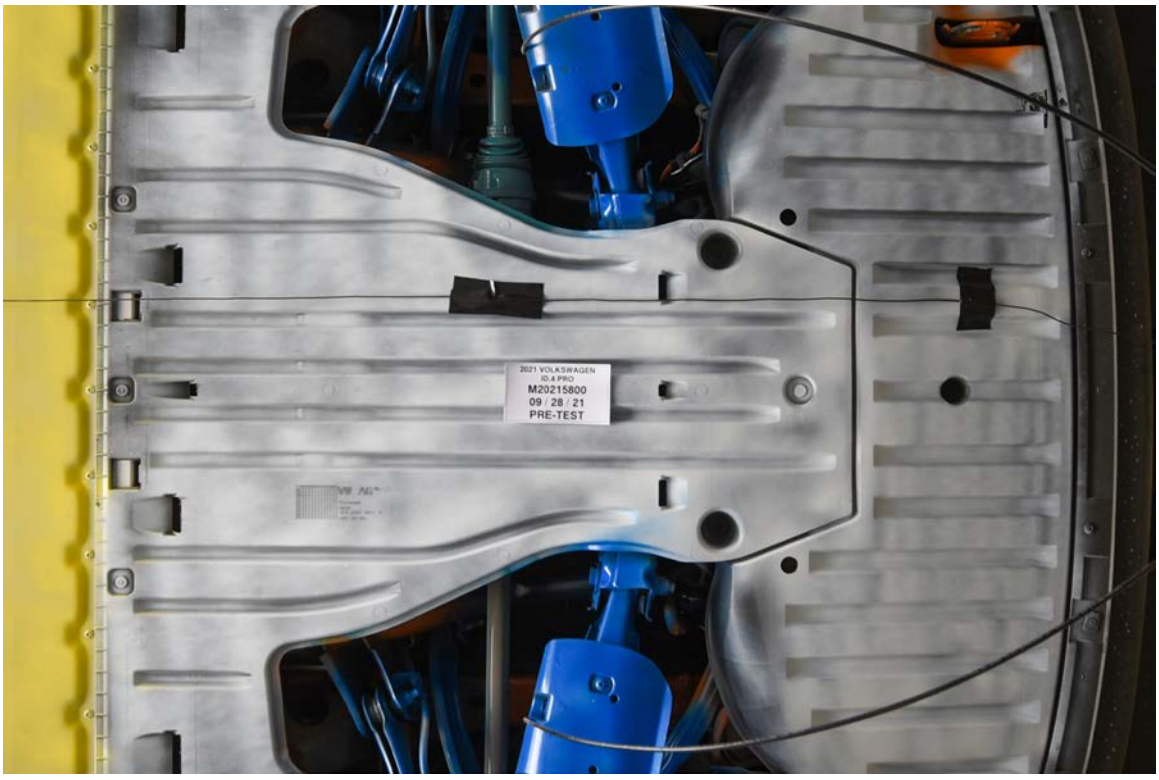


FIGURE 305-016. Pre-Impact View of Electric Propulsion Drive

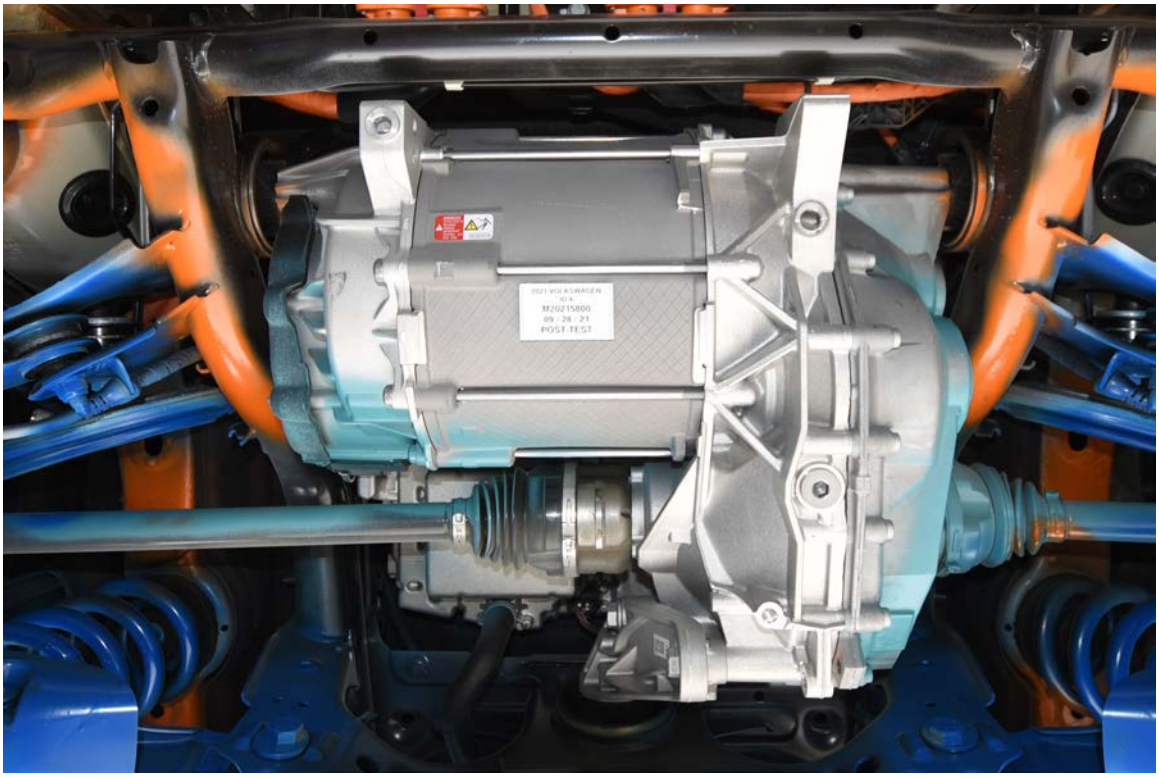


FIGURE 305-017. Post-Impact View of Electric Propulsion Drive

Photograph Not Available

FIGURE 305-018. Pre-Impact View of High Voltage Interconnect(s)

Photograph Not Available

Propulsion Battery Venting System Not Visible

FIGURE 305-019. Pre-Impact View Propulsion Battery Venting System(s)

Photograph Not Applicable

No Other Visible Electric Propulsion Components

FIGURE 305-020. Pre-Impact View of Other Visible Electric Propulsion Components

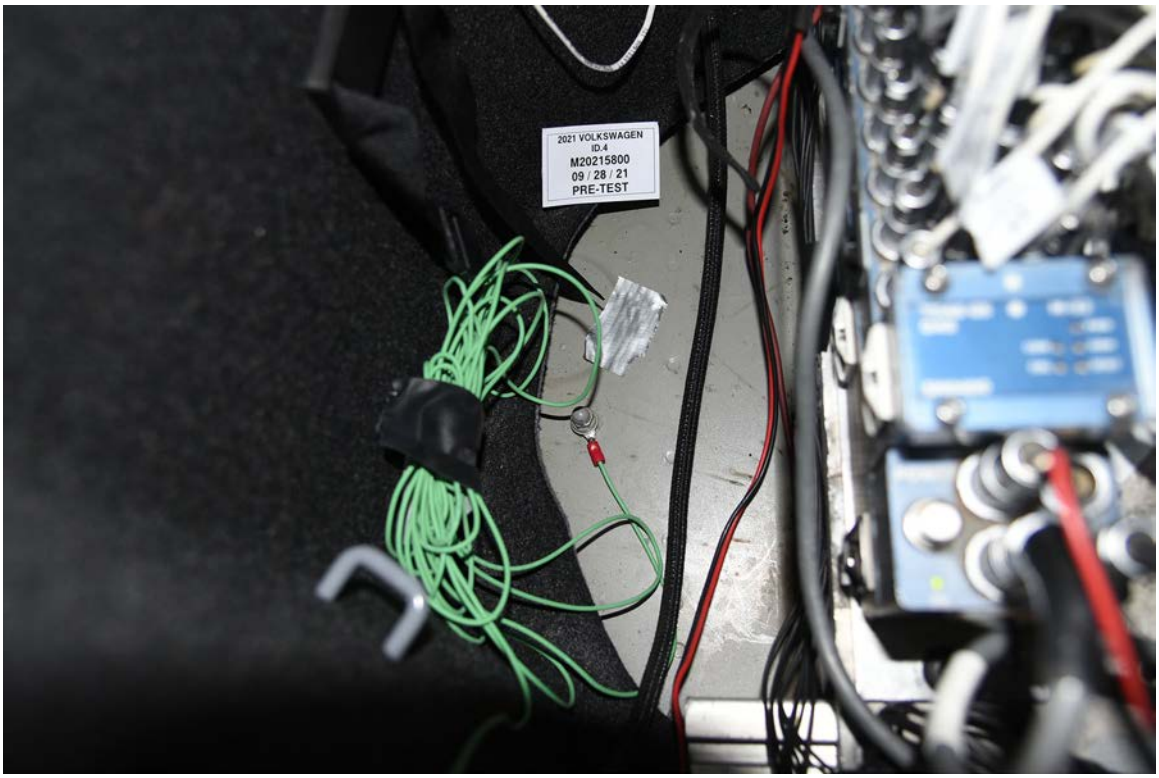


FIGURE 305-021. Pre-Impact View of Ground Lead Attached

FIGURE 305-022. Pre-Impact View of High Voltage Leads Attached

FIGURE 305-023. Pre-Impact Close-Up View of High Voltage Leads Attached

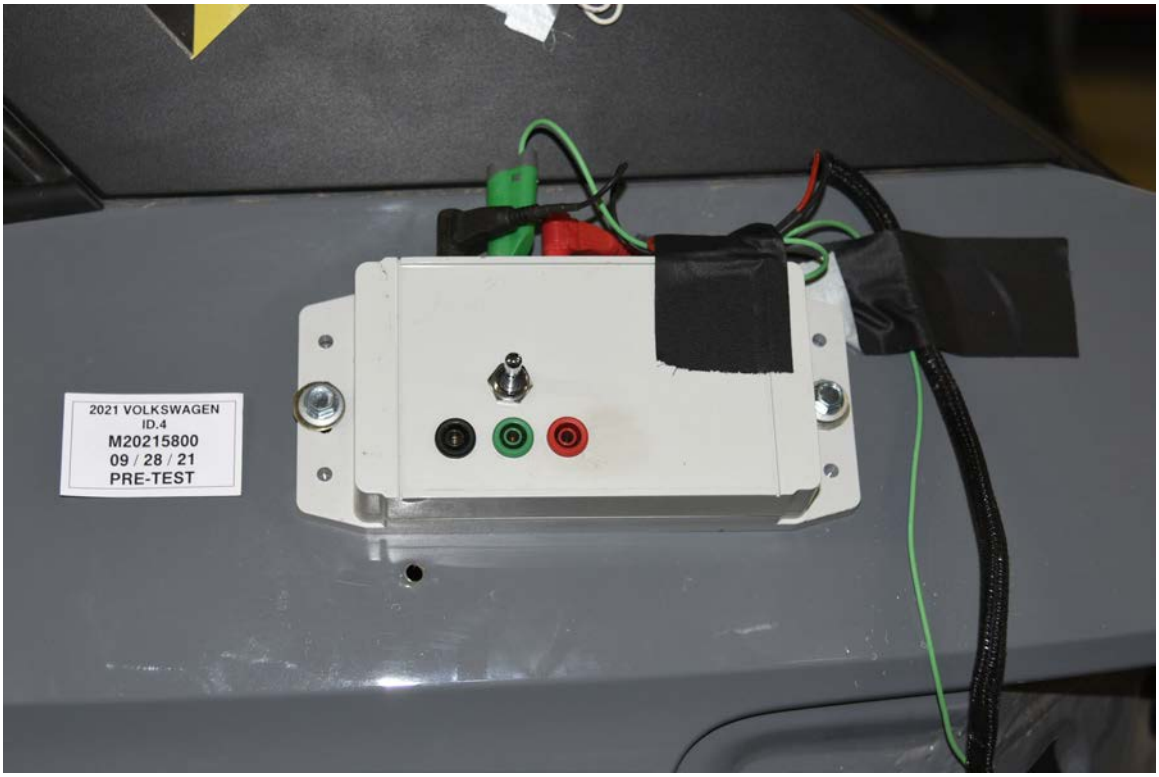


FIGURE 305-024. Pre-Impact View of Installed Test Interface Port

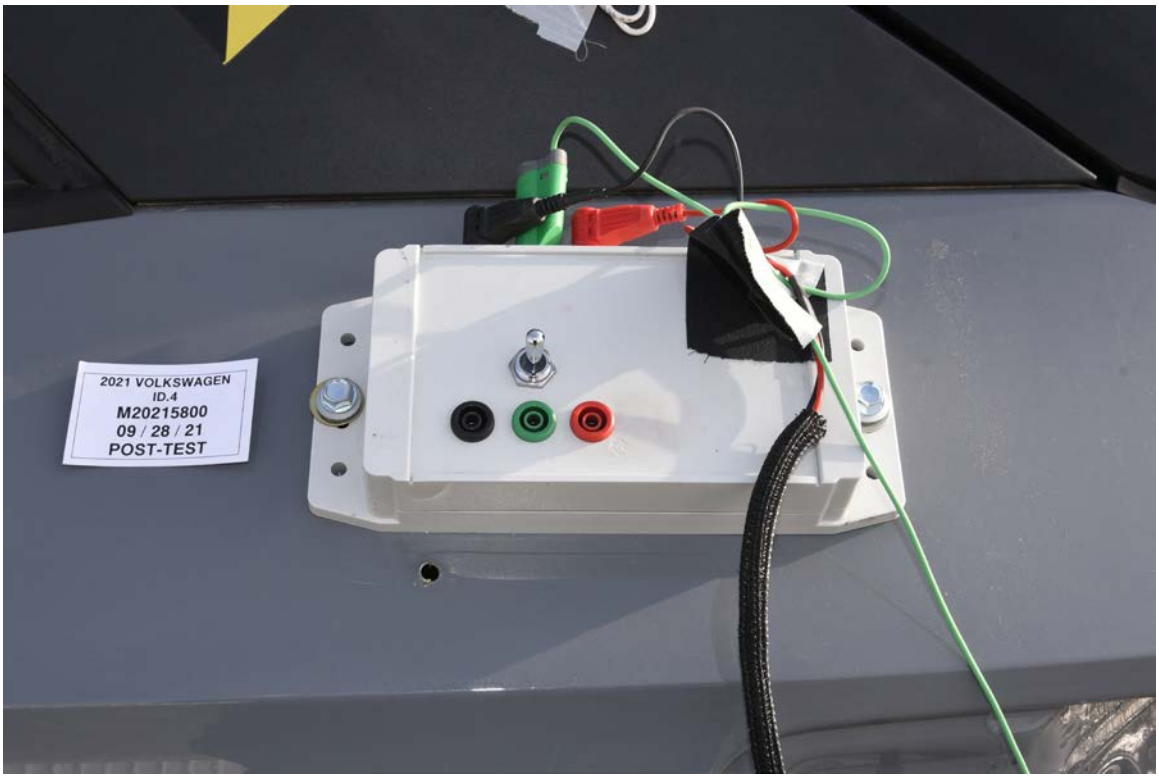


FIGURE 305-025. Post-Impact View of Installed Test Interface Port

FIGURE 305-026. Pre-Impact View of Other Test Devices

FIGURE 305-027. Post-Impact View of Other Test Devices

FIGURE 305-028. FMVSS No. 305 Static Rollover at 90°

FIGURE 305-029. FMVSS No. 305 Static Rollover at 180°

FIGURE 305-030. FMVSS No. 305 Static Rollover at 270°

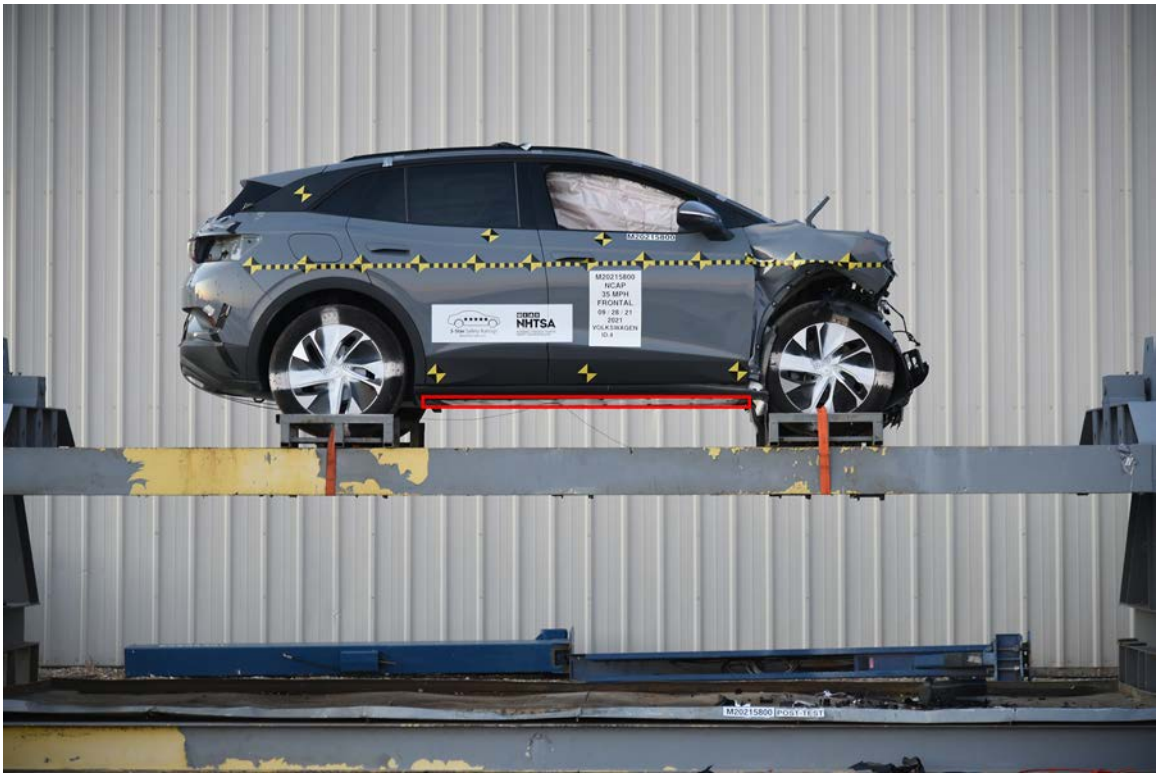


FIGURE 305-031. FMVSS No. 305 Static Rollover at 360°

FIGURE 305-032. Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

FIGURE 305-033. Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

Photograph Not Applicable

No Propulsion Battery Mounting and/or Intrusion Failure

FIGURE 305-034. Post-Impact Propulsion Battery System Mounting and or Intrusion Failure(s)

FIGURE 305-035. Post-Impact View of Battery Component Intrusion

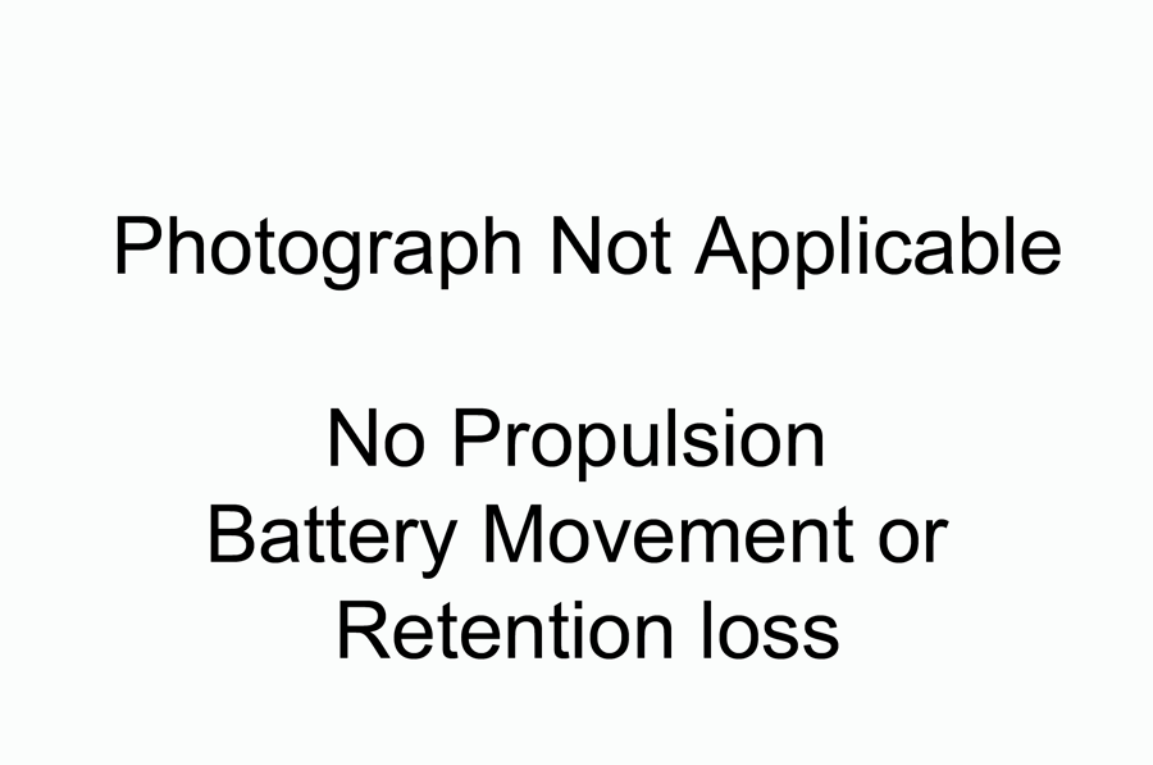


FIGURE 305-036. Post-Impact View of Battery Module Movement or Retention Loss

FIGURE 305-037. Post-Impact View of Propulsion Battery Electrolyte Spillage Location

FIGURE 305-038. Post-Test View of Propulsion Battery Electrolyte Spillage Location

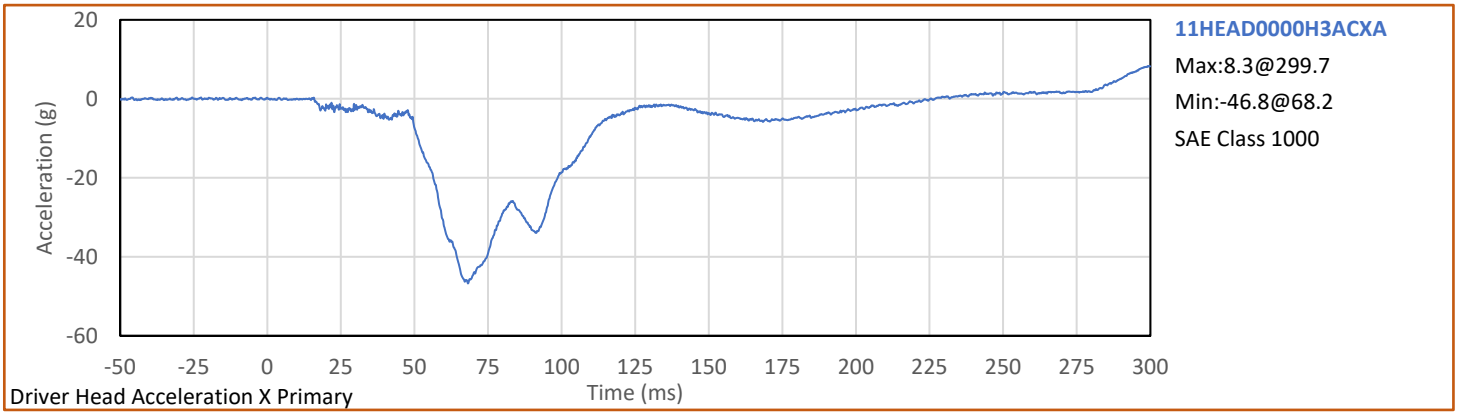
APPENDIX B
DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

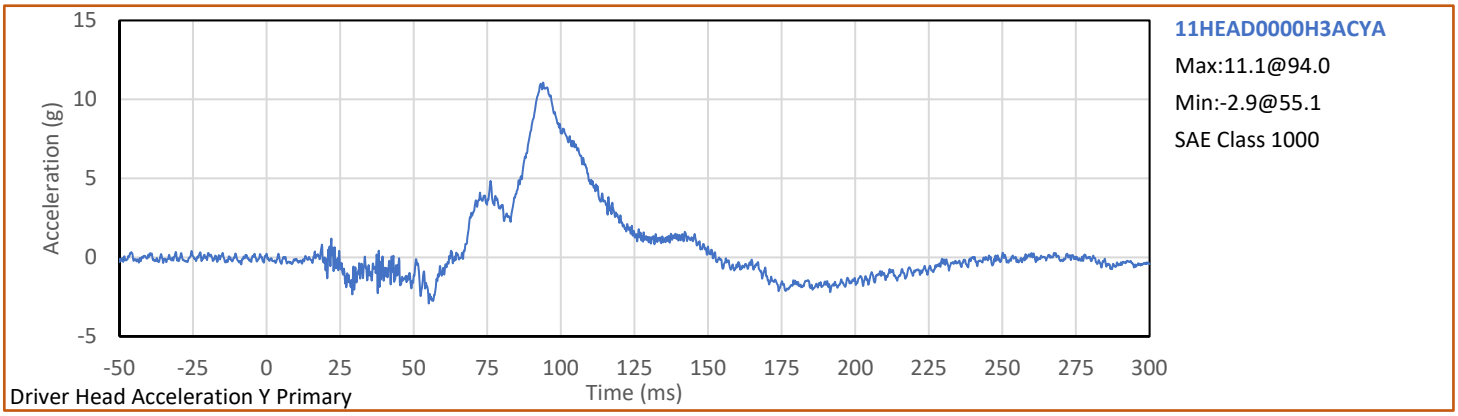
The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.gov

Driver Head X Acceleration Redundant
Driver Head Y Acceleration Redundant
Driver Head Z Acceleration Redundant
Driver Upper Neck Force Y
Driver Upper Neck Moment X
Driver Upper Neck Moment Z
Driver Chest X Acceleration Redundant
Driver Chest Y Acceleration Redundant
Driver Chest Z Acceleration Redundant
Driver Pelvis X
Driver Pelvis Y
Driver Pelvis Z
Driver Left Femur Force Z Redundant
Driver Right Femur Force Z Redundant
Driver Left Upper Tibia Moment X
Driver Left Upper Tibia Moment Y
Driver Left Upper Tibia Force Z
Driver Left Lower Tibia Moment X
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Right Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z
Driver Shoulder Belt Force
Driver Lap Belt Force
Driver Head Angular Velocity X
Driver Head Angular Velocity Y
Driver Head Angular Velocity Z
Passenger Head X Acceleration Redundant
Passenger Head Y Acceleration Redundant
Passenger Head Z Acceleration Redundant
Passenger Upper Neck Force X
Passenger Upper Neck Force Z
Passenger Upper Neck Moment Y

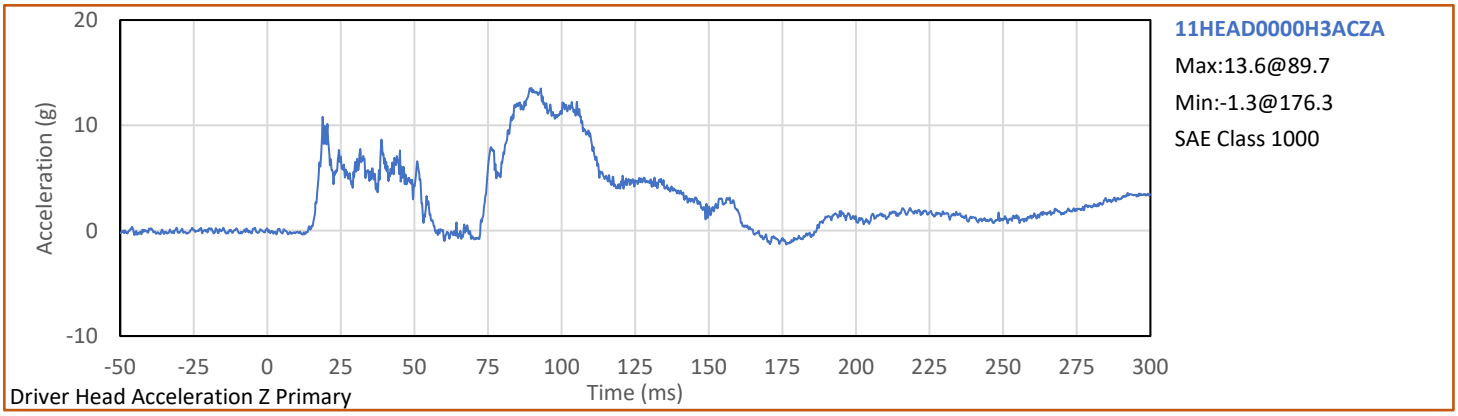
Passenger Chest X Acceleration Redundant
Passenger Chest Y Acceleration Redundant
Passenger Chest Z Acceleration Redundant
Passenger Pelvis X
Passenger Pelvis Y
Passenger Pelvis Z
Passenger Left Femur Force Redundant
Passenger Right Femur Force Redundant
Passenger Left Upper Tibia Moment X
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right Lower Tibia Moment X
Passenger Right Lower Tibia Moment Y
Passenger Right Lower Tibia Force Z
Passenger Left Foot Fore Z
Passenger Left Foot Aft X
Passenger Left Foot Aft Z
Passenger Right Foot Fore Z
Passenger Right Foot Aft X
Passenger Right Foot Aft Z
Passenger Shoulder Belt Force
Passenger Lap Belt Force
Passenger Head Angular Velocity X
Passenger Head Angular Velocity Y
Passenger Head Angular Velocity Z
Left Rear Seat Crossmember X
Left Rear Seat Crossmember Z
Right Rear Seat Crossmember X
Right Rear Seat Crossmember Z
Left Rear Seat Crossmember X Redundant
Right Rear Seat Crossmember X Redundant
Vehicle Engine Top X
Vehicle Engine Bottom X
Load Cell Barrier Forces and Moments



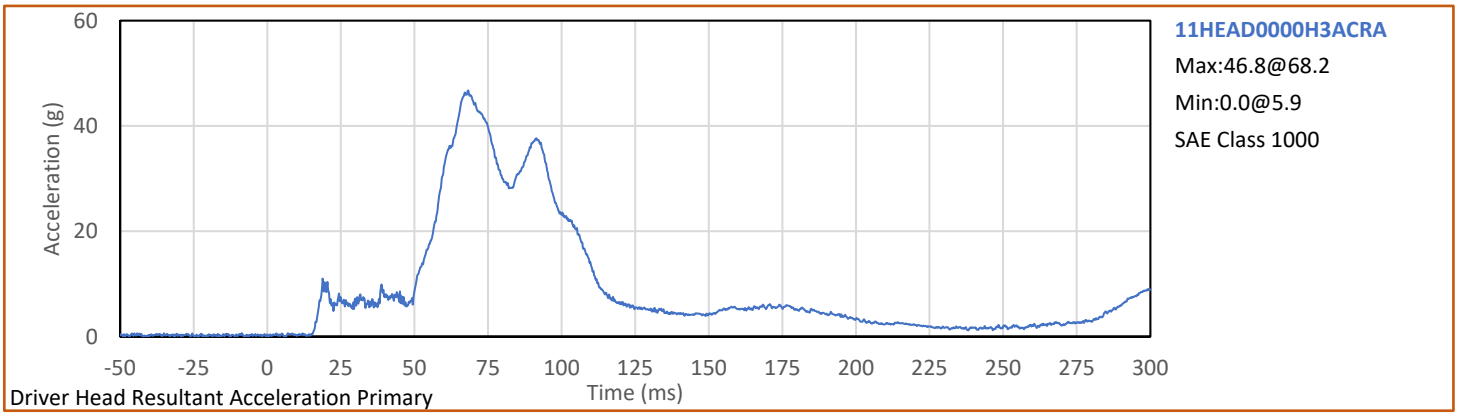
Driver Head Acceleration X Primary



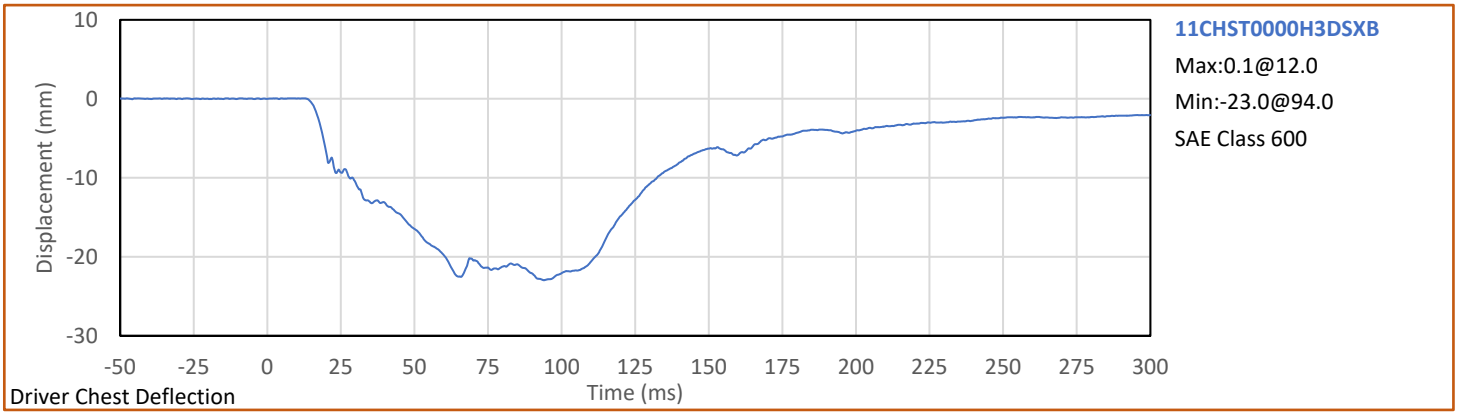
Driver Head Acceleration Y Primary



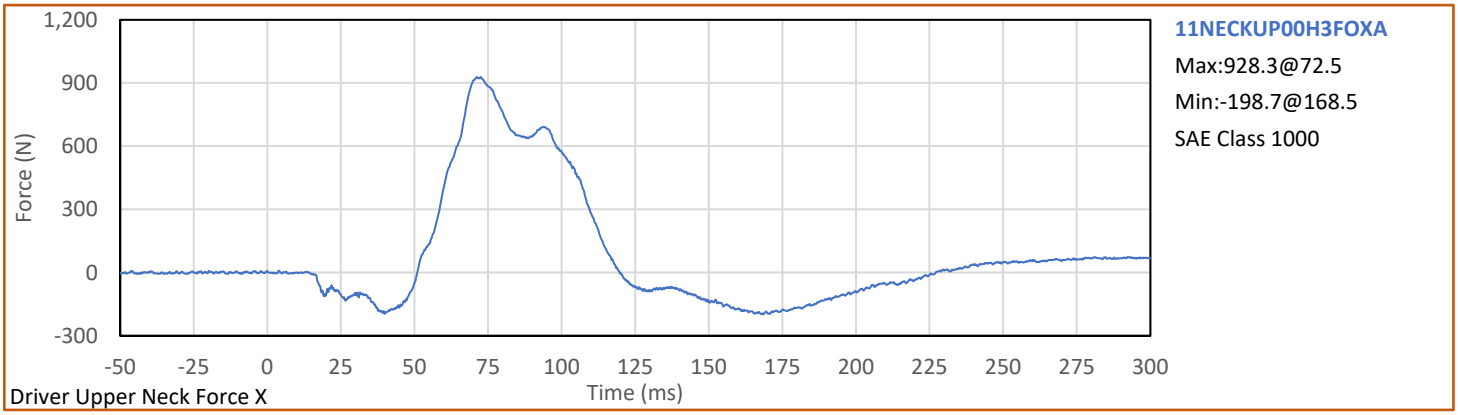
Driver Head Acceleration Z Primary

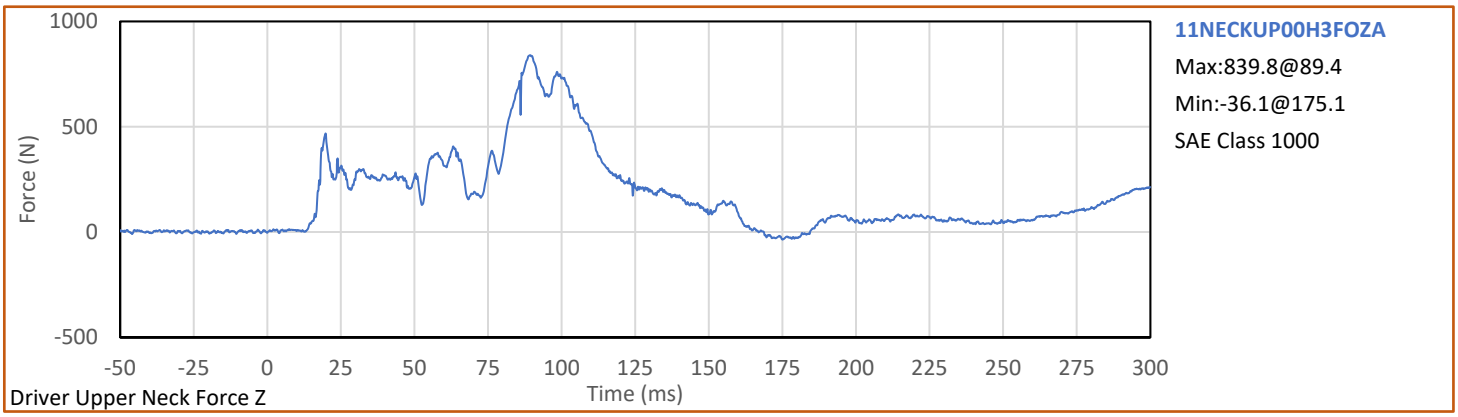


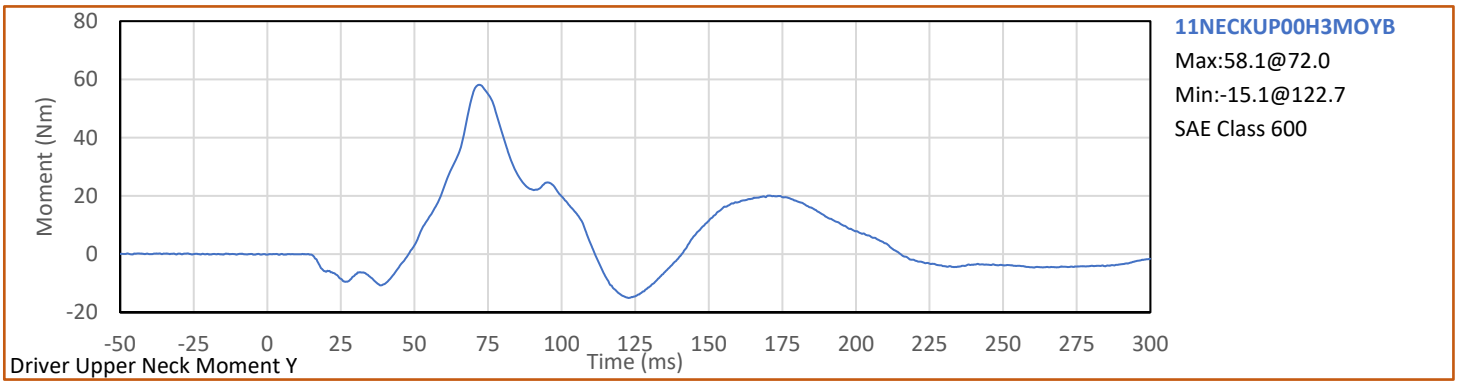
Driver Head Resultant Acceleration Primary

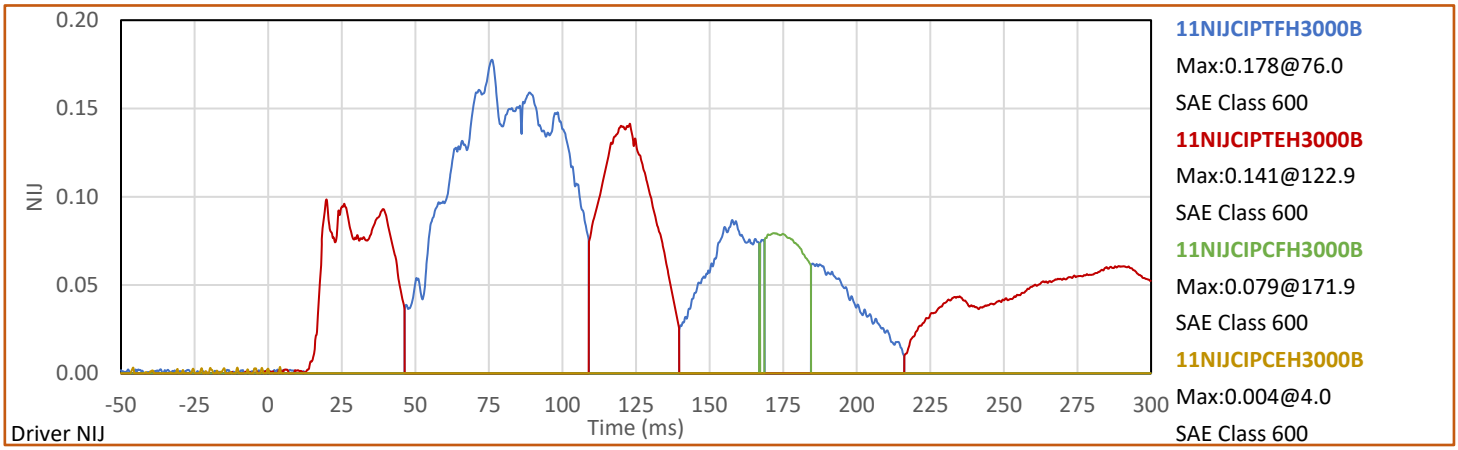


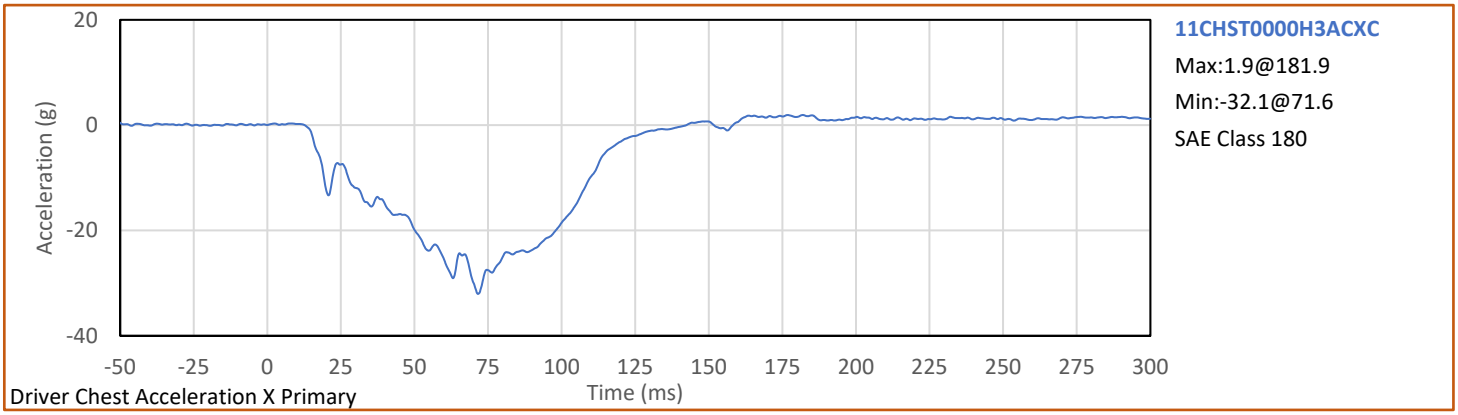
Driver Chest Deflection


1,200
900
600
300
0
-300
Force (N)
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Time (ms)
Driver Upper Neck Force X
11NECKUP00H3FOXA
Max:928.3@72.5
Min:-198.7@168.5
SAE Class 1000


1000
500
0
-500
Force (N)
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Time (ms)
Driver Upper Neck Force Z
11NECKUP00H3FOZA
Max:839.8@89.4
Min:-36.1@175.1
SAE Class 1000

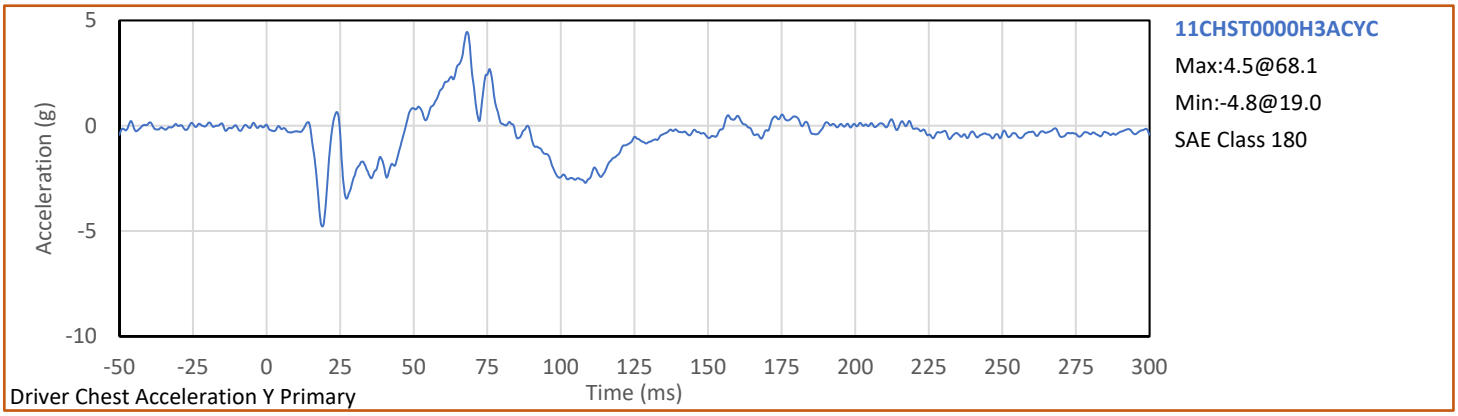

80
60
40
20
0
-20
Moment (Nm)
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Time (ms)
Driver Upper Neck Moment Y
11NECKUP00H3MOYB
Max:58.1@72.0
Min:-15.1@122.7
SAE Class 600


0.20
0.15
0.10
0.05
0.00
NIJ
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Time (ms)
Driver NIJ
11NIJCIPTFH3000B
Max:0.178@76.0
SAE Class 600
11NIJCIPTEH3000B
Max:0.141@122.9
SAE Class 600
11NIJCIPCFH3000B
Max:0.079@171.9
SAE Class 600
11NIJCIPCEH3000B
Max:0.004@4.0
SAE Class 600



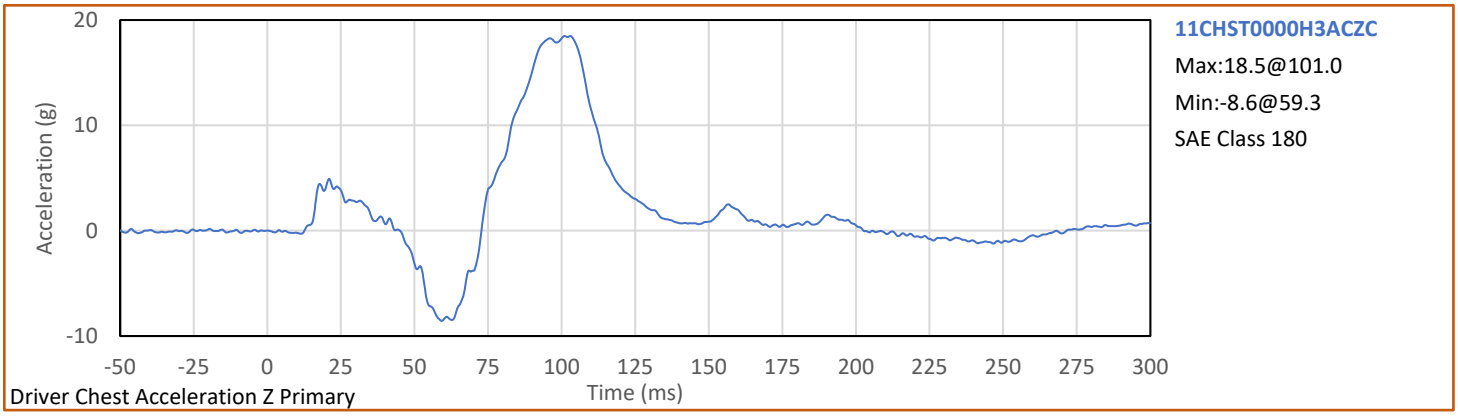
11CHST0000H3ACXC
Max:1.9@181.9
Min:-32.1@71.6
SAE Class 180

Driver Chest Acceleration X Primary



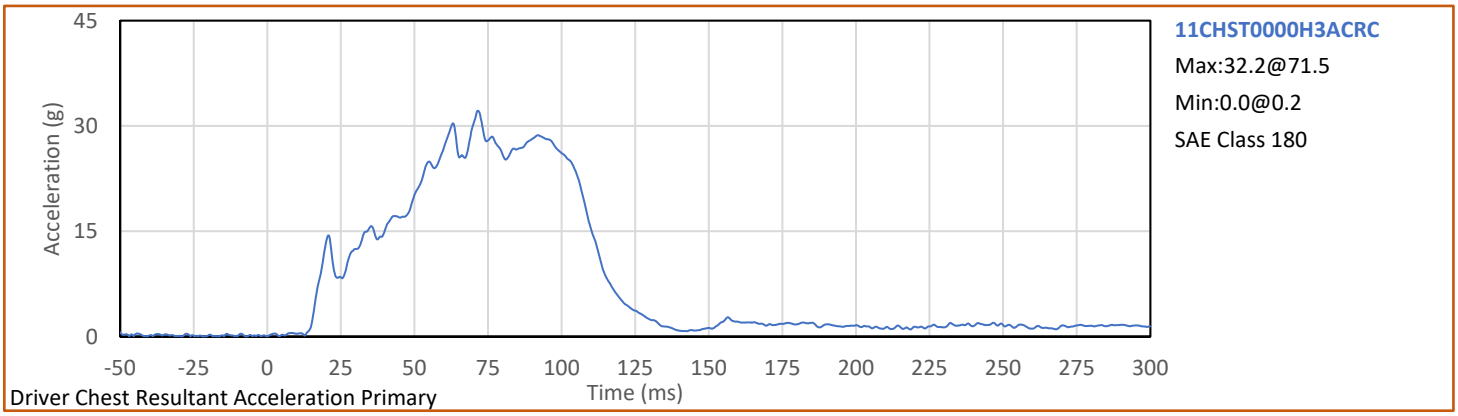
11CHST0000H3ACYC
Max:4.5@68.1
Min:-4.8@19.0
SAE Class 180

Driver Chest Acceleration Y Primary



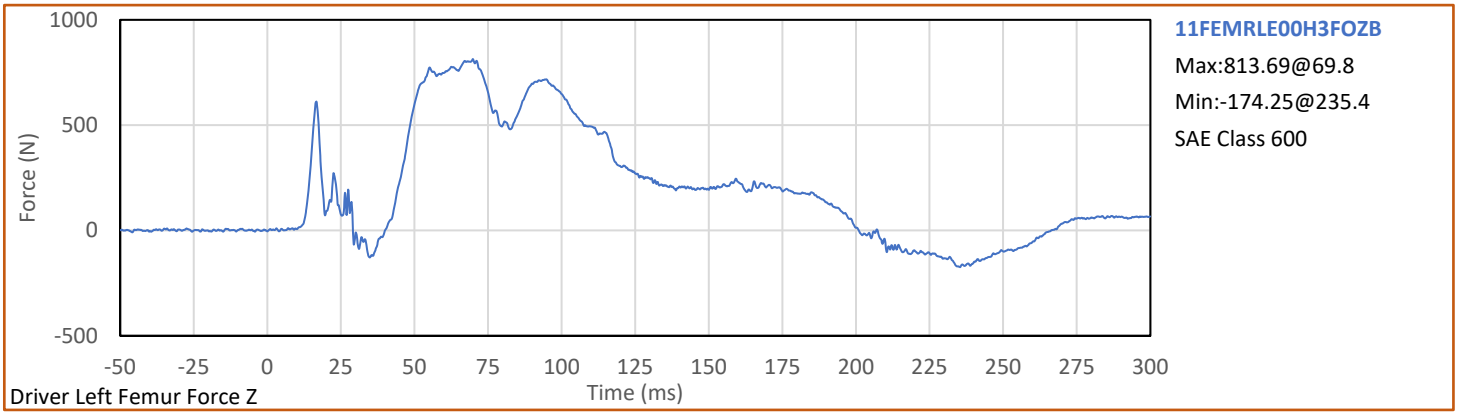
11CHST0000H3ACZC
Max:18.5@101.0
Min:-8.6@59.3
SAE Class 180

Driver Chest Acceleration Z Primary

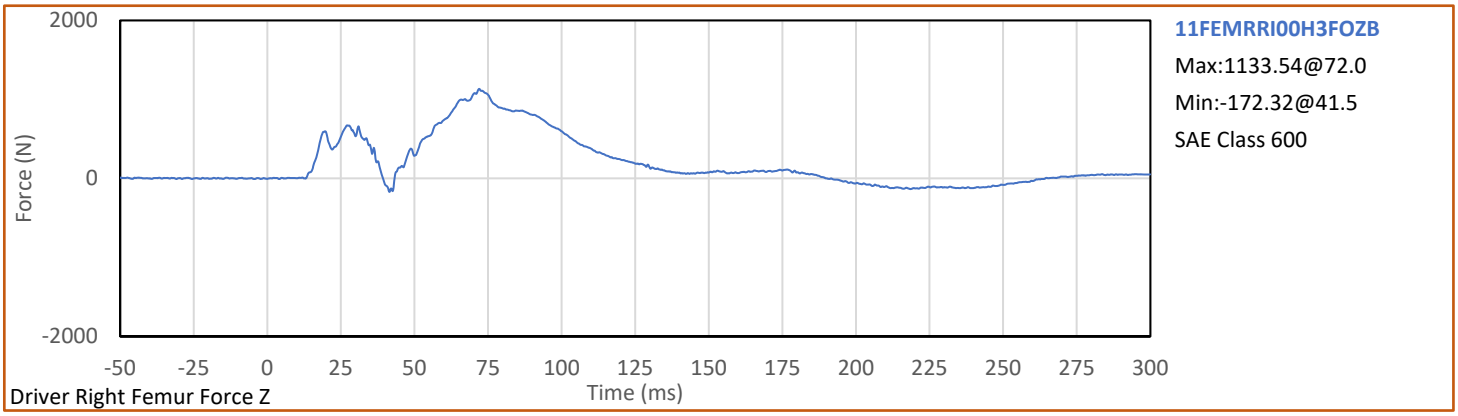


11CHST0000H3ACRC
Max:32.2@71.5
Min:0.0@0.2
SAE Class 180

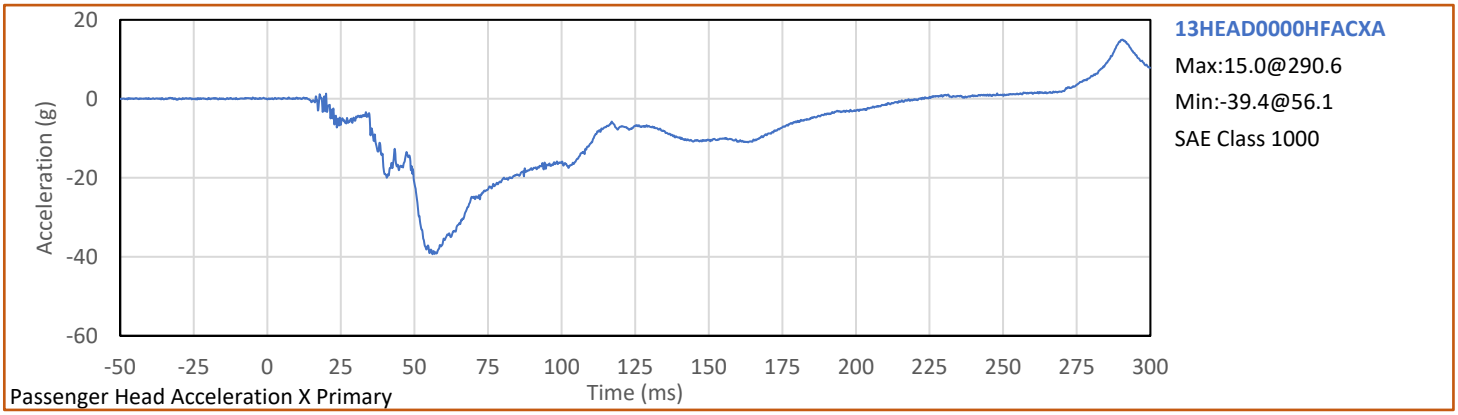
Driver Chest Resultant Acceleration Primary



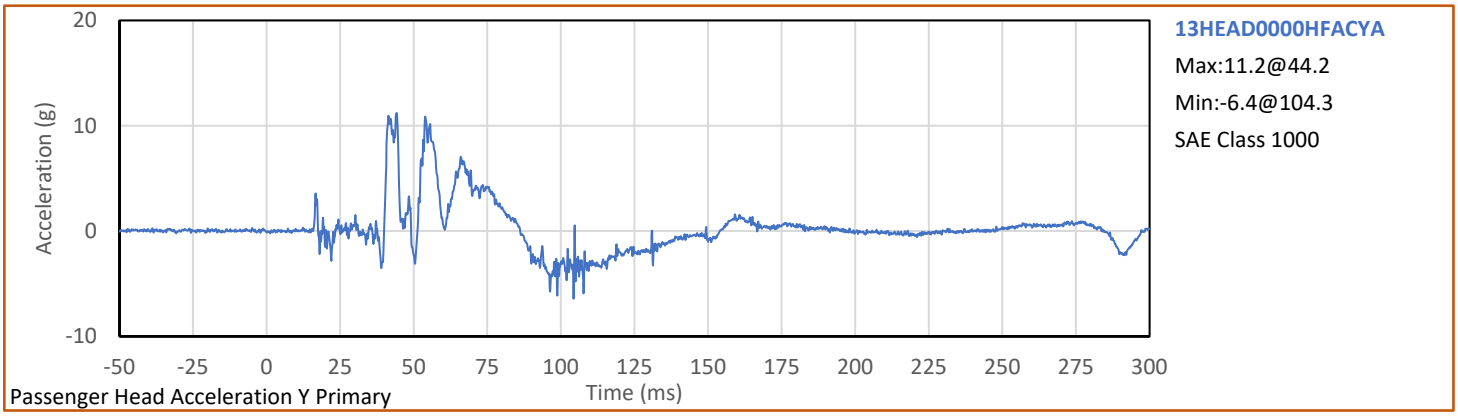
Driver Left Femur Force Z



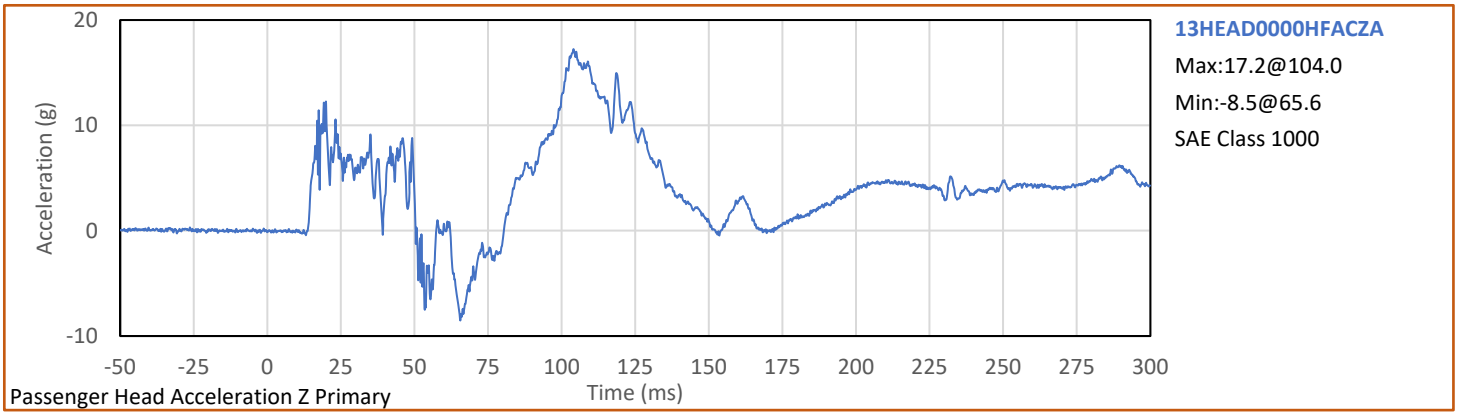
Driver Right Femur Force Z



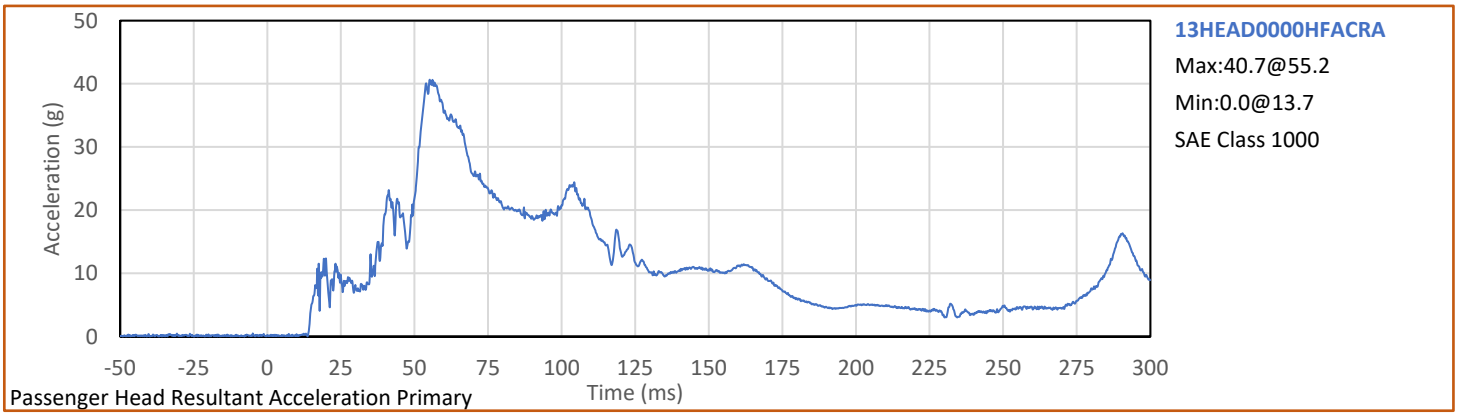
Passenger Head Acceleration X Primary



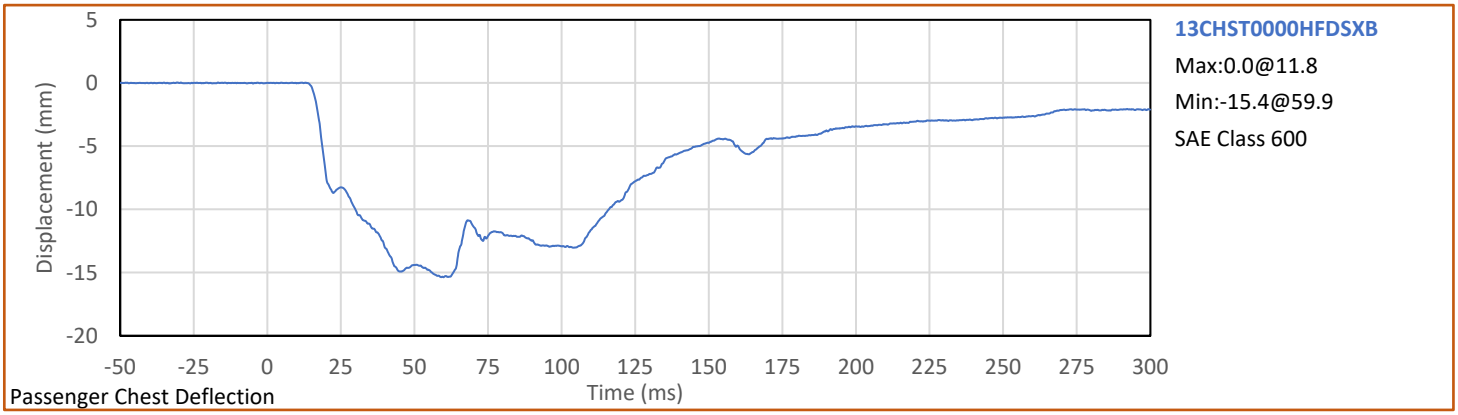
Passenger Head Acceleration Y Primary



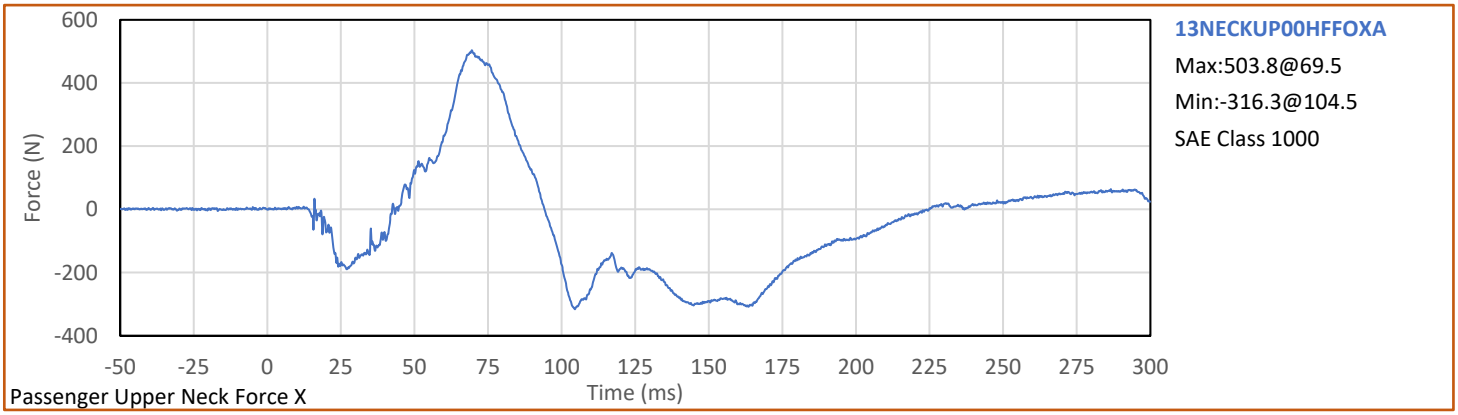
Passenger Head Acceleration Z Primary

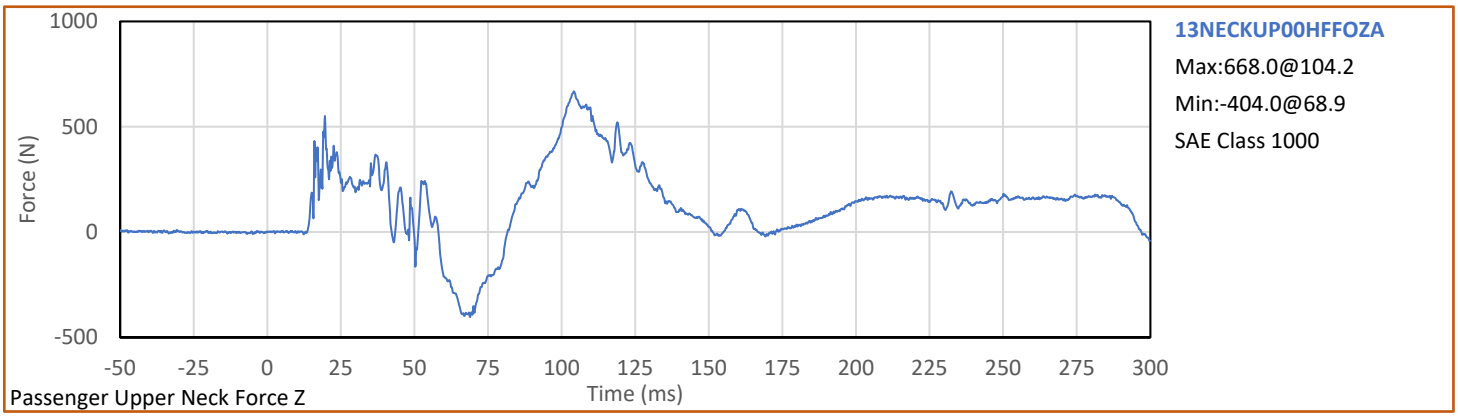


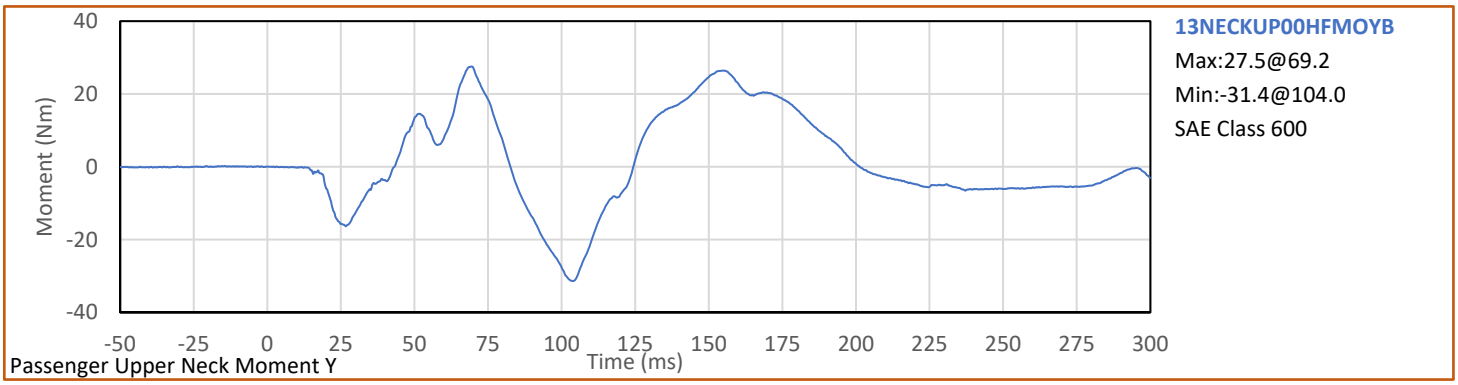
Passenger Head Resultant Acceleration Primary

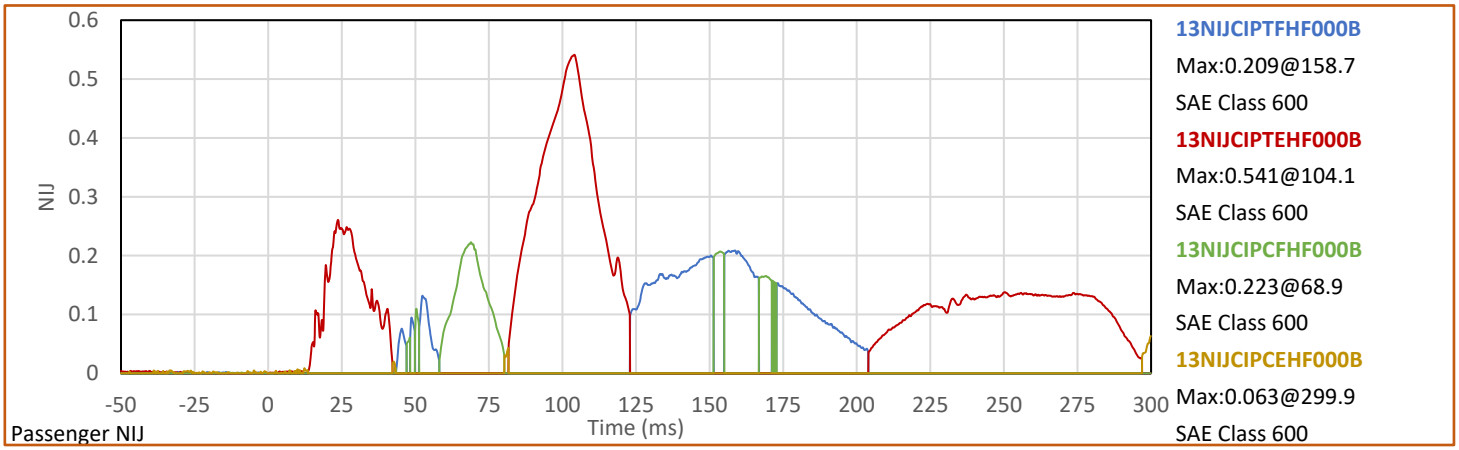


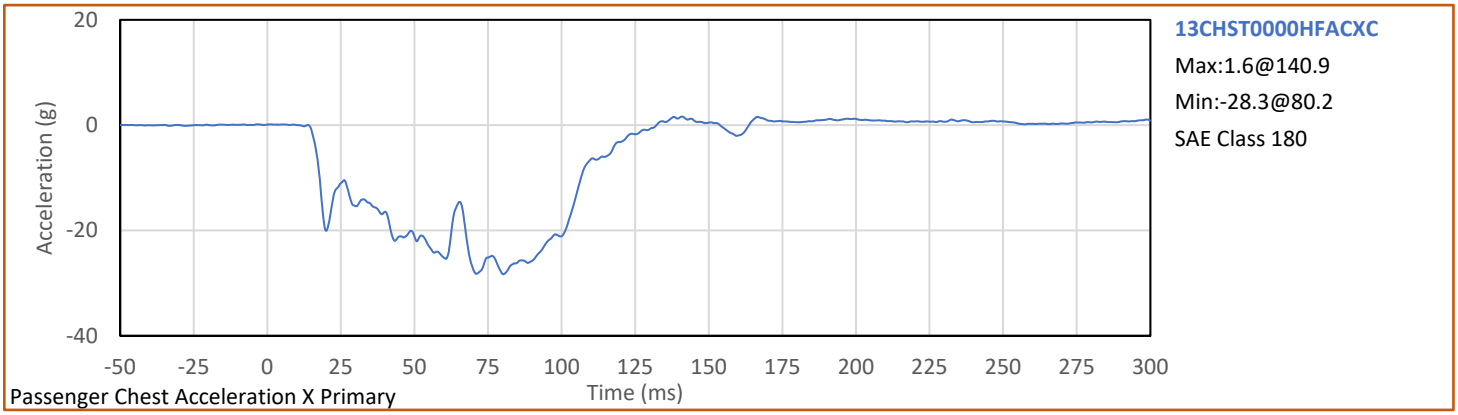
Passenger Chest Deflection


Force (N)
Time (ms)
Passenger Upper Neck Force X
13NECKUP00HFFOXA
Max:503.8@69.5
Min:-316.3@104.5
SAE Class 1000


Force (N)
Time (ms)
Passenger Upper Neck Force Z
13NECKUP00HFFOZA
Max:668.0@104.2
Min:-404.0@68.9
SAE Class 1000

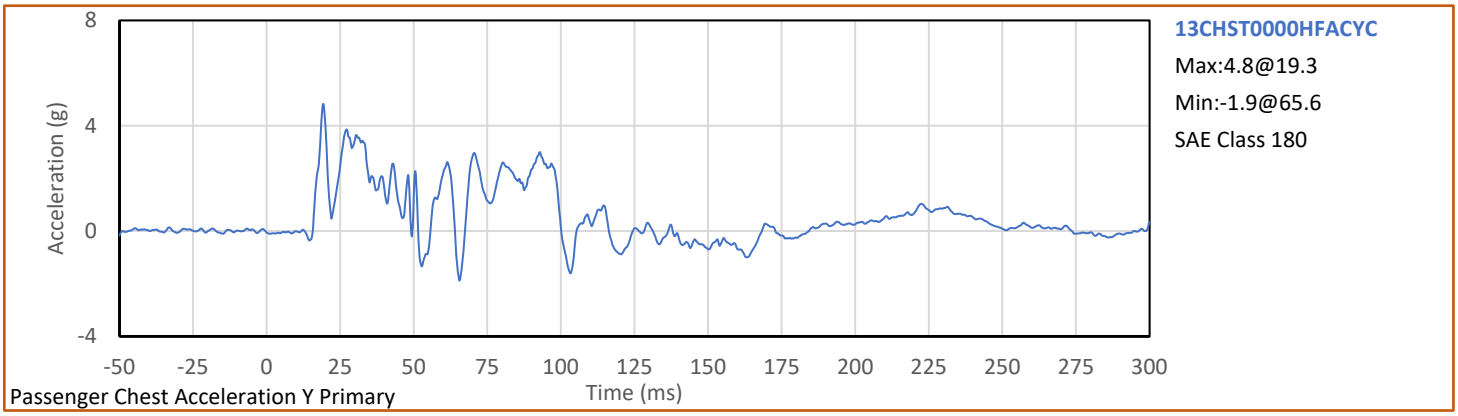

Moment (Nm)
Time (ms)
Passenger Upper Neck Moment Y
13NECKUP00HFMOYB
Max:27.5@69.2
Min:-31.4@104.0
SAE Class 600


NIJ
Time (ms)
Passenger NIJ
13NIJCIPTFHF000B
Max:0.209@158.7
SAE Class 600
13NIJCIPTEHF000B
Max:0.541@104.1
SAE Class 600
13NIJCIPCFHF000B
Max:0.223@68.9
SAE Class 600
13NIJCIPCEHF000B
Max:0.063@299.9
SAE Class 600



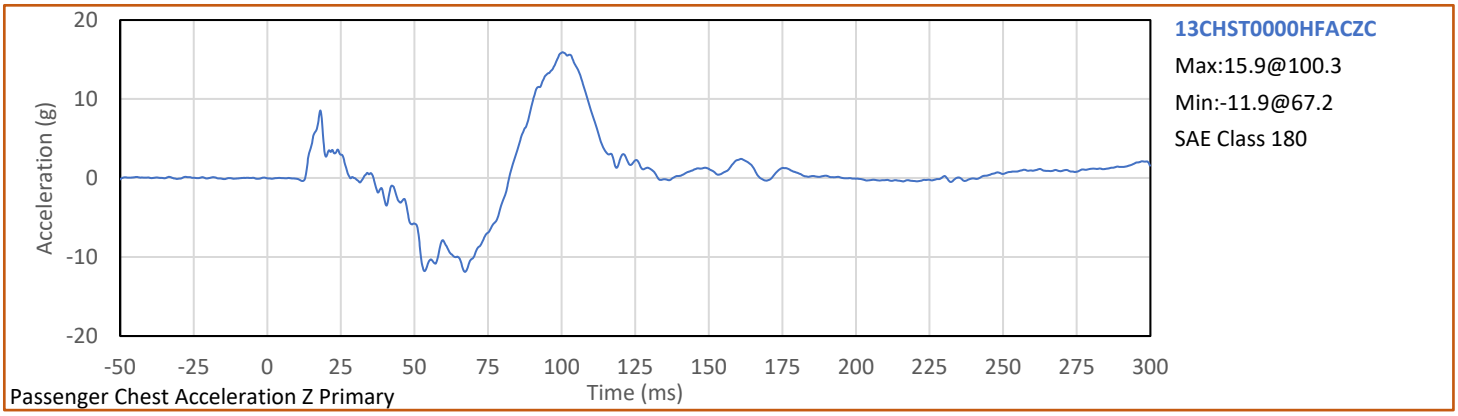
Passenger Chest Acceleration X Primary

13CHST0000HFACXC
Max:1.6@140.9
Min:-28.3@80.2
SAE Class 180



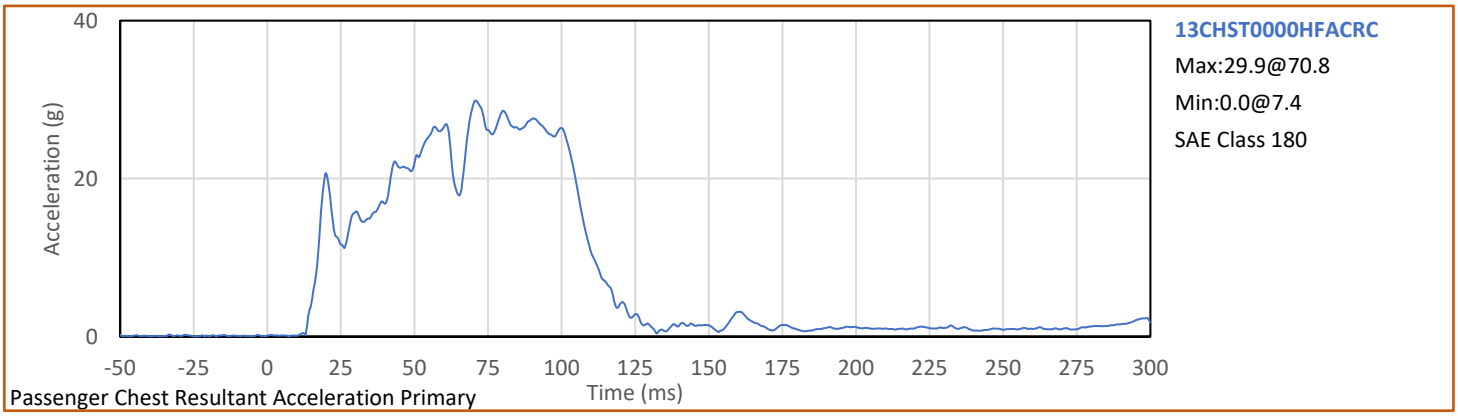
Passenger Chest Acceleration Y Primary

13CHST0000HFACYC
Max:4.8@19.3
Min:-1.9@65.6
SAE Class 180



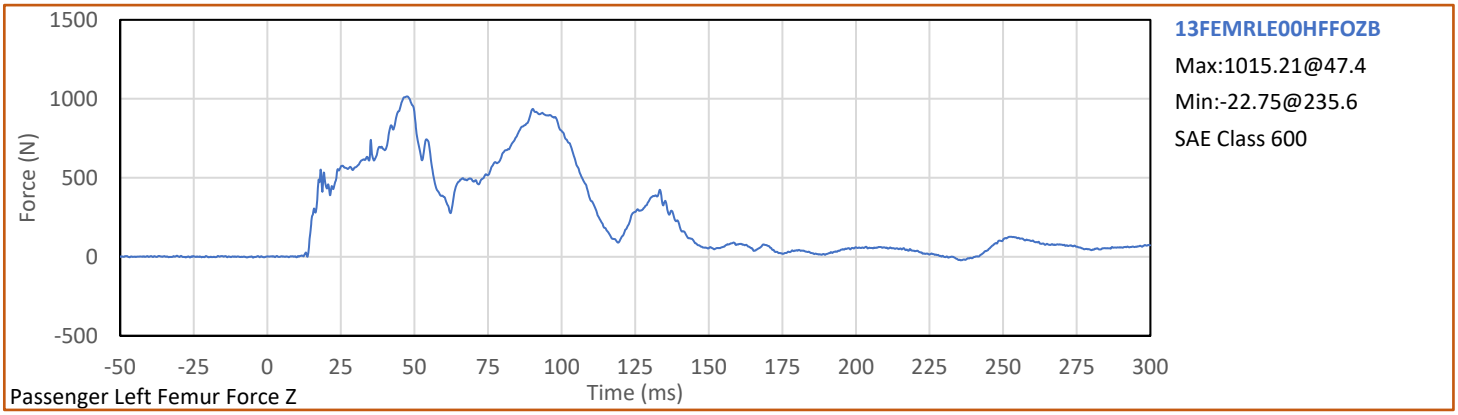
Passenger Chest Acceleration Z Primary

13CHST0000HFACZC
Max:15.9@100.3
Min:-11.9@67.2
SAE Class 180

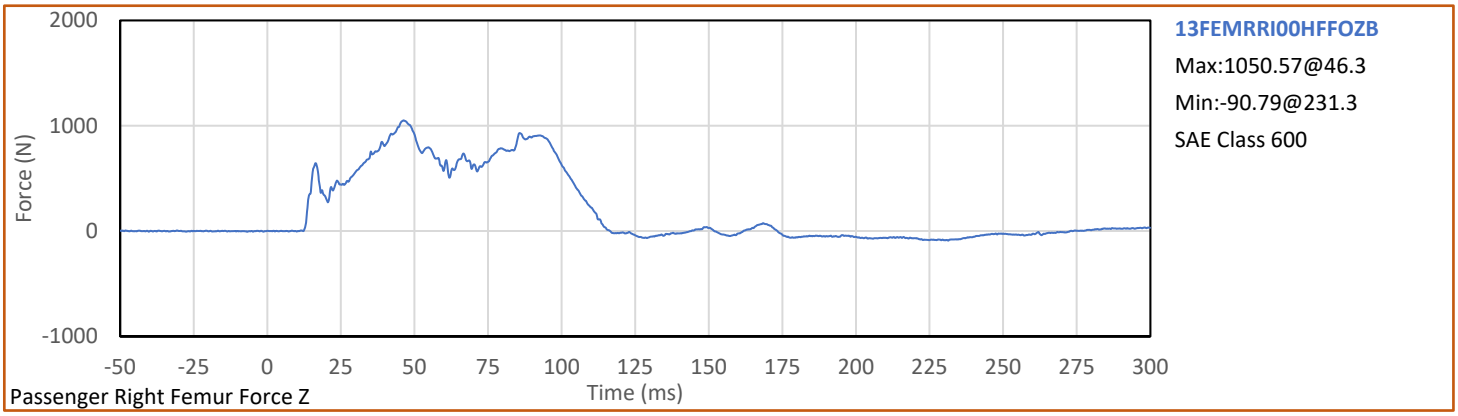


Passenger Chest Resultant Acceleration Primary

13CHST0000HFACRC
Max:29.9@70.8
Min:0.0@7.4
SAE Class 180



Passenger Left Femur Force Z



Passenger Right Femur Force Z

APPENDIX C

DUMMY QUALIFICATION AND PERFORMANCE VERIFICATION DATA

APPENDIX C
Pre-Test ATD Qualification and Performance Verification
Hybrid III 50th Percentile Male ATD
S/N: 360

Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
ATD Damage Checklist

ATD Serial No.: 360 Test Date: 2021-08-18

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

Hybrid III 50th Percentile Male ATD
External Measurements

ATD Serial No.: 360 Test Date: 2021-08-18

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	884	Pass
B - Shoulder pivot height	mm	505	521	515	Pass
C - 'H' point height	mm	84	89	88	Pass
D - 'H' point location from backline	mm	135	140	140	Pass
E - Shoulder pivot from backline	mm	84	94	91	Pass
F - Thigh clearance	mm	140	155	149	Pass
G - Back of elbow to wrist pivot	mm	290	305	292	Pass
H - Head back to backline	mm	41	46	45	Pass
I - Shoulder to elbow length	mm	330	345	336	Pass
J - Elbow rest height	mm	190	211	197	Pass
K - Buttock to knee length	mm	579	604	592	Pass
L - Popliteal length	mm	429	455	445	Pass
M - Knee pivot height	mm	485	500	495	Pass
N - Buttock popliteal length	mm	452	477	475	Pass
O - Chest depth without jacket	mm	213	229	227	Pass
P - Foot length	mm	251	267	262	Pass
V - Shoulder breadth	mm	422	437	431	Pass
W - Foot breadth	mm	91	107	100	Pass
Y - Chest circum. (w/chest jacket)	mm	970	1001	986	Pass
Z - Waist circum.	mm	836	866	857	Pass
AA - Location for chest circum.	mm	429	434	433	Pass
BB - Location for waist circum.	mm	226	231	228	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

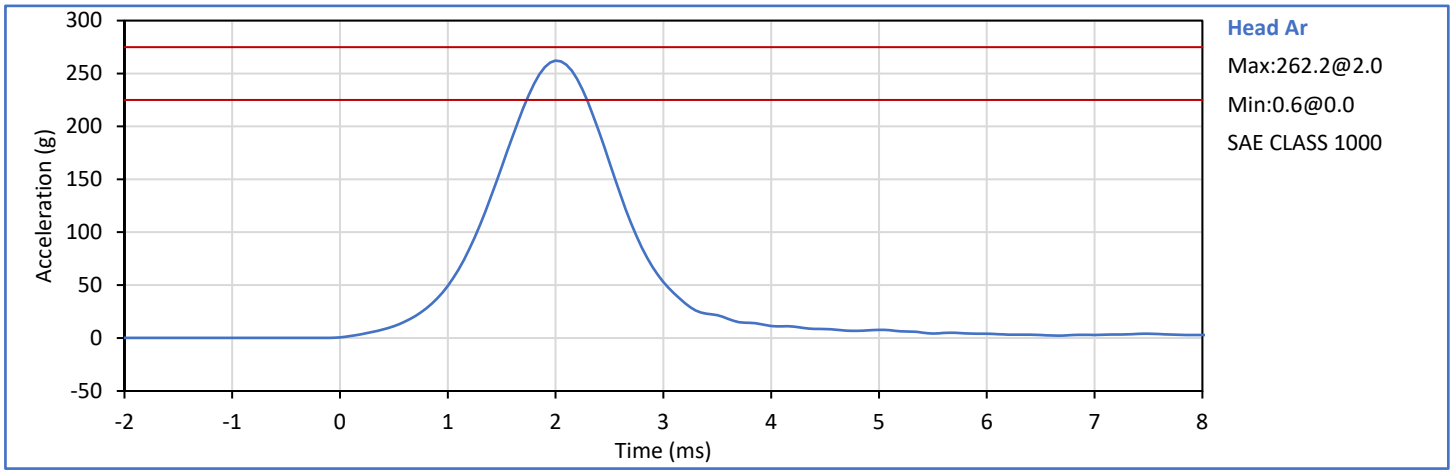
Applus IDIADA KARCO

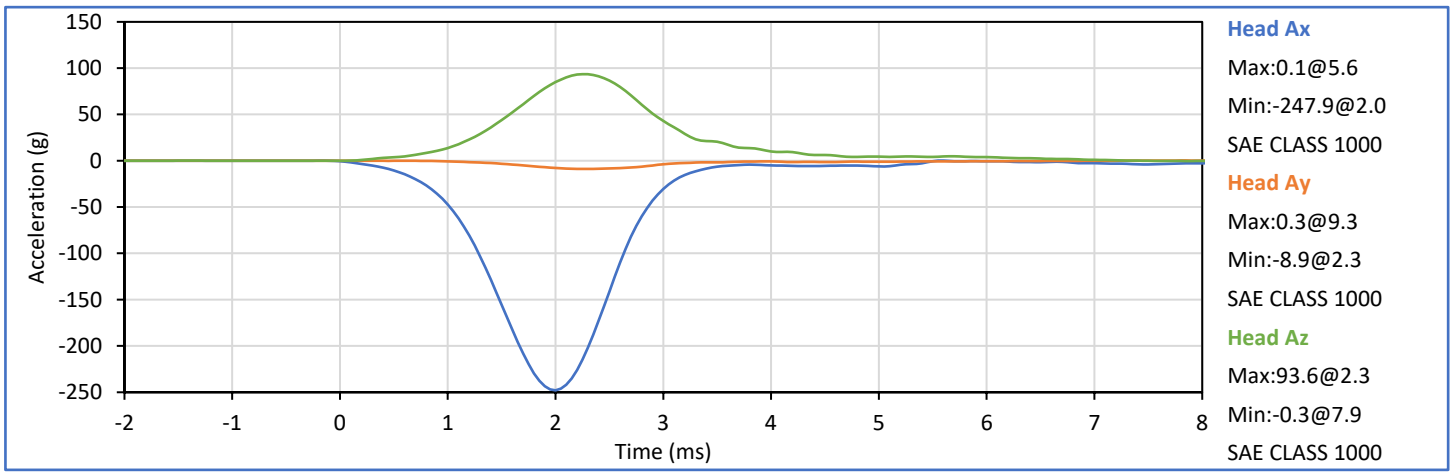
Hybrid III 50th Percentile Male ATD
Head Drop

ATD Serial No.: 360

Test Date: 2021-08-18

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	17	Pass
Peak Resultant Acceleration	g	225.0	275.0	262.2	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-8.9	Pass
Oscillations After Main Pulse	%	0.0	10.0	0.0	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

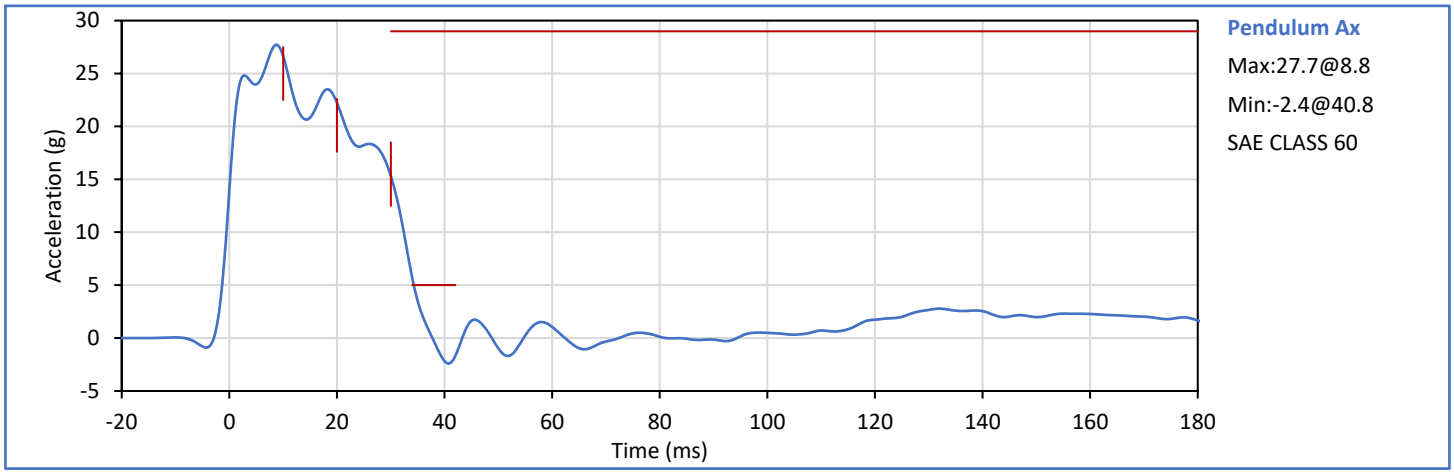
Applus IDIADA
KARCO

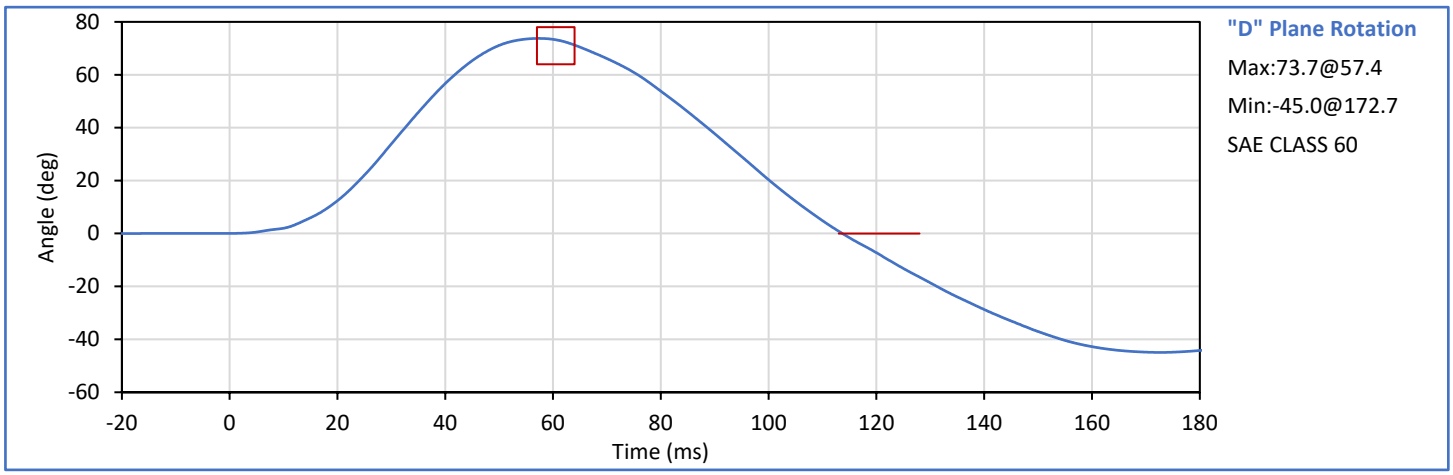
Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360

Test Date: 2021-08-18

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	24	Pass
Pendulum Velocity	m/s	6.89	7.13	6.96	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	26.6	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	22.2	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 5g	ms	34.0	42.0	34.3	Pass
"D" Plane Rotation peak	deg	64.0	78.0	73.7	Pass
	ms	57.0	64.0	57.4	Pass
"D" Plane Rotation Decay to Zero	ms	113.0	128.0	114.1	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	100.6	Pass
	ms	47.0	58.0	47.1	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	98.4	Pass
			Overall Test Results		Pass





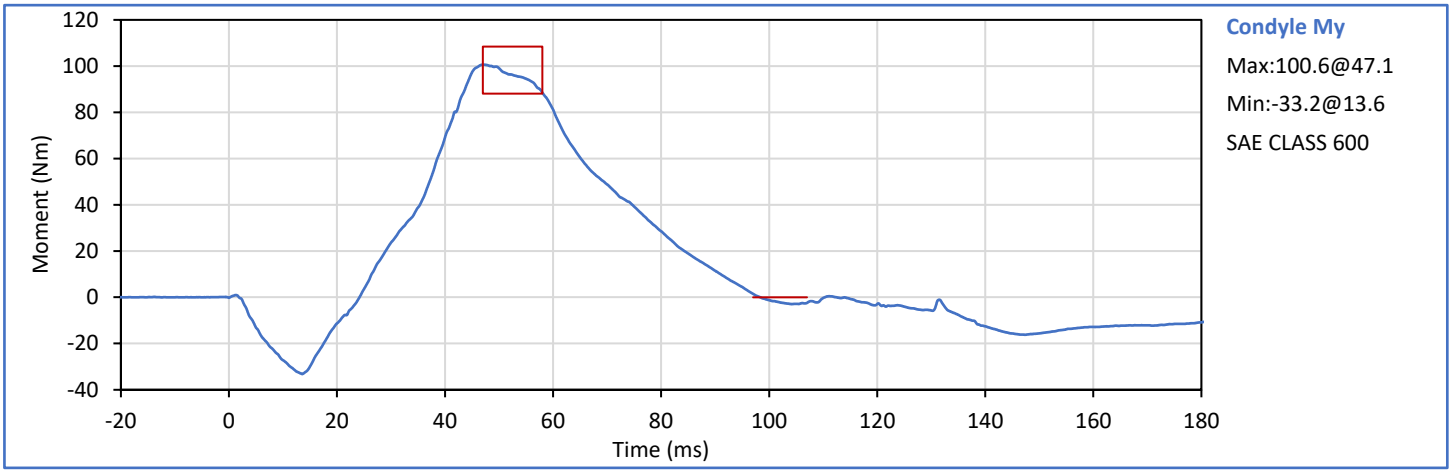
Technician: J. Hernandez

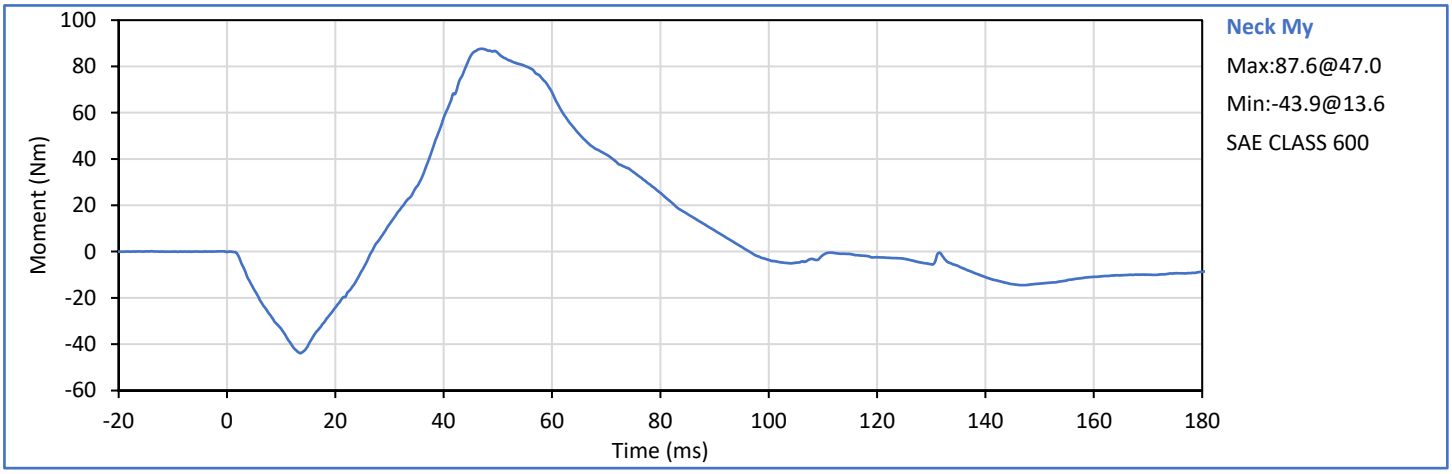
Approved By: P. Puzzuto

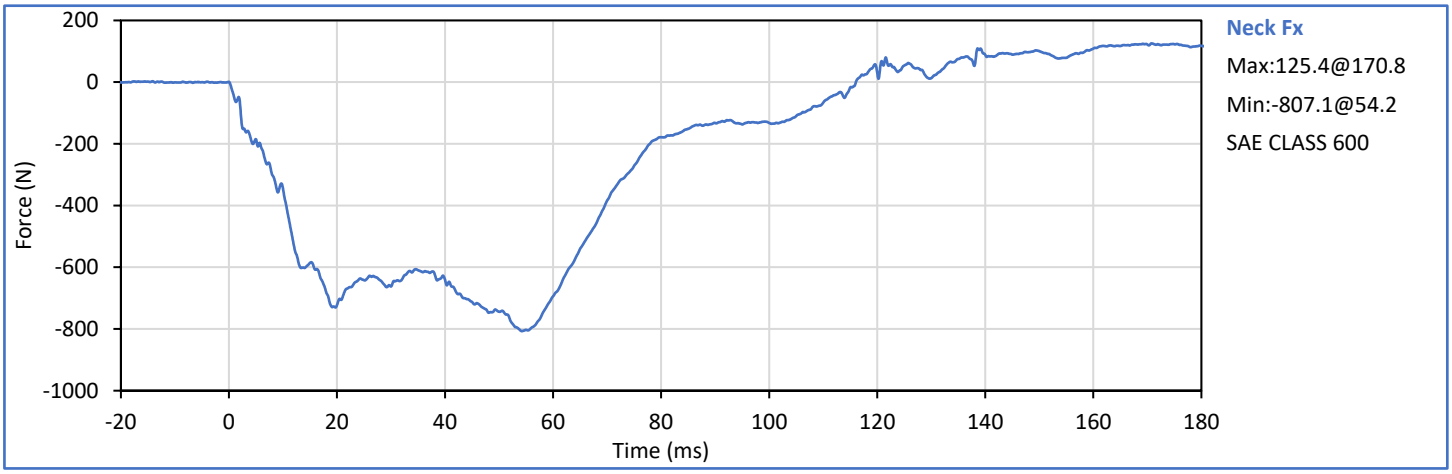
Applus IDIADA
KARCO

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2021-08-18







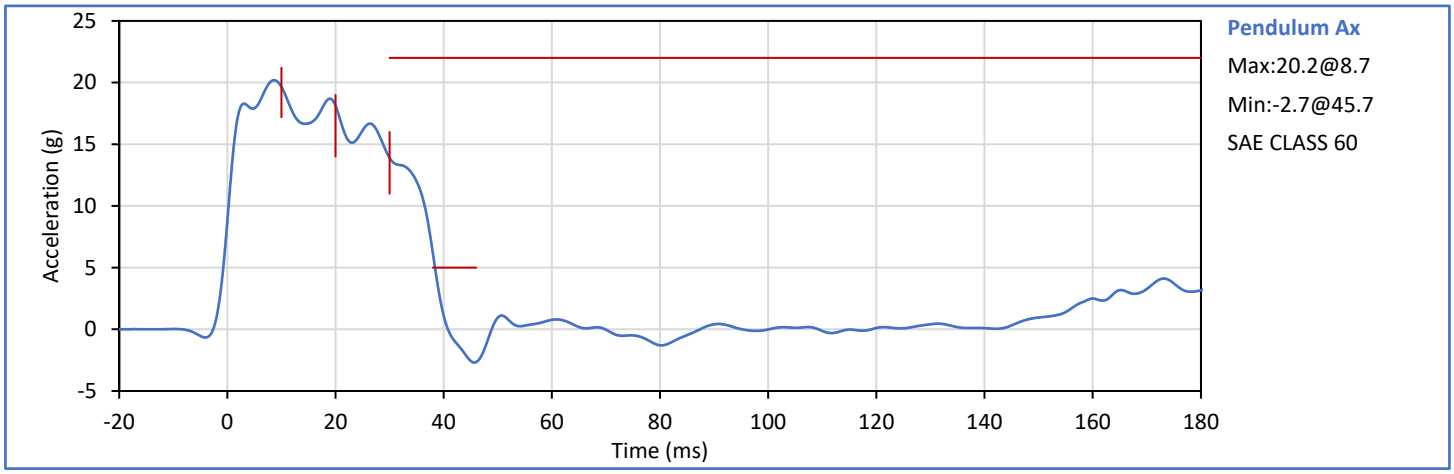
Applus IDIADA KARCO

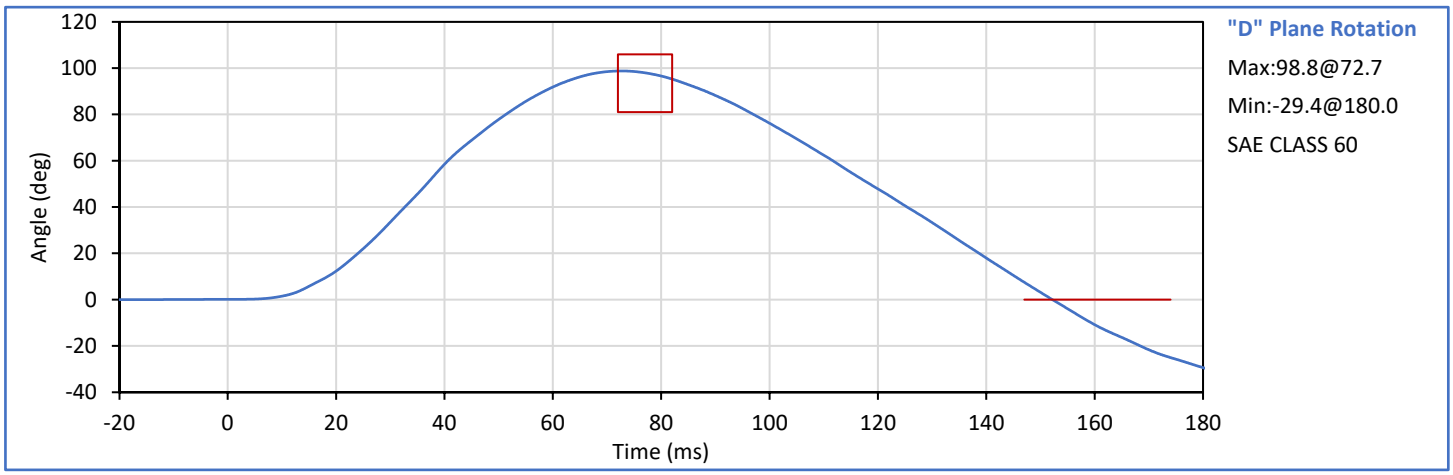
Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360

Test Date: 2021-08-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Relative Humidity	%	10	70	28	Pass
Pendulum Velocity	m/s	5.94	6.19	6.13	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	19.7	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	18.1	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	13.9	Pass
Peak Pendulum Decel After 30 ms	g	0.0	22.0	13.9	Pass
Deceleration Decay to Cross 5g	ms	38.0	46.0	38.4	Pass
"D" Plane Rotation peak	deg	81.0	106.0	98.8	Pass
	ms	72.0	82.0	72.7	Pass
"D" Plane Rotation Decay to Zero	ms	147.0	174.0	152.6	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-75.2	Pass
	ms	65.0	79.0	68.1	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	141.4	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

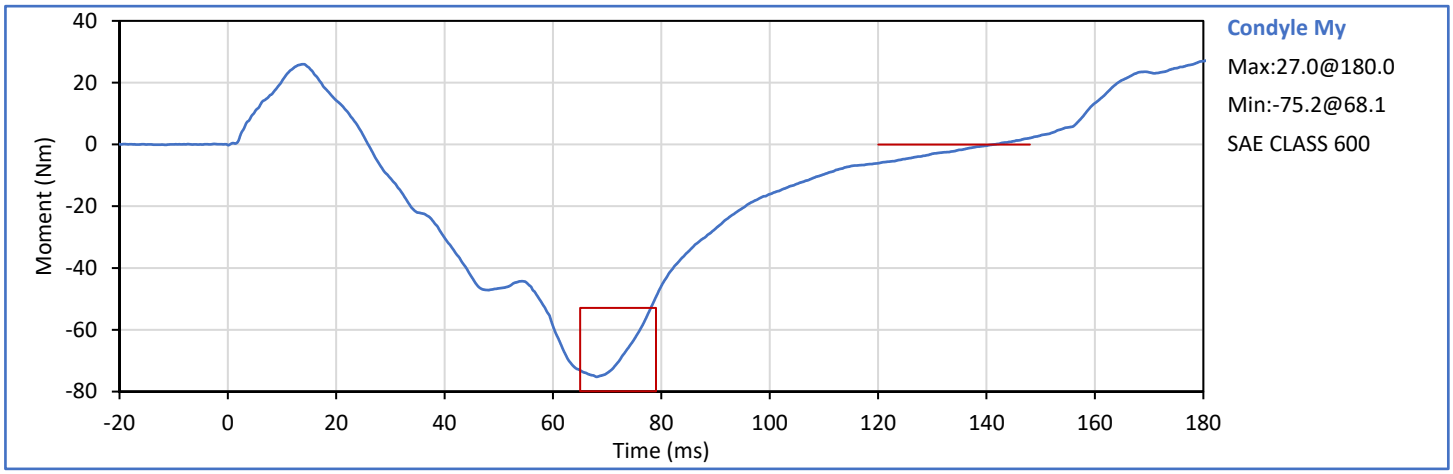
Approved By: P. Puzzuto

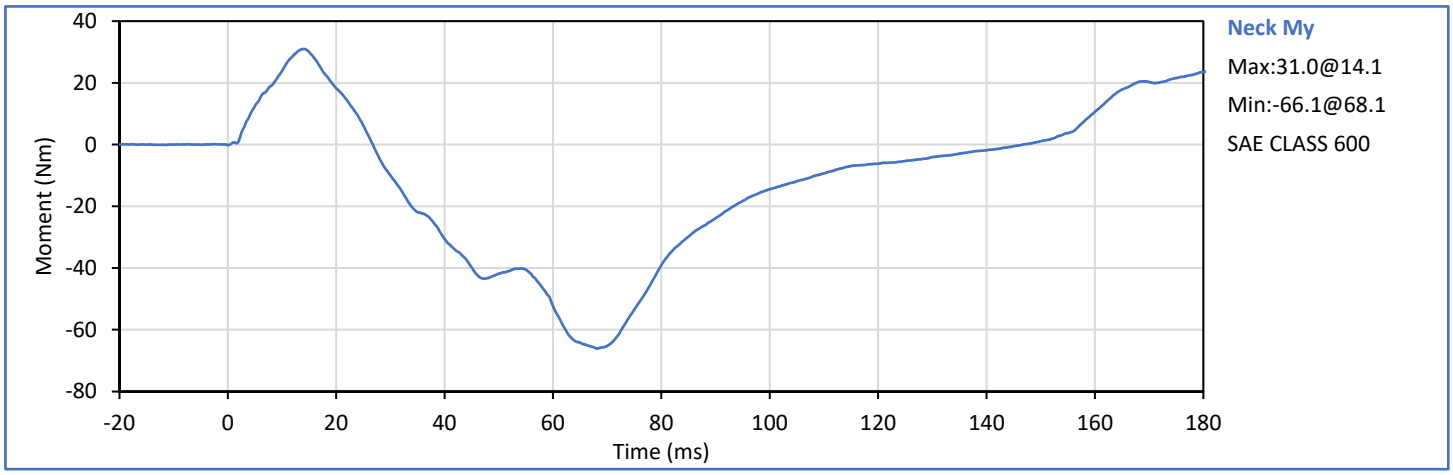
Applus IDIADA
KARCO

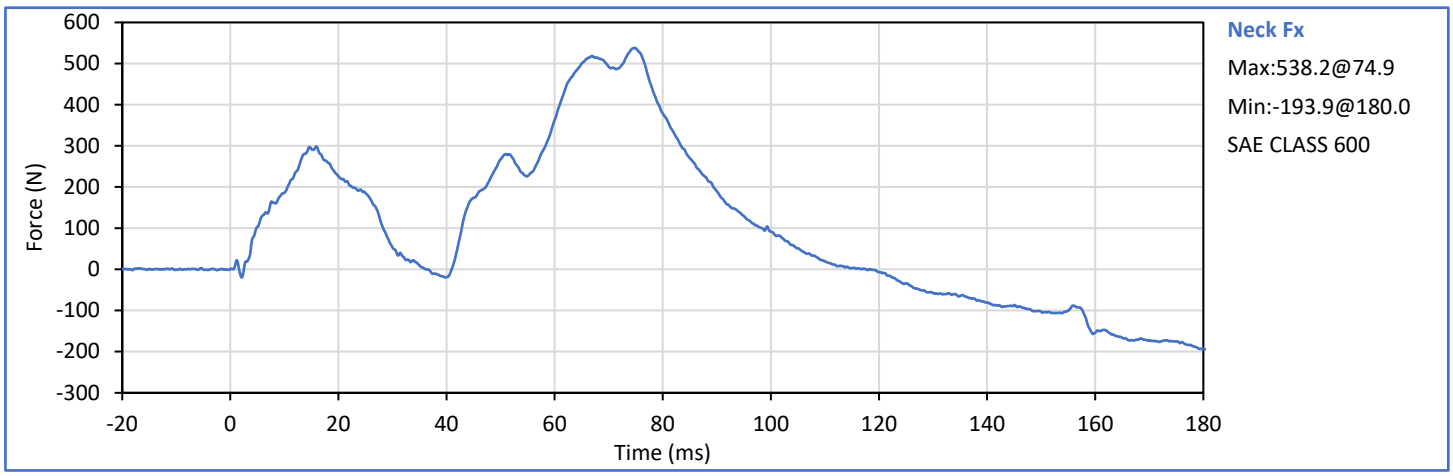
Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360

Test Date: 2021-08-19







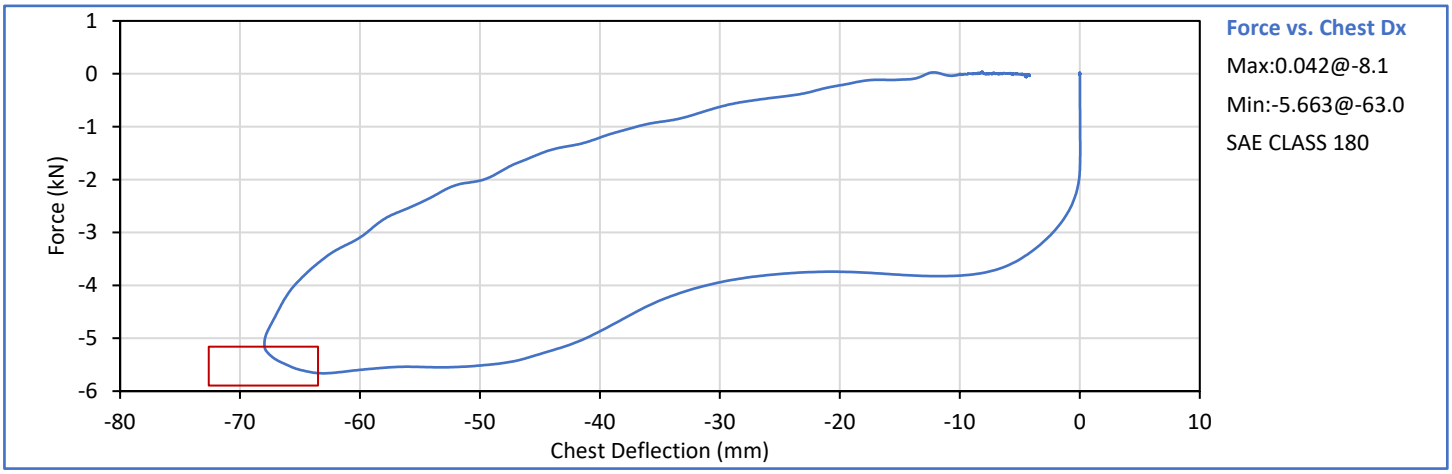
Applus IDIADA KARCO

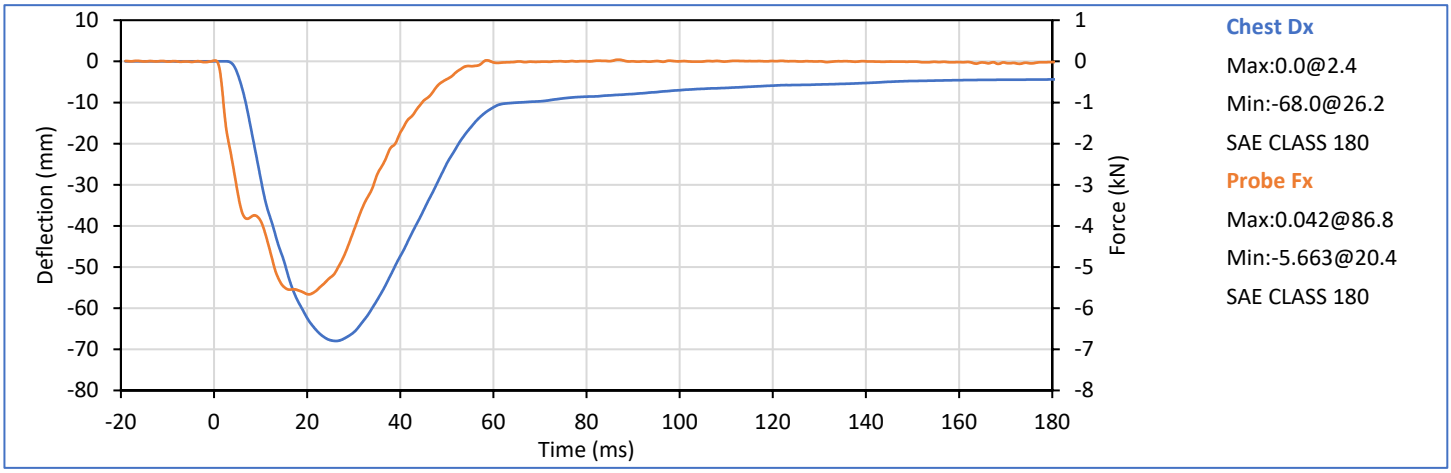
Hybrid III 50th Percentile Male ATD
Thorax Impact

ATD Serial No.: 360

Test Date: 2021-08-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Relative Humidity	%	10	70	25	Pass
Probe Velocity	m/s	6.58	6.82	6.72	Pass
Peak Chest Deflection	mm	-72.6	-63.5	-68.0	Pass
Peak Probe Force	kN	-5.893	-5.159	-5.663	Pass
Internal Hysterisis	%	69.0	85.0	72.3	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

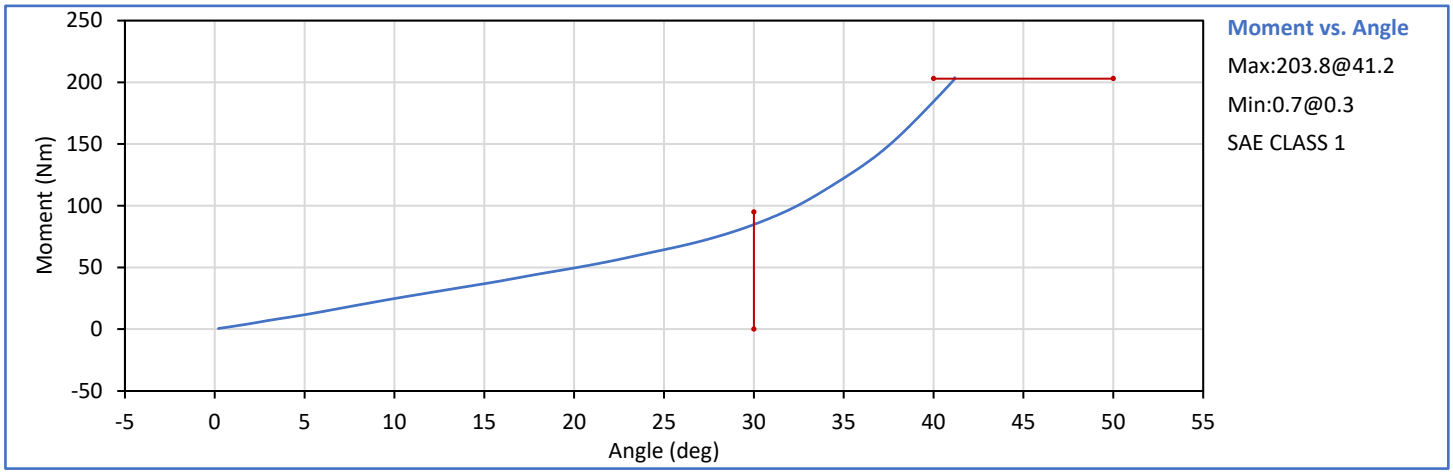
Applus IDIADA KARCO

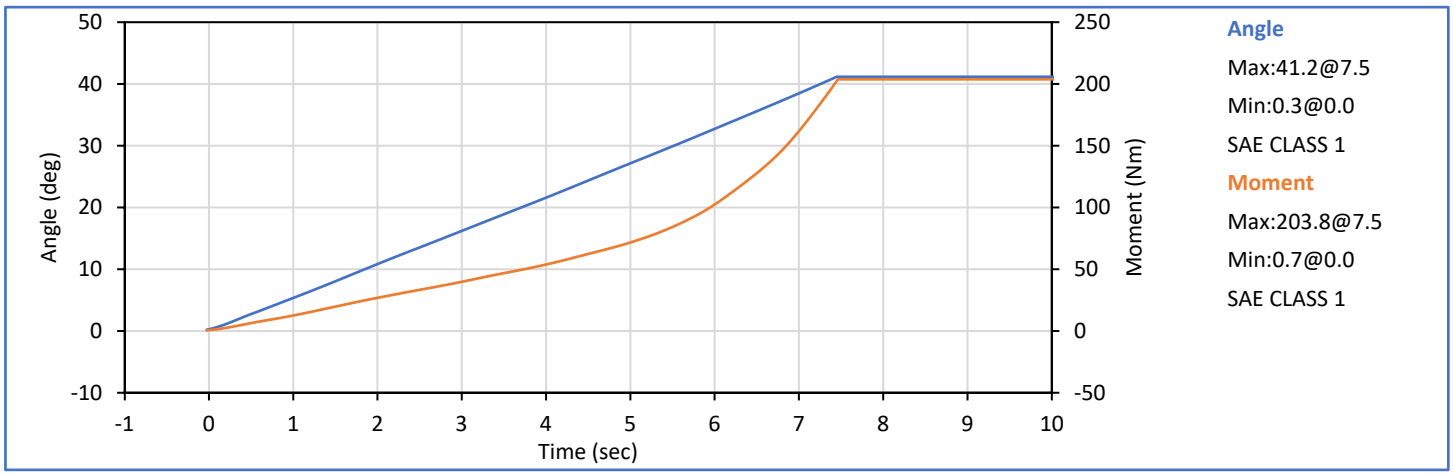
Hybrid III 50th Percentile Male ATD
Hip Range of Motion (Left)

ATD Serial No.: 360

Test Date: 2021-08-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.8	Pass
Laboratory Relative Humidity	%	10	70	26	Pass
Left Hip Rotation Rate	deg/s	5.0	10.0	5.5	Pass
Left Femur Torque at 30°	Nm	0.0	95.0	84.7	Pass
Left Hip Rotation at 203 Nm	deg	40.0	50.0	41.2	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

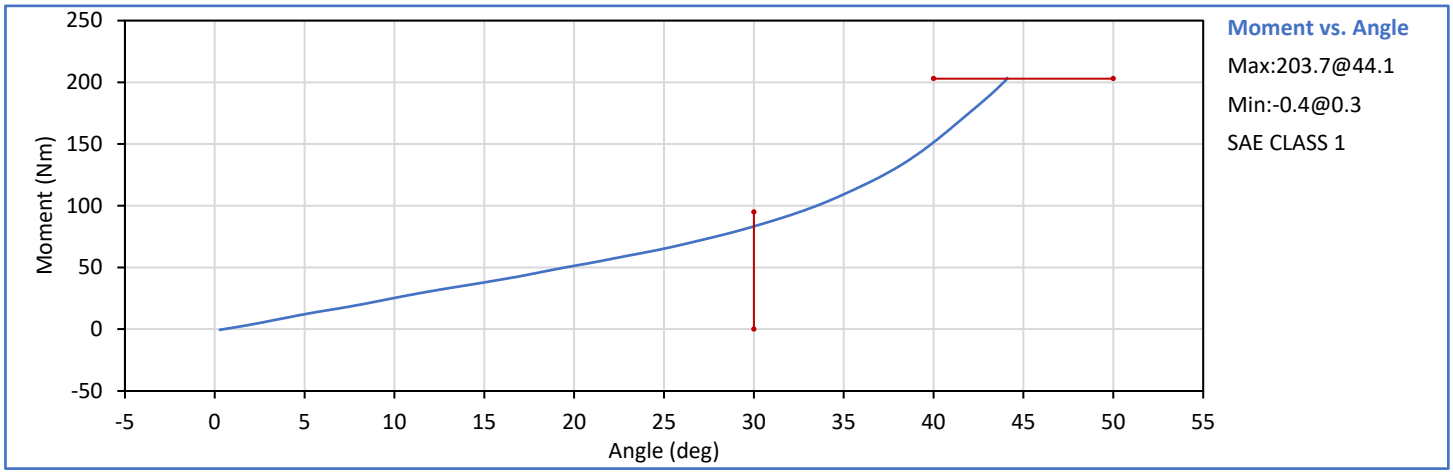
Applus IDIADA KARCO

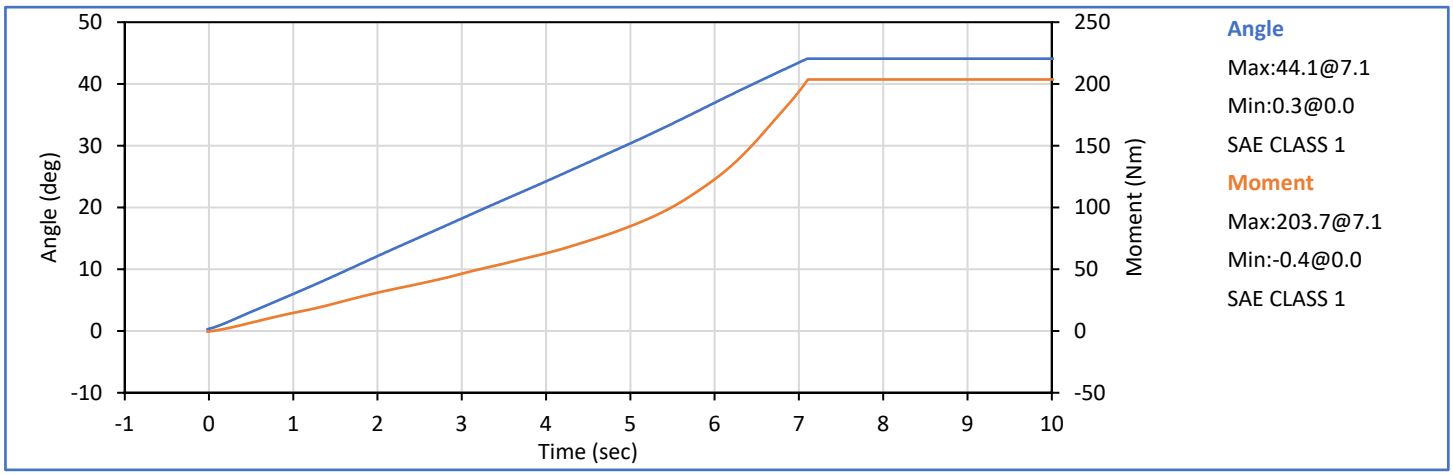
Hybrid III 50th Percentile Male ATD
Hip Range of Motion (Right)

ATD Serial No.: 360

Test Date: 2021-08-19

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	26	Pass
Right Hip Rotation Rate	deg/s	5.0	10.0	6.2	Pass
Right Femur Torque at 30°	Nm	0.0	95.0	83.2	Pass
Right Hip Rotation at 203 Nm	deg	40.0	50.0	44.1	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

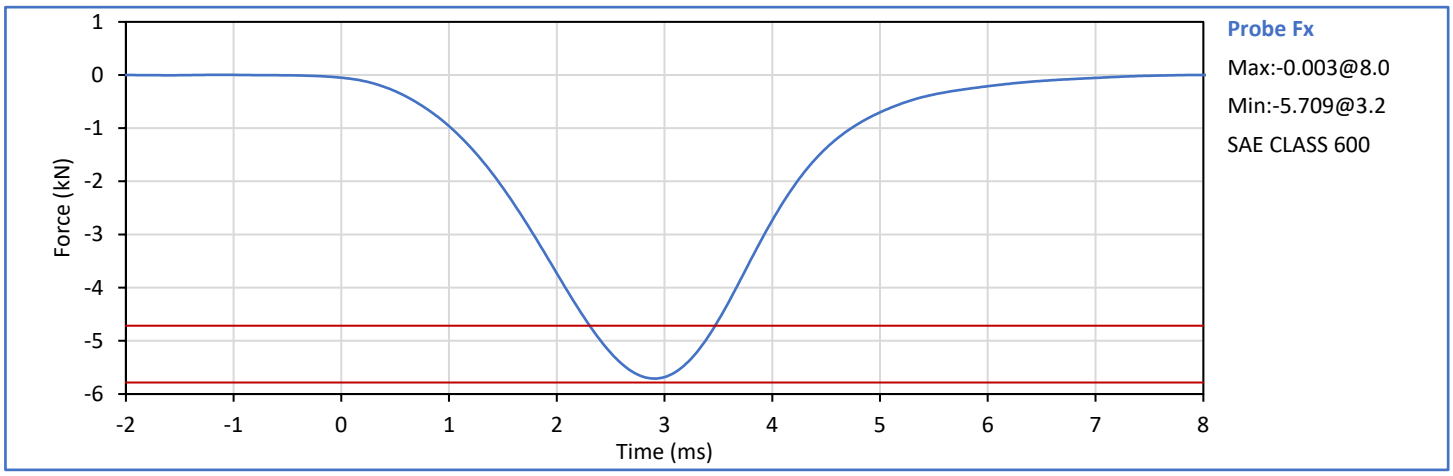
Applus IDIADA KARCO

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

ATD Serial No.: 360

Test Date: 2021-08-18

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	20.8	Pass
Laboratory Relative Humidity	%	10	70	27	Pass
Probe Velocity	m/s	2.070	2.130	2.125	Pass
Peak Resistive Force	kN	-5.782	-4.715	-5.709	Pass
			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

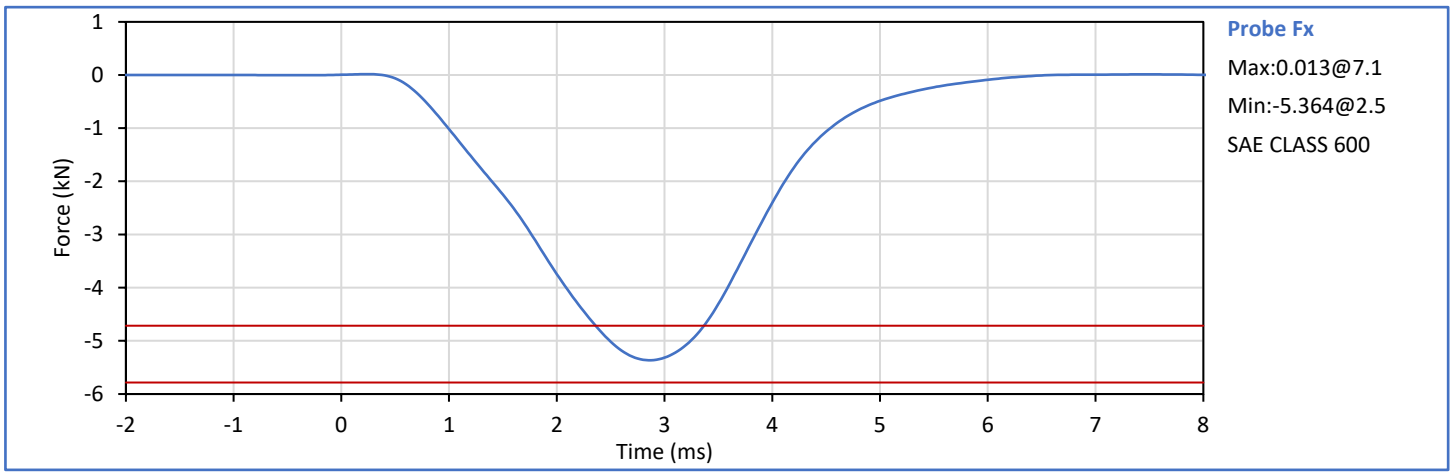
Applus IDIADA KARCO

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

ATD Serial No.: 360

Test Date: 2021-08-18

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	20.9	Pass
Laboratory Relative Humidity	%	10	70	27	Pass
Probe Velocity	m/s	2.070	2.130	2.103	Pass
Peak Resistive Force	kN	-5.782	-4.715	-5.364	Pass
			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

C-12

TR-P41221-01-NC

APPENDIX C
Pre-Test ATD Qualification and Performance Verification
Hybrid III 5th Percentile Female ATD
S/N: DH1644

Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Damage Checklist

ATD Serial No.: DH1644 Test Date: 2021-09-13

Dummy Item	Inspect for	Comments	Damage	Okay
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

Hybrid III 5th Percentile Female ATD
External Measurements

ATD Serial No.: DH1644 Test Date: 2021-09-13

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	47	Pass
A - Total sitting height	mm	775	800	793	Pass
B - Shoulder pivot height	mm	432	457	447	Pass
C - 'H' point height	mm	81	86	86	Pass
D - 'H' point location from backline	mm	145	150	149	Pass
E - Shoulder pivot from backline	mm	69	84	76	Pass
F - Thigh clearance	mm	119	135	124	Pass
G - Back of elbow to wrist pivot	mm	244	259	249	Pass
H - Head back to backline	mm	41	46	43	Pass
I - Shoulder to elbow length	mm	277	297	289	Pass
J - Elbow rest height	mm	183	203	197	Pass
K - Buttock to knee length	mm	521	546	535	Pass
L - Popliteal length	mm	356	376	367	Pass
M - Knee pivot height	mm	394	419	410	Pass
N - Buttock popliteal length	mm	414	439	423	Pass
O - Chest depth without jacket	mm	175	191	184	Pass
P - Foot length	mm	219	234	226	Pass
R - Buttock to Knee Pivot Length	mm	457	483	475	Pass
S - Head Breadth	mm	137	147	142	Pass
T - Head Depth	mm	178	188	185	Pass
U - Hip Breadth	mm	300	315	308	Pass
V - Shoulder breadth	mm	351	366	360	Pass
W - Foot breadth	mm	79	94	87	Pass
X - Head circum.	mm	528	549	542	Pass
Y - Chest circum. (w/chest jacket)	mm	851	881	867	Pass
Z - Waist circum.	mm	760	790	777	Pass
AA - Location for chest circum.	mm	333	358	350	Pass
BB - Location for waist circum.	mm	160	170	168	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

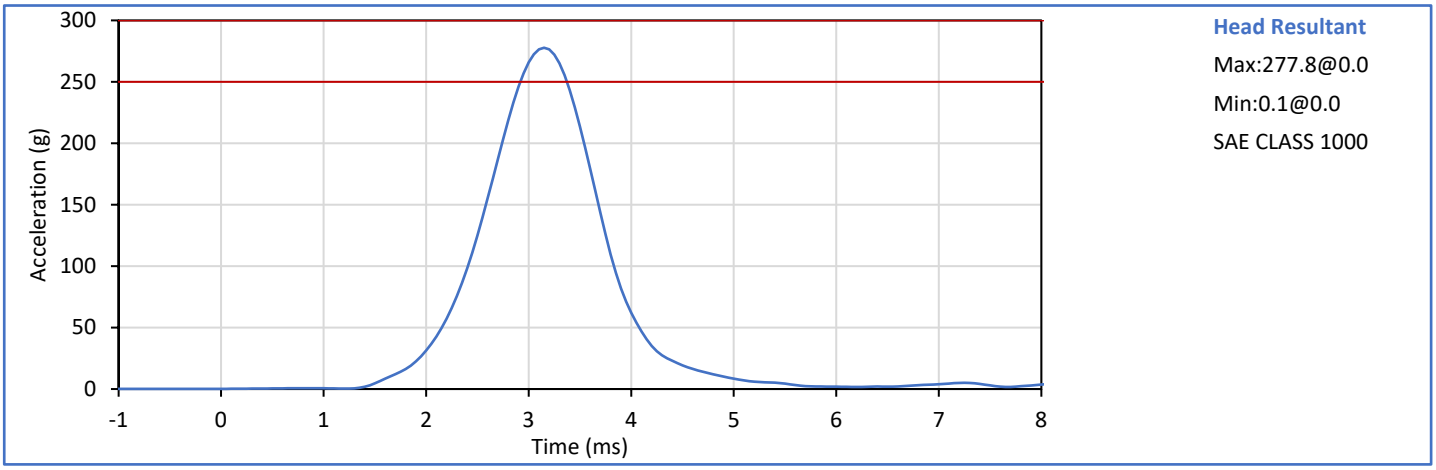
Applus IDIADA KARCO

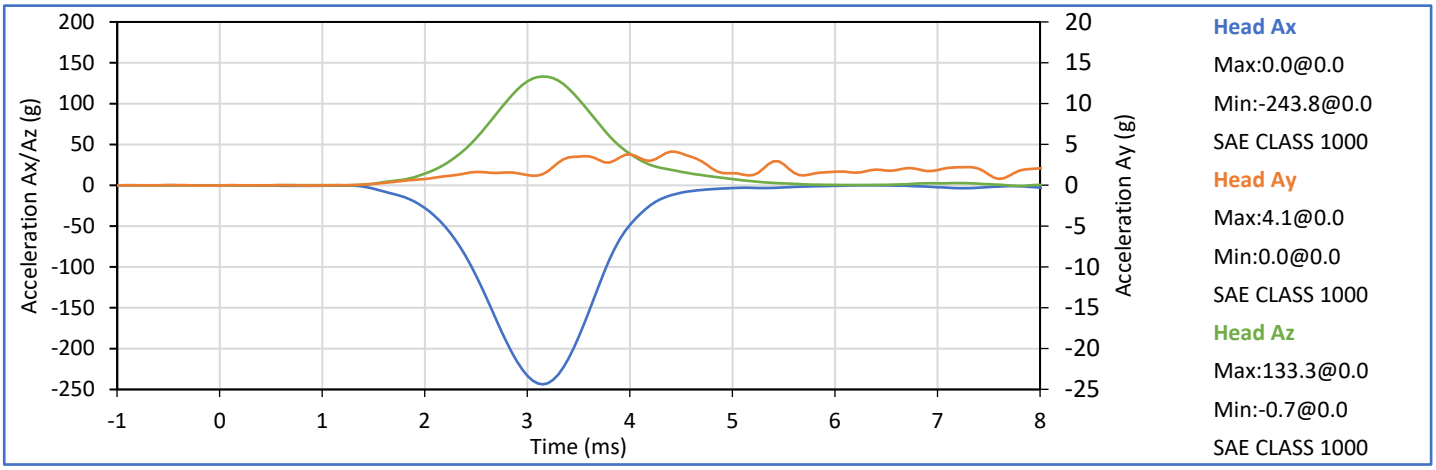
Hybrid III 5th Percentile Female ATD
Head Drop Test

ATD Serial No.: DH1644

Test Date: 2021-09-13

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.9	Pass
Laboratory Humidity	%	10	70	47	Pass
Peak Resultant Acceleration	g	250.0	300.0	277.8	Pass
Peak Lateral Acceleration	g	-15.0	15.0	4.1	Pass
Oscillations After Main Pulse	%	0.0	10.0	1.8	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

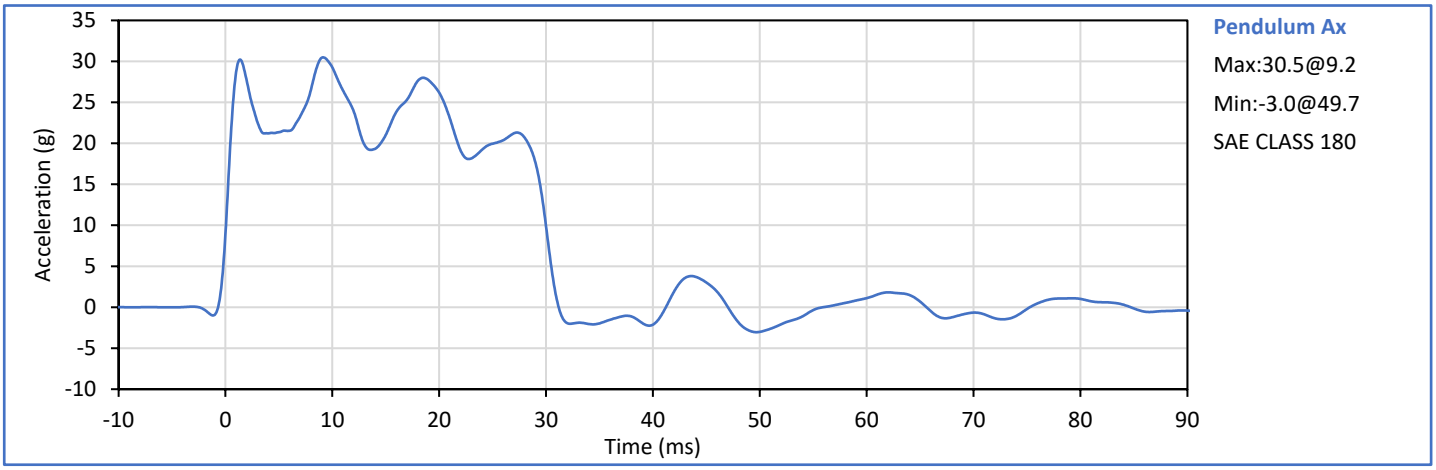
Approved By: P. Puzzuto

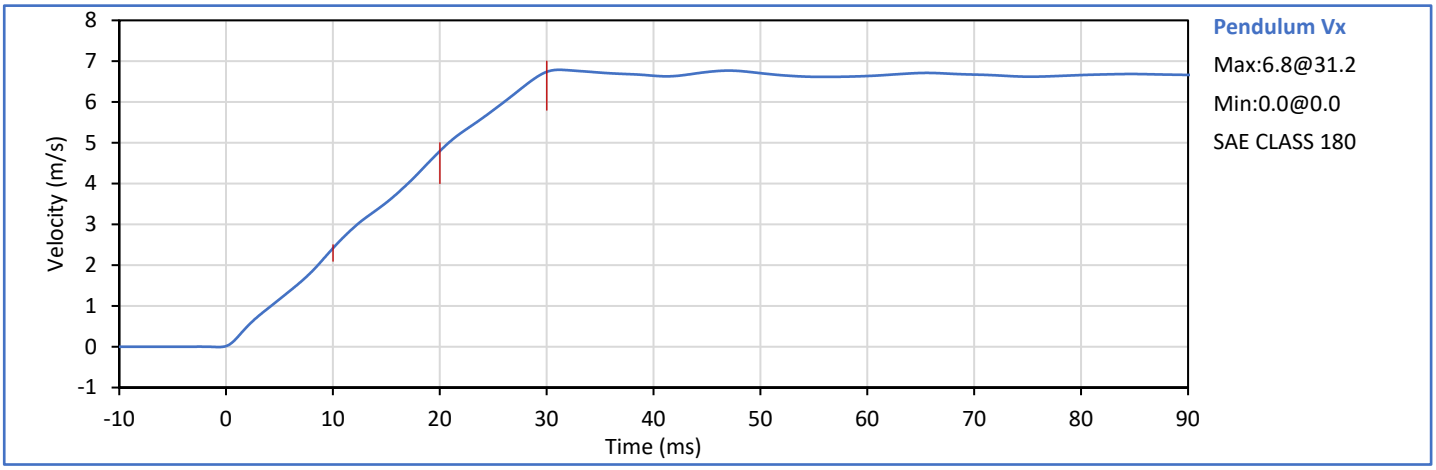
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: DH1644 Test Date: 2021-09-13

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Humidity	%	10	70	47	Pass
Pendulum Velocity	m/s	6.89	7.13	7.08	Pass
Pendulum Velocity at 10 ms	m/s	2.10	2.50	2.41	Pass
Pendulum Velocity at 20 ms	m/s	4.00	5.00	4.79	Pass
Pendulum Velocity at 30 ms	m/s	5.80	7.00	6.74	Pass
Peak "D" Plane Rotation	deg	77.0	91.0	81.7	Pass
Peak Moment in Rotation	Nm	69.0	83.0	72.3	Pass
Positive Moment Decay to 10 Nm	ms	80.0	100.0	85.1	Pass
			Overall Test Results		Pass





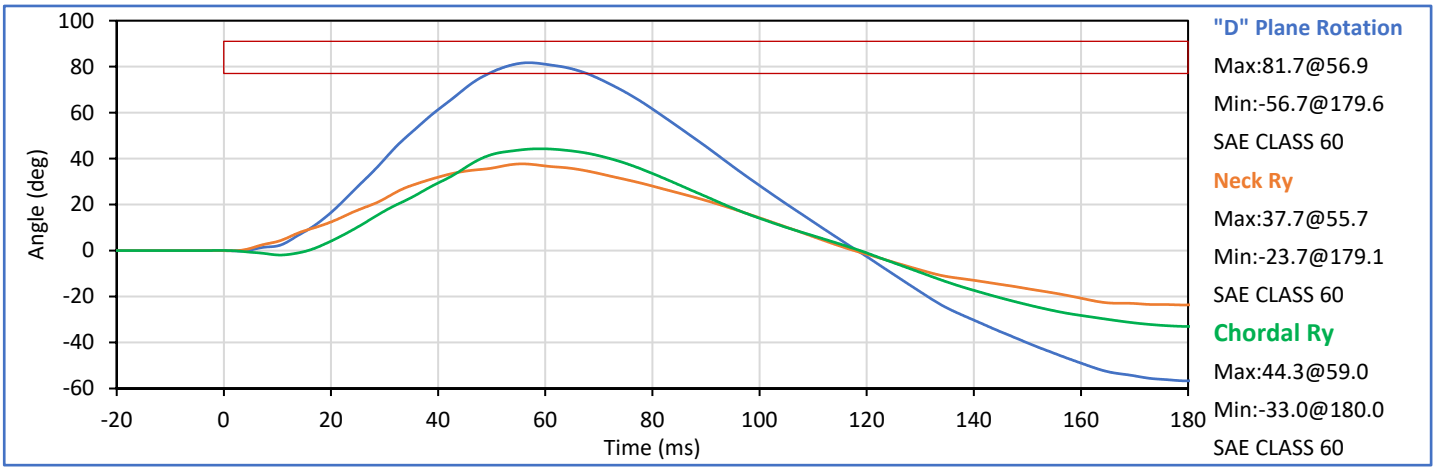
Technician: J. Hernandez

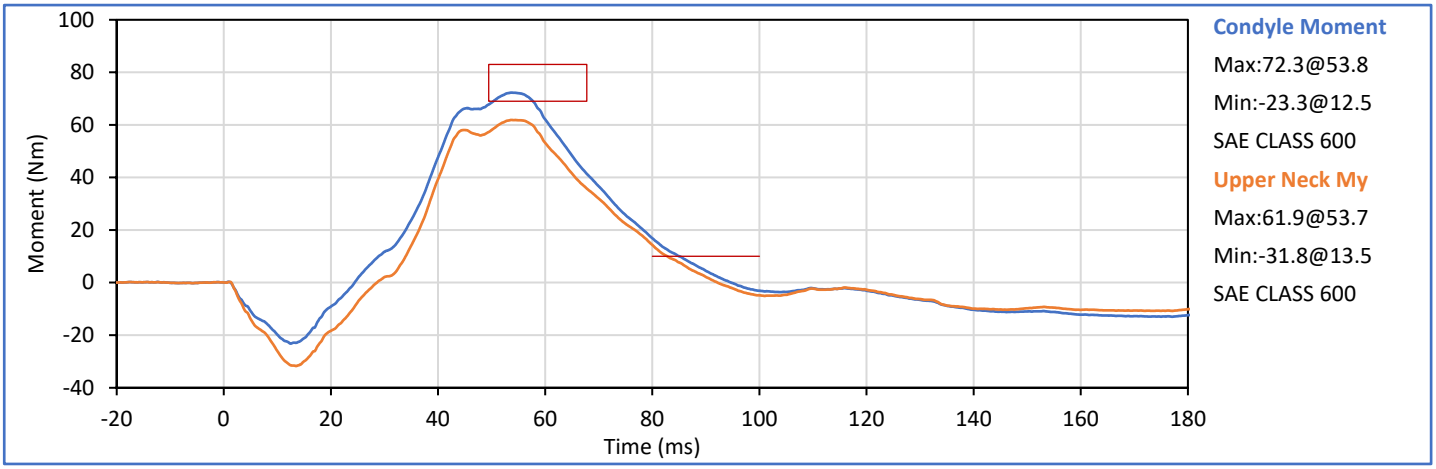
Approved By: P. Puzzuto

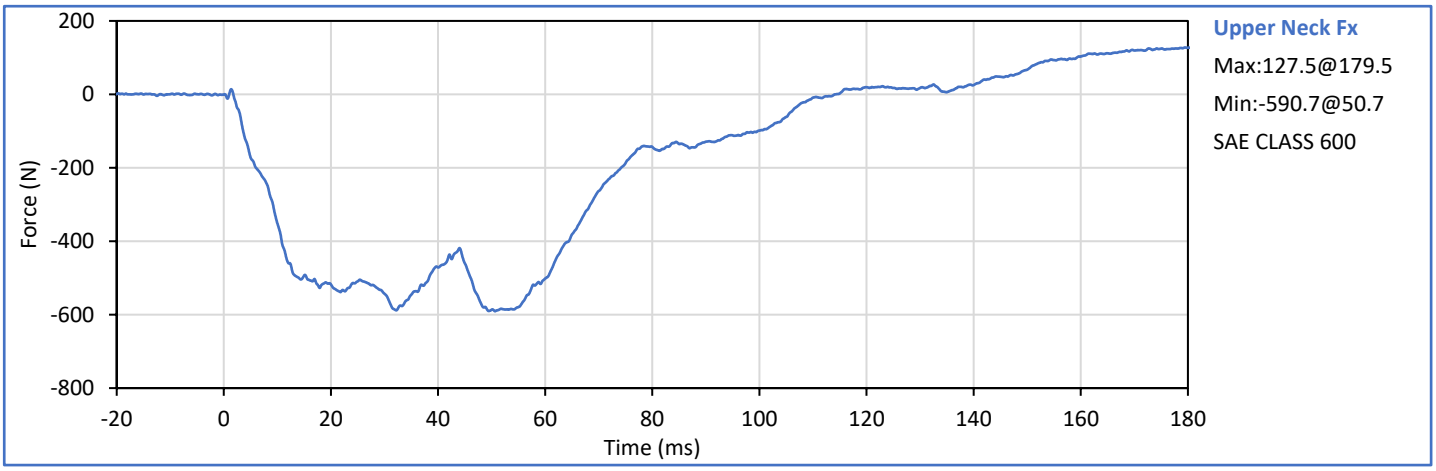
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: DH1644 Test Date: 2021-09-13





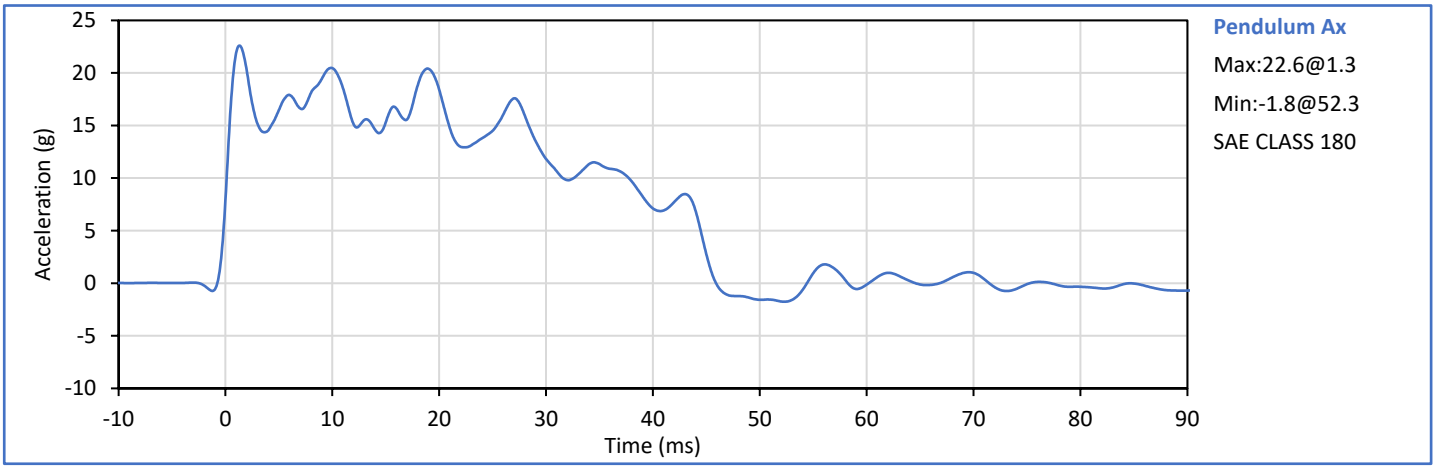


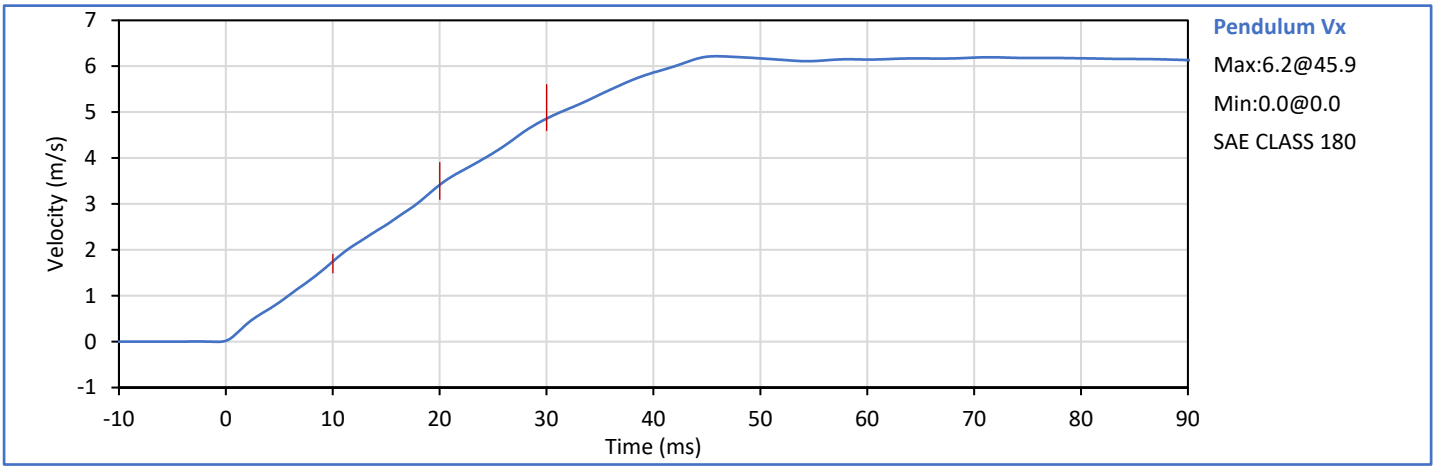
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Extension Test

ATD Serial No.: DH1644 Test Date: 2021-09-13

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	33	Pass
Pendulum Velocity	m/s	5.95	6.19	6.05	Pass
Pendulum Velocity at 10 ms	m/s	1.50	1.90	1.74	Pass
Pendulum Velocity at 20 ms	m/s	3.10	3.90	3.41	Pass
Pendulum Velocity at 30 ms	m/s	4.60	5.60	4.86	Pass
Peak "D" Plane Rotation	deg	99.0	114.0	110.1	Pass
Peak Moment in Rotation	Nm	-65.0	-53.0	-59.0	Pass
Negative Moment Decay to -10 Nm	ms	94.0	114.0	98.0	Pass
			Overall Test Results		Pass





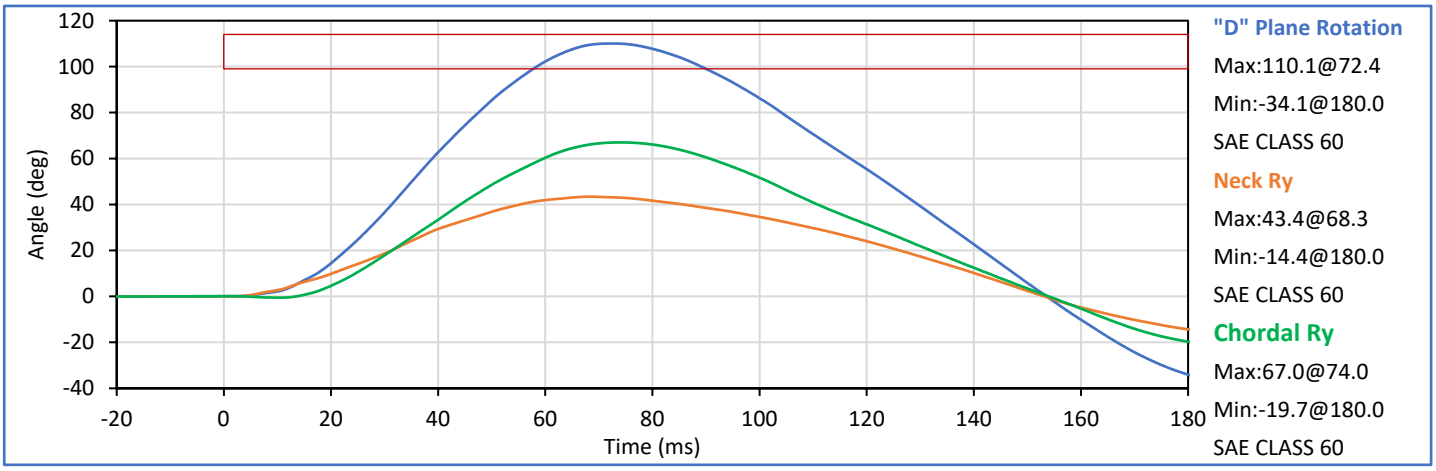
Technician: J. Hernandez

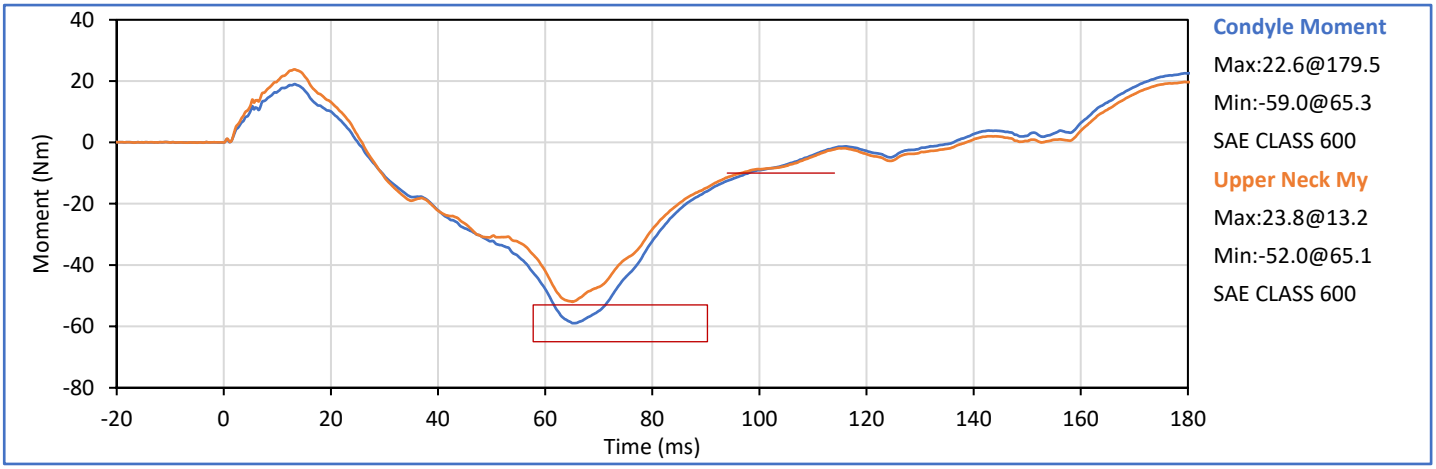
Approved By: P. Puzzuto

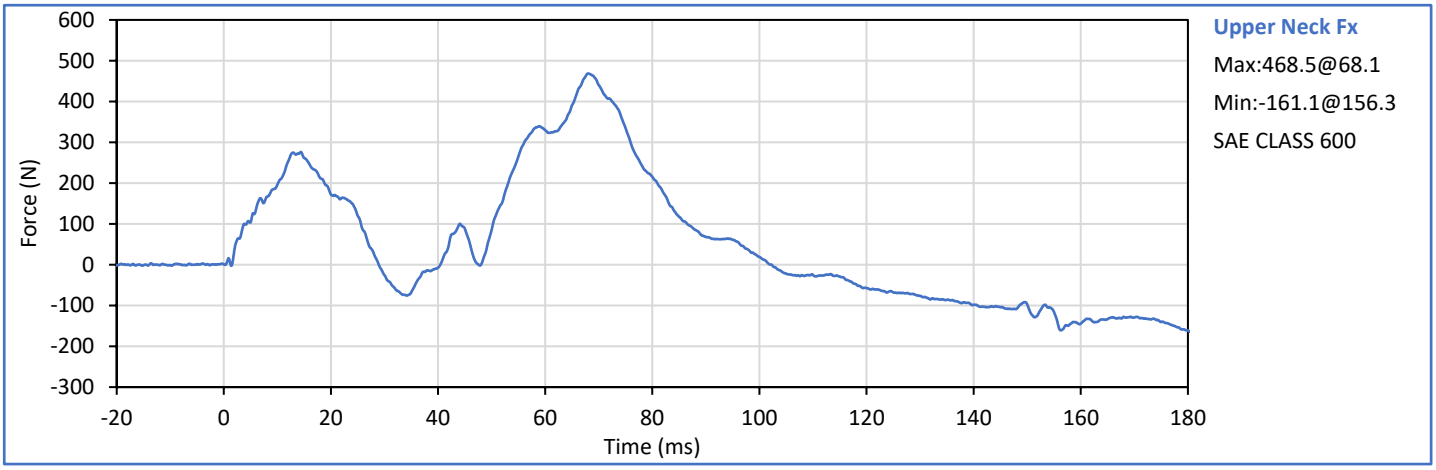
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Extension Test

ATD Serial No.: DH1644 Test Date: 2021-09-13







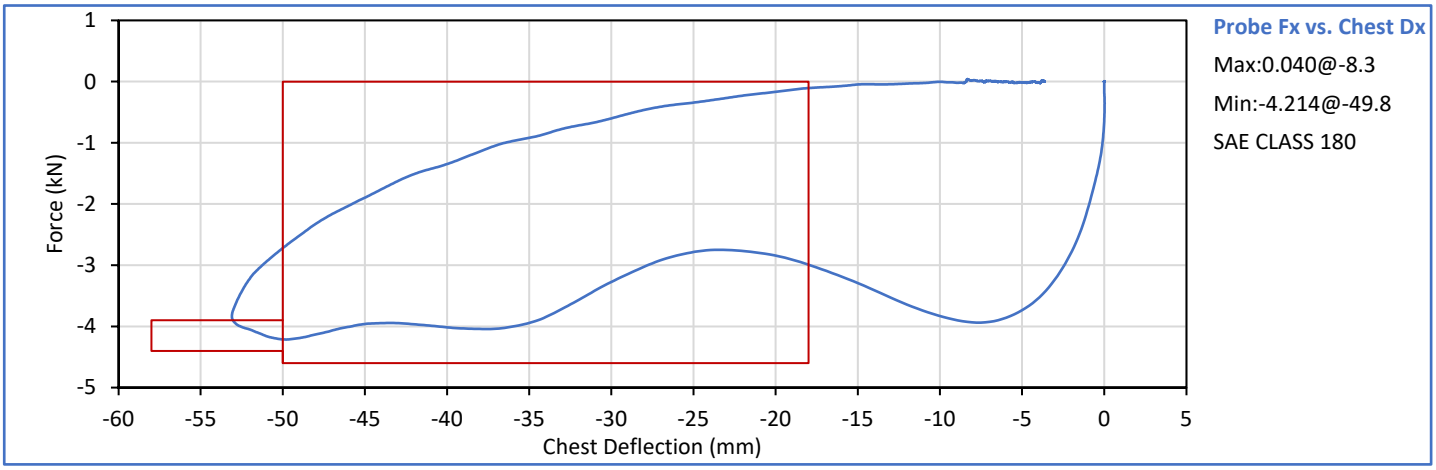
Applus IDIADA KARCO

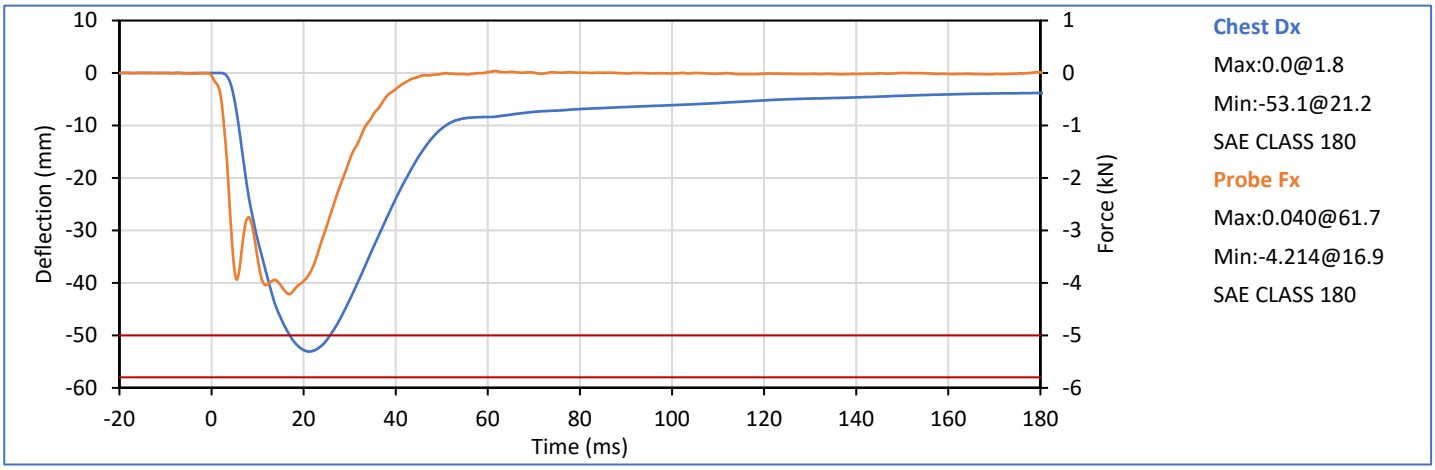
Hybrid III 5th Percentile Female ATD
Thorax Impact

ATD Serial No.: DH1644

Test Date: 2021-09-14

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.3	Pass
Laboratory RelativeHumidity	%	10	70	46	Pass
Probe Velocity	m/s	6.59	6.83	6.71	Pass
Peak Chest Deflection	mm	-58.0	-50.0	-53.1	Pass
Peak Probe Force, 50 and 58 mm	kN	-4.400	-3.900	-4.212	Pass
Peak Probe Force, 18 and 50 mm	kN	-4.600	0.000	-4.214	Pass
Internal Hysterisis	%	69.0	85.0	77.2	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

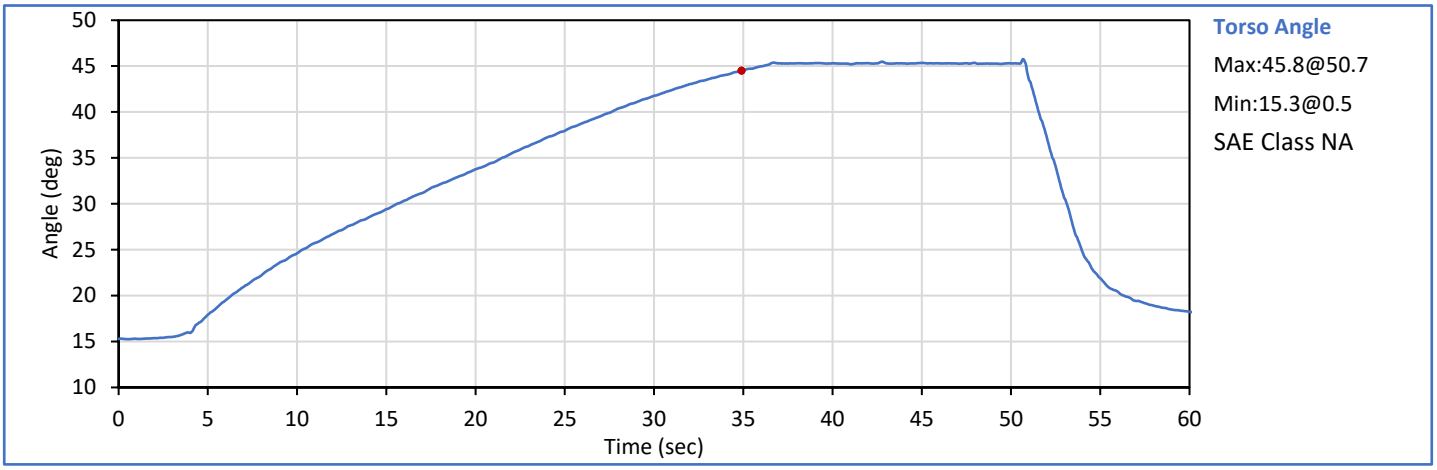
Applus IDIADA KARCO

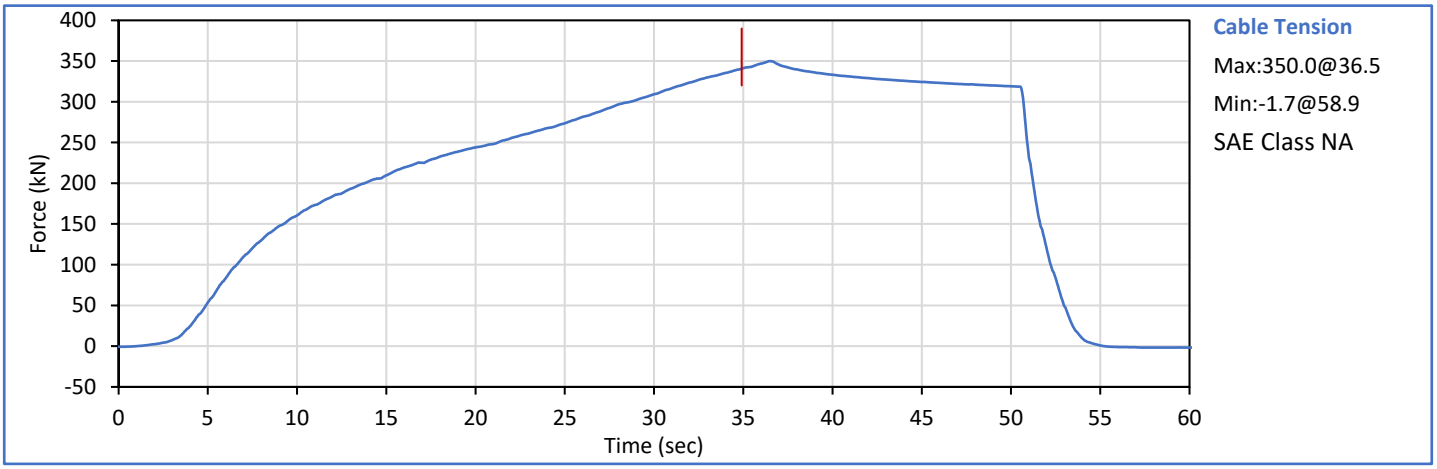
Hybrid III 5th Percentile Female ATD
Torso Flexion Test

ATD Serial No.: DH1644

Test Date: 2021-09-14

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.2	Pass
Laboratory Humidity	%	10	70	46	Pass
Orientation Angle	deg	0.0	20.0	14.3	Pass
Test Initial Angle	deg	11.0	19.0	15.3	Pass
Peak Force at 45° (+/-0.5°)	N	320.0	390.0	340.5	Pass
Torso Flexion Rate	deg/s	0.50	1.50	0.95	Pass
Final Reference Plane Angle	deg	-8.0	8.0	1.2	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

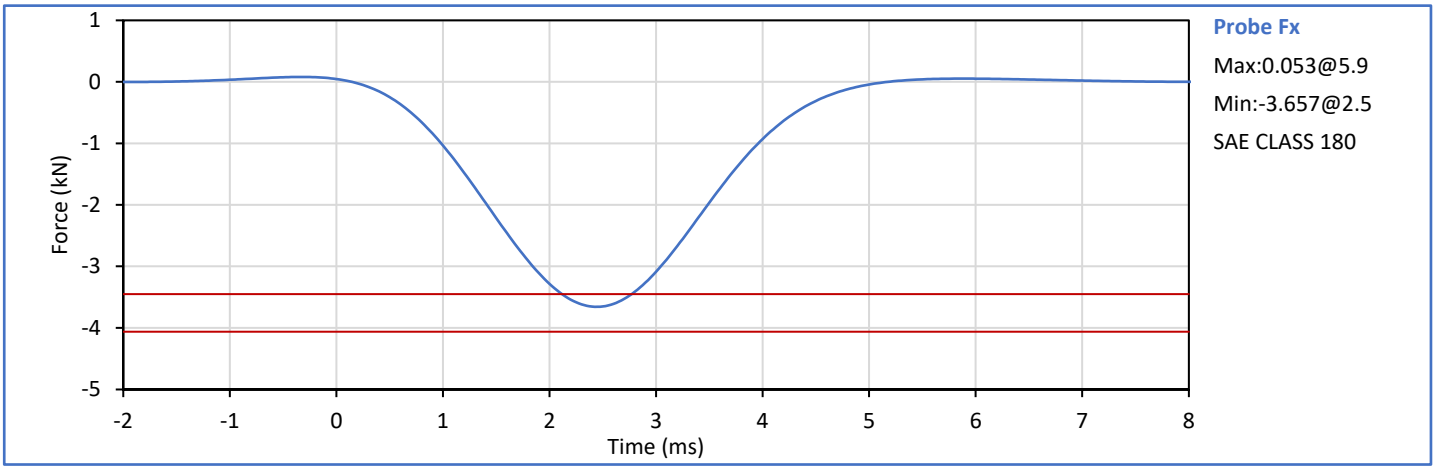
Applus IDIADA
KARCO

Hybrid III 5th Percentile Female ATD
Knee Impact (Left)

ATD Serial No.: DH1644

Test Date: 2021-09-13

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.2	Pass
Laboratory Relative Humidity	%	10	70	48	Pass
Probe Velocity	m/s	2.070	2.130	2.084	Pass
Peak Resistive Force	kN	-4.060	-3.450	-3.657	Pass
			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

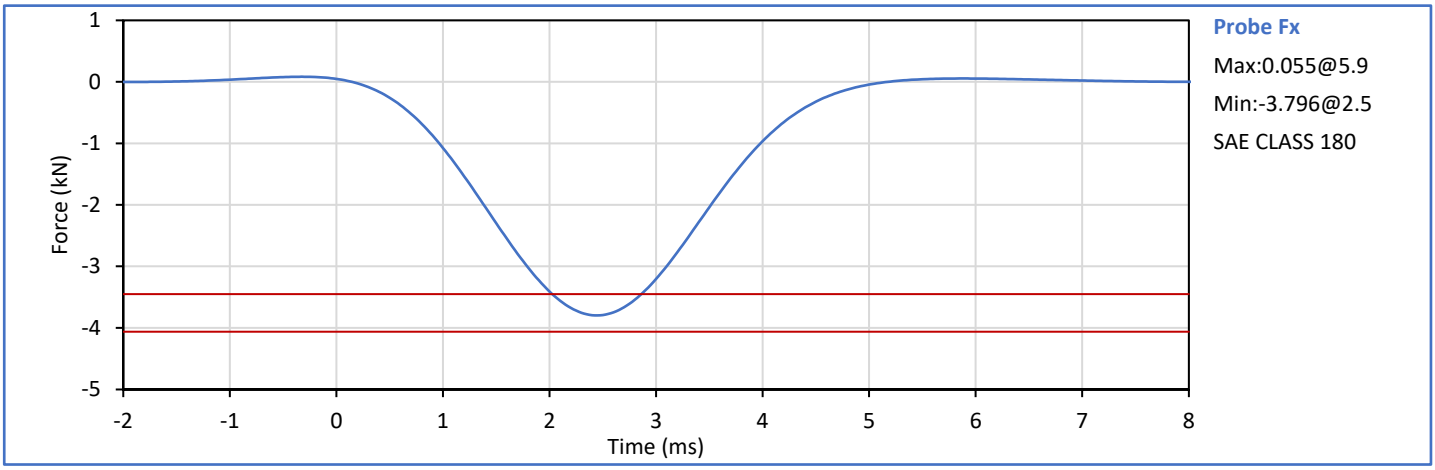
Applus IDIADA
KARCO

Hybrid III 5th Percentile Female ATD
Knee Impact (Right)

ATD Serial No.: DH1644

Test Date: 2021-09-13

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.3	Pass
Laboratory Relative Humidity	%	10	70	48	Pass
Probe Velocity	m/s	2.070	2.130	2.124	Pass
Peak Resistive Force	kN	-4.060	-3.450	-3.796	Pass
			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX C
Post-Test ATD Qualification and Performance Verification
Hybrid III 50th Percentile Male ATD
S/N: 360

Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
ATD Damage Checklist

ATD Serial No.: 360 Test Date: 2021-10-01

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

Hybrid III 50th Percentile Male ATD
External Measurements

ATD Serial No.: 360 Test Date: 2021-10-01

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	29	Pass
A - Total sitting height	mm	879	889	882	Pass
B - Shoulder pivot height	mm	505	521	515	Pass
C - 'H' point height	mm	84	89	86	Pass
D - 'H' point location from backline	mm	135	140	139	Pass
E - Shoulder pivot from backline	mm	84	94	89	Pass
F - Thigh clearance	mm	140	155	151	Pass
G - Back of elbow to wrist pivot	mm	290	305	295	Pass
H - Head back to backline	mm	41	46	45	Pass
I - Shoulder to elbow length	mm	330	345	337	Pass
J - Elbow rest height	mm	190	211	207	Pass
K - Buttock to knee length	mm	579	604	590	Pass
L - Popliteal length	mm	429	455	438	Pass
M - Knee pivot height	mm	485	500	493	Pass
N - Buttock popliteal length	mm	452	477	472	Pass
O - Chest depth without jacket	mm	213	229	220	Pass
P - Foot length	mm	251	267	256	Pass
V - Shoulder breadth	mm	422	437	429	Pass
W - Foot breadth	mm	91	107	101	Pass
Y - Chest circum. (w/chest jacket)	mm	970	1001	992	Pass
Z - Waist circum.	mm	836	866	855	Pass
AA - Location for chest circum.	mm	429	434	430	Pass
BB - Location for waist circum.	mm	226	231	228	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

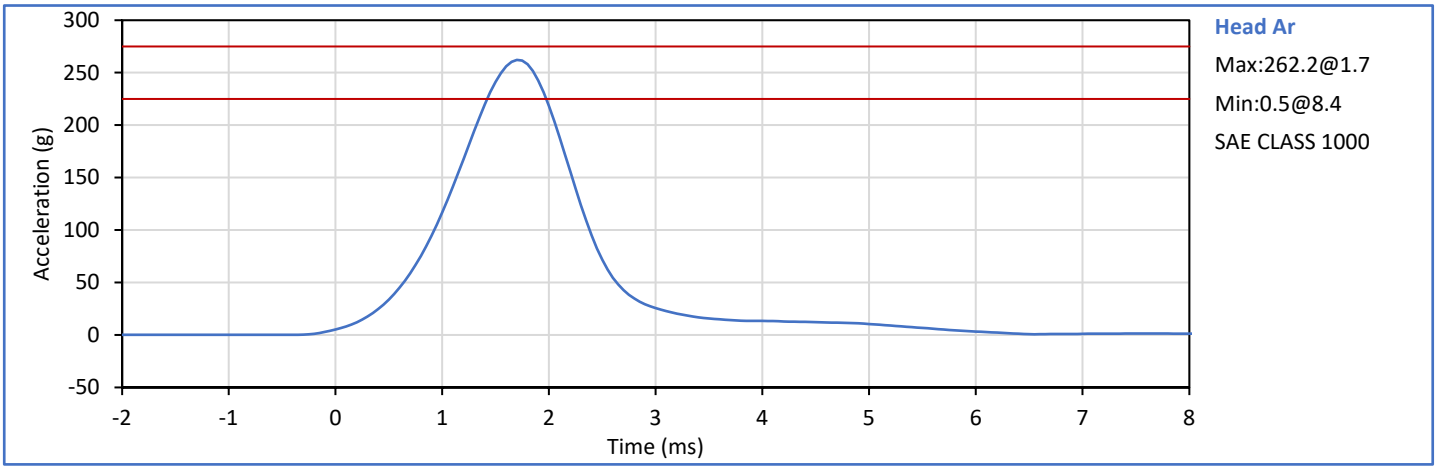
Applus IDIADA
KARCO

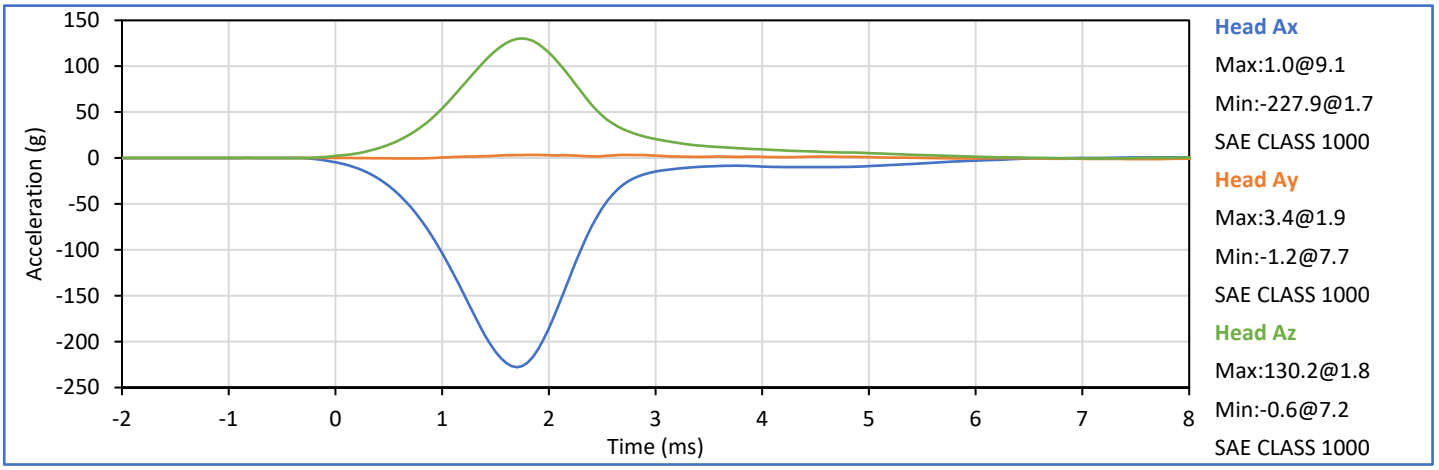
Hybrid III 50th Percentile Male ATD
Head Drop

ATD Serial No.: 360

Test Date: 2021-10-04

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.8	Pass
Laboratory Relative Humidity	%	10	70	29	Pass
Peak Resultant Acceleration	g	225.0	275.0	262.2	Pass
Peak Lateral Acceleration	g	-15.0	15.0	3.4	Pass
Oscillations After Main Pulse	%	0.0	10.0	0.0	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

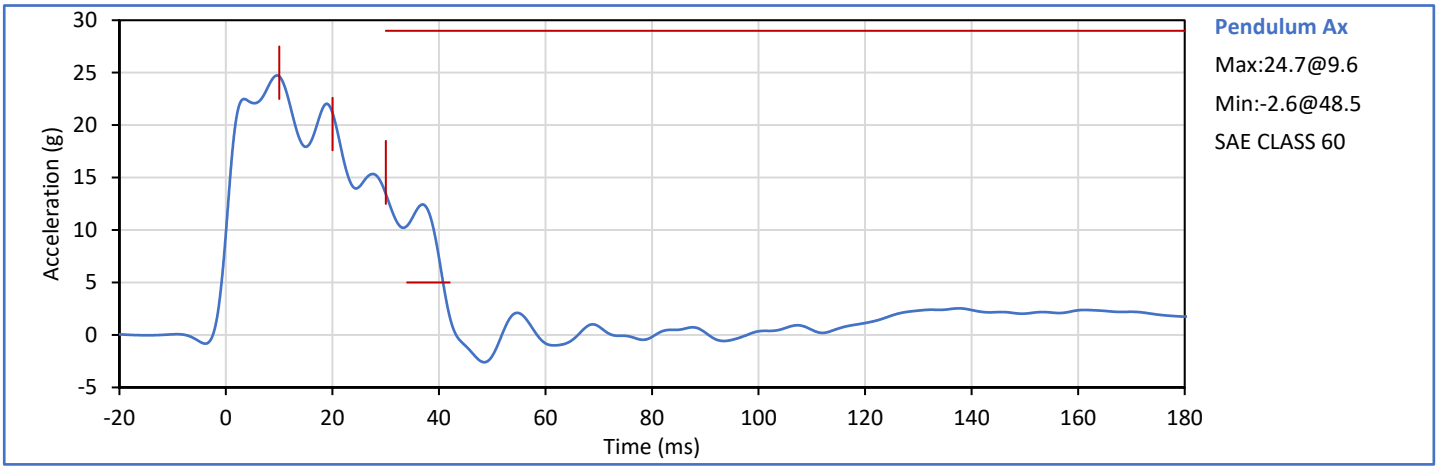
Approved By: P. Puzzuto

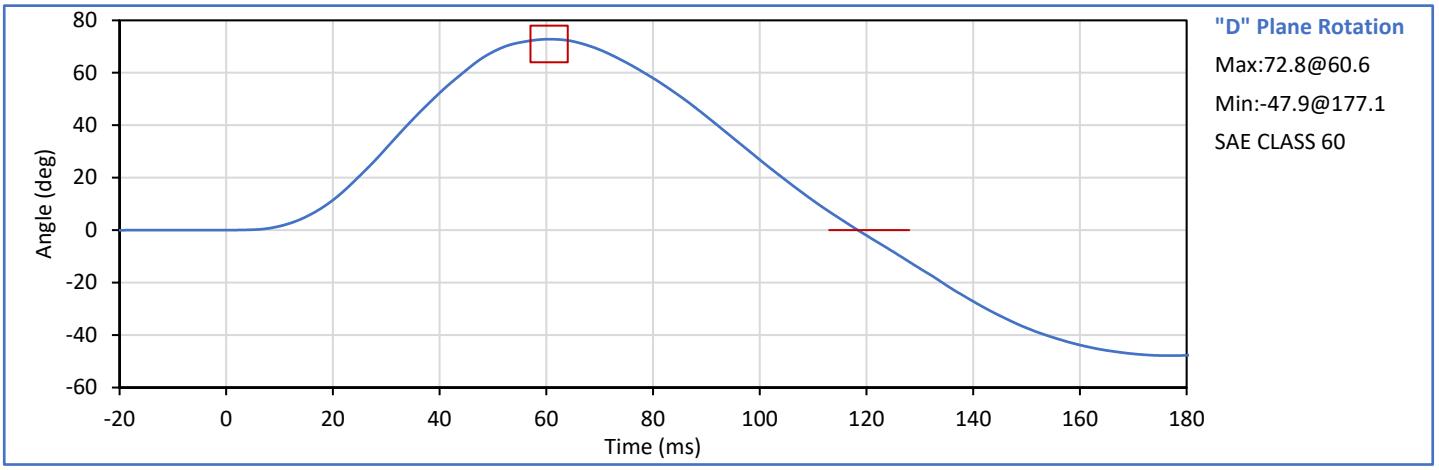
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2021-10-04

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	7.05	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	24.7	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	21.2	Pass
Pendulum Deceleration at 30 ms	g	12.5	18.5	13.5	Pass
Peak Pendulum Decel After 30 ms	g	0.0	29.0	13.5	Pass
Deceleration Decay to Cross 5g	ms	34.0	42.0	40.8	Pass
"D" Plane Rotation peak	deg	64.0	78.0	72.8	Pass
	ms	57.0	64.0	60.6	Pass
"D" Plane Rotation Decay to Zero	ms	113.0	128.0	118.4	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	93.4	Pass
	ms	47.0	58.0	54.6	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	99.3	Pass
			Overall Test Results		Pass





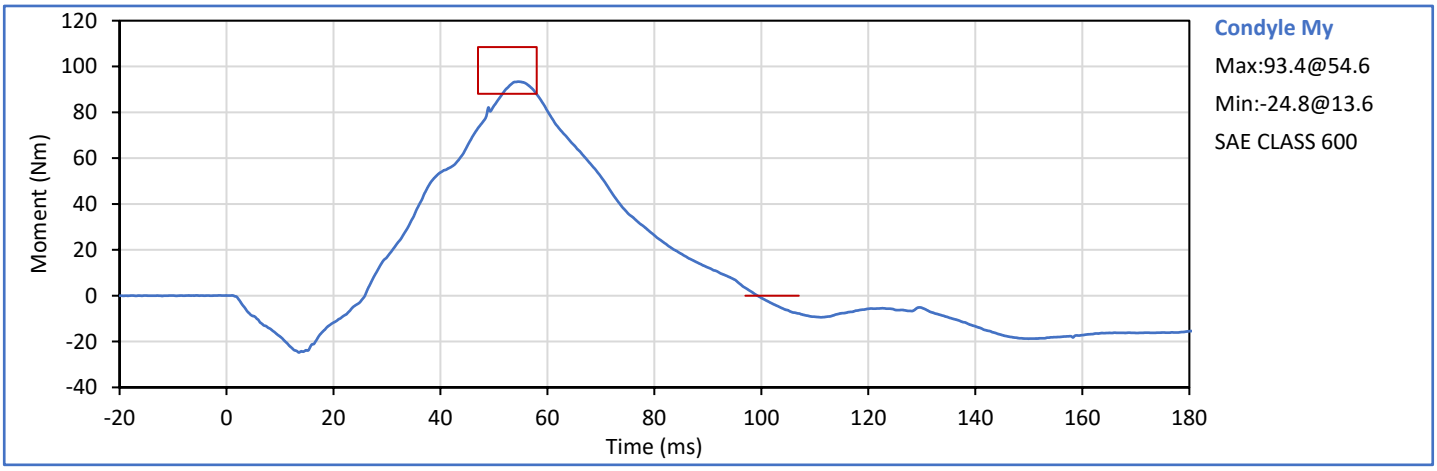
Technician: J. Hernandez

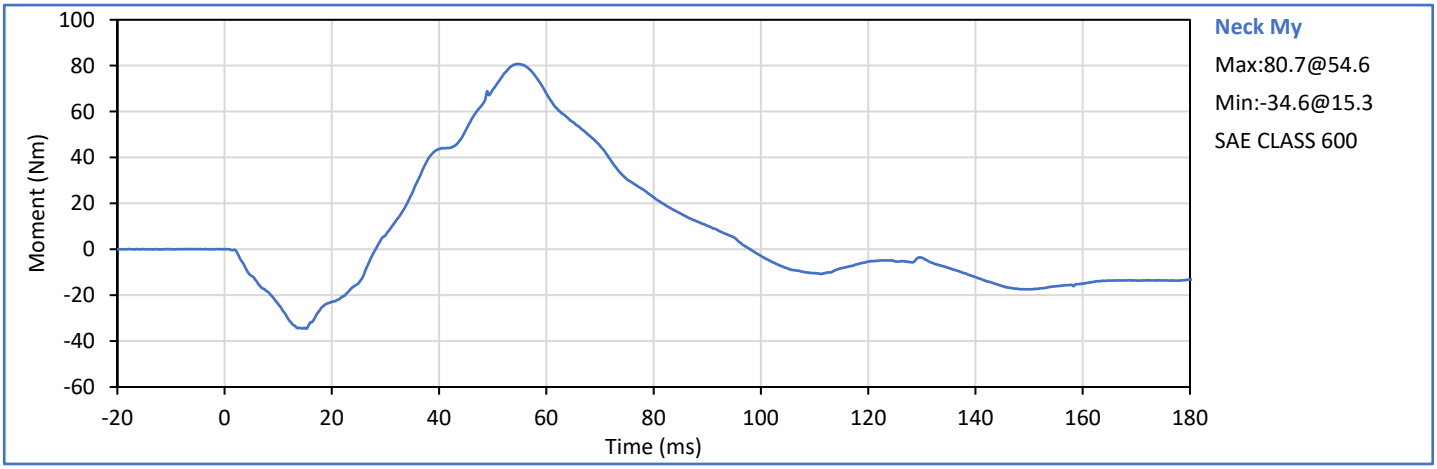
Approved By: P. Puzzuto

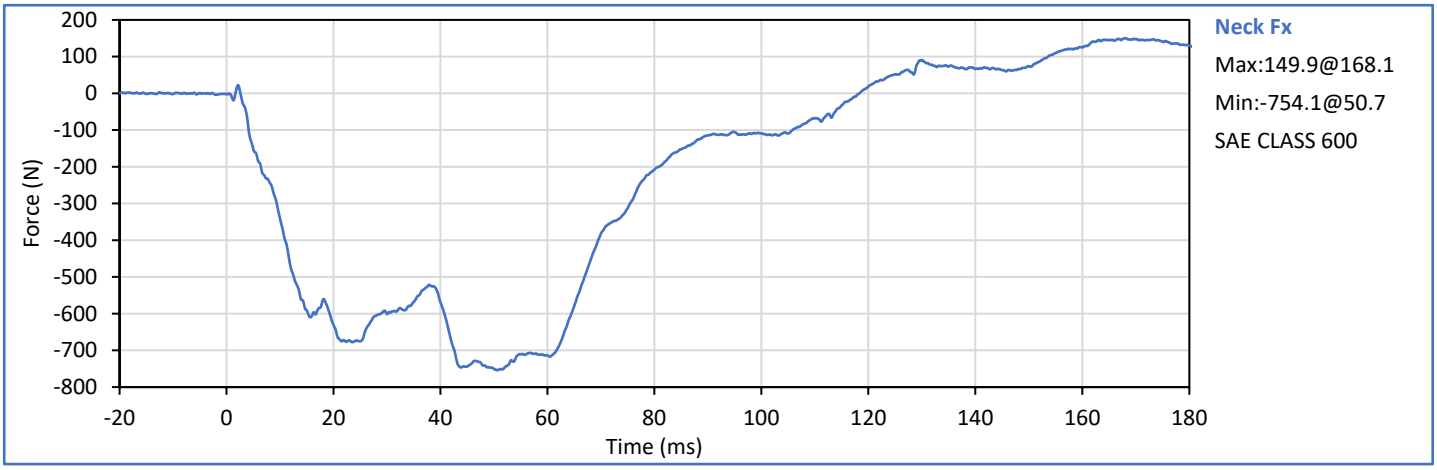
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2021-10-04





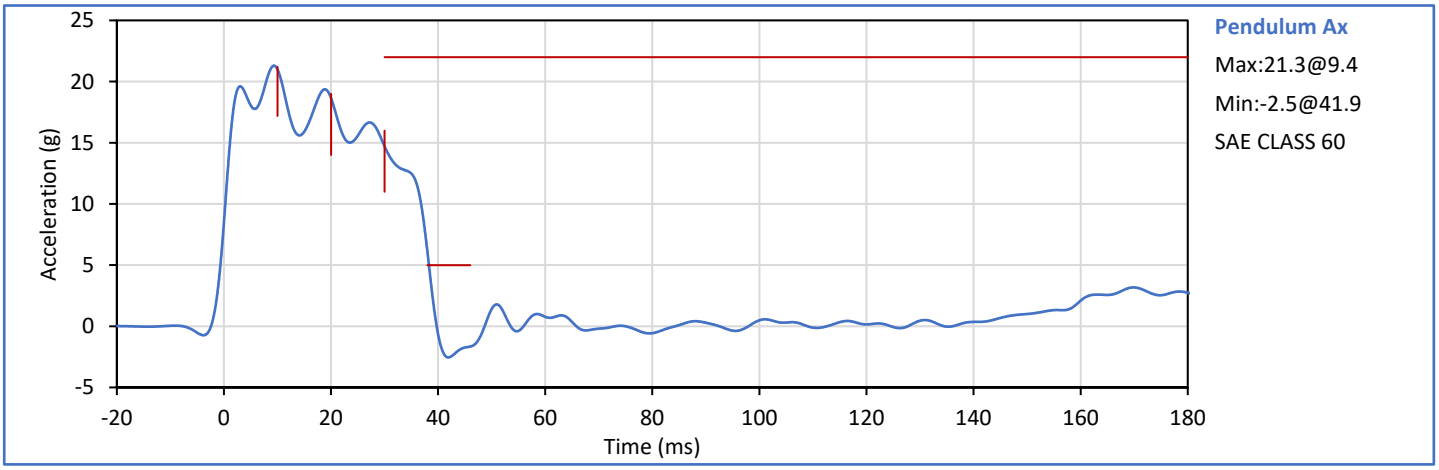


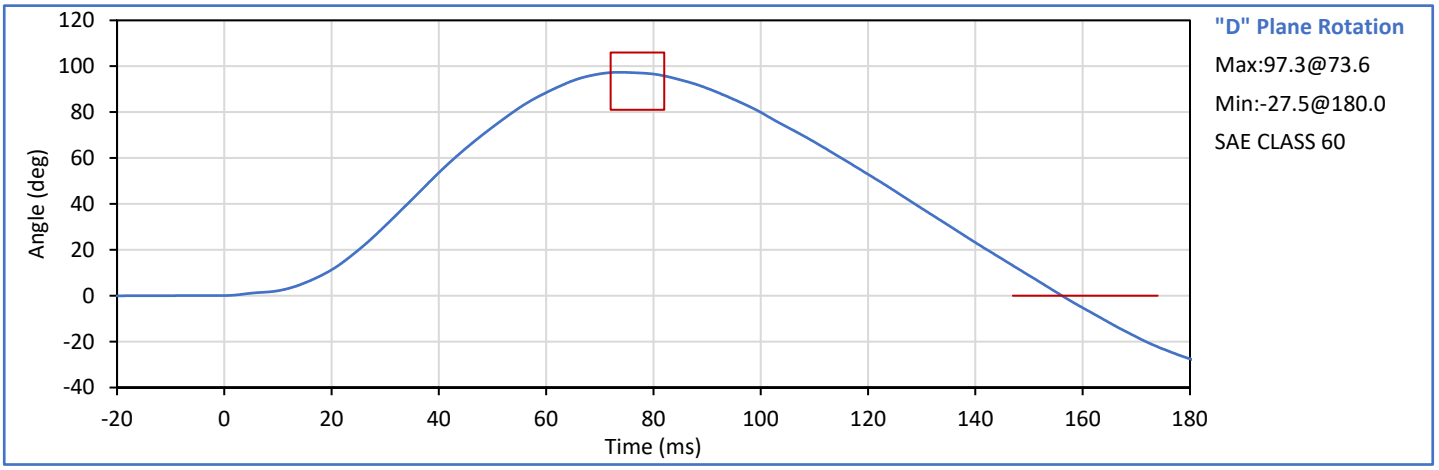
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360 Test Date: 2021-10-04

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	6.11	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	21.0	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	18.7	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	14.7	Pass
Peak Pendulum Decel After 30 ms	g	0.0	22.0	14.7	Pass
Deceleration Decay to Cross 5g	ms	38.0	46.0	38.3	Pass
"D" Plane Rotation peak	deg	81.0	106.0	97.3	Pass
	ms	72.0	82.0	73.6	Pass
"D" Plane Rotation Decay to Zero	ms	147.0	174.0	156.2	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-70.6	Pass
	ms	65.0	79.0	69.2	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	135.7	Pass
			Overall Test Results		Pass



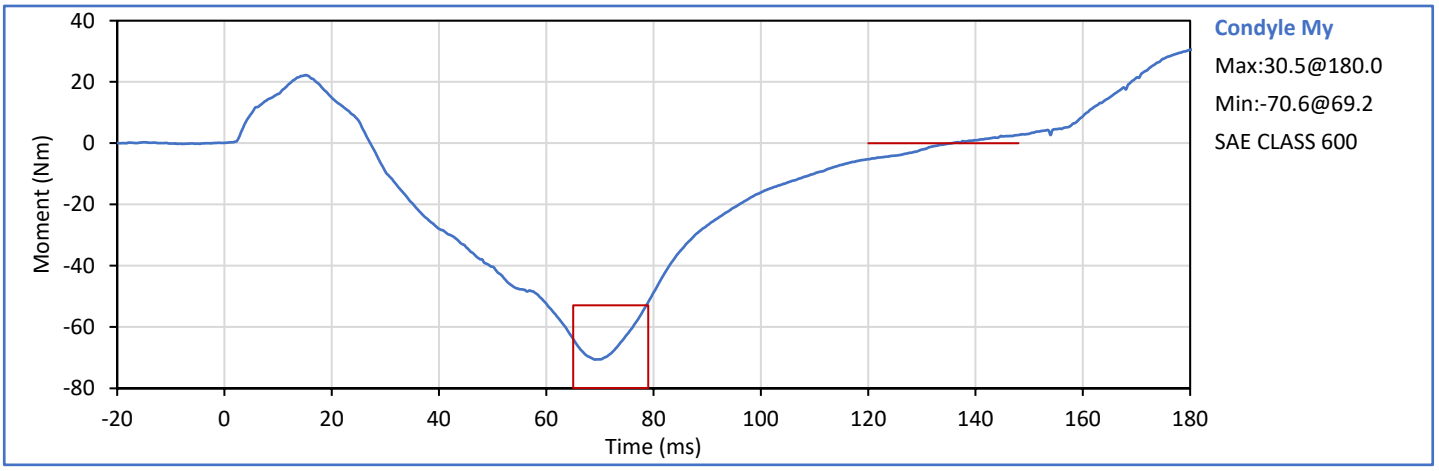


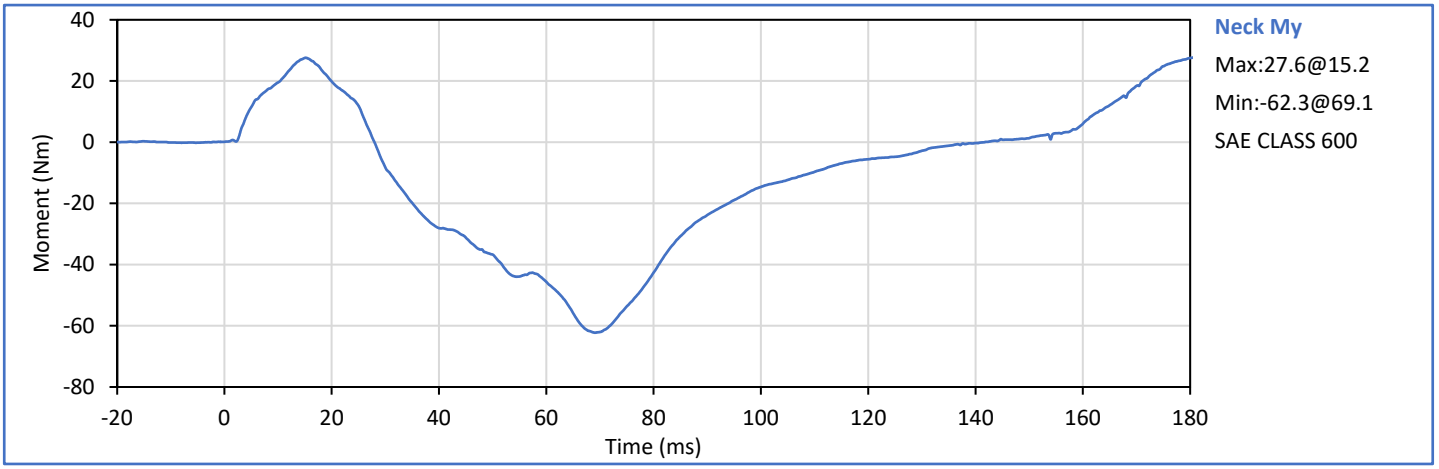
Technician: J. Hernandez

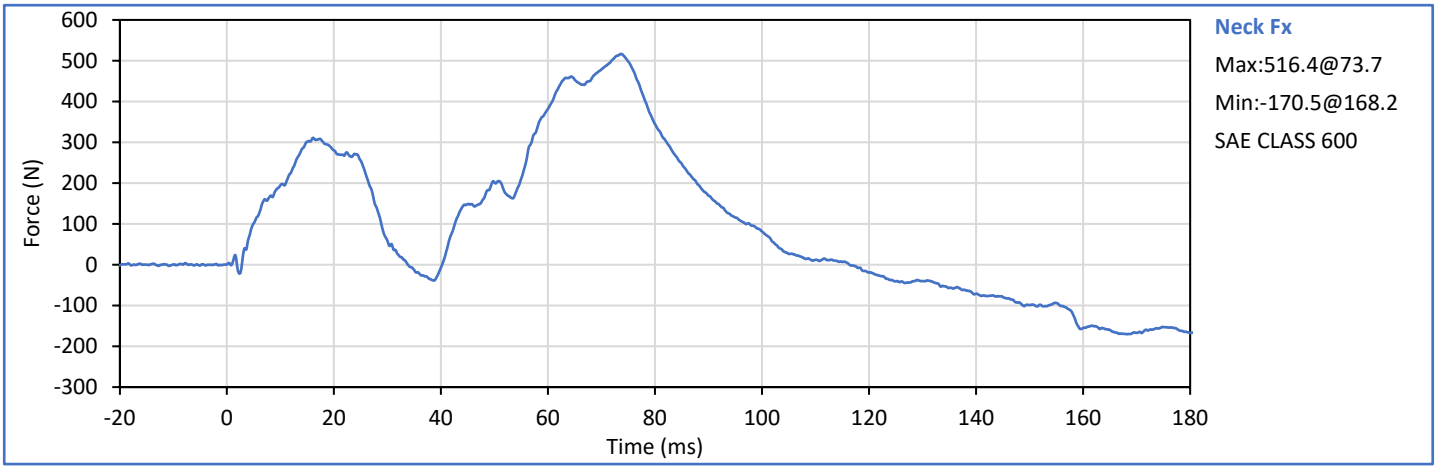
Approved By: P. Puzzuto

Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360 Test Date: 2021-10-04







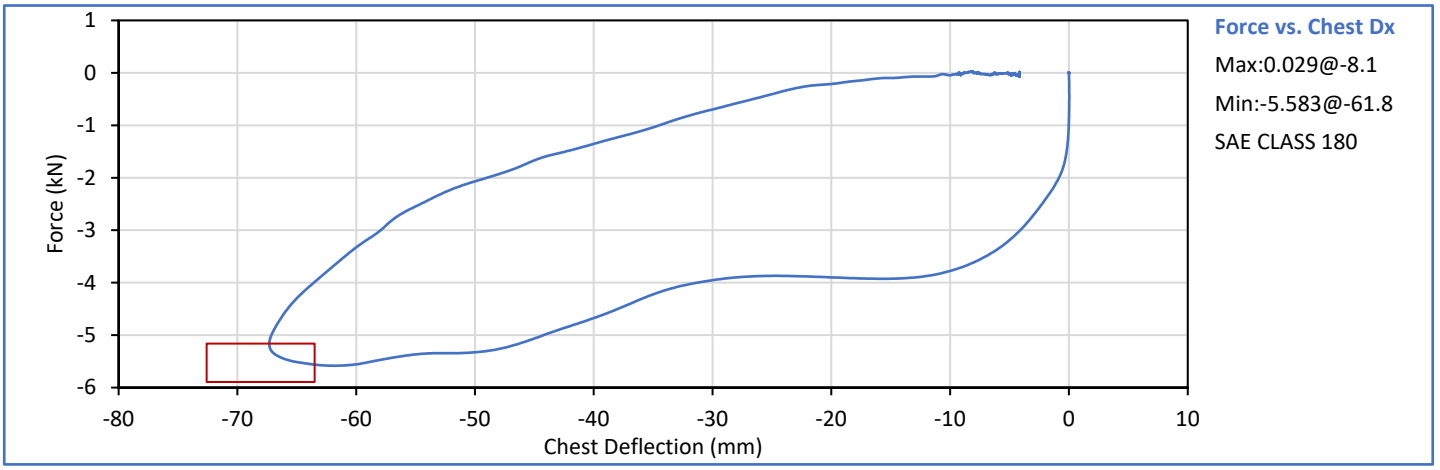
Applus IDIADA
KARCO

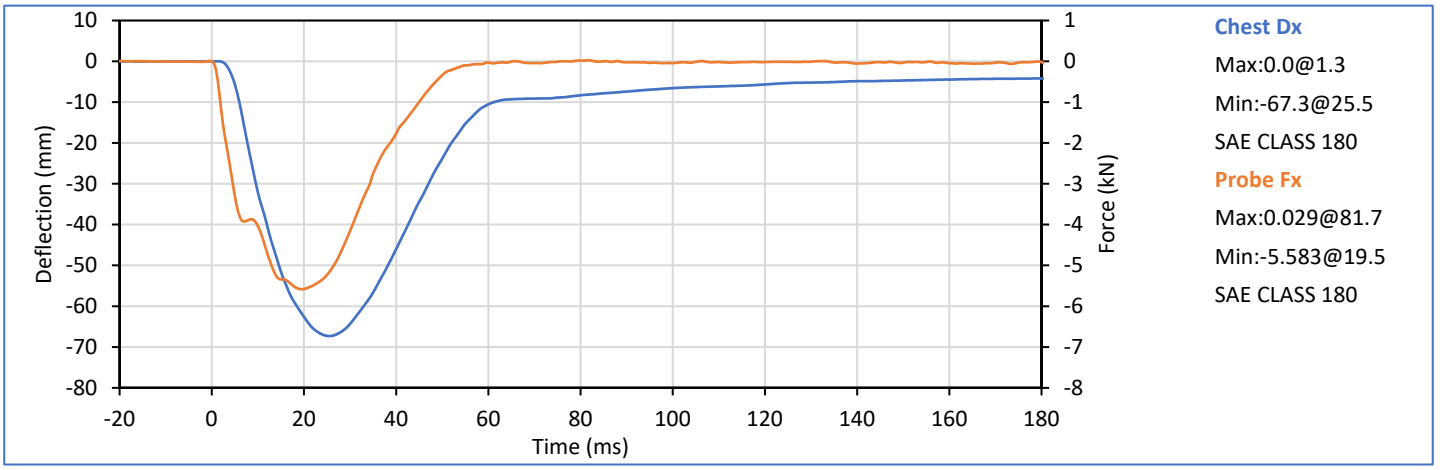
Hybrid III 50th Percentile Male ATD
Thorax Impact

ATD Serial No.: 360

Test Date: 2021-10-01

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	30	Pass
Probe Velocity	m/s	6.58	6.82	6.72	Pass
Peak Chest Deflection	mm	-72.6	-63.5	-67.3	Pass
Peak Probe Force	kN	-5.893	-5.159	-5.583	Pass
Internal Hysterisis	%	69.0	85.0	70.1	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

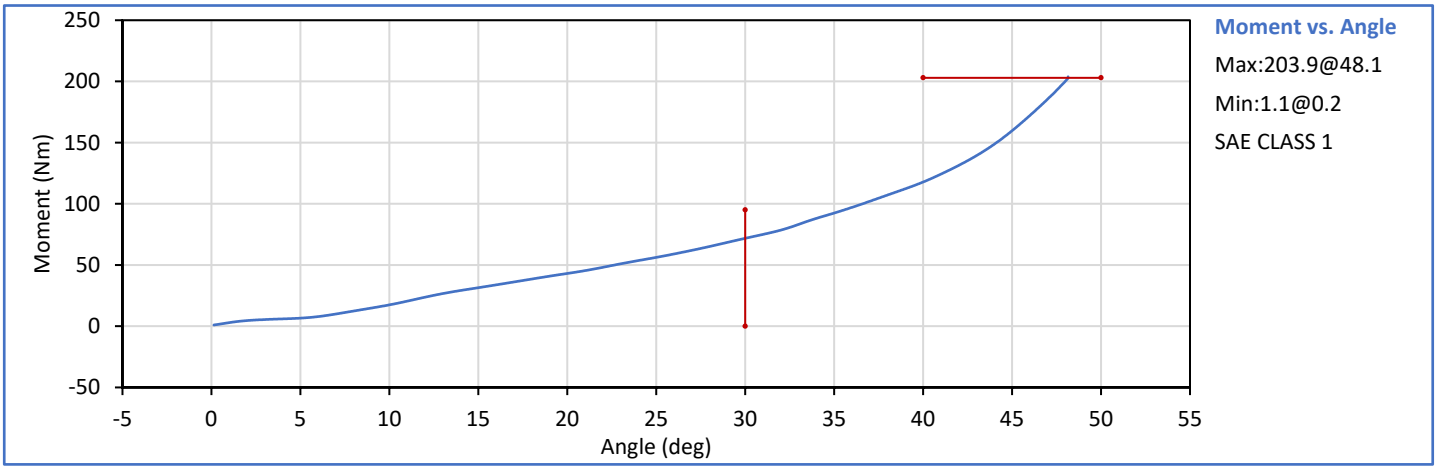
Approved By: P. Puzzuto

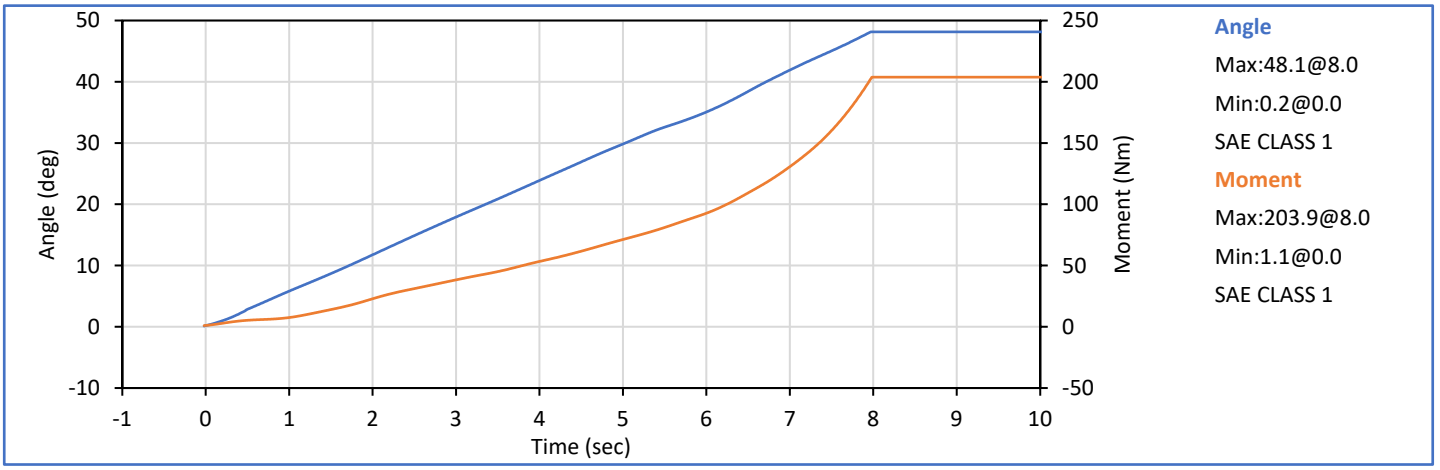
Applus IDIADA KARCO

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

ATD Serial No.: 360 Test Date: 2021-10-05

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	25	Pass
Left Hip Rotation Rate	deg/s	5.0	10.0	6.0	Pass
Left Femur Torque at 30°	Nm	0.0	95.0	71.7	Pass
Left Hip Rotation at 203 Nm	deg	40.0	50.0	48.1	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

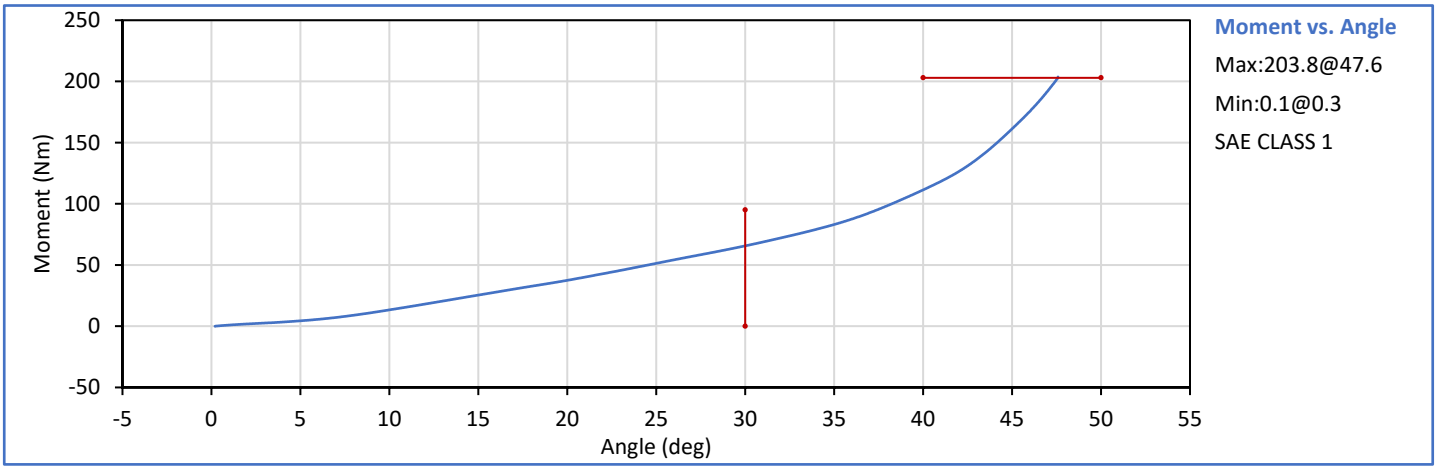
Approved By: P. Puzzuto

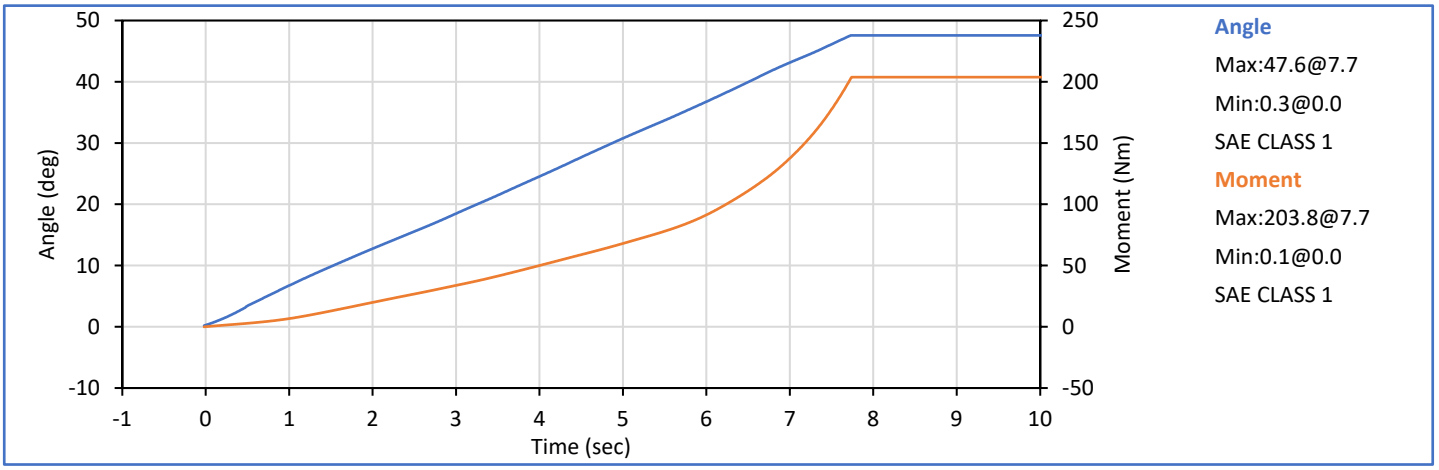
Applus IDIADA KARCO

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

ATD Serial No.: 360 Test Date: 2021-10-05

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	25	Pass
Right Hip Rotation Rate	deg/s	5.0	10.0	6.1	Pass
Right Femur Torque at 30°	Nm	0.0	95.0	65.5	Pass
Right Hip Rotation at 203 Nm	deg	40.0	50.0	47.6	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

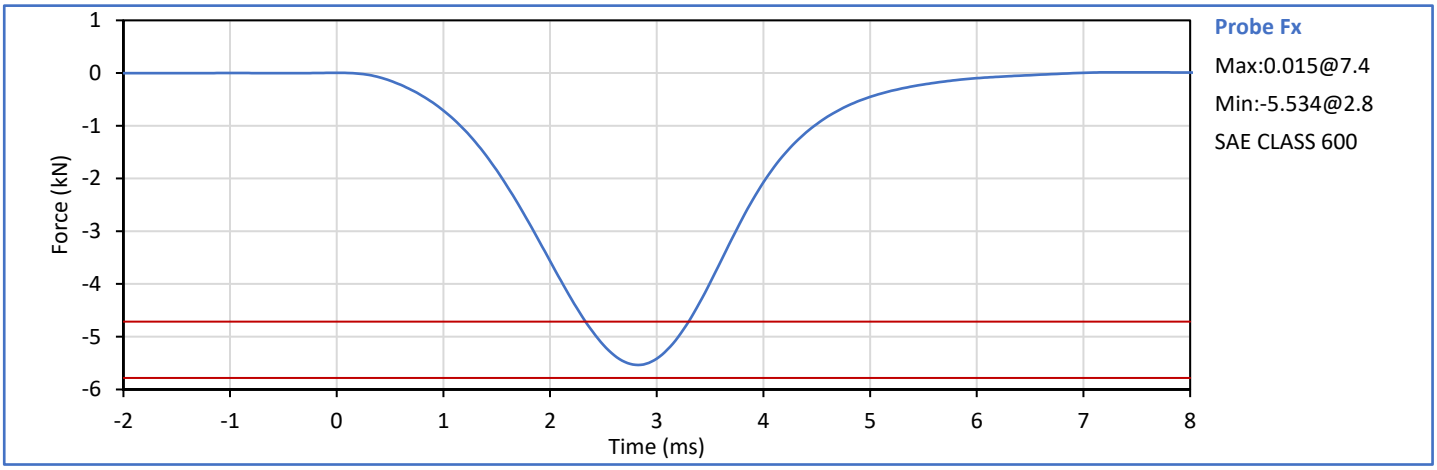
Applus IDIADA
KARCO

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

ATD Serial No.: 360

Test Date: 2021-10-04

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	20.9	Pass
Laboratory Relative Humidity	%	10	70	32	Pass
Probe Velocity	m/s	2.070	2.130	2.120	Pass
Peak Resistive Force	kN	-5.782	-4.715	-5.534	Pass
			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

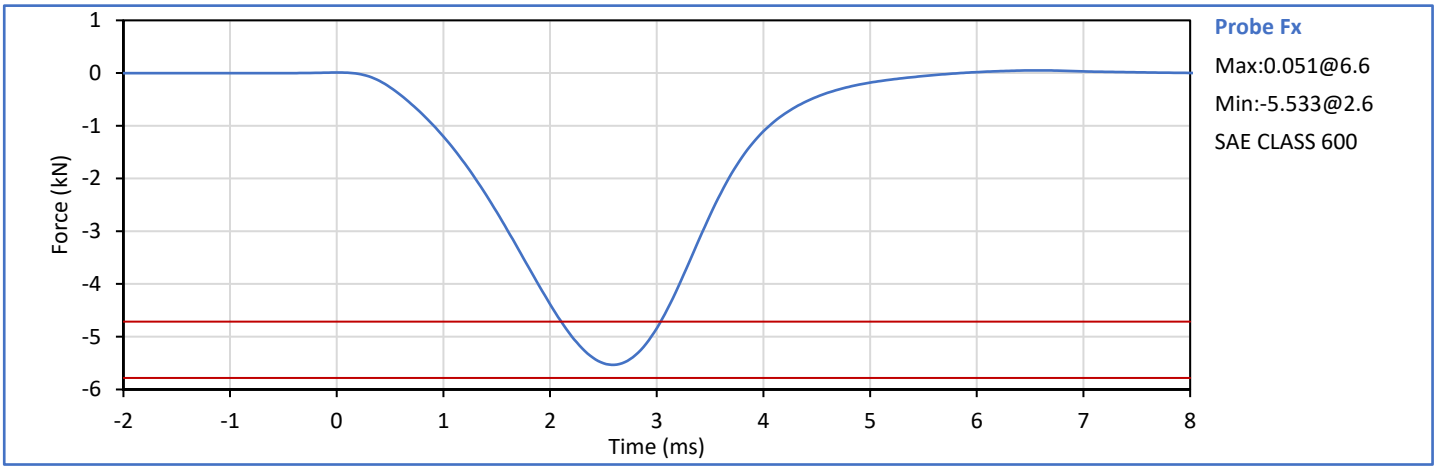
Applus IDIADA
KARCO

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

ATD Serial No.: 360

Test Date: 2021-10-04

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	20.8	Pass
Laboratory Relative Humidity	%	10	70	32	Pass
Probe Velocity	m/s	2.070	2.130	2.125	Pass
Peak Resistive Force	kN	-5.782	-4.715	-5.533	Pass
			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX C
Post-Test ATD Qualification and Performance Verification
Hybrid III 5th Percentile Female ATD
S/N: DH1644

Applus IDIADA
KARCO

Hybrid III 5th Percentile Female ATD
Damage Checklist

ATD Serial No.: DH1644 Test Date: 2021-10-01

Dummy Item	Inspect for	Comments	Damage	Okay
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

Hybrid III 5th Percentile Female ATD
External Measurements

ATD Serial No.: DH1644 Test Date: 2021-10-01

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.5	Pass
Laboratory Relative Humidity	%	10	70	26	Pass
A - Total sitting height	mm	775	800	790	Pass
B - Shoulder pivot height	mm	432	457	446	Pass
C - 'H' point height	mm	81	86	85	Pass
D - 'H' point location from backline	mm	145	150	148	Pass
E - Shoulder pivot from backline	mm	69	84	73	Pass
F - Thigh clearance	mm	119	135	130	Pass
G - Back of elbow to wrist pivot	mm	244	259	253	Pass
H - Head back to backline	mm	41	46	43	Pass
I - Shoulder to elbow length	mm	277	297	283	Pass
J - Elbow rest height	mm	183	203	194	Pass
K - Buttock to knee length	mm	521	546	527	Pass
L - Popliteal length	mm	356	376	365	Pass
M - Knee pivot height	mm	394	419	411	Pass
N - Buttock popliteal length	mm	414	439	425	Pass
O - Chest depth without jacket	mm	175	191	185	Pass
P - Foot length	mm	219	234	231	Pass
R - Buttock to Knee Pivot Length	mm	457	483	475	Pass
S - Head Breadth	mm	137	147	141	Pass
T - Head Depth	mm	178	188	182	Pass
U - Hip Breadth	mm	300	315	304	Pass
V - Shoulder breadth	mm	351	366	362	Pass
W - Foot breadth	mm	79	94	83	Pass
X - Head circum.	mm	528	549	537	Pass
Y - Chest circum. (w/chest jacket)	mm	851	881	864	Pass
Z - Waist circum.	mm	760	790	769	Pass
AA - Location for chest circum.	mm	333	358	337	Pass
BB - Location for waist circum.	mm	160	170	168	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

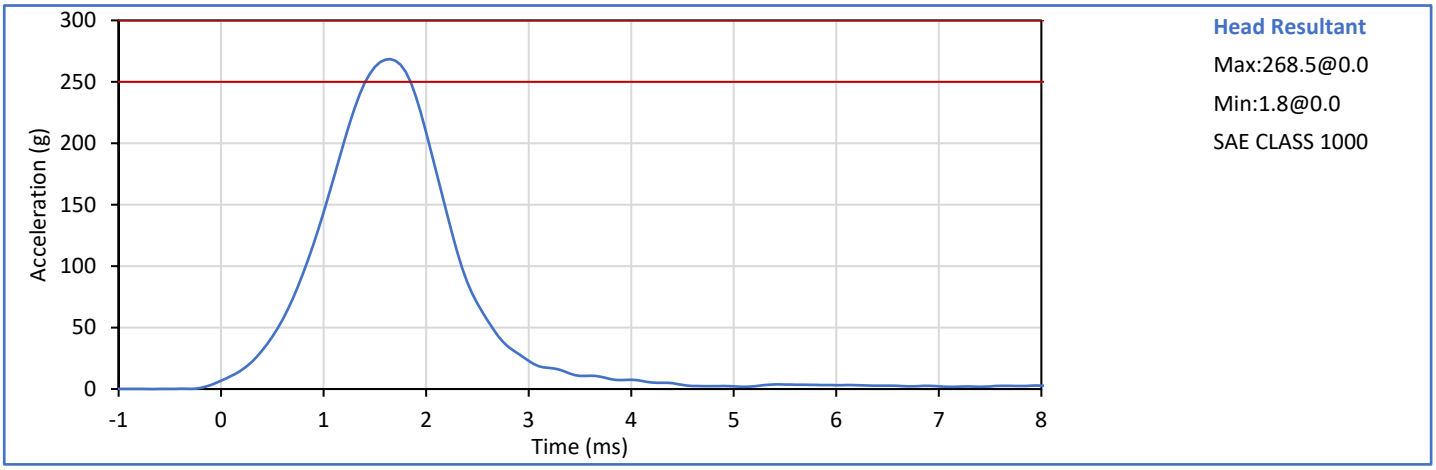
Applus IDIADA
KARCO

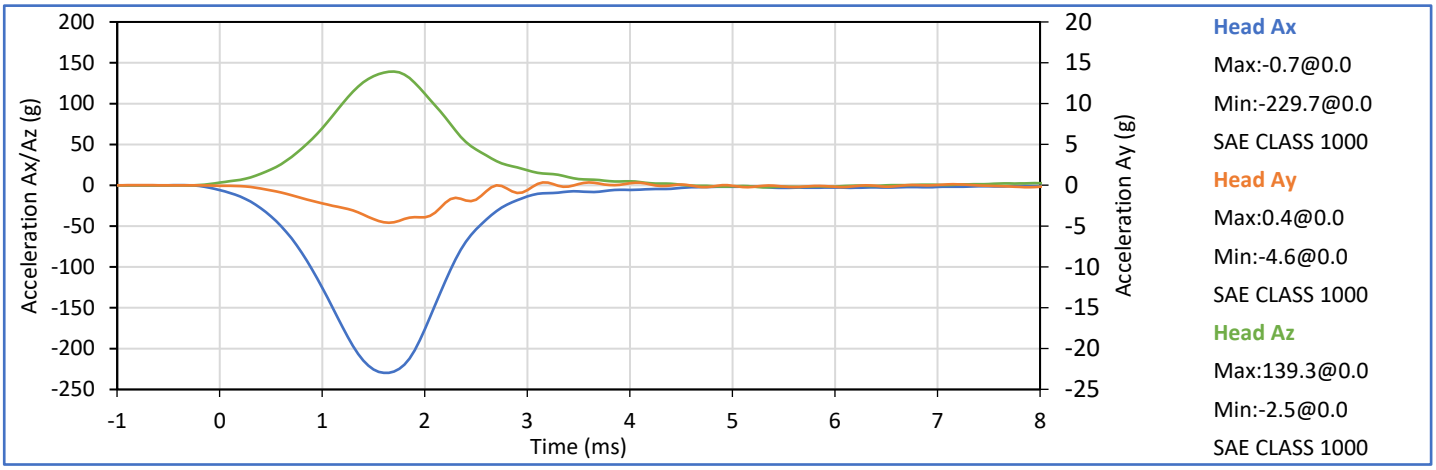
Hybrid III 5th Percentile Female ATD
Head Drop Test

ATD Serial No.: DH1644

Test Date: 2021-10-04

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.9	Pass
Laboratory Humidity	%	10	70	47	Pass
Peak Resultant Acceleration	g	250.0	300.0	268.5	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-4.6	Pass
Oscillations After Main Pulse	%	0.0	10.0	1.3	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

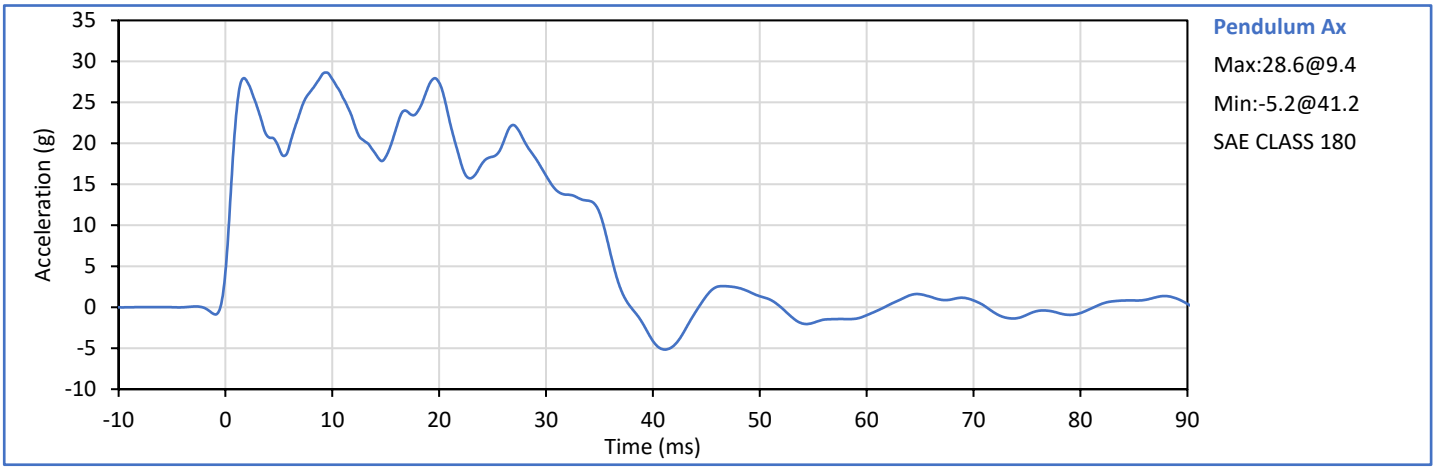
Approved By: P. Puzzuto

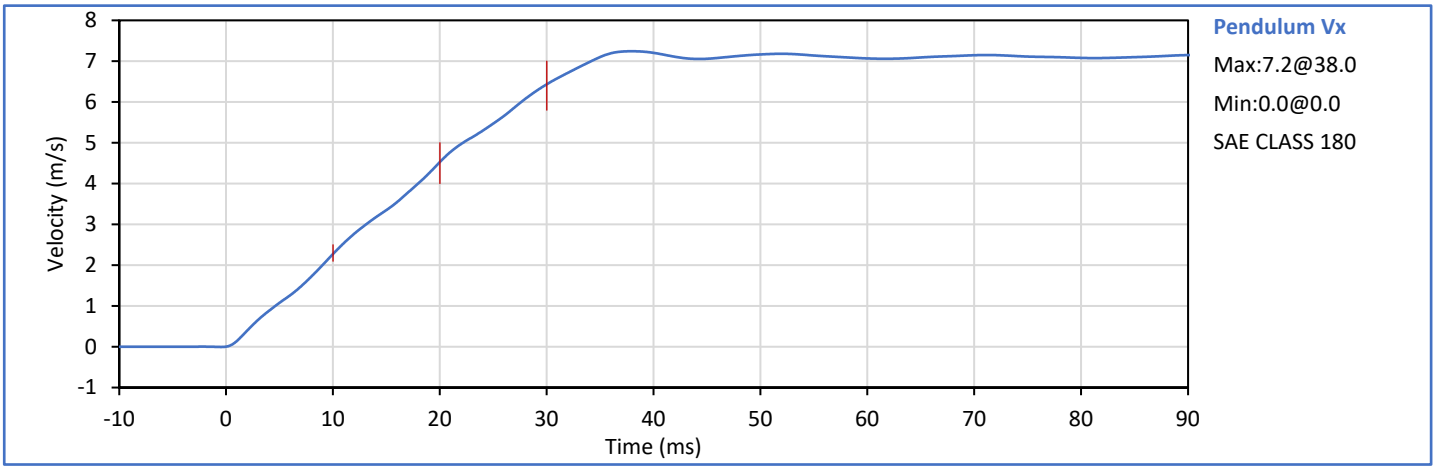
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: DH1644 Test Date: 2021-10-05

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Humidity	%	10	70	39	Pass
Pendulum Velocity	m/s	6.89	7.13	7.04	Pass
Pendulum Velocity at 10 ms	m/s	2.10	2.50	2.27	Pass
Pendulum Velocity at 20 ms	m/s	4.00	5.00	4.52	Pass
Pendulum Velocity at 30 ms	m/s	5.80	7.00	6.43	Pass
Peak "D" Plane Rotation	deg	77.0	91.0	81.5	Pass
Peak Moment in Rotation	Nm	69.0	83.0	76.0	Pass
Positive Moment Decay to 10 Nm	ms	80.0	100.0	83.2	Pass
			Overall Test Results		Pass





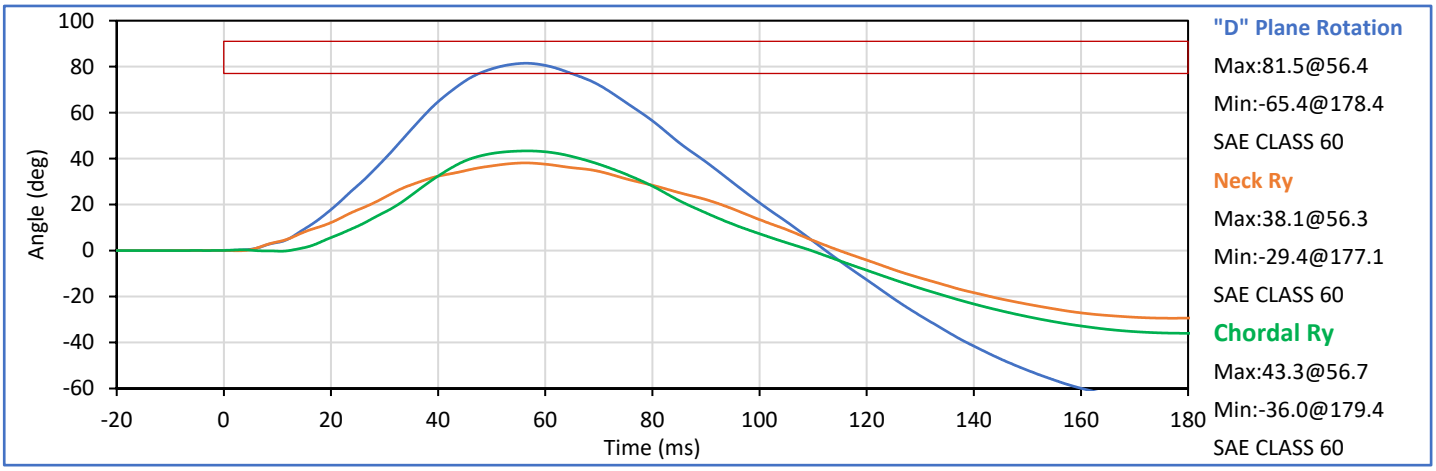
Technician: J. Hernandez

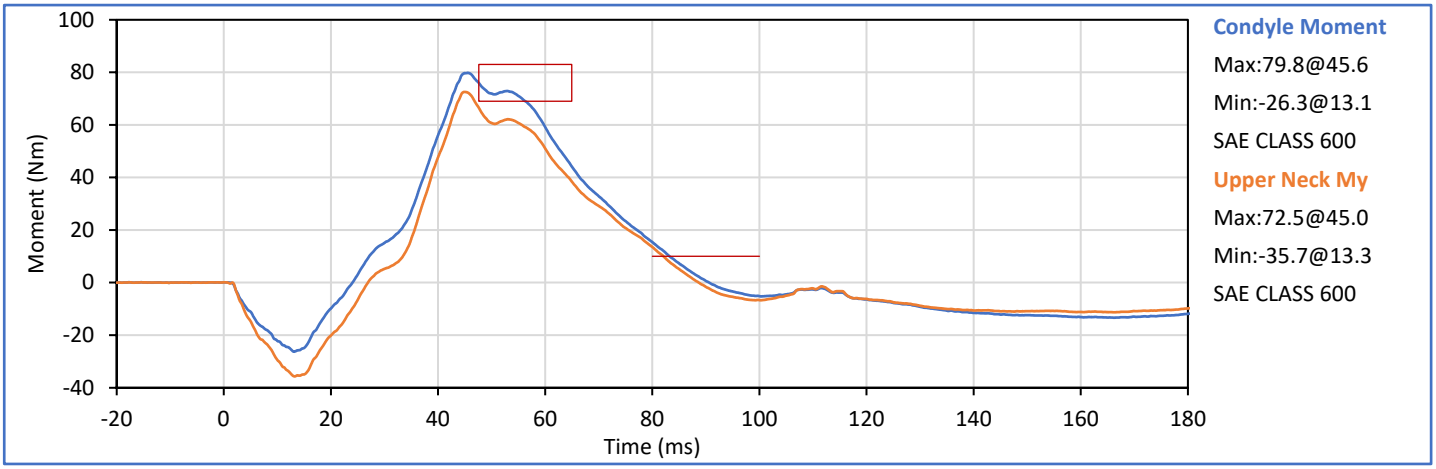
Approved By: P. Puzzuto

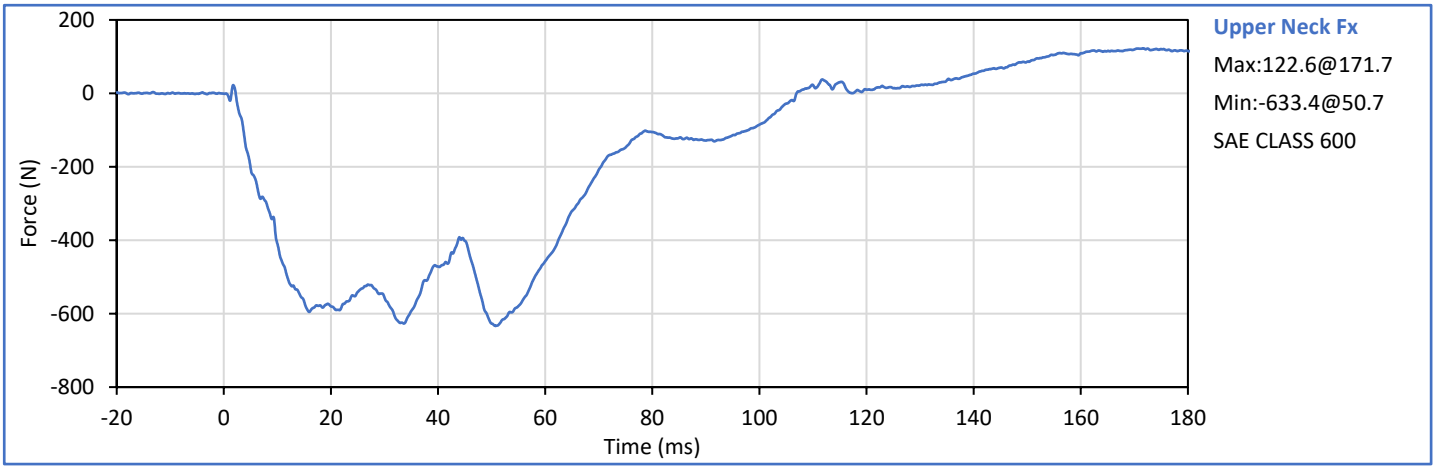
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: DH1644 Test Date: 2021-10-05





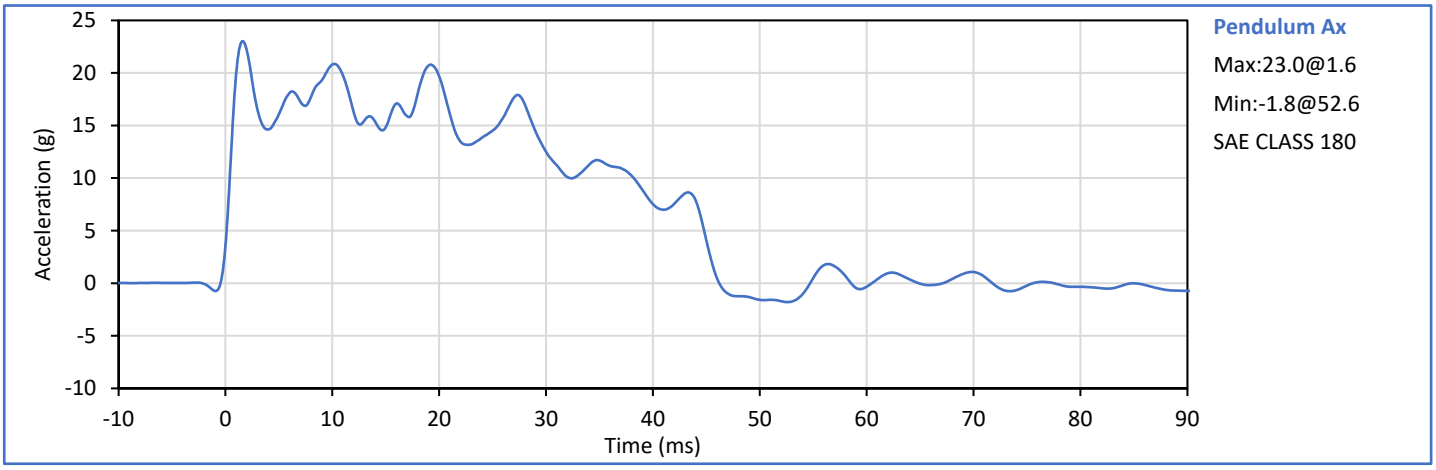


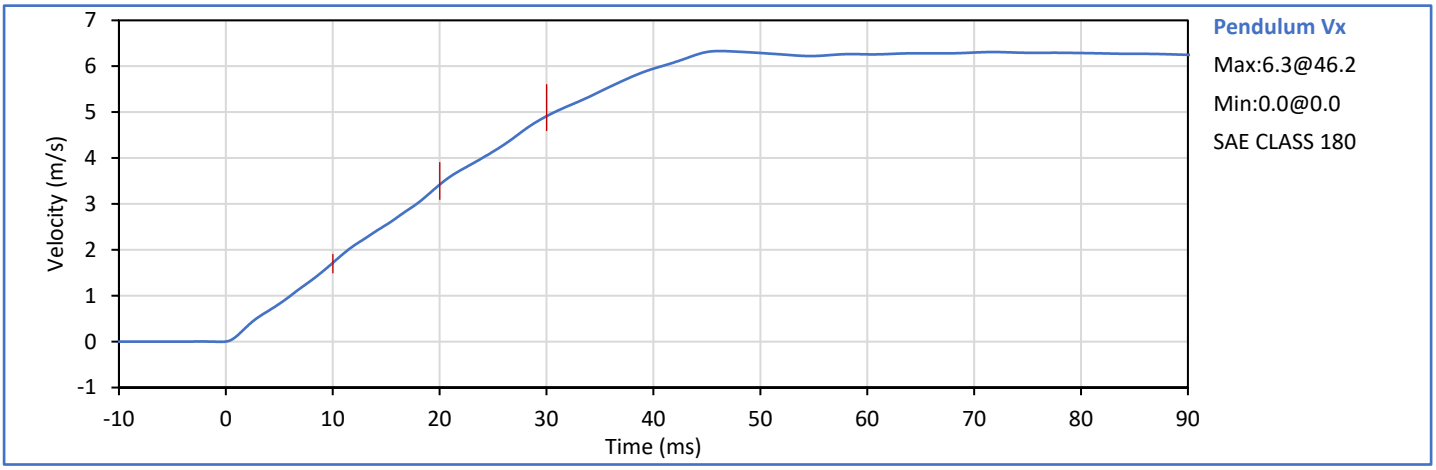
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Extension Test

ATD Serial No.: DH1644 Test Date: 2021-10-05

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Relative Humidity	%	10	70	39	Pass
Pendulum Velocity	m/s	5.95	6.19	6.06	Pass
Pendulum Velocity at 10 ms	m/s	1.50	1.90	1.71	Pass
Pendulum Velocity at 20 ms	m/s	3.10	3.90	3.42	Pass
Pendulum Velocity at 30 ms	m/s	4.60	5.60	4.91	Pass
Peak "D" Plane Rotation	deg	99.0	114.0	108.7	Pass
Peak Moment in Rotation	Nm	-65.0	-53.0	-59.4	Pass
Negative Moment Decay to -10 Nm	ms	94.0	114.0	98.5	Pass
			Overall Test Results		Pass





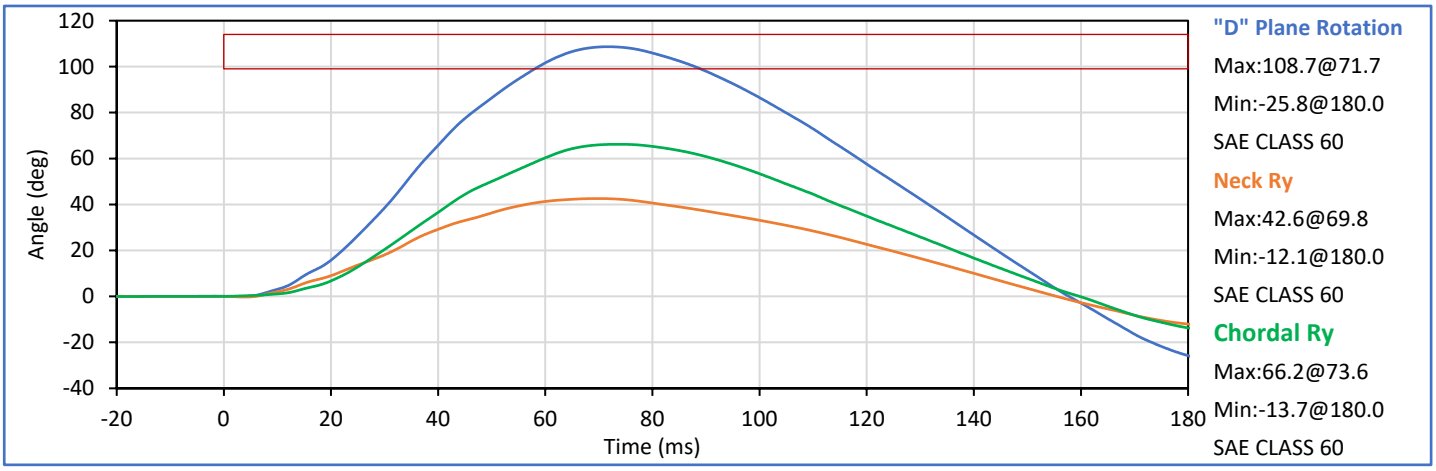
Technician: J. Hernandez

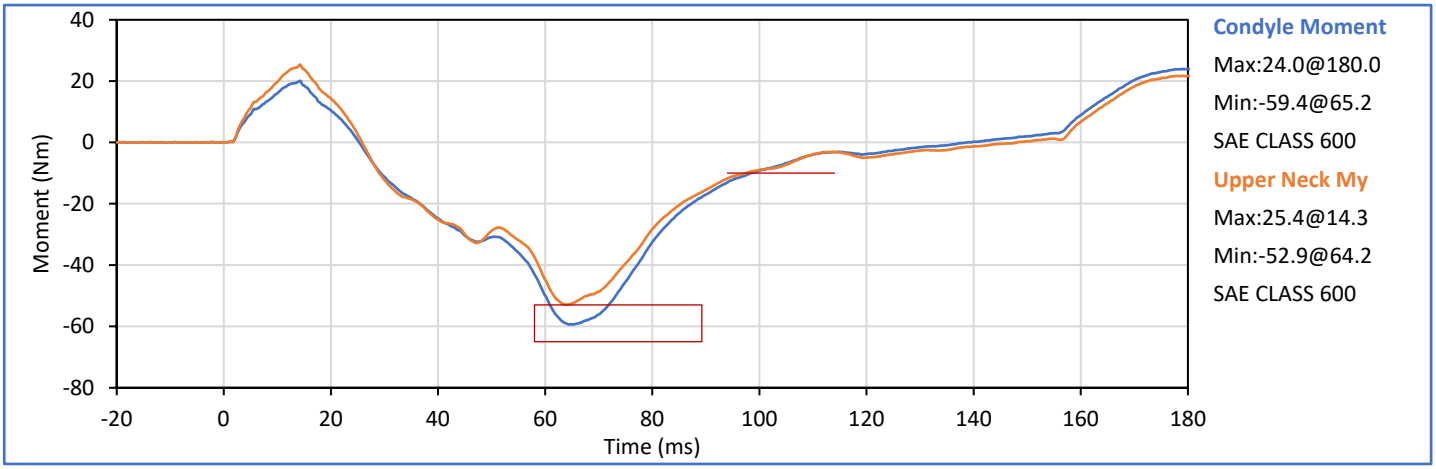
Approved By: P. Puzzuto

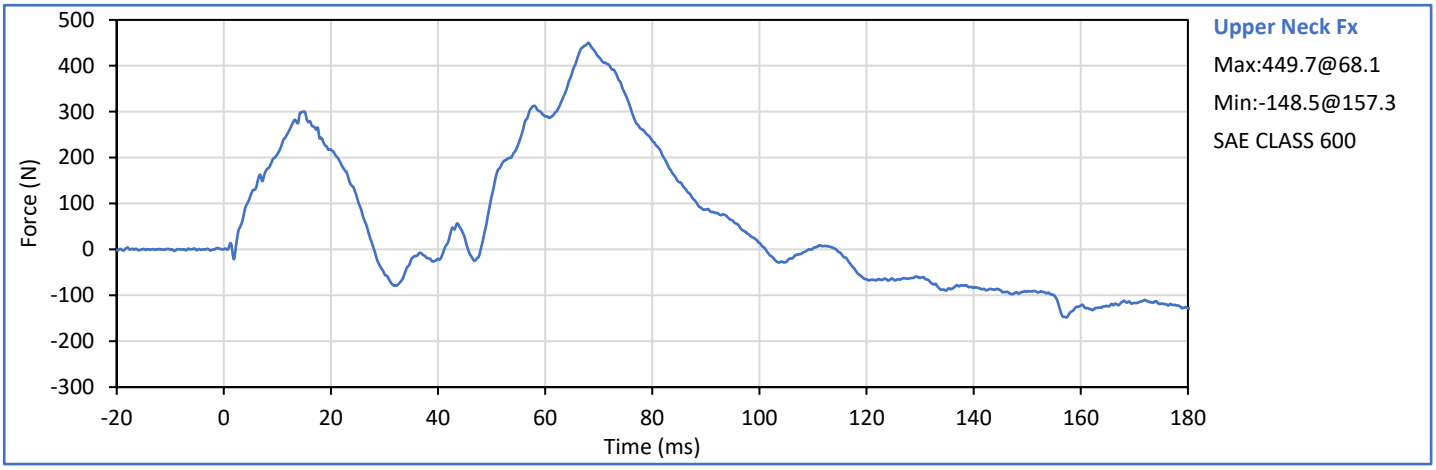
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Extension Test

ATD Serial No.: DH1644 Test Date: 2021-10-05







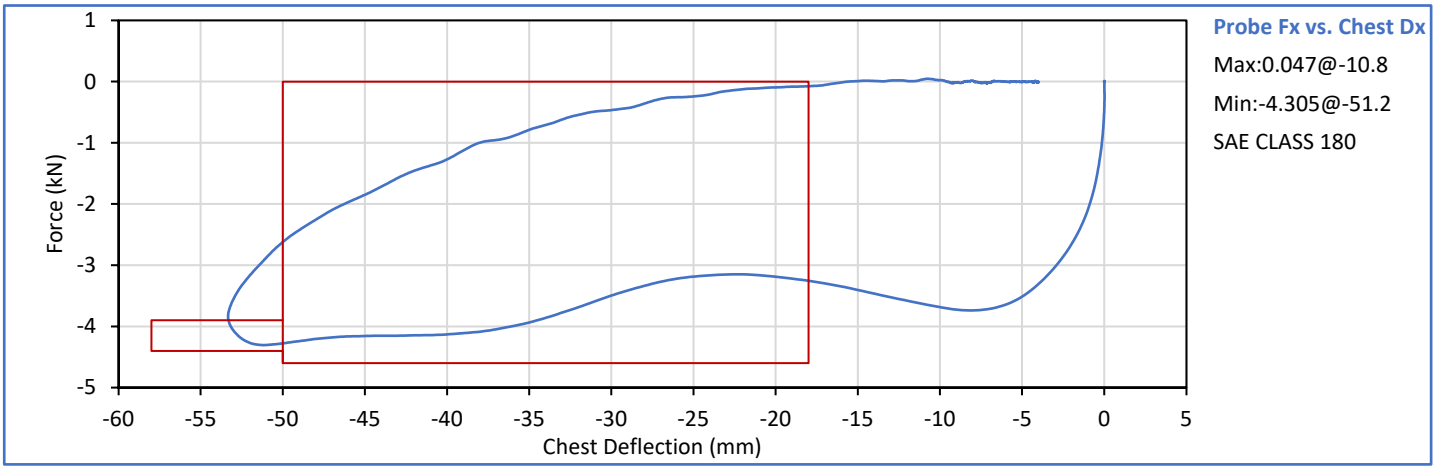
Applus IDIADA KARCO

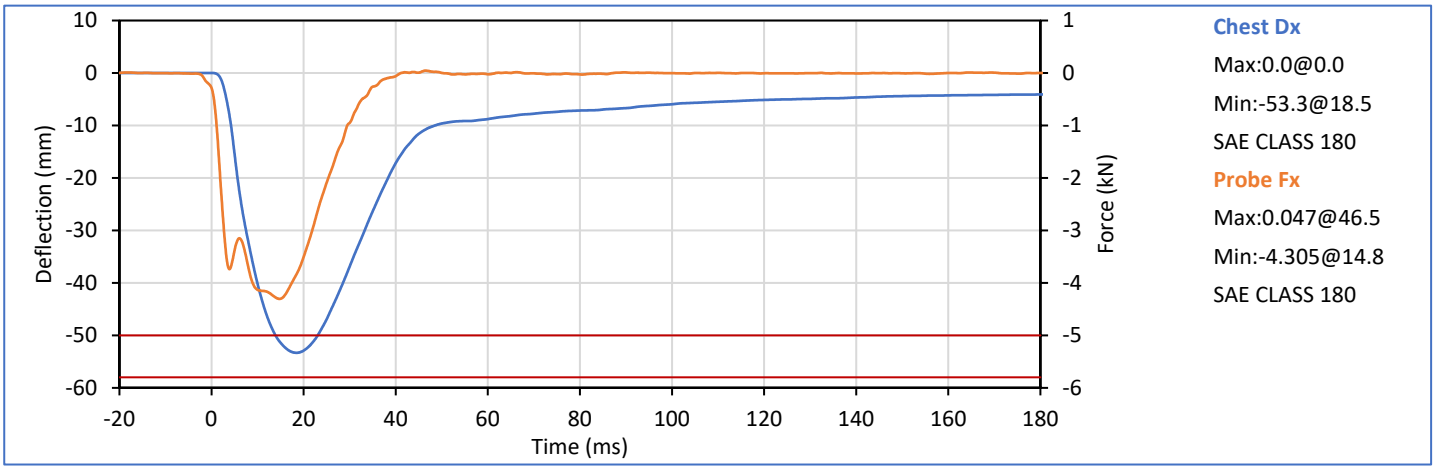
Hybrid III 5th Percentile Female ATD
Thorax Impact

ATD Serial No.: DH1644

Test Date: 2021-10-01

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.5	Pass
Laboratory RelativeHumidity	%	10	70	26	Pass
Probe Velocity	m/s	6.59	6.83	6.71	Pass
Peak Chest Deflection	mm	-58.0	-50.0	-53.3	Pass
Peak Probe Force, 50 and 58 mm	kN	-4.400	-3.900	-4.280	Pass
Peak Probe Force, 18 and 50 mm	kN	-4.600	0.000	-4.280	Pass
Internal Hysterisis	%	69.0	85.0	79.5	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

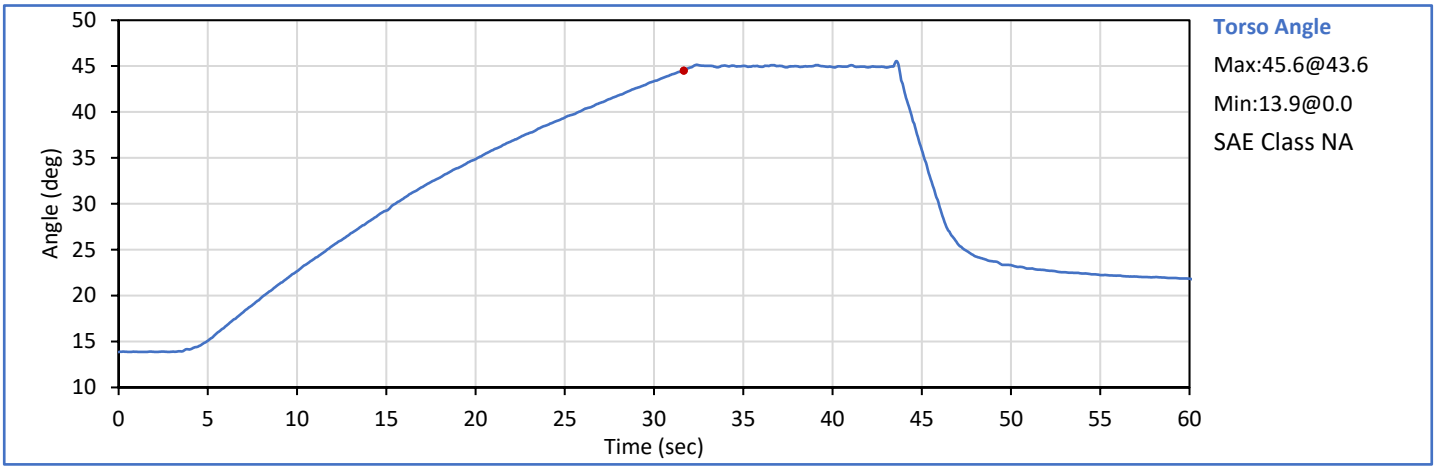
Approved By: P. Puzzuto

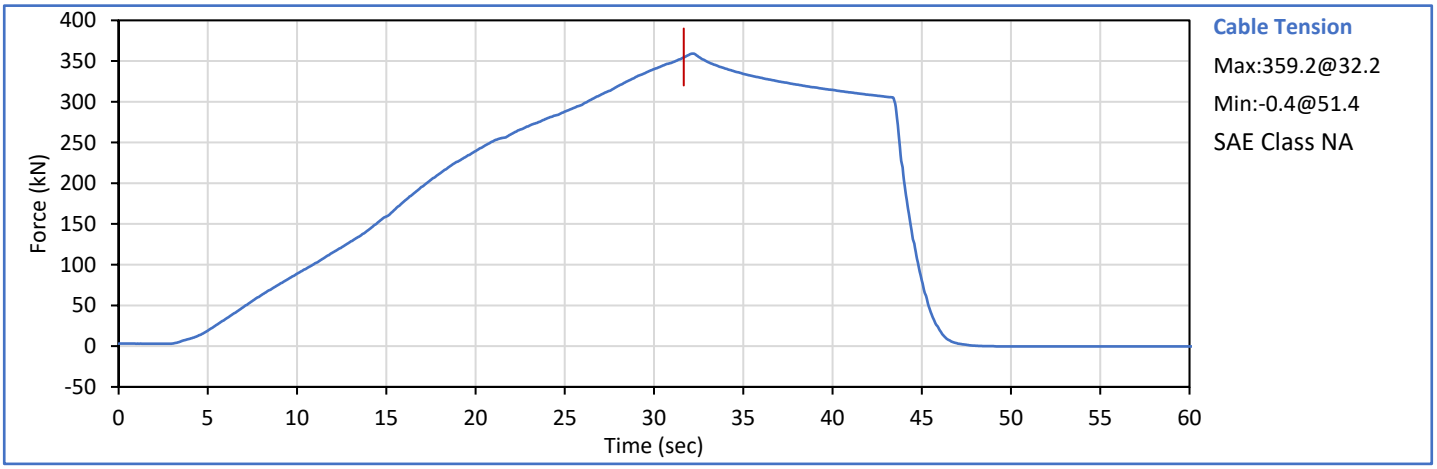
Applus IDIADA
KARCO

Hybrid III 5th Percentile Female ATD
Torso Flexion Test

ATD Serial No.: DH1644 Test Date: 2021-10-04

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.2	Pass
Laboratory Humidity	%	10	70	46	Pass
Orientation Angle	deg	0.0	20.0	14.3	Pass
Test Initial Angle	deg	11.0	19.0	13.9	Pass
Peak Force at 45° (+/-0.5°)	N	320.0	390.0	354.3	Pass
Torso Flexion Rate	deg/s	0.50	1.50	1.13	Pass
Final Reference Plane Angle	deg	-8.0	8.0	0.9	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

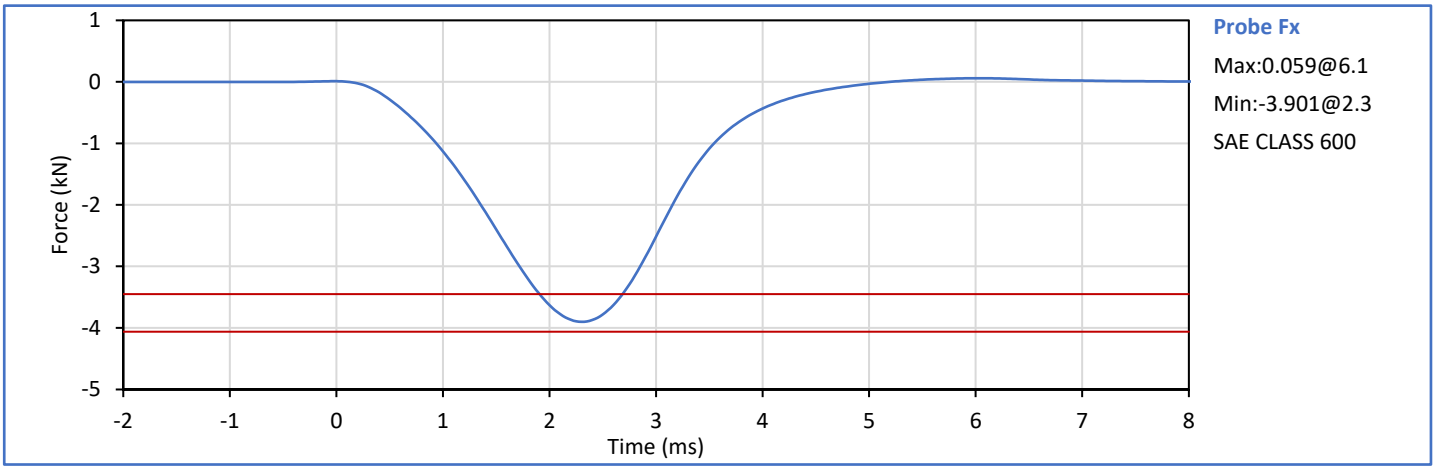
Applus IDIADA
KARCO

Hybrid III 5th Percentile Female ATD
Knee Impact (Left/Right)

ATD Serial No.: DH1644

Test Date: 2021-10-04

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	27	Pass
Probe Velocity	m/s	2.070	2.130	2.104	Pass
Peak Resistive Force	kN	-4.060	-3.450	-3.901	Pass
			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

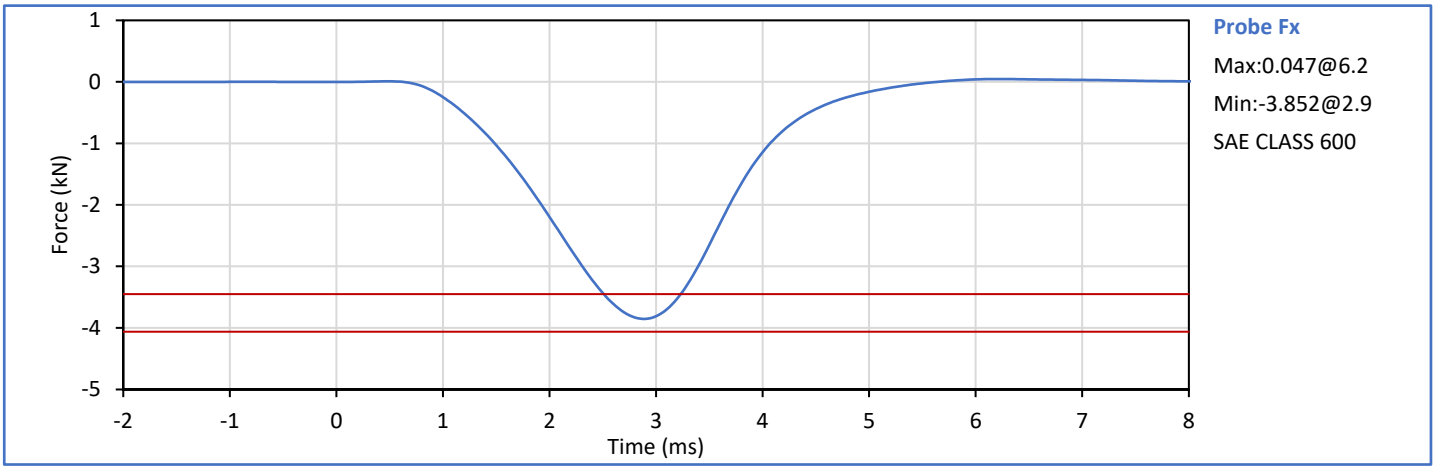
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Knee Impact (Left/Right)

ATD Serial No.: DH1644

Test Date: 2021-10-04

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	27	Pass
Probe Velocity	m/s	2.070	2.130	2.097	Pass
Peak Resistive Force	kN	-4.060	-3.450	-3.852	Pass
			Overall Test Results		Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

H3-50M ATD S/N: 360

Table 1 - Driver ATD Instrumentation

Sensor Location	Sensor S\N	Mfr	Model	Cal Date
Head Acceleration X Primary	P49209	Endevco	7264C-2k	2021-09-27
Head Acceleration Y Primary	P49228	Endevco	7264C-2k	2021-09-27
Head Acceleration Z Primary	P50101	Endevco	7264C-2k	2021-09-27
Head Acceleration X Redundant	P50103	Endevco	7264C-2k	2021-09-27
Head Acceleration Y Redundant	P49210	Endevco	7264C-2k	2021-09-27
Head Acceleration Z Redundant	P58713	Endevco	7264C-2k	2021-09-27
Head Rotation Rate X	ARS7449	DTS	ARS PRO-8k (2kHz)	2021-03-02
Head Rotation Rate Y	ARS7510	DTS	ARS PRO-8k (2kHz)	2021-03-02
Head Rotation Rate Z	ARS7573	DTS	ARS PRO-8k (2kHz)	2021-03-02
Upper Neck Force X	287 Fx	FTSS	IF-205	2021-04-09
Upper Neck Force Y	287 Fy	FTSS	IF-205	2021-04-09
Upper Neck Force Z	287 Fz	FTSS	IF-205	2021-04-09
Upper Neck Moment X	287 Mx	FTSS	IF-205	2021-04-09
Upper Neck Moment Y	287 My	FTSS	IF-205	2021-04-09
Upper Neck Moment Z	287 Mz	FTSS	IF-205	2021-04-09
Chest Acceleration X Primary	P52112	Endevco	7264C-2k	2021-09-01
Chest Acceleration Y Primary	P49208	Endevco	7264C-2k	2021-09-01
Chest Acceleration Z Primary	P51264	Endevco	7264C-2k	2021-09-01
Chest Acceleration X Redundant	P49461	Endevco	7264C-2k	2021-09-01
Chest Acceleration Y Redundant	P58774	Endevco	7264C-2k	2021-09-01
Chest Acceleration Z Redundant	P49168	Endevco	7264C-2k	2021-09-01
Chest Deflection	0606 (H3)	Servo	14CBI-3615	2021-09-01
Pelvis Acceleration X	P49238	Endevco	7264C-2k	2021-09-01
Pelvis Acceleration Y	P58877	Endevco	7264C-2k	2021-09-01
Pelvis Acceleration Z	P50087	Endevco	7264C-2k	2021-09-01
Left Femur Force Z	DS9756 (pri)	Humanetics	3821JLN2	2021-01-18
Right Femur Force Z	DS4141 (pri)	Humanetics	3821JLN2	2021-01-18
Left Femur Force Z Redundant	DS9756 (red)	Humanetics	3821JLN2	2021-01-18
Right Femur Force Z Redundant	DS4141 (red)	Humanetics	3821JLN2	2021-01-18
Left Upper Tibia Moment X	DH3309 Mx	FTSS	IF-857	2021-01-14
Left Upper Tibia Moment Y	DH3309 My	FTSS	IF-857	2021-01-14
Left Upper Tibia Force Z	DH3309 Fz	FTSS	IF-857	2021-01-14
Left Lower Tibia Moment X	DI4186 Mx	FTSS	IF-853	2021-01-14
Left Lower Tibia Moment Y	DI4186 My	FTSS	IF-853	2021-01-14
Left Lower Tibia Force Z	DI4186 Fz	FTSS	IF-853	2021-01-14
Right Upper Tibia Moment X	DG6679 Mx	FTSS	IF-857	2021-01-14
Right Upper Tibia Moment Y	DG6679 My	FTSS	IF-857	2021-01-14
Right Upper Tibia Force Z	DG6679 Fz	FTSS	IF-857	2021-01-14
Right Lower Tibia Moment X	405 Mx	R.A. Denton	3644	2021-01-14
Right Lower Tibia Moment Y	405 My	R.A. Denton	3644	2021-01-14
Right Lower Tibia Force Z	405 Fz	R.A. Denton	3644	2021-01-14
Left Ankle Acceleration X	03E20-N09	Entran	EGEB6Q-2k	2021-09-27
Left Ankle Acceleration Z	03D30-N13	Entran	EGEB6Q-2k	2021-09-27
Left Toe Acceleration Z	03H07-Z10	Entran	EGEB6Q-2k	2021-09-27
Right Ankle Acceleration X	03E29-N20	Entran	EGEB6Q-2k	2021-09-27
Right Ankle Acceleration Z	03E18-F02	Entran	EGEB6Q-2k	2021-09-27
Right Toe Acceleration Z	03D09-N01	Entran	EGEB6Q-2k	2021-09-27
Seat Belt Outside Lap Force	177	FTSS	IF-964	2020-10-02
Seat Belt Upper Diagonal Force	251	FTSS	IF-964	2020-10-02

H3-05F ATD S/N: DH1644

Table 2 - Right Front Passenger ATD Instrumentation

Sensor Location	Sensor S\N	Mfr	Model	Cal Date
Head Acceleration X Primary	P51889	Endevco	7264C-2k	2021-07-26
Head Acceleration Y Primary	P51861	Endevco	7264C-2k	2021-07-26
Head Acceleration Z Primary	P52077	Endevco	7264C-2k	2021-07-26
Head Acceleration X Redundant	P58835	Endevco	7264C-2k	2021-07-26
Head Acceleration Y Redundant	P51703	Endevco	7264C-2k	2021-07-26
Head Acceleration Z Redundant	P52096	Endevco	7264C-2k	2021-07-26
Head Rotation Rate X	ARS7367	DTS	ARS PRO-8k (2kHz)	2021-03-02
Head Rotation Rate Y	ARS7377	DTS	ARS PRO-8k (2kHz)	2021-03-02
Head Rotation Rate Z	ARS7498	DTS	ARS PRO-8k (2kHz)	2021-03-02
Upper Neck Force X	2185 Fx	R.A. Denton	1716ATF	2021-01-18
Upper Neck Force Y	2185 Fy	R.A. Denton	1716ATF	2021-01-18
Upper Neck Force Z	2185 Fz	R.A. Denton	1716ATF	2021-01-18
Upper Neck Moment X	2185 Mx	R.A. Denton	1716ATF	2021-01-18
Upper Neck Moment Y	2185 My	R.A. Denton	1716ATF	2021-01-18
Upper Neck Moment Z	2185 Mz	R.A. Denton	1716ATF	2021-01-18
Chest Acceleration X Primary	P58860	Endevco	7264C-2k	2021-07-26
Chest Acceleration Y Primary	P51876	Endevco	7264C-2k	2021-07-26
Chest Acceleration Z Primary	P58711	Endevco	7264C-2k	2021-07-26
Chest Acceleration X Redundant	P52049	Endevco	7264C-2k	2021-07-26
Chest Acceleration Y Redundant	P51862	Endevco	7264C-2k	2021-07-26
Chest Acceleration Z Redundant	P52048	Endevco	7264C-2k	2021-07-26
Chest Deflection	0724 (HF)	Servo	14CBI-3615	2021-06-14
Pelvis Acceleration X	P52090	Endevco	7264C-2k	2021-07-26
Pelvis Acceleration Y	P58849	Endevco	7264C-2k	2021-07-26
Pelvis Acceleration Z	P58756	Endevco	7264C-2k	2021-07-26
Left Femur Force Z	DS4137 (pri)	Humanetics	3821JLN2	2021-01-18
Right Femur Force Z	DS4139 (pri)	Humanetics	3821JLN2	2021-01-18
Left Femur Force Z Redundant	DS4137 (red)	Humanetics	3821JLN2	2021-01-18
Right Femur Force Z Redundant	DS4139 (red)	Humanetics	3821JLN2	2021-01-18
Left Upper Tibia Moment X	415 Mx	R.A. Denton	3643	2021-01-29
Left Upper Tibia Moment Y	415 My	R.A. Denton	3643	2021-01-29
Left Upper Tibia Force Z	415 Fz	R.A. Denton	3643	2021-01-29
Left Lower Tibia Moment X	365 Mx	R.A. Denton	3644	2021-01-29
Left Lower Tibia Moment Y	365 My	R.A. Denton	3644	2021-01-29
Left Lower Tibia Force Z	365 Fz	R.A. Denton	3644	2021-01-29
Right Upper Tibia Moment X	465 Mx	R.A. Denton	3643	2021-01-29
Right Upper Tibia Moment Y	465 My	R.A. Denton	3643	2021-01-29
Right Upper Tibia Force Z	465 Fz	R.A. Denton	3643	2021-01-29
Right Lower Tibia Moment X	493 Mx	R.A. Denton	3644	2021-01-29
Right Lower Tibia Moment Y	493 My	R.A. Denton	3644	2021-01-29
Right Lower Tibia Force Z	493 Fz	R.A. Denton	3644	2021-01-29
Left Ankle Acceleration X	P52057	Endevco	7264C-2k	2021-07-26
Left Ankle Acceleration Z	03E18-F07	Entran	EGEB6Q-2k	2021-07-26
Left Toe Acceleration Z	P49224	Endevco	7264C-2k	2021-07-26
Right Ankle Acceleration X	P52019	Endevco	7264C-2k	2021-07-26
Right Ankle Acceleration Z	P58755	Endevco	7264C-2k	2021-07-26
Right Toe Acceleration Z	P52076	Endevco	7264C-2k	2021-07-26
Seat Belt Outside Lap Force	300	FTSS	IF-964	2020-10-02
Seat Belt Upper Diagonal Force	313	FTSS	IF-964	2020-10-02

Table 3 - Vehicle Instrumentation

Sensor Location	Sensor S\N	Mfr	Model	Cal Date
Left Rear Primary Ax	A358693	MSI	52F-2k	2021-09-27
Right Rear Primary Ax	A358730	MSI	52F-2k	2021-09-27
Engine Top Ax	A356478	MSI	52F-2k	2021-09-27
Engine Bottom Ax	A298322	MSI	52F-2k	2021-06-22
Left Rear Az	A356295	MSI	52F-2k	2021-09-27
Right Rear Az	A359356	MSI	52F-2k	2021-09-27
Left Rear Redundant Ax	A358709	MSI	52F-2k	2021-09-27
Right Rear Redundant Ax	A356292	MSI	52F-2k	2021-09-27