REPORT NUMBER: NCAP-KAR-19-016

NEW CAR ASSESSMENT PROGRAM (NCAP)
FRONTAL BARRIER IMPACT TEST

BAYERISCHE MOTOREN WERKE AG
2019 BMW X3 XDRIVE30I 5-DOOR MPV

NHTSA NUMBER: M20194100

PREPARED BY:
APPLUS IDIADA KARCO ENGINEERING, LLC.
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FEBRUARY 26, 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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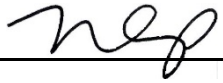
Reviewed By: 

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Approval Date: February 26, 2019

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date:

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

Date:

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	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 BMW X3 xDrive30i 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 February 12, 2019.

The impact velocity of the vehicle was 55.89 km/h and the ambient temperature at the barrier face at the time of impact was 18.3°C. The target vehicle's post-test maximum crush was 520 mm at the vehicle's centerline. The test vehicle's performance is as follows:

Measurement Description	Units	Driver ATD		Passenger ATD	
		Threshold	Result	Threshold	Result
Head Injury Criteria (HIC_{15})	N/A	700	101.6	700	176.4
Maximum Chest Compression	mm	63	-21	52	-15
Nij	N/A	1	0.21	1	0.38
Neck Tension	N	4170	898.4	2620	620.2
Neck Compression	N	4000	-282.7	2520	-320.9
Left Femur Force	N	10000	-517.8	6800	-815.0
Right Femur Force	N	10000	-1246.8	6800	-508.6

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UNCLASSIFIED	UNCLASSIFIED	134	

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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 BMW X3 xDrive30i 5-door MPV at a velocity of 55.89 km/h. The test was performed at Applus IDIADA KARCO Engineering, LLC. on February 12, 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. 630) were calibrated prior to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 106 channels of dummy and vehicle response data were recorded on an on-board data acquisition system. Appendix B contains the dummy response data traces.

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

The maximum static crush was 520 mm at the vehicle's centerline. Both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

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

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 airbag.

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)	101.6	79.7	94.7	-21	0.21	898.4	-282.7	-517.8	-1246.8
Passenger (5th)	176.4	69.4	84.4	-15	0.38	620.2	-320.9	-815.0	-508.6

The Passenger Upper Neck Moment X channel failed at 242.4 ms and the Engine Bottom X channel failed at 78.8 ms. Passenger Pelvis Z and LC1113 Force X both had questionable data.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

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 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	M20194100
Model Year	2019
Make	BMW
Model	X3 xDrive30i
Body Style	5-Door MPV
VIN	5UXTR9C52KLD94893
Body Color	Black
Odometer Reading (km / mi)	32 / 20
Engine Displacement (L)	2.0
Type / No. of Cylinders	Inline 4 Cylinders
Engine Placement	Longitudinal
Transmission Type	Automatic
Transmission Speeds	8 Speed
Overdrive	Yes
Final Drive	AWD
Roof Rack	Yes
Sunroof / T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
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	Yes
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	Bayerische Motoren Werke AG
Date of Manufacture	Sep-18

GVWR (kg)	2385
GAWR Front (kg)	1140
GAWR Rear (kg)	1370

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

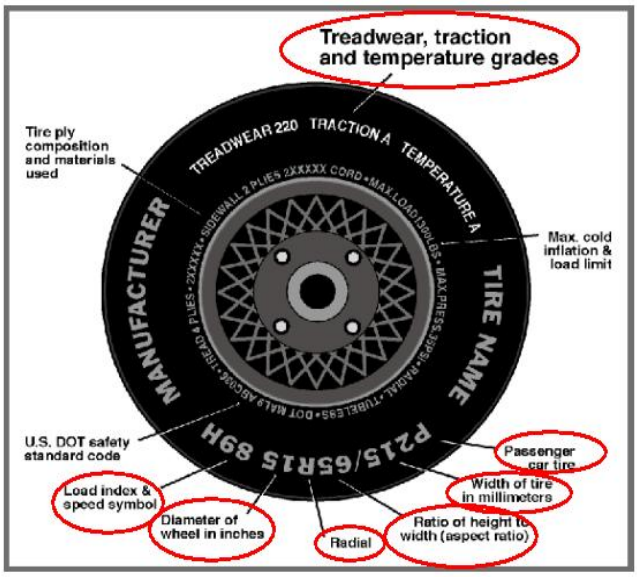
Measured Parameter	Front	Rear	Third	Total	
Type of Seats	Bucket	Split Bench			
Designated Seating Capacity	2	3		5	
Capacity Weight (VCW) (kg)				425.0	*A*
DSC x 68.04 (kg)				340.2	*B*
Cargo Weight (RCLW) (kg)				84.8	*A-B*

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	340	340
Cold Pressure (kPa)	220	250
Recommended Tire Size	P225/60R18	P225/60R18
Tire Size on Vehicle	P225/60R18	P225/60R18
Tire Manufacturer	Bridgestone	Bridgestone
Tire Model	Dueler H/P Sport AS	Dueler H/P Sport AS
Treadwear	500	500
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2 Rayon	2 Rayon
Tire Plies Body	2 Rayon, 2 Steel, 2 Nylon	2 Rayon, 2 Steel, 2 Nylon
Load Index / Speed Symbol	104H	104 H
Tire Material	Rayon, Steel, Nylon	Rayon, Steel, Nylon
DOT Safety Code Left	0BE4 LR0 3118	0BE4 LR0 3118
DOT Safety Code Right	0BE4 LR0 3118	0BE4 LR0 3118

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

TEST VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	447.5	478.0		482.0	569.0	
Right	kg	458.5	460.0		472.0	541.0	
Ratio	%	49.1%	50.9%	100.0%	46.2%	53.8%	100.0%
Total	kg	906.0	938.0	1844.0	954.0	1110.0	2064.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1844.0	A
Weight of 1 P572E ATD & 1 P572O ATD	kg	141.0	B
Rated Cargo/Luggage Weight (RCLW)	kg	84.8	C
Calculated Vehicle Target Weight (TVTW)	kg	2069.8	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	849	851	845	847	1457
As Tested	mm	823	825	808	814	1541
Post-Test	mm	878	879	810	828	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheelbase	mm	2865
Total Vehicle Length at Left Side	mm	4120
Total Vehicle Length at Centerline	mm	4703
Total Vehicle Length at Right Side	mm	4120
Weight of Ballast in Cargo Area	kg	87.0
Weight of Vehicle Components Removed	kg	8.0
Amount of Stoddard Solvent in Fuel Tank	L	63.20

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

Rear Trim (8.0 kg)

DATA SHEET NO. 1 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

TARGET VEHICLE STRUCTURAL MEASUREMENTS

No.	Description	Pre-Test
1	Total Length	4703
2	Total Width	1883
3	Bumper Top Height	635
4	Bumper Bottom Height	350
5	Longitudinal Member Top Height	590
6	Distance Between Longitudinal Members	815
7	Longitudinal Member Width	70
8	Engine Top Height	920
9	Engine Bottom Height	215
10	Engine and Gearbox Width	540
11	Front Bumper to Engine Distance	815
12	Front Shock Absorber Fixing Height	978
13	Bonnet Leading Edge Height	840
14	Front Shock Absorber Fixing Width	1193
15	Front Bumper to Front Axle Distance	847
16	Front Axle to A-Pillar Distance	655
17	A-Pillar to B-Pillar Distance	957
18	B-Pillar to Rear Axle Distance	1118
19	B-Pillar to C-Pillar Distance	850
20	Roof Sill Bottom Height	1495
21	Roof Sill Top Height	1613
22	Floor Sill Bottom Height	230
23	Floor Sill Top Height	390

All measurements in millimeters.

DATA SHEET NO. 2

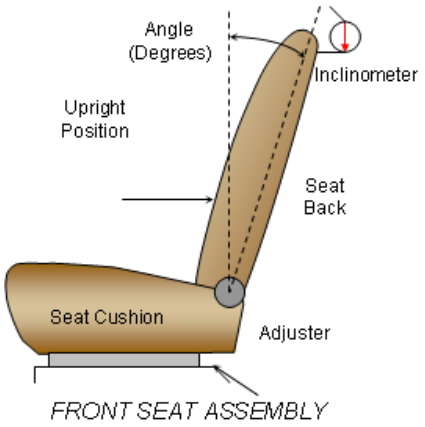
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

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.

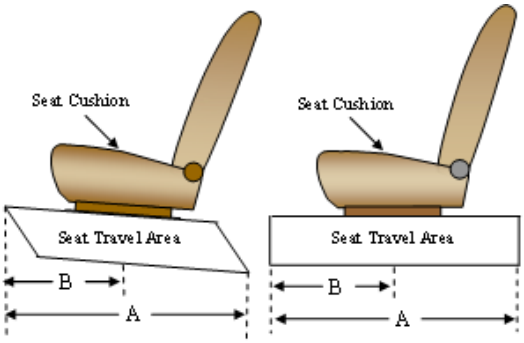


SEAT BACK ANGLE

Seating Position	Degrees
Driver Seat Back Angle	5.1
Passenger Seat Back Angle	3.0

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	316 mm	158 mm
Passenger Seat	230 mm	0 mm

SEAT BELT UPPER ANCHORAGE

The seat belt upper anchorage is positioned to the manufacturer's design position for a 50th percentile adult male ATD for the driver, and a 5th percentile adult female ATD for the passenger. Position "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	Fixed	Fixed
Passenger Seat	Fixed	Fixed

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

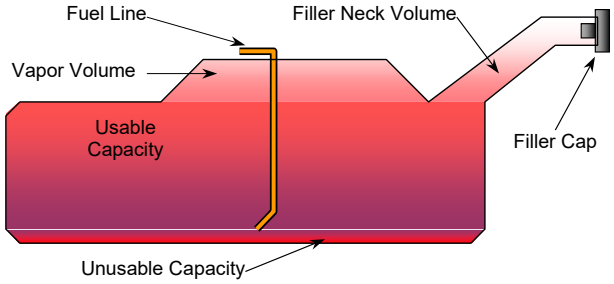
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank"	67.98
Usable Capacity of "Optional Tank"	
92 - 94% of Usable Capacity	62.54 to 63.9
Actual Amount of Stoddard Solvent Used	63.20
1/3 of Usable Capacity	22.66

FUEL PUMP

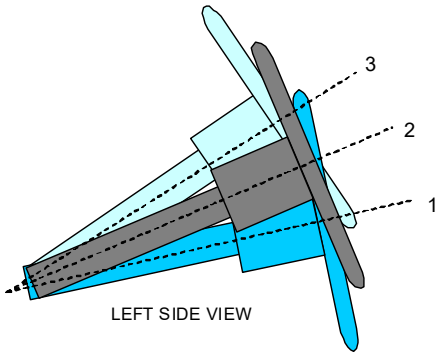
The vehicle is equipped with an electric fuel pump. The fuel pump starts when the ignition is on and will operate for 5 seconds. After pressure has been built up, the fuel pump switches to sleep mode until the engine is started or the pressure decreases.



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

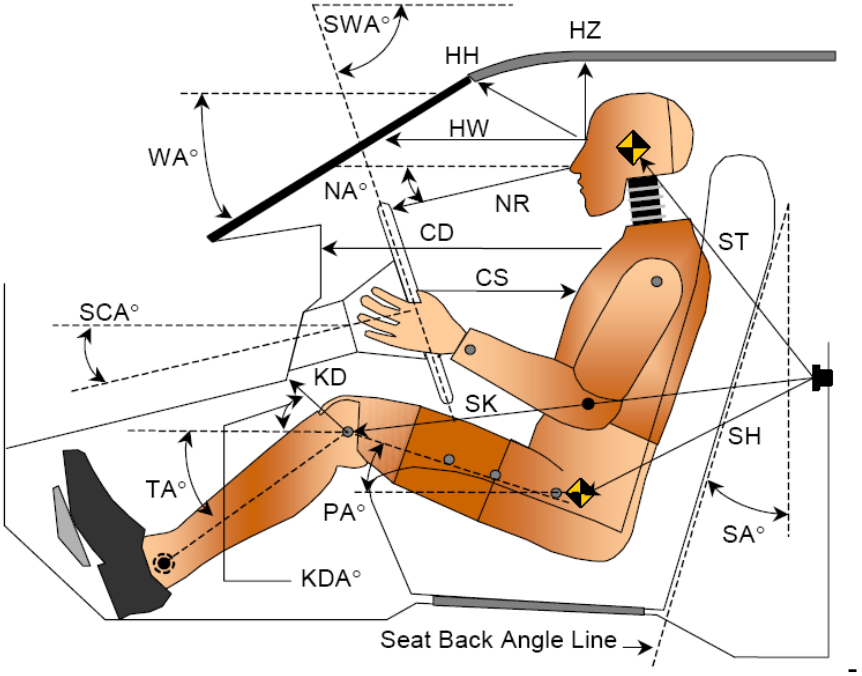
	Degrees	Fore-Aft Position (mm)
Lowermost Position, No. 1	22.8	130
Geometric Center Position, No. 2	24.4	159
Uppermost Position, No. 3	26.0	188
Telescoping Steering Wheel Travel		58
Test Position	24.4	159

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19



LEFT SIDE VIEW

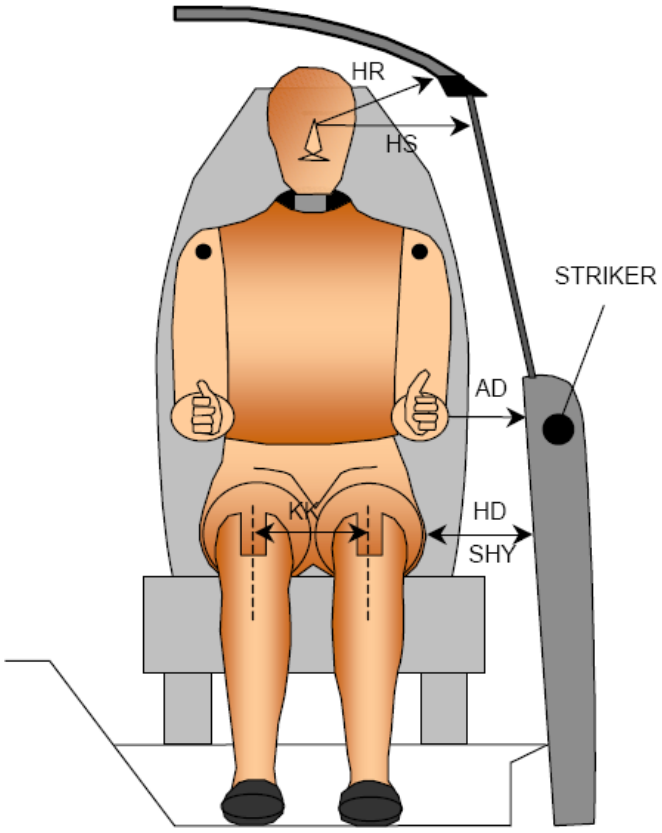
Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		28.9		
SWA°	Steering Wheel Angle		64.4		
SCA°	Steering Column Angle		23.4		
SA°	Seat Back Angle (On Headrest Post)		5.1		3.0
HZ	Head to Roof	251	90.0	250	90.0
HH	Head to Header	452	25.7	369	40.1
HW	Head to Windshield	223	0.0	632	0.0
NR	Nose to Rim	404	6.8	432	31.6
CD	Chest to Dash	525	14.9	383	2.6
CS	Chest to Steering Hub	320	1.5		
RA	Rim to Abdomen	205	18.8		
KDL	Left Knee to Dash	216	27.1	124	38.6
KDR	Right Knee to Dash	202	29.1	121	34.6
PA°	Pelvic Angle		24.8		20.3
TA°	Tibia Angle		46.6		49.6
SK	Striker to Knee	534	10.0	613	8.8
ST	Striker to Head	430	88.8	408	68.6
SH	Striker to H-Point	263	55.8	336	32.5

DATA SHEET NO. 4

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19



Code	Description	Driver (mm)	Passenger (mm)
AD	Arm to Door	120	99
HD	H-Point to Door	149	195
HR	Head to Side Header	243	268
HS	Head to Side Window	370	405
KK	Knee to Knee	290	165
SHY	Striker to H-Point (Y-Direction)	151	284
AA	Ankle to Ankle	300	175

DATA SHEET NO. 5

SEAT BELT POSITIONING DATA

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

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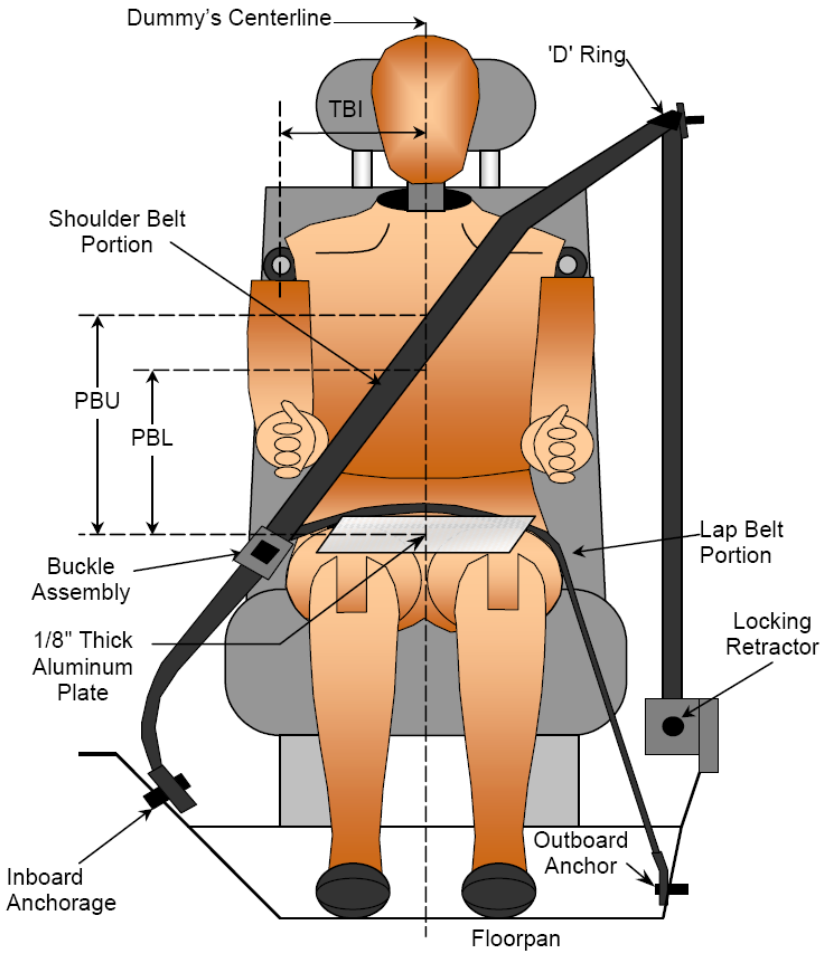


FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Code	Measurement Description	Units	Driver	Passenger
PBU	Top Surface of Aluminum Plate to Belt Upper Edge	mm	315	265
PBL	Top Surface of Aluminum Plate to Belt Lower Edge	mm	240	165

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as Measured on ATD	mm	856	873
Lap Belt Length as Measured on ATD	mm	644	666
Remainder of Belt on Reel	mm	1220	1150
Total Belt Length for Continuous Webbing Systems	mm	2720	2689

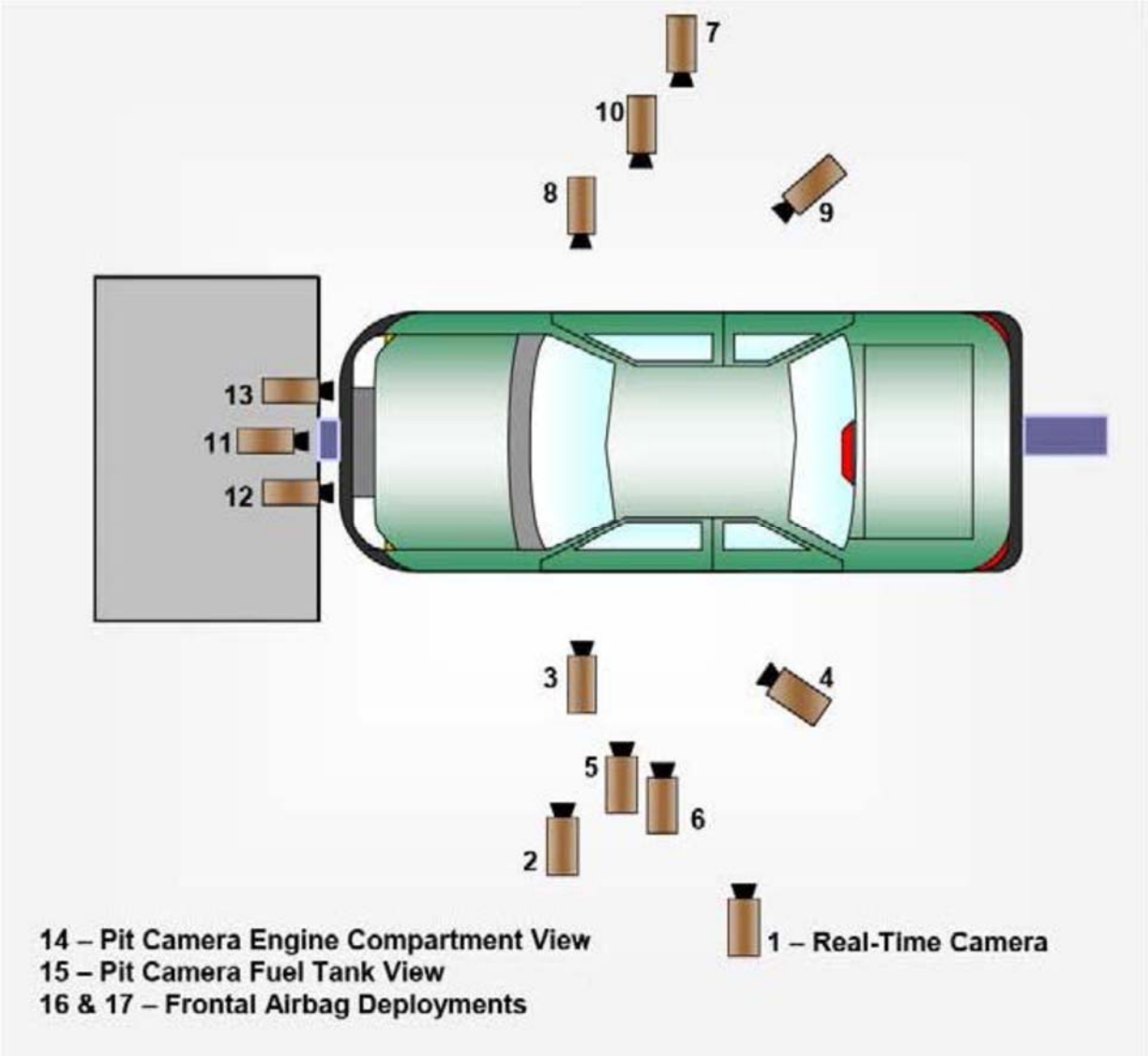
DATA SHEET NO. 6

HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 … (CONTINUED)

HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

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)	-2850	-260	-1500	8	1000
17	Onboard Passenger Airbag (Optional)	-2850	260	-1500	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

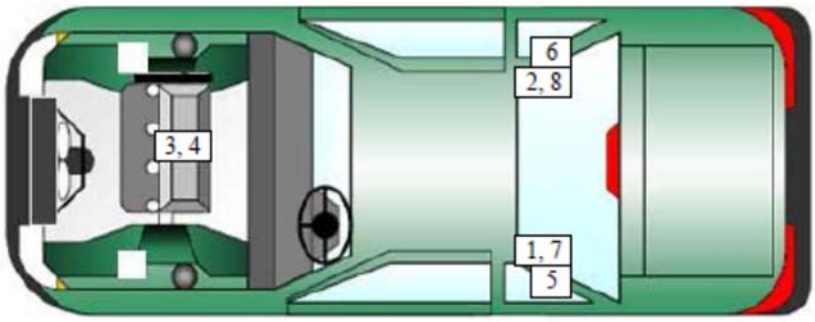
+Z = into ground

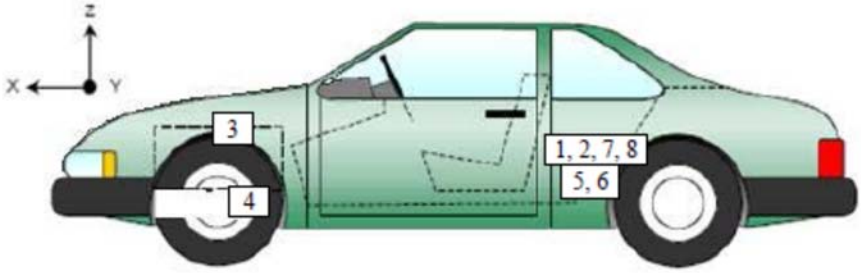
DATA SHEET NO. 7

VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Description	Location		
		X	Y	Z
1	Left Rear Accelerometer X-Direction	1760	-740	-420
2	Right Rear Accelerometer X-Direction	1765	740	-420
3	Engine Top X	3800	0	-1035
4	Engine Bottom X	3500	-500	-490
5	Left Rear Accelerometer Z-Direction	1760	-740	-420
6	Right Rear Accelerometer Z-Direction	1765	740	-420
7	Left Rear Accelerometer X-Direction Redundant	1760	-740	-420
8	Right Rear Accelerometer X-Direction Redundant	1765	740	-420

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

Y – Vehicle Centerline (+ to right)

Z – Ground Plane (+ down)

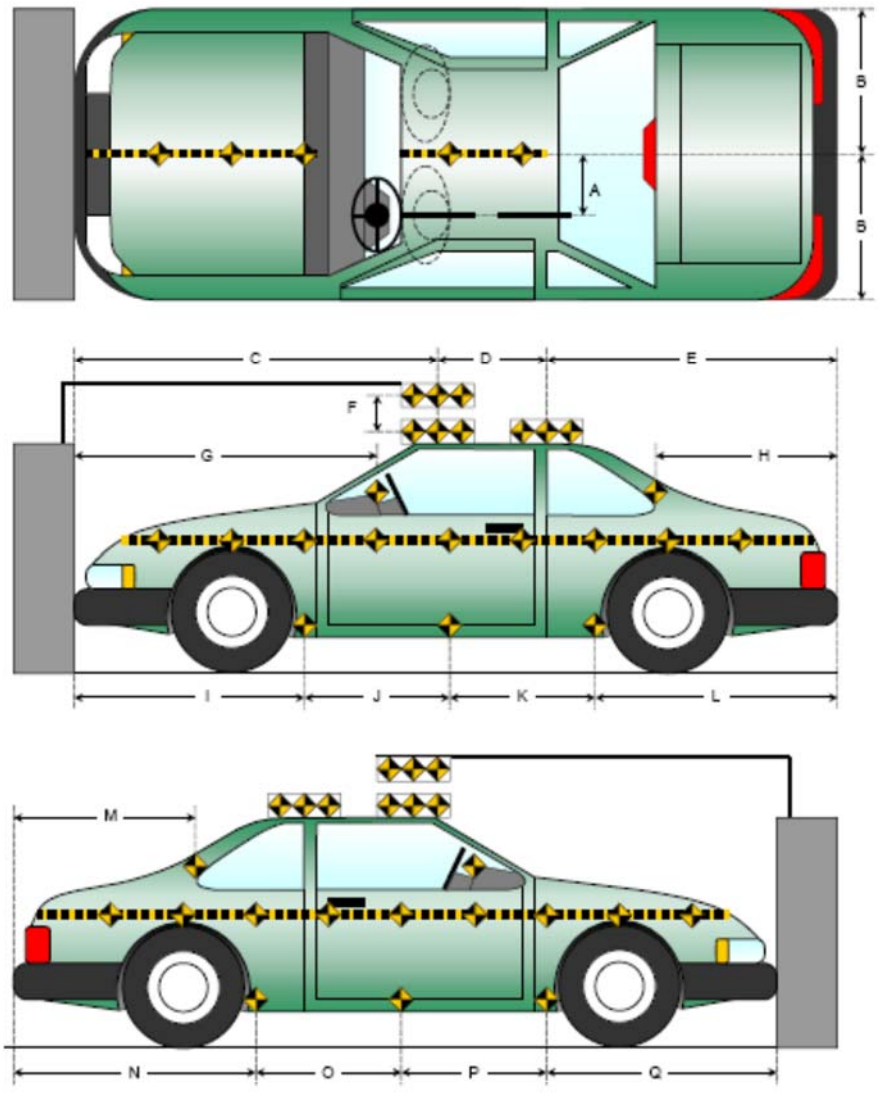
DATA SHEET NO. 8

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

Item	Value
A	410
B	991
C	2411
D	610
E	1666
F	305
G	1910
H	495
I	1345
J	920
K	920
L	1512
M	495
N	1512
O	921
P	921
Q	1345



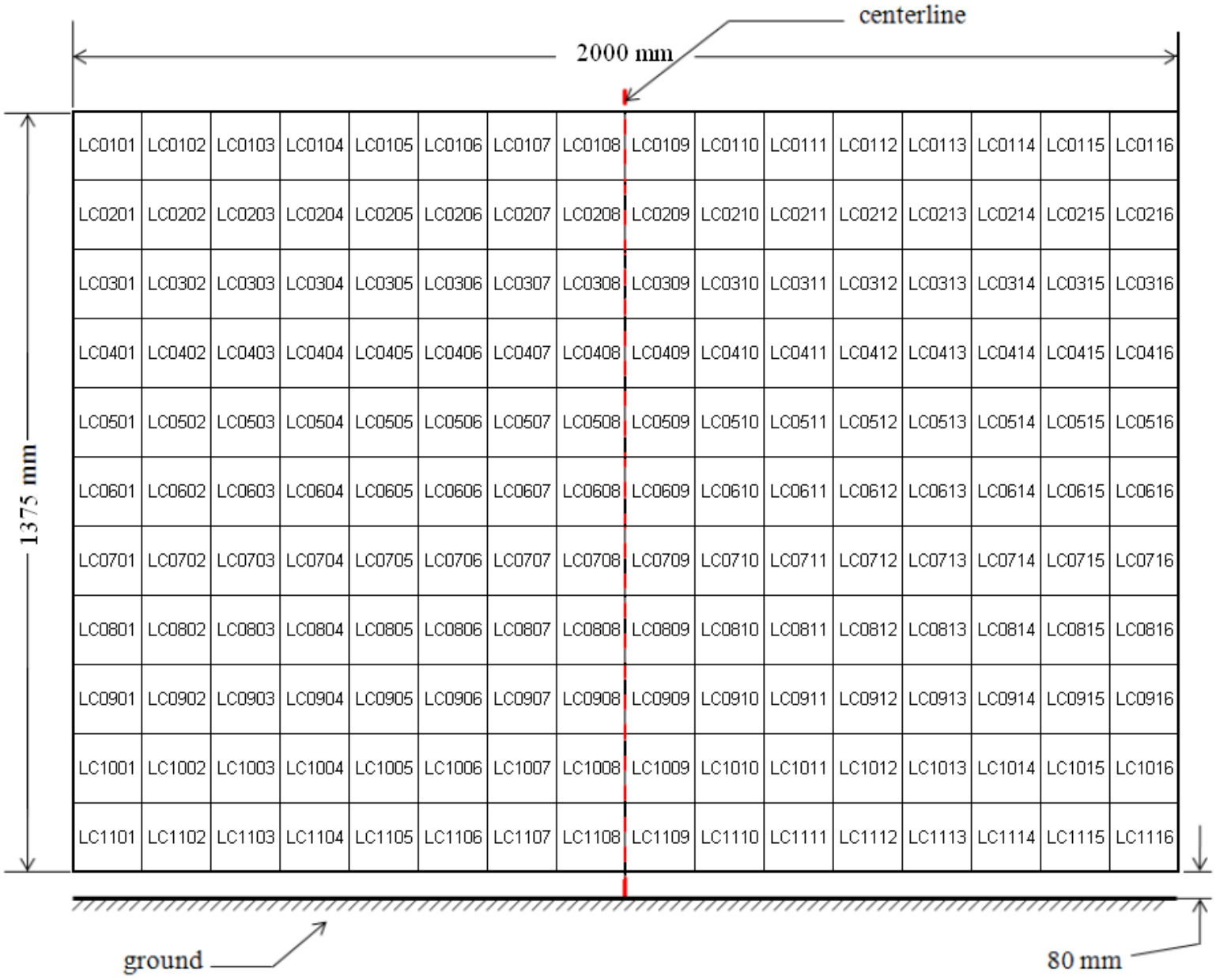
All measurements in millimeters.

DATA SHEET NO. 9

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19



DATA SHEET NO. 10

TEST VEHICLE CAMERA AND INSTRUMENTATION SUMMARY

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

INSTRUMENTATION

Driver Dummy Accelerometers	47
Passenger Dummy Accelerometers	47
Vehicle Structure Accelerometers	8
Seat Belt Load Cells	4
Load Cell Barrier	528
Total	634

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 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

TEST DUMMY INFORMATION AND CONTACT

Description	Driver	Passenger
Dummy Type/Serial No.	P572E 50th Percentile Male ATD / 360	P572O 5th Percentile Female ATD / 630
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	Knee Airbag
Right Knee Contact	Knee Airbag	Knee Airbag

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked / Unlocked Doors	Unlocked	Unlocked
Front Door Opening	Remained closed and latched, operational	Remained closed and latched, operational
Rear Door Opening	Remained closed and latched, operational	Remained closed and latched, operational
Seat Track Shift (mm)	5	9
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	Front windows rolled up

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	932
Center	mm	950
Right Side	mm	1008
Average	mm	963

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

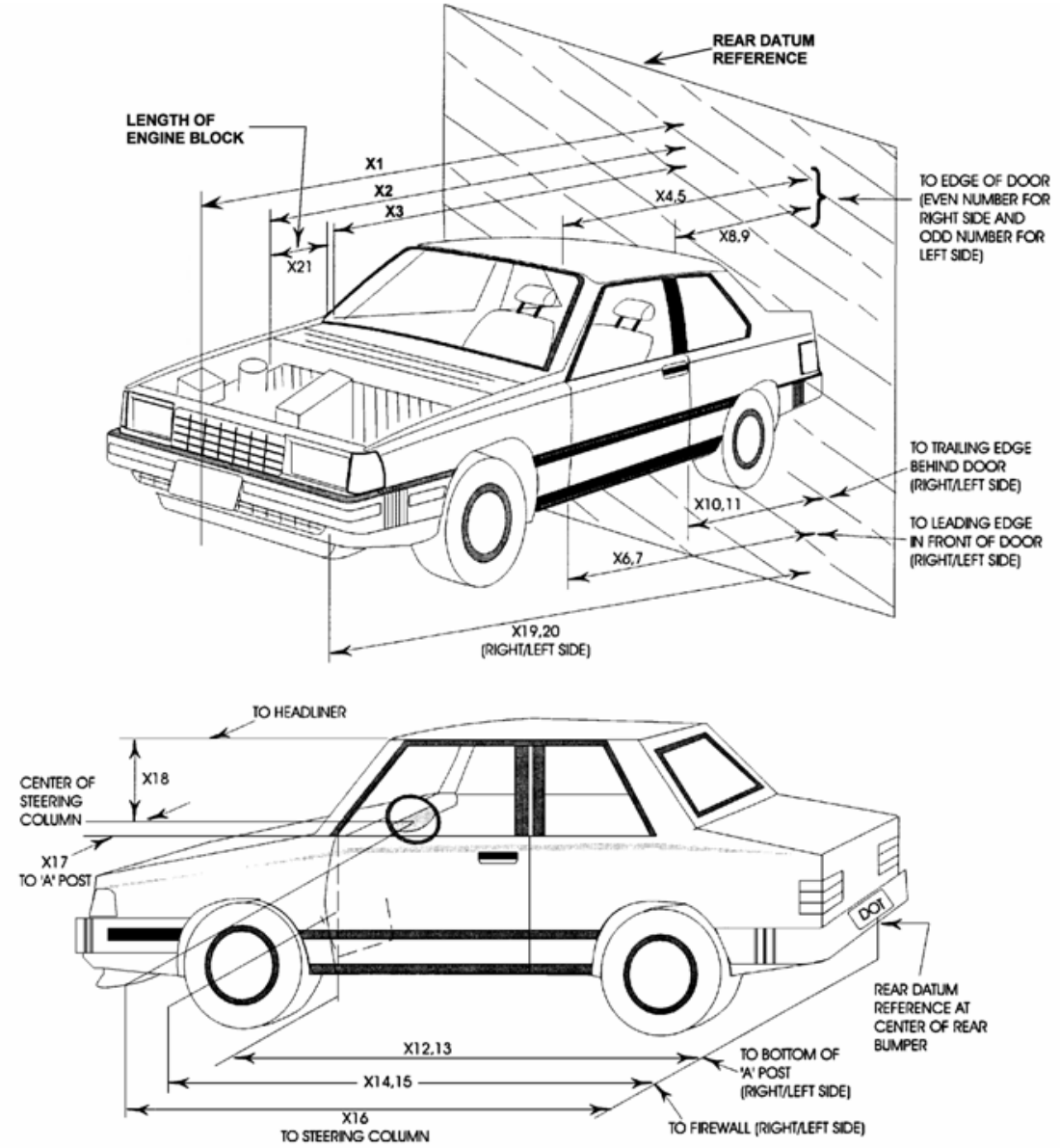
Restraint Type	Driver		Passenger	
	Installed	Operated	Installed	Operated
Front Airbag	Yes	Yes	Yes	Yes
Side Airbag 1 (Curtain)	Yes	Yes	Yes	Yes
Side Airbag 2 (Torso/Pelvis)	Yes	No	Yes	No
Knee Airbag	Yes	Yes	Yes	Yes
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Yes	Yes	Yes

DATA SHEET NO. 12

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19



DATA SHEET NO. 12 … (CONTINUED)

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4703	4183	-520
2	Rear Surface of Vehicle to Front of Engine	3888	3963	75
3	RSOV to Firewall	3403	3323	-80
4	RSOV to Upper Leading Edge of Right Door	3220	3200	-20
5	RSOV to Upper Leading Edge of Left Door	3220	3175	-45
6	RSOV to Lower Leading Edge of Right Door	3205	3200	-5
7	RSOV to Lower Leading Edge of Left Door	3207	3190	-17
8	RSOV to Upper Trailing Edge of Right Door	2068	2090	22
9	RSOV to Upper Trailing Edge of Left Door	2066	2085	19
10	RSOV to Lower Trailing Edge of Right Door	2113	2115	2
11	RSOV to Lower Trailing Edge of Left Door	2115	2105	-10
12	RSOV to Bottom of A-Pillar, Right Side	3115	3130	15
13	RSOV to Bottom of A-Pillar, Left Side	3110	3140	30
14	RSOV to Firewall, Right Side	3403	3418	15
15	RSOV to Firewall, Left Side	3403	3403	0
16	RSOV to Steering Column	2615	2630	15
17	Center of Steering Column to A-Pillar	445	420	-25
18	Center of Steering Column to Headliner	425	530	105
19	RSOV to Right Side of Front Bumper	4120	3880	-240
20	RSOV to Left Side of Front Bumper	4120	3930	-190
21	Length of Engine Block	490	490	0
RD	RSOV to Right Side of Dash Panel	2830	2830	0
CD	RSOV to Center of Dash Panel	2755	2810	55
LD	RSOV to Left Side of Dash Panel	2835	2870	35

All measurements in millimeters.

DATA SHEET NO. 13

ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

VEHICLE INFORMATION

VIN: 5UXTR9C52KLD94893 Wheelbase (mm): 2865

Vehicle Size Category: MPV Test Weight (kg): 2064.0

ACCELEROMETER DATA

Accelerometer Locations: Left Rear Crossmember

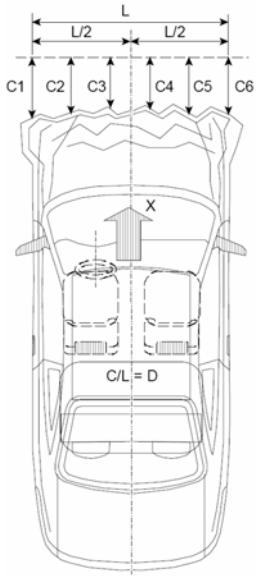
Cal. Procedure/Interval: Vibration Test / 6 months

Integration Algorithm: NHTSA Standard Linearity: Good

Impact Velocity (km/h): 55.89

Velocity Change (km/h): 66.0

Time of Separation (msec): 72.7



CRUSH PROFILE

Collision Deformation Classification: 12FDEW2

Midpoint of Damage: Vehicle Centerline

Damage Region Length (mm): 1357

Impact Mode: Full Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush Zone 1 at Left Side	mm	155	430	275
C2	Crush Zone 2 at Left Side	mm	35	505	470
C3	Crush Zone 3 at Left Side	mm	3	500	497
C4	Crush Zone 4 at Right Side	mm	3	500	497
C5	Crush Zone 5 at Right Side	mm	35	540	505
C6	Crush Zone 6 at Right Side	mm	155	520	365
L	C1 to C6	mm	1357		

DATA SHEET NO. 14

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

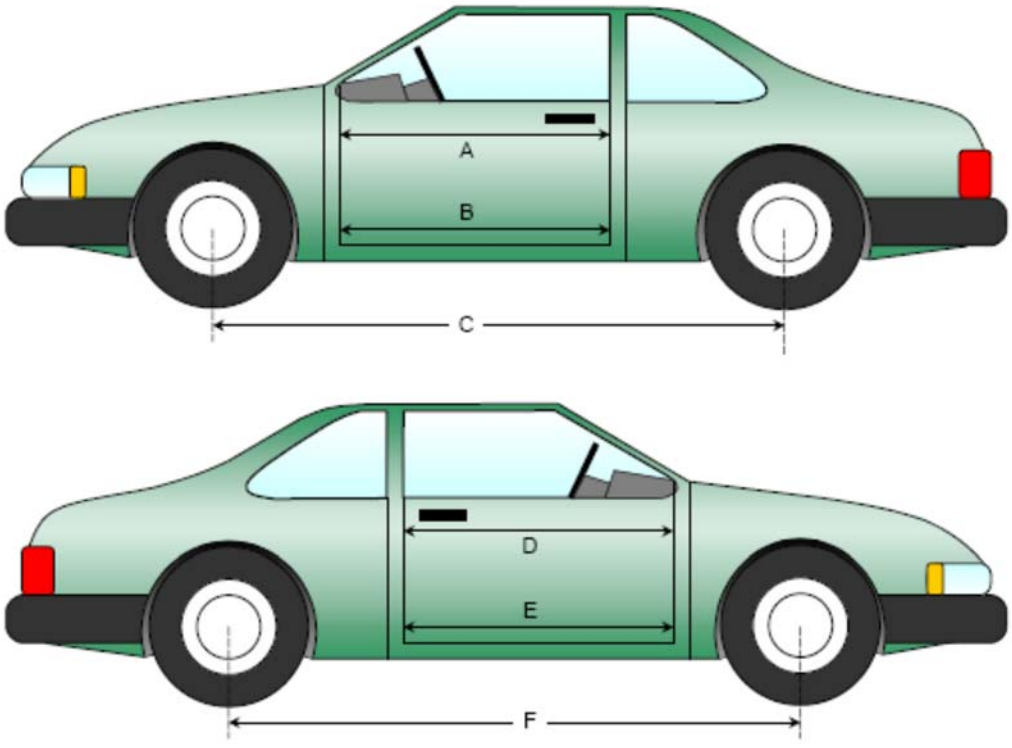
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	960	958	2
B	Left Side Lower	mm	860	864	-4
D	Right Side Upper	mm	961	959	2
E	Right Side Lower	mm	858	880	-22

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2865	2745	120
F	Right Side Wheelbase	mm	2863	2745	118



DATA SHEET NO. 14 … (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

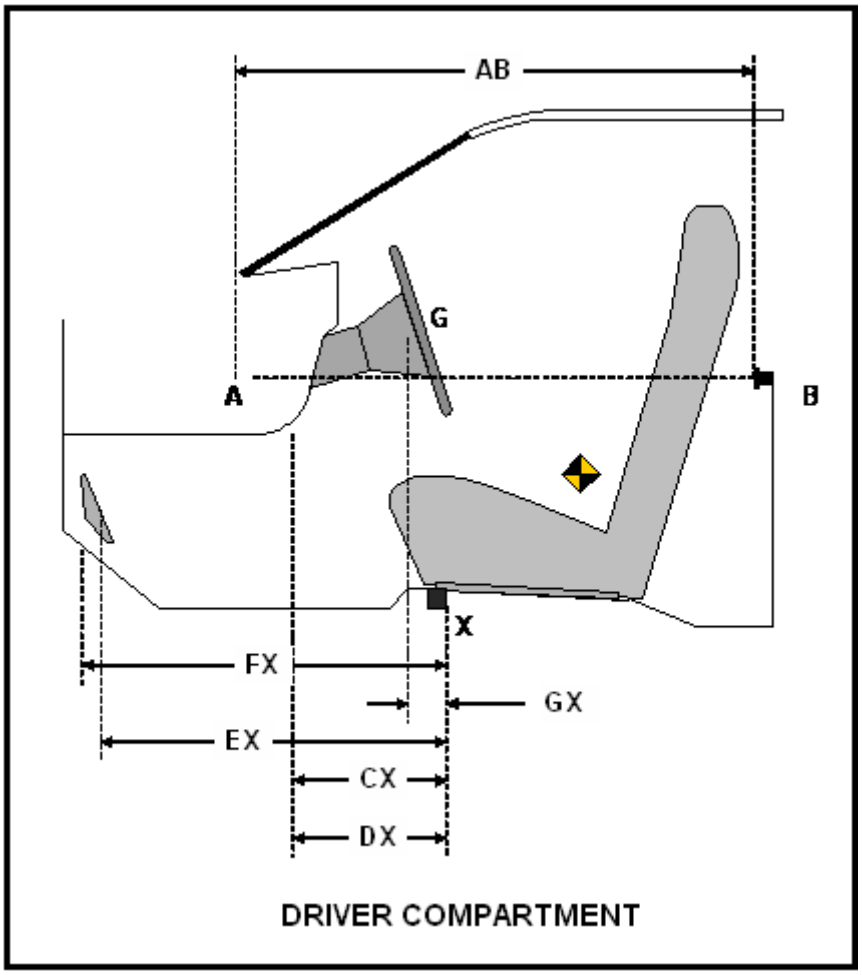
Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	835	773	62
CX	Left Knee Bolster to X	mm	290	350	-60
DX	Right Knee Bolster to X	mm	285	350	-65
EX	Brake Pedal to X	mm	510	510	0
FX	Foot Rest to X	mm	550	570	-20
GX	Center of Steering Wheel Hub to X	mm	50	130	-80

X = Front of Seat Track (Stationary)



DATA SHEET NO. 15

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

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

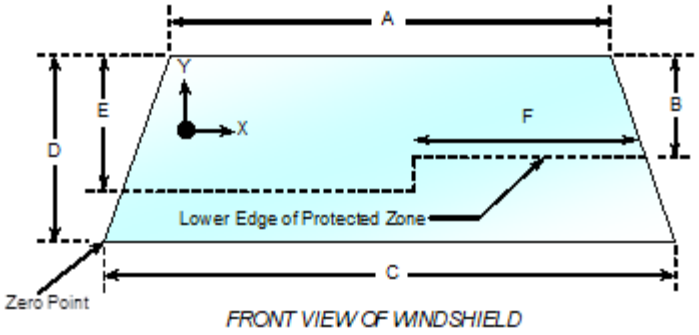
Windshield Mounting Details: Windshield glass is secured to the vehicle frame with rubber molding and rubber cement.

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: 21.5° C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2144	2144	100.0%
Right Side	2144	2144	100.0%
Total	4288	4288	100.0%



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1208
B	mm	340
C	mm	1430
D	mm	825
E	mm	475
F	mm	555

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 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 18.3° C Test Time: 2:10 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)

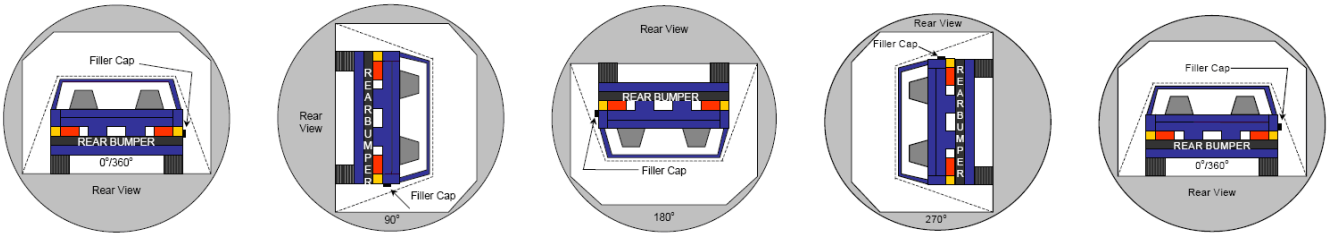
D. Spillage: There was no Stoddard solvent spillage.

DATA SHEET NO. 16

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19



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°	80	300	380
90° To 180°	81	300	381
180° To 270°	78	300	378
270° To 360°	84	300	384

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

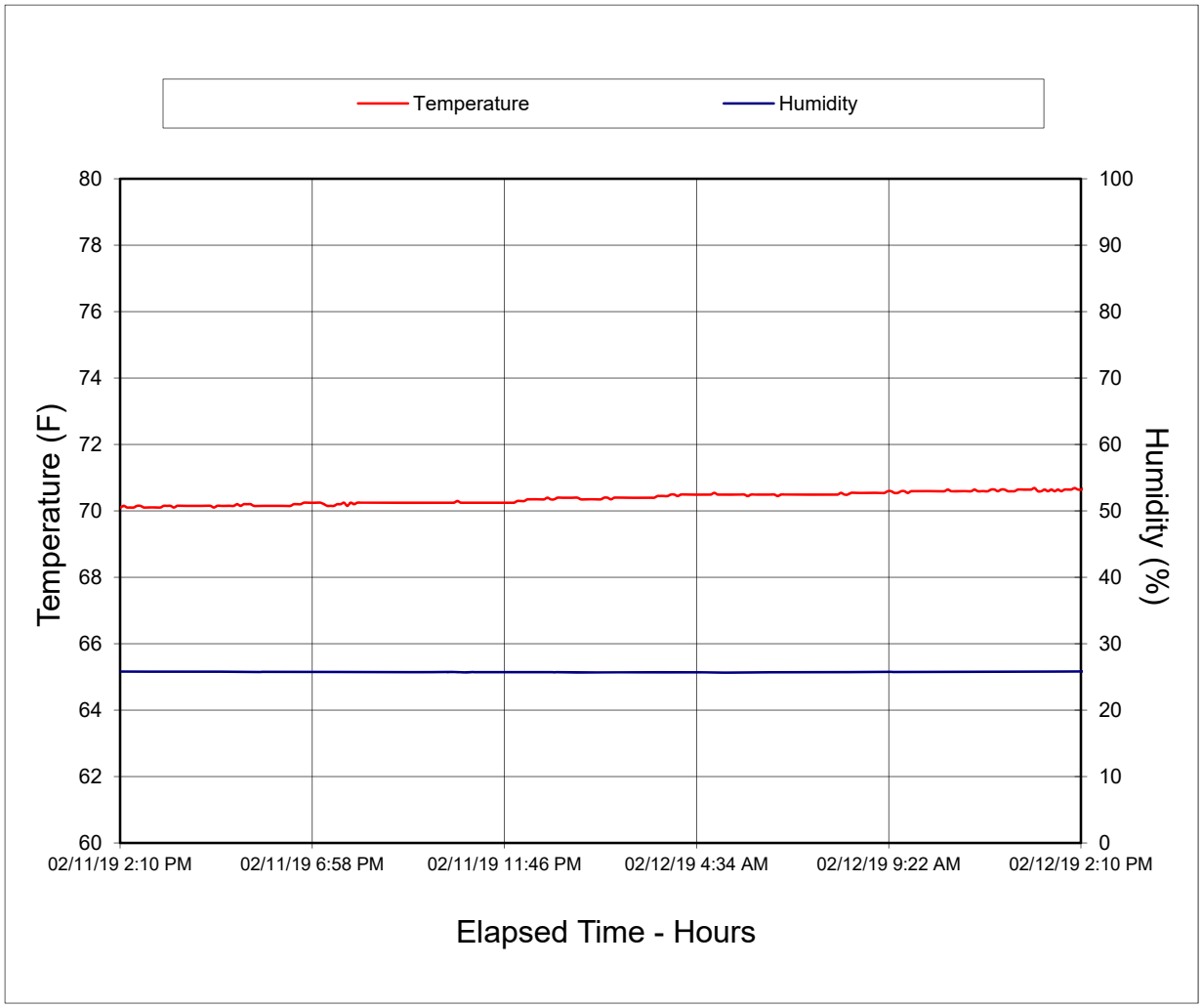
Test Phase	Spillage Location
0° To 90°	
90° To 180°	
180° To 270°	
270° To 360°	

DATA SHEET NO. 17

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2019 BMW X3 xDrive30i 5-Door MPV NHTSA No.: M20194100

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/12/19



APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

TABLE OF PHOTOGRAPHS … (CONTINUED)

TABLE OF PHOTOGRAPHS … (CONTINUED)

FIGURE 1. Load Cell Location

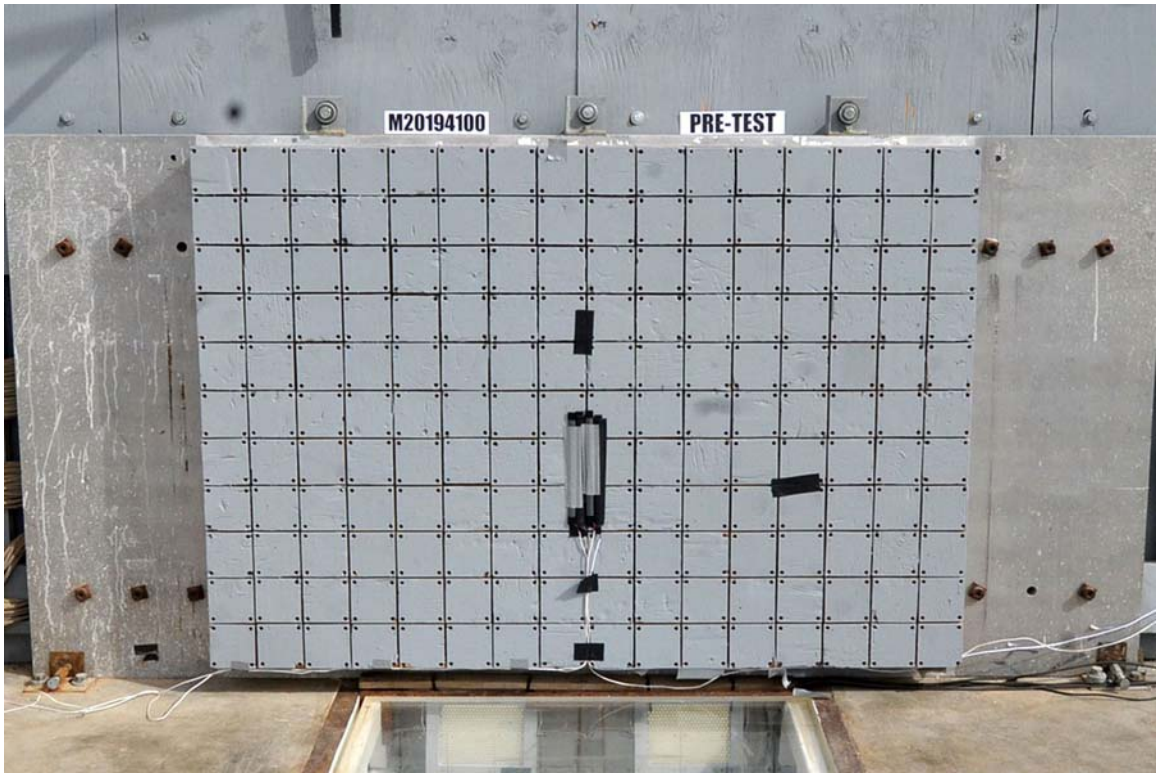


FIGURE 2. Pre-Test Load Cell Wall

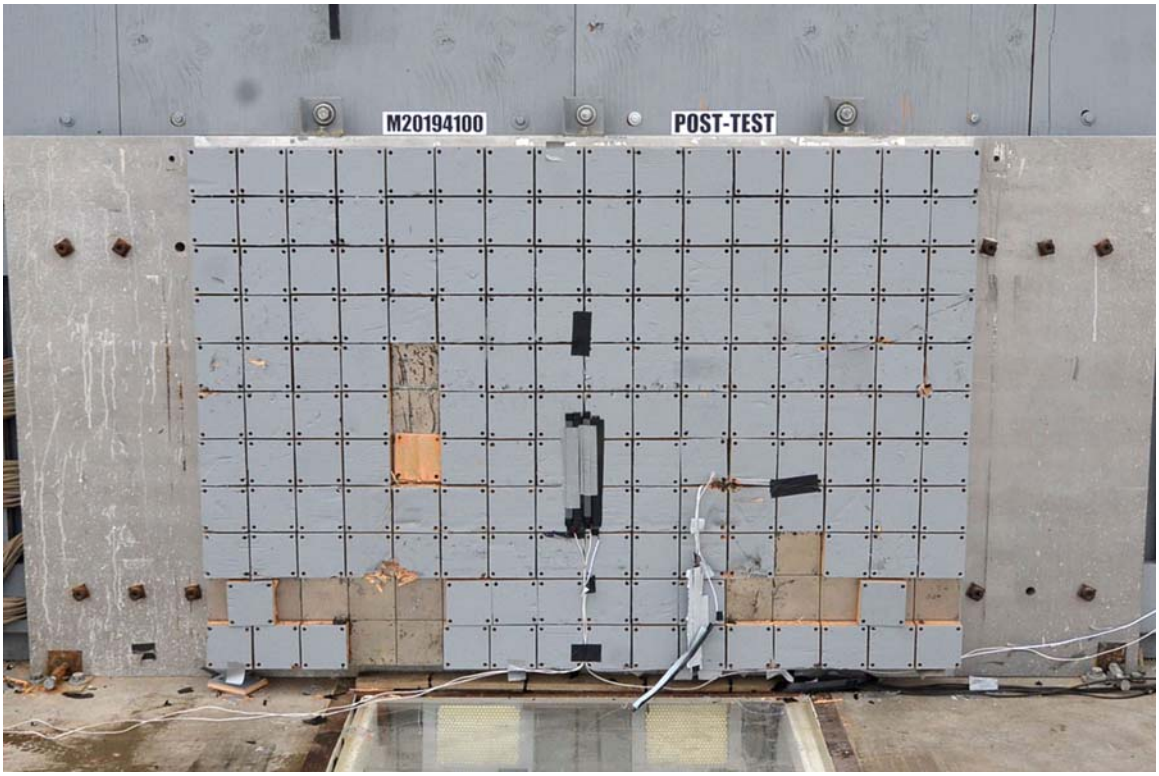


FIGURE 3. Post-Test Load Cell Wall

FIGURE 4. Manufacturer's Label

FIGURE 5. Tire Placard

FIGURE 6. 2019 BMW X3 xDrive30i Frontal as Delivered

FIGURE 7. Left Rear ¾ View, as Received

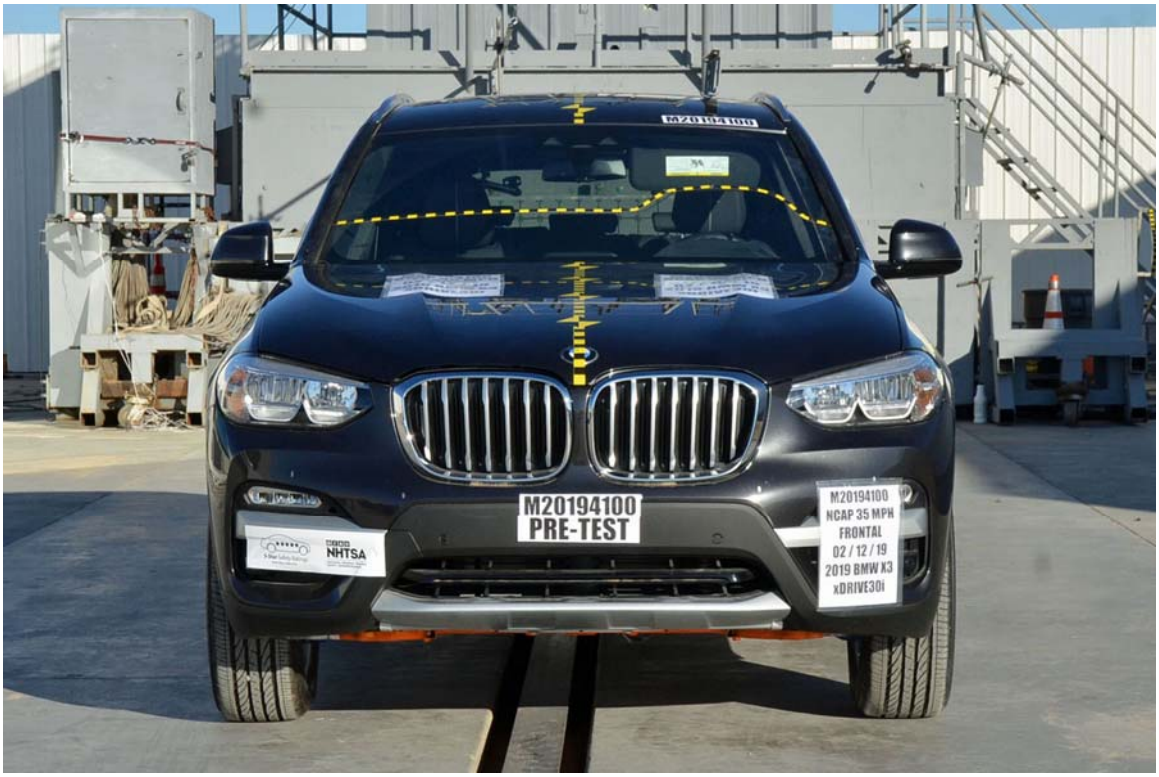


FIGURE 8. Pre-Test Front View of Test Vehicle

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

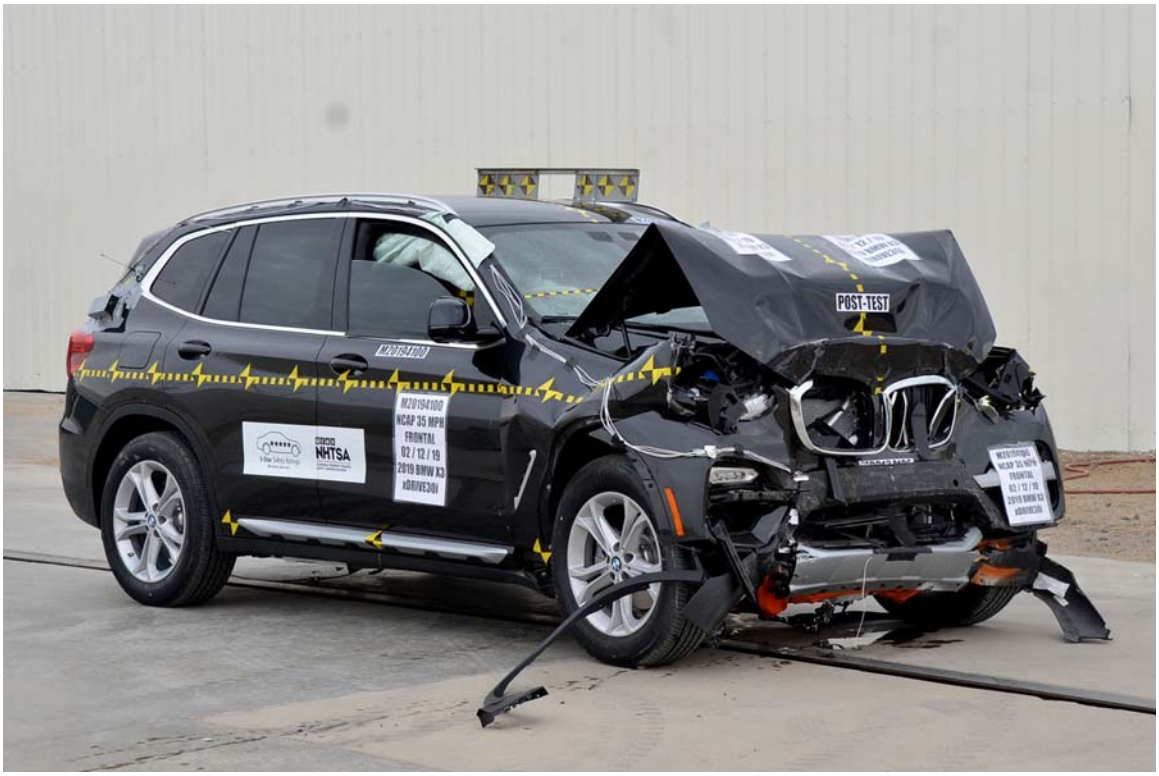


FIGURE 15. Post-Test Right Front ¾ View

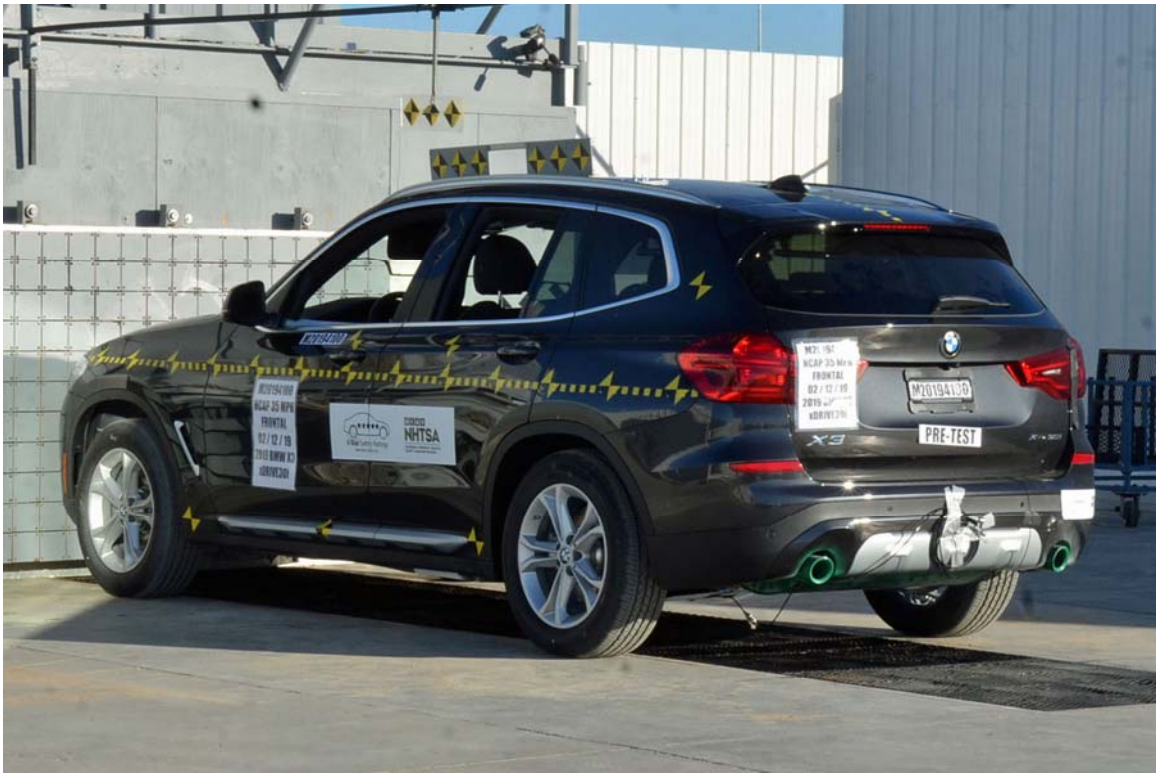


FIGURE 16. Pre-Test Left Rear ¾ View

FIGURE 17. Post-Test Left Rear ¾ View

FIGURE 18. Pre-Test Windshield View

FIGURE 19. Post-Test Windshield View

Photograph Not Available

FIGURE 20. Pre-Test Engine Compartment View

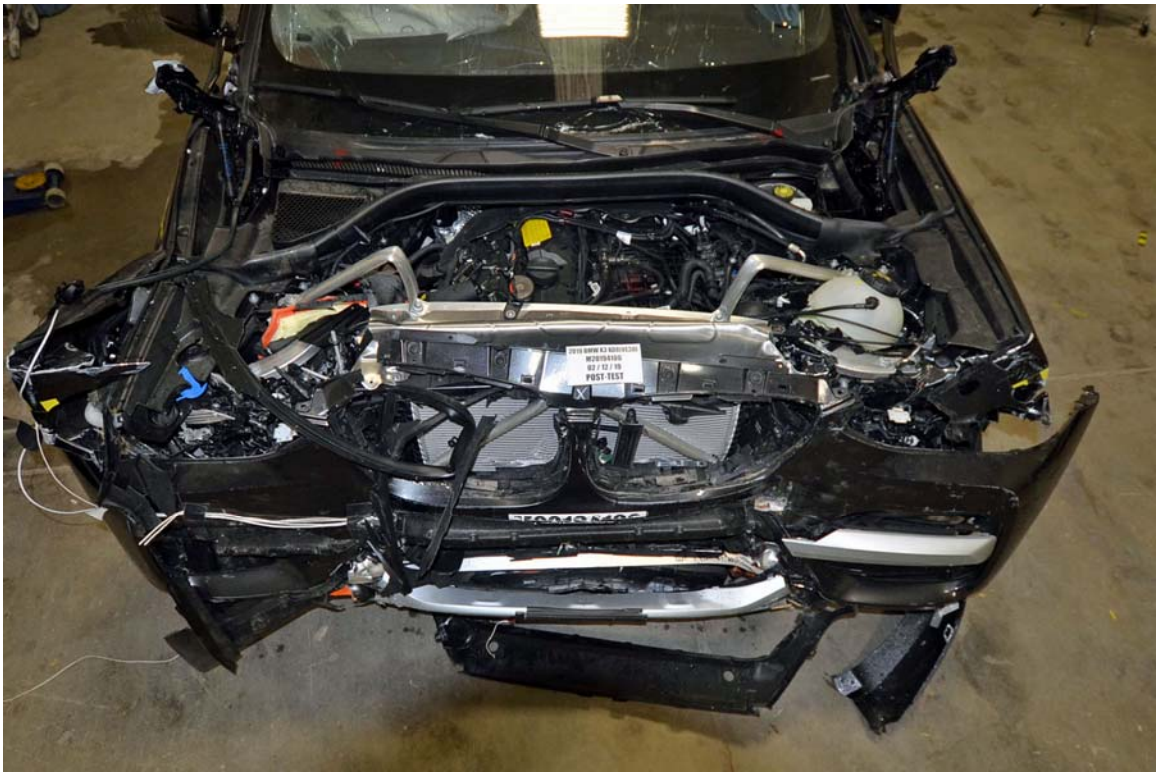


FIGURE 21. Post-Test Engine Compartment View

FIGURE 22. Pre-Test Fuel Filler Cap View

FIGURE 23. Post-Test Fuel Filler Cap View

FIGURE 24. Pre-Test Front Underbody View

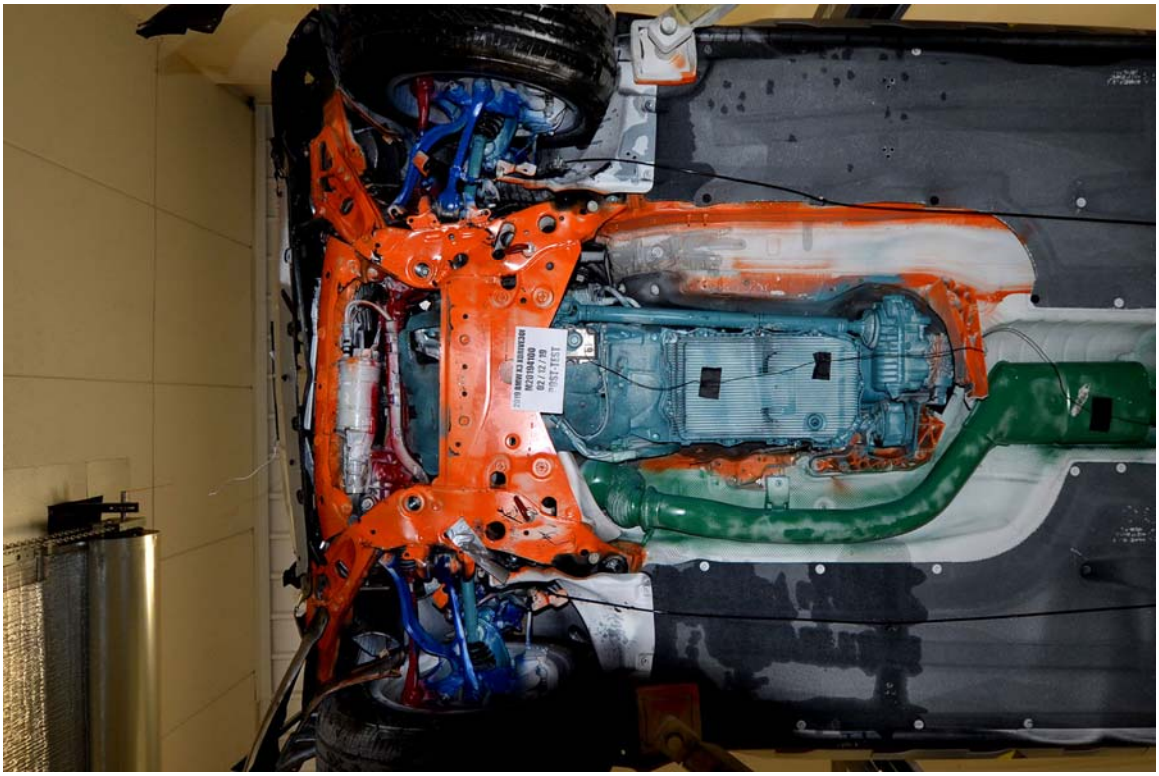


FIGURE 25. Post-Test Front Underbody View

FIGURE 26. Pre-Test Rear Underbody View

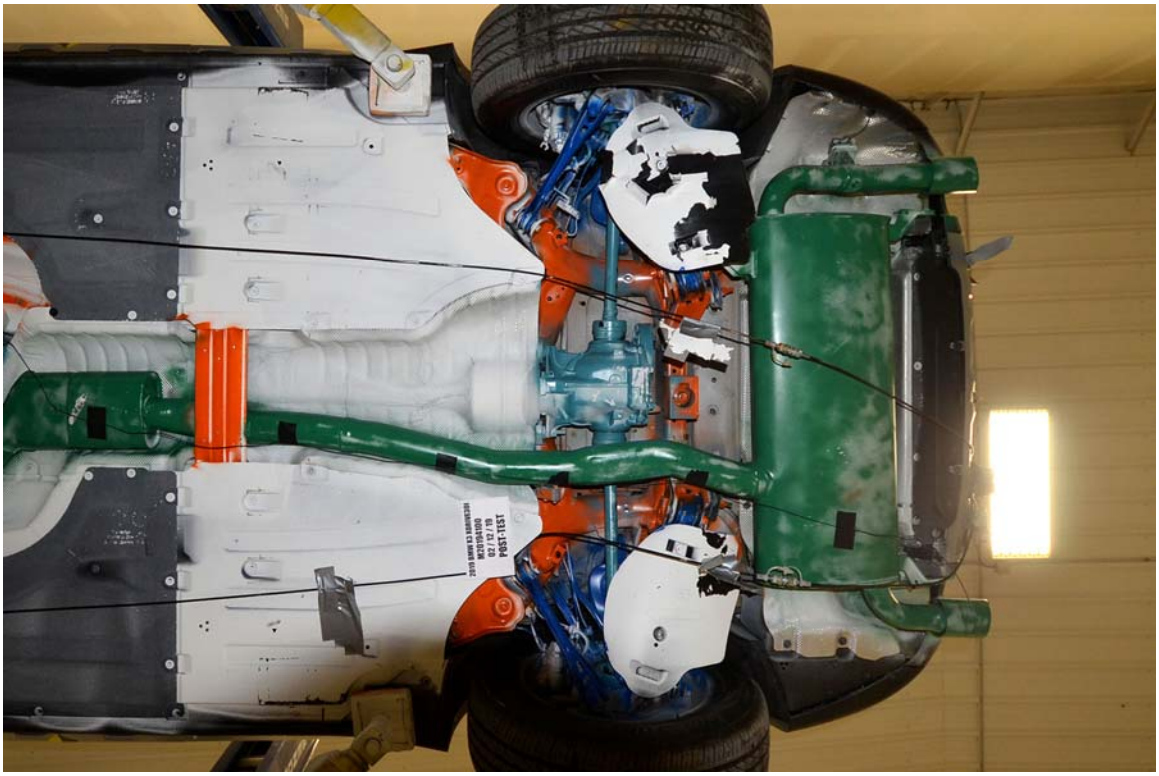


FIGURE 27. Post-Test Rear Underbody View

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

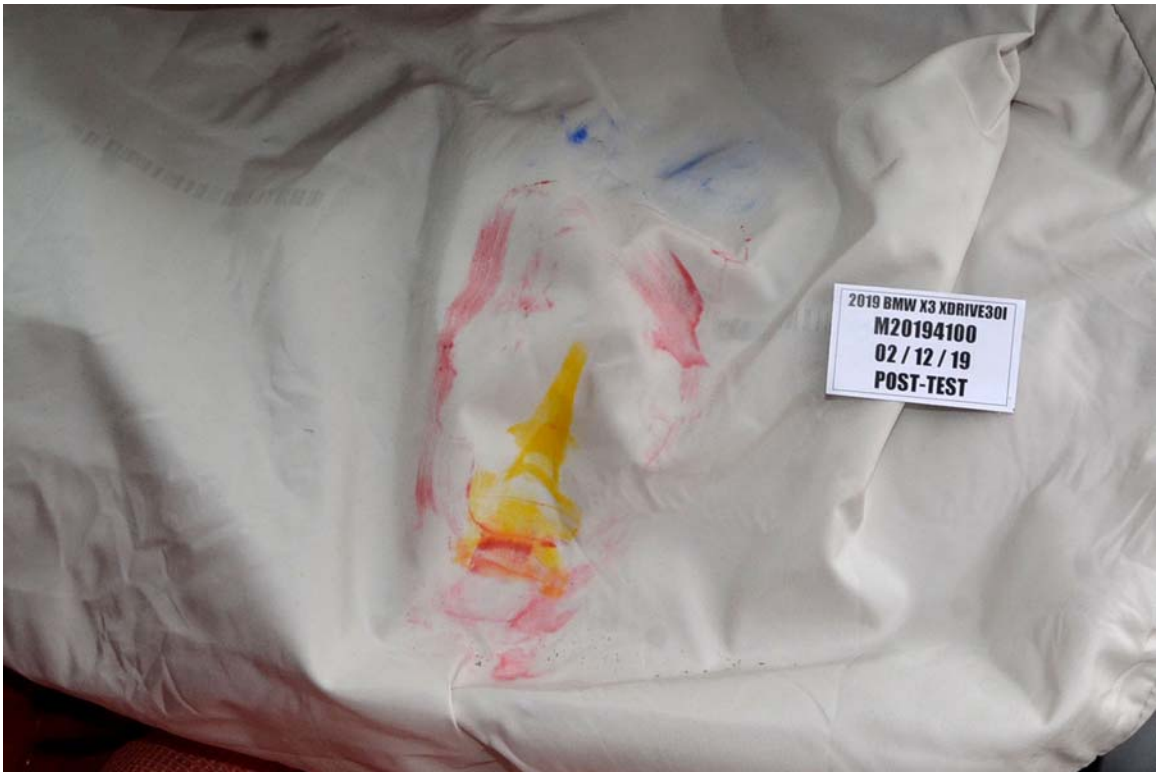


FIGURE 68. Post-Test Passenger Dummy Contact with Airbag

FIGURE 69. Post-Test Passenger Dummy Contact with Headrest

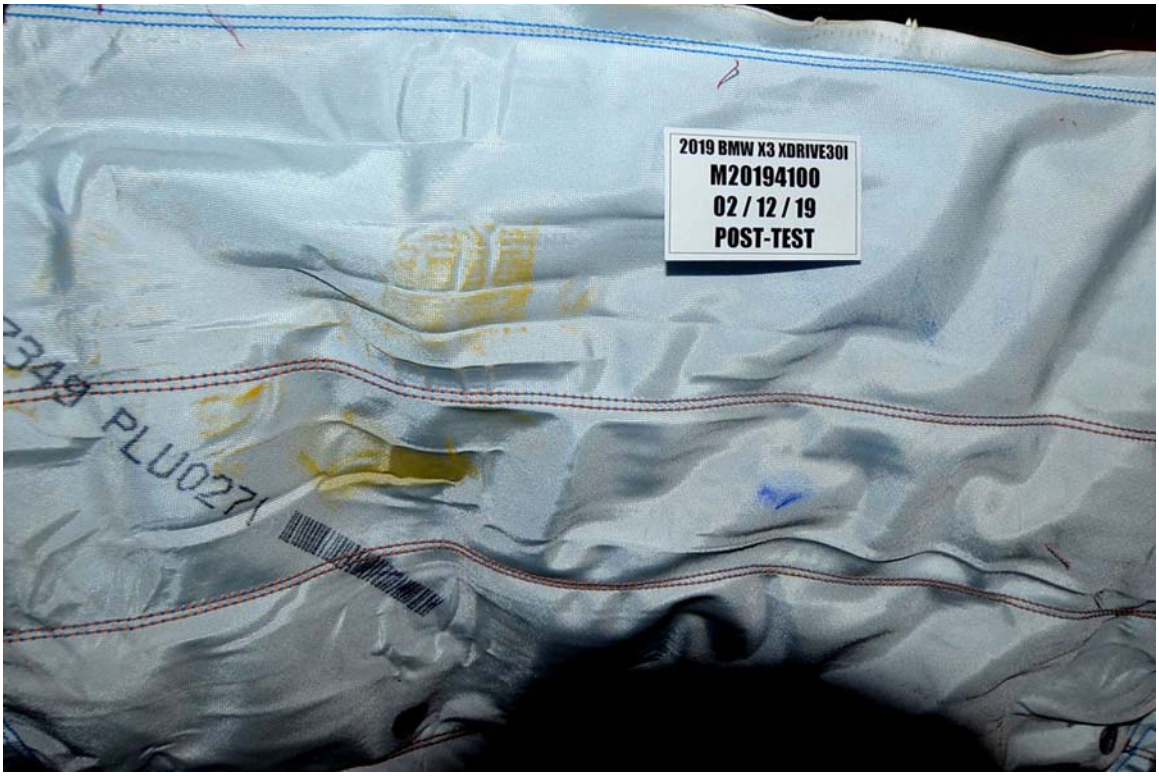


FIGURE 69a. Post-Test Passenger Dummy Contact with Knee Bolster

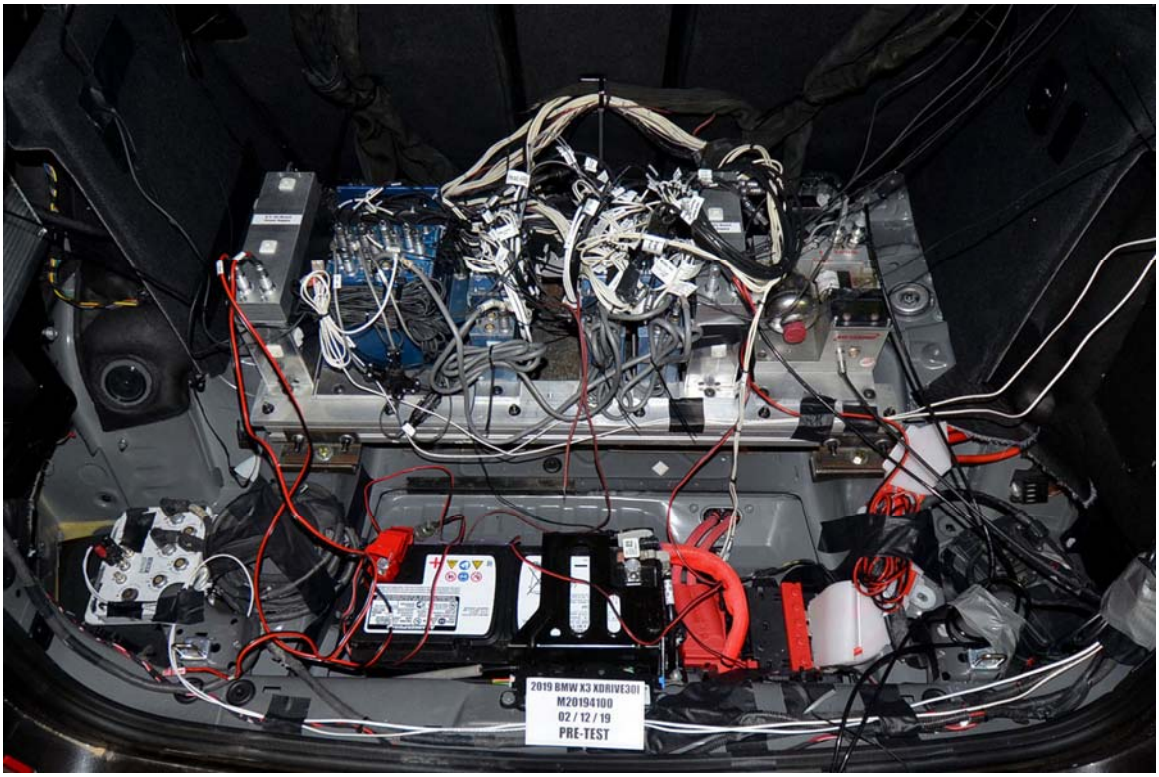


FIGURE 70. Photograph of Ballast Installed in Vehicle

Photograph Not Applicable

No Stoddard Solvent Spillage

FIGURE 71. Post-Test Stoddard Solvent Spillage Location View

FIGURE 72. Post-Test Speed Trap Read-Out

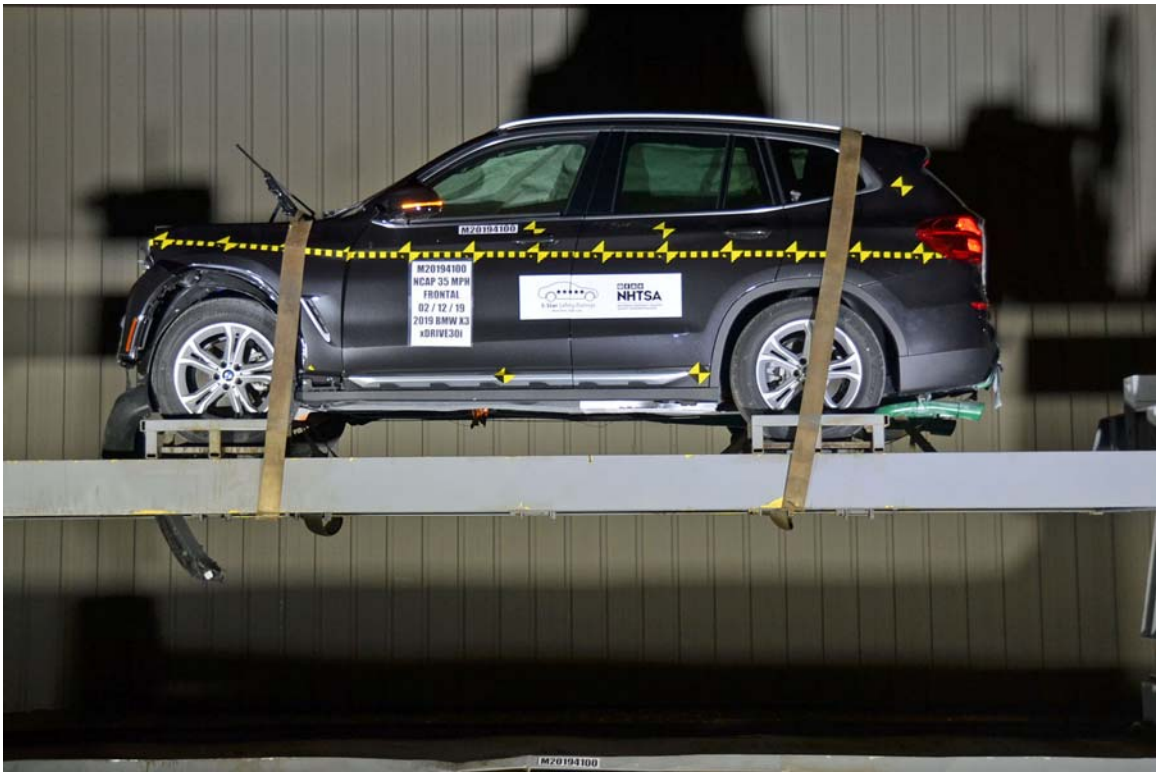


FIGURE 73. Vehicle at 0° on Static Rollover Device

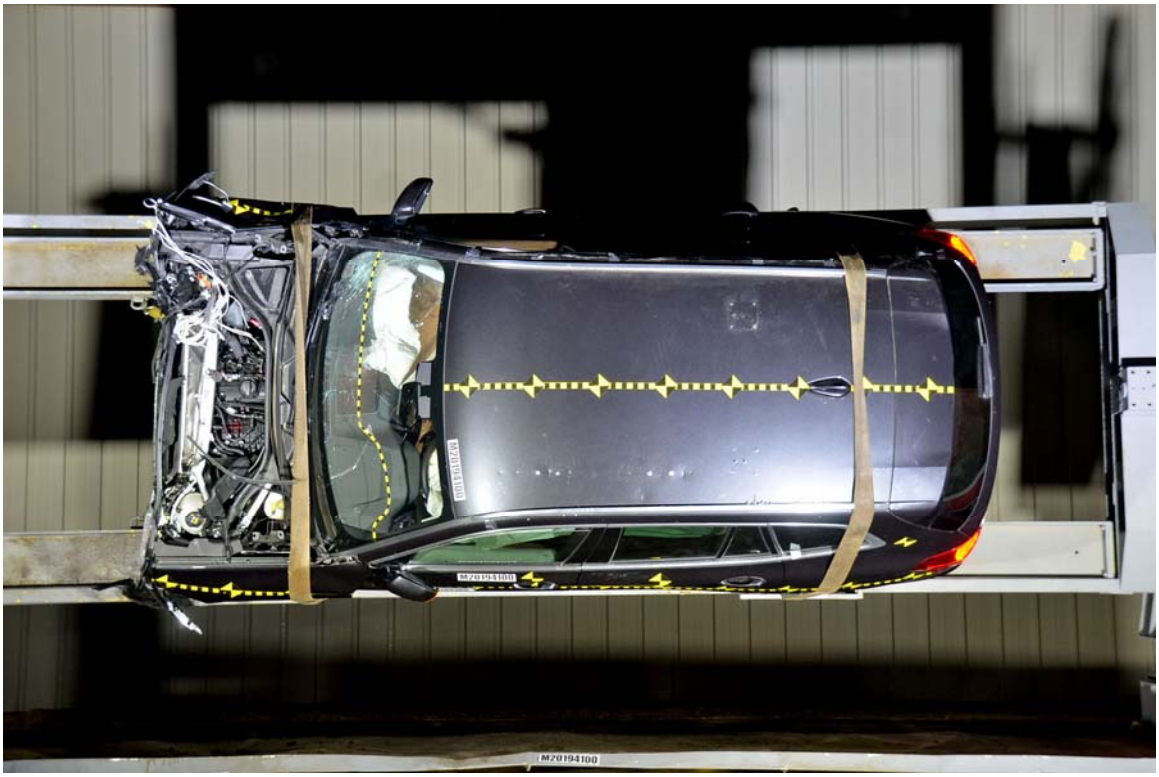


FIGURE 74. Vehicle at 90° on Static Rollover Device

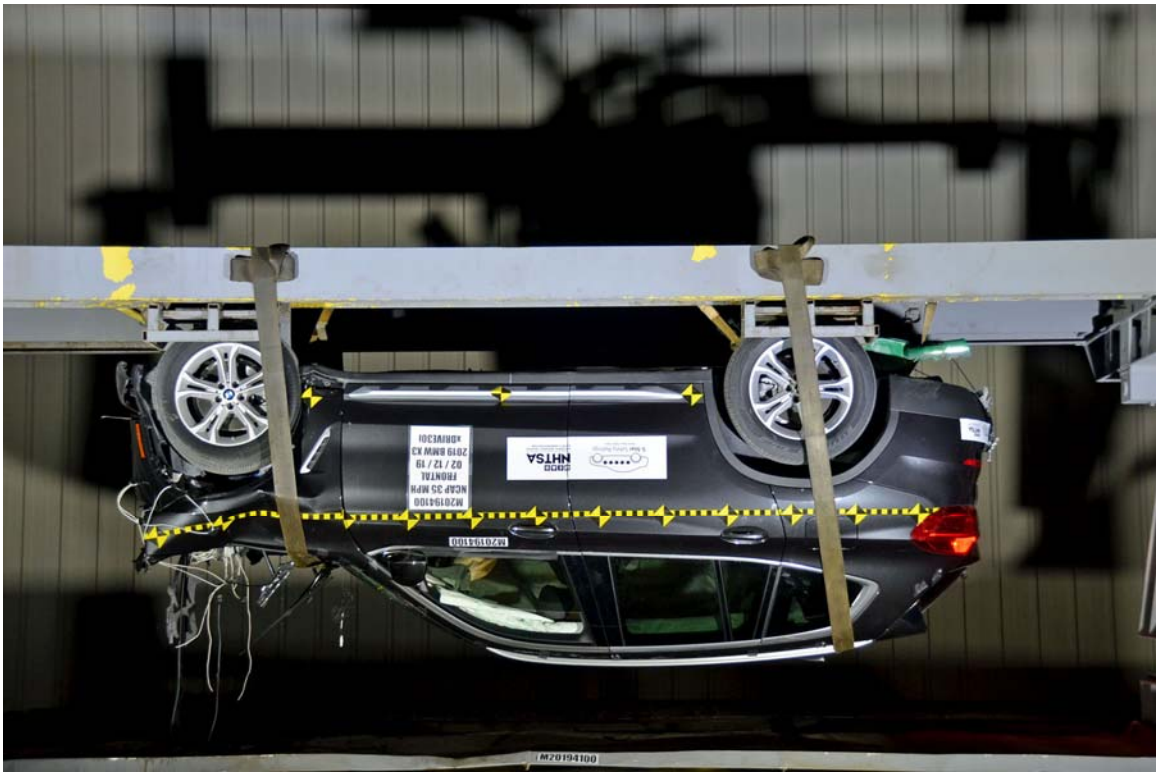


FIGURE 75. Vehicle at 180° on Static Rollover Device

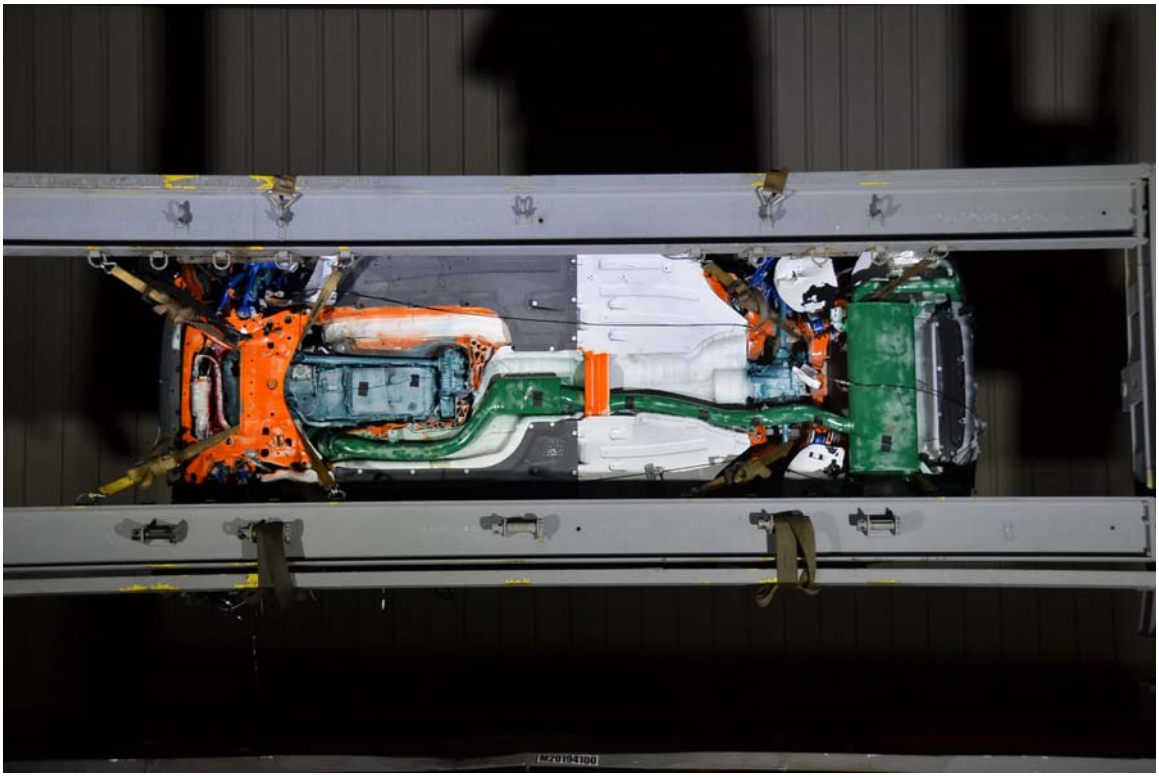


FIGURE 76. Vehicle at 270° on Static Rollover Device

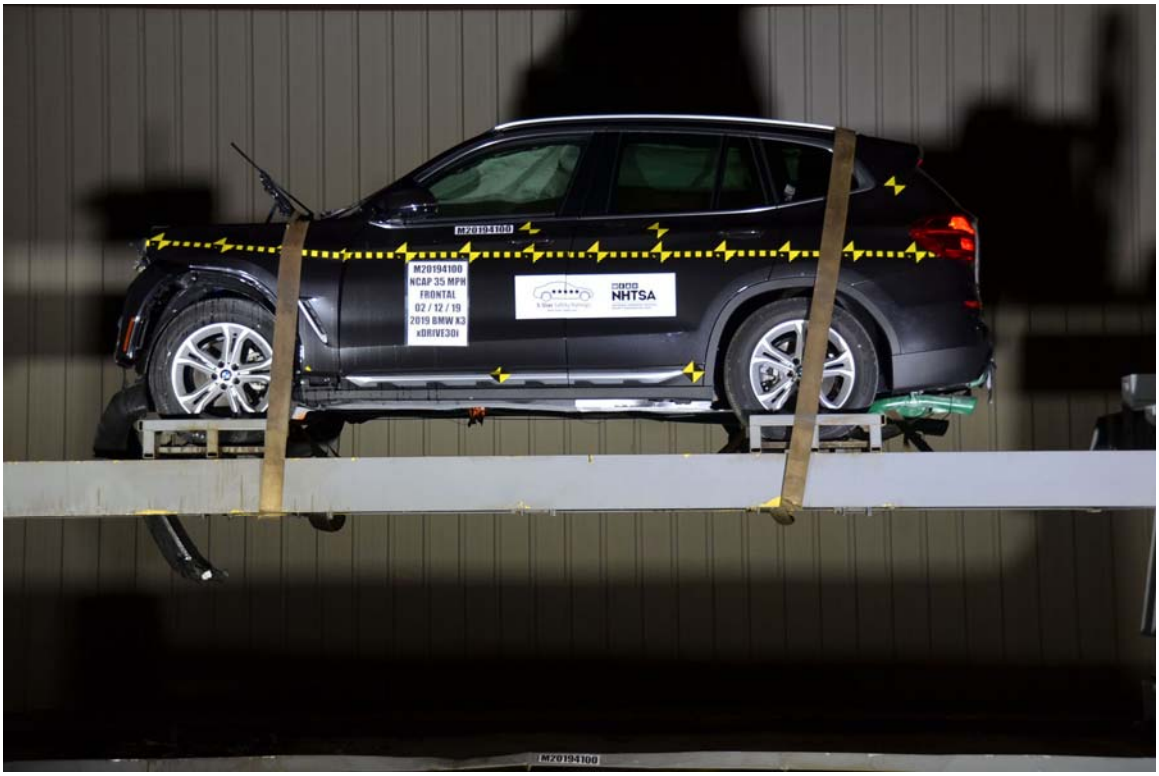


FIGURE 77. Vehicle at 360° on Static Rollover Device

FIGURE 78. 2019 BMW X3 xDrive30i Frontal Impact Event

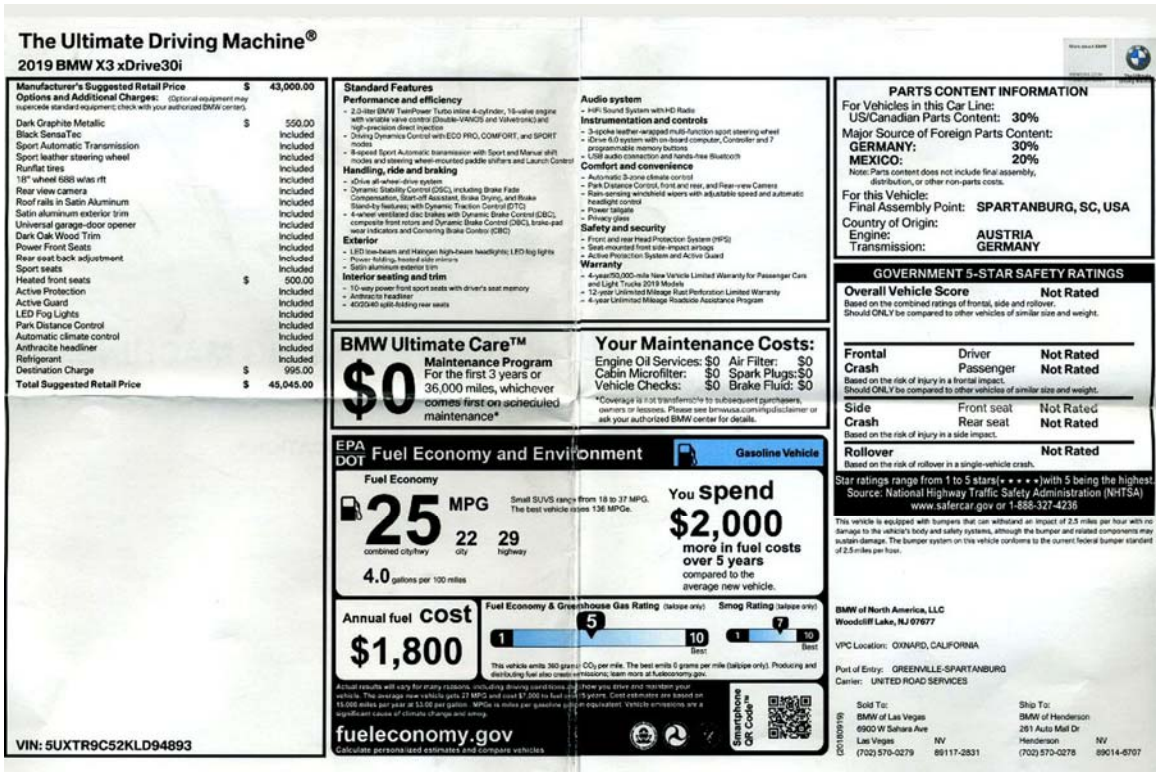


FIGURE 79. Monroney Label Photograph

APPENDIX B
DUMMY RESPONSE DATA TRACES

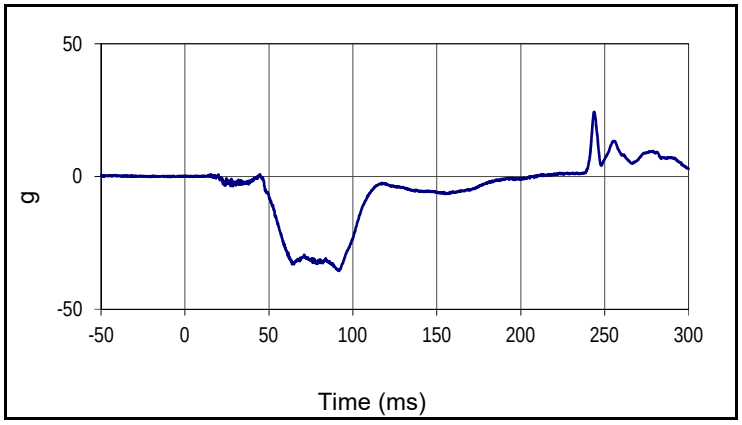
TABLE OF DATA PLOTS

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

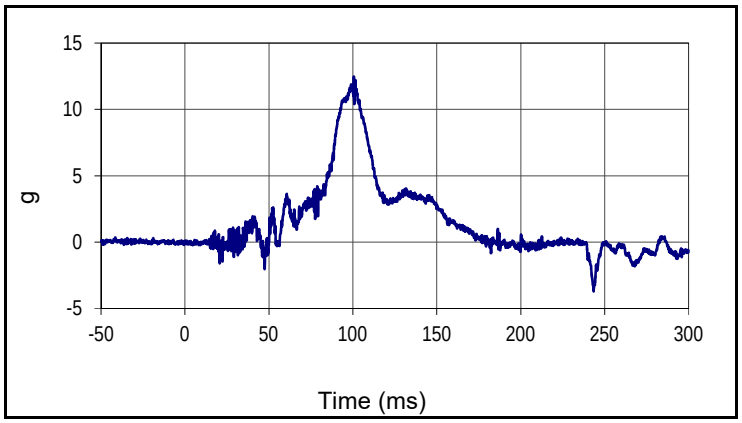
Driver Head X Acceleration Redundant
Driver Head Y Acceleration Redundant
Driver Head Z Acceleration Redundant
Driver Upper Neck Force Y
Driver Upper Neck Moment X
Driver Upper Neck Moment Z
Driver Chest X Acceleration Redundant
Driver Chest Y Acceleration Redundant
Driver Chest Z Acceleration Redundant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

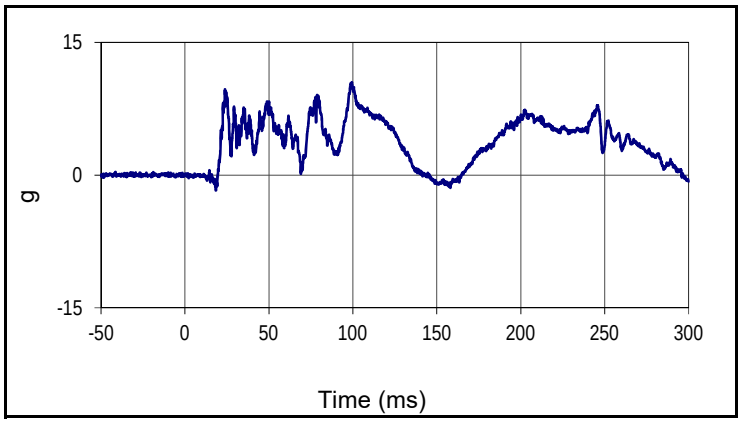
Test Vehicle:	2019 BMW X3 xDrive30i 5-Door MPV	NHTSA No.:	M20194100
Test Program:	56.3 km/h Frontal Impact NCAP Test	Test Date:	02/12/19



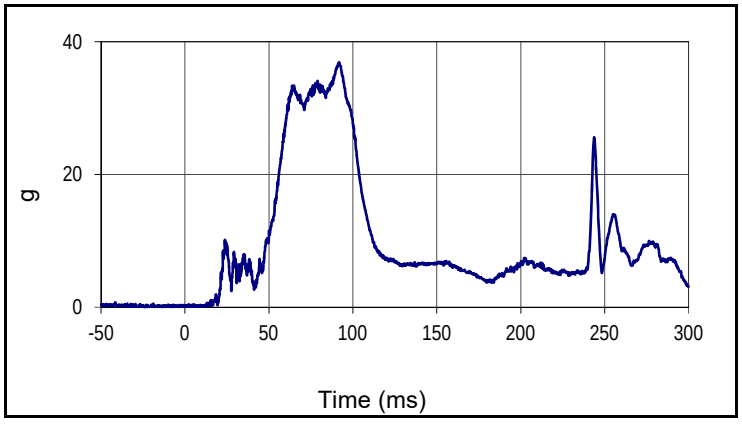
Curve Description			
Driver Head Acceleration X Primary			
Plot No.		SAE Class	Units
001		1000	g
Max	Time	Min	Time
24.3	243.7	-35.6	91.8



Curve Description			
Driver Head Acceleration Y Primary			
Plot No.		SAE Class	Units
002		1000	g
Max	Time	Min	Time
12.5	100.6	-3.7	243.4

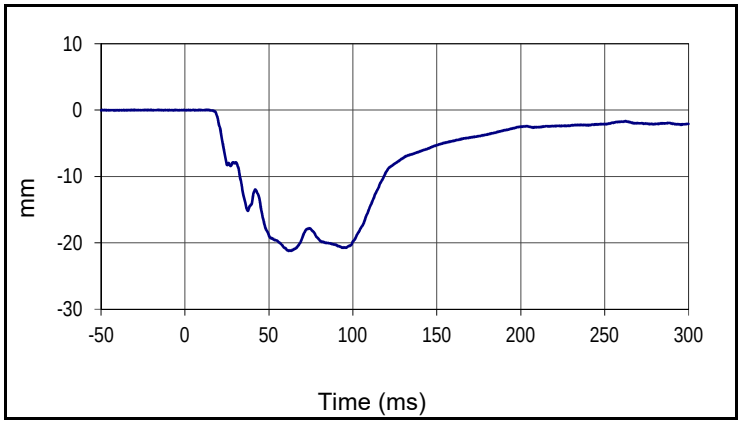


Curve Description			
Driver Head Acceleration Z Primary			
Plot No.		SAE Class	Units
003		1000	g
Max	Time	Min	Time
10.5	99.4	-1.7	18.4



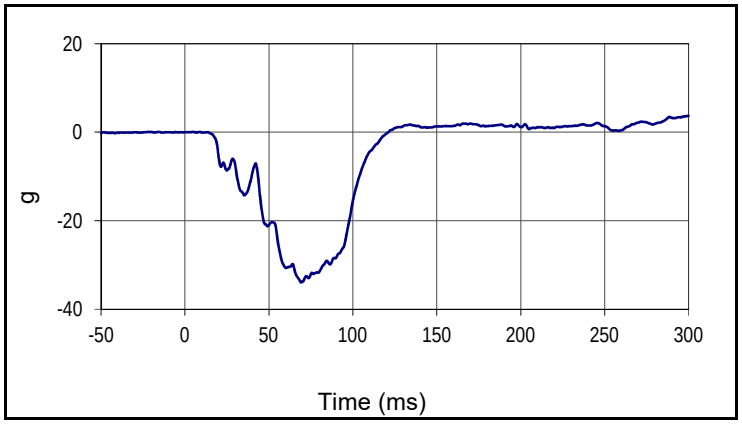
Curve Description			
Driver Head Resultant Acceleration Primary			
Plot No.		SAE Class	Units
004		1000	g
Max	Time	Min	Time
36.9	91.8	0.0	2.8

Test Vehicle:	2019 BMW X3 xDrive30i 5-Door MPV	NHTSA No.:	M20194100
Test Program:	56.3 km/h Frontal Impact NCAP Test	Test Date:	02/12/19

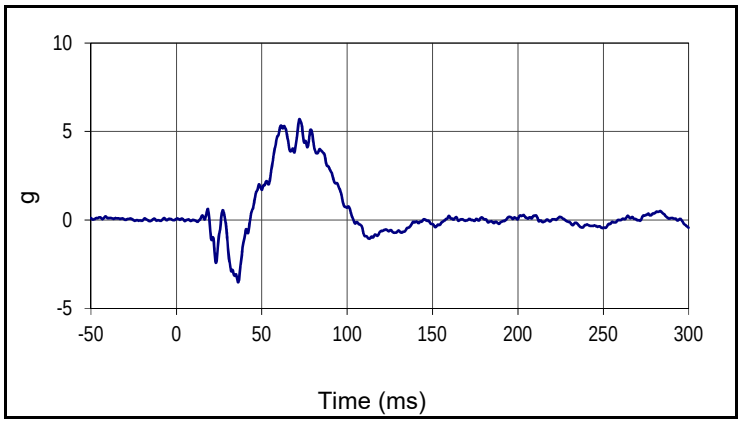


Curve Description			
Driver Chest Deflection			
Plot No.		SAE Class	Units
005		600	mm
Max	Time	Min	Time
0.0	13.9	-21.2	61.7

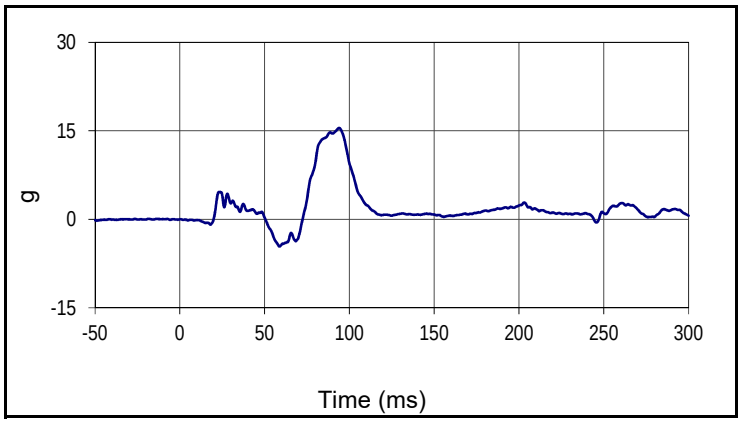
Test Vehicle:	2019 BMW X3 xDrive30i 5-Door MPV	NHTSA No.:	M20194100
Test Program:	56.3 km/h Frontal Impact NCAP Test	Test Date:	02/12/19



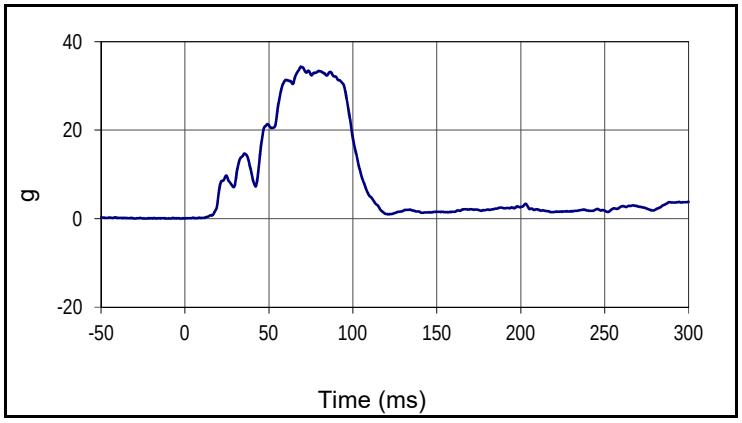
Curve Description			
Driver Chest Acceleration X Primary			
Plot No.		SAE Class	Units
006		180	g
Max	Time	Min	Time
3.7	299.9	-34.0	69.1



Curve Description			
Driver Chest Acceleration Y Primary			
Plot No.		SAE Class	Units
007		180	g
Max	Time	Min	Time
5.7	72.1	-3.5	36.1

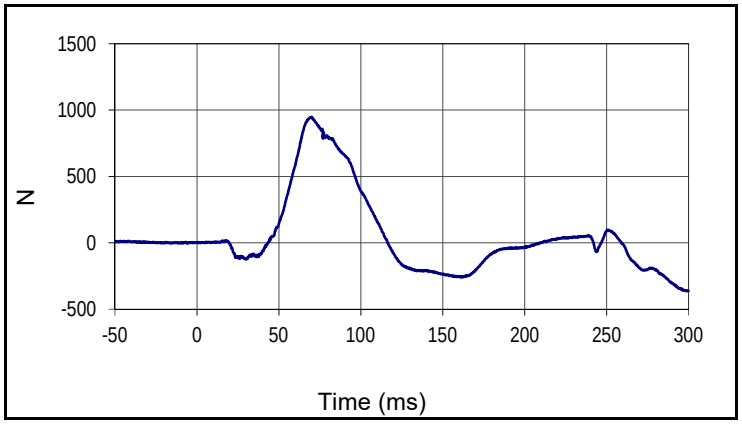


Curve Description			
Driver Chest Acceleration Z Primary			
Plot No.		SAE Class	Units
008		180	g
Max	Time	Min	Time
15.5	93.8	-4.6	58.7

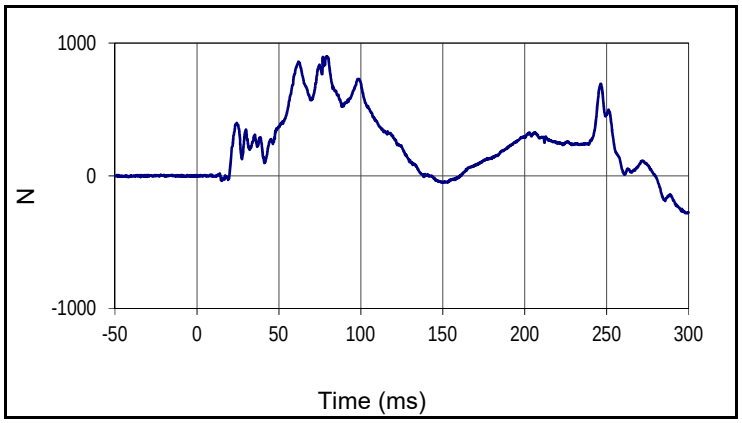


Curve Description			
Driver Chest Resultant Acceleration Primary			
Plot No.		SAE Class	Units
009		180	g
Max	Time	Min	Time
34.3	69.1	0.1	1.3

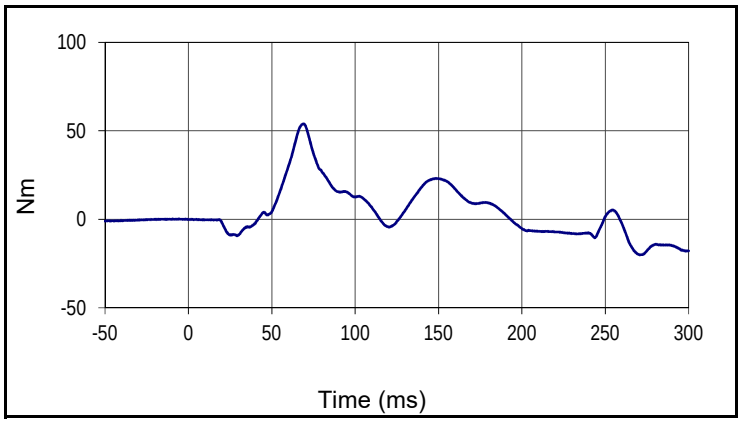
Test Vehicle:	2019 BMW X3 xDrive30i 5-Door MPV	NHTSA No.:	M20194100
Test Program:	56.3 km/h Frontal Impact NCAP Test	Test Date:	02/12/19



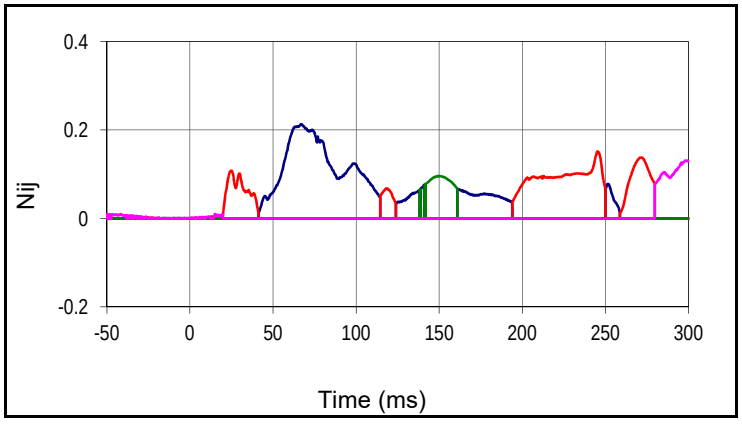
Curve Description			
Driver Upper Neck Force X			
Plot No.		SAE Class	Units
010		1000	N
Max	Time	Min	Time
947.7	69.8	-364.9	299.1



Curve Description			
Driver Upper Neck Force Z			
Plot No.		SAE Class	Units
011		1000	N
Max	Time	Min	Time
898.4	79.0	-282.7	299.4

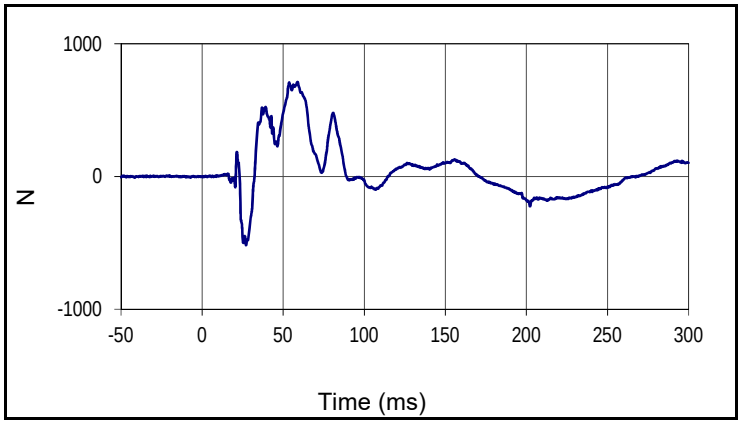


Curve Description			
Driver Upper Neck Moment Y			
Plot No.		SAE Class	Units
012		600	Nm
Max	Time	Min	Time
53.9	69.1	-20.1	270.6

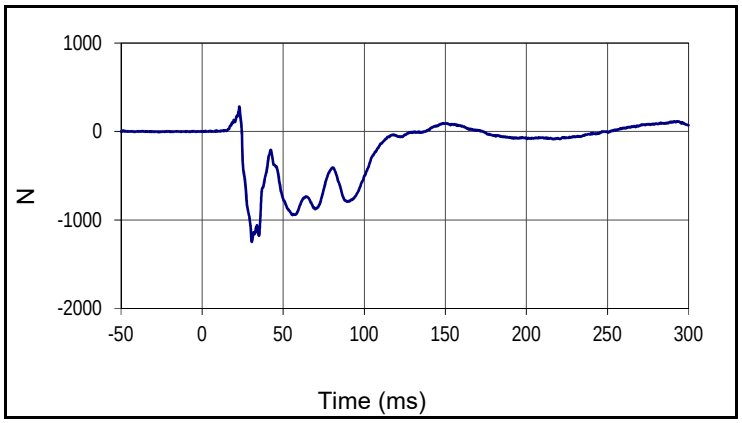


Curve Description		
Driver Nij		
Units	Max	Time
Ntf	0.21	66.9
Units	Max	Time
Nte	0.15	245.2
Units	Max	Time
Ncf	0.10	149.4
Units	Max	Time
Nce	0.13	298.2

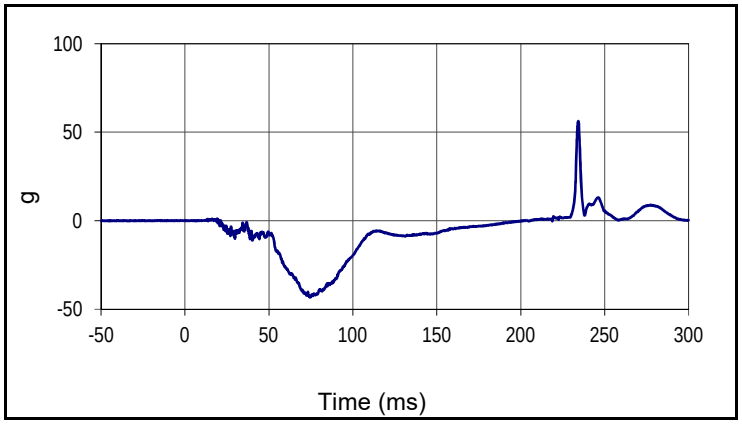
Test Vehicle:	2019 BMW X3 xDrive30i 5-Door MPV	NHTSA No.:	M20194100
Test Program:	56.3 km/h Frontal Impact NCAP Test	Test Date:	02/12/19



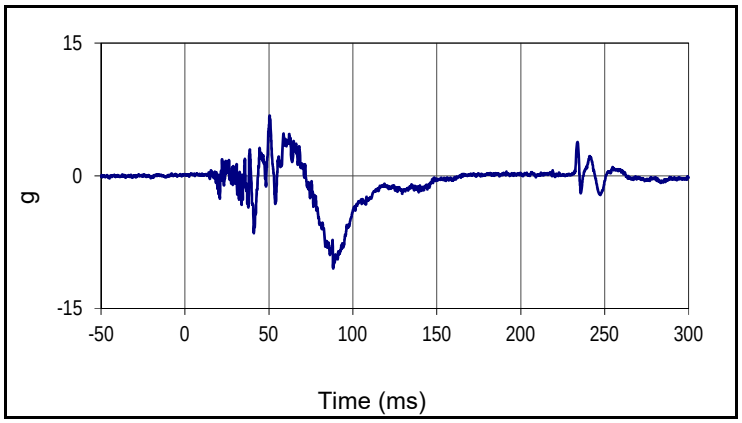
Curve Description			
Driver Left Femur Force Z			
Plot No.		SAE Class	Units
014		600	N
Max	Time	Min	Time
712.1	58.8	-517.8	27.1



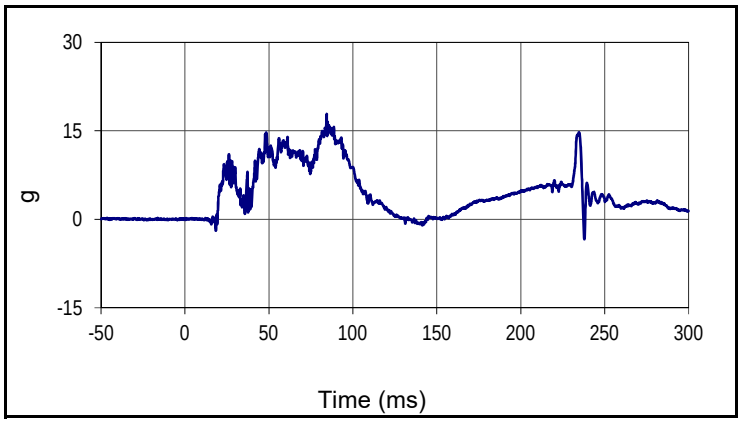
Curve Description			
Driver Right Femur Force Z			
Plot No.		SAE Class	Units
015		600	N
Max	Time	Min	Time
281.8	23.0	-1246.8	30.7



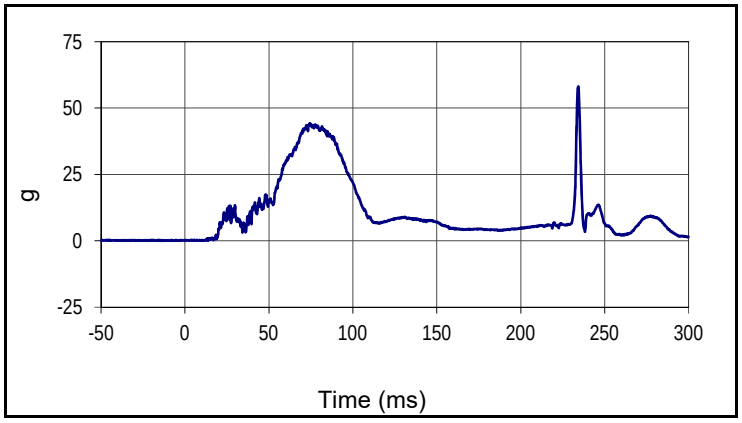
Curve Description			
Passenger Head Acceleration X Primary			
Plot No.		SAE Class	Units
016		1000	g
Max	Time	Min	Time
56.2	234.3	-43.3	74.2



Curve Description			
Passenger Head Acceleration Y Primary			
Plot No.		SAE Class	Units
017		1000	g
Max	Time	Min	Time
6.8	50.4	-10.5	88.3

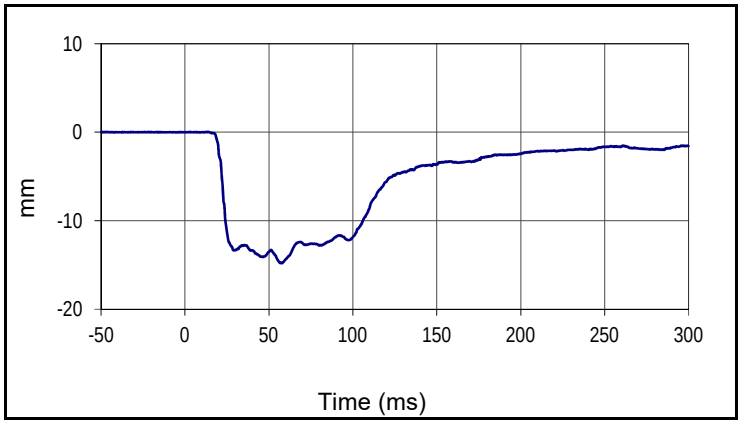


Curve Description			
Passenger Head Acceleration Z Primary			
Plot No.		SAE Class	Units
018		1000	g
Max	Time	Min	Time
17.8	84.4	-3.4	237.9

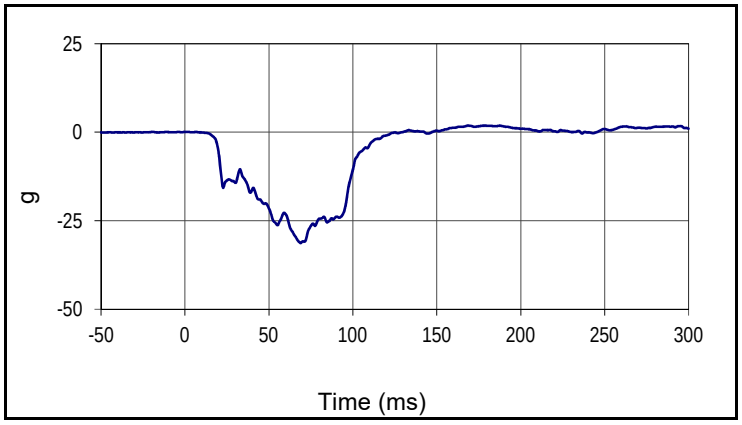


Curve Description			
Passenger Head Resultant Acceleration Primary			
Plot No.		SAE Class	Units
019		1000	g
Max	Time	Min	Time
58.1	234.3	0.0	8.1

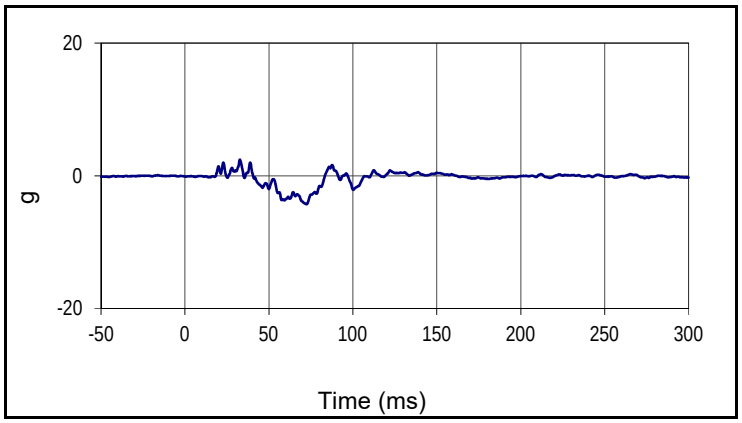
Test Vehicle:	2019 BMW X3 xDrive30i 5-Door MPV	NHTSA No.:	M20194100
Test Program:	56.3 km/h Frontal Impact NCAP Test	Test Date:	2/12/2019



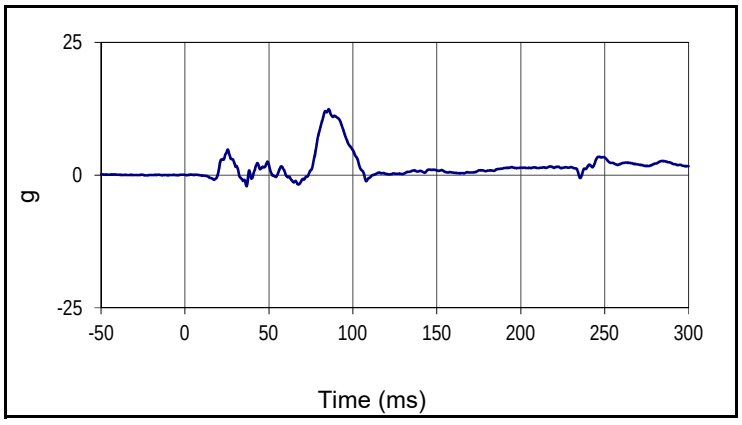
Curve Description			
Passenger Chest Deflection			
Plot No.		SAE Class	Units
020		600	mm
Max	Time	Min	Time
0.0	12.7	-14.8	56.8



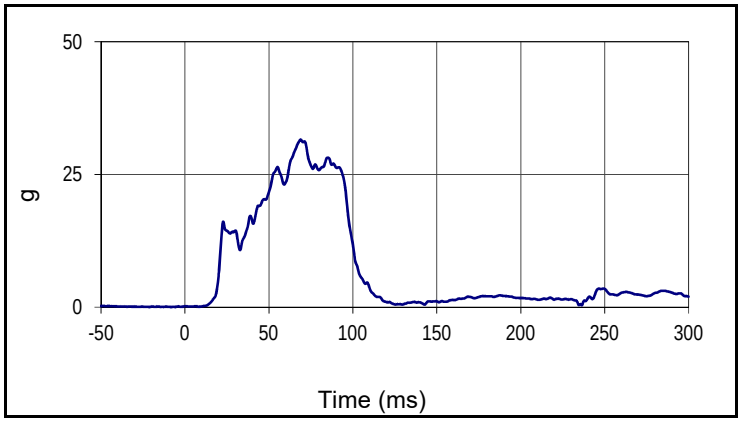
Curve Description			
Passenger Chest Acceleration X Primary			
Plot No.		SAE Class	Units
021		180	g
Max	Time	Min	Time
1.9	168.6	-31.3	68.8



Curve Description			
Passenger Chest Acceleration Y Primary			
Plot No.		SAE Class	Units
022		180	g
Max	Time	Min	Time
2.4	32.7	-4.3	72.4

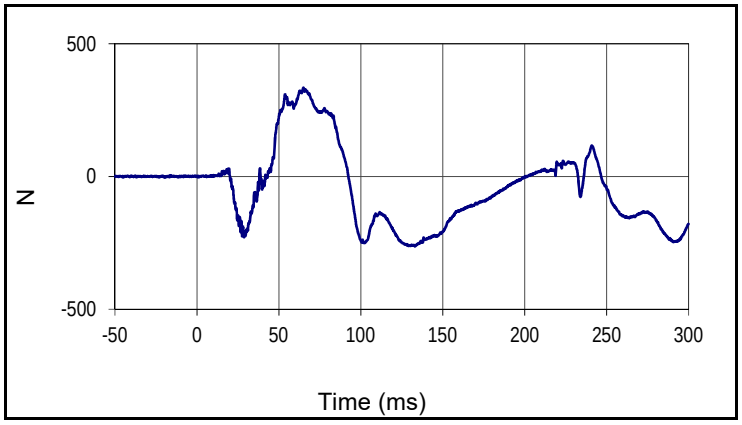


Curve Description			
Passenger Chest Acceleration Z Primary			
Plot No.		SAE Class	Units
023		180	g
Max	Time	Min	Time
12.4	85.6	-2.1	36.7

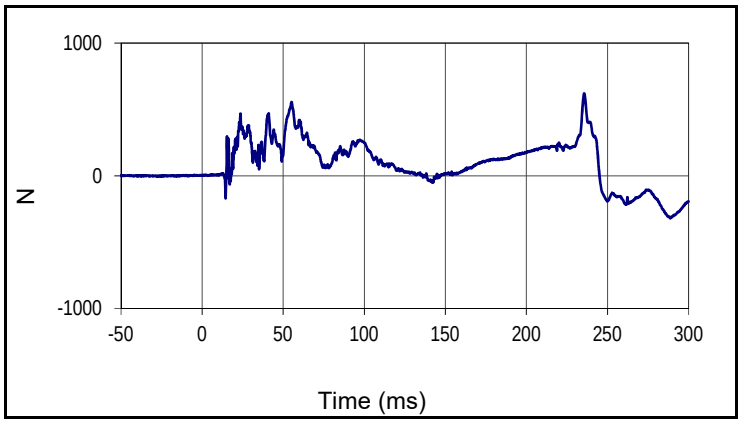


Curve Description			
Passenger Chest Resultant Acceleration Primary			
Plot No.		SAE Class	Units
024		180	g
Max	Time	Min	Time
31.6	68.9	0.1	7.9

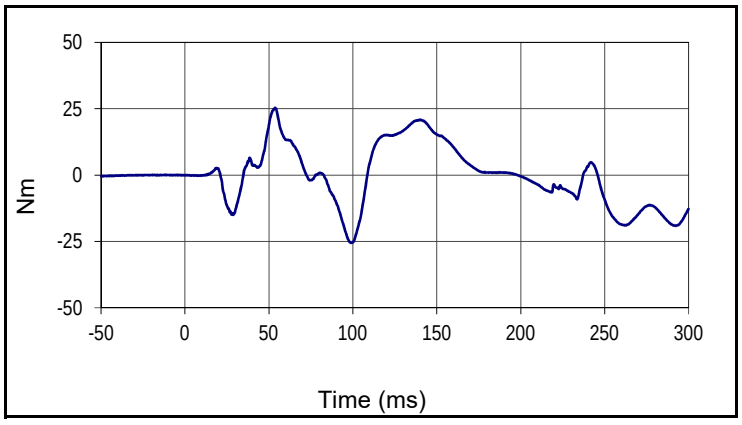
Test Vehicle:	2019 BMW X3 xDrive30i 5-Door MPV	NHTSA No.:	M20194100
Test Program:	56.3 km/h Frontal Impact NCAP Test	Test Date:	2/12/2019



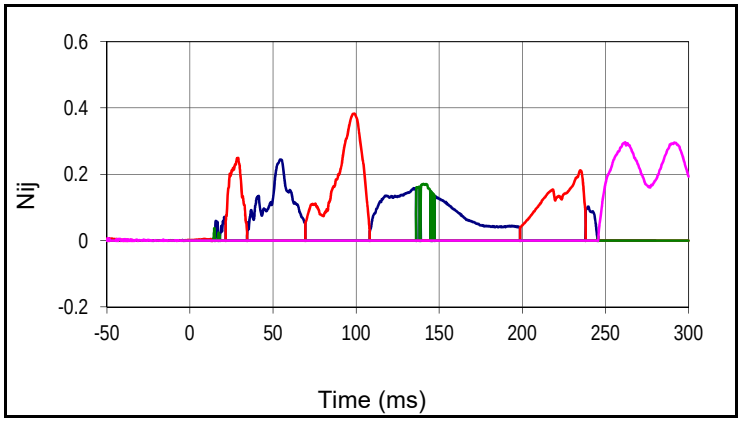
Curve Description			
Passenger Upper Neck Force X			
Plot No.		SAE Class	Units
025		1000	N
Max	Time	Min	Time
334.2	65.0	-263.7	133.0



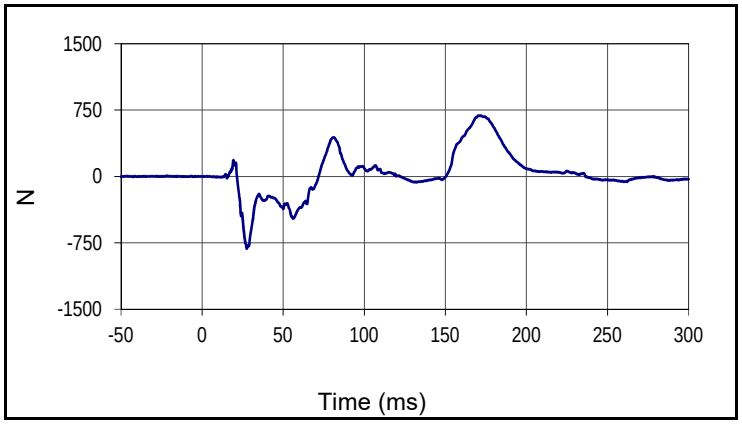
Curve Description			
Passenger Upper Neck Force Z			
Plot No.		SAE Class	Units
026		1000	N
Max	Time	Min	Time
620.2	235.6	-320.9	288.6



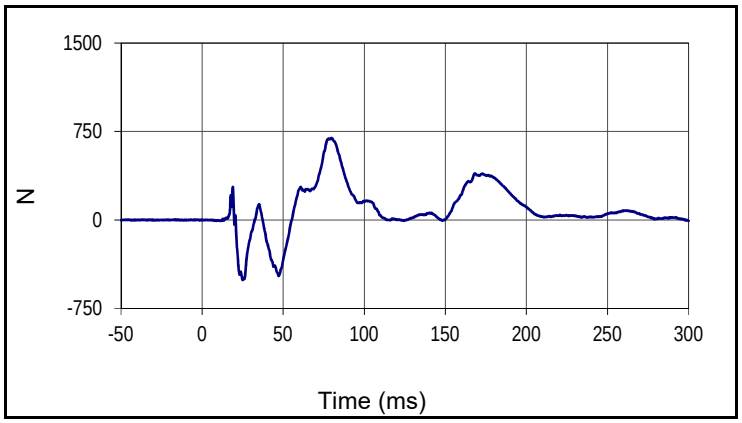
Curve Description			
Passenger Upper Neck Moment Y			
Plot No.		SAE Class	Units
027		600	Nm
Max	Time	Min	Time
25.3	53.7	-25.5	99.0



Curve Description		
Passenger Nij		
Units	Max	Time
Ntf	0.24	54.2
Units	Max	Time
Nte	0.38	98.8
Units	Max	Time
Ncf	0.17	140.4
Units	Max	Time
Nce	0.30	261.8



Curve Description			
Passenger Left Femur Force Z			
Plot No.		SAE Class	Units
029		600	N
Max	Time	Min	Time
688.1	171.9	-815.0	27.6



Curve Description			
Passenger Right Femur Force Z			
Plot No.		SAE Class	Units
030		600	N
Max	Time	Min	Time
695.0	79.8	-508.6	25.0

APPENDIX C
ATD CALIBRATION AND PERFORMANCE VERIFICATION DATA

APPENDIX C
PRE-TEST ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
ATD Damage Checklist

ATD Serial No.: 360 Test Date: 2019-02-08

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: 2019-02-08

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	888	Pass
B - Shoulder pivot height	mm	505	521	514	Pass
C - 'H' point height	mm	84	89	88	Pass
D - 'H' point location from backline	mm	135	140	140	Pass
E - Shoulder pivot from backline	mm	84	94	90	Pass
F - Thigh clearance	mm	140	155	145	Pass
G - Back of elbow to wrist pivot	mm	290	305	294	Pass
H - Head back to backline	mm	41	46	44	Pass
I - Shoulder to elbow length	mm	330	345	342	Pass
J - Elbow rest height	mm	190	211	205	Pass
K - Buttock to knee length	mm	579	604	596	Pass
L - Popliteal length	mm	429	455	437	Pass
M - Knee pivot height	mm	485	500	490	Pass
N - Buttock popliteal length	mm	452	477	460	Pass
O - Chest depth without jacket	mm	213	229	217	Pass
P - Foot length	mm	251	267	254	Pass
V - Shoulder breadth	mm	422	437	430	Pass
W - Foot breadth	mm	91	107	99	Pass
Y - Chest circum. (w/chest jacket)	mm	970	1001	981	Pass
Z - Waist circum.	mm	836	866	852	Pass
AA - Location for chest circum.	mm	429	434	433	Pass
BB - Location for waist circum.	mm	226	231	229	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

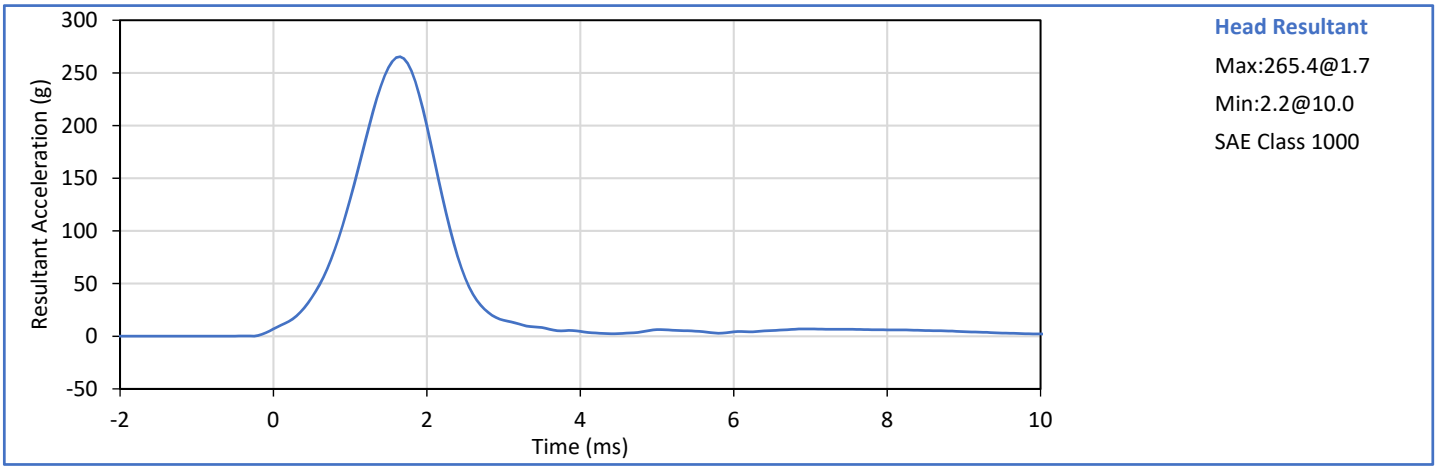
Approved By: P. Puzzuto

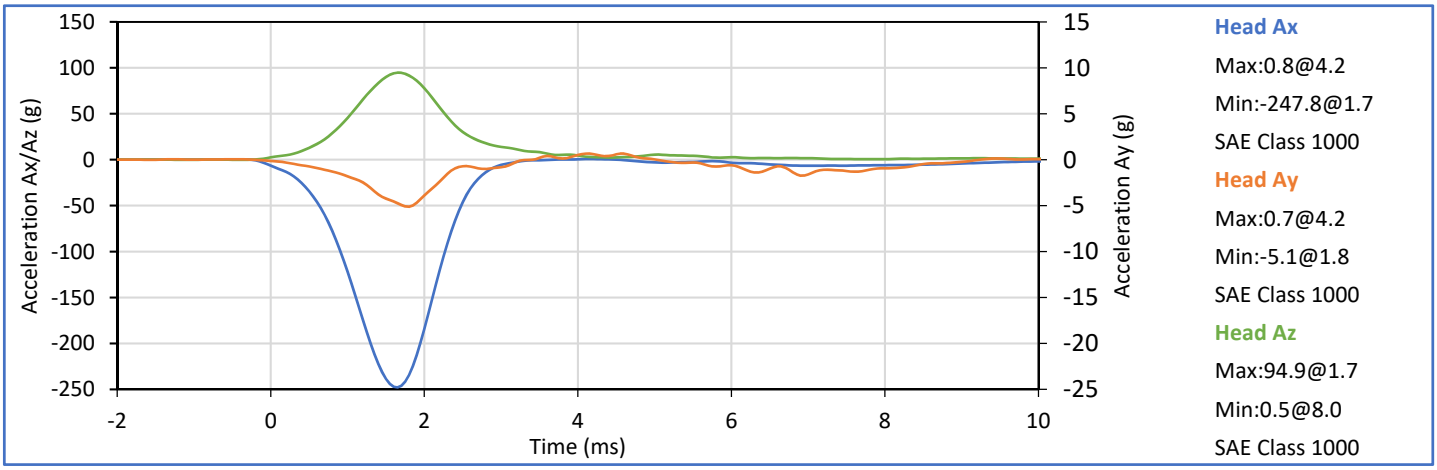
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Head Drop

ATD Serial No.: 360 Test Date: 2019-02-11

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.2	Pass
Laboratory Humidity	%	10	70	23	Pass
Peak Resultant Acceleration	g	225.0	275.0	265.4	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-5.1	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

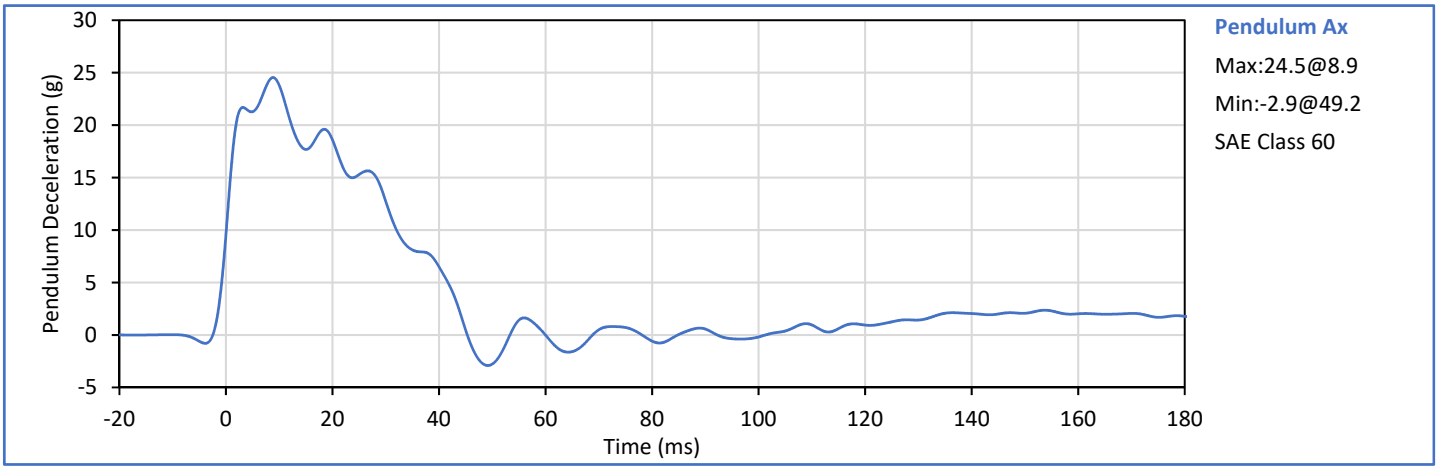
Approved By: P. Puzzuto

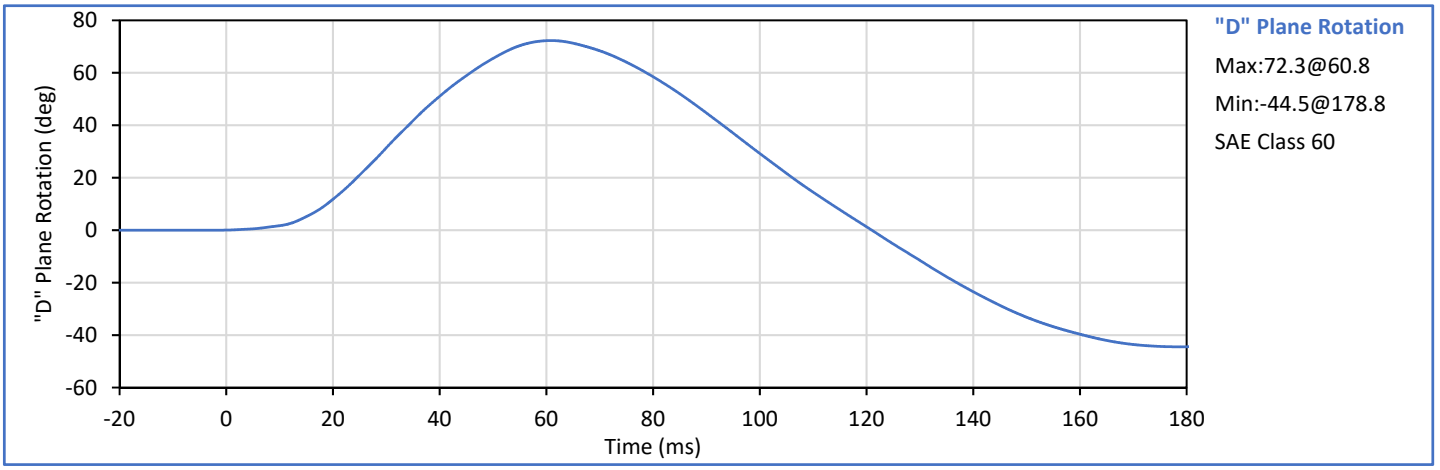
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2019-02-11

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	6.99	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	23.8	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	18.6	Pass
Pendulum Deceleration at 30 ms	g	12.5	18.5	12.7	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	29.0	12.7	Pass
Deceleration Decay to Cross 5 g	ms	34.0	42.0	41.7	Pass
"D" Plane Rotation peak	deg	64.0	78.0	72.3	Pass
	ms	57.0	64.0	60.8	Pass
"D" Plane Rotation Decay To Zero	ms	113.0	128.0	121.1	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	95.4	Pass
	ms	47.0	58.0	55.0	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	99.4	Pass
			Overall Test Results		Pass





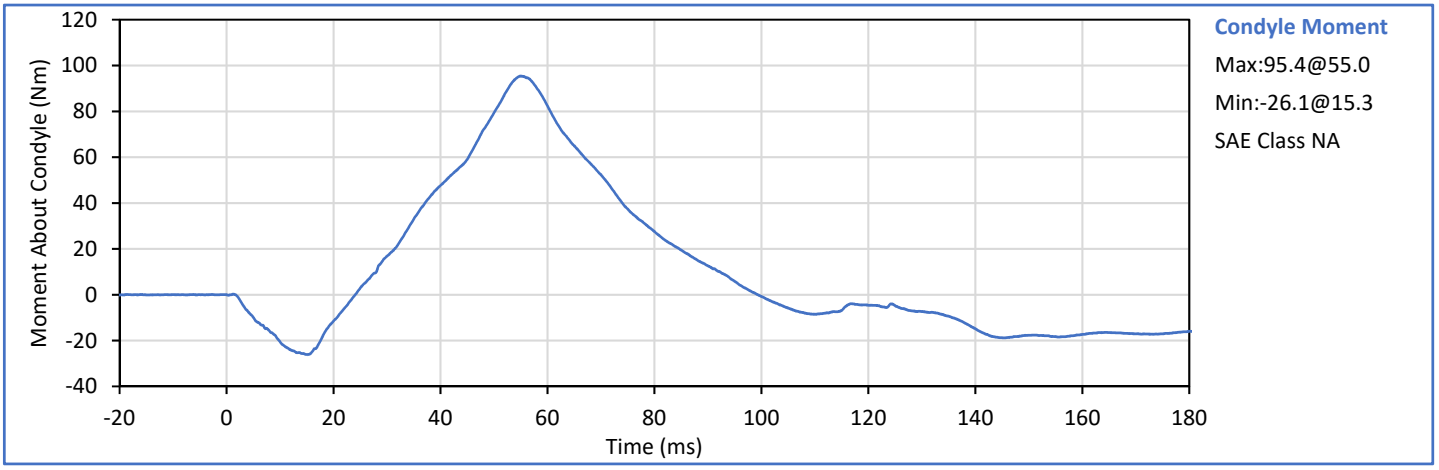
Technician: J. Hernandez

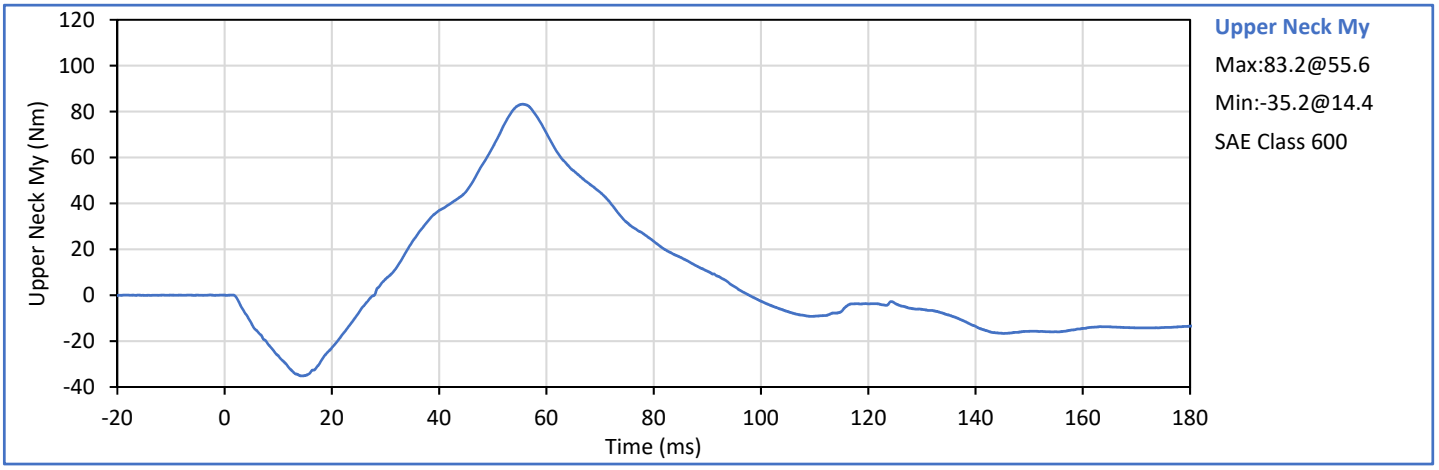
Approved By: P. Puzzuto

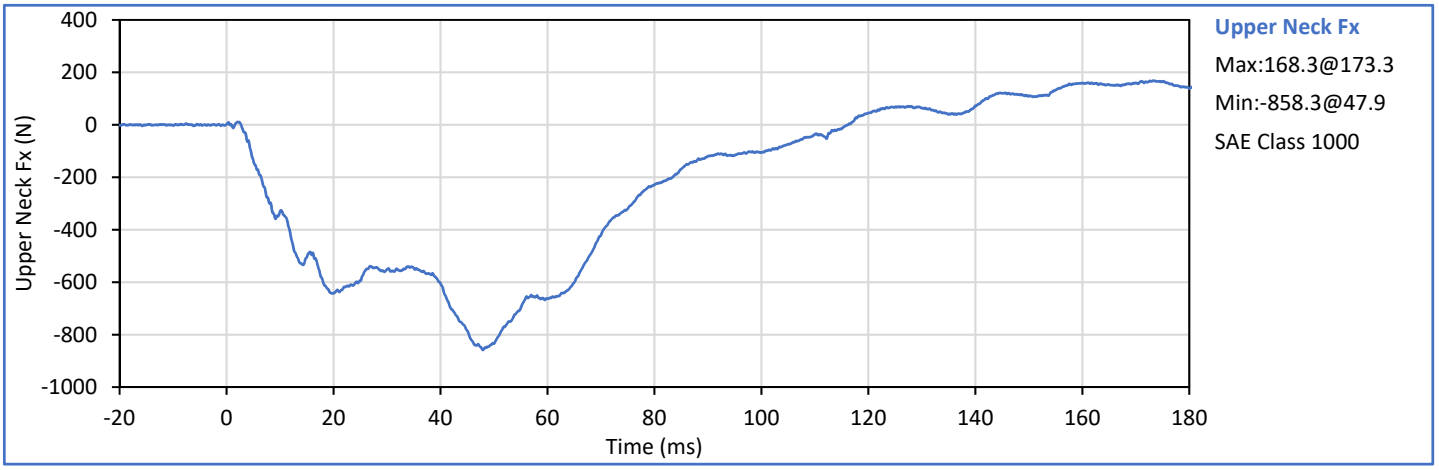
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2019-02-11





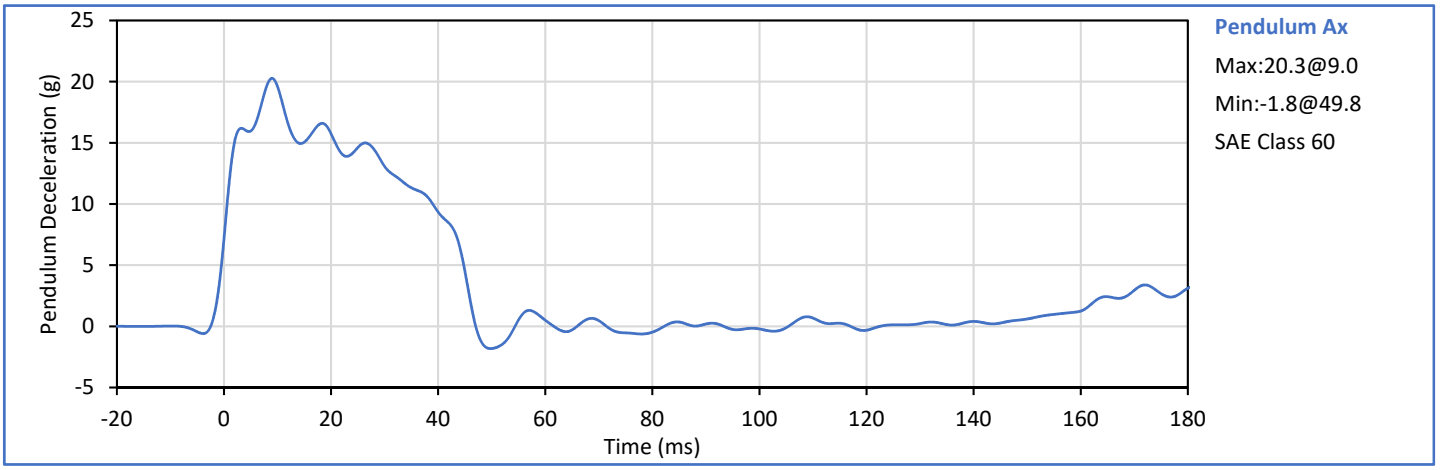


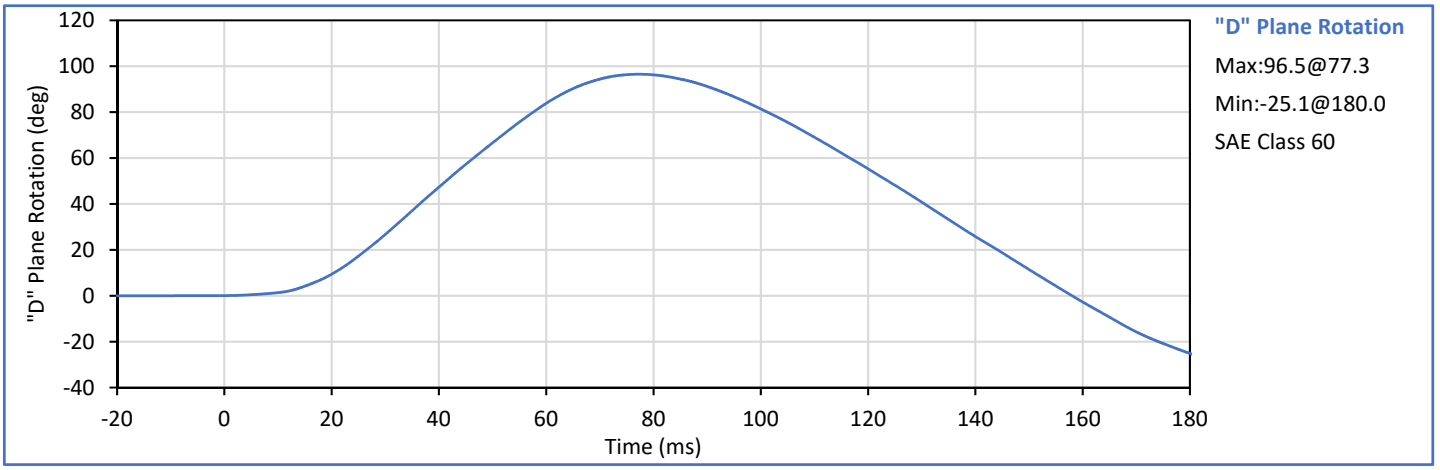
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360 Test Date: 2019-02-11

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Humidity	%	10	70	23	Pass
Pendulum Velocity	m/s	5.94	6.19	5.98	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	19.6	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	15.7	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	13.1	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	22.0	13.1	Pass
Deceleration Decay to Cross 5 g	ms	38.0	46.0	44.8	Pass
"D" Plane Rotation peak	deg	81.0	106.0	96.5	Pass
	ms	72.0	82.0	77.3	Pass
"D" Plane Rotation Decay To Zero	ms	147.0	174.0	158.1	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-68.2	Pass
	ms	65.0	79.0	71.5	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	139.1	Pass
			Overall Test Results		Pass





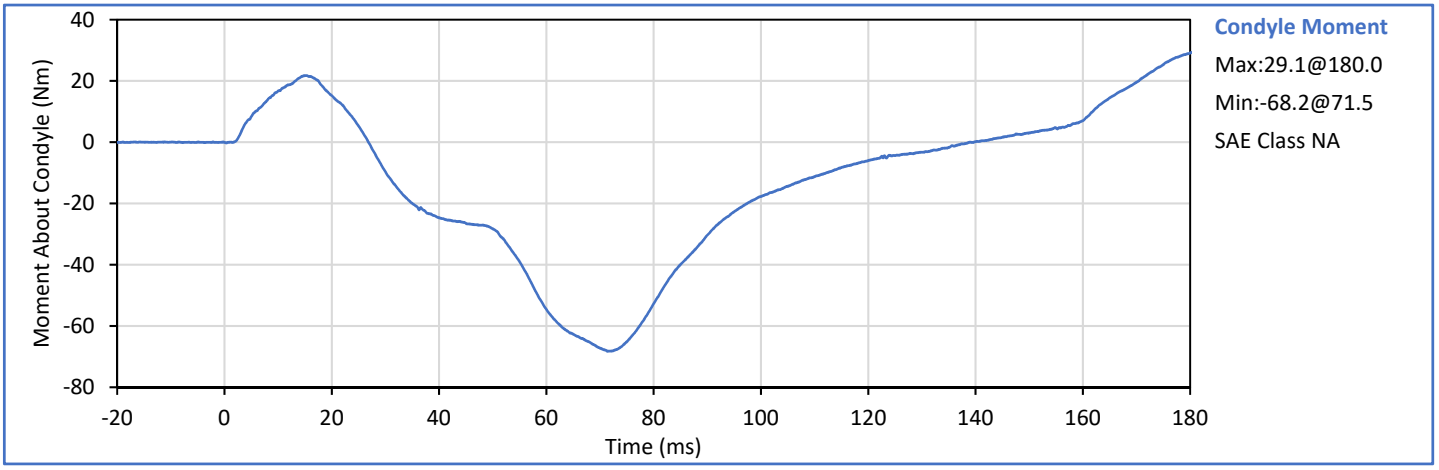
Technician: J. Hernandez

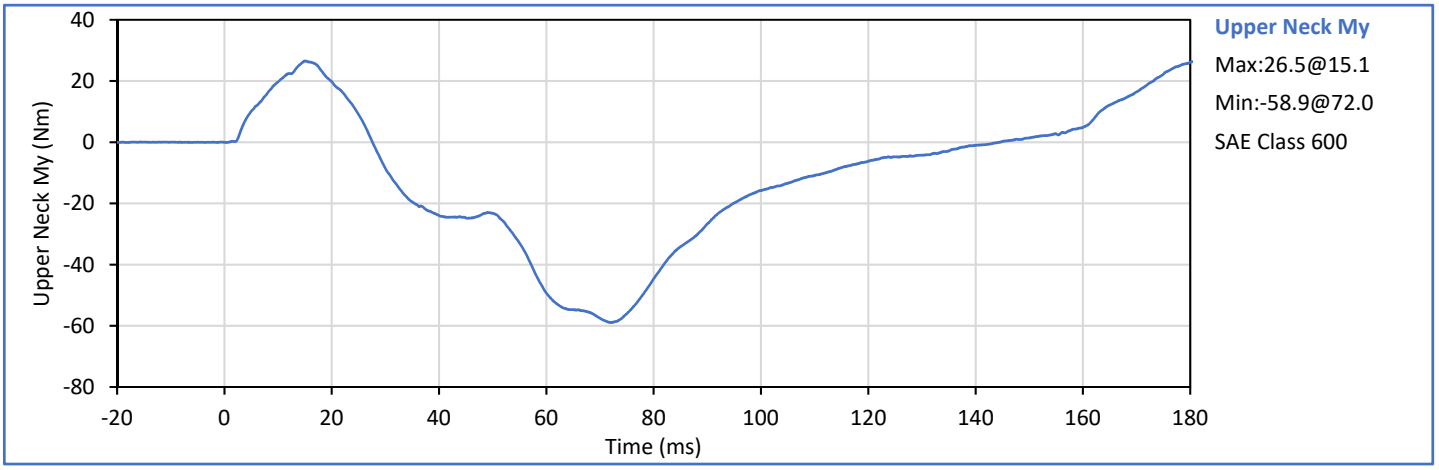
Approved By: P. Puzzuto

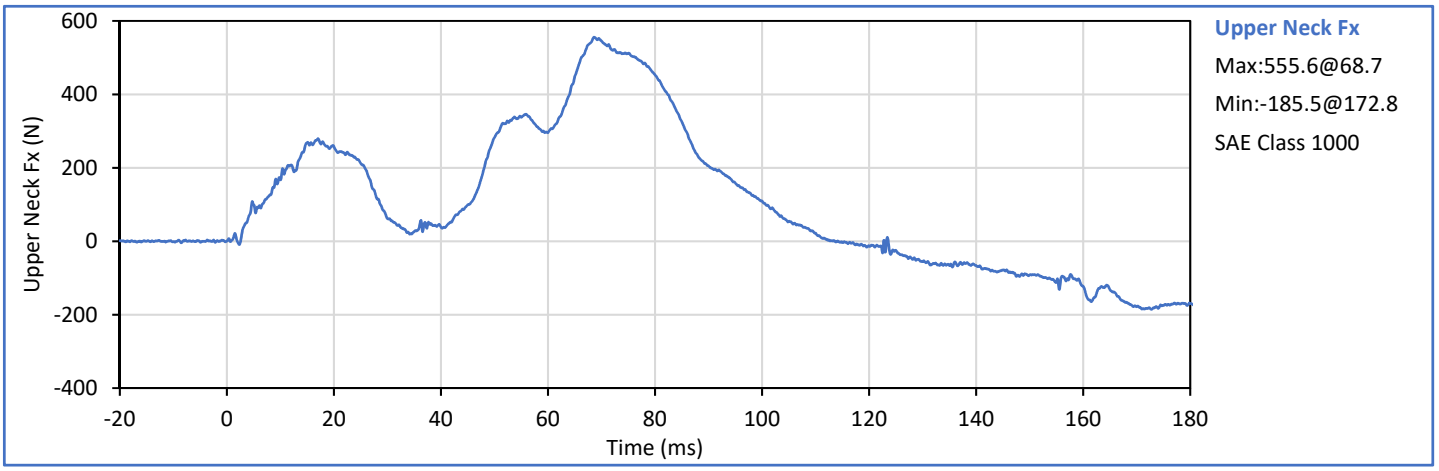
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360 Test Date: 2019-02-11





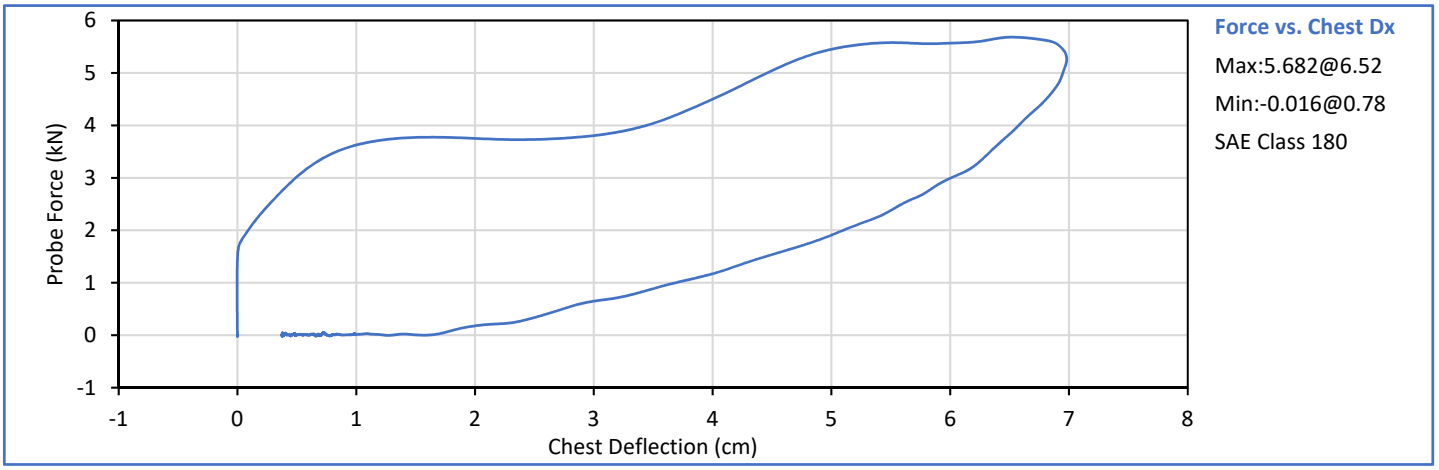


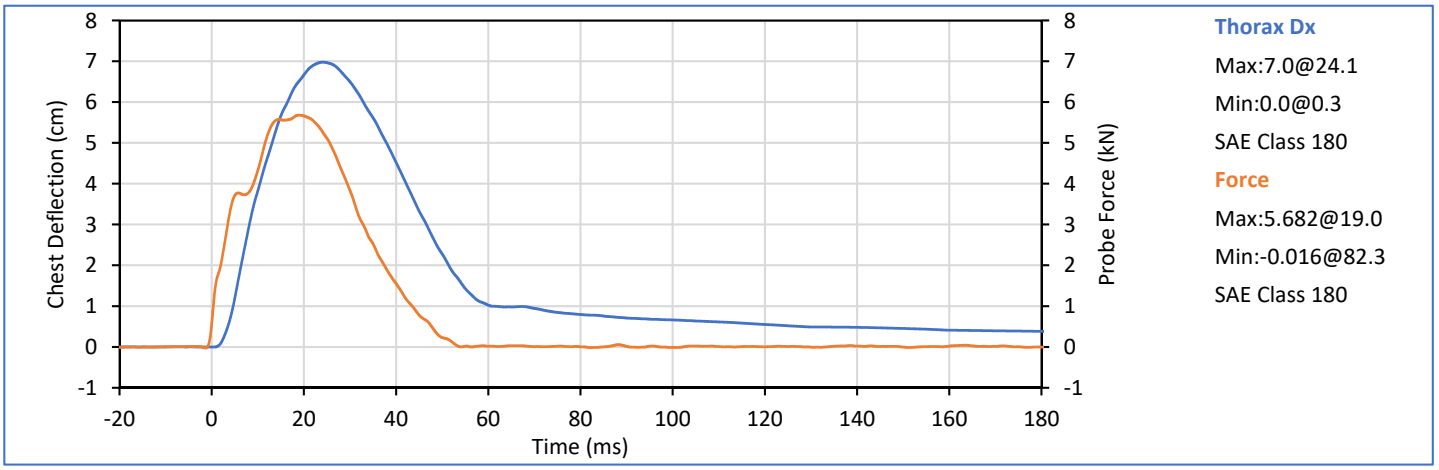
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Thorax Impact

ATD Serial No.: 360 Test Date: 2019-02-08

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
Probe Velocity	m/s	6.58	6.82	6.69	Pass
Peak Chest Deflection	cm	6.35	7.26	6.98	Pass
Peak Probe Force	kN	5.159	5.893	5.682	Pass
Internal Hysterisis	%	69.0	85.0	70.4	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

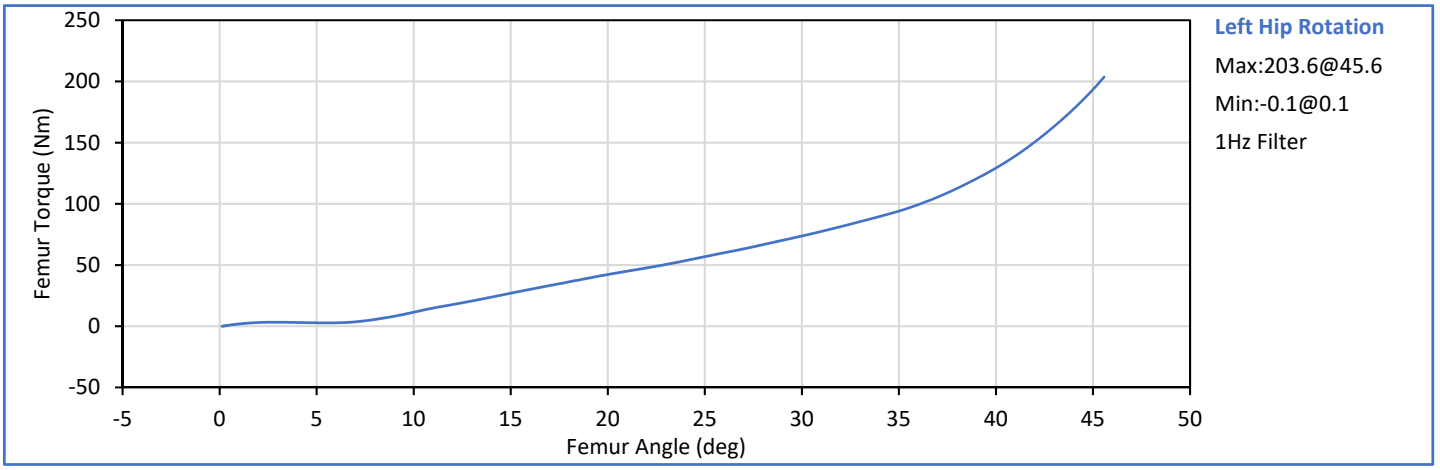
Approved By: P. Puzzuto

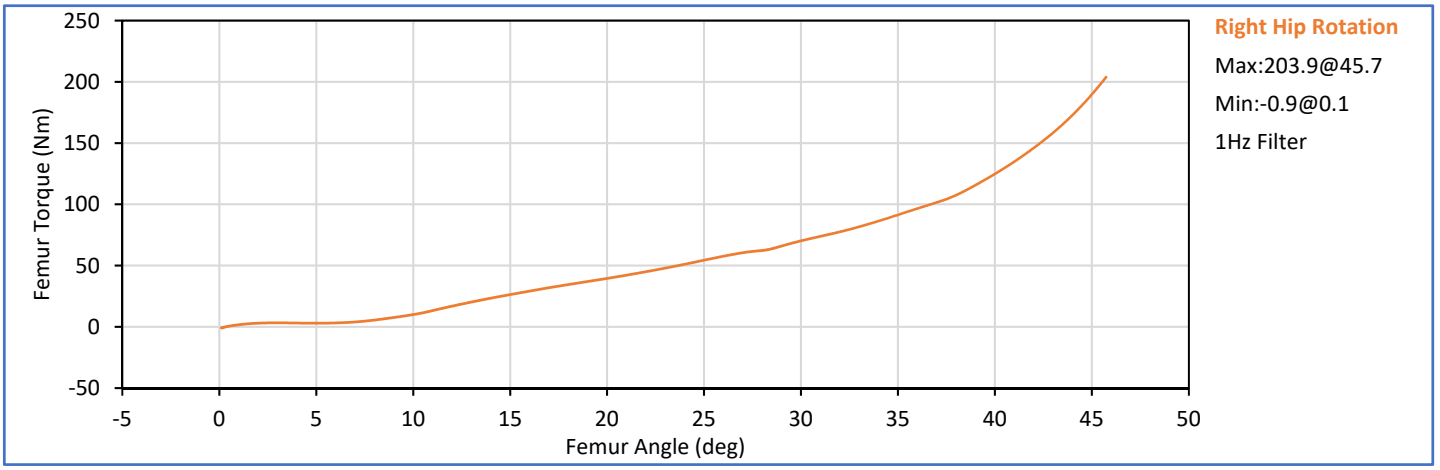
Applus IDIADA KARCO

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

ATD Serial No.: 360 Test Date: 2019-02-08

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.2	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	73.7	Pass
	Left Hip Rotation at 203 Nm	deg	40.0	50.0	45.5	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	70.3	Pass
	Right Hip Rotation at 203 Nm	deg	40.0	50.0	45.7	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

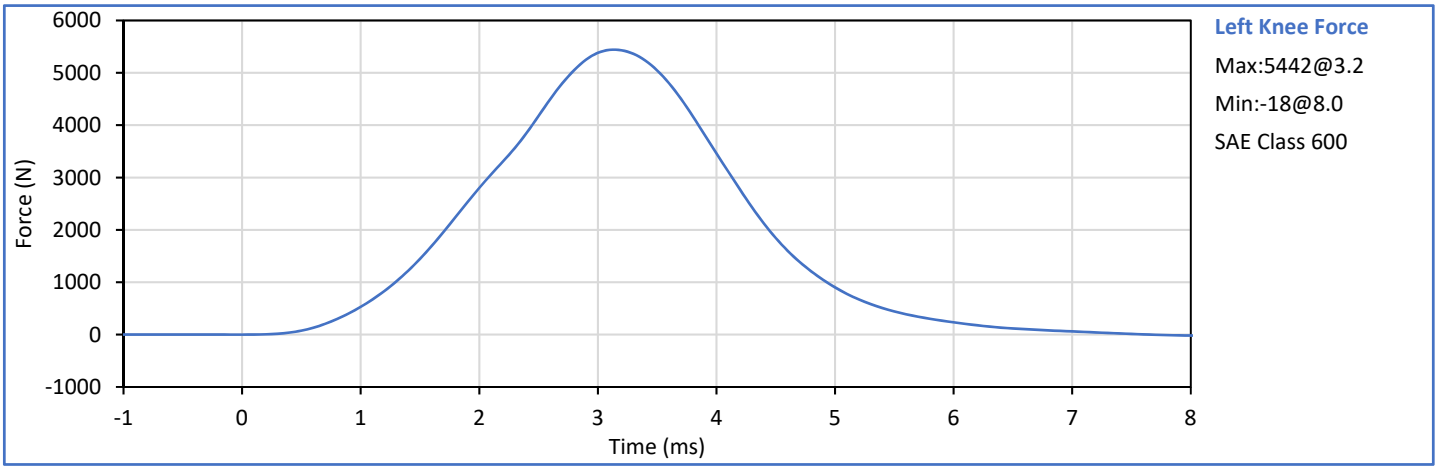
Applus IDIADA
KARCO

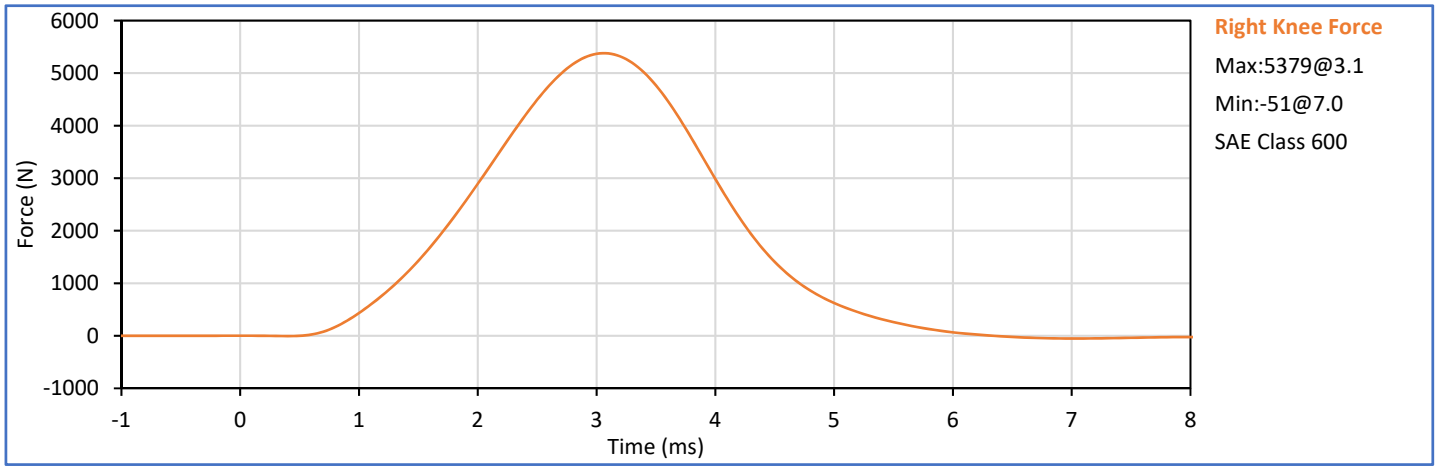
Hybrid III 50th Percentile Male ATD
Knee Impact (Left/Right)

ATD Serial No.: 360

Test Date: 2019-02-11

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.2	Pass
	Laboratory Humidity	%	10	70	21	Pass
Left Knee	Probe Velocity	m/s	2.070	2.130	2.118	Pass
	Peak Resistive Force	N	4715	5782	5442	Pass
Right Knee	Probe Velocity	m/s	2.070	2.130	2.120	Pass
	Peak Resistive Force	N	4715	5782	5379	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

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Hybrid III 5th Percentile Female
Damage Checklist

ATD Serial No.: 630 Test Date: 2019-01-21

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:

Technician: J. Hernandez

Approved By: P. Puzzuto

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Hybrid III 5th Percentile Female
External Measurements

ATD Serial No.: 630 Test Date: 2019-01-21

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	22	Pass
A - Total sitting height	mm	775	800	793	Pass
B - Shoulder pivot height	mm	432	457	445	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	75	Pass
F - Thigh clearance	mm	119	135	125	Pass
G - Back of elbow to wrist pivot	mm	244	259	253	Pass
H - Head back to backline	mm	41	46	44	Pass
I - Shoulder to elbow length	mm	277	297	287	Pass
J - Elbow rest height	mm	183	203	196	Pass
K - Buttock to knee length	mm	521	546	541	Pass
L - Popliteal length	mm	356	376	358	Pass
M - Knee pivot height	mm	394	419	406	Pass
N - Buttock popliteal length	mm	414	439	428	Pass
O - Chest depth without jacket	mm	175	191	185	Pass
P - Foot length	mm	219	234	227	Pass
R - Buttock to Knee Pivot Length	mm	457	483	469	Pass
S - Head Breadth	mm	137	147	145	Pass
T - Head Depth	mm	178	188	180	Pass
U - Hip Breadth	mm	300	315	308	Pass
V - Shoulder breadth	mm	351	366	361	Pass
W - Foot breadth	mm	79	94	88	Pass
X - Head circum.	mm	528	549	533	Pass
Y - Chest circum. (w/chest jacket)	mm	851	881	857	Pass
Z - Waist circum.	mm	760	790	778	Pass
AA - Location for chest circum.	mm	333	358	349	Pass
BB - Location for waist circum.	mm	160	170	167	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

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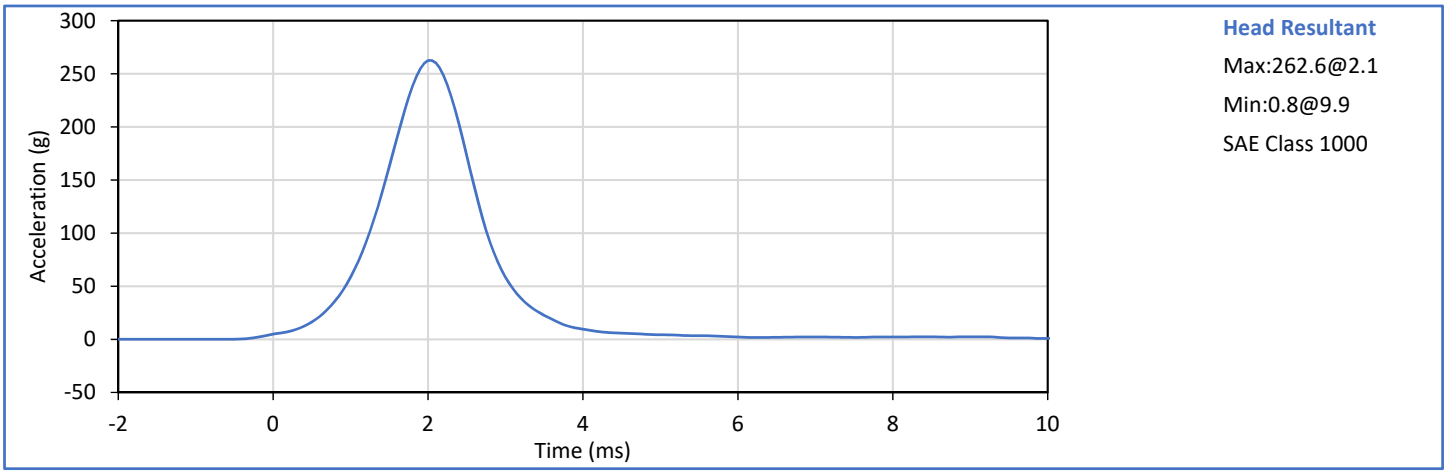
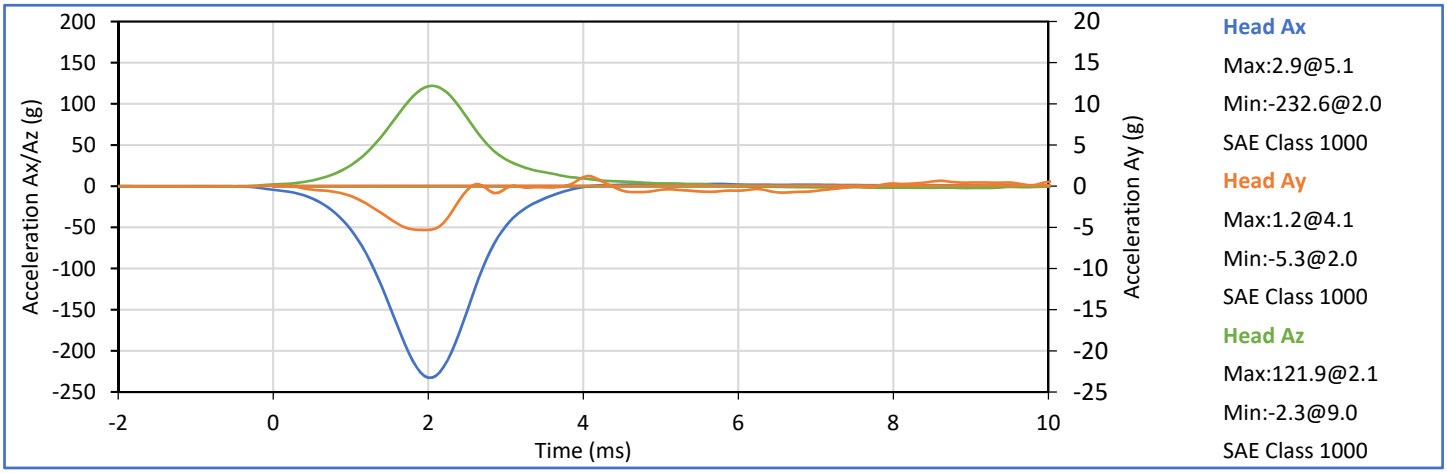
Hybrid III 5th Percentile Female
Head Drop

ATD Serial No.: 630

Test Date: 2019-01-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.8	Pass
Laboratory Humidity	%	10	70	20	Pass
Peak Resultant Acceleration	g	250.0	300.0	262.8	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-5.3	Pass
Oscillations After Main Pulse	%	0.0	10.0	0.9	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

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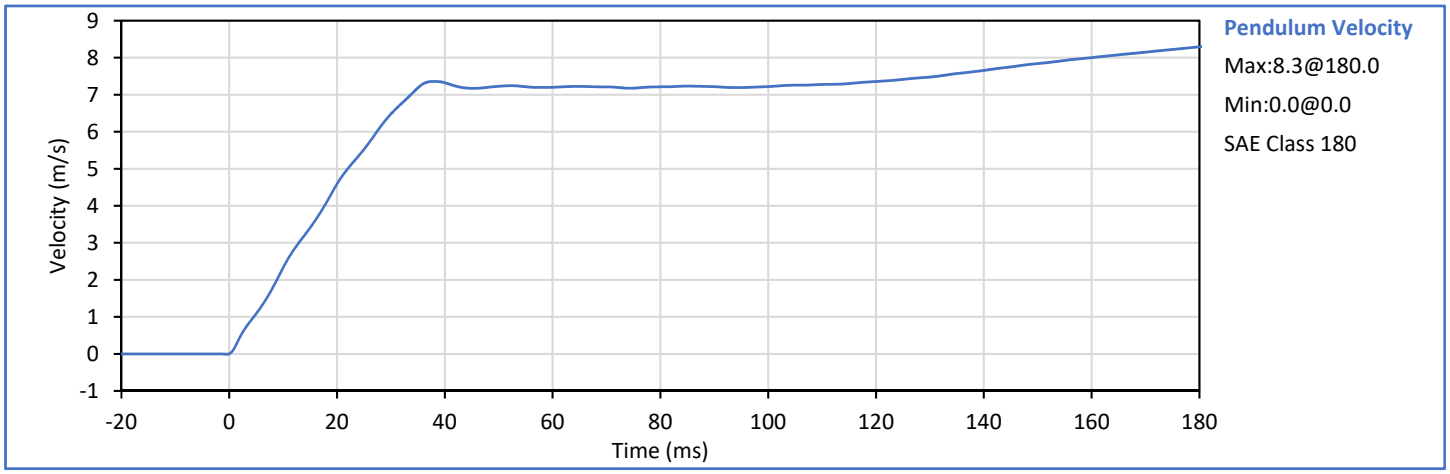
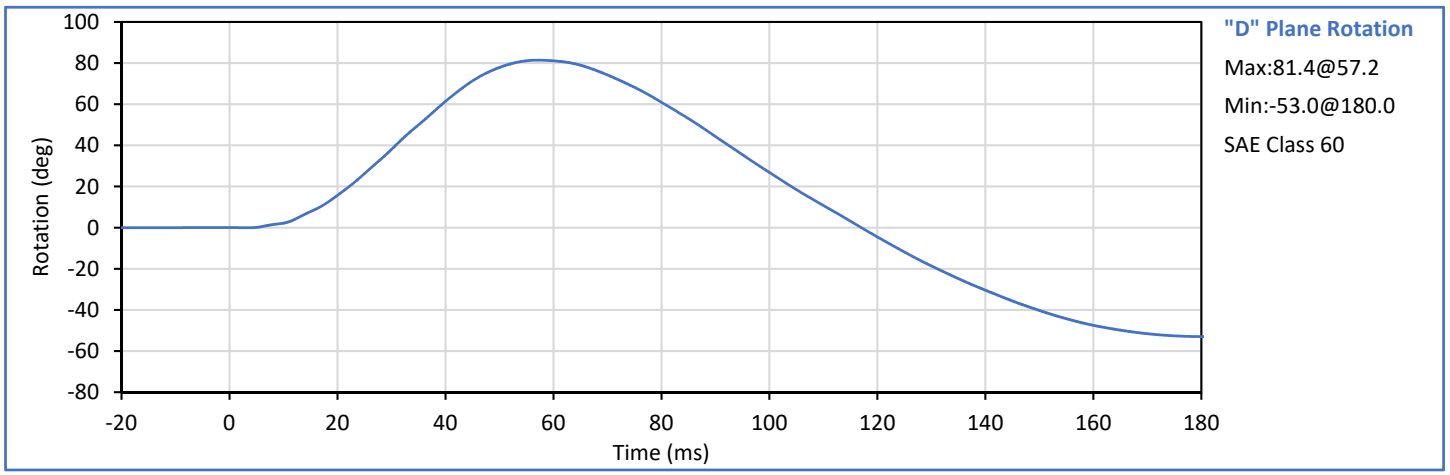
Hybrid III 5th Percentile Female
Neck Flexion Test

ATD Serial No.: 630

Test Date: 2019-01-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	16	Pass
Pendulum Velocity	m/s	6.89	7.13	7.02	Pass
Pendulum Velocity at 10 ms	m/s	2.10	2.50	2.33	Pass
Pendulum Velocity at 20 ms	m/s	4.00	5.00	4.59	Pass
Pendulum Velocity at 30 ms	m/s	5.80	7.00	6.48	Pass
Peak "D" Plane Rotation	deg	77.0	91.0	81.4	Pass
Peak Moment in Rotation	Nm	69.0	83.0	78.7	Pass
Positive Moment Decay to 10 Nm	ms	80.0	100.0	85.4	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

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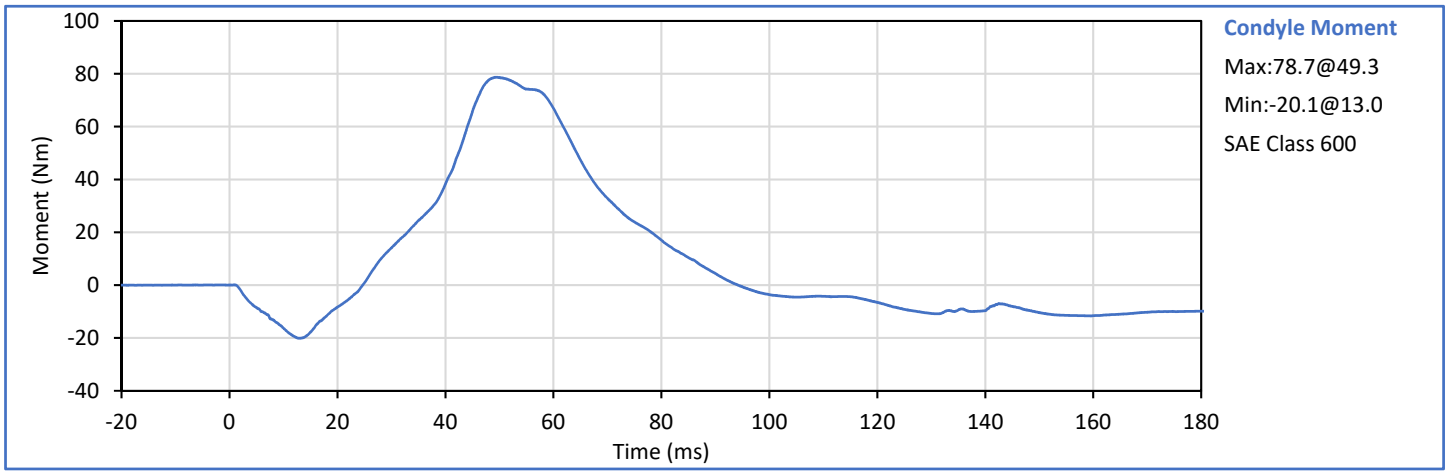
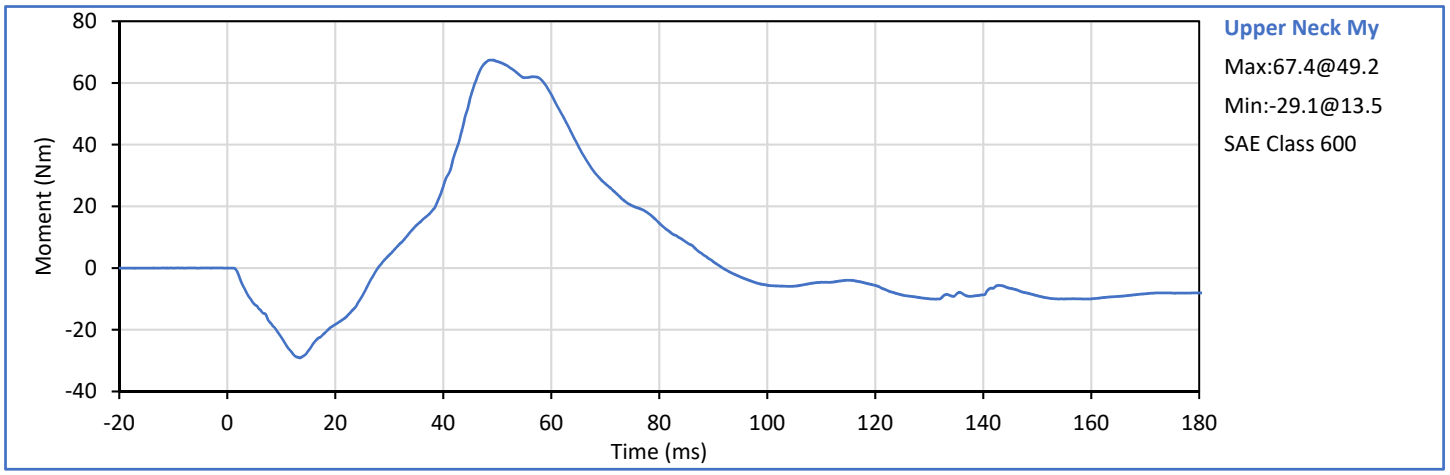
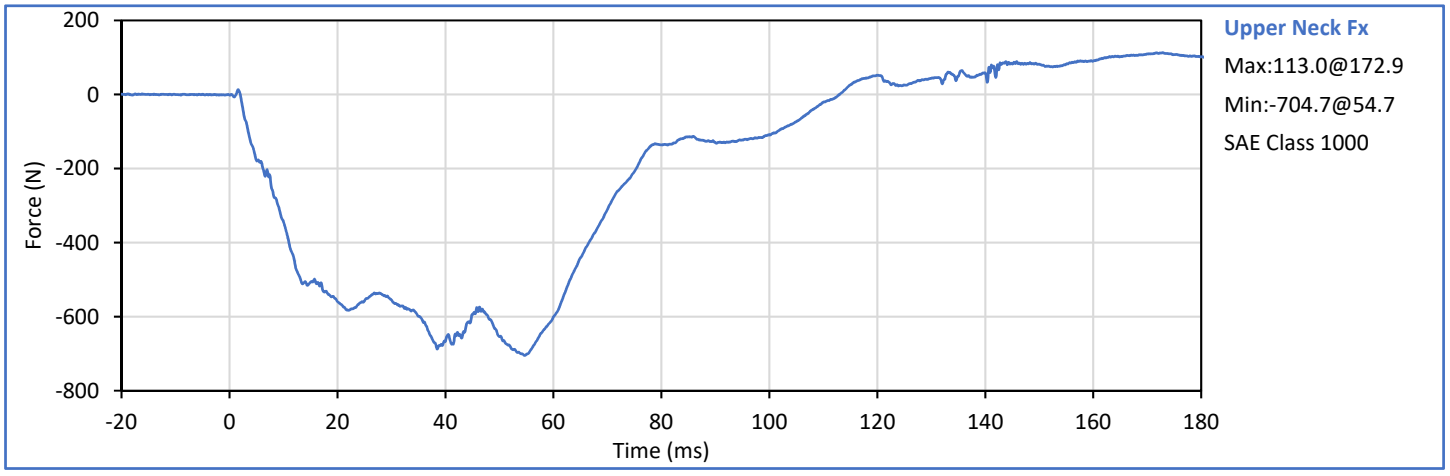
Hybrid III 5th Percentile Female
Neck Flexion Test

ATD Serial No.: 630 Test Date: 2019-01-21







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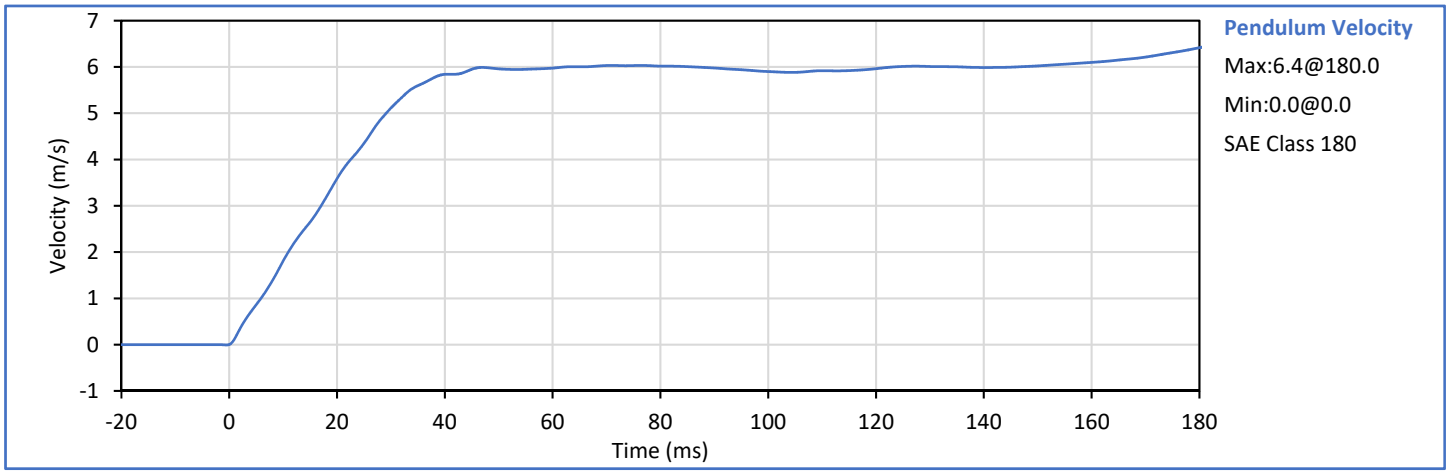
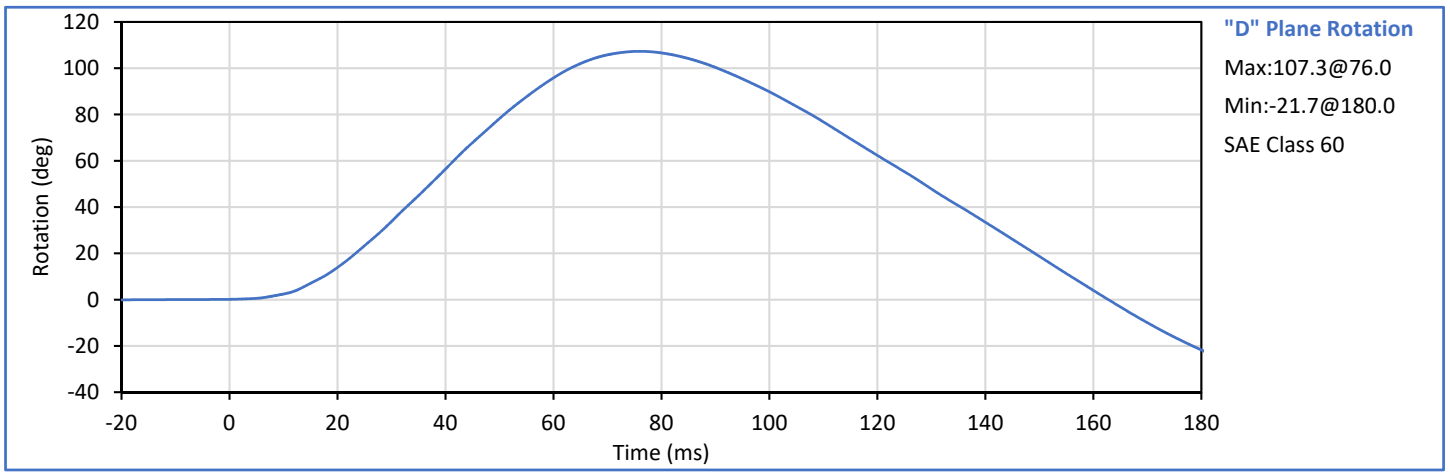
Hybrid III 5th Percentile Female
Neck Extension Test

ATD Serial No.: 630

Test Date: 2019-01-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	15	Pass
Pendulum Velocity	m/s	5.95	6.19	5.98	Pass
Pendulum Velocity at 10 ms	m/s	1.50	1.90	1.81	Pass
Pendulum Velocity at 20 ms	m/s	3.10	3.90	3.59	Pass
Pendulum Velocity at 30 ms	m/s	4.60	5.60	5.11	Pass
Peak "D" Plane Rotation	deg	99.0	114.0	107.3	Pass
Peak Moment in Rotation	Nm	-65.0	-53.0	-56.2	Pass
Negative Moment Decay to -10 Nm	ms	94.0	114.0	104.7	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

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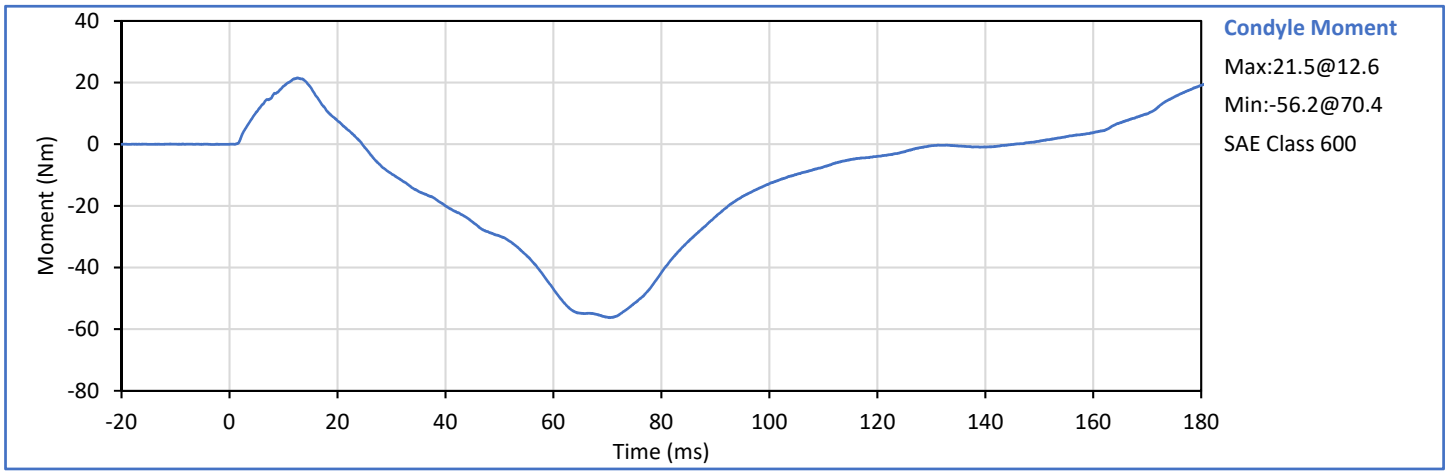
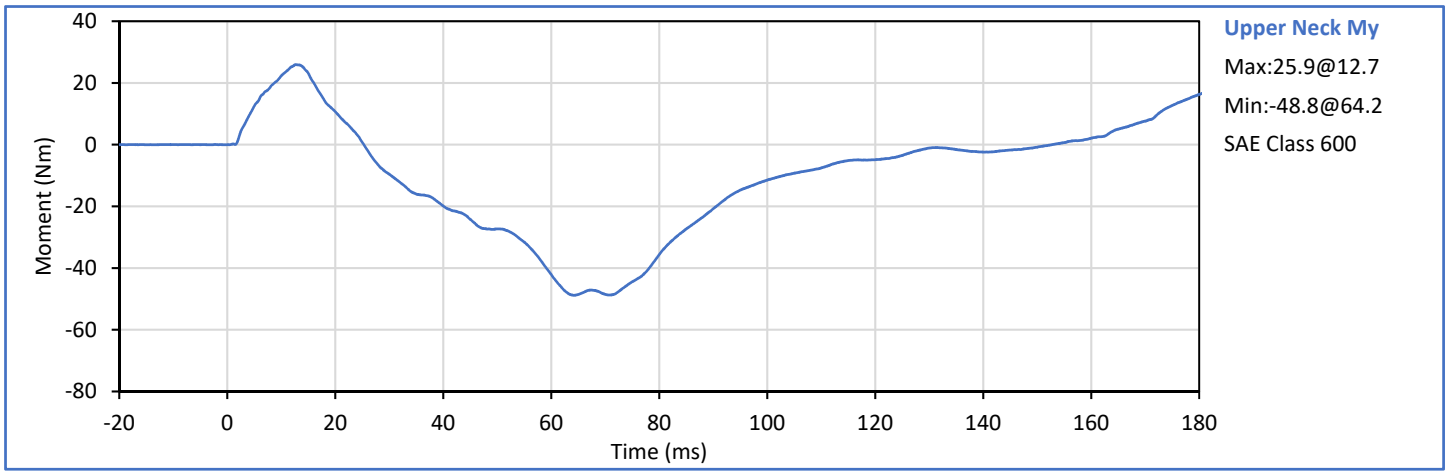
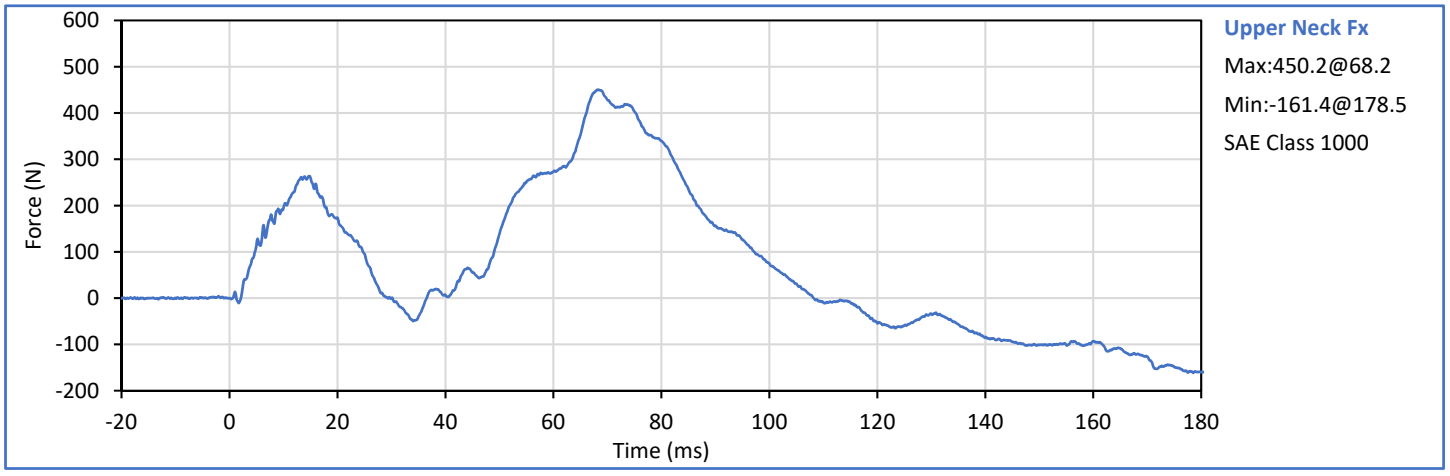
Hybrid III 5th Percentile Female
Neck Extension Test

ATD Serial No.: 630 Test Date: 2019-01-21







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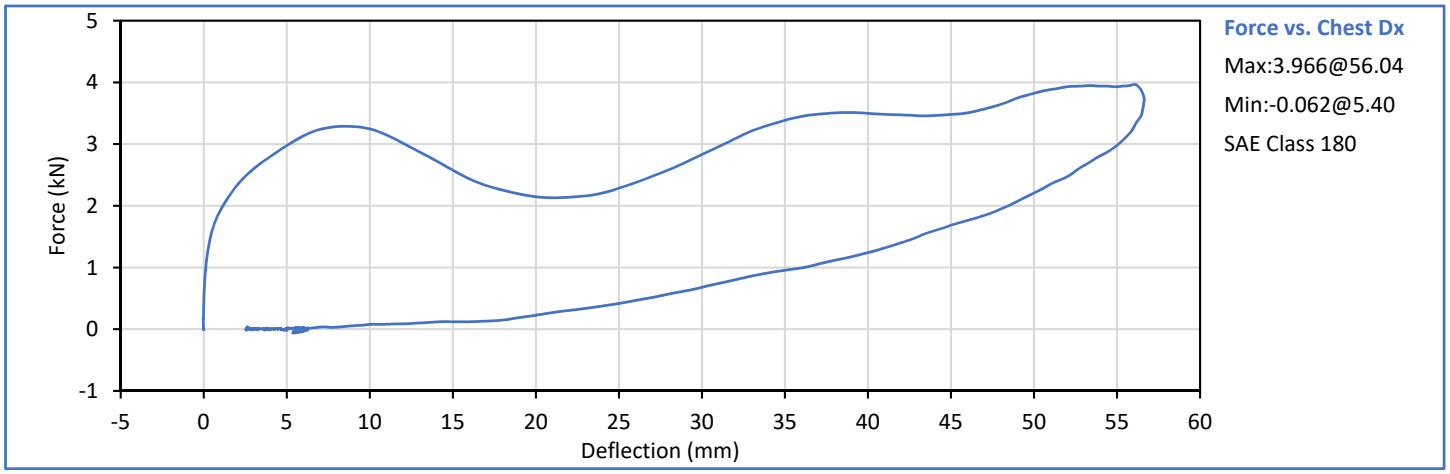
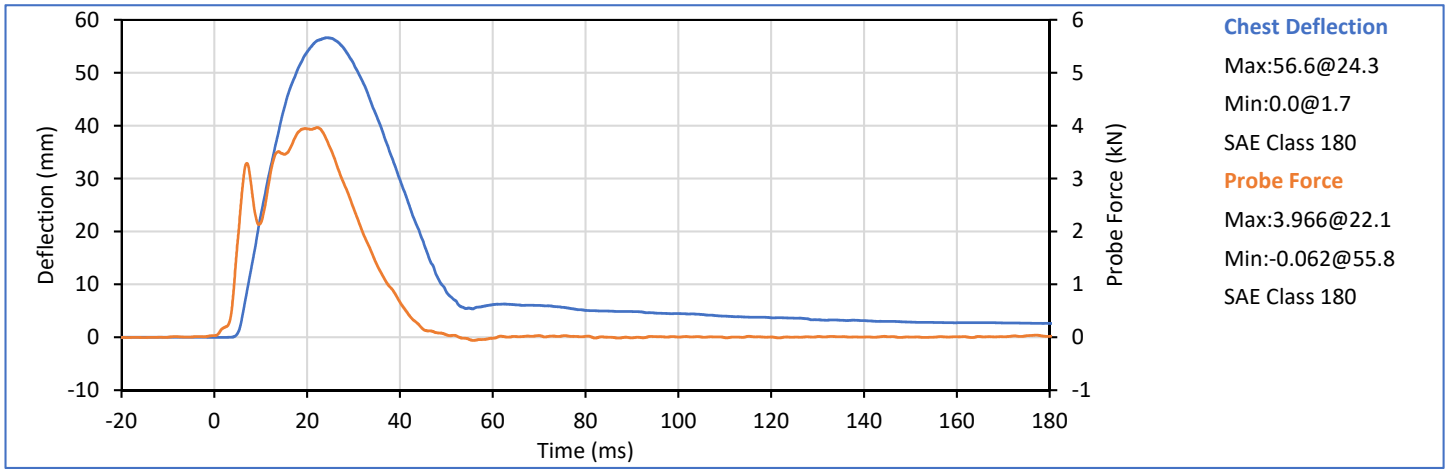
Hybrid III 5th Percentile Female
Thorax Impact

ATD Serial No.: 630

Test Date: 2019-01-22

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Humidity	%	10	70	33	Pass
Probe Velocity	m/s	6.59	6.83	6.73	Pass
Peak Chest Deflection	mm	50.0	58.0	56.6	Pass
Peak Probe Force, 50 and 58 mm	kN	3.900	4.400	3.966	Pass
Peak Probe Force, 18 and 50 mm	kN	0.000	4.600	3.821	Pass
Internal Hysterisis	%	69.0	85.0	70.7	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

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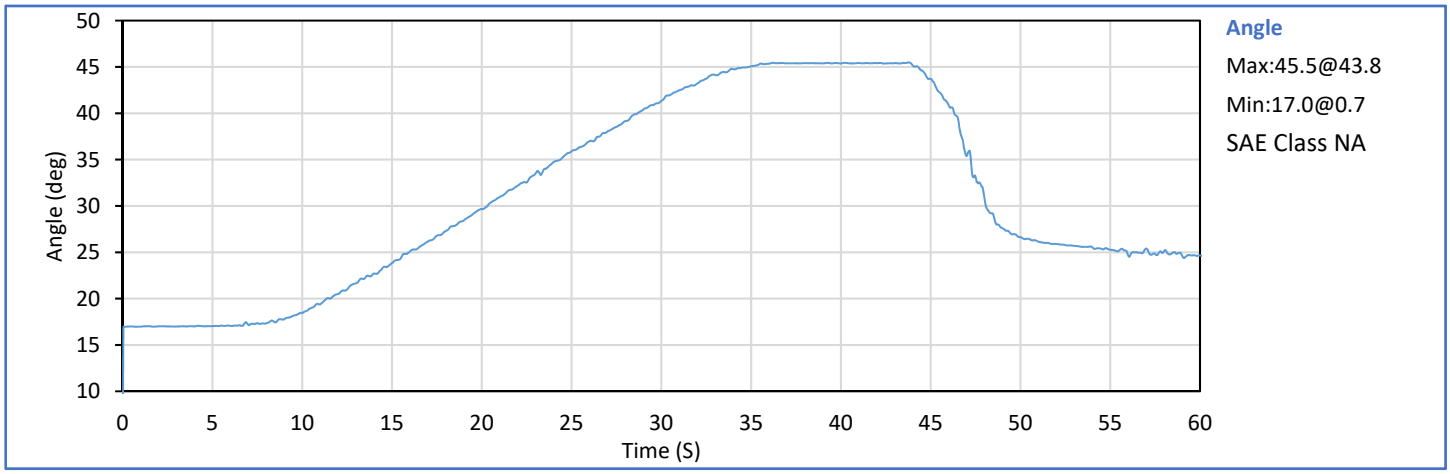
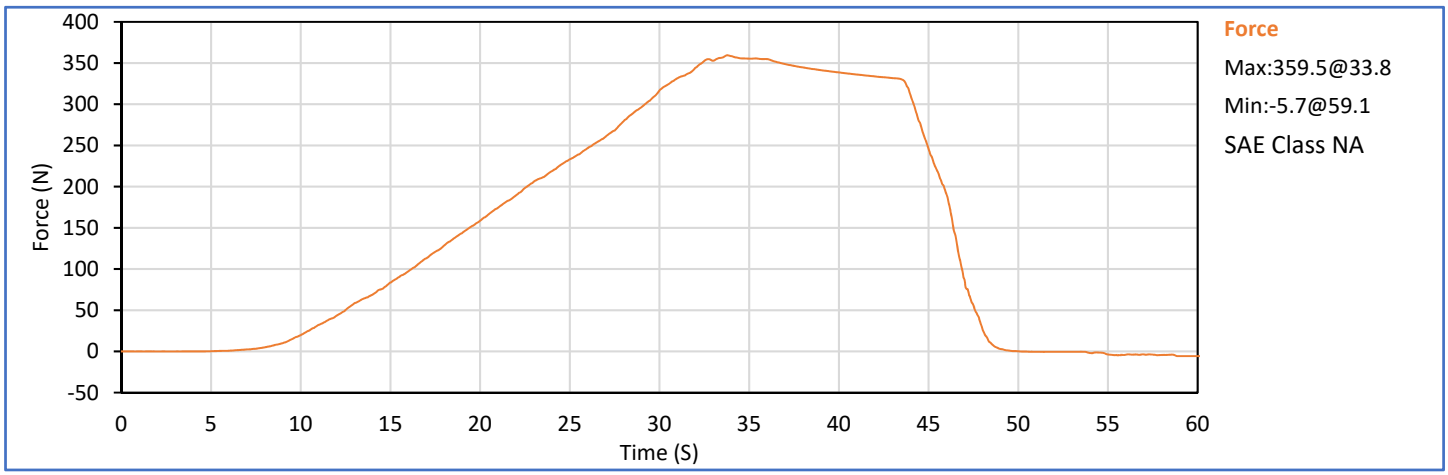
Hybrid III 5th Percentile Female
Torso Flexion Test

ATD Serial No.: 630

Test Date: 2019-01-22

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.6	Pass
Laboratory Humidity	%	10	70	23	Pass
Orientation Angle	deg	0.0	20.0	15.7	Pass
Test Initial Angle	deg	11.0	19.0	17.0	Pass
Peak Force at 45° (+/-0.5°)	N	320.0	390.0	359.5	Pass
Torso Flexion Rate	deg/s	0.50	1.50	1.09	Pass
Final Reference Plane Angle	deg	-8.0	8.0	5.0	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

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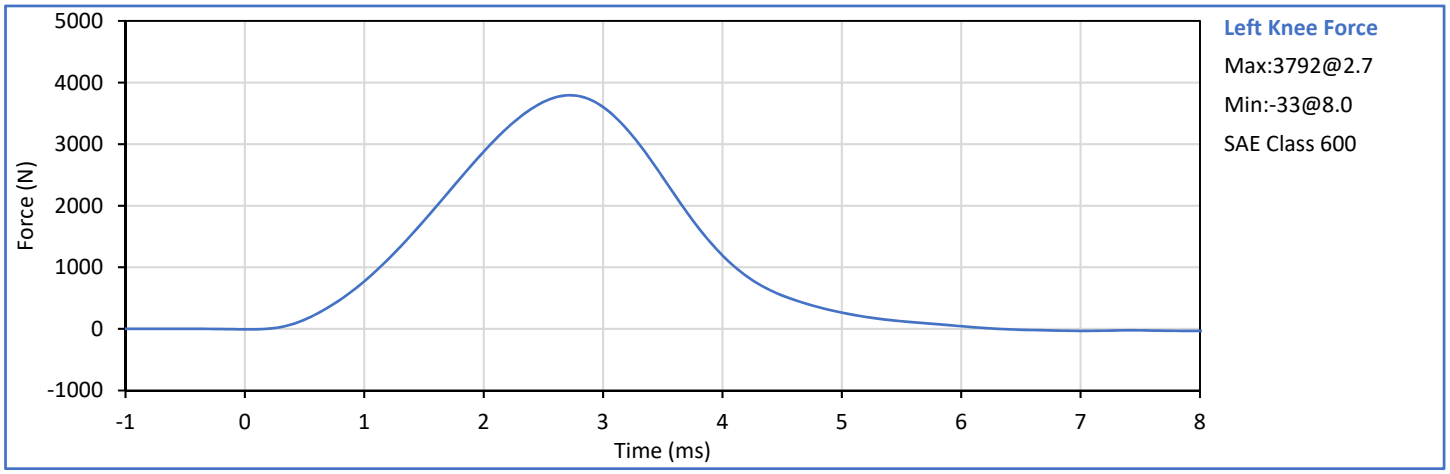
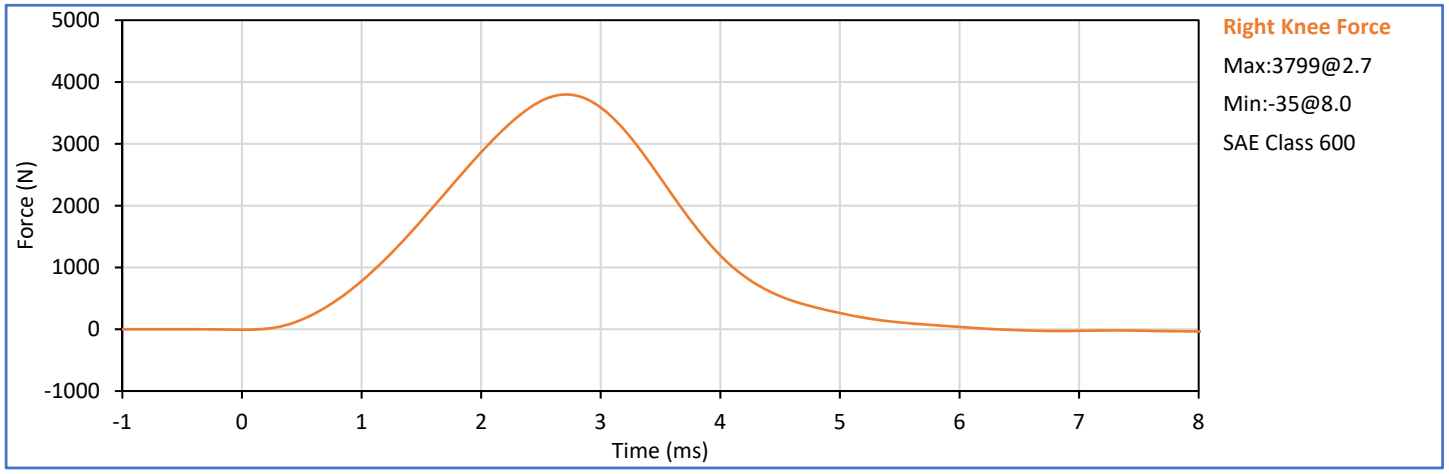
Hybrid III 5th Percentile Female
Knee Impact (Left/Right)

ATD Serial No.: 630

Test Date: 2019-01-21

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.9	Pass
	Laboratory Humidity	%	10	70	19	Pass
Left Knee	Probe Velocity	m/s	2.070	2.130	2.111	Pass
	Peak Resistive Force	N	3450	4060	3792	Pass
Right Knee	Probe Velocity	m/s	2.070	2.130	2.124	Pass
	Peak Resistive Force	N	3450	4060	3799	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX C
POST-TEST ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
ATD Damage Checklist

ATD Serial No.: 360 Test Date: 2019-02-15

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: 2019-02-15

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	519	Pass
C - 'H' point height	mm	84	89	87	Pass
D - 'H' point location from backline	mm	135	140	137	Pass
E - Shoulder pivot from backline	mm	84	94	88	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	46	Pass
I - Shoulder to elbow length	mm	330	345	341	Pass
J - Elbow rest height	mm	190	211	197	Pass
K - Buttock to knee length	mm	579	604	591	Pass
L - Popliteal length	mm	429	455	445	Pass
M - Knee pivot height	mm	485	500	492	Pass
N - Buttock popliteal length	mm	452	477	463	Pass
O - Chest depth without jacket	mm	213	229	220	Pass
P - Foot length	mm	251	267	259	Pass
V - Shoulder breadth	mm	422	437	434	Pass
W - Foot breadth	mm	91	107	105	Pass
Y - Chest circum. (w/chest jacket)	mm	970	1001	989	Pass
Z - Waist circum.	mm	836	866	847	Pass
AA - Location for chest circum.	mm	429	434	433	Pass
BB - Location for waist circum.	mm	226	231	228	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

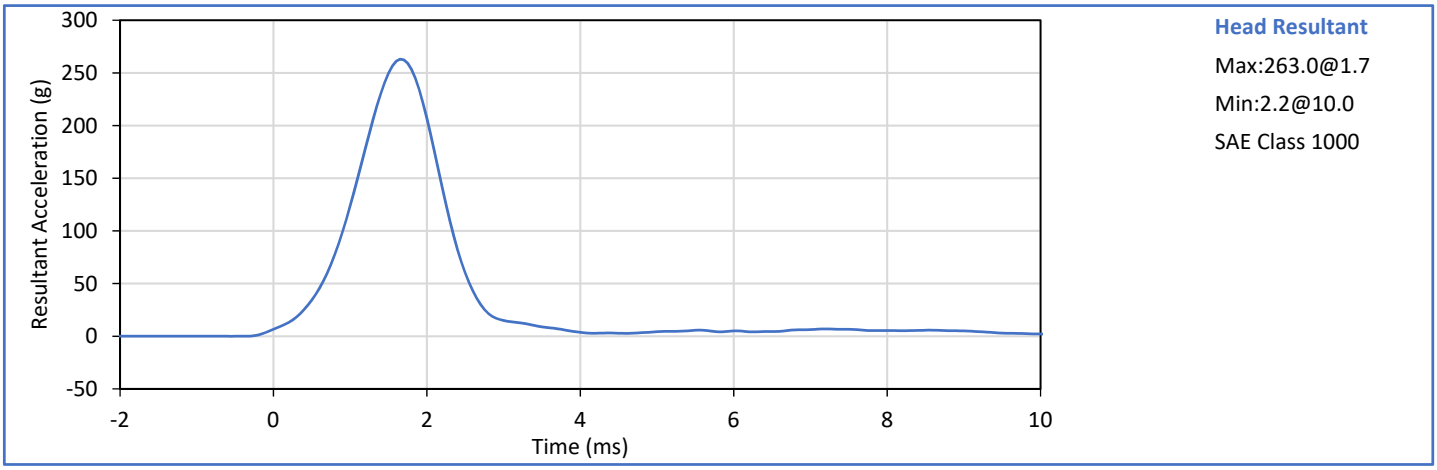
Applus IDIADA KARCO

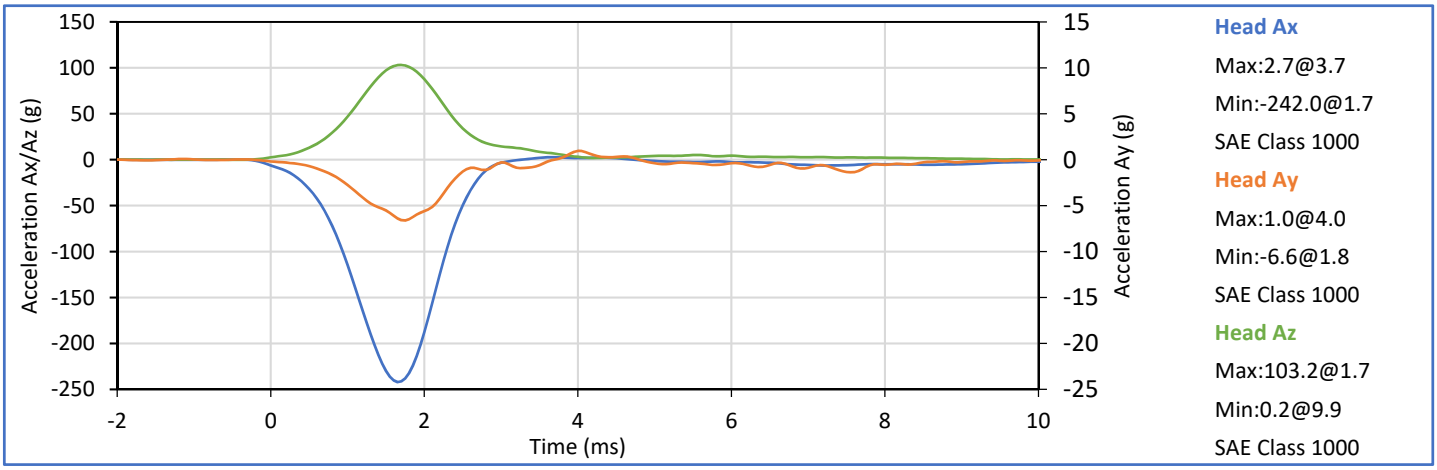
Hybrid III 50th Percentile Male ATD
Head Drop

ATD Serial No.: 360

Test Date: 2019-02-15

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	263.0	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-6.6	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

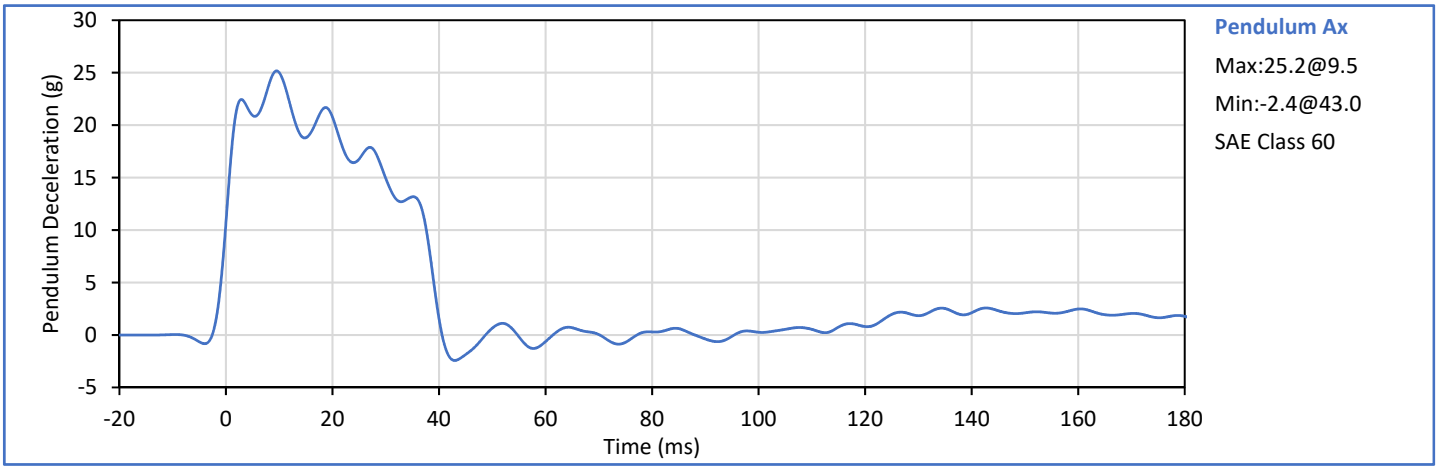
Approved By: P. Puzzuto

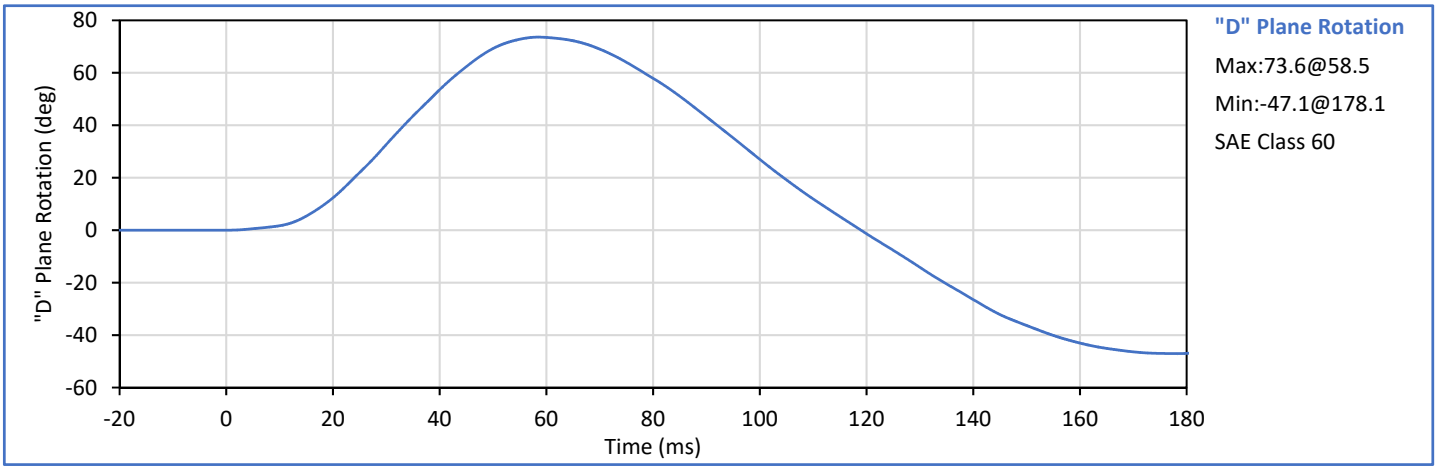
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2019-02-15

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	32	Pass
Pendulum Velocity	m/s	6.89	7.13	6.92	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	25.0	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	20.8	Pass
Pendulum Deceleration at 30 ms	g	12.5	18.5	14.9	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	29.0	14.9	Pass
Deceleration Decay to Cross 5 g	ms	34.0	42.0	39.0	Pass
"D" Plane Rotation peak	deg	64.0	78.0	73.6	Pass
	ms	57.0	64.0	58.5	Pass
"D" Plane Rotation Decay To Zero	ms	113.0	128.0	119.0	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	96.3	Pass
	ms	47.0	58.0	52.5	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	97.8	Pass
			Overall Test Results		Pass



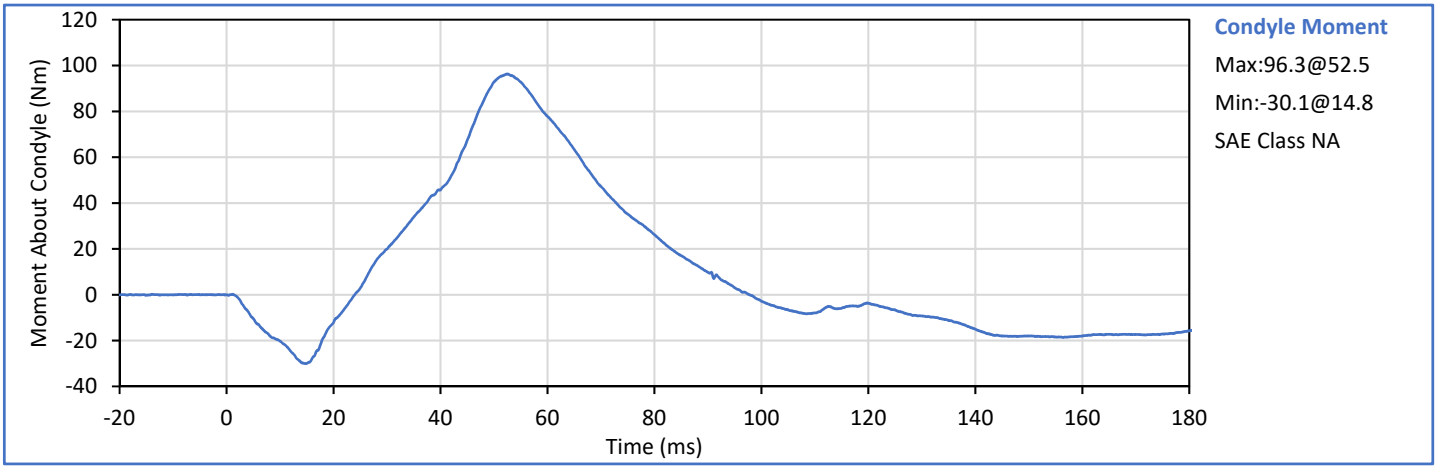


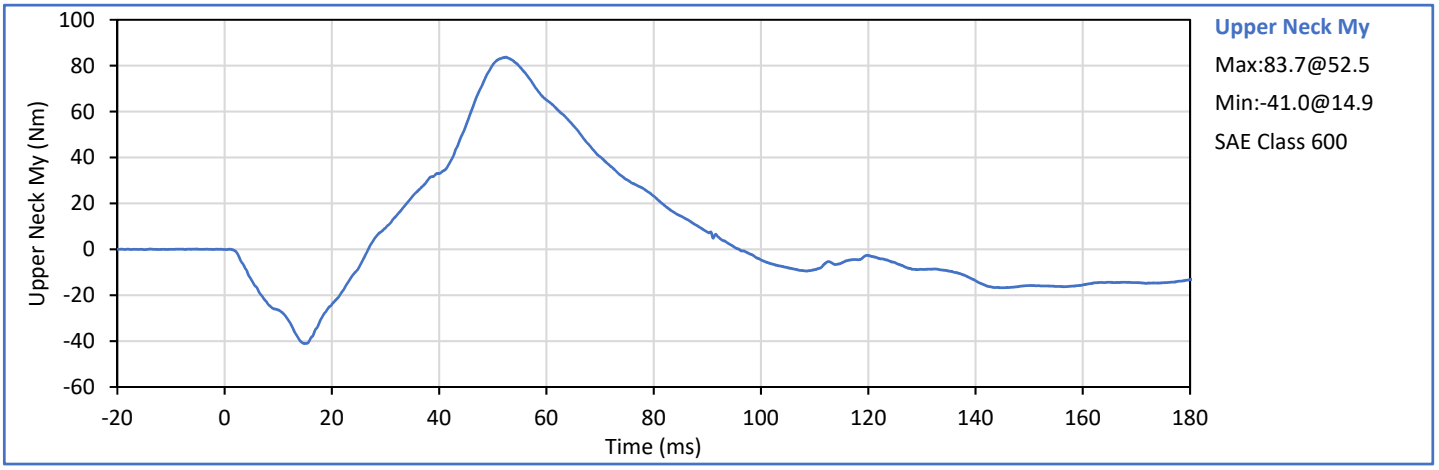
Technician: J. Hernandez

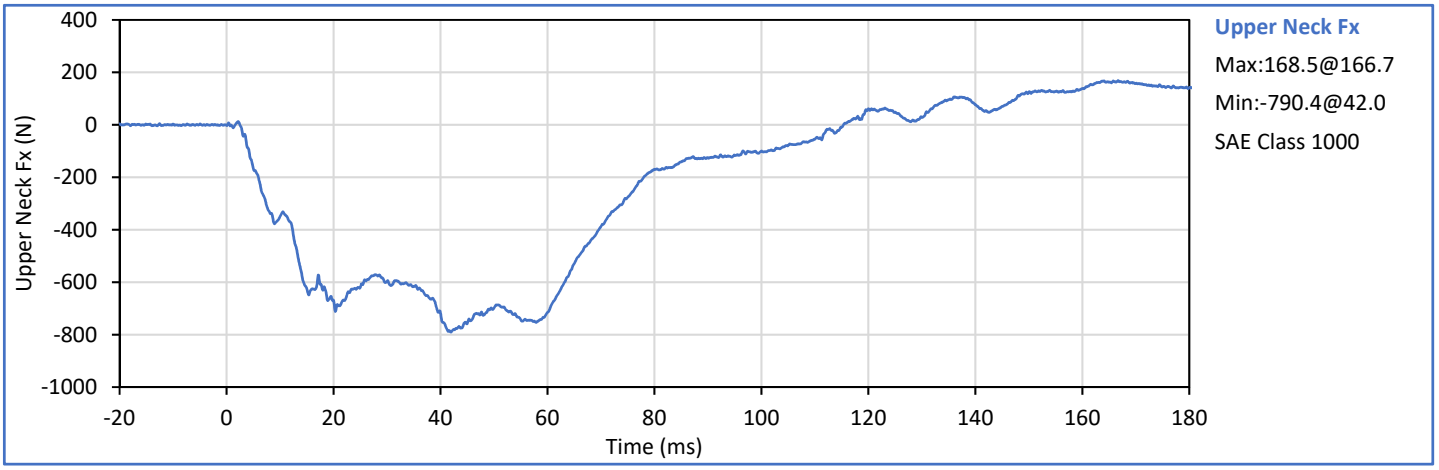
Approved By: P. Puzzuto

Hybrid III 50th Percentile Male ATD
Neck Flexion Test

ATD Serial No.: 360 Test Date: 2019-02-15





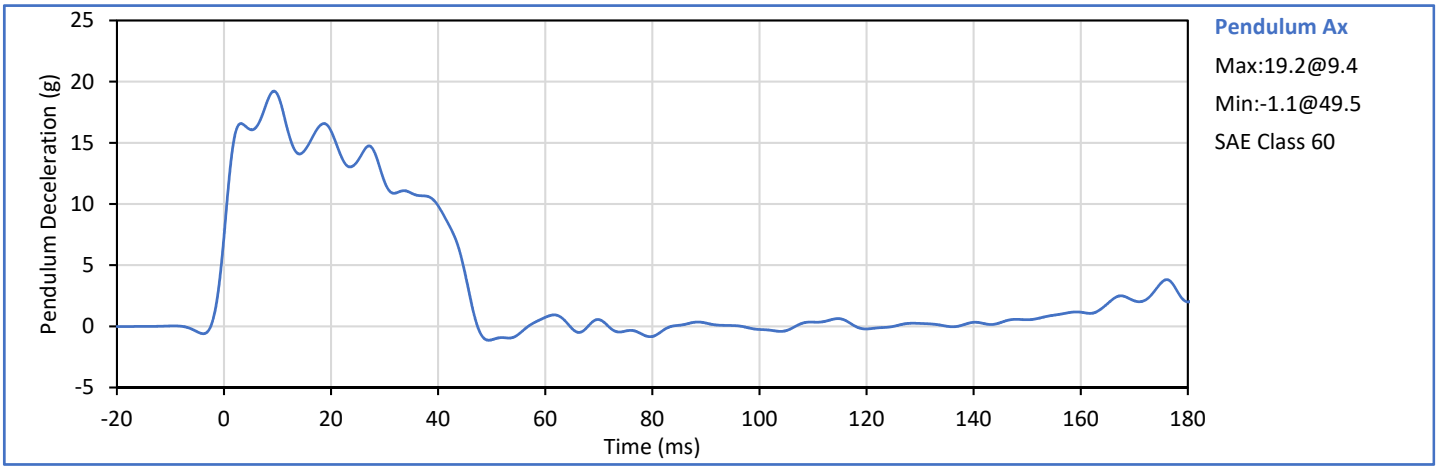


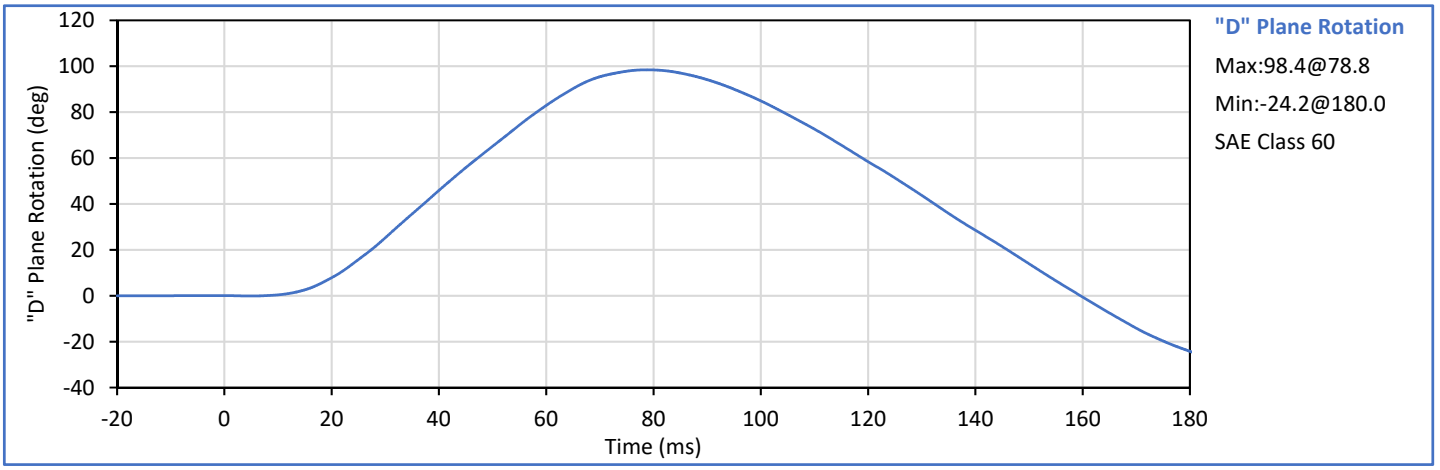
Applus IDIADA KARCO

Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360 Test Date: 2019-02-15

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	32	Pass
Pendulum Velocity	m/s	5.94	6.19	6.00	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	19.0	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	16.0	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	11.8	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	22.0	11.8	Pass
Deceleration Decay to Cross 5 g	ms	38.0	46.0	44.7	Pass
"D" Plane Rotation peak	deg	81.0	106.0	98.4	Pass
	ms	72.0	82.0	78.8	Pass
"D" Plane Rotation Decay To Zero	ms	147.0	174.0	159.7	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-69.1	Pass
	ms	65.0	79.0	72.5	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	141.9	Pass
			Overall Test Results		Pass



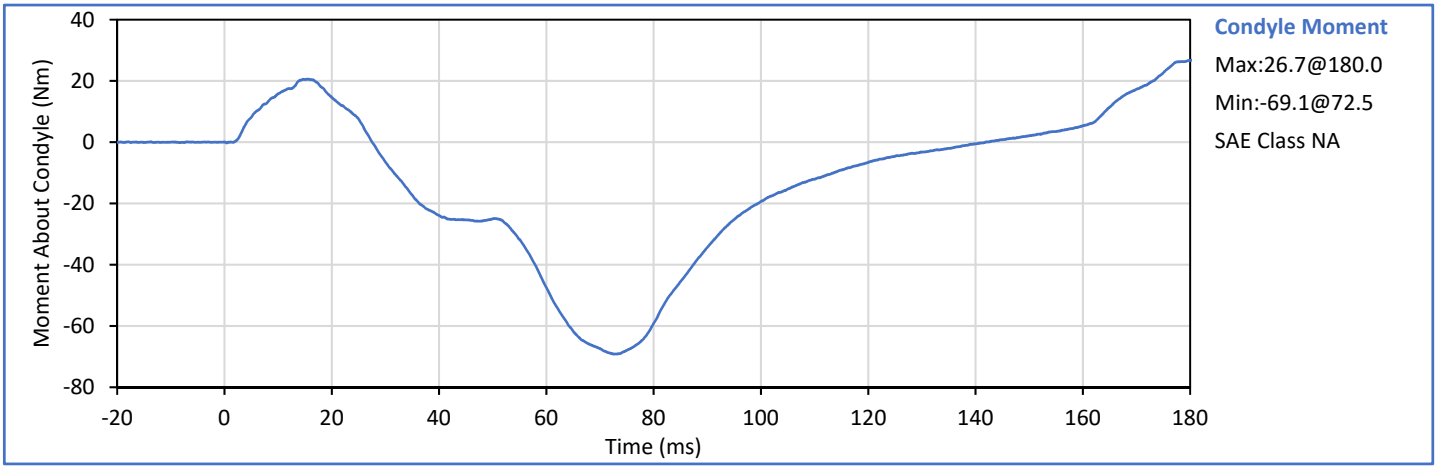


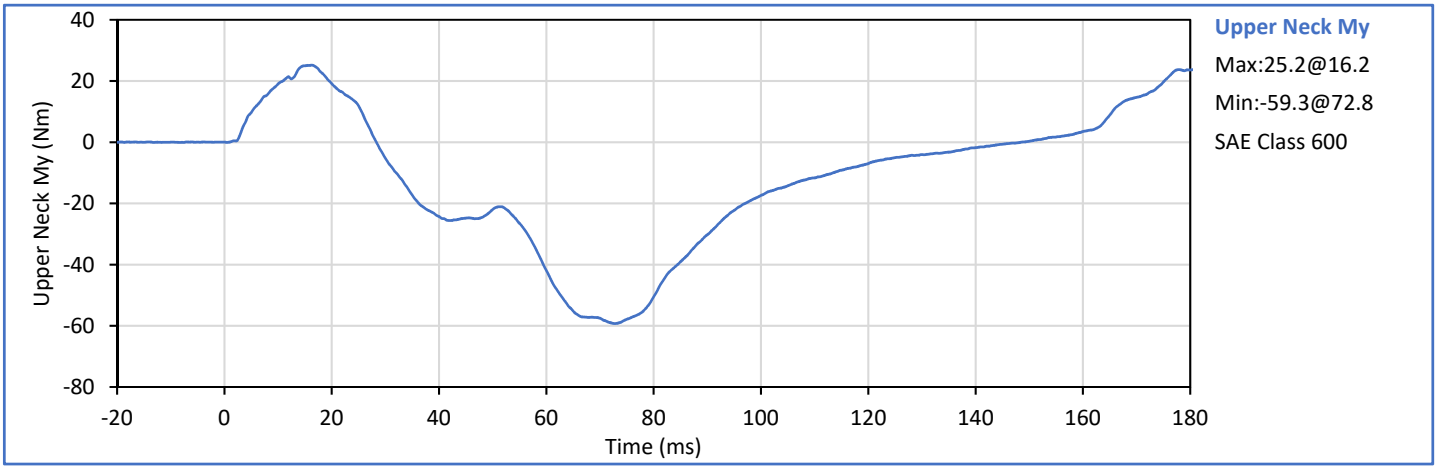
Technician: J. Hernandez

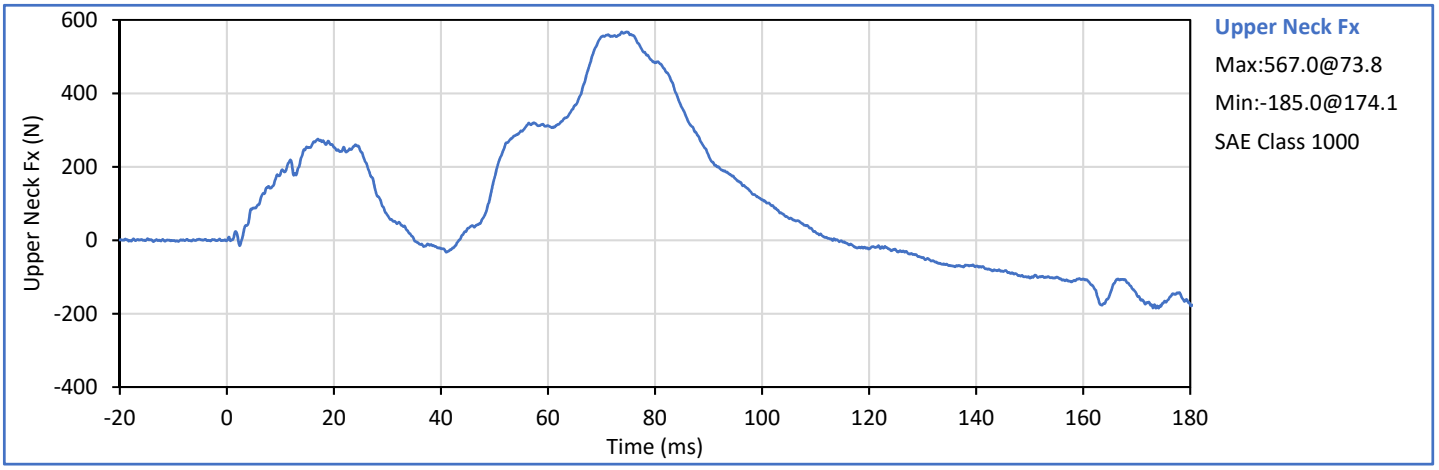
Approved By: P. Puzzuto

Hybrid III 50th Percentile Male ATD
Neck Extension Test

ATD Serial No.: 360 Test Date: 2019-02-15







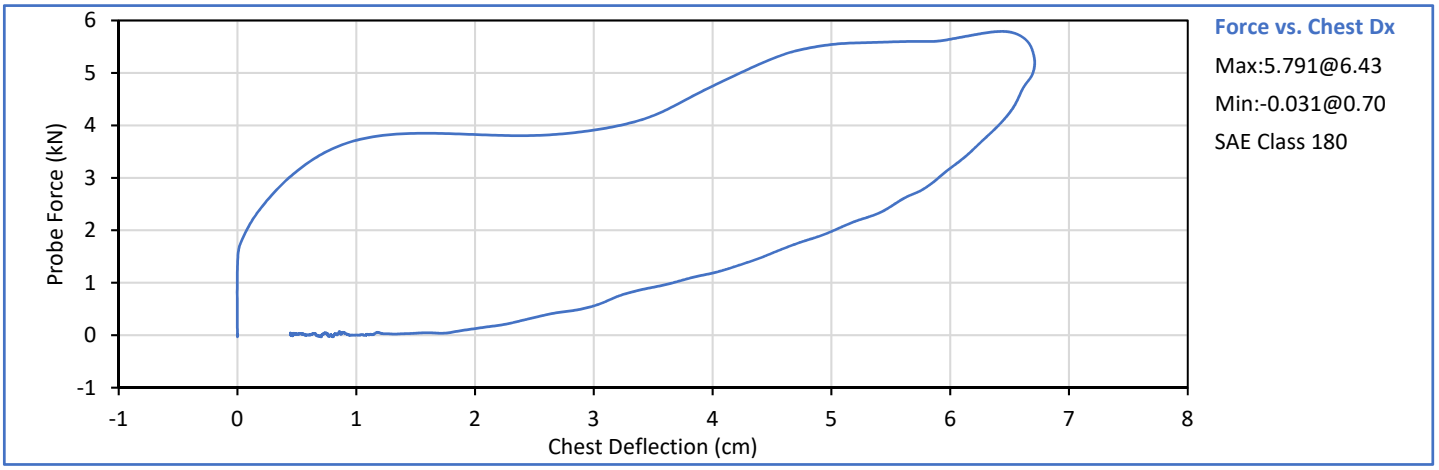
Applus IDIADA
KARCO

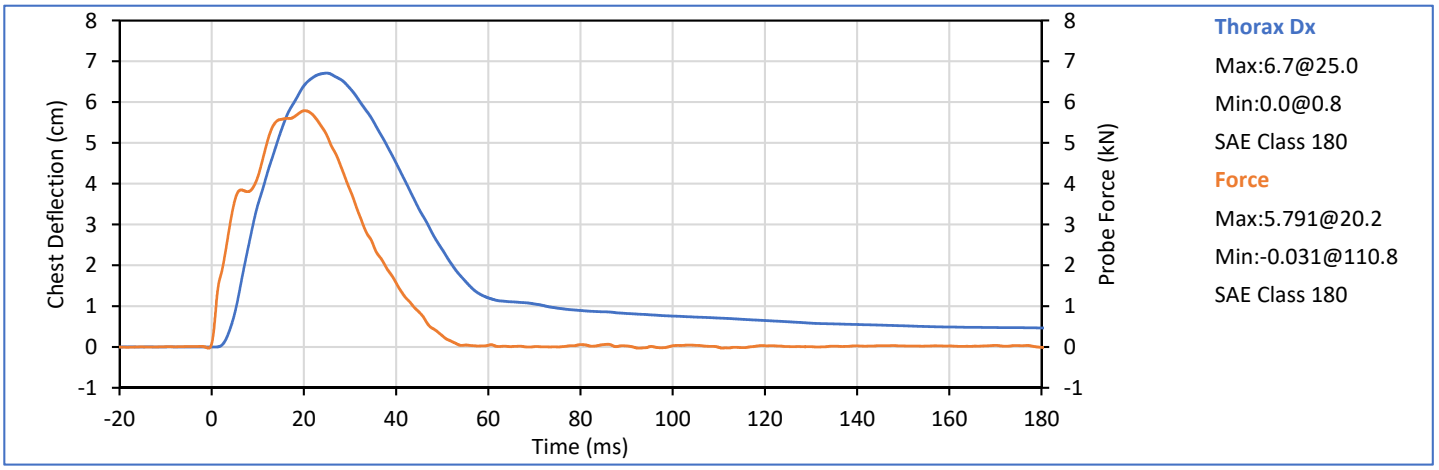
Hybrid III 50th Percentile Male ATD
Thorax Impact

ATD Serial No.: 360

Test Date: 2019-02-20

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	6.76	Pass
Peak Chest Deflection	cm	6.35	7.26	6.71	Pass
Peak Probe Force	kN	5.159	5.893	5.791	Pass
Internal Hysterisis	%	69.0	85.0	72.6	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

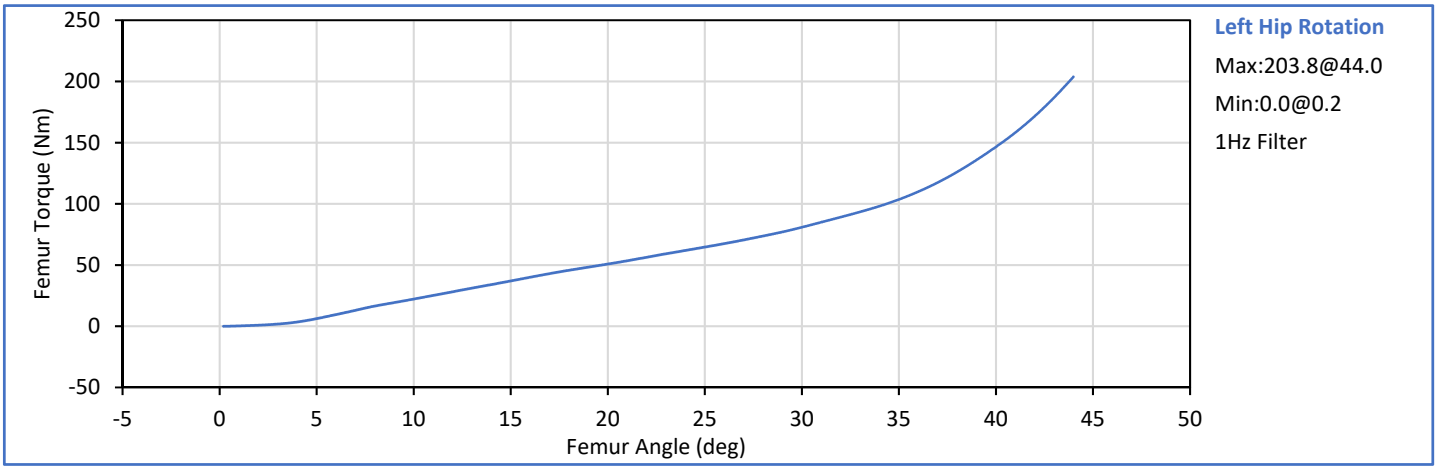
Applus IDIADA KARCO

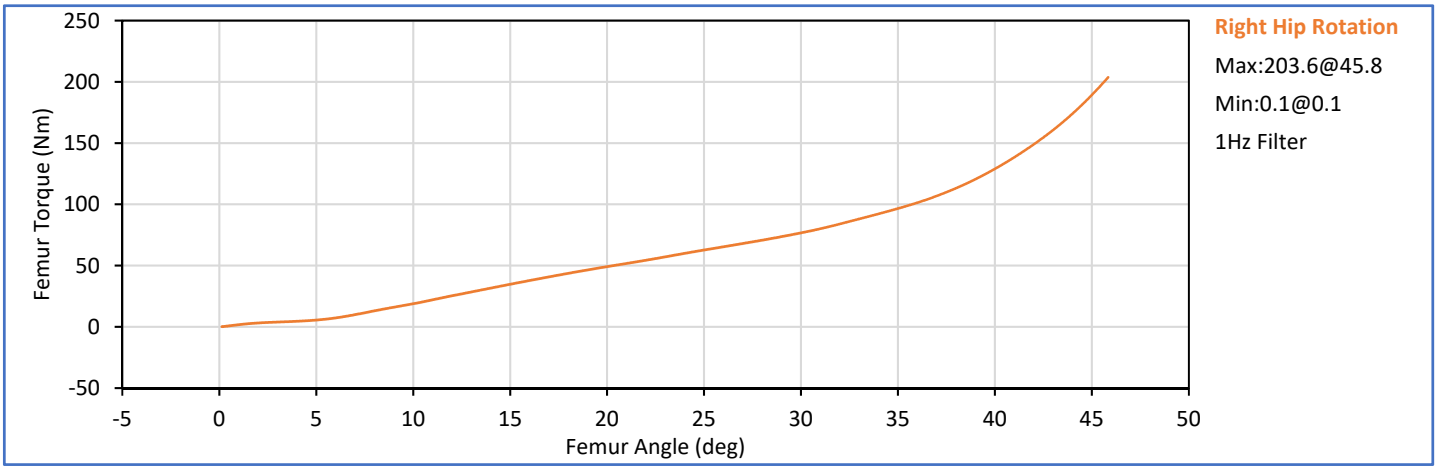
Hybrid III 50th Percentile Male ATD
Hip Flexion (Left/Right)

ATD Serial No.: 360

Test Date: 2019-02-18

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.4	Pass
	Laboratory Humidity	%	10	70	32	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	81.0	Pass
	Left Hip Rotation at 203 Nm	deg	40.0	50.0	43.9	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	76.8	Pass
	Right Hip Rotation at 203 Nm	deg	40.0	50.0	45.8	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

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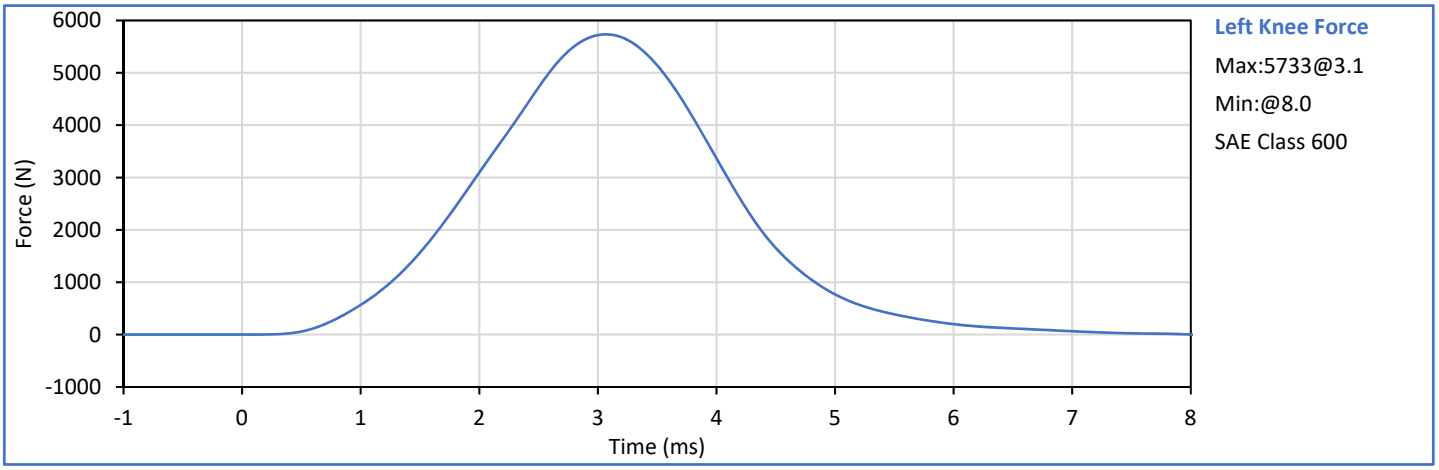
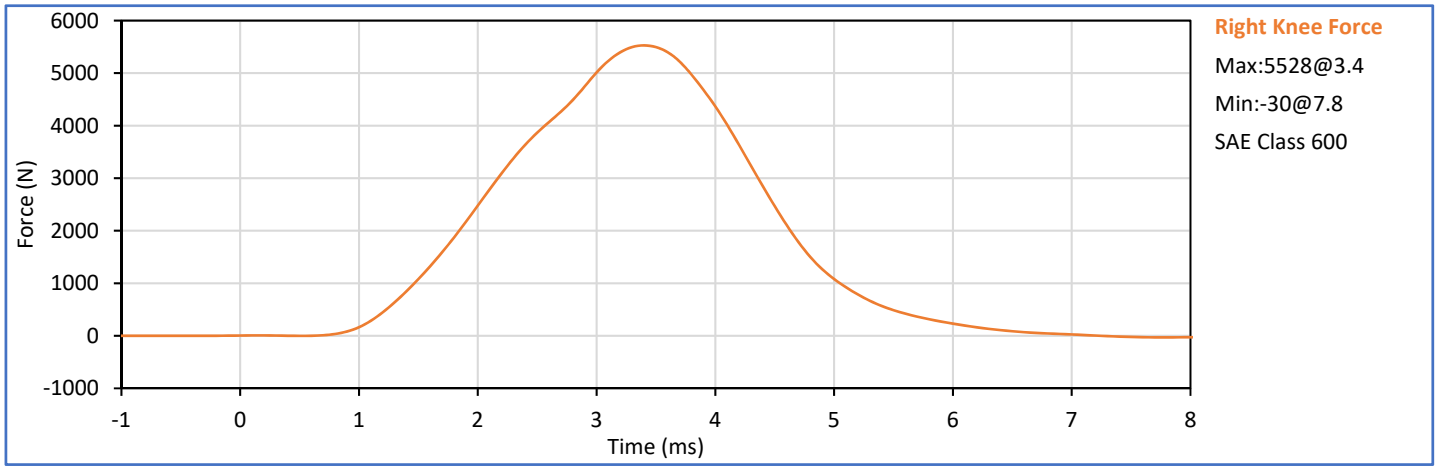
Hybrid III 50th Percentile Male ATD
Knee Impact (Left/Right)

ATD Serial No.: 360

Test Date: 2019-02-20

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.2	Pass
	Laboratory Humidity	%	10	70	21	Pass
Left Knee	Probe Velocity	m/s	2.070	2.130	2.115	Pass
	Peak Resistive Force	N	4715	5782	5733	Pass
Right Knee	Probe Velocity	m/s	2.070	2.130	2.116	Pass
	Peak Resistive Force	N	4715	5782	5528	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA
KARCO

Hybrid III 5th Percentile Female ATD
Damage Checklist

ATD Serial No.: 630

Test Date: 2019-02-19

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:

Technician: J. Hernandez

Approved By: P. Puzzuto

Applus IDIADA
KARCO

Hybrid III 5th Percentile Female ATD
External Measurements

ATD Serial No.: 630 Test Date: 2019-02-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Relative Humidity	%	10	70	22	Pass
A - Total sitting height	mm	775	800	786	Pass
B - Shoulder pivot height	mm	432	457	446	Pass
C - 'H' point height	mm	81	86	84	Pass
D - 'H' point location from backline	mm	145	150	147	Pass
E - Shoulder pivot from backline	mm	69	84	78	Pass
F - Thigh clearance	mm	119	135	126	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	286	Pass
J - Elbow rest height	mm	183	203	195	Pass
K - Buttock to knee length	mm	521	546	527	Pass
L - Popliteal length	mm	356	376	363	Pass
M - Knee pivot height	mm	394	419	405	Pass
N - Buttock popliteal length	mm	414	439	427	Pass
O - Chest depth without jacket	mm	175	191	183	Pass
P - Foot length	mm	219	234	229	Pass
R - Buttock to Knee Pivot Length	mm	457	483	468	Pass
S - Head Breadth	mm	137	147	144	Pass
T - Head Depth	mm	178	188	183	Pass
U - Hip Breadth	mm	300	315	309	Pass
V - Shoulder breadth	mm	351	366	359	Pass
W - Foot breadth	mm	79	94	89	Pass
X - Head circum.	mm	528	549	534	Pass
Y - Chest circum. (w/chest jacket)	mm	851	881	860	Pass
Z - Waist circum.	mm	760	790	769	Pass
AA - Location for chest circum.	mm	333	358	346	Pass
BB - Location for waist circum.	mm	160	170	168	Pass
			Overall Test Results		Pass

Technician: J. Hernandez

Approved By: P. Puzzuto

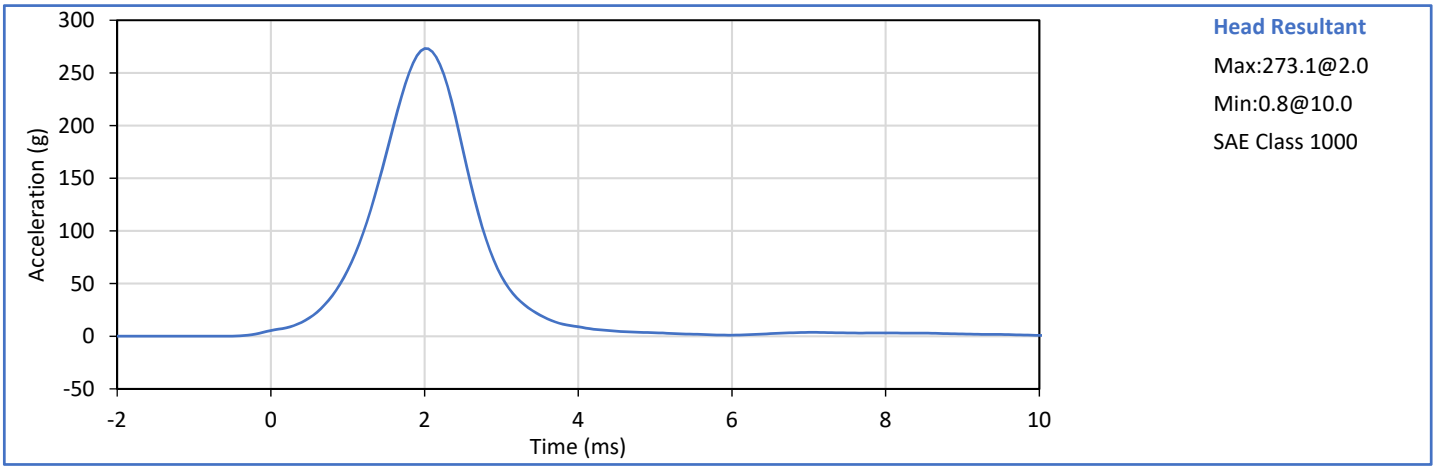
Applus IDIADA
KARCO

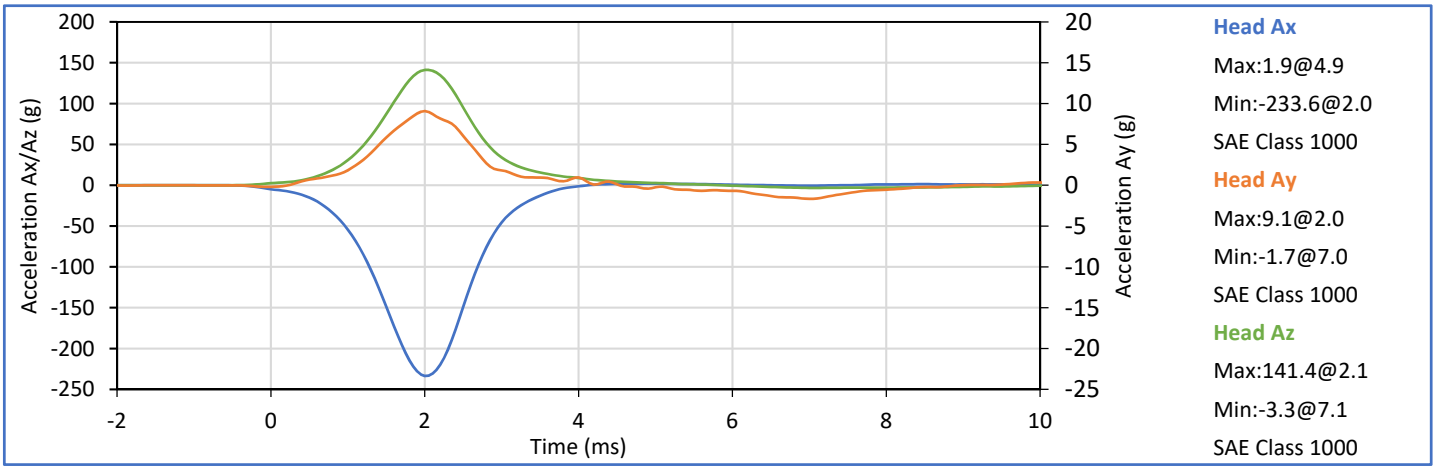
Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: 630

Test Date: 2019-02-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.4	Pass
Laboratory Humidity	%	10	70	22	Pass
Peak Resultant Acceleration	g	250.0	300.0	273.1	Pass
Peak Lateral Acceleration	g	-15.0	15.0	9.1	Pass
Oscillations After Main Pulse	%	0.0	10.0	1.4	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

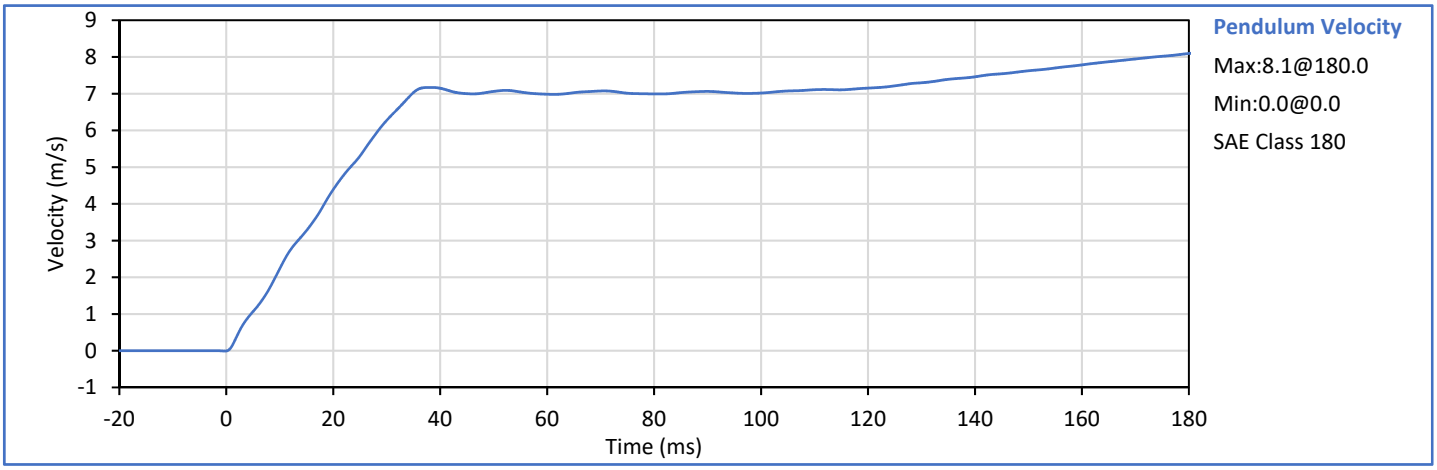
Applus IDIADA KARCO

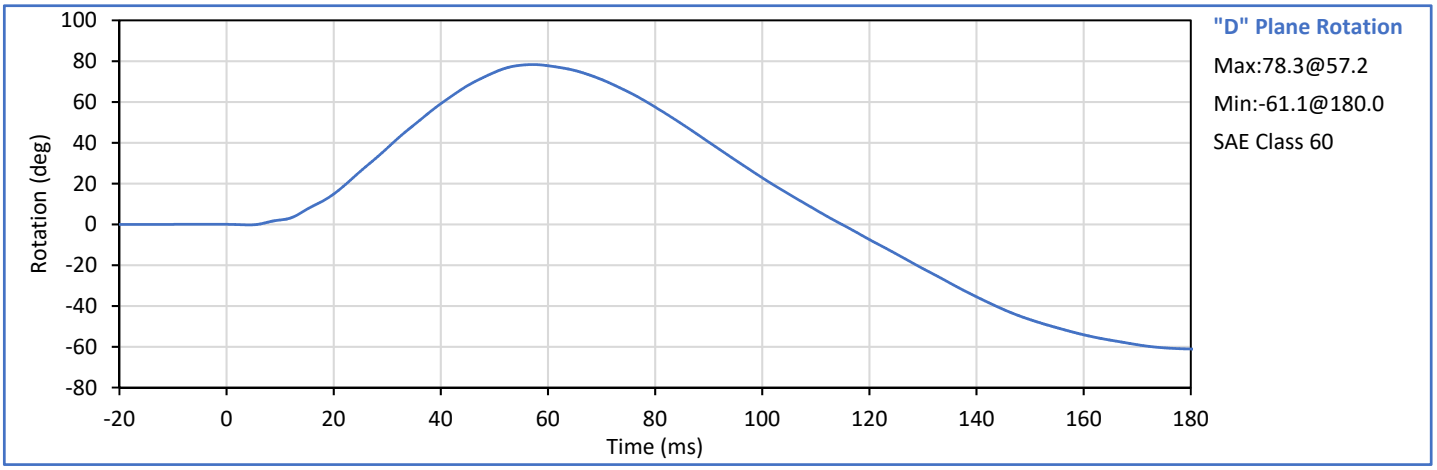
Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: 630

Test Date: 2019-02-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.0	Pass
Laboratory Humidity	%	10	70	25	Pass
Pendulum Velocity	m/s	6.89	7.13	6.93	Pass
Pendulum Velocity at 10 ms	m/s	2.10	2.50	2.24	Pass
Pendulum Velocity at 20 ms	m/s	4.00	5.00	4.39	Pass
Pendulum Velocity at 30 ms	m/s	5.80	7.00	6.27	Pass
Peak "D" Plane Rotation	deg	77.0	91.0	78.3	Pass
Peak Moment in Rotation	Nm	69.0	83.0	80.2	Pass
Positive Moment Decay to 10 Nm	ms	80.0	100.0	85.4	Pass
			Overall Test Results		Pass





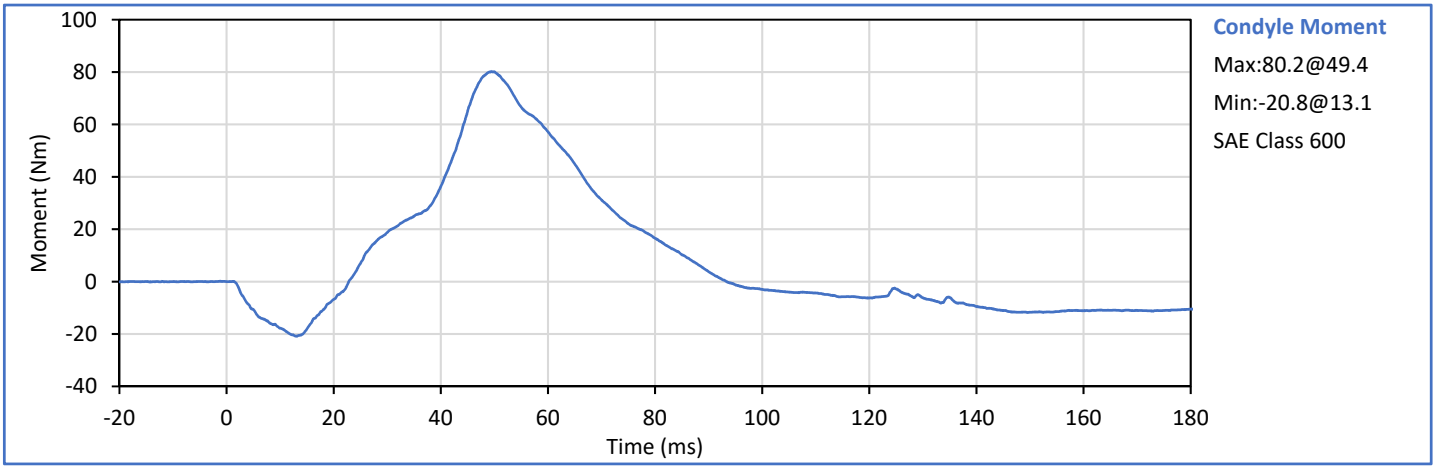
Technician: J. Hernandez

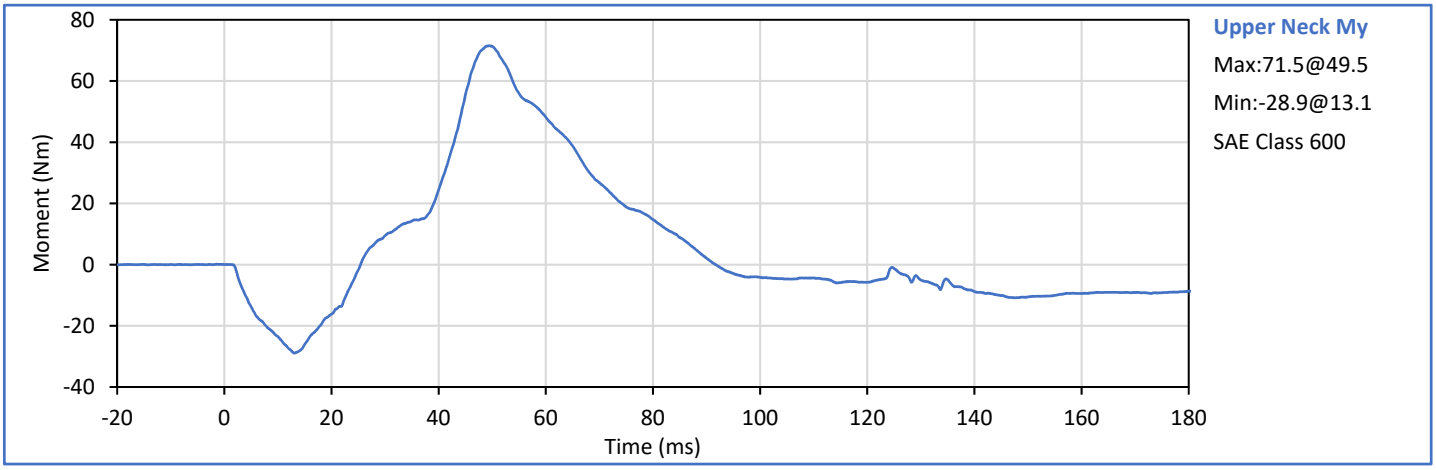
Approved By: P. Puzzuto

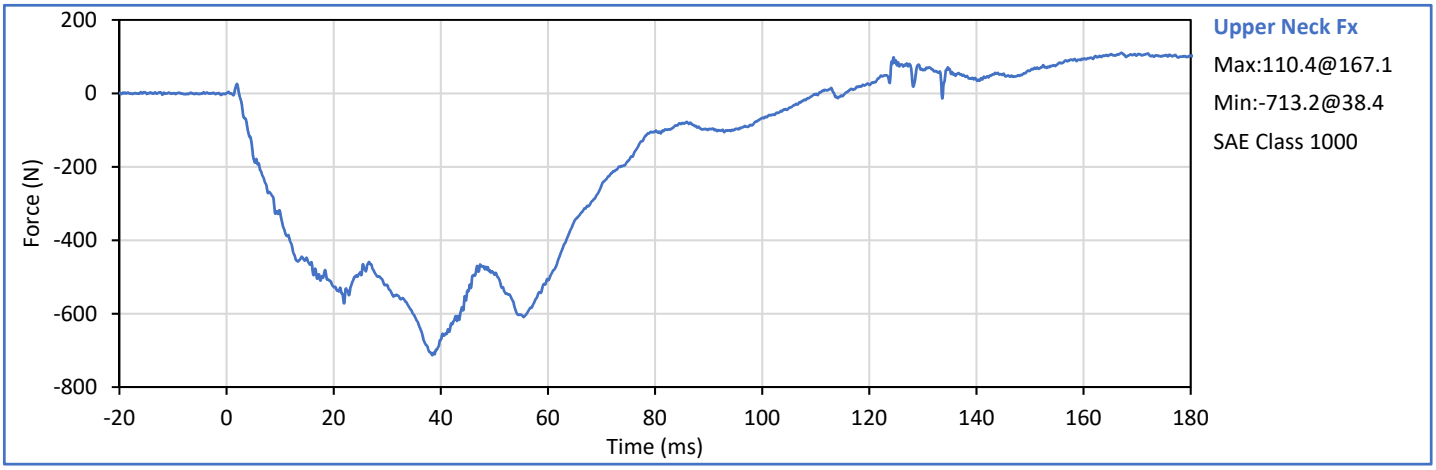
Applus IDIADA
KARCO

Hybrid III 5th Percentile Female ATD
Neck Flexion Test

ATD Serial No.: 630 Test Date: 2019-02-21





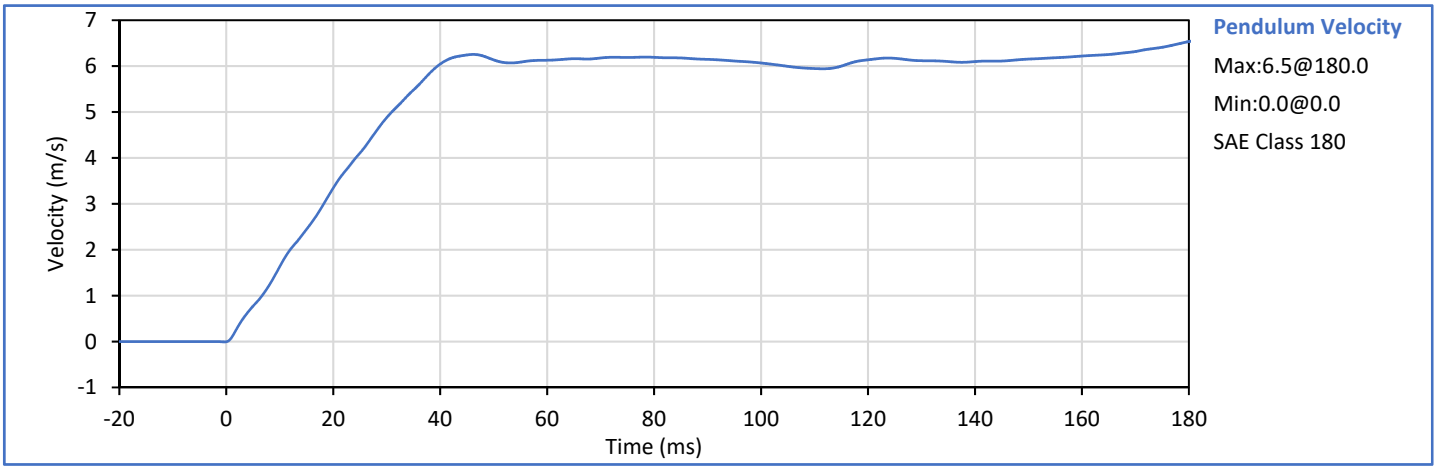


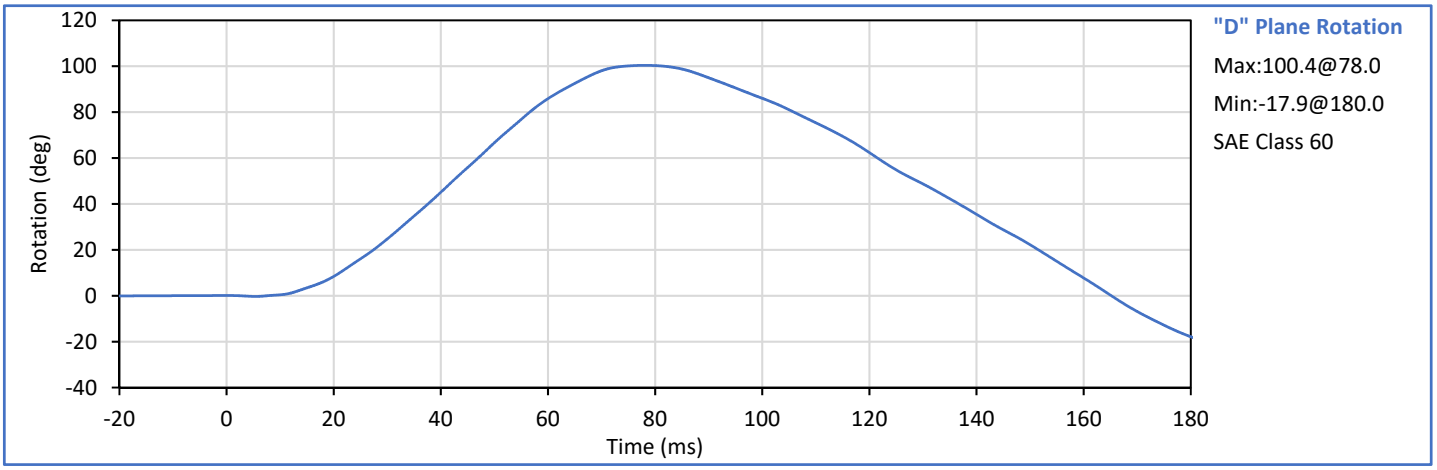
Applus IDIADA KARCO

Hybrid III 5th Percentile Female ATD
Neck Extension Test

ATD Serial No.: 630 Test Date: 2019-02-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.0	Pass
Laboratory Humidity	%	10	70	25	Pass
Pendulum Velocity	m/s	5.95	6.19	6.10	Pass
Pendulum Velocity at 10 ms	m/s	1.50	1.90	1.63	Pass
Pendulum Velocity at 20 ms	m/s	3.10	3.90	3.34	Pass
Pendulum Velocity at 30 ms	m/s	4.60	5.60	4.88	Pass
Peak "D" Plane Rotation	deg	99.0	114.0	100.4	Pass
Peak Moment in Rotation	Nm	-65.0	-53.0	-56.9	Pass
Negative Moment Decay to -10 Nm	ms	94.0	114.0	104.5	Pass
			Overall Test Results		Pass





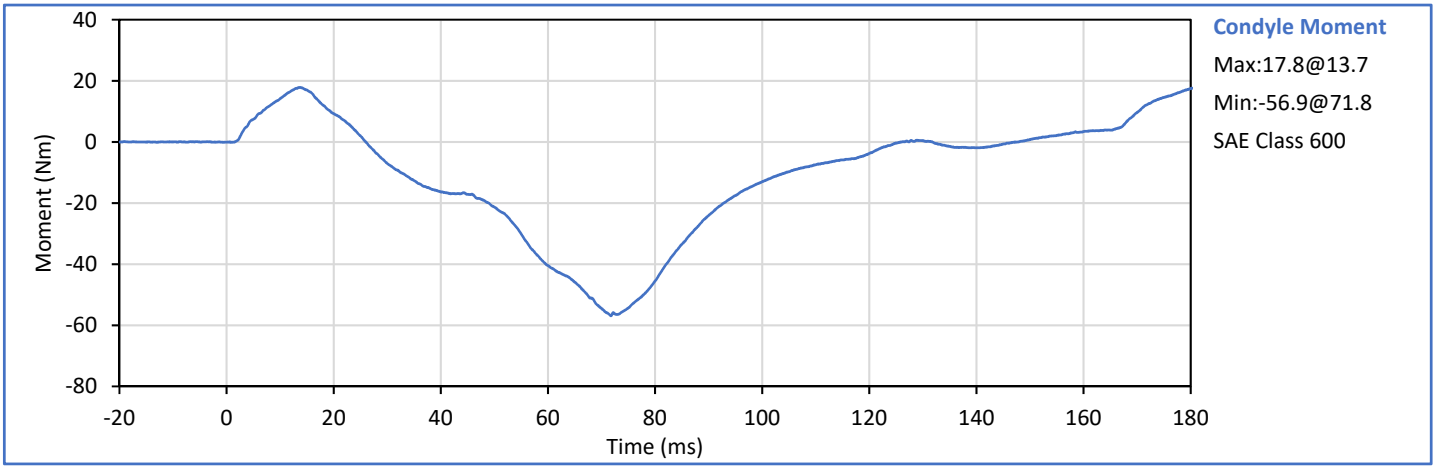
Technician: J. Hernandez

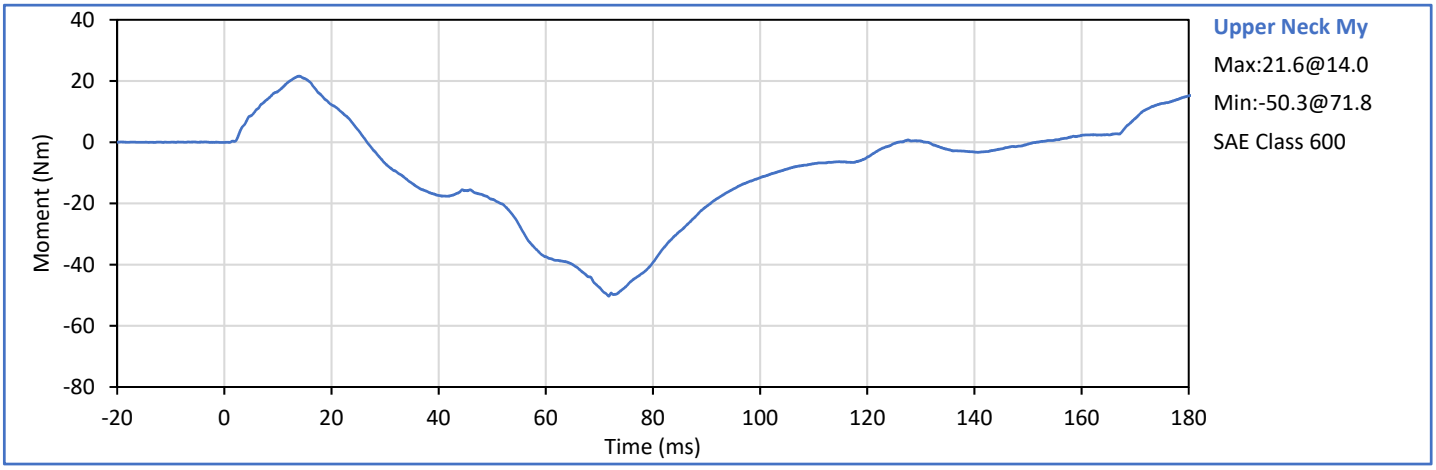
Approved By: P. Puzzuto

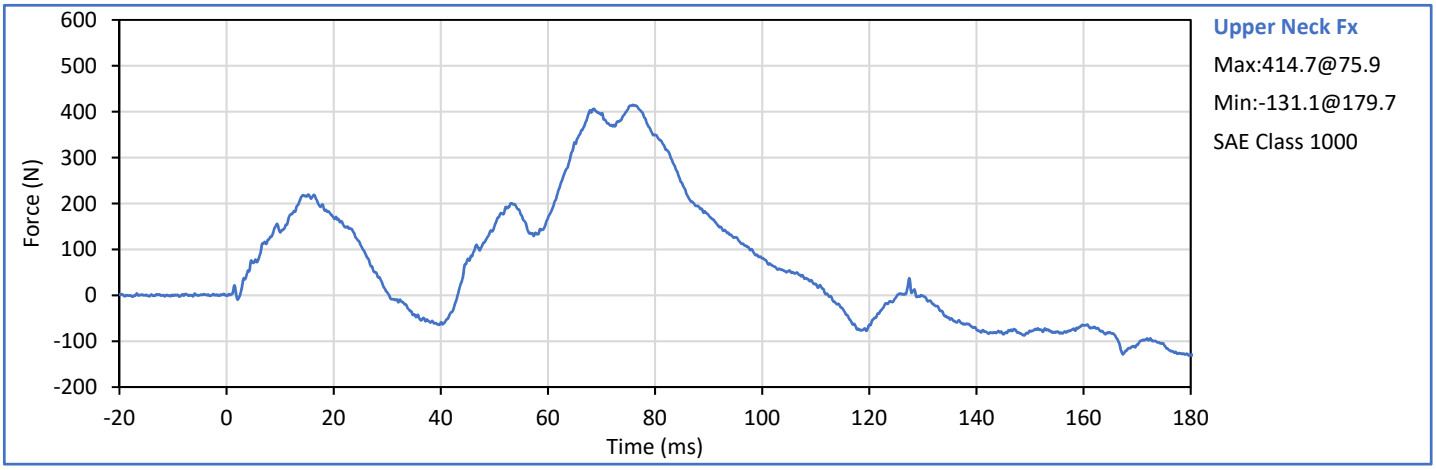
Applus IDIADA
KARCO

Hybrid III 5th Percentile Female ATD
Neck Extension Test

ATD Serial No.: 630 Test Date: 2019-02-21







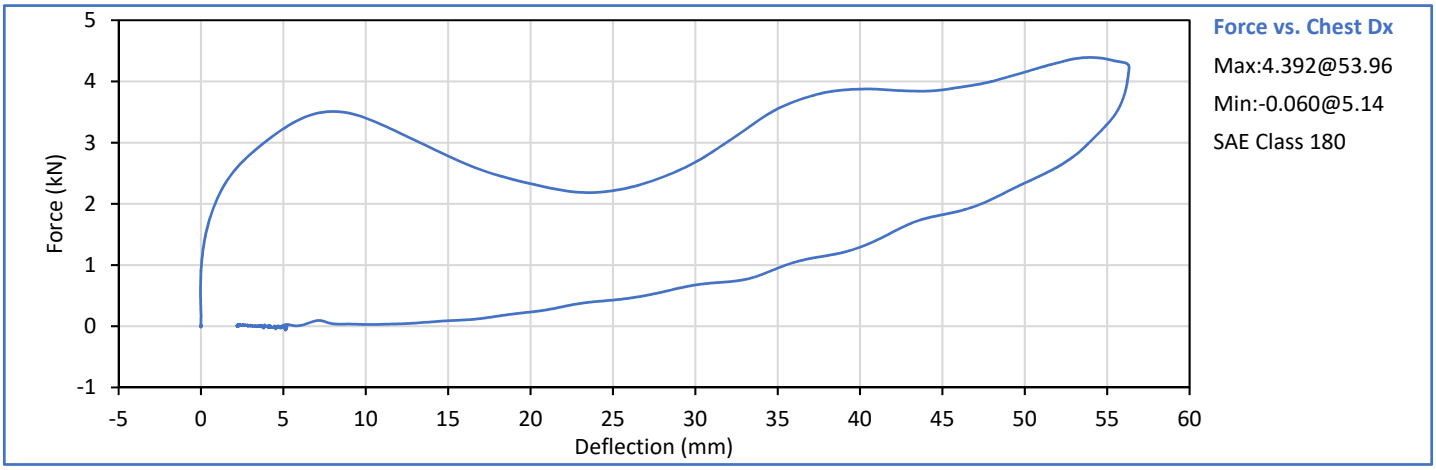
Applus IDIADA
KARCO

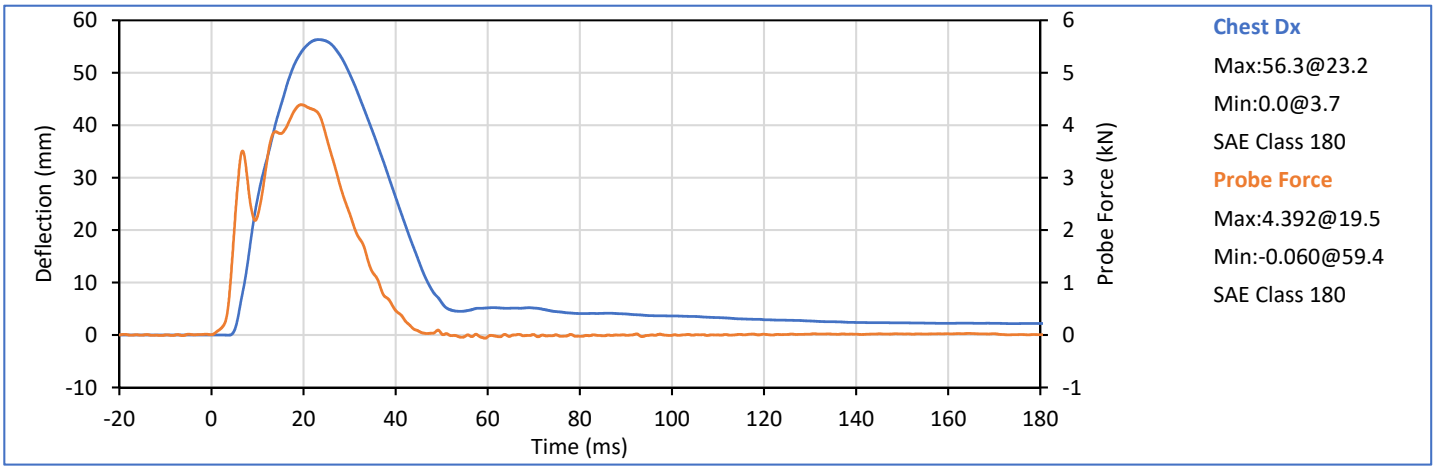
Hybrid III 5th Percentile Female ATD
Thorax Impact

ATD Serial No.: 630

Test Date: 2019-02-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Humidity	%	10	70	22	Pass
Probe Velocity	m/s	6.59	6.83	6.71	Pass
Peak Chest Deflection	mm	50.0	58.0	56.3	Pass
Peak Probe Force, 50 and 58 mm	kN	3.900	4.400	4.392	Pass
Peak Probe Force, 18 and 50 mm	kN	0.000	4.600	4.149	Pass
Internal Hysterisis	%	69.0	85.0	71.6	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

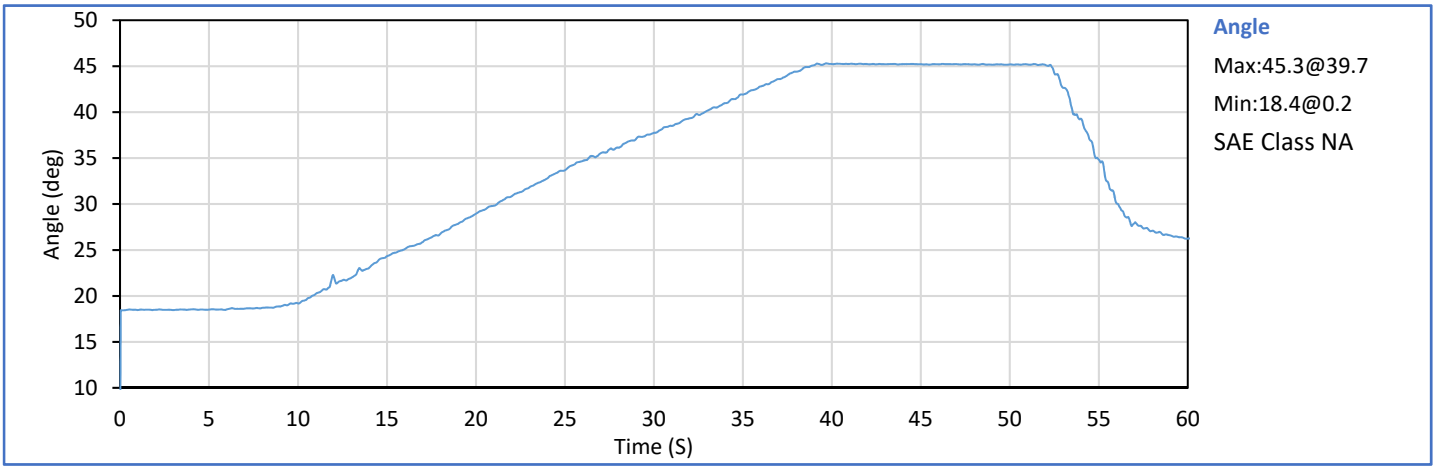
Applus IDIADA
KARCO

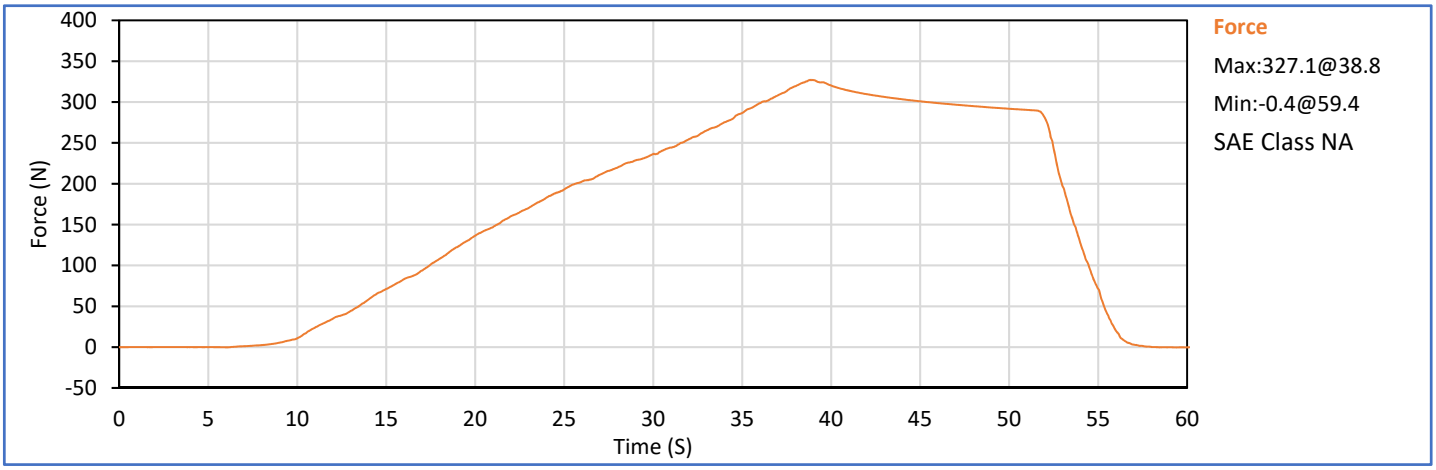
Hybrid III 5th Percentile Female ATD
Torso Flexion Test

ATD Serial No.: 630

Test Date: 2019-02-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.4	Pass
Laboratory Humidity	%	10	70	32	Pass
Orientation Angle	deg	0.0	20.0	15.1	Pass
Test Initial Angle	deg	11.0	19.0	18.4	Pass
Peak Force at 45° (+/-0.5°)	N	320.0	390.0	326.8	Pass
Torso Flexion Rate	deg/s	0.50	1.50	0.89	Pass
Final Reference Plane Angle	deg	-8.0	8.0	1.5	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

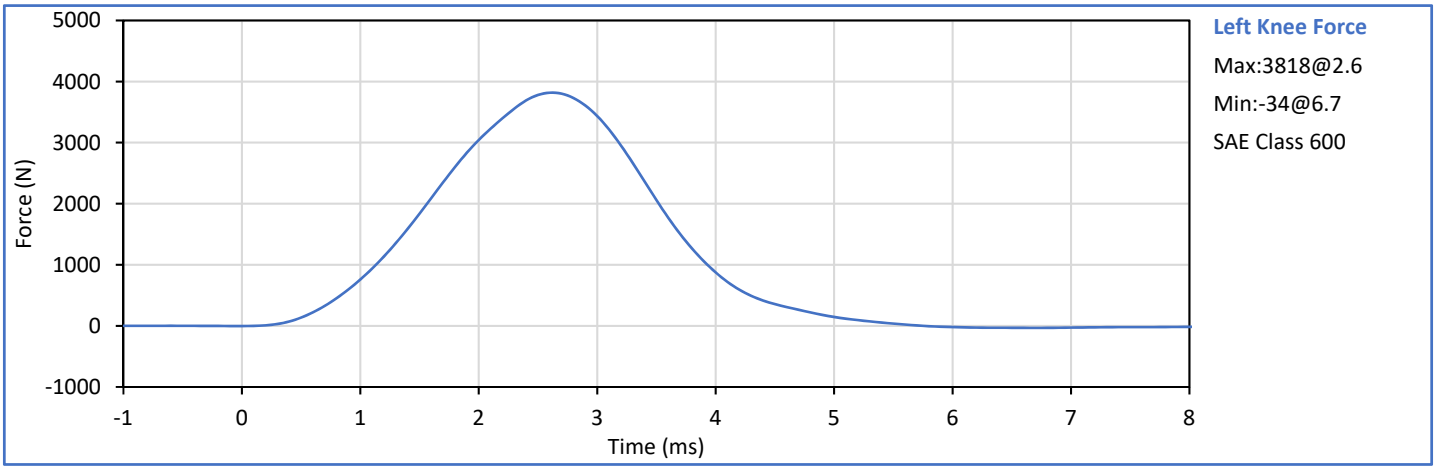
Applus IDIADA KARCO

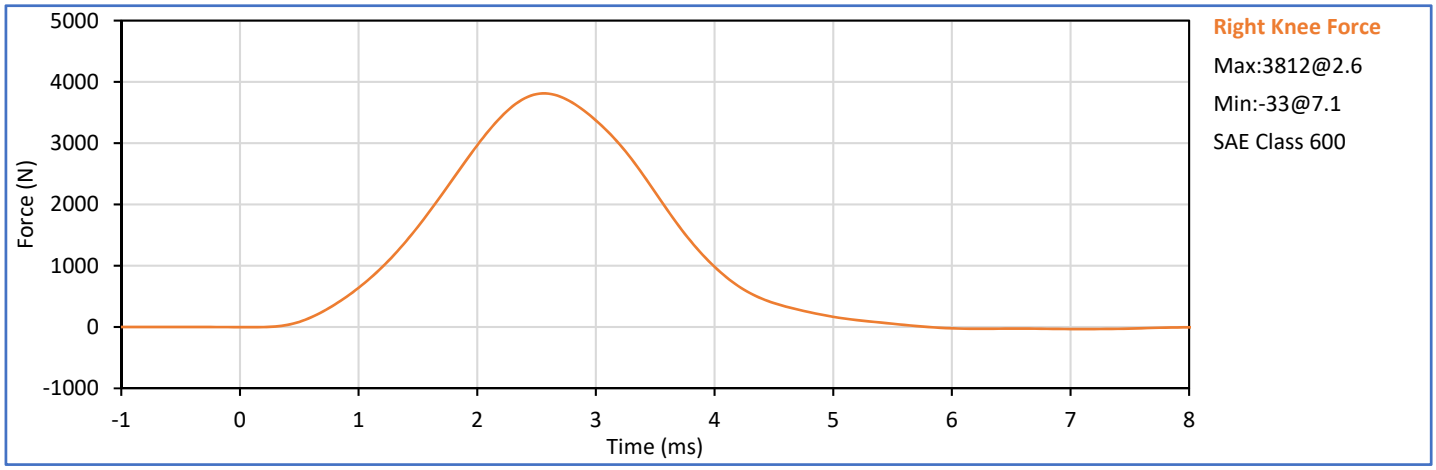
Hybrid III 5th Percentile Female ATD
Knee Impact (Left/Right)

ATD Serial No.: 630

Test Date: 2019-02-22

	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	2.102	Pass
	Peak Resistive Force	N	3450	4060	3818	Pass
Right Knee	Probe Velocity	m/s	2.070	2.130	2.108	Pass
	Peak Resistive Force	N	3450	4060	3812	Pass
				Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto