

REPORT NUMBER: NCAP-MGA-2019-021

**NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test**

**TOYOTA MOTOR MANUFACTURING, KENTUCKY, INC.
2019 Lexus ES 350 4-Door Sedan
NHTSA No.: O20195104**

**MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105**



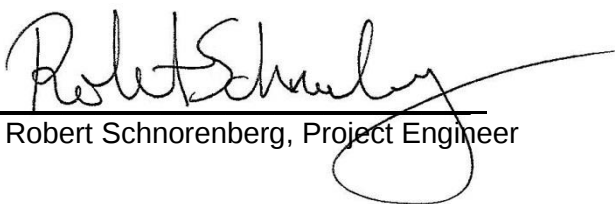
Test Date: January 23, 2019

Final Report Date: April 11, 2019

FINAL REPORT

**U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NRM-110
1200 New Jersey Ave, SE
Room W43-410
Washington, DC 20590**

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Prepared by: 
Robert Schnorenberg, Project Engineer

Approved by: 
Ben Fischer, Project Engineer

Approval Date: April 11, 2019

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

Technical Report Documentation Page

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16. Abstract A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2019 Lexus ES 350 4-Door Sedan 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), and 301 performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on January 23, 2019. The impact velocity of the vehicle was 56.19 km/h and the ambient temperature at the barrier face at the time of impact was 21.4°C. The target vehicle post-test maximum crush was 622 mm located at the vehicle centerline. The test vehicle's performance was as follows:																																																							
<table border="1" style="width: 100%; border-collapse: collapse;"> <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>120</td> <td>700</td> <td>319</td> </tr> <tr> <td>Maximum Chest</td> <td>mm</td> <td>63</td> <td>21</td> <td>52</td> <td>20</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>0.24</td> <td>1</td> <td>0.33</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>1063</td> <td>2620</td> <td>708</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>133</td> <td>2520</td> <td>277</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>2329</td> <td>6805</td> <td>2103</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>2793</td> <td>6805</td> <td>2303</td> </tr> </tbody> </table>				Measurement Description	Units	Driver ATD		Passenger ATD		Threshold	Result	Threshold	Result	Head Injury Criteria (HIC ₁₅)	N/A	700	120	700	319	Maximum Chest	mm	63	21	52	20	Nij	N/A	1	0.24	1	0.33	Neck Tension	N	4170	1063	2620	708	Neck Compression	N	4000	133	2520	277	Left Femur Force	N	10008	2329	6805	2103	Right Femur Force	N	10008	2793	6805	2303
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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-00258. 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 was conducted in accordance with the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure.

SUMMARY

A load cell barrier consisting of 176 load cells was impacted by a 2019 Lexus ES 350 4-Door Sedan at a velocity of 56.19 km/h. The test was performed at MGA Research Corporation on January 23, 2019. Pre-test and post-test photographs of the vehicle and dummies can be found in Appendix A.

Two (2) real-time cameras and fourteen (14) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in 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 test device (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 transducers, right/left femur load cells, and lower leg instrumentation.

The driver (position 1) ATD (Serial No. 351) and the right-front passenger (position 2) ATD (Serial No. 138) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 634 channels of data were recorded on a data acquisition system. Appendix B contains the dummy response data traces.

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

The maximum static crush of the vehicle was 622 mm located at the vehicle centerline and 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's head contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee airbag. The passenger's visible contact points were as follows: The passenger's head contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the knee airbag.

The occupant data is summarized below:

ATD position	HIC ₁₅	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (Gs)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50 th)	120	0.24	1063	133	38	21	2329	2793
Passenger (5 th)	319	0.33	708	277	38	20	2103	2303

The test data can be found on the NHTSA website at www.nhtsa.dot.gov.

TEST NOTES

Driver Shoulder Belt not installed.
Driver Lab Belt not installed.
Passenger Shoulder Belt not installed.
Passenger Lab Belt not installed.
Barrier K-03 Fx recorded questionable data.
Barrier K-15 My recorded no valid data.
Barrier I-05 My recorded no valid data.
Barrier C-01 Fx recorded no valid data.

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
Test Date: 01/23/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20195104	Traction Control System (TCS)	Yes
Model Year	2019	Power Steering	Yes
Make	Lexus	Power Window Auto-Reverse	Yes
Model	ES 350	Driver Frontal Airbag	Yes
Body Style	4-Door Sedan	Driver Curtain Airbag	Yes
VIN	58ABZ1B14KU006782	Driver Head/Torso Airbag	No
Body Color	Nightfall Mica	Driver Torso Airbag	No
Odometer (km/mi)	108 km / 67 mi	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	3.5 L	Driver Pelvis Airbag	No
Type/No. Cylinders	V6	Driver Knee Airbag	Yes
Engine Placement	Lateral	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	8	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	FWD	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof/T-Top	Yes	Front Pass. Knee Airbag	Yes
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	Yes	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Other	N/A

Does owner's manual provide instructions to turn off automatic door locks?

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	TOYOTA MOTOR MANUFACTURING. KENTUCKY, INC.
Date of Manufacture	09/18

GVWR (kg)	2150
GAWR Front (kg)	1191
GAWR Rear (kg)	1100

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Contoured		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				398
Cargo Weight (RCLW) (kg)				58

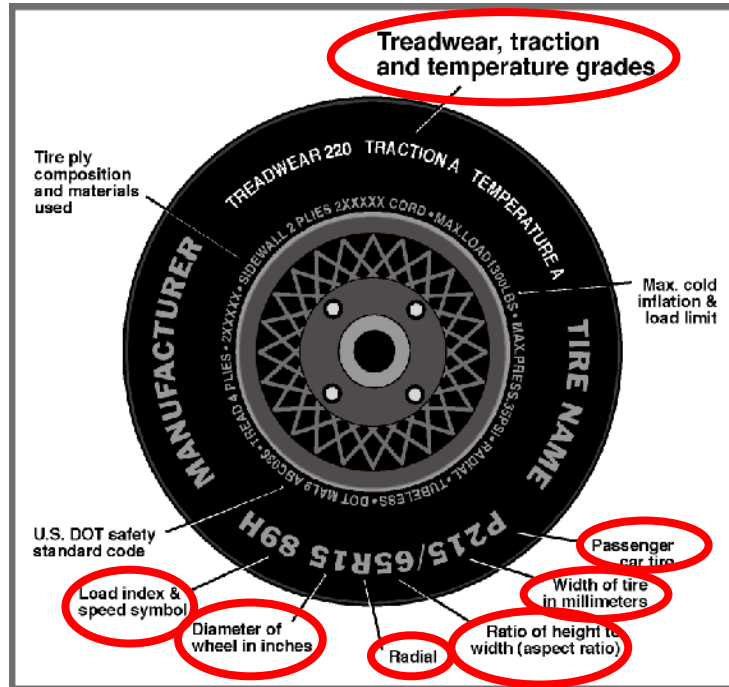
*Vehicle Capacity Weight (VCW) reduced by 12 kg to account for Load Carrying Capacity Reduction label.

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

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	235/45R18	235/45R18
Tire Size on Vehicle	235/45R18	235/45R18
Tire Manufacturer	Michelin	Michelin
Tire Model	Energy Saver A/S	Energy Saver A/S
Treadwear	480	480
Traction	A	A
Temperature Grade	B	B
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	94V	94V
Tire Material	Rubber	Rubber
DOT Safety Code Left	B9EL 02NX 3718	B9EL 02NX 3718
DOT Safety Code Right	B9EL 02NX 3718	B9EL 02NX 3718

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

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	487.5	363.5		516.5	439.5	
Right	kg	540.5	304.5		562.0	370.5	
Ratio	%	60.6%	39.4%		57.1%	42.9%	
Totals	kg	1028.0	668.0	1696.0	1078.5	810.0	1888.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1696.0
Weight of 1 P572E ATD & 1 P572O ATD	kg	141
Rated Cargo/Luggage Weight (RCLW)	kg	58
Calculated Test Vehicle Target Weight (TVTW)	kg	1895.0

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	719	725	713	726	1130
As Tested	mm	715	720	678	686	1231
Post Test	mm	821	809	693	656	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2870
Total Vehicle Length at Left Side	mm	4745
Total Vehicle Length at Centerline	mm	4977
Total Vehicle Length at Right Side	mm	4745
Weight of Ballast in Cargo Area	kg	47
Weight of Vehicle Components Removed	kg	39
Amount of Stoddard Solvent in Fuel Tank	L	56

List of components removed to meet test weight: None.

List of components removed for instrumentation, data box, and equipment installation: Cargo area cover, divider, jack/tool kit, spare tire and tire cover, LR and RR floor mats, subwoofer, RR taillight, cargo net, LF RF LR and RR underbody plastic.

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

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4977
2	Total Width	1869
3	Bumper Top Height	565
4	Bumper Bottom Height	430
5	Longitudinal Member Top Height	540
6	Distance between Longitudinal Members	995
7	Longitudinal Member Width	98
8	Engine Top Height	800
9	Engine Bottom Height	178
10	Engine and Gearbox Width	880
11	Front Bumper-Engine Distance	520
12	Front Shock Absorber Fixing Height	893
13	Bonnet Leading Edge Height	783
14	Front Shock Absorber Fixing Width	1200
15	Front Bumper – Front Axle Distance	1006
16	Front Axle – A-Pillar Distance	432
17	A-Pillar – B-Pillar Distance	1222
18	B-Pillar – Rear Axle Distance	1210
19	B-Pillar – C-Pillar Distance	743
20	Roof Sill Bottom Height	1300
21	Roof Sill Top Height	1410
22	Floor Sill Bottom Height	210
23	Floor Sill Top Height	350

DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

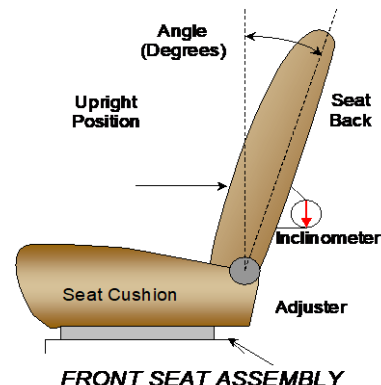
Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

NOMINAL DESIGN RIDING POSITION

The driver seat back is positioned as close as possible to the manufacturer's design angle. For the passenger seat back, seat back is adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated October 2015.

	Degrees
Driver Seat Back Angle	2.8° on outboard headrest post
Passenger Seat Back Angle	4.1° on outboard headrest post



SEAT FORE/AFT POSITIONS

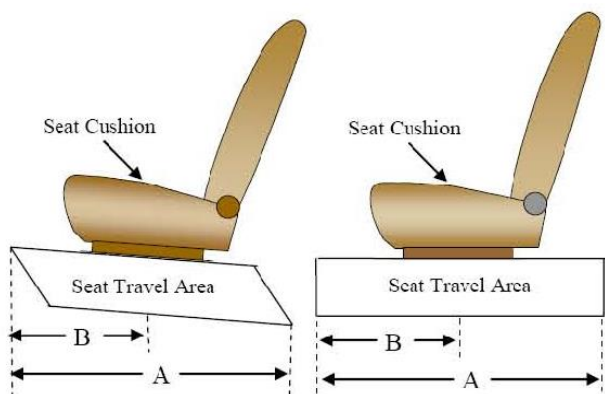
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated October 2015.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	314 mm	157 mm
Passenger Seat	260 mm	0 mm

SEAT BELT UPPER ANCHORAGES

The seat belt upper anchorages are positioning following the manufacturer's specified position as listed in Form 1.

	Total # of Positions	Placed in Position #
Driver Seat	4 (1 st as 1)	0 (1 st as 0)
Passenger Seat	4 (1 st as 1)	0 (1 st as 0)



DATA SHEET NO. 2 (CONTINUED)
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

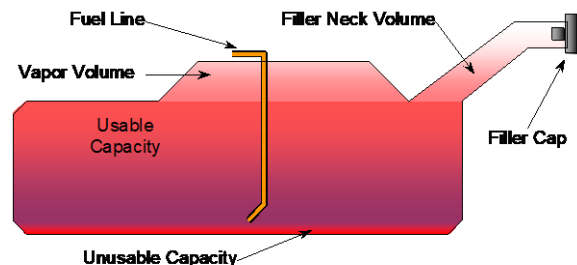
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	60.2
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	55.4 to 56.6
Actual Amount of Solvent used	56
1/3 of Usable Capacity	20.1

FUEL PUMP

Describe the fuel pump type, its behavior, and the location of the fuel filler pipe.

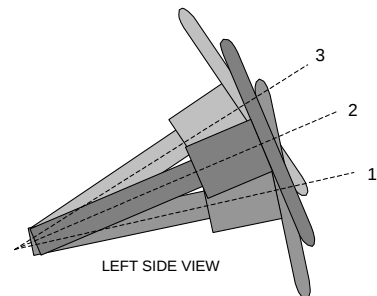
The vehicle is equipped with an electronic fuel pump.
The fuel pump is activated when the ignition is turned on.
The filler neck is located on the driver's side.



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. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured.



STEERING COLUMN ASSEMBLY

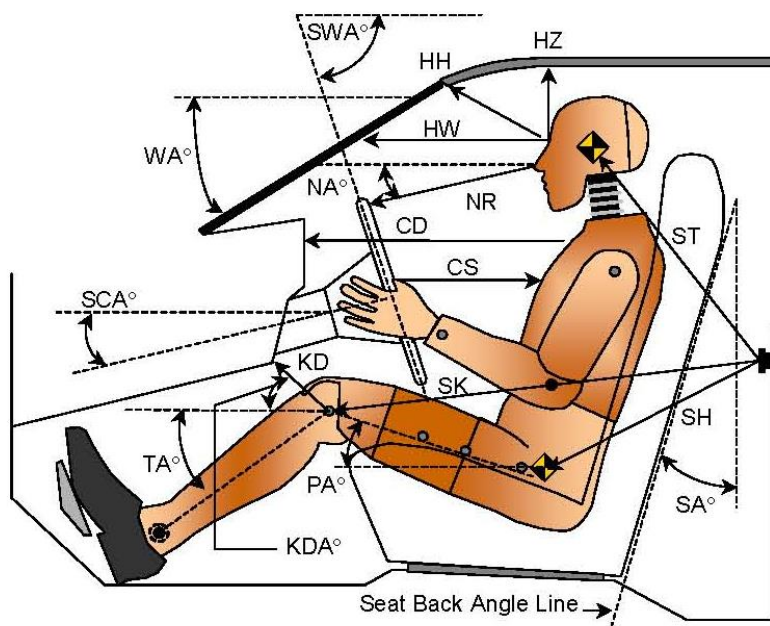
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	71.7	210
Geometric Center Position 2	69.4	182
Uppermost Position 3	67.0	154
Telescoping Steering Wheel Travel		56
Test Position	69.4	182

DATA SHEET NO. 3 DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
Test Date: 01/23/2019



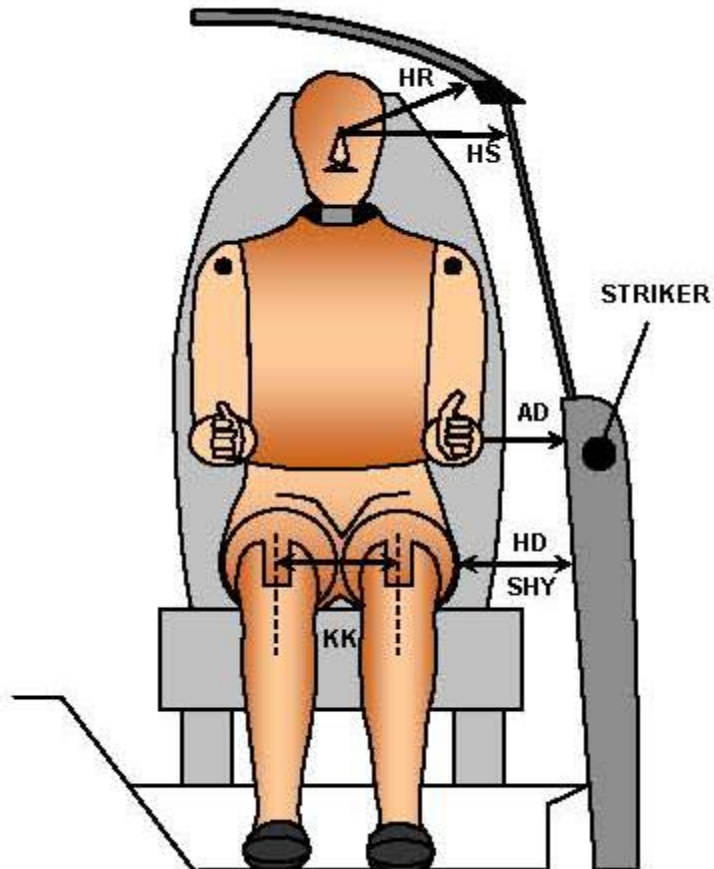
LEFT SIDE VIEW

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		23.6		
SWA°	Steering Wheel Angle		69.4		
SCA°	Steering Column Angle		20.6		
SA°	Seat Back Angle		2.8		4.1
HZ	Head to Roof (Z)	141	90	173	90
HH	Head to Header	304	25.3	257	49.6
HW	Head to Windshield	605	0	613	0
NR	Nose to Rim	373	14.9		
CD	Chest to Dash	508		356	
CS	Chest to Steering Hub	302	1.3		
RA	Rim to Abdomen	191	0		
KDL	Left Knee to Dash	177	27.1	121	44.9
KDR	Right Knee to Dash	147	29.8	122	44.0
PA°	Pelvic Angle		24.4		20.3
TA°	Tibia Angle		35.9		50.4
SK	Striker to Knee	617	99.7	718	95.8
ST	Striker to Head	456	16.6	468	34.3
SH	Striker to H-Point	280	134.3	440	114.2

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019



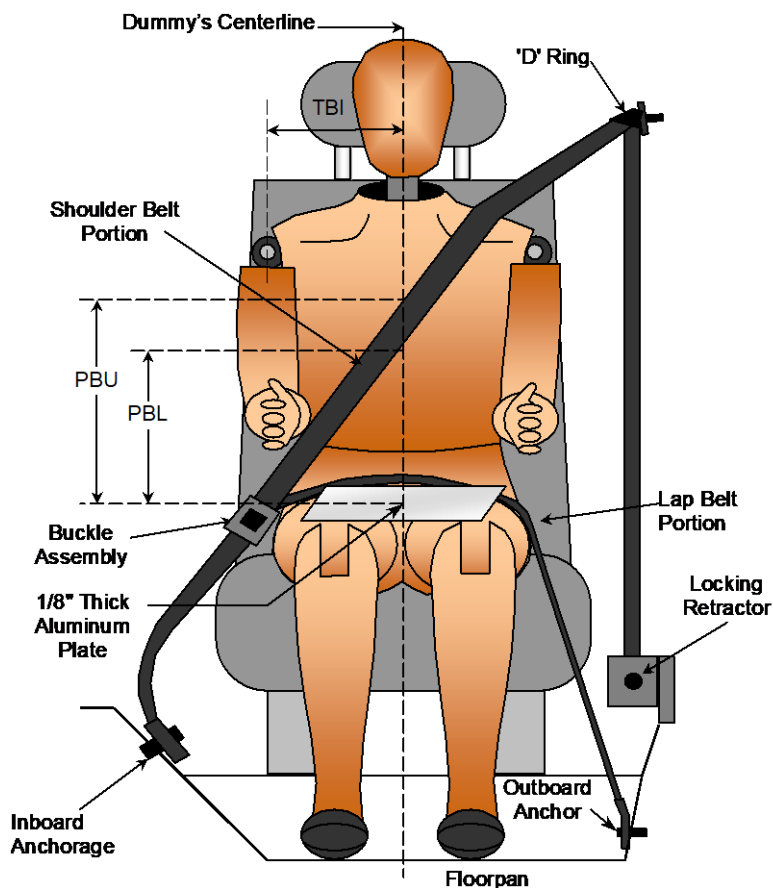
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
AD	Arm to Door	150	87
HD	H-Point to Door	141	167
HR	Head to Side Header	199	235
HS	Head to Side Window	338	361
KK	Knee to Knee	346	231
SHY	Striker to H-Point (Y Direction)	292	308
AA	Ankle to Ankle	330	169

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
Test Date: 01/23/2019



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	375	325
PBL - Top surface of reference to belt lower edge	mm	295	235

BELT LENGTH DATA

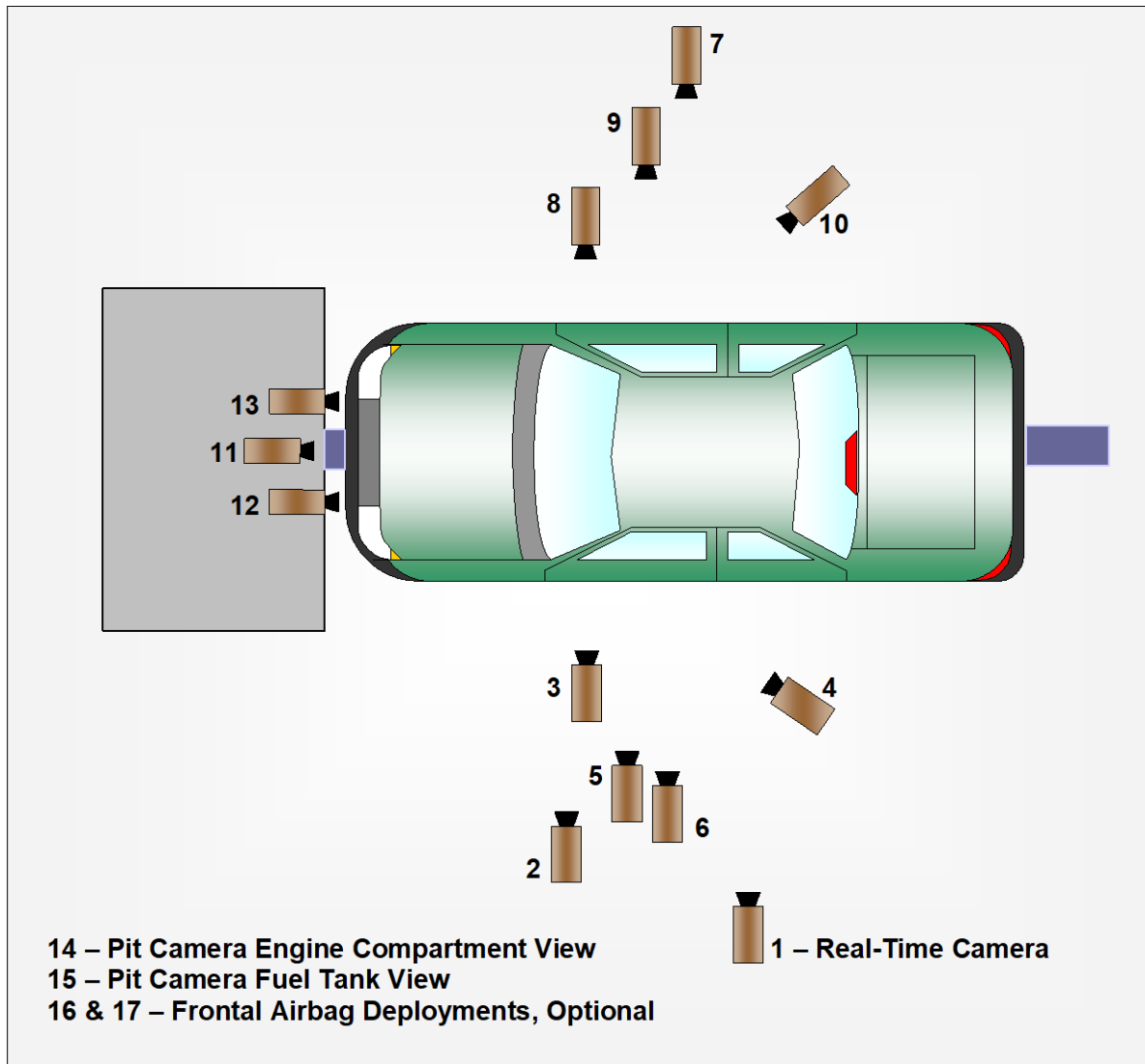
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	860	890
Lap Belt Length as measured on ATD	mm	580	525
Remainder of belt on reel	mm	860	885
Total Belt Length for Continuous Webbing Systems	mm	3000	3000

DATA SHEET NO. 6
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
Test Date: 01/23/2019

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 (CONTINUED)
CAMERA LOCATIONS AND DATA

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	-1860	-6970	-2030	50	1000
3	Left Front Half	-1320	-5730	-1420	24	1000
4	Left Angle	-7310	-5920	-2040	75	1000
5	Steering Column - Top					
6	Steering Column - Bottom					
7	Right Overall	-2160	12820	-1450	35	1000
8	Passenger Close-Up	-1830	13210	-2200	110	1000
9	Right Front Half	-1430	11420	-1470	50	1000
10	Right Angle	-7190	5750	-2080	75	1000
11	Windshield	70	0	-2310	11-16	1000
12	Driver Windshield	150	-370	-2230	25	1000
13	Passenger Windshield	150	370	-2230	25	1000
14	Pit Front	-880	0	3340	24	1000
15	Pit Rear	-3110	0	3340	24	1000
16	Onboard Driver Side				12	1000
17	Onboard Passenger Side				12	1000
18	Real-Time Pan View					30

***COORDINATES:**

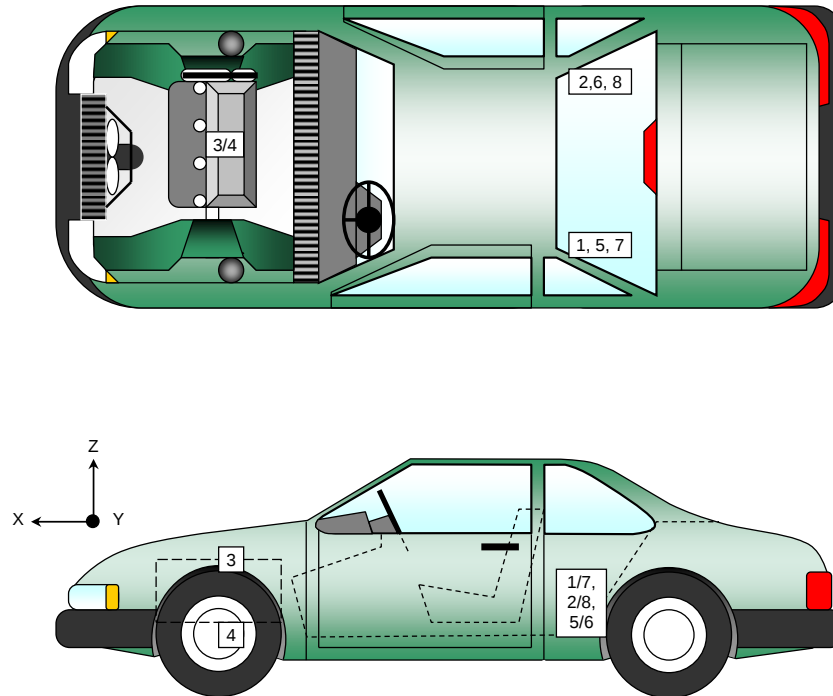
+X = forward of impact plane
 +Y = right of monorail centerline
 +Z = below ground level

Cameras 5 & 6 were not used for this test.

DATA SHEET NO. 7 VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
Test Date: 01/23/2019



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	2041	-400	-225
2	Right Rear Crossmember Accelerometer – X Direction	2041	400	-224
3	Engine Top X	4278	3	-812
4	Engine Bottom X	4042	270	-208
5	Left Rear Crossmember Accelerometer – Z Direction	2041	-370	-225
6	Right Rear Crossmember Accelerometer – Z Direction	2041	370	-224
7	Left Rear Crossmember Accelerometer Redundant – X Direction	2041	-370	-225
8	Right Rear Crossmember Accelerometer Redundant – X Direction	2041	370	-224

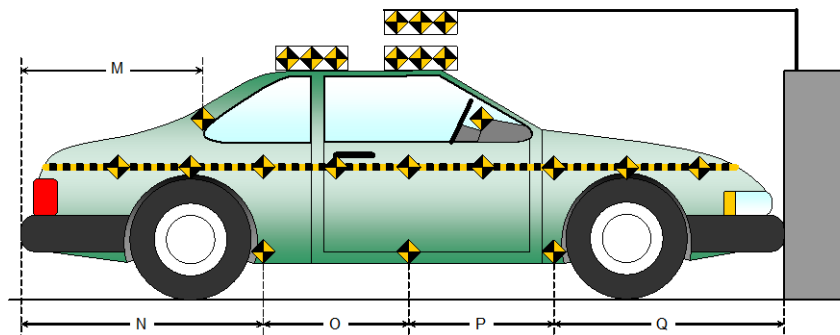
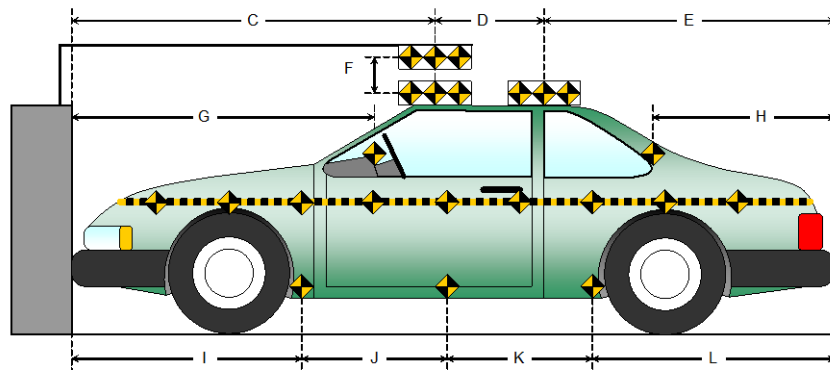
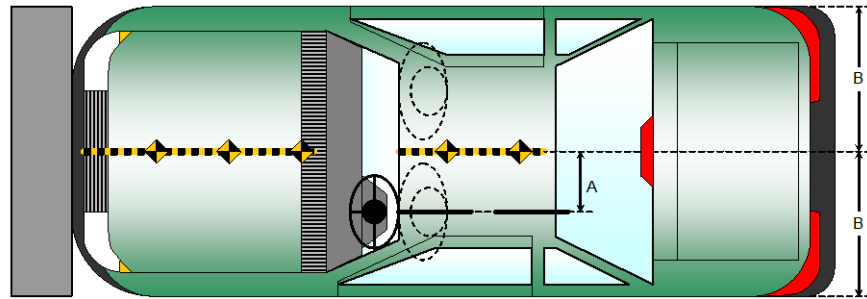
Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

Item	Value (mm)
A	370
B	935
C	2430
D	610
E	1937
F	326
G	
H	1213
I	1438
J	984
K	984
L	1571
M	1213
N	1571
O	984
P	984
Q	1438



DATA SHEET NO. 9 **LOAD CELL LOCATIONS ON FIXED BARRIER**

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

Advanced Research Load Cell Barrier

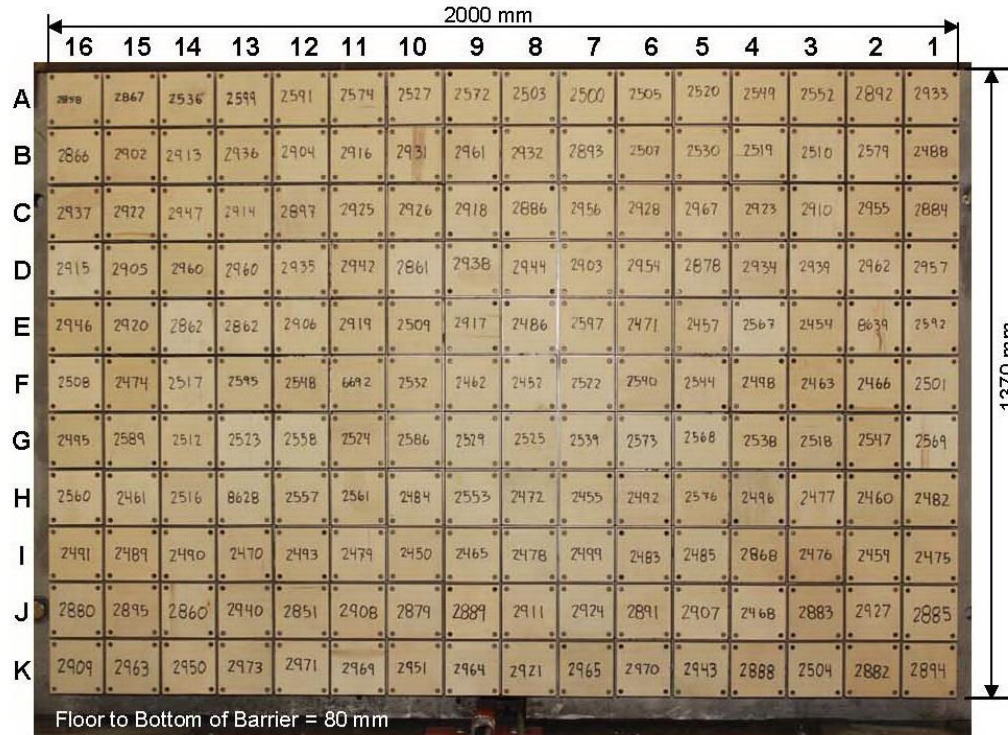


Photo for Reference Only

Centerline

A-16	A-15	A-14	A-13	A-12	A-11	A-10	A-09	A-08	A-07	A-06	A-05	A-04	A-03	A-02	A-01
B-16	B-15	B-14	B-13	B-12	B-11	B-10	B-09	B-08	B-07	B-06	B-05	B-04	B-03	B-02	B-01
C-16	C-15	C-14	C-13	C-12	C-11	C-10	C-09	C-08	C-07	C-06	C-05	C-04	C-03	C-02	C-01
D-16	D-15	D-14	D-13	D-12	D-11	D-10	D-09	D-08	D-07	D-06	D-05	D-04	D-03	D-02	D-01
E-16	E-15	E-14	E-13	E-12	E-11	E-10	E-09	E-08	E-07	E-06	E-05	E-04	E-03	E-02	E-01
F-16	F-15	F-14	F-13	F-12	F-11	F-10	F-09	F-08	F-07	F-06	F-05	F-04	F-03	F-02	F-01
G-16	G-15	G-14	G-13	G-12	G-11	G-10	G-09	G-08	G-07	G-06	G-05	G-04	G-03	G-02	G-01
H-16	H-15	H-14	H-13	H-12	H-11	H-10	H-09	H-08	H-07	H-06	H-05	H-04	H-03	H-02	H-01
I-16	I-15	I-14	I-13	I-12	I-11	I-10	I-09	I-08	I-07	I-06	I-05	I-04	I-03	I-02	I-01
J-16	J-15	J-14	J-13	J-12	J-11	J-10	J-09	J-08	J-07	J-06	J-05	J-04	J-03	J-02	J-01
K-16	K-15	K-14	K-13	K-12	K-11	K-10	K-09	K-08	K-07	K-06	K-05	K-04	K-03	K-02	K-01

Load Cells are 121 mm x 121 mm with a 7 mm gap in between each load cell.

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
Test Date: 01/23/2019

INSTRUMENTATION

Driver Dummy Data Channels	49
Passenger Dummy Data Channels	49
Vehicle Structure Accelerometers	8
Barrier Channels	528
Total	634

CAMERA COVERAGE

High-Speed Vehicle Onboard	2
High-Speed Offboard	12
Real-Time	2
Total	16

**DATA SHEET NO. 11
POST-TEST OBSERVATIONS**

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
Test Date: 01/23/2019

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIIL 50% / 351	HIIL 5% / 138
Head Contact	Airbag, Headrest	Airbag, Headrest
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Airbag	Knee Airbag
Right Knee Contact	Knee Airbag	Knee Airbag

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were unlocked	Doors were unlocked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None

POST TEST STRUCTURAL OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1779
Center	mm	1798
Right Side	mm	1812
Average	mm	1796

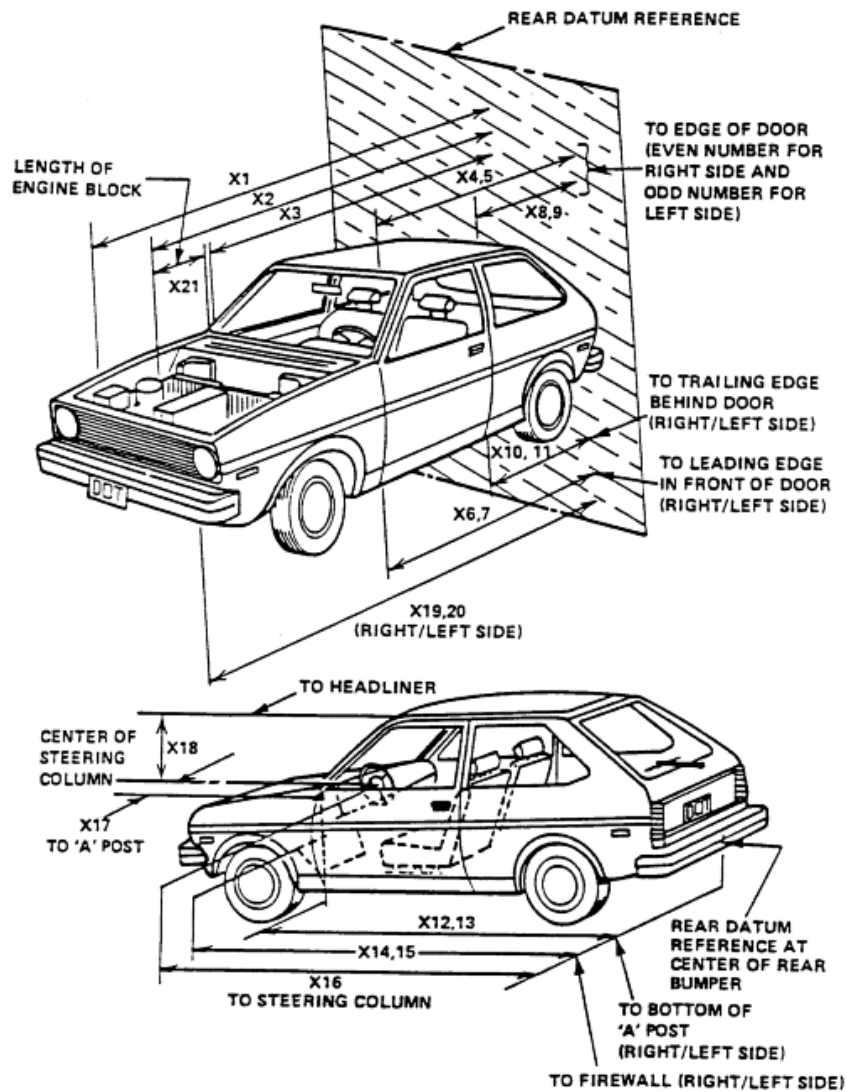
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver (Occupant 1)		Passenger (Occupant 2)	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Curtain Side Airbag	Yes	Yes	Yes	Yes
Torso/Pelvis Side Airbag	Yes	No	Yes	No
Knee Airbag	Yes	Yes	Yes	Yes
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	

DATA SHEET NO. 12 VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
Test Date: 01/23/2019



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4977	4355	622
2	RSOV to Front of Engine	mm	4415	4110	305
3	RSOV to Firewall	mm	3762	3745	17
4	RSOV to Upper Leading Edge of Right Door	mm	3412	3400	12
5	RSOV to Upper Leading Edge of Left Door	mm	3413	3406	7
6	RSOV to Lower Leading Edge of Right Door	mm	3440	3448	-8
7	RSOV to Lower Leading Edge of Left Door	mm	3437	3439	-2
8	RSOV to Upper Trailing Edge of Right Door	mm	2274	2266	8
9	RSOV to Upper Trailing Edge of Left Door	mm	2274	2271	3
10	RSOV to Lower Trailing Edge of Right Door	mm	2287	2296	-9
11	RSOV to Lower Trailing Edge of Left Door	mm	2290	2292	-2
12	RSOV to Bottom of "A" Post of Right Side	mm	3476	3487	-11
13	RSOV to Bottom of "A" Post of Left Side	mm	3471	3466	5
14	RSOV to Firewall, Right Side	mm	3702	3695	7
15	RSOV to Firewall, Left Side	mm	3704	3713	-9
16	RSOV to Steering Column	mm	2845	2918	-73
17	Center of Steering Column to "A" Post	mm	357	341	16
18	Center of Steering Column to Headliner	mm	405	403	2
19	RSOV to Right Side of Front Bumper	mm	4745	4360	385
20	RSOV to Left Side of Front Bumper	mm	4745	4346	399
21	Length of Engine Block	mm	495	495	0
RD	RSOV to Right Side of Dash Panel	mm	3098	3114	-16
CD	RSOV to Center of Dash Panel	mm	3098	3180	-82
LD	RSOV to Left Side of Dash Panel	mm	3124	3136	-12

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
Test Date: 01/23/2019

VEHICLE INFORMATION

VIN: 58ABZ1B14KU006782

Wheelbase (mm): 2870

Vehicle Size Category: Passenger Car

Test Weight (kg): 1888.5

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15

Cal. Procedure/Interval: MGA procedure / 6 month

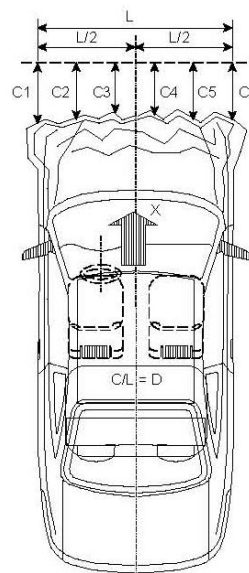
Integration Algorithm: Trapezoidal

Linearity: > 99%

Impact Velocity (km/h): 56.19

Velocity Change (km/h): 65.9

Time of Separation (msec): 87



CRUSH PROFILE

Collision Deformation Classification: 12FDEW2

Midpoint of Damage: Centerline

Damage Region Length (mm): 1600

Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4745	4346	399
C2	Crush zone 2 at left side	mm	4912	4390	522
C3	Crush zone 3 at left side	mm	4939	4384	555
C4	Crush zone 4 at right side	mm	4939	4375	564
C5	Crush zone 5 at right side	mm	4912	4388	524
C6	Crush zone 6 at right side	mm	4745	4360	385
L	C1 TO C6	mm	1600	1582	18

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

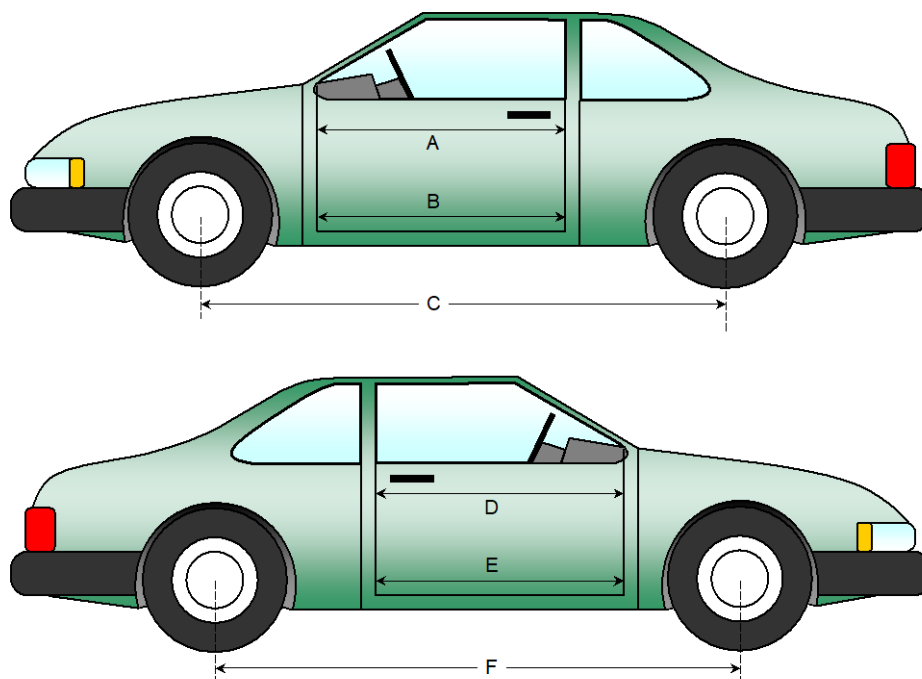
NHTSA No.: O20195104
Test Date: 01/23/2019

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1103	1103	0
B	Left Side Lower	mm	1013	1013	0
D	Right Side Upper	mm	1103	1103	0
E	Right Side Lower	mm	1013	1013	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2870	2780	90
F	Right Side Wheelbase	mm	2870	2810	60



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

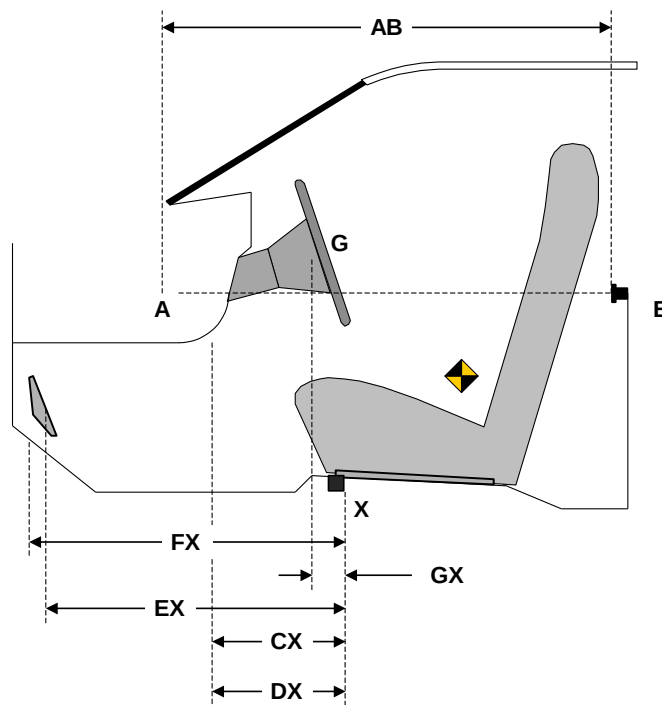
Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	837	836	1
CX	Left Knee Bolster to X	mm	255	247	8
DX	Right Knee Bolster to X	mm	245	232	13
EX	Brake Pedal to X	mm	570	519	51
FX	Foot Rest to X	mm	604	588	16
GX	Center of Steering Column Wheel Hub to X	mm	32	41	-9

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 15
SUMMARY OF FMVSS 212, FMVSS 219 (PARTIAL) DATA, AND 301 DATA

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

Windshield Mounting Details:

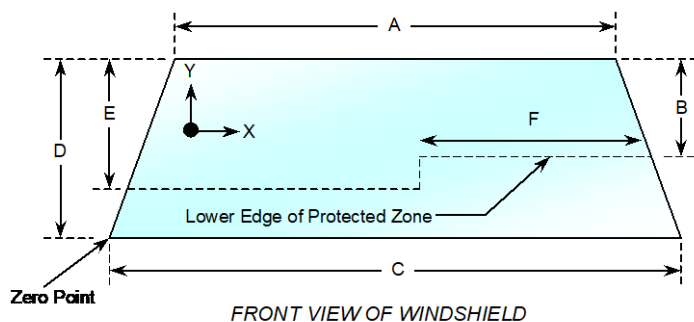
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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

Temperature of windshield molding during test: 21.4° C.

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2188	2188	100.0
Right Side	2188	2188	100.0
Total	4376	4376	100.0



Item	Units	Value
A	mm	1193
B	mm	398
C	mm	1482
D	mm	850
E	mm	500
F	mm	530

AREA OF PROTECTED ZONE FAILURES - NONE

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. **None**

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. **None**

X	Y

DATA SHEET NO. 15 (CONTINUED)
SUMMARY OF FMVSS 212, FMVSS 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
Test Date: 01/23/2019

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21.4°C

Test Time: 1:56 p.m.

- 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: None

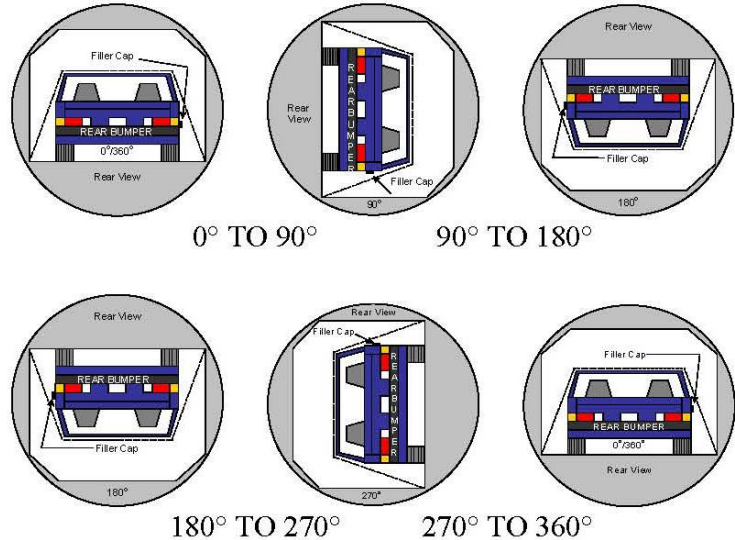
DATA SHEET NO. 16

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019

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: **None**



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	112	300	412
90° to 180°	111	300	411
180° to 270°	107	300	407
270° to 360°	110	300	410

FMVSS 301 SPILLAGE TABLE (units in ounces)

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

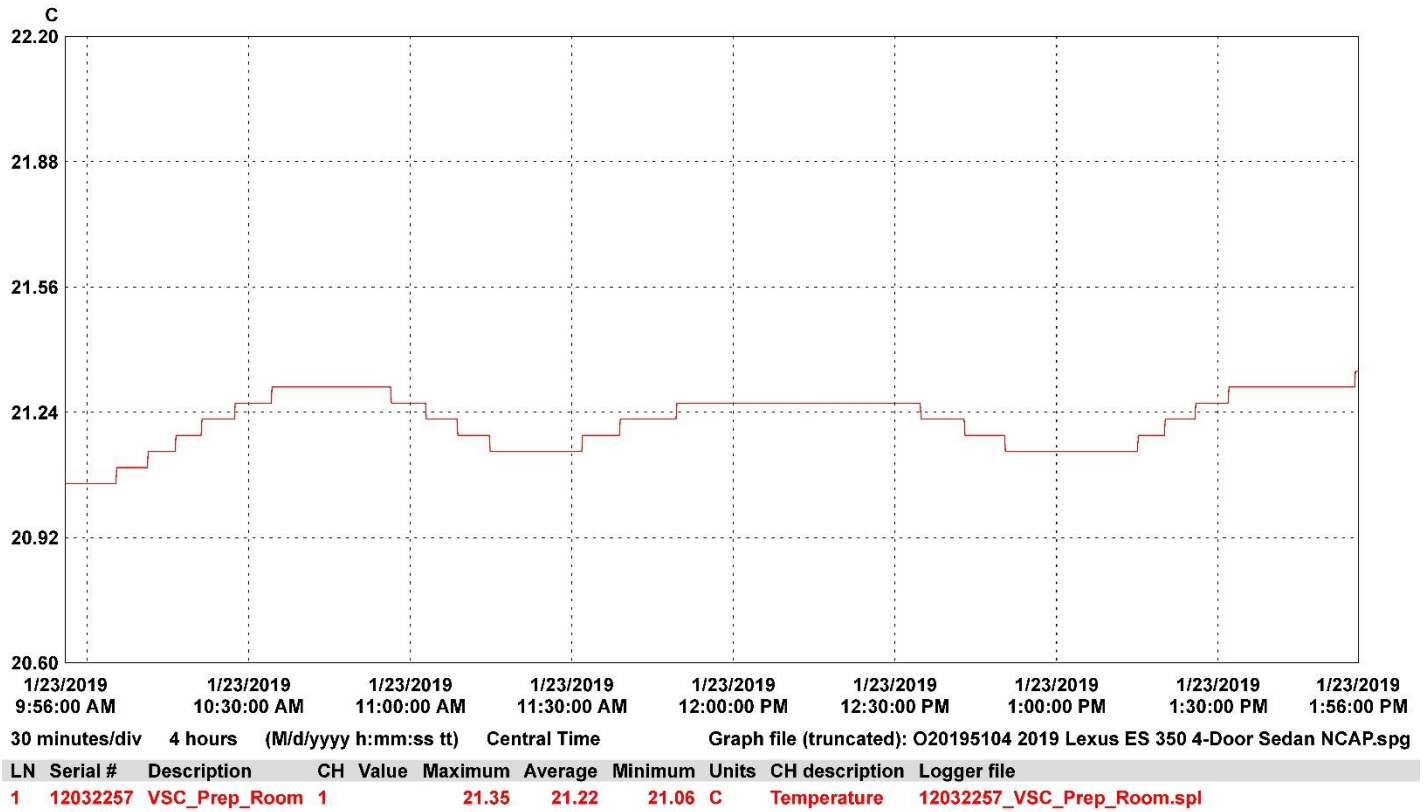
SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 17
DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2019 Lexus ES 350 4-Door Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20195104
 Test Date: 01/23/2019



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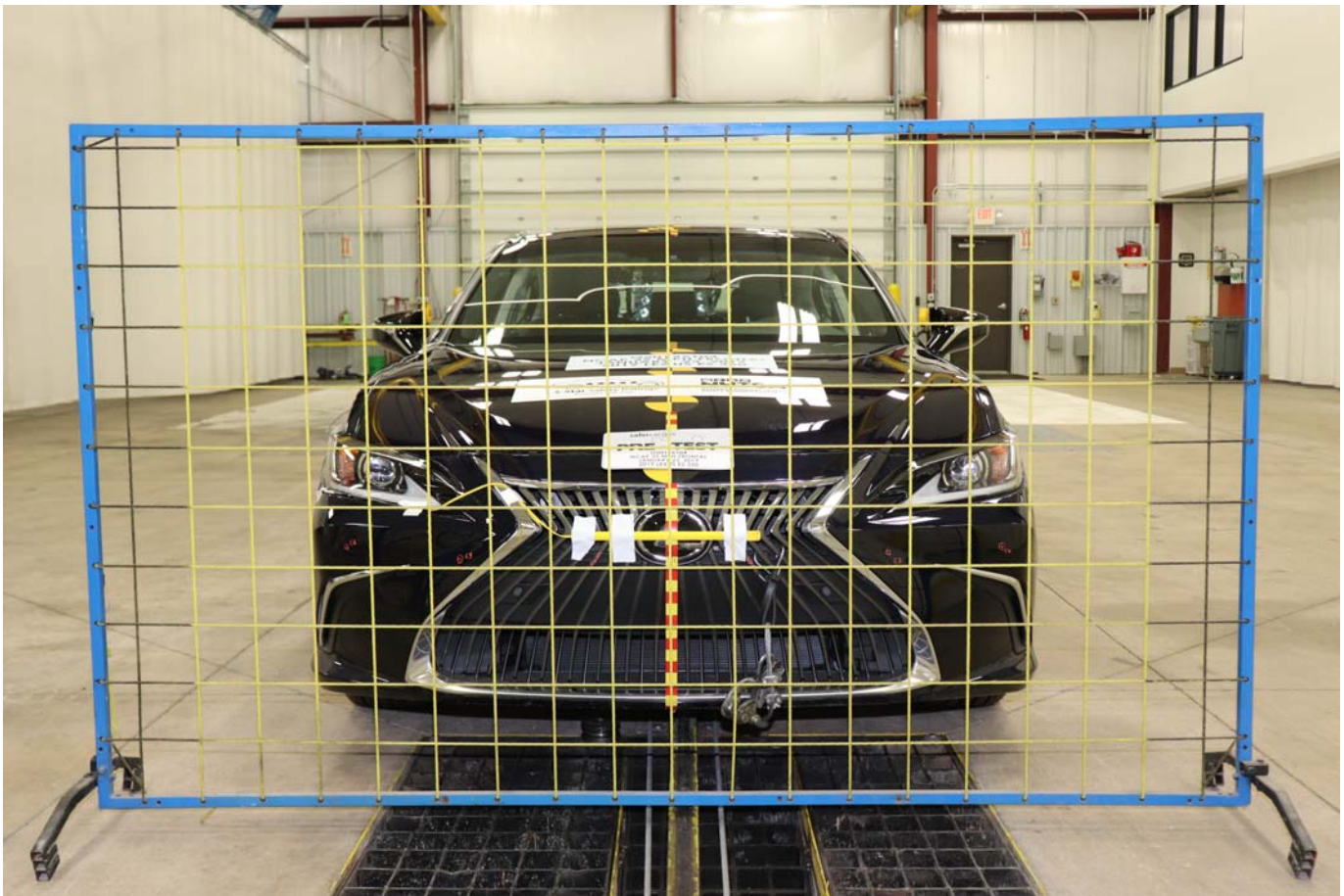


Photo No. 001 - Load Cell Location



Photo No. 002 - Pre-Test Load Cell Wall



Photo No. 003 - Post-Test Load Cell Wall



Photo No. 004 - Manufacturer Label

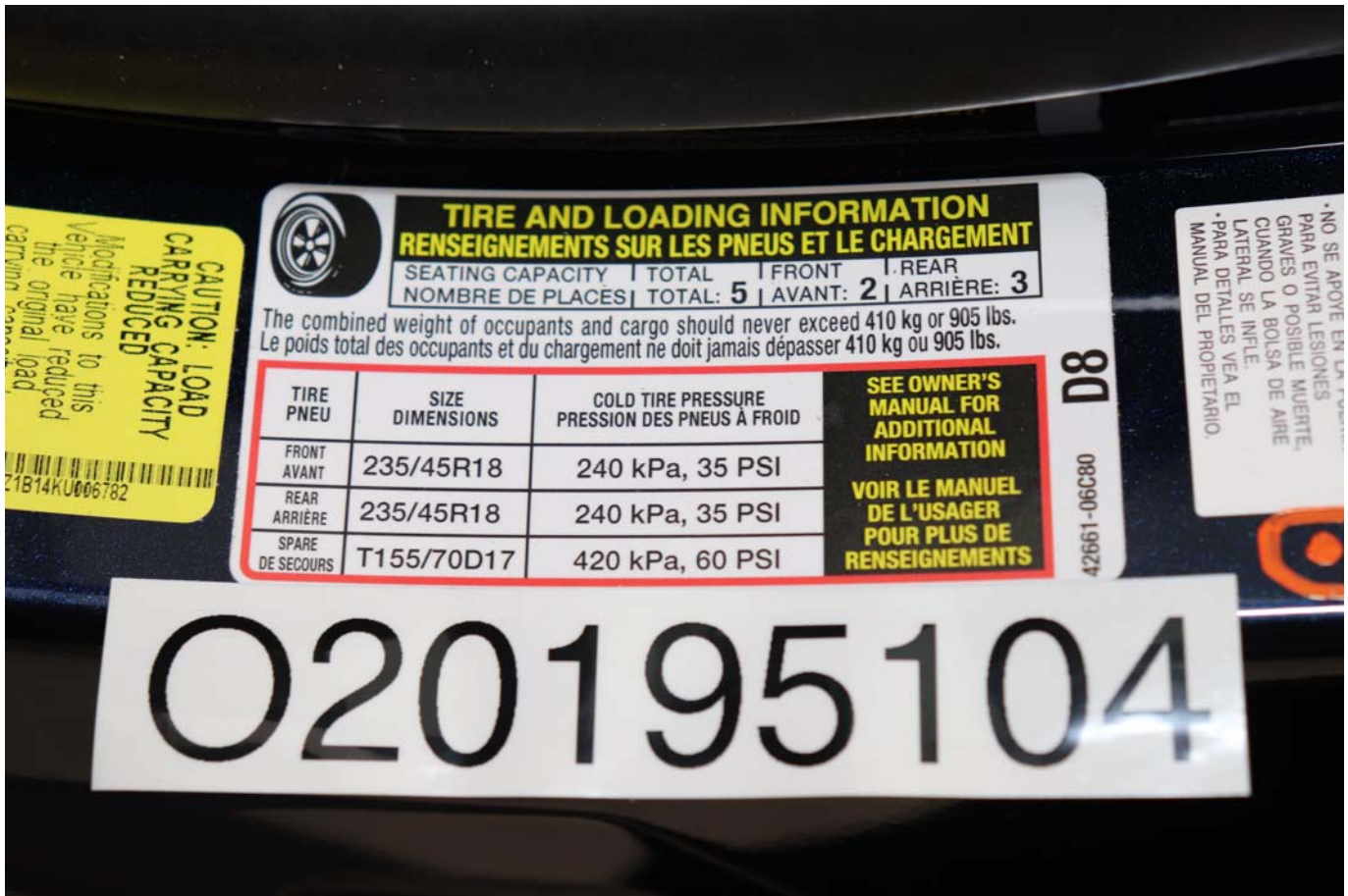


Photo No. 005 - Tire Placard



Photo No. 005a - Vehicle Load Carrying Capacity Reduction Label



Photo No. 006 - 2019 Lexus ES 350 4-Door Sedan Frontal As Delivered



Photo No. 007 - Left Rear 3-4 View, As Received

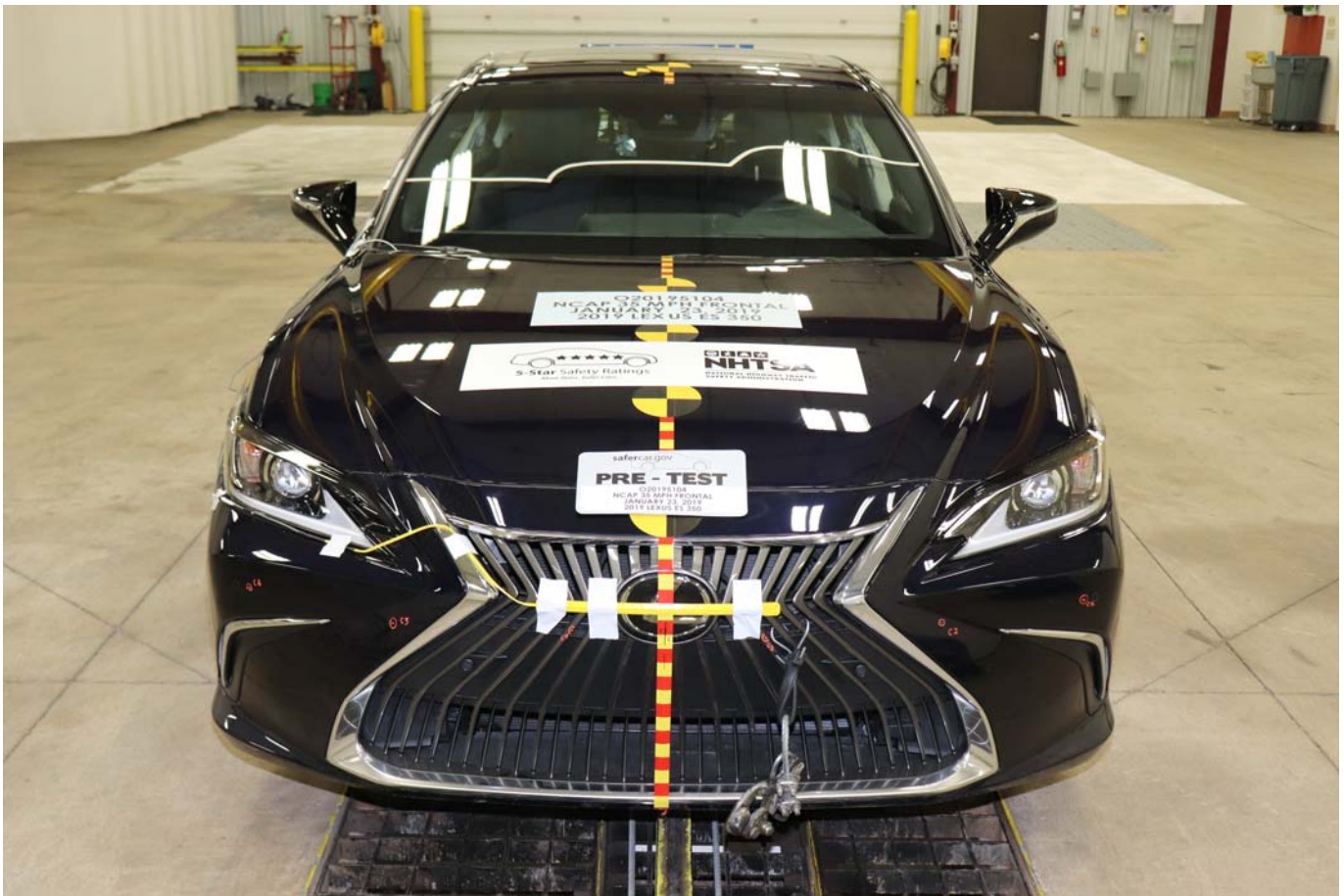


Photo No. 008 - Pre-Test Front View of Test Vehicle



Photo No. 009 - Post-Test Front View of Test Vehicle



Photo No. 010 - Pre-Test Left View of Test Vehicle



Photo No. 011 - Post-Test Left View of Test Vehicle



Photo No. 012 - Pre-Test Right View of Test Vehicle



Photo No. 013 - Post-Test Right View of Test Vehicle



Photo No. 014 - Pre-Test Right Front 3-4 View

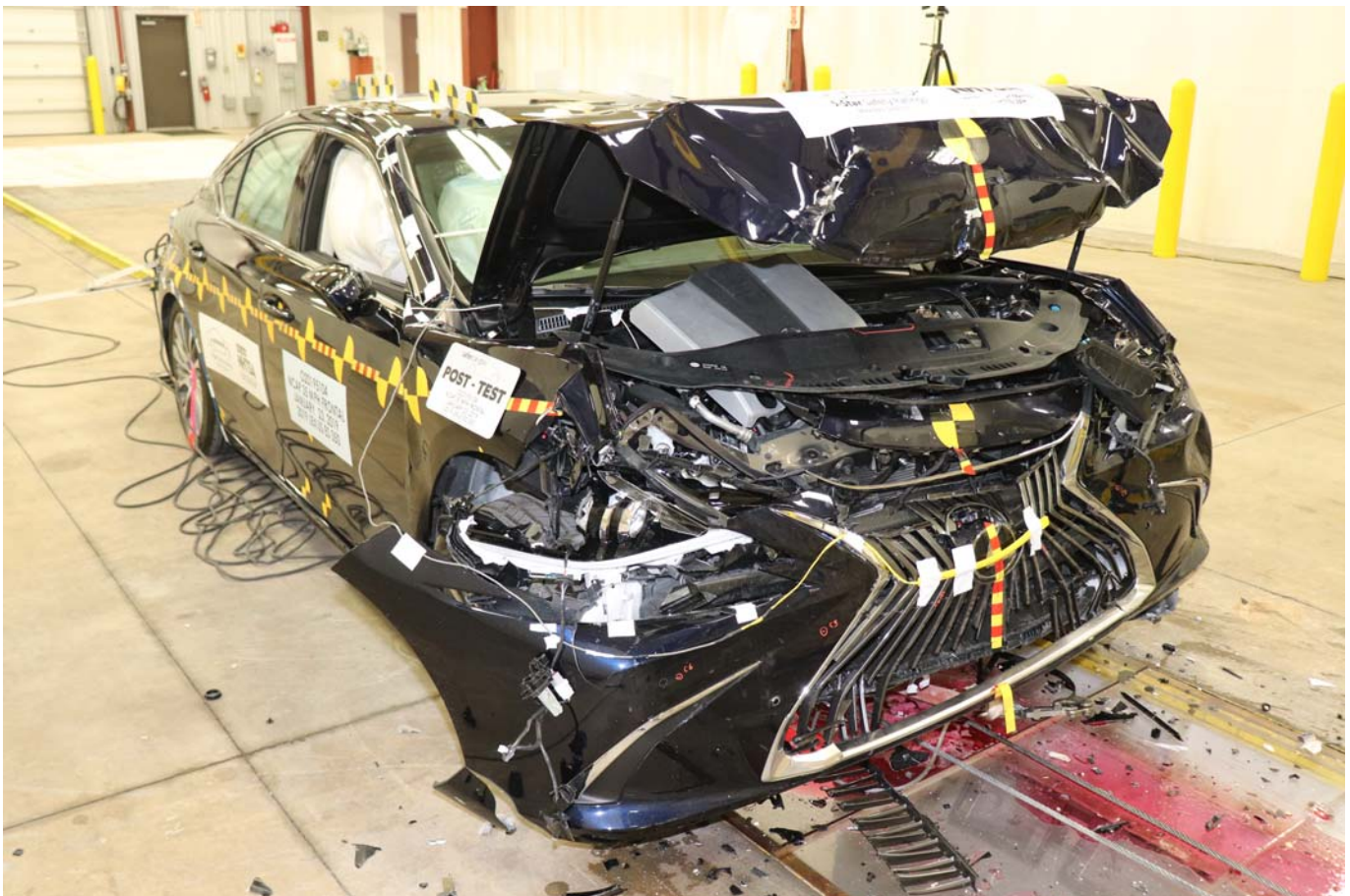


Photo No. 015 - Post-Test Right Front 3-4 View

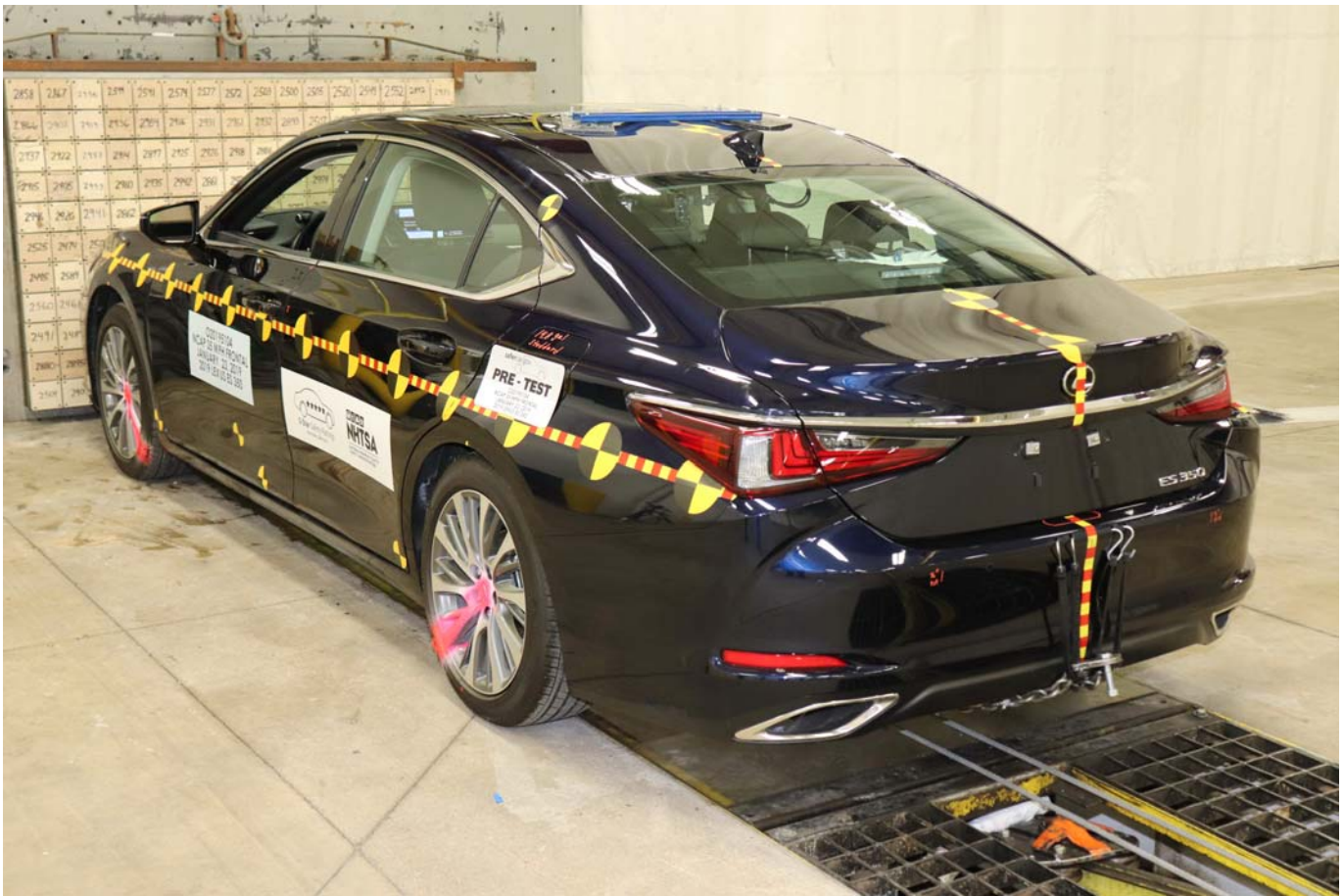


Photo No. 016 - Pre-Test Left Rear 3-4 View

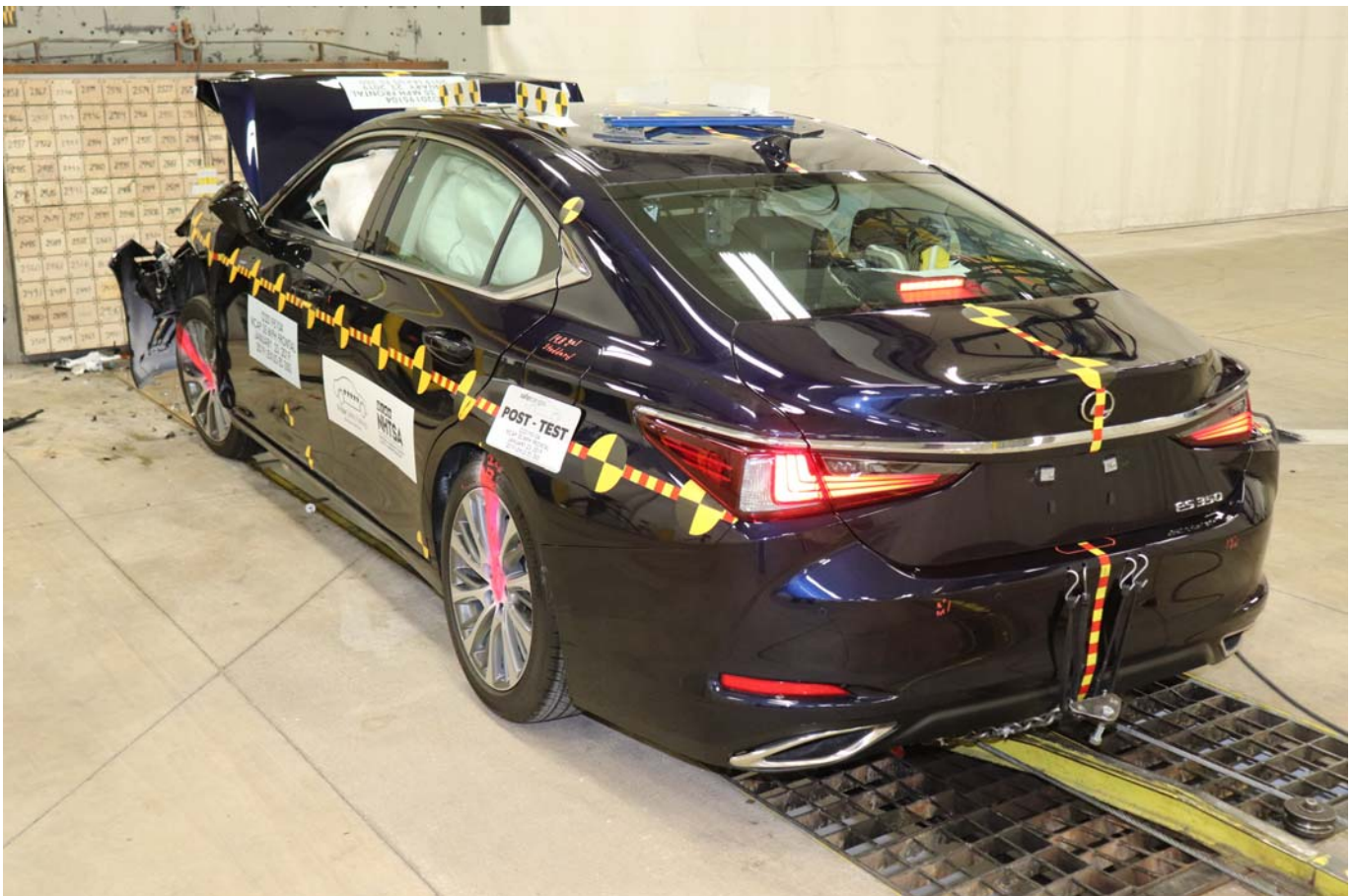


Photo No. 017 - Post-Test Left Rear 3-4 View



Photo No. 018 - Pre-Test Windshield View



Photo No. 019 - Post-Test Windshield View



Photo No. 020 - Pre-Test Engine Compartment View

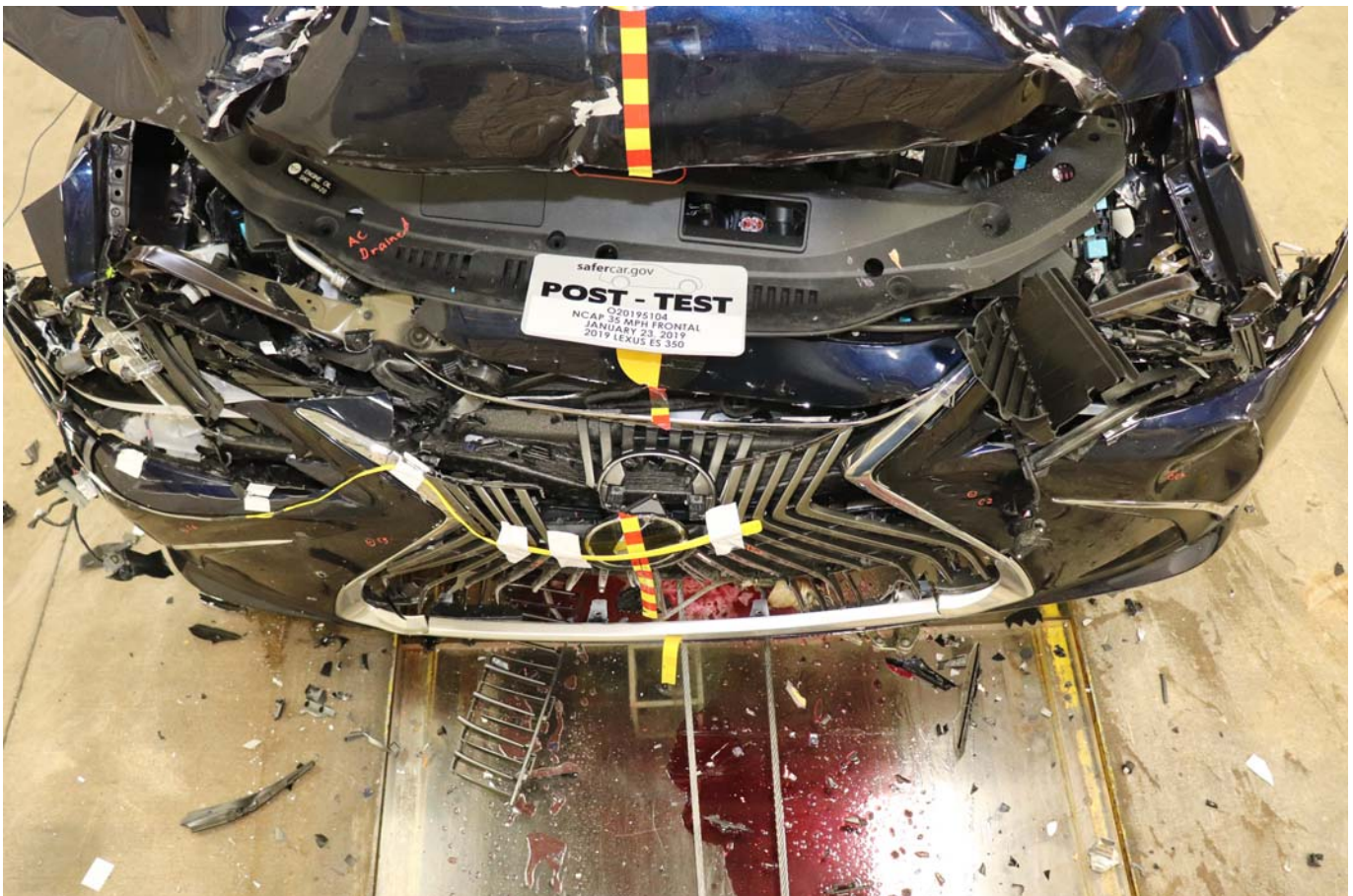


Photo No. 021 - Post-Test Engine Compartment View



Photo No. 022 - Pre-Test Fuel Filler Cap View



Photo No. 023 - Post-Test Fuel Filler Cap View

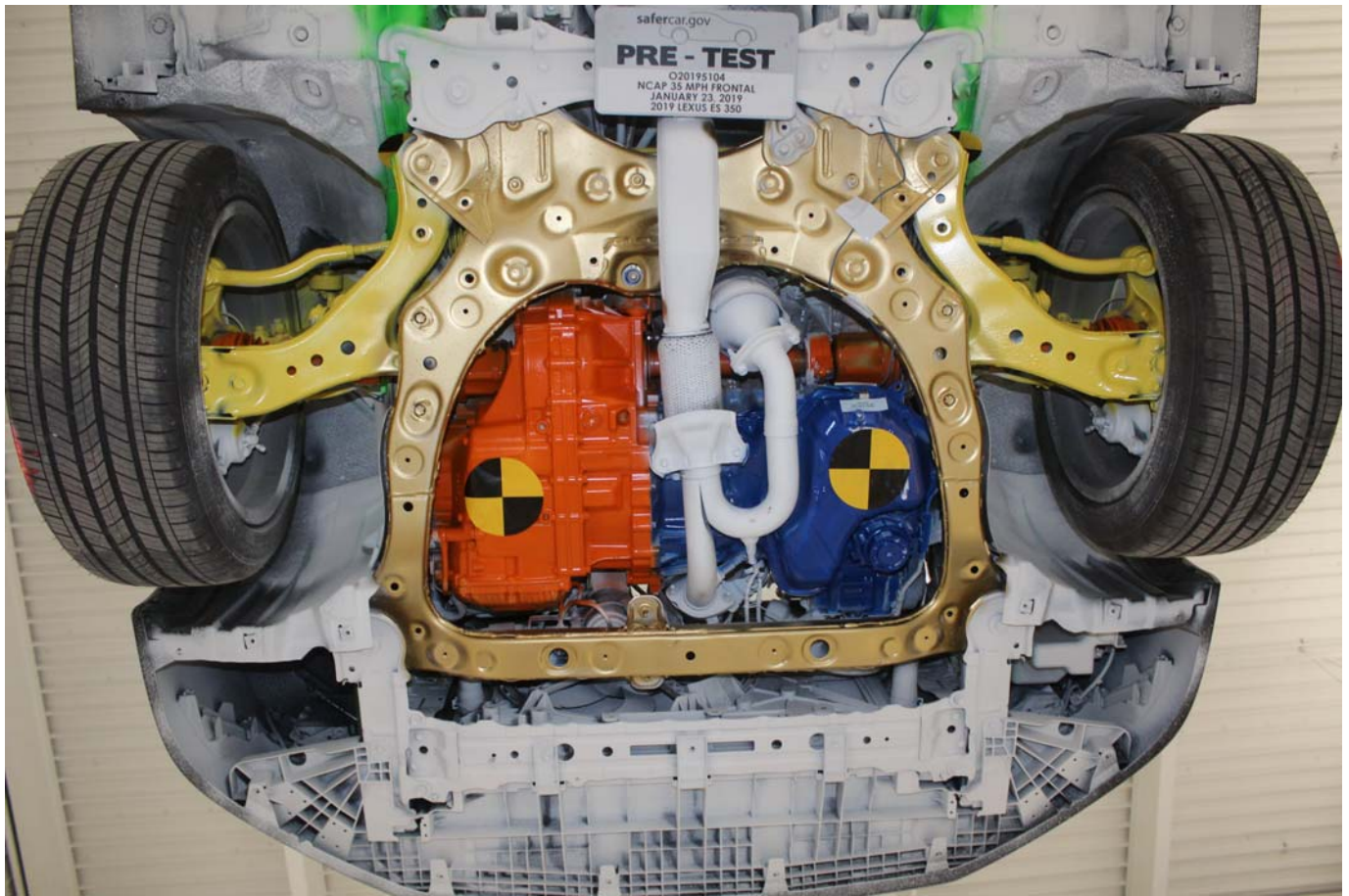


Photo No. 024 - Pre-Test Front Underbody View

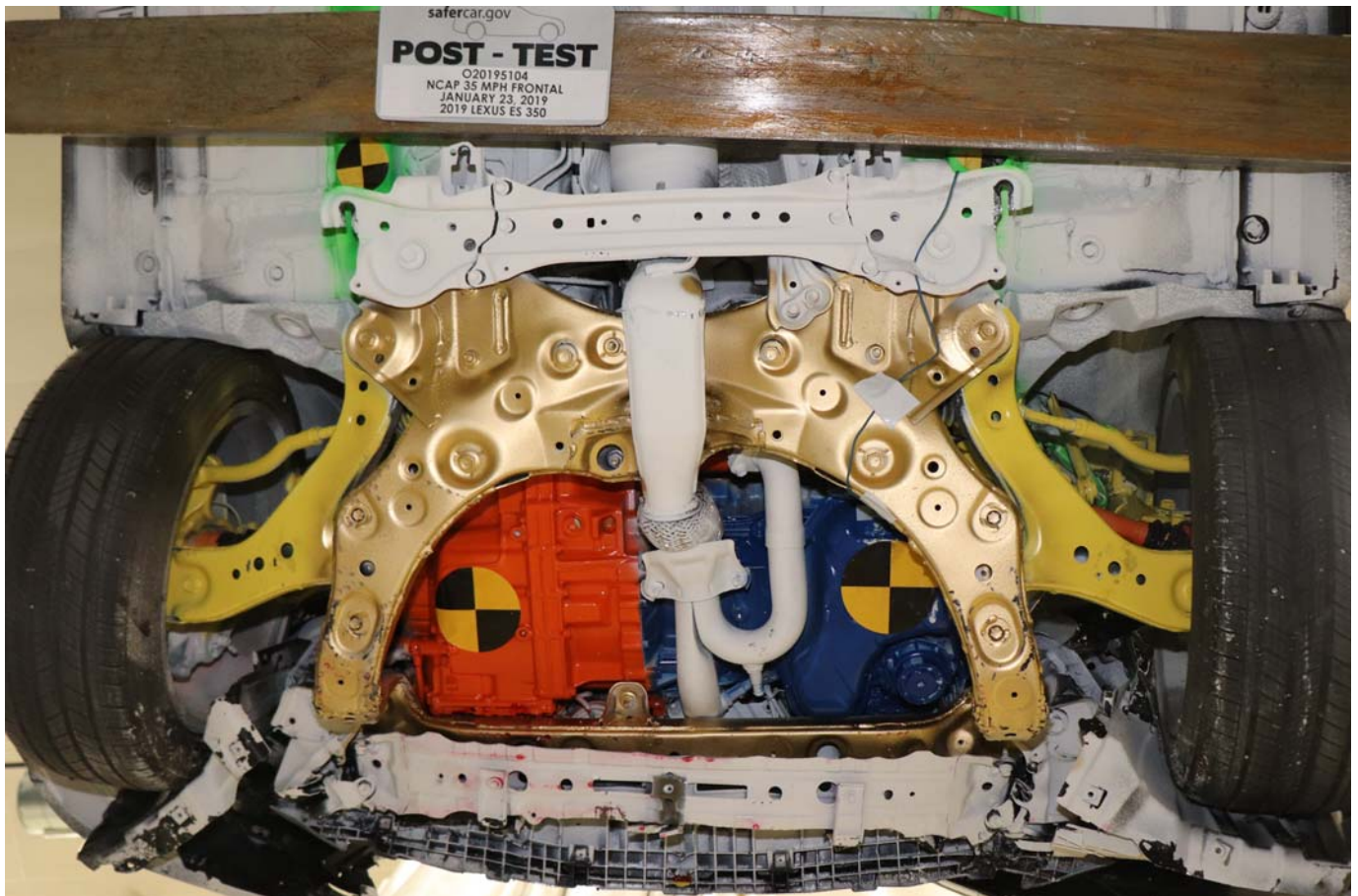


Photo No. 025 - Post-Test Front Underbody View



Photo No. 026 - Pre-Test Rear Underbody View

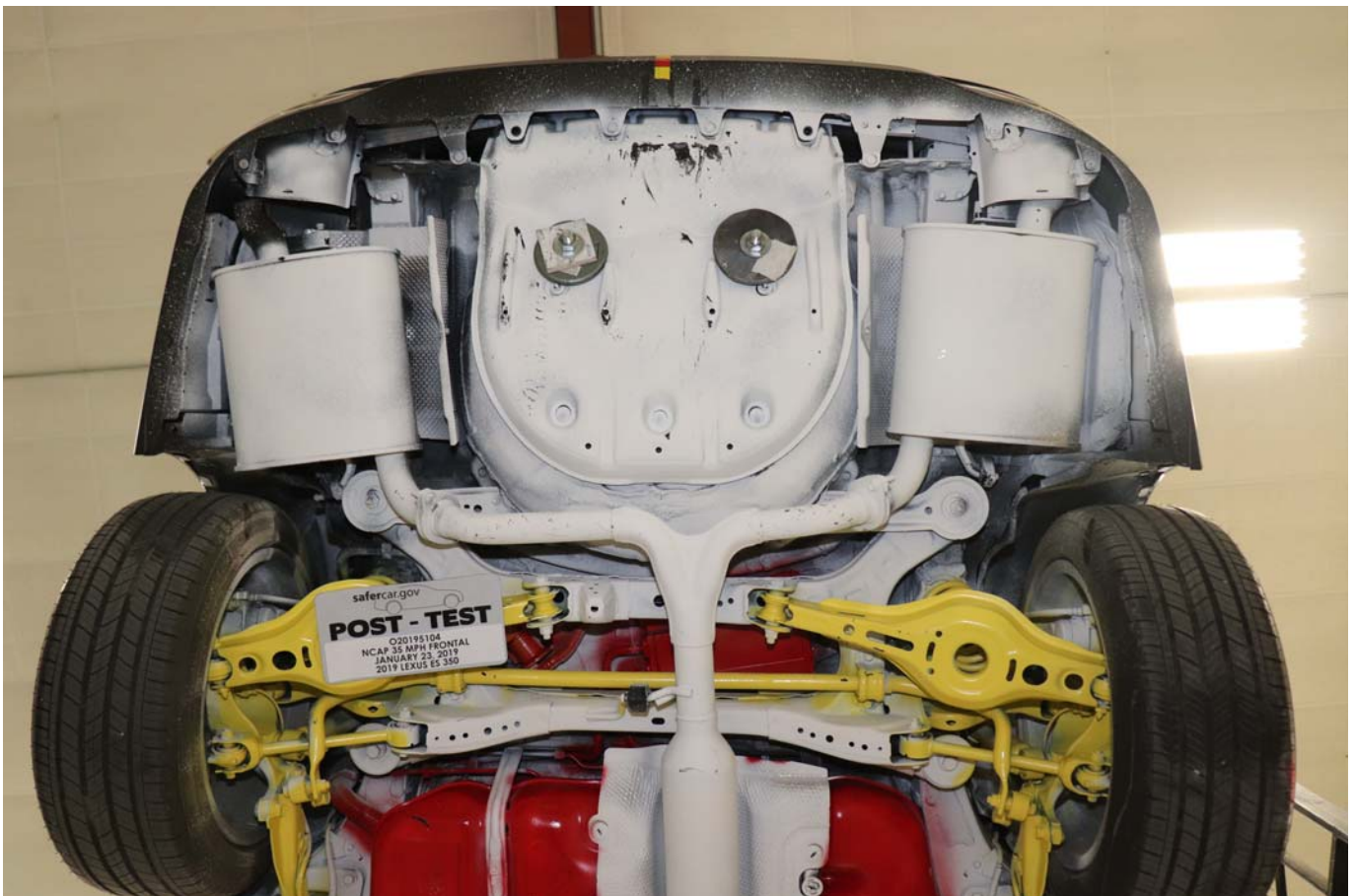


Photo No. 027 - Post-Test Rear Underbody View

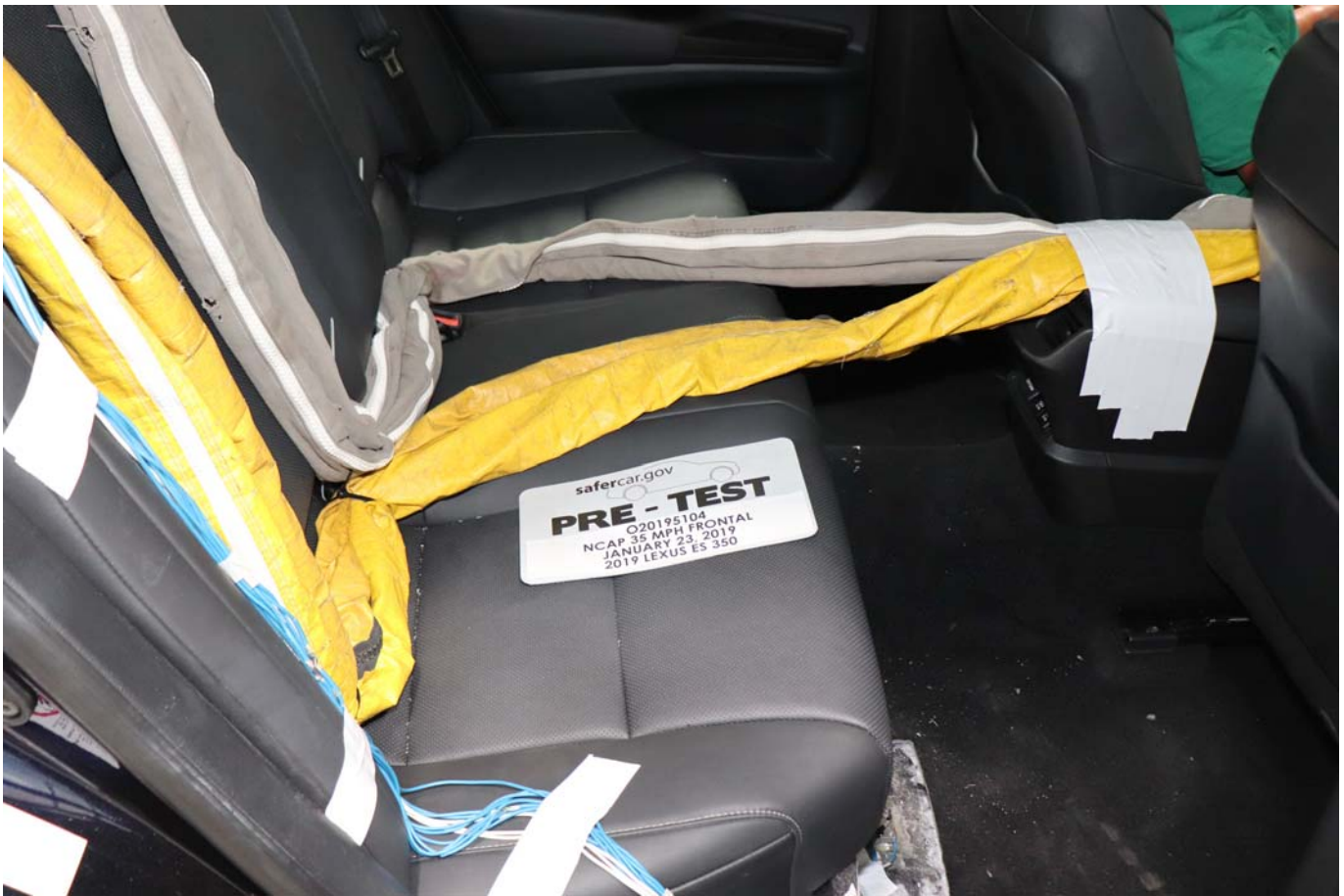


Photo No. 028 - Pre-Test Dummy Cable Routing

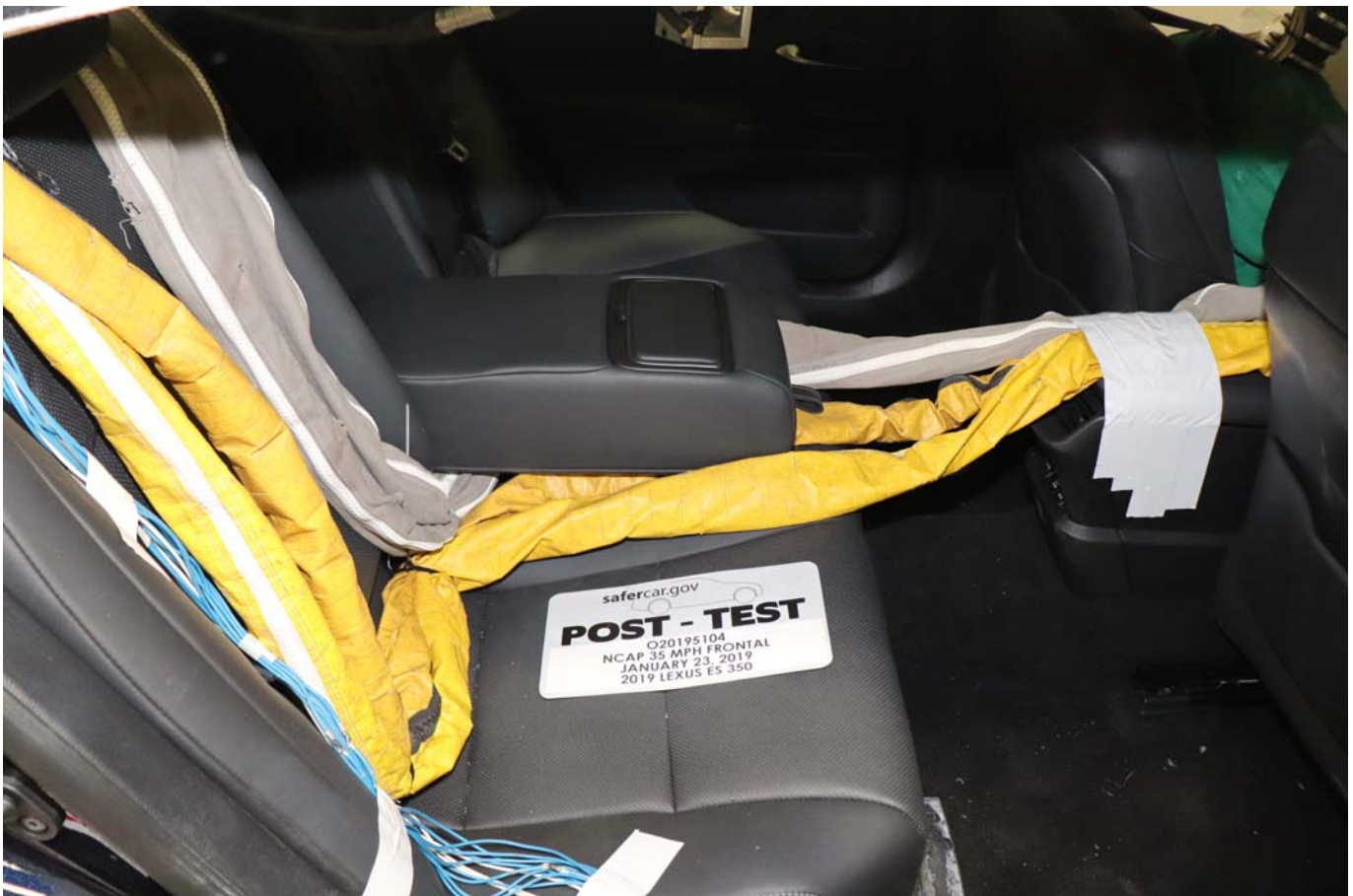


Photo No. 029 - Post-Test Dummy Cable Routing



Photo No. 030 - Pre-Test Driver Dummy Front View



Photo No. 031 - Post-Test Driver Dummy Front View



Photo No. 032 - Pre-Test Driver Dummy Window View



Photo No. 033 - Post-Test Driver Dummy Window View



Photo No. 034 - Pre-Test Driver Dummy and Vehicle Interior



Photo No. 035 - Post-Test Driver Dummy and Vehicle Interior



Photo No. 036 - Pre-Test Driver Seat Fore-Aft Markings



Photo No. 037 - Post-Test Driver Seat Fore-Aft Markings



Photo No. 038 - Pre-Test View of Belt Anchorage for Driver Dummy



Photo No. 039 - Post-Test View of Belt Anchorage for Driver Dummy



Photo No. 040 - Pre-Test Driver Dummy Feet



Photo No. 041 - Post-Test Driver Dummy Feet



Photo No. 042 - Pre-Test Driver Side Knee Bolster



Photo No. 043 - Post-Test Driver Side Knee Bolster



Photo No. 044 - Pre-Test Driver Side Floorpan



Photo No. 045 - Post-Test Driver Side Floorpan



Photo No. 046 - Post-Test Driver Dummy Face



Photo No. 047 - Post-Test Driver Dummy Contact with Airbag



Photo No. 048 - Post-Test Driver Dummy Contact with Headrest



Photo No. 049 - Pre-Test View of the Steering Wheel



Photo No. 050 - Post-Test View of the Steering Wheel



Photo No. 051 - Pre-Test Passenger Dummy Front View



Photo No. 052 - Post-Test Passenger Dummy Front View

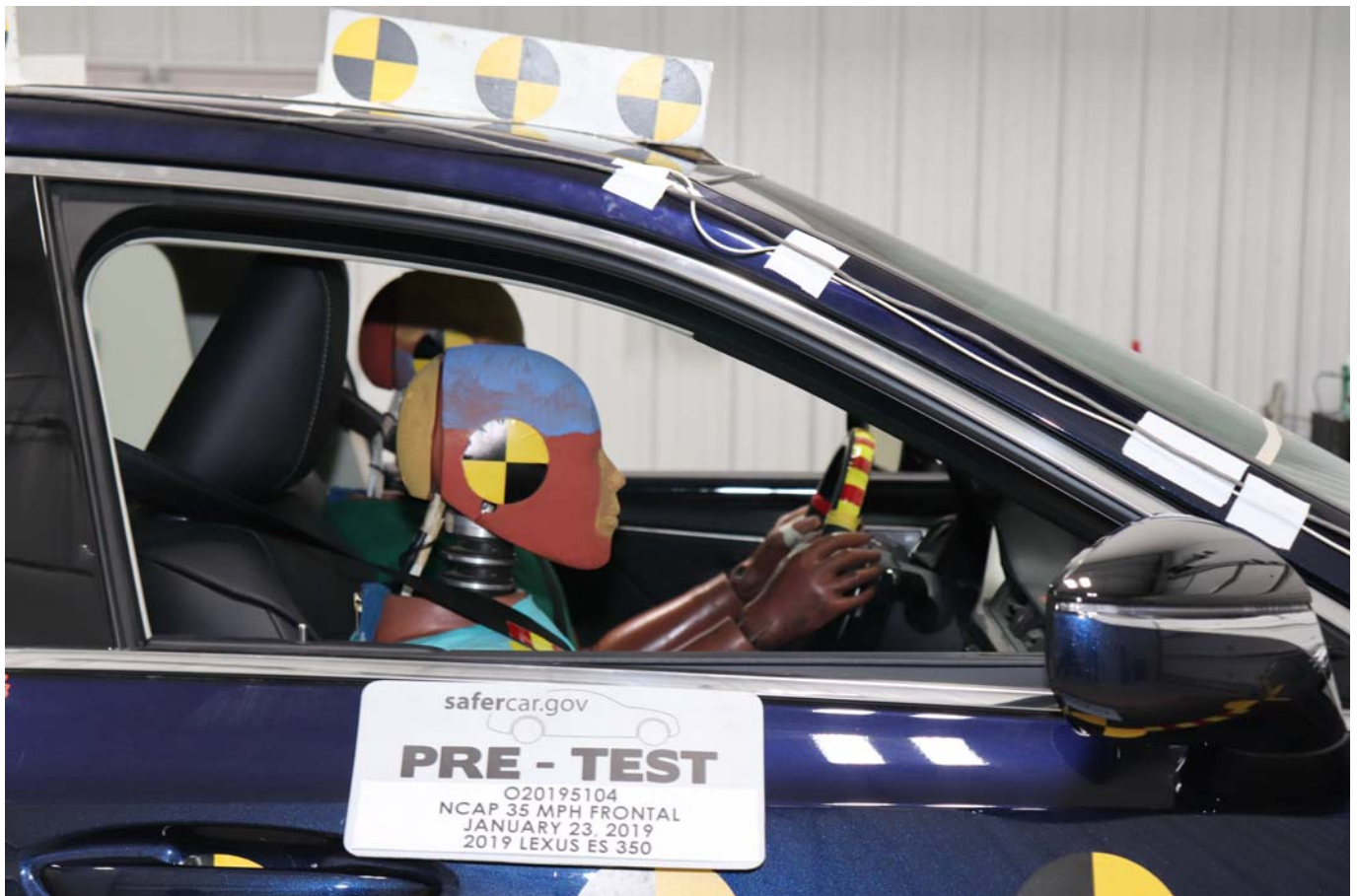


Photo No. 053 - Pre-Test Passenger Dummy Window View



Photo No. 054 - Post-Test Passenger Dummy Window View

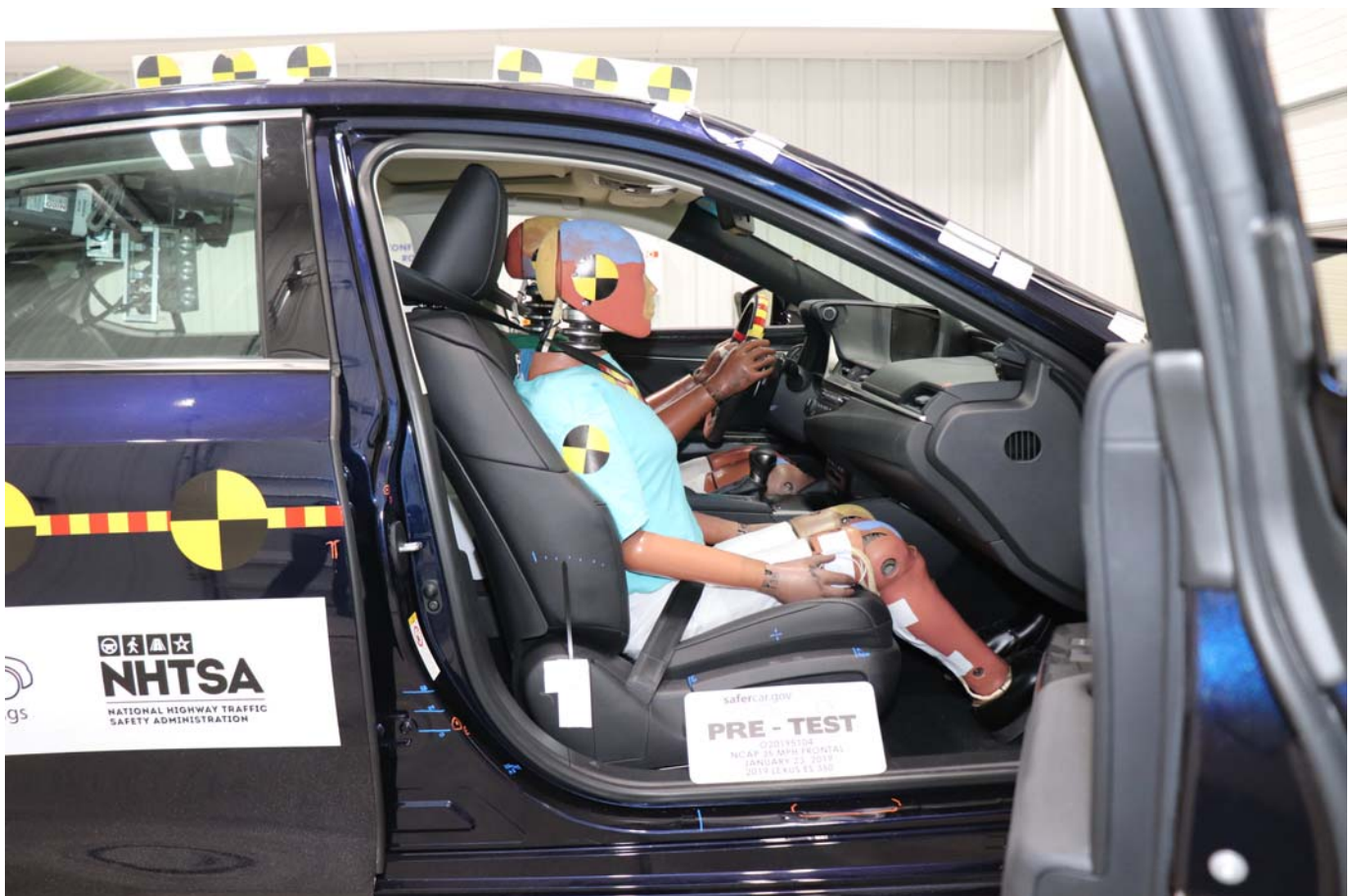


Photo No. 055 - Pre-Test Passenger Dummy and Vehicle Interior



Photo No. 056 - Post-Test Passenger Dummy and Vehicle Interior



Photo No. 057 - Pre-Test Passenger Seat Fore-Aft Markings



Photo No. 058 - Post-Test Passenger Seat Fore-Aft Markings



Photo No. 059 - Pre-Test View of Belt Anchorage for Passenger Dummy



Photo No. 060 - Post-Test View of Belt Anchorage for Passenger Dummy



Photo No. 061 - Pre-Test Passenger Dummy Feet

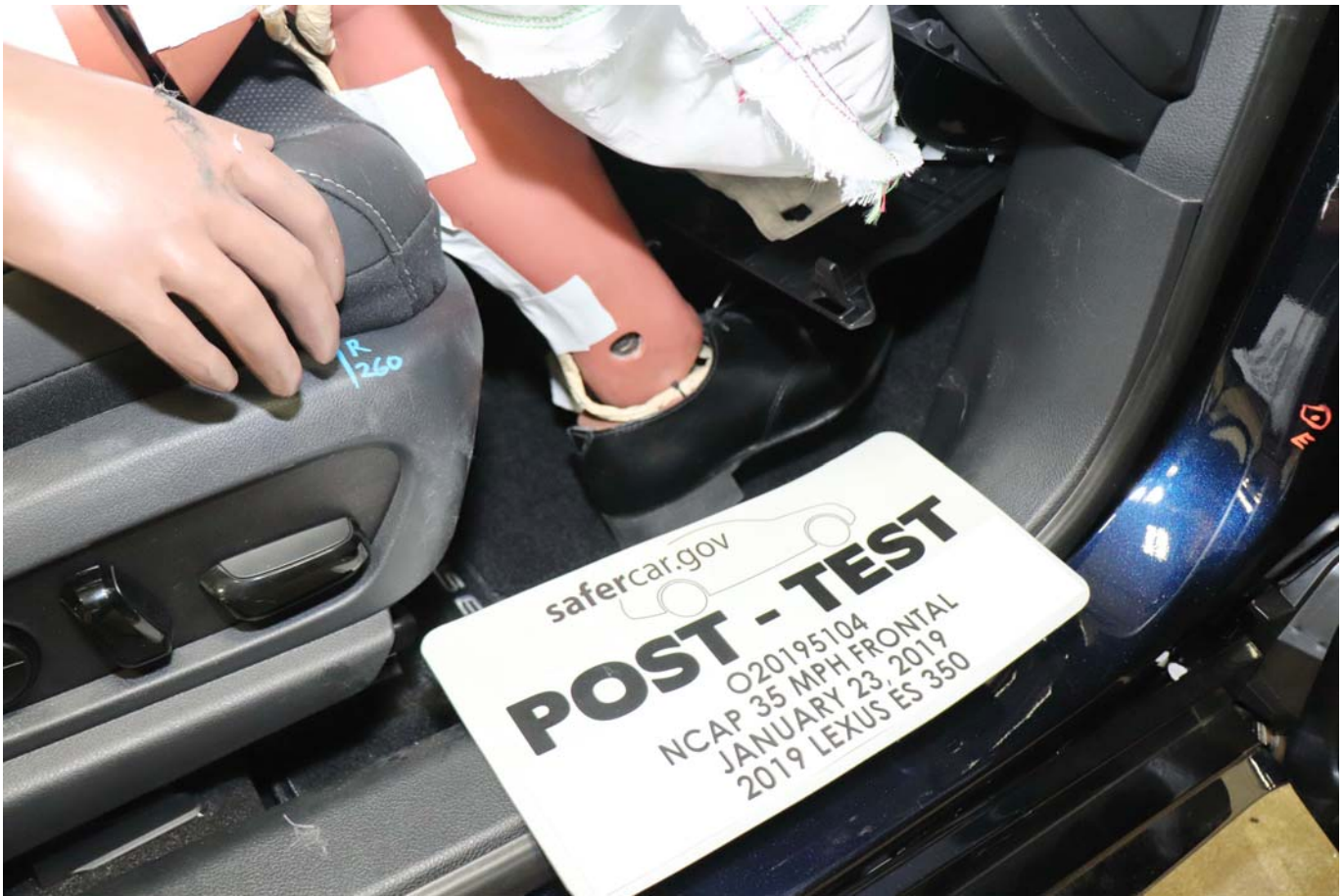


Photo No. 062 - Post-Test Passenger Dummy Feet



Photo No. 063 - Pre-Test Passenger Side Knee Bolster



Photo No. 064 - Post-Test Passenger Side Knee Bolster



Photo No. 065 - Pre-Test Passenger Side Floorpan

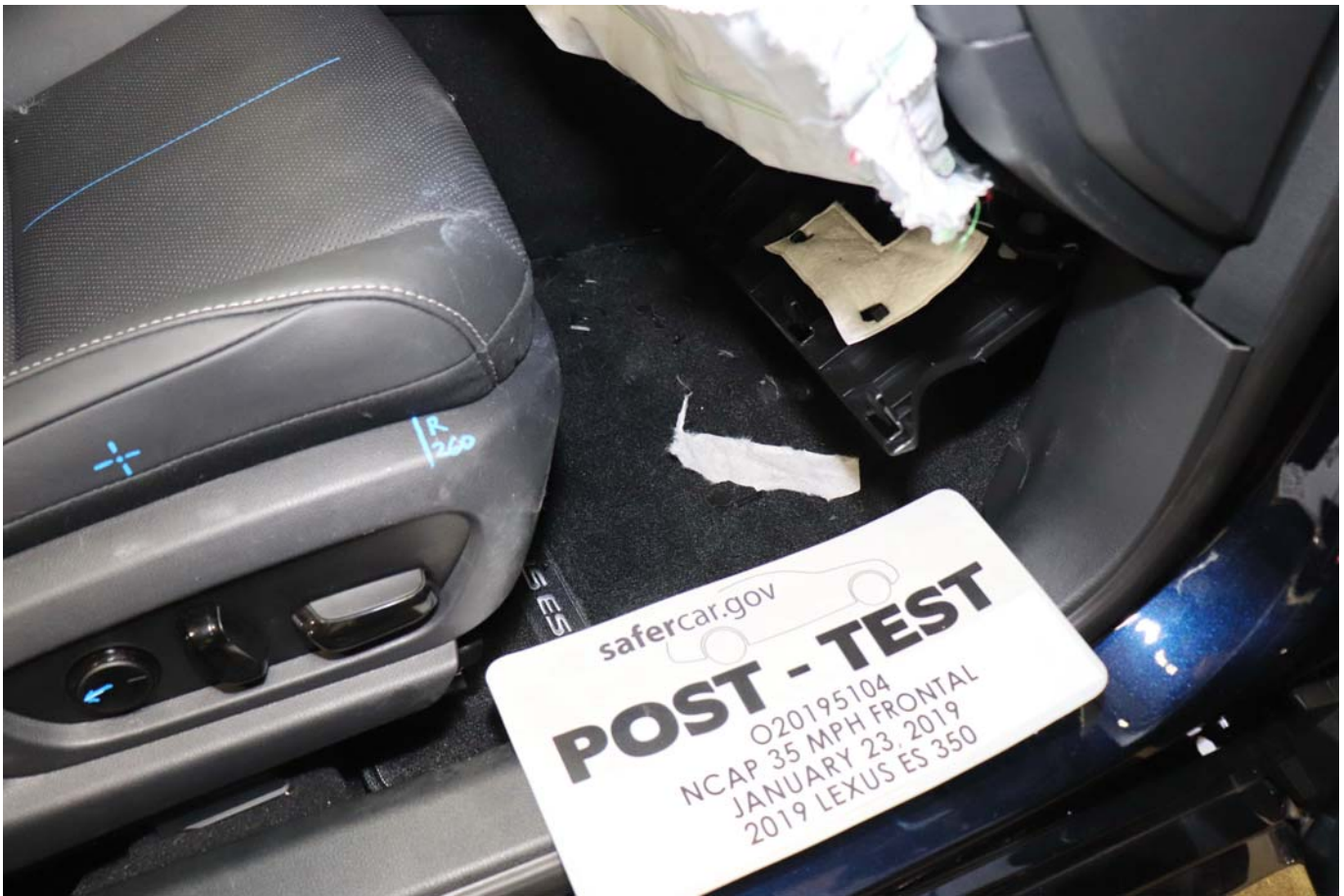


Photo No. 066 - Post-Test Passenger Side Floorpan



Photo No. 067 - Post-Test Passenger Dummy Face



Photo No. 068 - Post-Test Passenger Dummy Contact with Airbag



Photo No. 069 - Post-Test Passenger Dummy Contact with Headrest



Photo No. 070 - Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

Photo No. 071 - Post-Test Stoddard Solvent Spillage Location View



Photo No. 072 - Post-Test Speed Trap Read-Out



Photo No. 073 - Vehicle at 0 Degree on Static Rollover Device



Photo No. 074 - Vehicle at 90 Degrees on Static Rollover Device



Photo No. 075 - Vehicle at 180 Degrees on Static Rollover Device



Photo No. 076 - Vehicle at 270 Degrees on Static Rollover Device



Photo No. 077 - Vehicle at 360 Degrees on Static Rollover Device



Photo No. 078 - 2019 Lexus ES 350 4-Door Sedan Frontal Impact Event

LEXUS
EXPERIENCE AMAZING

DESCRIPTION 2019 / 9000C ES350 4-DR SEDAN

COLOR NIGHTFALL MICA
VIN 58ABZ1B14KU006782
FINAL ASSEMBLY POINT GEORGETOWN, KENTUCKY, U.S.A.

Delivered by Truck for
LEXUS OF BROOKFIELD
2001 WEST BLUEMOUND
BROOKFIELD WI53045

STANDARD FEATURES

- 3.5 Liter V8 - 24 Valve, Dual Overhead Cam (DOHC) with Variable Valve Timing Intelligent Wide (VVT-iW) Intake, (VVT-i) Exhaust
- 302 Horsepower, 267 lb-ft Torque
- Drive Mode Select (Eco, Normal, Sport)
- Steering Wheel Mounted Paddle Shifters
- 17" Split-5-Spoke Alloy Wheels
- Dual Fr Airbags, Dual Fr Knee Airbags, Fr & Rr Seat-Mounted Side Impact Airbags, Fr & Rr Side Curtain Airbags, Supplemental Restraint Sys (SRS)
- Theft-Deterrent System w/ Engine Immobilizer
- Vehicle Stability Control (VSC) with TRAC
- Anti-Lock Braking System (ABS) with Electronic Brakeforce Distribution (EBD), Brake Assist (BA), and Smart Stop Technology (TM)
- Lexus Safety System+ 2.0, Pre-Collision System (PCS) with Pedestrian Detection, All Speed-Dynamic Radar Cruise Control, Lane Tracing Assist, Lane Departure Alert w/ Steering Assist & Intelligent High Beam Headlamps, Road Sign Assist (RSA)
- Auto On/Off LED Low and High Beam Headlamps with Daytime Running Lights (DRL)

STANDARD EQUIPMENT & INSTALLED OPTIONS

- 10-Way Driver's & Front Passenger's Power Seats (Including 2-Way Lumbar)
- SmartAccess with Push-Button Start/Stop
- Electrochromic Heated Outside Mirrors
- Dual-Zone Automatic Climate Control
- One-Touch Open/Close Pwr Tilt-and-Slide Moonroof
- Lexus Multimedia System with 8.0 in Color Display, Apple CarPlay Compatibility, 10-Speaker Lexus Premium Sound System, Voice Command, Siri Eyes Free, Google Voice Ctrl.
- Lexus Enform Safety Connect & Service Connect (Complimentary for the first 10-yr of Ownership)
- Lexus Enform Wi-Fi, 4GB (1-Year Trial Included)
- Lexus Enform Remote (1-Year Trial Included)
- with Smart Watch & Alexa Skill Integration
- Lexus Enform App Suite 2.0 (Complimentary)
- w/Amazon Alexa Compatibility, Scout GPS Link TurnStream & MapStream Compatible (3-Year Trial)
- SiriusXM Satellite Radio (3-Mo. All Access Trial)
- Carpet Floor Mats

MANUFACTURER'S SUGGESTED RETAIL PRICE \$39,600.00

- ** Blind Spot Monitor w/Rear Cross Traffic Alert and Intuitive Parking Assist w/Auto Braking
- ** Wireless Charger 75.00
- ** 18-in Split 10-Spoke Alloy Wheels
- ** Navigation/Mark Levinson Audio Package: Navigation System with 12.3-in Color Multimedia Display, Lexus Enform, Dynamic Navigation (Complimentary For The First 3-Years of Ownership) Dynamic Voice Command, Lexus Enform Destination Assist (Complimentary for the 1-Year of Ownership) Electrochromic (Auto-Dimming) Rearview Mirror with Homelink, Mark Levinson PurePlay 17-speaker, 1800 Watt Premium Surround Sound Audio System
- ** Hands-Free Power Open/Close Trunk 550.00
- ** Premium Package: Lexus Memory System for Driver's Seat, Outside Mirrors and Steering Wheel, Power Tilt and Telescopic Steering Wheel, Rain Sensing Wipers, Heated and Ventilated Seats
- ** Heated Wood & Leather Trimmed Steering Wheel with Windshield Wiper Deicer and Fast Response Interior Heater 480.00
- ** Wood Trim with Ambient Lighting 540.00
- ** All Weather Floor Liners with Trunk Tray 248.00
- ** Lexus Universal Tablet Holder 199.00
- ** Trunk Mat, Cargo Net, Wheel Locks, Key Gloves 265.00

EPA DOT Fuel Economy and Environment

Fuel Economy

26 MPG
combined city/hwy

22 city 33 highway

3.8 gallons per 100 miles

Annual fuel Cost \$1,450

Fuel Economy & Greenhouse Gas Rating (tailpipe only)

5 (Best)

Smog Rating (tailpipe only)

5 (Best)

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 27 MPG and costs \$7,800 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$2.55 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fuel economy.gov
Calculate personalized estimates and compare vehicles

GOVERNMENT 5-STAR SAFETY RATINGS

This vehicle has not been rated by the government for overall vehicle score, frontal crash, side crash or rollover risk.

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.
Source: National Highway Traffic Safety Administration (NHTSA)
www.safercar.gov or 1-888-327-4236

DELIVERY, PROCESSING AND HANDLING FEE \$1,025.00

TOTAL \$48,892.00

APPLICABLE FEDERAL TAXES NOT INCLUDED

Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. License and title fees, state, local and applicable federal taxes, and dealer-installed options and accessories are not included in the manufacturer's suggested retail price.

LEXUS NEW VEHICLE LIMITED WARRANTY
Limited warranty coverage highlights include:
• 4-yr / 50,000-mile basic coverage
• 8-yr / 100,000-mile powertrain coverage
• 6-yr / unlimited-mile corrosion/perforation warranty

See your Warranty and Services Guide for details.

LEXUS IS PLEASED TO OFFER THE FOLLOWING OWNER SUPPORT PACKAGE WITH EACH NEW LEXUS
• 24-hour, 24/7 roadside assistance plan
• Complimentary 1st and 2nd scheduled maintenance services
• Lodging for emergency breakdown 100 miles from home

An extended service contract may be available for this vehicle. Ask dealer for details.

SUB-TOTAL \$47,867.00

DELIVERY, PROCESSING AND HANDLING FEE \$1,025.00

TOTAL \$48,892.00

181001 740

Photo No. 079 - Monroney Label Photograph

APPENDIX B
DUMMY RESPONSE DATA TRACES

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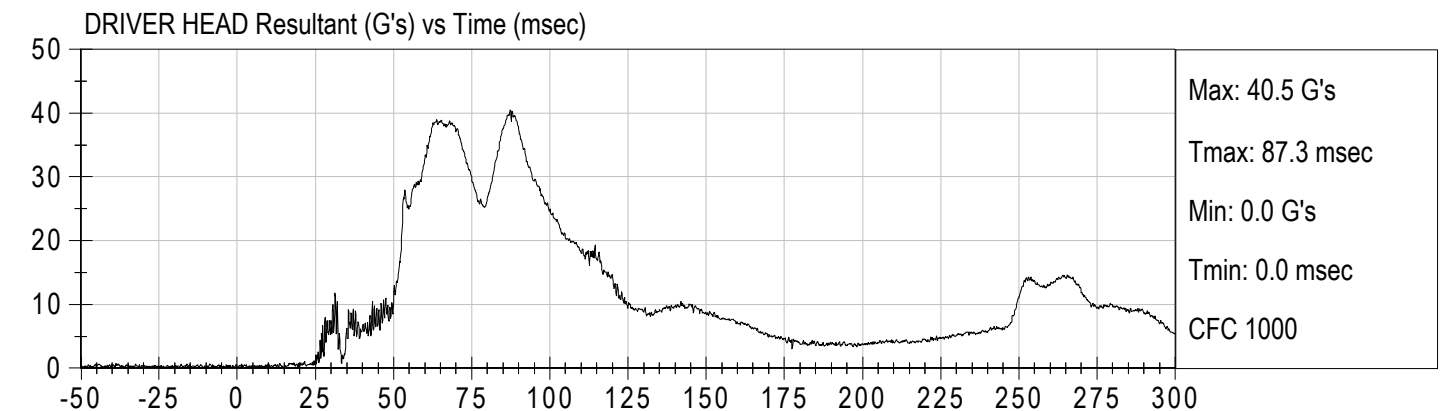
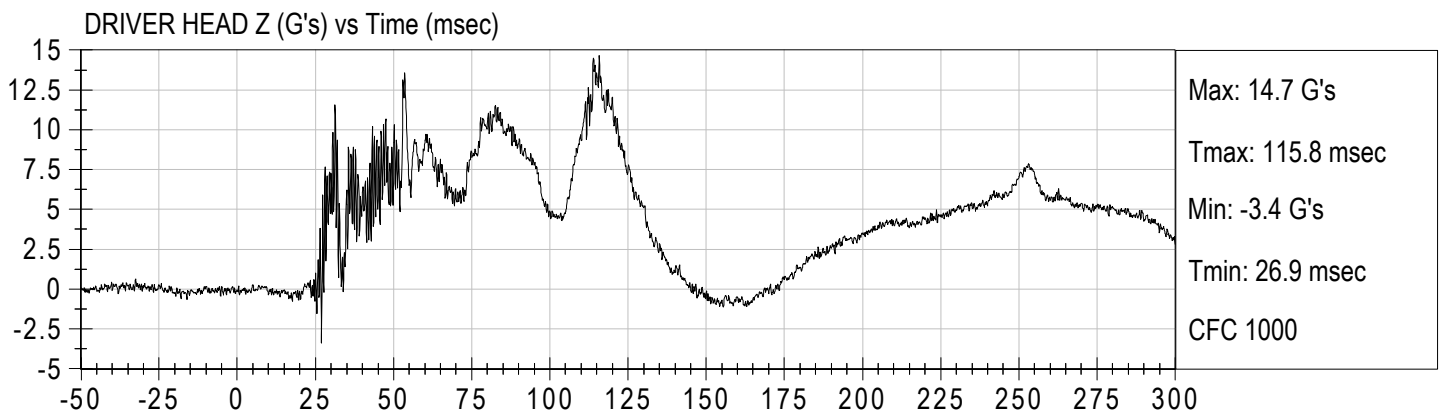
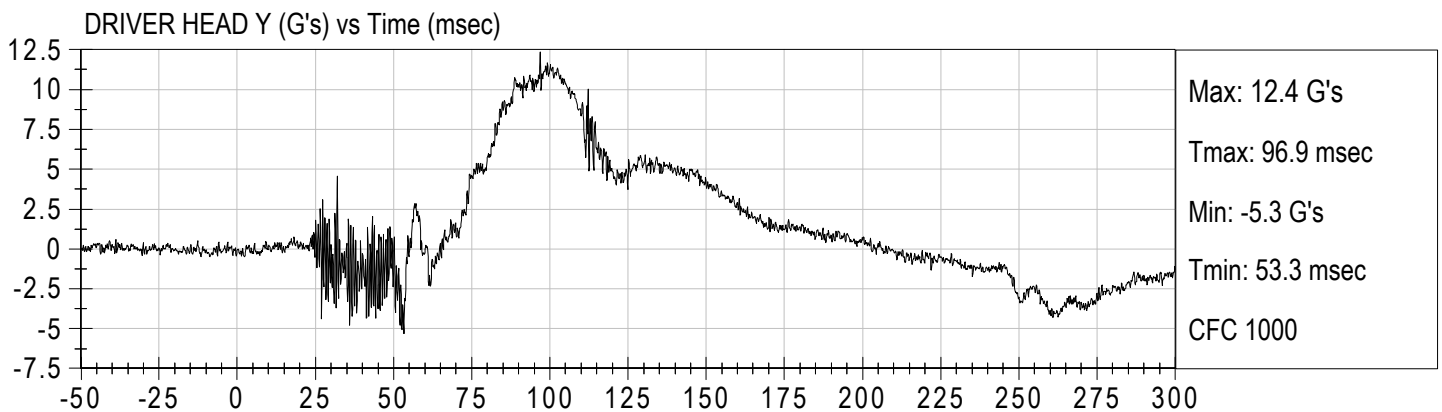
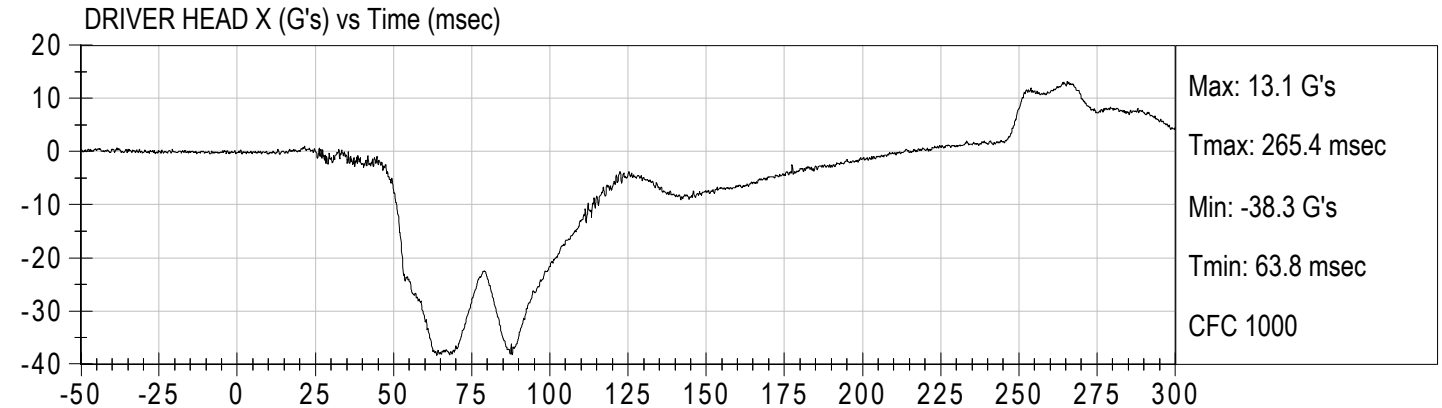
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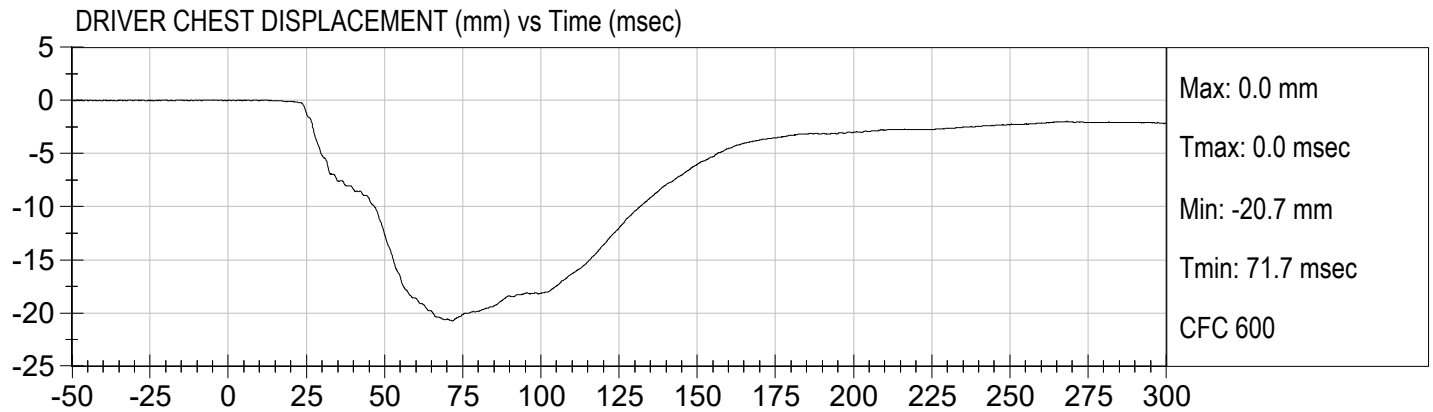
The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

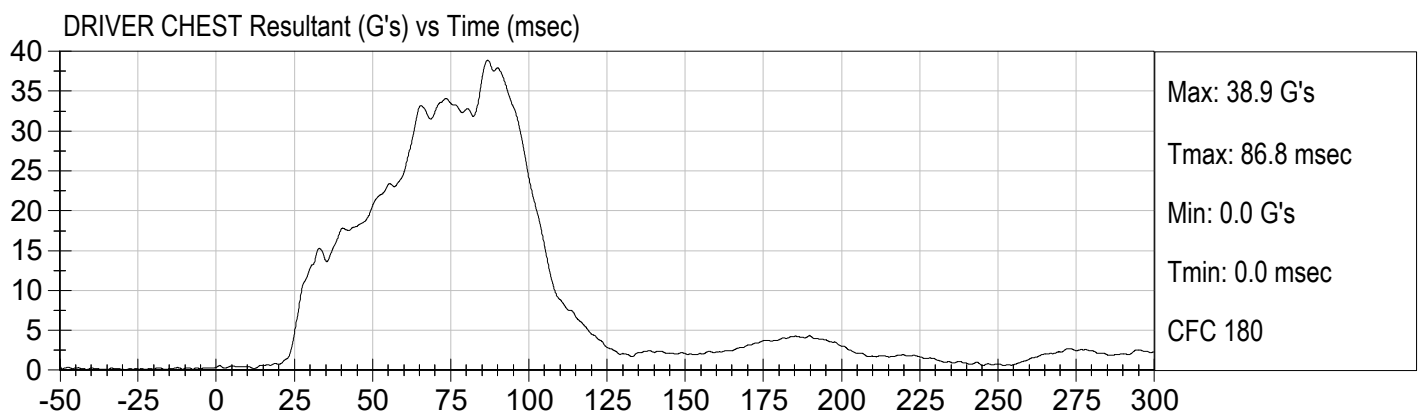
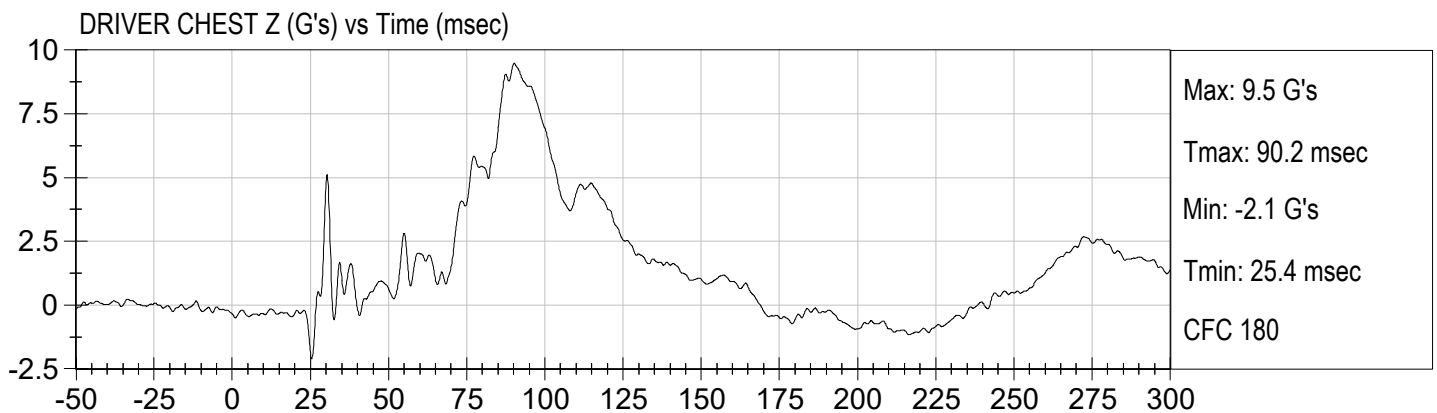
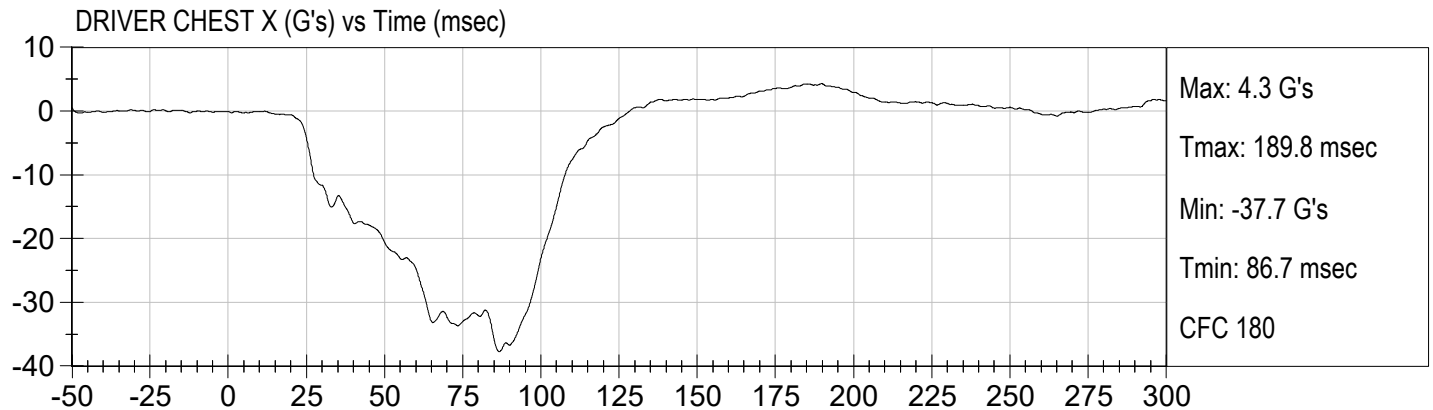
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 Driver Head Z Redundant
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 Driver Head Angular Velocity Y
 Driver Head Angular Velocity Z
 Driver Upper Neck Force Y
 Driver Upper Neck Moment X
 Driver Upper Neck Moment Z
 Driver Chest X Redundant
 Driver Chest Y Redundant
 Driver Chest Z Redundant
 Driver Pelvis X
 Driver Pelvis Y
 Driver Pelvis Z
 Driver Left Femur Redundant
 Driver Right Femur Redundant
 Driver Left Upper Tibia Moment X
 Driver Left Upper Tibia Moment Y

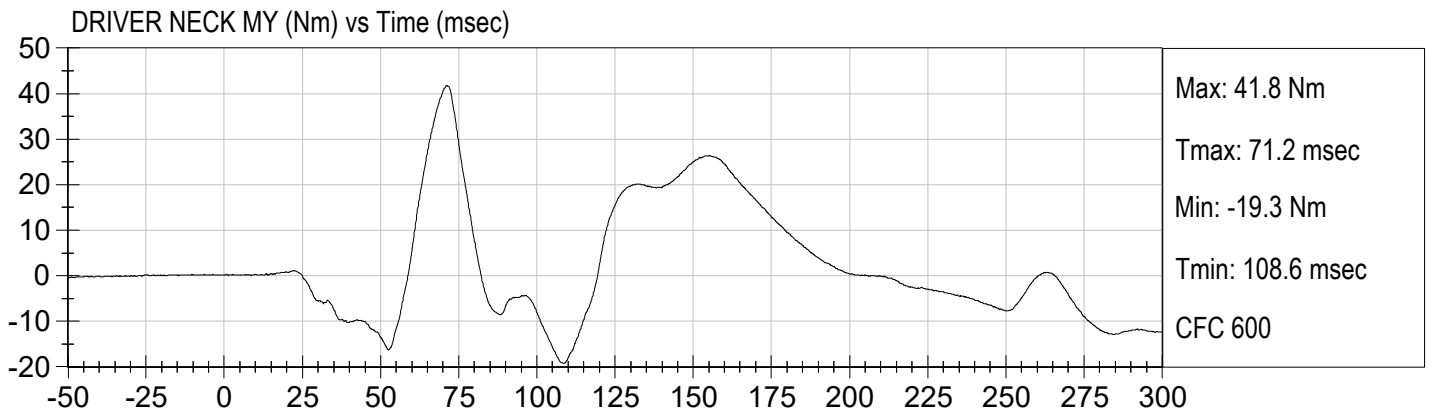
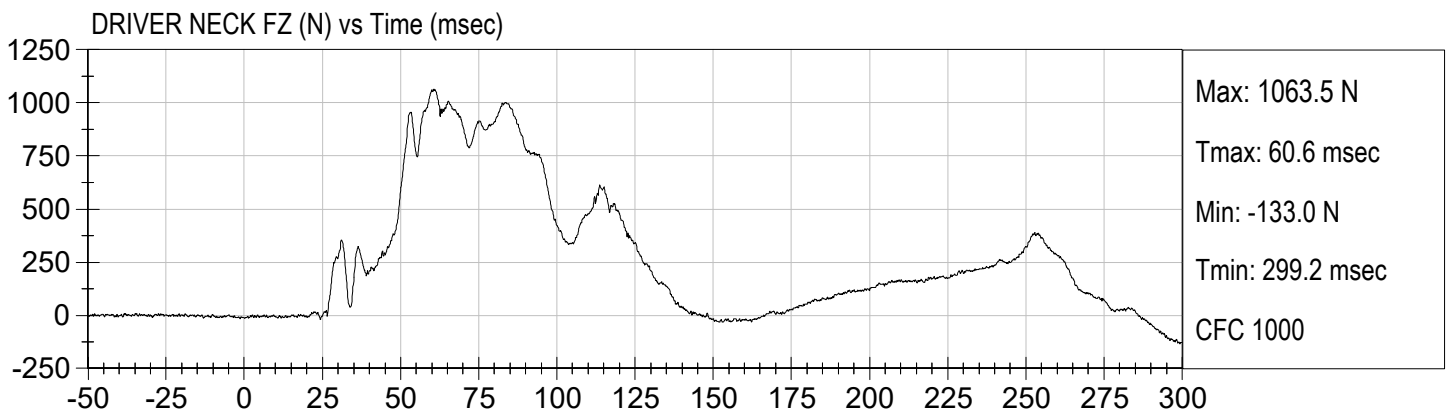
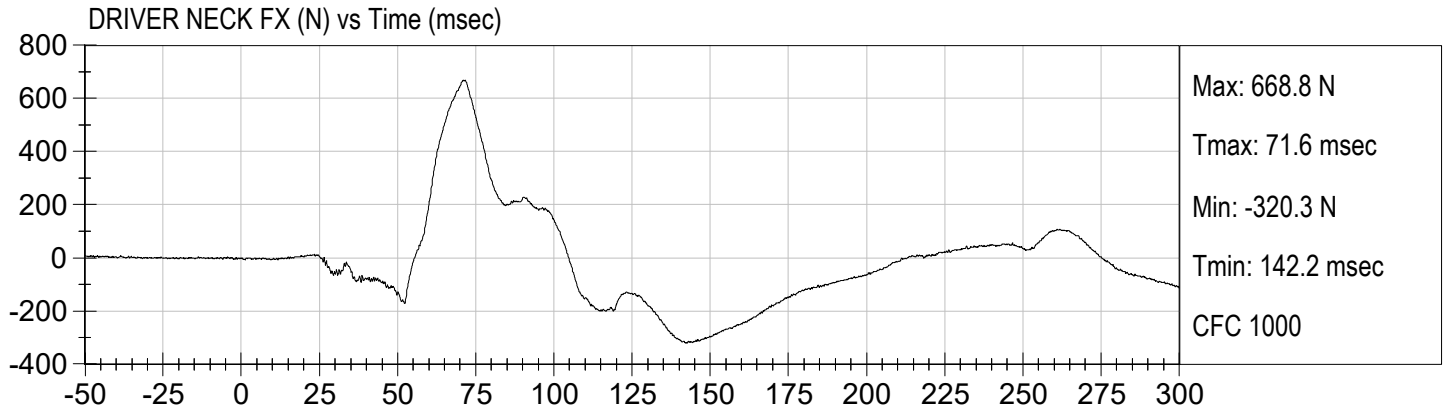
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Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Right Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z
Driver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

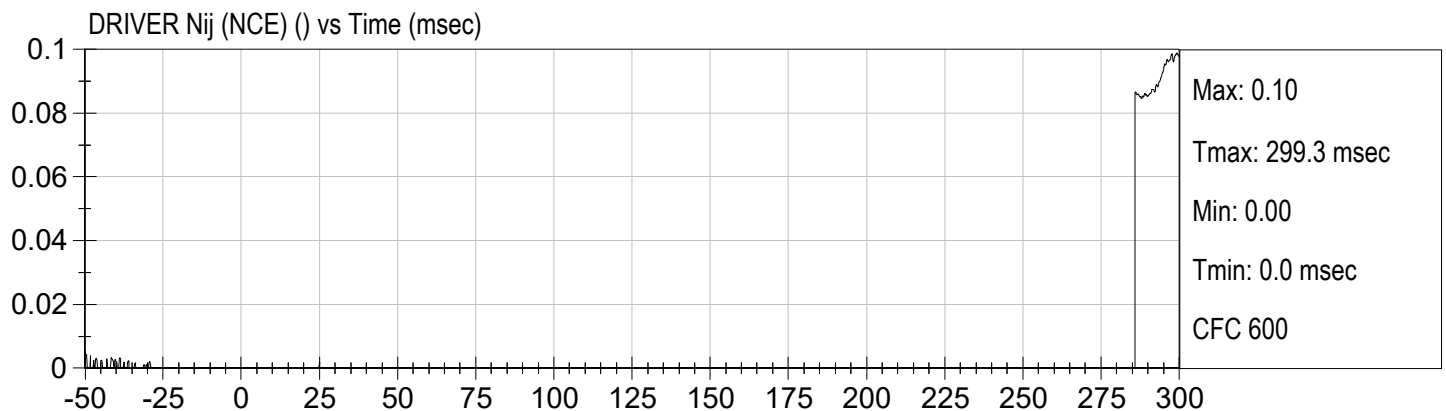
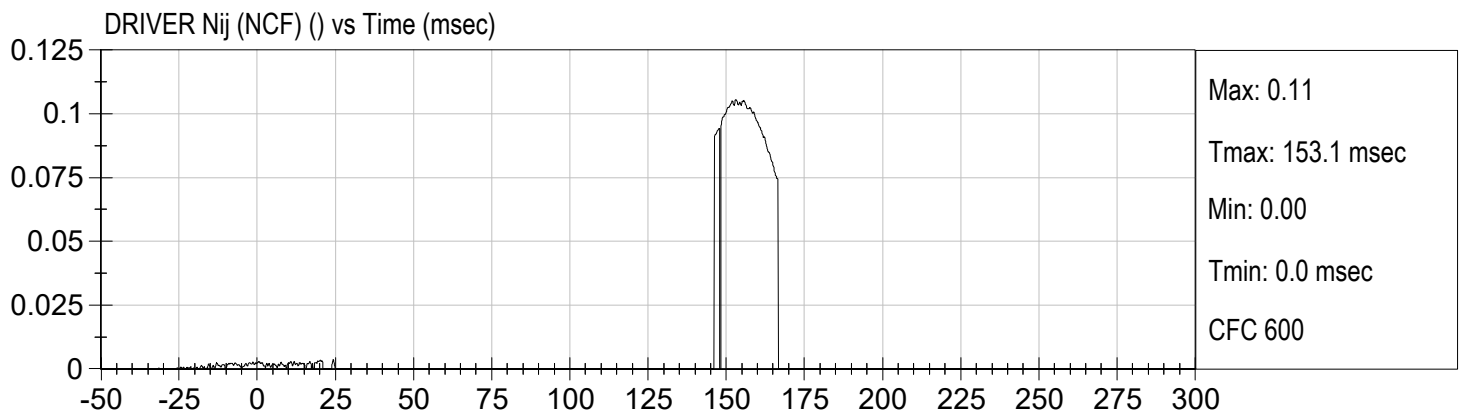
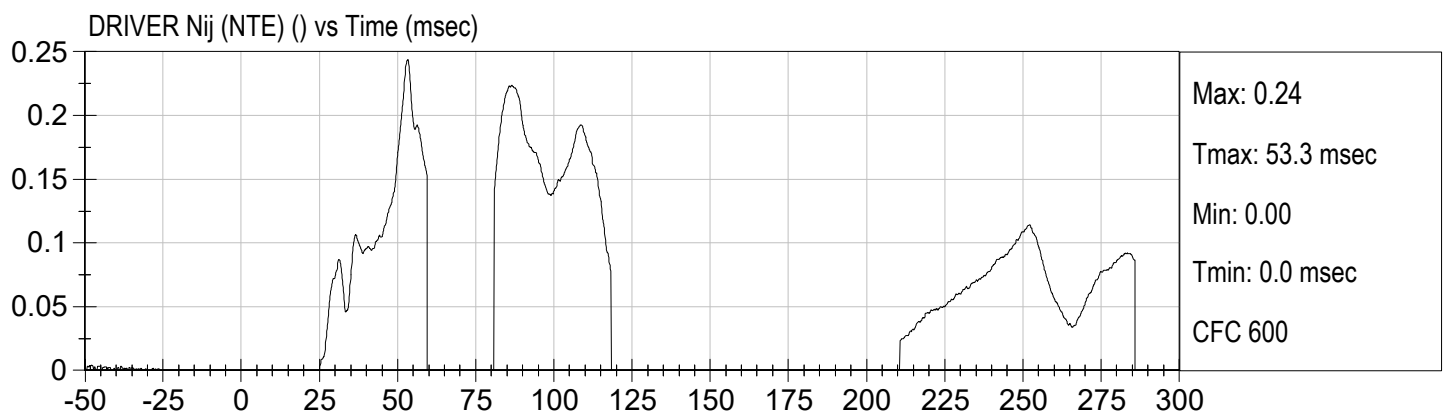
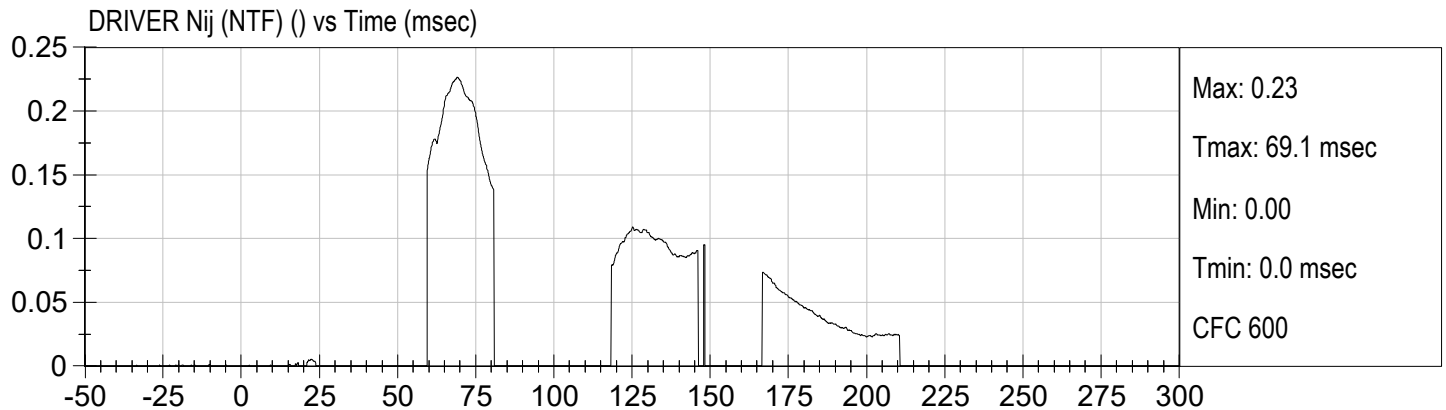
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Passenger Left Upper Tibia Moment Y
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Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right 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 Lap Belt Force
Passenger Shoulder Belt Force
Left Rear Seat Crossmember X
Right Rear Seat Crossmember X
Vehicle Engine Top X
Vehicle Engine Bottom X
Left Rear Seat Crossmember Z
Right Rear Seat Crossmember Z
Left Rear Seat Crossmember Xr
Right Rear Seat Crossmember Xr
Advanced Research Load Cell Barrier – 528 channels

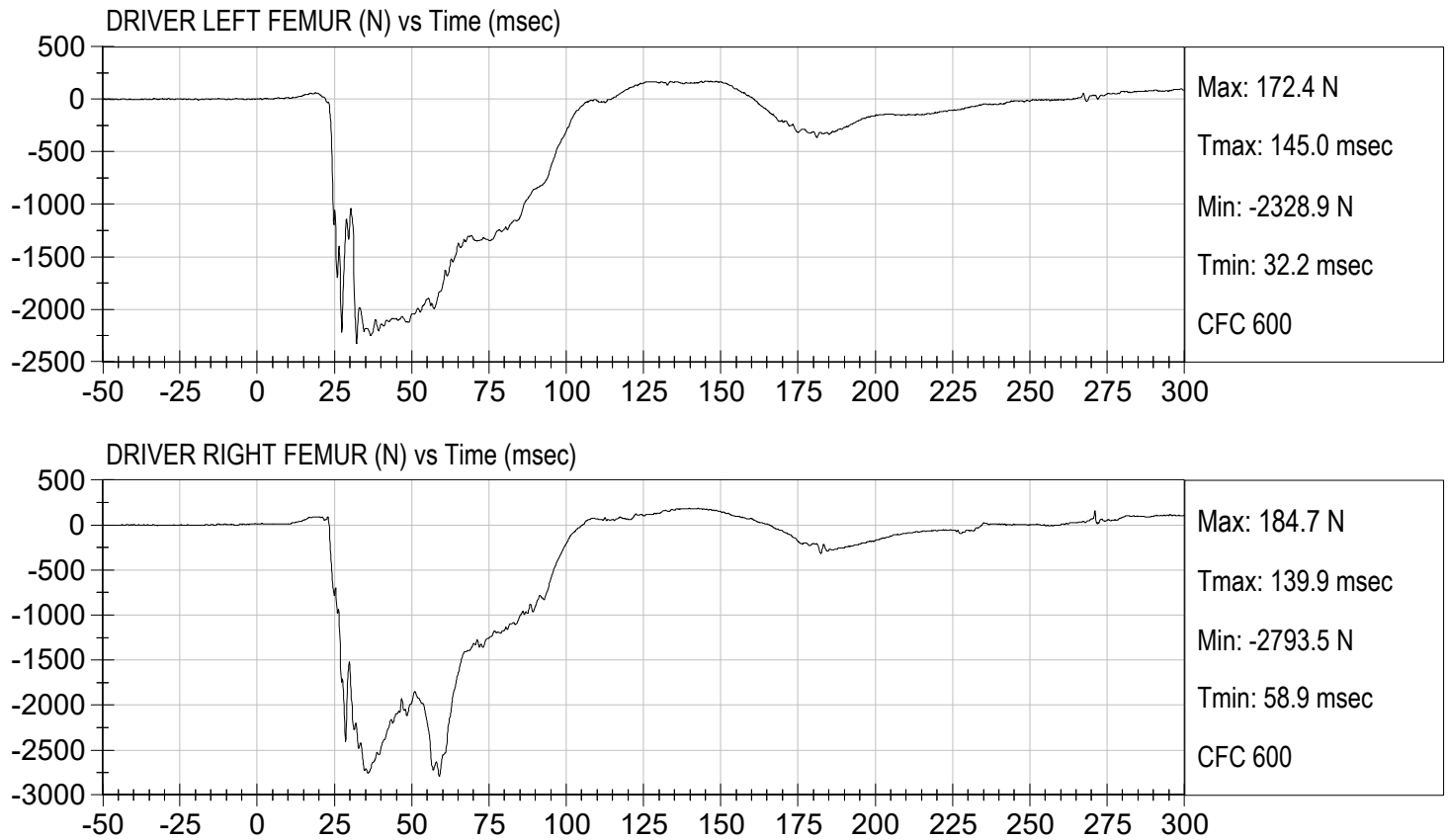


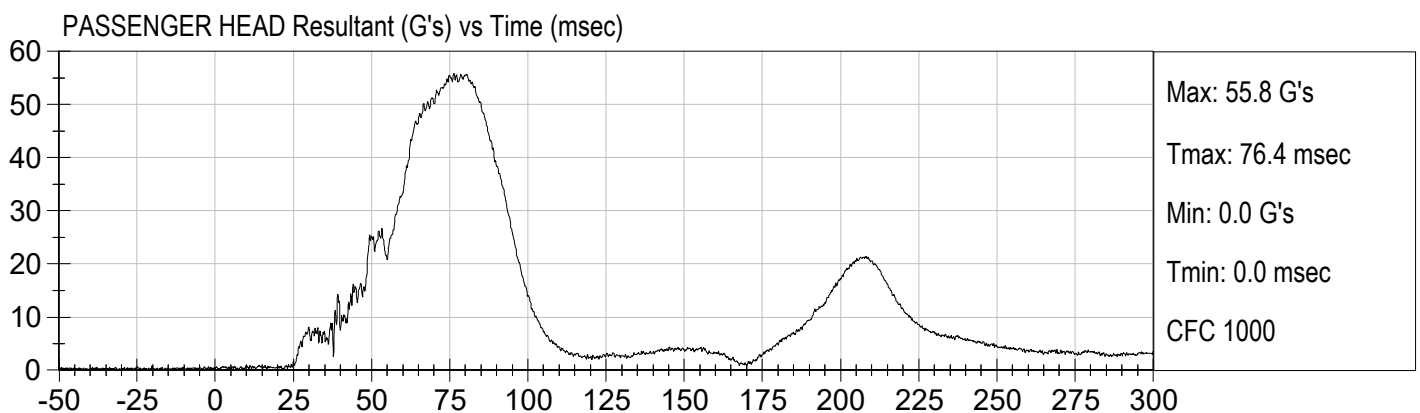
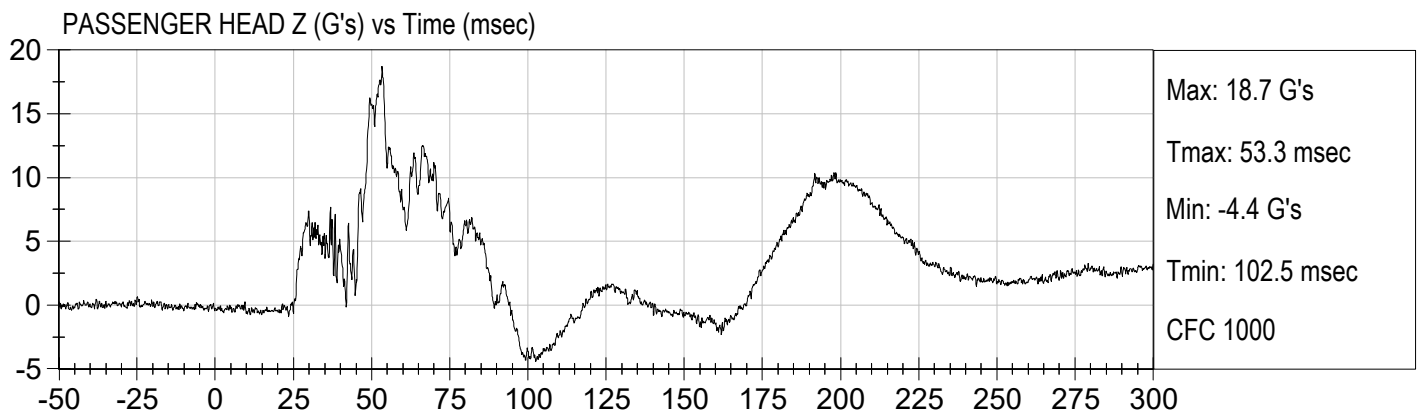
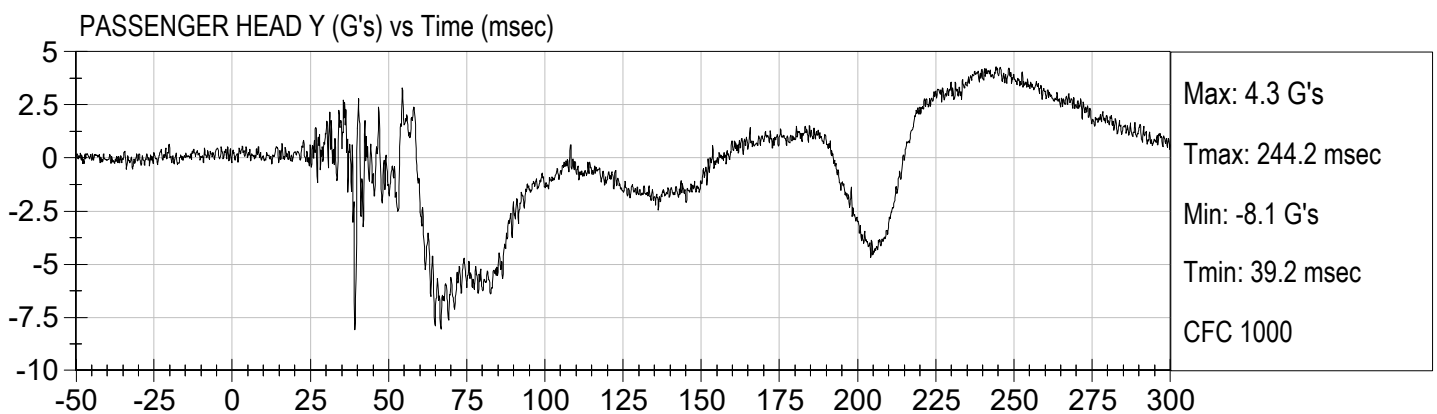
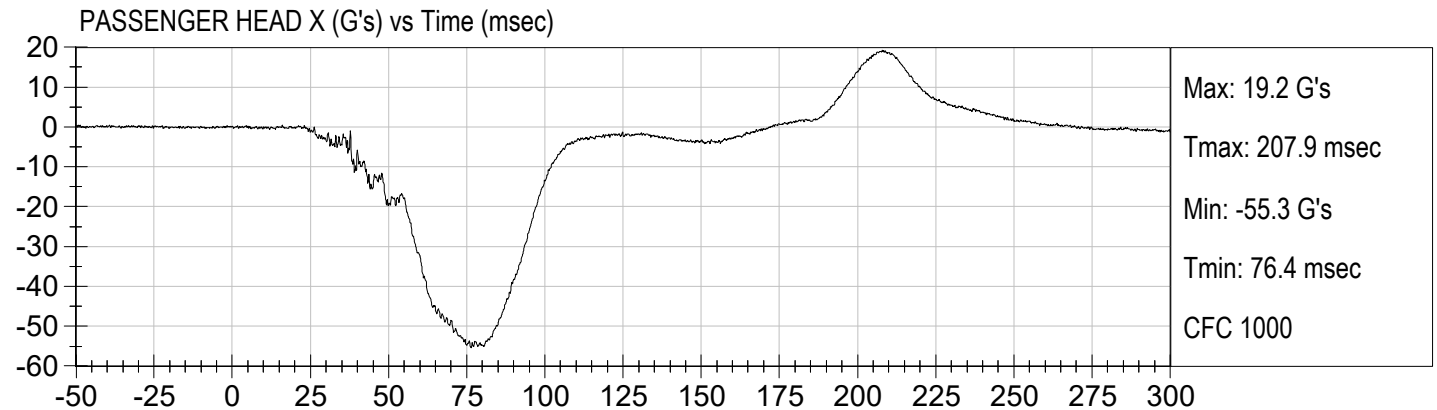


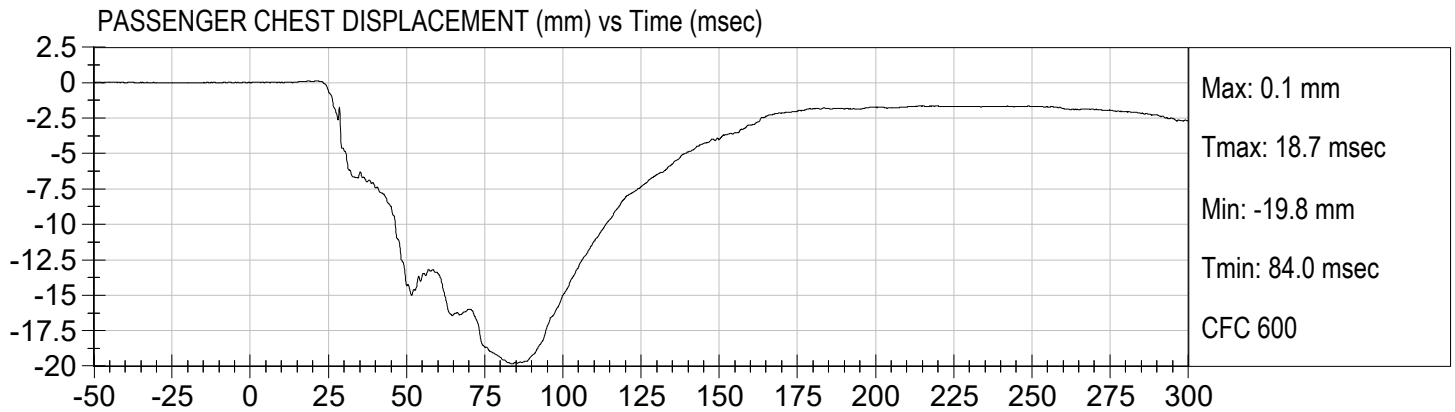


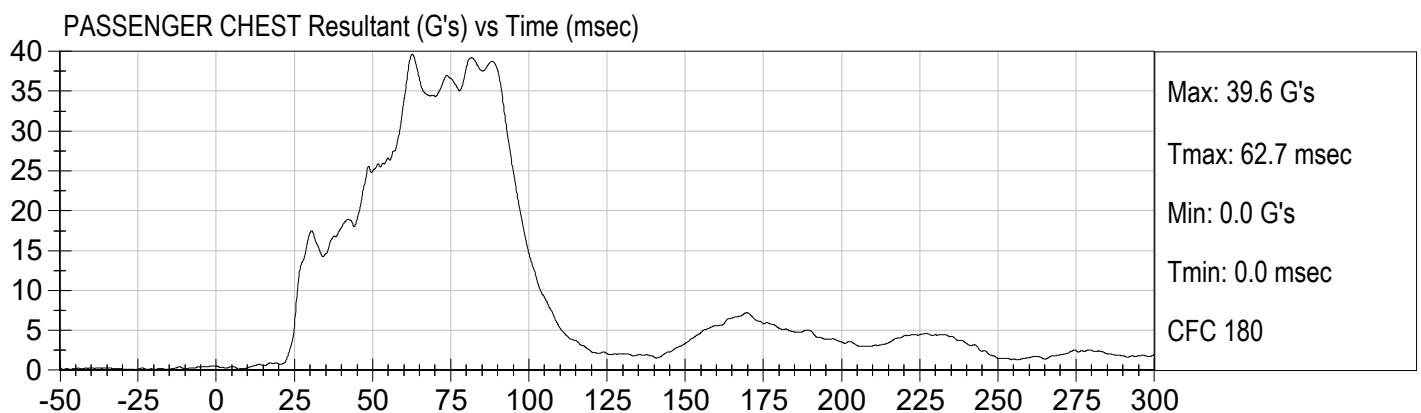
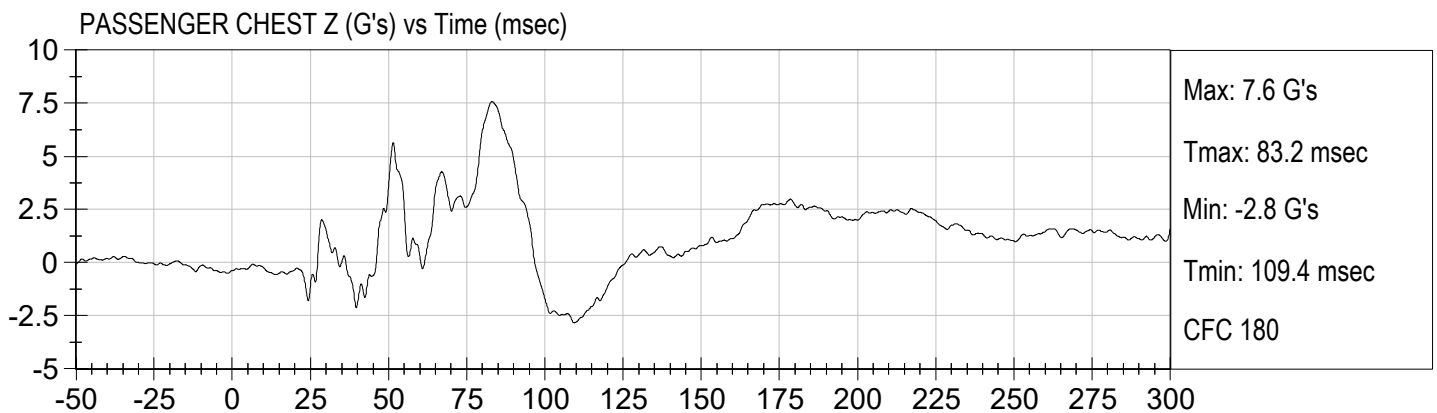
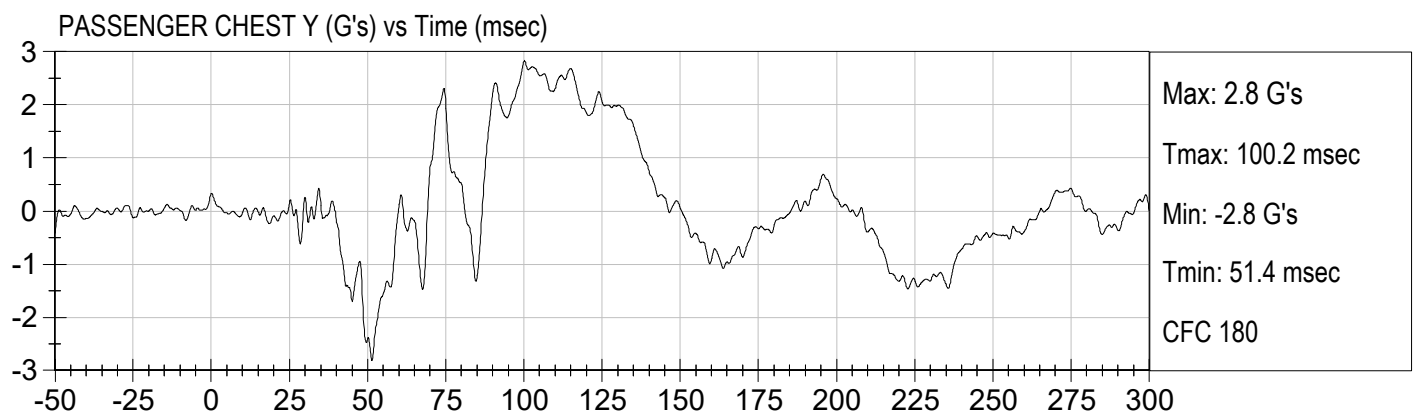
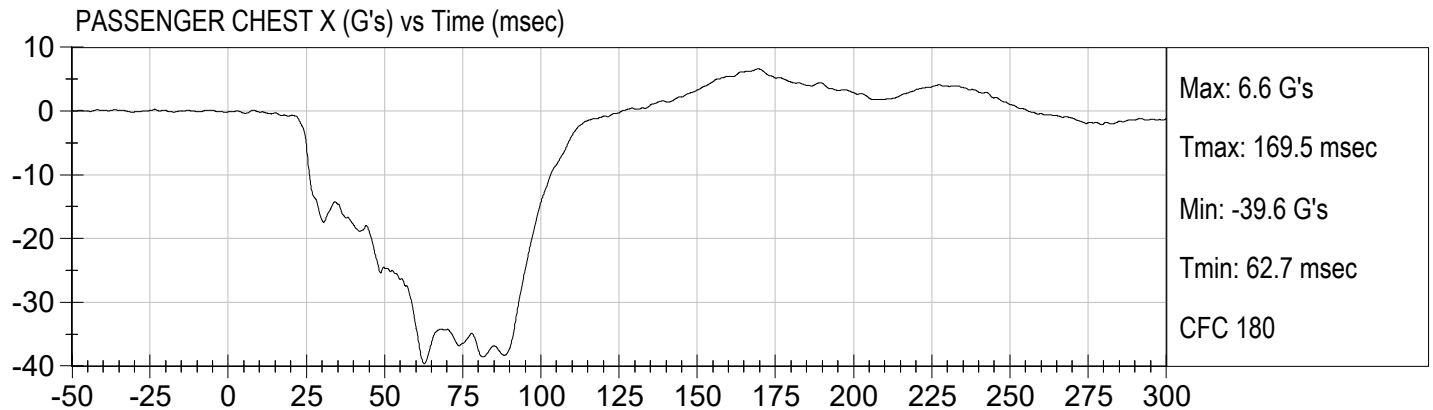


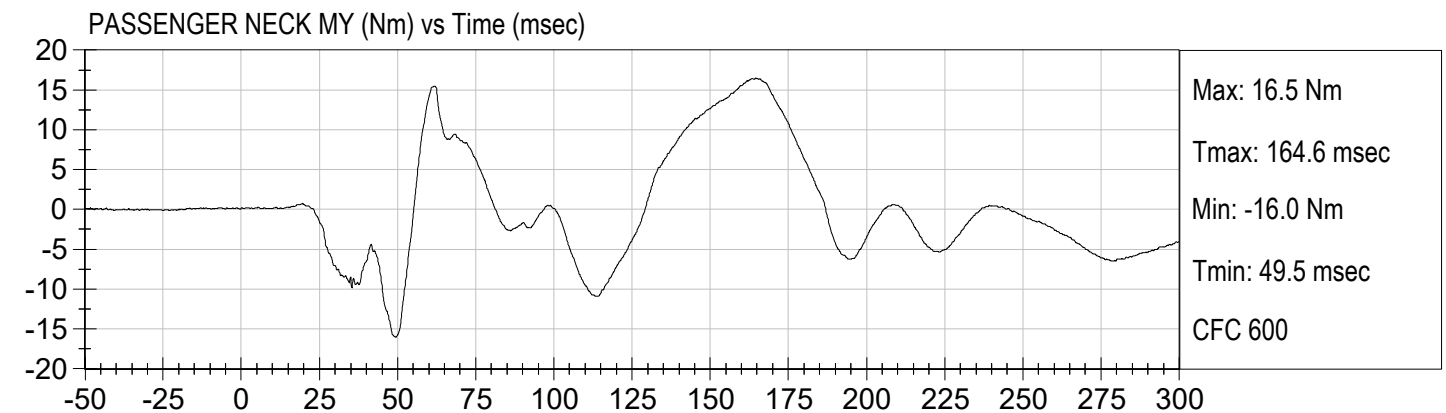
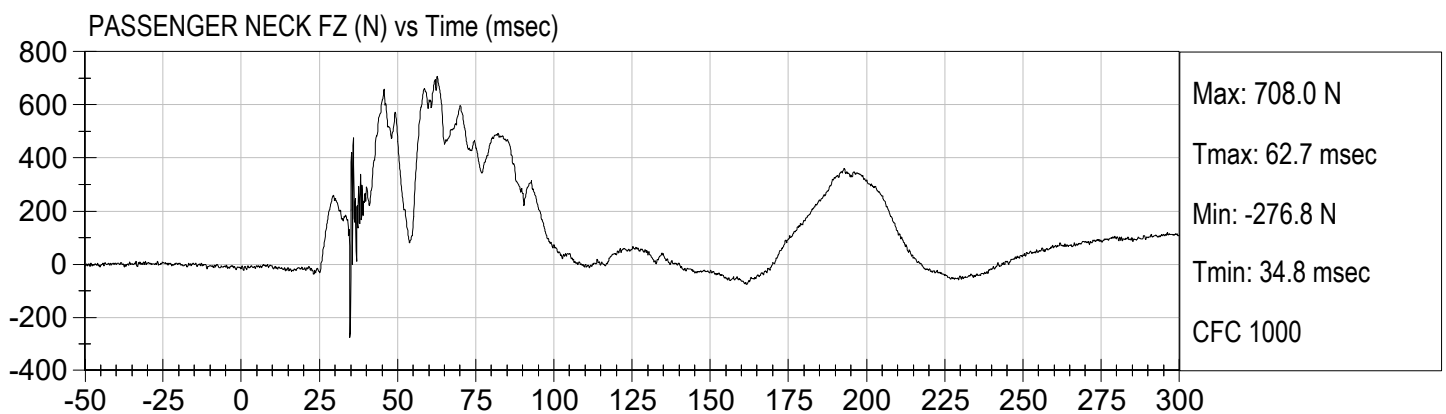
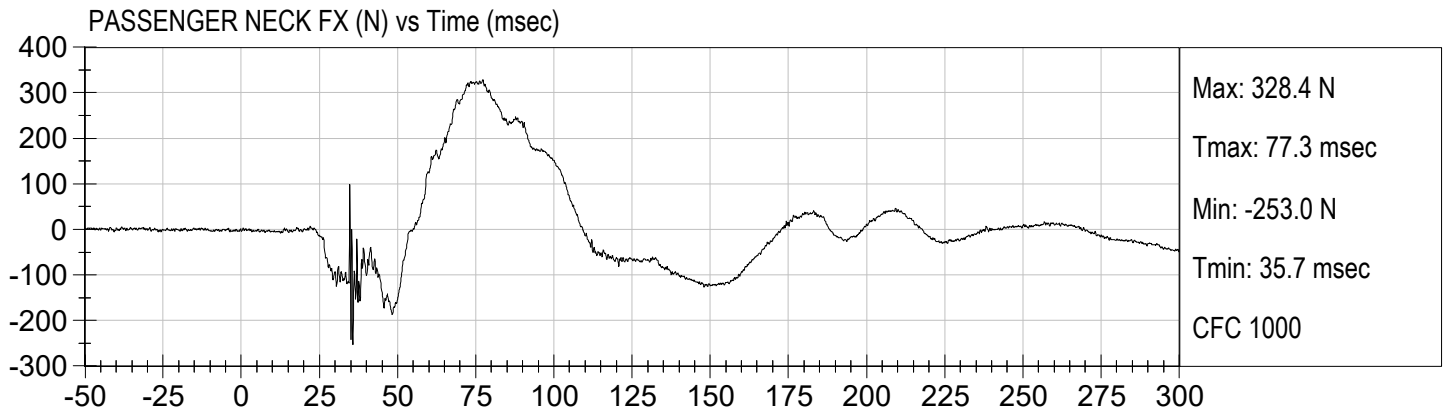


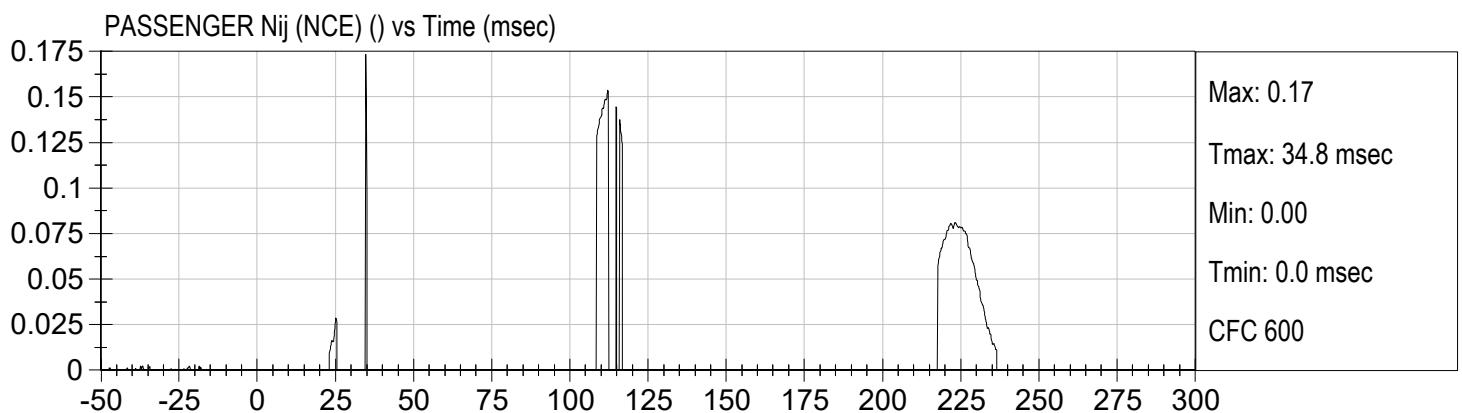
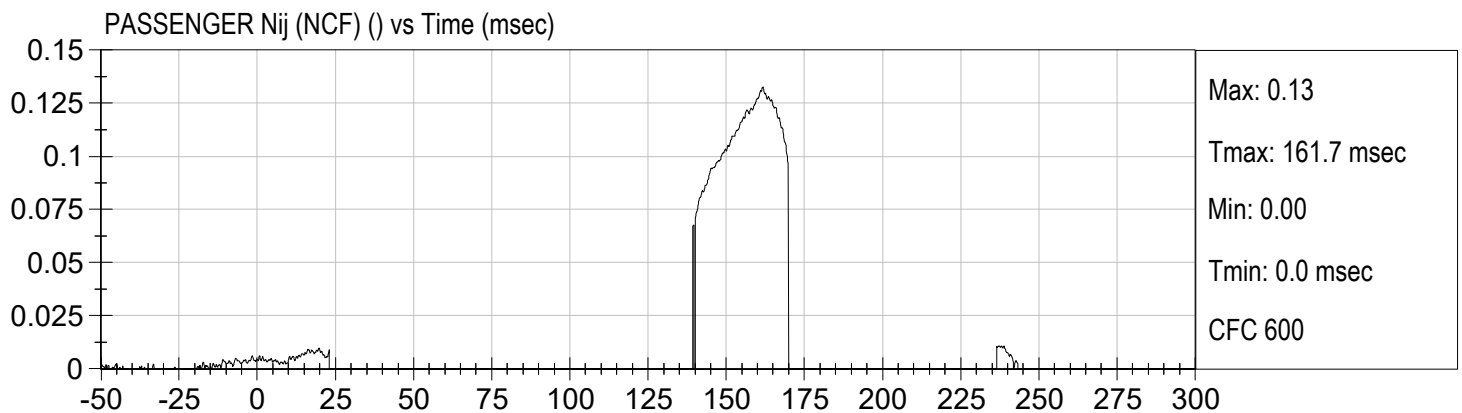
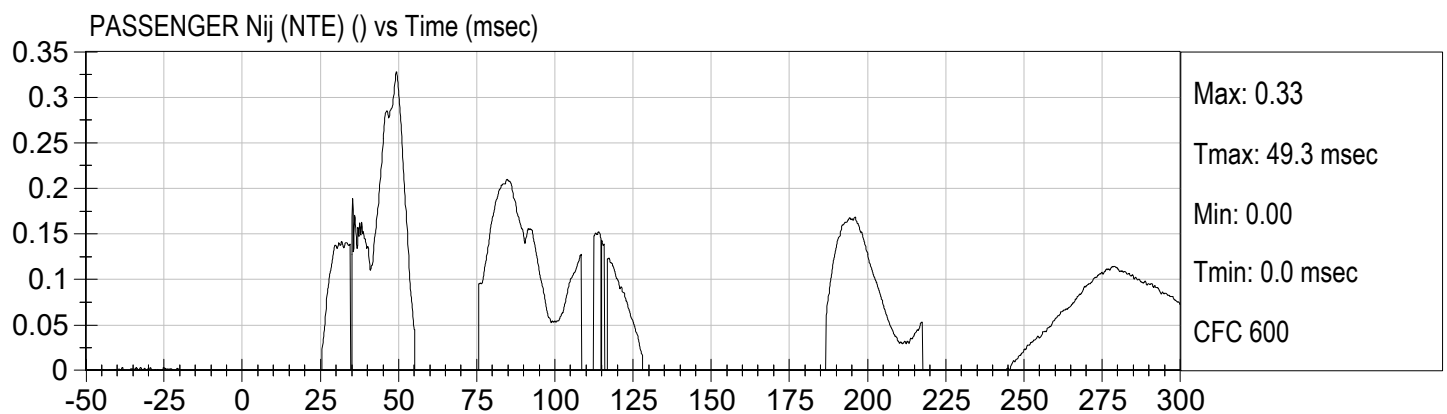
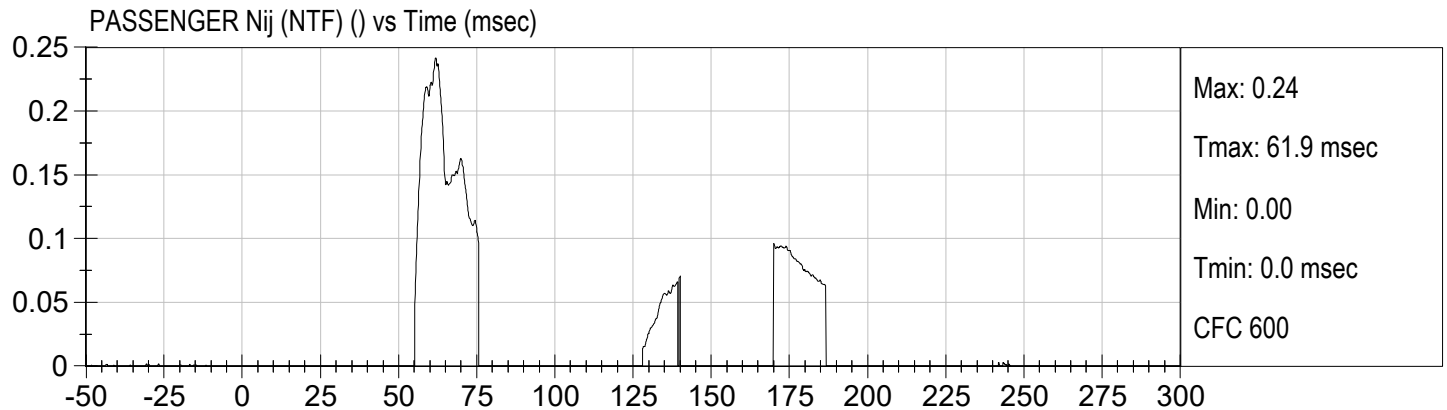


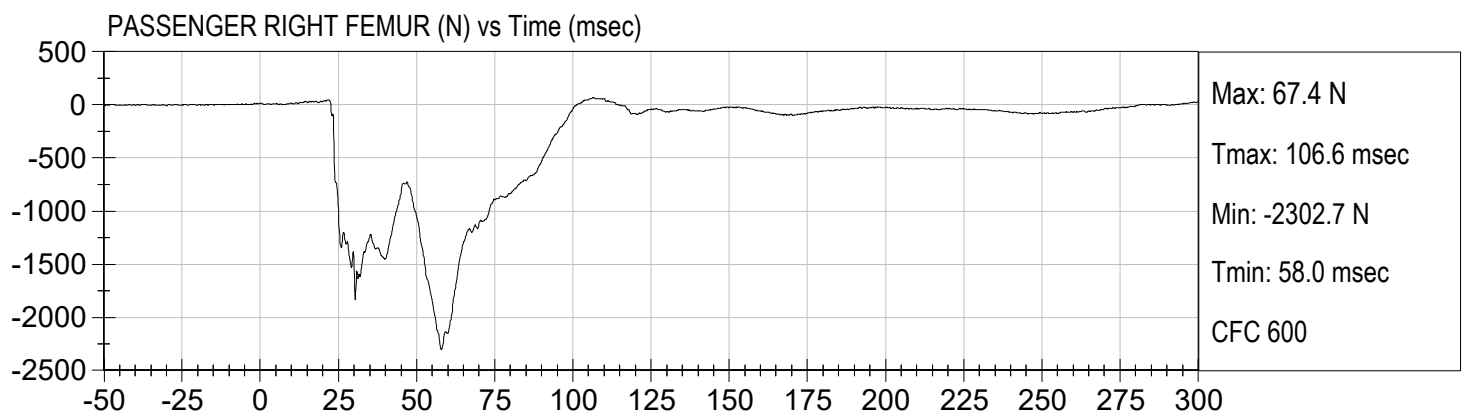
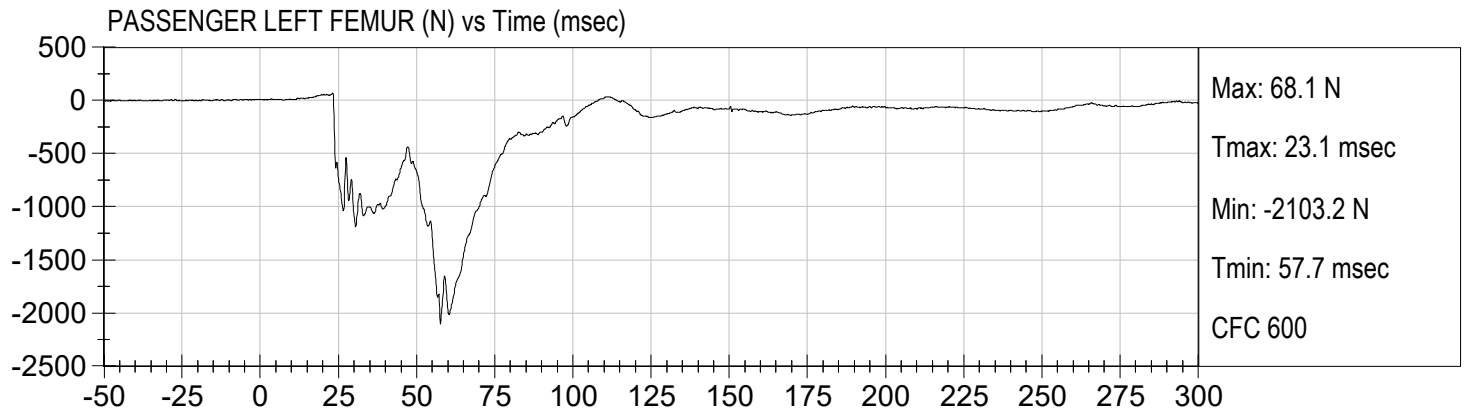












APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

**Hybrid III, 50th External Measurements
SN: 351**

HYBRID III, PART 572, SUBPART E EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (inches)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	34.6–35.0	34.8
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	19.9-20.5	20.0
C	H-POINT HEIGHT	Reference	3.3-3.5	3.4
D	H-POINT LOCATION FROM BACKLINE	Reference	5.3-5.5	5.5
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	3.3-3.7	3.5
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	5.5-6.1	6.0
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	11.4-12.0	11.8
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	1.6-1.8	1.7
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	13.0-13.6	13.3
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	7.5-8.3	7.8
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	22.8-23.8	23.8
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	16.9-17.9	17.0
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	19.1-19.7	19.5
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	17.8-18.8	18.8

HYBRID III, SUBPART E EXTERIOR DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS		ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 16.9-17.1 in. above seat surface	8.4-9.0	8.5
P	FOOT LENGTH	Tip of toe to rear of heel	9.9-10.5	10.3
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	16.3-17.2	16.5
W	FOOT BREADTH	The widest part of the foot	3.6-4.2	4.0
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 16.9-17.1 in. above seat surface	38.2-39.4	39.2
Z	WAIST CIRCUMFERENCE	Measured 8.9-9.1 in. above seat surface	32.9-34.1	33.7
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	16.9-17.1	17.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	8.9-9.1	9.0

NOTE: THE H-POINT IS LOCATED 1.83 INCHES FORWARD AND 2.57 INCHES DOWN FROM THE CENTER OF THE PELVIS ANGLE REFERENCE HOLE.

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

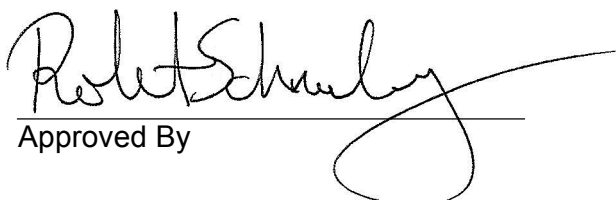
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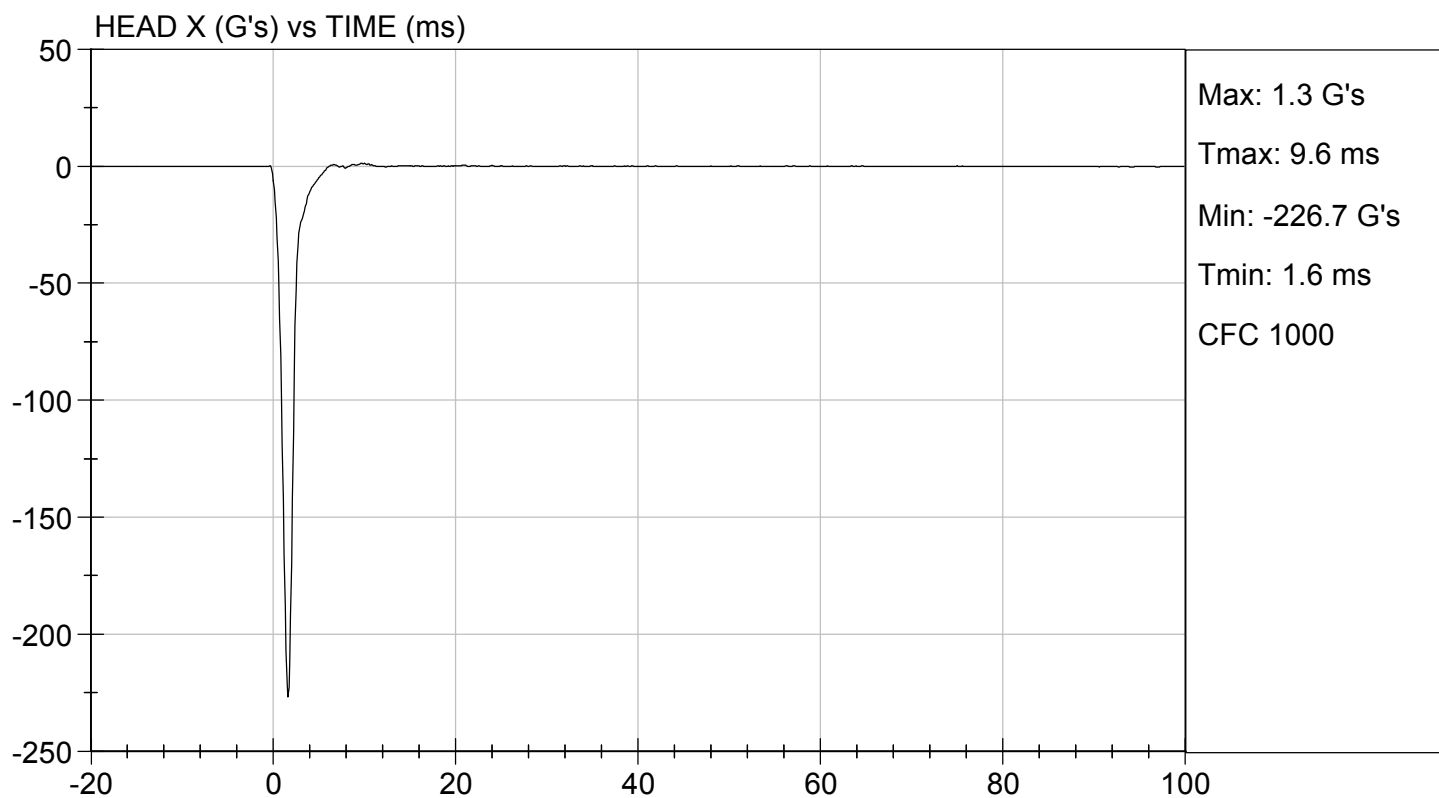
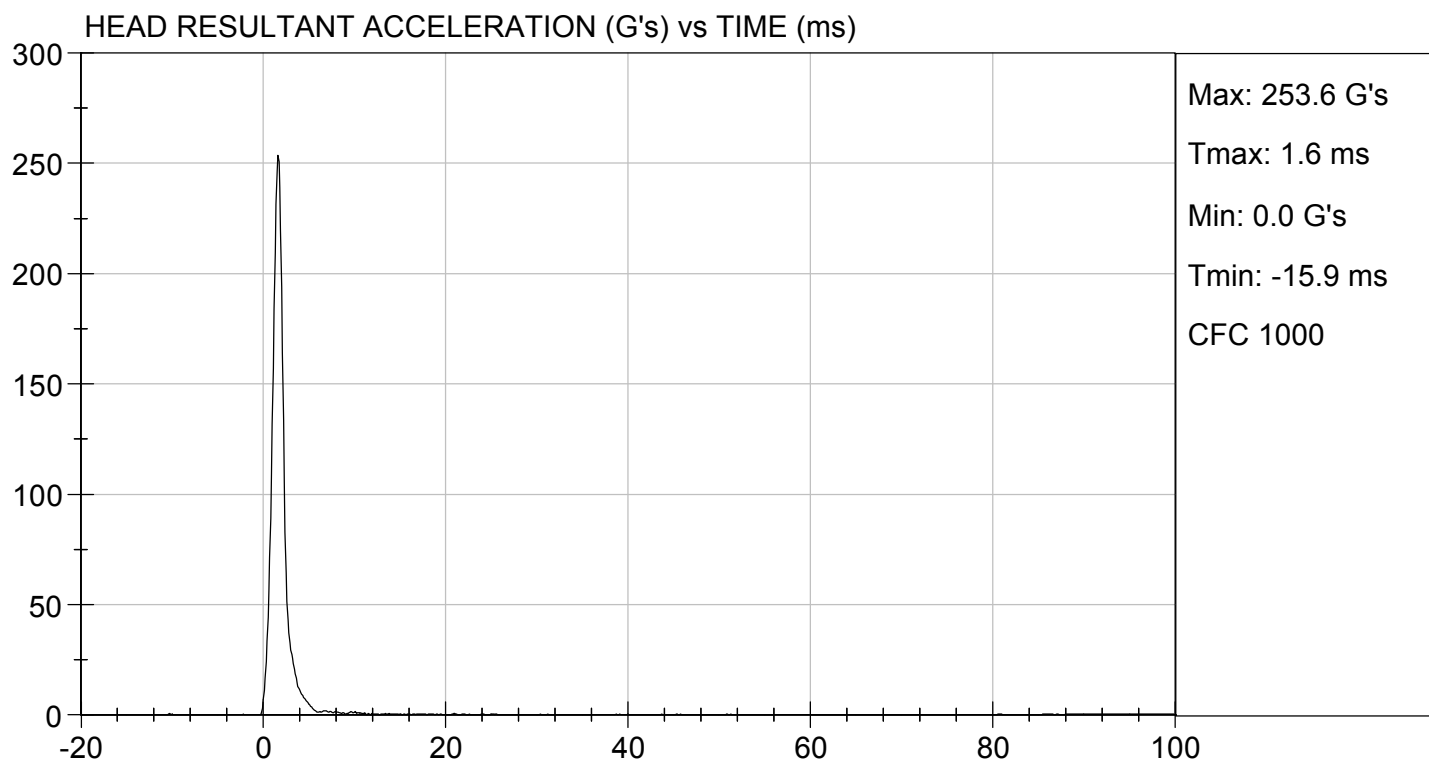
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	225 to 275	254	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-14.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

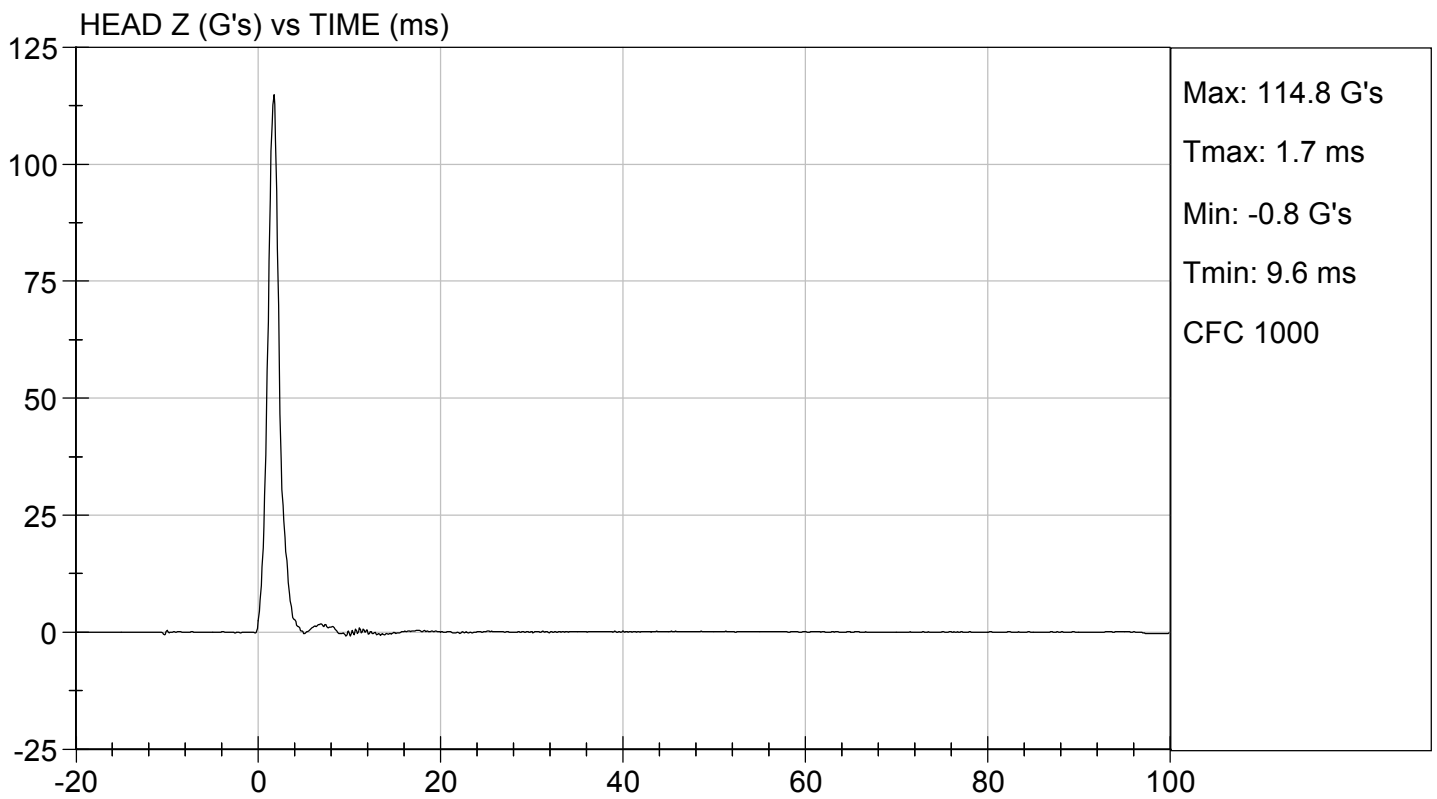
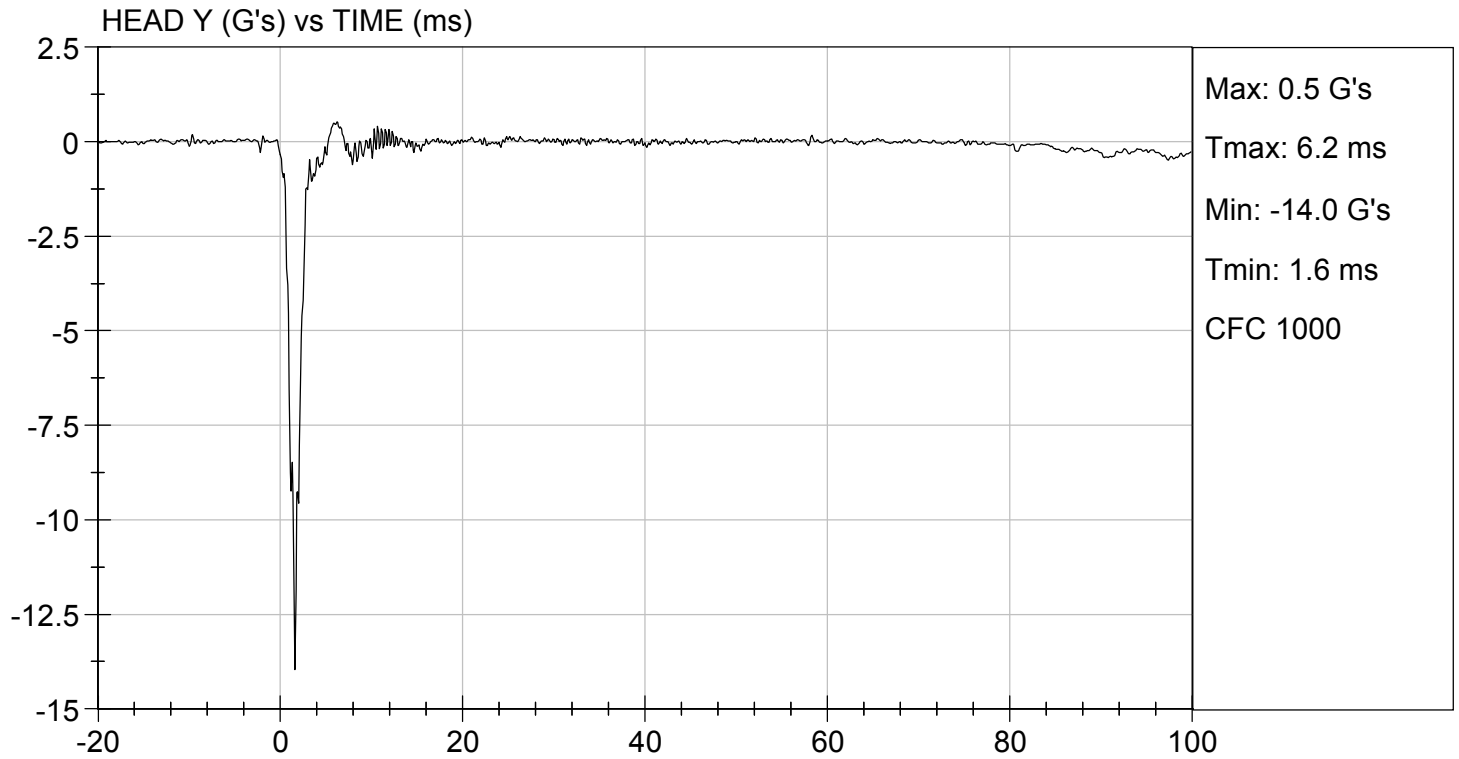

Laboratory Technician

01/14/2019

Test Date


Approved By





MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

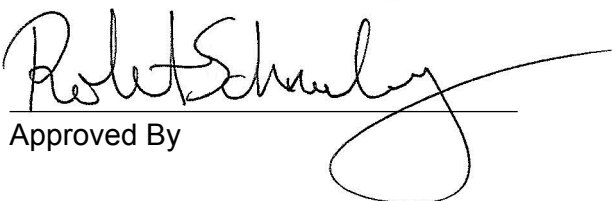
Test I.D: D190192

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	21.4	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.37	Pass
	20 ms	G's	17.60 to 22.60	20.57	Pass
	30 ms	G's	12.50 to 18.50	16.42	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	16.4	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.5	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	75.1	Pass
	Time	ms	57.0 to 64.0	60.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	120.1	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	91.3	Pass
	Time	ms	47.0 to 58.0	48.8	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	99.2	Pass
Overall Test Results					Pass


 Laboratory Technician

01/14/2019

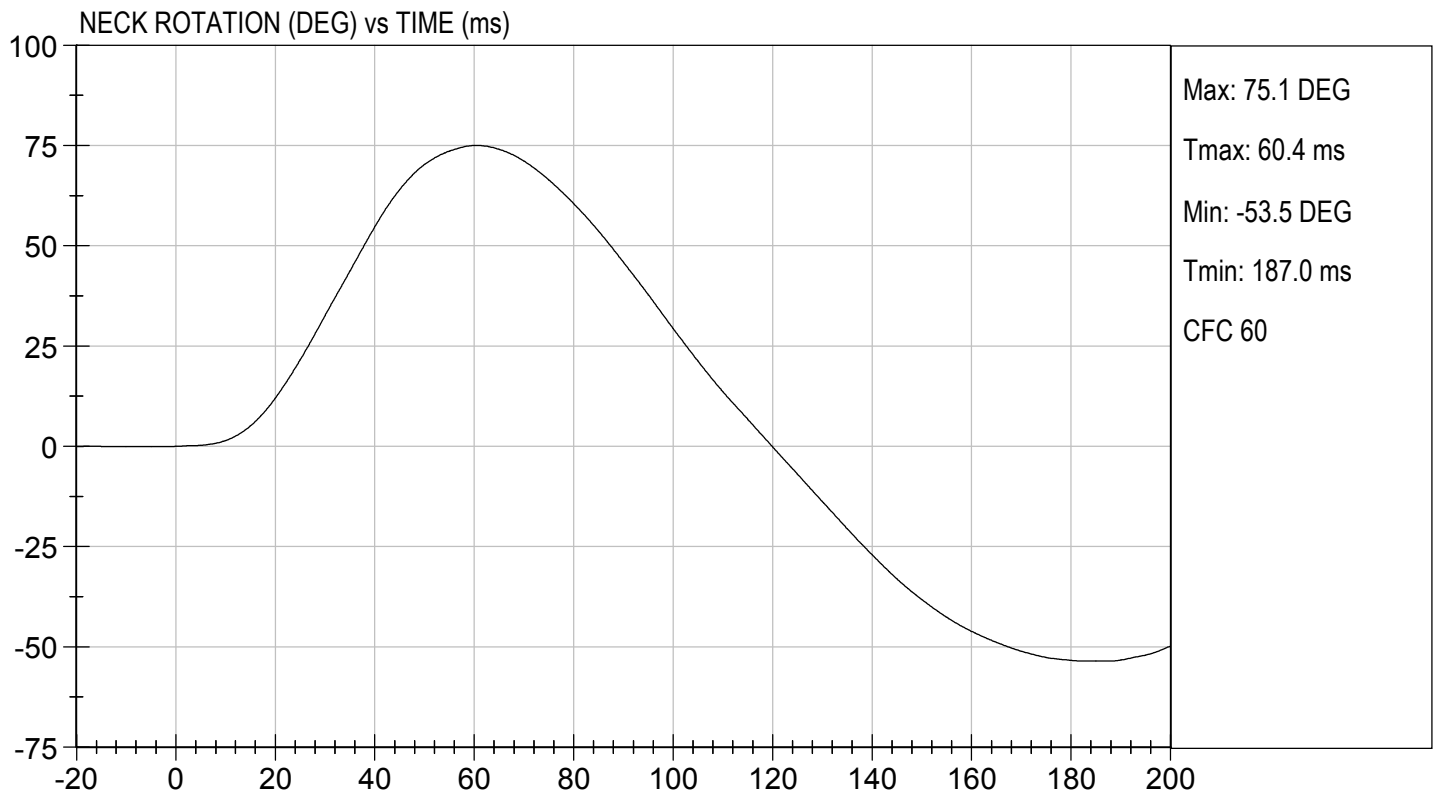
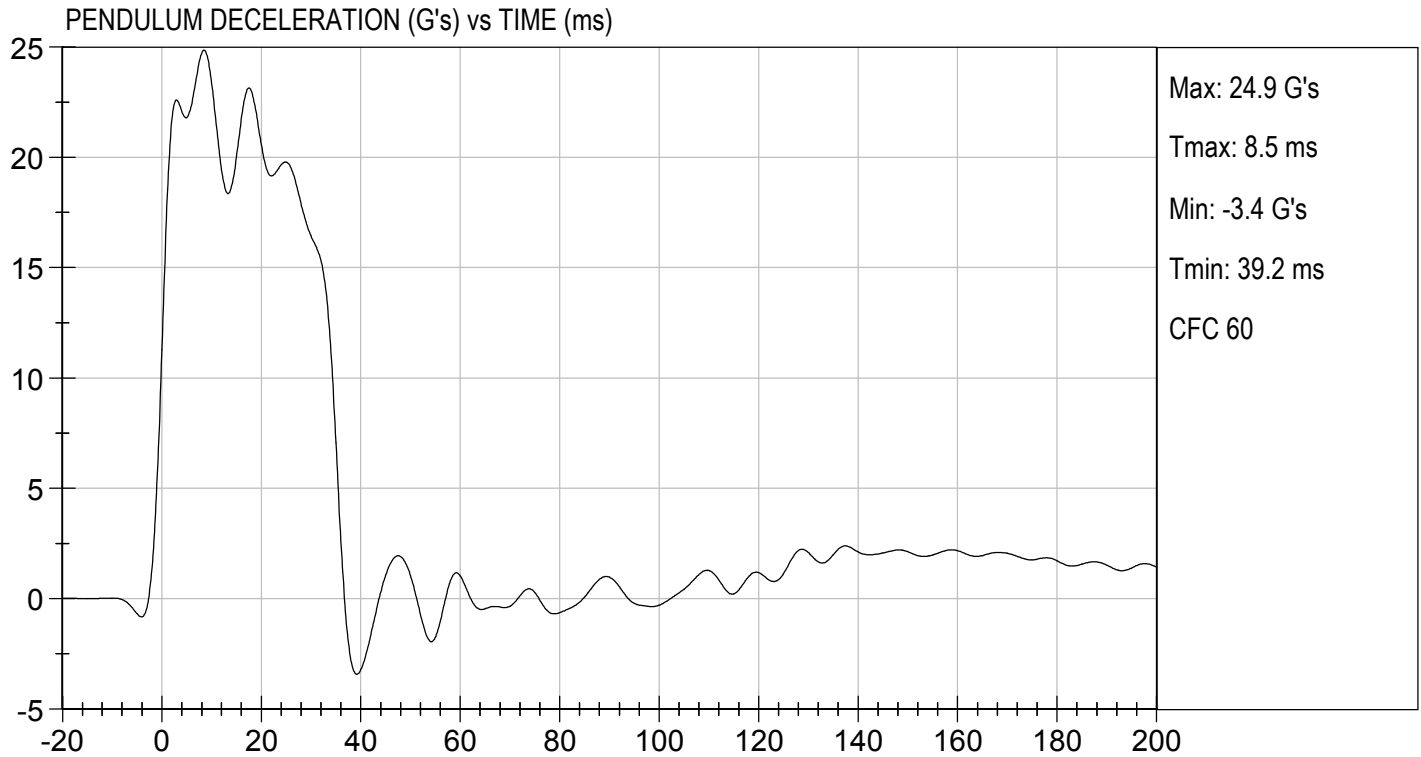
Test Date


 Approved By



TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

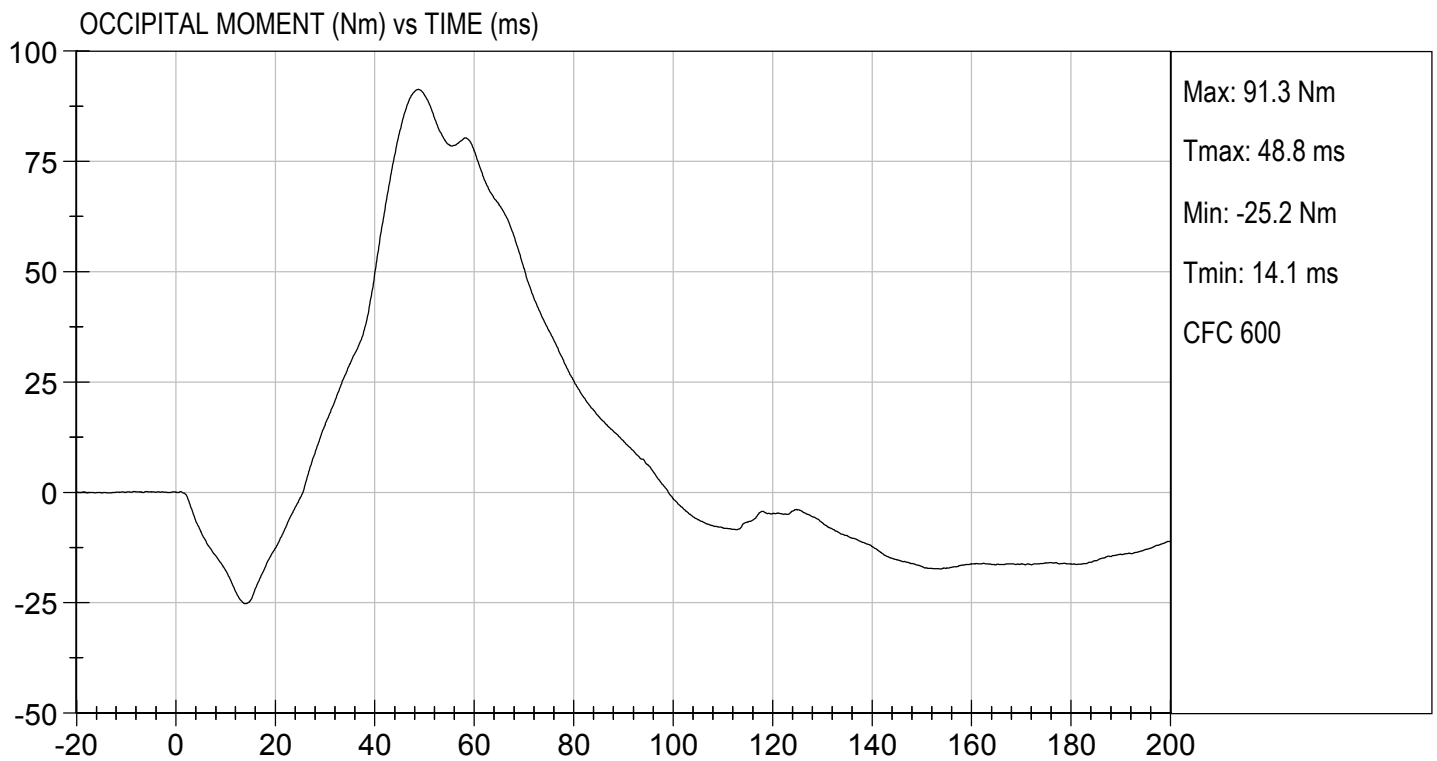
TEST DATE: 01/14/2019
TEST #: D190192





TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 01/14/2019
TEST #: D190192



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

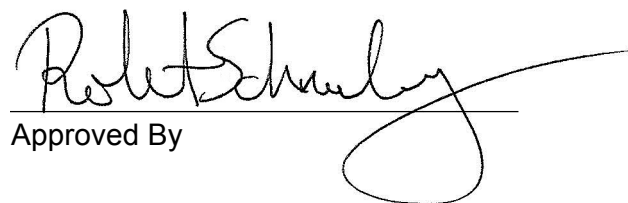
ATD Serial No: 351

Test I.D: D190193

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	21.4	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.19	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.55	Pass
	20 ms	G's	14.00 to 19.00	16.64	Pass
	30 ms	G's	11.00 to 16.00	13.03	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.0	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	40.8	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	104.7	Pass
	Time	ms	72.0 to 82.0	80.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	165.5	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-64.5	Pass
	Time	ms	65.0 to 79.0	72.3	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	146.6	Pass
Overall Test Results					Pass


 Laboratory Technician

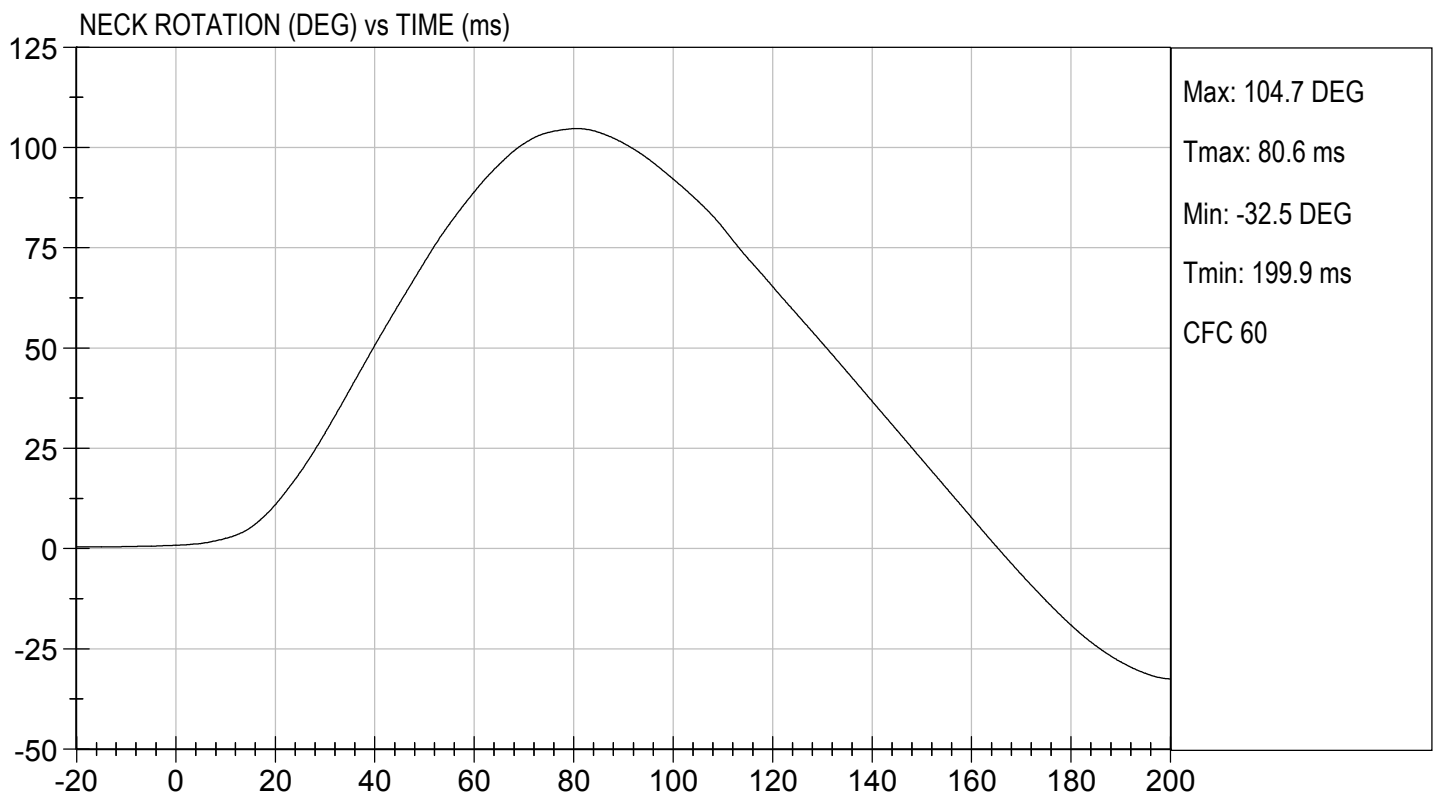
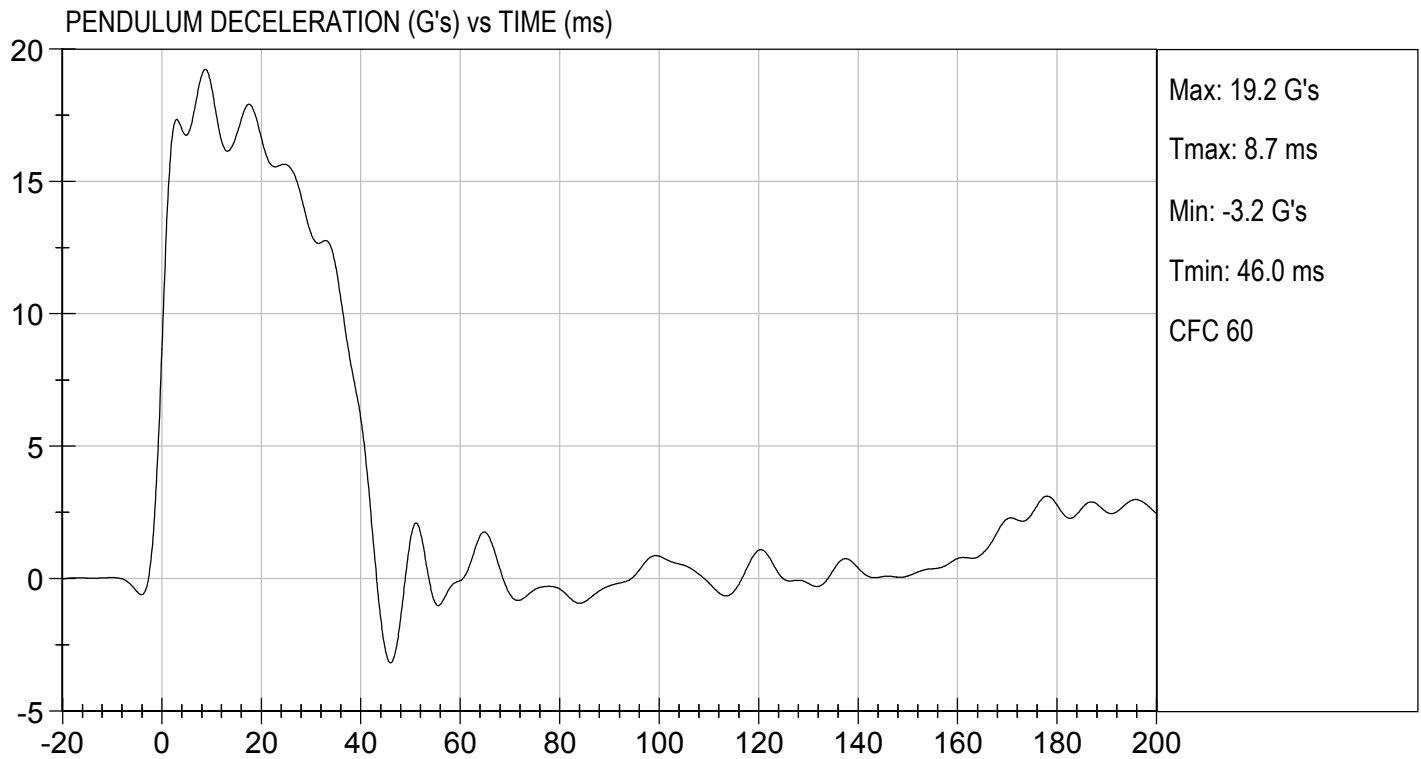
01/14/2019
 Test Date


 Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 01/14/2019
TEST #: D190193





TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 01/14/2019
TEST #: D190193

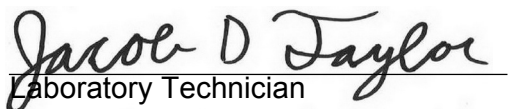


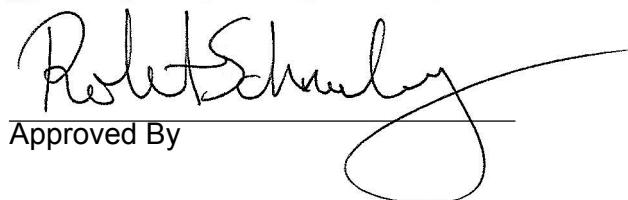
MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D190194

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,505	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.73	Pass
Internal Hysteresis	%	69 to 85	73	Pass
			Overall Test Results	Pass


Laboratory Technician

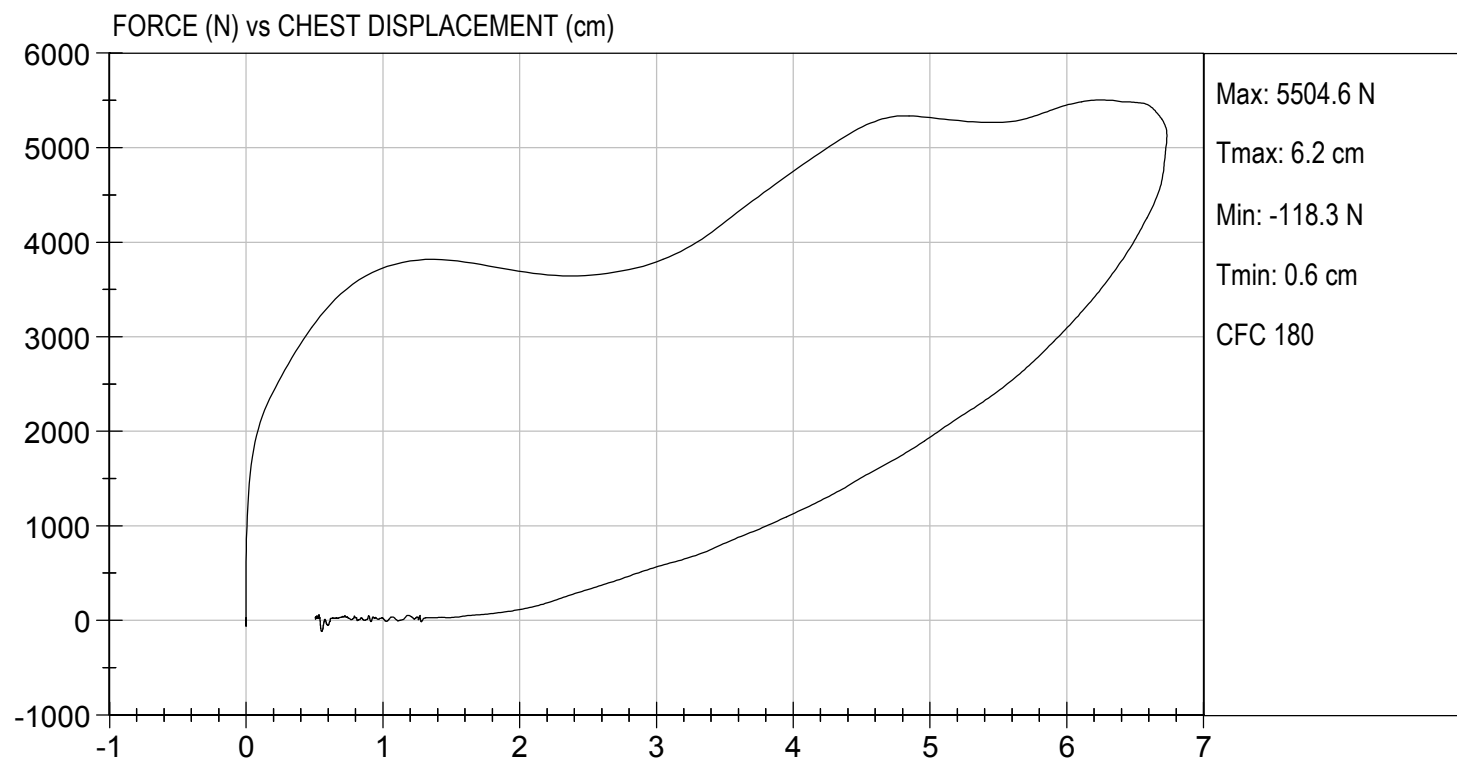

Approved By

01/15/2019
Test Date



TEST DESC: THORAX IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 01/15/2019
TEST #: D190194

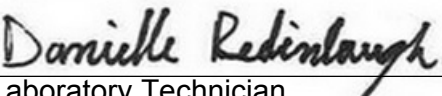


MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

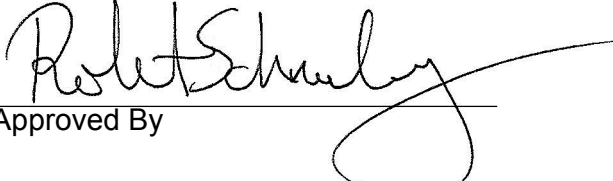
ATD Serial No: 351

Test I.D: D190195

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	20.3	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	4,728	Pass
Overall Test Results				Pass


Laboratory Technician

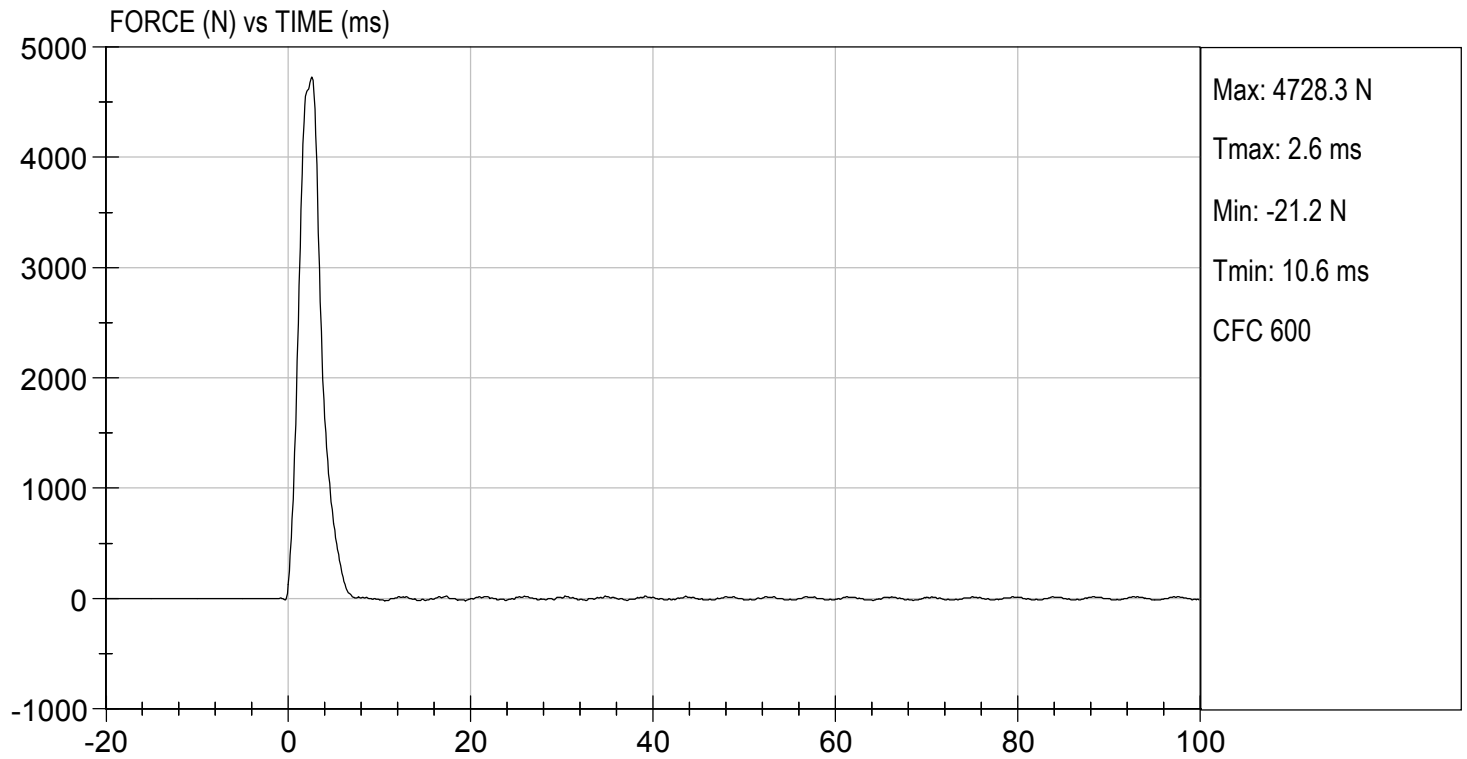
01/14/2019
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 01/14/2019
TEST #: D190195



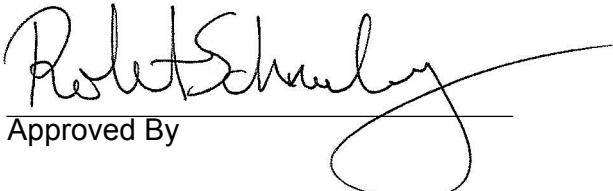
MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D190196

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	20.3	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,162	Pass
Overall Test Results				Pass


Laboratory Technician


Approved By

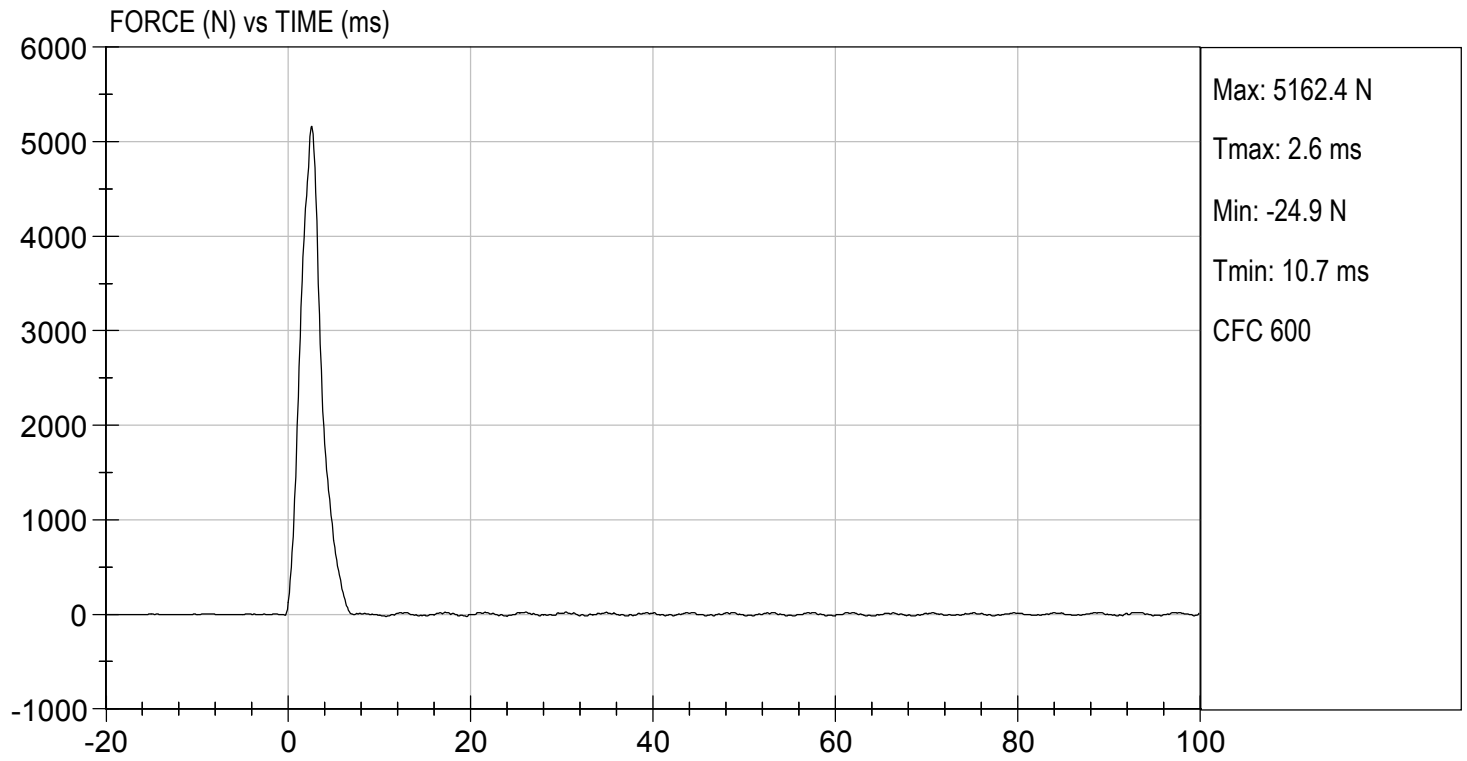
01/14/2019

Test Date



TEST DESC: LEFT KNEE
VELOCITY: 6.94 ft/s, 2.12 m/s

TEST DATE: 01/14/2019
TEST #: D190196



MGA RESEARCH CORPORATION
HIP-FEMUR FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

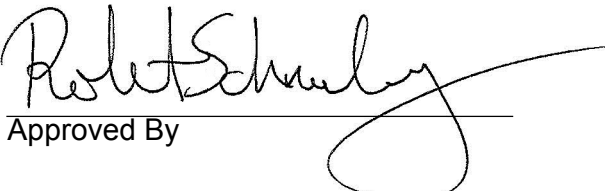
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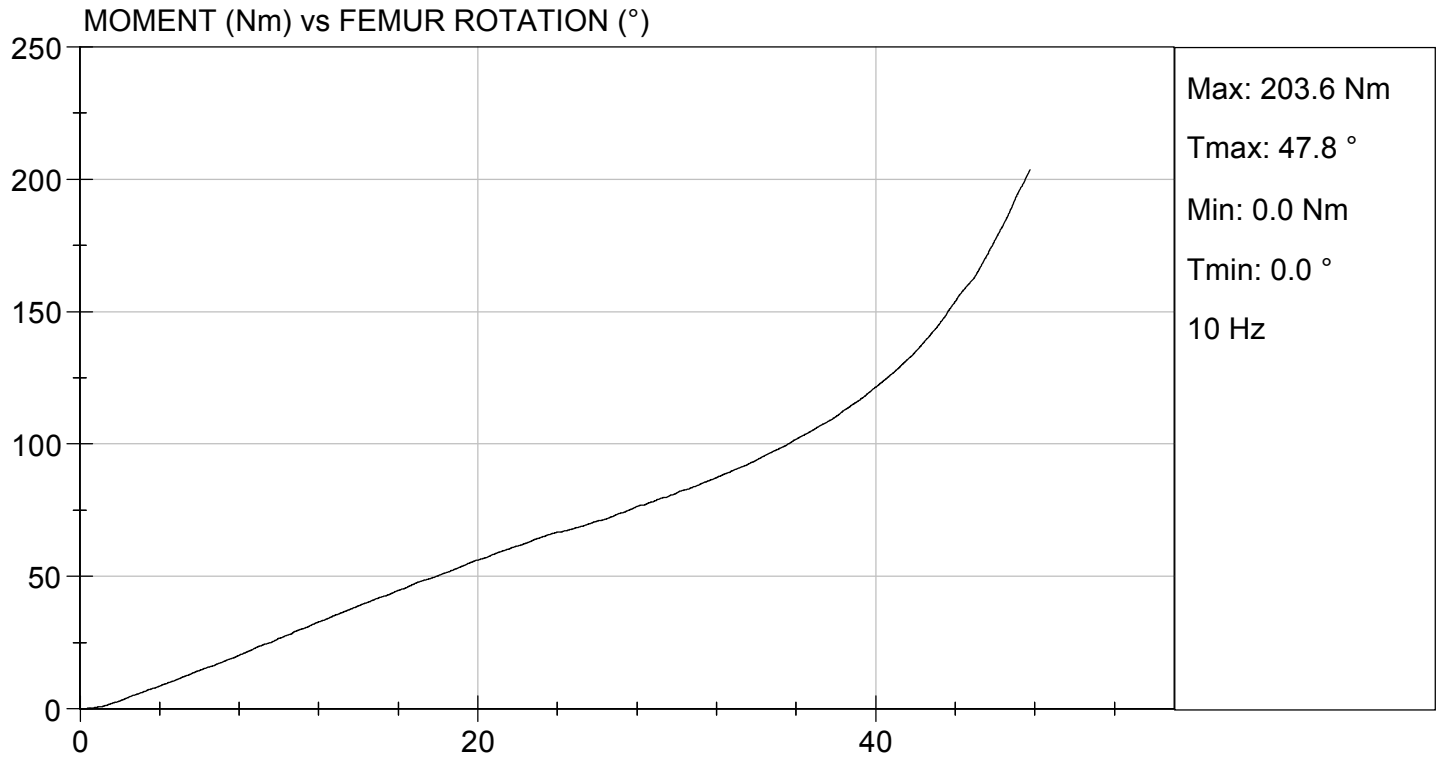
Test I.D: D190190

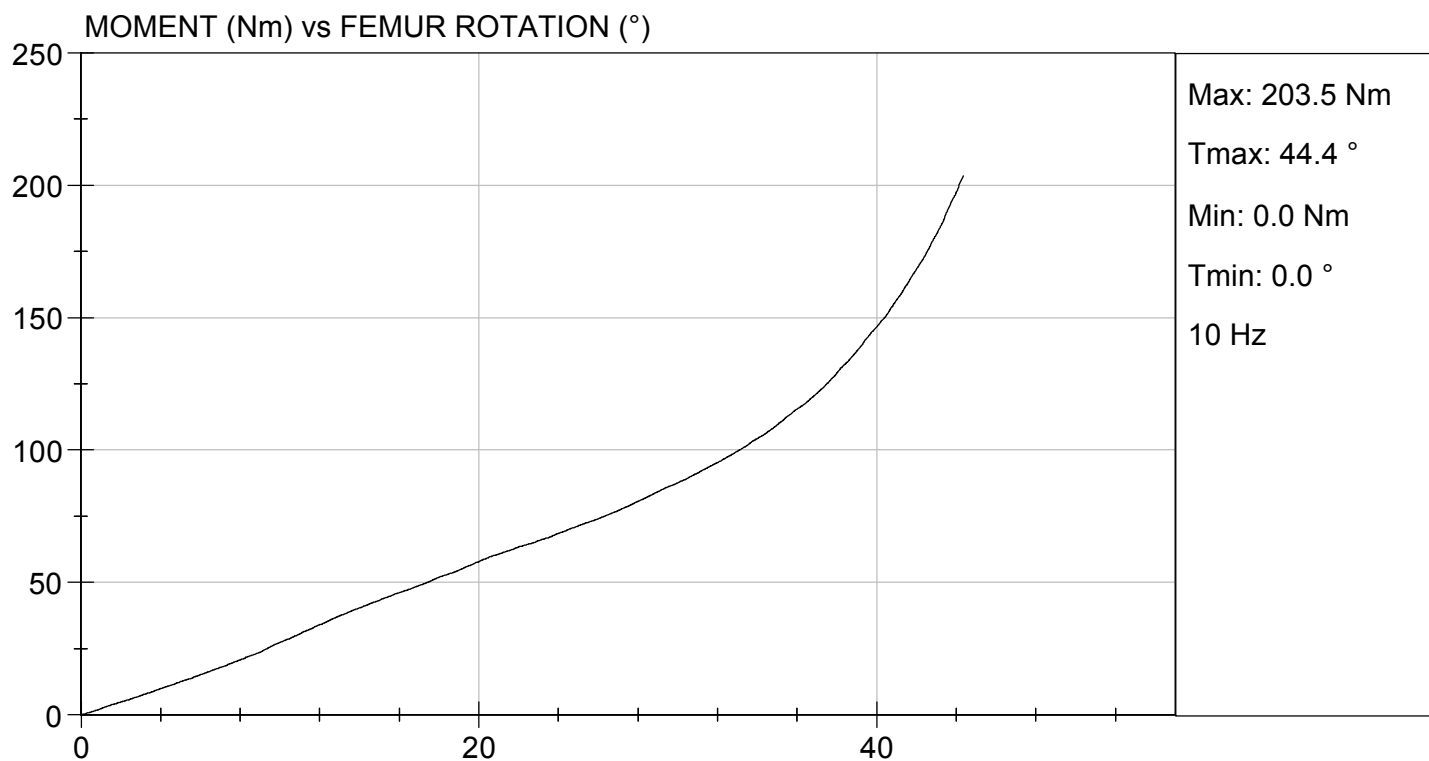
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	22	22	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.5	6.4	Pass
30 Degrees	Nm	94.9 Nm Max	81.6	87.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	47.8	44.4	Pass
Overall Test Results					Pass


Laboratory Technician

01/14/2019
Test Date


Approved By





CALIBRATION TEST RESULTS

POST-TEST

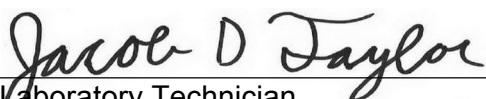
HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

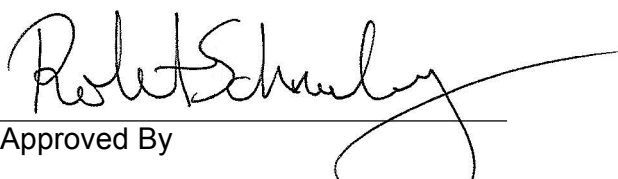
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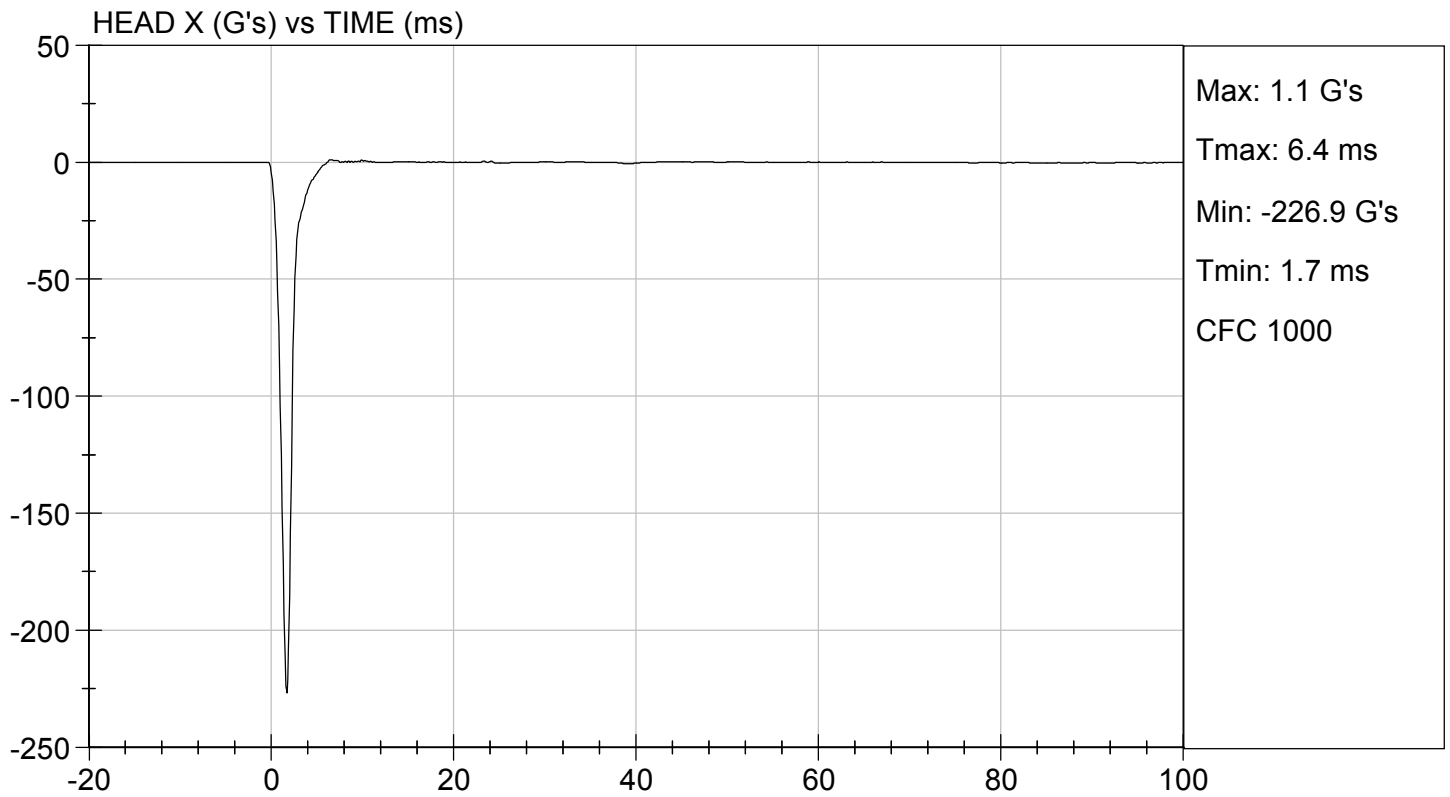
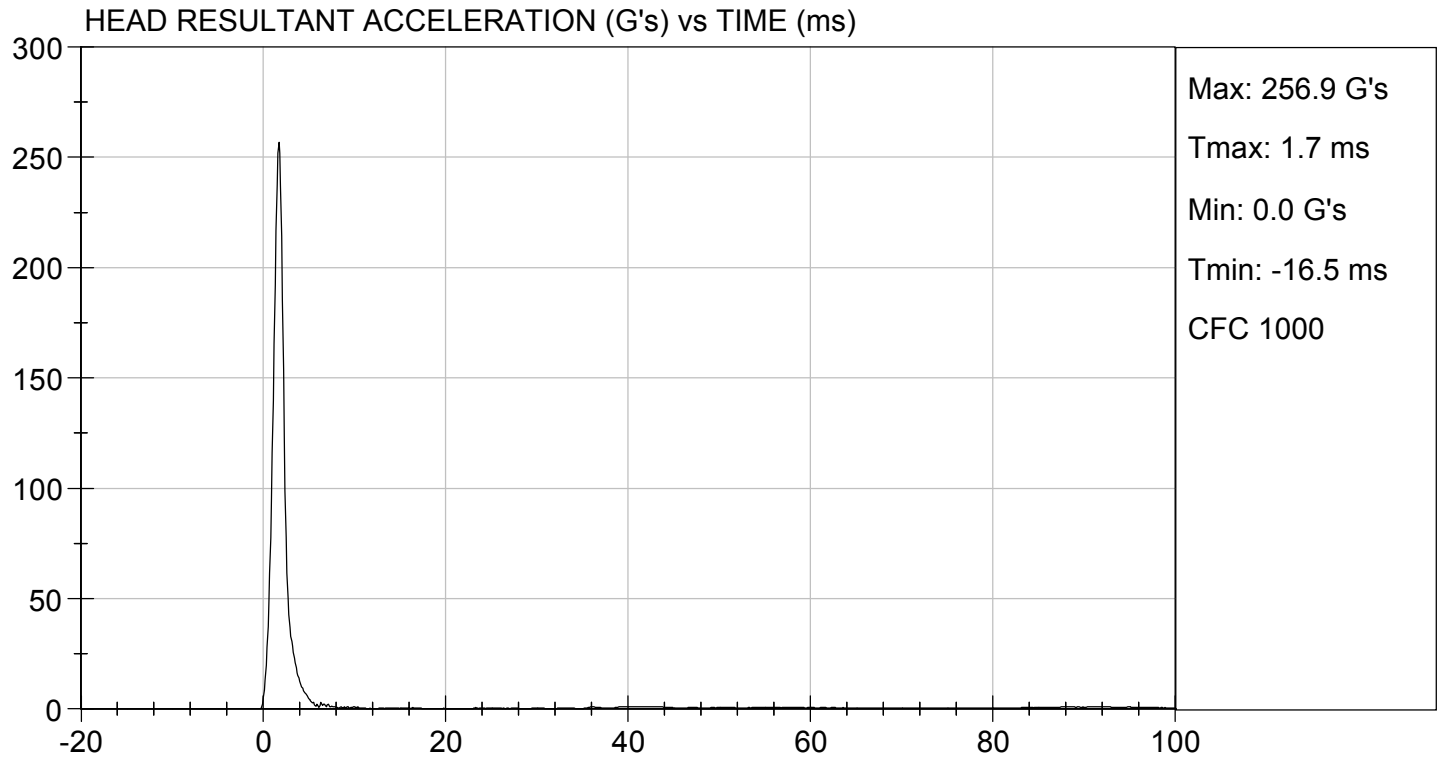
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	225 to 275	257	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-9.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

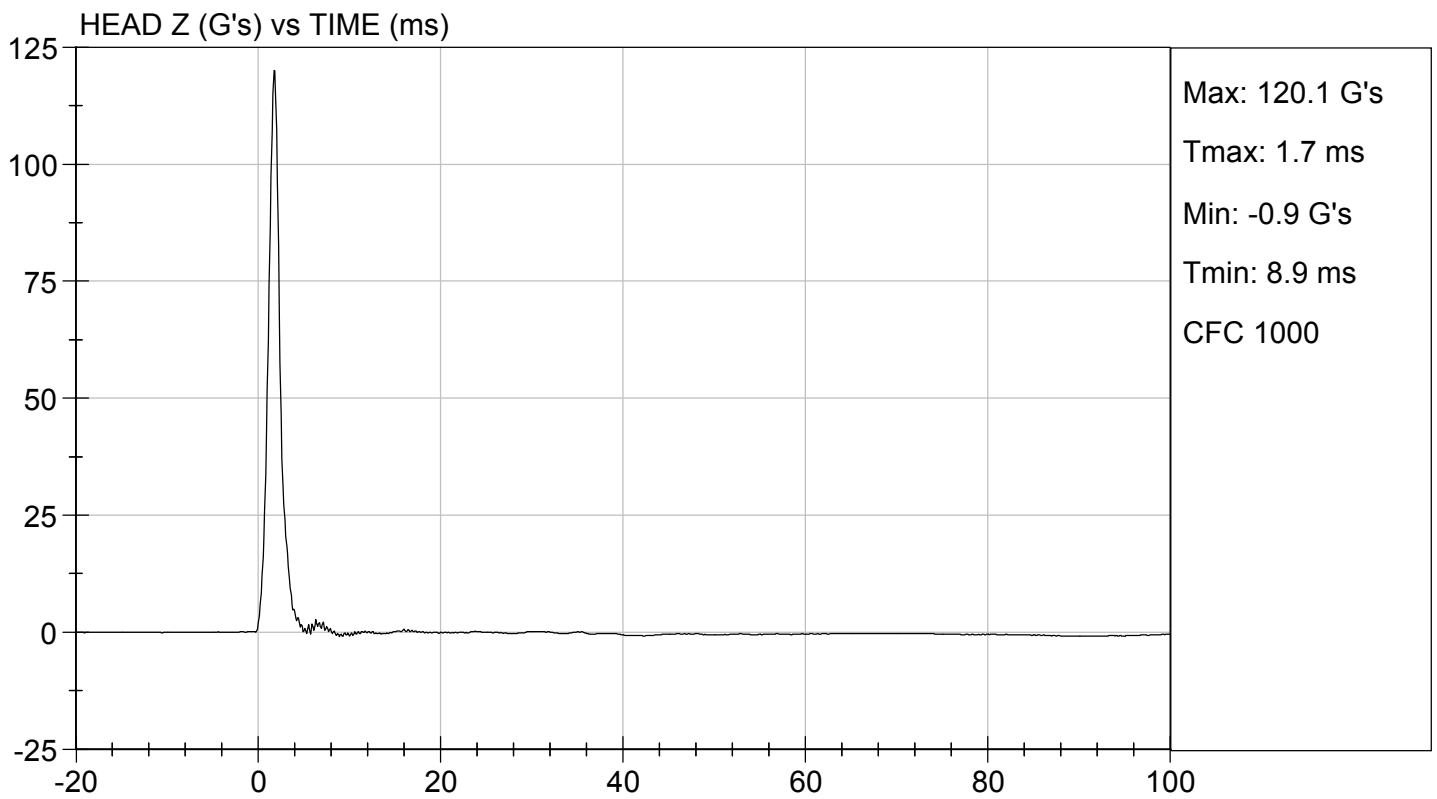
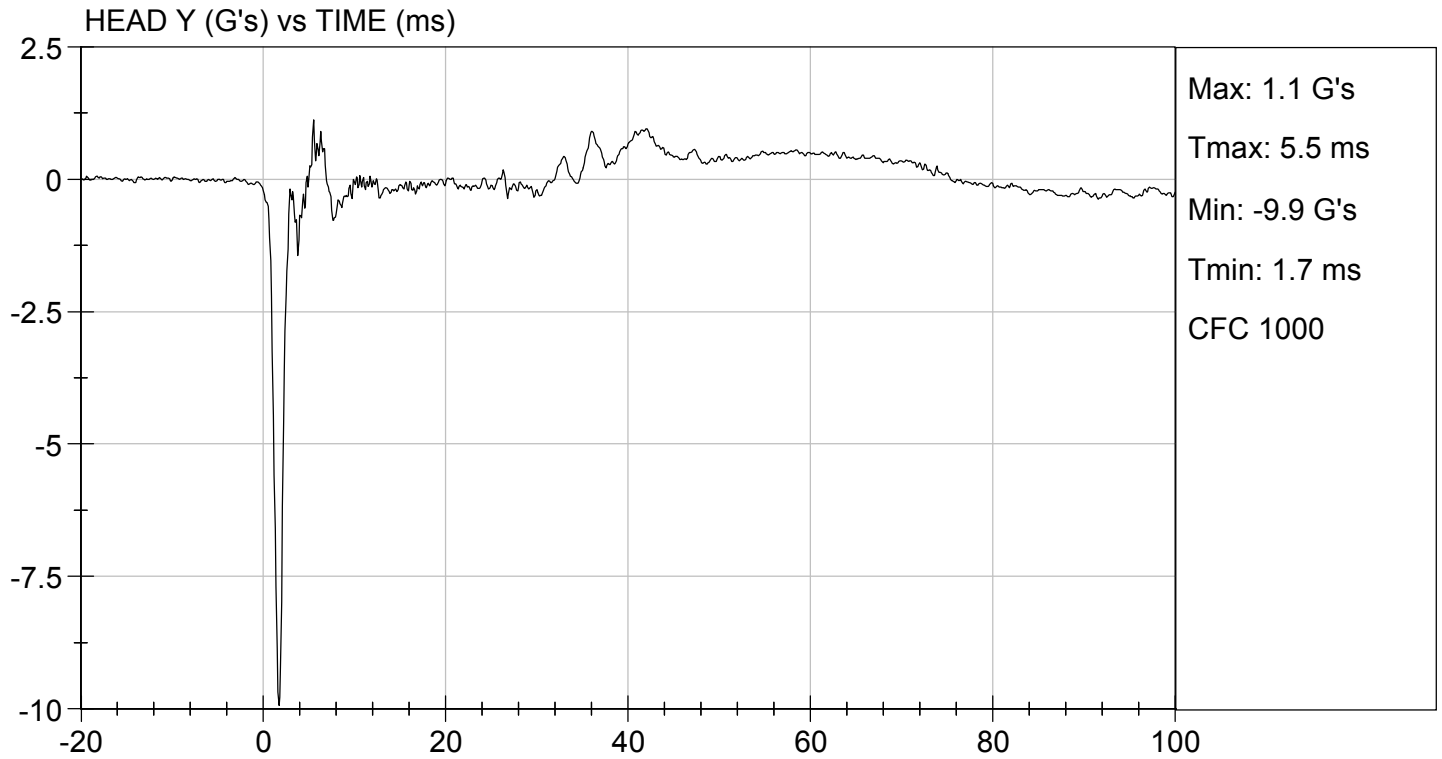

Laboratory Technician

01/24/2019

Test Date


Approved By



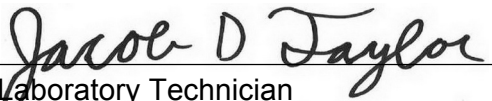


MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

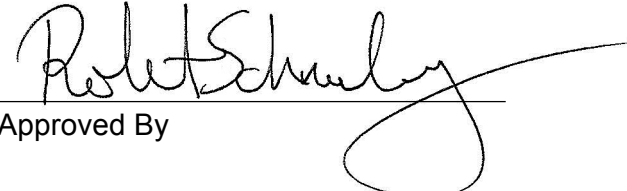
Test I.D: D190322

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	21	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.13	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.51	Pass
	20 ms	G's	17.60 to 22.60	19.65	Pass
	30 ms	G's	12.50 to 18.50	16.58	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	16.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.3	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	74.3	Pass
	Time	ms	57.0 to 64.0	59.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	120.5	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	88.3	Pass
	Time	ms	47.0 to 58.0	48.1	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	99.1	Pass
Overall Test Results					Pass


Laboratory Technician

01/24/2019

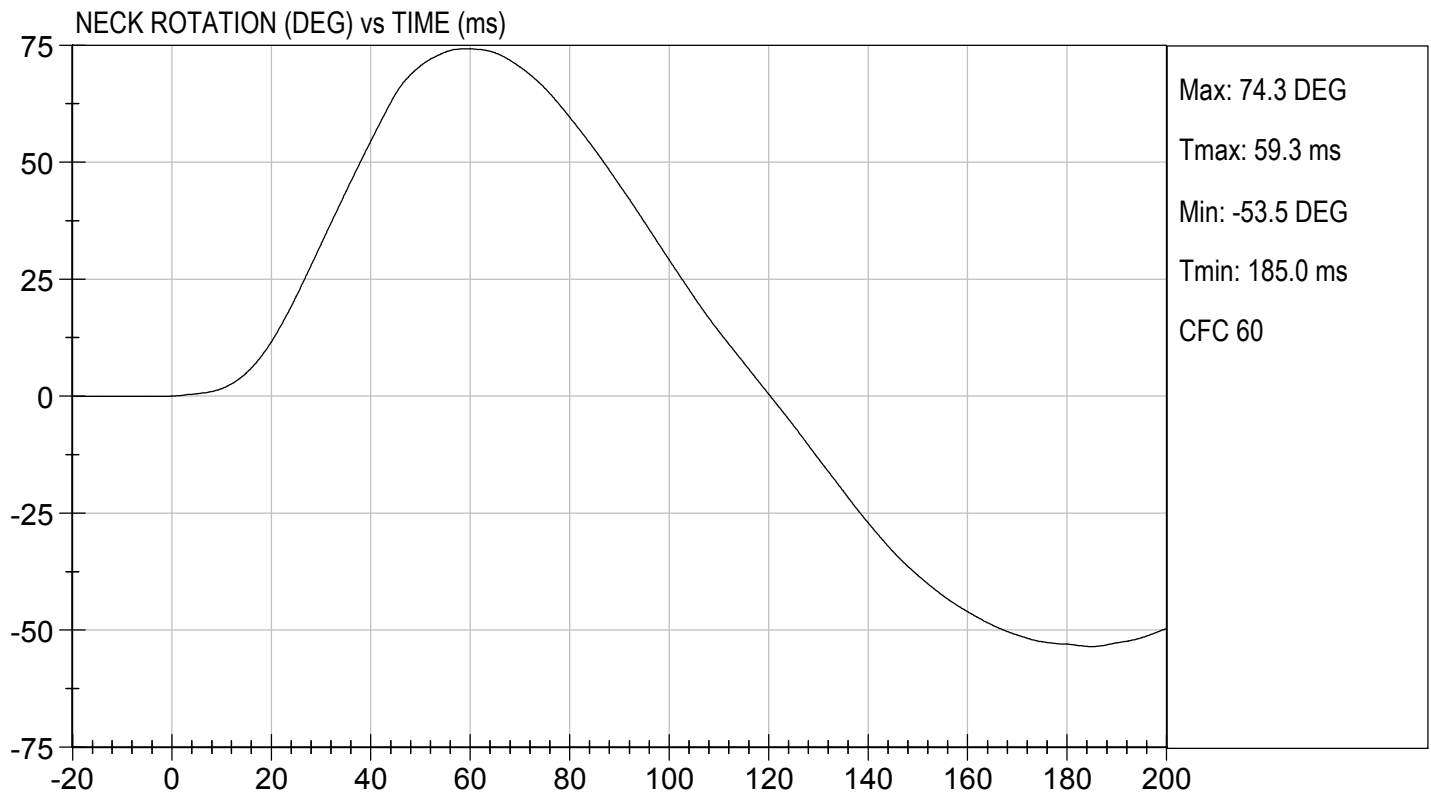
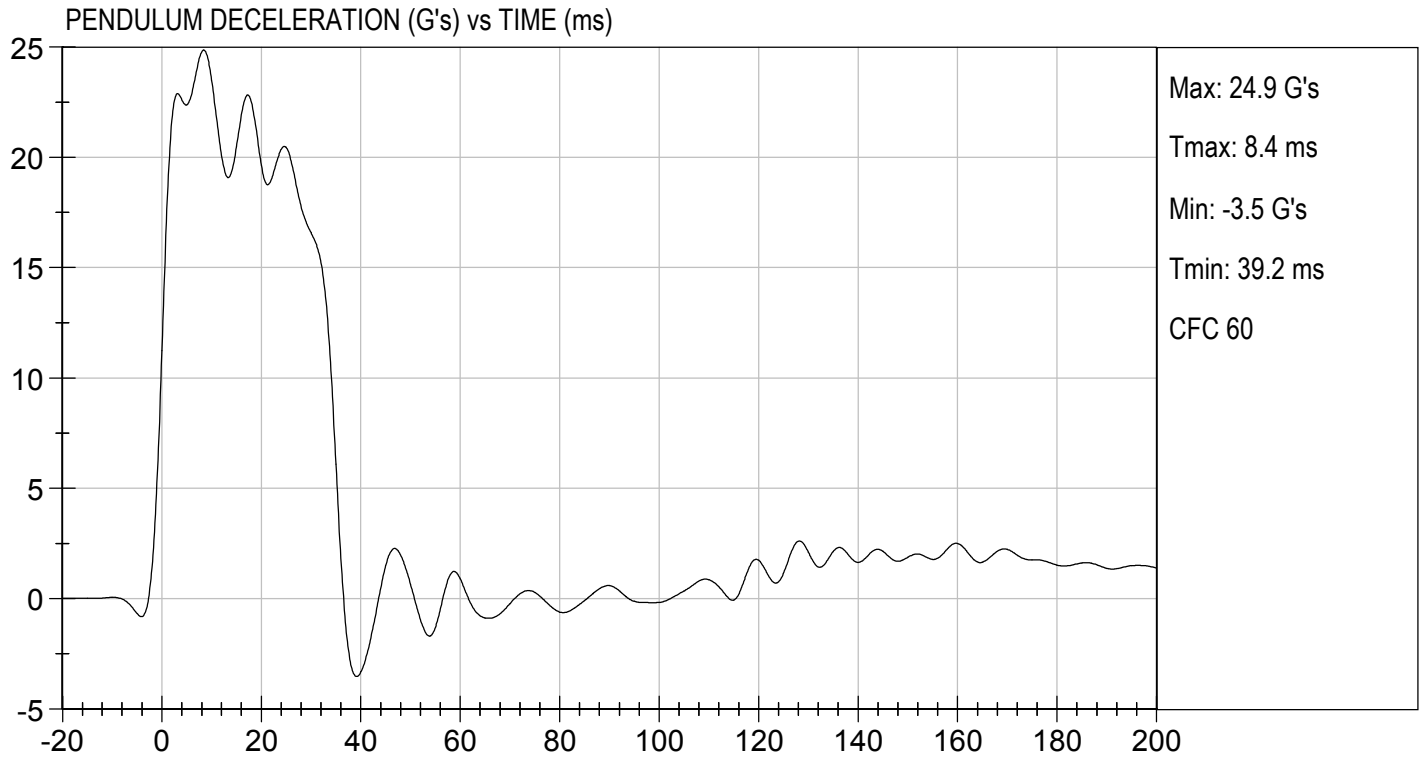
Test Date


Approved By



TEST DESC: NECK FLEXION
VELOCITY: 23.40 ft/s, 7.13 m/s

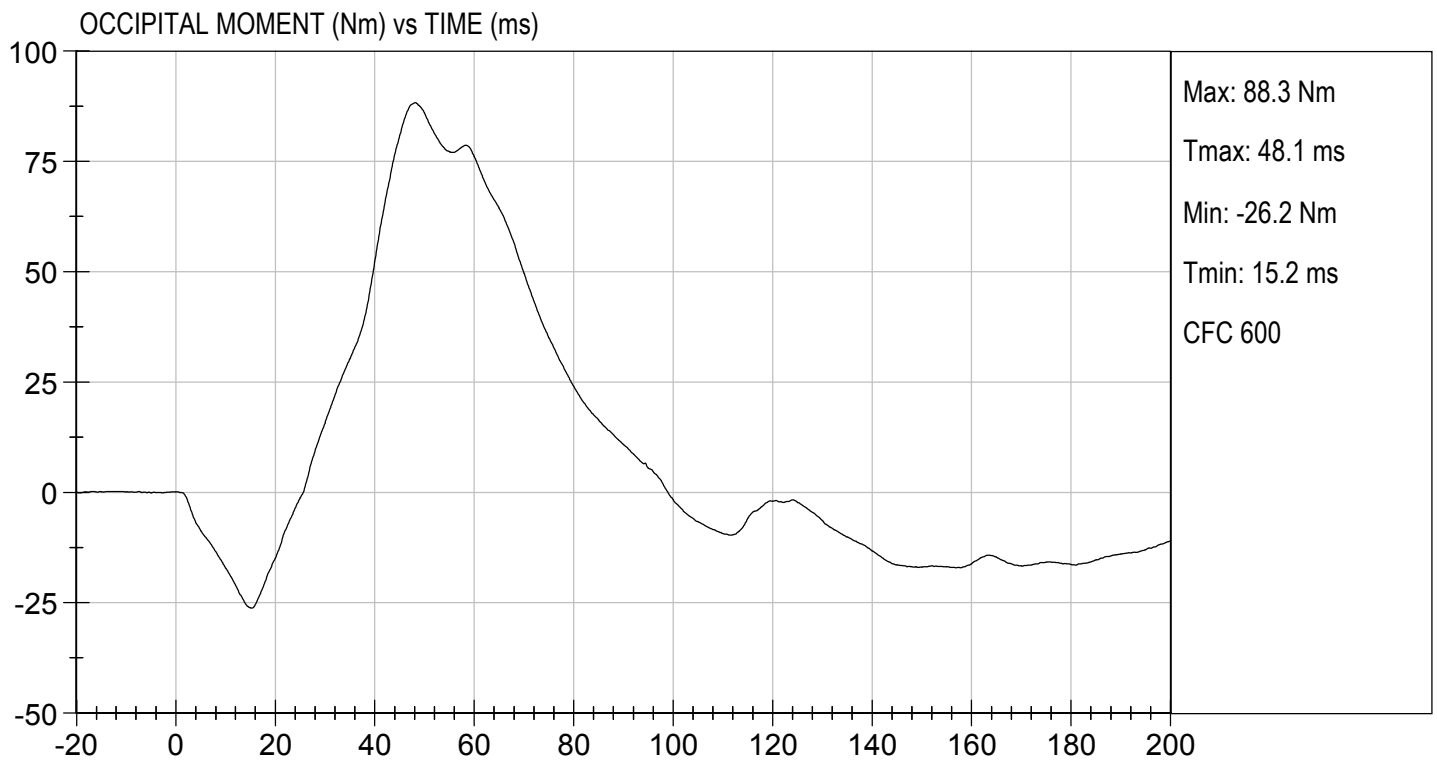
TEST DATE: 01/24/2019
TEST #: D190322





TEST DESC: NECK FLEXION
VELOCITY: 23.40 ft/s, 7.13 m/s

TEST DATE: 01/24/2019
TEST #: D190322

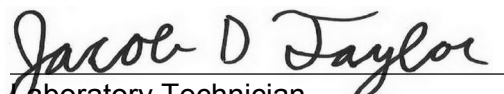


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

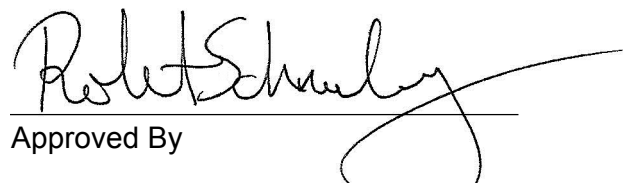
Test I.D: D190323

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	12	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.19	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.15	Pass
	20 ms	G's	14.00 to 19.00	16.00	Pass
	30 ms	G's	11.00 to 16.00	13.37	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	103.5	Pass
	Time	ms	72.0 to 82.0	78.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	164.9	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-66.3	Pass
	Time	ms	65.0 to 79.0	72.8	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	145.7	Pass
Overall Test Results					Pass


Laboratory Technician

01/28/2019

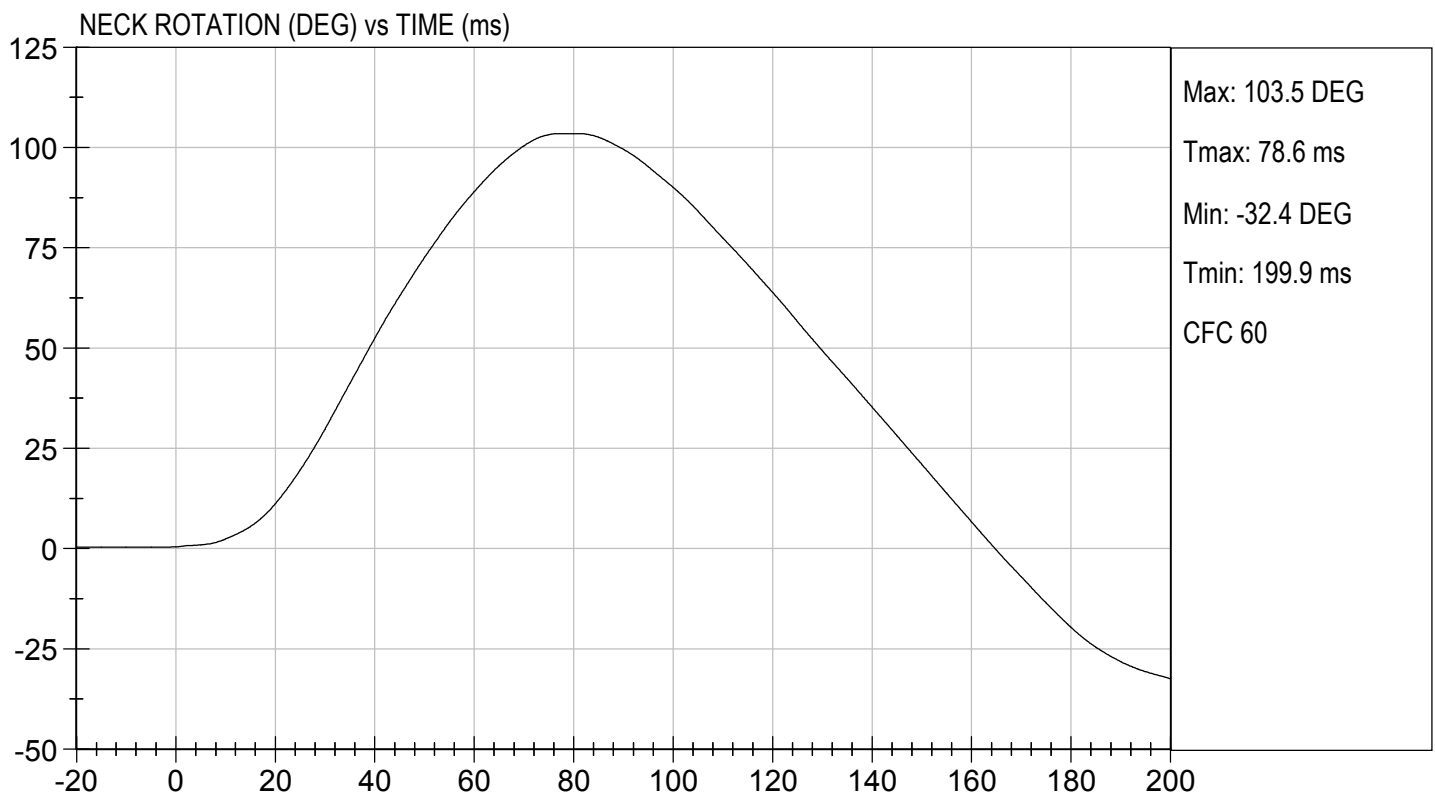
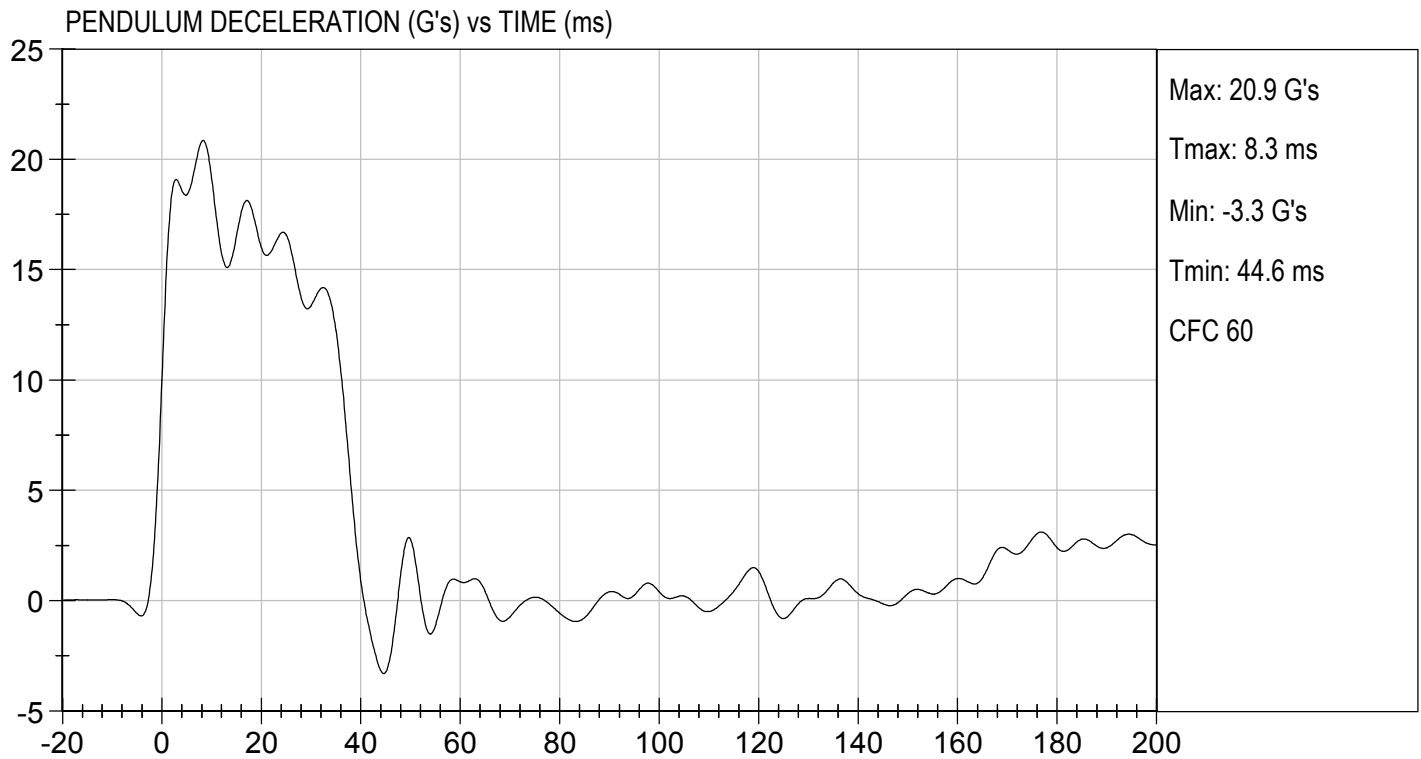
Test Date


Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

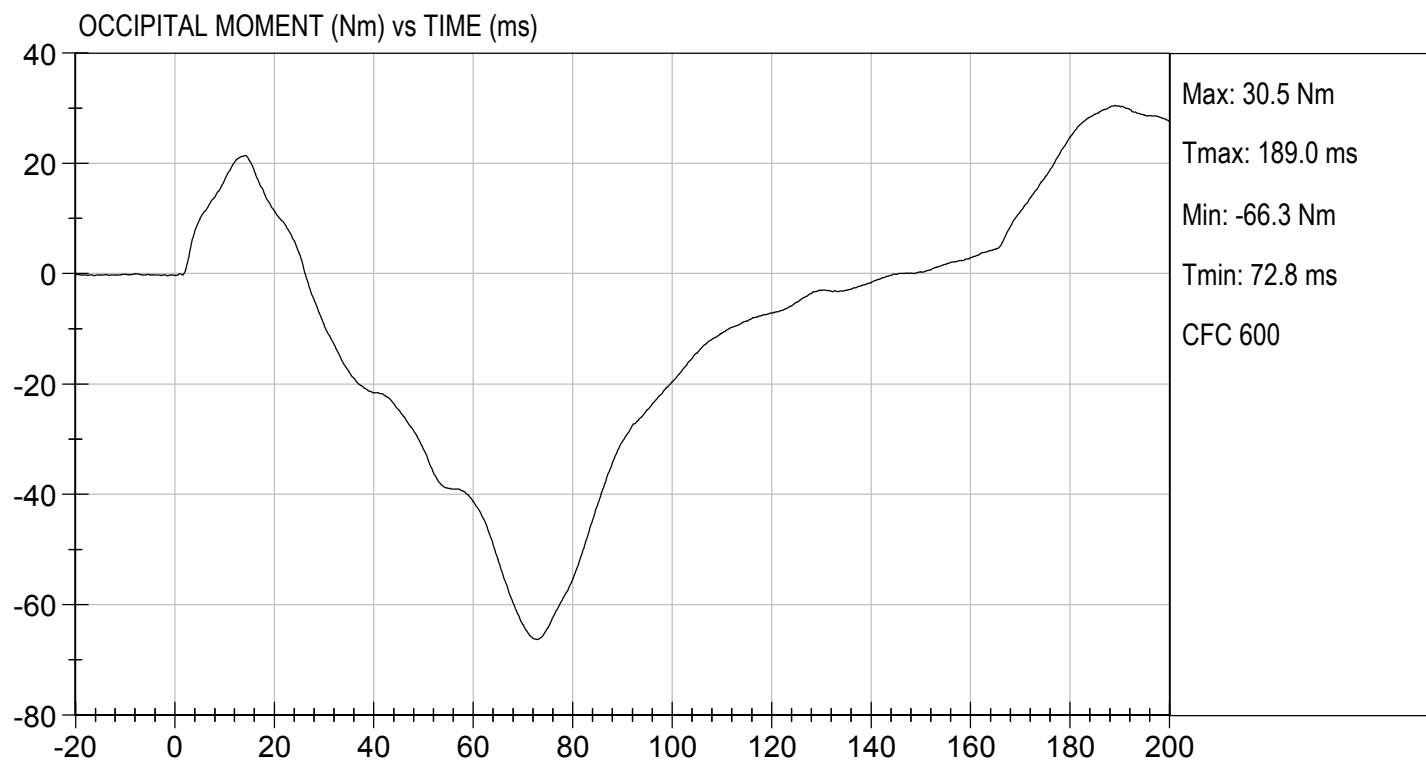
TEST DATE: 01/28/2019
TEST #: D190323





TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 01/28/2019
TEST #: D190323

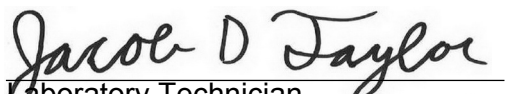


MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

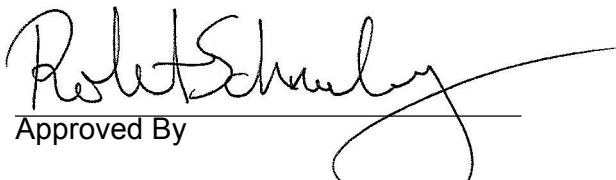
ATD Serial No: 351

Test I.D: D190324

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,661	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.73	Pass
Internal Hysteresis	%	69 to 85	72	Pass
			Overall Test Results	Pass


Laboratory Technician

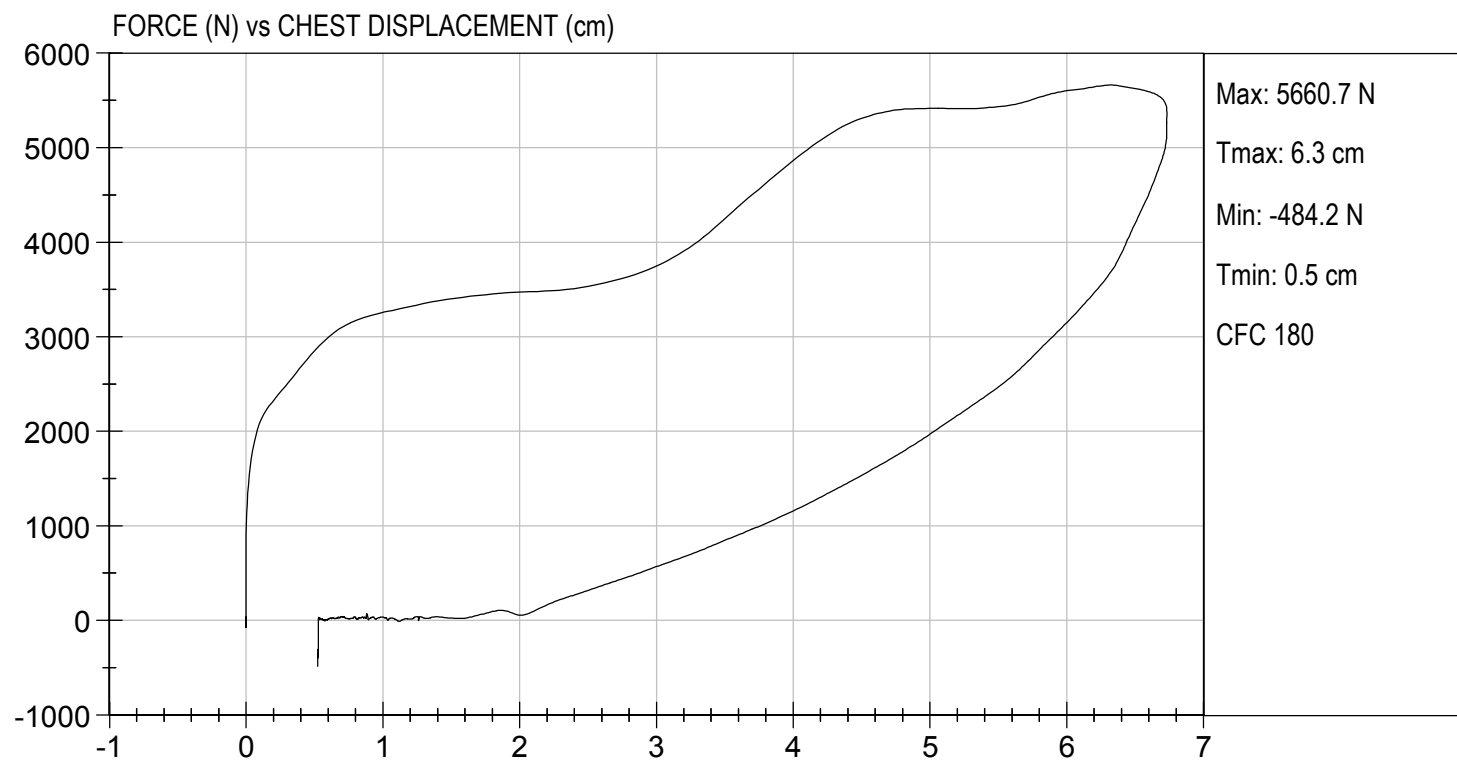
01/24/2019
Test Date


Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 01/24/2019
TEST #: D190324

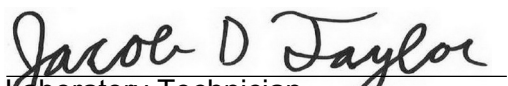


MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

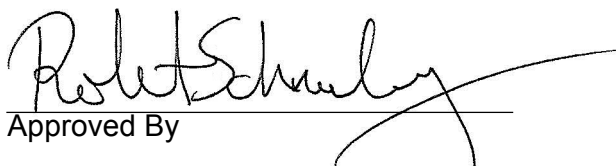
Test I.D: D190325

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Velocity	m/s	2.07 to 2.13	2.13	Pass
Peak Probe Force	N	4715 to 5782	5,641	Pass
Overall Test Results				Pass


Laboratory Technician

01/24/2019

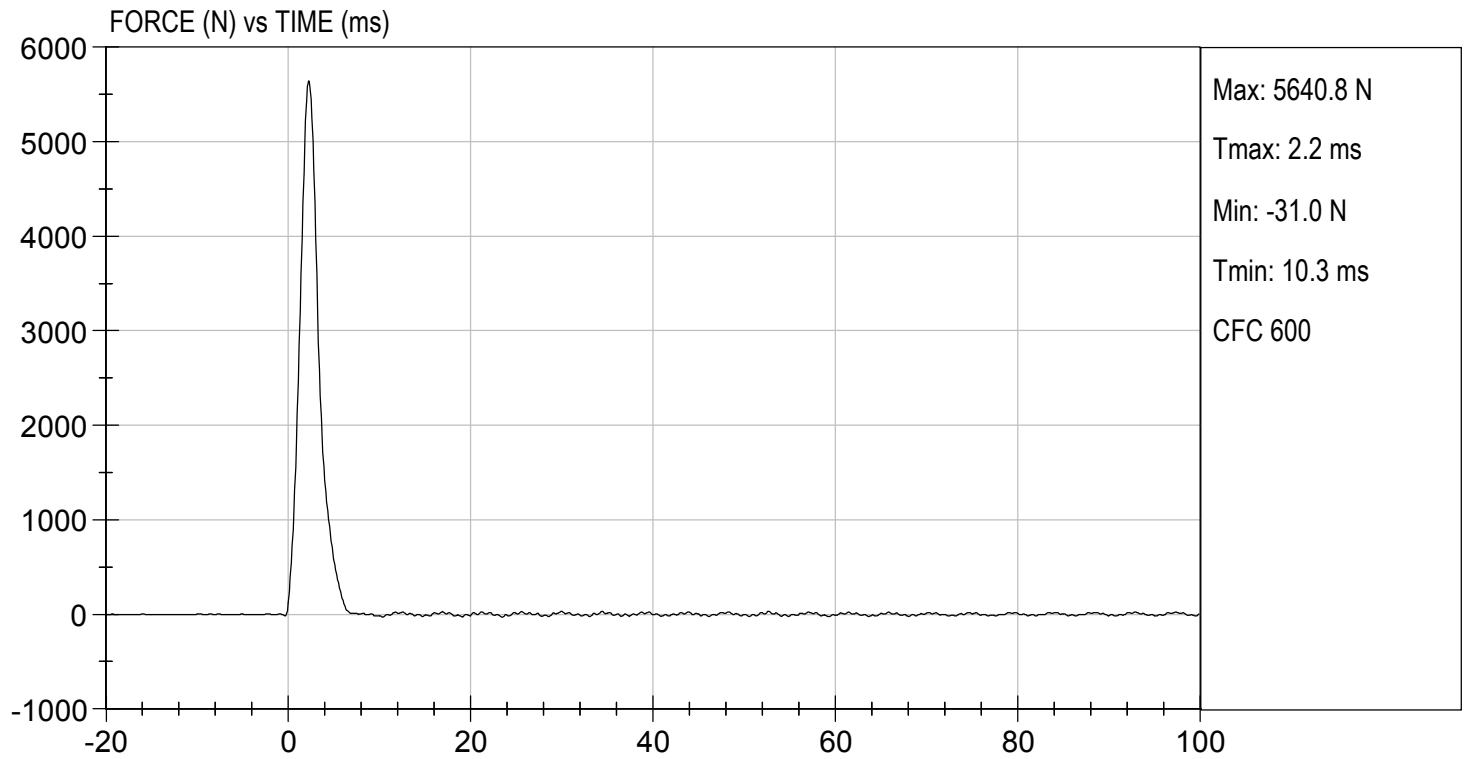
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 01/24/2019
TEST #: D190325



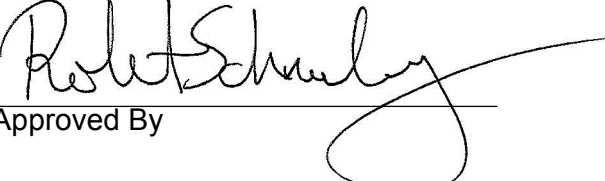
MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D190326

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Velocity	m/s	2.07 to 2.13	2.13	Pass
Peak Probe Force	N	4715 to 5782	5,674	Pass
Overall Test Results				Pass


Laboratory Technician


Approved By

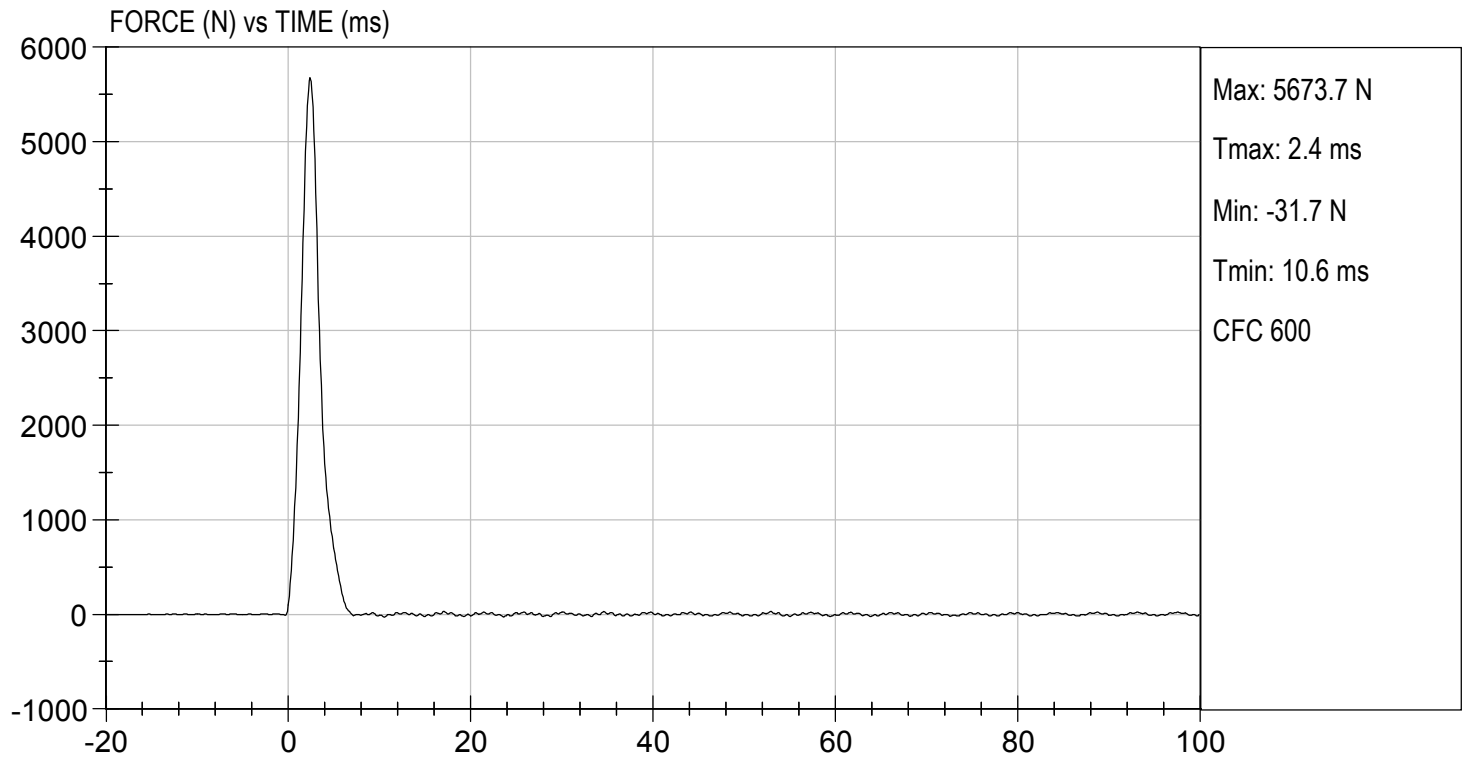
01/24/2019

Test Date



TEST DESC: LEFT KNEE
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 01/24/2019
TEST #: D190326

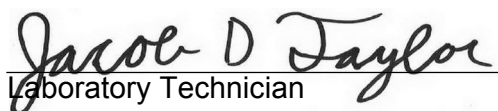


MGA RESEARCH CORPORATION
HIP-FEMUR FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

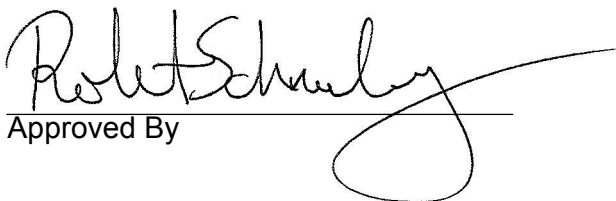
ATD Serial No: 351

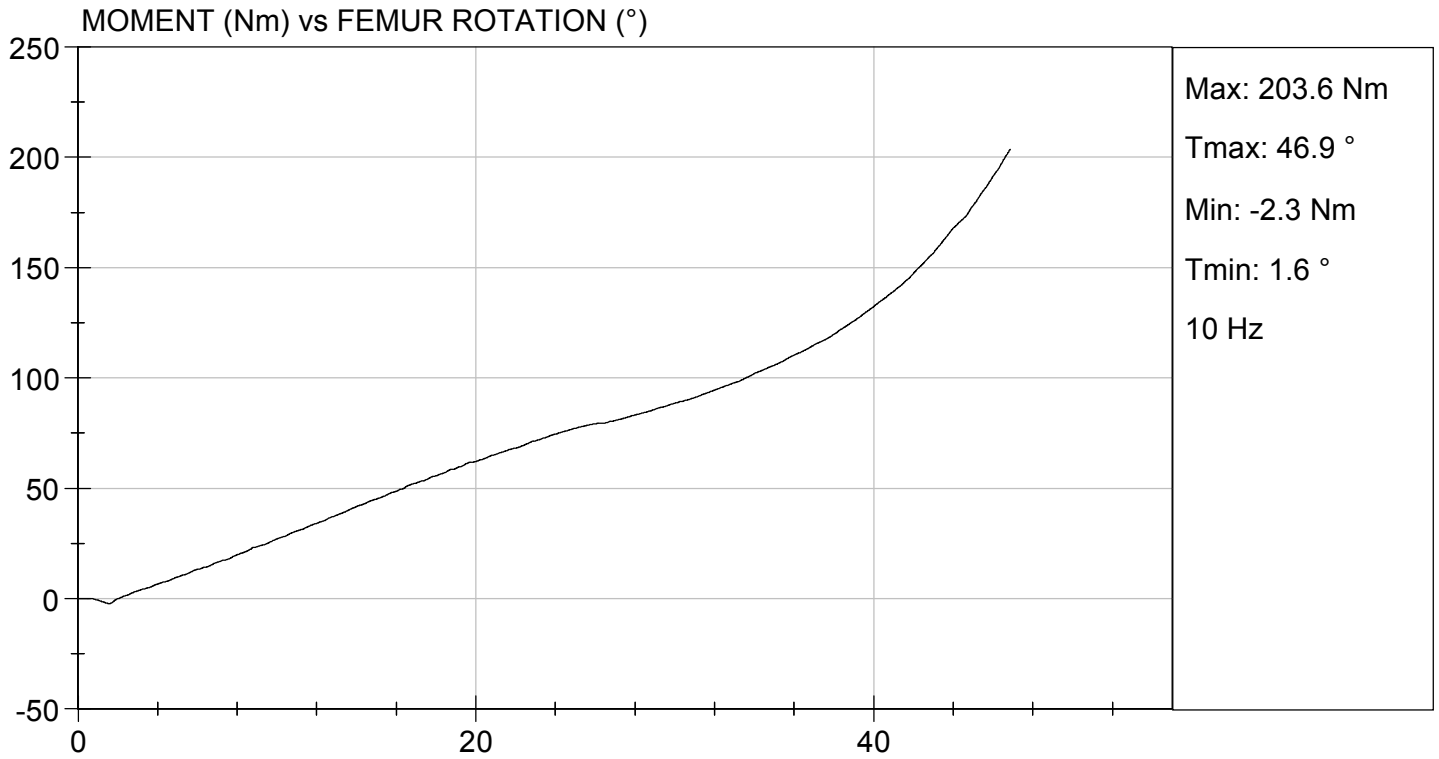
Test I.D: D190320

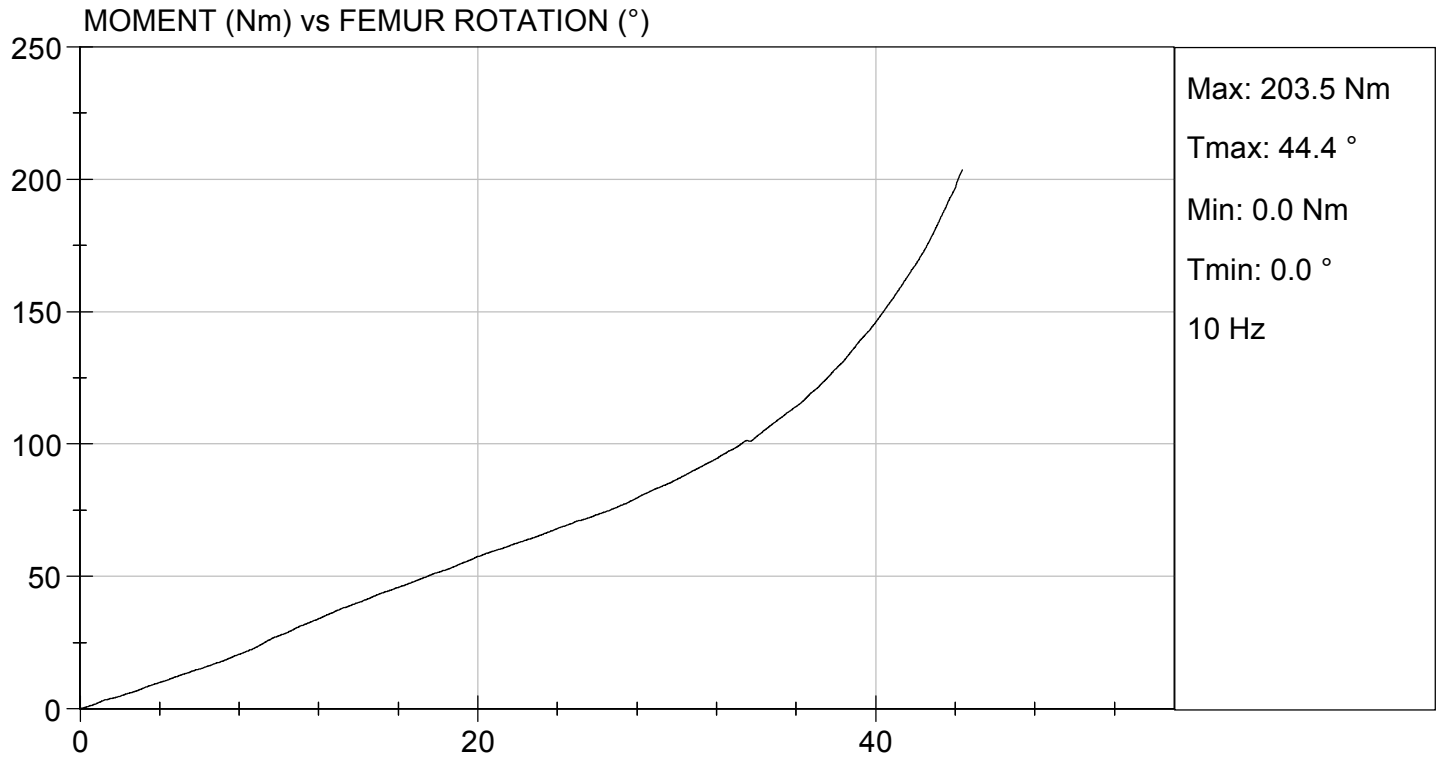
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.7	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	21	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.5	6.4	Pass
30 Degrees	Nm	94.9 Nm Max	88.5	86.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	46.9	44.4	Pass
Overall Test Results					Pass


Laboratory Technician

01/24/2019
Test Date


Approved By





CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

Hybrid III, 5th External Measurements
SN: 138

HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	785.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	456.8
C	H-POINT HEIGHT	Reference	81.3-86.3	84.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	146.2
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	78.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	127.5
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	249.6
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	280.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	201.9
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	526.7
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.3
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	398.0

N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	430.5
HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	184.6
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	221.0
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	472.6
S	HEAD BREADTH	The widest part of the head	137.1-147.3	141.9
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	184.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	307.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	360.5
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	85.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	546.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	875.1
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	785.4
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.4
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.1

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

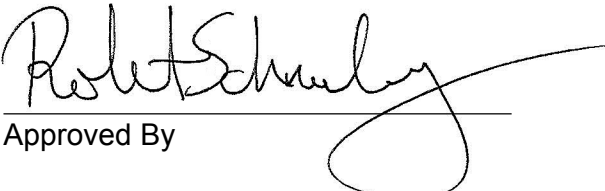
Test ID: D190181

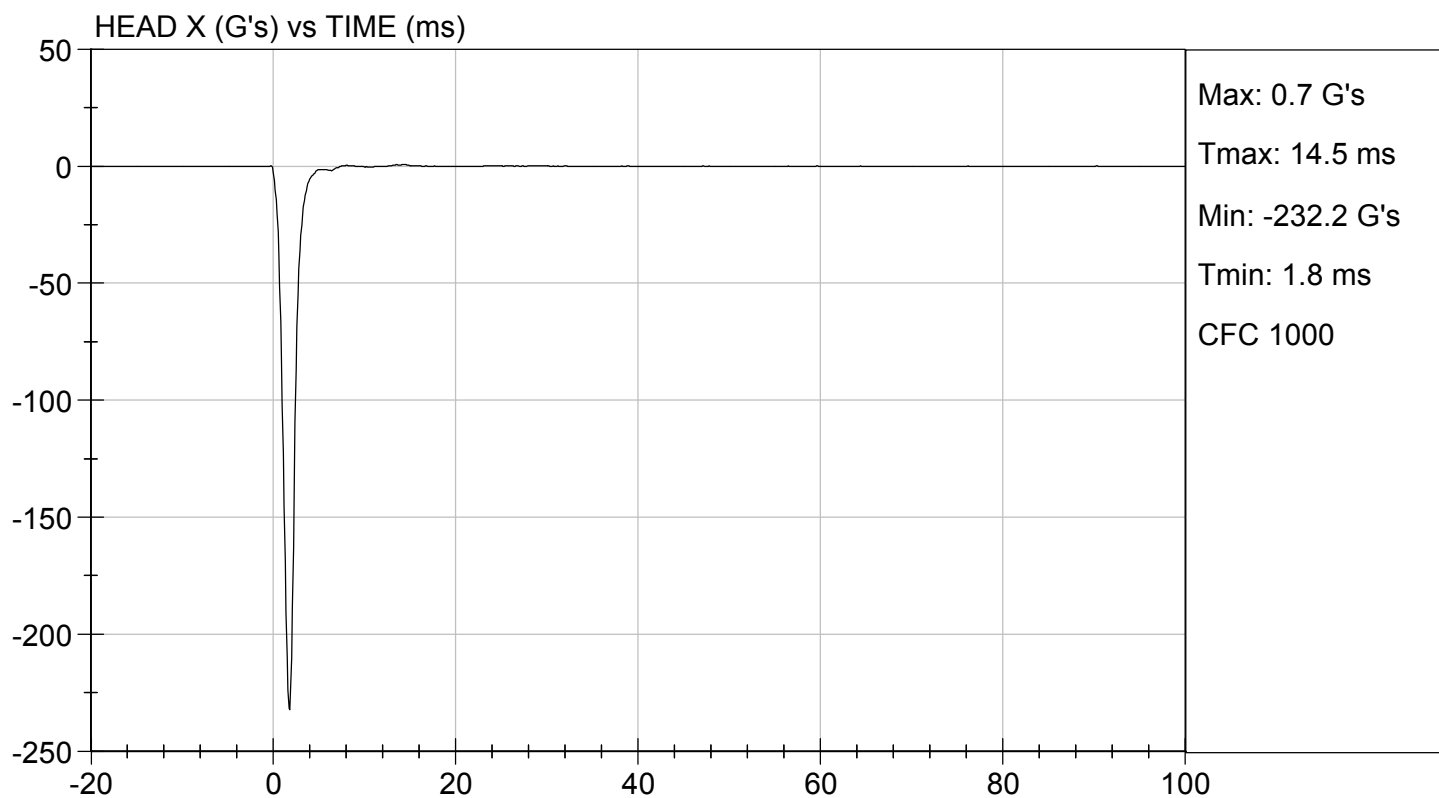
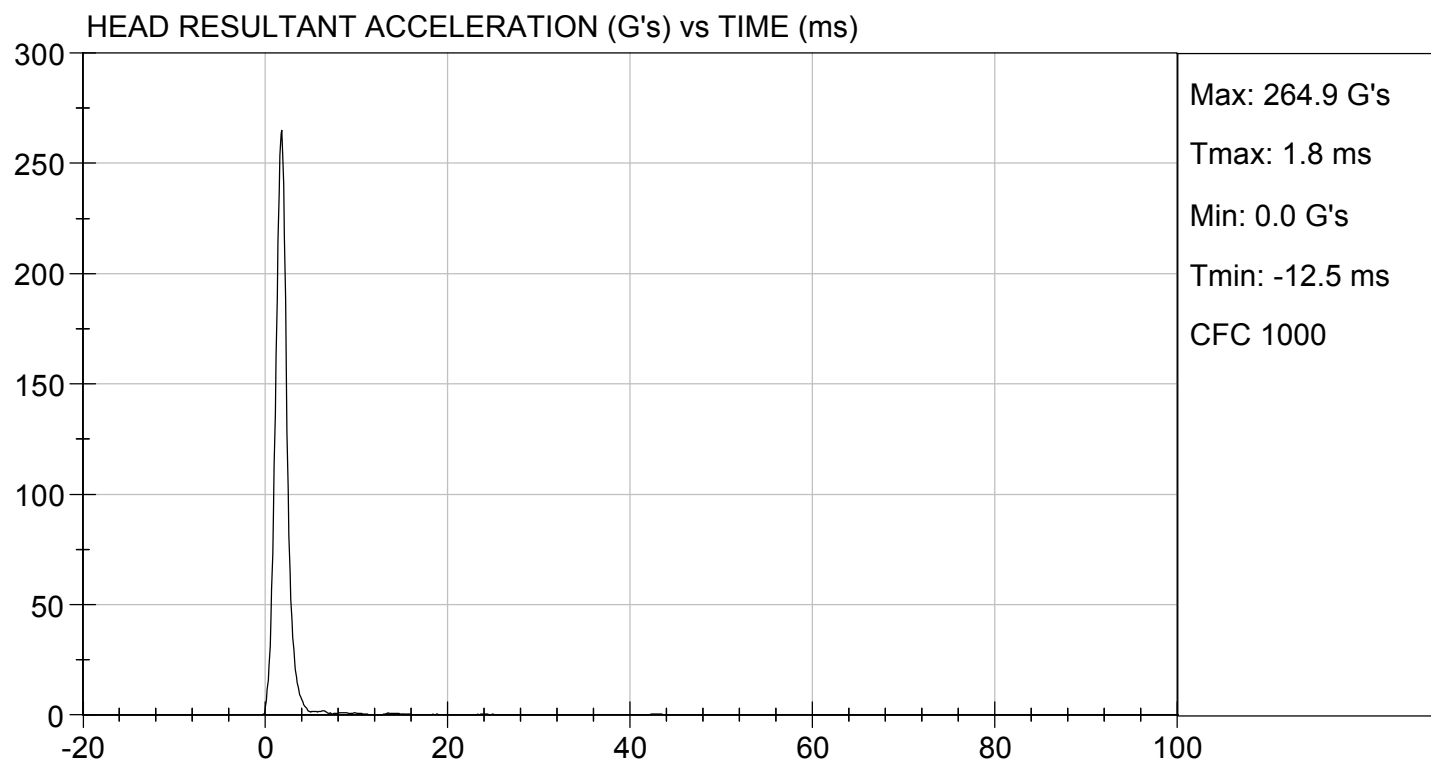
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	250 to 300	265	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-1.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

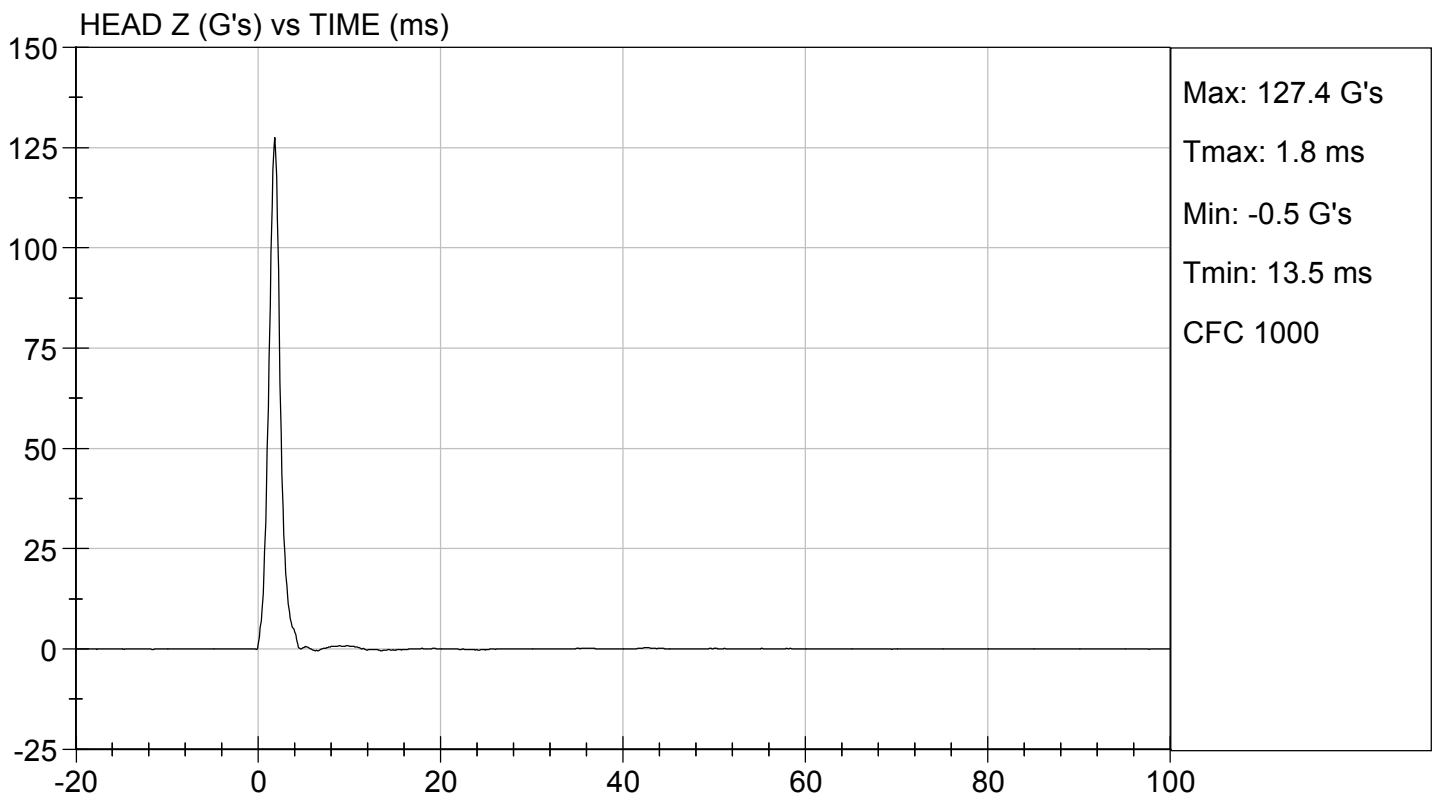
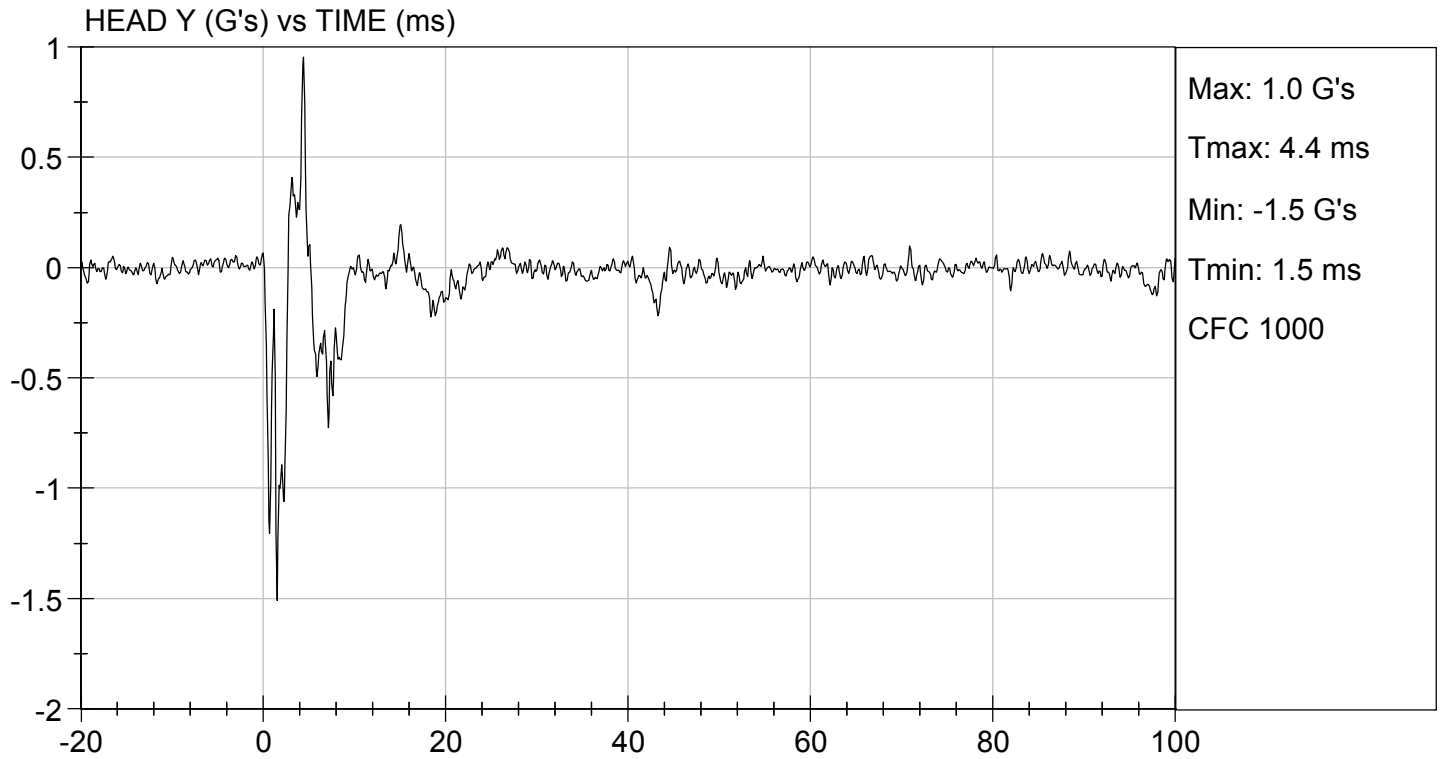

Laboratory Technician

01/14/2019

Test Date


Approved By





MGA RESEARCH CORPORATION

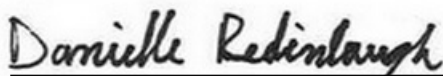
NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D190182

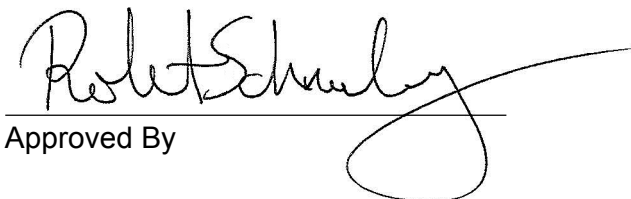
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	21.4	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.13	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.8	Pass
	30 ms	m/s	5.8 to 7.0	6.8	Pass
D Plane Rotation	Max	deg	77 to 91	80	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	70	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	83	Pass
Overall Results					Pass



Laboratory Technician

01/14/2019

Test Date

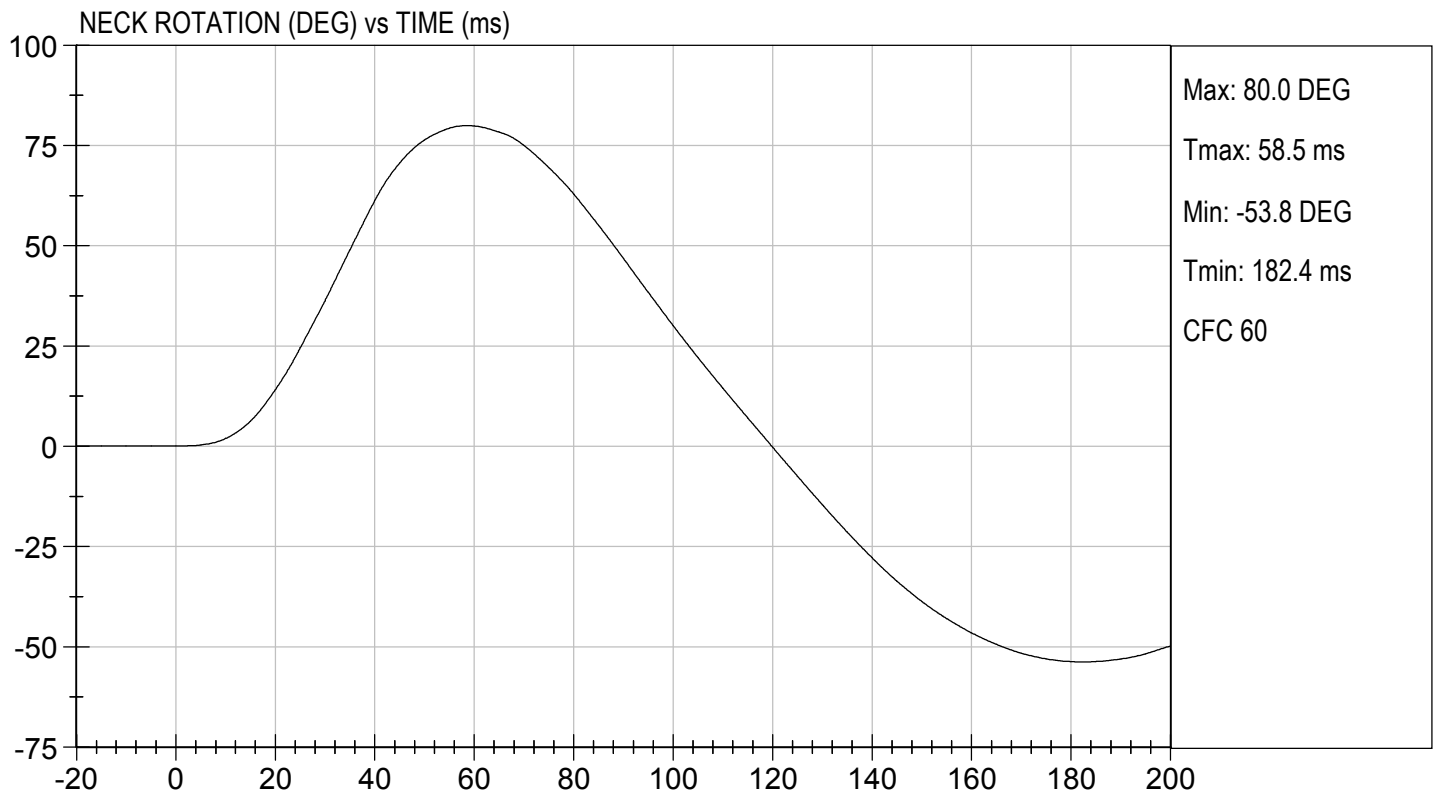
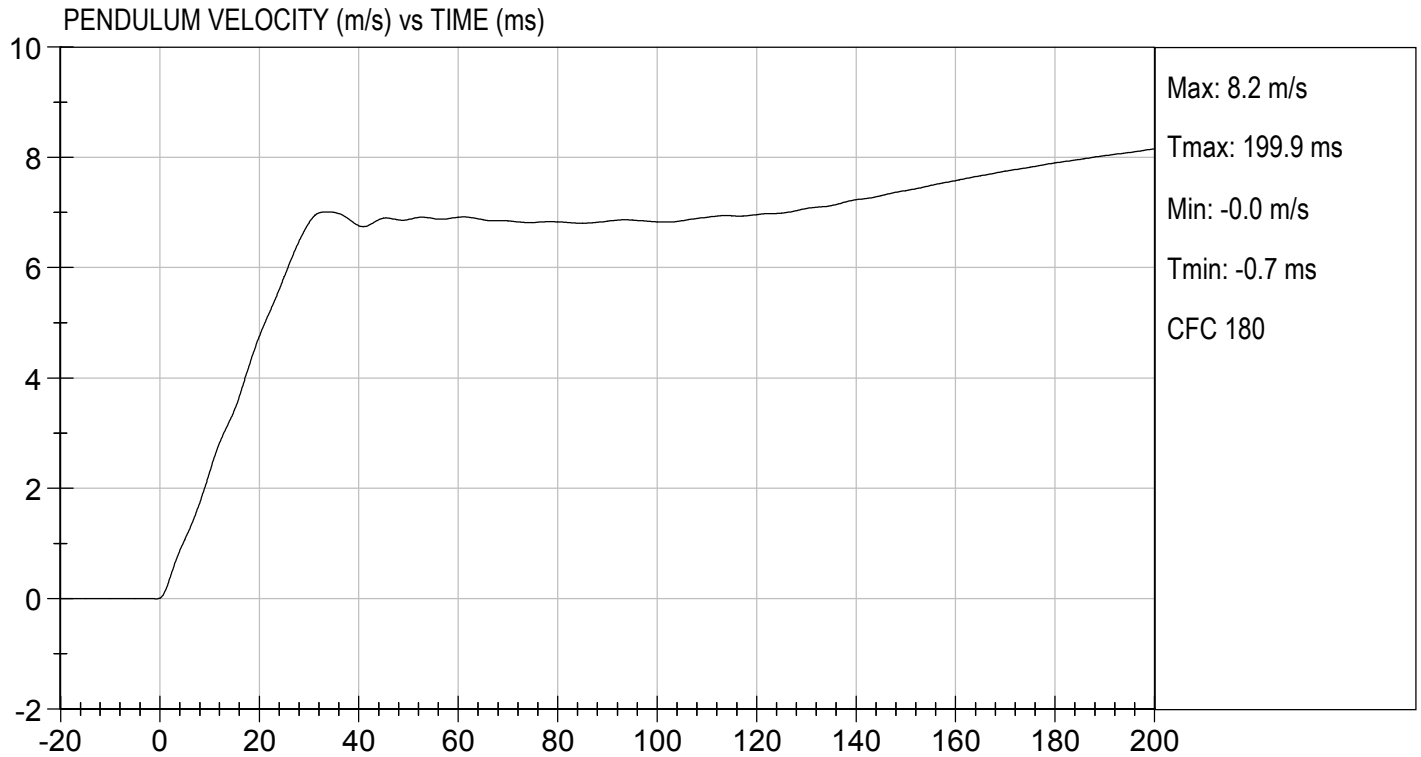


Approved By



TEST DESC: NECK FLEXION
VELOCITY: 23.40 ft/s, 7.13 m/s

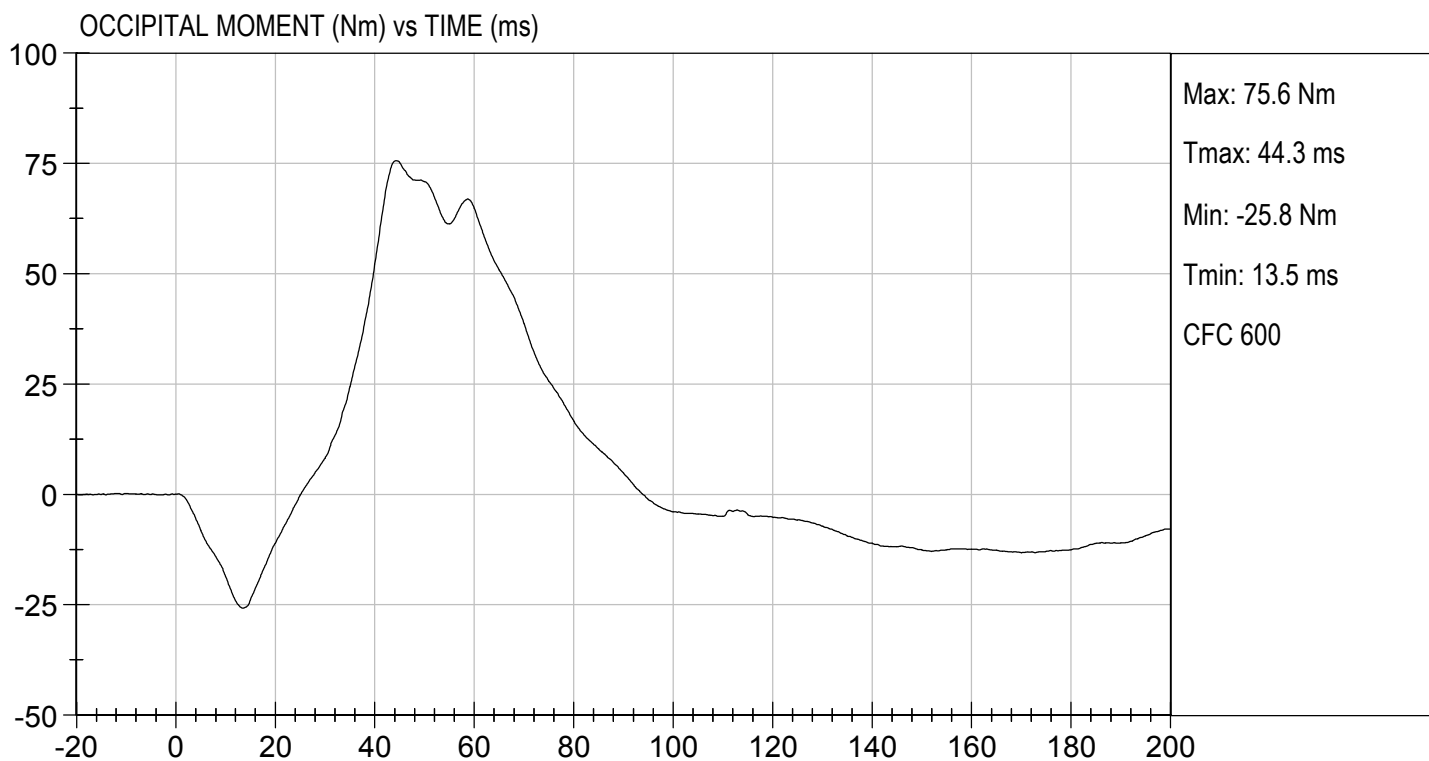
TEST DATE: 01/14/2019
TEST #: D190182





TEST DESC: NECK FLEXION
VELOCITY: 23.40 ft/s, 7.13 m/s

TEST DATE: 01/14/2019
TEST #: D190182

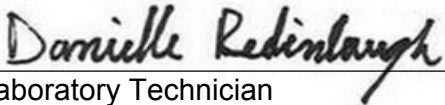


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

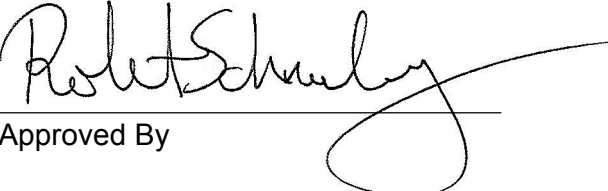
ATD Serial No: 138

Test I.D: D190183

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	21.4	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.19	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.7	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-57	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	102	Pass
Overall Results					Pass


Laboratory Technician

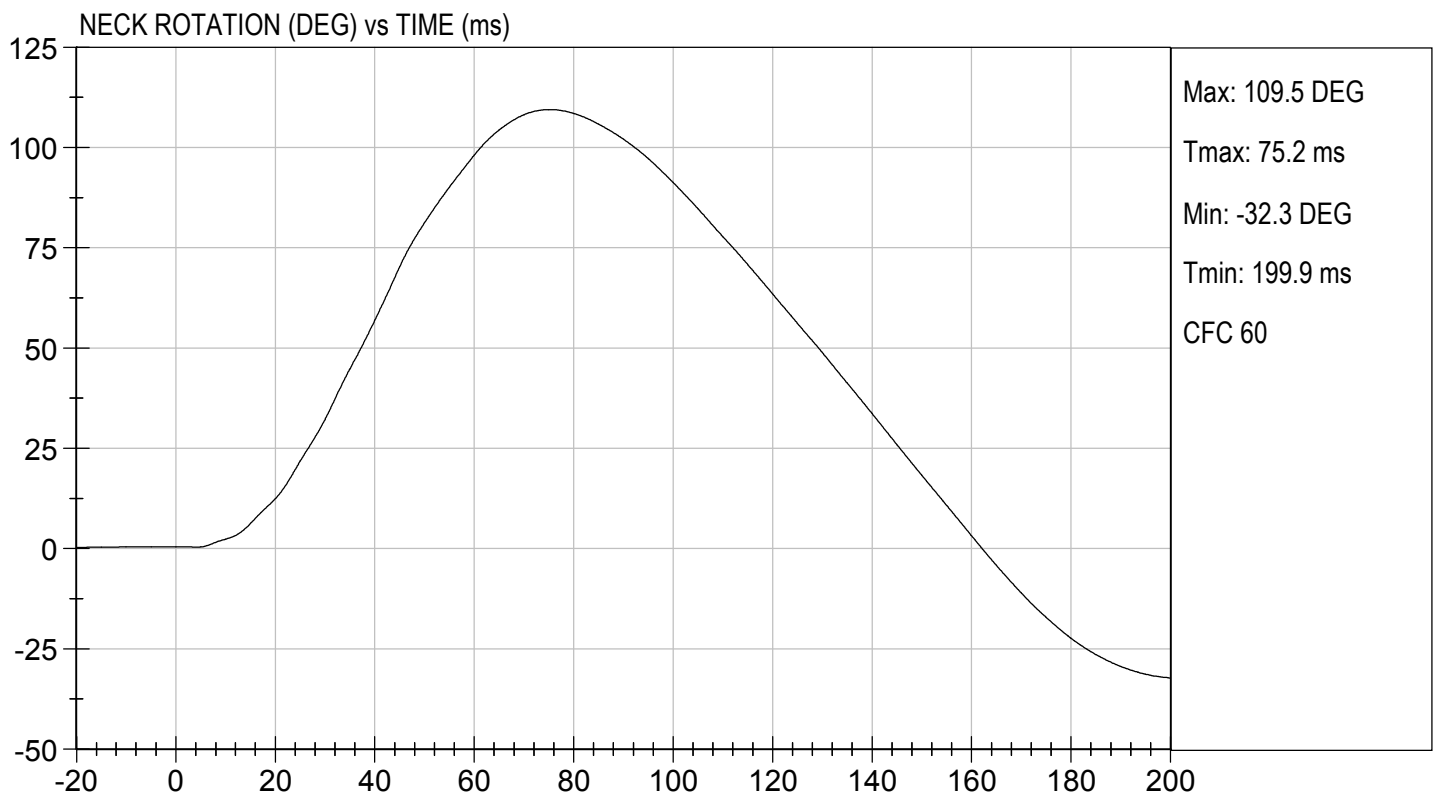
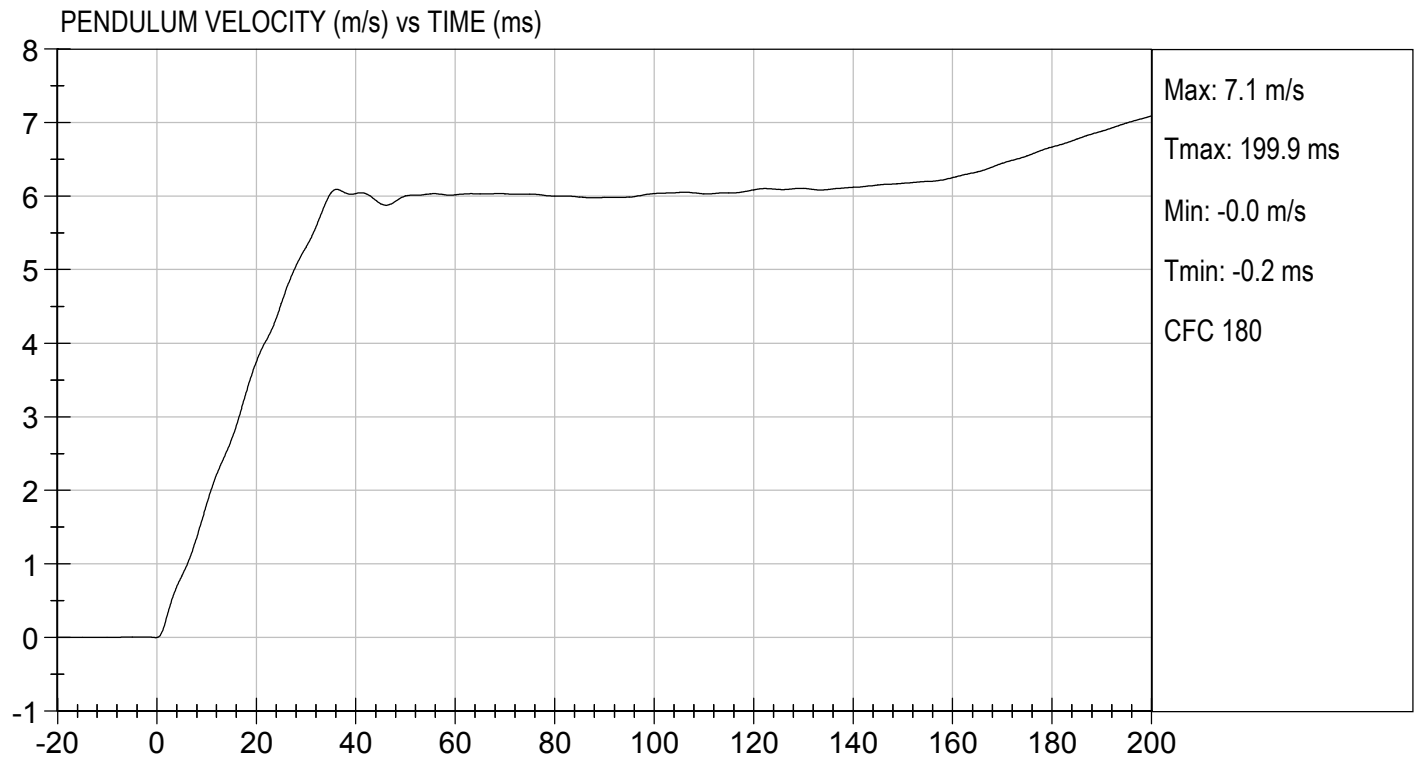
01/14/2019
Test Date


Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

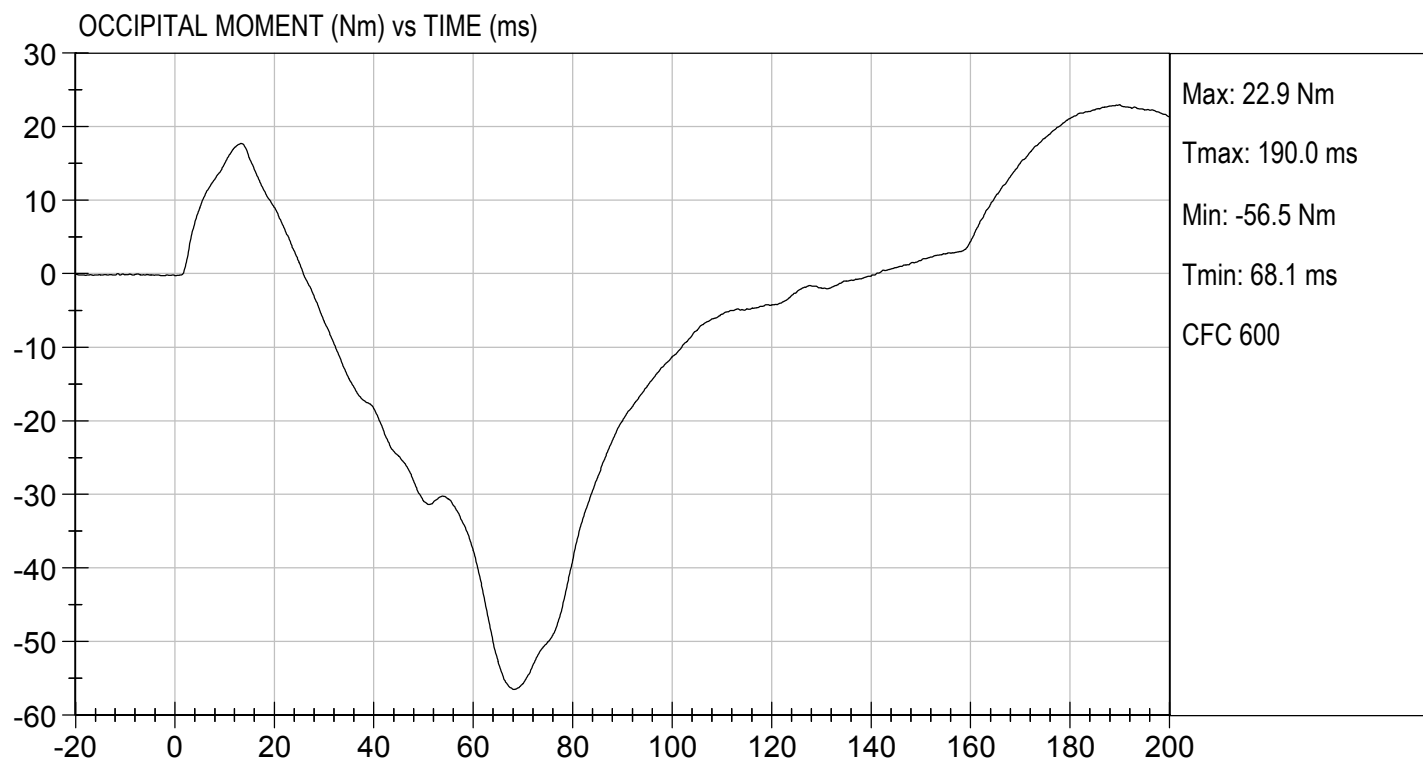
TEST DATE: 01/14/2019
TEST #: D190183





TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 01/14/2019
TEST #: D190183



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

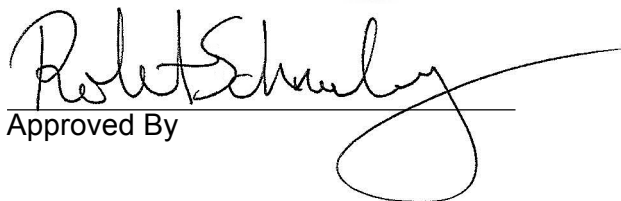
Test I.D: D190184

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Relative Humidity	%	10 to 70	22	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4292	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4293	Pass
Overall Test Results				Pass


Laboratory Technician

01/15/2019

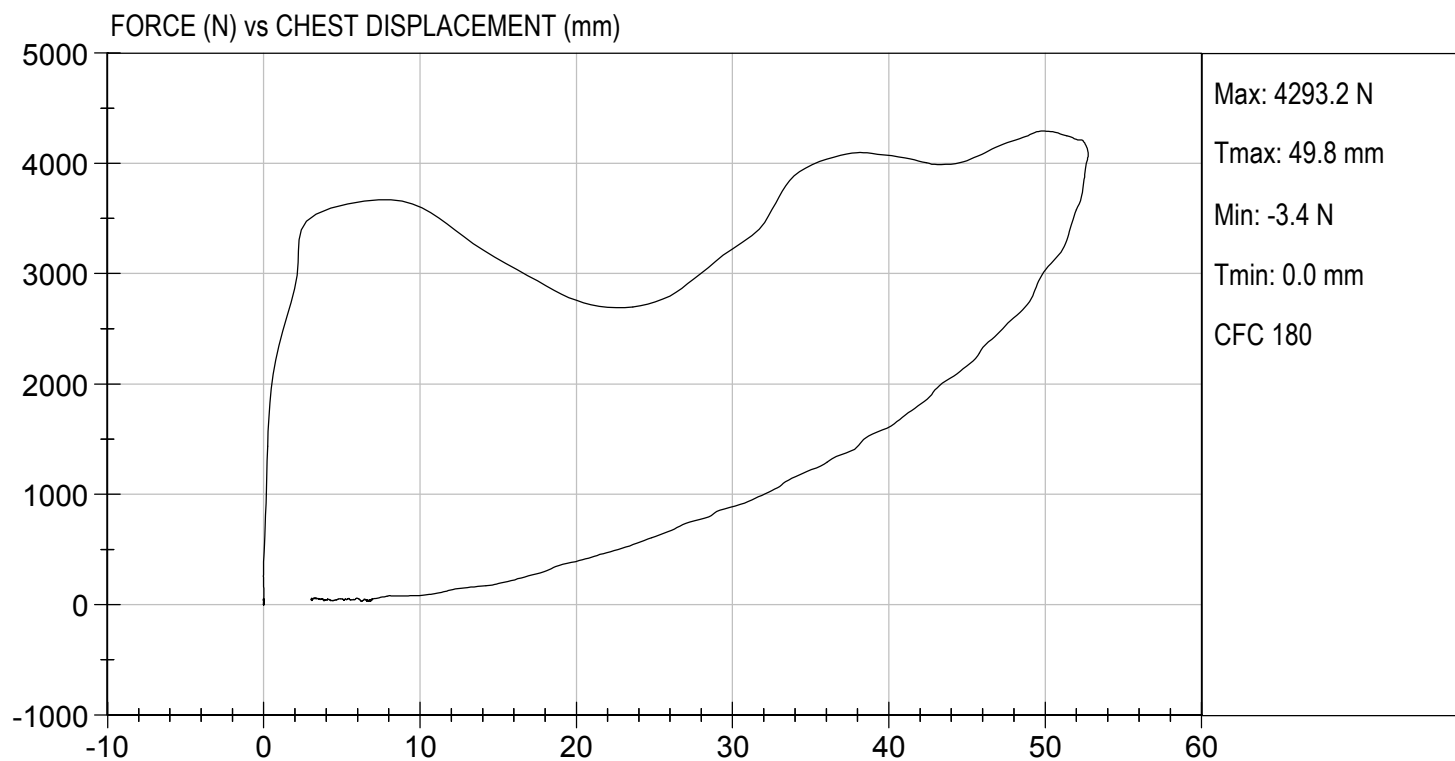
Test Date


Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 01/15/2019
TEST #: D190184



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

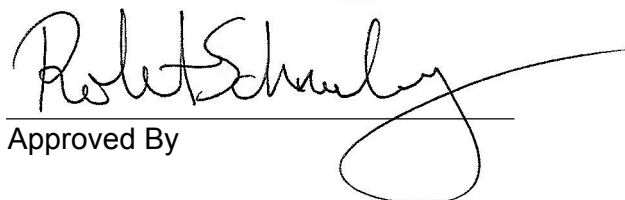
Test I.D: D190185

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	20.3	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3496	Pass
Overall Test Results				Pass


Laboratory Technician

01/14/2019

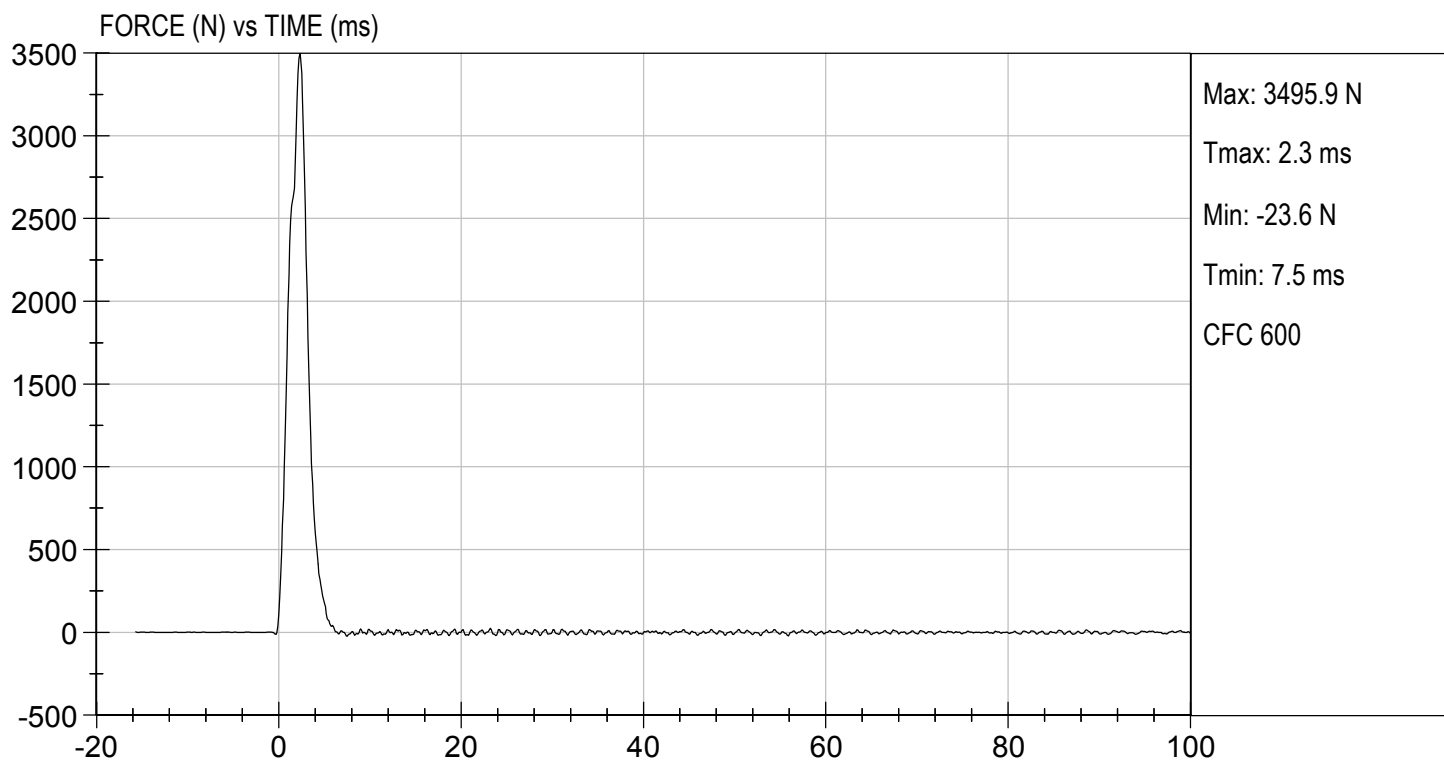
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 01/14/2019
TEST #: D190185



MGA RESEARCH CORPORATION

**LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE**

ATD Serial No: 138

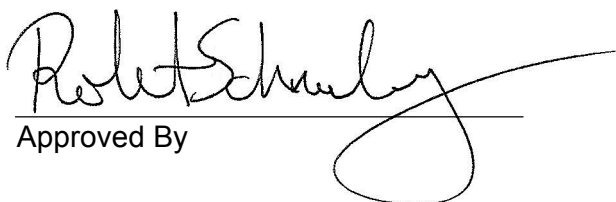
Test I.D: D190186

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	20.3	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3531	Pass
Overall Test Results				Pass


Laboratory Technician

01/14/2019

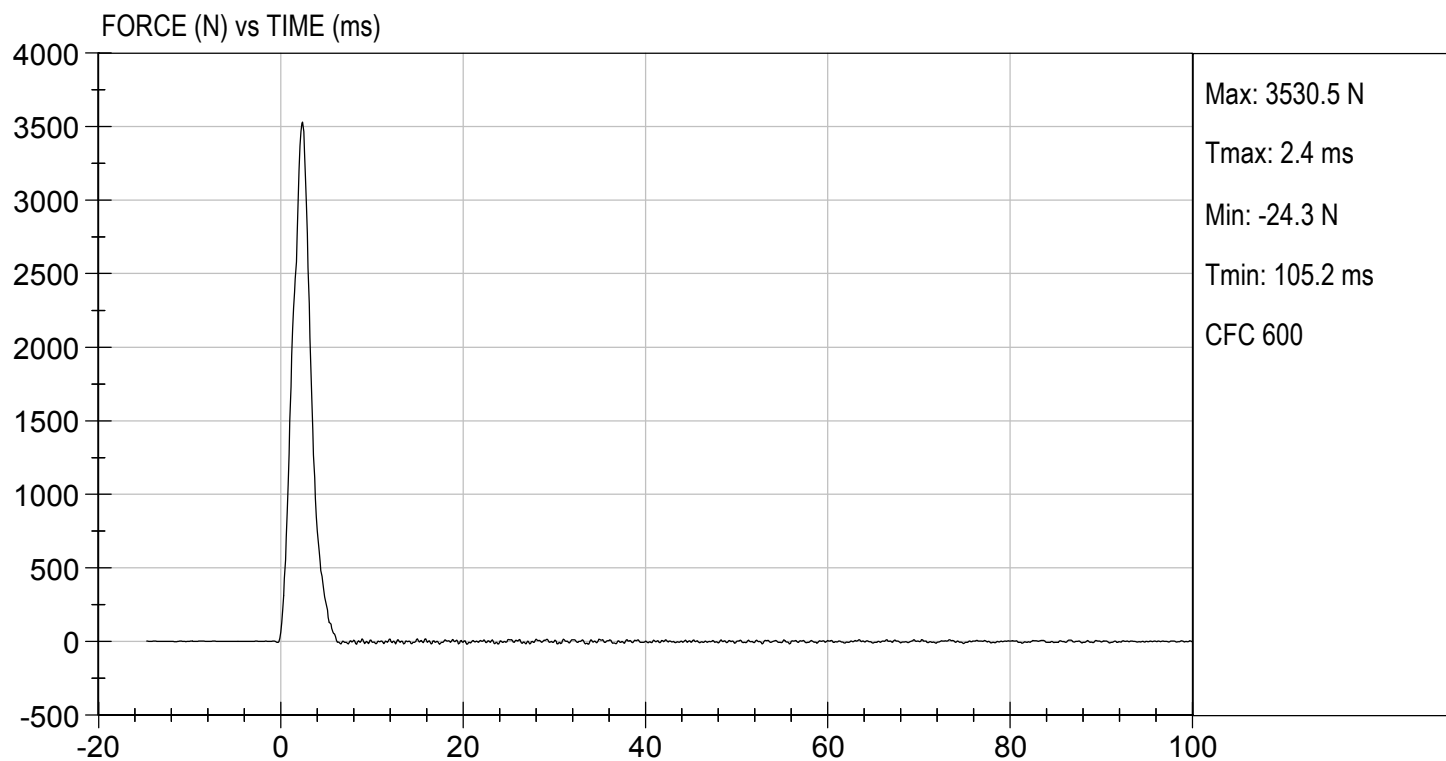
Test Date


Approved By



TEST DESC: LEFT KNEE
VELOCITY: 6.94 ft/s, 2.12 m/s

TEST DATE: 01/14/2019
TEST #: D190186



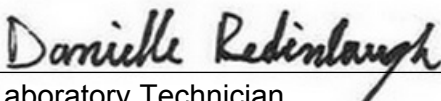
MGA RESEARCH CORPORATION

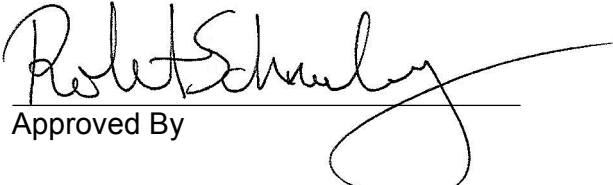
**TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE**

ATD Serial No: 138

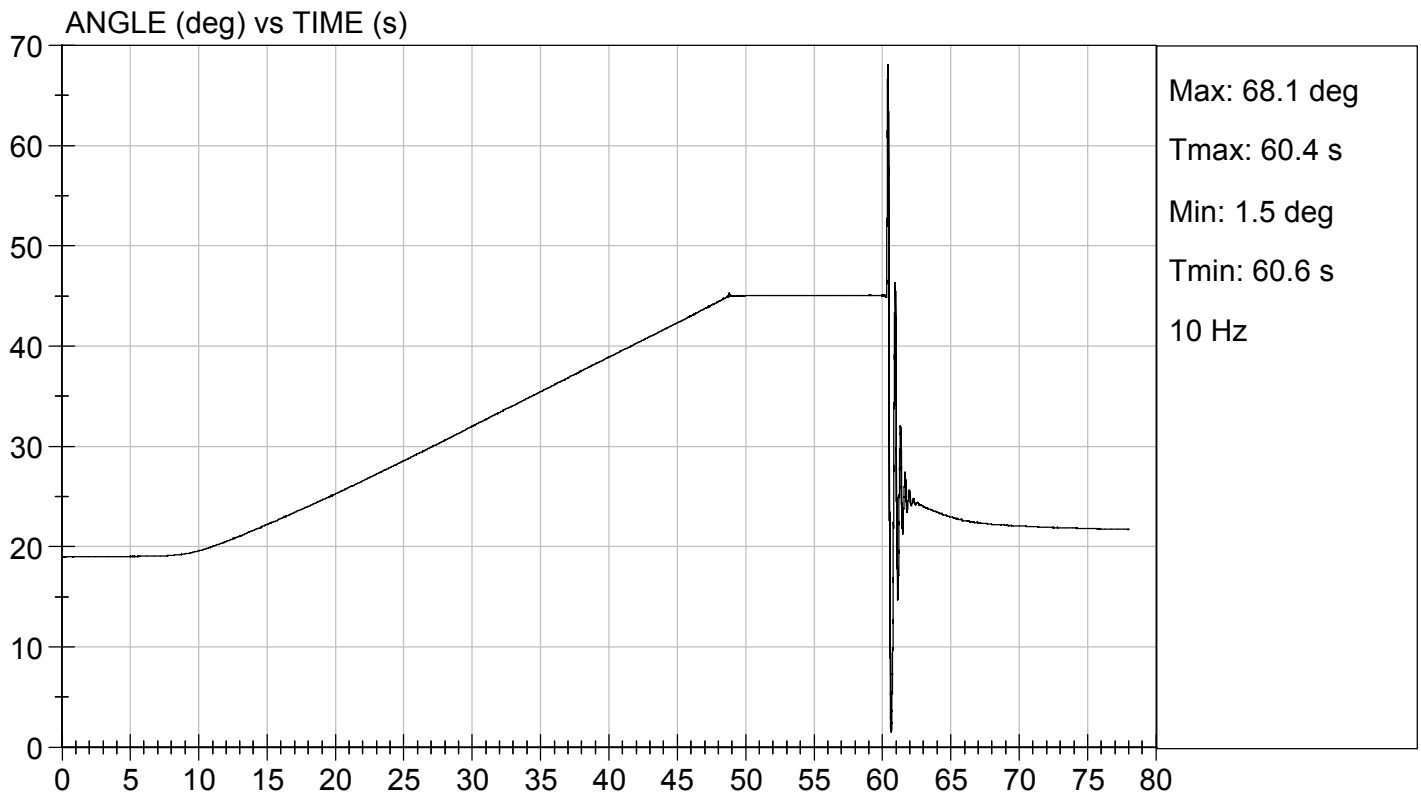
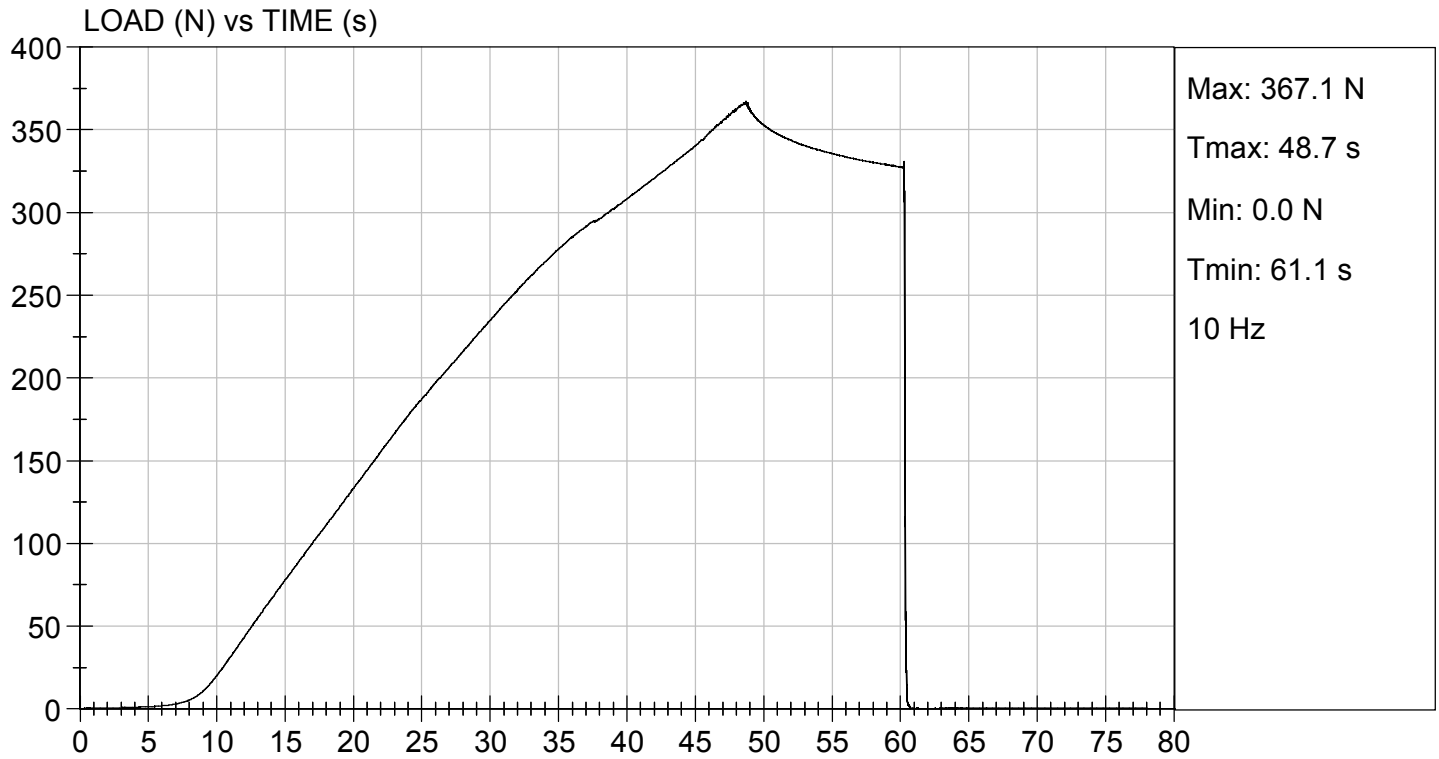
Test I.D: D190187

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	3	Pass
Force at 45 deg	N	320 to 390	367	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.7	Pass
Overall Result				Pass


Laboratory Technician


Approved By

01/14/2019
Test Date



CALIBRATION TEST RESULTS

POST-TEST

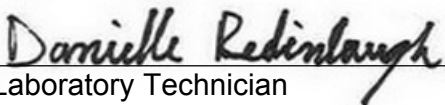
HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

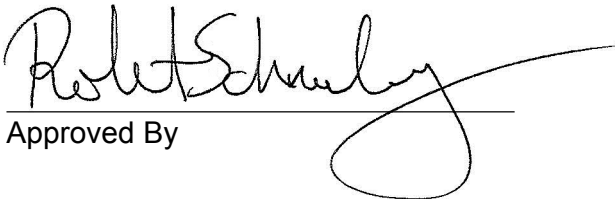
Test ID: D190331

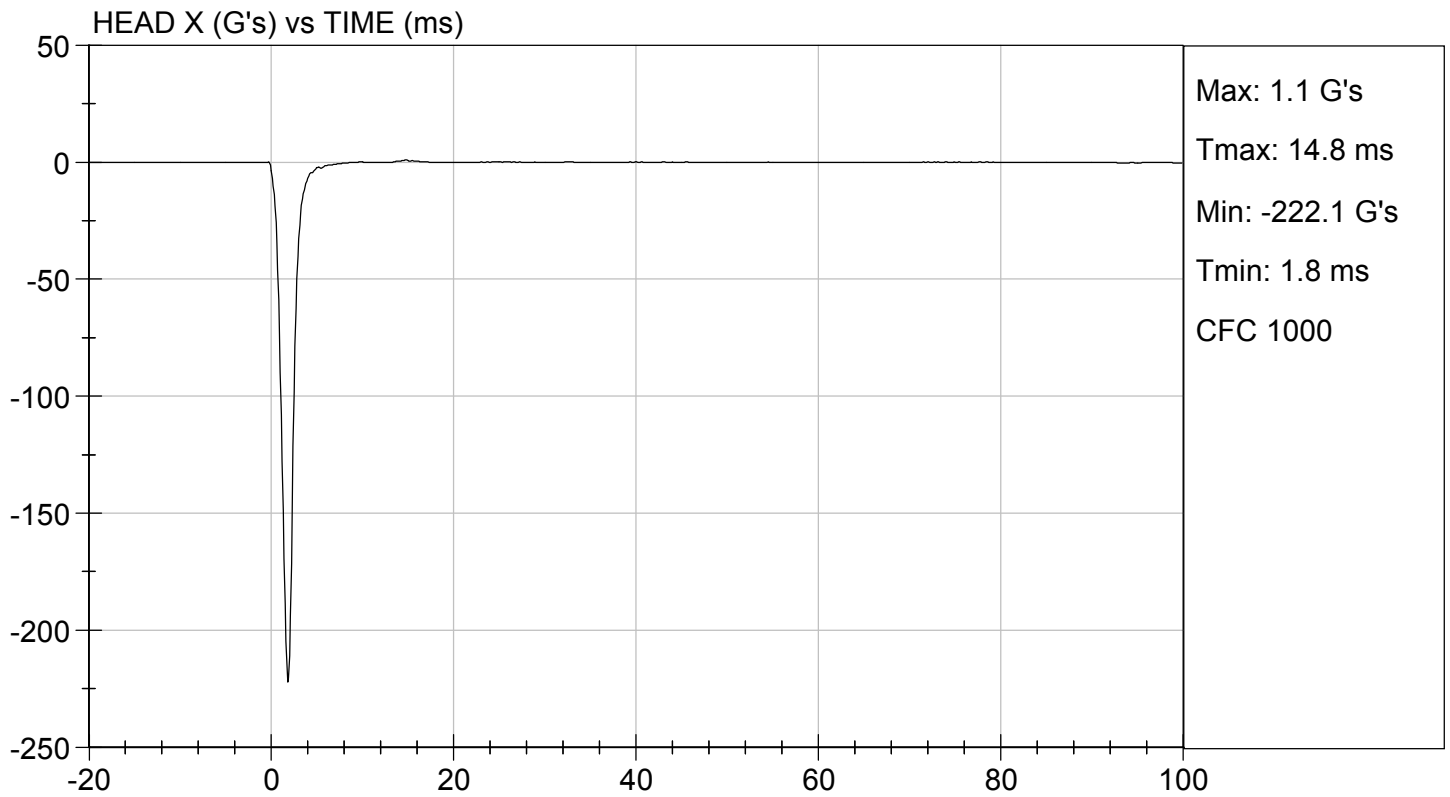
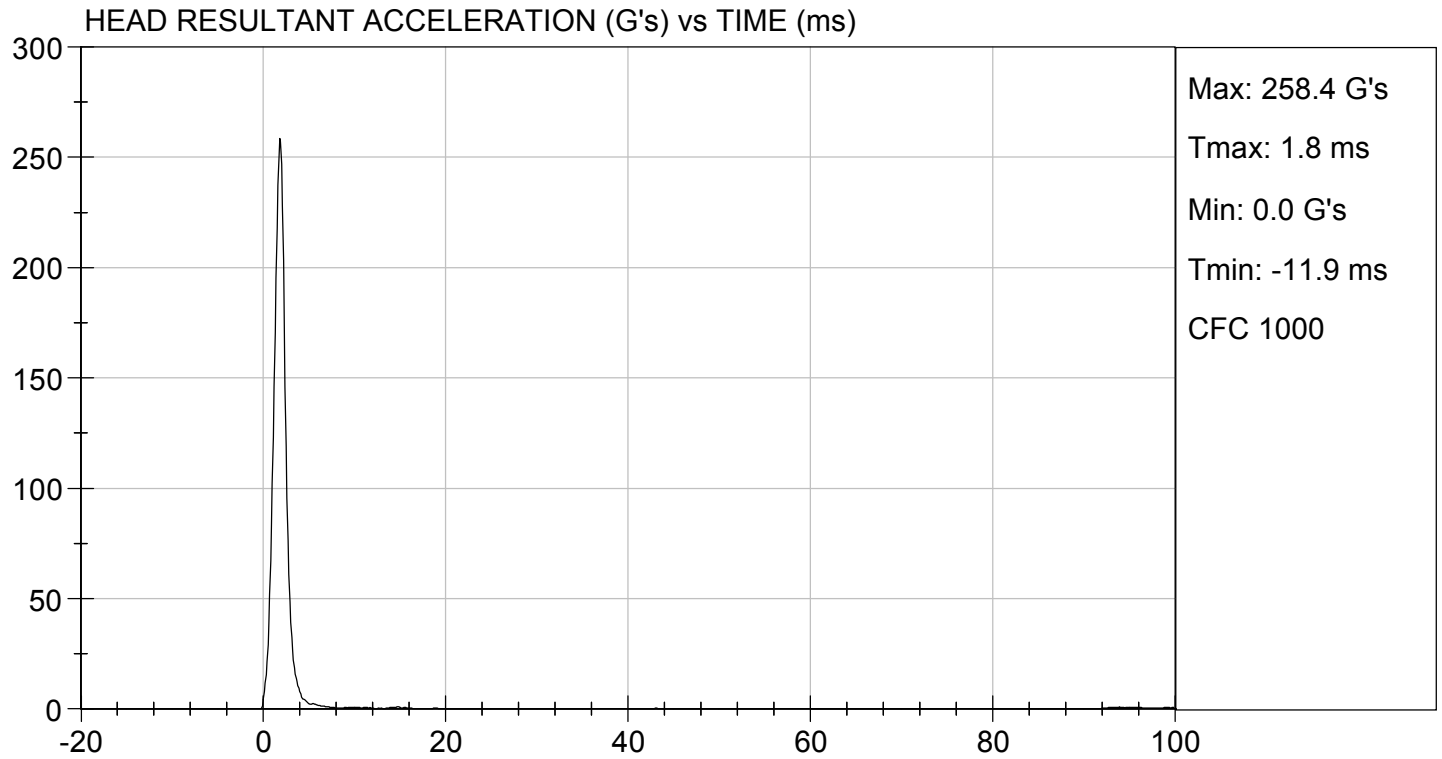
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	250 to 300	258	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	6.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

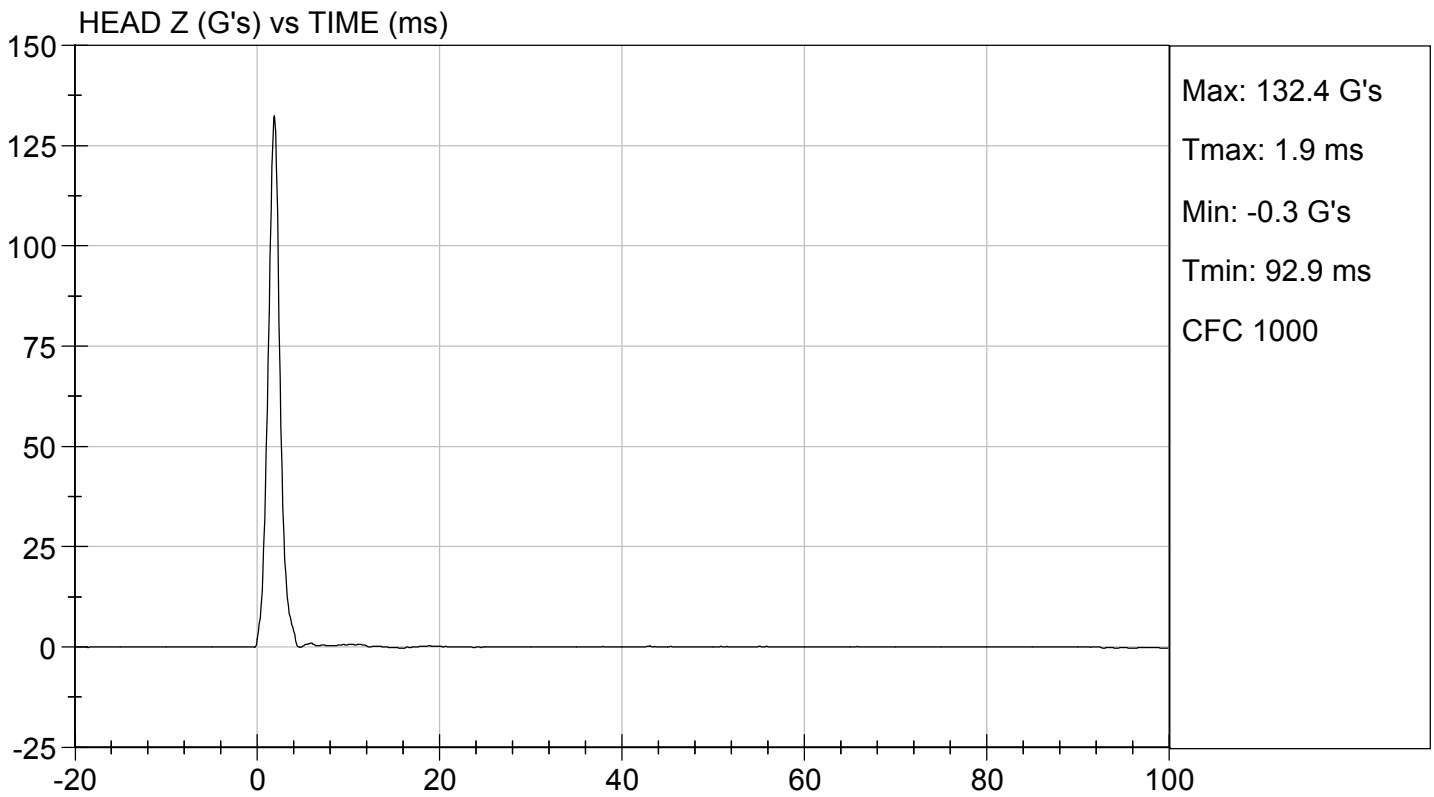
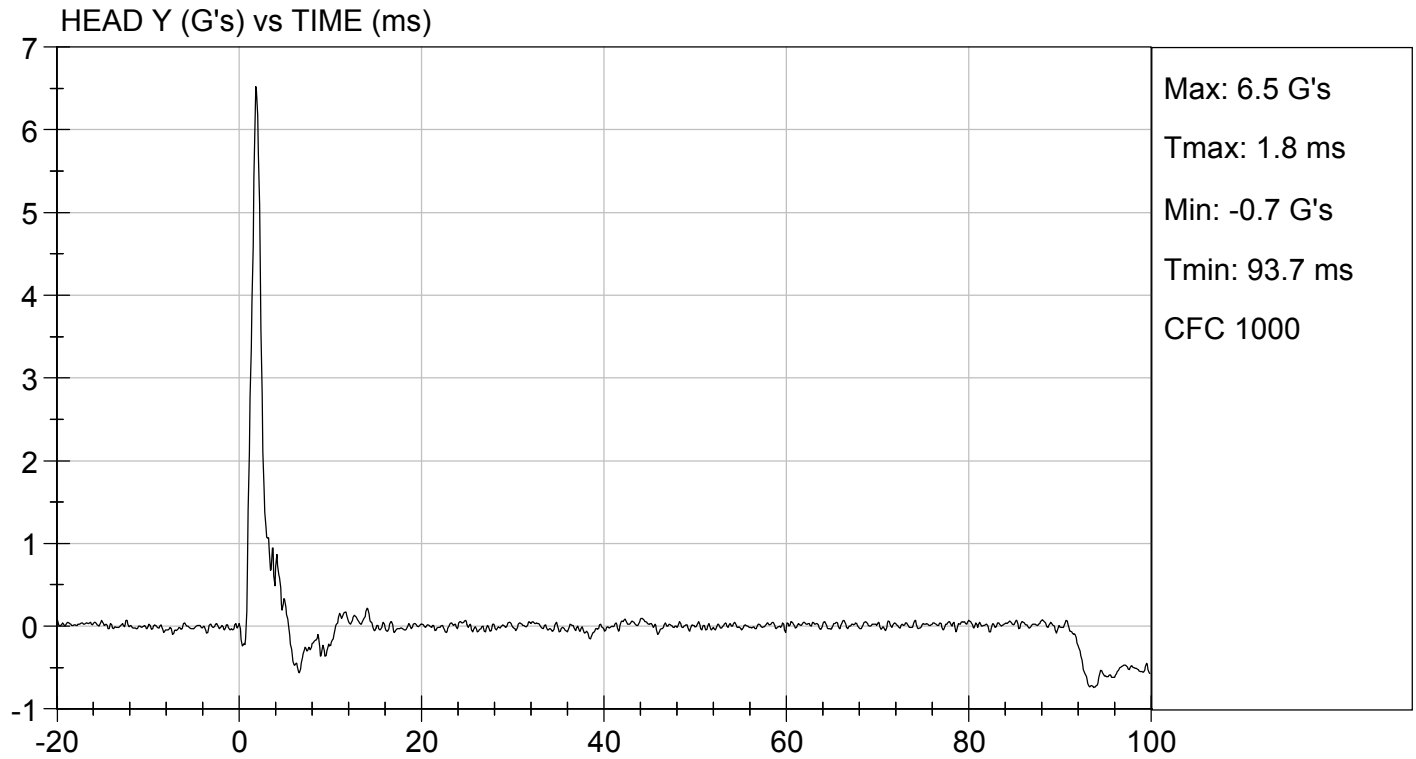

Laboratory Technician

01/24/2019

Test Date


Approved By





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D190332

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	16	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.1	Pass
	20 ms	m/s	4.0 to 5.0	4.4	Pass
	30 ms	m/s	5.8 to 7.0	6.5	Pass
D Plane Rotation	Max	deg	77 to 91	84	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	71	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
Overall Results					Pass

Danielle Redinlaugh
Laboratory Technician

01/28/2019

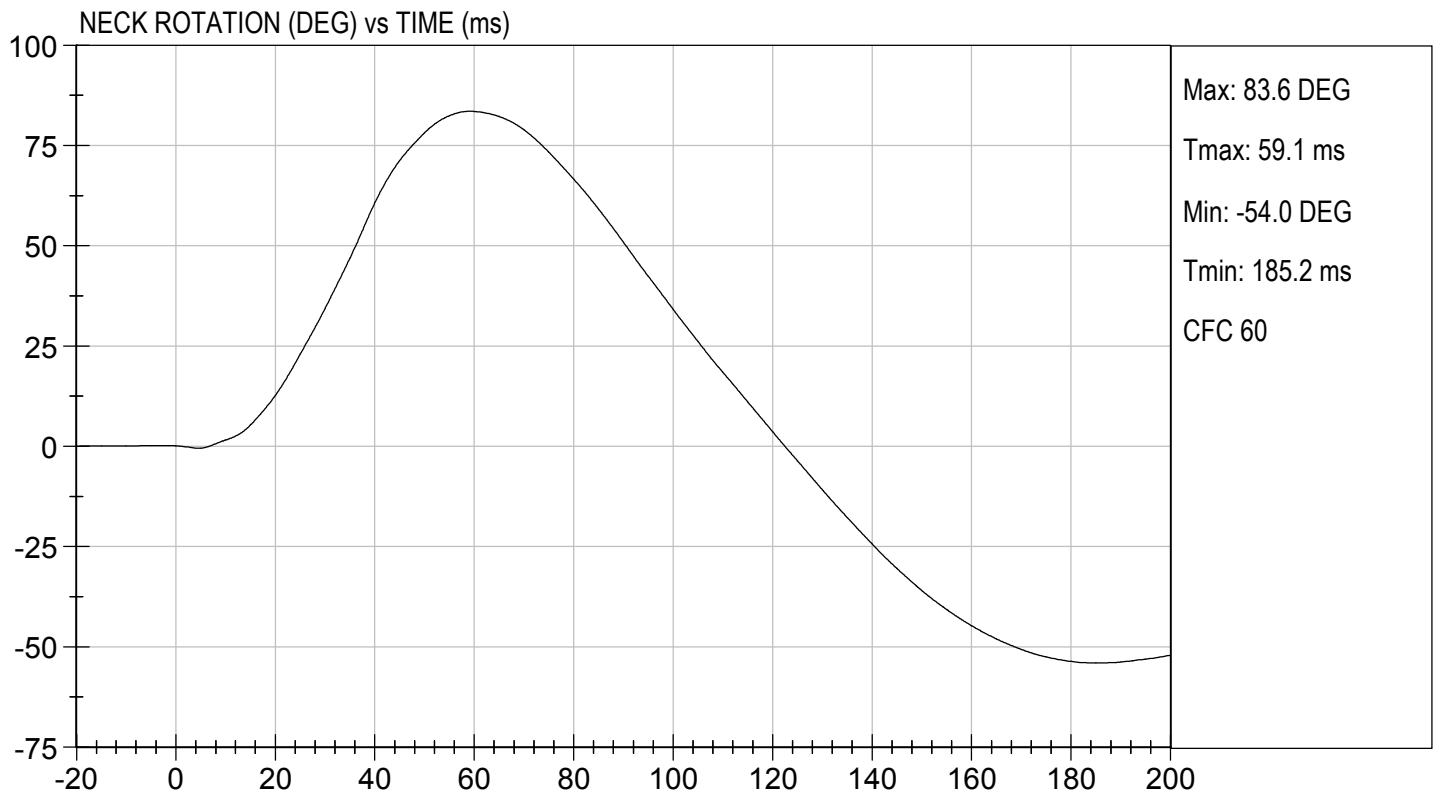
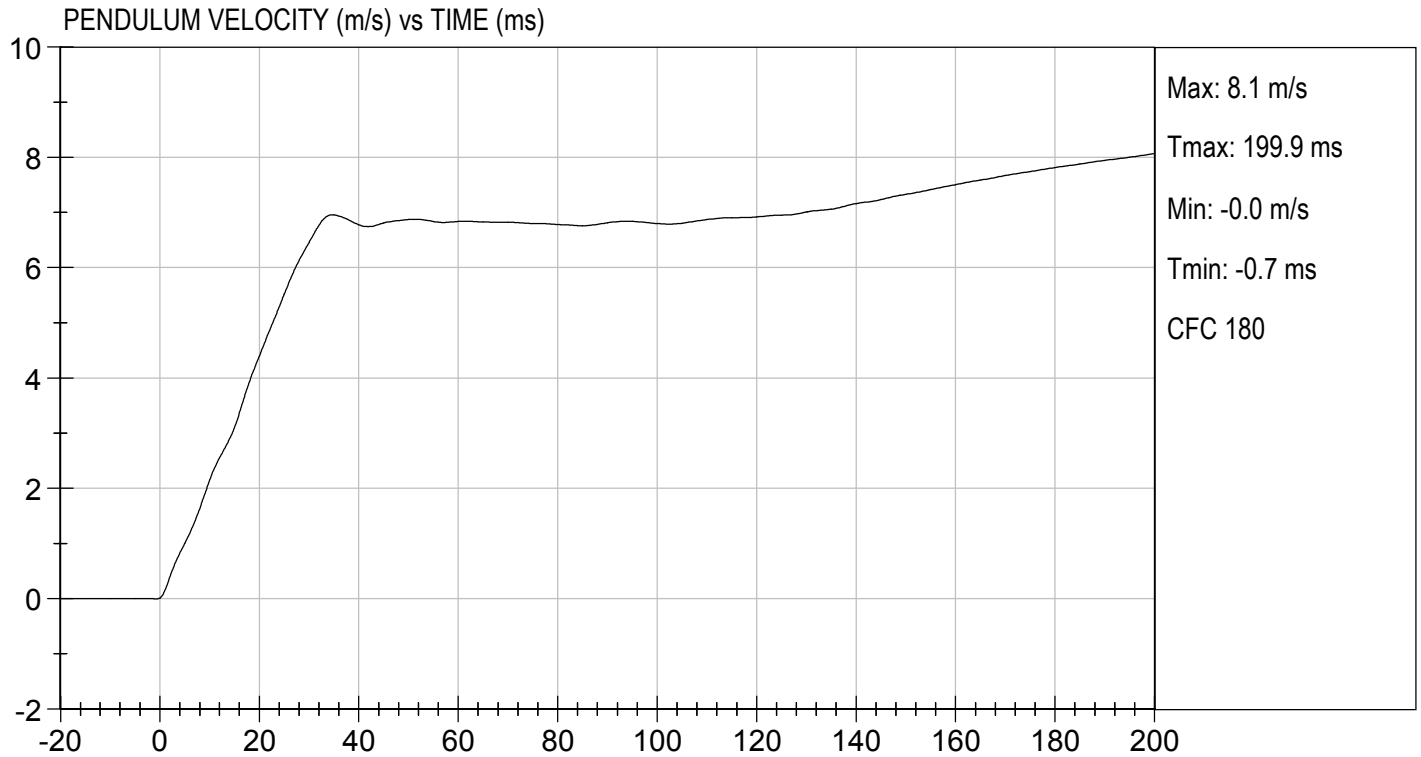
Test Date

Robert Schaubert
Approved By



TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

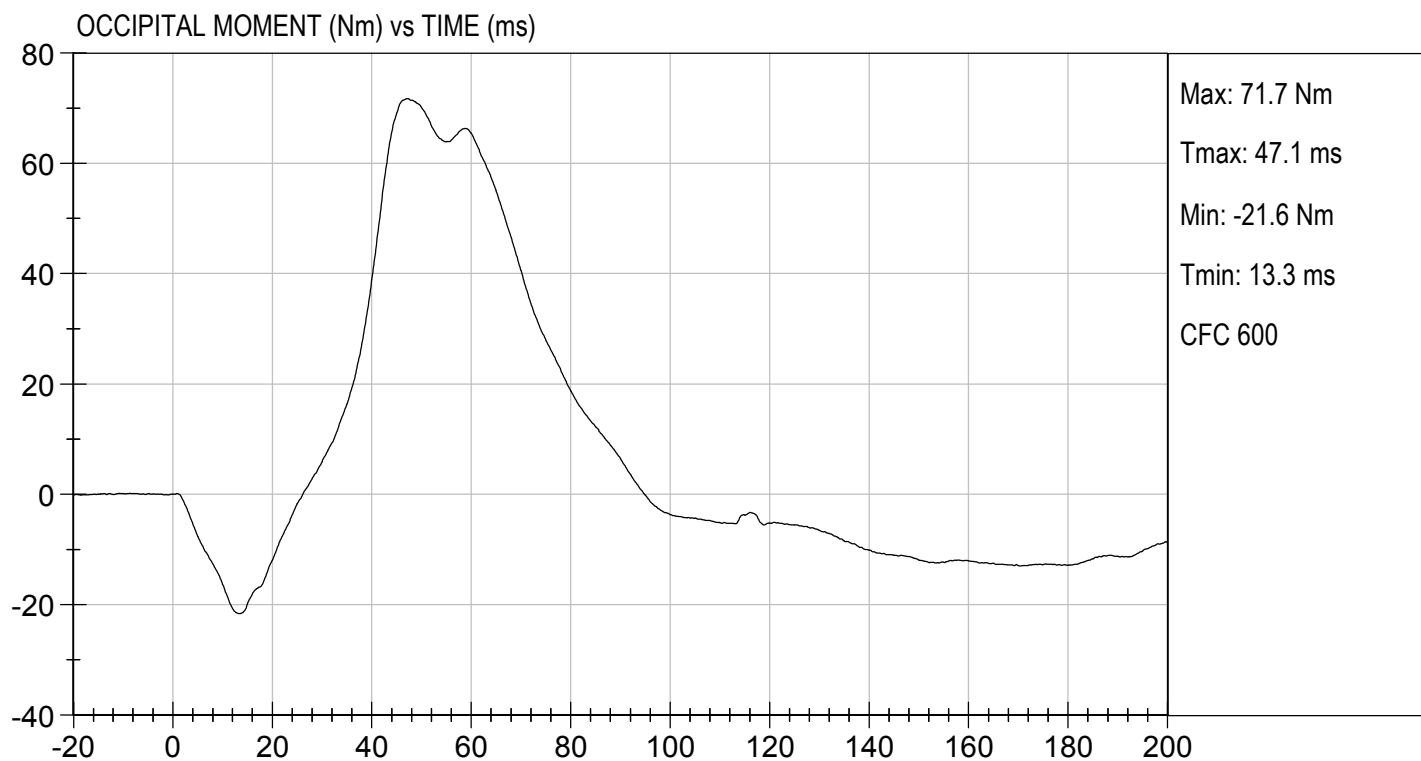
TEST DATE: 01/28/2019
TEST #: D190332





TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 01/28/2019
TEST #: D190332



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

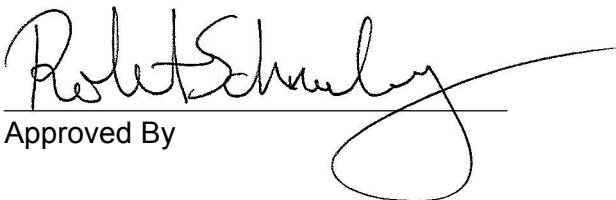
ATD Serial No: 138

Test I.D: D190333

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	16	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.19	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	108	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	103	Pass
Overall Results					Pass


Laboratory Technician

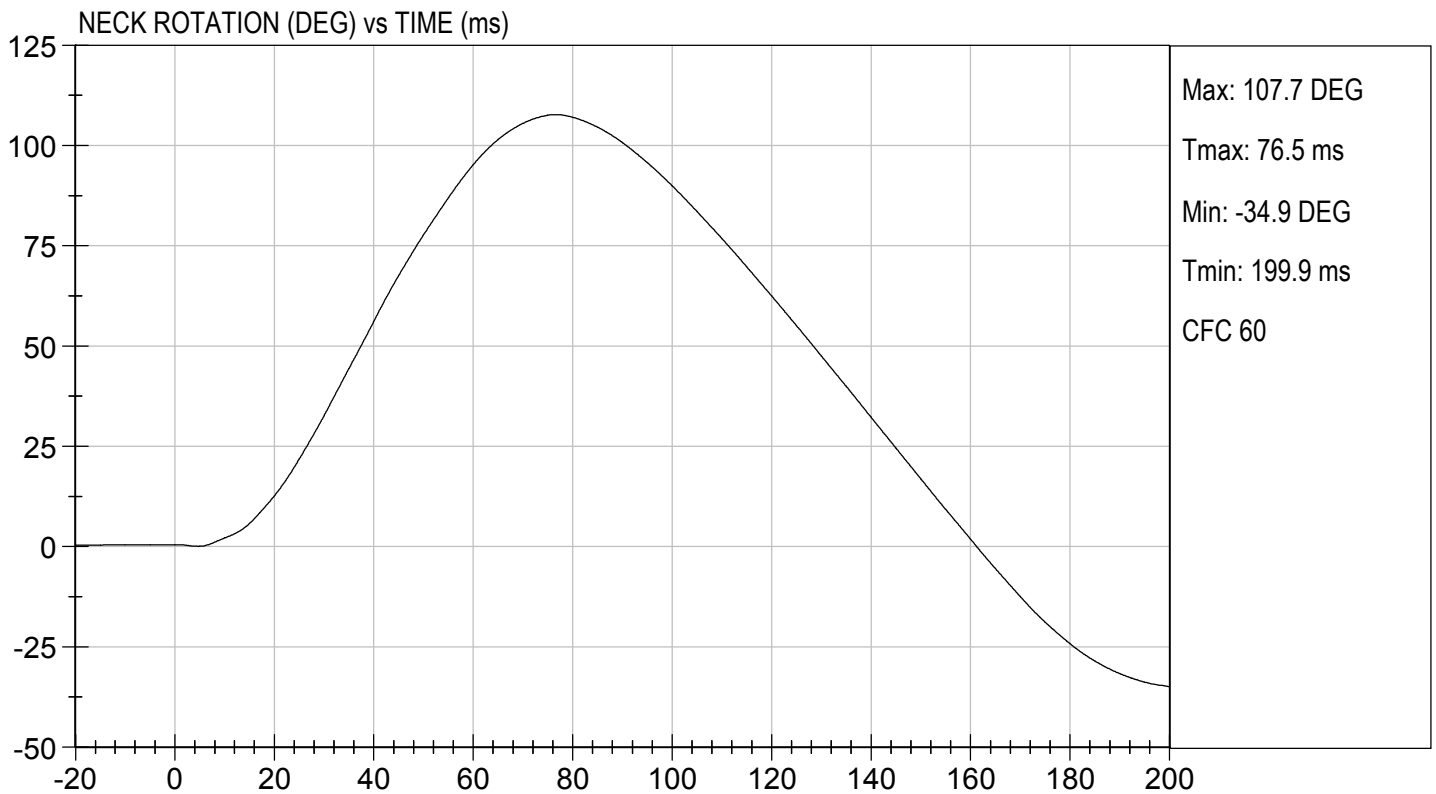
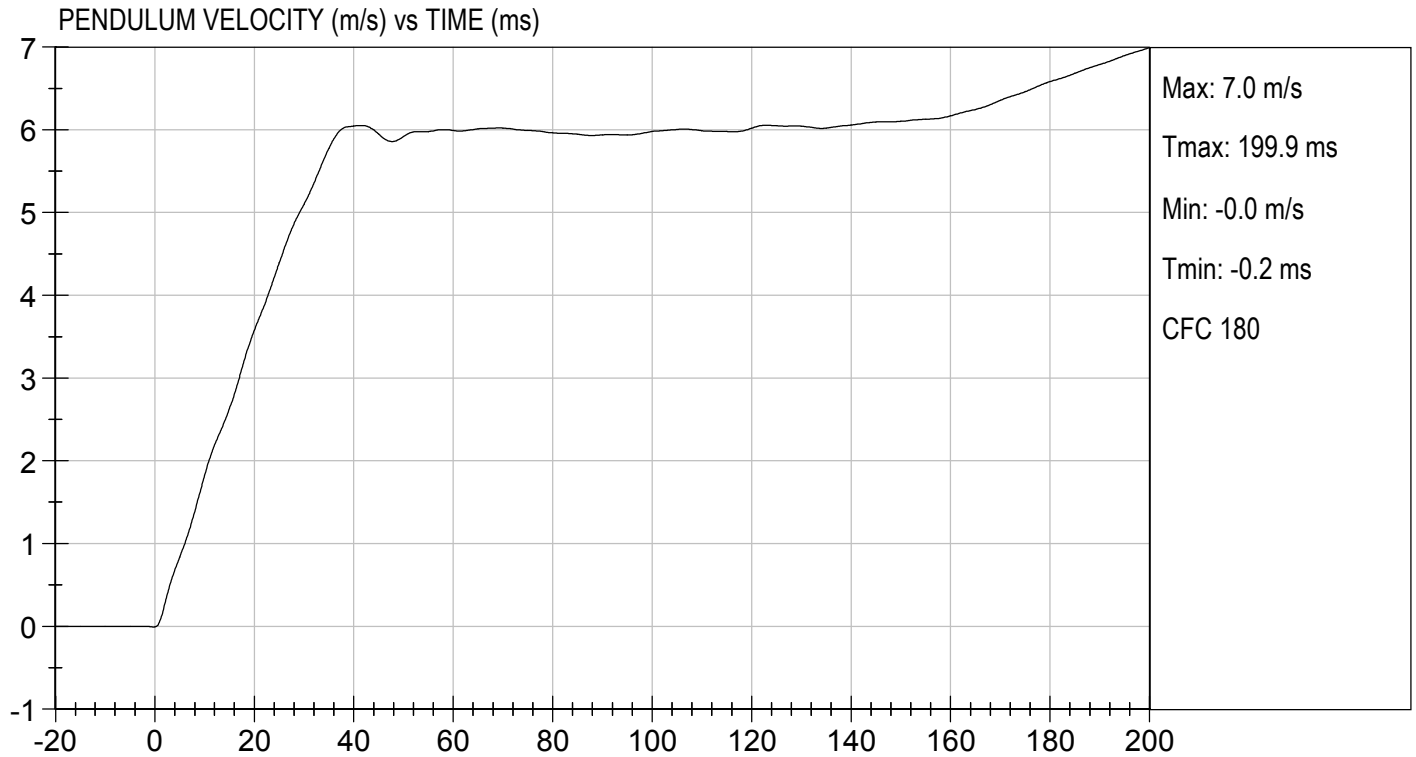
01/28/2019
Test Date


Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

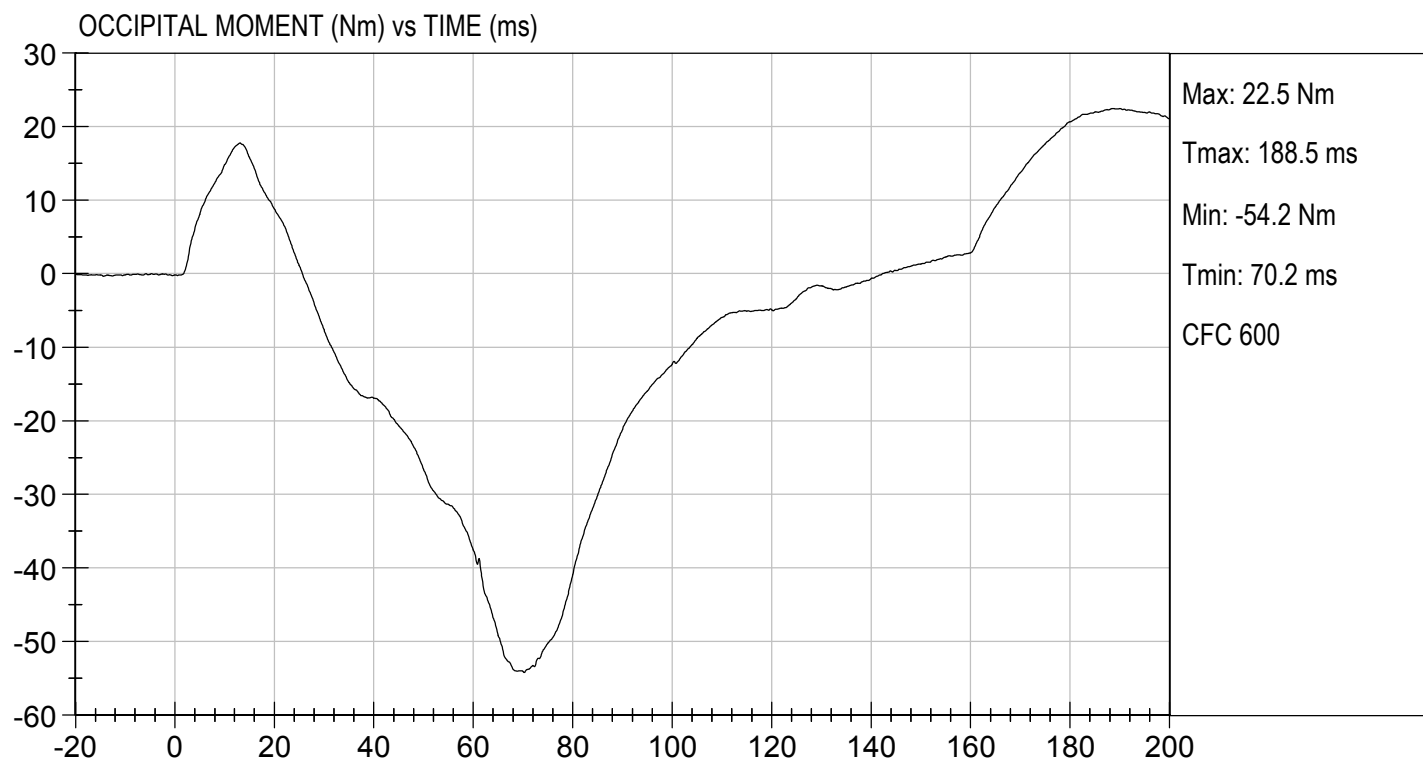
TEST DATE: 01/28/2019
TEST #: D190333





TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 01/28/2019
TEST #: D190333

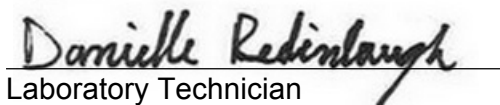


MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

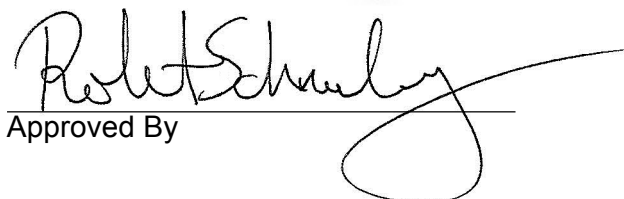
Test I.D: D190334

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21	Pass
Relative Humidity	%	10 to 70	20	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	52	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4312	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4389	Pass
Overall Test Results				Pass


Laboratory Technician

01/28/2019

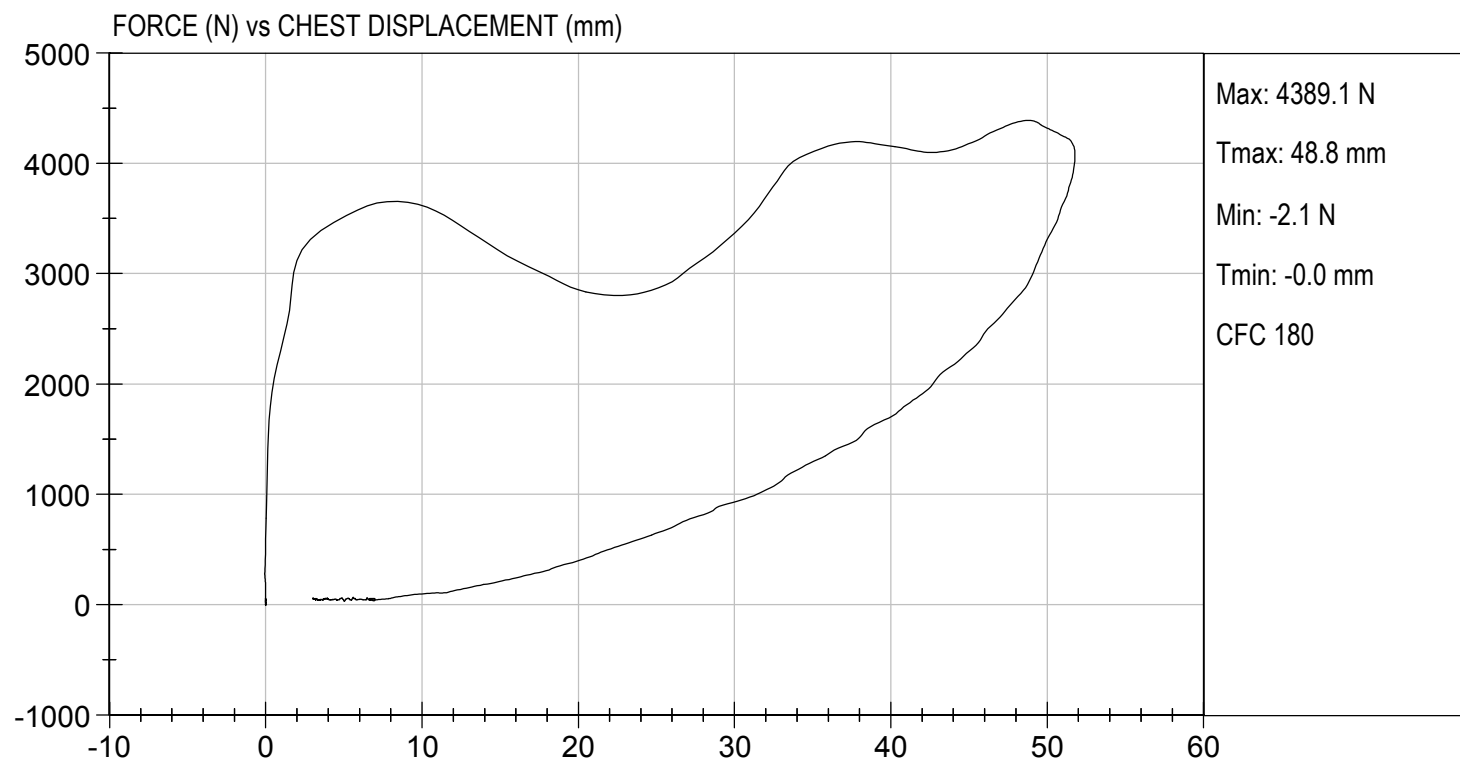
Test Date


Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 01/28/2019
TEST #: D190334



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D190335

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	3450 to 4060	3676	Pass
Overall Test Results				Pass

Danielle Redinlaugh
Laboratory Technician

01/24/2019

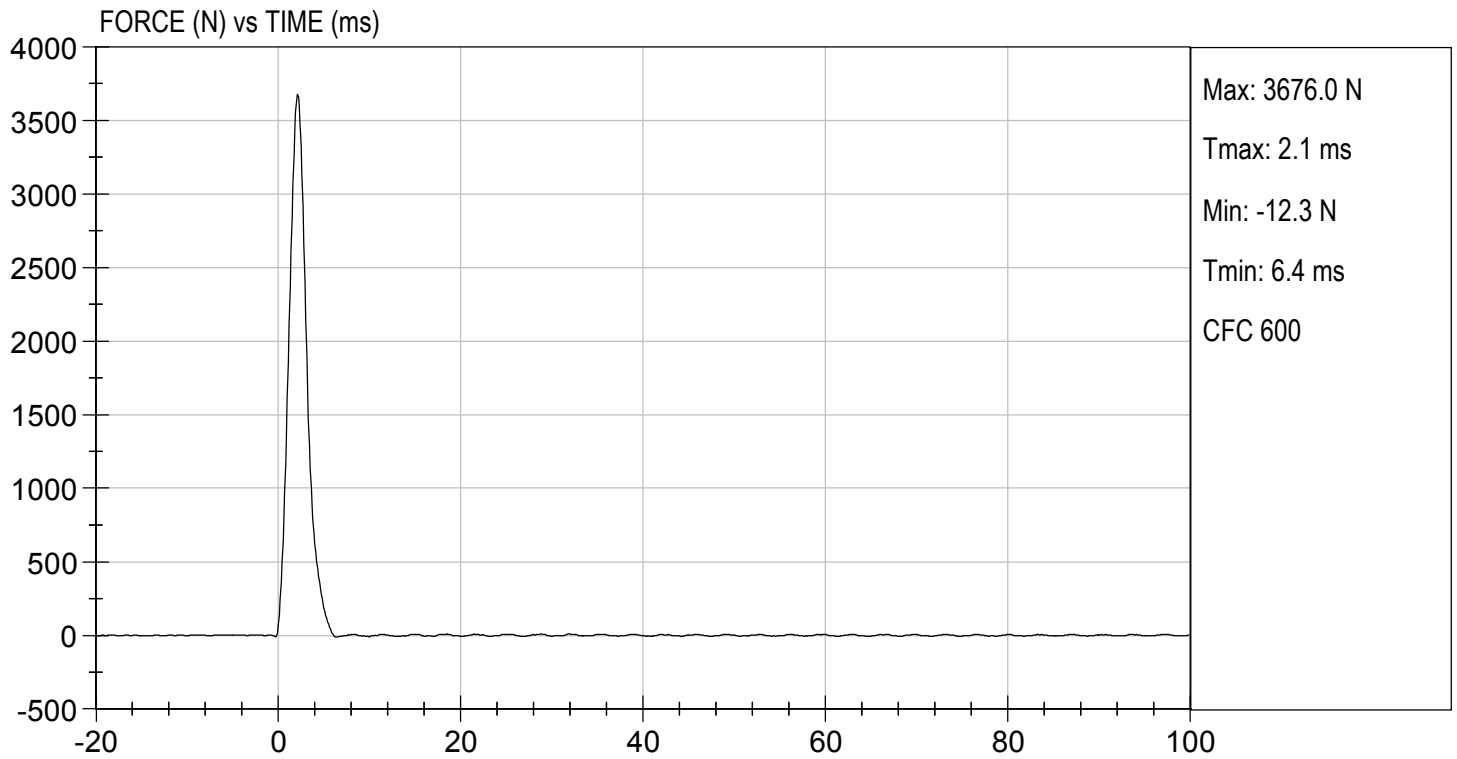
Test Date

Robert Schaefer
Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.86 ft/s, 2.09 m/s

TEST DATE: 01/24/2019
TEST #: D190335



MGA RESEARCH CORPORATION

**LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE**

ATD Serial No: 138

Test I.D: D190336

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3925	Pass
Overall Test Results				Pass

Danielle Redinlaugh
Laboratory Technician

01/24/2019

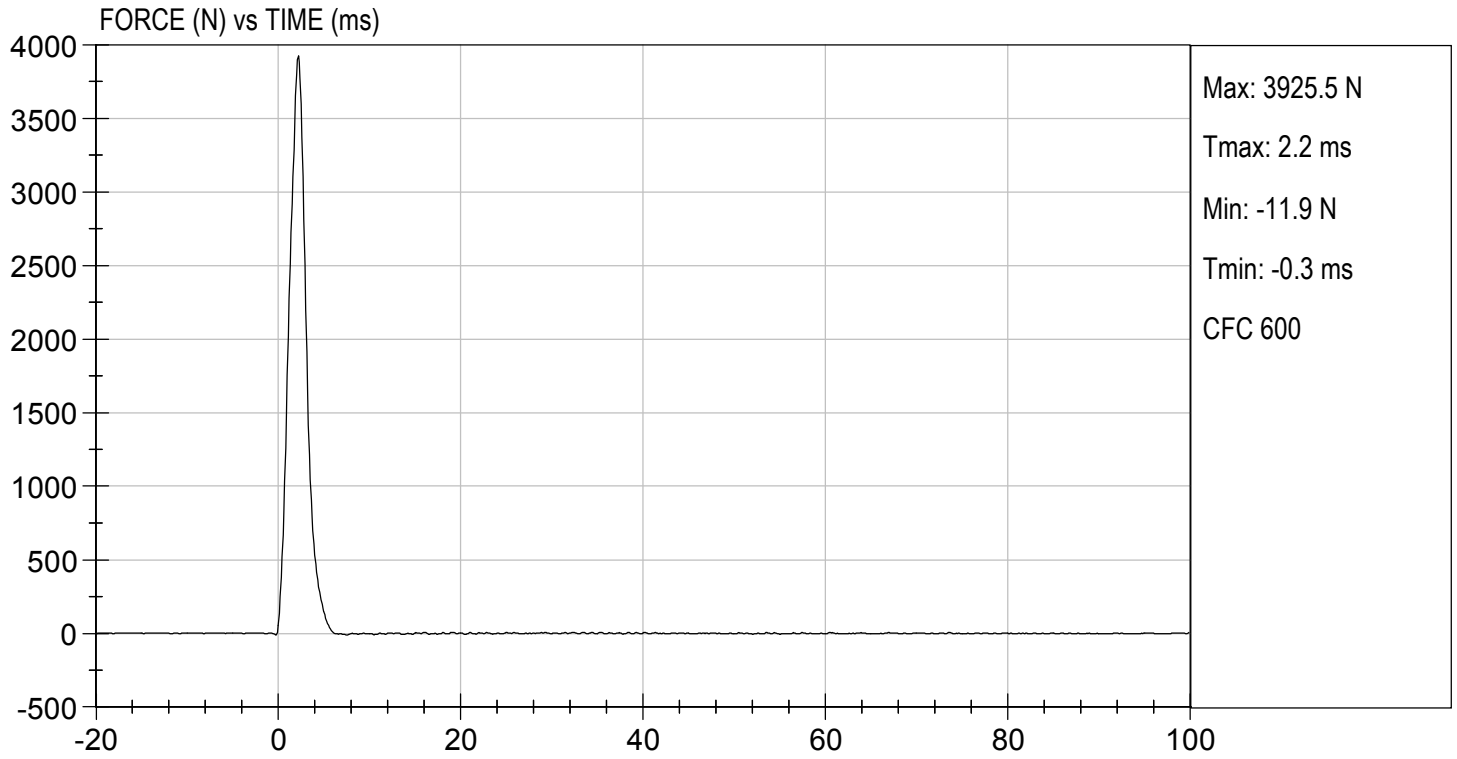
Test Date

Robert Schaefer
Approved By



TEST DESC: LEFT KNEE
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 01/24/2019
TEST #: D190336



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

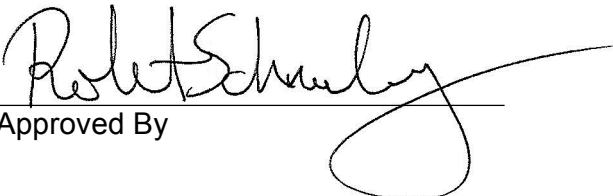
Test I.D: D190337

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	2	Pass
Force at 45 deg	N	320 to 390	352	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.7	Pass
Overall Result				Pass


Laboratory Technician

01/28/2019

Test Date


Approved By

