

REPORT NUMBER: NCAP-KAR-19-015

**NEW CAR ASSESSMENT PROGRAM (NCAP)
FRONTAL BARRIER IMPACT TEST**

**HYUNDAI MOTOR COMPANY
2019 HYUNDAI KONA SE AWD 5-DOOR MPV**

NHTSA NUMBER: M20194200

**PREPARED BY:
APPLUS IDIADA KARCO ENGINEERING, LLC.
9270 HOLLY ROAD
ADELANTO, CA 92301**



FEBRUARY 15, 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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		15. Supplementary Notes																																																					
16. Abstract A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2019 Hyundai Kona SE AWD 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 1, 2019. The impact velocity of the vehicle was 56.11 km/h and the ambient temperature at the barrier face at the time of impact was 16.1°C. The target vehicle's post-test maximum crush was 480 mm at DPD3 to the left of the vehicle's centerline. The test vehicle's performance is as follows: <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Measurement Description</th><th rowspan="2">Units</th><th colspan="2">Driver ATD</th><th colspan="2">Passenger ATD</th></tr> <tr> <th>Threshold</th><th>Result</th><th>Threshold</th><th>Result</th></tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td><td>N/A</td><td>700</td><td>205.2</td><td>700</td><td>216.9</td></tr> <tr> <td>Maximum Chest Compression</td><td>mm</td><td>63</td><td>-25</td><td>52</td><td>-16</td></tr> <tr> <td>Nij</td><td>N/A</td><td>1</td><td>0.20</td><td>1</td><td>0.37</td></tr> <tr> <td>Neck Tension</td><td>N</td><td>4170</td><td>919.1</td><td>2620</td><td>858.2</td></tr> <tr> <td>Neck Compression</td><td>N</td><td>4000</td><td>-252.5</td><td>2520</td><td>-310.3</td></tr> <tr> <td>Left Femur Force</td><td>N</td><td>10000</td><td>-128.0</td><td>6800</td><td>-260.5</td></tr> <tr> <td>Right Femur Force</td><td>N</td><td>10000</td><td>-1030.2</td><td>6800</td><td>-121.4</td></tr> </tbody> </table>				Measurement Description	Units	Driver ATD		Passenger ATD		Threshold	Result	Threshold	Result	Head Injury Criteria (HIC ₁₅)	N/A	700	205.2	700	216.9	Maximum Chest Compression	mm	63	-25	52	-16	Nij	N/A	1	0.20	1	0.37	Neck Tension	N	4170	919.1	2620	858.2	Neck Compression	N	4000	-252.5	2520	-310.3	Left Femur Force	N	10000	-128.0	6800	-260.5	Right Femur Force	N	10000	-1030.2	6800	-121.4
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program, sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-12-D-00259. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure, dated October 2015.

SUMMARY

A load cell barrier consisting of 176 load cells was impacted by a 2019 Hyundai Kona SE AWD 5-door MPV at a velocity of 56.11 km/h. The test was performed at Applus IDIADA KARCO Engineering, LLC. on February 1, 2019. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A of this report.

Three (3) real-time cameras and sixteen (16) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in Data Sheet 6 of this report.

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

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck force transducers, right / left femur load cells, and lower leg instrumentation. The driver (position 1) ATD (Serial No. 360) and the right-front passenger (position 2) ATD (Serial No. 141) were calibrated prior to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 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 408 mm at DPD3 to the left of the vehicle's centerline. Both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

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

The passenger's visible contact points were as follows: The passenger ATD's head contacted the frontal airbag and headrest. The upper torso contacted the frontal airbag.

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)	205.2	57.4	72.4	-25	0.20	919.1	-252.5	-128.0	-1030.2
Passenger (5th)	216.9	65.0	80.0	-16	0.37	858.2	-310.3	-260.5	-121.4

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

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	lb/in ²	kPa	6.895
Temperature	General Use	°F	°C	$=(T_f - 32)/1.8$
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 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
 Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	M20194200
Model Year	2019
Make	Hyundai
Model	Kona SE AWD
Body Style	5-Door MPV
VIN	KM8K1CAA3KU199714
Body Color	Pulse Red
Odometer Reading (km / mi)	179 / 111
Engine Displacement (L)	2.0
Type / No. of Cylinders	4 Cylinders
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	6 Speed
Overdrive	Yes
Final Drive	AWD
Roof Rack	No
Sunroof / T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADLs)	Yes

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

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

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Hyundai Motor Company
Date of Manufacture	Aug-18

GVWR (kg)	1900
GAWR Front (kg)	1040
GAWR Rear (kg)	1000

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)				390.0
DSC x 68.04 (kg)				340.2
Cargo Weight (RCLW) (kg)				49.8

A

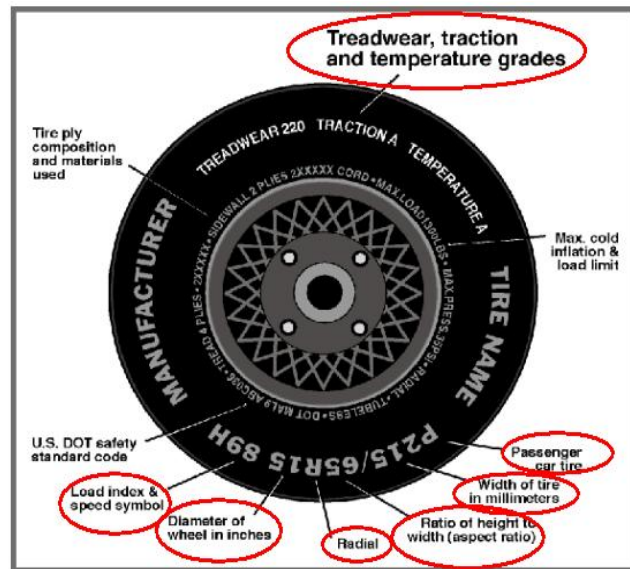
B

A-B

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
 Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	230	230
Recommended Tire Size	P205/60R16	P205/60R16
Tire Size on Vehicle	P205/60R16	P205/60R16
Tire Manufacturer	Hankook	Hankook
Tire Model	Kinergy GT	Kinergy GT
Treadwear	500	500
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 2 Steel, 1 Nylon	1 Polyester, 2 Steel, 1 Nylon
Load Index / Speed Symbol	92H	92H
Tire Material	Polyester, Steel, Nylon	Polyester, Steel, Nylon
DOT Safety Code Left	1T79X 1BHO 2718	1T79X 1BHO 2718
DOT Safety Code Right	1T79X 1BHO 2718	1T79X 1BHO 2718

DATA SHEET NO. 1 ... (CONTINUED)**GENERAL TEST AND VEHICLE PARAMETER DATA**Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19**TEST VEHICLE WEIGHTS**

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	408.5	298.0		456.5	360.5	
Right	kg	421.5	262.0		433.0	324.5	
Ratio	%	59.7%	40.3%	100.0%	56.5%	43.5%	100.0%
Total	kg	830.0	560.0	1390.0	889.5	685.0	1574.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1390.0	A
Weight of 1 P572E ATD & 1 P572O ATD	kg	141.0	B
Rated Cargo/Luggage Weight (RCLW)	kg	67.8	C
Calculated Vehicle Target Weight (TVTW)	kg	1598.8	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	861	859	900	902	1047
As Tested	mm	832	845	838	844	1131
Post-Test	mm	864	884	820	845	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheelbase	mm	2602
Total Vehicle Length at Left Side	mm	3520
Total Vehicle Length at Centerline	mm	4167
Total Vehicle Length at Right Side	mm	3515
Weight of Ballast in Cargo Area	kg	53.0
Weight of Vehicle Components Removed	kg	18.0
Amount of Stoddard Solvent in Fuel Tank	L	46.48

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

Rear Trim and Spare Tire (18.0 kg)

DATA SHEET NO. 1 ... (CONTINUED)**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

TARGET VEHICLE STRUCTURAL MEASUREMENTS

No.	Description	Pre-Test
1	Total Length	4167
2	Total Width	1805
3	Bumper Top Height	740
4	Bumper Bottom Height	345
5	Longitudinal Member Top Height	530
6	Distance Between Longitudinal Members	930
7	Longitudinal Member Width	80
8	Engine Top Height	873
9	Engine Bottom Height	206
10	Engine and Gearbox Width	400
11	Front Bumper to Engine Distance	410
12	Front Shock Absorber Fixing Height	877
13	Bonnet Leading Edge Height	874
14	Front Shock Absorber Fixing Width	1200
15	Front Bumper to Front Axle Distance	850
16	Front Axle to A-Pillar Distance	475
17	A-Pillar to B-Pillar Distance	953
18	B-Pillar to Rear Axle Distance	1077
19	B-Pillar to C-Pillar Distance	791
20	Roof Sill Bottom Height	1352
21	Roof Sill Top Height	1530
22	Floor Sill Bottom Height	355
23	Floor Sill Top Height	400

All measurements in millimeters.

DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

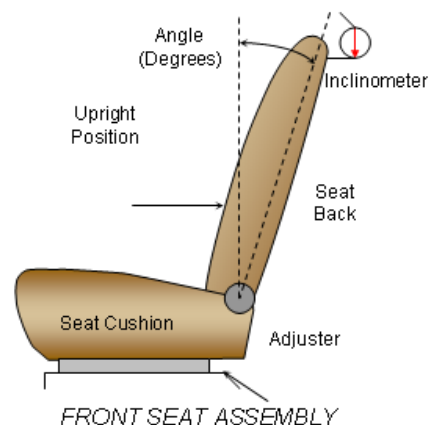
Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

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 $0^\circ \pm 0.5^\circ$. Seat back angle is measured at the headrest post.

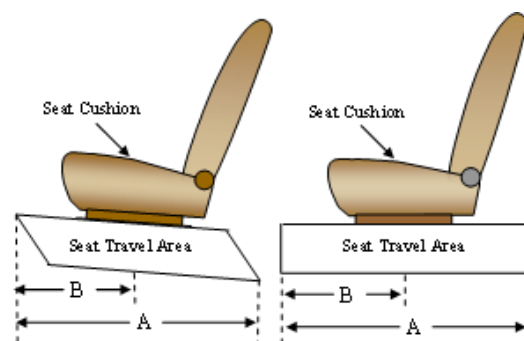
SEAT BACK ANGLE

Seating Position	Degrees
Driver Seat Back Angle	1.2
Passenger Seat Back Angle	2.9



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	38 detents	detent 14
Passenger Seat	35 detents	detent 0

SEAT BELT UPPER ANCHORAGE

The seat belt upper anchorage is positioned to the manufacturer's design position for a 50th percentile adult male ATD for the driver, and a 5th percentile adult female ATD for the passenger. Position "H" is the uppermost position, followed by position "M", and Position "L" is the lowermost position.

SEAT BELT UPPER ANCHORAGES

Seating Position	Total No. of Positions	Placed in Position
Driver Seat	3	H
Passenger Seat	3	M

DATA SHEET NO. 2 ... (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200

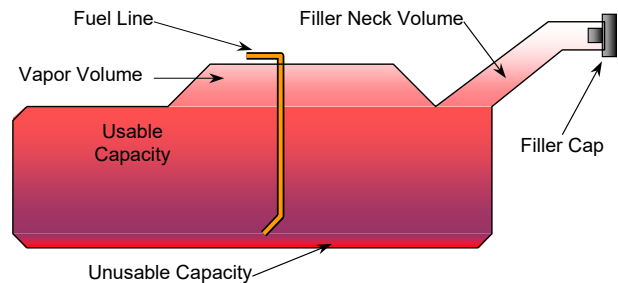
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank"	49.96
Usable Capacity of "Optional Tank"	
92 - 94% of Usable Capacity	45.96 to 46.96
Actual Amount of Stoddard Solvent Used	46.48
1/3 of Usable Capacity	16.65

FUEL PUMP

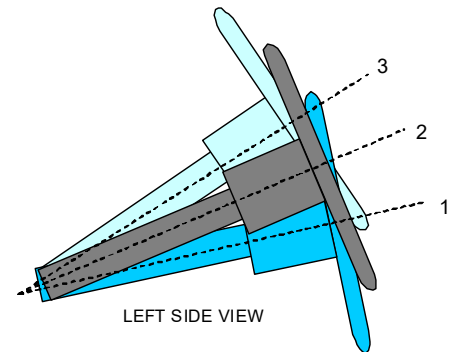
The vehicle is equipped with an electric fuel pump. The fuel pump operates a few seconds after the ignition switch is turned ON.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

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



STEERING COLUMN ASSEMBLY

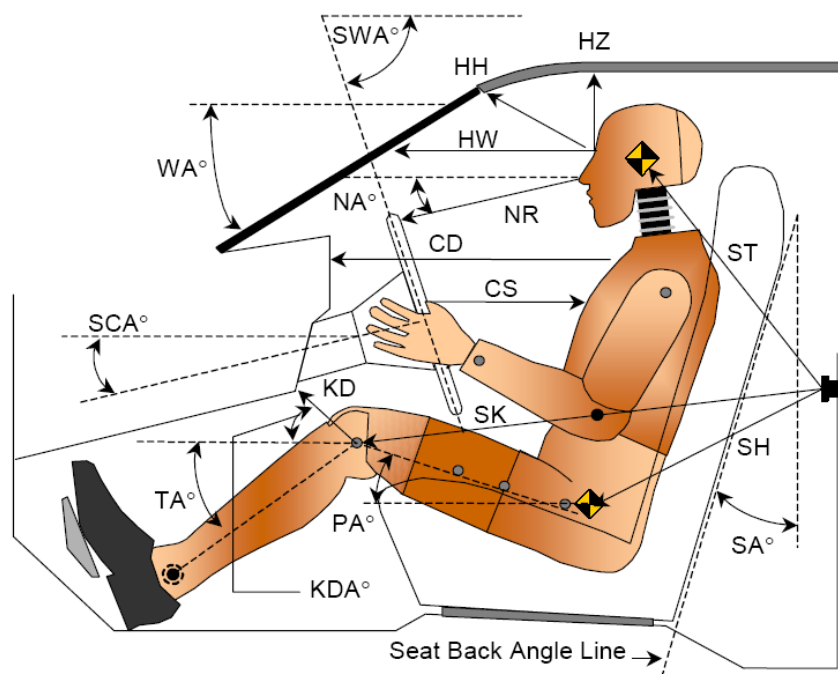
STEERING COLUMN POSITIONING

	Degrees	Fore-Aft Position (mm)
Lowermost Position, No. 1	24.3	95
Geometric Center Position, No. 2	27.0	118
Uppermost Position, No. 3	29.7	140
Telescoping Steering Wheel Travel		45
Test Position	27.0	118

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
 Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19



LEFT SIDE VIEW

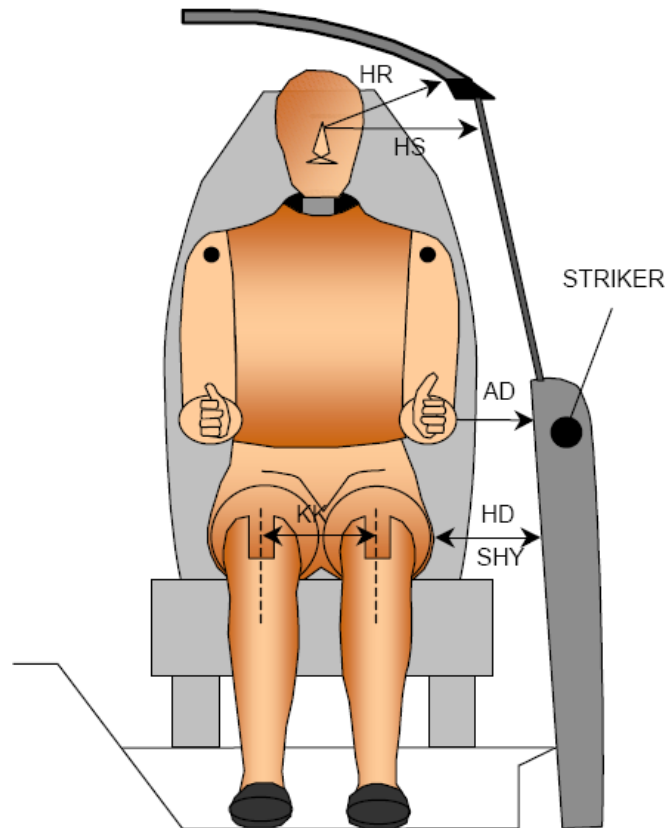
Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		26.8		
SWA°	Steering Wheel Angle		63.0		
SCA°	Steering Column Angle		27.0		
SA°	Seat Back Angle (On Headrest Post)		1.2		2.9
HZ	Head to Roof	210	90.0	284	90.0
HH	Head to Header	342	25.1	335	46.7
HW	Head to Windshield	685	0.0	696	0.0
NR	Nose to Rim	385	7.1	505	21.8
CD	Chest to Dash	522	9.9	471	0.6
CS	Chest to Steering Hub	299	1.4		
RA	Rim to Abdomen	181	0.0		
KDL	Left Knee to Dash	153	24.2	133	32.2
KDR	Right Knee to Dash	124	30.0	156	33.5
PA°	Pelvic Angle		24.8		21.4
TA°	Tibia Angle		49.4		47.4
SK	Striker to Knee	595	14.1	636	17.6
ST	Striker to Head	379	77.7	320	66.6
SH	Striker to H-Point	332	55.3	388	44.9

DATA SHEET NO. 4

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200

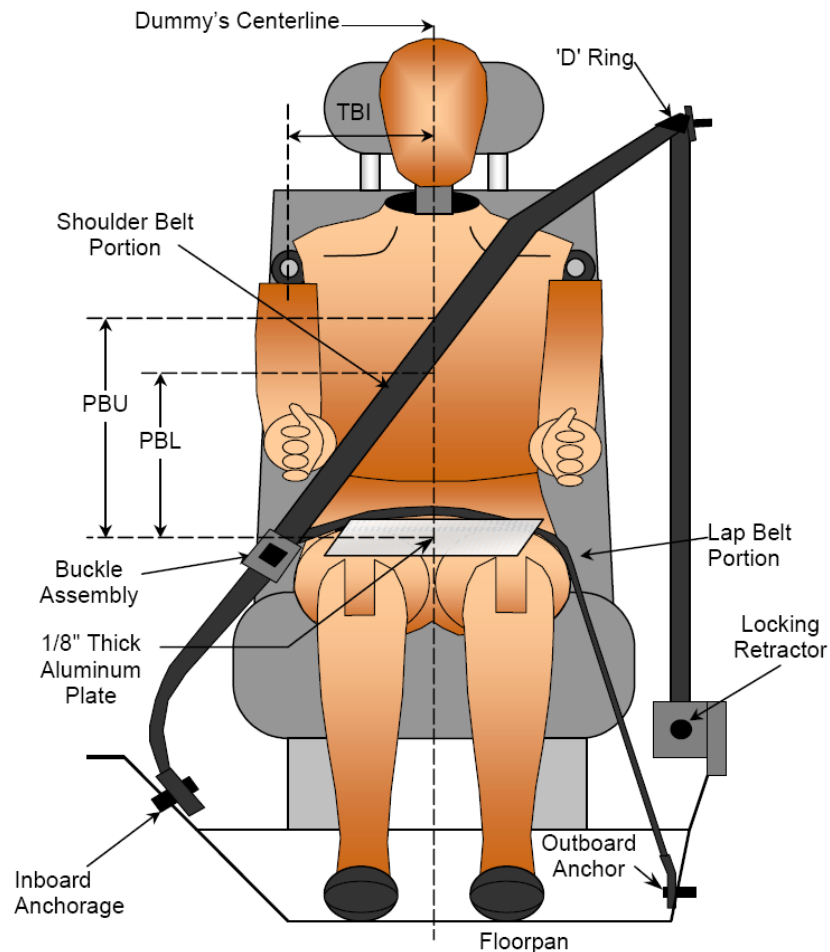
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19



Code	Description	Driver (mm)	Passenger (mm)
AD	Arm to Door	111	92
HD	H-Point to Door	136	192
HR	Head to Side Header	245	293
HS	Head to Side Window	360	395
KK	Knee to Knee	340	165
SHY	Striker to H-Point (Y-Direction)	228	269
AA	Ankle to Ankle	350	190

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
 Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Code	Measurement Description	Units	Driver	Passenger
PBU	Top Surface of Aluminum Plate to Belt Upper Edge	mm	325	285
PBL	Top Surface of Aluminum Plate to Belt Lower Edge	mm	250	205

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as Measured on ATD	mm	880	911
Lap Belt Length as Measured on ATD	mm	660	675
Remainder of Belt on Reel	mm	930	907
Total Belt Length for Continuous Webbing Systems	mm	2470	2493

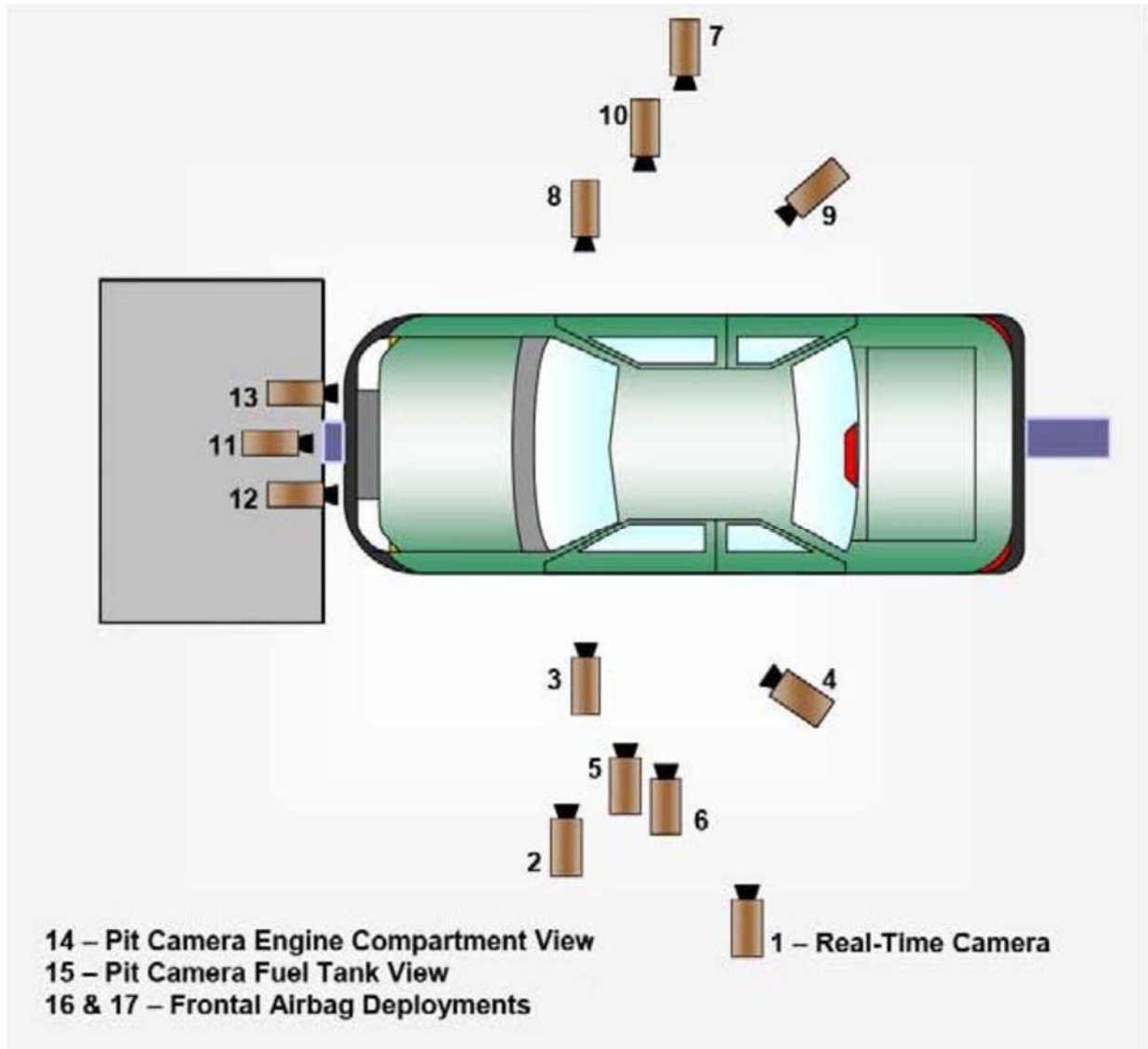
DATA SHEET NO. 6

HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 ... (CONTINUED)**HIGH-SPEED CAMERA LOCATIONS AND DATA**Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19**CAMERA LOCATIONS**

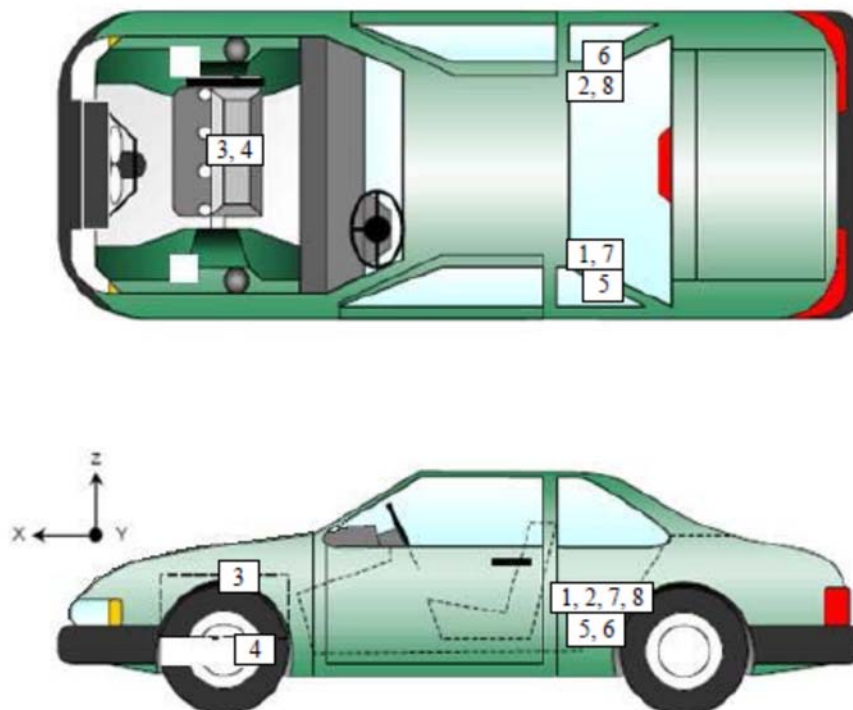
No.	Description	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall	-11412	-8150	-1484		30
2	Driver Close-Up	-2590	-7950	-1371	50	1000
3	Left Front Half	-1701	-6197	-1701	35	1000
4	Left Angle	-6696	-10308	-3211	105	1000
5	Steering Column - Top	-1966	-10412	-3688	35	1000
6	Steering 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 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
 Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Description	Location		
		X	Y	Z
1	Left Rear Accelerometer X-Direction	1560	-690	-350
2	Right Rear Accelerometer X-Direction	1560	690	-350
3	Engine Top X	3450	0	-870
4	Engine Bottom X	3440	-150	-380
5	Left Rear Accelerometer Z-Direction	3300	-880	-400
6	Right Rear Accelerometer Z-Direction	3300	880	-400
7	Left Rear Accelerometer X-Direction Redundant	1560	-690	-350
8	Right Rear Accelerometer X-Direction Redundant	1560	690	-350

Reference Points:

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

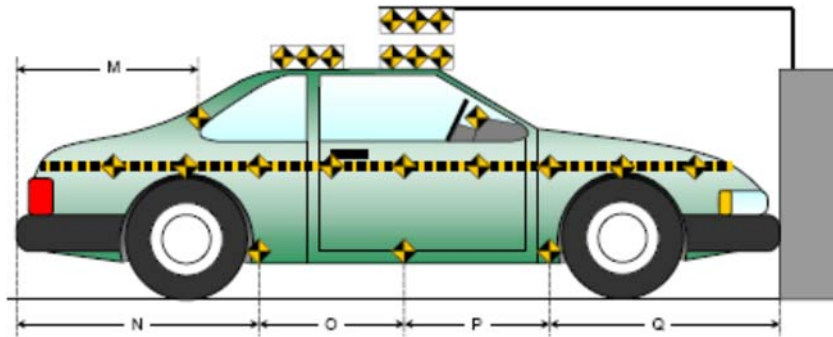
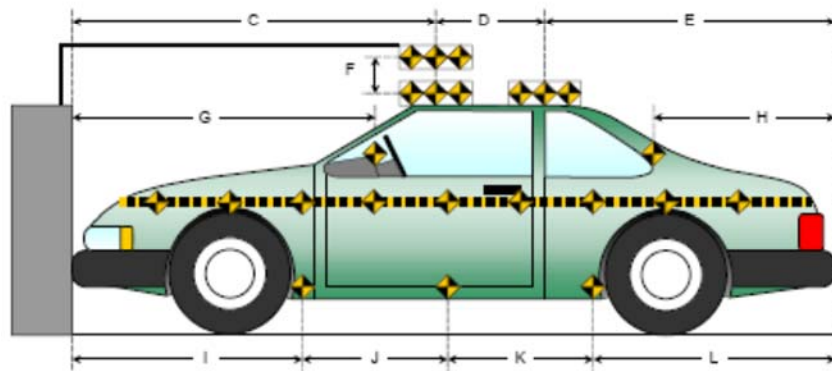
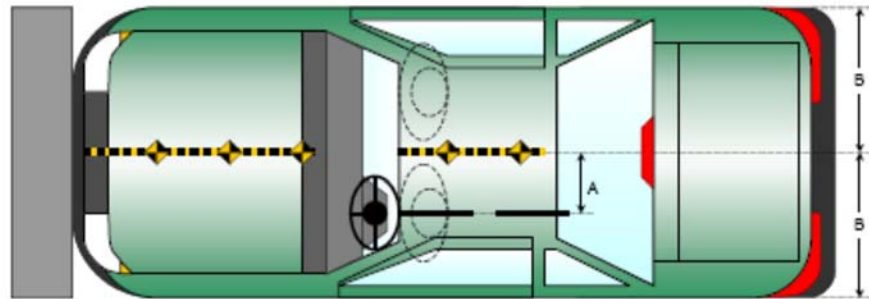
DATA SHEET NO. 8

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

Item	Value
A	380
B	902
C	2060
D	610
E	1510
F	305
G	1630
H	500
I	1295
J	850
K	850
L	1175
M	505
N	1175
O	850
P	850
Q	1295



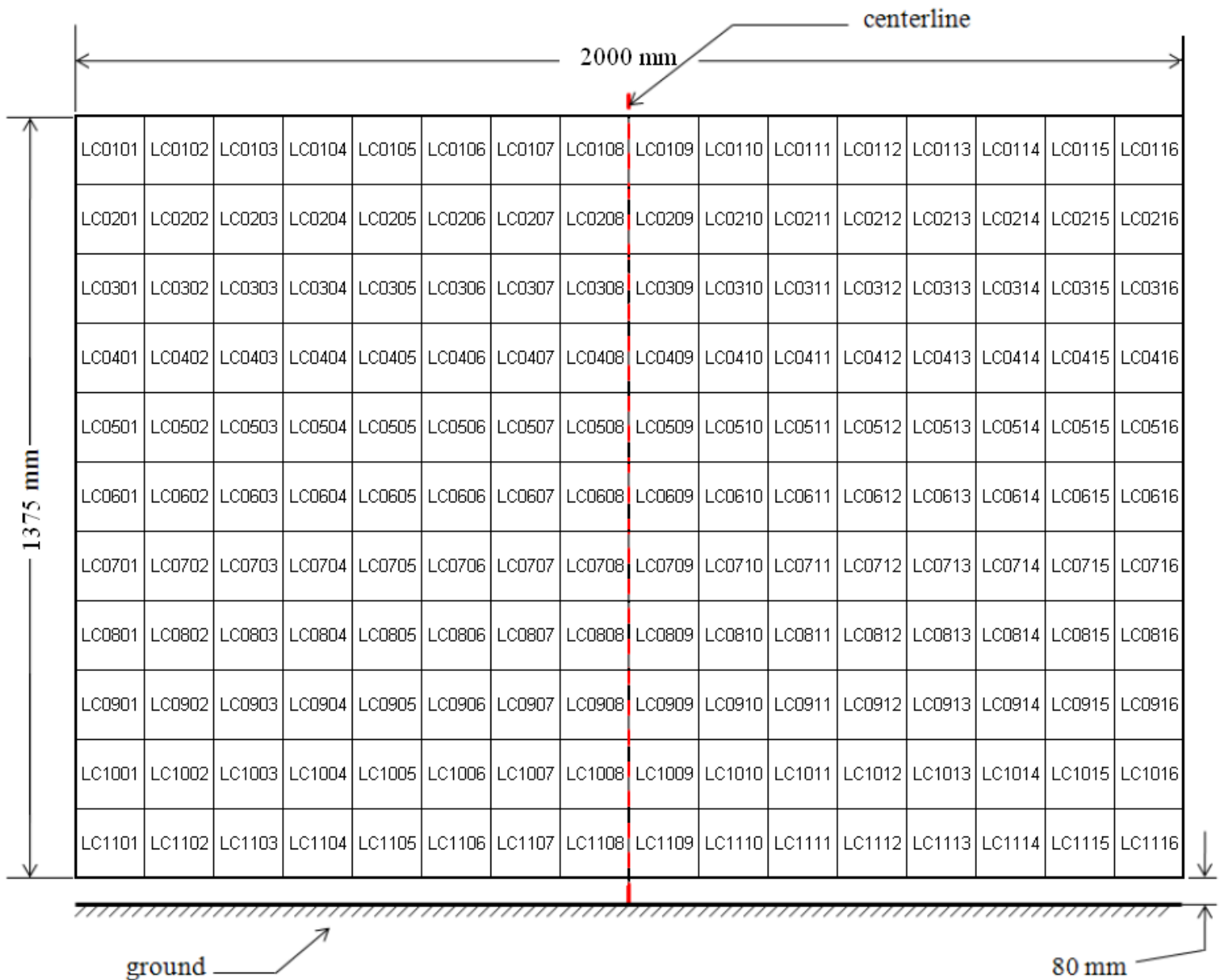
All measurements in millimeters.

DATA SHEET NO. 9

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19



DATA SHEET NO. 10**TEST VEHICLE CAMERA AND INSTRUMENTATION SUMMARY**Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19**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 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

TEST DUMMY INFORMATION AND CONTACT

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

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)	0	0
Seat Back Failure	None	None
Glazing Damage	None	None

POST-TEST STRUCTURAL OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	2515
Center	mm	2410
Right Side	mm	2360
Average	mm	2428

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

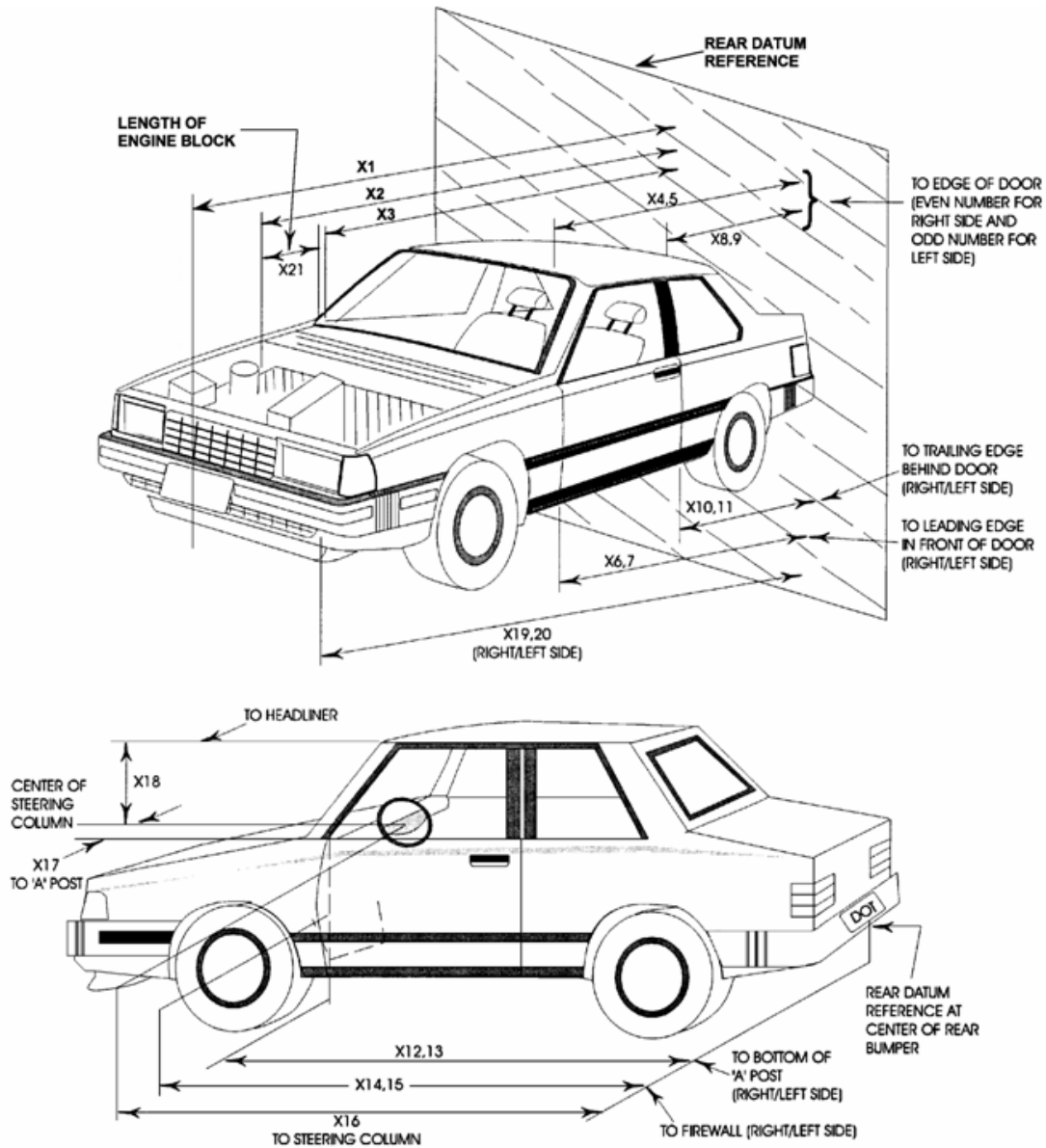
Restraint Type	Driver		Passenger	
	Installed	Operated	Installed	Operated
Front Airbag	Yes	Yes	Yes	Yes
Side Airbag 1 (Curtain)	Yes	No	Yes	No
Side Airbag 2 (Torso/Pelvis)	Yes	No	Yes	No
Knee Airbag	No		No	
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Yes	Yes	Yes

DATA SHEET NO. 12

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19



DATA SHEET NO. 12 ... (CONTINUED)**VEHICLE PROFILE MEASUREMENTS**Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4167	3787	-380
2	Rear Surface of Vehicle to Front of Engine	3757	3600	-157
3	RSOV to Firewall	3087	3077	-10
4	RSOV to Upper Leading Edge of Right Door	2860	2870	10
5	RSOV to Upper Leading Edge of Left Door	2865	2825	-40
6	RSOV to Lower Leading Edge of Right Door	2830	2830	0
7	RSOV to Lower Leading Edge of Left Door	2845	2840	-5
8	RSOV to Upper Trailing Edge of Right Door	1763	1775	12
9	RSOV to Upper Trailing Edge of Left Door	1770	1800	30
10	RSOV to Lower Trailing Edge of Right Door	1810	1800	-10
11	RSOV to Lower Trailing Edge of Left Door	1815	1805	-10
12	RSOV to Bottom of A-Pillar, Right Side	2791	2826	35
13	RSOV to Bottom of A-Pillar, Left Side	2790	2836	46
14	RSOV to Firewall, Right Side	3372	3372	0
15	RSOV to Firewall, Left Side	3367	3312	-55
16	RSOV to Steering Column	2550	2430	-120
17	Center of Steering Column to A-Pillar	410	415	5
18	Center of Steering Column to Headliner	450	440	-10
19	RSOV to Right Side of Front Bumper	3515	3577	62
20	RSOV to Left Side of Front Bumper	3520	3517	-3
21	Length of Engine Block	550	550	0
RD	RSOV to Right Side of Dash Panel	2600	2530	-70
CD	RSOV to Center of Dash Panel	2490	2500	10
LD	RSOV to Left Side of Dash Panel	2805	2610	-195

All measurements in millimeters.

DATA SHEET NO. 13**ACCIDENT INVESTIGATION DIVISION DATA**

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
 Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

VEHICLE INFORMATION

VIN: KM8K1CAA3KU199714 Wheelbase (mm): 2602
 Vehicle Size Category: MPV Test Weight (kg): 1574.5

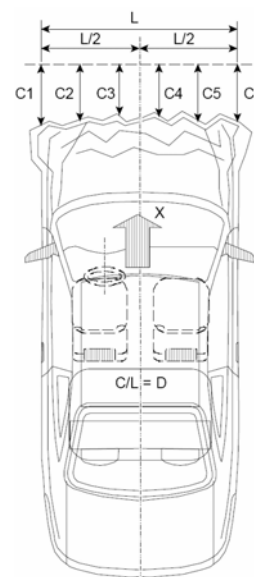
ACCELEROMETER DATA

Accelerometer Locations: Left Rear Crossmember
 Cal. Procedure/Interval: Vibration Test / 6 months
 Integration Algorithm: NHTSA Standard
 Impact Velocity (km/h): 56.11
 Velocity Change (km/h): 66.9
 Time of Separation (msec): 62.7

Linearity: Good

CRUSH PROFILE

Collision Deformation Classification: 12FDEW2
 Midpoint of Damage: Vehicle Centerline
 Damage Region Length (mm): 1392
 Impact Mode: Full Frontal



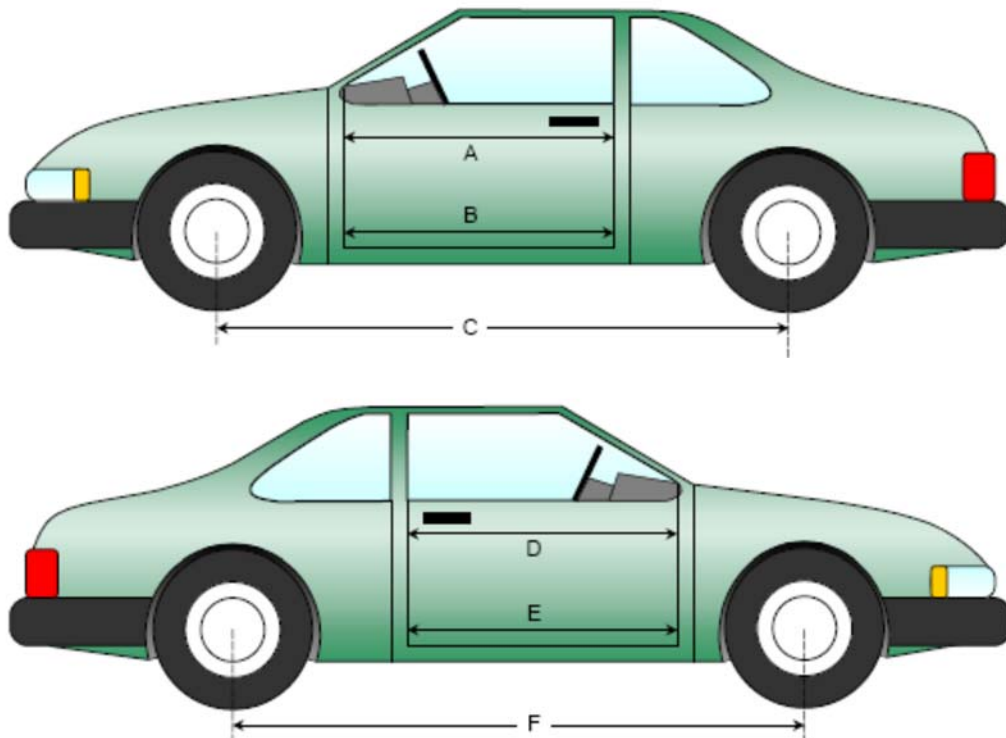
No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush Zone 1 at Left Side	mm	200	503	303
C2	Crush Zone 2 at Left Side	mm	40	460	420
C3	Crush Zone 3 at Left Side	mm	30	510	480
C4	Crush Zone 4 at Right Side	mm	30	510	480
C5	Crush Zone 5 at Right Side	mm	40	490	450
C6	Crush Zone 6 at Right Side	mm	200	485	285
L	C1 to C6	mm	1392		

DATA SHEET NO. 14**VEHICLE INTRUSION MEASUREMENTS**Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19**DOOR OPENING WIDTH**

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	966	961	5
B	Left Side Lower	mm	866	863	3
D	Right Side Upper	mm	959	956	3
E	Right Side Lower	mm	881	881	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2602	2540	62
F	Right Side Wheelbase	mm	2602	2560	42



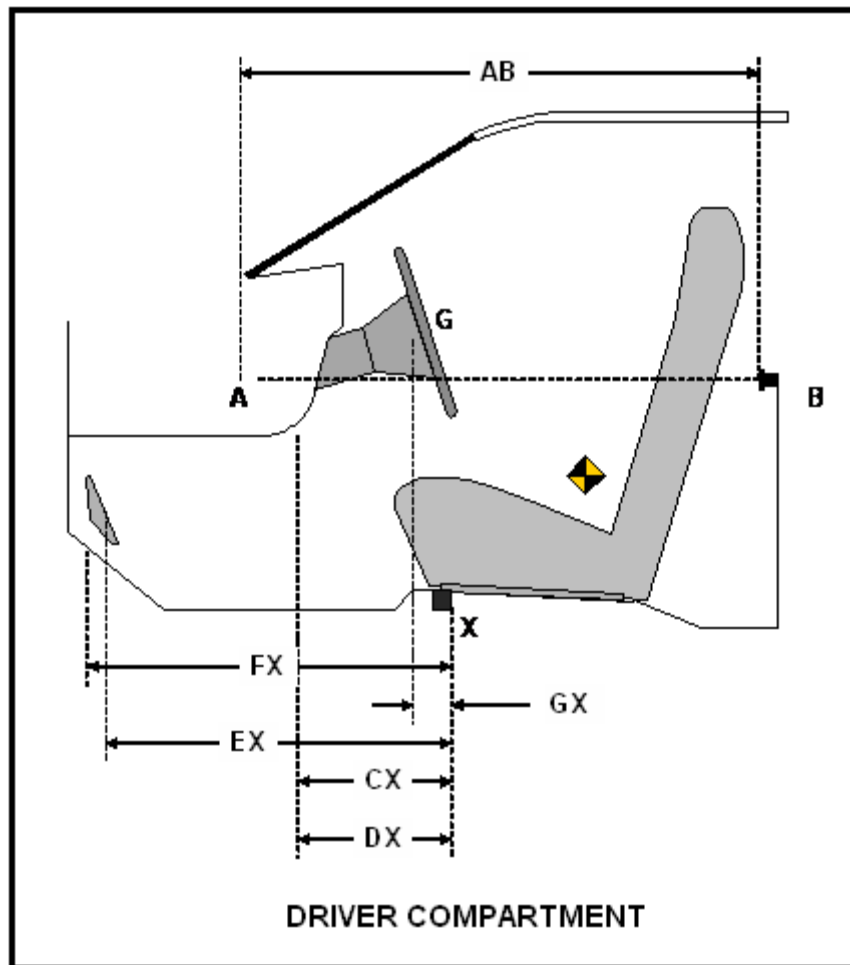
DATA SHEET NO. 14 ... (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
 Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	874	884	-10
CX	Left Knee Bolster to X	mm	330	340	-10
DX	Right Knee Bolster to X	mm	330	343	-13
EX	Brake Pedal to X	mm	530	530	0
FX	Foot Rest to X	mm	560	550	10
GX	Center of Steering Wheel Hub to X	mm	95	95	0

X = Front of Seat Track (Stationary)



DATA SHEET NO. 15

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

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
 Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

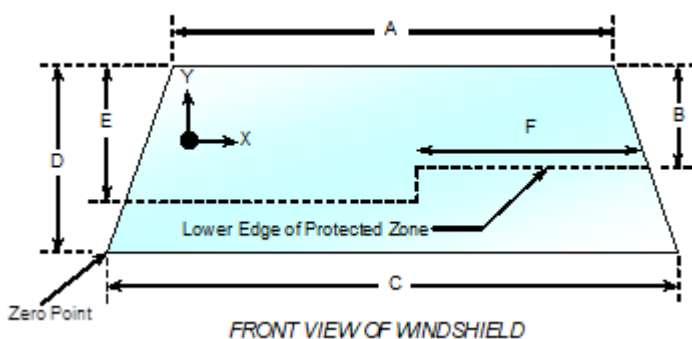
Windshield Mounting Details: Windshield glass is secured to the vehicle frame with rubber molding and rubber cement.

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

Temperature of windshield molding during test: 21.3° C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2222.5	2222.5	100.0%
Right Side	2222.5	2222.5	100.0%
Total	4445	4445	100.0%



Item	Units	Value
A	mm	1210
B	mm	390
C	mm	1465
D	mm	885
E	mm	276
F	mm	540

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 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 16.1° C Test Time: 12:27 PM

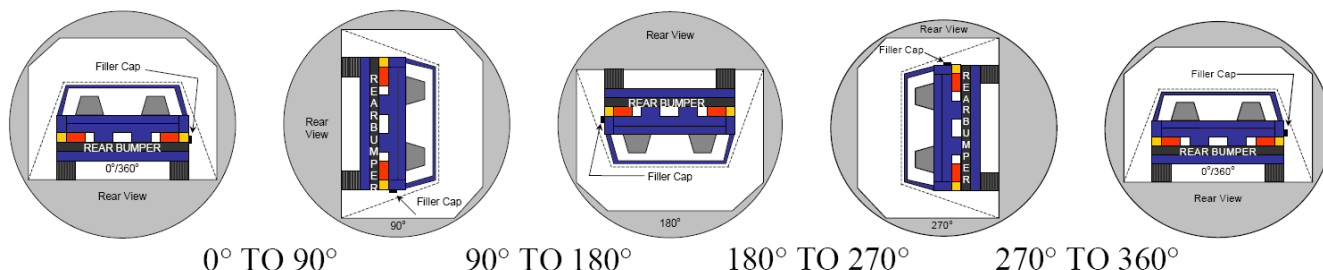
Stoddard Solvent Spillage Measurements

- A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)
- B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)
- C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)
- D. Spillage: There was no Stoddard solvent spillage.

DATA SHEET NO. 16

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200
 Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19



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°	79	300	379
90° To 180°	81	300	381
180° To 270°	81	300	381
270° To 360°	80	300	380

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

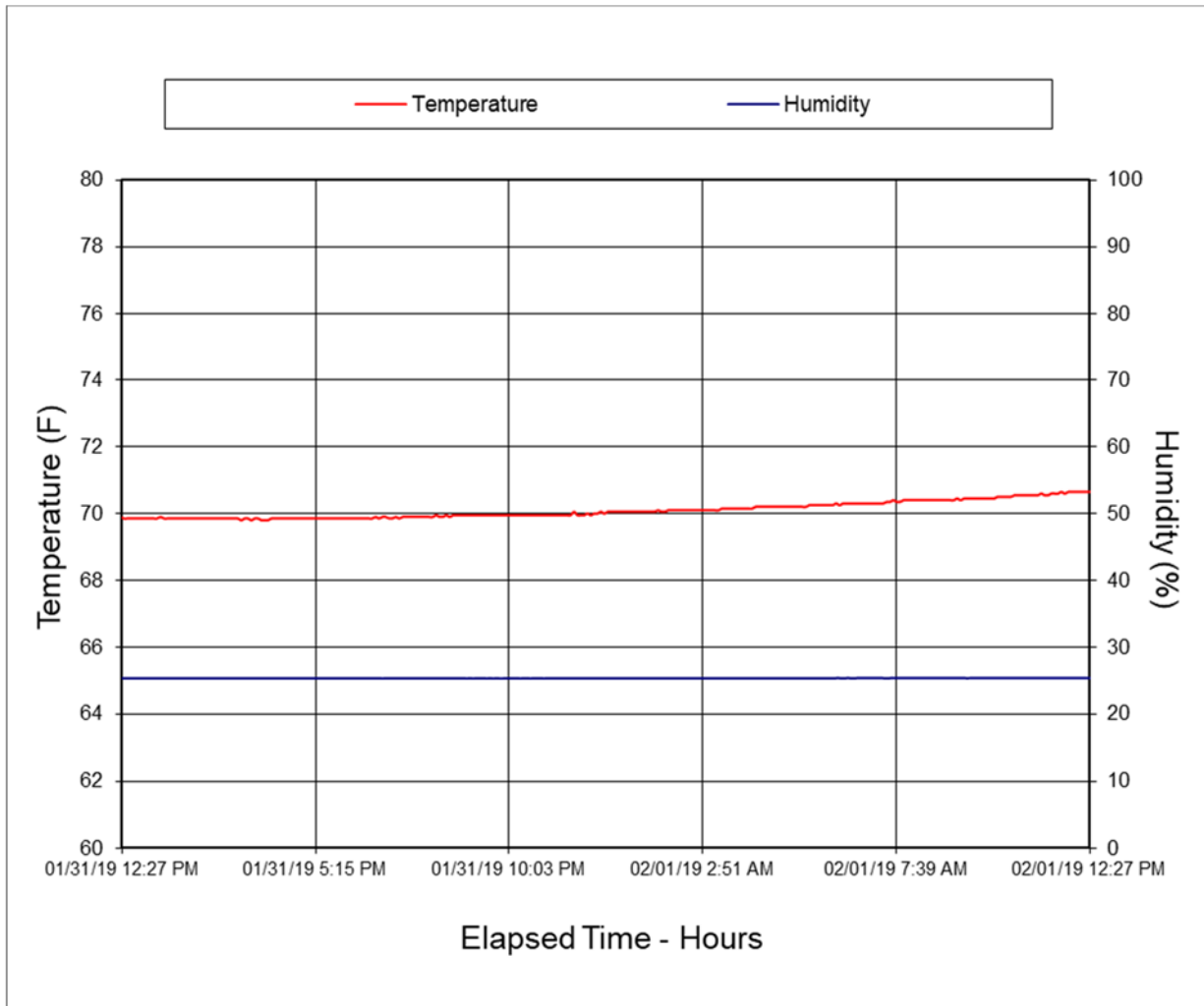
Test Phase	Spillage Location
0° To 90°	
90° To 180°	
180° To 270°	
270° To 360°	

DATA SHEET NO. 17

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV NHTSA No.: M20194200

Test Program: 56.3 km/h Frontal Impact NCAP Test Test Date: 02/01/19



APPENDIX A
PHOTOGRAPHS

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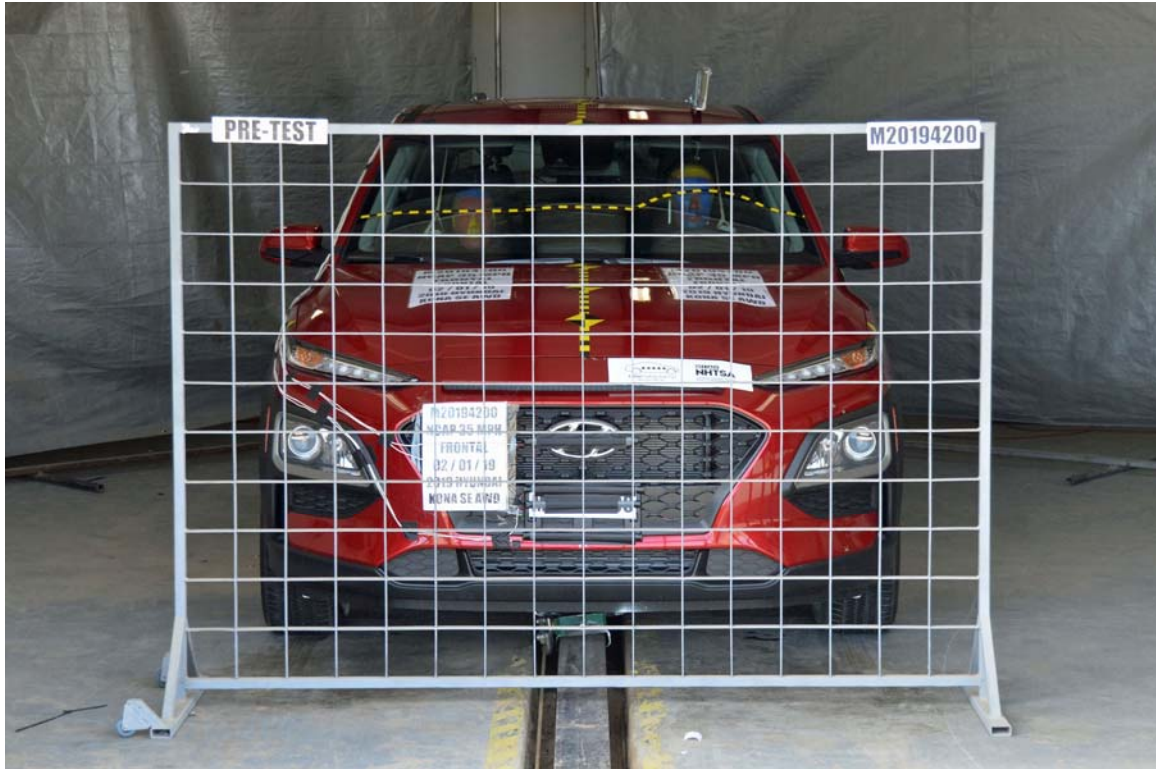


FIGURE 1. Load Cell Location

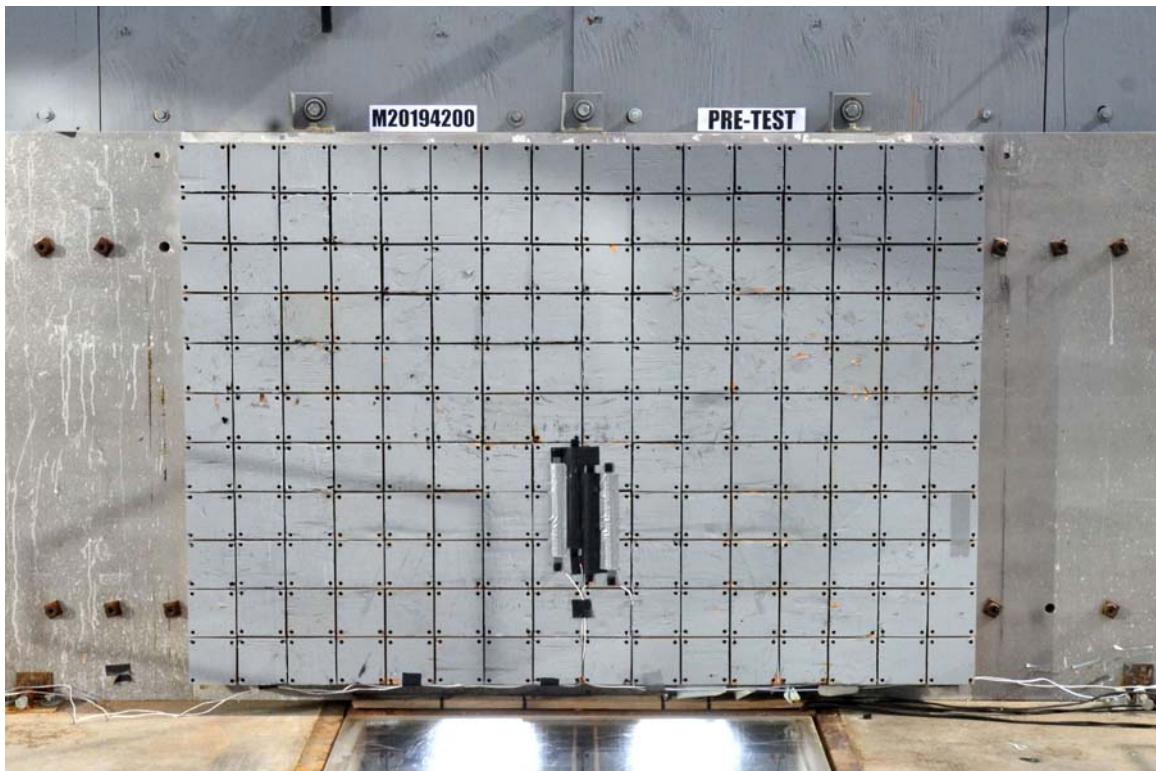


FIGURE 2. Pre-Test Load Cell Wall

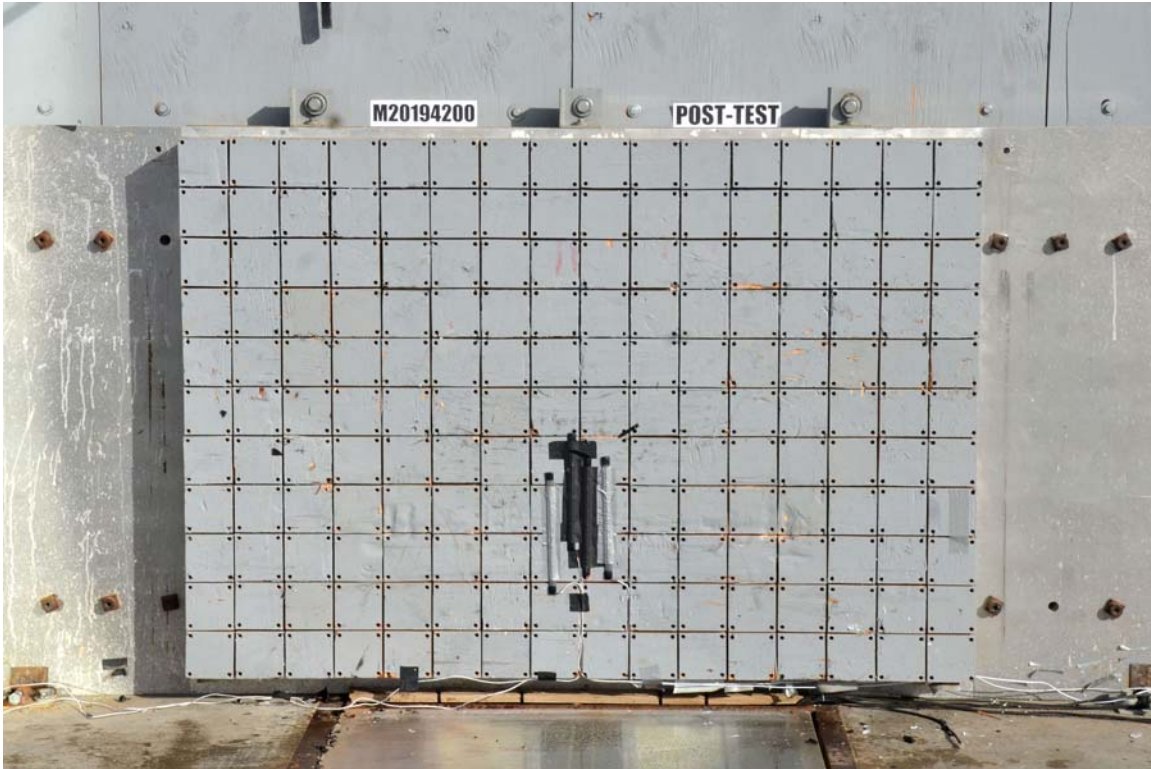


FIGURE 3. Post-Test Load Cell Wall



FIGURE 4. Manufacturer's Label



FIGURE 5. Tire Placard



FIGURE 6. 2019 Hyundai Kona SE AWD Frontal as Delivered



FIGURE 7. Left Rear $\frac{3}{4}$ 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 $\frac{3}{4}$ View



FIGURE 16. Pre-Test Left Rear $\frac{3}{4}$ View



FIGURE 17. Post-Test Left Rear $\frac{3}{4}$ View



FIGURE 18. Pre-Test Windshield View



FIGURE 19. Post-Test Windshield View



FIGURE 20. Pre-Test Engine Compartment View



FIGURE 21. Post-Test Engine Compartment View



FIGURE 22. Pre-Test Fuel Filler Cap View



FIGURE 23. Post-Test Fuel Filler Cap View

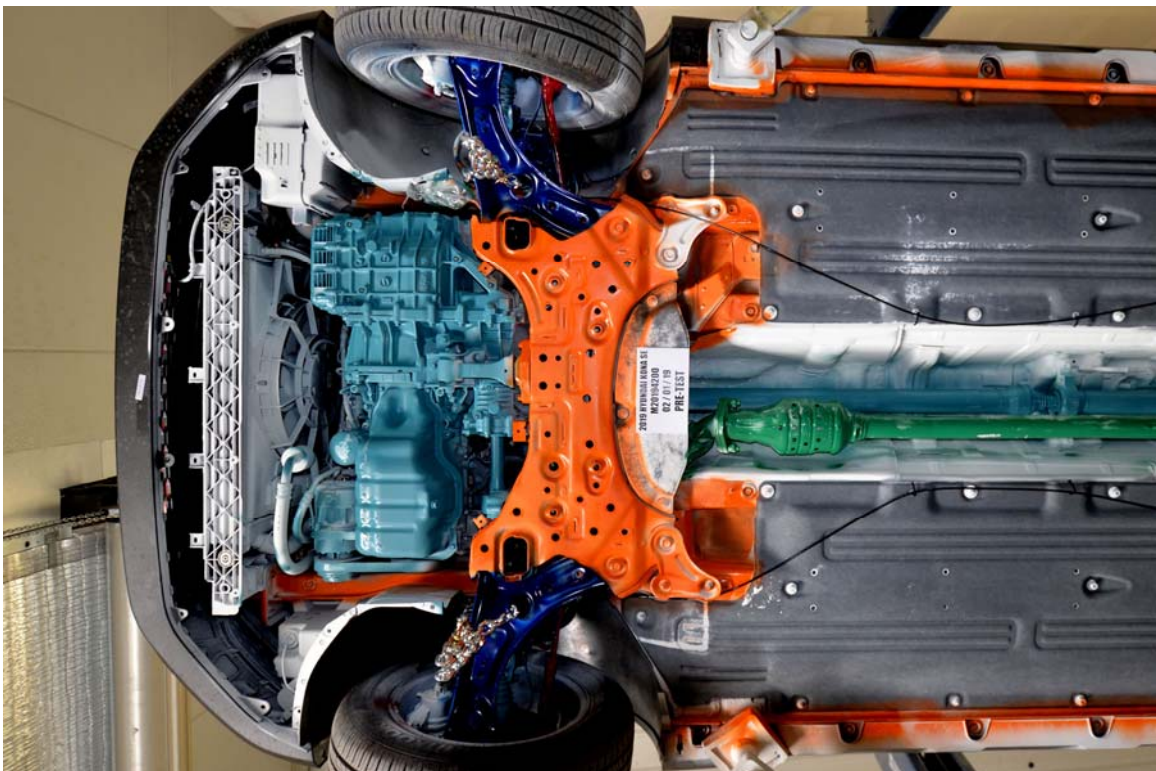


FIGURE 24. Pre-Test Front Underbody View



FIGURE 25. Post-Test Front Underbody View

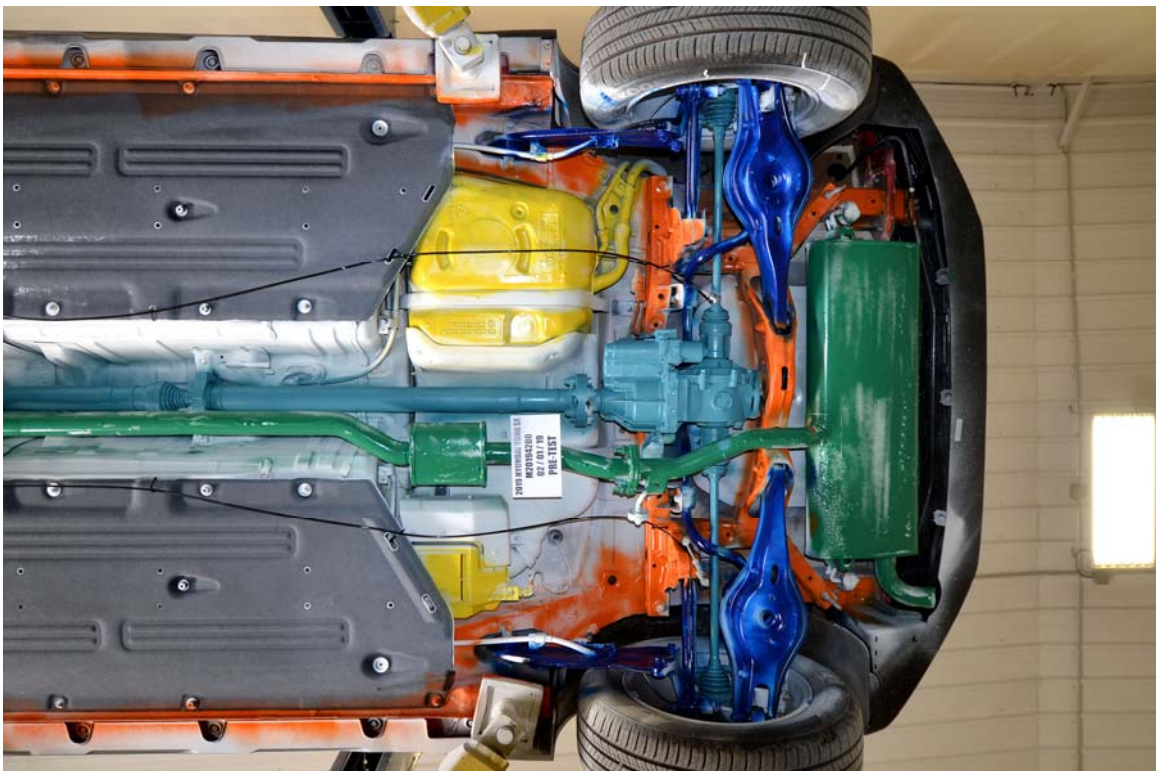


FIGURE 26. Pre-Test Rear Underbody View

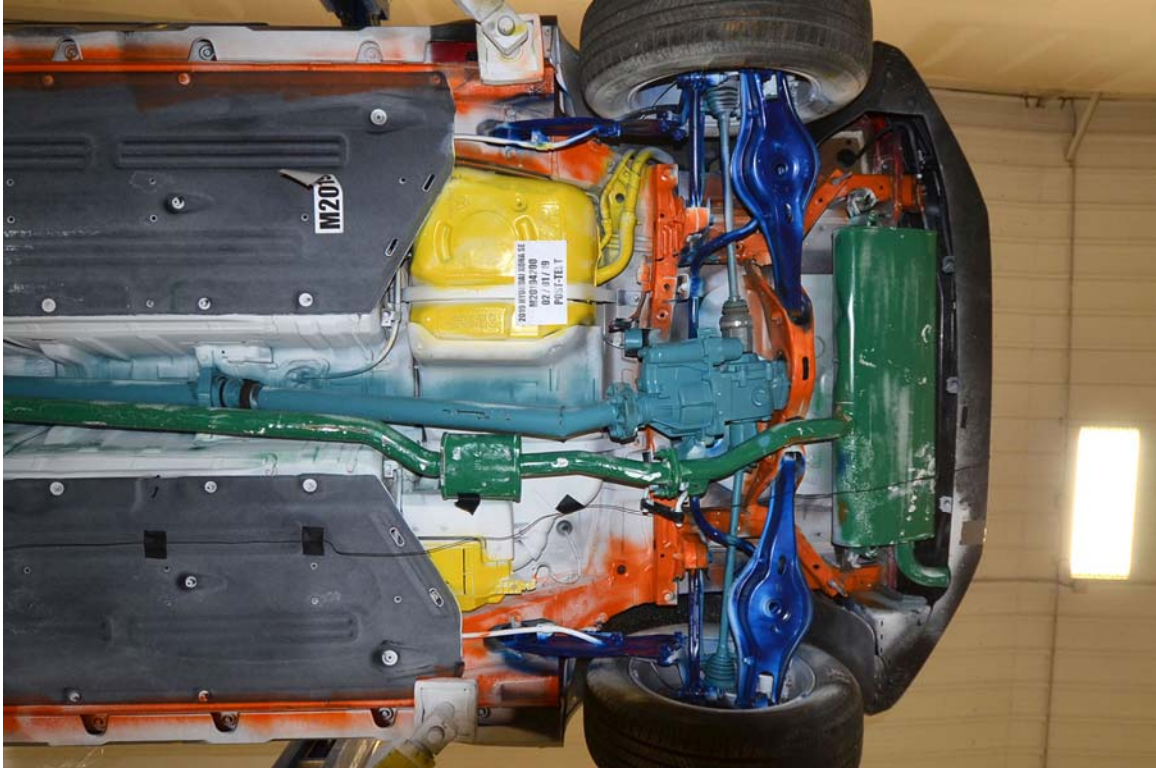


FIGURE 27. Post-Test Rear Underbody View



FIGURE 28. Pre-Test Dummy Cable Routing



FIGURE 29. Post-Test Dummy Cable Routing



FIGURE 30. Pre-Test Driver Dummy Front View



FIGURE 31. Post-Test Driver Dummy Front View



FIGURE 32. Pre-Test Driver Dummy Window View



FIGURE 33. Post-Test Driver Dummy Window View



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



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



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



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



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



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



FIGURE 40. Pre-Test Driver Dummy Feet



FIGURE 41. Post-Test Driver Dummy Feet



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



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



FIGURE 44. Pre-Test Driver's Side Floorpan



FIGURE 45. Post-Test Driver's Side Floorpan



FIGURE 46. Post-Test Driver Dummy Face



FIGURE 47. Post-Test Driver Dummy Contact with Airbag



FIGURE 48. Post-Test Driver Dummy Contact with Headrest



FIGURE 48a. Post-Test Driver Dummy Contact with Steering Column



FIGURE 48b. Post-Test Driver Dummy Contact with Knee Bolster



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

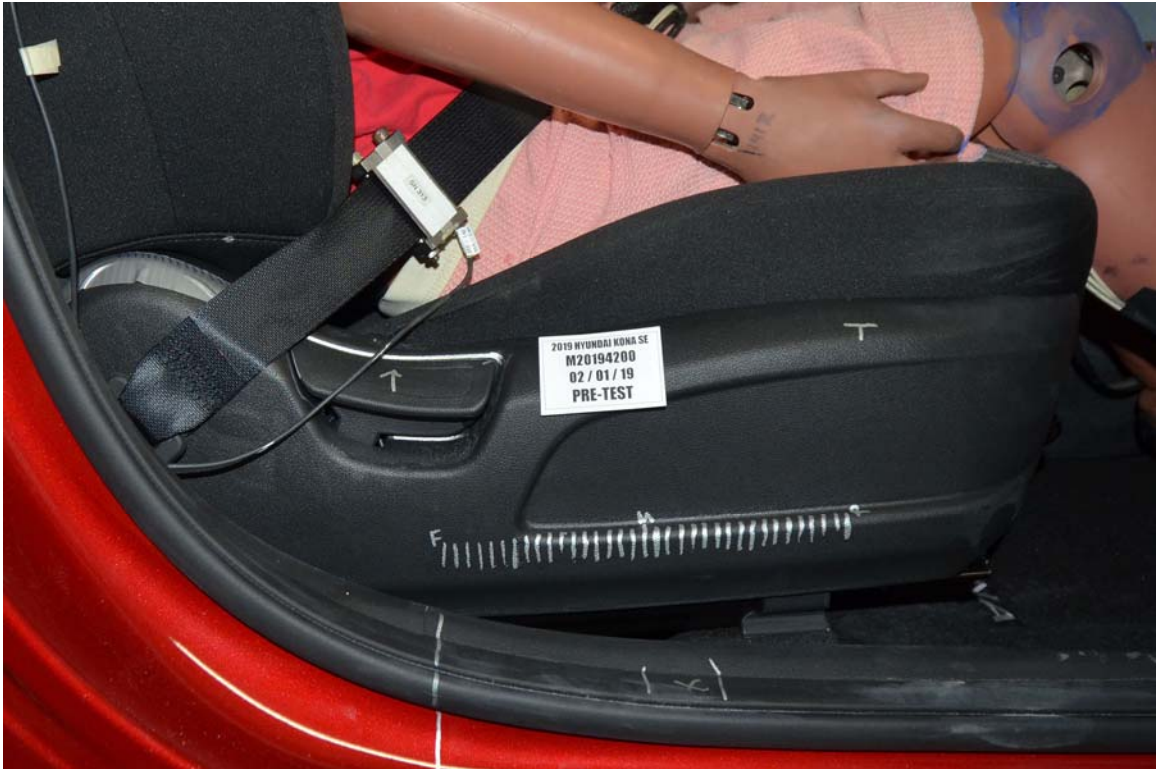


FIGURE 57. Pre-Test Passenger's Seat Fore-Aft Markings



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

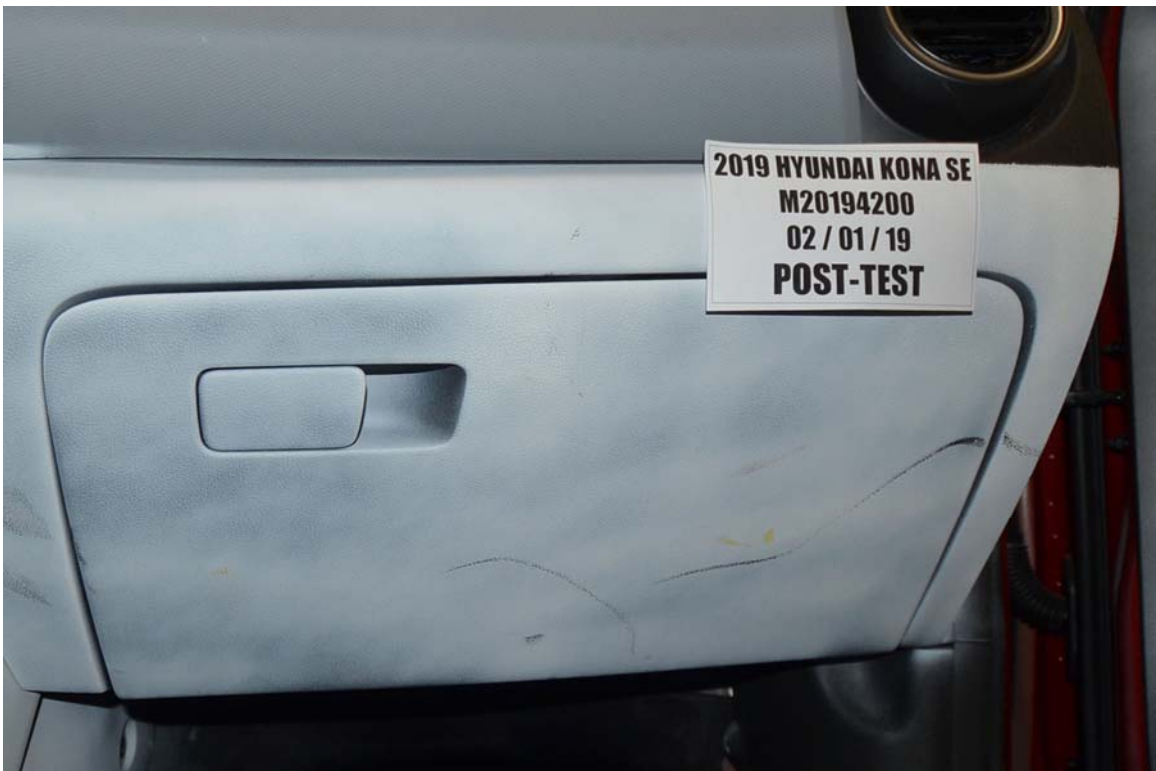


FIGURE 64. Post-Test Passenger's Side Knee Bolster



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

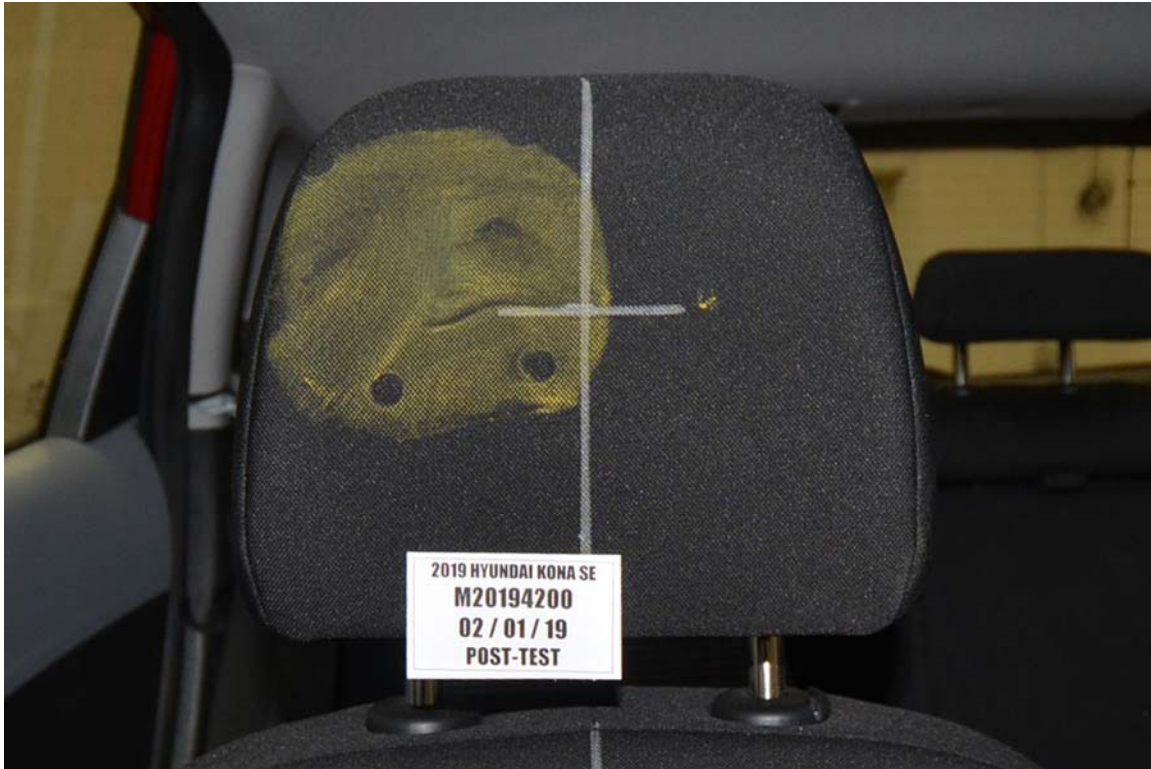


FIGURE 69. Post-Test Passenger Dummy Contact with Headrest



FIGURE 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 Hyundai Kona SE AWD Frontal Impact Event

APPENDIX B
DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

Plot		Page
1	Driver Head Acceleration X Primary	B-1
2	Driver Head Acceleration Y Primary	B-1
3	Driver Head Acceleration Z Primary	B-1
4	Driver Head Resultant Acceleration Primary	B-1
5	Driver Chest X Deflection	B-2
6	Driver Chest Acceleration X Primary	B-3
7	Driver Chest Acceleration Y Primary	B-3
8	Driver Chest Acceleration Z Primary	B-3
9	Driver Chest Resultant Acceleration Primary	B-3
10	Driver Upper Neck Force X	B-4
11	Driver Upper Neck Force Z	B-4
12	Driver Upper Neck Moment Y	B-4
13	Driver Nij	B-4
14	Driver Left Femur Force Z	B-5
15	Driver Right Femur Force Z	B-5
16	Passenger Head Acceleration X Primary	B-6
17	Passenger Head Acceleration Y Primary	B-6
18	Passenger Head Acceleration Z Primary	B-6
19	Passenger Head Resultant Acceleration Primary	B-6
20	Passenger Chest X Deflection	B-7
21	Passenger Chest Acceleration X Primary	B-8
22	Passenger Chest Acceleration Y Primary	B-8
23	Passenger Chest Acceleration Z Primary	B-8
24	Passenger Chest Resultant Acceleration Primary	B-8
25	Passenger Upper Neck Force X	B-9
26	Passenger Upper Neck Force Z	B-9
27	Passenger Upper Neck Moment Y	B-9
28	Passenger Nij	B-9
29	Passenger Left Femur Force Z	B-10
30	Passenger Right Femur Force Z	B-10

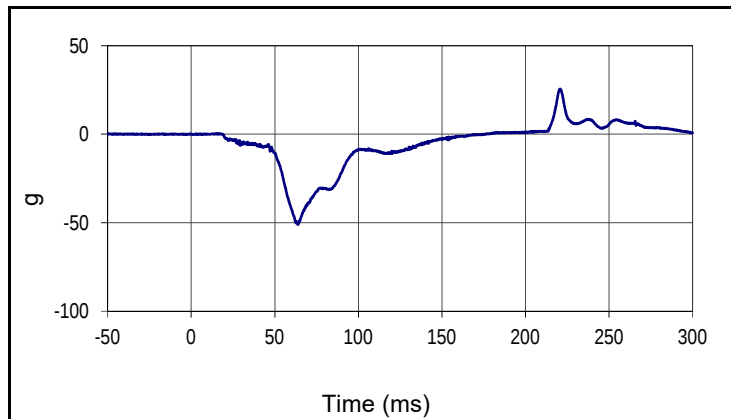
The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.gov

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

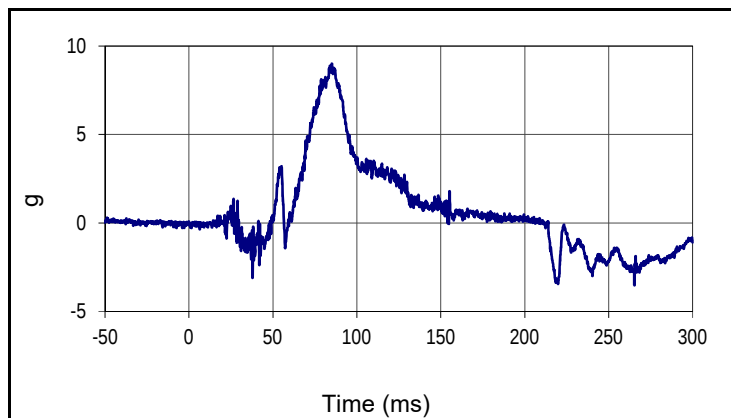
Passenger Pelvis X
Passenger Pelvis Y
Passenger Pelvis Z
Passenger Left Femur Force Redundant
Passenger Right Femur Force Redundant
Passenger Left Upper Tibia Moment X
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia 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 Hyundai Kona SE AWD 5-Door MPV
 Test Program: 56.3 km/h Frontal Impact NCAP Test

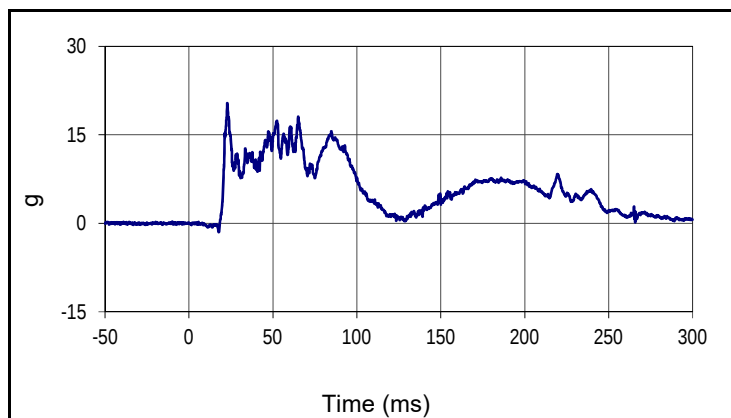
NHTSA No.: M20194200
 Test Date: 02/01/19



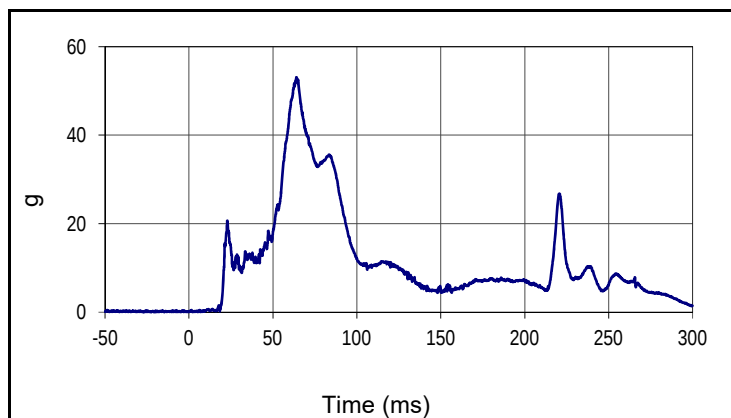
Curve Description			
Driver Head Acceleration X Primary			
Plot No.		SAE Class	Units
001		1000	g
Max	Time	Min	Time
25.6	220.8	-51.1	64.0



Curve Description			
Driver Head Acceleration Y Primary			
Plot No.		SAE Class	Units
002		1000	g
Max	Time	Min	Time
9.0	85.1	-3.5	265.3



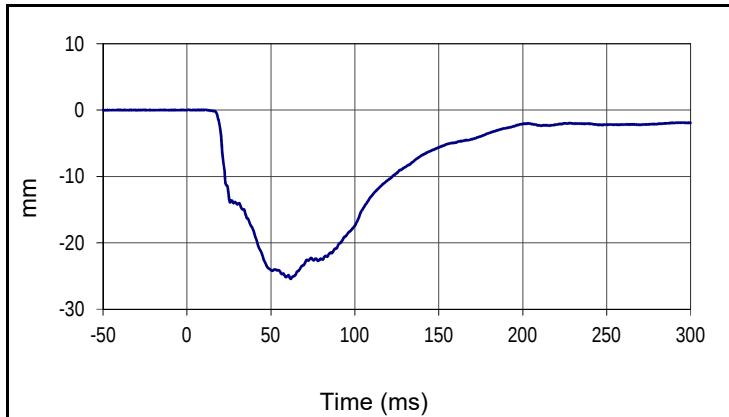
Curve Description			
Driver Head Acceleration Z Primary			
Plot No.		SAE Class	Units
003		1000	g
Max	Time	Min	Time
20.4	22.8	-1.5	17.7



Curve Description			
Driver Head Resultant Acceleration Primary			
Plot No.		SAE Class	Units
004		1000	g
Max	Time	Min	Time
53.1	64.0	0.0	2.4

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV
 Test Program: 56.3 km/h Frontal Impact NCAP Test

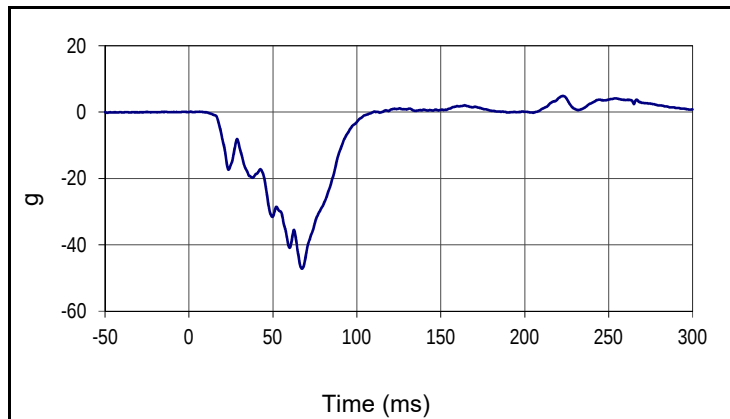
NHTSA No.: M20194200
 Test Date: 02/01/19



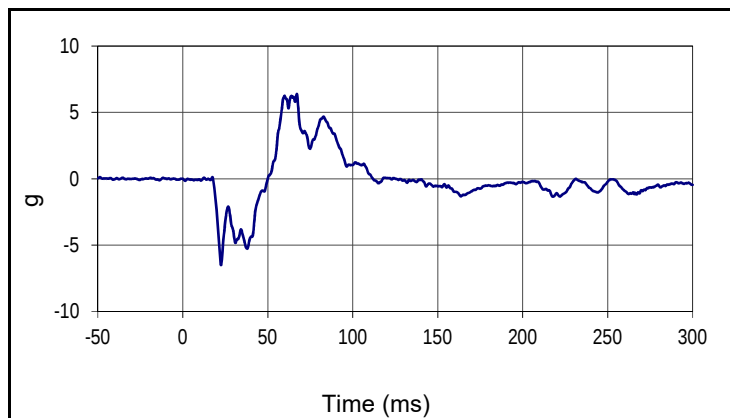
Curve Description			
Driver Chest Deflection			
Plot No.		SAE Class	Units
005		600	mm
Max	Time	Min	Time
0.1	6.4	-25.5	61.8

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV
 Test Program: 56.3 km/h Frontal Impact NCAP Test

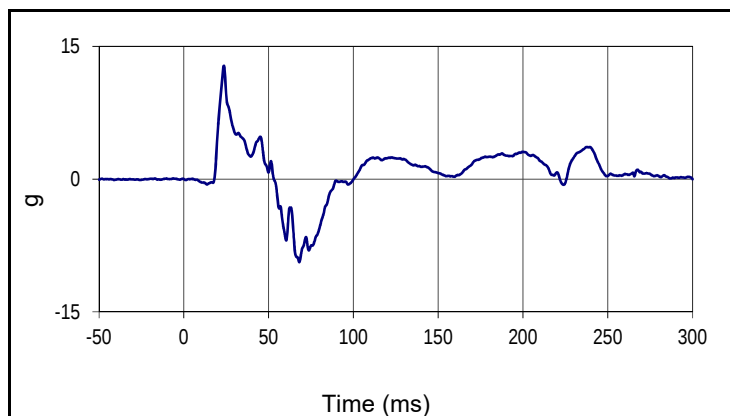
NHTSA No.: M20194200
 Test Date: 02/01/19



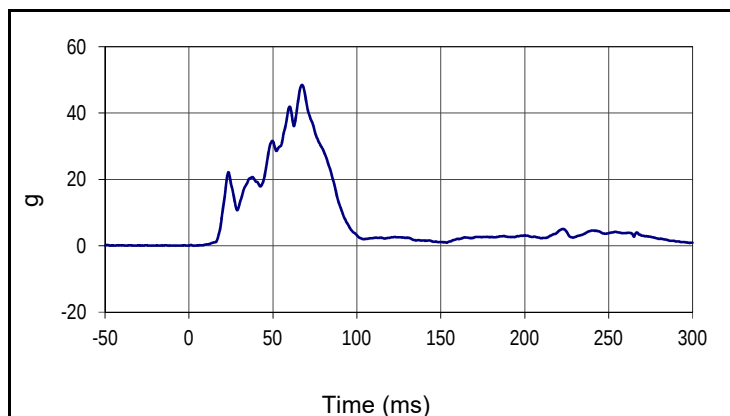
Curve Description			
Driver Chest Acceleration X Primary			
Plot No.		SAE Class	Units
006		180	g
Max	Time	Min	Time
4.9	222.7	-47.2	67.3



Curve Description			
Driver Chest Acceleration Y Primary			
Plot No.		SAE Class	Units
007		180	g
Max	Time	Min	Time
6.4	67.1	-6.5	22.5



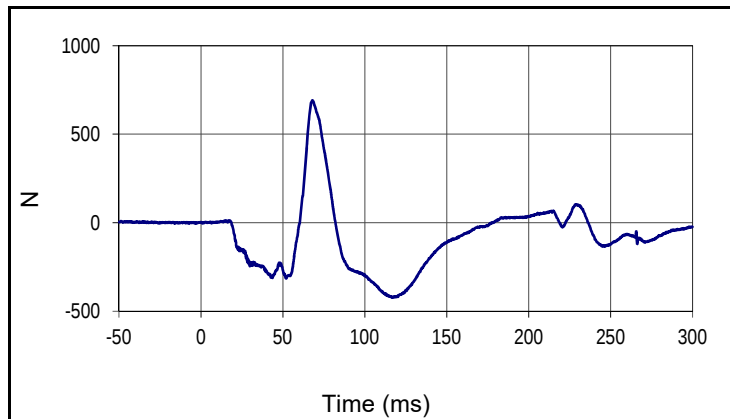
Curve Description			
Driver Chest Acceleration Z Primary			
Plot No.		SAE Class	Units
008		180	g
Max	Time	Min	Time
12.8	23.6	-9.4	68.0



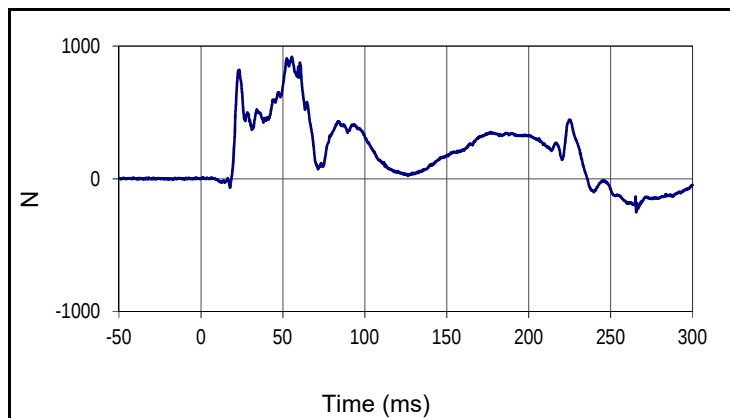
Curve Description			
Driver Chest Resultant Acceleration Primary			
Plot No.		SAE Class	Units
009		180	g
Max	Time	Min	Time
48.5	67.3	0.0	2.9

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV
 Test Program: 56.3 km/h Frontal Impact NCAP Test

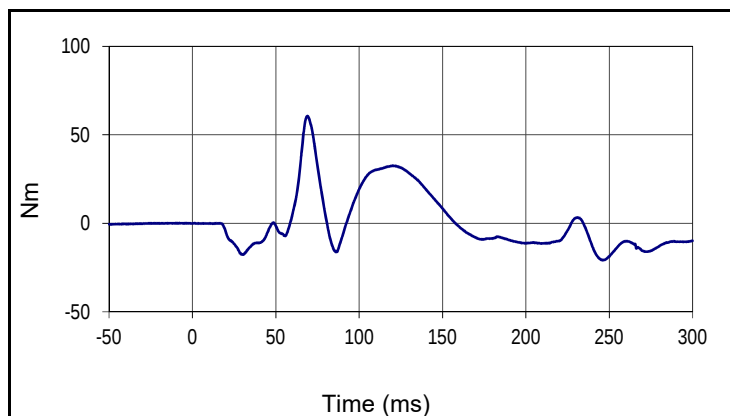
NHTSA No.: M20194200
 Test Date: 02/01/19



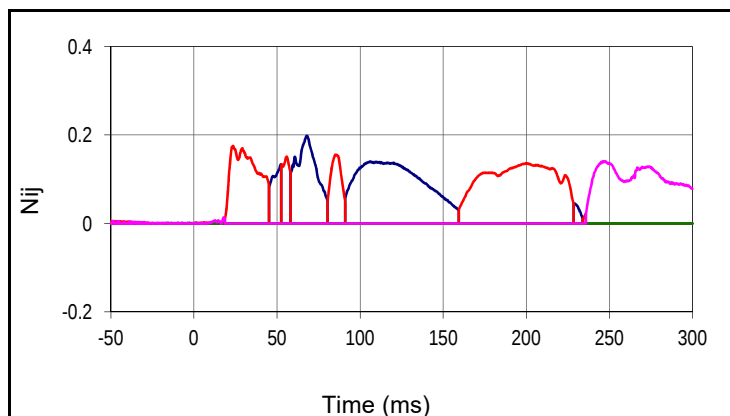
Curve Description			
Driver Upper Neck Force X			
Plot No.		SAE Class	Units
010		1000	N
Max	Time	Min	Time
691.3	68.0	-423.1	116.5



Curve Description			
Driver Upper Neck Force Z			
Plot No.		SAE Class	Units
011		1000	N
Max	Time	Min	Time
919.1	55.4	-252.5	265.6



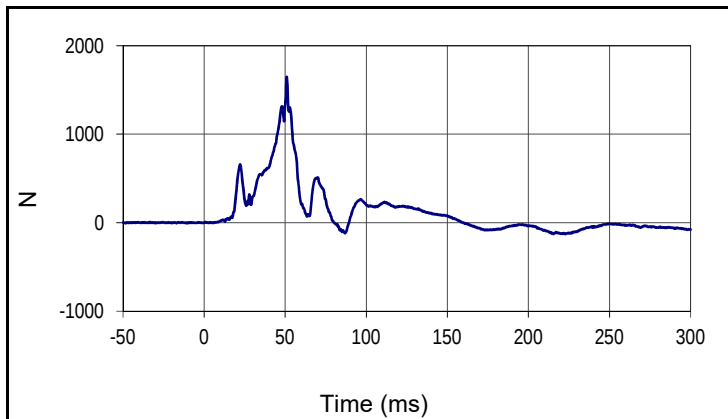
Curve Description			
Driver Upper Neck Moment Y			
Plot No.		SAE Class	Units
012		600	Nm
Max	Time	Min	Time
60.6	69.0	-20.8	246.0



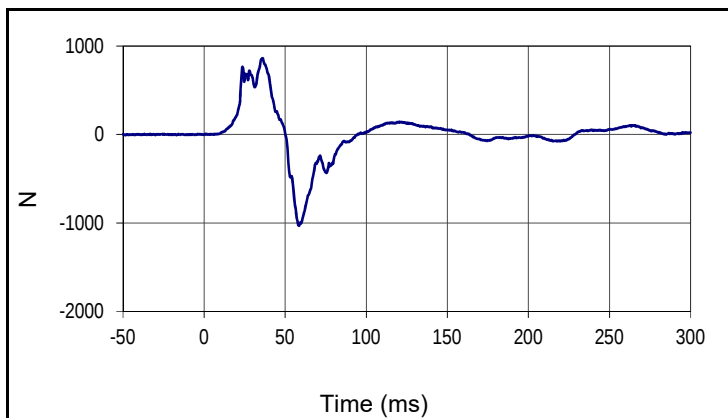
Curve Description		
Driver Nij		
Units	Max	Time
Ntf	0.20	67.9
Units	Max	Time
Nte	0.18	23.6
Units	Max	Time
Ncf	0.00	-9.5
Units	Max	Time
Nce	0.14	247.1

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV
 Test Program: 56.3 km/h Frontal Impact NCAP Test

NHTSA No.: M20194200
 Test Date: 02/01/19



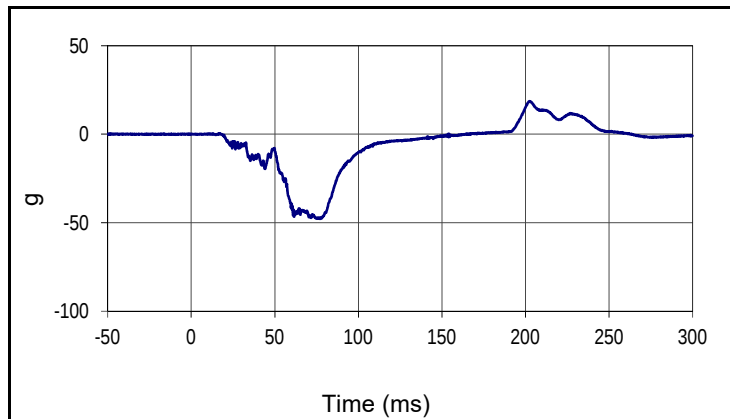
Curve Description			
Driver Left Femur Force Z			
Plot No.		SAE Class	Units
014		600	N
Max	Time	Min	Time
1648.4	51.0	-128.0	222.7



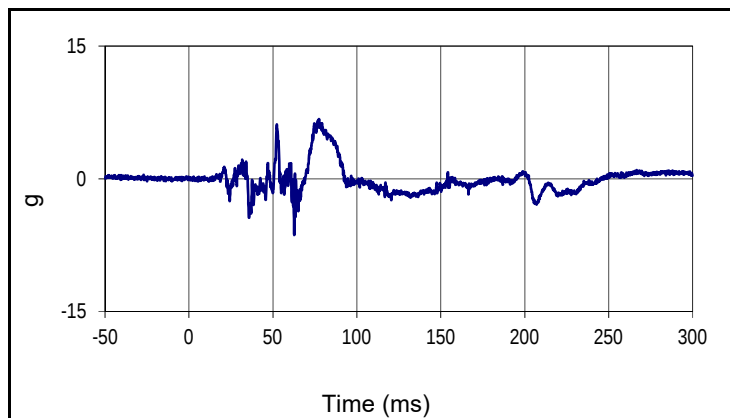
Curve Description			
Driver Right Femur Force Z			
Plot No.		SAE Class	Units
015		600	N
Max	Time	Min	Time
863.2	36.1	-1030.2	58.6

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV
 Test Program: 56.3 km/h Frontal Impact NCAP Test

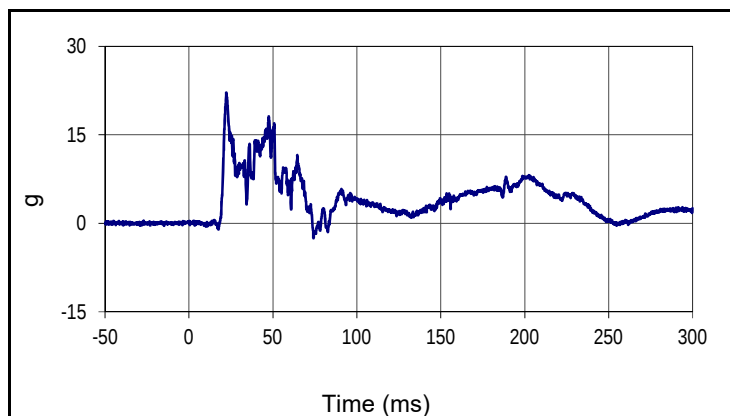
NHTSA No.: M20194200
 Test Date: 02/01/19



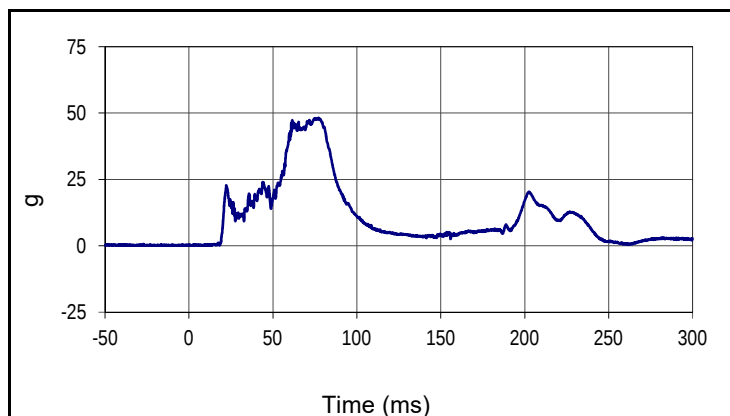
Curve Description			
Passenger Head Acceleration X Primary			
Plot No.		SAE Class	Units
016		1000	g
Max	Time	Min	Time
18.7	202.6	-47.9	77.1



Curve Description			
Passenger Head Acceleration Y Primary			
Plot No.		SAE Class	Units
017		1000	g
Max	Time	Min	Time
6.7	77.4	-6.4	62.7



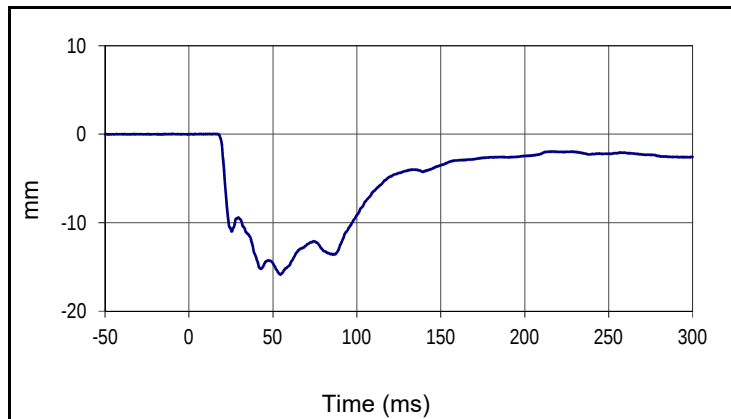
Curve Description			
Passenger Head Acceleration Z Primary			
Plot No.		SAE Class	Units
018		1000	g
Max	Time	Min	Time
22.2	22.2	-2.5	74.2



Curve Description			
Passenger Head Resultant Acceleration Primary			
Plot No.		SAE Class	Units
019		1000	g
Max	Time	Min	Time
48.2	77.1	0.1	5.8

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV
 Test Program: 56.3 km/h Frontal Impact NCAP Test

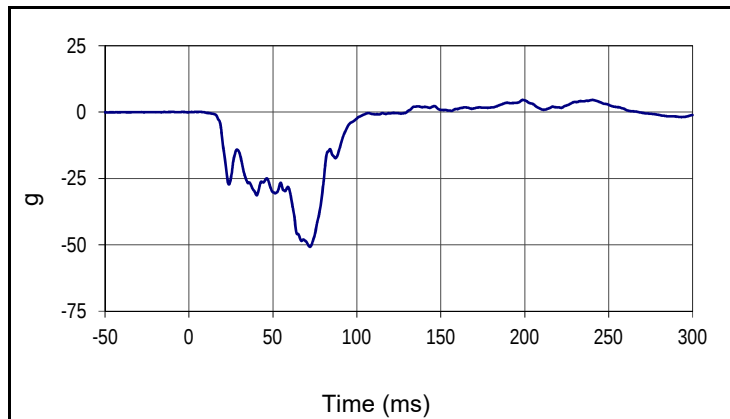
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 Test Date: 02/01/19



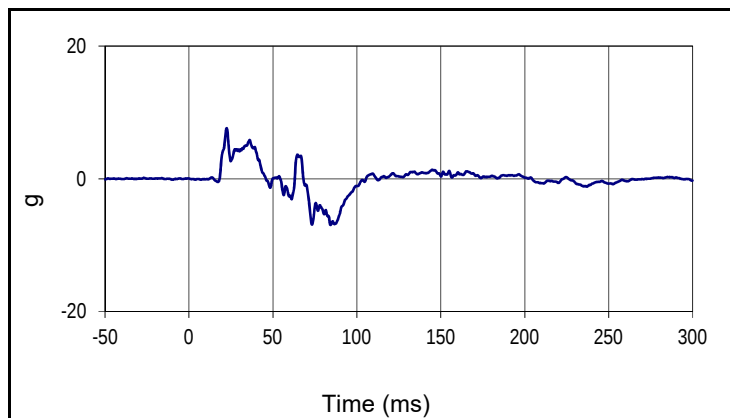
Curve Description			
Passenger Chest Deflection			
Plot No.		SAE Class	Units
020		600	mm
Max	Time	Min	Time
0.0	11.8	-15.9	54.5

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV
 Test Program: 56.3 km/h Frontal Impact NCAP Test

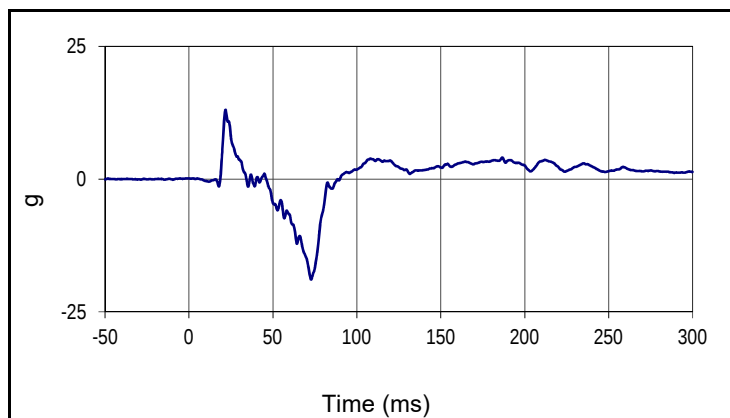
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 Test Date: 02/01/19



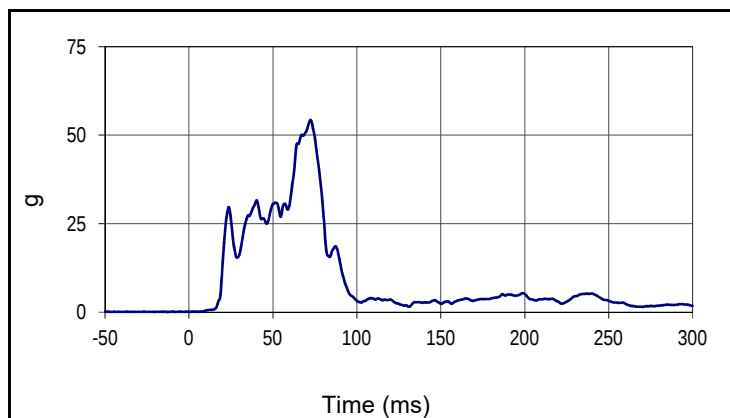
Curve Description			
Passenger Chest Acceleration X Primary			
Plot No.		SAE Class	Units
021		180	g
Max	Time	Min	Time
4.6	198.8	-50.8	72.1



Curve Description			
Passenger Chest Acceleration Y Primary			
Plot No.		SAE Class	Units
022		180	g
Max	Time	Min	Time
7.6	22.4	-7.0	84.3



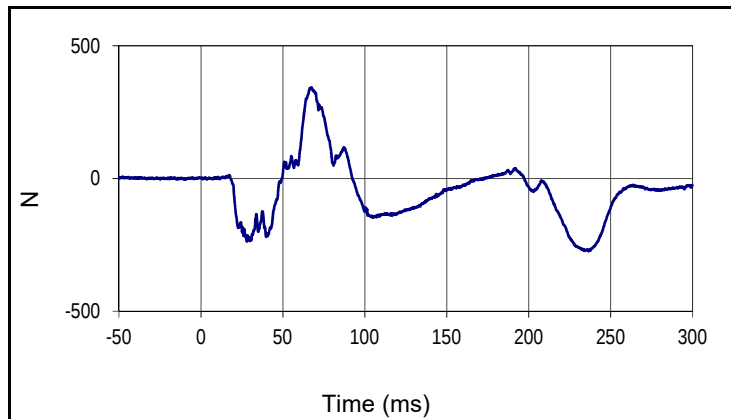
Curve Description			
Passenger Chest Acceleration Z Primary			
Plot No.		SAE Class	Units
023		180	g
Max	Time	Min	Time
13.0	21.7	-18.9	72.7



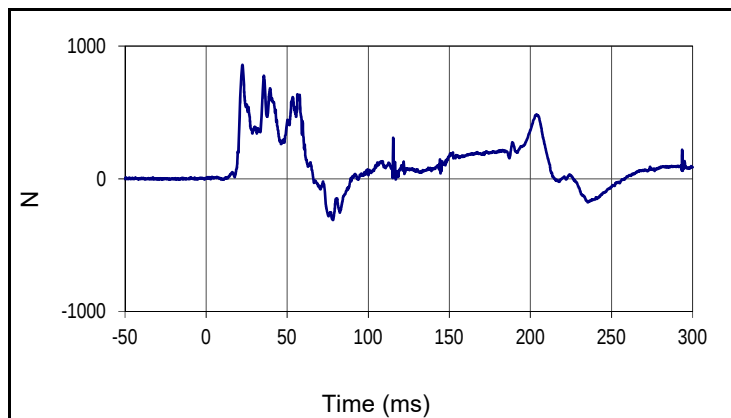
Curve Description			
Passenger Chest Resultant Acceleration Primary			
Plot No.		SAE Class	Units
024		180	g
Max	Time	Min	Time
54.3	72.4	0.1	6.0

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV
 Test Program: 56.3 km/h Frontal Impact NCAP Test

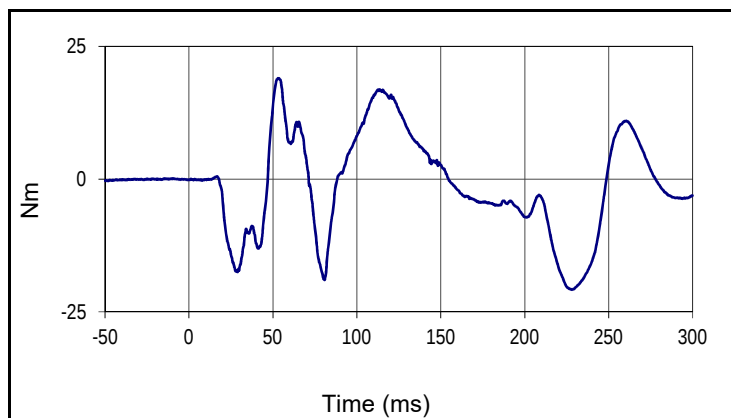
NHTSA No.: M20194200
 Test Date: 02/01/19



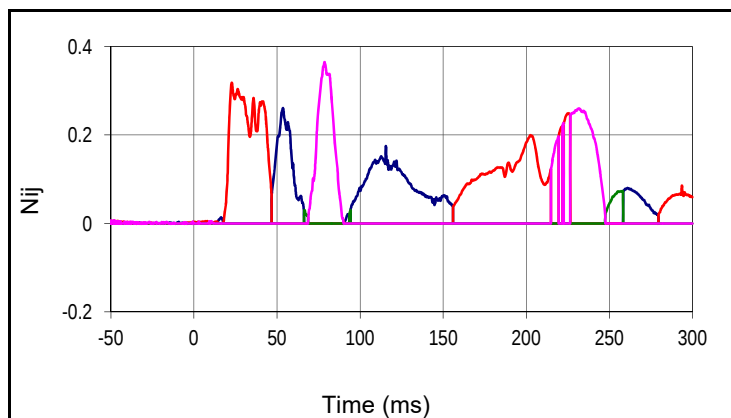
Curve Description			
Passenger Upper Neck Force X			
Plot No.		SAE Class	Units
025		1000	N
Max	Time	Min	Time
342.8	67.5	-273.9	236.7



Curve Description			
Passenger Upper Neck Force Z			
Plot No.		SAE Class	Units
026		1000	N
Max	Time	Min	Time
858.2	22.4	-310.3	78.3



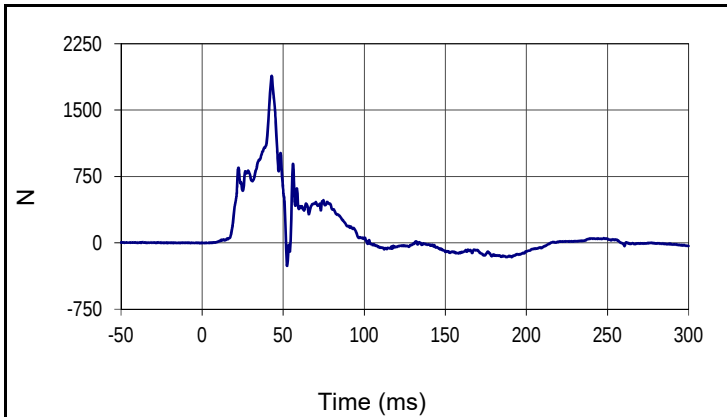
Curve Description			
Passenger Upper Neck Moment Y			
Plot No.		SAE Class	Units
027		600	Nm
Max	Time	Min	Time
19.0	53.5	-20.8	228.0



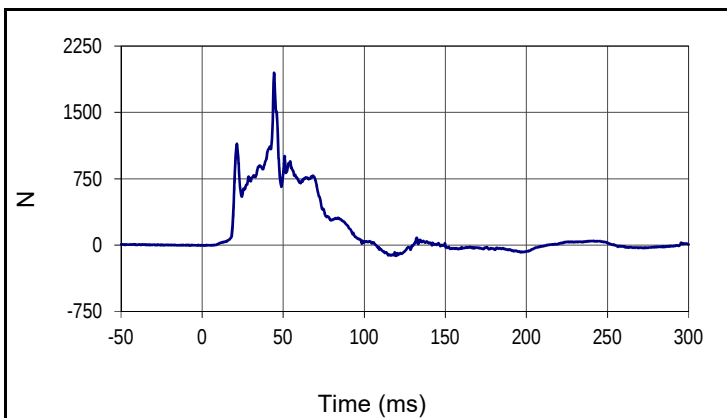
Curve Description		
Passenger Nij		
Units	Max	Time
Ntf	0.26	53.6
Units	Max	Time
Nte	0.32	22.8
Units	Max	Time
Ncf	0.07	257.2
Units	Max	Time
Nce	0.36	78.6

Test Vehicle: 2019 Hyundai Kona SE AWD 5-Door MPV
 Test Program: 56.3 km/h Frontal Impact NCAP Test

NHTSA No.: M20194200
 Test Date: 02/01/19



Curve Description			
Passenger Left Femur Force Z			
Plot No.		SAE Class	Units
029		600	N
Max	Time	Min	Time
1887.4	42.9	-260.5	52.4



Curve Description			
Passenger Right Femur Force Z			
Plot No.		SAE Class	Units
030		600	N
Max	Time	Min	Time
1947.3	44.4	-121.4	119.7

APPENDIX C
ATD CALIBRATION AND PERFORMANCE VERIFICATION DATA

APPENDIX C
PRE-TEST ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA



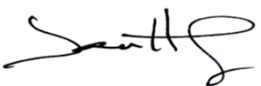
Hybrid III 50th Percentile Male
ATD Damage Checklist

ATD Serial No.: 360

Test Date: 2018-12-19

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. Assembly	Bent shaft			✓
	Slider arm riding in track			✓
Sensors	Check cables for cuts, tears			✓
	Check for damaged insulation			✓
Accelerometer Mounting	Head mounting secure			✓
	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



Hybrid III 50th Percentile Male
External Measurements

ATD Serial No.: 360

Test Date: 2018-12-19

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	518	Pass
C - 'H' point height	mm	84	89	88	Pass
D - 'H' point location from backline	mm	135	140	137	Pass
E - Shoulder pivot from backline	mm	84	94	89	Pass
F - Thigh clearance	mm	140	155	151	Pass
G - Back of elbow to wrist pivot	mm	290	305	296	Pass
H - Head back to backline	mm	41	46	44	Pass
I - Shoulder to elbow length	mm	330	345	338	Pass
J - Elbow rest height	mm	190	211	204	Pass
K - Buttock to knee length	mm	579	604	586	Pass
L - Popliteal length	mm	429	455	445	Pass
M - Knee pivot height	mm	485	500	495	Pass
N - Buttock popliteal length	mm	452	477	469	Pass
O - Chest depth without jacket	mm	213	229	225	Pass
P - Foot length	mm	251	267	259	Pass
V - Shoulder breadth	mm	422	437	427	Pass
W - Foot breadth	mm	91	107	102	Pass
Y - Chest circum. (w/chest jacket)	mm	970	1001	977	Pass
Z - Waist circum.	mm	836	866	851	Pass
AA - Location for chest circum.	mm	429	434	431	Pass
BB - Location for waist circum.	mm	226	231	230	Pass
			Overall Test Results		Pass

Technician: _____

J. Hernandez

Approved By: _____

P. Puzzuto



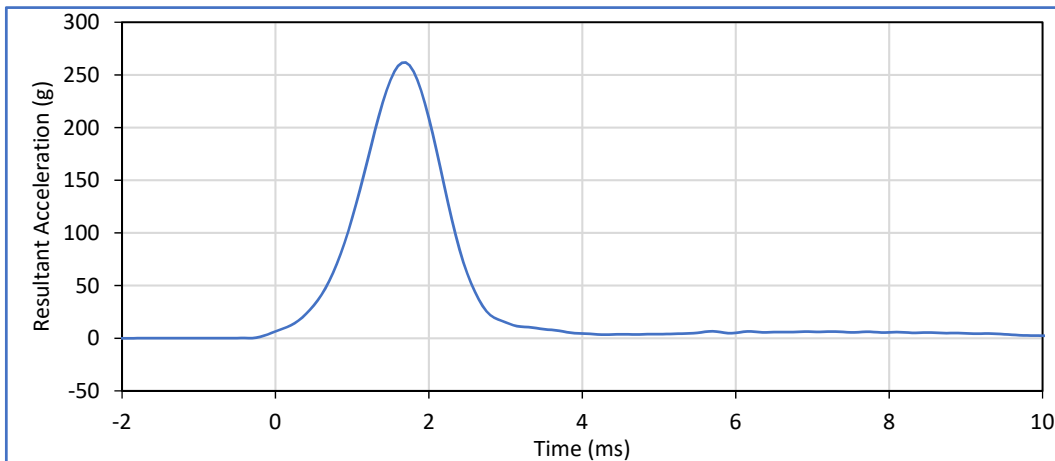
9270 Holly Road, Adelanto, CA 92301
Tel: +1 760 246 1672 Fax: +1 760 246 8112
Info@karco.com www.karco.com

Hybrid III 50th Percentile Male Head Drop

ATD Serial No.: 360

Test Date: 2018-12-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.1	Pass
Laboratory Humidity	%	10	70	35	Pass
Peak Resultant Acceleration	g	225.0	275.0	261.8	Pass
Peak Lateral Acceleration	g	-15.0	15.0	1.2	Pass
Oscillations After Main Pulse	%	0.0	10.0	2.5	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results	Pass	

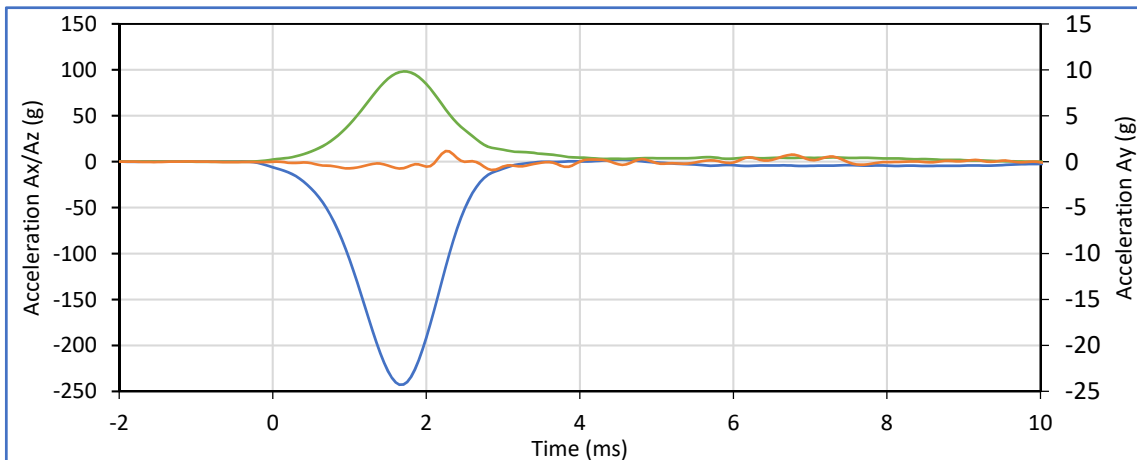


Head Resultant

Max: 261.8@1.7

Min: 2.4@10.0

SAE Class 1000



Head Ax

Max: 2.1@4.6

Min: -242.7@1.7

SAE Class 1000

Head Ay

Max: 1.2@2.3

Min: -0.9@2.9

SAE Class 1000

Head Az

Max: 98.3@1.7

Min: 0.0@9.9

SAE Class 1000

Technician: _____

J. Hernandez

Approved By: _____

P. Puzzuto

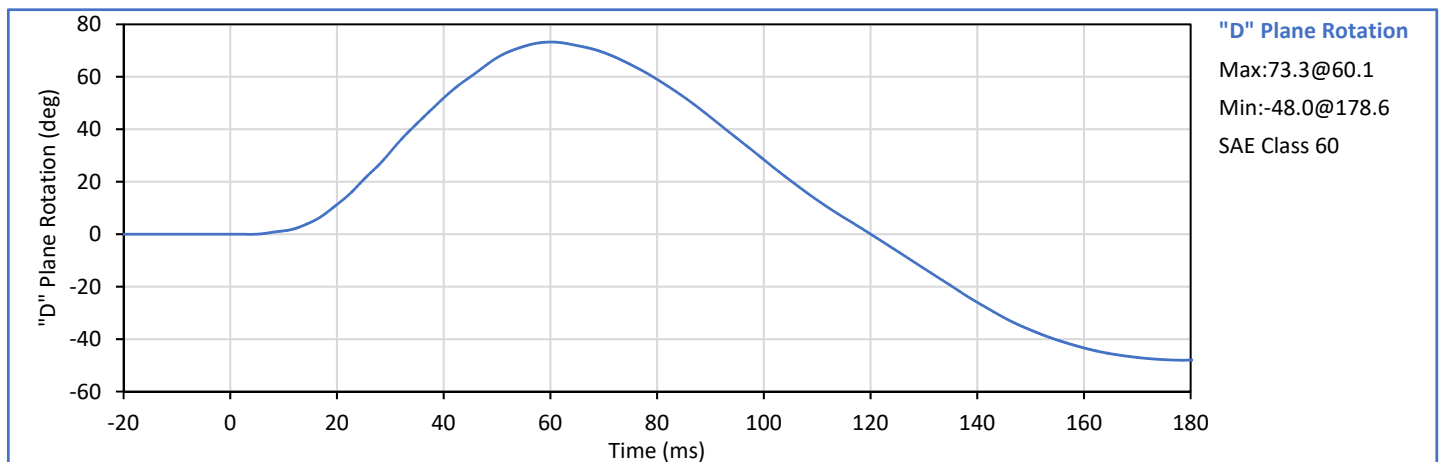
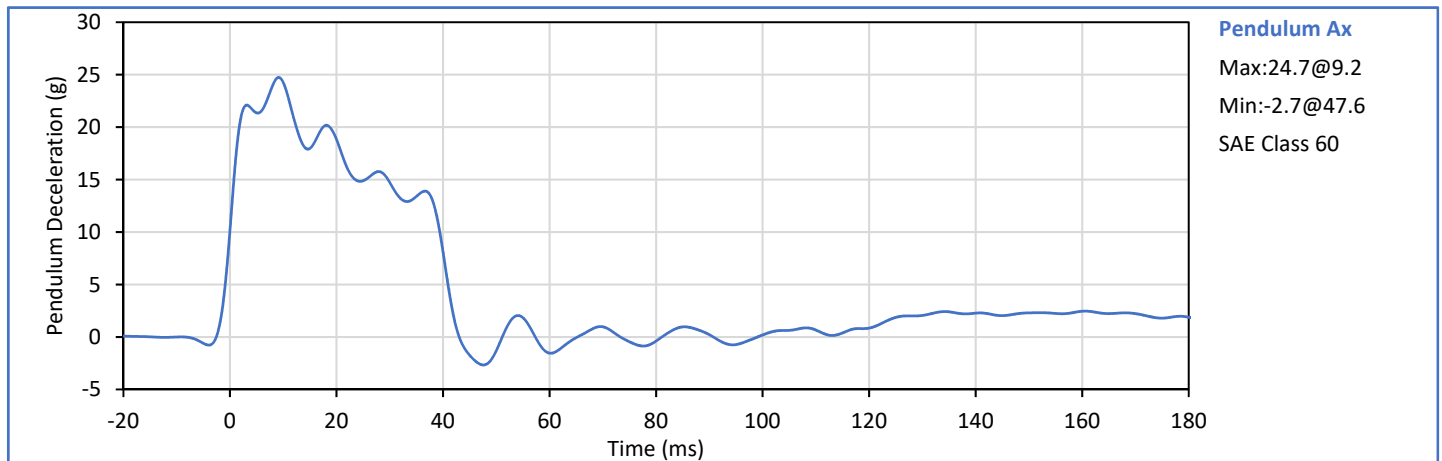


Hybrid III 50th Percentile Male Neck Flexion Test

ATD Serial No.: 360

Test Date: 2018-12-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	6.89	7.13	6.98	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	24.3	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	18.8	Pass
Pendulum Deceleration at 30 ms	g	12.5	18.5	14.7	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	29.0	14.7	Pass
Deceleration Decay to Cross 5 g	ms	34.0	42.0	40.9	Pass
"D" Plane Rotation peak	deg	64.0	78.0	73.3	Pass
	ms	57.0	64.0	60.1	Pass
"D" Plane Rotation Decay To Zero	ms	113.0	128.0	120.1	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	99.4	Pass
	ms	47.0	58.0	54.1	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	100.0	Pass
Overall Test Results					Pass



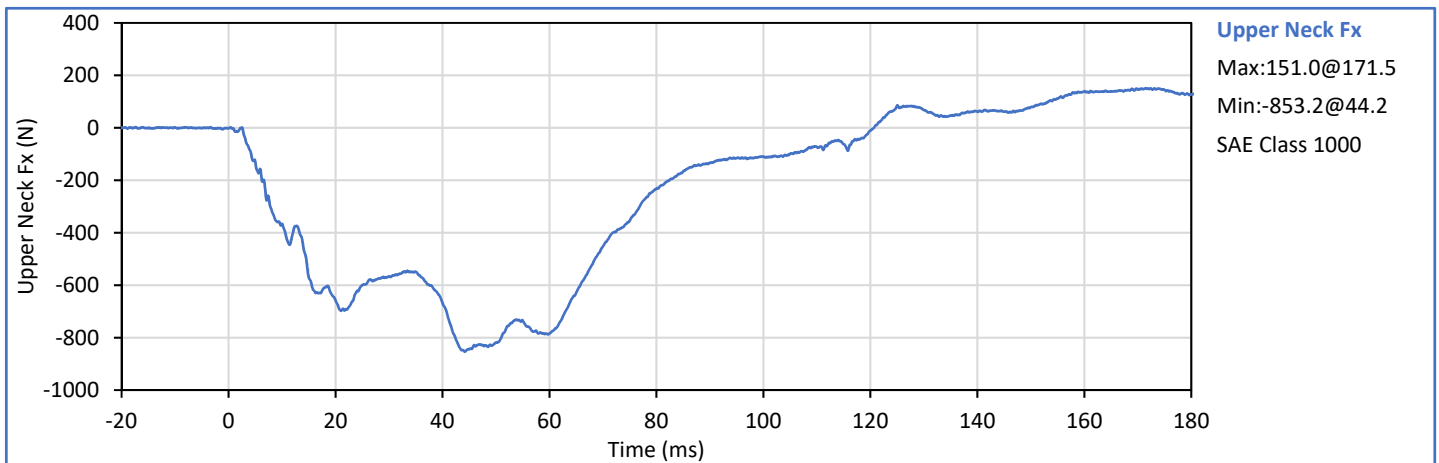
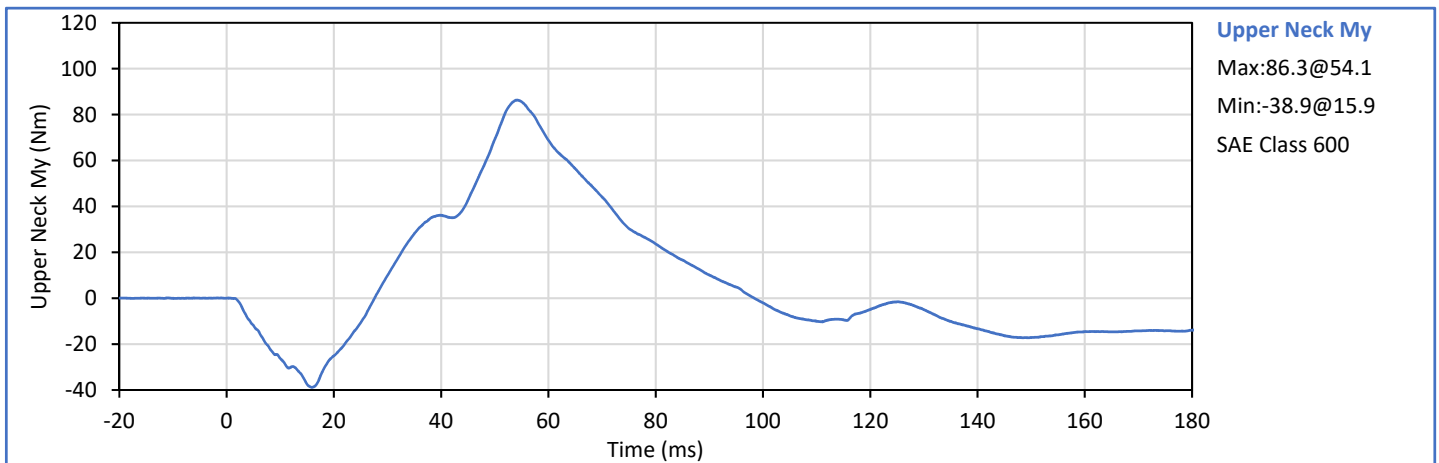
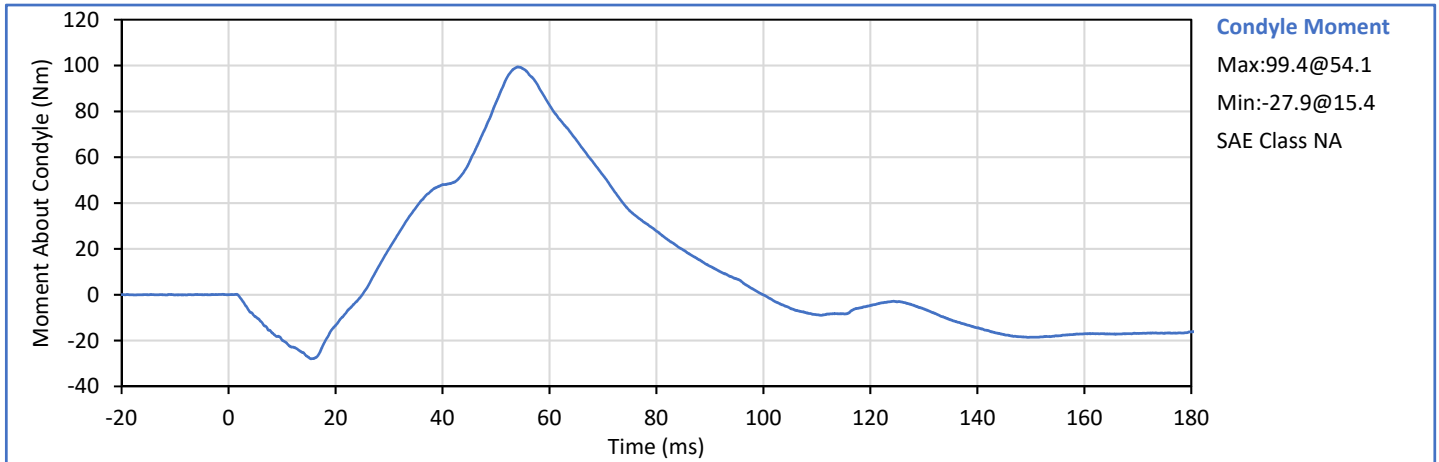
Technician: J. Hernandez

Approved By: P. Puzzuto



ATD Serial No.: 360

Test Date: 2018-12-21



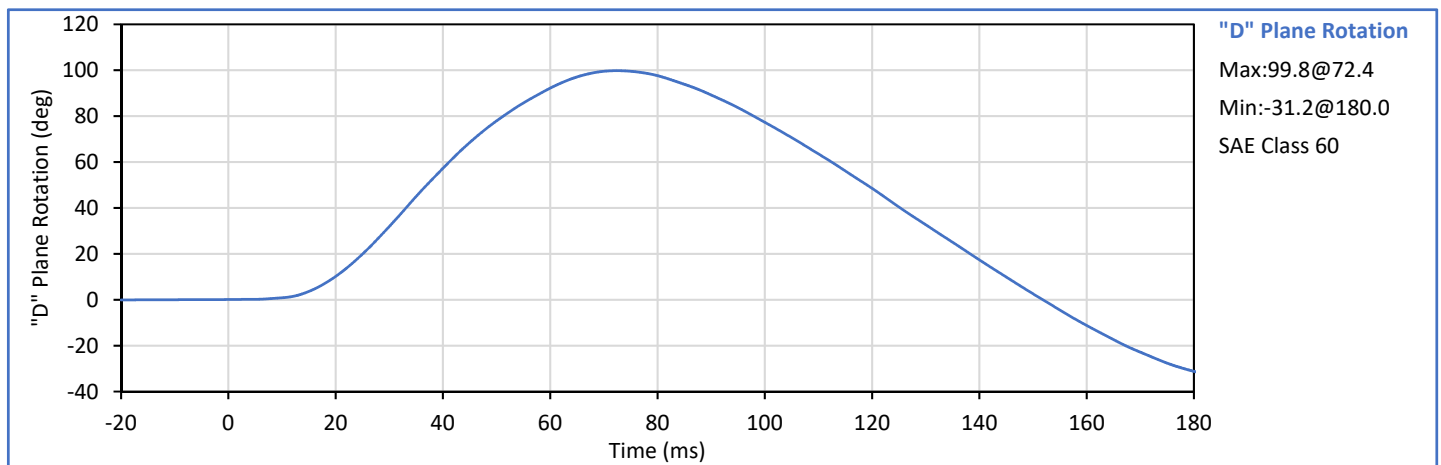
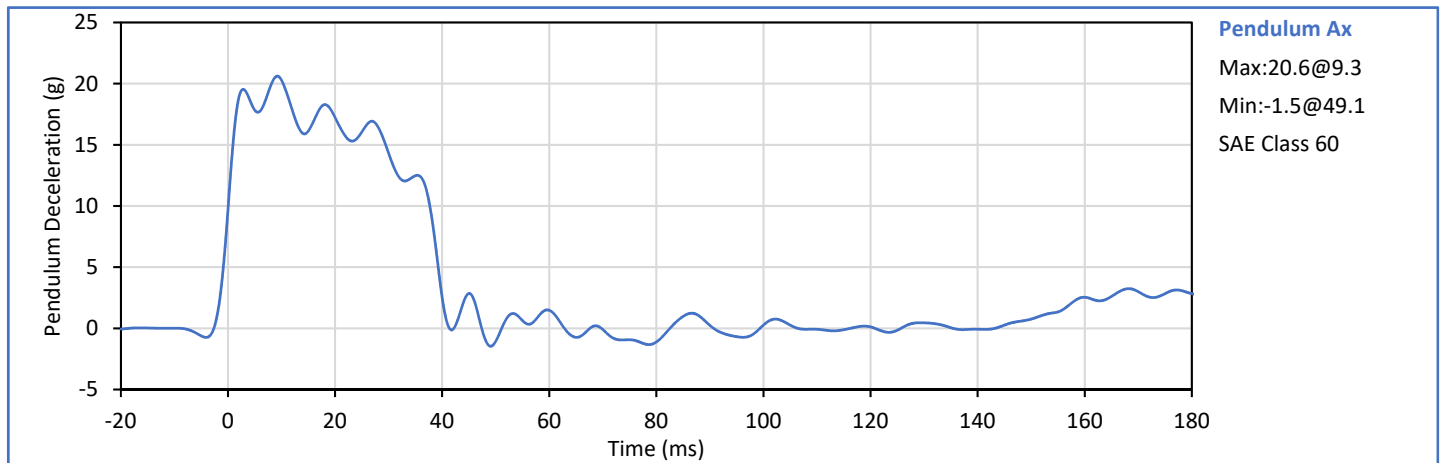


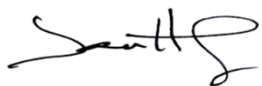
Hybrid III 50th Percentile Male
Neck Extension Test

ATD Serial No.: 360

Test Date: 2018-12-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	5.94	6.19	6.03	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	20.3	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	17.2	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	14.3	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	22.0	14.3	Pass
Deceleration Decay to Cross 5 g	ms	38.0	46.0	39.3	Pass
"D" Plane Rotation peak	deg	81.0	106.0	99.8	Pass
	ms	72.0	82.0	72.4	Pass
"D" Plane Rotation Decay To Zero	ms	147.0	174.0	151.9	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-75.1	Pass
	ms	65.0	79.0	67.1	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	132.6	Pass
Overall Test Results					Pass



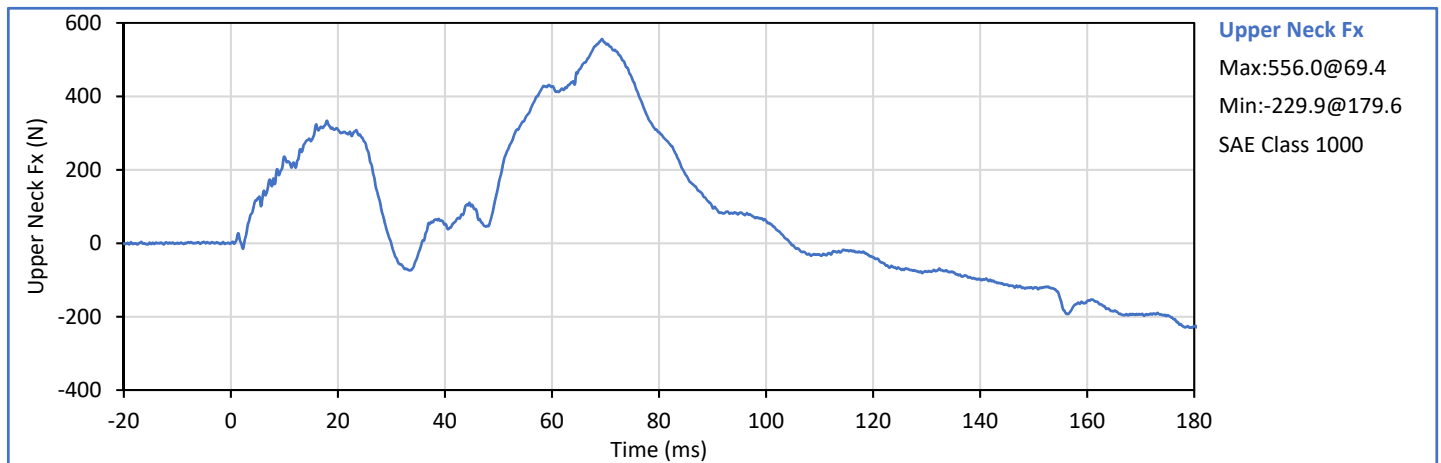
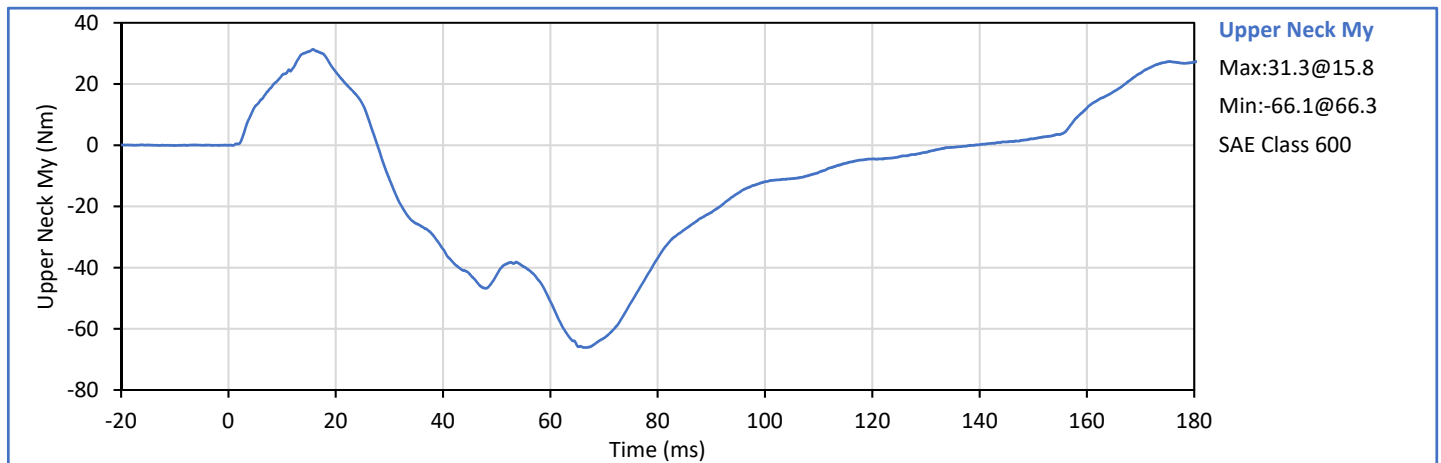
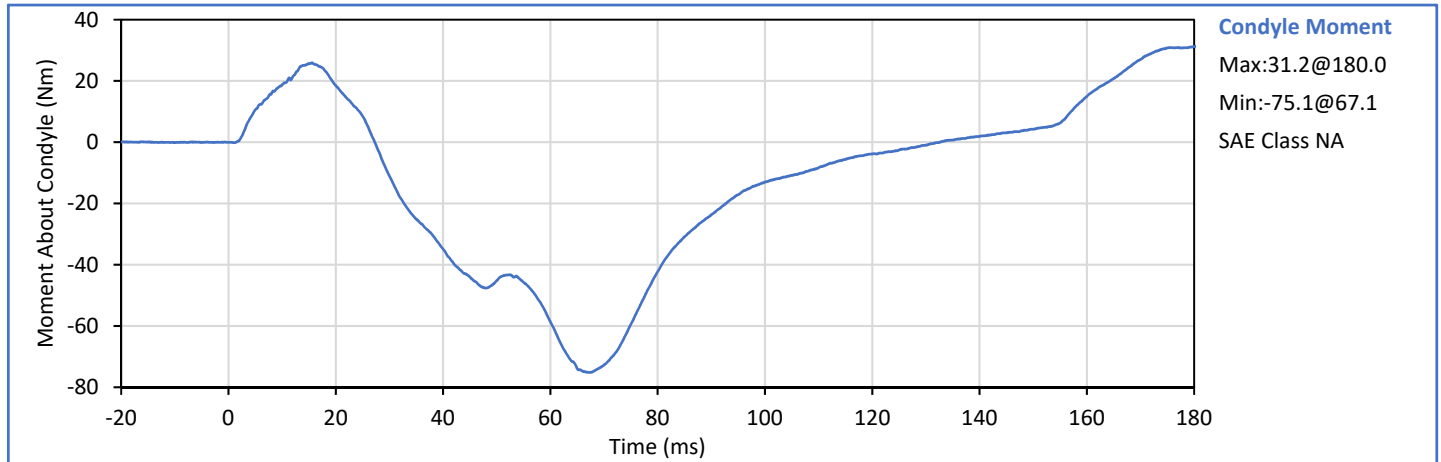
Technician: 
J. Hernandez

Approved By: 
P. Puzzuto



ATD Serial No.: 360

Test Date: 2018-12-21





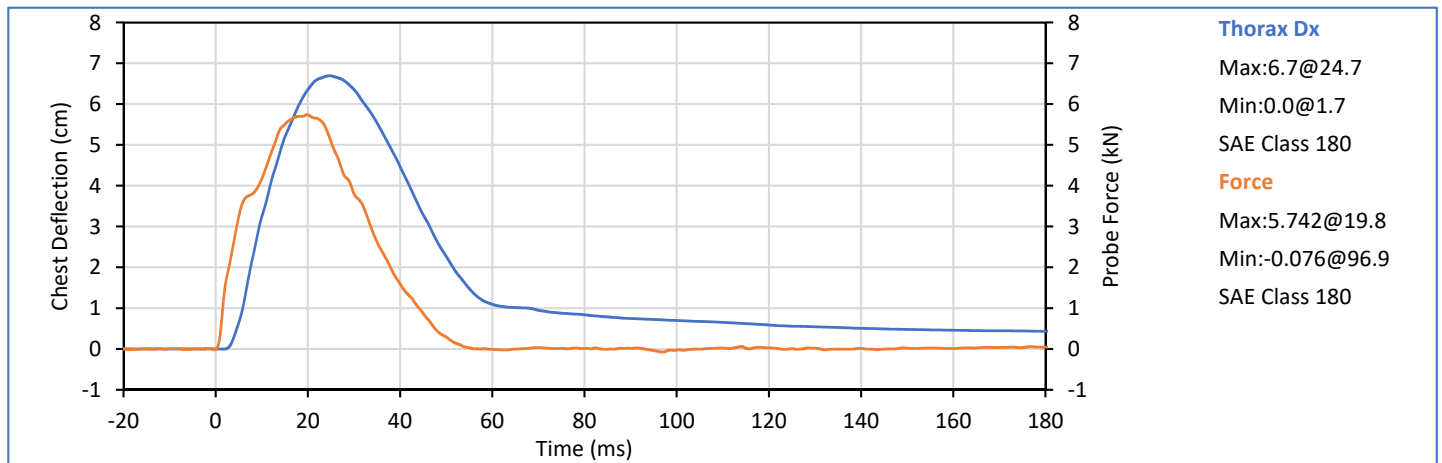
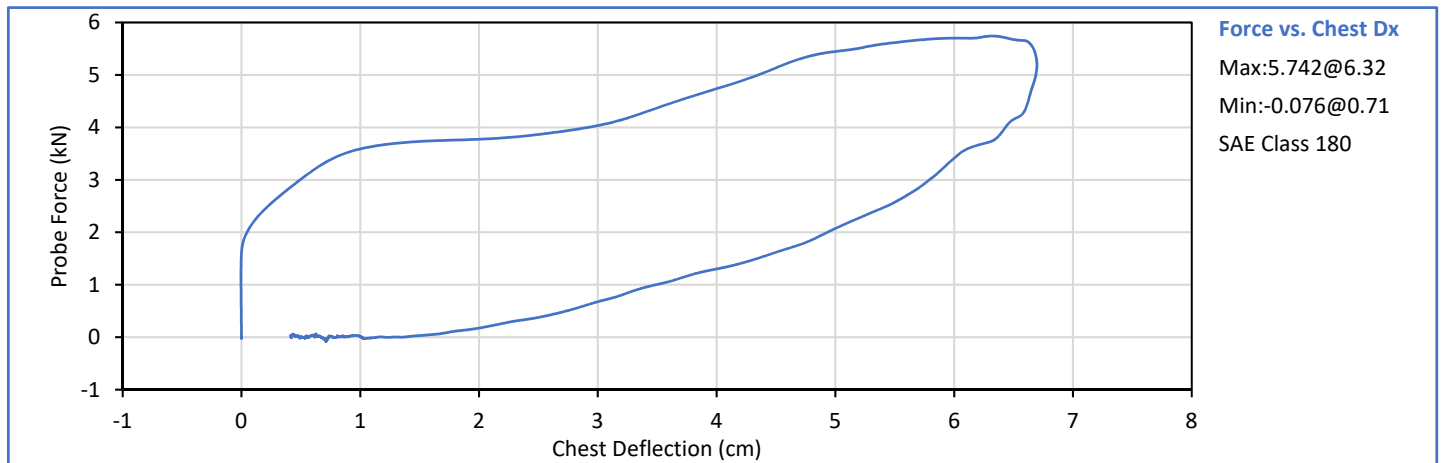
9270 Holly Road, Adelanto, CA 92301
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Hybrid III 50th Percentile Male Thorax Impact

ATD Serial No.: 360

Test Date: 2018-12-19

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	6.68	Pass
Peak Chest Deflection	cm	6.35	7.26	6.70	Pass
Peak Probe Force	kN	5.159	5.893	5.742	Pass
Internal Hysteresis	%	69.0	85.0	71.4	Pass
Overall Test Results				Pass	Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

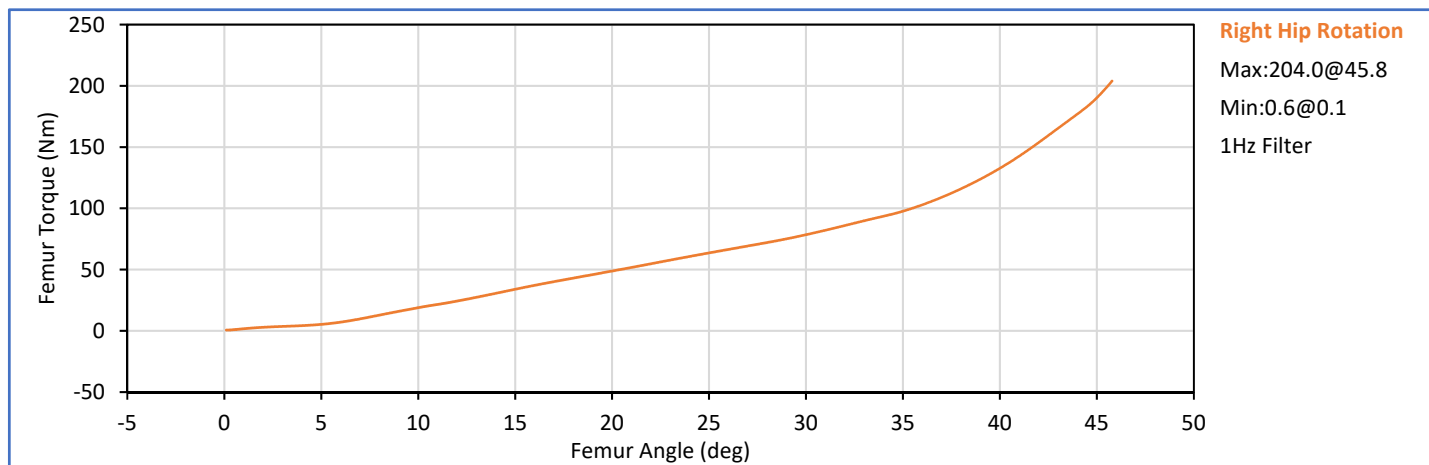
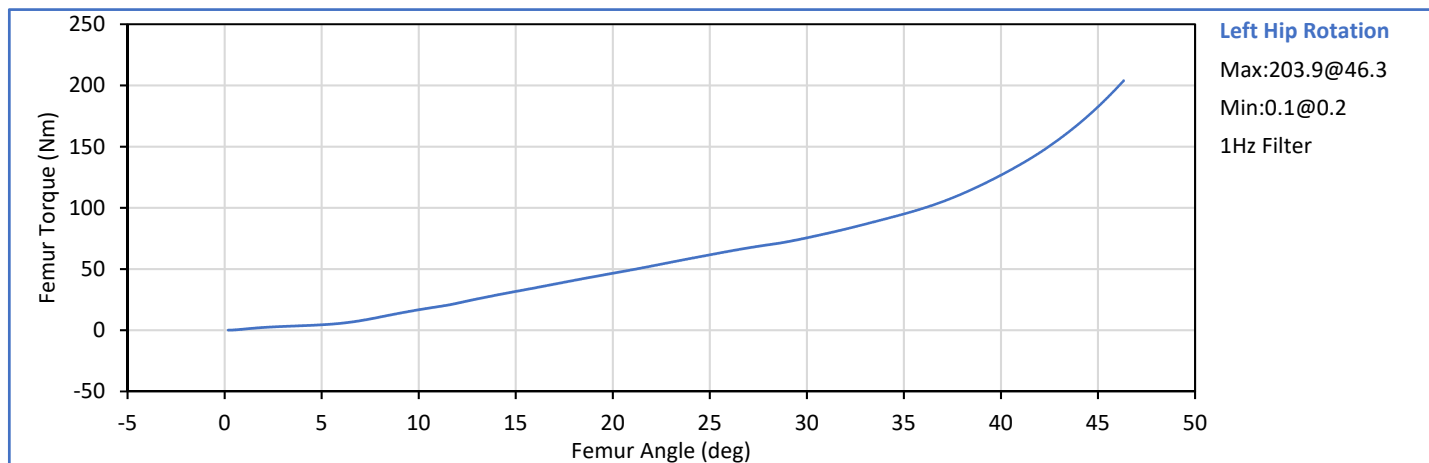


Hybrid III 50th Percentile Male
Hip Flexion (Left/Right)

ATD Serial No.: 360

Test Date: 2018-12-21

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.2	Pass
	Laboratory Humidity	%	10	70	30	Pass
Left Hip	Left Hip Rotation Rate	deg/s	5.0	10.0	5.8	Pass
	Left Femur Torque at 30°	Nm	0.0	95.0	75.5	Pass
	Left Hip Rotation at 203 Nm	deg	40.0	50.0	46.3	Pass
Right Hip	Right Hip Rotation Rate	deg/s	5.0	10.0	5.8	Pass
	Right Femur Torque at 30°	Nm	0.0	95.0	78.6	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



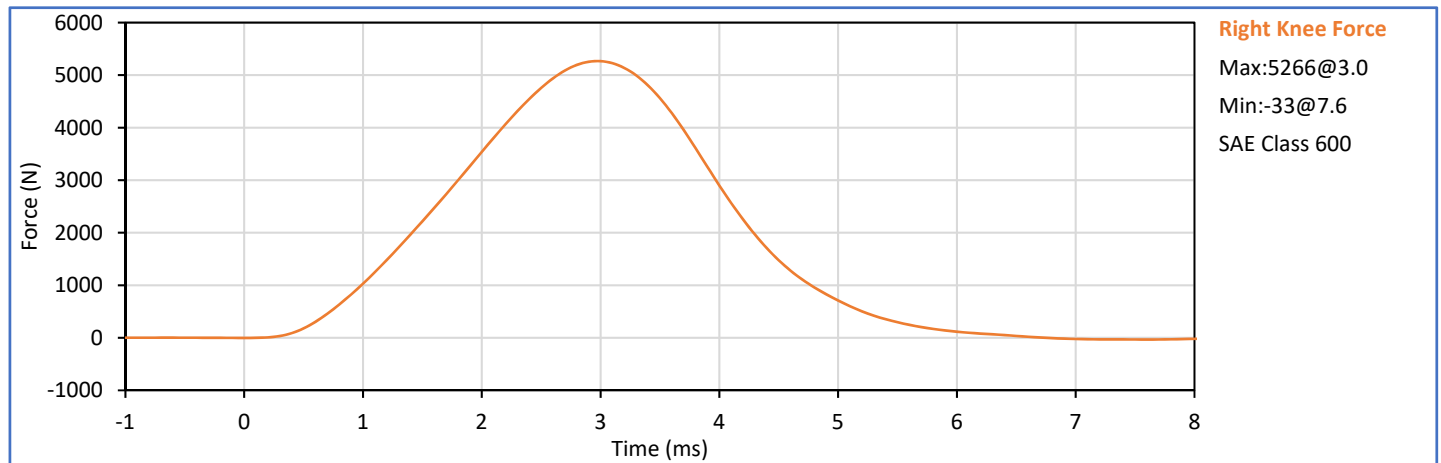
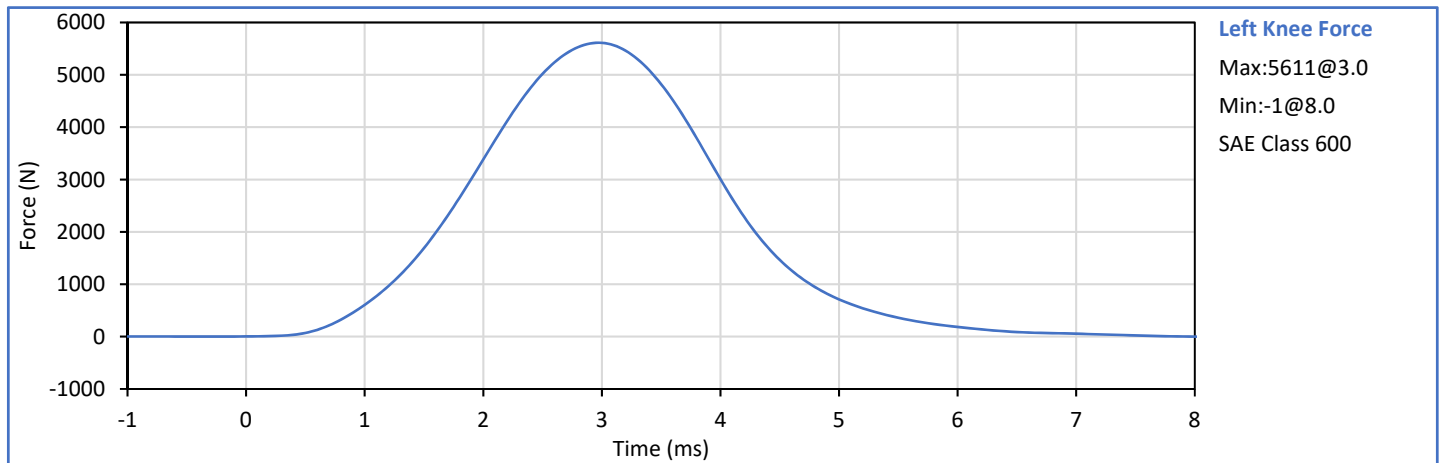
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Hybrid III 50th Percentile Male Knee Impact (Left/Right)

ATD Serial No.: 360

Test Date: 2018-12-21

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.2	Pass
	Laboratory Humidity	%	10	70	21	Pass
Left	Probe Velocity	m/s	2.070	2.130	2.085	Pass
Knee	Peak Resistive Force	N	4715	5782	5611	Pass
Right	Probe Velocity	m/s	2.070	2.130	2.087	Pass
Knee	Peak Resistive Force	N	4715	5782	5266	Pass
Overall Test Results						Pass



Technician: J. Hernandez

Approved By: P. Puzzuto



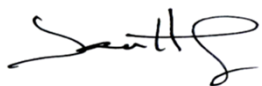
**Hybrid III 5th Percentile Female
Damage Checklist**

ATD Serial No.: 141

Test Date: 2018-12-16

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



**Hybrid III 5th Percentile Female
External Measurements**

ATD Serial No.: 141

Test Date: 2018-12-16

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	30	Pass
A - Total sitting height	mm	775	800	783	Pass
B - Shoulder pivot height	mm	432	457	444	Pass
C - 'H' point height	mm	81	86	85	Pass
D - 'H' point location from backline	mm	145	150	146	Pass
E - Shoulder pivot from backline	mm	69	84	80	Pass
F - Thigh clearance	mm	119	135	128	Pass
G - Back of elbow to wrist pivot	mm	244	259	256	Pass
H - Head back to backline	mm	41	46	44	Pass
I - Shoulder to elbow length	mm	277	297	285	Pass
J - Elbow rest height	mm	183	203	196	Pass
K - Buttock to knee length	mm	521	546	531	Pass
L - Popliteal length	mm	356	376	369	Pass
M - Knee pivot height	mm	394	419	411	Pass
N - Buttock popliteal length	mm	414	439	426	Pass
O - Chest depth without jacket	mm	175	191	187	Pass
P - Foot length	mm	219	234	231	Pass
R - Buttock to Knee Pivot Length	mm	457	483	472	Pass
S - Head Breadth	mm	137	147	144	Pass
T - Head Depth	mm	178	188	181	Pass
U - Hip Breadth	mm	300	315	304	Pass
V - Shoulder breadth	mm	351	366	363	Pass
W - Foot breadth	mm	79	94	85	Pass
X - Head circum.	mm	528	549	539	Pass
Y - Chest circum. (w/chest jacket)	mm	851	881	871	Pass
Z - Waist circum.	mm	760	790	769	Pass
AA - Location for chest circum.	mm	333	358	343	Pass
BB - Location for waist circum.	mm	160	170	168	Pass
			Overall Test Results		Pass

Technician: _____

J. Hernandez

Approved By: _____

P. Puzzuto

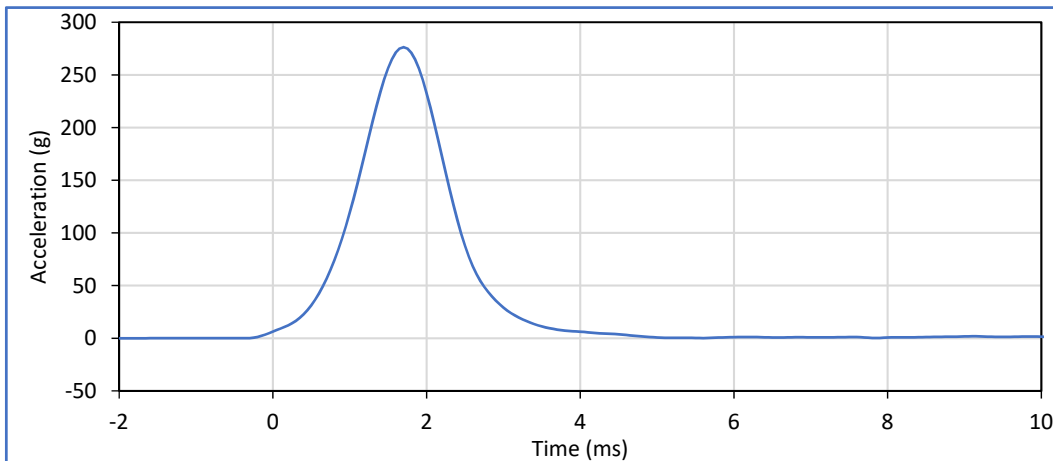


Hybrid III 5th Percentile Female Head Drop

ATD Serial No.: 141

Test Date: 2018-12-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.1	Pass
Laboratory Humidity	%	10	70	30	Pass
Peak Resultant Acceleration	g	250.0	300.0	276.4	Pass
Peak Lateral Acceleration	g	-15.0	15.0	8.0	Pass
Oscillations After Main Pulse	%	0.0	10.0	0.7	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results	Pass	

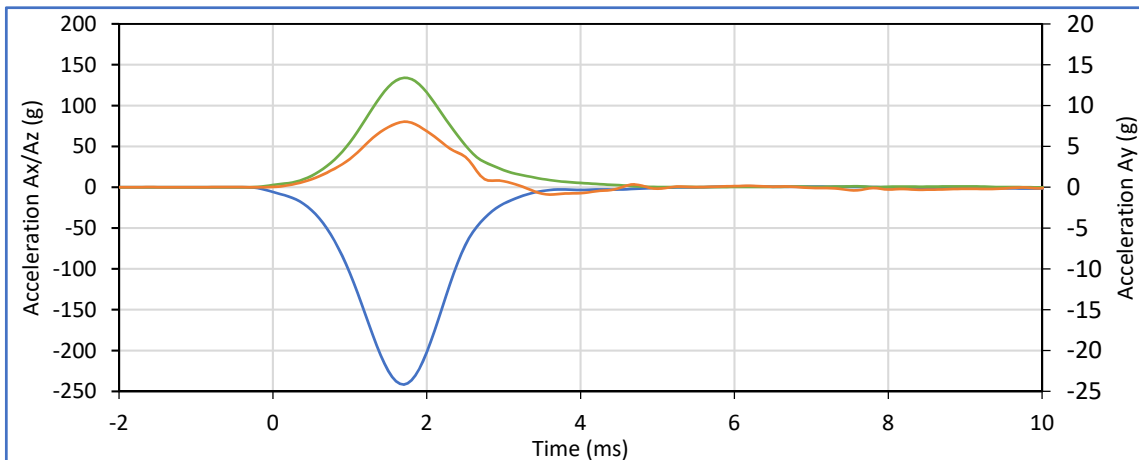


Head Resultant

Max:276.4@1.7

Min:0.2@5.6

SAE Class 1000



Head Ax

Max:1.1@6.2

Min:-241.5@1.7

SAE Class 1000

Head Ay

Max:8.0@1.7

Min:-0.9@3.6

SAE Class 1000

Head Az

Max:134.1@1.7

Min:-0.2@10.0

SAE Class 1000

Technician:

J. Hernandez

Approved By:

P. Puzzuto

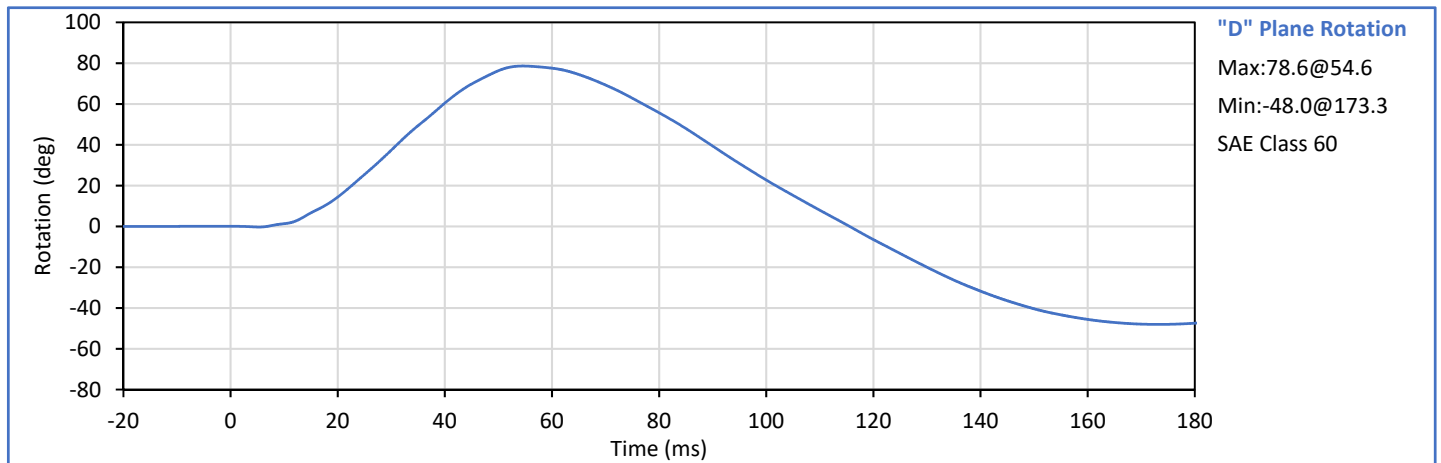
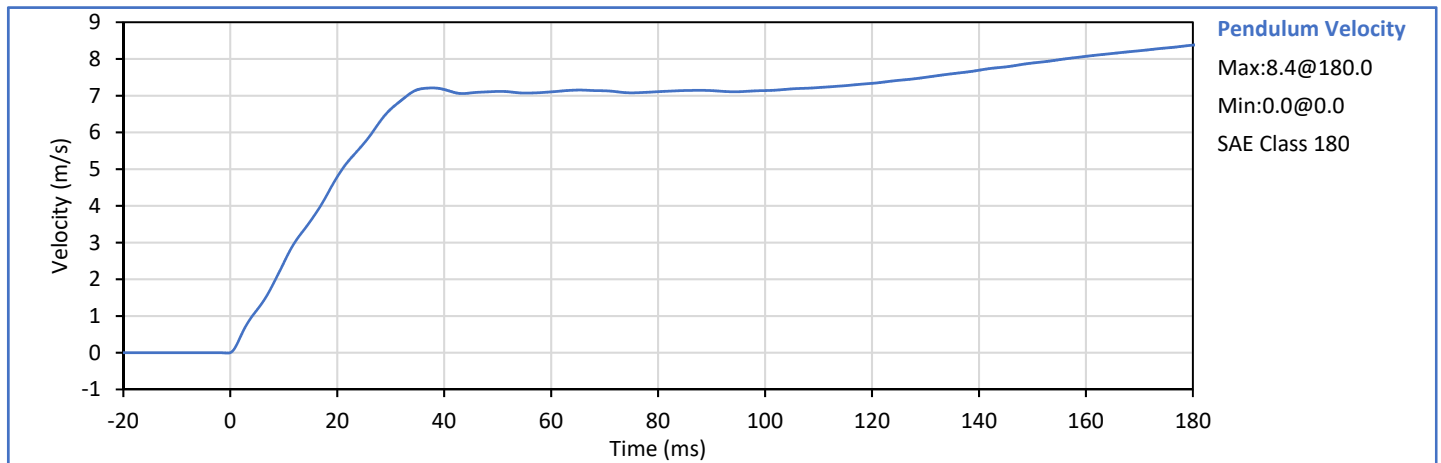


Hybrid III 5th Percentile Female Neck Flexion Test

ATD Serial No.: 141

Test Date: 2018-12-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	6.89	7.13	6.98	Pass
Pendulum Velocity at 10 ms	m/s	2.10	2.50	2.45	Pass
Pendulum Velocity at 20 ms	m/s	4.00	5.00	4.79	Pass
Pendulum Velocity at 30 ms	m/s	5.80	7.00	6.63	Pass
Peak "D" Plane Rotation	deg	77.0	91.0	78.6	Pass
Peak Moment in Rotation	Nm	69.0	83.0	79.3	Pass
Positive Moment Decay to 10 Nm	ms	80.0	100.0	82.7	Pass
Overall Test Results				Pass	Pass



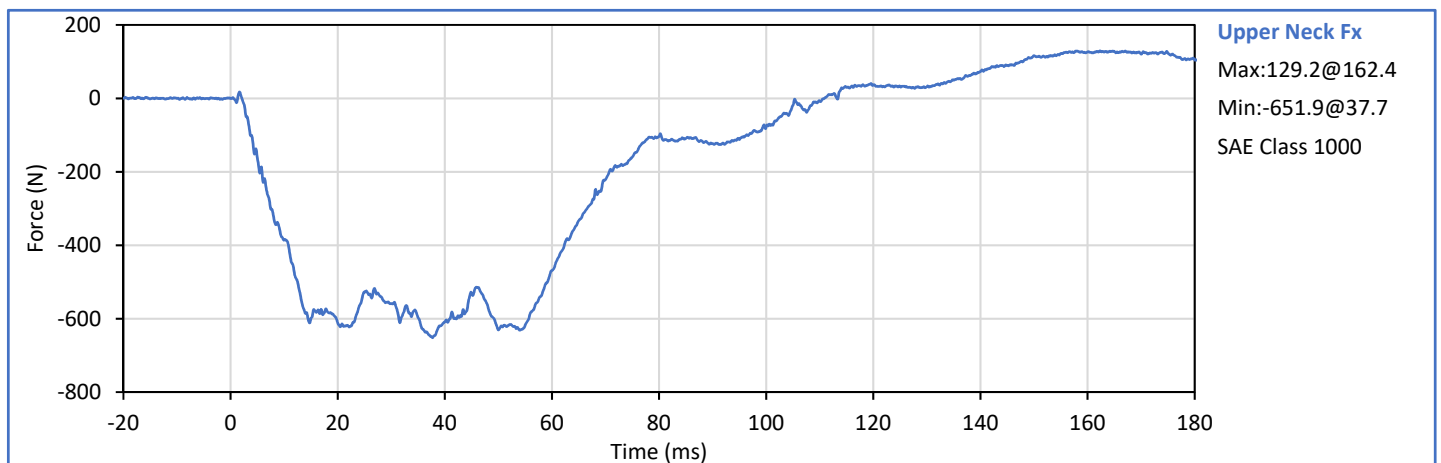
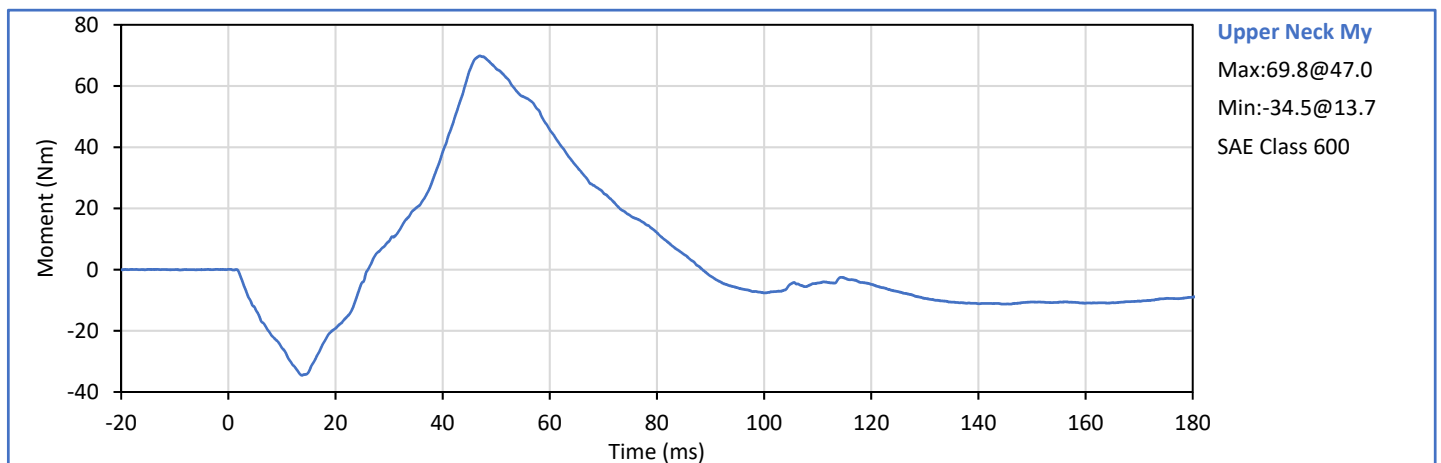
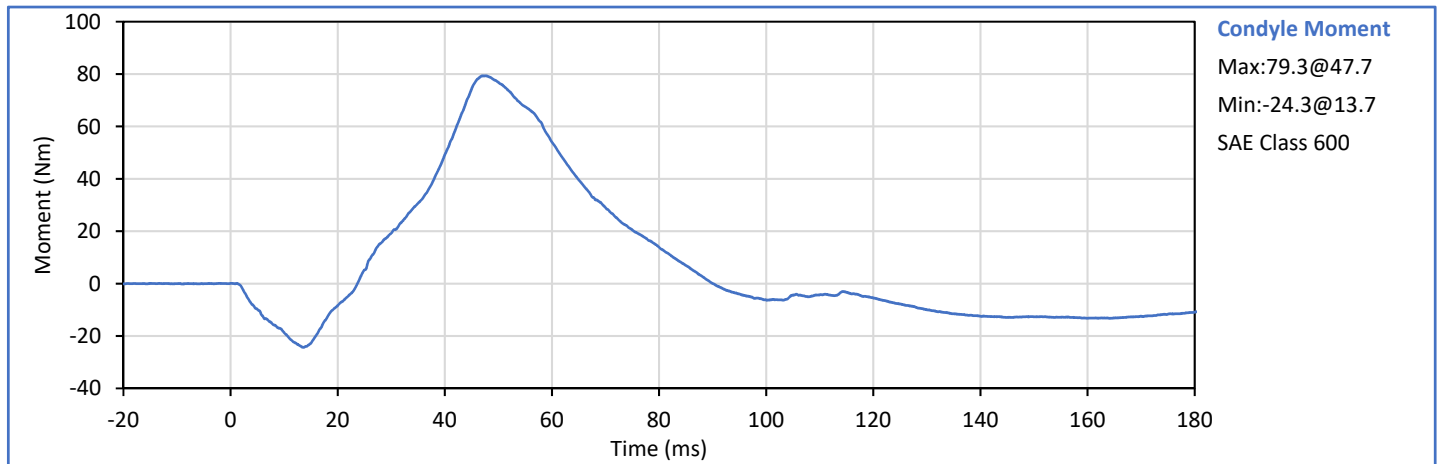
Technician: J. Hernandez

Approved By: P. Puzzuto



ATD Serial No.: 141

Test Date: 2018-12-21



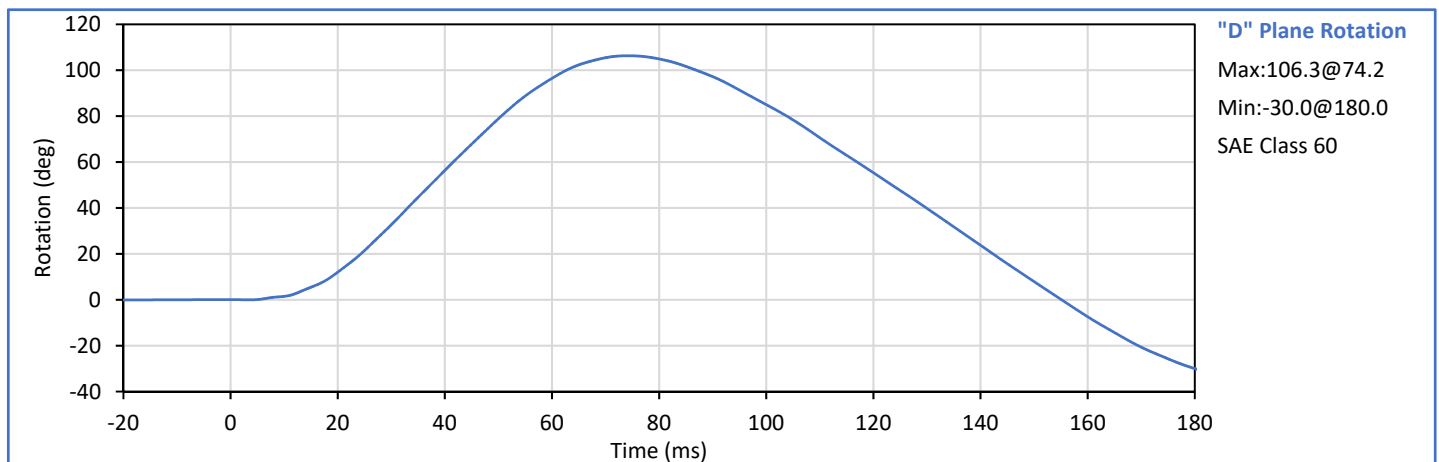
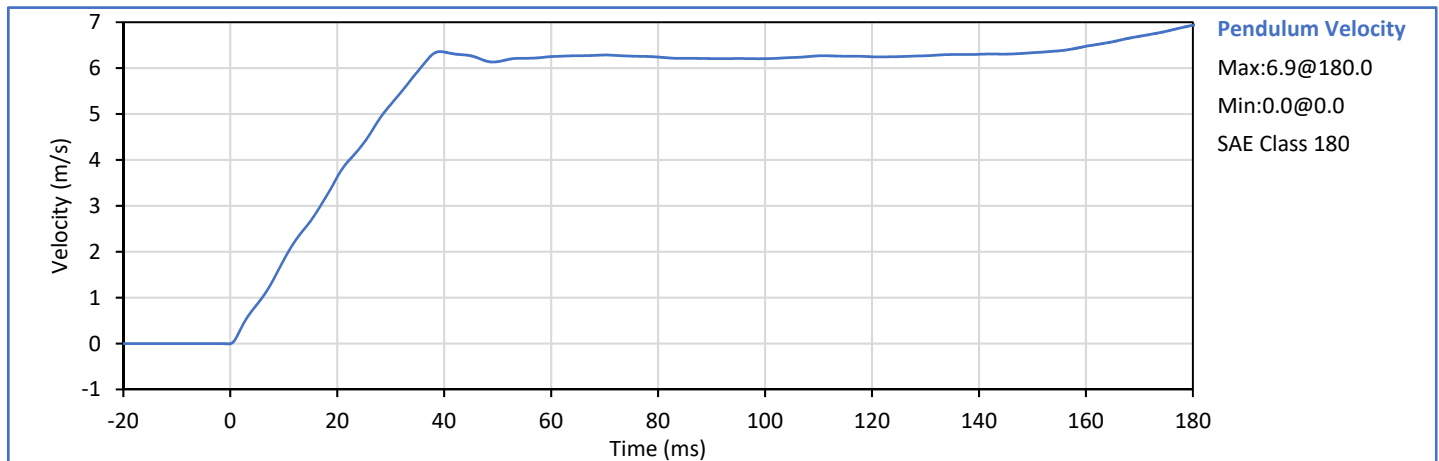


**Hybrid III 5th Percentile Female
Neck Extension Test**

ATD Serial No.: 141

Test Date: 2018-12-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Humidity	%	10	70	30	Pass
Pendulum Velocity	m/s	5.95	6.19	6.12	Pass
Pendulum Velocity at 10 ms	m/s	1.50	1.90	1.82	Pass
Pendulum Velocity at 20 ms	m/s	3.10	3.90	3.63	Pass
Pendulum Velocity at 30 ms	m/s	4.60	5.60	5.21	Pass
Peak "D" Plane Rotation	deg	99.0	114.0	106.3	Pass
Peak Moment in Rotation	Nm	-65.0	-53.0	-57.2	Pass
Negative Moment Decay to -10 Nm	ms	94.0	114.0	101.3	Pass
Overall Test Results				Pass	Pass



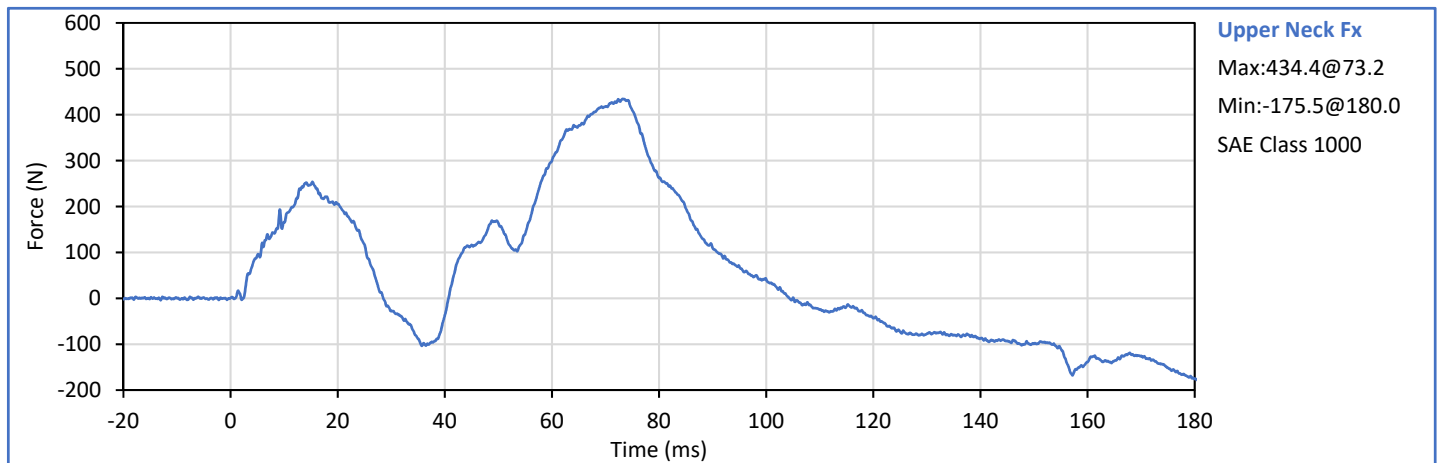
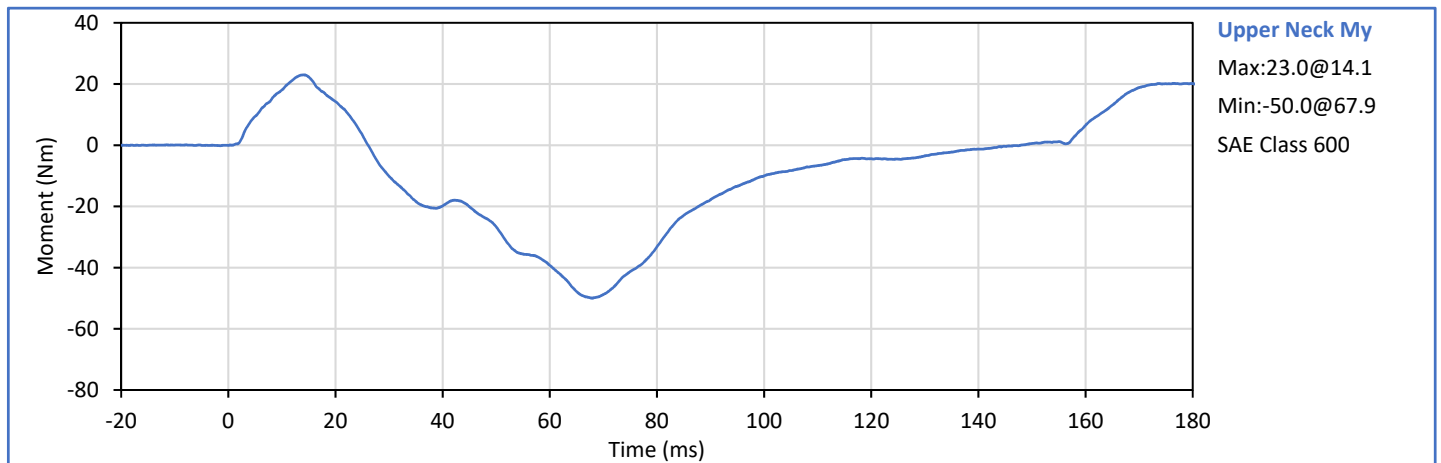
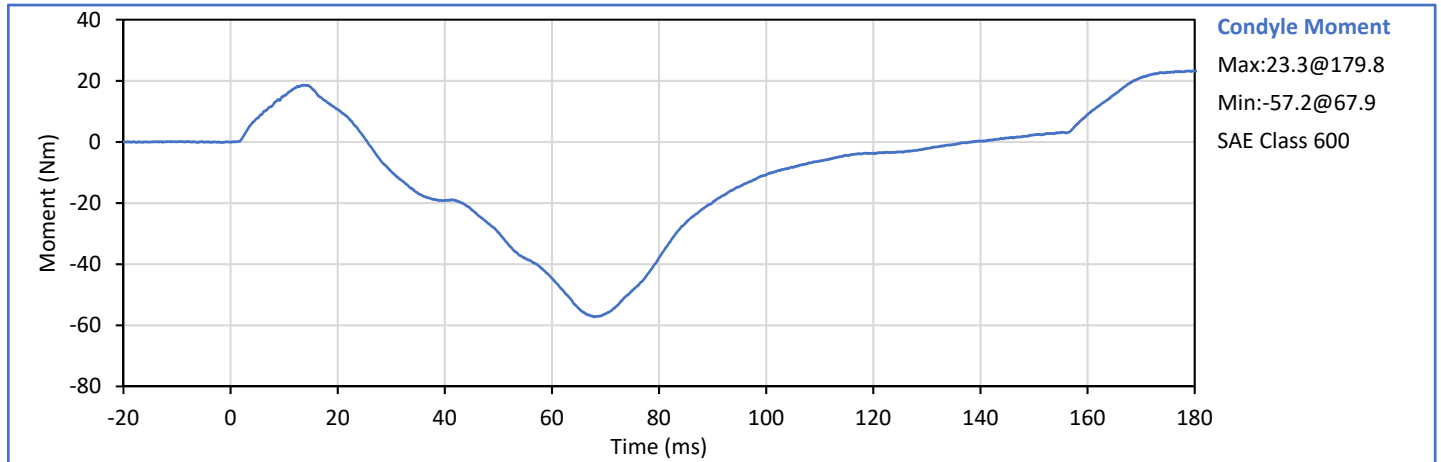
Technician: J. Hernandez

Approved By: P. Puzzuto



ATD Serial No.: 141

Test Date: 2018-12-21



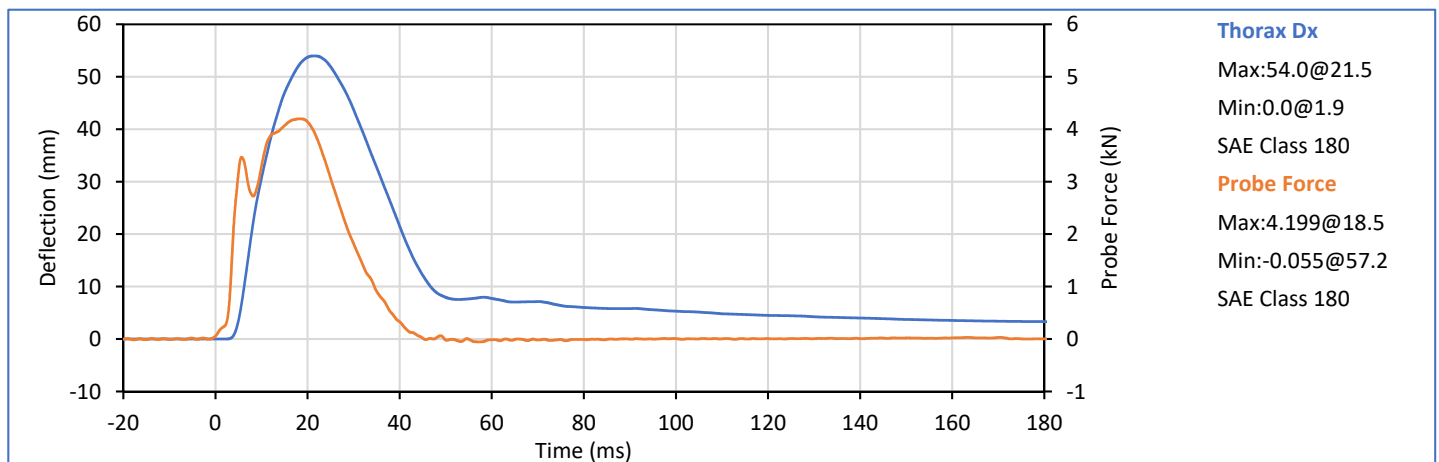
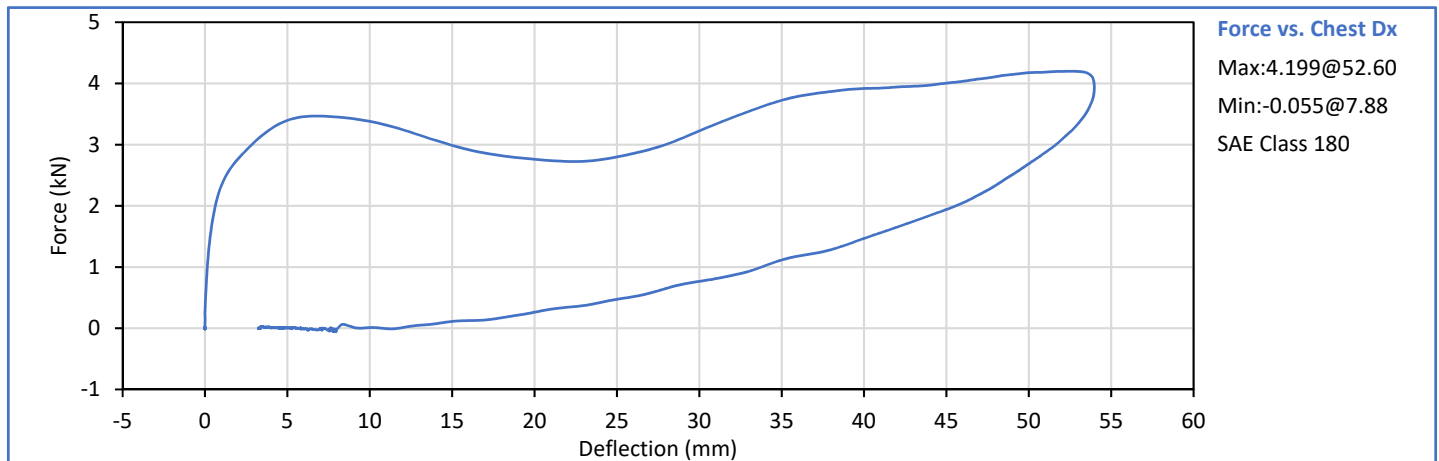


Hybrid III 5th Percentile Female Thorax Impact

ATD Serial No.: 141

Test Date: 2018-12-16

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.8	Pass
Laboratory Humidity	%	10	70	27	Pass
Probe Velocity	m/s	6.59	6.83	6.64	Pass
Peak Chest Deflection	mm	50.0	58.0	54.0	Pass
Peak Probe Force, 50 and 58 mm	kN	3.900	4.400	4.199	Pass
Peak Probe Force, 18 and 50 mm	kN	0.000	4.600	4.176	Pass
Internal Hysterisis	%	69.0	85.0	73.1	Pass
Overall Test Results					Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

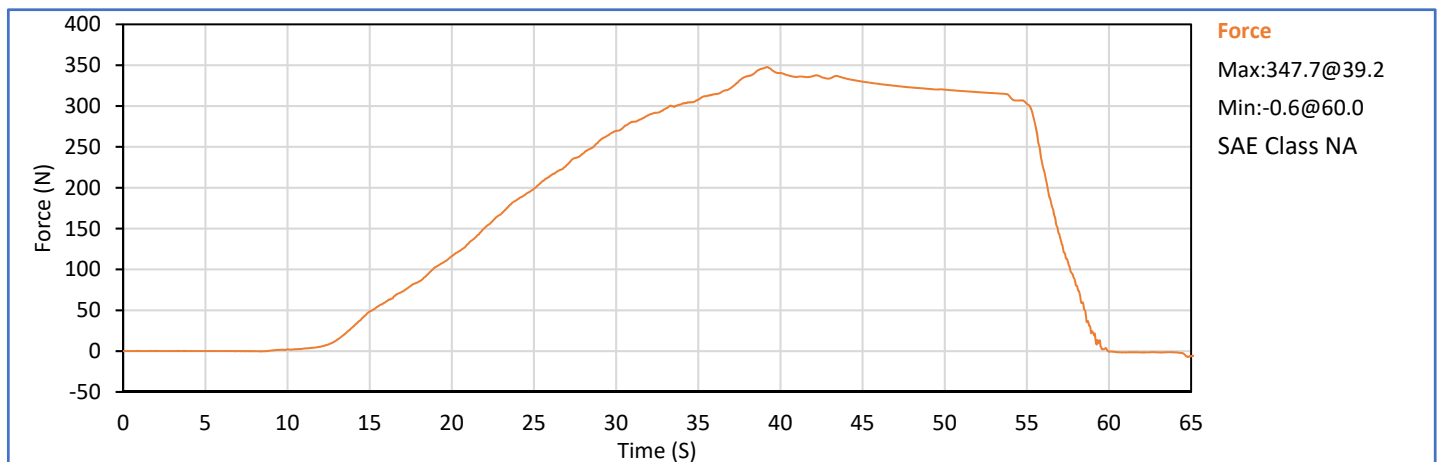
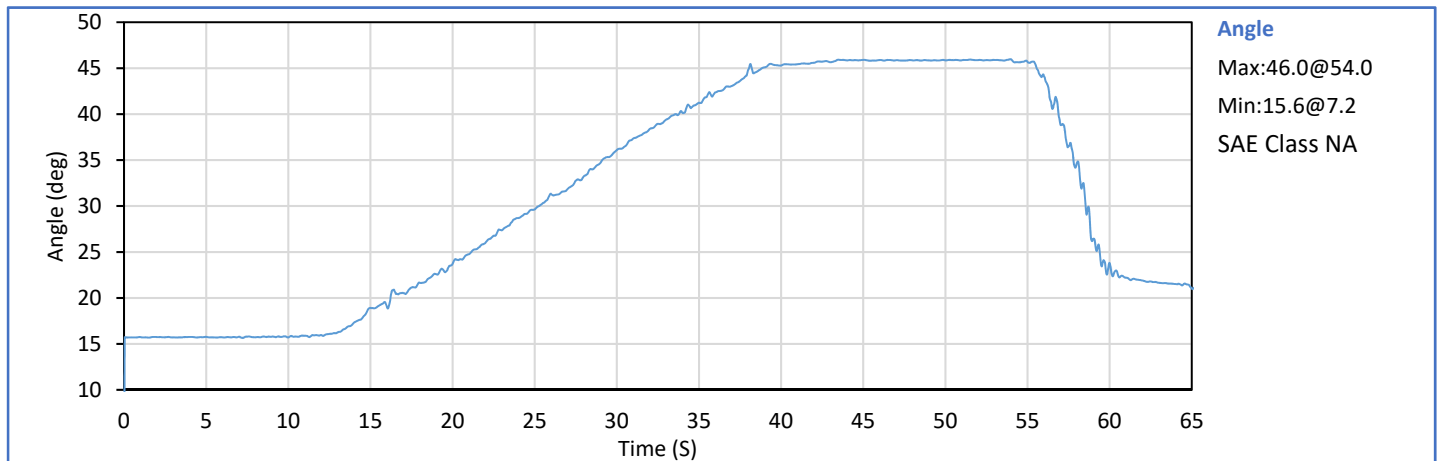


**Hybrid III 5th Percentile Female
Torso Flexion Test**

ATD Serial No.: 141

Test Date: 2018-12-21

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.6	Pass
Laboratory Humidity	%	10	70	30	Pass
Orientation Angle	deg	0.0	20.0	13.5	Pass
Test Initial Angle	deg	11.0	19.0	15.7	Pass
Peak Force at 45° (+/-0.5°)	N	320.0	390.0	336.7	Pass
Torso Flexion Rate	deg/s	0.50	1.50	1.15	Pass
Final Reference Plane Angle	deg	-8.0	8.0	4.0	Pass
Overall Test Results					Pass



Technician: J. Hernandez

Approved By: P. Puzzuto



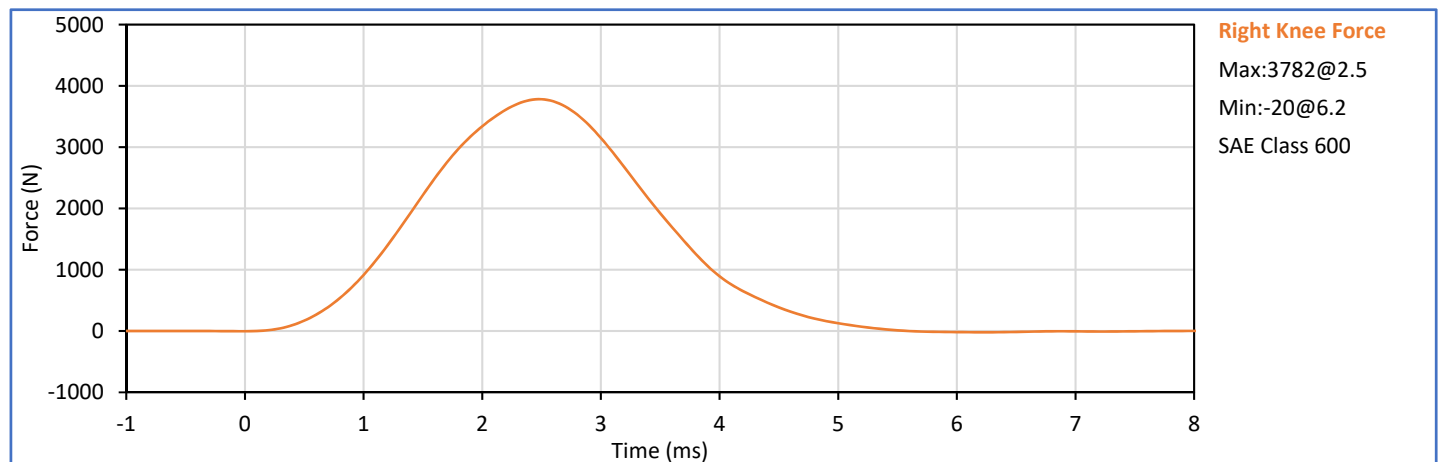
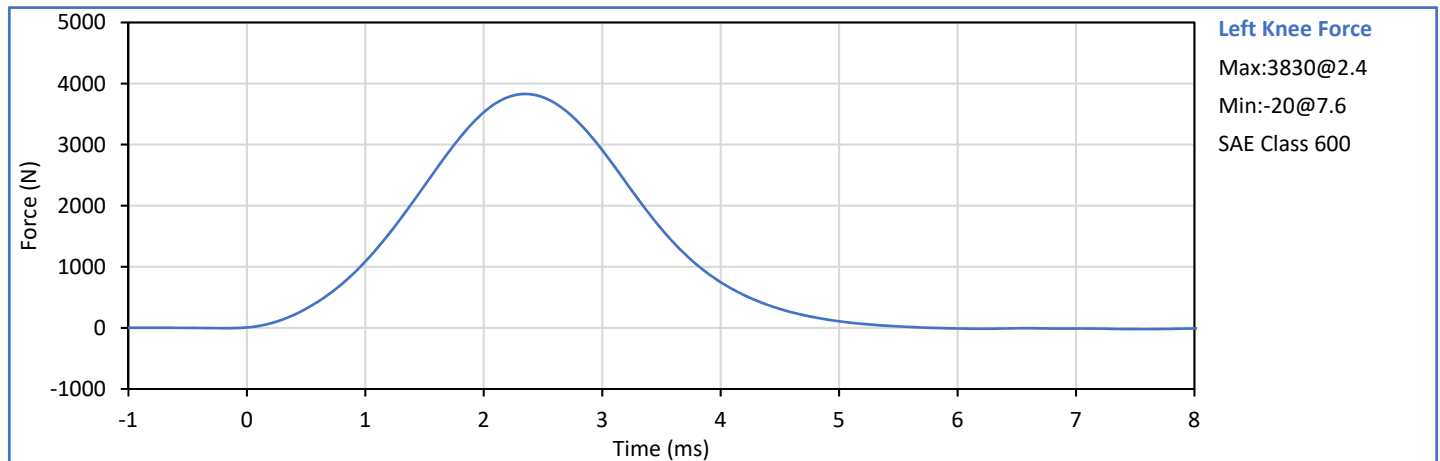
9270 Holly Road, Adelanto, CA 92301
Tel: +1 760 246 1672 Fax: +1 760 246 8112
Info@karco.com www.karco.com

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

ATD Serial No.: 141

Test Date: 2018-12-21

Tested Parameter		Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature		°C	18.9	25.6	21.1	Pass
Laboratory Humidity		%	10	70	30	Pass
Left	Probe Velocity	m/s	2.070	2.130	2.078	Pass
Knee	Peak Resistive Force	N	3450	4060	3830	Pass
Right	Probe Velocity	m/s	2.070	2.130	2.070	Pass
Knee	Peak Resistive Force	N	3450	4060	3782	Pass
Overall Test Results						Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

APPENDIX C
POST-TEST ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

ATD Serial No.: 360

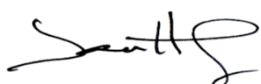
Test Date: 2019-02-08

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. Assembly	Bent shaft			✓
	Slider arm riding in track			✓
Sensors	Check cables for cuts, tears			✓
	Check for damaged insulation			✓
Accelerometer Mounting	Head mounting secure			✓
	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

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:



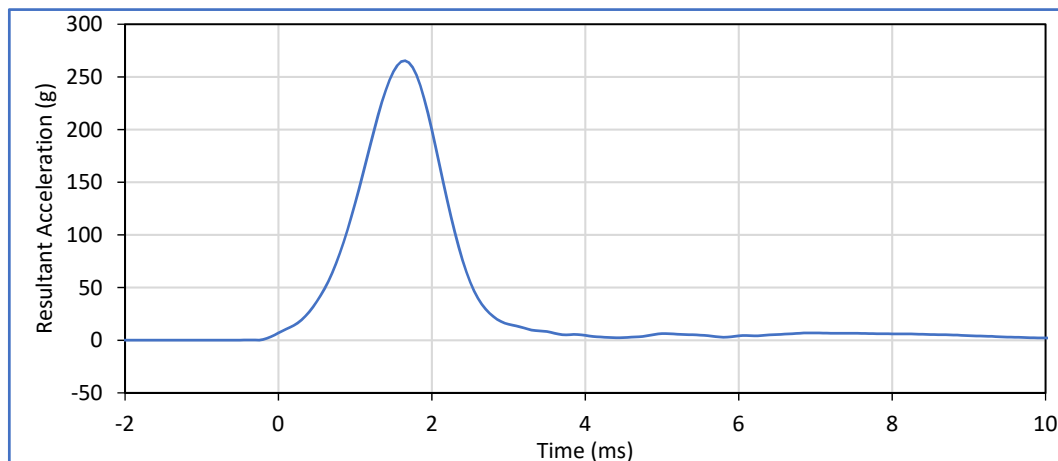
J. Hernandez

Approved By:



P. Puzzuto

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	

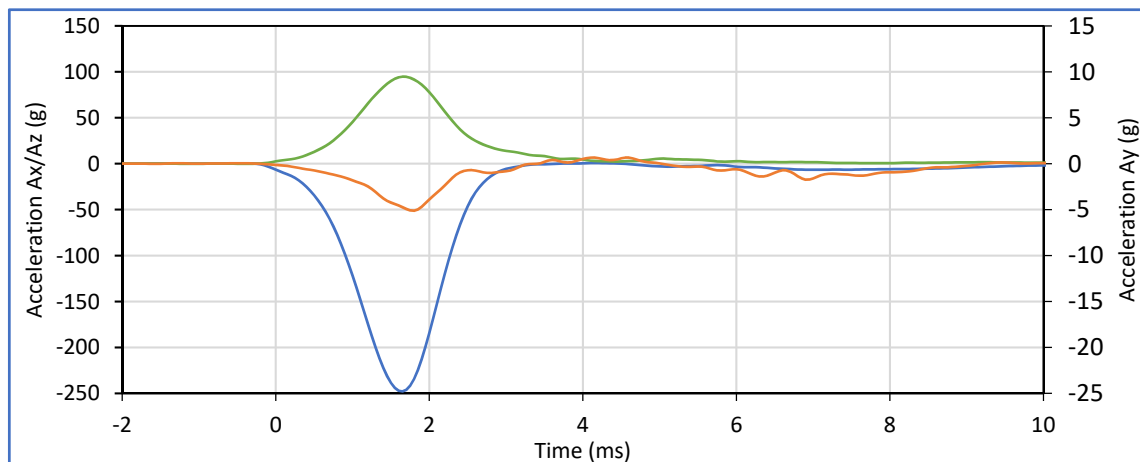


Head Resultant

Max:265.4@1.7

Min:2.2@10.0

SAE Class 1000



Head Ax

Max:0.8@4.2

Min:-247.8@1.7

SAE Class 1000

Head Ay

Max:0.7@4.2

Min:-5.1@1.8

SAE Class 1000

Head Az

Max:94.9@1.7

Min:0.5@8.0

SAE Class 1000

Technician:

J. Hernandez

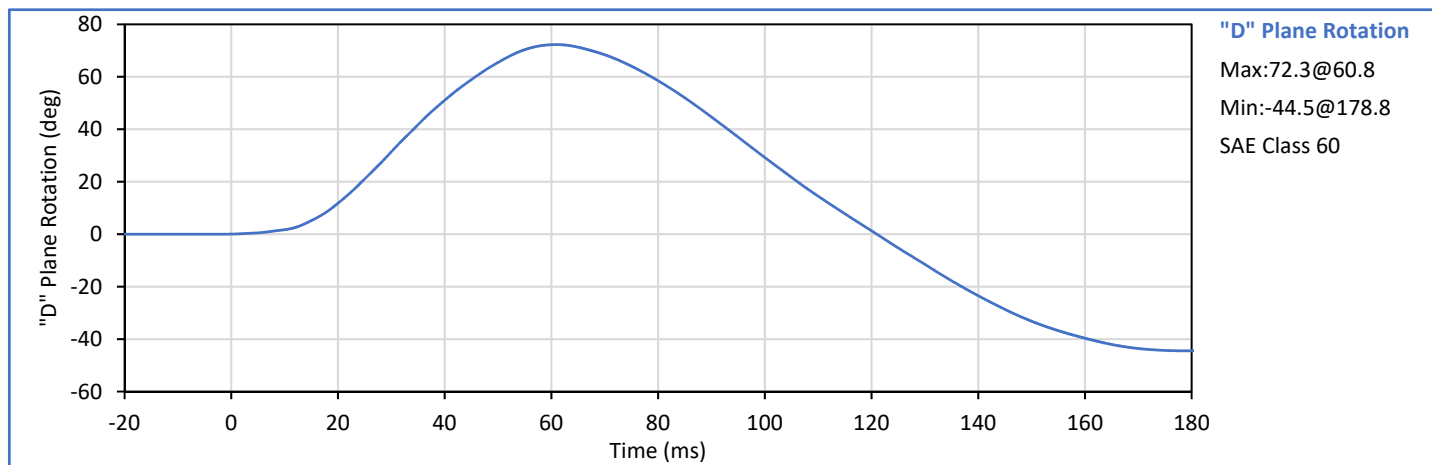
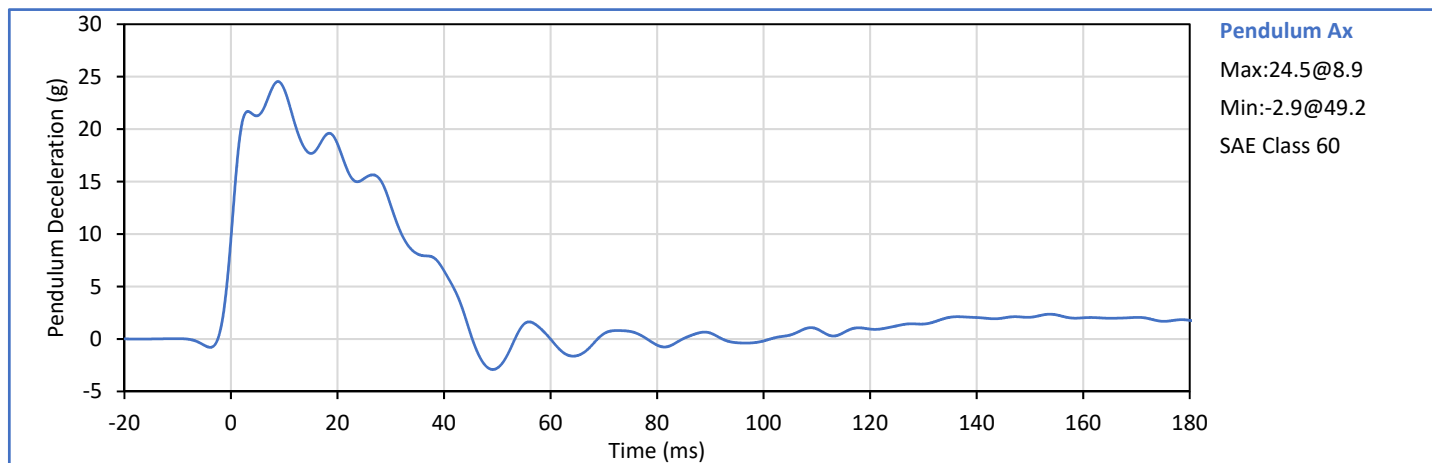
J. Hernandez

Approved By:

P. Puzzuto

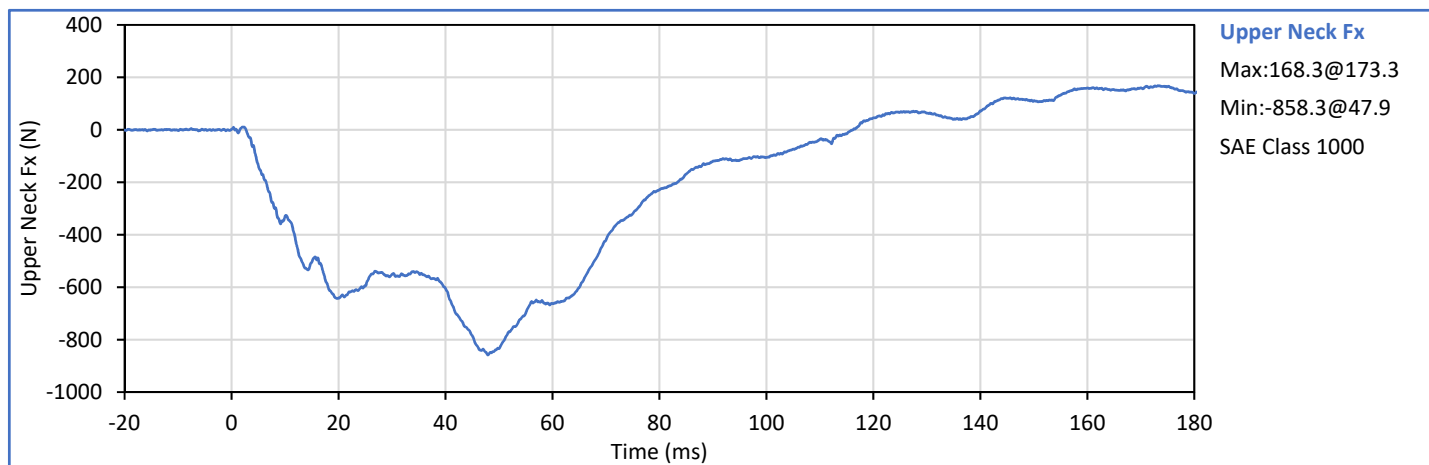
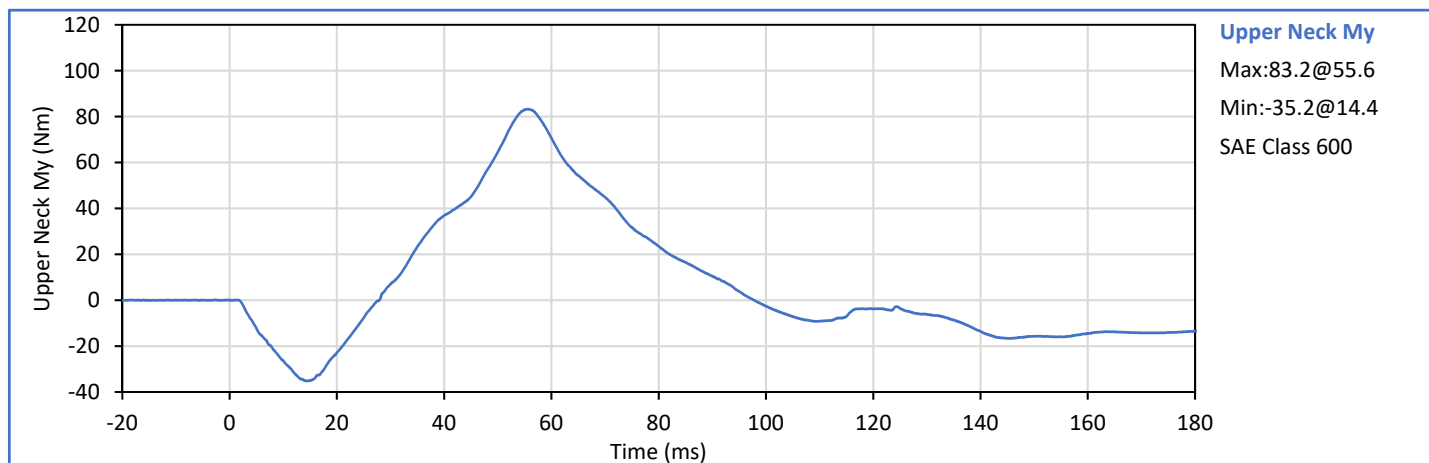
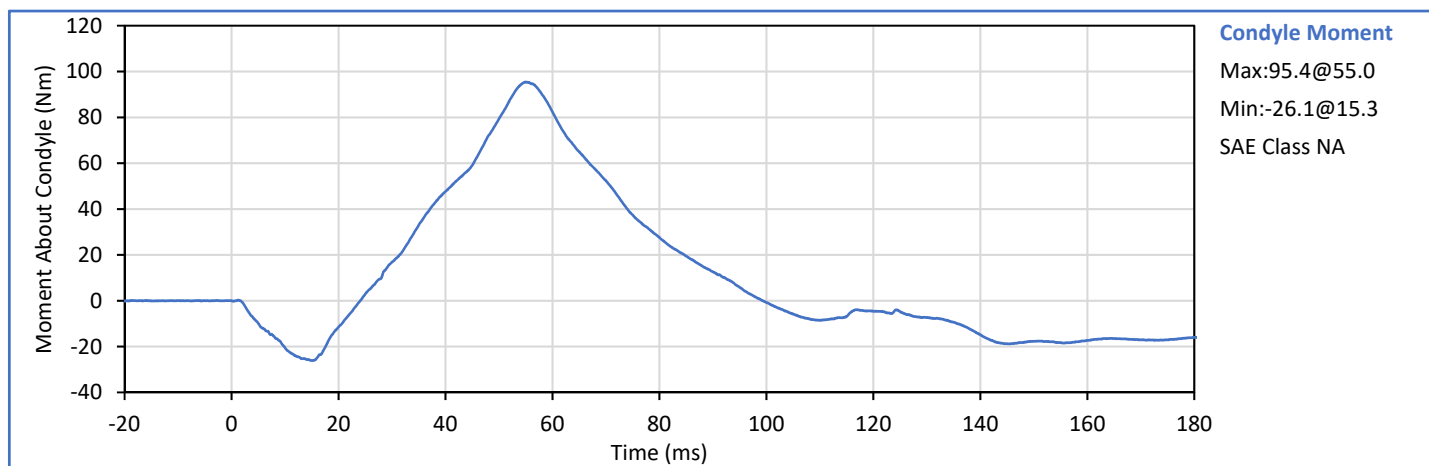
P. Puzzuto

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

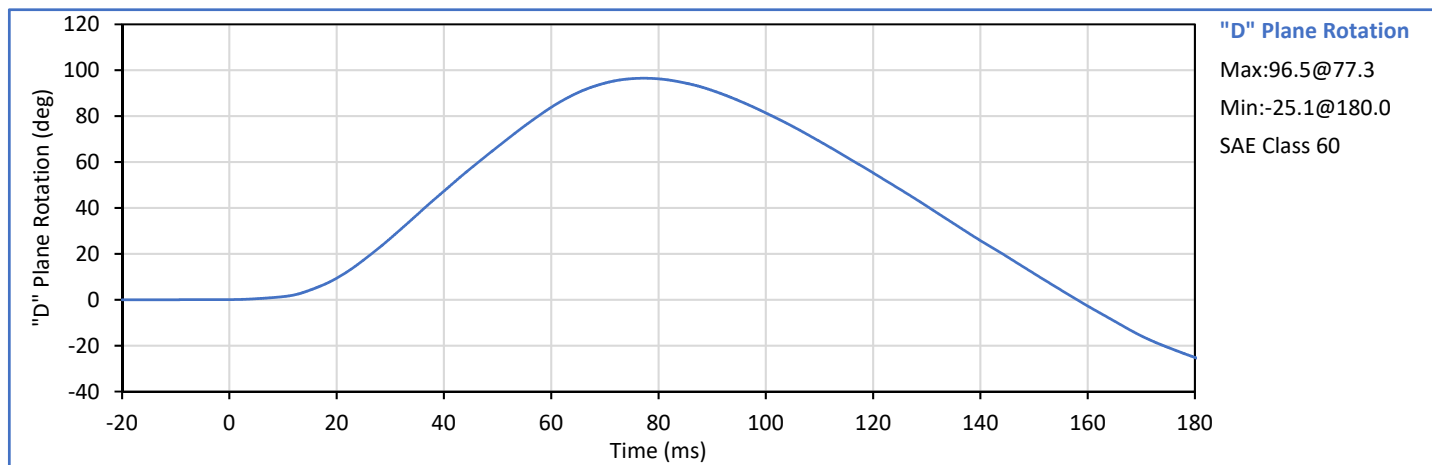
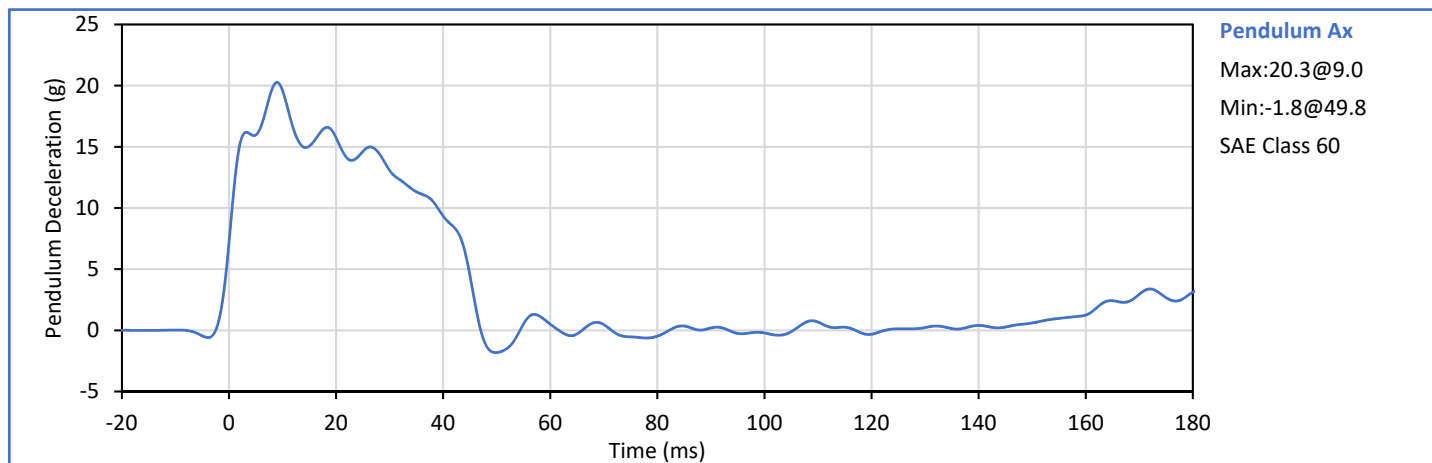


Technician: J. Hernandez

Approved By: P. Puzzuto

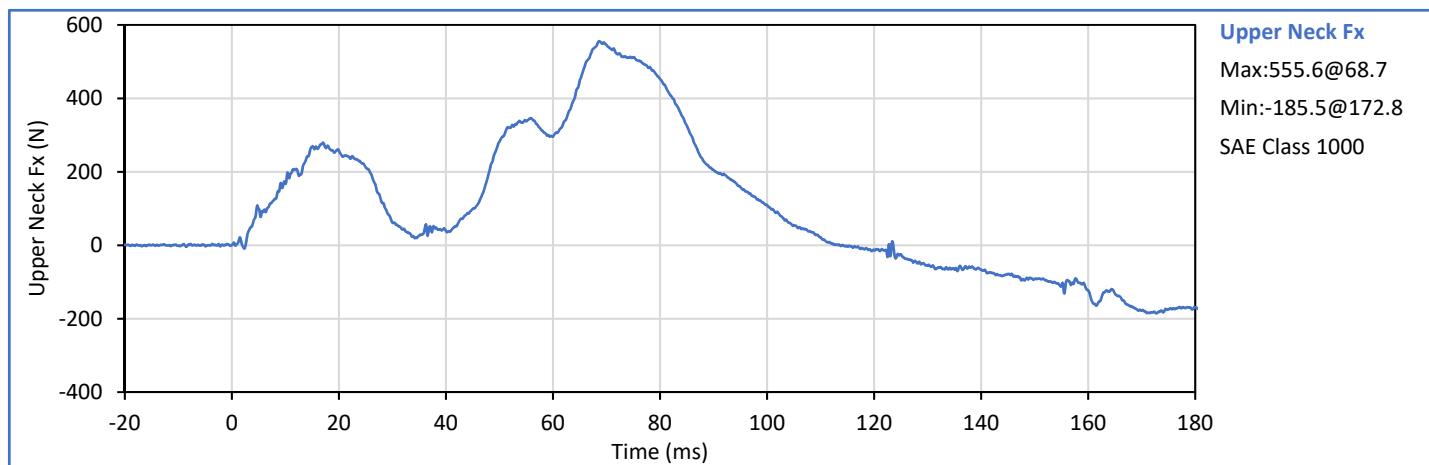
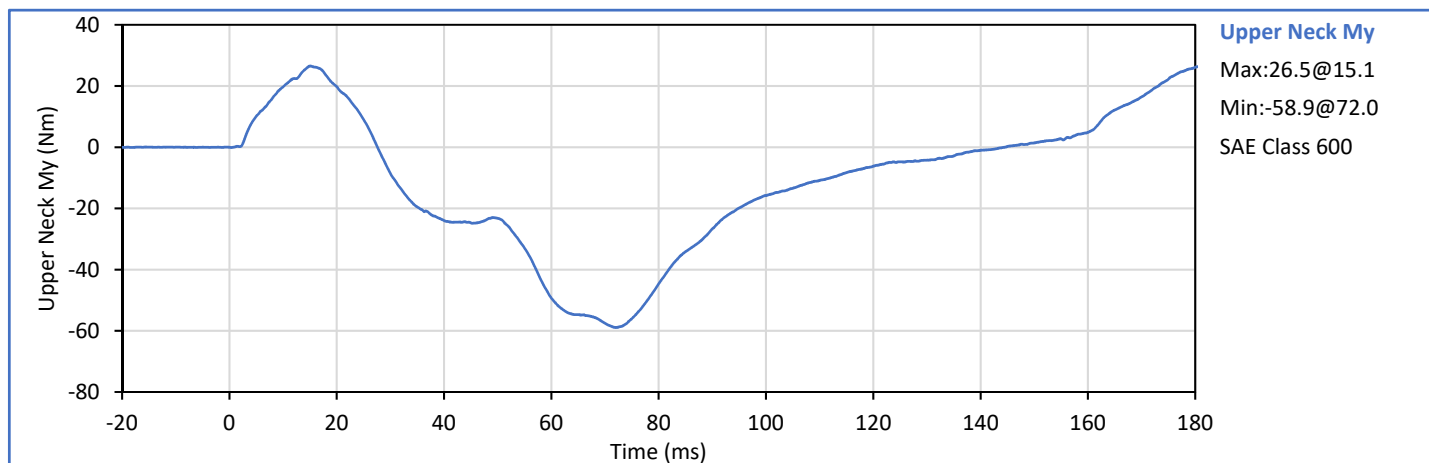
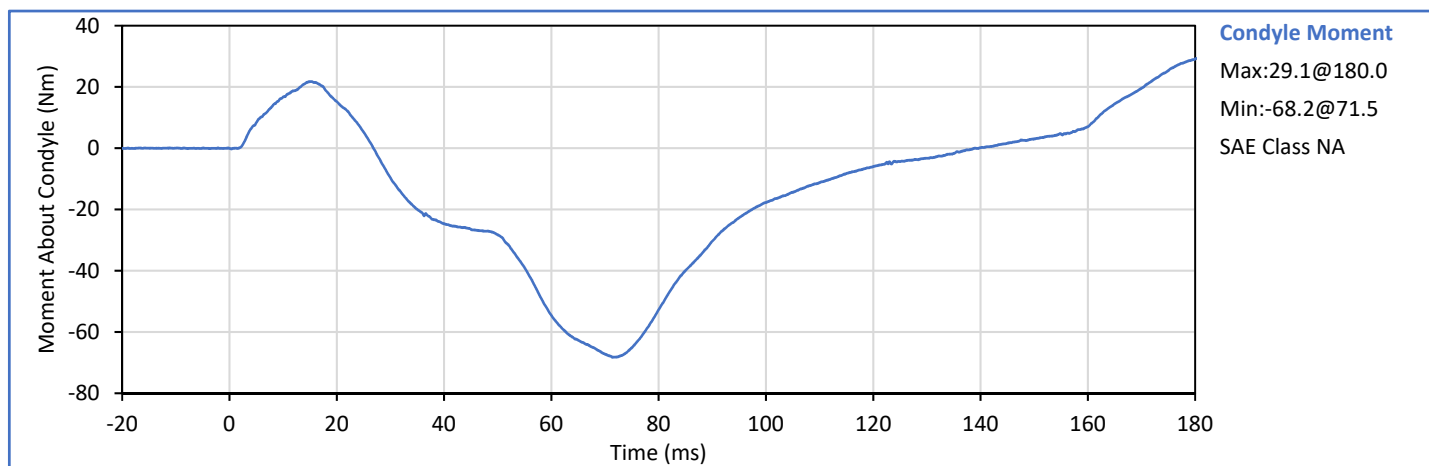


Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Humidity	%	10	70	23	Pass
Pendulum Velocity	m/s	5.94	6.19	5.98	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	19.6	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	15.7	Pass
Pendulum Deceleration 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

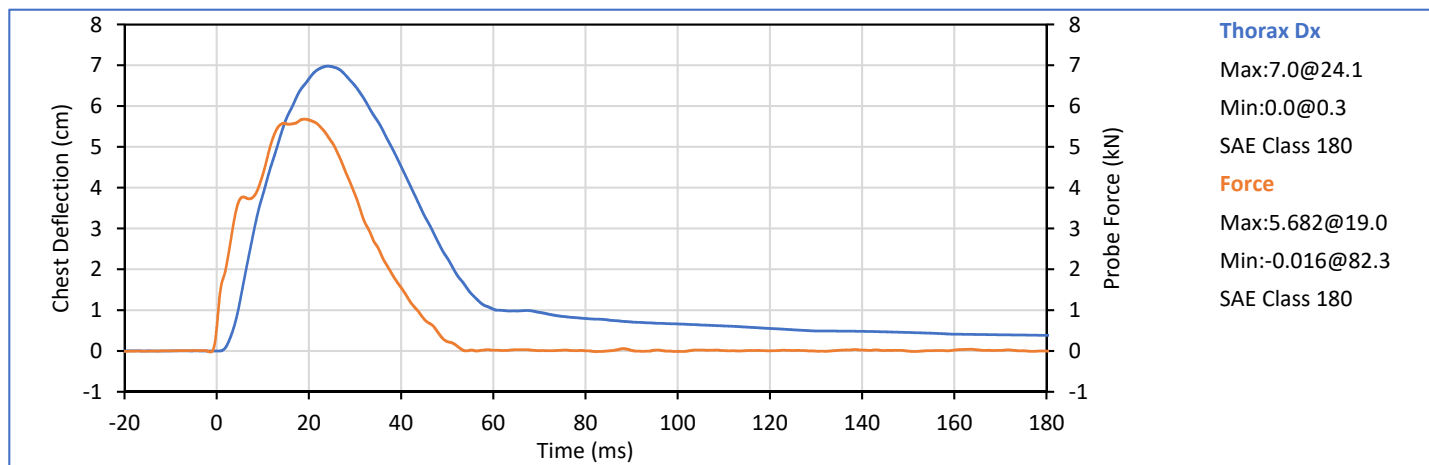
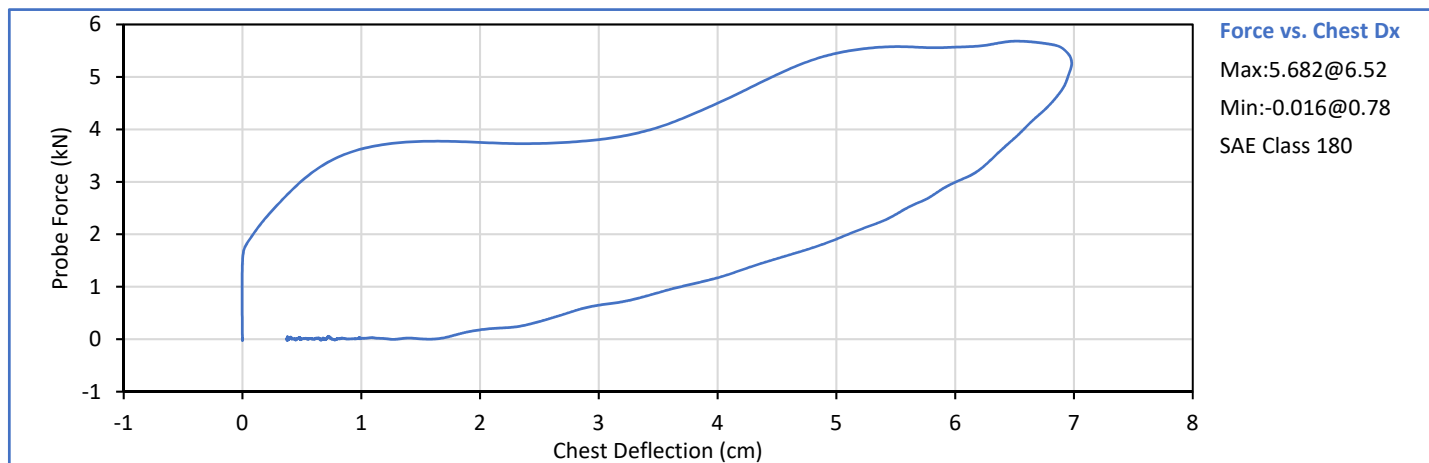


Technician: J. Hernandez

Approved By: P. Puzzuto



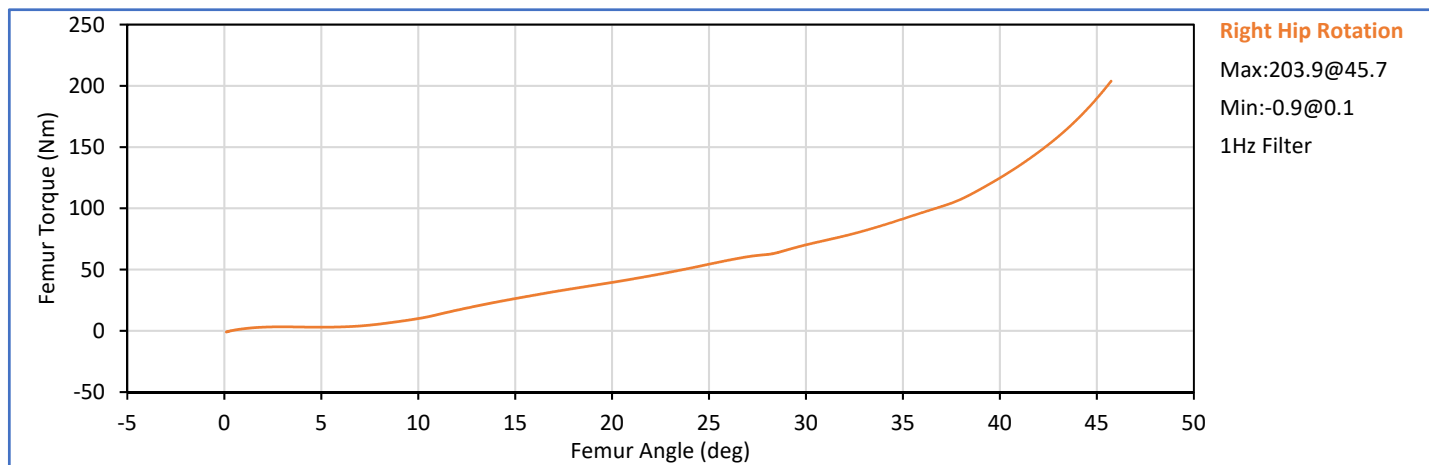
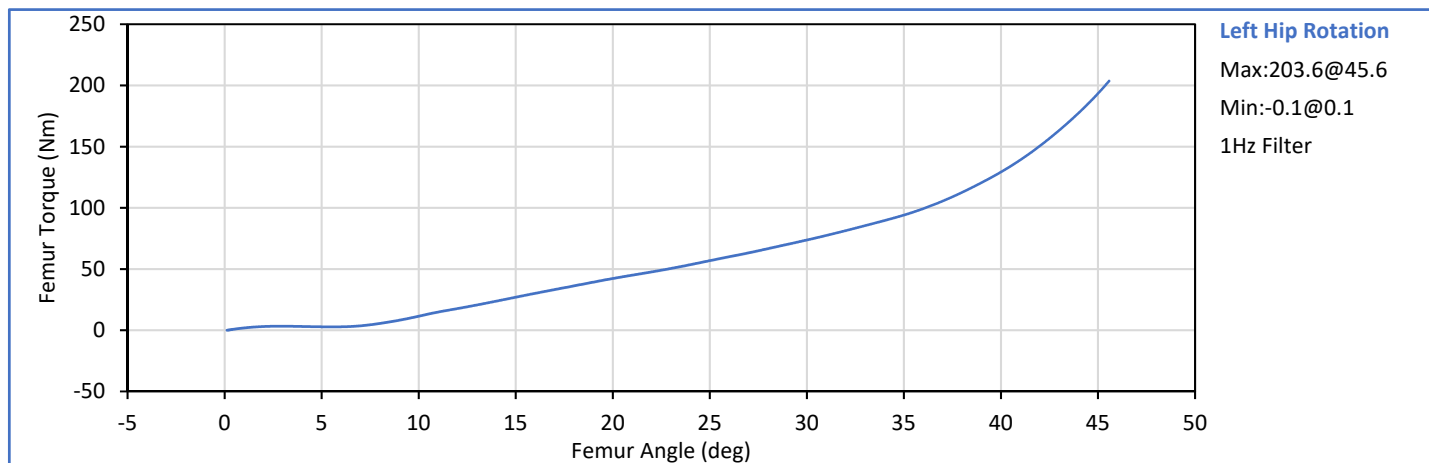
Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Humidity	%	10	70	30	Pass
Probe Velocity	m/s	6.58	6.82	6.69	Pass
Peak Chest Deflection	cm	6.35	7.26	6.98	Pass
Peak Probe Force	kN	5.159	5.893	5.682	Pass
Internal Hysteresis	%	69.0	85.0	70.4	Pass
Overall Test Results				Pass	



Technician: J. Hernandez

Approved By: P. Puzzuto

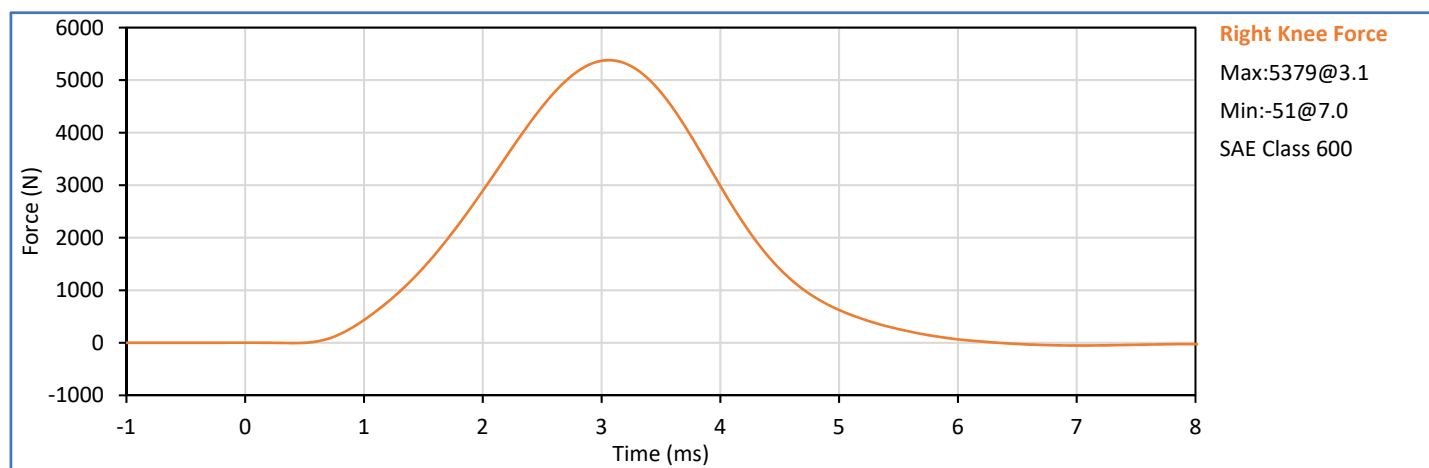
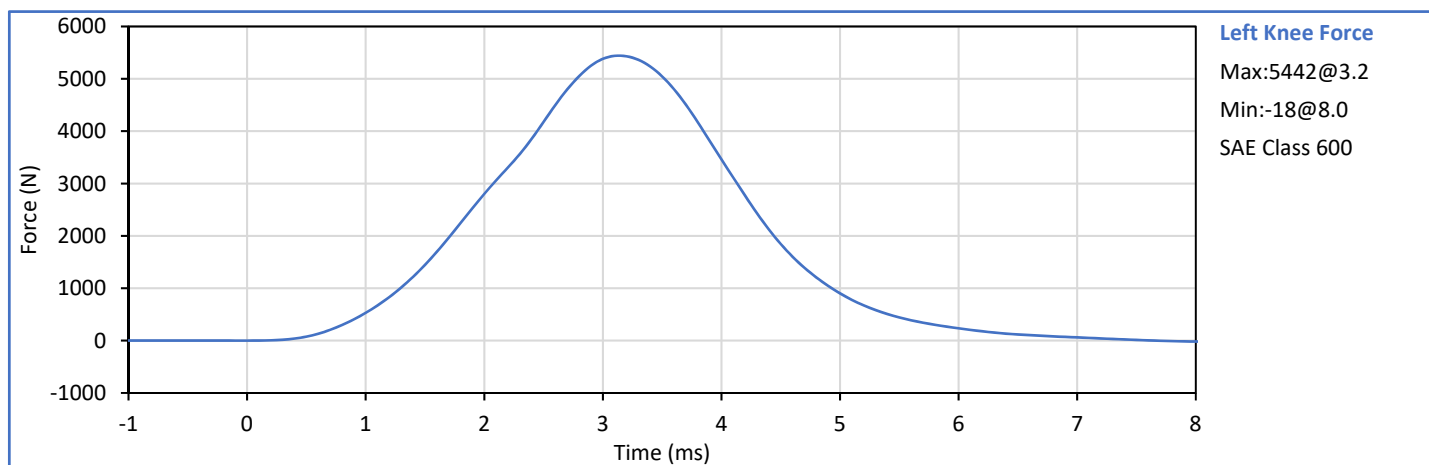
	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.2	Pass
	Laboratory Humidity	%	10	70	30	Pass
Left Hip	Left Hip Rotation Rate	deg/s	5.0	10.0	5.8	Pass
	Left Femur Torque at 30°	Nm	0.0	95.0	73.7	Pass
	Left Hip Rotation at 203 Nm	deg	40.0	50.0	45.5	Pass
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

	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	Probe Velocity	m/s	2.070	2.130	2.118	Pass
Knee	Peak Resistive Force	N	4715	5782	5442	Pass
Right	Probe Velocity	m/s	2.070	2.130	2.120	Pass
Knee	Peak Resistive Force	N	4715	5782	5379	Pass
Overall Test Results						Pass

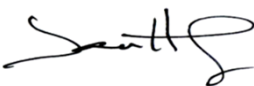


Technician: J. Hernandez

Approved By: P. Puzzuto

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

ATD Serial No.: 141

Test Date: 2019-02-08

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	788	Pass
B - Shoulder pivot height	mm	432	457	453	Pass
C - 'H' point height	mm	81	86	86	Pass
D - 'H' point location from backline	mm	145	150	148	Pass
E - Shoulder pivot from backline	mm	69	84	78	Pass
F - Thigh clearance	mm	119	135	128	Pass
G - Back of elbow to wrist pivot	mm	244	259	254	Pass
H - Head back to backline	mm	41	46	43	Pass
I - Shoulder to elbow length	mm	277	297	287	Pass
J - Elbow rest height	mm	183	203	197	Pass
K - Buttock to knee length	mm	521	546	531	Pass
L - Popliteal length	mm	356	376	367	Pass
M - Knee pivot height	mm	394	419	407	Pass
N - Buttock popliteal length	mm	414	439	428	Pass
O - Chest depth without jacket	mm	175	191	183	Pass
P - Foot length	mm	219	234	231	Pass
R - Buttock to Knee Pivot Length	mm	457	483	473	Pass
S - Head Breadth	mm	137	147	144	Pass
T - Head Depth	mm	178	188	184	Pass
U - Hip Breadth	mm	300	315	308	Pass
V - Shoulder breadth	mm	351	366	360	Pass
W - Foot breadth	mm	79	94	88	Pass
X - Head circum.	mm	528	549	535	Pass
Y - Chest circum. (w/chest jacket)	mm	851	881	868	Pass
Z - Waist circum.	mm	760	790	776	Pass
AA - Location for chest circum.	mm	333	358	339	Pass
BB - Location for waist circum.	mm	160	170	168	Pass
			Overall Test Results		Pass

Technician:



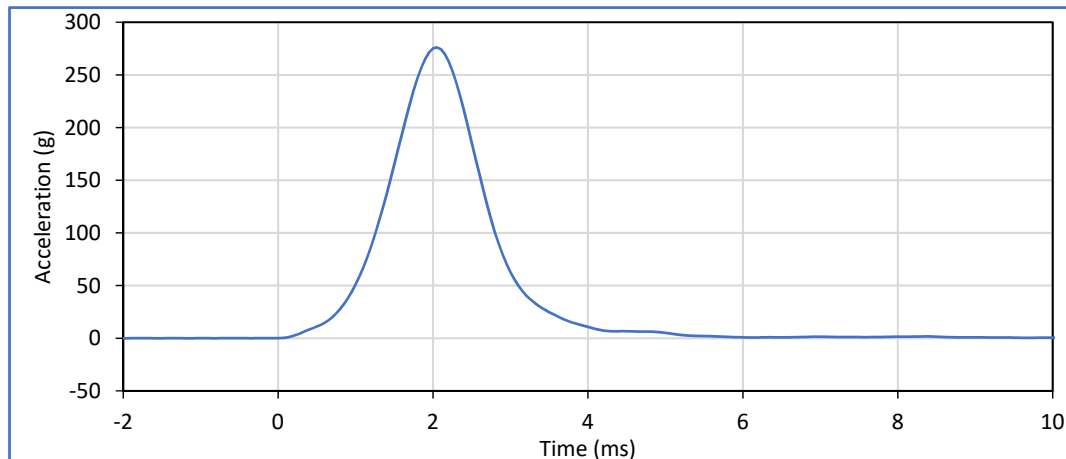
J. Hernandez

Approved By:



P. Puzzuto

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	276.1	Pass
Peak Lateral Acceleration	g	-15.0	15.0	4.2	Pass
Oscillations After Main Pulse	%	0.0	10.0	0.6	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results	Pass	

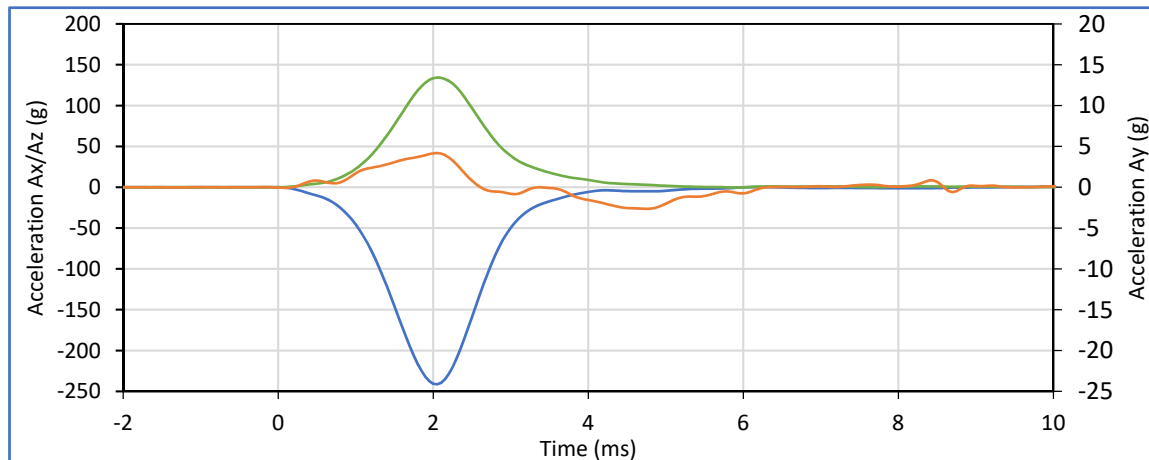


Head Resultant

Max: 276.1@2.1

Min: 0.1@0.0

SAE Class 1000



Head Ax

Max: 0.5@9.9

Min: -241.2@2.1

SAE Class 1000

Head Ay

Max: 4.2@2.1

Min: -2.6@4.8

SAE Class 1000

Head Az

Max: 134.3@2.1

Min: -0.5@5.9

SAE Class 1000

Technician:

J. Hernandez

J. Hernandez

Approved By:

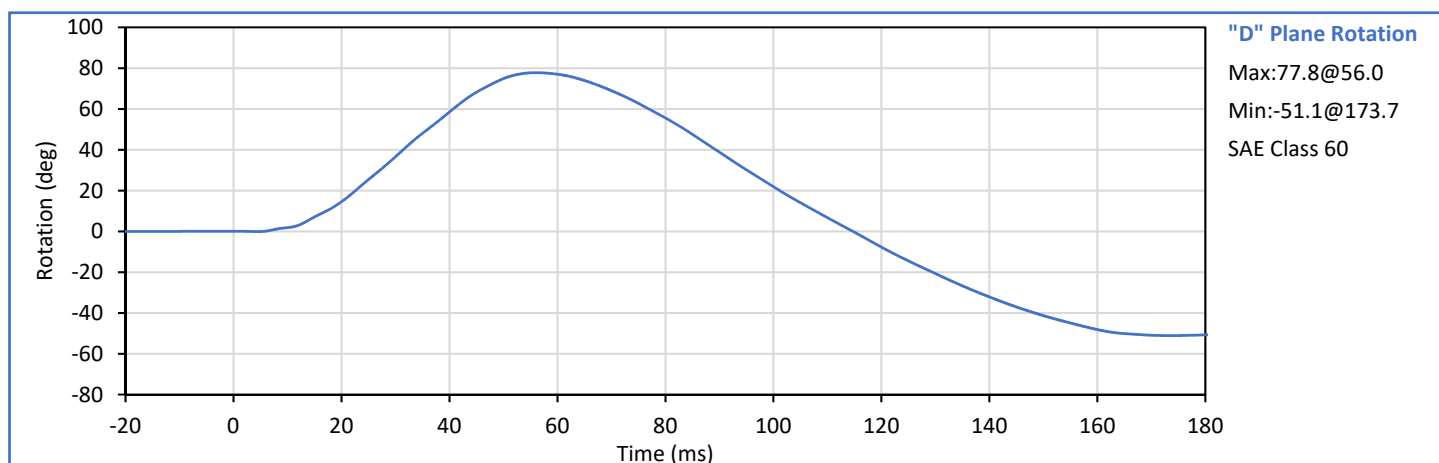
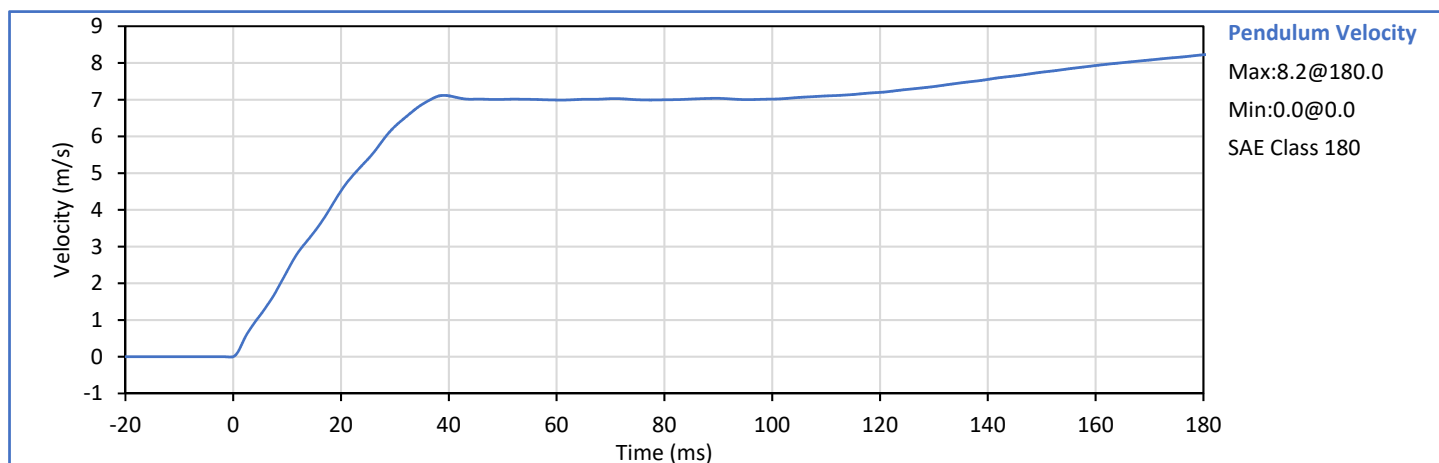
P. Puzzuto

P. Puzzuto

ATD Serial No.: 141

Test Date: 2019-02-11

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.3	Pass
Laboratory Humidity	%	10	70	27	Pass
Pendulum Velocity	m/s	6.89	7.13	7.04	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	4.52	Pass
Pendulum Velocity at 30 ms	m/s	5.80	7.00	6.27	Pass
Peak "D" Plane Rotation	deg	77.0	91.0	77.8	Pass
Peak Moment in Rotation	Nm	69.0	83.0	79.1	Pass
Positive Moment Decay to 10 Nm	ms	80.0	100.0	84.1	Pass
Overall Test Results				Pass	Pass



Technician:

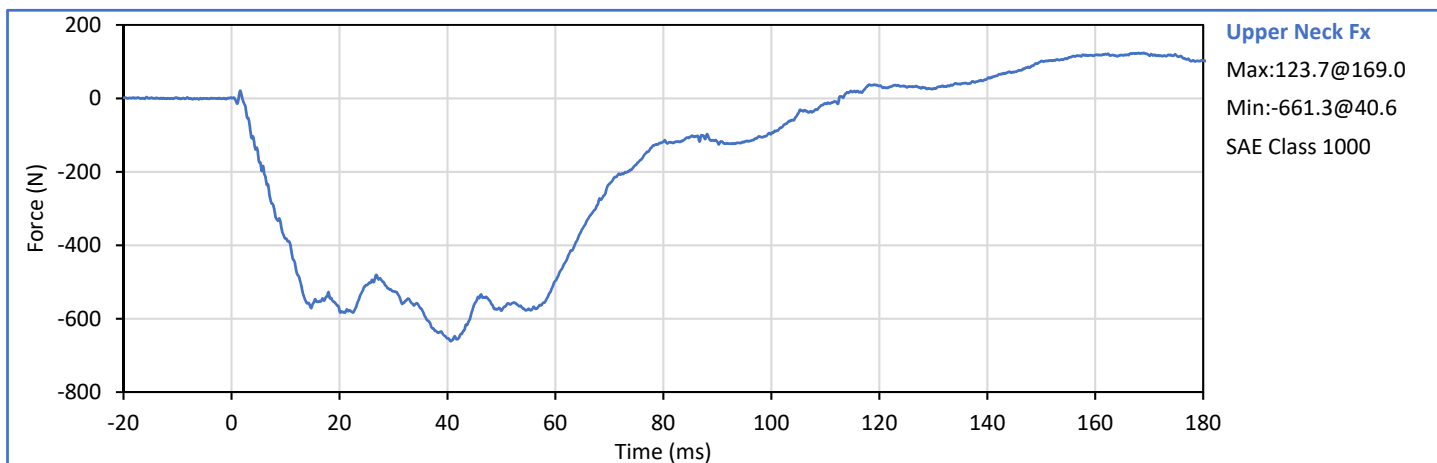
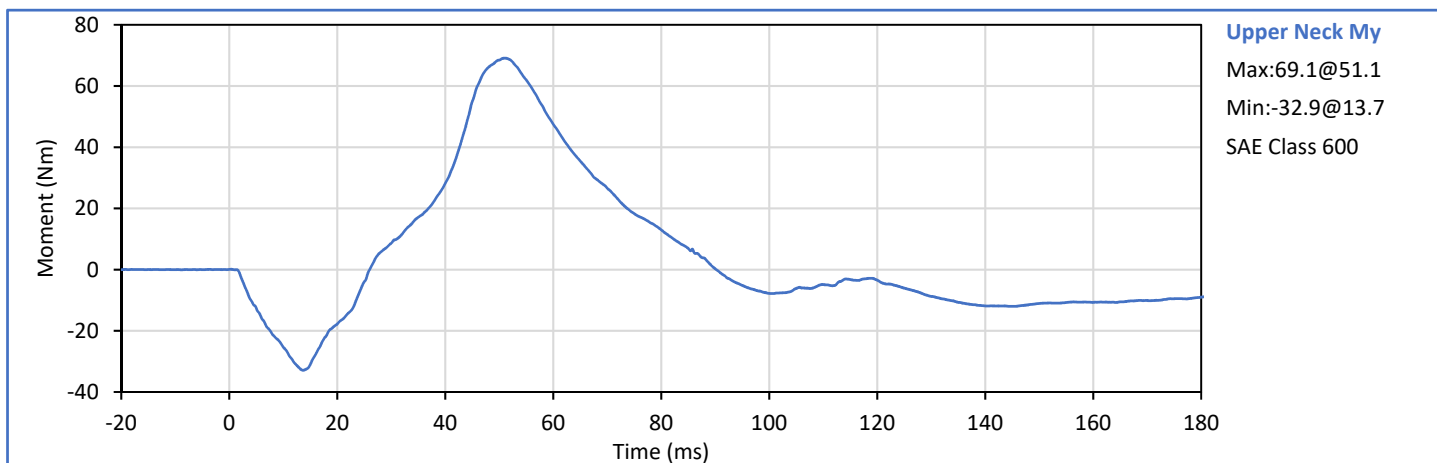
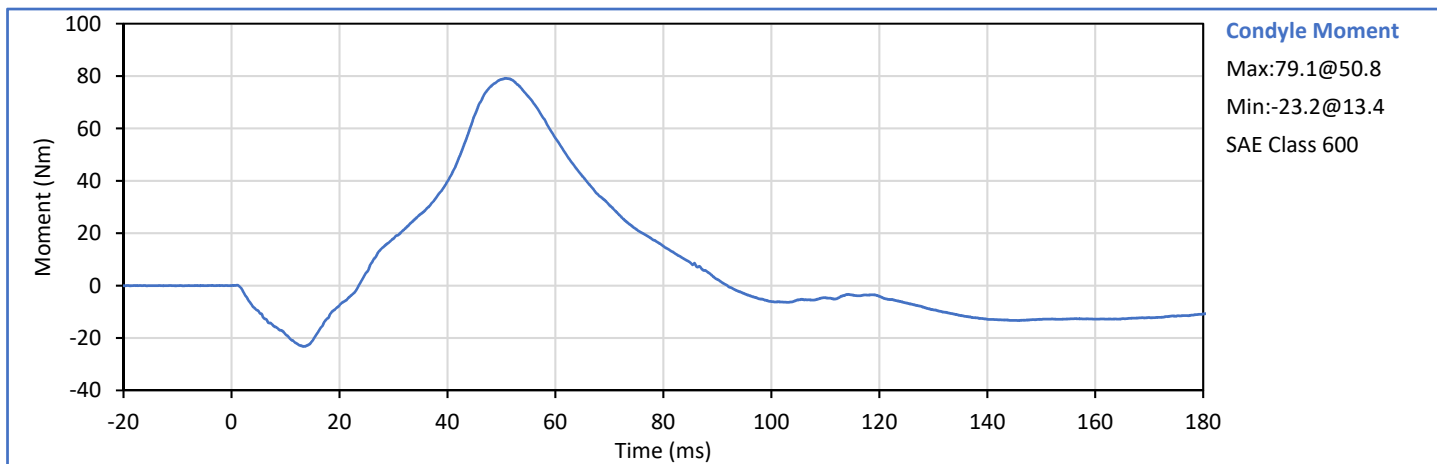
J. Hernandez

J. Hernandez

Approved By:

P. Puzzuto

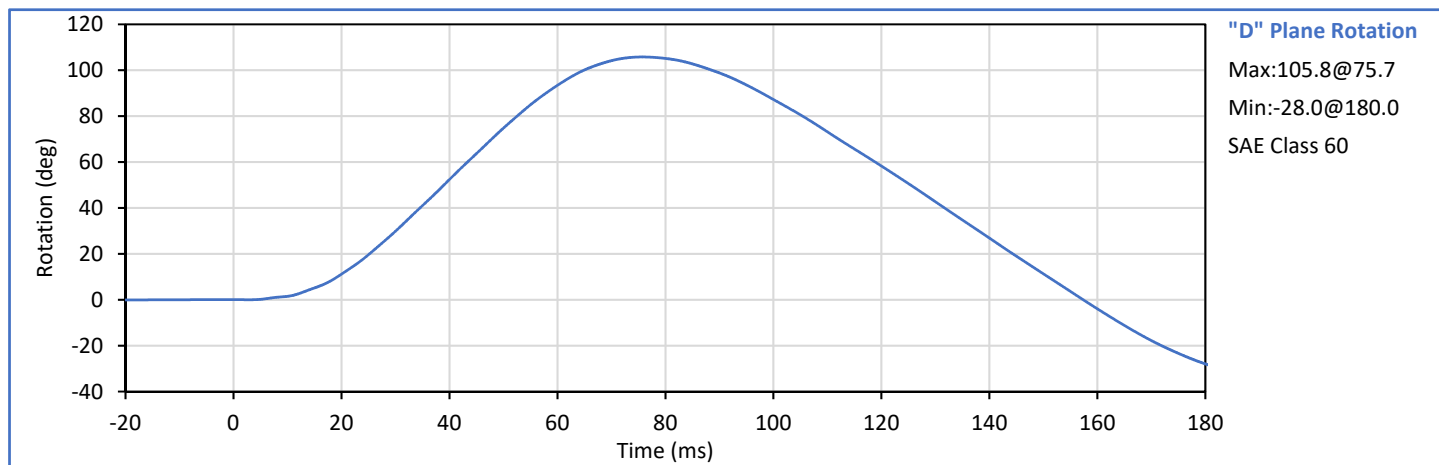
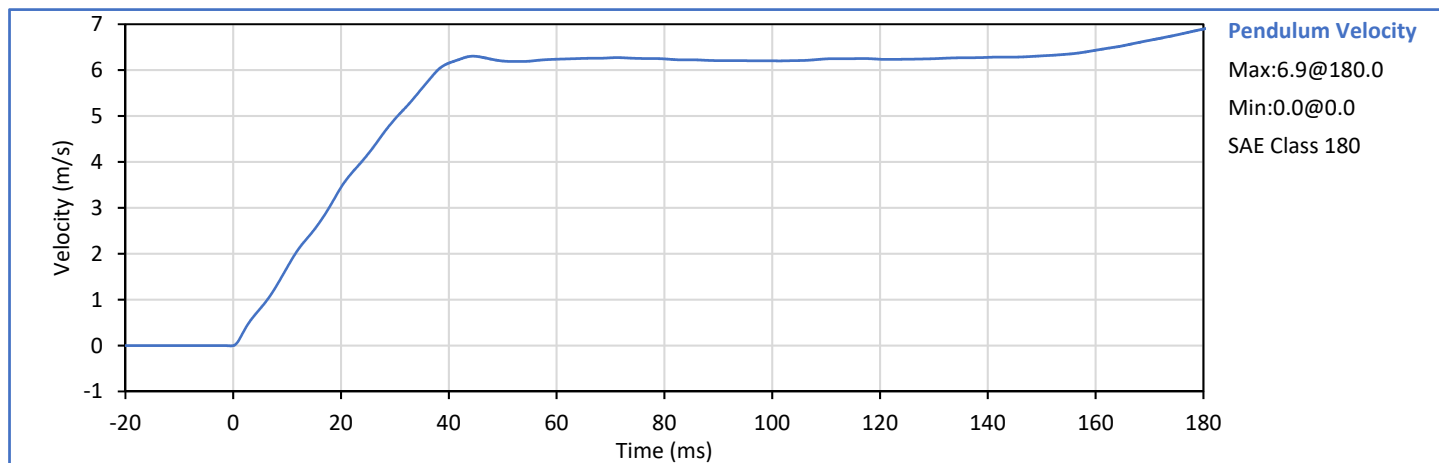
P. Puzzuto



ATD Serial No.: 141

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	27	Pass
Pendulum Velocity	m/s	5.95	6.19	6.02	Pass
Pendulum Velocity at 10 ms	m/s	1.50	1.90	1.70	Pass
Pendulum Velocity at 20 ms	m/s	3.10	3.90	3.45	Pass
Pendulum Velocity at 30 ms	m/s	4.60	5.60	4.94	Pass
Peak "D" Plane Rotation	deg	99.0	114.0	105.8	Pass
Peak Moment in Rotation	Nm	-65.0	-53.0	-54.1	Pass
Negative Moment Decay to -10 Nm	ms	94.0	114.0	103.8	Pass
Overall Test Results				Pass	Pass



Technician:

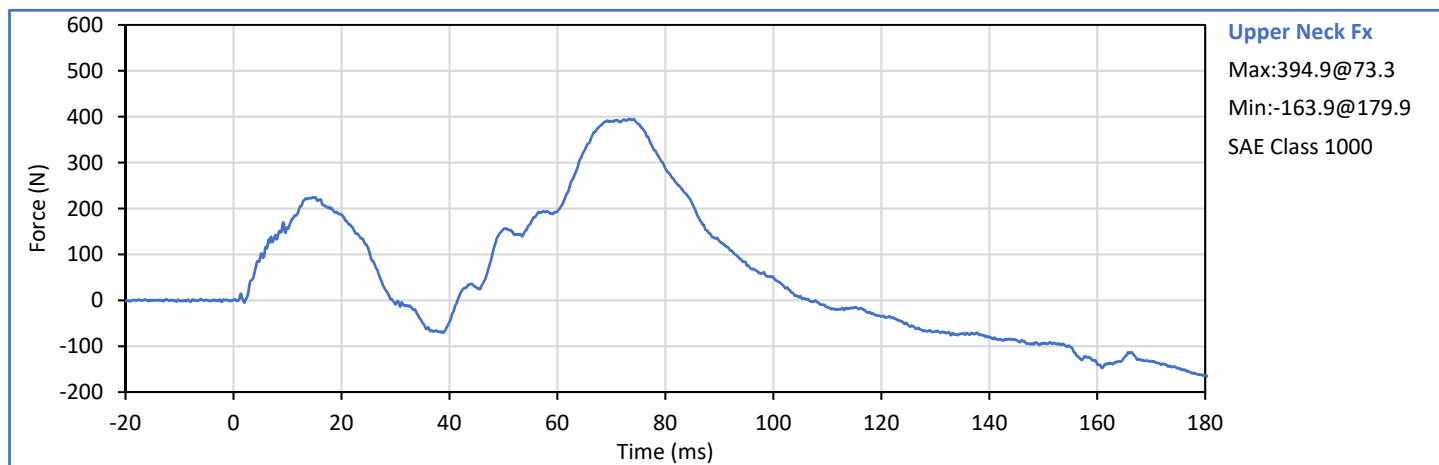
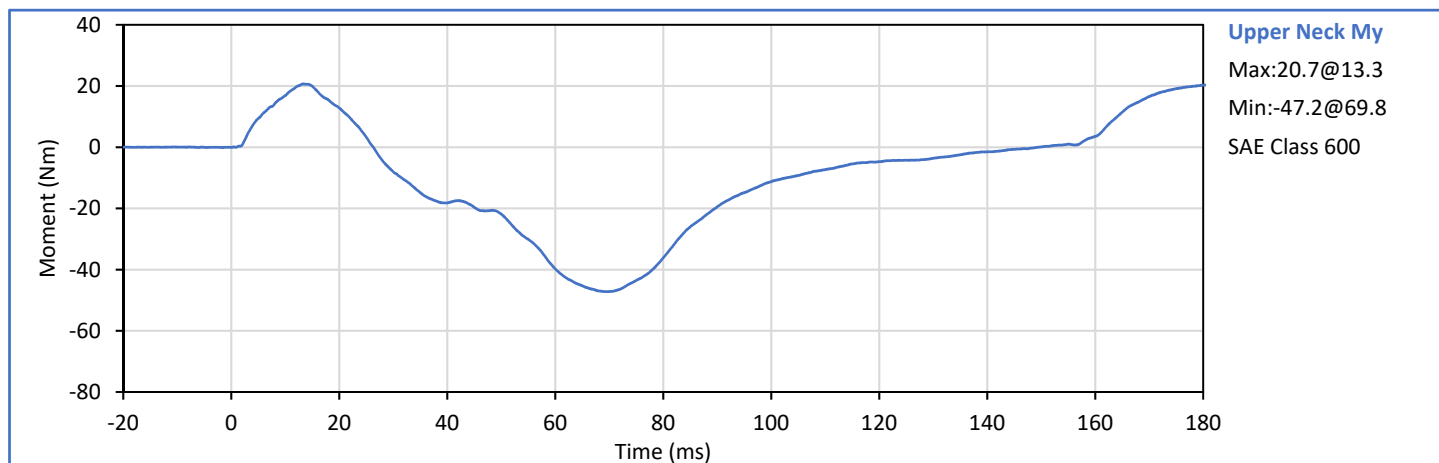
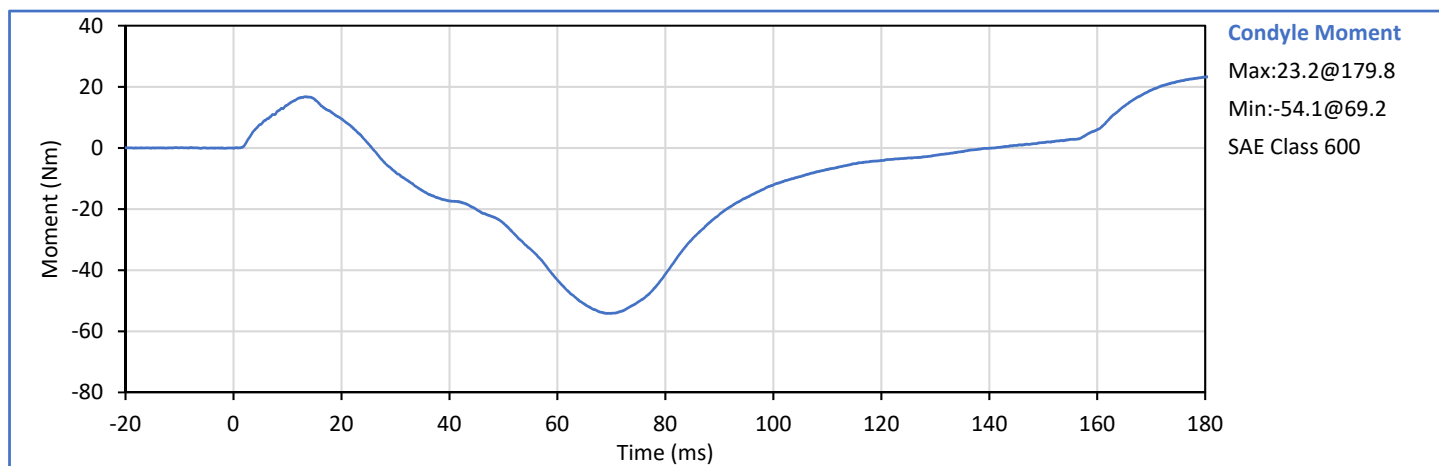
J. Hernandez

J. Hernandez

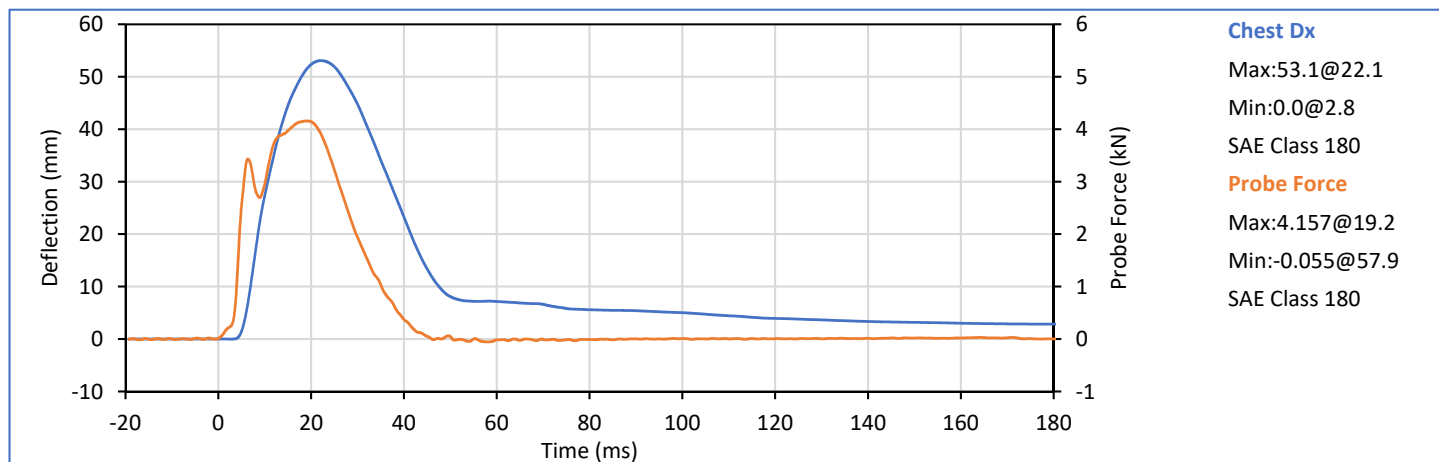
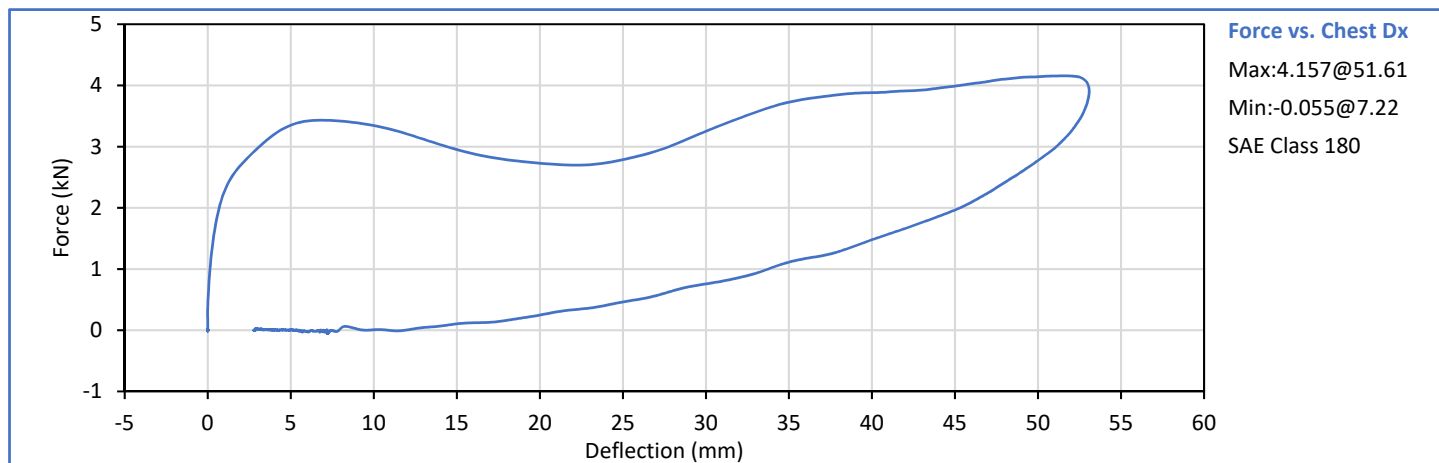
Approved By:

P. Puzzuto

P. Puzzuto



Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Humidity	%	10	70	33	Pass
Probe Velocity	m/s	6.59	6.83	6.70	Pass
Peak Chest Deflection	mm	50.0	58.0	53.1	Pass
Peak Probe Force, 50 and 58 mm	kN	3.900	4.400	4.157	Pass
Peak Probe Force, 18 and 50 mm	kN	0.000	4.600	4.142	Pass
Internal Hysteresis	%	69.0	85.0	73.8	Pass
Overall Test Results				Pass	



Technician:

J. Hernandez

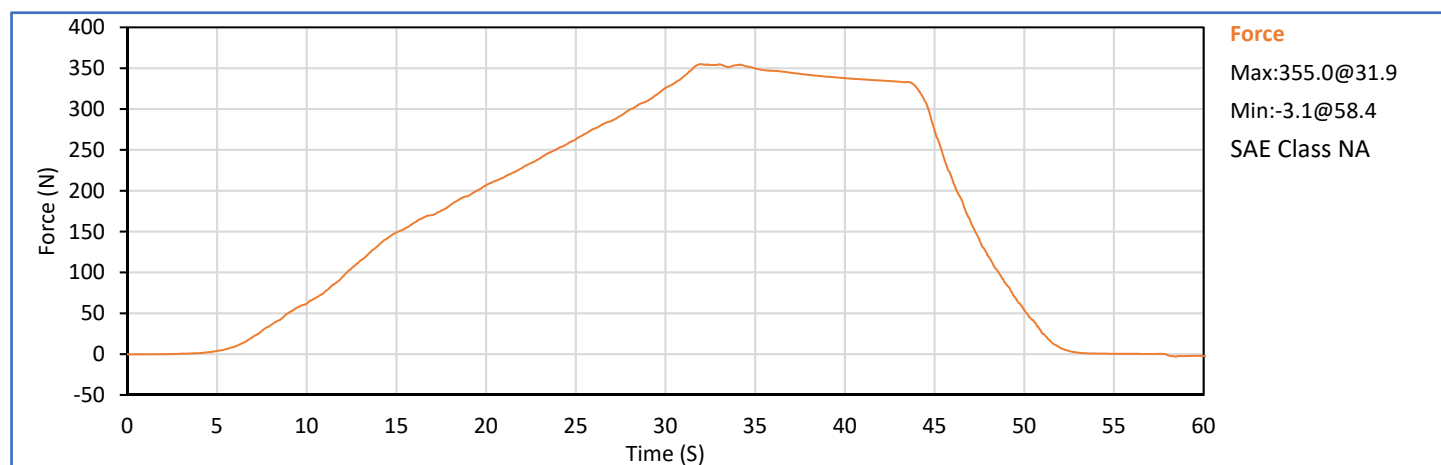
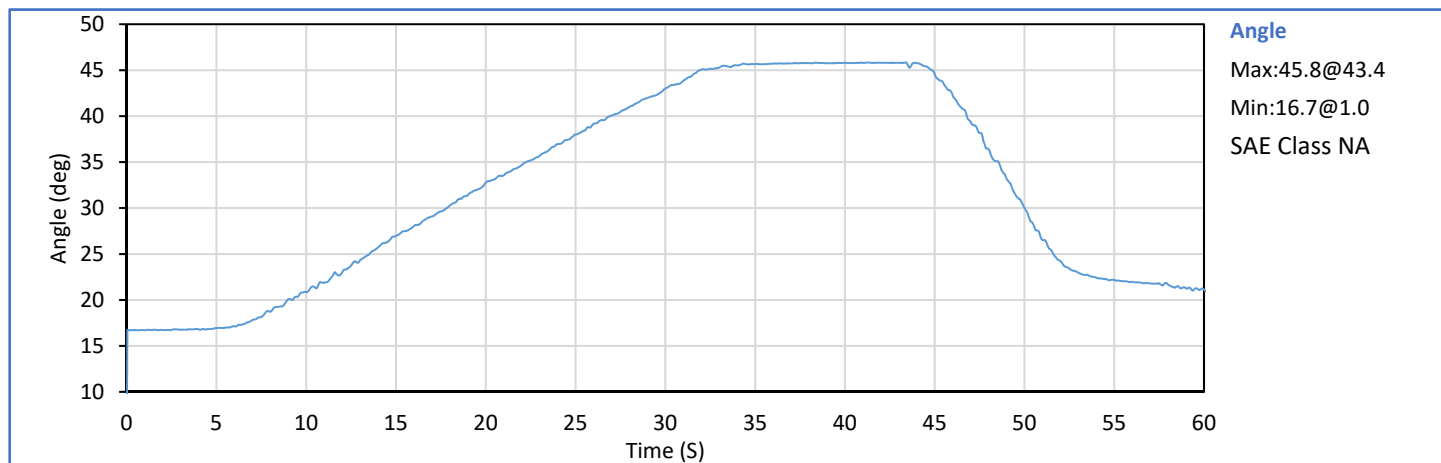
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.6	Pass
Laboratory Humidity	%	10	70	34	Pass
Orientation Angle	deg	0.0	20.0	15.1	Pass
Test Initial Angle	deg	11.0	19.0	16.7	Pass
Peak Force at 45° (+/-0.5°)	N	320.0	390.0	354.7	Pass
Torso Flexion Rate	deg/s	0.50	1.50	1.09	Pass
Final Reference Plane Angle	deg	-8.0	8.0	3.1	Pass
Overall Test Results				Pass	



Technician:

J. Hernandez

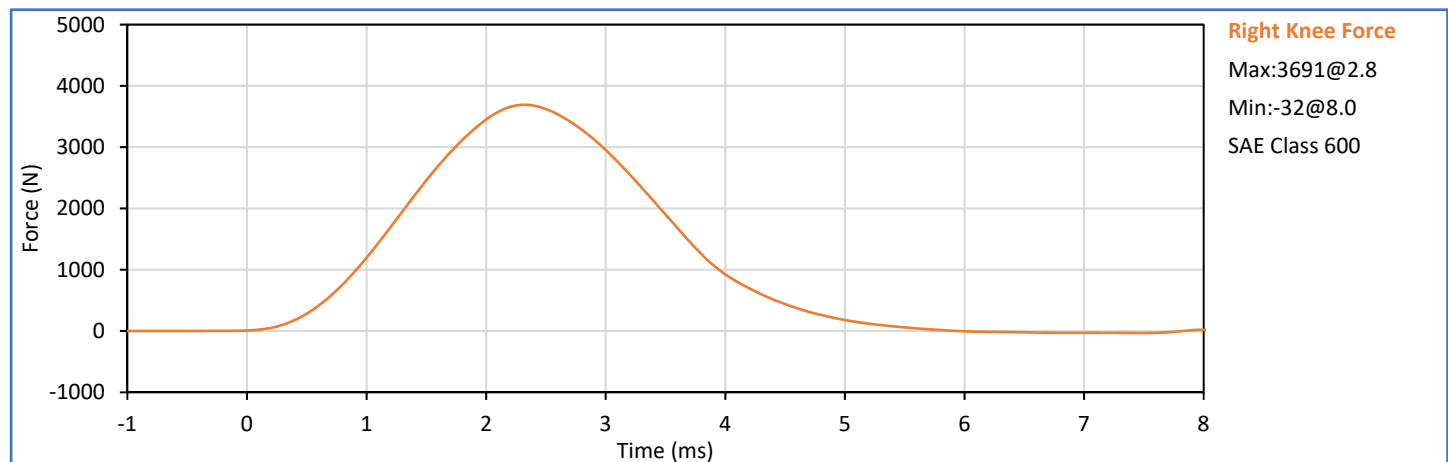
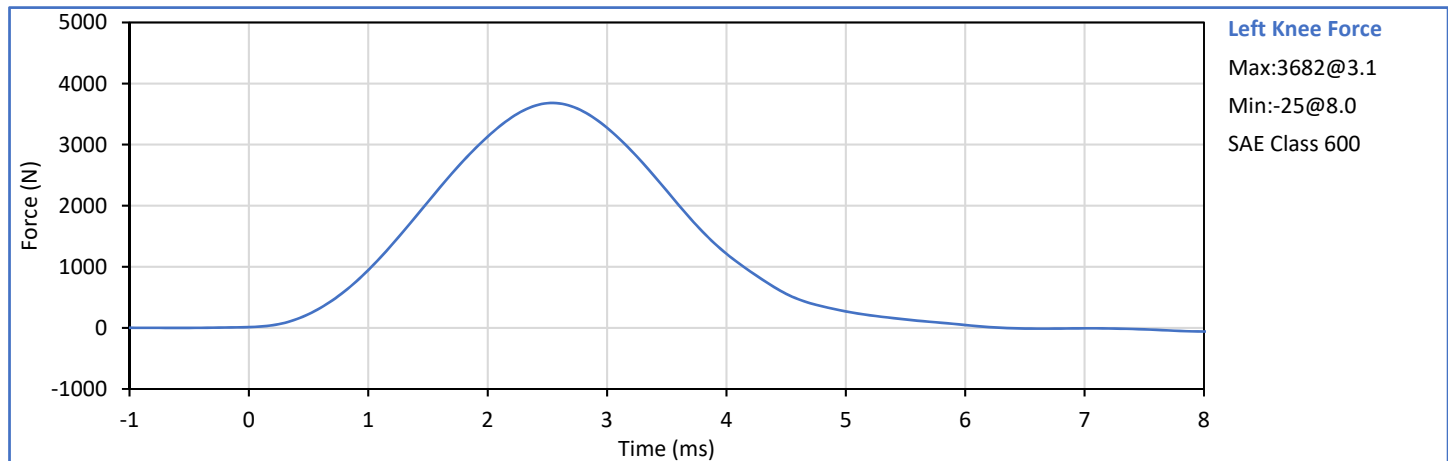
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.2	Pass
	Laboratory Humidity	%	10	70	29	Pass
Left	Probe Velocity	m/s	2.070	2.130	2.091	Pass
Knee	Peak Resistive Force	N	3450	4060	3682	Pass
Right	Probe Velocity	m/s	2.070	2.130	2.089	Pass
Knee	Peak Resistive Force	N	3450	4060	3691	Pass
Overall Test Results					Pass	



Technician: J. Hernandez

Approved By: P. Puzzuto