

REPORT NUMBER: NCAP-MGA-2013-060

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

**NISSAN MOTOR CO., LTD.
2013 Nissan Leaf S 5-Dr Hatchback
NHTSA No.: MD5209**

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



Test Date: April 10, 2013

Final Report Date: April 29, 2013

FINAL REPORT

**U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NVS-111
1200 New Jersey Ave, SE
Room W43-410
Washington, DC 20590**

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Approval Date: April 29, 2013

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

1. Report No. NCAP-MGA-2013-060		2. Government Accession No.		3. Recipient's Catalog No.																																																			
4. Title and Subtitle Final Report of New Car Assessment Program Frontal Impact Testing of 2013 Nissan Leaf S 5-Dr Hatchback, NHTSA No.: MD5209				5. Report Date April 29, 2013																																																			
				6. Performing Organization Code MGA																																																			
7. Author(s) Donna Janovicz, Project Manager Ben Fischer, Project Engineer				8. Performing Organization Report No. NCAP-MGA-2013-060																																																			
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105				10. Work Unit No.																																																			
				11. Contract or Grant No. DTNH22-12-D-00258																																																			
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NVS-111) 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C. 20590				13. Type of Report and Period Covered Final Test Report April 10, 2013 to April 29, 2013																																																			
				14. Sponsoring Agency Code NVS-111																																																			
15. Supplementary Notes																																																							
16. Abstract A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2013 Nissan Leaf S 5-Dr Hatchback 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 foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on April 10, 2013. The impact velocity was 56.5 km/h and the ambient temperature at the barrier face at the time of impact was 21.6°C. The target vehicle post-test maximum crush was 655 mm located at the vehicle's centerline. The test vehicle's performance was as follows: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">Threshold</th> <th rowspan="2">Driver ATD</th> <th rowspan="2">Passenger ATD</th> </tr> <tr> <th>50th</th> <th>5th</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td> <td>N/A</td> <td>700</td> <td>700</td> <td>171</td> <td>178</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>52</td> <td>22</td> <td>14</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>1</td> <td>0.24</td> <td>0.63</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>2620</td> <td>1098</td> <td>928</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>2520</td> <td>460</td> <td>119</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>1914</td> <td>2872</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>3142</td> <td>1739</td> </tr> </tbody> </table>						Measurement Description	Units	Threshold		Driver ATD	Passenger ATD	50 th	5 th	Head Injury Criteria (HIC ₁₅)	N/A	700	700	171	178	Maximum Chest Compression	mm	63	52	22	14	Nij	N/A	1	1	0.24	0.63	Neck Tension	N	4170	2620	1098	928	Neck Compression	N	4000	2520	460	119	Left Femur Force	N	10008	6805	1914	2872	Right Femur Force	N	10008	6805	3142	1739
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19. Security Classification of Report Unclassified	20. Security Classification of Page Unclassified	21. No. of Pages 170		22. Price																																																			

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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 2013 Nissan Leaf S 5-Dr Hatchback at a velocity of 56.5 km/h. The test was performed at MGA Research Corporation on April 10, 2013. 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 (1) Part 572E 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one (1) 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 and passenger's lap belts to measure dummy pelvic 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 an on-board data acquisition system. Appendix B contains the vehicle, load cell barrier, and dummy response data traces.

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

The maximum static crush of the vehicle was 655 mm 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 and chest contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee bolster and steering column. The passenger's visible contact points were as follows: The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC ₁₅	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (Gs)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50 th)	171	0.24	1098	460	36	22	1914	3142
Passenger (5 th)	178	0.63	928	119	41	14	2872	1739

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

TEST NOTES

Barrier K-16 MY has 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: 2013 Nissan Leaf S 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
Test Date: 04/10/2013

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MD5209	Traction Control System (TCS)	Yes
Model Year	2013	Power Steering	Yes
Make	Nissan	Power Window Auto-Reverse	Yes
Model	Leaf	Driver Frontal Airbag	Yes
Body Style	Hatchback	Driver Curtain Airbag	Yes
VIN	1N4AZ0CP4DC402360	Driver Head/Torso Airbag	No
Body Color	Brilliant Silver	Driver Torso Airbag	No
Odometer (km/mi)	71 / 44	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	N/A	Driver Pelvis Airbag	No
Type/No. Cylinders	N/A	Driver Knee Airbag	No
Engine Placement	Lateral	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	1	Front Pass. Head/Torso Airbag	No
Overdrive	N/A	Front Pass. Torso Airbag	No
Final Drive	Front Wheel Drive	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.	GVWR (kg)	1902
Date of Manufacture	02/13	GAWR Front (kg)	983
		GAWR Rear (kg)	923

VEHICLE SEATING AND WEIGHT CAPACITY DATA

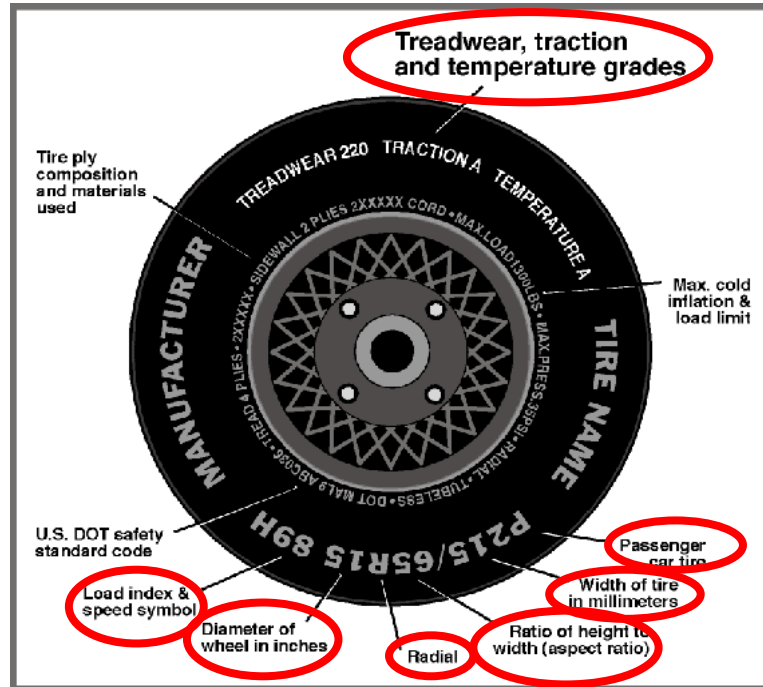
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				390
Cargo Weight (RCLW) (kg)				50

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

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	250	250
Recommended Tire Size	P205/55R16	P205/55R16
Tire Size on Vehicle	P205/55R16	P205/55R16
Tire Manufacturer	Bridgestone	Bridgestone
Tire Model	ECOPIA	ECOPIA
Treadwear	400	400
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 2 Steel, 1 Nylon	1 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	89H	89H
Tire Material	Rubber	Rubber
DOT Safety Code Left	EL8K JBC4512	EL8K JBC4512
DOT Safety Code Right	EL8K JBC4512	EL8K JBC4512

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

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	430.0	316.2		475.4	368.3	
Right	kg	416.9	317.5		453.6	367.4	
Ratio	%	57.2	42.8		55.8	44.2	
Totals	kg	846.9	633.7	1480.6	929.0	735.7	1664.7

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1480.6
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	50
Calculated Vehicle Target Weight (TVTW)	kg	1671.2

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	704	704	709	711	1158
As Tested	mm	686	695	691	694	1196
Post Test	mm	717	699	718	666	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2706
Total Vehicle Length at Left Side	mm	4249
Total Vehicle Length at Centerline	mm	4445
Total Vehicle Length at Right Side	mm	4249
Weight of Ballast in Cargo Area	kg	7.7
Weight of Vehicle Components Removed	kg	14.1
Amount of Stoddard Solvent in Fuel Tank	L	

List of components removed: Wheel Covers, tire repair kit, cargo net, cargo carpet, right taillight, LF underbody plastic, right c-pillar trim, and cargo cover.

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

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4445
2	Total Width	1764
3	Bumper Top Height	545
4	Bumper Bottom Height	438
5	Longitudinal Member Top Height	610
6	Distance between Longitudinal Members	912
7	Longitudinal Member Width	54
8	Engine Top Height	872
9	Engine Bottom Height	207
10	Engine and Gearbox Width	510
11	Front Bumper-Engine Distance	442
12	Front Shock Absorber Fixing Height	860
13	Bonnet Leading Edge Height	773
14	Front Shock Absorber Fixing Width	1172
15	Front Bumper – Front Axle Distance	904
16	Front Axle – A-Pillar Distance	496
17	A-Pillar – B-Pillar Distance	1093
18	B-Pillar – Rear Axle Distance	1122
19	B-Pillar – C-Pillar Distance	702
20	Roof Sill Bottom Height	1411
21	Roof Sill Top Height	1546
22	Floor Sill Bottom Height	177
23	Floor Sill Top Height	386

DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

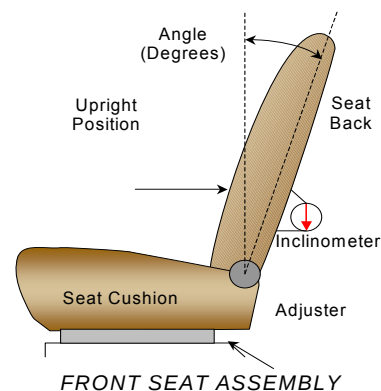
Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

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 September 2012.

	Degrees
Driver Seat Back Angle	9.3° on headrest post
Passenger Seat Back Angle	8.2° on headrest post



SEAT FORE/AFT POSITIONS

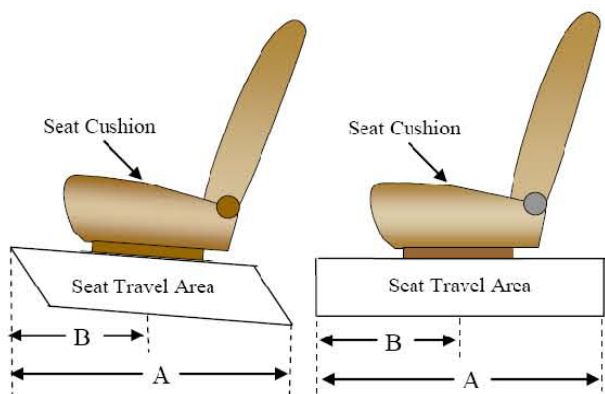
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated September 2012.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	256 mm, 24 detents (1 st as 0)	120 mm, 12 th detent (foremost as 0)
Passenger Seat	240 mm, 24 detents (1 st as 0)	0 mm, 0 detent (foremost 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 (1 st as 1)	0 (uppermost as 0)
Passenger Seat	4 (1 st as 1)	0 (uppermost as 0)



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

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

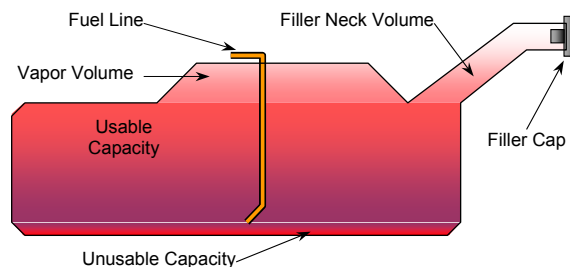
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	
Actual Amount of Solvent used	
1/3 of Usable Capacity	

FUEL PUMP

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

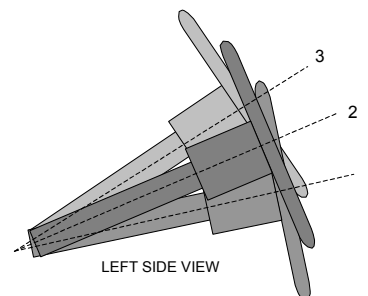
Not Applicable



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

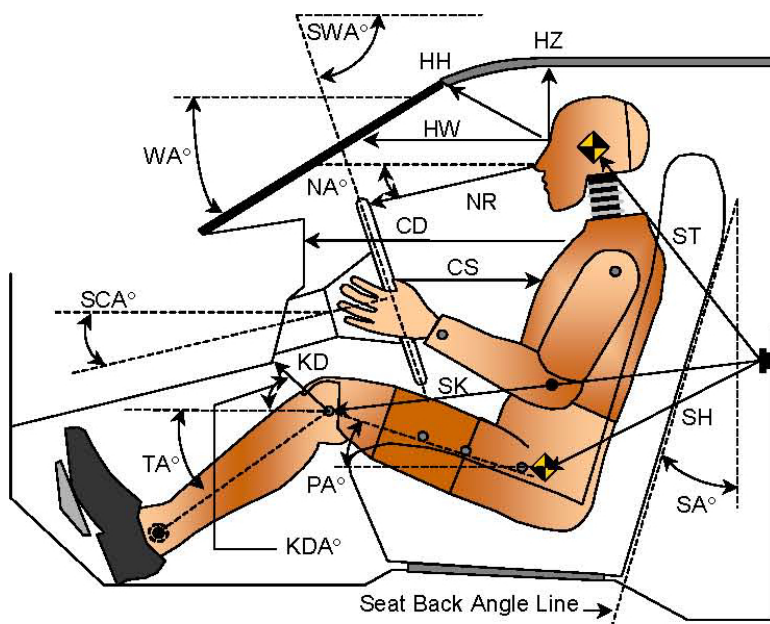
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	66.6	
Geometric Center Position 2	64.0	
Uppermost Position 3	61.4	
Telescoping Steering Wheel Travel		
Test Position	64.0	

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013



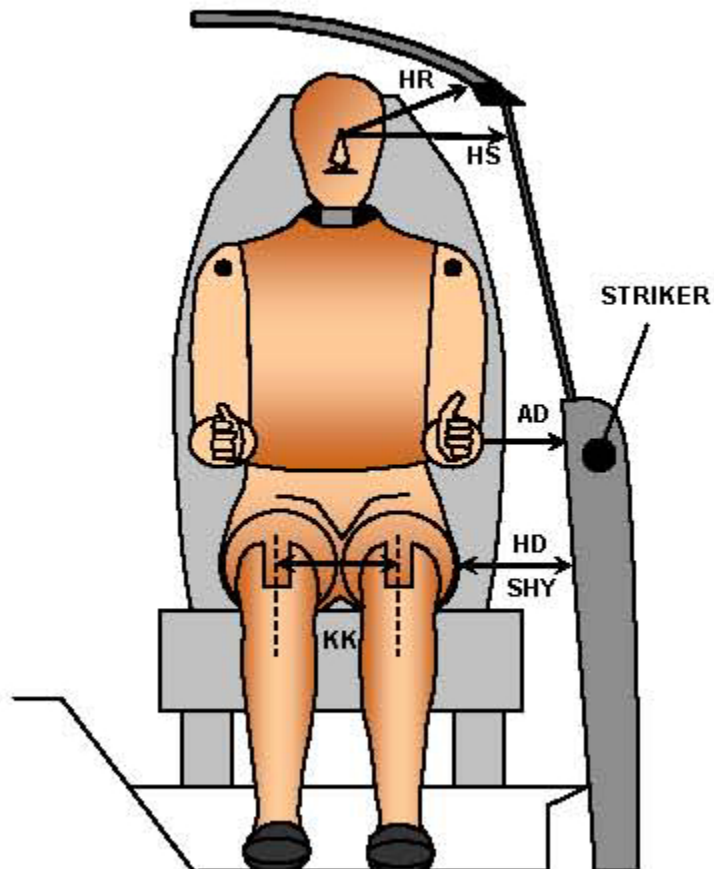
LEFT SIDE VIEW

Code	Measurement Description	Driver S/N 351		Passenger S/N 138	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		24.9		
SWA°	Steering Wheel Angle		64.0		
SCA°	Steering Column Angle		26.0		
SA°	Seat Back Angle (on headrest post)		9.3		8.2
HZ	Head to Roof (Z)	195	90.0	214	90.0
HH	Head to Header	372	23.3	312	38.5
HW	Head to Windshield	653	0.0	693	0.0
NR	Nose to Rim	388	16.1		
CD	Chest to Dash	502		379	
CS	Chest to Steering Hub	292	14.5		
RA	Rim to Abdomen	168	0.0		
KDL	Left Knee to Dash	123	20.2	63	35.8
KDR	Right Knee to Dash	125	19.6	70	37.3
PA°	Pelvic Angle		20.3		21.5
TA°	Tibia Angle		52.2		56.8
SK	Striker to Knee	671	93.6	721	97.2
ST	Striker to Head	525	21.8	516	31.5
SH	Striker to H-Point	318	122.5	432	110.4

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013



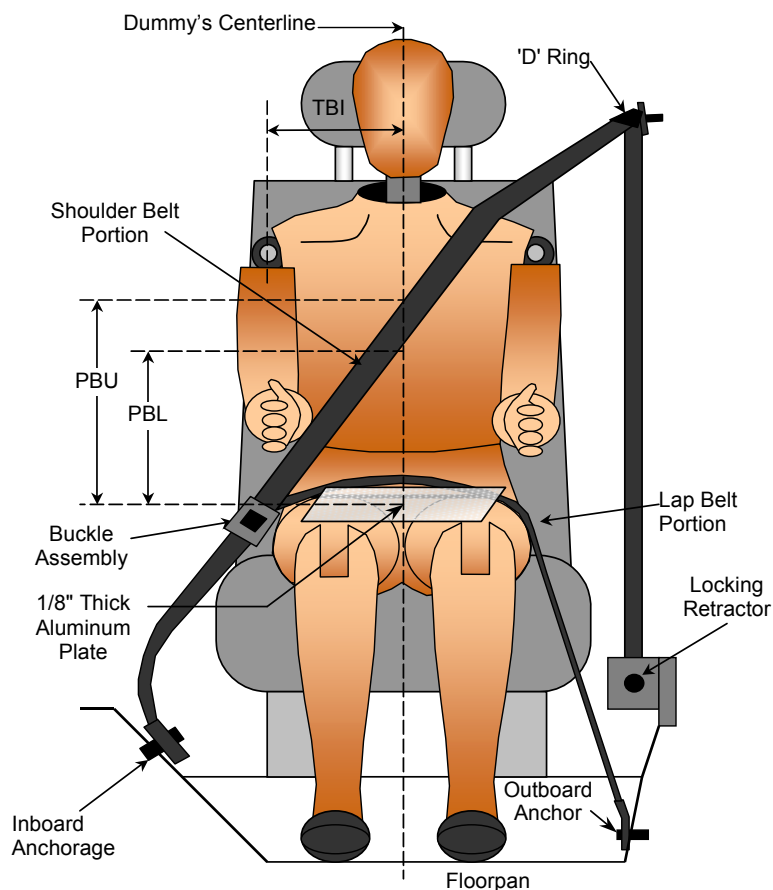
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver S/N 351	Passenger S/N 138
		Length (mm)	
AD	Arm to Door	84	143
HD	H-Point to Door	127	154
HR	Head to Side Header	211	248
HS	Head to Side Window	308	344
KK	Knee to Knee	345	220
SHY	Striker to H-Point (Y Direction)	285	300
AA	Ankle to Ankle	315	182

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
Test Date: 04/10/2013



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	365	330
PBL - Top surface of reference to belt lower edge	mm	295	245

BELT LENGTH DATA

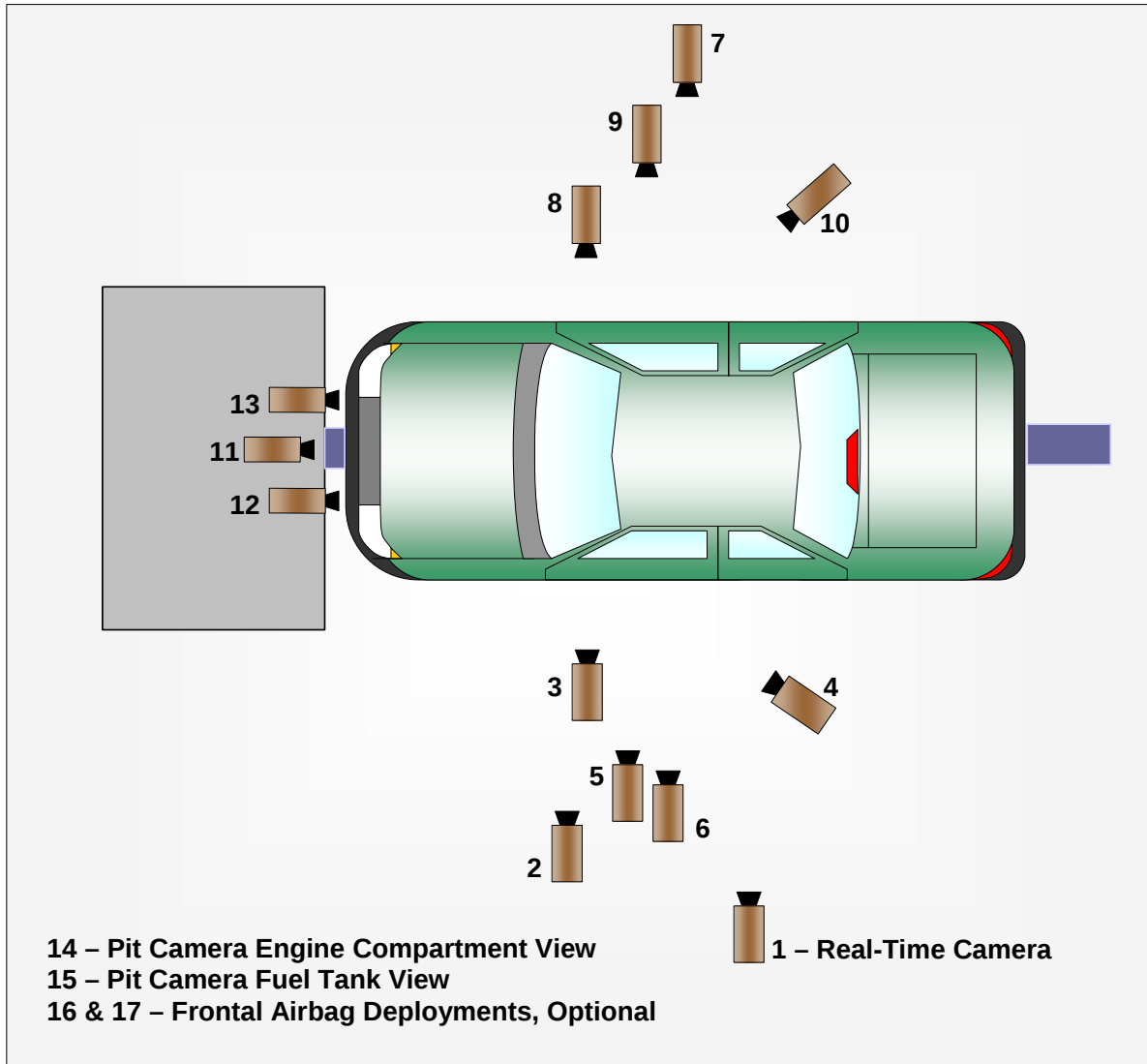
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	900	935
Lap Belt Length as measured on ATD	mm	670	875
Remainder of belt on reel	mm	930	700
Total Belt Length for Continuous Webbing Systems	mm	2500	2510

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

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
Test Date: 04/10/2013

CAMERA POSITIONS FOR FRONTAL IMPACTS



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

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	1280	-6240	-1730	35	1000
3	Left Front Half	990	-4850	-1360	24	1000
4	Left Angle	5280	-5160	-2040	50	1000
5	Steering Column - Top	510	-4860	-1240	24	1000
6	Steering Column - Bottom	490	-4810	-830	24	1000
7	Right Overall	1950	6300	-1340	20	1000
8	Passenger Close-Up	1320	6740	-1730	35	1000
9	Right Front Half	1140	5030	-1260	24	1000
10	Right Angle	5610	4720	-1930	50	1000
11	Windshield	-1780	0	-2810	20	1000
12	Driver Windshield	1470	-450	-2030	8.5	1000
13	Passenger Windshield	1470	450	-2030	8.5	1000
14	Pit Front	1000	0	3150	24	1000
15	Pit Rear	2930	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

***COORDINATES:**

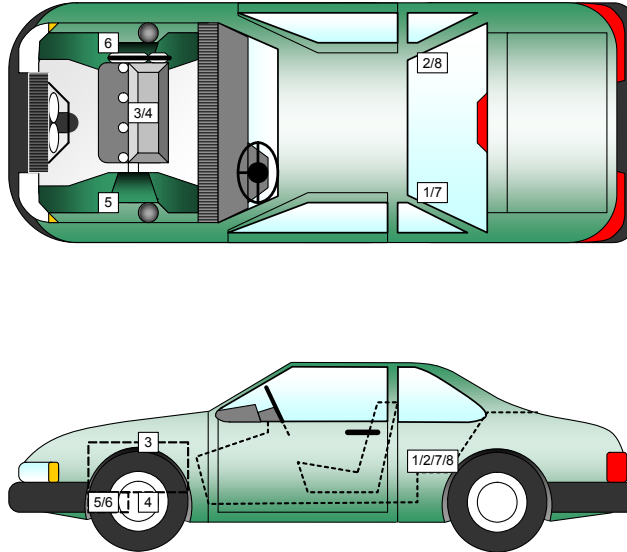
- +X = forward of impact plane
- +Y = right of monorail centerline
- +Z = below ground level

Cameras 16 & 17 were not used for this test.

DATA SHEET NO. 7 **VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	1603	-315	-348
2	Right Rear Crossmember Accelerometer – X Direction	1603	423	-348
3	Engine Top X	3581	-115	-747
4	Engine Bottom X	3586	93	-232
5	Left Rear Crossmember Accelerometer – Z Direction	1603	-315	-348
6	Right Rear Crossmember Accelerometer – Z Direction	1603	423	-348
7	Left Rear Crossmember Accelerometer Redundant – X Direction	1603	-315	-348
8	Right Rear Crossmember Accelerometer Redundant – X Direction	1603	423	-348

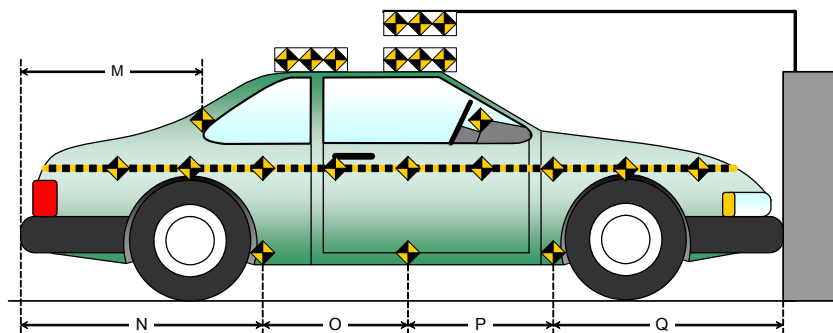
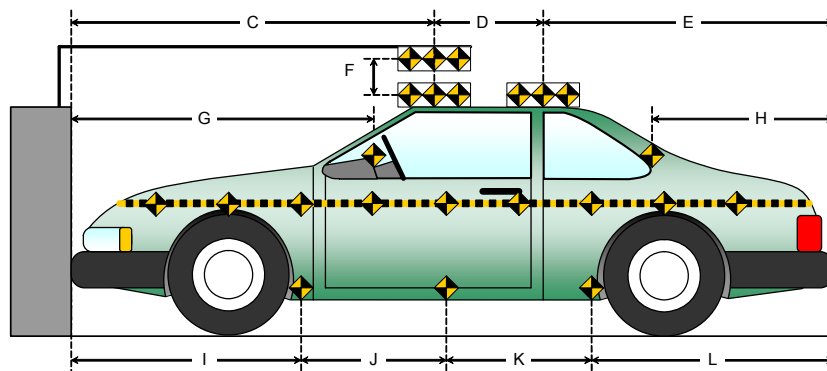
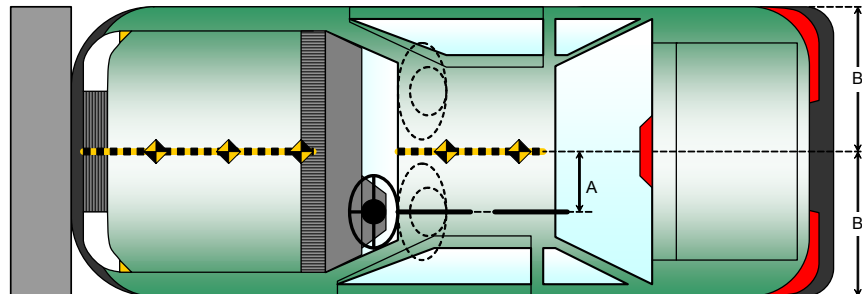
Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 8 **PHOTOGRAPHIC REFERENCE TARGET LOCATIONS**

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

Item	Value (mm)
A	363
B	882
C	2255
D	662
E	1528
F	100
G	
H	805
I	1478
J	899
K	899
L	1169
M	805
N	1169
O	899
P	899
Q	1478



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

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

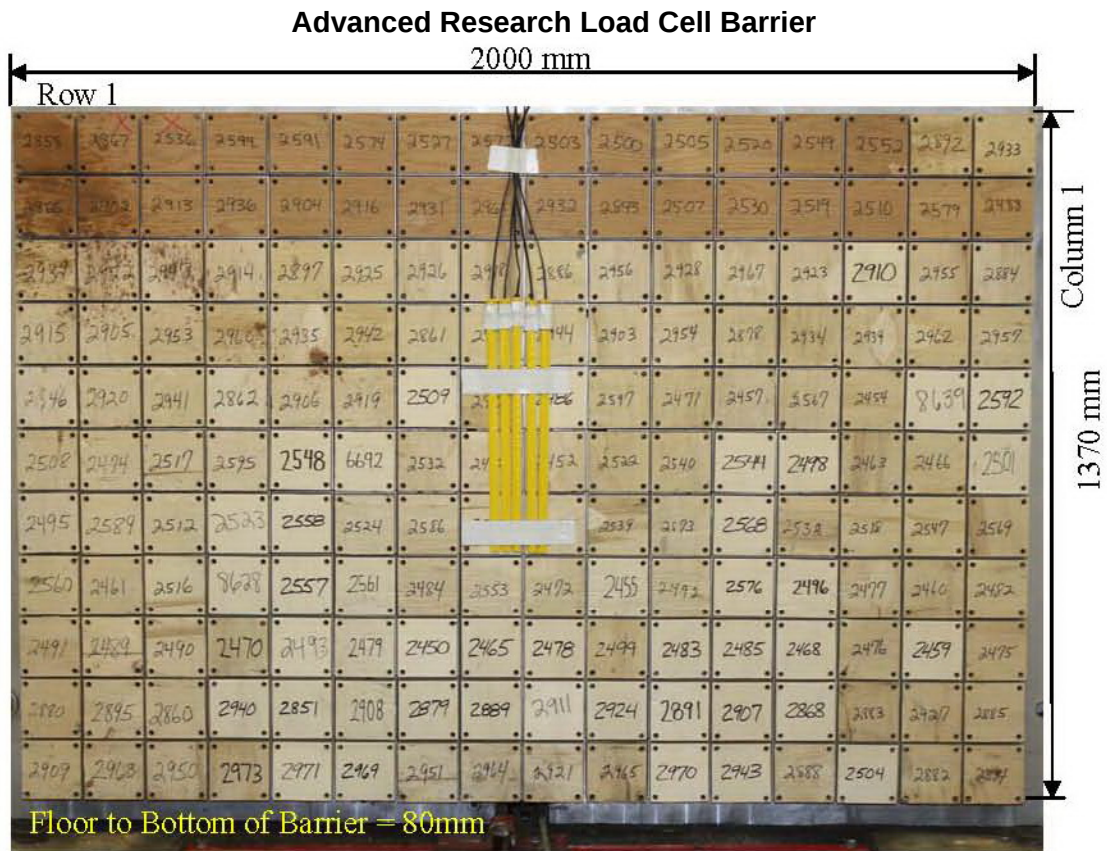


Photo for Reference Only

								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: 2013 Nissan Leaf S 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
Test Date: 04/10/2013

INSTRUMENTATION

Driver Dummy Data Channels	52
Passenger Dummy Data Channels	46
Vehicle Structure Accelerometers	8
Barrier Channels	528
Total	634

CAMERA COVERAGE

High-Speed Vehicle Onboard	0
High-Speed Offboard	14
Real-Time	2
Total	16

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

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
Test Date: 04/10/2013

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 Bolster	Glove Box
Right Knee Contact	Knee Bolster, Steering Column	Glove Box

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	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None

POST TEST STRUCTURAL OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	2094
Center	mm	1987
Right Side	mm	1954
Average	mm	2012

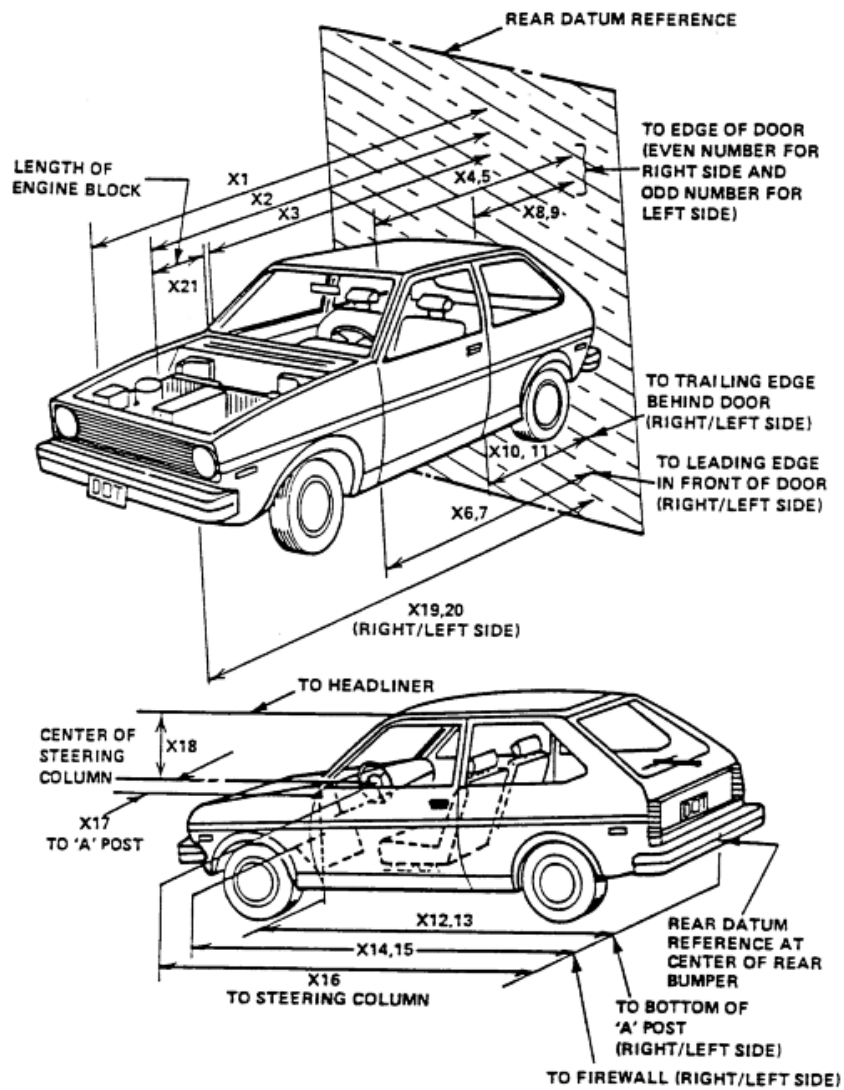
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Right Front (Passenger) P2	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Curtain Side Airbag	Yes	No	Yes	No
Torso/Pelvis Side Airbag	Yes	No	Yes	No
Knee Airbag	No		No	
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	
Other	No		No	

DATA SHEET NO. 12 VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
Test Date: 04/10/2013



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4445	3790	655
2	RSOV to Front of Engine	mm	3773	3526	247
3	RSOV to Firewall	mm	3493	3431	62
4	RSOV to Upper Leading Edge of Right Door	mm	2942	2949	-7
5	RSOV to Upper Leading Edge of Left Door	mm	2942	2970	-28
6	RSOV to Lower Leading Edge of Right Door	mm	2968	2967	1
7	RSOV to Lower Leading Edge of Left Door	mm	2968	2972	-4
8	RSOV to Upper Trailing Edge of Right Door	mm	1856	1882	-26
9	RSOV to Upper Trailing Edge of Left Door	mm	1856	1884	-28
10	RSOV to Lower Trailing Edge of Right Door	mm	1874	1883	-9
11	RSOV to Lower Trailing Edge of Left Door	mm	1874	1879	-5
12	RSOV to Bottom of "A" Post of Right Side	mm	2969	2978	-9
13	RSOV to Bottom of "A" Post of Left Side	mm	2977	2995	-18
14	RSOV to Firewall, Right Side	mm	3439	3395	44
15	RSOV to Firewall, Left Side	mm	3439	3397	42
16	RSOV to Steering Column	mm	2491	2558	-67
17	Center of Steering Column to "A" Post	mm	439	413	26
18	Center of Steering Column to Headliner	mm	446	417	29
19	RSOV to Right Side of Front Bumper	mm	4249	3748	501
20	RSOV to Left Side of Front Bumper	mm	4249	3736	513
21	Length of Engine Block	mm	460	460	0
RD	RSOV to Right Side of Dash Panel	mm	2764	2778	-14
CD	RSOV to Center of Dash Panel	mm	2775	2780	-5
LD	RSOV to Left Side of Dash Panel	mm	2764	2779	-15

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
Test Date: 04/10/2013

VEHICLE INFORMATION

VIN: 1N4AZ0CP4DC402360

Wheelbase (mm): 2706

Vehicle Size Category: Passenger

Test Weight (kg): 1664.7

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15

Cal. Procedure/Interval: MGA procedure / 6 month

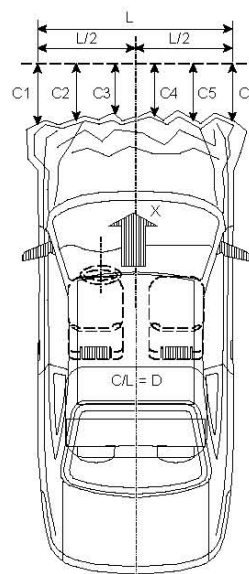
Integration Algorithm: Trapezoidal

Linearity: ≥ 99%

Impact Velocity (km/h): 56.5

Velocity Change (km/h): 65.3

Time of Separation (msec): 131.0



CRUSH PROFILE

Collision Deformation Classification: Frontal

Midpoint of Damage: Centerline

Damage Region Length (mm): 1260

Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4249	3736	513
C2	Crush zone 2 at left side	mm	4344	3755	569
C3	Crush zone 3 at left side	mm	4386	3782	604
C4	Crush zone 4 at right side	mm	4386	3754	632
C5	Crush zone 5 at right side	mm	4344	3773	571
C6	Crush zone 6 at right side	mm	4249	3748	501
L	C1 TO C6	mm	1260	1253	7

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
Test Program: NCAP Frontal Barrier Impact Test

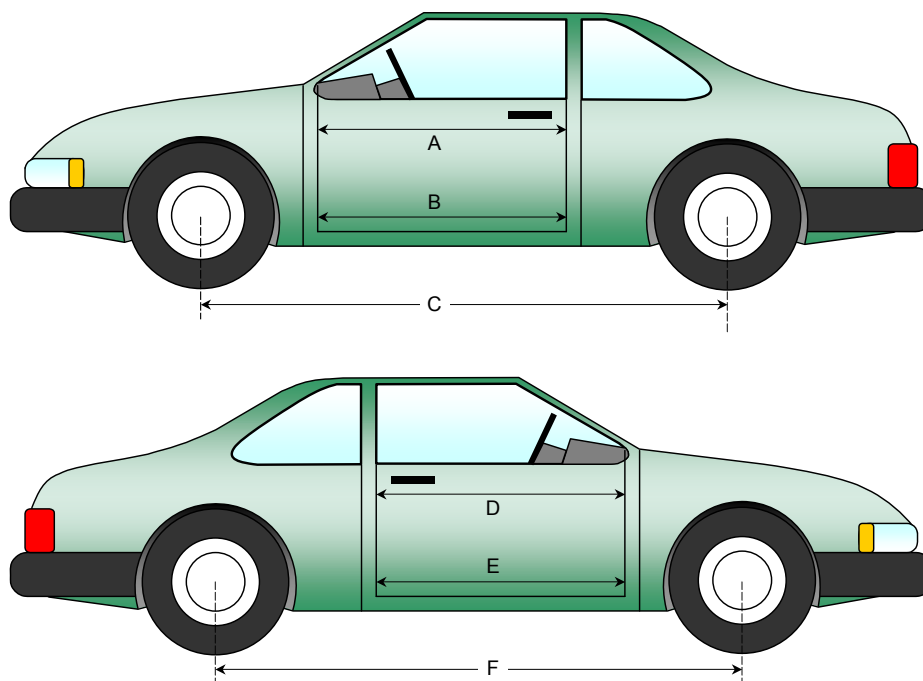
NHTSA No.: MD5209
Test Date: 04/10/2013

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	957	962	-5
B	Left Side Lower	mm	974	972	2
D	Right Side Upper	mm	957	957	0
E	Right Side Lower	mm	974	962	12

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2706	2644	62
F	Right Side Wheelbase	mm	2706	2635	71



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

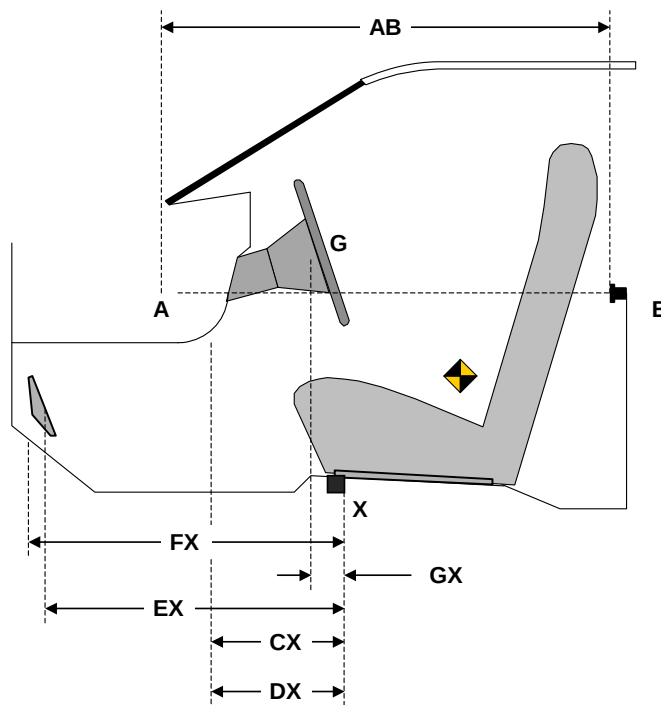
Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	813	813	0
CX	Left Knee Bolster to X	mm	237	229	8
DX	Right Knee Bolster to X	mm	239	231	8
EX	Brake Pedal to X	mm	612	558	54
FX	Foot Rest to X	mm	651	550	101
GX	Center of Steering Column Wheel Hub to X	mm	52	76	-24

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: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

Windshield Mounting Details:

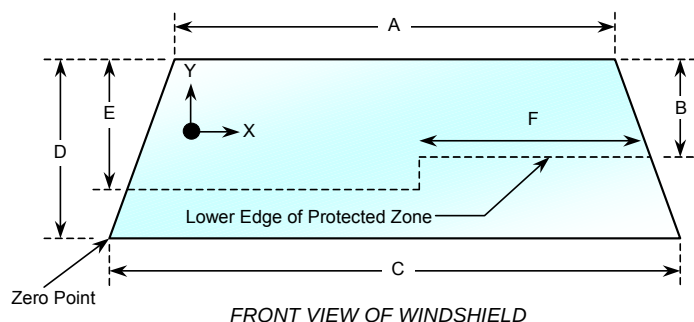
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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

Temperature of windshield molding during test: 21.6°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2188	2188	100
Right Side	2188	2188	100
Total	4376	4376	100



Item	Units	Value
A	mm	1196
B	mm	540
C	mm	1440
D	mm	870
E	mm	569
F	mm	543

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:	<u>2013 Nissan Leaf S 5-Dr Hatchback</u>	NHTSA No.:	<u>MD5209</u>
Test Program:	<u>NCAP Frontal Barrier Impact Test</u>	Test Date:	<u>04/10/2013</u>

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

ELECTRIC VEHICLE – NOT APPLICABLE

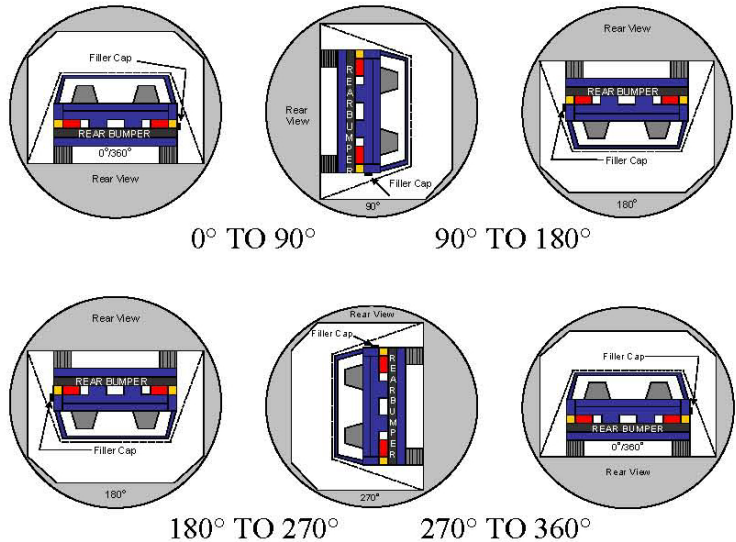
- | | |
|--|-----------------------|
| A. From impact until vehicle motion ceases:
(Maximum allowable = 1 oz.) | <u>Not Applicable</u> |
| B. For the 5 minute period after motion ceases:
(Maximum allowable = 5 oz.) | <u>Not Applicable</u> |
| C. For the following 25 minutes:
(Maximum allowable = 1 oz./minute) | <u>Not Applicable</u> |
| D. Spillage: | <u>Not Applicable</u> |

DATA SHEET NO. 16 **FMVSS 301 STATIC ROLLOVER RESULTS**

Test Vehicle: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013

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: **Not Applicable**



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°			
90° to 180°			
180° to 270°			
270° to 360°			

FMVSS 301 SPILLAGE TABLE (units in ounces)

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

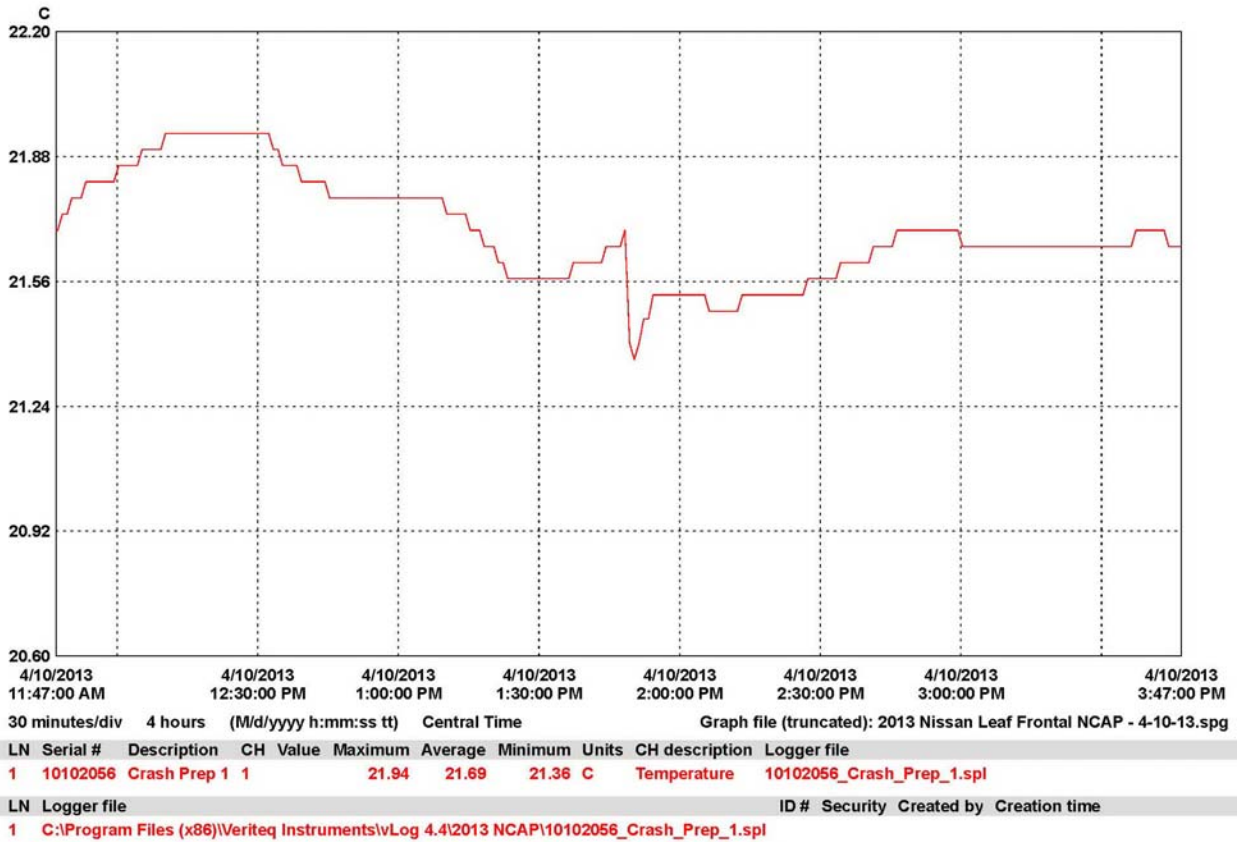
SOLVENT SPILLAGE LOCATION TABLE

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: 2013 Nissan Leaf S 5-Dr Hatchback
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD5209
 Test Date: 04/10/2013



APPENDIX A
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Manufacturer's Label



Tire Placard



2013 Nissan Leaf Frontal As Delivered



Left Rear 3-4 View, As Received



Pre-Test Front View of Test Vehicle



Post-Test Front View of Test Vehicle



Pre-Test Left View of Test Vehicle



Post-Test Left View of Test Vehicle



Pre-Test Right View of Test Vehicle



Post-Test Right View of Test Vehicle



Pre-Test Right Front 3-4 View



Post-Test Right Front 3-4 View



Pre-Test Left Rear 3-4 View



Post-Test Left Rear 3-4 View



Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



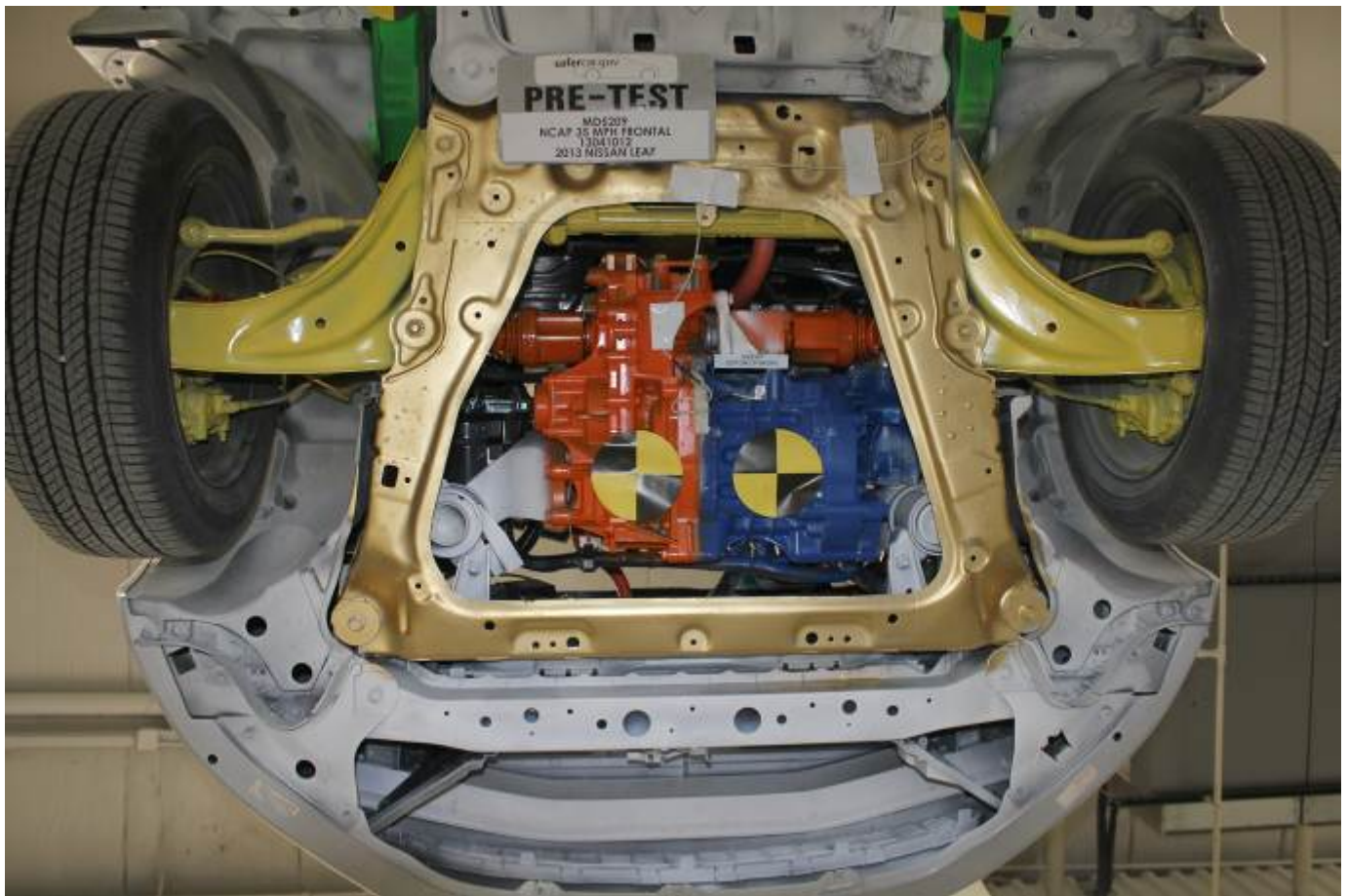
Post-Test Engine Compartment View

PHOTOGRAPH NOT APPLICABLE

Pre-Test Fuel Filler Cap View

PHOTOGRAPH NOT APPLICABLE

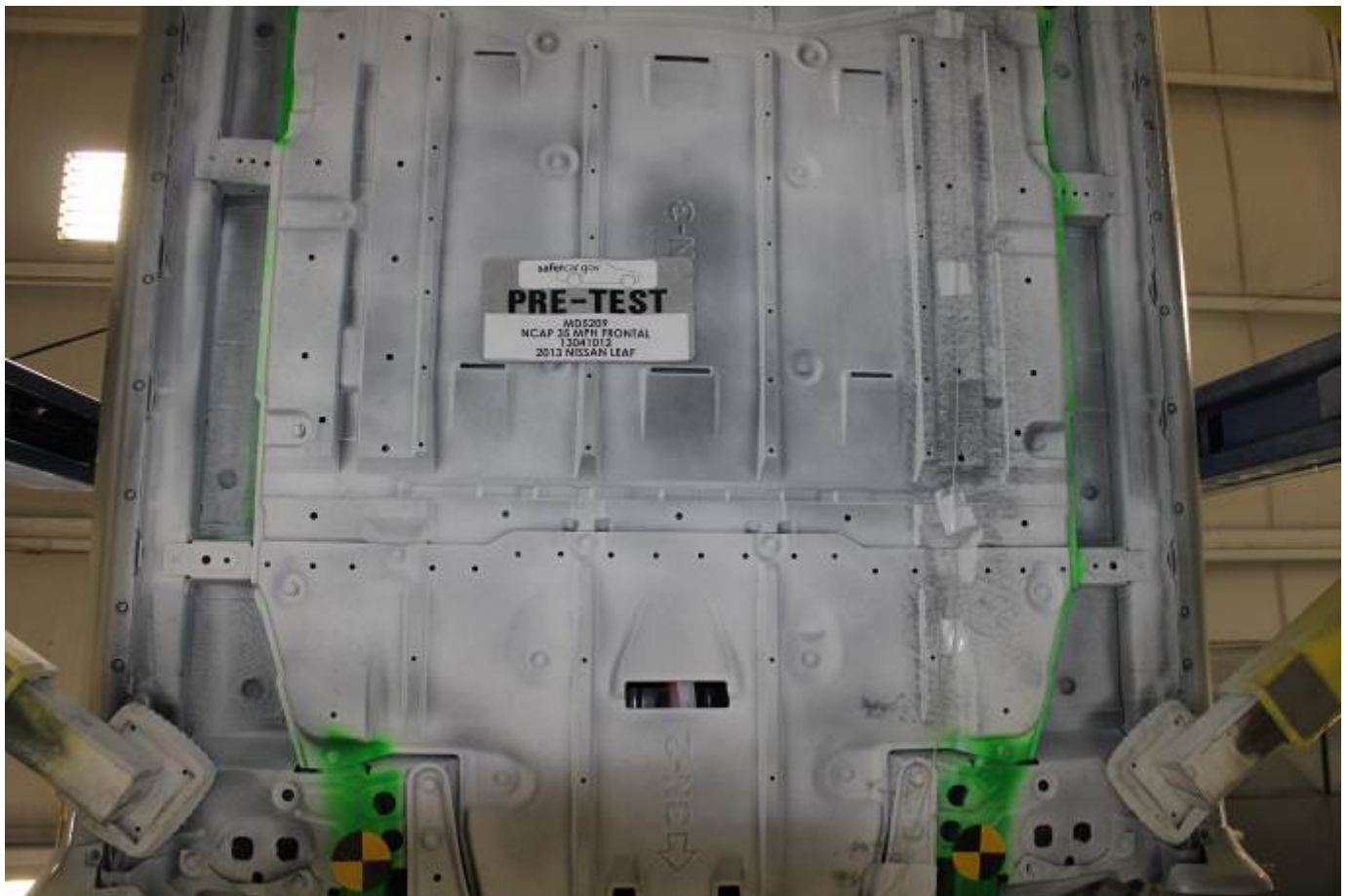
Post-Test Fuel Filler Cap View



Pre-Test Front Underbody View



Post-Test Front Underbody View



Pre-Test Mid Front Underbody View



Post-Test Mid Front Underbody View



Pre-Test Mid Rear Underbody View



Post-Test Mid Rear Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View



Pre-Test Dummy Cable Routing



Post-Test Dummy Cable Routing



Pre-Test Driver Dummy Front View



Post-Test Driver Dummy Front View



Pre-Test Driver Dummy Window View



Post-Test Driver Dummy Window View



Pre-Test Driver Dummy and Vehicle Interior (Door Open)



Post-Test Driver Dummy and Vehicle Interior (Door Open)



Pre-Test Driver's Seat Fore-Aft Markings



Post-Test Driver's Seat Fore-Aft Markings



Pre-Test View of Belt Anchorage for Driver Dummy



Post-Test View of Belt Anchorage for Driver Dummy



Pre-Test Driver Dummy Feet



Post-Test Driver Dummy Feet



Pre-Test Driver's Side Knee Bolster (without dummy)



Post-Test Driver's Side Knee Bolster (without dummy)



Pre-Test Driver's Side Floorpan



Post-Test Driver's Side Floorpan



Post-Test Driver Dummy Face



Post-Test Driver Dummy Contact with Airbag



Post-Test Driver Dummy Contact with Headrest



Post-Test Driver Dummy Contact with Knee Bolster



Pre-Test View of the Steering Wheel



Post-Test View of the Steering Wheel



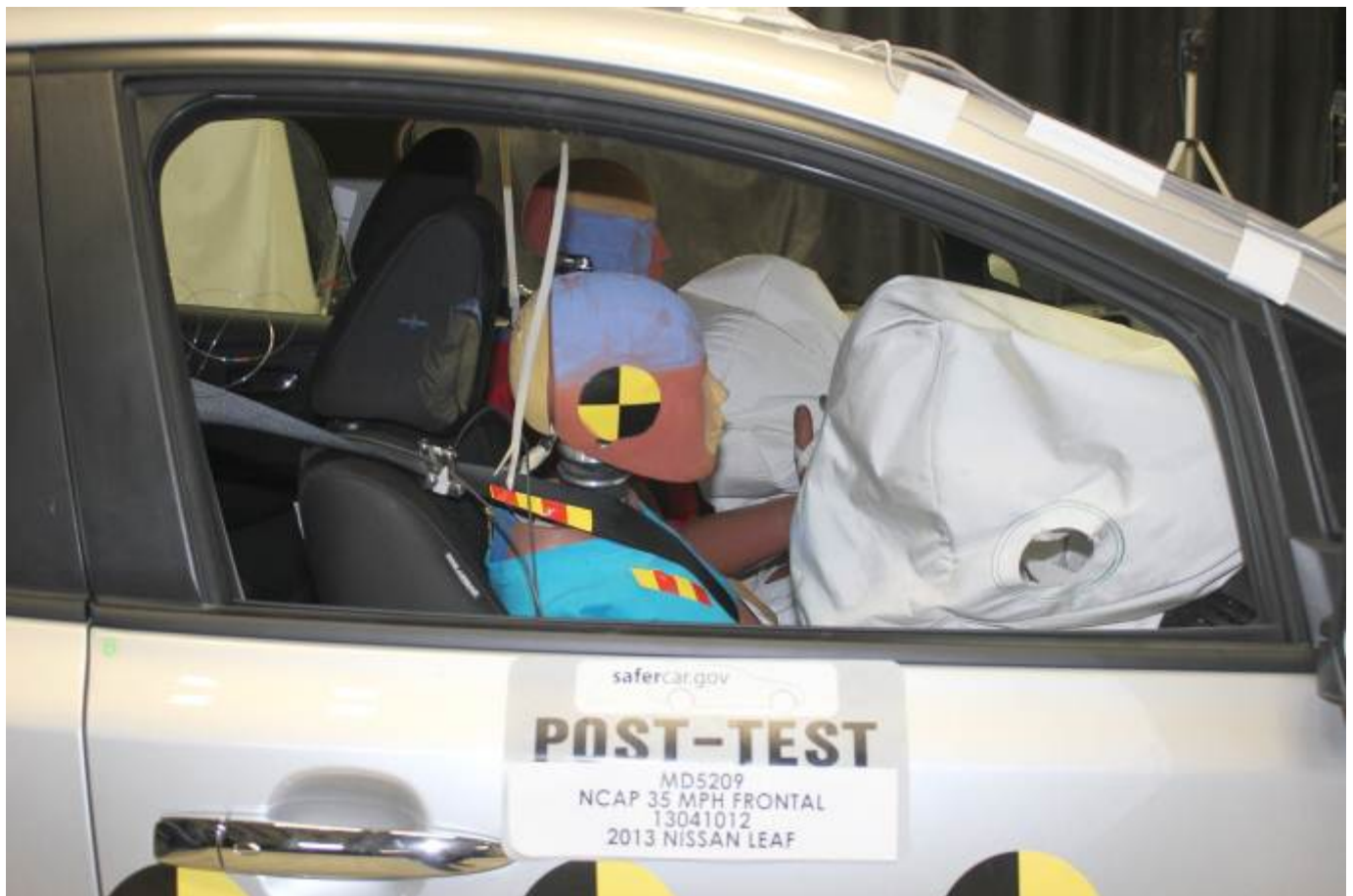
Pre-Test Passenger Dummy Front View



Post-Test Passenger Dummy Front View



Pre-Test Passenger Dummy Window View



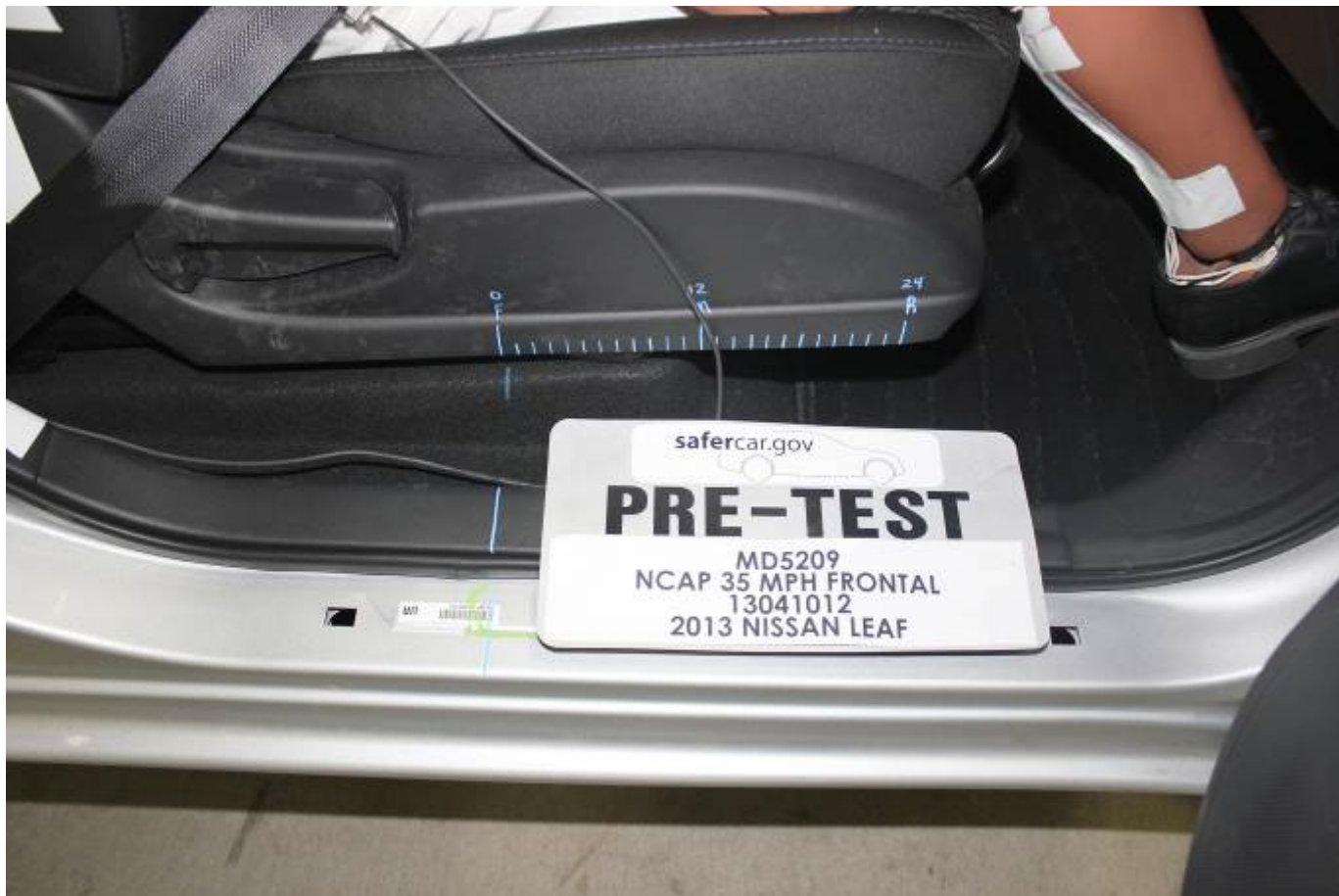
Post-Test Passenger Dummy Window View



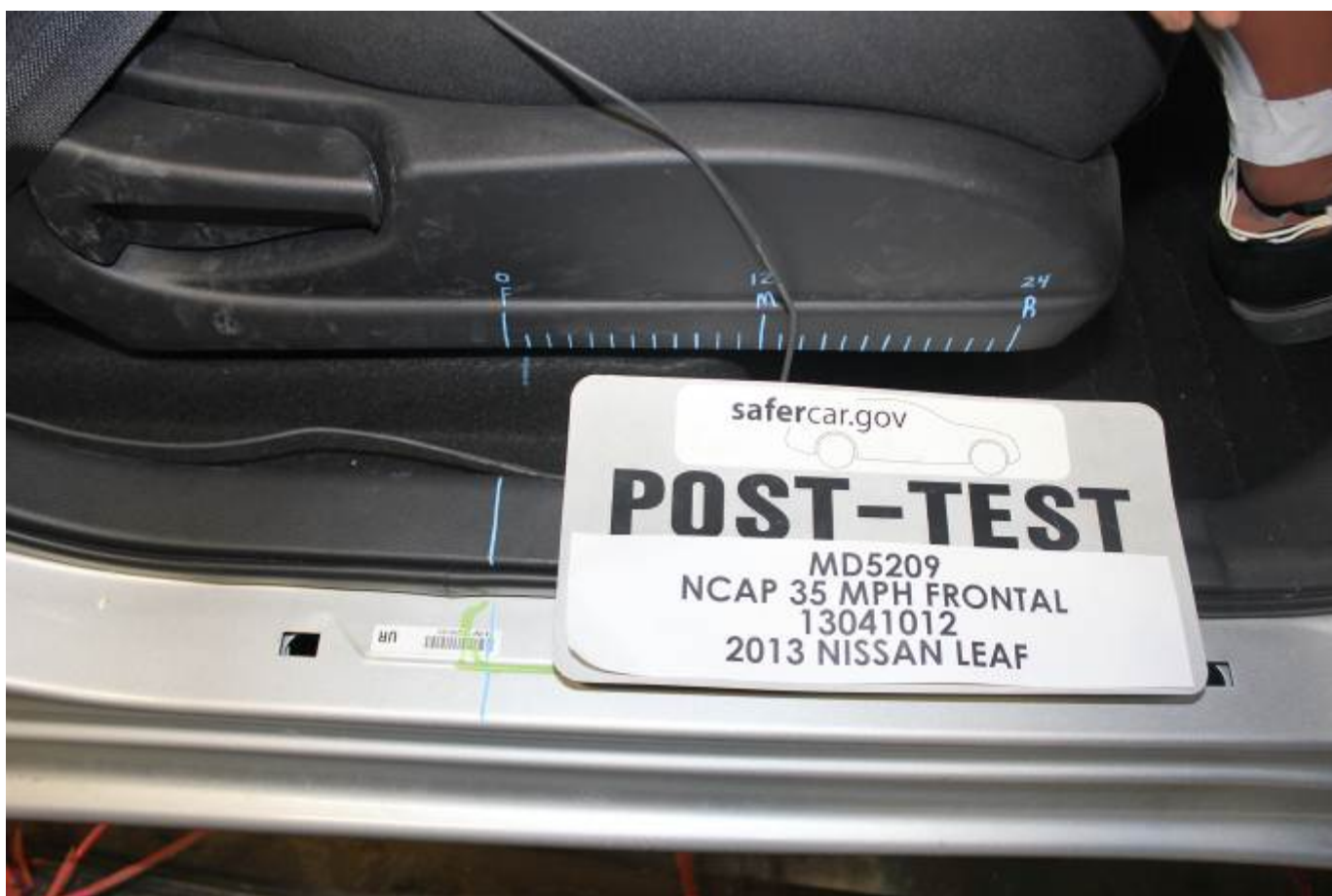
Pre-Test Passenger Dummy and Vehicle Interior (Door Open)



Post-Test Passenger Dummy and Vehicle Interior (Door Open)



Pre-Test Passenger's Seat Fore-Aft Markings



Post-Test Passenger's Seat Fore-Aft Markings



Pre-Test View of Belt Anchorage for Passenger Dummy



Post-Test View of Belt Anchorage for Passenger Dummy



Pre-Test Passenger Dummy Feet



Post-Test Passenger Dummy Feet



Pre-Test Passenger's Side Knee Bolster (without dummy)



Post-Test Passenger's Side Knee Bolster (without dummy)



Pre-Test Passenger's Side Floorpan



Post-Test Passenger's Side Floorpan



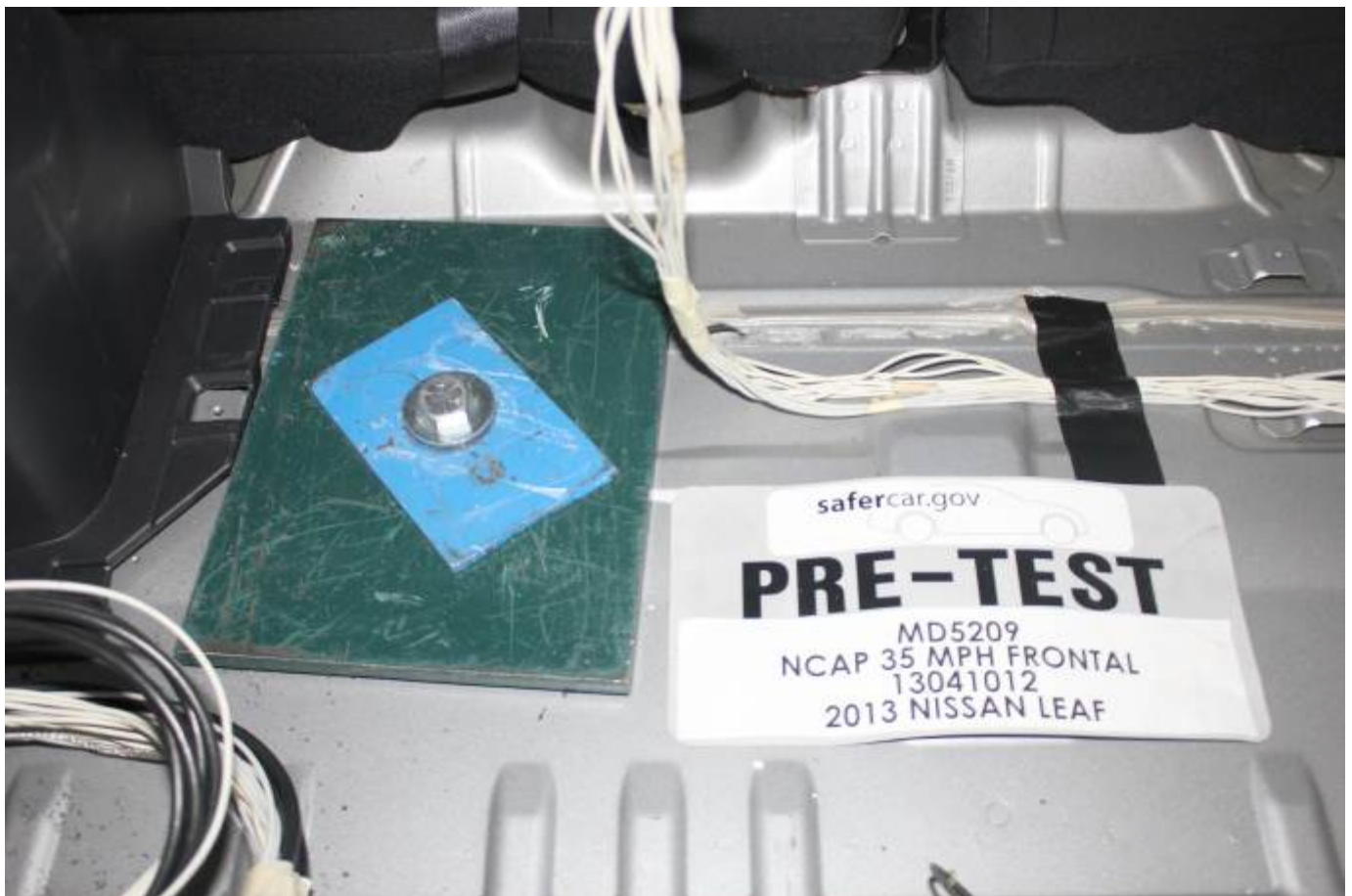
Post-Test Passenger Dummy Contact with Airbag



Post-Test Passenger Dummy Contact with Headrest



Post-Test Passenger Dummy Contact with Glove Box



Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

Post-Test Stoddard Solvent Spillage Location View



Post-Test Speed Trap Read-Out



Vehicle at 0° on Static Rollover Device



Vehicle at 90° on Static Rollover Device



Vehicle at 180° on Static Rollover Device



Vehicle at 270° on Static Rollover Device



Vehicle at 360° on Static Rollover Device



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eSafety Park Assist
Nissan Vehicle Immobilizer System
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Traction Control System (TCS)

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6-Way Adjustable Driver's Seat
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AM/FM/CD/XM in Audio System
4.3" Color LCD Display and 4 Speakers
USB Connection Port for iPod/iPhone and Other Compatible Devices
SiriusXM Satellite Radio**
Nissan Intelligent Key/SmartCharge Port
Door Release
Power Door Locks
Charging Timer

EXTERIOR FEATURES

Dual Power Remote-Controlled Heated Outside Mirror
Aerodynamic Underbody Cover and Rear Diffuser
Charge Port Light and Lock

Manufacturer's Suggested Retail Base Price

\$28,800.00

Options Included by Manufacturer

SPLASH GUARDS 145.00
FLOOR MATS & CARGO AREA MAT 170.00
CARGO NET 35.00
SAFETY KIT 75.00
First Aid Kit
Emergency Kit

DESTINATION CHARGES

\$50.00

Total \$30,055.00

**SiriusXM Satellite Radio includes activation & 3 months of service only. SiriusXM Satellite Radio coverage not available in HI or AK and some markets.

*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

Electric Vehicle

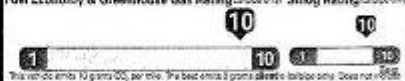
Fuel Economy



You save \$9,100
in fuel costs over 5 years compared to the average new vehicle.

Annual fuel COST \$500

Fuel Economy & Greenhouse Gas Rating (tailpipe only) Smog Rating (tailpipe only)



Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 23 MPGe and costs \$11,880 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$0.12 per kWh or \$0.10 per gallon gasoline equivalent. Vehicle emissions are a significant source of climate change and smog.

fuel economy.gov

Calculate personalized estimates and compare vehicles

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score
Based on the combined ratings of frontal, side and rollover.
Should ONLY be compared to other vehicles of similar size and weight.

Frontal Crash
Based on the risk of injury in a frontal impact.
Should ONLY be compared to other vehicles of similar size and weight.

Side Crash
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

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DELIVERY

VEHICLE COLORS:
EXT: BRILLIANT SILVER
INT: BLACK

FINAL ASSEMBLY POINT:
SMYRNA
TRANSPORT METHOD:
TRUCK

DEALER:
ROSEN NISSAN OF GURNEE
7000 GRAND AVENUE
GURNEE, IL 60031

VIN: 1NVAZ3CP4DC42350
EWS: 50 STATE EWS@ONS
NDL: 17013-402305 K23-G
OPT: G-880C03L52H-95522208

2013025/2013118/RF3033

Monroney Label

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 CG X Redundant
 Driver Head CG Y Redundant
 Driver Head CG Z Redundant
 Driver 9 Axis Head X Arm Y
 Driver 9 Axis Head X Arm Z
 Driver 9 Axis Head Y Arm X
 Driver 9 Axis Head Y Arm Z
 Driver 9 Axis Head Z Arm X
 Driver 9 Axis Head Z Arm Y
 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 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
Passenger Head X Redundant
Passenger Head Y Redundant
Passenger Head Z Redundant
Passenger Upper Neck Force Y
Passenger Upper Neck Moment X
Passenger Upper Neck Moment Z
Left Rear Seat Crossmember X
Right Rear Seat Crossmember X
Vehicle Engine Top X
Vehicle Engine Bottom X

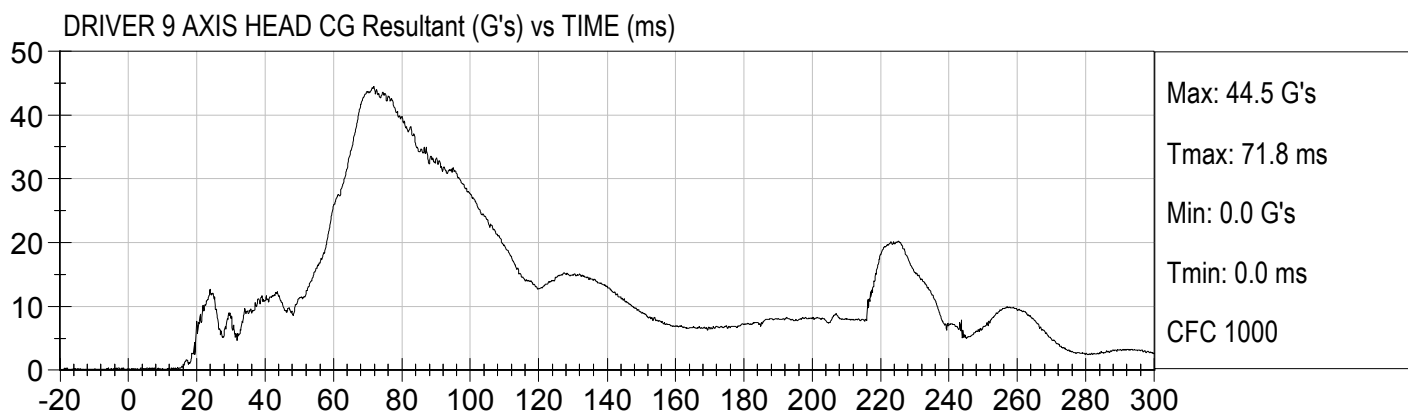
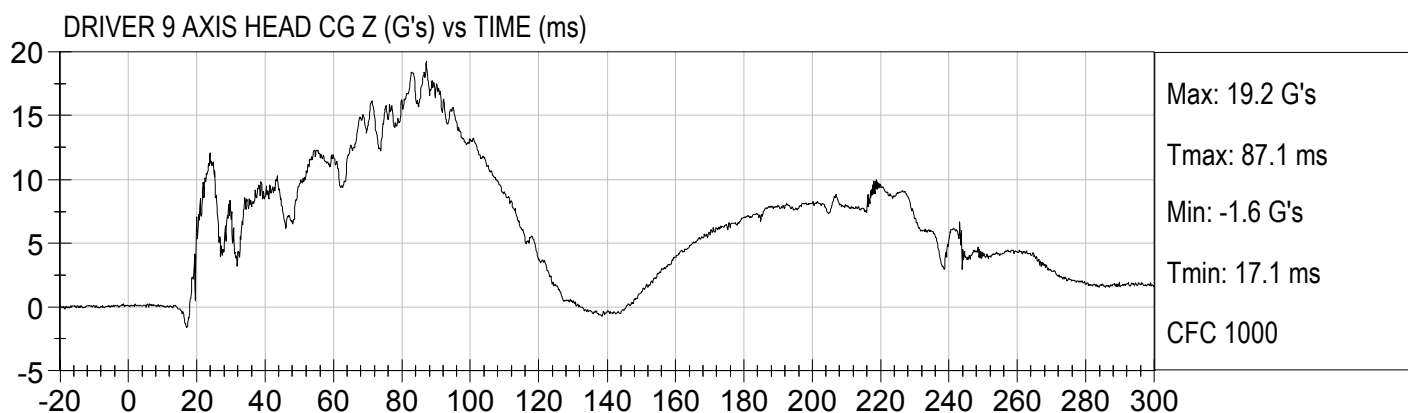
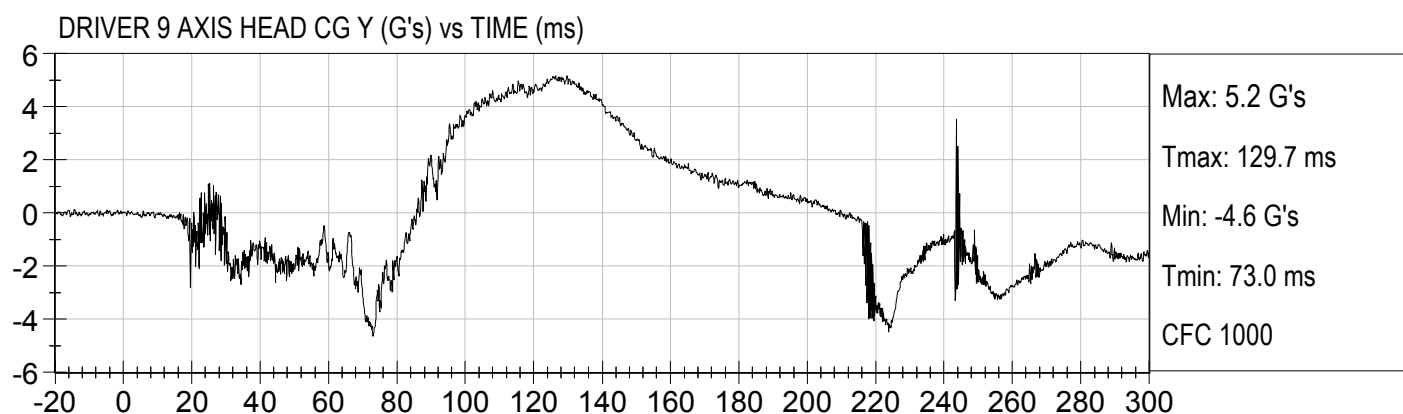
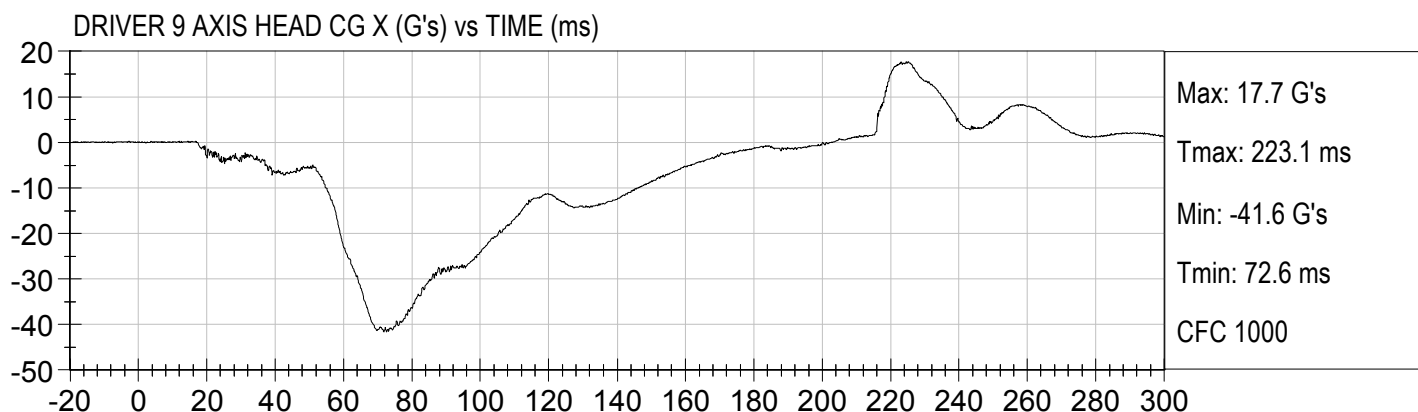
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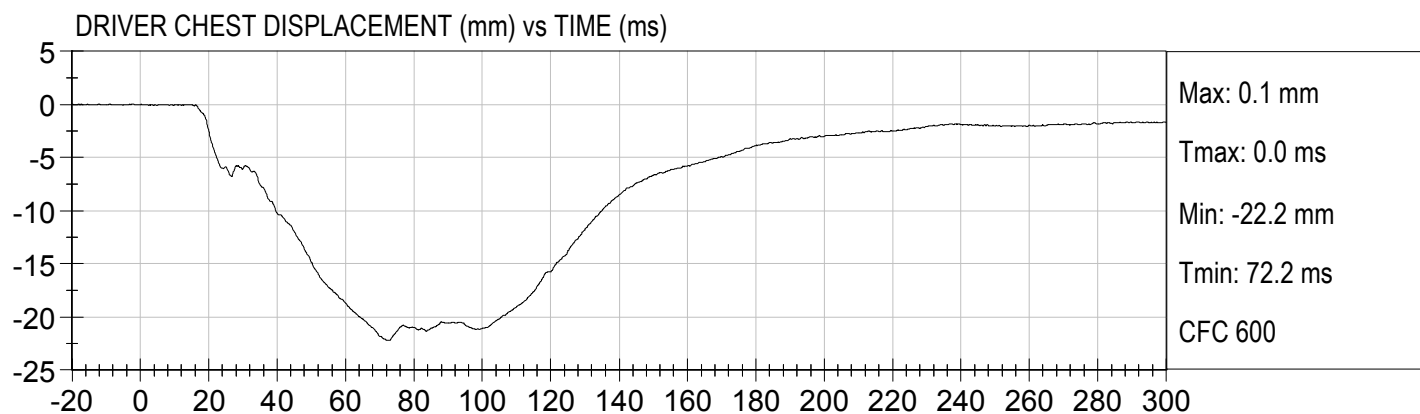
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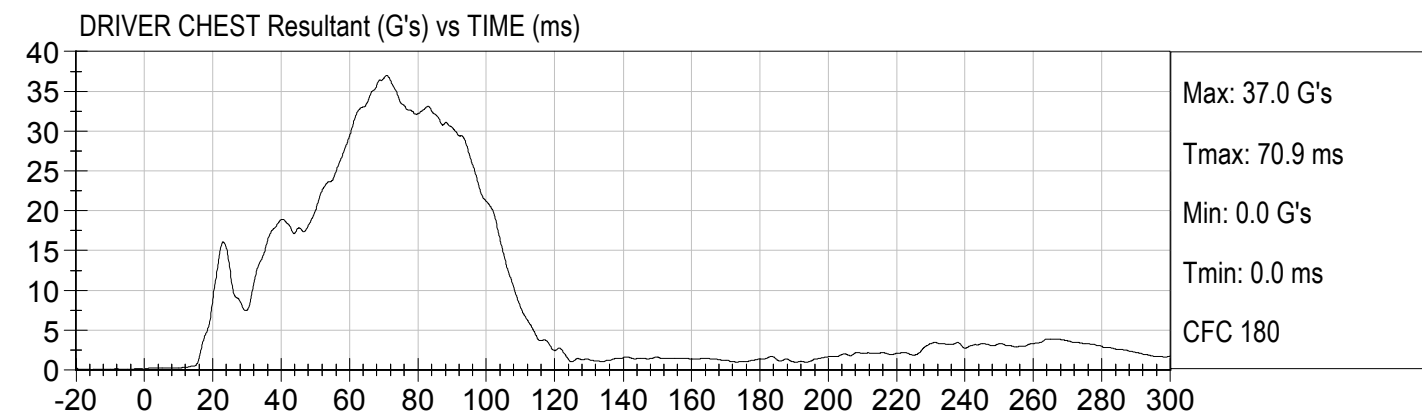
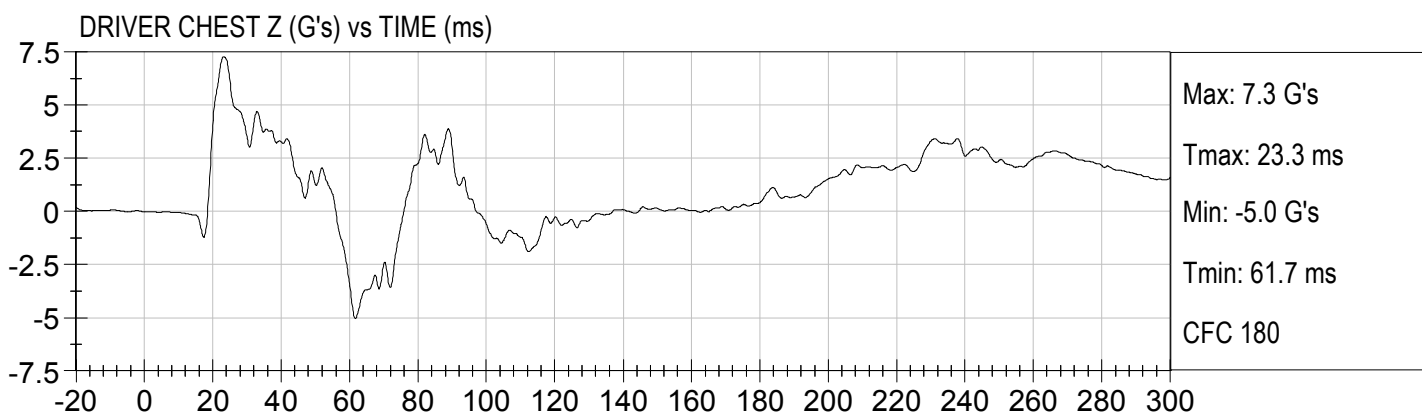
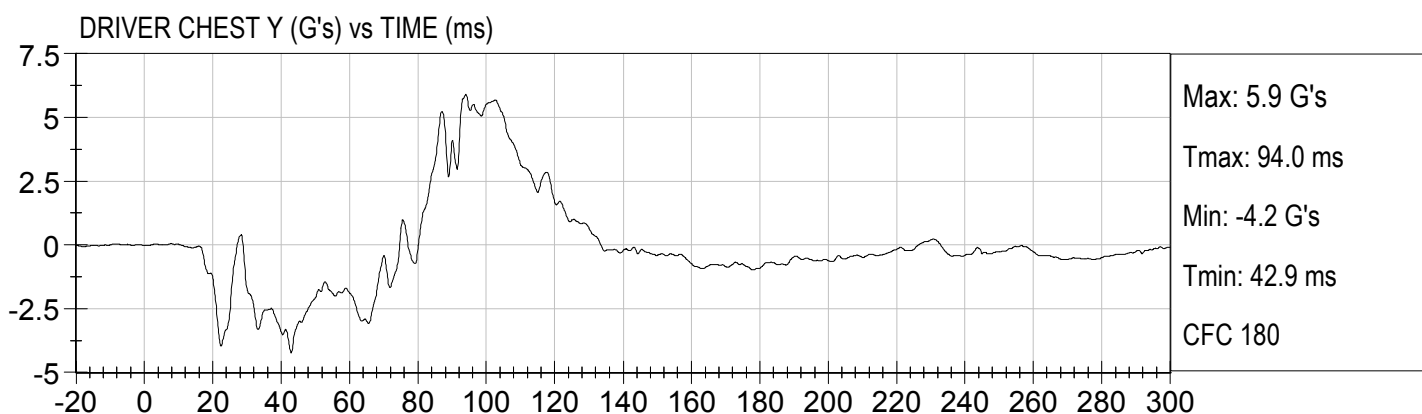
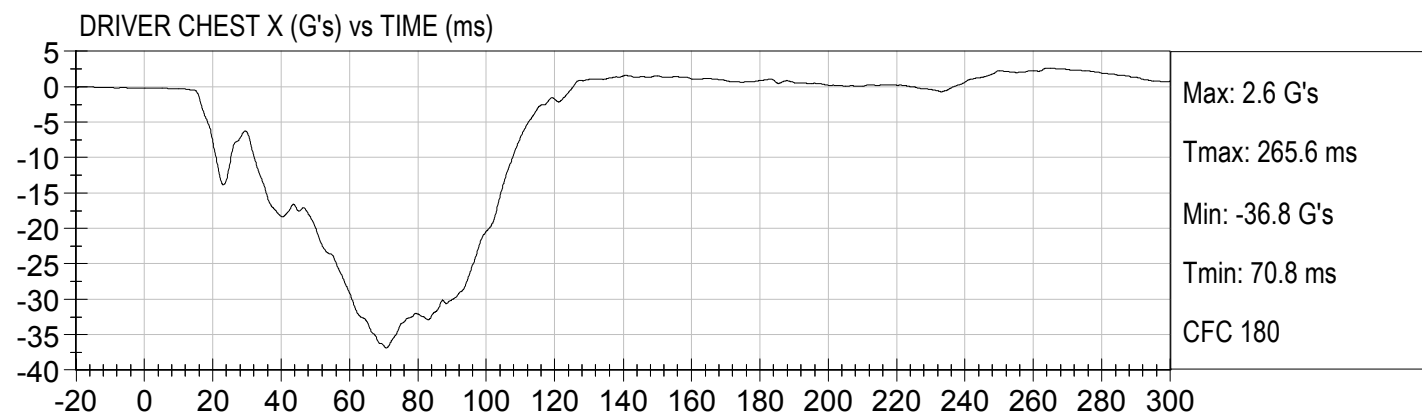
Left Rear Seat Crossmember Xr

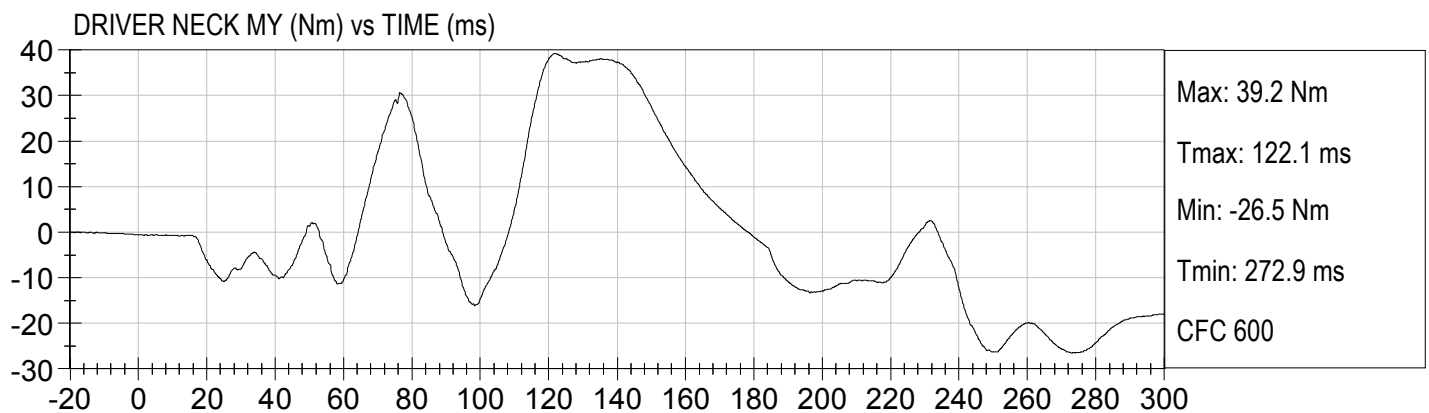
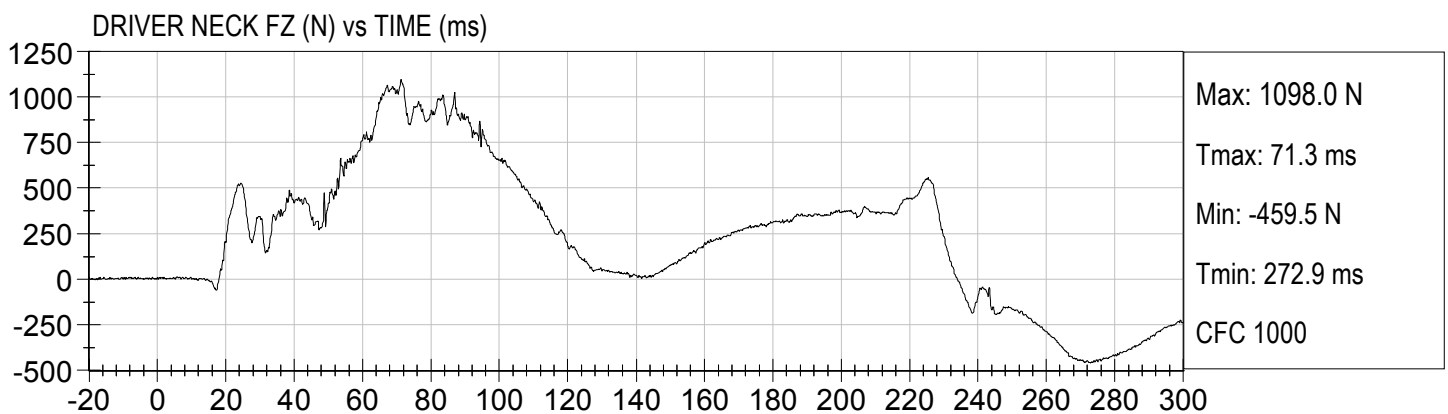
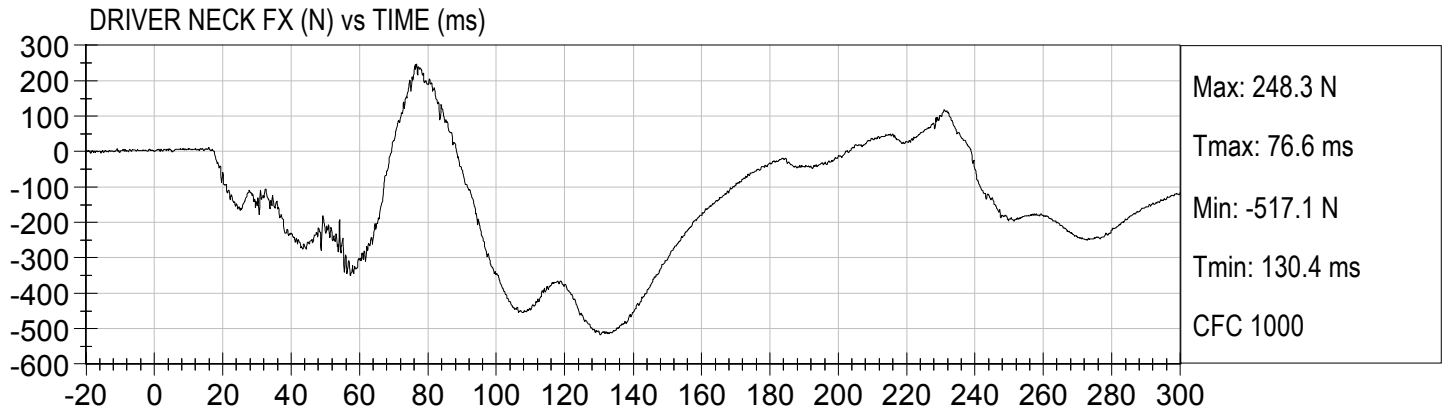
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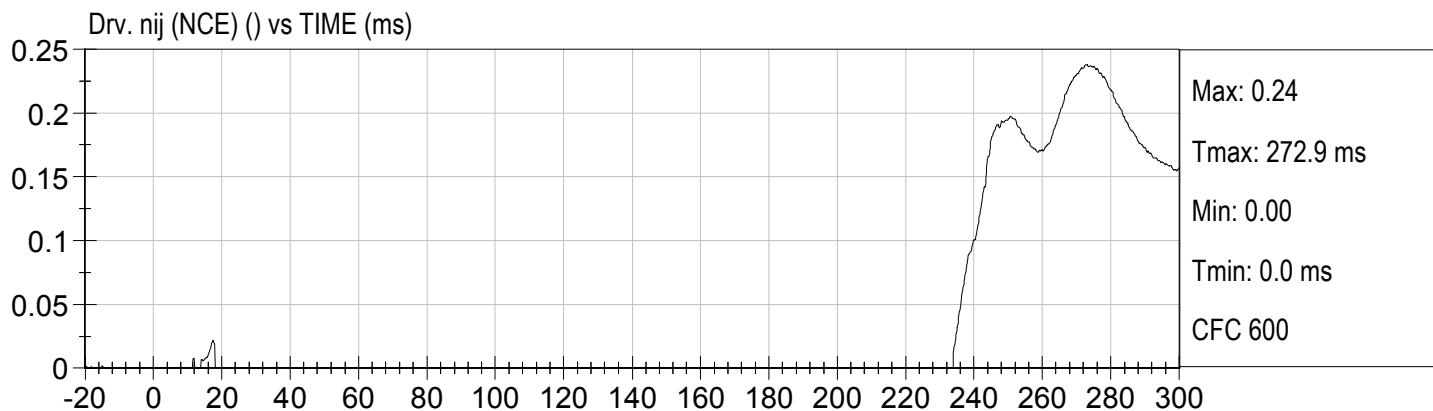
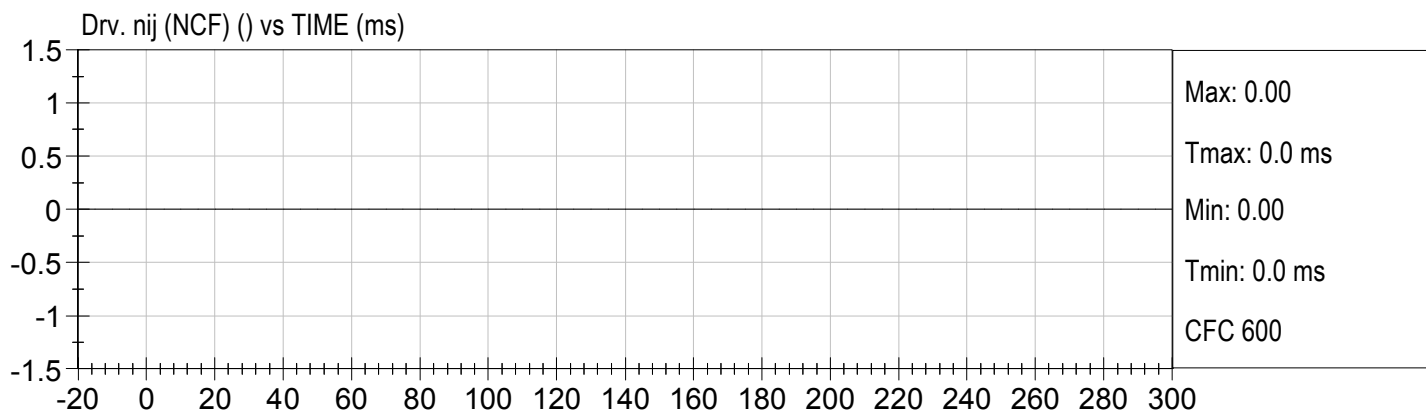
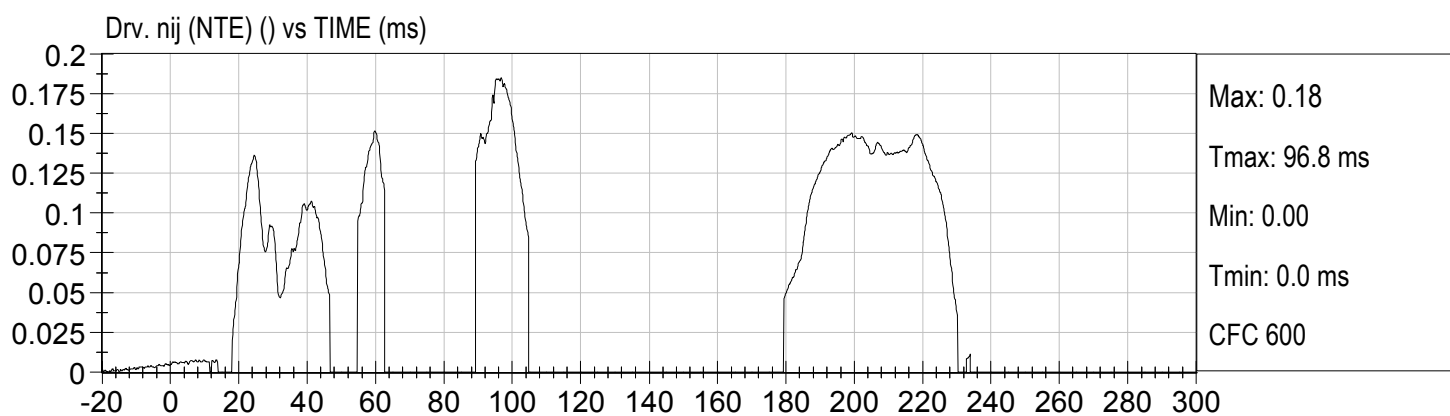
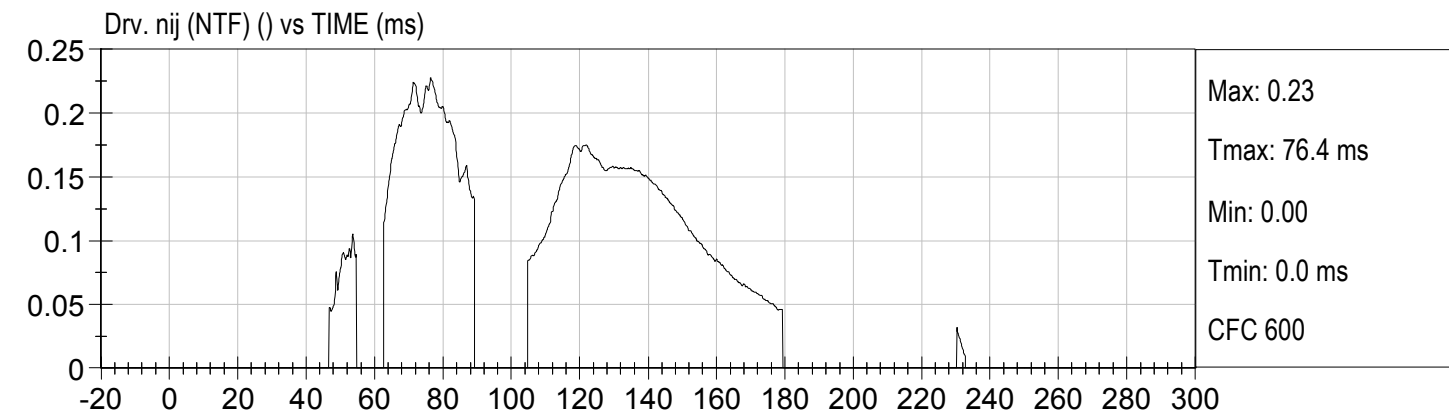
Advanced Research Load Cell Barrier – 528 channels

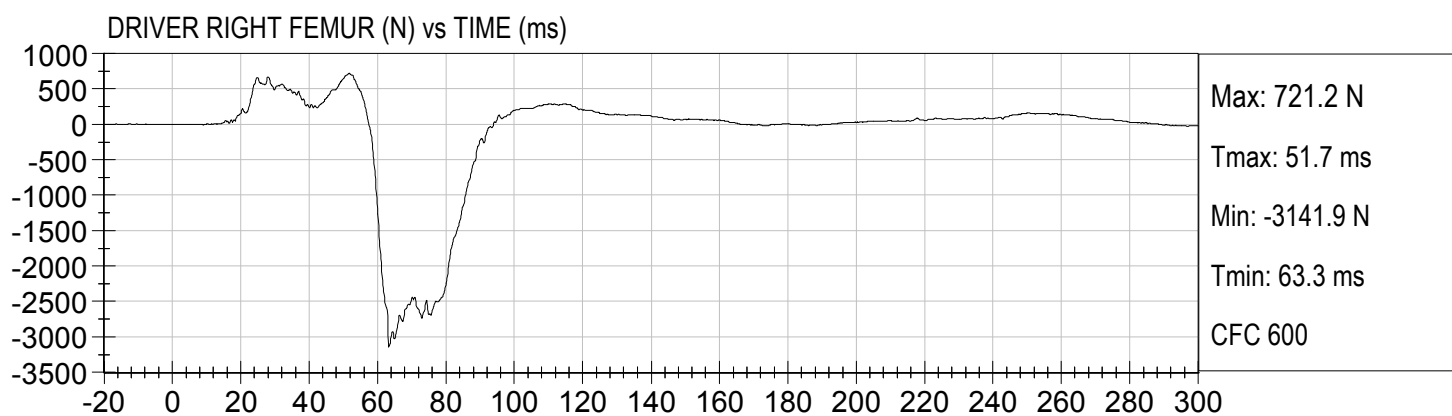
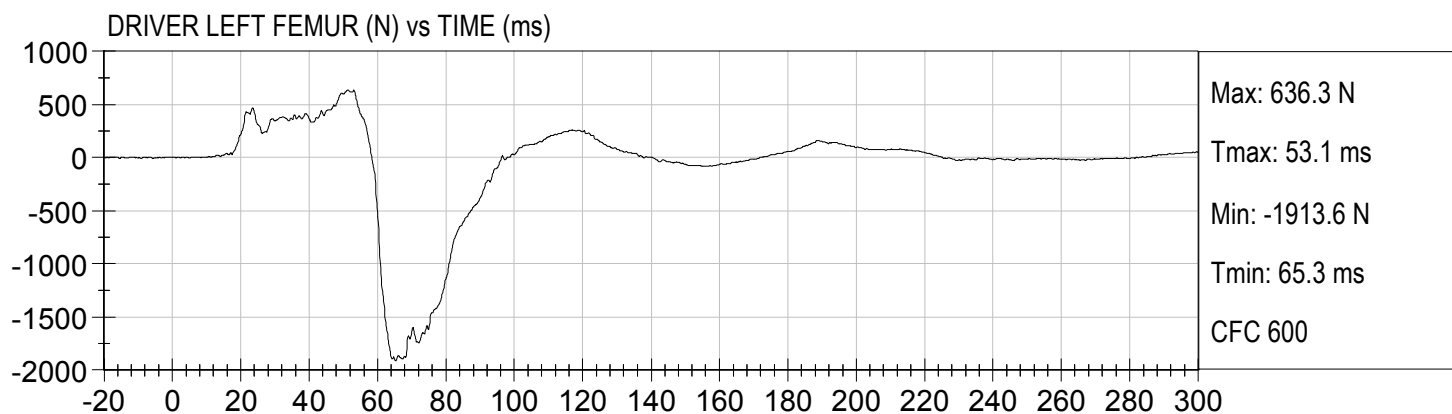






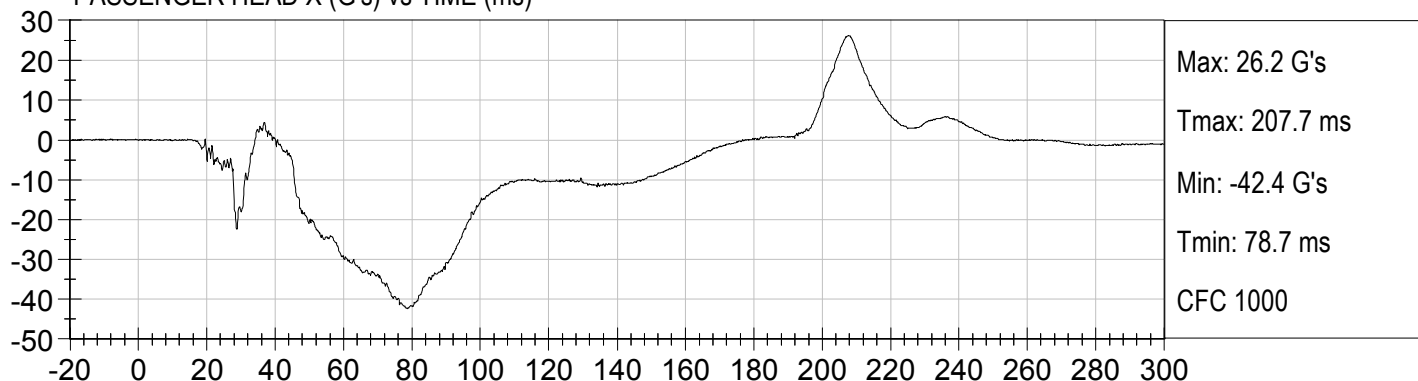




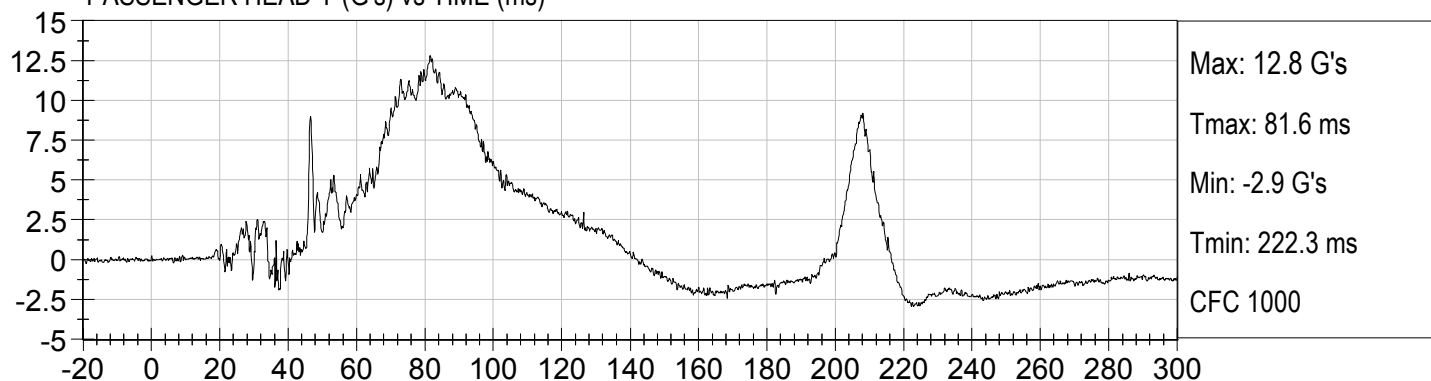




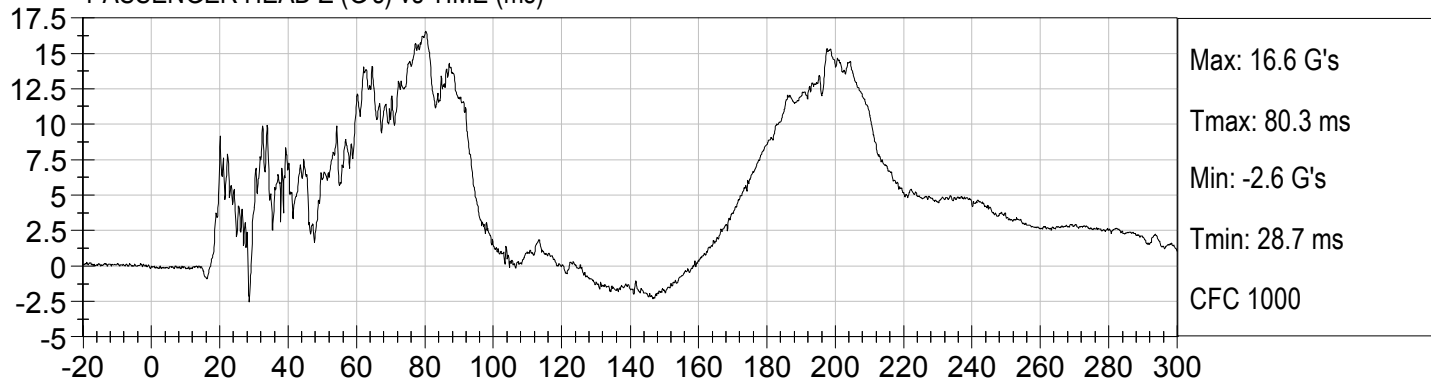
PASSENGER HEAD X (G's) vs TIME (ms)



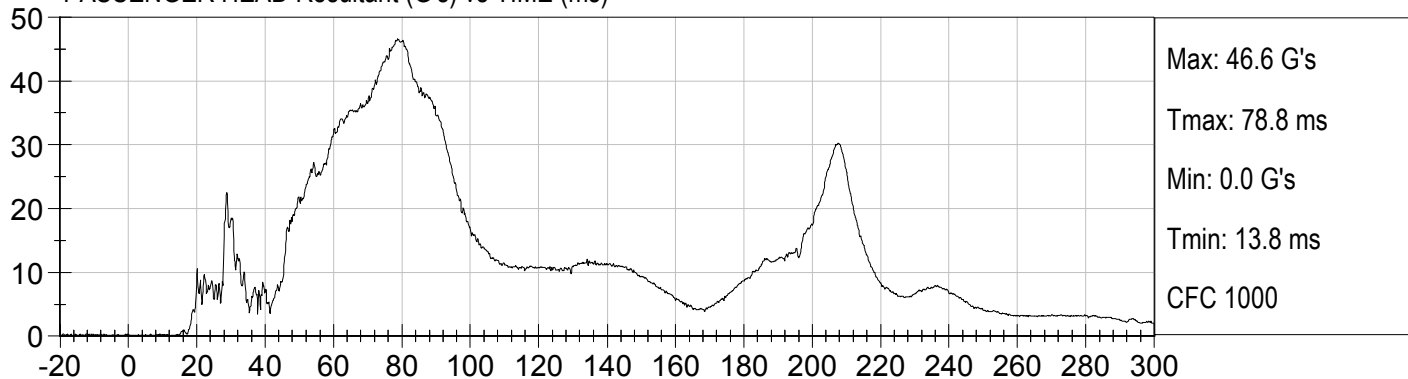
PASSENGER HEAD Y (G's) vs TIME (ms)

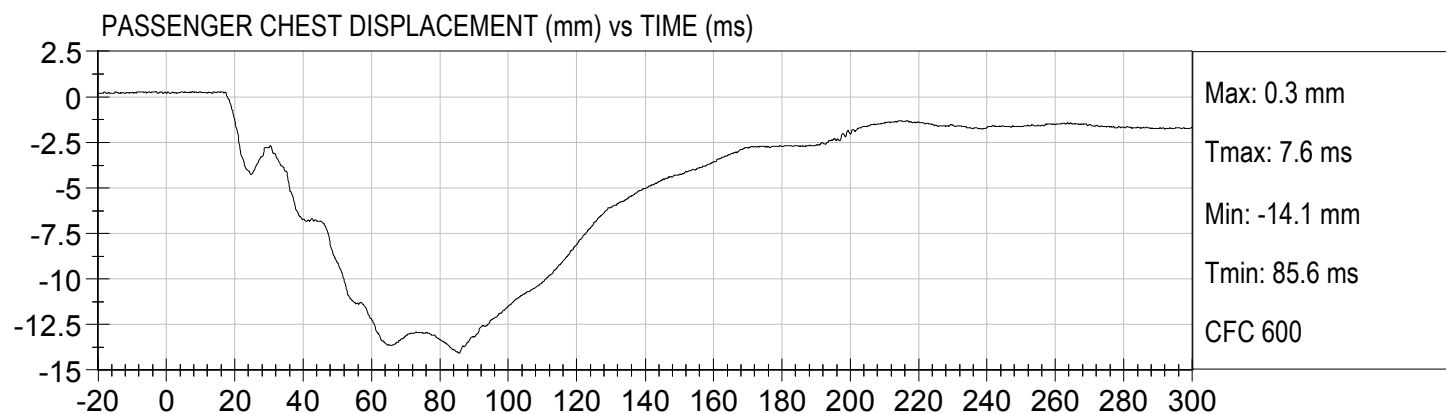


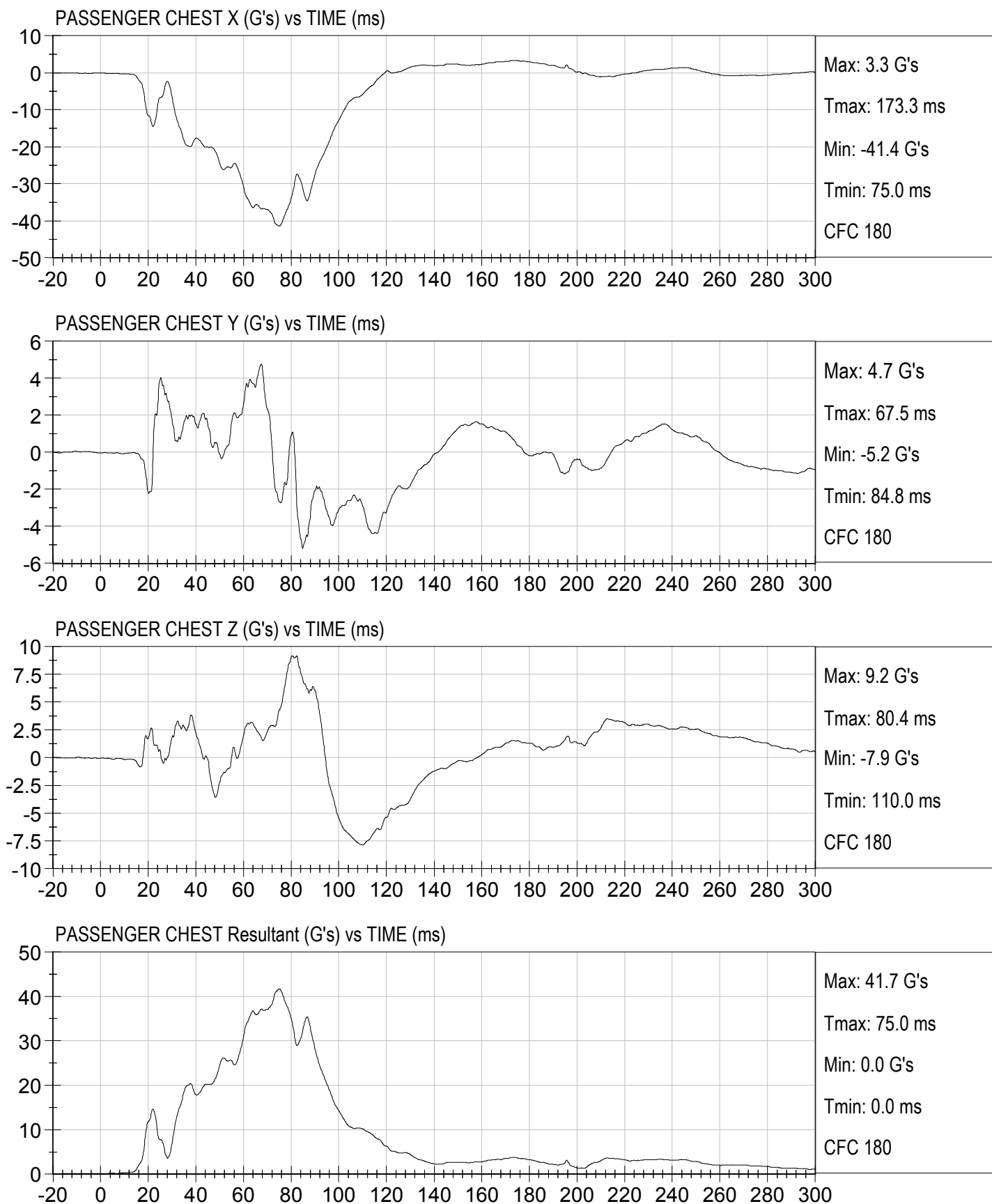
PASSENGER HEAD Z (G's) vs TIME (ms)

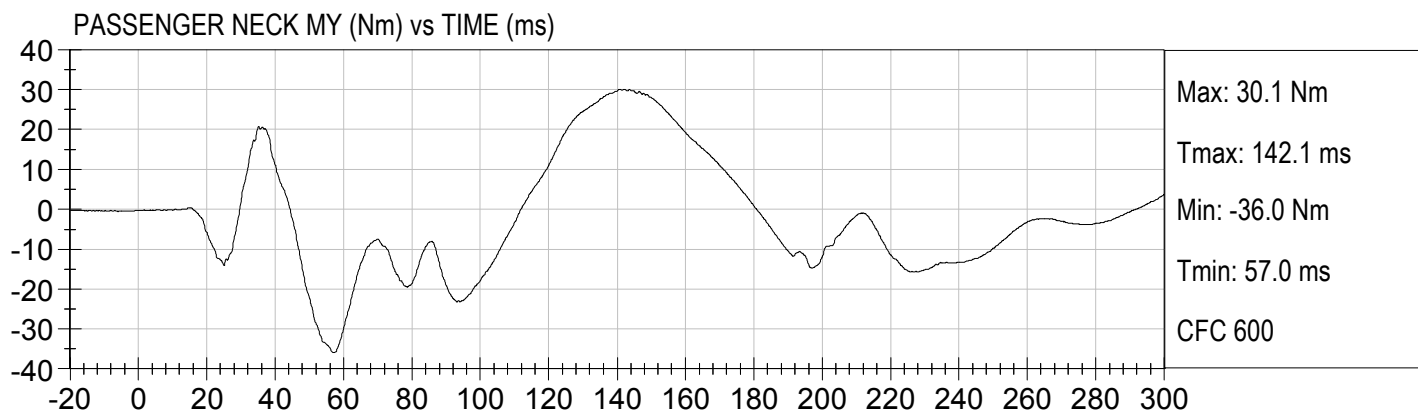
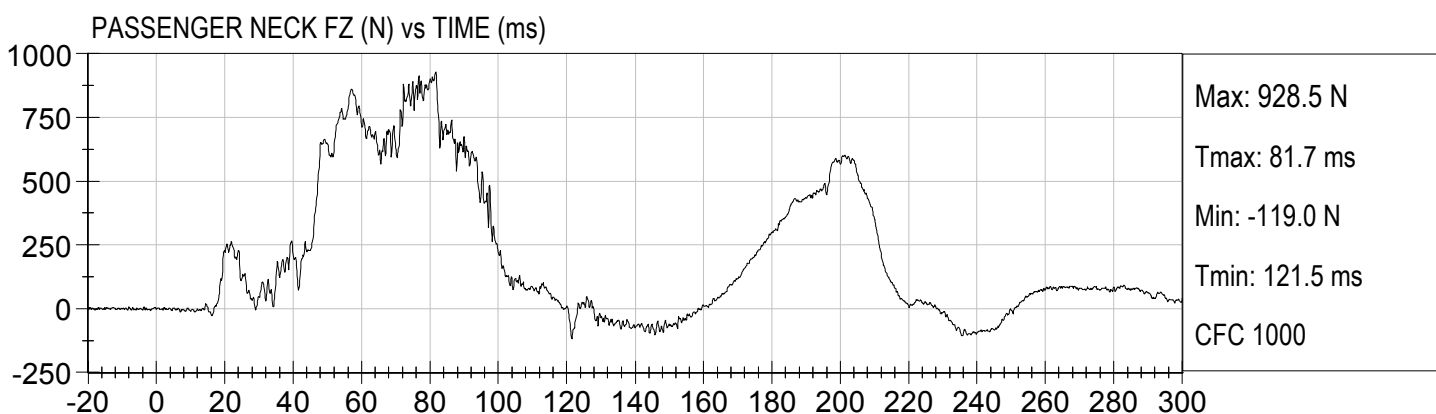
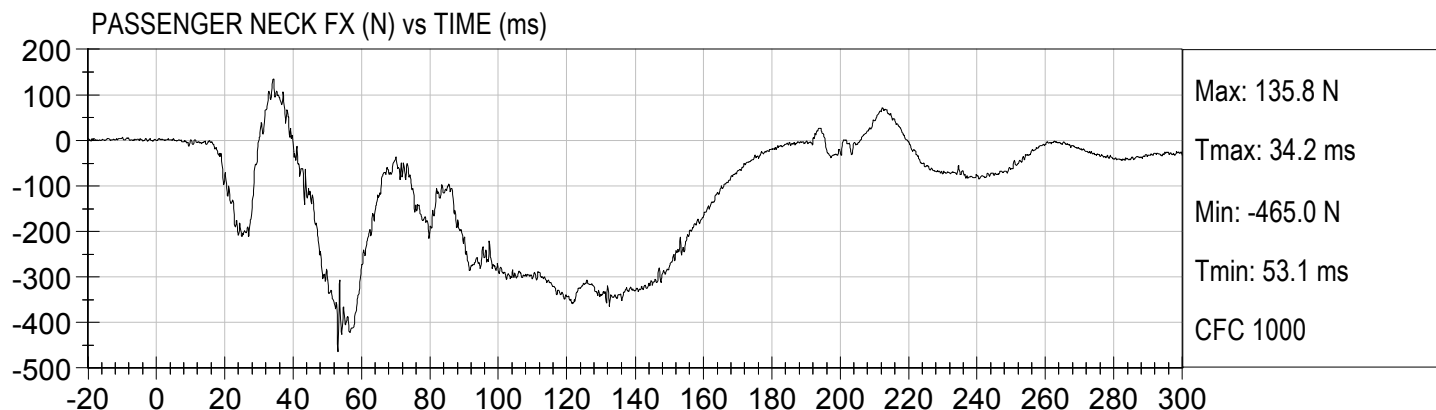


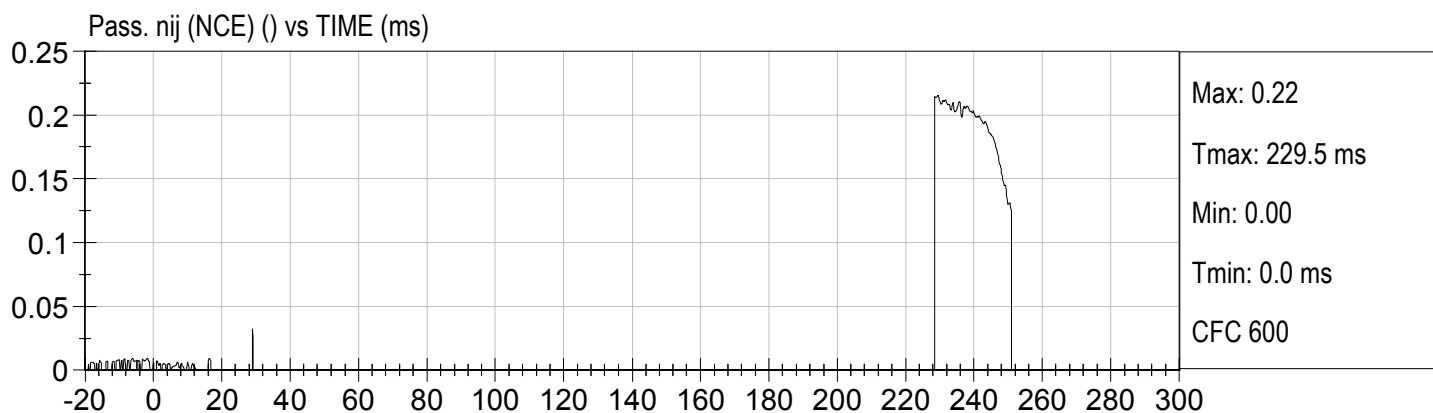
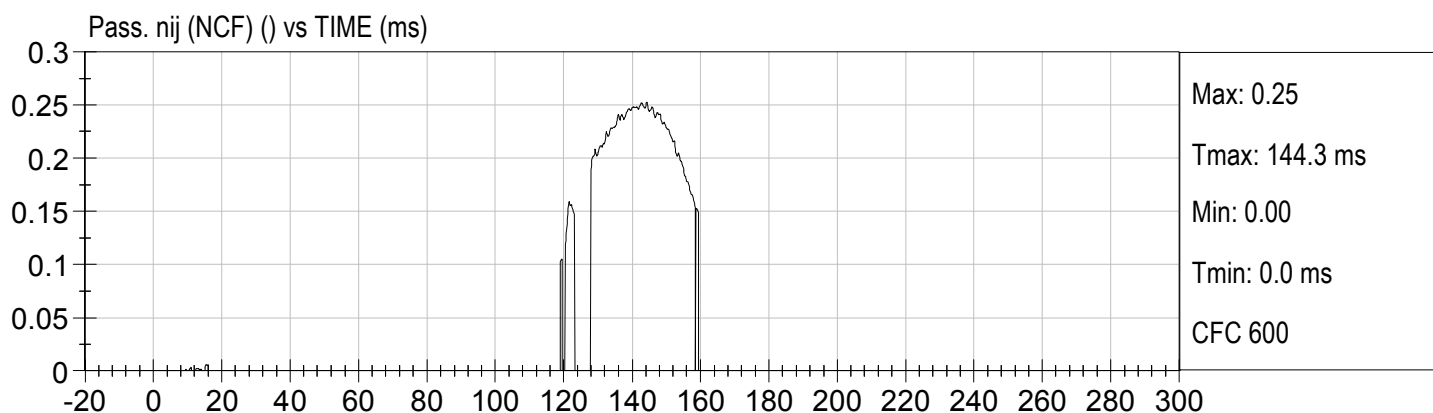
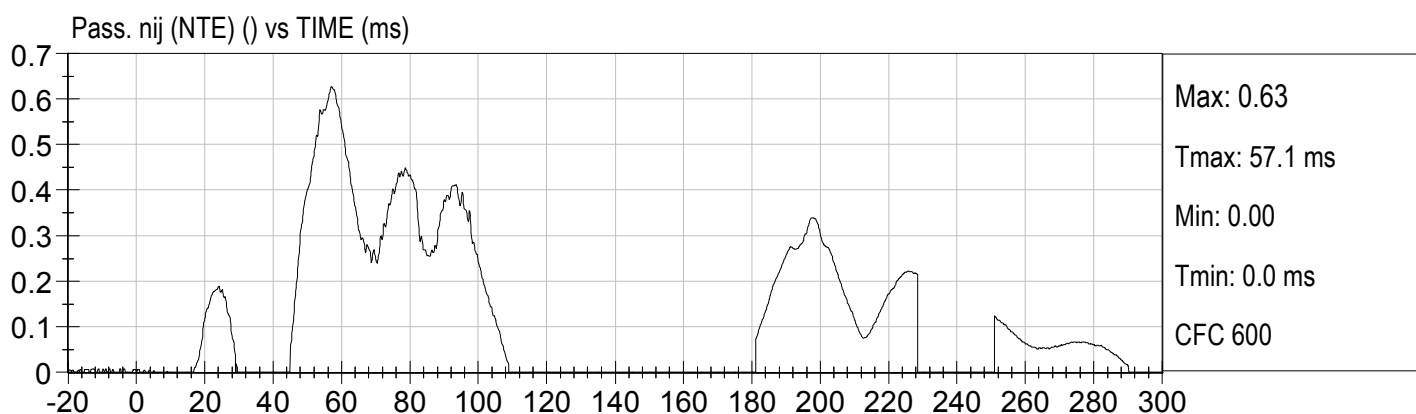
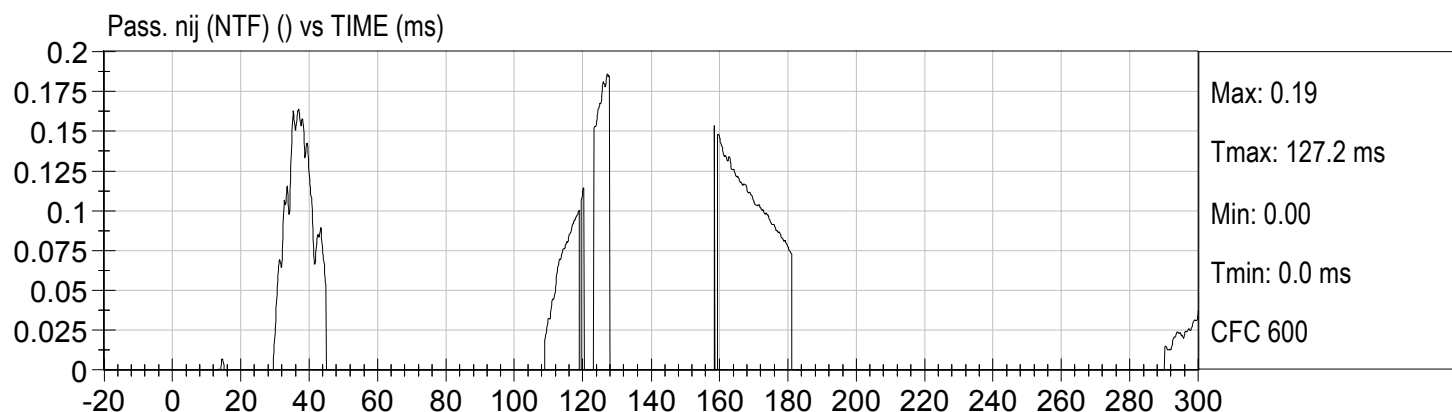
PASSENGER HEAD Resultant (G's) vs TIME (ms)

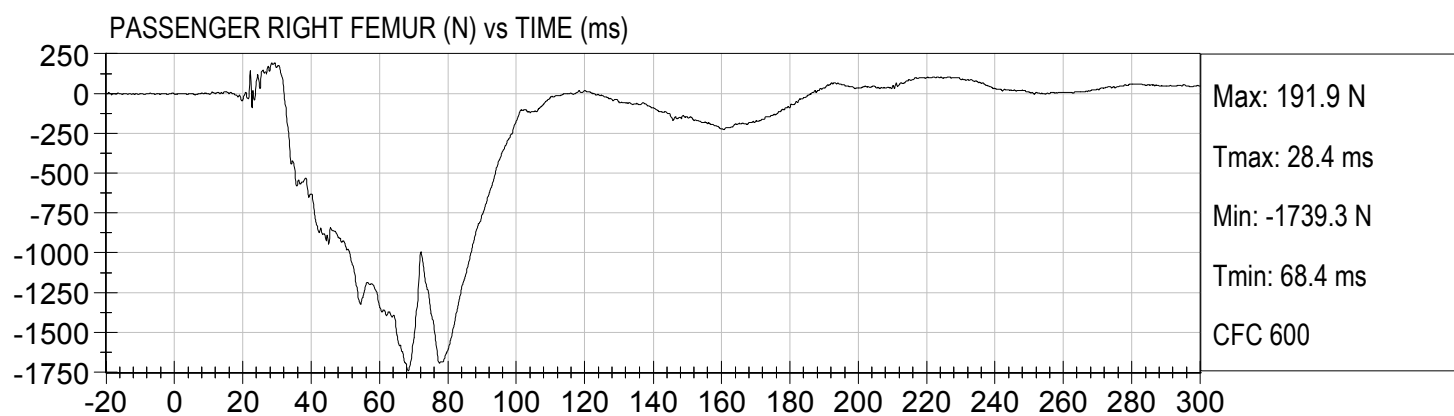
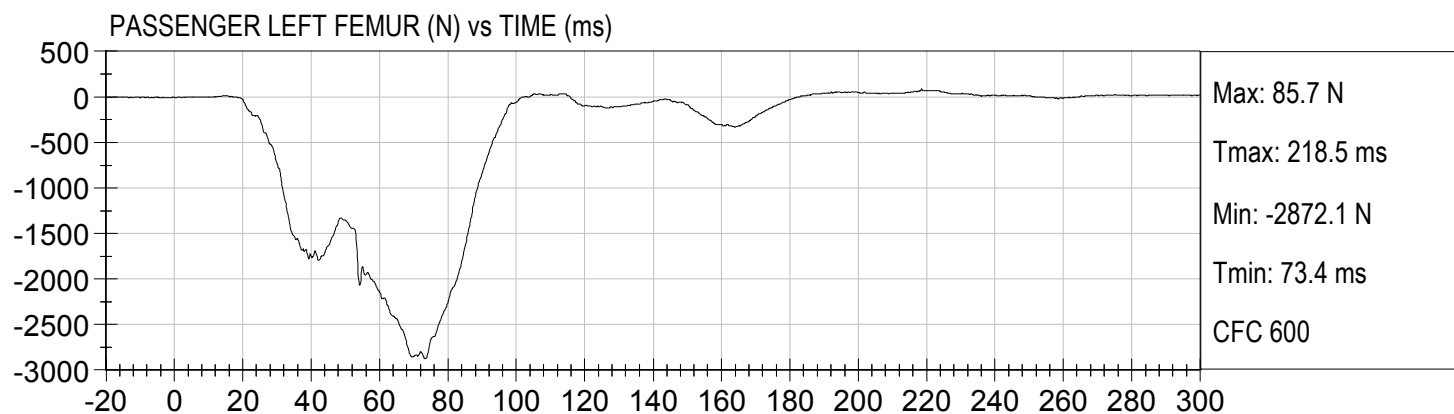












APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

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

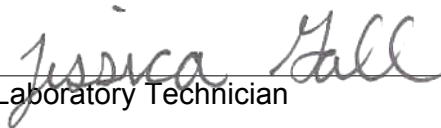
NOTE: THE H-POINT IS LOCATED 1.83 INCHES FORWARD AND 2.57 INCHES DOWN FROM THE CENTER OF THE PELVIS ANGLE REFERENCE HOLE.

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

ATD Serial No: 351

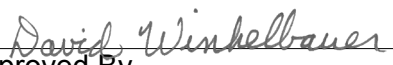
Test ID: D131211

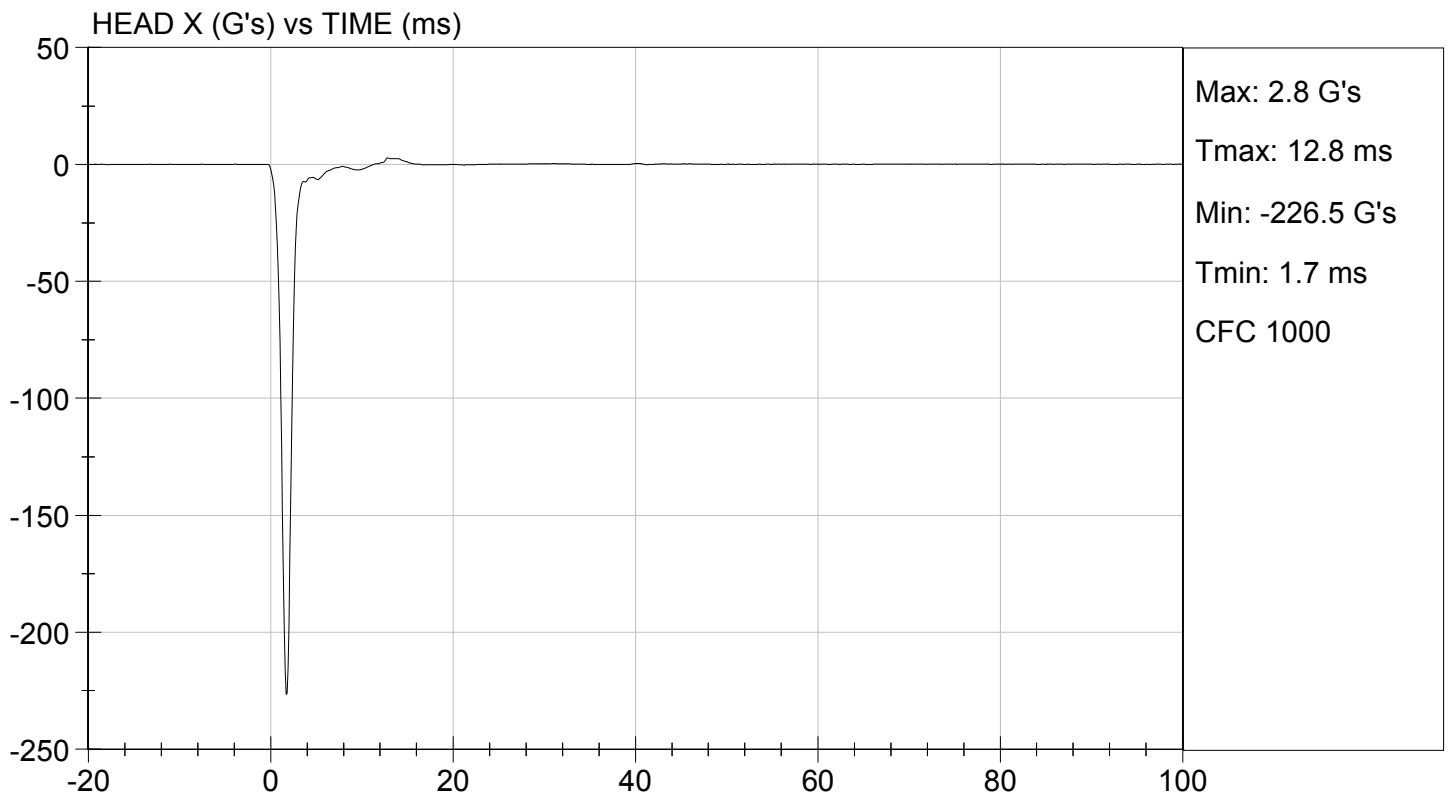
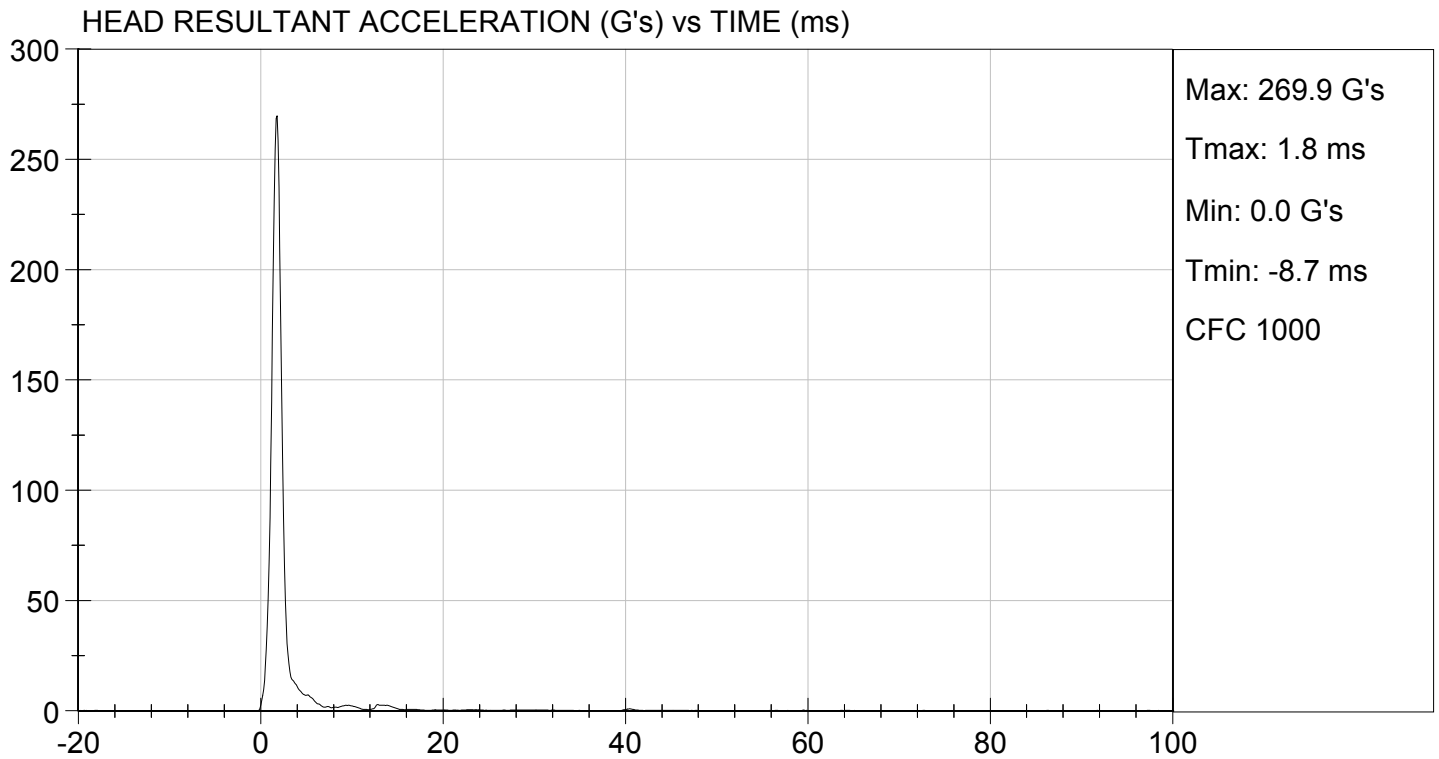
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Peak Resultant Acceleration	G's	225 to 275	270	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-1.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

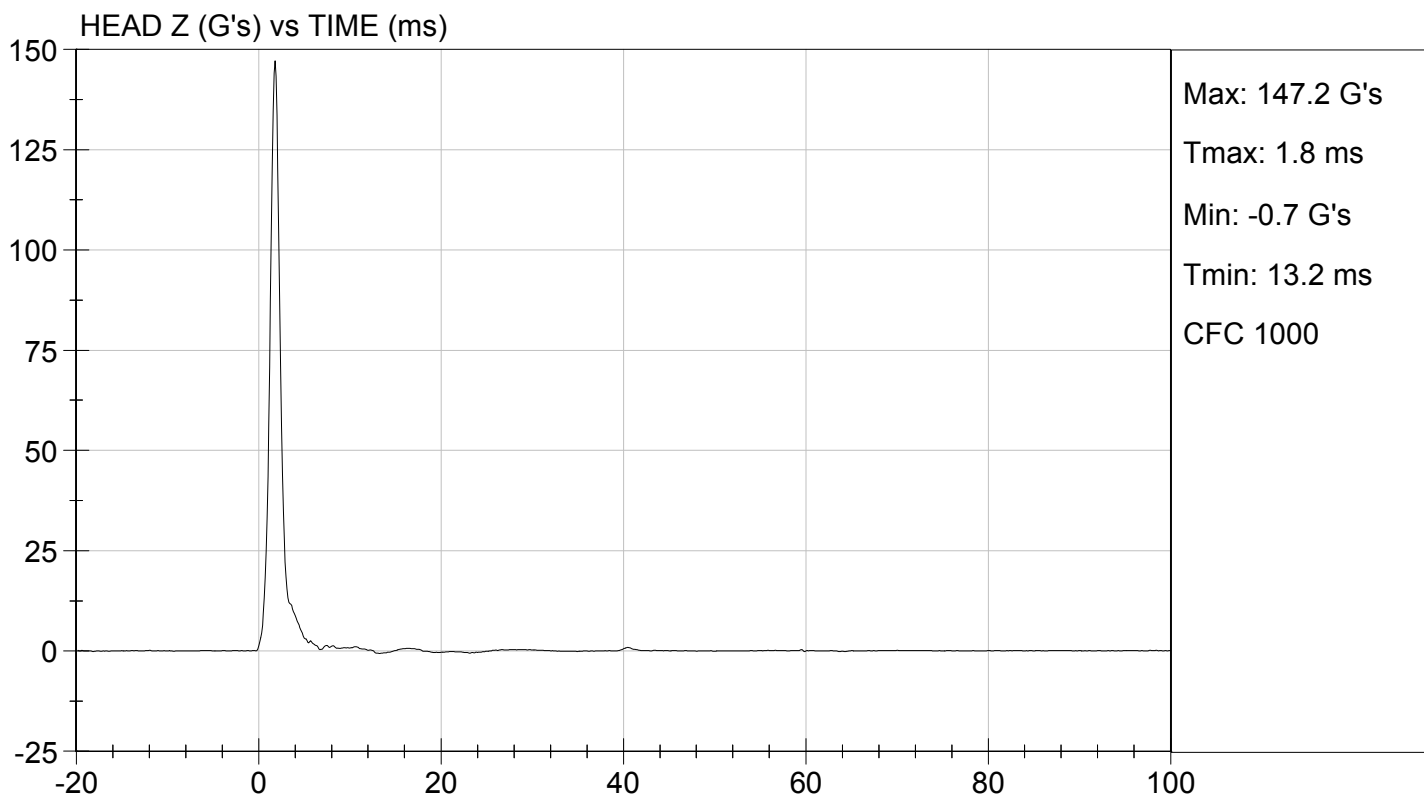
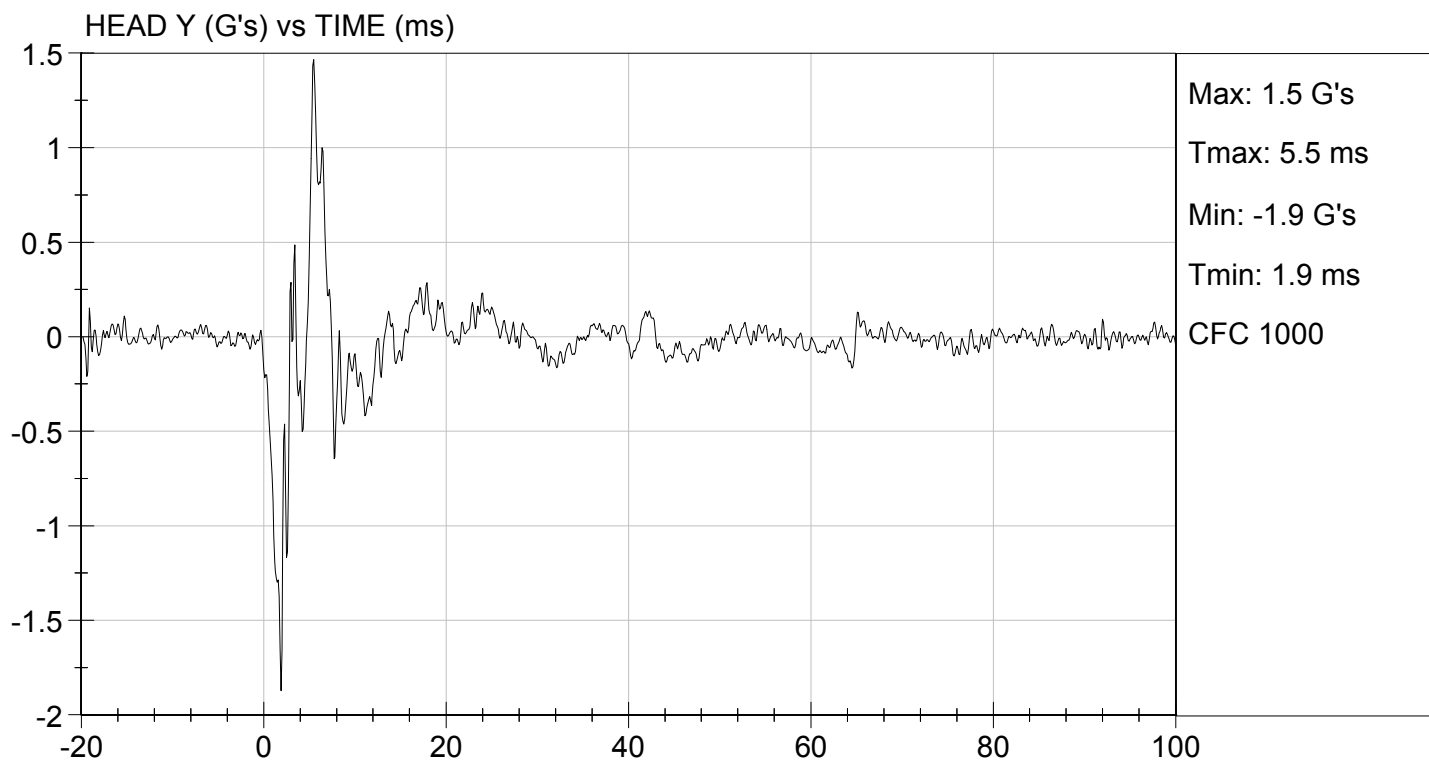

Laboratory Technician

04/09/2013

Test Date


Approved By





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

ATD Serial No: 351

Test I.D: D131212

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	40	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.38	Pass
	20 ms	G's	17.60 to 22.60	18.61	Pass
	30 ms	G's	12.50 to 18.50	14.43	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.4	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	68.2	Pass
	Time	ms	57.0 to 64.0	57.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.4	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	91.7	Pass
	Time	ms	47.0 to 58.0	47.6	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	97.3	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

04/09/2013

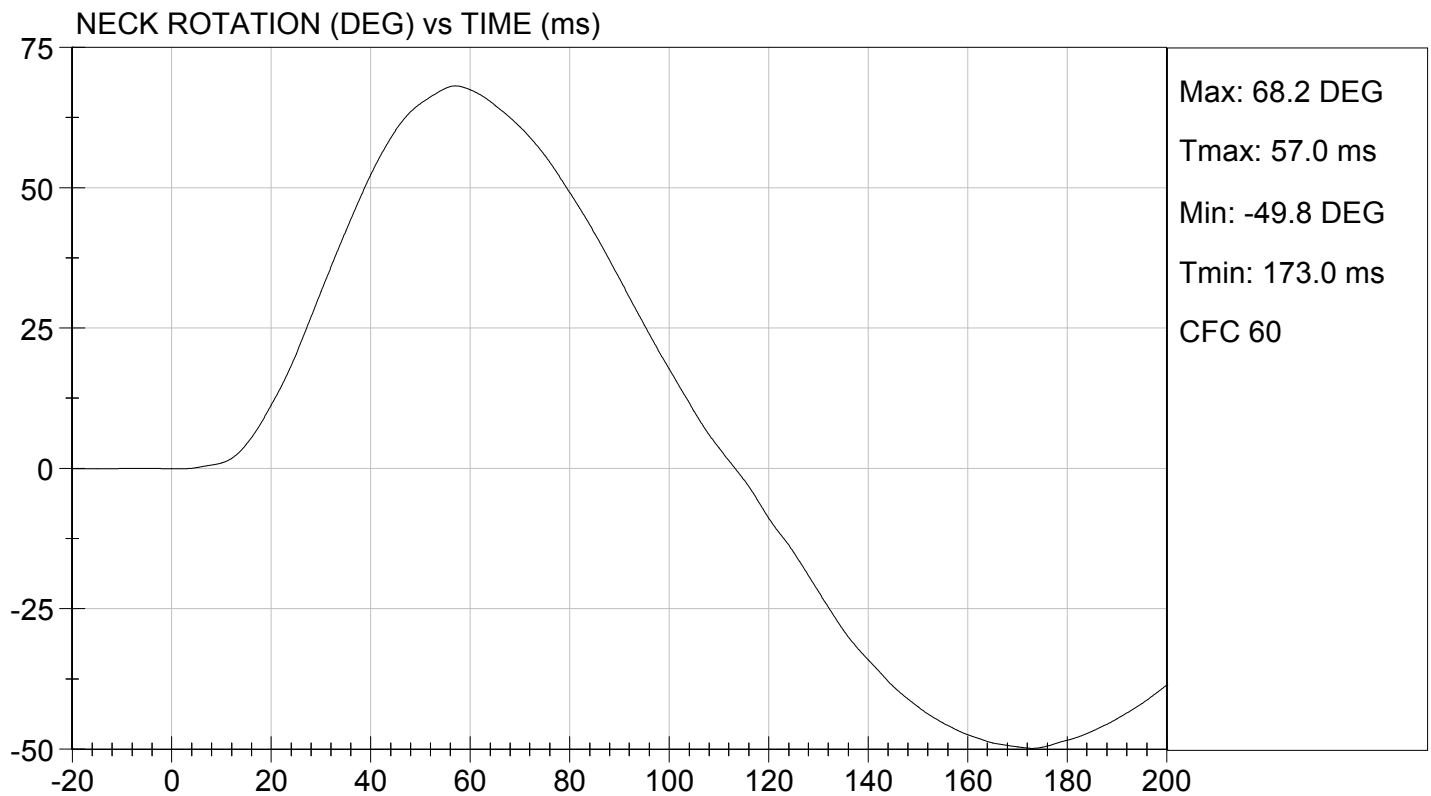
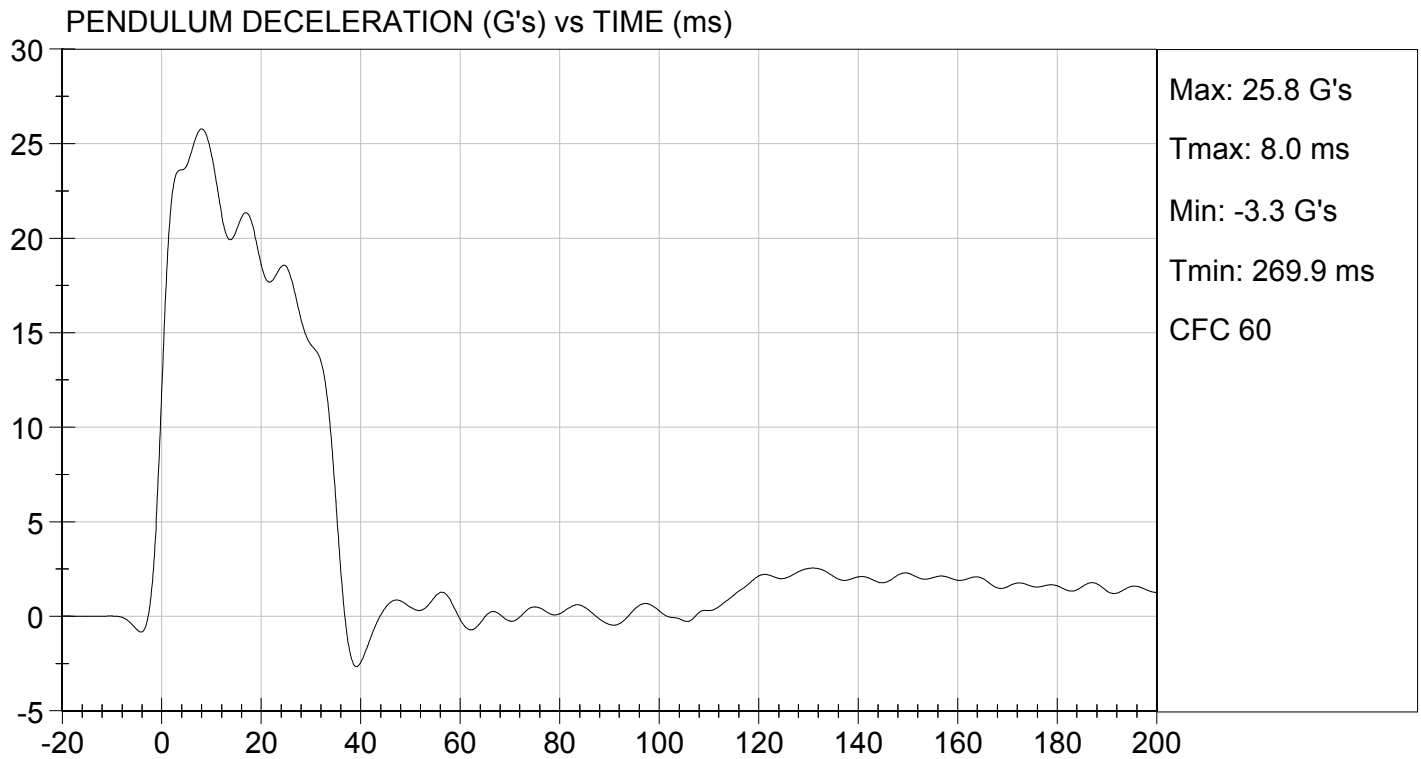
Test Date

David Winkelbauer
Approved By



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

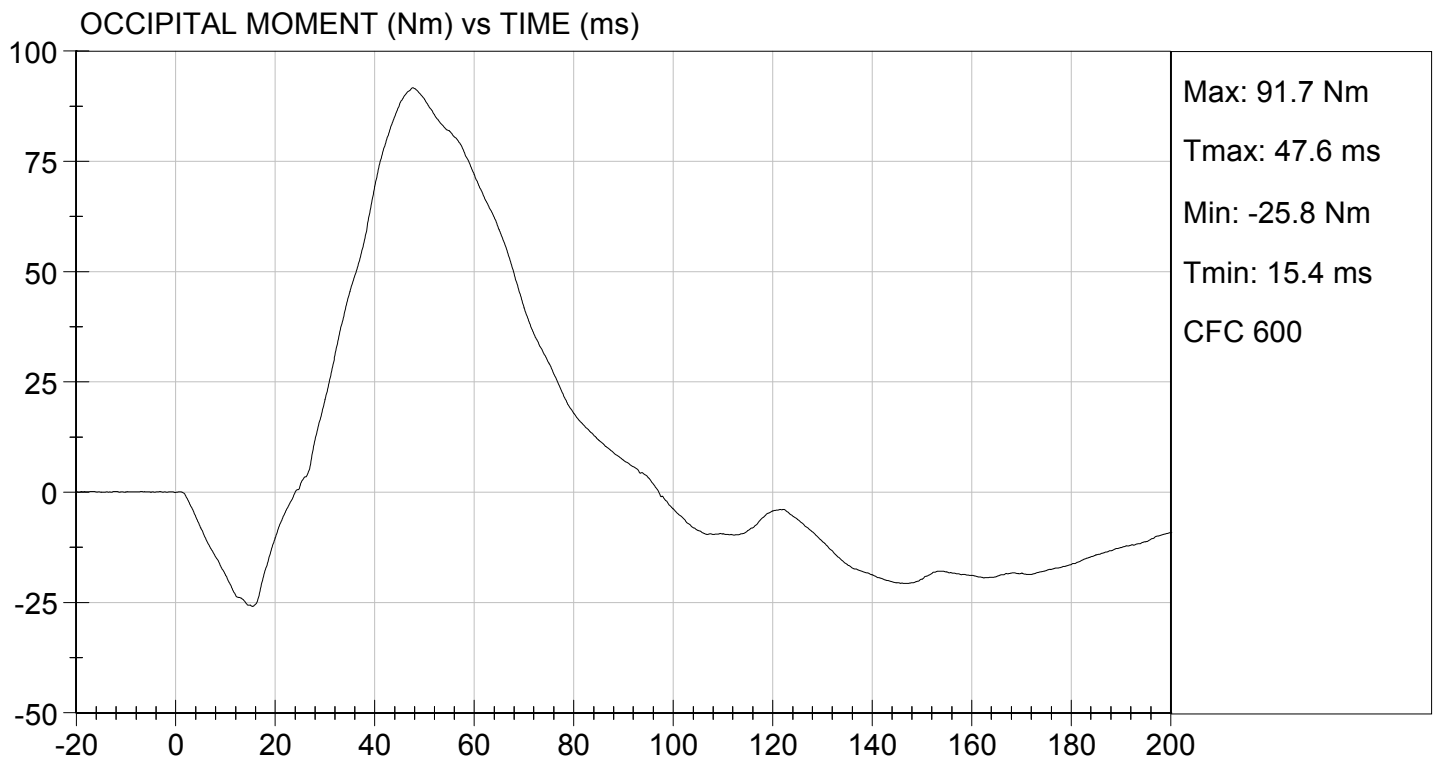
TEST DATE: 04/09/2013
TEST #: D131212





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

TEST DATE: 04/09/2013
TEST #: D131212

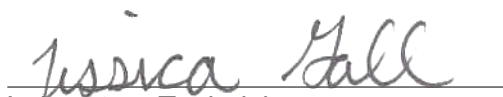


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

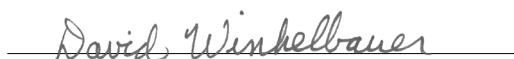
Test I.D: D131213

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	40	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.92	Pass
	20 ms	G's	14.00 to 19.00	14.77	Pass
	30 ms	G's	11.00 to 16.00	12.29	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	42.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	93.4	Pass
	Time	ms	72.0 to 82.0	78.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	156.4	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-58.7	Pass
	Time	ms	65.0 to 79.0	71.2	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.3	Pass
Overall Test Results					Pass


Laboratory Technician

04/09/2013

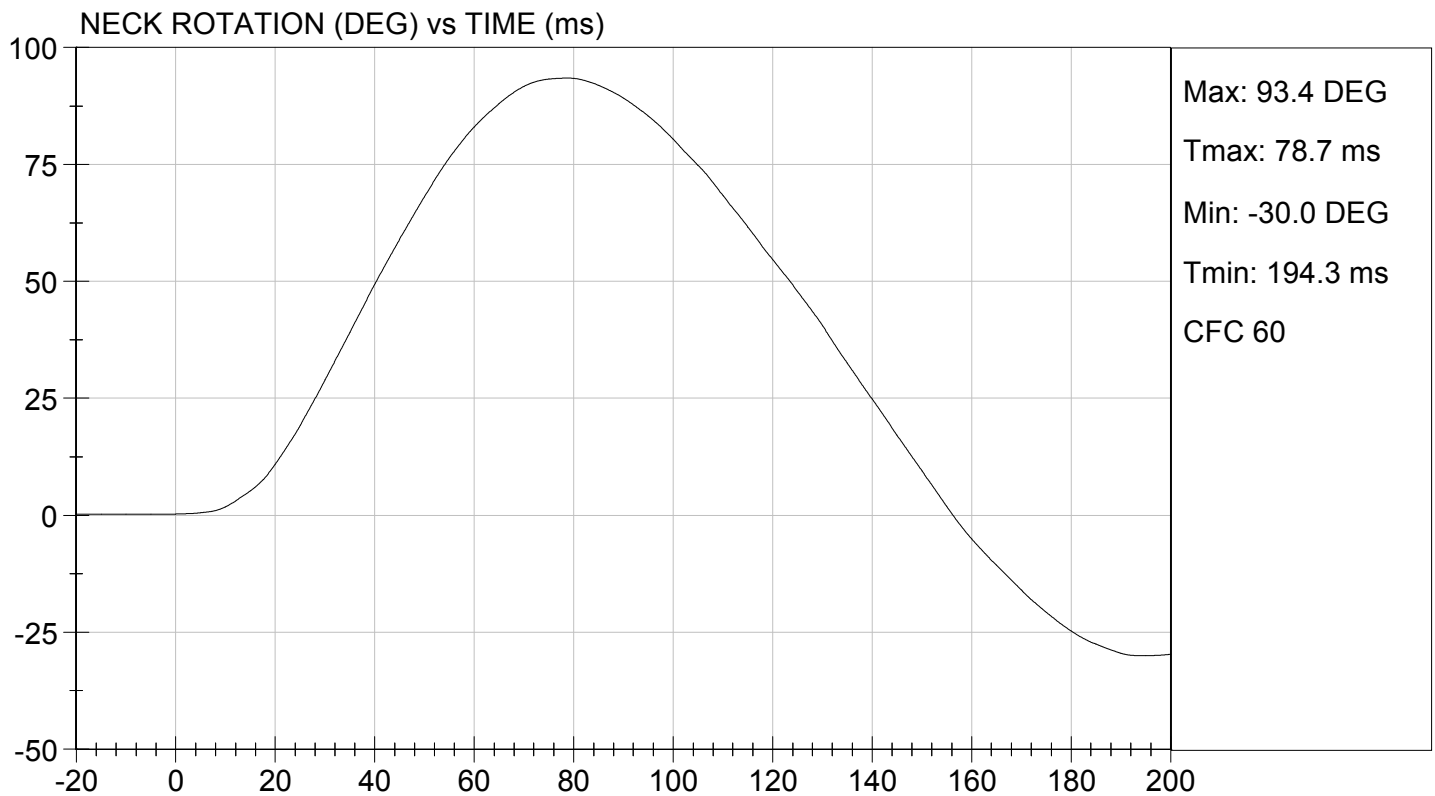
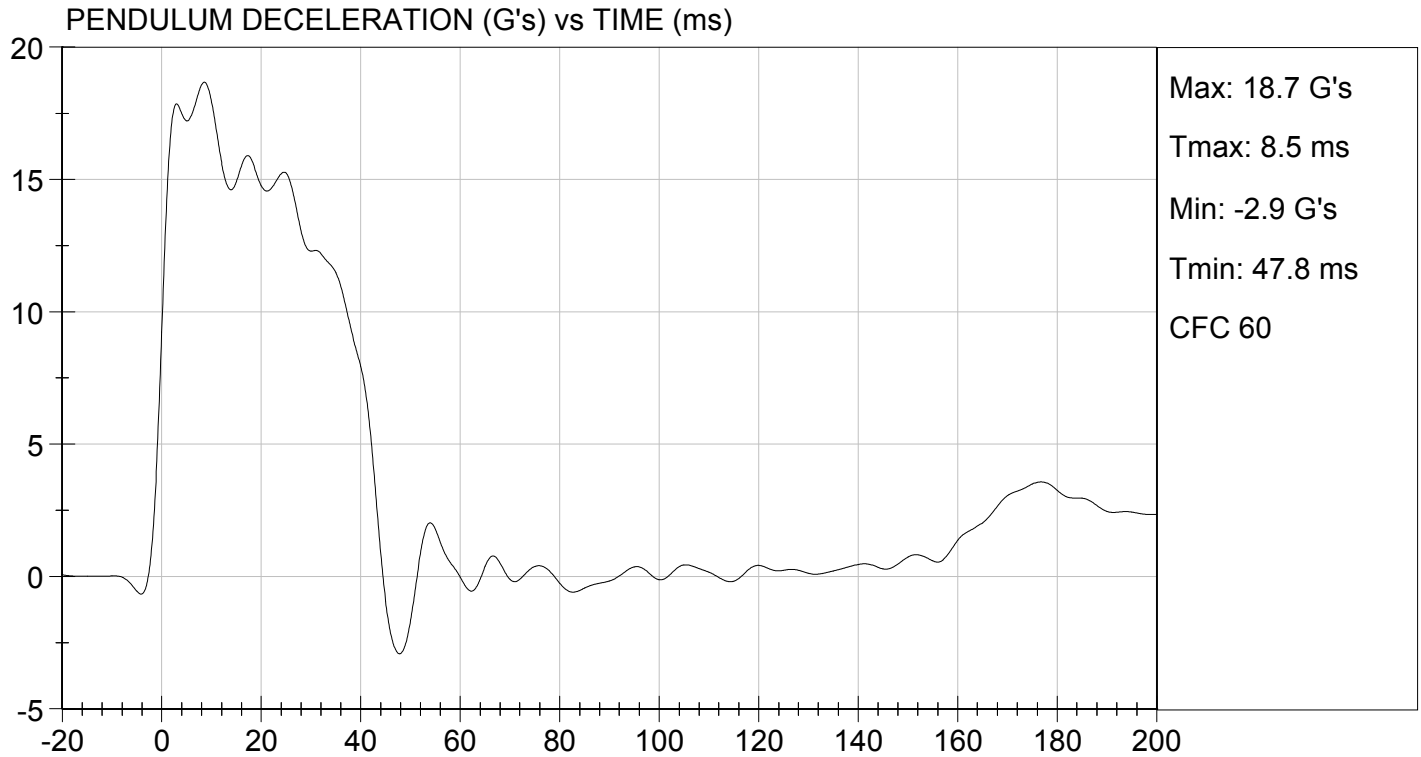
Test Date


Approved By



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

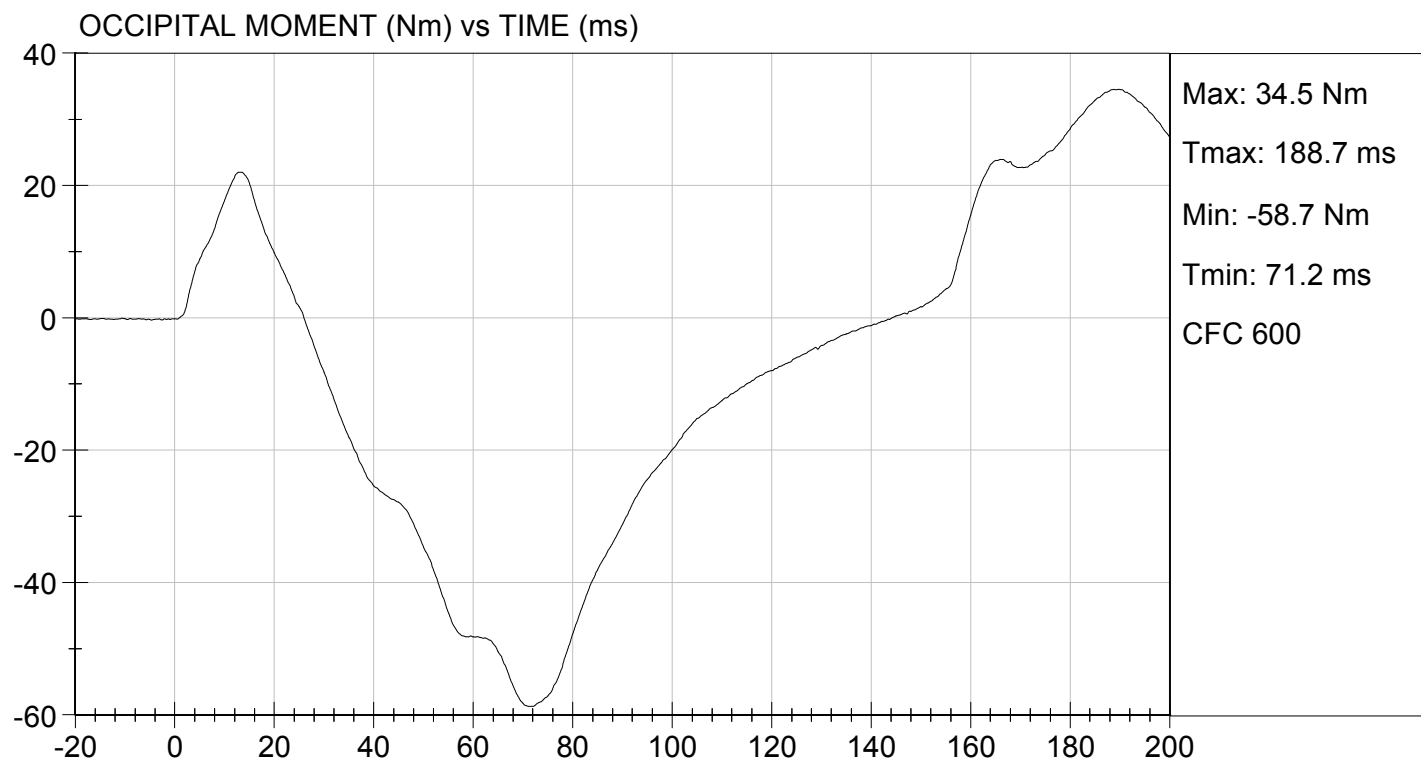
TEST DATE: 04/09/2013
TEST #: D131213





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

TEST DATE: 04/09/2013
TEST #: D131213



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D131214

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	40	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,345	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	7.09	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Overall Test Results			Pass	


Laboratory Technician

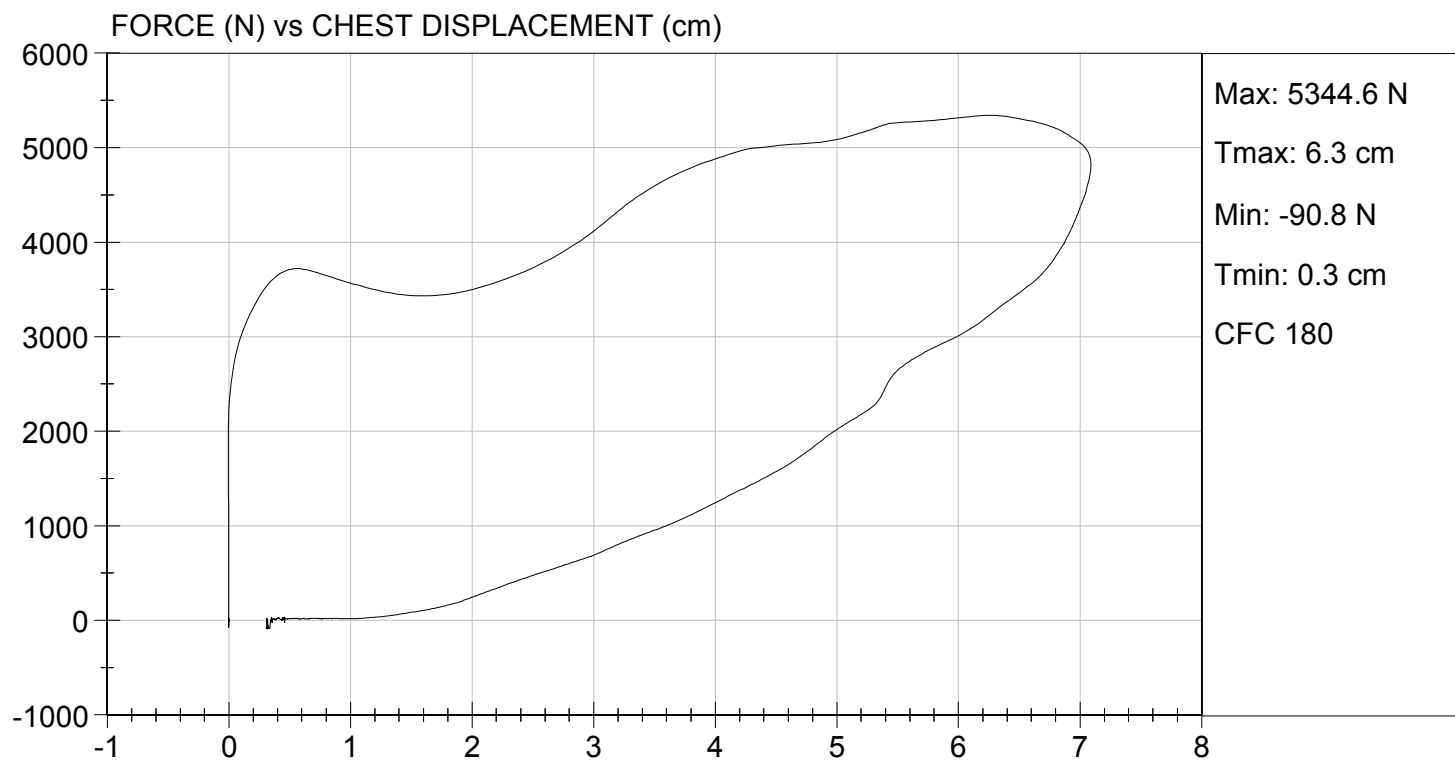
04/09/2013
Test Date


Approved By



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

TEST DATE: 04/09/2013
TEST #: D131214



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

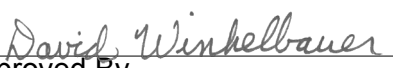
ATD Serial No: 351

Test I.D: D131215

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	40	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	5,303	Pass
Overall Test Results				Pass


Laboratory Technician

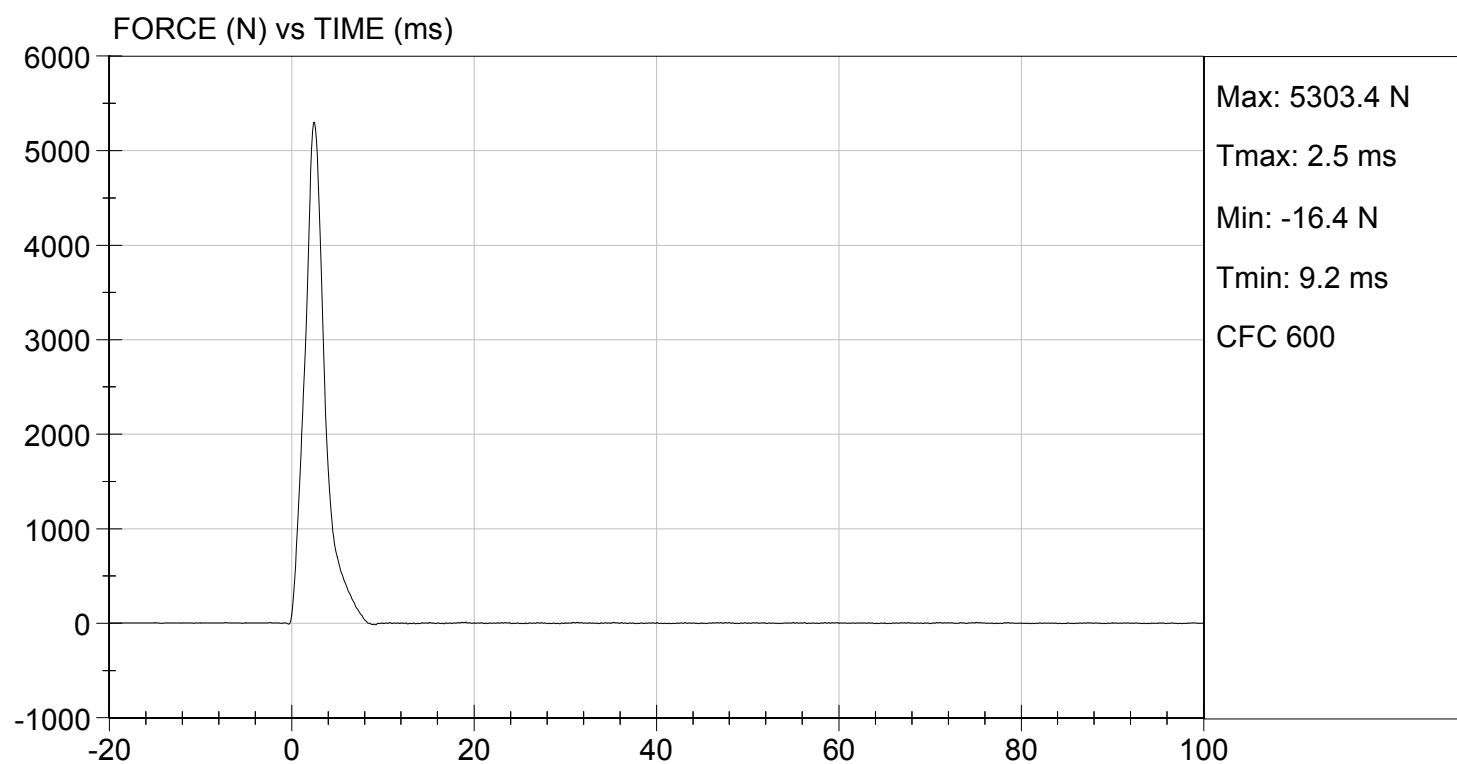
04/09/2013
Test Date


Approved By



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

TEST DATE: 04/09/2013
TEST #: D131215



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

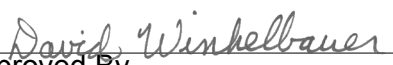
ATD Serial No: 351

Test I.D: D131216

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	40	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	4,762	Pass
Overall Test Results				Pass


Laboratory Technician

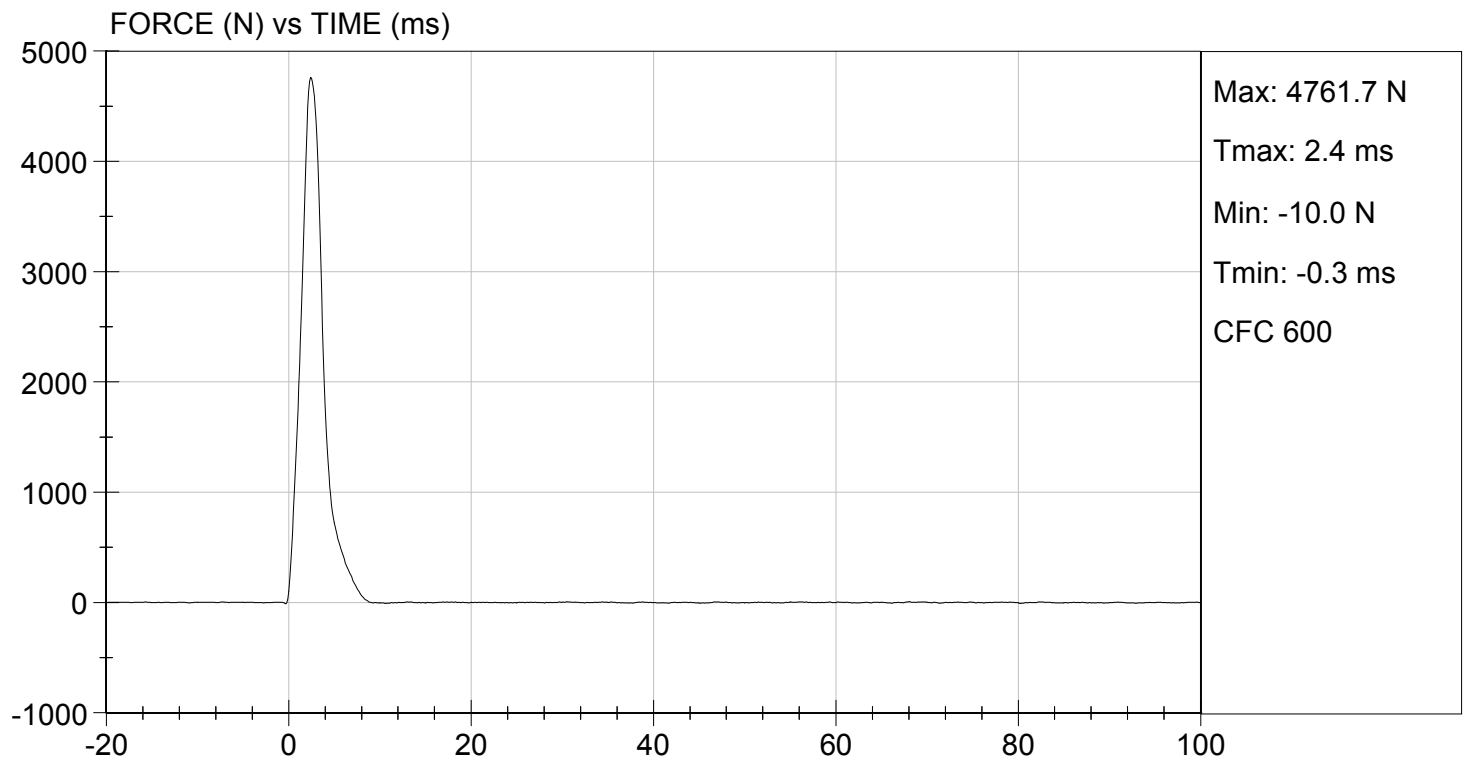
04/09/2013
Test Date


Approved By



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

TEST DATE: 04/09/2013
TEST #: D131216



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

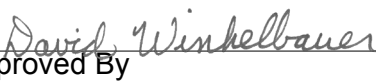
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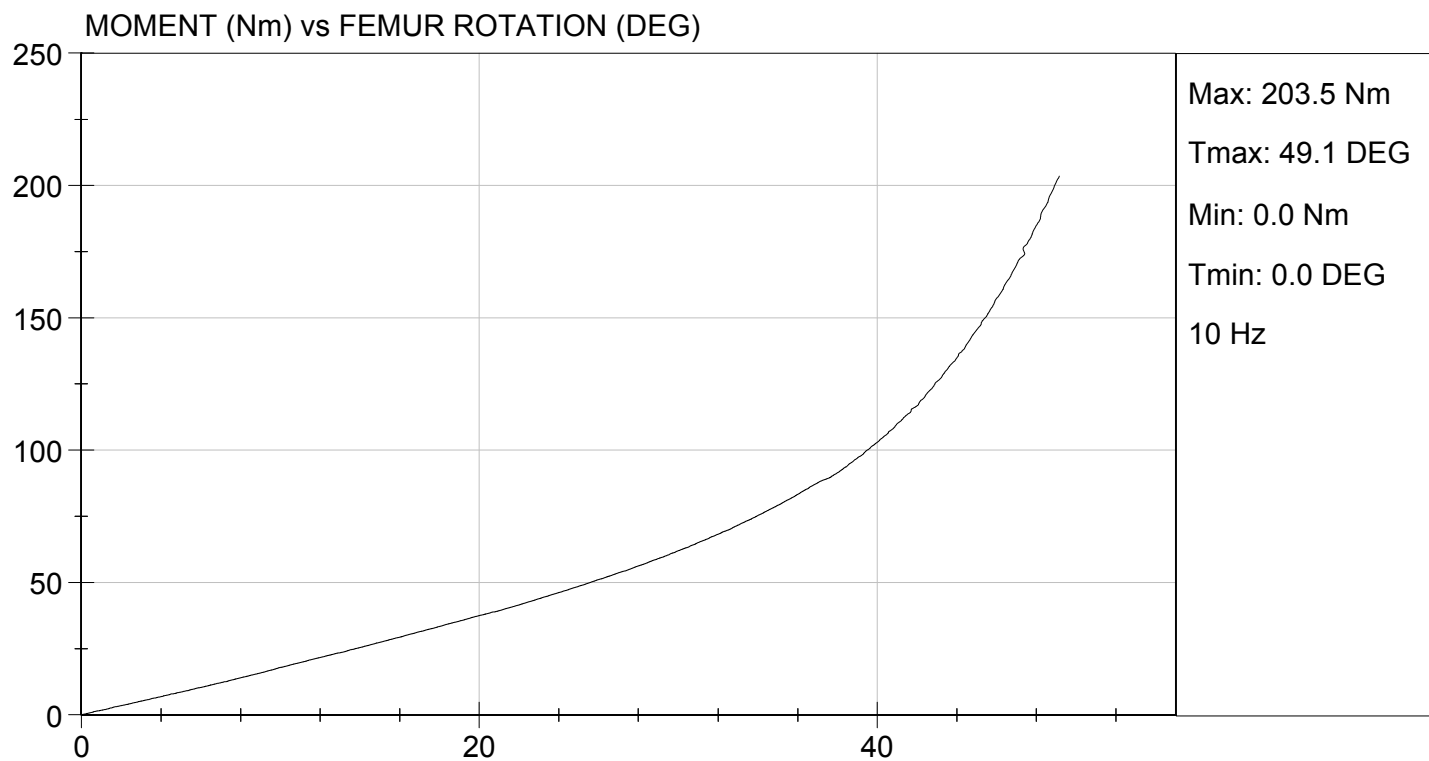
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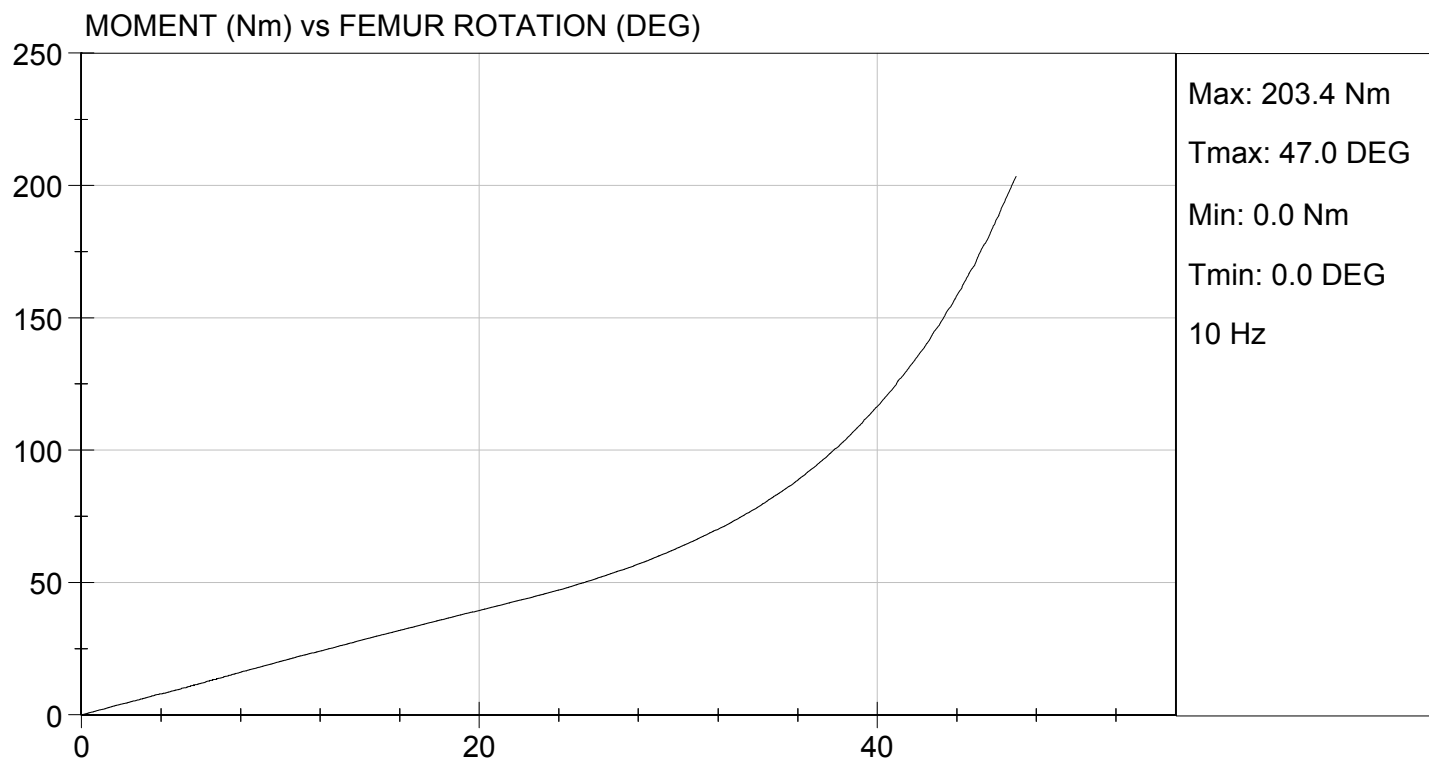
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	40	40	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	62.0	63.2	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	49.1	47.0	Pass
Overall Test Results					Pass


 Laboratory Technician

04/09/2013
 Test Date


 Approved By





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

ATD Serial No: 351

Test ID: D131251

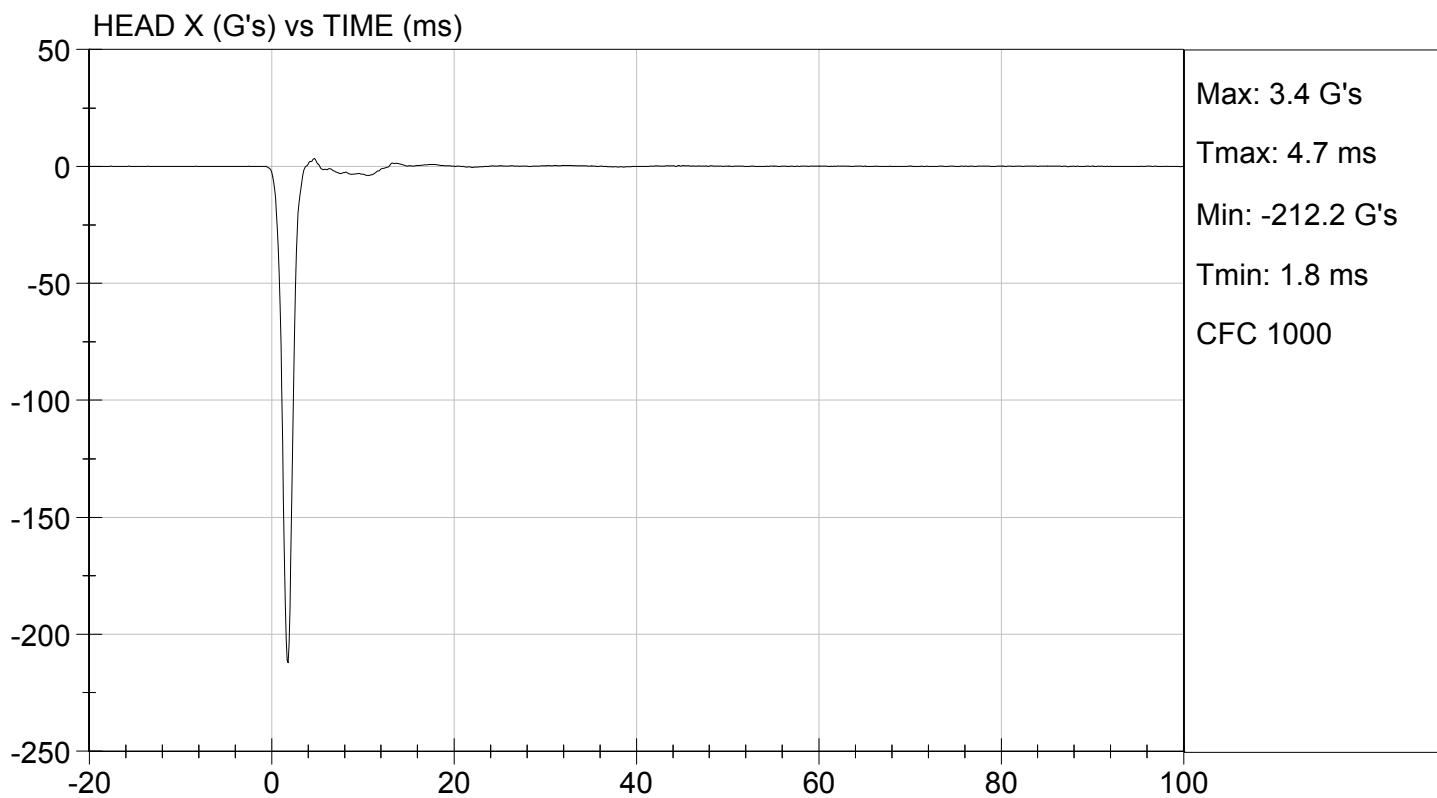
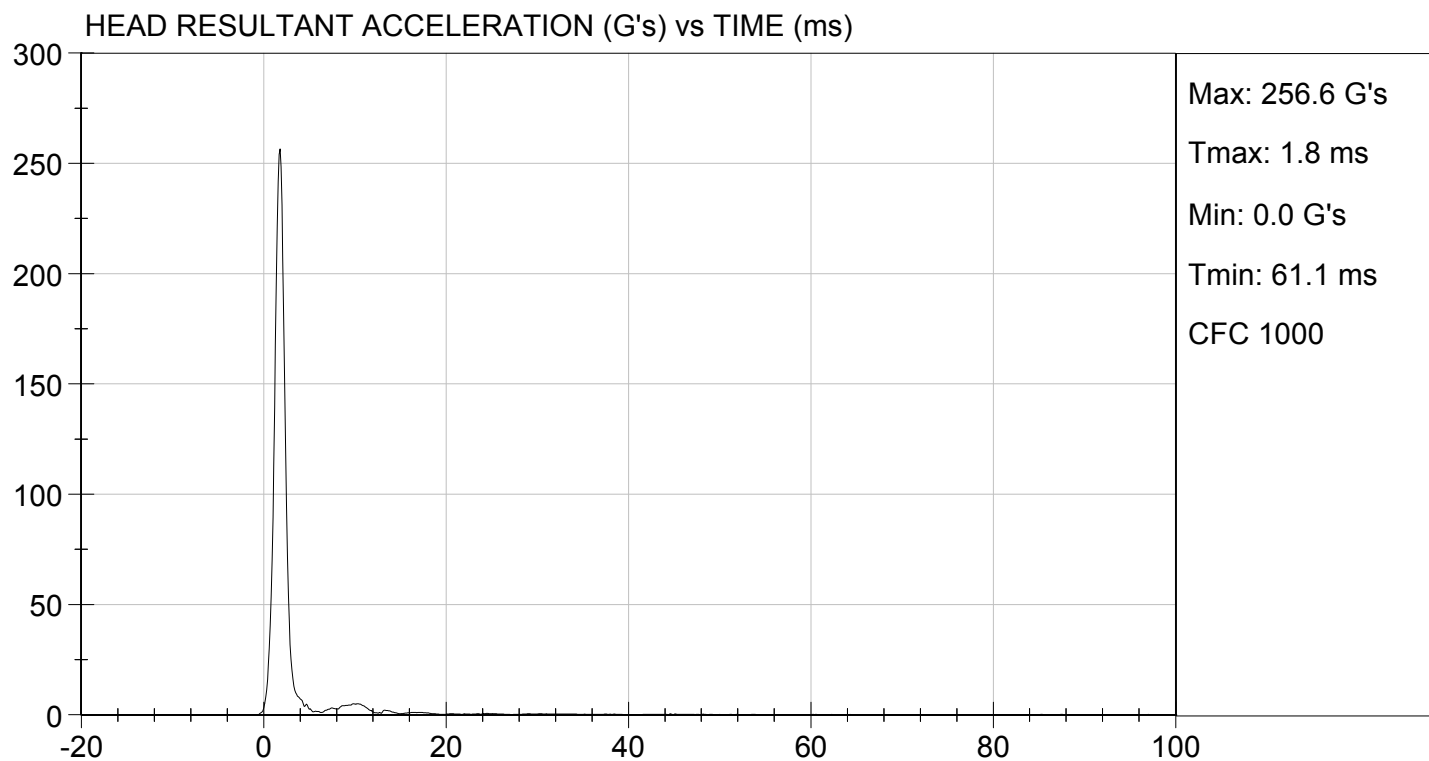
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Peak Resultant Acceleration	G's	225 to 275	257	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	2.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

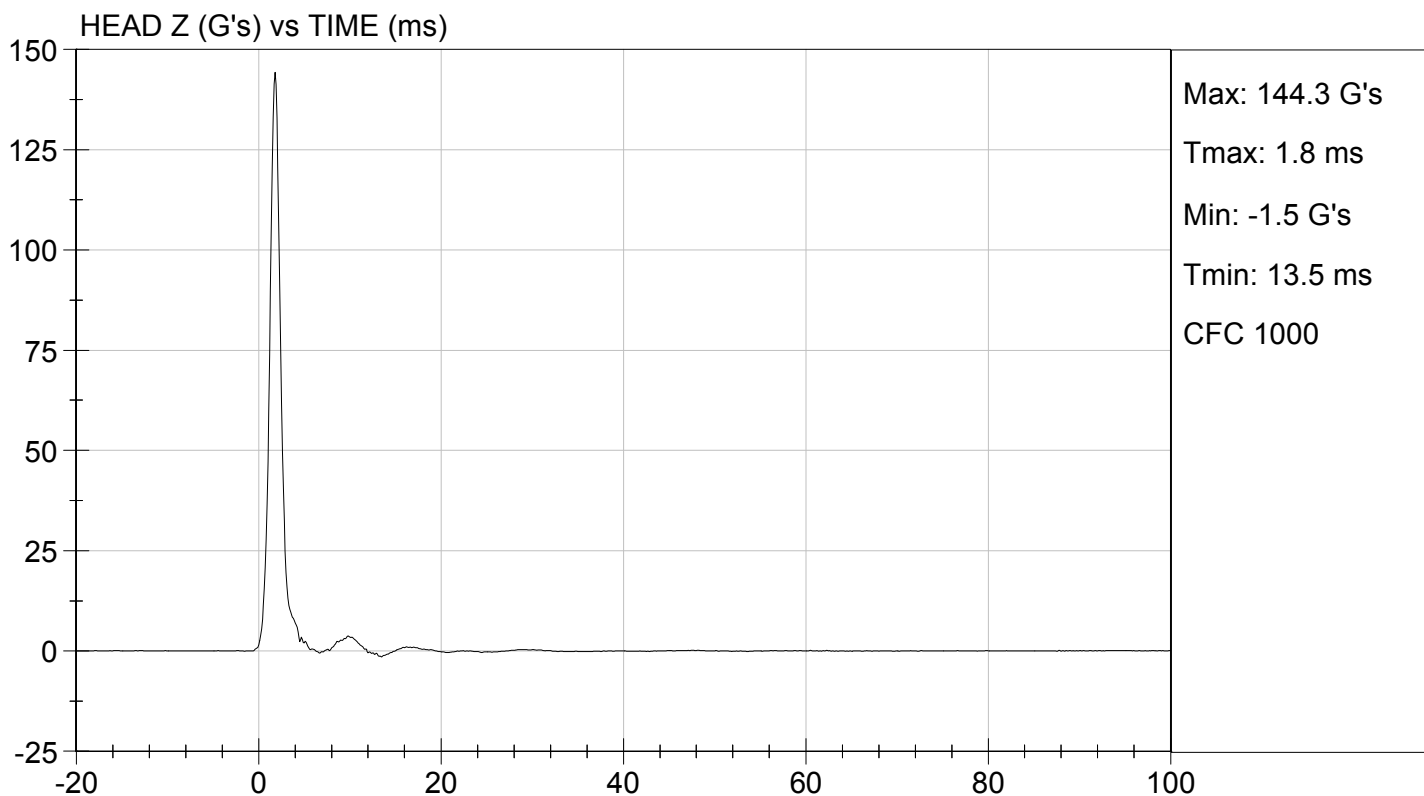
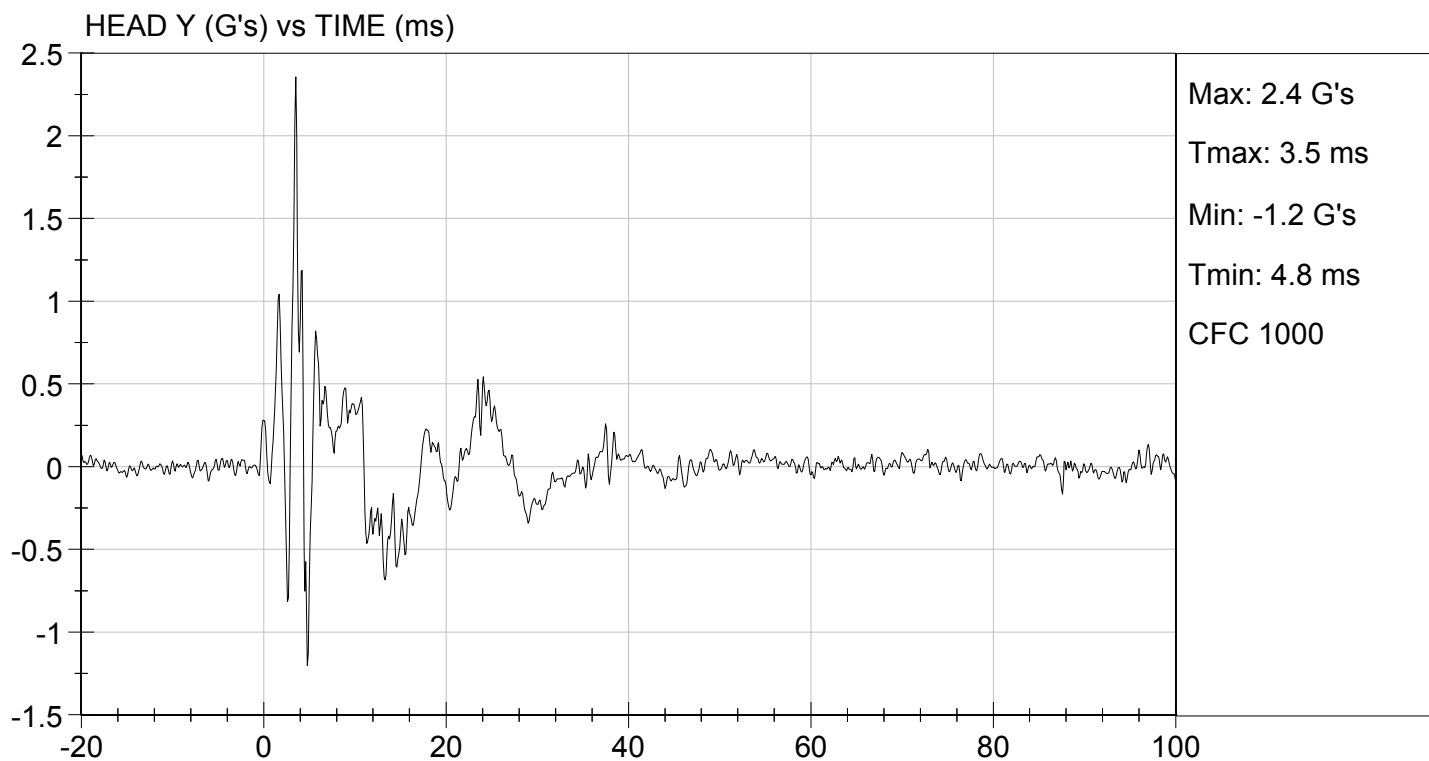

Laboratory Technician

04/10/2013

Test Date


Approved By



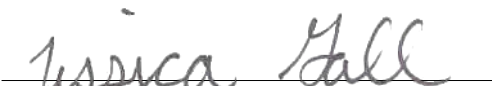


MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

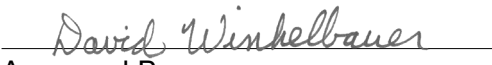
Test I.D: D131252

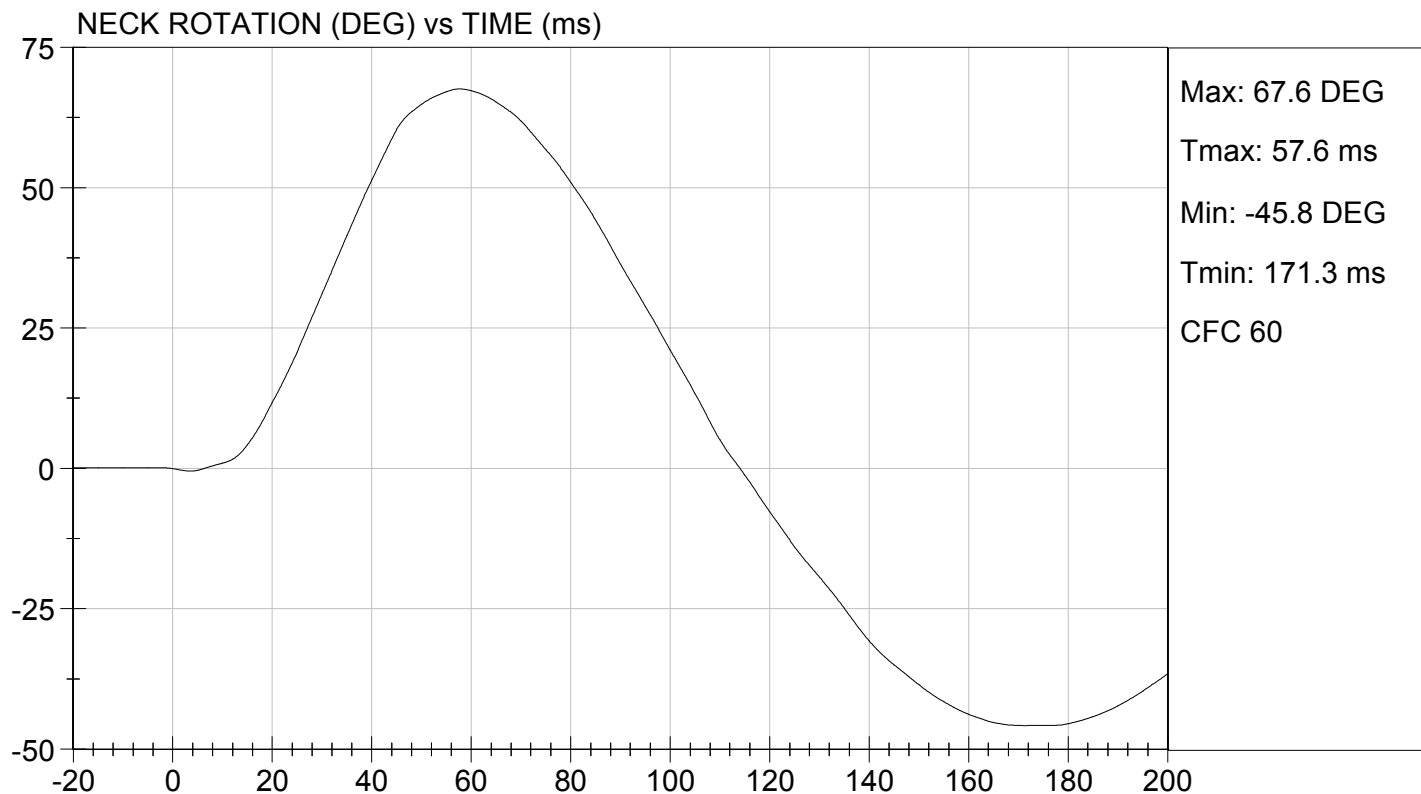
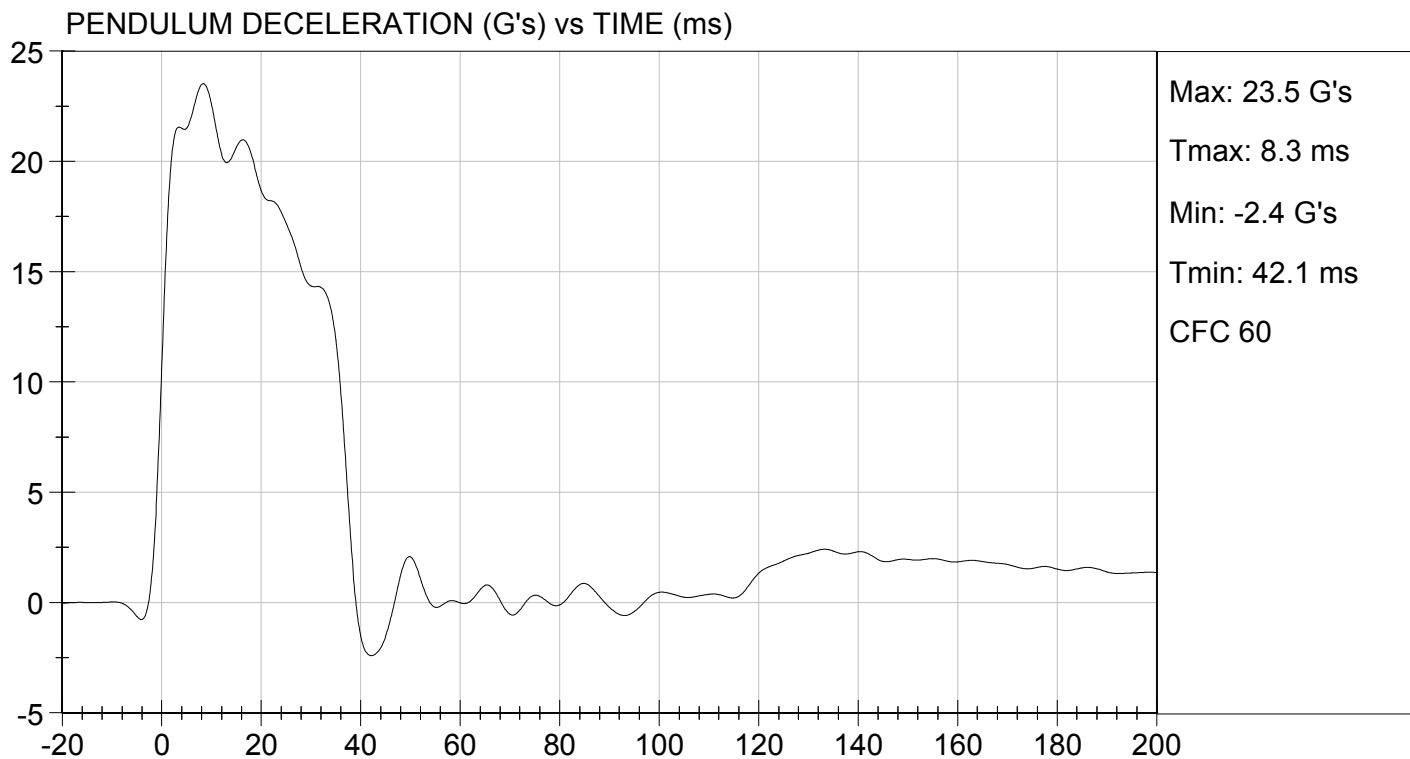
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	33	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.56	Pass
	20 ms	G's	17.60 to 22.60	18.68	Pass
	30 ms	G's	12.50 to 18.50	14.31	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	37.4	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	67.6	Pass
	Time	ms	57.0 to 64.0	57.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.2	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	93.5	Pass
	Time	ms	47.0 to 58.0	49.7	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	99.2	Pass
Overall Test Results					Pass


 Laboratory Technician

04/11/2013

Test Date

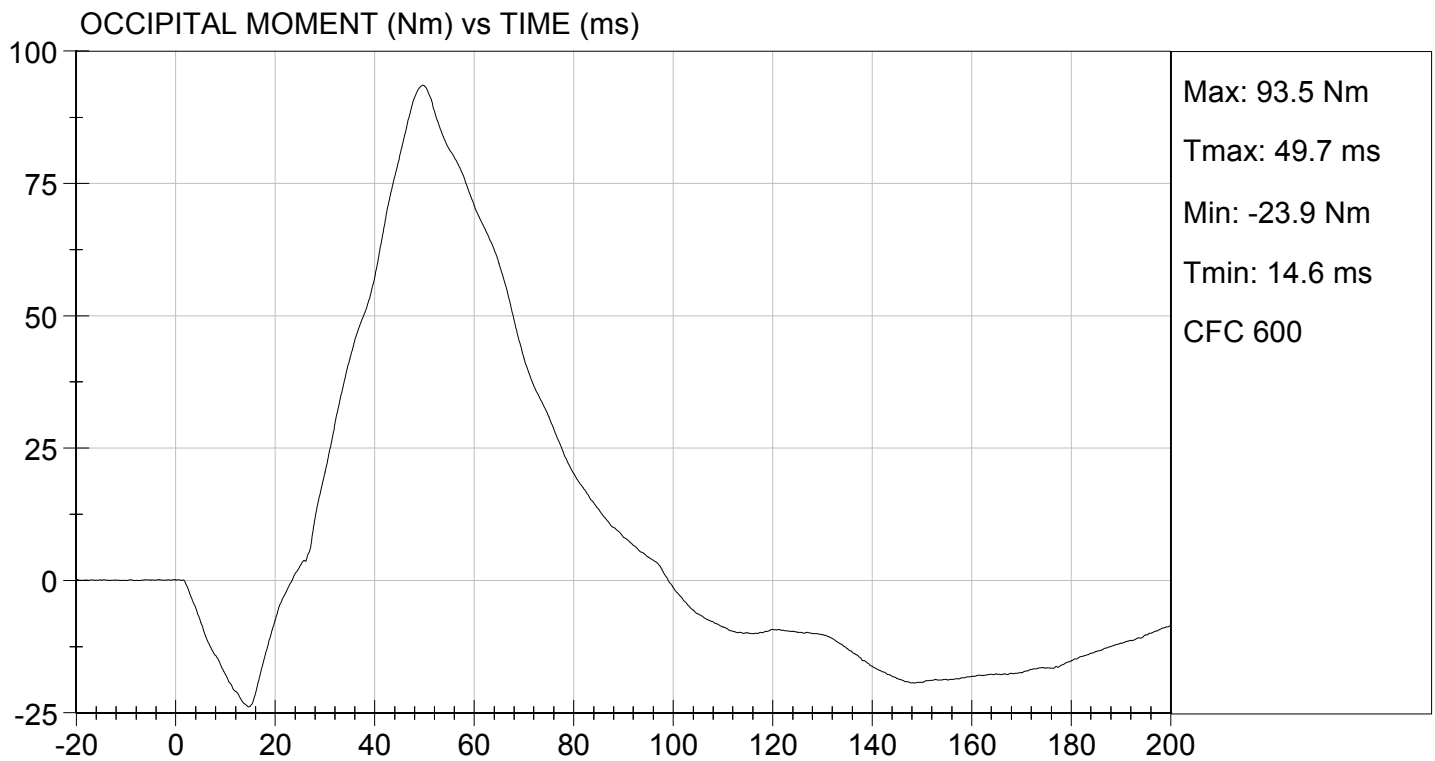

 Approved By





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

TEST DATE: 04/11/2013
TEST #: D131252

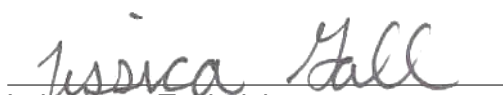


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

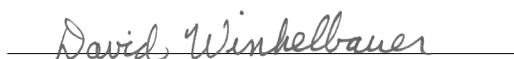
Test I.D: D131253

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	33	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.87	Pass
	20 ms	G's	14.00 to 19.00	16.38	Pass
	30 ms	G's	11.00 to 16.00	13.05	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.0	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	39.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.1	Pass
	Time	ms	72.0 to 82.0	77.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	156.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-61.9	Pass
	Time	ms	65.0 to 79.0	70.6	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	142.6	Pass
Overall Test Results					Pass


Laboratory Technician

04/11/2013

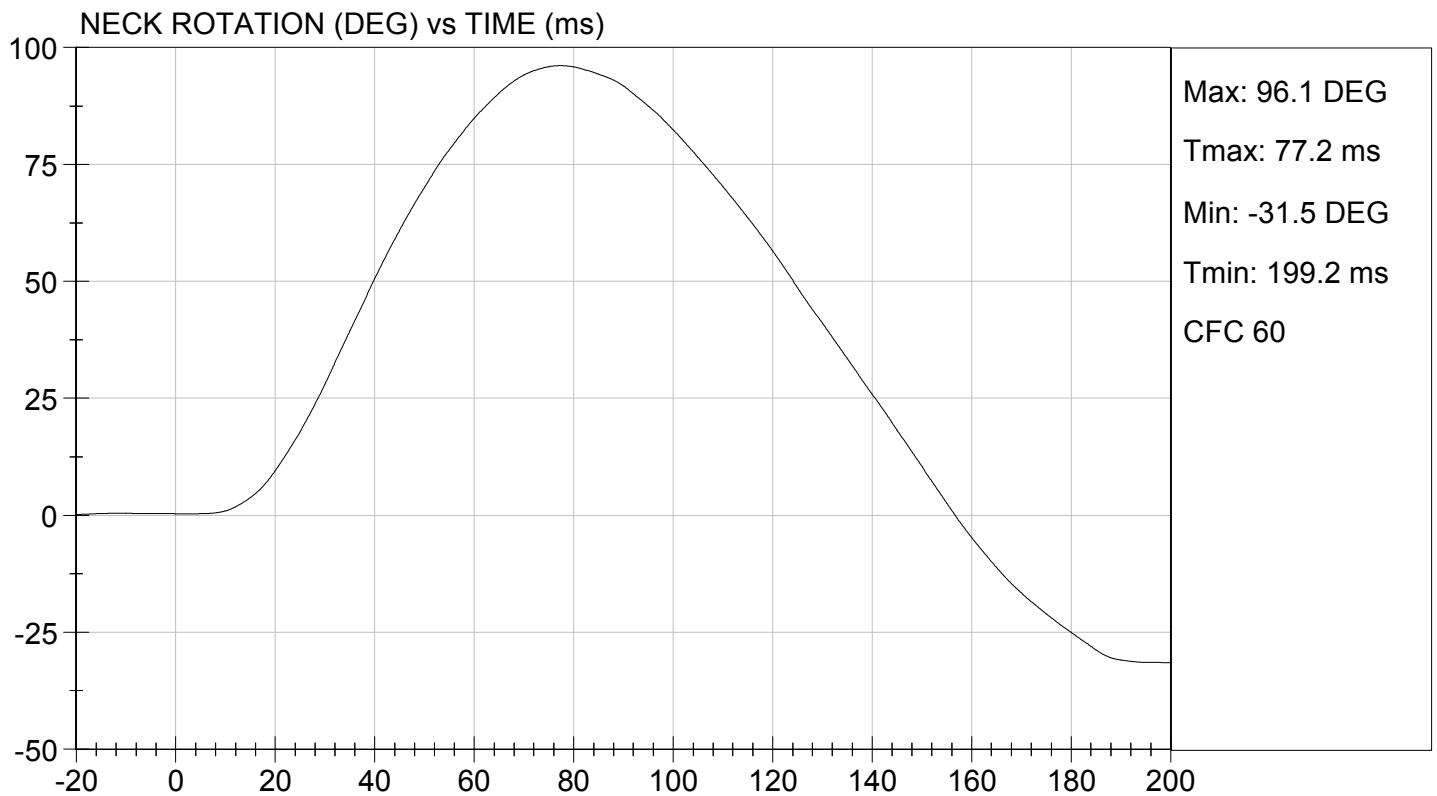
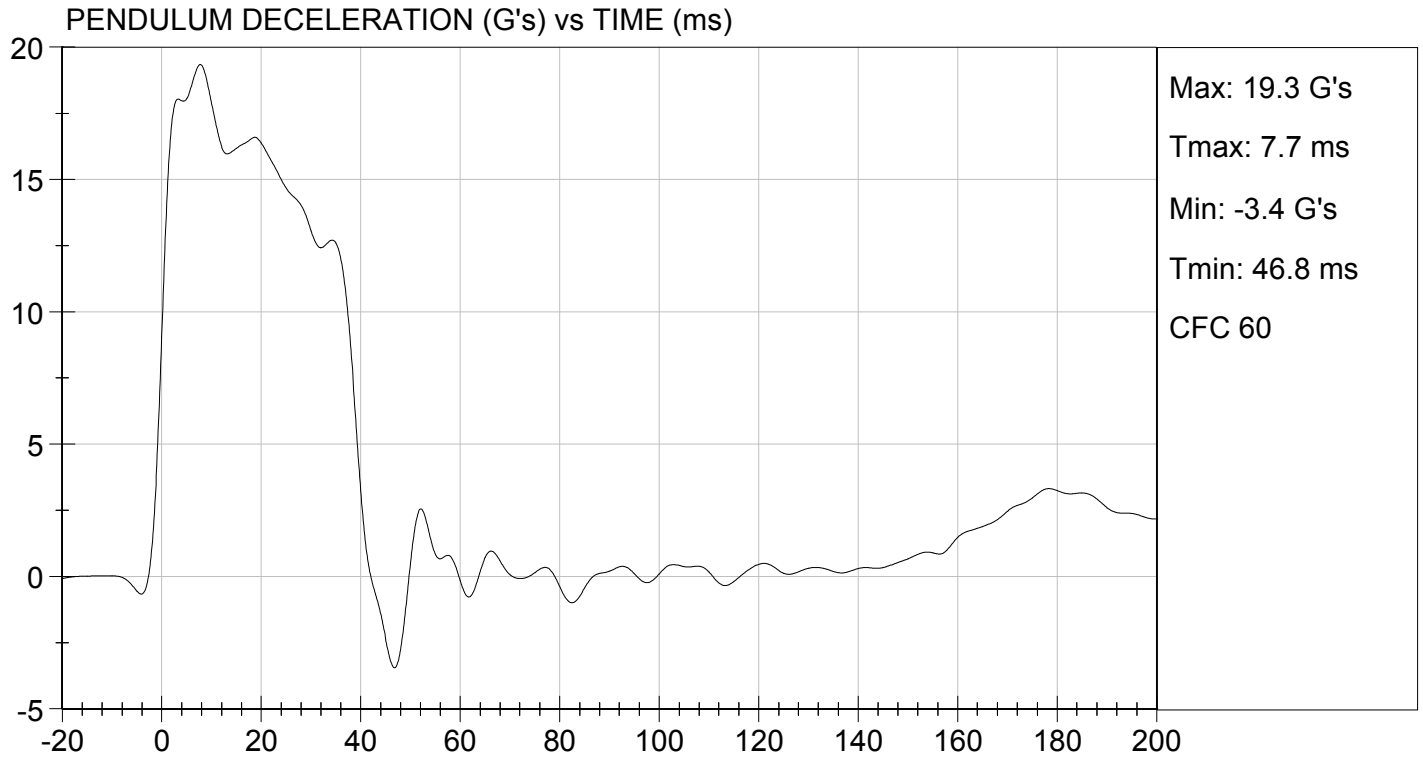
Test Date


Approved By



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

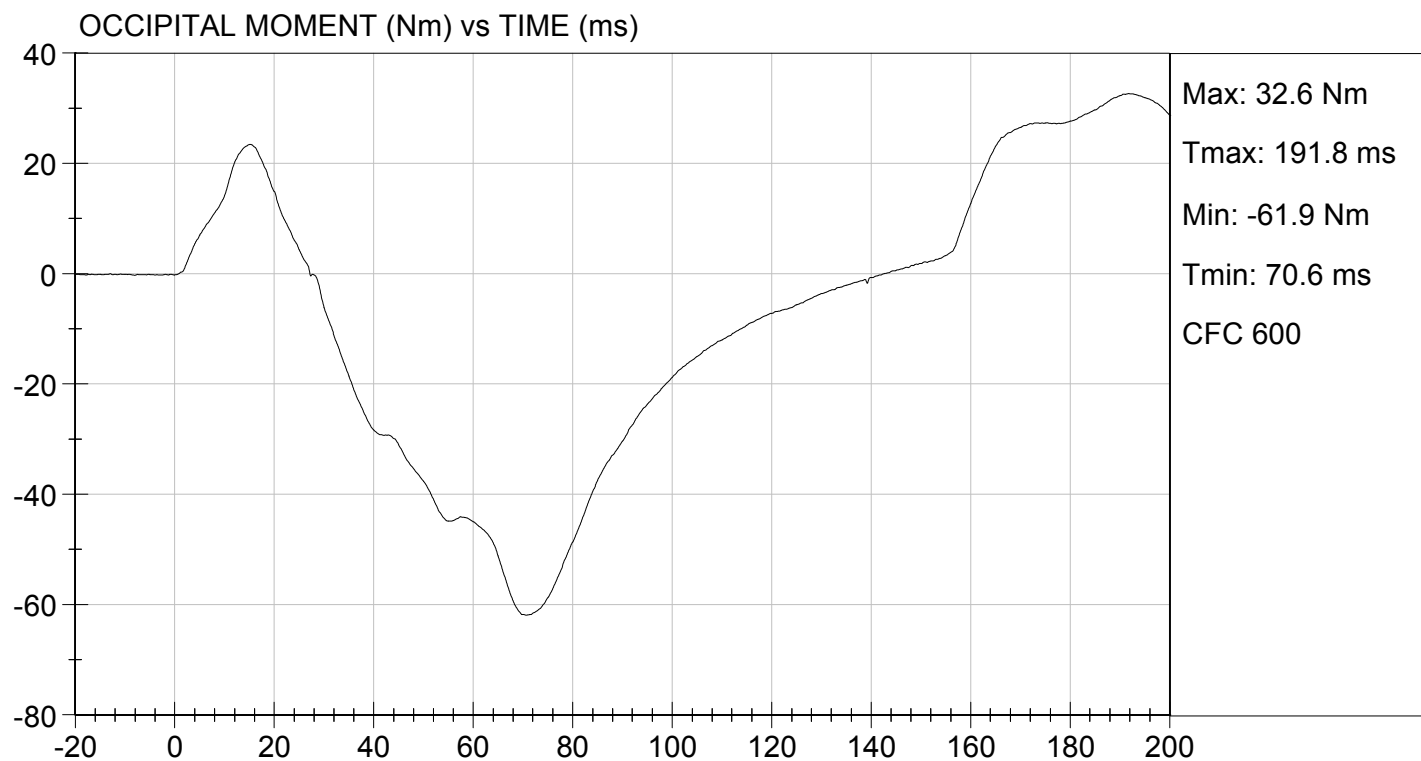
TEST DATE: 04/11/2013
TEST #: D131253





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

TEST DATE: 04/11/2013
TEST #: D131253



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D131254

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	35	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,198	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.46	Pass
Internal Hysteresis	%	69 to 85	70	Pass
			Overall Test Results	Pass


Laboratory Technician

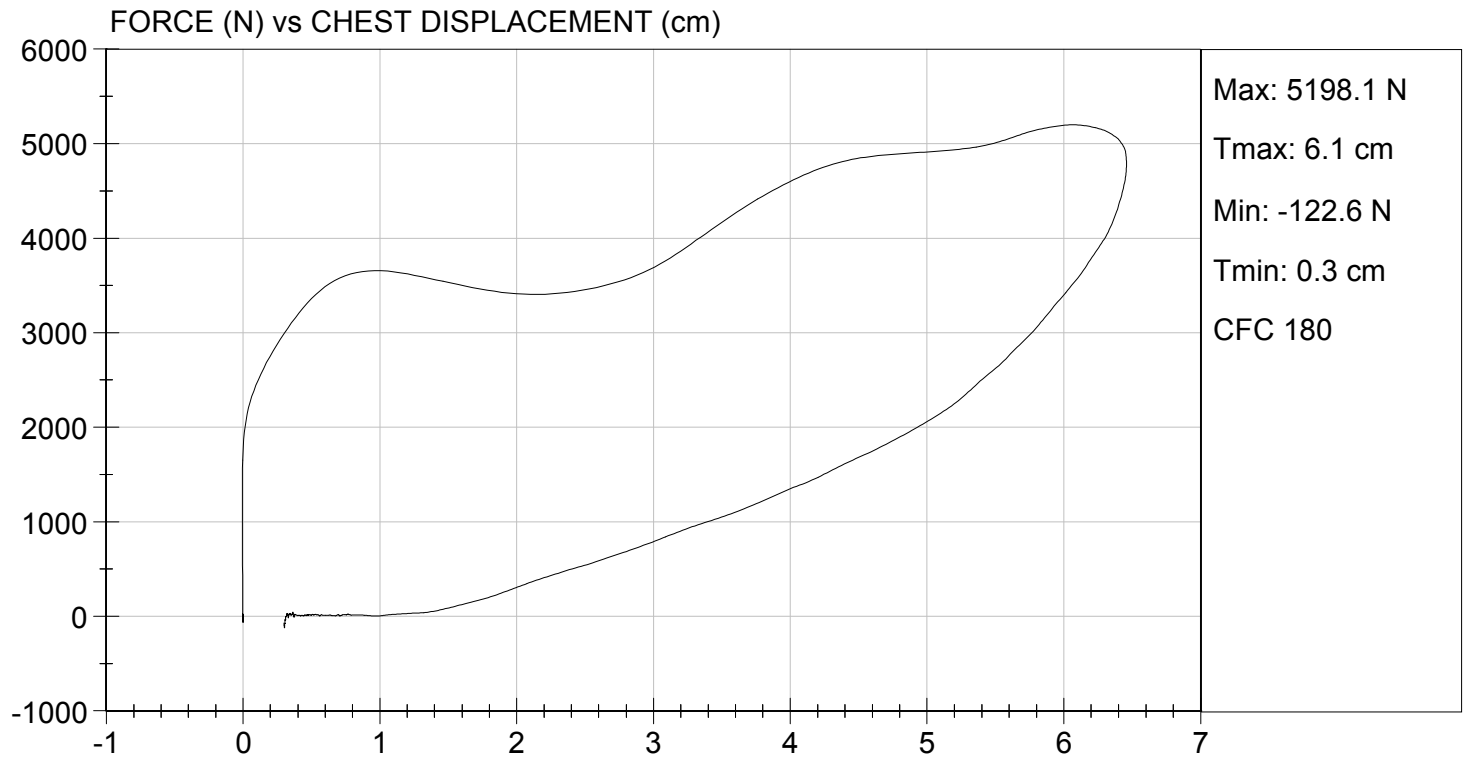
04/10/2013
Test Date


Approved By



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

TEST DATE: 04/10/2013
TEST #: D131254



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

ATD Serial No: 351

Test I.D: D131255

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	34	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,378	Pass
Overall Test Results				Pass


Laboratory Technician

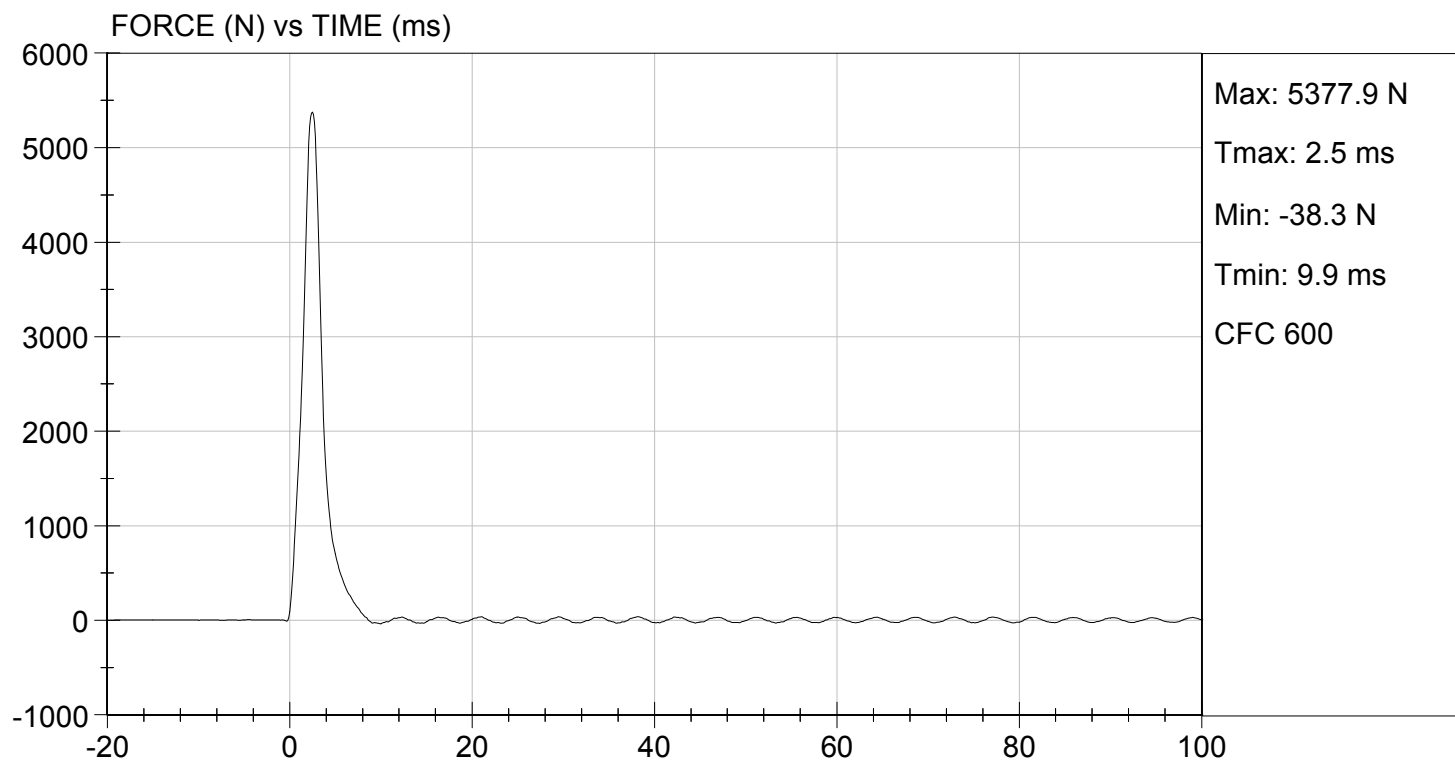
04/10/2013
Test Date


Approved By



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

TEST DATE: 04/10/2013
TEST #: D131255



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

ATD Serial No: 351

Test I.D: D131256

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	34	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,504	Pass
Overall Test Results				Pass


Laboratory Technician

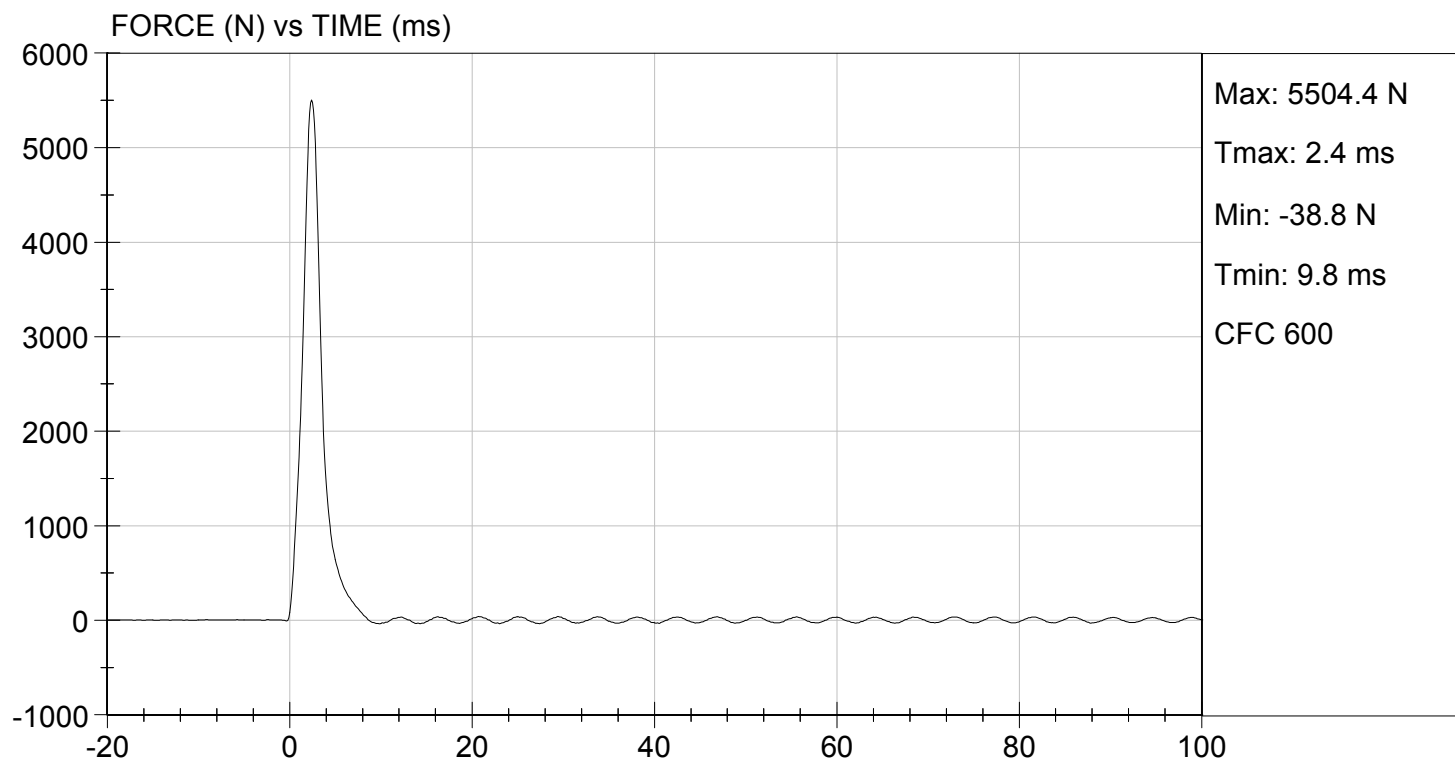
04/10/2013
Test Date


Approved By



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

TEST DATE: 04/10/2013
TEST #: D131256

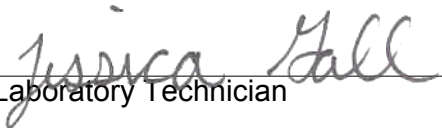


MGA RESEARCH CORPORATION
HIP-FEMUR FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

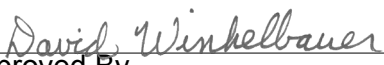
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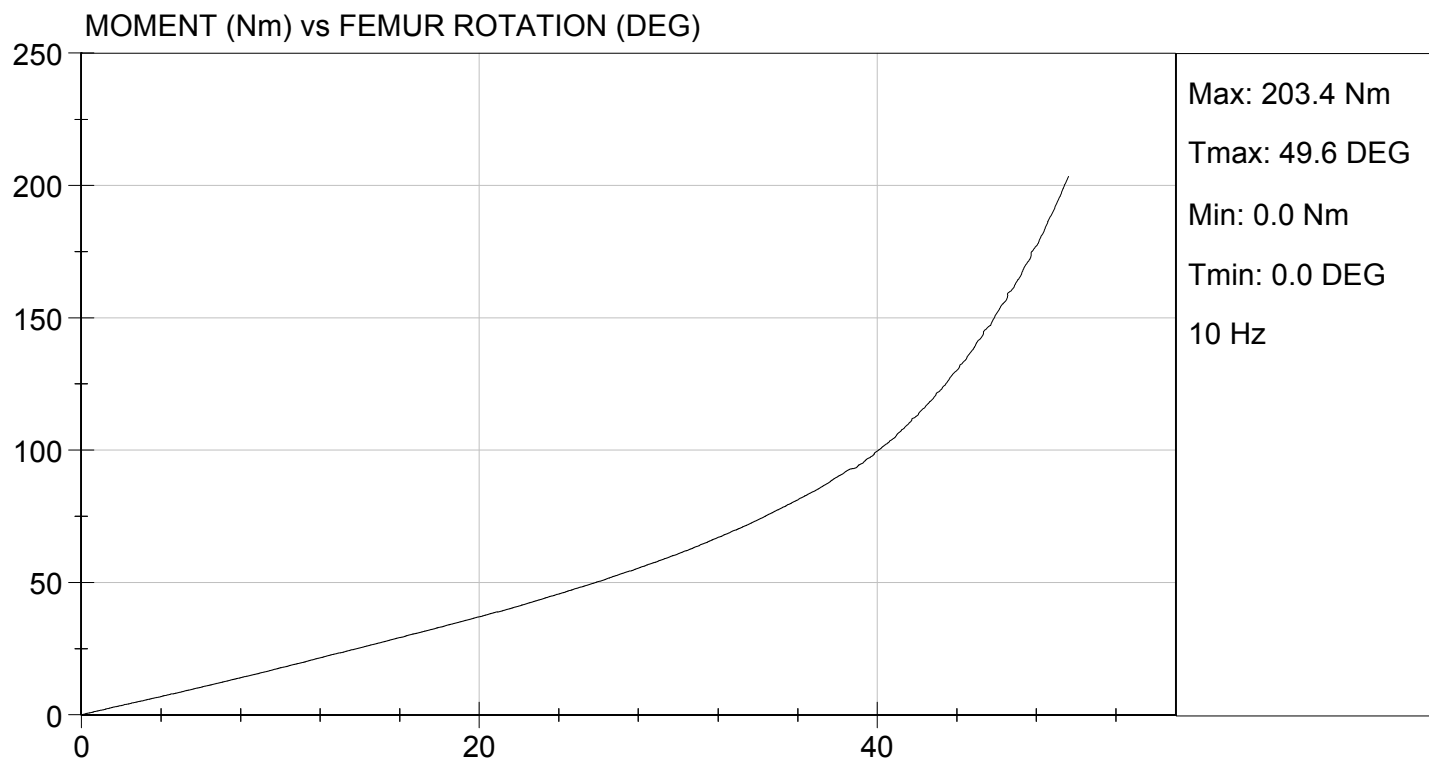
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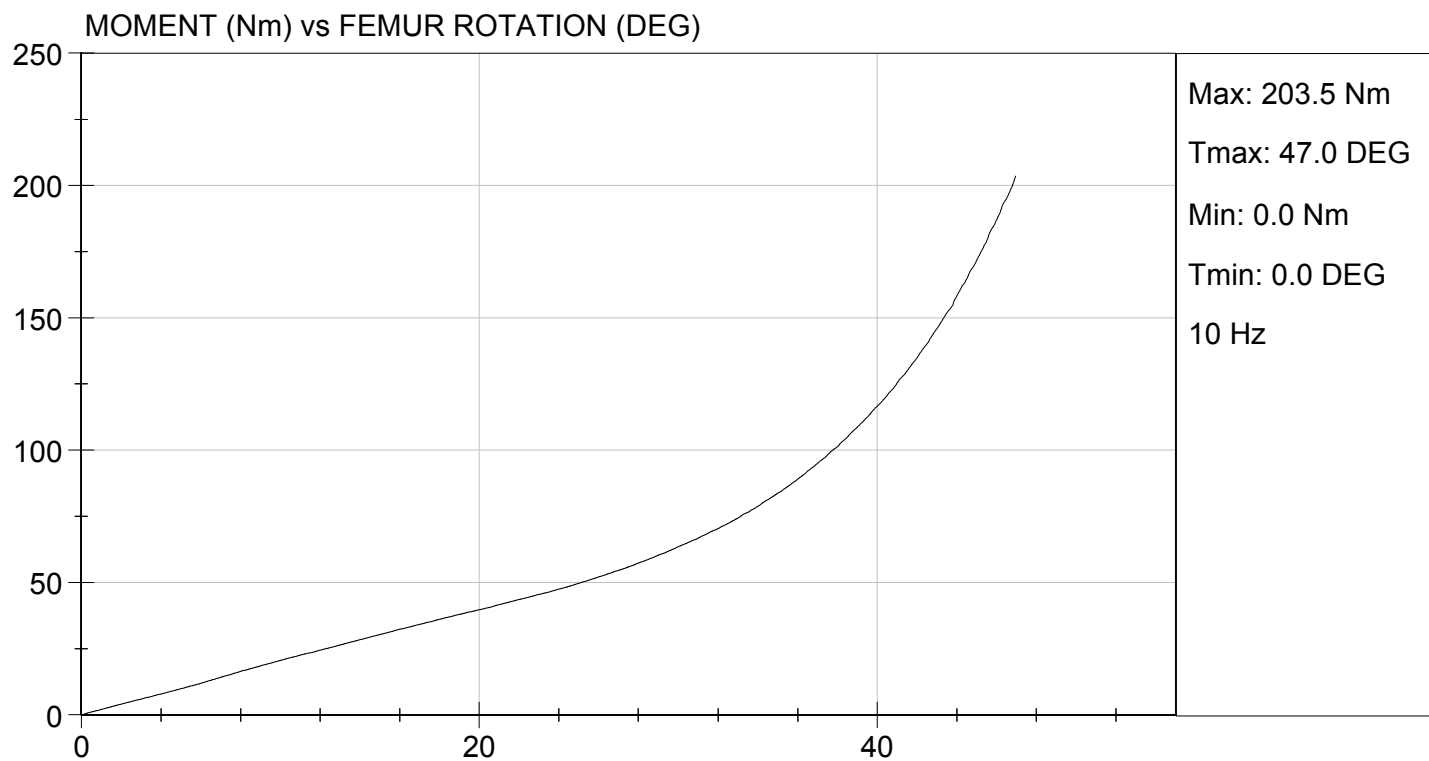
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.4	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	34	34	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	60.9	63.5	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	49.6	47.0	Pass
Overall Test Results					Pass


Laboratory Technician

04/10/2013
Test Date


Approved By





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

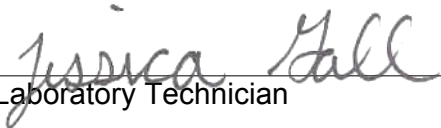
HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	184.6
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	221.0
Q	STANDING HEIGHT	(THEORETICAL)	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

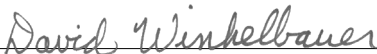
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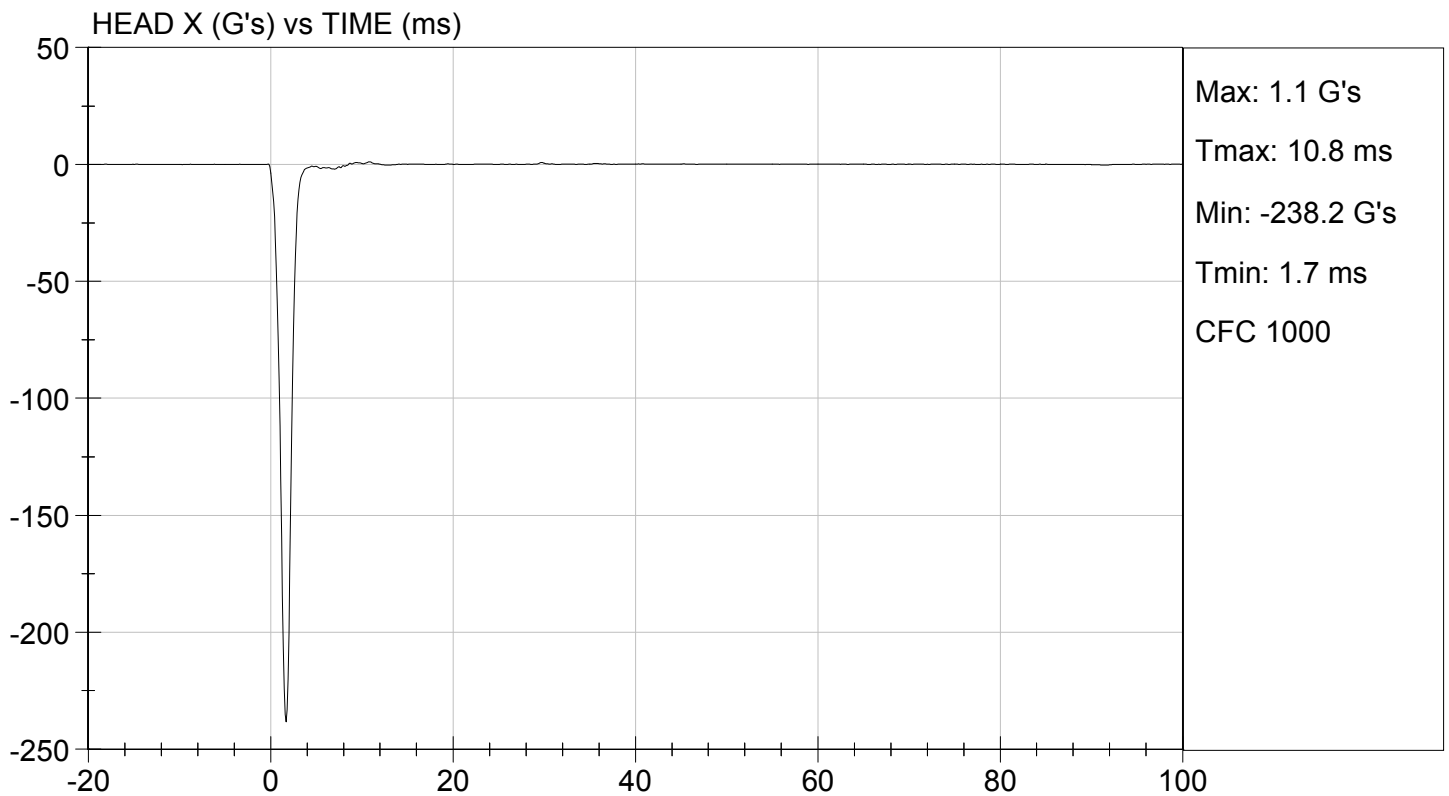
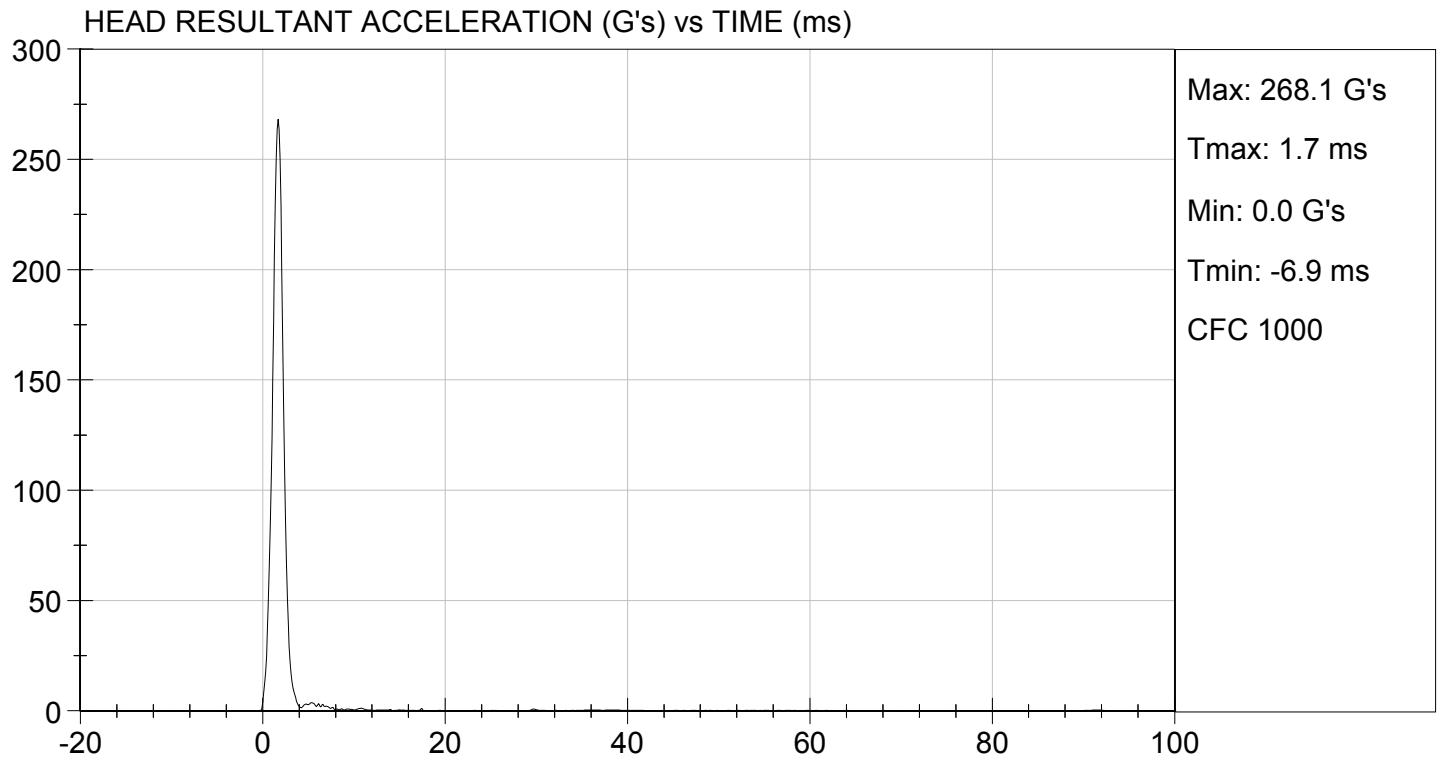
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	250 to 300	268	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-10.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

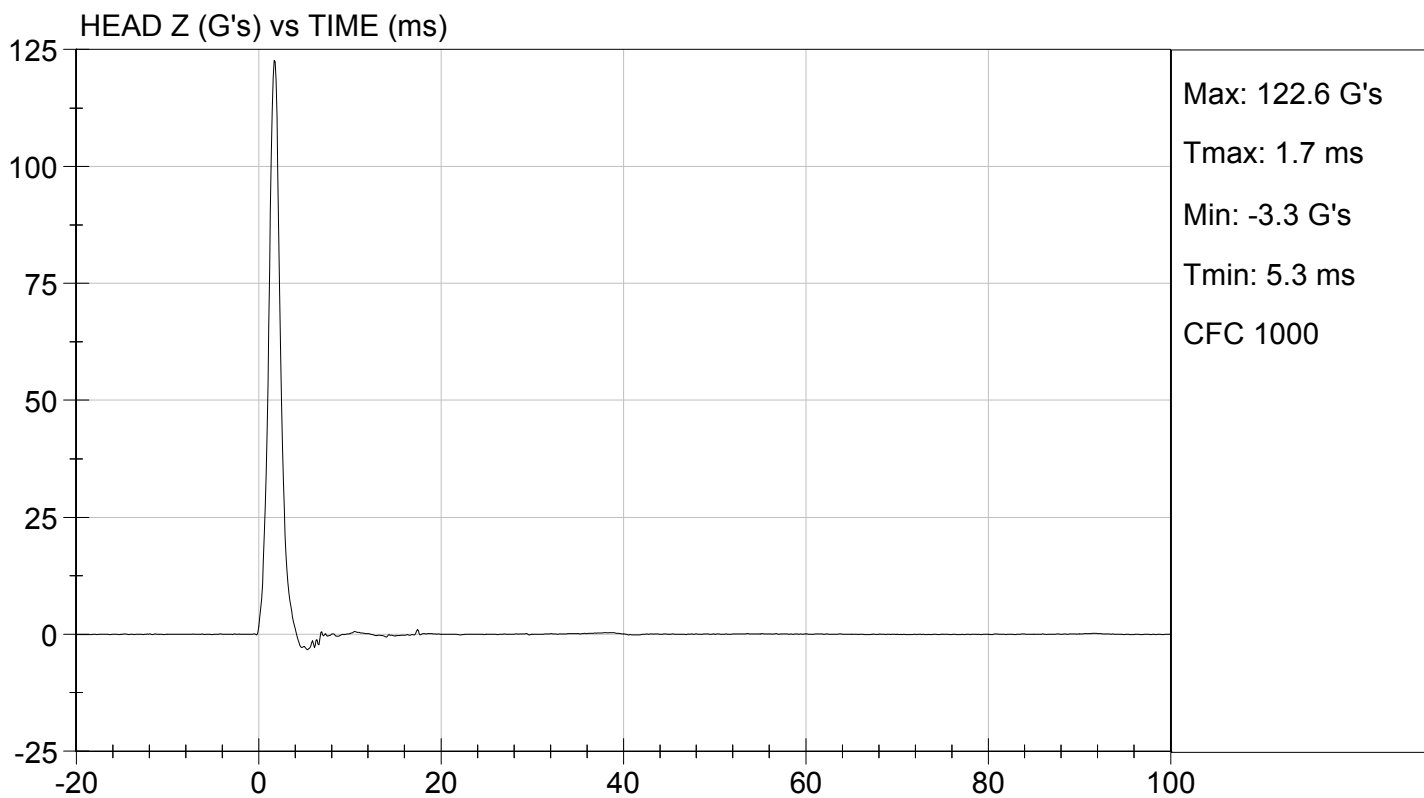
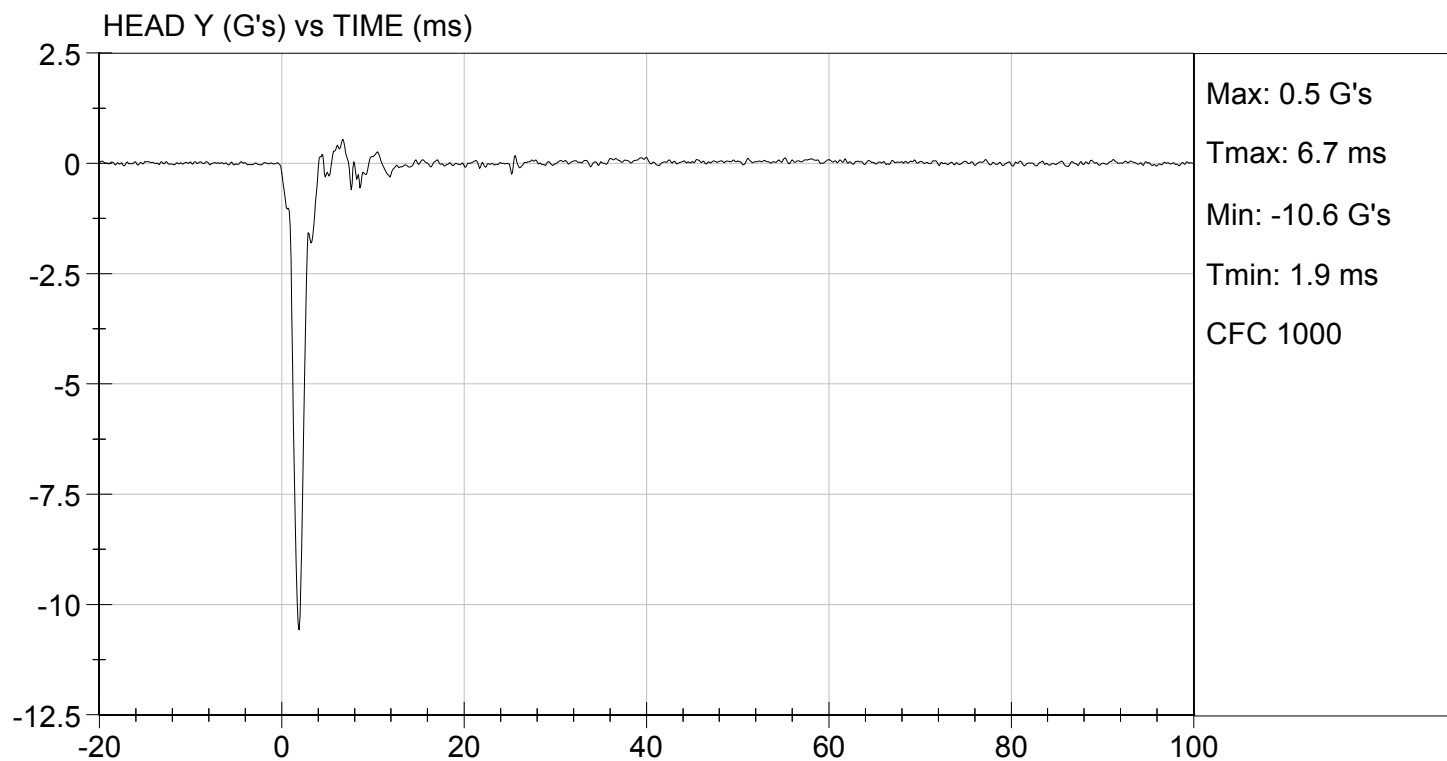

Laboratory Technician

03/09/2013

Test Date


Approved By





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D13792

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	23	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	4.2	Pass
	30 ms	m/s	5.8 to 7.0	6.1	Pass
D Plane Rotation	Max	deg	77 to 91	86	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	88	Pass
Overall Results					Pass

Jessica Hall
Laboratory Technician

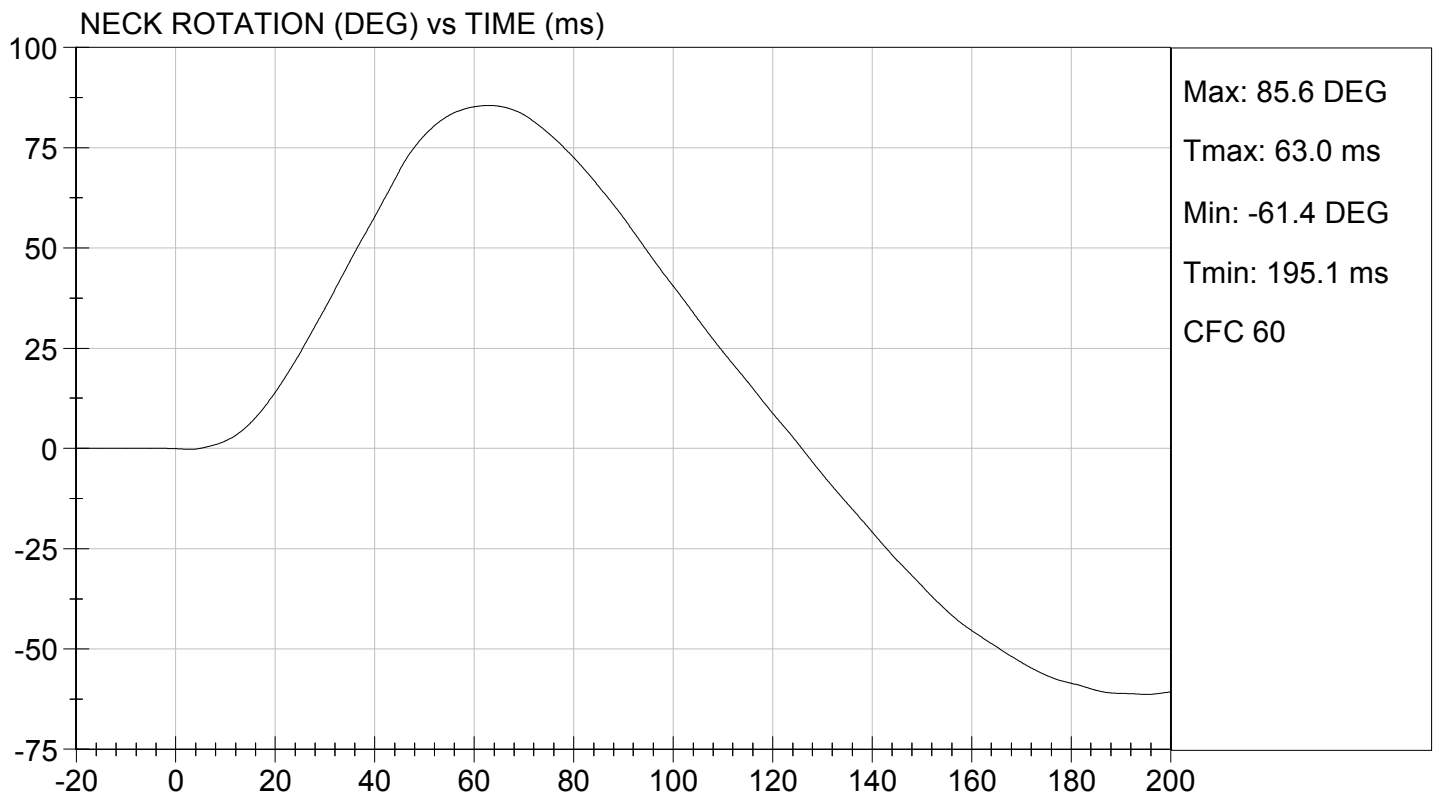
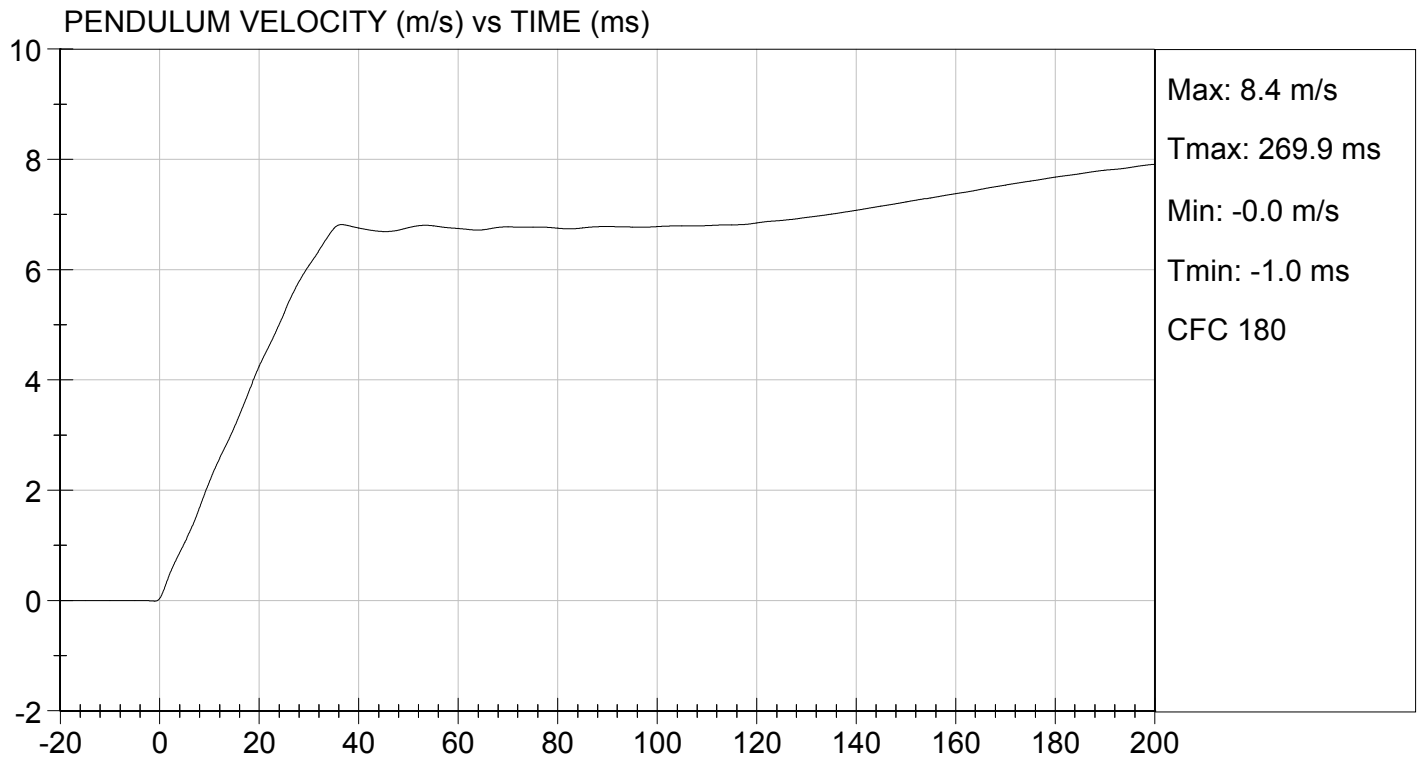
03/08/2013
Test Date

David Winkelbauer
Approved By



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

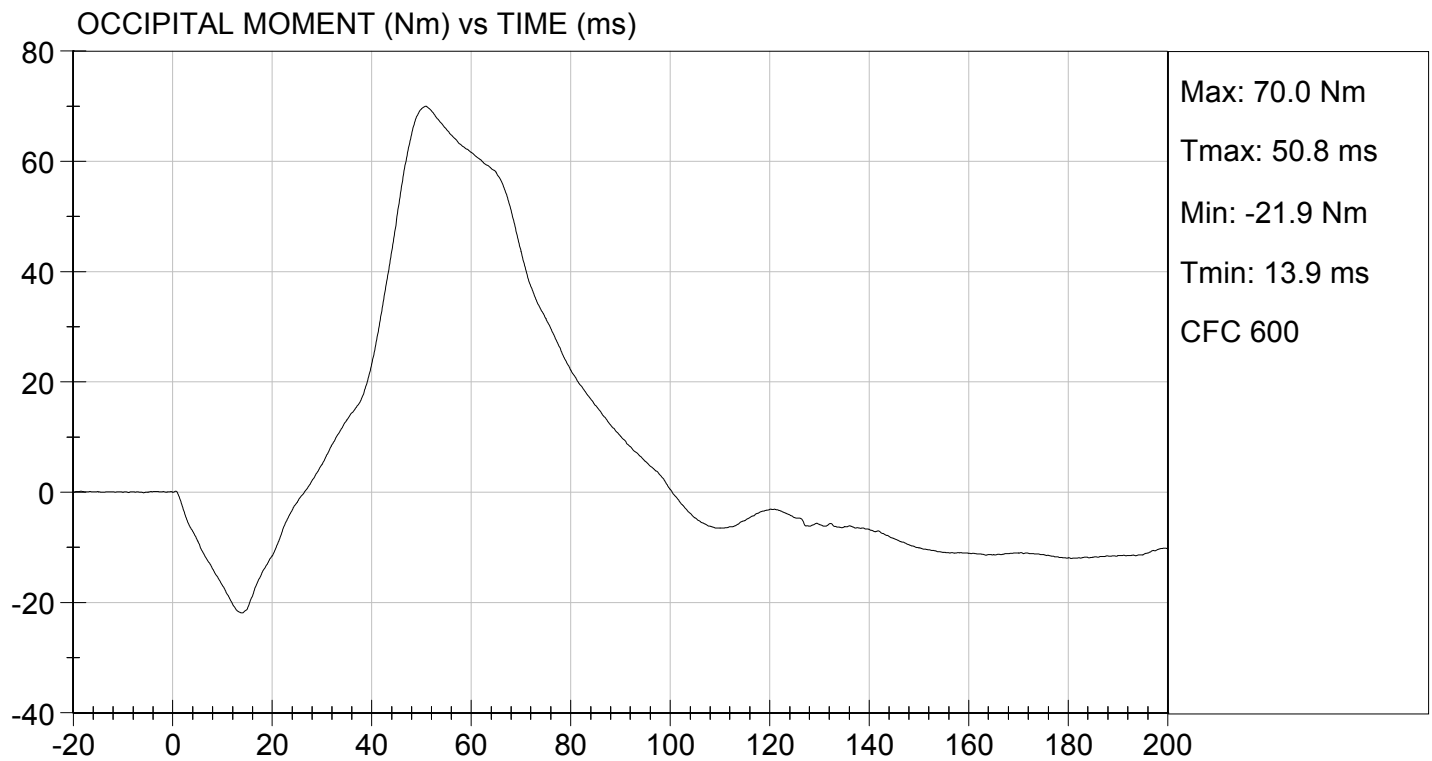
TEST DATE: 03/08/2013
TEST #: D13792





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

TEST DATE: 03/08/2013
TEST #: D13792



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D13793

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	23	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.4	Pass
	30 ms	m/s	4.6 to 5.6	4.8	Pass
D Plane Rotation	Max	deg	99 to 114	109	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	101	Pass
Overall Results					Pass

Jessica Gall
Laboratory Technician

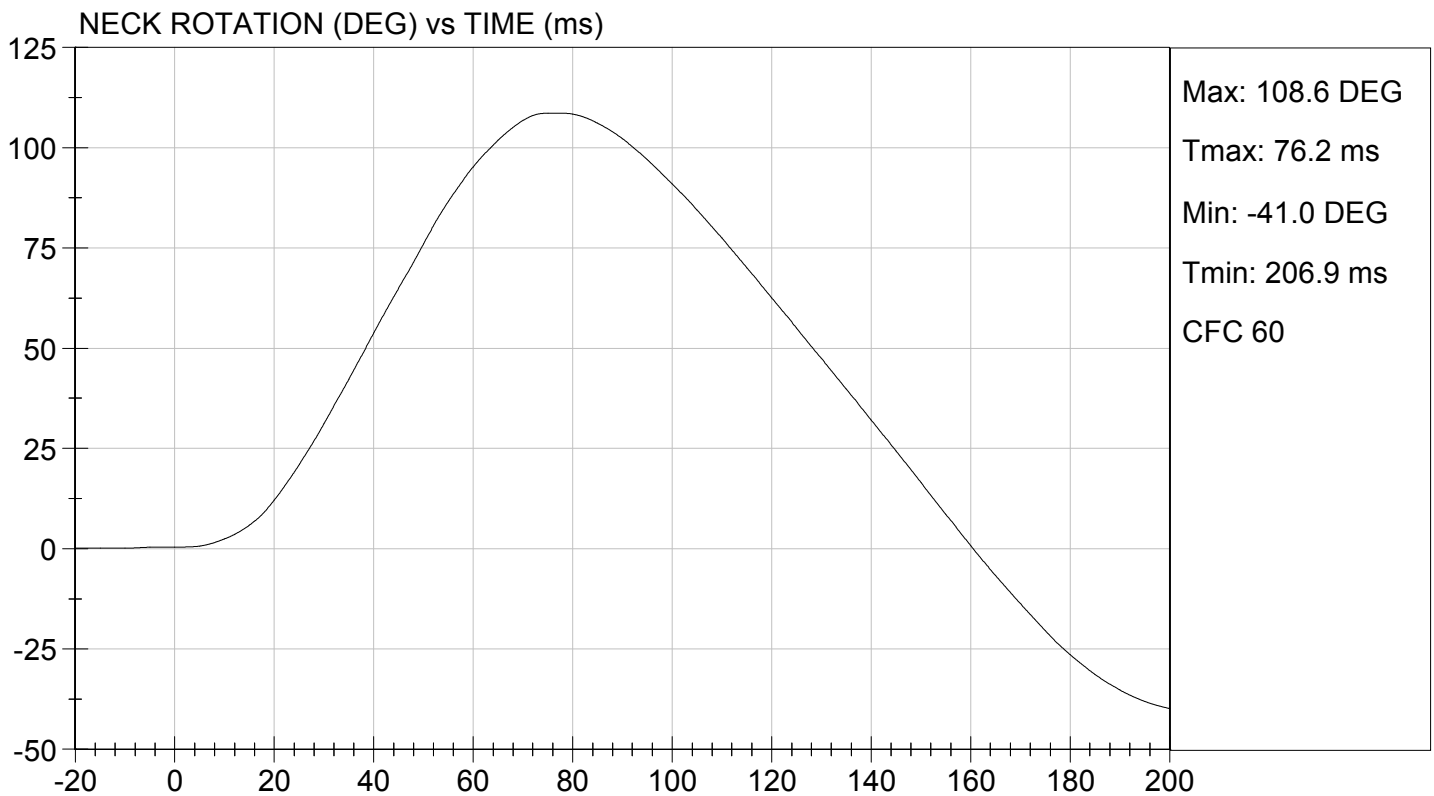
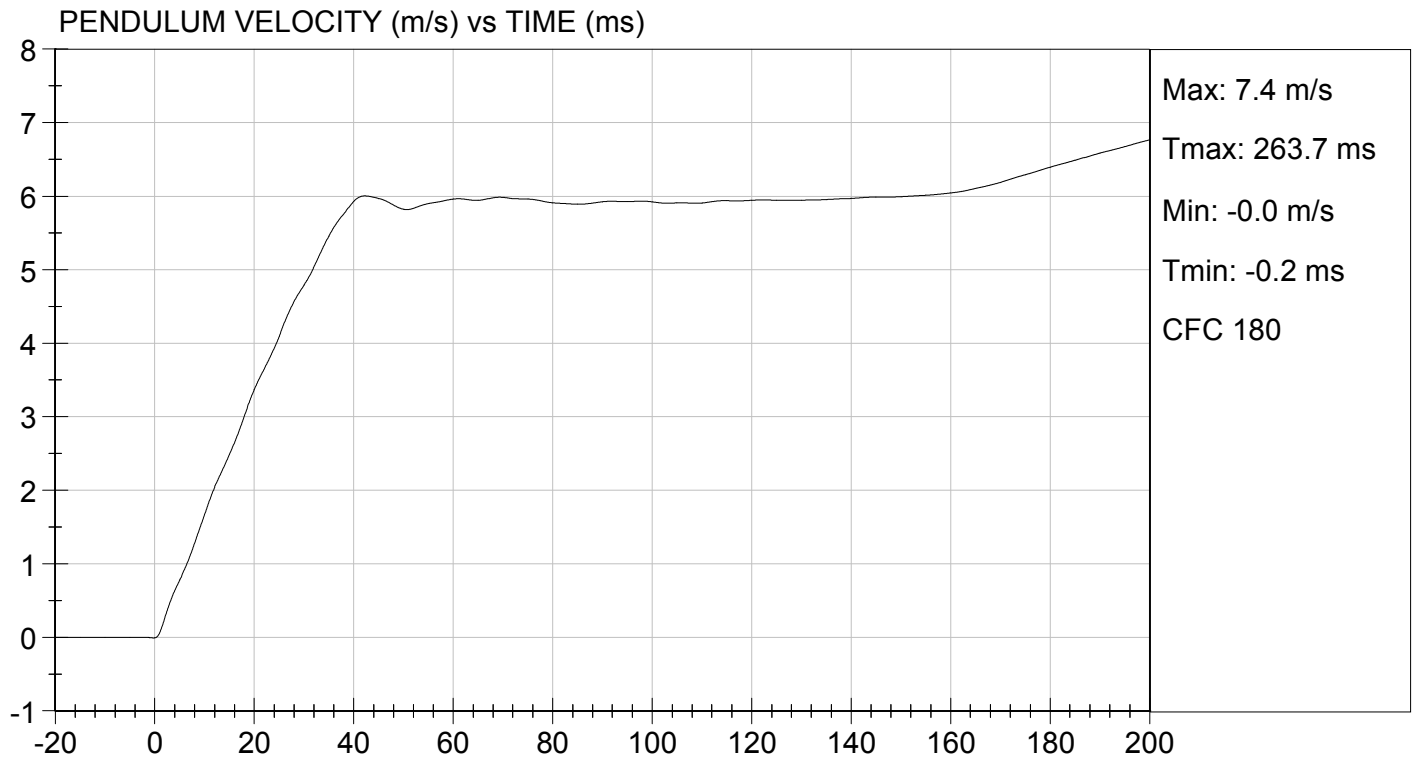
03/08/2013
Test Date

David Winkelbauer
Approved By



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

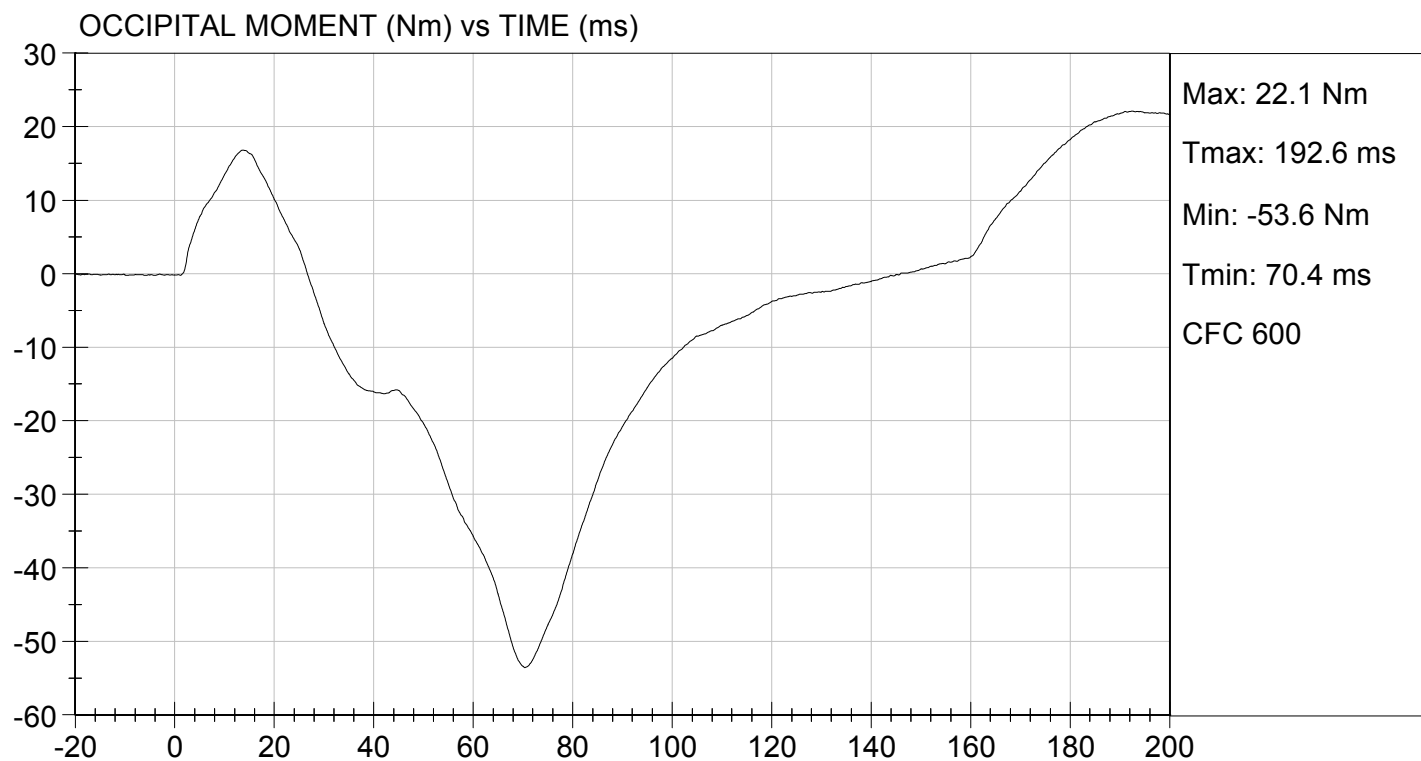
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TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 03/08/2013
TEST #: D13793

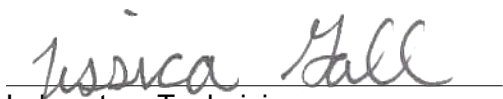


MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D13794

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	35	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	54	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4095	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4012	Pass
Overall Test Results				Pass


Laboratory Technician

03/11/2013

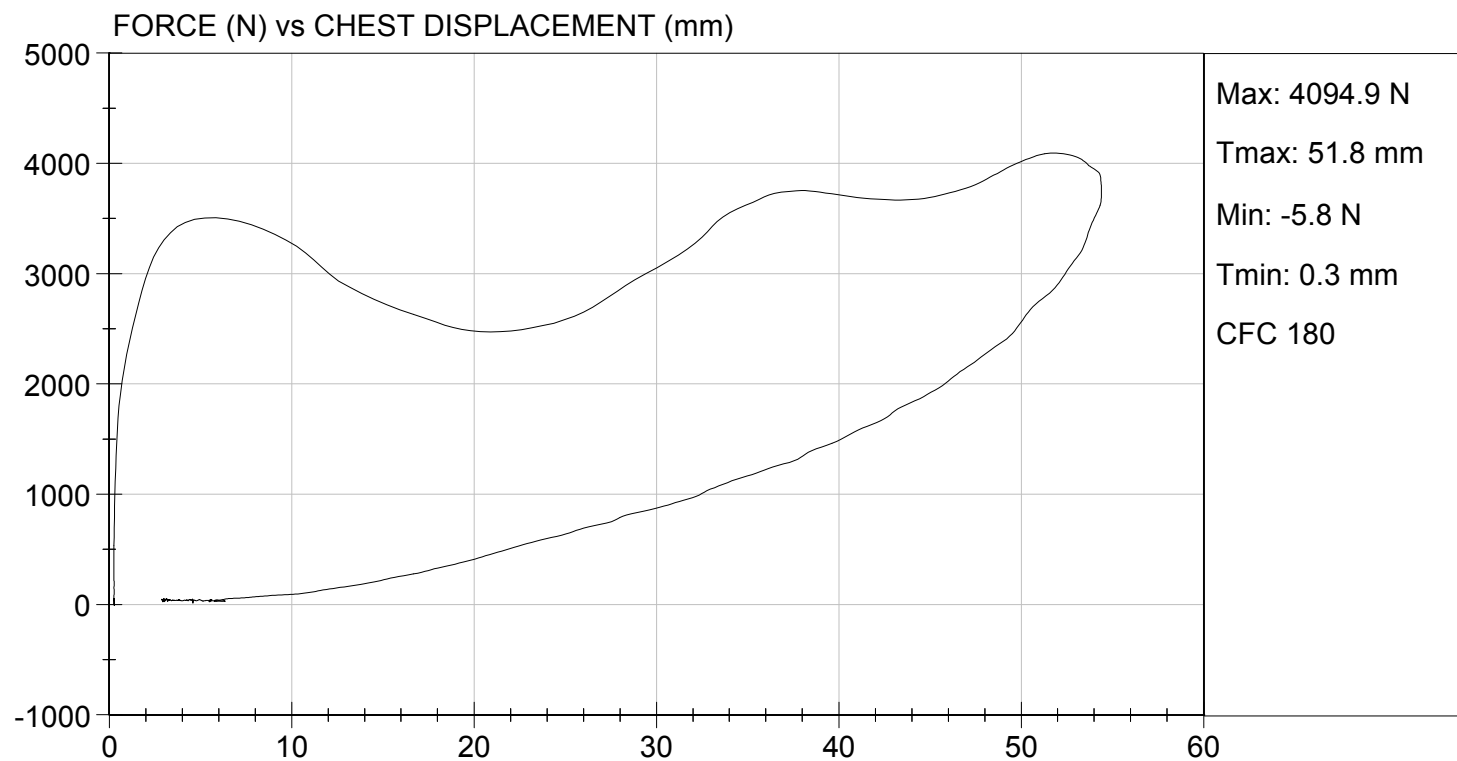
Test Date


Approved By



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

TEST DATE: 03/11/2013
TEST #: D13794



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D13795

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3616	Pass
Overall Test Results				Pass


Laboratory Technician

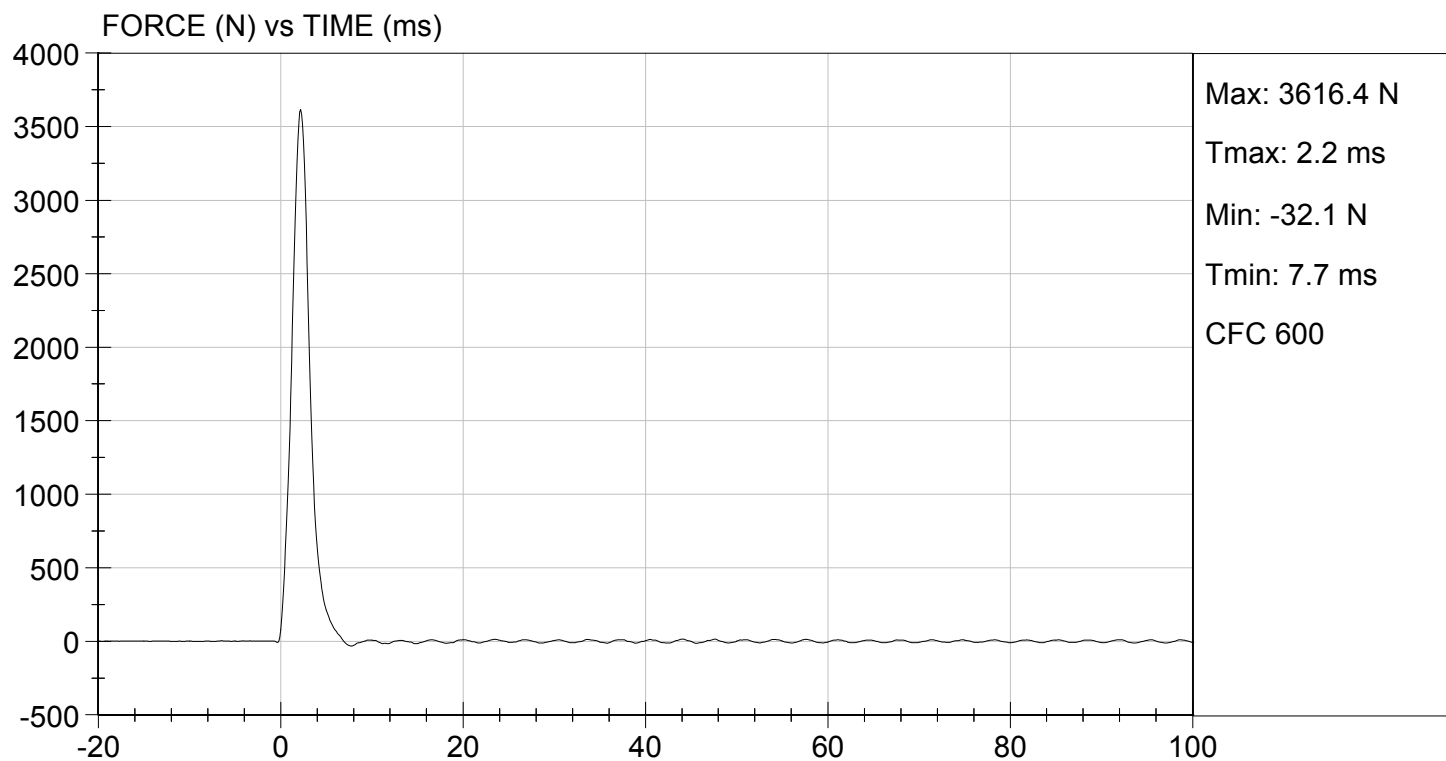
03/09/2013
Test Date


Approved By



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

TEST DATE: 03/09/2013
TEST #: D13795



MGA RESEARCH CORPORATION

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

ATD Serial No: 138

Test I.D: D13796

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3539	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

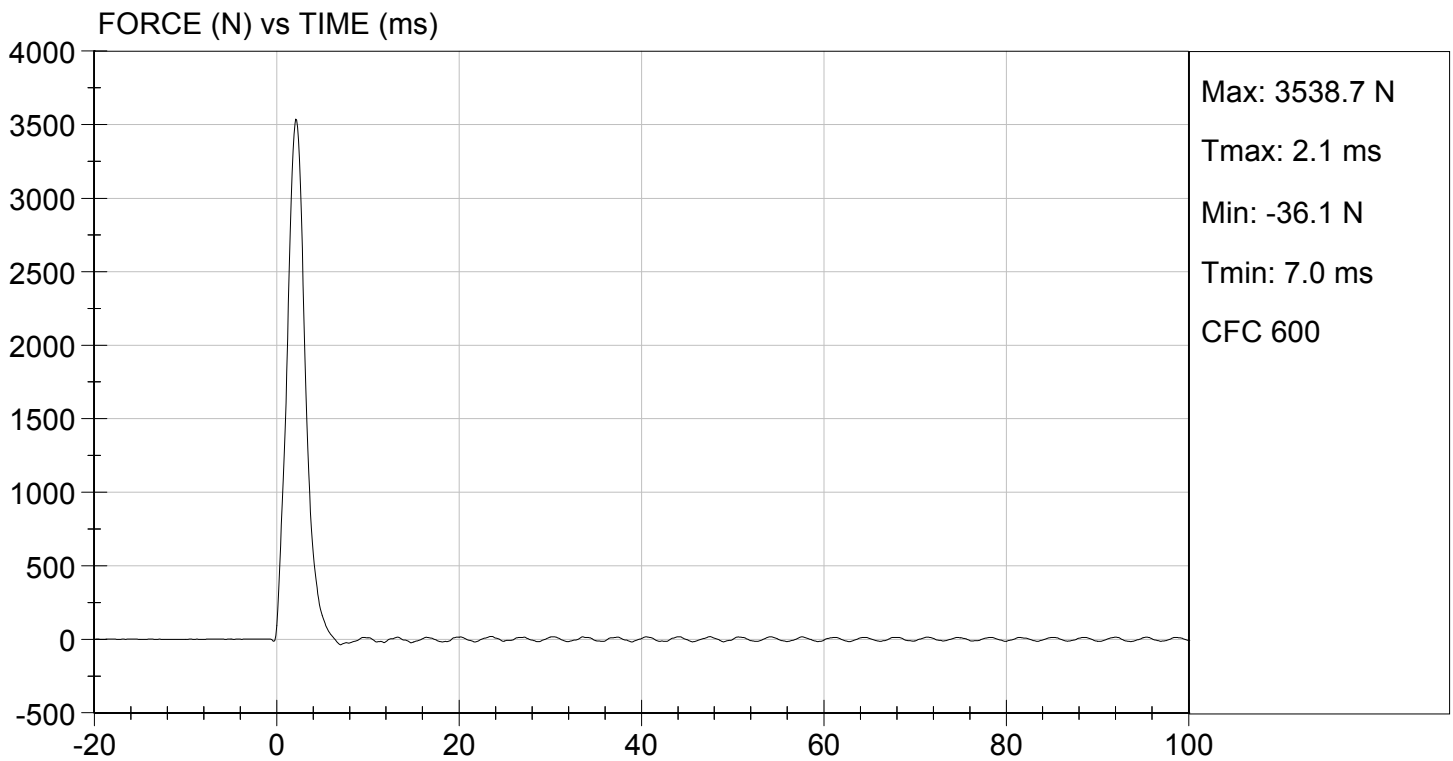
03/09/2013
Test Date

David Winkelbauer
Approved By



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

TEST DATE: 03/09/2013
TEST #: D13796



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D13797

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	389	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
Overall Result			Pass	

Jessica Hall
Laboratory Technician

03/11/2013

Test Date

David Winkelbauer
Approved By

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

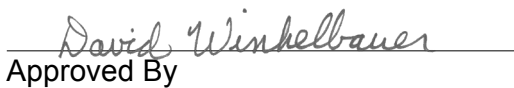
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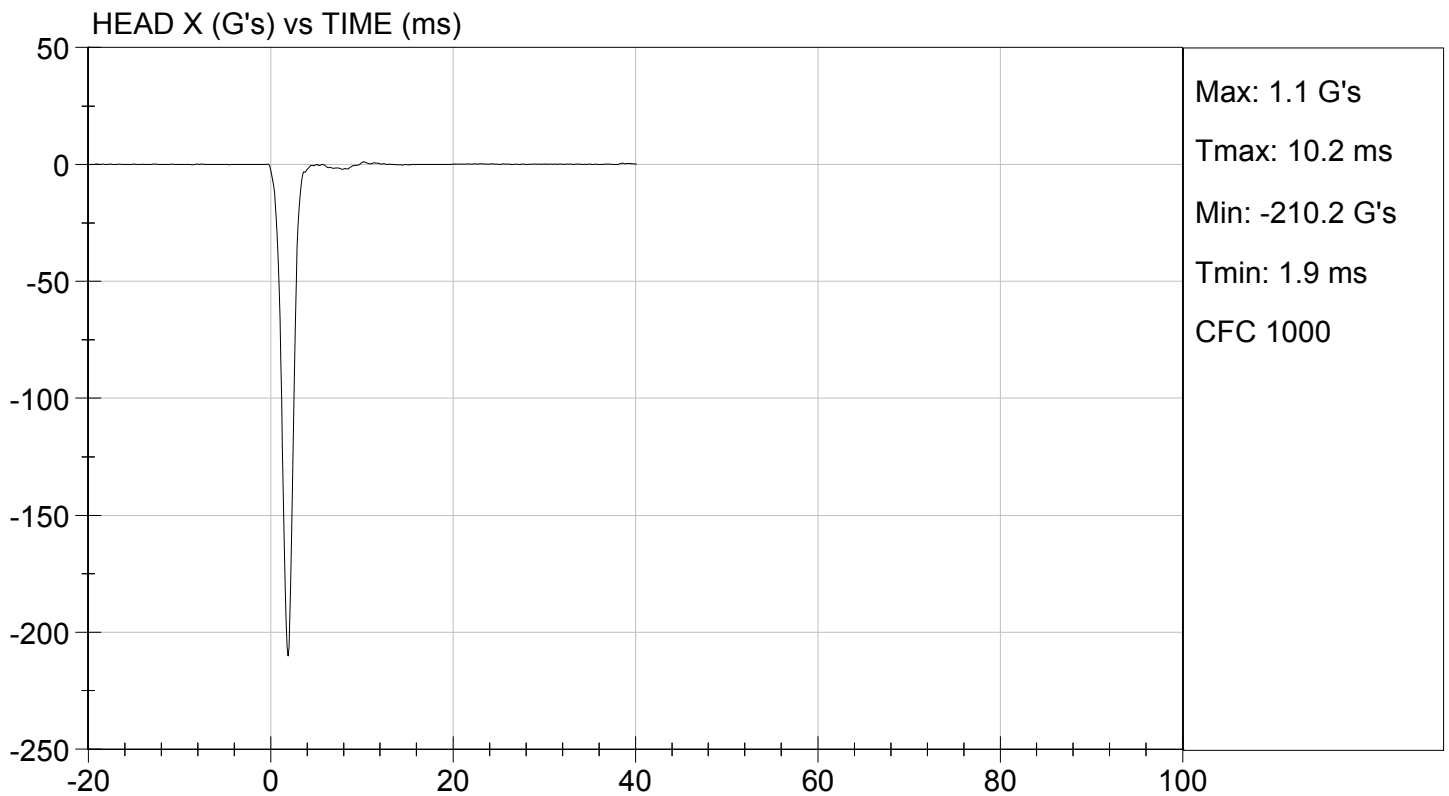
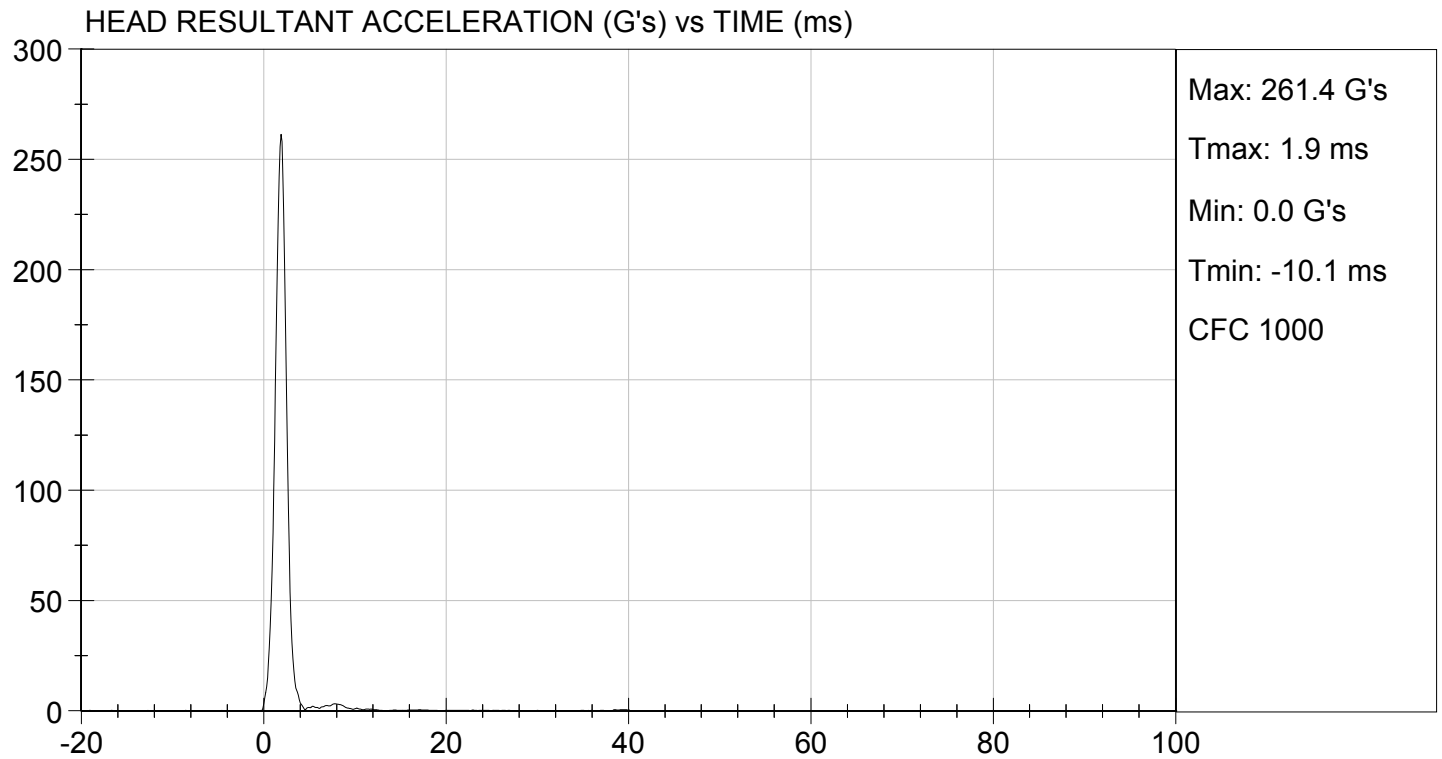
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Peak Resultant Acceleration	G's	250 to 300	261	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	8.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass

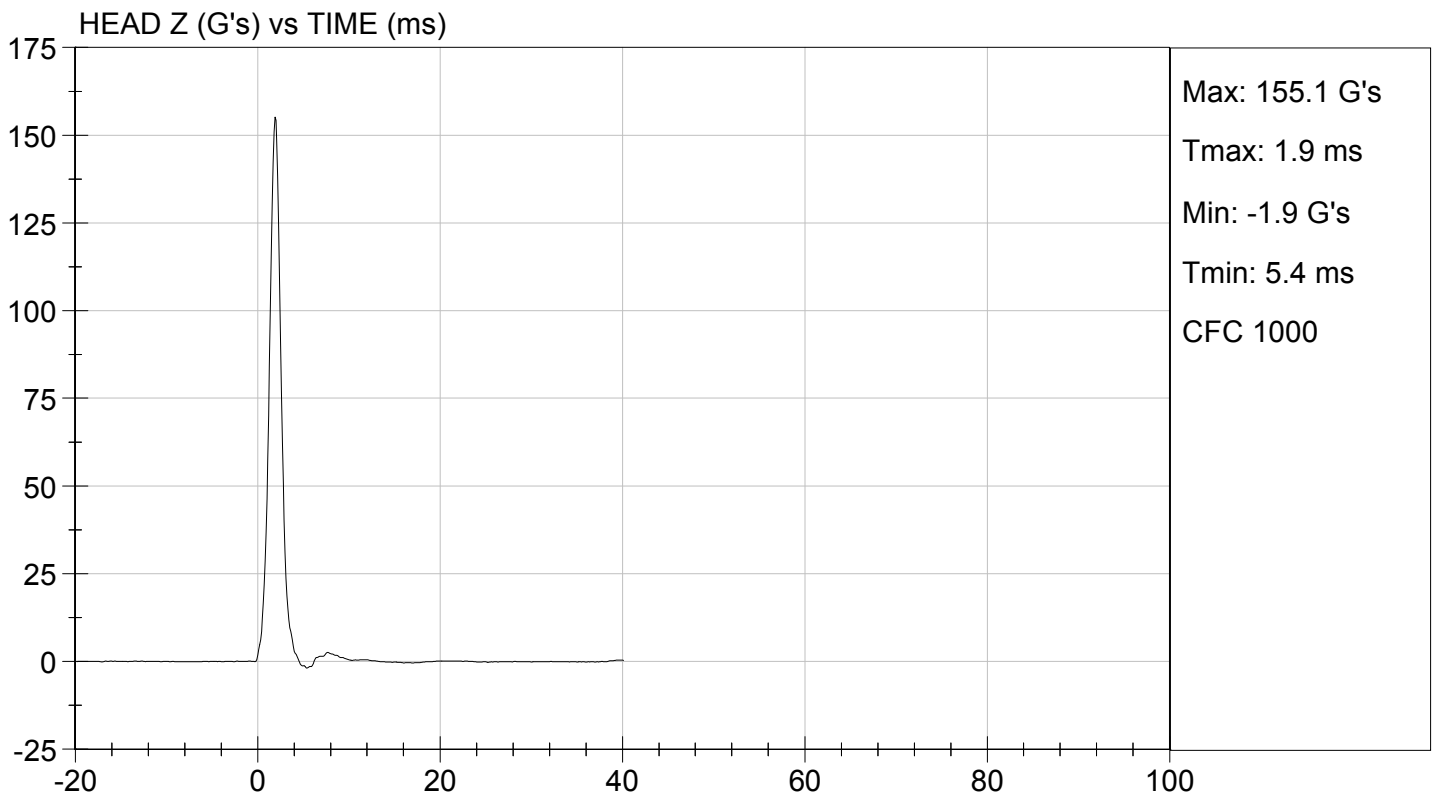
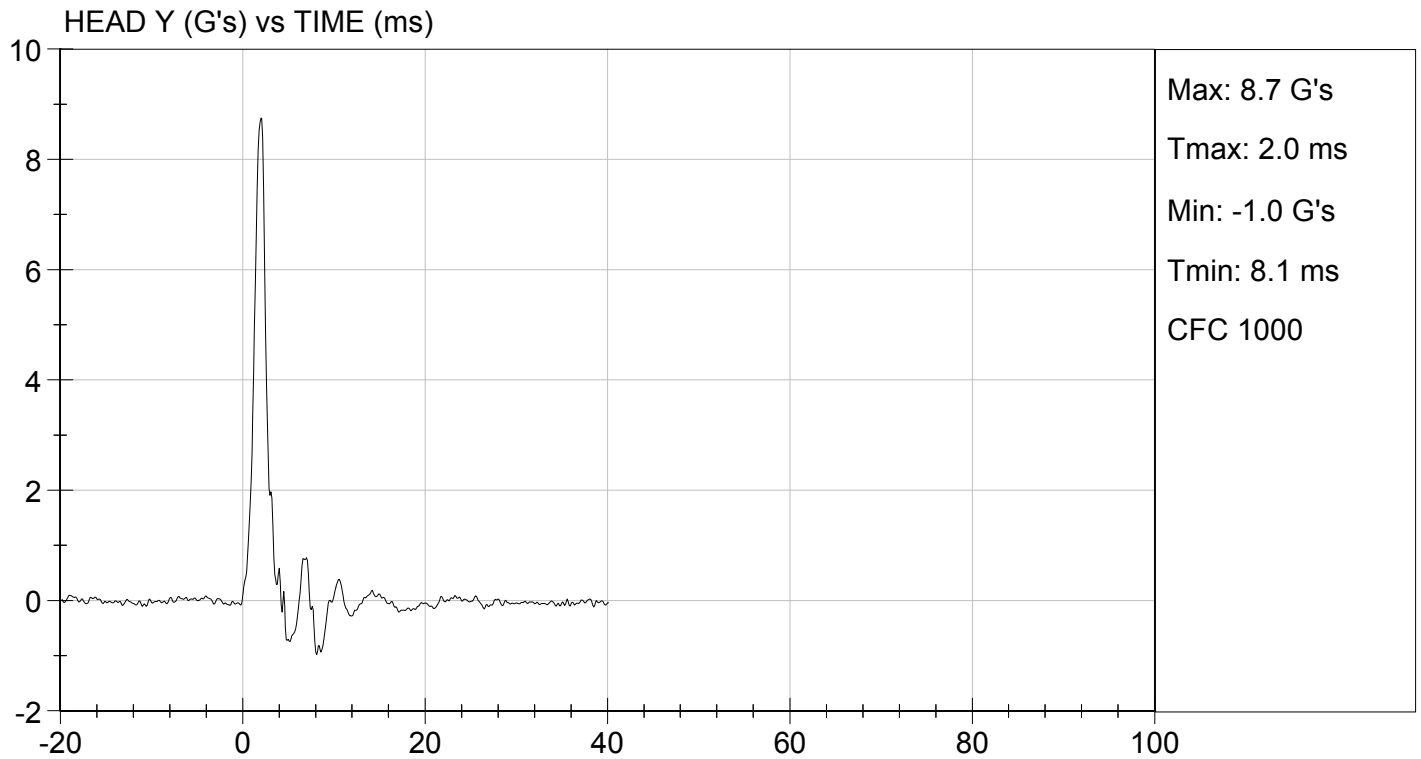

Laboratory Technician

04/10/2013

Test Date


Approved By





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

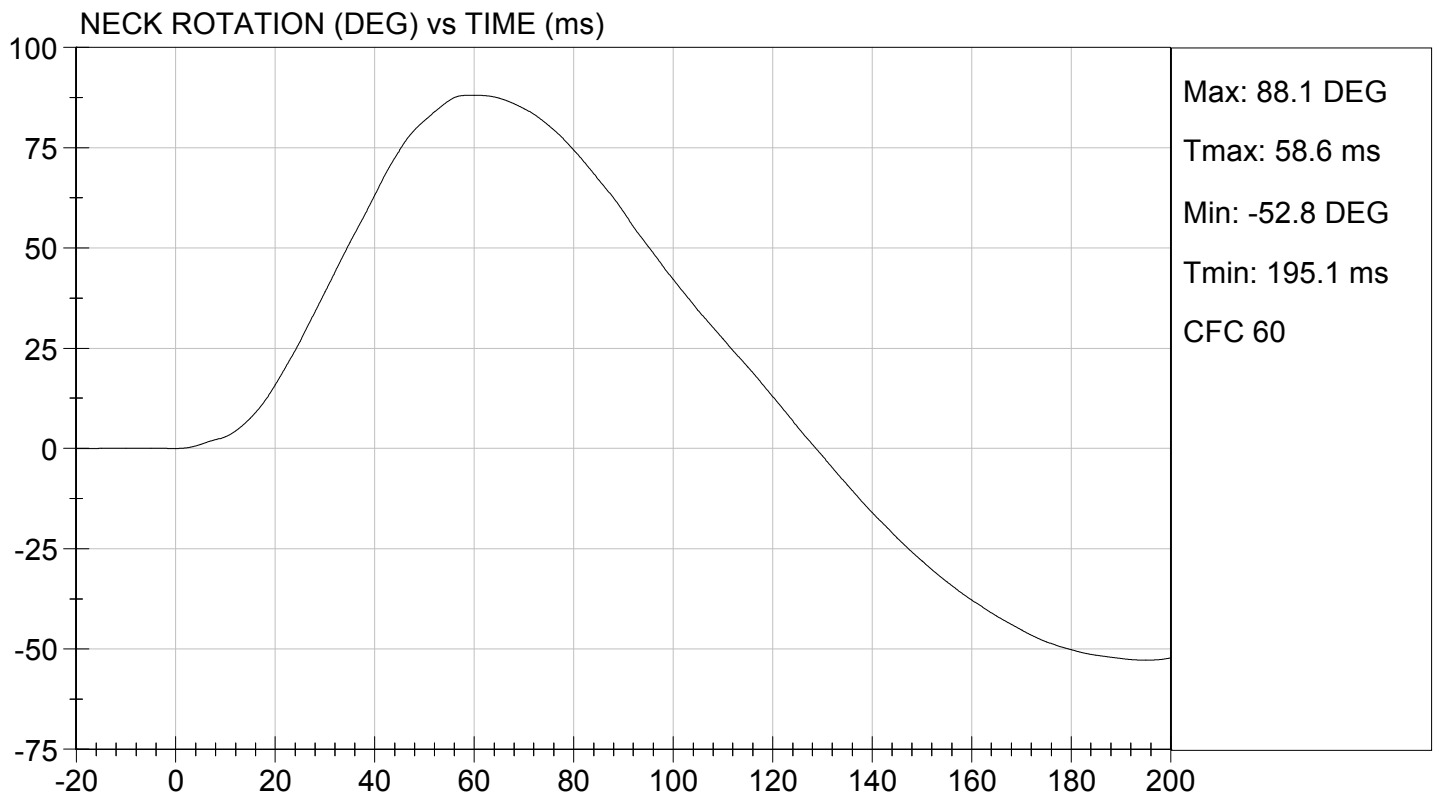
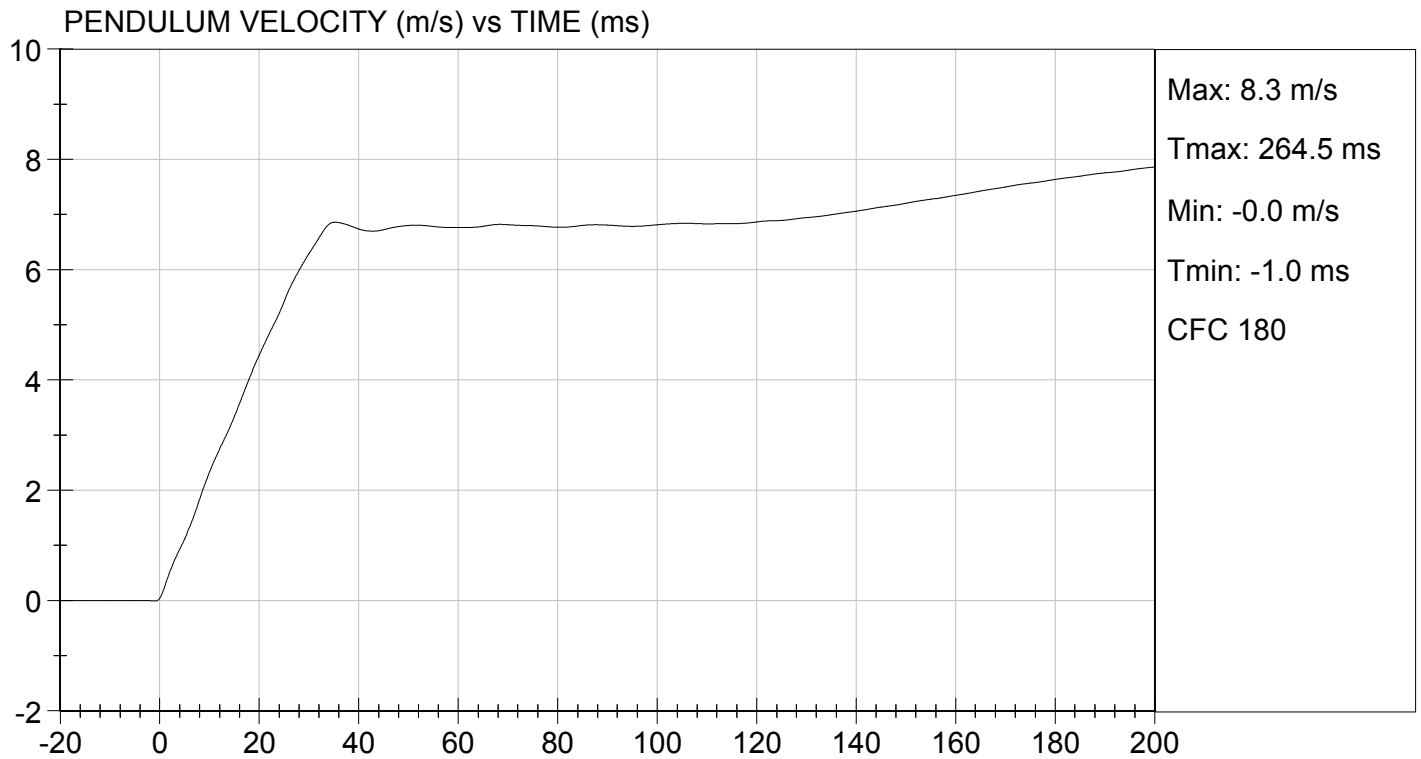
Test I.D: D131262

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	33	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	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.3	Pass
D Plane Rotation	Max	deg	77 to 91	88	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	69	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	87	Pass
Overall Results					Pass

Jessica Hall
Laboratory Technician

04/11/2013
Test Date

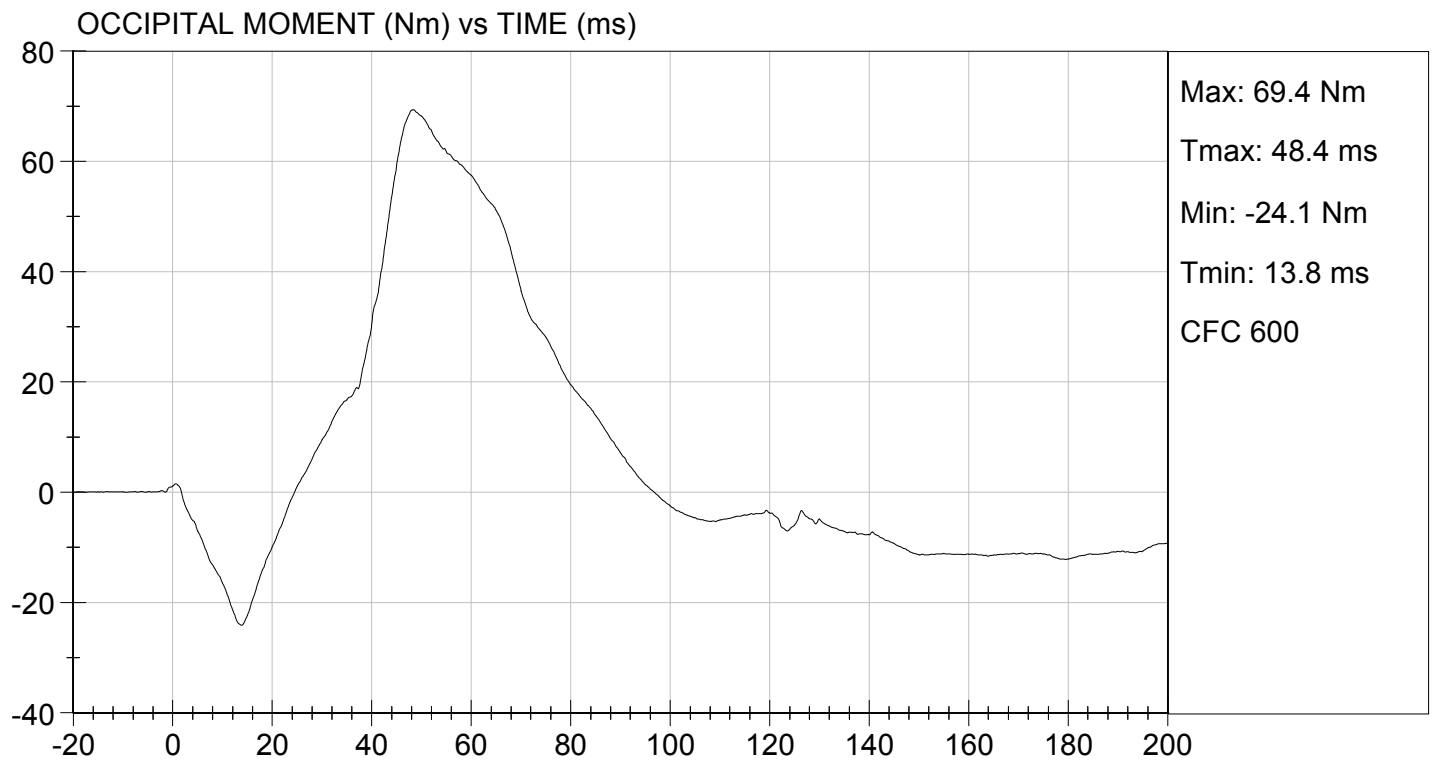
David Winkelbauer
Approved By





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

TEST DATE: 04/11/2013
TEST #: D131262



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

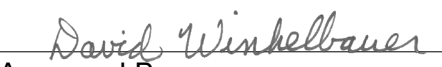
ATD Serial No: 138

Test I.D: D131263

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	33	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.6	Pass
	20 ms	m/s	3.1 to 3.9	3.3	Pass
	30 ms	m/s	4.6 to 5.6	4.9	Pass
D Plane Rotation	Max	deg	99 to 114	107	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	100	Pass
Overall Results					Pass


Laboratory Technician

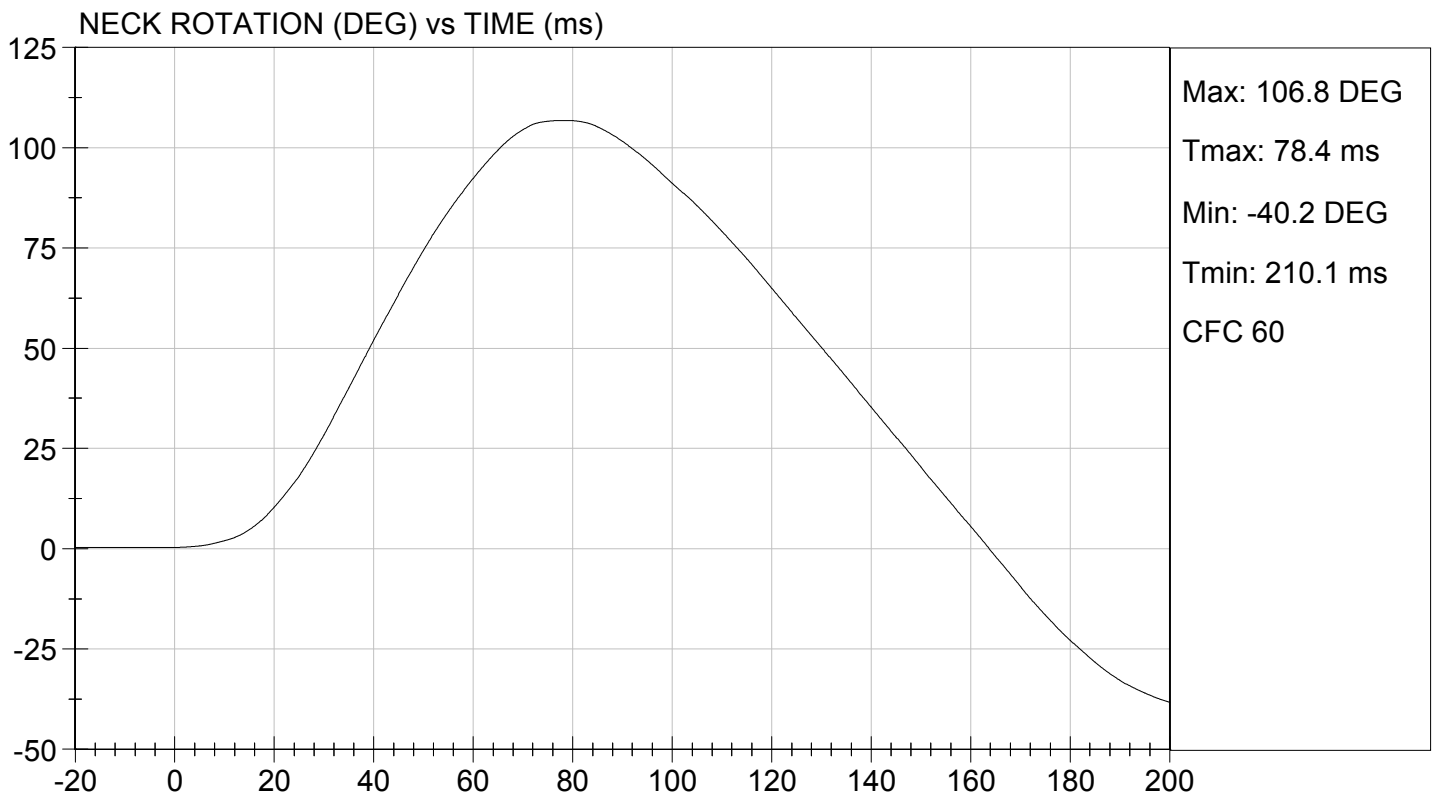
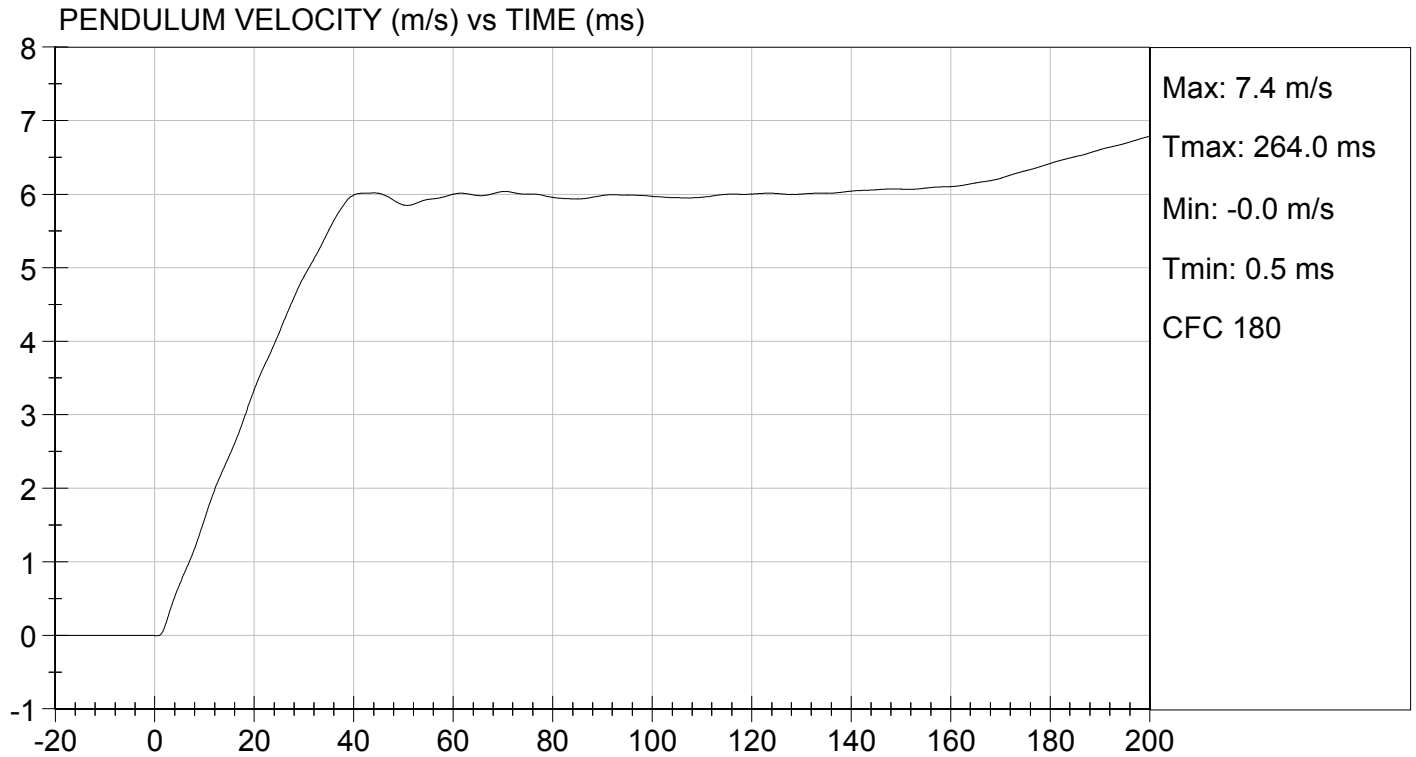
04/11/2013
Test Date


Approved By



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

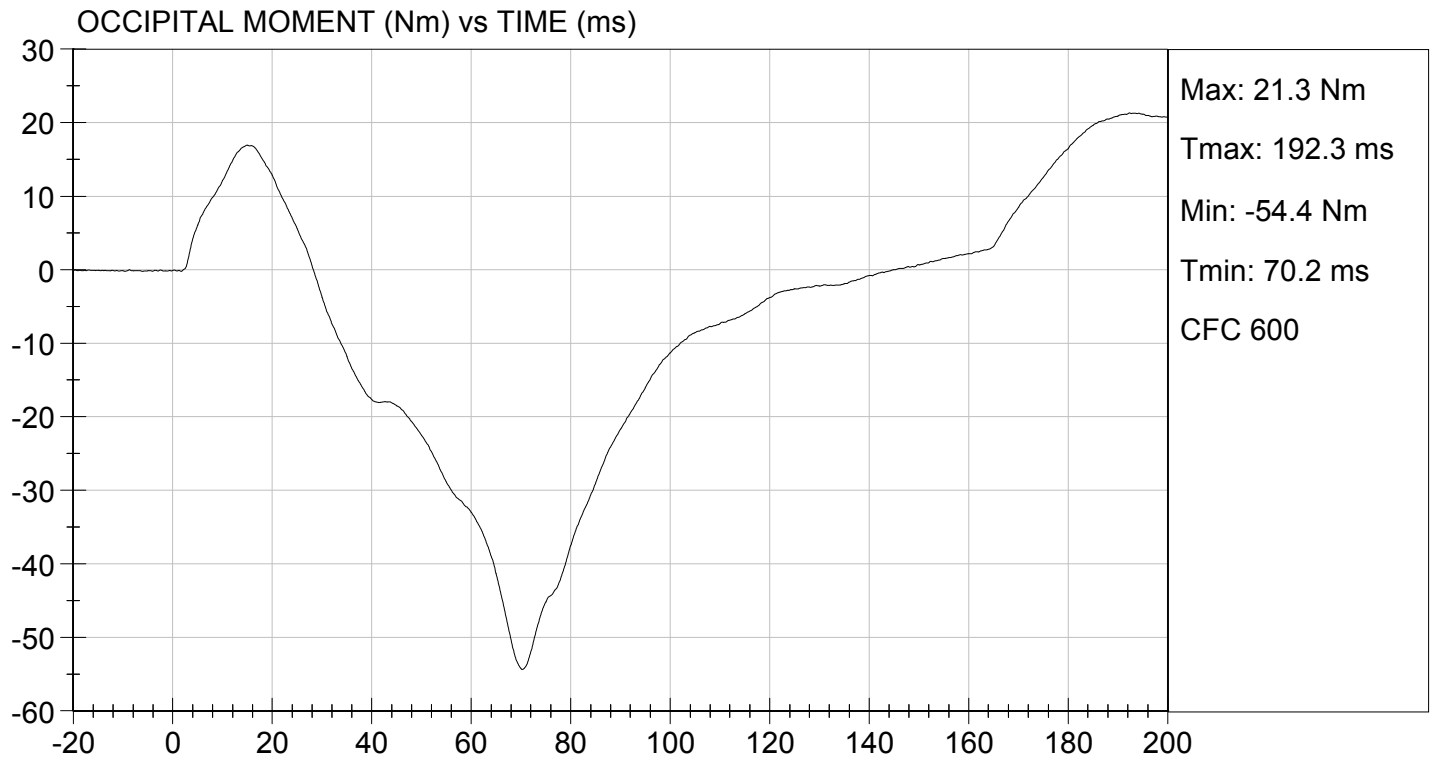
TEST DATE: 04/11/2013
TEST #: D131263





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

TEST DATE: 04/11/2013
TEST #: D131263

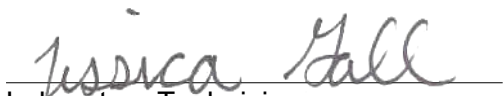


MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

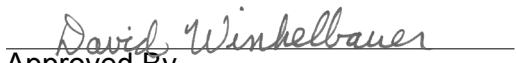
Test I.D: D131264

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Relative Humidity	%	10 to 70	36	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	3982	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	3984	Pass
Overall Test Results				Pass


Laboratory Technician

04/10/2013

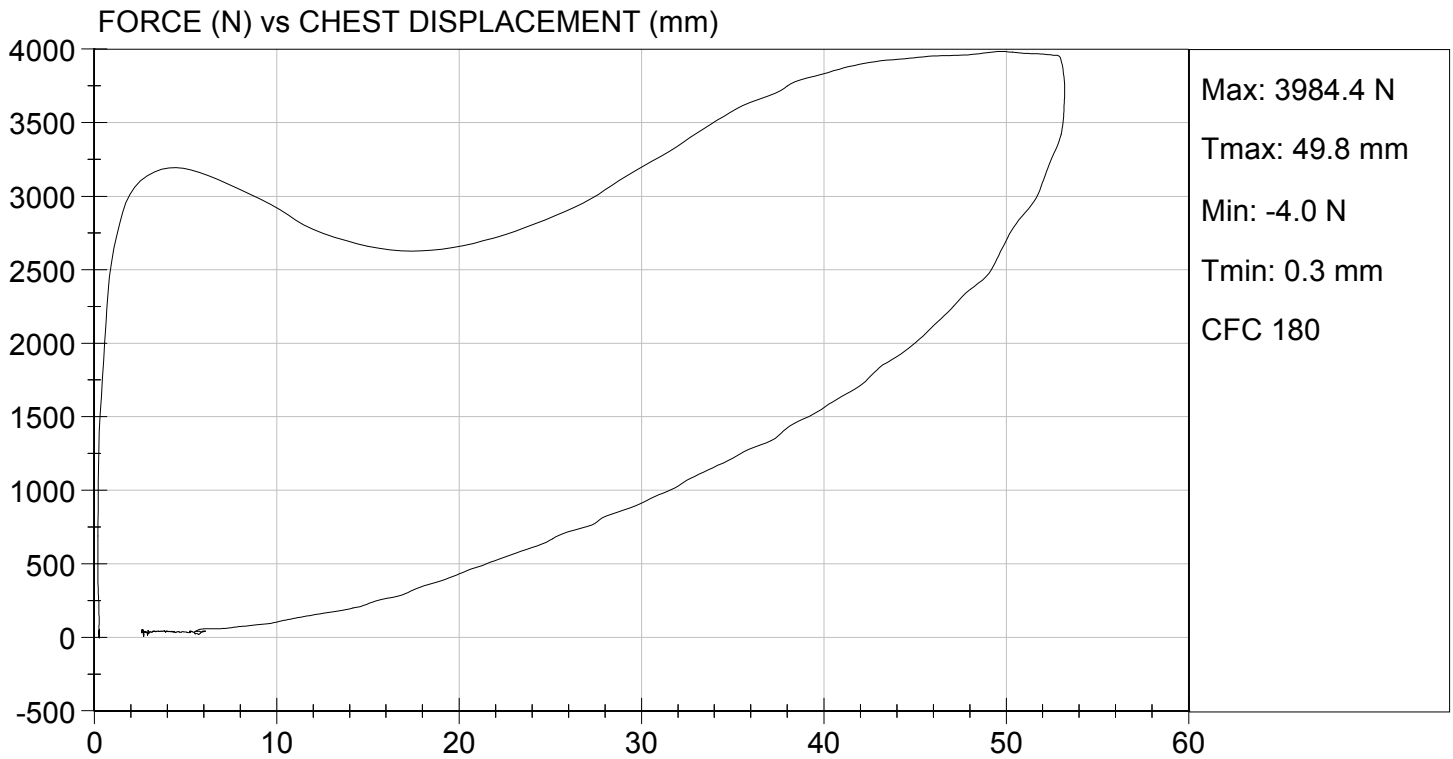
Test Date


Approved By



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

TEST DATE: 04/10/2013
TEST #: D131264



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

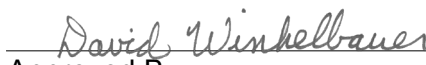
ATD Serial No: 138

Test I.D: D131265

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	35	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3526	Pass
Overall Test Results				Pass


Laboratory Technician

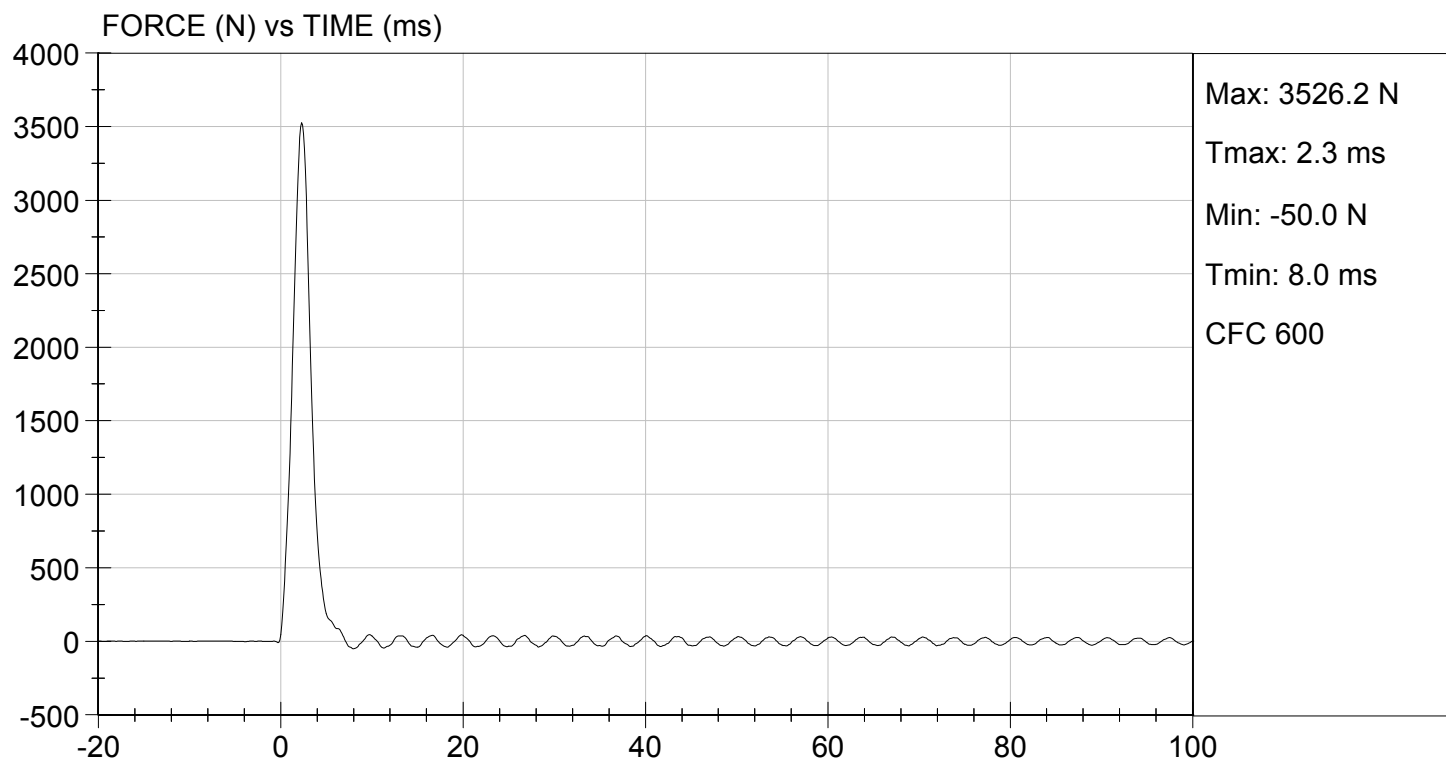
04/10/2013
Test Date


Approved By



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

TEST DATE: 04/10/2013
TEST #: D131265



MGA RESEARCH CORPORATION

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

ATD Serial No: 138

Test I.D: D131266

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	35	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3497	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

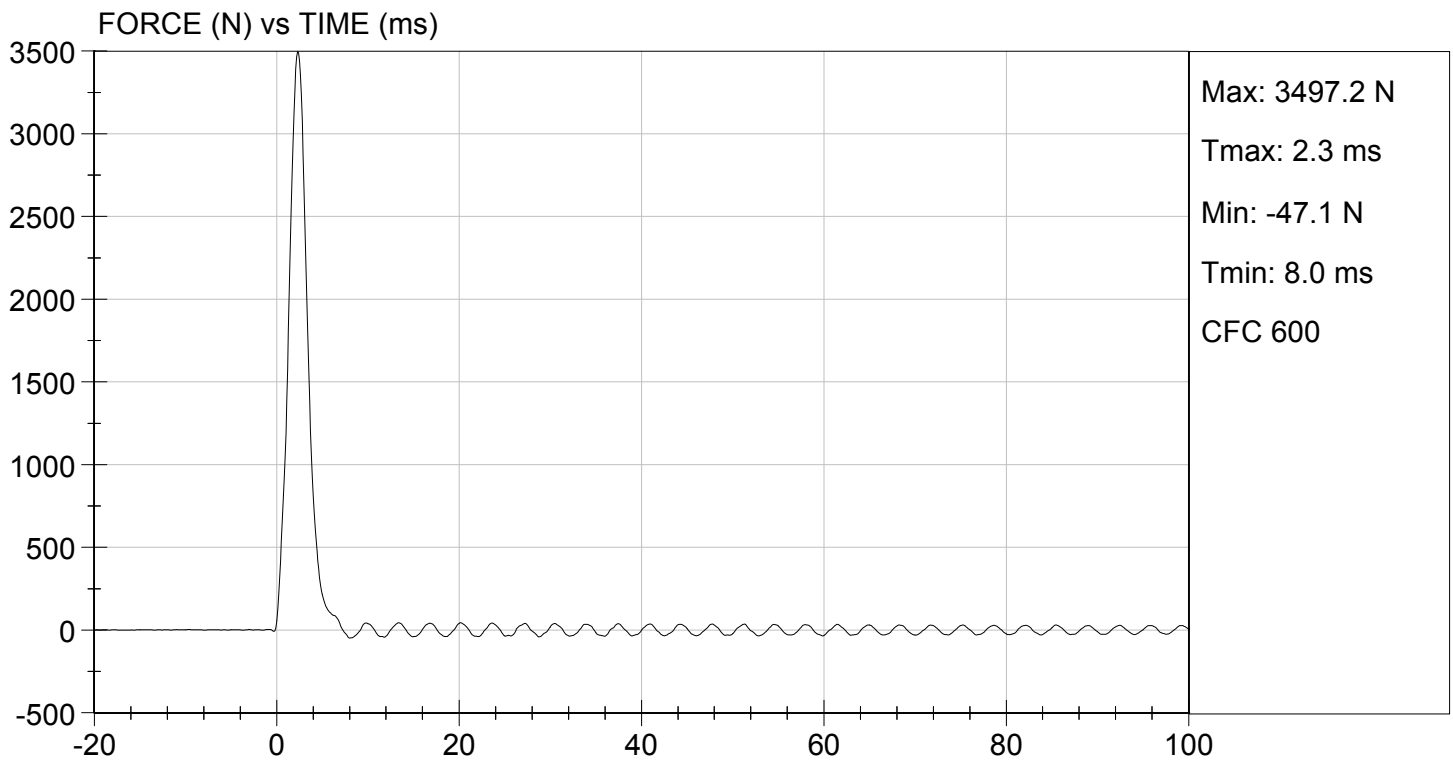
04/10/2013
Test Date

David Winkelbauer
Approved By



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

TEST DATE: 04/10/2013
TEST #: D131266



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

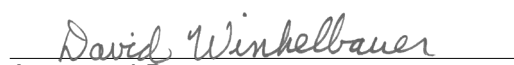
Test I.D: D131267

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	2	Pass
Force at 45 deg	N	320 to 390	372	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
Overall Result				Pass


Laboratory Technician

04/11/2013

Test Date


Approved By

