REPORT NUMBER: NCAP-MGA-2013-064

NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test

FORD MOTOR CO.
2013 Ford Fusion Energi SE 4-Dr Sedan
NHTSA No.: MD0220

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: April 16, 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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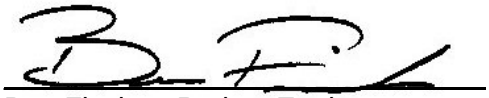
Approved by: 
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Approval Date: April 29, 2013

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NHTSA, Office of Crashworthiness Standards

Date: _____

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

Date: _____

Technical Report Documentation Page

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16. Abstract

A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2013 Ford Fusion Energi SE 4-Dr Sedan in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on April 16, 2013.

The impact velocity was 56.4 km/h and the ambient temperature at the barrier face at the time of impact was 21.3°C. The target vehicle post-test maximum crush was 555 mm located at the vehicle's centerline. The test vehicle's performance was as follows:

Measurement Description	Units	Threshold		Driver ATD	Passenger ATD
		50th	5th		
Head Injury Criteria (HIC_{15})	N/A	700	700	143	168
Maximum Chest Compression	mm	63	52	13	7
Nij	N/A	1	1	0.26	0.41
Neck Tension	N	4170	2620	904	589
Neck Compression	N	4000	2520	169	294
Left Femur Force	N	10008	6805	926	57
Right Femur Force	N	10008	6805	1462	58

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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 Ford Fusion Energi SE 4-Dr Sedan at a velocity of 56.4 km/h. The test was performed at MGA Research Corporation on April 16, 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 and shoulder belts to measure dummy torso and 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. 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 555 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. 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})	143	0.26	904	169	40	13	926	1462
Passenger (5^{th})	168	0.41	589	294	40	7	57	58

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

TEST NOTES

Top of Engine X has no valid data after 46 ms.
Load Cell K-16 MY has no valid data.
The 2013 Fusion air bag deployment strategy for the NCAP Frontal Mode suppresses the passenger knee airbag for the 5^{th} percentile occupant.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MD0220	Traction Control System (TCS)	Yes
Model Year	2013	Power Steering	Yes
Make	Ford	Power Window Auto-Reverse	Yes
Model	Fusion Energi	Driver Frontal Airbag	Yes
Body Style	Sedan	Driver Curtain Airbag	Yes
VIN	3FA6P0PU4DR233695	Driver Head/Torso Airbag	No
Body Color	Ice Storm	Driver Torso Airbag	No
Odometer (km/mi)	41 / 66	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	2.0	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	CVT	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	Yes	Front Pass. Knee Airbag	Yes
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	Yes	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Other	N/A

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

DATA FROM CERTIFICATION LABEL

Manufactured By	FORD MOTOR CO.
Date of Manufacture	02/13

GVWR (kg)	2227
GAWR Front (kg)	1105
GAWR Rear (kg)	1127

VEHICLE SEATING AND WEIGHT CAPACITY DATA

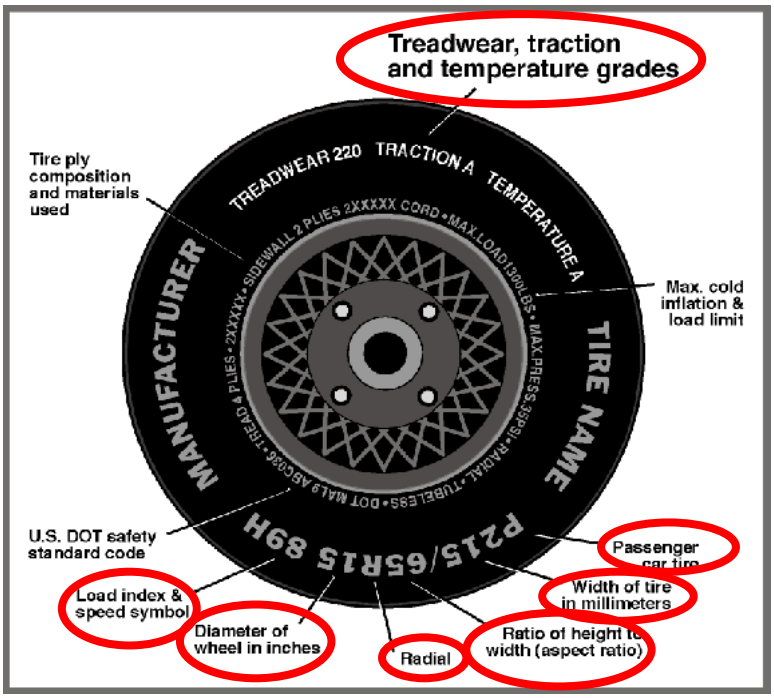
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				385
Cargo Weight (RCLW) (kg)				45

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

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD0220
Test Date: 04/16/2013

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	P225/50R17	P225/50R17
Tire Size on Vehicle	P225/50R17	P225/50R17
Tire Manufacturer	Michelin	Michelin
Tire Model	Energy Saver	Energy Saver
Treadwear	480	480
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 1 Polyamide, 2 Steel	1 Polyester, 1 Polyamide, 2 Steel
Load Index/Speed Symbol	93V	93V
Tire Material	Rubber	Rubber
DOT Safety Code Left	B90A 00NX 5112	B90A 00NX 5112
DOT Safety Code Right	B90A 00NX 5012	B90A 00NX 5112

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

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	481.7	454.1		508.0	519.4	
Right	kg	511.7	373.3		536.2	436.3	
Ratio	%	54.6	45.4		52.2	47.8	
Totals	kg	993.4	827.4	1820.8	1044.2	955.7	1999.9

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1820.8
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	45
Calculated Vehicle Target Weight (TVTW)	kg	2006.4

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	707	704	704	716	1290
As Tested	mm	688	691	678	681	1356
Post Test	mm	745	772	659	673	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2838
Total Vehicle Length at Left Side	mm	4714
Total Vehicle Length at Centerline	mm	4881
Total Vehicle Length at Right Side	mm	4714
Weight of Ballast in Cargo Area	kg	21.8
Weight of Vehicle Components Removed	kg	3.6
Amount of Stoddard Solvent in Fuel Tank	L	49.2

List of components removed to meet test weight: Cargo carpet and right taillight.

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

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

TARGET VEHICLE STRUCTURAL MEASUREMENT

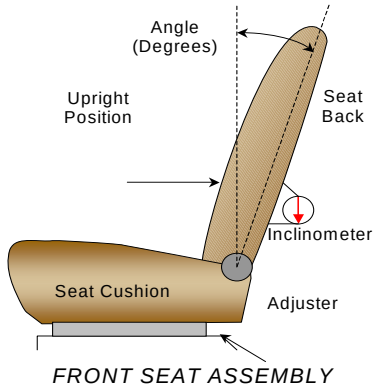
	Elements	Pre-Test (mm)
1	Total Length	4881
2	Total Width	1832
3	Bumper Top Height	496
4	Bumper Bottom Height	398
5	Longitudinal Member Top Height	556
6	Distance between Longitudinal Members	963
7	Longitudinal Member Width	86
8	Engine Top Height	821
9	Engine Bottom Height	193
10	Engine and Gearbox Width	817
11	Front Bumper-Engine Distance	345
12	Front Shock Absorber Fixing Height	889
13	Bonnet Leading Edge Height	803
14	Front Shock Absorber Fixing Width	1177
15	Front Bumper – Front Axle Distance	948
16	Front Axle – A-Pillar Distance	437
17	A-Pillar – B-Pillar Distance	1174
18	B-Pillar – Rear Axle Distance	1238
19	B-Pillar – C-Pillar Distance	799
20	Roof Sill Bottom Height	1309
21	Roof Sill Top Height	1432
22	Floor Sill Bottom Height	159
23	Floor Sill Top Height	386

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

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

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.



FRONT SEAT ASSEMBLY

	Degrees
Driver Seat Back Angle	3.0° on headrest post
Passenger Seat Back Angle	-1.7° on headrest post

SEAT FORE/AFT POSITIONS

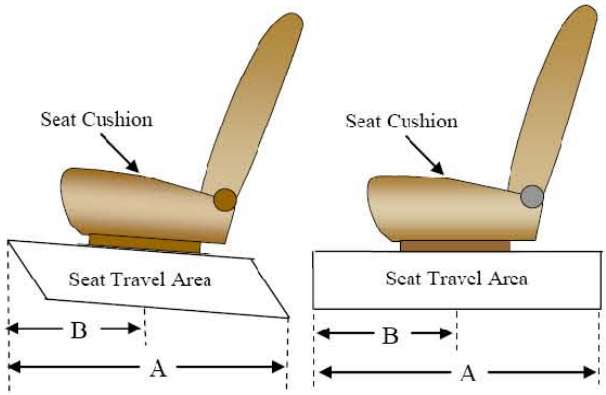
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated September 2012.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	322 mm	161 mm (from foremost)
Passenger Seat	267 mm	0 mm (from foremost)

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 (1st as 1)	0 (uppermost as 0)
Passenger Seat	4 (1st as 1)	0 (uppermost as 0)



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

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

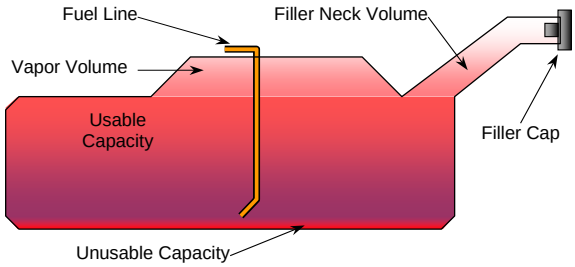
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	53.0
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	48.8 to 49.8
Actual Amount of Solvent used	49.2
1/3 of Usable Capacity	17.7

FUEL PUMP

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

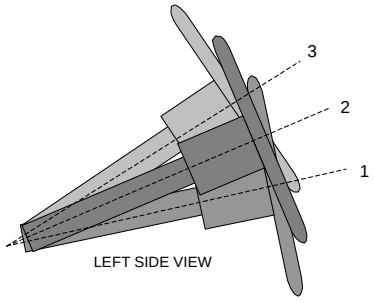
The vehicle is equipped with an electric fuel pump. Fuel pump cycles for a brief period when key is moved to on position, but does not pump fuel unless engine is running. The fuel pipe is on the left side.



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

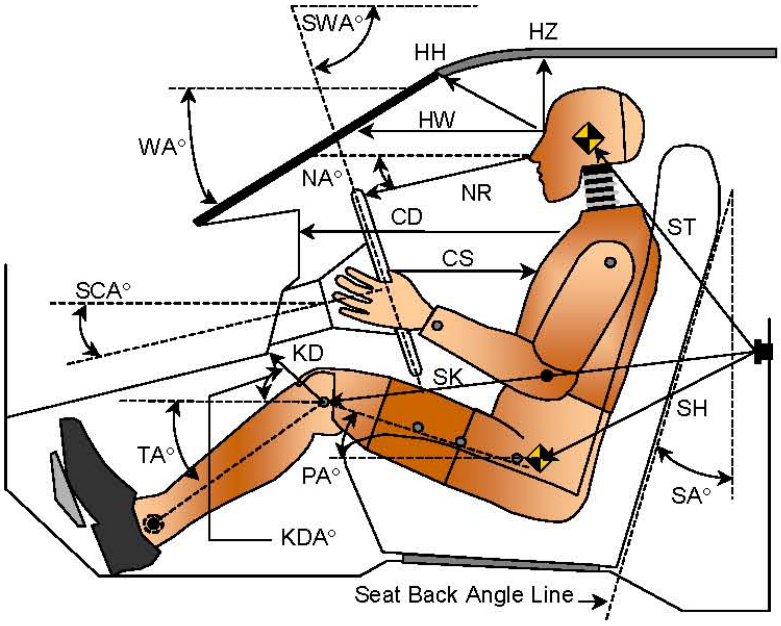
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	68.6	181
Geometric Center Position 2	65.6	156
Uppermost Position 3	62.6	131
Telescoping Steering Wheel Travel		50
Test Position	65.6	156

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD0220
Test Date: 04/16/2013



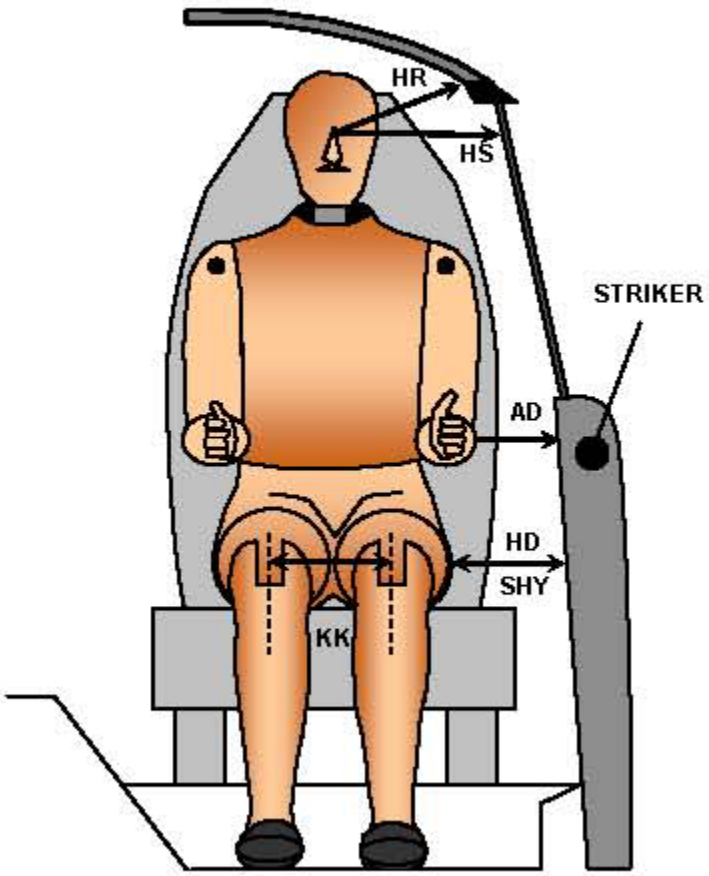
LEFT SIDE VIEW

Code	Measurement Description	Driver S/N 351		Passenger S/N 138	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		23.2		
SWA°	Steering Wheel Angle		65.6		
SCA°	Steering Column Angle		24.4		
SA°	Seat Back Angle (on headrest post)		3.0		-1.7
HZ	Head to Roof (Z)	177	90.0	206	90.0
HH	Head to Header	355	26.9	284	49.4
HW	Head to Windshield	712	0.0	694	0.0
NR	Nose to Rim	387	7.7		
CD	Chest to Dash	530		404	
CS	Chest to Steering Hub	306	2.5		
RA	Rim to Abdomen	178	0.0		
KDL	Left Knee to Dash	226	34.7	138	36.1
KDR	Right Knee to Dash	190	31.3	140	35.4
PA°	Pelvic Angle		24.8		19.6
TA°	Tibia Angle		45.6		48.0
SK	Striker to Knee	531	94.6	650	97.9
ST	Striker to Head	481	3.2	466	29.5
SH	Striker to H-Point	237	137.5	373	116.0

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD0220
Test Date: 04/16/2013



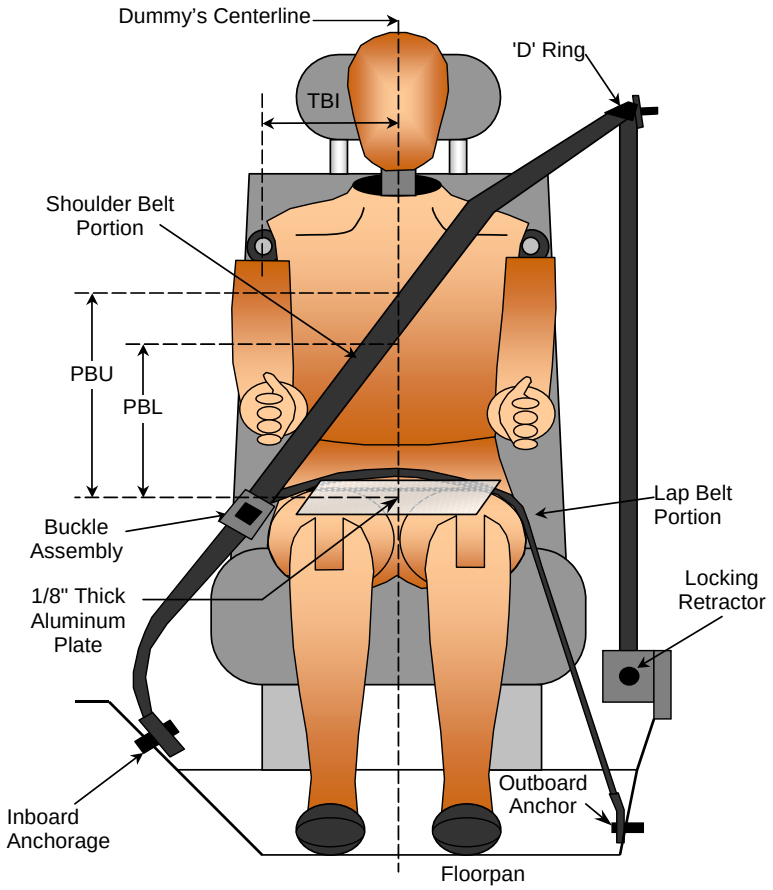
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver S/N 351	Passenger S/N 138
		Length (mm)	
AD	Arm to Door	138	98
HD	H-Point to Door	151	171
HR	Head to Side Header	205	251
HS	Head to Side Window	335	372
KK	Knee to Knee	325	227
SHY	Striker to H-Point (Y Direction)	290	316
AA	Ankle to Ankle	325	199

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD0220
Test Date: 04/16/2013



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	370	350
PBL - Top surface of reference to belt lower edge	mm	305	245

BELT LENGTH DATA

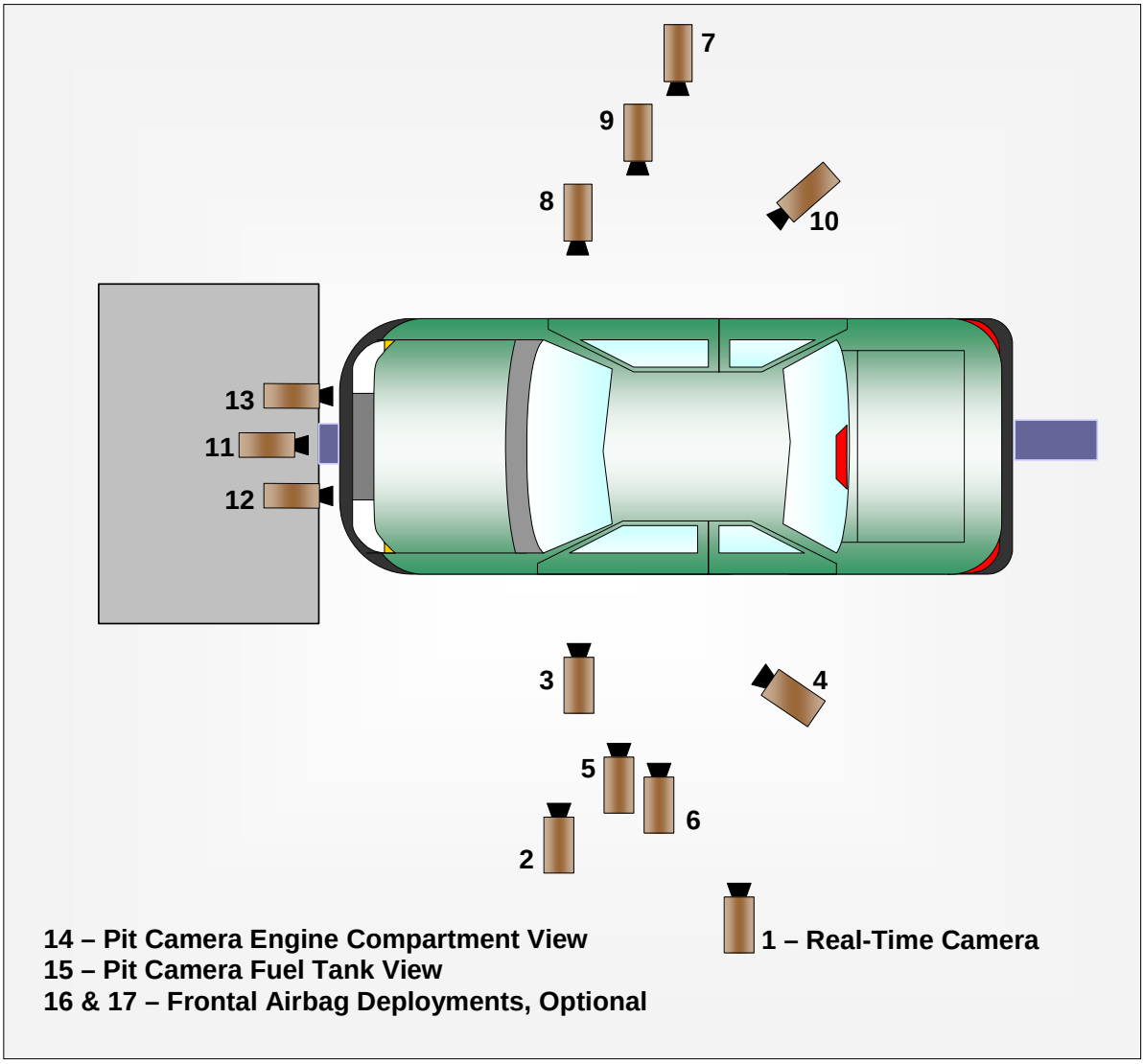
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	870	930
Lap Belt Length as measured on ATD	mm	630	665
Remainder of belt on reel	mm	1500	1365
Total Belt Length for Continuous Webbing Systems	mm	3000	2960

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

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD0220
Test Date: 04/16/2013

CAMERA POSITIONS FOR FRONTAL IMPACTS



14 – Pit Camera Engine Compartment View
15 – Pit Camera Fuel Tank View
16 & 17 – Frontal Airbag Deployments, Optional

1 – Real-Time Camera

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

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	1610	-6270	-1800	35	1000
3	Left Front Half	1250	-4970	-1370	24	1000
4	Left Angle	5470	-5110	-1900	50	1000
5	Steering Column - Top	680	-4800	-1240	24	1000
6	Steering Column - Bottom	660	-4780	-840	24	1000
7	Right Overall	2110	6730	-1430	20	1000
8	Passenger Close-Up	1500	6530	-1750	35	1000
9	Right Front Half	1290	4960	-1340	24	1000
10	Right Angle	5710	4860	-1860	50	1000
11	Windshield	-1780	0	-2810	24	1000
12	Driver Windshield	-1470	-450	-2030	8.5	1000
13	Passenger Windshield	-1470	450	-2030	8.5	1000
14	Pit Front	1070	0	3150	24	1000
15	Pit Rear	3010	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

*COORDINATES:

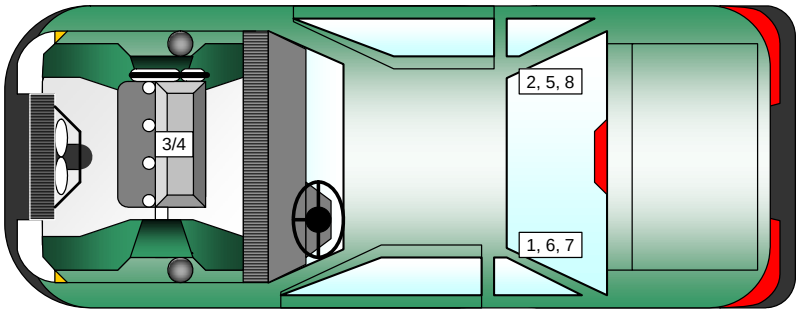
+X = forward of impact plane
+Y = right of monorail centerline
+Z = below ground level

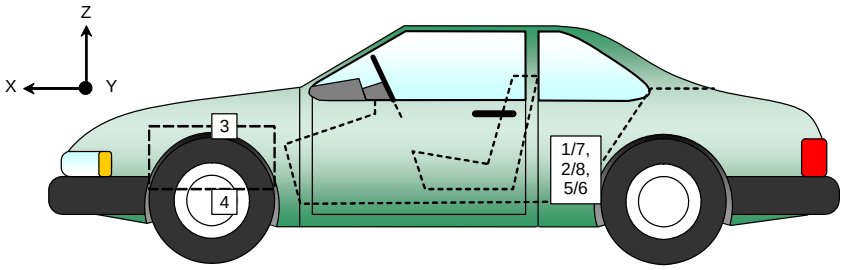
Cameras 16 & 17 were not used for this test.

DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD0220
Test Date: 04/16/2013





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	2072	-468	-215
2	Right Rear Crossmember Accelerometer – X Direction	2068	458	-216
3	Engine Top X	4179	0	-781
4	Engine Bottom X	4086	0	-222
5	Left Rear Crossmember Accelerometer – Z Direction	2072	-468	-215
6	Right Rear Crossmember Accelerometer – Z Direction	2068	458	-216
7	Left Rear Crossmember Accelerometer Redundant – X Direction	2072	-468	-215
8	Right Rear Crossmember Accelerometer Redundant – X Direction	2068	458	-216

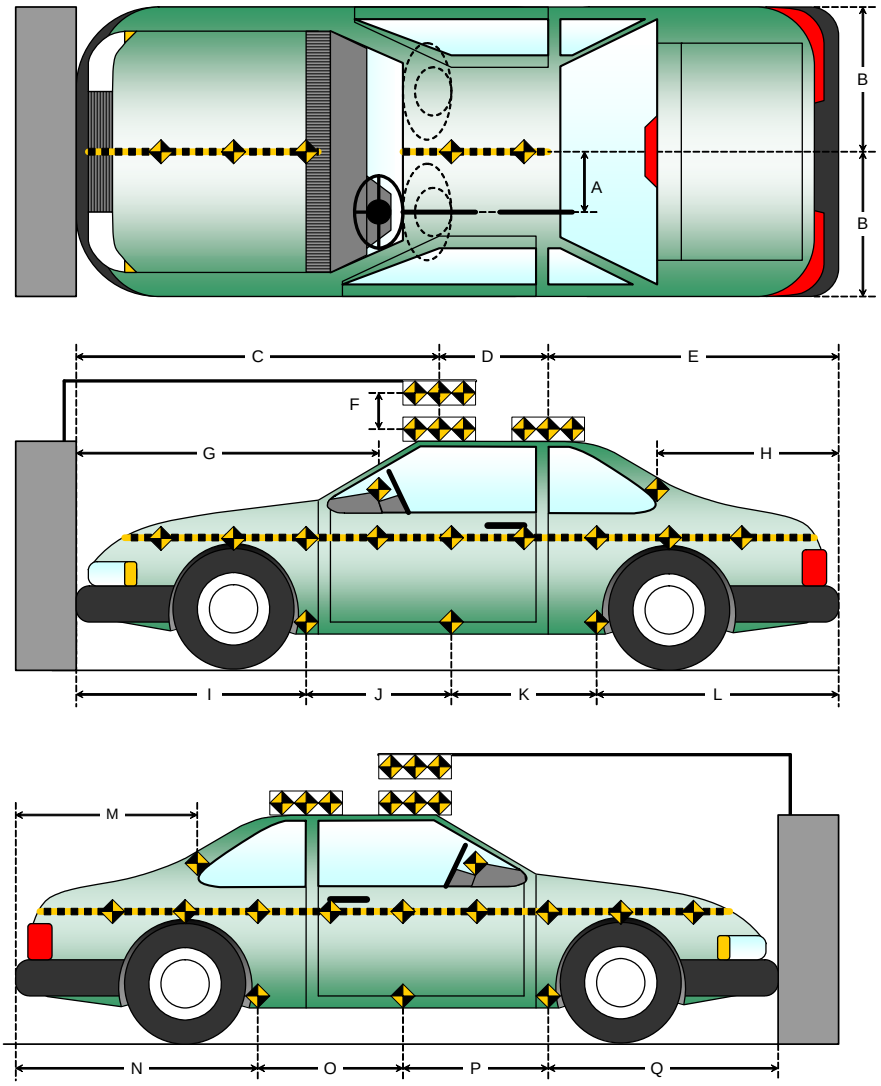
Reference Points: X - Rear Surface of Vehicle (+ forward)
Y - Vehicle Centerline (+ to right)
Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD0220
Test Date: 04/16/2013

Item	Value (mm)
A	390
B	916
C	2385
D	665
E	1831
F	180
G	
H	1448
I	1403
J	987
K	987
L	1504
M	1448
N	1504
O	987
P	987
Q	1403



DATA SHEET NO. 9
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD0220
Test Date: 04/16/2013

Advanced Research Load Cell Barrier

Photo for Reference Only

Centerline

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

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

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD0220
Test Date: 04/16/2013

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 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

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 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	None
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1900
Center	mm	1916
Right Side	mm	2008
Average	mm	1941

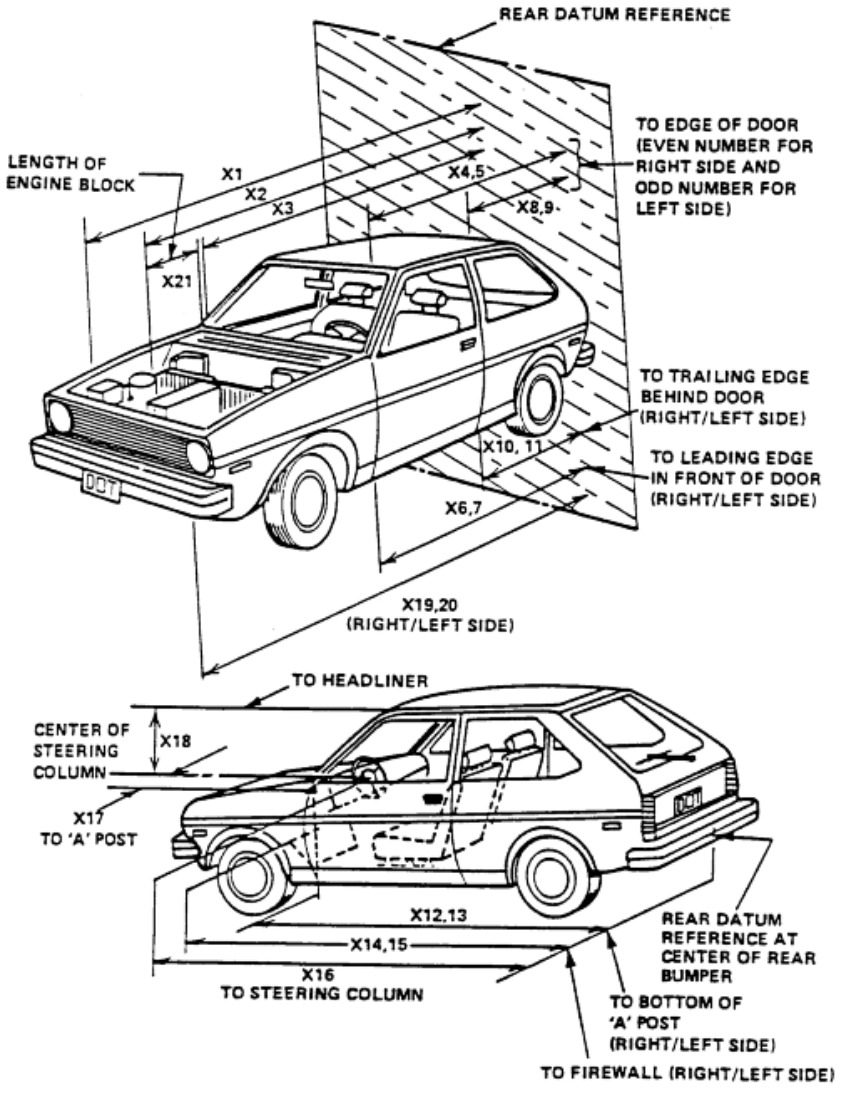
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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	Yes	No*
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	

***** The 2013 Fusion air bag deployment strategy for the NCAP Frontal Mode suppresses the passenger knee airbag for the 5th percentile occupant.

DATA SHEET NO. 12
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4881	4326	555
2	RSOV to Front of Engine	mm	4428	4204	224
3	RSOV to Firewall	mm	3848	3825	23
4	RSOV to Upper Leading Edge of Right Door	mm	3345	3345	0
5	RSOV to Upper Leading Edge of Left Door	mm	3345	3345	0
6	RSOV to Lower Leading Edge of Right Door	mm	3358	3357	1
7	RSOV to Lower Leading Edge of Left Door	mm	3358	3356	2
8	RSOV to Upper Trailing Edge of Right Door	mm	2254	2254	0
9	RSOV to Upper Trailing Edge of Left Door	mm	2254	2255	1
10	RSOV to Lower Trailing Edge of Right Door	mm	2304	2304	0
11	RSOV to Lower Trailing Edge of Left Door	mm	2304	2303	1
12	RSOV to Bottom of “A” Post of Right Side	mm	3372	3368	4
13	RSOV to Bottom of “A” Post of Left Side	mm	3378	3370	8
14	RSOV to Firewall, Right Side	mm	3631	3627	4
15	RSOV to Firewall, Left Side	mm	3631	3631	0
16	RSOV to Steering Column	mm	2867	2903	-36
17	Center of Steering Column to “A” Post	mm	332	327	5
18	Center of Steering Column to Headliner	mm	394	405	-11
19	RSOV to Right Side of Front Bumper	mm	4714	4318	396
20	RSOV to Left Side of Front Bumper	mm	4714	4288	426
21	Length of Engine Block	mm	515	515	0
RD	RSOV to Right Side of Dash Panel	mm	3129	3126	3
CD	RSOV to Center of Dash Panel	mm	3197	3194	3
LD	RSOV to Left Side of Dash Panel	mm	3129	3129	0

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

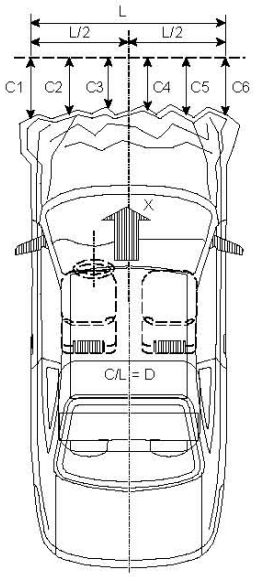
Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

VEHICLE INFORMATION

VIN: 3FA6P0PU4DR233695 Wheelbase (mm): 2838
Vehicle Size Category: Passenger Test Weight (kg): 1999.9

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): 56.4
Velocity Change (km/h): 63.2
Time of Separation (msec): 122.0



CRUSH PROFILE

Collision Deformation Classification: Frontal
Midpoint of Damage: Centerline
Damage Region Length (mm): 1329
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4714	4288	426
C2	Crush zone 2 at left side	mm	4828	4302	526
C3	Crush zone 3 at left side	mm	4843	4322	521
C4	Crush zone 4 at right side	mm	4843	4308	535
C5	Crush zone 5 at right side	mm	4828	4283	545
C6	Crush zone 6 at right side	mm	4714	4318	396
L	C1 TO C6	mm	1329	1295	34

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

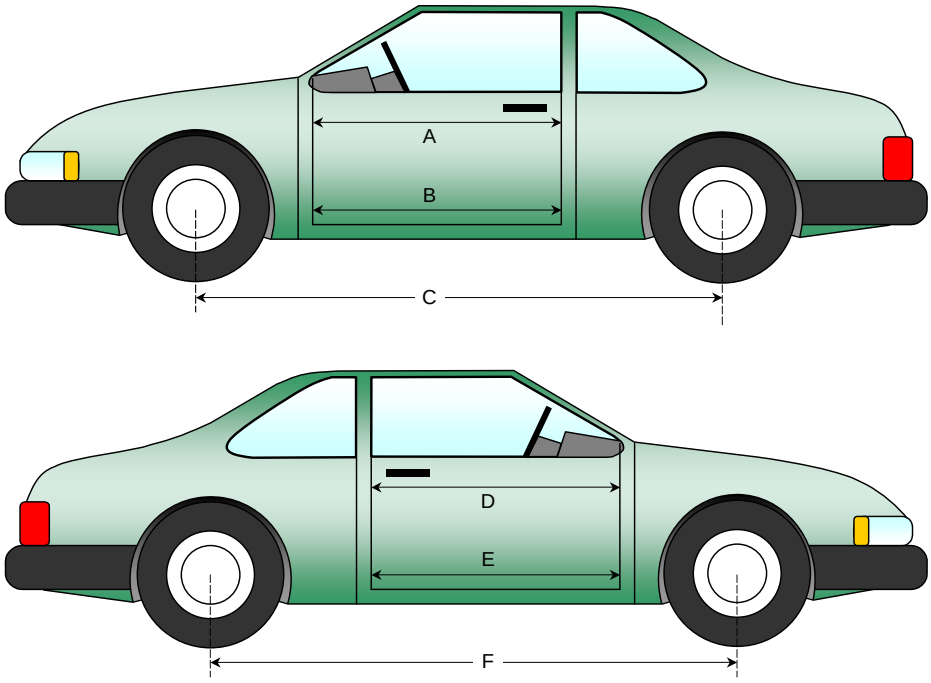
NHTSA No.: MD0220
Test Date: 04/16/2013

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	979	979	0
B	Left Side Lower	mm	840	840	0
D	Right Side Upper	mm	979	979	0
E	Right Side Lower	mm	840	840	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2838	2747	91
F	Right Side Wheelbase	mm	2838	2732	106



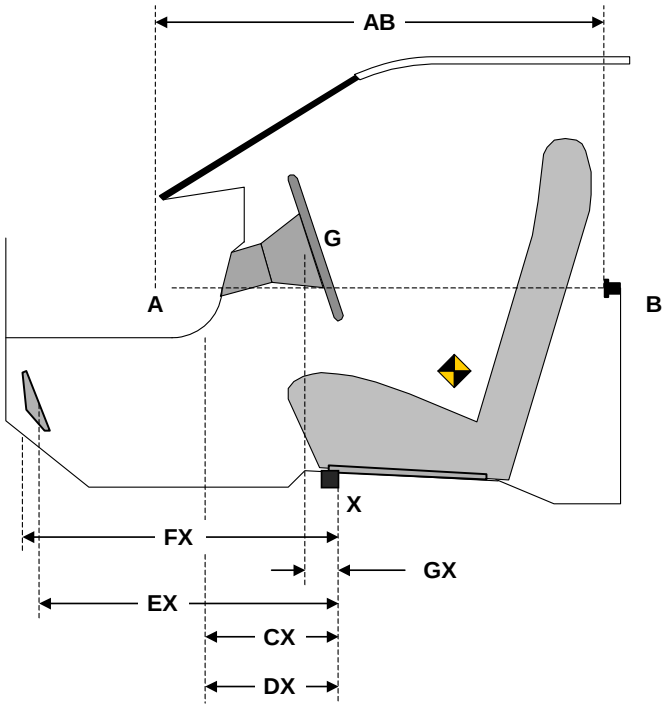
DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	756	756	0
CX	Left Knee Bolster to X	mm	269	244	25
DX	Right Knee Bolster to X	mm	265	240	25
EX	Brake Pedal to X	mm	555	420	135
FX	Foot Rest to X	mm	596	507	89
GX	Center of Steering Column Wheel Hub to X	mm	332	40	292

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 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

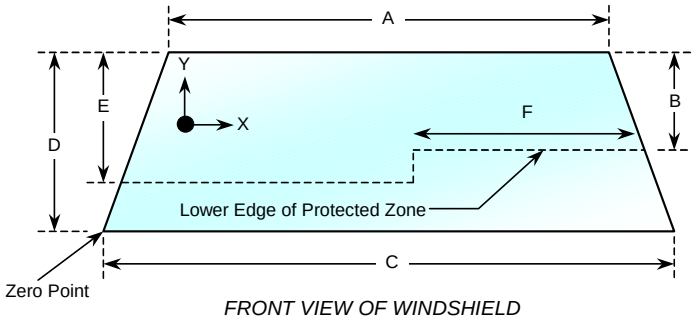
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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: 21.3°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2205	2205	100
Right Side	2205	2205	100
Total	4410	4410	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1242
B	mm	467
C	mm	1520
D	mm	824
E	mm	516
F	mm	490

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 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21.3°C Test Time: 3:45 p.m.

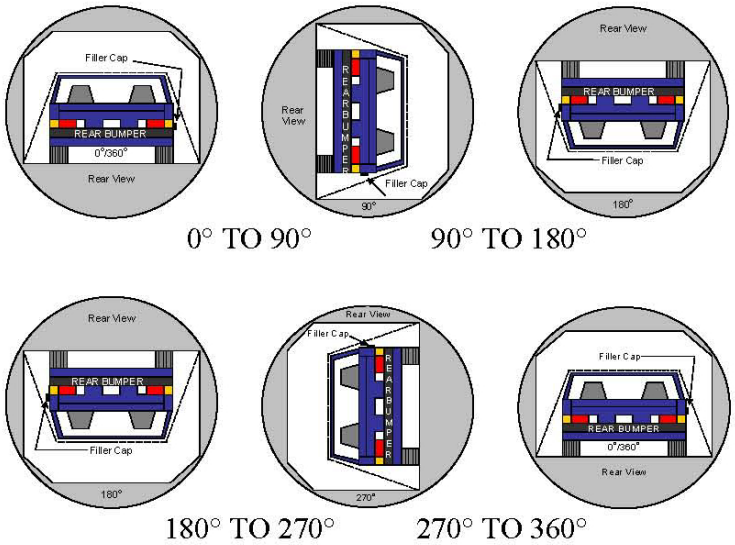
A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)
B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)
C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)
D. Spillage: None

DATA SHEET NO. 16
FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MD0220
Test Date: 04/16/2013

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°	111	300	411
90° to 180°	109	300	409
180° to 270°	107	300	407
270° to 360°	110	300	410

FMVSS 301 SPILLAGE TABLE (units in ounces)

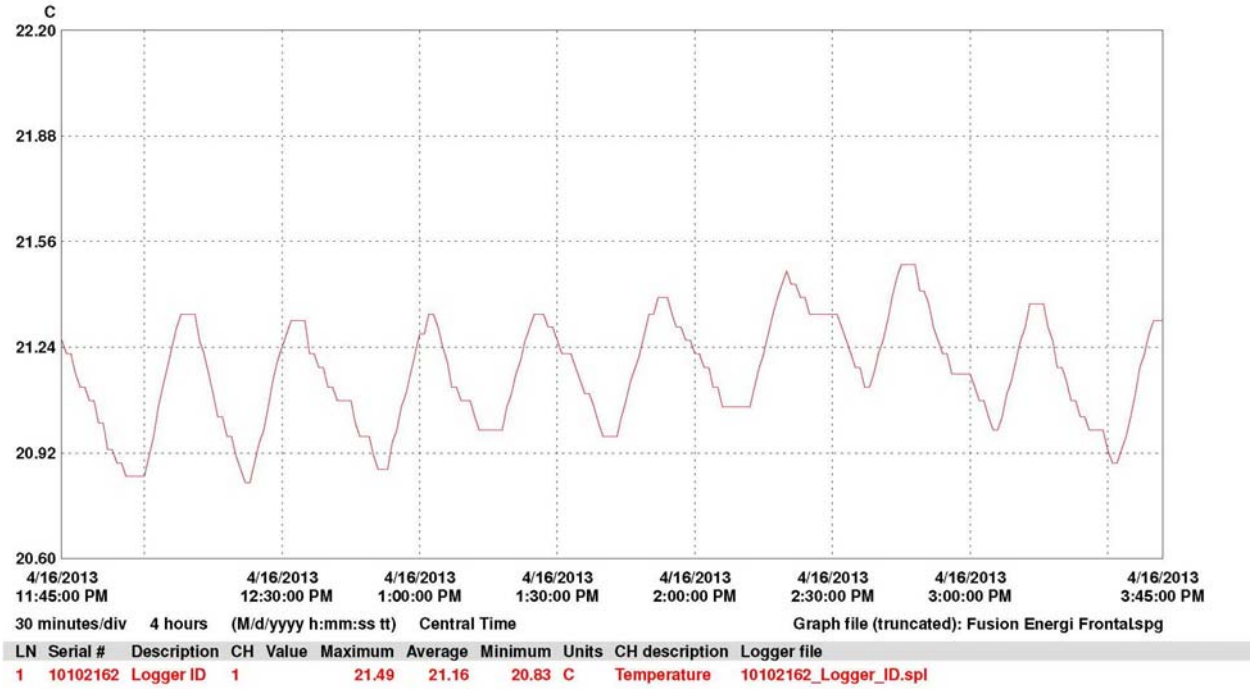
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 17
DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2013 Ford Fusion Energi SE 4-Dr Sedan NHTSA No.: MD0220
Test Program: NCAP Frontal Barrier Impact Test Test Date: 04/16/2013



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	10102162	Logger ID	1		21.49	21.16	20.83	C	Temperature	10102162_Logger_ID.spl

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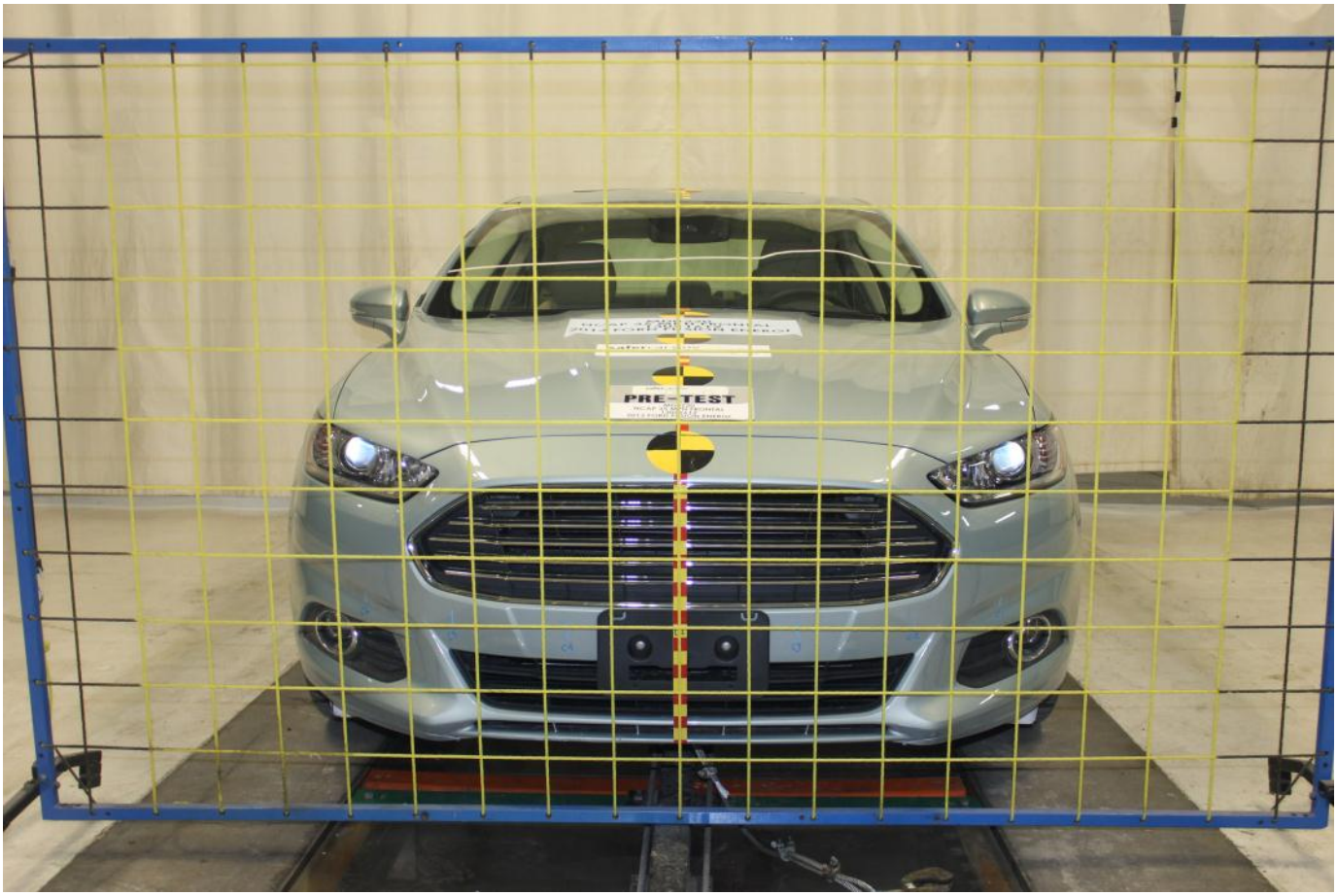

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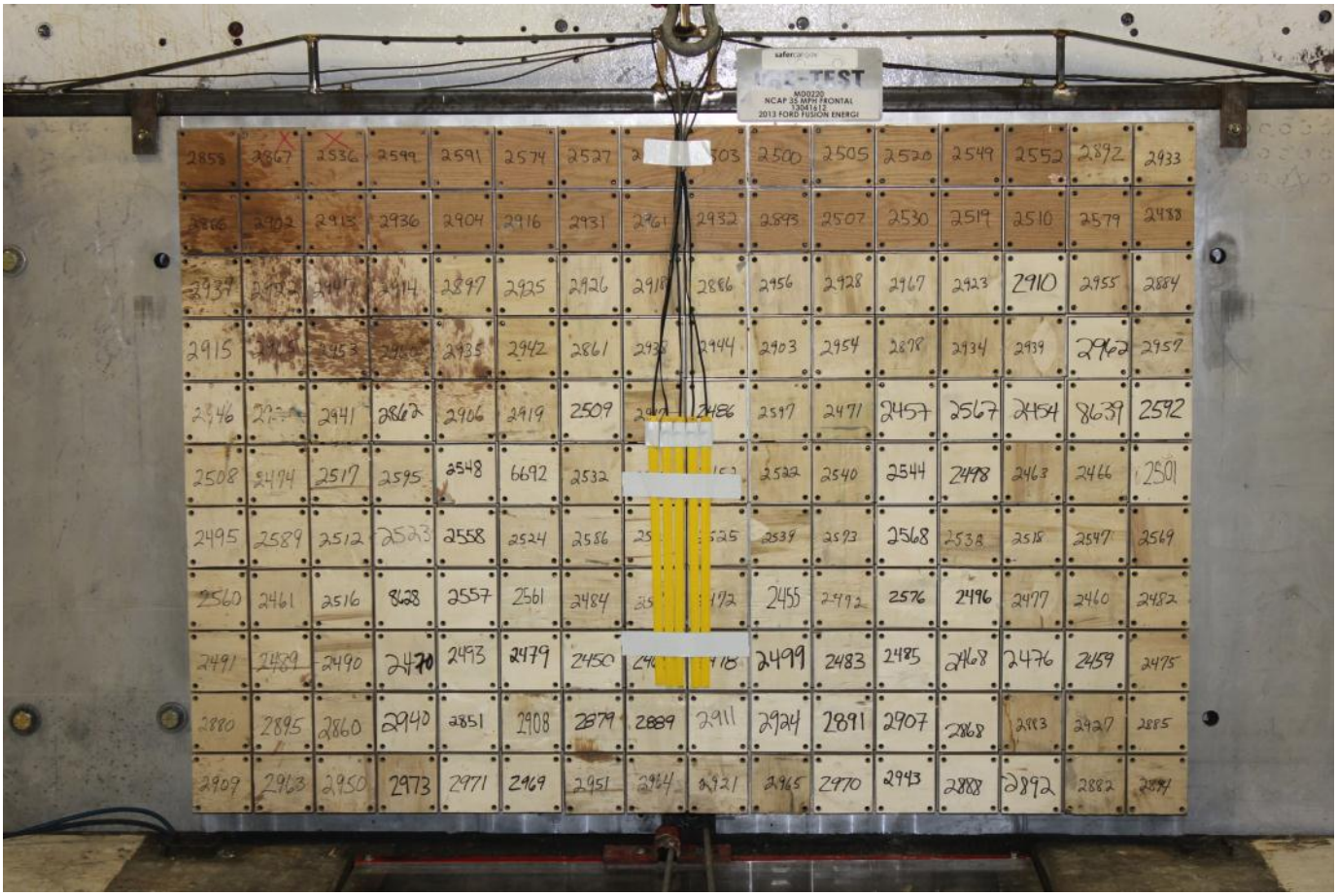
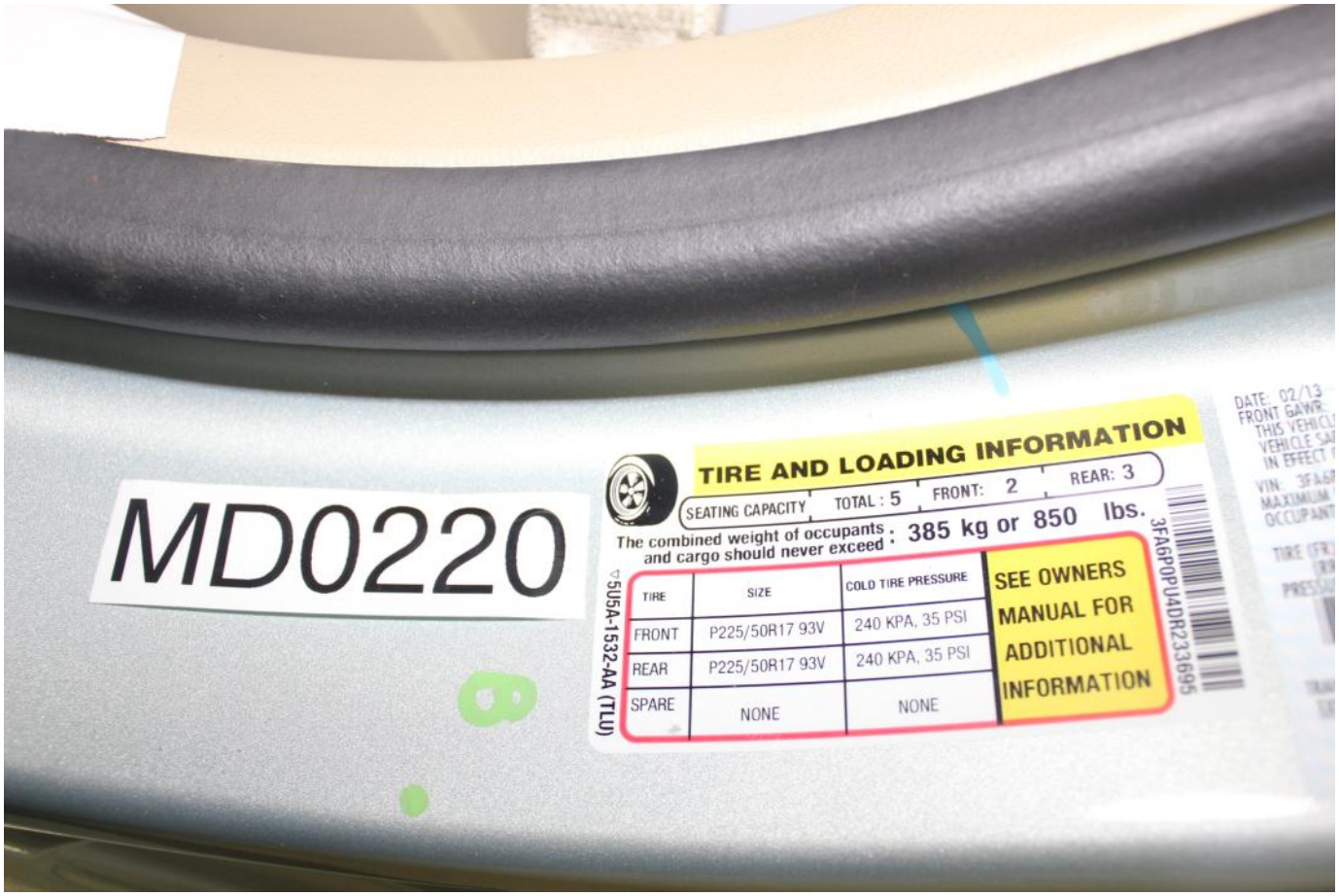


Load Cell Wall

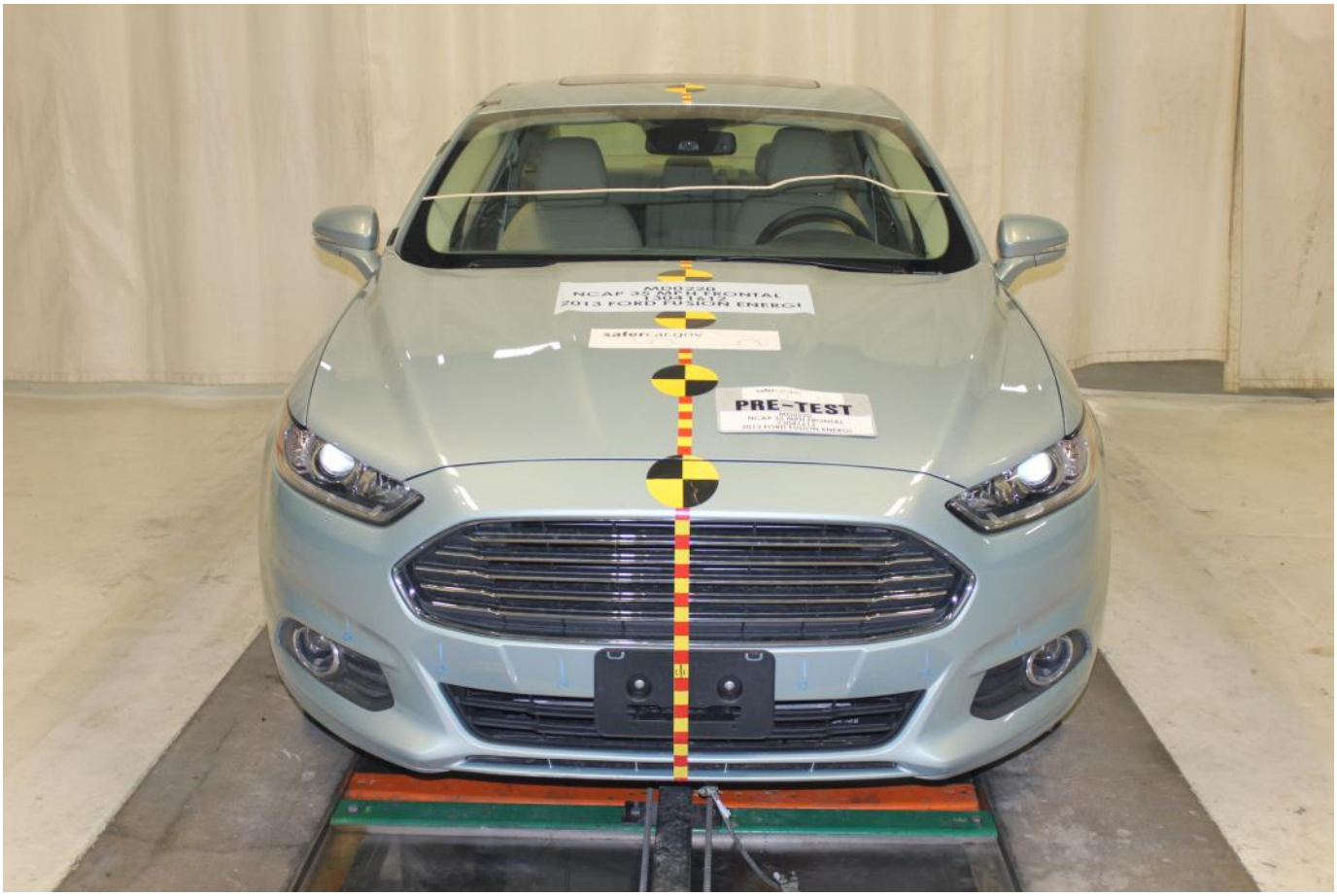
Manufacturer's Label



Tire Placard

2013 Ford Fusion Energi 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

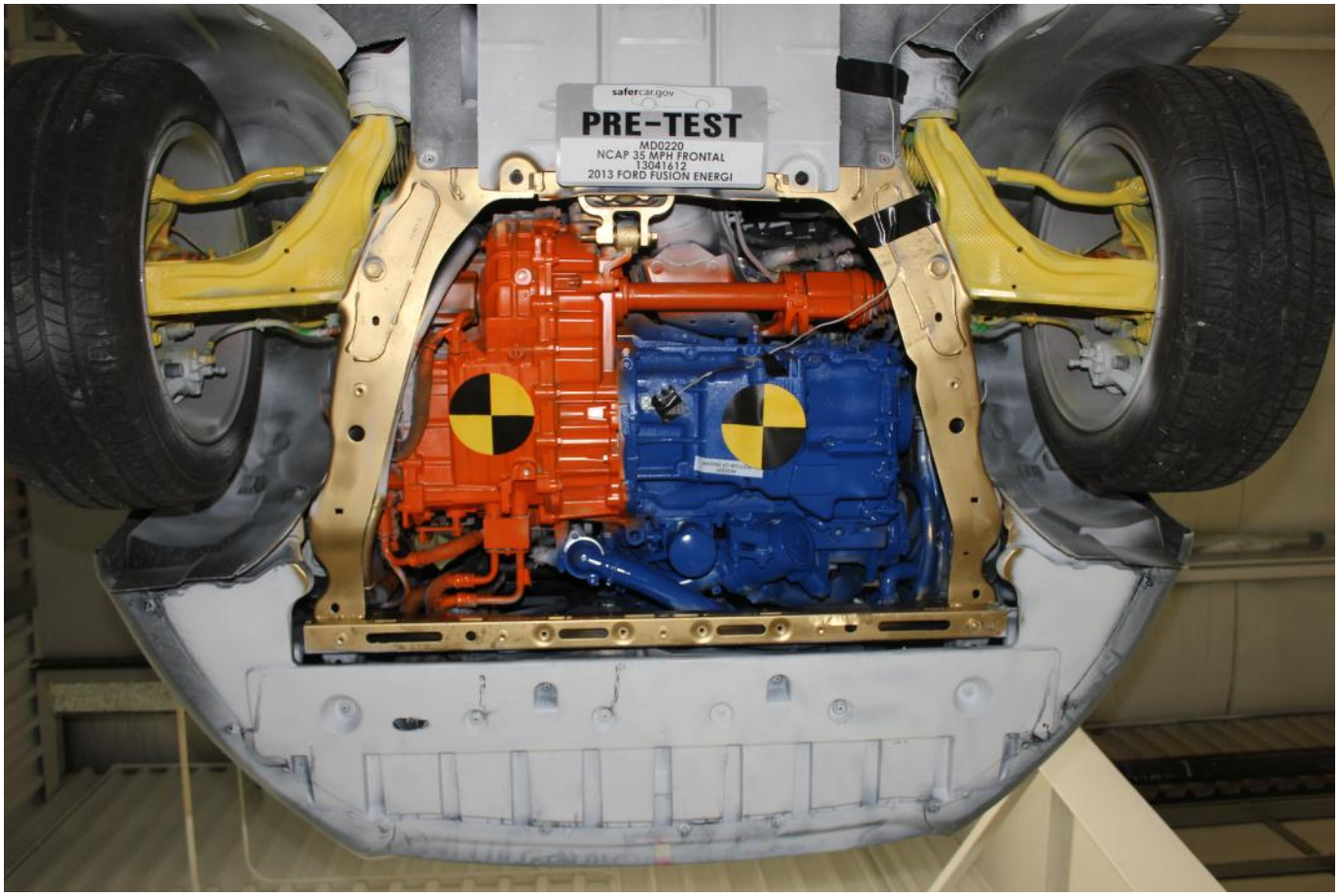
Post-Test Windshield View

Pre-Test Engine Compartment View

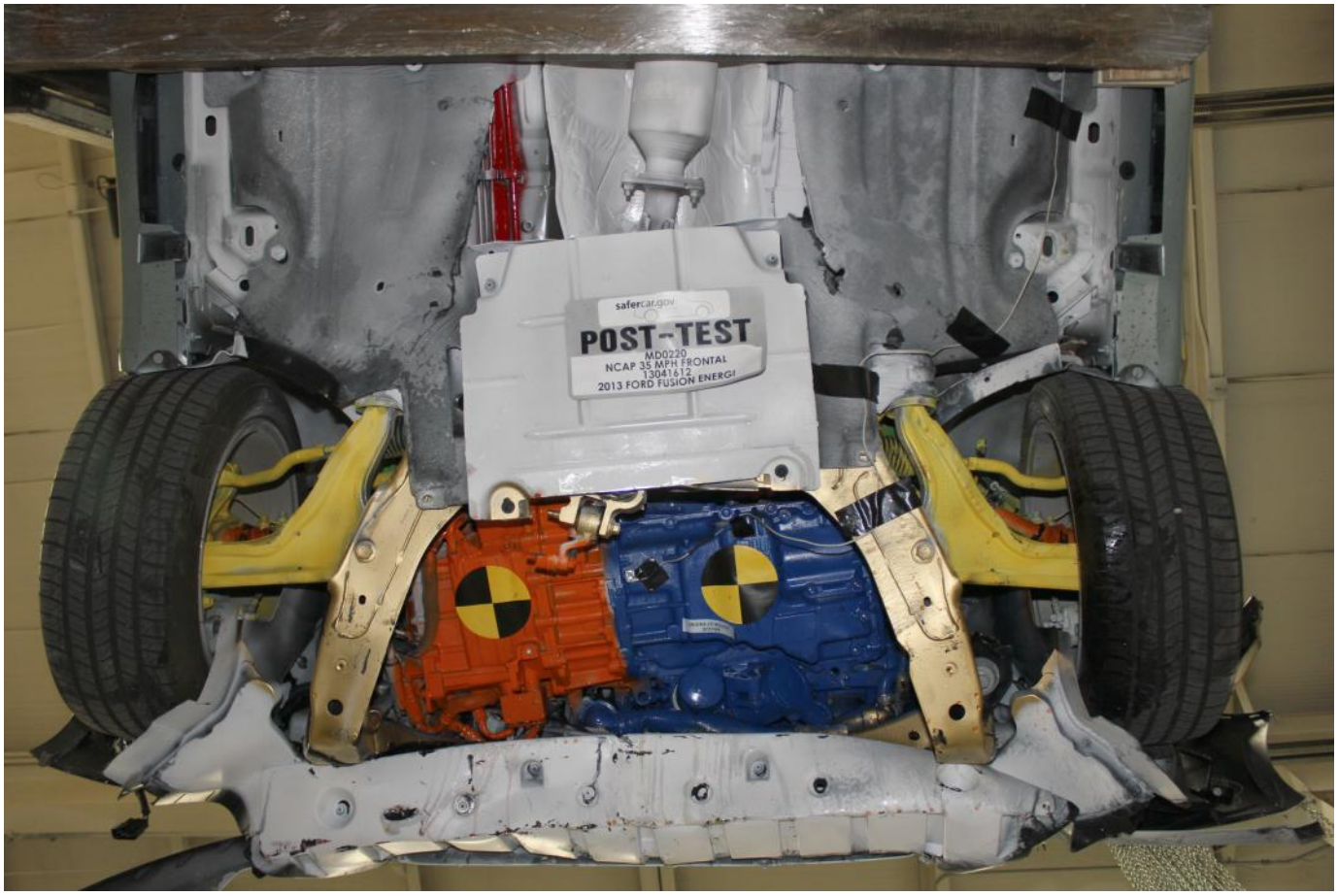
Post-Test Engine Compartment View

Pre-Test Fuel Filler Cap View

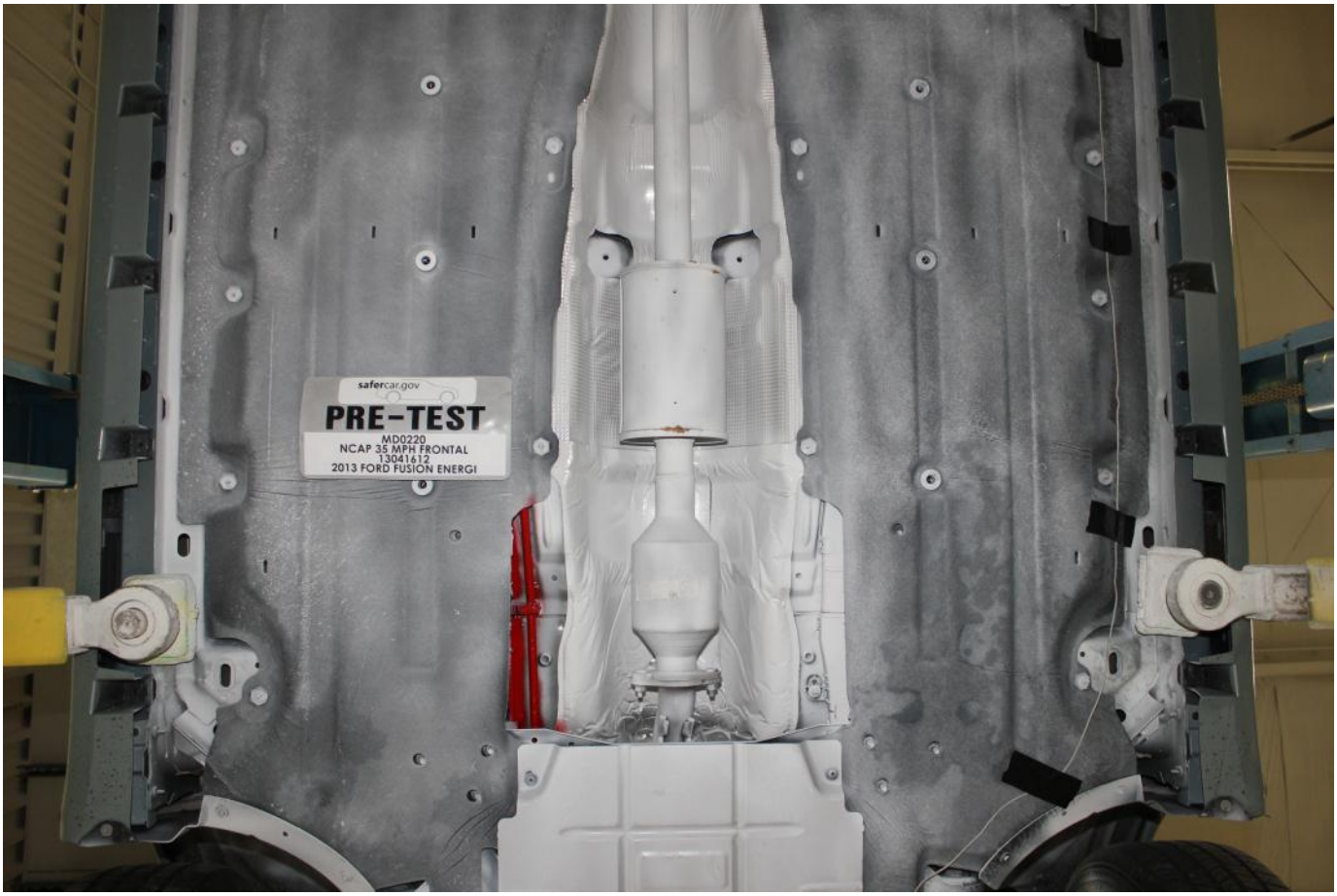
Post-Test Fuel Filler Cap View



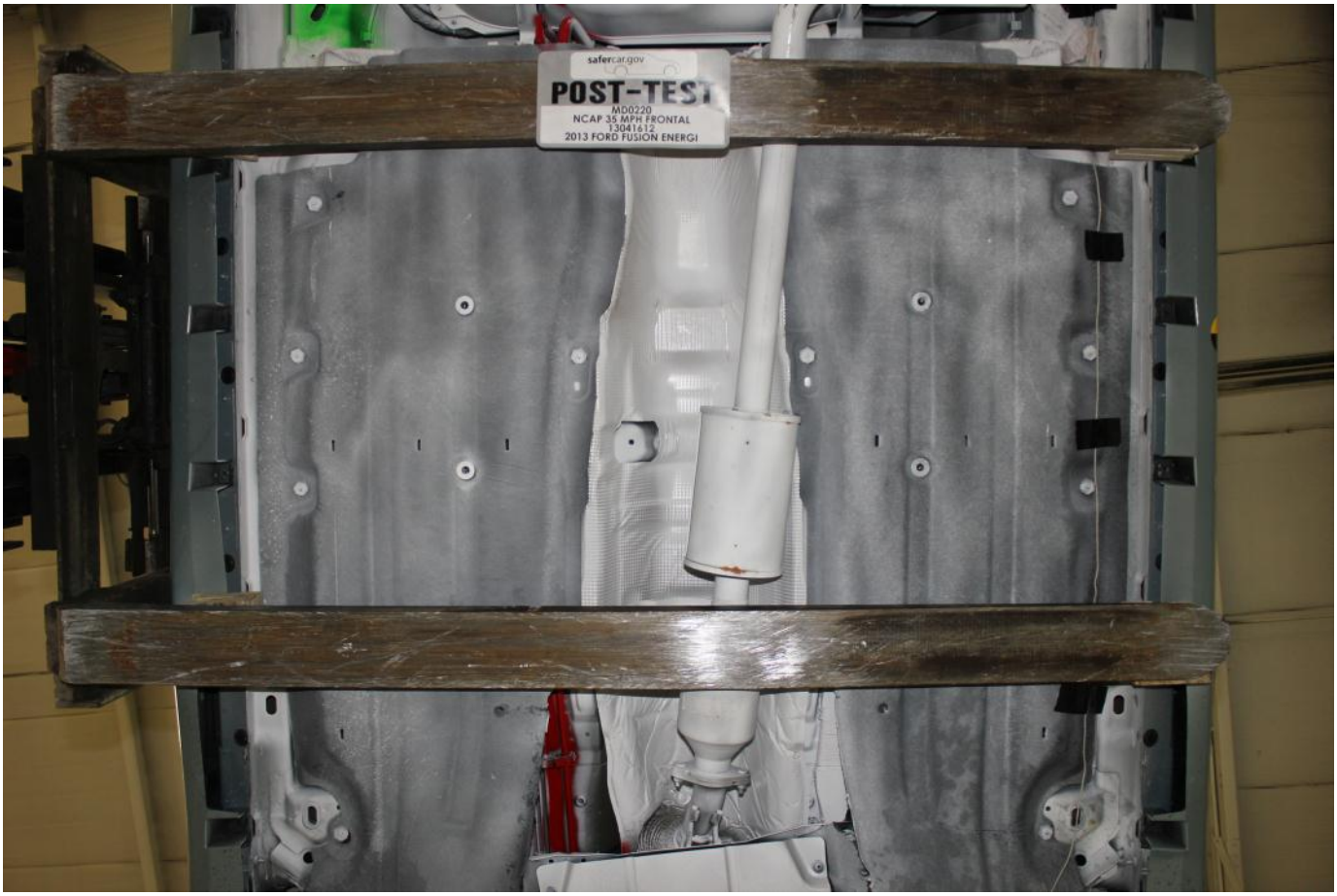
Pre-Test Front Underbody View



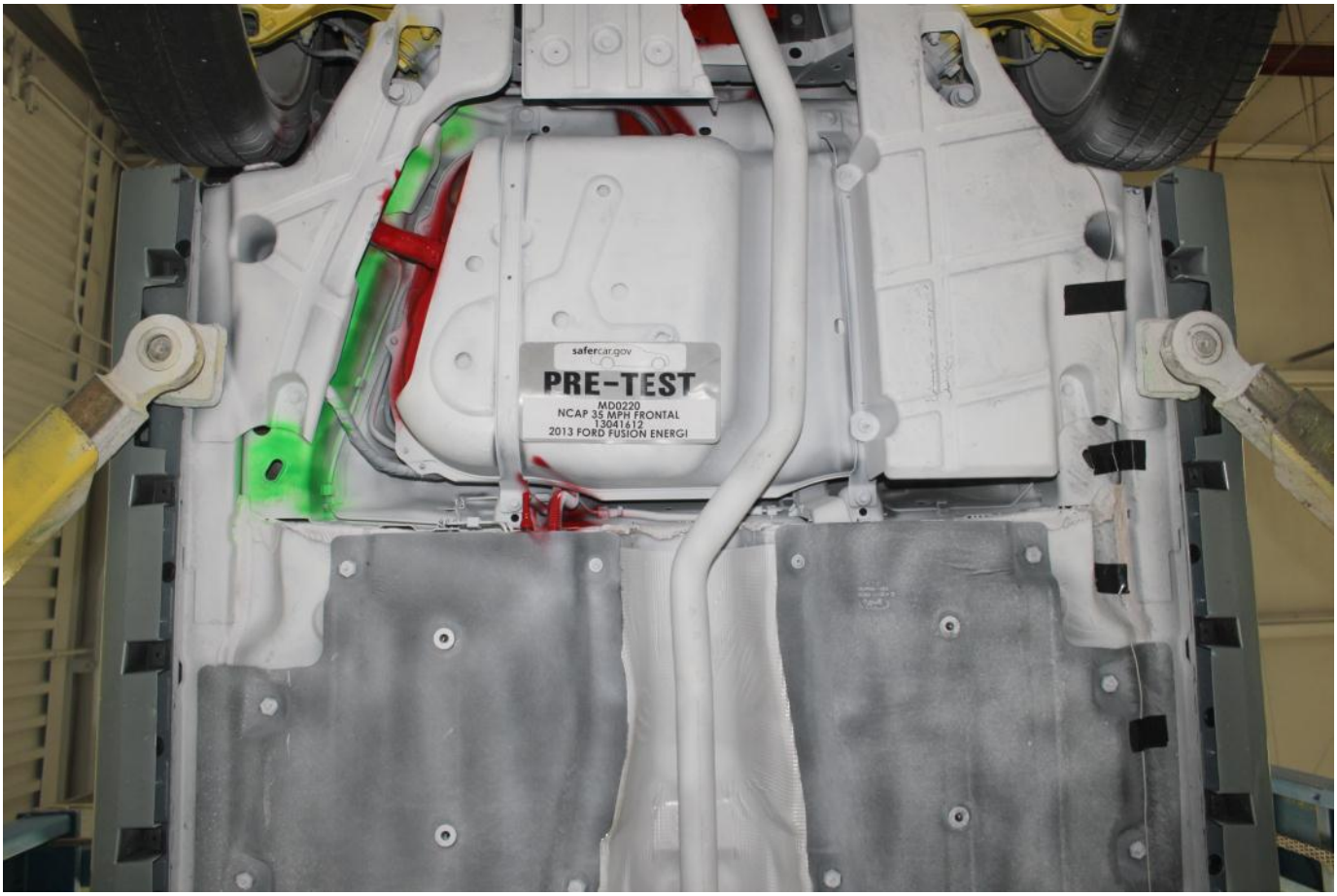
Post-Test Front Underbody View



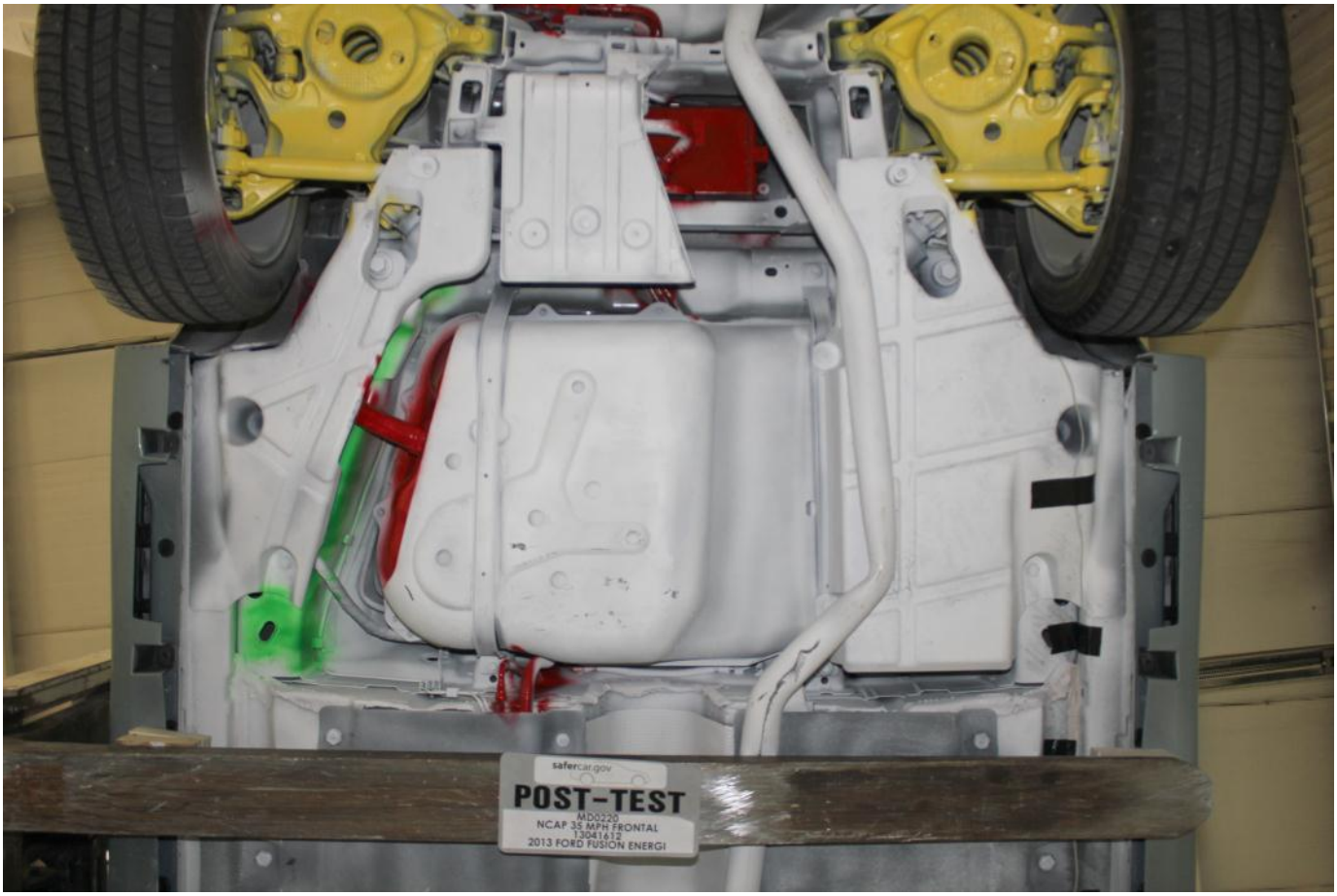
Pre-Test Mid Front Underbody View



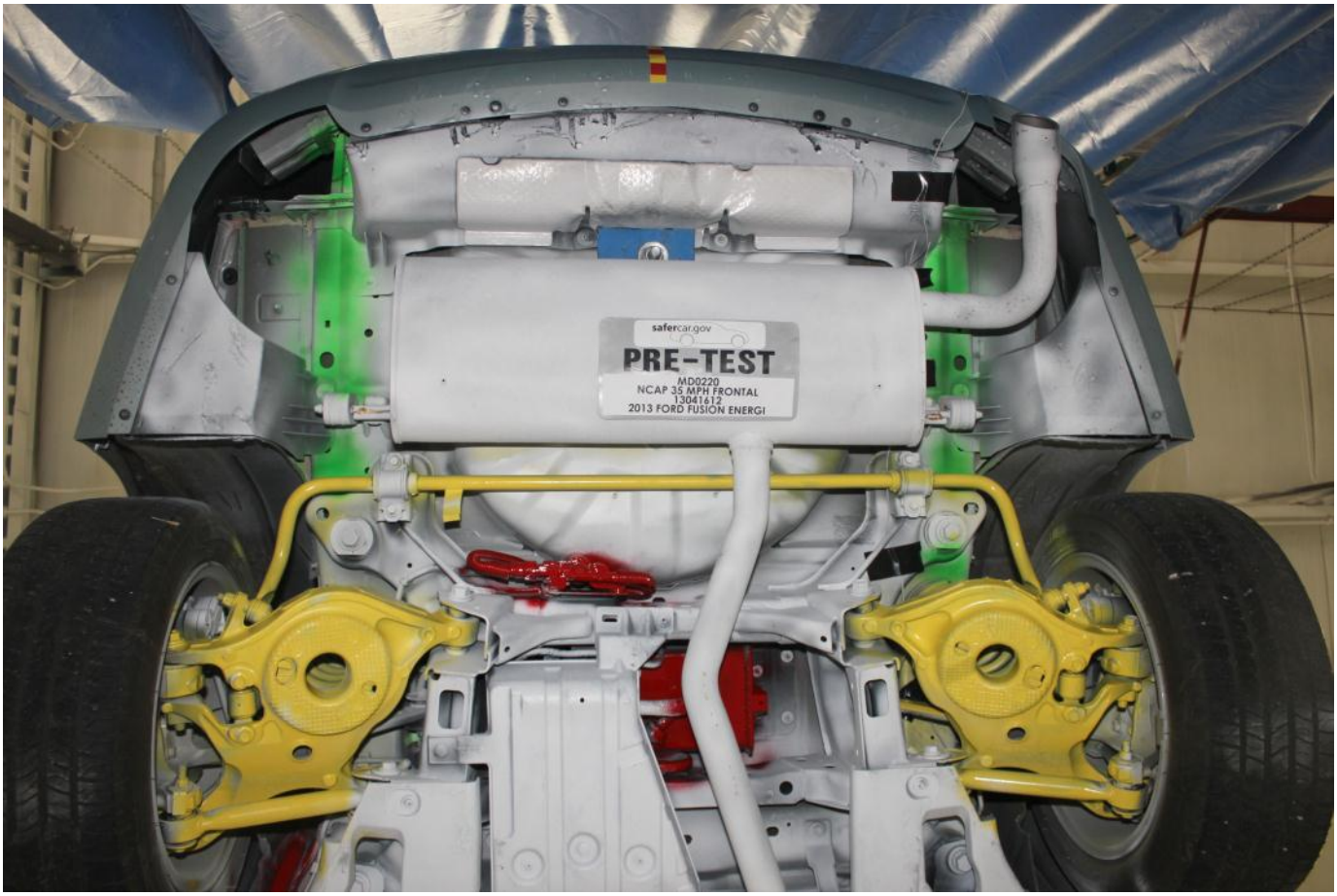
Post-Test Mid Front Underbody View



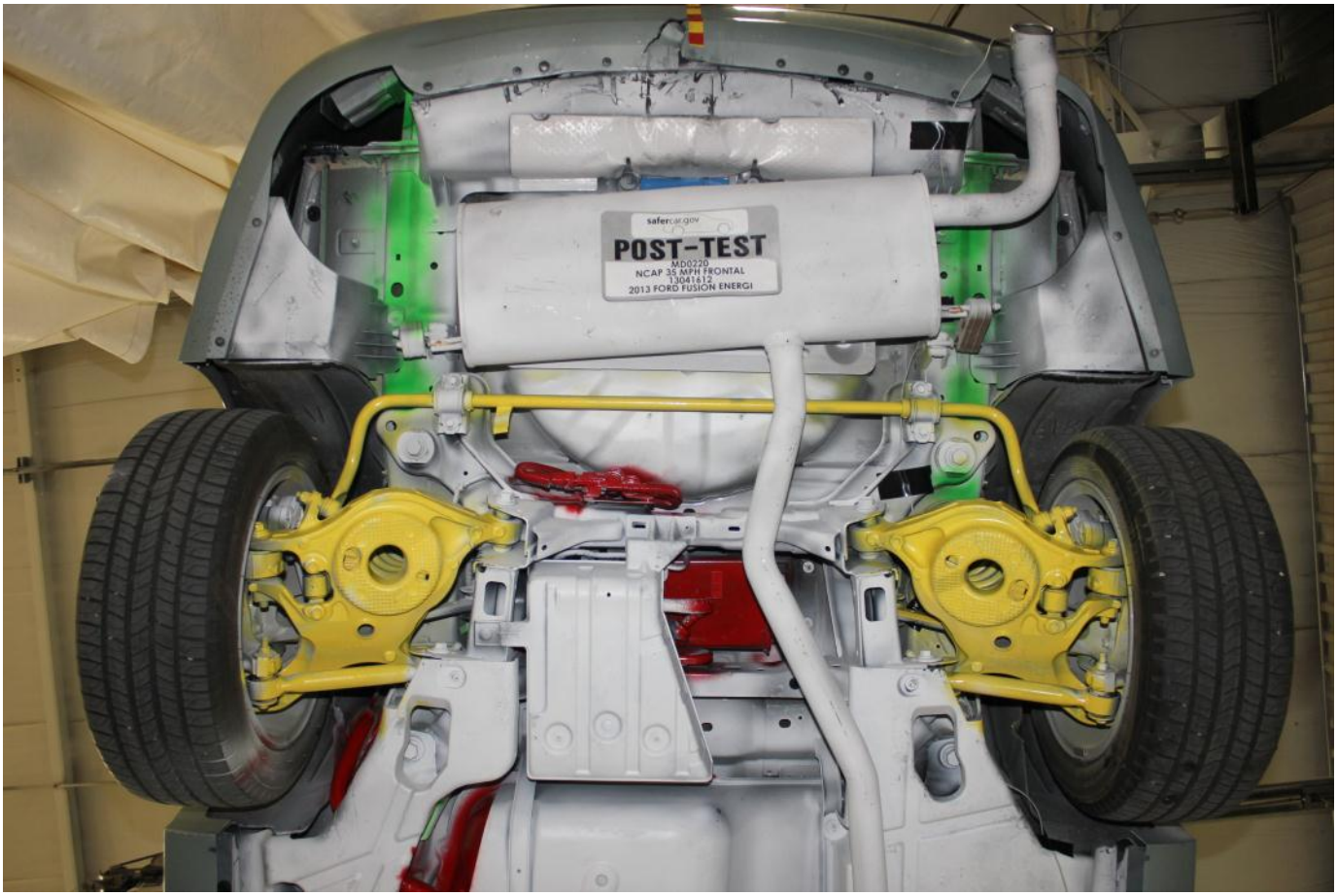
Pre-Test Mid Rear Underbody View



Post-Test Mid Rear Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View

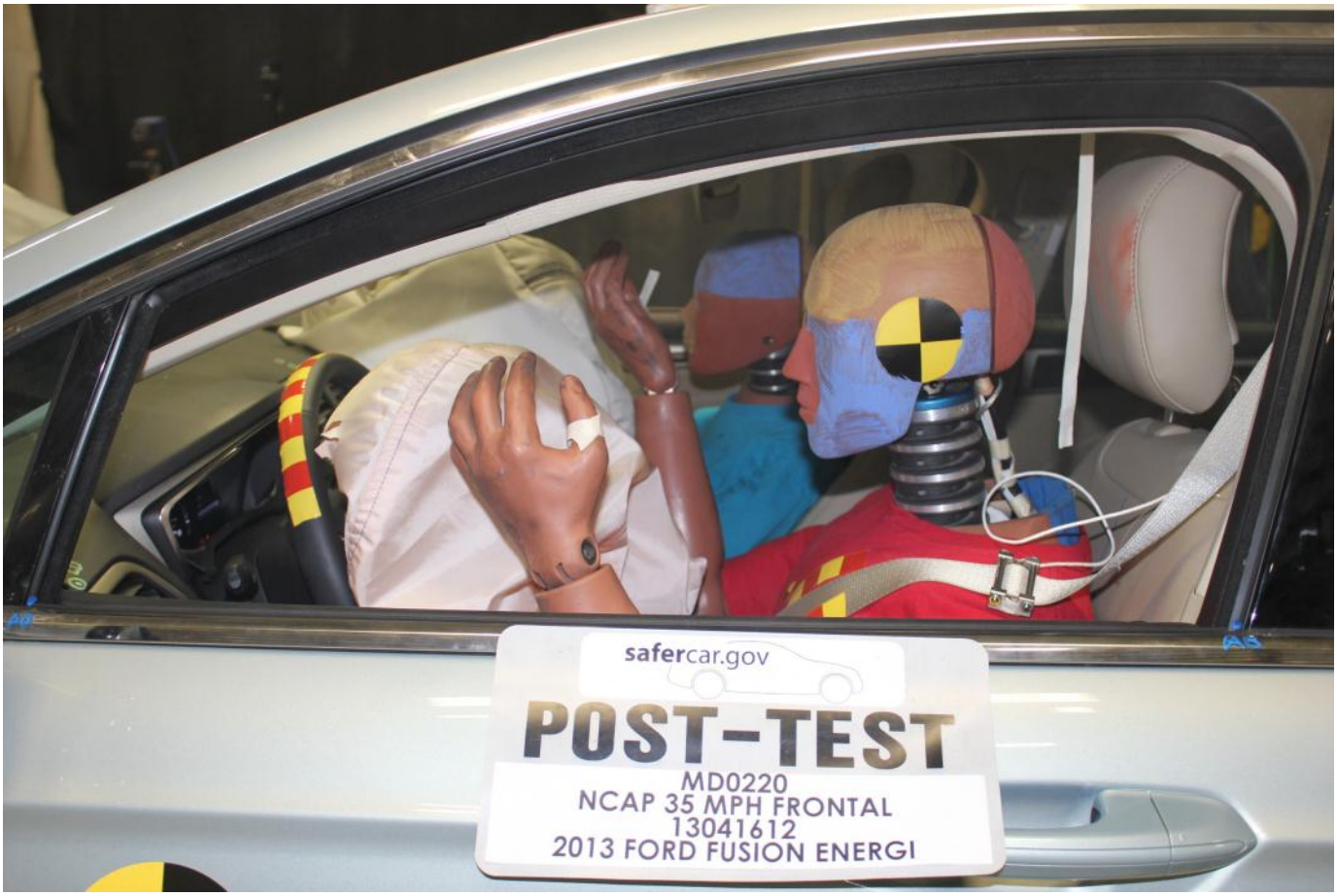
Pre-Test Dummy Cable Routing

Post-Test Dummy Cable Routing

Pre-Test Driver Dummy Front View

Post-Test Driver Dummy Front View

Pre-Test Driver Dummy Window View

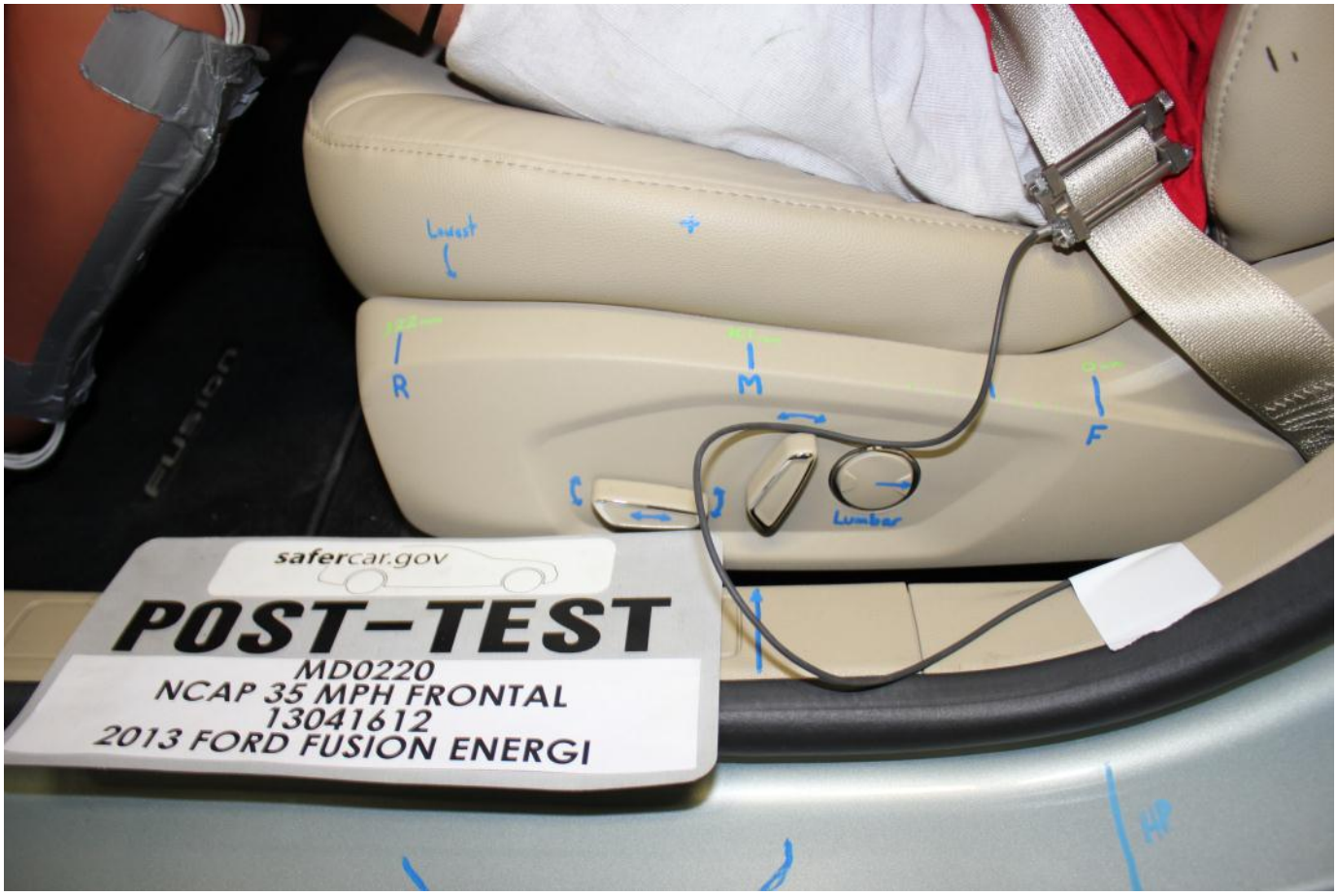


Post-Test Driver Dummy Window View

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 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

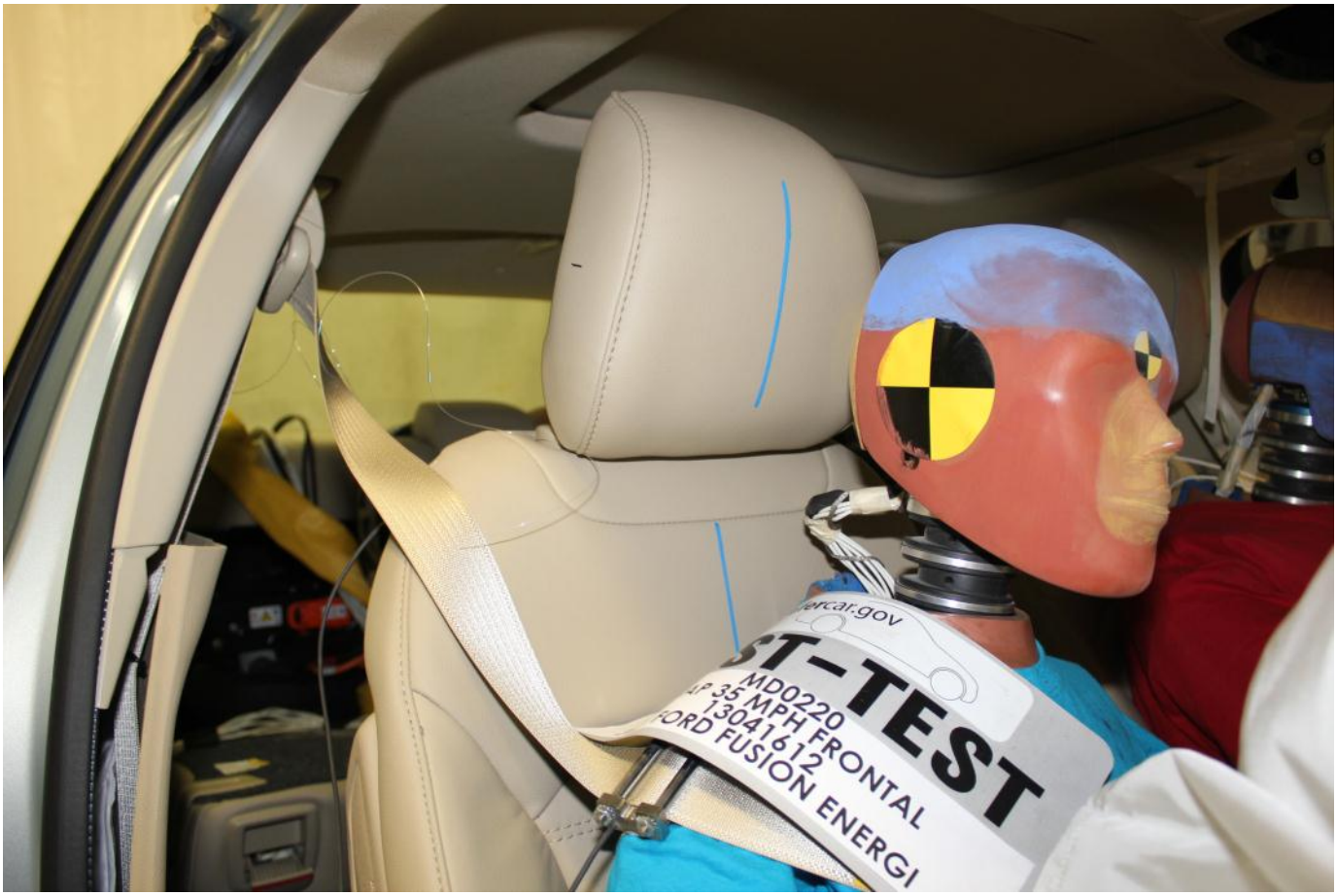
Pre-Test Passenger's Side Knee Bolster (without dummy)

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 Glove Box

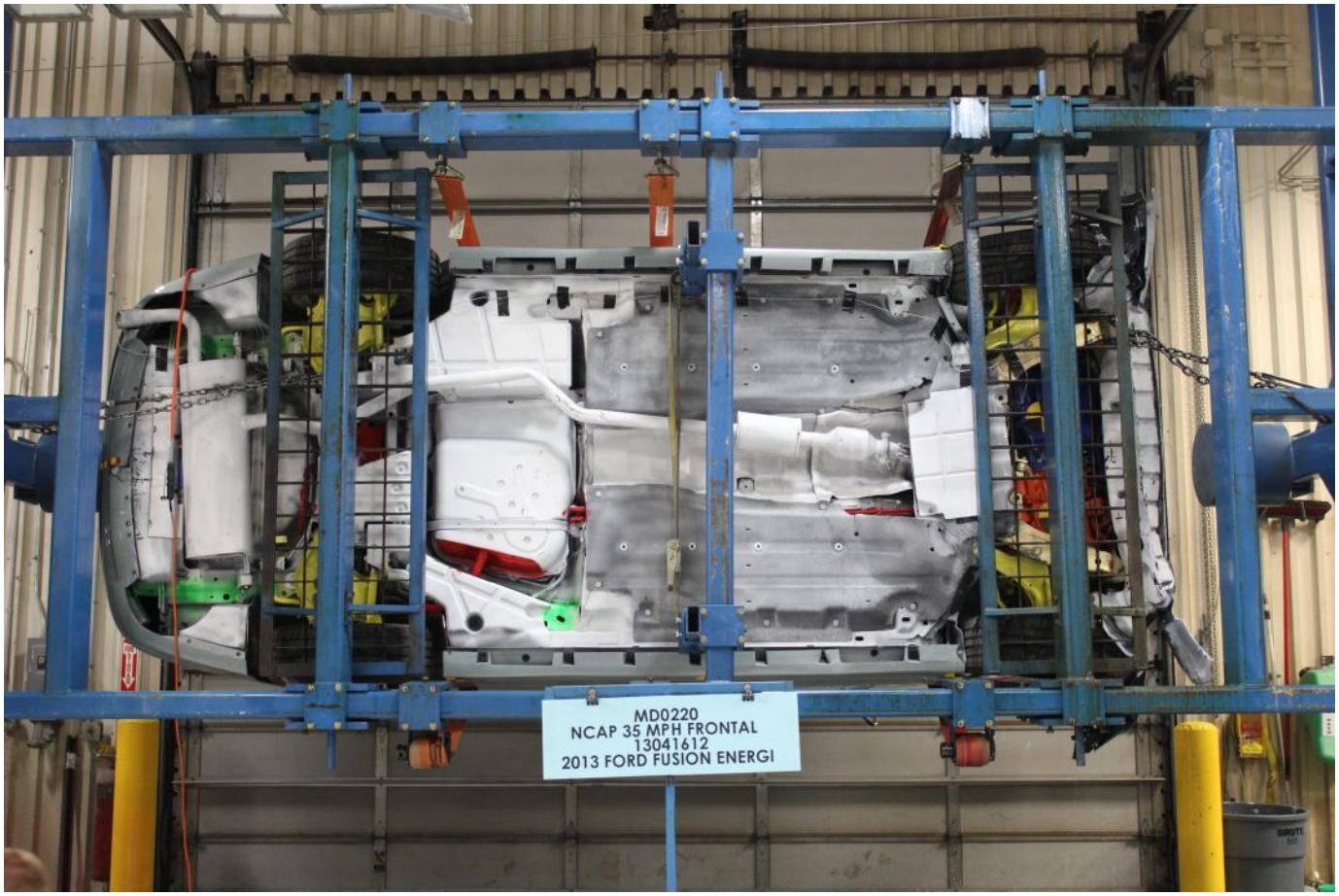
Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

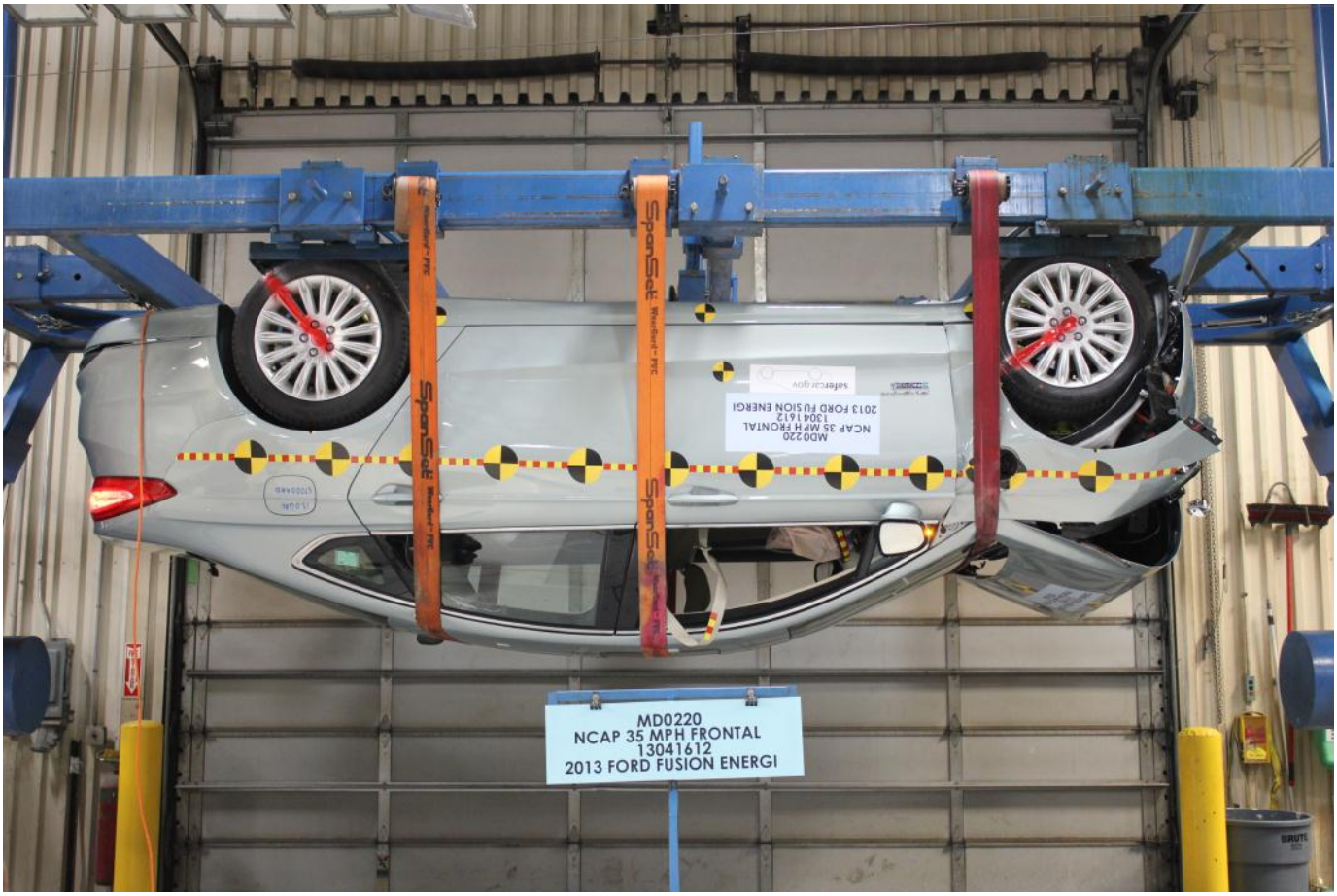
Post-Test Stoddard Solvent Spillage Location View

Post-Test Speed Trap Read-Out

Vehicle at 0° on Static Rollover Device



Vehicle at 90° on Static Rollover Device

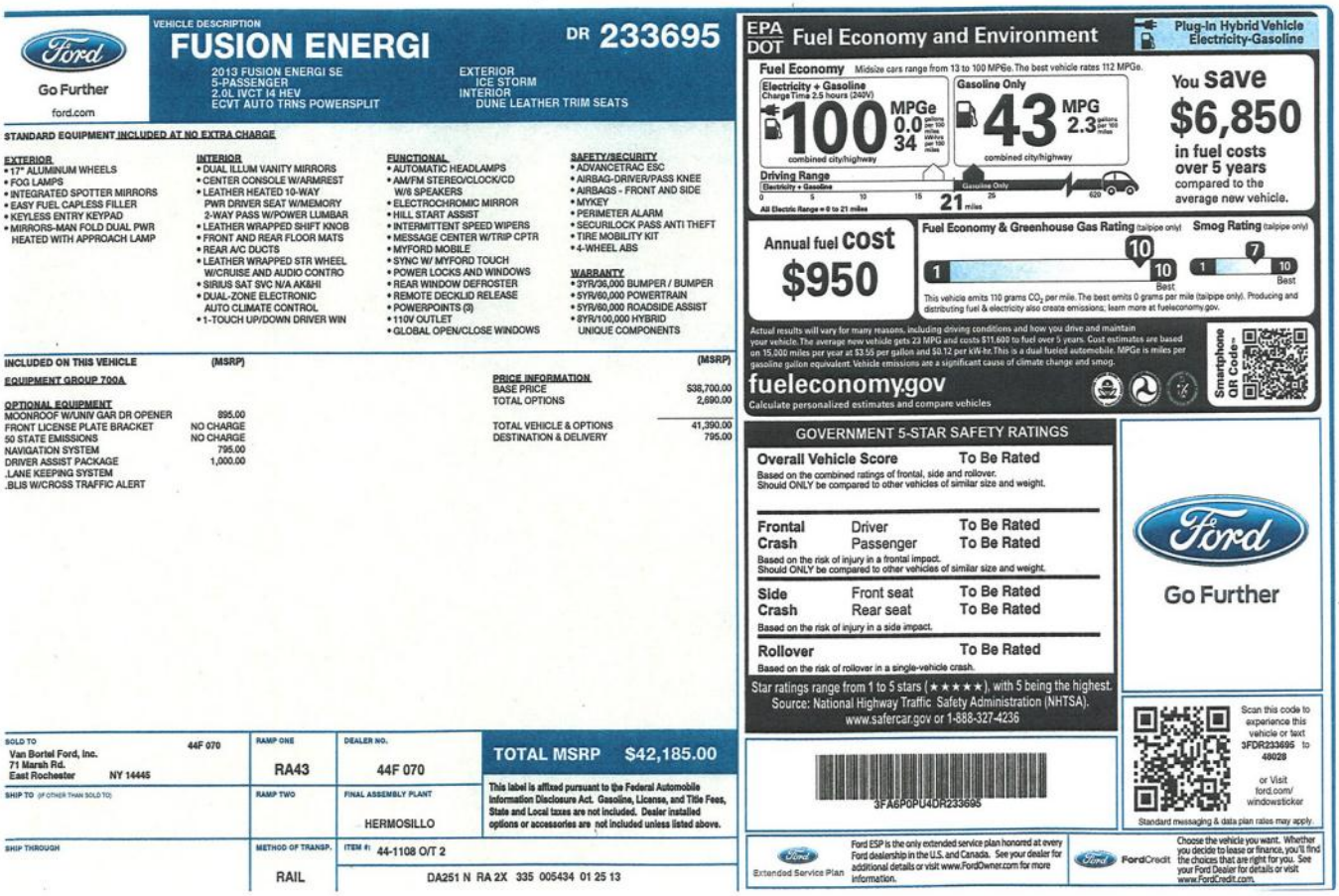


Vehicle at 180° on Static Rollover Device

Vehicle at 270° on Static Rollover Device

Vehicle at 360° on Static Rollover Device

2013 Ford Fusion Energi Frontal Impact Event



VEHICLE DESCRIPTION

FUSION ENERGI

DR 233695

2013 FUSION ENERGI SE
5-PASSENGER
2.0L IVCT I4 HEV
ECVT AUTO TRNS POWERSPLIT

EXTERIOR
ICE STORM
INTERIOR
DUNE LEATHER TRIM SEATS

Ford
Go Further
ford.com

STANDARD EQUIPMENT INCLUDED AT NO EXTRA CHARGE

EXTERIOR
- 17" ALUMINUM WHEELS
- FOG LAMPS
- INTEGRATED SPOTTER MIRRORS
- EASY FUEL CAPLESS FILLER
- KEYLESS ENTRY KEYPAD
- MIRRORS-MAN FOLD DUAL PWR HEATED WITH APPROACH LAMP

INTERIOR
- DUAL ILLUM VANITY MIRRORS
- CENTER CONSOLE W/ARMREST
- LEATHER HEATED 10-WAY PWR DRIVER SEAT W/MEMORY 2-WAY PASS W/POWER LUMBAR
- LEATHER WRAPPED SHIFT KNOB
- FRONT AND REAR FLOOR MATS
- REAR A/C DUCTS
- LEATHER WRAPPED STR WHEEL W/CRUISE AND AUDIO CONTRO
- SIRIUS SAT SVC N/A AK&HI
- DUAL-ZONE ELECTRONIC AUTO CLIMATE CONTROL
- 1-TOUCH UP/DOWN DRIVER WIN

FUNCTIONAL
- AUTOMATIC HEADLAMPS
- AM/FM STEREO/CLOCK/CD W/8 SPEAKERS
- ELECTROCHROMIC MIRROR
- HILL START ASSIST
- INTERMITTENT SPEED WIPERS
- MESSAGE CENTER W/TRIP CPTR
- MYFORD MOBILE
- SYNC W/ MYFORD TOUCH
- POWER LOCKS AND WINDOWS
- REAR WINDOW DEFROSTER
- REMOTE DECKLID RELEASE
- POWERPOINTS (3)
- 110V OUTLET
- GLOBAL OPEN/CLOSE WINDOWS

SAFETY/SECURITY
- ADVANCETRAC ESC
- AIRBAG-DRIVER/PASS KNEE
- AIRBAGS - FRONT AND SIDE
- MYKEY
- PERIMETER ALARM
- SECURILOCK PASS ANTI THEFT
- TIRE MOBILITY KIT
- 4-WHEEL ABS

WARRANTY
- 3YR/36,000 BUMPER / BUMPER
- 5YR/60,000 POWERTRAIN
- 5YR/60,000 ROADSIDE ASSIST
- 8YR/100,000 HYBRID UNIQUE COMPONENTS

INCLUDED ON THIS VEHICLE	(MSRP)
EQUIPMENT GROUP 700A	
OPTIONAL EQUIPMENT	
MOONROOF W/UNIV GAR DR OPENER	895.00
FRONT LICENSE PLATE BRACKET	NO CHARGE
50 STATE EMISSIONS	NO CHARGE
NAVIGATION SYSTEM	795.00
DRIVER ASSIST PACKAGE	1,000.00
.LANE KEEPING SYSTEM	
.BLIS W/CROSS TRAFFIC ALERT	

PRICE INFORMATION	(MSRP)
BASE PRICE	$38,700.00
TOTAL OPTIONS	2,690.00
TOTAL VEHICLE & OPTIONS	41,390.00
DESTINATION & DELIVERY	795.00

SOLD TO	44F 070	RAMP ONE	DEALER NO.	TOTAL MSRP $42,185.00
Van Bortel Ford, Inc. 71 Marsh Rd. East Rochester NY 14445		RA43	44F 070	This label is affixed pursuant to the Federal Automobile Information Disclosure Act. Gasoline, License, and Title Fees, State and Local taxes are not included. Dealer installed options or accessories are not included unless listed above.
SHIP TO (IF OTHER THAN SOLD TO)		RAMP TWO	FINAL ASSEMBLY PLANT	
			HERMOSILLO	
SHIP THROUGH		METHOD OF TRANSP.	ITEM #: 44-1108 O/T 2	
		RAIL	DA251 N RA 2X 335 005434 01 25 13	

EPA DOT **Fuel Economy and Environment**

Plug-In Hybrid Vehicle Electricity-Gasoline

Fuel Economy Midsize cars range from 13 to 100 MPGe. The best vehicle rates 112 MPGe.

Electricity + Gasoline (Charge Time 2.5 hours (240V)): **100** MPGe, 0.0 gallons per 100 miles, 34 kWhrs per 100 miles, combined city/highway

Gasoline Only: **43** MPG, 2.3 gallons per 100 miles, combined city/highway

You save **$6,850** in fuel costs over 5 years compared to the average new vehicle.

Driving Range: Electricity + Gasoline 0 5 10 15 21 miles 25 Gasoline Only 620 — All Electric Range = 0 to 21 miles

Annual fuel cost **$950**

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 1 — 10 Best

Smog Rating (tailpipe only): 1 — 7 — 10 Best

This vehicle emits 110 grams CO_2 per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel & electricity also create emissions; learn more at fueleconomy.gov.

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 23 MPG and costs $11,600 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $3.55 per gallon and $0.12 per kW-hr. This is a dual-fueled automobile. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fueleconomy.gov
Calculate personalized estimates and compare vehicles

Smartphone QR Code

GOVERNMENT 5-STAR SAFETY RATINGS

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

Frontal Crash	Driver	To Be Rated
	Passenger	To Be Rated

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

Side Crash	Front seat	To Be Rated
	Rear seat	To Be Rated

Based on the risk of injury in a side impact.

Rollover — To Be Rated
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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Standard messaging & data plan rates may apply.

Ford Extended Service Plan — Ford ESP is the only extended service plan honored at every Ford dealership in the U.S. and Canada. See your dealer for additional details or visit www.FordOwner.com for more information.

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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

Left Rear Seat Crossmember Z

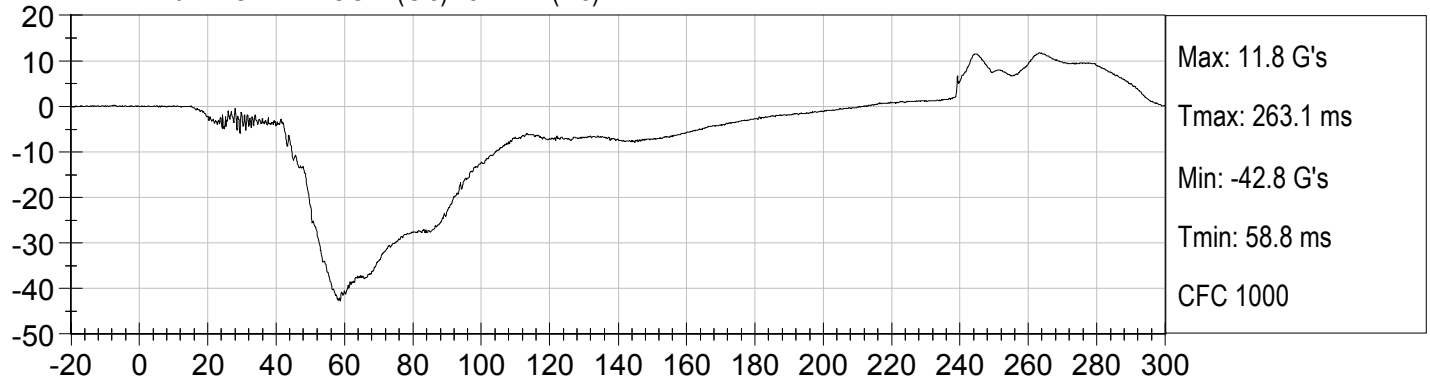
Right Rear Seat Crossmember Z

Left Rear Seat Crossmember Xr

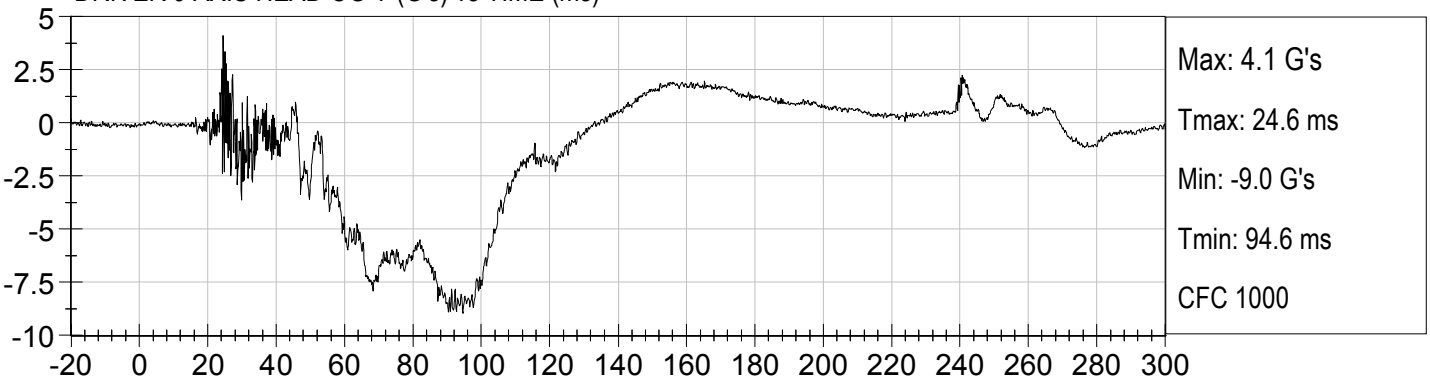
Right Rear Seat Crossmember Xr

Advanced Research Load Cell Barrier – 528 channels

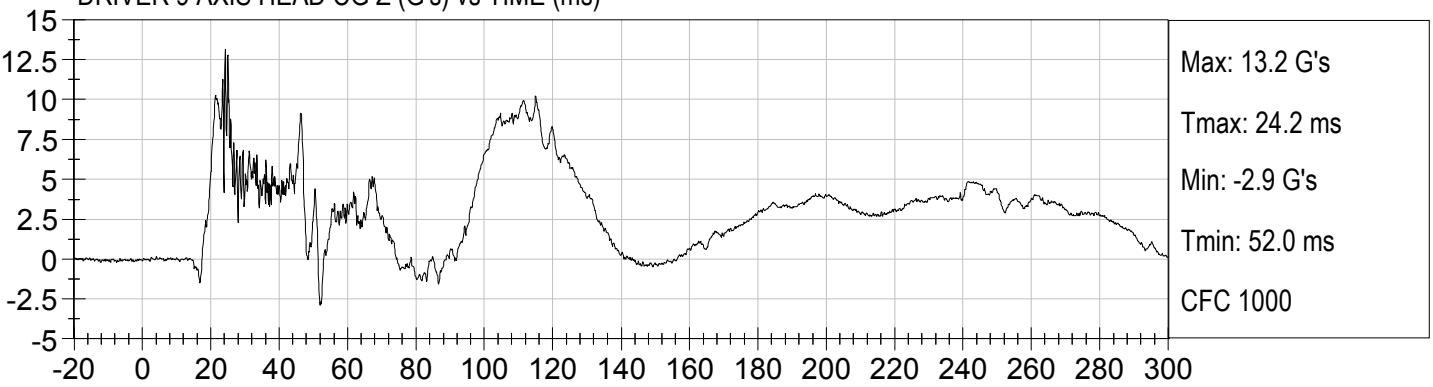
DRIVER 9 AXIS HEAD CG X (G's) vs TIME (ms)



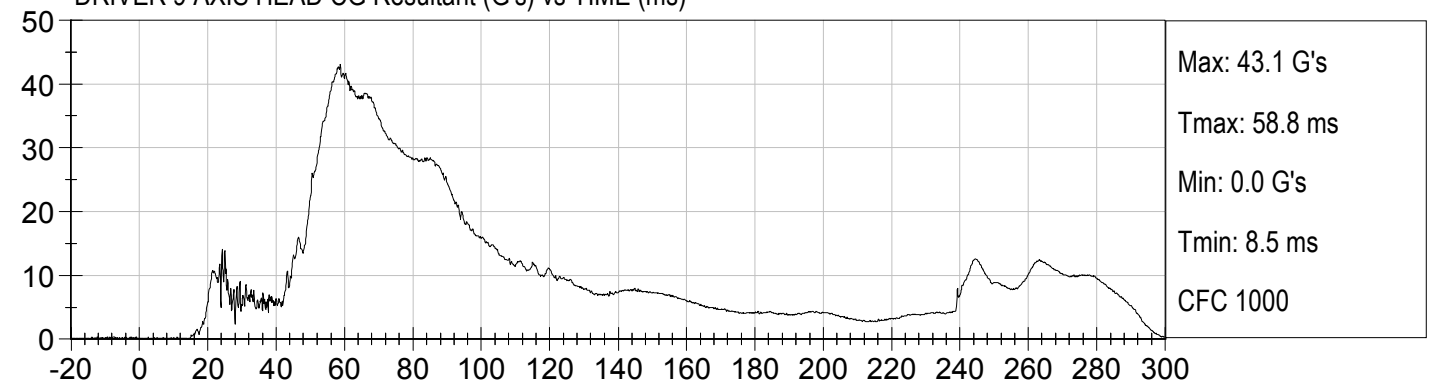
DRIVER 9 AXIS HEAD CG Y (G's) vs TIME (ms)



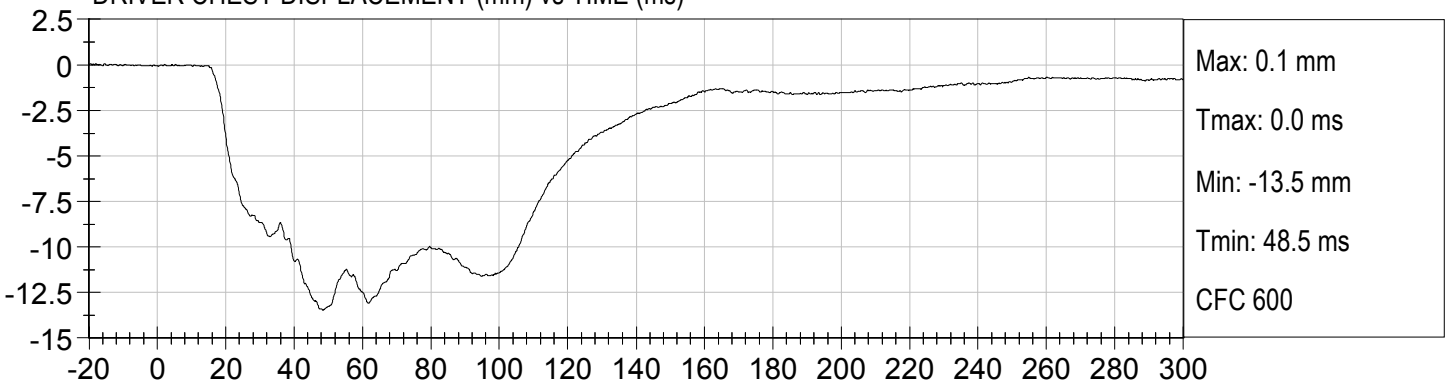
DRIVER 9 AXIS HEAD CG Z (G's) vs TIME (ms)



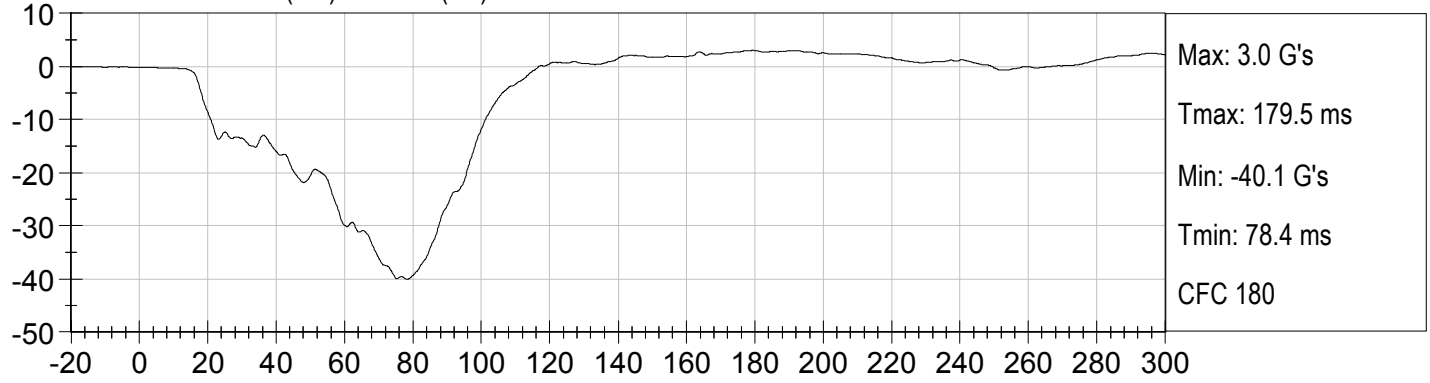
DRIVER 9 AXIS HEAD CG Resultant (G's) vs TIME (ms)



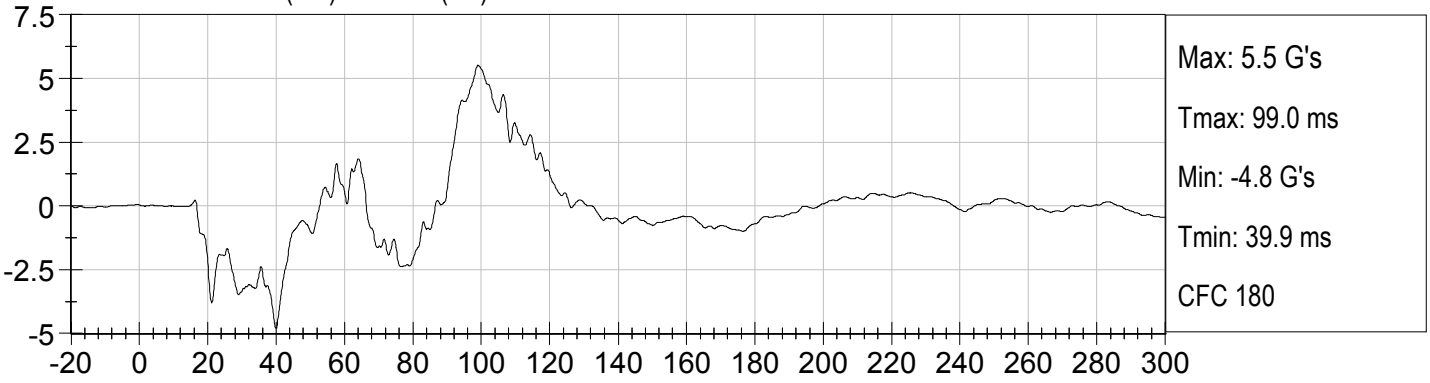
DRIVER CHEST DISPLACEMENT (mm) vs TIME (ms)



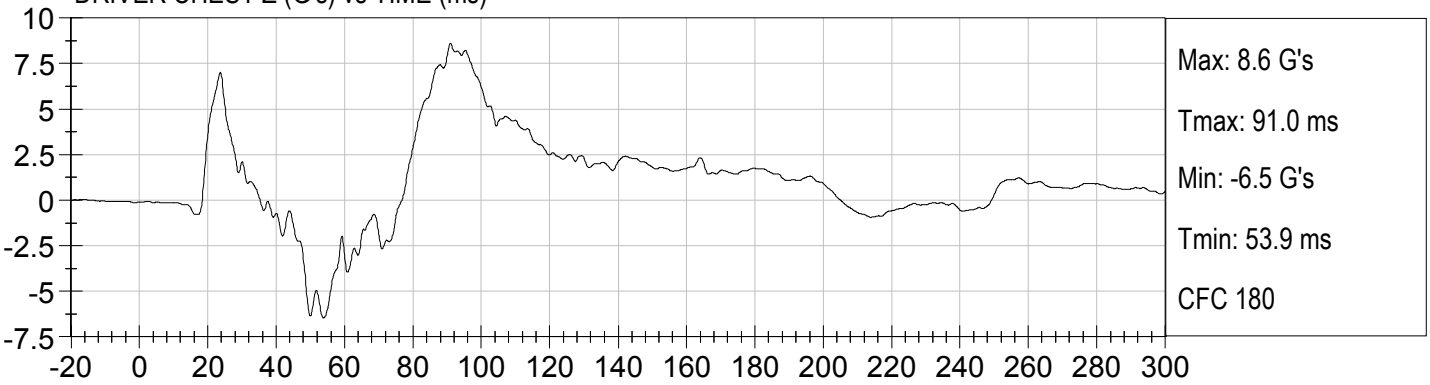
DRIVER CHEST X (G's) vs TIME (ms)



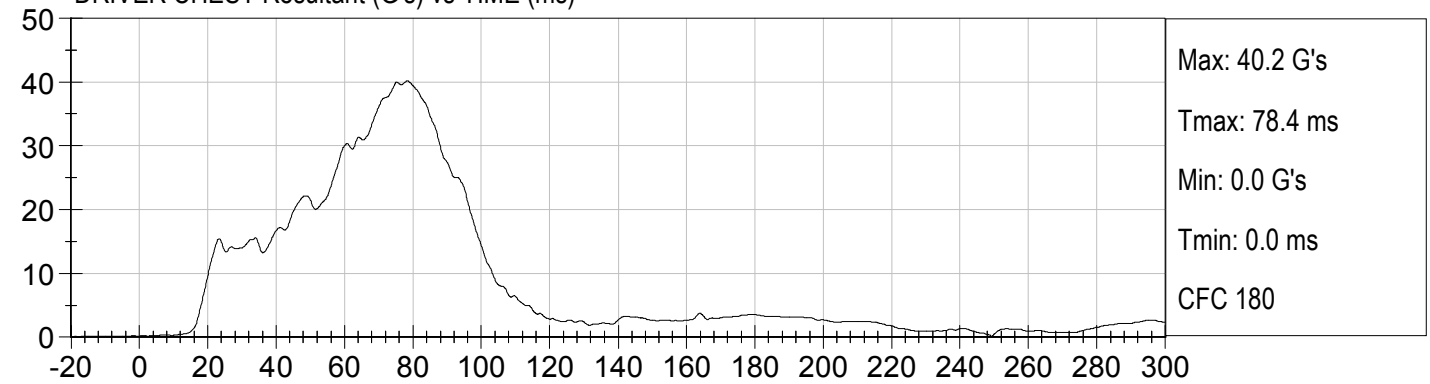
DRIVER CHEST Y (G's) vs TIME (ms)



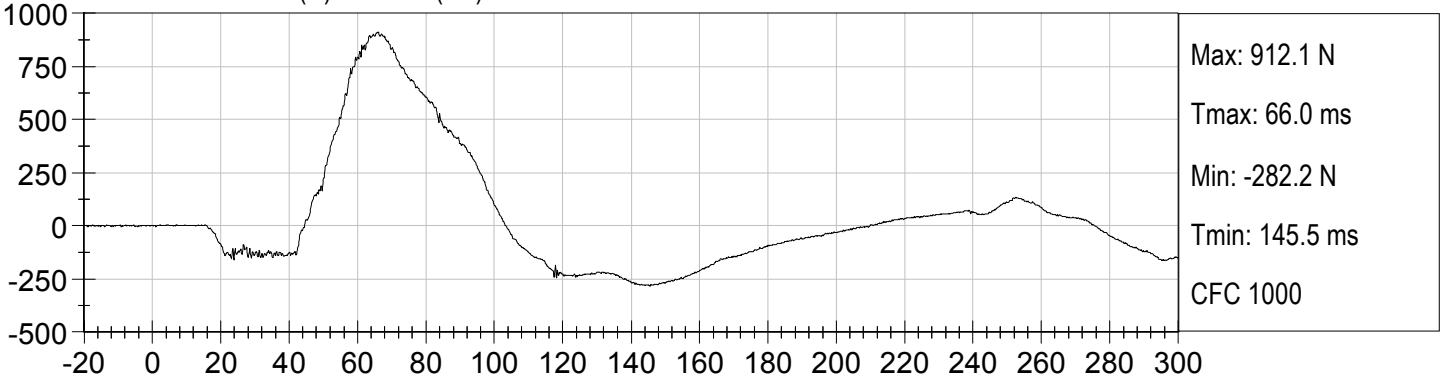
DRIVER CHEST Z (G's) vs TIME (ms)



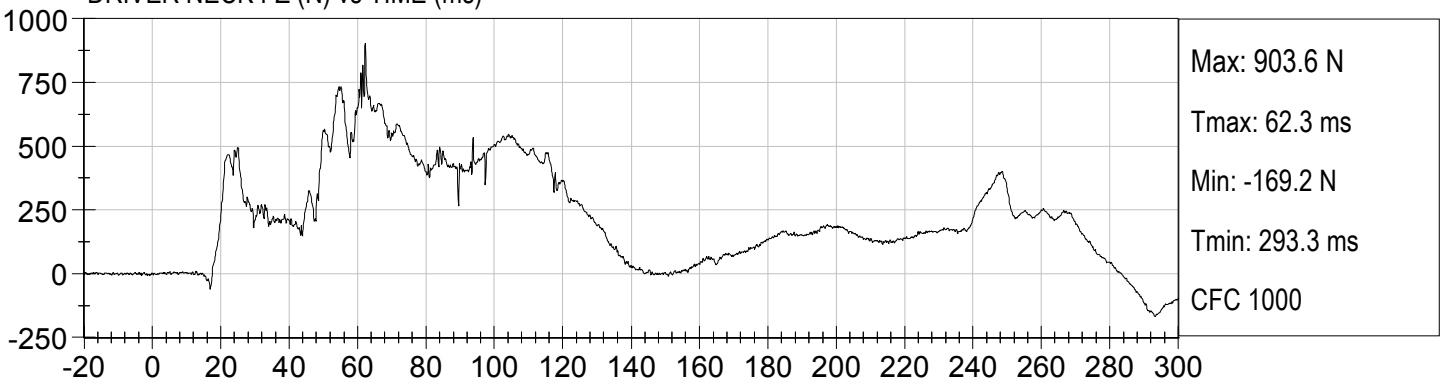
DRIVER CHEST Resultant (G's) vs TIME (ms)



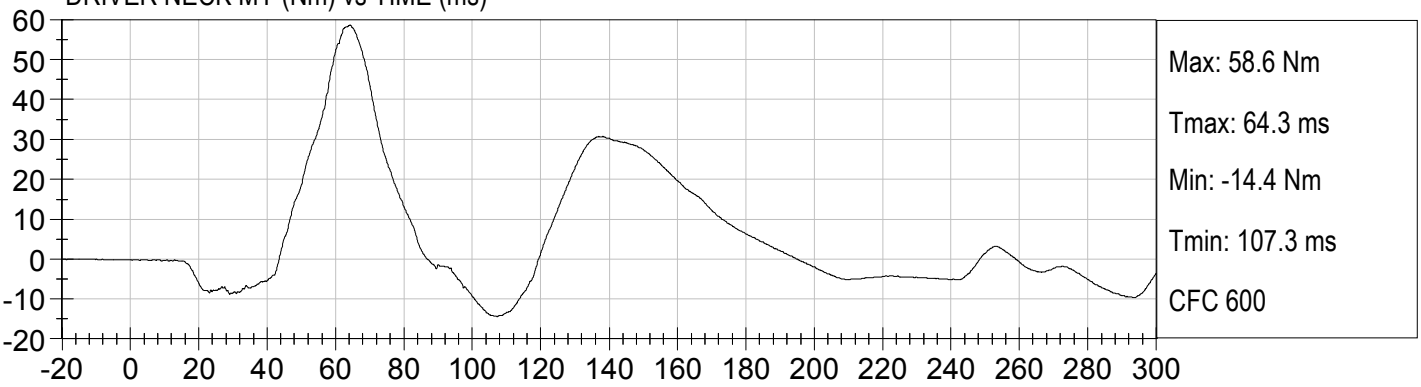
DRIVER NECK FX (N) vs TIME (ms)

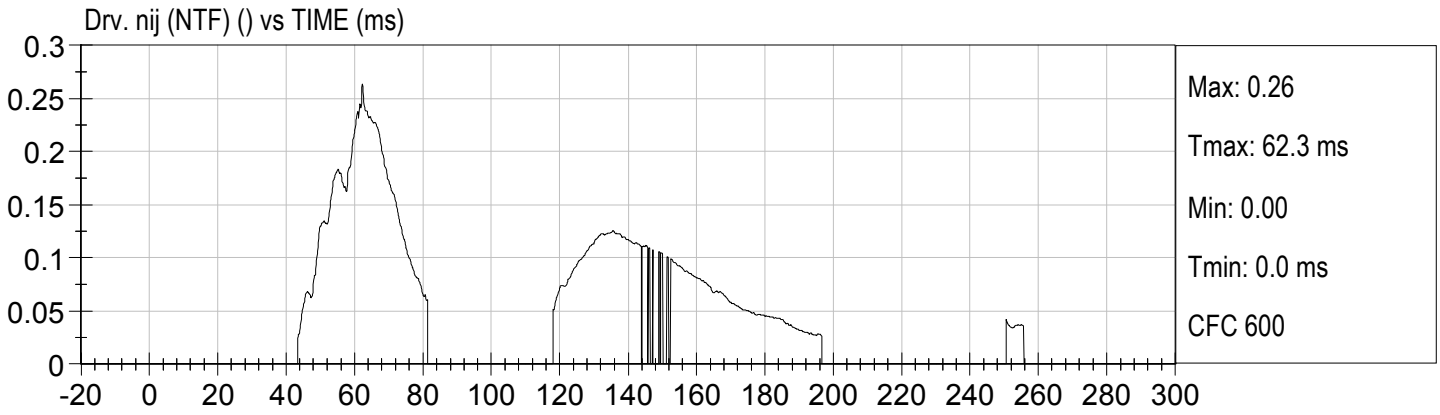


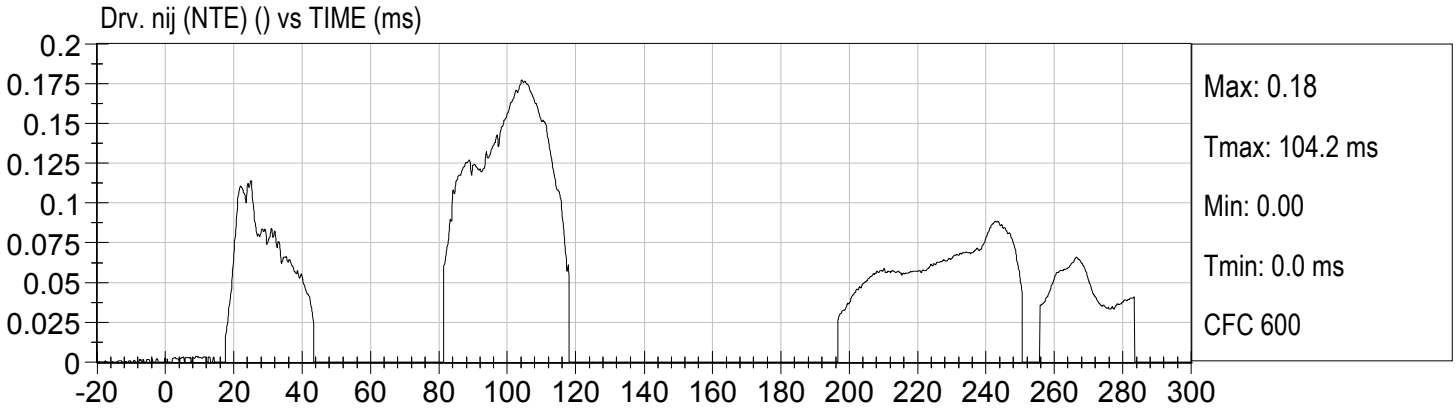
DRIVER NECK FZ (N) vs TIME (ms)

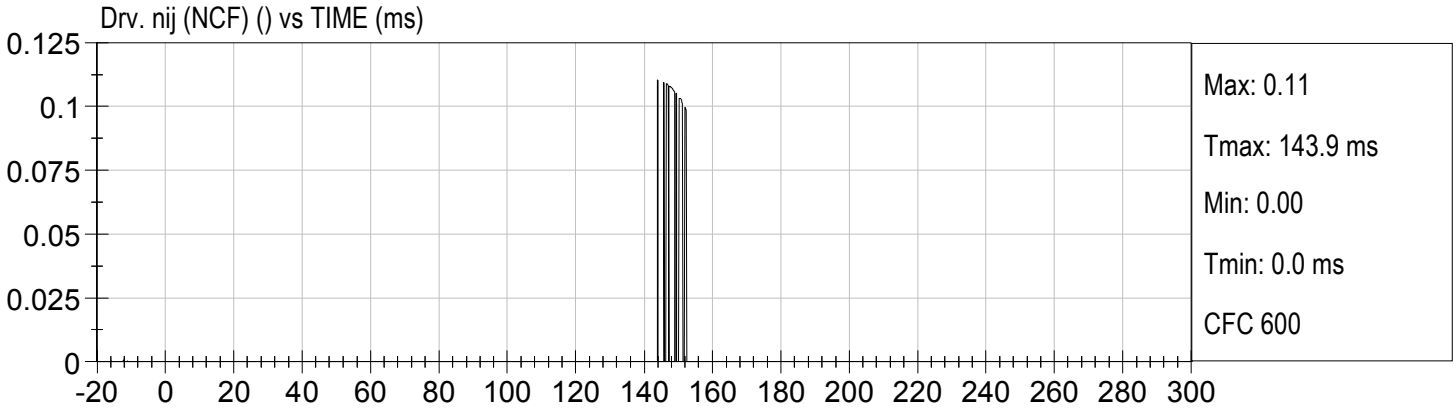


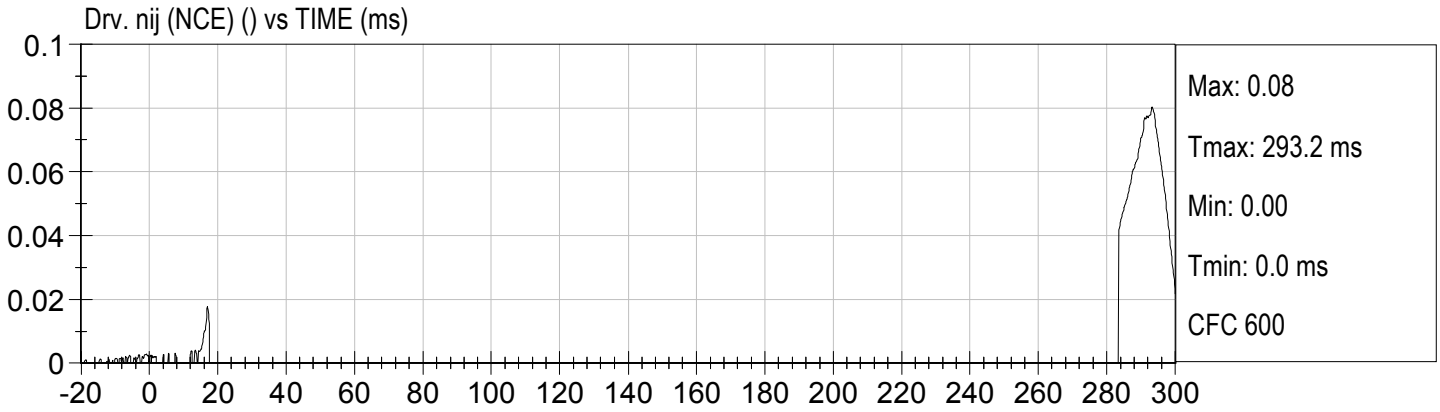
DRIVER NECK MY (Nm) vs TIME (ms)



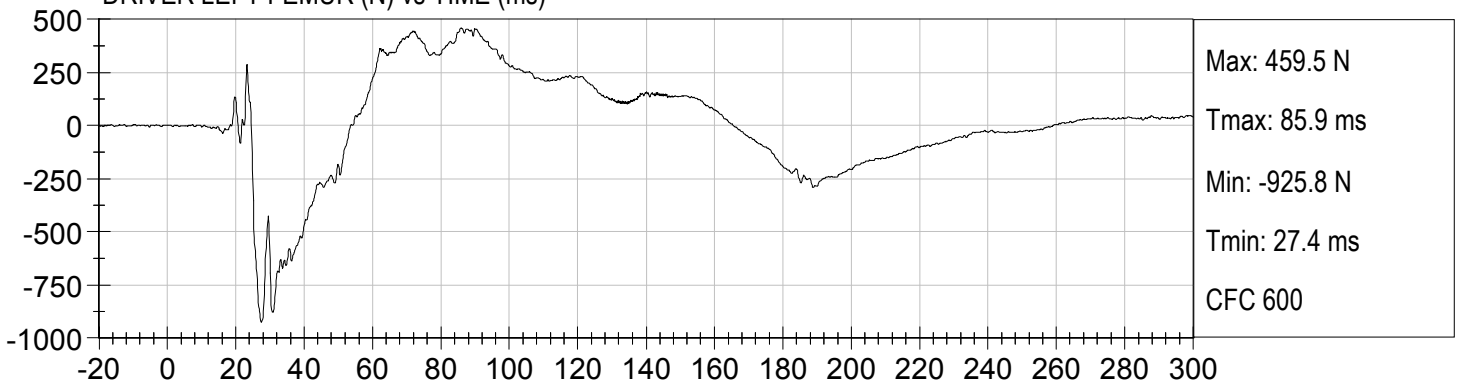

Drv. nij (NTF) () vs TIME (ms)
0.3
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.26
Tmax: 62.3 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


Drv. nij (NTE) () vs TIME (ms)
0.2
0.175
0.15
0.125
0.1
0.075
0.05
0.025
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.18
Tmax: 104.2 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

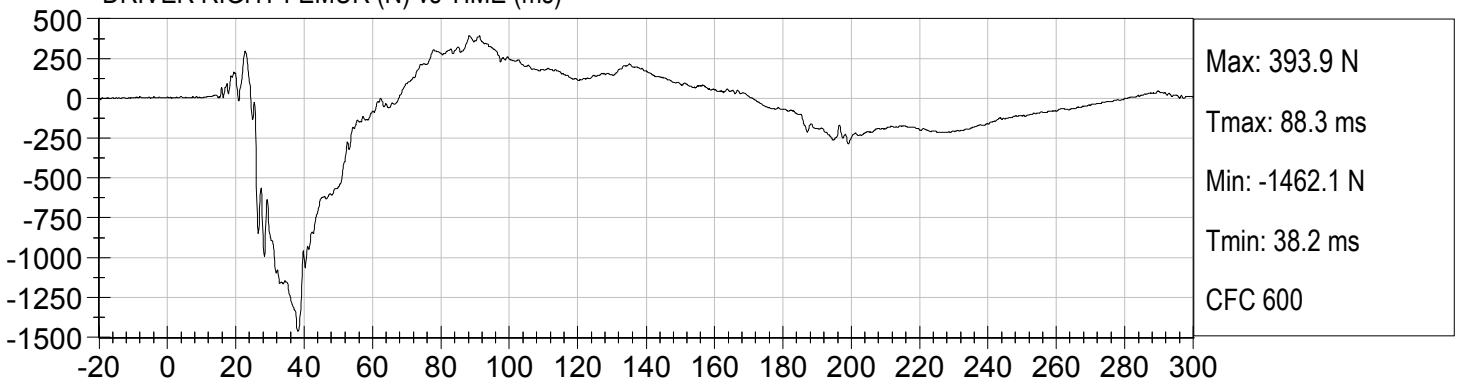

Drv. nij (NCF) () vs TIME (ms)
0.125
0.1
0.075
0.05
0.025
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.11
Tmax: 143.9 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


Drv. nij (NCE) () vs TIME (ms)
0.1
0.08
0.06
0.04
0.02
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.08
Tmax: 293.2 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

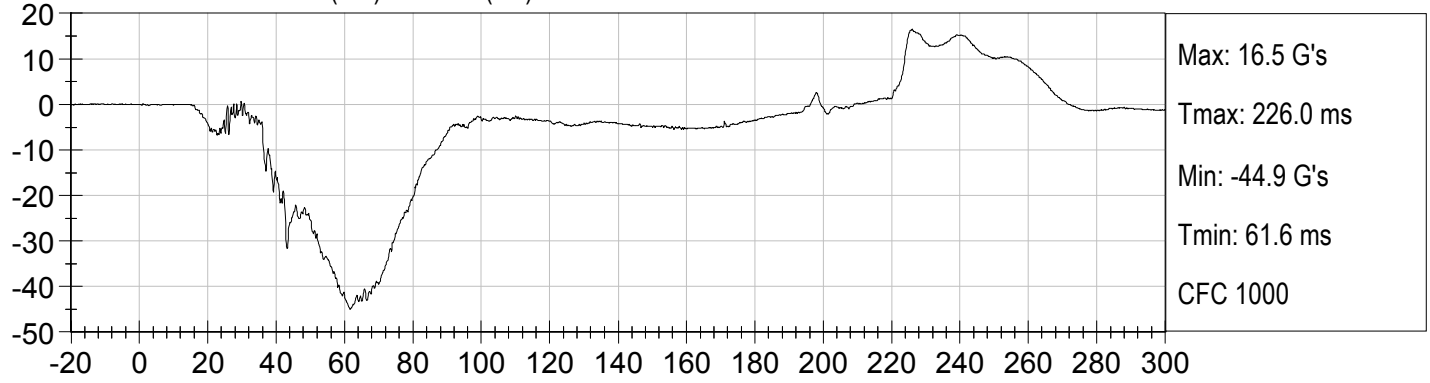
DRIVER LEFT FEMUR (N) vs TIME (ms)



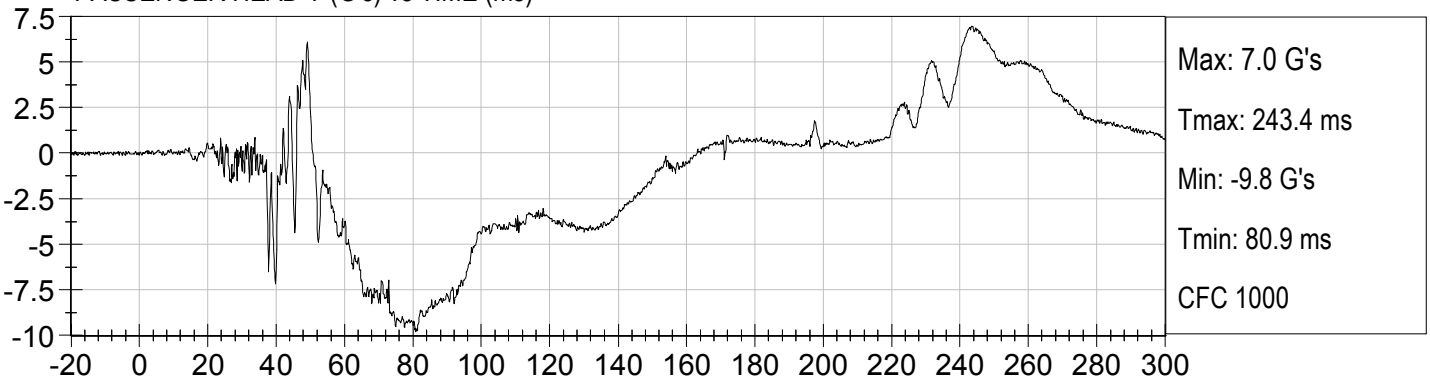
DRIVER RIGHT FEMUR (N) vs TIME (ms)



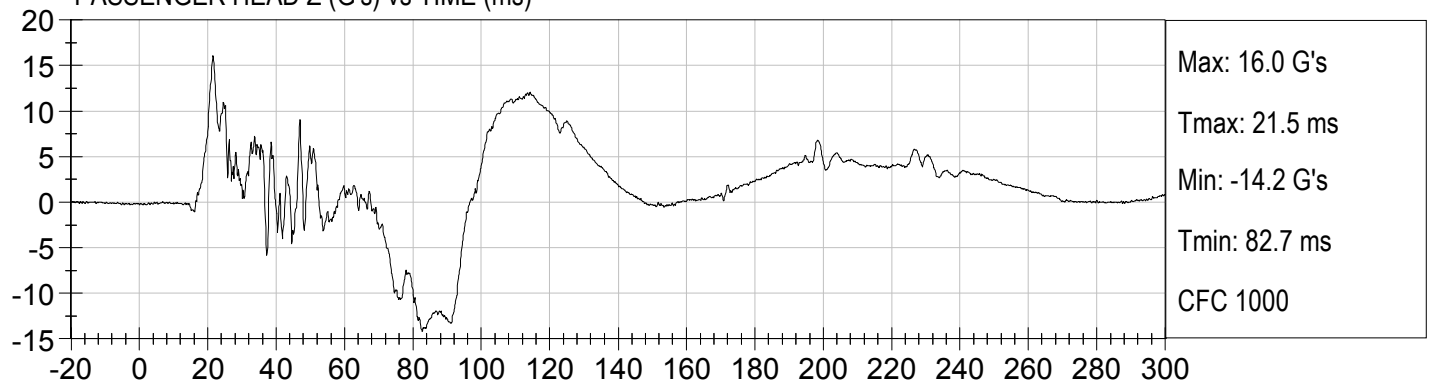
PASSENGER HEAD X (G's) vs TIME (ms)



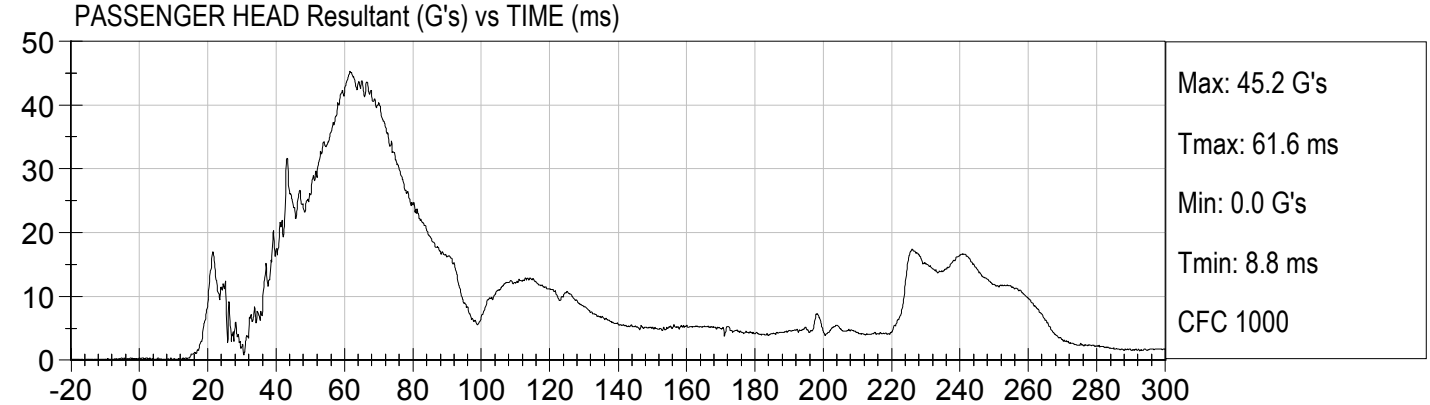
PASSENGER HEAD Y (G's) vs TIME (ms)

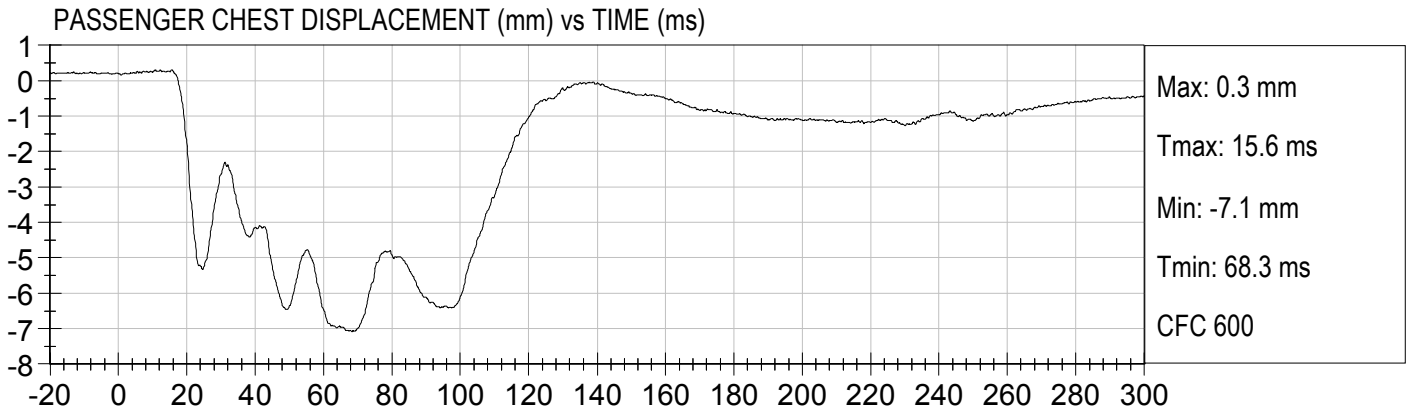


PASSENGER HEAD Z (G's) vs TIME (ms)

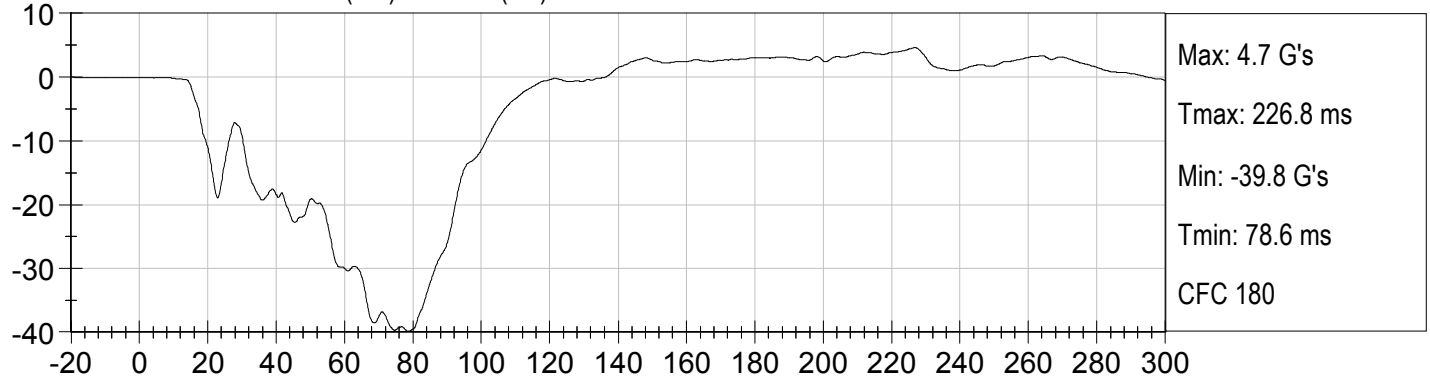


PASSENGER HEAD Resultant (G's) vs TIME (ms)

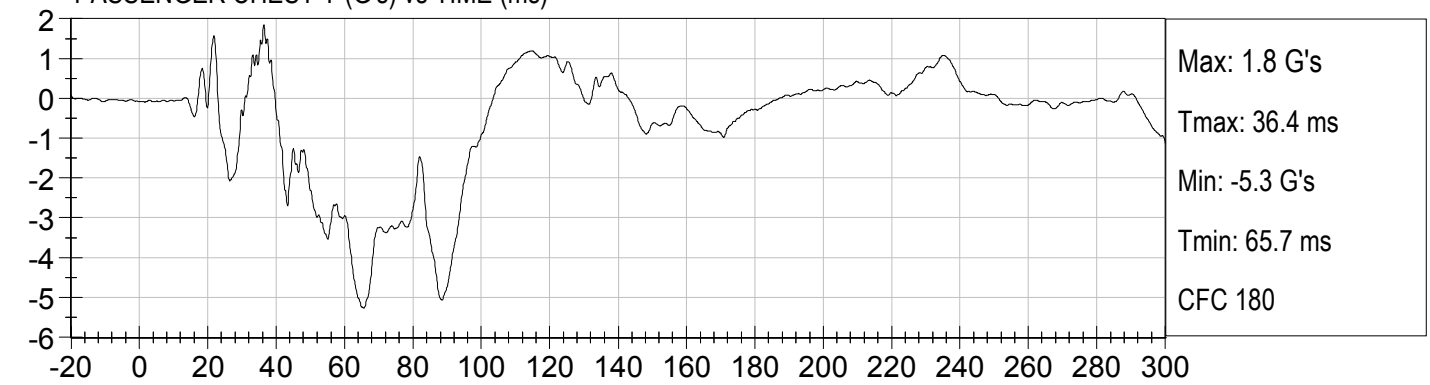



PASSENGER CHEST DISPLACEMENT (mm) vs TIME (ms)
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-20
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
Max: 0.3 mm
Tmax: 15.6 ms
Min: -7.1 mm
Tmin: 68.3 ms
CFC 600

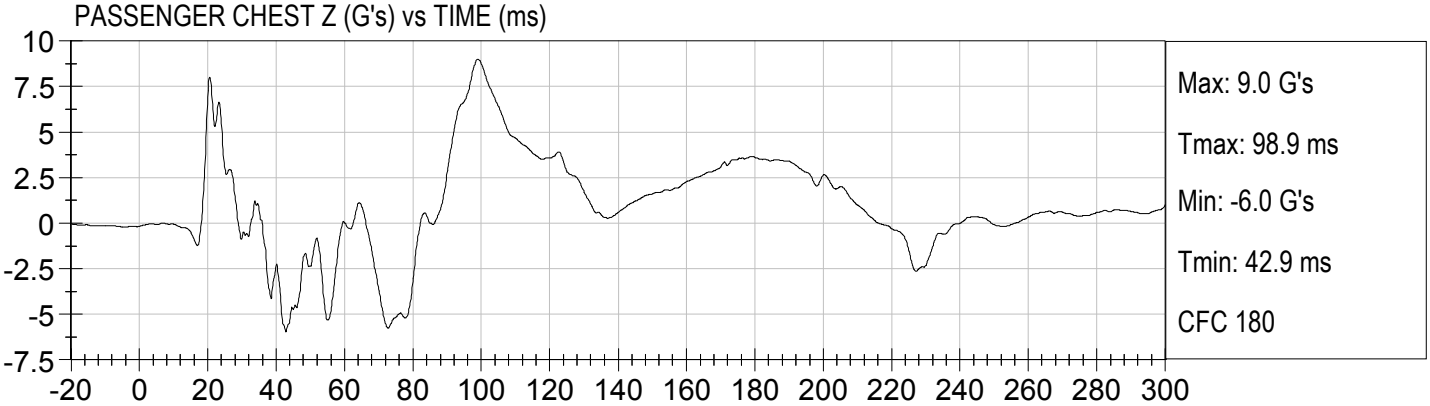
PASSENGER CHEST X (G's) vs TIME (ms)



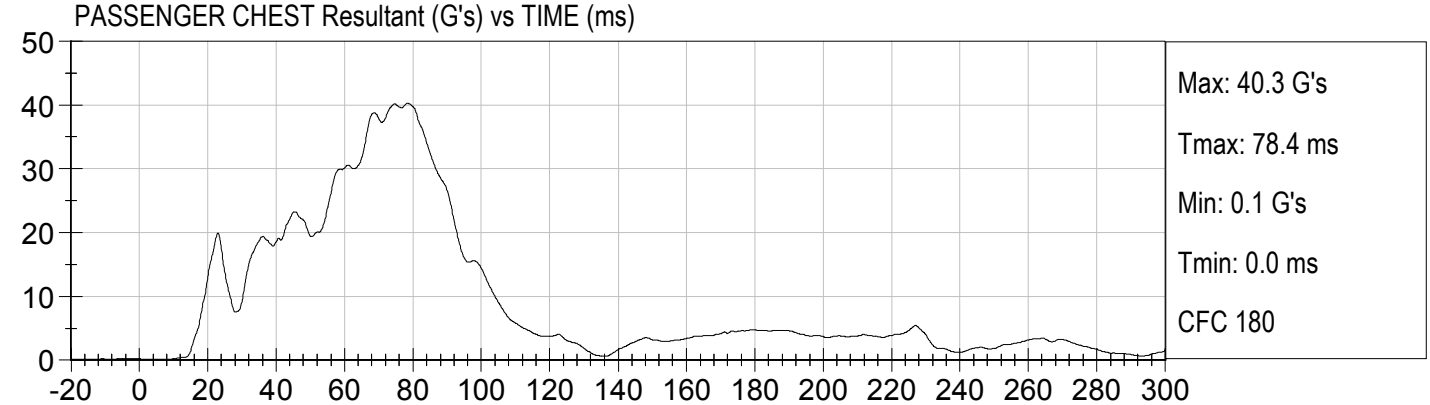
PASSENGER CHEST Y (G's) vs TIME (ms)



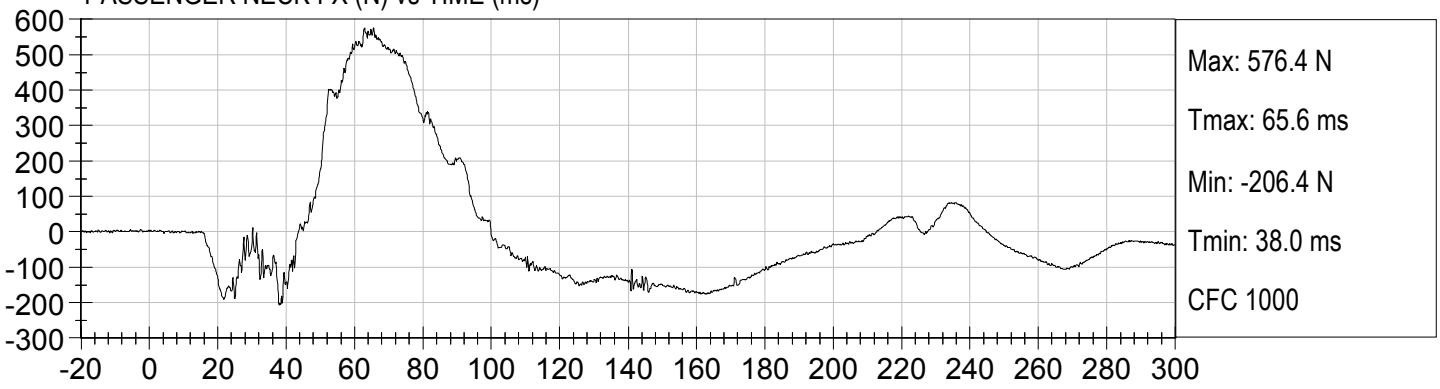
PASSENGER CHEST Z (G's) vs TIME (ms)



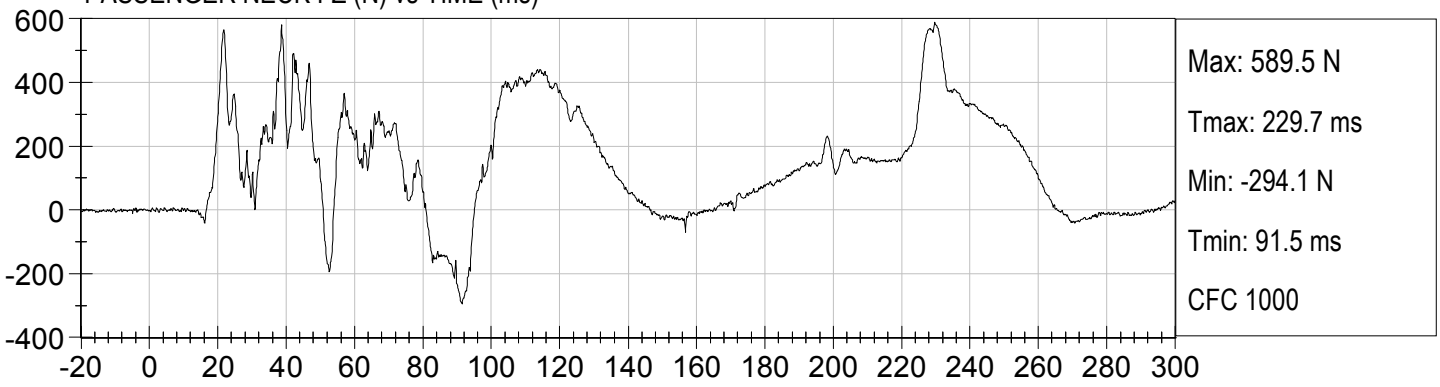
PASSENGER CHEST Resultant (G's) vs TIME (ms)



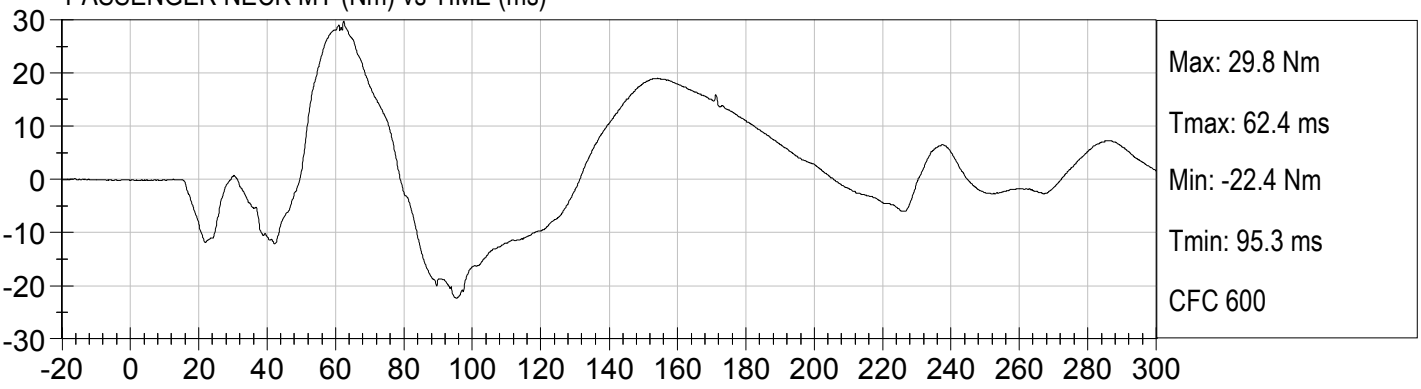
PASSENGER NECK FX (N) vs TIME (ms)

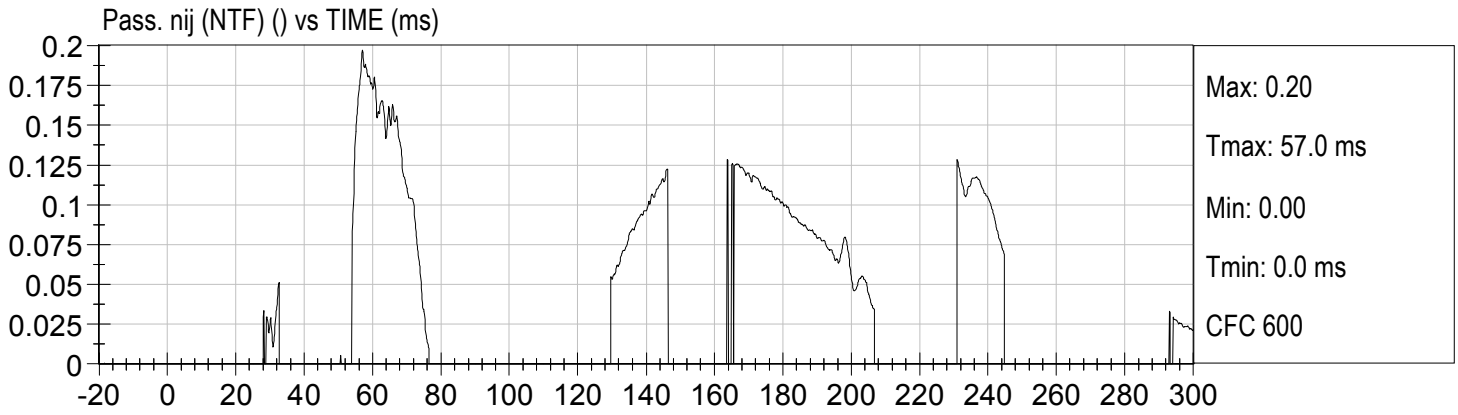


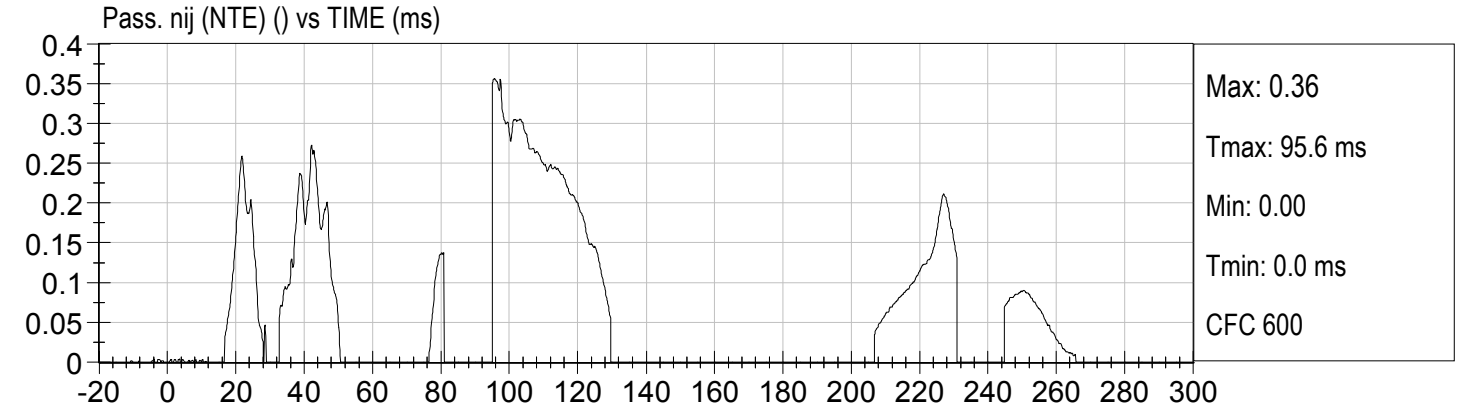
PASSENGER NECK FZ (N) vs TIME (ms)

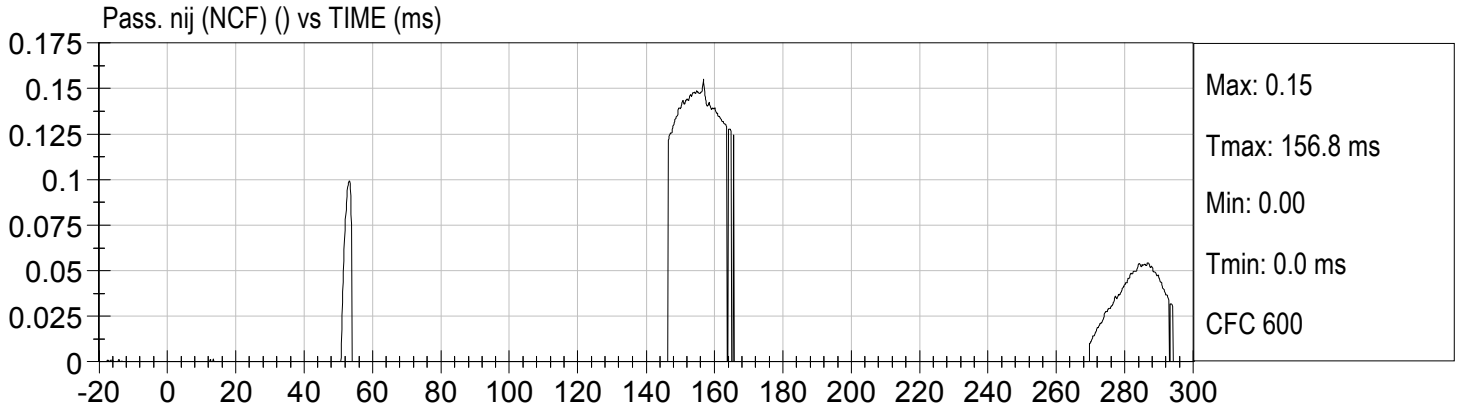


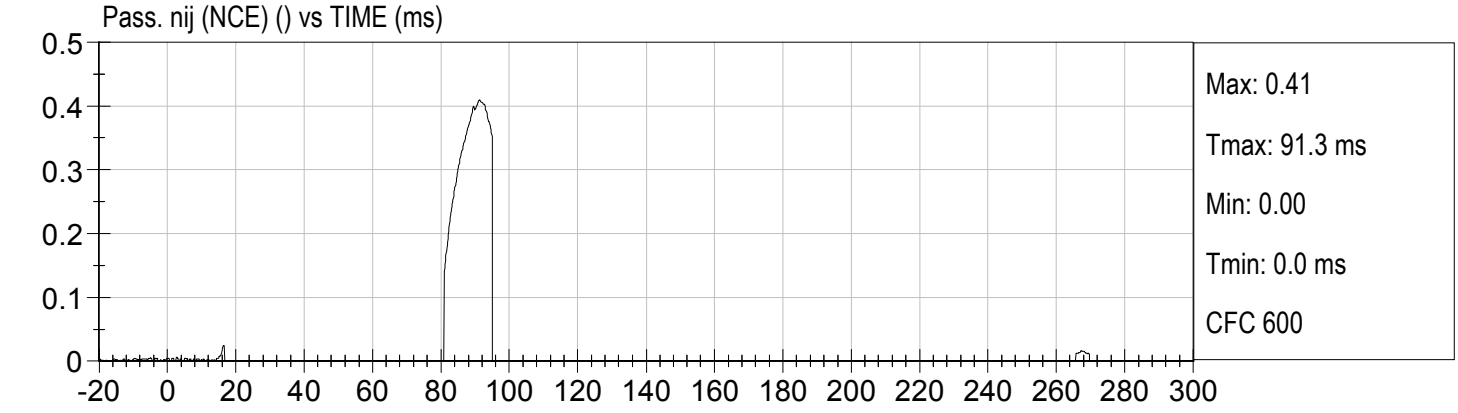
PASSENGER NECK MY (Nm) vs TIME (ms)



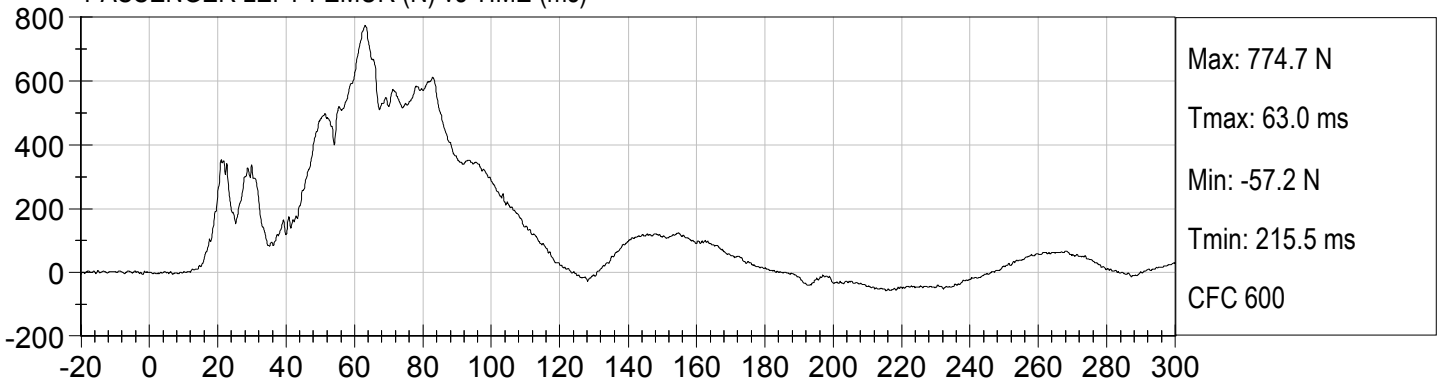

Pass. nij (NTF) () vs TIME (ms)
0.2
0.175
0.15
0.125
0.1
0.075
0.05
0.025
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.20
Tmax: 57.0 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


Pass. nij (NTE) () vs TIME (ms)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.36
Tmax: 95.6 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

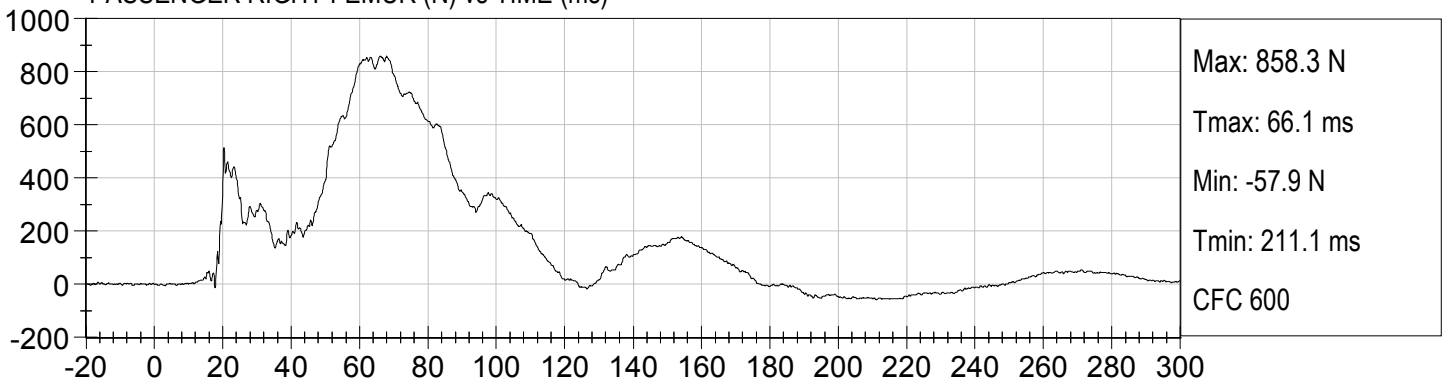

Pass. nij (NCF) () vs TIME (ms)
0.175
0.15
0.125
0.1
0.075
0.05
0.025
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.15
Tmax: 156.8 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600


Pass. nij (NCE) () vs TIME (ms)
0.5
0.4
0.3
0.2
0.1
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.41
Tmax: 91.3 ms
Min: 0.00
Tmin: 0.0 ms
CFC 600

PASSENGER LEFT FEMUR (N) vs TIME (ms)



PASSENGER RIGHT FEMUR (N) vs TIME (ms)



APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

Hybrid III, 50th External Measurements
SN: 351

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

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

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

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

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

Jessica Hall
Laboratory Technician

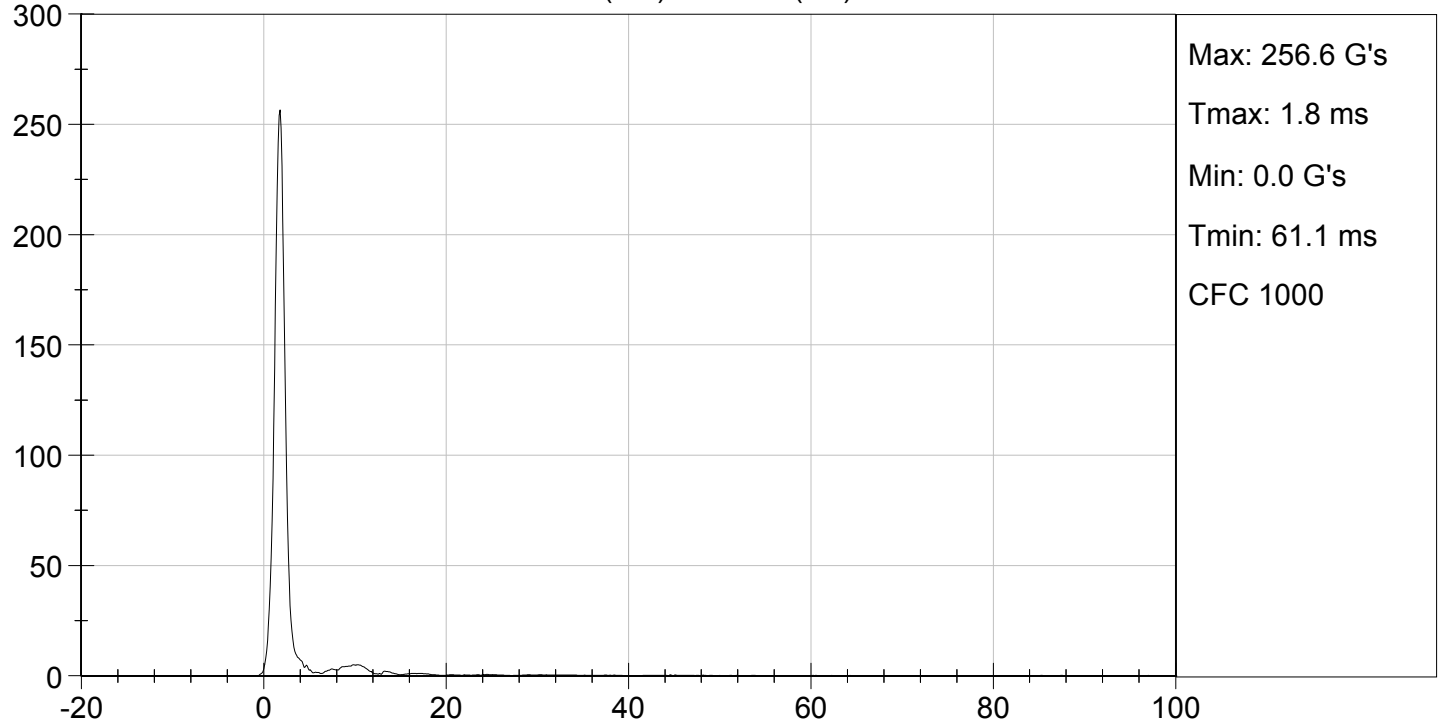
04/10/2013
Test Date

David Winkelbauer
Approved By

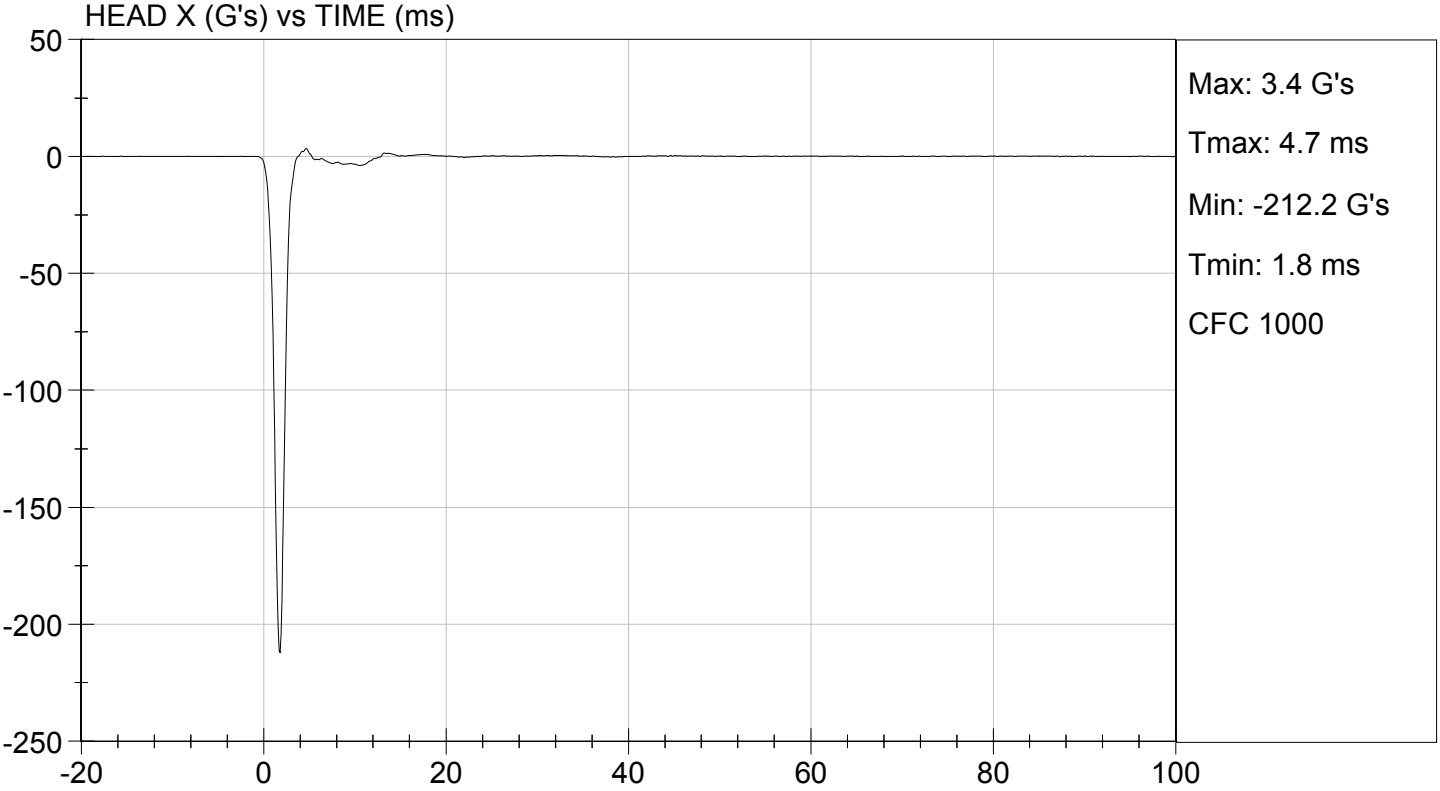
TEST DESC: HEAD DROP

TEST DATE: 04/10/2013
TEST #: D131251

HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)



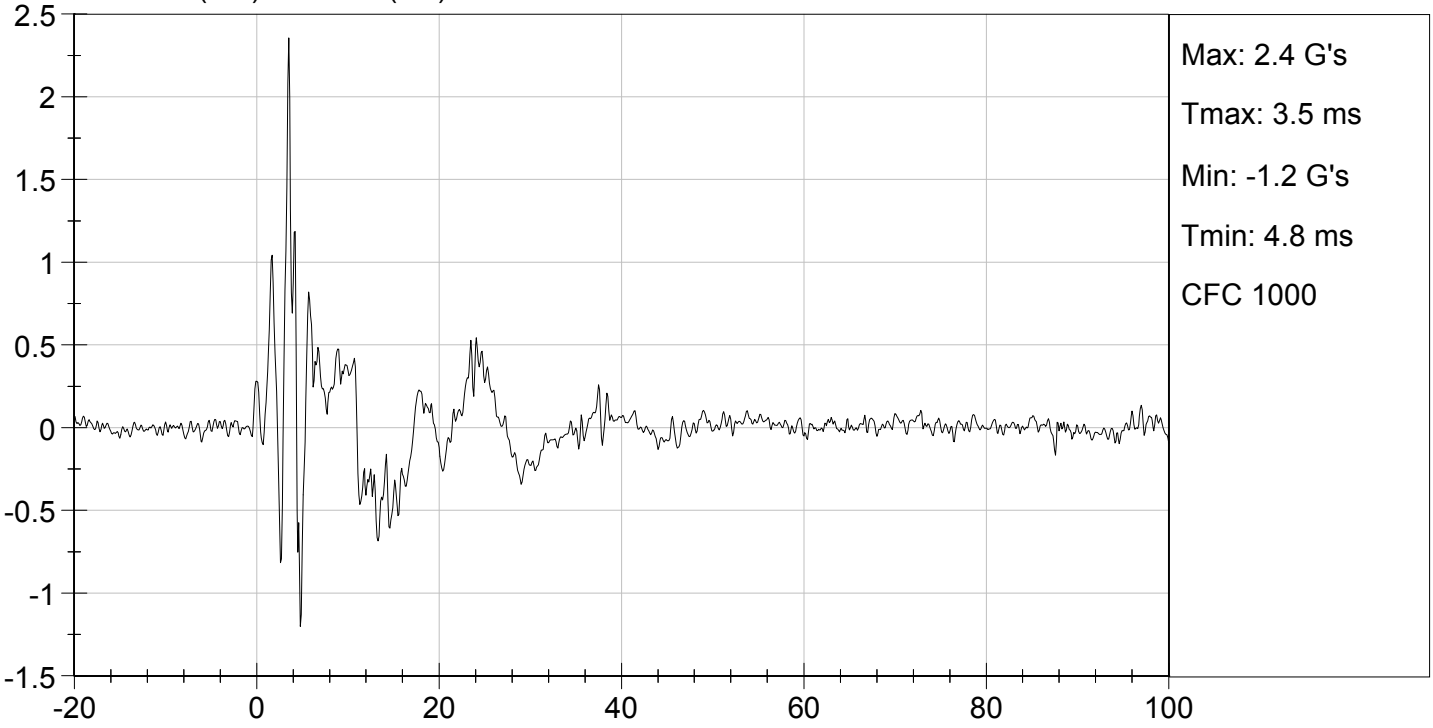
HEAD X (G's) vs TIME (ms)



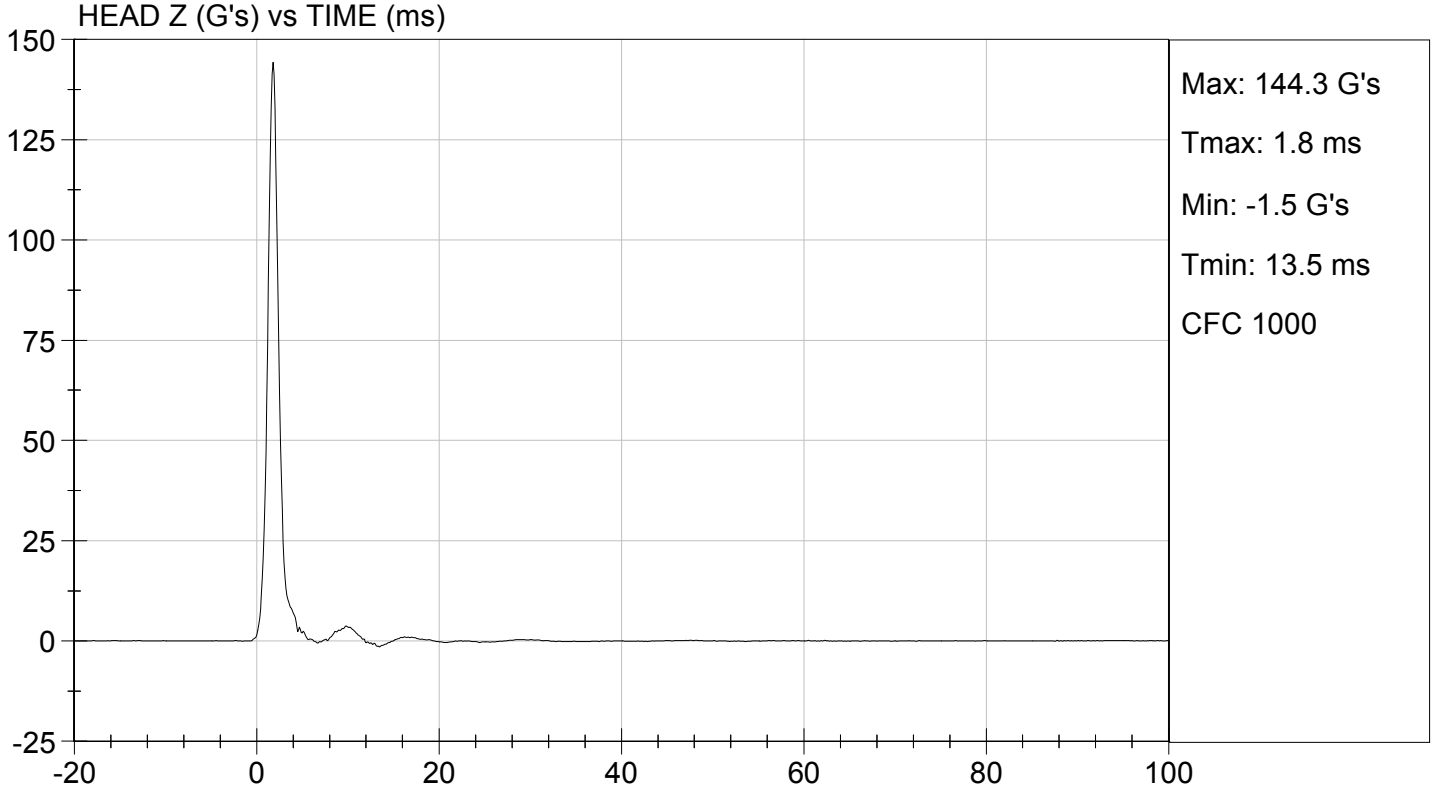
TEST DESC: HEAD DROP

TEST DATE: 04/10/2013
TEST #: D131251

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



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



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

Jessica Hall
Laboratory Technician

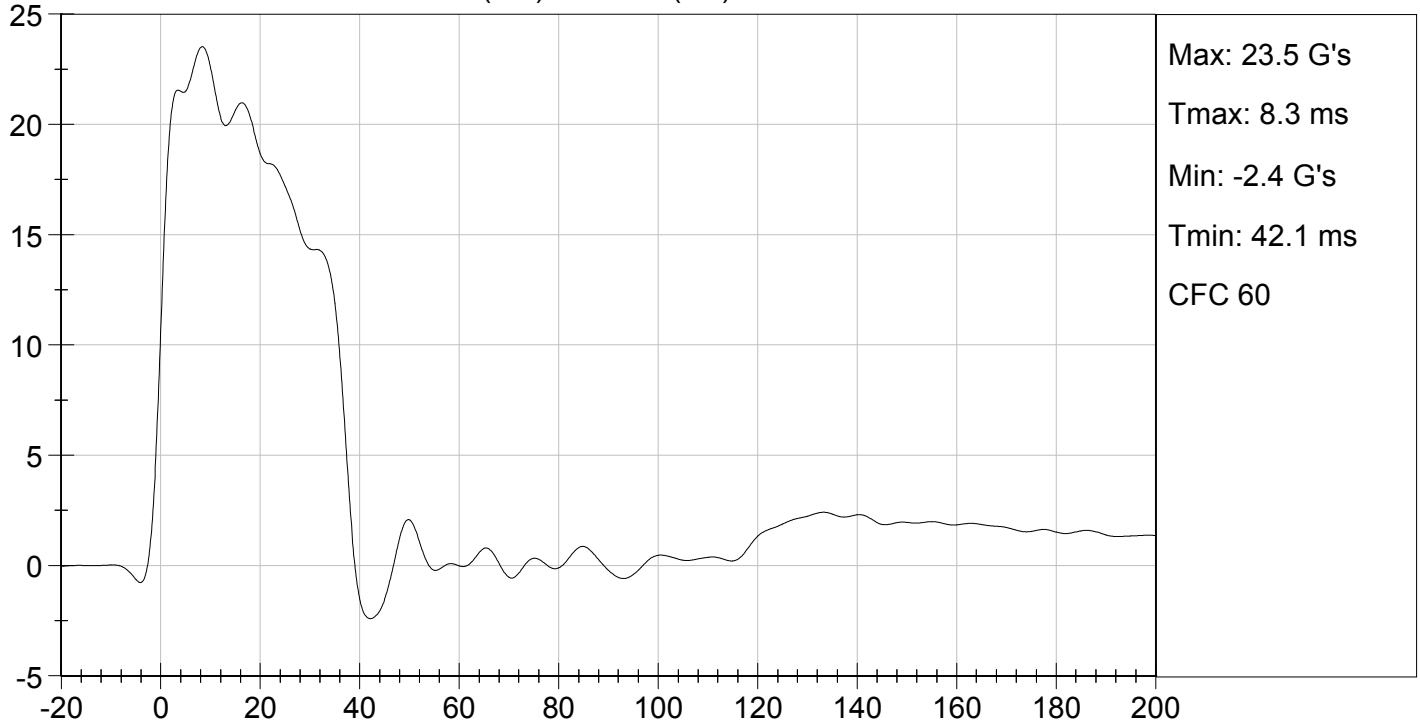
04/11/2013
Test Date

David Winkelbauer
Approved By

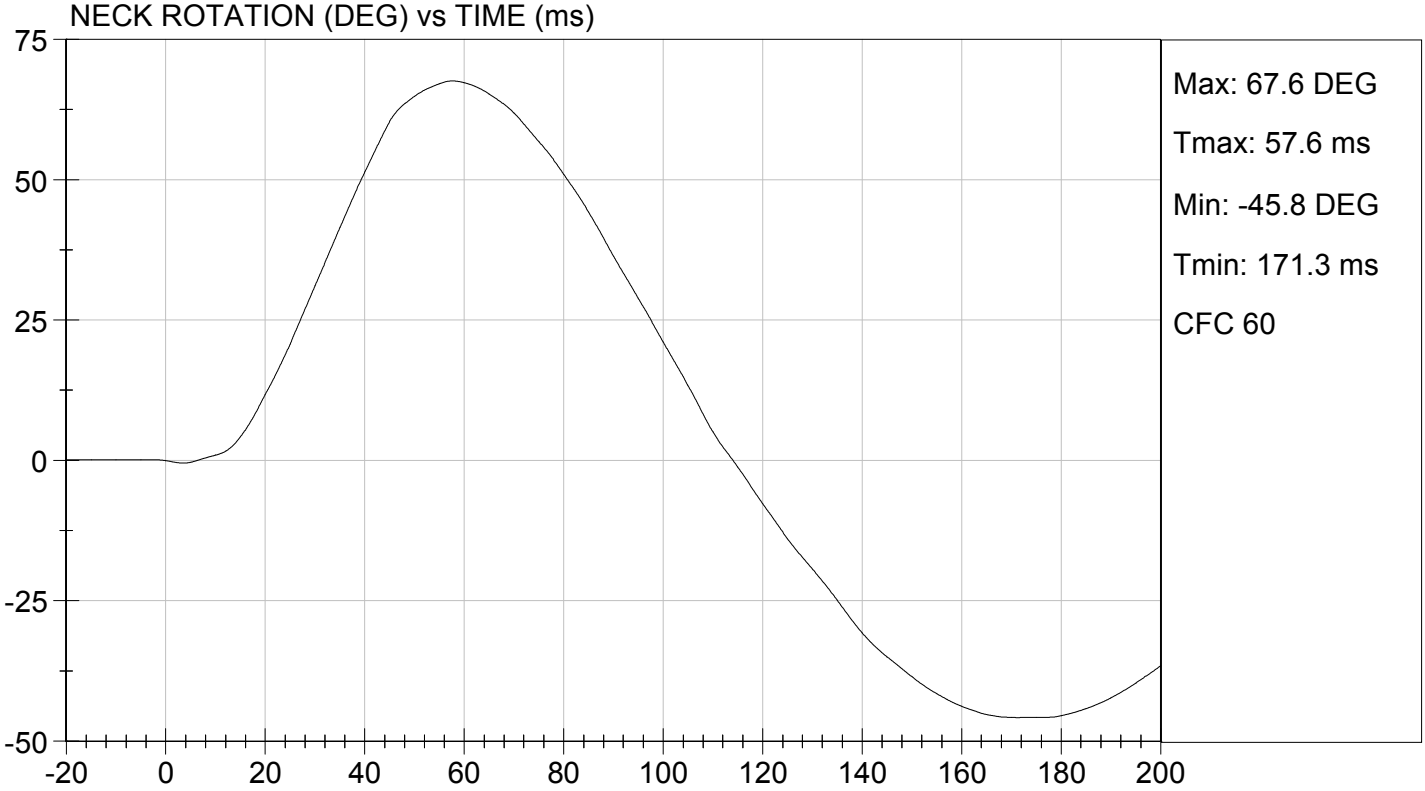
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

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

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



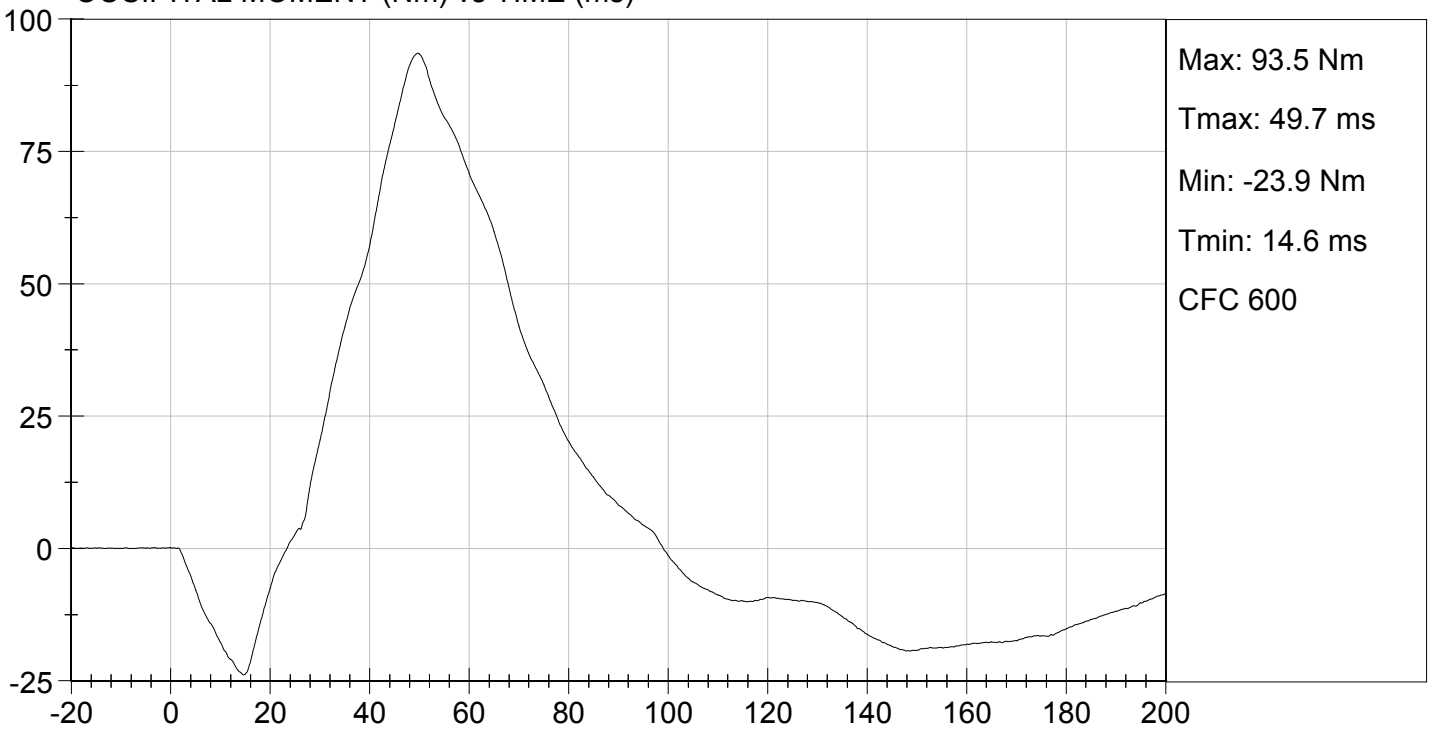
NECK ROTATION (DEG) vs TIME (ms)



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

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

OCCIPITAL MOMENT (Nm) vs TIME (ms)



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

Jessica Hall
Laboratory Technician

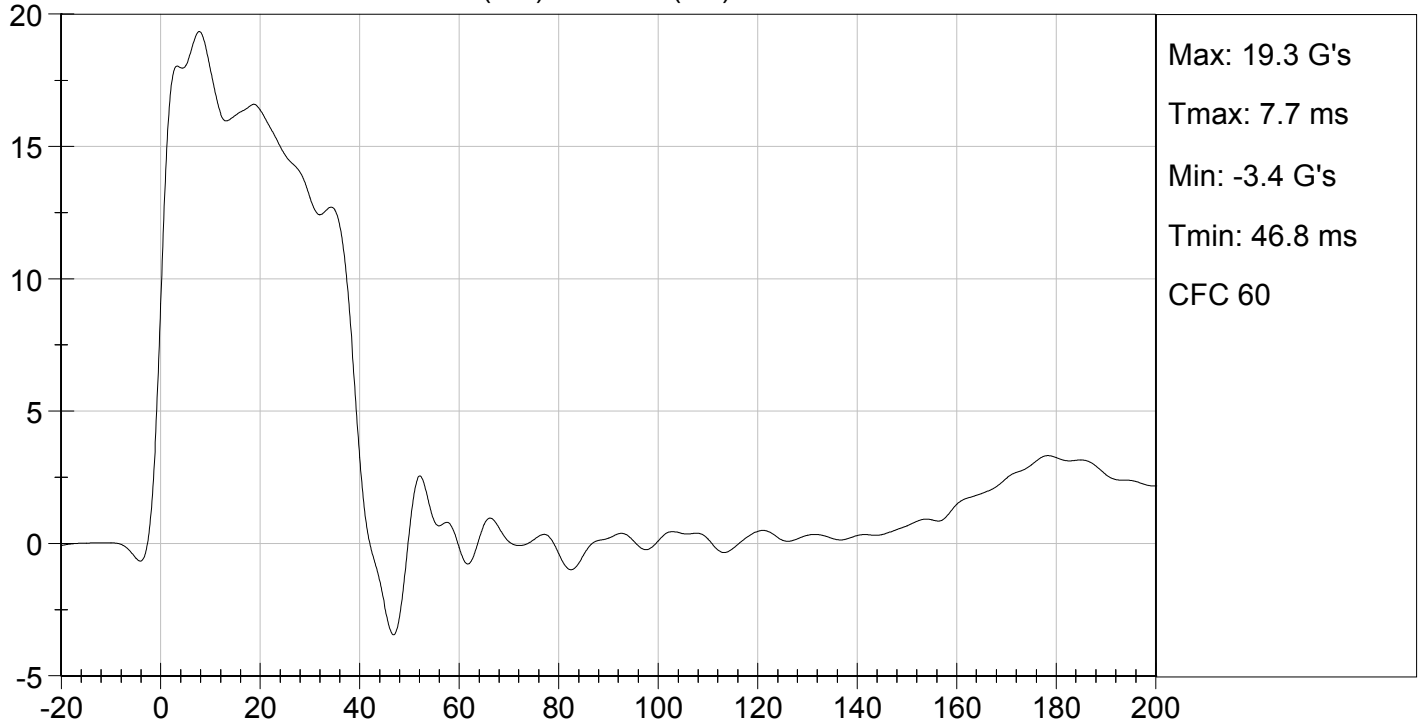
04/11/2013
Test Date

David Winkelbauer
Approved By

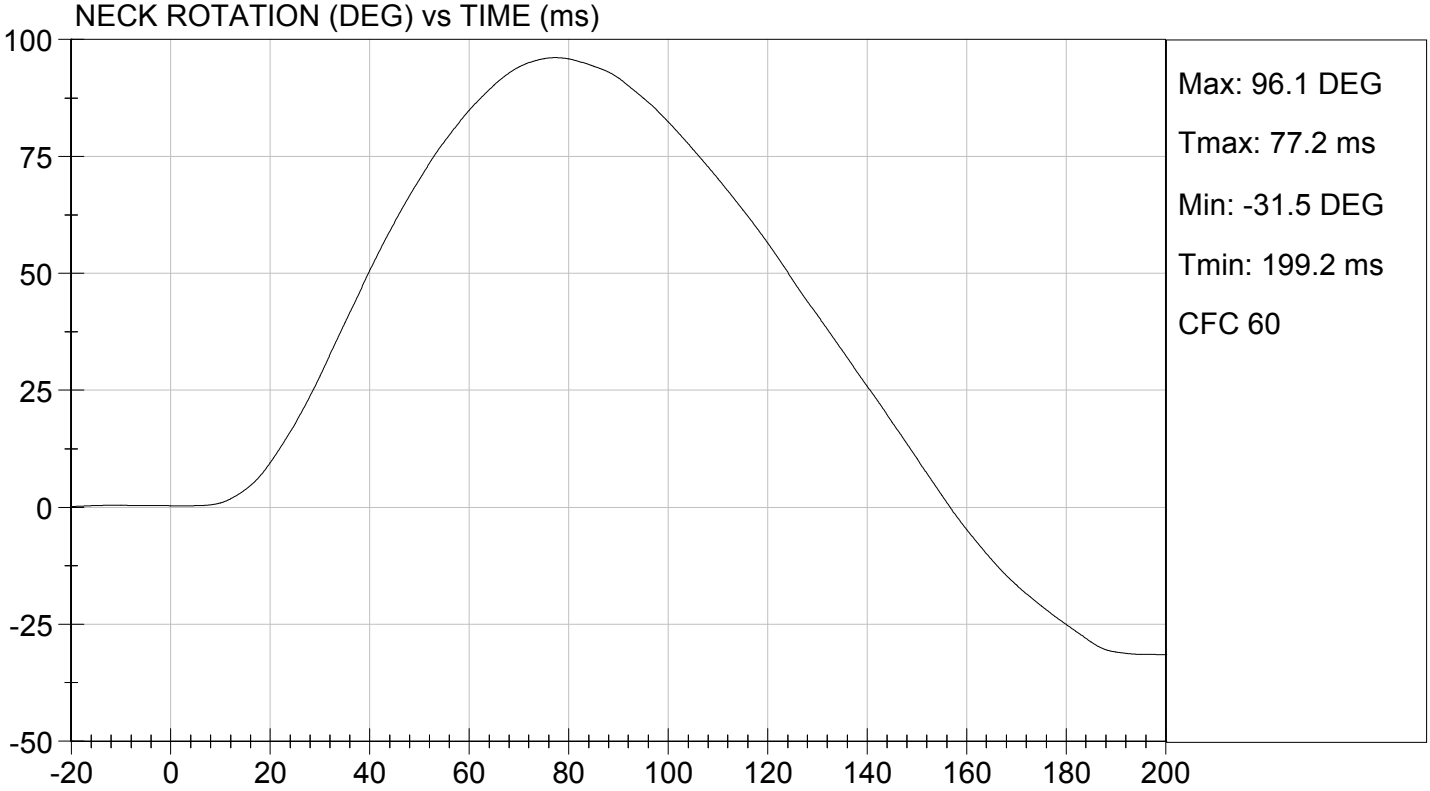
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

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

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

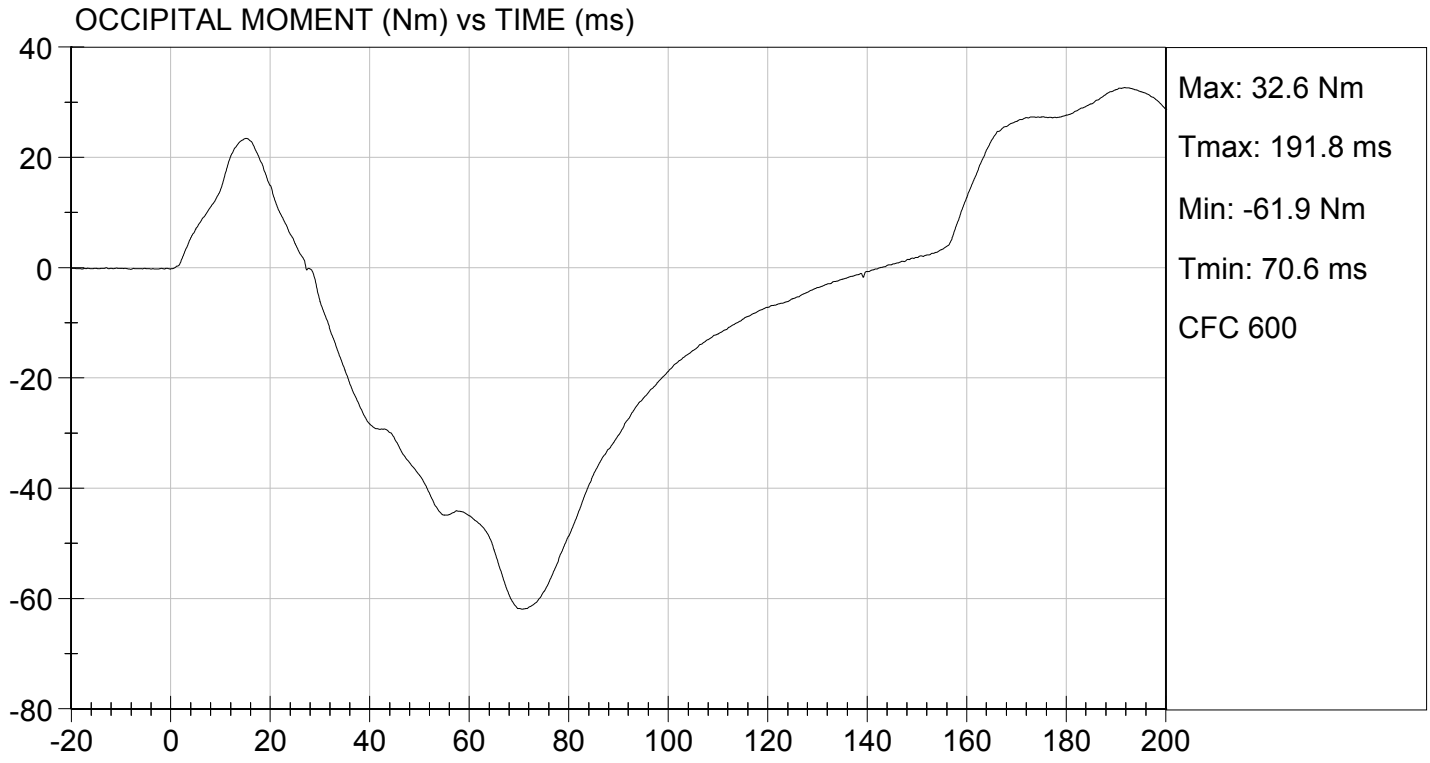


NECK ROTATION (DEG) vs TIME (ms)



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

Jessica Hall
Laboratory Technician

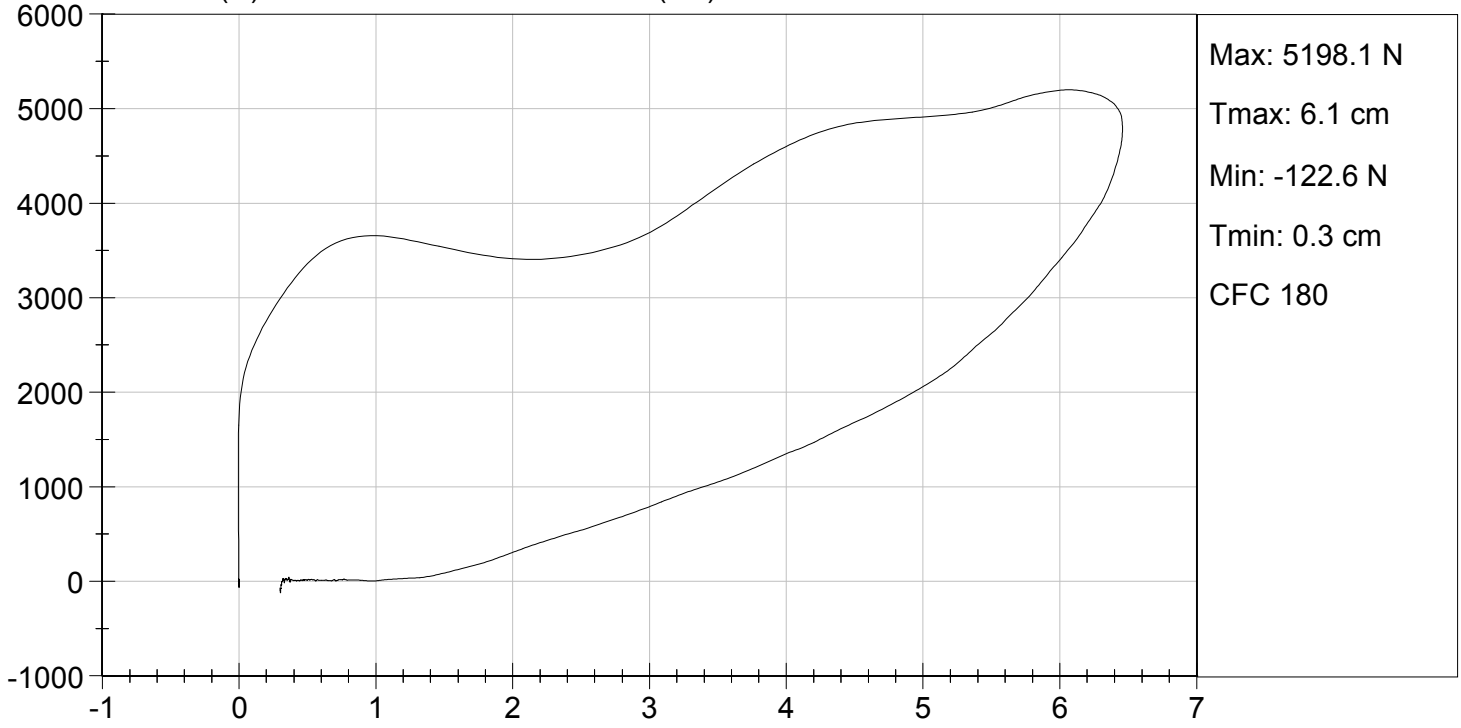
04/10/2013
Test Date

David Winkelbauer
Approved By

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

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

FORCE (N) vs CHEST DISPLACEMENT (cm)



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

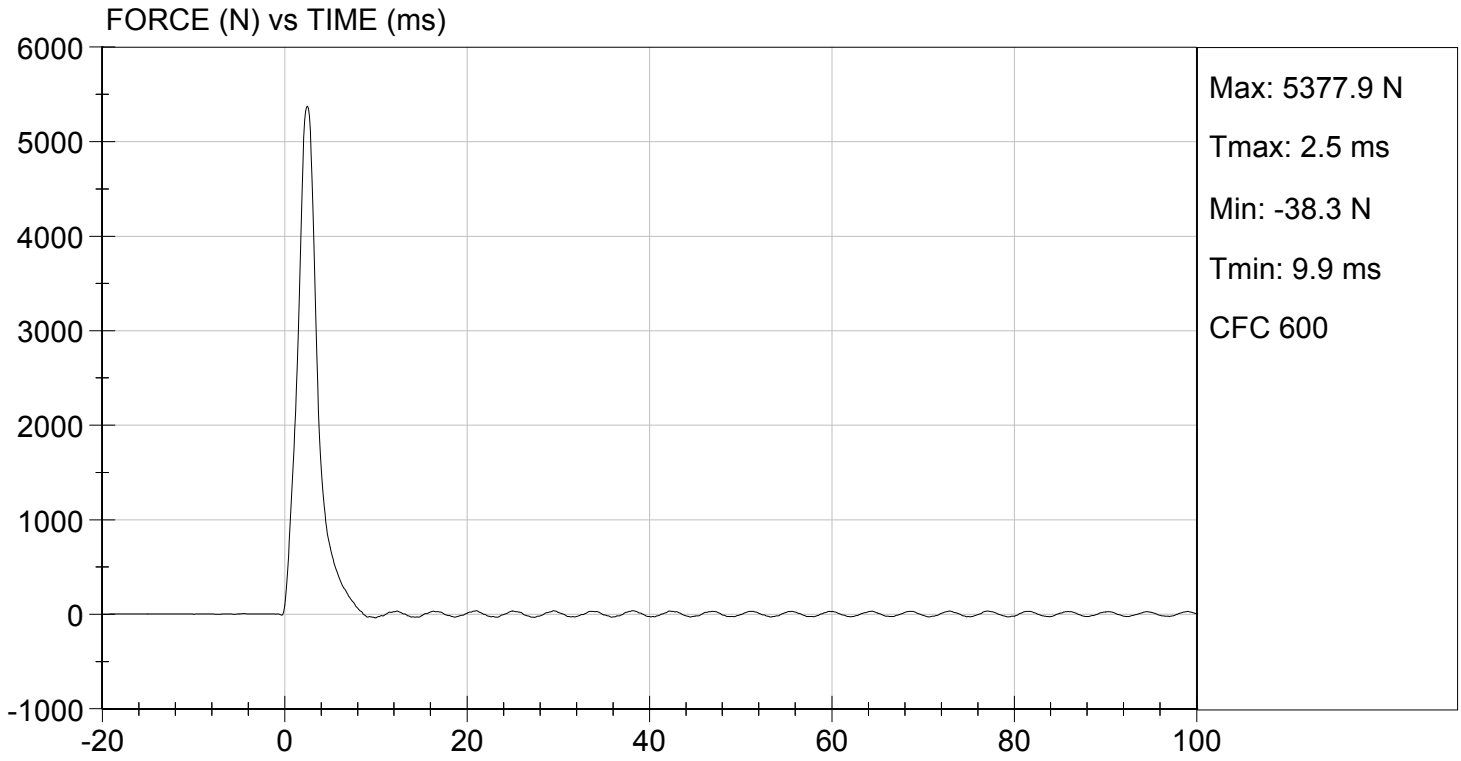
Jessica Gall
Laboratory Technician

04/10/2013
Test Date

David Winkelbauer
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

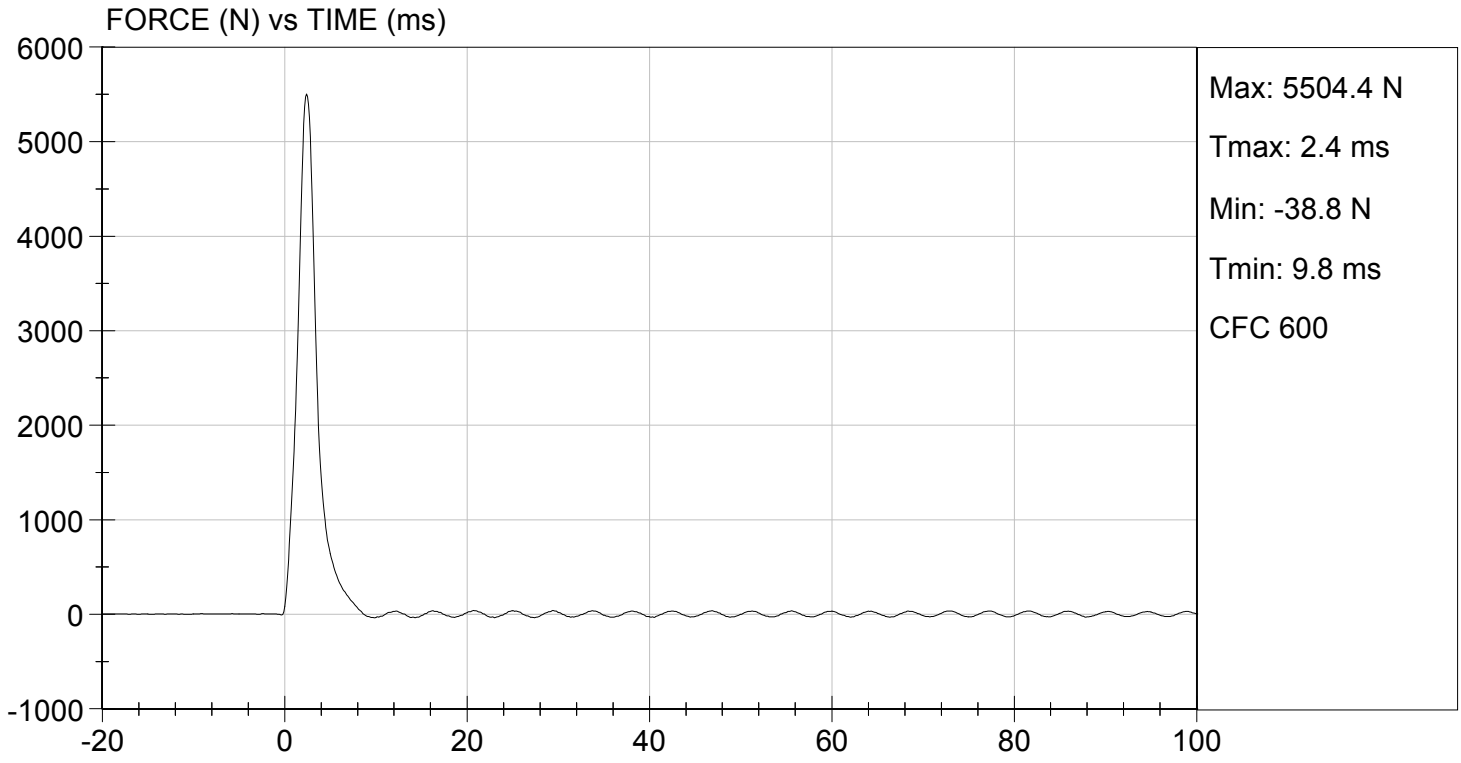
Jessica Gall
Laboratory Technician

04/10/2013
Test Date

David Winkelbauer
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

ATD Serial No: 351 **Test I.D:** D131250

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

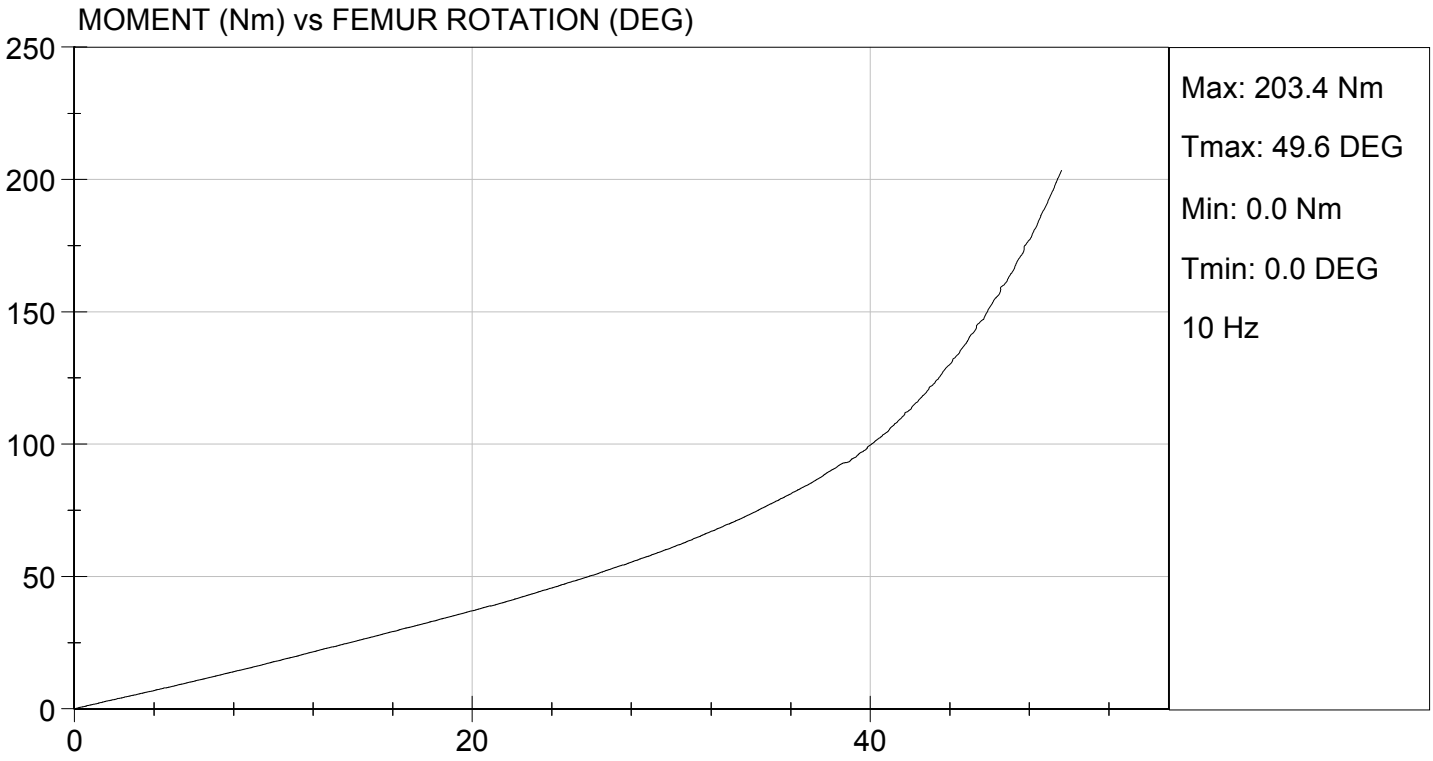
Jessica Hall
Laboratory Technician

04/10/2013
Test Date

David Winkelbauer
Approved By

TEST DESC: RIGHT HIP FEMUR FLEXION

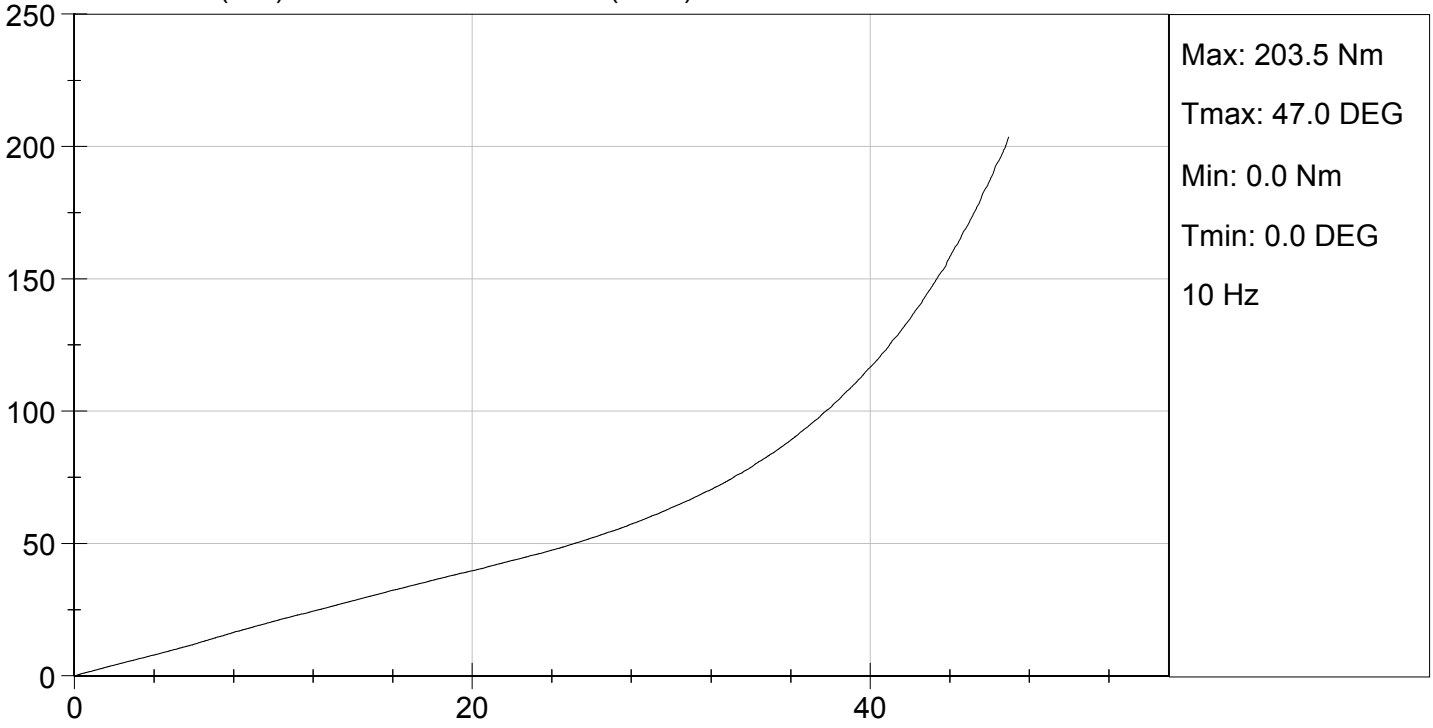
TEST DATE: 04/10/2013
TEST #: D131259



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 04/10/2013
TEST #: D131250

MOMENT (Nm) vs FEMUR ROTATION (DEG)



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test ID:** D131341

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	35	Pass
Peak Resultant Acceleration	G's	225 to 275	270	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	1.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

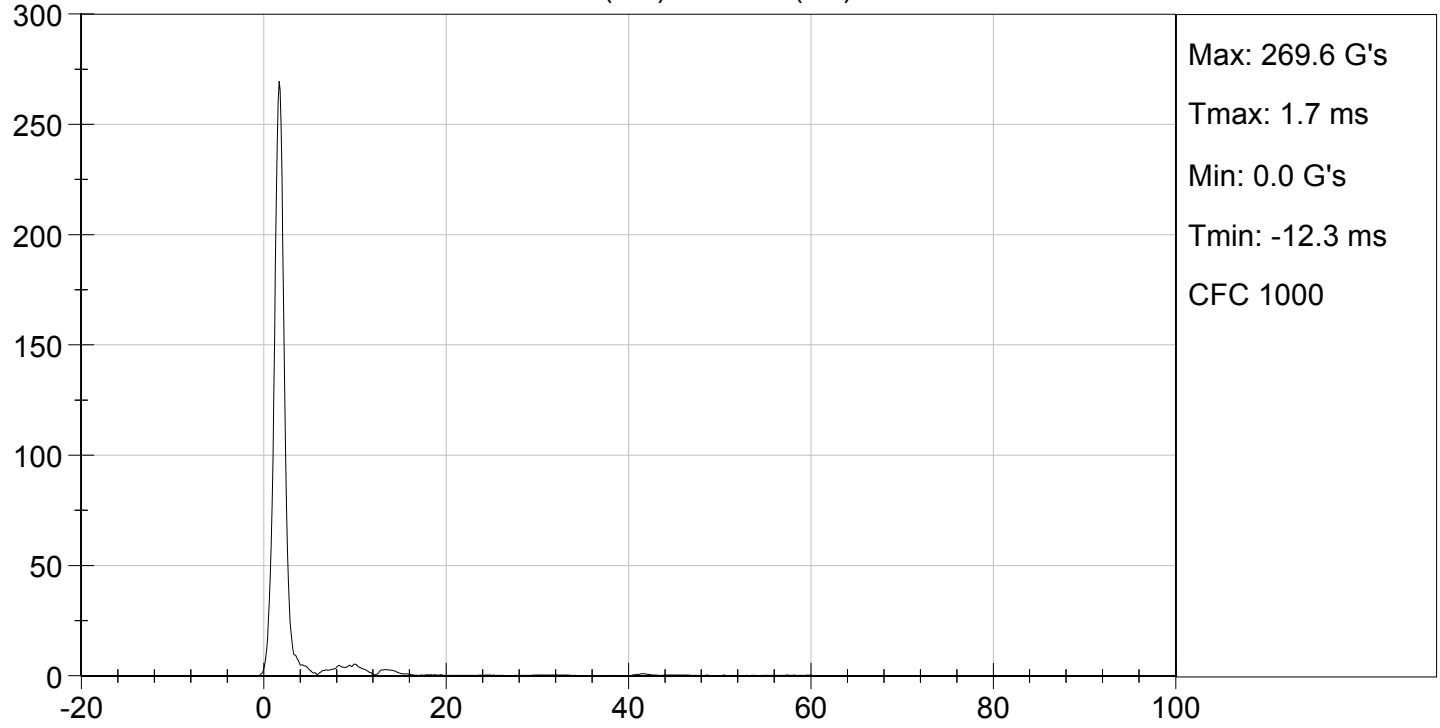
04/16/2013
Test Date

David Winkelbauer
Approved By

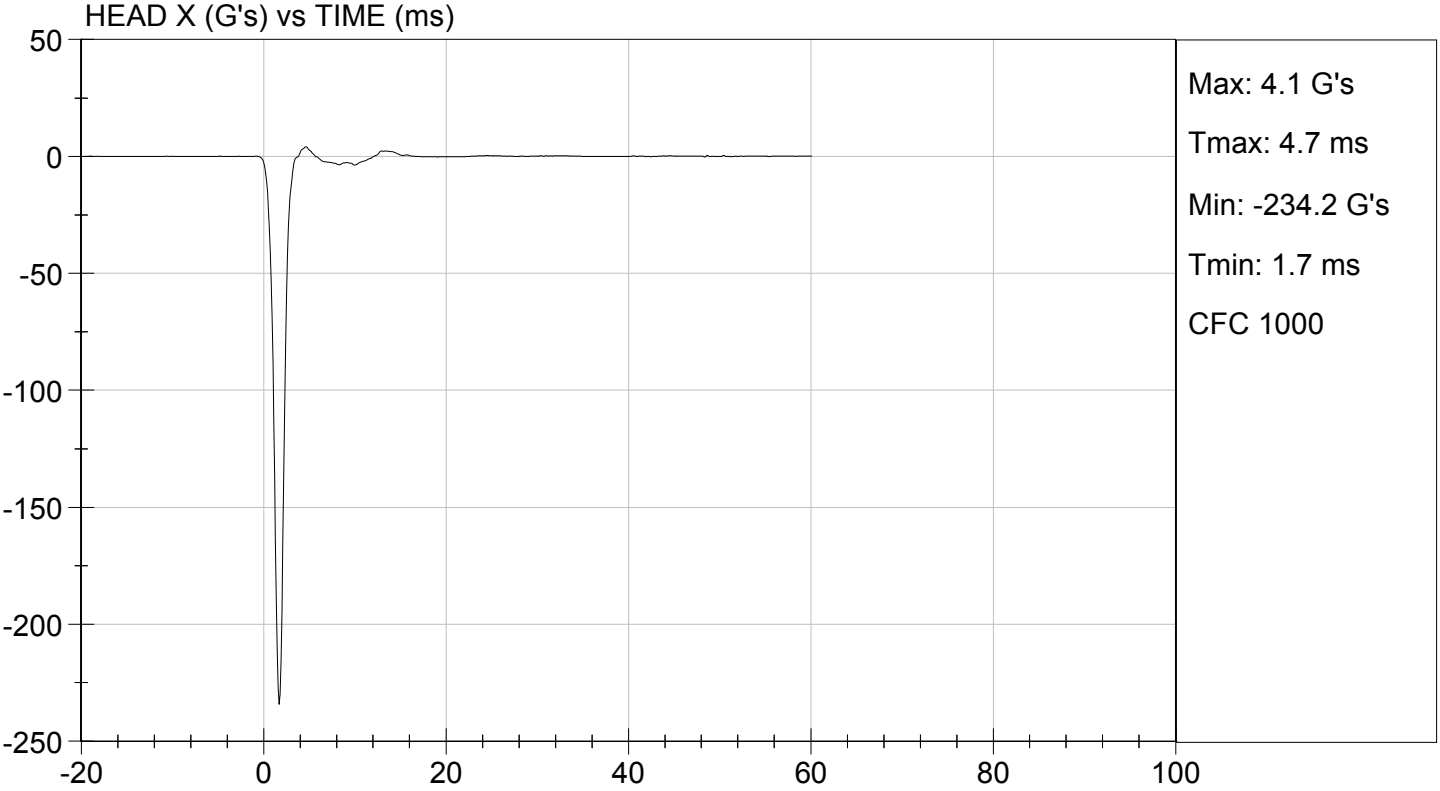
TEST DESC: HEAD DROP

TEST DATE: 04/16/2013
TEST #: D131341

HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)

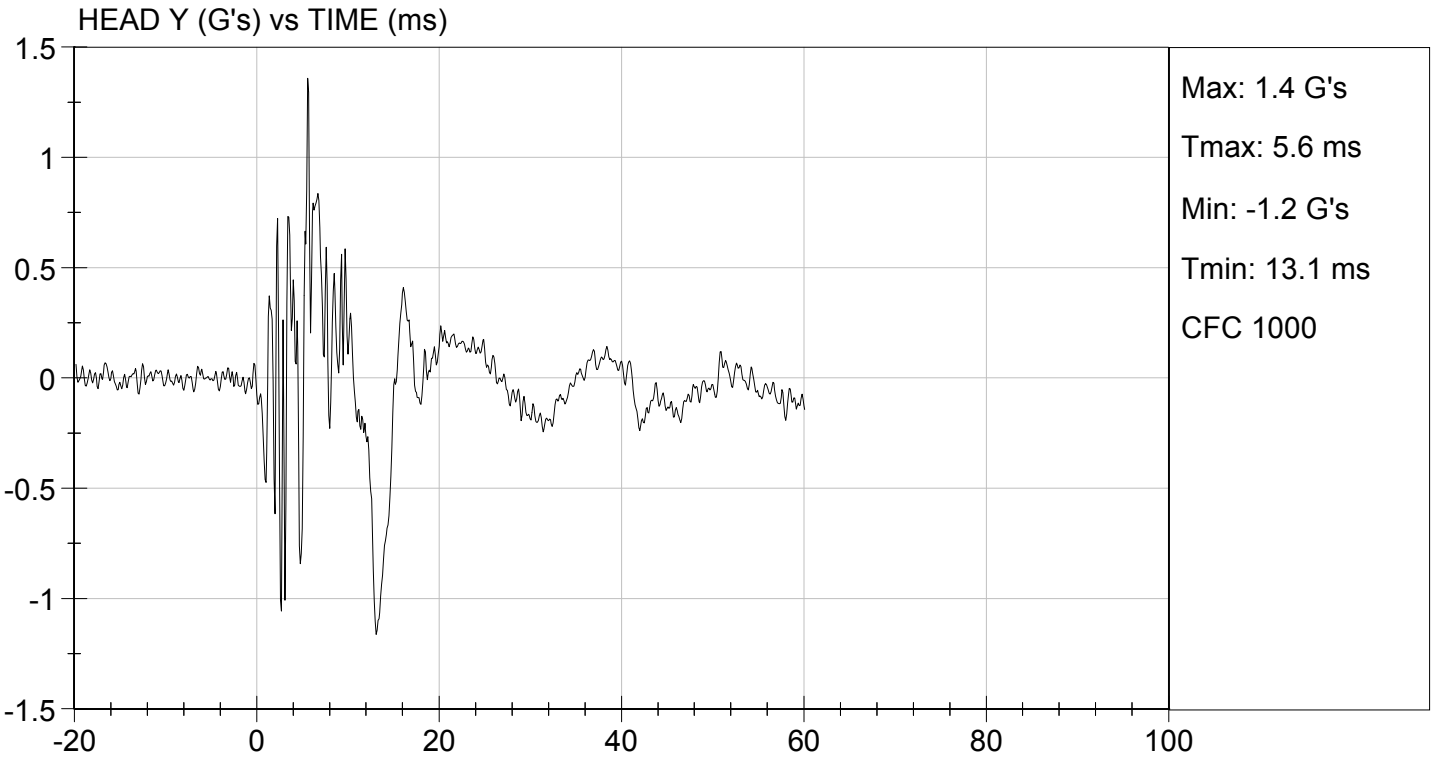


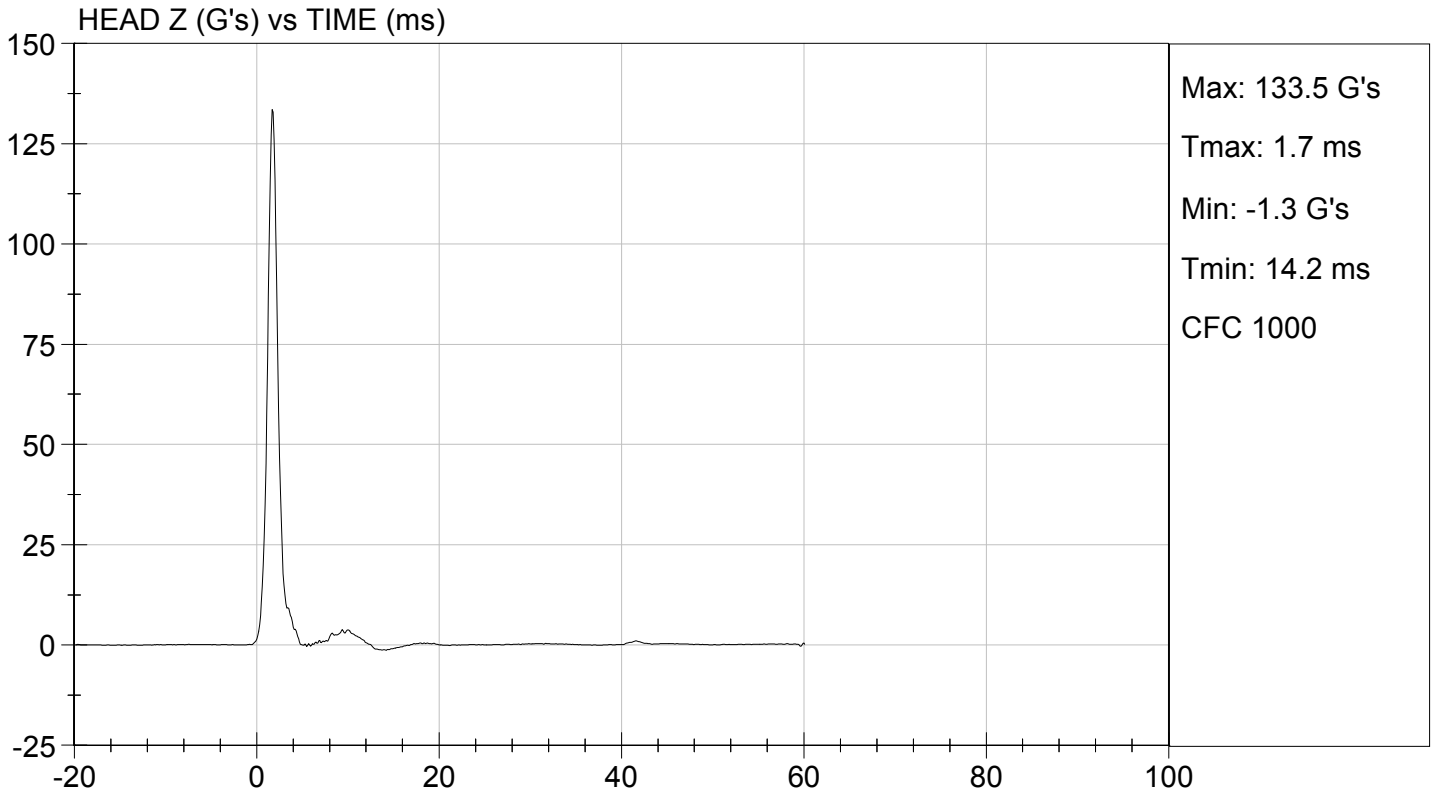
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 04/16/2013
TEST #: D131341





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D131342

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	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	24.00	Pass
	20 ms	G's	17.60 to 22.60	18.51	Pass
	30 ms	G's	12.50 to 18.50	14.61	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.6	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	36.3	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	66.5	Pass
	Time	ms	57.0 to 64.0	57.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.4	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	95.0	Pass
	Time	ms	47.0 to 58.0	48.4	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	97.2	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

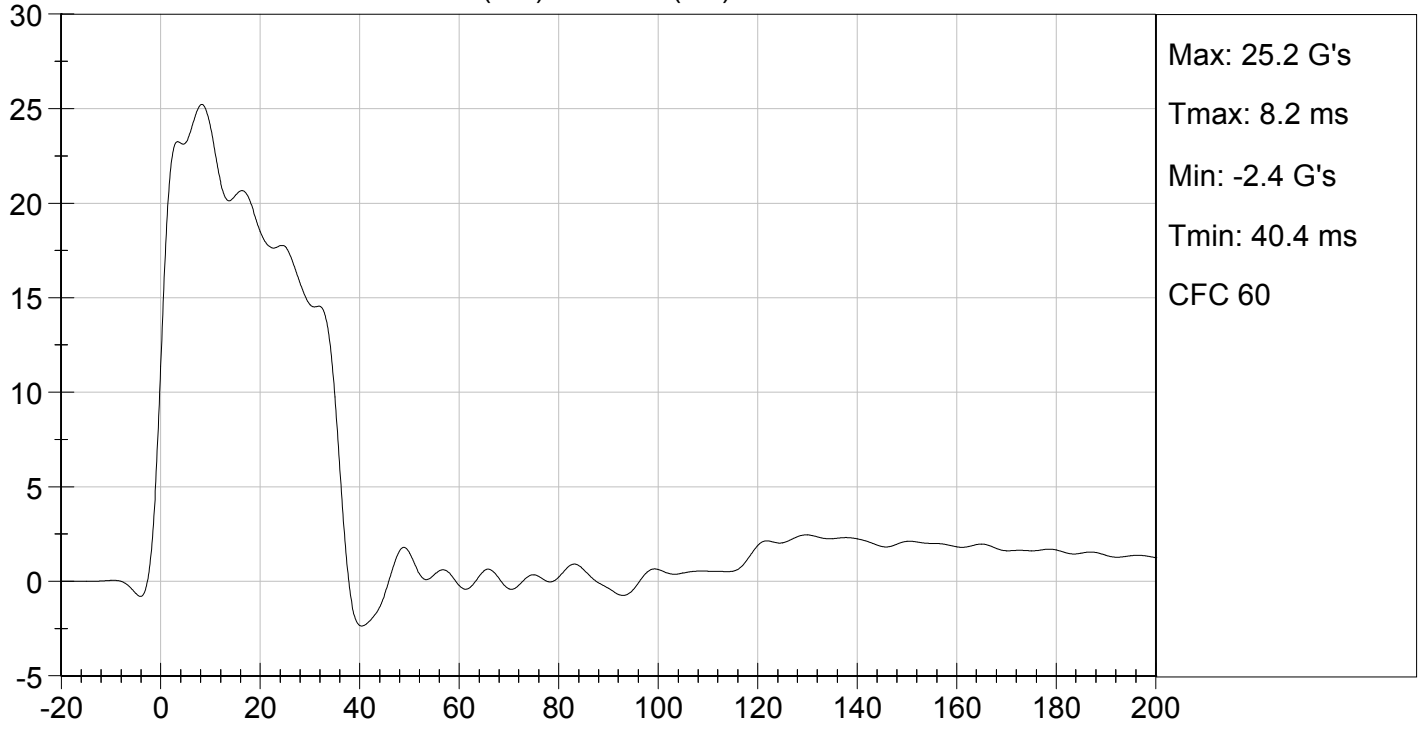
04/17/2013
Test Date

David Winkelbauer
Approved By

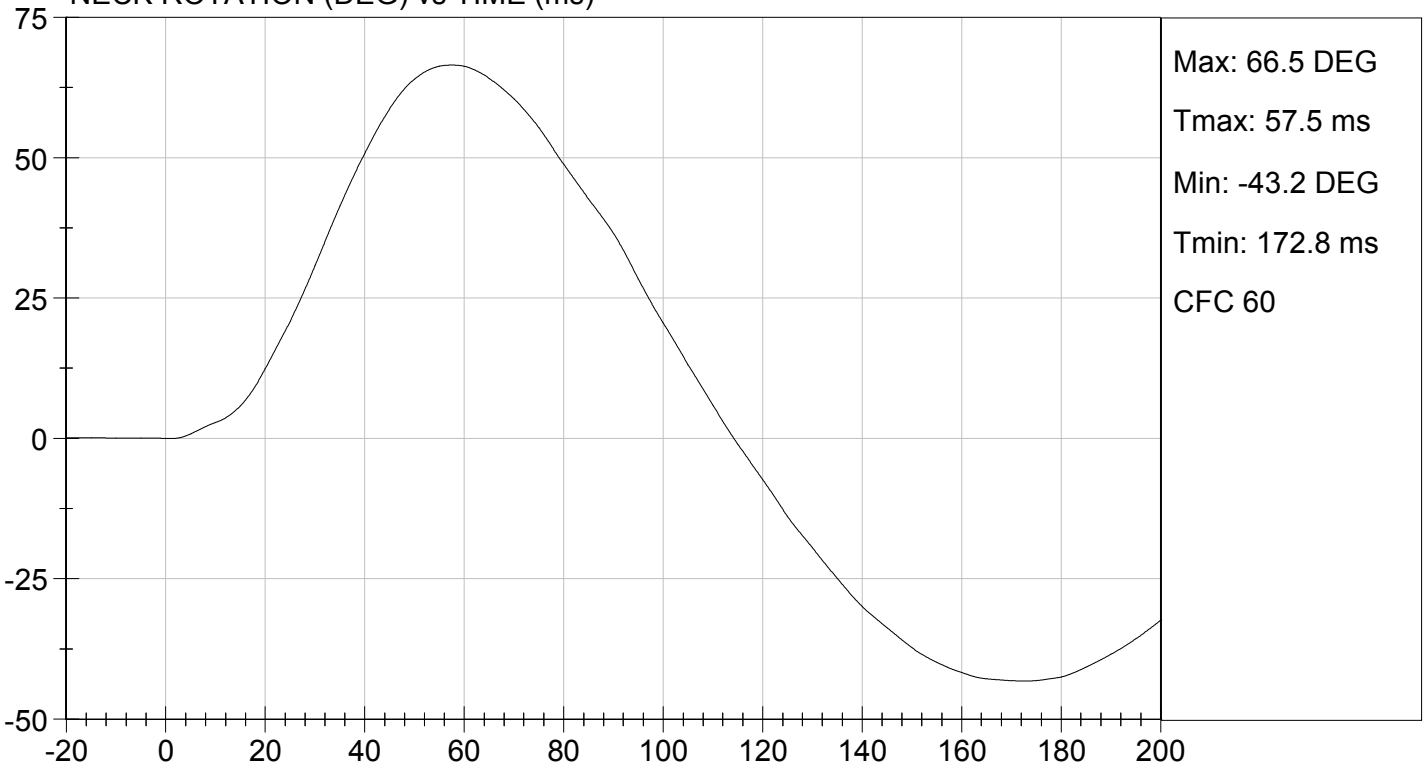
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 04/17/2013
TEST #: D131342

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

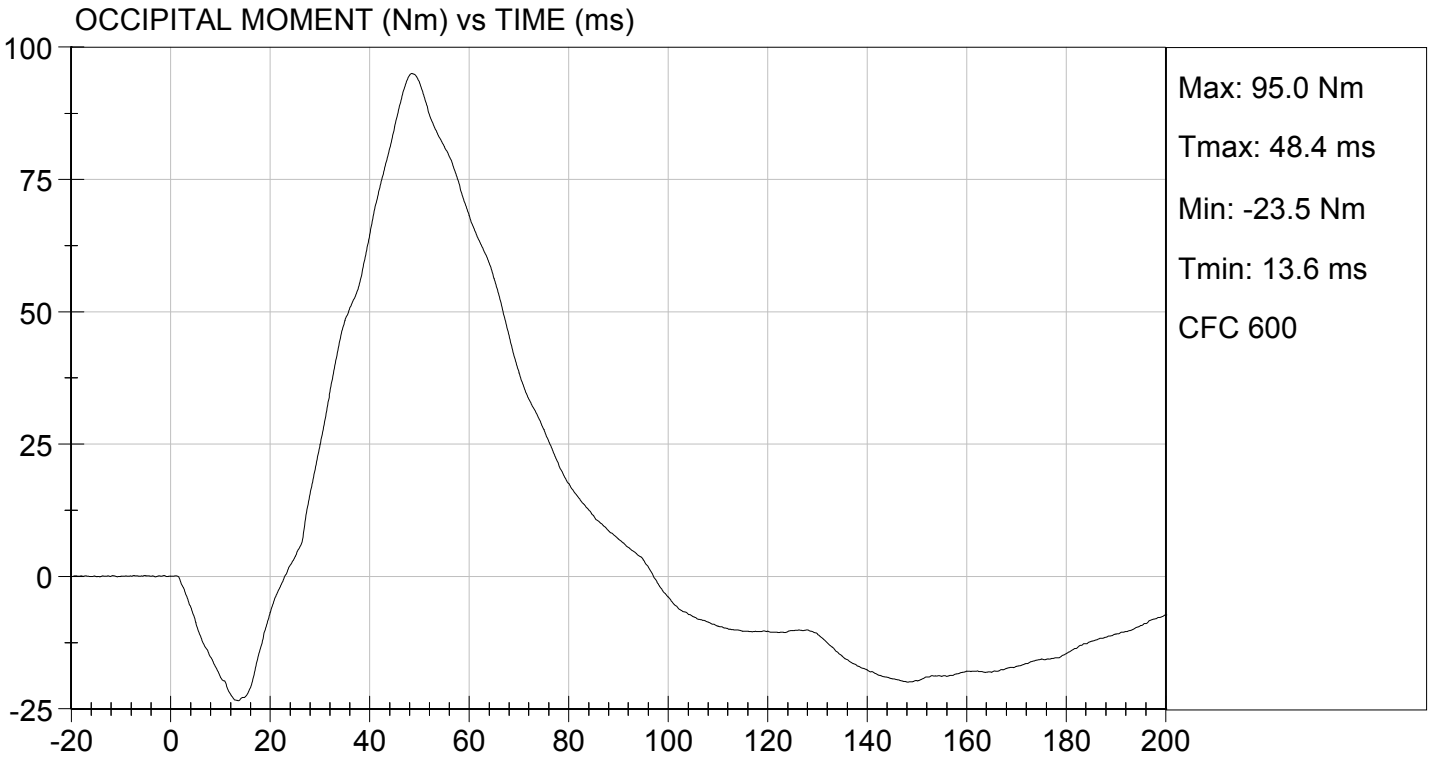


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 04/17/2013
TEST #: D131342



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D131343

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	30	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.46	Pass
	20 ms	G's	14.00 to 19.00	15.03	Pass
	30 ms	G's	11.00 to 16.00	11.28	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	11.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	45.8	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	91.4	Pass
	Time	ms	72.0 to 82.0	76.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	158.9	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-53.2	Pass
	Time	ms	65.0 to 79.0	74.3	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.9	Pass
			Overall Test Results		Pass

Jessica Gall
Laboratory Technician

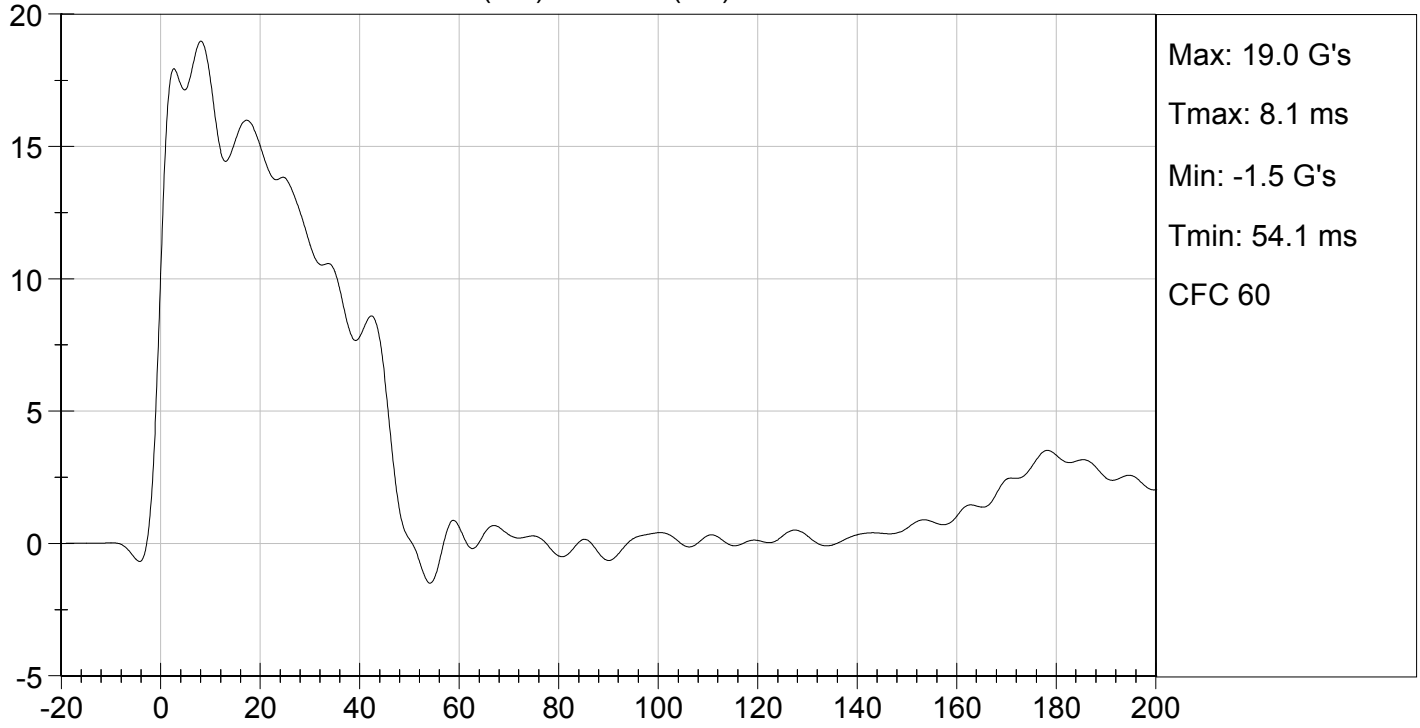
04/17/2013
Test Date

David Winkelbauer
Approved By

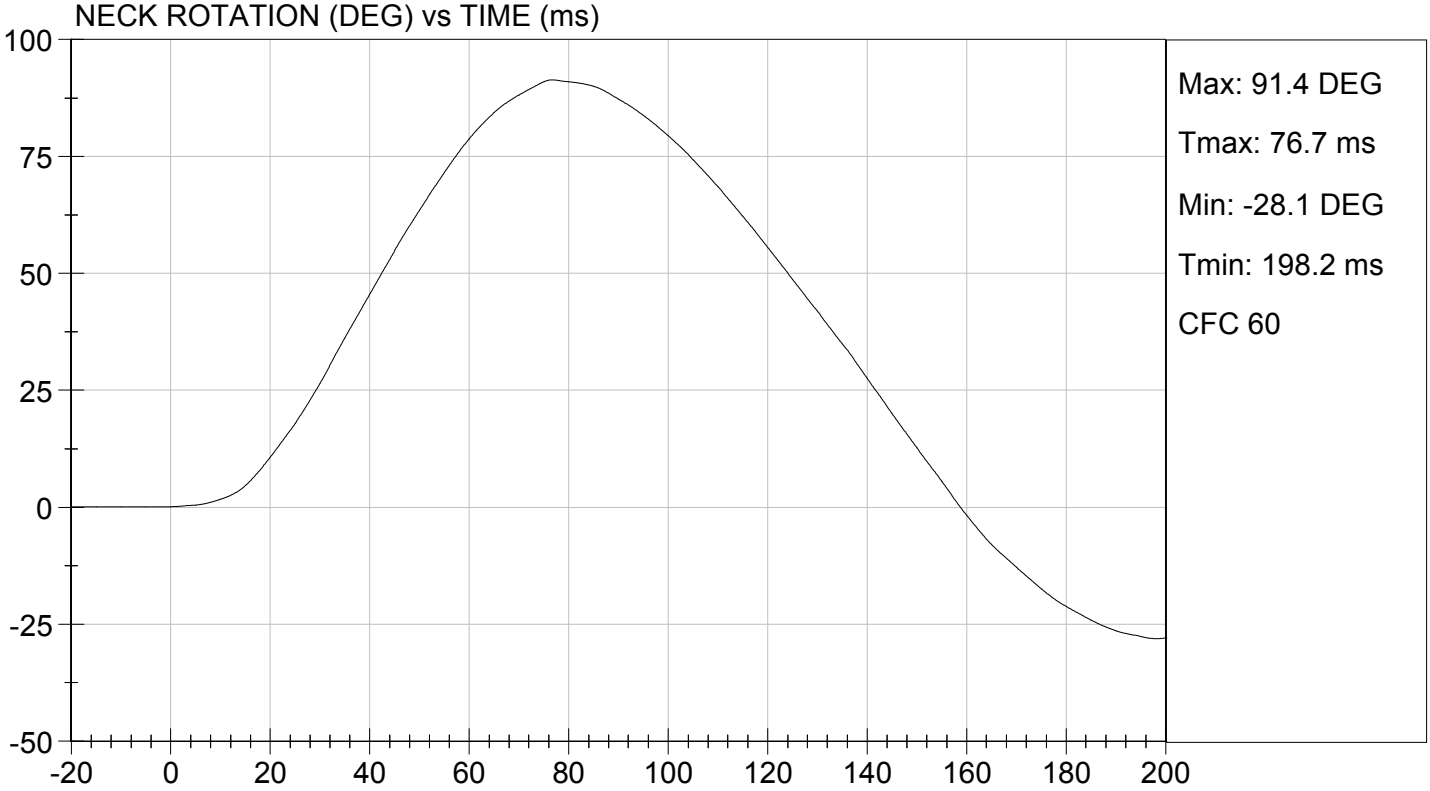
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 04/17/2013
TEST #: D131343

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

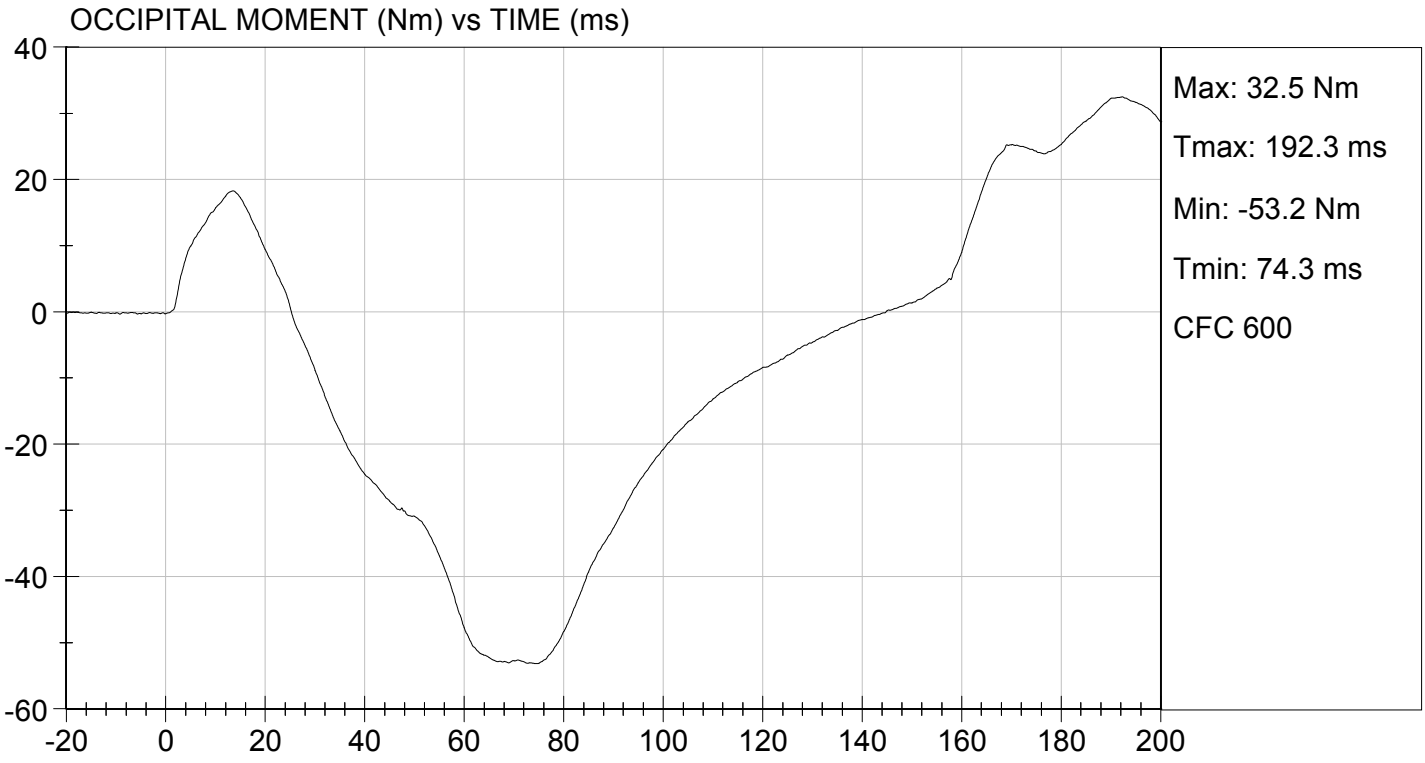


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 04/17/2013
TEST #: D131343



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D131344

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	32	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,174	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.57	Pass
Internal Hysteresis	%	69 to 85	70	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

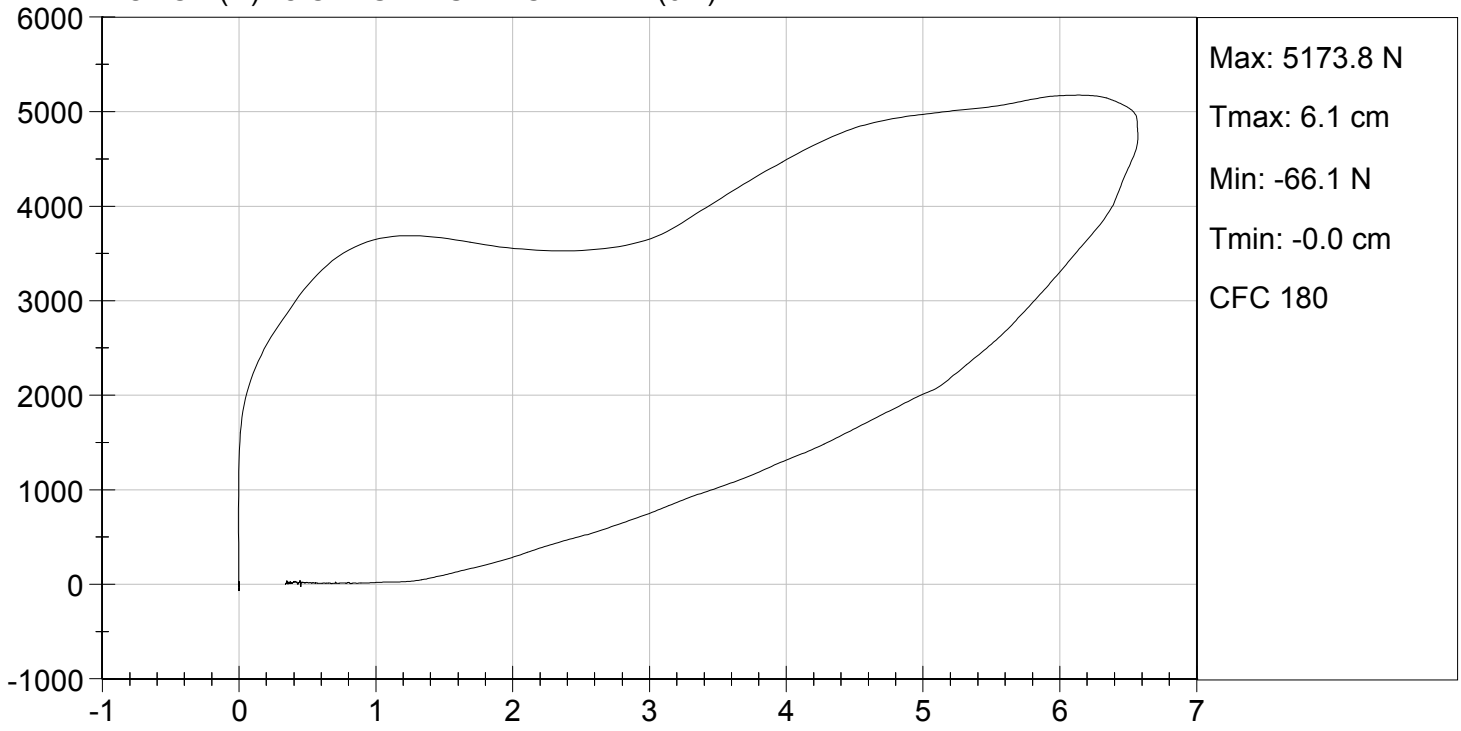
04/16/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 04/16/2013
TEST #: D131344

FORCE (N) vs CHEST DISPLACEMENT (cm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D131345

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	35	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,357	Pass
		Overall Test Results		Pass

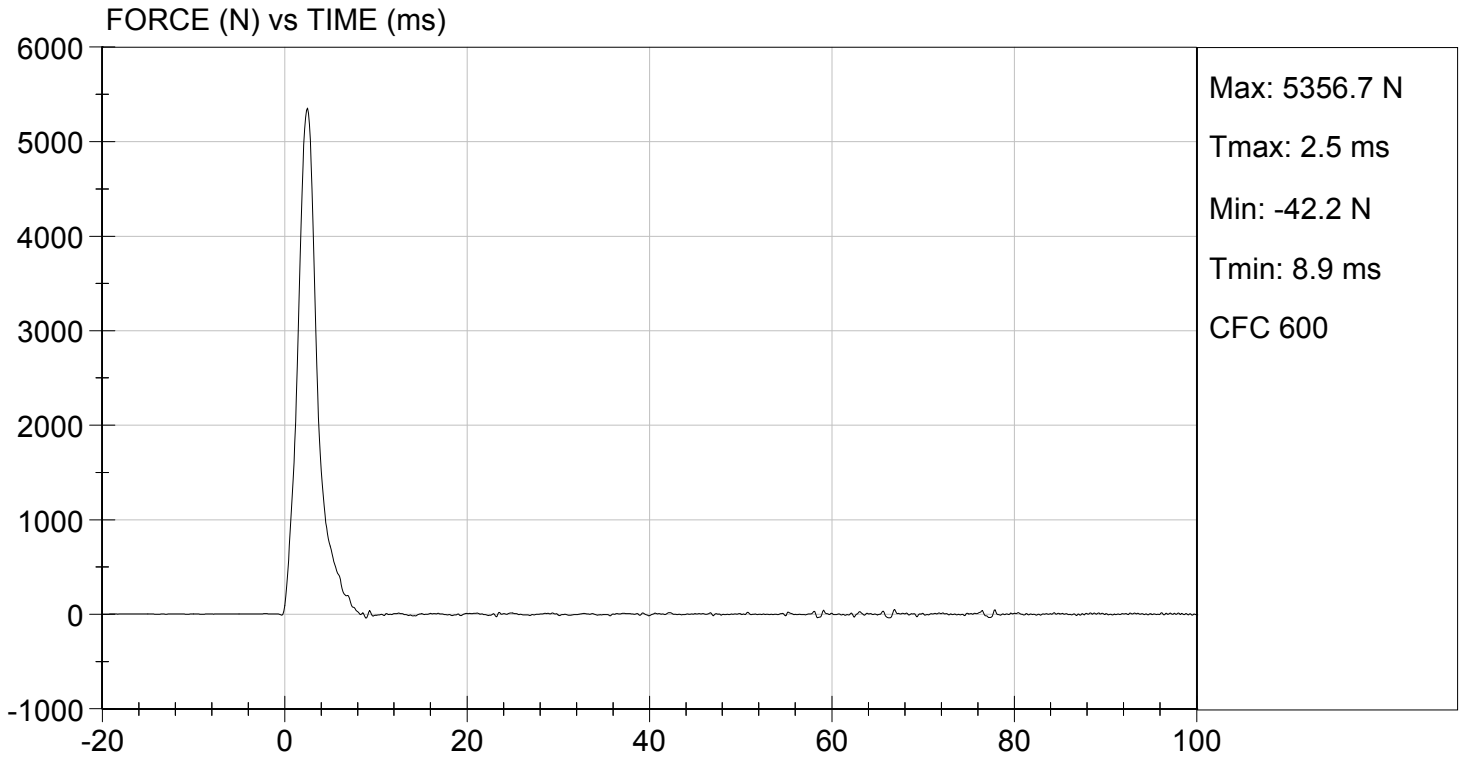
Jessica Gall
Laboratory Technician

04/16/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 04/16/2013
TEST #: D131345



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D131346

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	35	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,096	Pass
		Overall Test Results		Pass

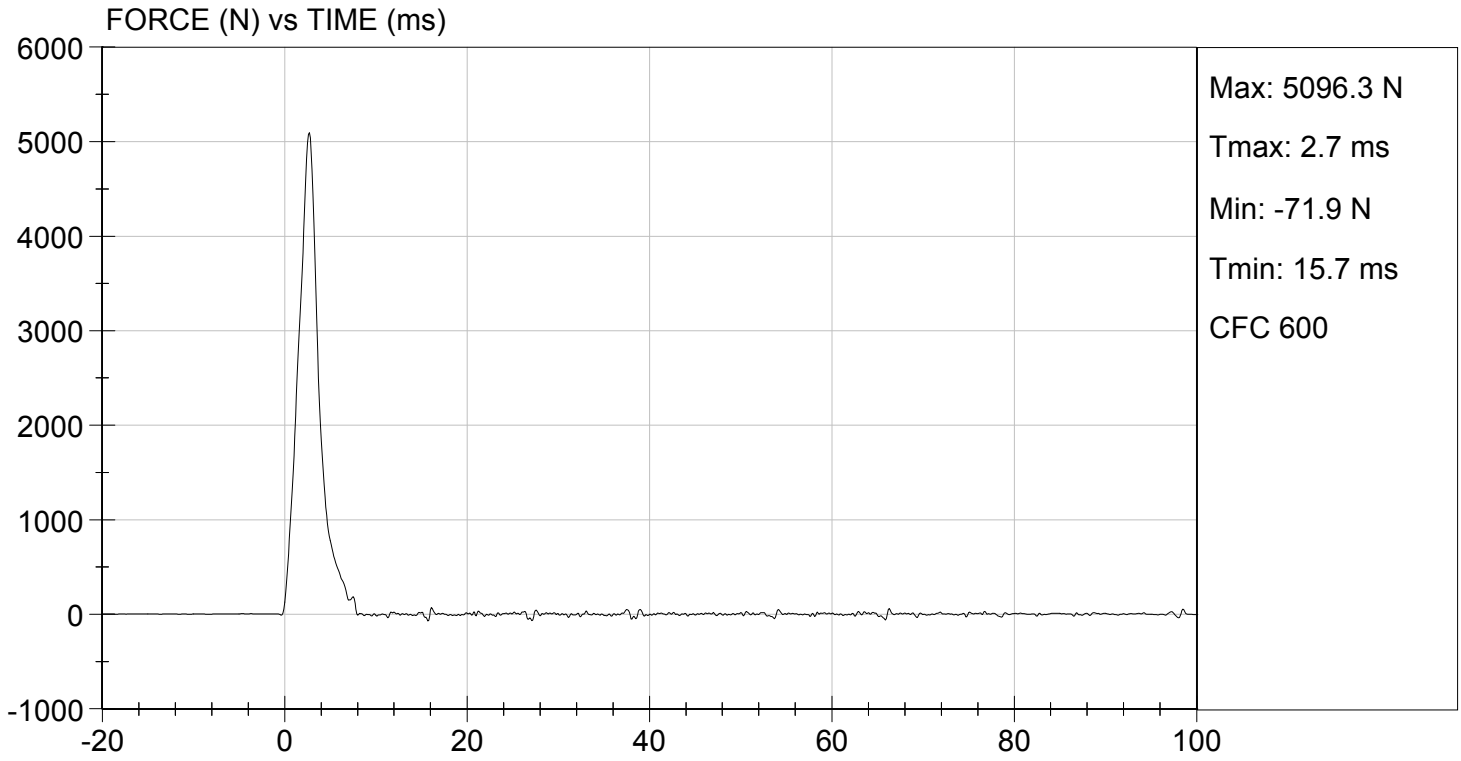
Jessica Gall
Laboratory Technician

04/16/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 04/16/2013
TEST #: D131346



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

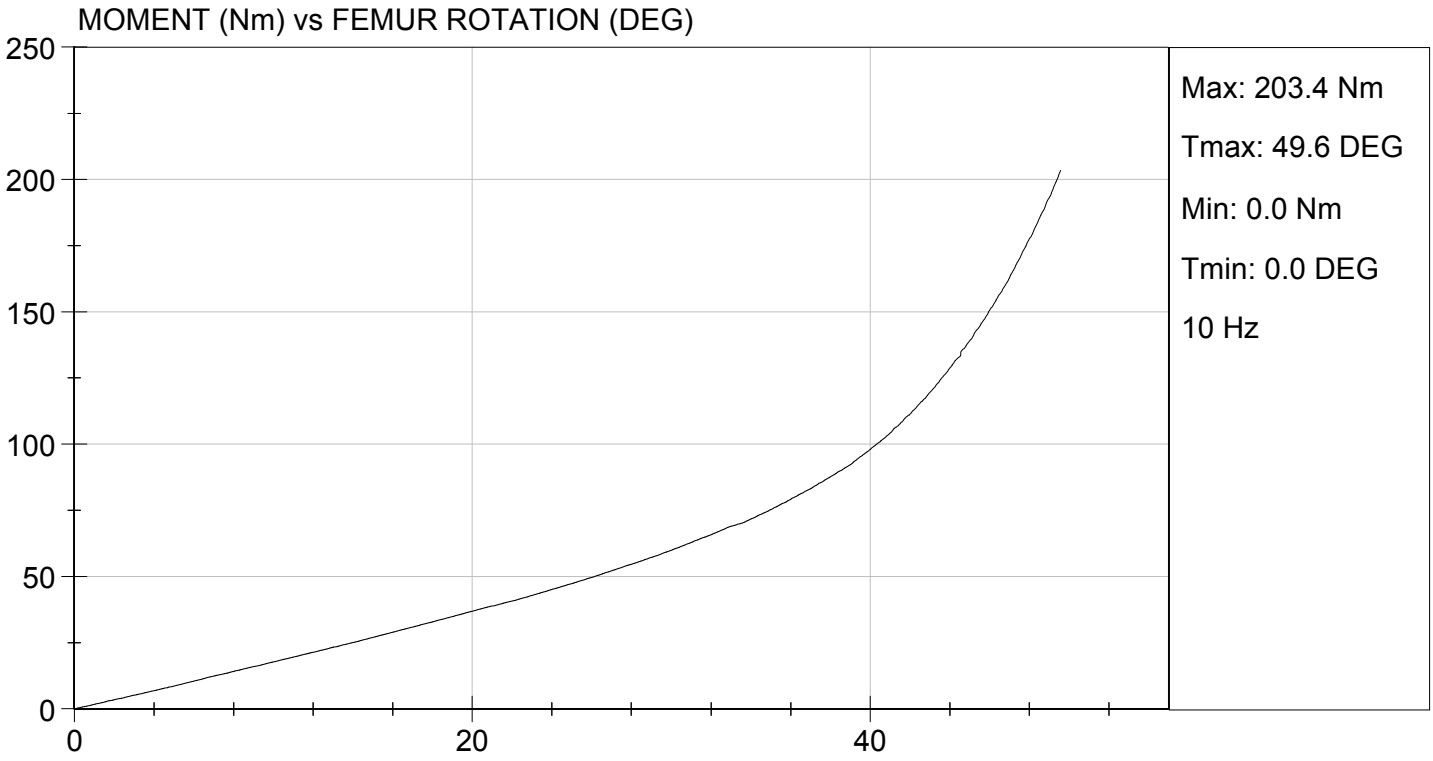
ATD Serial No: 351 **Test I.D:** D131340

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	34	34	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	59.9	62.3	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	49.6	47.3	Pass
		Overall Test Results			Pass

Jessica Hall
Laboratory Technician

04/16/2013
Test Date

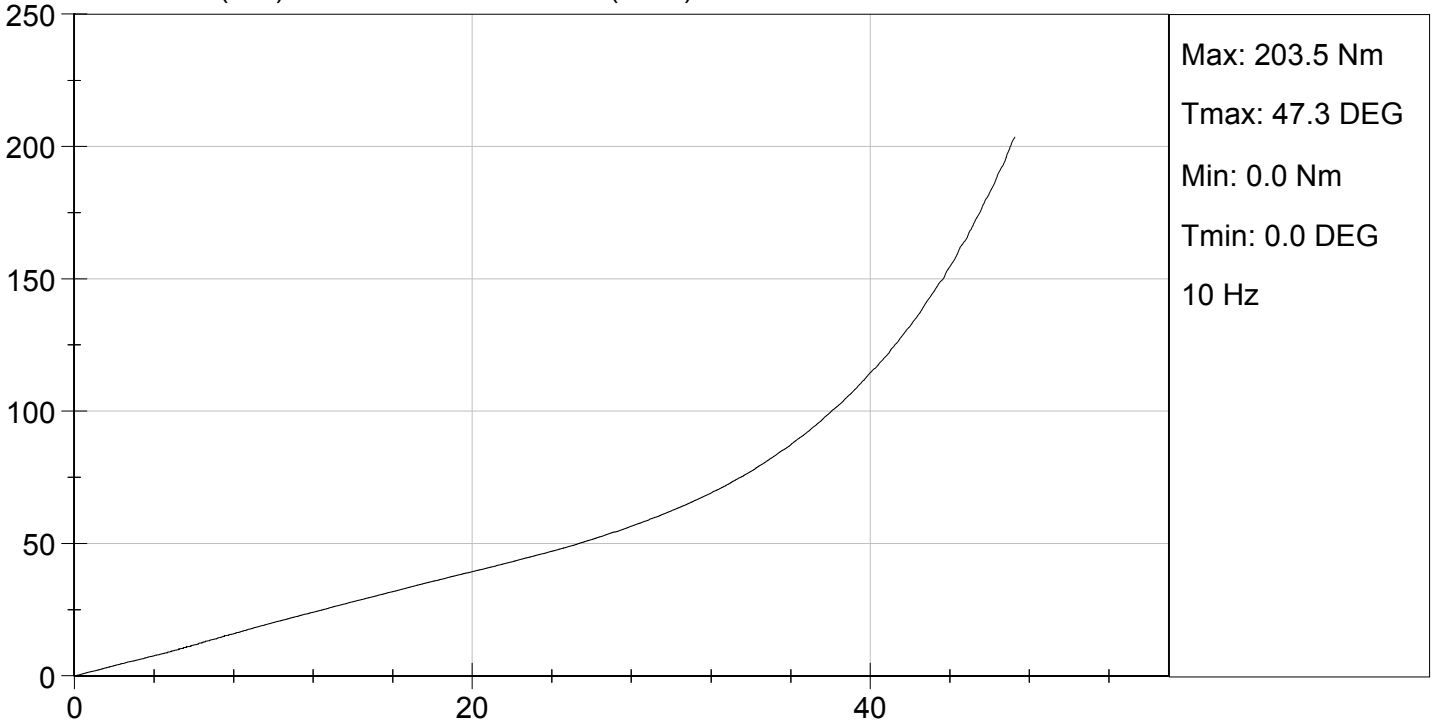
David Winkelbauer
Approved By


MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.4 Nm
Tmax: 49.6 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz

TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 04/16/2013
TEST #: D131340

MOMENT (Nm) vs FEMUR ROTATION (DEG)



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:** D131261

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

Jessica Hall
Laboratory Technician

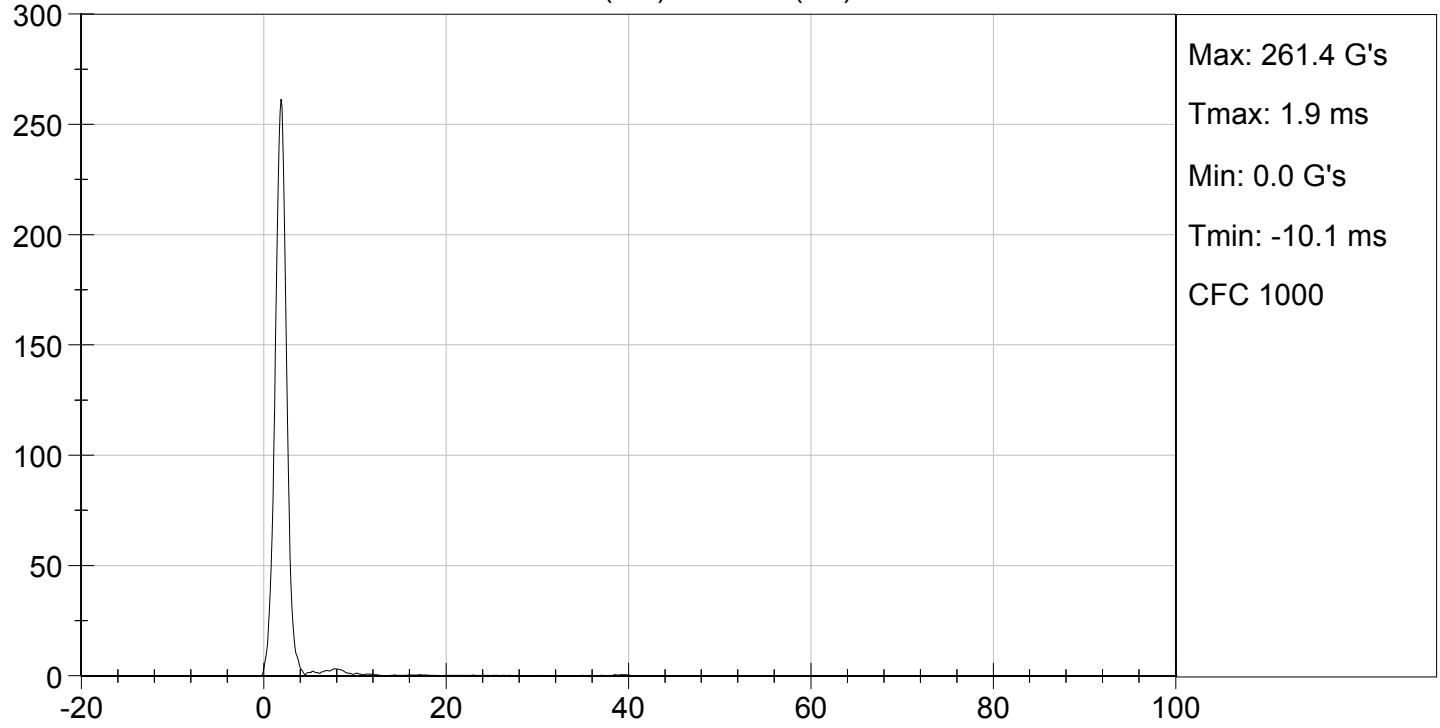
04/10/2013
Test Date

David Winkelbauer
Approved By

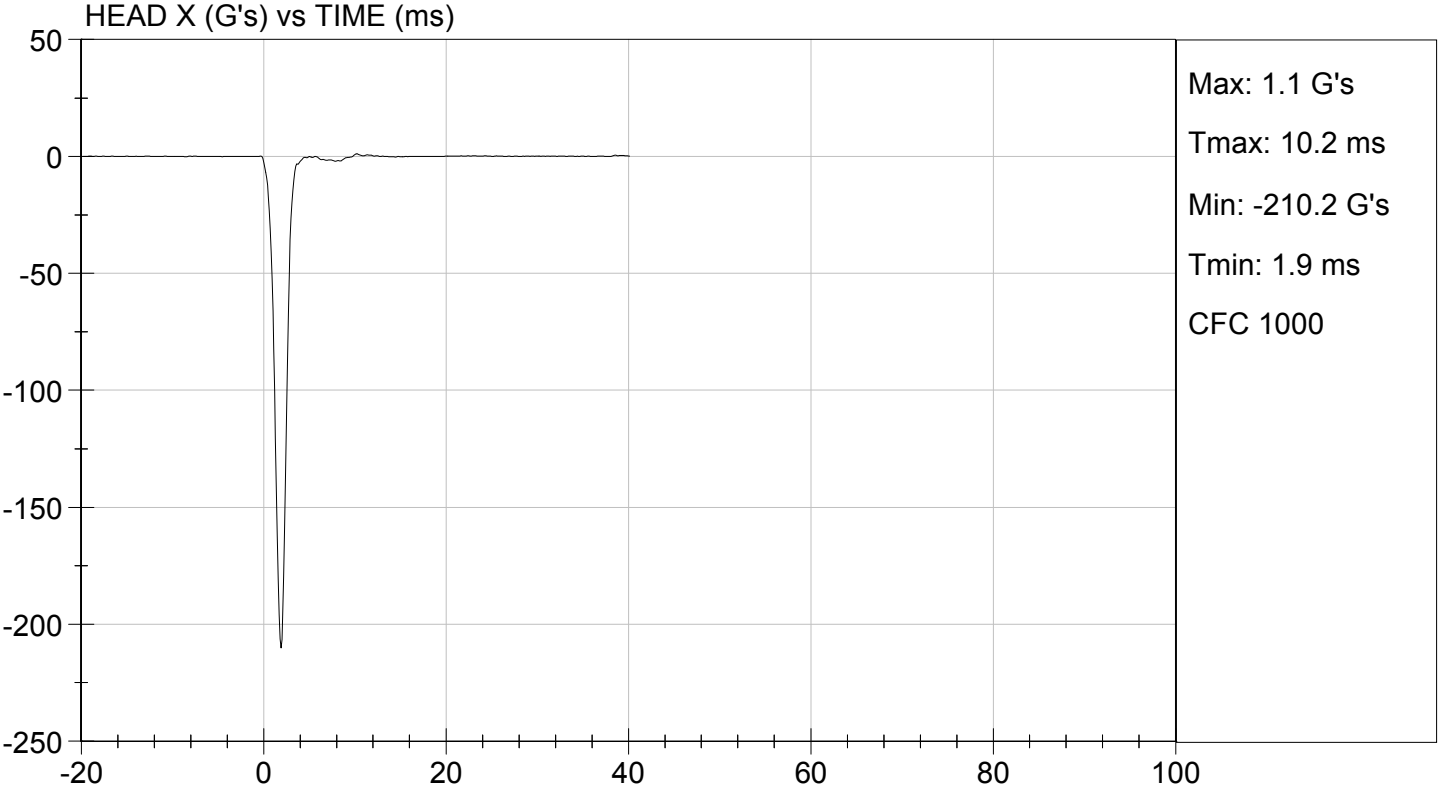
TEST DESC: HEAD DROP

TEST DATE: 04/10/2013
TEST #: D131261

HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)



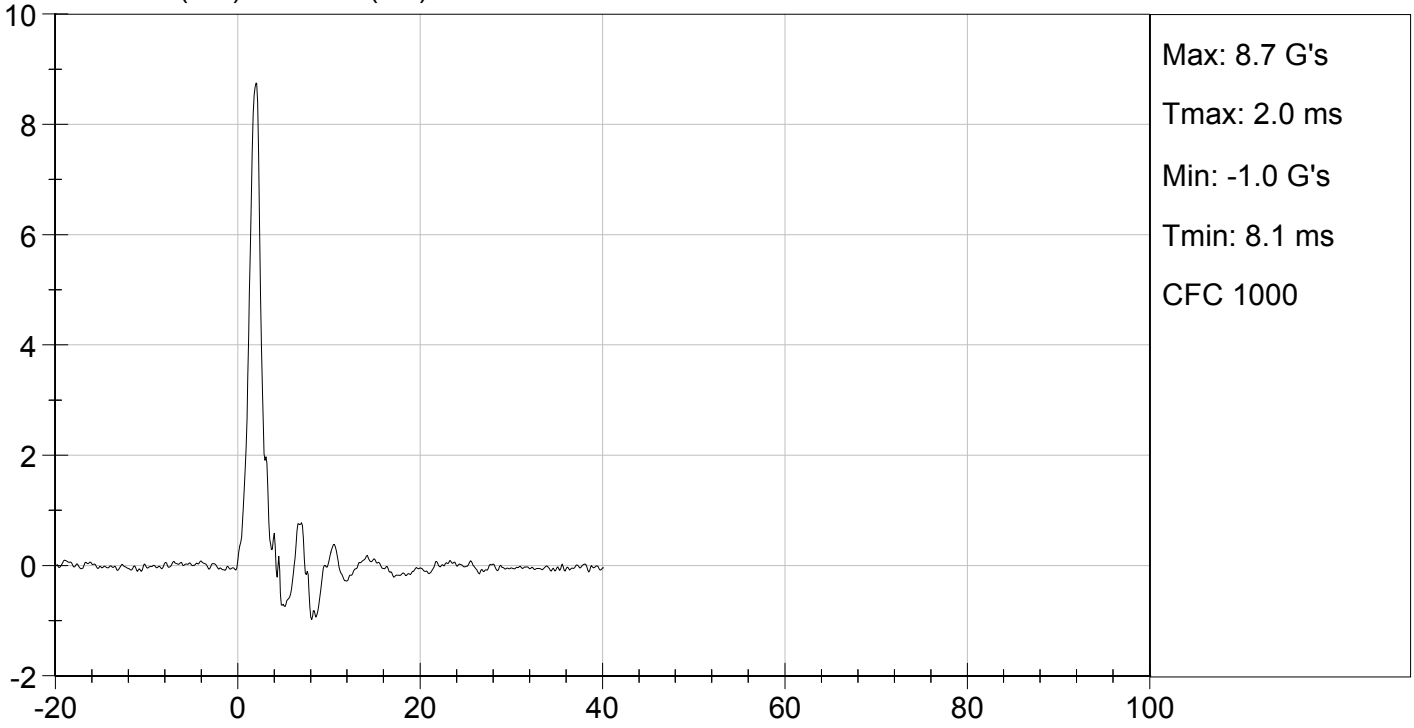
HEAD X (G's) vs TIME (ms)



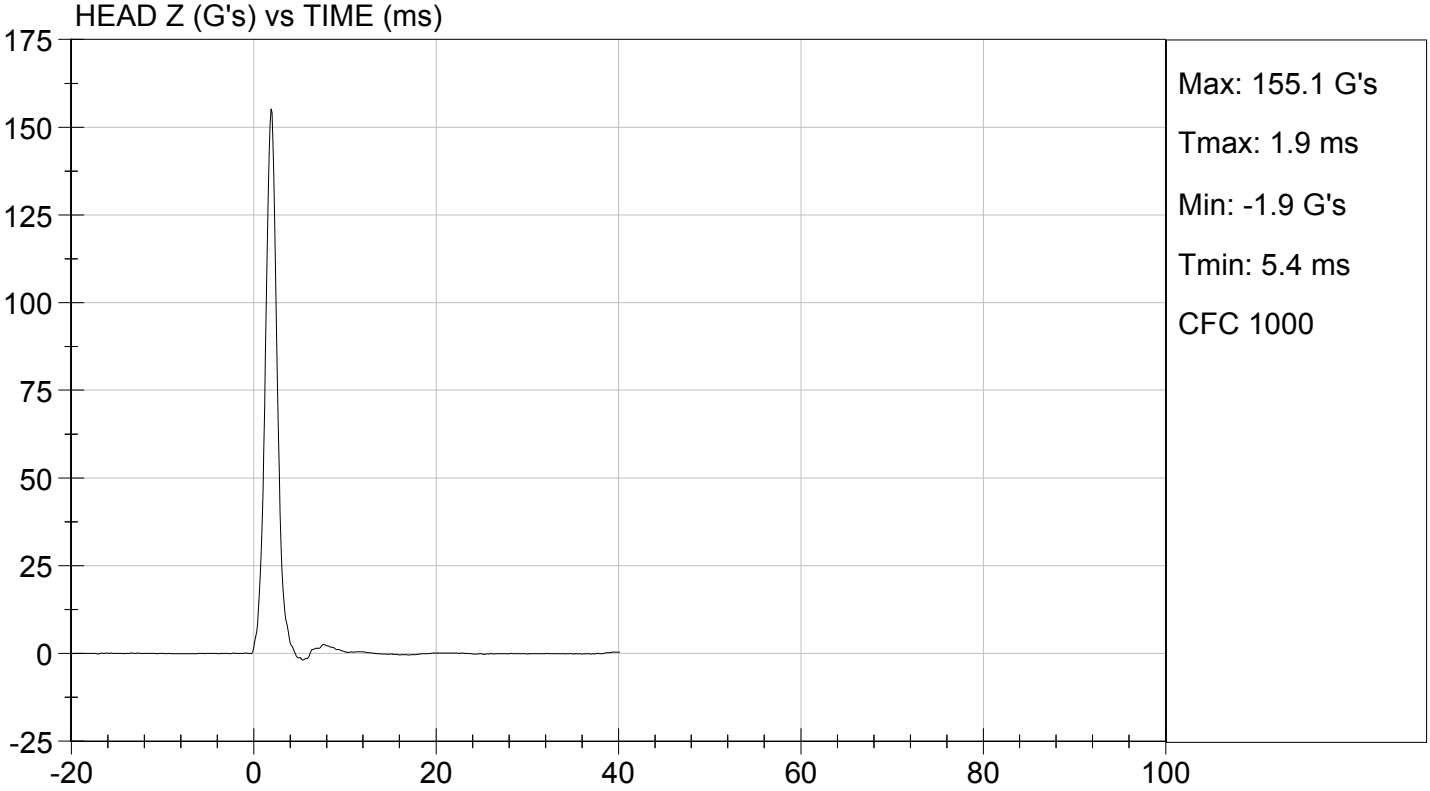
TEST DESC: HEAD DROP

TEST DATE: 04/10/2013
TEST #: D131261

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



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



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

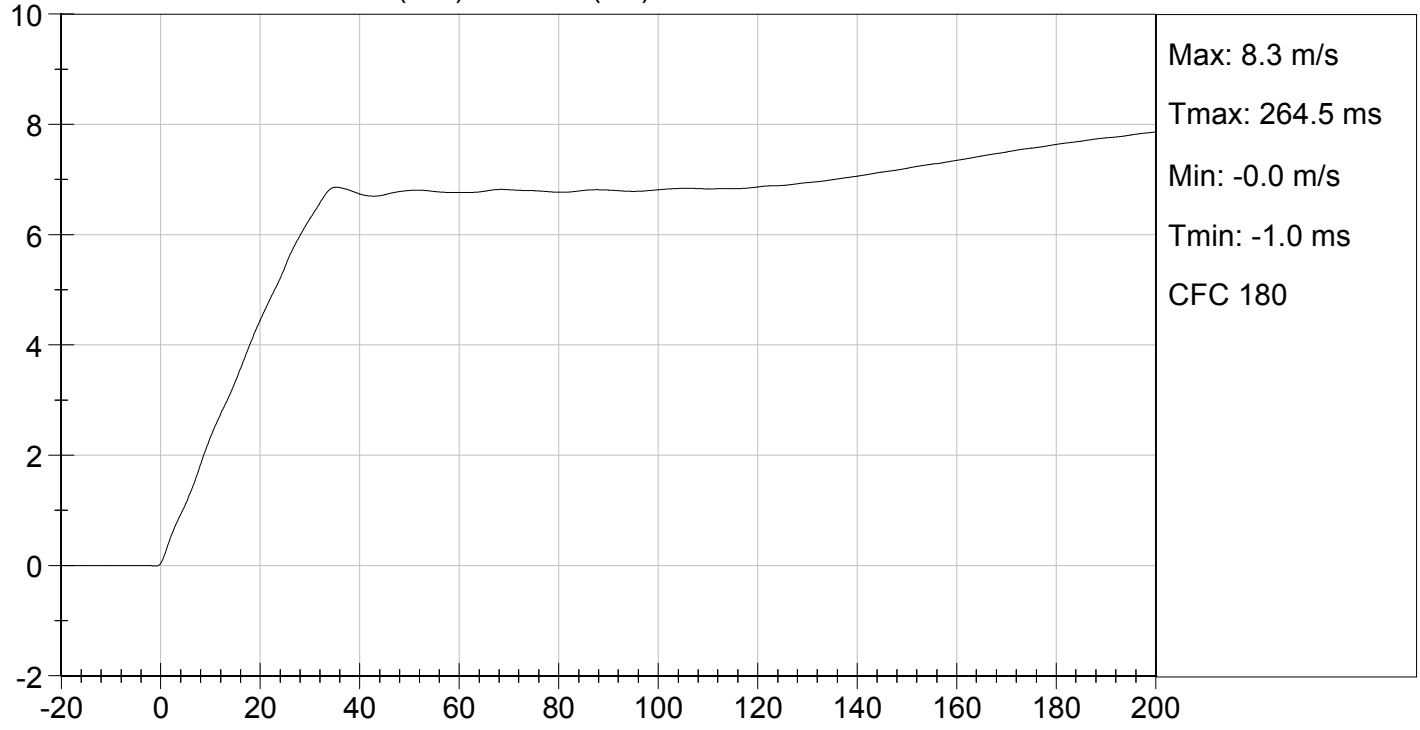
04/11/2013
Test Date

David Winkelbauer
Approved By

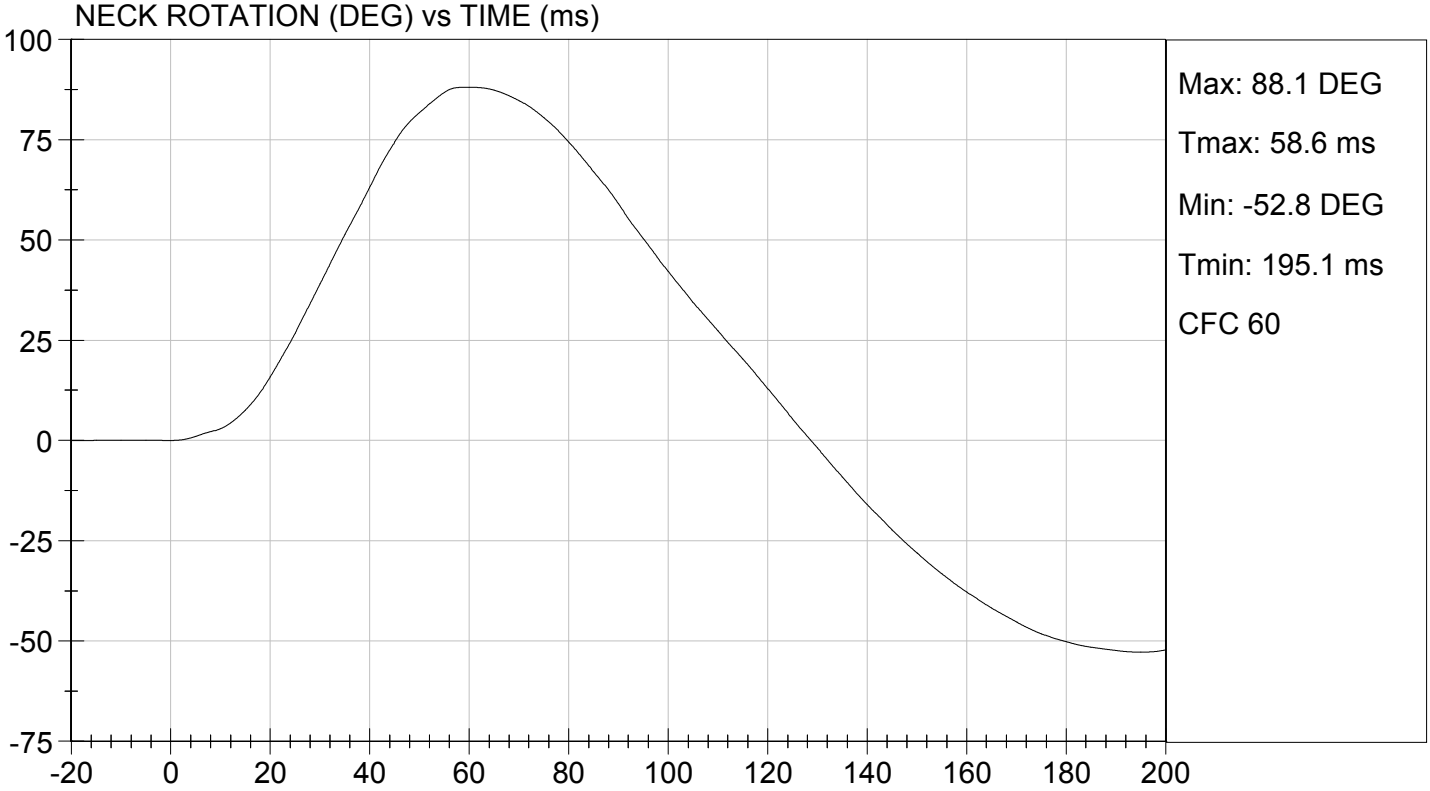
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

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

PENDULUM VELOCITY (m/s) vs TIME (ms)



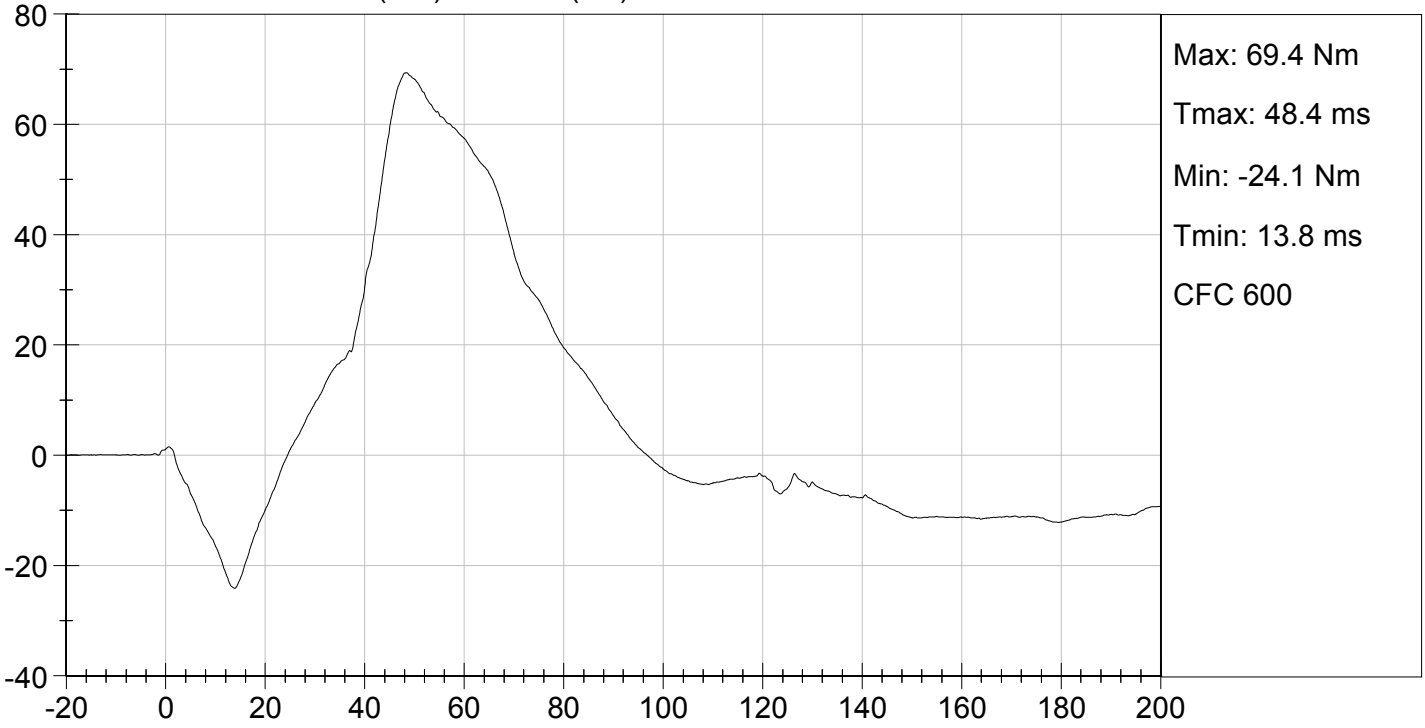
NECK ROTATION (DEG) vs TIME (ms)



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

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

OCCIPITAL MOMENT (Nm) vs TIME (ms)



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

Jessica Hall
Laboratory Technician

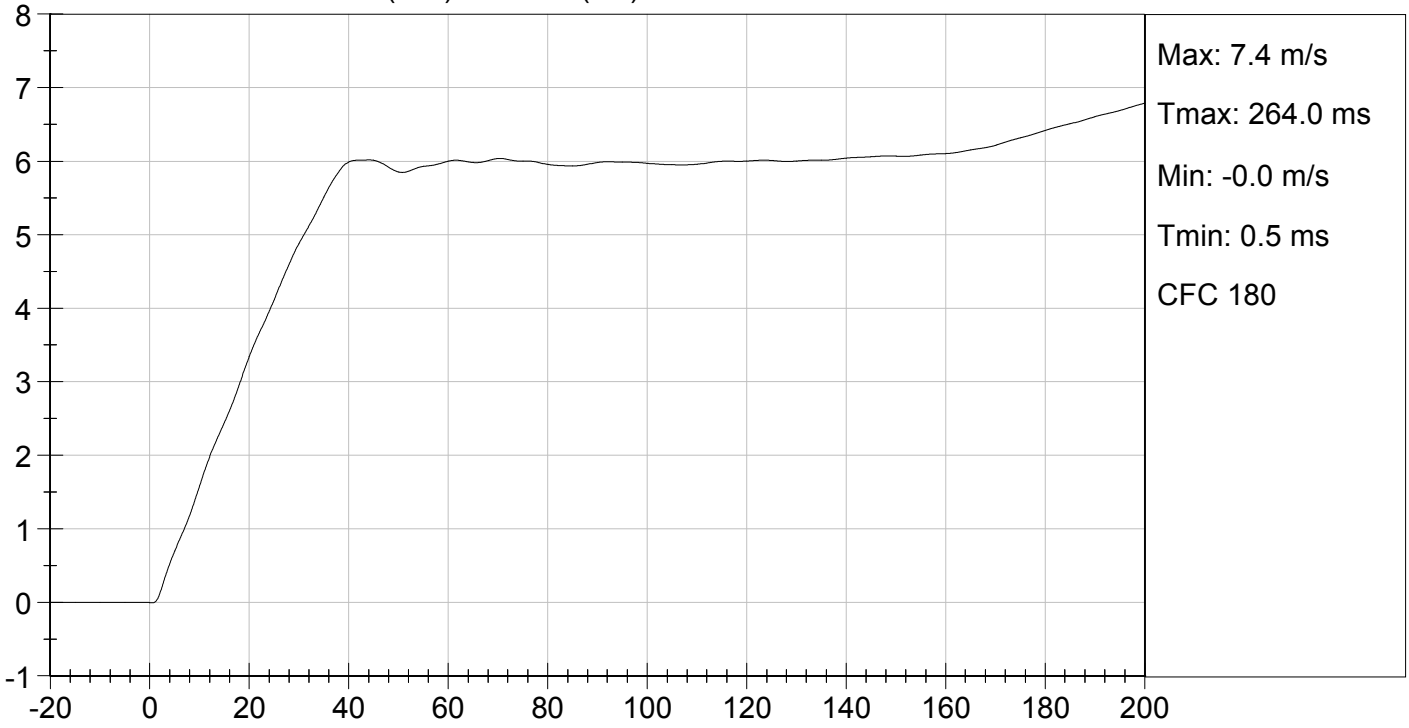
04/11/2013
Test Date

David Winkelbauer
Approved By

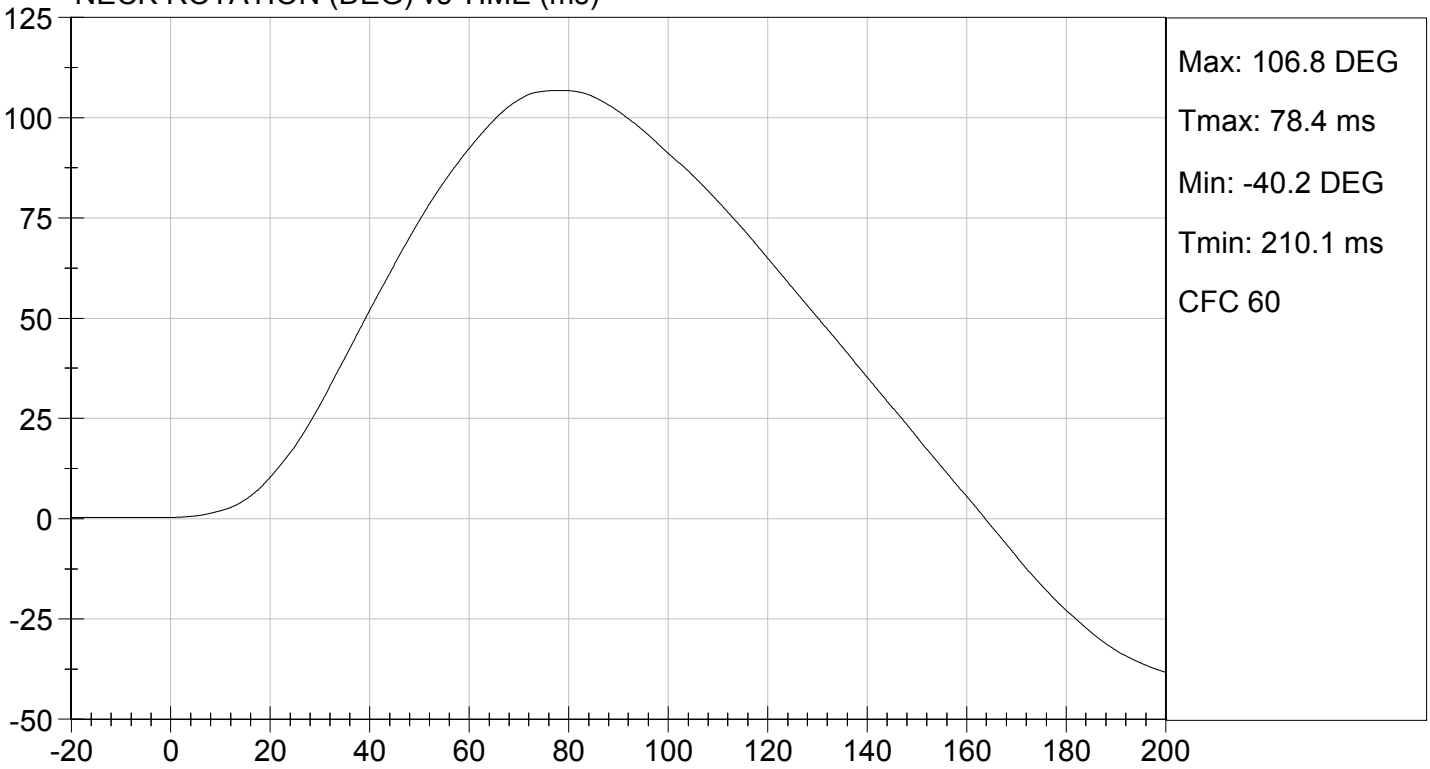
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

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

PENDULUM VELOCITY (m/s) vs TIME (ms)

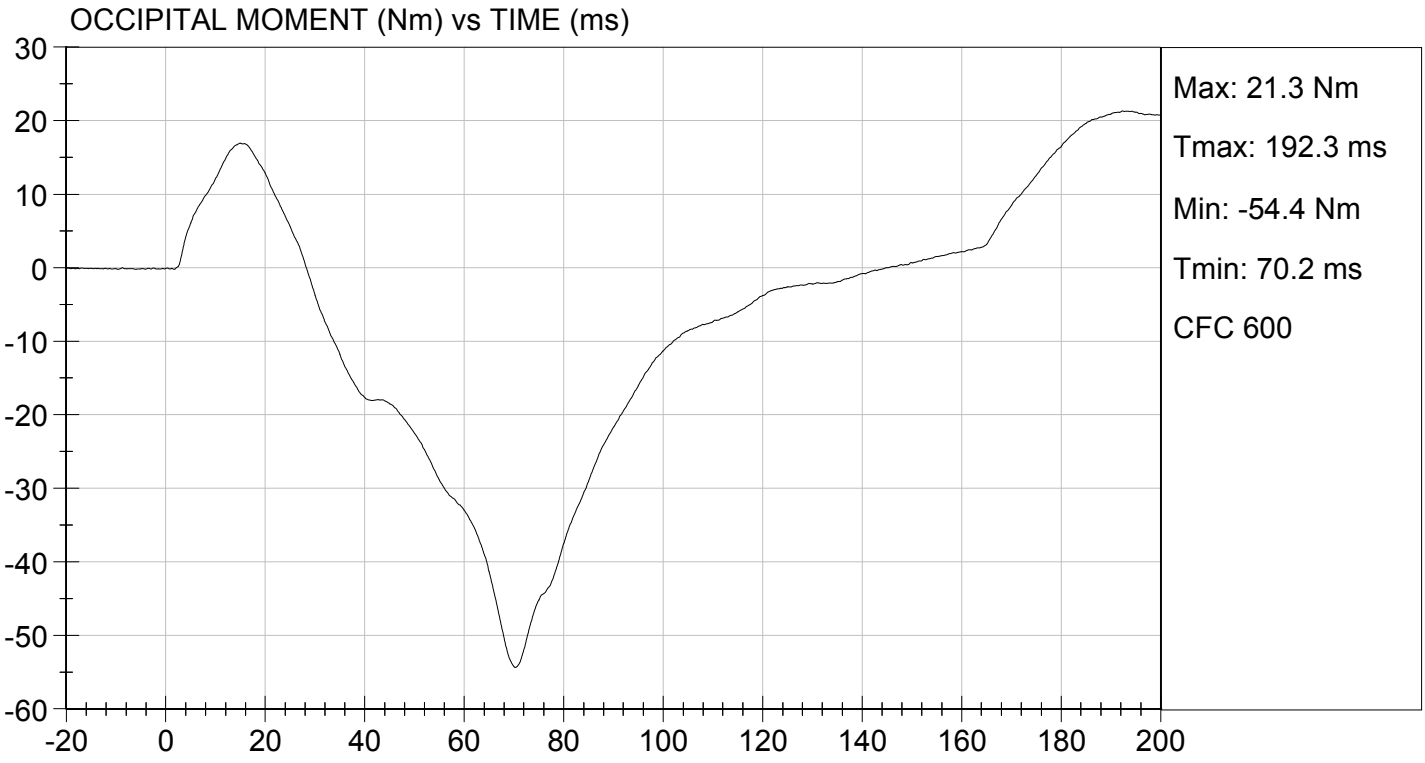


NECK ROTATION (DEG) vs TIME (ms)



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

Jessica Hall
Laboratory Technician

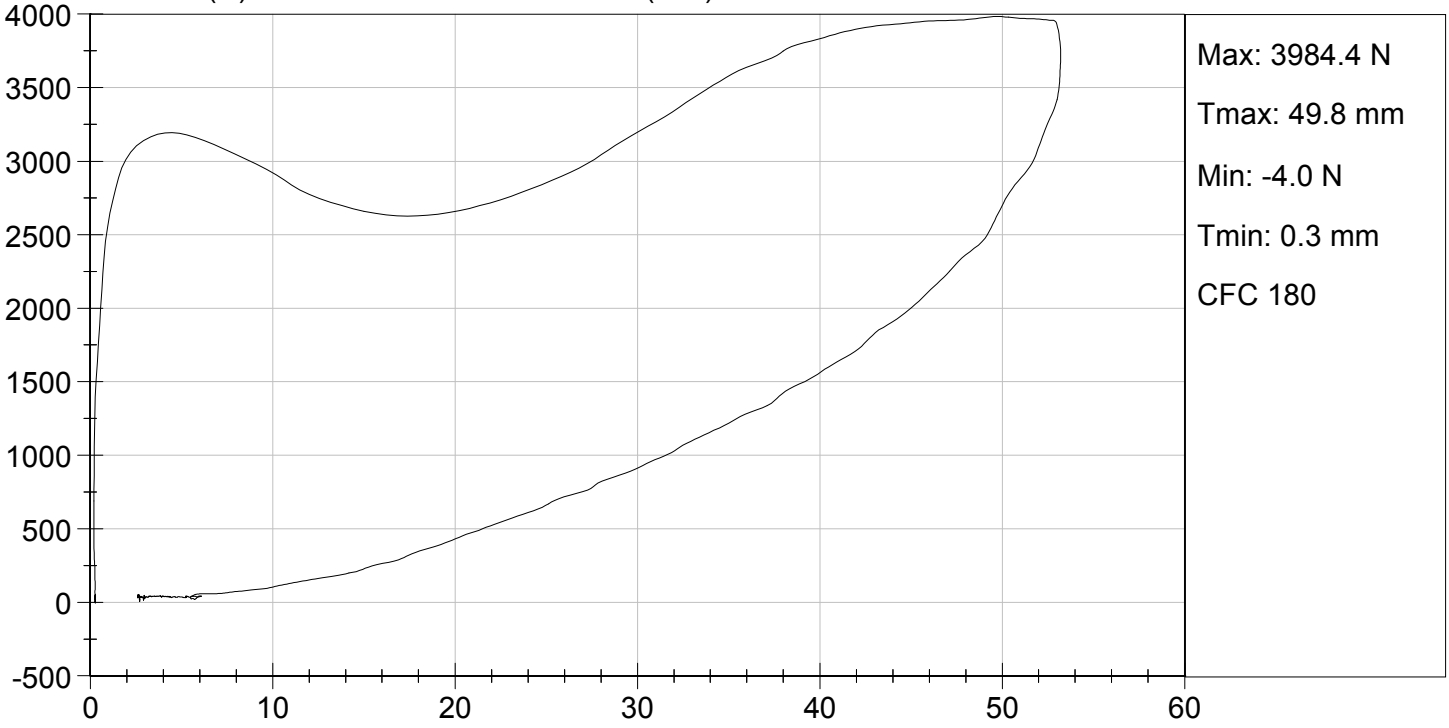
04/10/2013
Test Date

David Winkelbauer
Approved By

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

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

FORCE (N) vs CHEST DISPLACEMENT (mm)



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

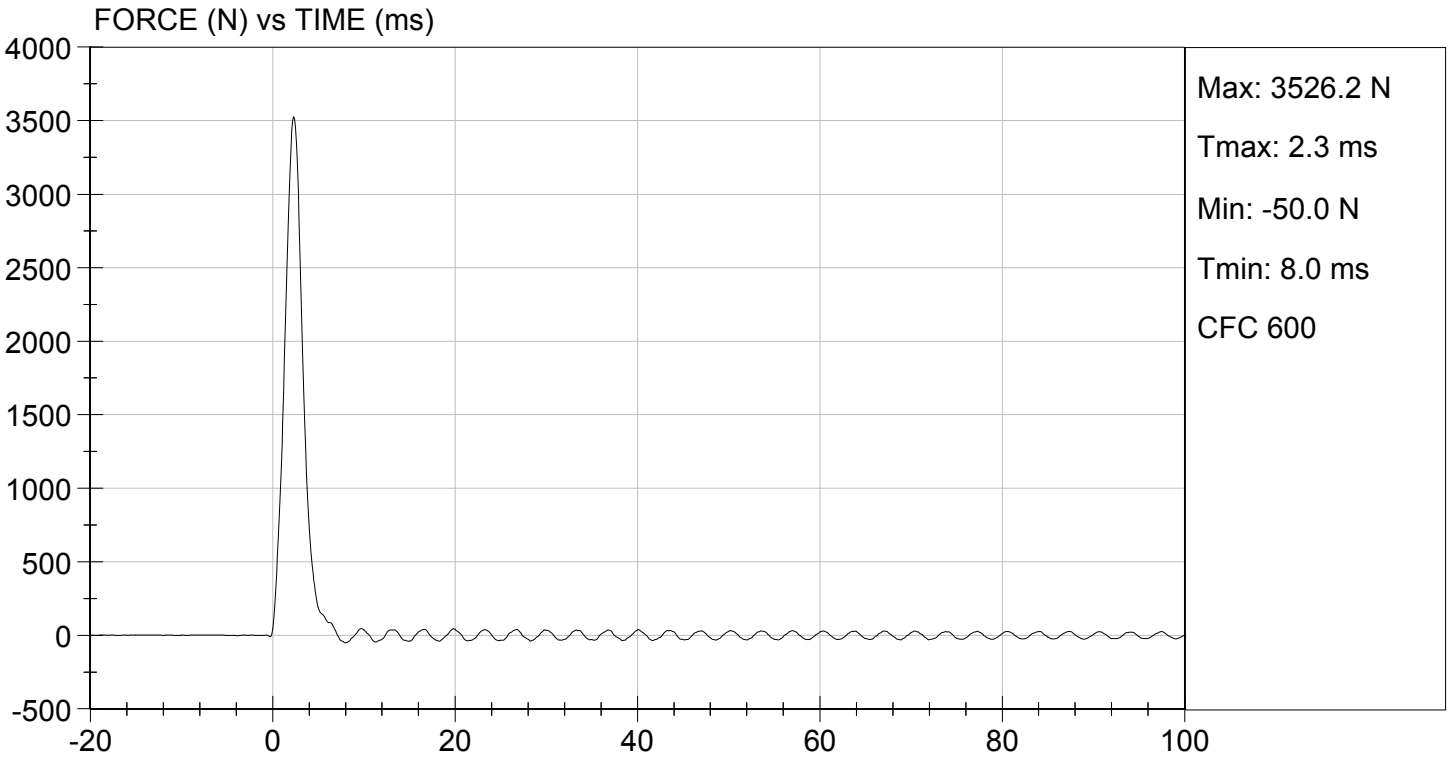
Jessica Hall
Laboratory Technician

04/10/2013
Test Date

David Winkelbauer
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

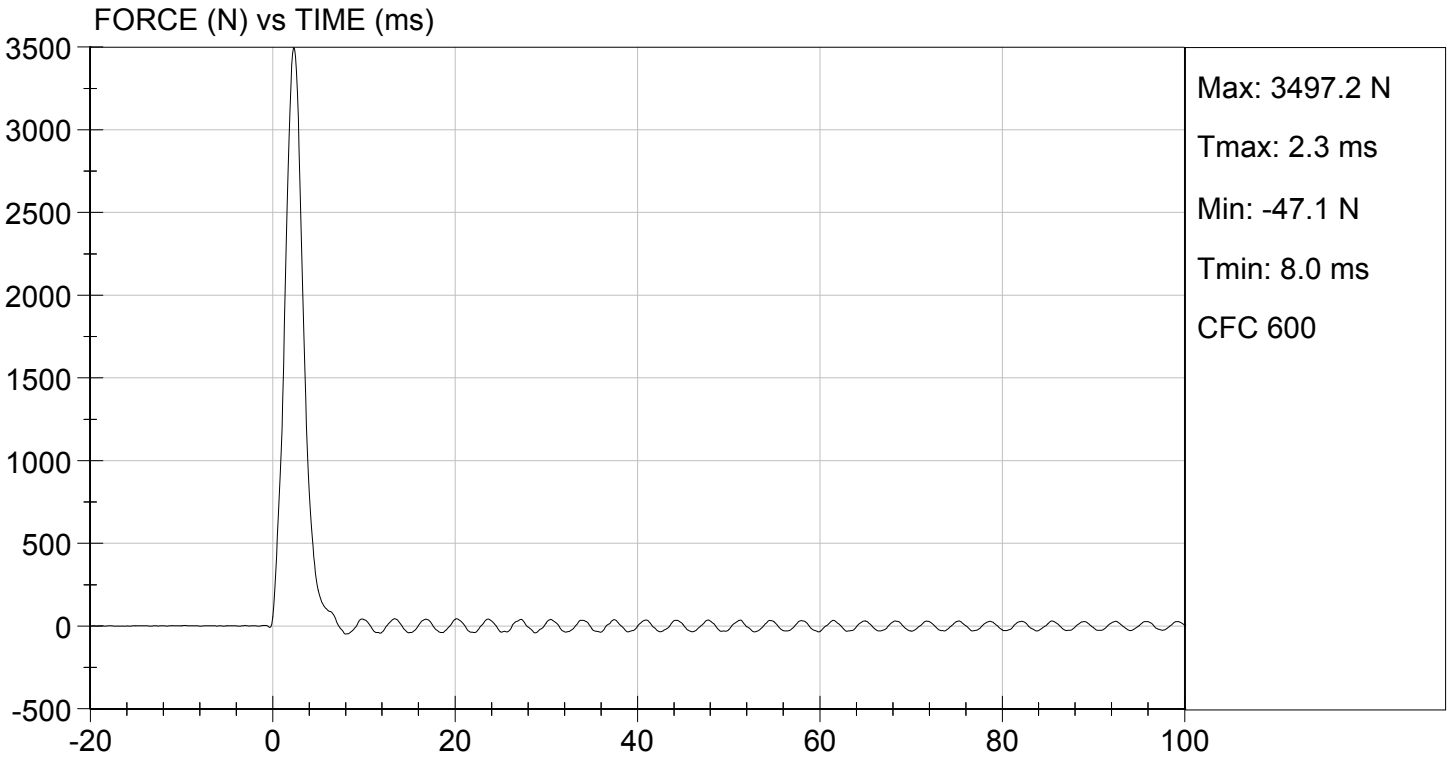
Jessica Hall
Laboratory Technician

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

Jessica Hall
Laboratory Technician

04/11/2013
Test Date

David Winkelbauer
Approved By

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test ID:** D131351

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	35	Pass
Peak Resultant Acceleration	G's	250 to 300	282	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	8.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

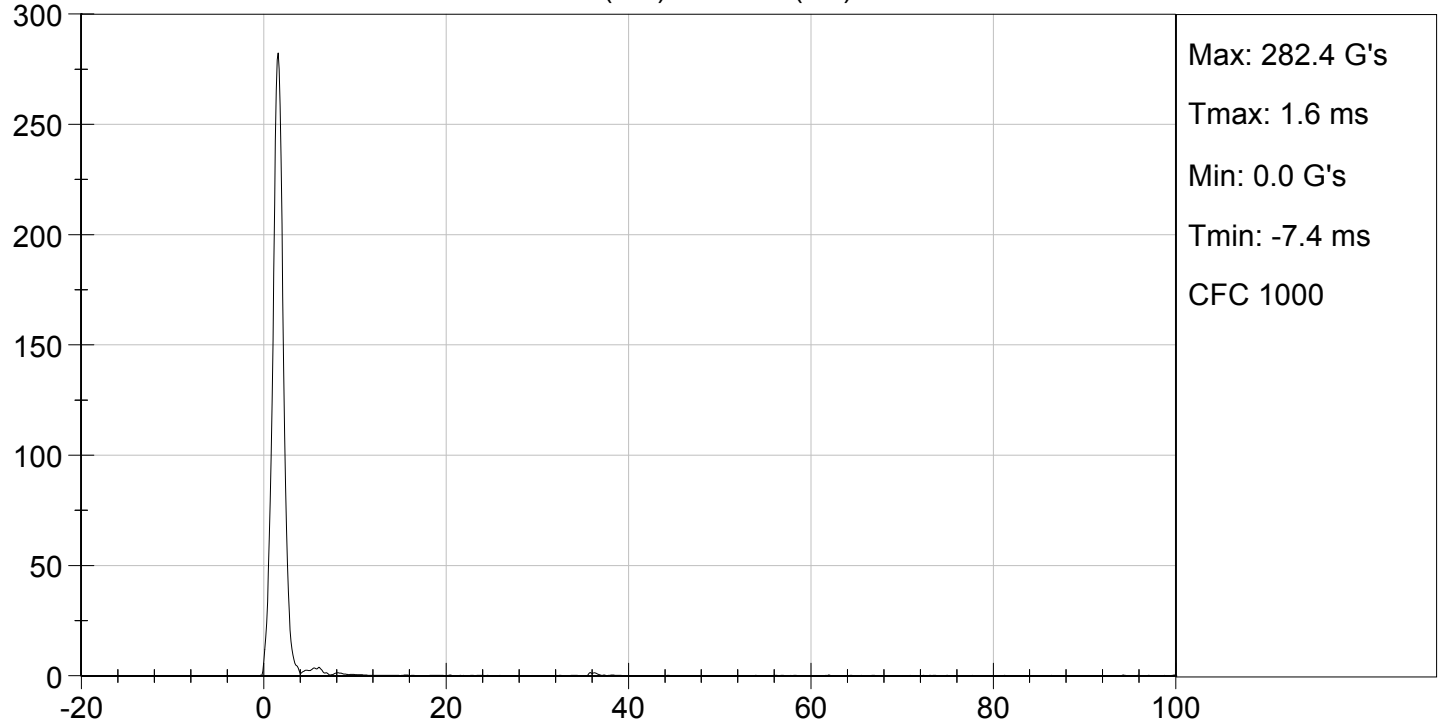
04/16/2013
Test Date

David Winkelbauer
Approved By

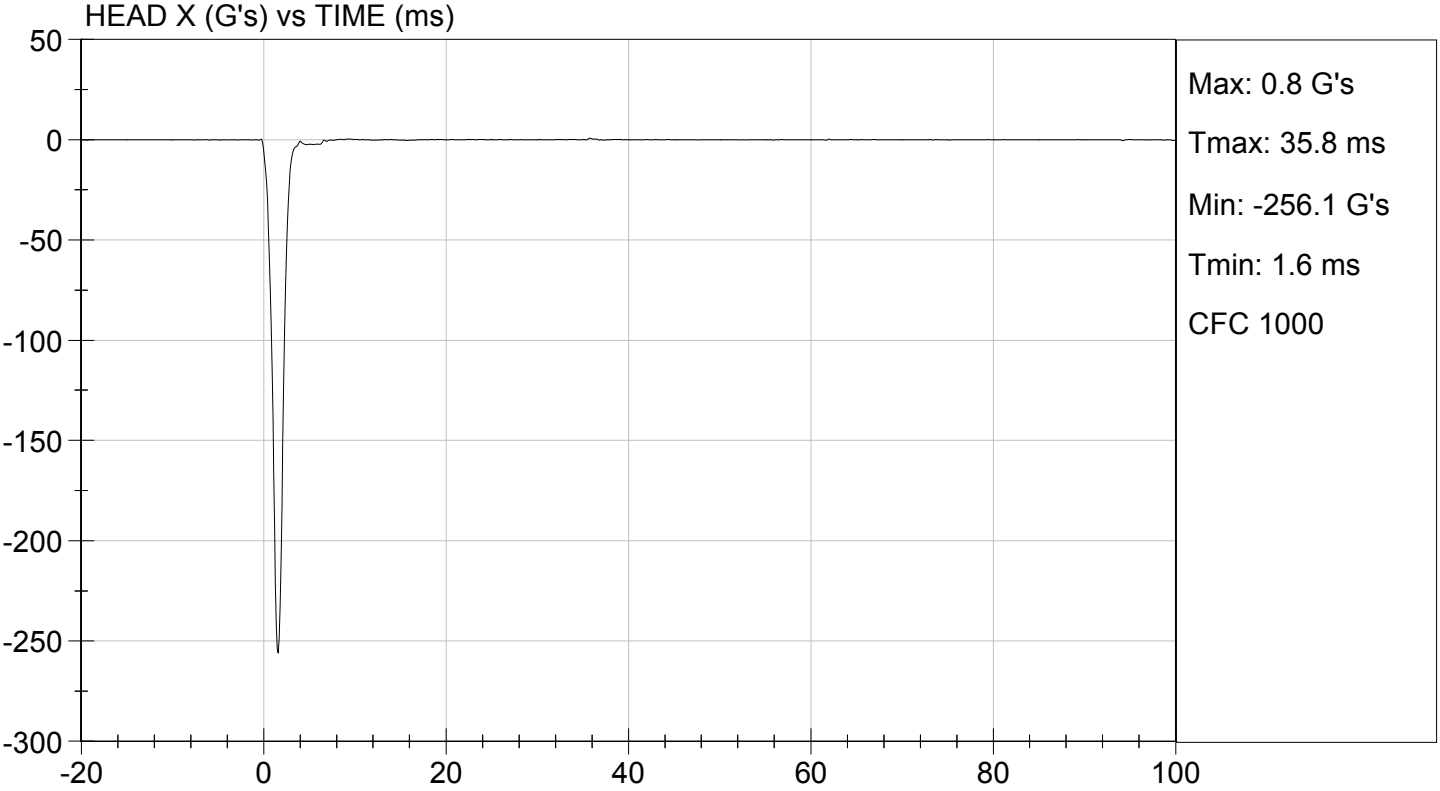
TEST DESC: HEAD DROP

TEST DATE: 04/16/2013
TEST #: D131351

HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)



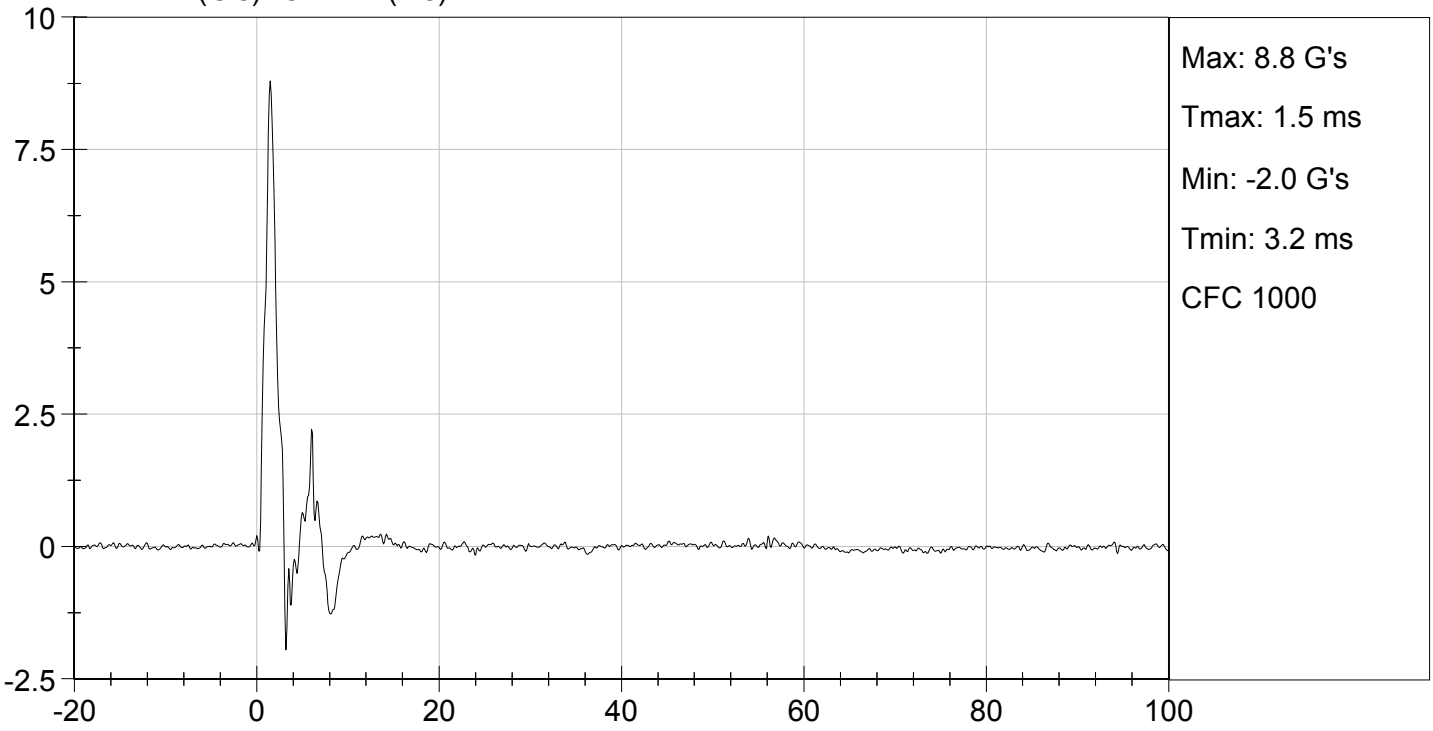
HEAD X (G's) vs TIME (ms)



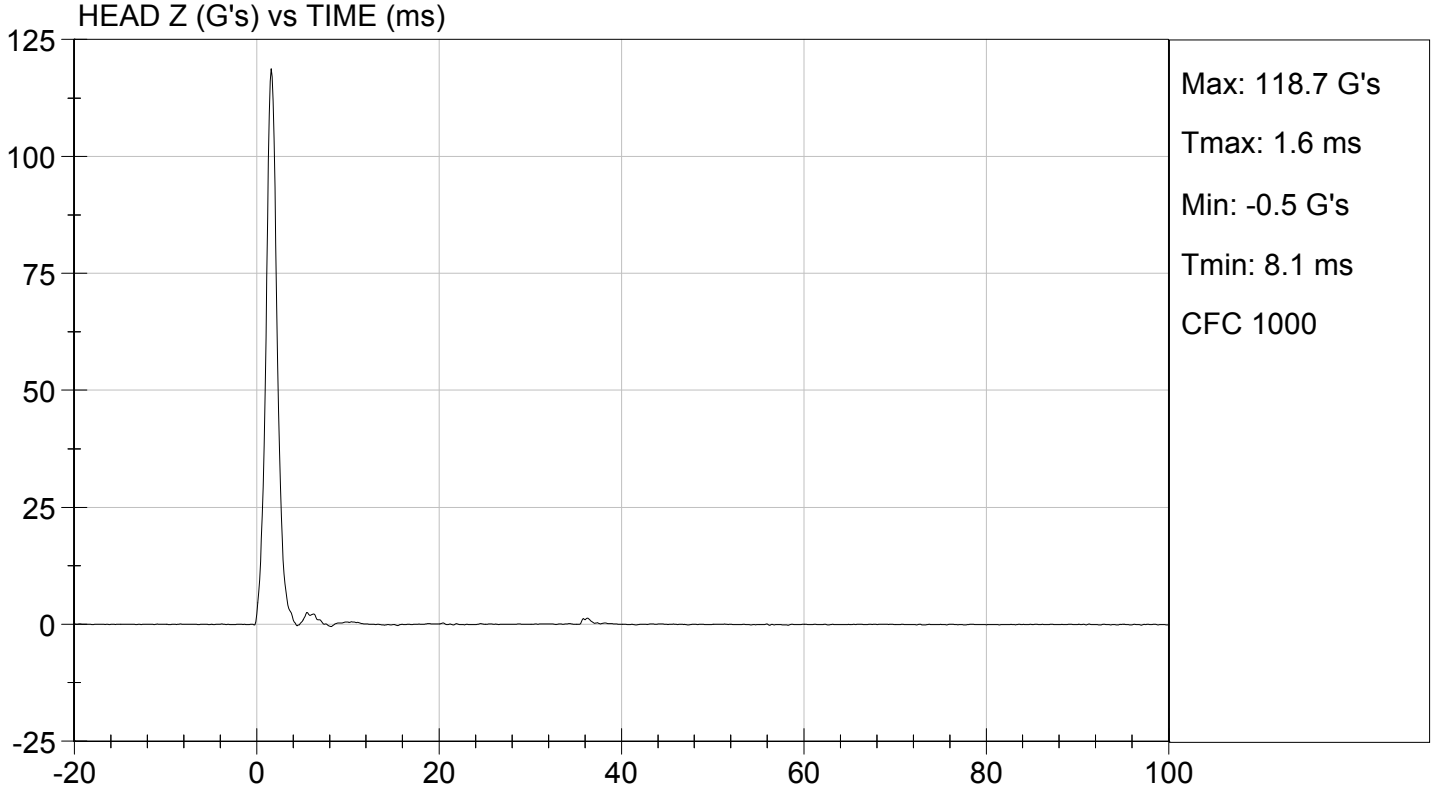
TEST DESC: HEAD DROP

TEST DATE: 04/16/2013
TEST #: D131351

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



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D131352

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	30	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.7	Pass
	30 ms	m/s	5.8 to 7.0	6.4	Pass
D Plane Rotation	Max	deg	77 to 91	82	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	71	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	89	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

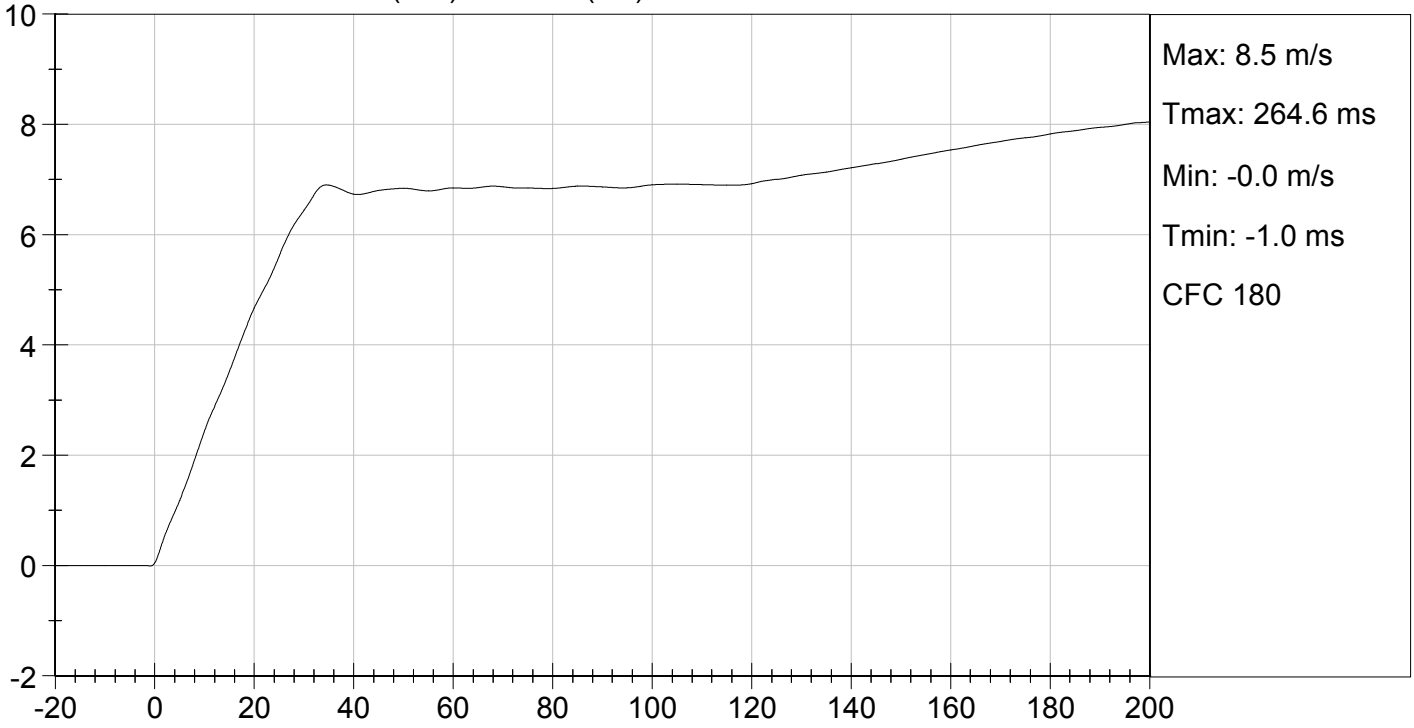
04/17/2013
Test Date

David Winkelbauer
Approved By

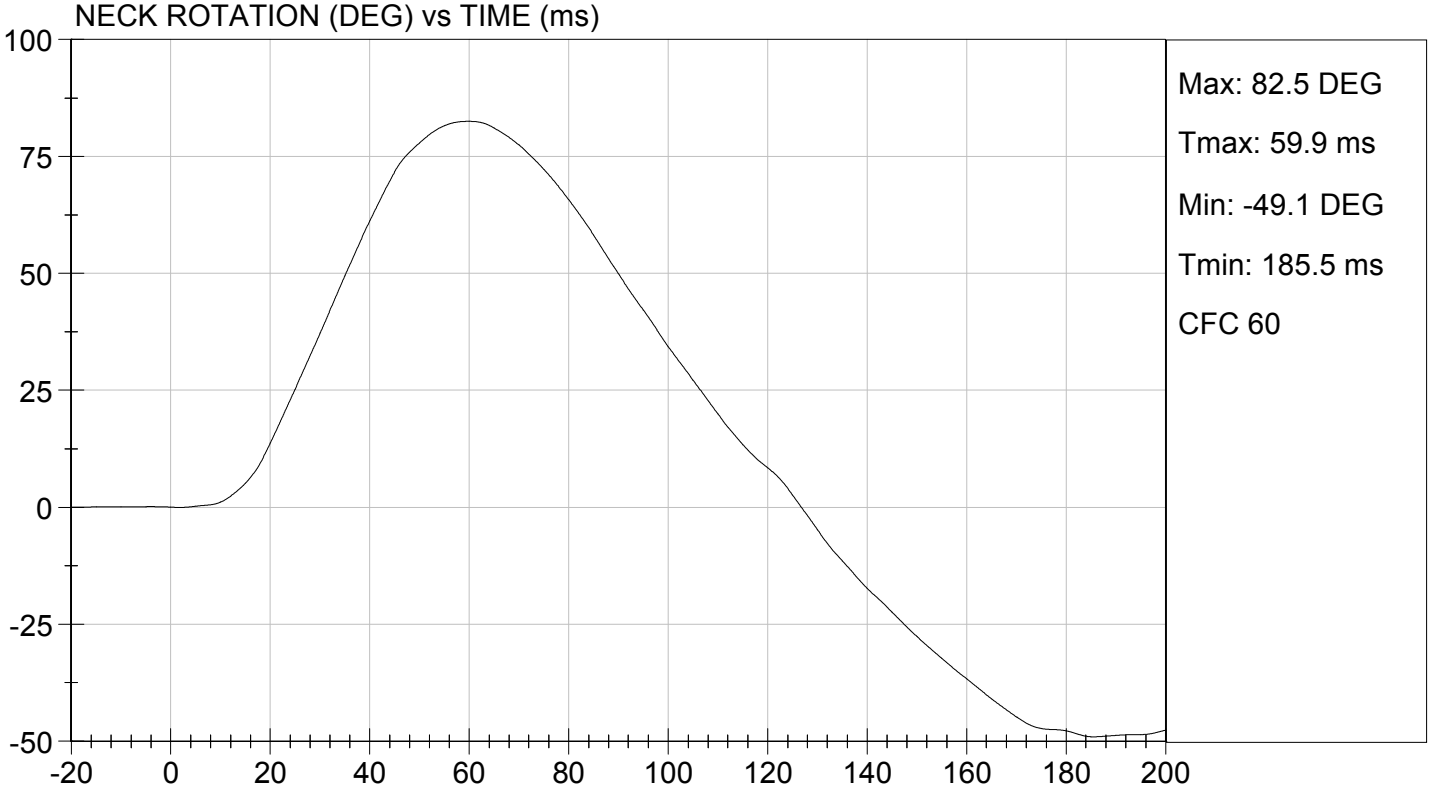
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 04/17/2013
TEST #: D131352

PENDULUM VELOCITY (m/s) vs TIME (ms)

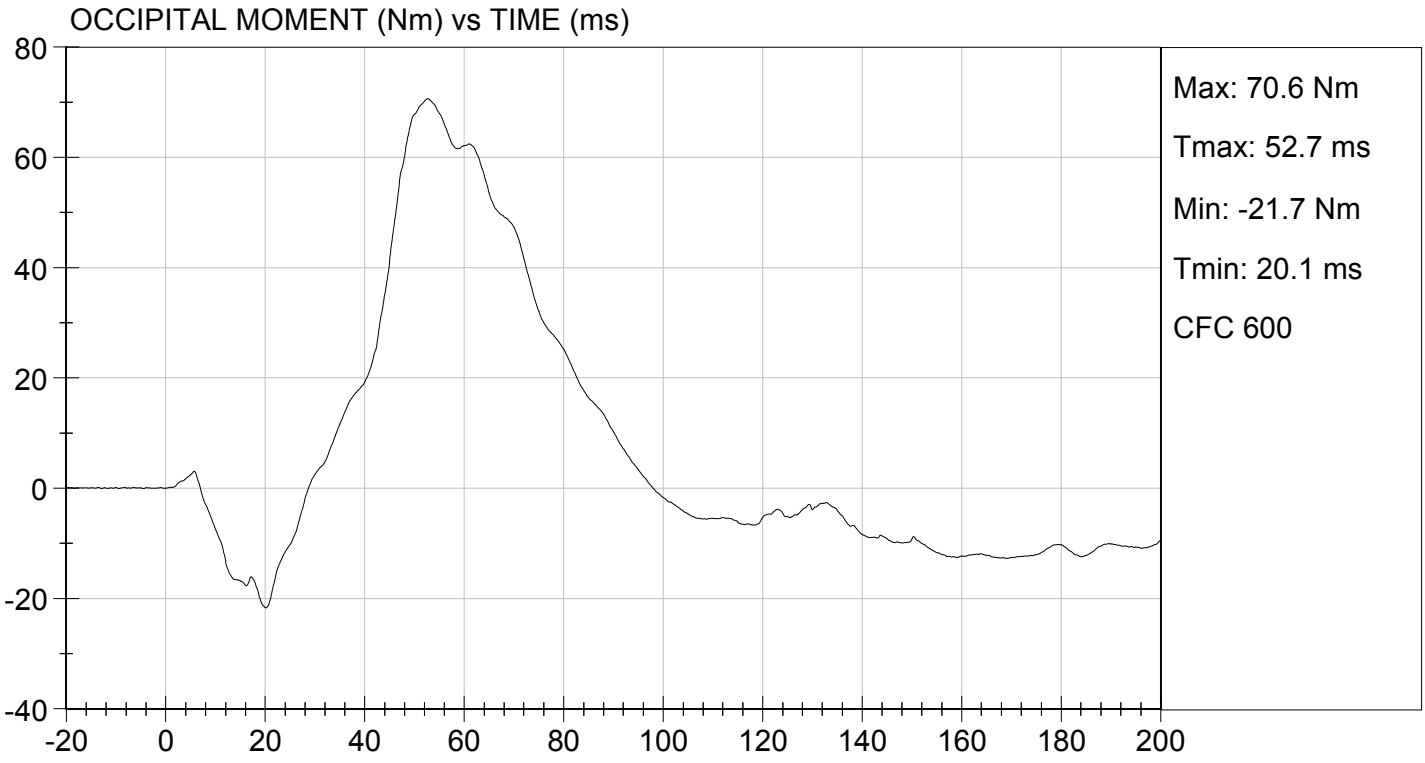


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 04/17/2013
TEST #: D131352



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D131353

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	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	1.5	Pass
	20 ms	m/s	3.1 to 3.9	3.3	Pass
	30 ms	m/s	4.6 to 5.6	4.8	Pass
D Plane Rotation	Max	deg	99 to 114	103	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

Jessica Gall
Laboratory Technician

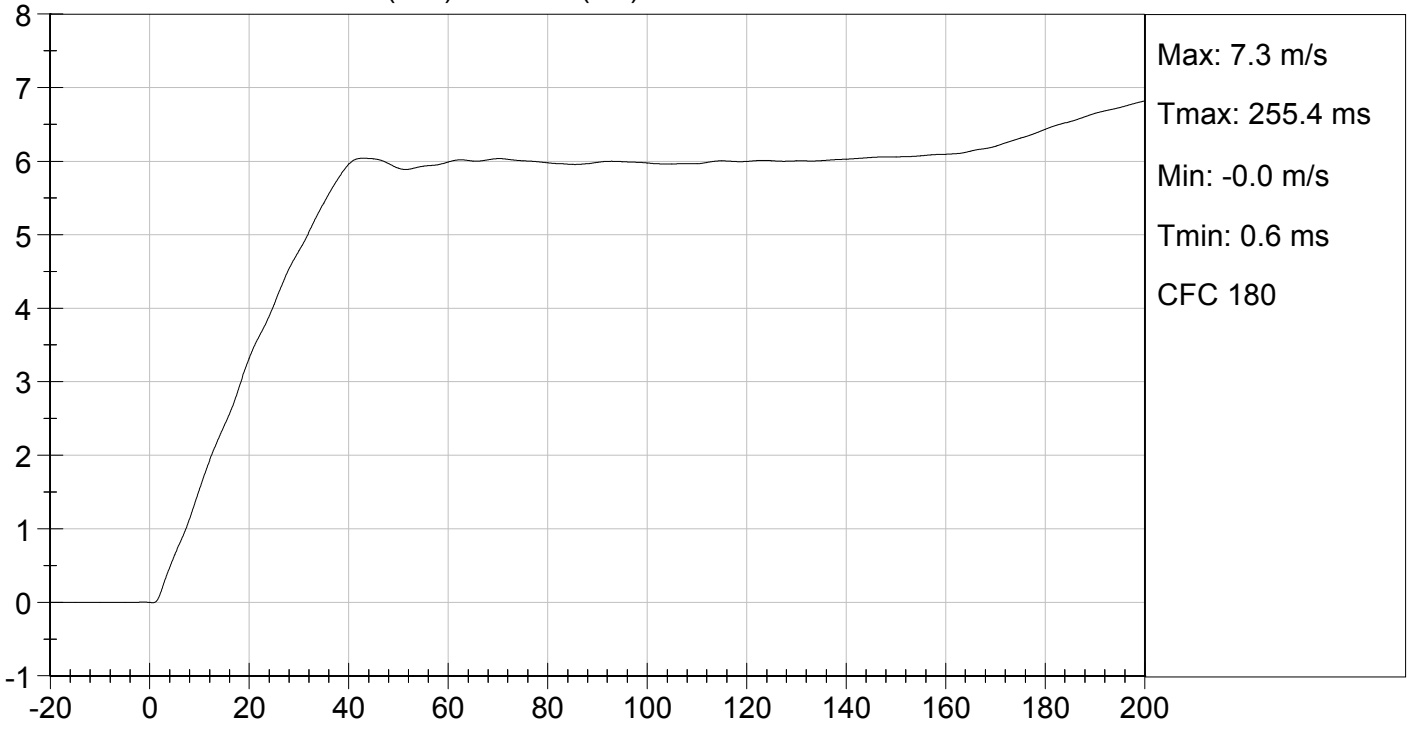
04/17/2013
Test Date

David Winkelbauer
Approved By

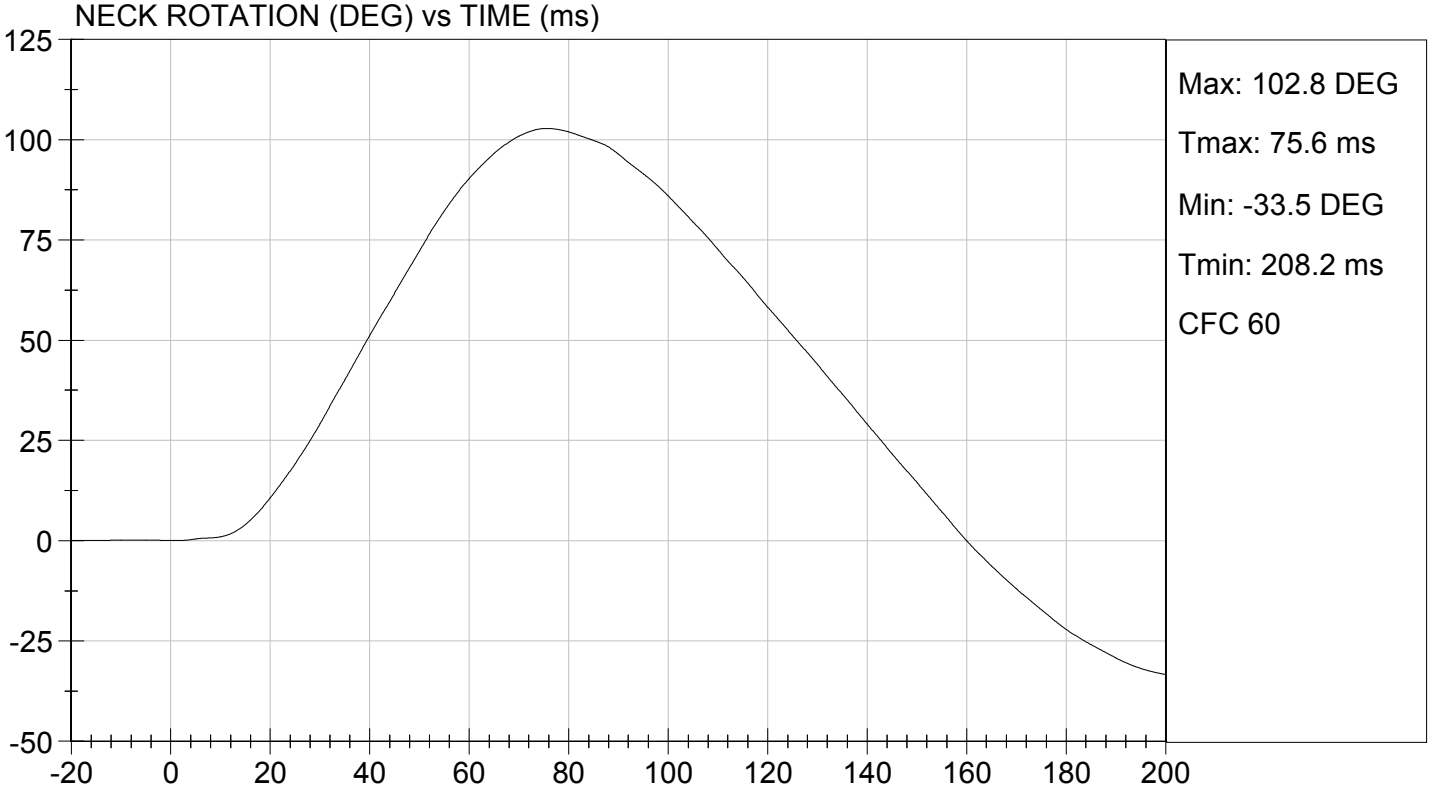
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 04/17/2013
TEST #: D131353

PENDULUM VELOCITY (m/s) vs TIME (ms)

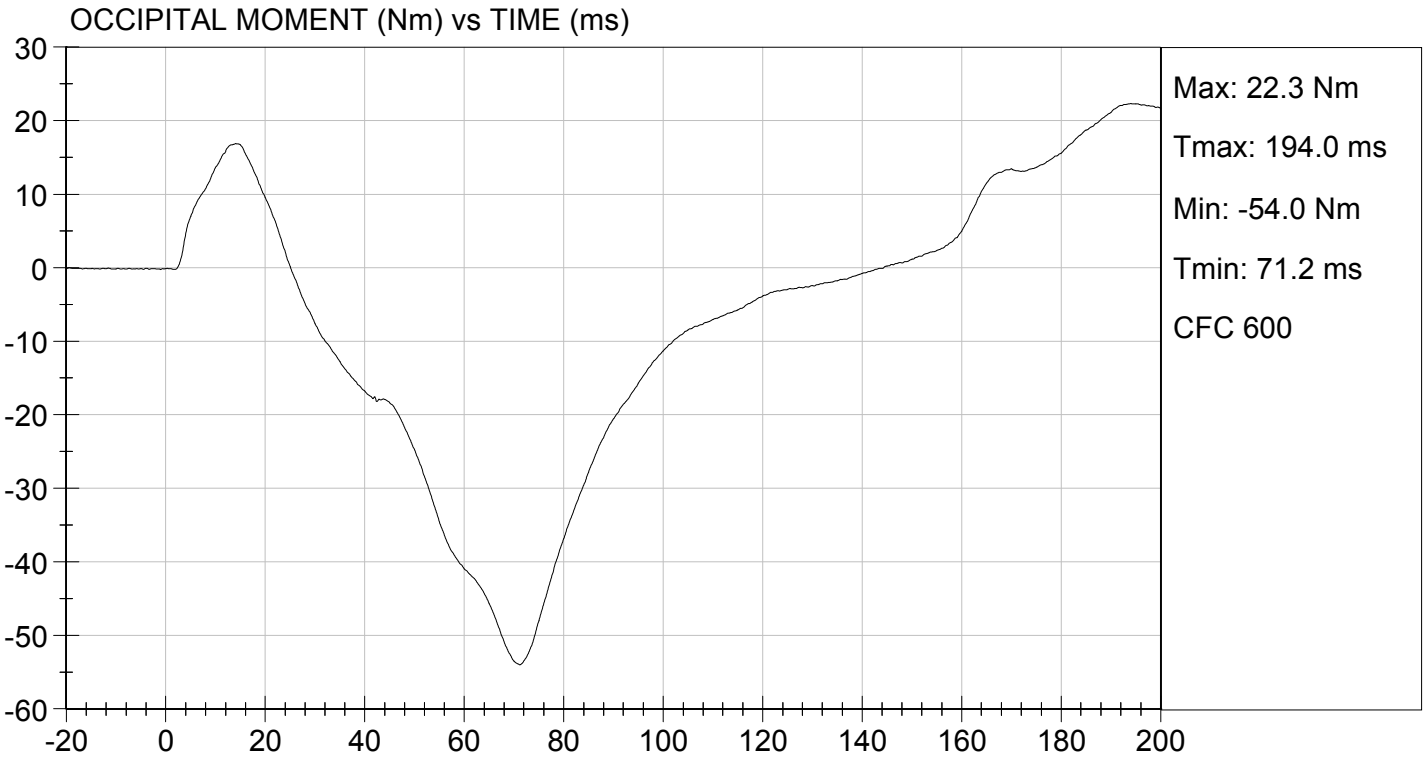


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 04/17/2013
TEST #: D131353



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D131354

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Relative Humidity	%	10 to 70	35	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	56	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4207	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4134	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

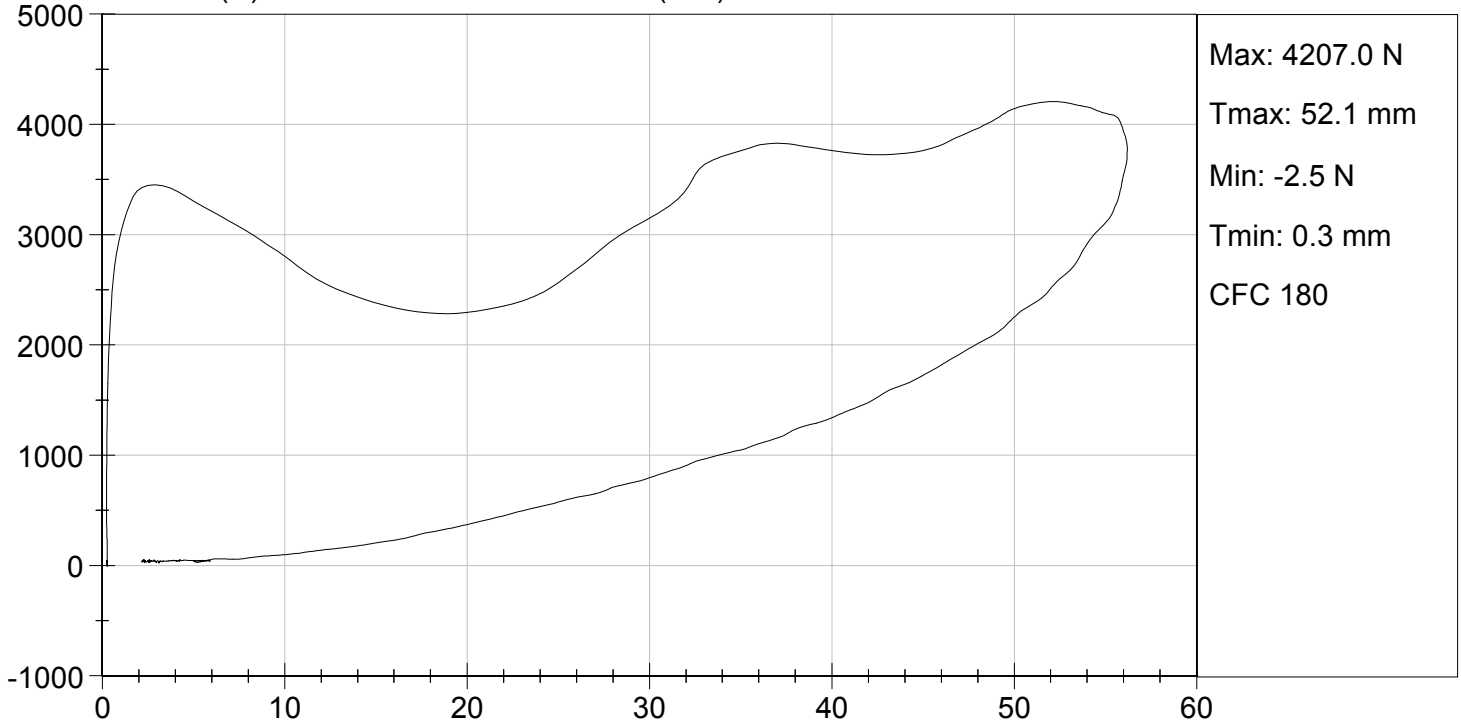
04/16/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 04/16/2013
TEST #: D131354

FORCE (N) vs CHEST DISPLACEMENT (mm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D131355

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	35	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3509	Pass
		Overall Test Results		Pass

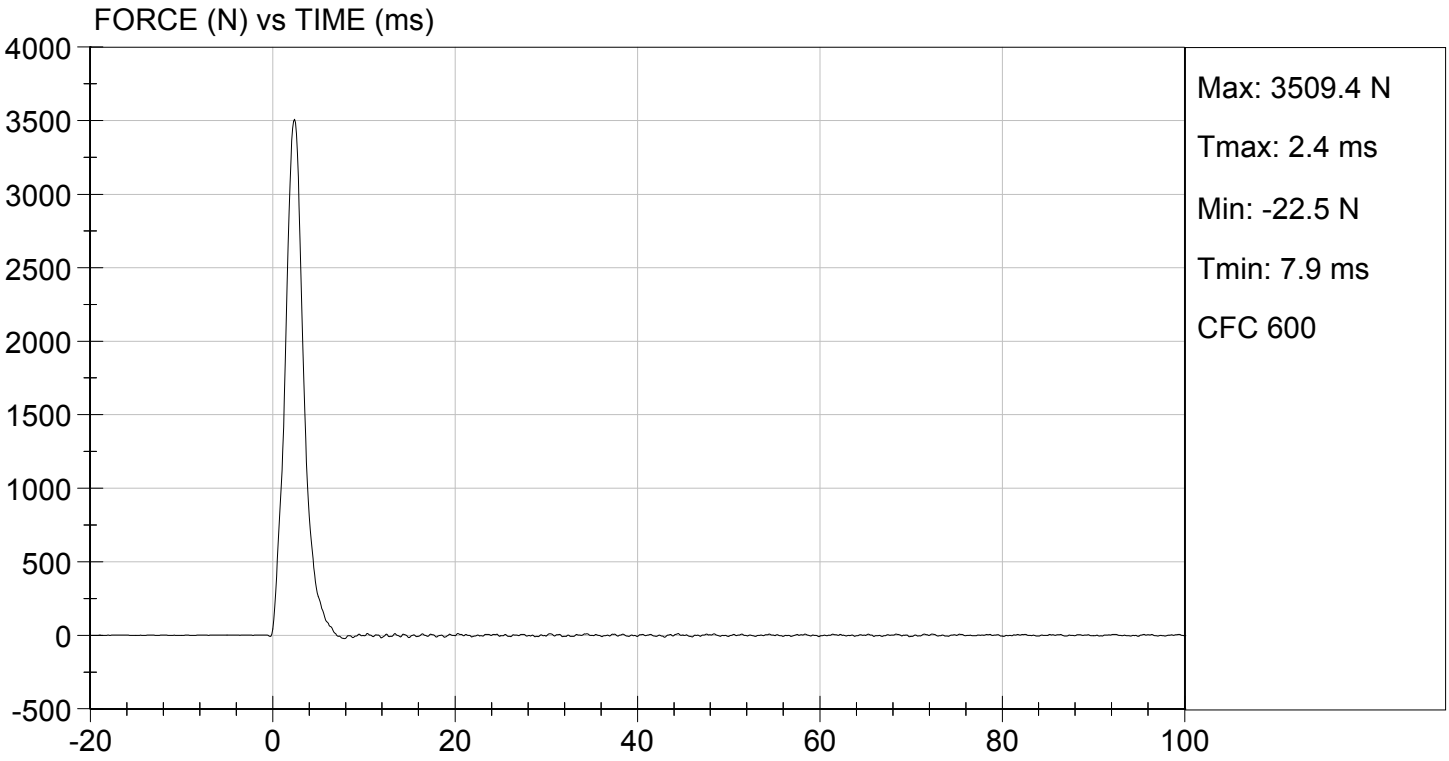
Jessica Gall
Laboratory Technician

04/16/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 04/16/2013
TEST #: D131355



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D131356

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	35	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3536	Pass
		Overall Test Results		Pass

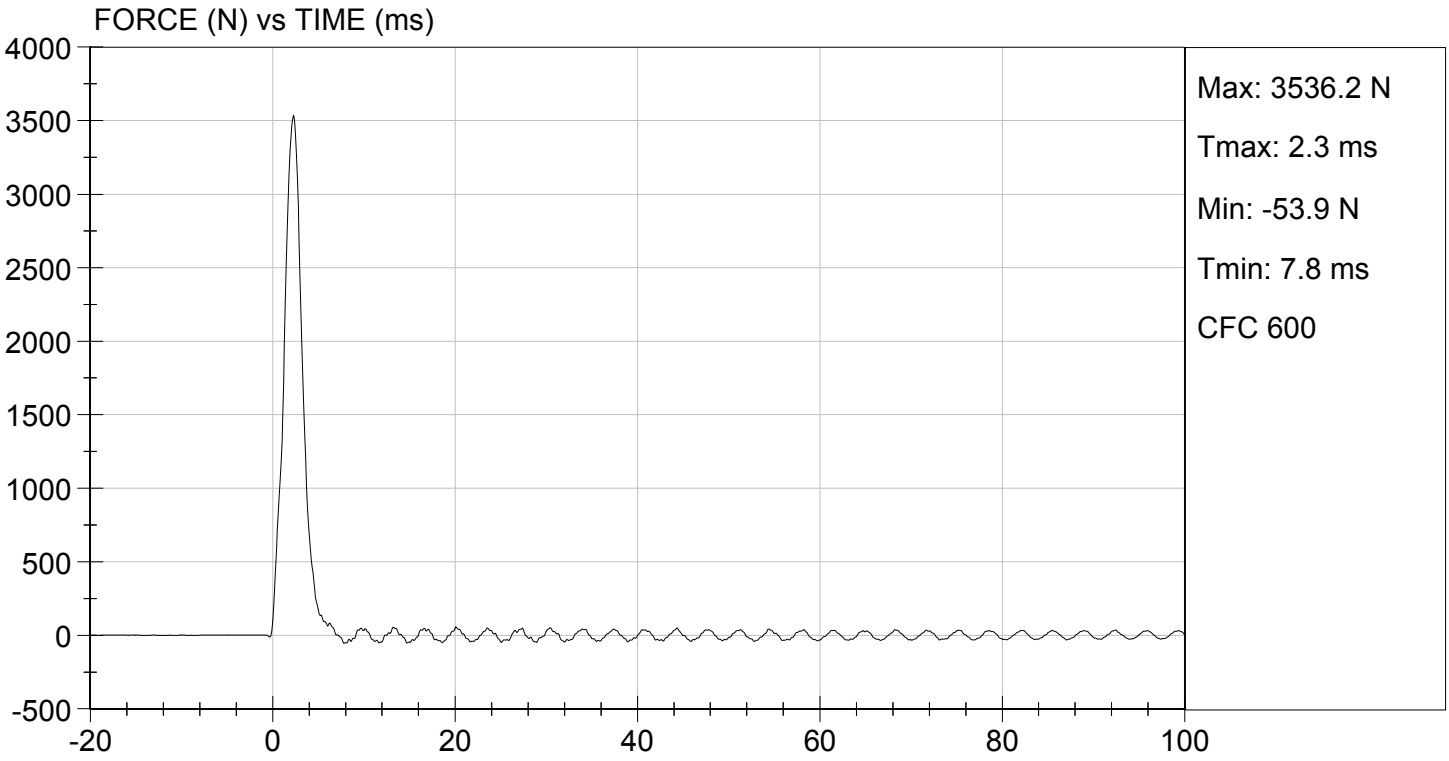
Jessica Hall
Laboratory Technician

04/16/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 04/16/2013
TEST #: D131356



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D131357

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	35	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	386	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
		Overall Result		Pass

Jessica Hall
Laboratory Technician

04/16/2013
Test Date

David Winkelbauer
Approved By