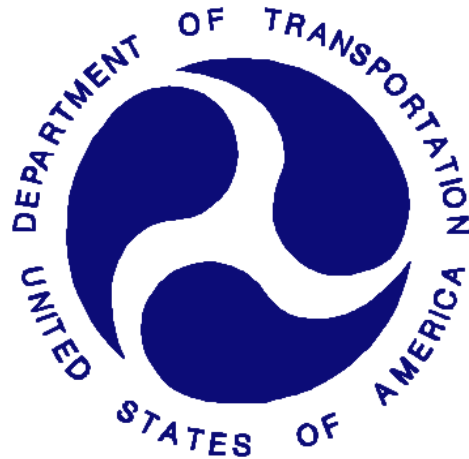


REPORT NUMBER: NCAP-MGA-2013-055

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

**TOYOTA MOTOR MANUFACTURING CANADA INC.
2013 Toyota RAV4 LE AWD SUV
NHTSA No.: YD5109**

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



Test Date: March 8, 2013

Final Report Date: April 25, 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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Prepared by: 
Donna Janovicz, Project Manager

Approved by: 
Ben Fischer, Project Engineer

Approval Date: April 25, 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

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15. Supplementary Notes																																																							
16. Abstract A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2013 Toyota RAV4 LE AWD 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), 301, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on March 8, 2013. The impact velocity was 56.7 km/h and the ambient temperature at the barrier face at the time of impact was 21.5°C. The target vehicle post-test maximum crush was 452 mm located at the vehicle's centerline. The test vehicle's performance was as follows: <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">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>351</td> <td>343</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>52</td> <td>18</td> <td>12</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>1</td> <td>0.43</td> <td>0.41</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>2620</td> <td>2268</td> <td>1076</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>2520</td> <td>83</td> <td>406</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>1995</td> <td>1819</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>2286</td> <td>1262</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	351	343	Maximum Chest Compression	mm	63	52	18	12	Nij	N/A	1	1	0.43	0.41	Neck Tension	N	4170	2620	2268	1076	Neck Compression	N	4000	2520	83	406	Left Femur Force	N	10008	6805	1995	1819	Right Femur Force	N	10008	6805	2286	1262
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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 Toyota RAV4 LE AWD SUV at a velocity of 56.7 km/h. The test was performed at MGA Research Corporation on March 8, 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 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 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 628 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. 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 452 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 airbag. 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 and seatback. 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)	351	0.43	2268	83	51	18	1995	2286
Passenger (5 th)	343	0.41	1076	406	51	12	1819	1262

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

TEST NOTES

Barrier K-14 FX has no valid data.

Barrier K-14 MY has no valid data.

Barrier K-14 MZ has no valid data.

Driver and Passenger Shoulder Belt load cells were not installed for this test.

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 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	YD5109	Traction Control System (TCS)	Yes
Model Year	2013	Power Steering	Yes
Make	Toyota	Power Window Auto-Reverse	No
Model	RAV4	Driver Frontal Airbag	Yes
Body Style	SUV	Driver Curtain Airbag	Yes
VIN	2T3BFREV6DW007388	Driver Head/Torso Airbag	No
Body Color	Shoreline Blue Pearl	Driver Torso Airbag	No
Odometer (km/mi)	69 / 43	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	2.5	Driver Pelvis Airbag	No
Type/No. Cylinders	4	Driver Knee Airbag	Yes
Engine Placement	Lateral	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	6	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	All-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	Front Pass. Seat Cushion Airbag	Yes

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

DATA FROM CERTIFICATION LABEL

Manufactured By	TOYOTA MOTOR MANUFACTURING CANADA INC.	GVWR (kg)	2085
Date of Manufacture	02/13	GAWR Front (kg)	1150
		GAWR Rear (kg)	1150

VEHICLE SEATING AND WEIGHT CAPACITY DATA

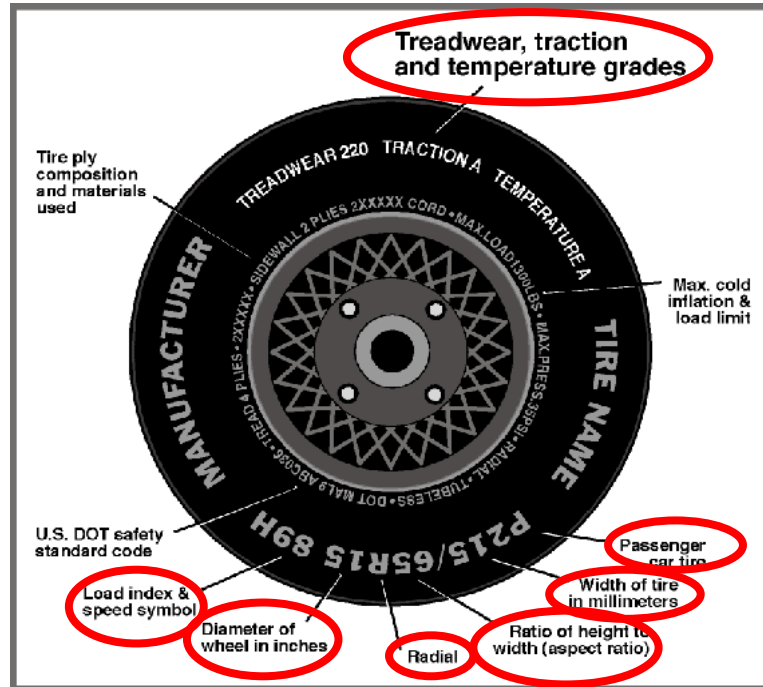
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				405
Cargo Weight (RCLW) (kg)				65

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

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	230	230
Recommended Tire Size	225/65R17	225/65R17
Tire Size on Vehicle	225/65R17	225/65R17
Tire Manufacturer	Dunlop	Dunlop
Tire Model	Grand Trek	Grand Trek
Treadwear	360	360
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 1 Polyamide, 2 Steel	2 Polyester, 1 Polyamide, 2 Steel
Load Index/Speed Symbol	102H	102H
Tire Material	Rubber	Rubber
DOT Safety Code Left	U2F5 3M5R4312 E2847	U2F5 3M5R4312 E2845
DOT Safety Code Right	U2F5 3M5R4312 E2852	U2F5 3M5R4312 D2955

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

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	483.5	344.7		504.4	427.3	
Right	kg	452.7	334.4		474.0	407.3	
Ratio	%	58.0	42.0		54.0	46.0	
Totals	kg	936.2	679.1	1615.3	978.4	834.6	1813.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1615.3
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	65
Calculated Vehicle Target Weight (TVTW)	kg	1820.9

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	804	808	833	836	1120
As Tested	mm	794	803	807	814	1226
Post Test	mm	781	775	790	803	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2664
Total Vehicle Length at Left Side	mm	4422
Total Vehicle Length at Centerline	mm	4570
Total Vehicle Length at Right Side	mm	4422
Weight of Ballast in Cargo Area	kg	65.3
Weight of Vehicle Components Removed	kg	35.4
Amount of Stoddard Solvent in Fuel Tank	L	56.0

List of components removed: Jack and tools, wheel covers, cargo cover, cargo carpet, cargo divider, spare tire, left taillight, and LF underbody plastic.

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

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4570
2	Total Width	1828
3	Bumper Top Height	587
4	Bumper Bottom Height	493
5	Longitudinal Member Top Height	593
6	Distance between Longitudinal Members	900
7	Longitudinal Member Width	55
8	Engine Top Height	948
9	Engine Bottom Height	208
10	Engine and Gearbox Width	880
11	Front Bumper-Engine Distance	277
12	Front Shock Absorber Fixing Height	962
13	Bonnet Leading Edge Height	901
14	Front Shock Absorber Fixing Width	1200
15	Front Bumper – Front Axle Distance	910
16	Front Axle – A-Pillar Distance	473
17	A-Pillar – B-Pillar Distance	1080
18	B-Pillar – Rear Axle Distance	1108
19	B-Pillar – C-Pillar Distance	642
20	Roof Sill Bottom Height	1498
21	Roof Sill Top Height	1634
22	Floor Sill Bottom Height	269
23	Floor Sill Top Height	445

DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

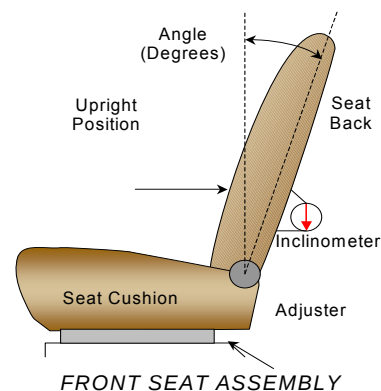
Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

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	5.1° on headrest post
Passenger Seat Back Angle	4.6° on headrest post



SEAT FORE/AFT POSITIONS

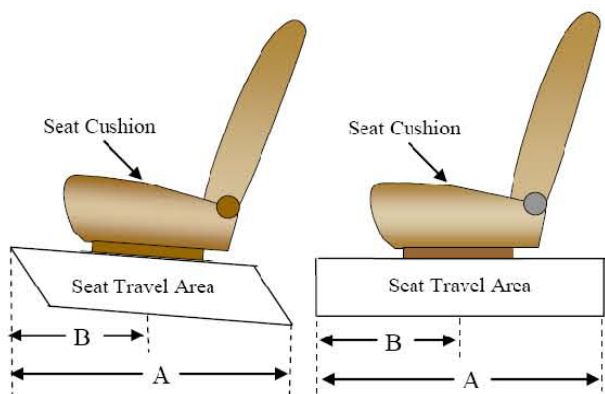
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated September 2012.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	295 mm, 25 Detents (1 st as 1)	154 mm, 10 th Detent (foremost as 0)
Passenger Seat	260 mm, 27 Detents (1 st as 1)	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 0)	0 (uppermost as 0)
Passenger Seat	4 (1 st as 0)	0 (uppermost as 0)



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

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

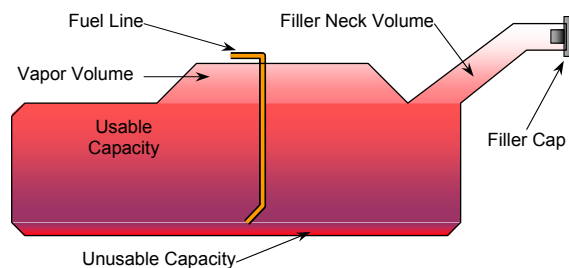
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	60.2
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	55.4 to 56.6
Actual Amount of Solvent used	56.0
1/3 of Usable Capacity	20.1

FUEL PUMP

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

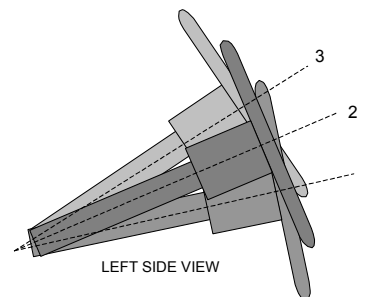
The vehicle is equipped with an electric fuel pump. The fuel pump is activated when the ignition is turned on. The fuel pipe is on the left side.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured.



STEERING COLUMN ASSEMBLY

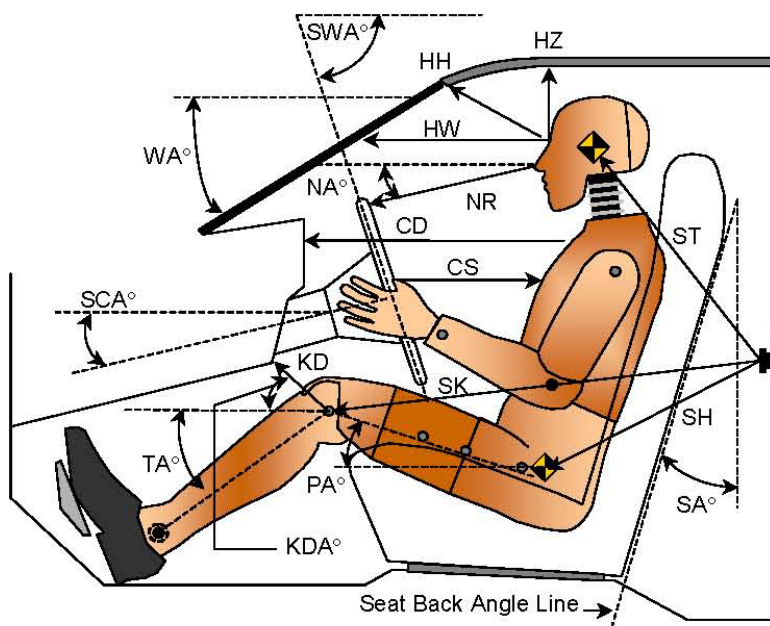
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	66.8	231
Geometric Center Position 2	64.8	211
Uppermost Position 3	62.8	191
Telescoping Steering Wheel Travel		40
Test Position	64.8	211

DATA SHEET NO. 3 DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
Test Date: 03/08/2013



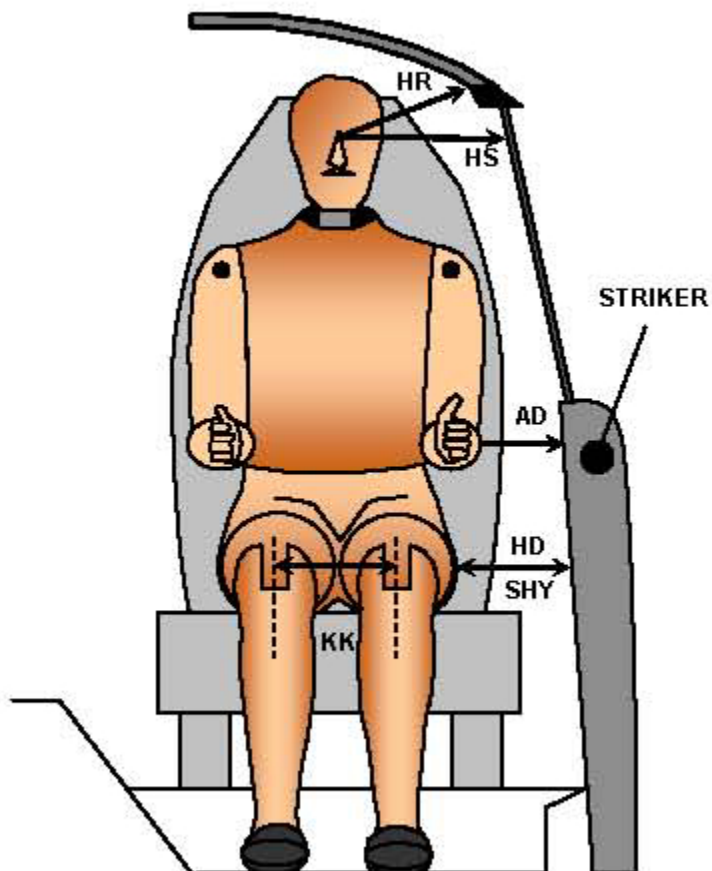
LEFT SIDE VIEW

Code	Measurement Description	Driver S/N 351		Passenger S/N 138	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		27.4		
SWA°	Steering Wheel Angle		64.8		
SCA°	Steering Column Angle		25.2		
SA°	Seat Back Angle (on headrest post)		5.1		4.6
HZ	Head to Roof (Z)	219	90.0	224	90.0
HH	Head to Header	346	25.3	275	49.2
HW	Head to Windshield	657	0.0	645	0.0
NR	Nose to Rim	407	13.9		
CD	Chest to Dash	521		342	
CS	Chest to Steering Hub	320	3.4		
RA	Rim to Abdomen	198	0.0		
KDL	Left Knee to Dash	162	25.3	63	33.2
KDR	Right Knee to Dash	142	29.8	74	35.4
PA°	Pelvic Angle		23.3		21.2
TA°	Tibia Angle		49.6		51.4
SK	Striker to Knee	589	101.3	693	102.8
ST	Striker to Head	452	9.8	425	32.5
SH	Striker to H-Point	301	139.2	409	118.2

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013



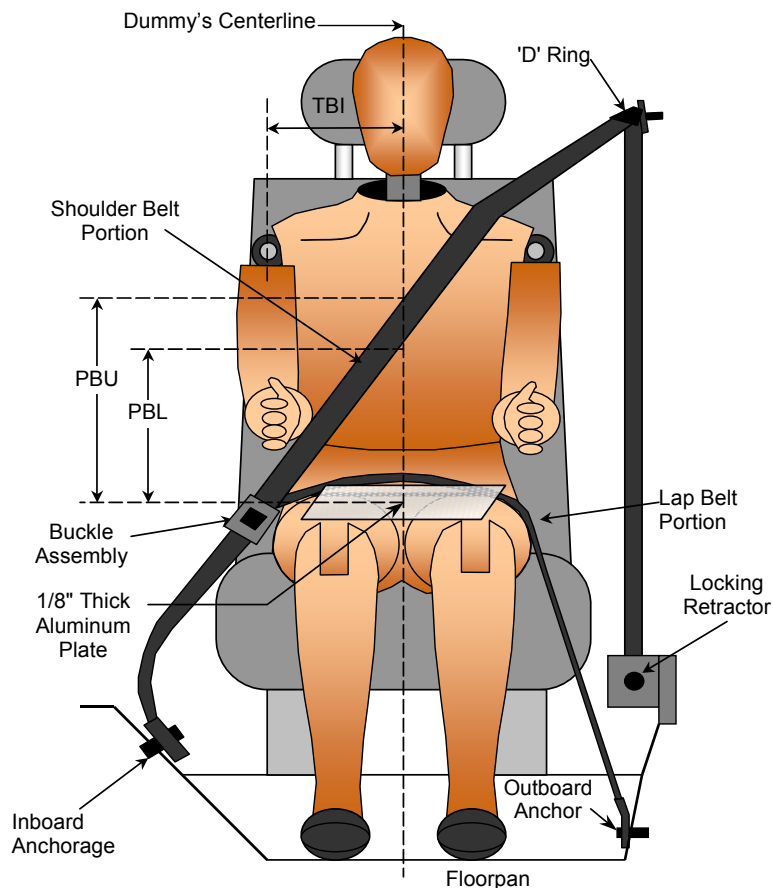
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver S/N 351	Passenger S/N 138
		Length (mm)	
AD	Arm to Door	127	88
HD	H-Point to Door	148	176
HR	Head to Side Header	238	267
HS	Head to Side Window	338	362
KK	Knee to Knee	350	225
SHY	Striker to H-Point (Y Direction)	275	320
AA	Ankle to Ankle	351	185

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
Test Date: 03/08/2013



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	300	250

BELT LENGTH DATA

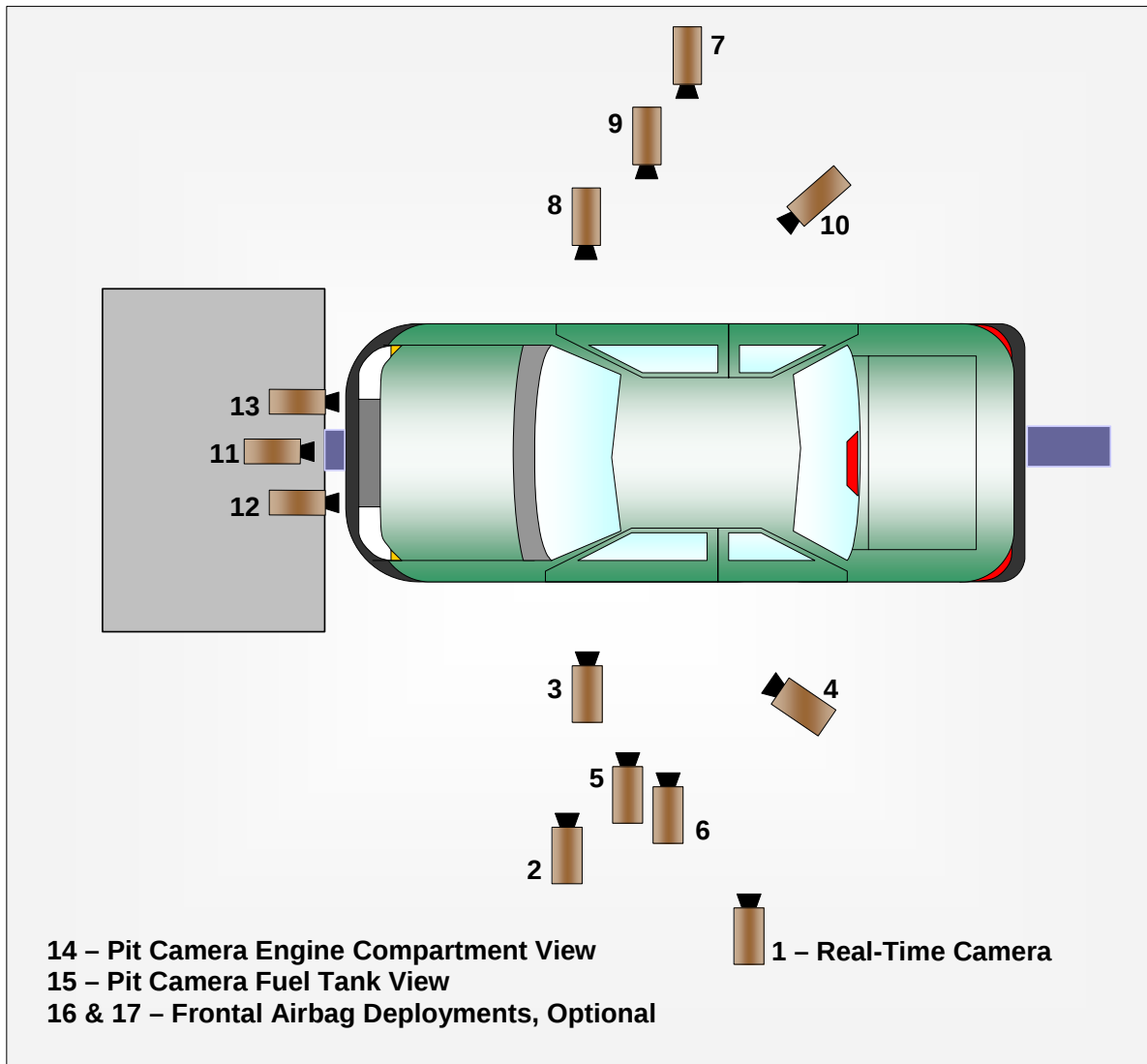
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	880	950
Lap Belt Length as measured on ATD	mm	800	830
Remainder of belt on reel	mm	1620	1470
Total Belt Length for Continuous Webbing Systems	mm	3300	3250

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

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
Test Date: 03/08/2013

CAMERA POSITIONS FOR FRONTAL IMPACTS



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

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	1620	-6680	-1960	35	1000
3	Left Front Half	1200	-4850	-1420	24	1000
4	Left Angle	5210	-5380	-2070	50	1000
5	Steering Column - Top	570	-5020	-1240	24	1000
6	Steering Column - Bottom	540	-4920	-810	24	1000
7	Right Overall	2110	6310	-1310	20	1000
8	Passenger Close-Up	1690	6890	-1970	35	1000
9	Right Front Half	1240	5070	-1390	24	1000
10	Right Angle	5260	5110	-2060	50	1000
11	Windshield	-50	0	-2810	20	1000
12	Driver Windshield	240	-450	-2030	8.5	1000
13	Passenger Windshield	240	450	-2030	8.5	1000
14	Pit Front	1090	0	3150	24	1000
15	Pit Rear	2920	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

***COORDINATES:**

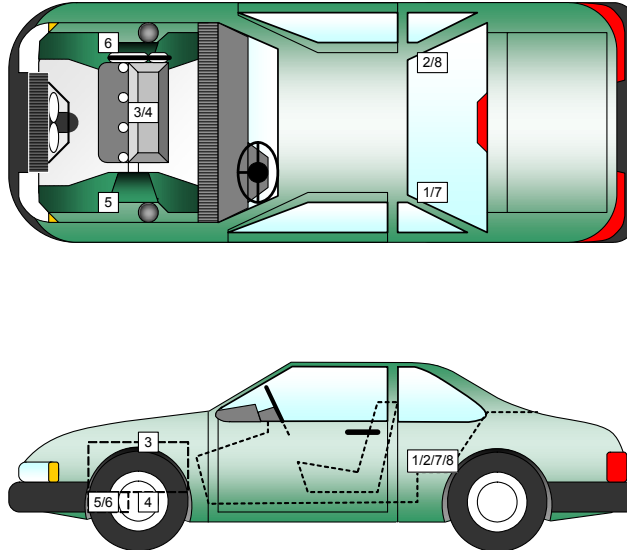
- +X = forward of impact plane
- +Y = right of monorail centerline
- +Z = below ground level

Cameras 16 & 17 were not used for this test.

DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Accelerometer – X Direction	1759	-310	-417
2	Right Rear Accelerometer – X Direction	1760	340	-425
3	Engine Top X	3824	0	-920
4	Engine Bottom X	3828	-123	-198
5	Left Rear Accelerometer – Z Direction	1759	-310	-417
6	Right Rear Accelerometer – Z Direction	1760	340	-425
7	Left Rear Accelerometer Redundant – X Direction	1759	-310	-417
8	Right Rear Accelerometer Redundant – X Direction	1760	340	-425

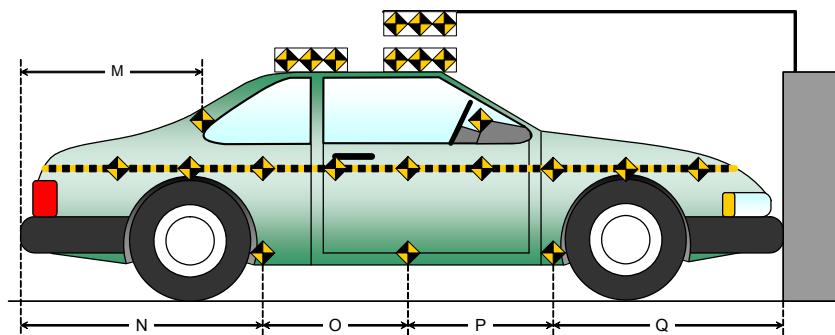
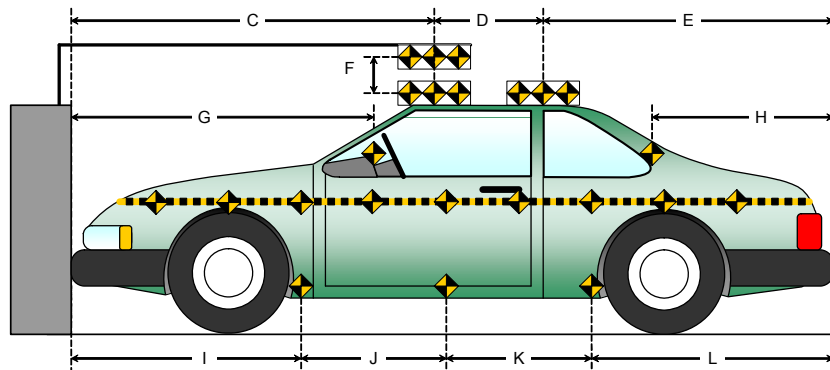
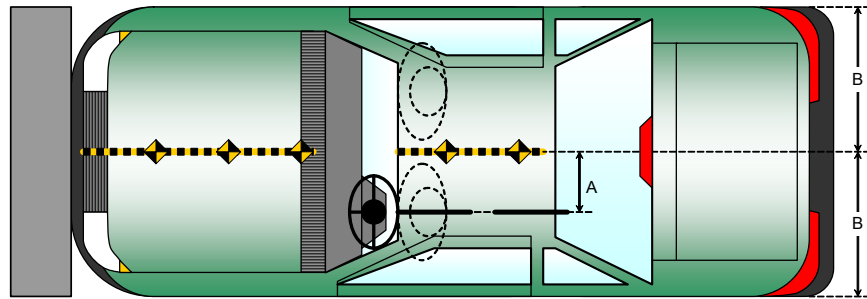
Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

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

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

Item	Value (mm)
A	388
B	914
C	2320
D	670
E	1580
F	140
G	
H	720
I	1380
J	860
K	860
L	1470
M	720
N	1470
O	860
P	860
Q	1380



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

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

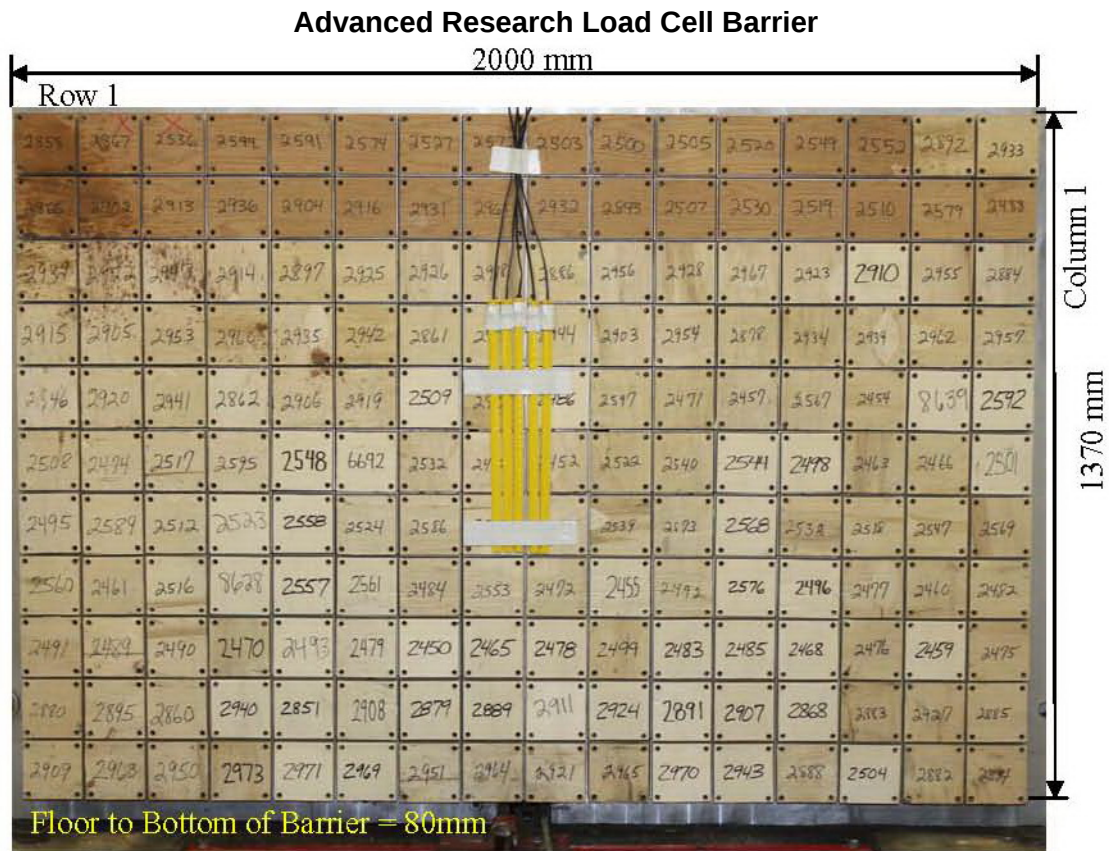


Photo for Reference Only

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 Toyota RAV4 LE AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
Test Date: 03/08/2013

INSTRUMENTATION

Driver Dummy Data Channels	46
Passenger Dummy Data Channels	46
Vehicle Structure Accelerometers	8
Barrier Channels	528
Total	628

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 Toyota RAV4 LE AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
Test Date: 03/08/2013

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, Seatback
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Airbag	Glove Box
Right Knee Contact	Knee Airbag	Glove Box

DOOR OPENING AND SEAT TRACK INFORMATION

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

POST TEST STRUCTURAL OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1429
Center	mm	1331
Right Side	mm	1394
Average	mm	1385

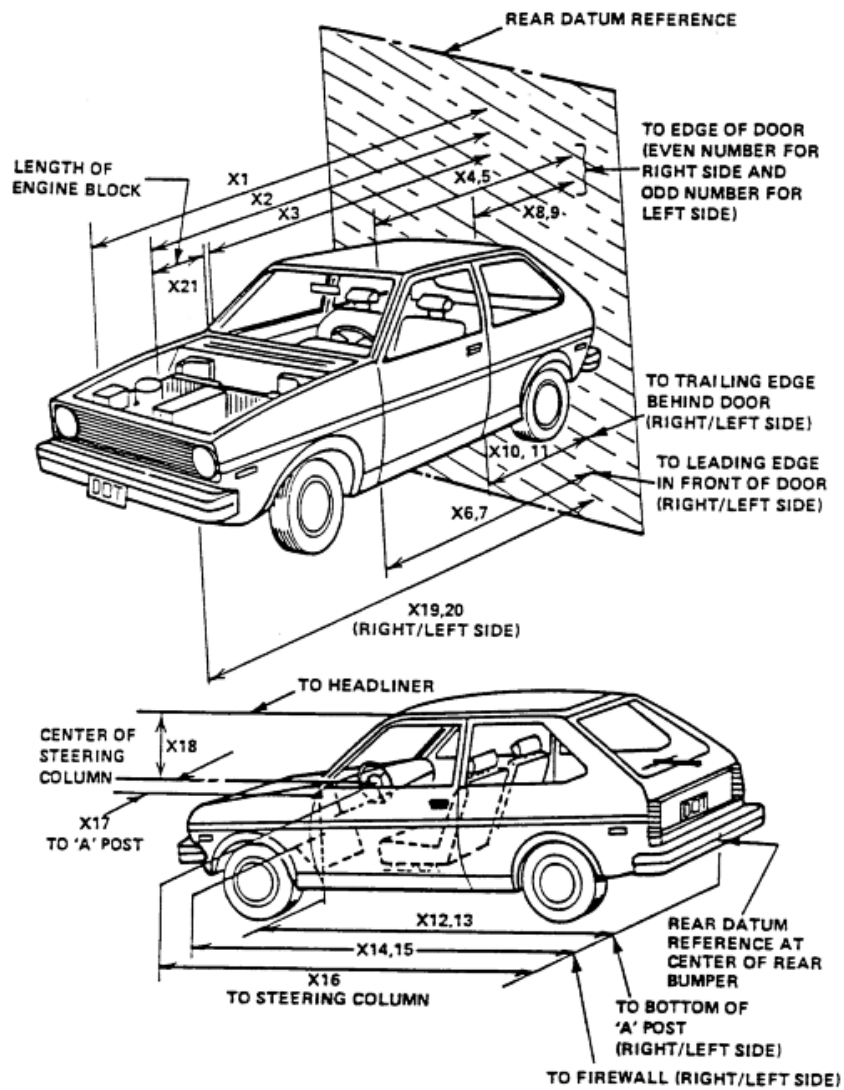
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

DATA SHEET NO. 12 **VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4570	4118	452
2	RSOV to Front of Engine	mm	4106	3892	214
3	RSOV to Firewall	mm	3528	3458	70
4	RSOV to Upper Leading Edge of Right Door	mm	3138	3142	-4
5	RSOV to Upper Leading Edge of Left Door	mm	3138	3143	-5
6	RSOV to Lower Leading Edge of Right Door	mm	3084	3092	-8
7	RSOV to Lower Leading Edge of Left Door	mm	3084	3045	39
8	RSOV to Upper Trailing Edge of Right Door	mm	2075	2077	-2
9	RSOV to Upper Trailing Edge of Left Door	mm	2075	2077	-2
10	RSOV to Lower Trailing Edge of Right Door	mm	2075	2077	-2
11	RSOV to Lower Trailing Edge of Left Door	mm	2075	2077	-2
12	RSOV to Bottom of "A" Post of Right Side	mm	3095	3094	1
13	RSOV to Bottom of "A" Post of Left Side	mm	3091	3091	0
14	RSOV to Firewall, Right Side	mm	3503	3372	131
15	RSOV to Firewall, Left Side	mm	3503	3374	129
16	RSOV to Steering Column	mm	2674	2762	-88
17	Center of Steering Column to "A" Post	mm	402	394	8
18	Center of Steering Column to Headliner	mm	452	473	-21
19	RSOV to Right Side of Front Bumper	mm	4422	4041	381
20	RSOV to Left Side of Front Bumper	mm	4422	4057	365
21	Length of Engine Block	mm	502	502	0
RD	RSOV to Right Side of Dash Panel	mm	2870	2908	-38
CD	RSOV to Center of Dash Panel	mm	2754	2721	33
LD	RSOV to Left Side of Dash Panel	mm	2879	2892	-13

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
Test Date: 03/08/2013

VEHICLE INFORMATION

VIN: 2T3BFREV6DW007388 Wheelbase (mm): 2664
Vehicle Size Category: MPV Test Weight (kg): 1813.0

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15

Cal. Procedure/Interval: MGA procedure / 6 month

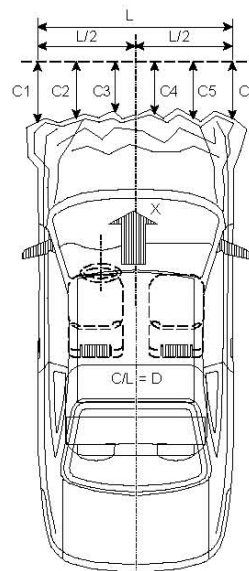
Integration Algorithm: Trapezoidal

Linearity: > 99%

Impact Velocity (km/h): 56.7

Velocity Change (km/h): 66.1

Time of Separation (msec): 81.2



CRUSH PROFILE

Collision Deformation Classification: Frontal

Midpoint of Damage: Centerline

Damage Region Length (mm): 1290

Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4422	4057	365
C2	Crush zone 2 at left side	mm	4507	4101	406
C3	Crush zone 3 at left side	mm	4526	4124	402
C4	Crush zone 4 at right side	mm	4526	4121	405
C5	Crush zone 5 at right side	mm	4507	4086	421
C6	Crush zone 6 at right side	mm	4422	4041	381
L	C1 TO C6	mm	1290	1290	0

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

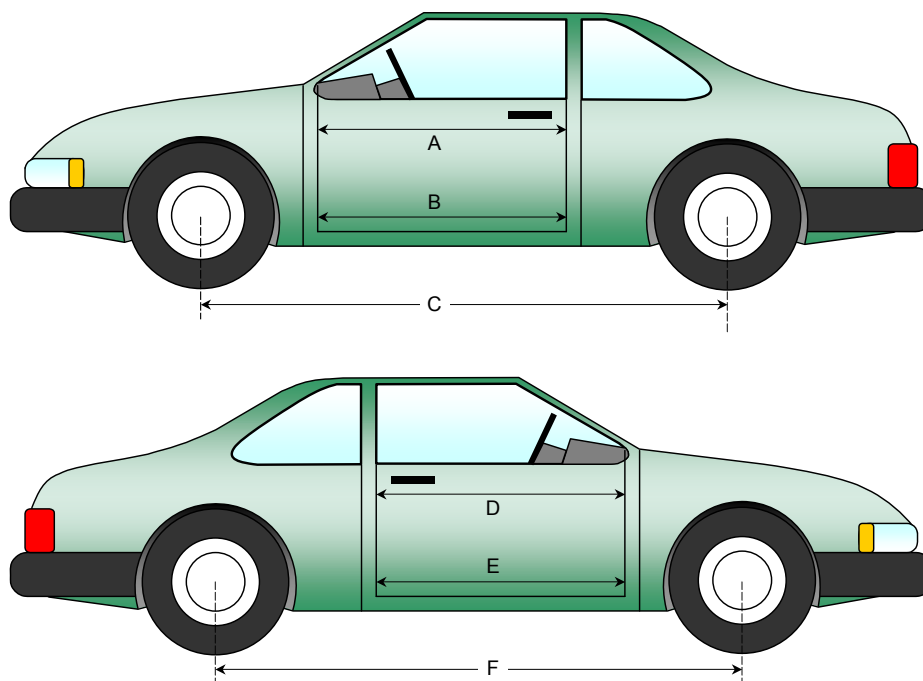
NHTSA No.: YD5109
Test Date: 03/08/2013

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	976	975	1
B	Left Side Lower	mm	880	874	6
D	Right Side Upper	mm	976	976	0
E	Right Side Lower	mm	880	876	4

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2664	2649	15
F	Right Side Wheelbase	mm	2664	2654	10



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

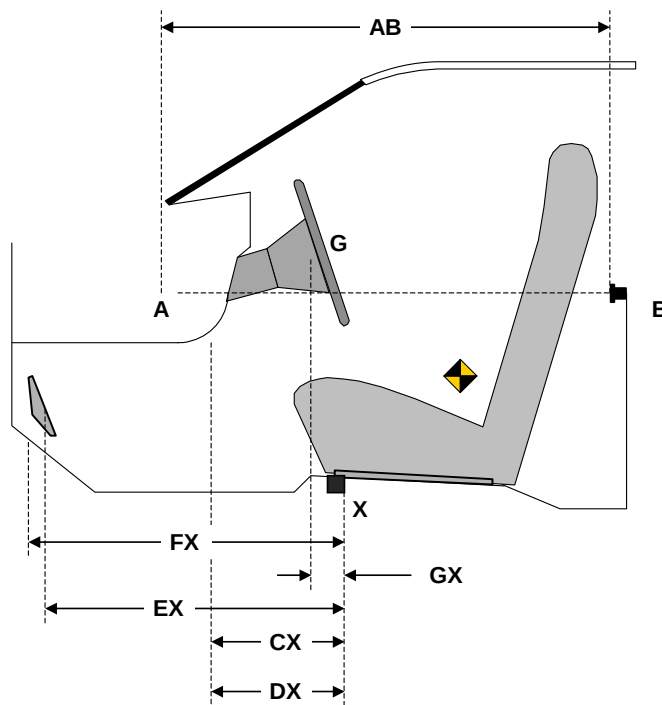
Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	825	825	0
CX	Left Knee Bolster to X	mm	276	302	-26
DX	Right Knee Bolster to X	mm	288	322	-34
EX	Brake Pedal to X	mm	577	611	-34
FX	Foot Rest to X	mm	633	630	3
GX	Center of Steering Column Wheel Hub to X	mm	93	182	-89

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 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

Windshield Mounting Details:

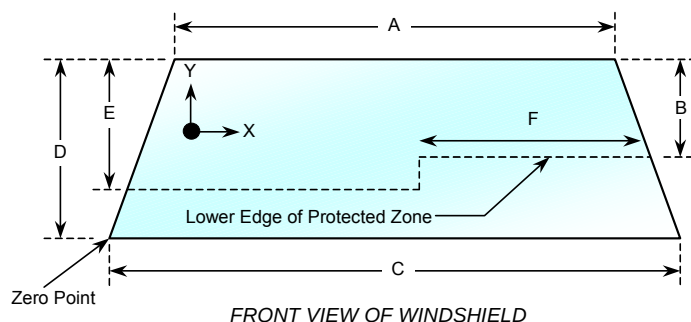
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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: 21.5°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2109	2109	100
Right Side	2109	2109	100
Total	4218	4218	100



Item	Units	Value
A	mm	1202
B	mm	501
C	mm	1364
D	mm	826
E	mm	503
F	mm	582

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: 2013 Toyota RAV4 LE AWD SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
Test Date: 03/08/2013

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21.5°C Test Time: 2:23 p.m.

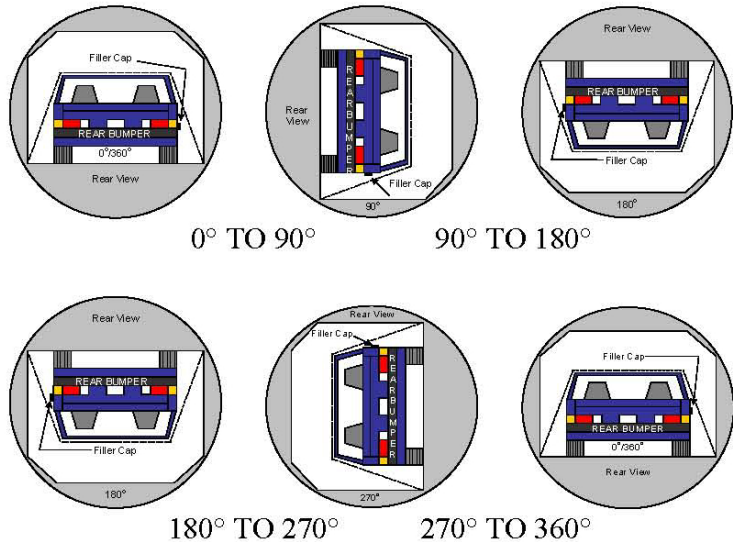
- A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)
- B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)
- C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)
- D. Spillage: None

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

Test Vehicle: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013

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: **None**



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	115	300	415
90° to 180°	110	300	410
180° to 270°	108	300	408
270° to 360°	113	300	413

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

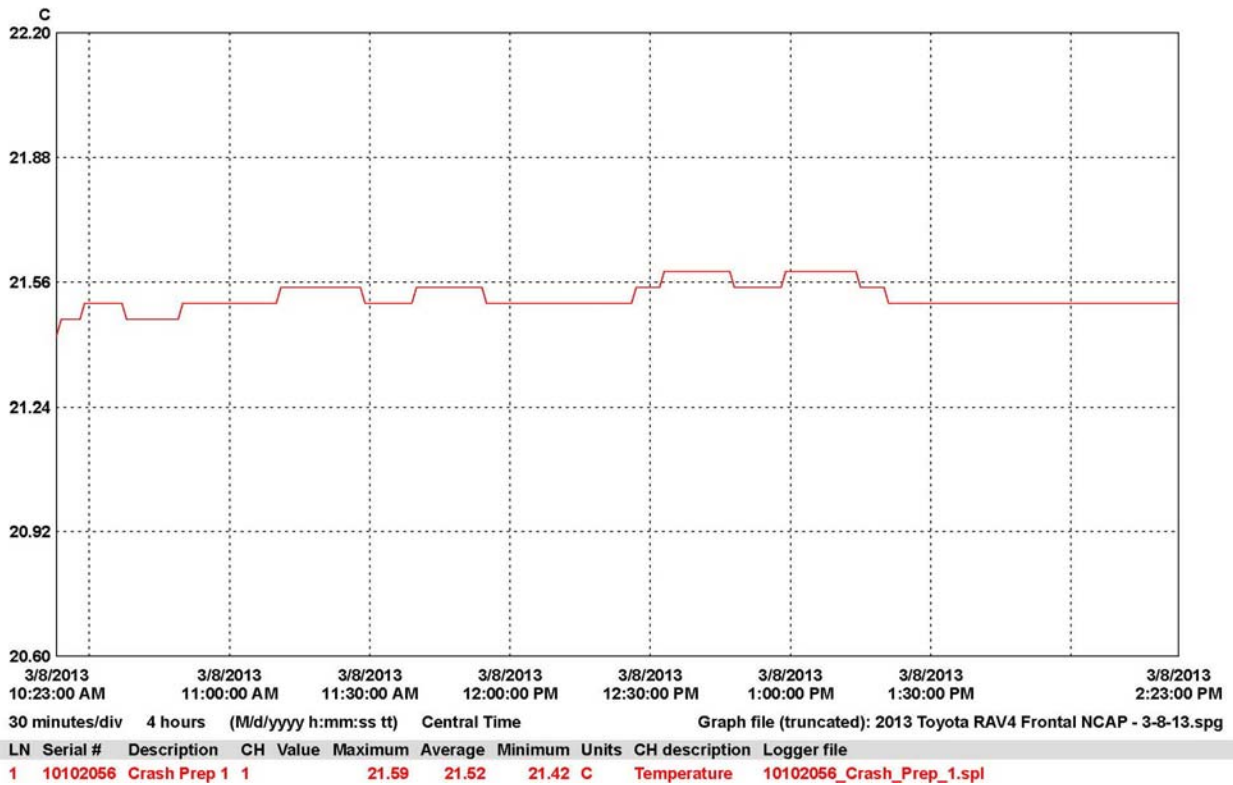
SOLVENT SPILLAGE LOCATION TABLE

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: 2013 Toyota RAV4 LE AWD SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: YD5109
 Test Date: 03/08/2013



APPENDIX A
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Load Cell Location



Load Cell Wall



Manufacturer's Label



Reduced Load Carrying Capacity



Tire Placard



2013 Toyota RAV4 AWD 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



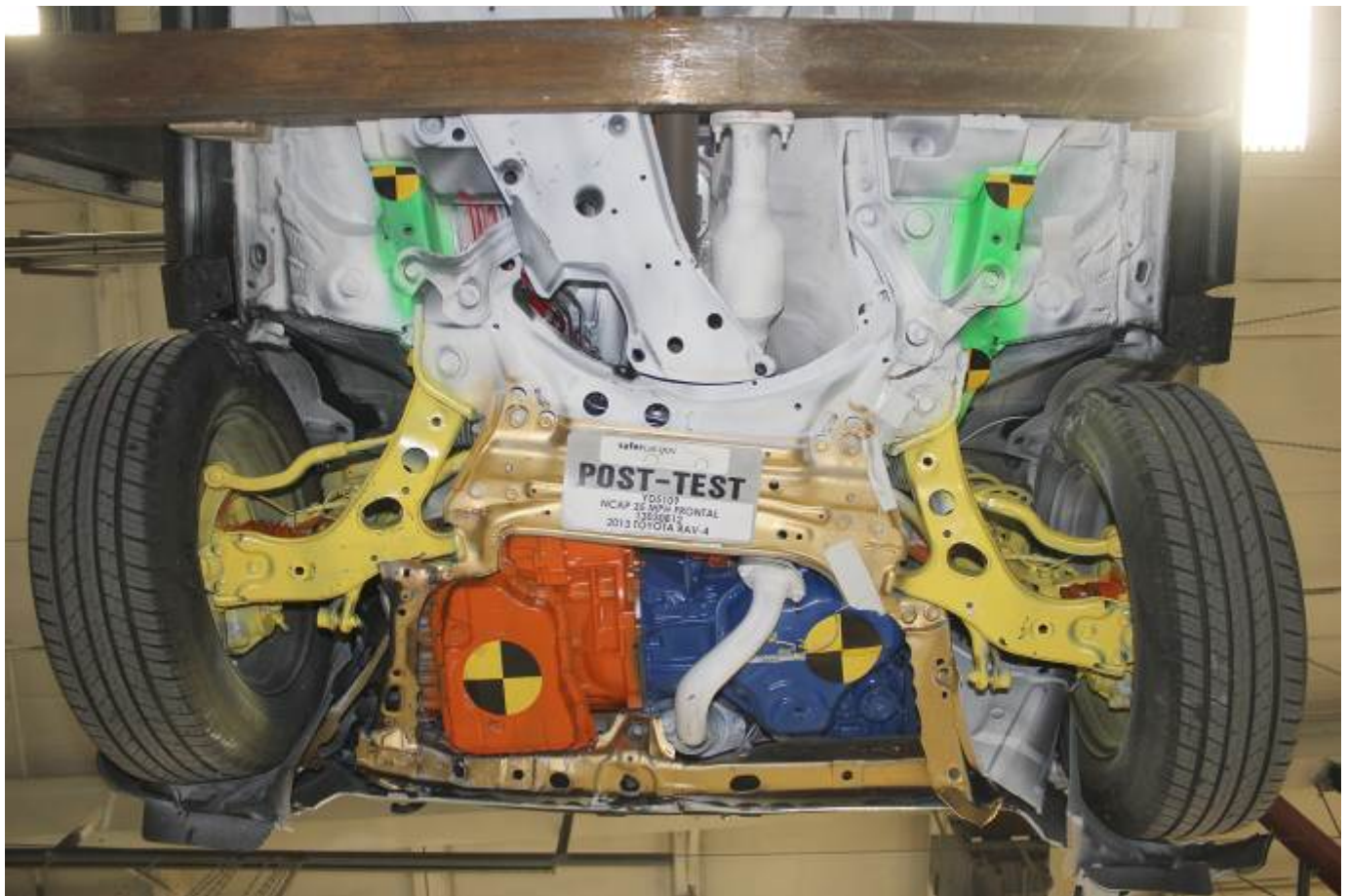
Pre-Test Fuel Filler Cap View



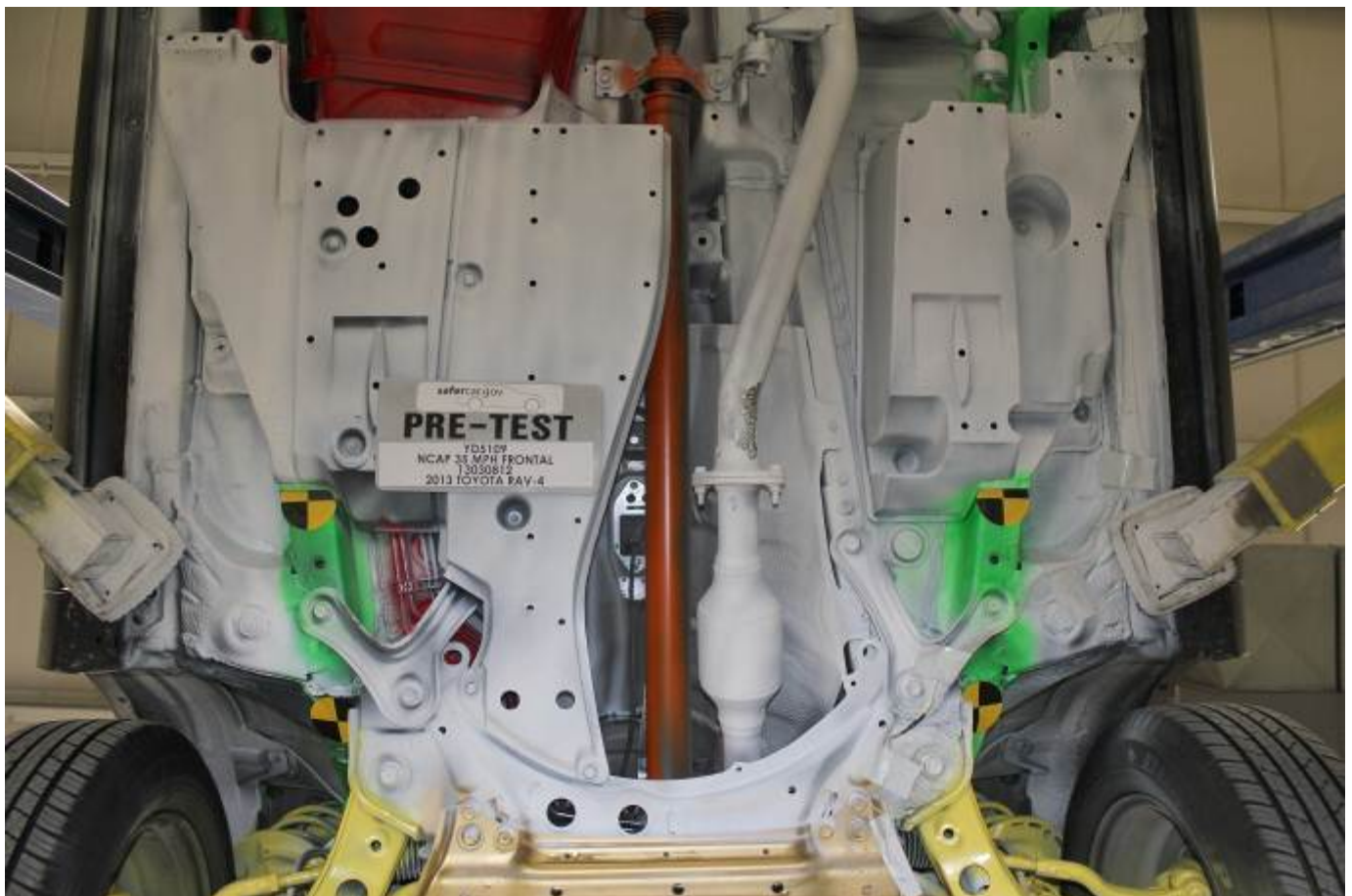
Post-Test Fuel Filler Cap View



Pre-Test Front Underbody View



Post-Test Front Underbody View



Pre-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



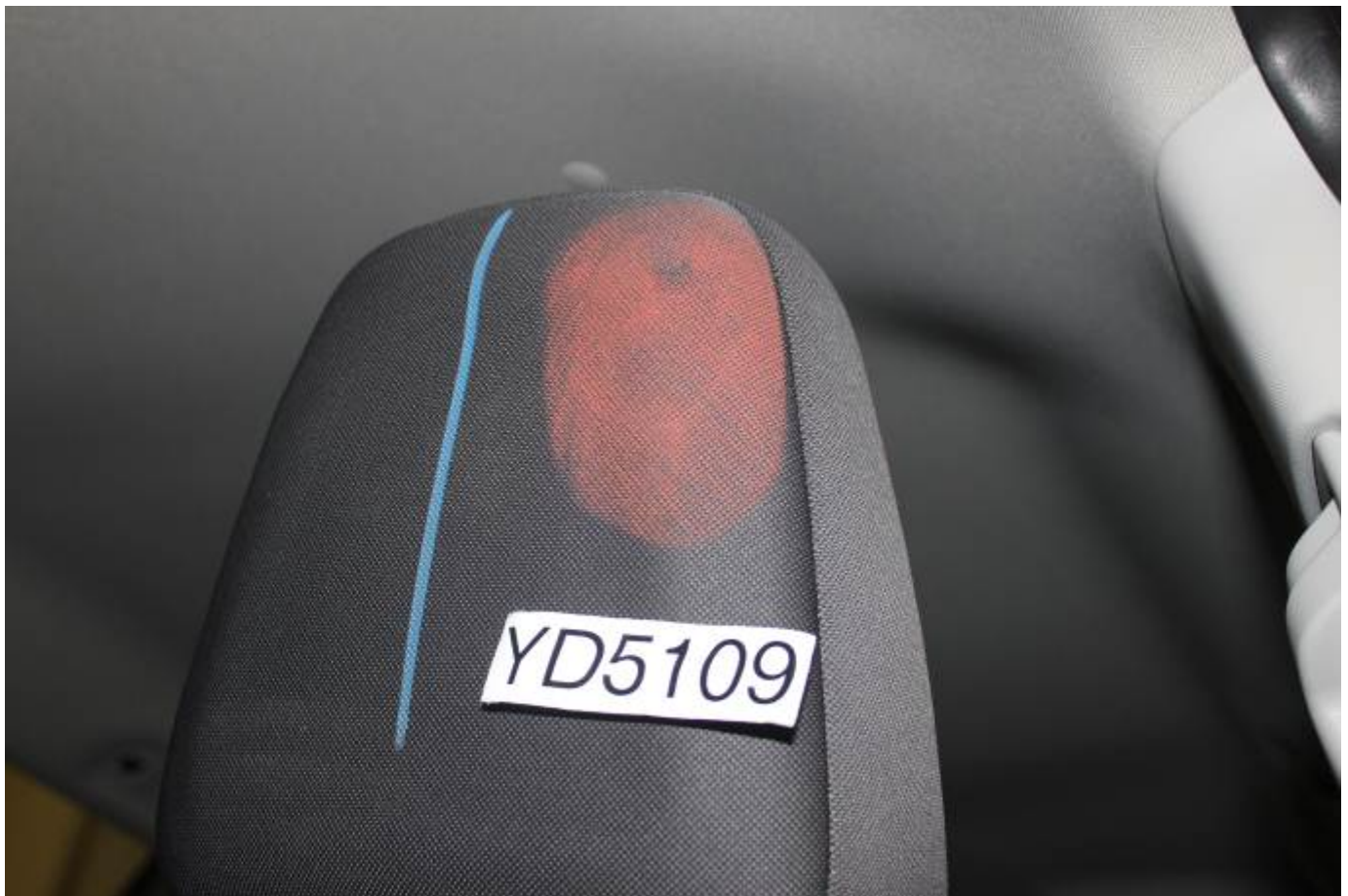
Post-Test Driver's Side Floorpan



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 Airbag



Post-Test Driver Dummy Contact with Knee Airbag



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



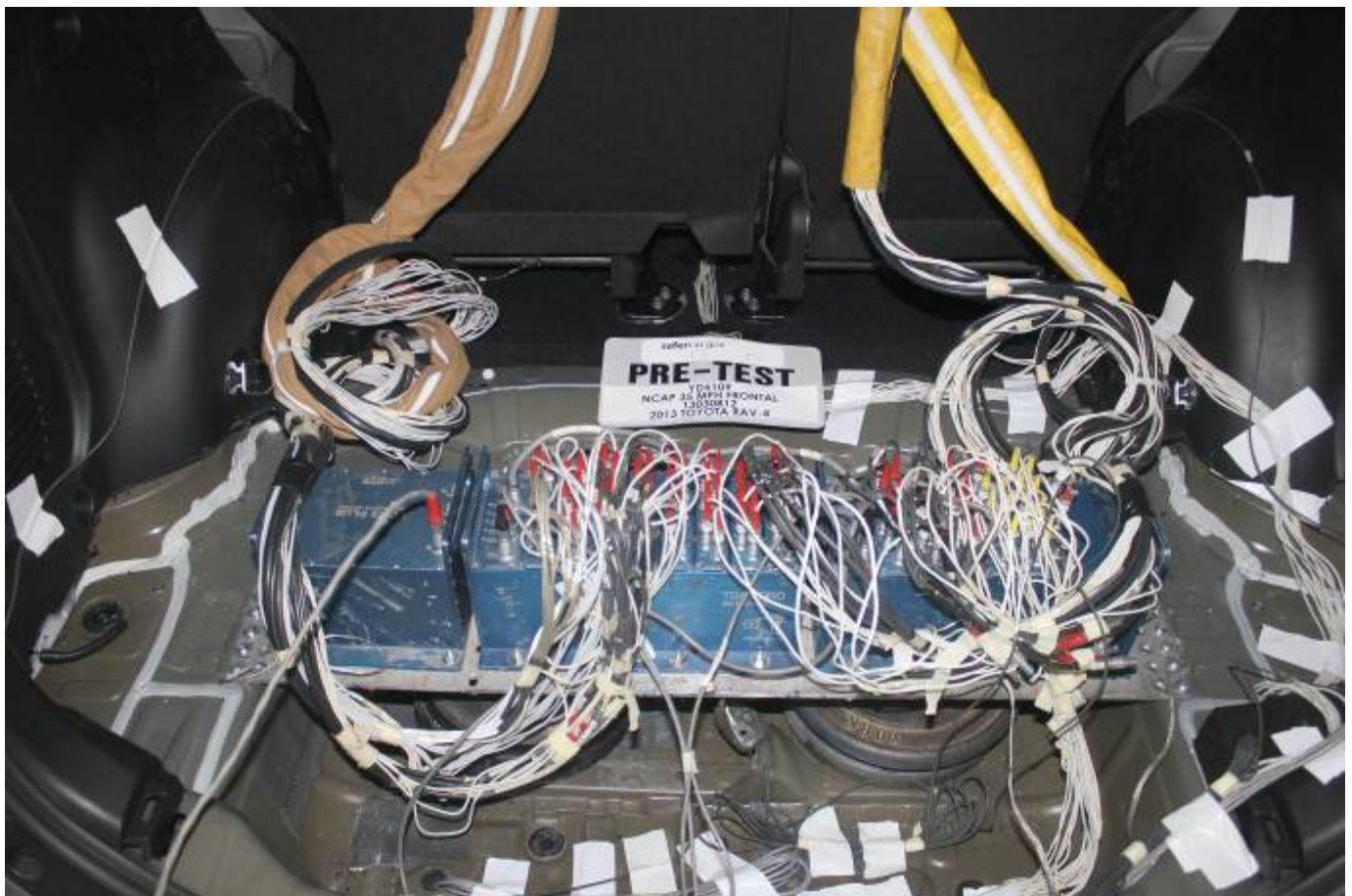
Post-Test Passenger Dummy Contact with Headrest



Post-Test Passenger Dummy Contact with Seatback



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



2013 Toyota RAV4 AWD Frontal Impact Event

APPENDIX B
DUMMY RESPONSE DATA TRACES

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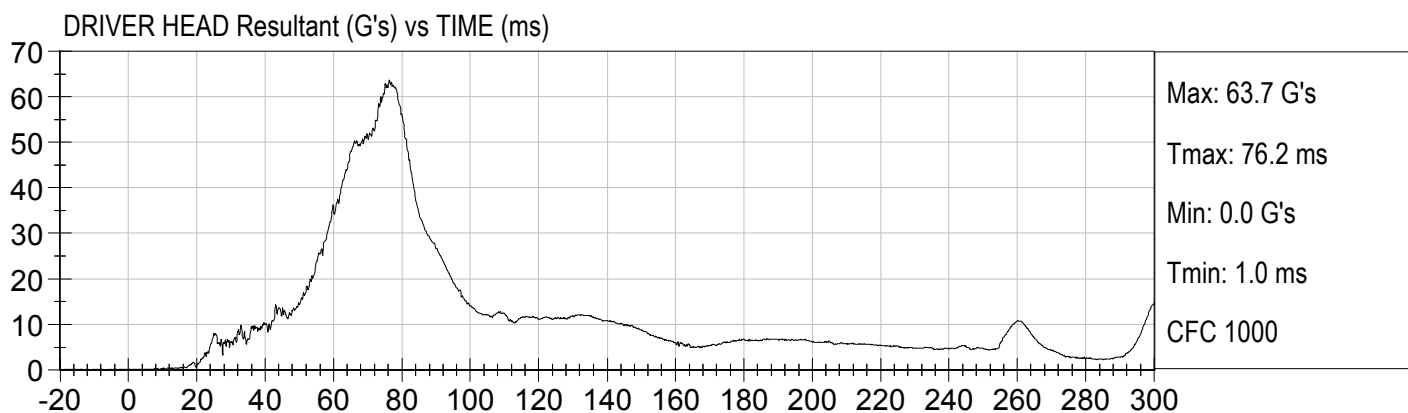
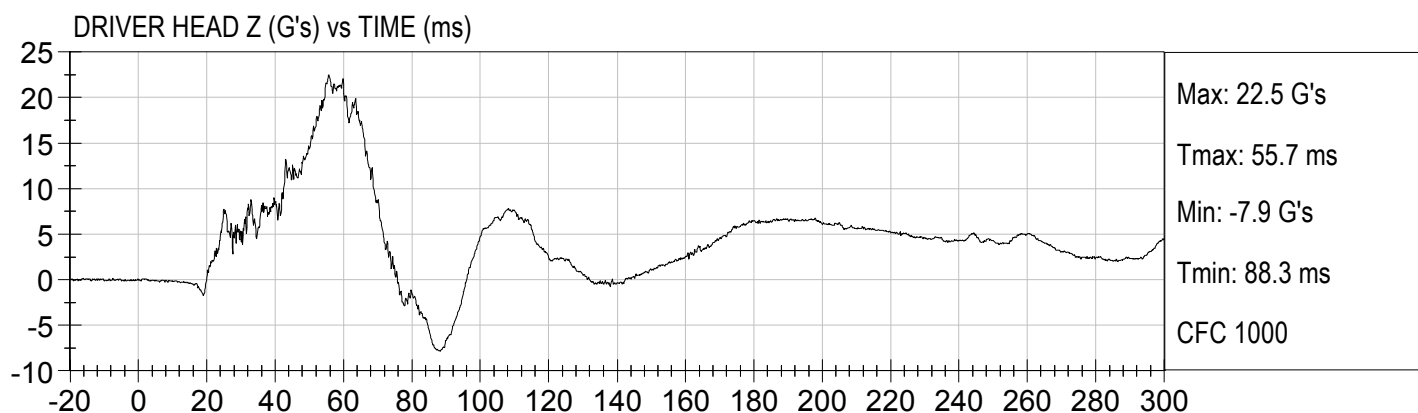
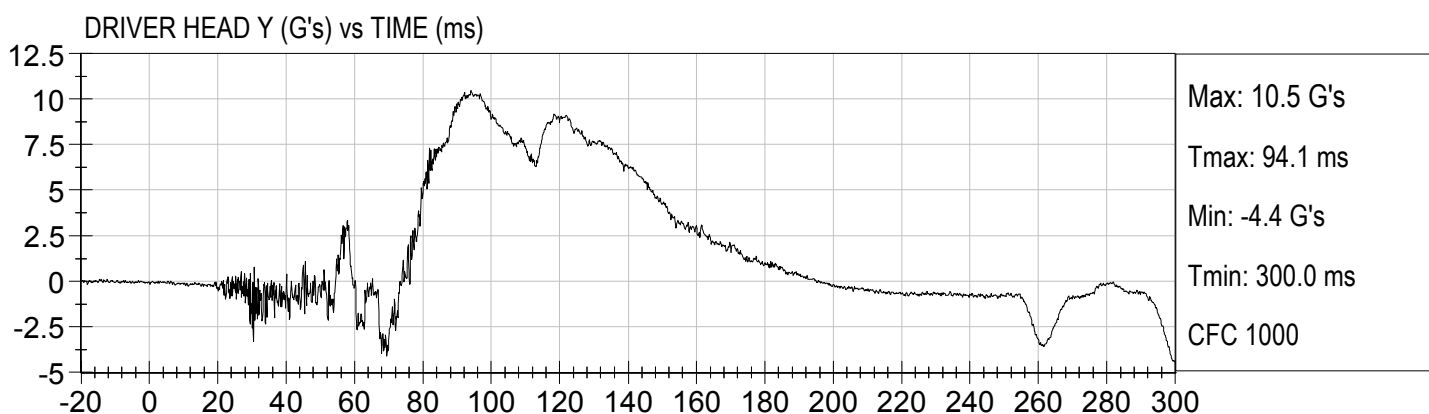
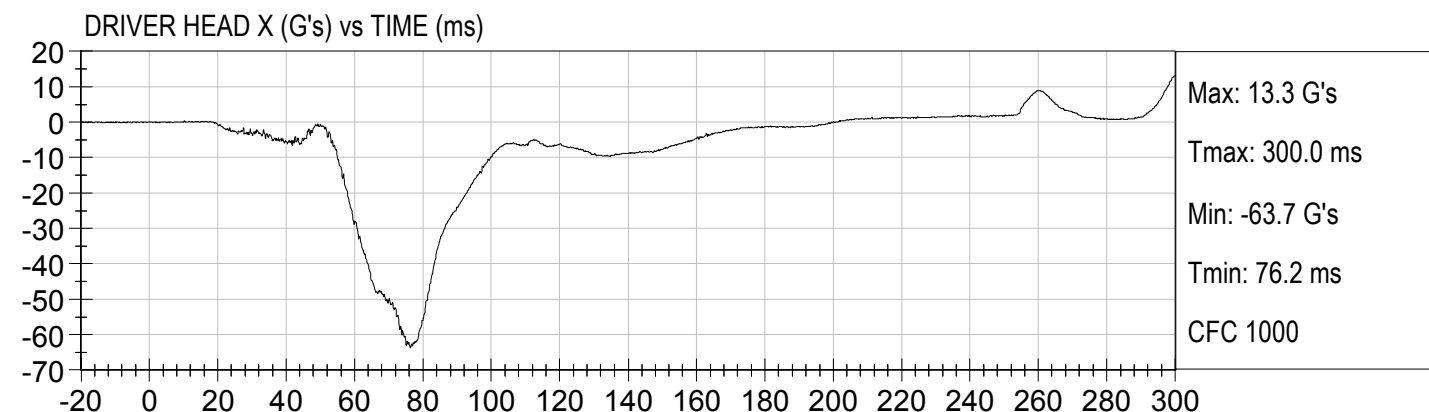
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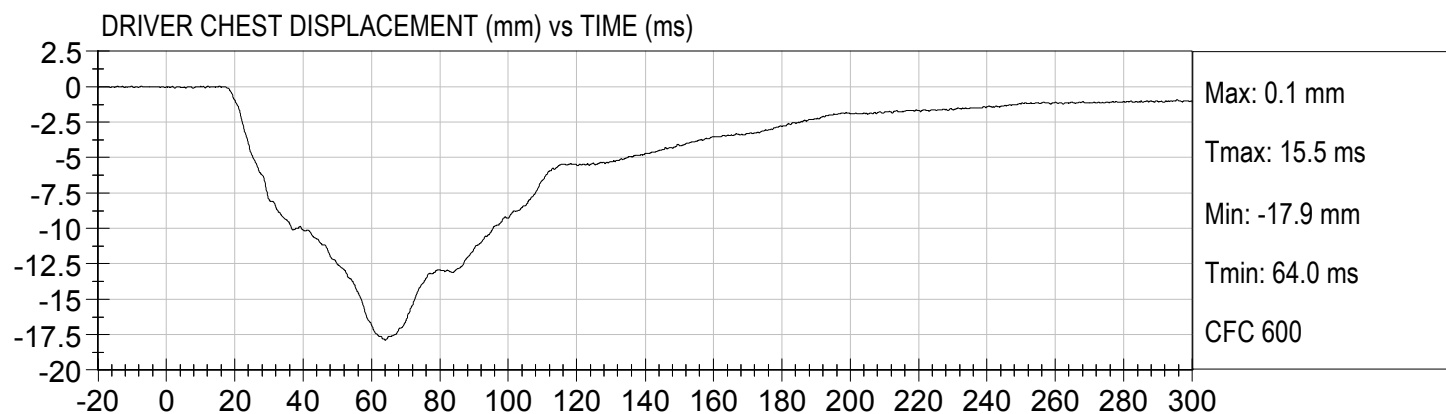
The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

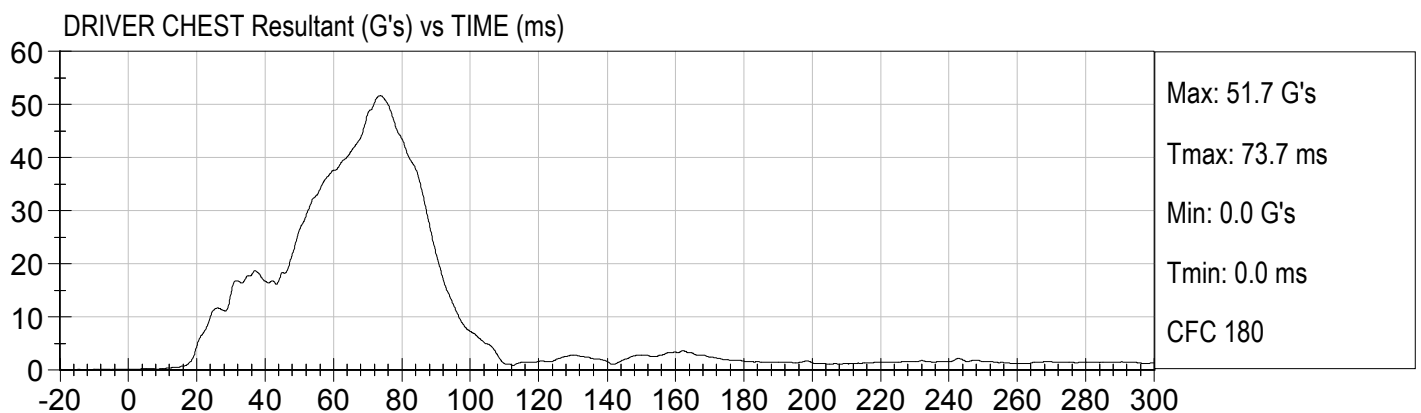
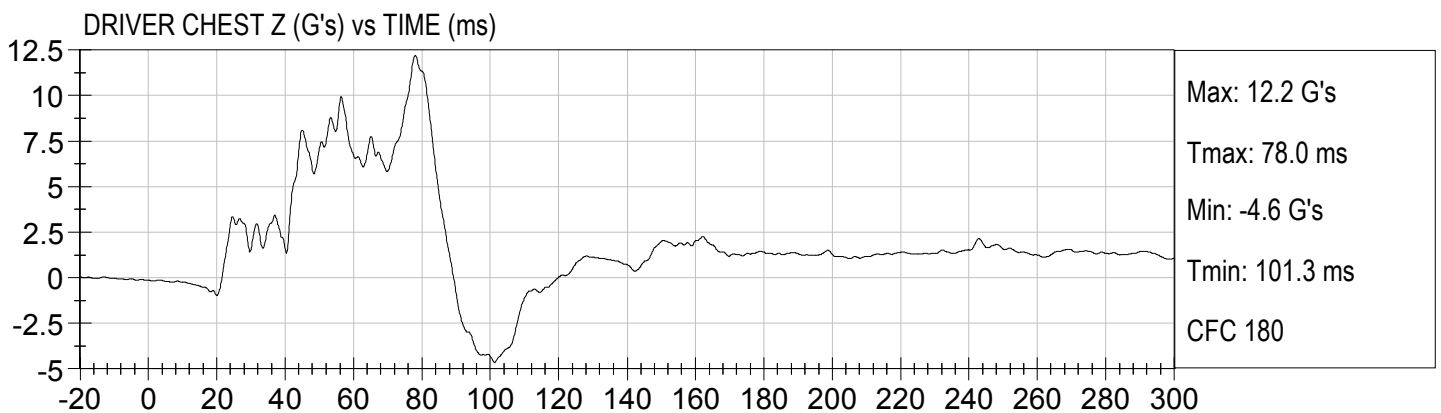
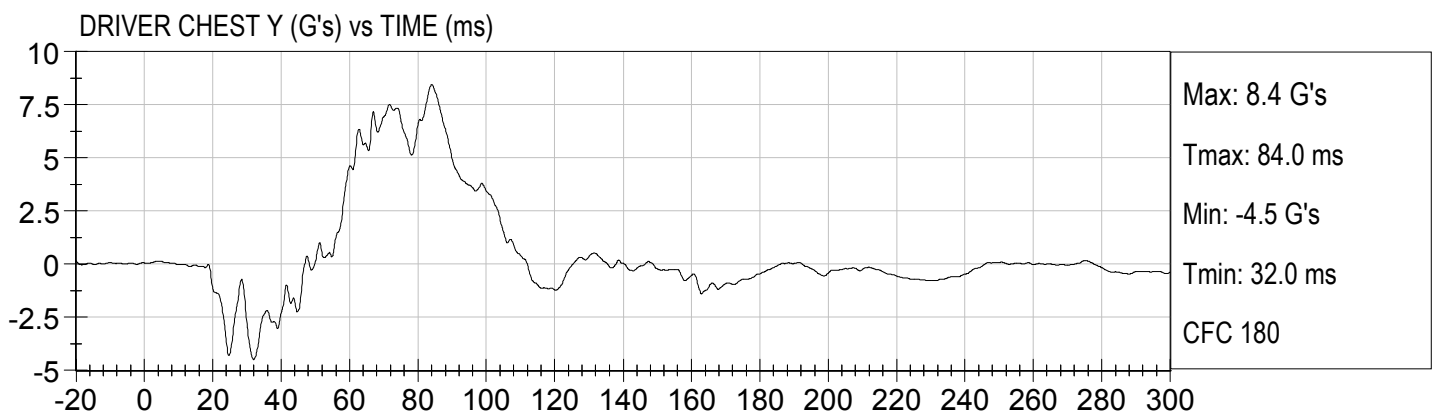
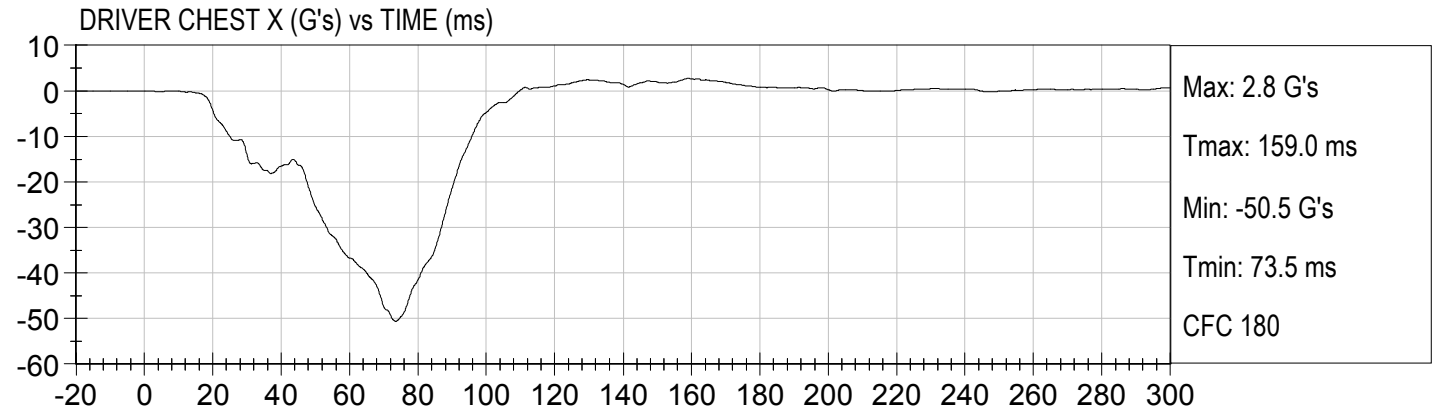
Driver Head X Redundant
 Driver Head Y Redundant
 Driver Head Z Redundant
 Driver Upper Neck Force Y
 Driver Upper Neck Moment X
 Driver Upper Neck Moment Z
 Driver Chest X Redundant
 Driver Chest Y Redundant
 Driver Chest Z Redundant
 Driver Pelvis X
 Driver Pelvis Y
 Driver Pelvis Z
 Driver Left Femur 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

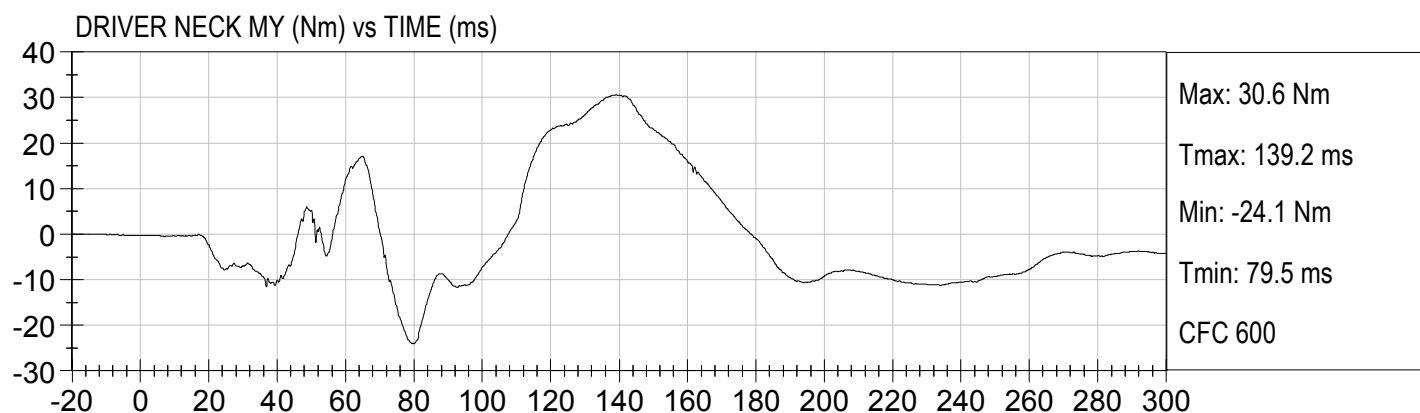
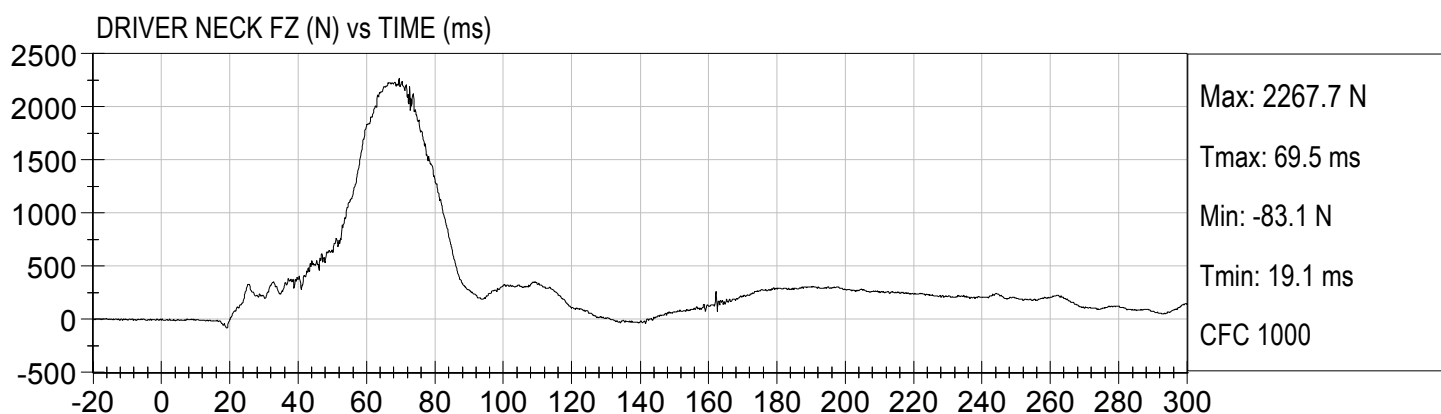
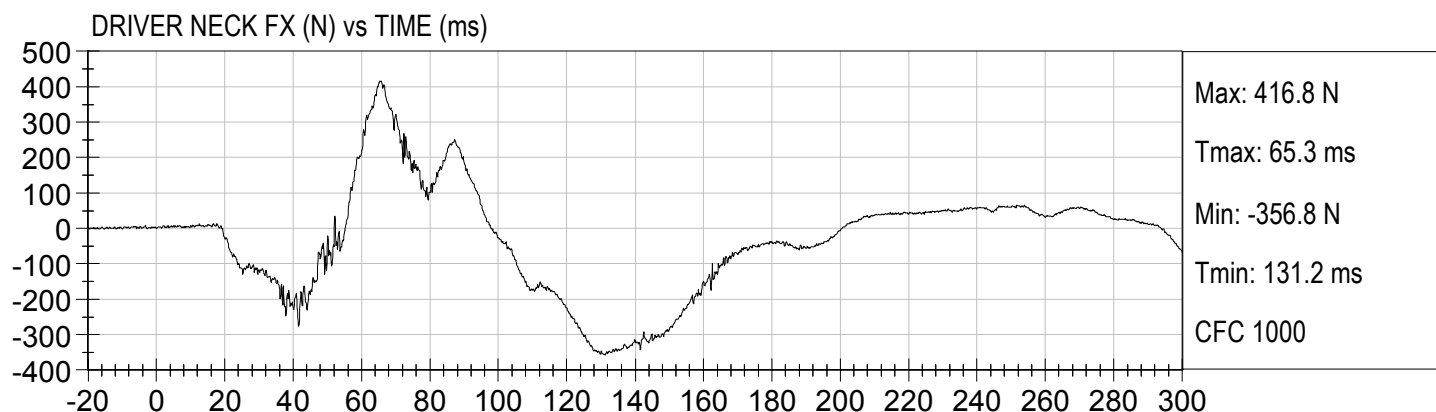
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Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot 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 – Not Installed
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

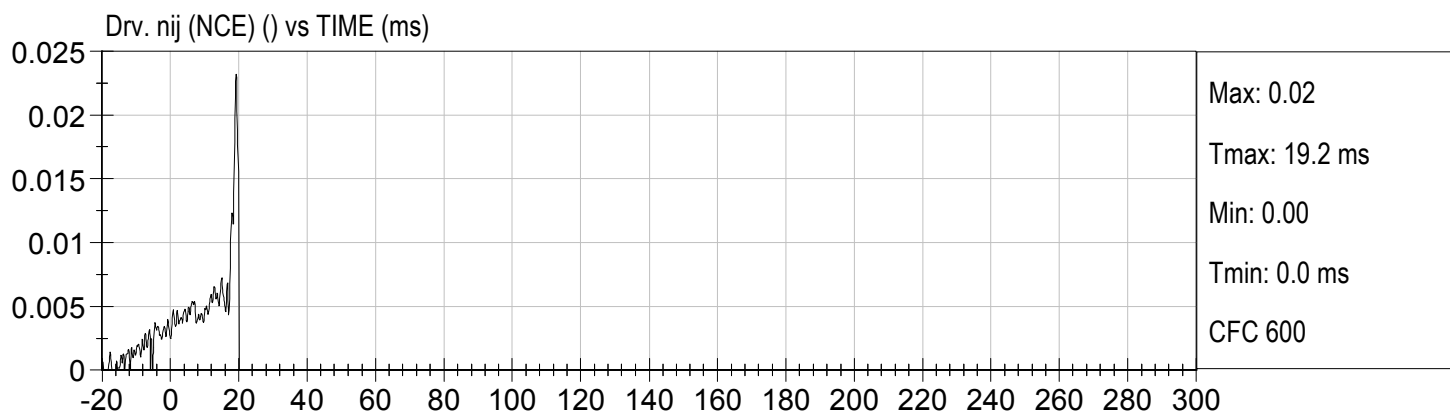
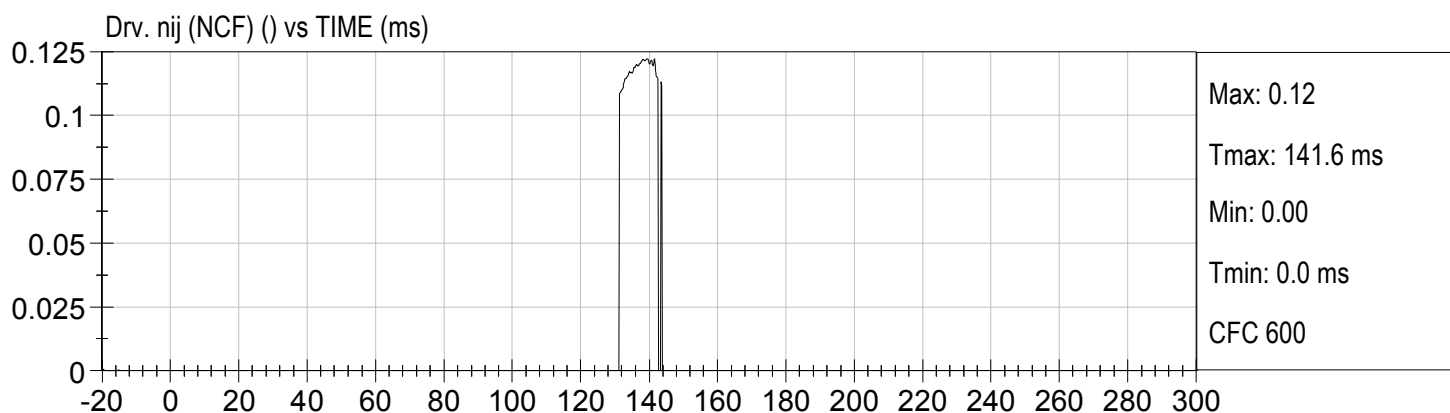
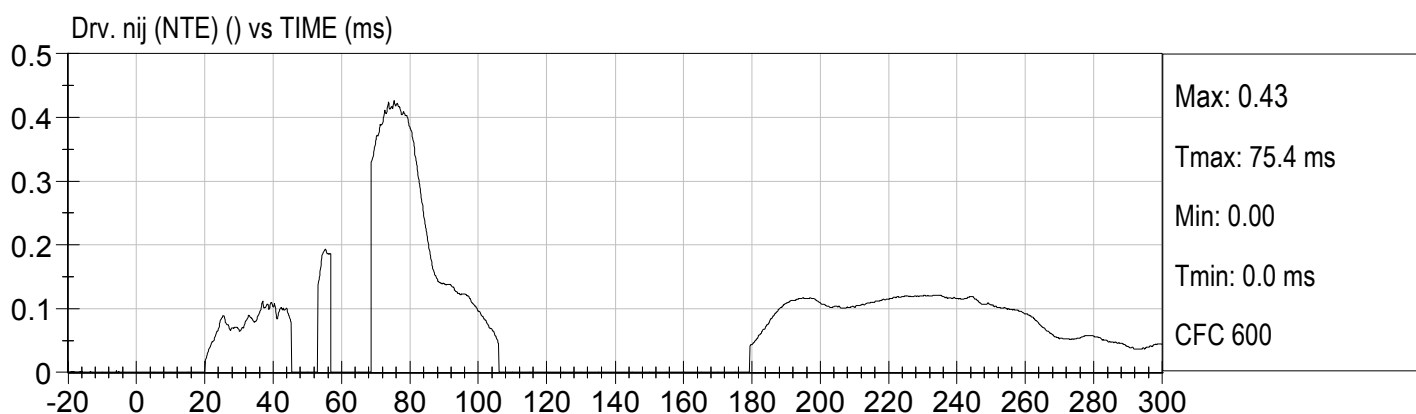
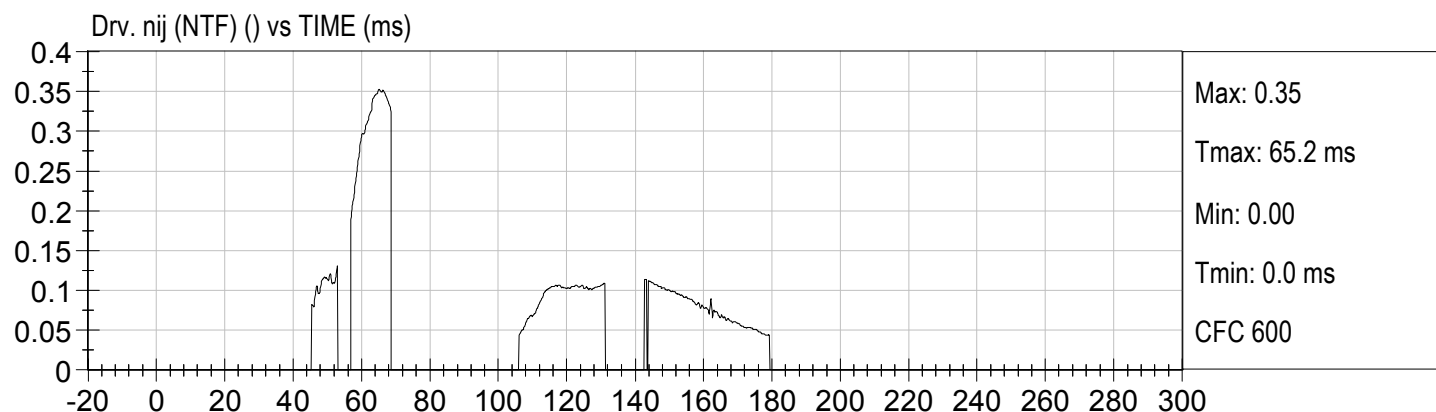
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right 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 – Not Installed
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

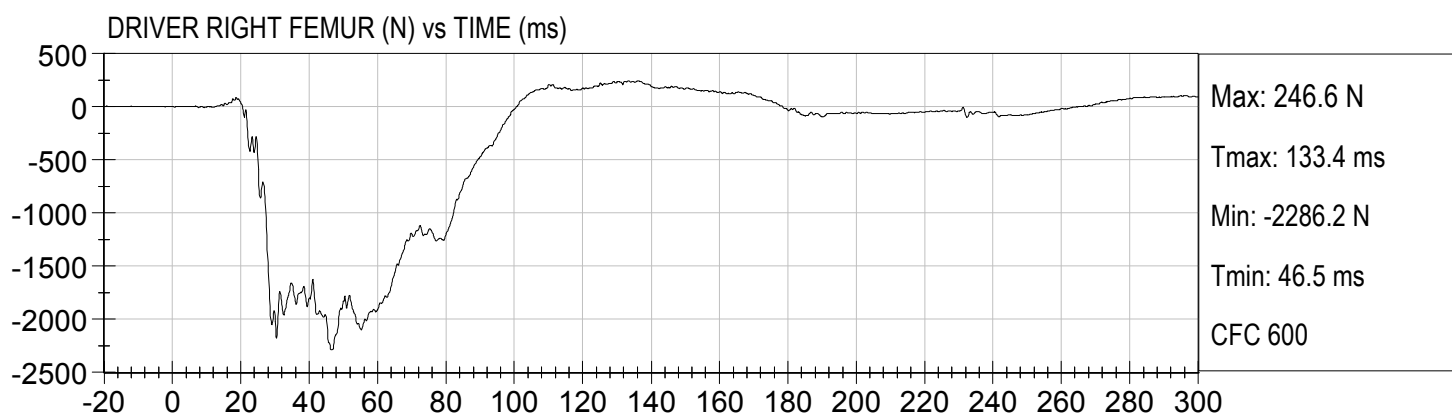
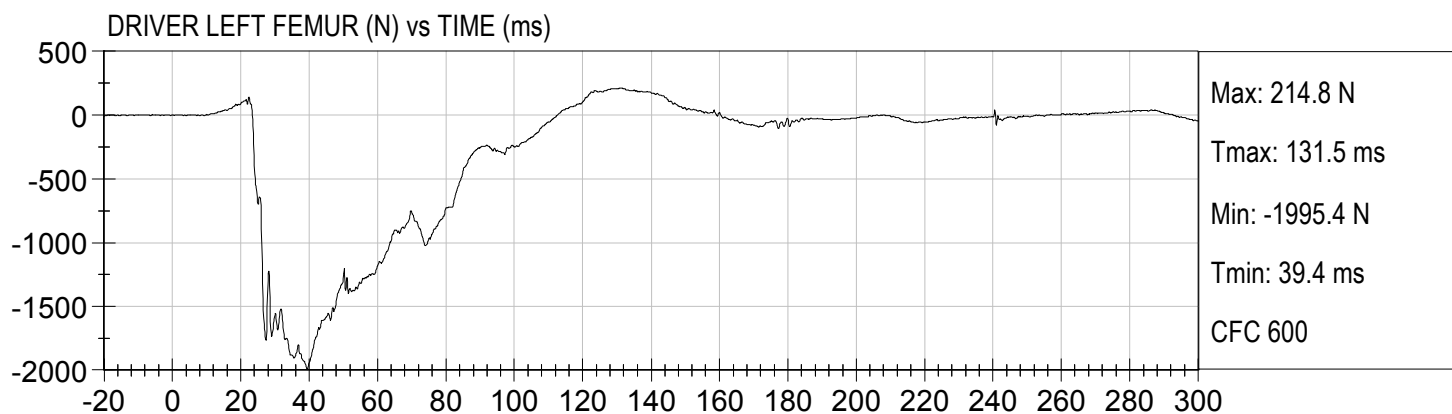


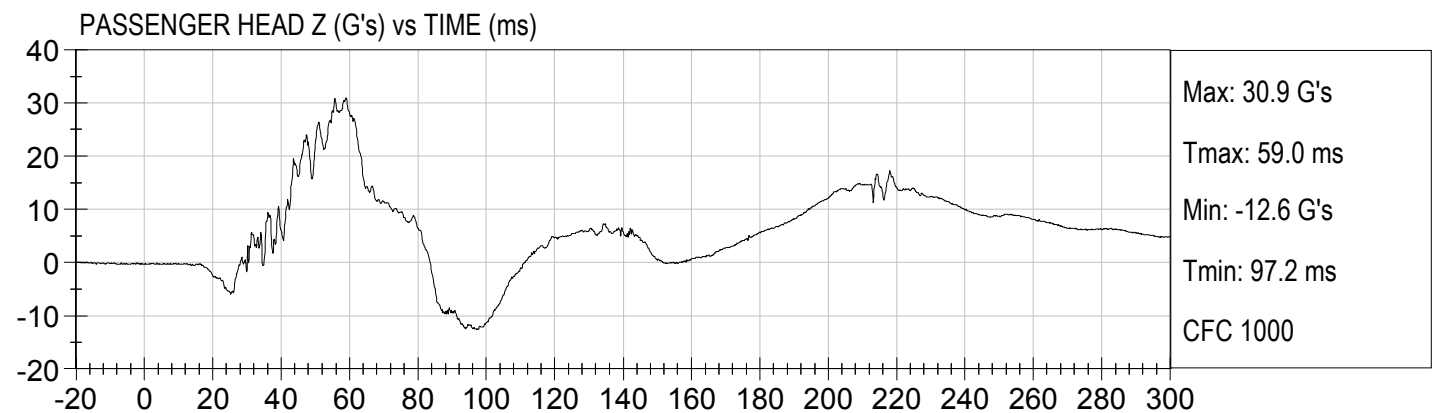
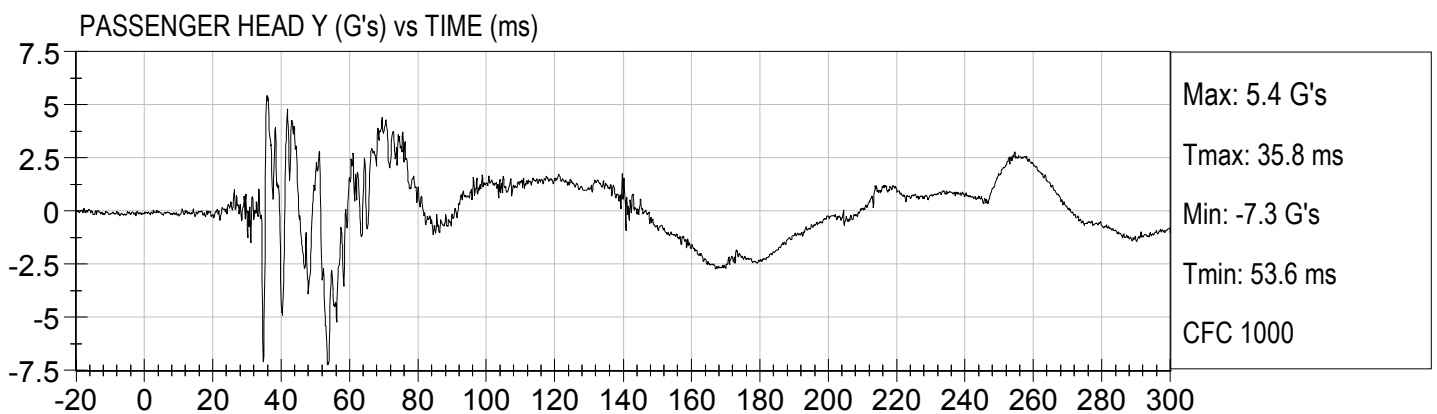
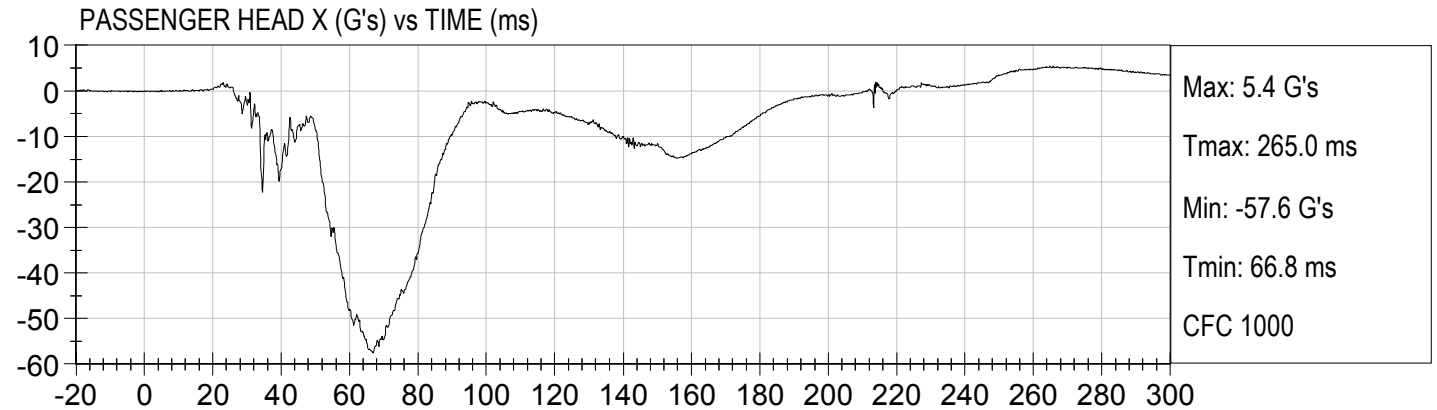


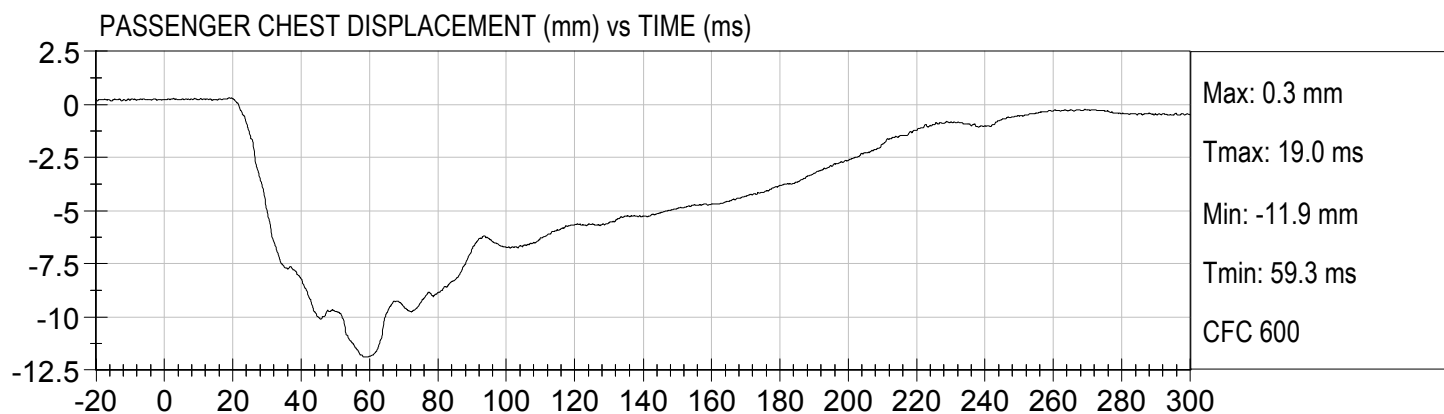


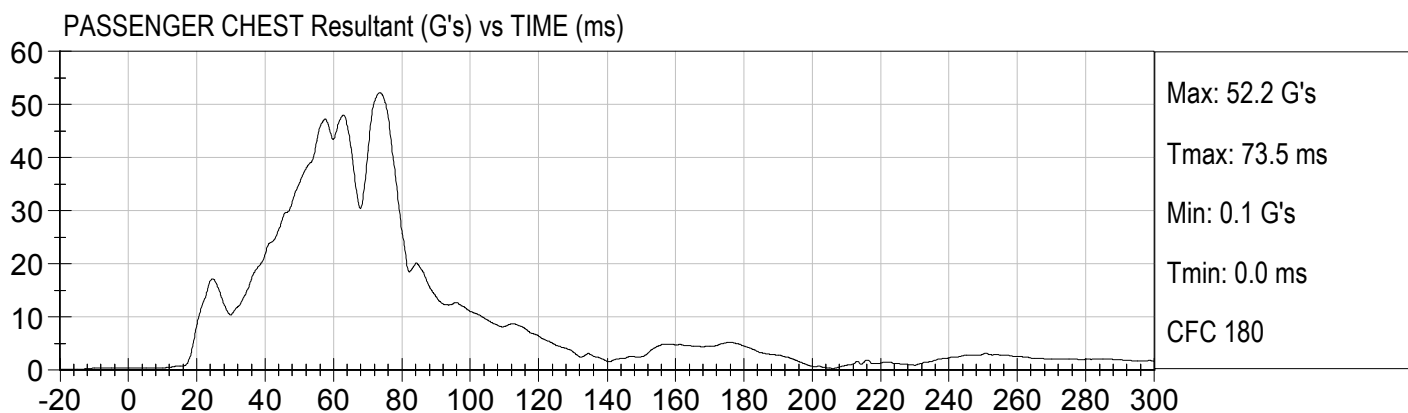
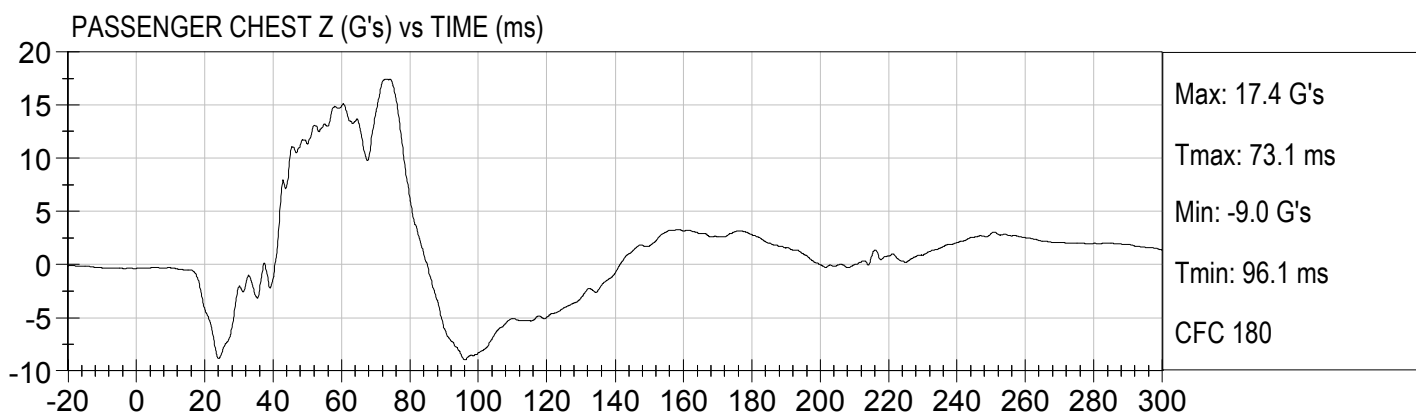
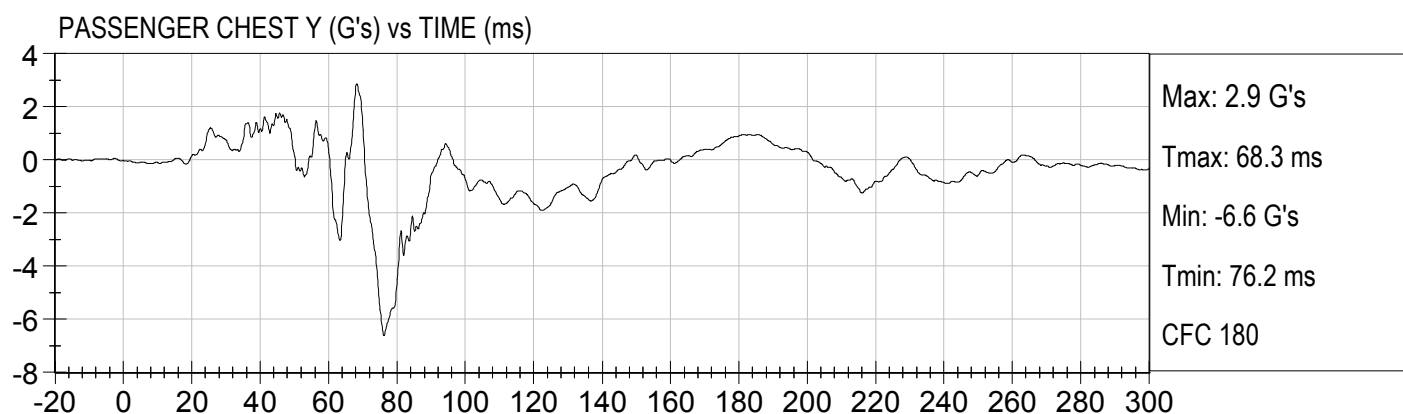
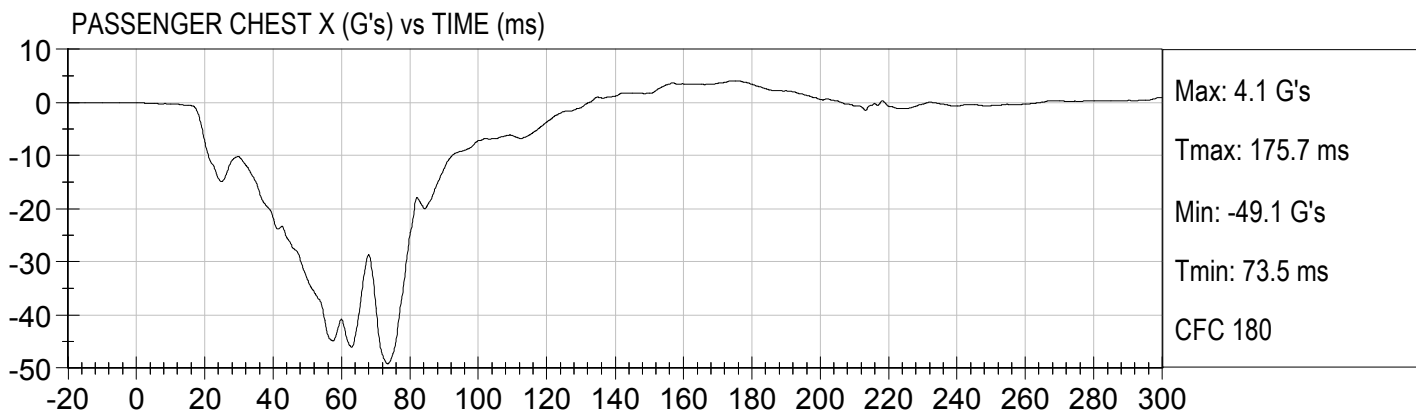


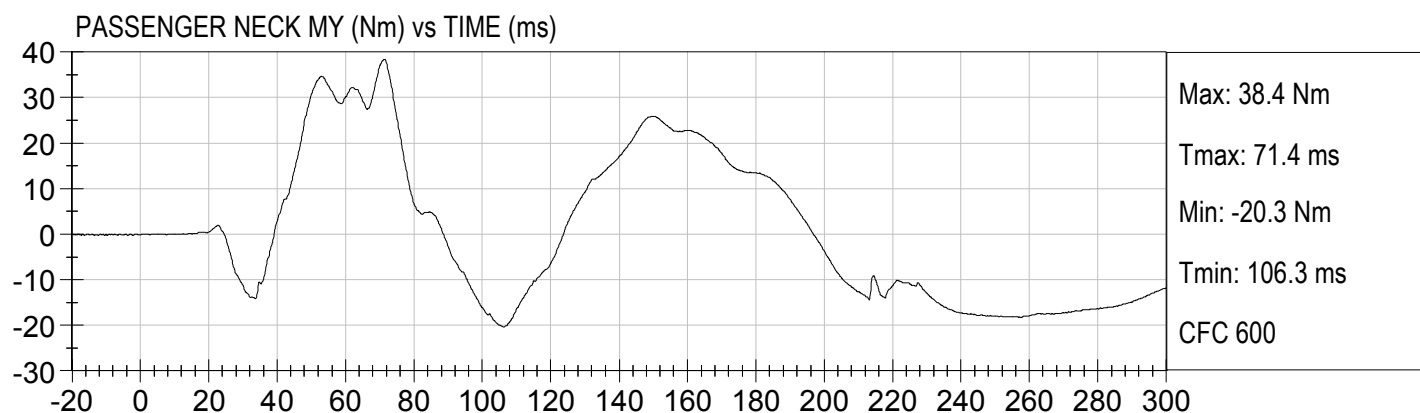
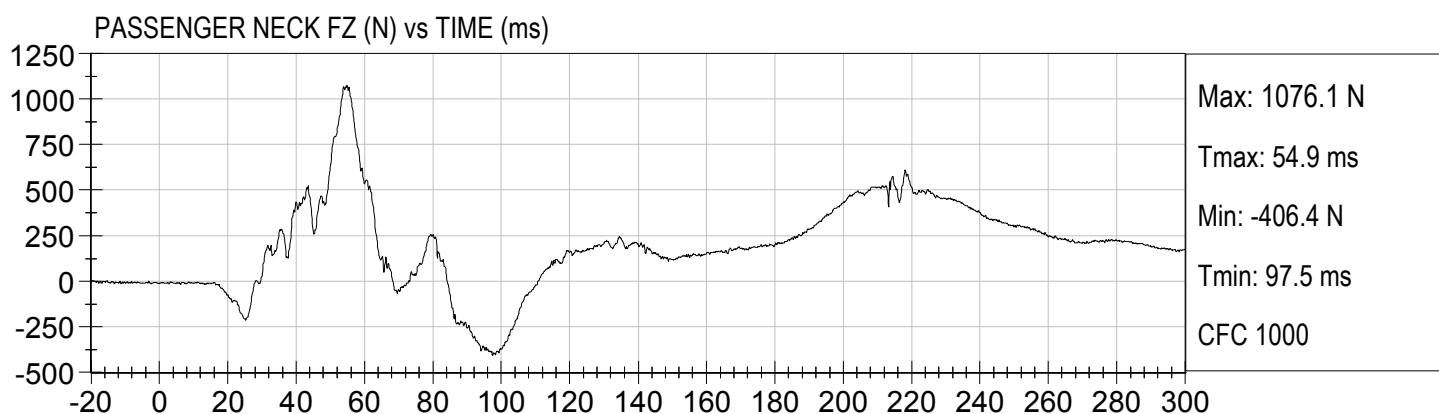
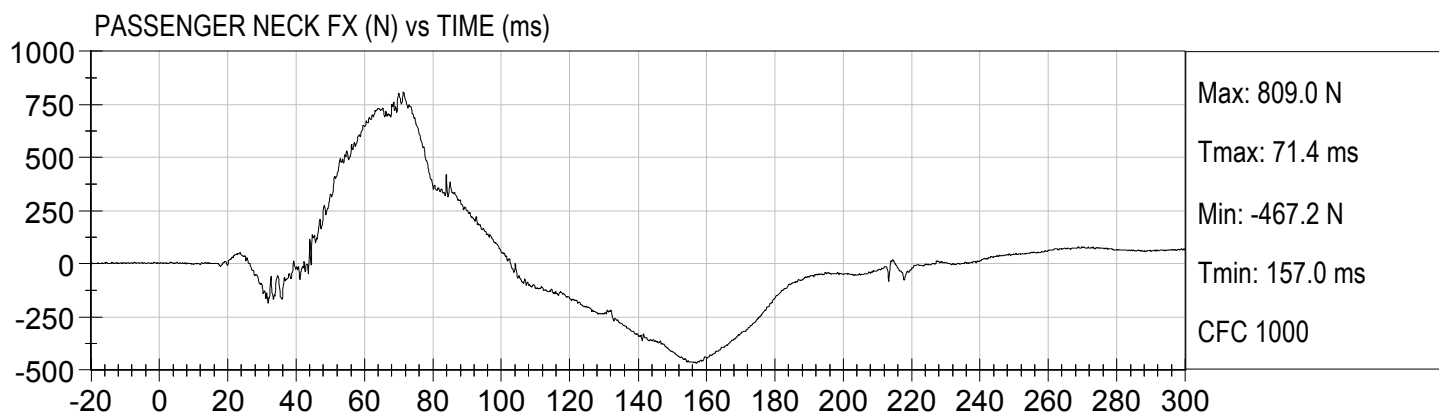


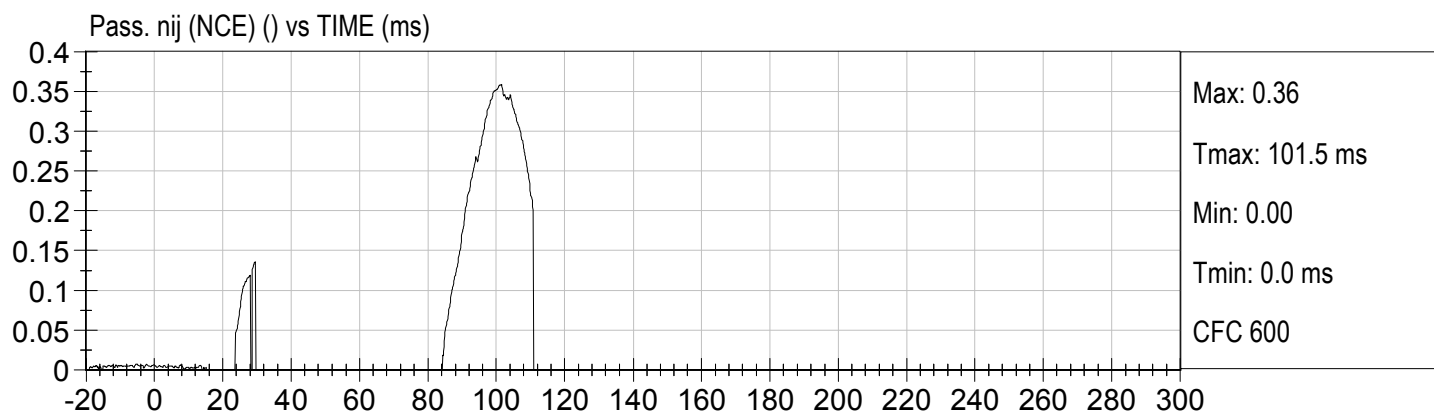
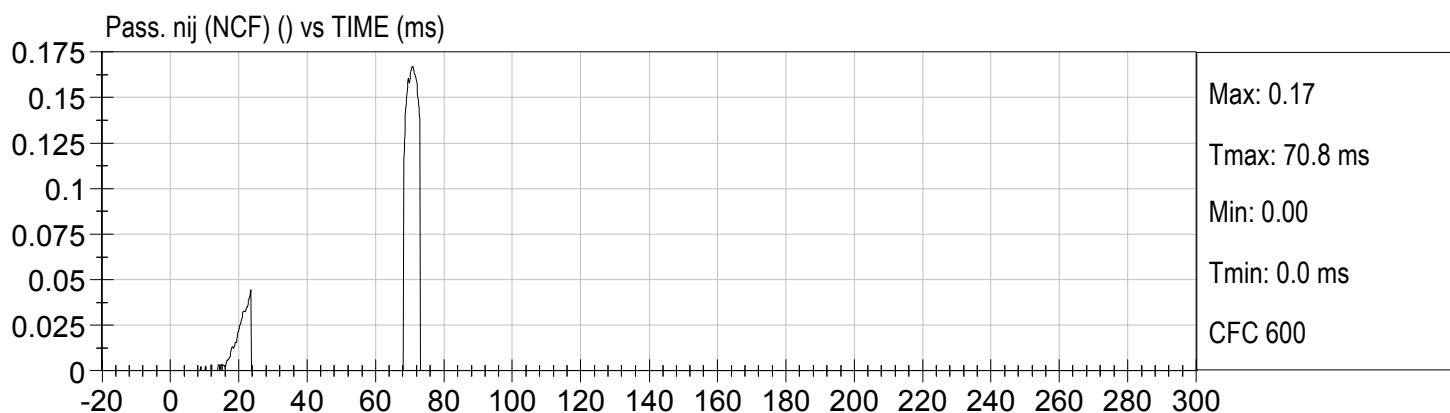
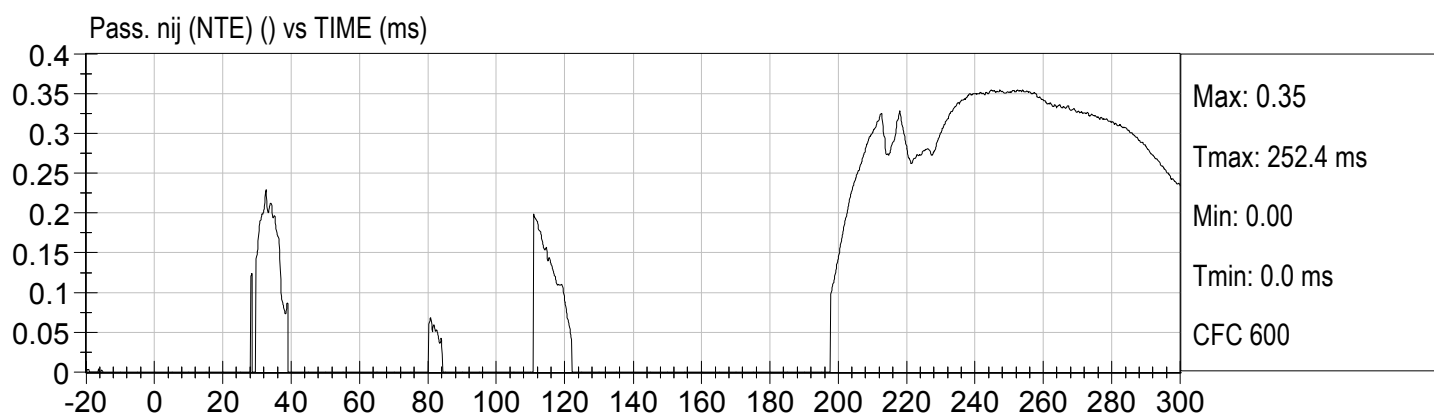
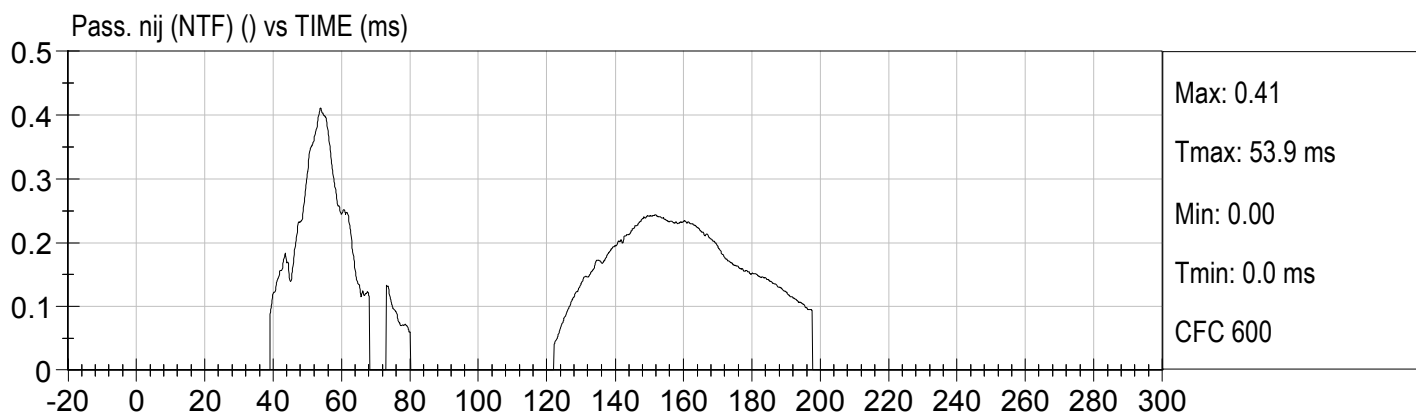


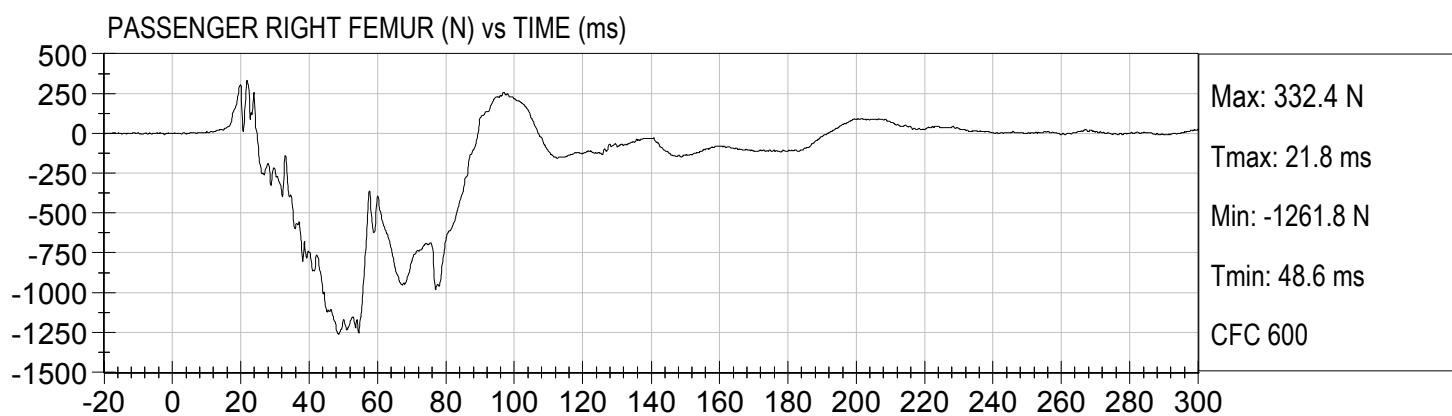
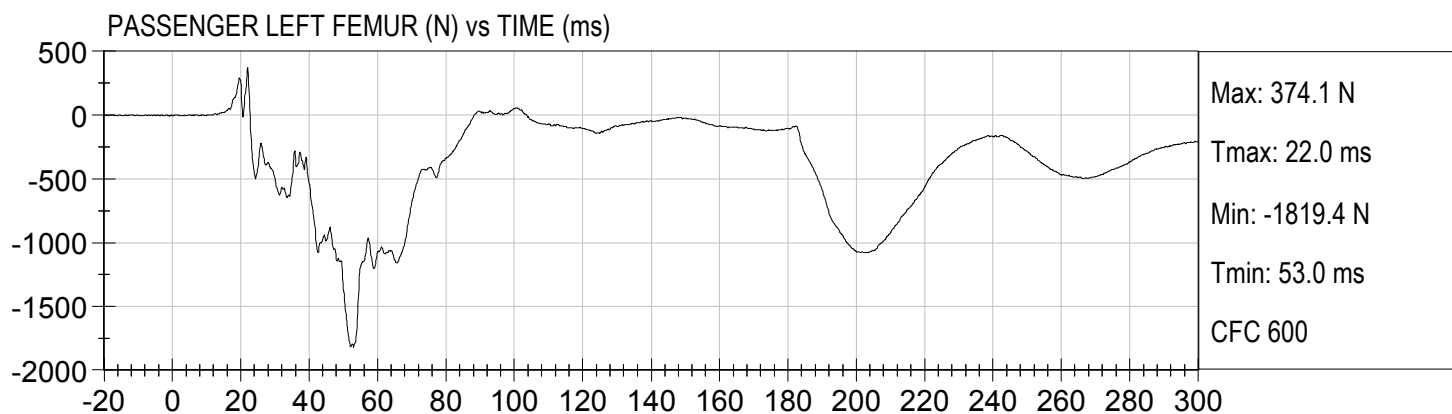












APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

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

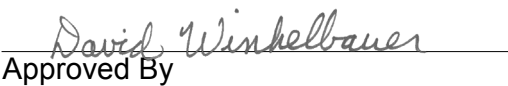
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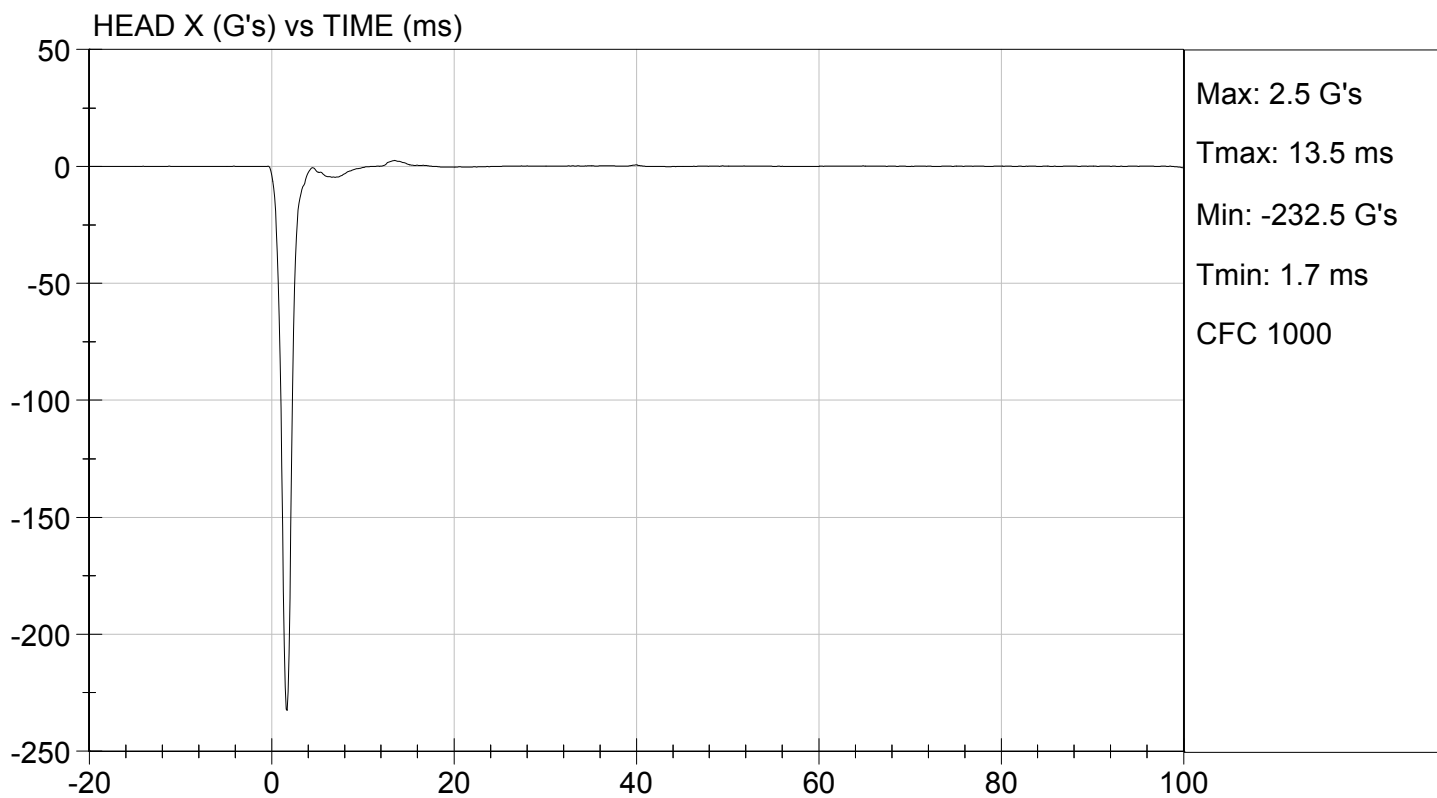
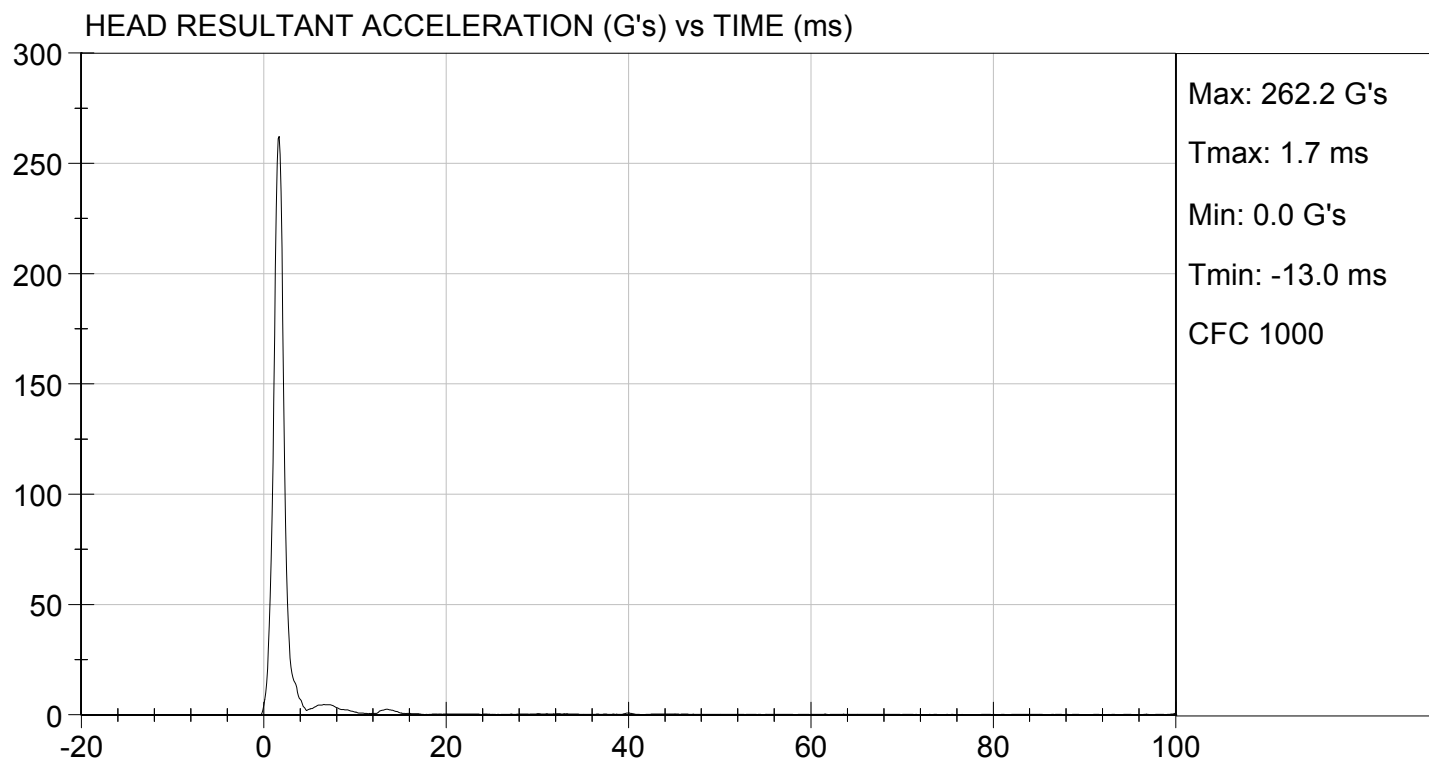
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	28	Pass
Peak Resultant Acceleration	G's	225 to 275	262	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	8.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

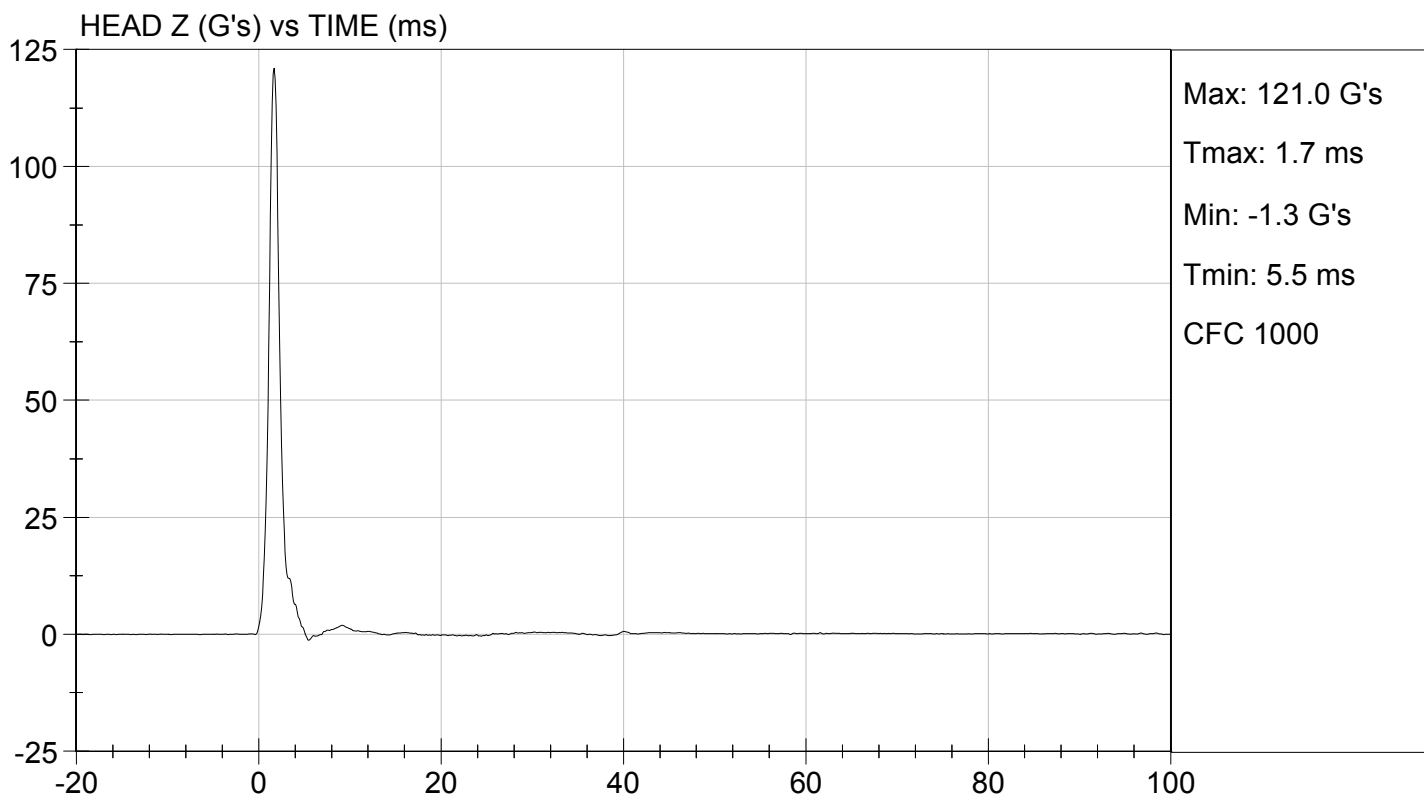
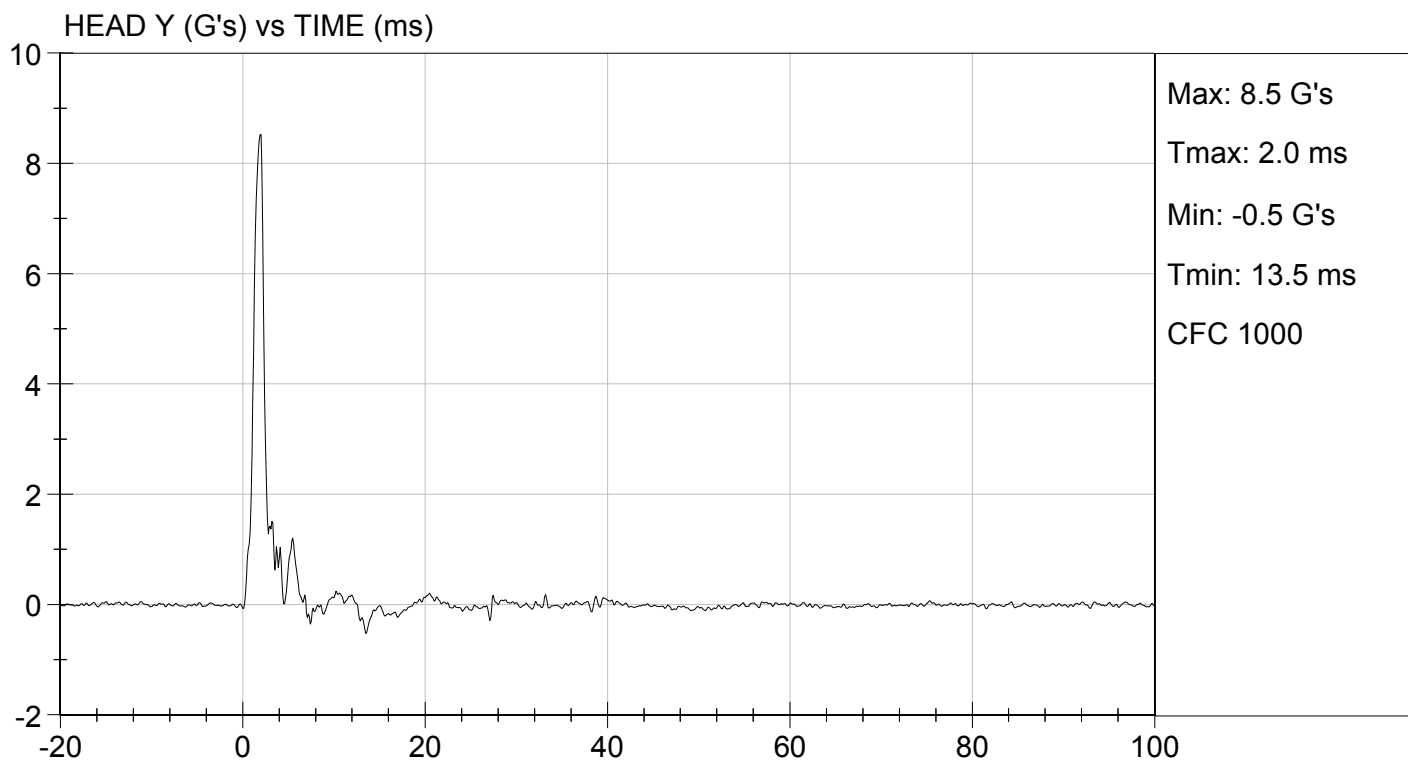

Laboratory Technician

02/27/2013

Test Date


Approved By





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

ATD Serial No: 351

Test I.D: D13612

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.12	Pass
	20 ms	G's	17.60 to 22.60	18.17	Pass
	30 ms	G's	12.50 to 18.50	14.52	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	41.6	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	66.2	Pass
	Time	ms	57.0 to 64.0	60.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	119.2	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	91.1	Pass
	Time	ms	47.0 to 58.0	56.7	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	102.0	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

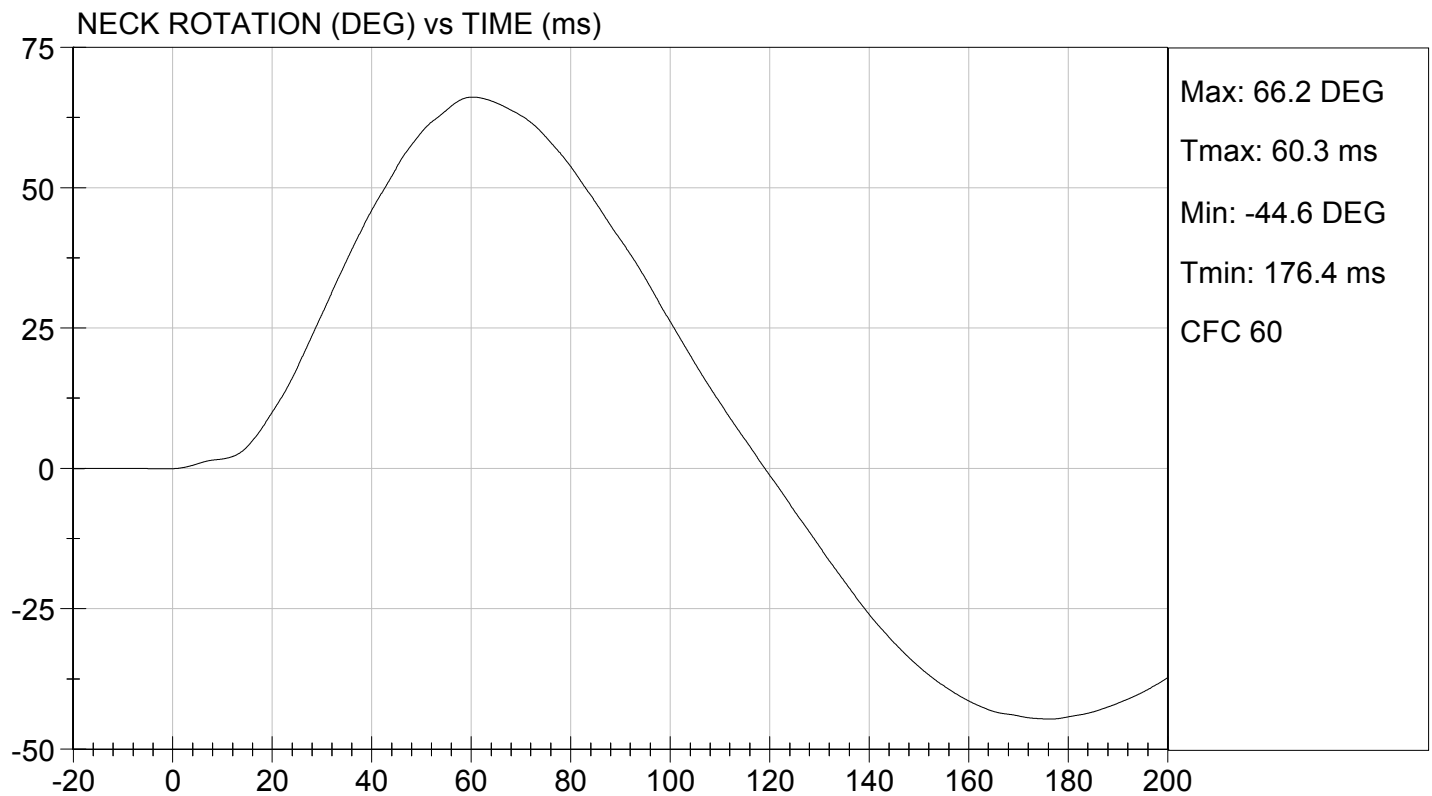
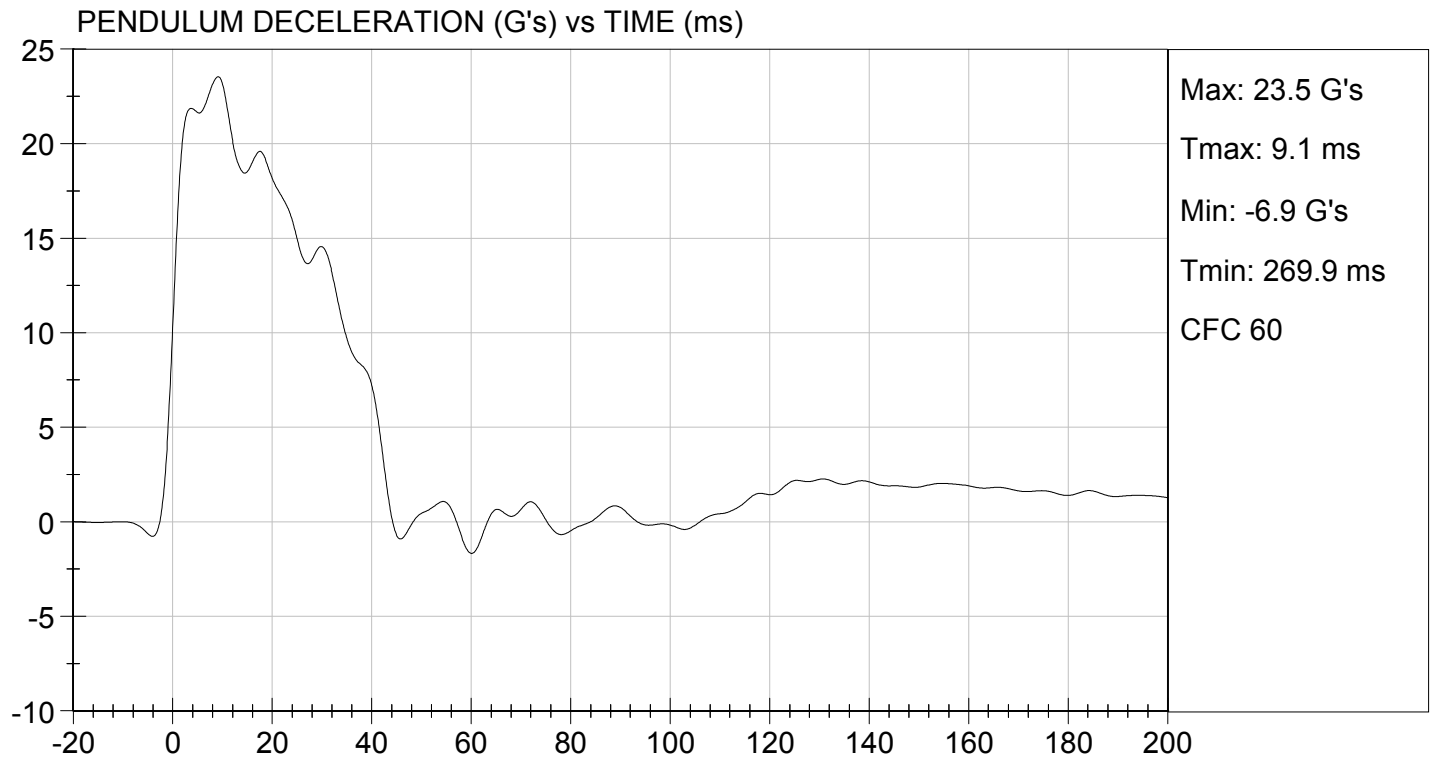
02/27/2013
Test Date

David Winkelbauer
Approved By



TEST DESC: NECK FLEXION
VELOCITY: 22.84 ft/s, 6.96 m/s

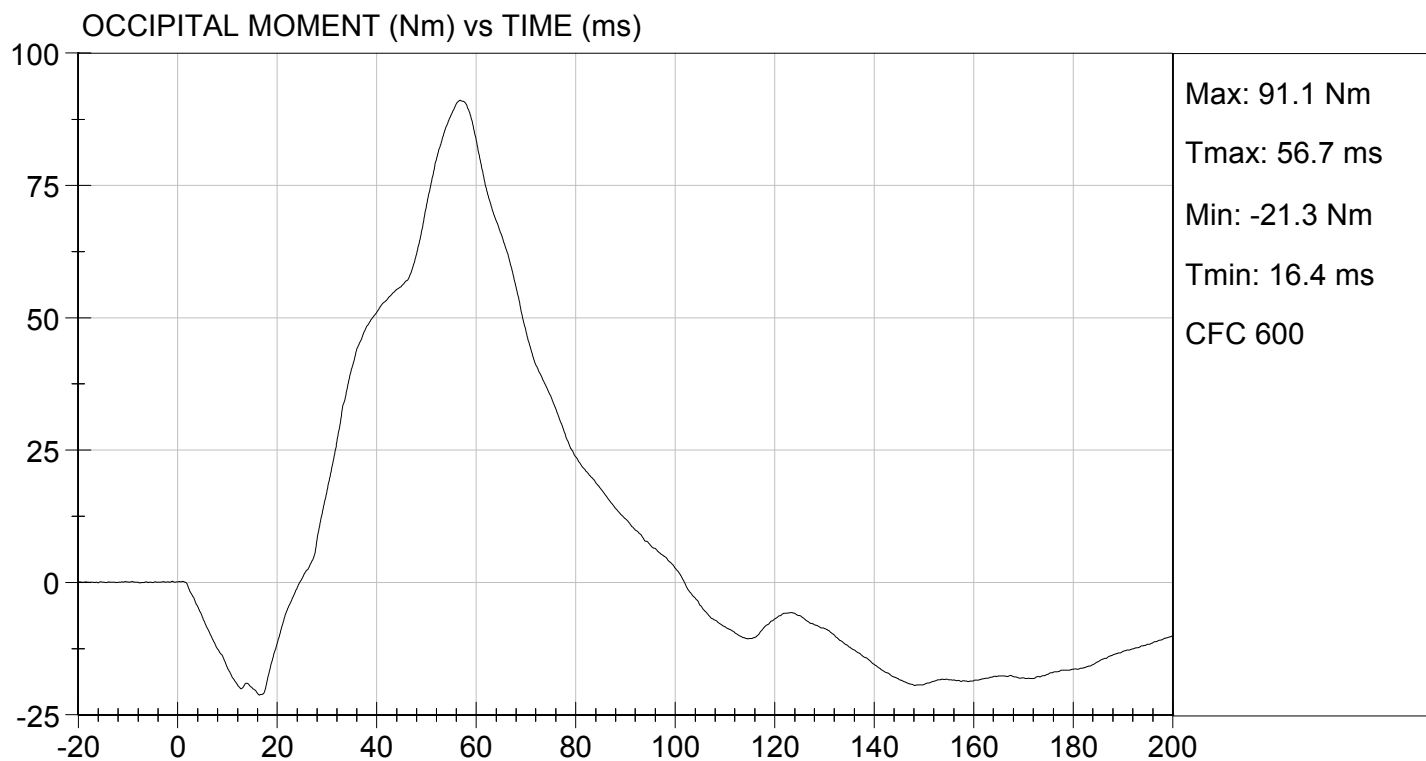
TEST DATE: 02/27/2013
TEST #: D13612





TEST DESC: NECK FLEXION
VELOCITY: 22.84 ft/s, 6.96 m/s

TEST DATE: 02/27/2013
TEST #: D13612

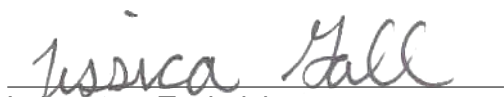


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D13613

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.36	Pass
	20 ms	G's	14.00 to 19.00	14.89	Pass
	30 ms	G's	11.00 to 16.00	12.19	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	45.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	92.6	Pass
	Time	ms	72.0 to 82.0	81.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	162.7	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-55.2	Pass
	Time	ms	65.0 to 79.0	76.4	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	147.5	Pass
Overall Test Results					Pass


Laboratory Technician

02/27/2013

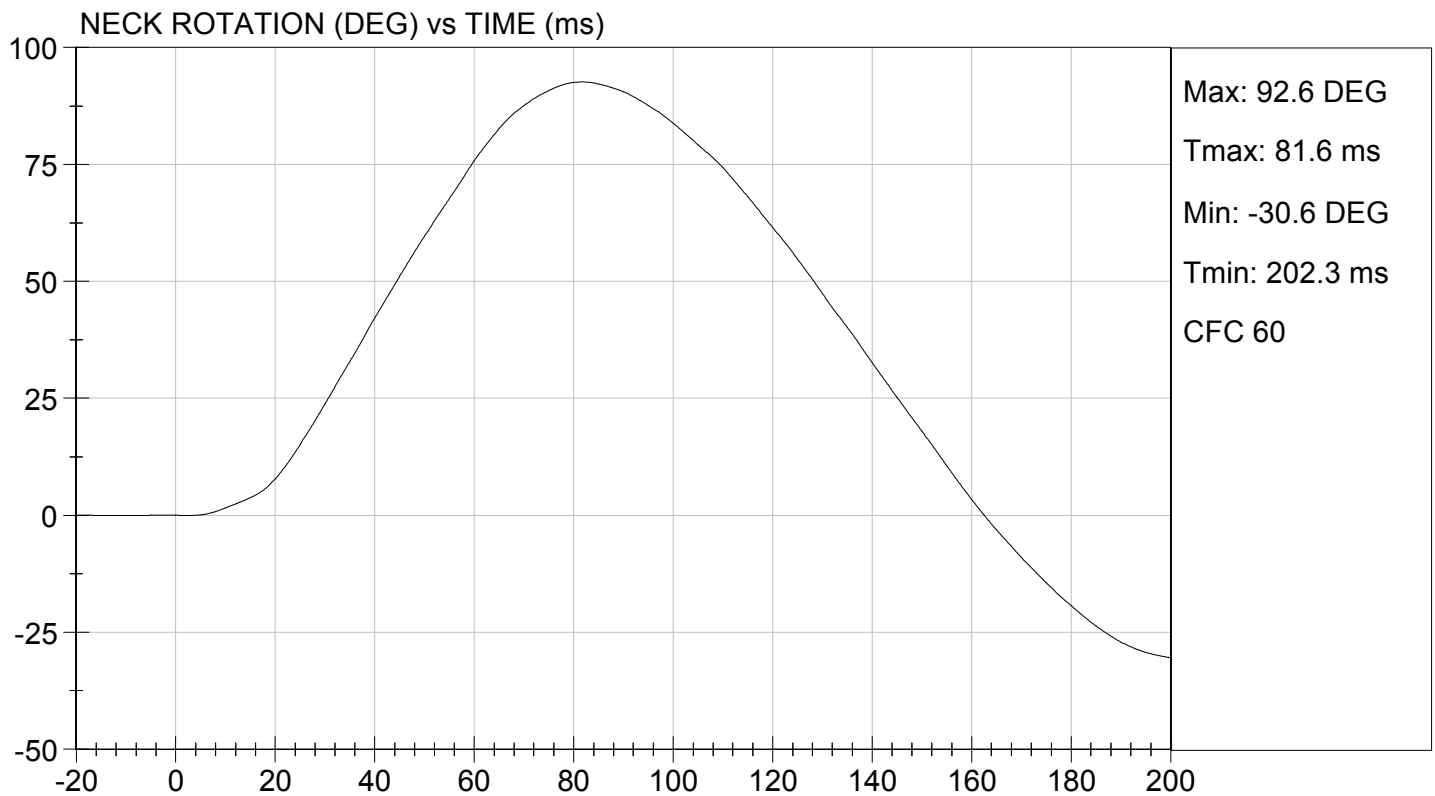
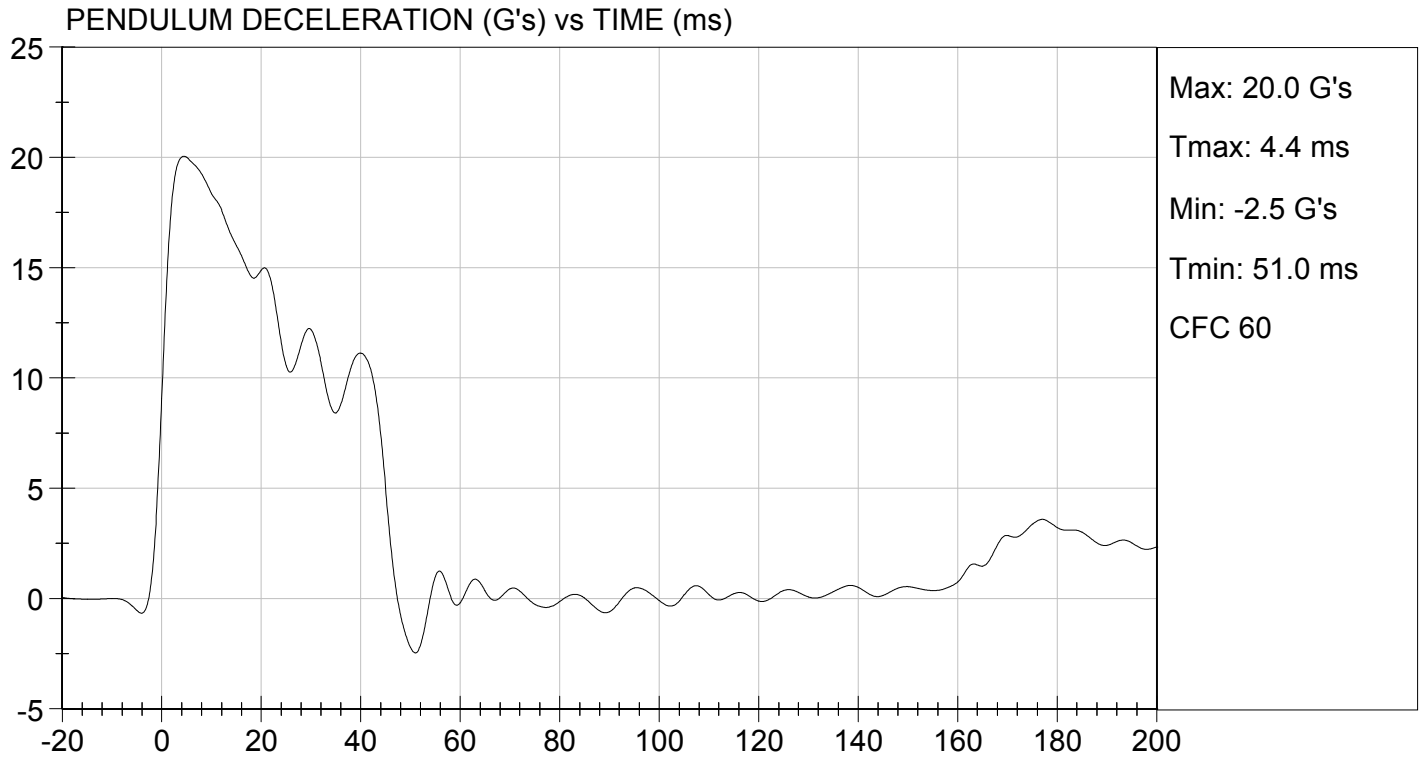
Test Date


Approved By



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

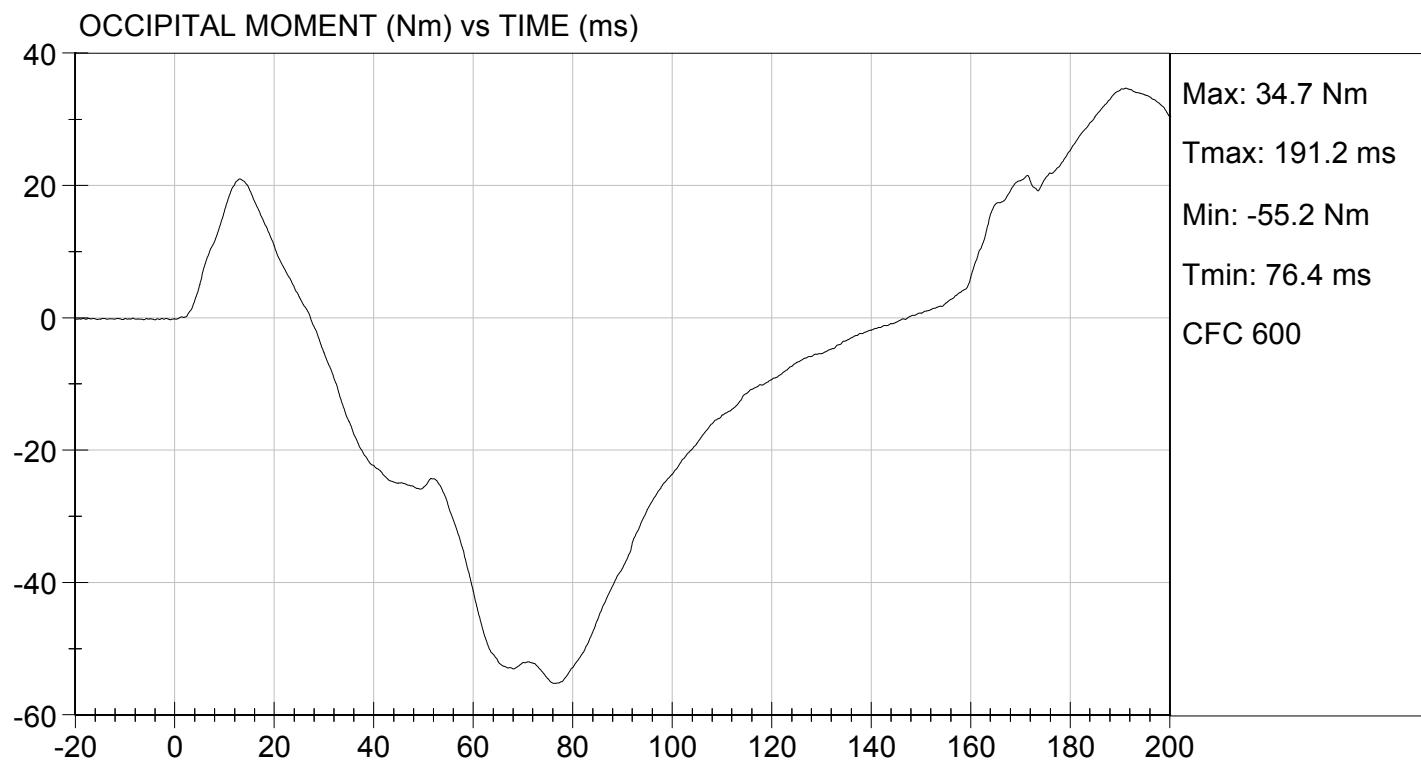
TEST DATE: 02/27/2013
TEST #: D13613





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

TEST DATE: 02/27/2013
TEST #: D13613



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D13614

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	29	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,217	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.67	Pass
Internal Hysteresis	%	69 to 85	70	Pass
			Overall Test Results	Pass


Laboratory Technician

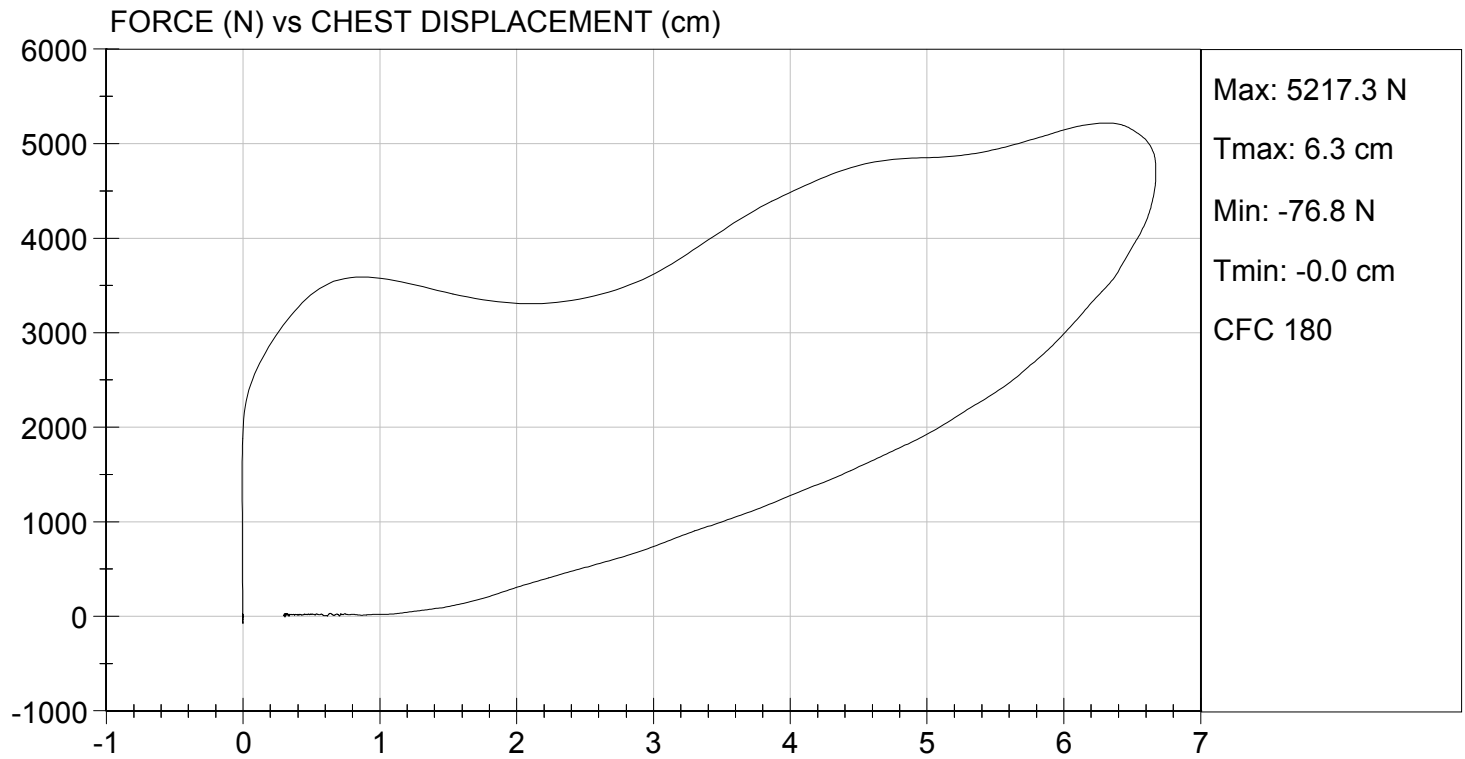
02/27/2013
Test Date


Approved By



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

TEST DATE: 02/27/2013
TEST #: D13614



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

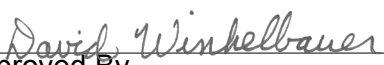
ATD Serial No: 351

Test I.D: D13615

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	5,478	Pass
Overall Test Results				Pass


Laboratory Technician

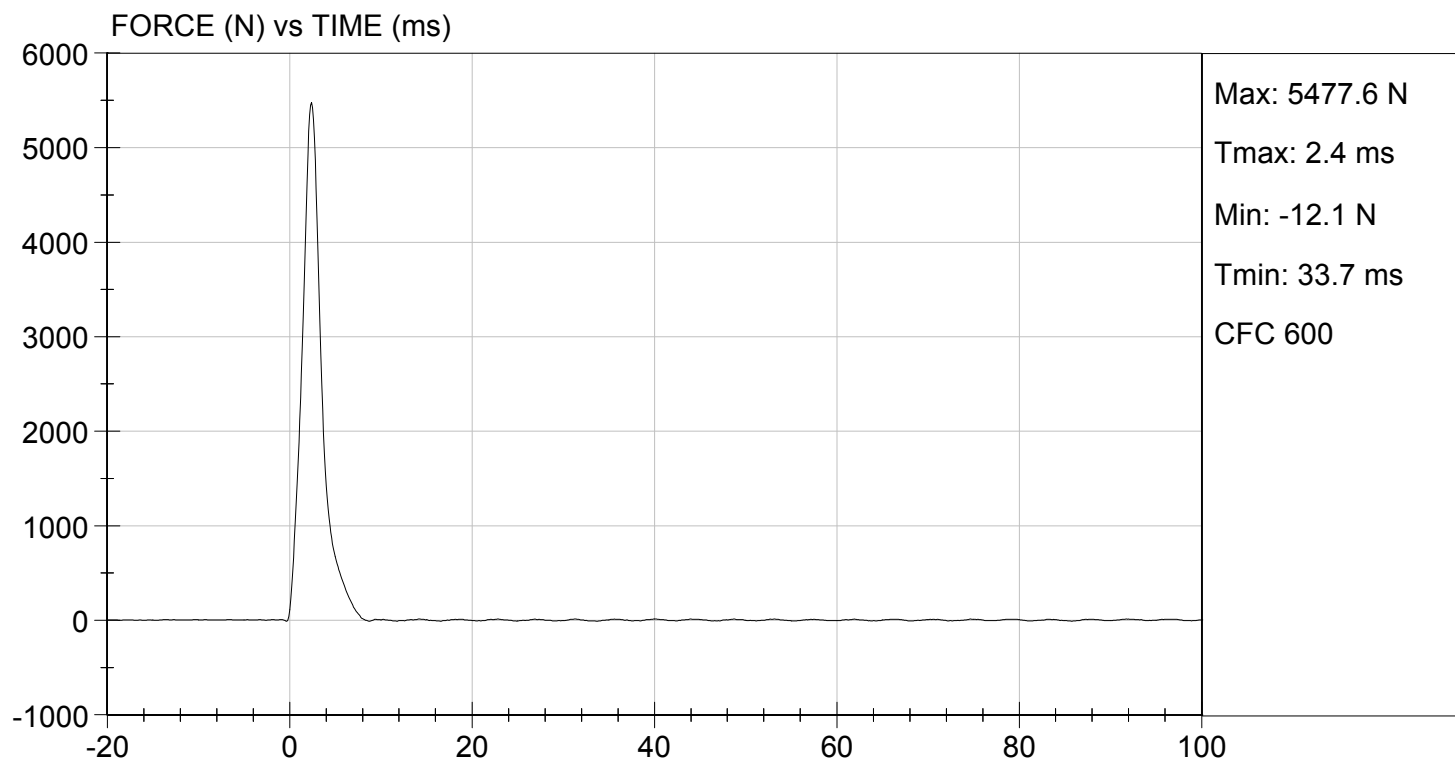
02/27/2013
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 02/27/2013
TEST #: D13615



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

ATD Serial No: 351

Test I.D: D13616

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,426	Pass
Overall Test Results				Pass


Laboratory Technician

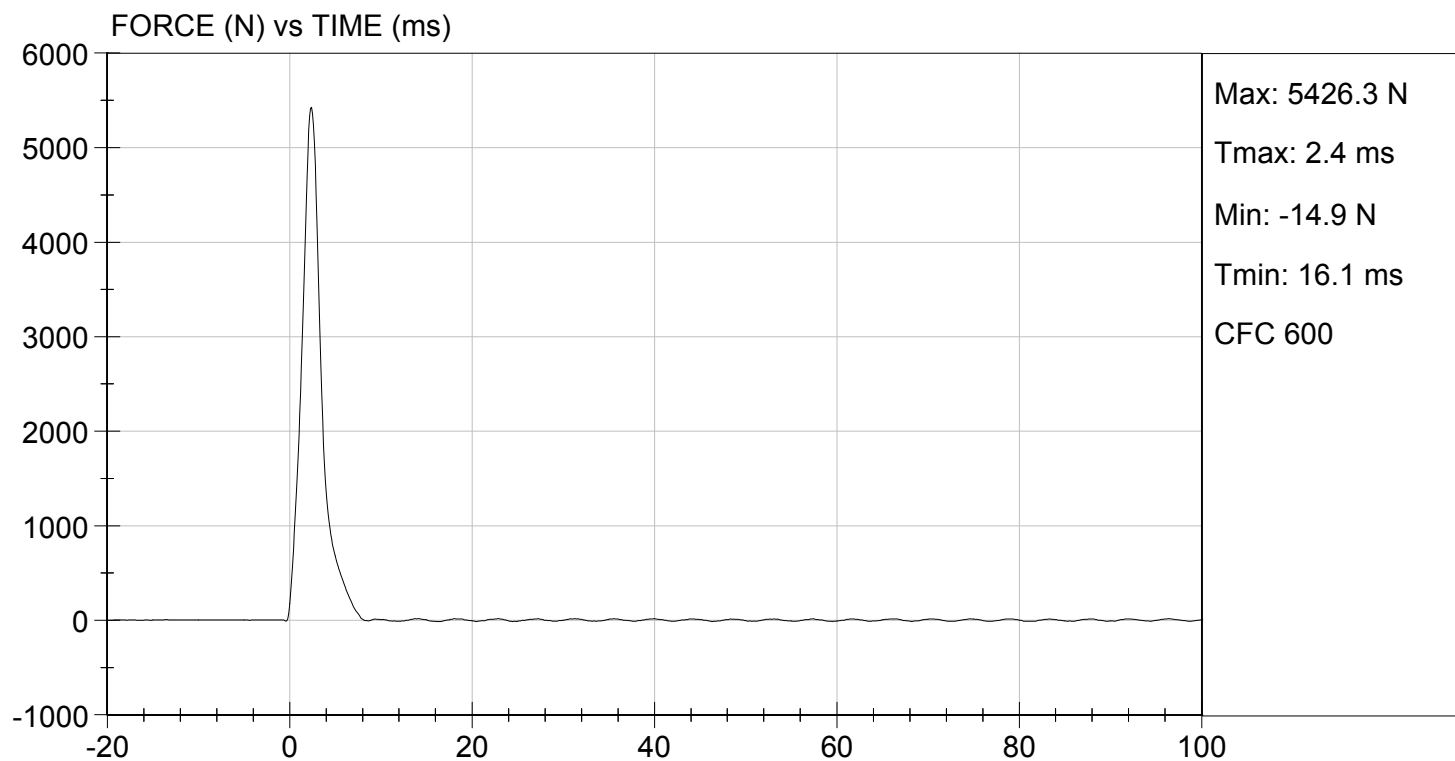
02/27/2013
Test Date


Approved By



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

TEST DATE: 02/27/2013
TEST #: D13616



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

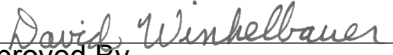
ATD Serial No: 351

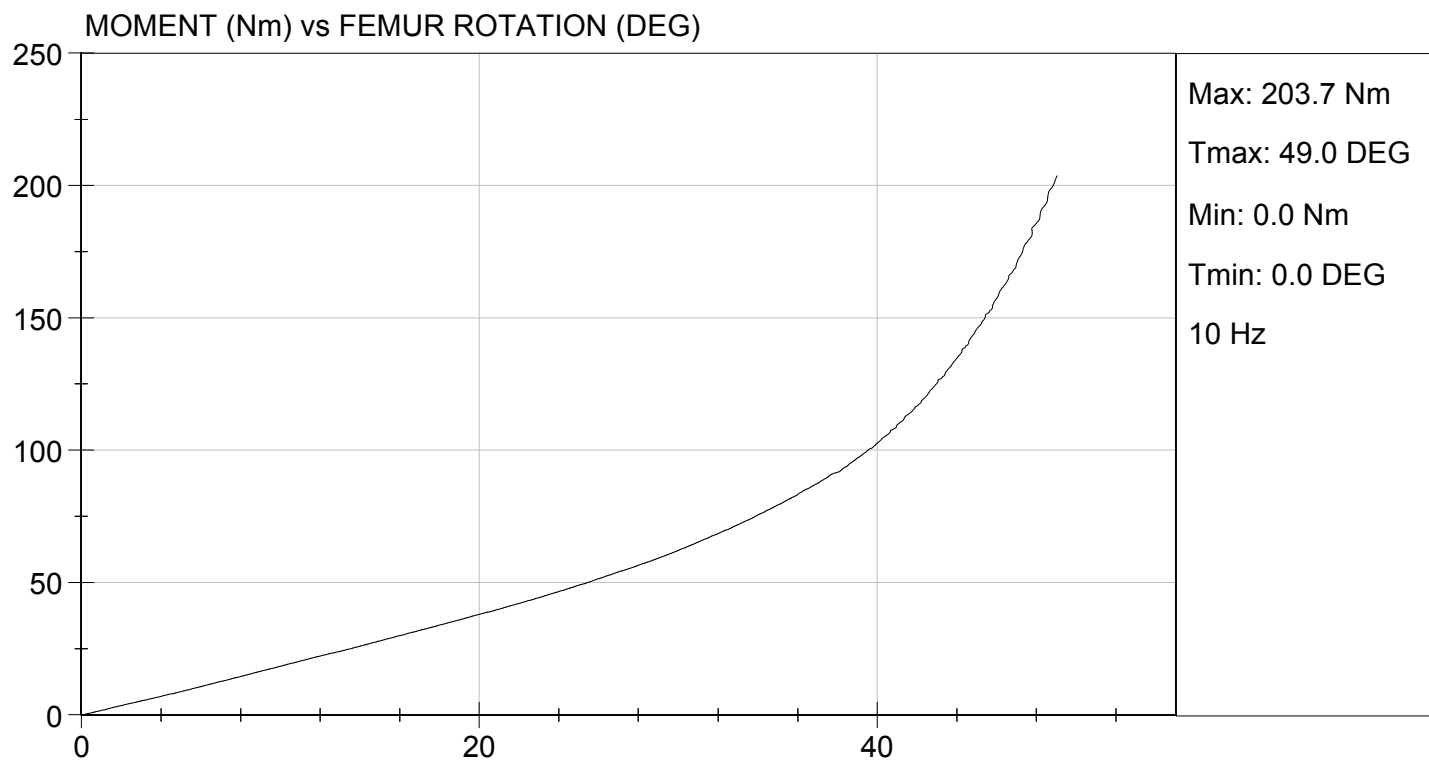
Test I.D: D13610

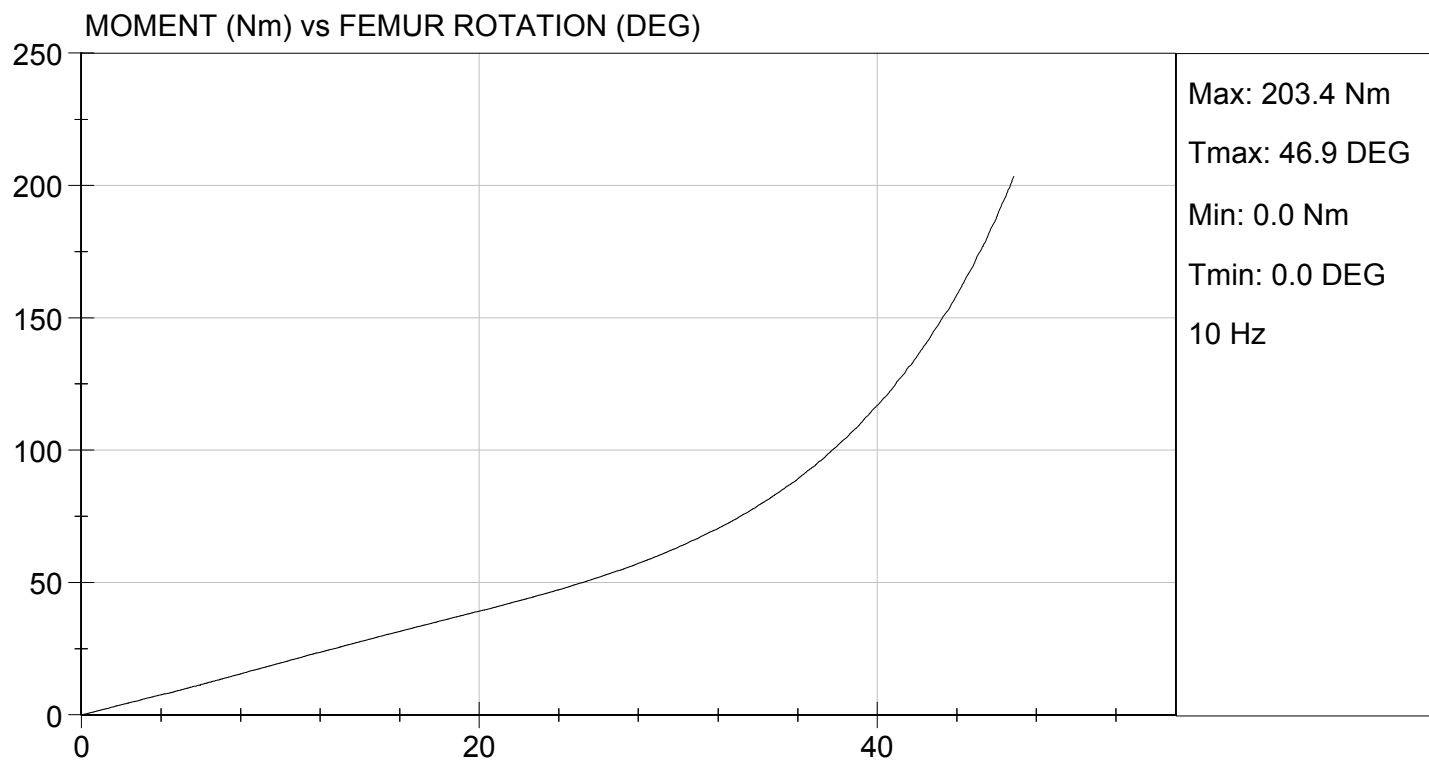
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	32	32	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	62.1	63.3	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	49.0	46.9	Pass
Overall Test Results					Pass


Laboratory Technician

02/27/2013
Test Date


Approved By





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

ATD Serial No: 351

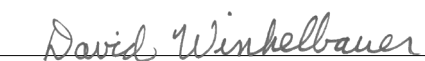
Test ID: D13781

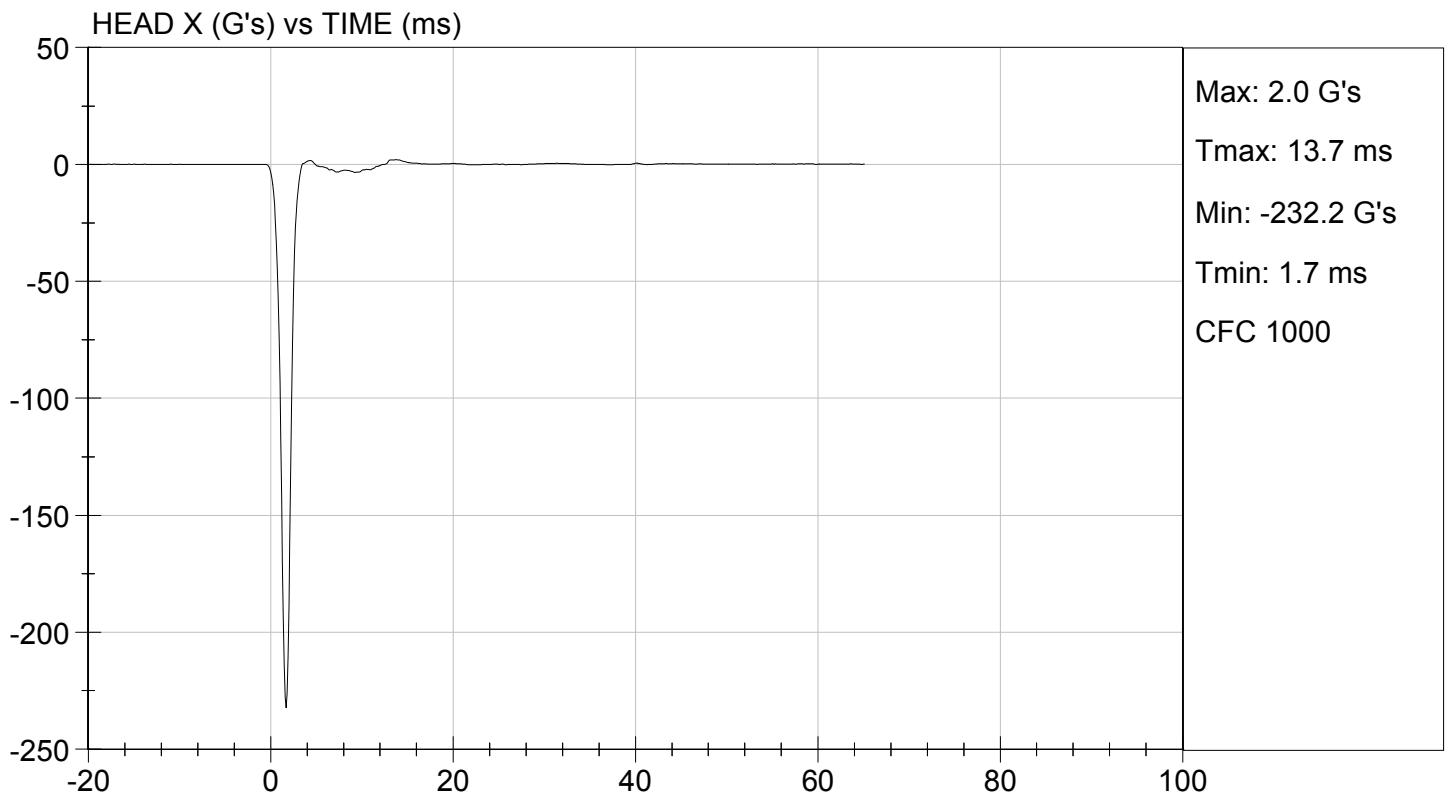
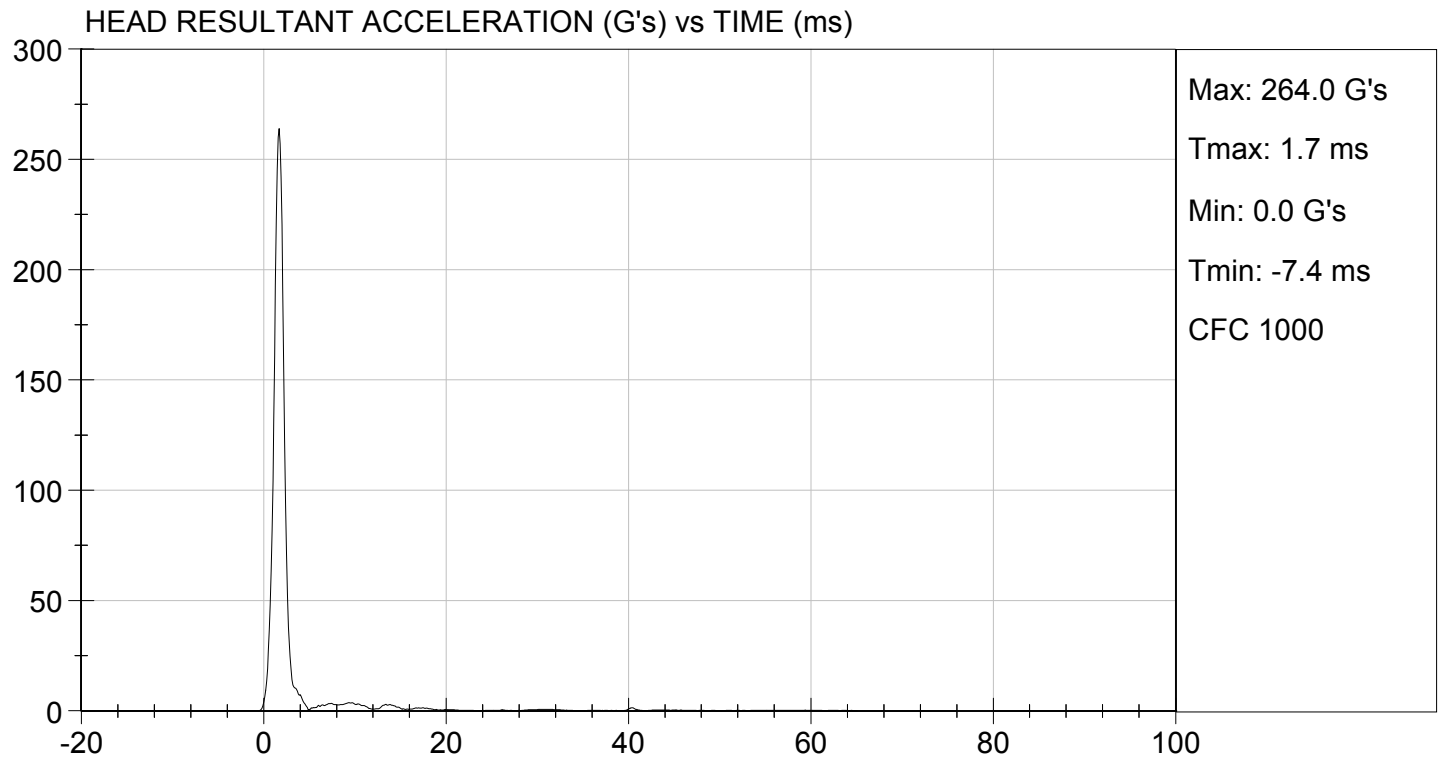
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.3	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	225 to 275	264	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-5.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

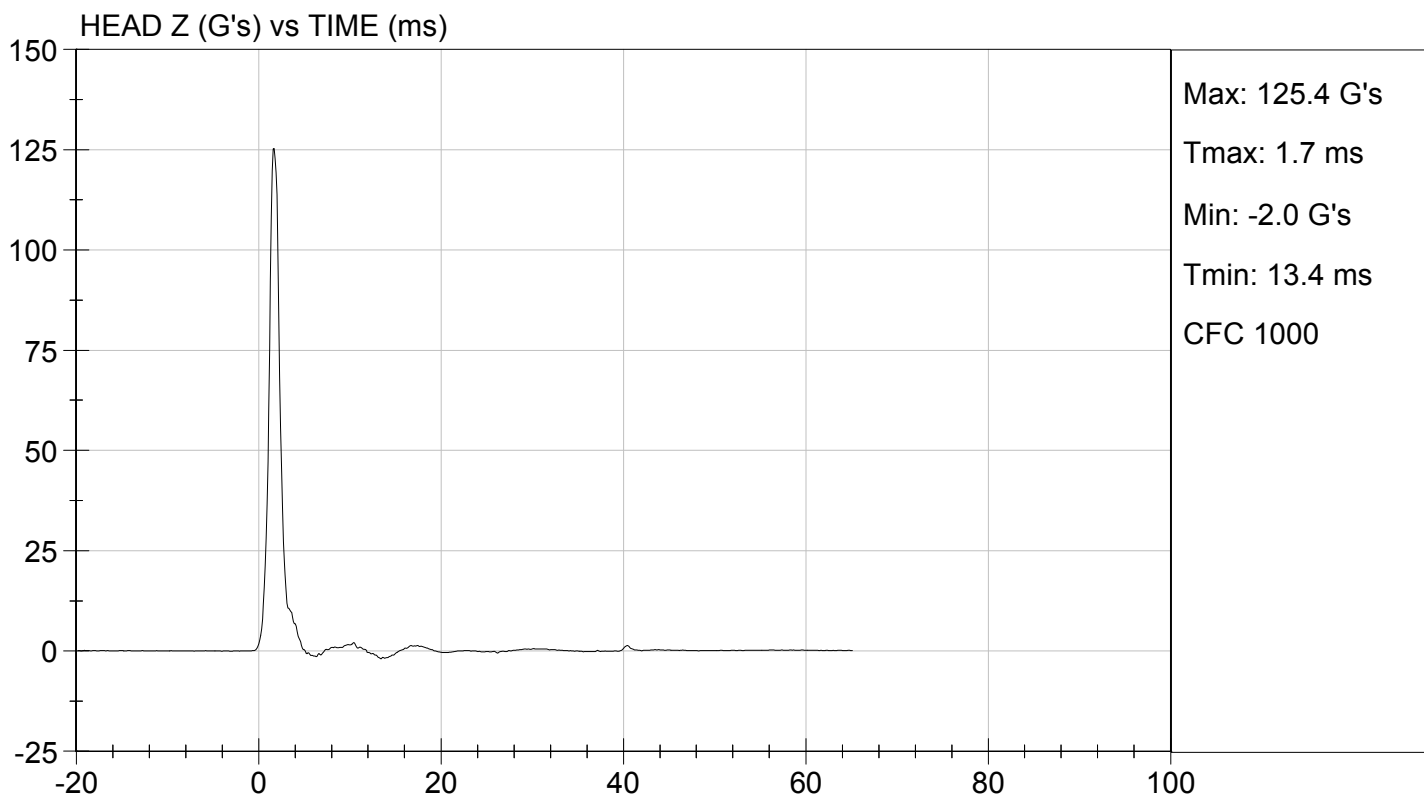
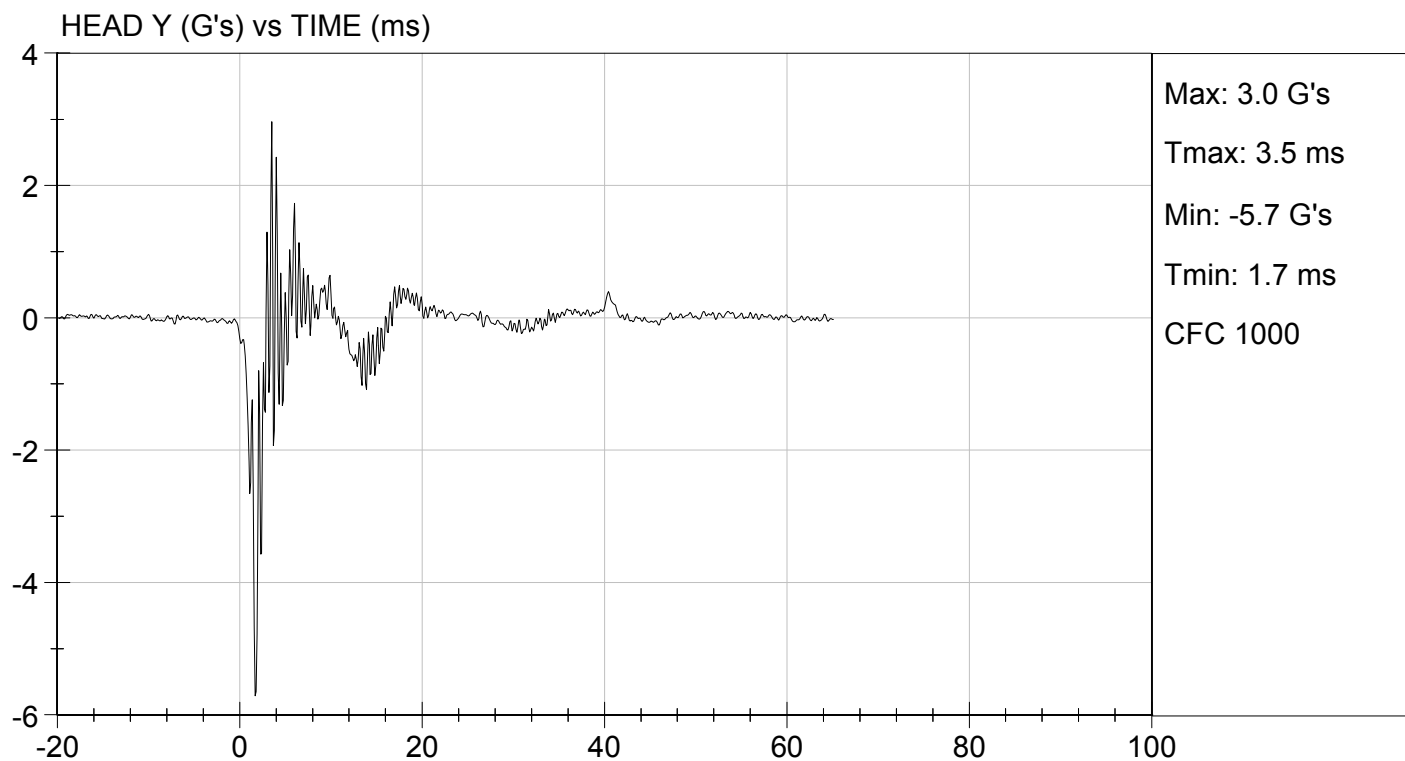

Laboratory Technician

03/09/2013

Test Date


Approved By





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

ATD Serial No: 351

Test I.D: D13782

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	35	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.65	Pass
	20 ms	G's	17.60 to 22.60	18.23	Pass
	30 ms	G's	12.50 to 18.50	13.42	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	13.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	39.6	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	67.6	Pass
	Time	ms	57.0 to 64.0	58.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.9	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	95.9	Pass
	Time	ms	47.0 to 58.0	51.4	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.6	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

03/11/2013

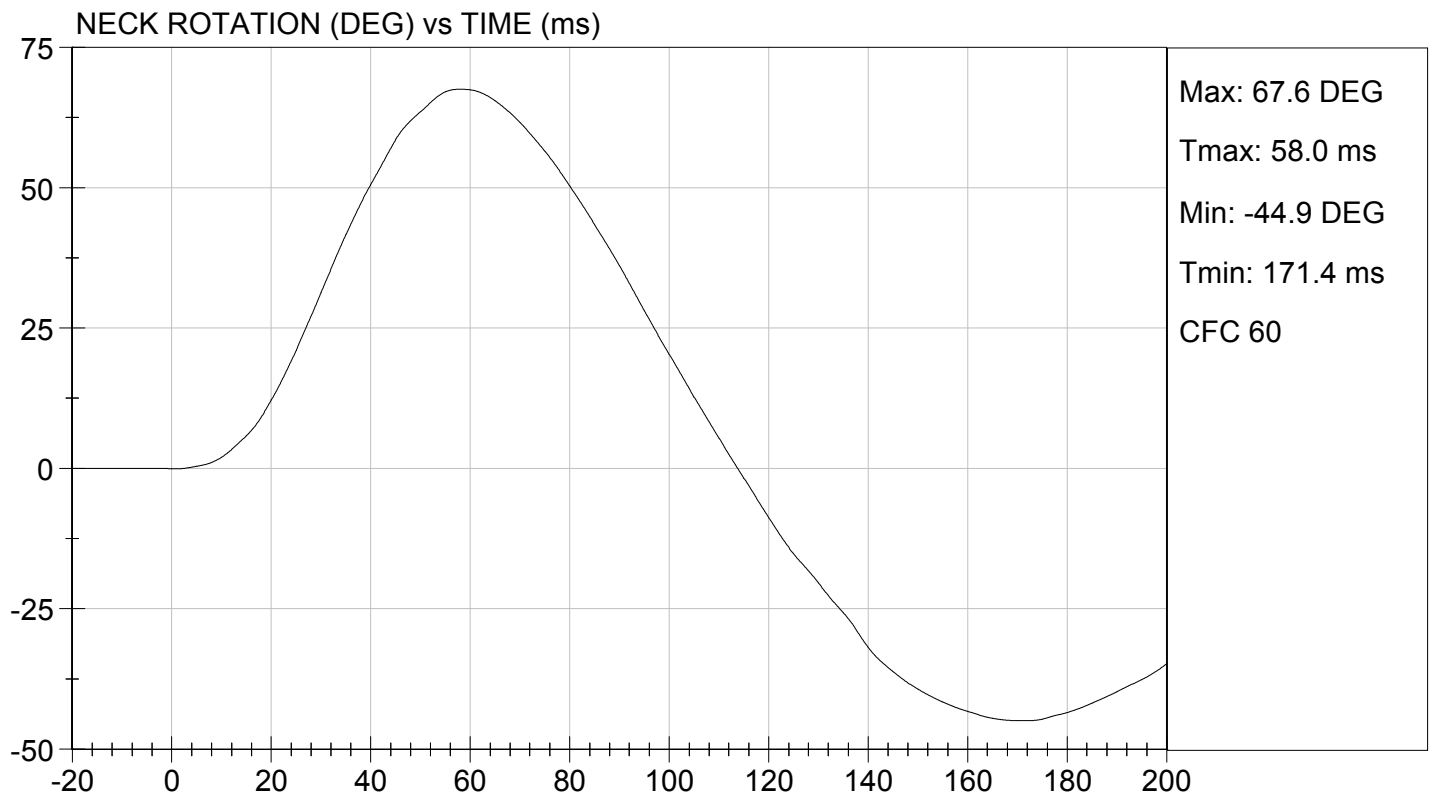
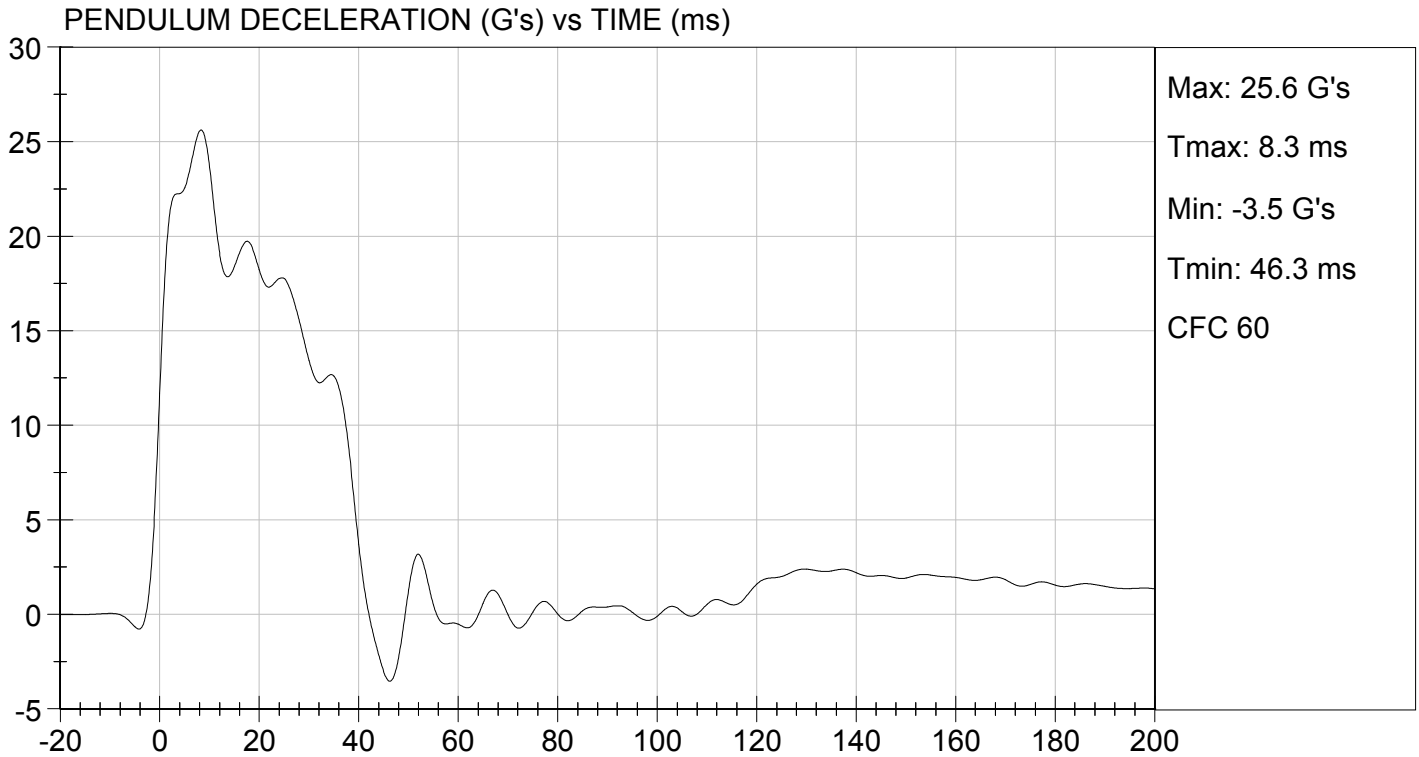
Test Date

David Winkelbauer
Approved By



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

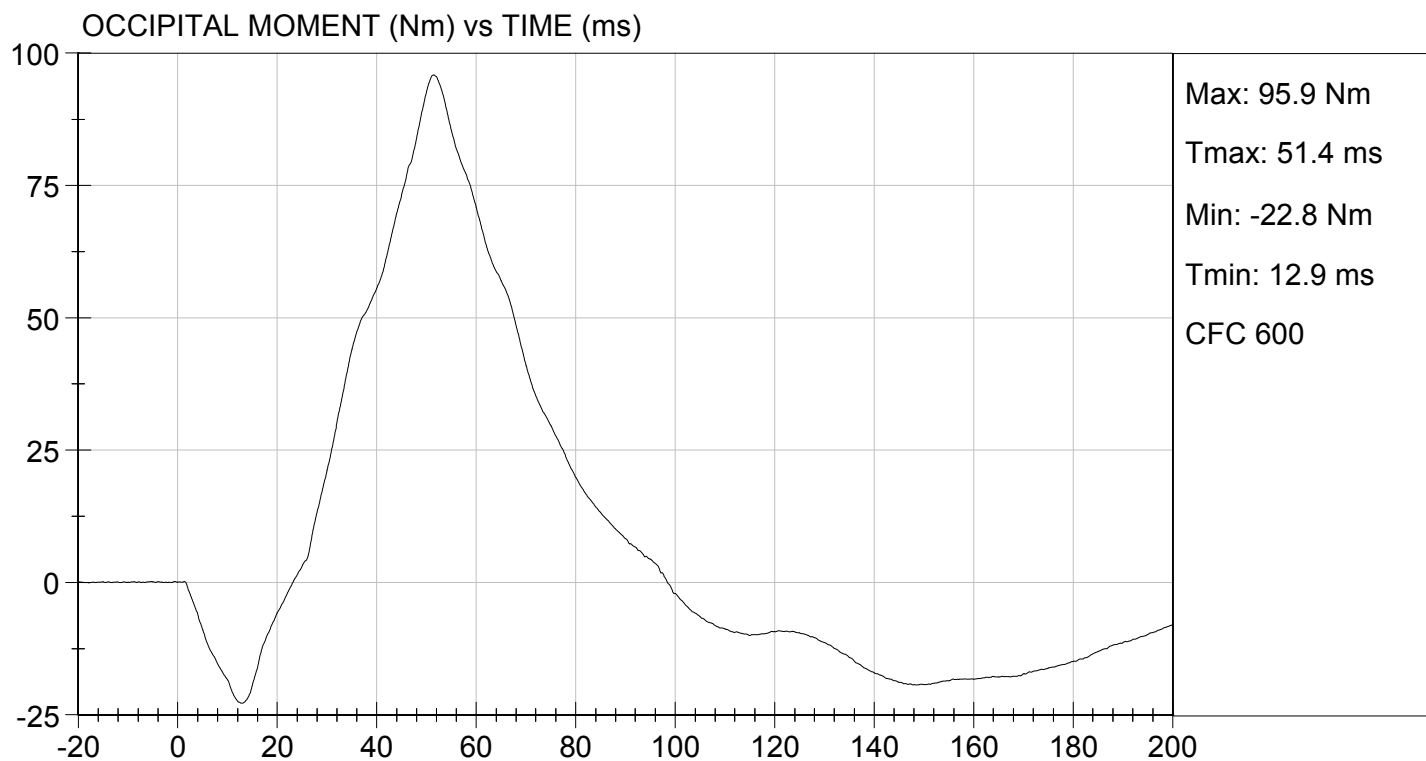
TEST DATE: 03/11/2013
TEST #: D13782





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

TEST DATE: 03/11/2013
TEST #: D13782

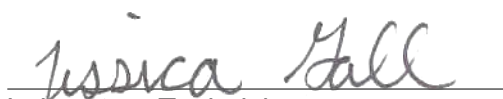


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

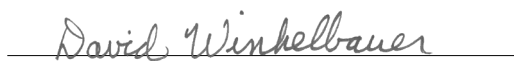
Test I.D: D13783

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	35	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.13	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.76	Pass
	20 ms	G's	14.00 to 19.00	14.22	Pass
	30 ms	G's	11.00 to 16.00	11.30	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	11.4	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	43.8	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	95.2	Pass
	Time	ms	72.0 to 82.0	80.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	158.2	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-59.6	Pass
	Time	ms	65.0 to 79.0	72.8	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.0	Pass
Overall Test Results					Pass


Laboratory Technician

03/11/2013

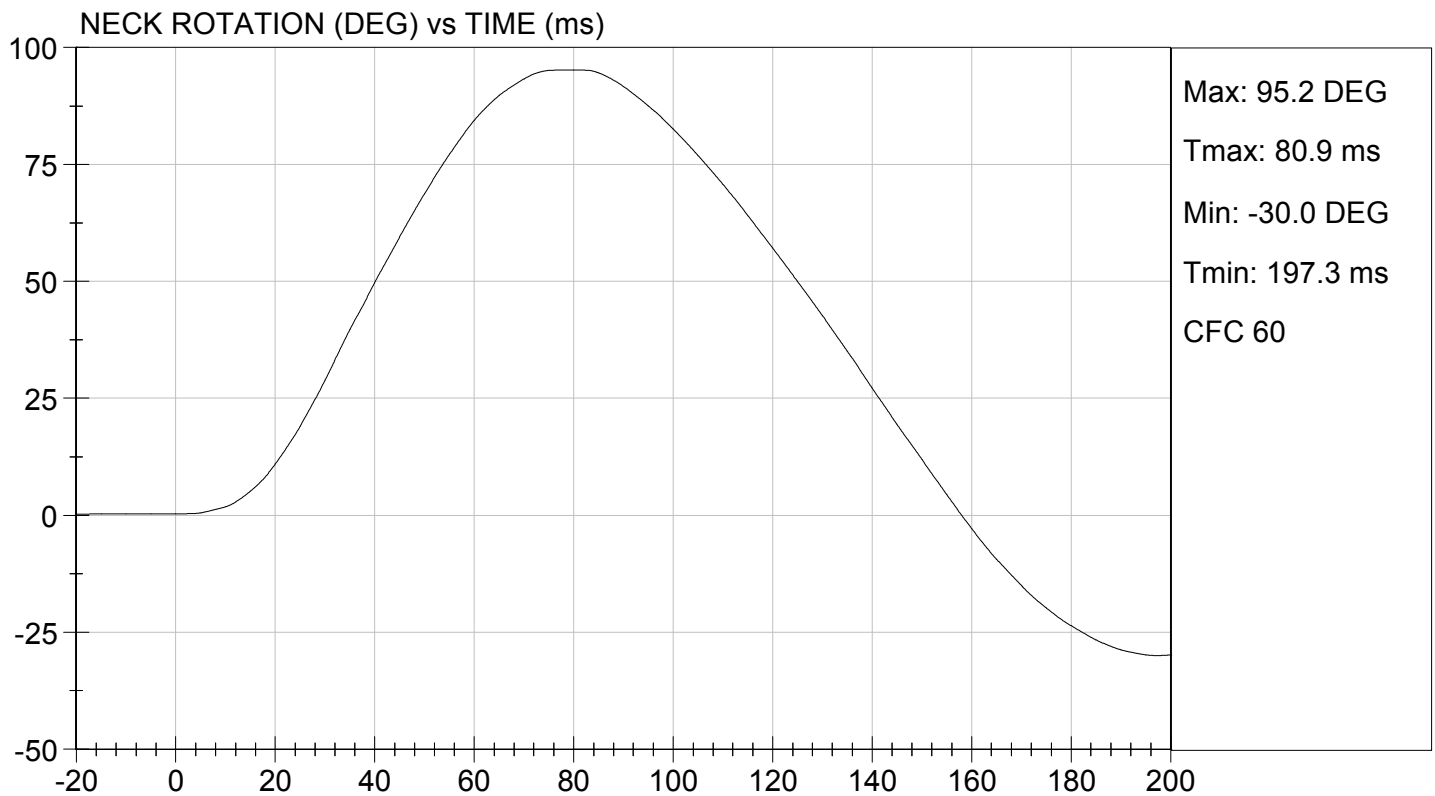
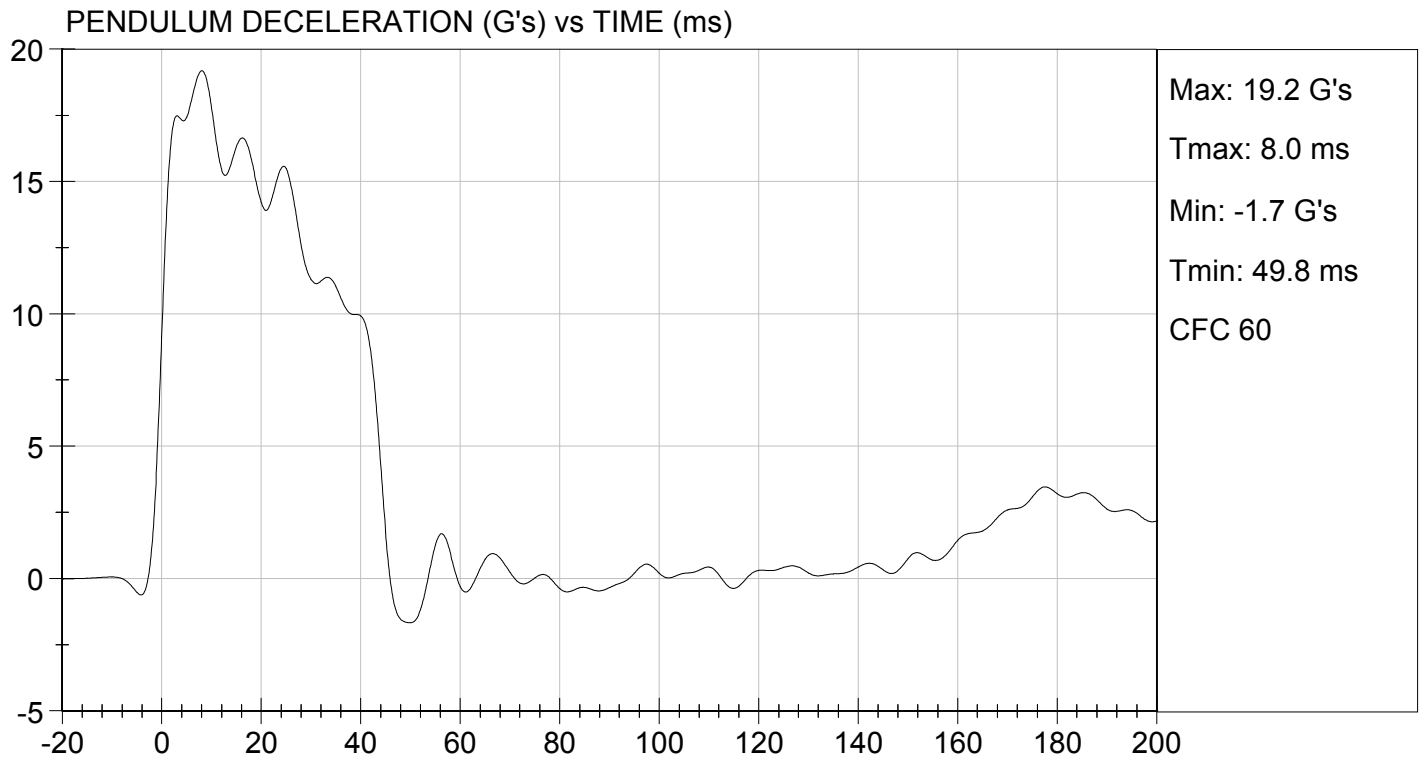
Test Date


Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 20.10 ft/s, 6.13 m/s

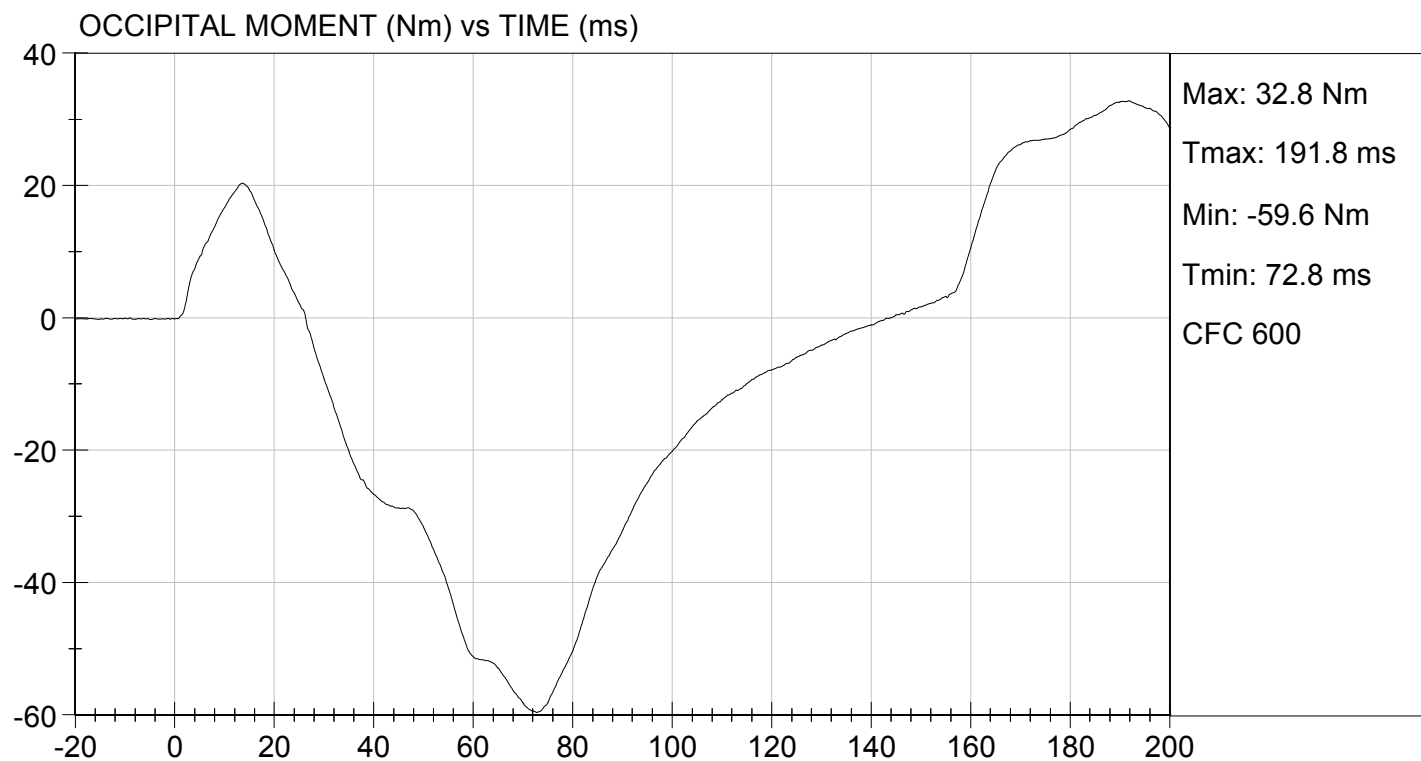
TEST DATE: 03/11/2013
TEST #: D13783





TEST DESC: NECK EXTENSION
VELOCITY: 20.10 ft/s, 6.13 m/s

TEST DATE: 03/11/2013
TEST #: D13783



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D13784

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	35	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,183	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.48	Pass
Internal Hysteresis	%	69 to 85	71	Pass
			Overall Test Results	Pass


Laboratory Technician

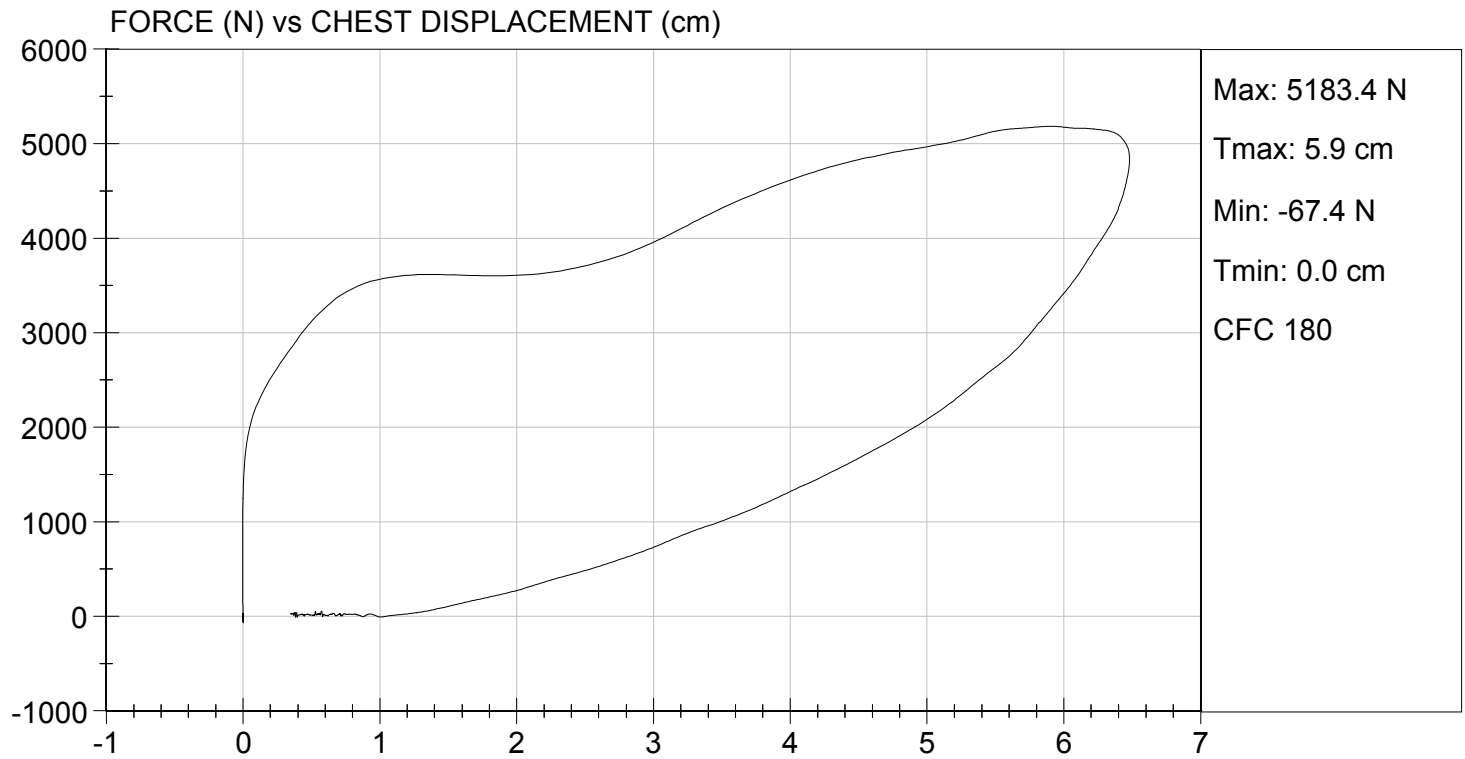
03/11/2013
Test Date


Approved By



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

TEST DATE: 03/11/2013
TEST #: D13784



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

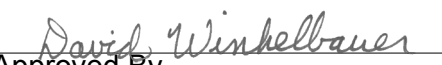
ATD Serial No: 351

Test I.D: D13785

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.3	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	5,350	Pass
Overall Test Results				Pass


Laboratory Technician

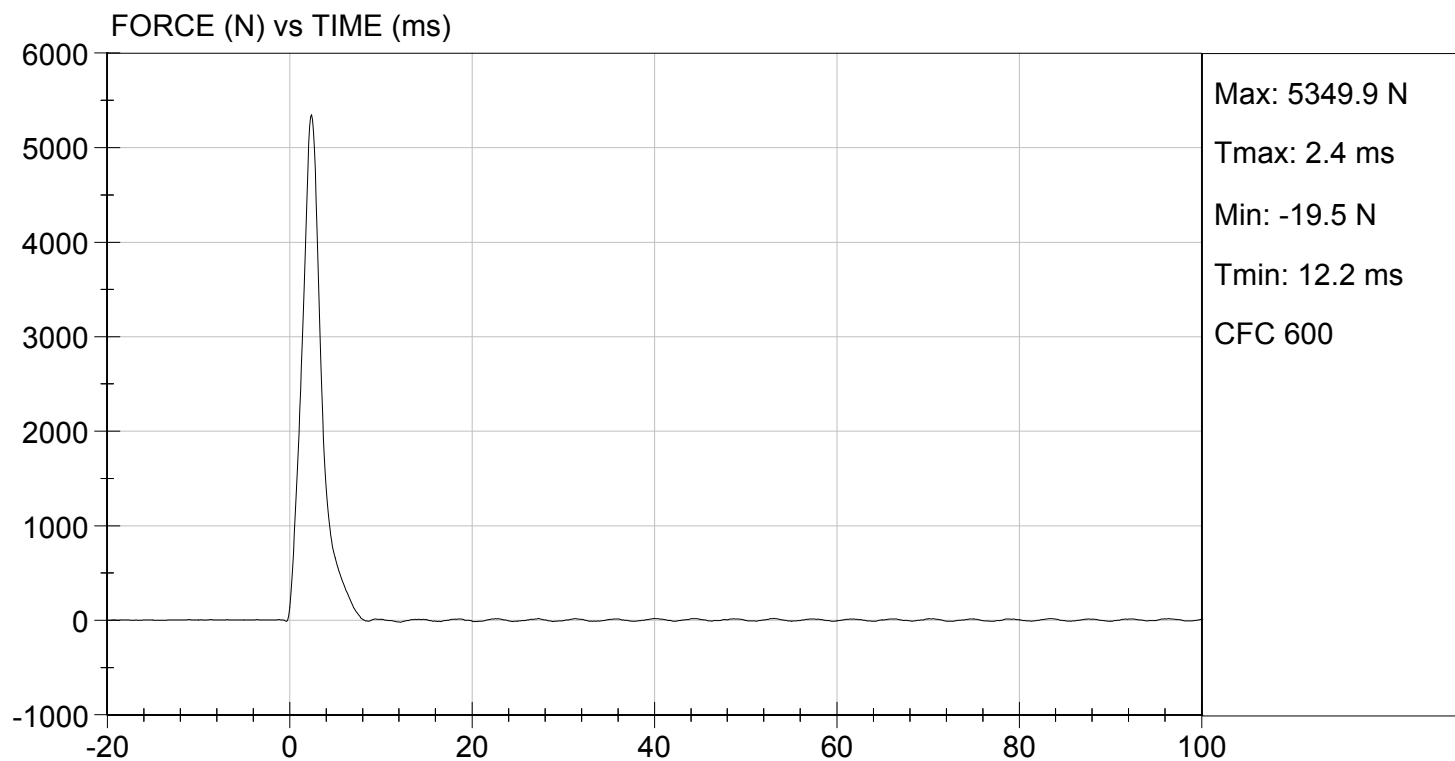
03/08/2013
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 03/08/2013
TEST #: D13785

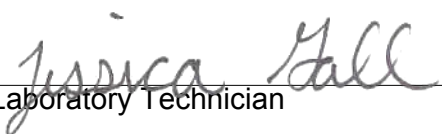


MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D13786

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.3	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Probe Velocity	m/s	2.07 to 2.13	2.13	Pass
Peak Probe Force	N	4715 to 5782	5,278	Pass
Overall Test Results				Pass


Laboratory Technician

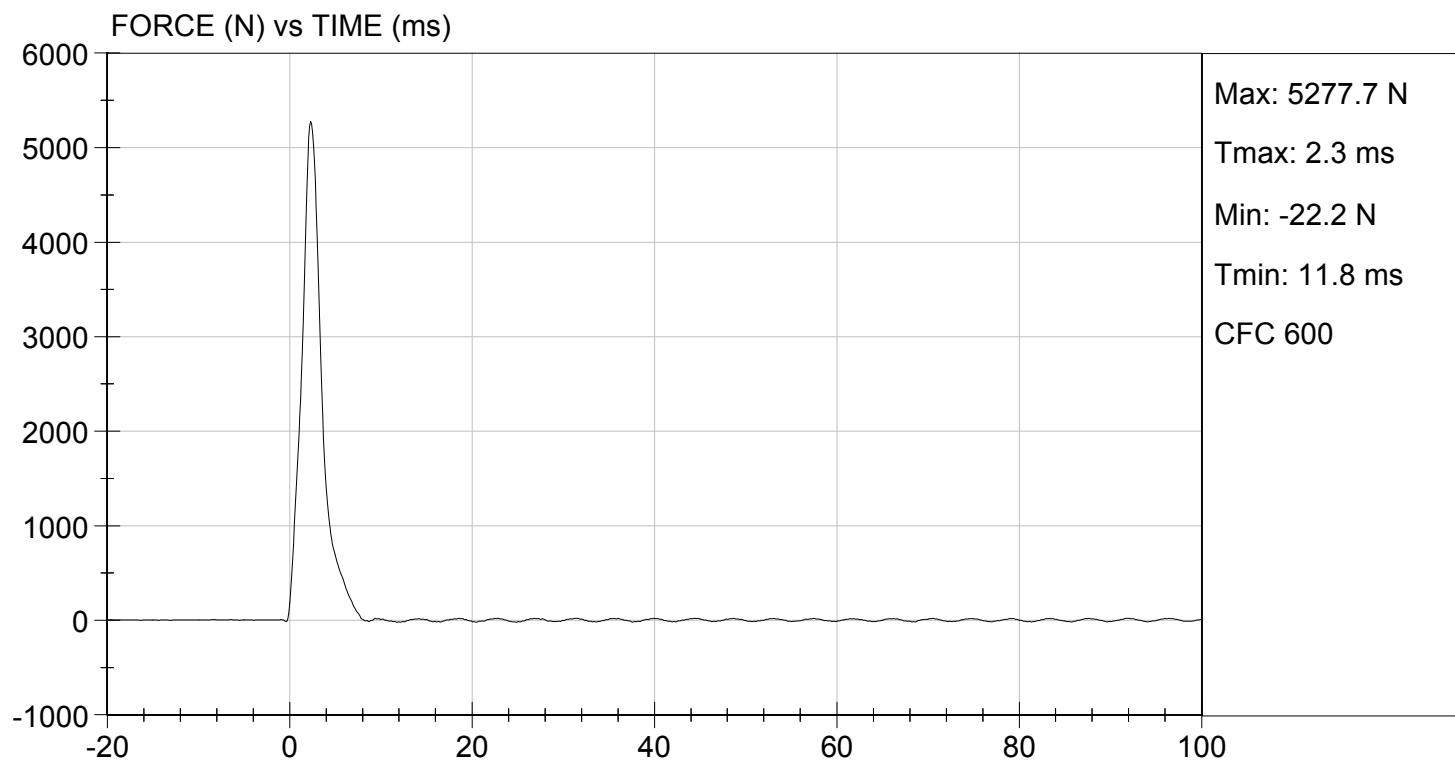
03/08/2013
Test Date


Approved By



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

TEST DATE: 03/08/2013
TEST #: D13786



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

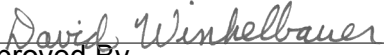
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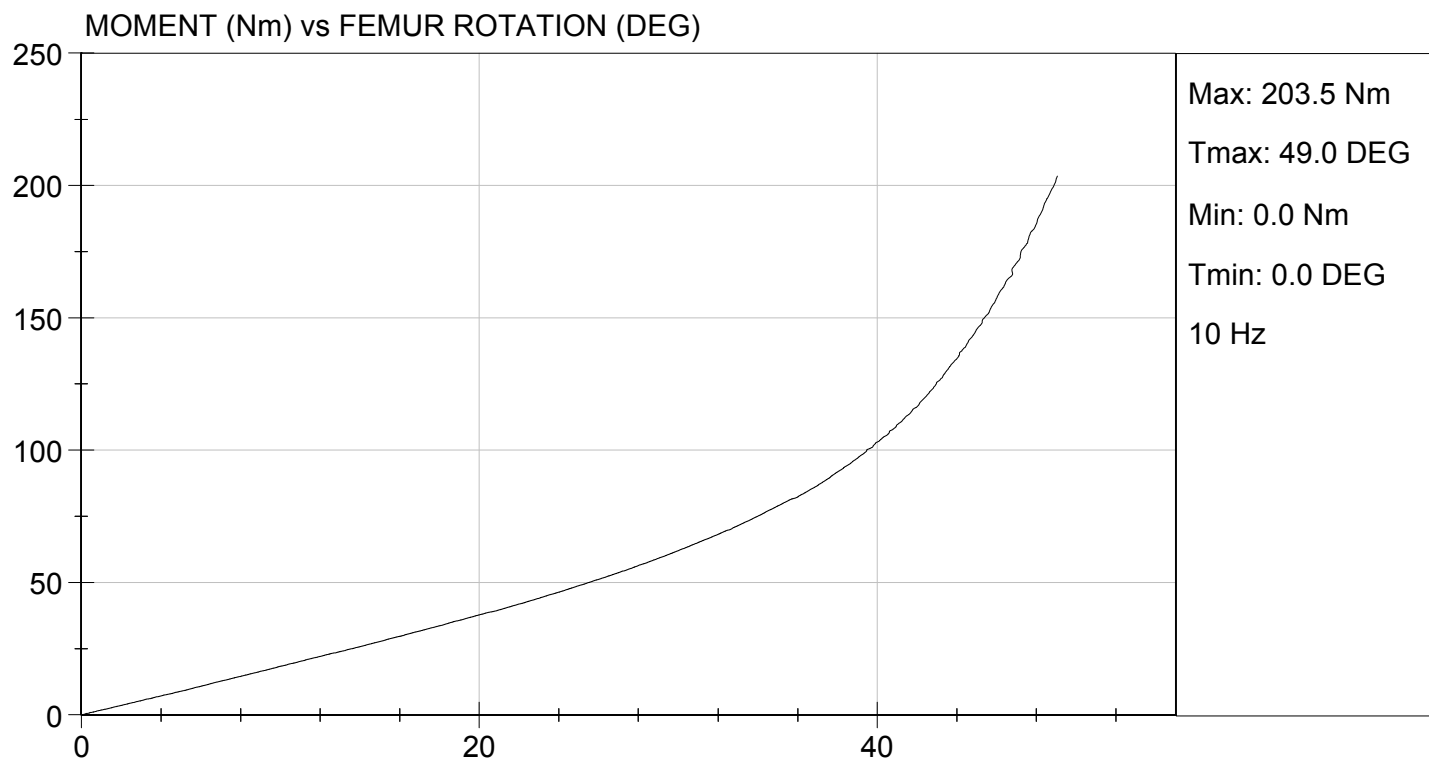
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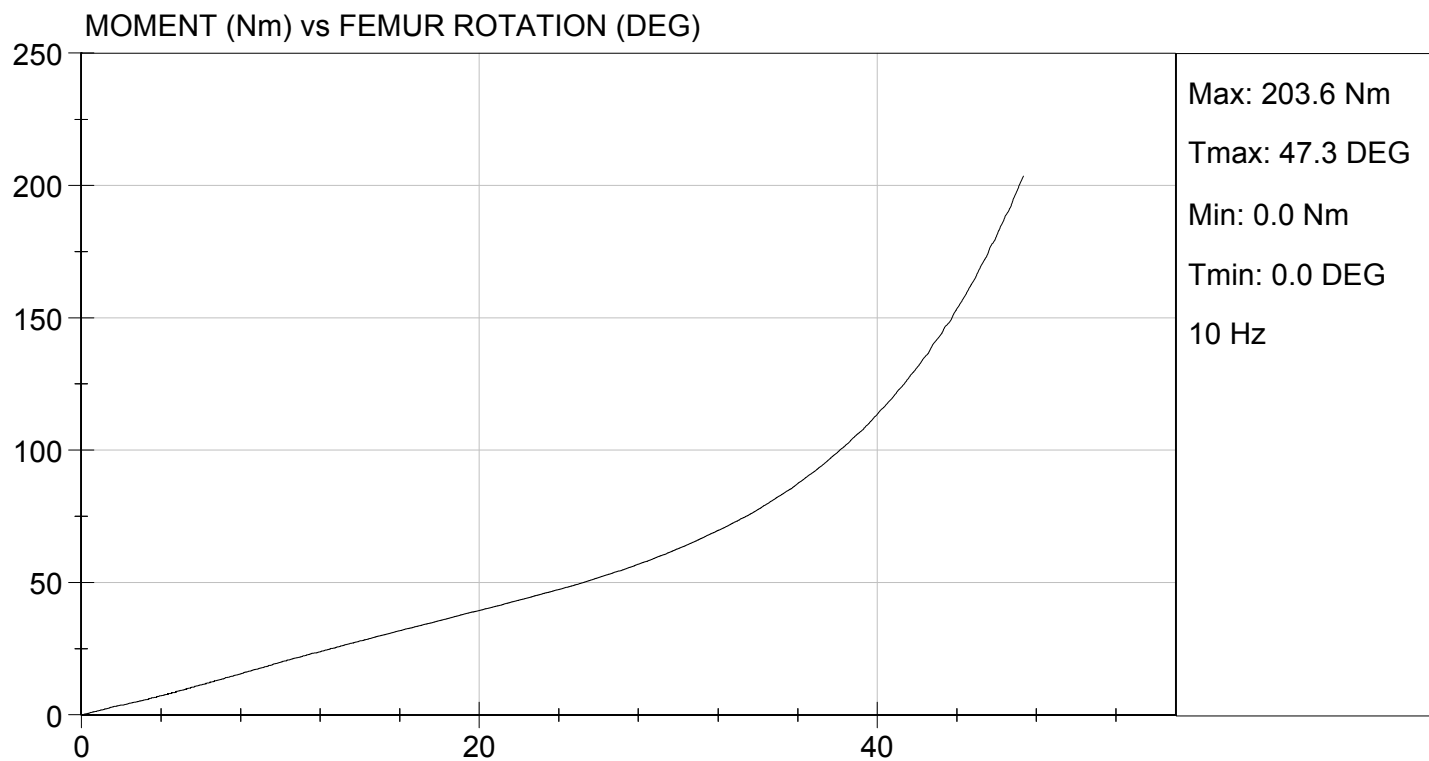
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	22.0	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	23	23	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	62.0	62.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	49.0	47.3	Pass
Overall Test Results					Pass


Laboratory Technician

03/08/2013
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

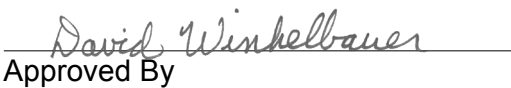
Test ID: D13621

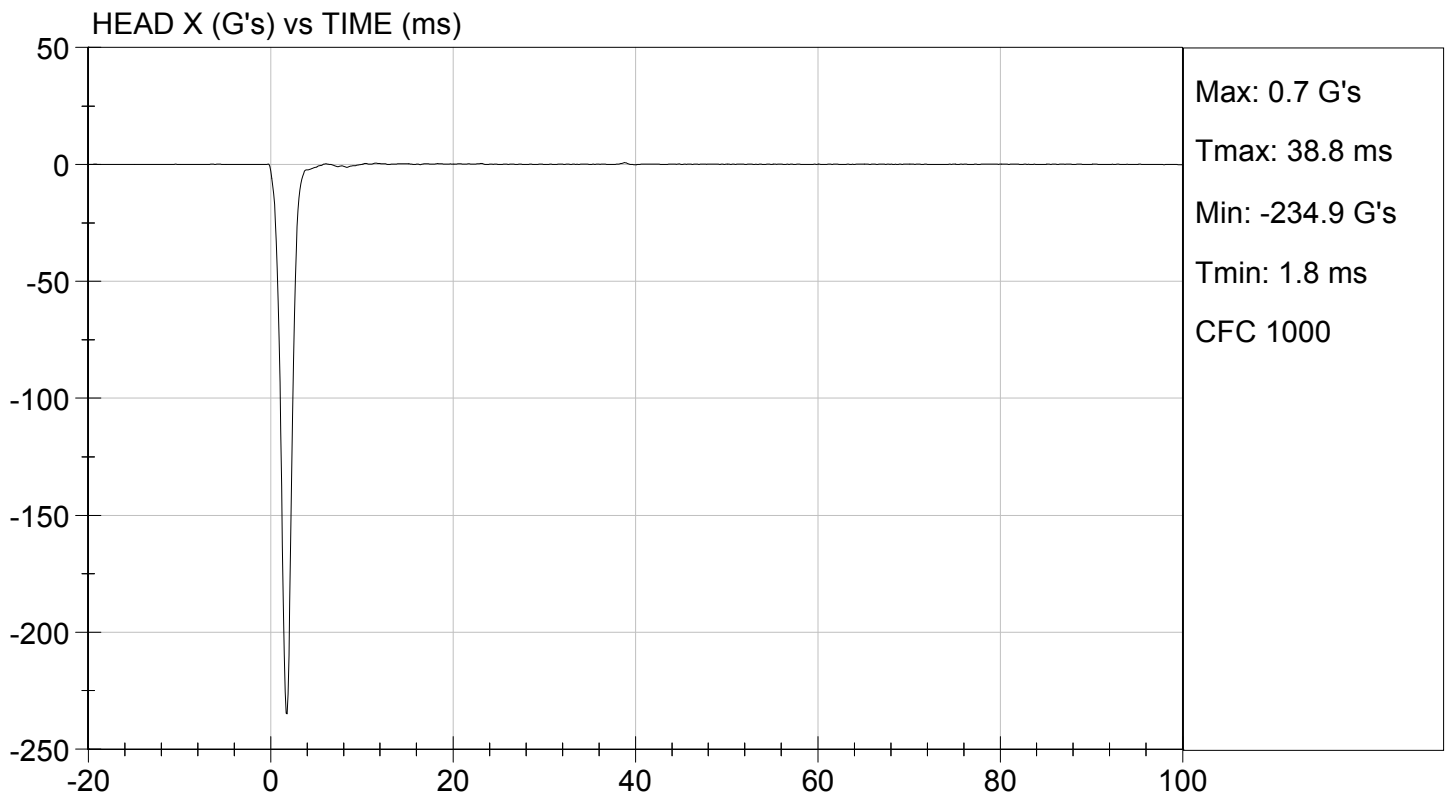
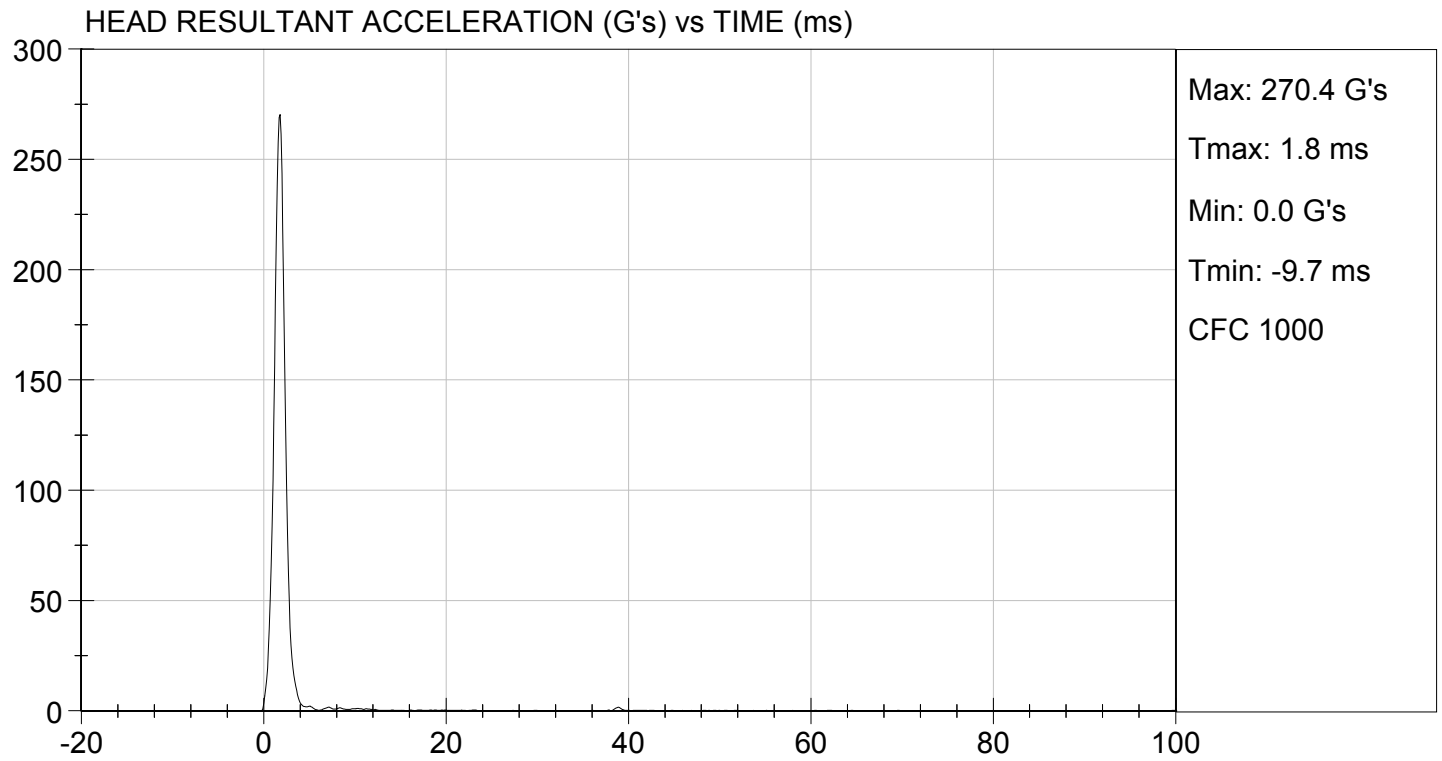
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	28	Pass
Peak Resultant Acceleration	G's	250 to 300	270	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	7.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass

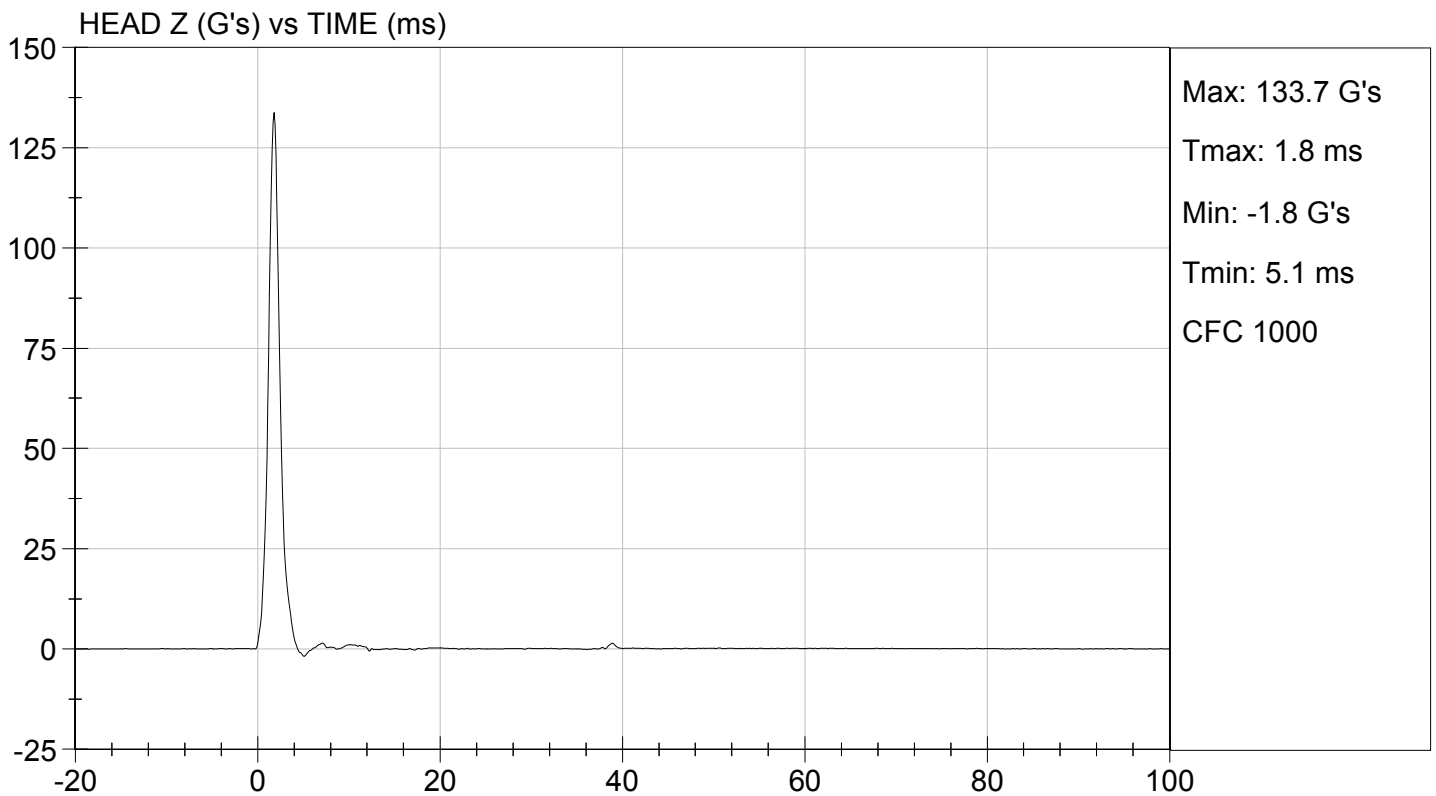
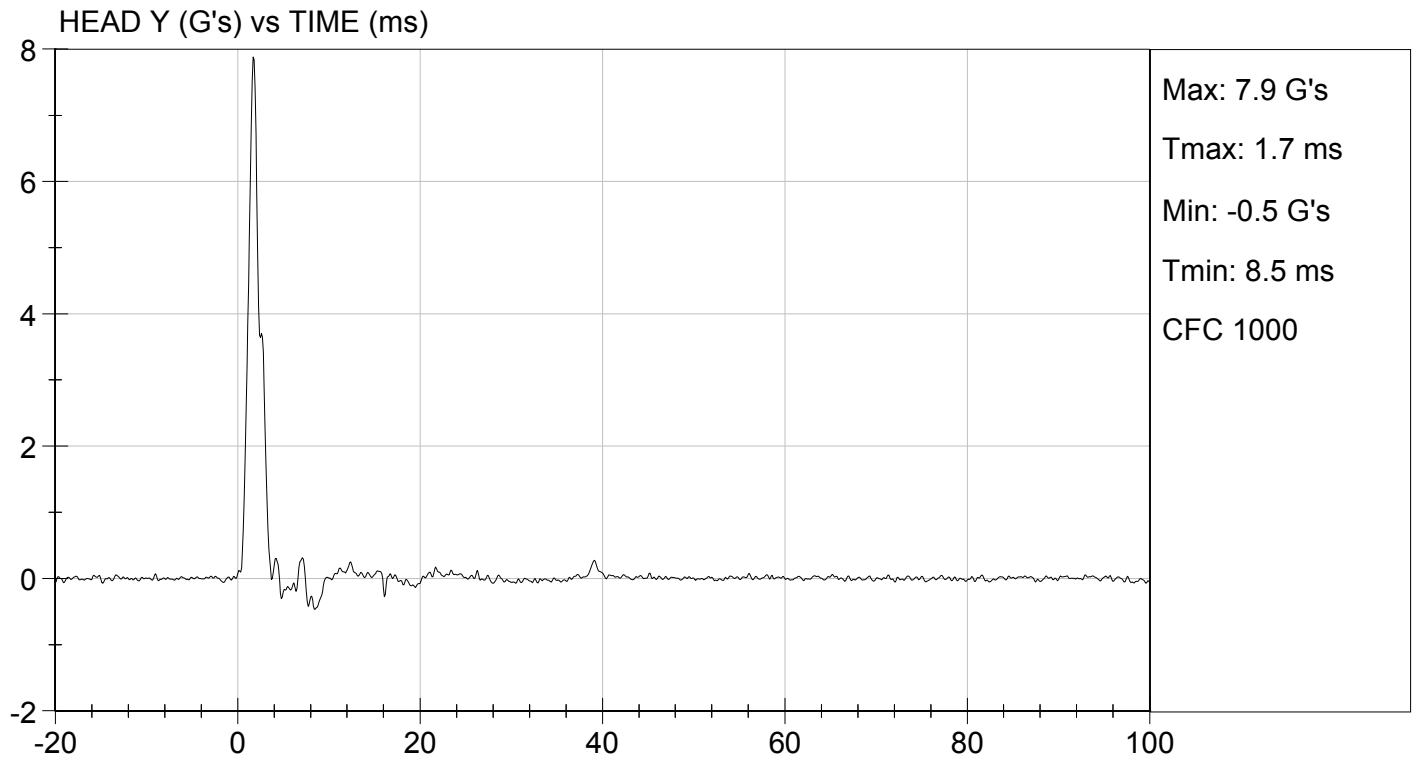

Laboratory Technician

02/27/2013

Test Date


Approved By





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D13622

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Speed		m/s	6.89 to 7.13	6.96	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.3	Pass
	30 ms	m/s	5.8 to 7.0	5.8	Pass
D Plane Rotation	Max	deg	77 to 91	79	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	73	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	90	Pass
Overall Results					Pass

Jessica Hall
 Laboratory Technician

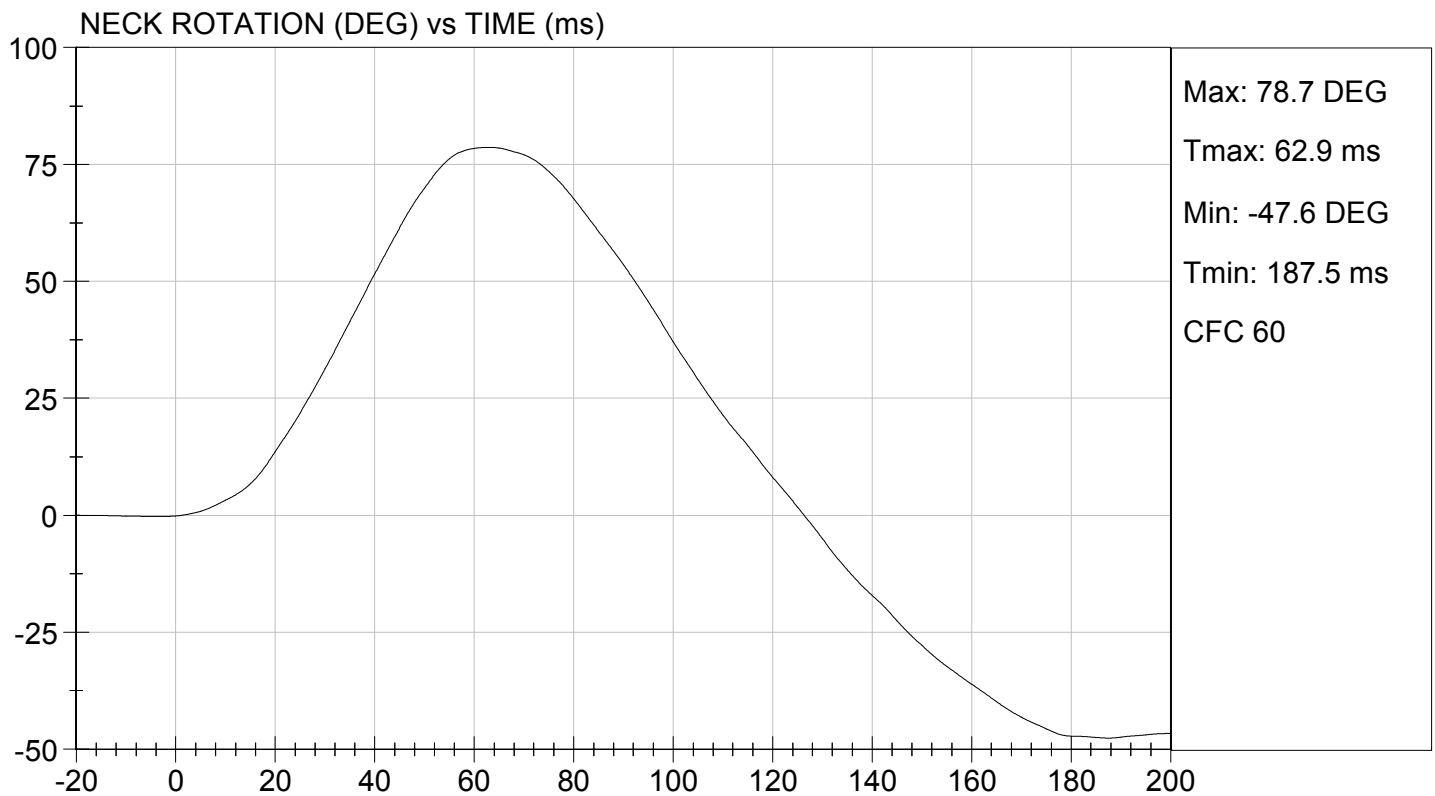
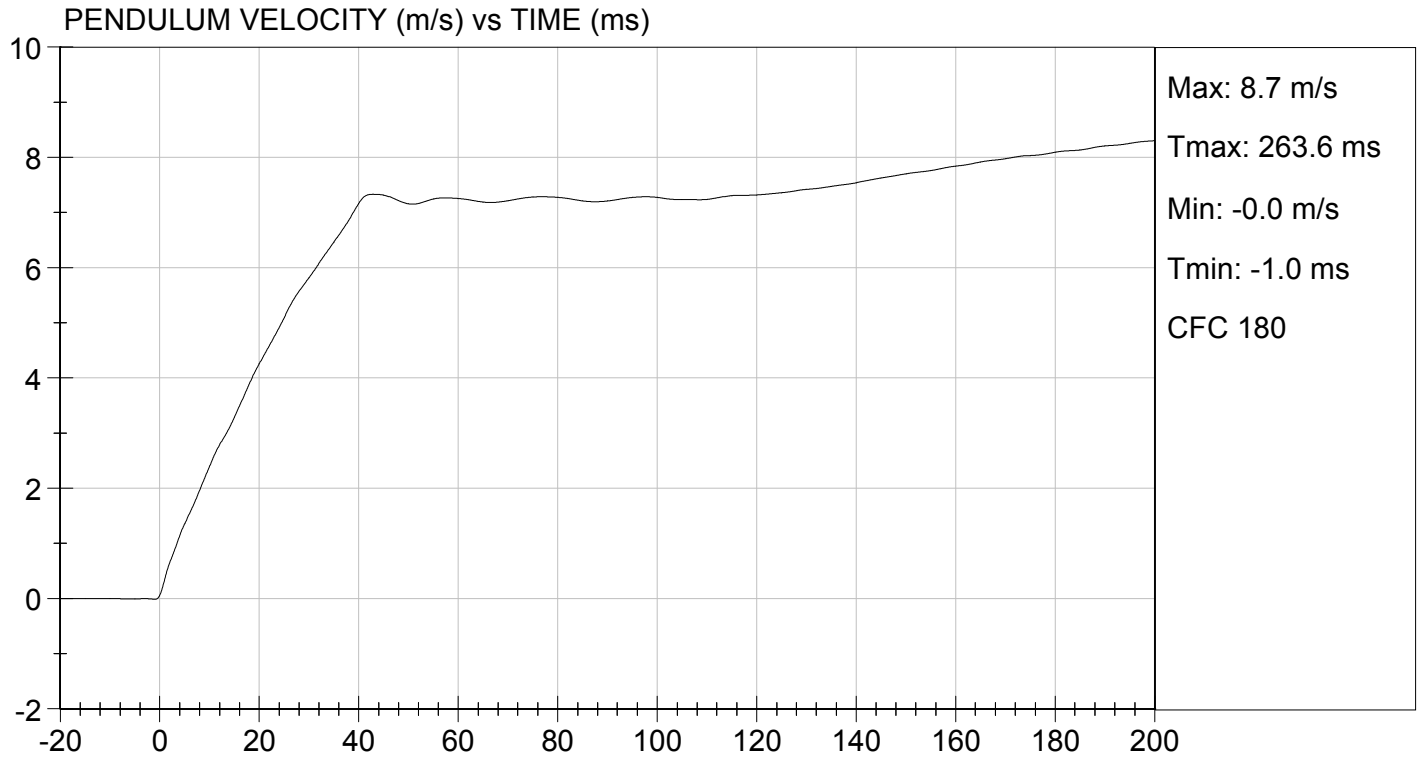
02/27/2013
 Test Date

David Winkelbauer
 Approved By



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

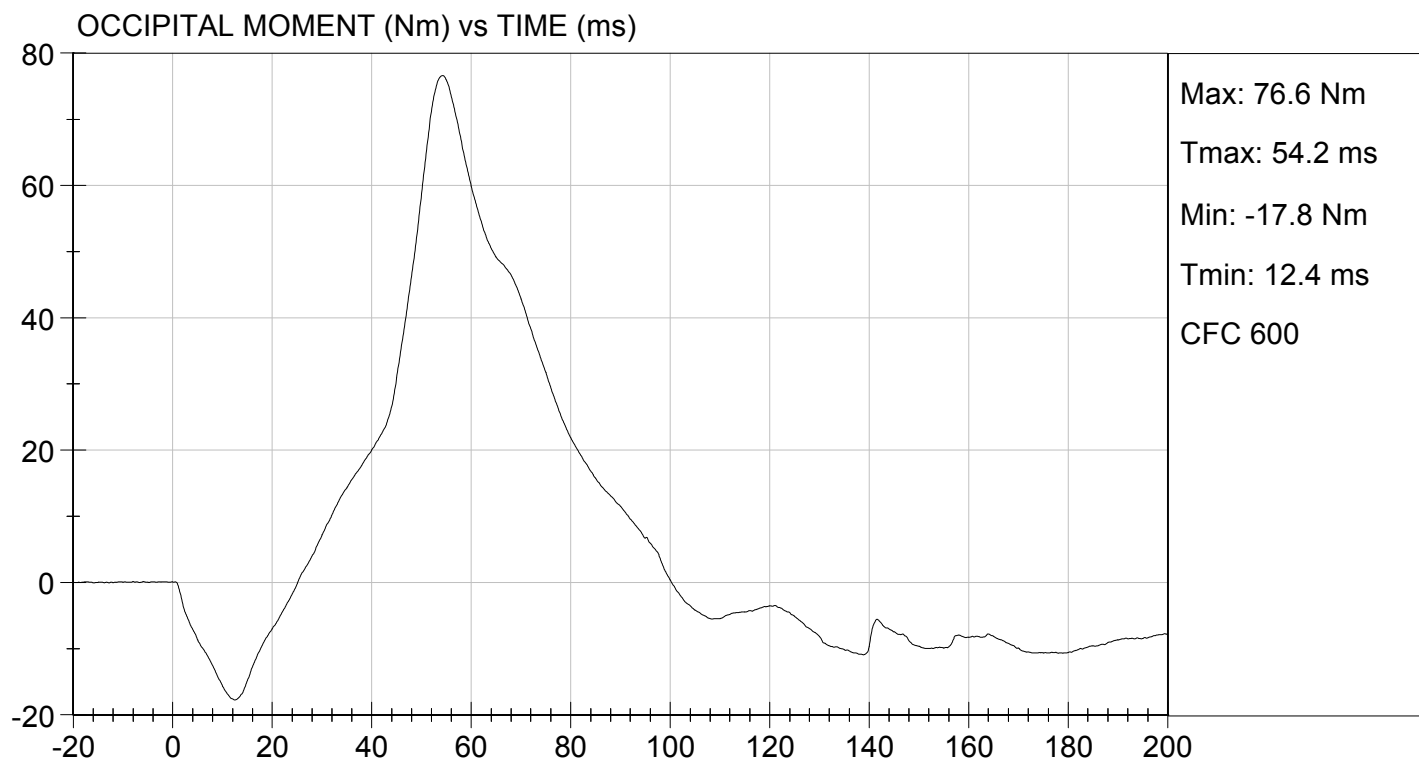
TEST DATE: 02/27/2013
TEST #: D13622





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

TEST DATE: 02/27/2013
TEST #: D13622



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

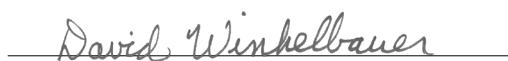
ATD Serial No: 138

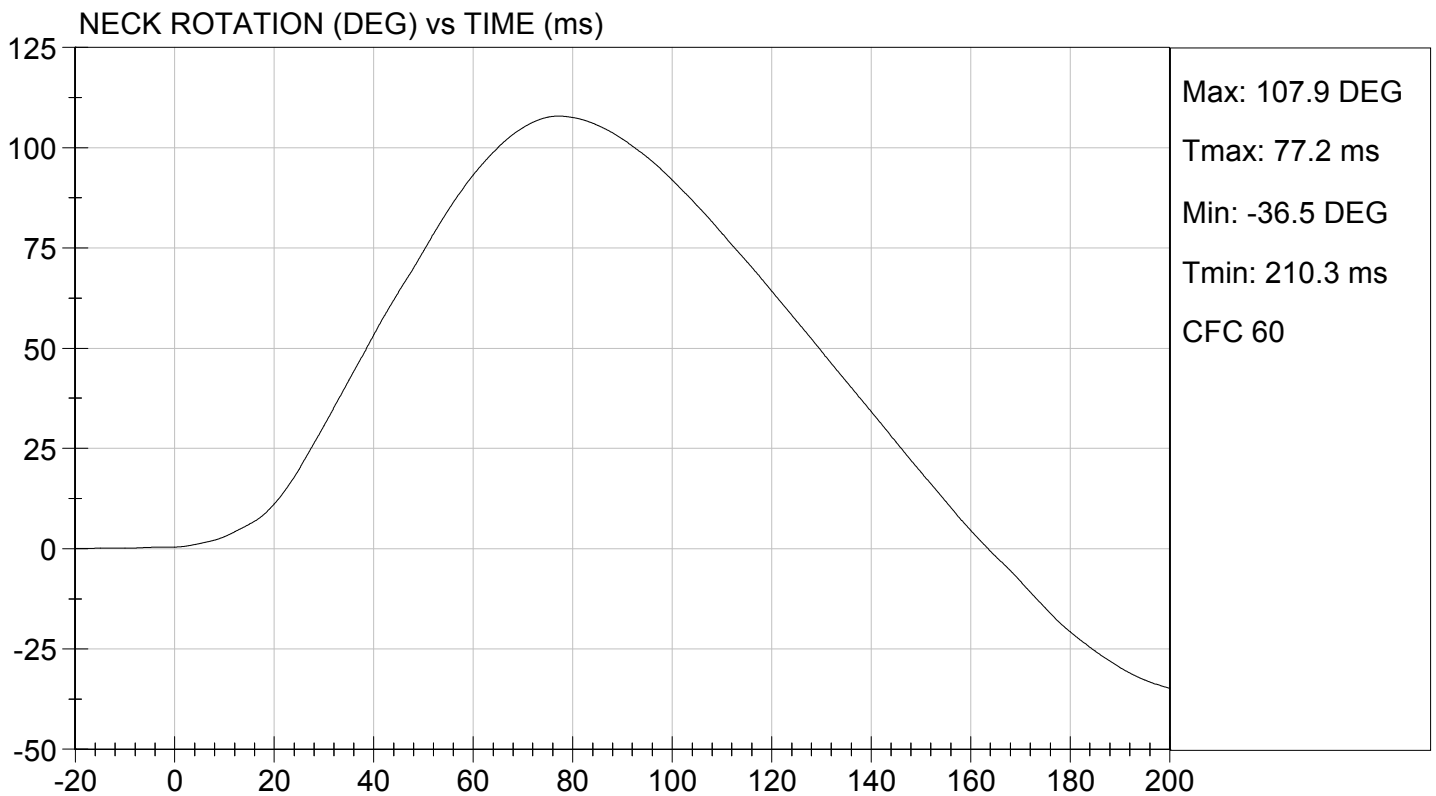
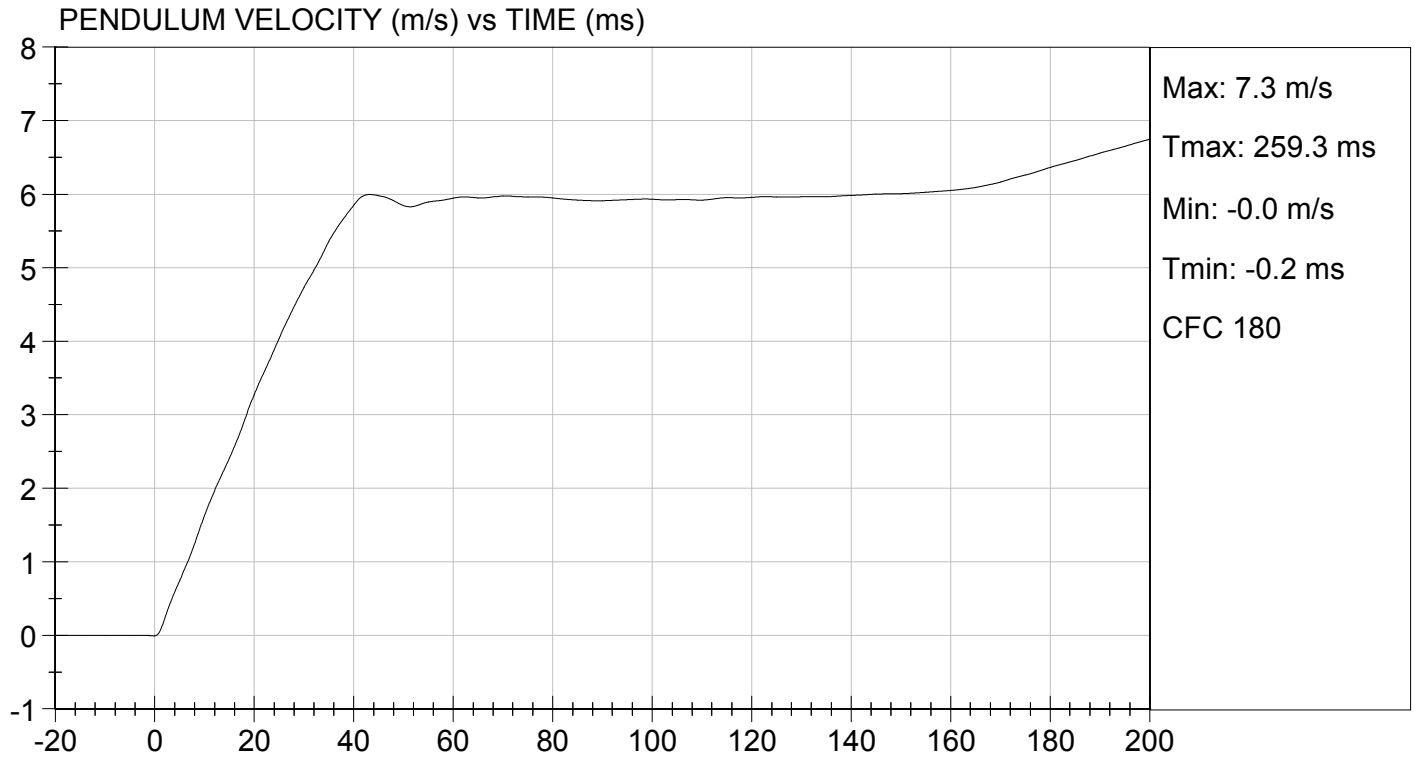
Test I.D: D13623

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	30	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	4.7	Pass
D Plane Rotation	Max	deg	99 to 114	108	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-57	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	103	Pass
Overall Results					Pass


Laboratory Technician

02/27/2013
Test Date

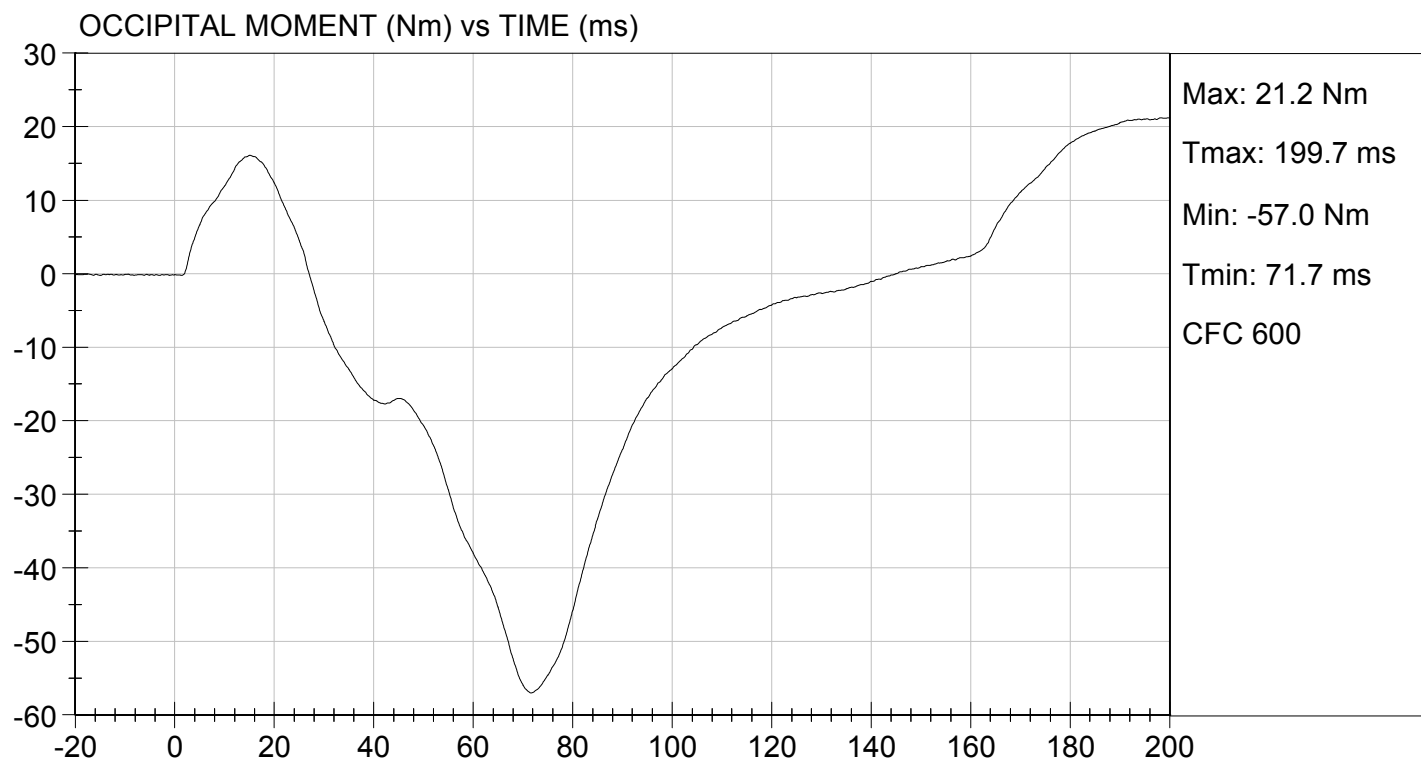

Approved By





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

TEST DATE: 02/27/2013
TEST #: D13623



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D13624

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	31	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	55	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	3989	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	3919	Pass
Overall Test Results				Pass


Laboratory Technician

02/27/2013

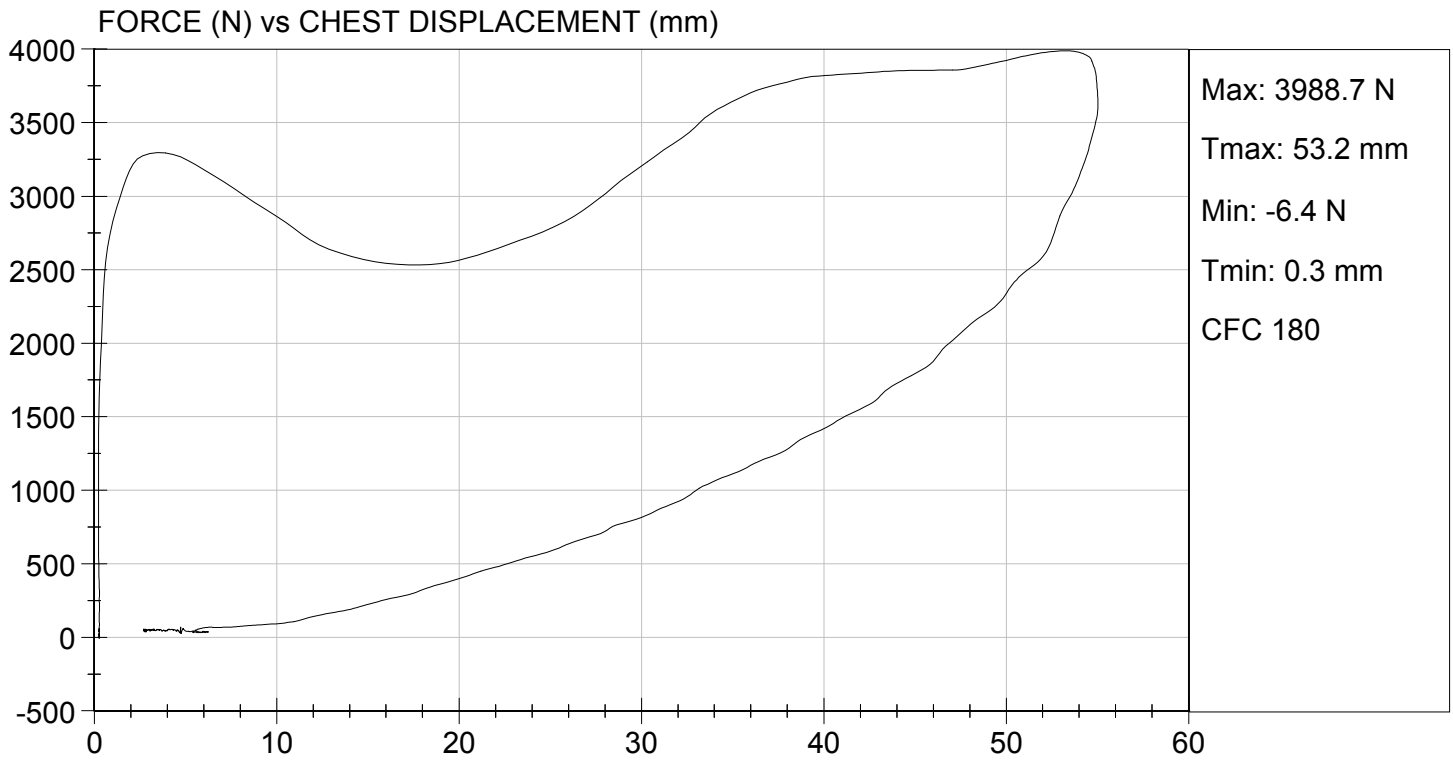
Test Date


Approved By



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

TEST DATE: 02/27/2013
TEST #: D13624



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D13625

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	29	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3614	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

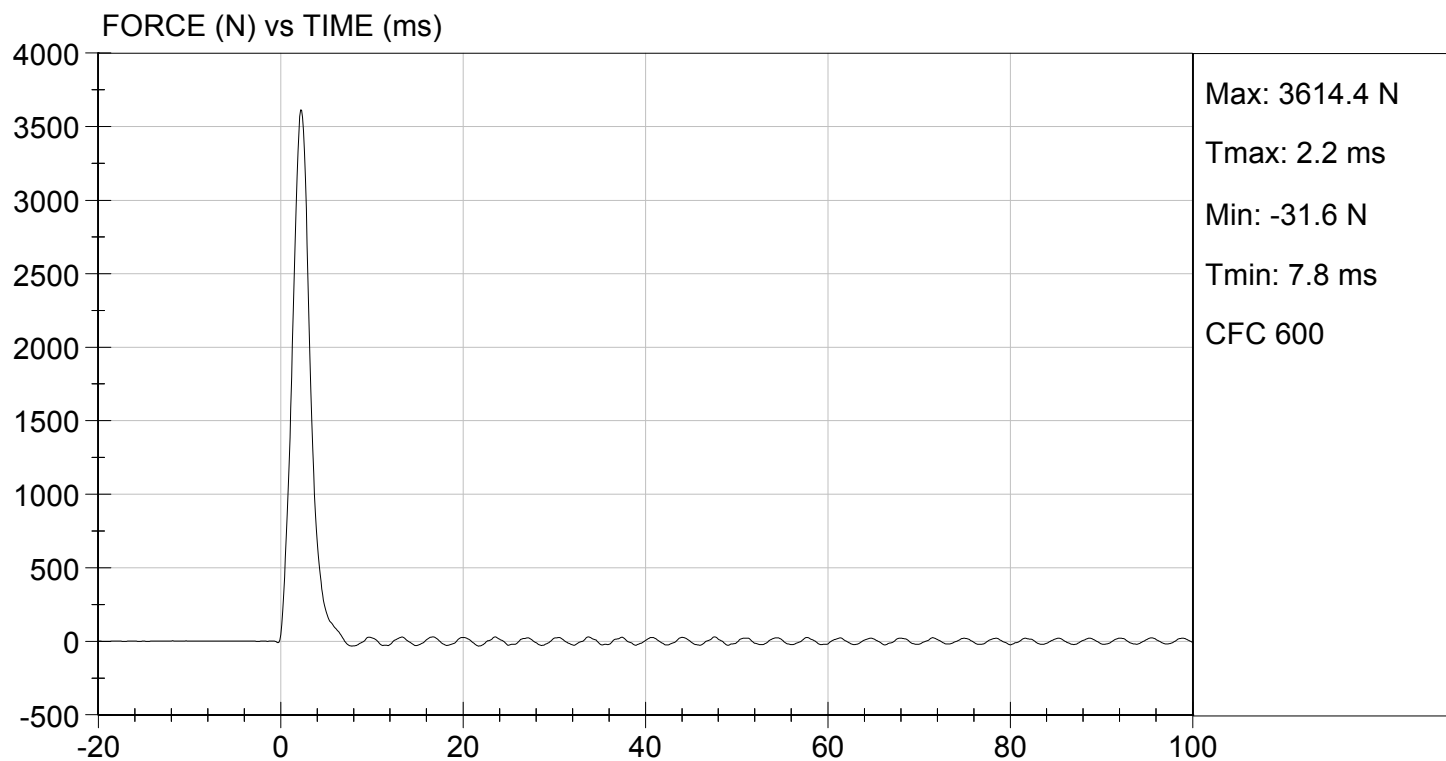
02/27/2013
Test Date

David Winkelbauer
Approved By



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

TEST DATE: 02/27/2013
TEST #: D13625



MGA RESEARCH CORPORATION

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

ATD Serial No: 138

Test I.D: D13626

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	29	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3598	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

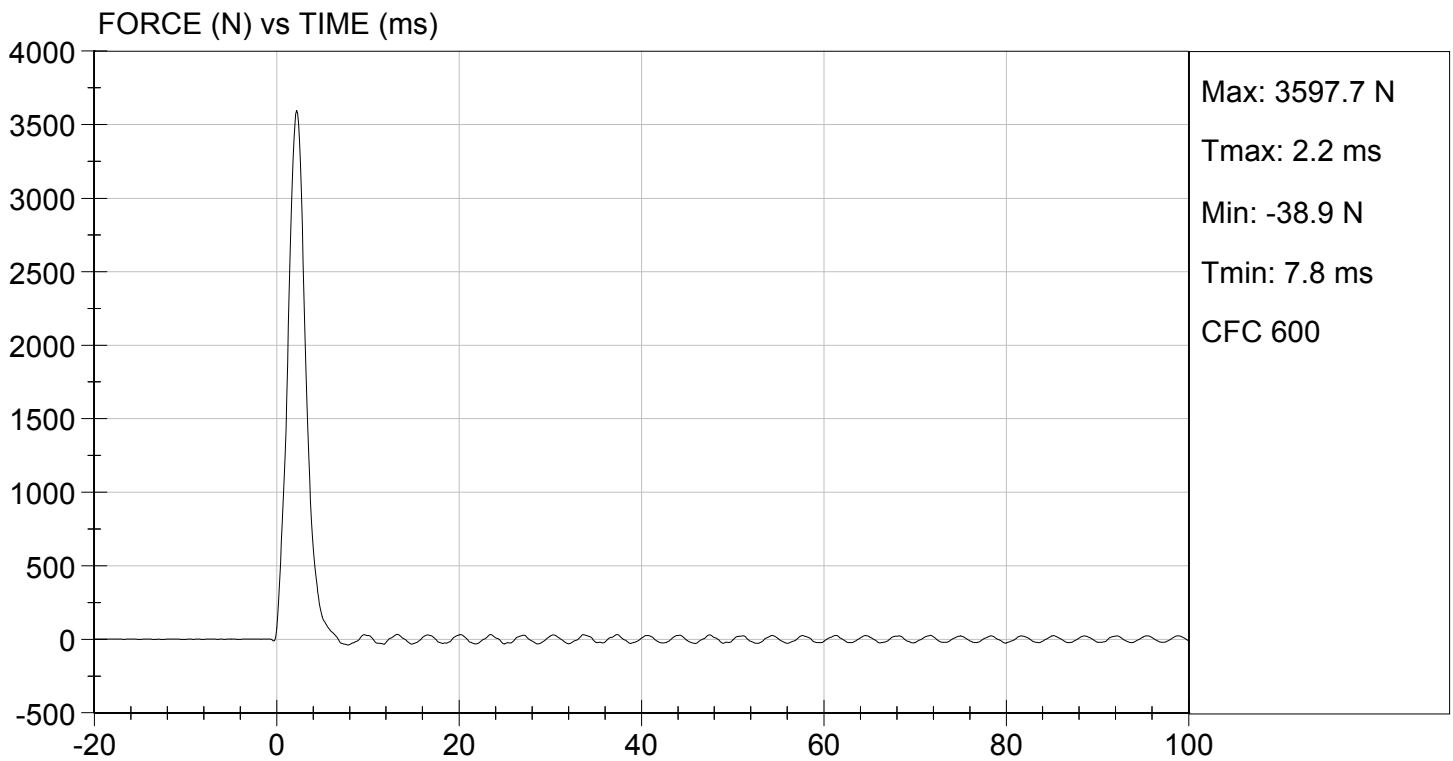
02/27/2013
Test Date

David Winkelbauer
Approved By



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

TEST DATE: 02/27/2013
TEST #: D13626



MGA RESEARCH CORPORATION

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

ATD Serial No: 138

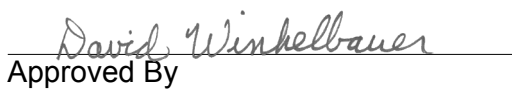
Test I.D: D13627

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	30	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	2	Pass
Force at 45 deg	N	320 to 390	383	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
Overall Result				Pass


Laboratory Technician

02/27/2013

Test Date

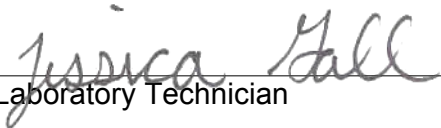

Approved By

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

ATD Serial No: 138

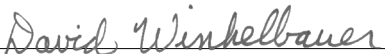
Test ID: D13791

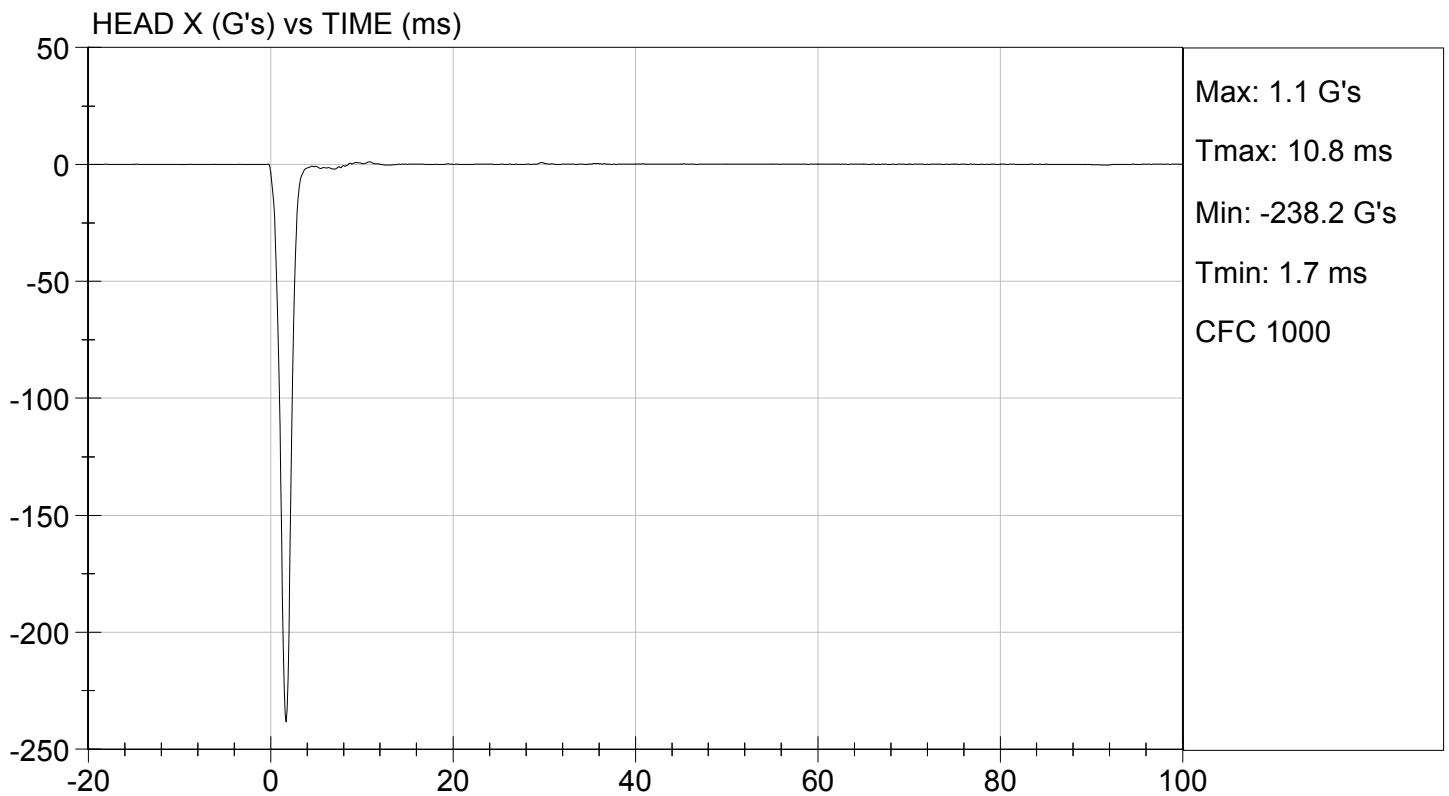
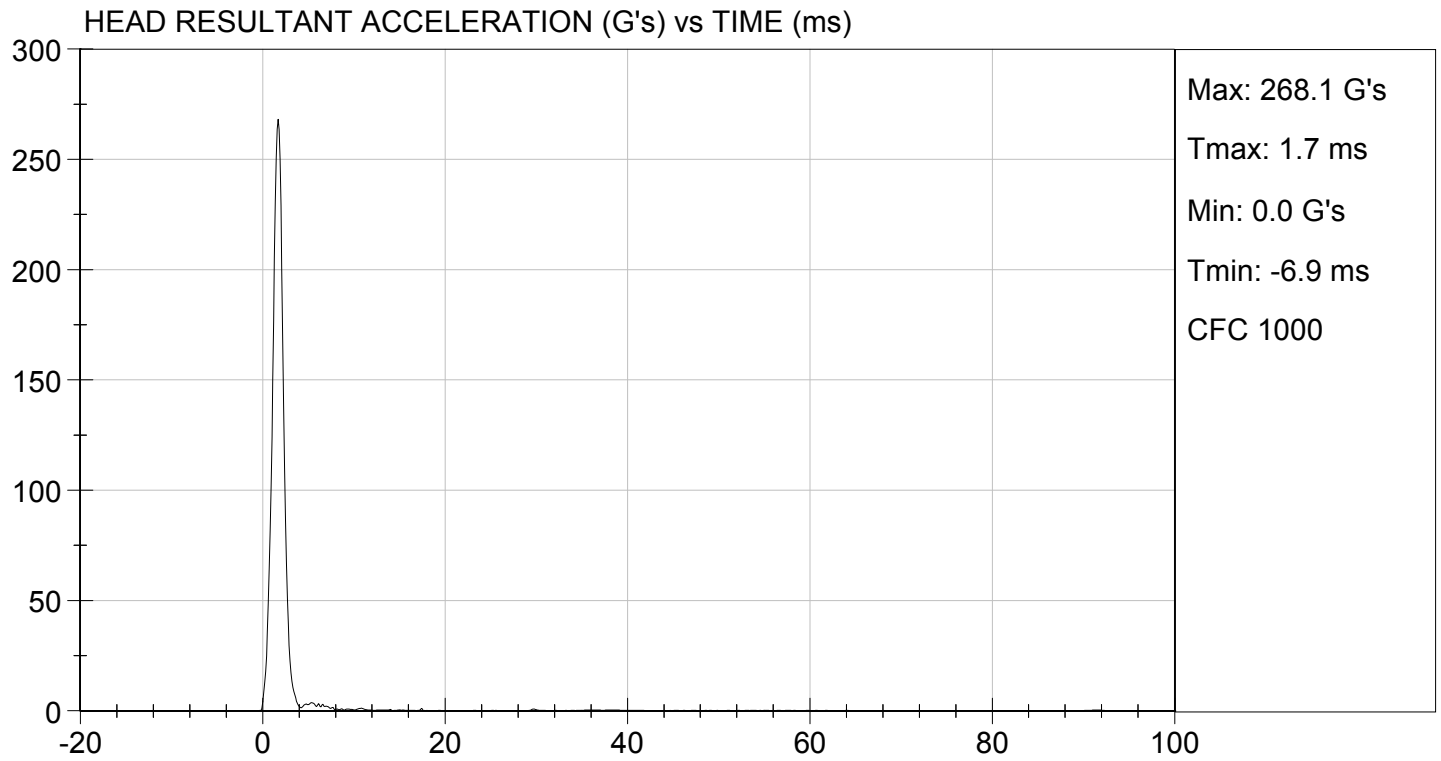
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	225 to 275	268	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-10.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

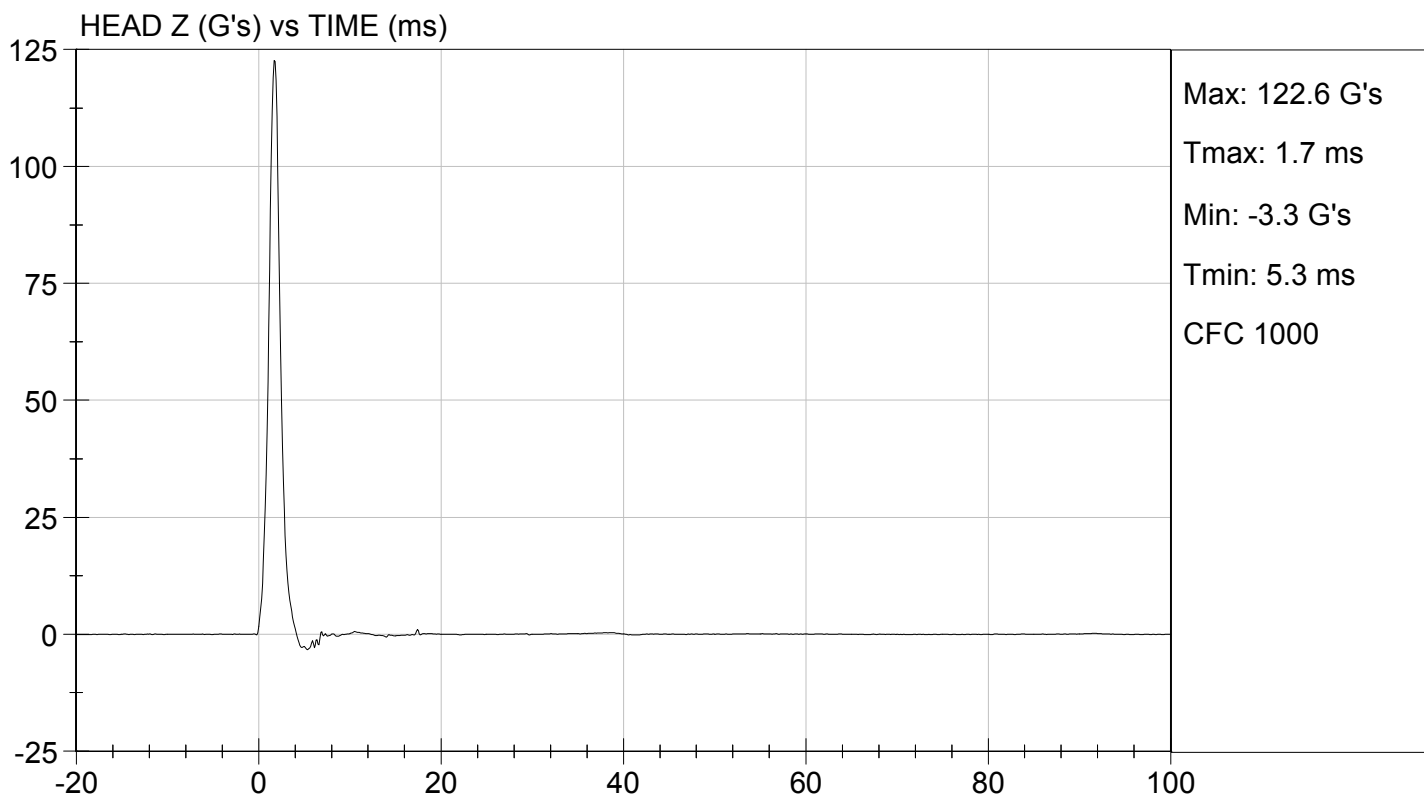
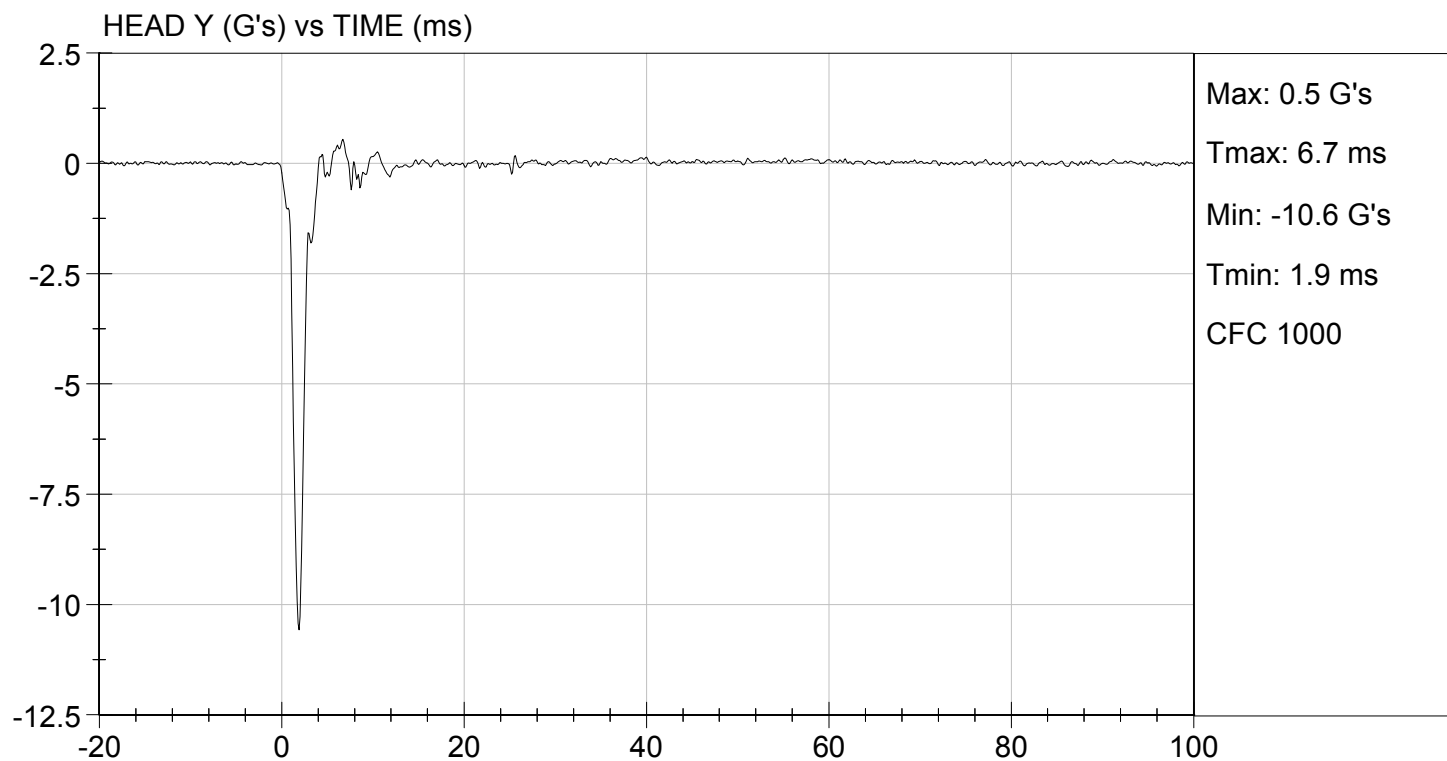

Laboratory Technician

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

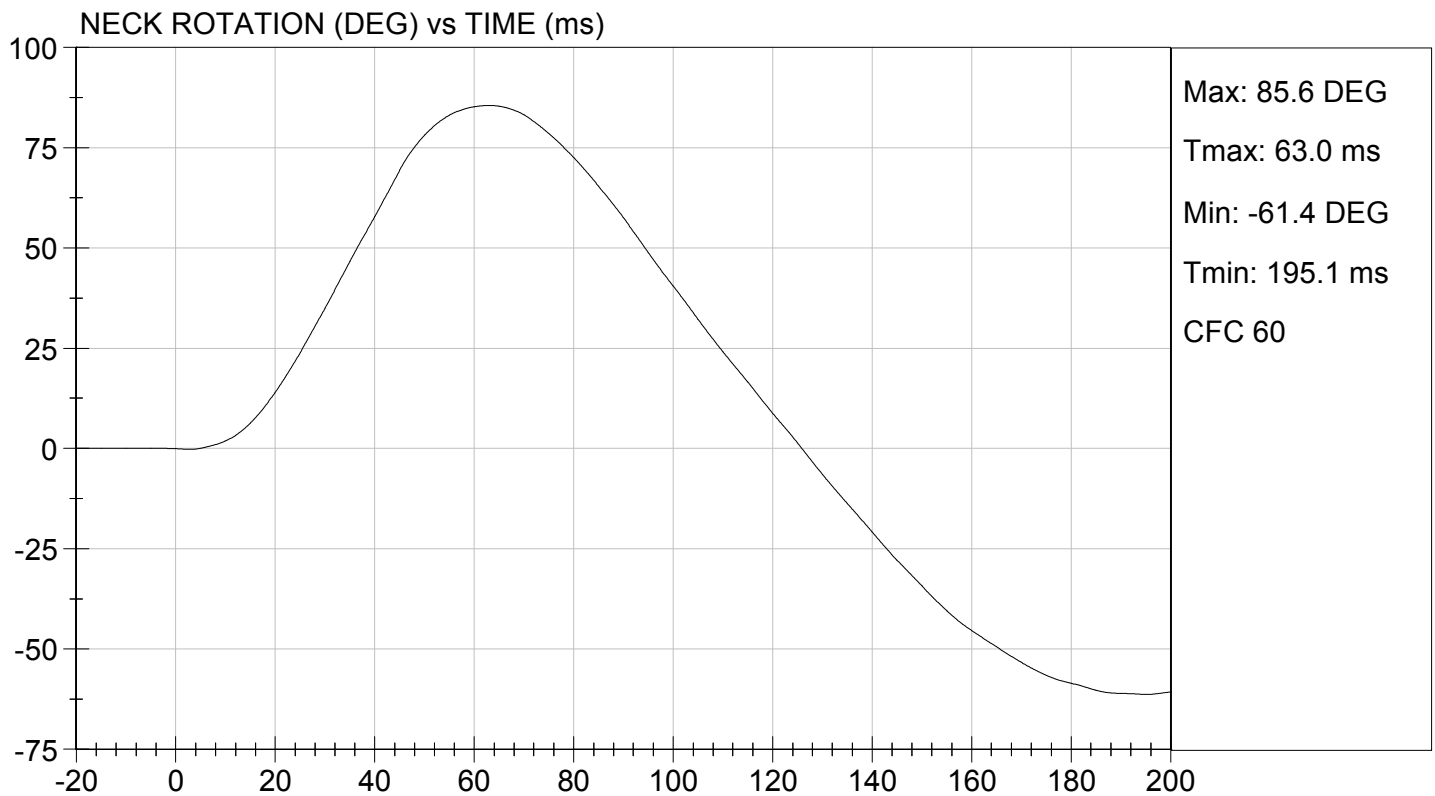
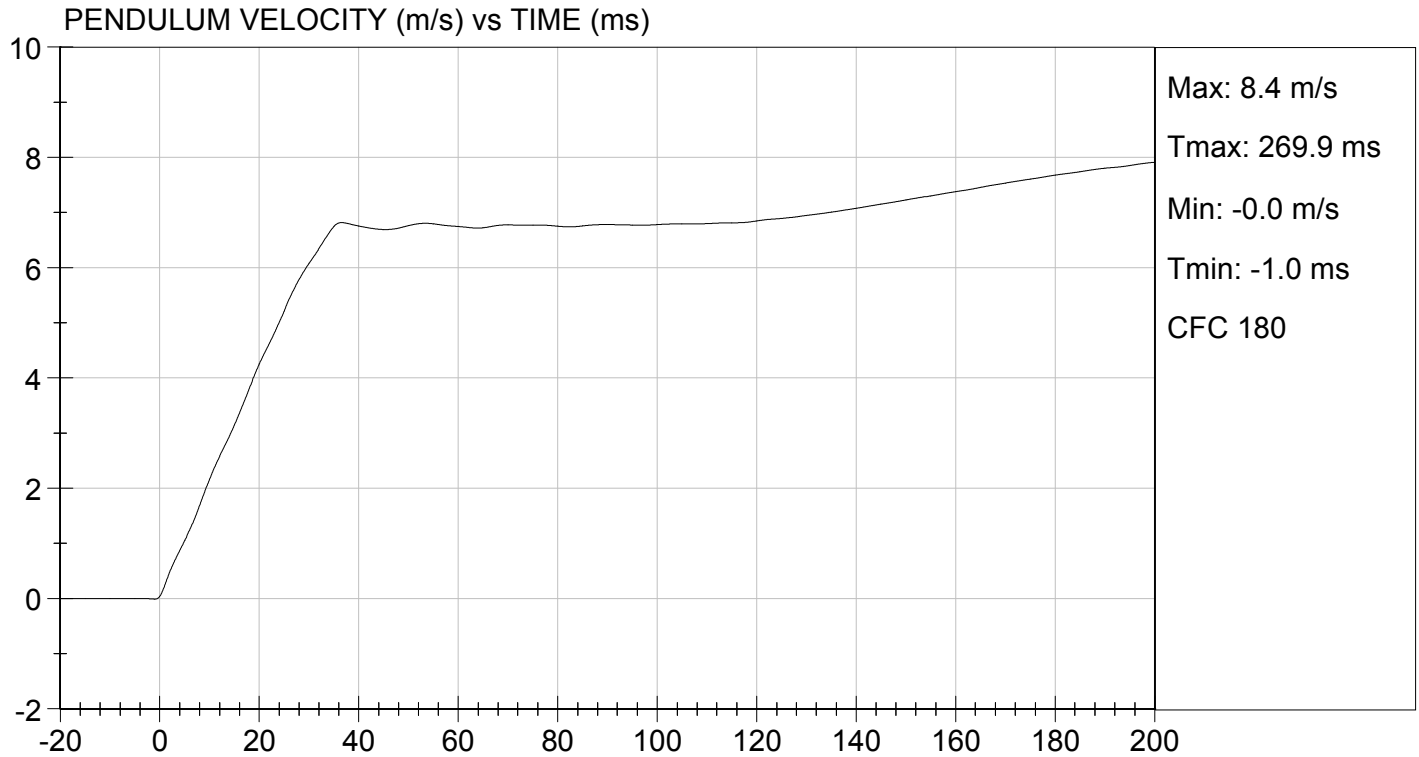
03/08/2013
 Test Date

David Winkelbauer
 Approved By



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

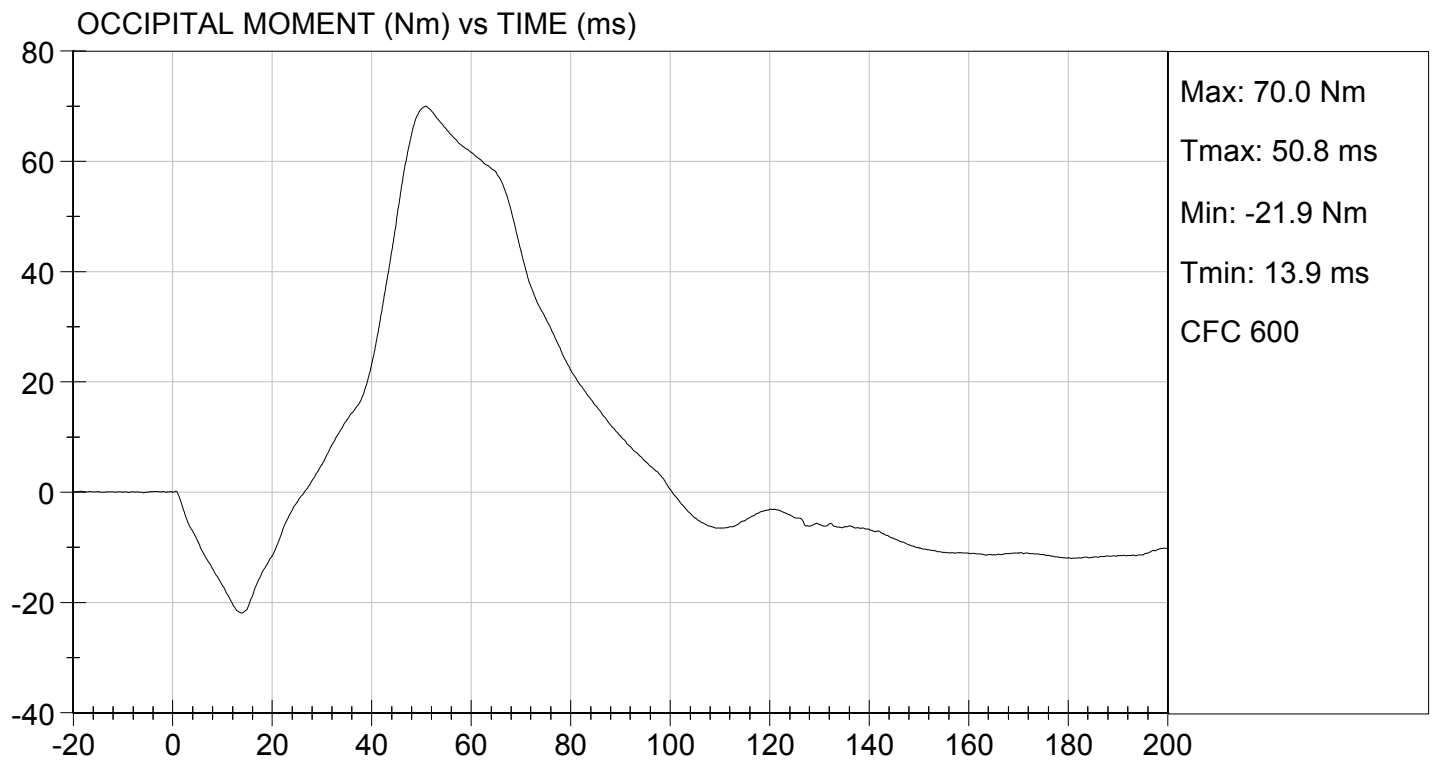
TEST DATE: 03/08/2013
TEST #: D13792





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


Laboratory Technician

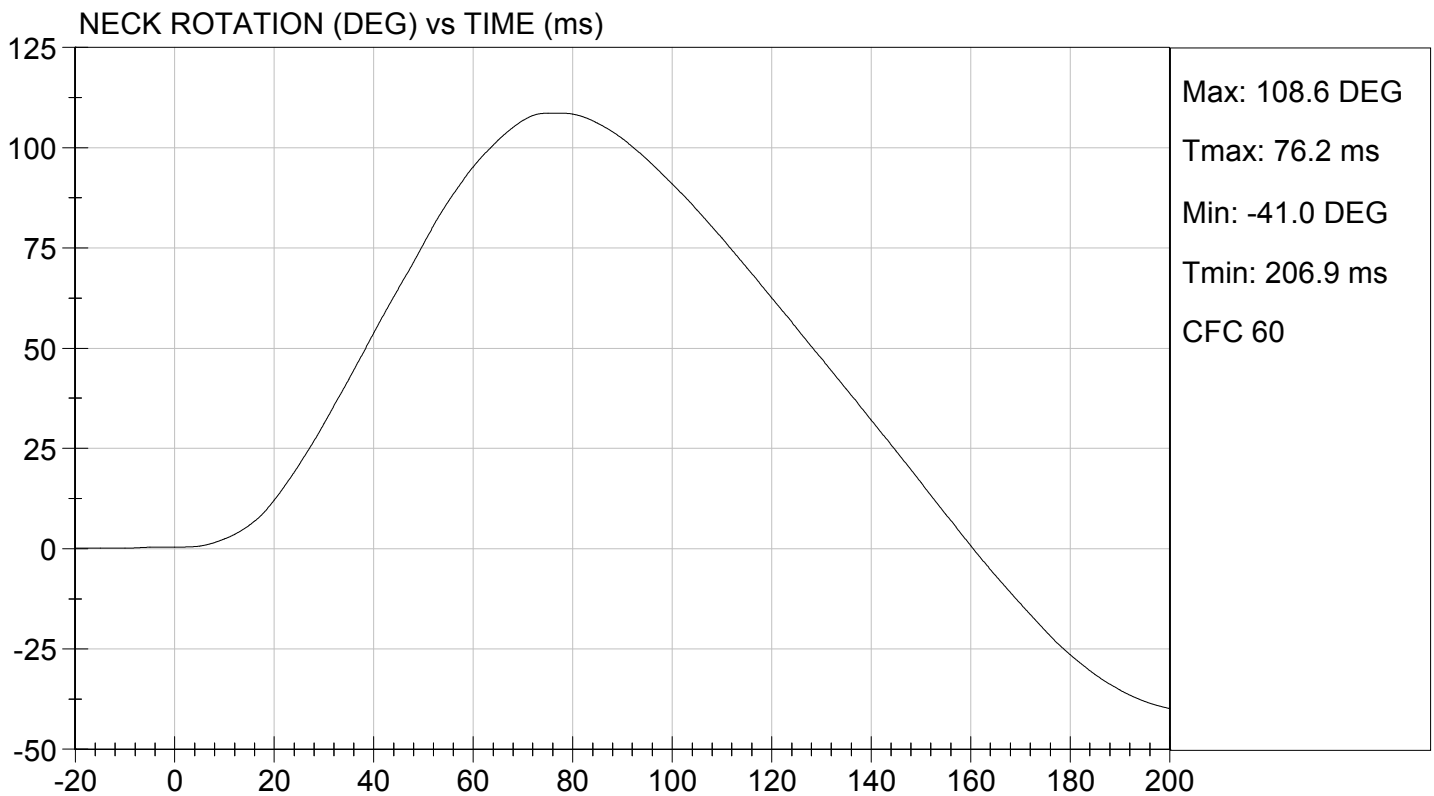
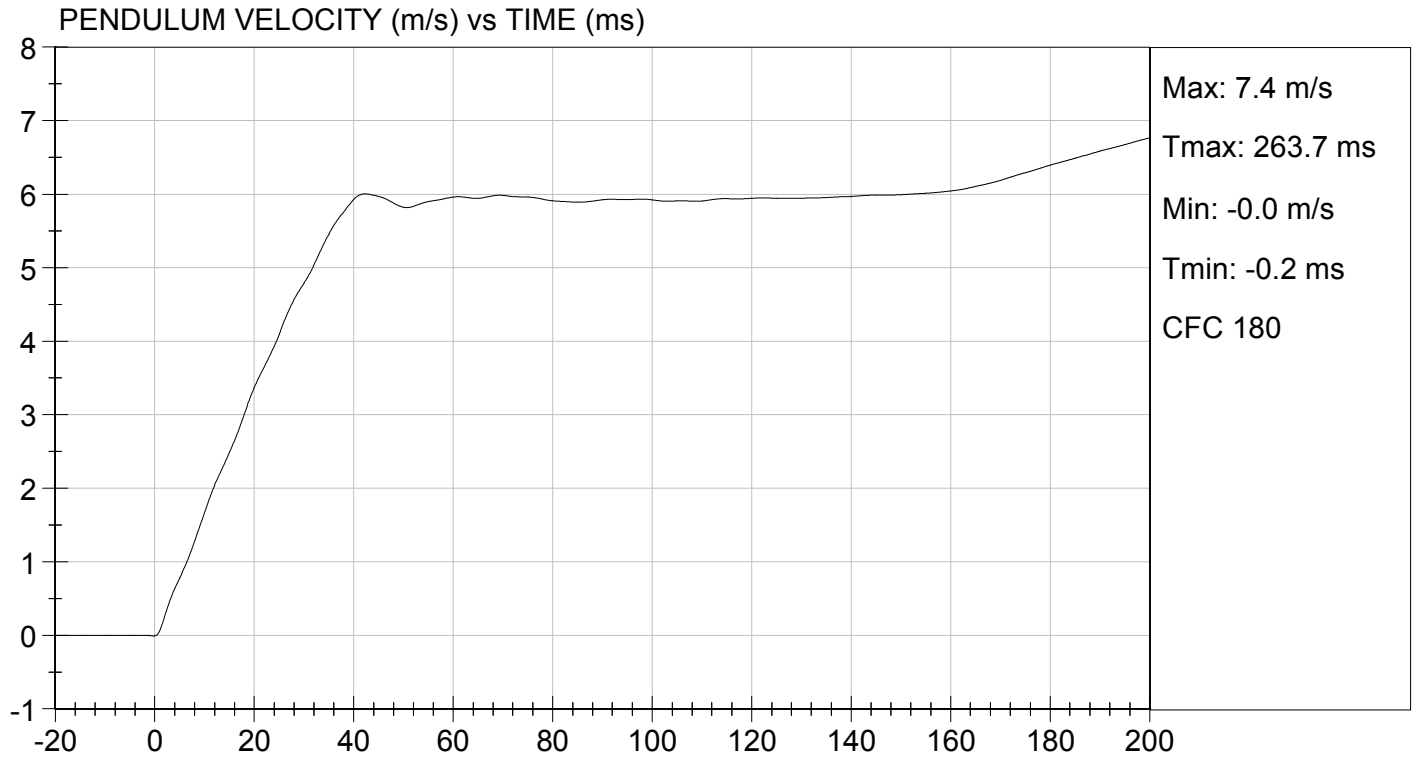
03/08/2013
Test Date


Approved By



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

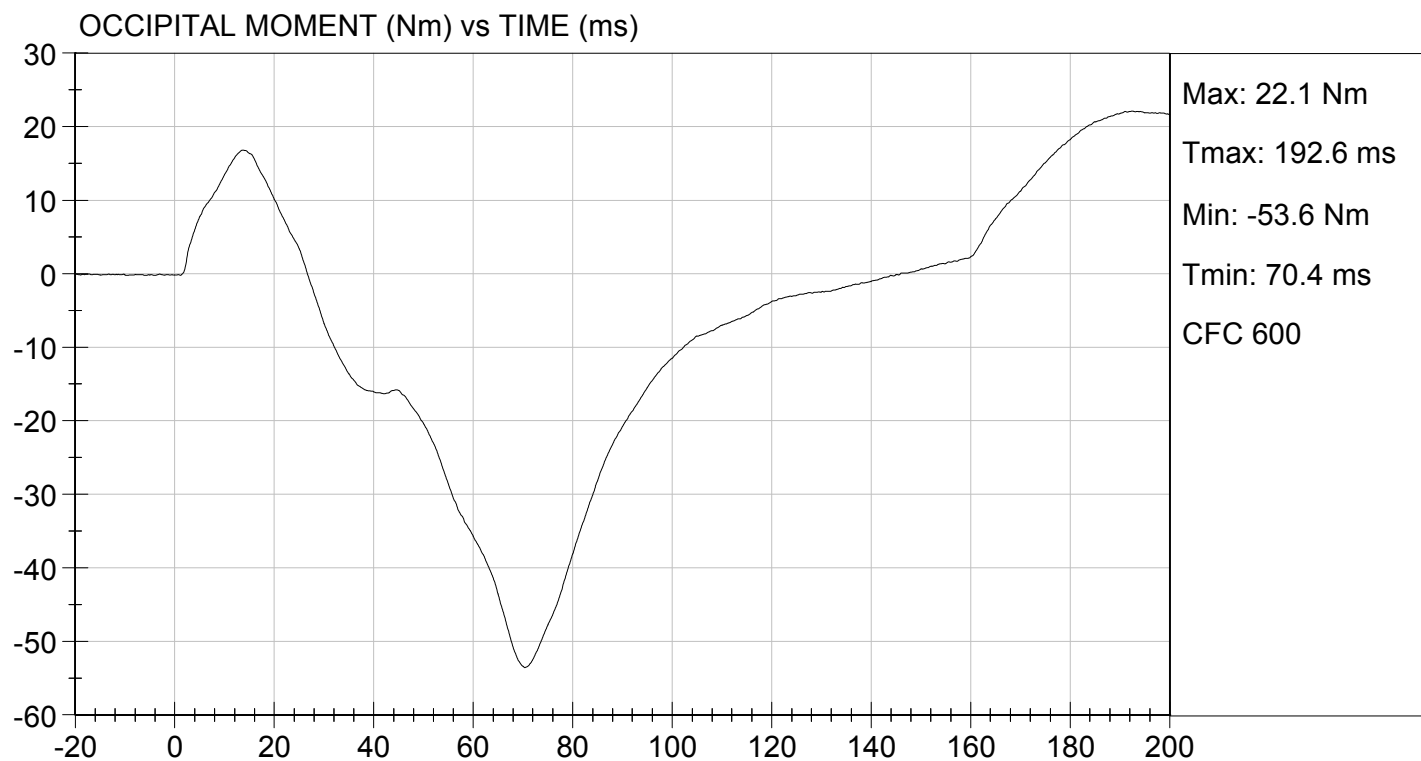
TEST DATE: 03/08/2013
TEST #: D13793





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

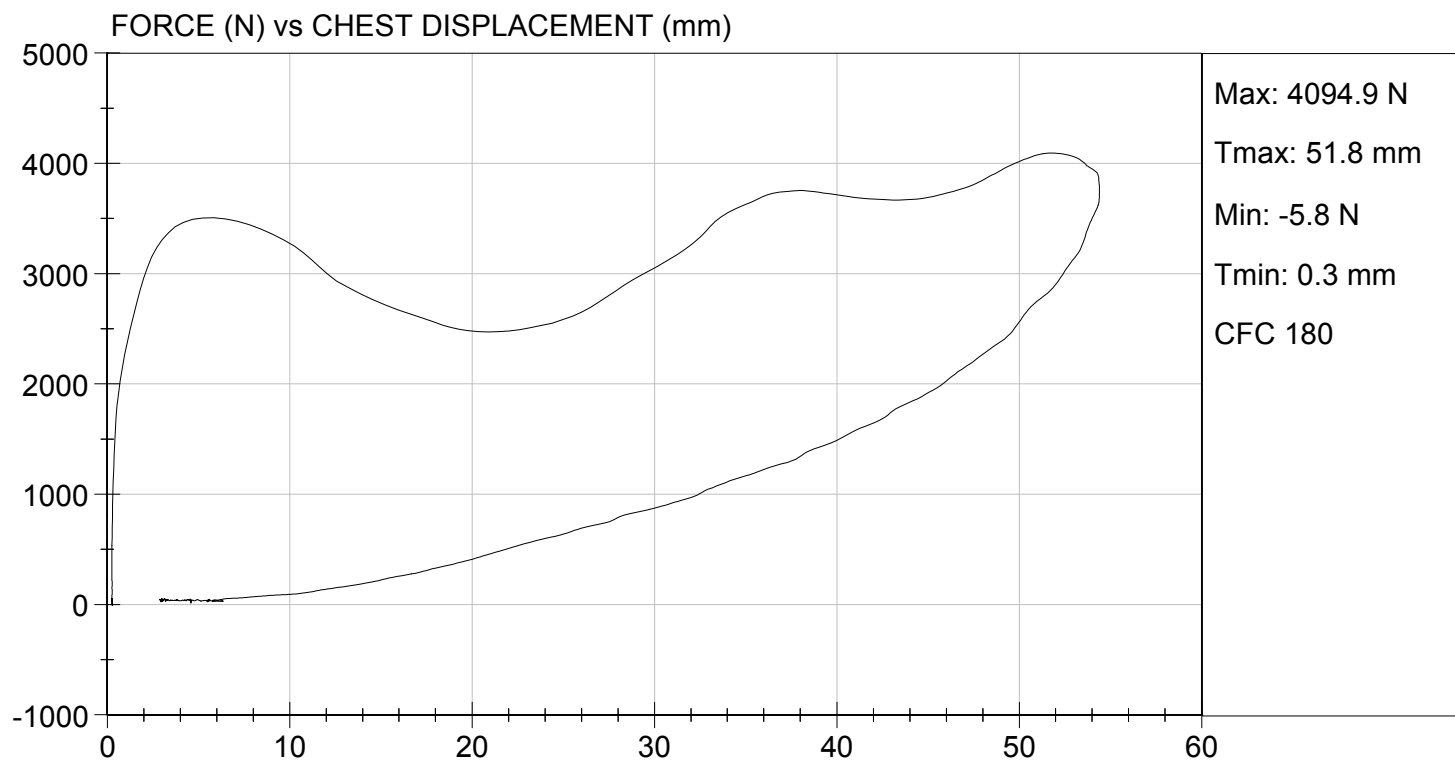
Test Date


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

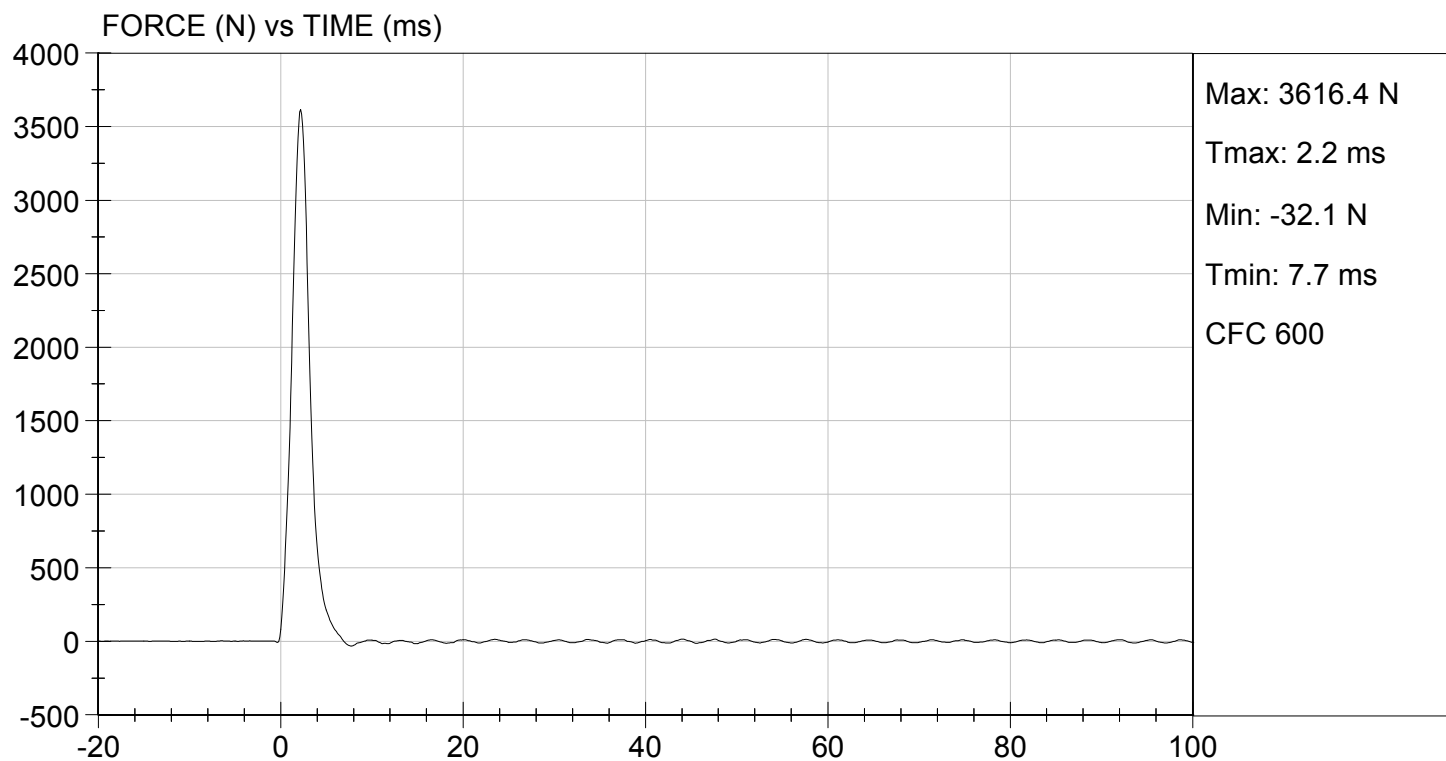
03/09/2013
Test Date


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


Laboratory Technician

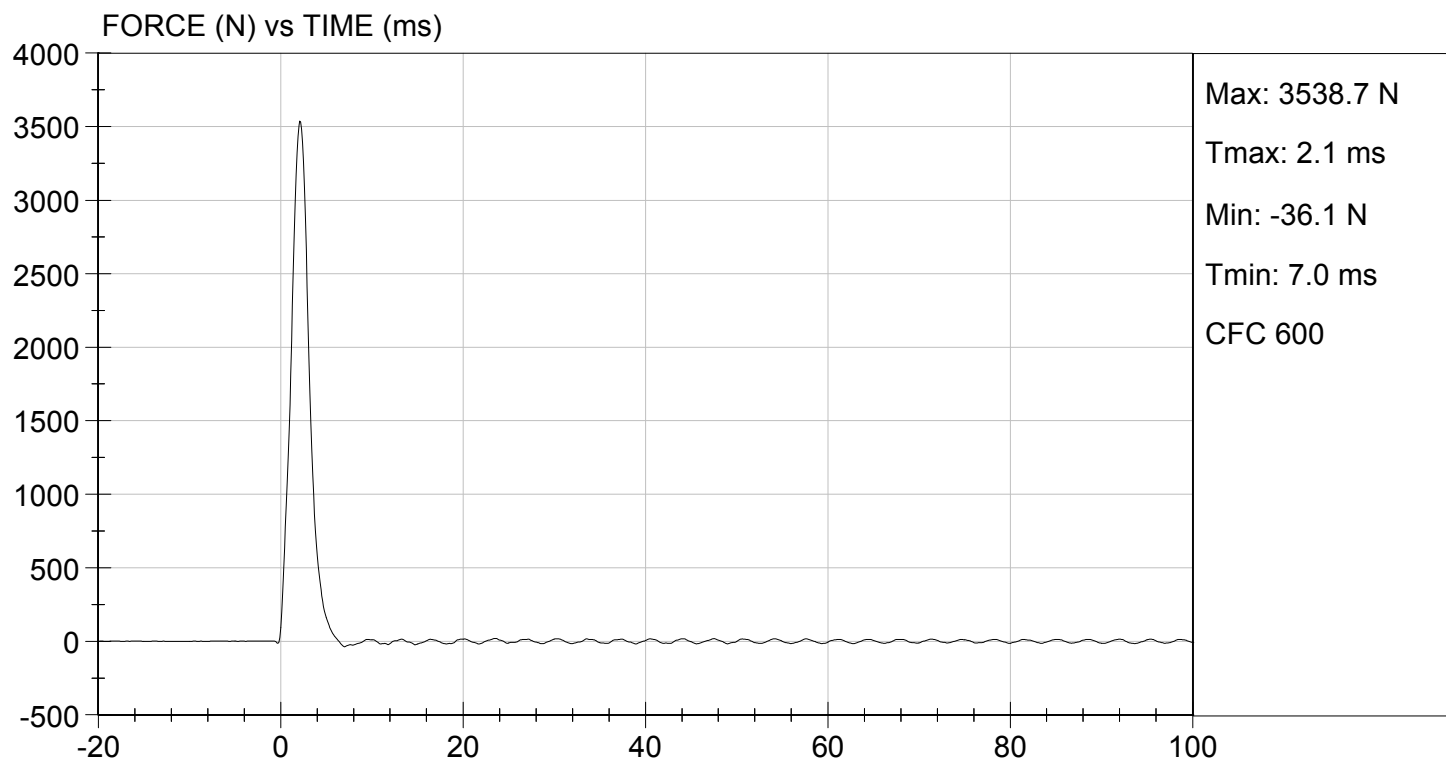
03/09/2013
Test Date


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