REPORT NUMBER: NCAP-KAR-19-023

NEW CAR ASSESSMENT PROGRAM (NCAP)
FRONTAL BARRIER IMPACT TEST

KIA MOTORS CORPORATION
2019 KIA NIRO HYBRID LX 5-DOOR MPV

NHTSA NUMBER: M20194209

PREPARED BY:
APPLUS IDIADA KARCO ENGINEERING, LLC.
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JUNE 4, 2019

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
1200 NEW JERSEY AVE, SE
ROOM W43-410
WASHINGTON, DC 20590

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Approval Date: June 4, 2019

FINAL REPORT ACCEPTANCE BY OCWS:

_____

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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-19-023		

4. Title and Subtitle	5. Report Date
Final Report of New Car Assessment Program Testing of a 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No. M20194209	June 4, 2019
	6. Performing Organization Code KAR
7. Authors Mr. Amjad A. Jadallah, Project Engineer, Applus IDIADA KARCO Mr. Steven D. Matsusaka, Engineering Manager, Applus IDIADA KARCO	**8. Performing Organization Report No.** TR-P39145-01-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. DTNH22-12-D-00259
12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards 1200 New Jersey Ave., SE, Room W43-410 Washington, D.C. 20590	**13. Type of Report and Period Covered** Final Test Report, May 20 - June 4, 2019
	14. Sponsoring Agency Code NRM-110

15. Supplementary Notes

16. Abstract

A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2019 Kia Niro Hybrid LX 5-door MPV in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and footwell intrusion performance. The test was conducted at the Applus IDIADA KARCO Engineering, LLC. facility in Adelanto, California on May 20, 2019.

The impact velocity of the vehicle was 56.56 km/h and the ambient temperature at the barrier face at the time of impact was 22.2°C. The target vehicle's post-test maximum crush was 548 mm at DPD 4 right of 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	139.4	700	223.9
Maximum Chest Compression	mm	63	-28	52	-12
Nij	N/A	1	0.27	1	0.80
Neck Tension	N	4170	1294.5	2620	920.3
Neck Compression	N	4000	-163.1	2520	-278.4
Left Femur Force	N	10000	-330.4	6800	-639.0
Right Femur Force	N	10000	-1198.6	6800	-58.6

17. Key Words	18. Distribution Statement
35 mph Frontal Barrier Impact Test New Car Assessment Program (NCAP)	Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 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	136	

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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 DTNH22-12-D-00259. 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 Frontal NCAP Laboratory Test Procedure, dated October 2015.

SUMMARY

A load cell barrier consisting of 176 load cells was impacted by a 2019 Kia Niro Hybrid LX 5-door MPV at a velocity of 56.56 km/h. The test was performed at Applus IDIADA KARCO Engineering, LLC. on May 20, 2019. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A of this report.

Three (3) 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 572E 50th percentile male anthropomorphic test device (ATD) was placed in the driver seating position and one Part 572O 5th percentile female ATD was placed in the right-front passenger seating position according to dummy placement instructions specified in the Frontal NCAP Laboratory Test Procedure.

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. 141) were calibrated prior to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 102 channels of dummy and vehicle response data were recorded on an on-board data acquisition system. Appendix B contains the dummy response data traces.

There was 100% windshield retention and no intrusion into the protected zone of the windshield during the event.

The maximum static crush was 548 mm at DPD 4 right of 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 torso contacted the frontal airbag. The left knee contacted the knee airbag and steering column. The right knee contacted the knee airbag and the steering column.

The passenger's visible contact points were as follows: The passenger ATD's head contacted the frontal airbag and headrest. The upper torso contacted the frontal airbag. Both left and right knees contacted the knee bolster.

The occupant data is summarized below:

ATD Position	HIC_{15}	T^1 (ms)	T^2 (ms)	Chest Disp. (mm)	Nij	Neck Tension (N)	Neck Comp. (N)	Left Femur (N)	Right Femur (N)
Driver (50th)	139.4	54.1	69.1	-28	0.27	1294.5	-163.1	-330.4	-1198.6
Passenger (5th)	223.9	69.8	84.8	-12	0.80	920.3	-278.4	-639.0	-58.6

Upon impact the rear hatch of the vehicle opened. The Passenger Left Foot Fore Acceleration Z channel data was questionable. The Driver Left Lower Tibia Force Z, Barrier Load Cell LC1103 Moment Z, and Barrier Load Cell LC0803 Force X channels failed and no data was collected.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

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: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	M20194209
Model Year	2019
Make	Kia
Model	Niro Hybrid LX
Body Style	5-Door MPV
VIN	KNDCB3LC5K5243579
Body Color	Silver
Odometer Reading (km / mi)	148 / 92
Engine Displacement (L)	1.6
Type / No. of Cylinders	Inline 4 Cylinder
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	6
Overdrive	Yes
Final Drive	FWD
Roof Rack	No
Sunroof / T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADLs)	Yes

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

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

DATA FROM CERTIFICATION LABEL

Manufactured By	Kia Motors Corporation
Date of Manufacture	Oct-18

GVWR (kg)	1900
GAWR Front (kg)	1052
GAWR Rear (kg)	908

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

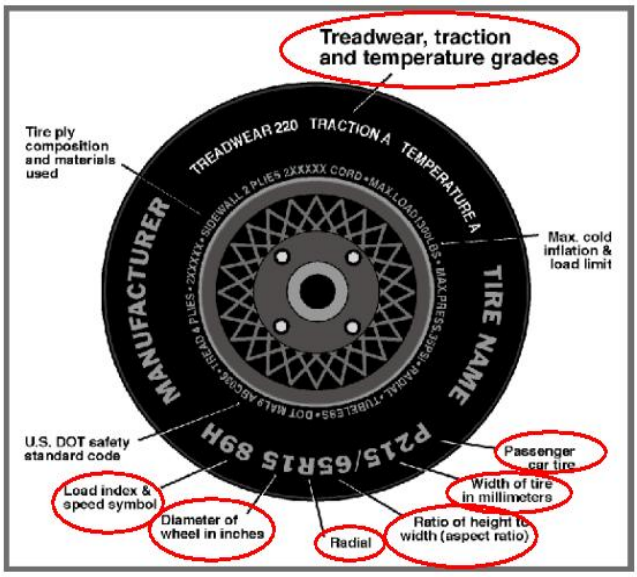
Measured Parameter	Front	Rear	Third	Total	
Type of Seats	Bucket	Split Bench			
Designated Seating Capacity	2	3		5	
Capacity Weight (VCW) (kg)				385.0	*A*
DSC x 68.04 (kg)				340.2	*B*
Cargo Weight (RCLW) (kg)				44.8	*A-B*

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	250	250
Recommended Tire Size	P205/60R16	P205/60R16
Tire Size on Vehicle	P205/60R16	P205/60R16
Tire Manufacturer	Michelin	Michelin
Tire Model	Energy Saver A/S	Energy Saver A/S
Treadwear	480	480
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 1 Polyamide, 2 Steel	1 Polyester, 1 Polyamide, 2 Steel
Load Index / Speed Symbol	92H	92H
Tire Material	Polyester, Polyamide, Steel	Polyester, Polyamide, Steel
DOT Safety Code Left	B37R 04MX 5317	B37R 04MX 5317
DOT Safety Code Right	B37R 04MX 5317	B37R 04MX 5317

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

TEST VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	437.0	287.0		477.0	356.0	
Right	kg	428.5	275.0		447.0	327.0	
Ratio	%	60.6%	39.4%	100.0%	57.5%	42.5%	100.0%
Total	kg	865.5	562.0	1427.5	924.0	683.0	1607.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1427.5	A
Weight of 1 P572E ATD & 1 P572O ATD	kg	141.0	B
Rated Cargo/Luggage Weight (RCLW)	kg	44.8	C
Calculated Vehicle Target Weight (TVTW)	kg	1613.3	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	735	735	738	740	1063
As Tested	mm	707	708	693	698	1148
Post-Test	mm	730	718	684	689	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheelbase	mm	2700
Total Vehicle Length at Left Side	mm	3775
Total Vehicle Length at Centerline	mm	4345
Total Vehicle Length at Right Side	mm	3773
Weight of Ballast in Cargo Area	kg	74.5
Weight of Vehicle Components Removed	kg	10.0
Amount of Stoddard Solvent in Fuel Tank	L	41.82

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

Rear Trim (13.0 kg), Rear Headrest (2.0 kg), Underbody Front Trim (4.0 kg)

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

TARGET VEHICLE STRUCTURAL MEASUREMENTS

No.	Description	Pre-Test
1	Total Length	4345
2	Total Width	1800
3	Bumper Top Height	608
4	Bumper Bottom Height	305
5	Longitudinal Member Top Height	550
6	Distance Between Longitudinal Members	910
7	Longitudinal Member Width	70
8	Engine Top Height	825
9	Engine Bottom Height	219
10	Engine and Gearbox Width	450
11	Front Bumper to Engine Distance	355
12	Front Shock Absorber Fixing Height	905
13	Bonnet Leading Edge Height	870
14	Front Shock Absorber Fixing Width	1240
15	Front Bumper to Front Axle Distance	865
16	Front Axle to A-Pillar Distance	1345
17	A-Pillar to B-Pillar Distance	1014
18	B-Pillar to Rear Axle Distance	1140
19	B-Pillar to C-Pillar Distance	876
20	Roof Sill Bottom Height	1385
21	Roof Sill Top Height	1495
22	Floor Sill Bottom Height	350
23	Floor Sill Top Height	225

All measurements in millimeters.

DATA SHEET NO. 2

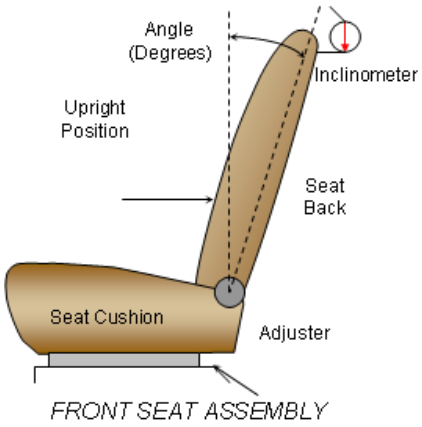
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

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 headrest post.

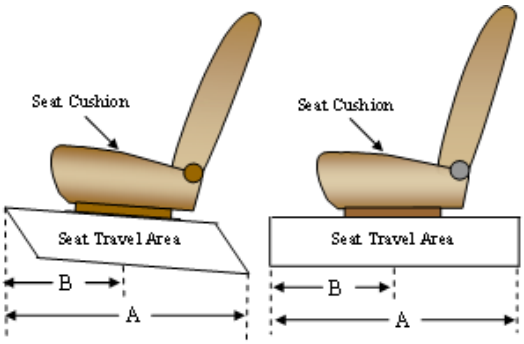


SEAT BACK ANGLE

Seating Position	Degrees
Driver Seat Back Angle	1.7
Passenger Seat Back Angle	0.7

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	63 Detents	Detent 25
Passenger Seat	63 Detents	Detent 0

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 "H" is the uppermost position, followed by position "M", and Position "L" is the lowermost position.

SEAT BELT UPPER ANCHORAGES

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

DATA SHEET NO. 2 … (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

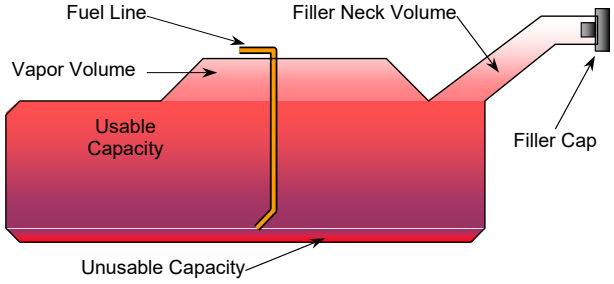
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank"	45.00
Usable Capacity of "Optional Tank"	
92 - 94% of Usable Capacity	41.4 to 42.3
Actual Amount of Stoddard Solvent Used	41.82
1/3 of Usable Capacity	15.00

FUEL PUMP

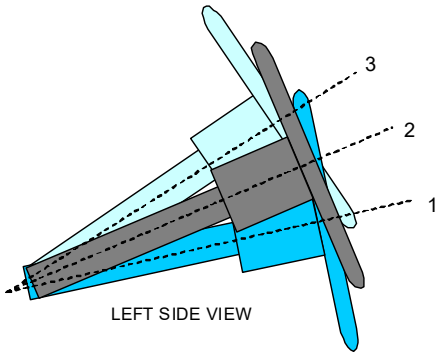
The vehicle is equipped with an electric fuel pump. The fuel pump starts when the ignition is on.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

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



STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITIONING

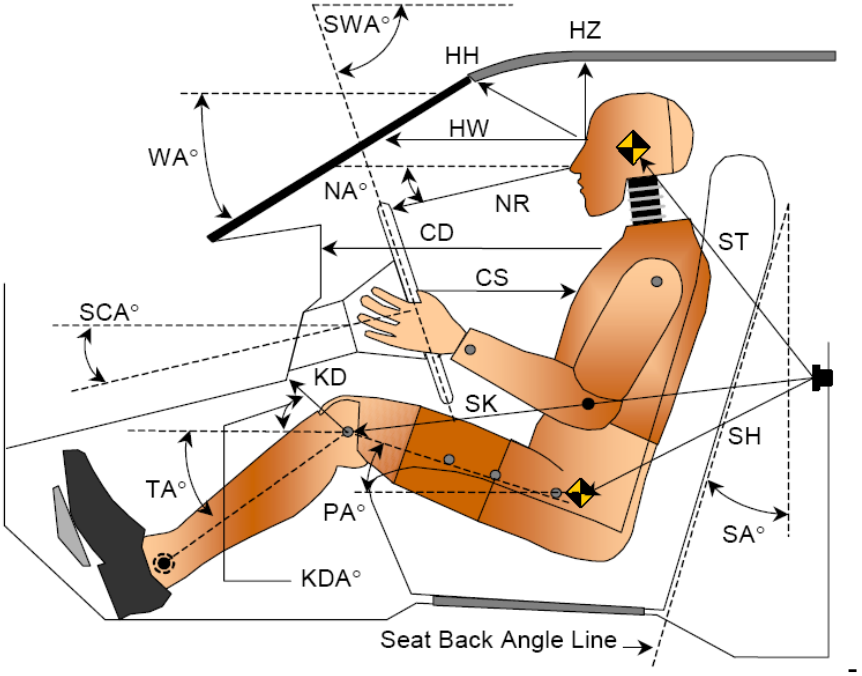
	Degrees	Fore-Aft Position (mm)
Lowermost Position, No. 1	22.2	88
Geometric Center Position, No. 2	24.7	113
Uppermost Position, No. 3	27.2	137
Telescoping Steering Wheel Travel		49
Test Position	24.7	113

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19



LEFT SIDE VIEW

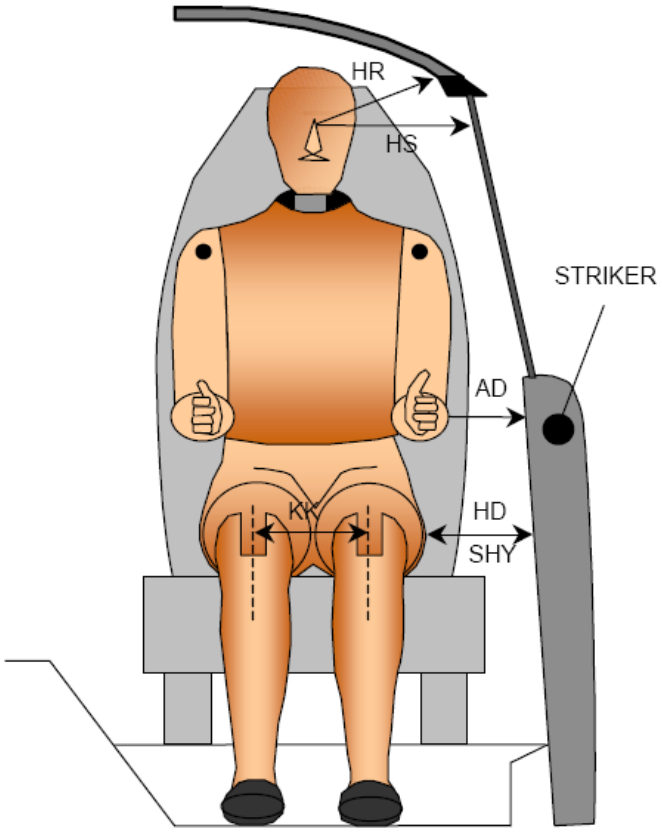
Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		26.6		
SWA°	Steering Wheel Angle		66.2		
SCA°	Steering Column Angle		23.8		
SA°	Seat Back Angle (On Headrest Post)		1.7		0.7
HZ	Head to Roof	231	90.0	253	90.0
HH	Head to Header	408	25.4	303	47.4
HW	Head to Windshield	706	0.0	710	0.0
NR	Nose to Rim	401	7.5	476	12.3
CD	Chest to Dash	544	14.2	423	12.0
CS	Chest to Steering Hub	302	0.0		
RA	Rim to Abdomen	213	0.0		
KDL	Left Knee to Dash	212	19.0	151	35.1
KDR	Right Knee to Dash	164	34.3	173	32.1
PA°	Pelvic Angle		23.5		19.1
TA°	Tibia Angle		49.6		49.7
SK	Striker to Knee	598	12.2	688	14.3
ST	Striker to Head	393	76.2	378	57.2
SH	Striker to H-Point	342	51.7	418	35.7

DATA SHEET NO. 4

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19



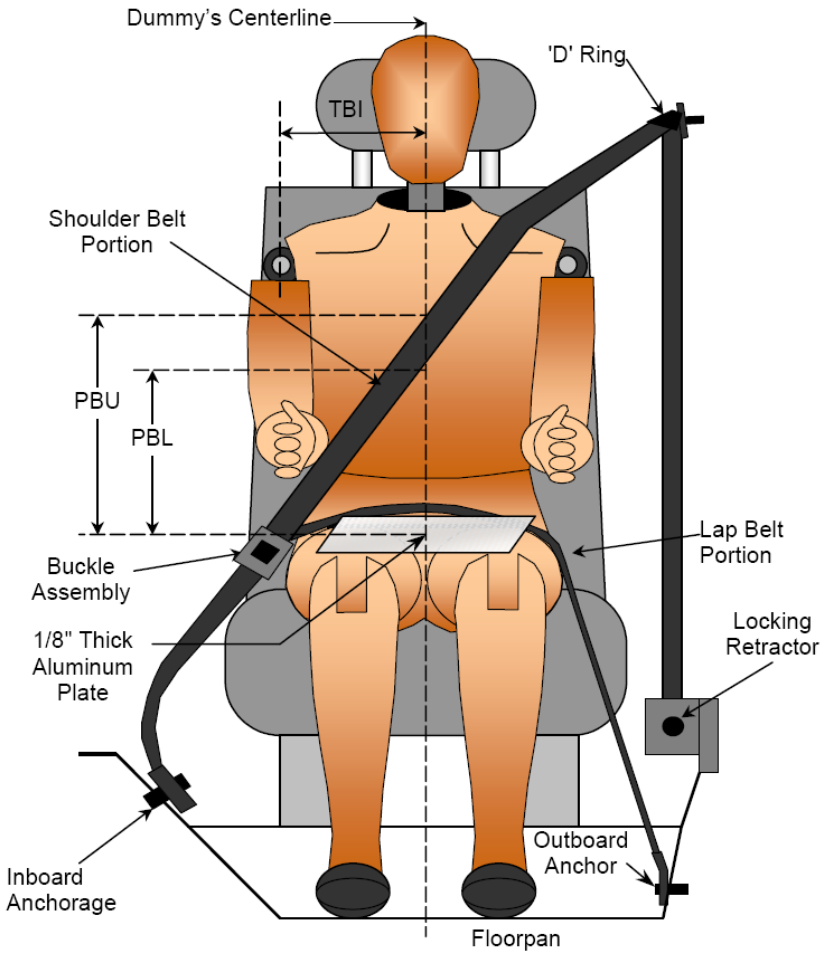
Code	Description	Driver (mm)	Passenger (mm)
AD	Arm to Door	134	93
HD	H-Point to Door	154	200
HR	Head to Side Header	241	292
HS	Head to Side Window	308	396
KK	Knee to Knee	347	170
SHY	Striker to H-Point (Y-Direction)	250	279
AA	Ankle to Ankle	340	172

DATA SHEET NO. 5

SEAT BELT POSITIONING DATA

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19



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	345	255
PBL	Top Surface of Aluminum Plate to Belt Lower Edge	mm	269	170

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as Measured on ATD	mm	860	920
Lap Belt Length as Measured on ATD	mm	605	682
Remainder of Belt on Reel	mm	999	920
Total Belt Length for Continuous Webbing Systems	mm	2464	2522

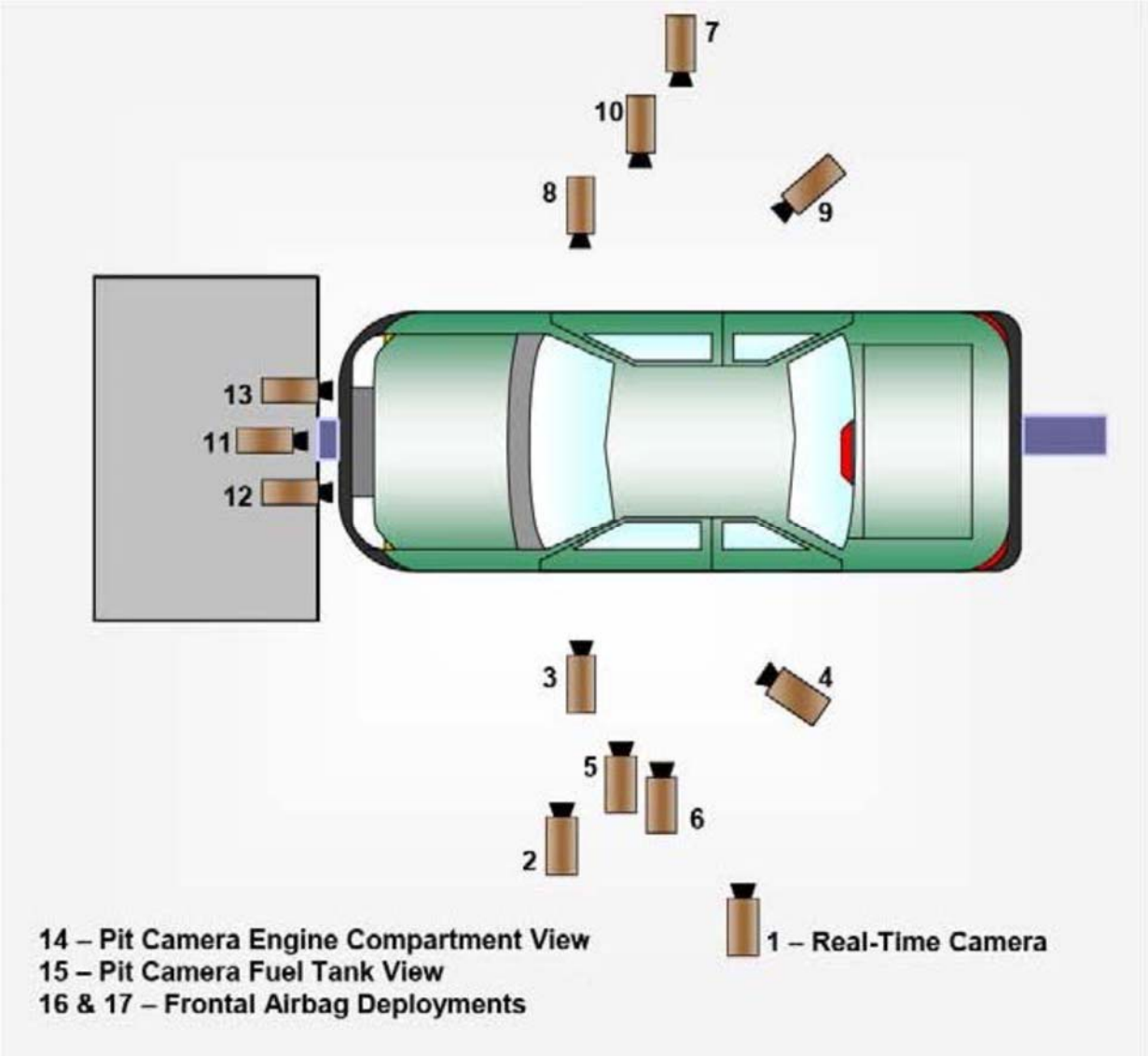
DATA SHEET NO. 6

HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 … (CONTINUED)

HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

CAMERA LOCATIONS

No.	Description	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall	-11412	-8150	-1484		30
2	Driver Close-Up	-2590	-7950	-1371	50	1000
3	Left Front Half	-1701	-6197	-1701	35	1000
4	Left Angle	-6696	-10308	-3211	105	1000
5	Steering Column - Top	-1966	-10412	-3688	35	1000
6	Steering Column - Bottom	-1972	-10412	-3379	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	20	1000
15	Pit Rear	-3398	0	1495	20	1000
16	Onboard Driver Airbag (Optional)	1110	-250	-1450	8	1000
17	Onboard Passenger Airbag (Optional)	1110	250	-1450	8	1000
18	Real-Time Left View of Impact					
19	Real-Time Right View of Impact					

Coordinates: +X = forward impact plane

+Y = right of monorail center

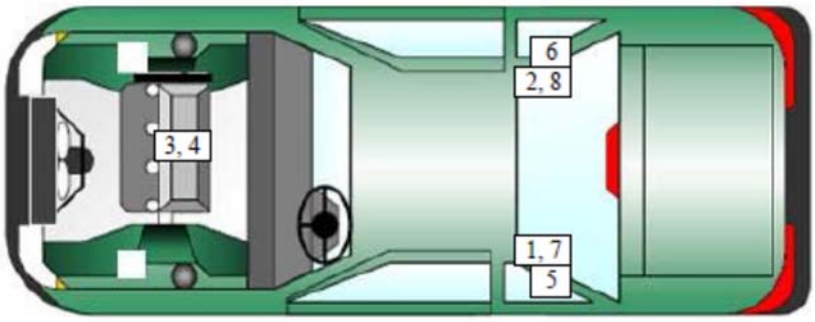
+Z = into ground

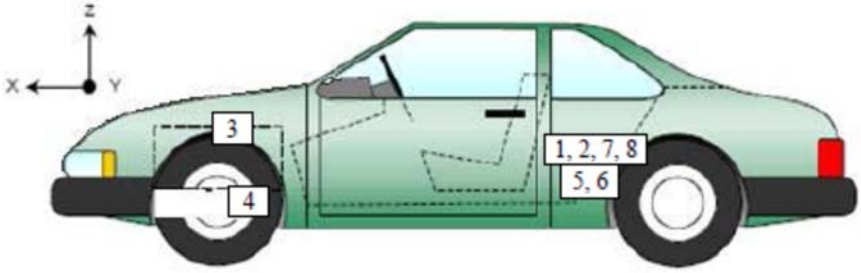
DATA SHEET NO. 7

VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Description	Location		
		X	Y	Z
1	Left Rear Accelerometer X-Direction	1545	-350	690
2	Right Rear Accelerometer X-Direction	1545	350	690
3	Engine Top X	3620	825	340
4	Engine Bottom X	3650	450	260
5	Left Rear Accelerometer Z-Direction	1545	-350	690
6	Right Rear Accelerometer Z-Direction	1545	350	690
7	Left Rear Accelerometer X-Direction Redundant	1545	-350	690
8	Right Rear Accelerometer X-Direction Redundant	1545	350	690

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

Y – Vehicle Centerline (+ to right)

Z – Ground Plane (+ down)

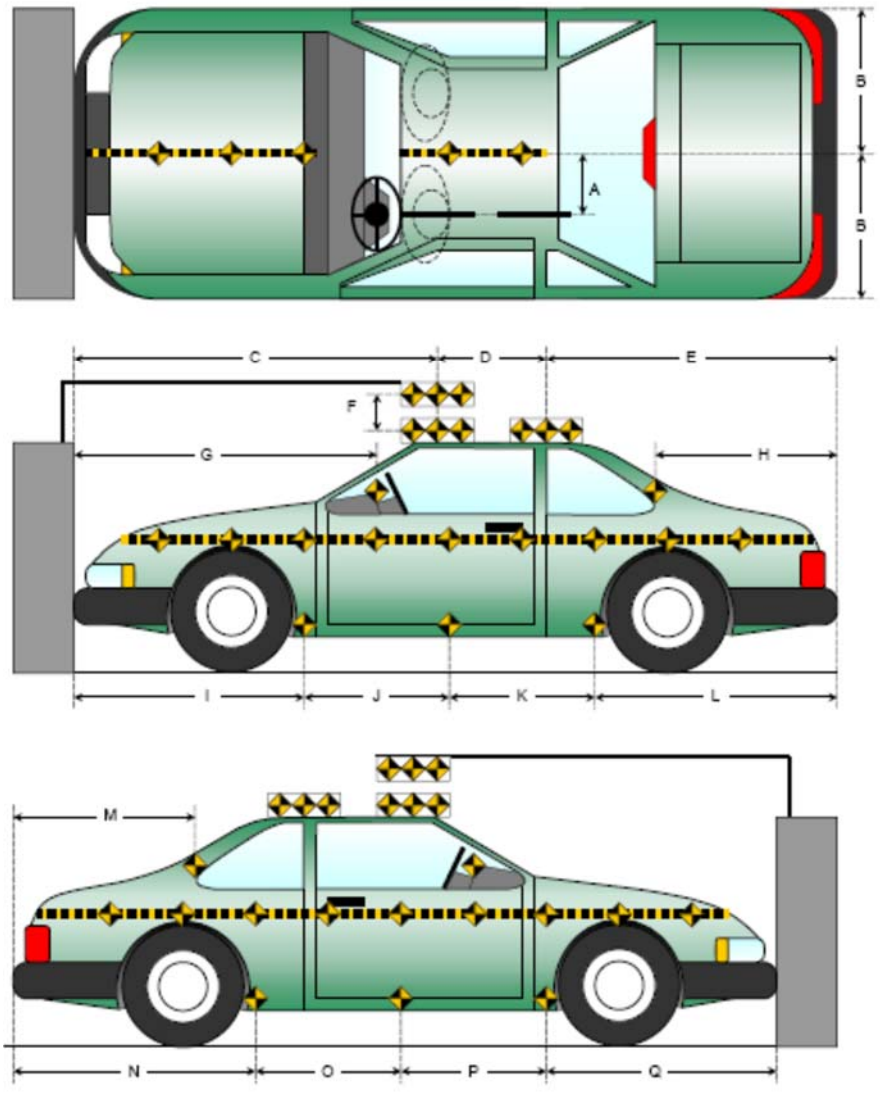
DATA SHEET NO. 8

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

Item	Value
A	400
B	900
C	2192
D	610
E	1550
F	305
G	1700
H	460
I	1307
J	900
K	900
L	1237
M	461
N	1238
O	900
P	900
Q	1309



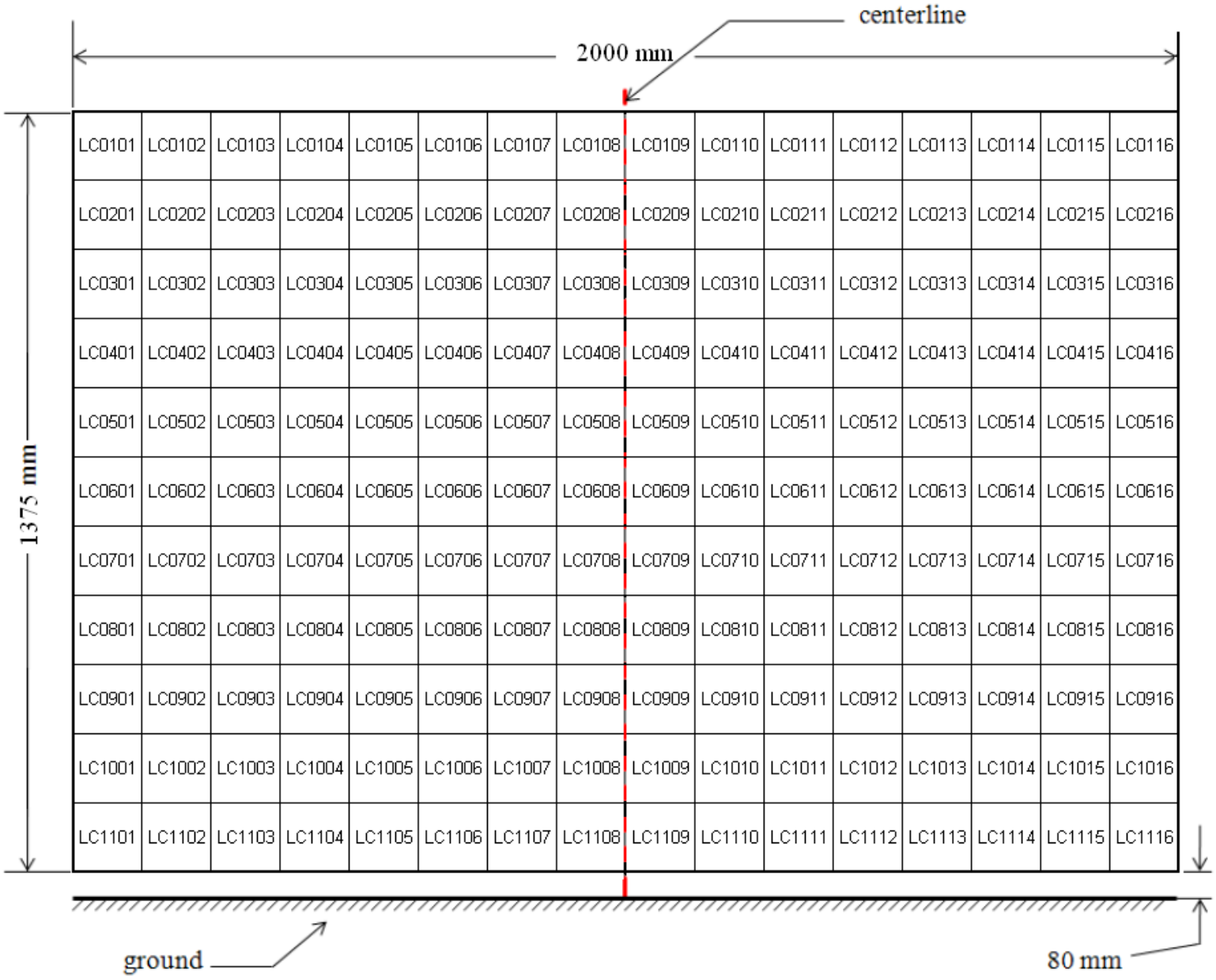
All measurements in millimeters.

DATA SHEET NO. 9

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19



DATA SHEET NO. 10

TEST VEHICLE CAMERA AND INSTRUMENTATION SUMMARY

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

INSTRUMENTATION

Driver Dummy Accelerometers	47
Passenger Dummy Accelerometers	47
Vehicle Structure Accelerometers	8
Load Cell Barrier	528
Total	630

CAMERA COVERAGE

High-Speed Vehicle On Board	2
High-Speed Off Board	14
Real Time	3
Total	19

DATA SHEET NO. 11

POST-TEST OBSERVATIONS

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

TEST DUMMY INFORMATION AND CONTACT

Description	Driver	Passenger
Dummy Type/Serial No.	P572E 50th Percentile Male ATD / 360	P572O 5th Percentile Female ATD / 141
Head Contact	Frontal Airbag, Headrest	Frontal Airbag, Headrest
Upper Torso Contact	Frontal Airbag	Frontal Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Airbag, Steering Column	Knee Bolster
Right Knee Contact	Knee Airbag, Steering Column	Knee Bolster

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked / Unlocked Doors	Locked	Locked
Front Door Opening	Remained closed and latched, operational	Remained closed and latched, operational
Rear Door Opening	Remained closed and latched, operational	Remained closed and latched, operational
Seat Track Shift (mm)	3	1
Seat Back Failure	None	None
Glazing Damage	None	None

POST-TEST STRUCTURAL 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	4325
Center	mm	4330
Right Side	mm	4320
Average	mm	4325

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

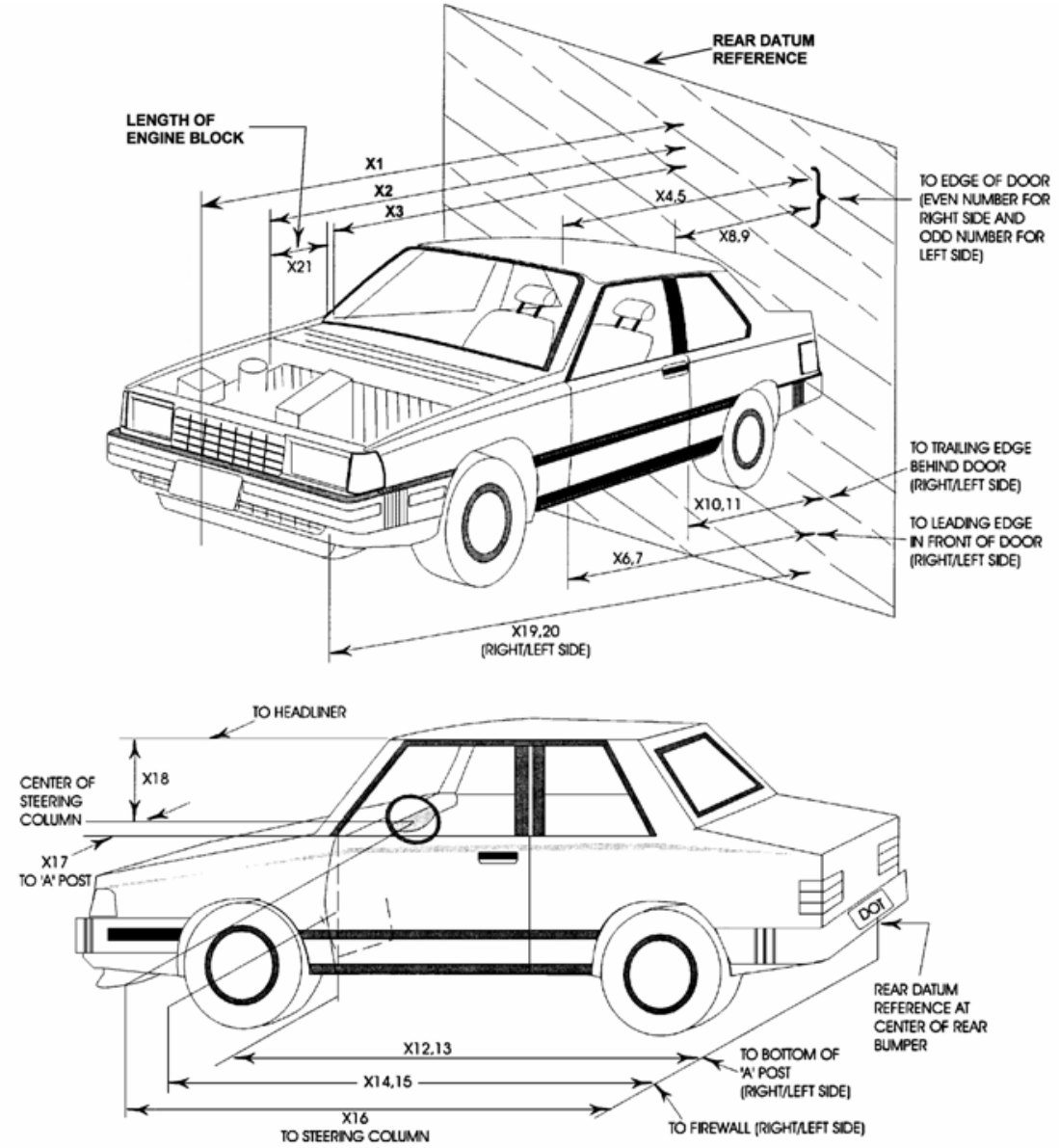
Restraint Type	Driver		Passenger	
	Installed	Operated	Installed	Operated
Front Airbag	Yes	Yes	Yes	Yes
Side Airbag 1 (Curtain)	Yes	No	Yes	No
Side Airbag 2 (Torso/Pelvis)	Yes	No	Yes	No
Knee Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Yes	Yes	Yes

DATA SHEET NO. 12

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19



DATA SHEET NO. 12 … (CONTINUED)

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4345	3930	-415
2	Rear Surface of Vehicle to Front of Engine	3990	3705	-285
3	RSOV to Firewall	3215	3245	30
4	RSOV to Upper Leading Edge of Right Door	3002	2995	-7
5	RSOV to Upper Leading Edge of Left Door	3000	3039	39
6	RSOV to Lower Leading Edge of Right Door	2982	2970	-12
7	RSOV to Lower Leading Edge of Left Door	2985	2970	-15
8	RSOV to Upper Trailing Edge of Right Door	1894	1895	1
9	RSOV to Upper Trailing Edge of Left Door	1895	1918	23
10	RSOV to Lower Trailing Edge of Right Door	1921	1905	-16
11	RSOV to Lower Trailing Edge of Left Door	1920	1905	-15
12	RSOV to Bottom of A-Pillar, Right Side	2978	2975	-3
13	RSOV to Bottom of A-Pillar, Left Side	2976	2991	15
14	RSOV to Firewall, Right Side	3215	3210	-5
15	RSOV to Firewall, Left Side	3225	3221	-4
16	RSOV to Steering Column	2510	2555	45
17	Center of Steering Column to A-Pillar	415	385	-30
18	Center of Steering Column to Headliner	425	435	10
19	RSOV to Right Side of Front Bumper	3773	3760	-13
20	RSOV to Left Side of Front Bumper	3775	3685	-90
21	Length of Engine Block	600	600	0
RD	RSOV to Right Side of Dash Panel	2780	2805	25
CD	RSOV to Center of Dash Panel	2670	2630	-40
LD	RSOV to Left Side of Dash Panel	2780	2805	25

All measurements in millimeters.

DATA SHEET NO. 13

ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

VEHICLE INFORMATION

VIN: KNDCB3LC5K5243579 Wheelbase (mm): 2700

Vehicle Size Category: Passenger Car Test Weight (kg): 1607.0

ACCELEROMETER DATA

Accelerometer Locations: Left Rear Crossmember

Cal. Procedure/Interval: Vibration Test / 6 months

Integration Algorithm: NHTSA Standard Linearity: Good

Impact Velocity (km/h): 56.56

Velocity Change (km/h): 69.4

Time of Separation (msec): 65.1

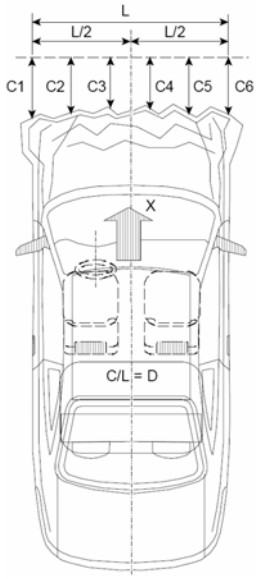
CRUSH PROFILE

Collision Deformation Classification: 12FDEW2

Midpoint of Damage: Vehicle Centerline

Damage Region Length (mm): 1300

Impact Mode: Full Frontal



No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush Zone 1 at Left Side	mm	140	530	390
C2	Crush Zone 2 at Left Side	mm	30	535	505
C3	Crush Zone 3 at Left Side	mm	2	545	543
C4	Crush Zone 4 at Right Side	mm	2	550	548
C5	Crush Zone 5 at Right Side	mm	30	550	520
C6	Crush Zone 6 at Right Side	mm	140	570	430
L	C1 to C6	mm	1300		

DATA SHEET NO. 14

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

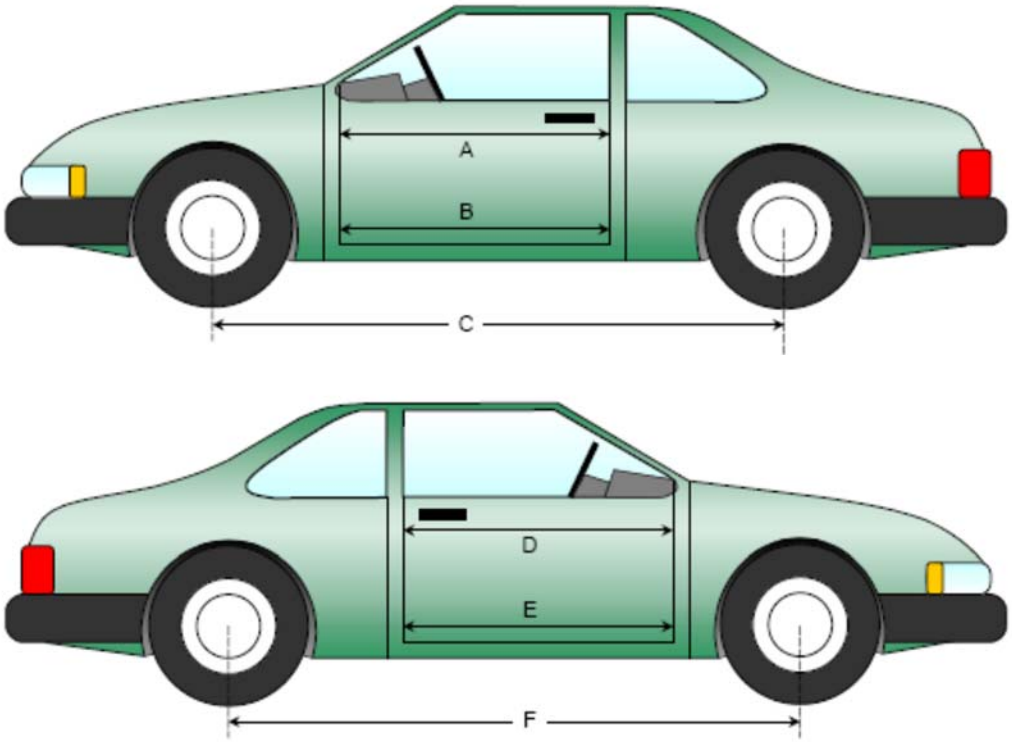
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1014	1013	1
B	Left Side Lower	mm	934	926	8
D	Right Side Upper	mm	1014	1013	1
E	Right Side Lower	mm	916	914	2

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2700	2620	80
F	Right Side Wheelbase	mm	2700	2645	55



DATA SHEET NO. 14 … (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

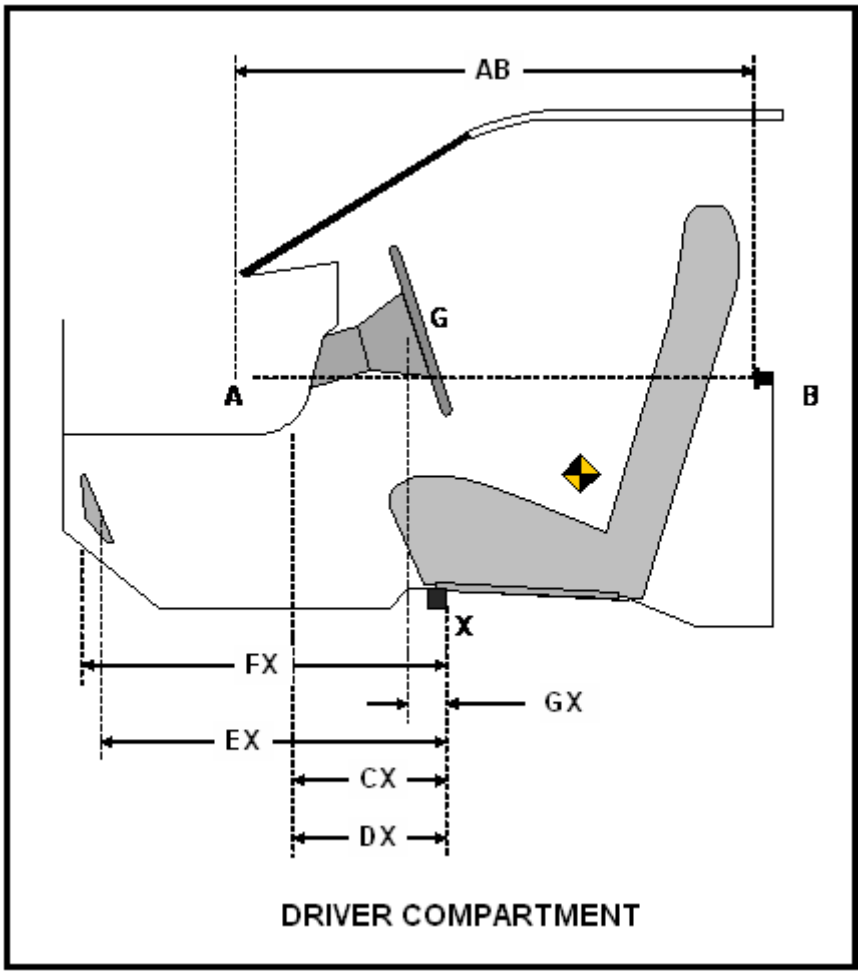
Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	906	906	0
CX	Left Knee Bolster to X	mm	320	330	-10
DX	Right Knee Bolster to X	mm	320	335	-15
EX	Brake Pedal to X	mm	550	475	75
FX	Foot Rest to X	mm	570	575	-5
GX	Center of Steering Wheel Hub to X	mm	100	115	-15

X = Front of Seat Track (Stationary)



DATA SHEET NO. 15

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

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

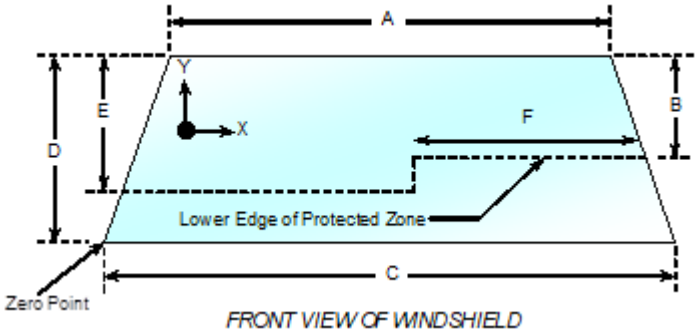
Windshield Mounting Details: Windshield glass is secured to the vehicle frame with rubber molding and rubber cement.

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: 21.3° C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2198	2198	100.0%
Right Side	2198	2198	100.0%
Total	4396	4396	100.0%



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1200
B	mm	442
C	mm	1465
D	mm	890
E	mm	550
F	mm	570

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. 15 … (CONTINUED)

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

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 22.2° C Test Time: 12:27 PM

Stoddard Solvent Spillage Measurements

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

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

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

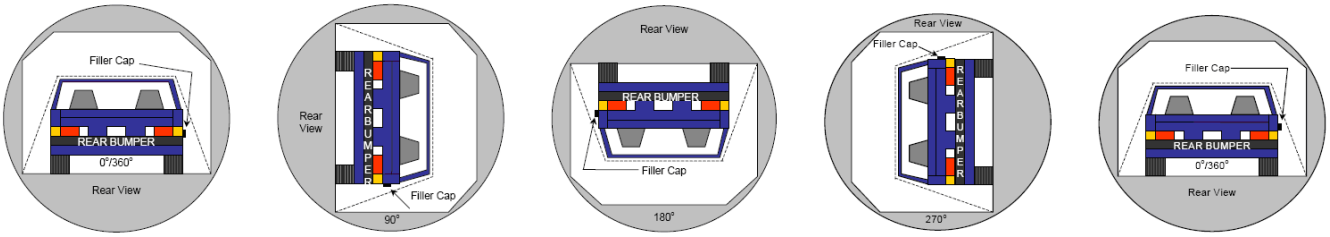
D. Spillage: There was no Stoddard solvent spillage.

DATA SHEET NO. 16

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19



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

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

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	82	300	382
90° To 180°	83	300	383
180° To 270°	79	300	379
270° To 360°	81	300	381

FMVSS 301 SPILLAGE TABLE

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

SOLVENT SPILLAGE LOCATION TABLE

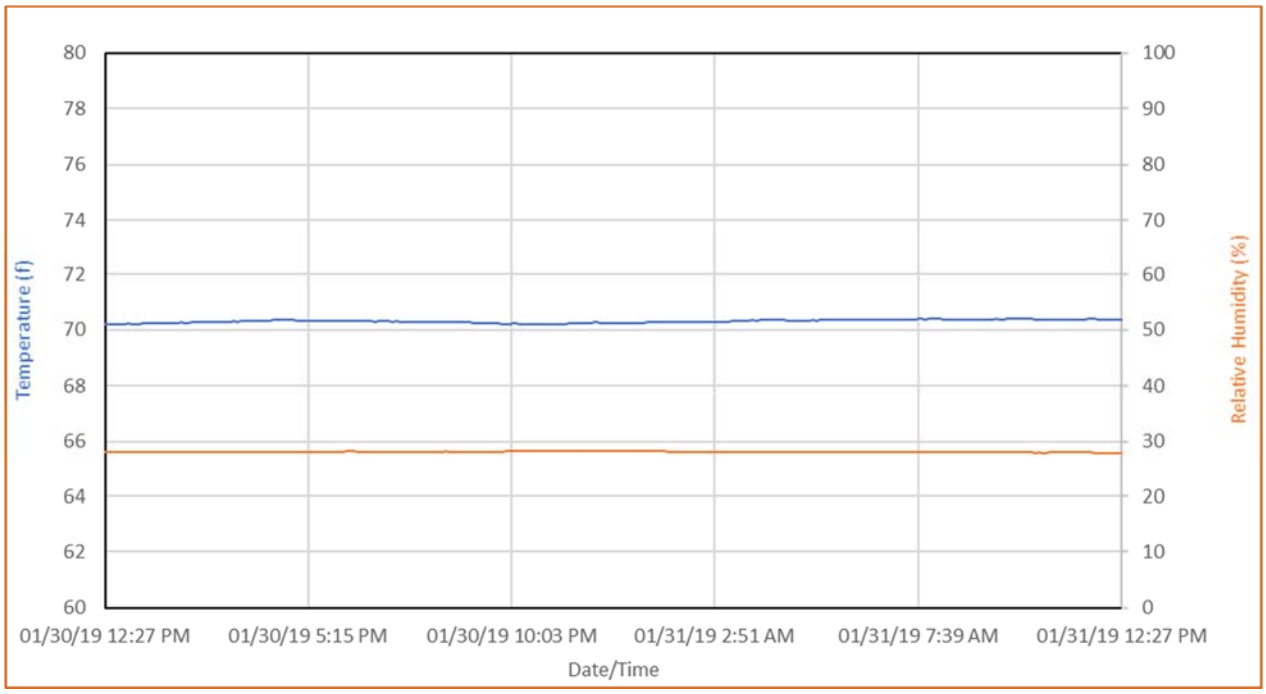
Test Phase	Spillage Location
0° To 90°	
90° To 180°	
180° To 270°	
270° To 360°	

DATA SHEET NO. 17

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2019 Kia Niro Hybrid LX 5-Door MPV NHTSA No.: M20194209

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 05/20/19



APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

TABLE OF PHOTOGRAPHS … (CONTINUED)

TABLE OF PHOTOGRAPHS … (CONTINUED)

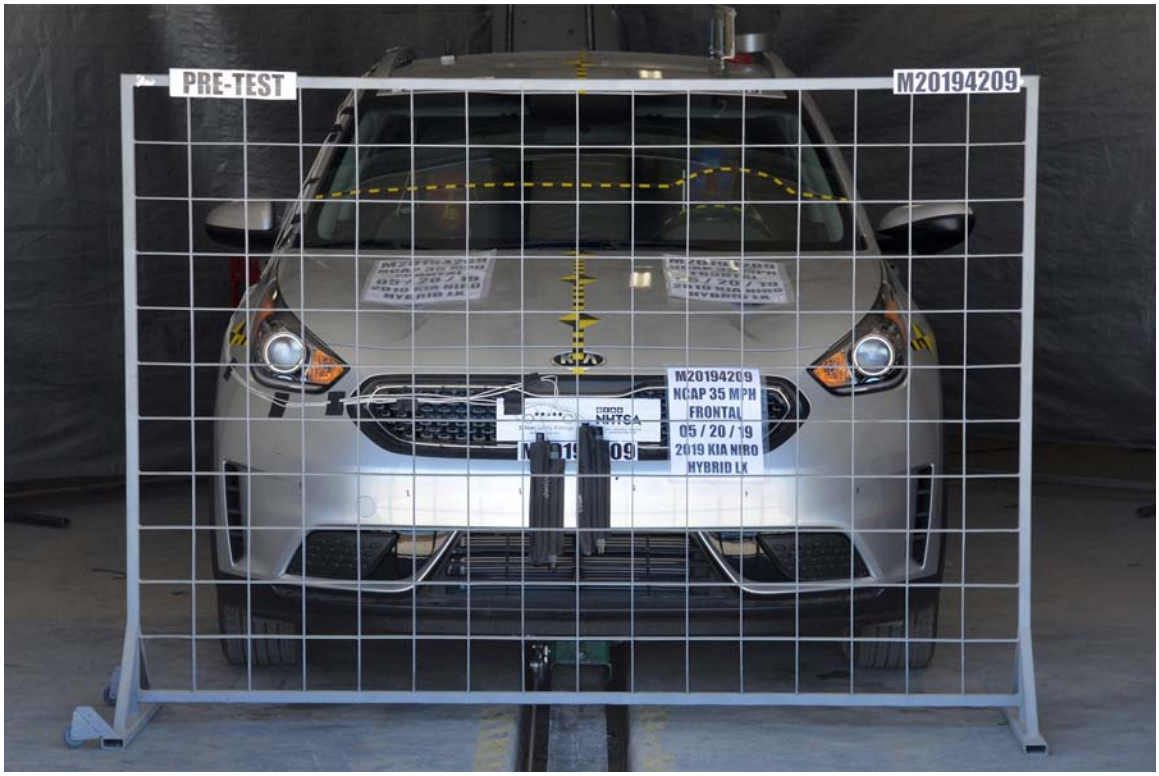


FIGURE 1. Load Cell Location

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. 2019 Kia Niro Hybrid LX 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

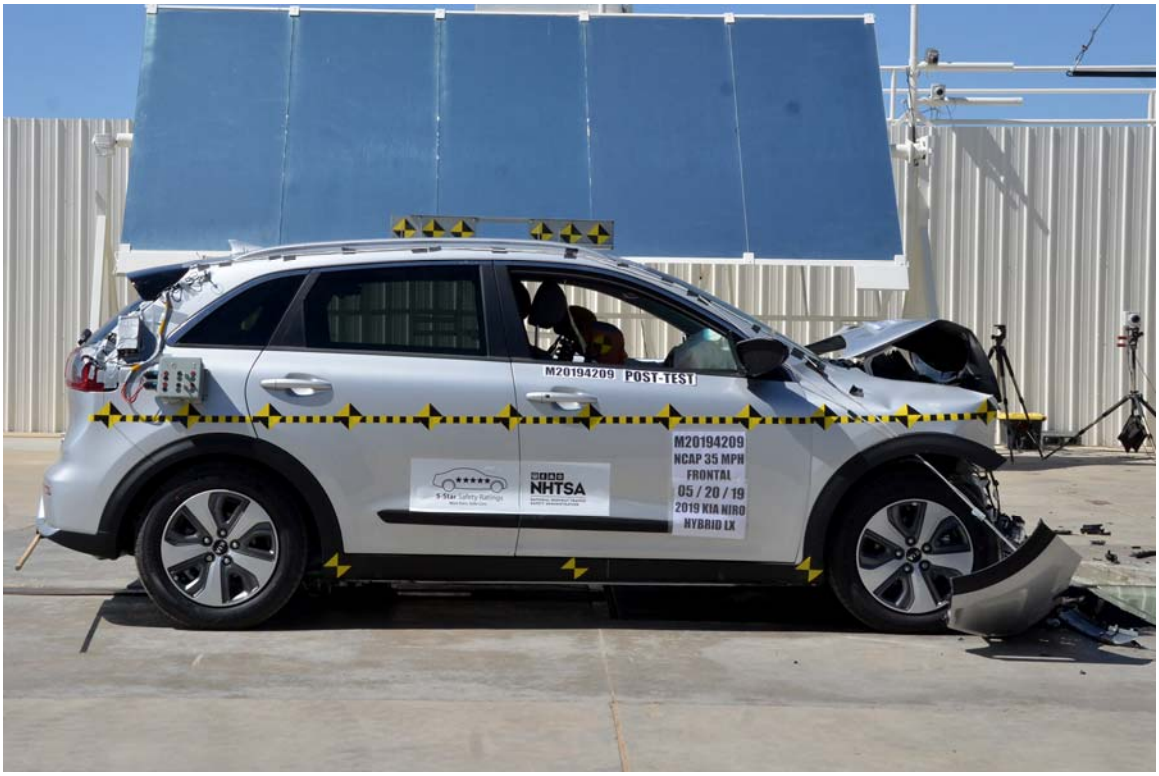


FIGURE 13. Post-Test Right View of Test Vehicle

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

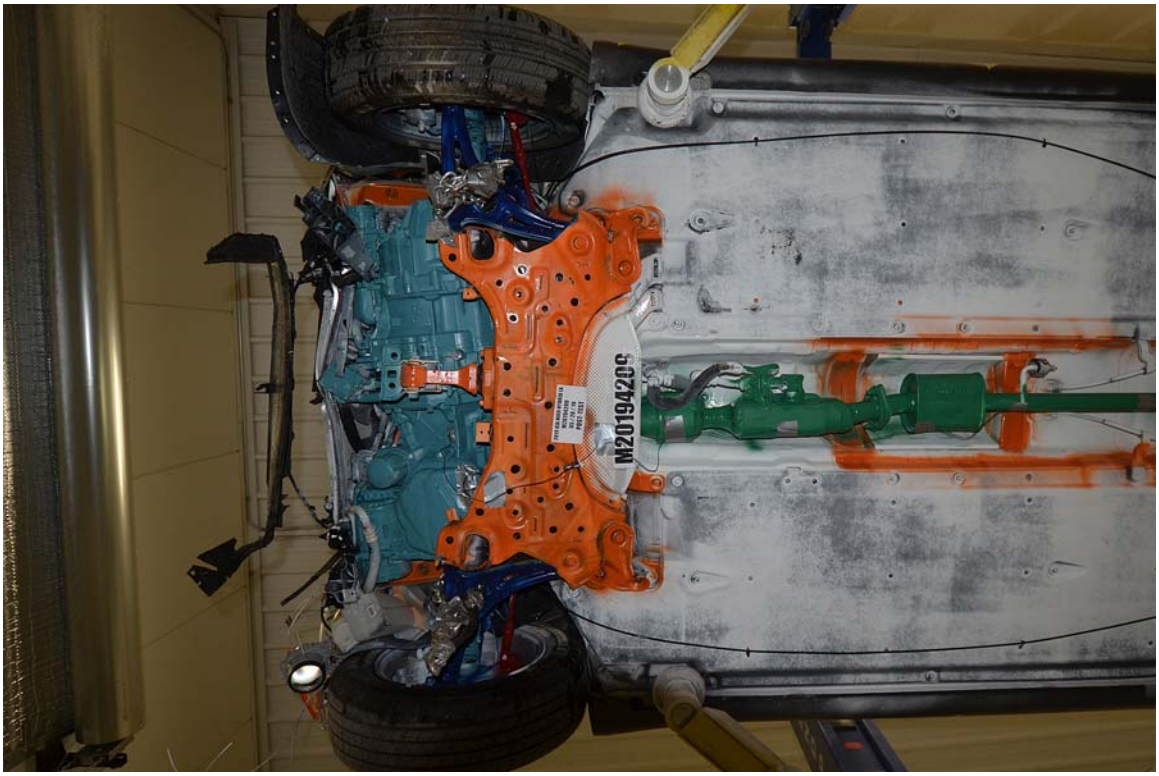


FIGURE 25. Post-Test Front Underbody View

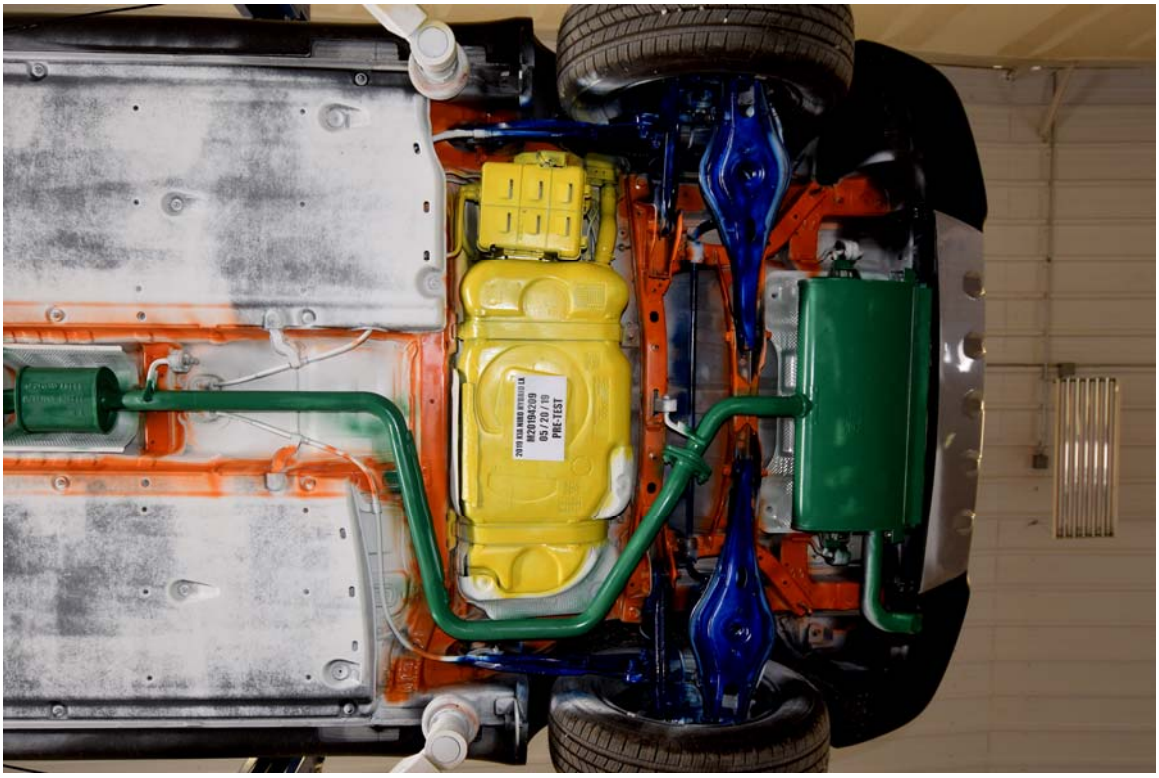


FIGURE 26. Pre-Test Rear Underbody View

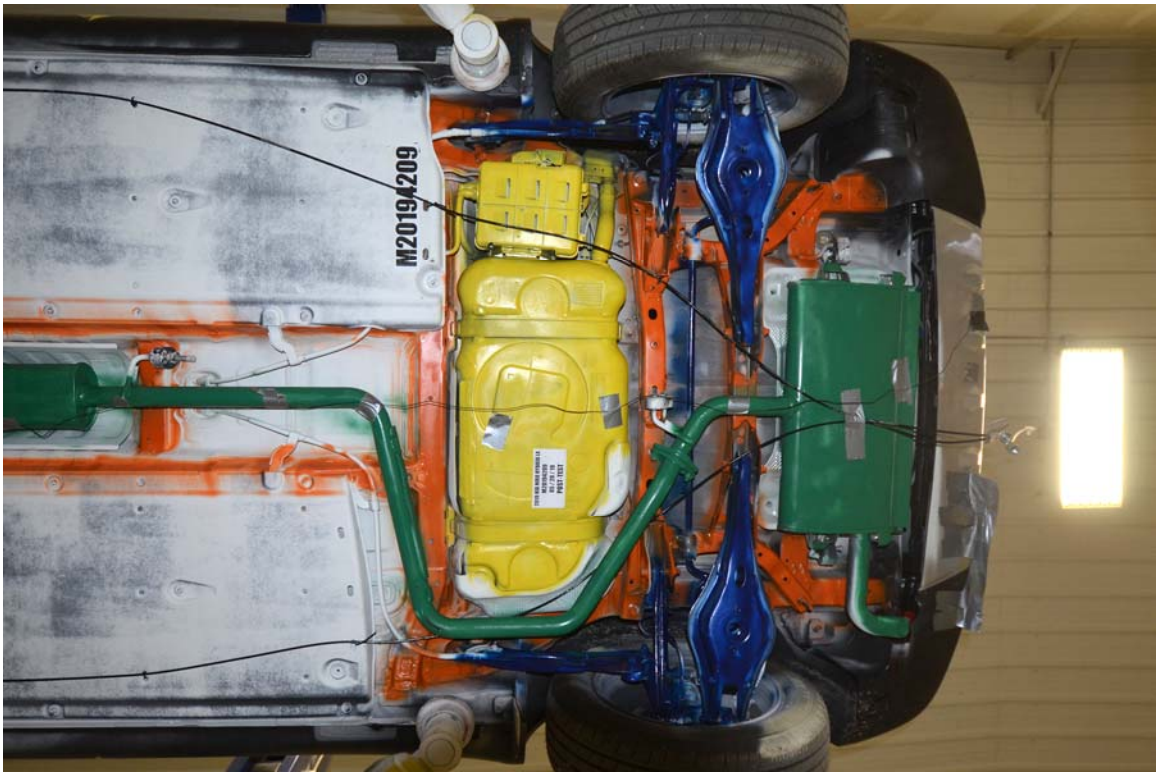


FIGURE 27. Post-Test Rear Underbody View

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 Driver Dummy Feet

FIGURE 41. Post-Test Driver Dummy Feet

FIGURE 42. Pre-Test Driver's Side Knee Bolster

FIGURE 43. Post-Test Driver's Side Knee Bolster

FIGURE 44. Pre-Test Driver's Side Floorpan

FIGURE 45. Post-Test Driver's Side Floorpan

FIGURE 46. Post-Test Driver Dummy Face

FIGURE 47. Post-Test Driver Dummy Contact with Airbag

FIGURE 48. Post-Test Driver Dummy Contact with Headrest

FIGURE 48a. Post-Test Driver Dummy Contact with Knee Airbag

FIGURE 49. Pre-Test View of the Steering Wheel

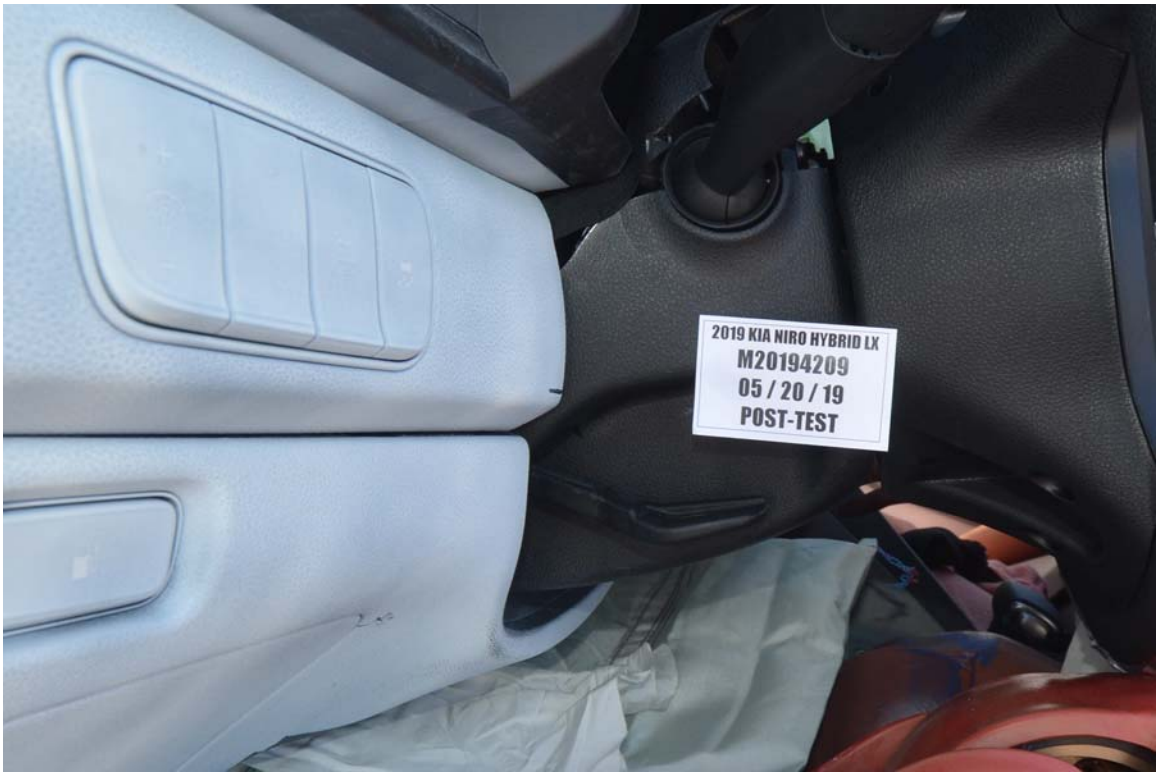


FIGURE 50. Post-Test View of the Steering Wheel

FIGURE 51. Pre-Test Passenger Dummy Front View

FIGURE 52. Post-Test Passenger Dummy Front View

FIGURE 53. Pre-Test Passenger Dummy Window View

FIGURE 54. Post-Test Passenger Dummy Window View

FIGURE 55. Pre-Test Passenger Dummy and Vehicle Interior View

FIGURE 56. Post-Test Passenger Dummy and Vehicle Interior View

FIGURE 57. Pre-Test Passenger's Seat Fore-Aft Markings

FIGURE 58. Post-Test Passenger's Seat Fore-Aft Markings

FIGURE 59. Pre-Test View of Belt Anchorage for Passenger Dummy

FIGURE 60. Post-Test View of Belt Anchorage for Passenger Dummy

FIGURE 61. Pre-Test Passenger Dummy Feet

FIGURE 62. Post-Test Passenger Dummy Feet

FIGURE 63. Pre-Test Passenger's Side Knee Bolster

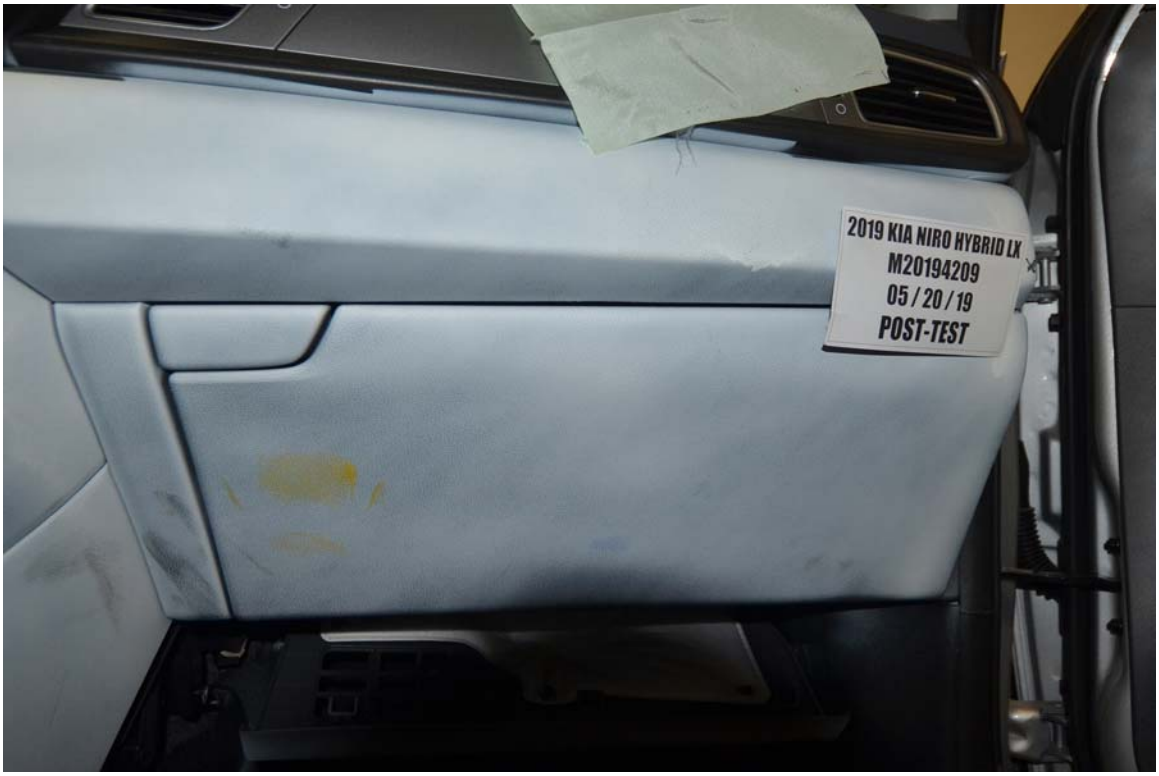


FIGURE 64. Post-Test Passenger's Side Knee Bolster

FIGURE 65. Pre-Test Passenger's Side Floorpan

FIGURE 66. Post-Test Passenger's Side Floorpan

FIGURE 67. Post-Test Passenger Dummy Face

FIGURE 68. Post-Test Passenger Dummy Contact with Airbag

FIGURE 69. Post-Test Passenger Dummy Contact with Headrest

FIGURE 69a. Post-Test Passenger Dummy Contact with Knee Glovebox

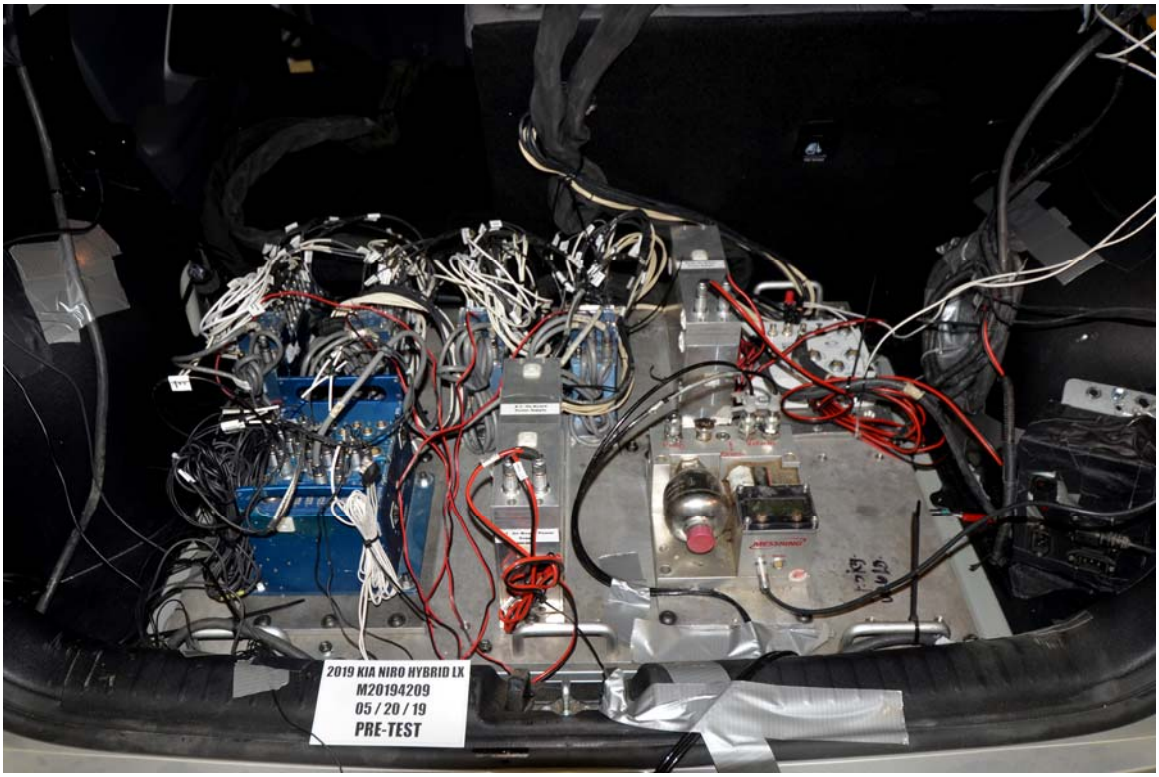


FIGURE 70. Photograph of Ballast Installed in Vehicle

Photograph Not Applicable

No Stoddard Solvent Spillage

FIGURE 71. Post-Test Stoddard Solvent Spillage Location View

FIGURE 72. Post-Test Speed Trap Read-Out

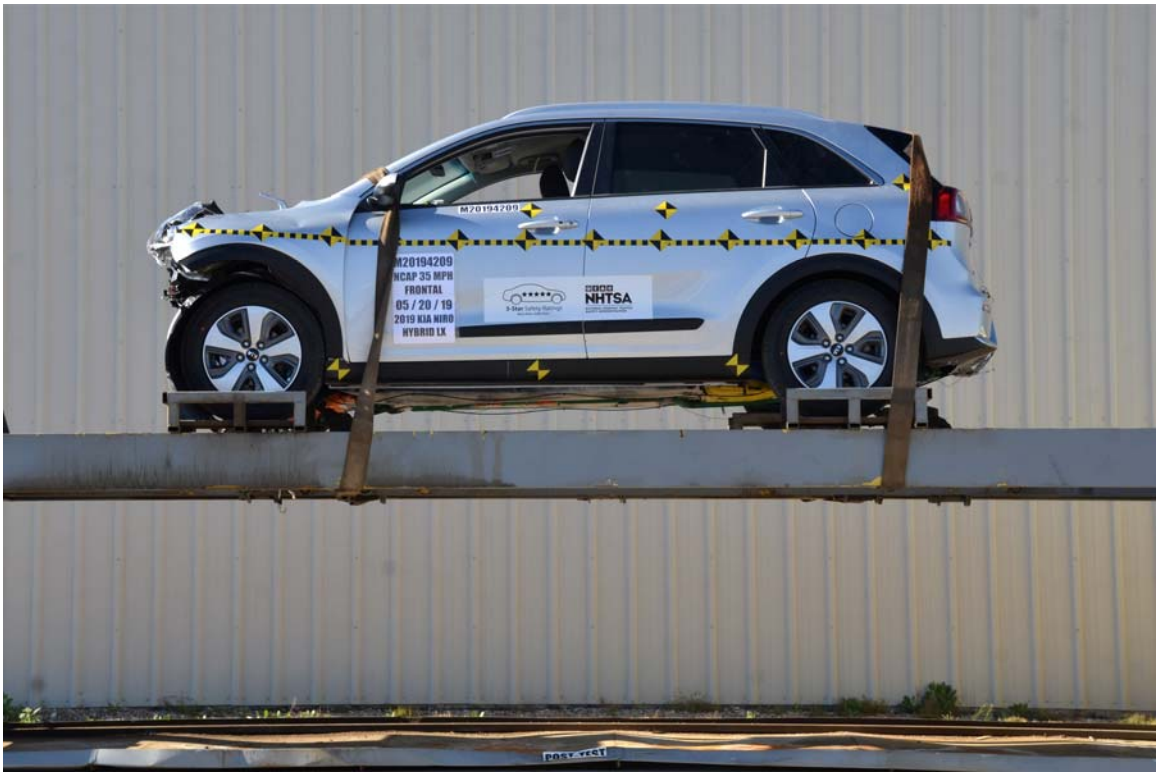


FIGURE 73. Vehicle at 0° on Static Rollover Device

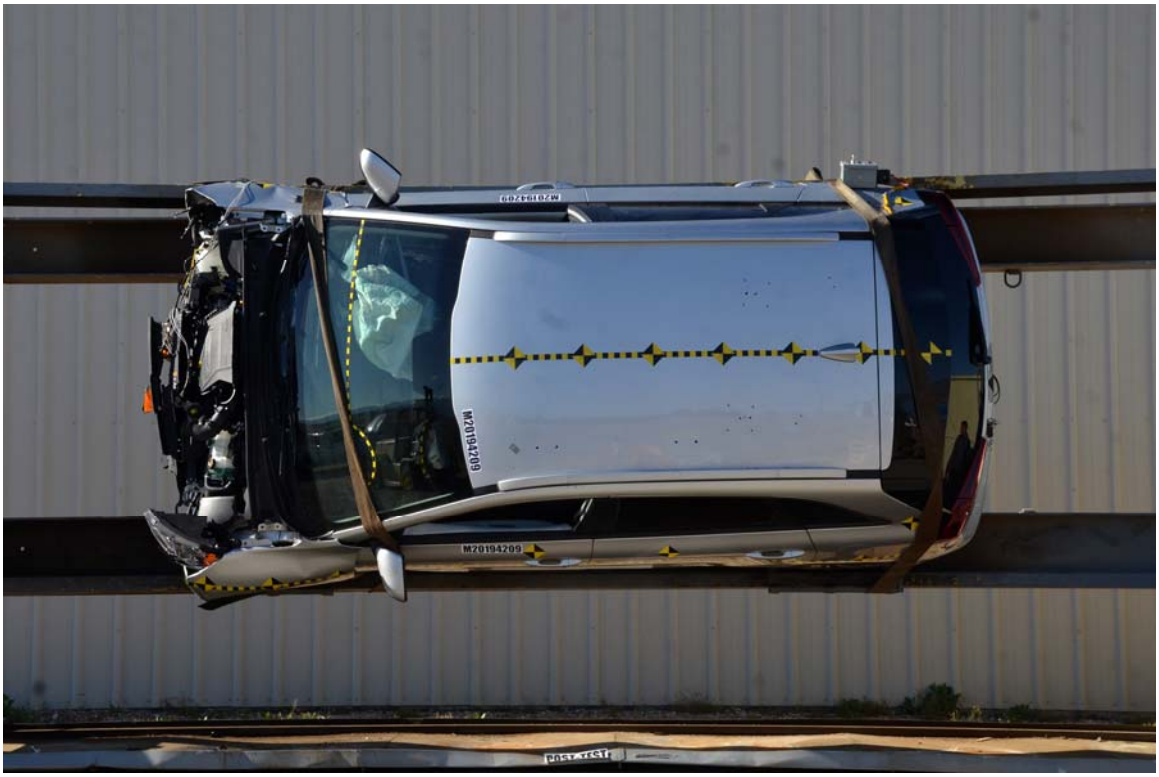


FIGURE 74. Vehicle at 90° on Static Rollover Device

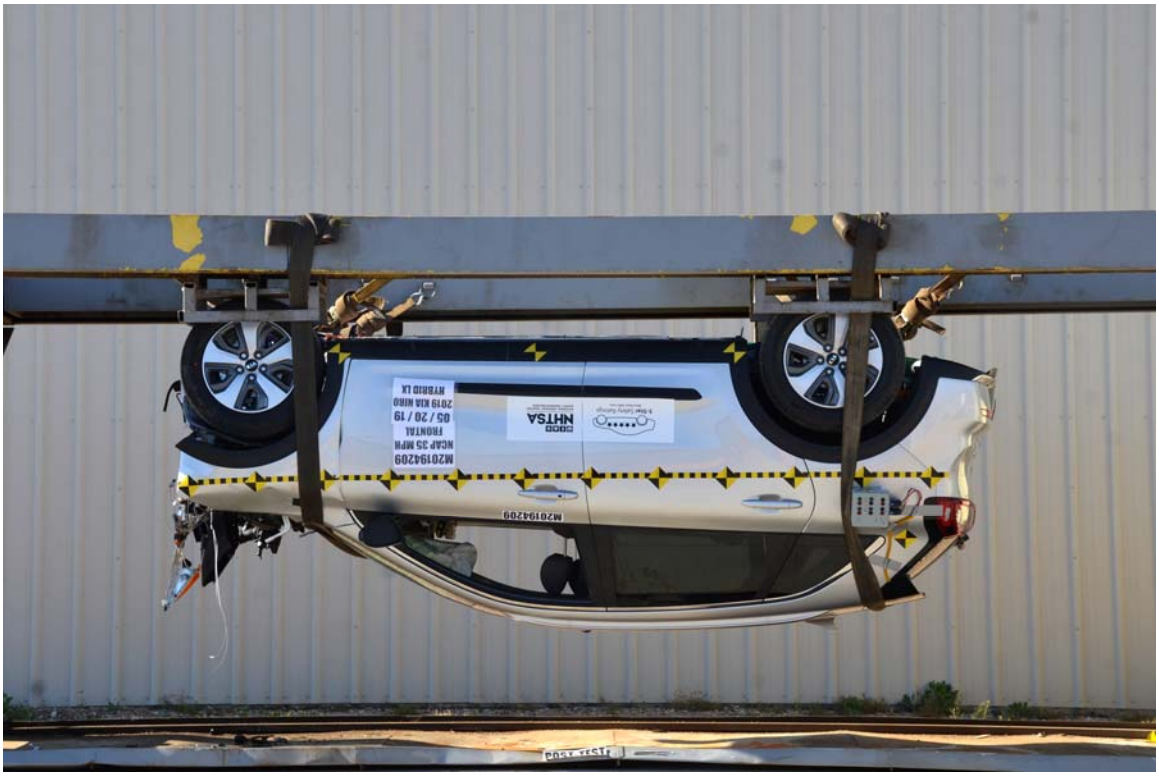


FIGURE 75. Vehicle at 180° on Static Rollover Device

FIGURE 76. Vehicle at 270° on Static Rollover Device

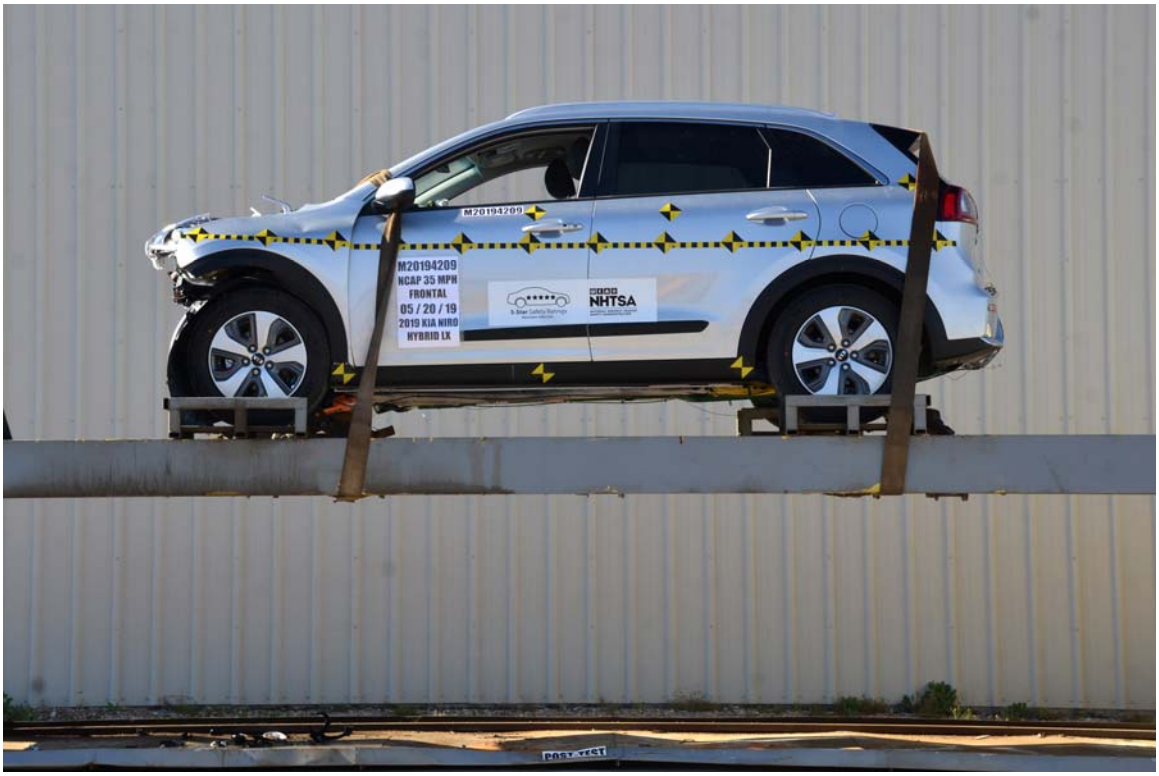


FIGURE 77. Vehicle at 360° on Static Rollover Device

FIGURE 78. 2019 Kia Niro Hybrid LX Frontal Impact Event

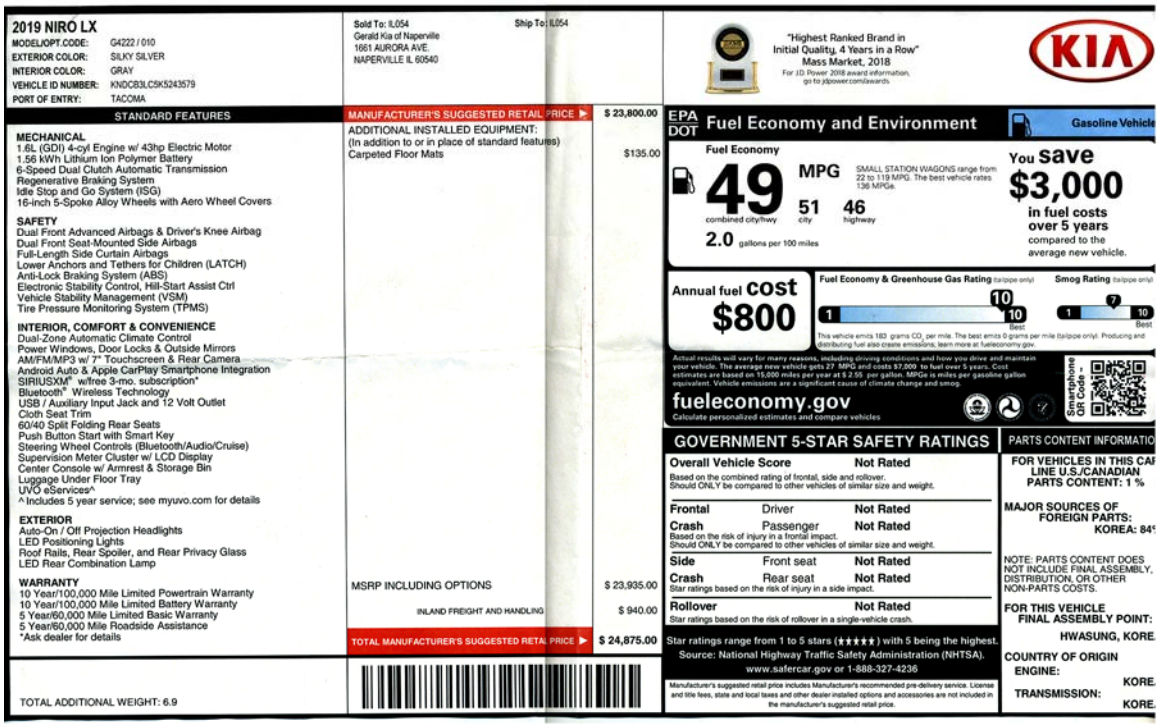


FIGURE 79. Monroney Label Photograph

APPENDIX B
DUMMY RESPONSE DATA TRACES

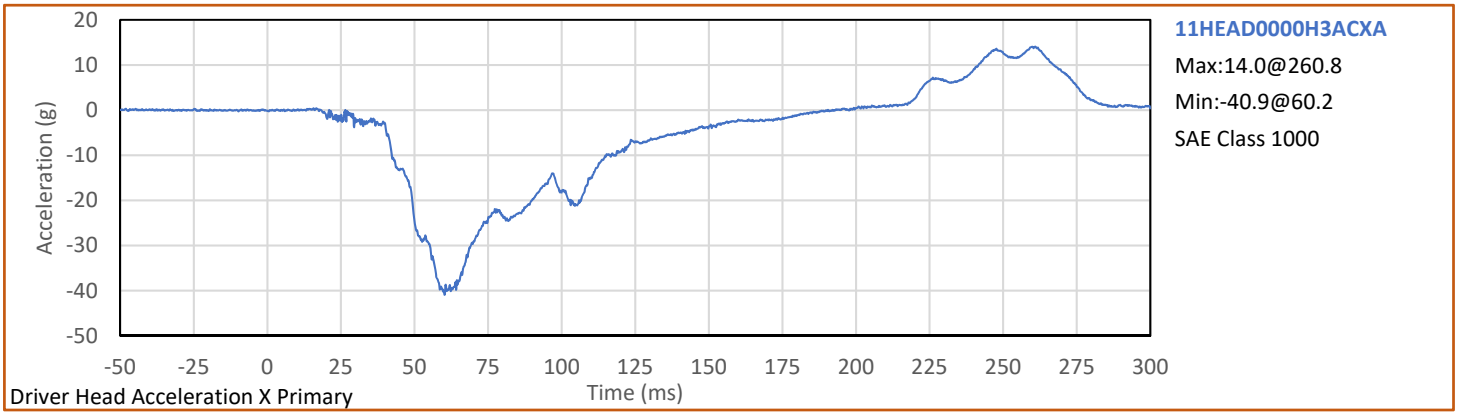
TABLE OF DATA PLOTS

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

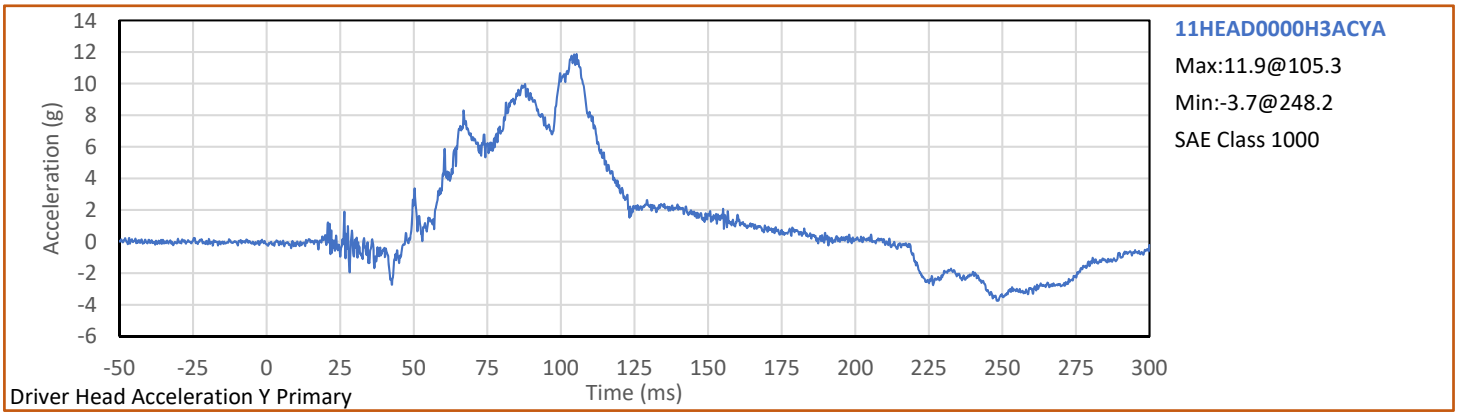
Driver Head X Acceleration Redundant
Driver Head Y Acceleration Redundant
Driver Head Z Acceleration Redundant
Driver Upper Neck Force Y
Driver Upper Neck Moment X
Driver Upper Neck Moment Z
Driver Chest X Acceleration Redundant
Driver Chest Y Acceleration Redundant
Driver Chest Z Acceleration Redundant
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
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
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

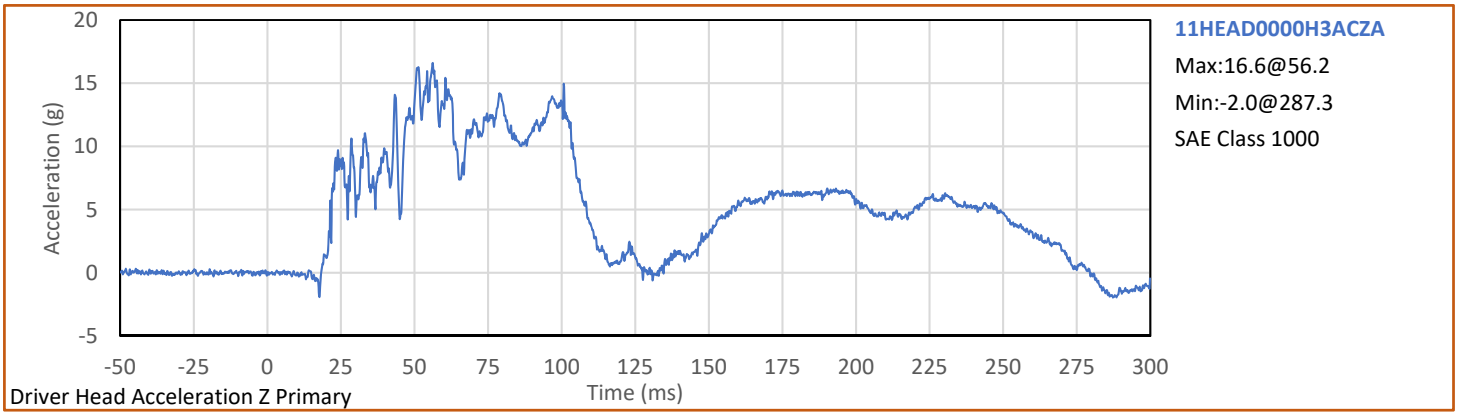
Test Vehicle:	2019 Kia Niro Hybrid LX 5-Door MPV	NHTSA No.:	M20194209
Test Program:	56.3 km/h Frontal Impact NCAP Test	Test Date:	5/20/2019



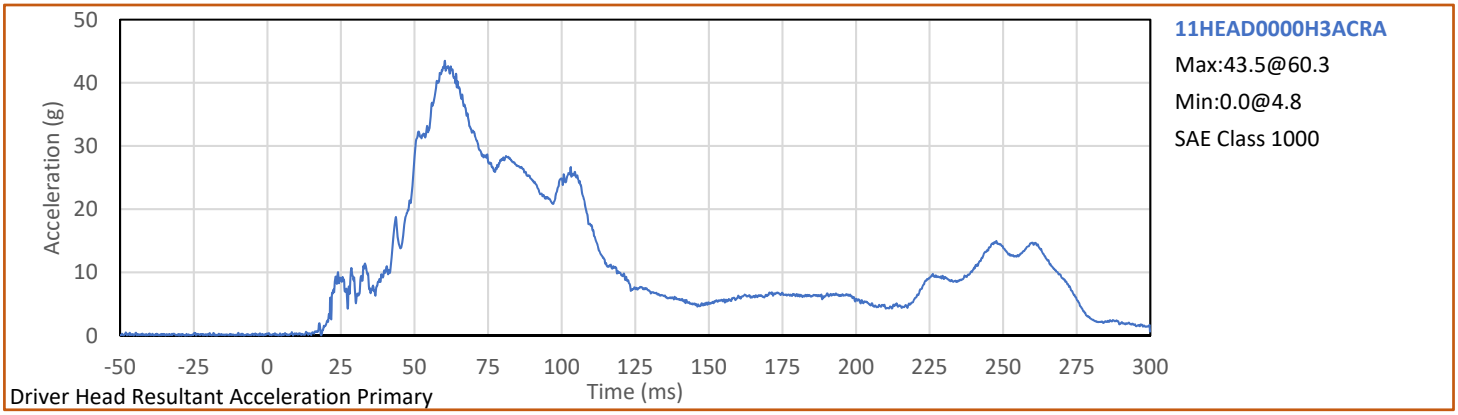
Driver Head Acceleration X Primary



Driver Head Acceleration Y Primary

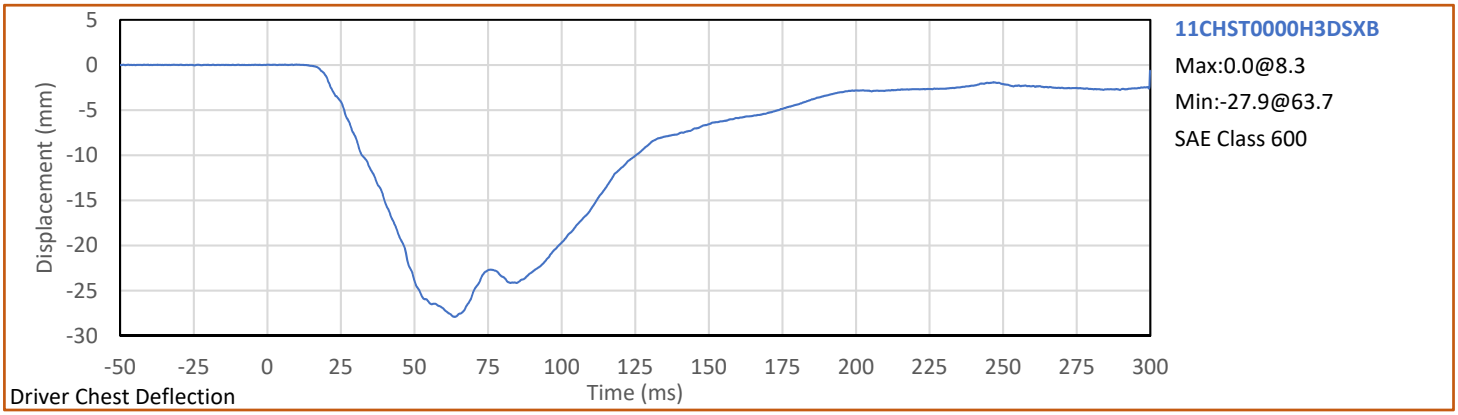


Driver Head Acceleration Z Primary

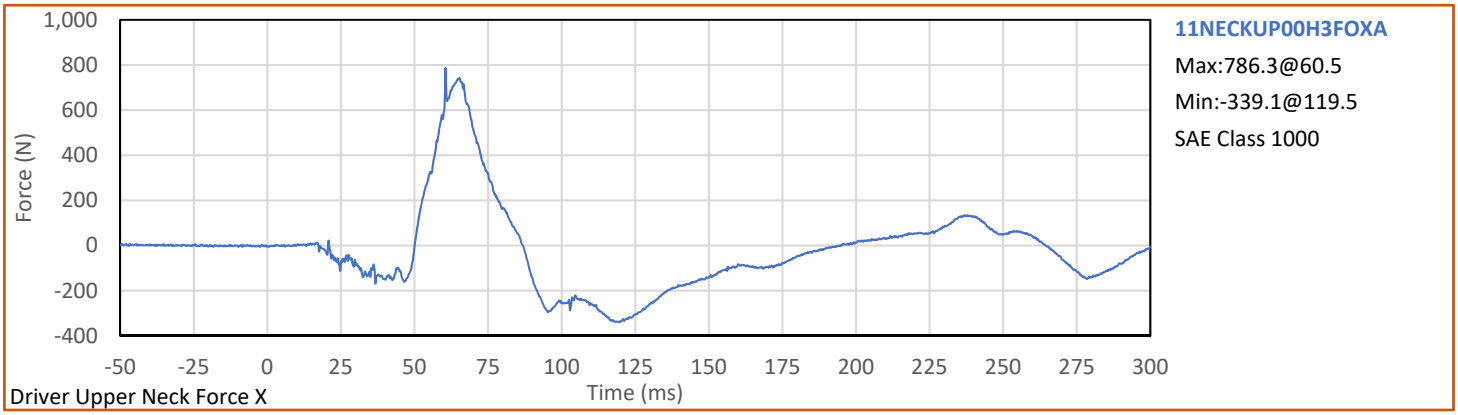


Driver Head Resultant Acceleration Primary

Test Vehicle:	2019 Kia Niro Hybrid LX 5-Door MPV	NHTSA No.:	M20194209
Test Program:	56.3 km/h Frontal Impact NCAP Test	Test Date:	5/20/2019

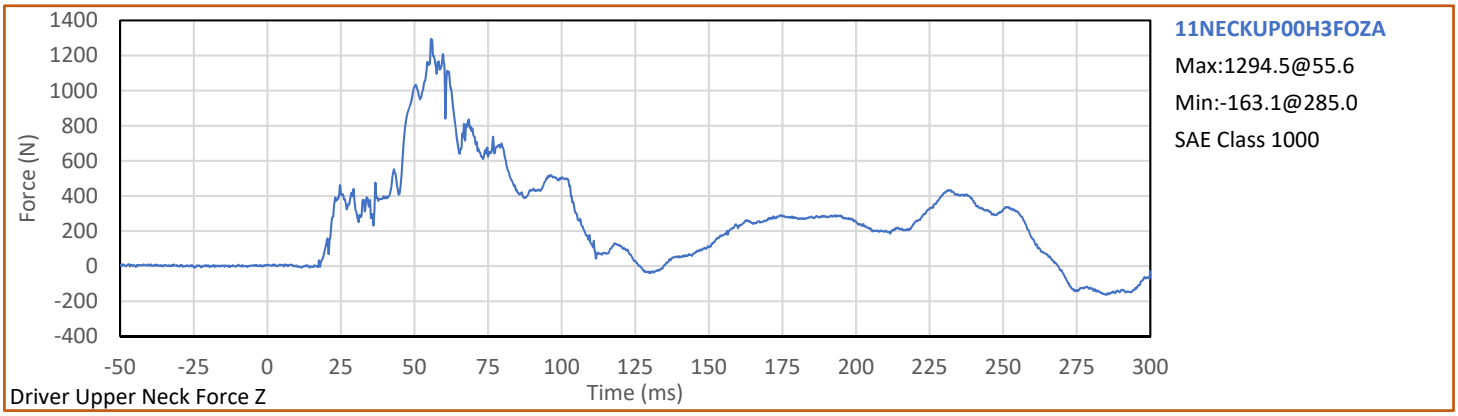


Driver Chest Deflection



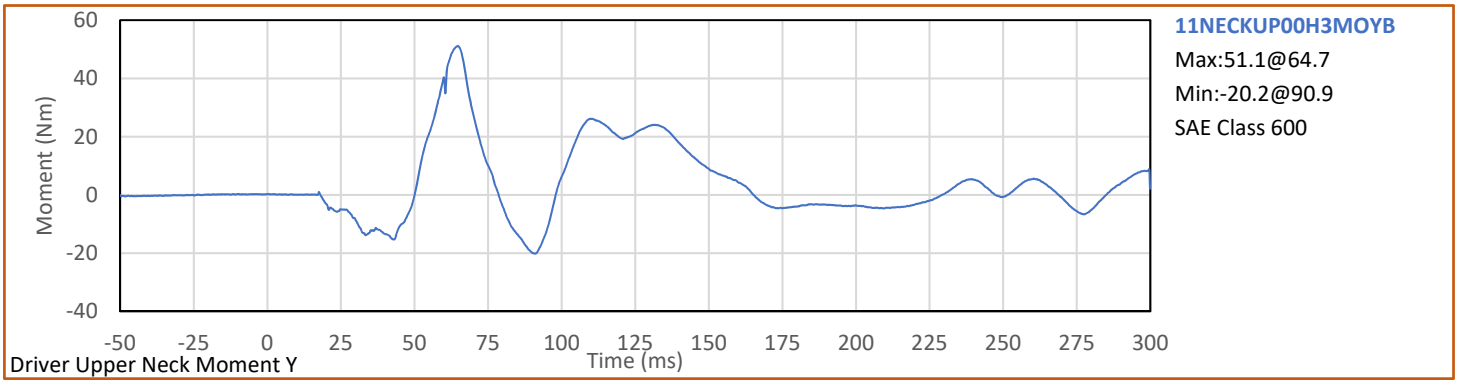
Driver Upper Neck Force X

11NECKUP00H3FOXA
Max:786.3@60.5
Min:-339.1@119.5
SAE Class 1000



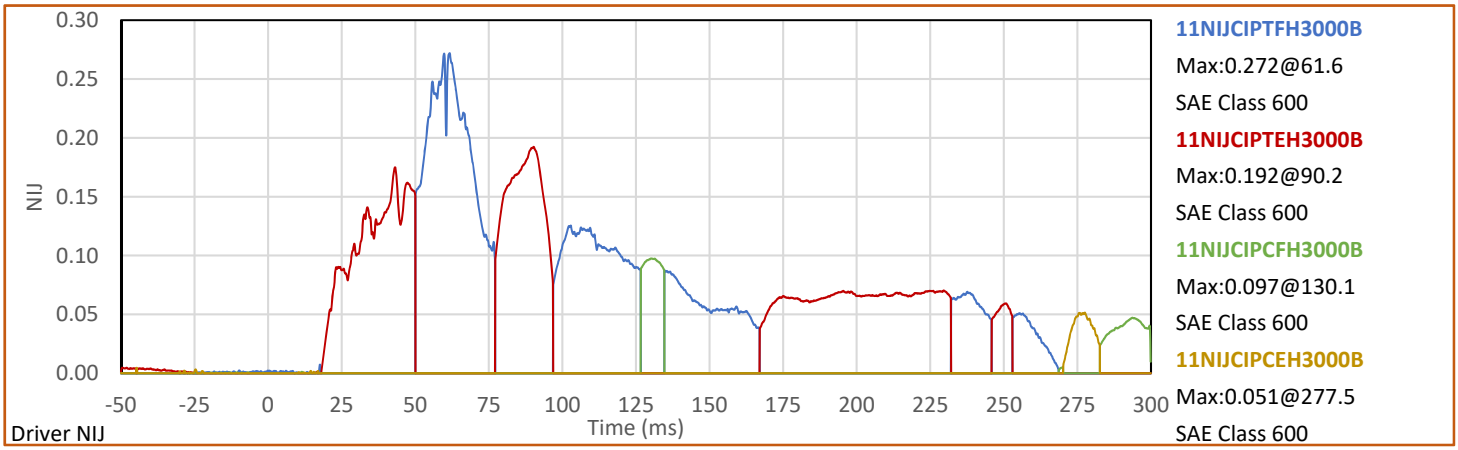
Driver Upper Neck Force Z

11NECKUP00H3FOZA
Max:1294.5@55.6
Min:-163.1@285.0
SAE Class 1000



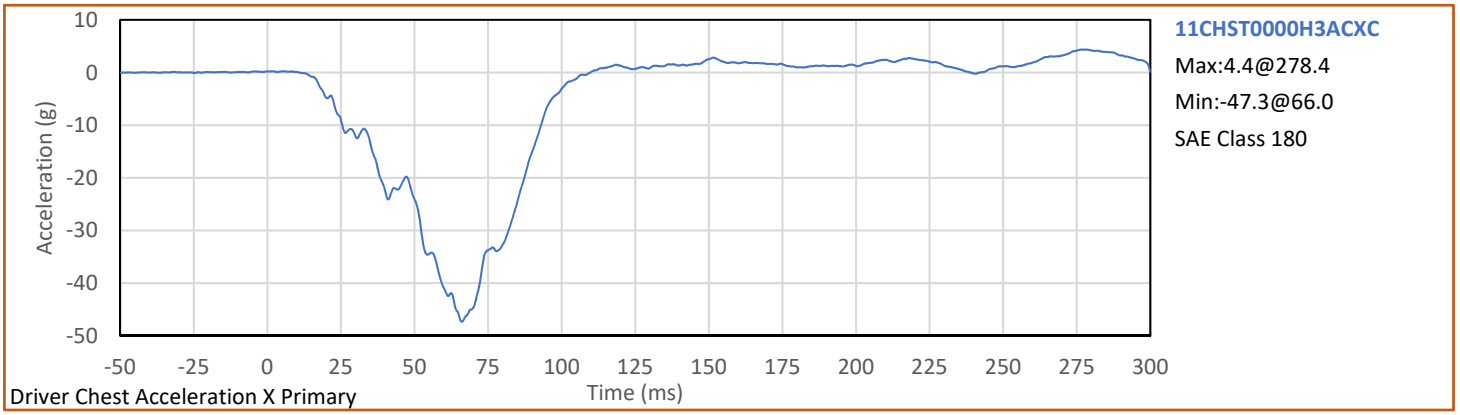
Driver Upper Neck Moment Y

11NECKUP00H3MOYB
Max:51.1@64.7
Min:-20.2@90.9
SAE Class 600

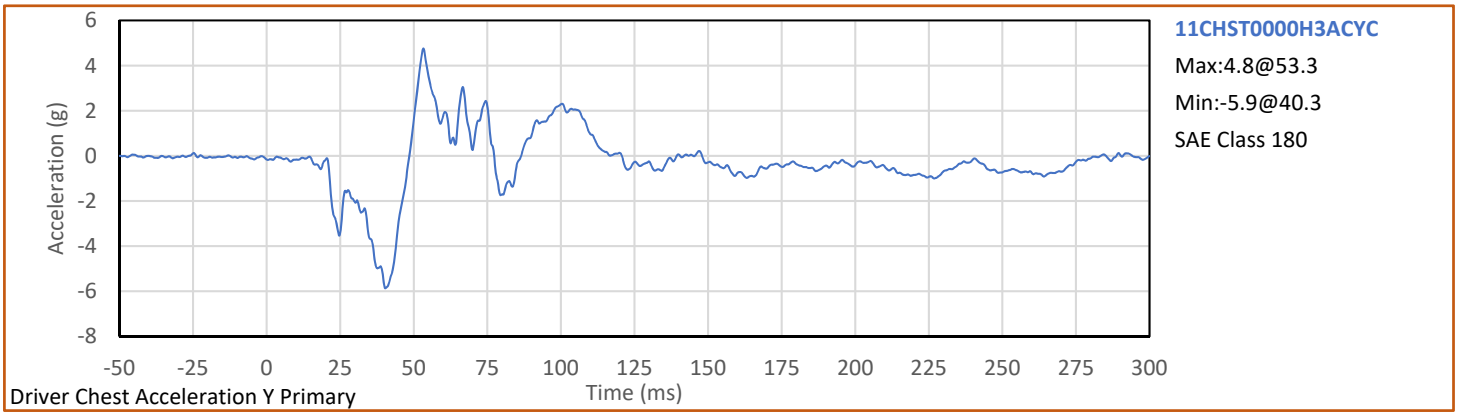


Driver NIJ

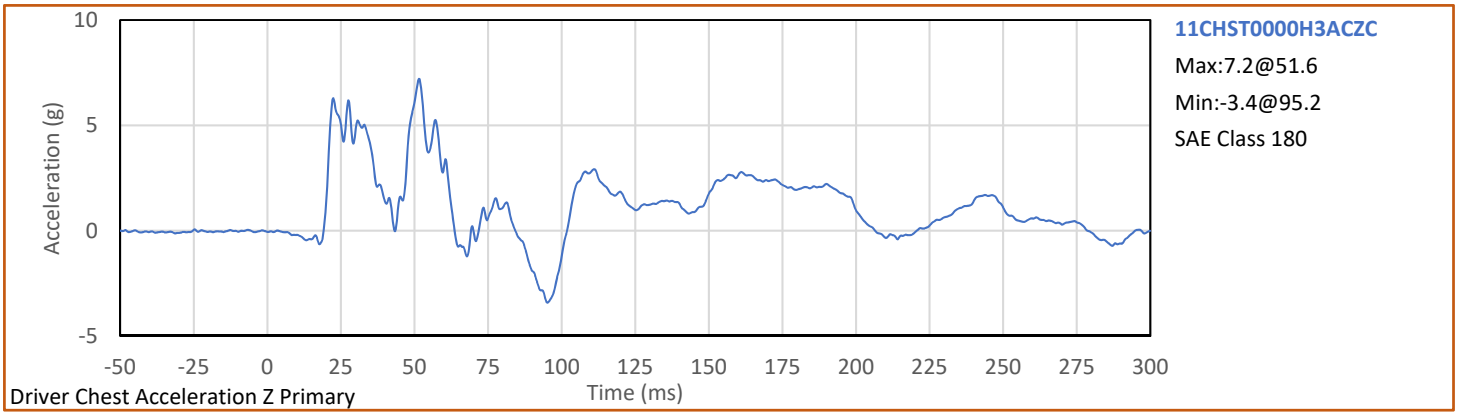
11NIJCIPTFH3000B
Max:0.272@61.6
SAE Class 600
11NIJCIPTEH3000B
Max:0.192@90.2
SAE Class 600
11NIJCIPCFH3000B
Max:0.097@130.1
SAE Class 600
11NIJCIPCEH3000B
Max:0.051@277.5
SAE Class 600



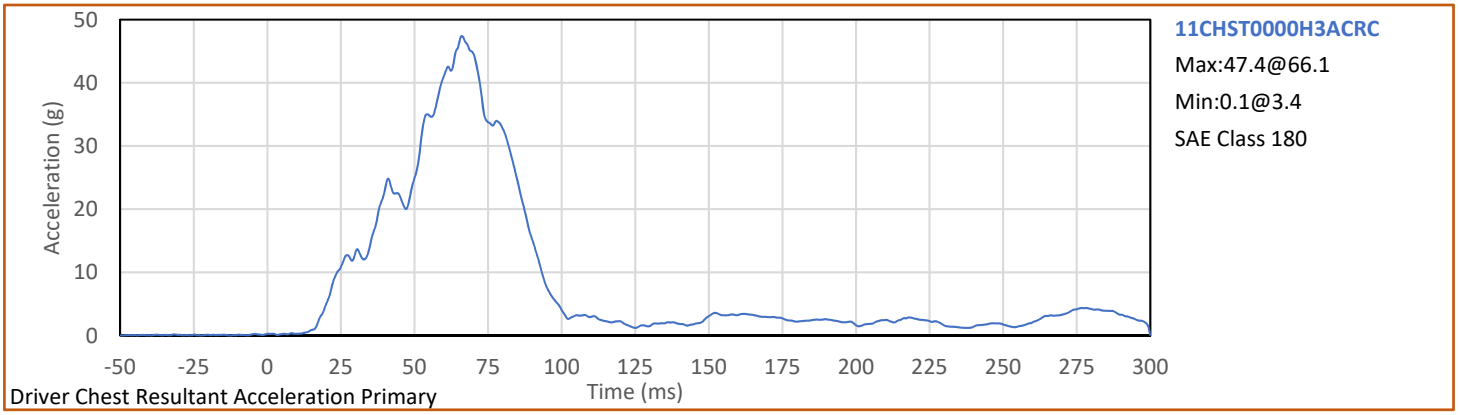
Driver Chest Acceleration X Primary



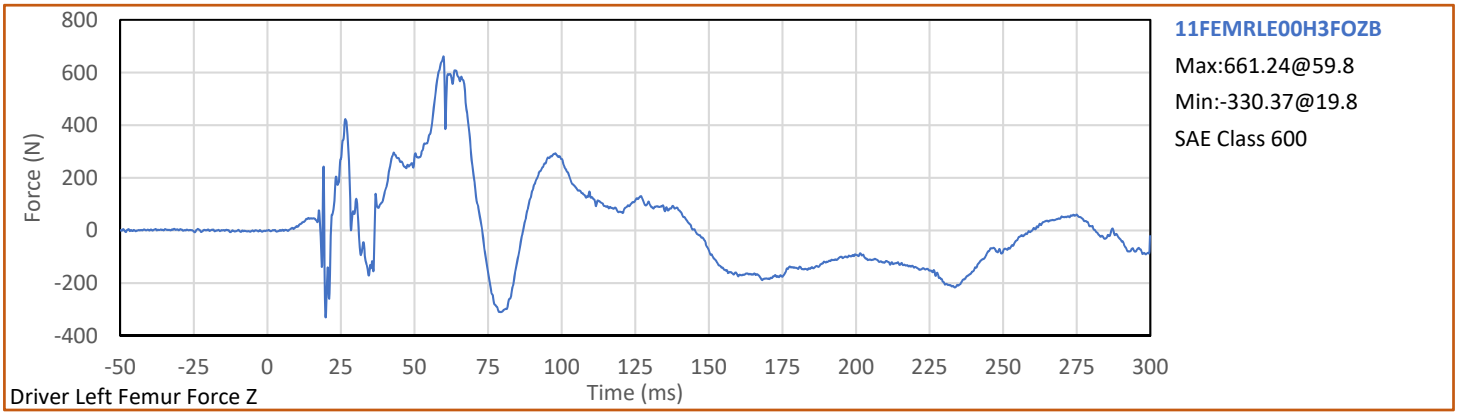
Driver Chest Acceleration Y Primary



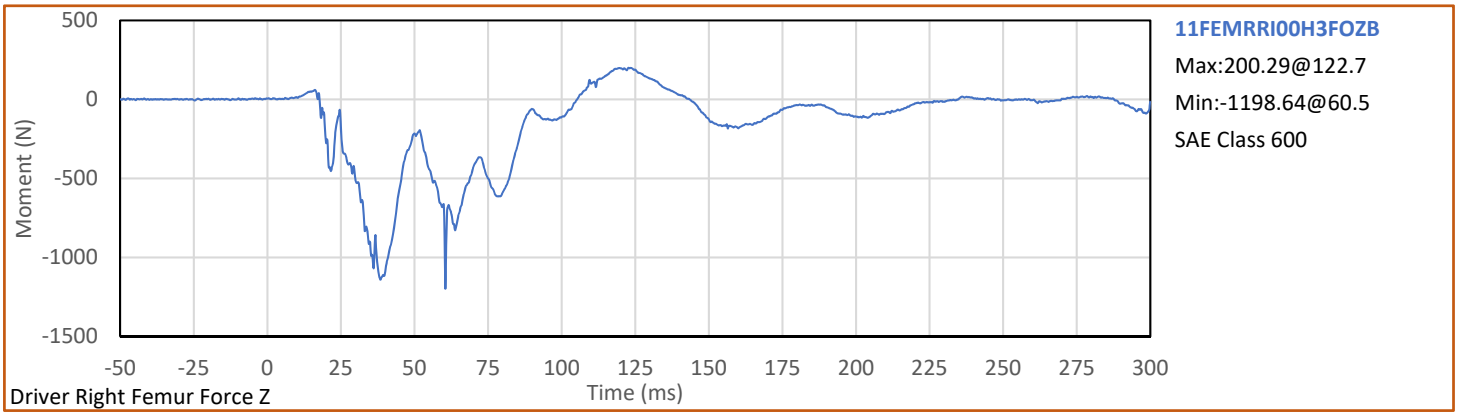
Driver Chest Acceleration Z Primary



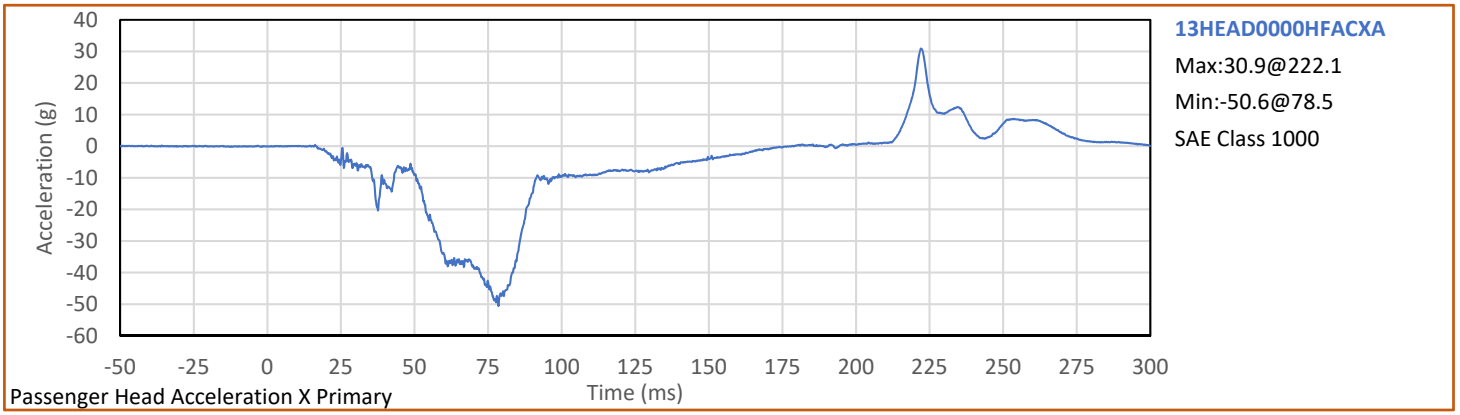
Driver Chest Resultant Acceleration Primary



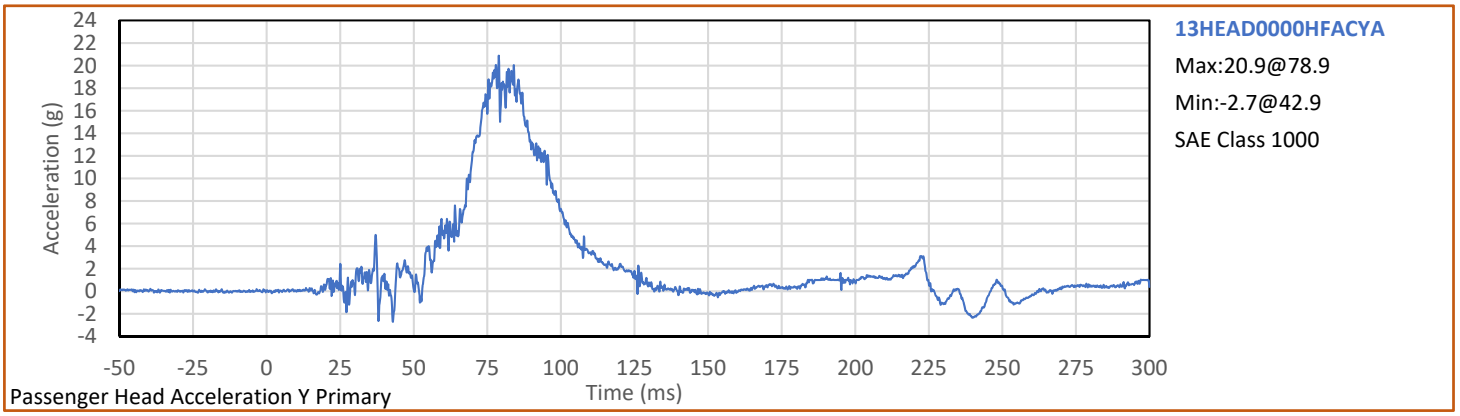
Driver Left Femur Force Z



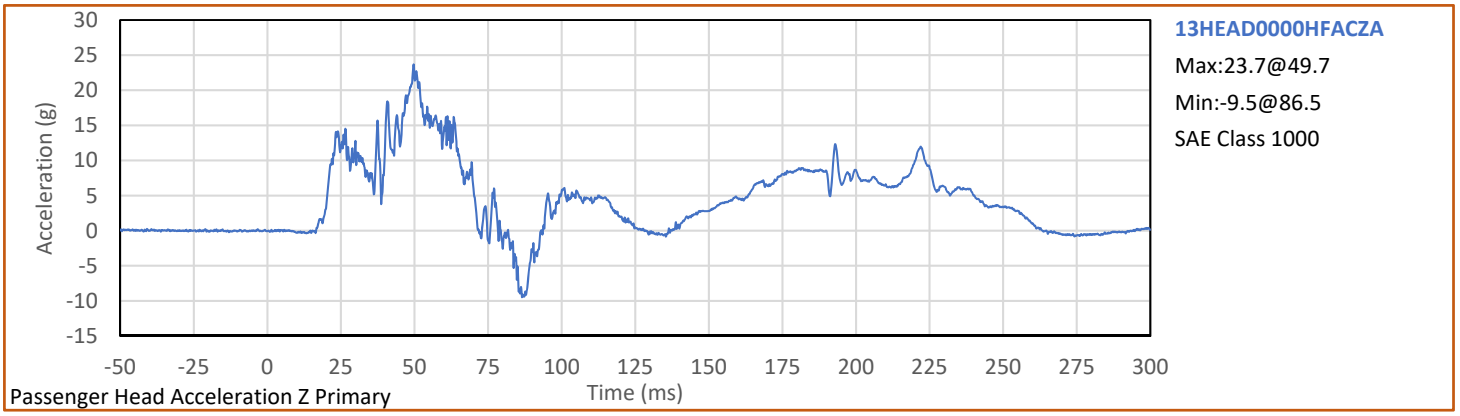
Driver Right Femur Force Z



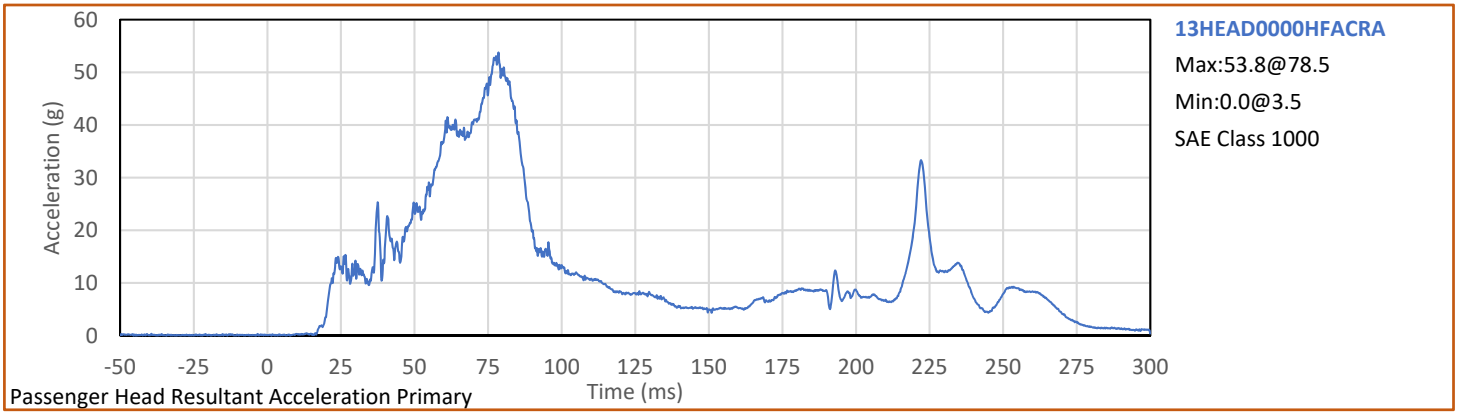
Passenger Head Acceleration X Primary



Passenger Head Acceleration Y Primary

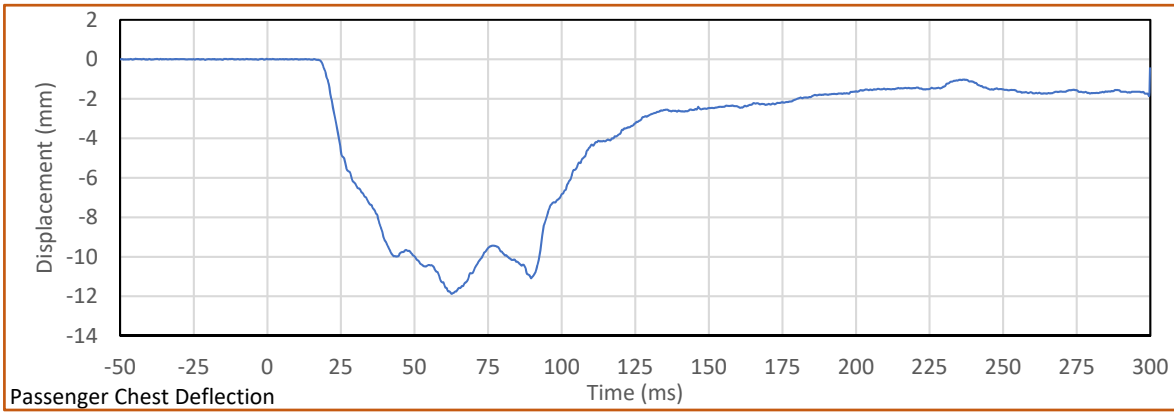


Passenger Head Acceleration Z Primary



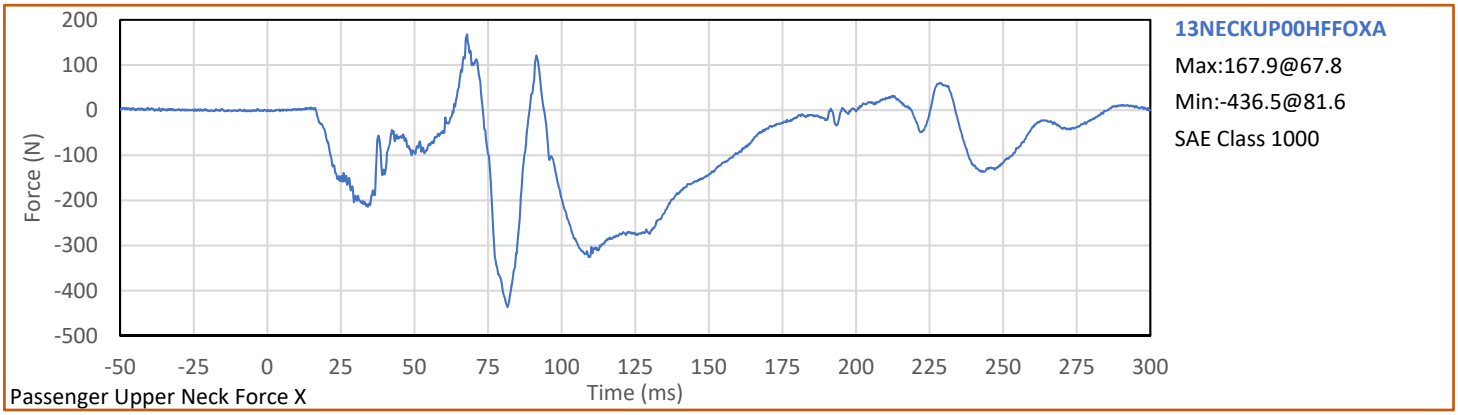
Passenger Head Resultant Acceleration Primary

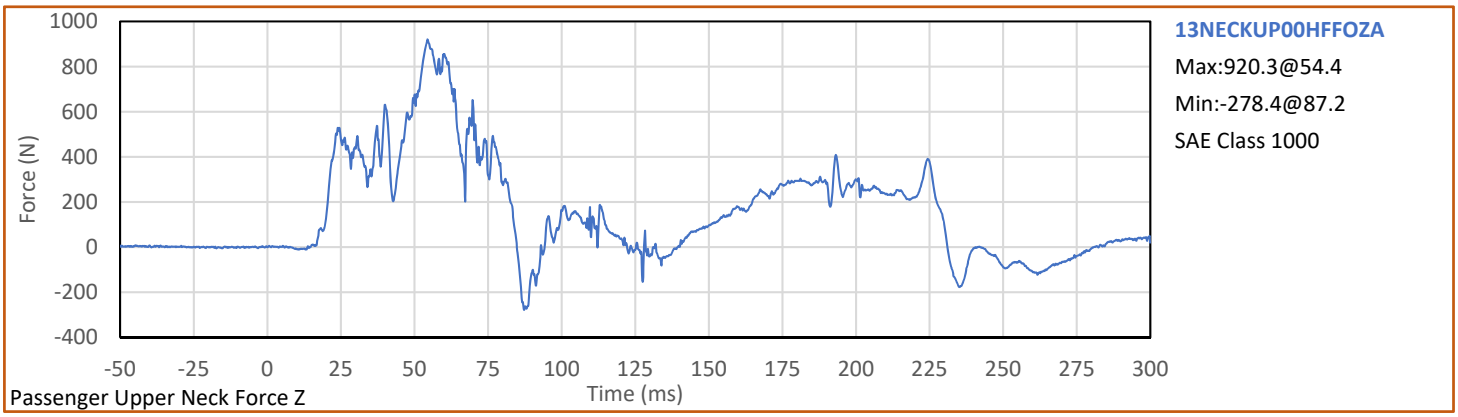
Test Vehicle:	2019 Kia Niro Hybrid LX 5-Door MPV	NHTSA No.:	M20194209
Test Program:	56.3 km/h Frontal Impact NCAP Test	Test Date:	5/20/2019

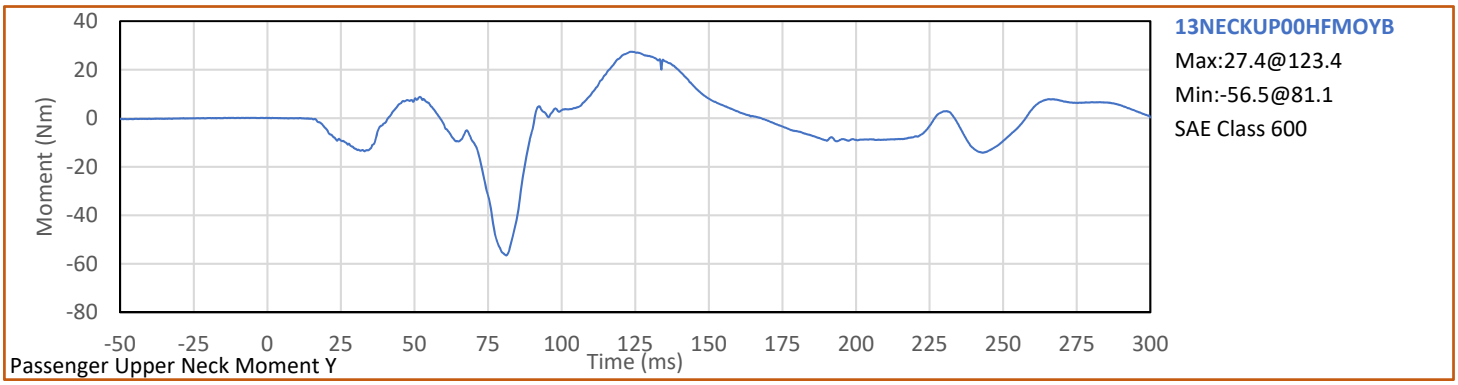


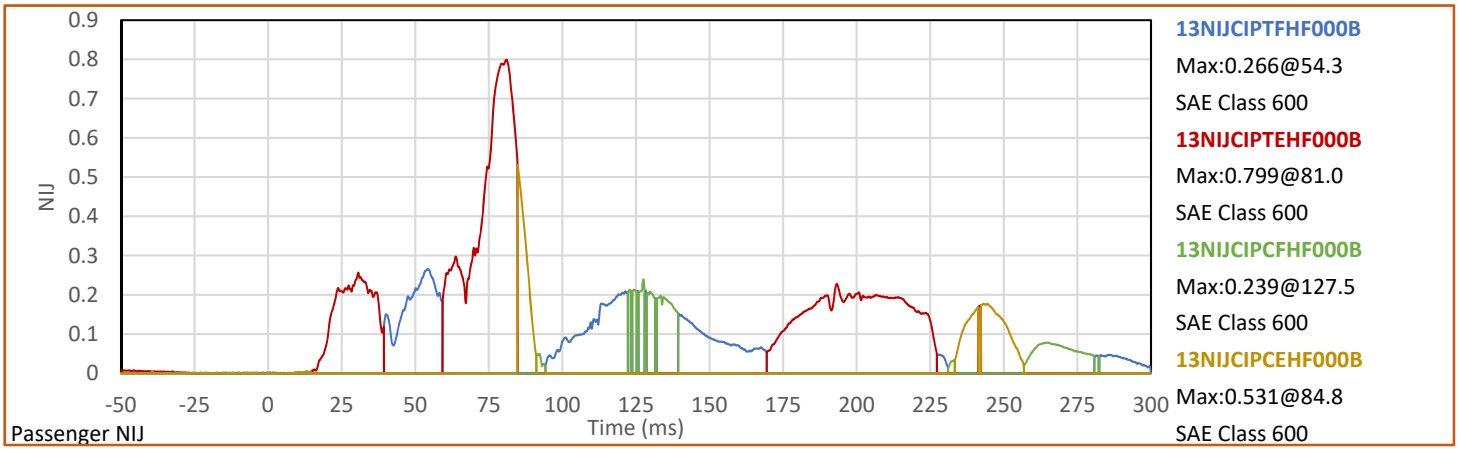
Passenger Chest Deflection

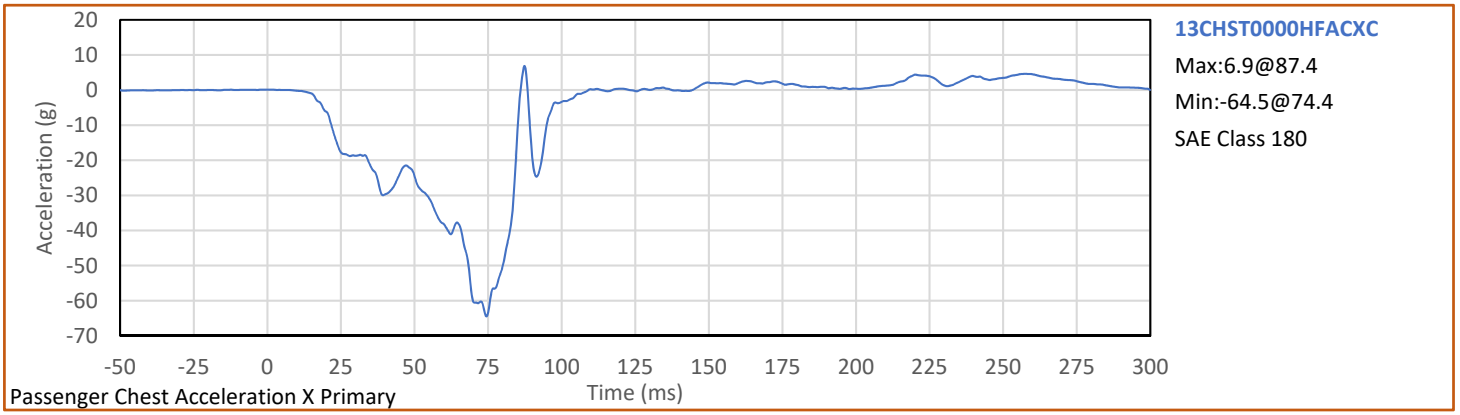
13CHST0000HFDSXB
Max:0.0@1.8
Min:-11.9@62.7
SAE Class 600


Force (N)
Time (ms)
Passenger Upper Neck Force X
13NECKUP00HFFOXA
Max:167.9@67.8
Min:-436.5@81.6
SAE Class 1000

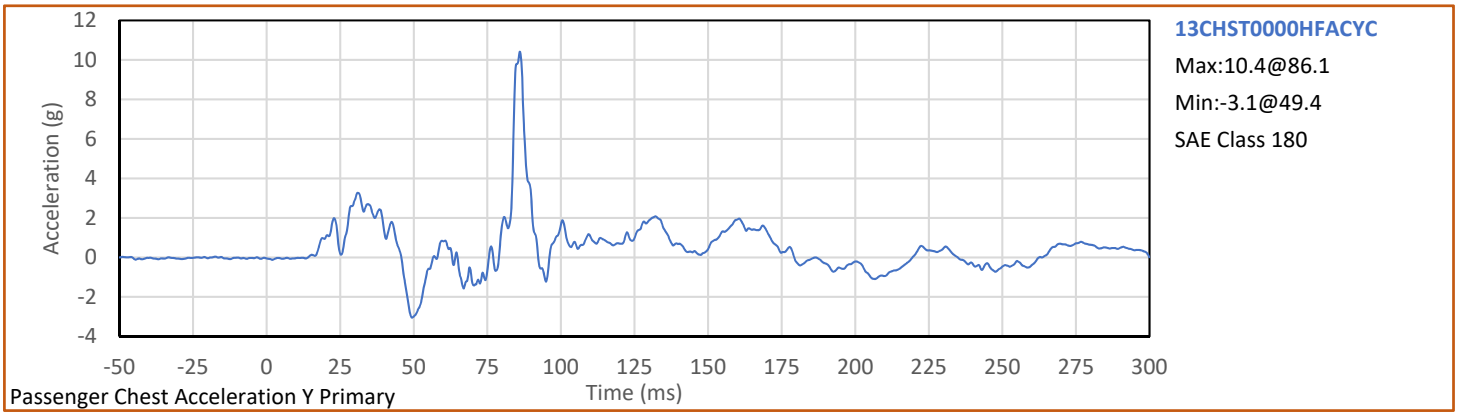

Force (N)
Time (ms)
Passenger Upper Neck Force Z
13NECKUP00HFFOZA
Max:920.3@54.4
Min:-278.4@87.2
SAE Class 1000


Moment (Nm)
Time (ms)
Passenger Upper Neck Moment Y
13NECKUP00HFMOYB
Max:27.4@123.4
Min:-56.5@81.1
SAE Class 600

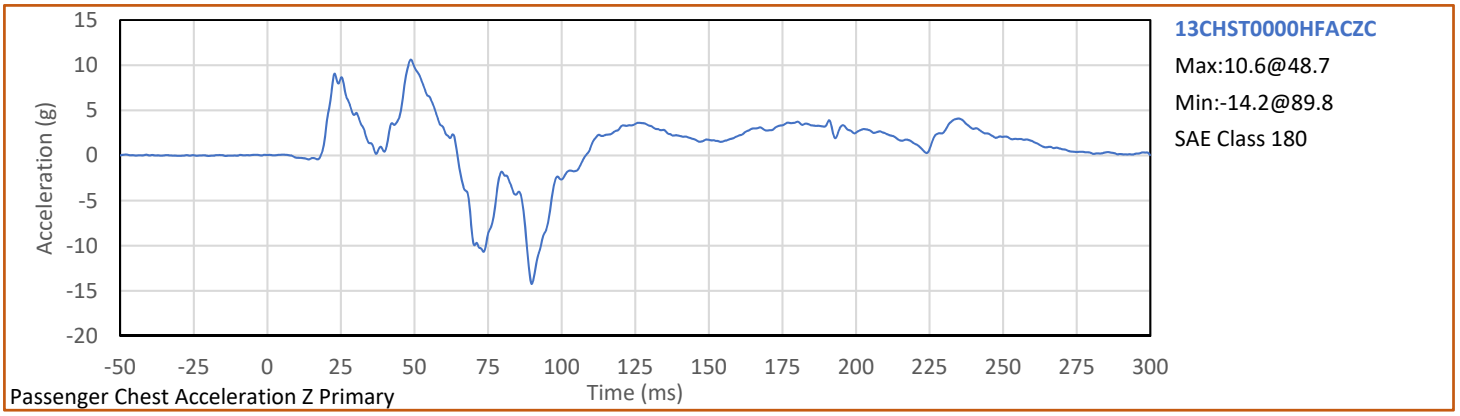

NIJ
Time (ms)
Passenger NIJ
13NIJCIPTFHF000B
Max:0.266@54.3
SAE Class 600
13NIJCIPTEHF000B
Max:0.799@81.0
SAE Class 600
13NIJCIPCFHF000B
Max:0.239@127.5
SAE Class 600
13NIJCIPCEHF000B
Max:0.531@84.8
SAE Class 600



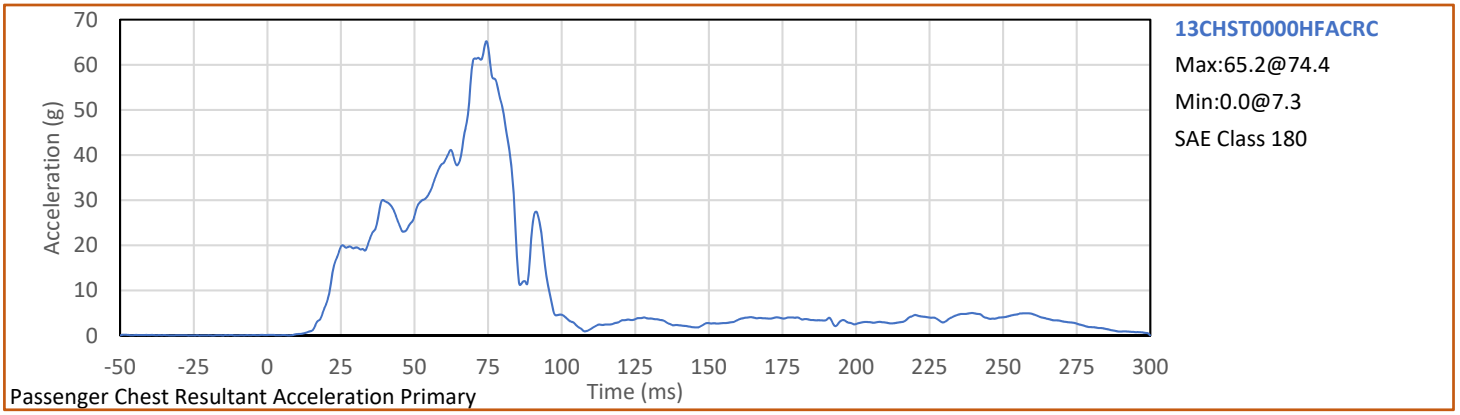
13CHST0000HFACXC
Max:6.9@87.4
Min:-64.5@74.4
SAE Class 180



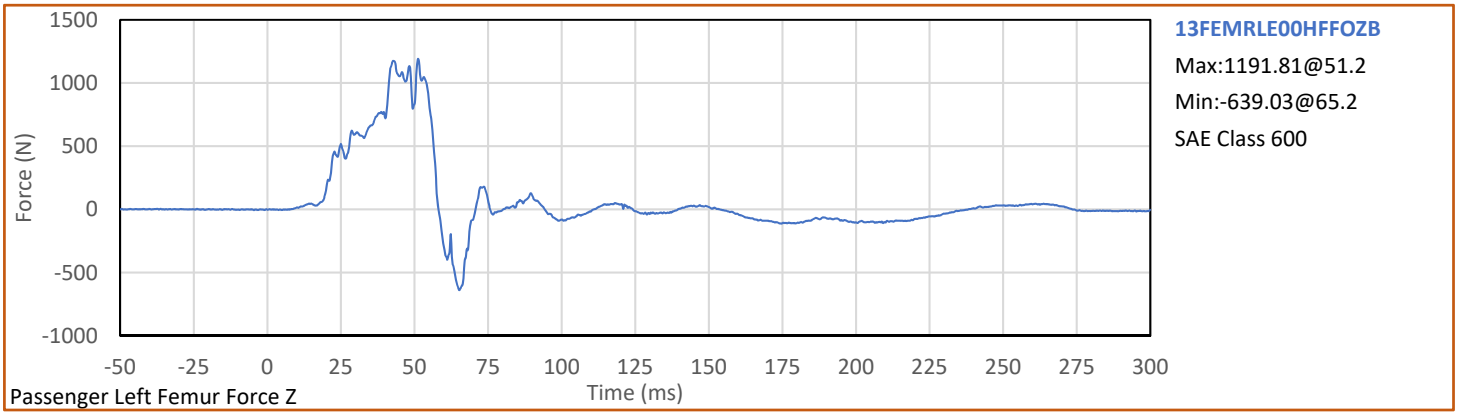
13CHST0000HFACYC
Max:10.4@86.1
Min:-3.1@49.4
SAE Class 180



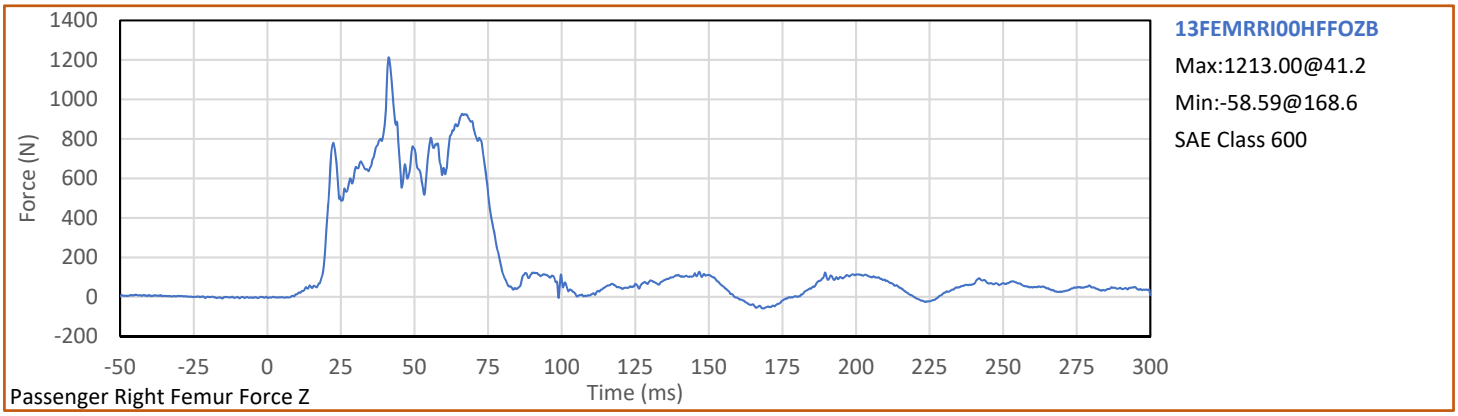
13CHST0000HFACZC
Max:10.6@48.7
Min:-14.2@89.8
SAE Class 180



13CHST0000HFACRC
Max:65.2@74.4
Min:0.0@7.3
SAE Class 180



Passenger Left Femur Force Z



Passenger Right Femur Force Z

APPENDIX C
ATD CALIBRATION AND PERFORMANCE VERIFICATION DATA

APPENDIX C
PRE-TEST ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA
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: 2019-05-01

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: 2019-05-01

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	30	Pass
A - Total sitting height	mm	879	889	886	Pass
B - Shoulder pivot height	mm	505	521	512	Pass
C - 'H' point height	mm	84	89	86	Pass
D - 'H' point location from backline	mm	135	140	140	Pass
E - Shoulder pivot from backline	mm	84	94	90	Pass
F - Thigh clearance	mm	140	155	147	Pass
G - Back of elbow to wrist pivot	mm	290	305	301	Pass
H - Head back to backline	mm	41	46	45	Pass
I - Shoulder to elbow length	mm	330	345	342	Pass
J - Elbow rest height	mm	190	211	204	Pass
K - Buttock to knee length	mm	579	604	591	Pass
L - Popliteal length	mm	429	455	450	Pass
M - Knee pivot height	mm	485	500	489	Pass
N - Buttock popliteal length	mm	452	477	471	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	427	Pass
W - Foot breadth	mm	91	107	103	Pass
Y - Chest circum. (w/chest jacket)	mm	970	1001	983	Pass
Z - Waist circum.	mm	836	866	852	Pass
AA - Location for chest circum.	mm	429	434	431	Pass
BB - Location for waist circum.	mm	226	231	228	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

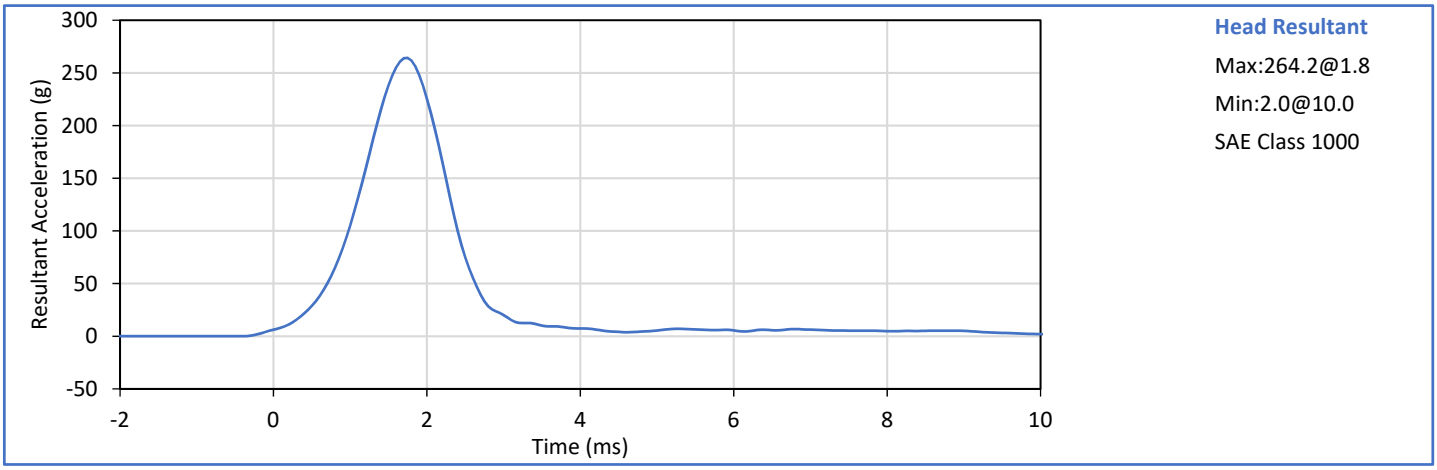
Approved By: P. Puzzuto

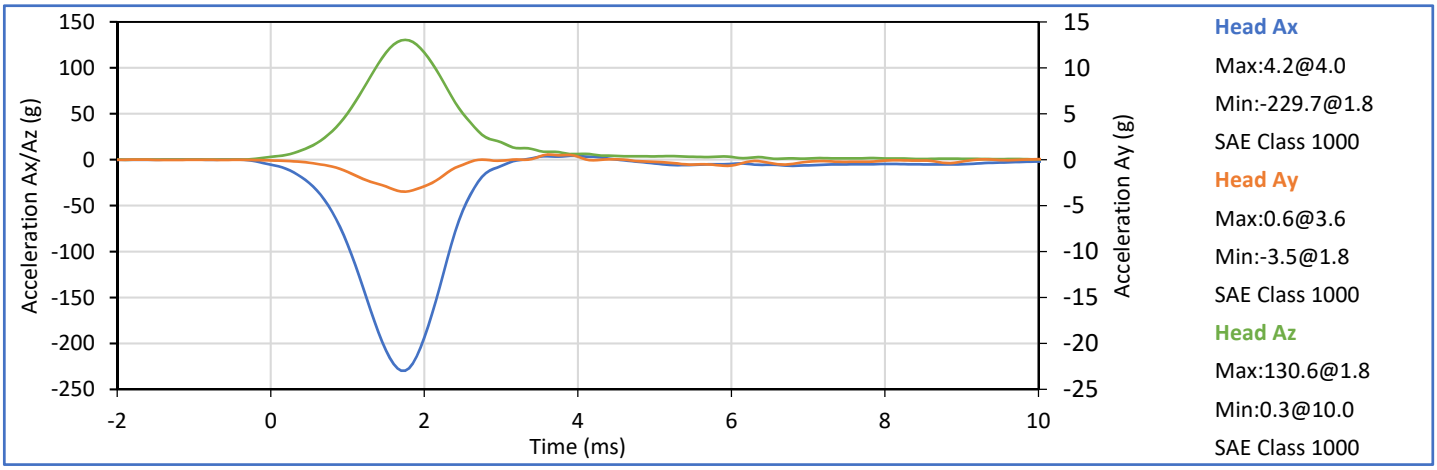
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Head Drop

ATD Serial No.: 360 Test Date: 2019-05-02

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	20.5	Pass
Laboratory Humidity	%	10	70	30	Pass
Peak Resultant Acceleration	g	225.0	275.0	264.2	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-3.5	Pass
Oscillations After Main Pulse	%	0.0	10.0	2.6	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

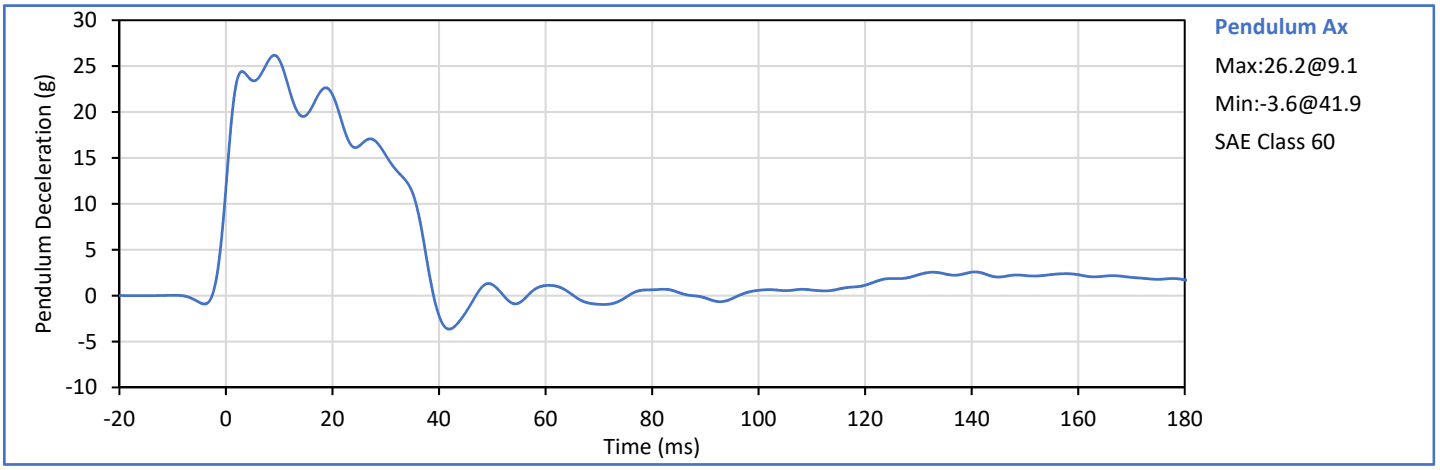
Approved By: P. Puzzuto

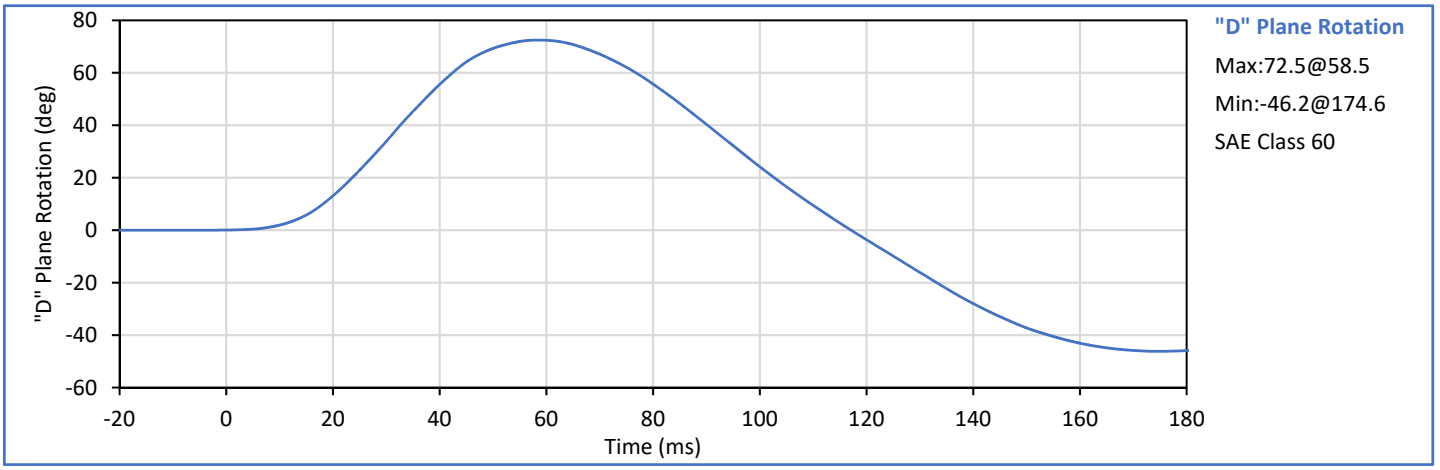
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2019-05-02

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	20.8	Pass
Laboratory Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	6.89	7.13	6.95	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	25.7	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	21.9	Pass
Pendulum Deceleration at 30 ms	g	12.5	18.5	15.3	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	29.0	15.3	Pass
Deceleration Decay to Cross 5 g	ms	34.0	42.0	37.4	Pass
"D" Plane Rotation peak	deg	64.0	78.0	72.5	Pass
	ms	57.0	64.0	58.5	Pass
"D" Plane Rotation Decay To Zero	ms	113.0	128.0	117.2	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	95.9	Pass
	ms	47.0	58.0	49.4	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	99.5	Pass
			Overall Test Results		Pass





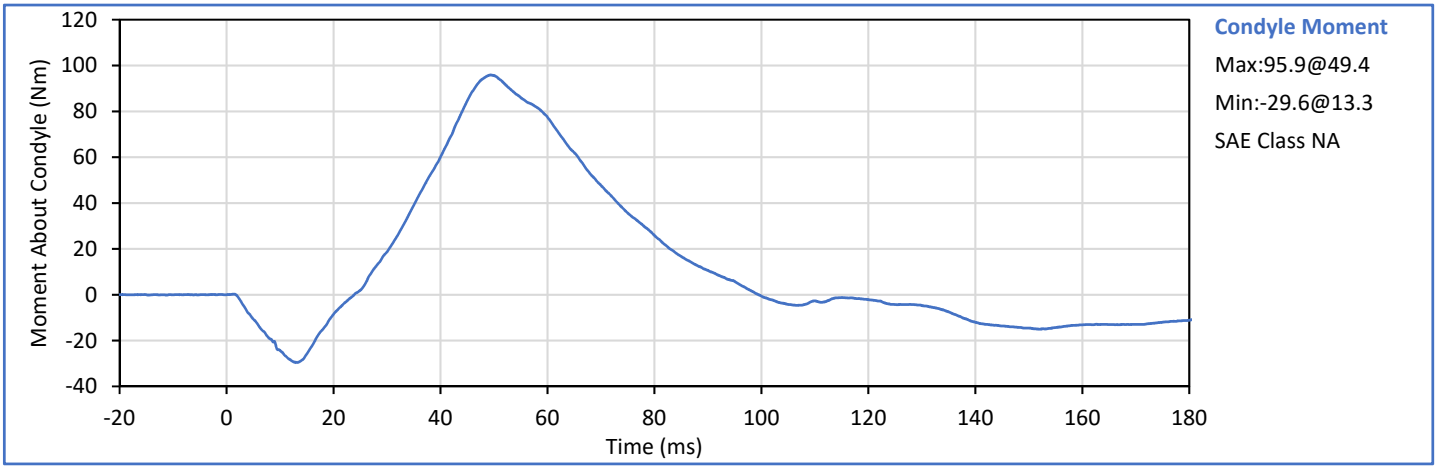
Technician: J. Hernandez

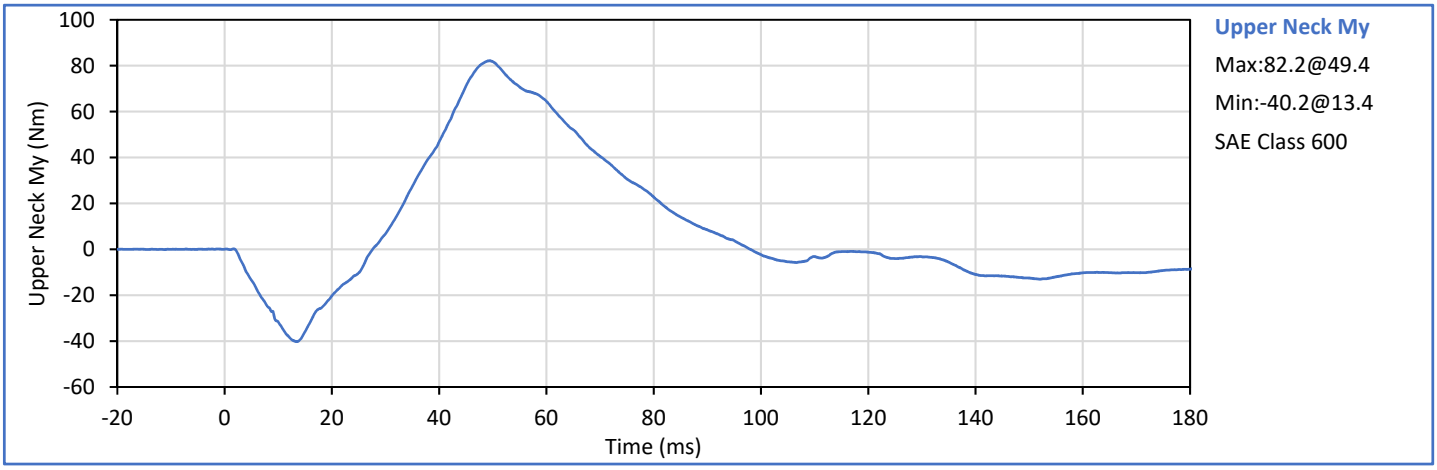
Approved By: P. Puzzuto

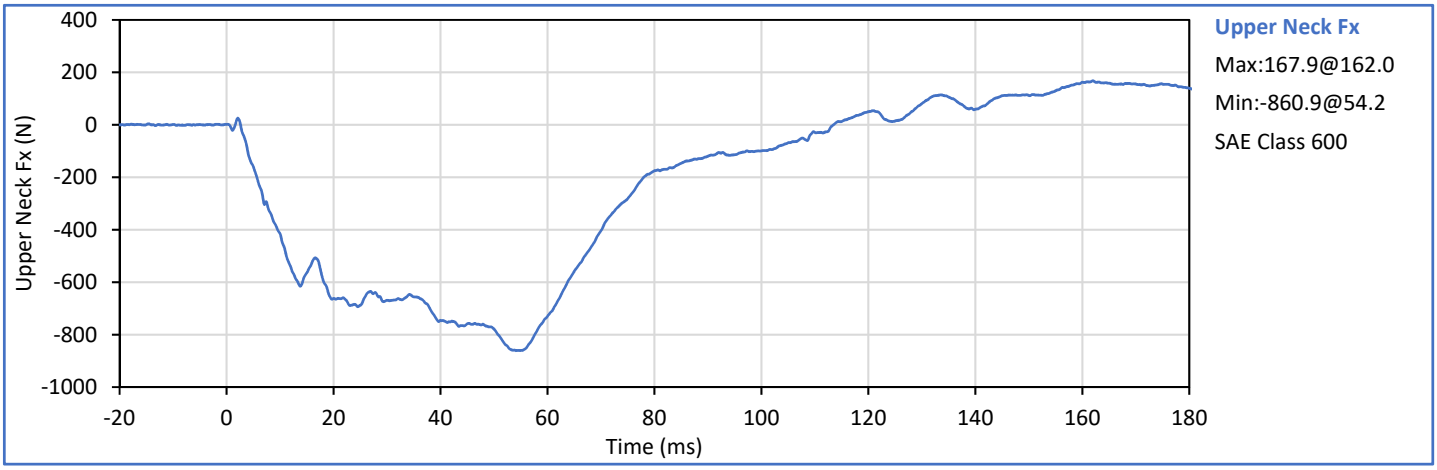
Applus IDIADA
KARCO

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2019-05-02





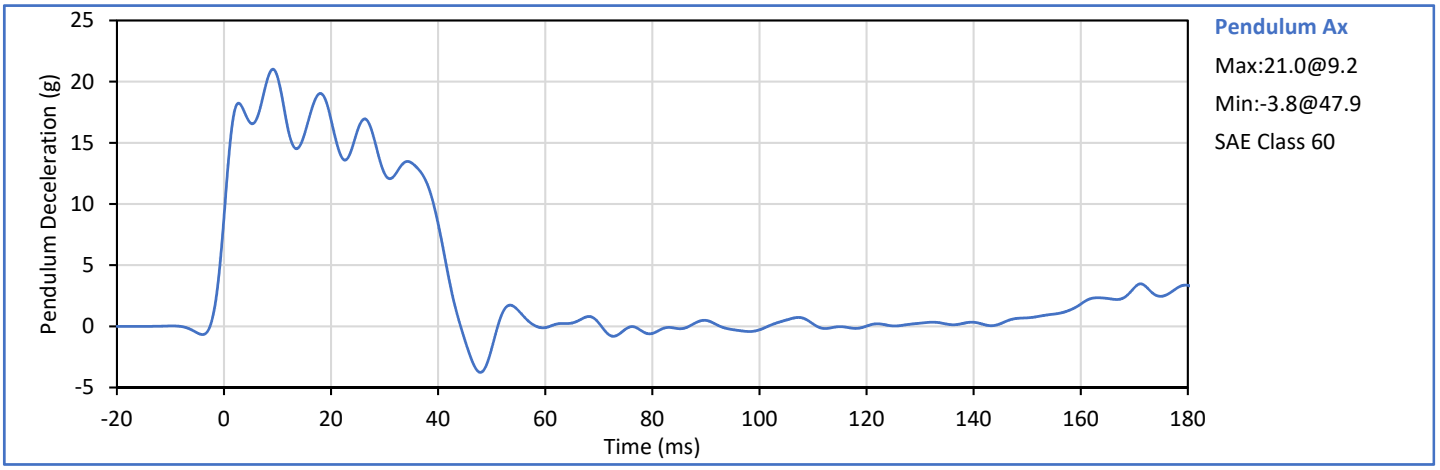


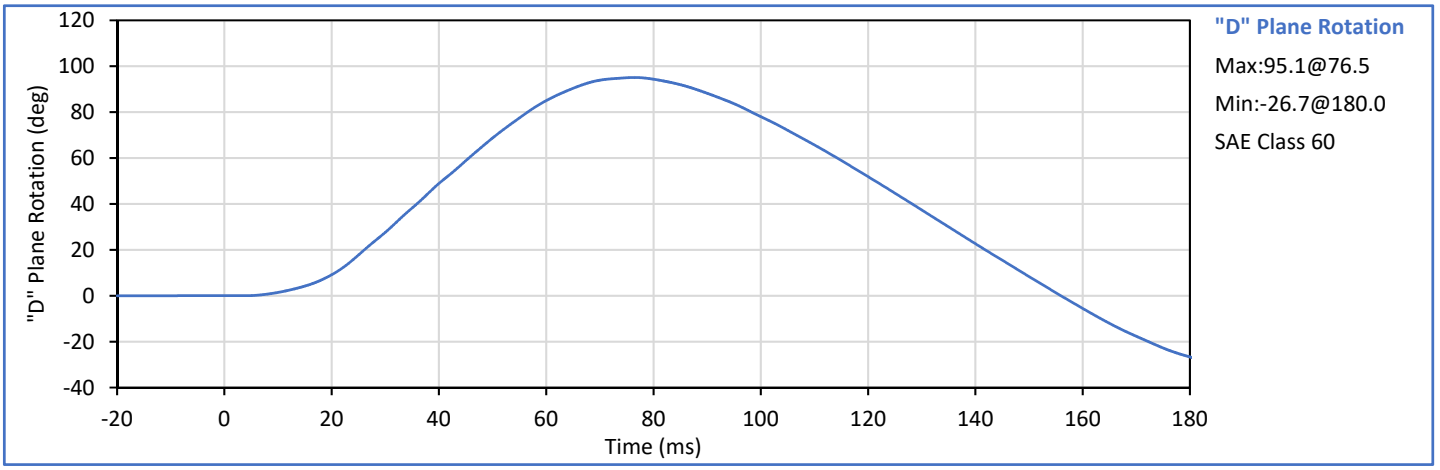
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360 Test Date: 2019-05-02

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	20.8	Pass
Laboratory Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	5.94	6.19	6.01	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	20.4	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	16.9	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	12.5	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	22.0	13.5	Pass
Deceleration Decay to Cross 5 g	ms	38.0	46.0	41.5	Pass
"D" Plane Rotation peak	deg	81.0	106.0	95.1	Pass
	ms	72.0	82.0	76.5	Pass
"D" Plane Rotation Decay To Zero	ms	147.0	174.0	156.0	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-69.7	Pass
	ms	65.0	79.0	70.6	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	137.7	Pass
			Overall Test Results		Pass





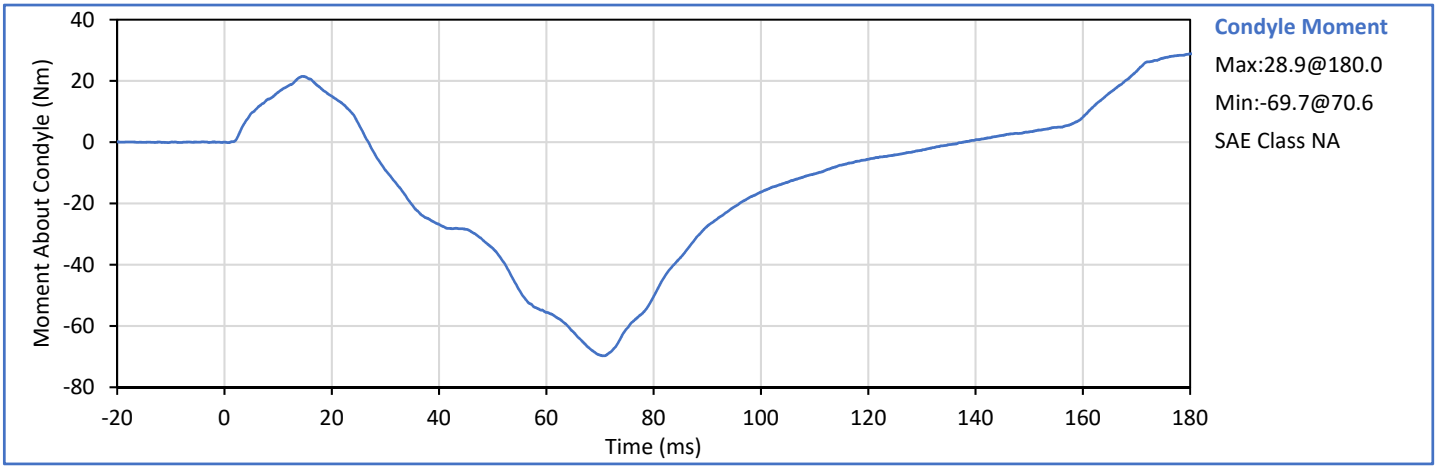
Technician: J. Hernandez

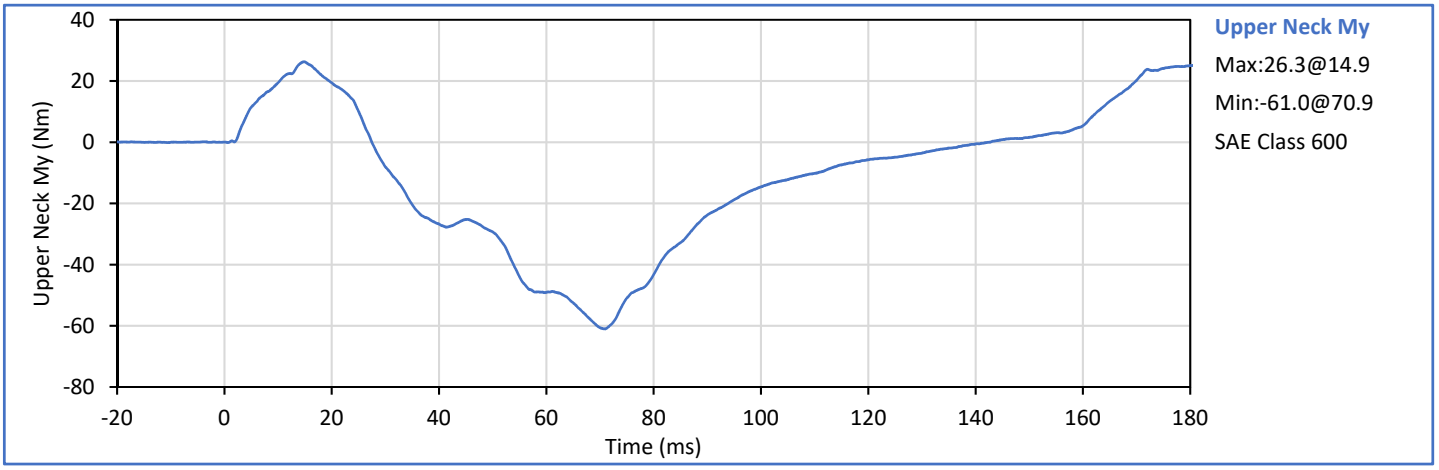
Approved By: P. Puzzuto

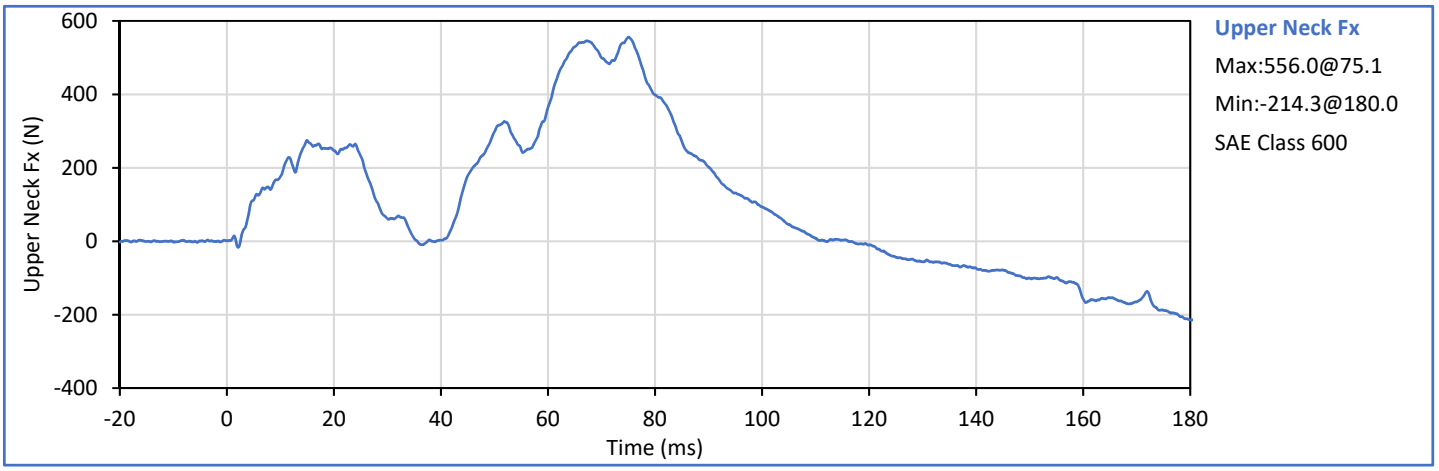
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360 Test Date: 2019-05-02





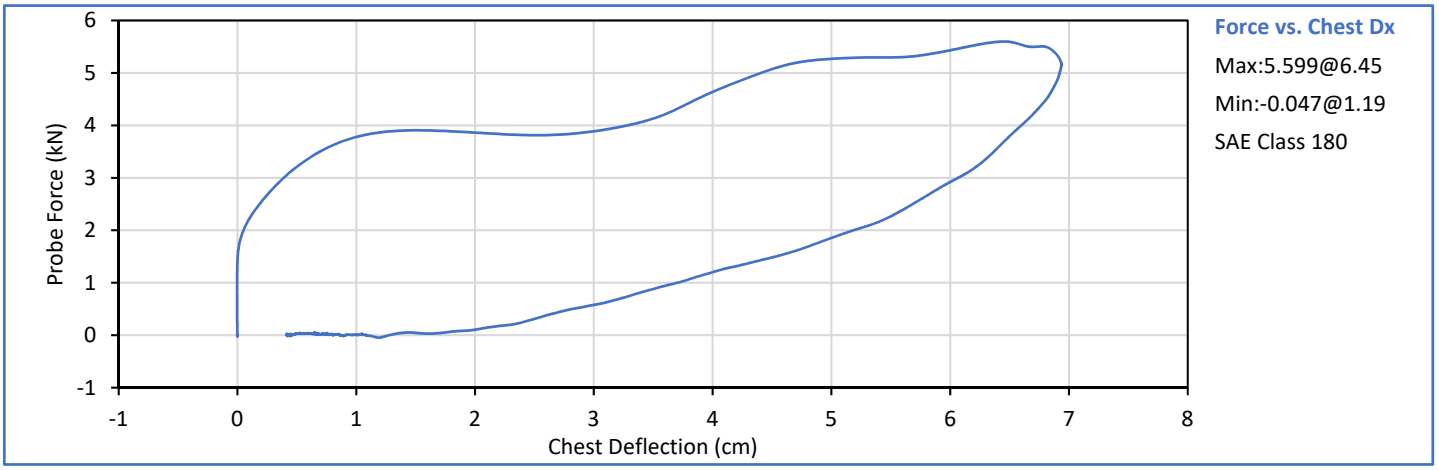


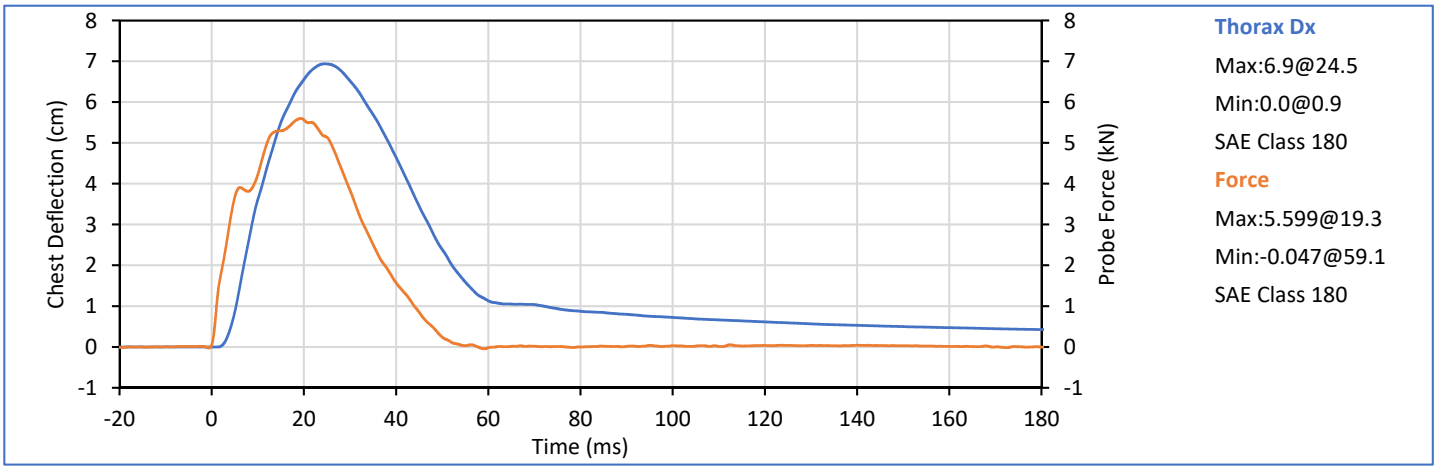
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Thorax Impact

ATD Serial No.: 360 Test Date: 2019-05-01

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.6	Pass
Laboratory Humidity	%	10	70	30	Pass
Probe Velocity	m/s	6.58	6.82	6.71	Pass
Peak Chest Deflection	cm	6.35	7.26	6.94	Pass
Peak Probe Force	kN	5.159	5.893	5.599	Pass
Internal Hysterisis	%	69.0	85.0	71.8	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

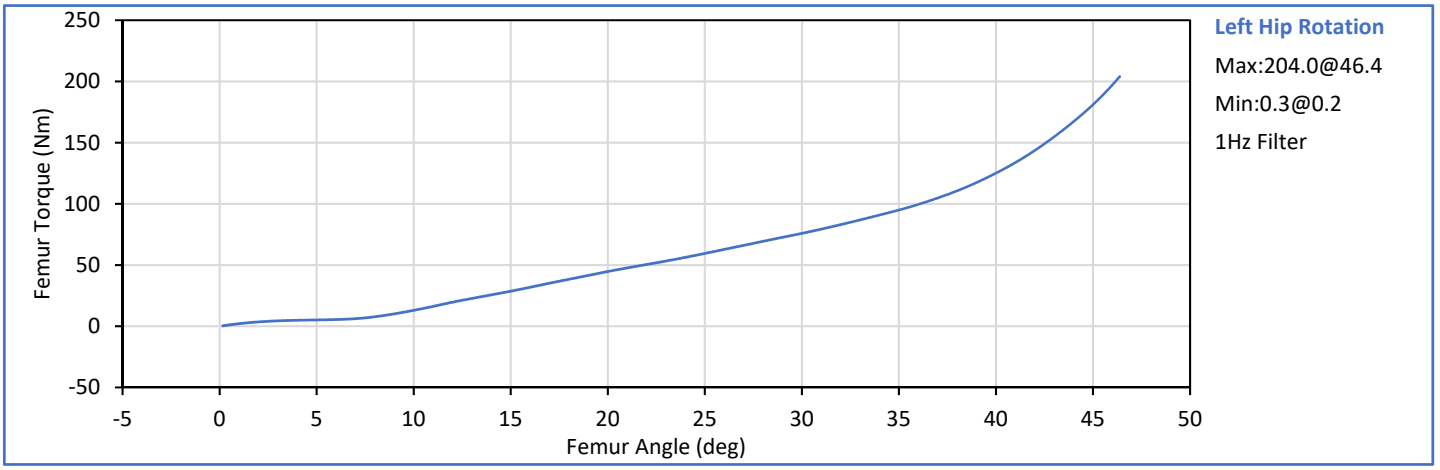
Approved By: P. Puzzuto

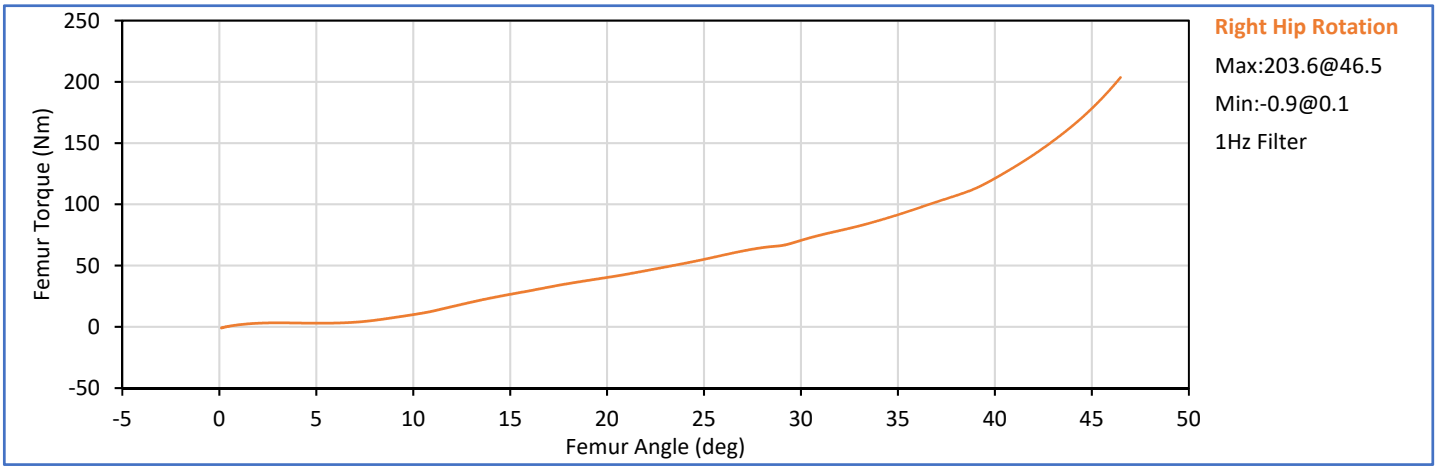
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Hip Flexion (Left/Right)

ATD Serial No.: 360 Test Date: 2019-05-02

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.1	Pass
	Laboratory Humidity	%	10	70	30	Pass
Left Hip	Left Hip Rotation Rate	deg/s	5.0	10.0	5.8	Pass
	Left Femur Torque at 30°	Nm	0.0	95.0	75.9	Pass
	Left Hip Rotation at 203 Nm	deg	40.0	50.0	46.3	Pass
Right Hip	Right Hip Rotation Rate	deg/s	5.0	10.0	5.8	Pass
	Right Femur Torque at 30°	Nm	0.0	95.0	70.6	Pass
	Right Hip Rotation at 203 Nm	deg	40.0	50.0	46.4	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

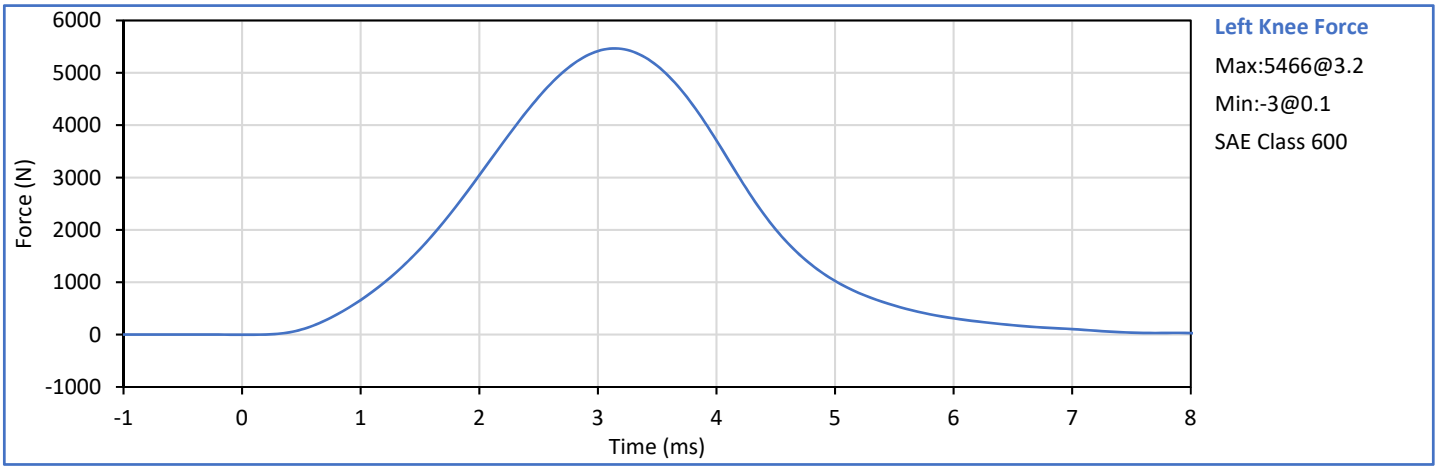
Applus IDIADA
KARCO

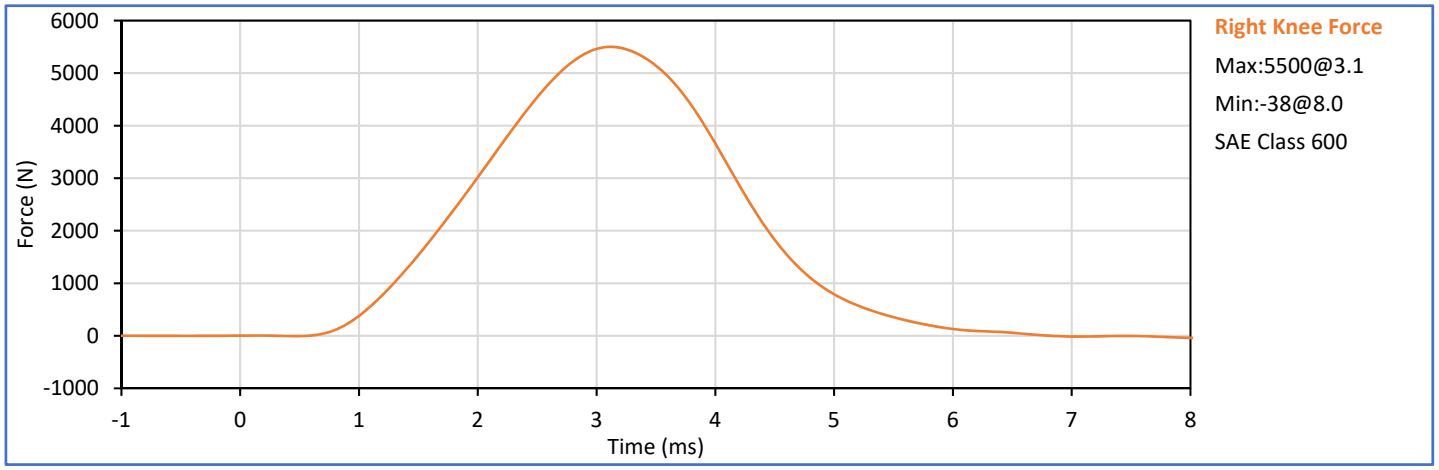
Hybrid III 50th Percentile Male ATD
Knee Impact (Left/Right)

ATD Serial No.: 360

Test Date: 2019-05-02

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.4	Pass
	Laboratory Humidity	%	10	70	30	Pass
Left Knee	Probe Velocity	m/s	2.070	2.130	2.103	Pass
	Peak Resistive Force	N	4715	5782	5466	Pass
Right Knee	Probe Velocity	m/s	2.070	2.130	2.106	Pass
	Peak Resistive Force	N	4715	5782	5500	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX C
PRE-TEST ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA
Hybrid III 5th Percentile Female ATD
S/N: 141

Applus IDIADA
KARCO

Hybrid III 5th Percentile Female ATD
Damage Checklist

ATD Serial No.: 141 Test Date: 2019-05-01

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.: 141 Test Date: 2019-05-01

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
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	81	Pass
F - Thigh clearance	mm	119	135	124	Pass
G - Back of elbow to wrist pivot	mm	244	259	250	Pass
H - Head back to backline	mm	41	46	44	Pass
I - Shoulder to elbow length	mm	277	297	291	Pass
J - Elbow rest height	mm	183	203	194	Pass
K - Buttock to knee length	mm	521	546	536	Pass
L - Popliteal length	mm	356	376	368	Pass
M - Knee pivot height	mm	394	419	412	Pass
N - Buttock popliteal length	mm	414	439	422	Pass
O - Chest depth without jacket	mm	175	191	181	Pass
P - Foot length	mm	219	234	231	Pass
R - Buttock to Knee Pivot Length	mm	457	483	468	Pass
S - Head Breadth	mm	137	147	141	Pass
T - Head Depth	mm	178	188	186	Pass
U - Hip Breadth	mm	300	315	311	Pass
V - Shoulder breadth	mm	351	366	357	Pass
W - Foot breadth	mm	79	94	90	Pass
X - Head circum.	mm	528	549	539	Pass
Y - Chest circum. (w/chest jacket)	mm	851	881	862	Pass
Z - Waist circum.	mm	760	790	769	Pass
AA - Location for chest circum.	mm	333	358	342	Pass
BB - Location for waist circum.	mm	160	170	167	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

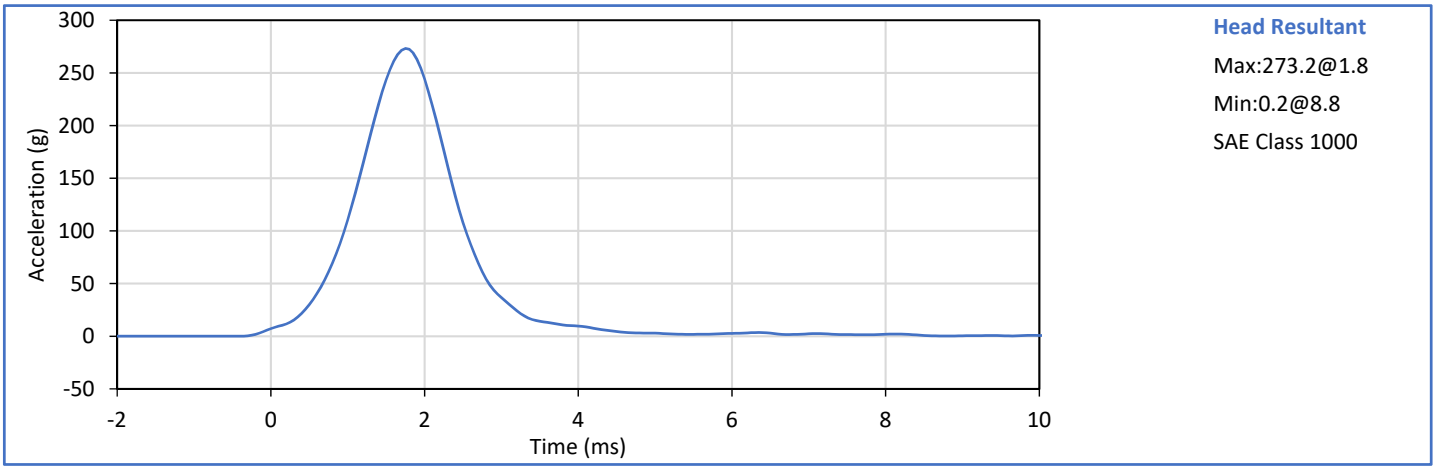
Applus IDIADA
KARCO

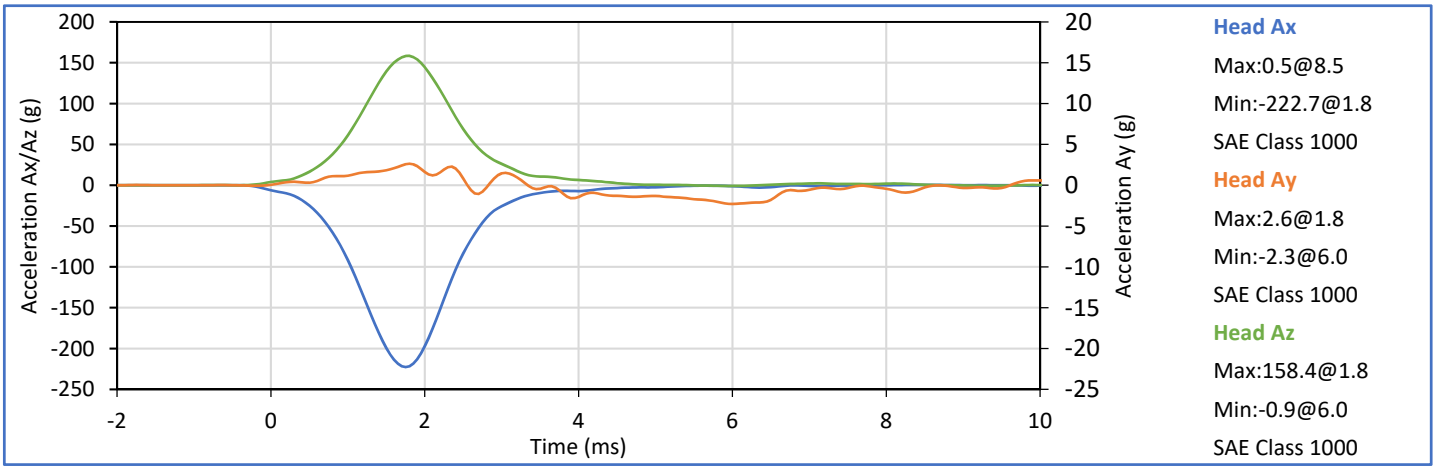
Hybrid III 5th Percentile Female ATD
Head Drop Test

ATD Serial No.: 141

Test Date: 2019-05-01

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.3	Pass
Laboratory Humidity	%	10	70	30	Pass
Peak Resultant Acceleration	g	250.0	300.0	273.2	Pass
Peak Lateral Acceleration	g	-15.0	15.0	2.6	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

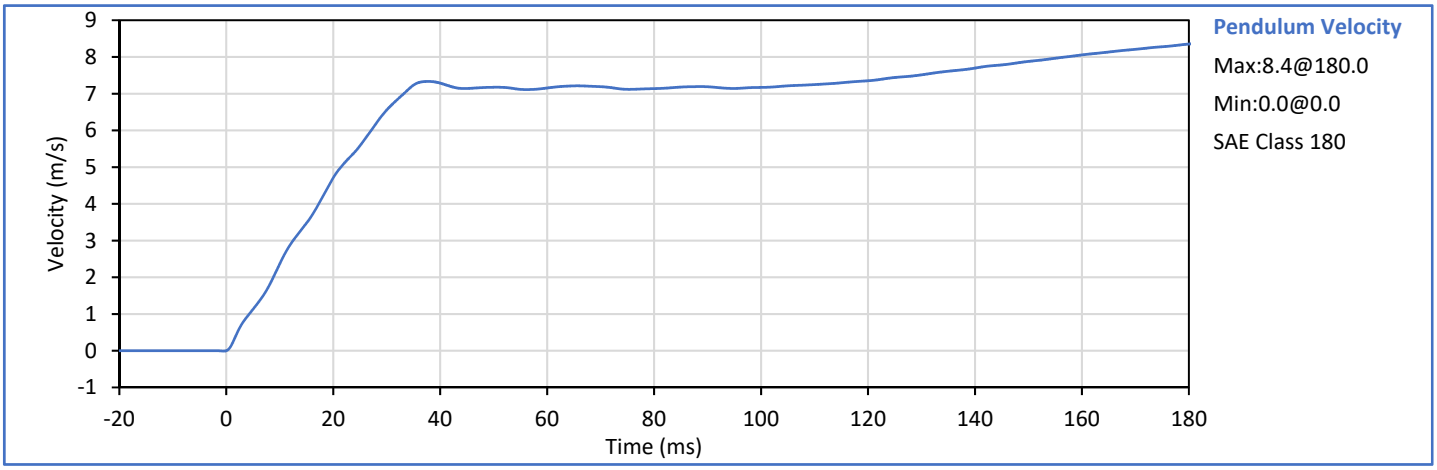
Approved By: P. Puzzuto

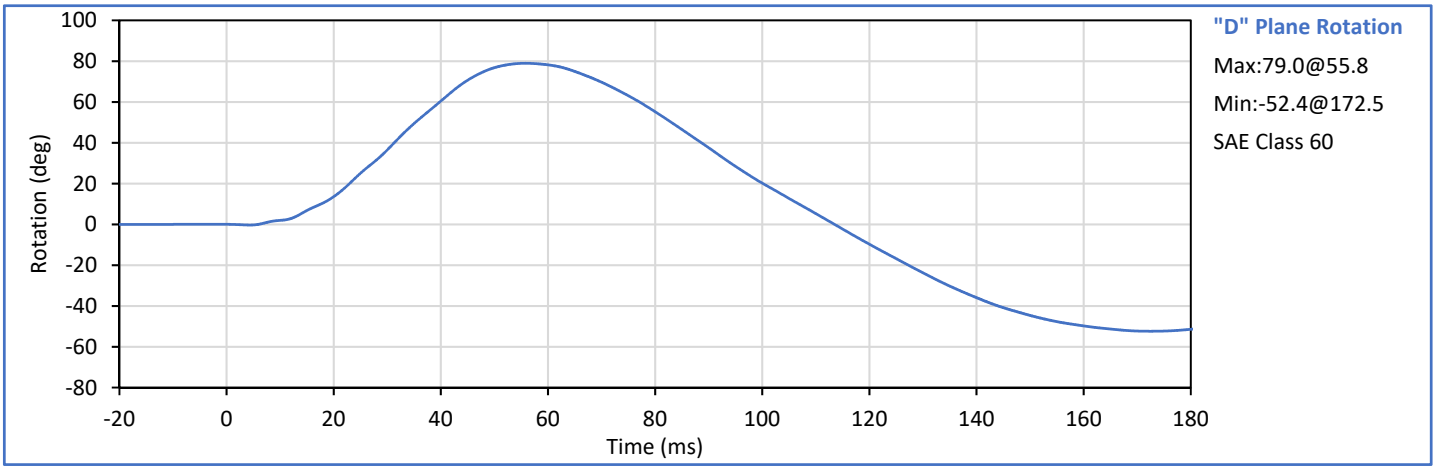
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: 141 Test Date: 2019-05-01

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	6.89	7.13	6.93	Pass
Pendulum Velocity at 10 ms	m/s	2.10	2.50	2.37	Pass
Pendulum Velocity at 20 ms	m/s	4.00	5.00	4.71	Pass
Pendulum Velocity at 30 ms	m/s	5.80	7.00	6.56	Pass
Peak "D" Plane Rotation	deg	77.0	91.0	79.0	Pass
Peak Moment in Rotation	Nm	69.0	83.0	80.6	Pass
Positive Moment Decay to 10 Nm	ms	80.0	100.0	83.6	Pass
			Overall Test Results		Pass



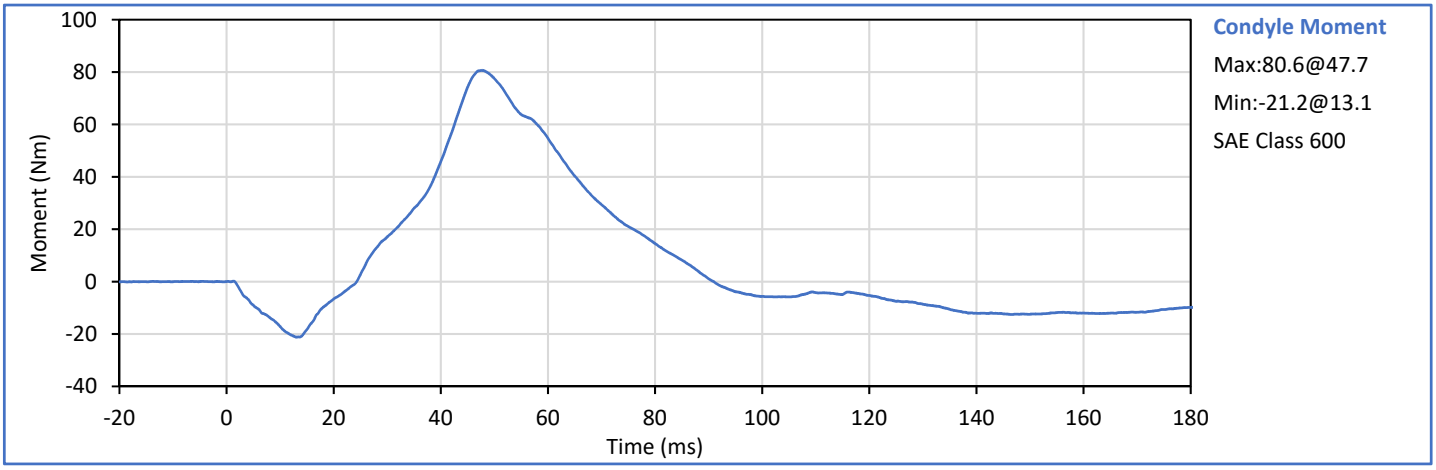


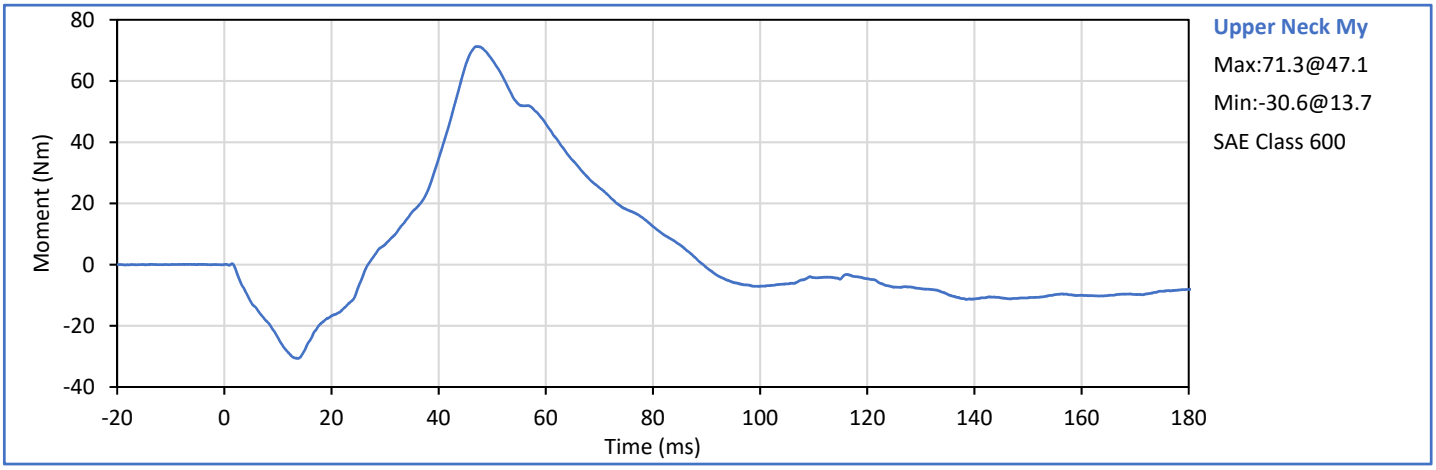
Technician: J. Hernandez

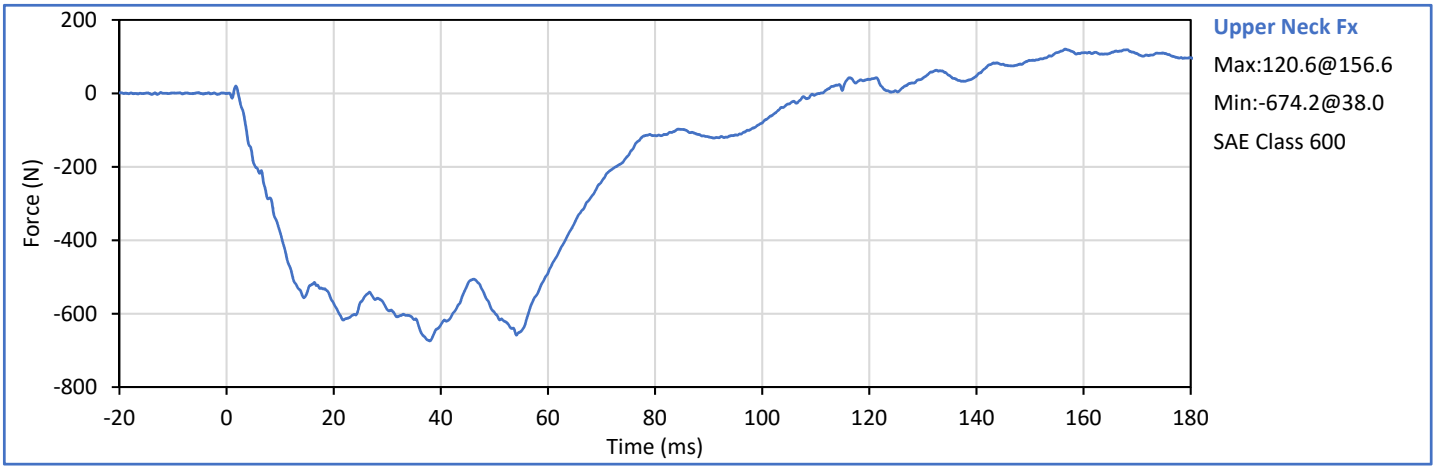
Approved By: P. Puzzuto

Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: 141 Test Date: 2019-05-01





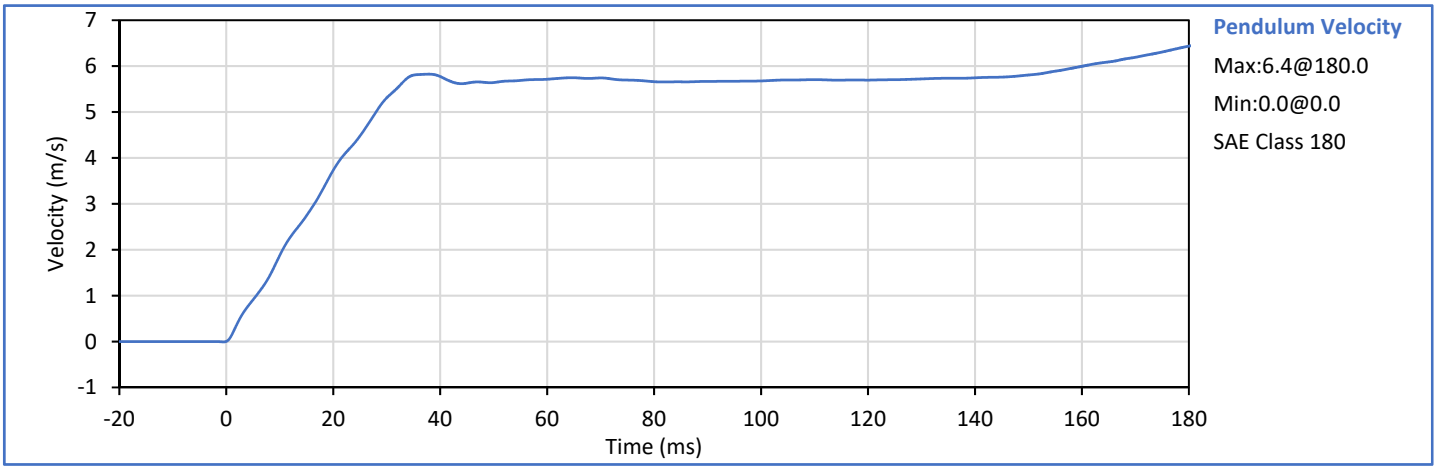


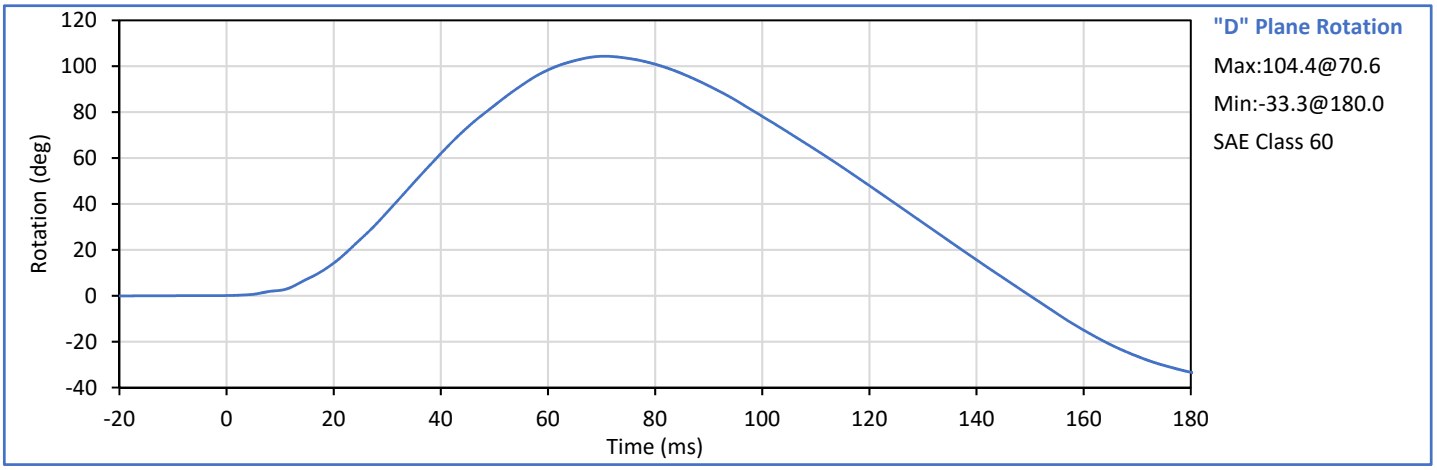
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Extension Test

ATD Serial No.: 141 Test Date: 2019-05-01

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	5.95	6.19	6.09	Pass
Pendulum Velocity at 10 ms	m/s	1.50	1.90	1.88	Pass
Pendulum Velocity at 20 ms	m/s	3.10	3.90	3.73	Pass
Pendulum Velocity at 30 ms	m/s	4.60	5.60	5.31	Pass
Peak "D" Plane Rotation	deg	99.0	114.0	104.4	Pass
Peak Moment in Rotation	Nm	-65.0	-53.0	-59.7	Pass
Negative Moment Decay to -10 Nm	ms	94.0	114.0	97.6	Pass
			Overall Test Results		Pass



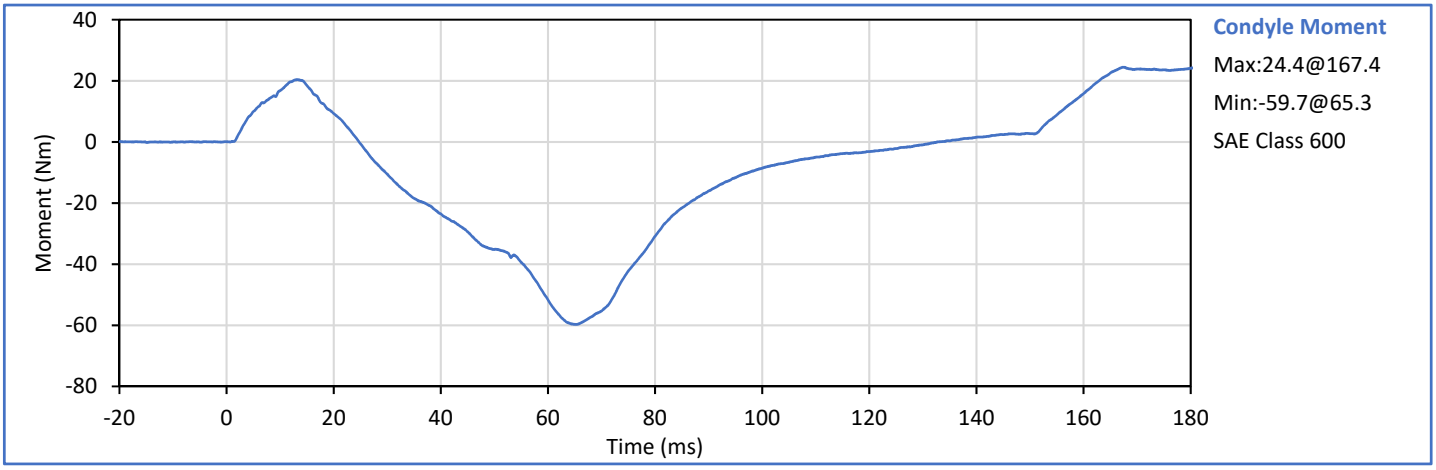


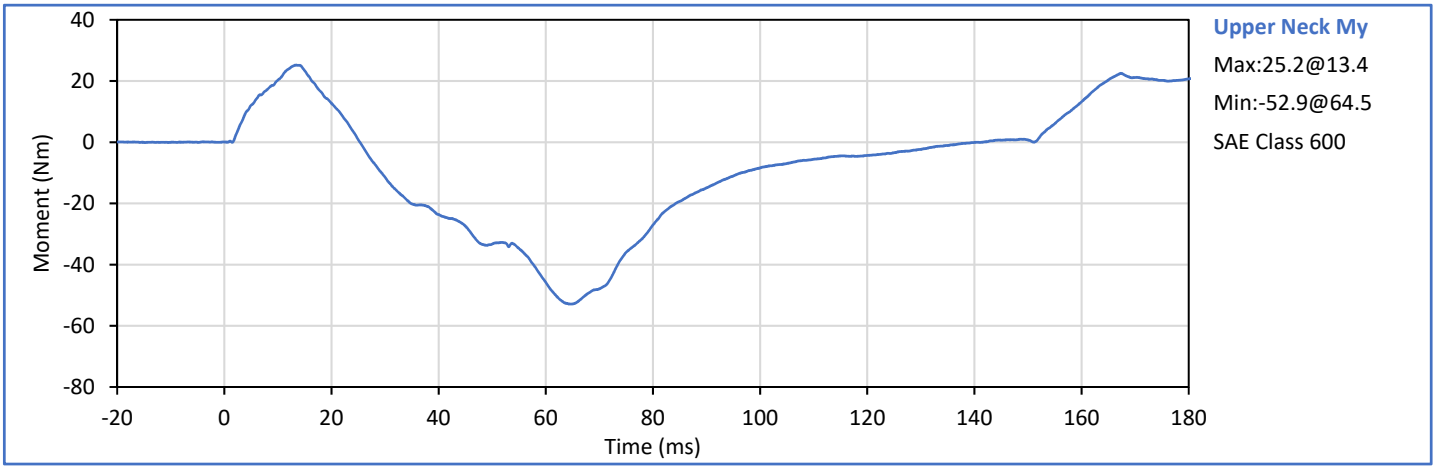
Technician: J. Hernandez

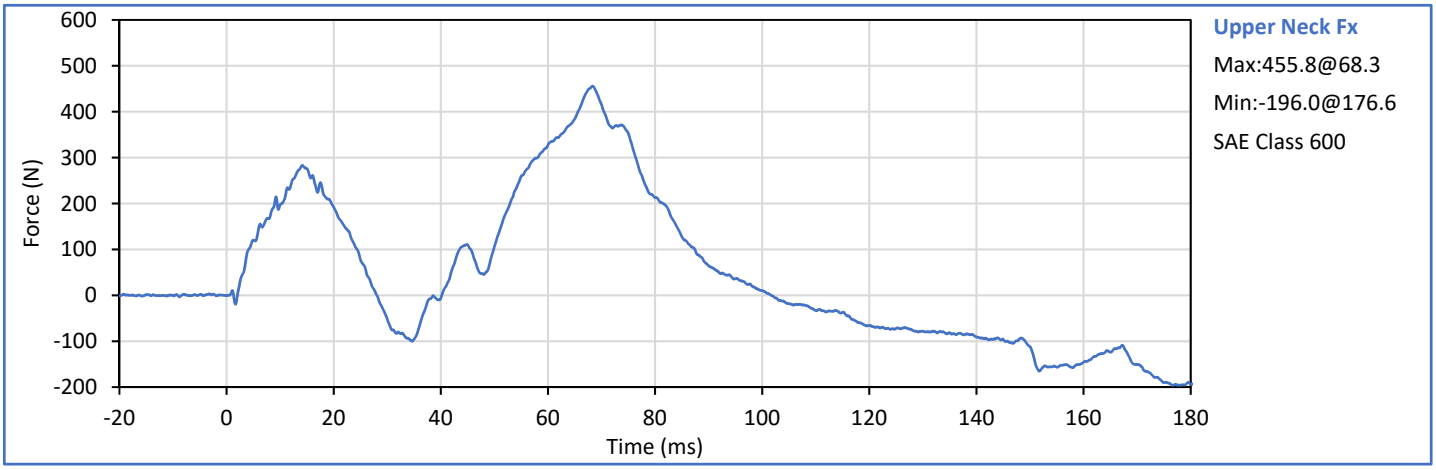
Approved By: P. Puzzuto

Hybrid III 5th Percentile Female ATD
Neck Extension Test

ATD Serial No.: 141 Test Date: 2019-05-01







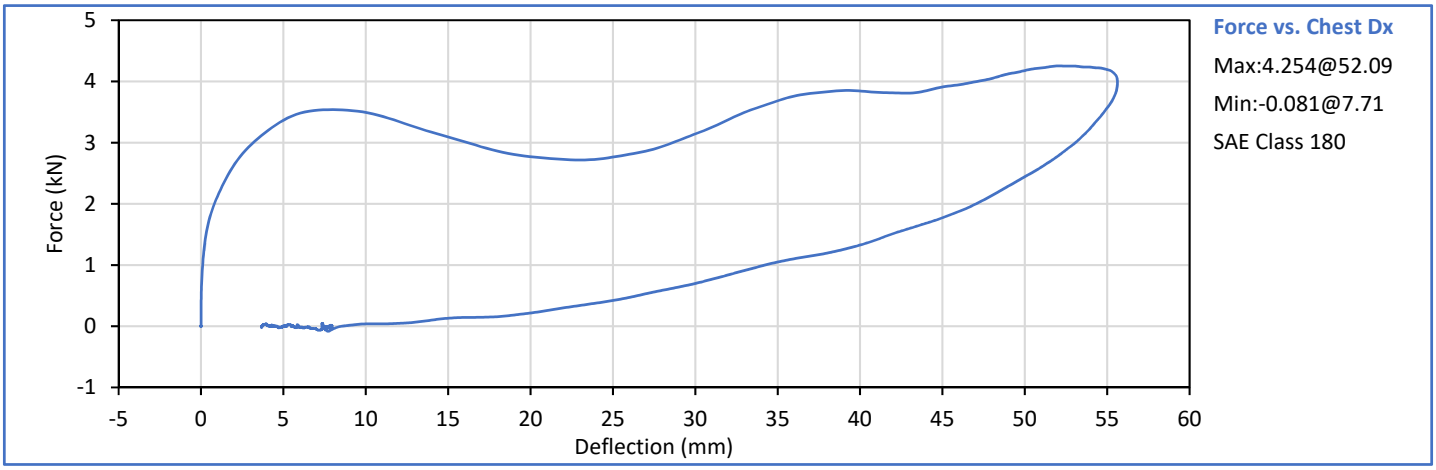
Applus IDIADA
KARCO

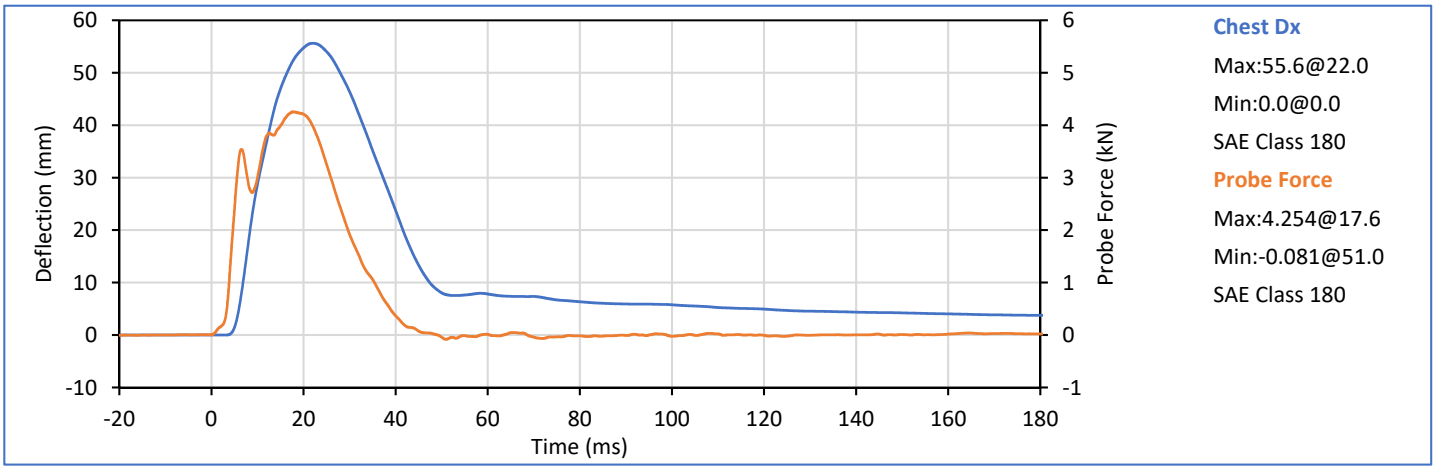
Hybrid III 5th Percentile Female ATD
Thorax Impact

ATD Serial No.: 141

Test Date: 2019-05-01

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	20.8	Pass
Laboratory Humidity	%	10	70	31	Pass
Probe Velocity	m/s	6.59	6.83	6.68	Pass
Peak Chest Deflection	mm	50.0	58.0	55.6	Pass
Peak Probe Force, 50 and 58 mm	kN	3.900	4.400	4.254	Pass
Peak Probe Force, 18 and 50 mm	kN	0.000	4.600	4.179	Pass
Internal Hysterisis	%	69.0	85.0	73.1	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

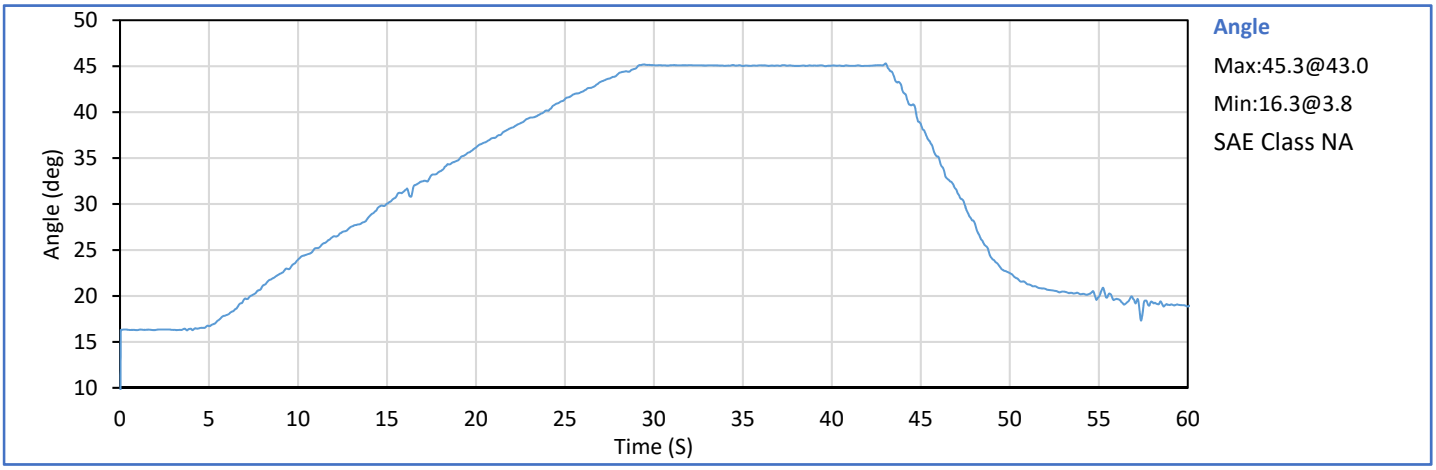
Applus IDIADA
KARCO

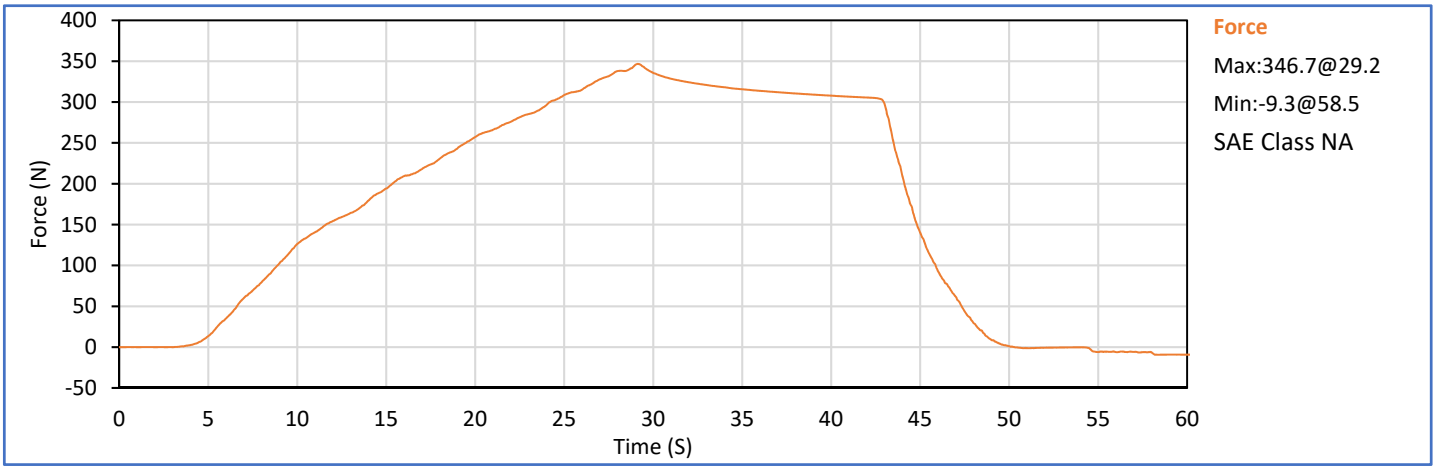
Hybrid III 5th Percentile Female ATD
Torso Flexion Test

ATD Serial No.: 141

Test Date: 2019-05-01

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.8	Pass
Laboratory Humidity	%	10	70	36	Pass
Orientation Angle	deg	0.0	20.0	14.5	Pass
Test Initial Angle	deg	11.0	19.0	16.3	Pass
Peak Force at 45° (+/-0.5°)	N	320.0	390.0	346.7	Pass
Torso Flexion Rate	deg/s	0.50	1.50	1.17	Pass
Final Reference Plane Angle	deg	-8.0	8.0	3.6	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

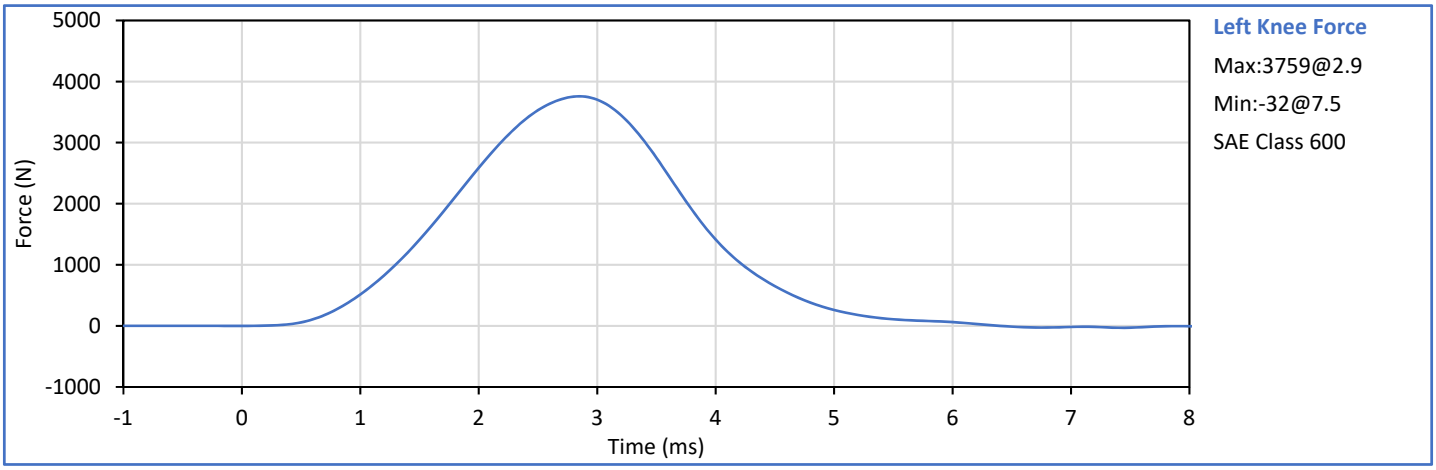
Applus IDIADA KARCO

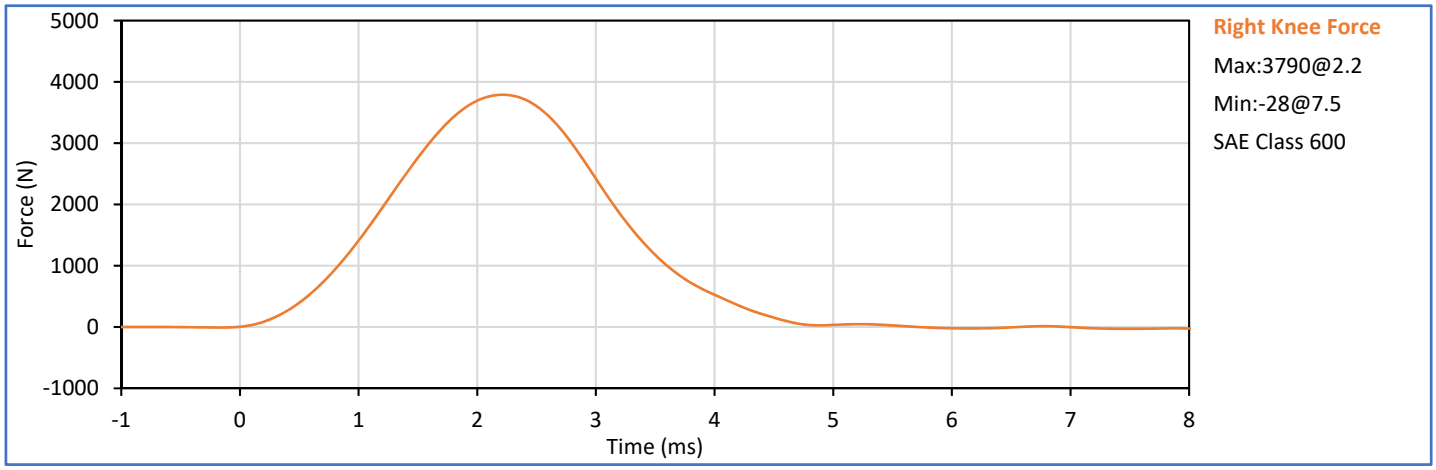
Hybrid III 5th Percentile Female ATD
Knee Impact (Left/Right)

ATD Serial No.: 141

Test Date: 2019-05-02

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.1	Pass
	Laboratory Humidity	%	10	70	31	Pass
Left Knee	Probe Velocity	m/s	2.070	2.130	2.101	Pass
	Peak Resistive Force	N	3450	4060	3759	Pass
Right Knee	Probe Velocity	m/s	2.070	2.130	2.103	Pass
	Peak Resistive Force	N	3450	4060	3790	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX C
POST-TEST ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA
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: 2019-05-21

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:

Other: Left Leg Lower Tibia Force Z, S/N: DI4186, spikes and dropouts in the data. A marginal connection shorting a signal lead to the LEMO case (shield) has been remedied

Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA
KARCO

Hybrid III 50th Percentile Male ATD
External Measurements

ATD Serial No.: 360 Test Date: 2019-05-21

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	518	Pass
C - 'H' point height	mm	84	89	86	Pass
D - 'H' point location from backline	mm	135	140	138	Pass
E - Shoulder pivot from backline	mm	84	94	90	Pass
F - Thigh clearance	mm	140	155	151	Pass
G - Back of elbow to wrist pivot	mm	290	305	299	Pass
H - Head back to backline	mm	41	46	46	Pass
I - Shoulder to elbow length	mm	330	345	339	Pass
J - Elbow rest height	mm	190	211	197	Pass
K - Buttock to knee length	mm	579	604	597	Pass
L - Popliteal length	mm	429	455	447	Pass
M - Knee pivot height	mm	485	500	498	Pass
N - Buttock popliteal length	mm	452	477	469	Pass
O - Chest depth without jacket	mm	213	229	224	Pass
P - Foot length	mm	251	267	261	Pass
V - Shoulder breadth	mm	422	437	430	Pass
W - Foot breadth	mm	91	107	102	Pass
Y - Chest circum. (w/chest jacket)	mm	970	1001	980	Pass
Z - Waist circum.	mm	836	866	844	Pass
AA - Location for chest circum.	mm	429	434	433	Pass
BB - Location for waist circum.	mm	226	231	230	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

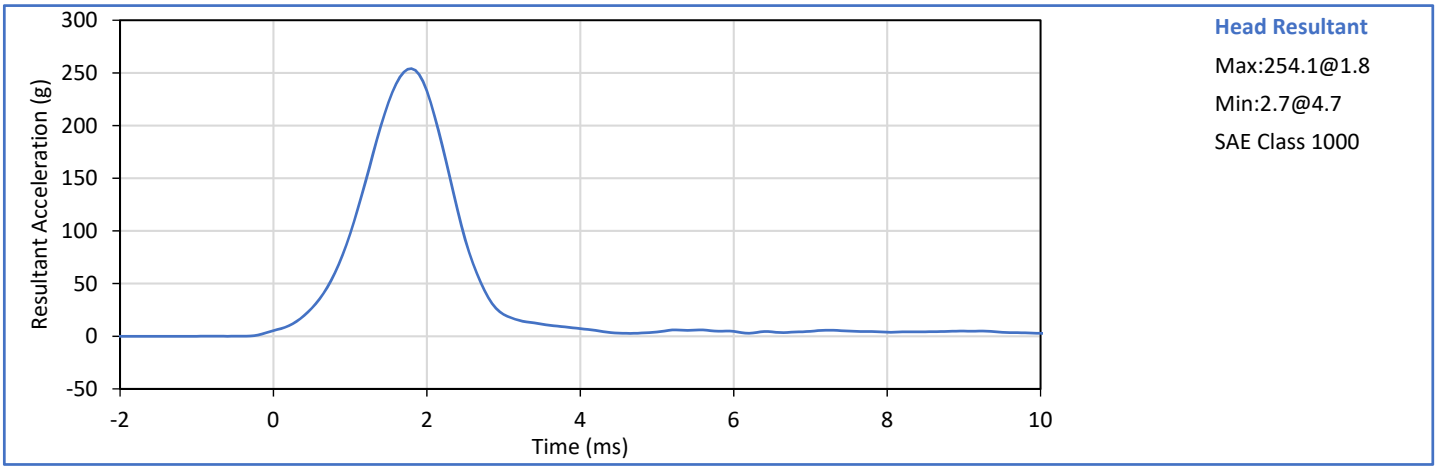
Applus IDIADA KARCO

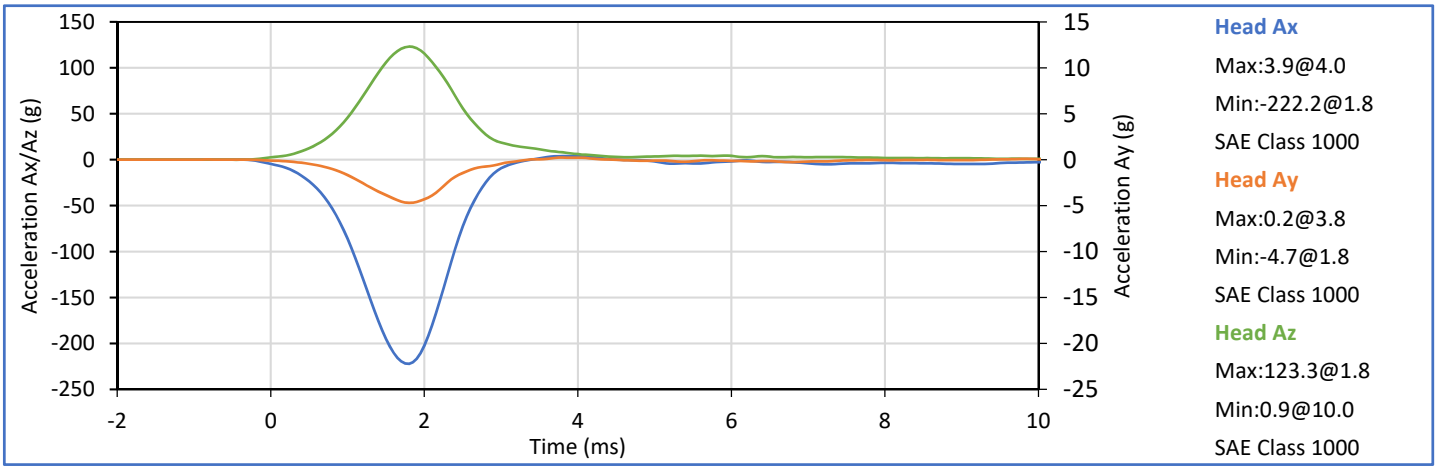
Hybrid III 50th Percentile Male ATD
Head Drop

ATD Serial No.: 360

Test Date: 2019-05-22

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.1	Pass
Laboratory Humidity	%	10	70	22	Pass
Peak Resultant Acceleration	g	225.0	275.0	254.1	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-4.7	Pass
Oscillations After Main Pulse	%	0.0	10.0	2.3	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

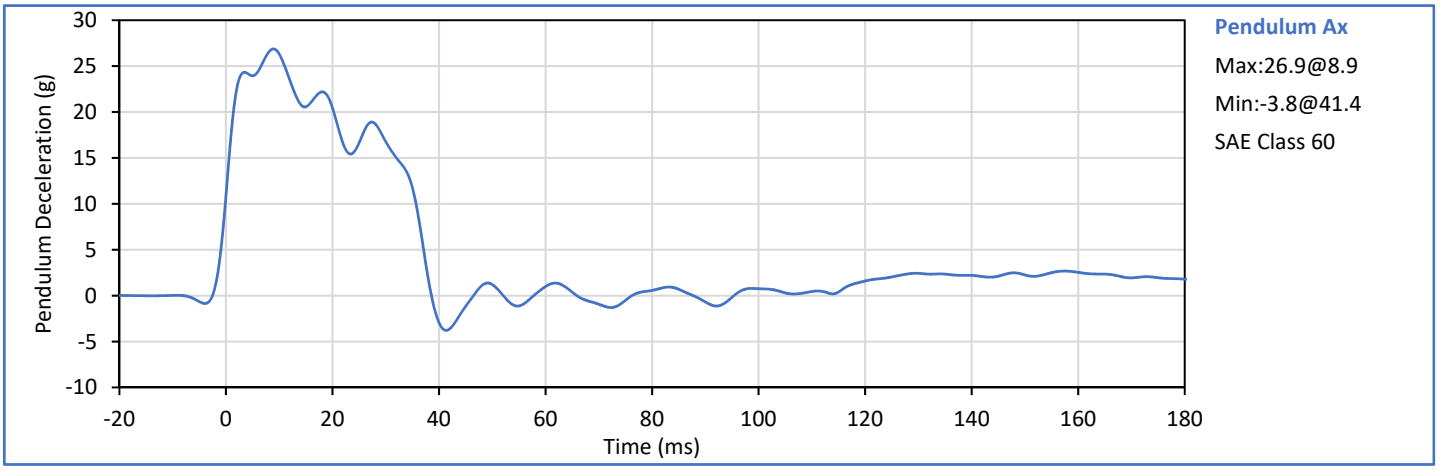
Approved By: P. Puzzuto

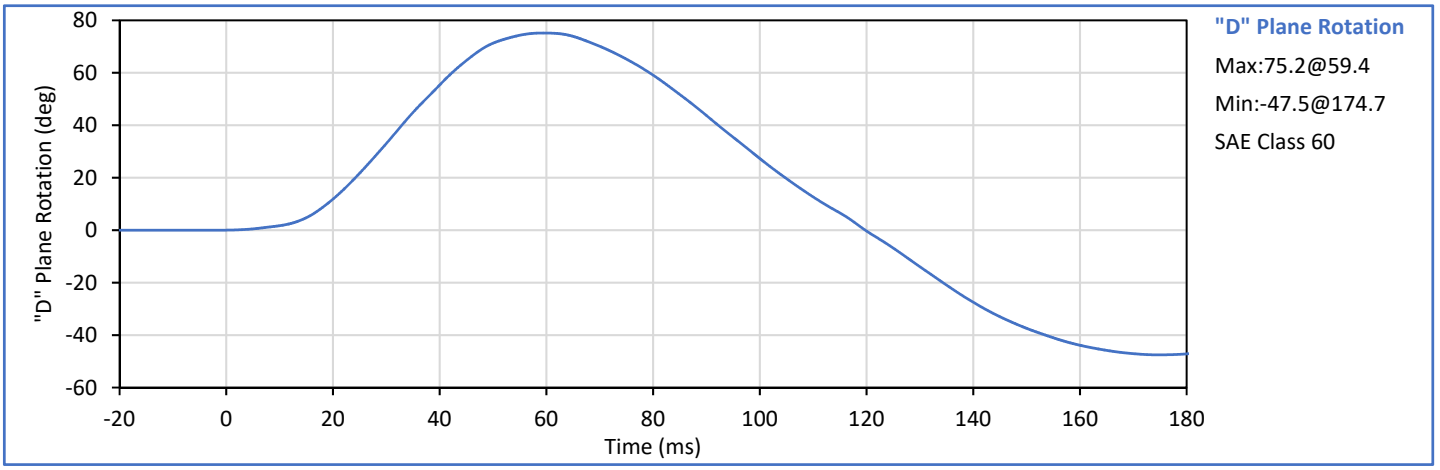
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2019-05-22

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	22	Pass
Pendulum Velocity	m/s	6.89	7.13	7.00	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	26.3	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	20.4	Pass
Pendulum Deceleration at 30 ms	g	12.5	18.5	16.8	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	29.0	16.8	Pass
Deceleration Decay to Cross 5 g	ms	34.0	42.0	37.1	Pass
"D" Plane Rotation peak	deg	64.0	78.0	75.2	Pass
	ms	57.0	64.0	59.4	Pass
"D" Plane Rotation Decay To Zero	ms	113.0	128.0	119.8	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	96.1	Pass
	ms	47.0	58.0	50.0	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	97.8	Pass
			Overall Test Results		Pass





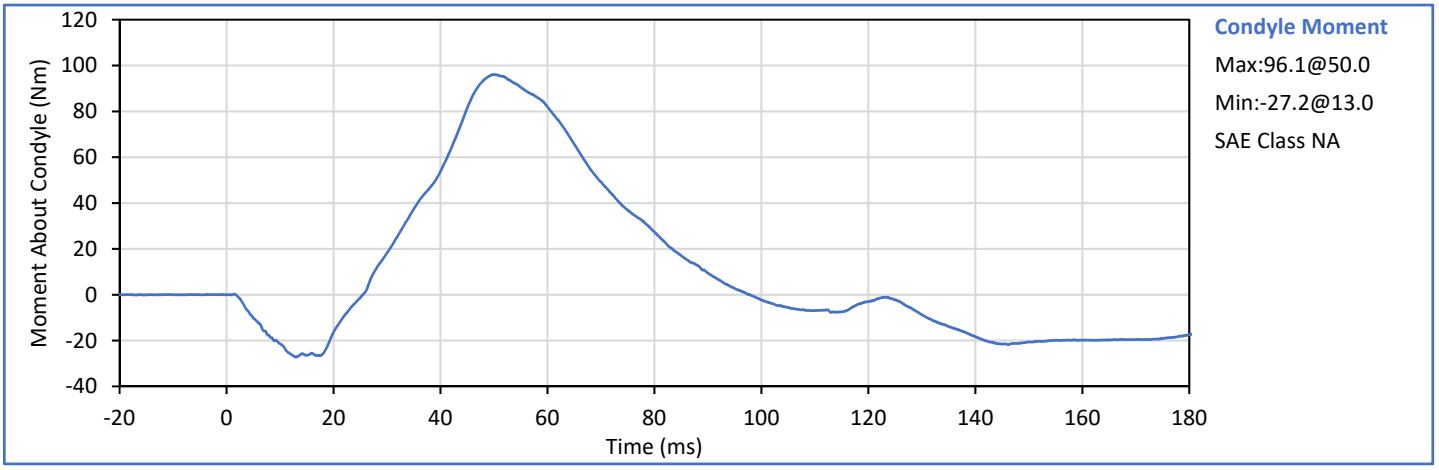
Technician: J. Hernandez

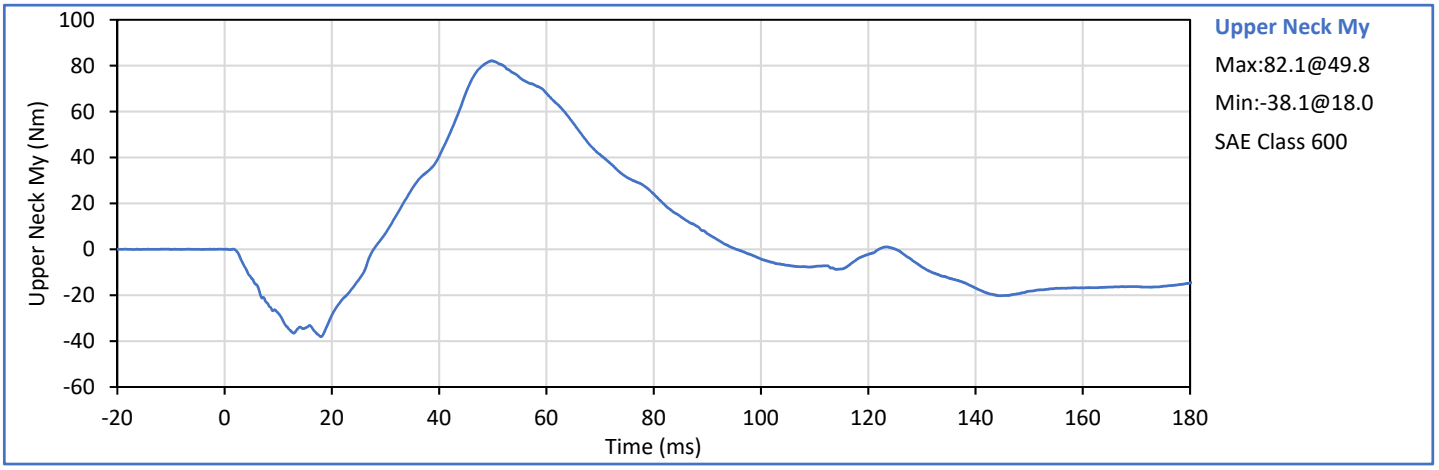
Approved By: P. Puzzuto

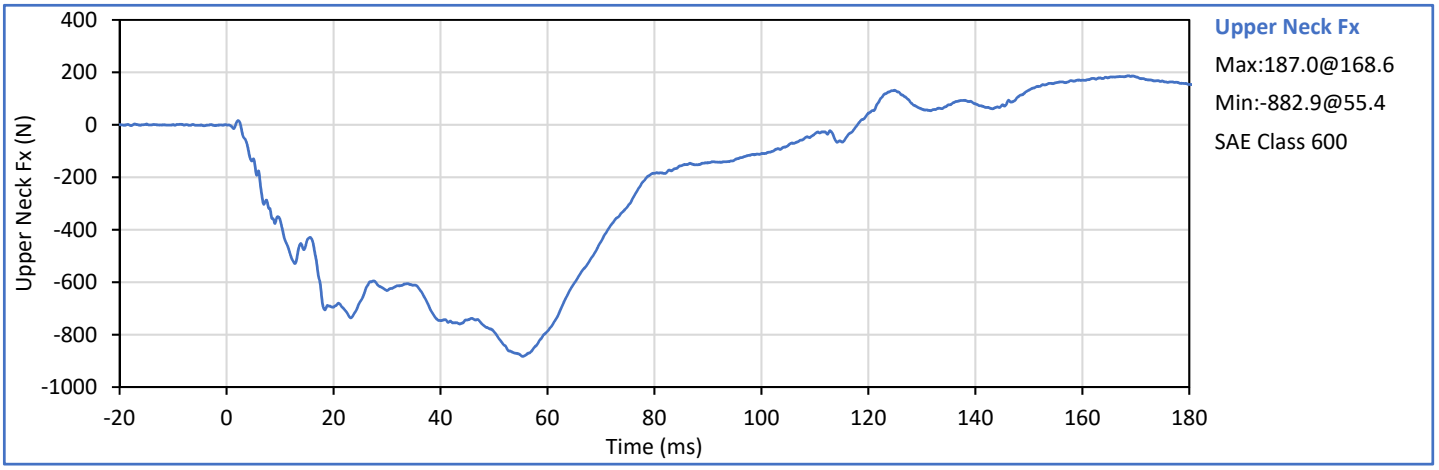
Applus IDIADA
KARCO

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2019-05-22





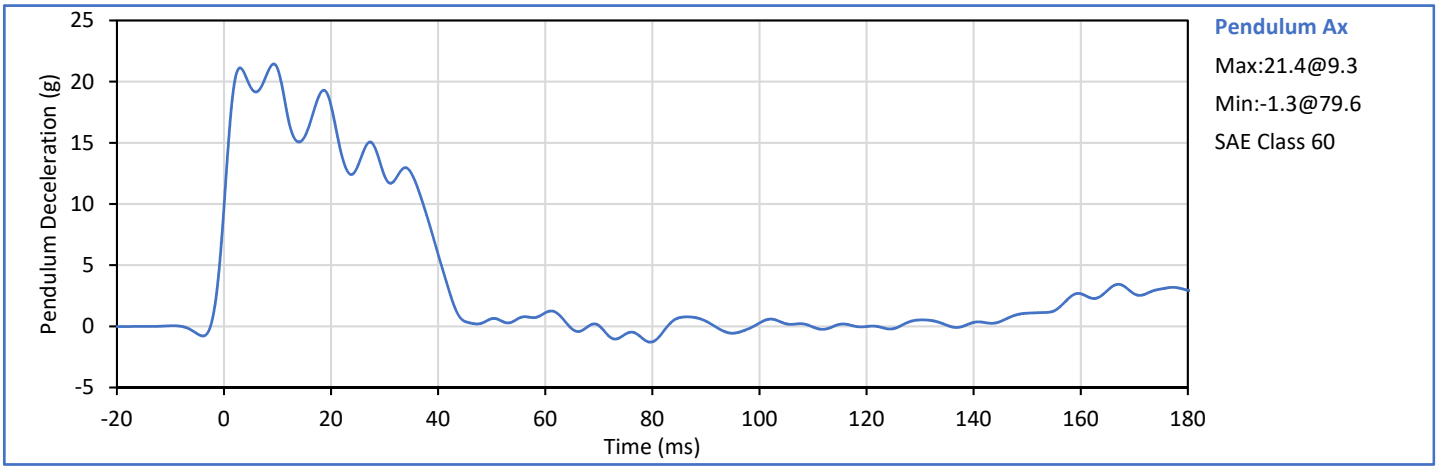


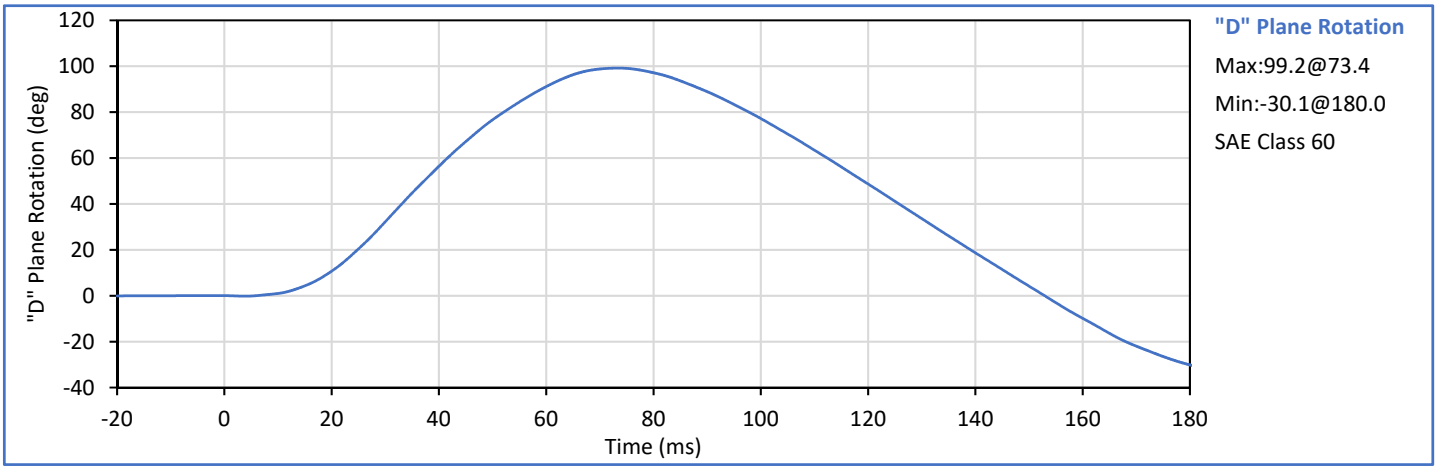
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360 Test Date: 2019-05-22

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	22	Pass
Pendulum Velocity	m/s	5.94	6.19	5.99	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	21.1	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	18.1	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	12.3	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	22.0	13.0	Pass
Deceleration Decay to Cross 5 g	ms	38.0	46.0	40.6	Pass
"D" Plane Rotation peak	deg	81.0	106.0	99.2	Pass
	ms	72.0	82.0	73.4	Pass
"D" Plane Rotation Decay To Zero	ms	147.0	174.0	153.0	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-76.2	Pass
	ms	65.0	79.0	66.8	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	133.6	Pass
			Overall Test Results		Pass





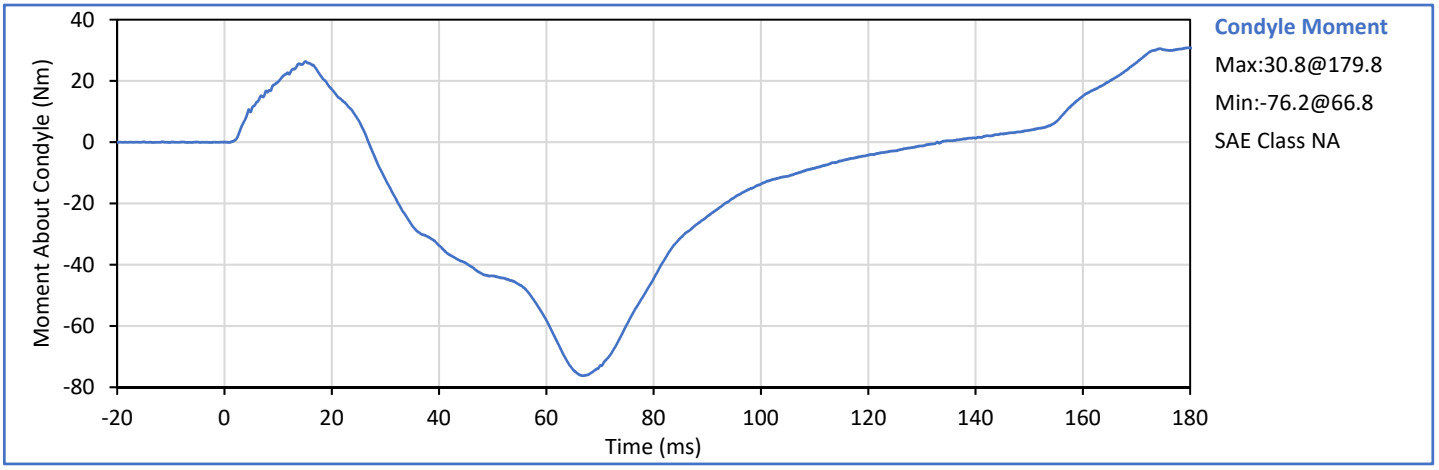
Technician: J. Hernandez

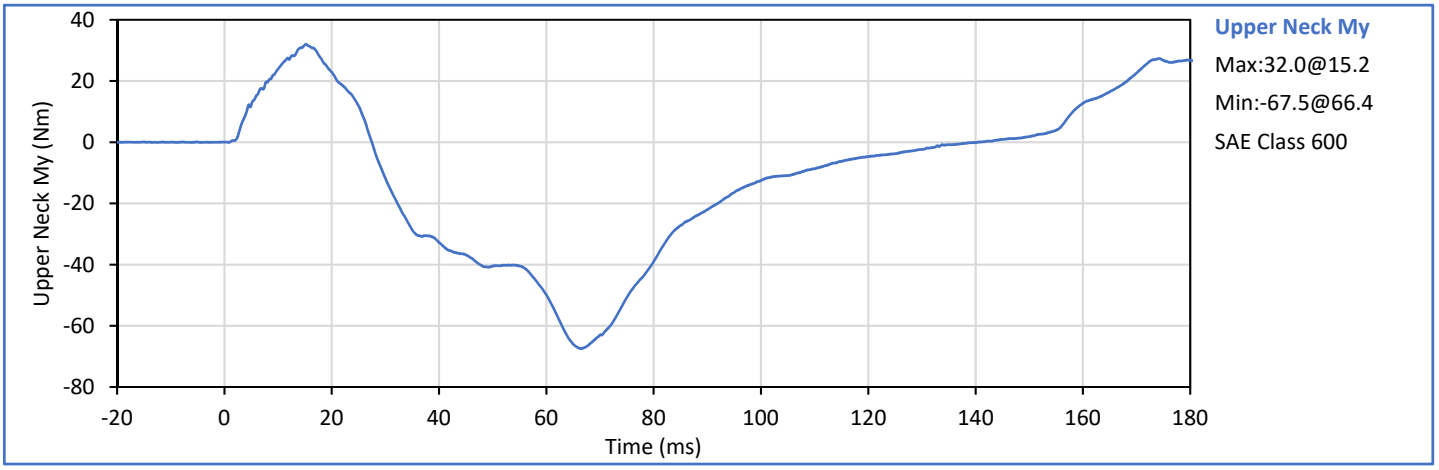
Approved By: P. Puzzuto

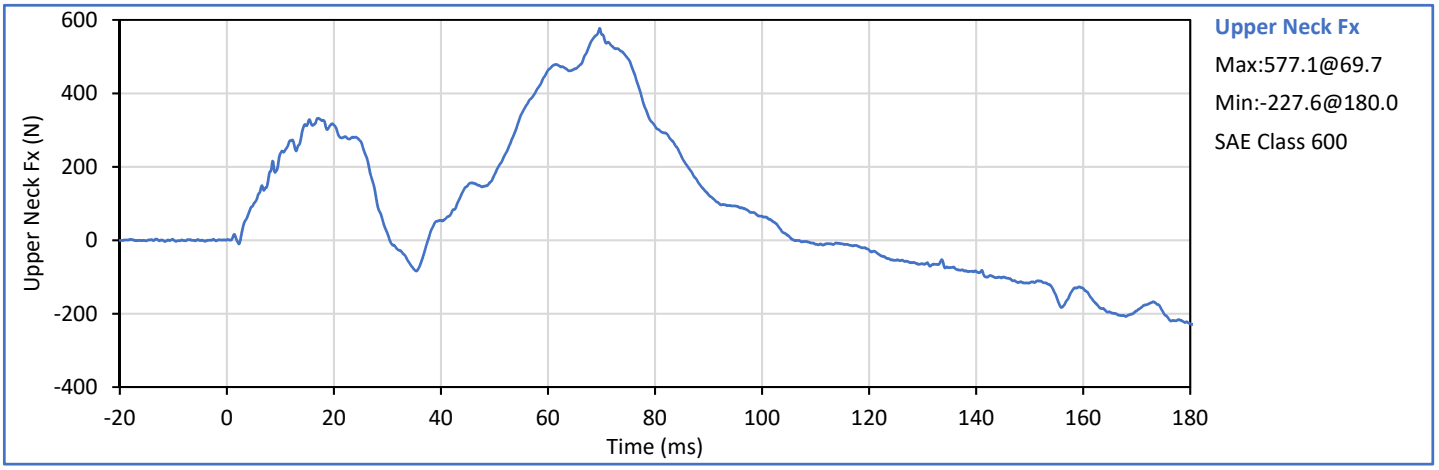
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360 Test Date: 2019-05-22







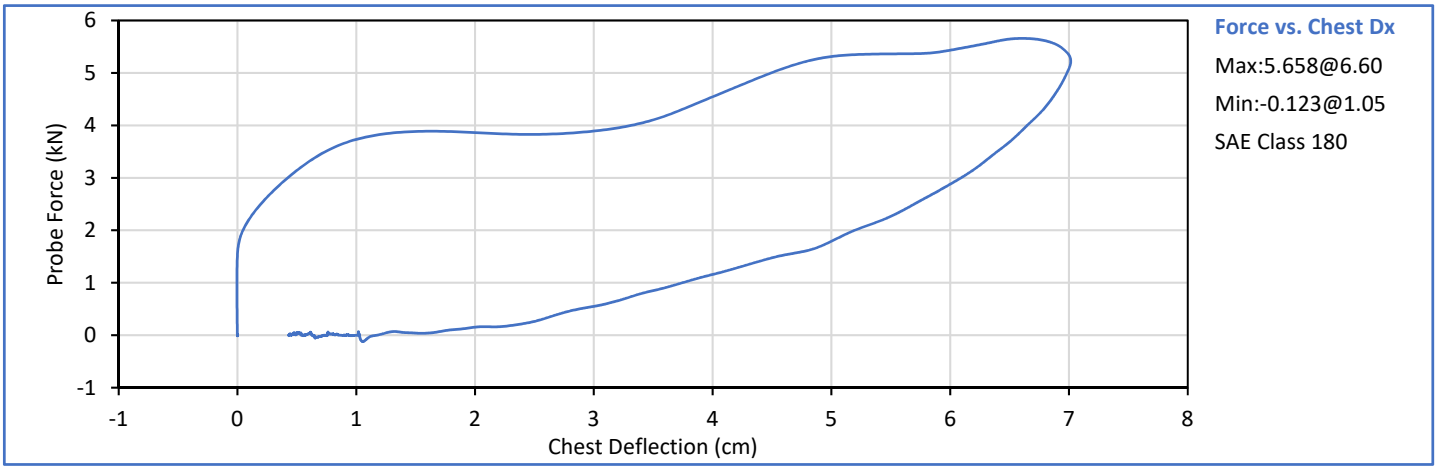
Applus IDIADA KARCO

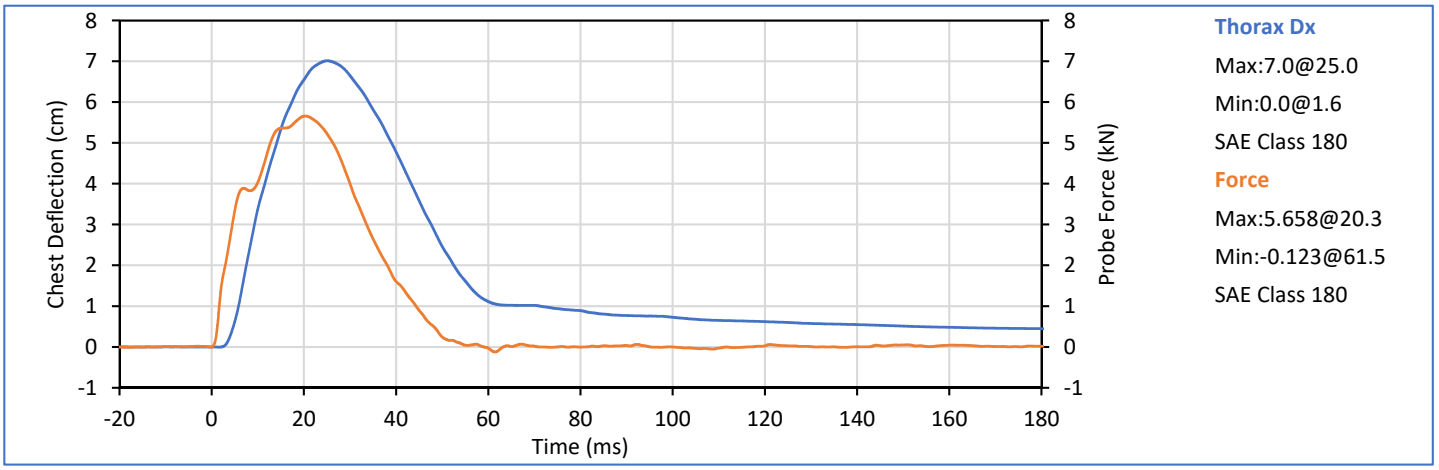
Hybrid III 50th Percentile Male ATD
Thorax Impact

ATD Serial No.: 360

Test Date: 2019-05-23

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	26	Pass
Probe Velocity	m/s	6.58	6.82	6.77	Pass
Peak Chest Deflection	cm	6.35	7.26	7.01	Pass
Peak Probe Force	kN	5.159	5.893	5.658	Pass
Internal Hysterisis	%	69.0	85.0	71.5	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

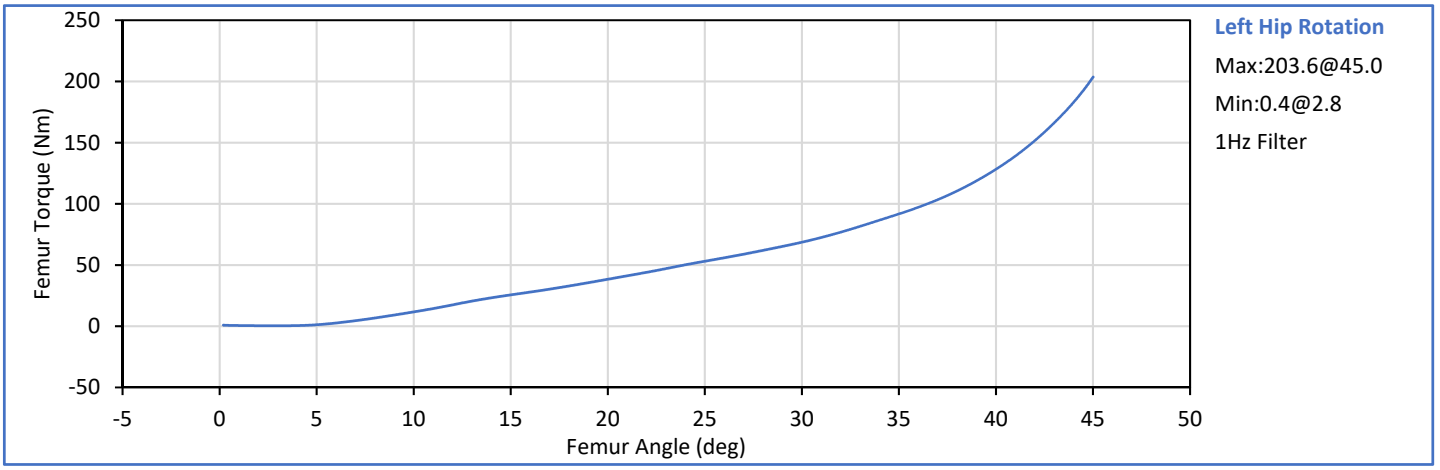
Applus IDIADA
KARCO

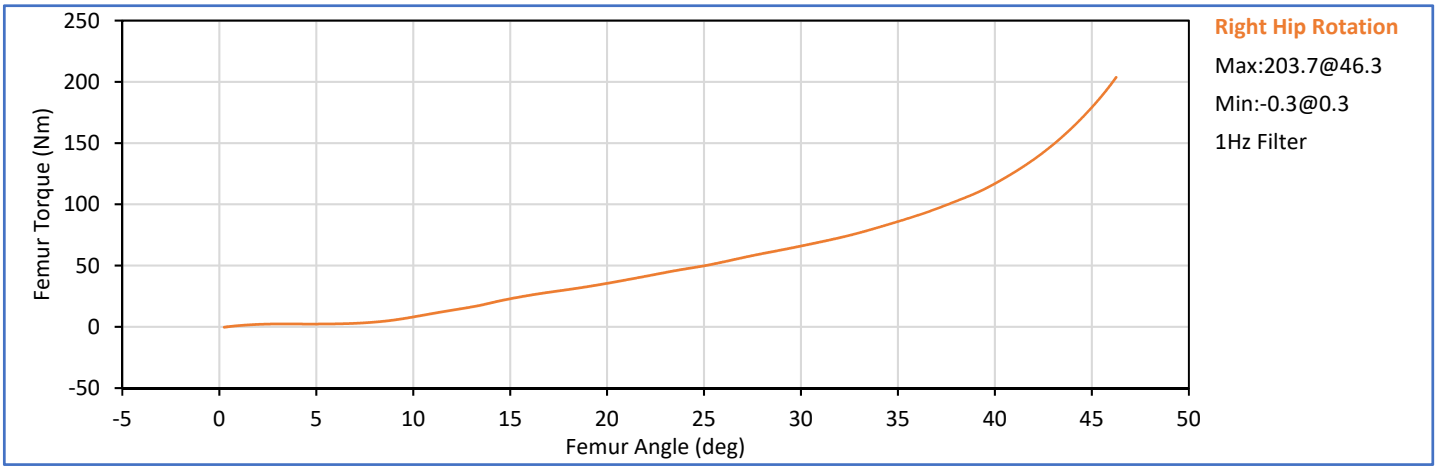
Hybrid III 50th Percentile Male ATD
Hip Flexion (Left/Right)

ATD Serial No.: 360

Test Date: 2019-05-23

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.1	Pass
	Laboratory Humidity	%	10	70	28	Pass
Left Hip	Left Hip Rotation Rate	deg/s	5.0	10.0	5.7	Pass
	Left Femur Torque at 30°	Nm	0.0	95.0	68.7	Pass
	Left Hip Rotation at 203 Nm	deg	40.0	50.0	45.0	Pass
Right Hip	Right Hip Rotation Rate	deg/s	5.0	10.0	5.7	Pass
	Right Femur Torque at 30°	Nm	0.0	95.0	66.0	Pass
	Right Hip Rotation at 203 Nm	deg	40.0	50.0	46.2	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

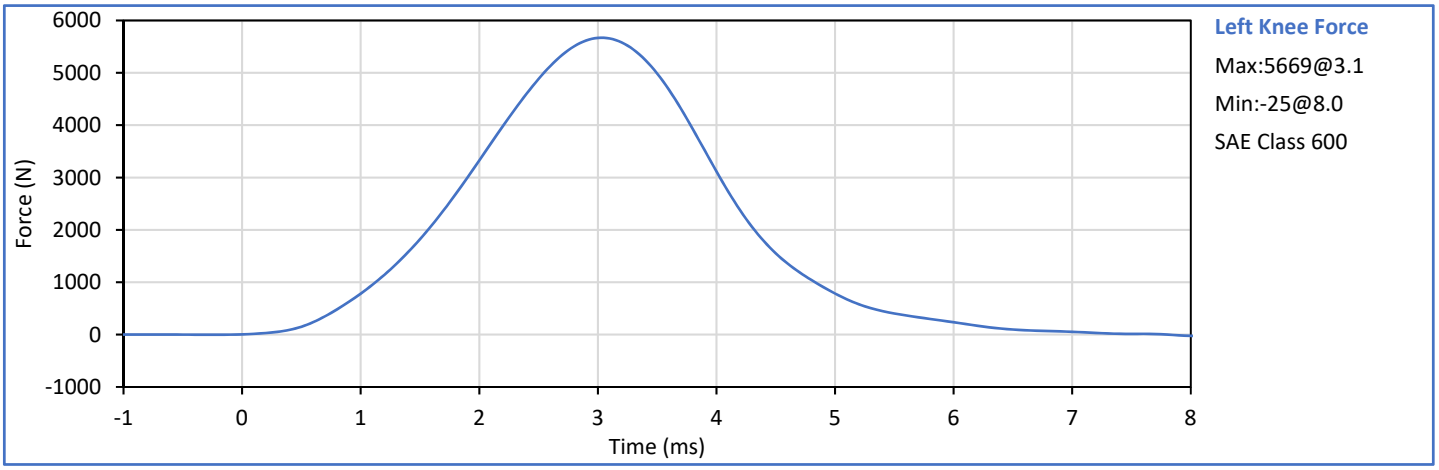
Applus IDIADA
KARCO

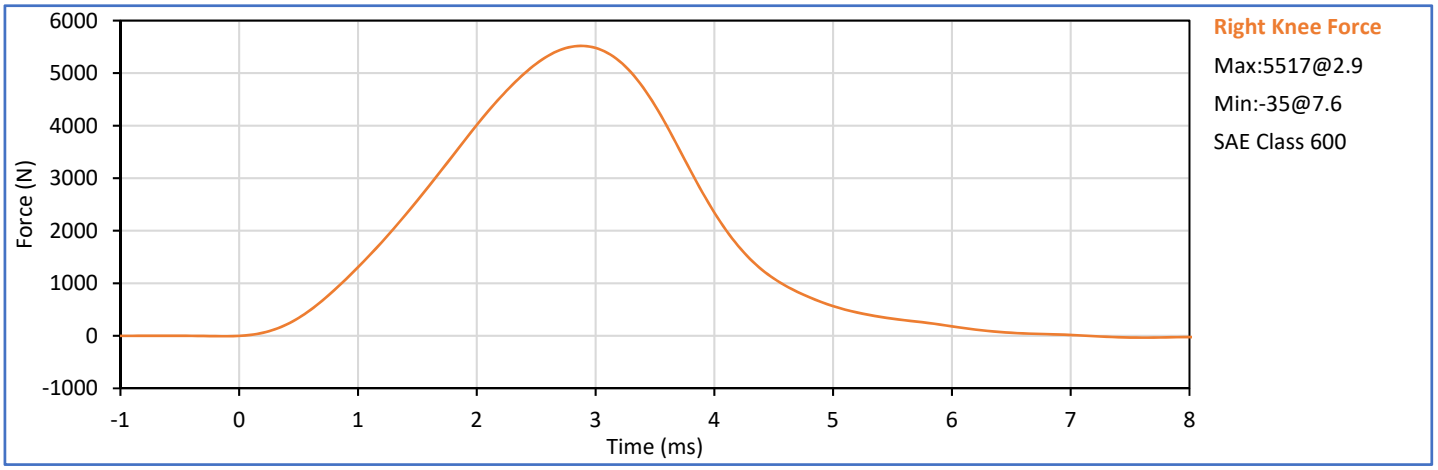
Hybrid III 50th Percentile Male ATD
Knee Impact (Left/Right)

ATD Serial No.: 360

Test Date: 2019-05-21

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.2	Pass
	Laboratory Humidity	%	10	70	25	Pass
Left Knee	Probe Velocity	m/s	2.070	2.130	2.109	Pass
	Peak Resistive Force	N	4715	5782	5669	Pass
Right Knee	Probe Velocity	m/s	2.070	2.130	2.128	Pass
	Peak Resistive Force	N	4715	5782	5517	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX C
POS-TEST ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA
Hybrid III 5th Percentile Female ATD
S/N: 141

Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Damage Checklist

ATD Serial No.: 141 Test Date: 2019-05-21

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.: 141 Test Date: 2019-05-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	24	Pass
A - Total sitting height	mm	775	800	794	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	147	Pass
E - Shoulder pivot from backline	mm	69	84	77	Pass
F - Thigh clearance	mm	119	135	131	Pass
G - Back of elbow to wrist pivot	mm	244	259	252	Pass
H - Head back to backline	mm	41	46	42	Pass
I - Shoulder to elbow length	mm	277	297	285	Pass
J - Elbow rest height	mm	183	203	193	Pass
K - Buttock to knee length	mm	521	546	530	Pass
L - Popliteal length	mm	356	376	362	Pass
M - Knee pivot height	mm	394	419	410	Pass
N - Buttock popliteal length	mm	414	439	425	Pass
O - Chest depth without jacket	mm	175	191	181	Pass
P - Foot length	mm	219	234	230	Pass
R - Buttock to Knee Pivot Length	mm	457	483	466	Pass
S - Head Breadth	mm	137	147	141	Pass
T - Head Depth	mm	178	188	182	Pass
U - Hip Breadth	mm	300	315	306	Pass
V - Shoulder breadth	mm	351	366	362	Pass
W - Foot breadth	mm	79	94	91	Pass
X - Head circum.	mm	528	549	539	Pass
Y - Chest circum. (w/chest jacket)	mm	851	881	865	Pass
Z - Waist circum.	mm	760	790	775	Pass
AA - Location for chest circum.	mm	333	358	338	Pass
BB - Location for waist circum.	mm	160	170	165	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

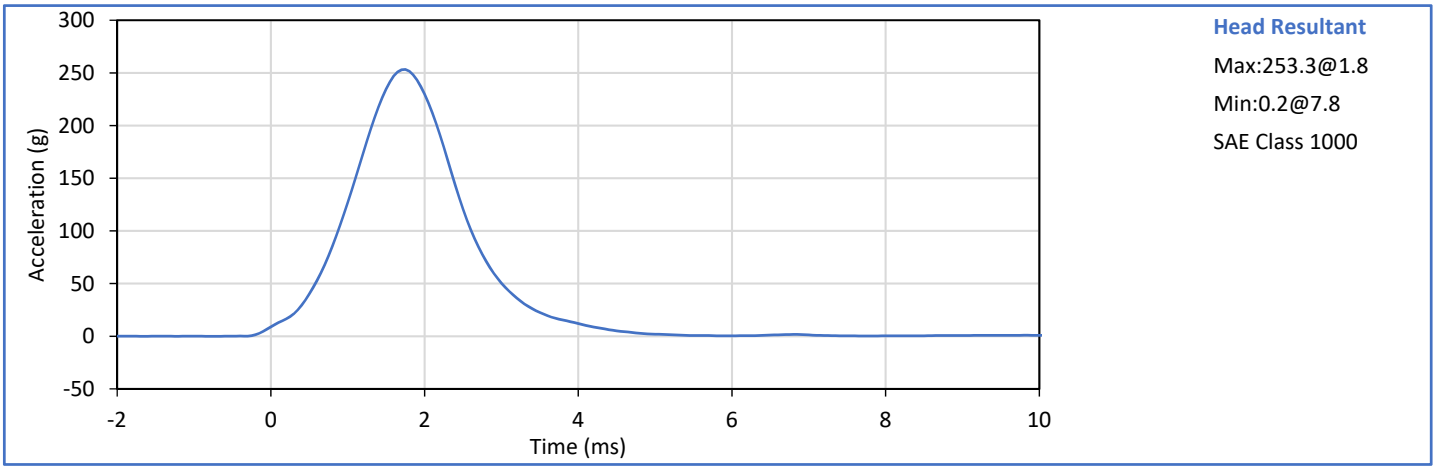
Applus IDIADA
KARCO

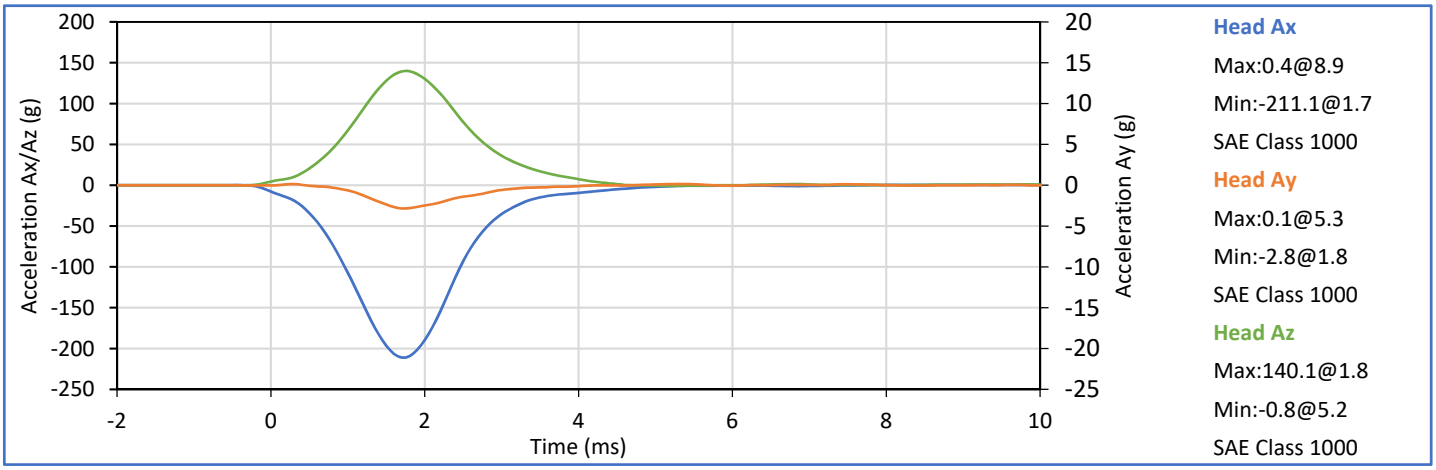
Hybrid III 5th Percentile Female ATD
Head Drop Test

ATD Serial No.: 141

Test Date: 2019-05-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.1	Pass
Laboratory Humidity	%	10	70	26	Pass
Peak Resultant Acceleration	g	250.0	300.0	253.3	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-2.8	Pass
Oscillations After Main Pulse	%	0.0	10.0	0.7	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

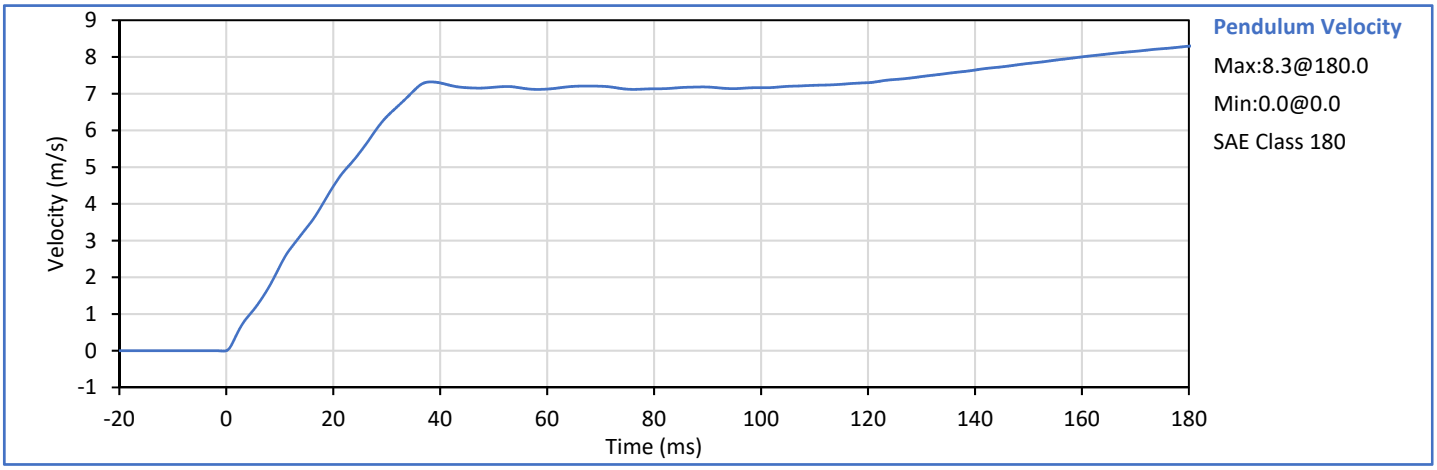
Approved By: P. Puzzuto

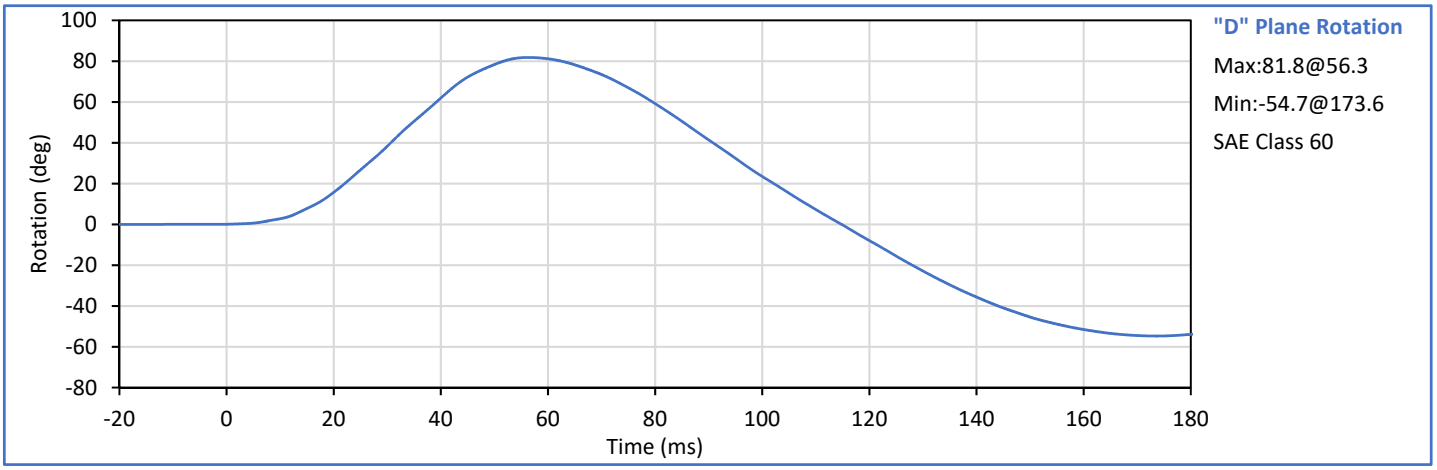
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: 141 Test Date: 2019-05-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	22	Pass
Pendulum Velocity	m/s	6.89	7.13	6.91	Pass
Pendulum Velocity at 10 ms	m/s	2.10	2.50	2.30	Pass
Pendulum Velocity at 20 ms	m/s	4.00	5.00	4.47	Pass
Pendulum Velocity at 30 ms	m/s	5.80	7.00	6.37	Pass
Peak "D" Plane Rotation	deg	77.0	91.0	81.8	Pass
Peak Moment in Rotation	Nm	69.0	83.0	82.4	Pass
Positive Moment Decay to 10 Nm	ms	80.0	100.0	83.9	Pass
			Overall Test Results		Pass





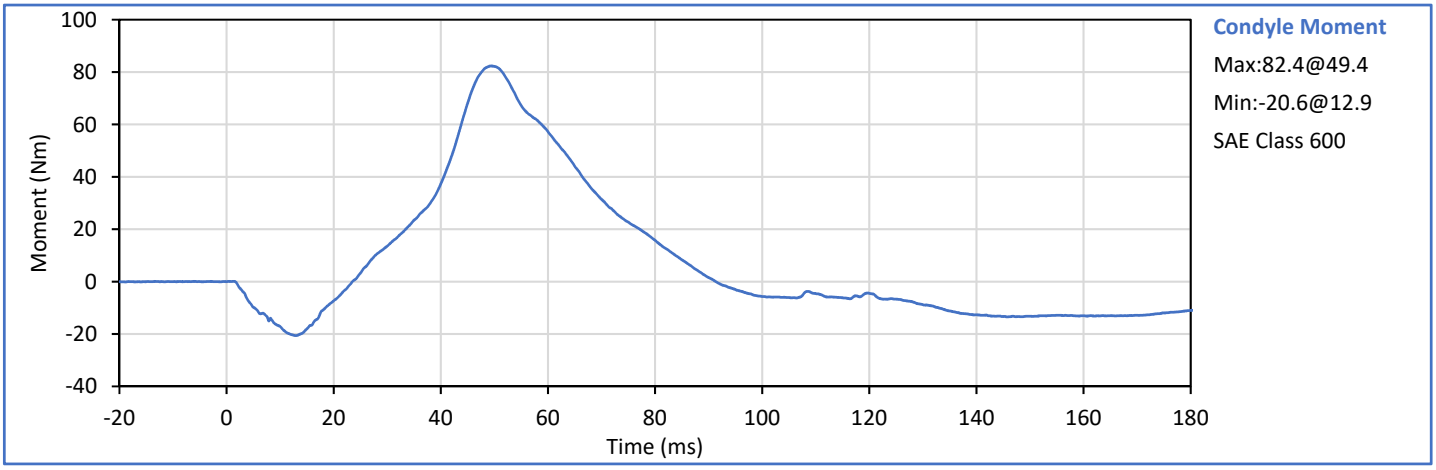
Technician: J. Hernandez

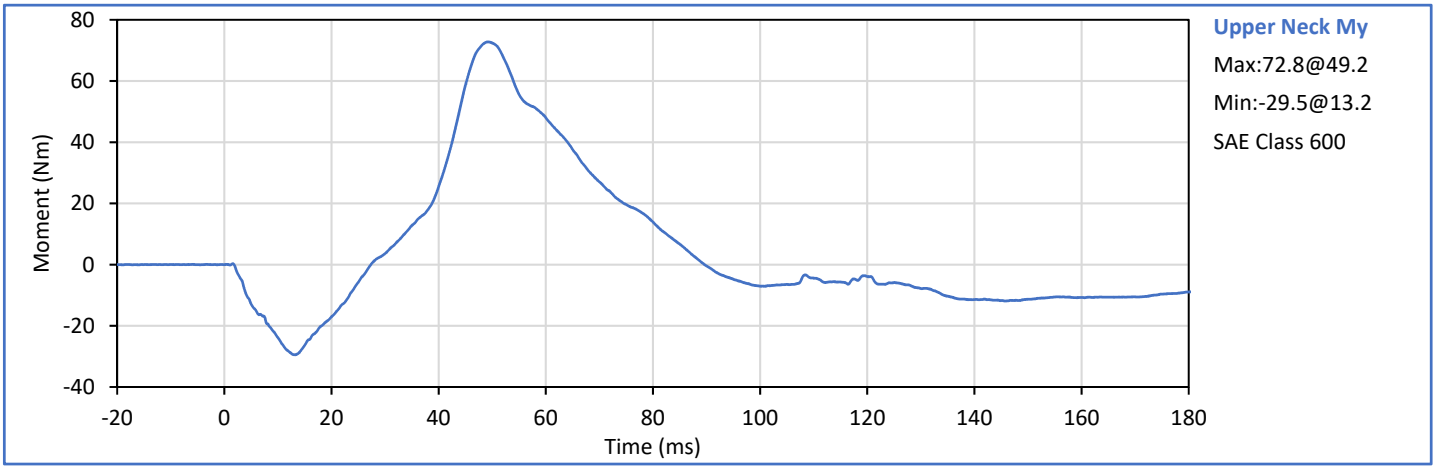
Approved By: P. Puzzuto

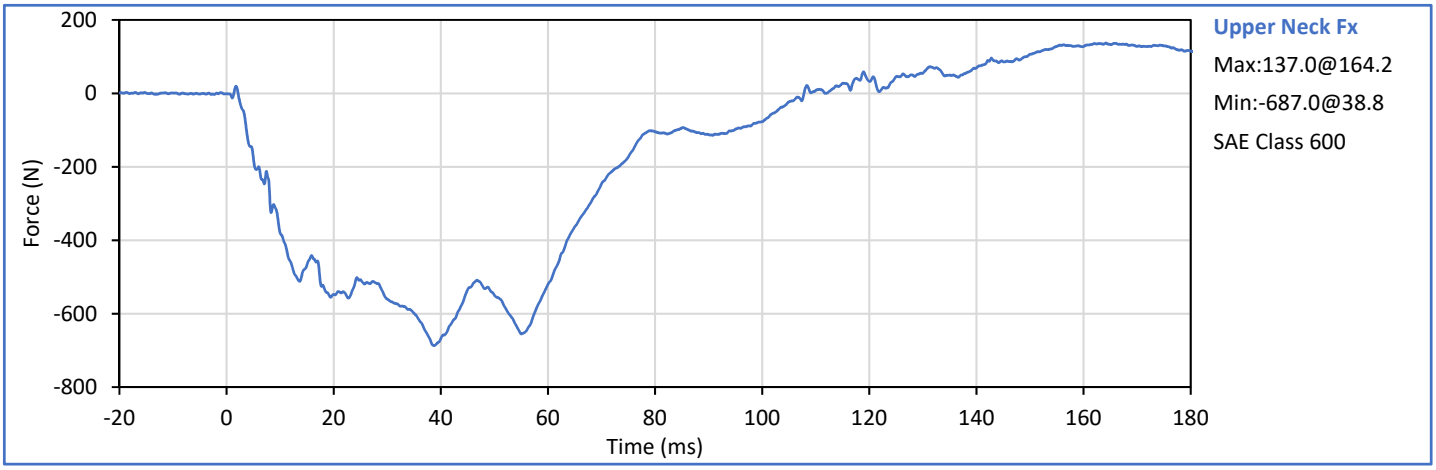
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: 141 Test Date: 2019-05-21







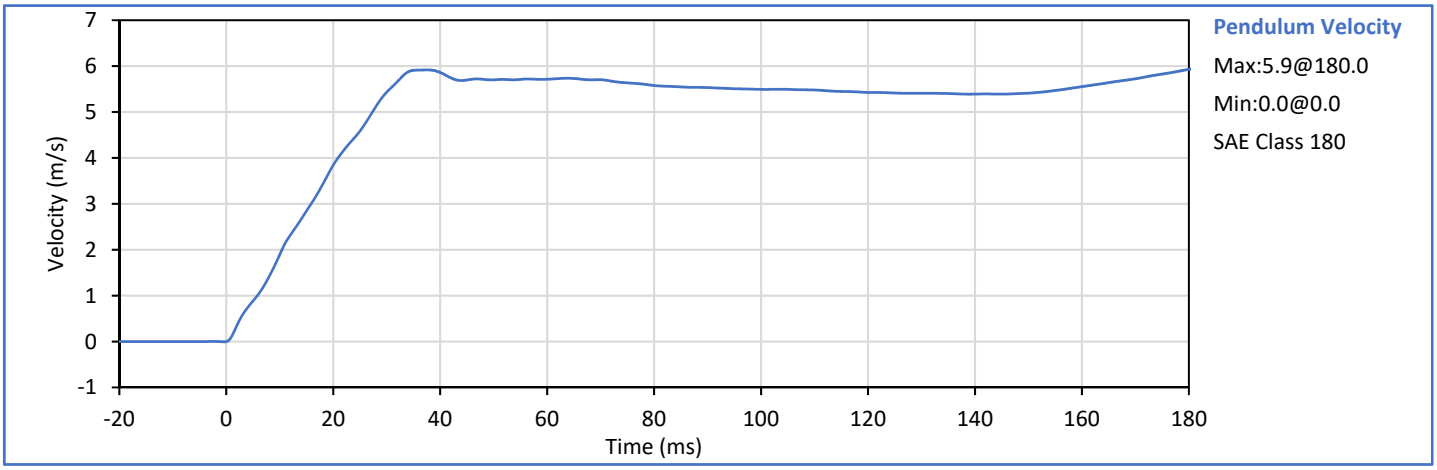
Applus IDIADA
KARCO

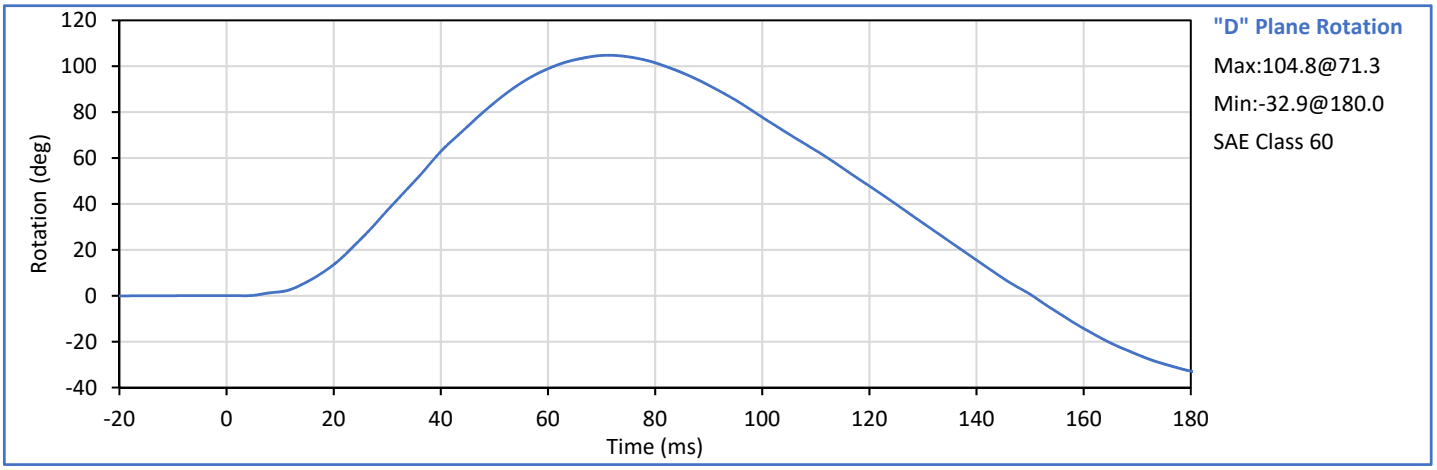
Hybrid III 5th Percentile Female ATD
Neck Extension Test

ATD Serial No.: 141

Test Date: 2019-05-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	22	Pass
Pendulum Velocity	m/s	5.95	6.19	5.97	Pass
Pendulum Velocity at 10 ms	m/s	1.50	1.90	1.90	Pass
Pendulum Velocity at 20 ms	m/s	3.10	3.90	3.84	Pass
Pendulum Velocity at 30 ms	m/s	4.60	5.60	5.43	Pass
Peak "D" Plane Rotation	deg	99.0	114.0	104.8	Pass
Peak Moment in Rotation	Nm	-65.0	-53.0	-59.4	Pass
Negative Moment Decay to -10 Nm	ms	94.0	114.0	97.8	Pass
			Overall Test Results		Pass



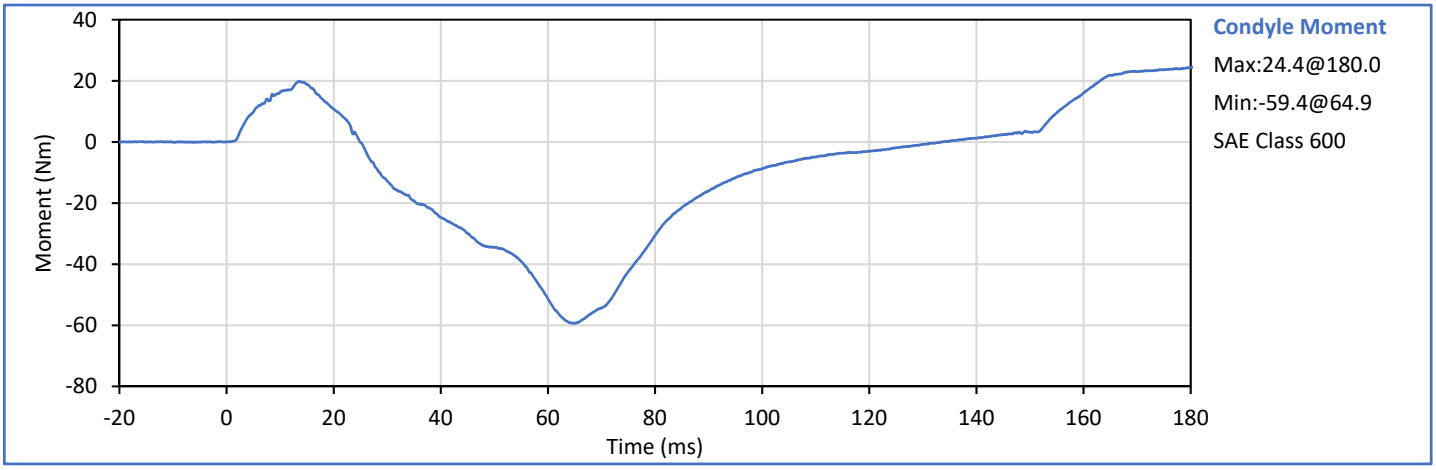


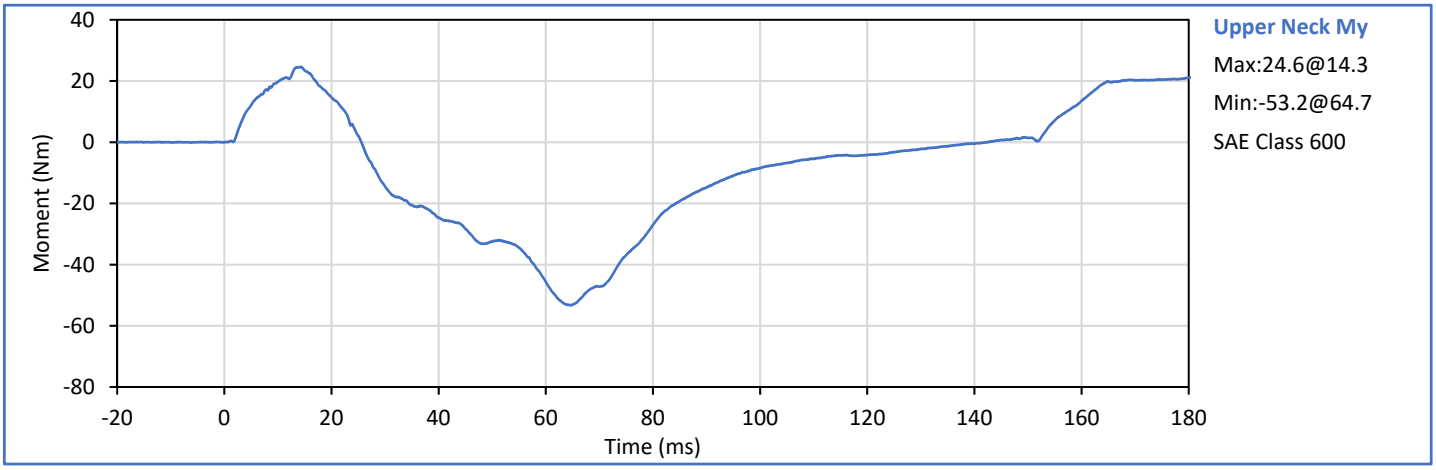
Technician: J. Hernandez

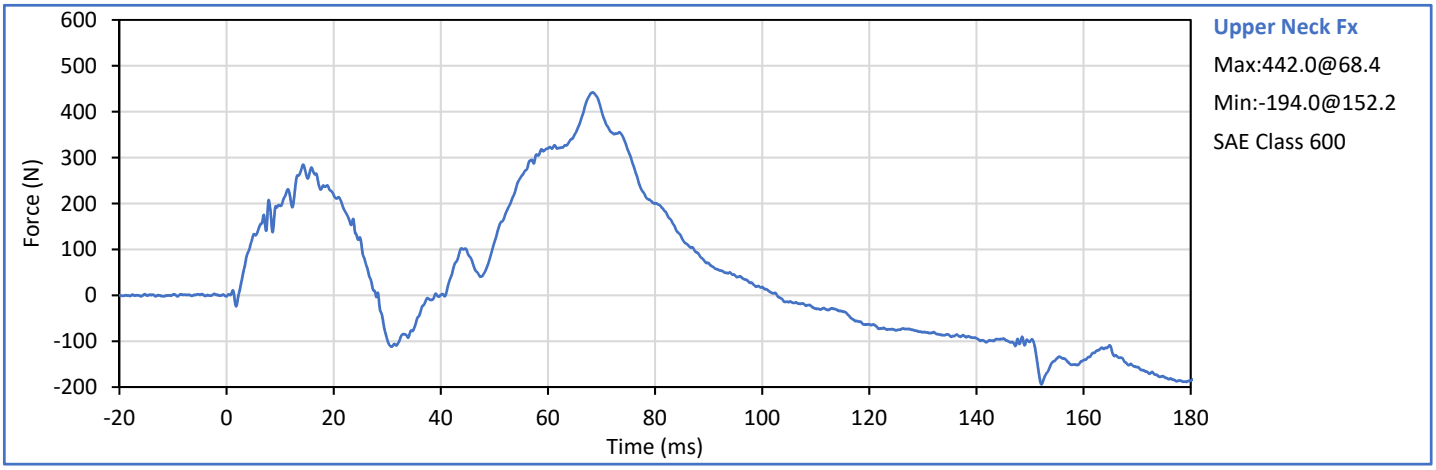
Approved By: P. Puzzuto

Hybrid III 5th Percentile Female ATD
Neck Extension Test

ATD Serial No.: 141 Test Date: 2019-05-21







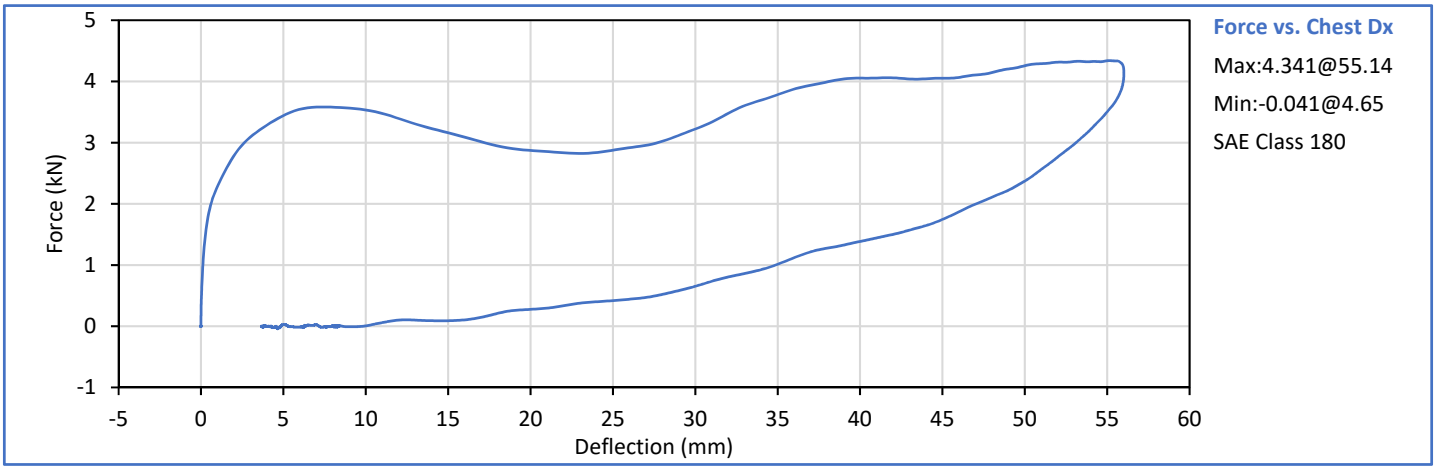
Applus IDIADA
KARCO

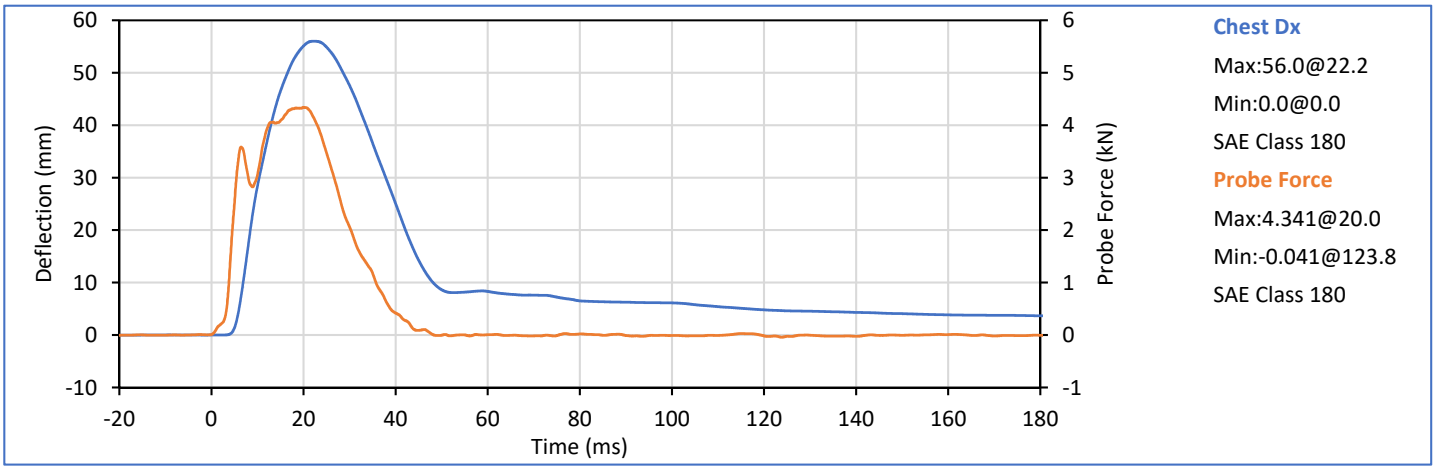
Hybrid III 5th Percentile Female ATD
Thorax Impact

ATD Serial No.: 141

Test Date: 2019-05-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	26	Pass
Probe Velocity	m/s	6.59	6.83	6.78	Pass
Peak Chest Deflection	mm	50.0	58.0	56.0	Pass
Peak Probe Force, 50 and 58 mm	kN	3.900	4.400	4.341	Pass
Peak Probe Force, 18 and 50 mm	kN	0.000	4.600	4.257	Pass
Internal Hysterisis	%	69.0	85.0	73.5	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

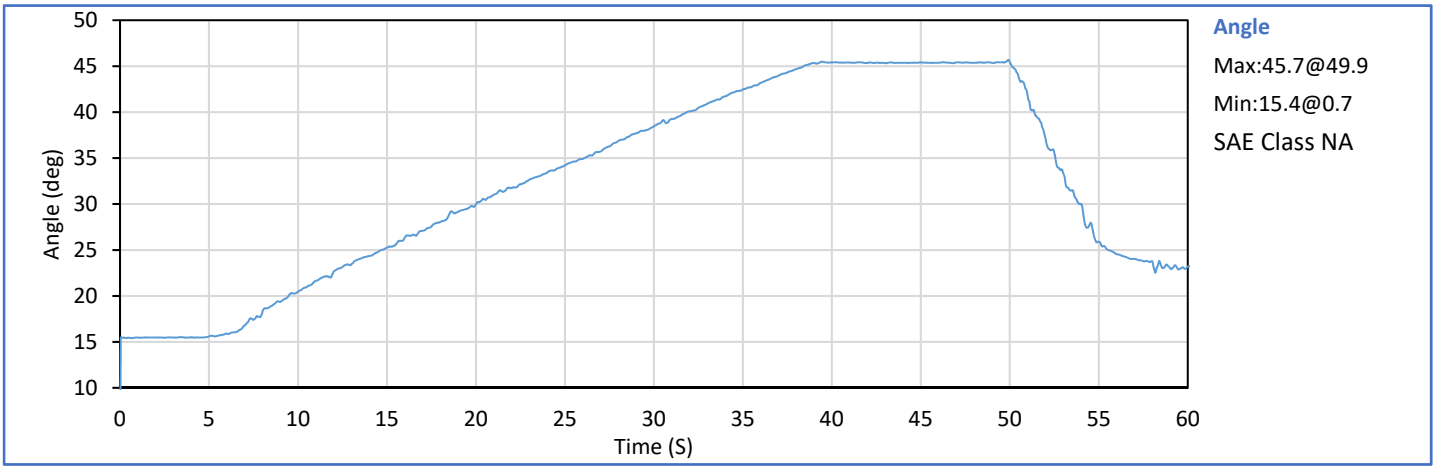
Applus IDIADA
KARCO

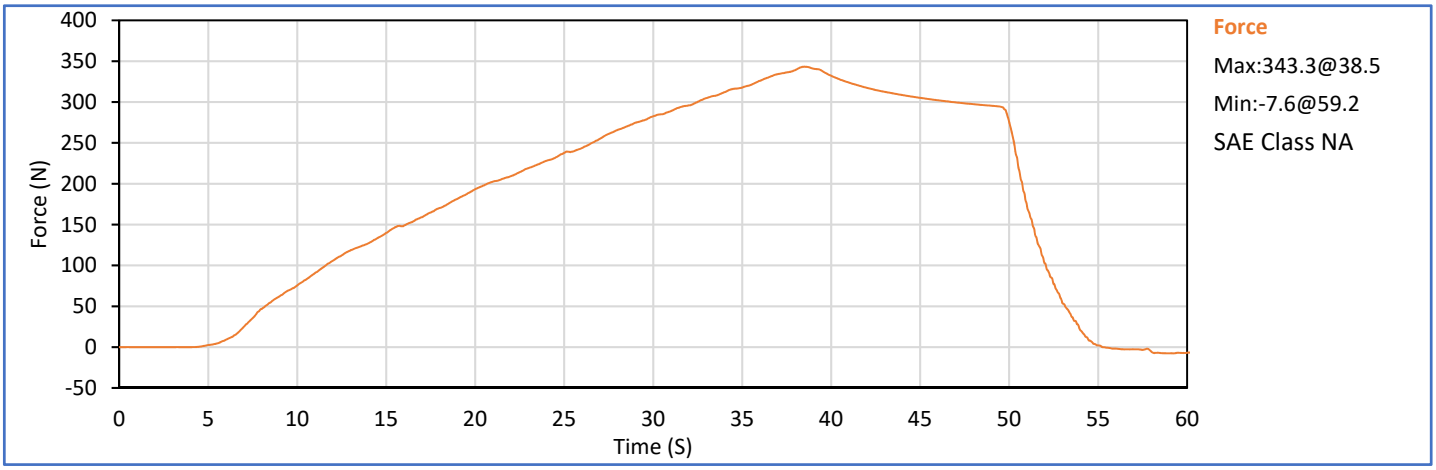
Hybrid III 5th Percentile Female ATD
Torso Flexion Test

ATD Serial No.: 141

Test Date: 2019-05-28

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.6	Pass
Laboratory Humidity	%	10	70	34	Pass
Orientation Angle	deg	0.0	20.0	15.1	Pass
Test Initial Angle	deg	11.0	19.0	15.5	Pass
Peak Force at 45° (+/-0.5°)	N	320.0	390.0	343.3	Pass
Torso Flexion Rate	deg/s	0.50	1.50	0.90	Pass
Final Reference Plane Angle	deg	-8.0	8.0	5.0	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

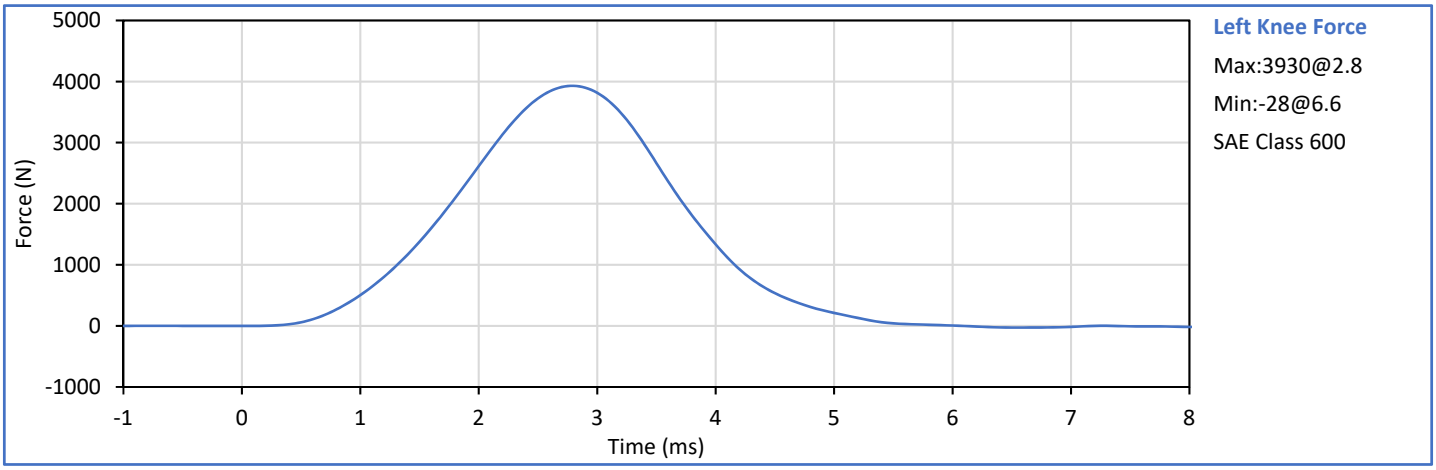
Applus IDIADA KARCO

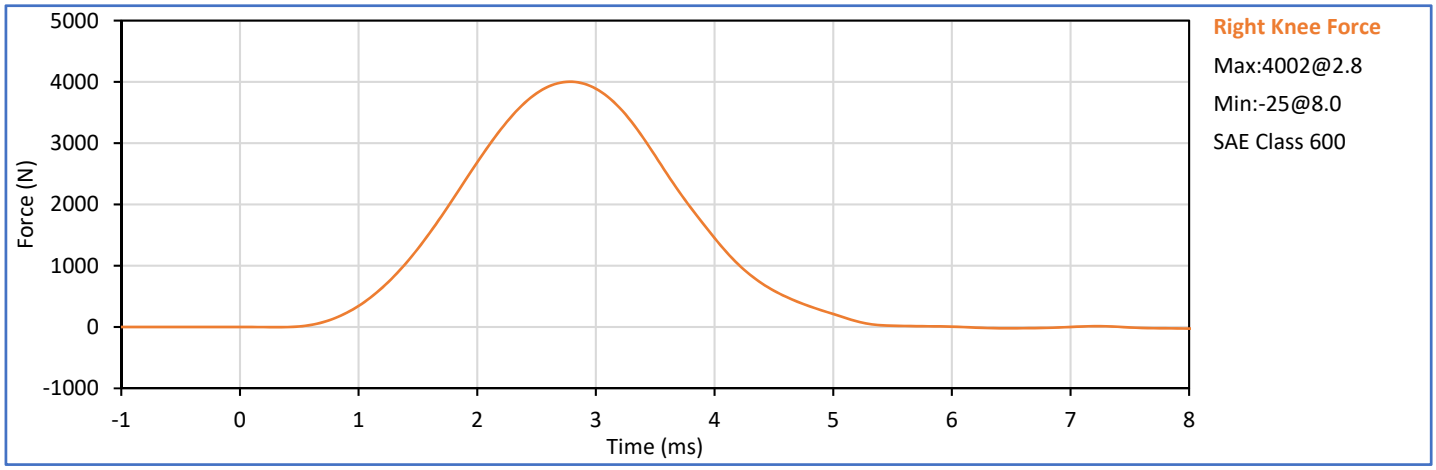
Hybrid III 5th Percentile Female ATD
Knee Impact (Left/Right)

ATD Serial No.: 141

Test Date: 2019-05-21

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.6	Pass
	Laboratory Humidity	%	10	70	34	Pass
Left Knee	Probe Velocity	m/s	2.070	2.130	2.084	Pass
	Peak Resistive Force	N	3450	4060	3930	Pass
Right Knee	Probe Velocity	m/s	2.070	2.130	2.087	Pass
	Peak Resistive Force	N	3450	4060	4002	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto