REPORT NUMBER: NCAP-MGA-2016-056

NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test

NISSAN MOTOR CO., LTD.
2016 Nissan Murano S AWD 5-Door SUV
NHTSA No.: O20165201

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: August 23, 2016

Final Report Date: September 15, 2016

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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Approval Date: September 15, 2016

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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15. Supplementary Notes		

16. Abstract

A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2016 Nissan Murano S AWD 5-Door SUV 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 August 23, 2016.

The impact velocity of the vehicle was 56.36 km/h and the ambient temperature at the barrier face at the time of impact was 22.2°C. The target vehicle post-test maximum crush was 534mm located to the right of the vehicle's centerline. The test vehicle's performance was as follows:

Measurement Description	Units	Driver ATD		Passenger ATD	
		Threshold	Result	Threshold	Result
Head Injury Criteria (HIC_{15})	N/A	700	456	700	278
Maximum Chest	mm	63	23	52	16
Nij	N/A	1	0.31	1	0.49
Neck Tension	N	4170	1373	2620	741
Neck Compression	N	4000	380	2520	498
Left Femur Force	N	10008	866	6805	523
Right Femur Force	N	10008	1067	6805	104

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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 2016 Nissan Murano S AWD 5-Door SUV at a velocity of 56.36 km/h. The test was performed at MGA Research Corporation on August 23, 2016. 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. Seat belt load cells were also installed on the driver's shoulder belt, driver's lap belt, passenger's shoulder belt, and passenger's lap belt to measure dummy torso section loading.

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 534mm to the right of 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 glovebox.

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 (50th)	456	0.31	1373	380	43	23	866	1067
Passenger (5th)	278	0.49	741	498	46	16	523	104

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

TEST NOTES

Barrier K-16 My recorded no valid data.
Barrier C-04 Fx recorded no valid data.
Barrier C-04 My recorded no valid data.
Barrier C-04 Mz 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: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20165201	Traction Control System (TCS)	Yes
Model Year	2016	Power Steering	Yes
Make	Nissan	Power Window Auto-Reverse	Yes
Model	Murano S	Driver Frontal Airbag	Yes
Body Style	5-Door SUV	Driver Curtain Airbag	Yes
VIN	5N1AZ2MH6GN120447	Driver Head/Torso Airbag	No
Body Color	Cayenne Red	Driver Torso Airbag	No
Odometer (km/mi)	48km / 30mi	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	CVT	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	AWD	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof/T-Top	No	Front Pass. Knee Airbag	No
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	No	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?	No

DATA FROM CERTIFICATION LABEL

Manufactured By	NISSAN MOTOR CO., LTD.
Date of Manufacture	02/16

GVWR (kg)	2395
GAWR Front (kg)	1271
GAWR Rear (kg)	1210

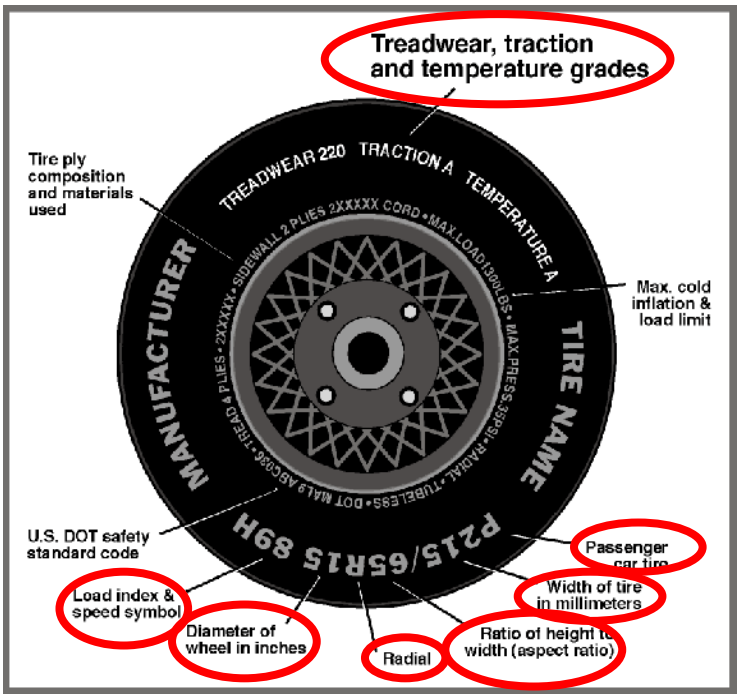
VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Contoured		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				408
Cargo Weight (RCLW) (kg)				68

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

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV NHTSA No.: O20165201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 8/23/2016

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	230	230
Recommended Tire Size	235/65R18	235/65R18
Tire Size on Vehicle	235/65R18	235/65R18
Tire Manufacturer	Toyo	Toyo
Tire Model	Open Country	Open Country
Treadwear	300	300
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Steel, 2 Polyester, 1 Nylon	2 Steel, 2 Polyester, 1 Nylon
Load Index/Speed Symbol	106T	106T
Tire Material	Rubber	Rubber
DOT Safety Code Left	73VK 31K 0516	73VK 31K 0516
DOT Safety Code Right	73VK 31K 0516	73VK 31K 0516

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

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	539.5	349.5		572.0	431.5	
Right	kg	518.5	362.5		534.5	434.0	
Ratio	%	59.8%	40.2%		56.1%	43.9%	
Totals	kg	1058.0	712.0	1770.0	1106.5	865.5	1972.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1770.0
Weight of 1 P572E ATD & 1 P572O ATD	kg	141
Rated Cargo/Luggage Weight (RCLW)	kg	68
Calculated Test Vehicle Target Weight (TVTW)	kg	1979

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	828	828	820	822	1135
As Tested	mm	822	823	792	794	1239
Post Test	mm	810		760	827	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2822
Total Vehicle Length at Left Side	mm	4699
Total Vehicle Length at Centerline	mm	4890
Total Vehicle Length at Right Side	mm	4699
Weight of Ballast in Cargo Area	kg	13
Weight of Vehicle Components Removed	kg	34
Amount of Stoddard Solvent in Fuel Tank	L	67.0

List of components removed to meet test weight: None.

List of components removed for instrumentation, data box, and equipment installation: Cargo area carpet and trim, LR/RR floor mat, jack and tool kit, spare tire and cover.

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

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4890
2	Total Width	1912
3	Bumper Top Height	630
4	Bumper Bottom Height	485
5	Longitudinal Member Top Height	672
6	Distance between Longitudinal Members	985
7	Longitudinal Member Width	55
8	Engine Top Height	964
9	Engine Bottom Height	235
10	Engine and Gearbox Width	940
11	Front Bumper-Engine Distance	472
12	Front Shock Absorber Fixing Height	988
13	Bonnet Leading Edge Height	933
14	Front Shock Absorber Fixing Width	1265
15	Front Bumper – Front Axle Distance	1047
16	Front Axle – A-Pillar Distance	524
17	A-Pillar – B-Pillar Distance	1129
18	B-Pillar – Rear Axle Distance	1171
19	B-Pillar – C-Pillar Distance	665
20	Roof Sill Bottom Height	1514
21	Roof Sill Top Height	1696
22	Floor Sill Bottom Height	295
23	Floor Sill Top Height	472

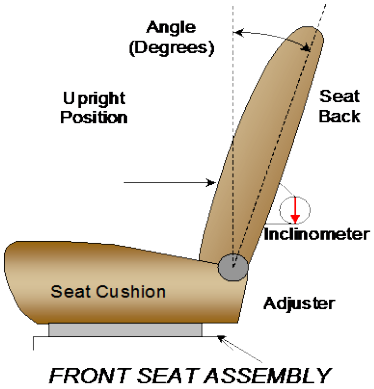
DATA SHEET NO. 2
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

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	-0.6° on headrest post
Passenger Seat Back Angle	-0.8° on headrest post

SEAT FORE/AFT POSITIONS

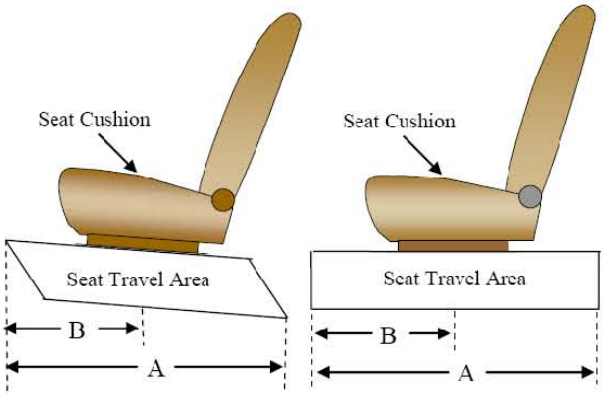
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated October 2015.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	282 mm / 25 detents	142 mm / 10th detent (1st as 0)
Passenger Seat	240 mm / 25 detents	0 mm / 0th detent (1st as 0)

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	0 (Uppermost as 0)
Passenger Seat	4	0 (Uppermost as 0)



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

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

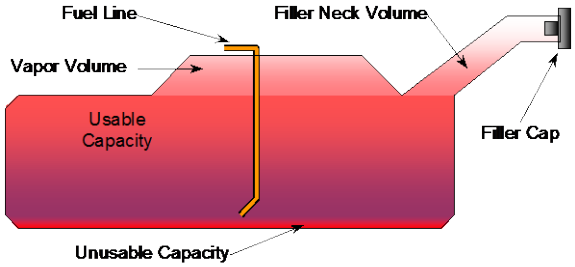
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	71.9
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	66.2 to 67.4
Actual Amount of Solvent used	67.0
1/3 of Usable Capacity	24.0

FUEL PUMP

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

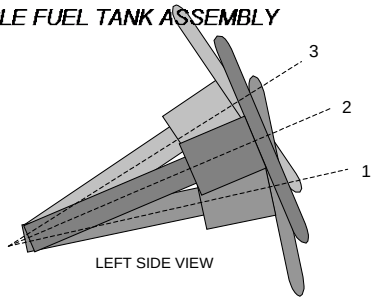
The test vehicle is equipped with an electronic fuel pump. Pump operates for 1.0 seconds after the ignition is switched to "ON", while the engine is running, and for 1.5 seconds after the engine stops running.



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.



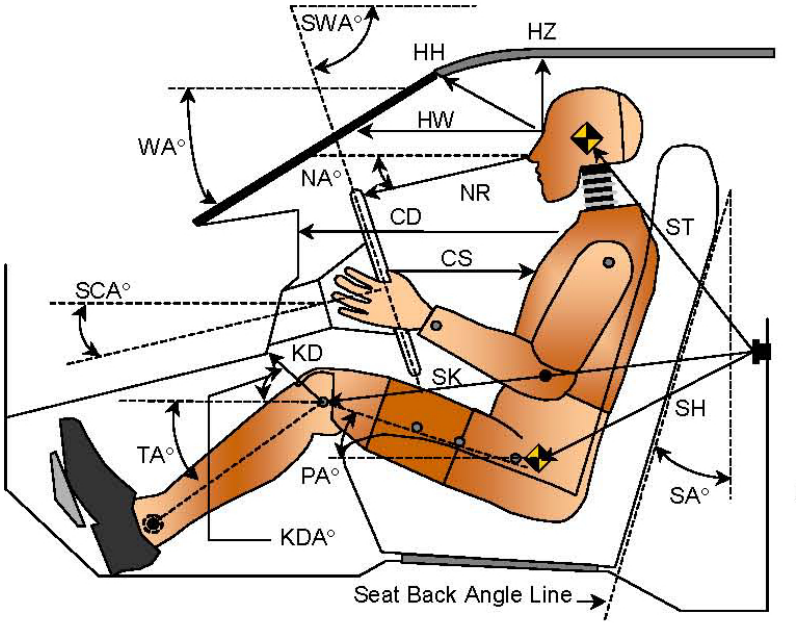
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	66.2	174
Geometric Center Position 2	63.4	195
Uppermost Position 3	60.6	215
Telescoping Steering Wheel Travel		41
Test Position	63.4	195

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV NHTSA No.: O20165201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 8/23/2016



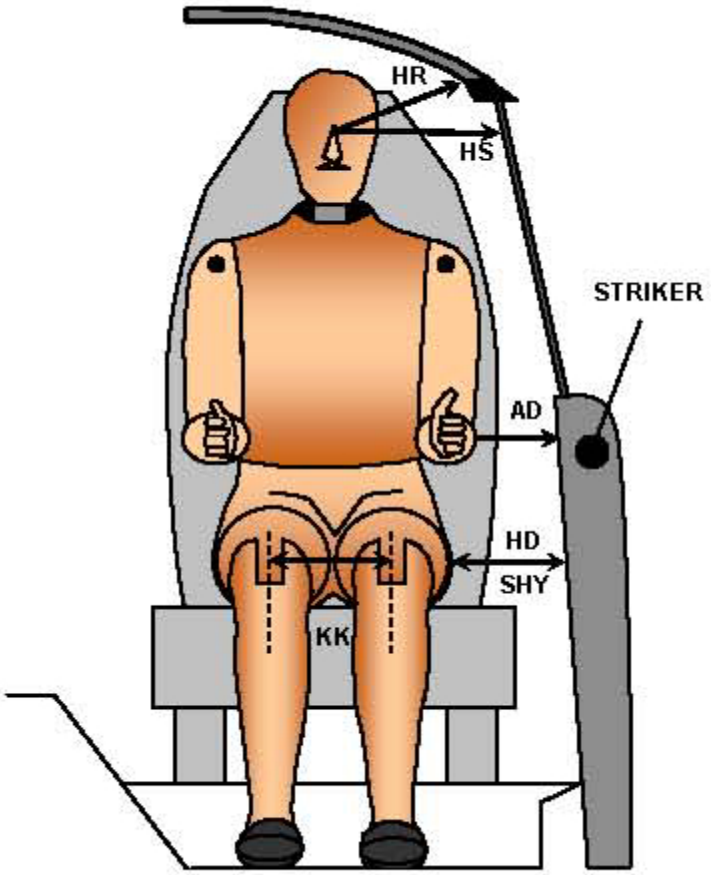
LEFT SIDE VIEW

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		22.2		
SWA°	Steering Wheel Angle		63.4		
SCA°	Steering Column Angle		26.6		
SA°	Seat Back Angle		-0.6		-0.8
HZ	Head to Roof (Z)	207	90	250	90
HH	Head to Header	387	27.7	325	41.4
HW	Head to Windshield	757	0	763	0
NR	Nose to Rim	399	7.8		
CD	Chest to Dash	536		393	
CS	Chest to Steering Hub	317	4.0		
RA	Rim to Abdomen	188	0		
KDL	Left Knee to Dash	144	33.0	82	44.8
KDR	Right Knee to Dash	110	38.7	94	43.1
PA°	Pelvic Angle		24.8		19.8
TA°	Tibia Angle		50.7		55.5
SK	Striker to Knee	622	91.4	709	91.5
ST	Striker to Head	574	14.9	534	29.6
SH	Striker to H-Point	290	112.0	391	100.4

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016



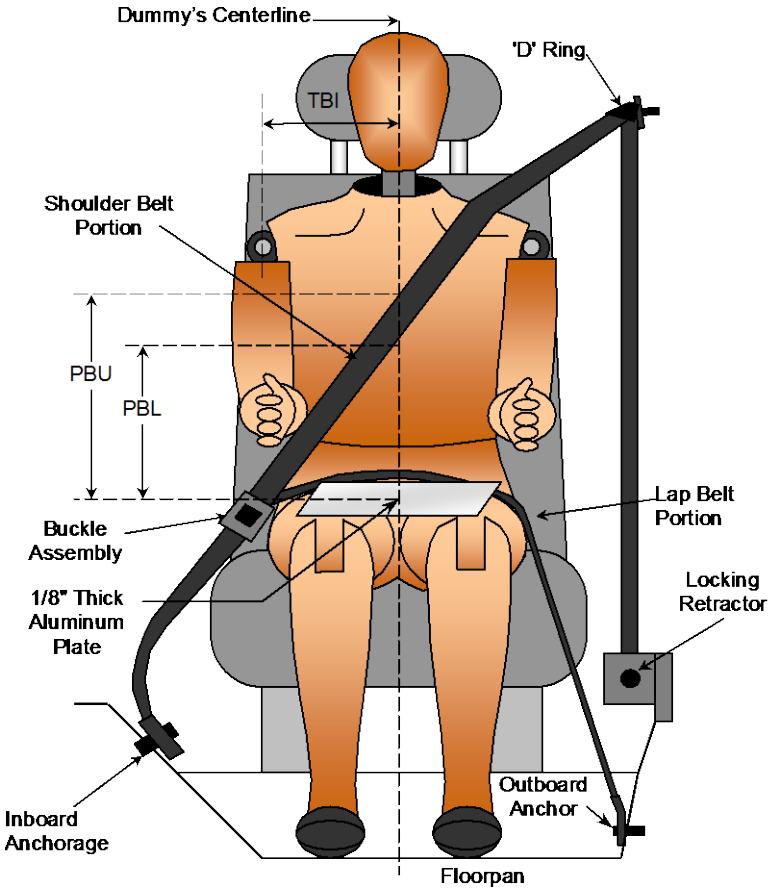
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
AD	Arm to Door	146	94
HD	H-Point to Door	163	180
HR	Head to Side Header	241	263
HS	Head to Side Window	350	356
KK	Knee to Knee	367	228
SHY	Striker to H-Point (Y Direction)	313	347
AA	Ankle to Ankle	379	172

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	375	330
PBL - Top surface of reference to belt lower edge	mm	275	240

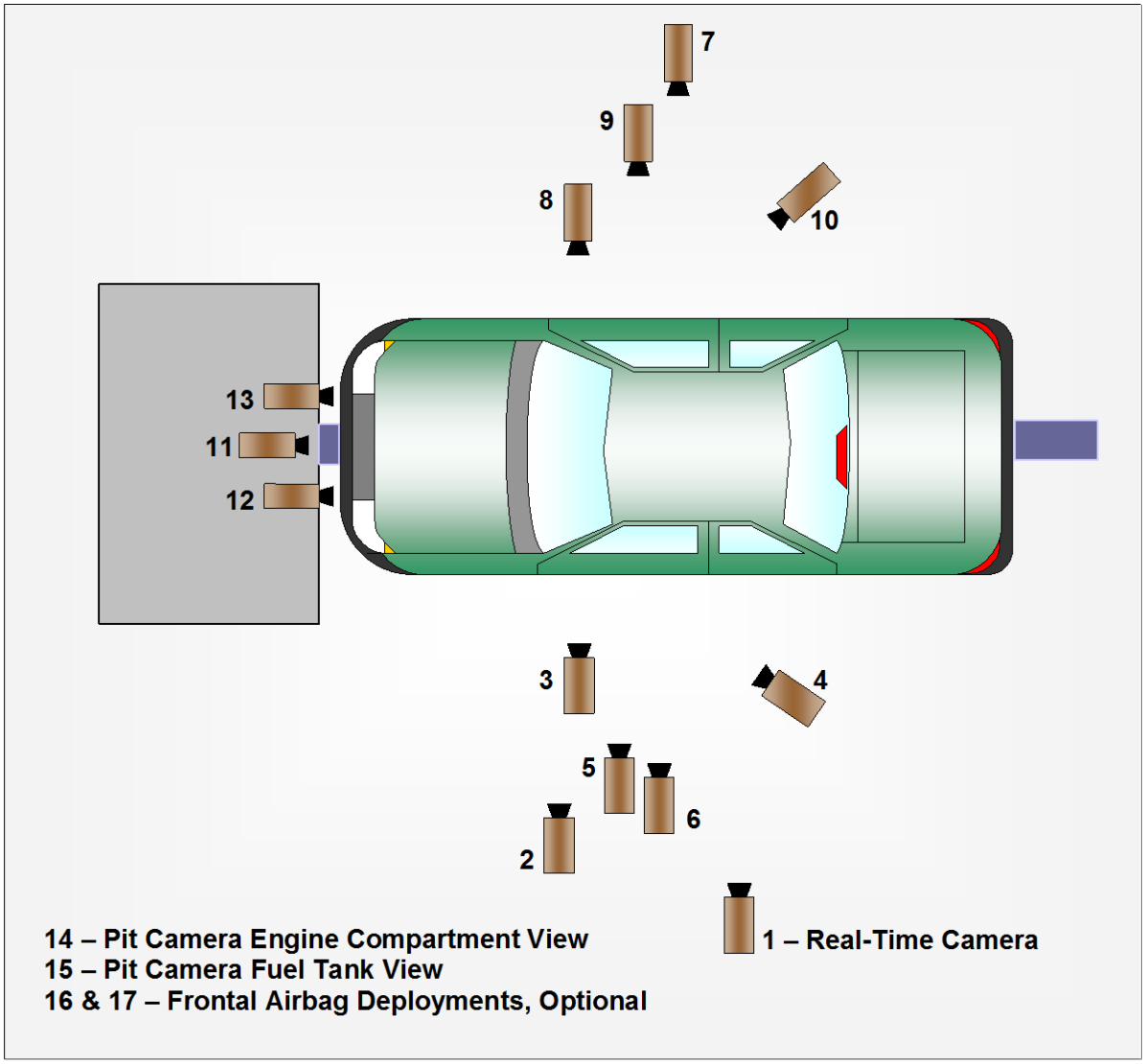
BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	860	795
Lap Belt Length as measured on ATD	mm	925	945
Remainder of belt on reel	mm	915	960
Total Belt Length for Continuous Webbing Systems	mm	3400	3400

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

Test Vehicle:	2016 Nissan Murano S AWD 5-Door SUV	NHTSA No.:	O20165201
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	8/23/2016

CAMERA POSITIONS FOR FRONTAL IMPACTS



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

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	-1820	-6640	-2020	35	1000
3	Left Front Half	-1240	-5210	-1130	24	1000
4	Left Angle	-6160	-5200	-2050	50	1000
5	Steering Column - Top					
6	Steering Column - Bottom					
7	Right Overall	-2380	67440	-1250	20	1000
8	Passenger Close-Up	-1940	6740	-2070	35	1000
9	Right Front Half	-1240	5290	-1290	24	1000
10	Right Angle	-5900	5230	-2120	50	1000
11	Windshield	450	0	-2810	20	1000
12	Driver Windshield	-30	-450	-2030	8.5	1000
13	Passenger Windshield	-30	450	-2030	8.5	1000
14	Pit Front	-1100	0	3150	24	1000
15	Pit Rear	-3110	0	3150	24	1000
16	Onboard Driver Side				12	1000
17	Onboard Passenger Side				12	1000
18	Real-Time Pan View					30

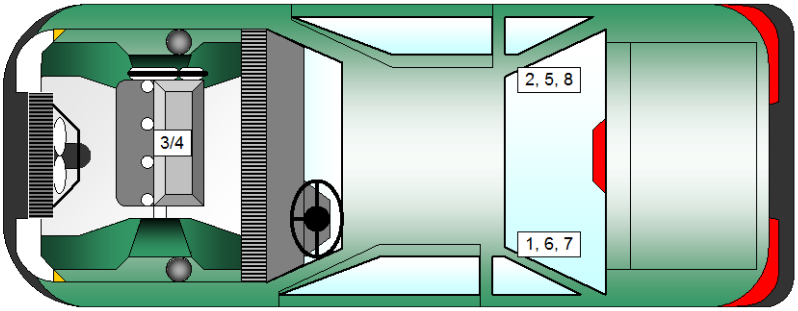
*COORDINATES:

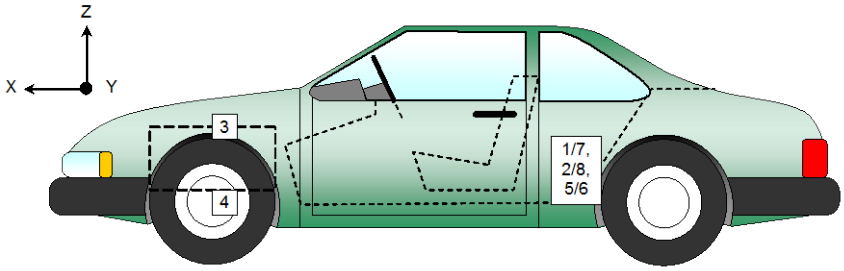
+X = forward of impact plane
+Y = right of monorail centerline
+Z = below ground level

Cameras 5 & 6 were not used for this test.

DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV NHTSA No.: O20165201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 8/23/2016





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	1870	-400	-364
2	Right Rear Crossmember Accelerometer – X Direction	1917	375	-368
3	Engine Top X	4205	28	-839
4	Engine Bottom X	4130	-55	-297
5	Left Rear Crossmember Accelerometer – Z Direction	1870	-400	-364
6	Right Rear Crossmember Accelerometer – Z Direction	1917	375	-368
7	Left Rear Crossmember Accelerometer Redundant – X Direction	1913	-400	-364
8	Right Rear Crossmember Accelerometer Redundant – X Direction	1957	375	-368

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

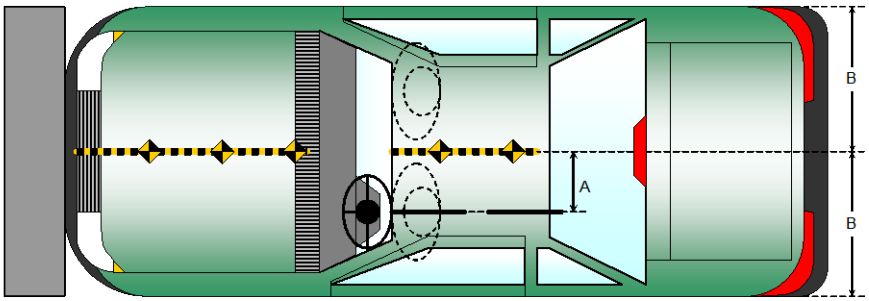
DATA SHEET NO. 8

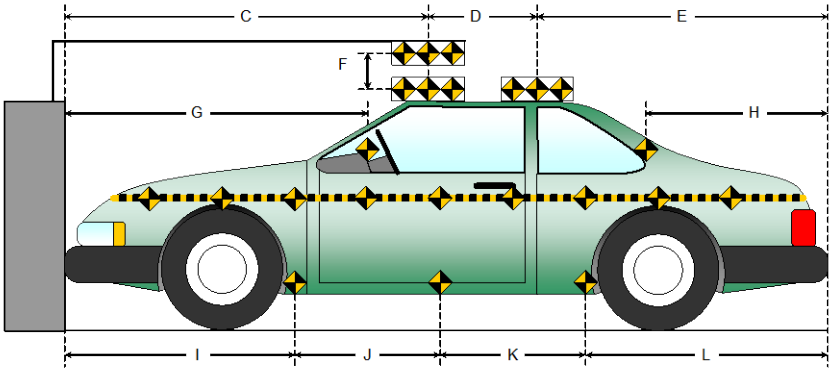
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

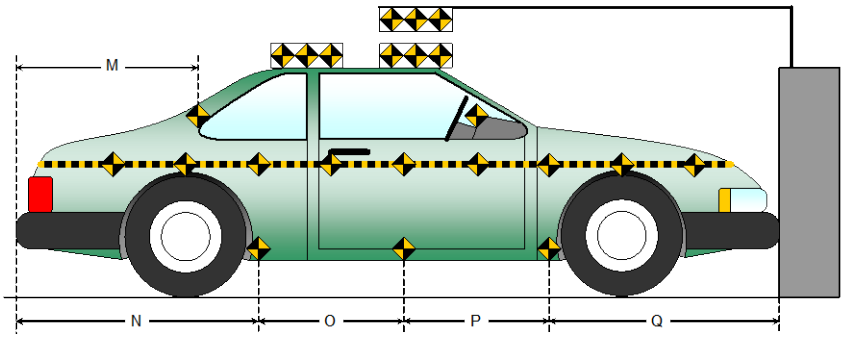
Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

Item	Value (mm)
A	384
B	956
C	2335
D	619
E	1936
F	165
G	
H	1339
I	1570
J	897
K	897
L	1526
M	1339
N	1526
O	897
P	897
Q	1570







DATA SHEET NO. 9
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV NHTSA No.: O20165201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 8/23/2016

Advanced Research Load Cell Barrier

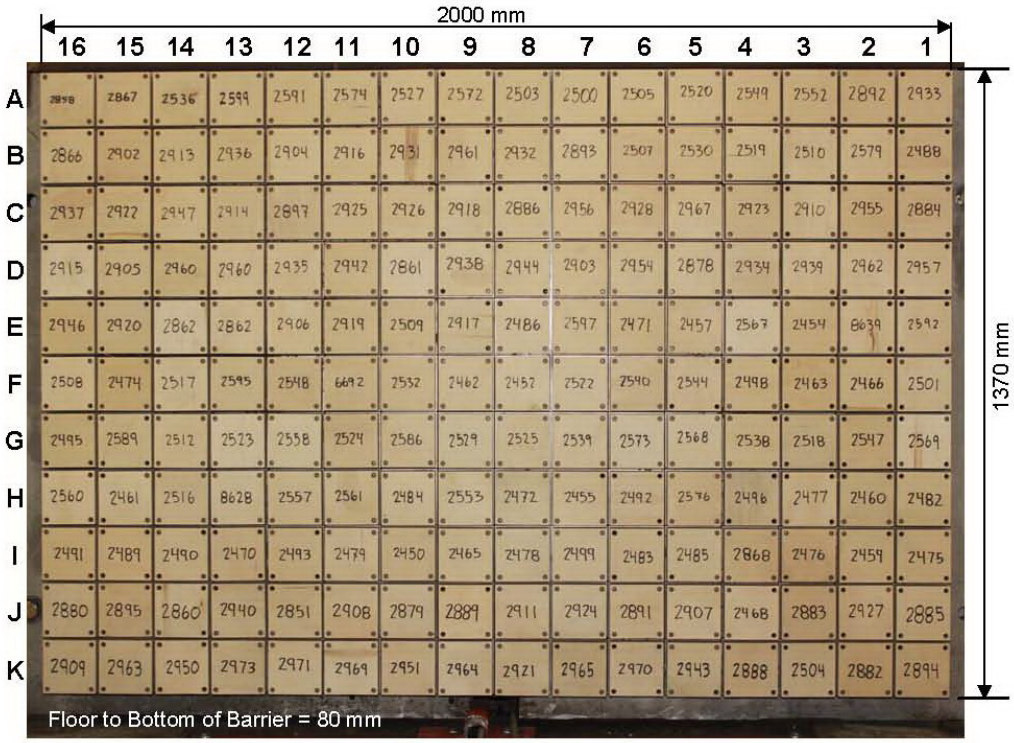


Photo for Reference Only

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: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

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: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

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

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were locked	Doors were locked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening		
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

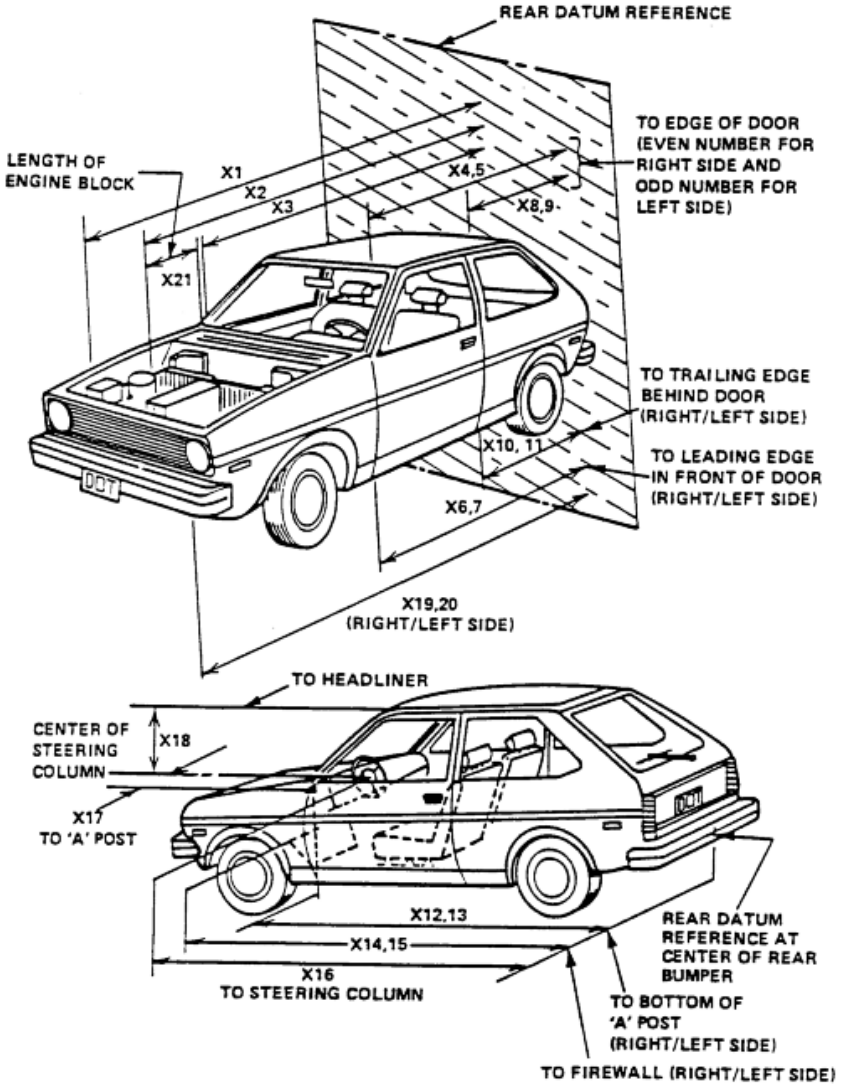
Measured Parameter	Units	Value
Left Side	mm	2100
Center	mm	2130
Right Side	mm	2165
Average	mm	2132

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	Yes	Yes	Yes
Knee Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	

DATA SHEET NO. 12
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV NHTSA No.: O20165201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 8/23/2016



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4890	4395	495
2	RSOV to Front of Engine	mm	4325	4088	237
3	RSOV to Firewall	mm	3668	3652	16
4	RSOV to Upper Leading Edge of Right Door	mm	3271	3284	-13
5	RSOV to Upper Leading Edge of Left Door	mm	3271	3282	-11
6	RSOV to Lower Leading Edge of Right Door	mm	3254	3254	0
7	RSOV to Lower Leading Edge of Left Door	mm	3254	3258	-4
8	RSOV to Upper Trailing Edge of Right Door	mm	2130	2129	1
9	RSOV to Upper Trailing Edge of Left Door	mm	2130	2132	-2
10	RSOV to Lower Trailing Edge of Right Door	mm	2157	2155	2
11	RSOV to Lower Trailing Edge of Left Door	mm	2157	2154	3
12	RSOV to Bottom of “A” Post of Right Side	mm	3255	3256	-1
13	RSOV to Bottom of “A” Post of Left Side	mm	3254	3251	3
14	RSOV to Firewall, Right Side	mm	3598	3607	-9
15	RSOV to Firewall, Left Side	mm	3598	3603	-5
16	RSOV to Steering Column	mm	2788	2834	-46
17	Center of Steering Column to “A” Post	mm	400	398	2
18	Center of Steering Column to Headliner	mm	414	473	-59
19	RSOV to Right Side of Front Bumper	mm	4699	4371	328
20	RSOV to Left Side of Front Bumper	mm	4699	4349	350
21	Length of Engine Block	mm	496	496	0
RD	RSOV to Right Side of Dash Panel	mm	3109	3120	-11
CD	RSOV to Center of Dash Panel	mm	3112	3108	4
LD	RSOV to Left Side of Dash Panel	mm	3114	3096	18

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV NHTSA No.: O20165201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 8/23/2016

VEHICLE INFORMATION

VIN: 5N1AZ2MH6GN120447 Wheelbase (mm): 2822
Vehicle Size Category: MPV Test Weight (kg): 1972.0

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15

Cal. Procedure/Interval: MGA procedure / 6 month

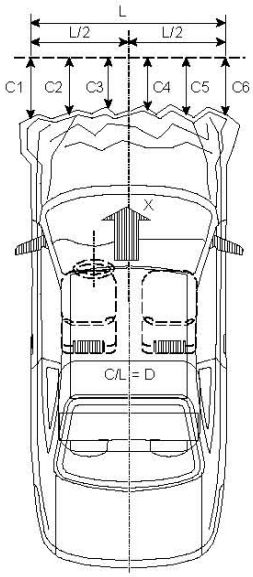
Integration Algorithm: Trapezoidal

Linearity: > 99%

Impact Velocity (km/h): 56.36

Velocity Change (km/h): 68.1

Time of Separation (msec): 99



CRUSH PROFILE

Collision Deformation Classification: Frontal

Midpoint of Damage: Centerline

Damage Region Length (mm): 1308

Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4699	4349	350
C2	Crush zone 2 at left side	mm	4830	4399	431
C3	Crush zone 3 at left side	mm	4854	4384	470
C4	Crush zone 4 at right side	mm	4854	4320	534
C5	Crush zone 5 at right side	mm	4830	4352	478
C6	Crush zone 6 at right side	mm	4699	4371	328
L	C1 TO C6	mm	1308	1274	34

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

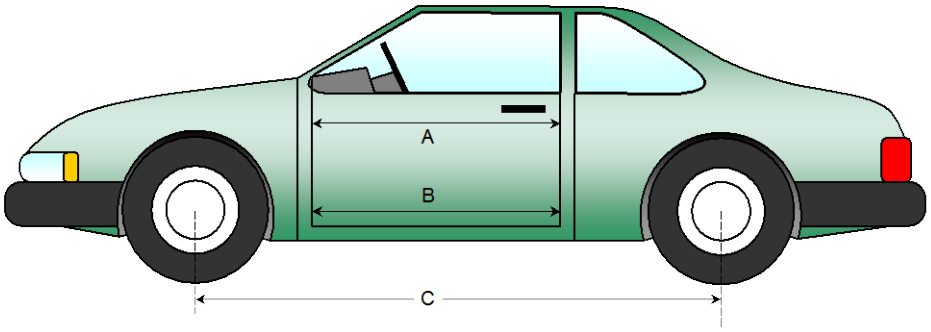
NHTSA No.: O20165201
Test Date: 8/23/2016

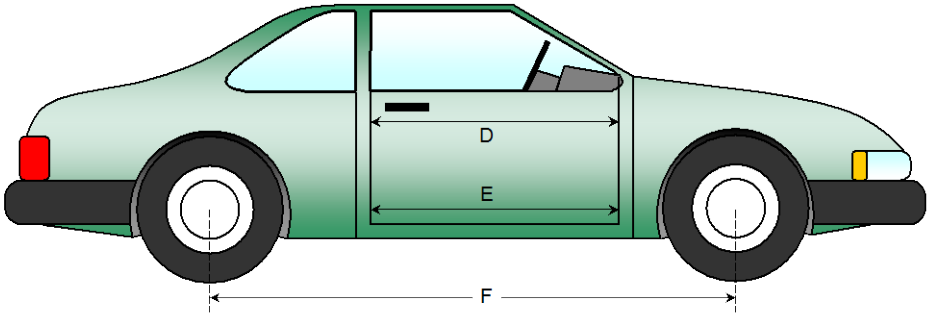
DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1042	1042	0
B	Left Side Lower	mm	997	997	0
D	Right Side Upper	mm	1042	1042	0
E	Right Side Lower	mm	997	997	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2822	2784	38
F	Right Side Wheelbase	mm	2822	2839	-17





DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

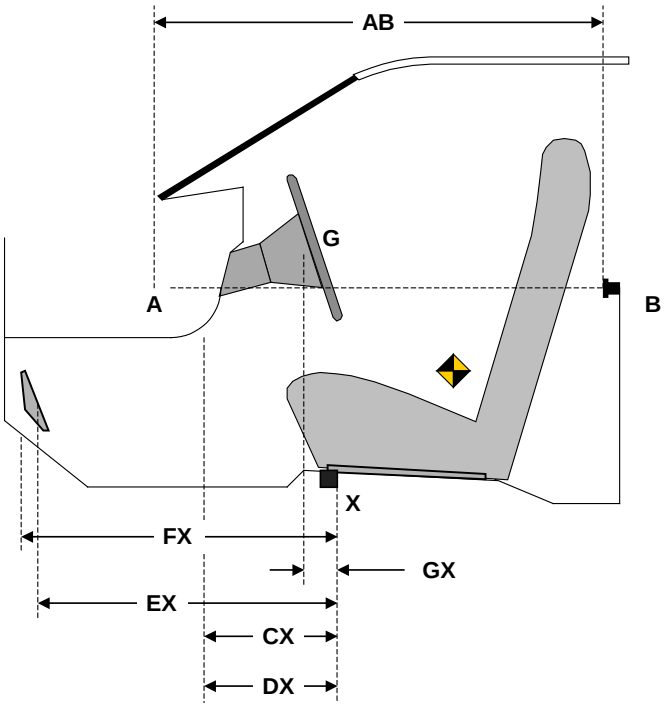
Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	888	888	0
CX	Left Knee Bolster to X	mm	255	264	-9
DX	Right Knee Bolster to X	mm	223	238	-15
EX	Brake Pedal to X	mm	562	628	-66
FX	Foot Rest to X	mm	548	537	11
GX	Center of Steering Column Wheel Hub to X	mm	71	114	-43

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: 2016 Nissan Murano S AWD 5-Door SUV NHTSA No.: O20165201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 8/23/2016

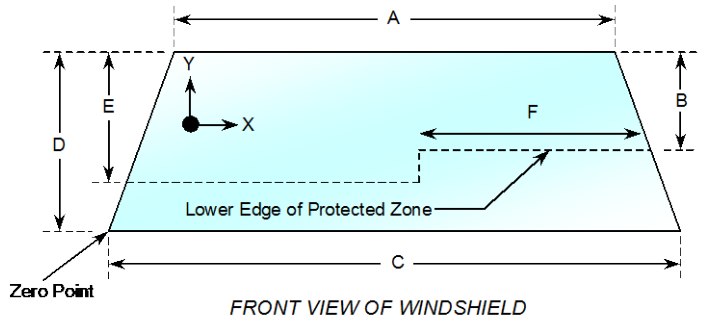
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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: 22.2° C.

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2317	2317	100.0
Right Side	2317	2317	100.0
Total	4634	4634	100.0



Item	Units	Value
A	mm	1284
B	mm	550
C	mm	1556
D	mm	897
E	mm	544
F	mm	558

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: 2016 Nissan Murano S AWD 5-Door SUV NHTSA No.: O20165201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 8/23/2016

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 22.2°C Test Time: 11:19 a.m.

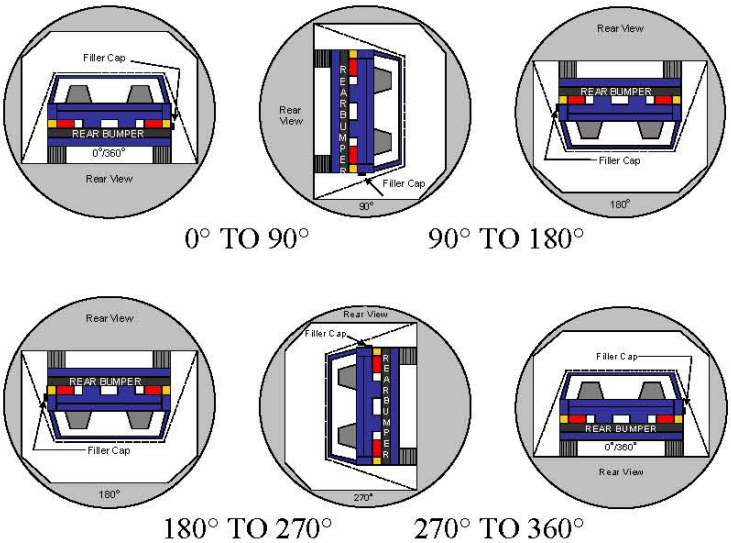
A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)
B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)
C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)
D. Spillage: None

DATA SHEET NO. 16
FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2016 Nissan Murano S AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20165201
Test Date: 8/23/2016

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°	113	300	413
90° to 180°	110	300	410
180° to 270°	108	300	408
270° to 360°	110	300	410

FMVSS 301 SPILLAGE TABLE (units in ounces)

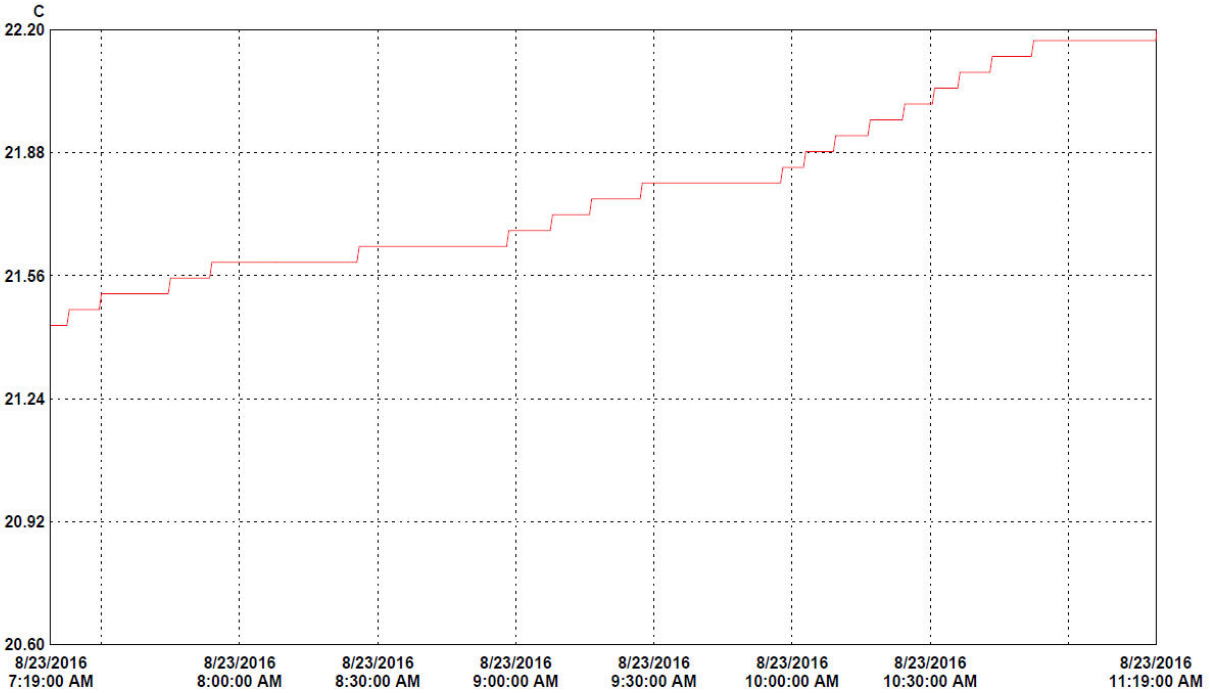
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

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: 2016 Nissan Murano S AWD 5-Door SUV NHTSA No.: O20165201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 8/23/2016



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	15212045	CrashPrep1521204	1		22.17	21.78	21.43	C	Temperature	15212045_CrashPrep1521204.spl

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PHOTOGRAPHS

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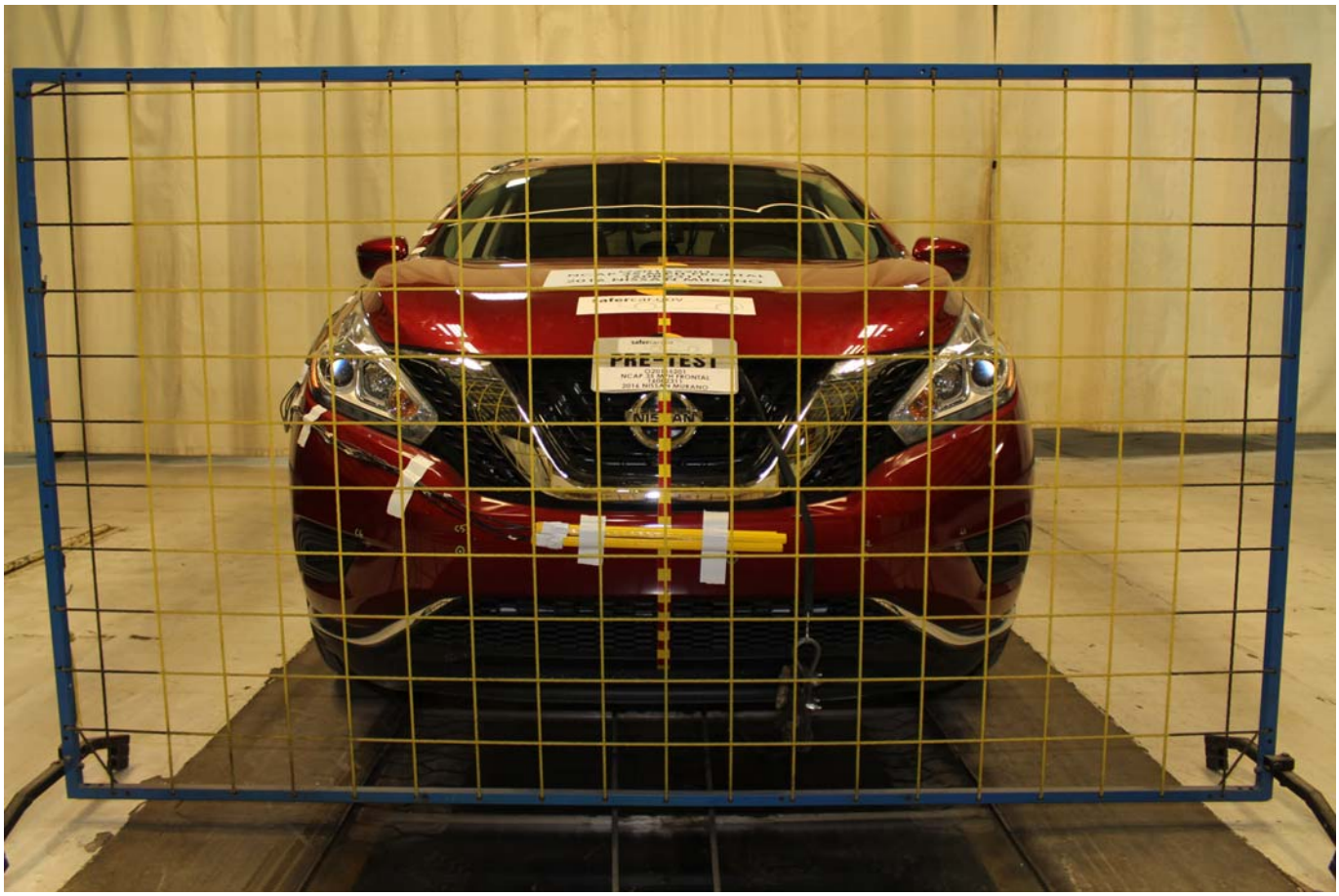

Photo No. 001 - Load Cell Location

Photo No. 002 - Pre-Test Load Cell Wall

Photo No. 003 - Post-Test Load Cell Wall

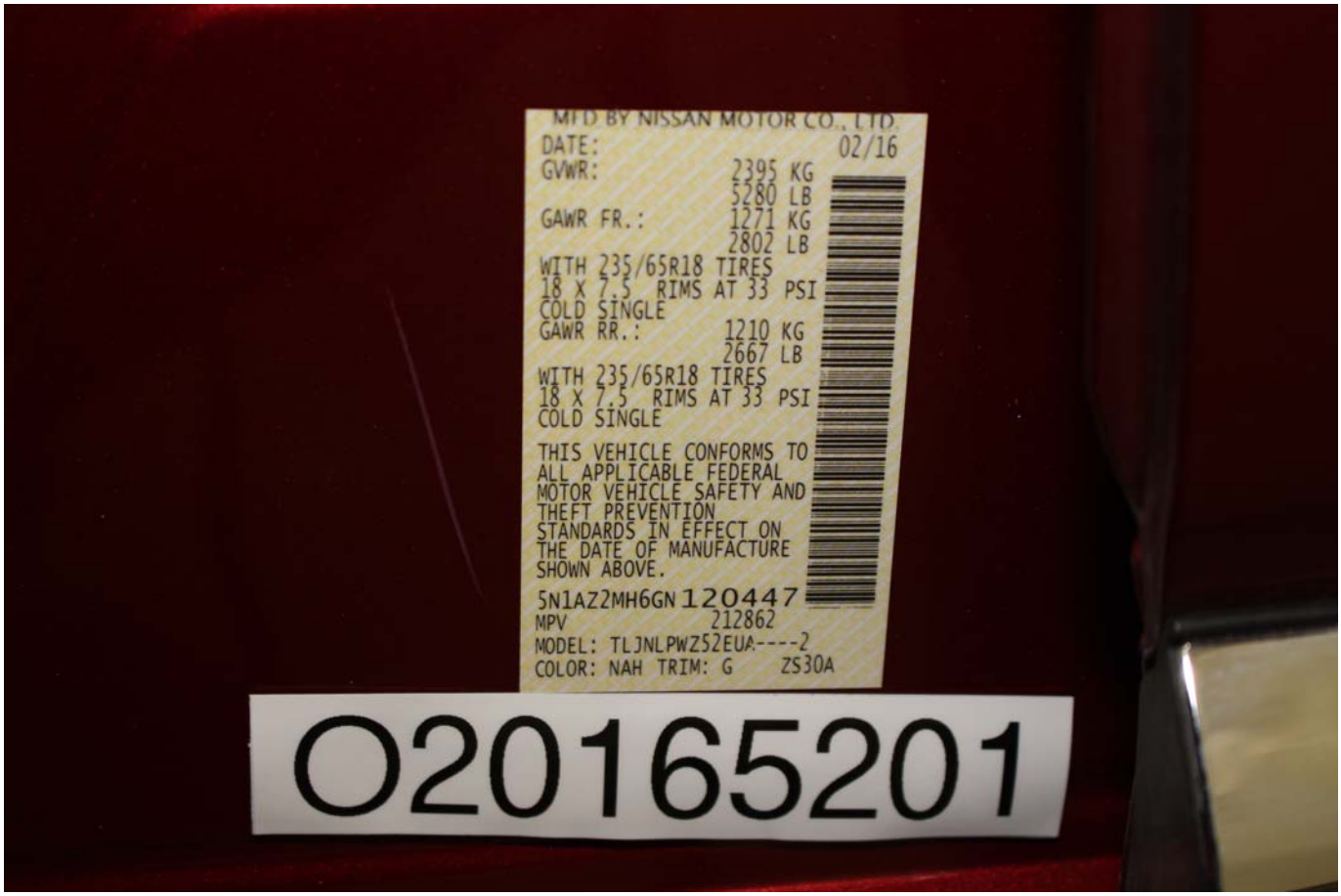

Photo No. 004 - Manufacturer's Label

Photo No. 005 - Tire Placard

Photo No. 006 - 2016 Nissan Muran S AWD Frontal As Delivered

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

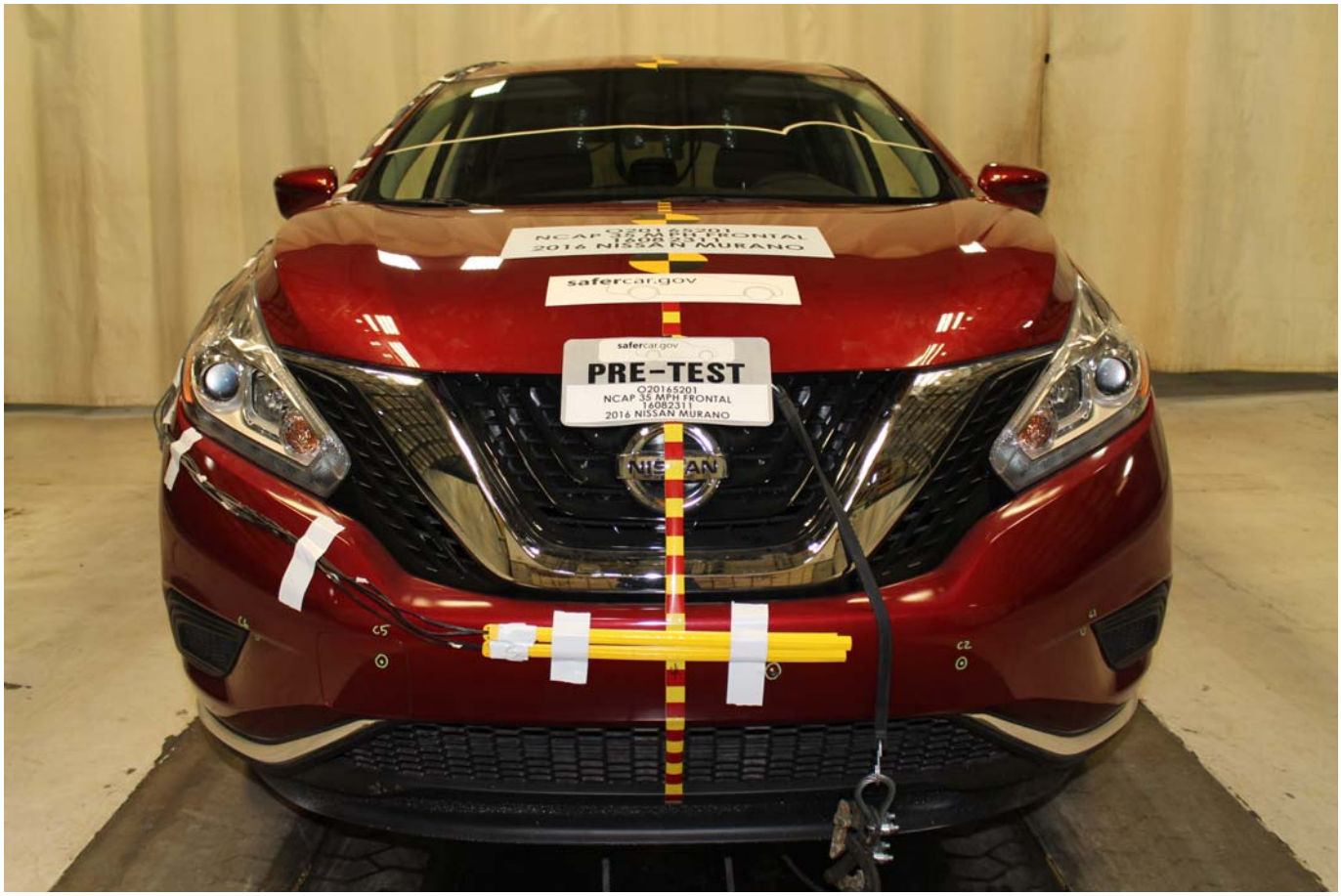

Photo No. 008 - Pre-Test Front View of Test Vehicle

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

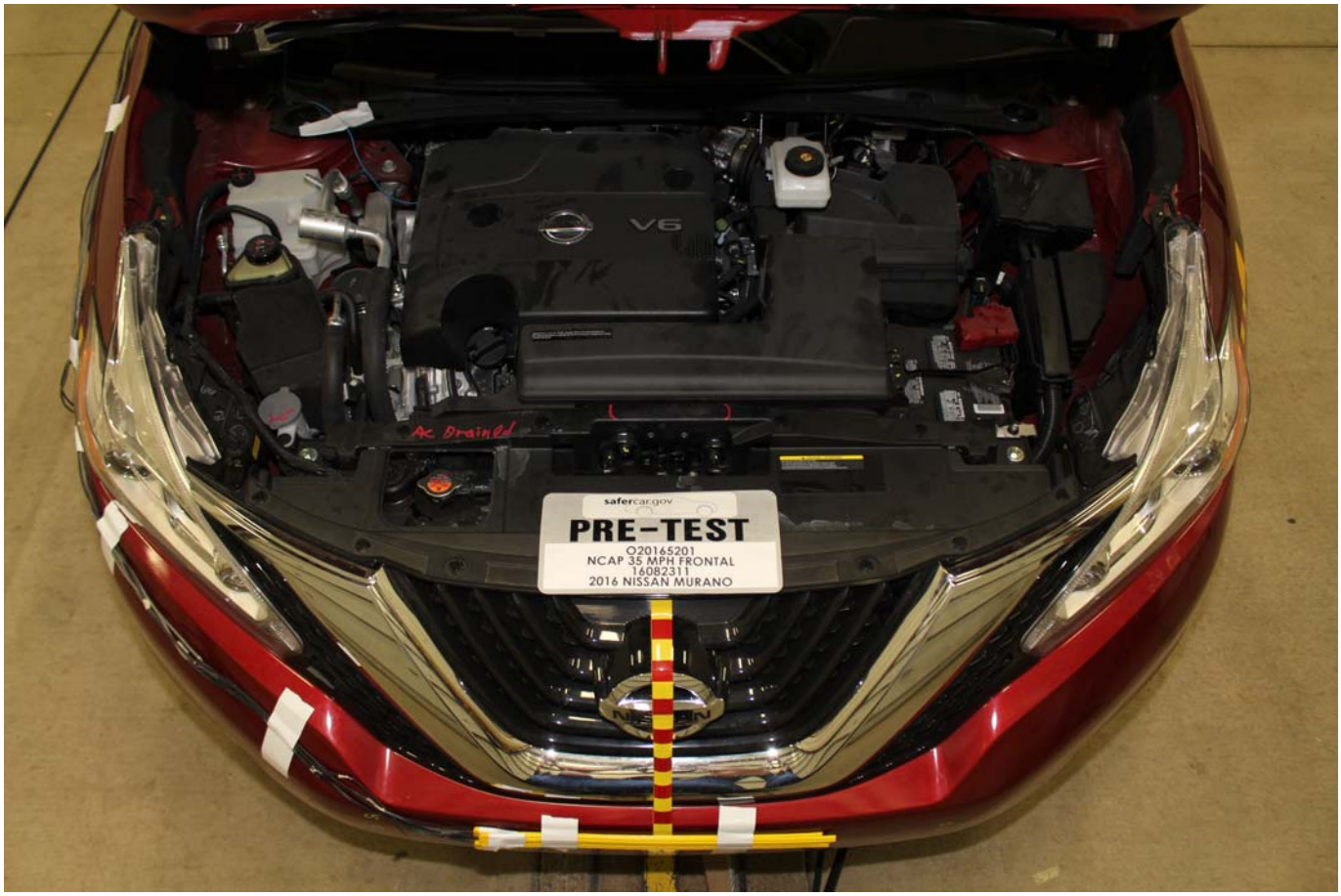

Photo No. 020 - Pre-Test Engine Compartment View

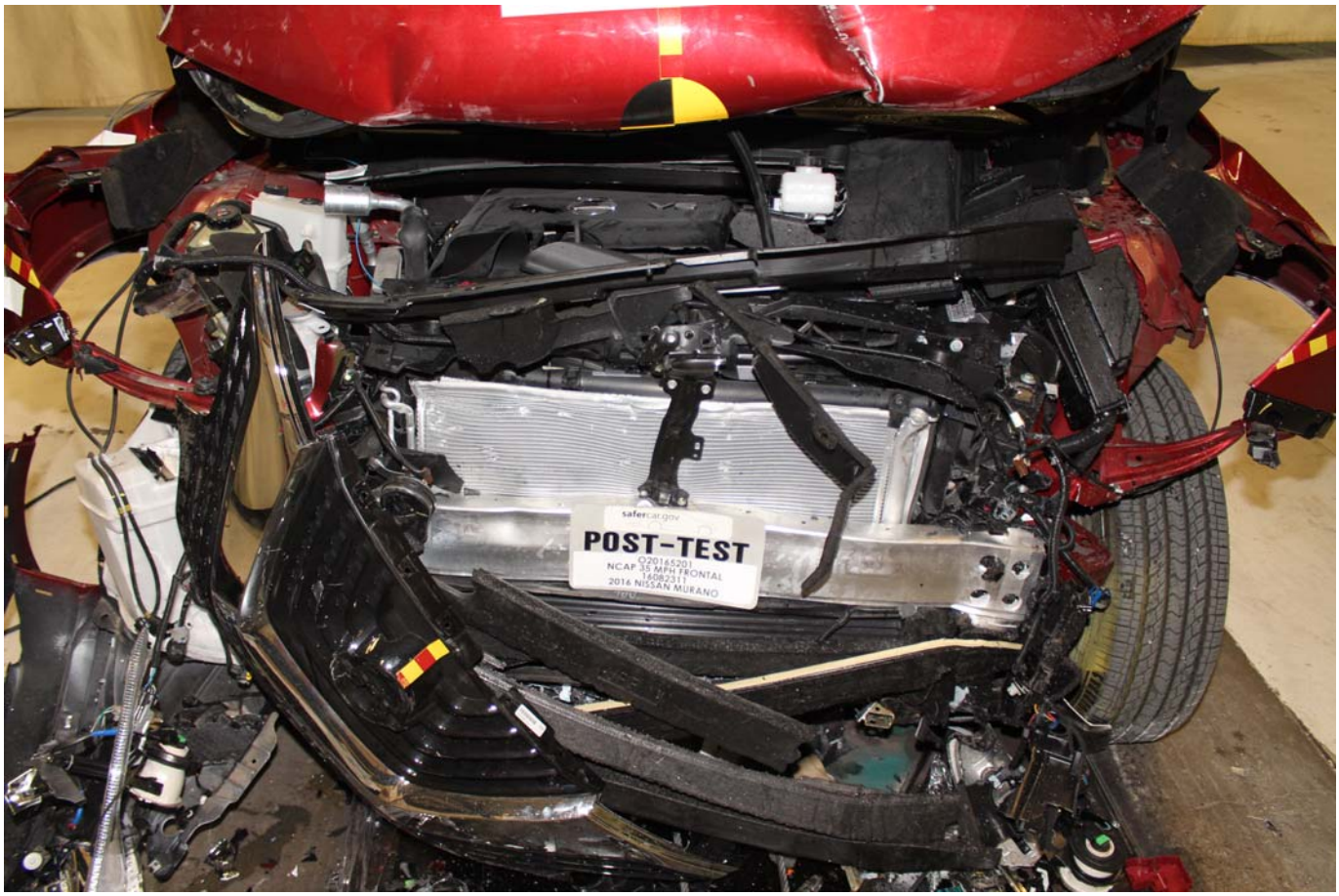

Photo No. 021 - Post-Test Engine Compartment View

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

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

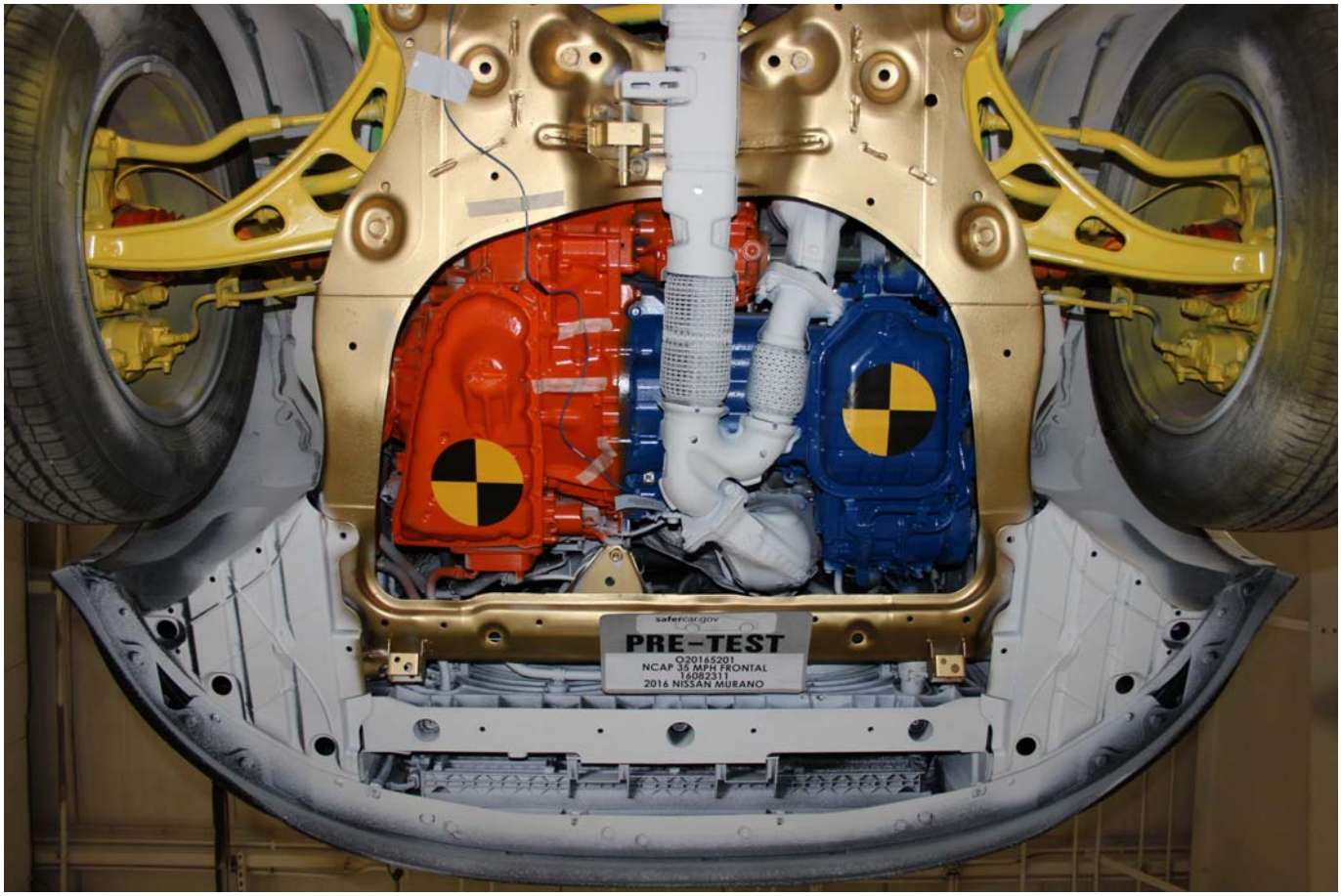

Photo No. 024 - Pre-Test Front Underbody View

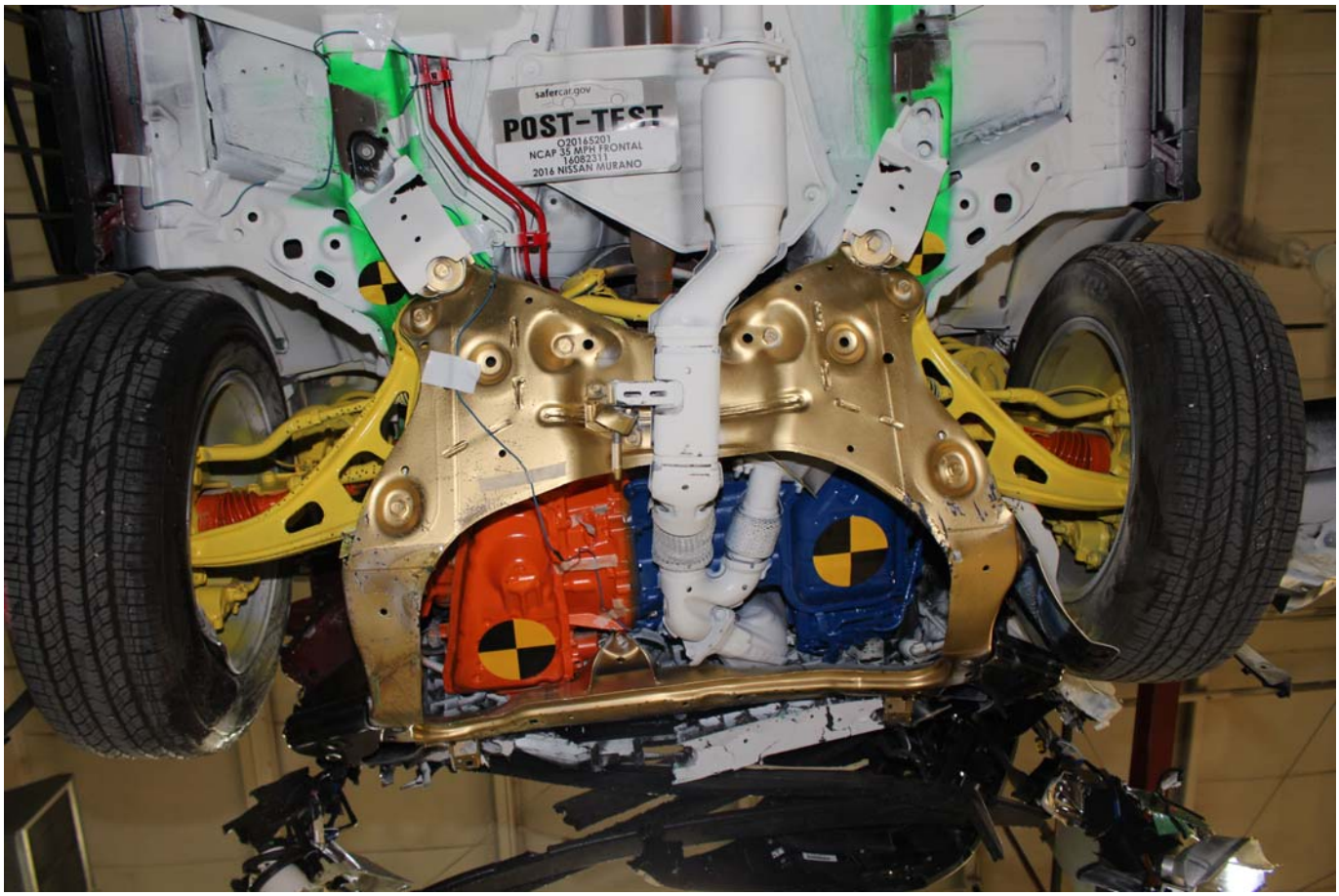

Photo No. 025 - Post-Test Front Underbody View

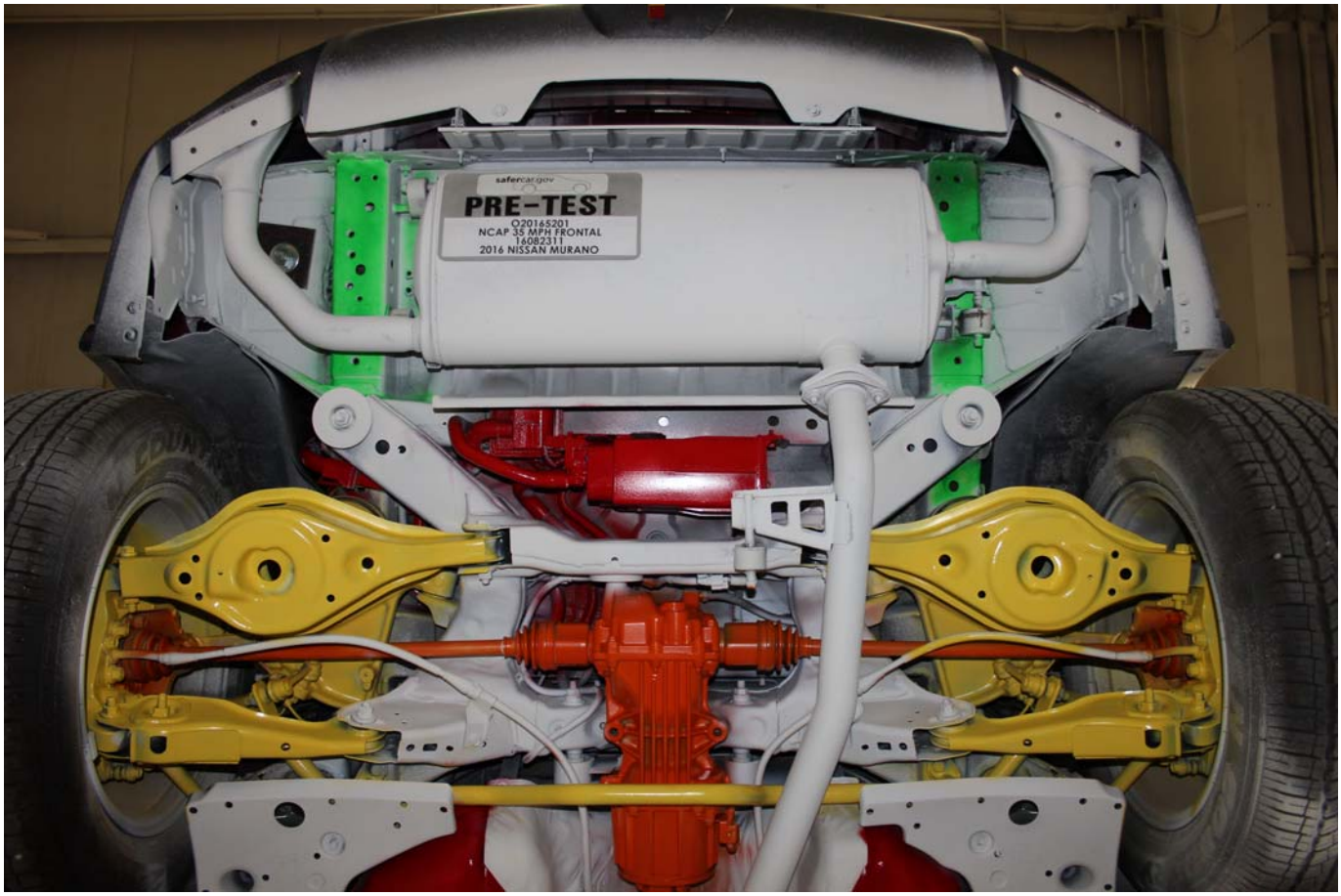

Photo No. 026 - Pre-Test Rear Underbody View

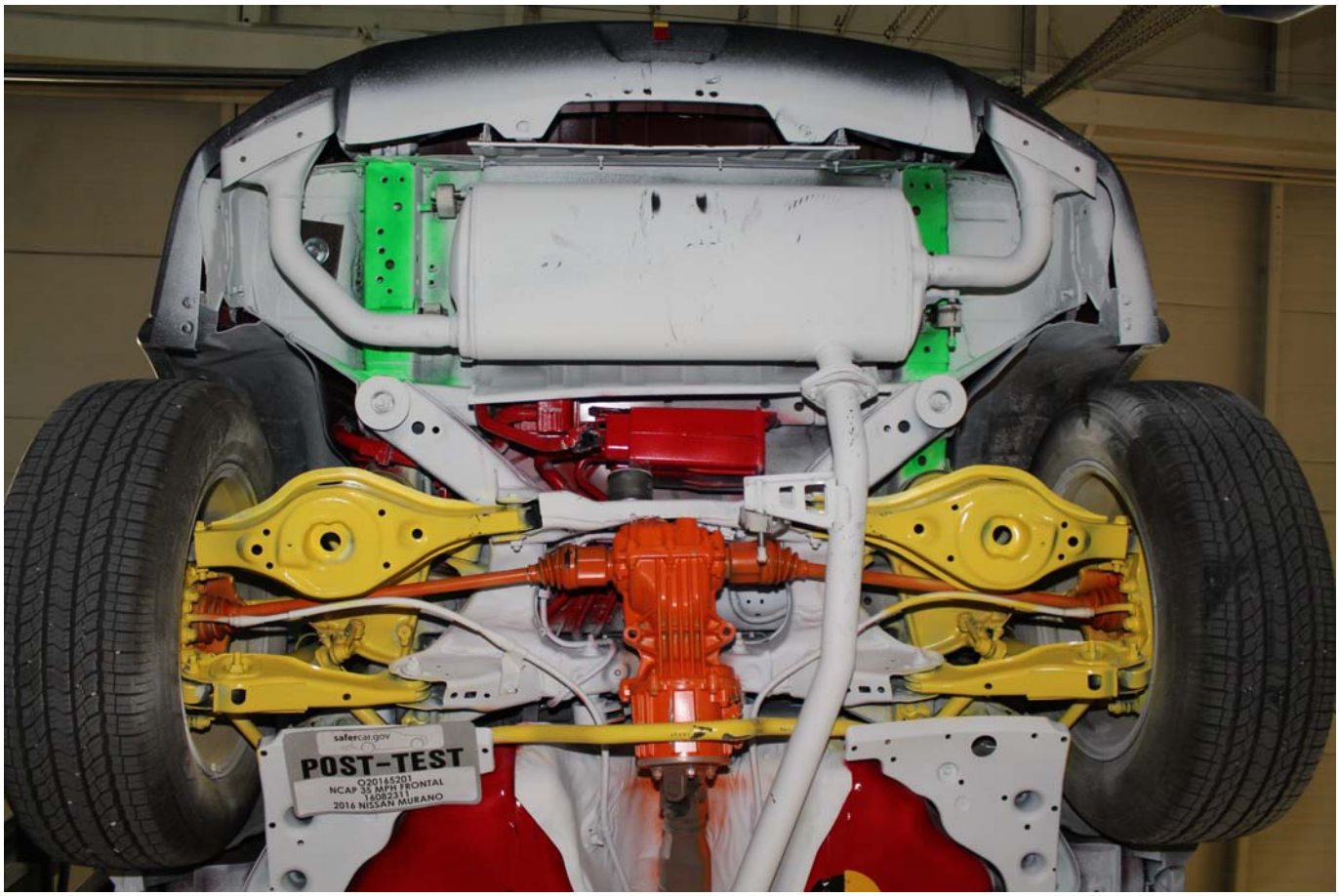

Photo No. 027 - Post-Test Rear Underbody View

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

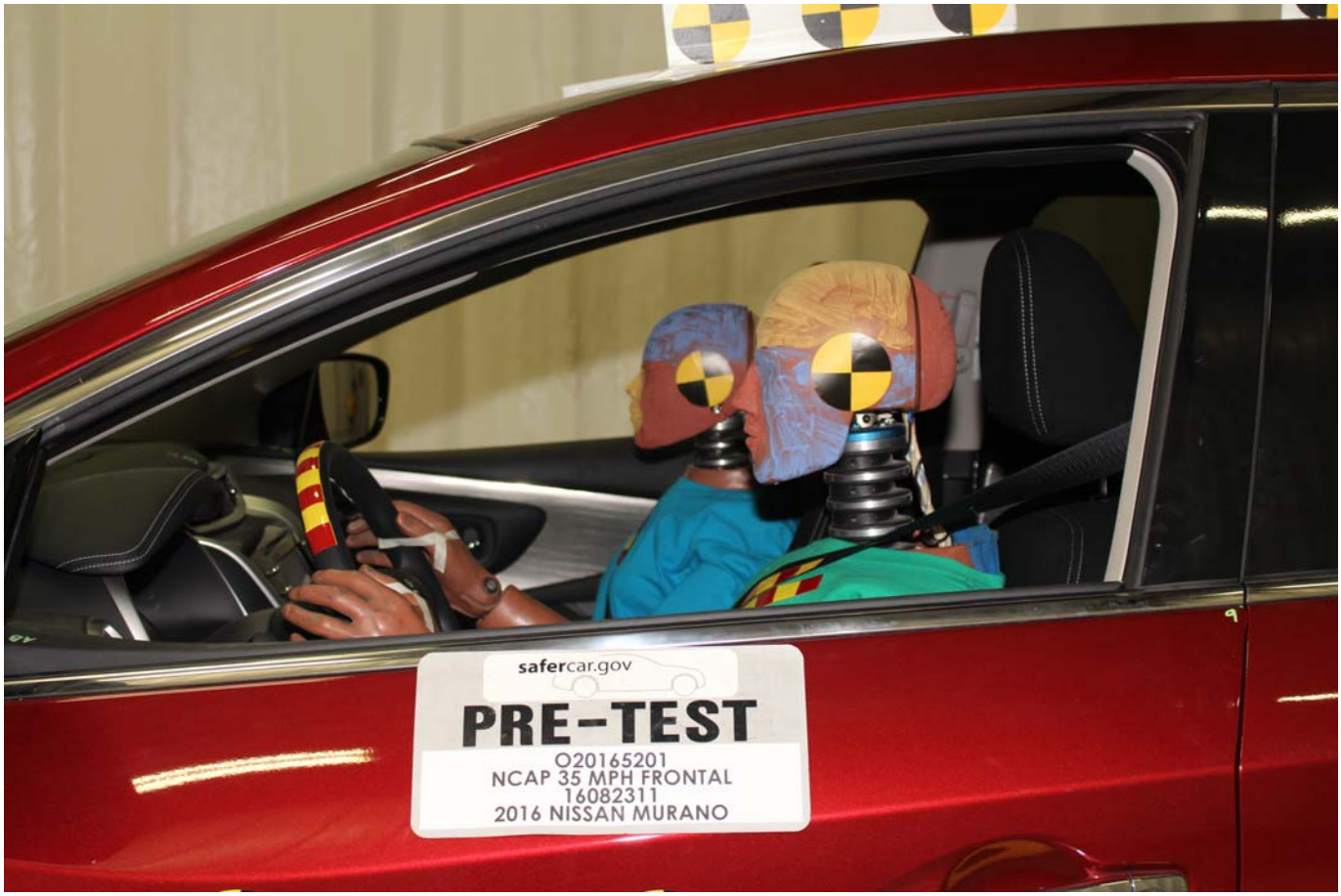

Photo No. 032 - Pre-Test Driver Dummy Window View

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

Photo No. 034 - Pre-Test Driver Dummy and Vehicle Interior (Door Open)

Photo No. 035 - Post-Test Driver Dummy and Vehicle Interior (Door Open)

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

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

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

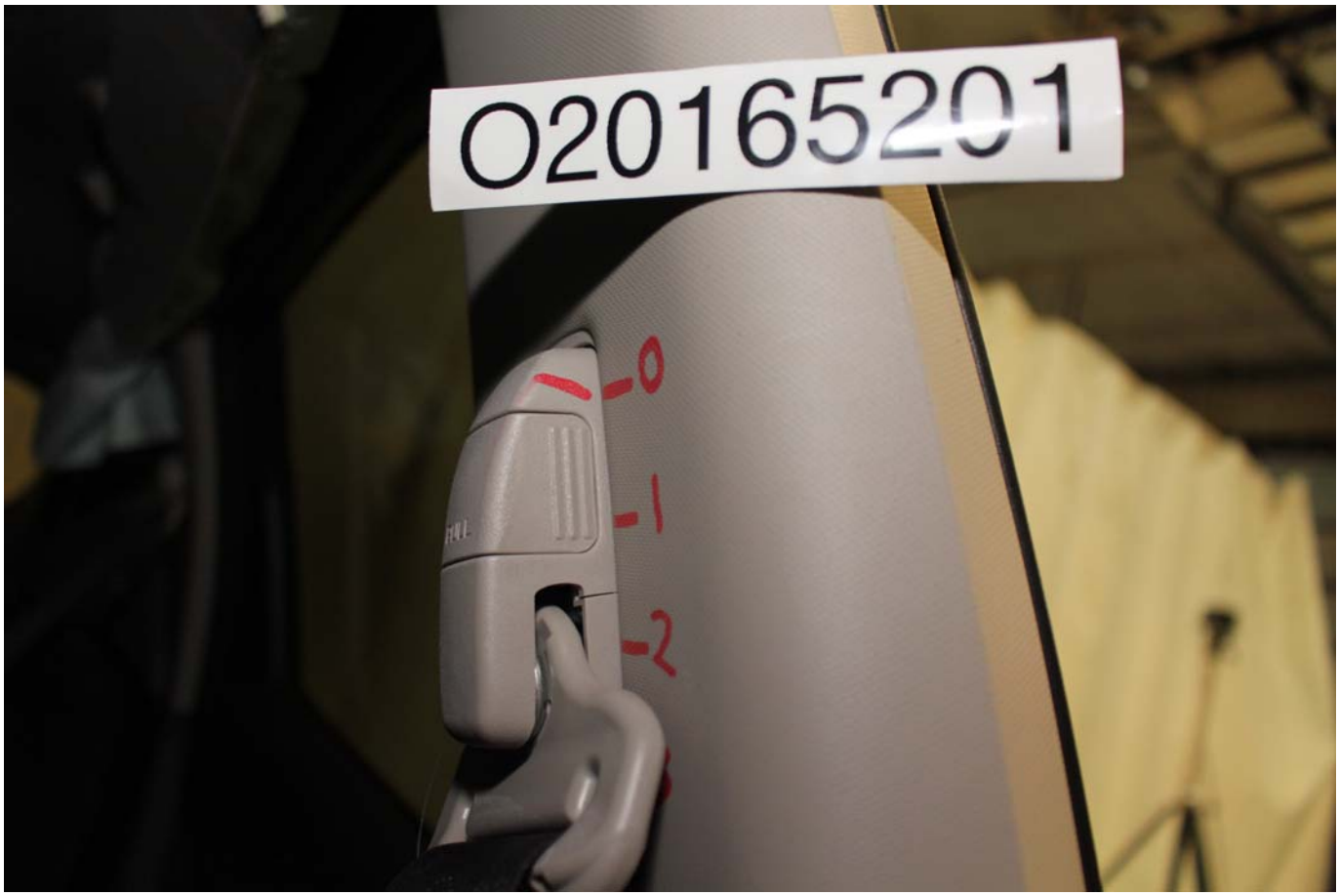

Photo No. 039 - Post-Test View of Belt Anchorage for Driver Dummy

Photo No. 040 - Pre-Test Driver Dummy Feet

Photo No. 041 - Post-Test Driver Dummy Feet

Photo No. 042 - Pre-Test Driver’s Side Knee Bolster (without dummy)

Photo No. 043 - Post-Test Driver's Side Knee Bolster (without dummy)

Photo No. 044 - Pre-Test Driver's Side Floorpan

Photo No. 045 - Post-Test Driver's 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

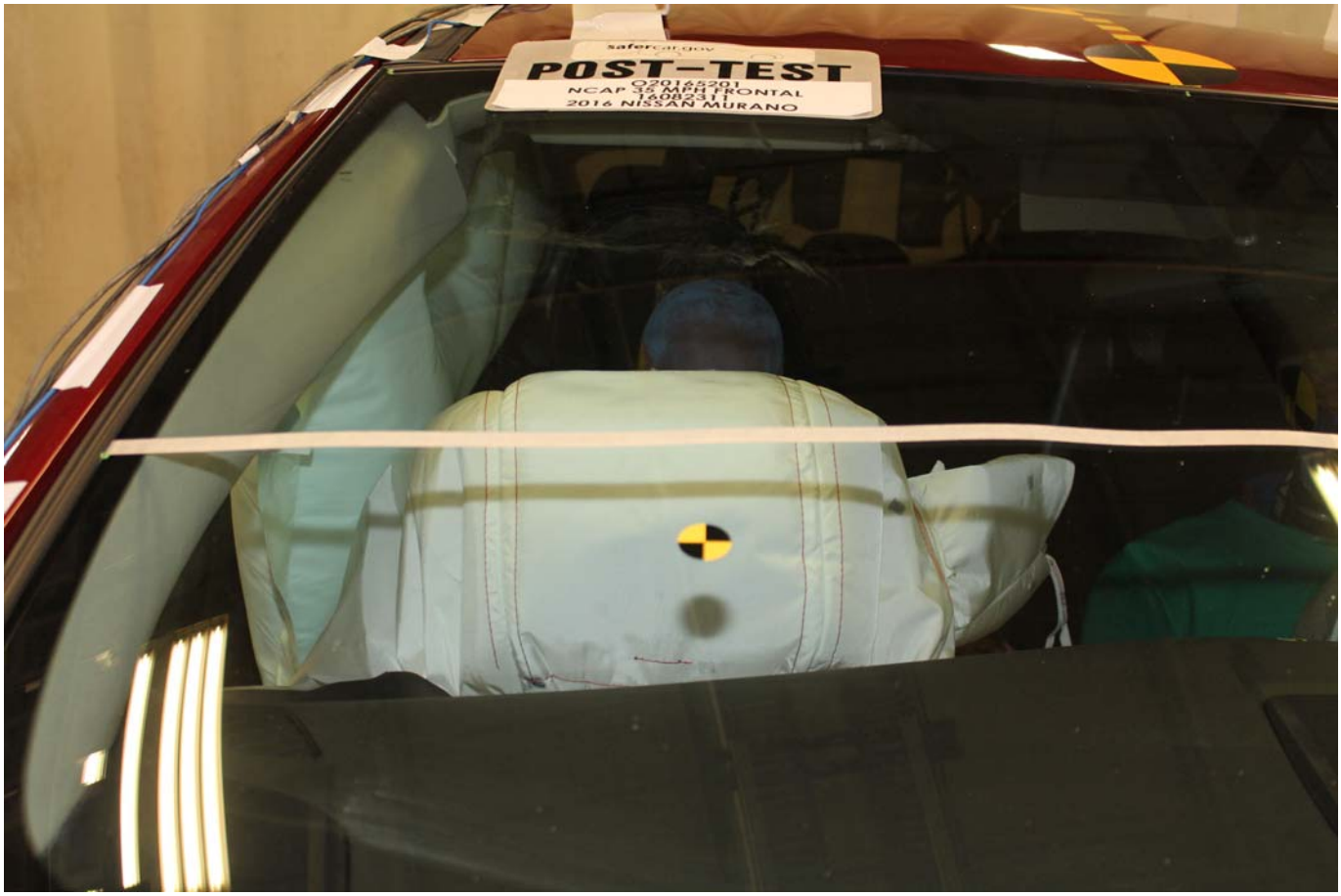

Photo No. 052 - Post-Test Passenger Dummy Front View

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 (Door Open)

Photo No. 056 - Post-Test Passenger Dummy and Vehicle Interior (Door Open)

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

Photo No. 058 - Post-Test Passenger's 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's Side Knee Bolster (without dummy)

Photo No. 064 - Post-Test Passenger's Side Knee Bolster (without dummy)

Photo No. 065 - Pre-Test Passenger's Side Floorpan

Photo No. 066 - Post-Test Passenger's 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

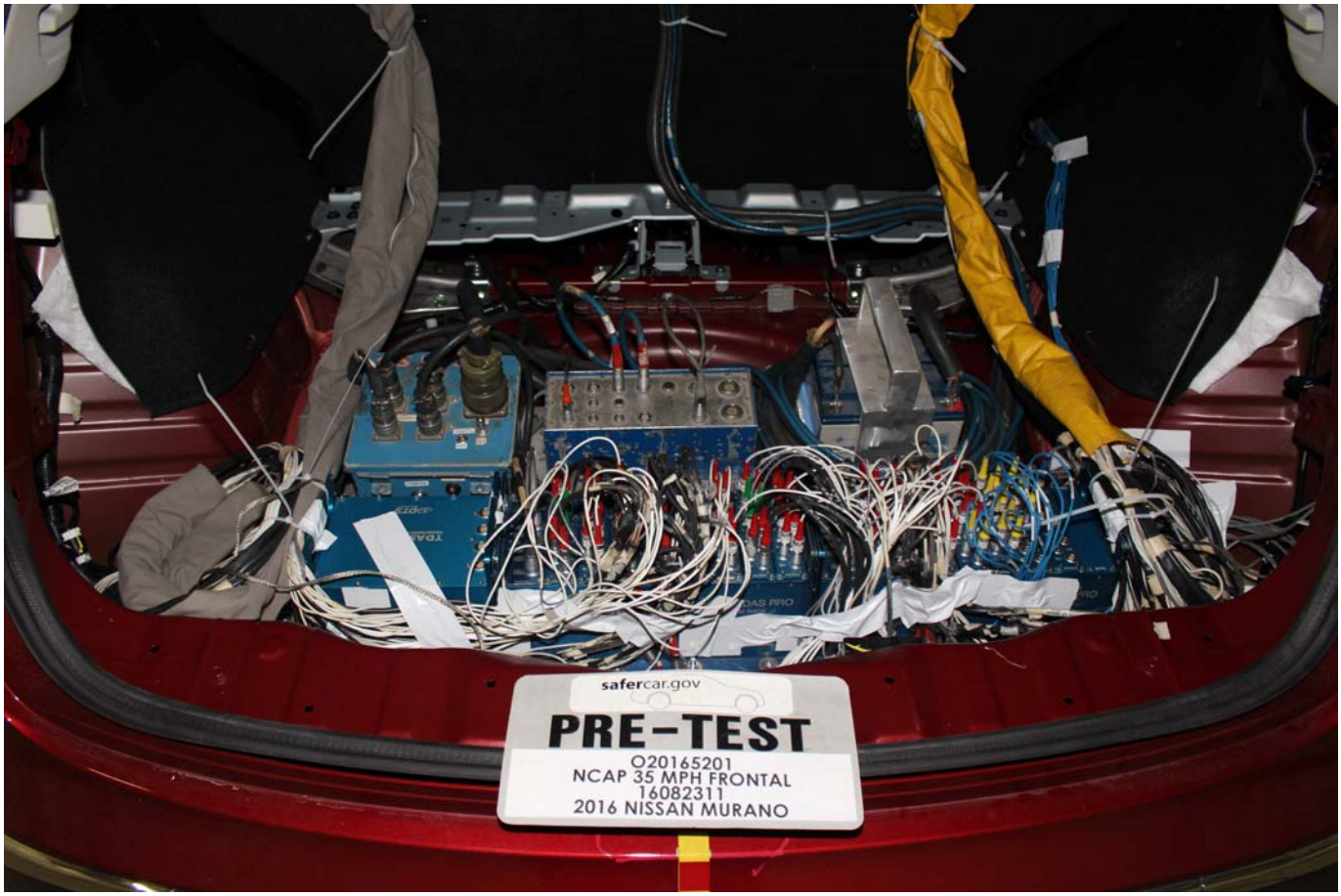

Photo No. 070 - Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

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

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

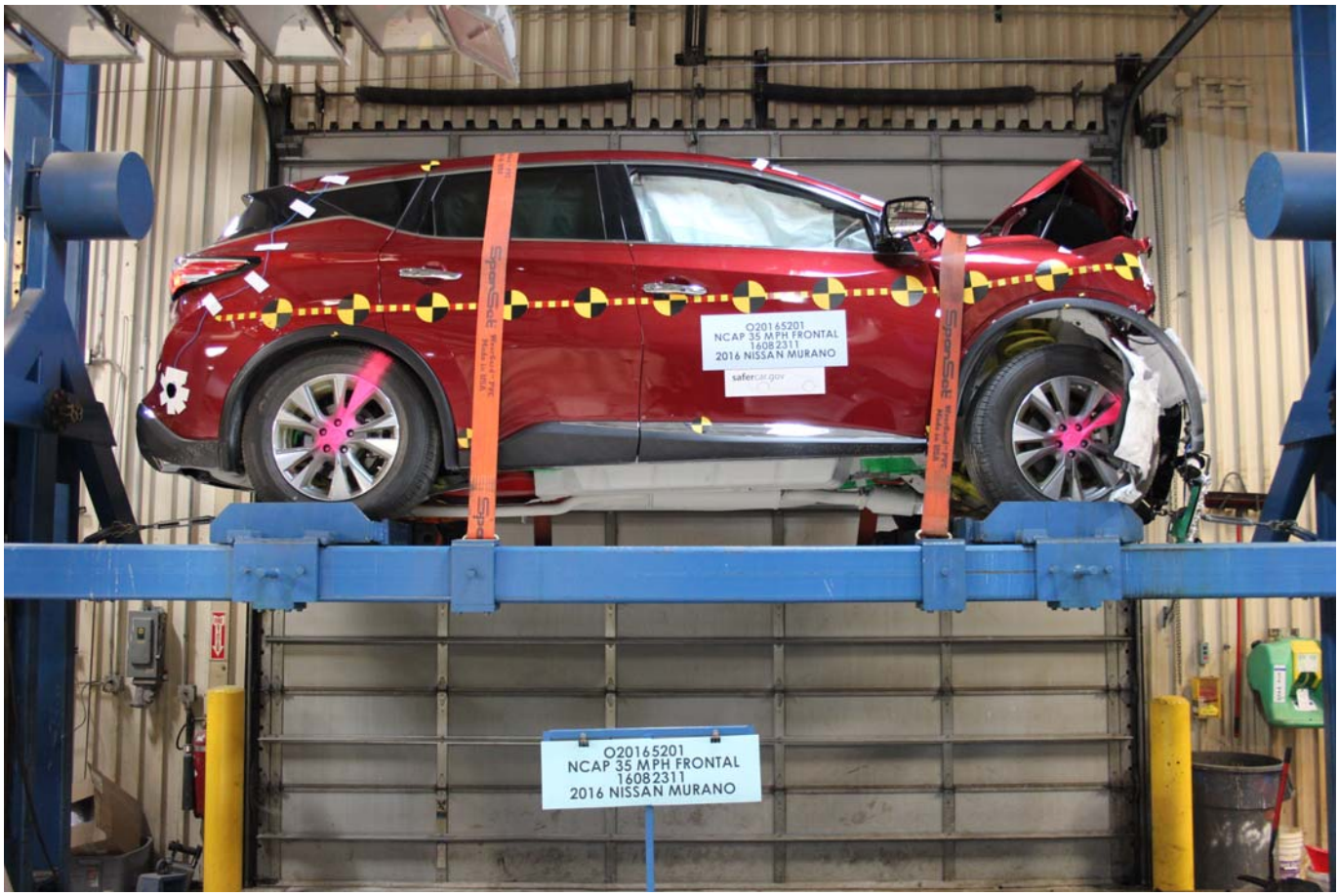

Photo No. 073 - Vehicle at 0 Degree on Static Rollover Device

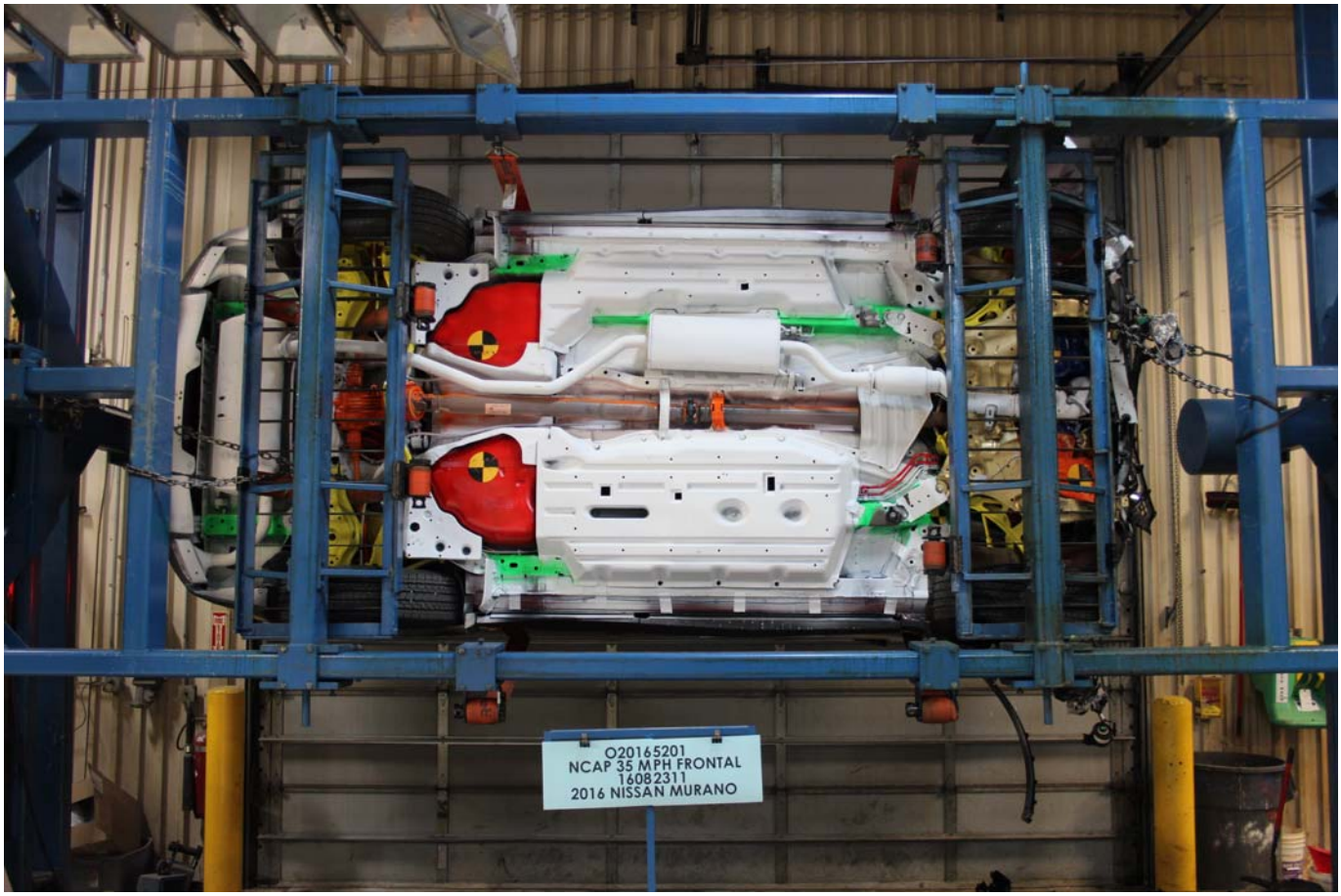

Photo No. 074 - Vehicle at 90 Degrees on Static Rollover Device

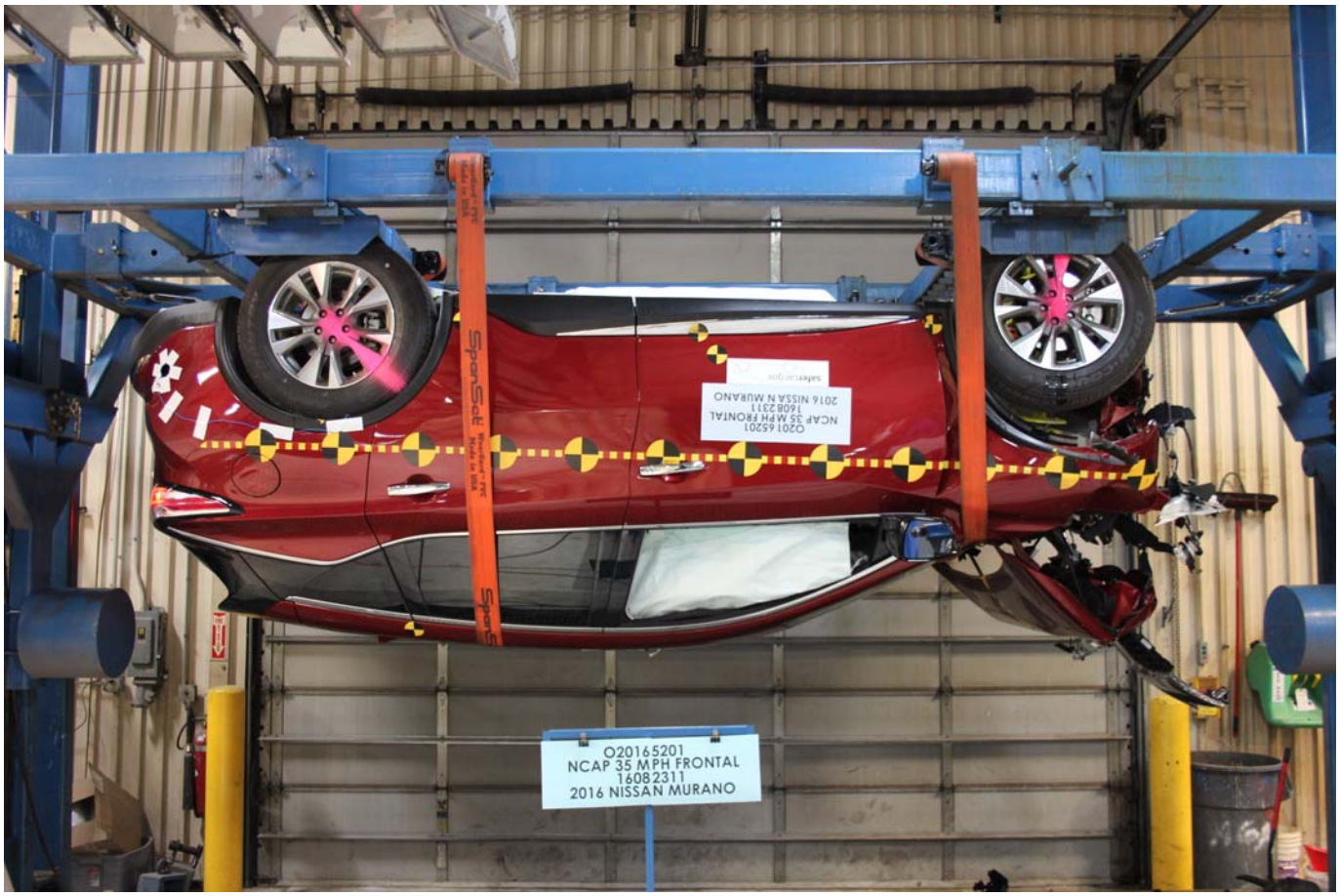

Photo No. 075 - Vehicle at 180 Degrees on Static Rollover Device

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

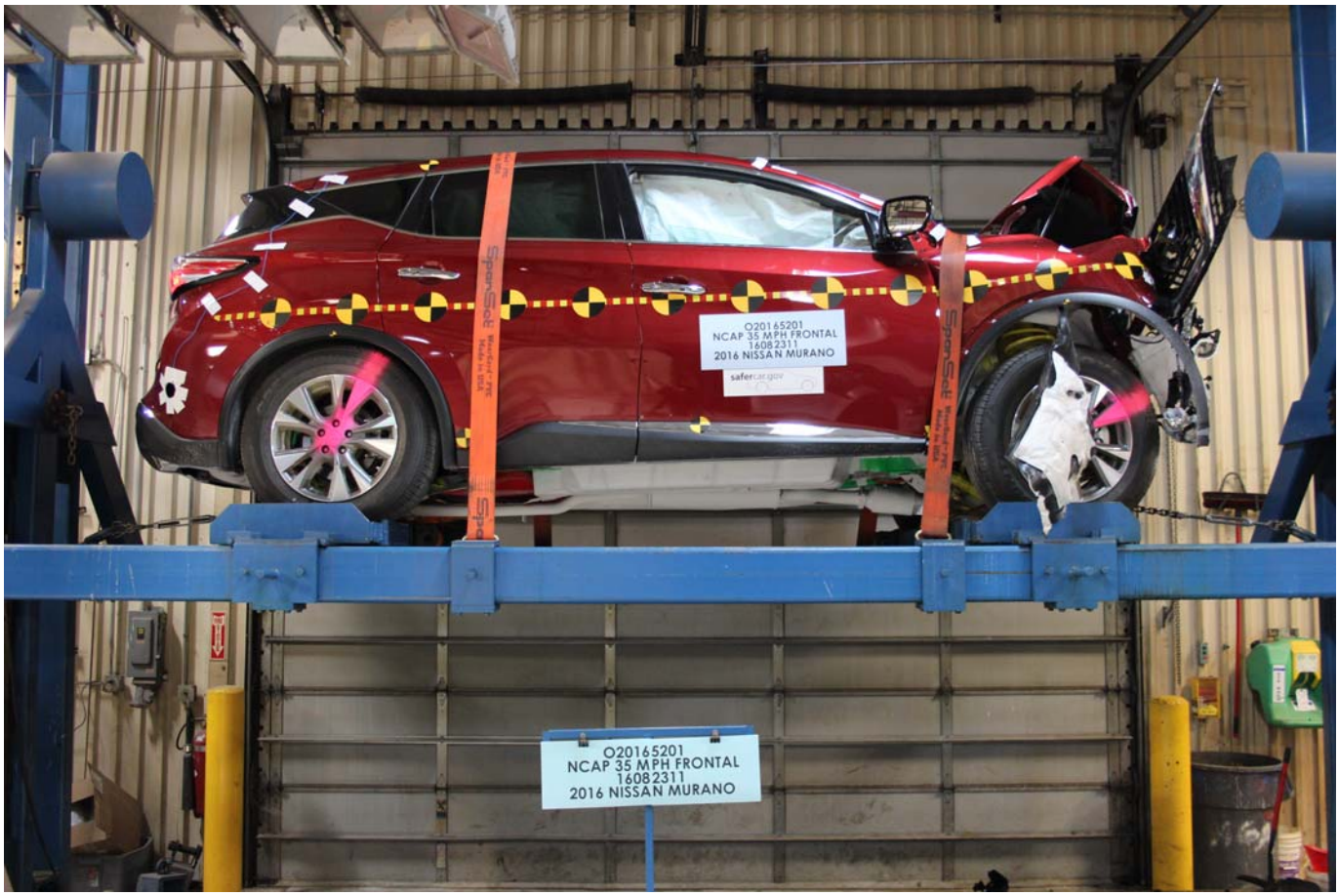

Photo No. 077 - Vehicle at 360 Degrees on Static Rollover Device

Photo No. 078 - 2016 Nissan Murano S AWD Frontal Impact Event

2016 NISSAN MURANO
S AWD

Scan QR code for general model information & options

Manufacturer's Suggested Retail Base Price: $31,260.00

Options Included by Manufacturer

DESTINATION CHARGES 900.00

Total* **$32,160.00**

Standard Equipment Included at No Extra Charge

MECHANICAL & PERFORMANCE
3.5 Liter V6 Engine
XTRONIC CVT®
(Continuously Variable Transmission)
All-Wheel Drive
18" Machined Aluminum-Alloy Wheels

SAFETY & SECURITY
Driver & Front Passenger, Side-Impact, & Curtain Air Bags
Driver Knee Air Bag
Lower Anchors & Tethers for CHildren (LATCH)
4-Wheel Anti-lock Braking System (ABS)
Vehicle Dynamic Control (VDC)
Traction Control System (TCS)
Tire Pressure Monitoring System (TPMS) with Easy-Fill Tire Alert
Vehicle Security System (VSS)
Hill Start Assist

COMFORT & CONVENIENCE
NASA-Inspired Zero Gravity Front and Rear Outboard Seats
6-Way Manual Driver's Seat
4-Way Manual Front Passenger's Seat
60/40 Split Fold-Down Rear Seats
Cloth Seats
Cruise Control
AM/FM/CD/MP3/WMA In-Dash Changer Audio System with 6 Speakers
NissanConnect™ with Mobile Apps****
7" Color Center Display
SiriusXM Satellite Radio**
Front USB Connection Port
Bluetooth® Hands-free Phone System*****
Streaming Audio via Bluetooth®
Auxiliary Audio Input Jack
Hands-Free Text Messaging Assistant*****
RearView Monitor
7" Advanced Drive-Assist® Display
Dual Zone Automatic Temperature Control (ATC) with Front & Rear Vents
Nissan Intelligent Key® with Push Button Ignition
Power Windows with Front Window One-Touch Auto-Up/Down and Auto-Reverse Feature
Three 12-Volt DC Power Outlets

EXTERIOR
LED Signature and Daytime Running Lights
Automatic On/Off Headlights
Outside Mirrors with LED Turn Indicators
LED Taillights
Rear Tinted Privacy Glass

**SiriusXM includes activation & 3 months of service only; subscription sold separately. SiriusXM services are not available in AK, HI and some markets.

***Optional Equipment Replaces Standard Where Applicable

****Only use features when safe to do so. App availability is dependent upon vehicle model, trim level, packaging, and/or options. See NissanUSA.com/Connect for complete app availability details. Compatible smartphone required. Cellular network and GPS signals not available in all areas and/or at all times. Nissan is not responsible for associated costs, if any, for continued operation due to cellular network termination/changes. Cellular or other third party provider may terminate/restrict service without notice. Subscription Agreement required. See www.NissanUSA.com/Connect for details. Text rates and/or data usage may apply.

*****Compatible smartphone required. Text rates and/or data usage may apply.

*Does not include dealer installed options and accessories, local taxes or license fees. This label has been applied pursuant to federal law. Do not remove prior to delivery to the ultimate purchaser.

EPA DOT Fuel Economy and Environment — Gasoline Vehicle

Fuel Economy **24 MPG** combined city/hwy — 21 city, 28 highway

MID-SIZE STATION WAGON range from 16 to 42 MPG. The best vehicle rates 119 MPGe.

4.2 gallons per 100 miles

You **spend $500** more in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost $1,900

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 5 (1–10, Best)

Smog Rating (tailpipe only): 7 (1–10, Best)

This vehicle emits 376 grams CO_2 per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fueleconomy.gov.

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 25 MPG and costs $9,000 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $3.00 per gallon. MPGe is miles per gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fueleconomy.gov — Calculate personalized estimates and compare vehicles

Smartphone QR Code -

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score — **Not Rated**
Based on the combined ratings of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight.

Frontal Crash — Driver: **Not Rated**; Passenger: **Not Rated**
Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight.

Side Crash — Front seat: ★★★★★; Rear seat: ★★★★★
Based on the risk of injury in a side impact.

Rollover — ★★★★
Based on the risk of rollover in a single-vehicle crash.

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

This Vehicle qualifies for Nissan's

Security+Plus Extended Protection Plan

The only service agreement backed by Nissan Extended Services North America
Ask your dealer for details, or call 1-800-NISSAN-1 for more information

DELIVERY

VEHICLE COLORS:
EXT: CAYENNE RED
INT: GRAPHITE

FINAL ASSEMBLY POINT: CANTON

TRANSPORT METHOD: TRUCK

DEALER:
MAGUIRE NISSAN / SYRACUSE
716 W GENESEE
SYRACUSE NY
13204

VIN: 5N1AZ2MH6GN120447
EMS: 50 STATE EMISSIONS
MDL: 23016-120447 NAH-G
OPT: H-C03Z86

20160623102615RL5542

Photo No. 079 - Monroney Label Photograph

APPENDIX B
DUMMY RESPONSE DATA TRACES

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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

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Head Angular Velocity X

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

Driver Left Upper Tibia Force Z

Driver Left Lower Tibia Moment X

Driver Left Lower Tibia Moment Y

Driver Left Lower Tibia Force Z

Driver Right Upper Tibia Moment X

Driver Right Upper Tibia Moment Y

Driver Right Upper Tibia Force Z

Driver Right Lower Tibia Moment X

Driver Right Lower Tibia Moment Y

Driver Right Lower Tibia Force Z

Driver Left Foot Fore Z

Driver Left Foot Aft X

Driver Left Foot Aft Z

Driver Right Foot Fore Z

Driver Right Foot Aft X

Driver Right Foot Aft Z

Driver 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

Passenger Chest X Redundant

Passenger Chest Y Redundant

Passenger Chest Z Redundant

Passenger Pelvis X

Passenger Pelvis Y

Passenger Pelvis Z

Passenger Left Femur Redundant

Passenger Right Femur Redundant

Passenger Left Upper Tibia Moment X

Passenger Left Upper Tibia Moment Y

Passenger Left Upper Tibia Force Z

Passenger Left Lower Tibia Moment X

Passenger Left Lower Tibia Moment Y

Passenger Left Lower Tibia Force Z

Passenger Right Upper Tibia Moment X

Passenger Right Upper Tibia Moment Y

Passenger Right Upper Tibia Force Z

Passenger Right Lower Tibia Moment X

Passenger Right Lower Tibia Moment Y

Passenger Right Lower Tibia Force Z

Passenger Left Foot Fore Z

Passenger Left Foot Aft X

Passenger Left Foot Aft Z

Passenger Right Foot Fore Z

Passenger Right Foot Aft X

Passenger Right Foot Aft Z

Passenger 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

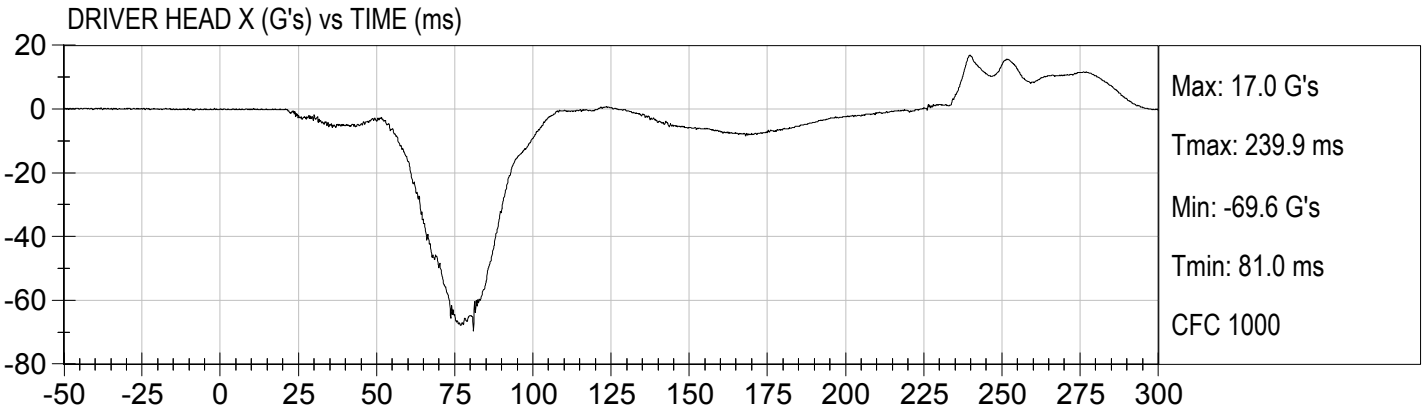
Left Rear Seat Crossmember Z

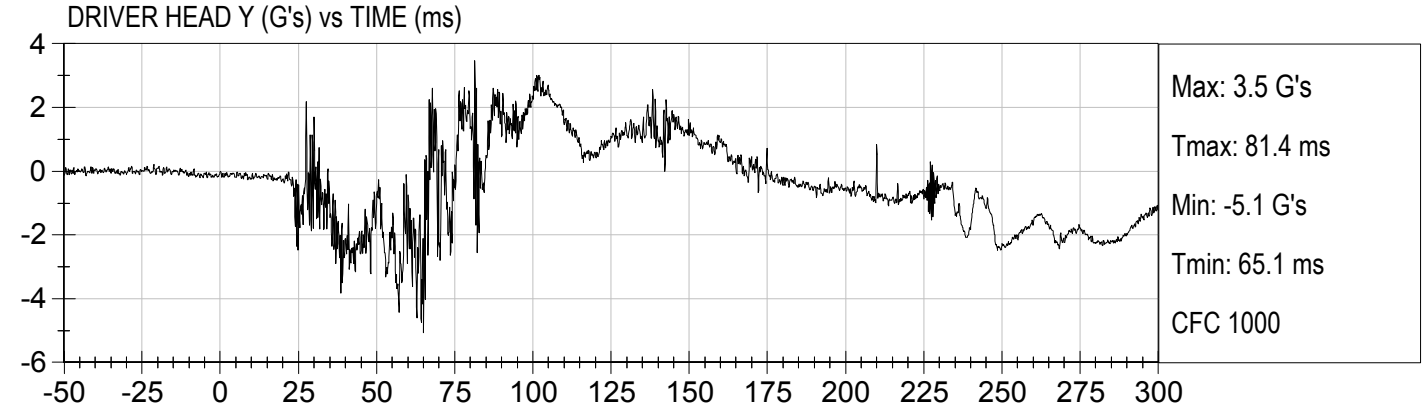
Right Rear Seat Crossmember Z

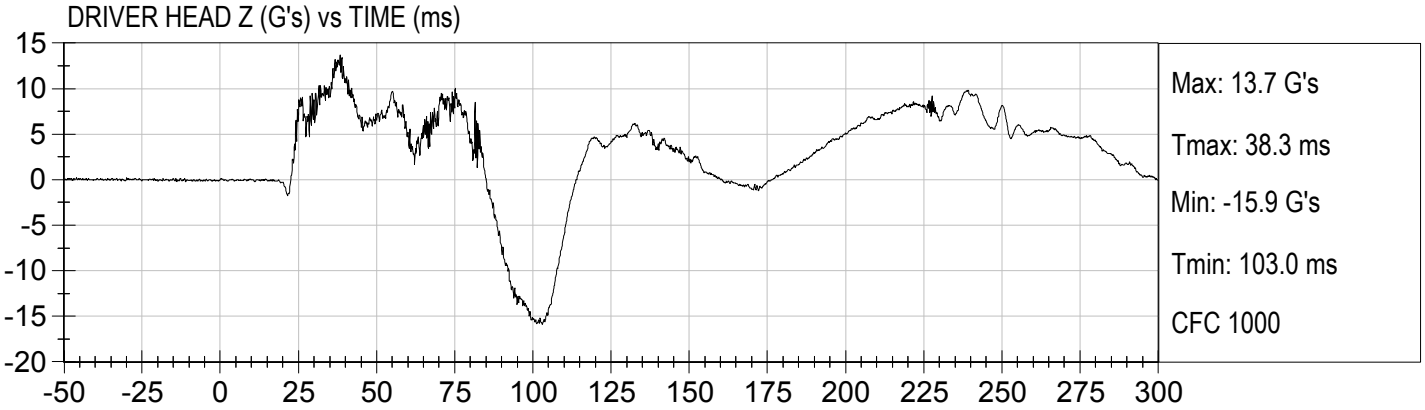
Left Rear Seat Crossmember Xr

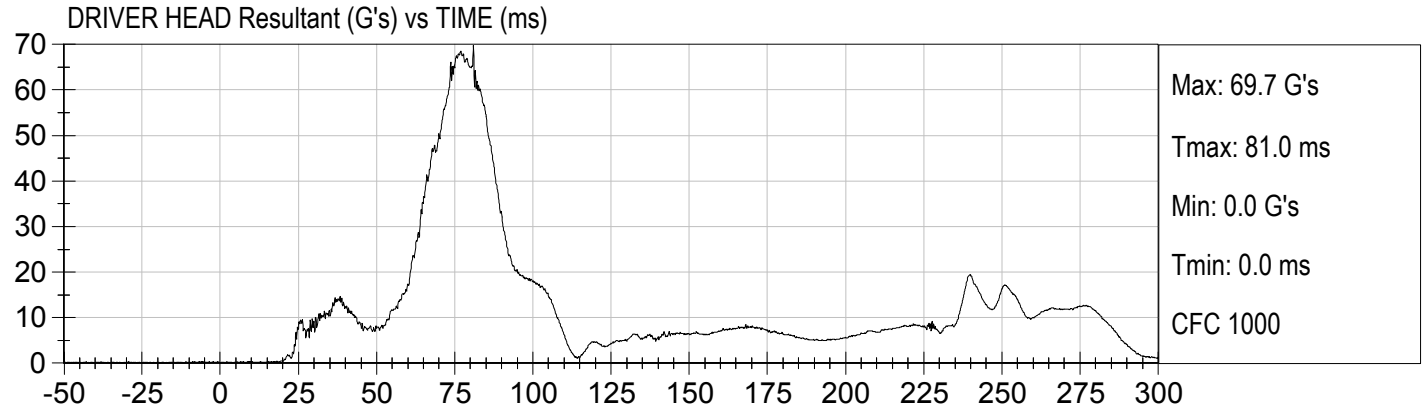
Right Rear Seat Crossmember Xr

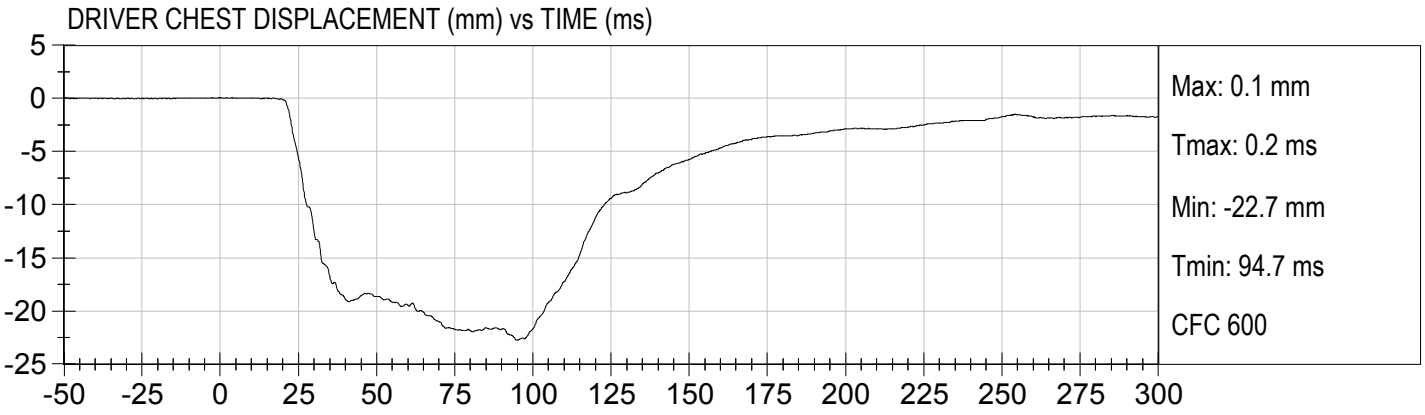
Advanced Research Load Cell Barrier – 528 channels


DRIVER HEAD X (G's) vs TIME (ms)
Max: 17.0 G's
Tmax: 239.9 ms
Min: -69.6 G's
Tmin: 81.0 ms
CFC 1000

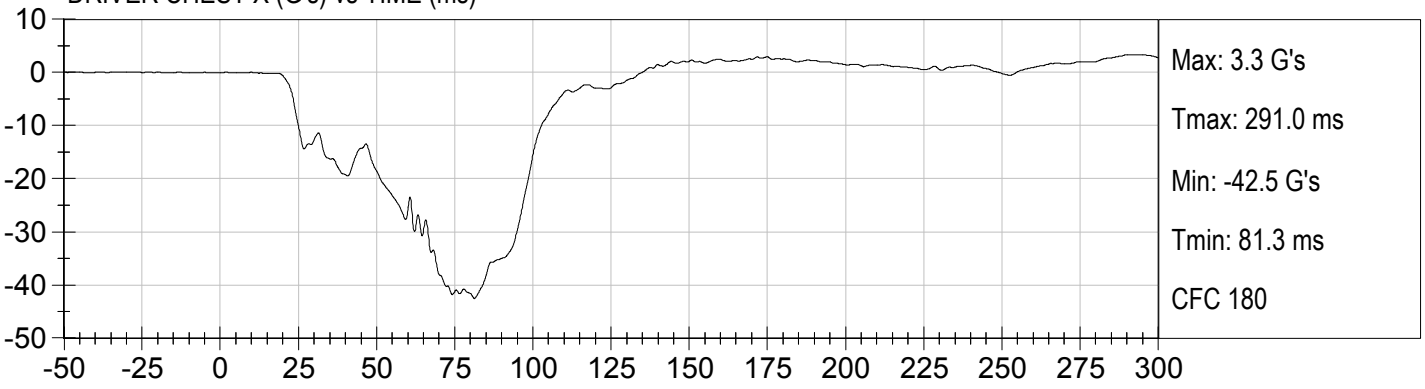

DRIVER HEAD Y (G's) vs TIME (ms)
Max: 3.5 G's
Tmax: 81.4 ms
Min: -5.1 G's
Tmin: 65.1 ms
CFC 1000


DRIVER HEAD Z (G's) vs TIME (ms)
Max: 13.7 G's
Tmax: 38.3 ms
Min: -15.9 G's
Tmin: 103.0 ms
CFC 1000

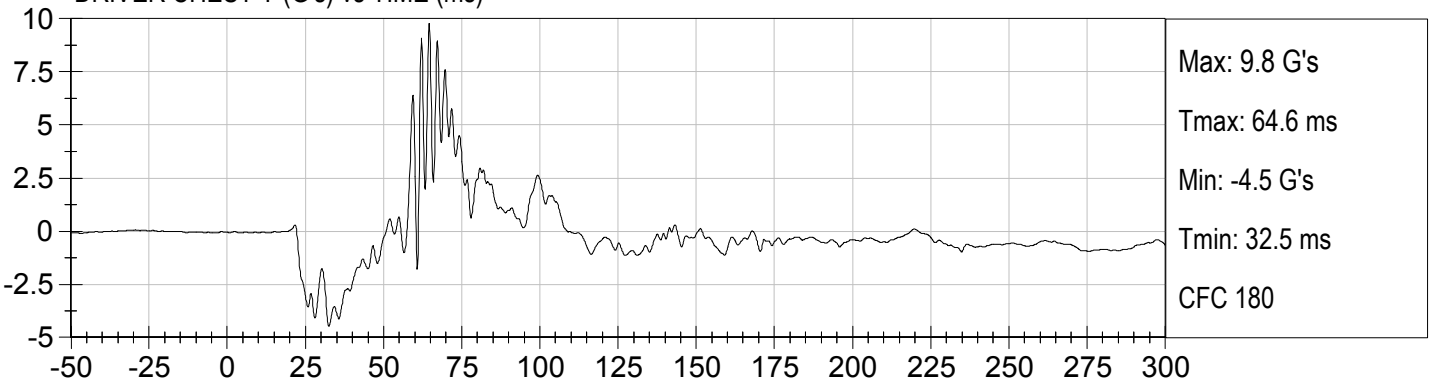

DRIVER HEAD Resultant (G's) vs TIME (ms)
Max: 69.7 G's
Tmax: 81.0 ms
Min: 0.0 G's
Tmin: 0.0 ms
CFC 1000


DRIVER CHEST DISPLACEMENT (mm) vs TIME (ms)
5
0
-5
-10
-15
-20
-25
-50
-25
0
25
50
75
100
125
150
175
200
225
250
275
300
Max: 0.1 mm
Tmax: 0.2 ms
Min: -22.7 mm
Tmin: 94.7 ms
CFC 600

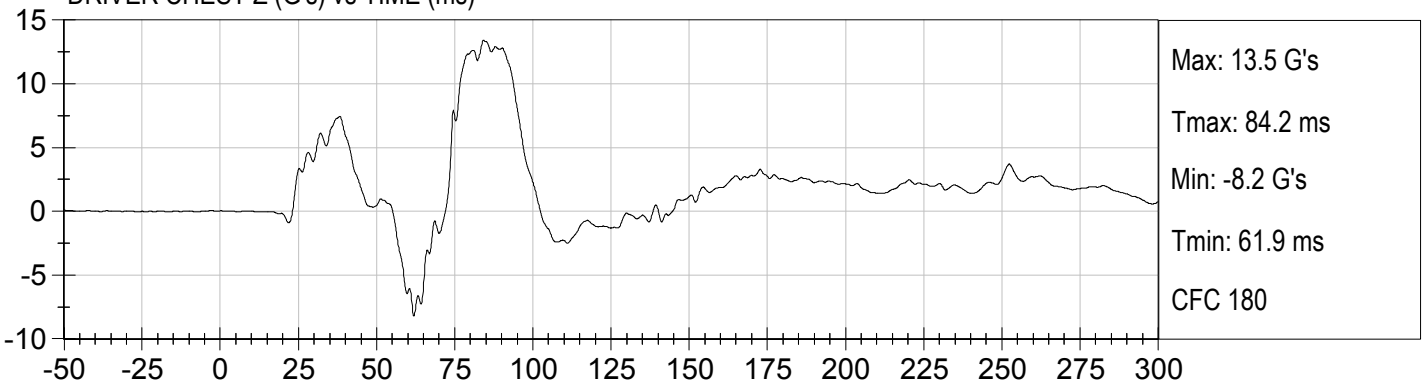
DRIVER CHEST X (G's) vs TIME (ms)



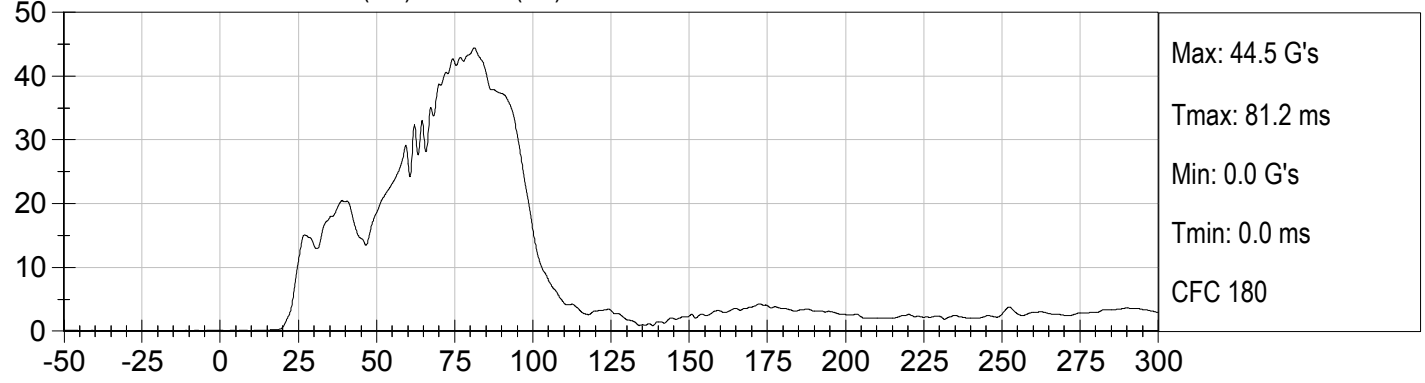
DRIVER CHEST Y (G's) vs TIME (ms)



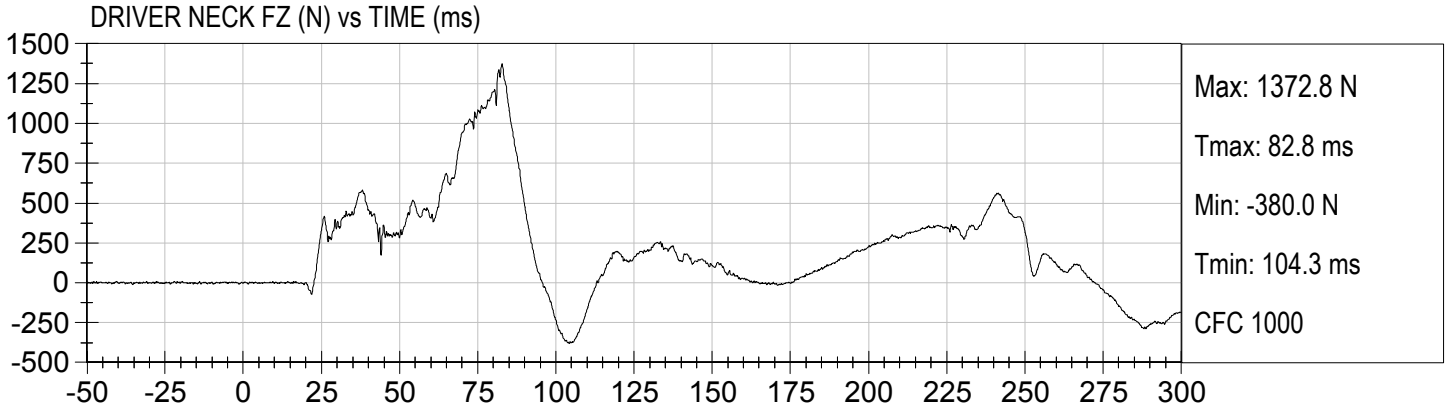
DRIVER CHEST Z (G's) vs TIME (ms)

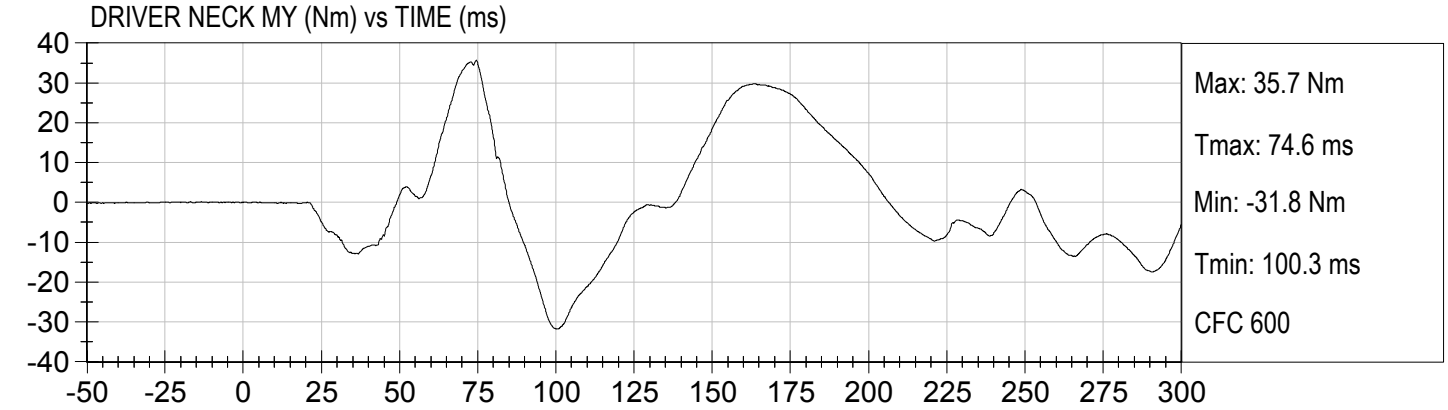


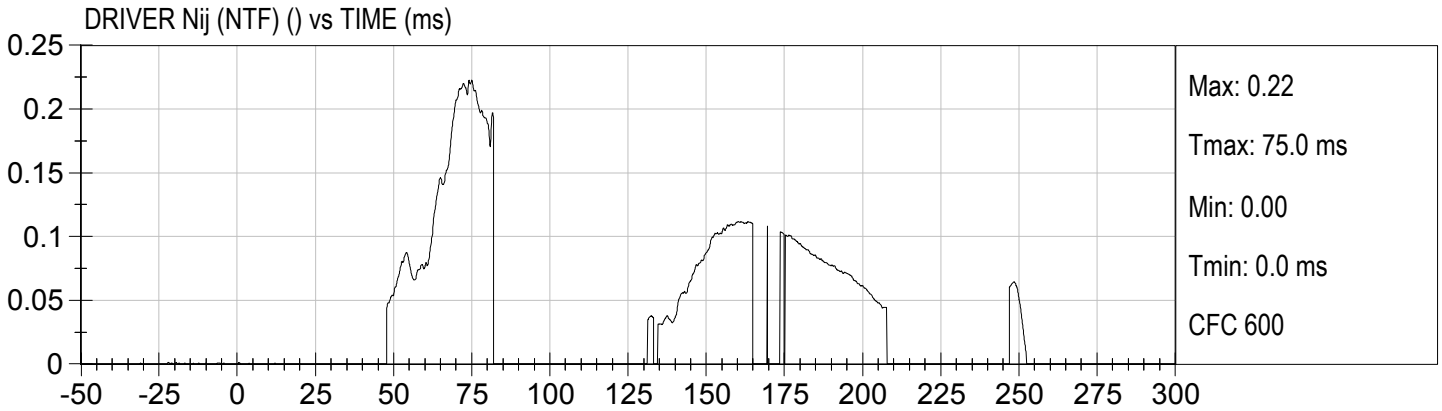
DRIVER CHEST Resultant (G's) vs TIME (ms)

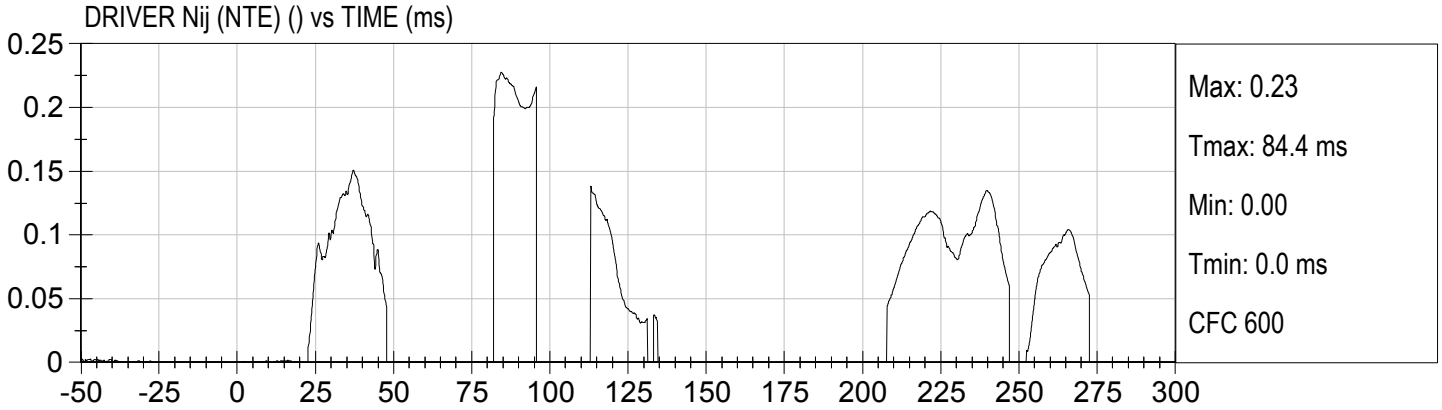


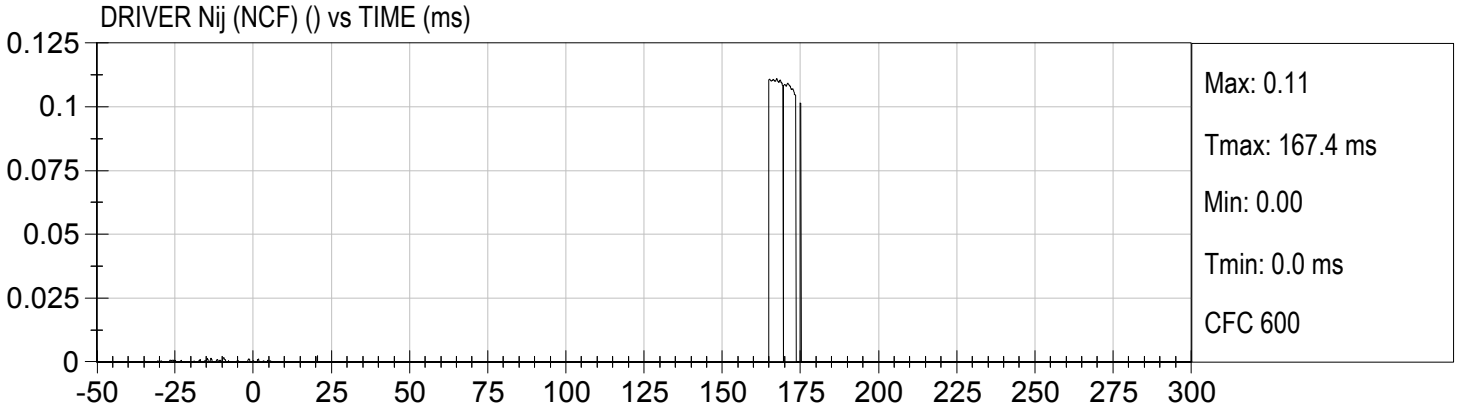
DRIVER NECK FX (N) vs TIME (ms)
1000
750
500
250
0
-250
-500
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 851.1 N
Tmax: 75.5 ms
Min: -266.3 N
Tmin: 169.9 ms
CFC 1000

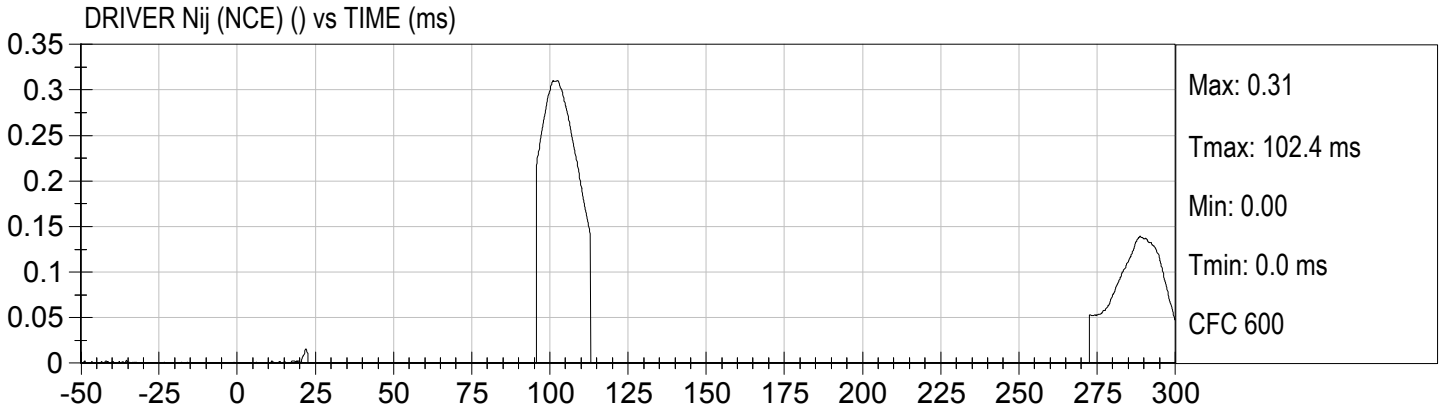

DRIVER NECK FZ (N) vs TIME (ms)
1500
1250
1000
750
500
250
0
-250
-500
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 1372.8 N
Tmax: 82.8 ms
Min: -380.0 N
Tmin: 104.3 ms
CFC 1000

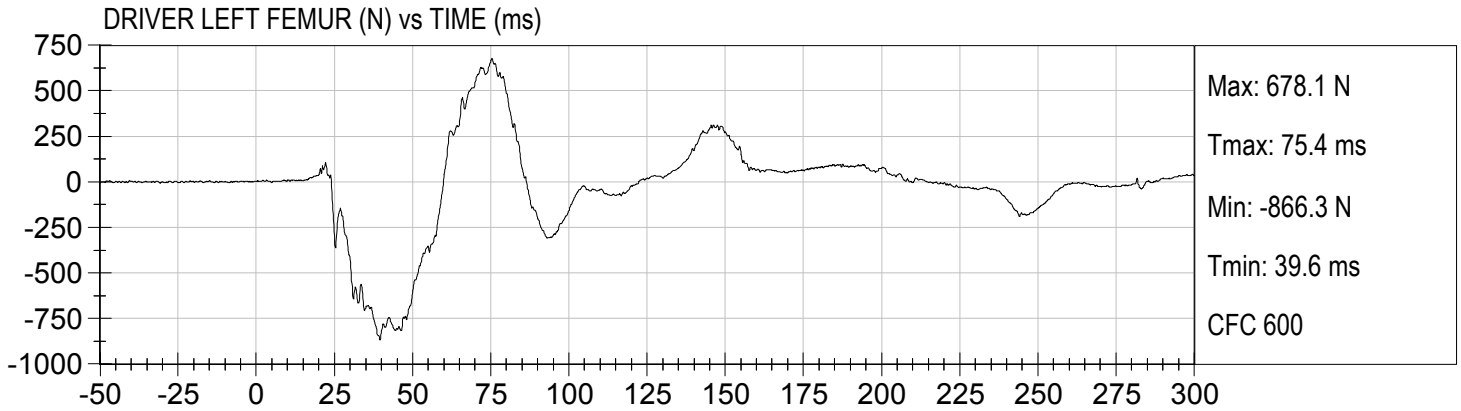

DRIVER NECK MY (Nm) vs TIME (ms)
40
30
20
10
0
-10
-20
-30
-40
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 35.7 Nm
Tmax: 74.6 ms
Min: -31.8 Nm
Tmin: 100.3 ms
CFC 600

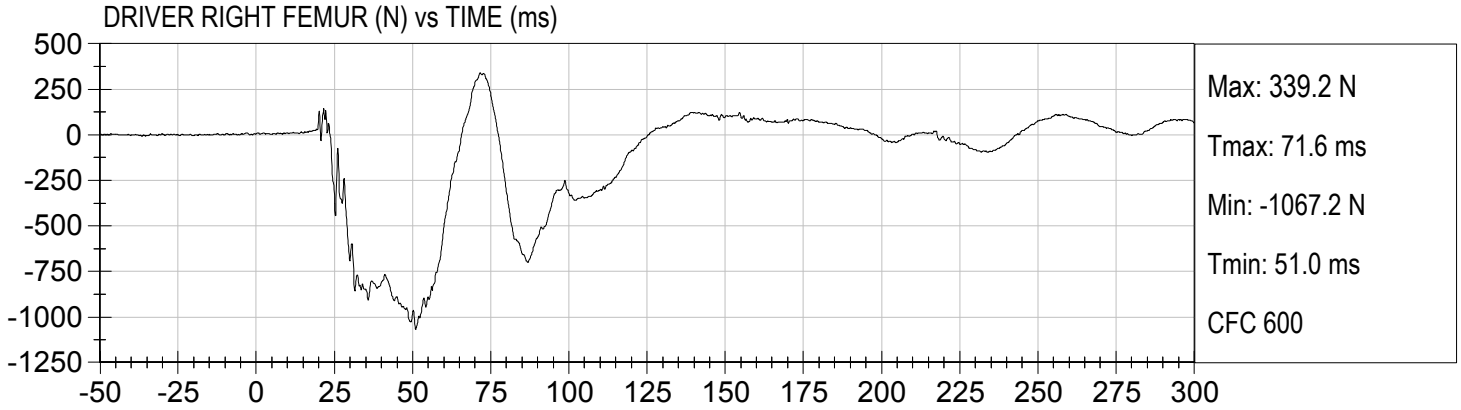

DRIVER Nij (NTF) () vs TIME (ms)
Max: 0.22
Tmax: 75.0 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


DRIVER Nij (NTE) () vs TIME (ms)
Max: 0.23
Tmax: 84.4 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

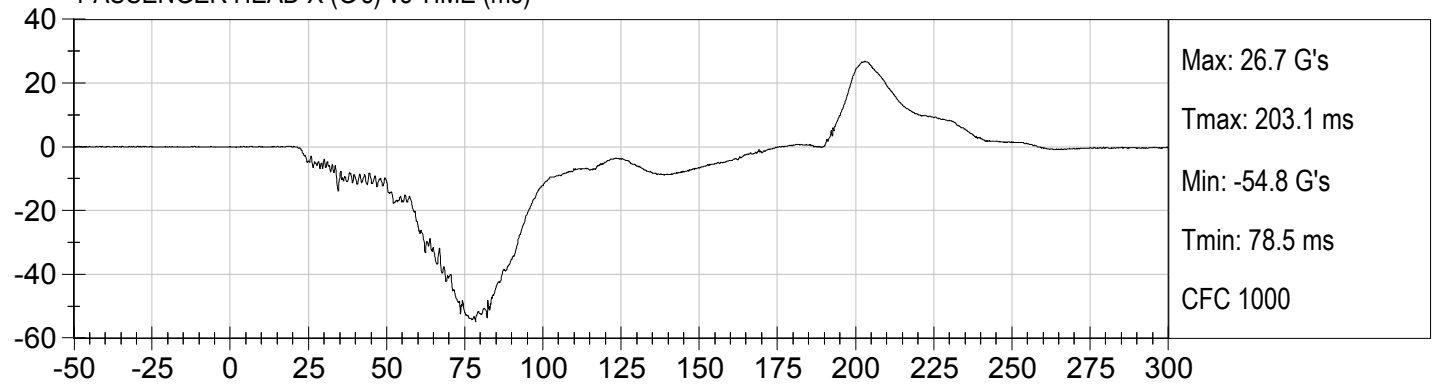

DRIVER Nij (NCF) () vs TIME (ms)
Max: 0.11
Tmax: 167.4 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


DRIVER Nij (NCE) () vs TIME (ms)
Max: 0.31
Tmax: 102.4 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

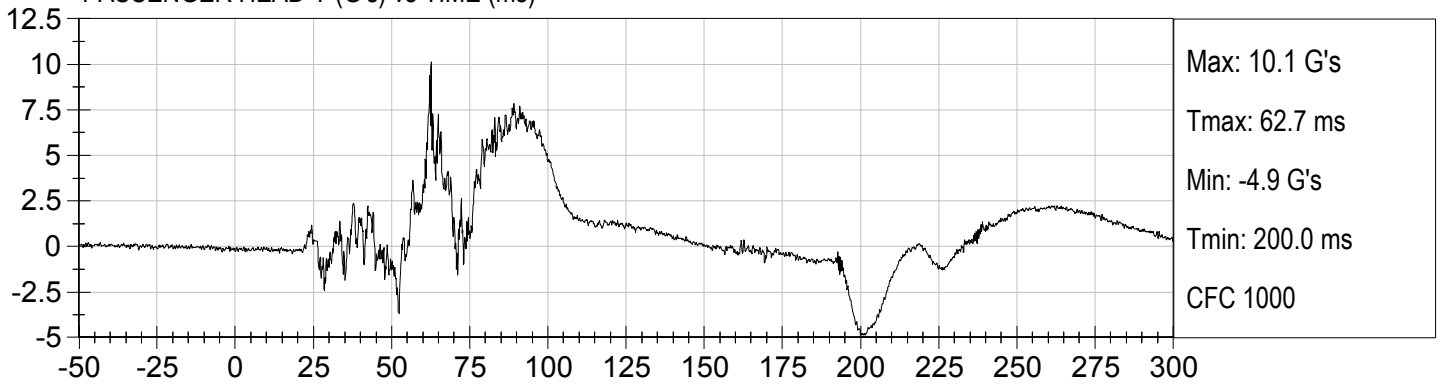

DRIVER LEFT FEMUR (N) vs TIME (ms)
750
500
250
0
-250
-500
-750
-1000
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 678.1 N
Tmax: 75.4 ms
Min: -866.3 N
Tmin: 39.6 ms
CFC 600


DRIVER RIGHT FEMUR (N) vs TIME (ms)
500
250
0
-250
-500
-750
-1000
-1250
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 339.2 N
Tmax: 71.6 ms
Min: -1067.2 N
Tmin: 51.0 ms
CFC 600

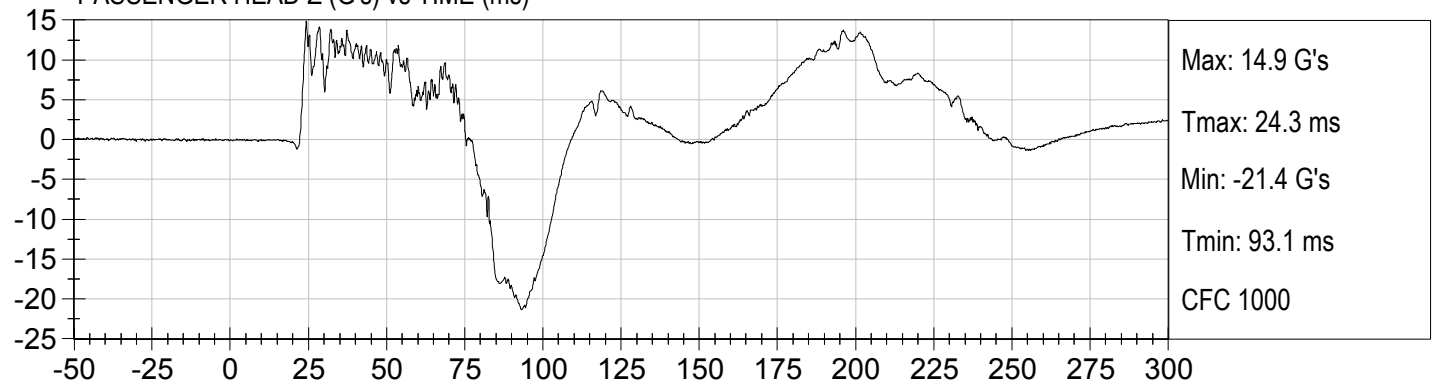
PASSENGER HEAD X (G's) vs TIME (ms)



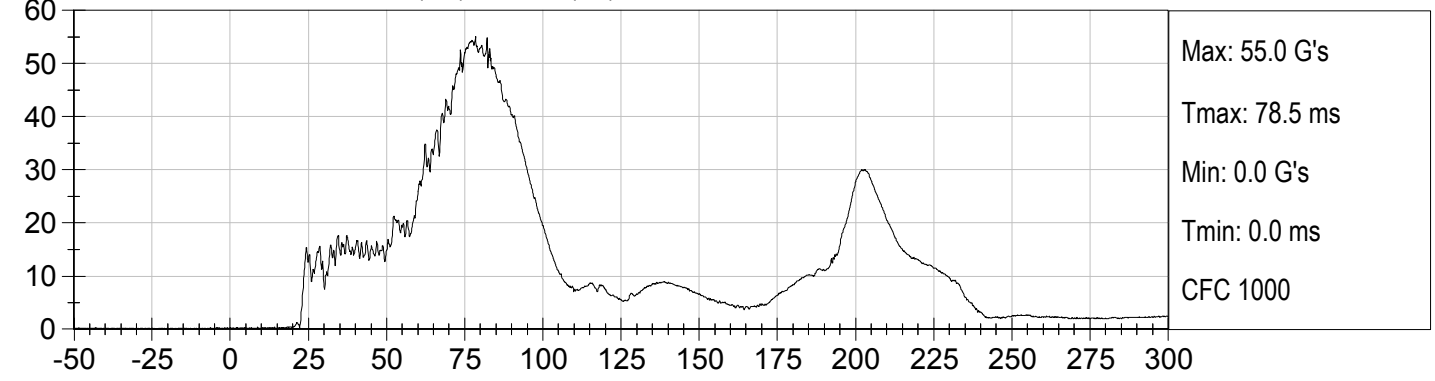
PASSENGER HEAD Y (G's) vs TIME (ms)

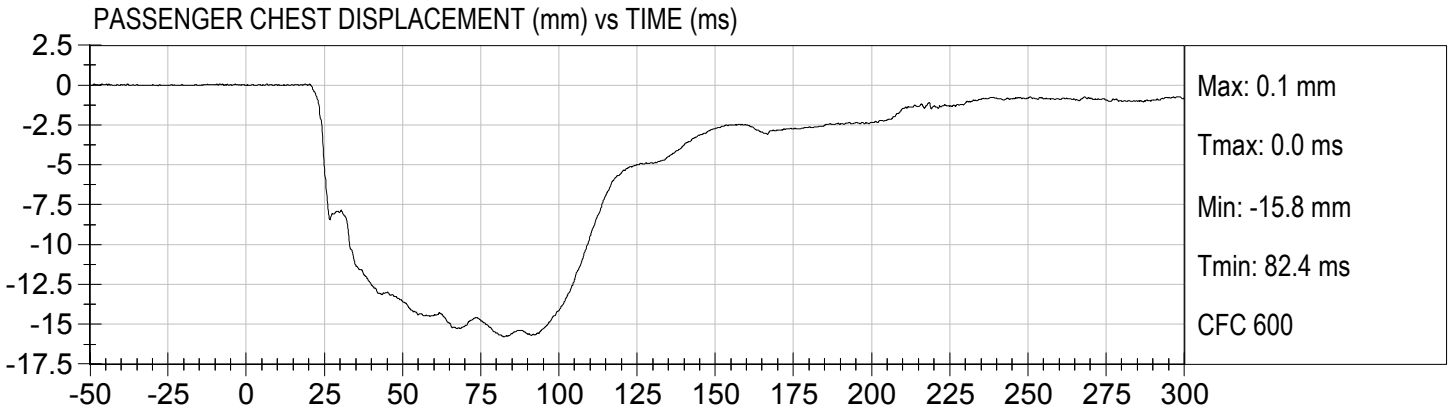


PASSENGER HEAD Z (G's) vs TIME (ms)

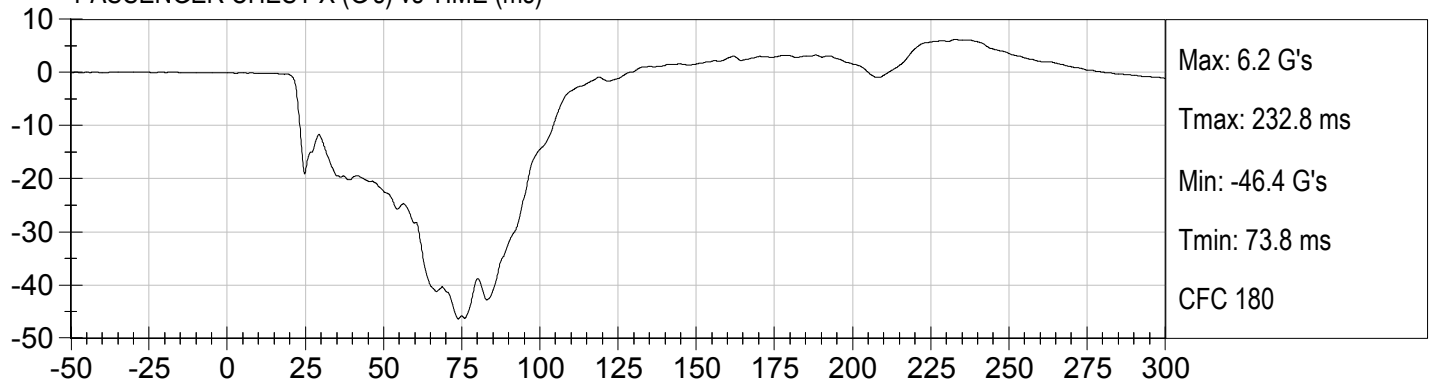


PASSENGER HEAD Resultant (G's) vs TIME (ms)

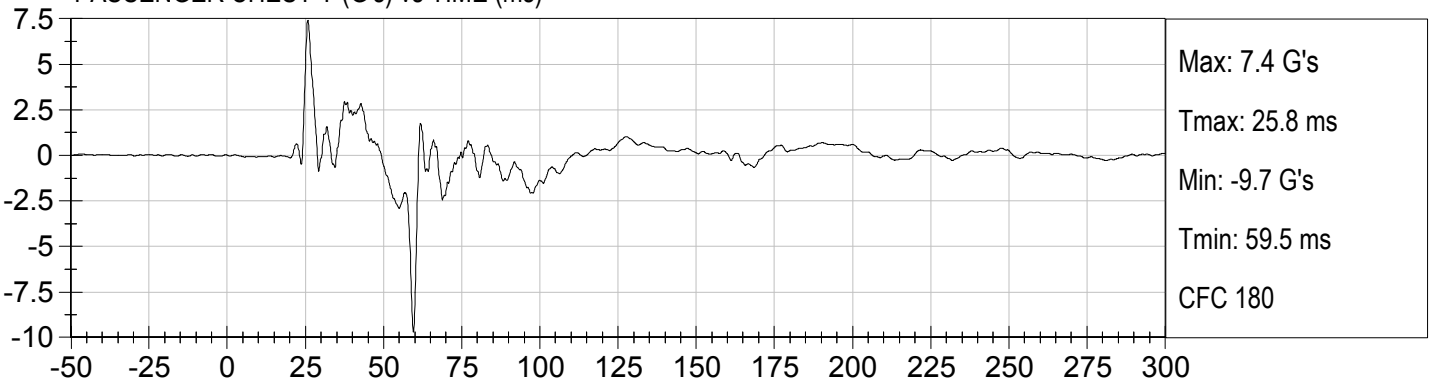



PASSENGER CHEST DISPLACEMENT (mm) vs TIME (ms)
2.5
0
-2.5
-5
-7.5
-10
-12.5
-15
-17.5
-50
-25
0
25
50
75
100
125
150
175
200
225
250
275
300
Max: 0.1 mm
Tmax: 0.0 ms
Min: -15.8 mm
Tmin: 82.4 ms
CFC 600

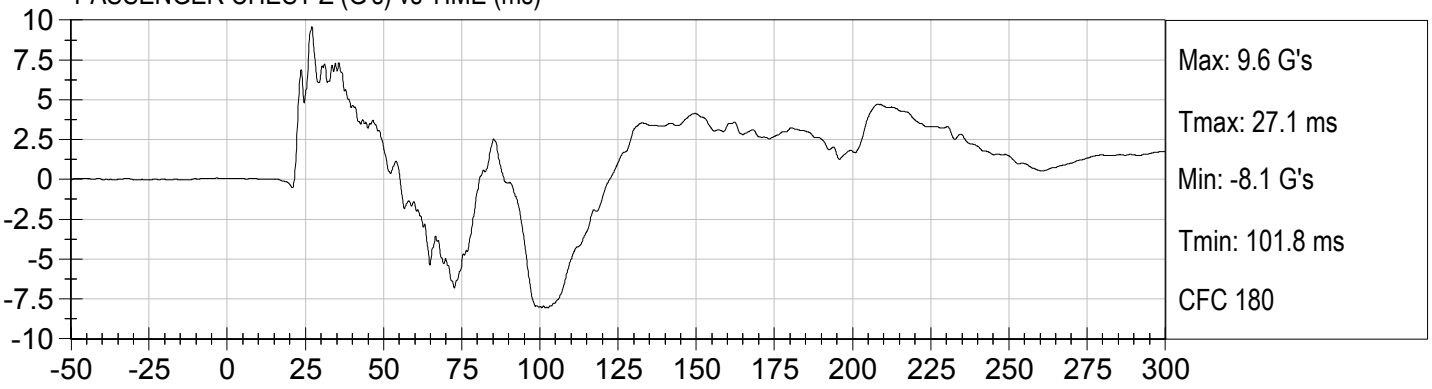
PASSENGER CHEST X (G's) vs TIME (ms)



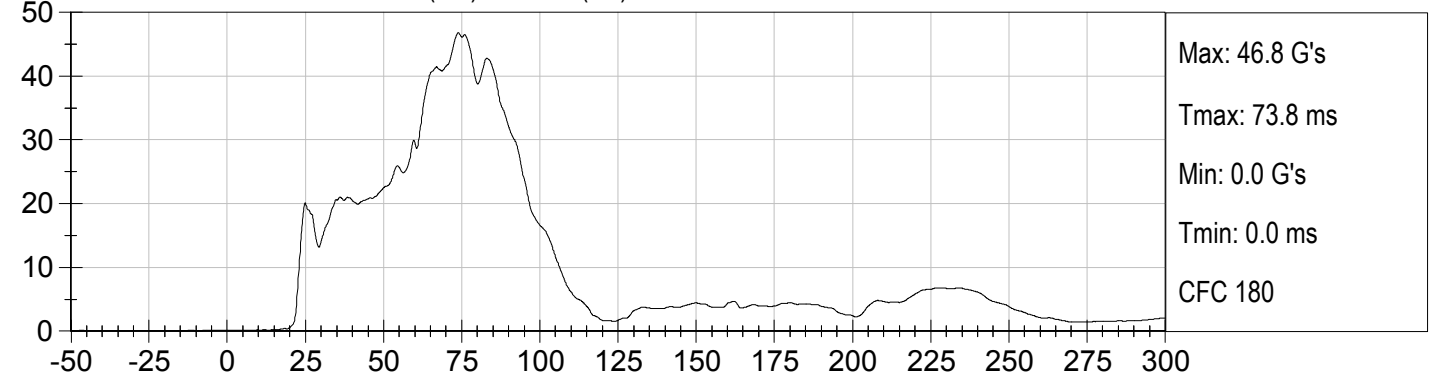
PASSENGER CHEST Y (G's) vs TIME (ms)

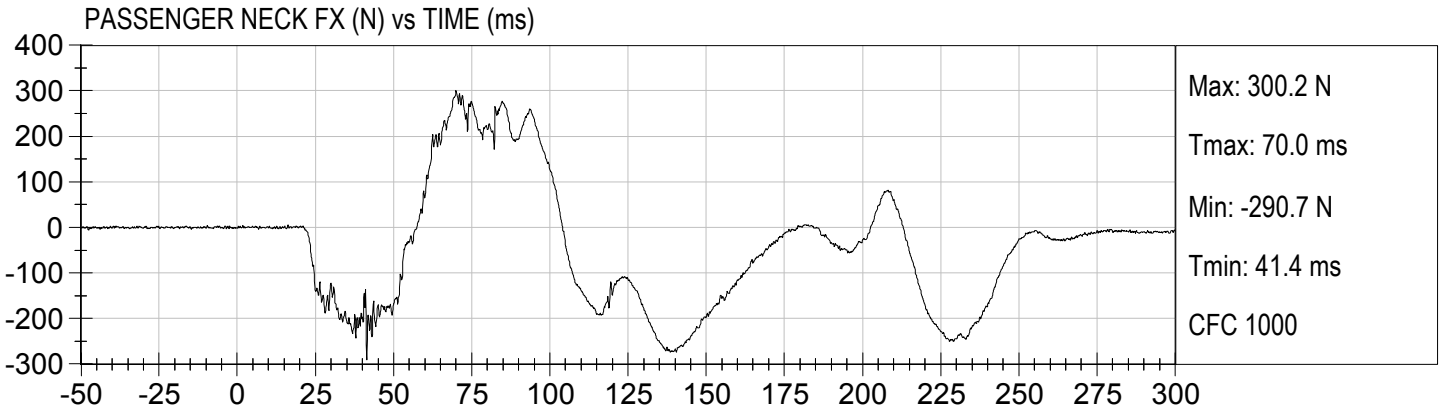


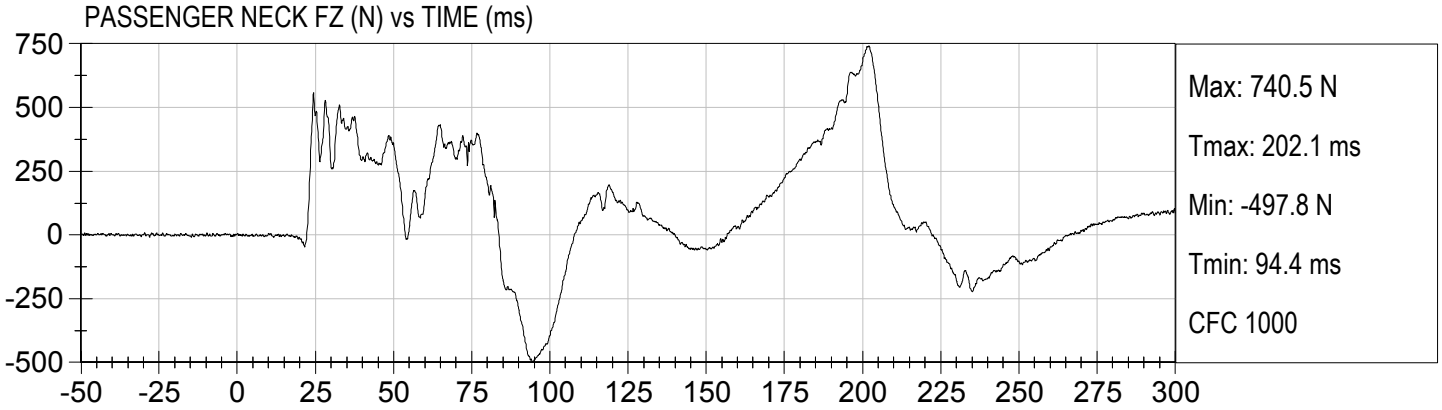
PASSENGER CHEST Z (G's) vs TIME (ms)

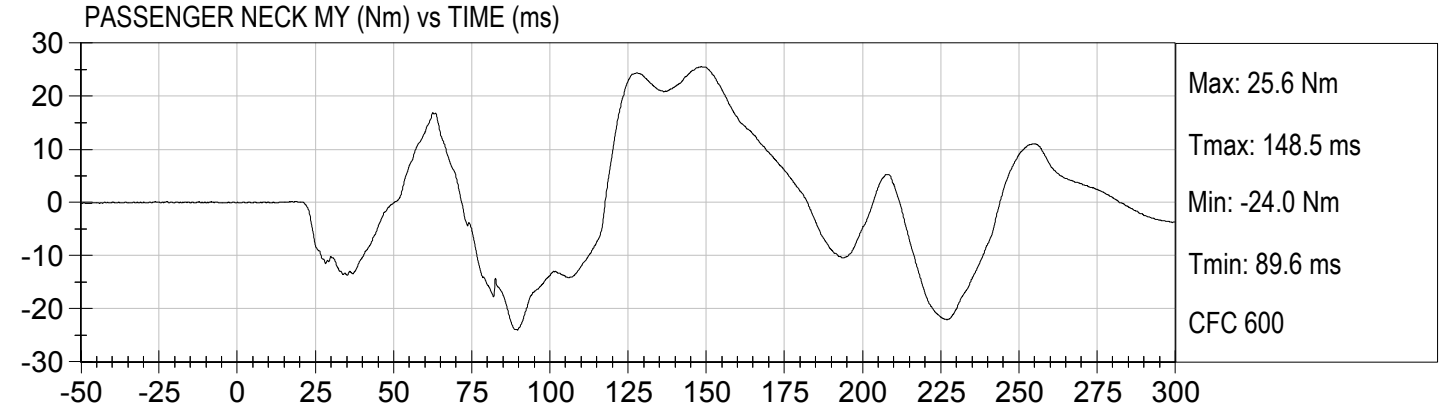


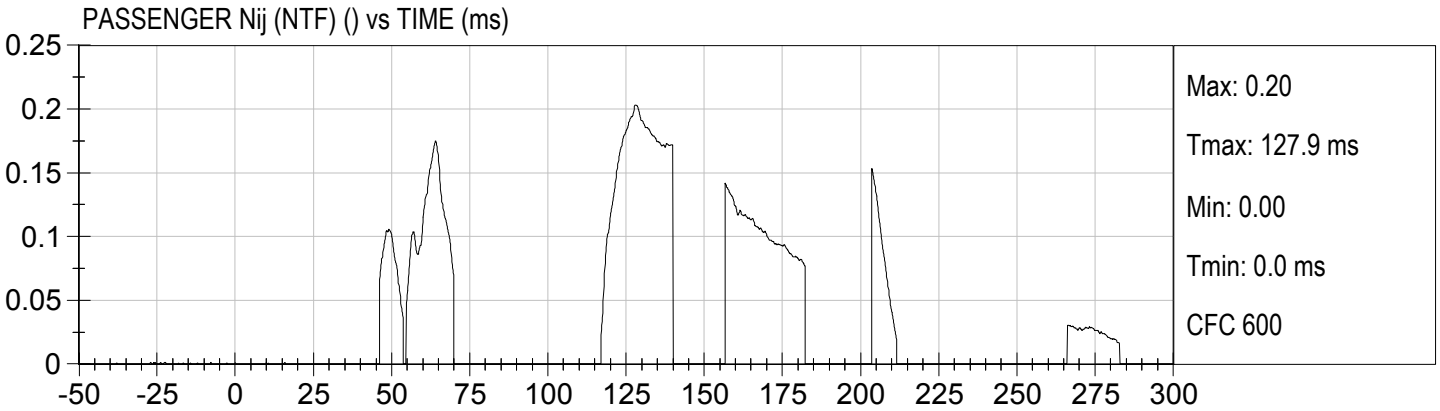
PASSENGER CHEST Resultant (G's) vs TIME (ms)

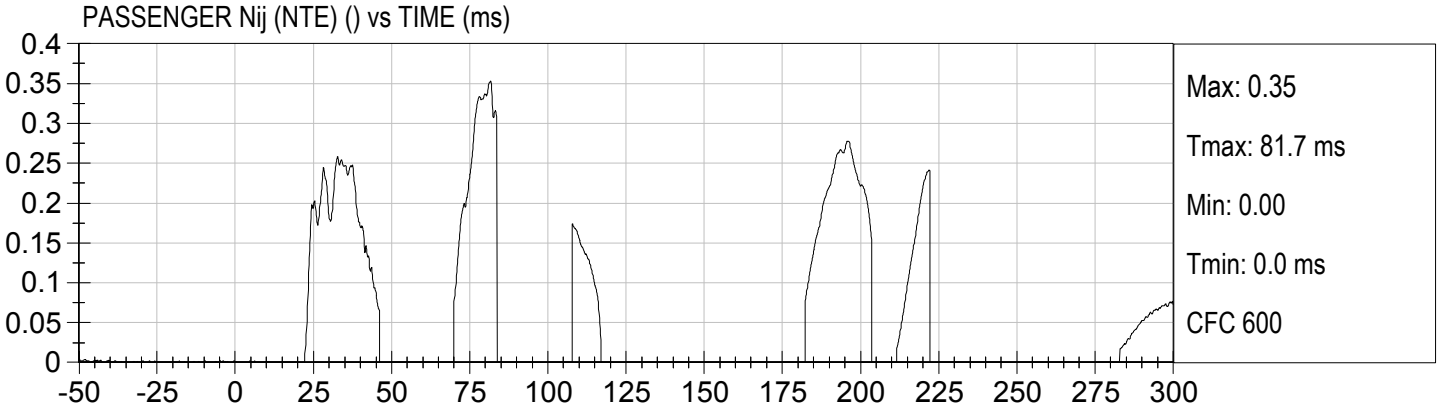


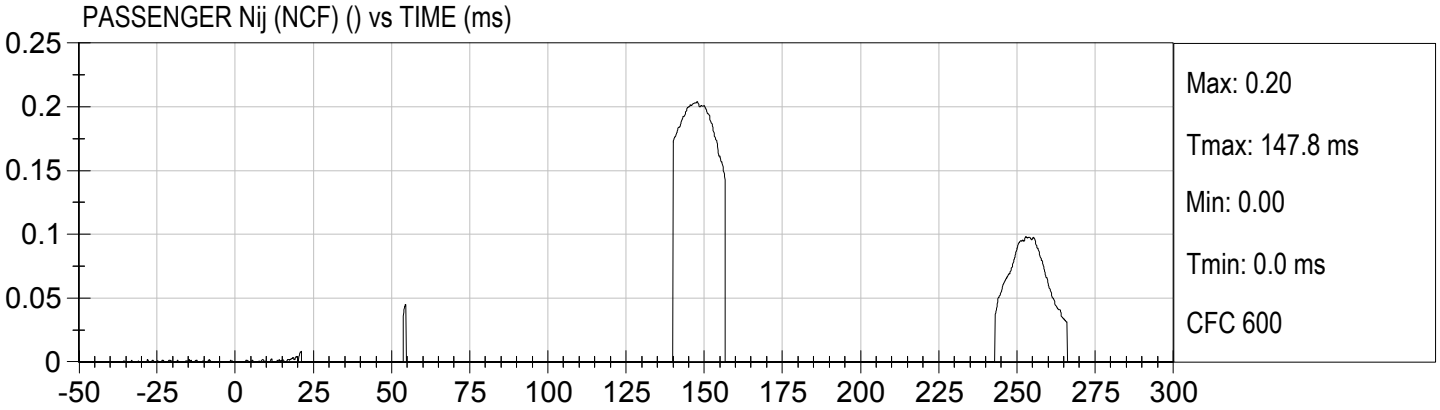

PASSENGER NECK FX (N) vs TIME (ms)
400
300
200
100
0
-100
-200
-300
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 300.2 N
Tmax: 70.0 ms
Min: -290.7 N
Tmin: 41.4 ms
CFC 1000

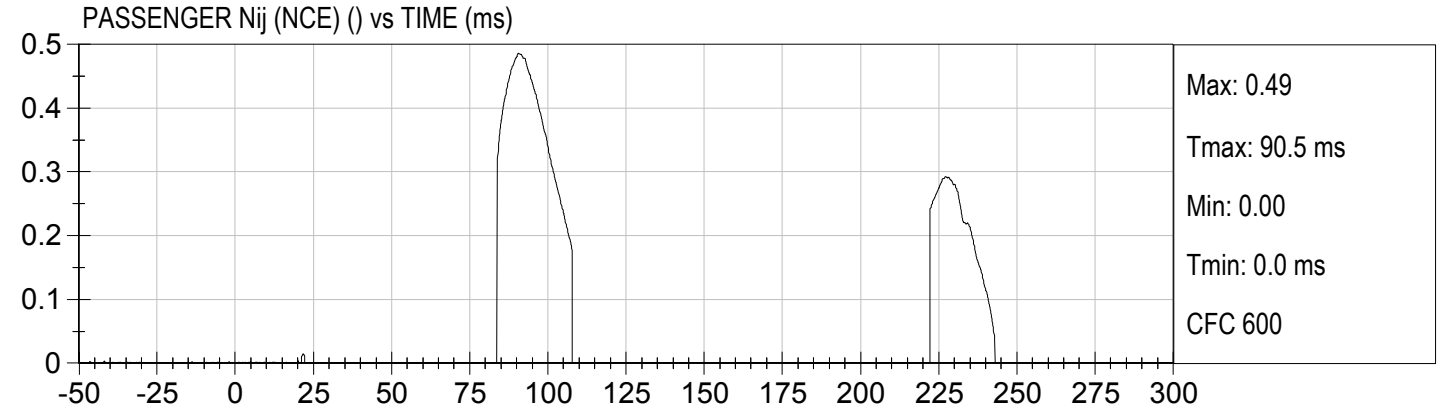

PASSENGER NECK FZ (N) vs TIME (ms)
750
500
250
0
-250
-500
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 740.5 N
Tmax: 202.1 ms
Min: -497.8 N
Tmin: 94.4 ms
CFC 1000


PASSENGER NECK MY (Nm) vs TIME (ms)
30
20
10
0
-10
-20
-30
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 25.6 Nm
Tmax: 148.5 ms
Min: -24.0 Nm
Tmin: 89.6 ms
CFC 600

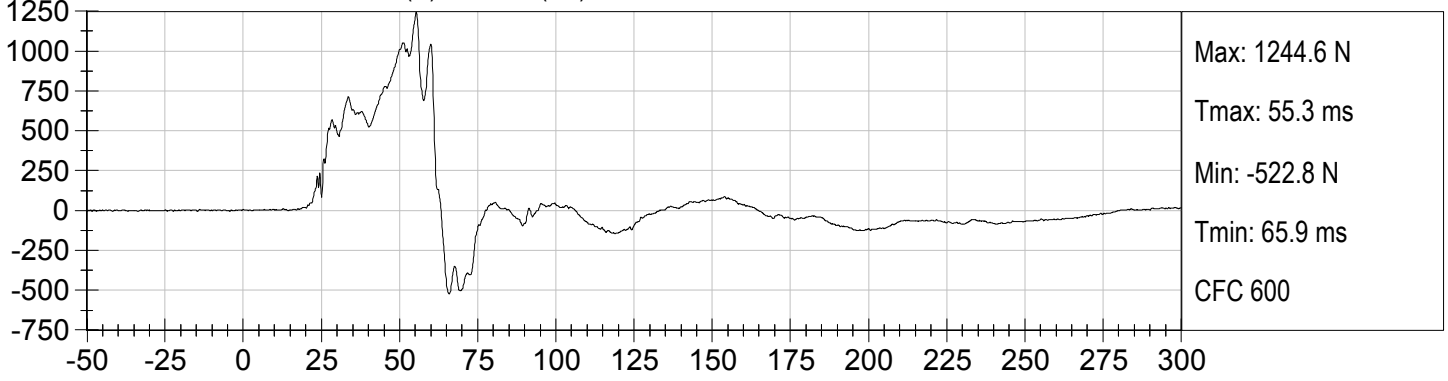

PASSENGER Nij (NTF) () vs TIME (ms)
Max: 0.20
Tmax: 127.9 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


PASSENGER Nij (NTE) () vs TIME (ms)
Max: 0.35
Tmax: 81.7 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

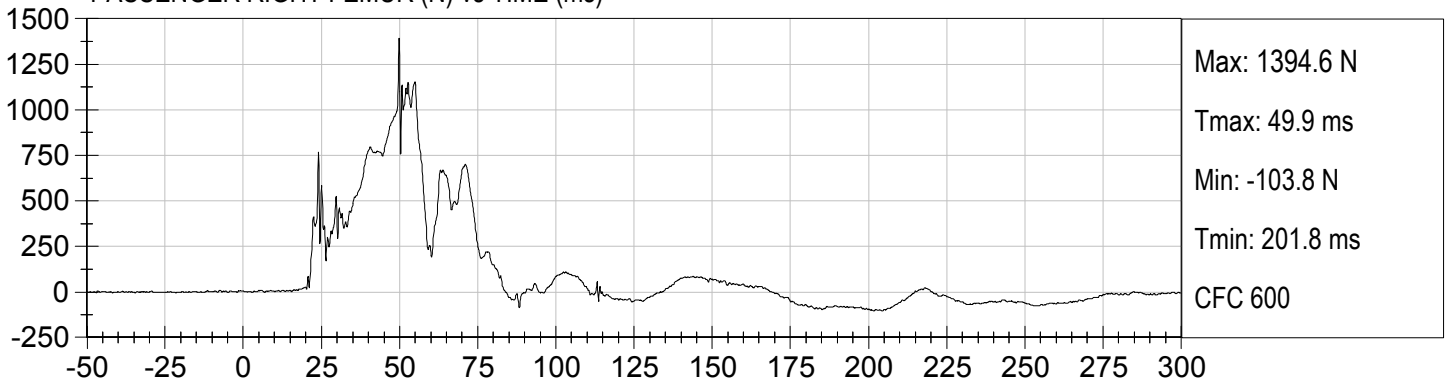

PASSENGER Nij (NCF) () vs TIME (ms)
Max: 0.20
Tmax: 147.8 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


PASSENGER Nij (NCE) () vs TIME (ms)
Max: 0.49
Tmax: 90.5 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

PASSENGER LEFT FEMUR (N) vs TIME (ms)



PASSENGER RIGHT FEMUR (N) vs TIME (ms)



APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

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 **Test ID:** D162351

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Peak Resultant Acceleration	G's	225 to 275	266	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	11.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

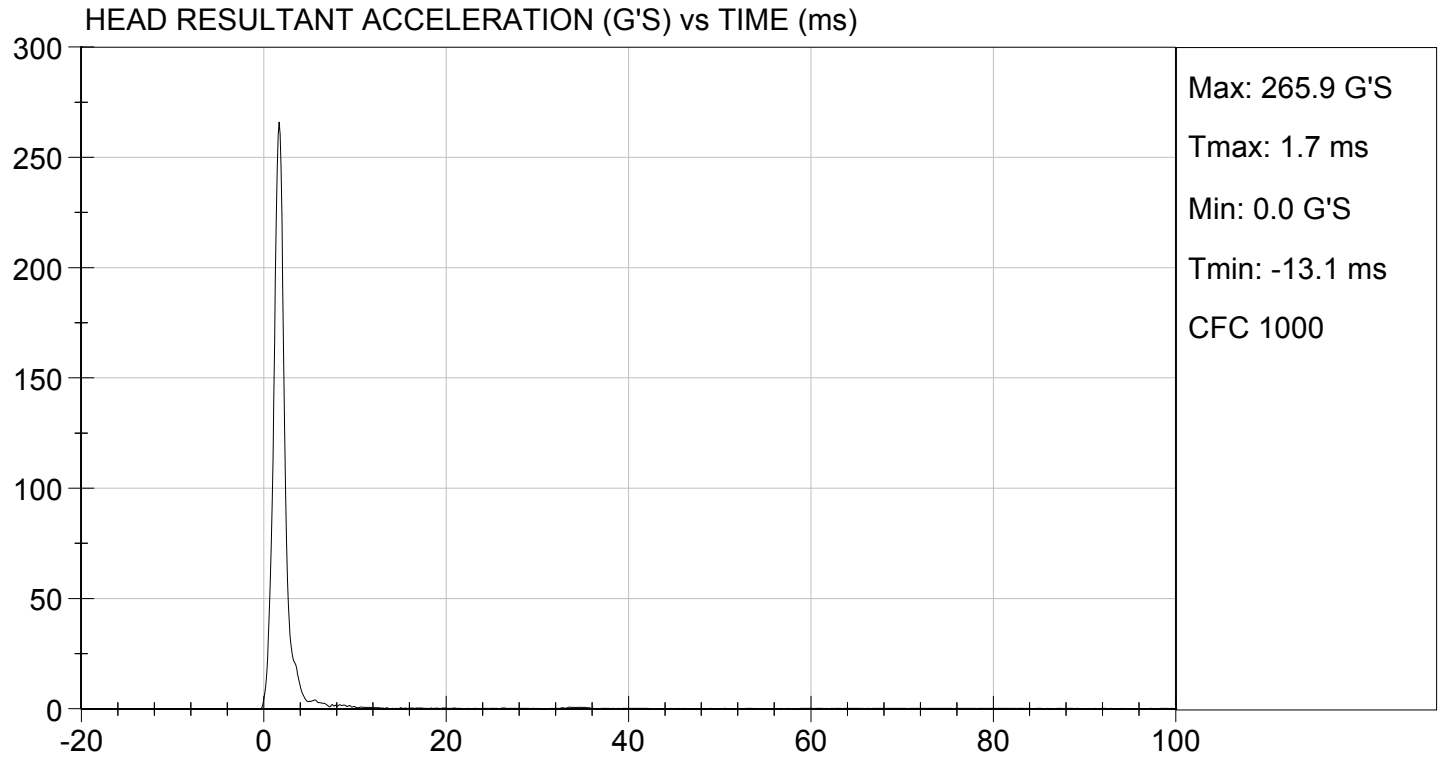
Laboratory Technician

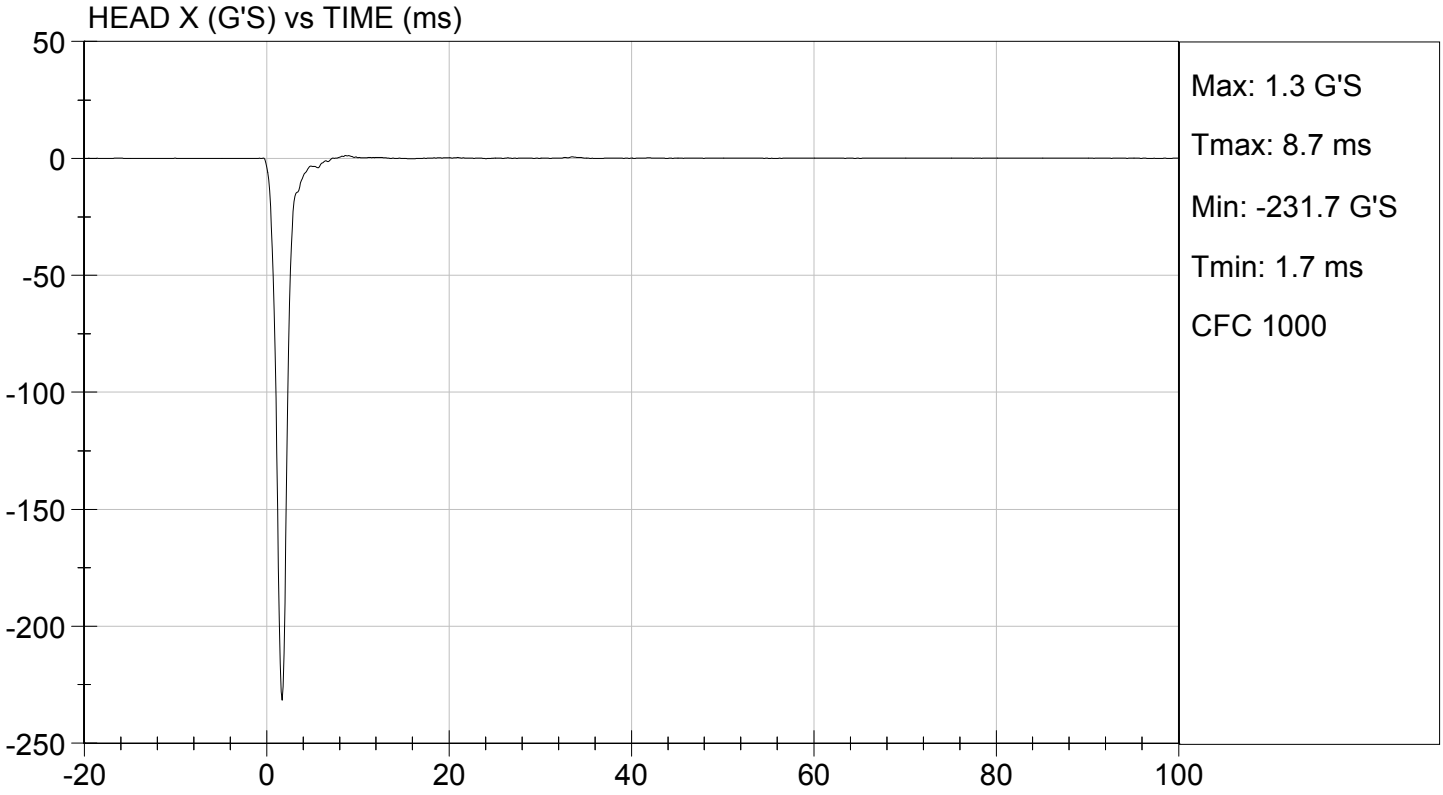
07/12/2016
Test Date

Approved By

TEST DESC: HEAD DROP

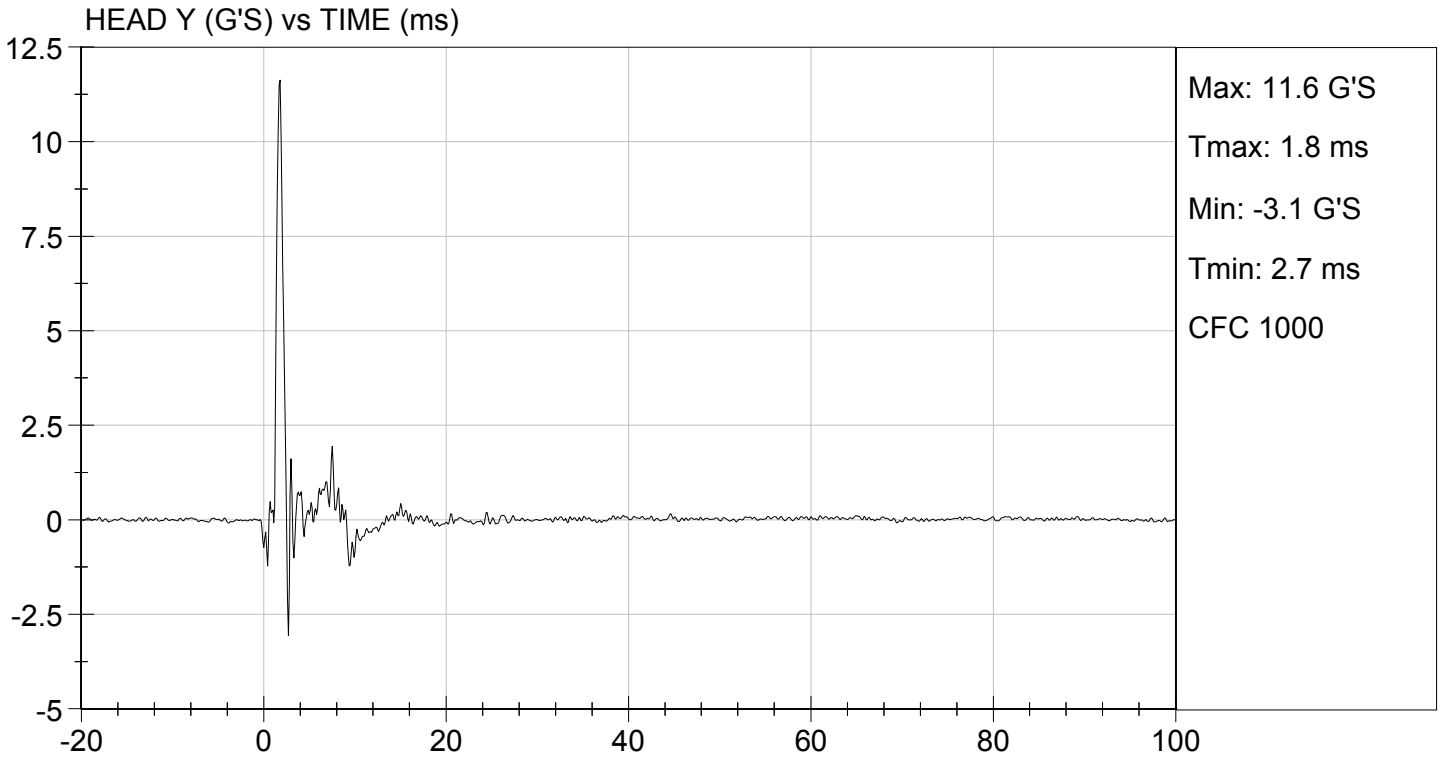
TEST DATE: 07/12/2016
TEST #: D162351

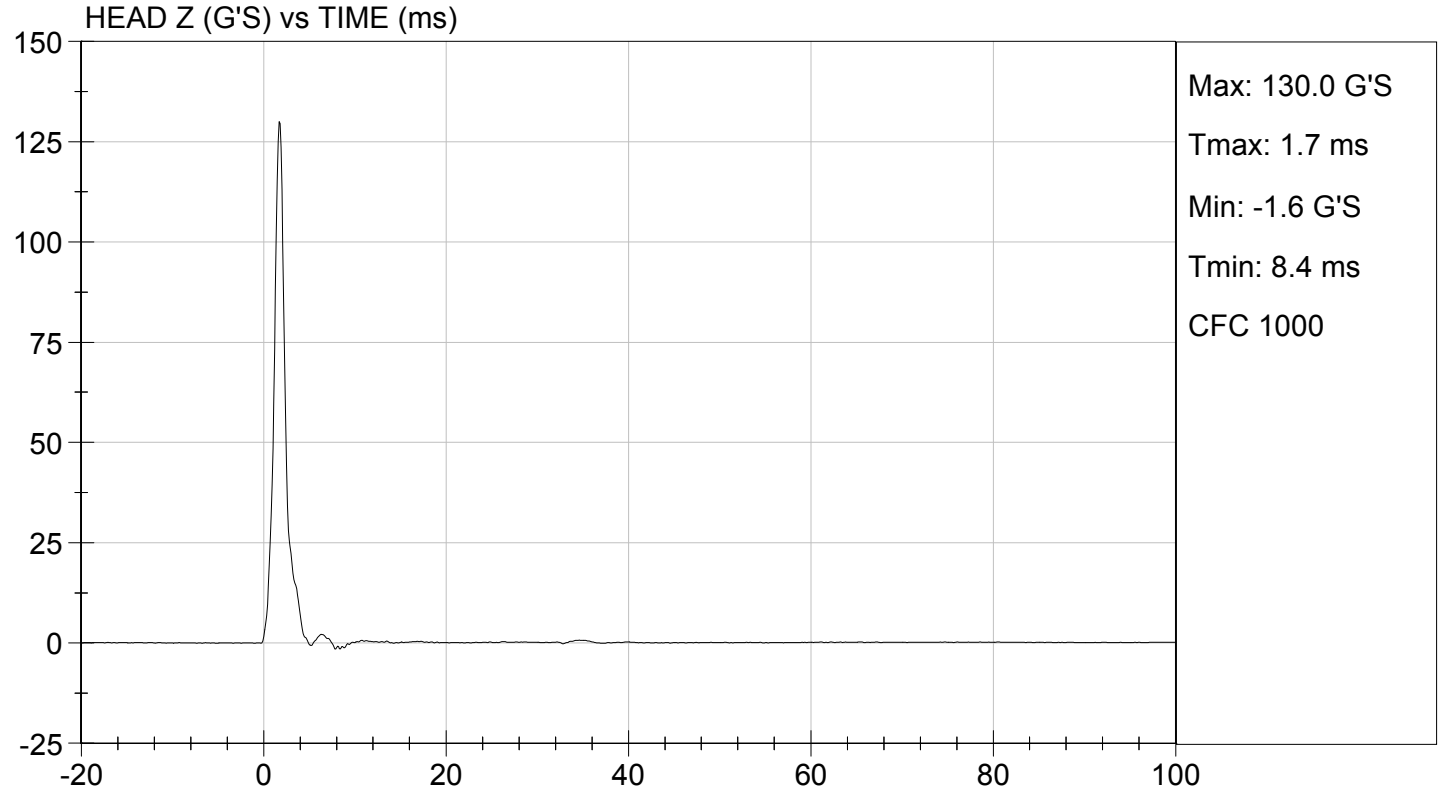




TEST DESC: HEAD DROP

TEST DATE: 07/12/2016
TEST #: D162351





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162352

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.93	Pass
	20 ms	G's	17.60 to 22.60	22.44	Pass
	30 ms	G's	12.50 to 18.50	17.24	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	17.1	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.9	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	72.0	Pass
	Time	ms	57.0 to 64.0	57.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	117.9	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	89.1	Pass
	Time	ms	47.0 to 58.0	48.9	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	97.6	Pass
			Overall Test Results		Pass

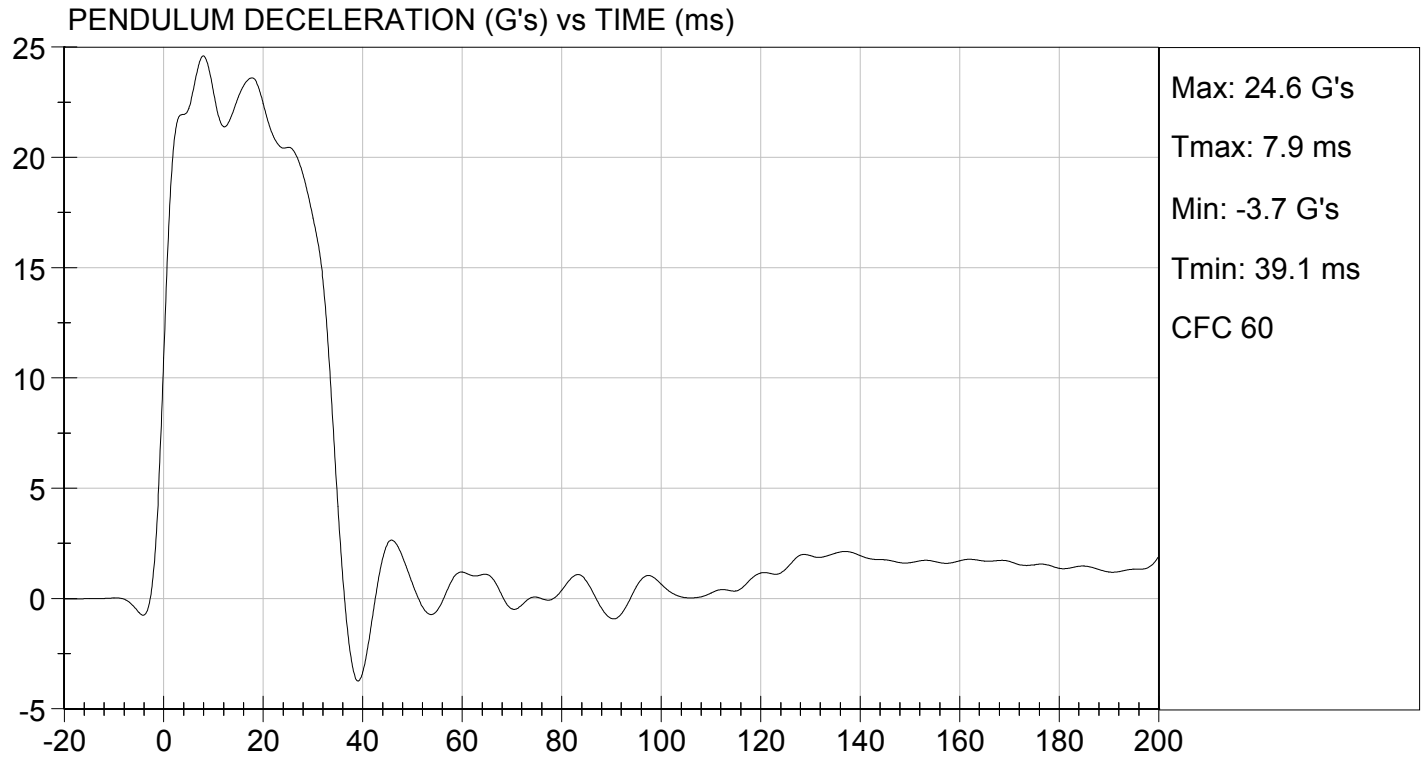
Jessica Hall
Laboratory Technician

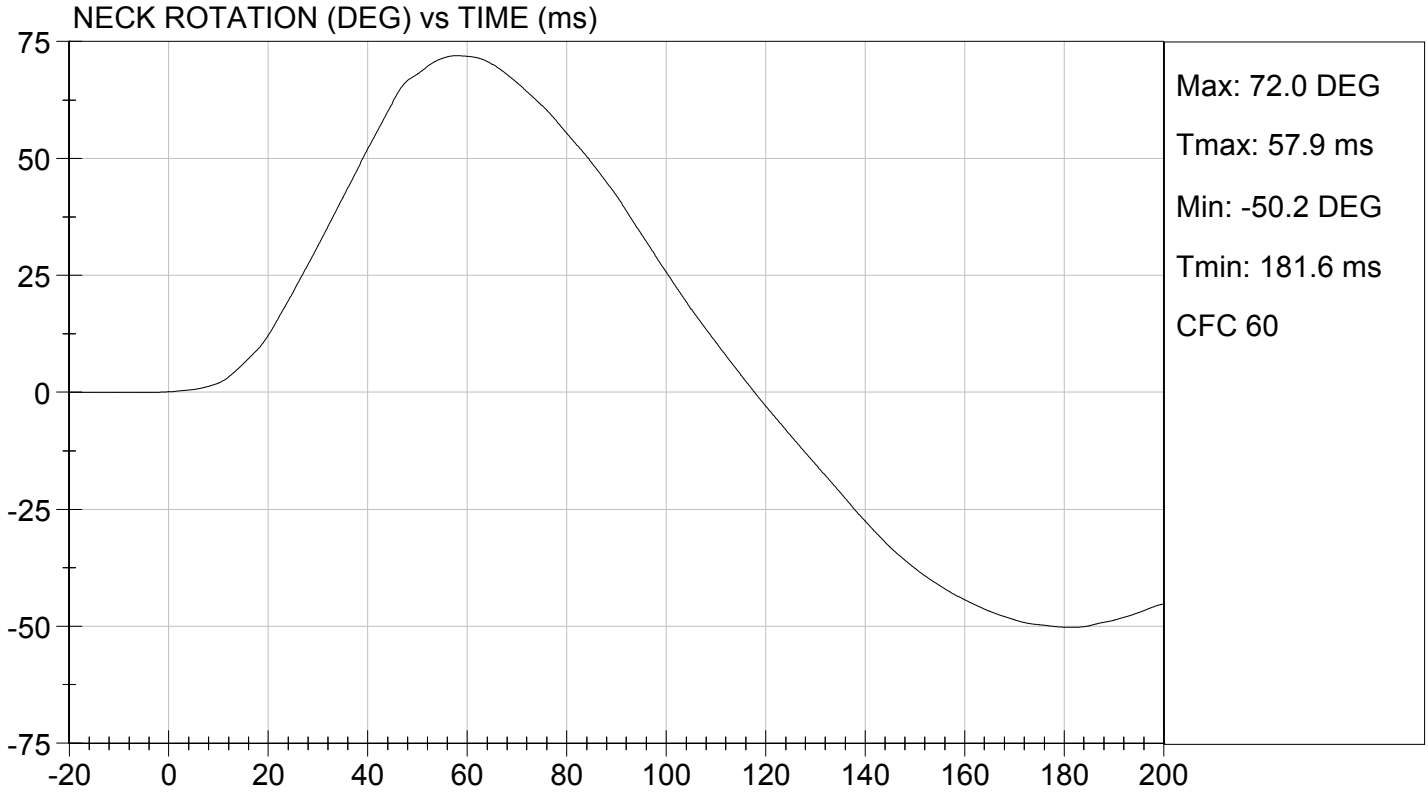
07/12/2016
Test Date

Thom A. Miller
Approved By

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

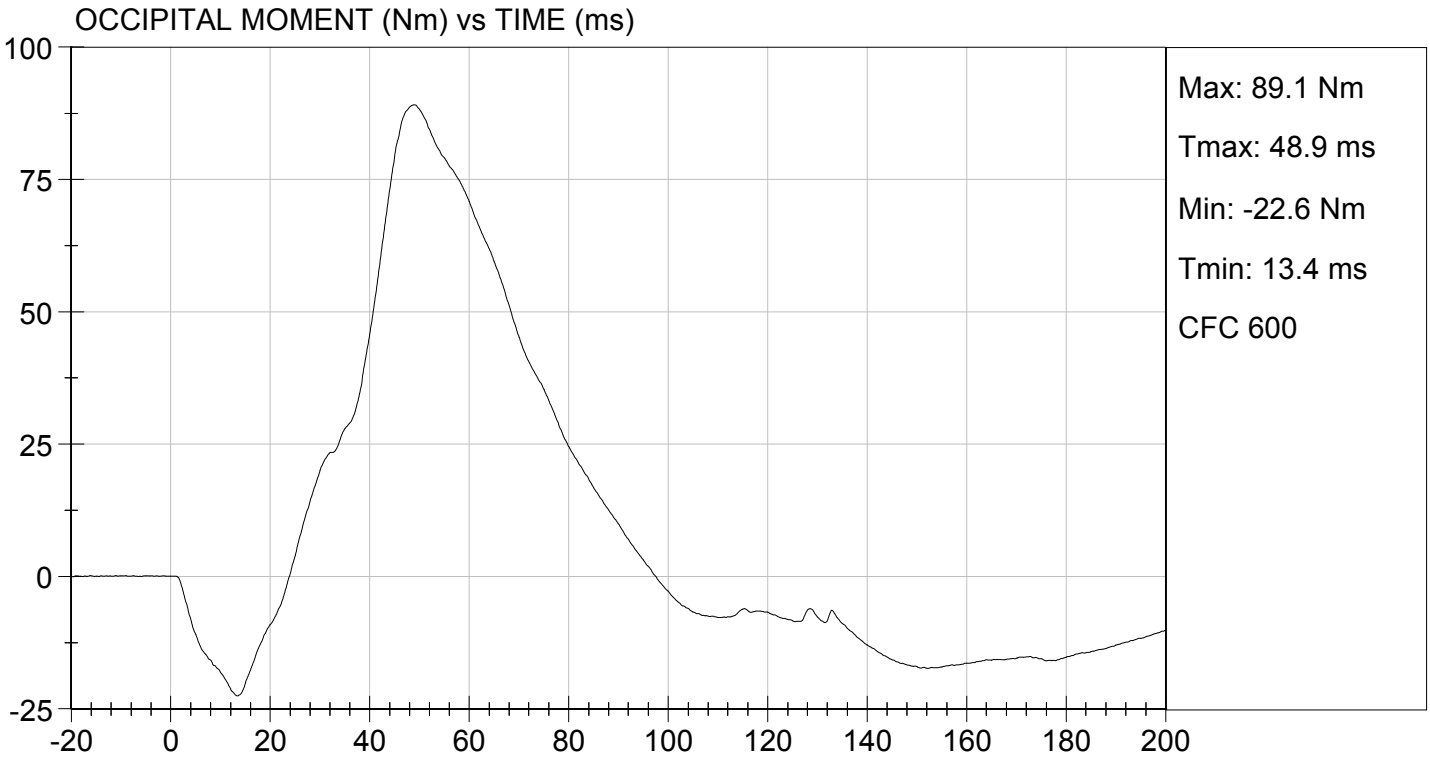
TEST DATE: 07/12/2016
TEST #: D162352





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

TEST DATE: 07/12/2016
TEST #: D162352



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162353

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.65	Pass
	20 ms	G's	14.00 to 19.00	17.71	Pass
	30 ms	G's	11.00 to 16.00	14.44	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.6	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	92.4	Pass
	Time	ms	72.0 to 82.0	79.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	158.9	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-58.1	Pass
	Time	ms	65.0 to 79.0	71.1	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	147.5	Pass
			Overall Test Results		Pass

Jessica Hall

Laboratory Technician

07/12/2016

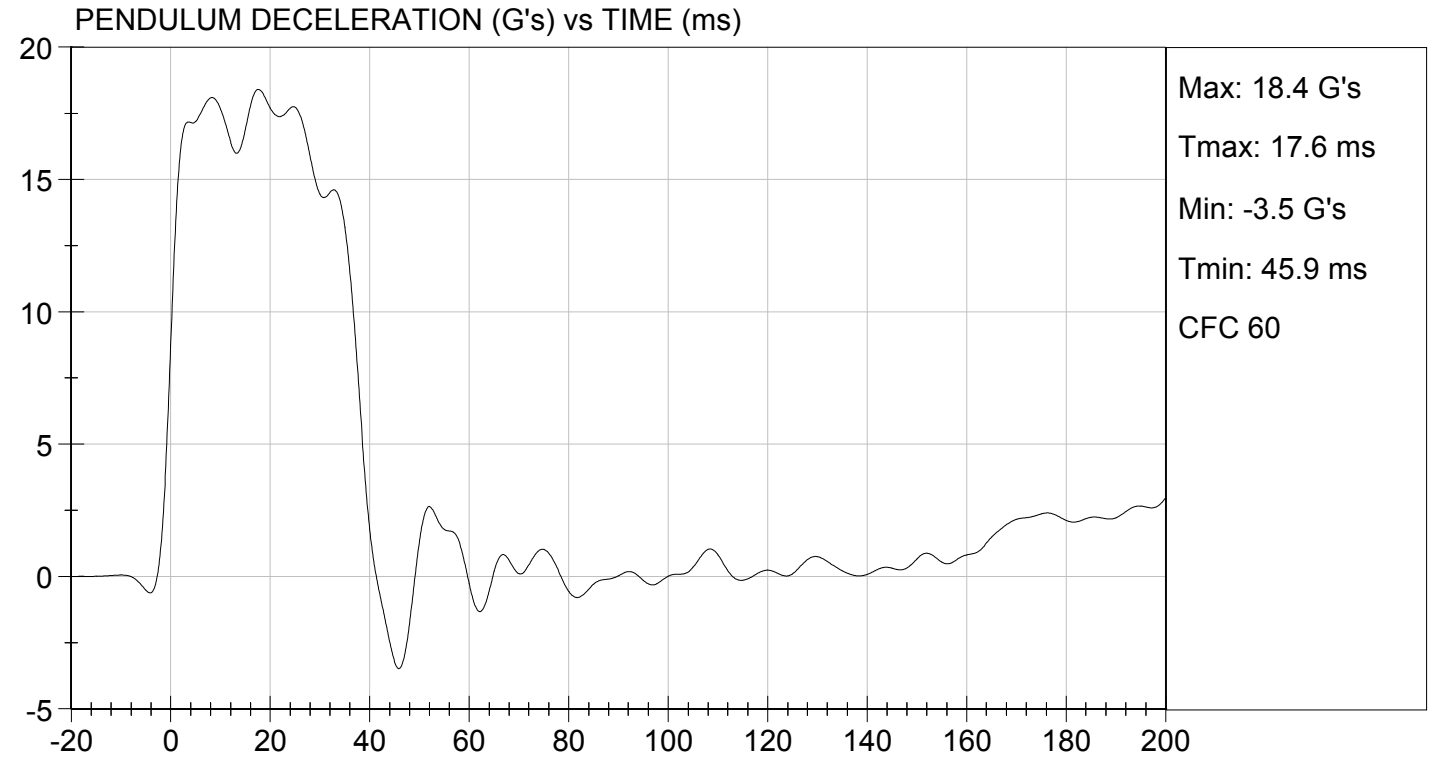
Test Date

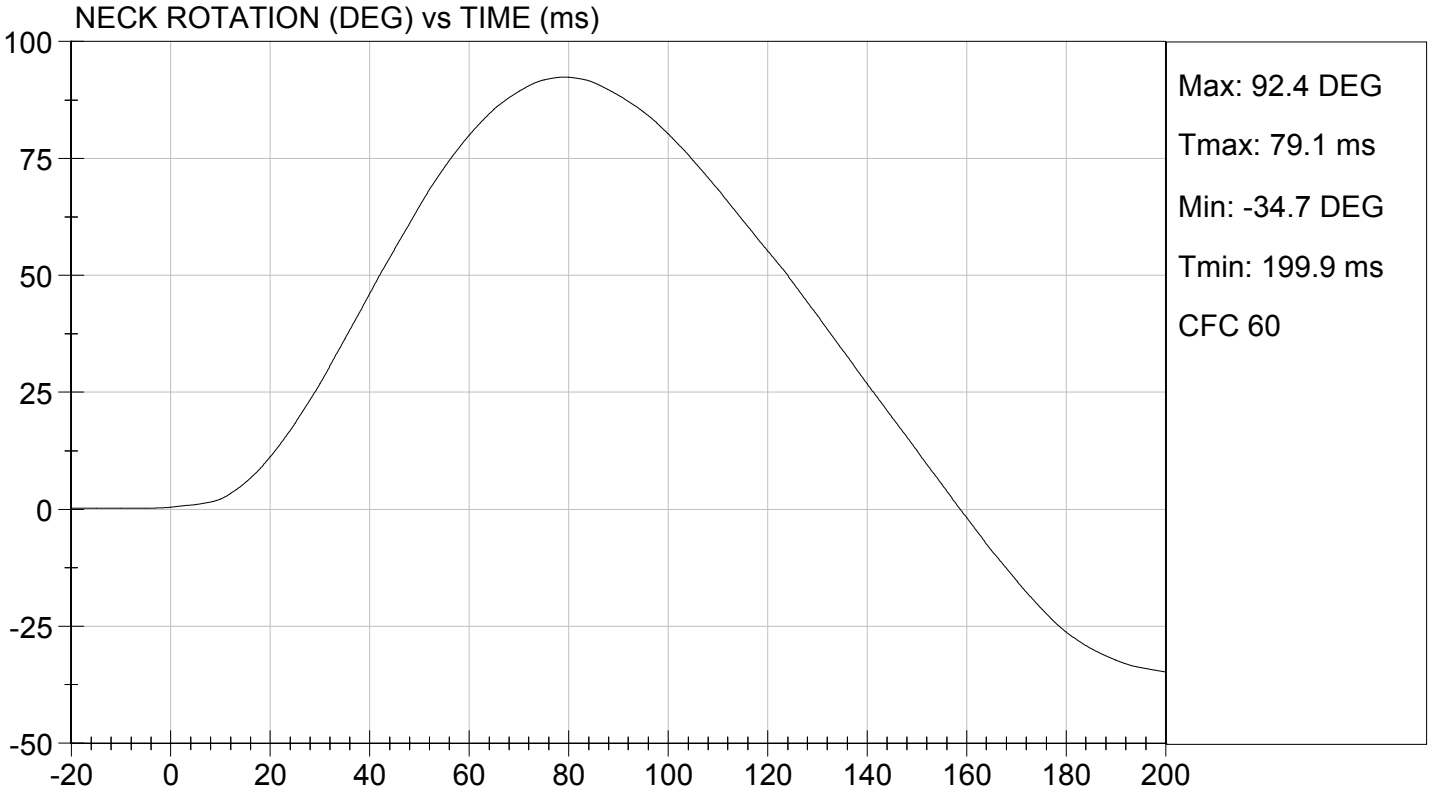
Thomas D. Miller

Approved By

TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

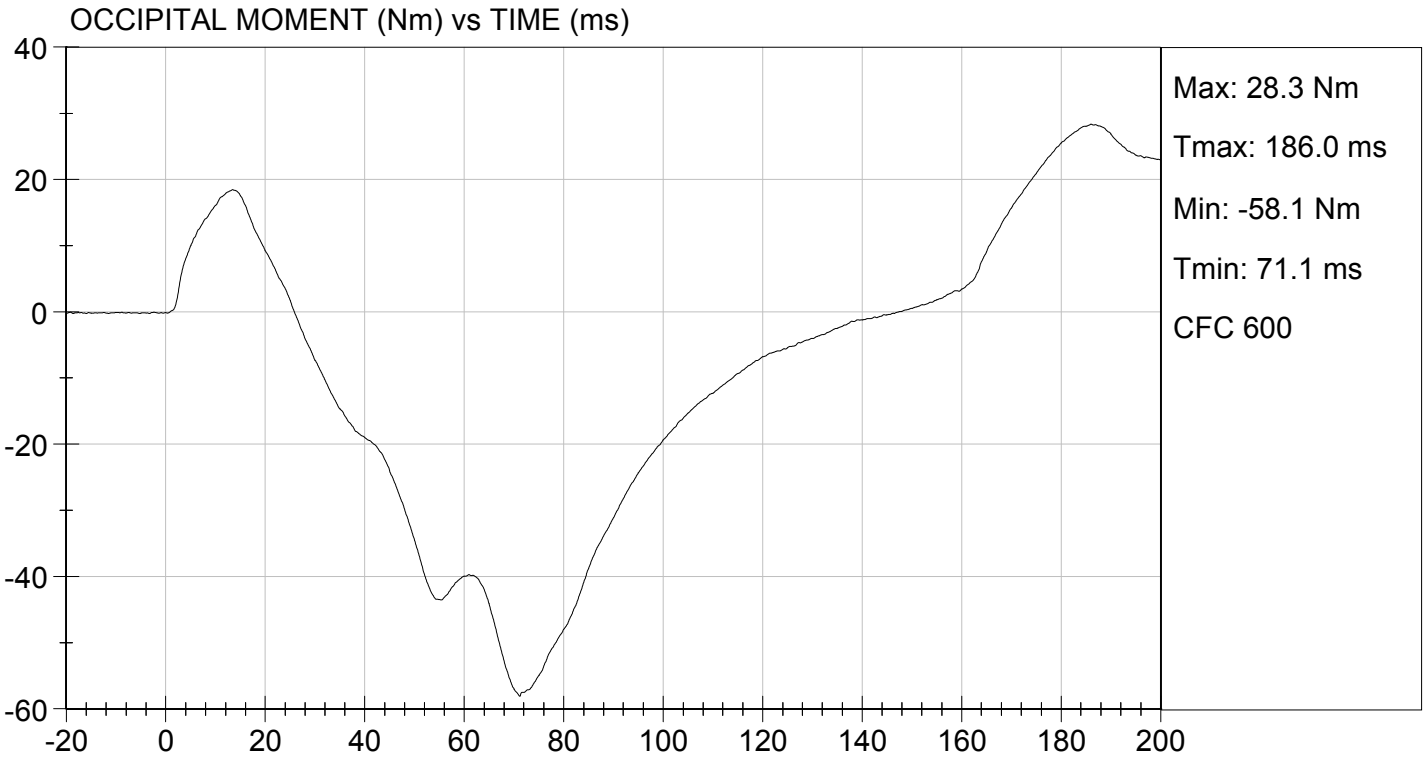
TEST DATE: 07/12/2016
TEST #: D162353





TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 07/12/2016
TEST #: D162353



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162354

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,512	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.80	Pass
Internal Hysteresis	%	69 to 85	73	Pass
		Overall Test Results		Pass

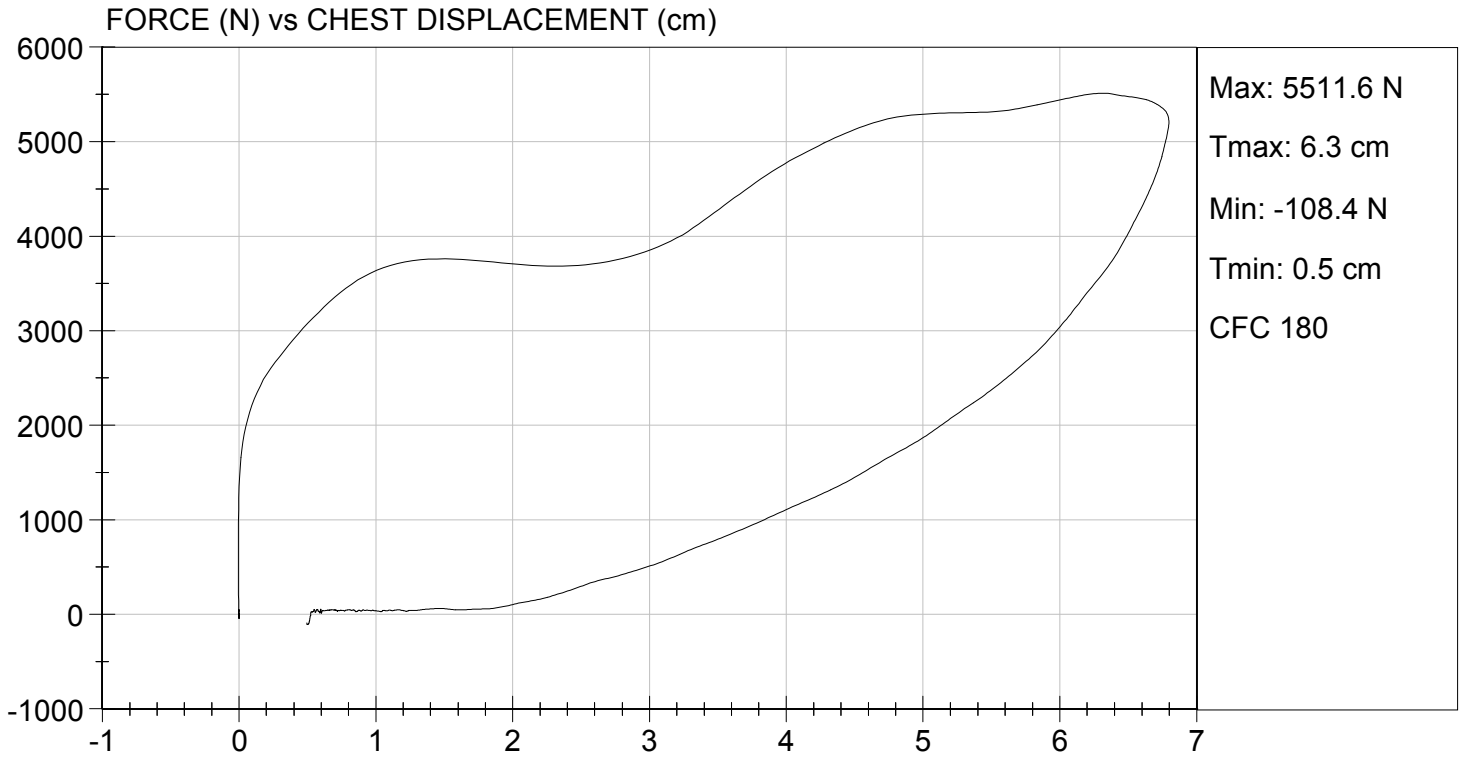
Laboratory Technician

07/12/2016
Test Date

Approved By

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

TEST DATE: 07/12/2016
TEST #: D162354



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162355

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Velocity	m/s	2.07 to 2.13	2.08	Pass
Peak Probe Force	N	4715 to 5782	4,820	Pass
		Overall Test Results		Pass

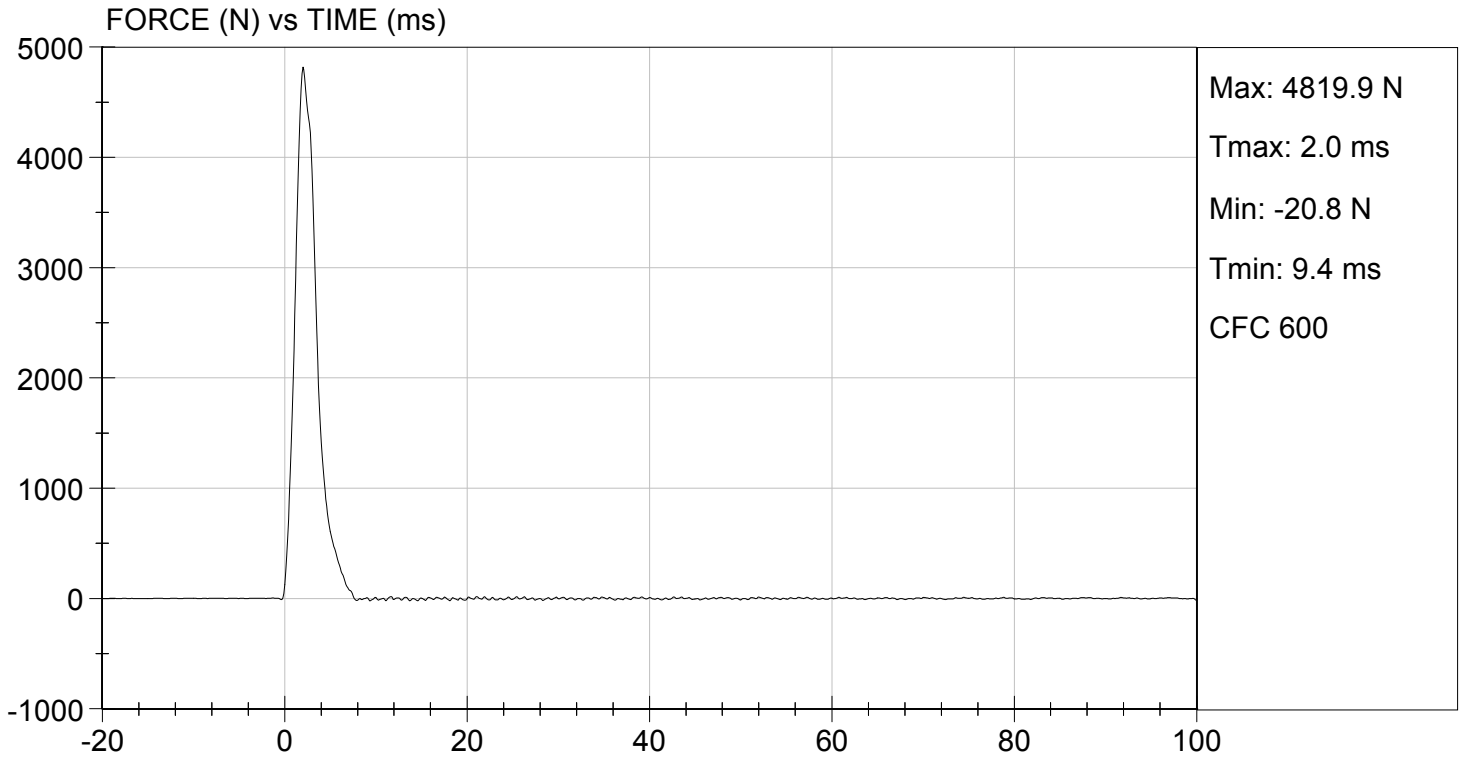
Laboratory Technician

07/12/2016
Test Date

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.83 ft/s, 2.08 m/s

TEST DATE: 07/12/2016
TEST #: D162355



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162356

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Velocity	m/s	2.07 to 2.13	2.08	Pass
Peak Probe Force	N	4715 to 5782	5,339	Pass
		Overall Test Results		Pass

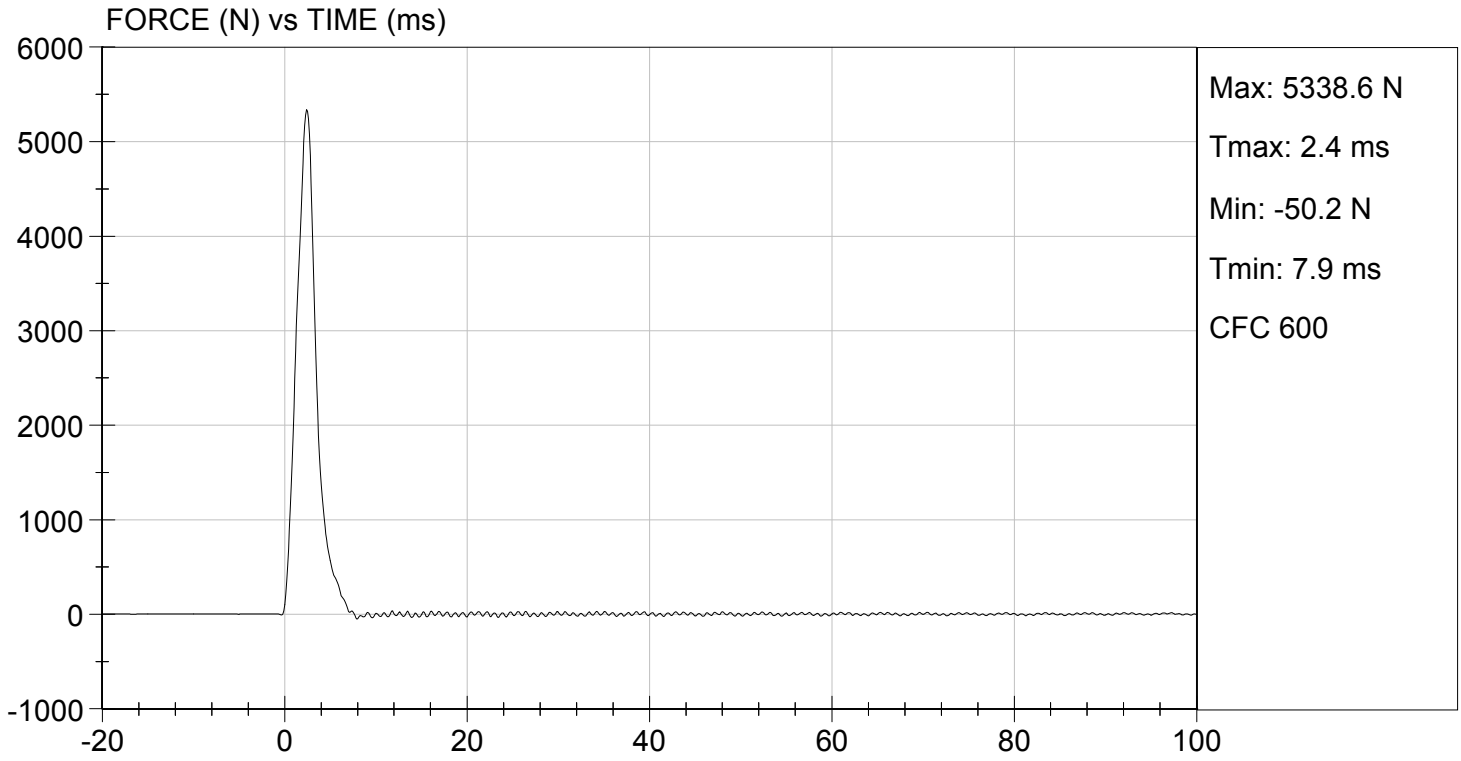
Laboratory Technician

07/12/2016
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.83 ft/s, 2.08 m/s

TEST DATE: 07/12/2016
TEST #: D162356



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162350

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	50	50	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.2	Pass
30 Degrees	Nm	94.9 Nm Max	70.2	80.3	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	44.5	43.1	Pass
		Overall Test Results			Pass

Laboratory Technician

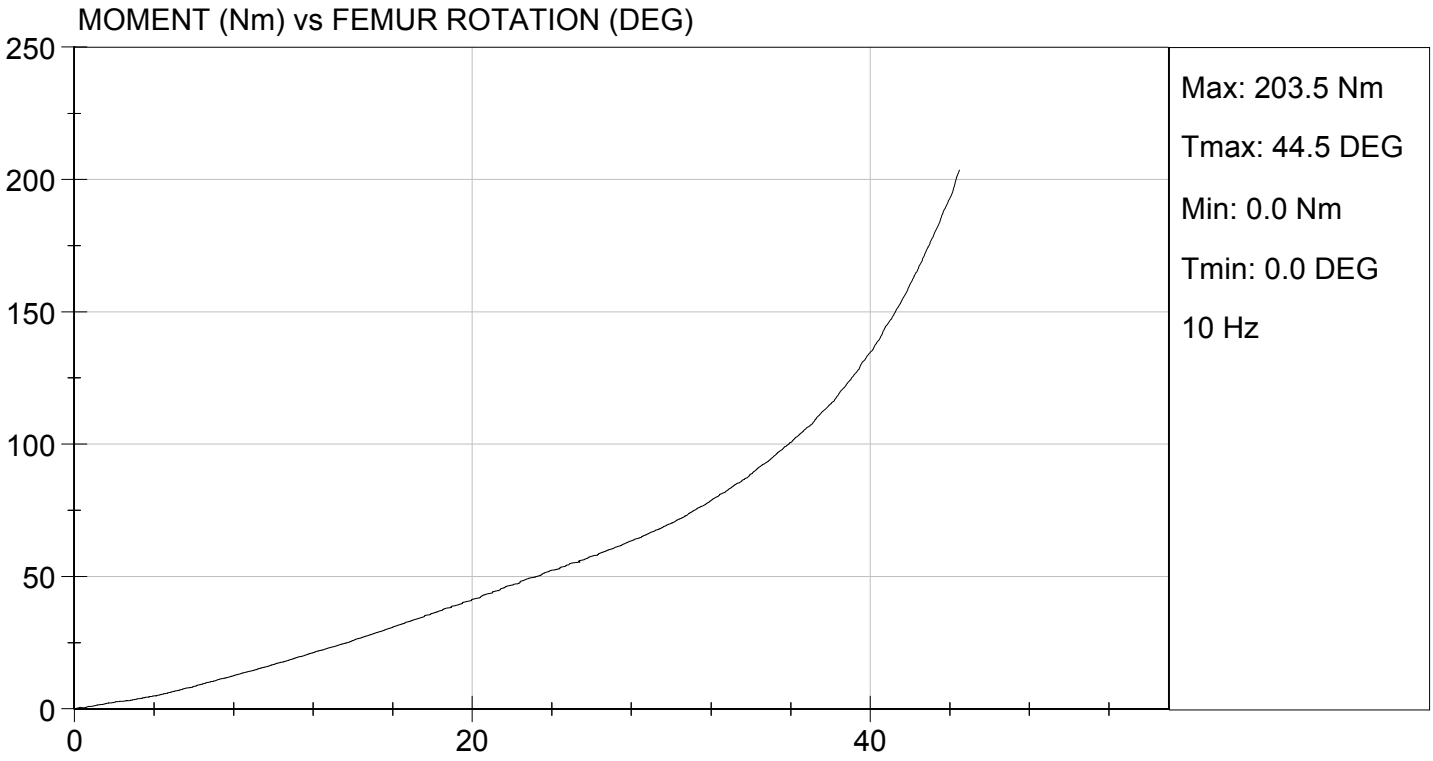
07/12/2016
Test Date

Approved By

TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 07/12/2016

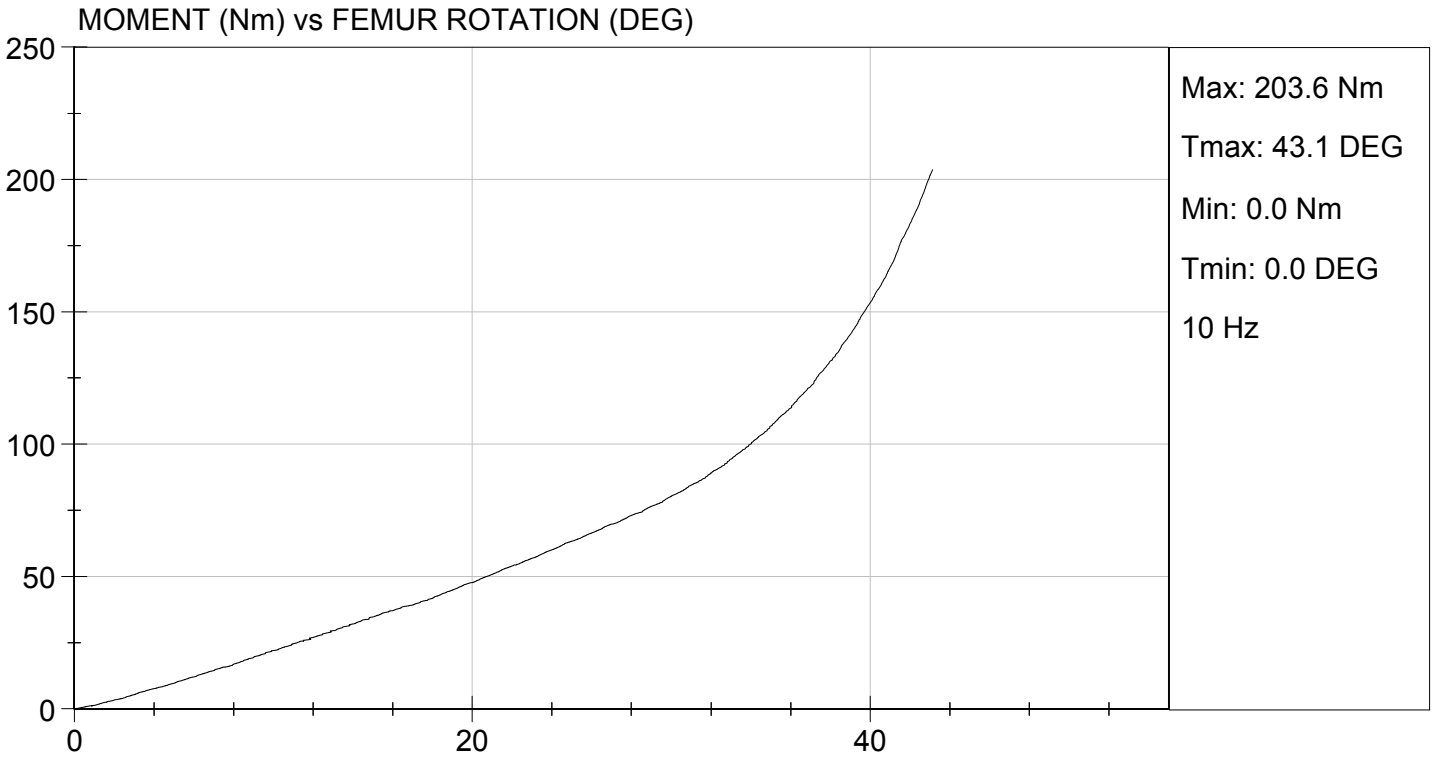
TEST #: D162359



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 07/12/2016

TEST #: D162350



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test ID:** D162821

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Peak Resultant Acceleration	G's	225 to 275	255	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-10.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

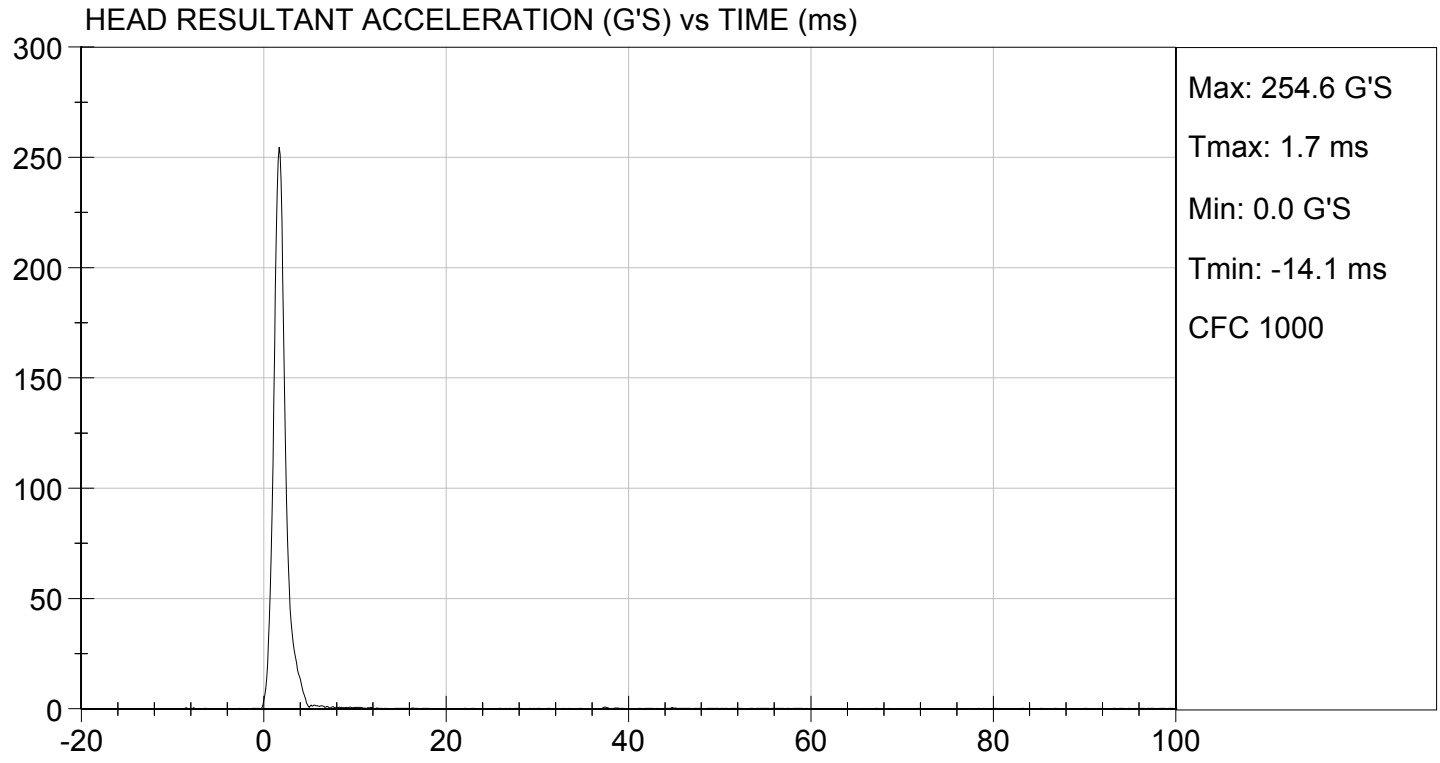
Laboratory Technician

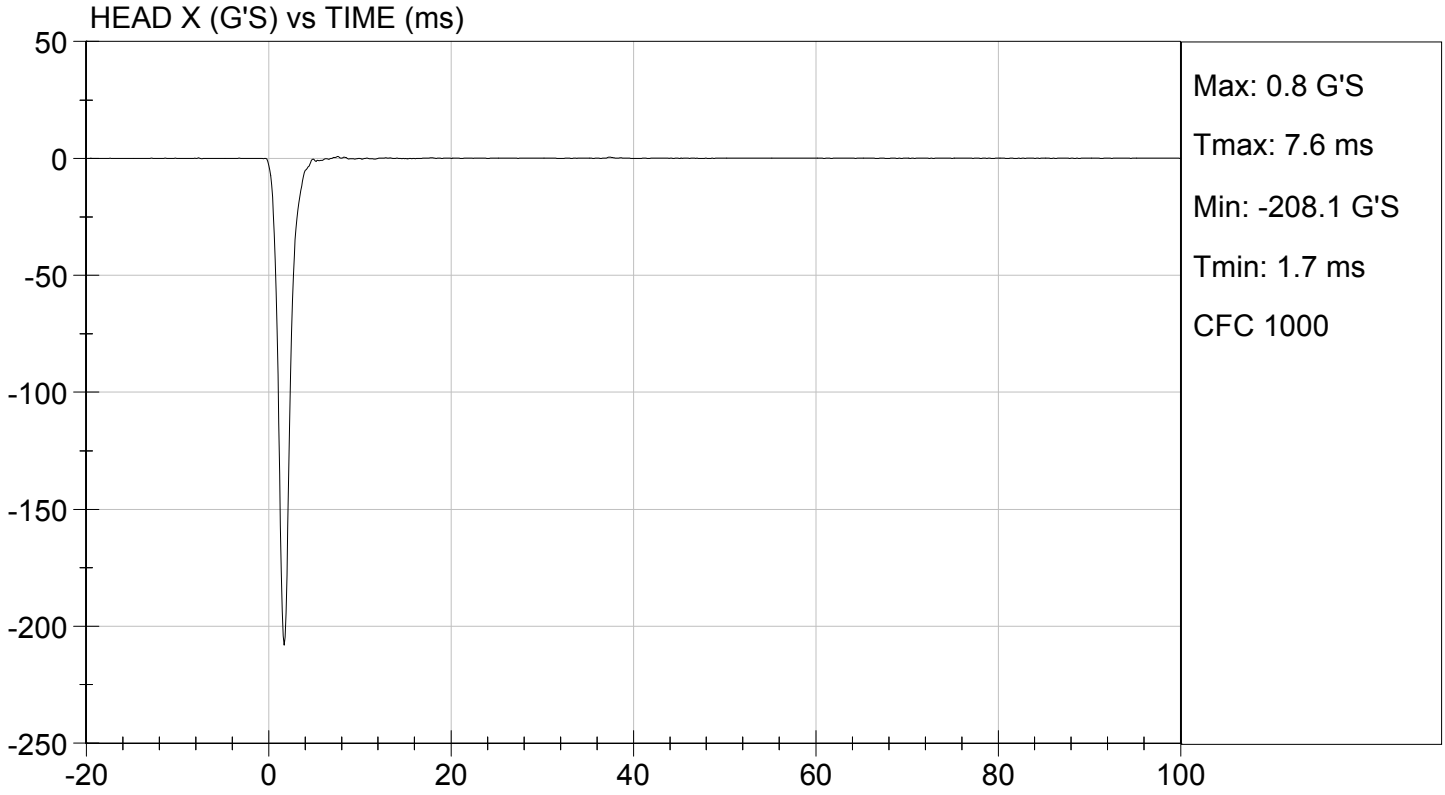
08/24/2016
Test Date

Jessica Gall
Approved By

TEST DESC: HEAD DROP

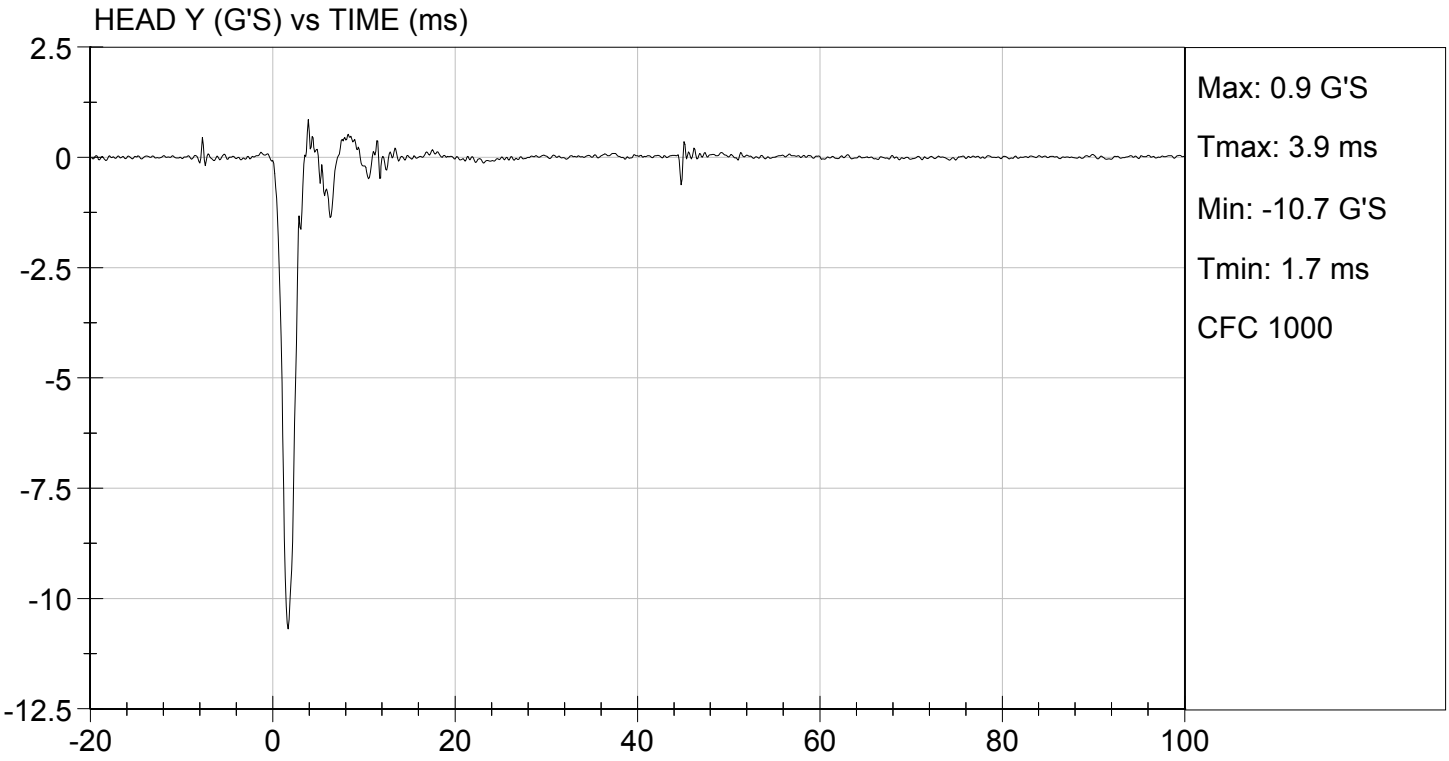
TEST DATE: 08/24/2016
TEST #: D162821

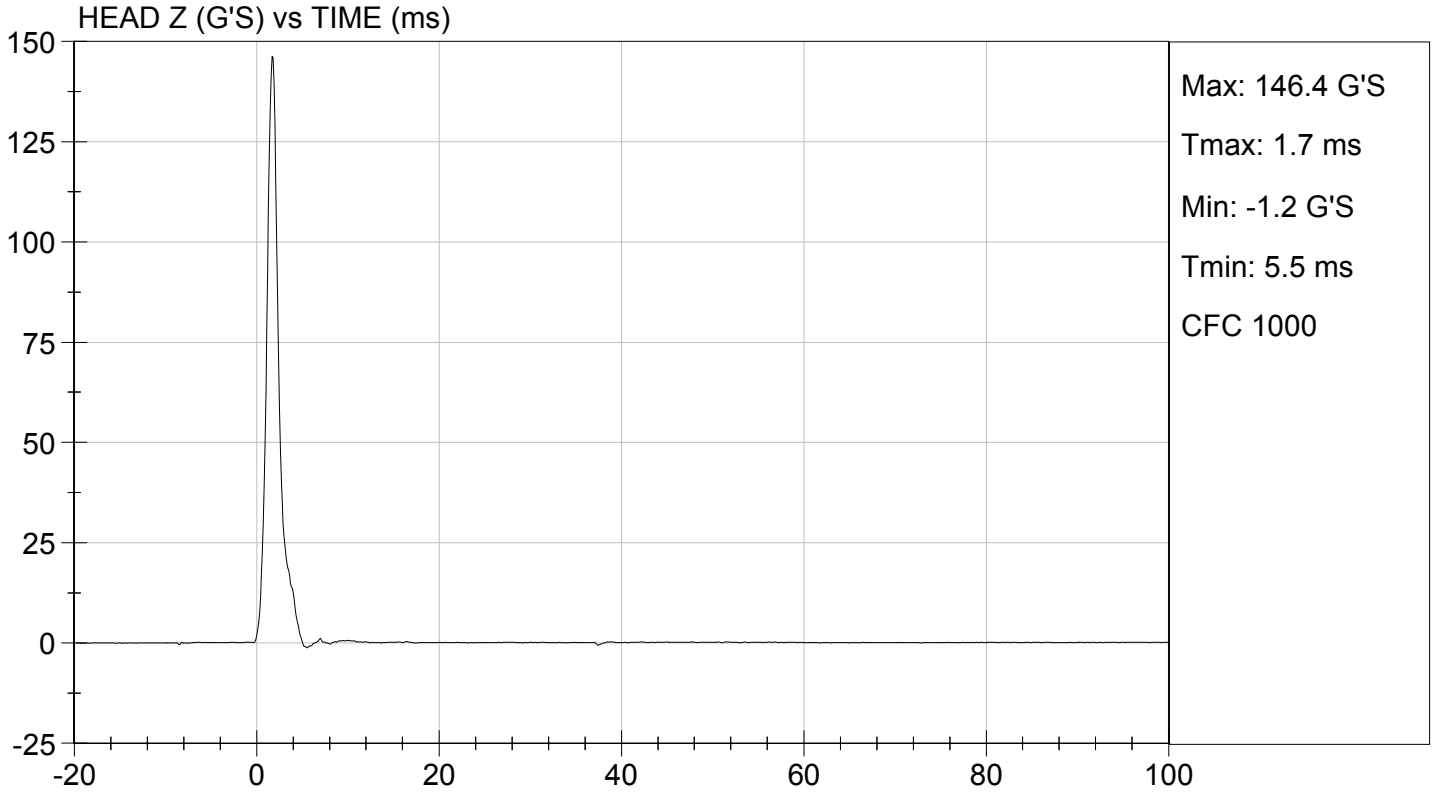




TEST DESC: HEAD DROP

TEST DATE: 08/24/2016
TEST #: D162821





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162822

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	52	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.41	Pass
	20 ms	G's	17.60 to 22.60	21.53	Pass
	30 ms	G's	12.50 to 18.50	15.34	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	15.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.0	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	68.5	Pass
	Time	ms	57.0 to 64.0	58.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.2	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	92.6	Pass
	Time	ms	47.0 to 58.0	47.3	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.7	Pass
			Overall Test Results		Pass

Jessica Gall

Laboratory Technician

08/24/2016

Test Date

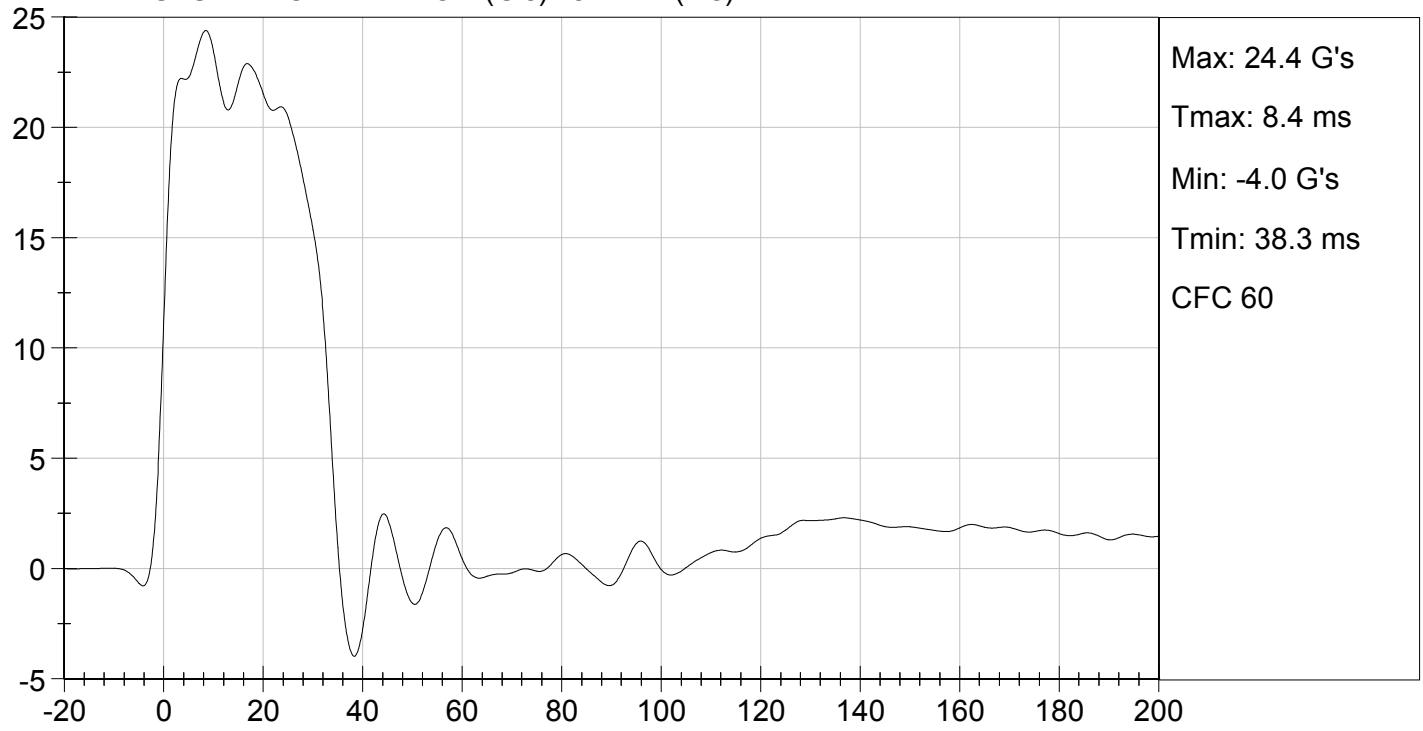
Thom A. Nelle

Approved By

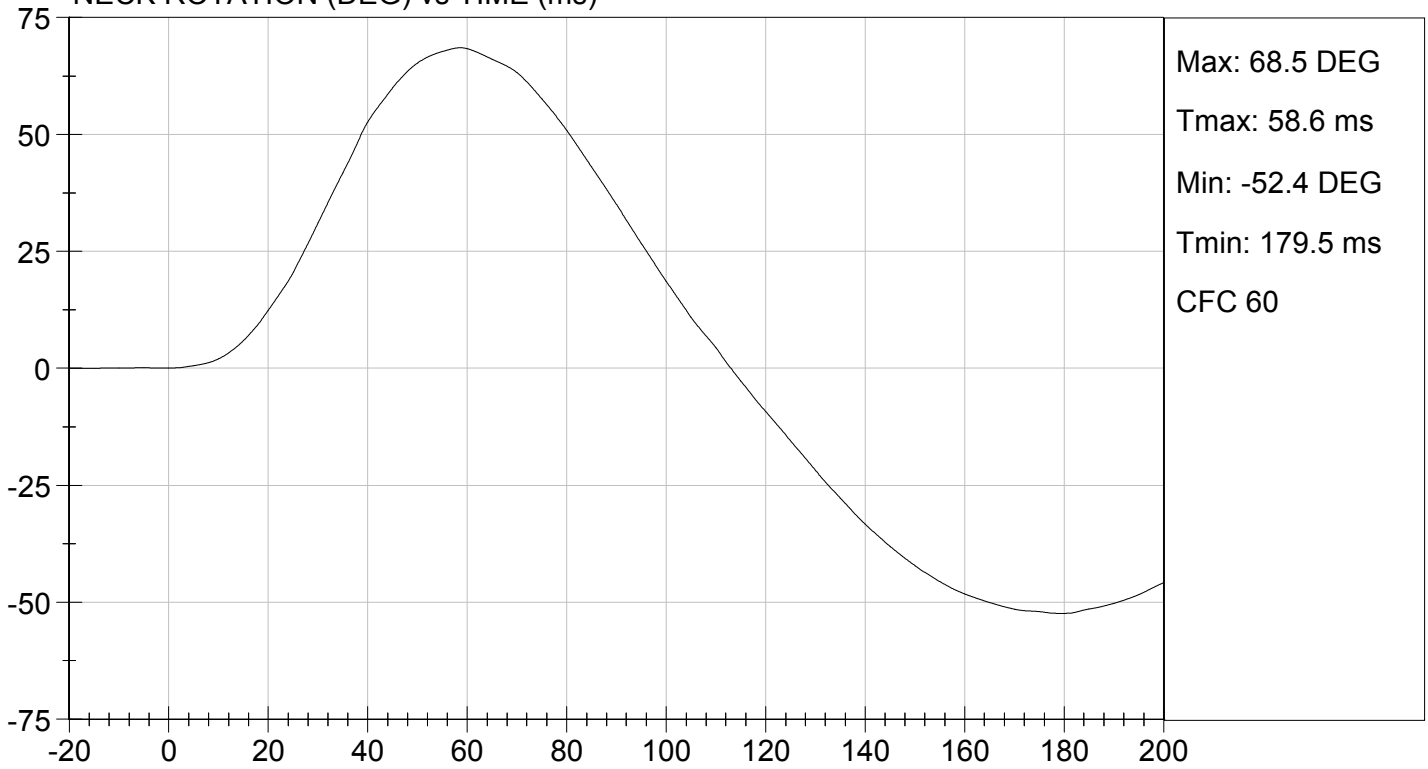
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 08/24/2016
TEST #: D162822

PENDULUM DECELERATION (G's) vs TIME (ms)

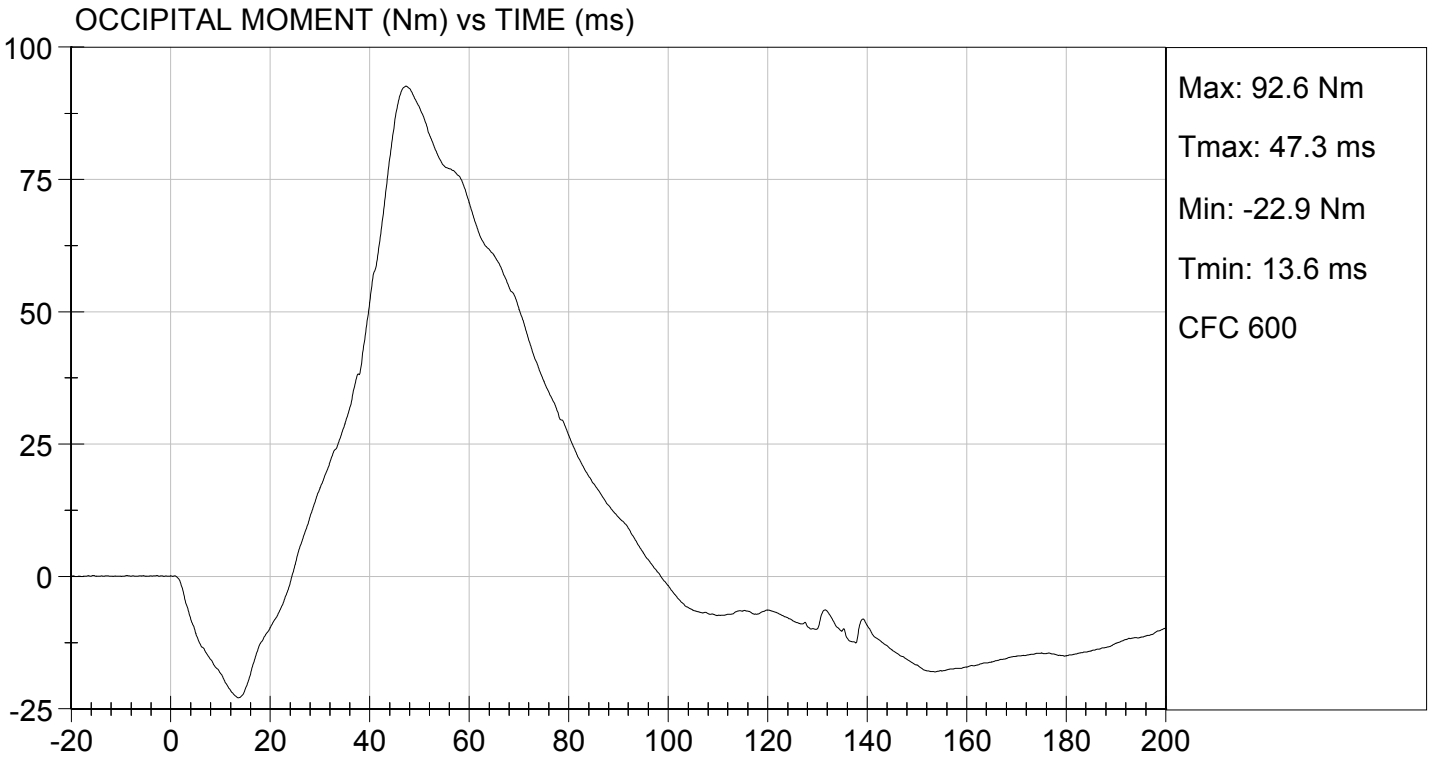


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 08/24/2016
TEST #: D162822



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162823

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	52	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.15	Pass
	20 ms	G's	14.00 to 19.00	17.27	Pass
	30 ms	G's	11.00 to 16.00	14.49	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.1	Pass
	Time	ms	72.0 to 82.0	77.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	159.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-59.7	Pass
	Time	ms	65.0 to 79.0	71.1	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	147.4	Pass
			Overall Test Results		Pass

Jessica Gall

Laboratory Technician

08/24/2016

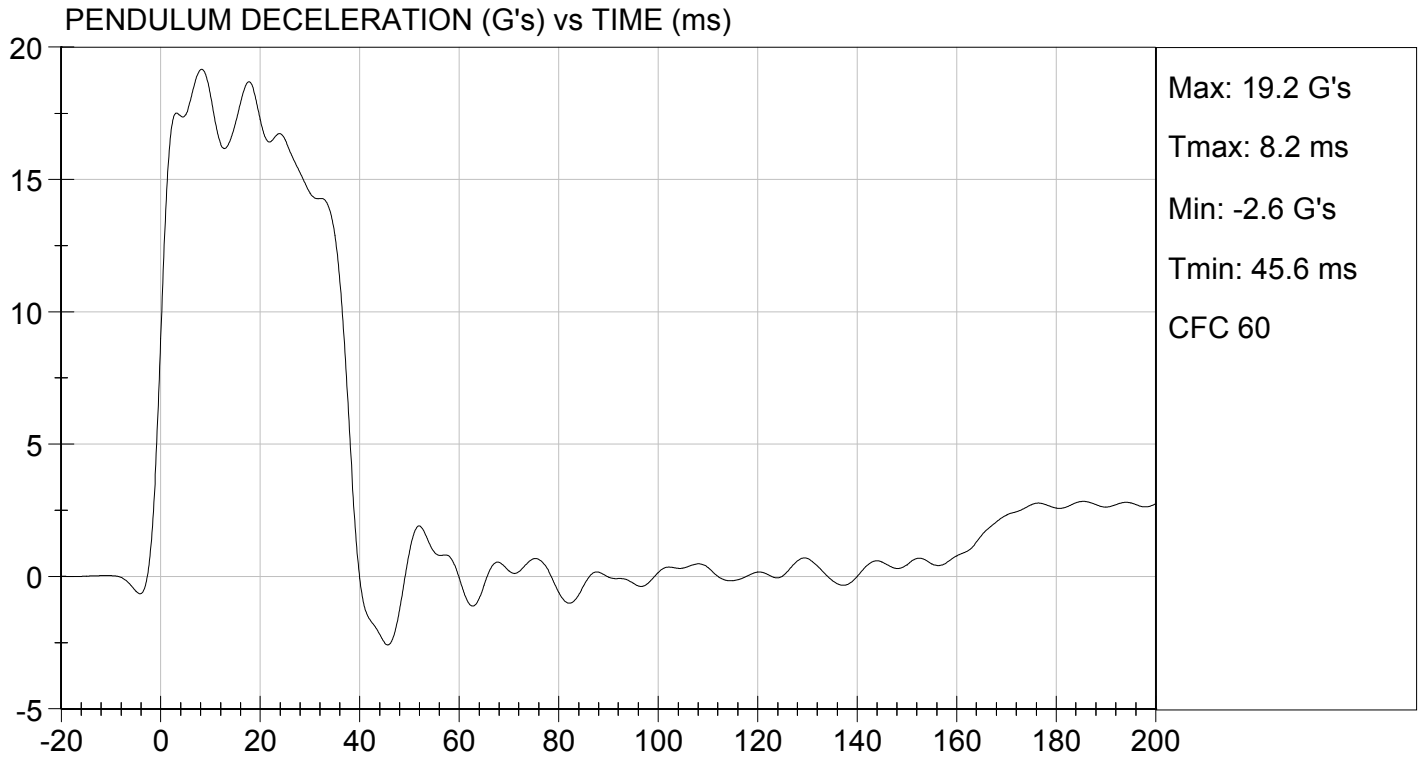
Test Date

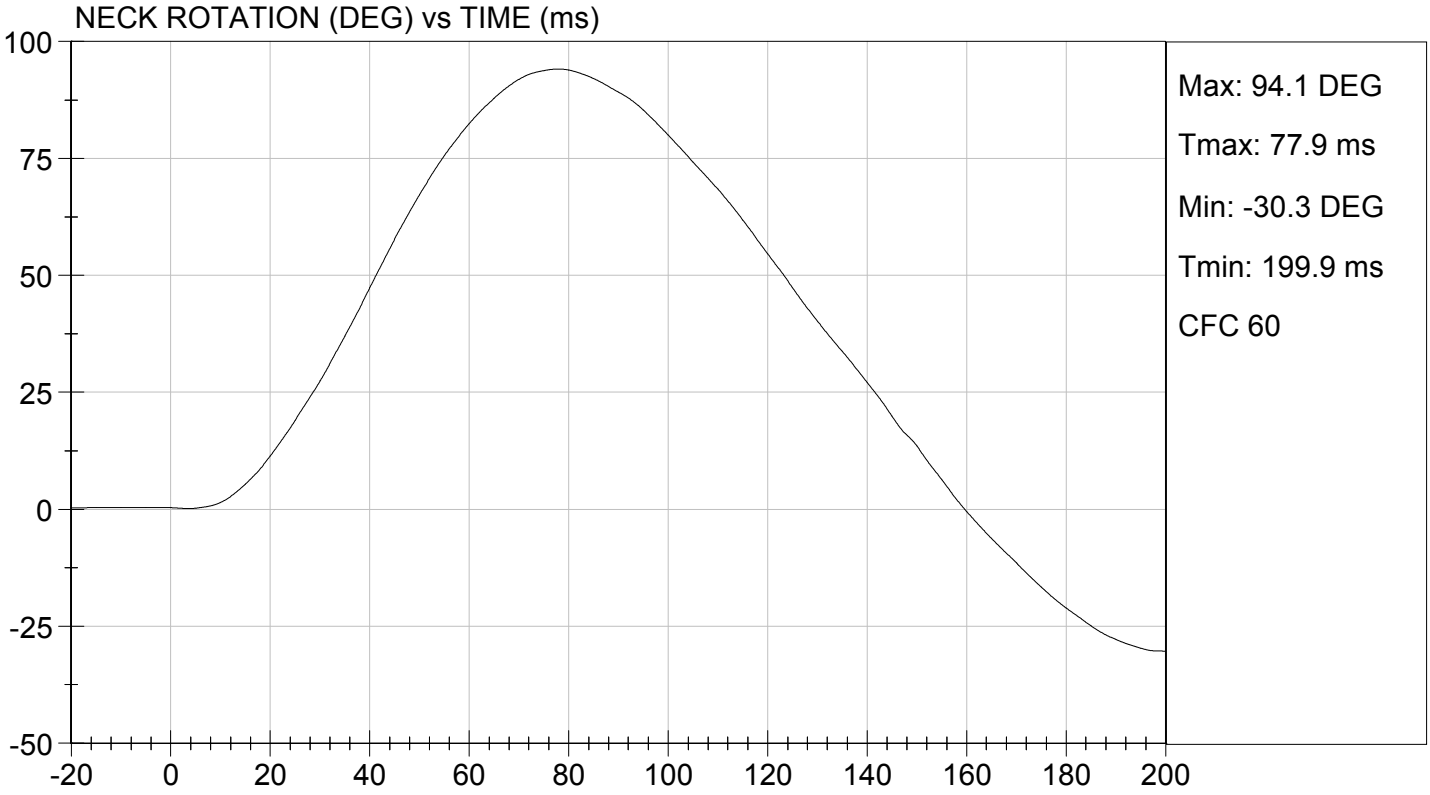
Thom D. Nelle

Approved By

TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

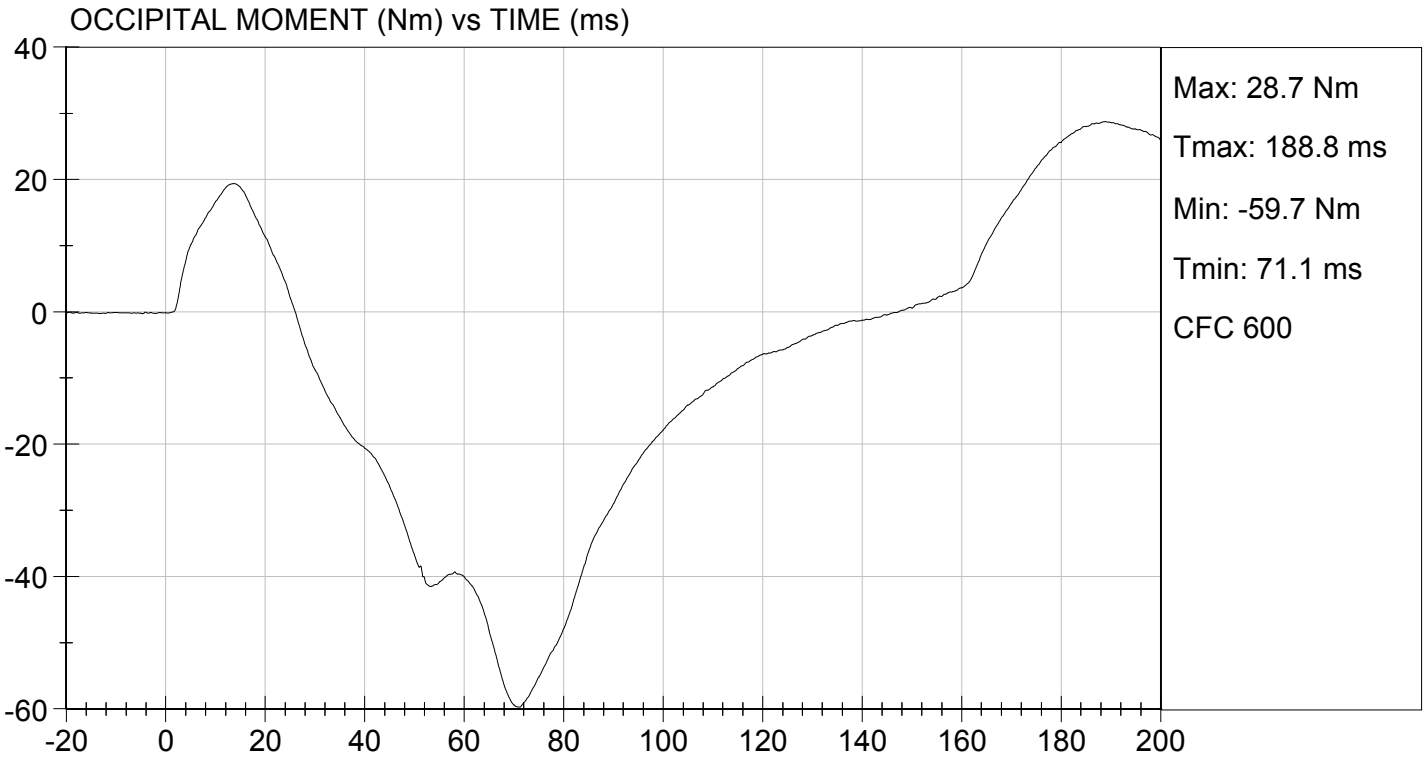
TEST DATE: 08/24/2016
TEST #: D162823





TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 08/24/2016
TEST #: D162823



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162824

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,433	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.62	Pass
Internal Hysteresis	%	69 to 85	73	Pass
		Overall Test Results		Pass

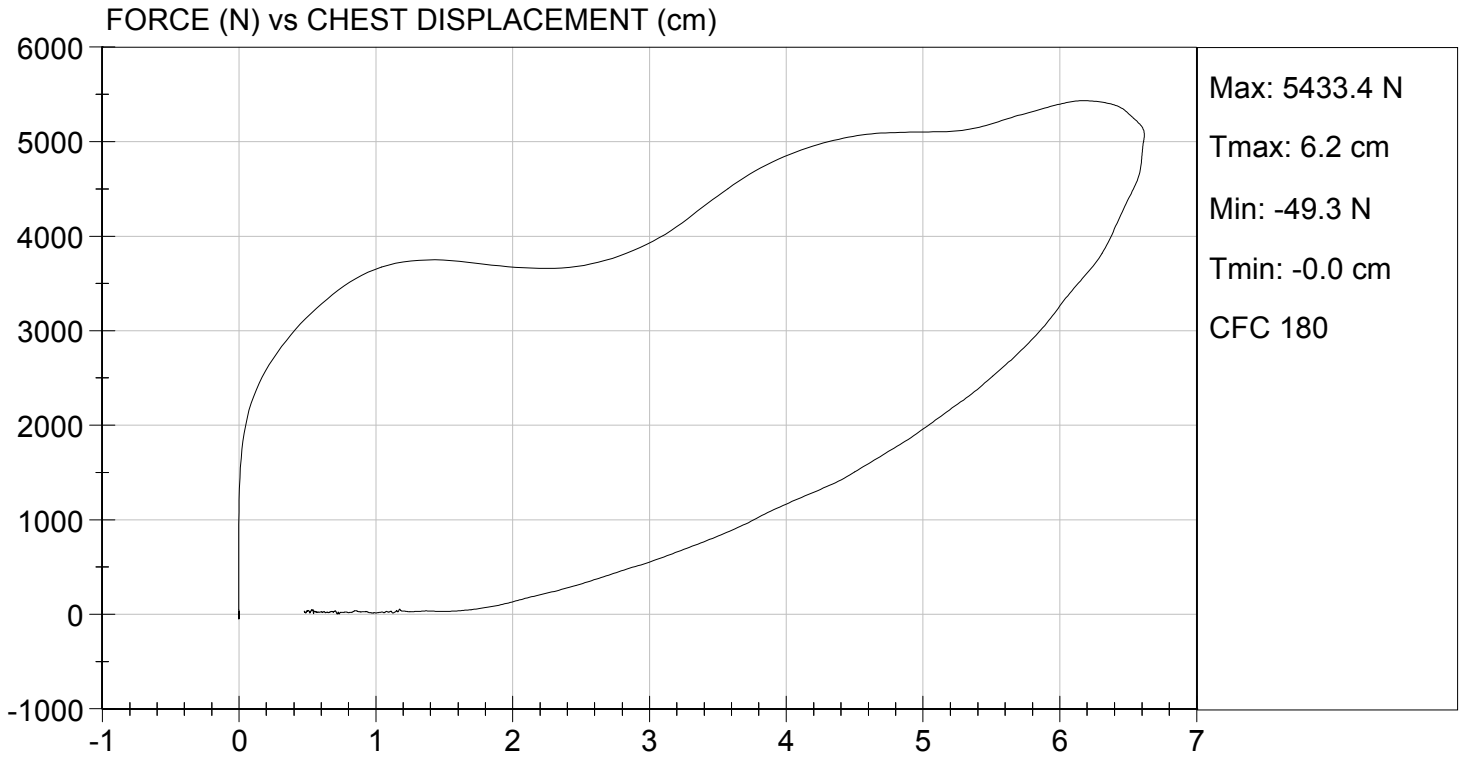
Laboratory Technician

08/24/2016
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 08/24/2016
TEST #: D162824



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162825

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Probe Velocity	m/s	2.07 to 2.13	2.08	Pass
Peak Probe Force	N	4715 to 5782	5,572	Pass
		Overall Test Results		Pass

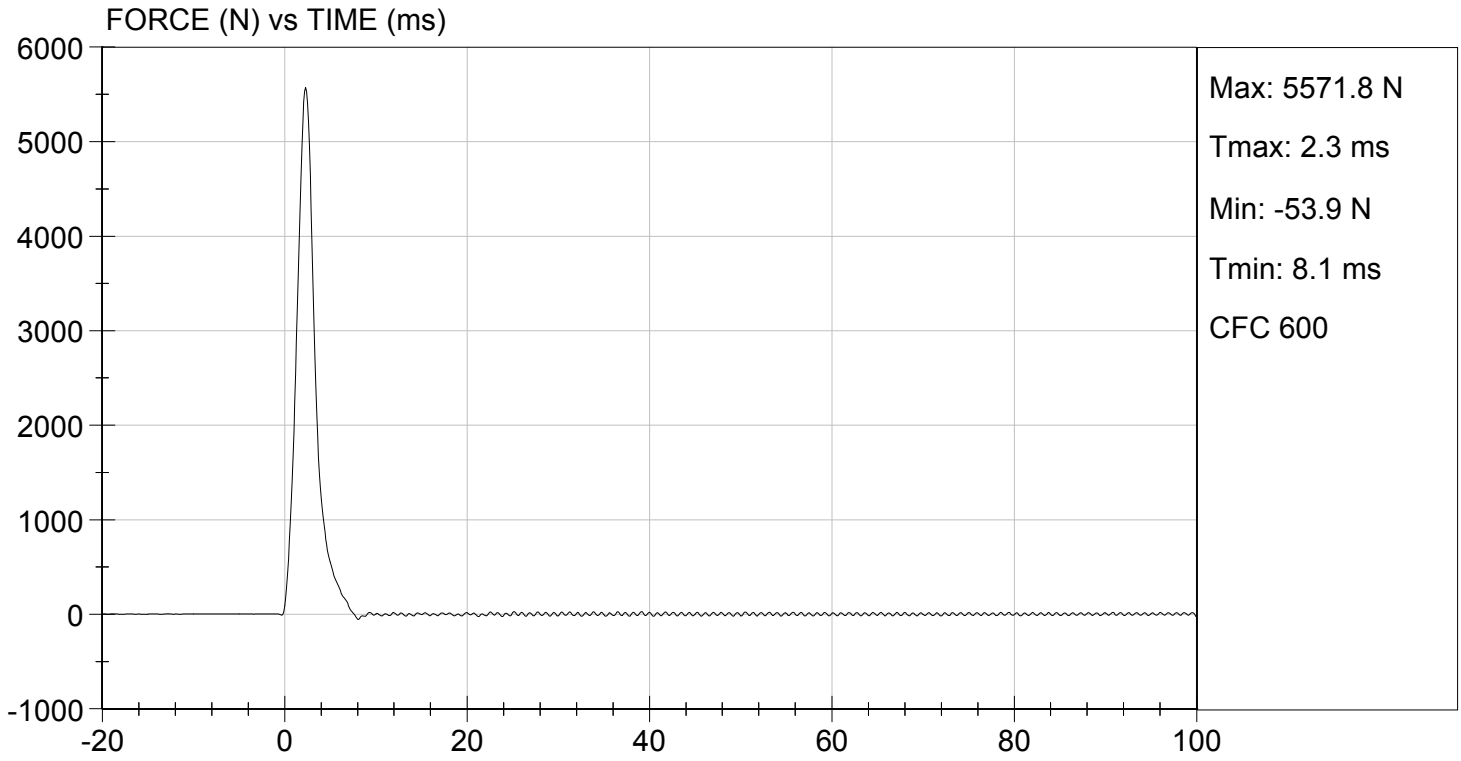
Jessica Hall
Laboratory Technician

08/24/2016
Test Date

Thom A. Miller
Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.83 ft/s, 2.08 m/s

TEST DATE: 08/24/2016
TEST #: D162825



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162826

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,179	Pass
		Overall Test Results		Pass

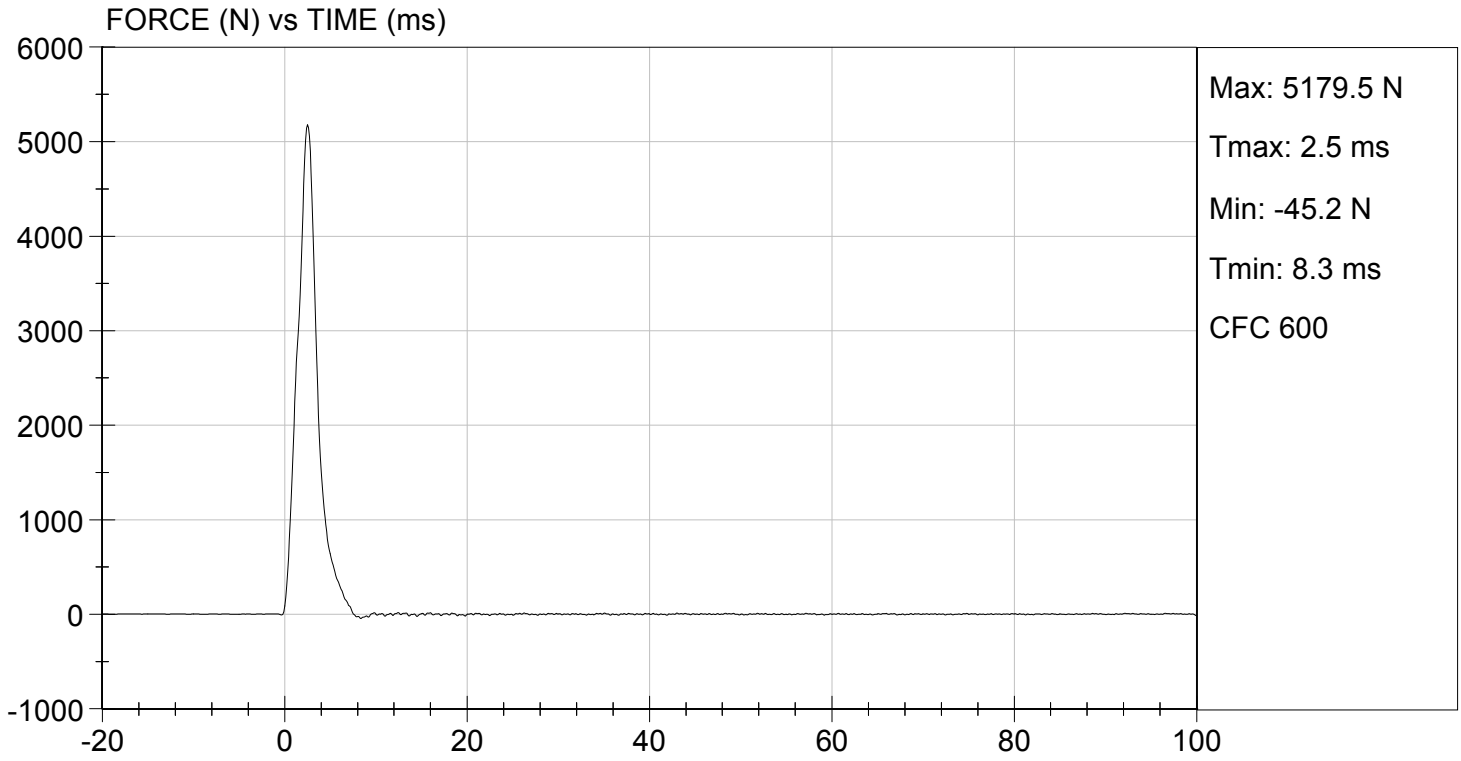
Jessica Gall
Laboratory Technician

08/24/2016
Test Date

Thom A. Miller
Approved By

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

TEST DATE: 08/24/2016
TEST #: D162826



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D162820

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.4	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	51	51	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	76.4	73.3	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	44.1	42.9	Pass
		Overall Test Results			Pass

Laboratory Technician

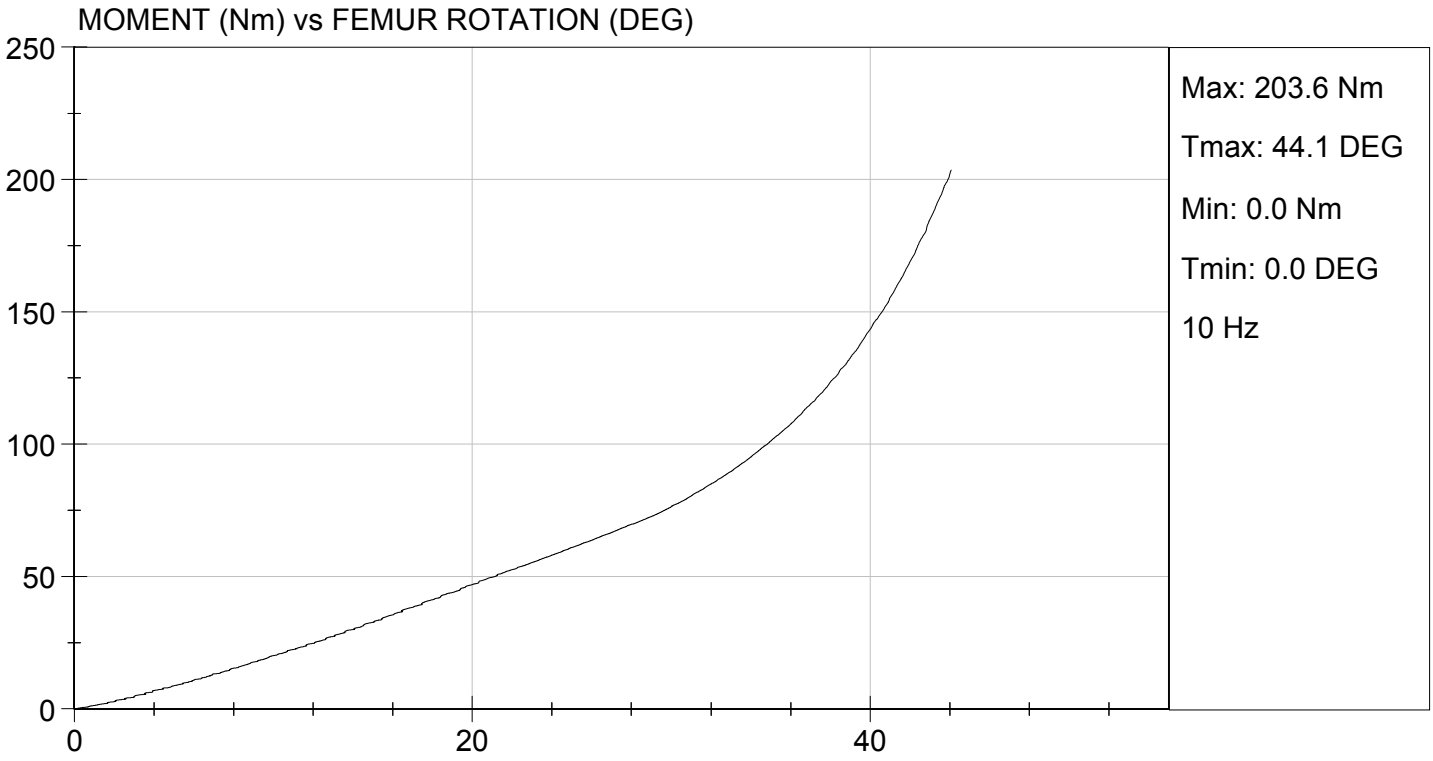
08/24/2016
Test Date

Approved By

TEST DESC: RIGHT HIP FEMUR FLEXION

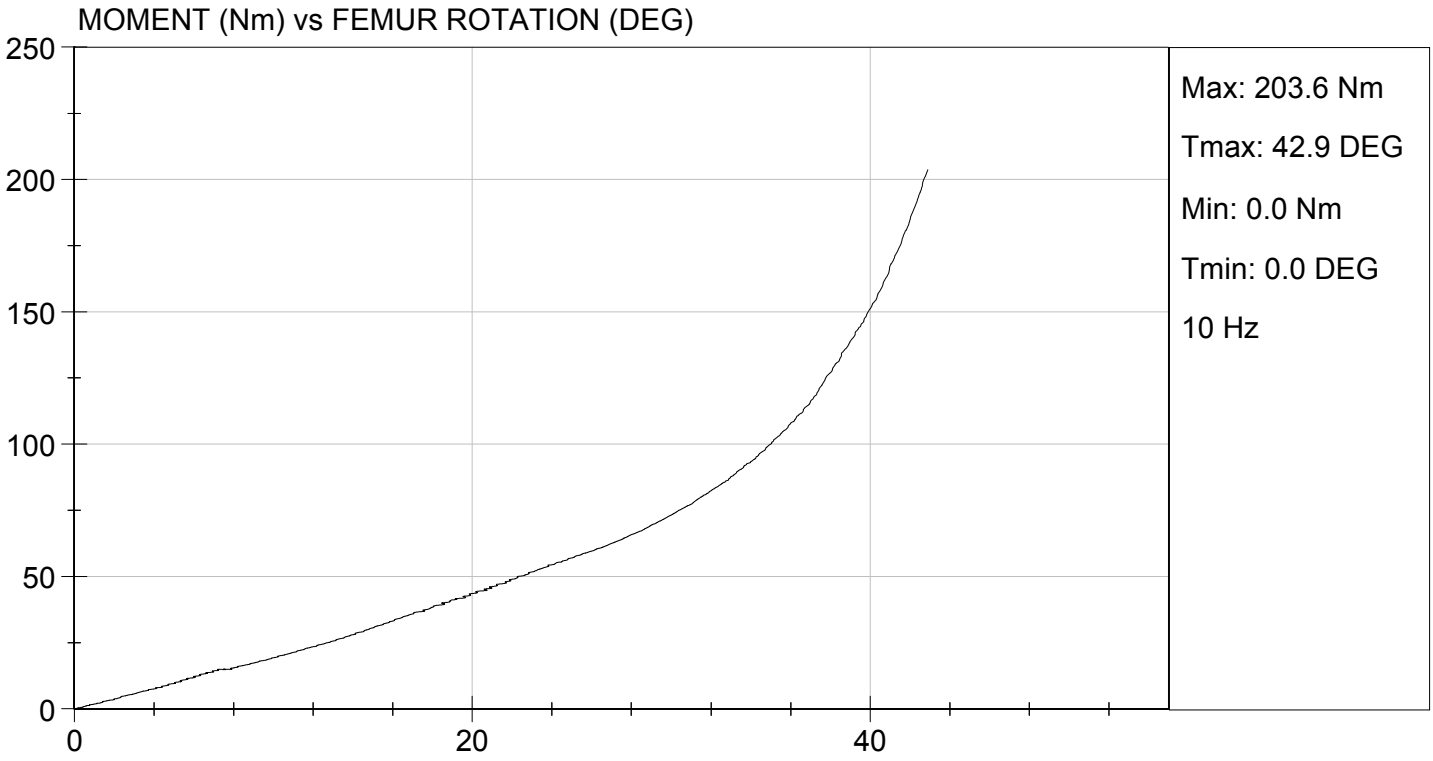
TEST DATE: 08/24/2016

TEST #: D162829



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 08/24/2016
TEST #: D162820



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:** D162711

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	52	Pass
Peak Resultant Acceleration	G's	250 to 300	263	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	10.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

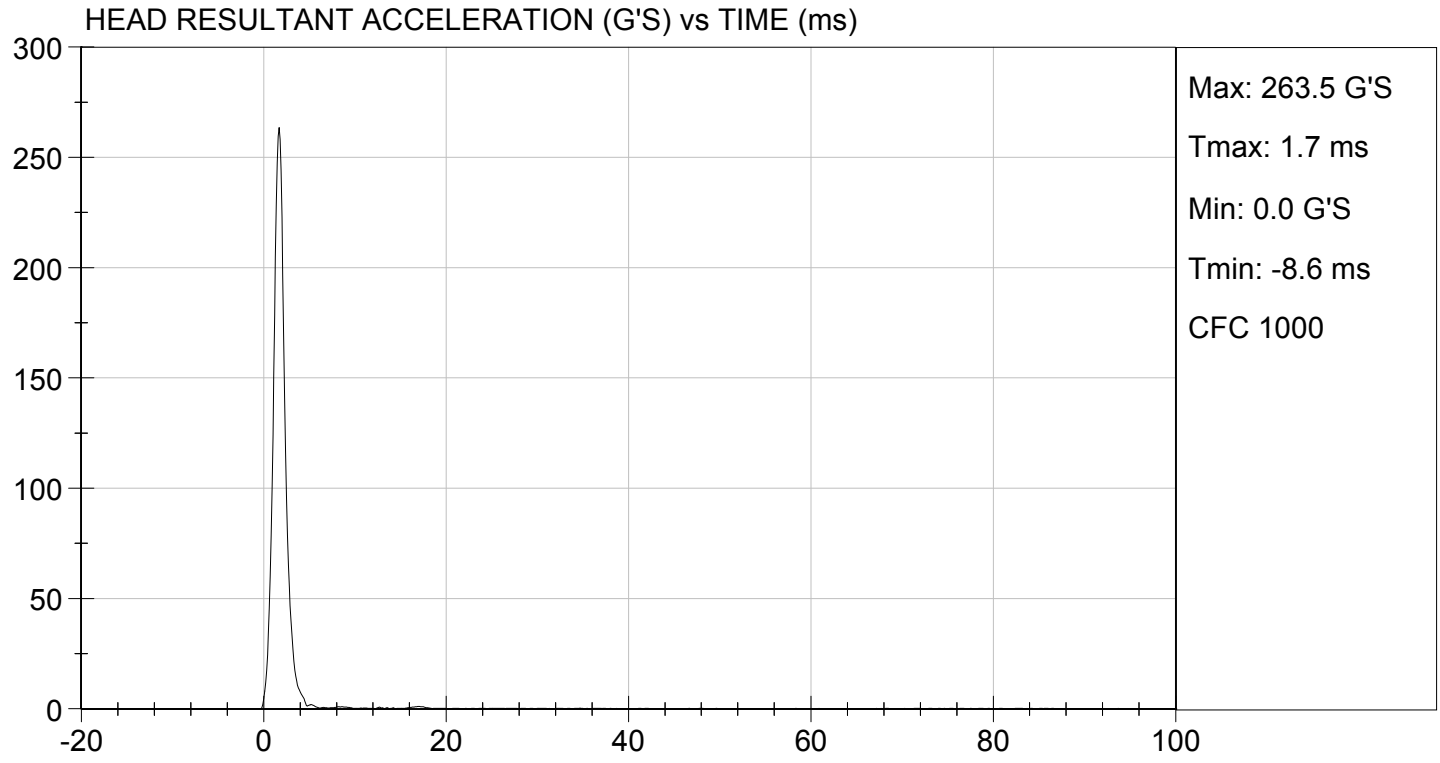
Laboratory Technician

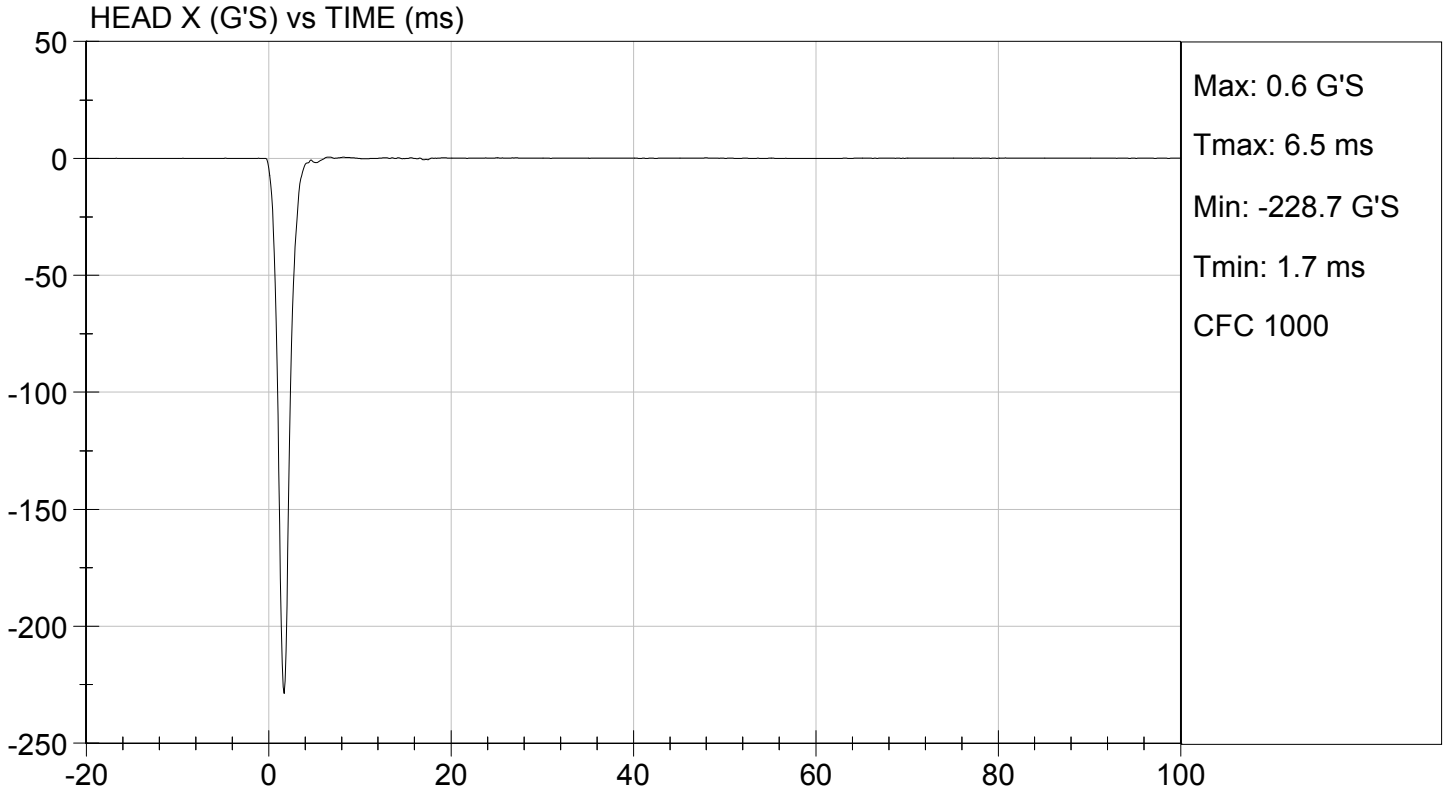
08/16/2016
Test Date

Approved By

TEST DESC: HEAD DROP

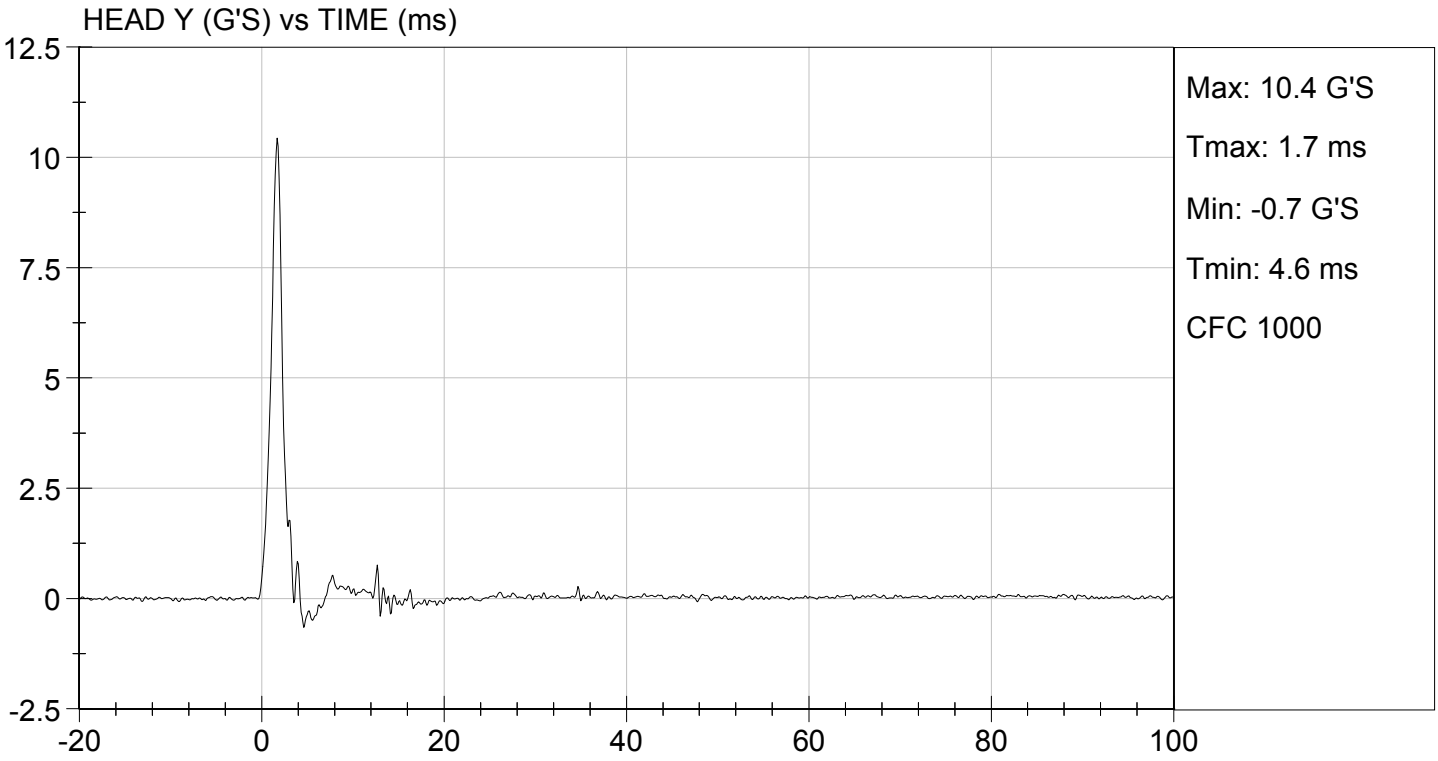
TEST DATE: 08/16/2016
TEST #: D162711

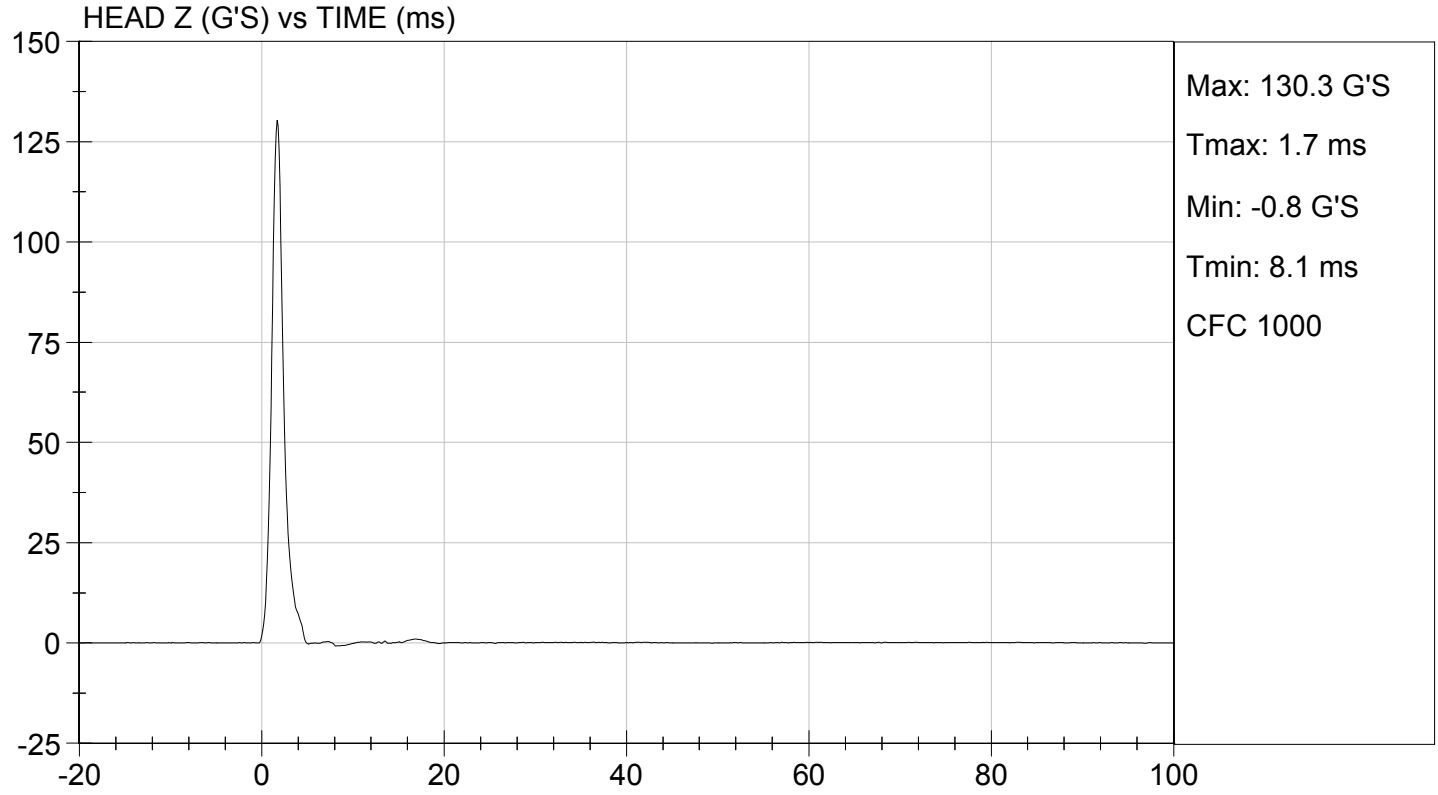




TEST DESC: HEAD DROP

TEST DATE: 08/16/2016
TEST #: D162711





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162712

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	52	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.2	Pass
	20 ms	m/s	4.0 to 5.0	4.3	Pass
	30 ms	m/s	5.8 to 7.0	6.1	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	87	Pass
			Overall Results		Pass

Laboratory Technician

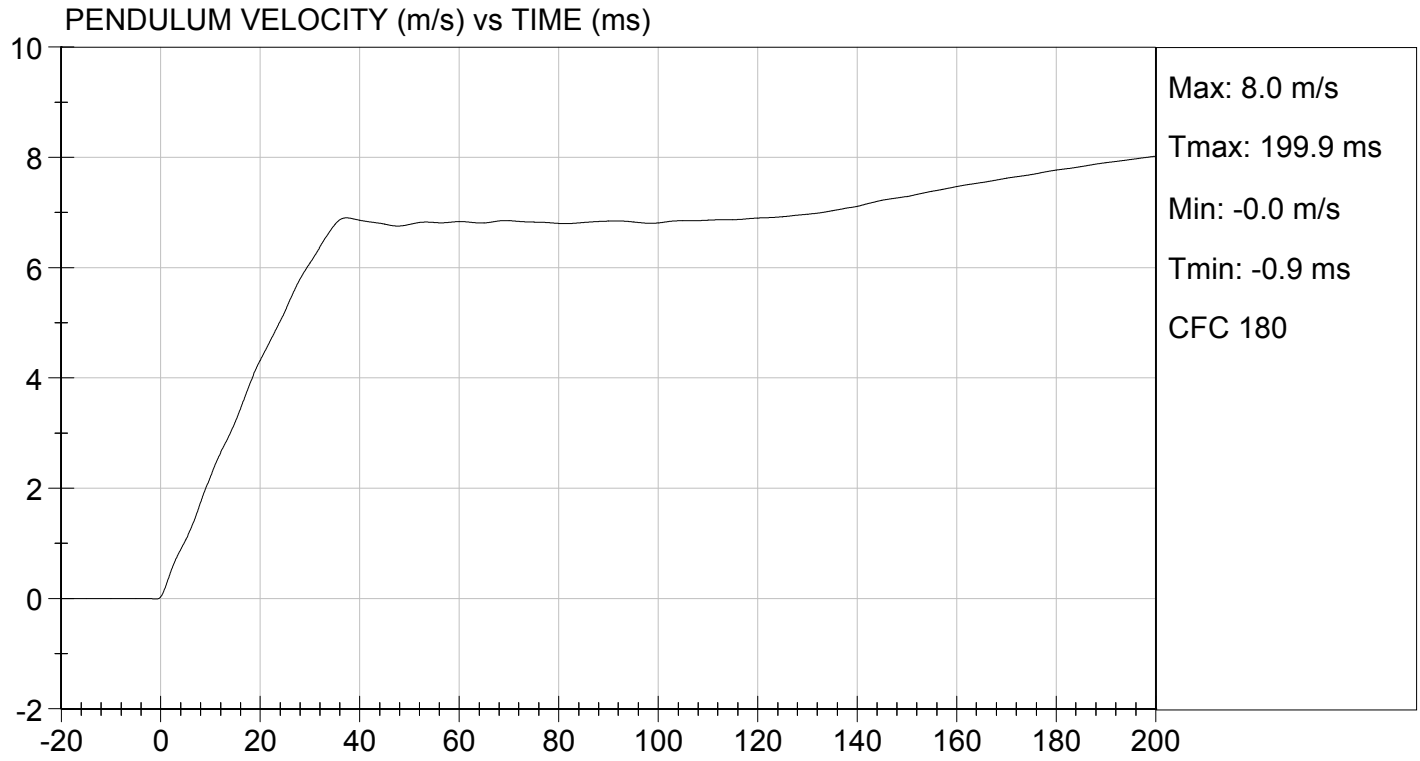
08/16/2016

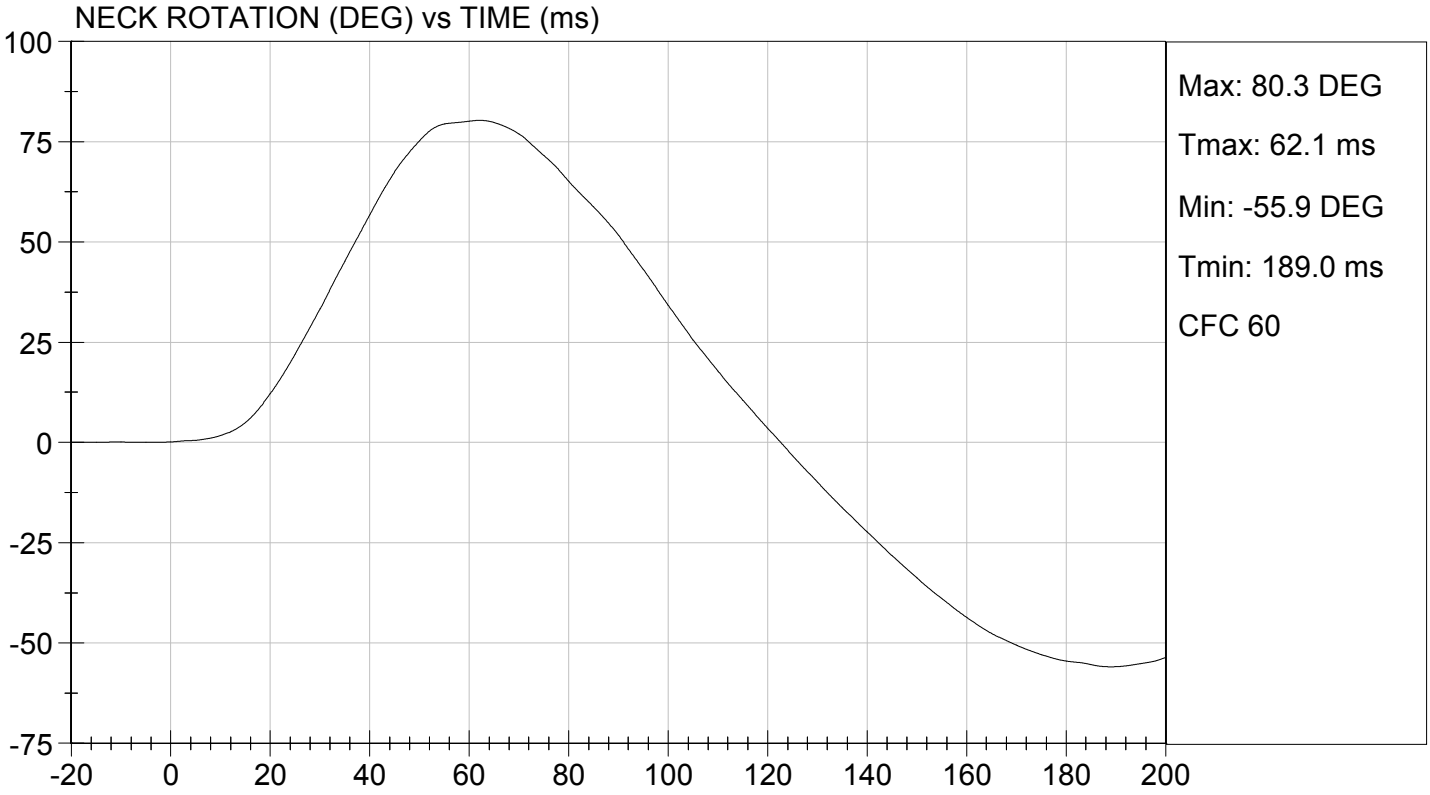
Test Date

Approved By

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

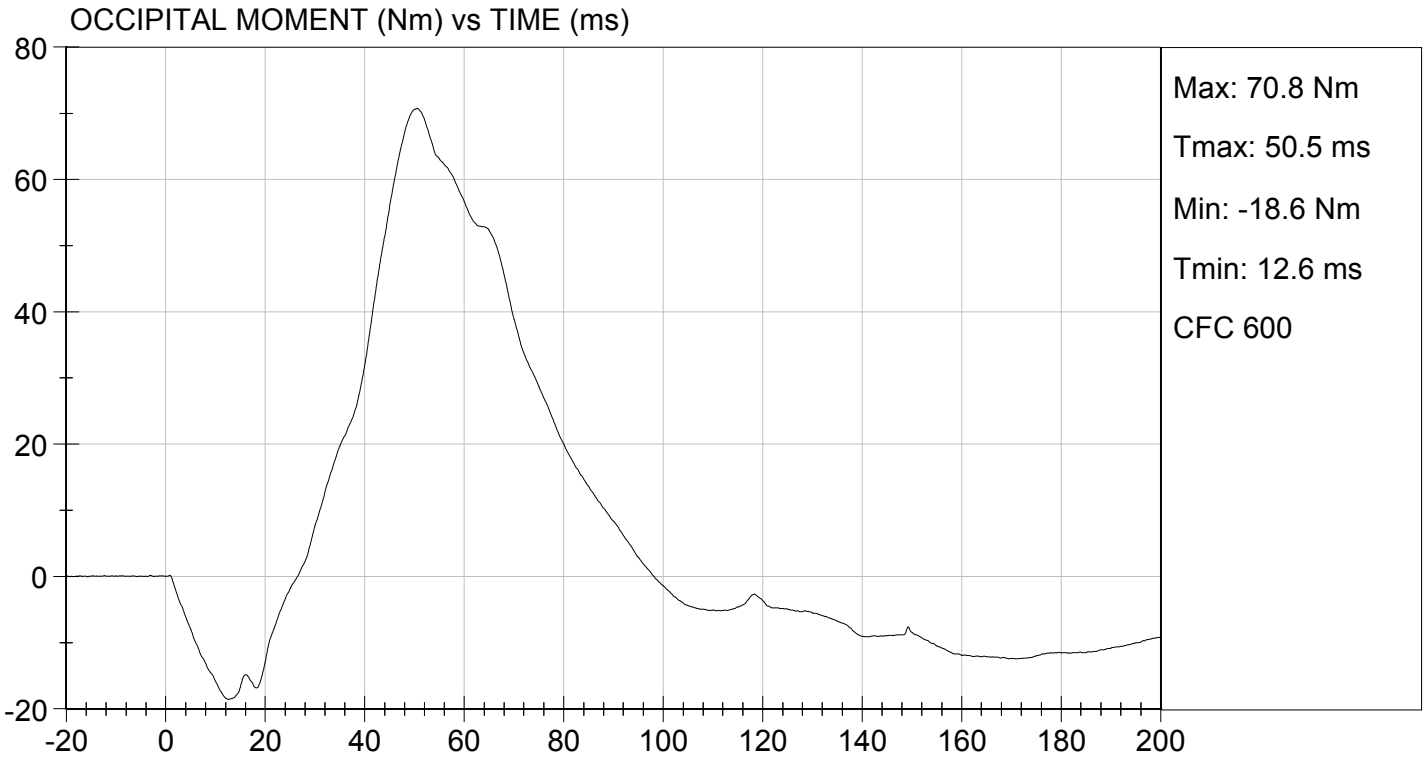
TEST DATE: 08/16/2016
TEST #: D162712





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

TEST DATE: 08/16/2016
TEST #: D162712



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162713

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	52	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.05	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.0	Pass
D Plane Rotation	Max	deg	99 to 114	111	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-53	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	103	Pass
			Overall Results		Pass

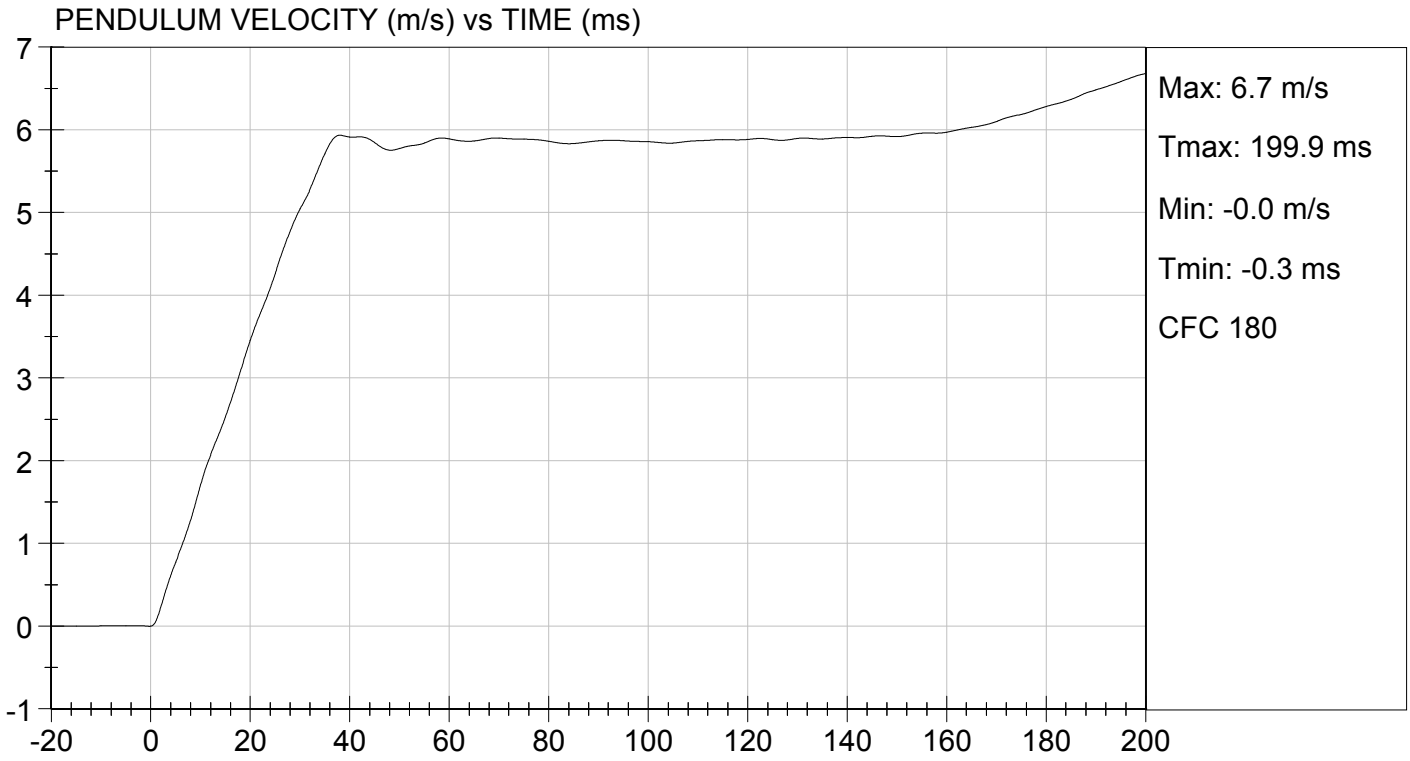
Laboratory Technician

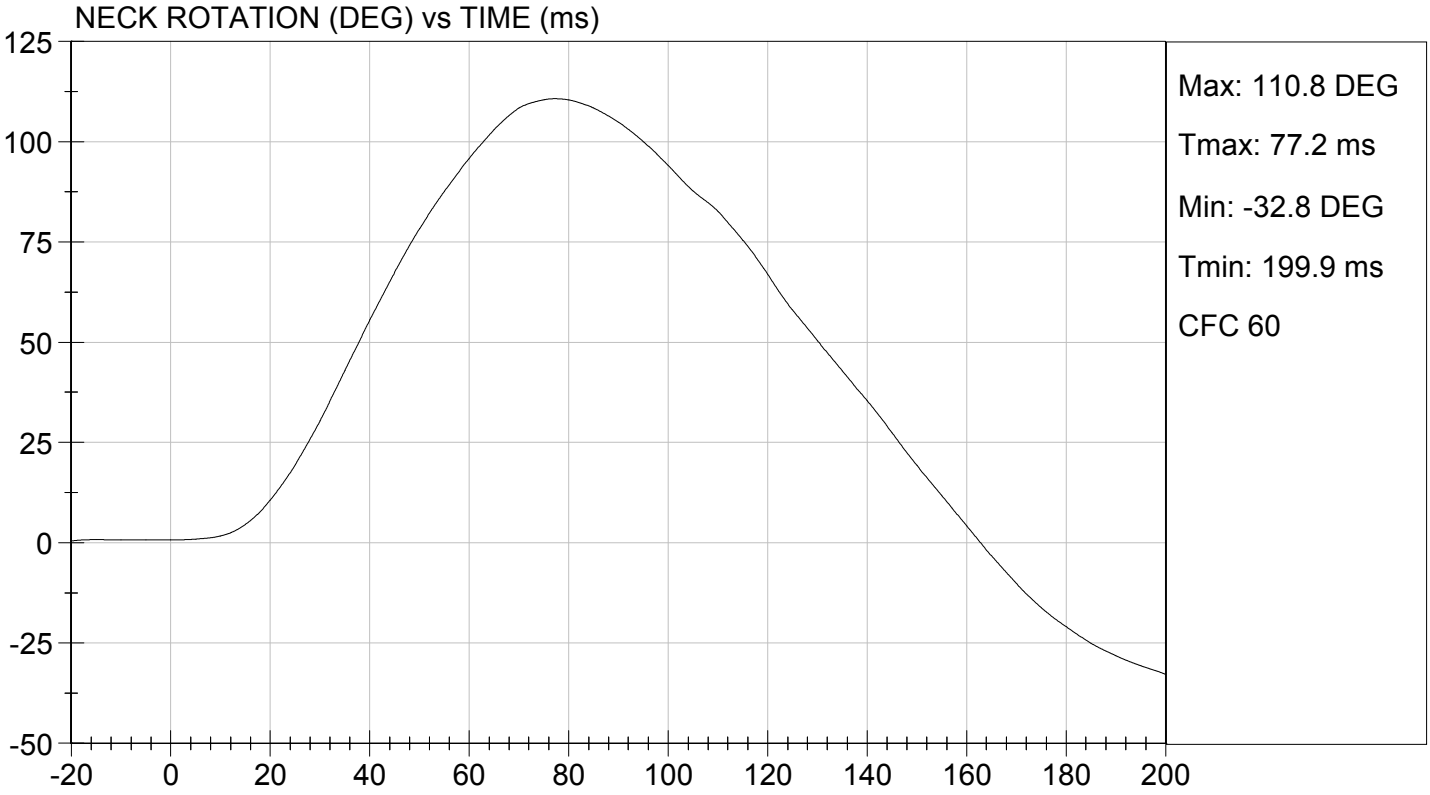
08/16/2016
Test Date

Approved By

TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

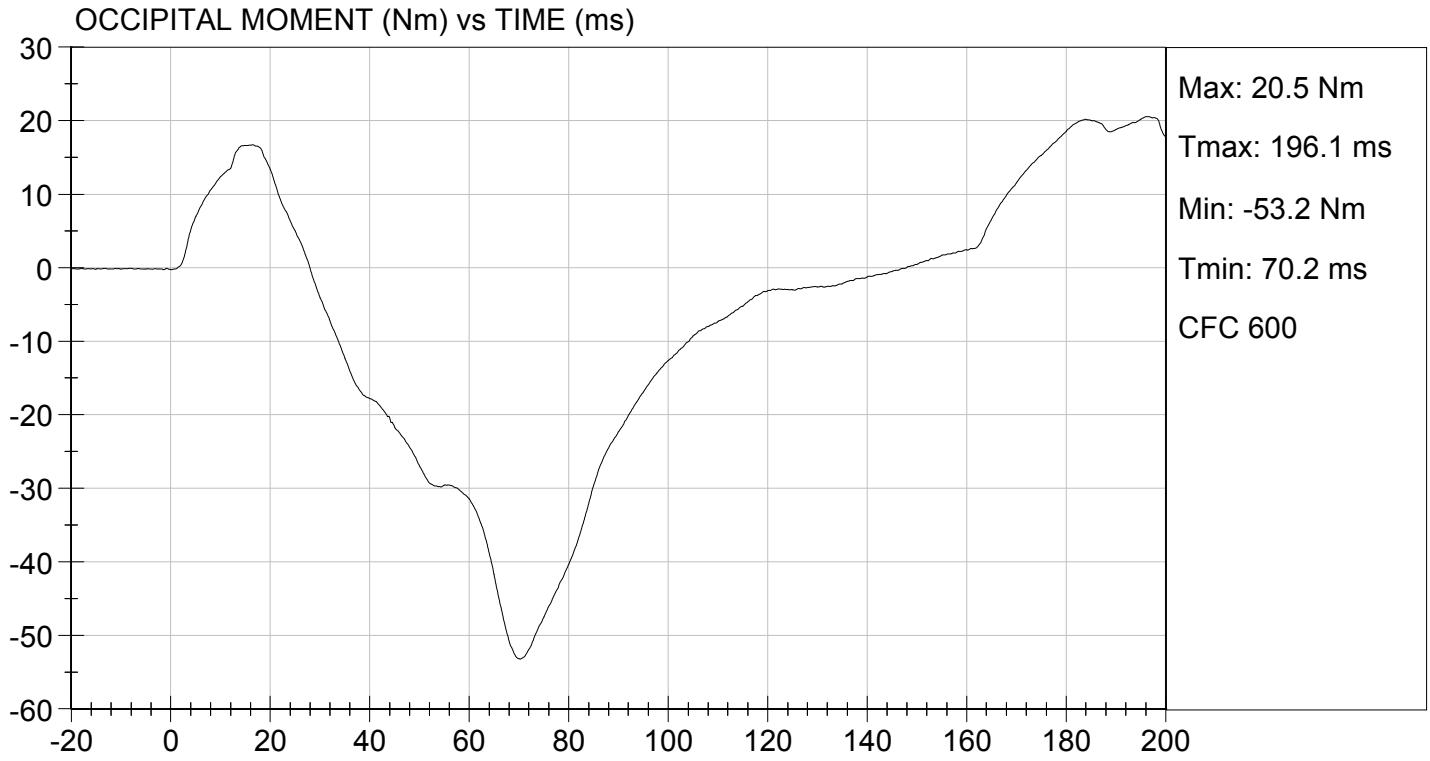
TEST DATE: 08/16/2016
TEST #: D162713





TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 08/16/2016
TEST #: D162713



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162714

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	6.59 to 6.83	6.60	Pass
Peak Deflection	mm	50 to 58	55	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4282	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4194	Pass
		Overall Test Results		Pass

Laboratory Technician

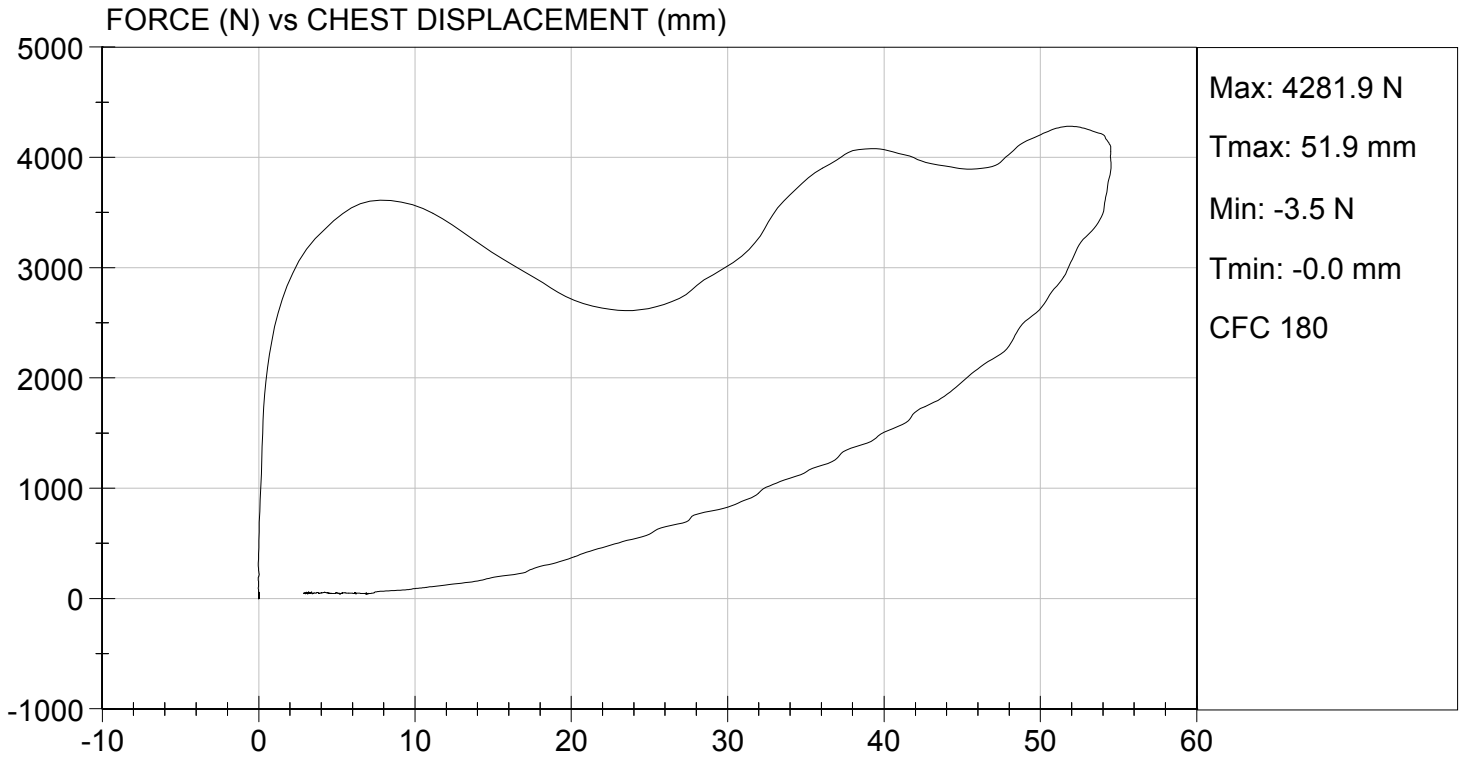
08/16/2016

Test Date

Approved By

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

TEST DATE: 08/16/2016
TEST #: D162714



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162715

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	52	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	N	3450 to 4060	3640	Pass
		Overall Test Results		Pass

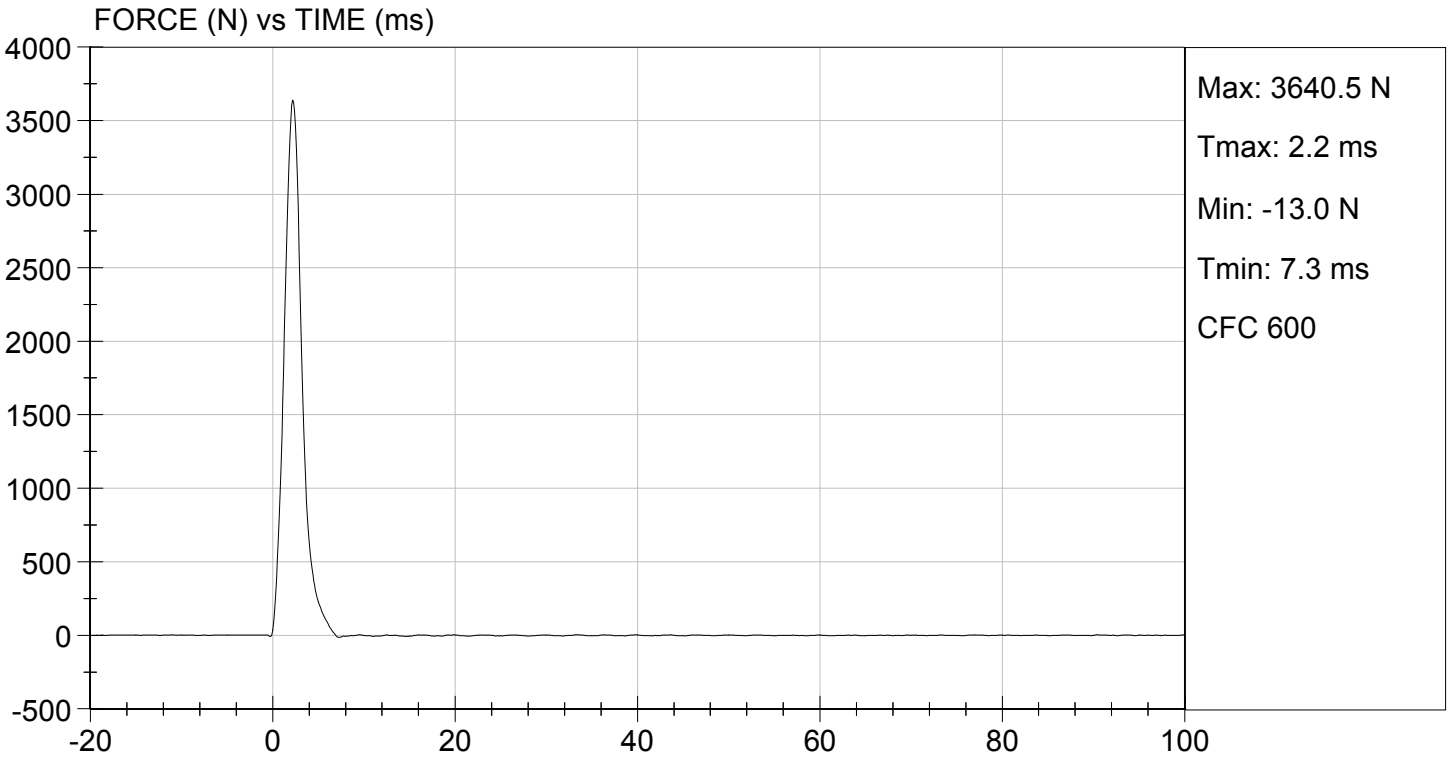
Laboratory Technician

08/16/2016
Test Date

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.92 ft/s, 2.11 m/s

TEST DATE: 08/16/2016
TEST #: D162715



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162716

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	52	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	N	3450 to 4060	3525	Pass
		Overall Test Results		Pass

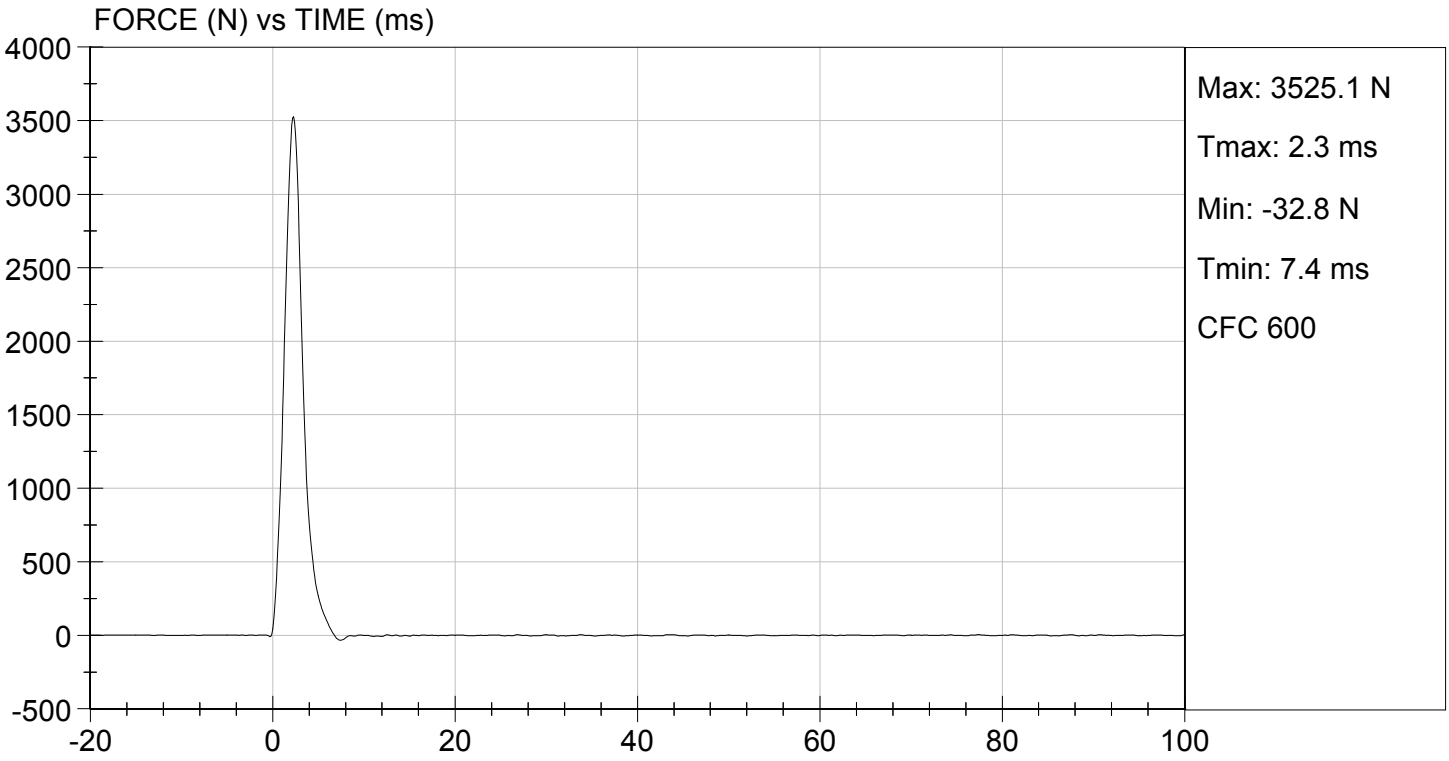
Laboratory Technician

08/16/2016
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.92 ft/s, 2.11 m/s

TEST DATE: 08/16/2016
TEST #: D162716



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162717

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	3	Pass
Force at 45 deg	N	320 to 390	369	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
		Overall Result		Pass

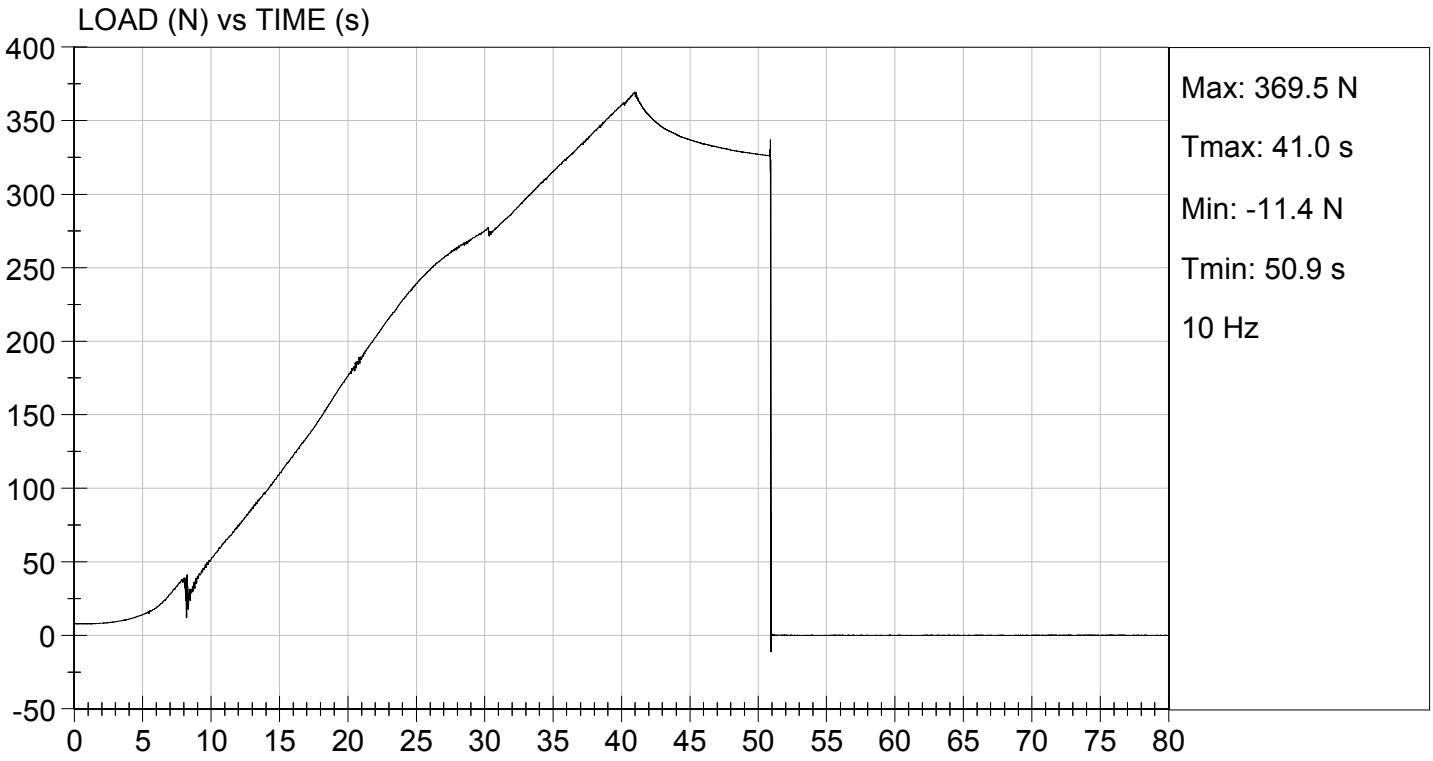
Laboratory Technician

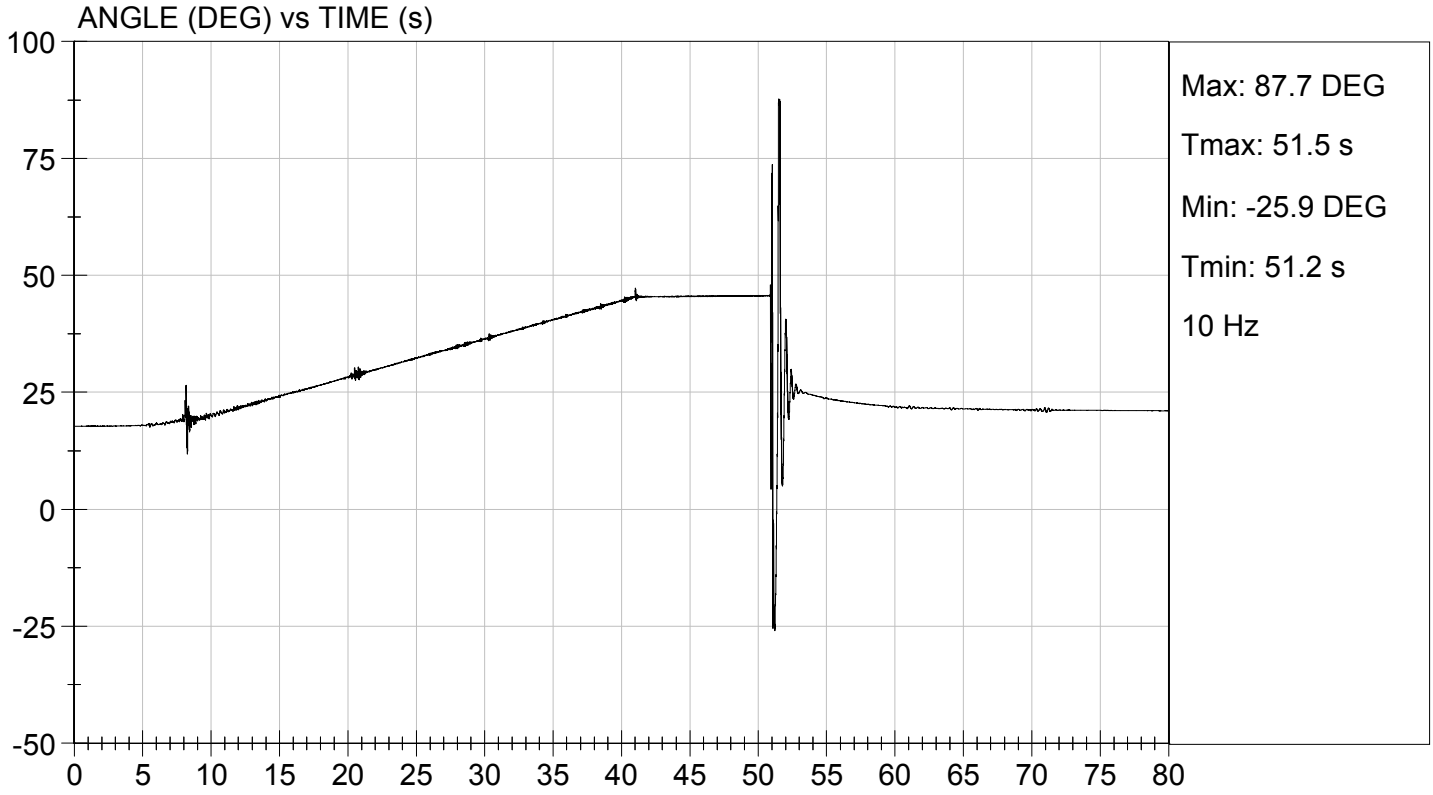
08/16/2016
Test Date

Approved By

TEST DESC: LUMBAR FLEXION

TEST DATE: 08/16/2016
TEST #: D162717





MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test ID:** D162811

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Peak Resultant Acceleration	G's	250 to 300	256	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-7.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

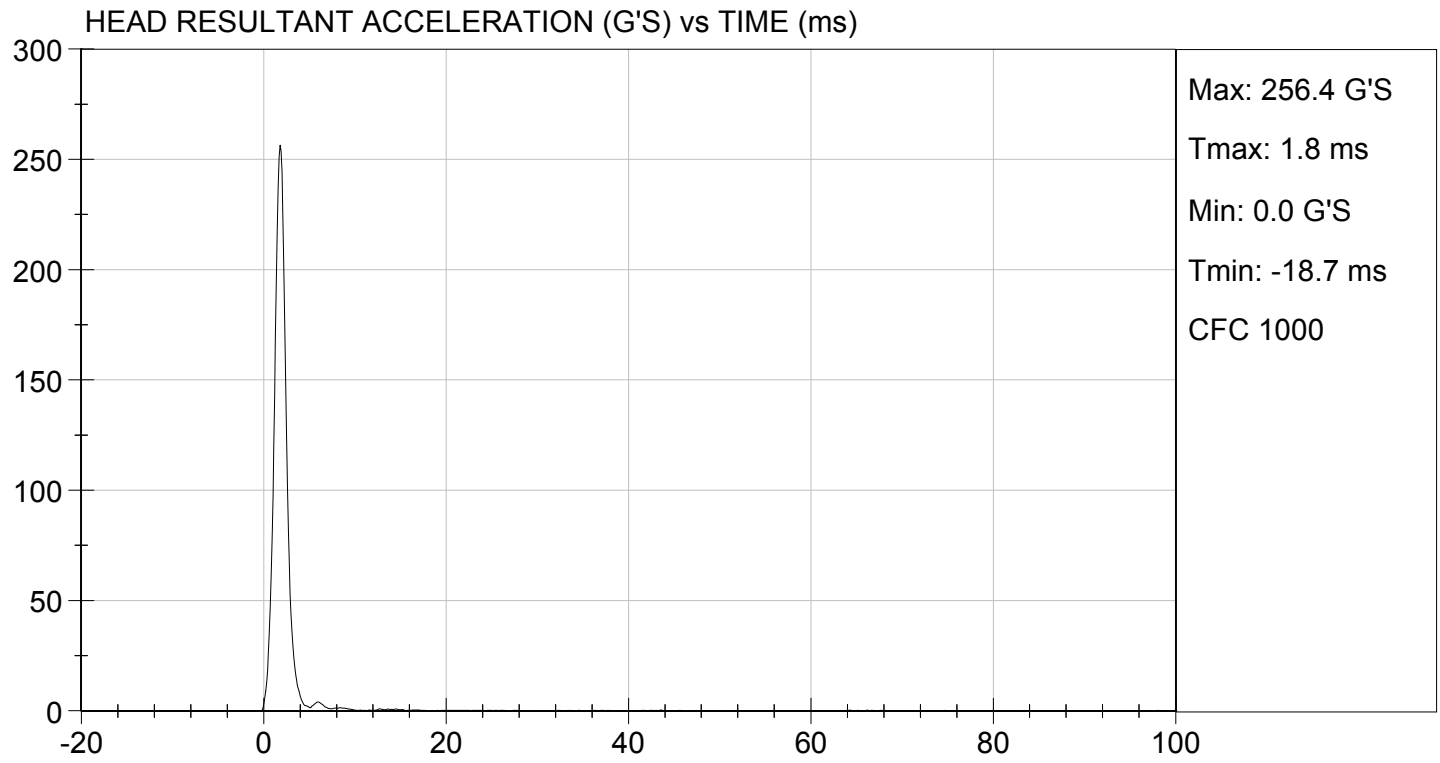
Laboratory Technician

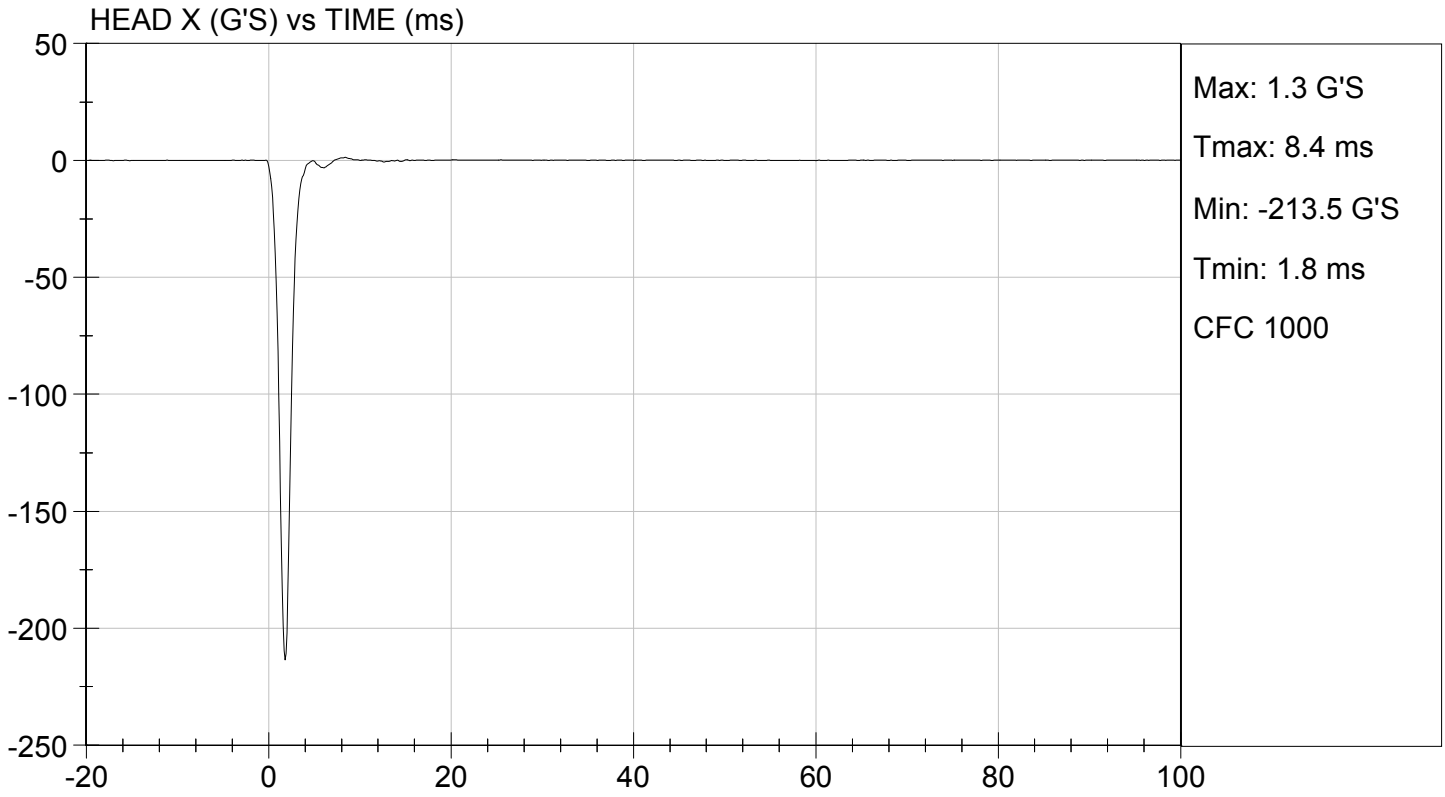
08/23/2016
Test Date

Approved By

TEST DESC: HEAD DROP

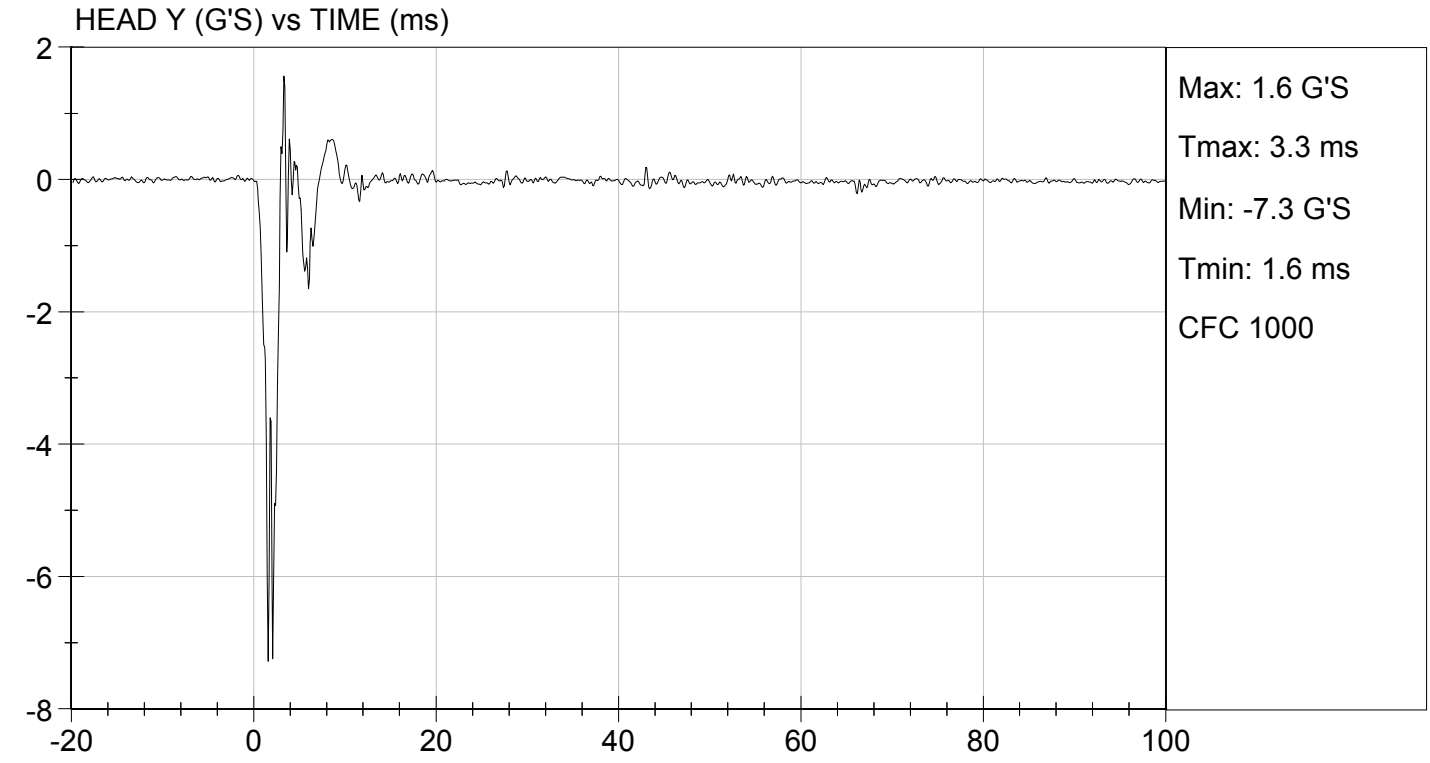
TEST DATE: 08/23/2016
TEST #: D162811

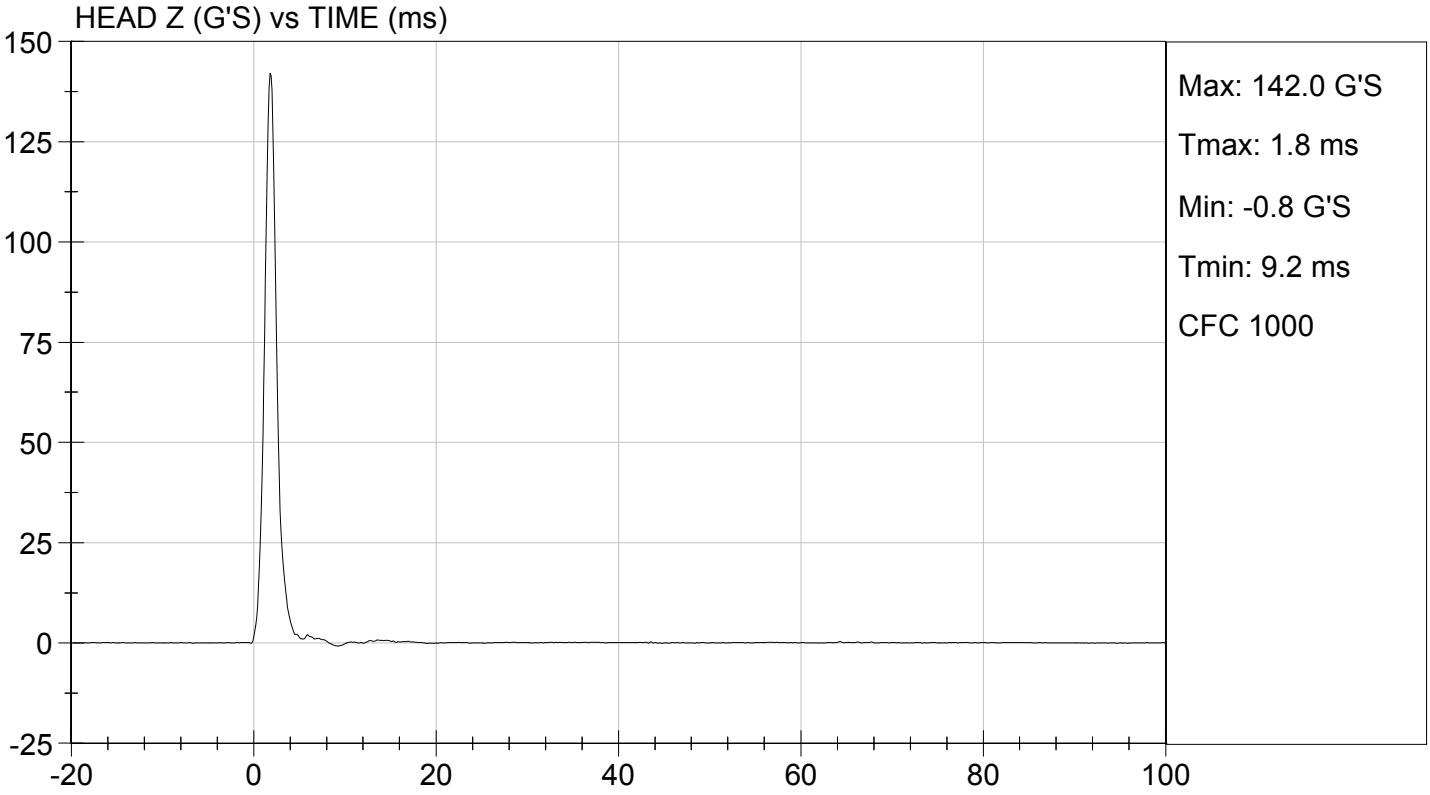




TEST DESC: HEAD DROP

TEST DATE: 08/23/2016
TEST #: D162811





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162812

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	49	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.4	Pass
	30 ms	m/s	5.8 to 7.0	6.1	Pass
D Plane Rotation	Max	deg	77 to 91	81	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	87	Pass
			Overall Results		Pass

Laboratory Technician

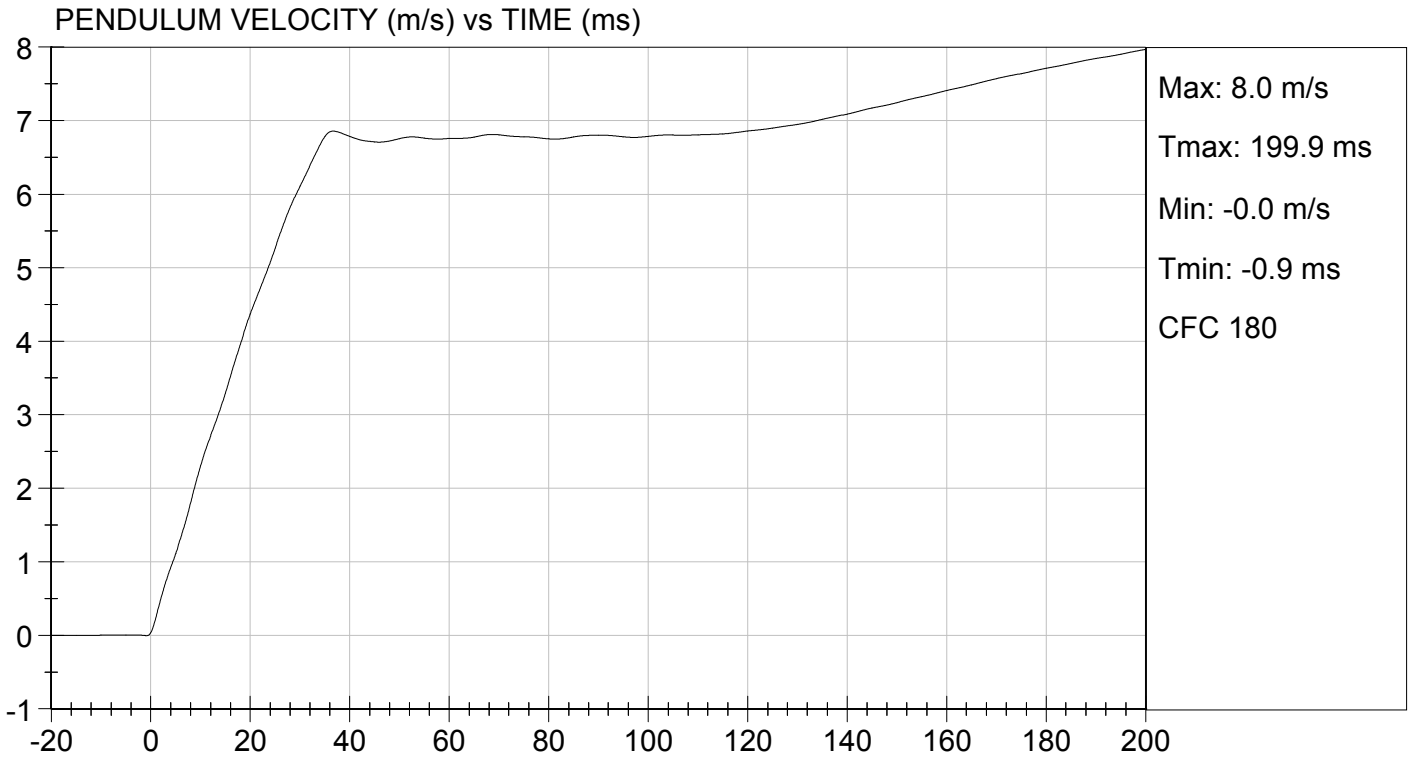
08/23/2016

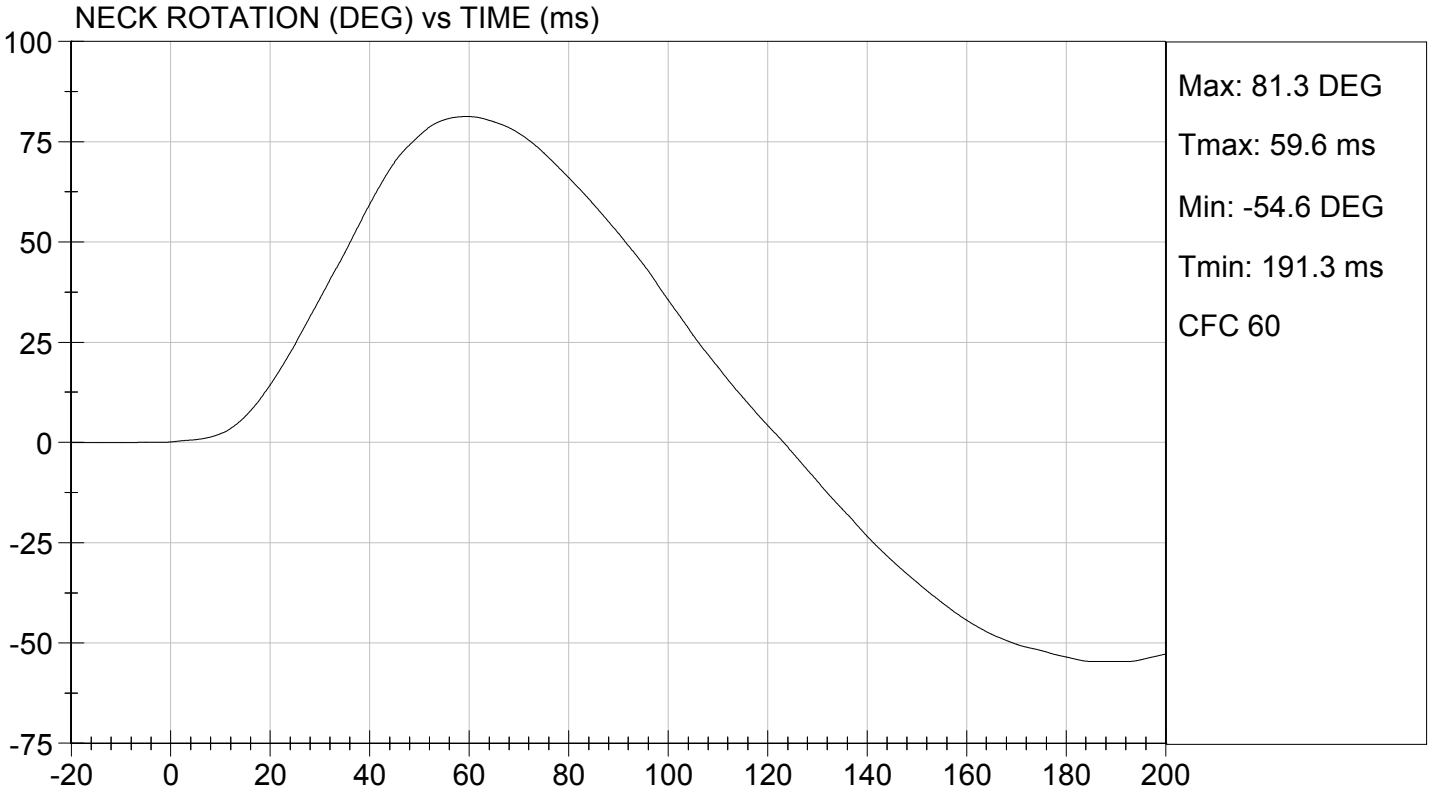
Test Date

Approved By

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

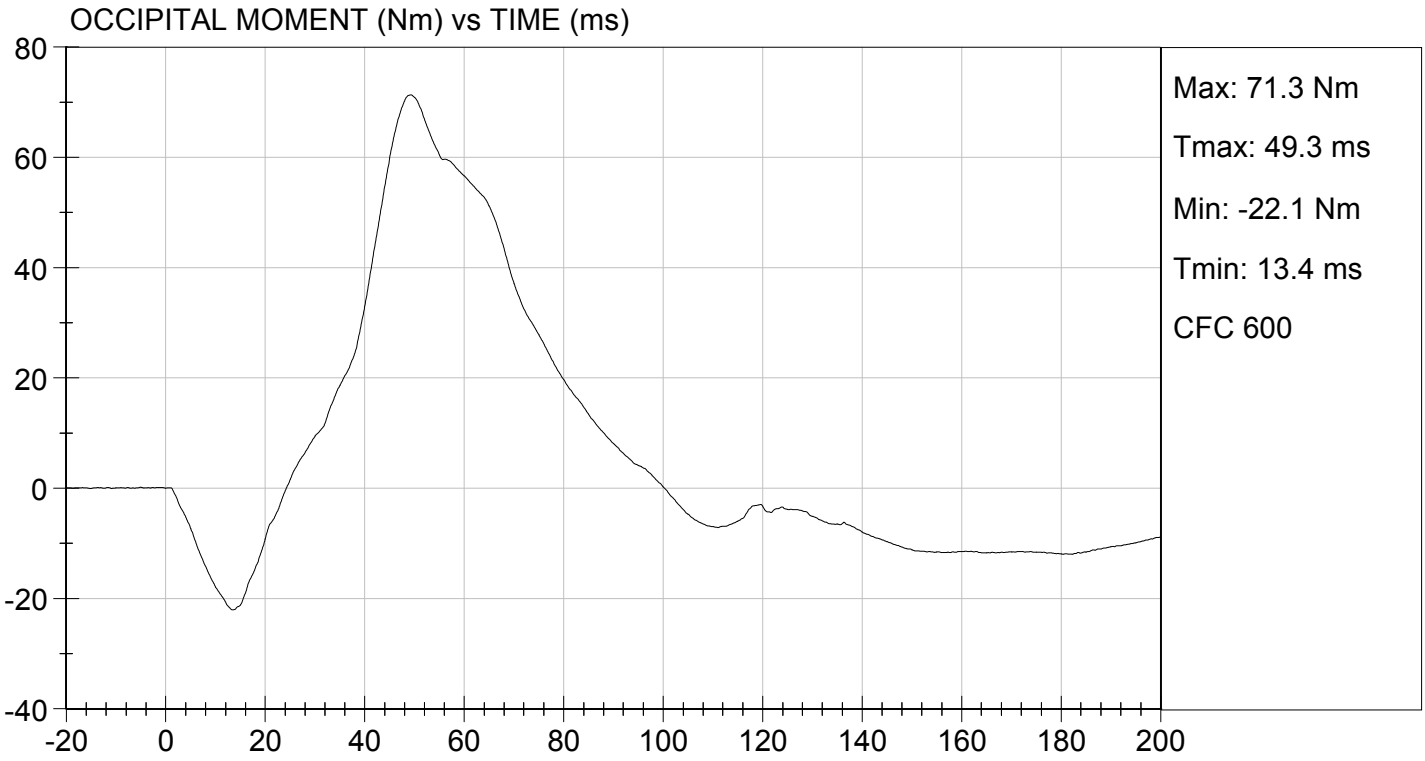
TEST DATE: 08/23/2016
TEST #: D162812





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

TEST DATE: 08/23/2016
TEST #: D162812



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162813

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	49	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	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	101	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	102	Pass
			Overall Results		Pass

Laboratory Technician

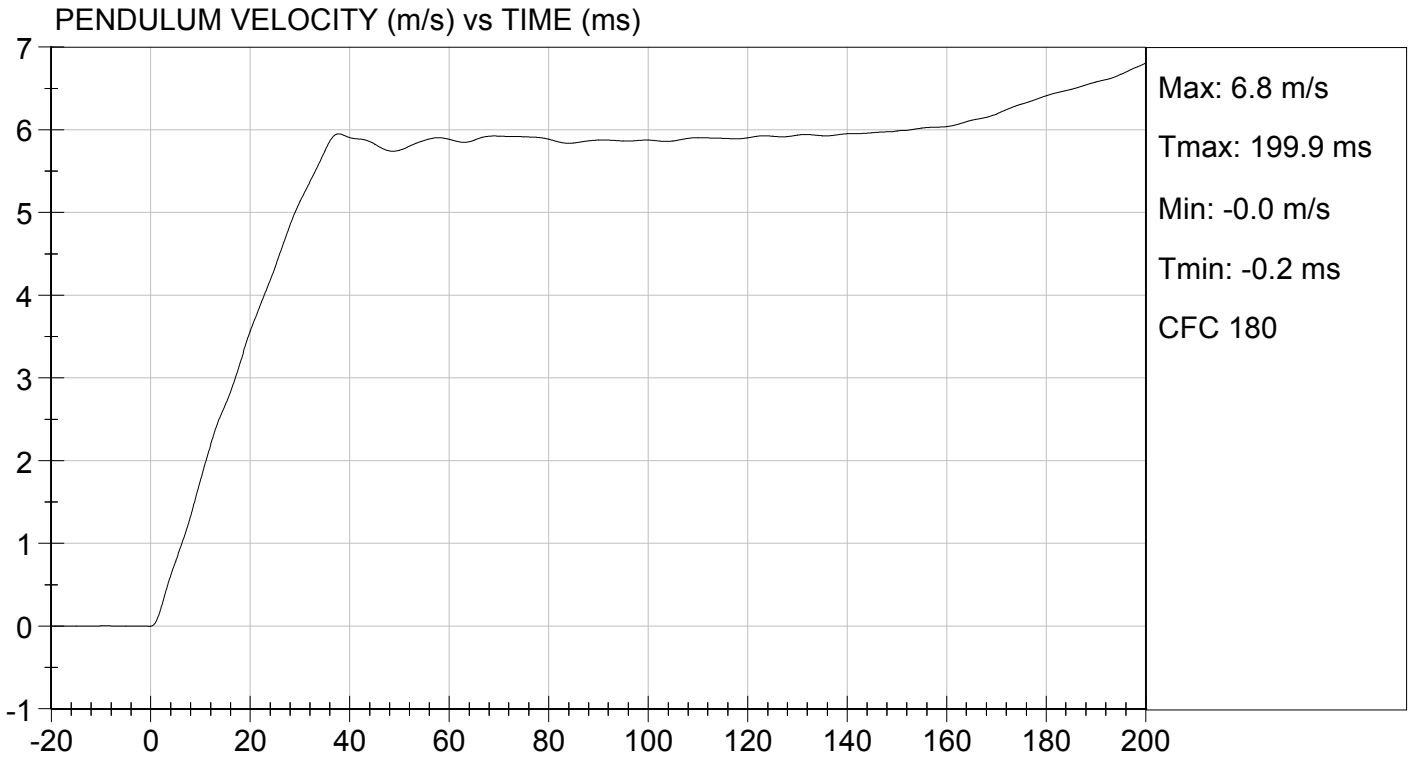
08/23/2016

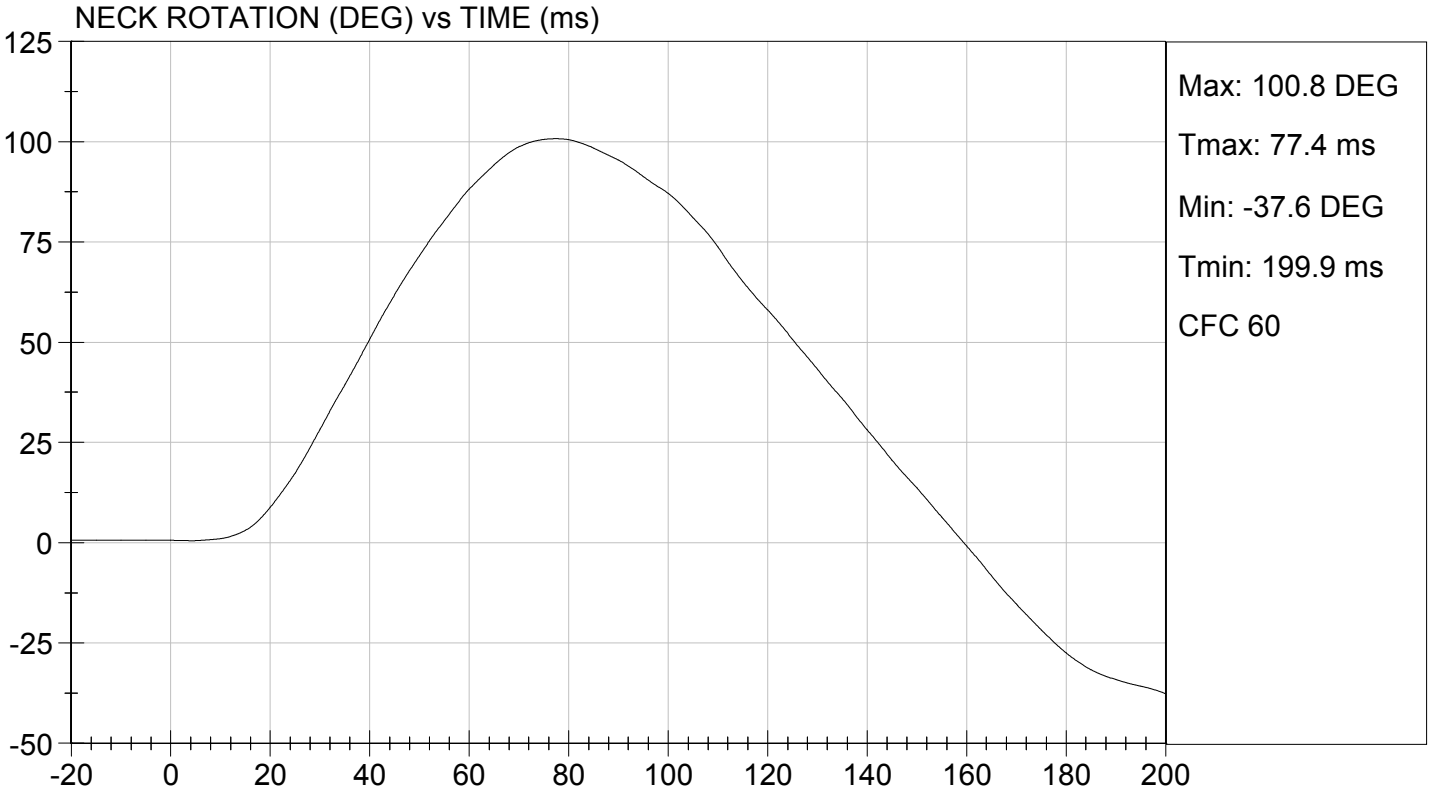
Test Date

Approved By

TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

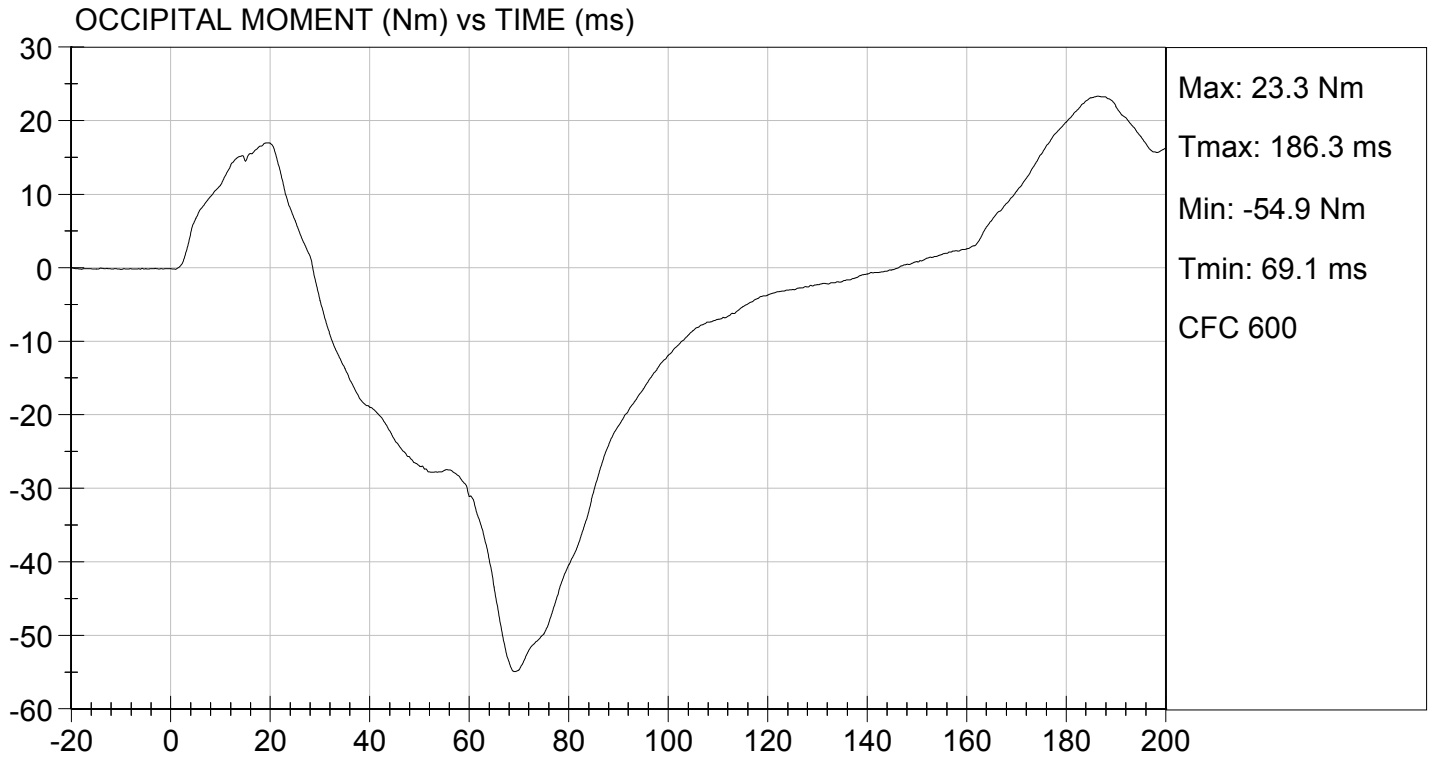
TEST DATE: 08/23/2016
TEST #: D162813





TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 08/23/2016
TEST #: D162813



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162814

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	51	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	54	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4167	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4160	Pass
		Overall Test Results		Pass

Laboratory Technician

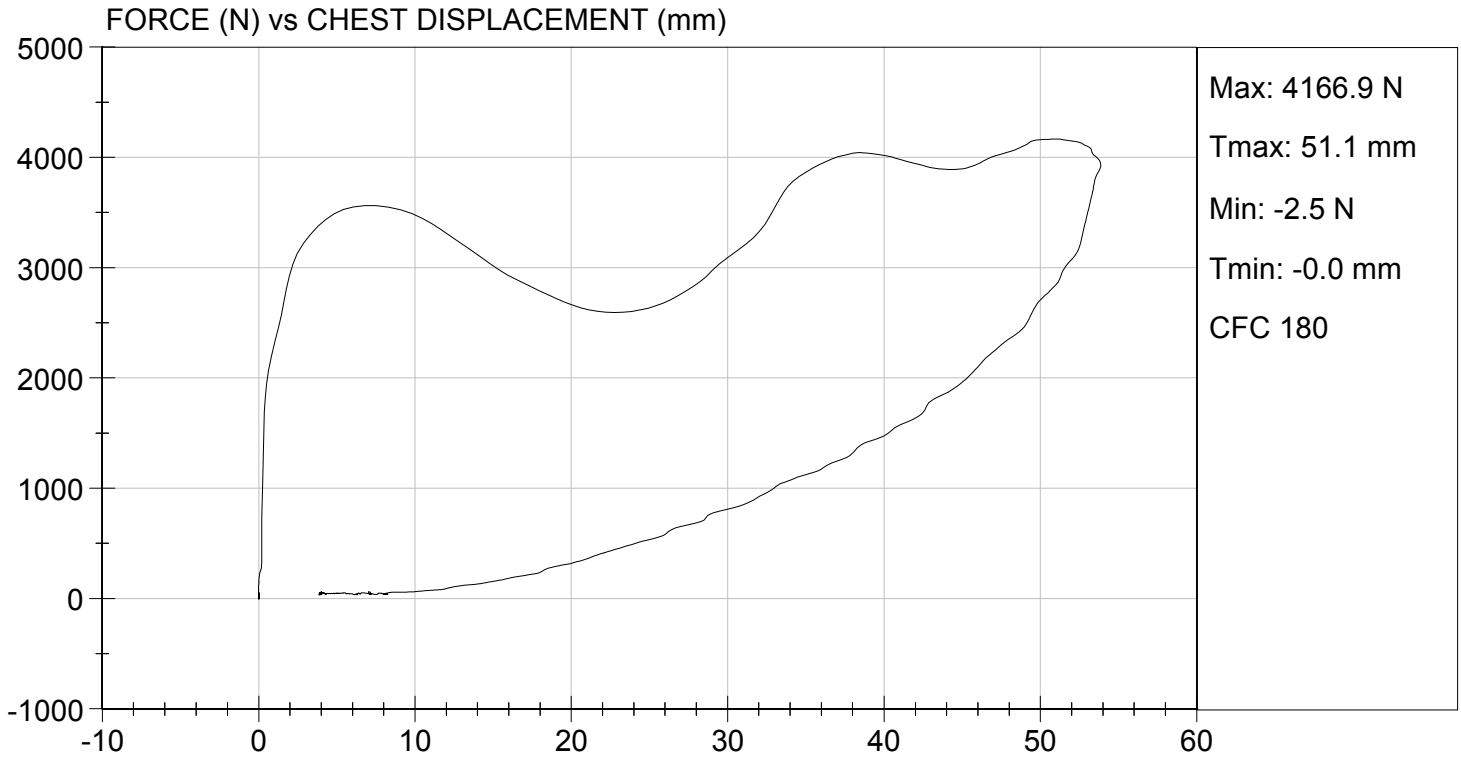
08/24/2016

Test Date

Approved By

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

TEST DATE: 08/24/2016
TEST #: D162814



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162815

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3463	Pass
		Overall Test Results		Pass

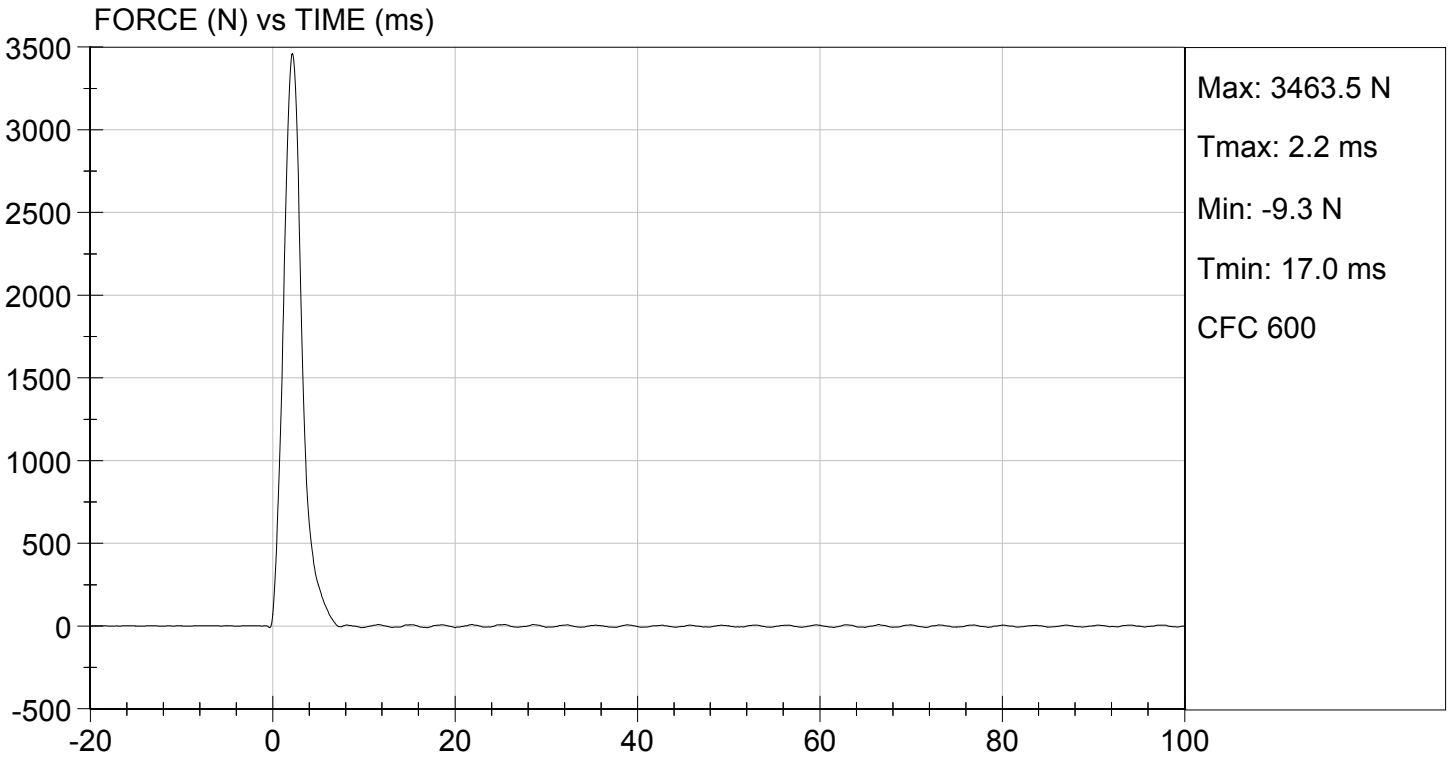
Laboratory Technician

08/23/2016
Test Date

Approved By

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

TEST DATE: 08/23/2016
TEST #: D162815



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D162816

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3464	Pass
		Overall Test Results		Pass

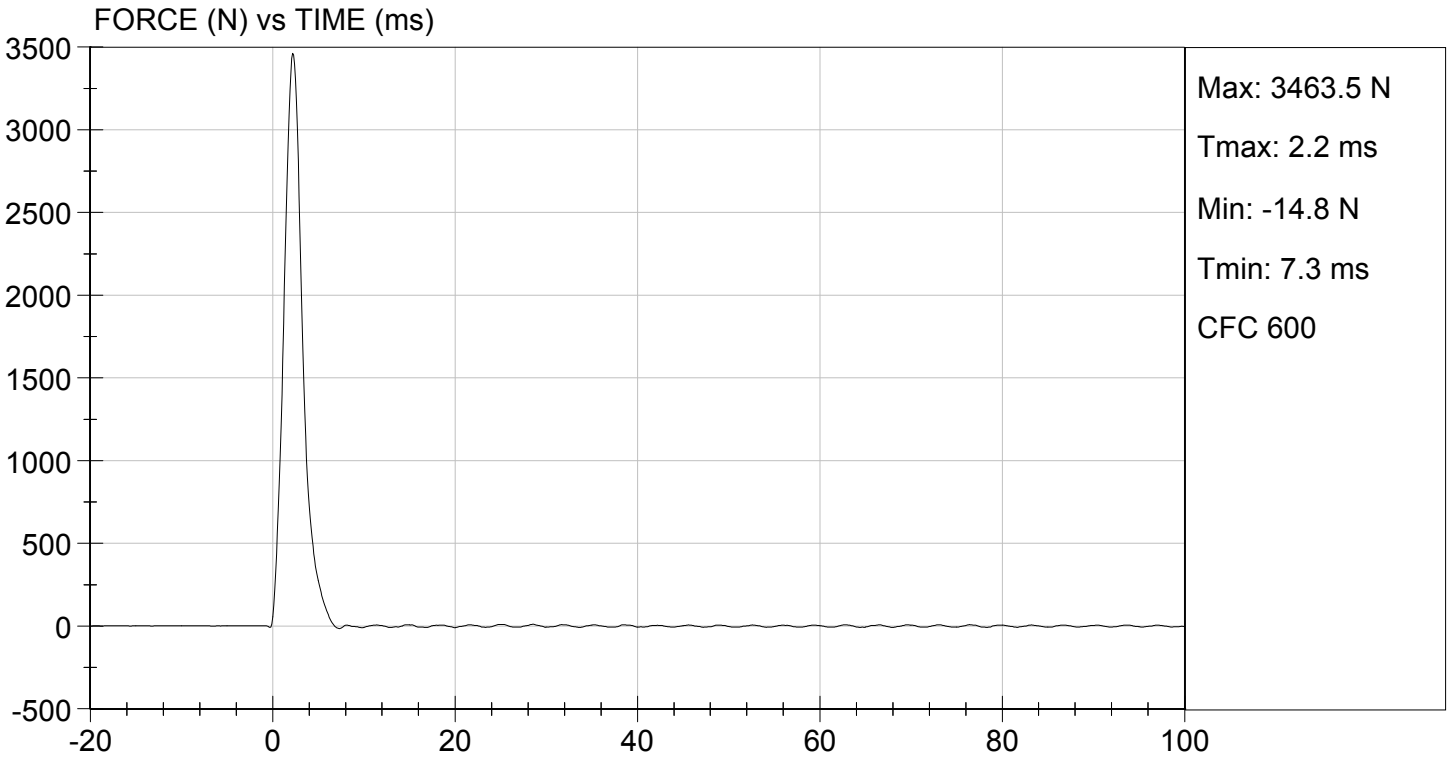
Laboratory Technician

08/23/2016
Test Date

Approved By

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

TEST DATE: 08/23/2016
TEST #: D162816



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

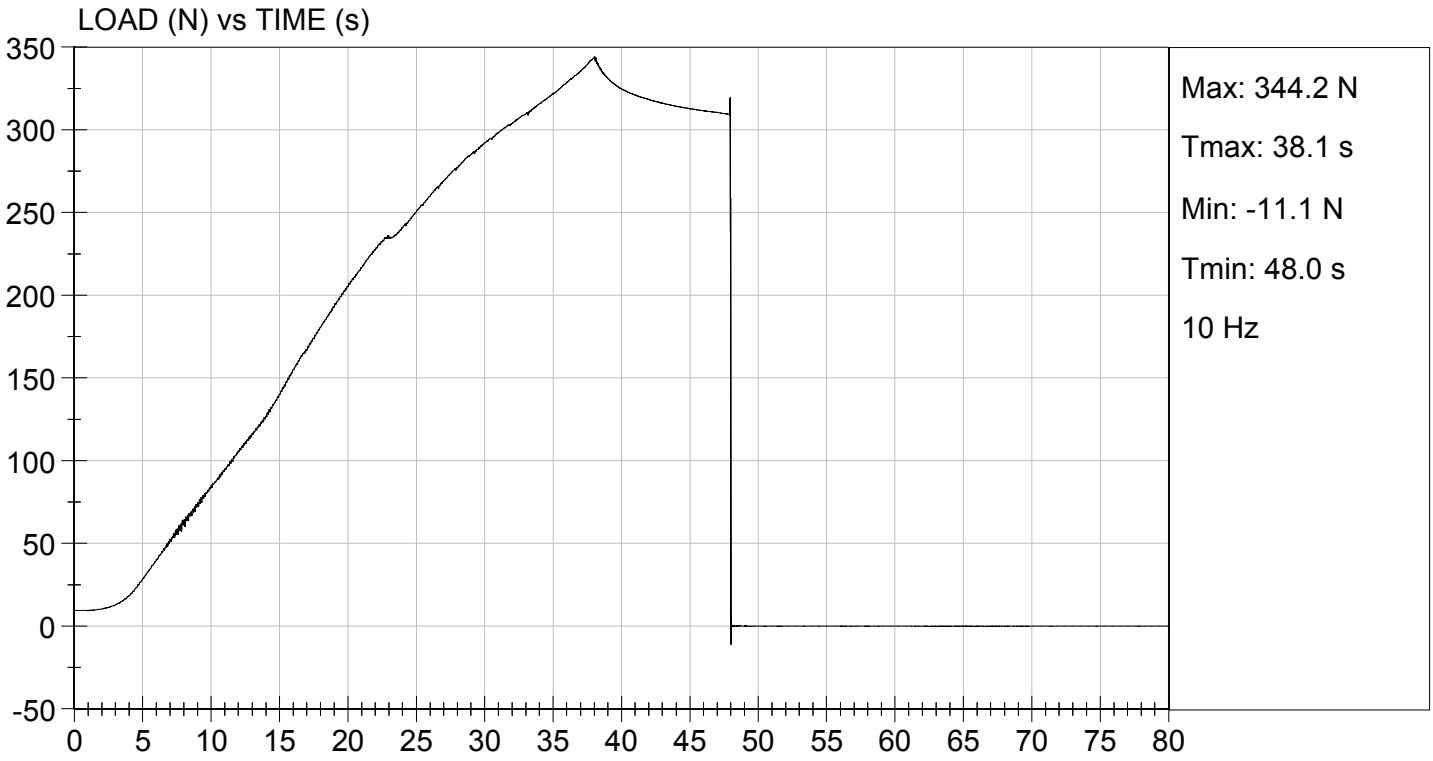
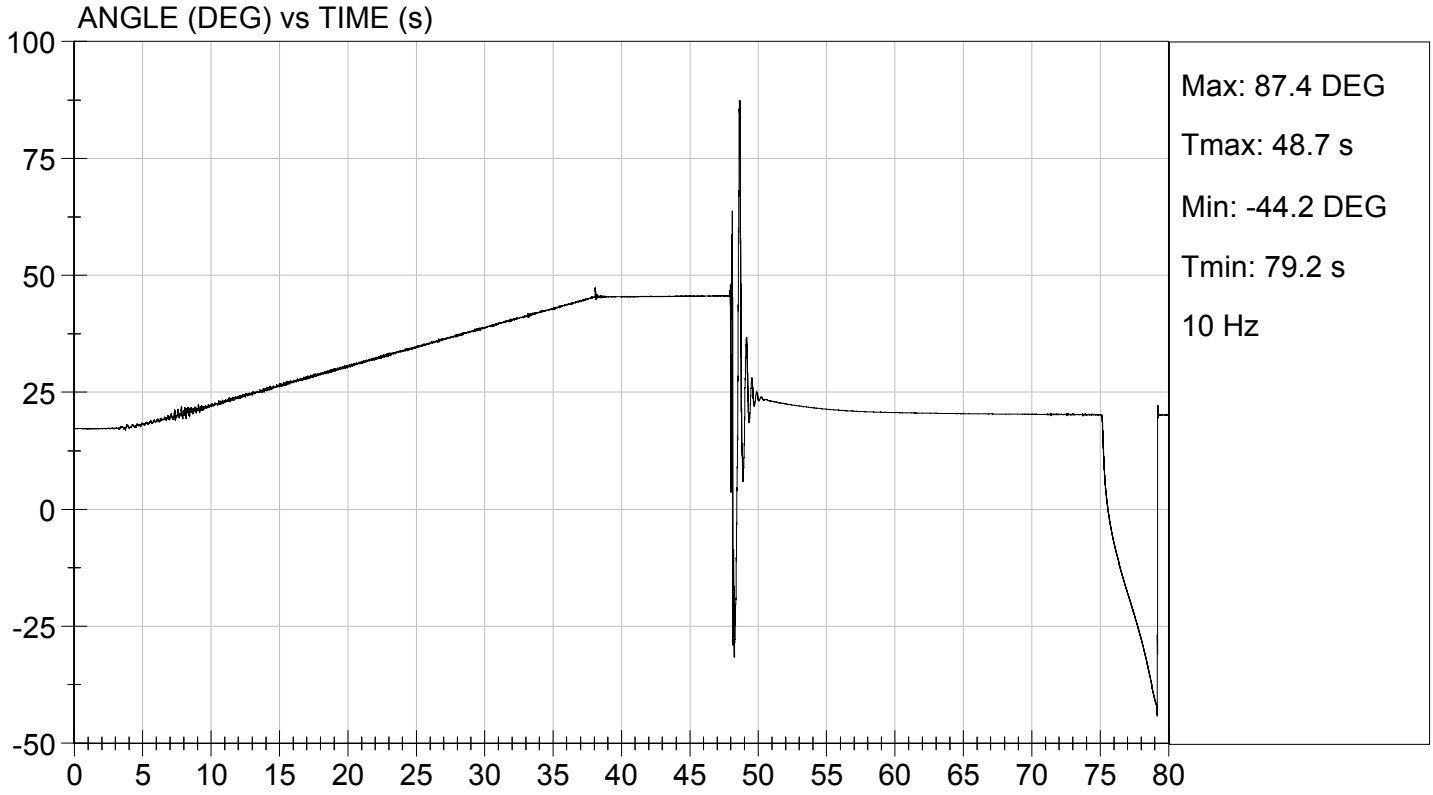
ATD Serial No: 138 **Test I.D:** D162817

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle	deg	+/- 8	3	Pass
Force at 45 deg	N	320 to 390	344	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
		Overall Result		Pass

Laboratory Technician

08/24/2016
Test Date

Approved By

TEST DESC: LUMBAR FLEXION

TEST DATE: 08/24/2016
TEST #: D162817