REPORT NUMBER: NCAP-MGA-2014-042

NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test

CHRYSLER GROUP LLC
2014 Ram 2500 Crew Cab 4WD Long Box
NHTSA No.: M20140312

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: December 17, 2013

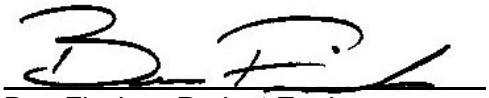
Final Report Date: January 28, 2014

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

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared by: 
Donna Janovicz, Project Manager

Approved by: 
Ben Fischer, Project Engineer

Approval Date: January 28, 2014

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

Technical Report Documentation Page

1. Report No. NCAP-MGA-2014-042	*2. Government Accession No.*	*3. Recipient's Catalog No.*
4. Title and Subtitle Final Report of New Car Assessment Program Frontal Impact Testing of a 2014 Ram 2500 Crew Cab 4WD Long Box, NHTSA No.: M20140312		*5. Report Date* January 28, 2014 *6. Performing Organization Code* MGA
7. Author(s) Donna Janovicz, Project Manager Ben Fischer, Project Engineer		*8. Performing Organization Report No.* NCAP-MGA-2014-042
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-12-D-00258
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NVS-111) 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C. 20590		*13. Type of Report and Period Covered* Final Test Report December 17, 2013 to January 28, 2014 *14. Sponsoring Agency Code* NVS-111
15. Supplementary Notes		

16. Abstract

A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2014 Ram 2500 Crew Cab 4WD Long Box in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), and 301 performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on December 17, 2013.

The impact velocity of the vehicle was 56.4 km/h and the ambient temperature at the barrier face at the time of impact was 21.0°C. The target vehicle post-test maximum crush was 786 located on the vehicle's centerline. The test vehicle's performance was as follows:

Measurement Description	Units	Driver ATD		Passenger ATD	
		Threshold	Result	Threshold	Result
Head Injury Criteria	N/A	700	215	700	473
Maximum Chest	mm	63	30	52	8
Nij	N/A	1	0.31	1	0.45
Neck Tension	N	4170	1826	2620	995
Neck Compression	N	4000	224	2520	315
Left Femur Force	N	10008	4058	6805	2629
Right Femur Force	N	10008	2405	6805	2534

17. Key Words 35 mph Frontal Barrier Impact Test New Car Assessment Program (NCAP)		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave, SE Washington, DC 20590 Email: tis@nhtsa.dot.gov FAX: 202-493-2833	
19. Security Classification of Report Unclassified	*20. Security Classification of Page* Unclassified	*21. No. of Pages* 170	22. Price

TABLE OF CONTENTS

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 2014 Ram 2500 Crew Cab 4WD Long Box at a velocity of 56.4 km/h. The test was performed at MGA Research Corporation on December 17, 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 lap and shoulder belts and the 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. 634) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 640 channels of data were recorded on a data acquisition system. Appendix B contains the dummy response data traces.

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

The maximum static crush of the vehicle was 786 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: The driver's head and chest contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee bolster. 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 glovebox and frontal airbag.

The occupant data is summarized below:

ATD position	HIC_{15}	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (Gs)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50^{th})	215	0.31	1826	224	35	30	4058	2405
Passenger (5^{th})	473	0.45	995	315	35	8	2629	2534

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

TEST NOTES

Load Cell K-15 MY has questionable data

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20140312	Traction Control System (TCS)	Yes
Model Year	2014	Power Steering	Yes
Make	Ram	Power Window Auto-Reverse	Yes
Model	2500	Driver Frontal Airbag	Yes
Body Style	Crew Cab Truck, Long Box	Driver Curtain Airbag	Yes
VIN	3C6TR5HT6EG129255	Driver Head/Torso Airbag	No
Body Color	Bright Silver Metallic	Driver Torso Airbag	Yes
Odometer (km/mi)	23 / 14	Driver Torso/Pelvis Airbag	No
Engine Displacement (L)	5.7	Driver Pelvis Airbag	No
Type/No. Cylinders	8	Driver Knee Airbag	No
Engine Placement	Longitudinal	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	6	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	Yes
Final Drive	4WD	Front Pass. Torso/Pelvis Airbag	No
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof/T-Top	No	Front Pass. Knee Airbag	No
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	No	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Other	N/A

Does owner's manual provide instructions to turn off automatic door locks?	No

DATA FROM CERTIFICATION LABEL

Manufactured By	Chrysler Group LLC
Date of Manufacture	09/13

GVWR (kg)	4083
GAWR Front (kg)	2382
GAWR Rear (kg)	2722

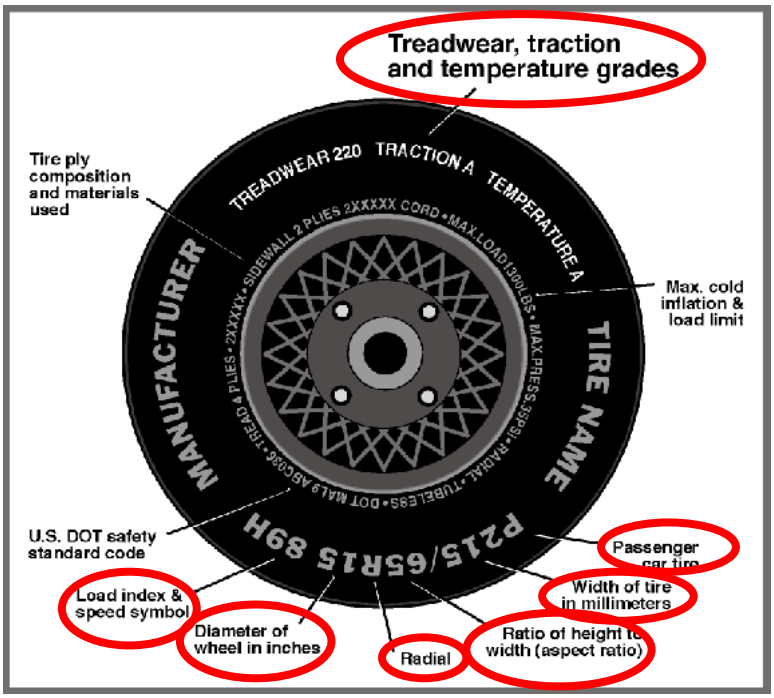
VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Split Bench	Bench		
Designated Seating Capacity (DSC)	3	3		6
Capacity Weight (VCW) (kg)				941
Cargo Weight (RCLW) (kg)				533

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

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	550	550
Cold Pressure (kPa)	520	550
Recommended Tire Size	LT245/70R17	LT245/70R17
Tire Size on Vehicle	LT245/70R17	LT245/70R17
Tire Manufacturer	Firestone	Firestone
Tire Model	Transforce HT	Transforce HT
Treadwear		
Traction		
Temperature Grade		
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Nylon	2 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	119/116R	119/116R
Tire Material	Rubber	Rubber
DOT Safety Code Left	VPN8 THO 2713	VPN8 THO 2713
DOT Safety Code Right	VPN8 THO 2713	VPN8 THO 2713

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

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	892.2	669.5		945.7	753.0	
Right	kg	905.8	628.3		952.1	714.9	
Ratio	%	58.1	41.9		56.4	43.6	
Totals	kg	1798.0	1297.8	3095.8	1897.8	1467.9	3365.7

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	3095.8
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	136
Calculated Test Vehicle Target Weight (TVTW)	kg	3372.4

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	1005	998	1062	1075	1806
As Tested	mm	998	994	1062	1061	1879
Post Test	mm	1061	1012	1074	1048	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	4308
Total Vehicle Length at Left Side	mm	6065
Total Vehicle Length at Centerline	mm	6600
Total Vehicle Length at Right Side	mm	6065
Weight of Ballast in Cargo Area	kg	59.4
Weight of Vehicle Components Removed	kg	0.0
Amount of Stoddard Solvent in Fuel Tank	L	109.0

List of components removed to meet test weight: None

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

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

TARGET VEHICLE STRUCTURAL MEASUREMENT

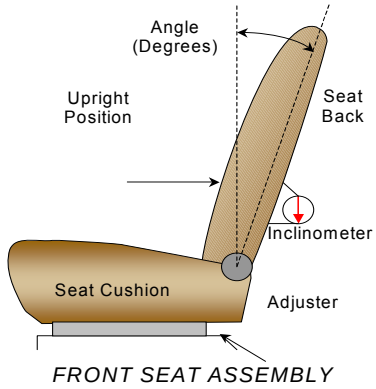
	Elements	Pre-Test (mm)
1	Total Length	6600
2	Total Width	2020
3	Bumper Top Height	792
4	Bumper Bottom Height	450
5	Longitudinal Member Top Height	715
6	Distance between Longitudinal Members	883
7	Longitudinal Member Width	50
8	Engine Top Height	1190
9	Engine Bottom Height	420
10	Engine and Gearbox Width	467
11	Front Bumper-Engine Distance	578
12	Front Shock Absorber Fixing Height	870
13	Bonnet Leading Edge Height	1253
14	Front Shock Absorber Fixing Width	825
15	Front Bumper – Front Axle Distance	982
16	Front Axle – A-Pillar Distance	582
17	A-Pillar – B-Pillar Distance	1108
18	B-Pillar – Rear Axle Distance	2622
19	B-Pillar – C-Pillar Distance	928
20	Roof Sill Bottom Height	1852
21	Roof Sill Top Height	1958
22	Floor Sill Bottom Height	434
23	Floor Sill Top Height	674

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

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

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 August 2013.



	Degrees
Driver Seat Back Angle	5.3° on headrest post
Passenger Seat Back Angle	2.3° on headrest post

SEAT FORE/AFT POSITIONS

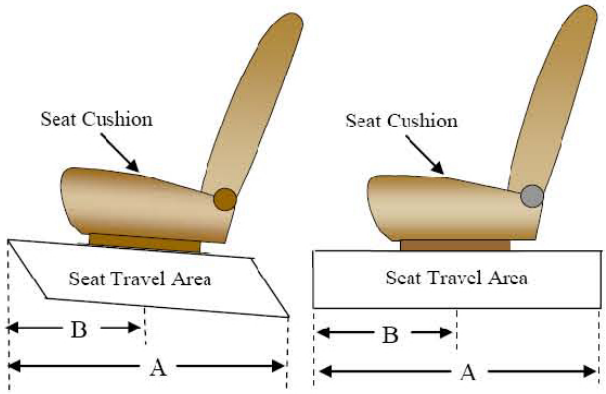
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated August 2013.

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

SEAT BELT UPPER ANCHORAGES

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

	Total # of Positions	Placed in Position #
Driver Seat	5 (1st as 1)	0 (uppermost as 0)
Passenger Seat	5 (1st as 1)	0 (uppermost as 0)



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

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

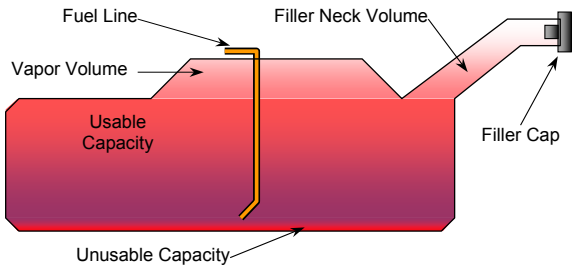
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	121.1
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	111.4 to 113.8
Actual Amount of Solvent used	109.0
1/3 of Usable Capacity	40.4

FUEL PUMP

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

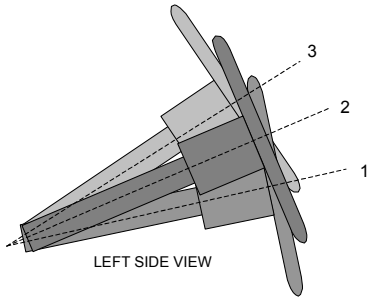
The vehicle is equipped with an electric fuel pump. The fuel pump will pump fuel when the ignition key is in and turned to the run position. The fuel pipe is on the left side.



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.



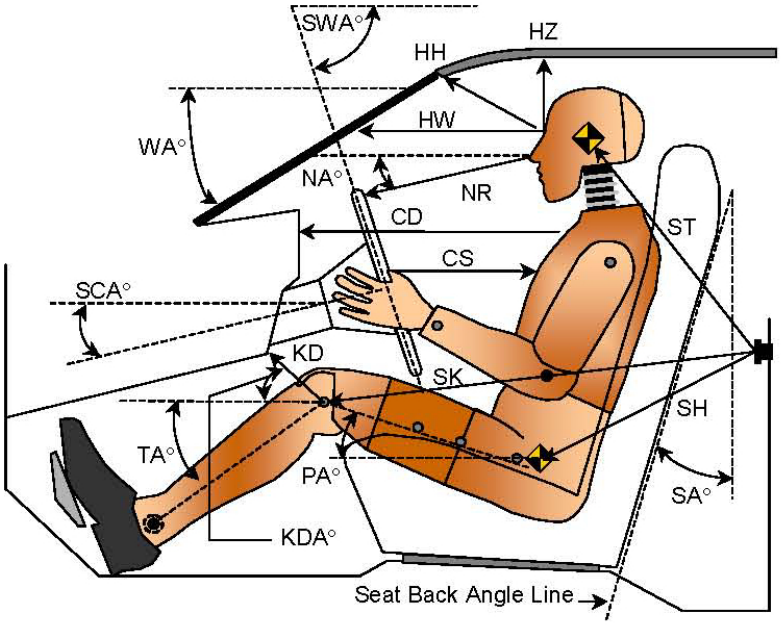
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	76.4	
Geometric Center Position 2	67.8	
Uppermost Position 3	59.2	
Telescoping Steering Wheel Travel		
Test Position	68.8	

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20140312
Test Date: 12/17/2013

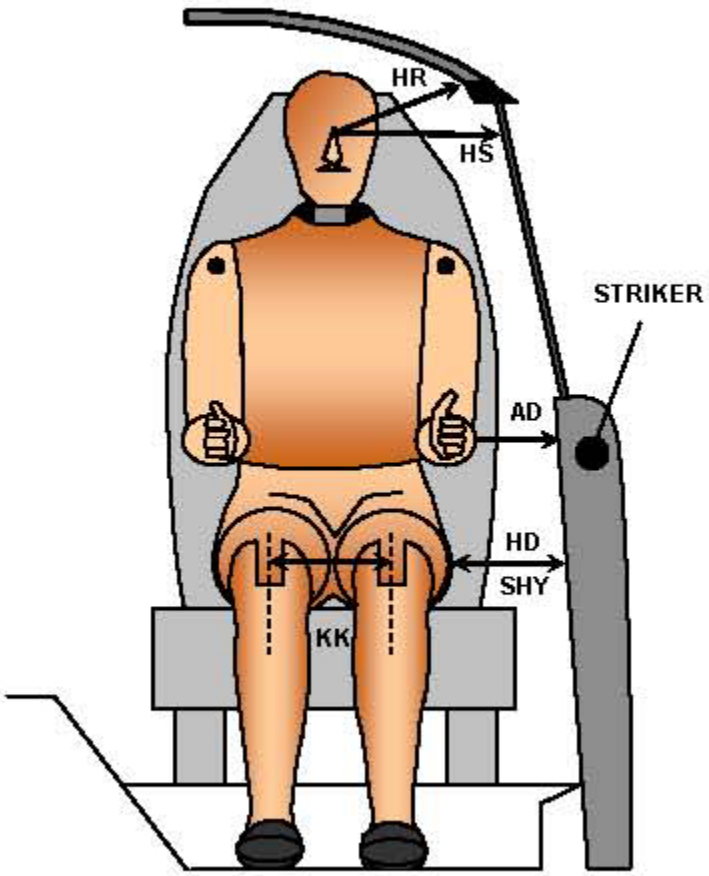


LEFT SIDE VIEW

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		33.4		
SWA°	Steering Wheel Angle		68.8		
SCA°	Steering Column Angle		21.2		
SA°	Seat Back Angle (on headrest post)		5.3		2.3
HZ	Head to Roof (Z)	240	90.0	268	90.0
HH	Head to Header	454	22.7	396	36.1
HW	Head to Windshield	685	0.0	725	0.0
NR	Nose to Rim	424	18.4		
CD	Chest to Dash	587		455	
CS	Chest to Steering Hub	361	12.7		
RA	Rim to Abdomen	219	0.0		
KDL	Left Knee to Dash	156	13.6	65	30.3
KDR	Right Knee to Dash	140	18.7	78	28.4
PA°	Pelvic Angle		24.3		22.3
TA°	Tibia Angle		55.4		66.6
SK	Striker to Knee	581	80.3	672	92.0
ST	Striker to Head	677	6.8	615	21.4
SH	Striker to H-Point	203	88.6	379	82.4

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20140312
Test Date: 12/17/2013

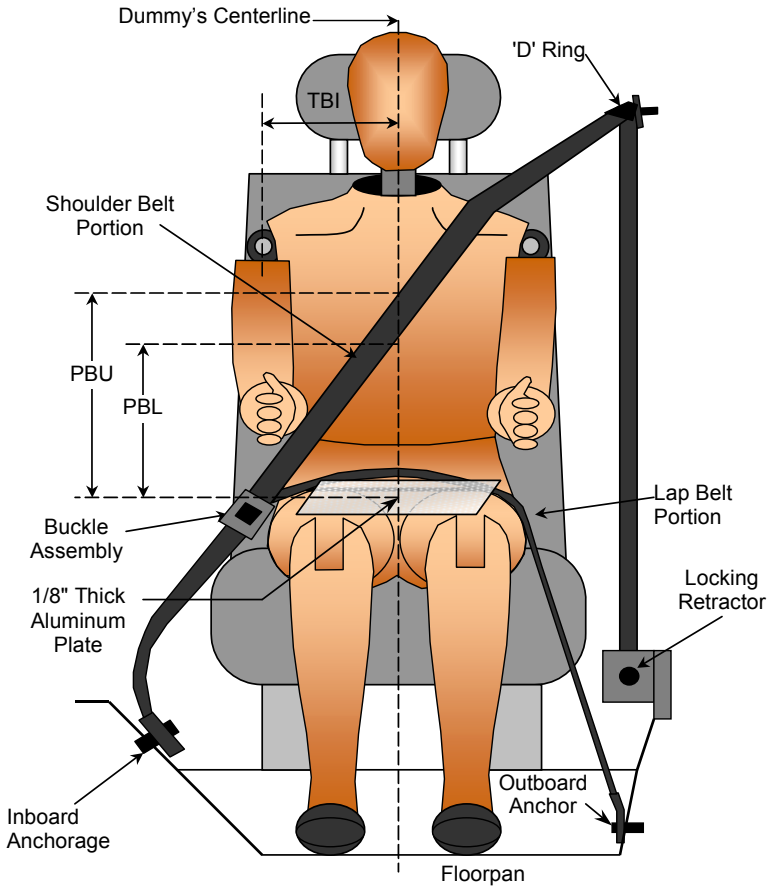


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
AD	Arm to Door	124	92
HD	H-Point to Door	141	175
HR	Head to Side Header	203	264
HS	Head to Side Window	312	342
KK	Knee to Knee	314	230
SHY	Striker to H-Point (Y Direction)	259	294
AA	Ankle to Ankle	291	131

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20140312
Test Date: 12/17/2013



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	385	310
PBL - Top surface of reference to belt lower edge	mm	310	220

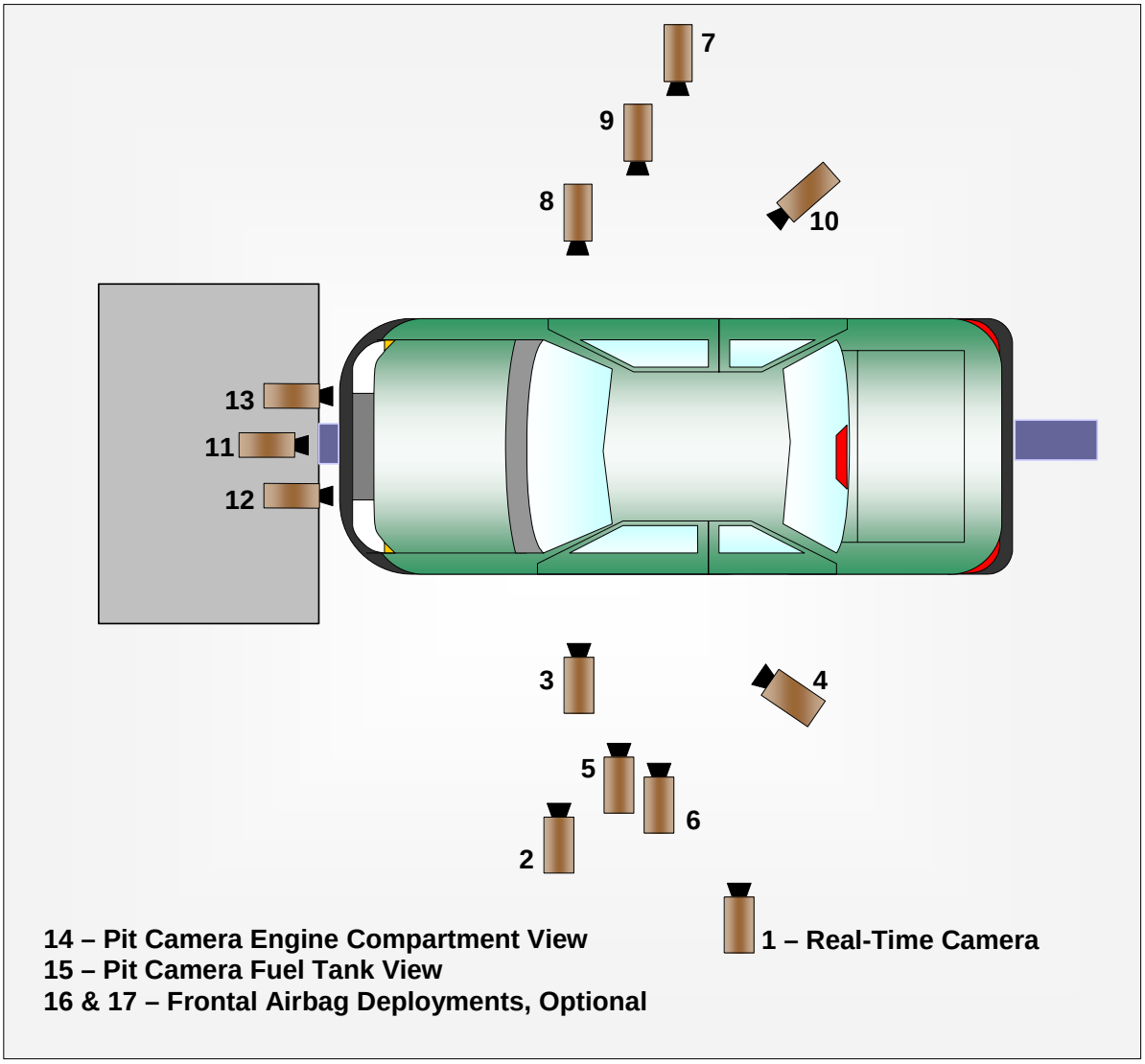
BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	865	880
Lap Belt Length as measured on ATD	mm	850	850
Remainder of belt on reel	mm	1885	1870
Total Belt Length for Continuous Webbing Systems	mm	3600	3600

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

Test Vehicle:	2014 Ram 2500 Crew Cab 4WD Long Box	NHTSA No.:	M20140312
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	12/17/2013

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: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	1700	-6740	-1910	35	1000
3	Left Front Half	1470	-5640	-1510	24	1000
4	Left Angle	5740	-5530	-1960	50	1000
5	Steering Column - Top	580	-5200	-1210	24	1000
6	Steering Column - Bottom	570	-5240	-810	24	1000
7	Right Overall	2950	6650	-1490	20	1000
8	Passenger Close-Up	1410	7030	-1970	35	1000
9	Right Front Half	1360	5800	-1470	24	1000
10	Right Angle	5810	5410	-1940	50	1000
11	Windshield	-90	0	-2830	20	1000
12	Driver Windshield	200	-400	-2030	8.5	1000
13	Passenger Windshield	200	420	-2010	8.5	1000
14	Pit Front	1070	0	3150	24	1000
15	Pit Rear	3090	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

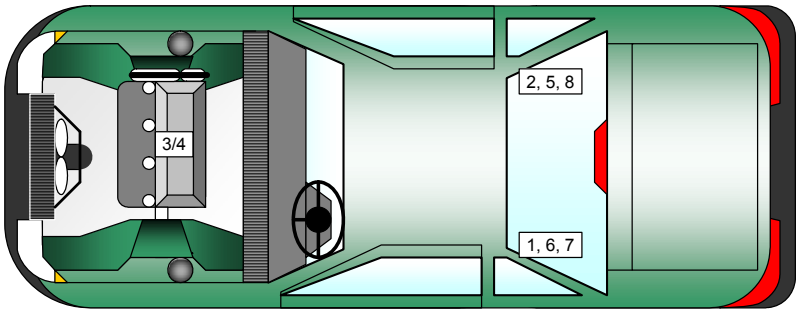
*COORDINATES:

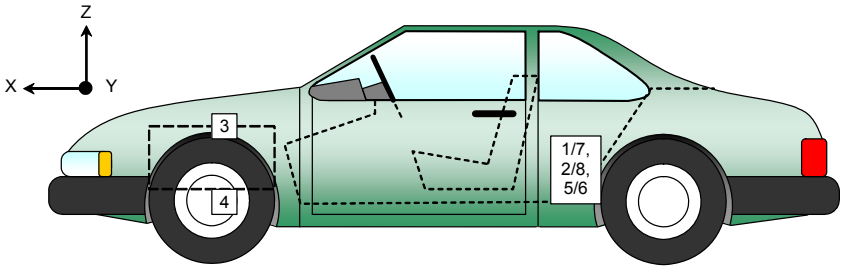
+X = forward of impact plane
+Y = right of monorail centerline
+Z = below ground level

Cameras 16 & 17 were not used for this test.

DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20140312
Test Date: 12/17/2013





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	3506	-494	-700
2	Right Rear Crossmember Accelerometer – X Direction	3506	496	-698
3	Engine Top X	5654	42	-1189
4	Engine Bottom X	5383	38	-414
5	Left Rear Crossmember Accelerometer – Z Direction	3506	-494	-700
6	Right Rear Crossmember Accelerometer – Z Direction	3506	496	-698
7	Left Rear Crossmember Accelerometer Redundant – X Direction	3506	-494	-700
8	Right Rear Crossmember Accelerometer Redundant – X Direction	3506	496	-698

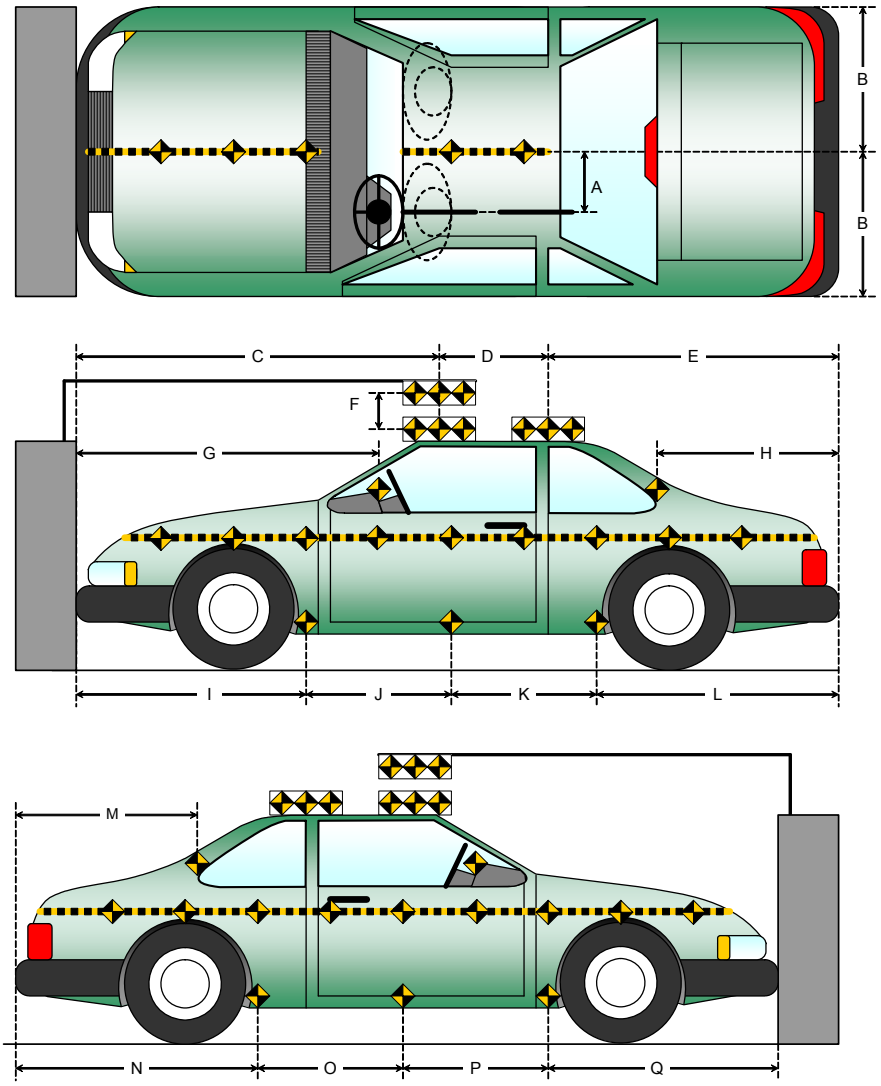
Reference Points: X - Rear Surface of Vehicle (+ forward)
Y - Vehicle Centerline (+ to right)
Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20140312
Test Date: 12/17/2013

Item	Value (mm)
A	500
B	1010
C	2510
D	661
E	3429
F	50
G	
H	2962
I	1588
J	1019
K	1019
L	2974
M	2962
N	2974
O	1019
P	1019
Q	1588



DATA SHEET NO. 9
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

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: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

INSTRUMENTATION

Driver Dummy Data Channels	52
Passenger Dummy Data Channels	52
Vehicle Structure Accelerometers	8
Barrier Channels	528
Total	640

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: 2014 Ram 2500 Crew Cab 4WD Long Box
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20140312
Test Date: 12/17/2013

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 351	HIII 5% / 634
Head Contact	Airbag, Headrest	Airbag, Headrest
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Bolster	Glovebox, Frontal Airbag
Right Knee Contact	Knee Bolster	Glovebox, Frontal Airbag

DOOR OPENING AND SEAT TRACK INFORMATION

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

POST TEST STRUCTURAL OBSERVATIONS

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

VEHICLE REBOUND FROM BARRIER

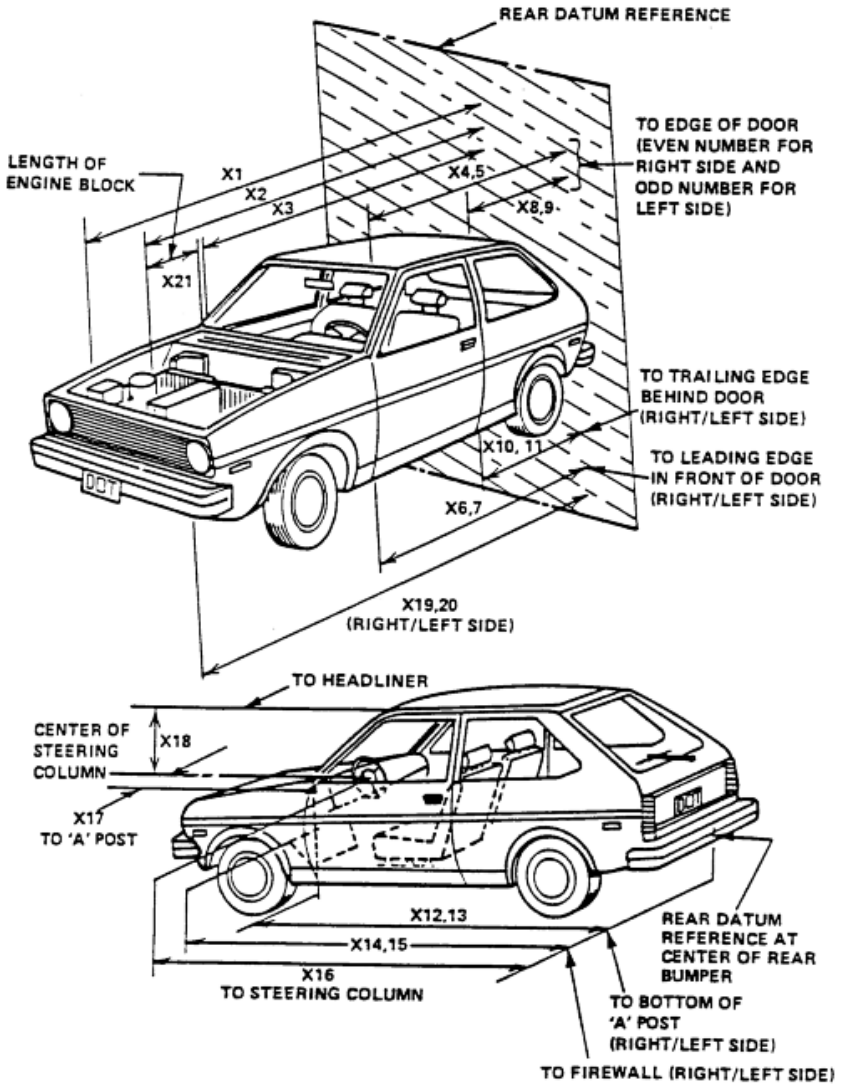
Measured Parameter	Units	Value
Left Side	mm	895
Center	mm	890
Right Side	mm	830
Average	mm	872

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

DATA SHEET NO. 12
VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2014 Ram 2500 Crew Cab 4WD Long Box	NHTSA No.:	M20140312
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	12/17/2013



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	6600	5814	786
2	RSOV to Front of Engine	mm	5835	5593	242
3	RSOV to Firewall	mm	5457	5118	339
4	RSOV to Upper Leading Edge of Right Door	mm	5023	4979	44
5	RSOV to Upper Leading Edge of Left Door	mm	5023	4982	41
6	RSOV to Lower Leading Edge of Right Door	mm	4960	4944	16
7	RSOV to Lower Leading Edge of Left Door	mm	4960	4947	13
8	RSOV to Upper Trailing Edge of Right Door	mm	3890	3858	32
9	RSOV to Upper Trailing Edge of Left Door	mm	3890	3862	28
10	RSOV to Lower Trailing Edge of Right Door	mm	3883	3873	10
11	RSOV to Lower Trailing Edge of Left Door	mm	3883	3871	12
12	RSOV to Bottom of “A” Post of Right Side	mm	4966	4957	9
13	RSOV to Bottom of “A” Post of Left Side	mm	4966	4958	8
14	RSOV to Firewall, Right Side	mm	5365	5278	87
15	RSOV to Firewall, Left Side	mm	5365	5283	82
16	RSOV to Steering Column	mm	4495	4432	63
17	Center of Steering Column to “A” Post	mm	430	440	-10
18	Center of Steering Column to Headliner	mm	476	501	-25
19	RSOV to Right Side of Front Bumper	mm	6065	5760	305
20	RSOV to Left Side of Front Bumper	mm	6065	5668	397
21	Length of Engine Block	mm	525	525	0
RD	RSOV to Right Side of Dash Panel	mm	4850	4806	44
CD	RSOV to Center of Dash Panel	mm	4806	4708	98
LD	RSOV to Left Side of Dash Panel	mm	4855	4776	79

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

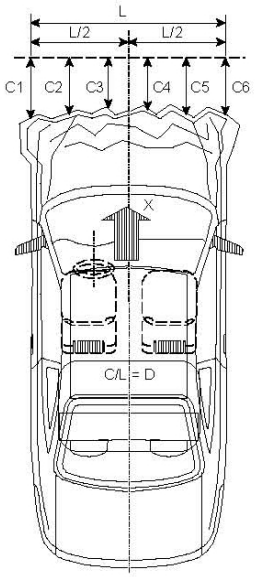
Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

VEHICLE INFORMATION

VIN: 3C6TR5HT6EG129255 Wheelbase (mm): 4308
Vehicle Size Category: Truck Test Weight (kg): 3365.7

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15
Cal. Procedure/Interval: MGA procedure / 6 month
Integration Algorithm: Trapezoidal
Linearity: > 99%
Impact Velocity (km/h): 56.4
Velocity Change (km/h): 66.7
Time of Separation (msec): 142.5



CRUSH PROFILE

Collision Deformation Classification: Frontal
Midpoint of Damage: Centerline
Damage Region Length (mm): 2464
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	6065	5668	397
C2	Crush zone 2 at left side	mm	6394	5872	522
C3	Crush zone 3 at left side	mm	6546	5840	706
C4	Crush zone 4 at right side	mm	6546	5805	741
C5	Crush zone 5 at right side	mm	6394	5842	552
C6	Crush zone 6 at right side	mm	6065	5760	305
L	C1 TO C6	mm	2464	2381	83

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

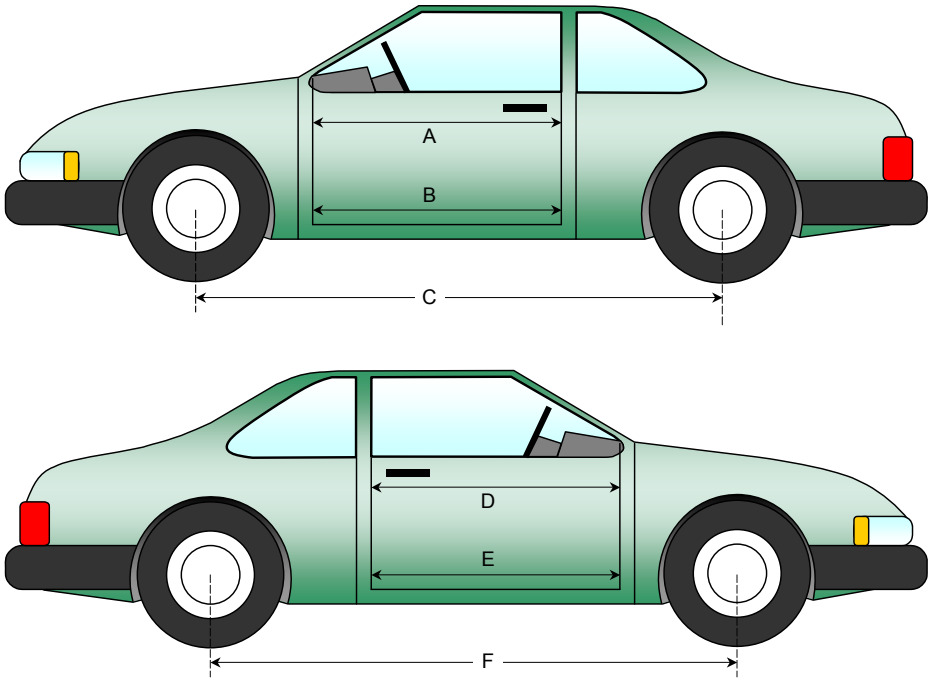
Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20140312
Test Date: 12/17/2013

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	976	971	5
B	Left Side Lower	mm	946	943	3
D	Right Side Upper	mm	976	966	10
E	Right Side Lower	mm	946	942	4

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	4308	4230	78
F	Right Side Wheelbase	mm	4308	4192	116



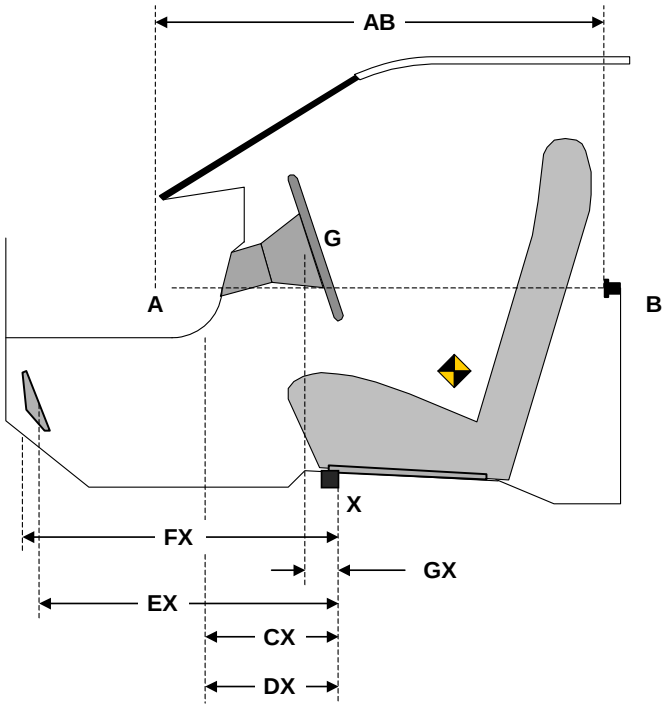
DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2014 Ram 2500 Crew Cab 4WD Long Box
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20140312
Test Date: 12/17/2013

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	763	761	2
CX	Left Knee Bolster to X	mm	245	214	31
DX	Right Knee Bolster to X	mm	225	162	63
EX	Brake Pedal to X	mm	492	394	98
FX	Foot Rest to X	mm	613	556	57
GX	Center of Steering Column Wheel Hub to X	mm	41	-21	-62

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: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

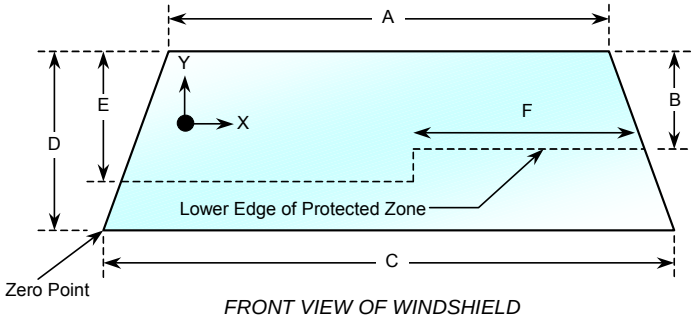
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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: 21.0°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2302	2302	100
Right Side	2302	2302	100
Total	4604	4604	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1398
B	mm	474
C	mm	1538
D	mm	834
E	mm	522
F	mm	525

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: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

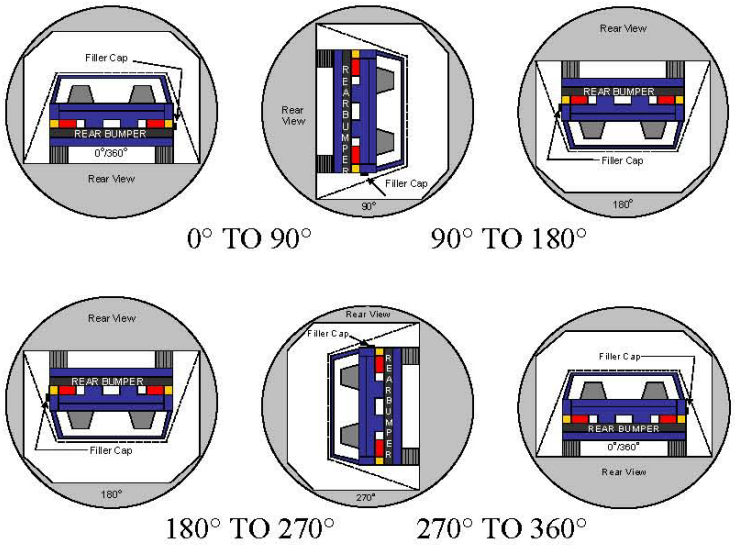
Temperature at Time of Impact: 21.0°C Test Time: 3:41 p.m.

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: 2014 Ram 2500 Crew Cab 4WD Long Box
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: M20140312
Test Date: 12/17/2013

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°	161	300	461
90° to 180°	149	300	449
180° to 270°	150	300	450
270° to 360°	157	300	457

FMVSS 301 SPILLAGE TABLE (units in ounces)

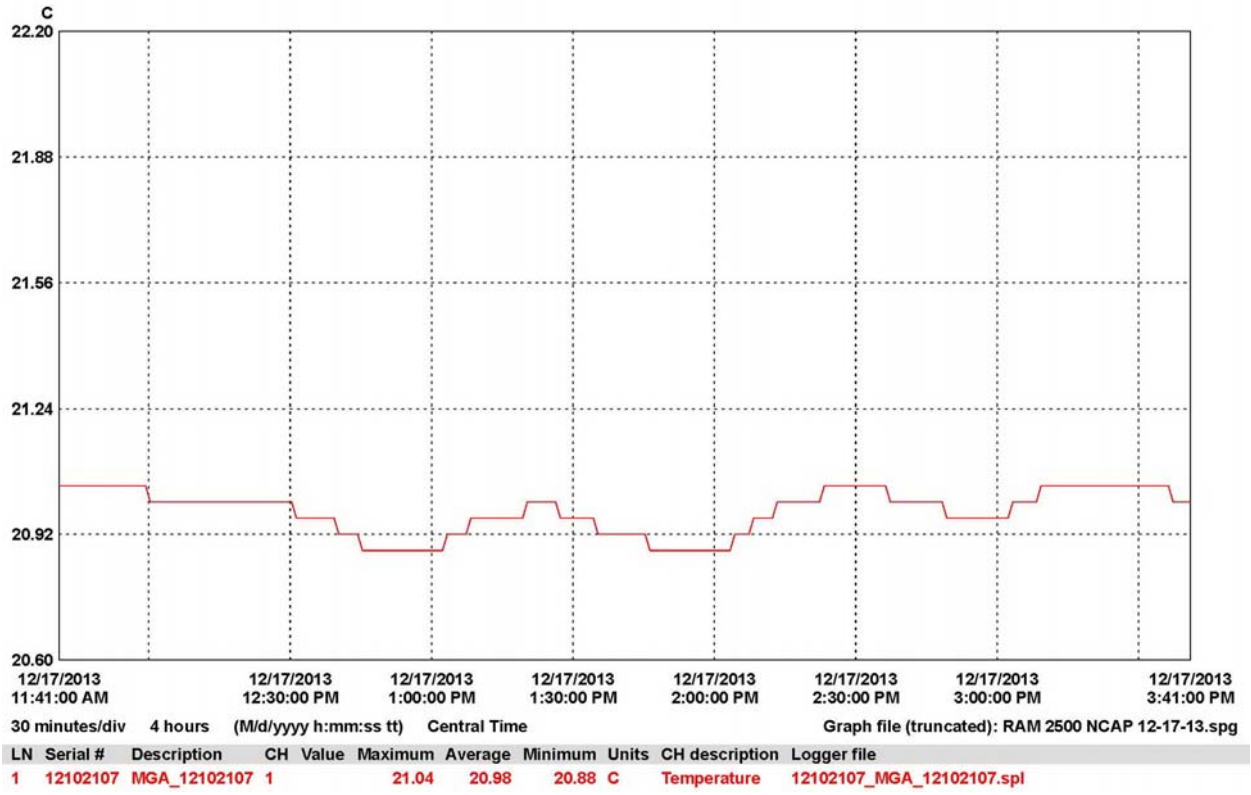
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

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: 2014 Ram 2500 Crew Cab 4WD Long Box NHTSA No.: M20140312
Test Program: NCAP Frontal Barrier Impact Test Test Date: 12/17/2013

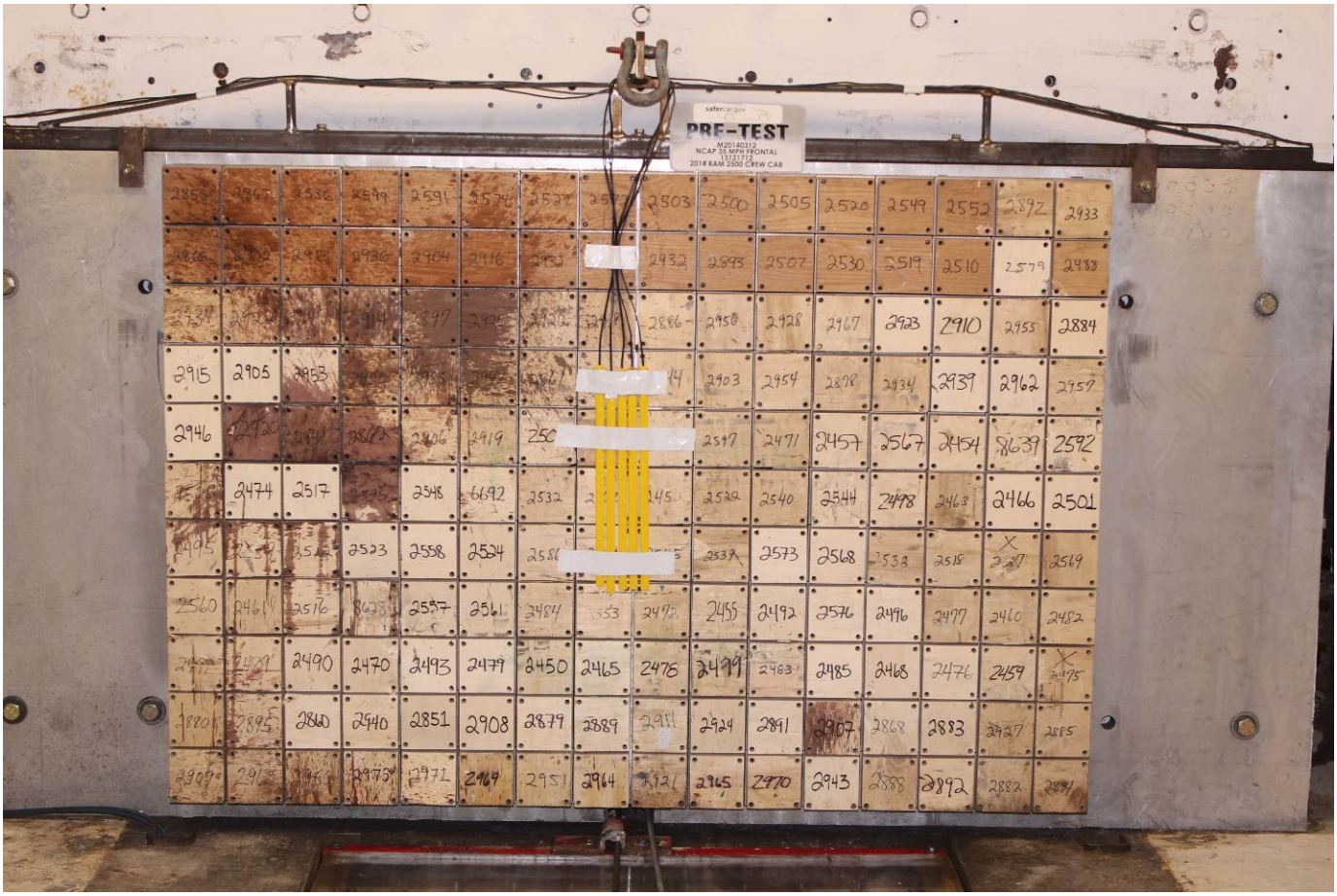


LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	12102107	MGA_12102107	1		21.04	20.98	20.88	C	Temperature	12102107_MGA_12102107.spl

APPENDIX A
PHOTOGRAPHS

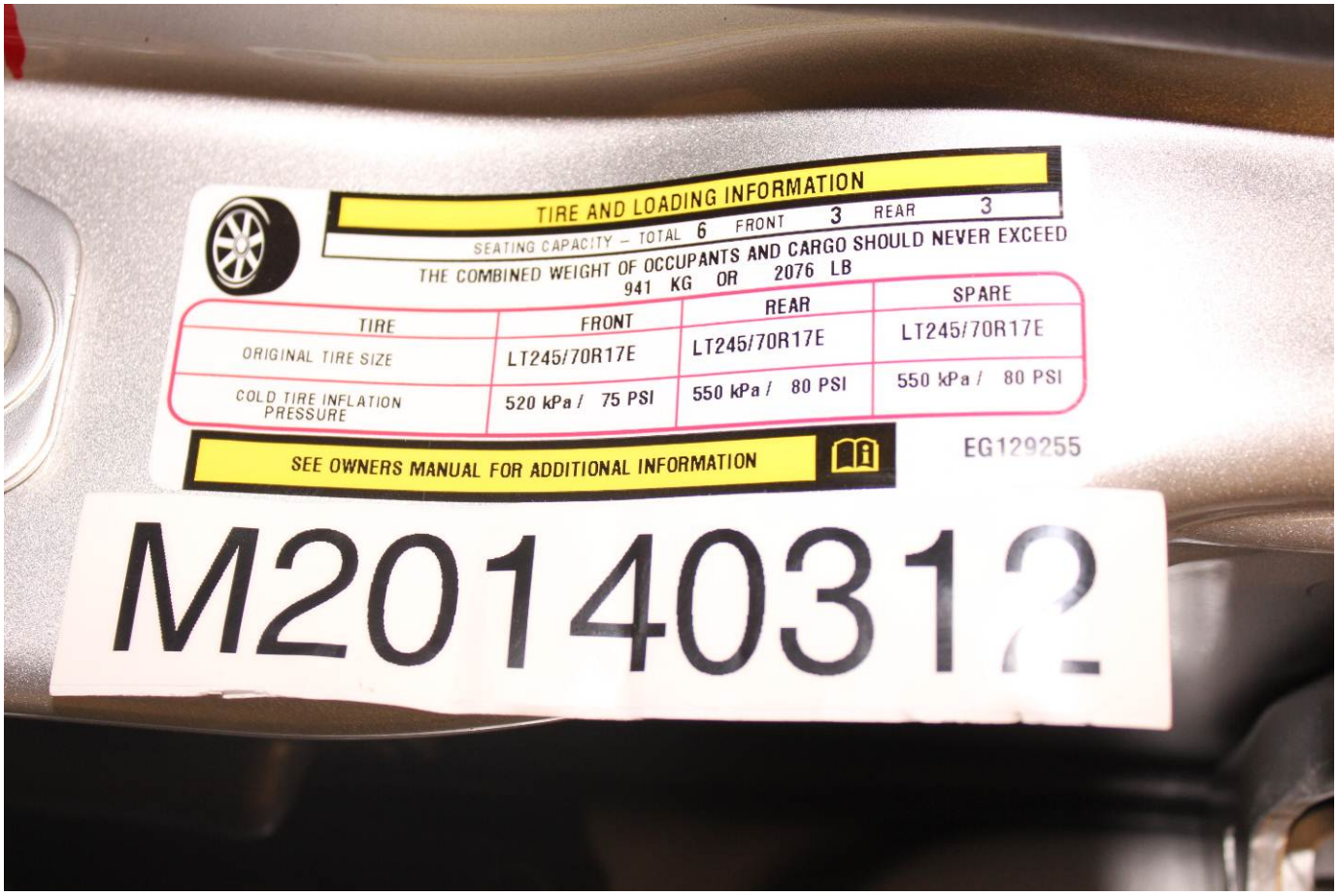
TABLE OF PHOTOGRAPHS

Load Cell Location



Load Cell Wall

Manufacturer's Label



Tire Placard

2014 Ram 2500 Crew Cab 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

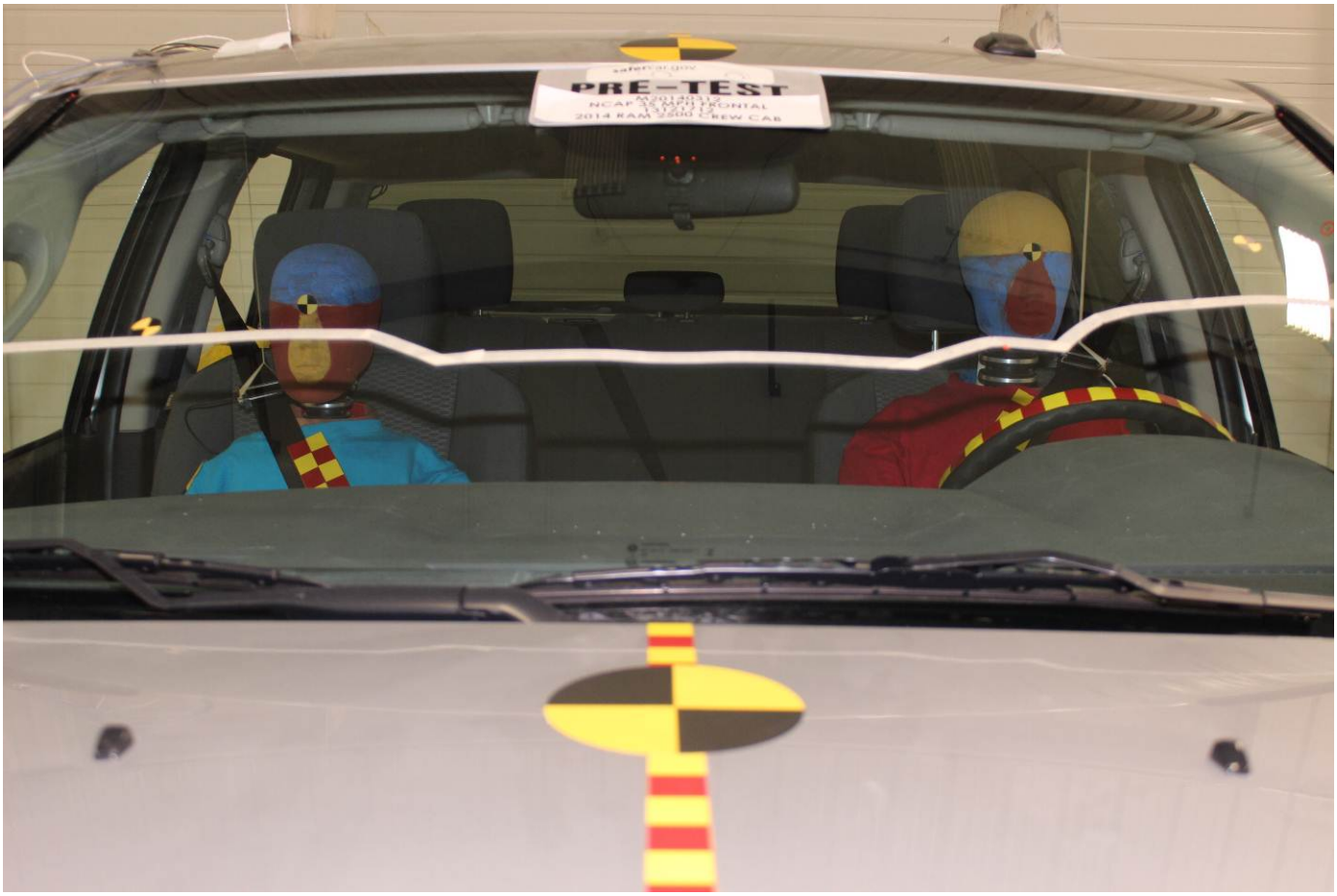
Post-Test Right View of Test Vehicle

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

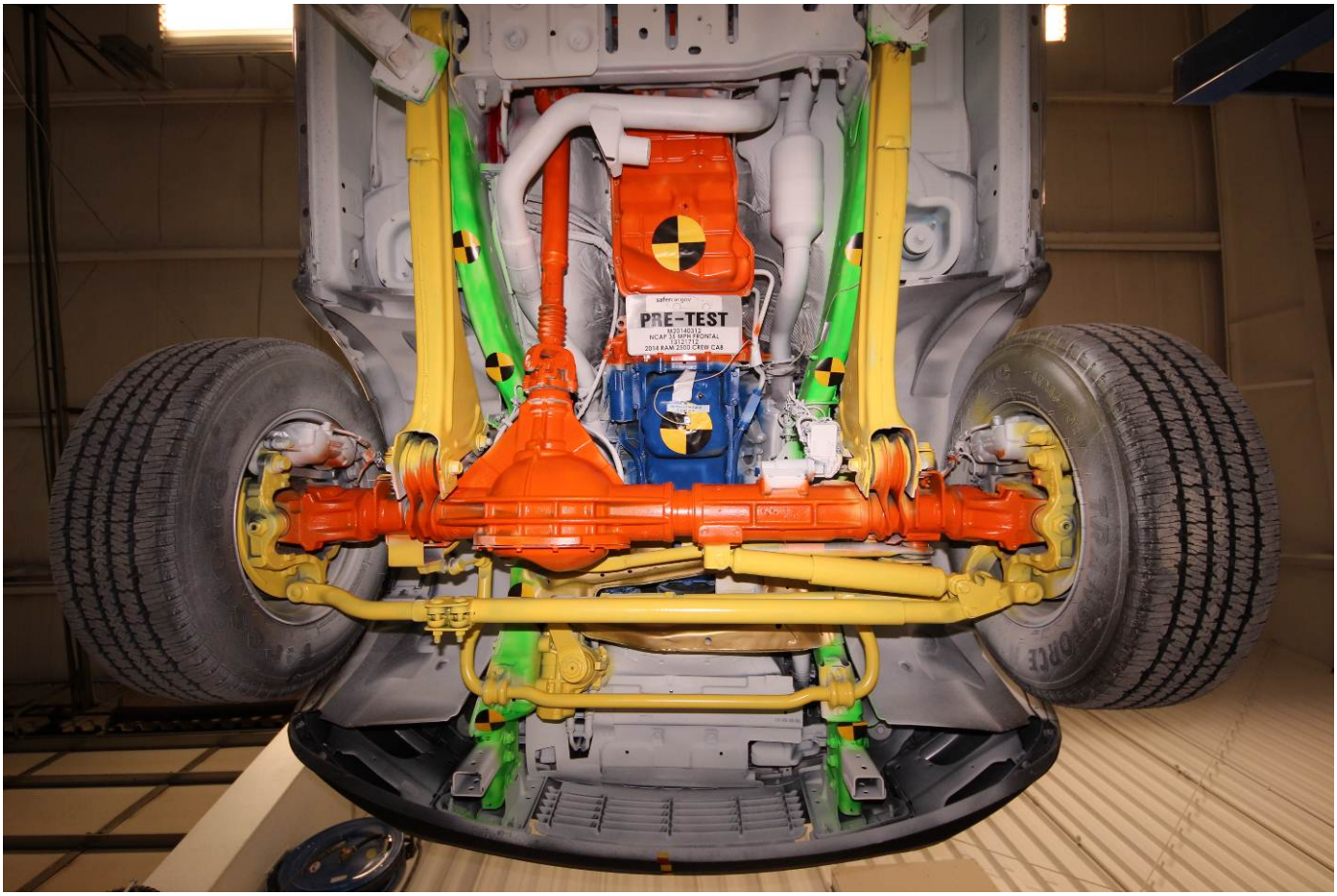
Post-Test Windshield View

Pre-Test Engine Compartment View

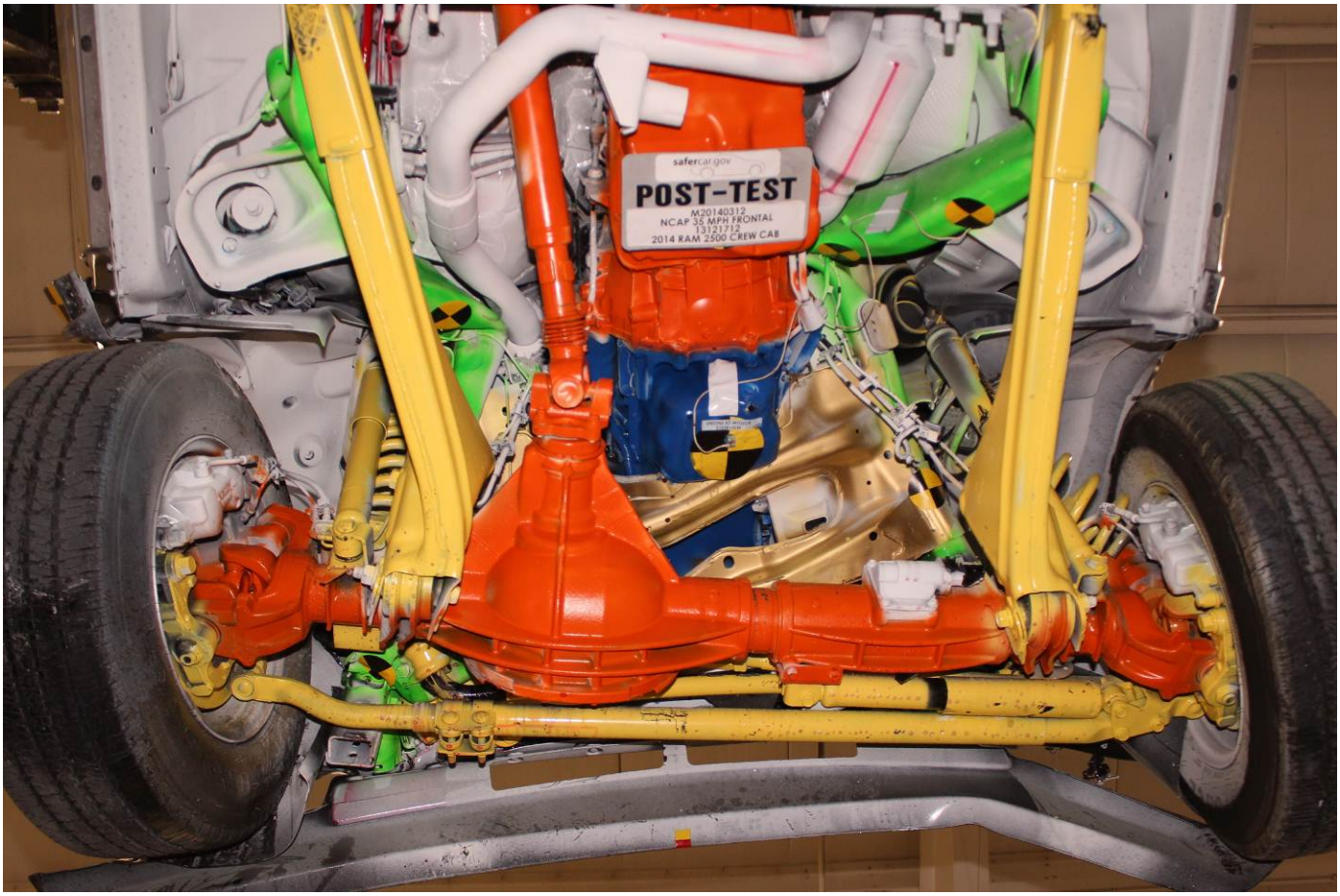
Post-Test Engine Compartment View

Pre-Test Fuel Filler Cap View

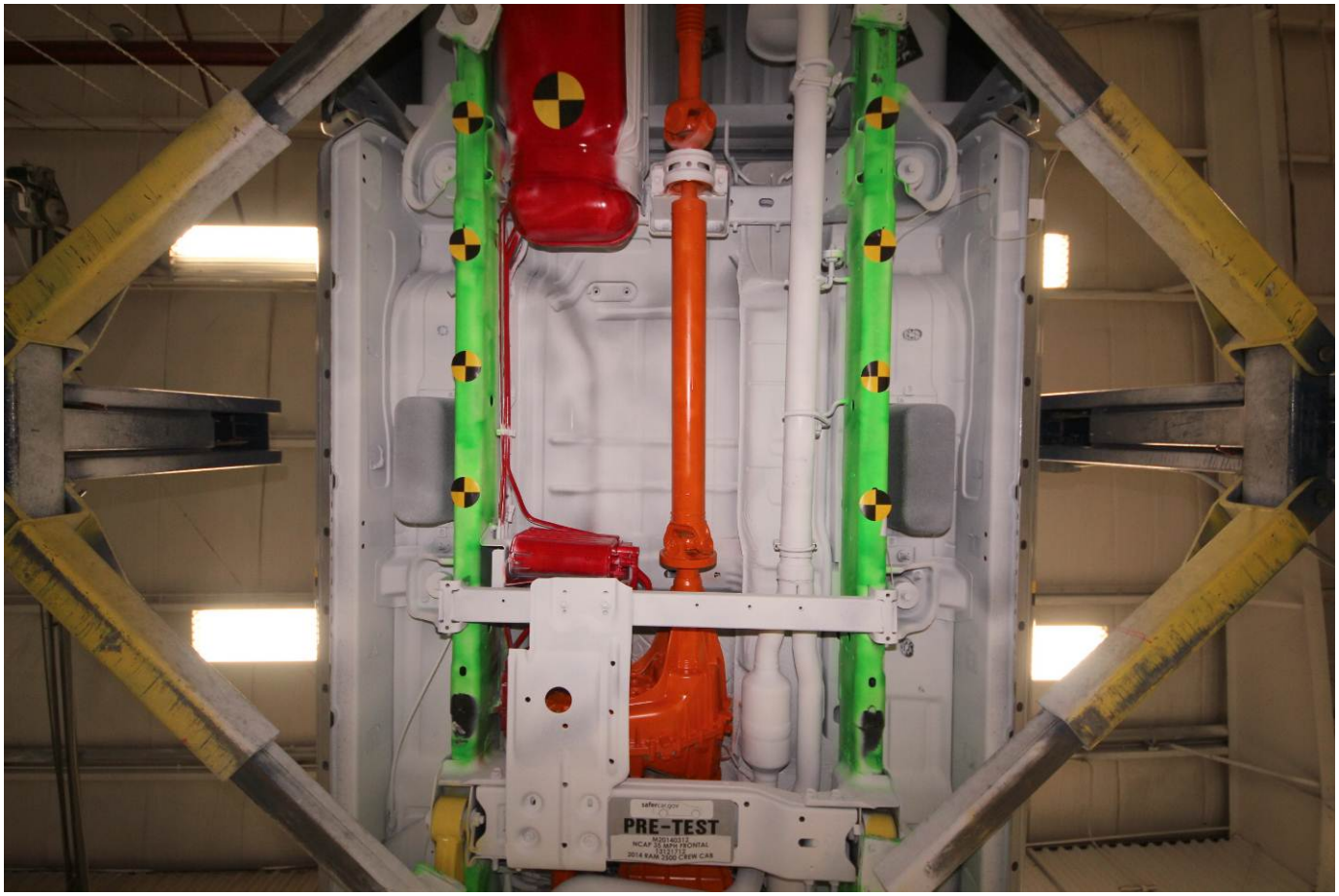
Post-Test Fuel Filler Cap View



Pre-Test Front Underbody View

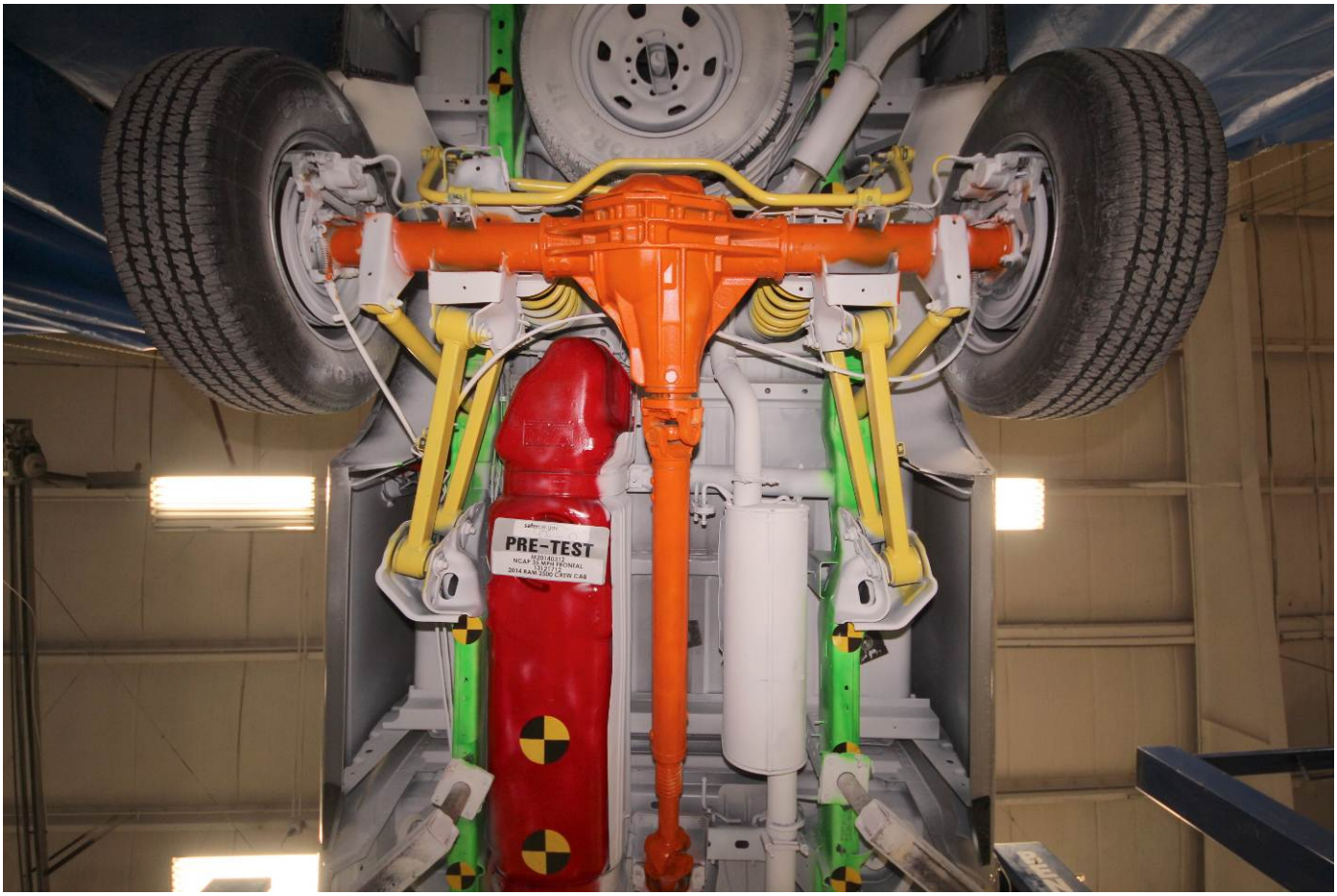


Post-Test Front Underbody View



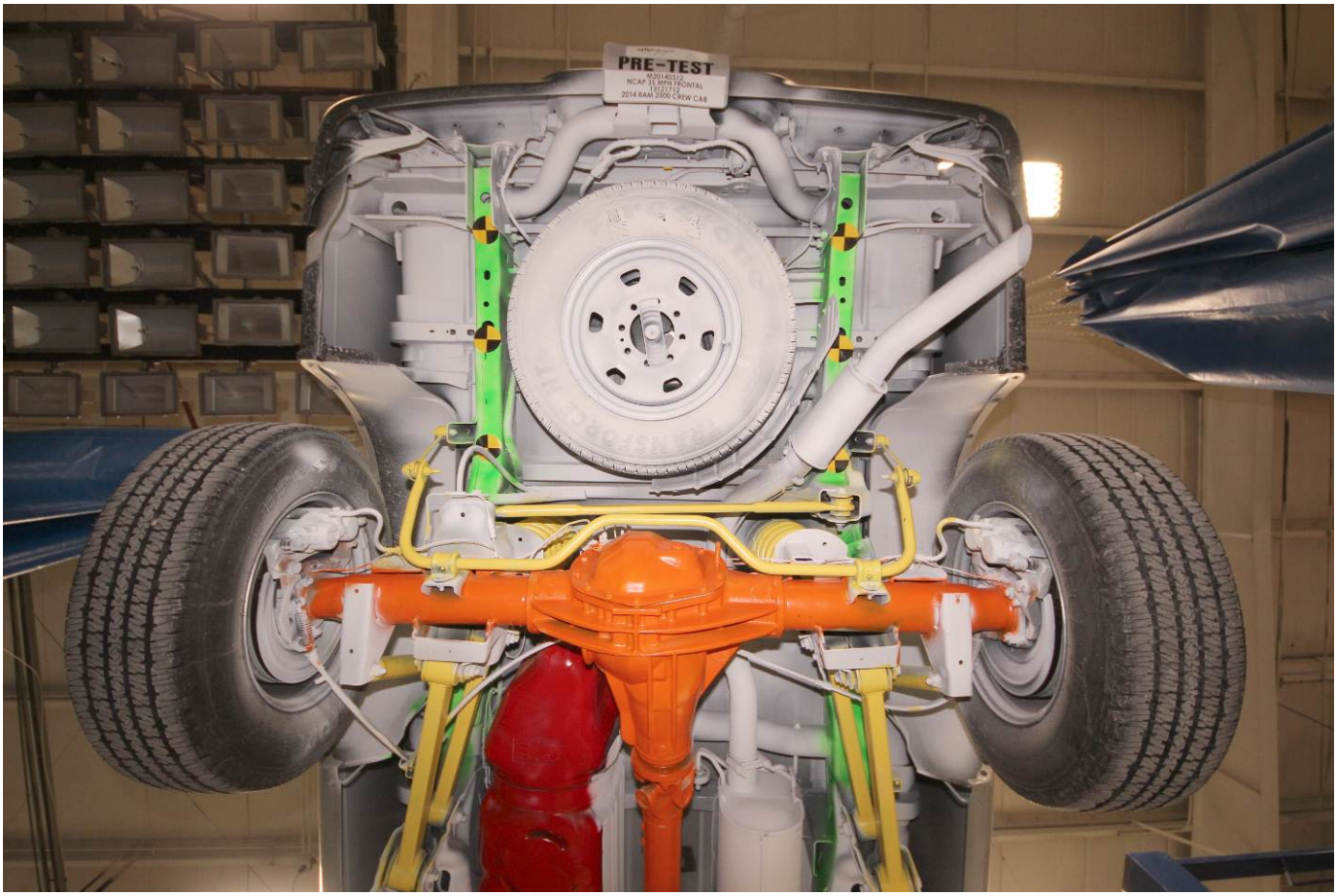
Pre-Test Mid Front Underbody View

Post-Test Mid Front Underbody View

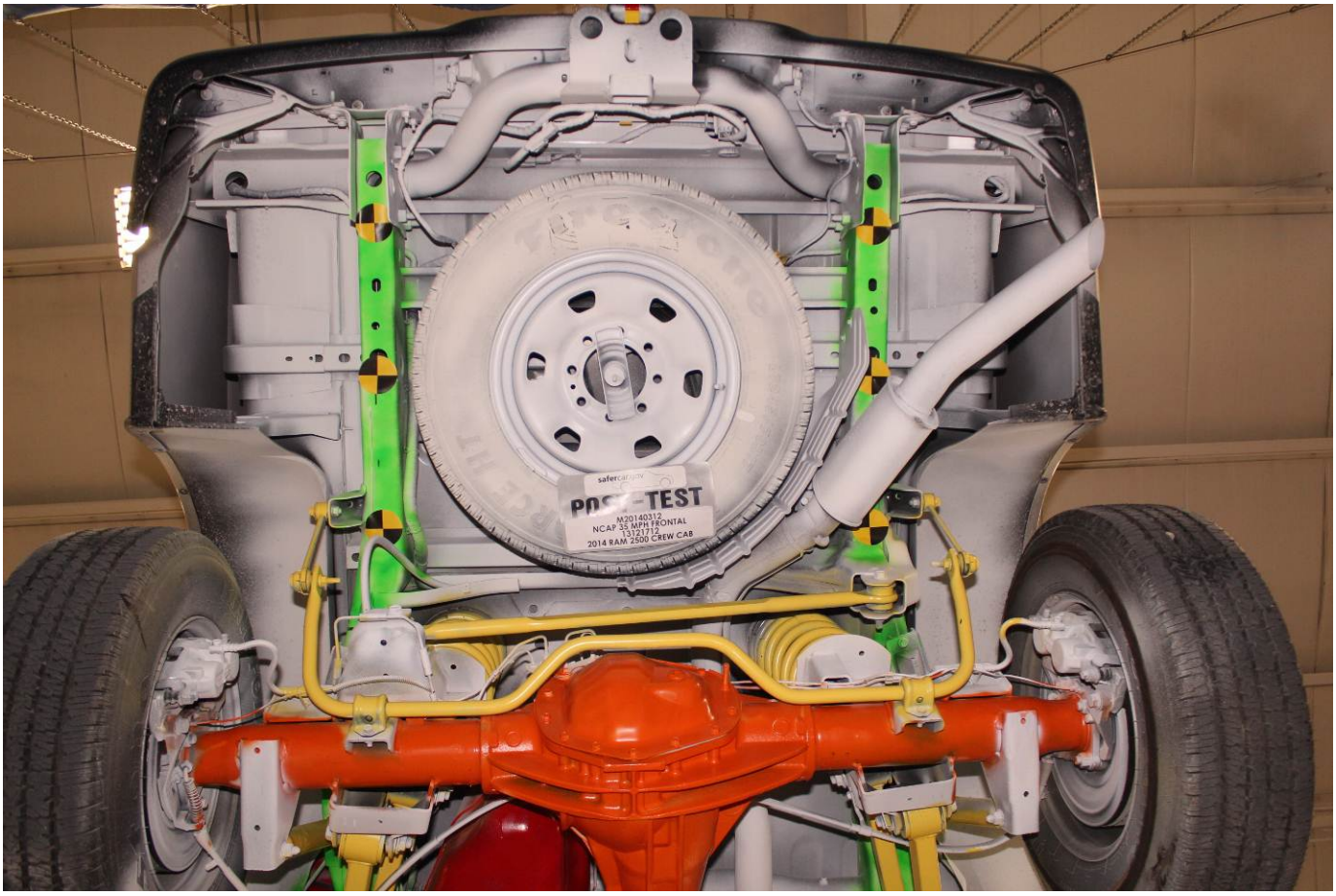


Pre-Test Mid Rear Underbody View

Post-Test Mid Rear Underbody View



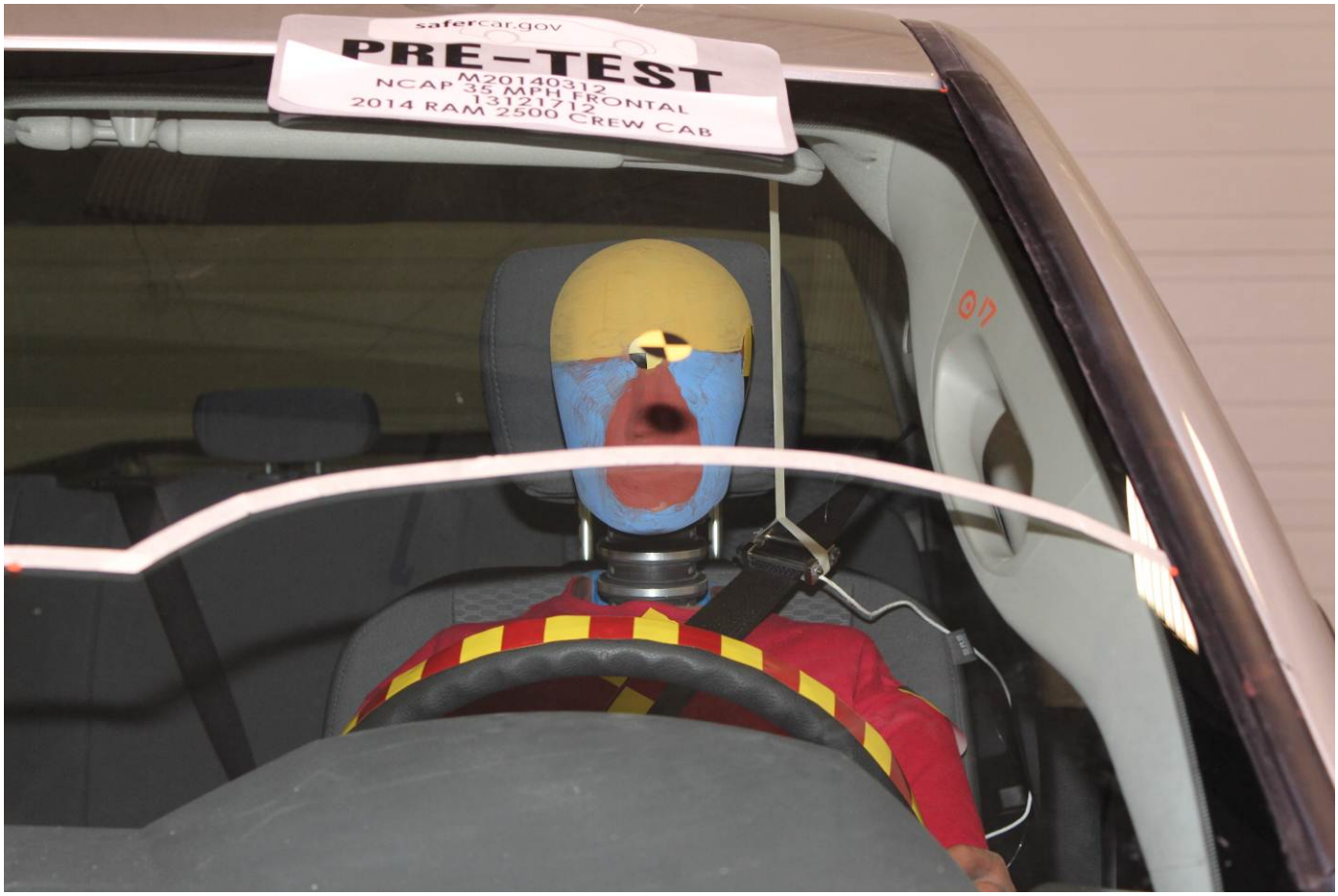
Pre-Test Rear Underbody View



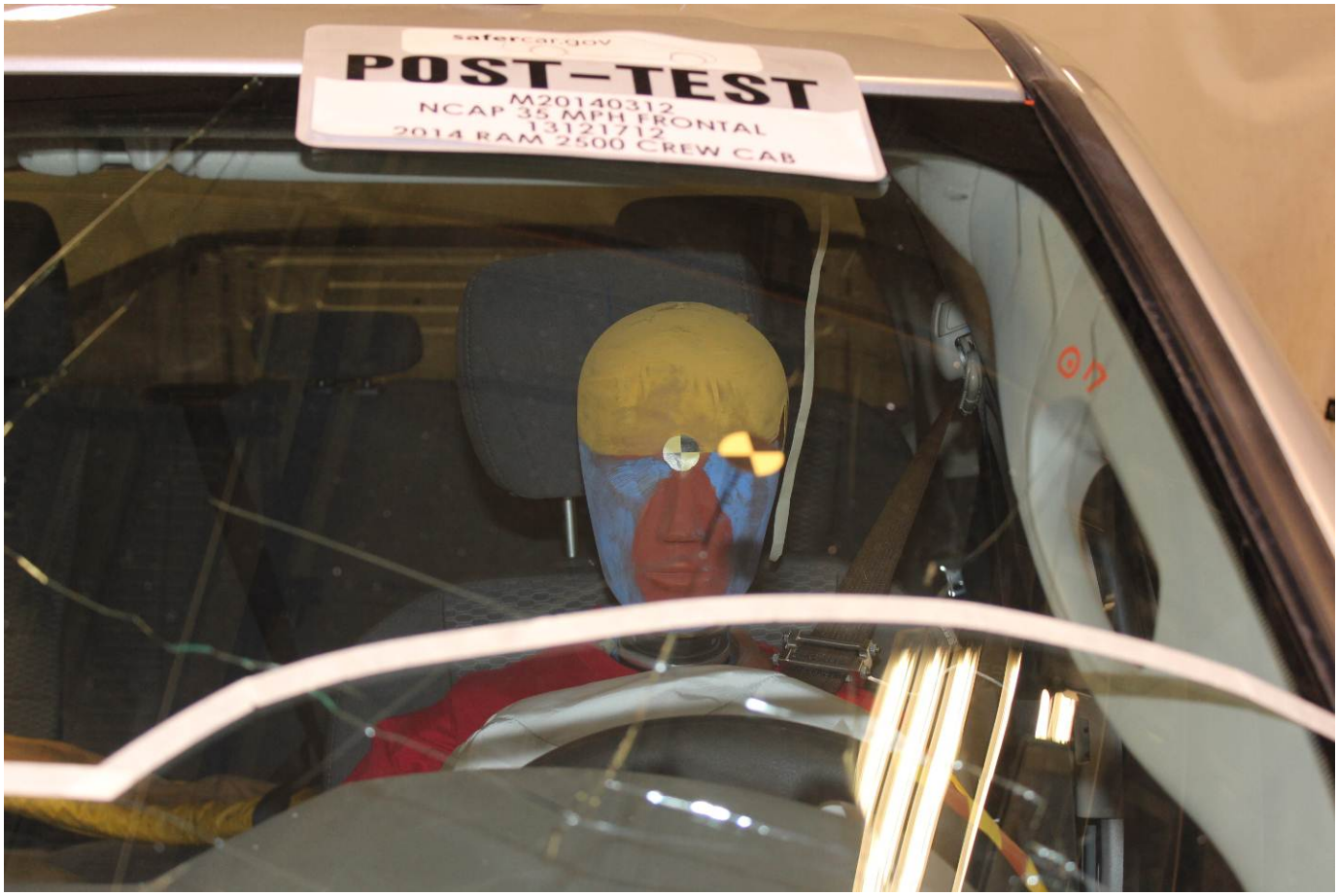
Post-Test Rear Underbody View

Pre-Test Dummy Cable Routing

Post-Test Dummy Cable Routing



Pre-Test Driver Dummy Front View



Post-Test Driver Dummy Front View

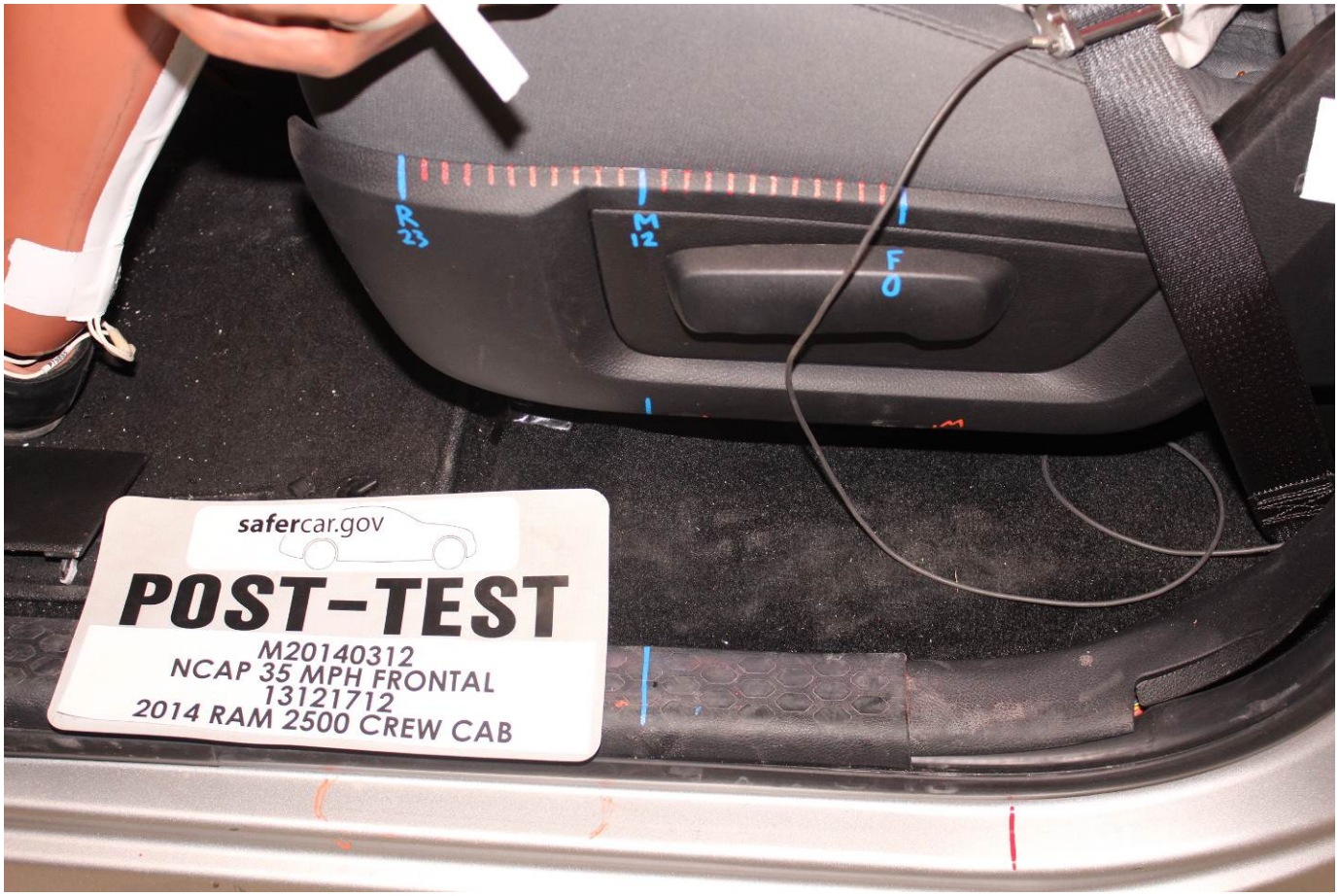
Pre-Test Driver Dummy Window View

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

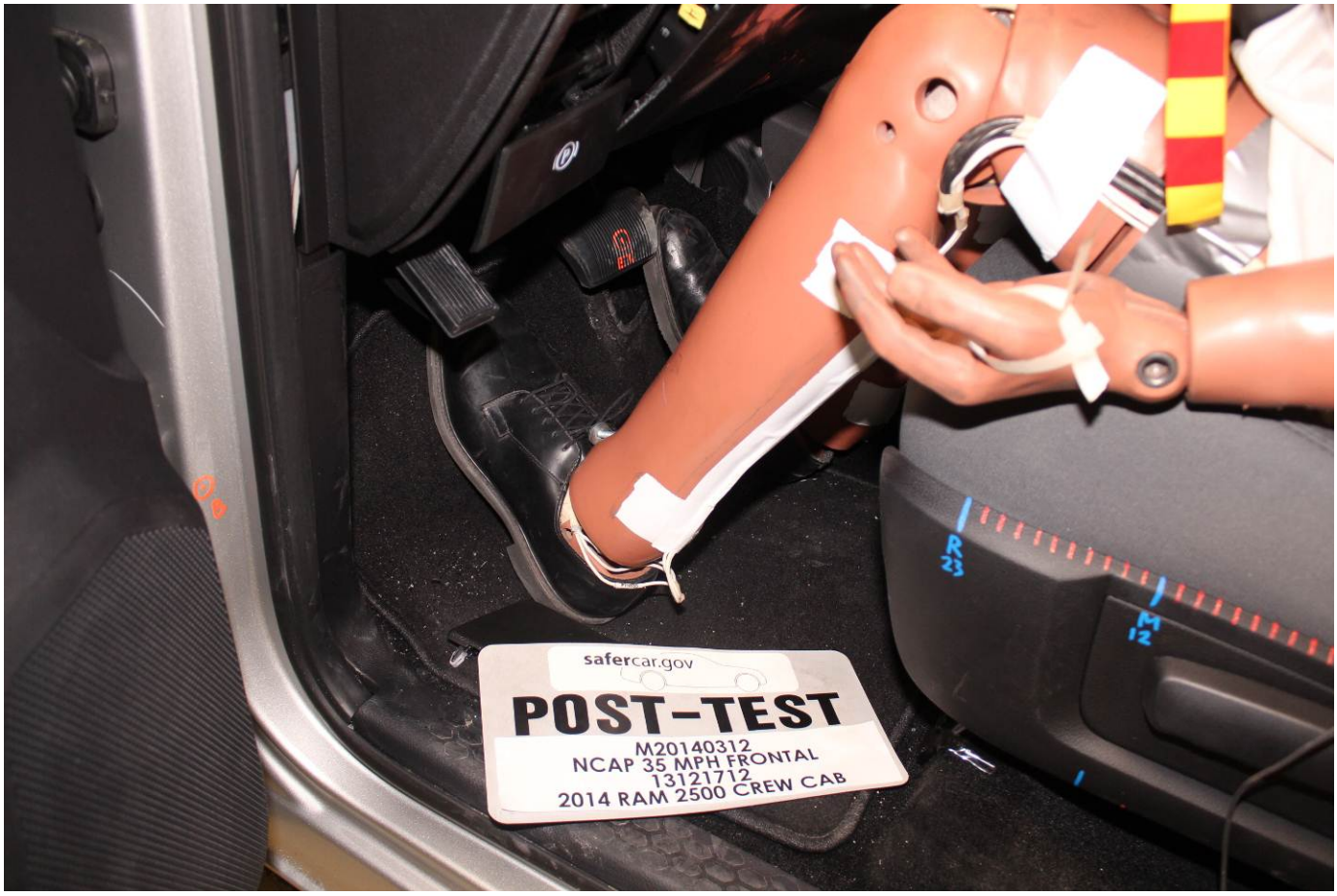


Post-Test Driver's Seat Fore-Aft Markings

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

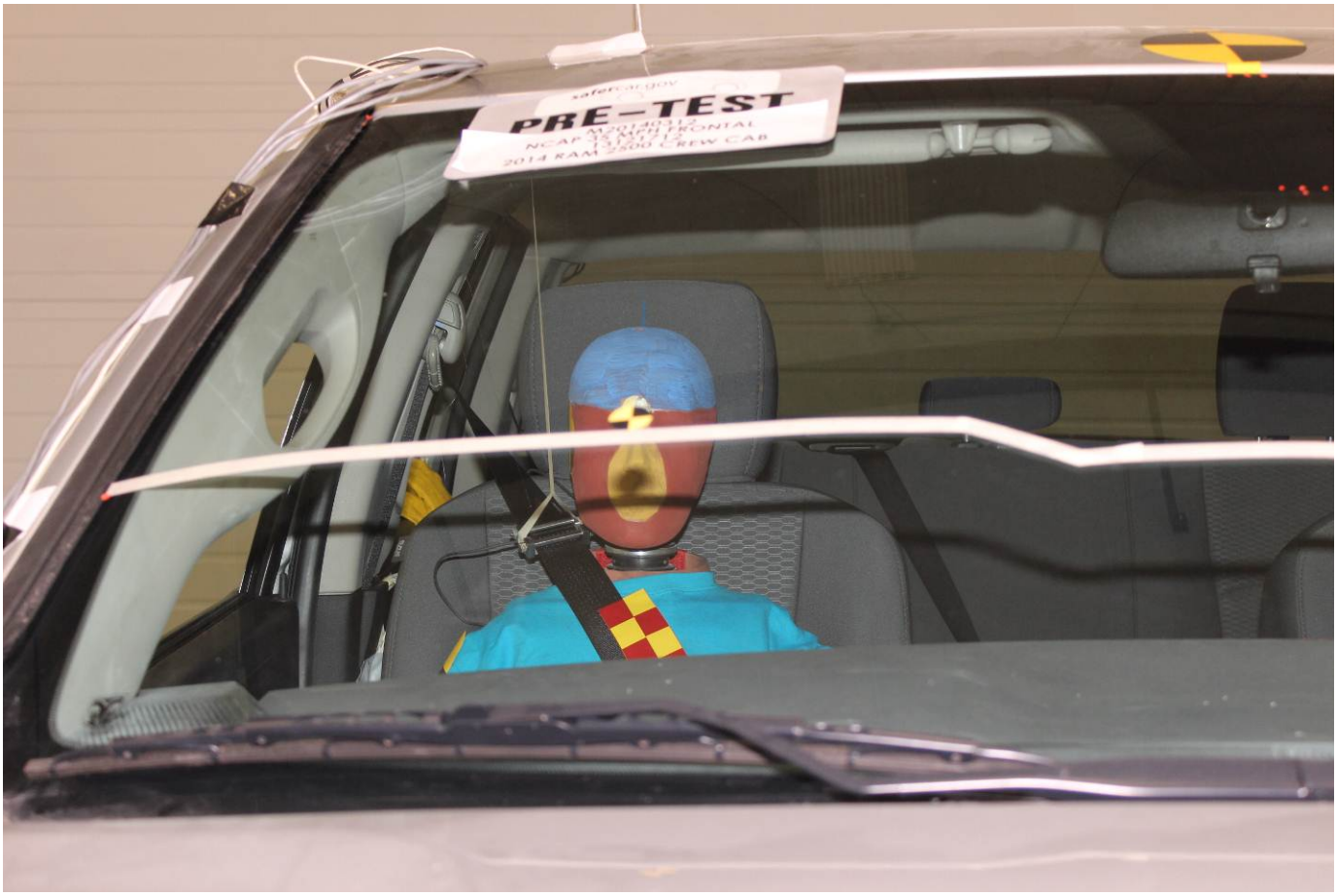
Post-Test Driver Dummy Contact with Airbag

Post-Test Driver Dummy Contact with Headrest

Post-Test Driver Dummy Contact with Knee Bolster

Pre-Test View of the Steering Wheel

Post-Test View of the Steering Wheel



Pre-Test Passenger Dummy Front View

Post-Test Passenger Dummy Front View

Pre-Test Passenger Dummy Window View

Post-Test Passenger Dummy Window View

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

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

Pre-Test Passenger's Seat Fore-Aft Markings

Post-Test Passenger's Seat Fore-Aft Markings

Pre-Test View of Belt Anchorage for Passenger Dummy

Post-Test View of Belt Anchorage for Passenger Dummy

Pre-Test Passenger Dummy Feet

Post-Test Passenger Dummy Feet

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

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

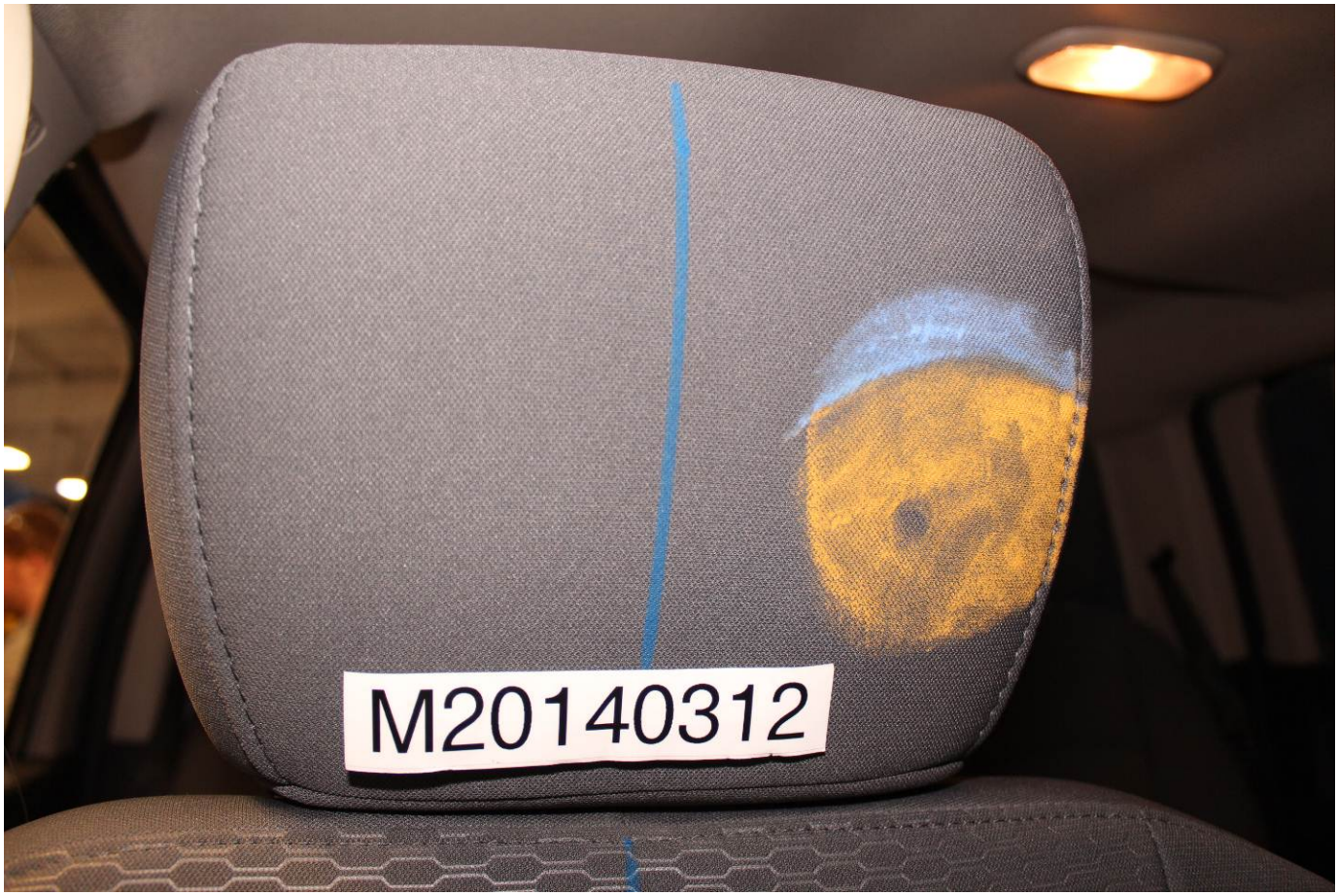
Pre-Test Passenger's Side Floorpan

Post-Test Passenger's Side Floorpan

Post-Test Passenger Dummy Face

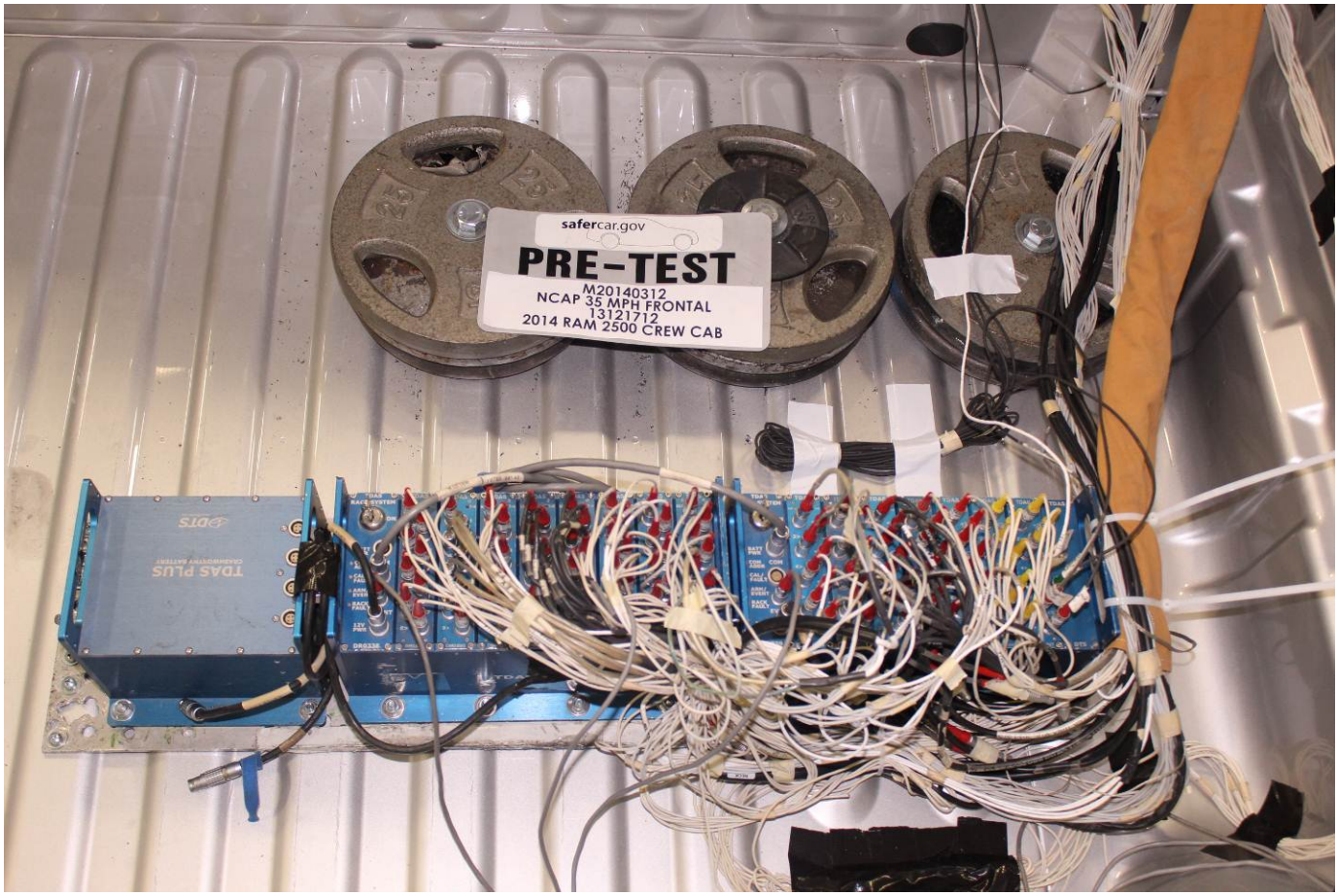
Post-Test Passenger Dummy Contact with Airbag

Post-Test Passenger Dummy Contact with Airbag



Post-Test Passenger Dummy Contact with Headrest

Post-Test Passenger Dummy Contact with Glovebox

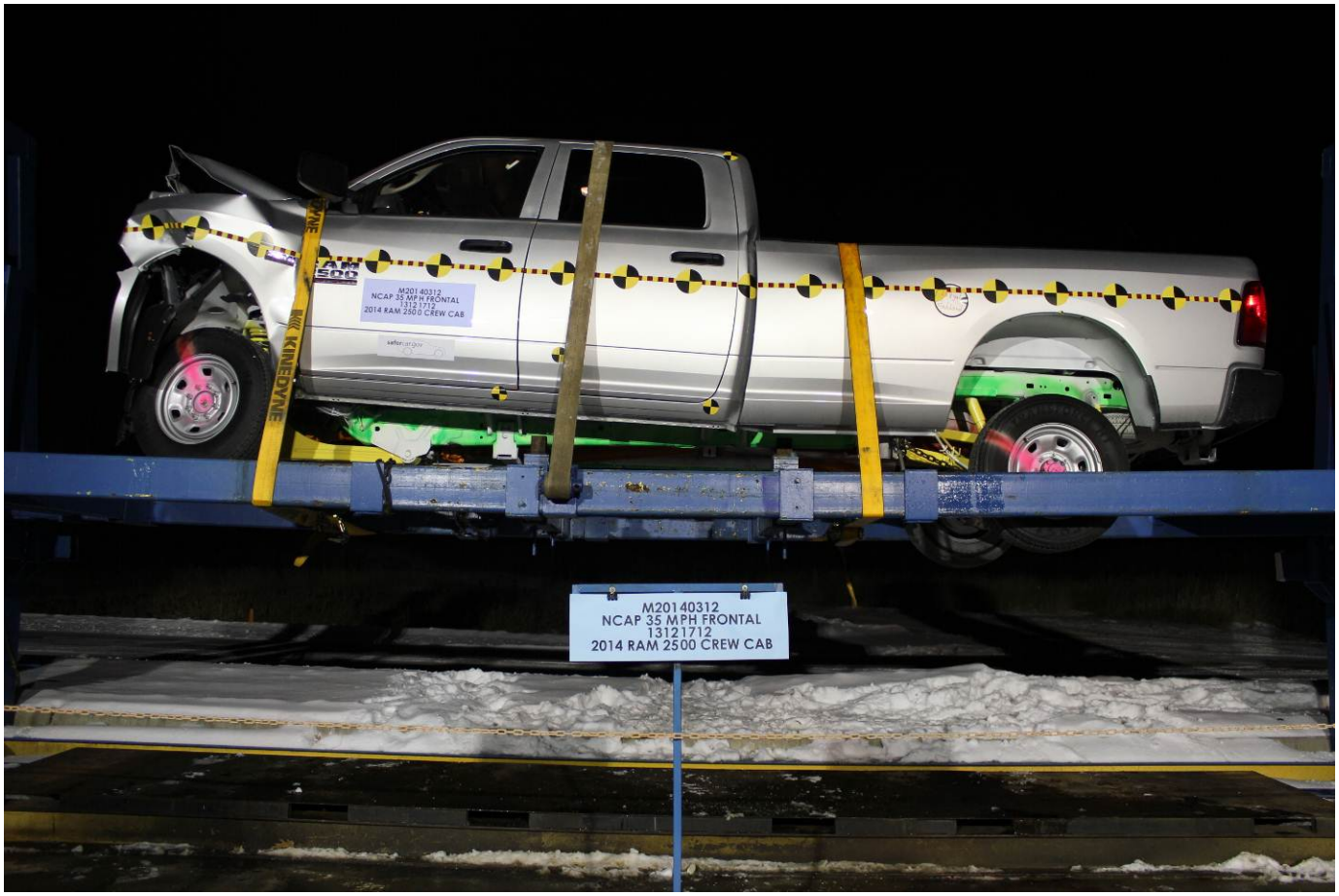


Ballast Installed in Vehicle

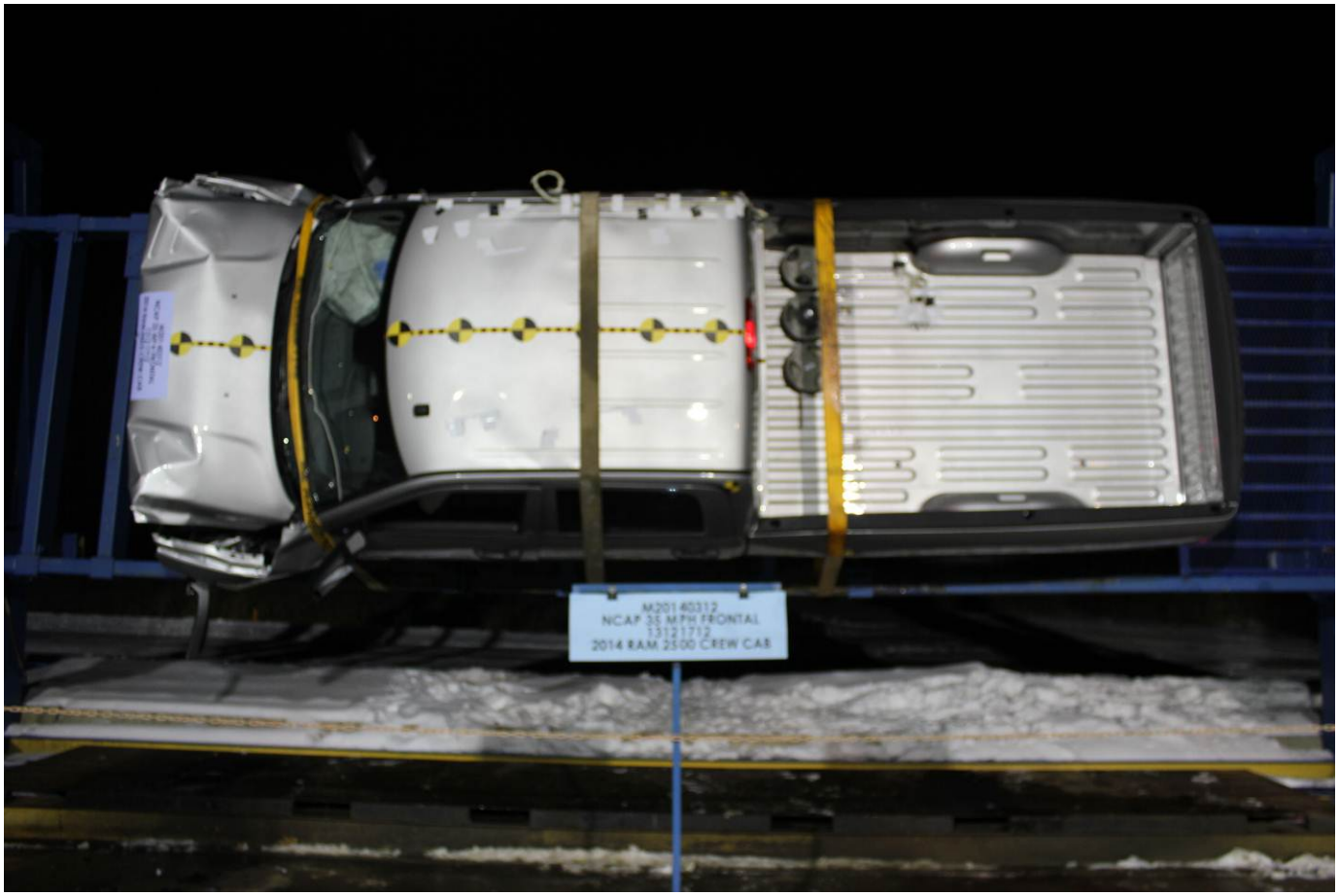
PHOTOGRAPH NOT APPLICABLE

Post-Test Stoddard Solvent Spillage Location View

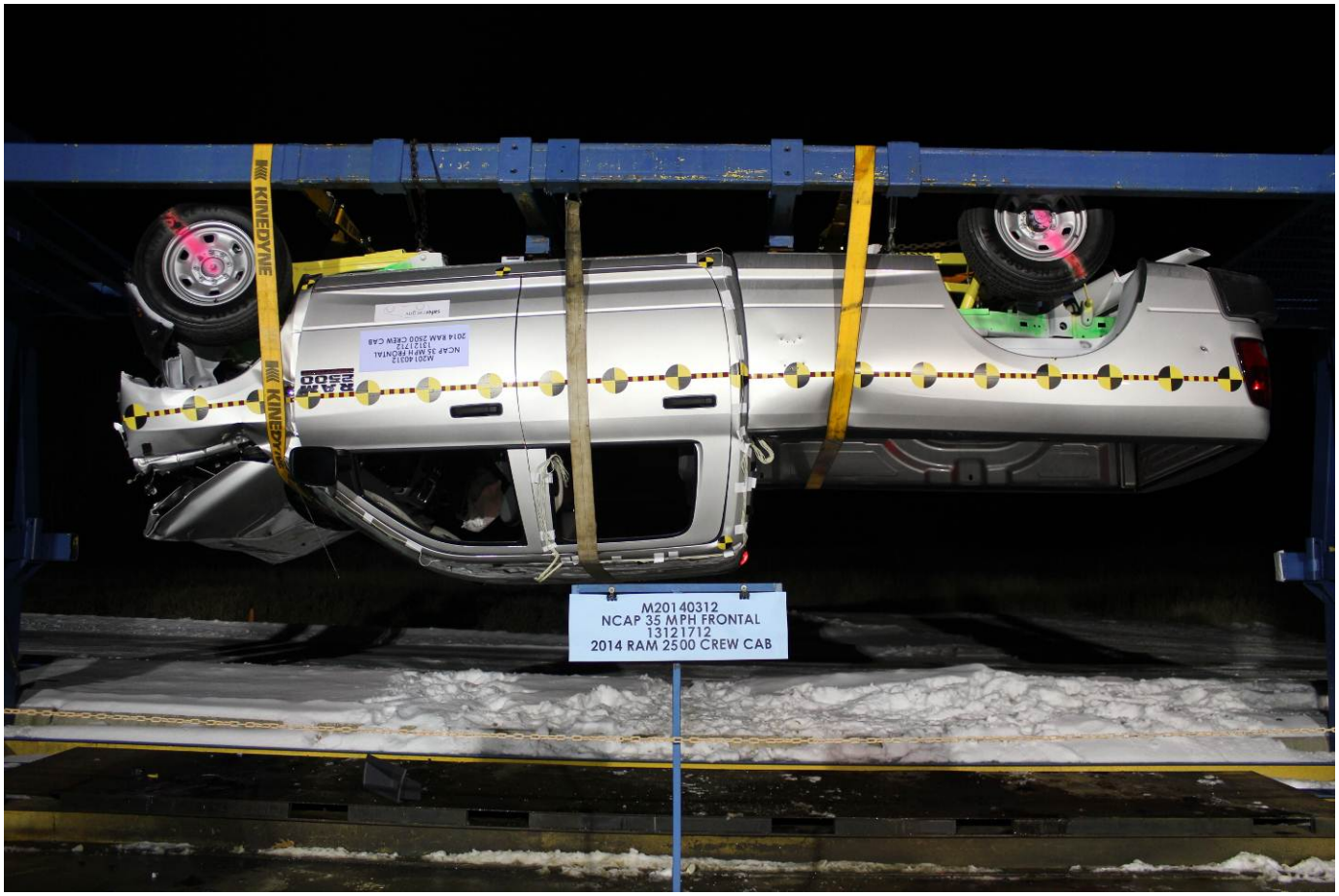
Post-Test Speed Trap Read-Out



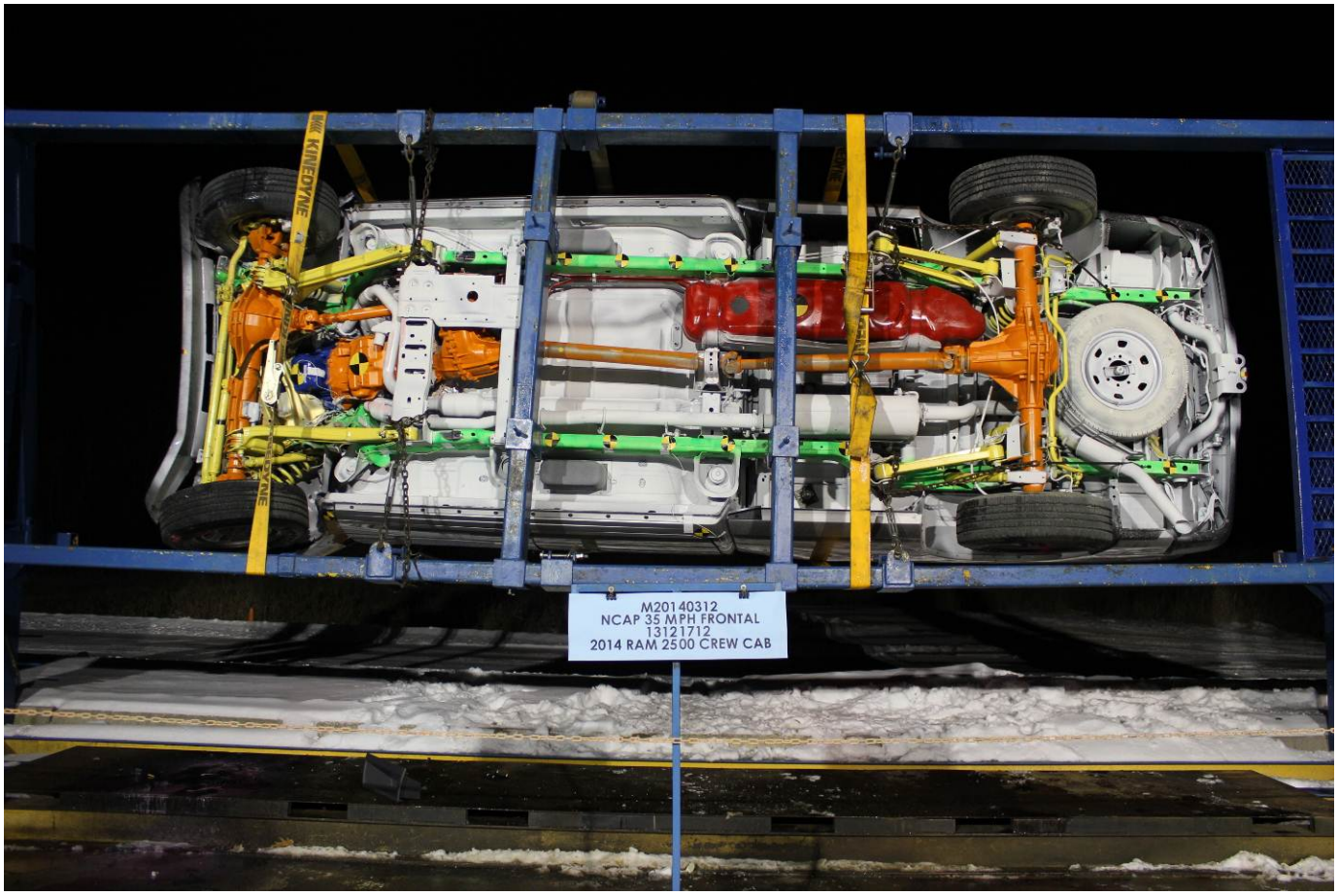
Vehicle at 0 Degree on Static Rollover Device



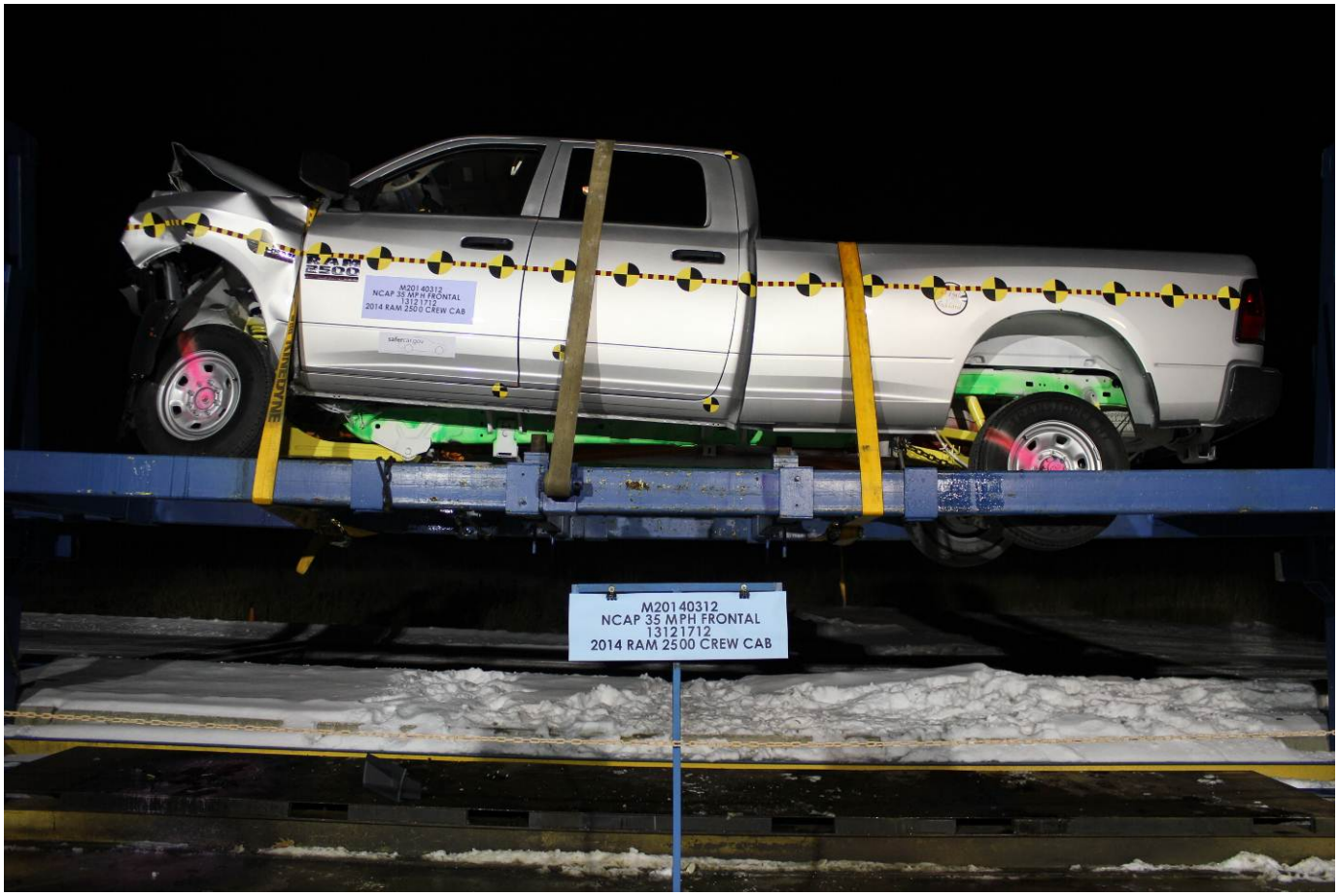
Vehicle at 90 Degrees on Static Rollover Device



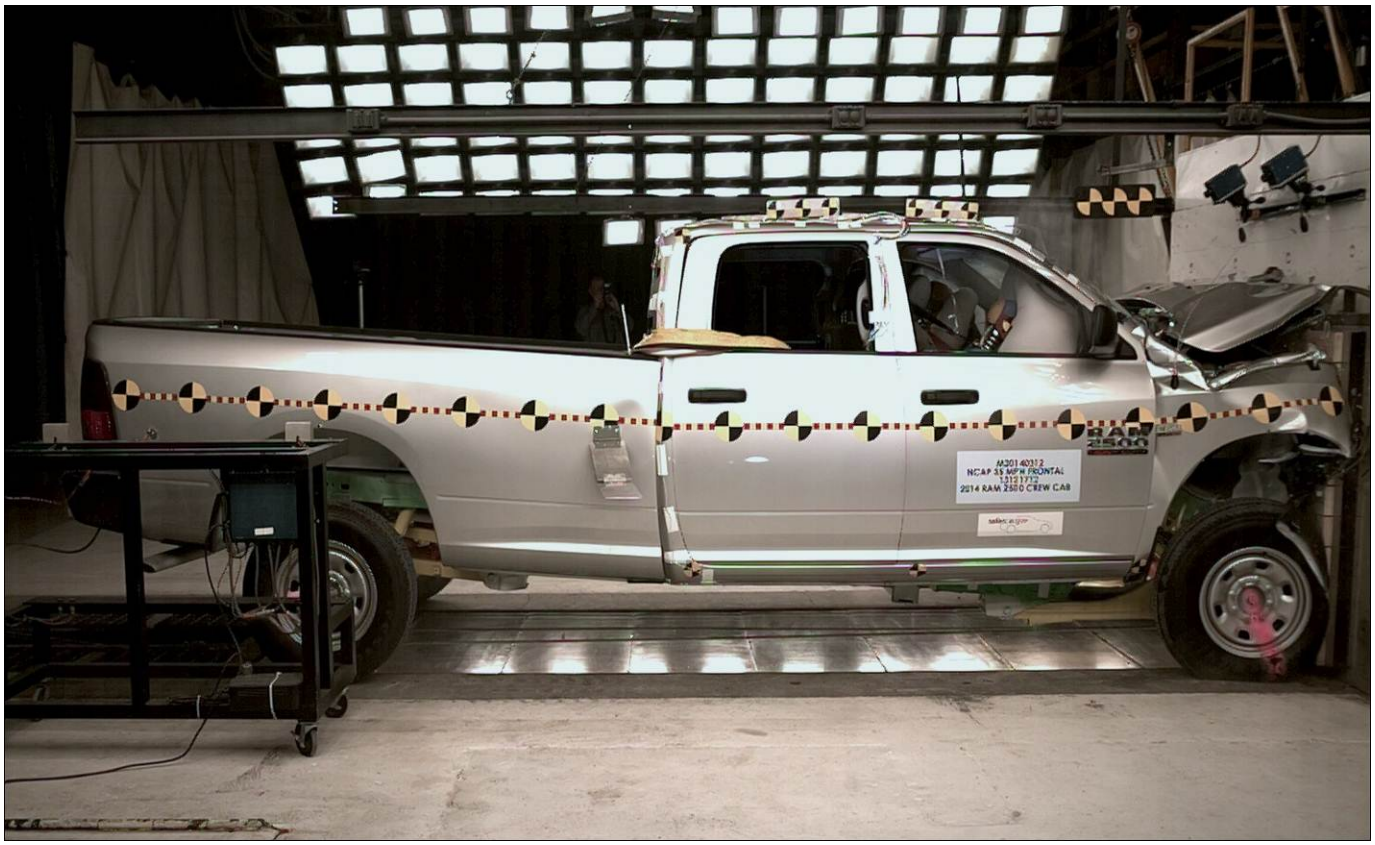
Vehicle at 180 Degrees on Static Rollover Device

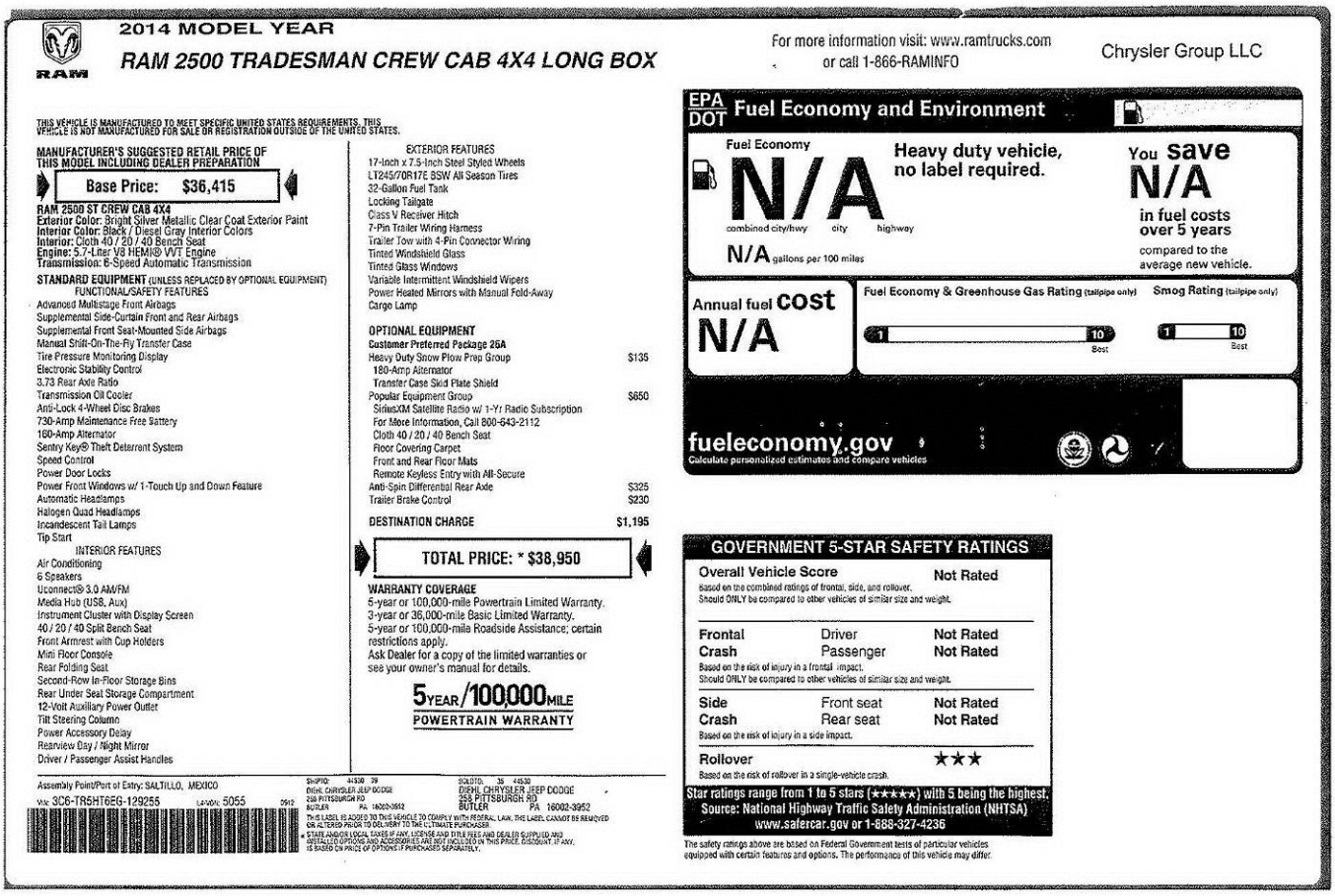


Vehicle at 270 Degrees on Static Rollover Device



Vehicle at 360 Degrees on Static Rollover Device


2014 Ram 2500 Crew Cab Frontal Impact Event



2014 MODEL YEAR

RAM 2500 TRADESMAN CREW CAB 4X4 LONG BOX

For more information visit: www.ramtrucks.com or call 1-866-RAMINFO

Chrysler Group LLC

THIS VEHICLE IS MANUFACTURED TO MEET SPECIFIC UNITED STATES REQUIREMENTS. THIS VEHICLE IS NOT MANUFACTURED FOR SALE OR REGISTRATION OUTSIDE OF THE UNITED STATES.

MANUFACTURER'S SUGGESTED RETAIL PRICE OF THIS MODEL INCLUDING DEALER PREPARATION

Base Price: $36,415

RAM 2500 ST CREW CAB 4X4
Exterior Color: Bright Silver Metallic Clear Coat Exterior Paint
Interior Color: Black / Diesel Gray Interior Colors
Interior: Cloth 40 / 20 / 40 Bench Seat
Engine: 5.7-Liter V8 HEMI® VVT Engine
Transmission: 6-Speed Automatic Transmission

STANDARD EQUIPMENT (UNLESS REPLACED BY OPTIONAL EQUIPMENT)

FUNCTIONAL/SAFETY FEATURES
Advanced Multistage Front Airbags
Supplemental Side-Curtain Front and Rear Airbags
Supplemental Front Seat-Mounted Side Airbags
Manual Shift-On-The-Fly Transfer Case
Tire Pressure Monitoring Display
Electronic Stability Control
3.73 Rear Axle Ratio
Transmission Oil Cooler
Anti-Lock 4-Wheel Disc Brakes
730-Amp Maintenance Free Battery
160-Amp Alternator
Sentry Key® Theft Deterrent System
Speed Control
Power Door Locks
Power Front Windows w/ 1-Touch Up and Down Feature
Automatic Headlamps
Halogen Quad Headlamps
Incandescent Tail Lamps
Tip Start

INTERIOR FEATURES
Air Conditioning
6 Speakers
Uconnect® 3.0 AM/FM
Media Hub (USB, Aux)
Instrument Cluster with Display Screen
40 / 20 / 40 Split Bench Seat
Front Armrest with Cup Holders
Mini Floor Console
Rear Folding Seat
Second-Row In-Floor Storage Bins
Rear Under Seat Storage Compartment
12-Volt Auxiliary Power Outlet
Tilt Steering Column
Power Accessory Delay
Rearview Day / Night Mirror
Driver / Passenger Assist Handles

EXTERIOR FEATURES
17-Inch x 7.5-Inch Steel Styled Wheels
LT245/70R17E BSW All Season Tires
32-Gallon Fuel Tank
Locking Tailgate
Class V Receiver Hitch
7-Pin Trailer Wiring Harness
Trailer Tow with 4-Pin Connector Wiring
Tinted Windshield Glass
Tinted Glass Windows
Variable Intermittent Windshield Wipers
Power Heated Mirrors with Manual Fold-Away
Cargo Lamp

OPTIONAL EQUIPMENT

Customer Preferred Package 26A	
Heavy Duty Snow Plow Prep Group	$135
180-Amp Alternator	
Transfer Case Skid Plate Shield	
Popular Equipment Group	$650
SiriusXM Satellite Radio w/ 1-Yr Radio Subscription	
For More Information, Call 800-643-2112	
Cloth 40 / 20 / 40 Bench Seat	
Floor Covering Carpet	
Front and Rear Floor Mats	
Remote Keyless Entry with All-Secure	
Anti-Spin Differential Rear Axle	$325
Trailer Brake Control	$230
DESTINATION CHARGE	$1,195

TOTAL PRICE: * $38,950

WARRANTY COVERAGE
5-year or 100,000-mile Powertrain Limited Warranty.
3-year or 36,000-mile Basic Limited Warranty.
5-year or 100,000-mile Roadside Assistance; certain restrictions apply.
Ask Dealer for a copy of the limited warranties or see your owner's manual for details.

5YEAR/100,000MILE POWERTRAIN WARRANTY

Assembly Point/Port of Entry: SALTILLO, MEXICO

VIN: 3C6-TR5HT6EG-129255 LAWDN: 5055 0912

SHIPTO: 44530 39
DIRK CHRYSLER JEEP DODGE
258 PITTSBURGH RD
BUTLER PA 16002-3952

SOLDTO: 35 44530
DIRK CHRYSLER JEEP DODGE
258 PITTSBURGH RD
BUTLER PA 16002-3952

This label is added to this vehicle to comply with federal law. The label cannot be removed or altered prior to delivery to the ultimate purchaser.

* State and/or local taxes of law, license and title fees and dealer supplied and installed options and accessories are not included in this price. Discount, if any, is based on price of options if purchased separately.

EPA DOT Fuel Economy and Environment

Fuel Economy
N/A
combined city/hwy city highway
N/A gallons per 100 miles

Heavy duty vehicle, no label required.

You save N/A in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost N/A

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

Smog Rating (tailpipe only) 1 10 Best

fueleconomy.gov
Calculate personalized estimates and compare vehicles

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score		Not Rated
based on the combined ratings of frontal, side, and rollover. Should ONLY be compared to other vehicles of similar size and weight.		
Frontal Crash	Driver	Not Rated
	Passenger	Not Rated
Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight.		
Side Crash	Front seat	Not Rated
	Rear seat	Not Rated
Based on the risk of injury in a side impact.		
Rollover		★★★
Based on the risk of rollover in a single-vehicle crash.		

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

The safety ratings above are based on Federal Government tests of particular vehicles equipped with certain features and options. The performance of this vehicle may differ.

Monroney Label

APPENDIX B
DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

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 CG X Redundant

Passenger Head CG Y Redundant

Passenger Head CG Z Redundant

Passenger 9 Axis Head X Arm Y

Passenger 9 Axis Head X Arm Z

Passenger 9 Axis Head Y Arm X

Passenger 9 Axis Head Y Arm Z

Passenger 9 Axis Head Z Arm X

Passenger 9 Axis Head Z Arm Y

Passenger Upper Neck Force Y

Passenger Upper Neck Moment X

Passenger Upper Neck Moment Z

Passenger Chest X Redundant

Passenger Chest Y Redundant

Passenger Chest Z Redundant

Passenger Pelvis X

Passenger Pelvis Y

Passenger Pelvis Z

Passenger Left Femur Redundant

Passenger Right Femur Redundant

Passenger Left Upper Tibia Moment X

Passenger Left Upper Tibia Moment Y

Passenger Left Upper Tibia Force Z

Passenger Left Lower Tibia Moment X

Passenger Left Lower Tibia Moment Y

Passenger Left Lower Tibia Force Z

Passenger Right Upper Tibia Moment X

Passenger Right Upper Tibia Moment Y

Passenger Right Upper Tibia Force Z

Passenger Right Lower Tibia Moment X

Passenger Right Lower Tibia Moment Y

Passenger Right Lower Tibia Force Z

Passenger Left Foot Fore Z

Passenger Left Foot Aft X

Passenger Left Foot Aft Z

Passenger Right Foot Fore Z

Passenger Right Foot Aft X

Passenger Right Foot Aft Z

Passenger Lap Belt Force

Passenger Shoulder Belt Force

Left Rear Seat Crossmember X

Right Rear Seat Crossmember X

Vehicle Engine Top X

Vehicle Engine Bottom X

Left Rear Seat Crossmember Z

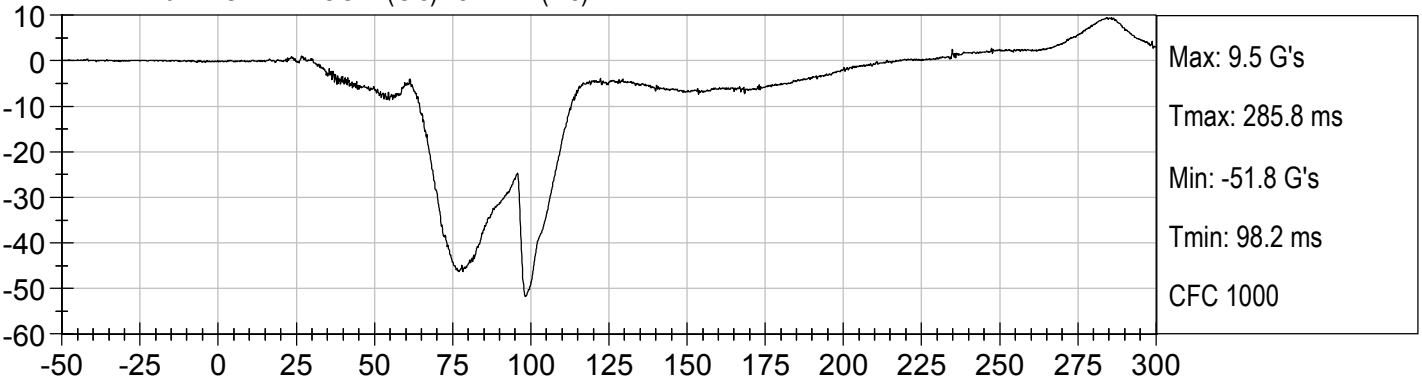
Right Rear Seat Crossmember Z

Left Rear Seat Crossmember Xr

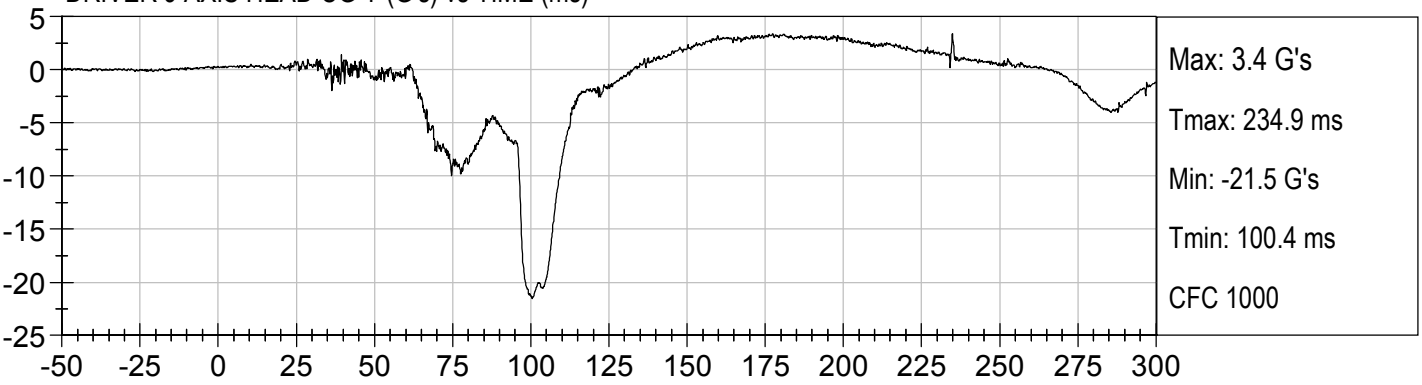
Right Rear Seat Crossmember Xr

Advanced Research Load Cell Barrier – 528 channels

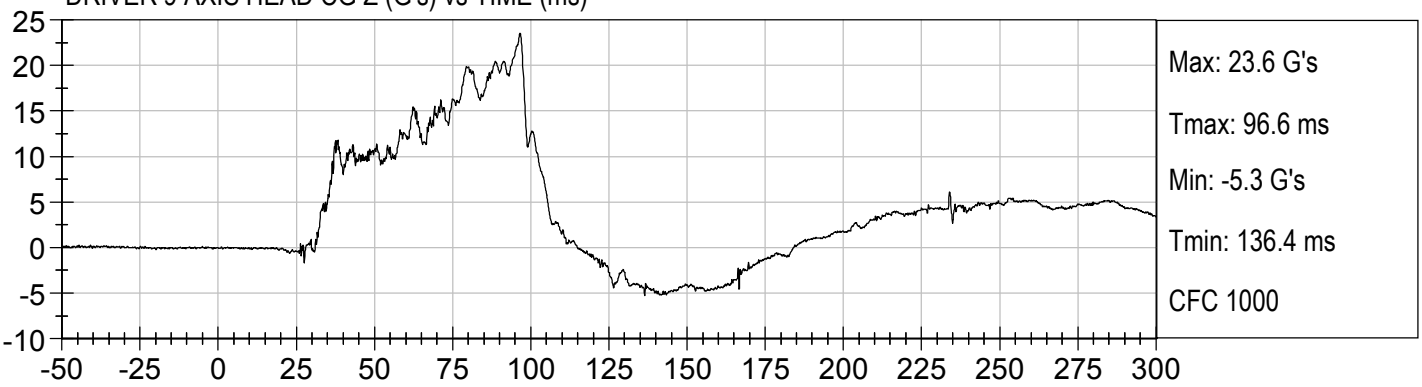
DRIVER 9 AXIS HEAD CG X (G's) vs TIME (ms)



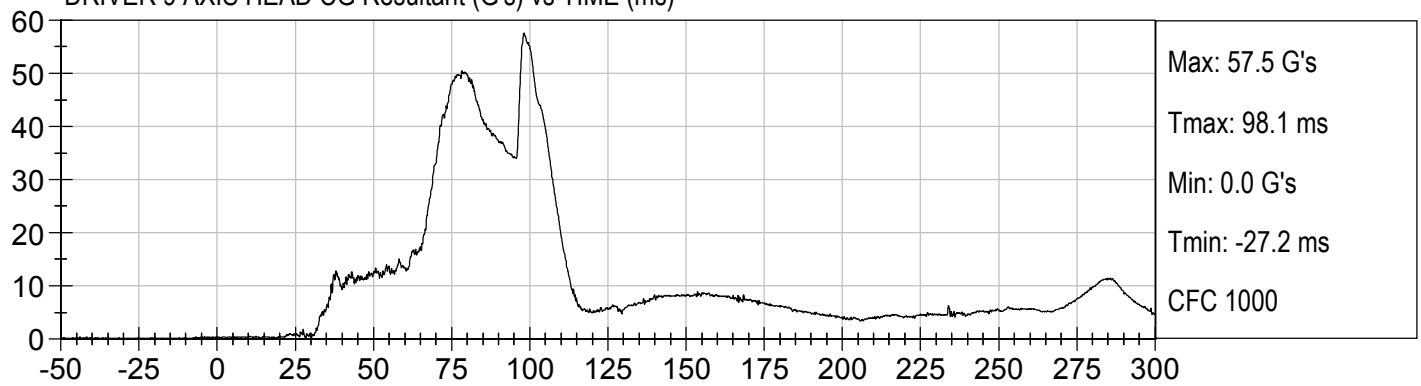
DRIVER 9 AXIS HEAD CG Y (G's) vs TIME (ms)



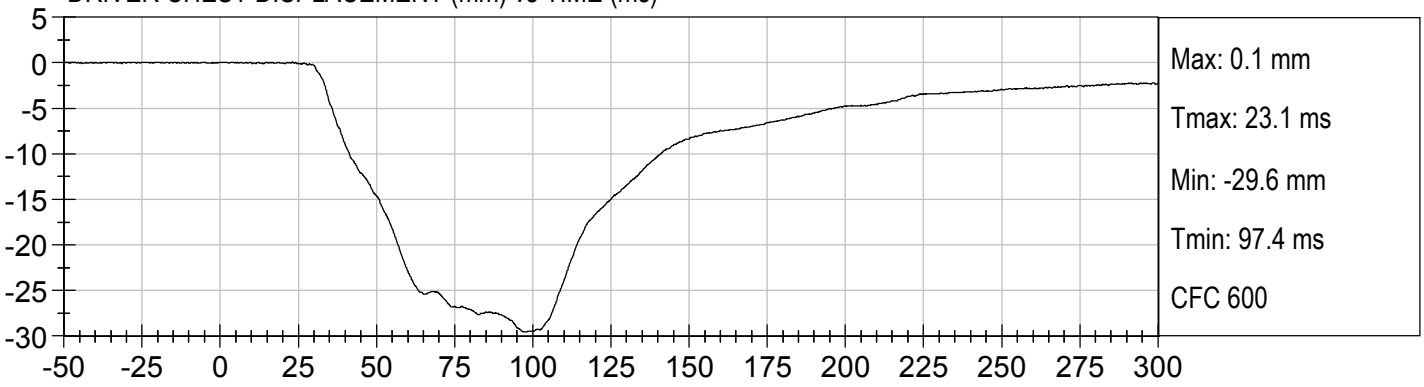
DRIVER 9 AXIS HEAD CG Z (G's) vs TIME (ms)

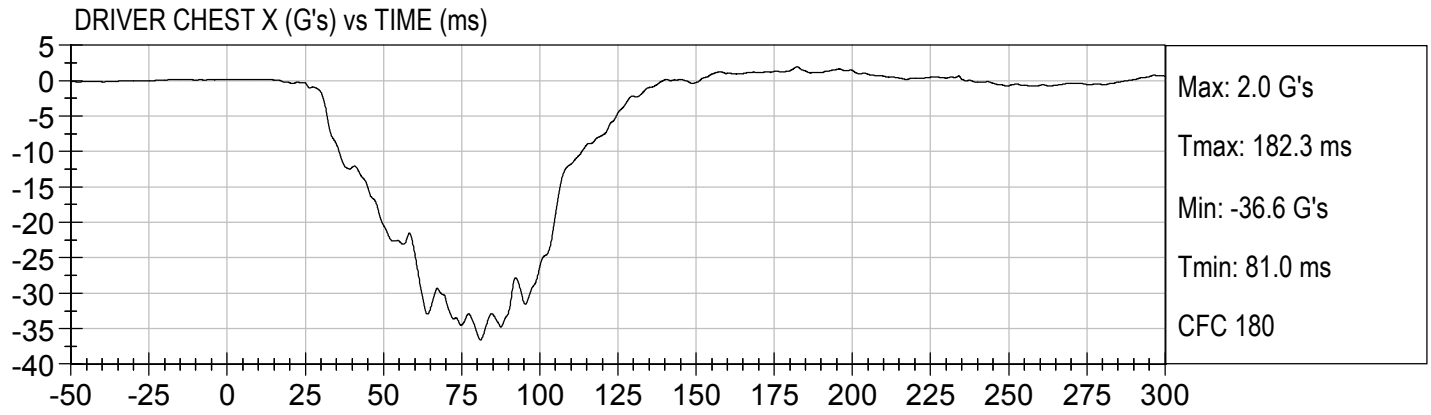


DRIVER 9 AXIS HEAD CG Resultant (G's) vs TIME (ms)

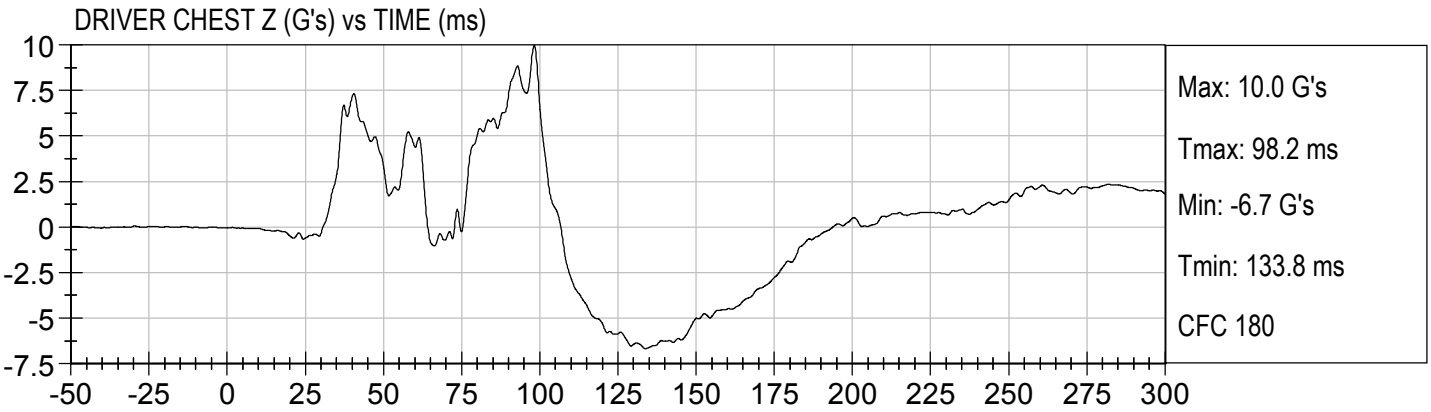


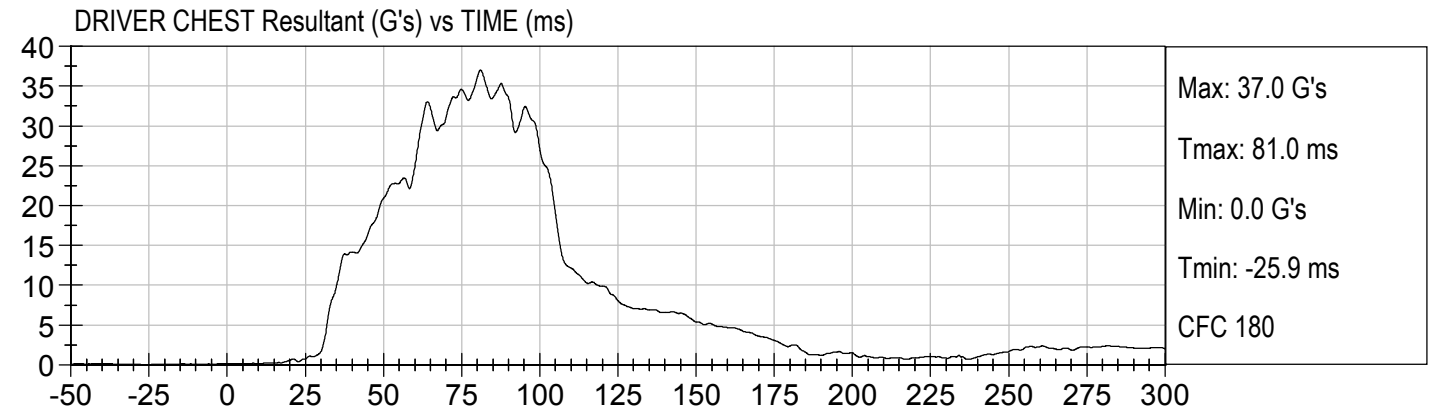
DRIVER CHEST DISPLACEMENT (mm) vs TIME (ms)



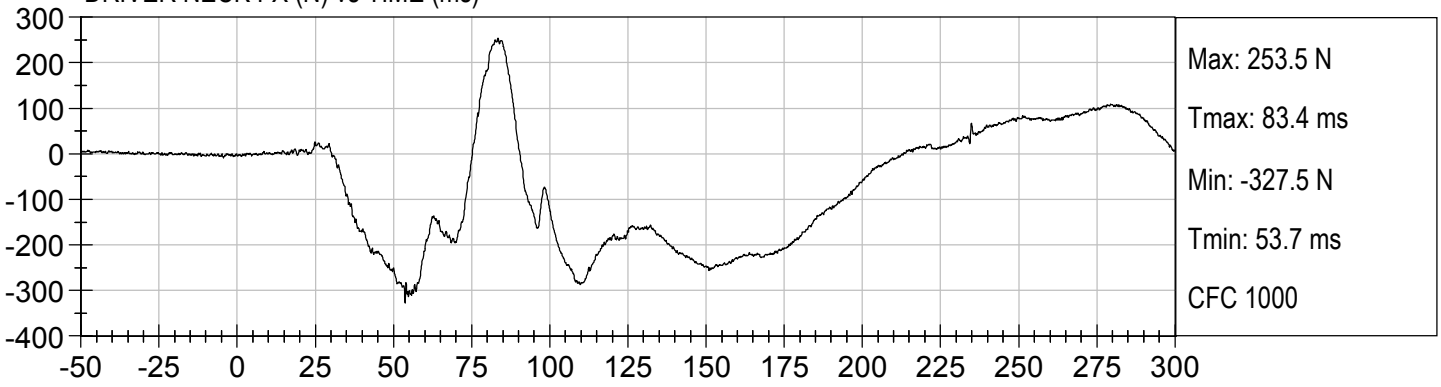

DRIVER CHEST X (G's) vs TIME (ms)
Max: 2.0 G's
Tmax: 182.3 ms
Min: -36.6 G's
Tmin: 81.0 ms
CFC 180


DRIVER CHEST Y (G's) vs TIME (ms)
Max: 3.2 G's
Tmax: 122.5 ms
Min: -4.0 G's
Tmin: 45.1 ms
CFC 180


DRIVER CHEST Z (G's) vs TIME (ms)
Max: 10.0 G's
Tmax: 98.2 ms
Min: -6.7 G's
Tmin: 133.8 ms
CFC 180

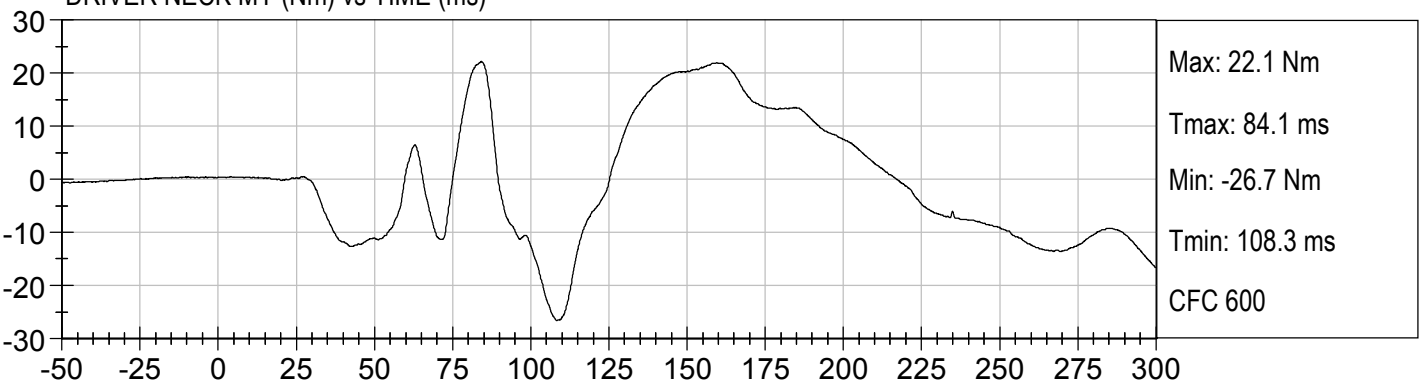

DRIVER CHEST Resultant (G's) vs TIME (ms)
Max: 37.0 G's
Tmax: 81.0 ms
Min: 0.0 G's
Tmin: -25.9 ms
CFC 180

DRIVER NECK FX (N) vs TIME (ms)

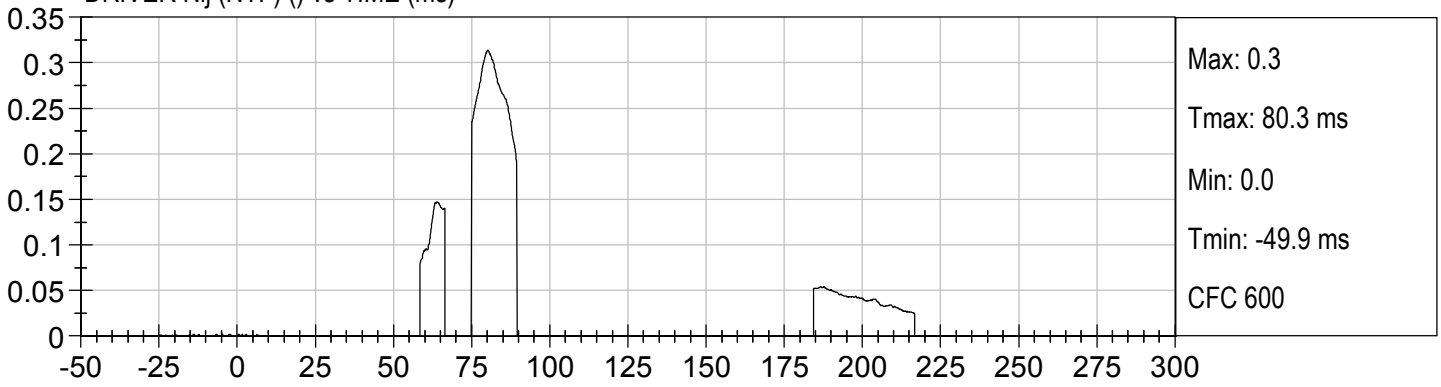


DRIVER NECK FZ (N) vs TIME (ms)

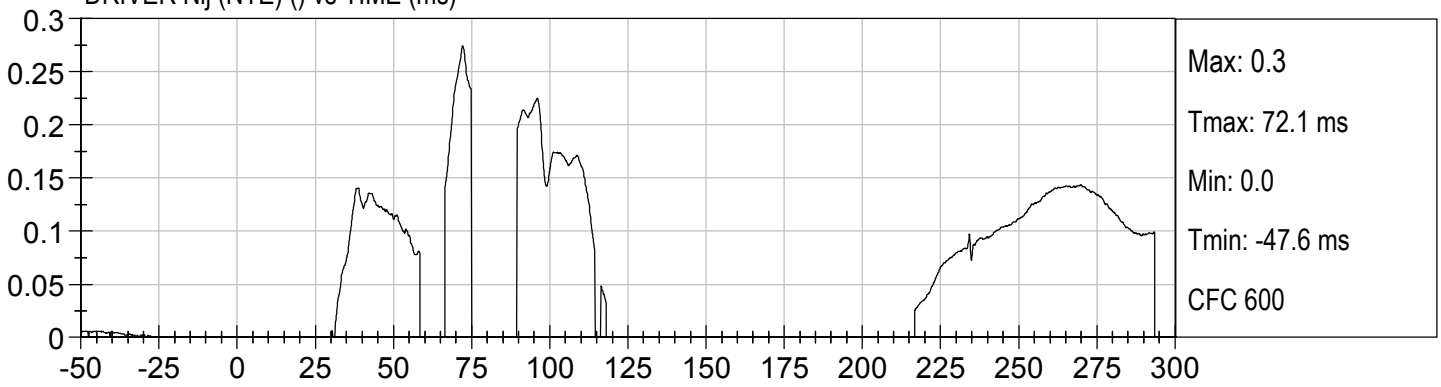
DRIVER NECK MY (Nm) vs TIME (ms)



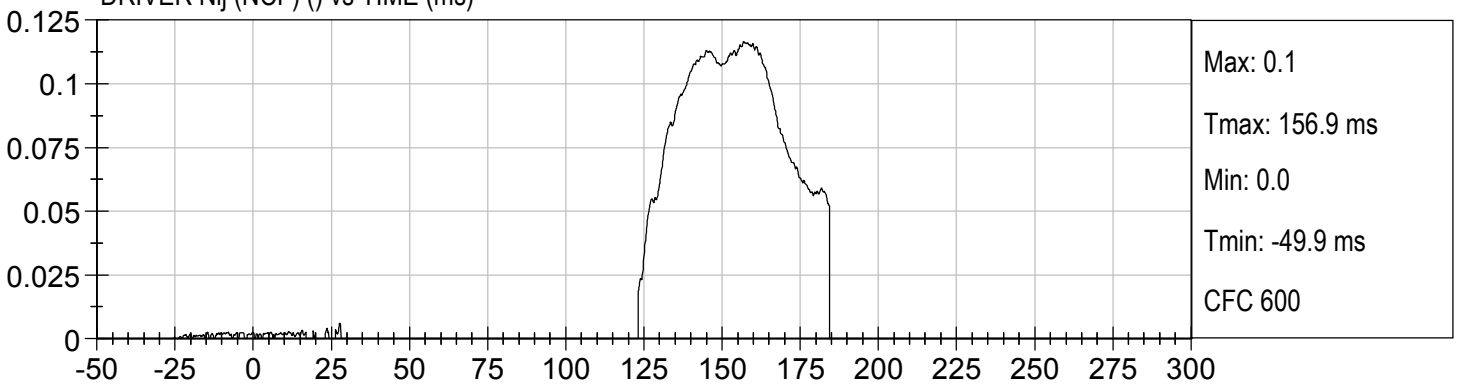
DRIVER Nij (NTF) () vs TIME (ms)



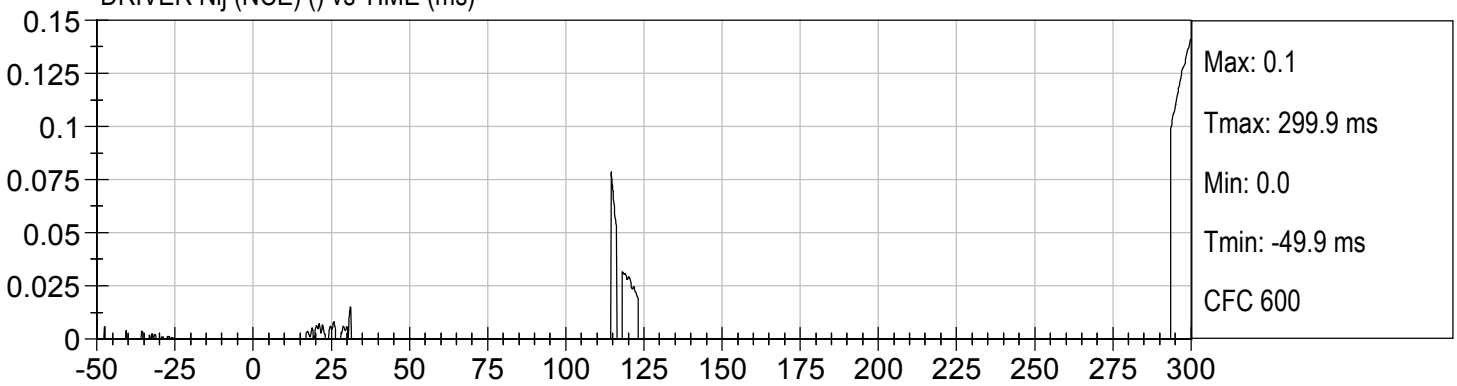
DRIVER Nij (NTE) () vs TIME (ms)



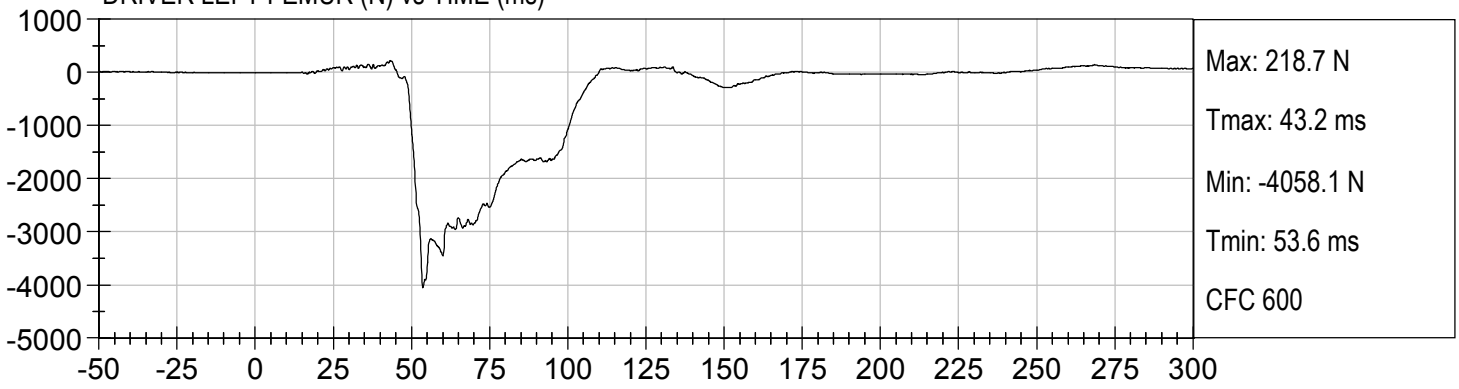
DRIVER Nij (NCF) () vs TIME (ms)



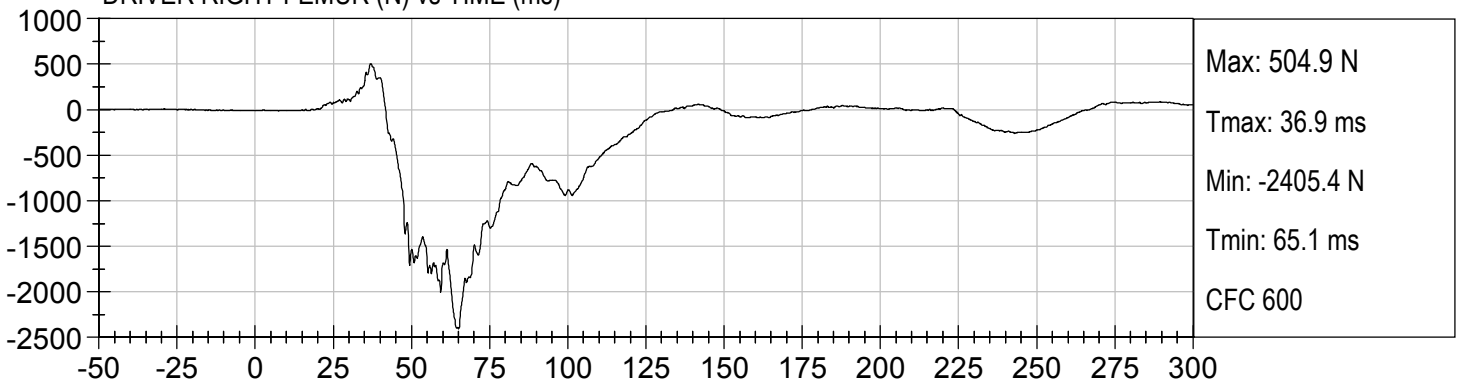
DRIVER Nij (NCE) () vs TIME (ms)



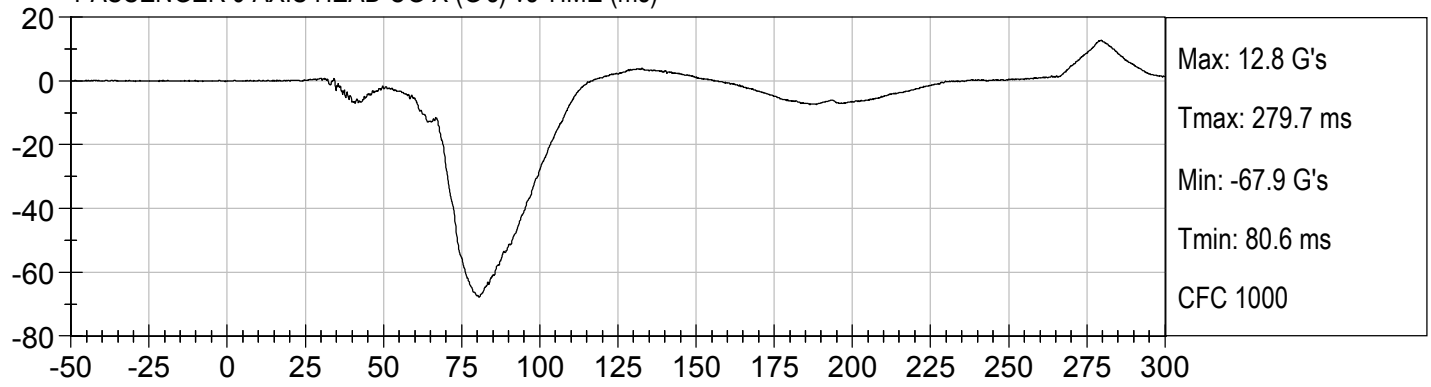
DRIVER LEFT FEMUR (N) vs TIME (ms)



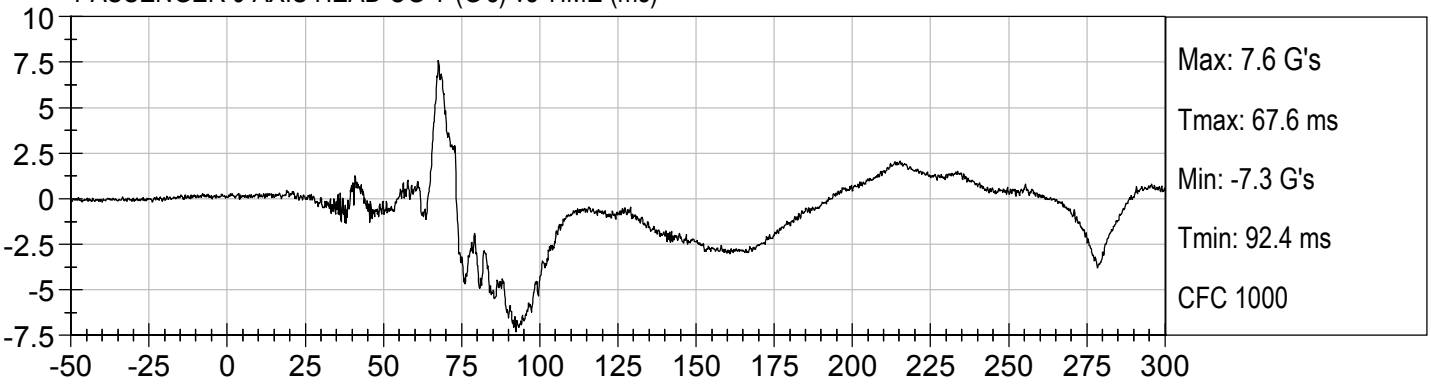
DRIVER RIGHT FEMUR (N) vs TIME (ms)



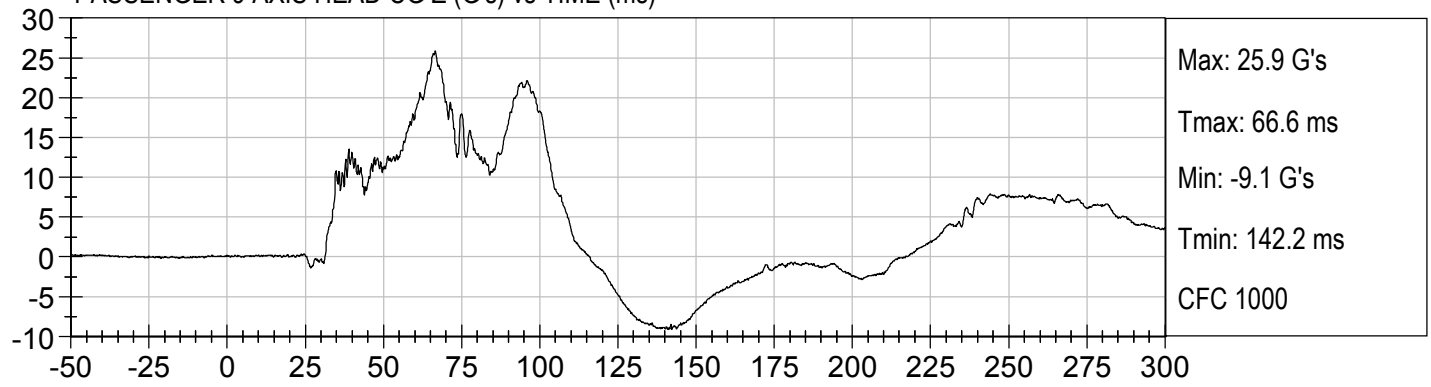
PASSENGER 9 AXIS HEAD CG X (G's) vs TIME (ms)



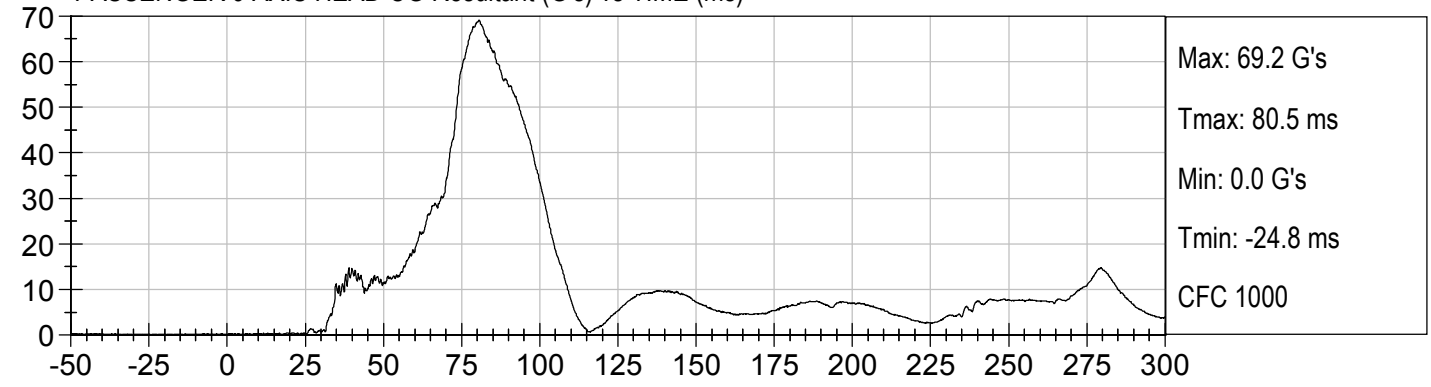
PASSENGER 9 AXIS HEAD CG Y (G's) vs TIME (ms)



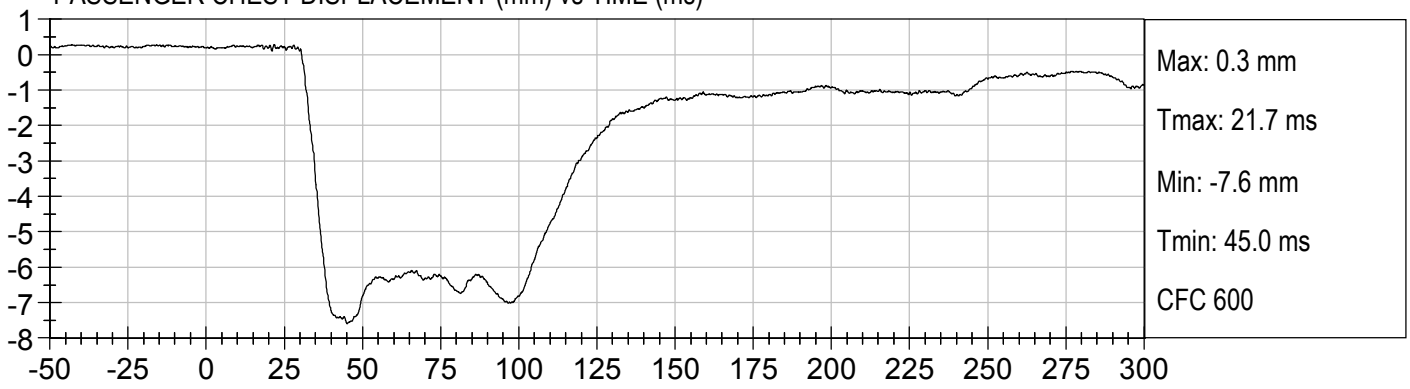
PASSENGER 9 AXIS HEAD CG Z (G's) vs TIME (ms)



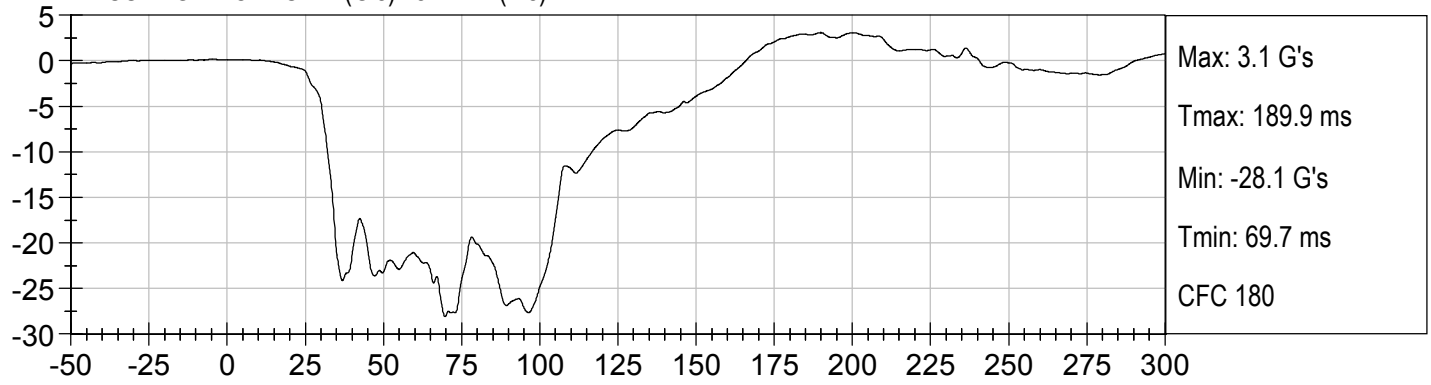
PASSENGER 9 AXIS HEAD CG Resultant (G's) vs TIME (ms)



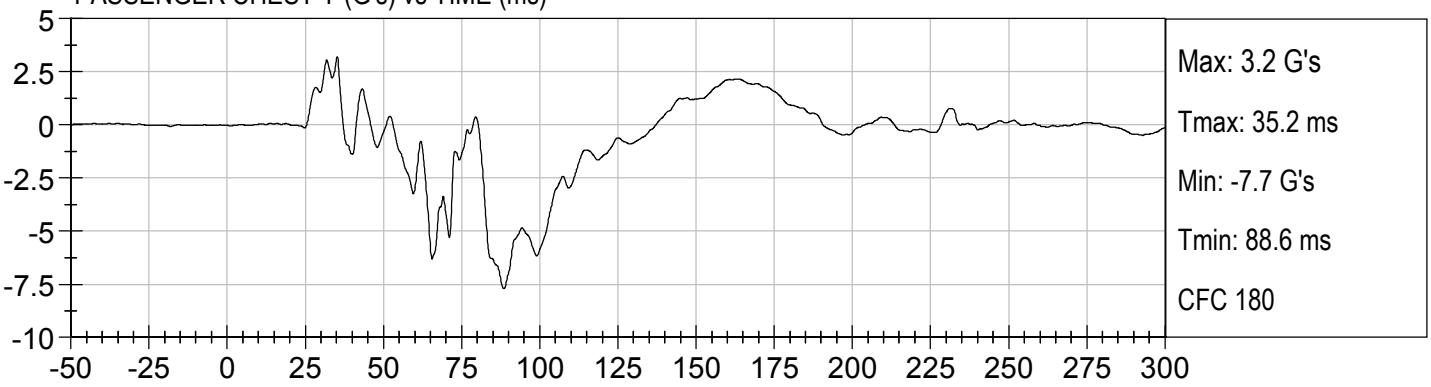
PASSENGER CHEST DISPLACEMENT (mm) vs TIME (ms)



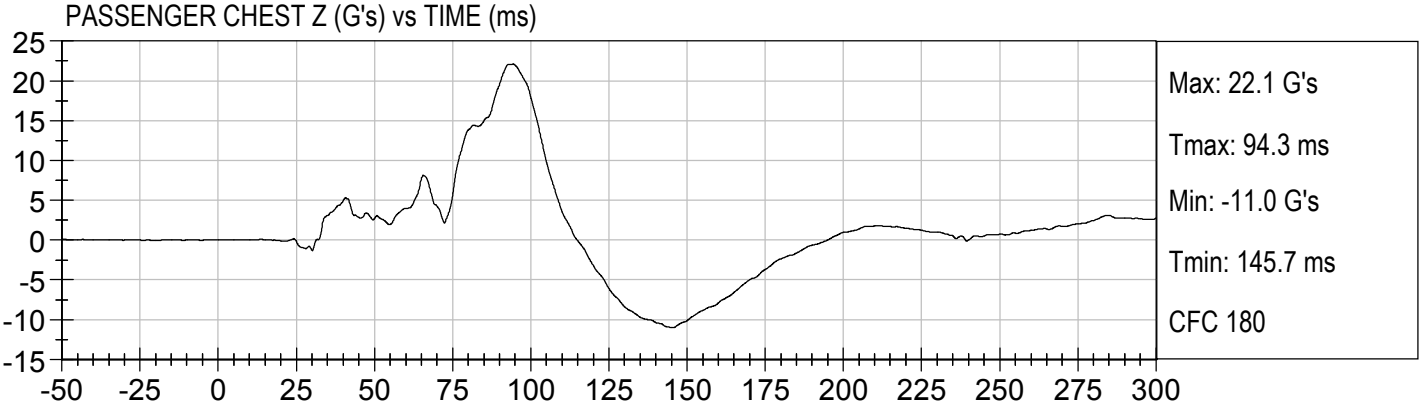
PASSENGER CHEST X (G's) vs TIME (ms)



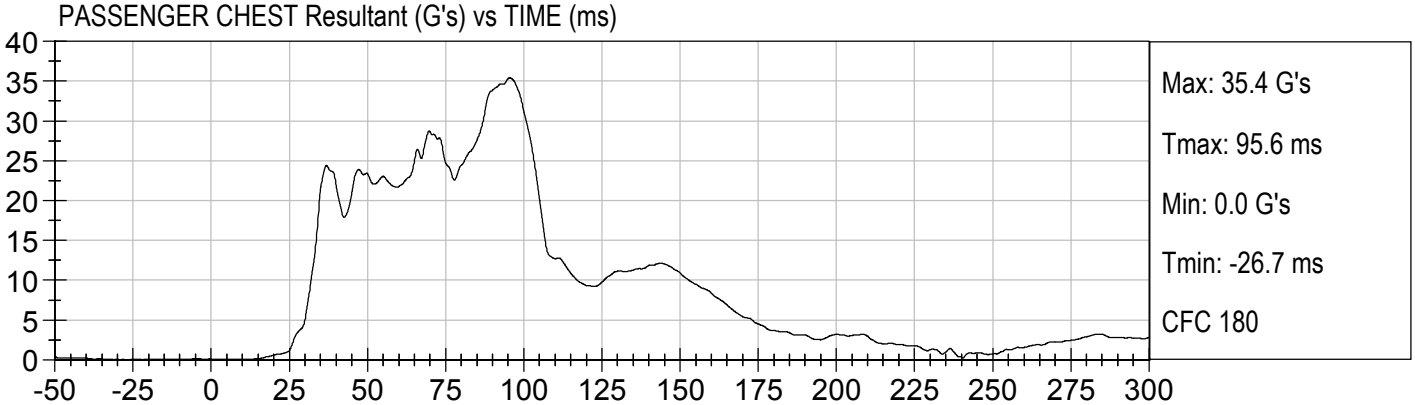
PASSENGER CHEST Y (G's) vs TIME (ms)

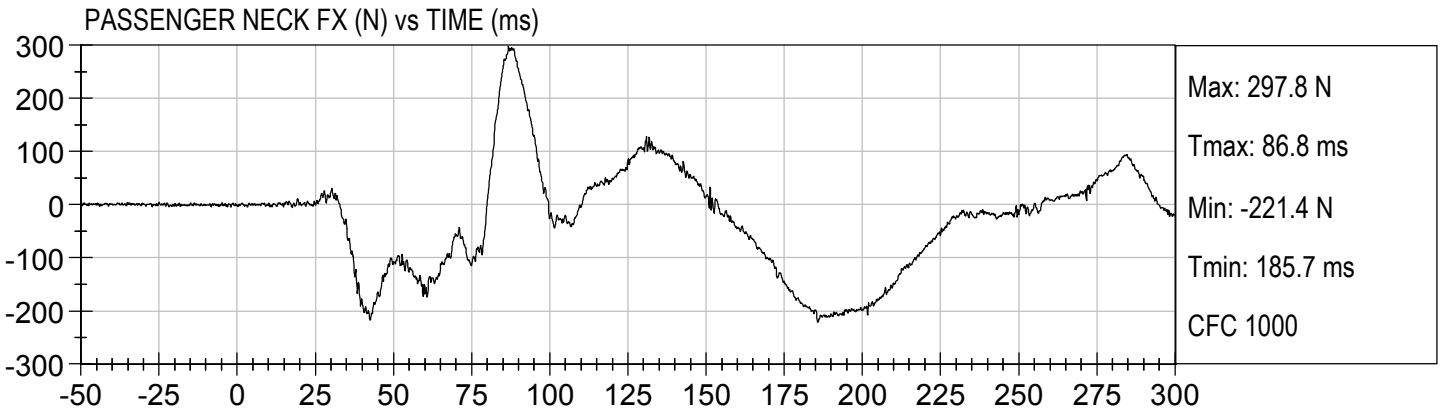


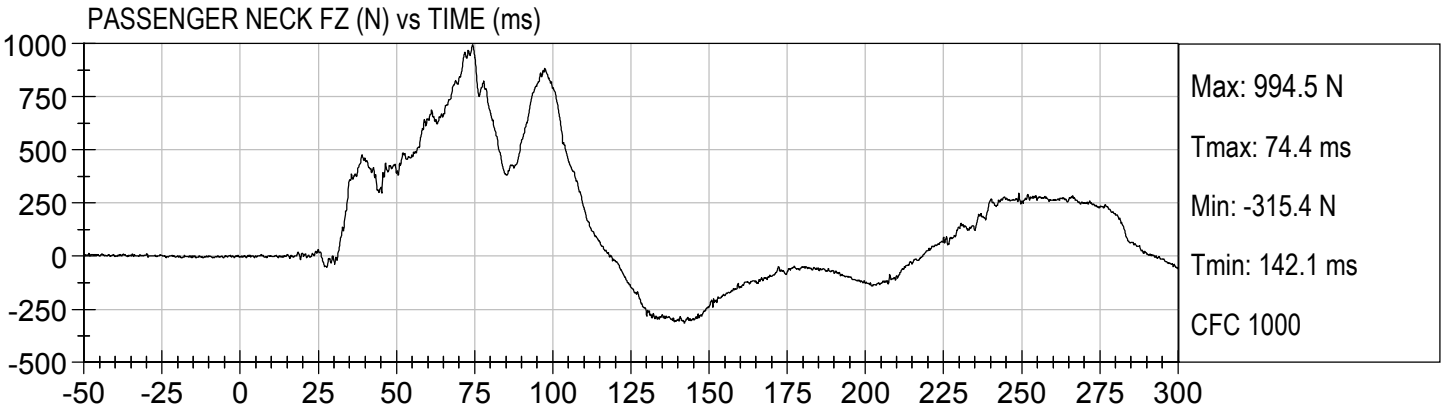
PASSENGER CHEST Z (G's) vs TIME (ms)

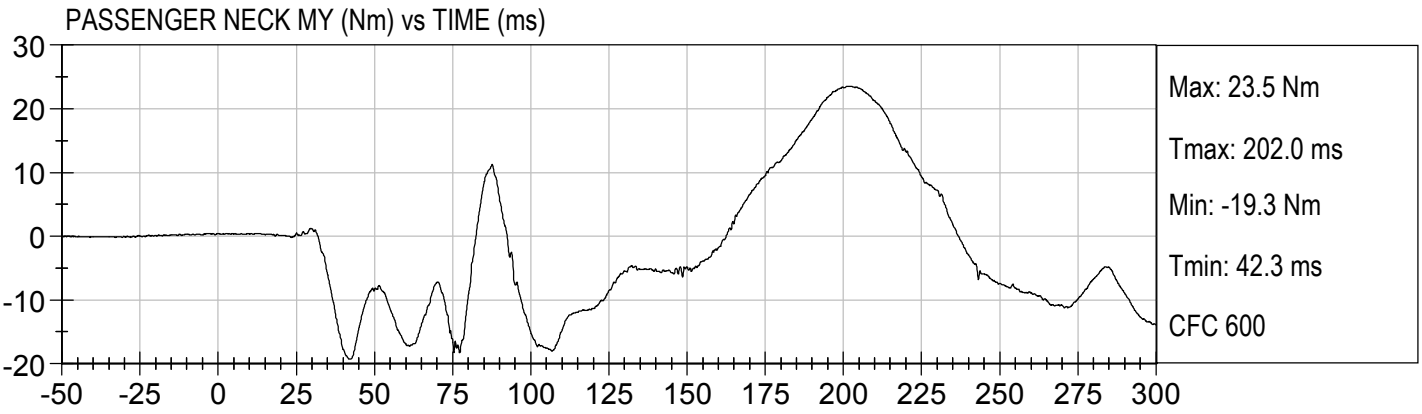


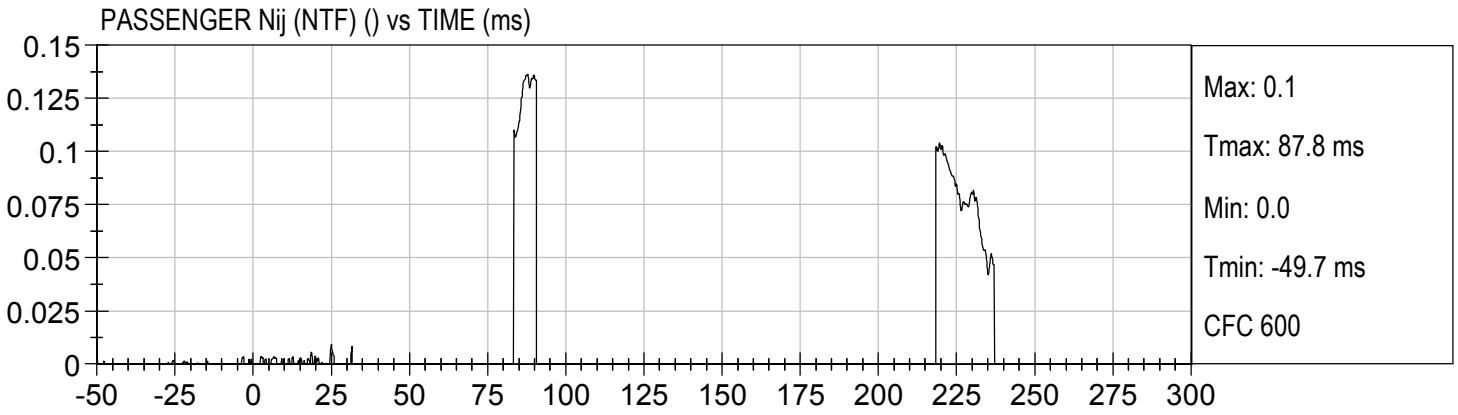
PASSENGER CHEST Resultant (G's) vs TIME (ms)

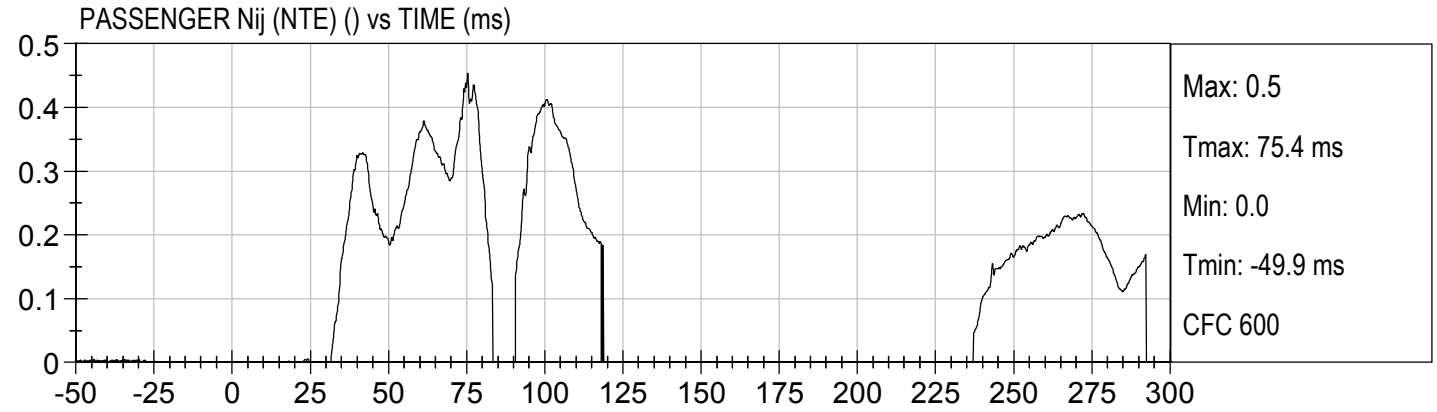


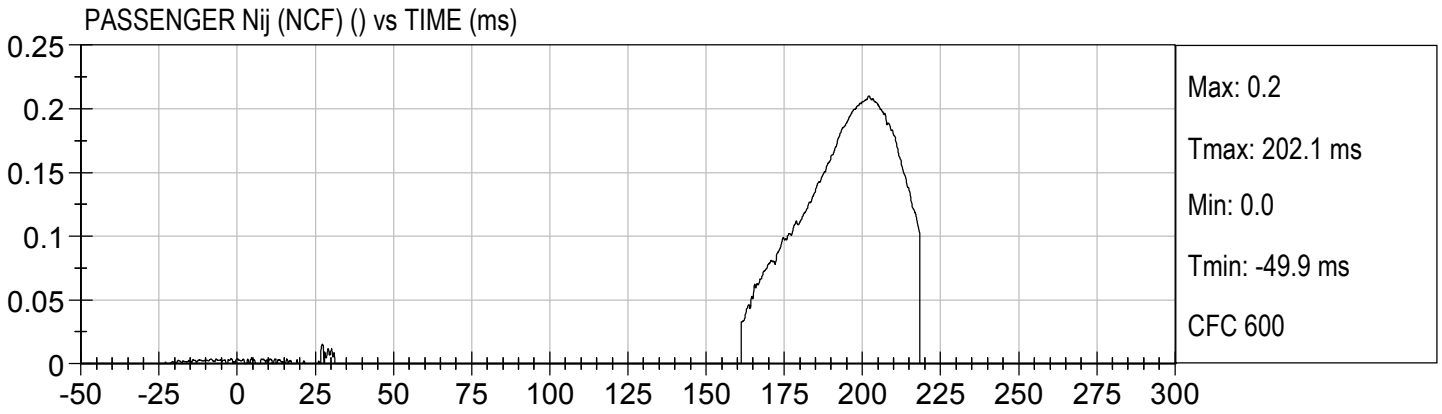

PASSENGER NECK FX (N) vs TIME (ms)
300
200
100
0
-100
-200
-300
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 297.8 N
Tmax: 86.8 ms
Min: -221.4 N
Tmin: 185.7 ms
CFC 1000

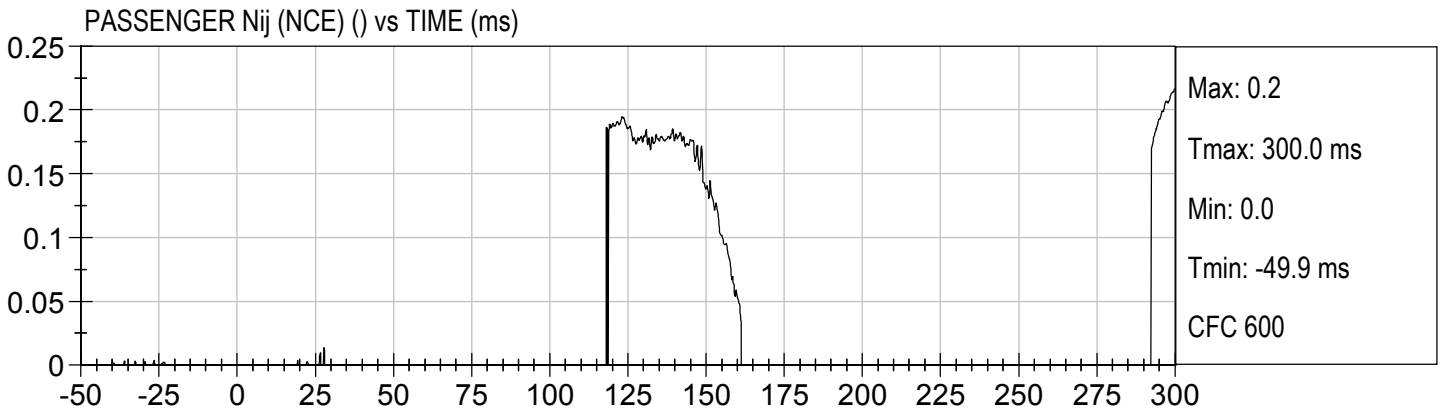

PASSENGER NECK FZ (N) vs TIME (ms)
1000
750
500
250
0
-250
-500
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 994.5 N
Tmax: 74.4 ms
Min: -315.4 N
Tmin: 142.1 ms
CFC 1000


PASSENGER NECK MY (Nm) vs TIME (ms)
30
20
10
0
-10
-20
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 23.5 Nm
Tmax: 202.0 ms
Min: -19.3 Nm
Tmin: 42.3 ms
CFC 600

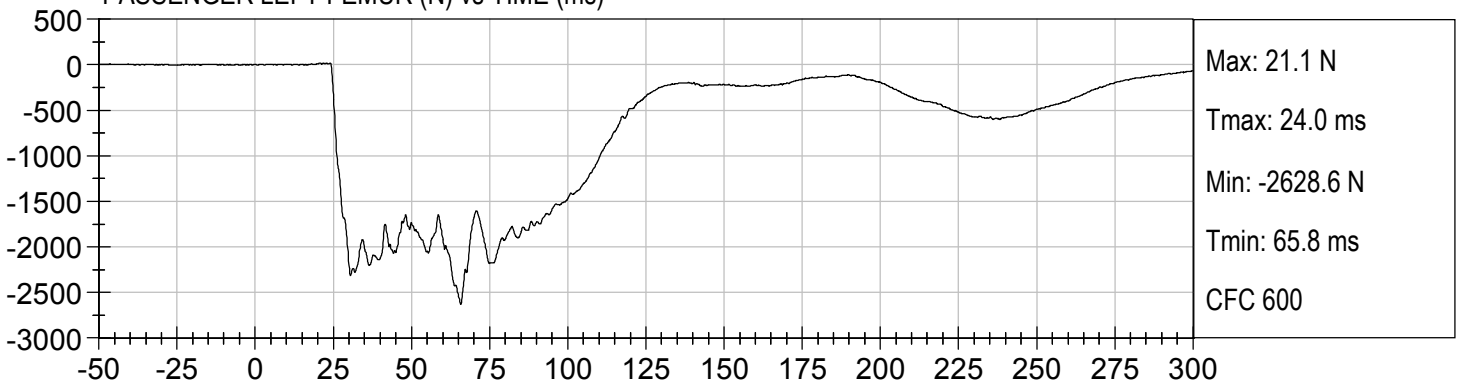

PASSENGER Nij (NTF) () vs TIME (ms)
0.15
0.125
0.1
0.075
0.05
0.025
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.1
Tmax: 87.8 ms
Min: 0.0
Tmin: -49.7 ms
CFC 600


PASSENGER Nij (NTE) () vs TIME (ms)
0.5
0.4
0.3
0.2
0.1
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.5
Tmax: 75.4 ms
Min: 0.0
Tmin: -49.9 ms
CFC 600

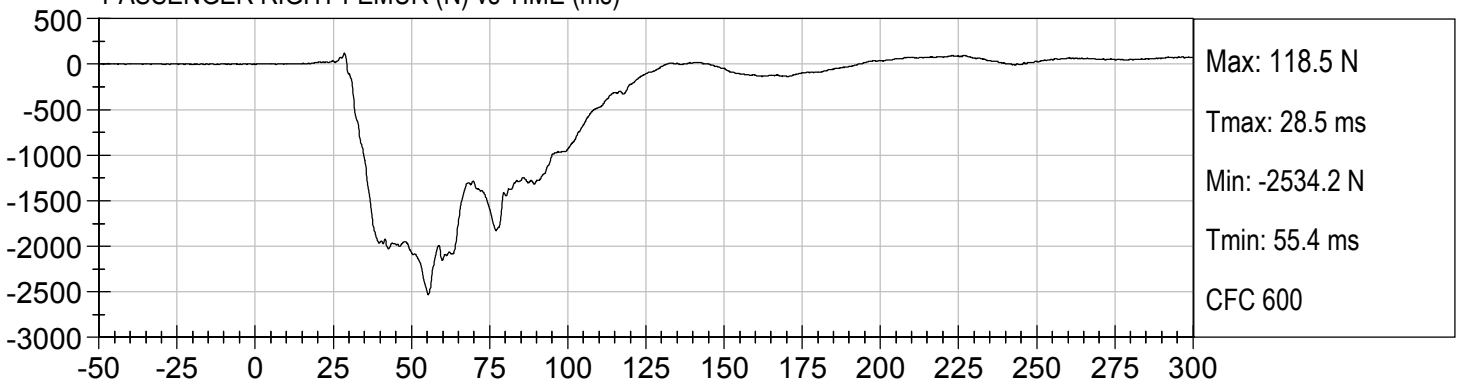

PASSENGER Nij (NCF) () vs TIME (ms)
0.25
0.2
0.15
0.1
0.05
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.2
Tmax: 202.1 ms
Min: 0.0
Tmin: -49.9 ms
CFC 600


PASSENGER Nij (NCE) () vs TIME (ms)
0.25
0.2
0.15
0.1
0.05
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.2
Tmax: 300.0 ms
Min: 0.0
Tmin: -49.9 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:** D134261

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	225 to 275	270	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-5.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

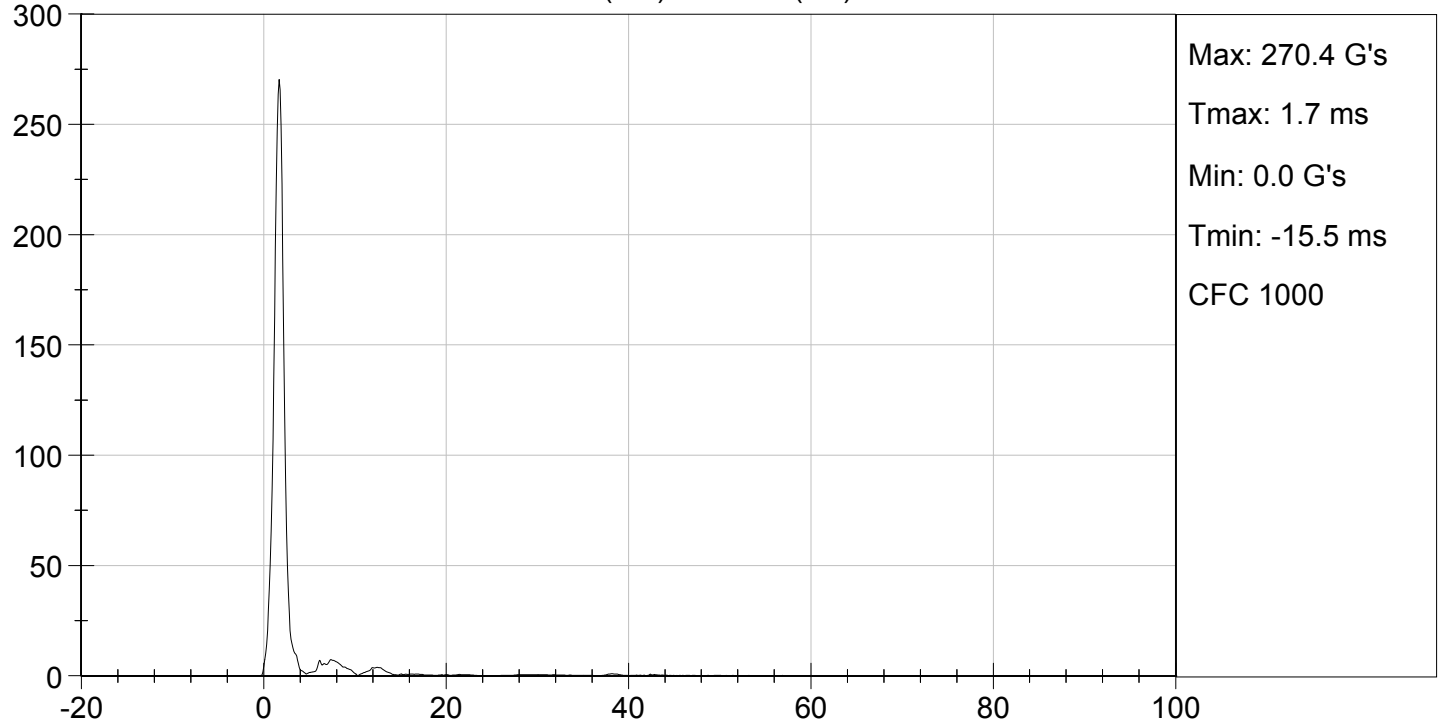
12/13/2013
Test Date

David Winkelbauer
Approved By

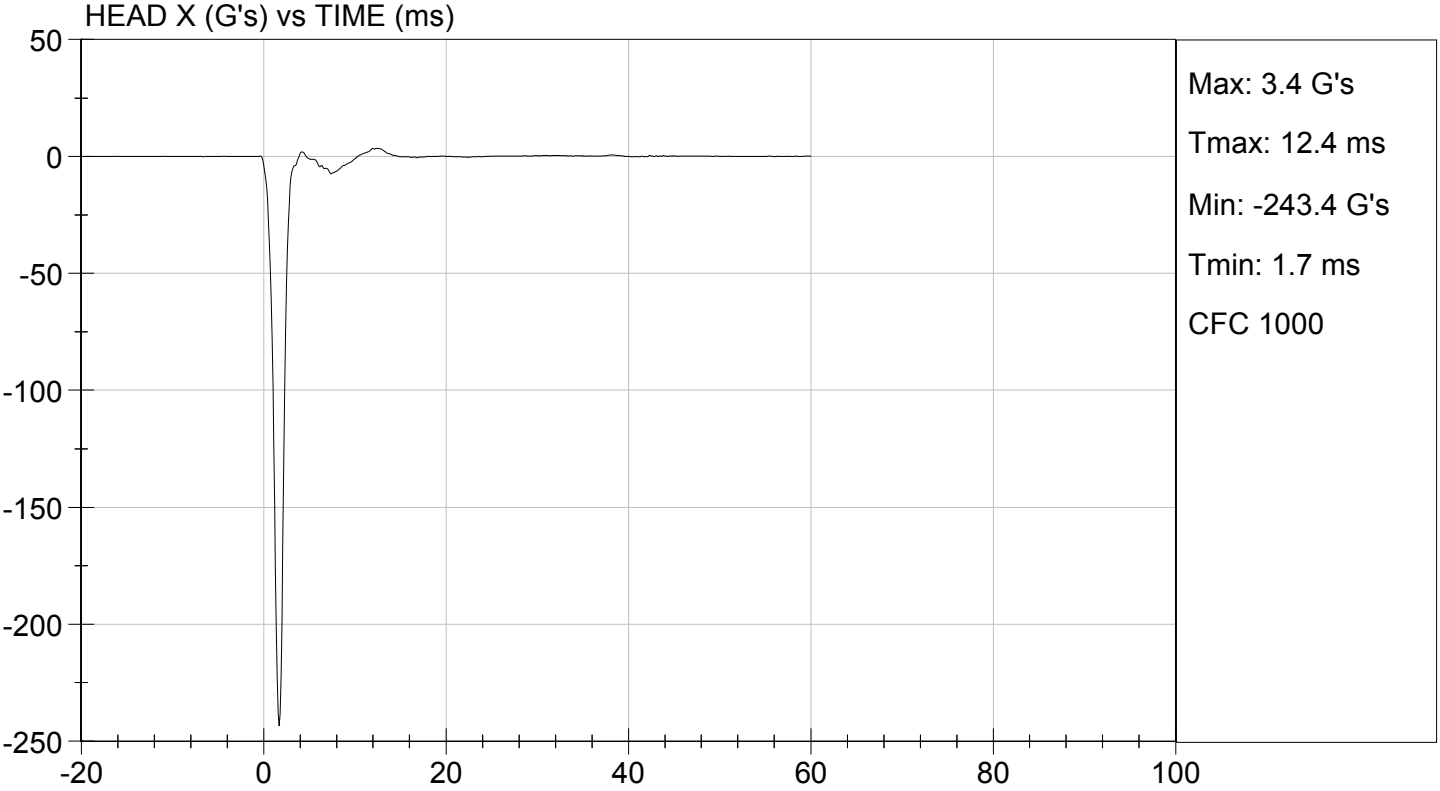
TEST DESC: HEAD DROP

TEST DATE: 12/13/2013
TEST #: D134261

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



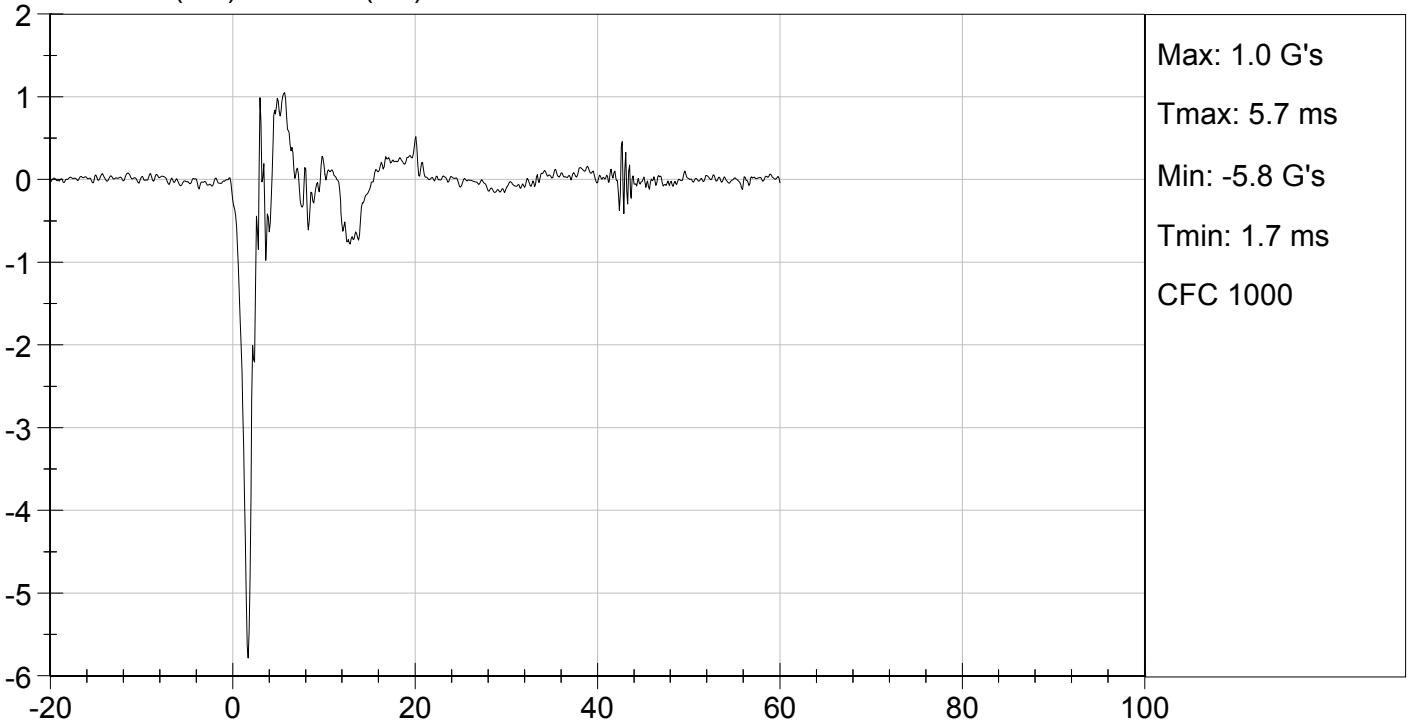
HEAD X (G's) vs TIME (ms)



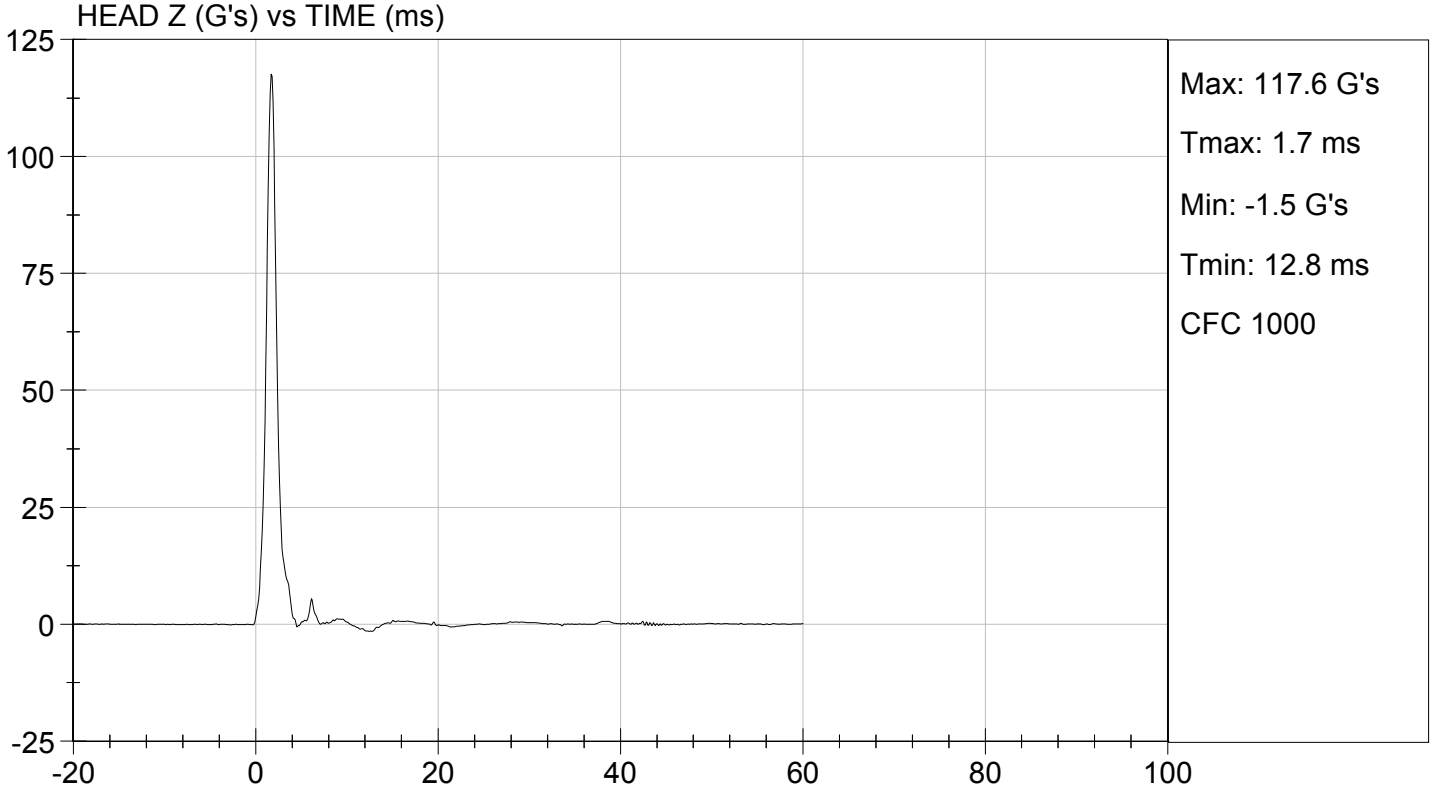
TEST DESC: HEAD DROP

TEST DATE: 12/13/2013
TEST #: D134261

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:** D134262

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	11	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.46	Pass
	20 ms	G's	17.60 to 22.60	21.16	Pass
	30 ms	G's	12.50 to 18.50	14.82	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.7	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.4	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	70.1	Pass
	Time	ms	57.0 to 64.0	63.3	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	94.7	Pass
	Time	ms	47.0 to 58.0	47.1	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.5	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

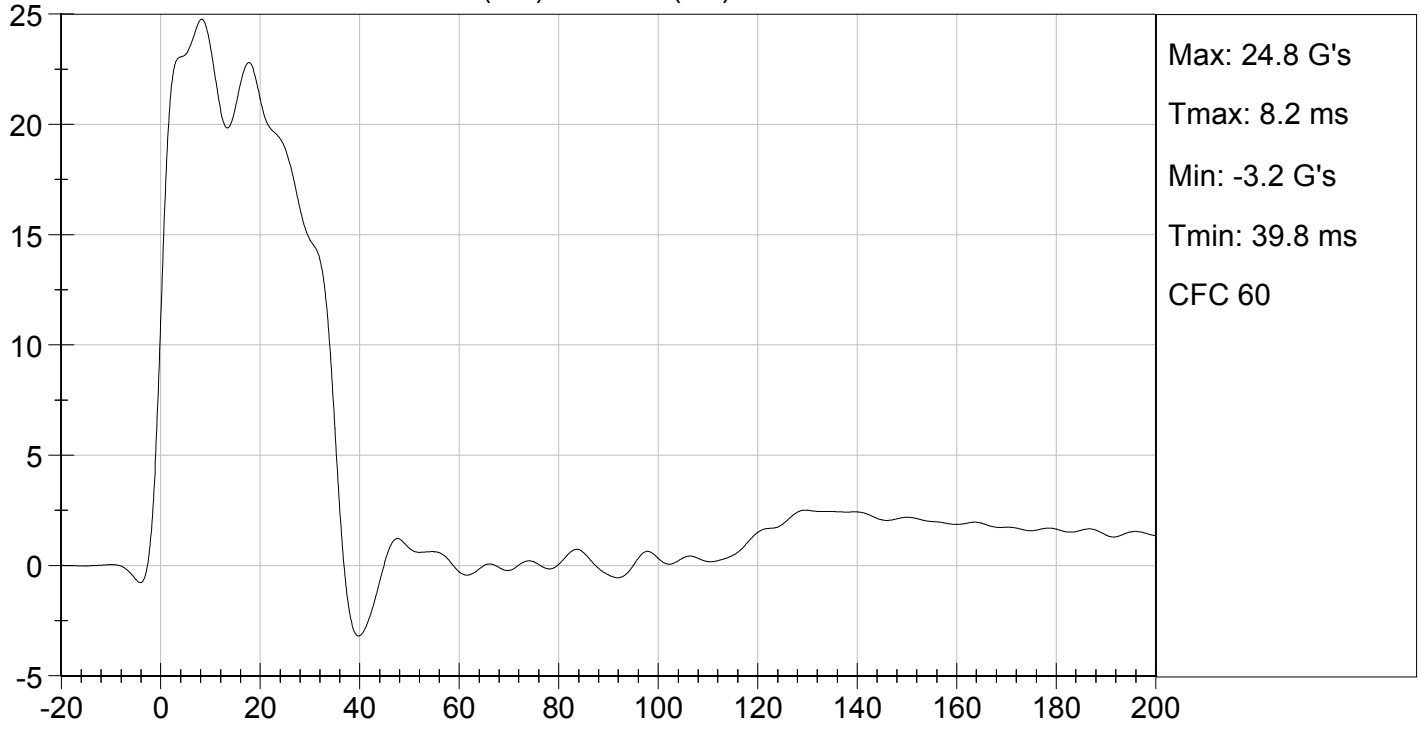
12/16/2013
Test Date

David Winkelbauer
Approved By

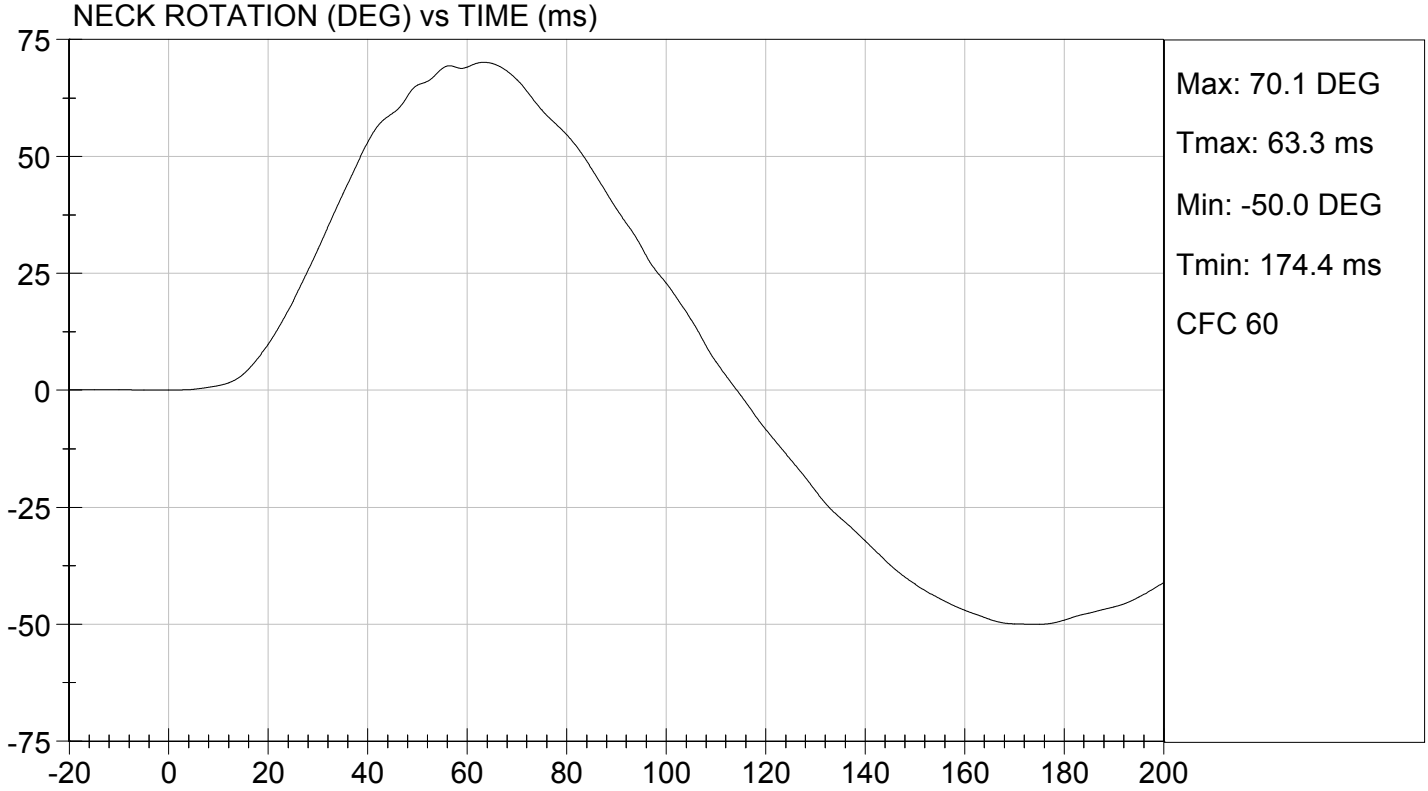
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 12/16/2013
TEST #: D134262

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



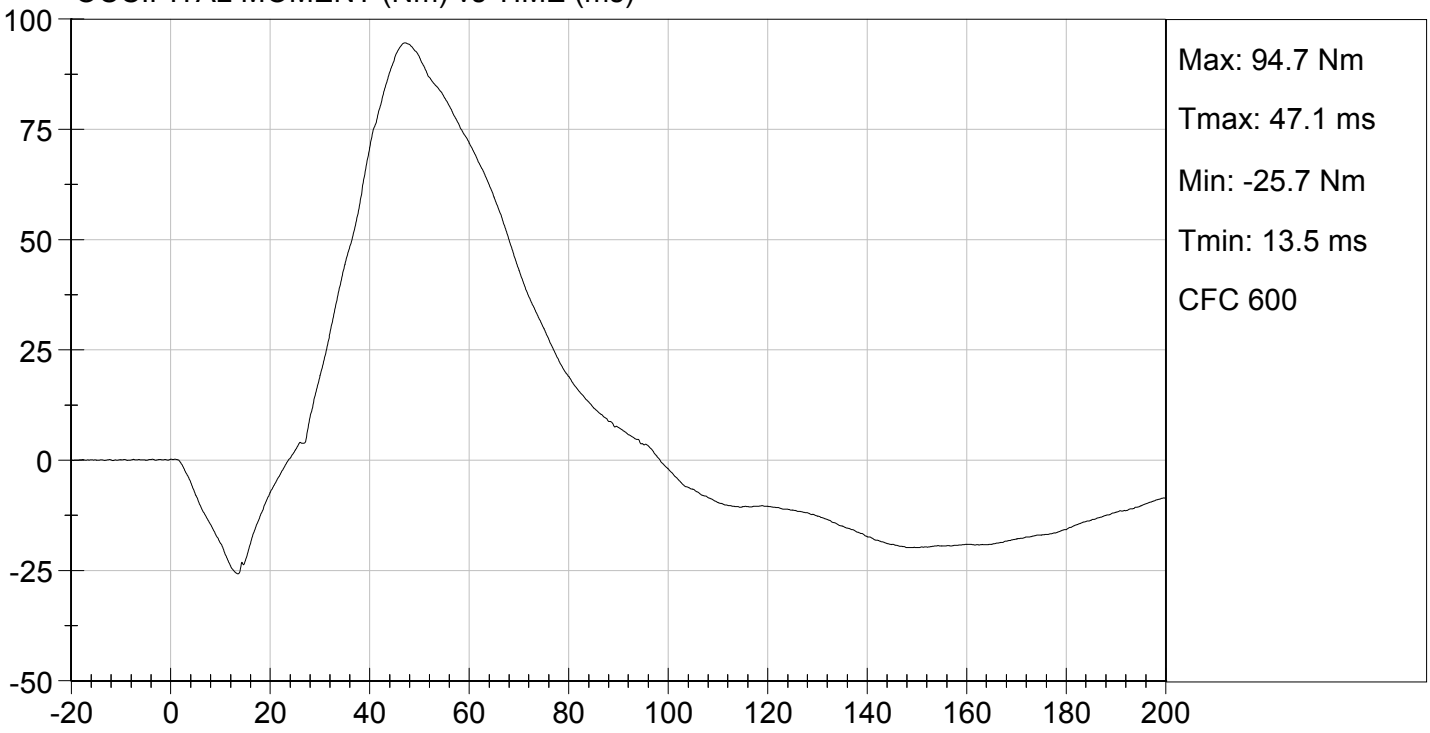
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/16/2013
TEST #: D134262

OCCIPITAL MOMENT (Nm) vs TIME (ms)



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D134263

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	11	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.66	Pass
	20 ms	G's	14.00 to 19.00	17.18	Pass
	30 ms	G's	11.00 to 16.00	12.56	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	41.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.1	Pass
	Time	ms	72.0 to 82.0	78.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	155.7	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-61.2	Pass
	Time	ms	65.0 to 79.0	70.4	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	142.9	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

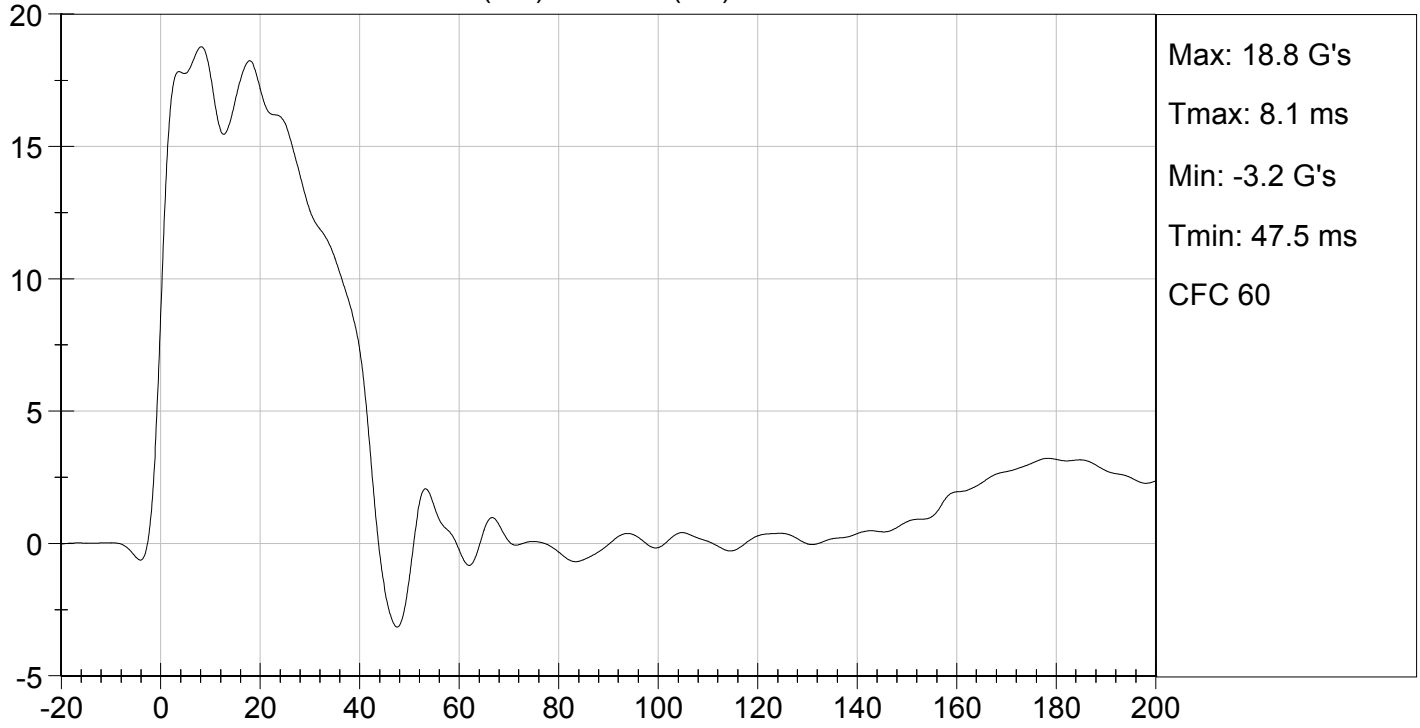
12/16/2013
Test Date

David Winkelbauer
Approved By

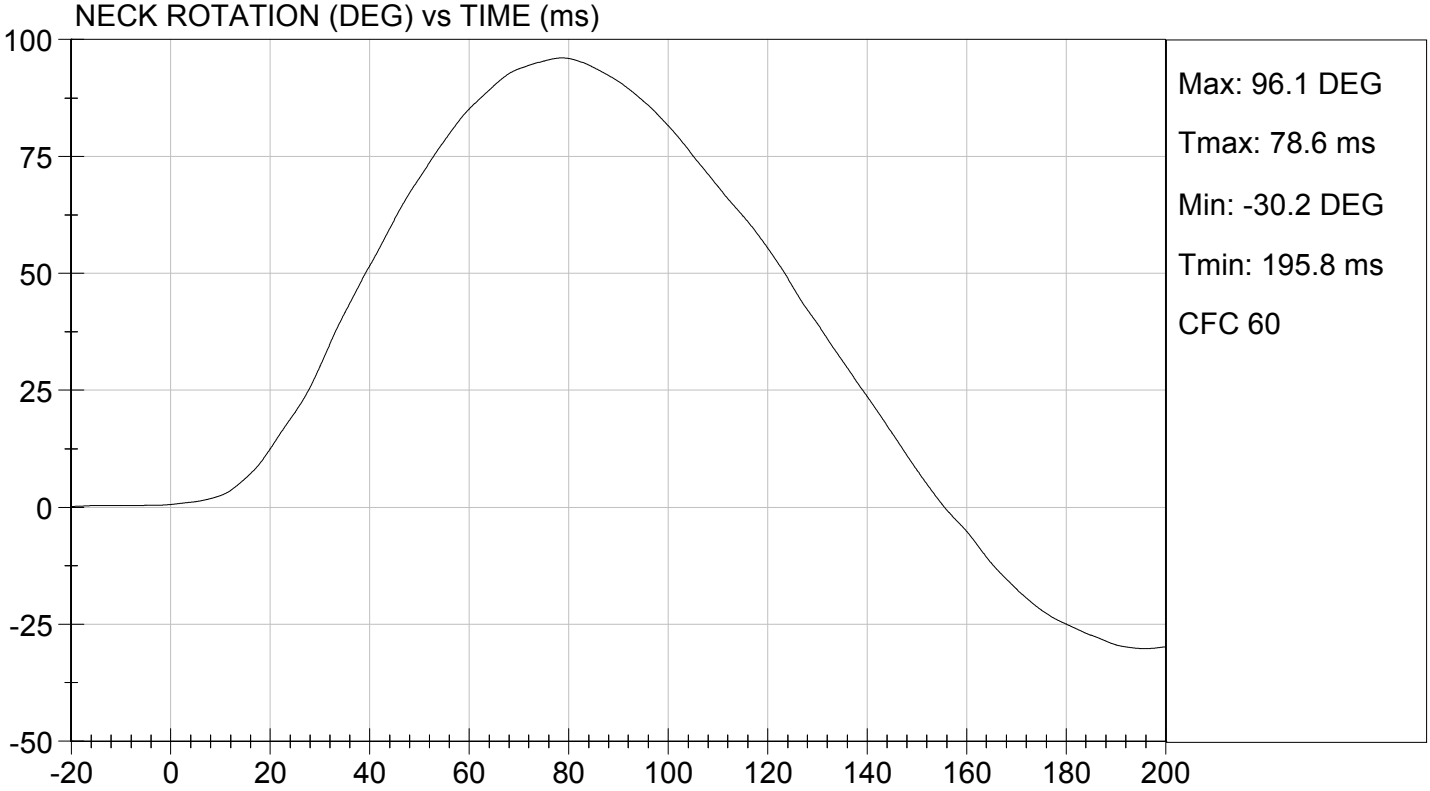
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 12/16/2013
TEST #: D134263

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

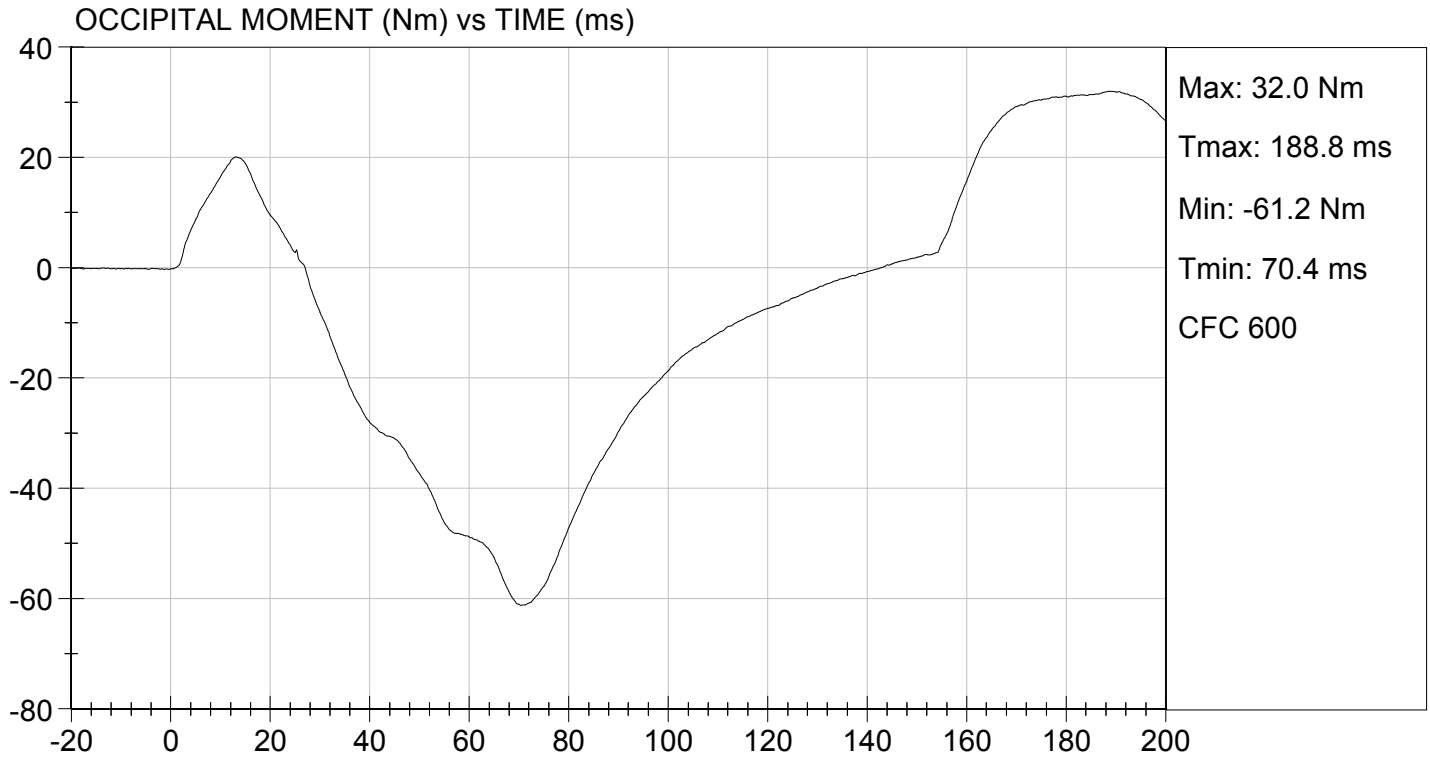


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/16/2013
TEST #: D134263



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D134264

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	12	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,288	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.70	Pass
Internal Hysteresis	%	69 to 85	69	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

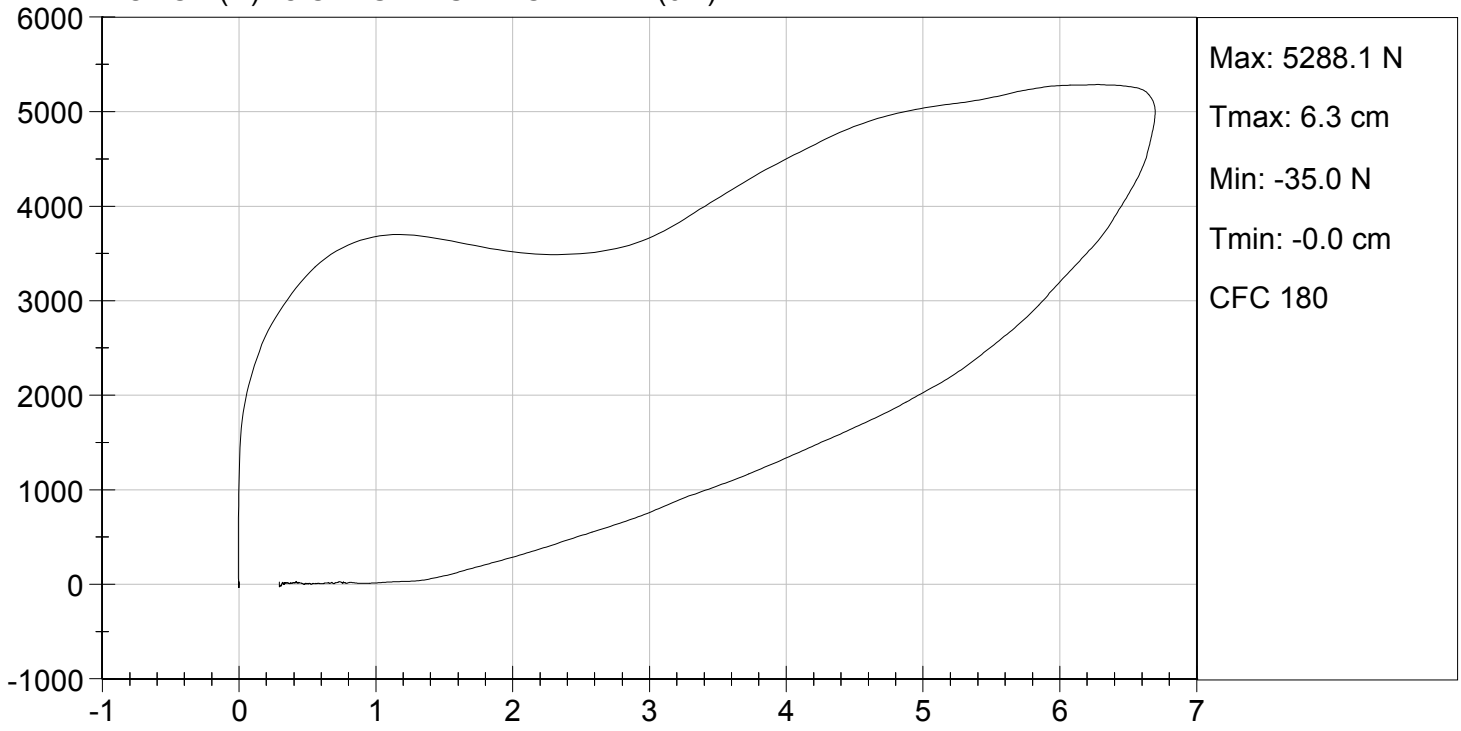
12/16/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 12/16/2013
TEST #: D134264

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:** D134265

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	18	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	5,214	Pass
		Overall Test Results		Pass

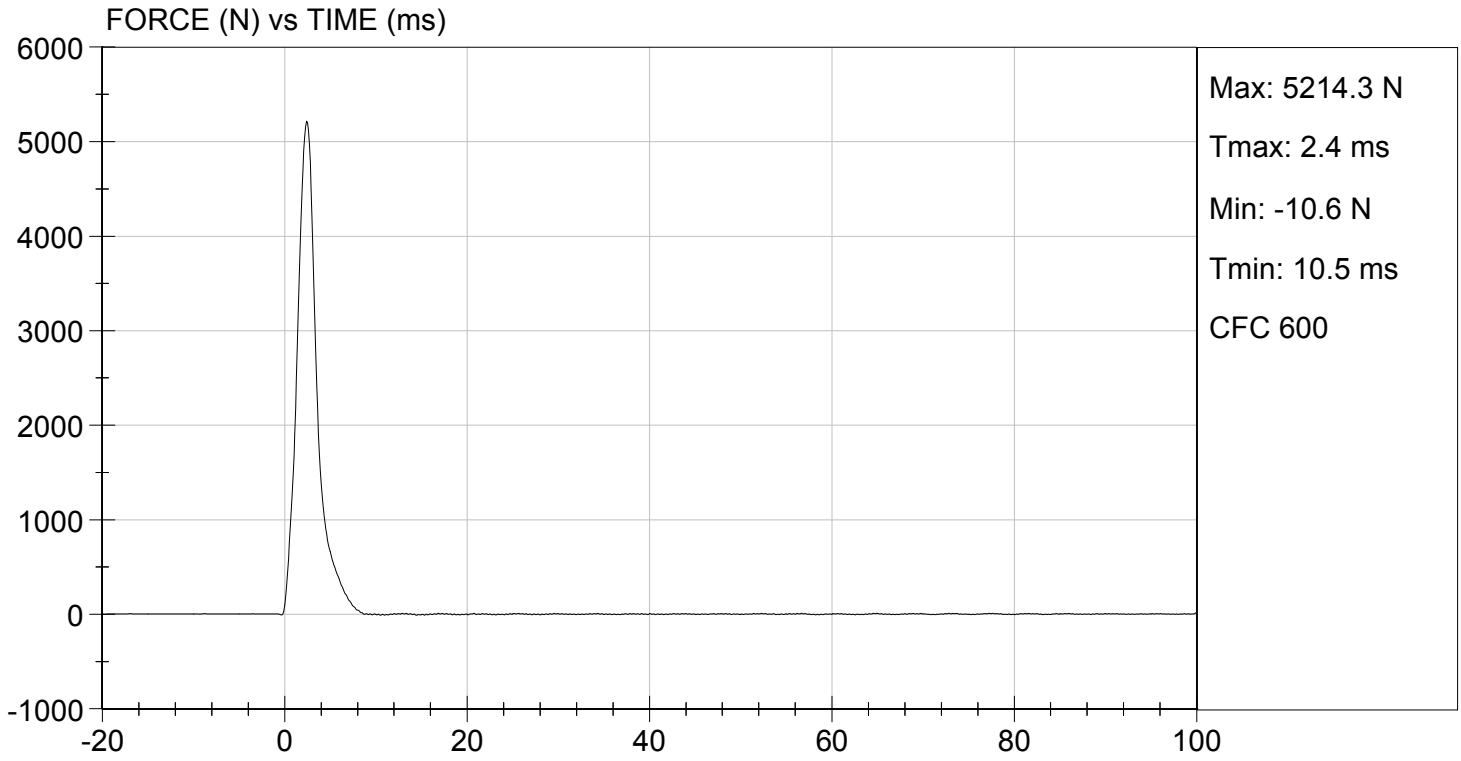
Jessica Gall
Laboratory Technician

12/13/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 12/13/2013
TEST #: D134265



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D134266

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	18	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	5,261	Pass
		Overall Test Results		Pass

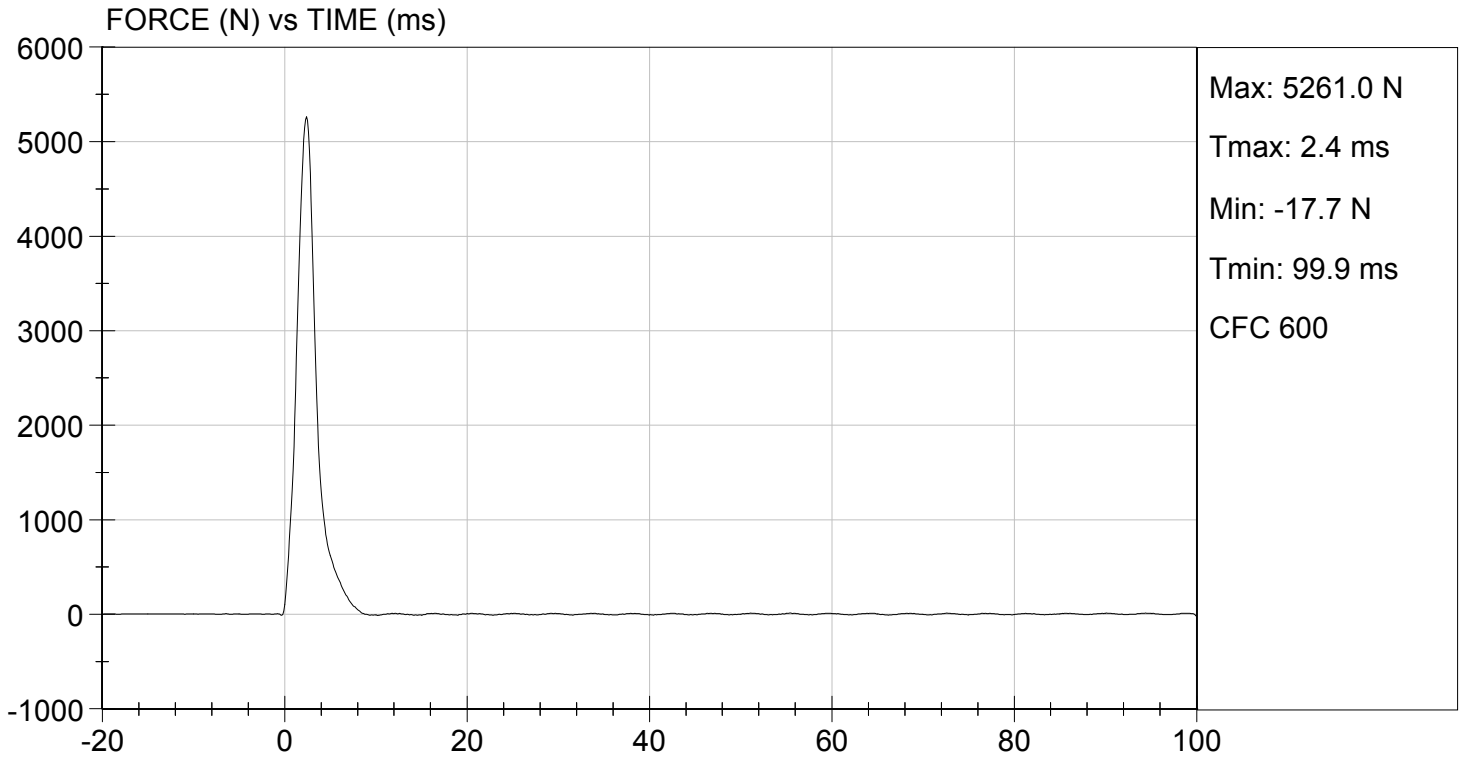
Jessica Gall
Laboratory Technician

12/13/2013
Test Date

David Winkelbauer
Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.88 ft/s, 2.10 m/s

TEST DATE: 12/13/2013
TEST #: D134266



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D134260

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	20.8	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	19	19	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	50.8	65.9	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	49.5	46.6	Pass
		Overall Test Results			Pass

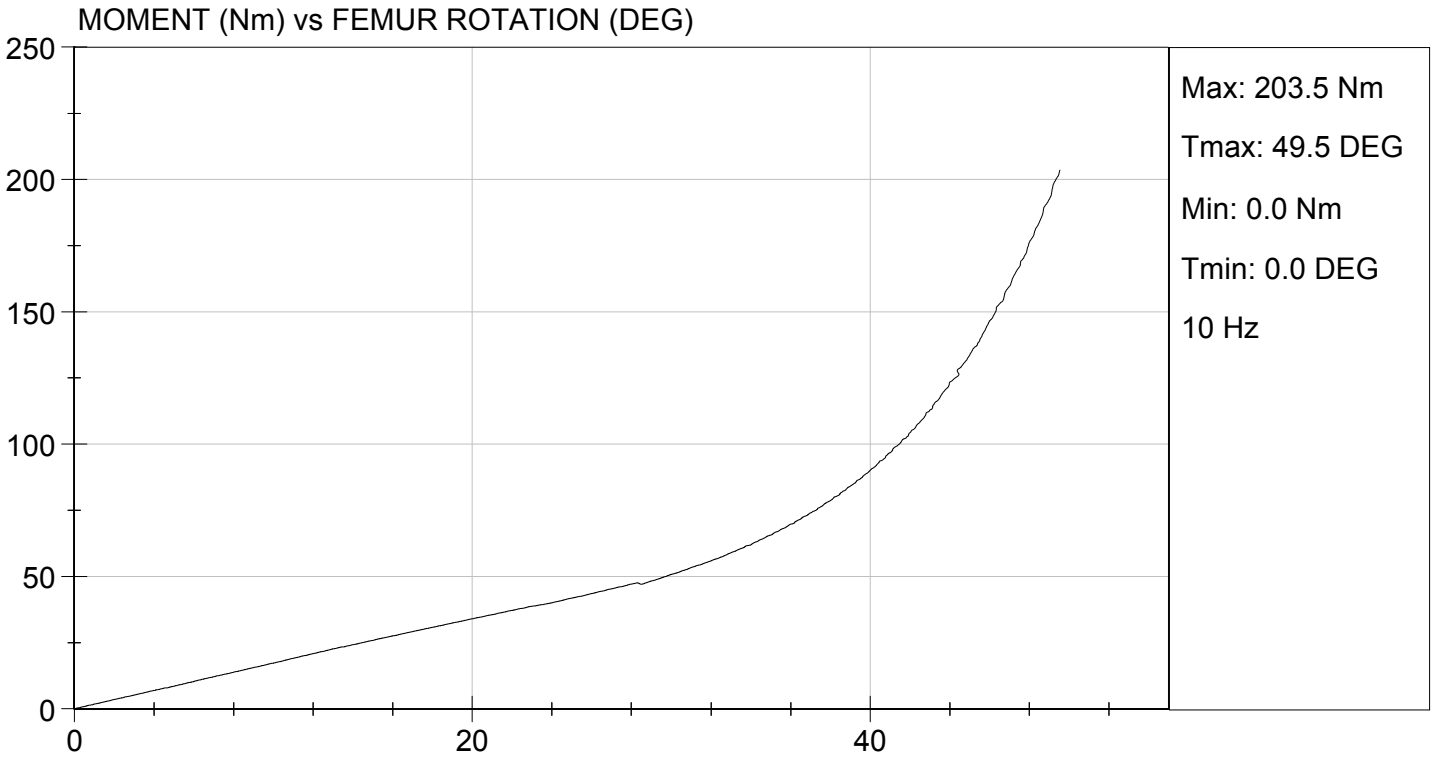
Jessica Hall
Laboratory Technician

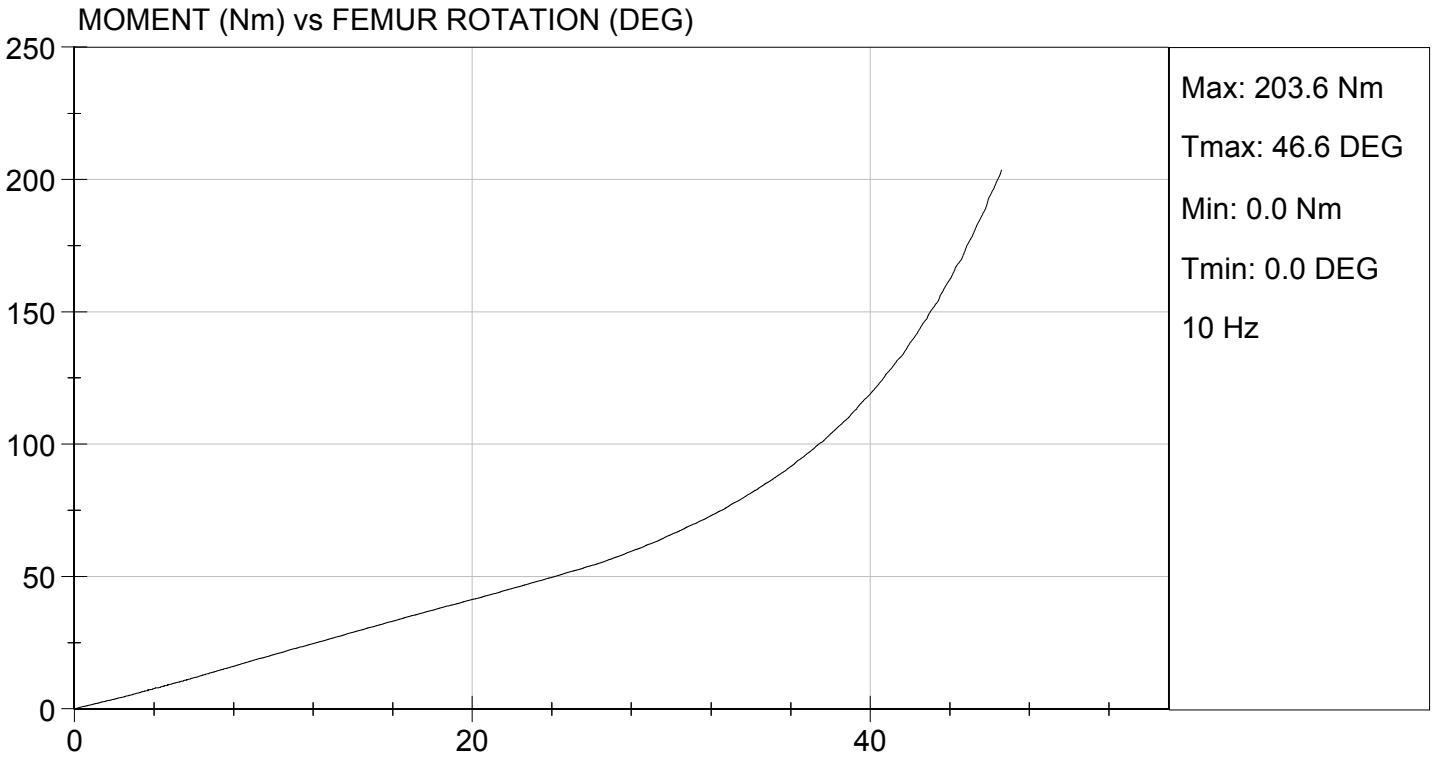
12/13/2013
Test Date

David Winkelbauer
Approved By

TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 12/13/2013
TEST #: D134269




MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.6 Nm
Tmax: 46.6 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test ID:** D134331

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Peak Resultant Acceleration	G's	225 to 275	273	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-3.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

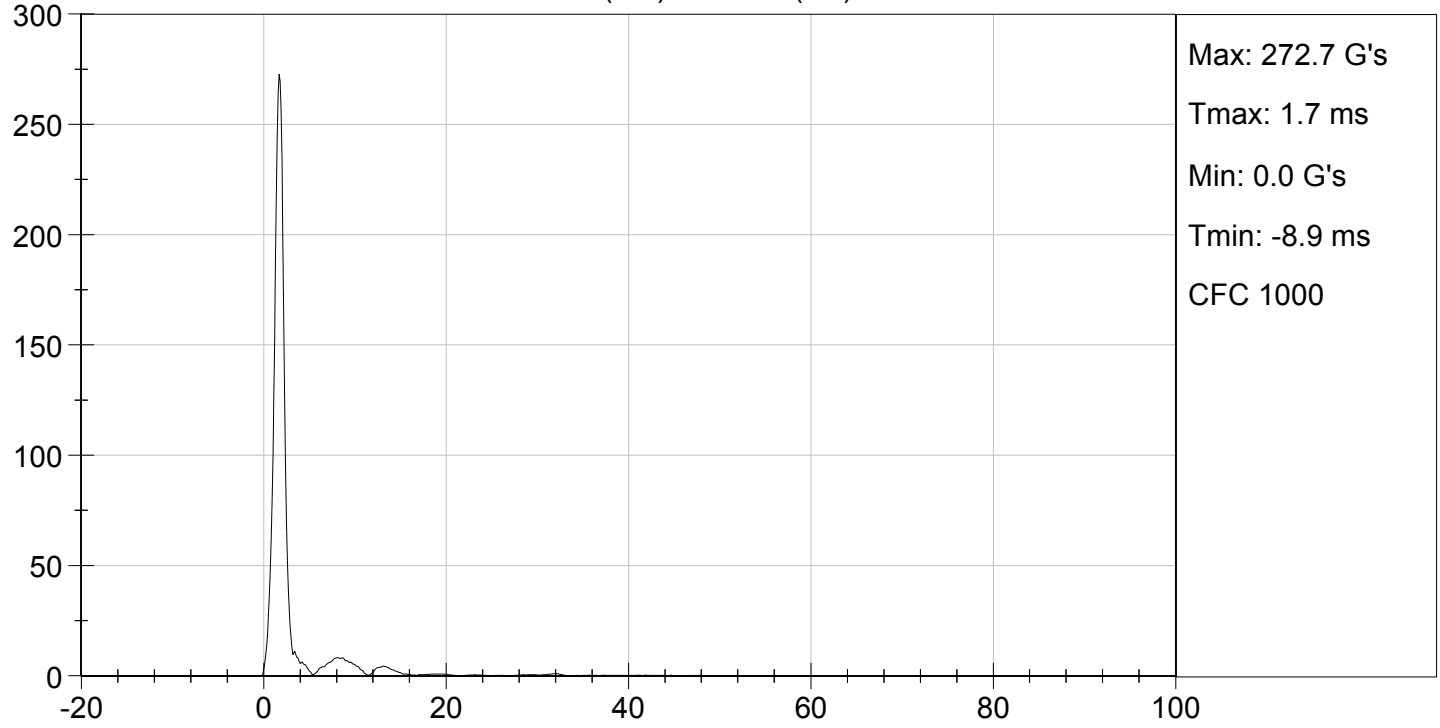
12/18/2013
Test Date

David Winkelbauer
Approved By

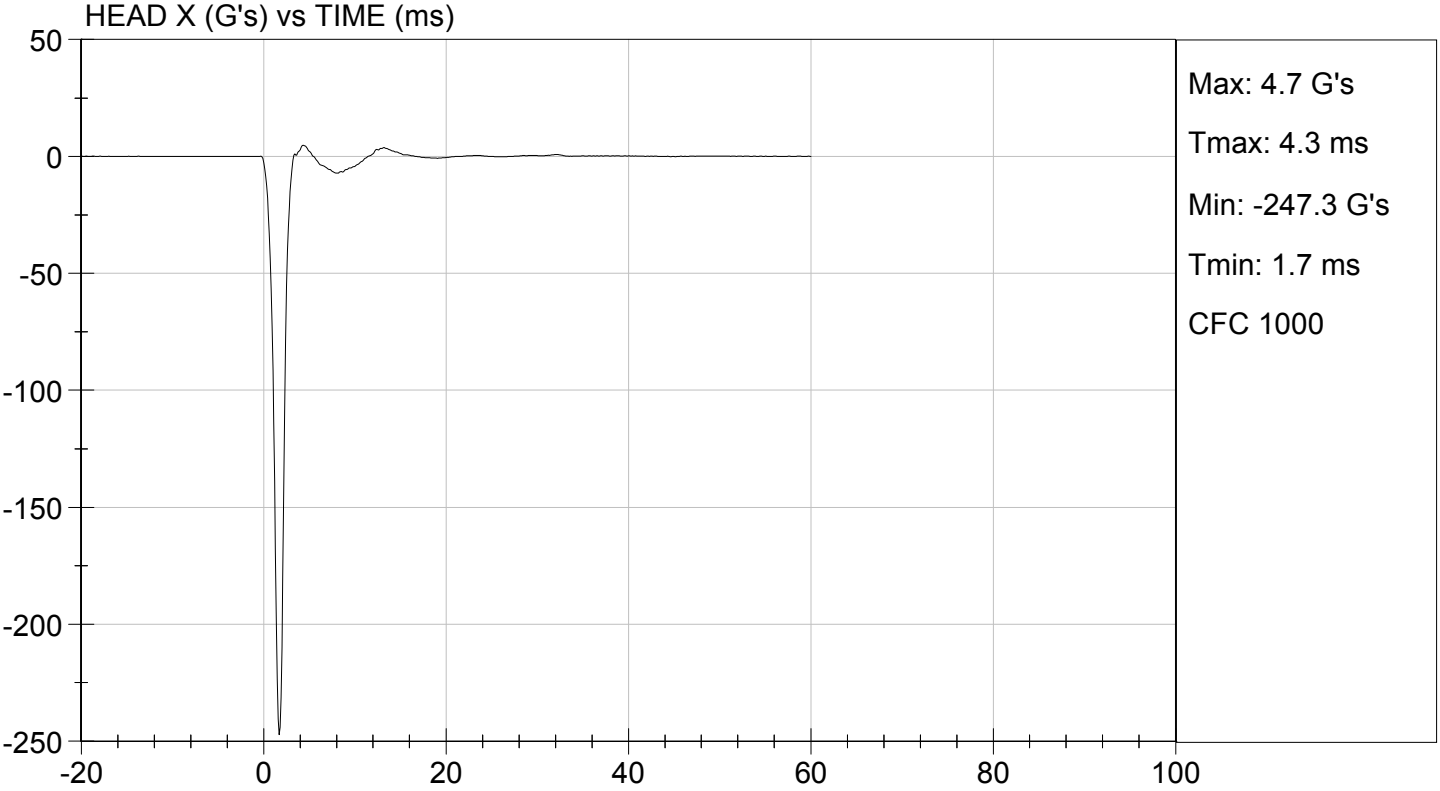
TEST DESC: HEAD DROP

TEST DATE: 12/18/2013
TEST #: D134331

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



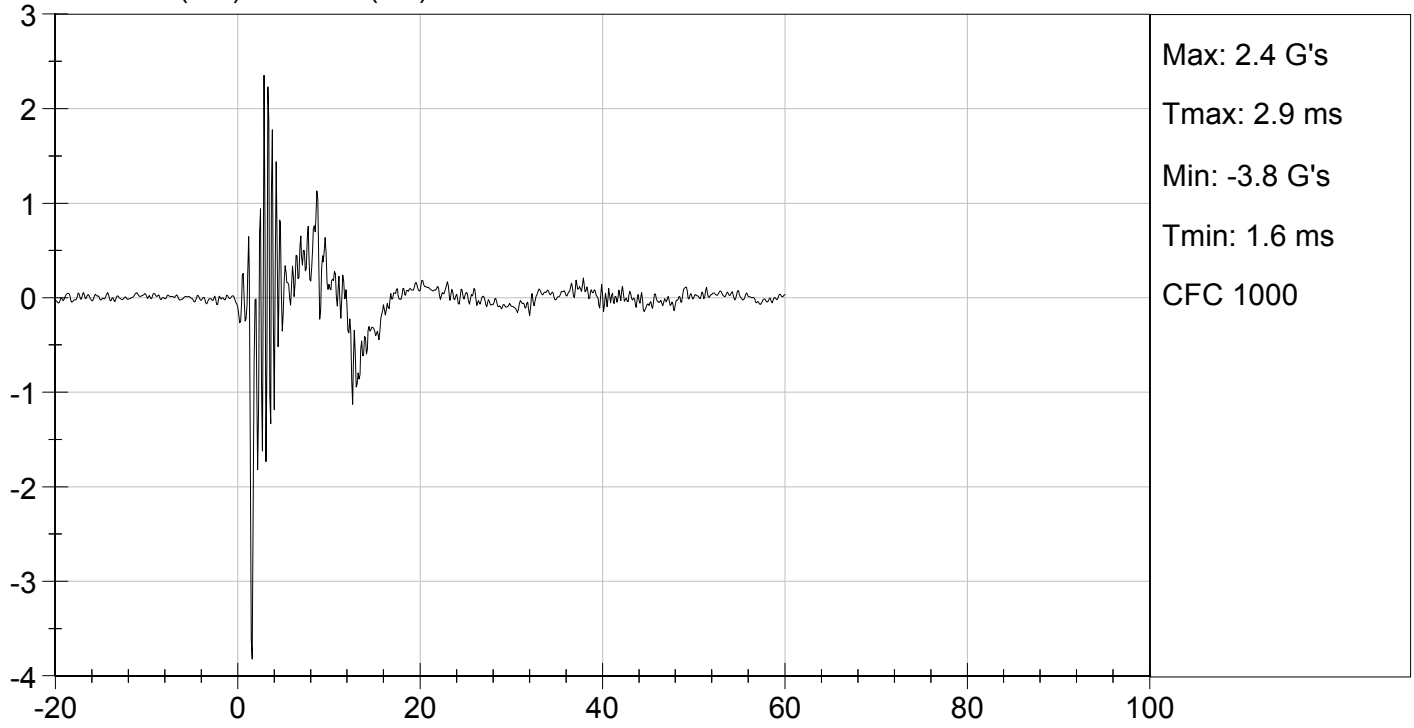
HEAD X (G's) vs TIME (ms)



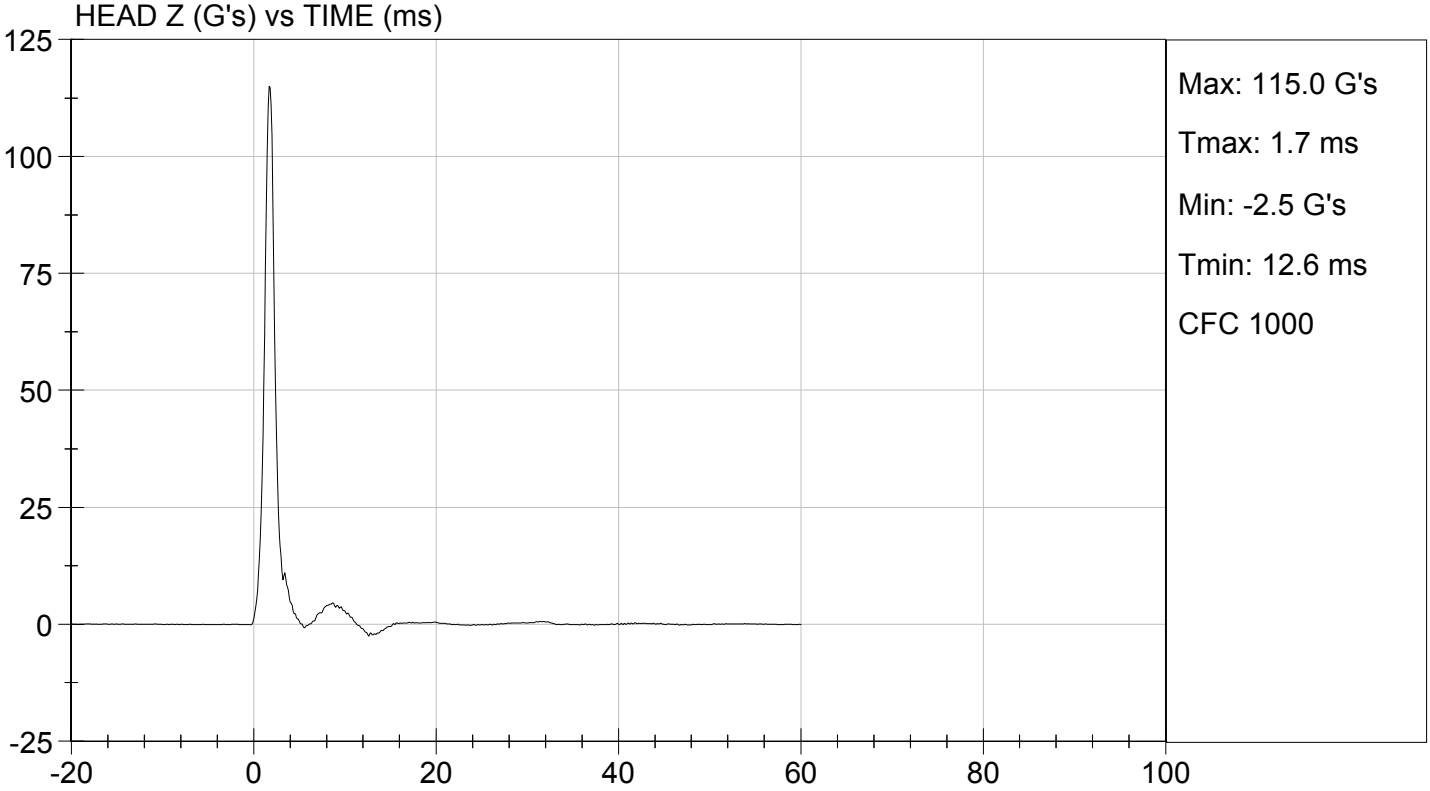
TEST DESC: HEAD DROP

TEST DATE: 12/18/2013
TEST #: D134331

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:** D134332

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	18	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.77	Pass
	20 ms	G's	17.60 to 22.60	20.61	Pass
	30 ms	G's	12.50 to 18.50	15.02	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	15.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	36.2	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	69.7	Pass
	Time	ms	57.0 to 64.0	58.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.9	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	92.2	Pass
	Time	ms	47.0 to 58.0	48.9	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	99.3	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

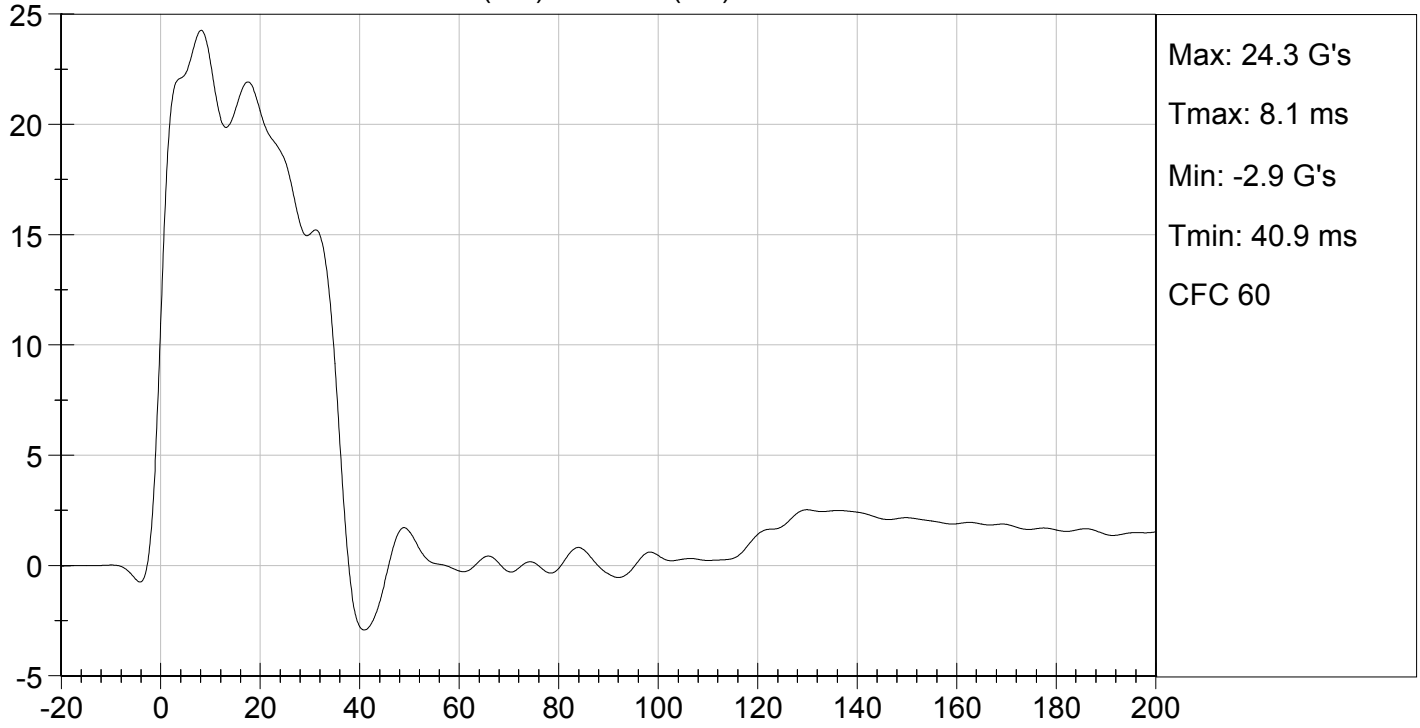
12/18/2013
Test Date

David Winkelbauer
Approved By

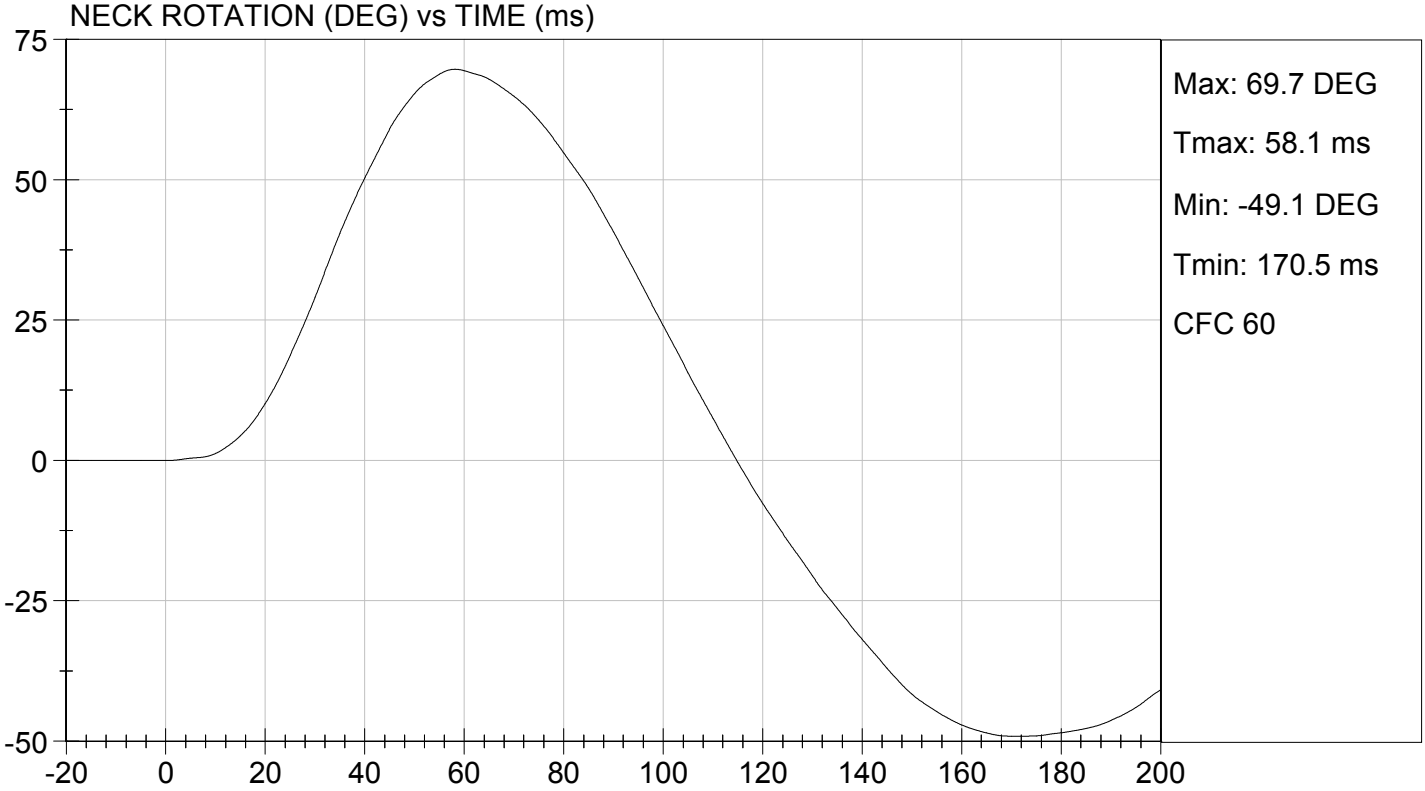
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 12/18/2013
TEST #: D134332

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



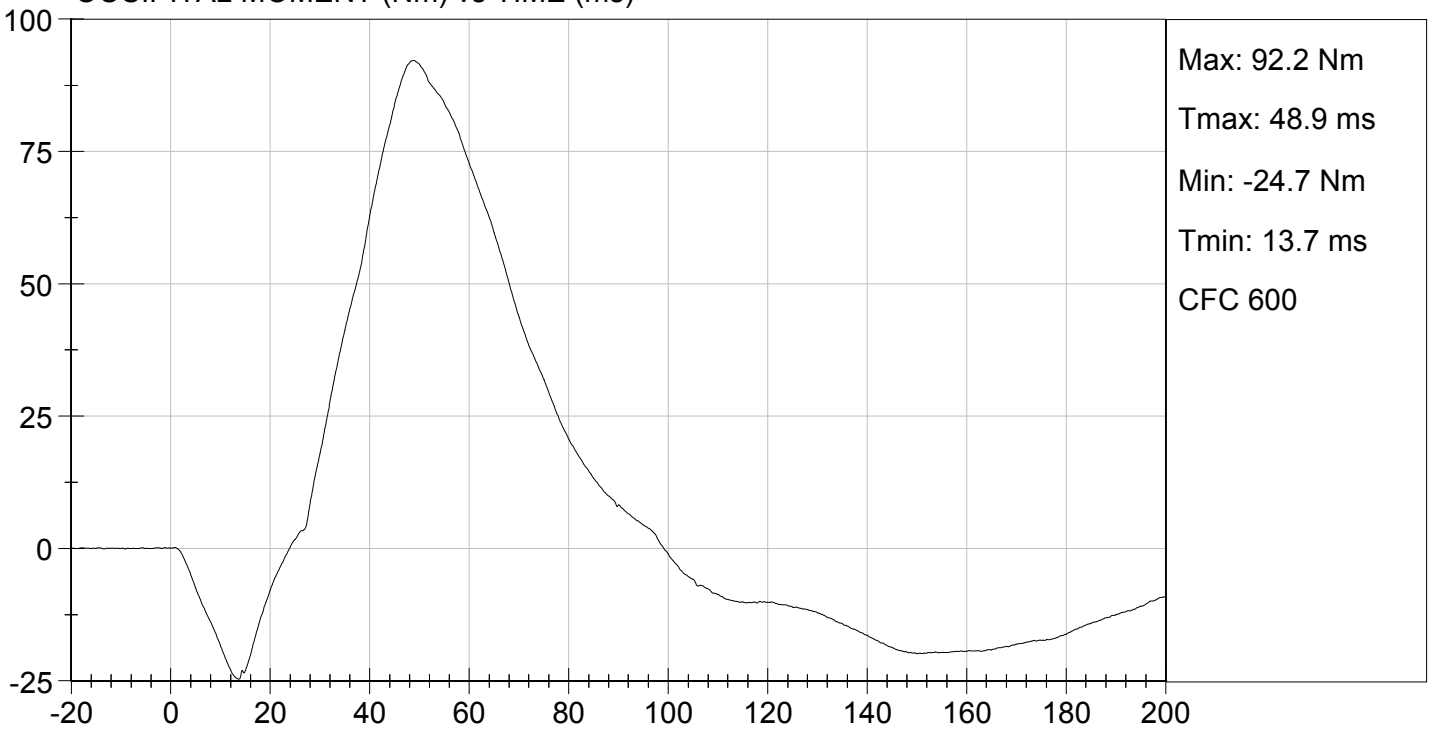
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/18/2013
TEST #: D134332

OCCIPITAL MOMENT (Nm) vs TIME (ms)



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D134333

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	18	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.52	Pass
	20 ms	G's	14.00 to 19.00	15.15	Pass
	30 ms	G's	11.00 to 16.00	11.74	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.0	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	44.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	95.3	Pass
	Time	ms	72.0 to 82.0	78.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	158.4	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-58.6	Pass
	Time	ms	65.0 to 79.0	73.8	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	145.9	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

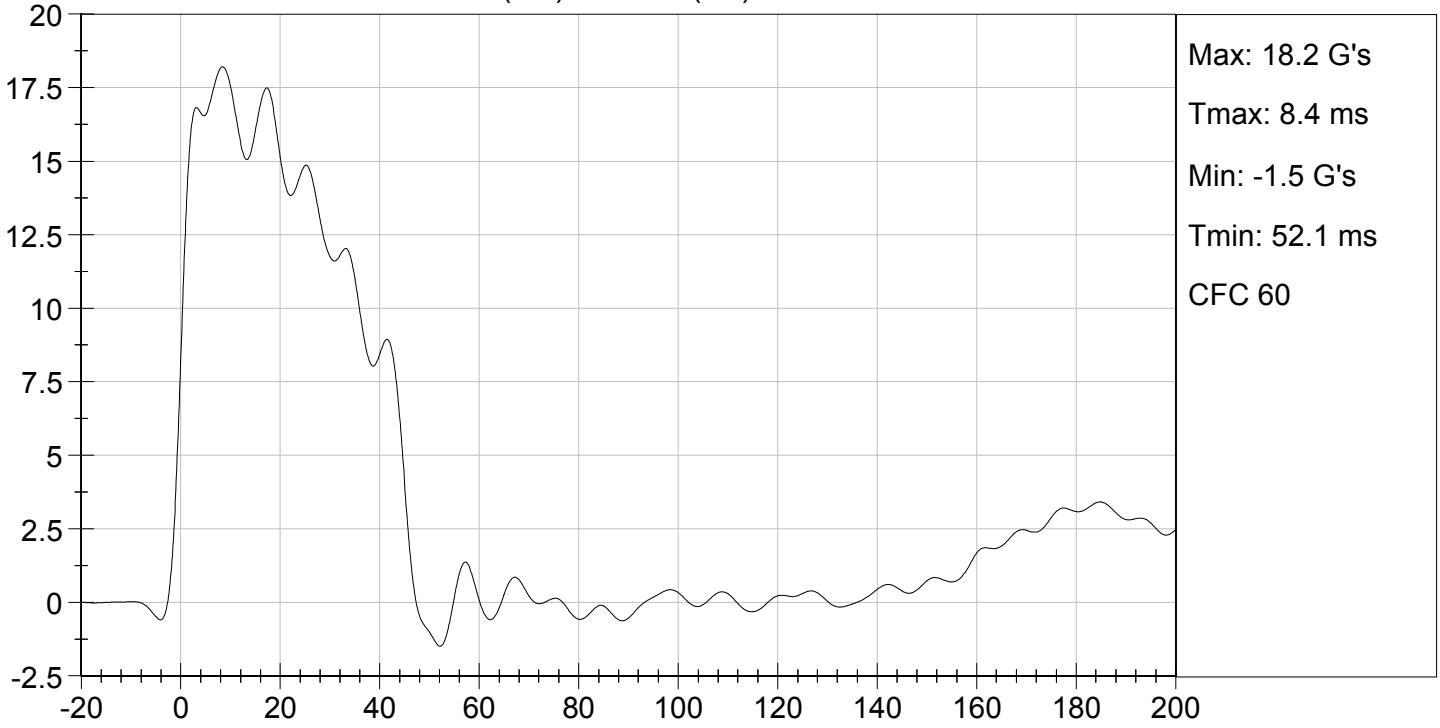
12/18/2013
Test Date

David Winkelbauer
Approved By

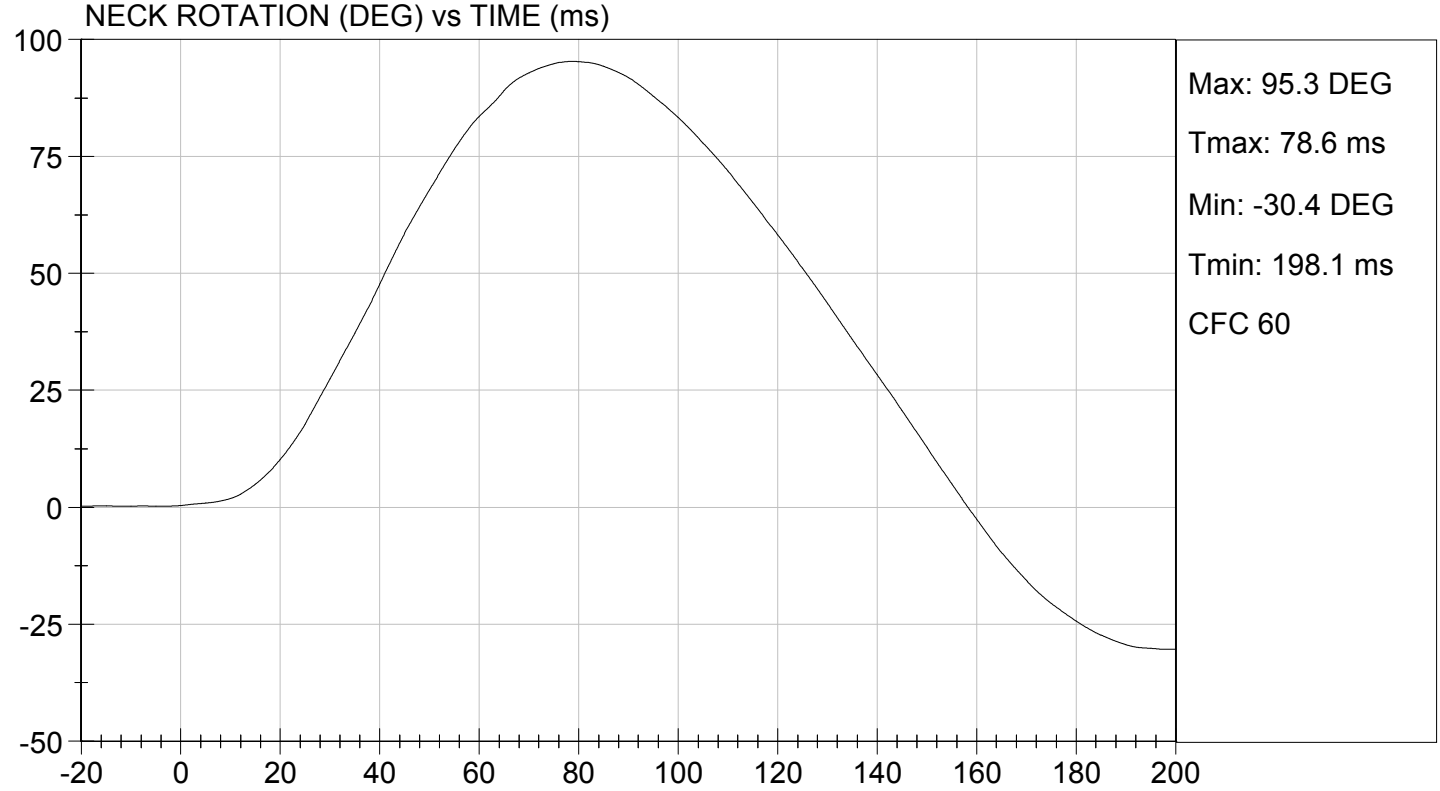
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 12/18/2013
TEST #: D134333

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

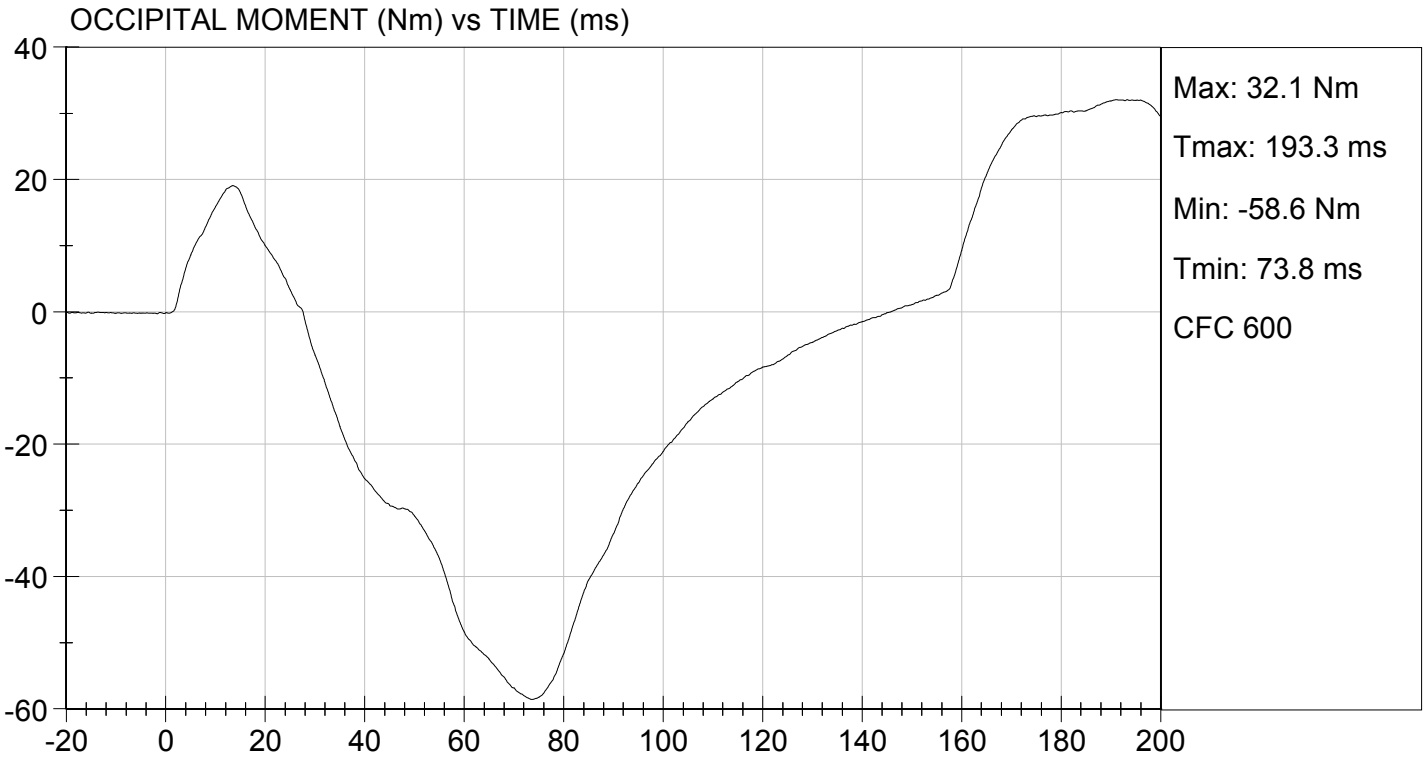


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/18/2013
TEST #: D134333



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D134334

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,259	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.40	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

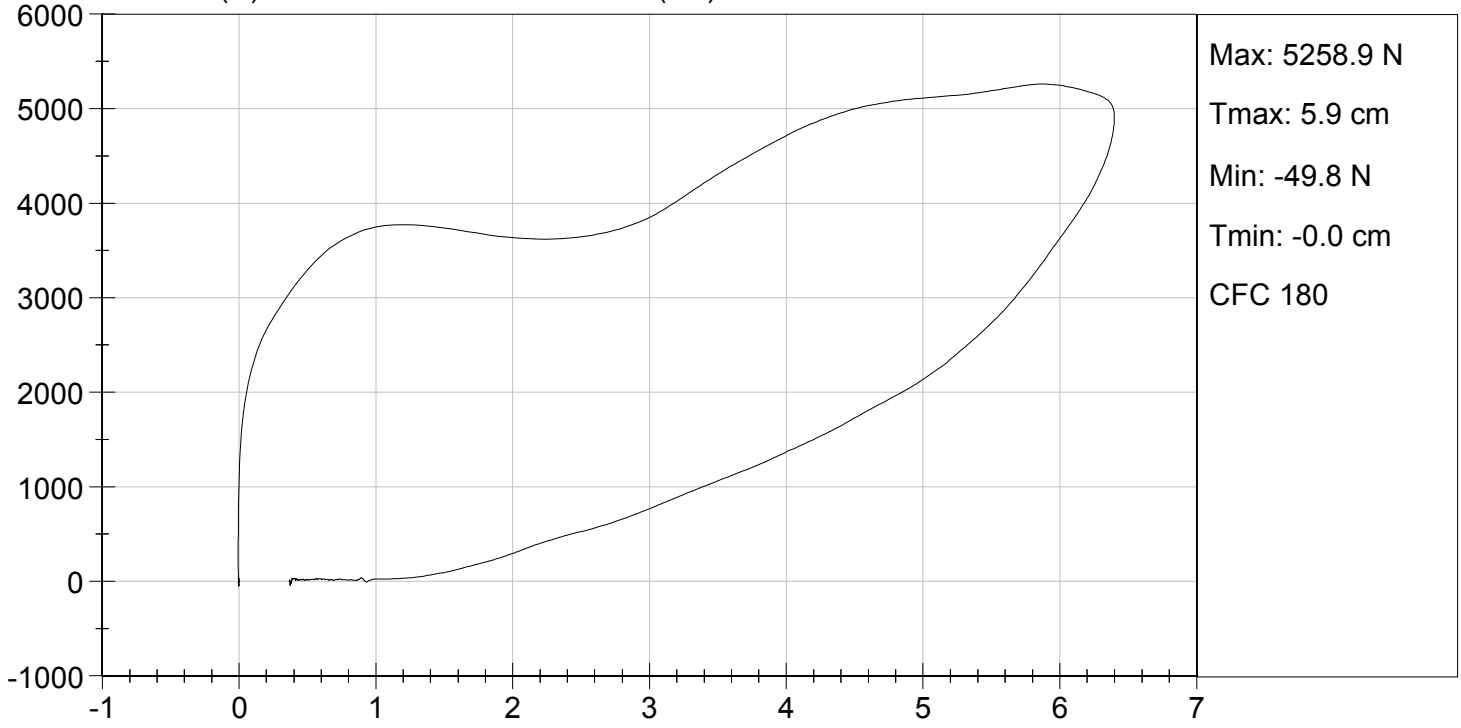
12/18/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 12/18/2013
TEST #: D134334

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:** D134335

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	2.07 to 2.13	2.09	Pass
Peak Probe Force	N	4715 to 5782	5,021	Pass
		Overall Test Results		Pass

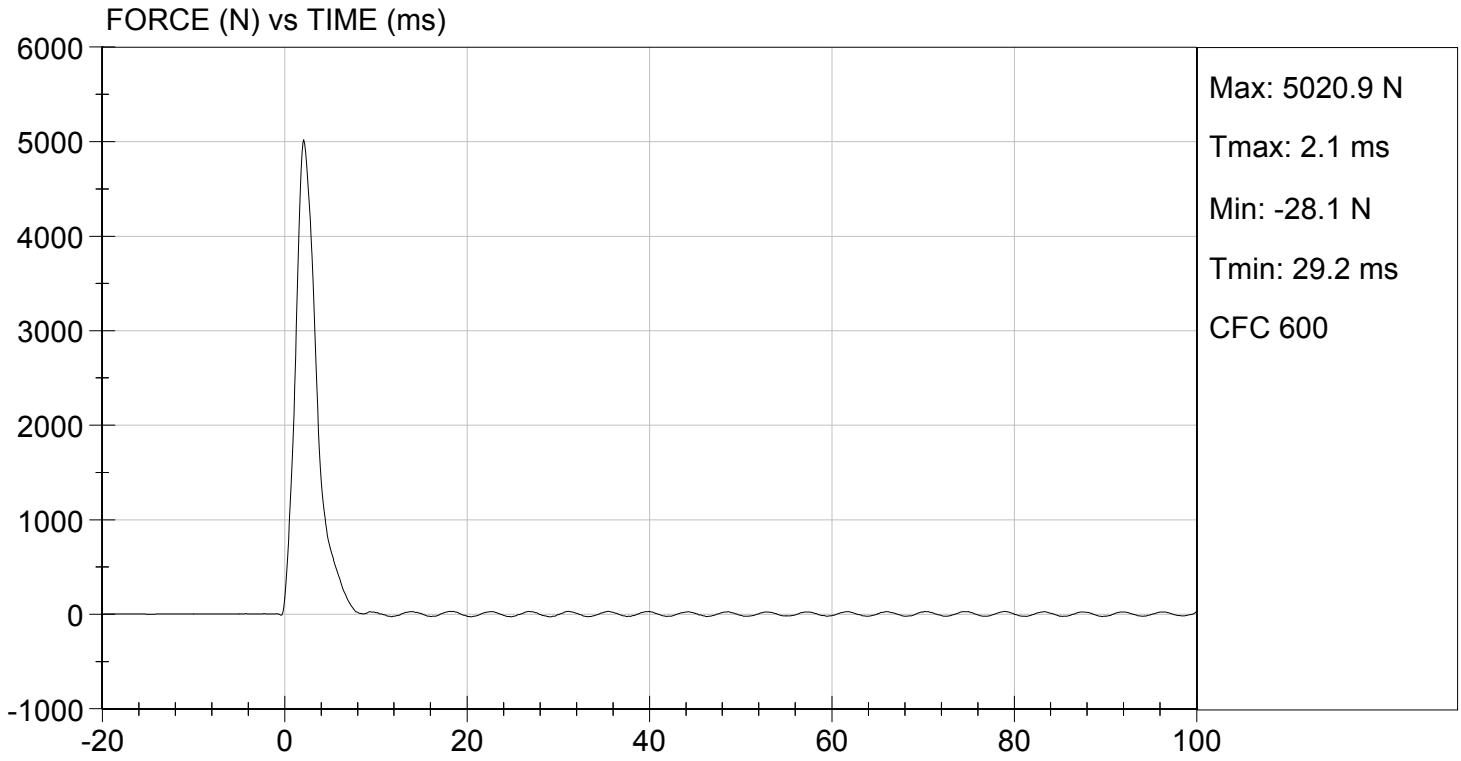
Jessica Hall
Laboratory Technician

12/18/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 12/18/2013
TEST #: D134335



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D134336

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	2.07 to 2.13	2.09	Pass
Peak Probe Force	N	4715 to 5782	5,604	Pass
		Overall Test Results		Pass

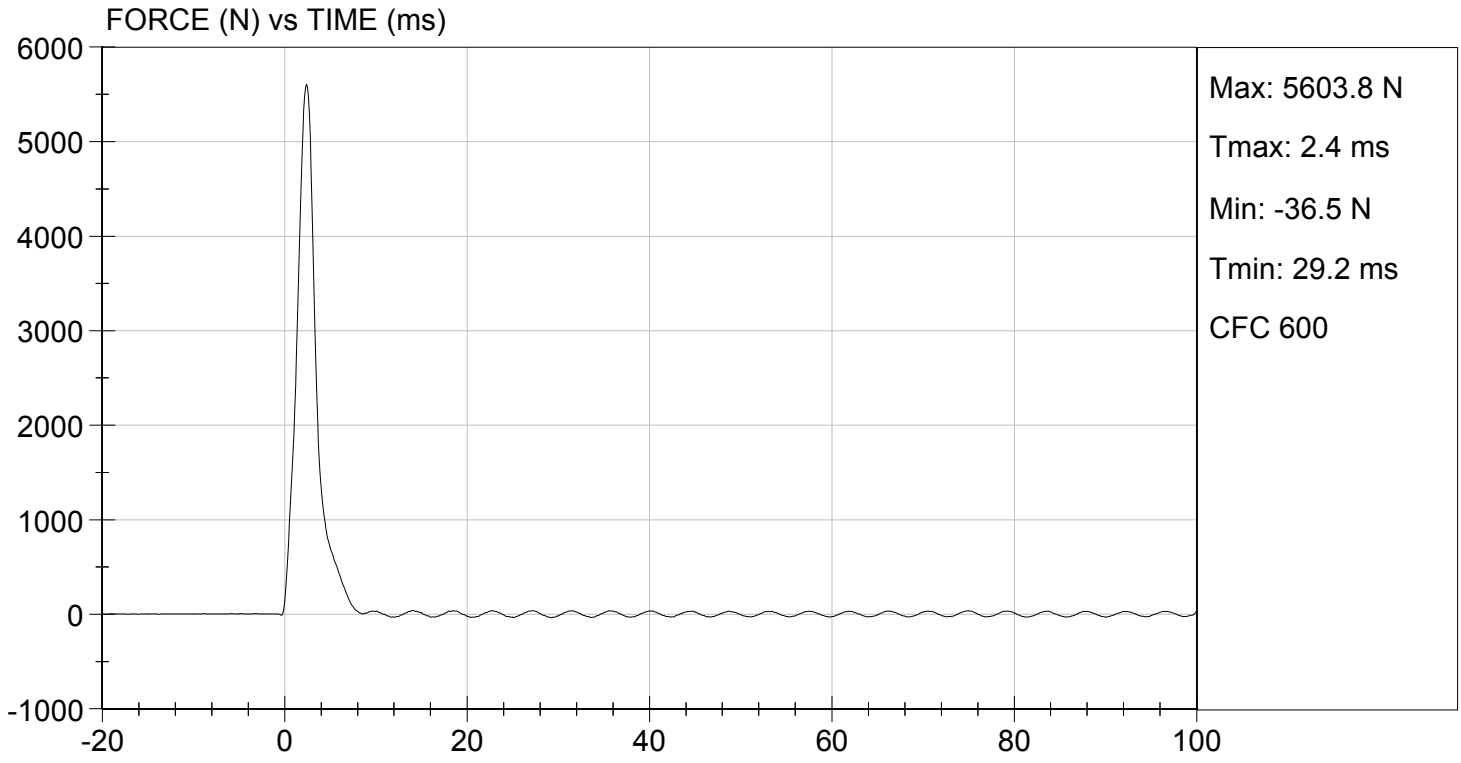
Jessica Gall
Laboratory Technician

12/18/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 12/18/2013
TEST #: D134336



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D134330

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	22	22	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	50.6	59.6	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	48.7	48.7	Pass
		Overall Test Results			Pass

Jessica Hall
Laboratory Technician

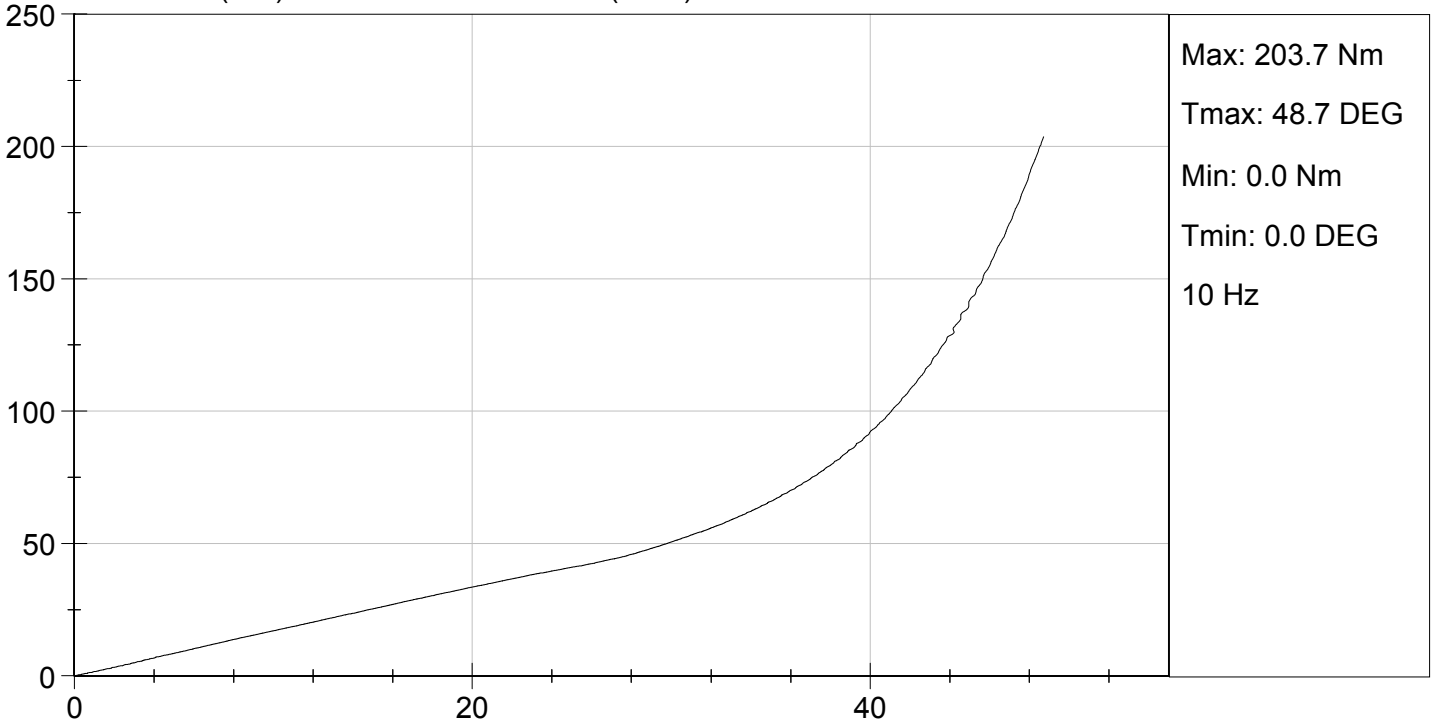
12/18/2013
Test Date

David Winkelbauer
Approved By

TEST DESC: RIGHT HIP FEMUR FLEXION

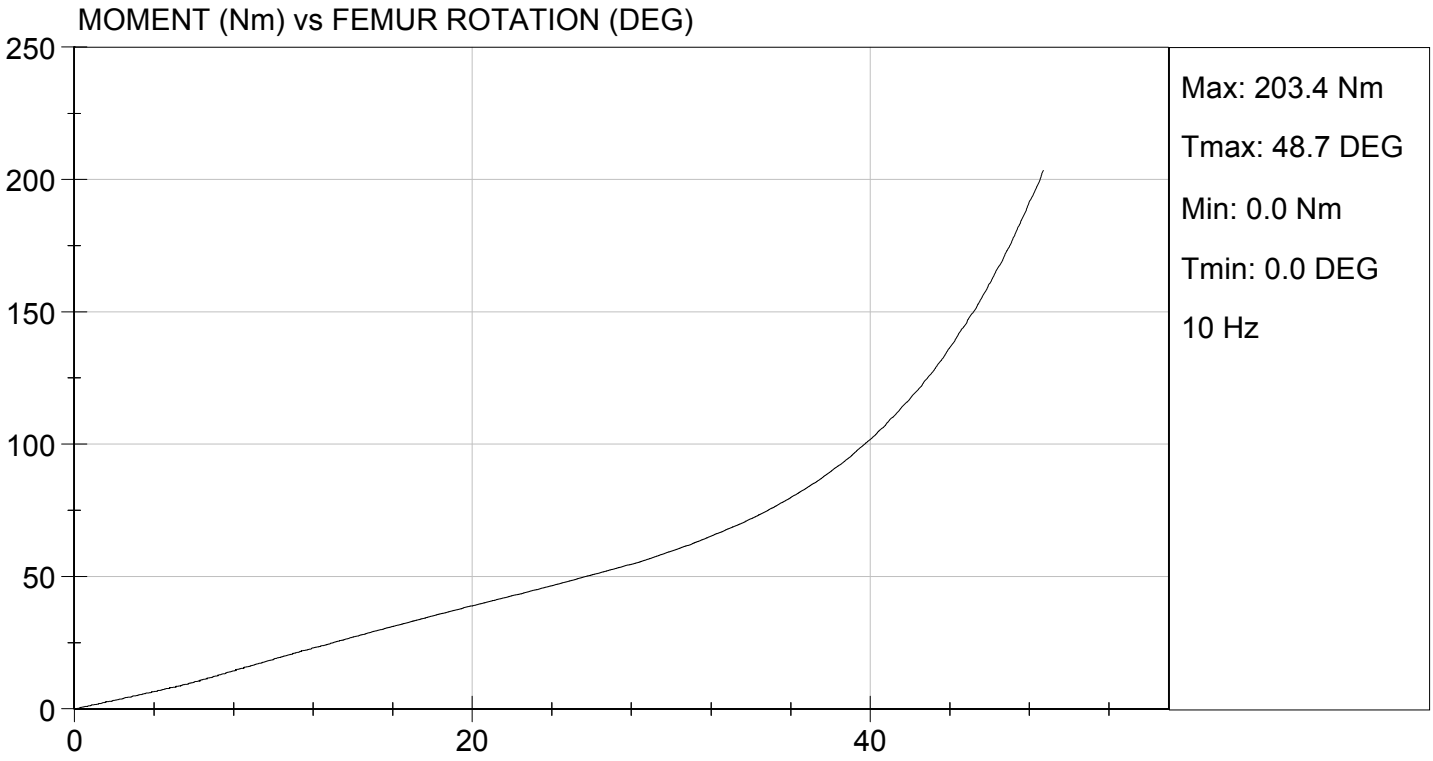
TEST DATE: 12/17/2013
TEST #: D134339

MOMENT (Nm) vs FEMUR ROTATION (DEG)



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 12/18/2013
TEST #: D134330



Hybrid III, 5th External Measurements
SN: 634

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	784.6
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	449.0
C	H-POINT HEIGHT	Reference	81.3-86.3	85.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	145.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	79.2
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	125.6
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	253.4
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	277.8
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	197.5
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	541.4
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.1
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	400.4
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	428.6

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	181.6
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	224.7
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	482.0
S	HEAD BREADTH	The widest part of the head	137.1-147.3	139.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	179.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	306.1
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	355.5
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	90.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. “T”	528.3-548.7	540.6
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	868.7
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	786.8
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: 634 **Test ID:** D134051

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Peak Resultant Acceleration	G's	250 to 300	268	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	7.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

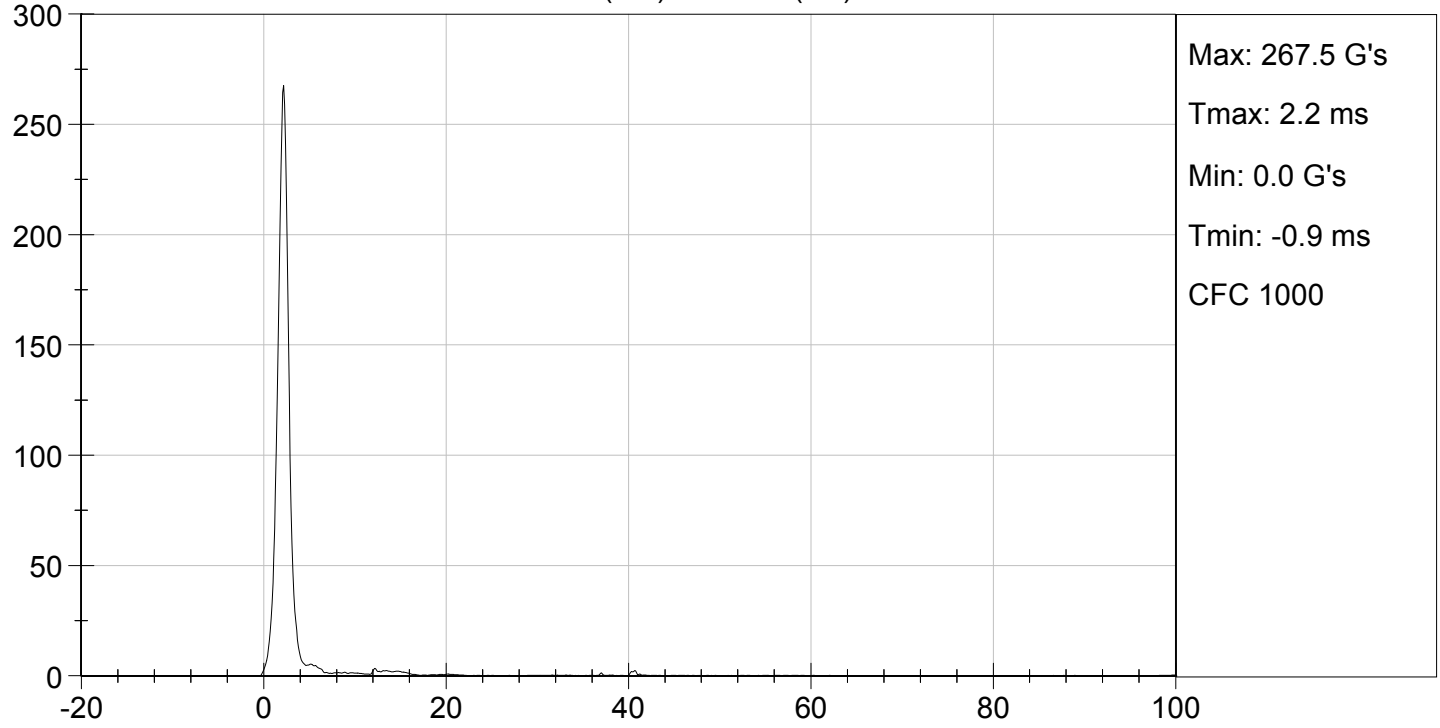
11/27/2013
Test Date

David Winkelbauer
Approved By

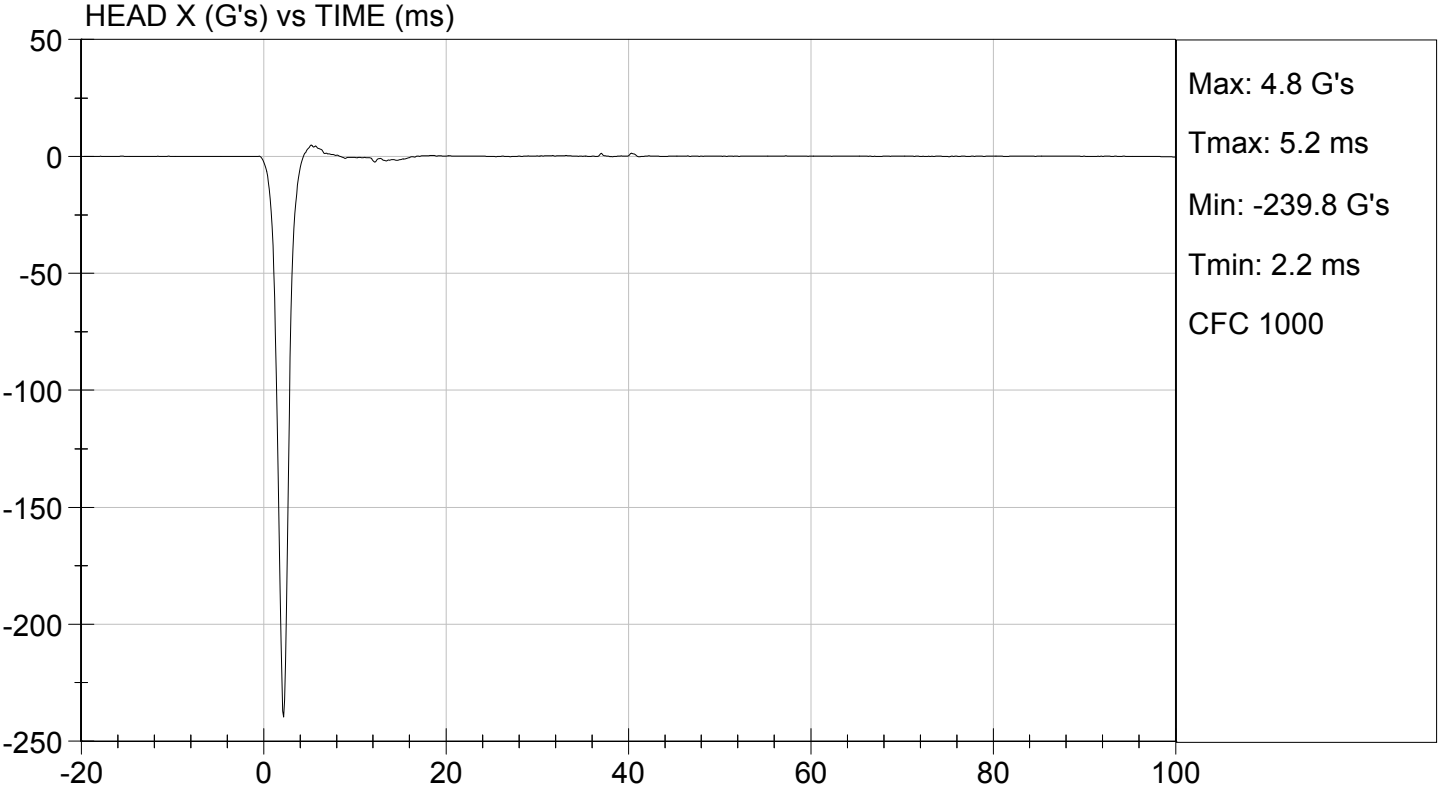
TEST DESC: HEAD DROP

TEST DATE: 11/27/2013
TEST #: D134051

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



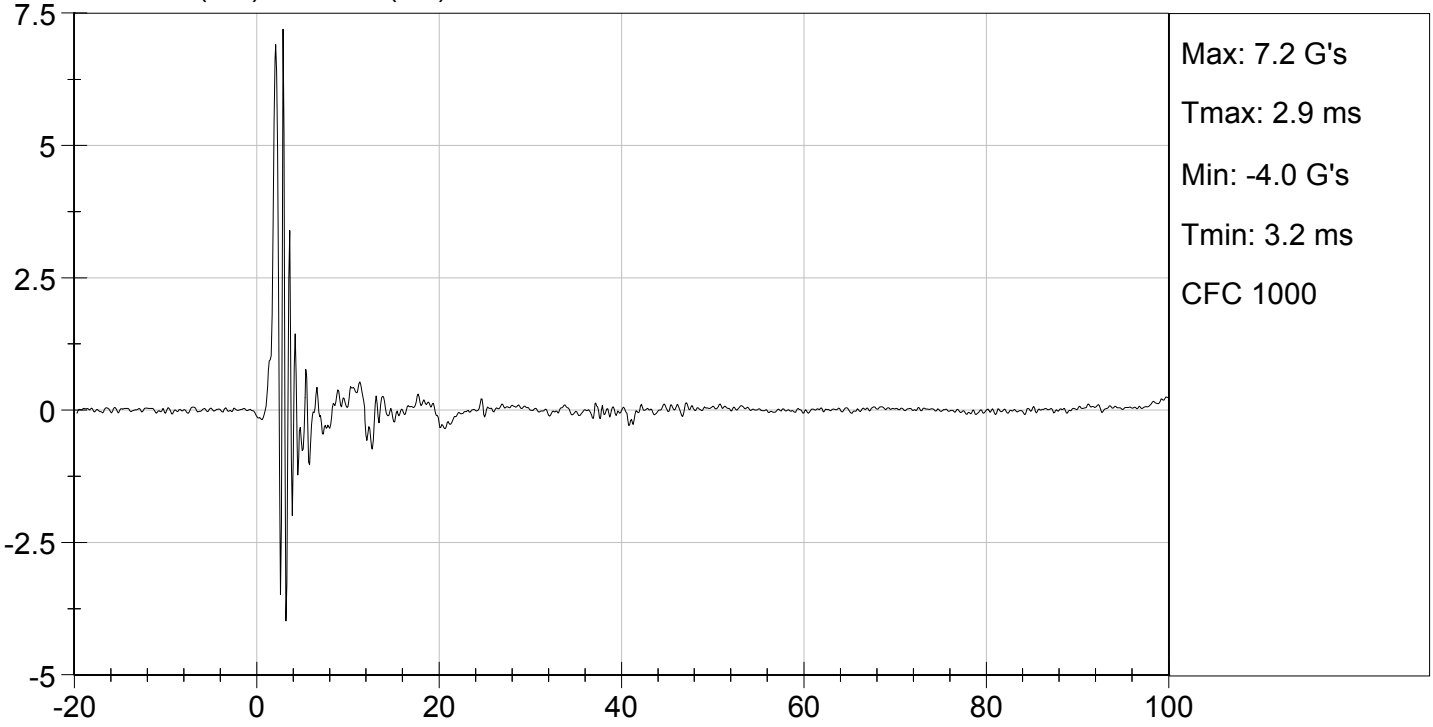
HEAD X (G's) vs TIME (ms)



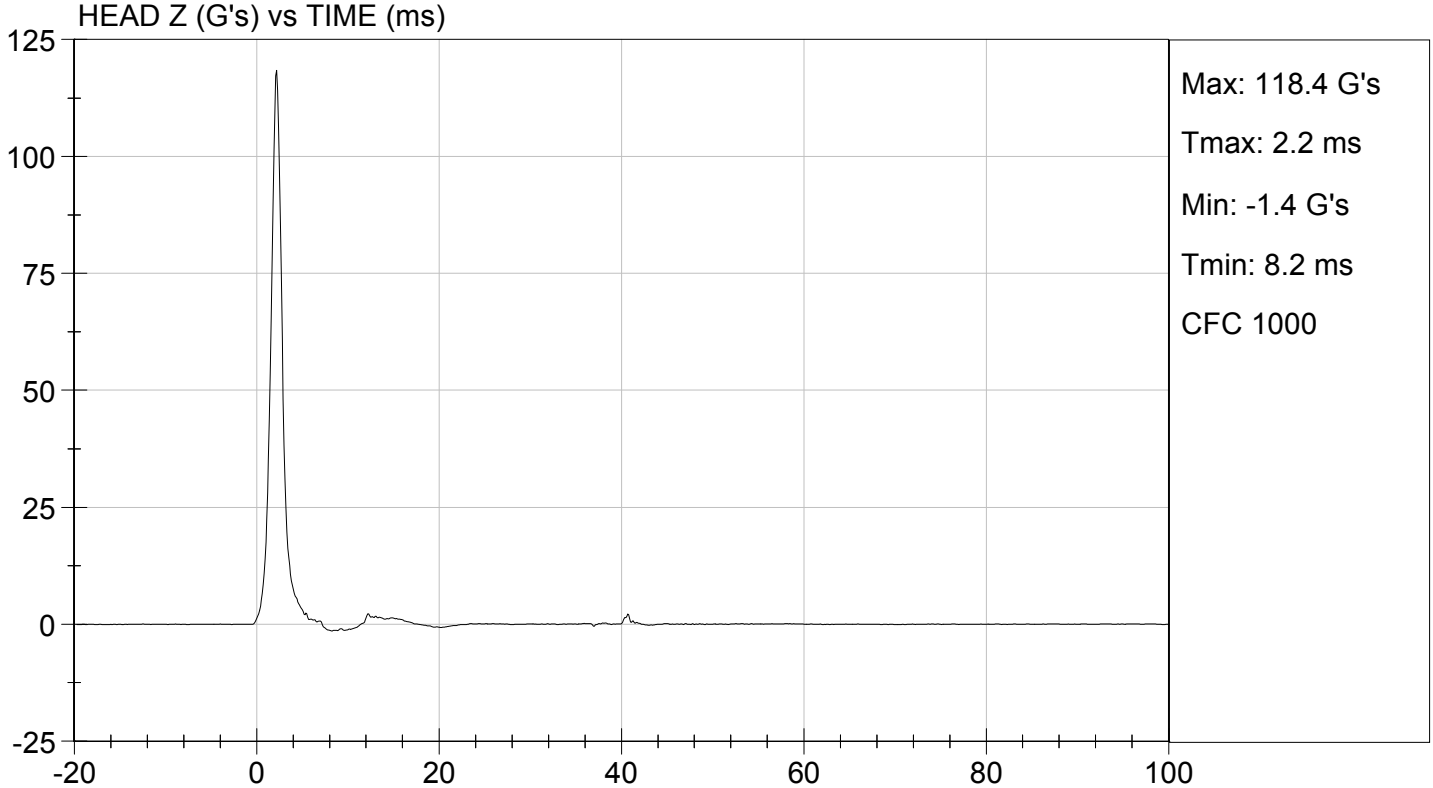
TEST DESC: HEAD DROP

TEST DATE: 11/27/2013
TEST #: D134051

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: 634 **Test I.D:** D134052

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	18	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	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.3	Pass
D Plane Rotation	Max	deg	77 to 91	85	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	86	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

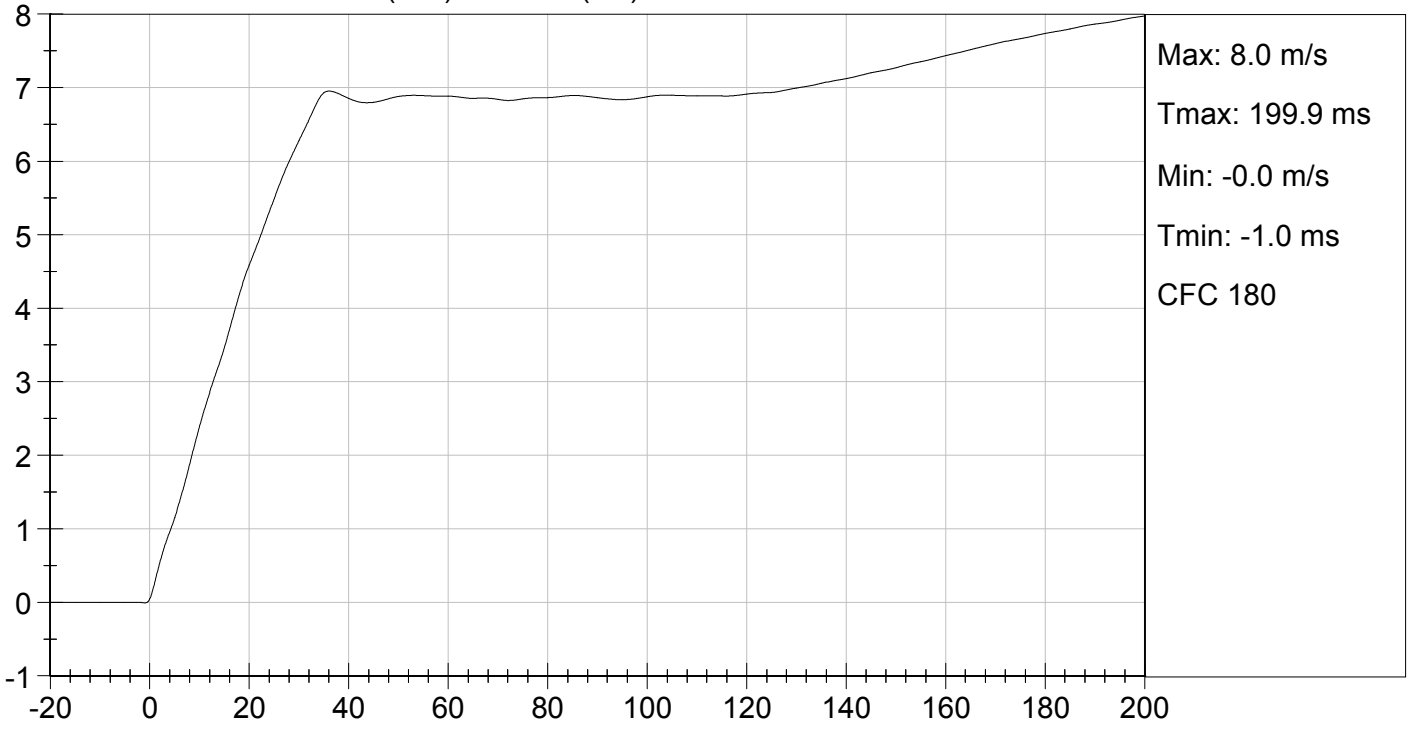
11/27/2013
Test Date

David Winkelbauer
Approved By

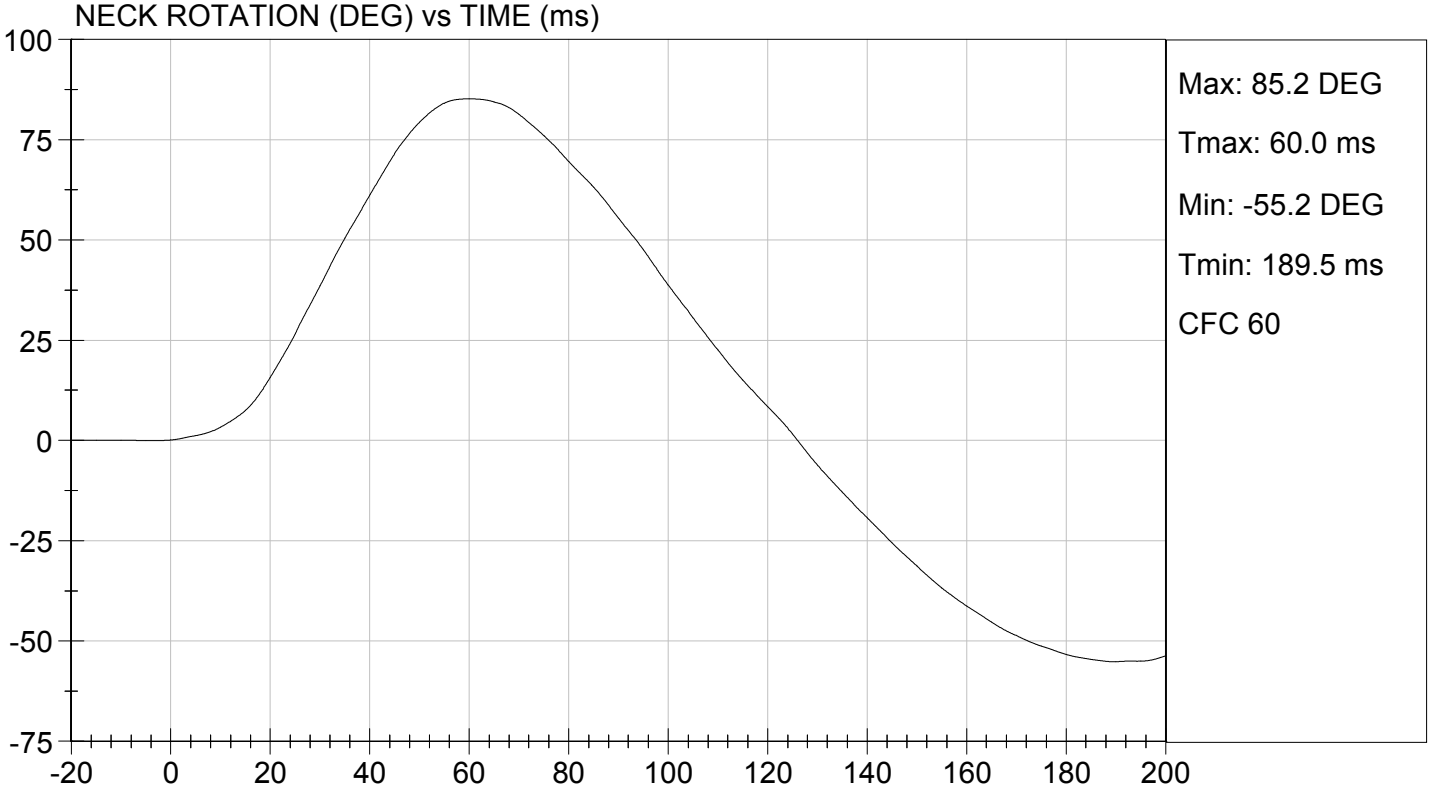
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 11/27/2013
TEST #: D134052

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

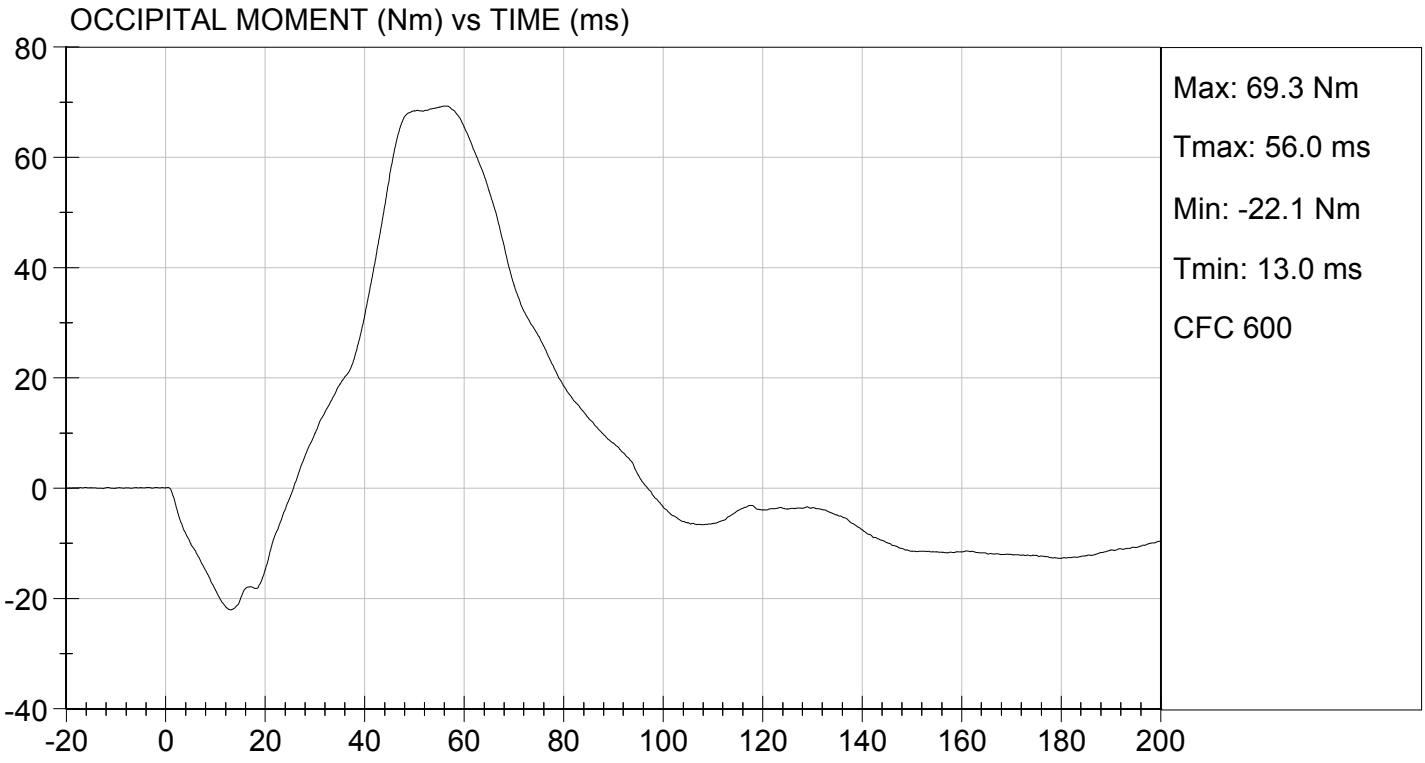


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/27/2013
TEST #: D134052



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134053

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	18	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	4.8	Pass
D Plane Rotation	Max	deg	99 to 114	100	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	98	Pass
			Overall Results		Pass

Jessica Gall
Laboratory Technician

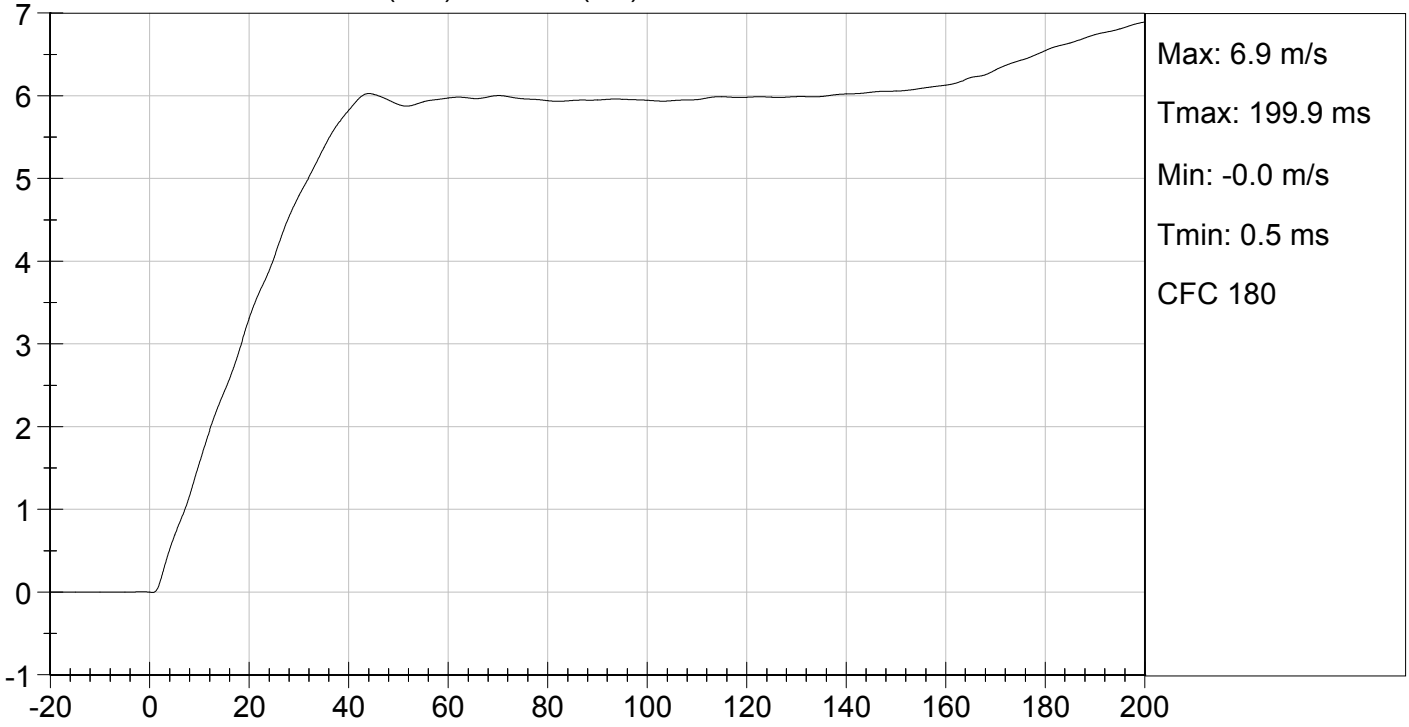
11/27/2013
Test Date

David Winkelbauer
Approved By

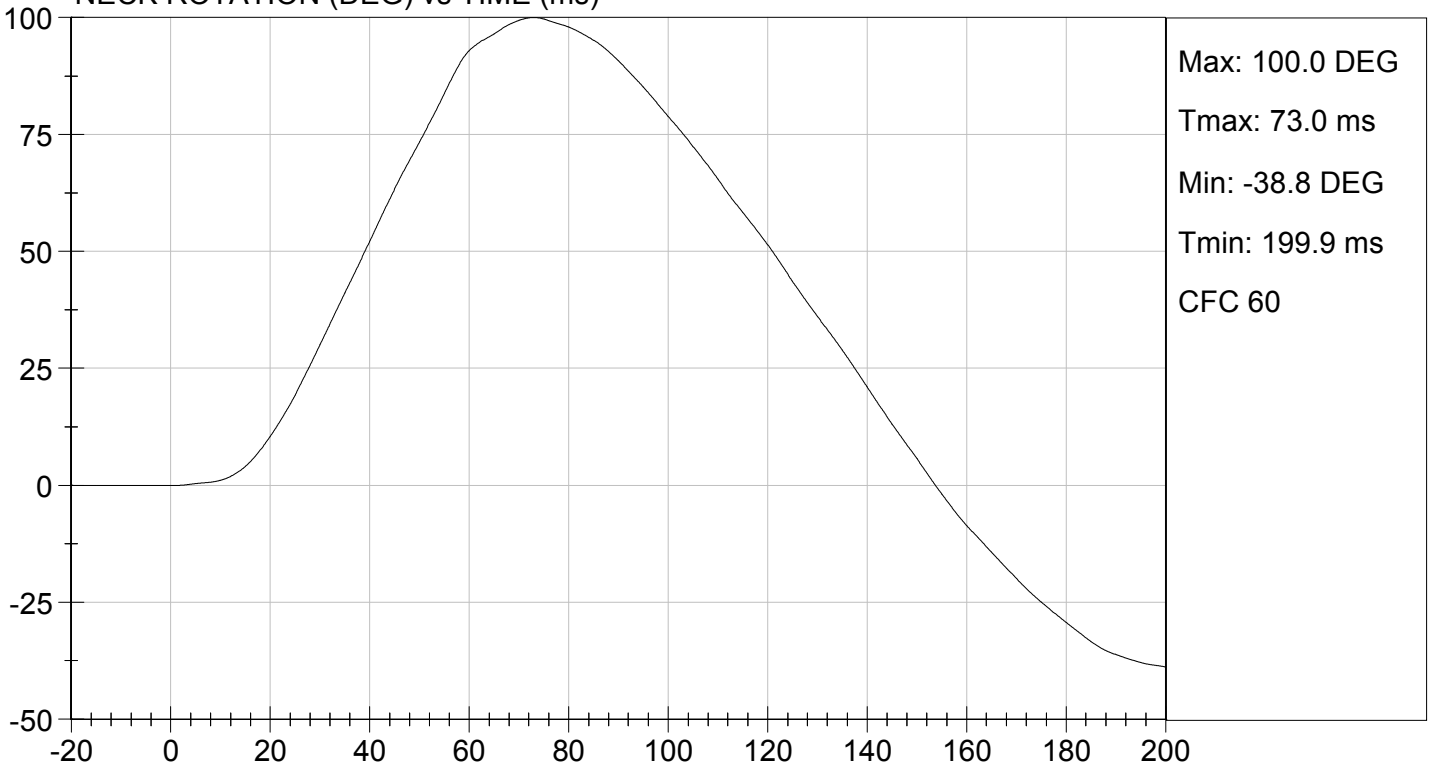
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 11/27/2013
TEST #: D134053

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

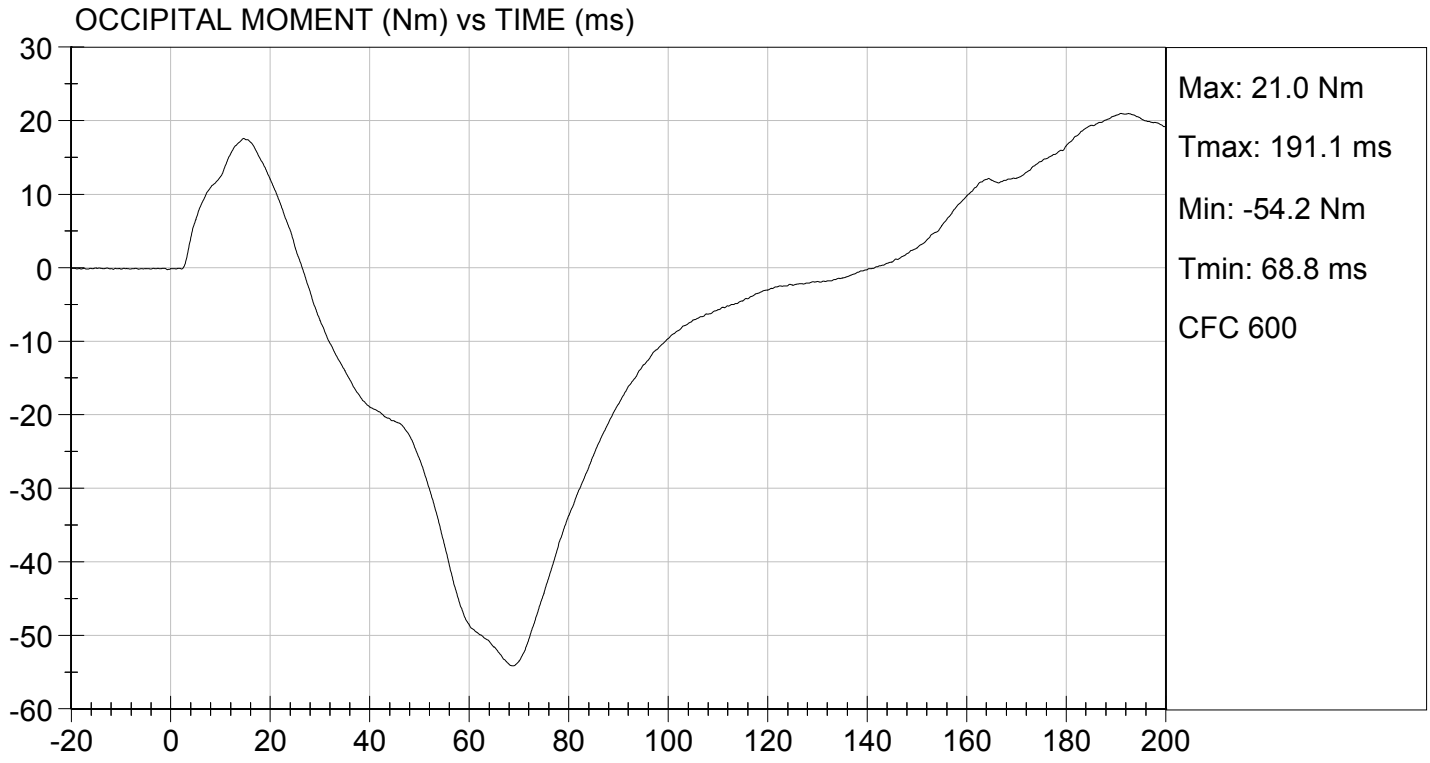


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/27/2013
TEST #: D134053



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134054

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Relative Humidity	%	10 to 70	18	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4309	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4313	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

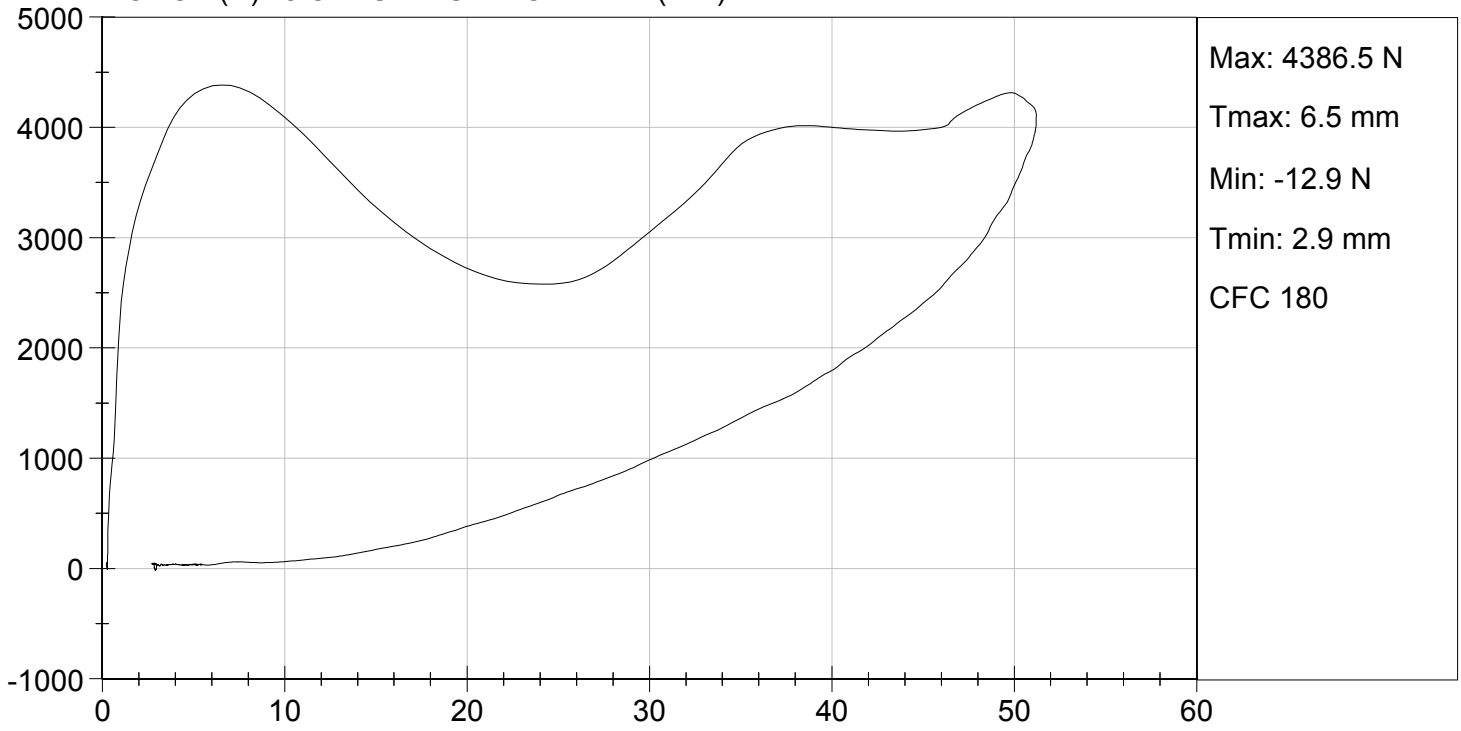
11/27/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 11/27/2013
TEST #: D134054

FORCE (N) vs CHEST DISPLACEMENT (mm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134055

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3855	Pass
		Overall Test Results		Pass

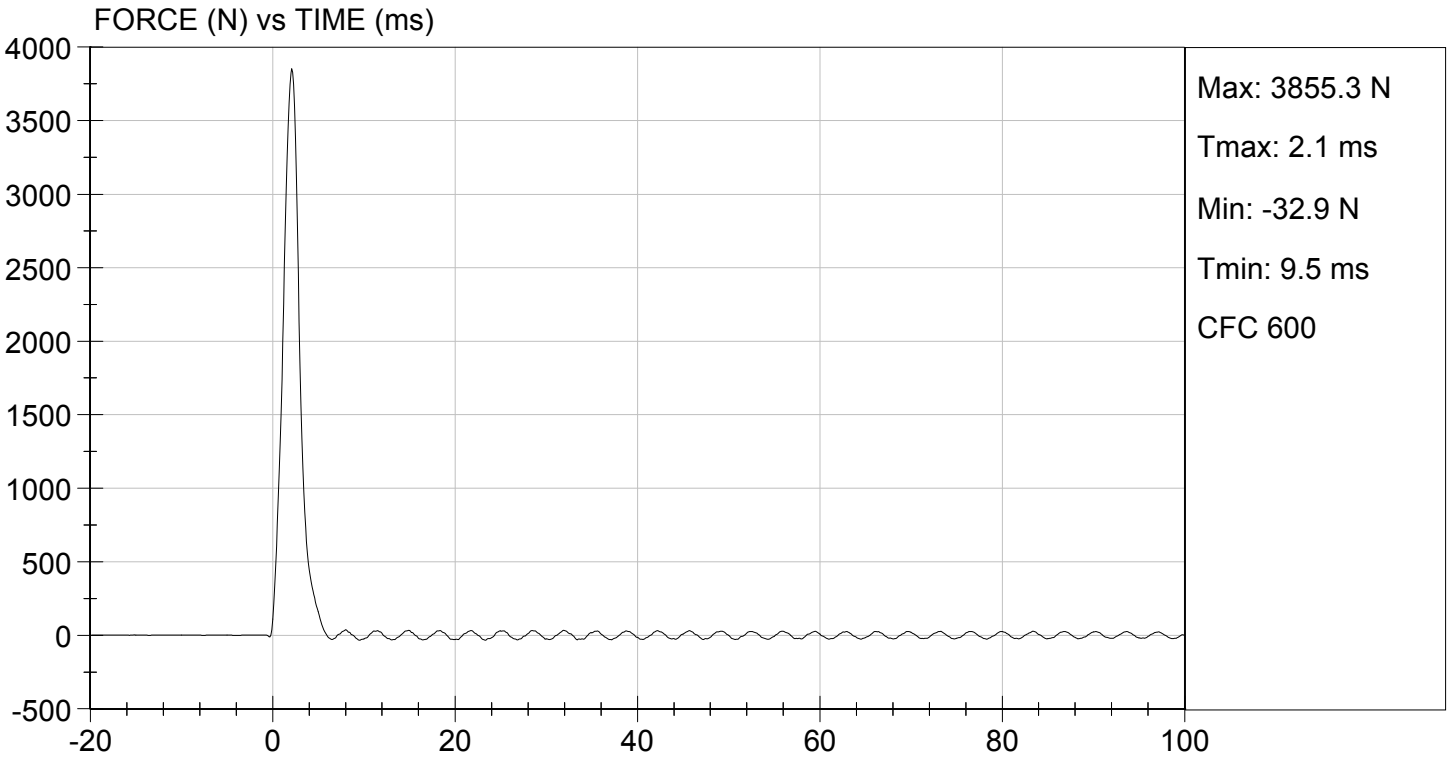
Jessica Gall
Laboratory Technician

11/27/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 11/27/2013
TEST #: D134055



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134056

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3659	Pass
		Overall Test Results		Pass

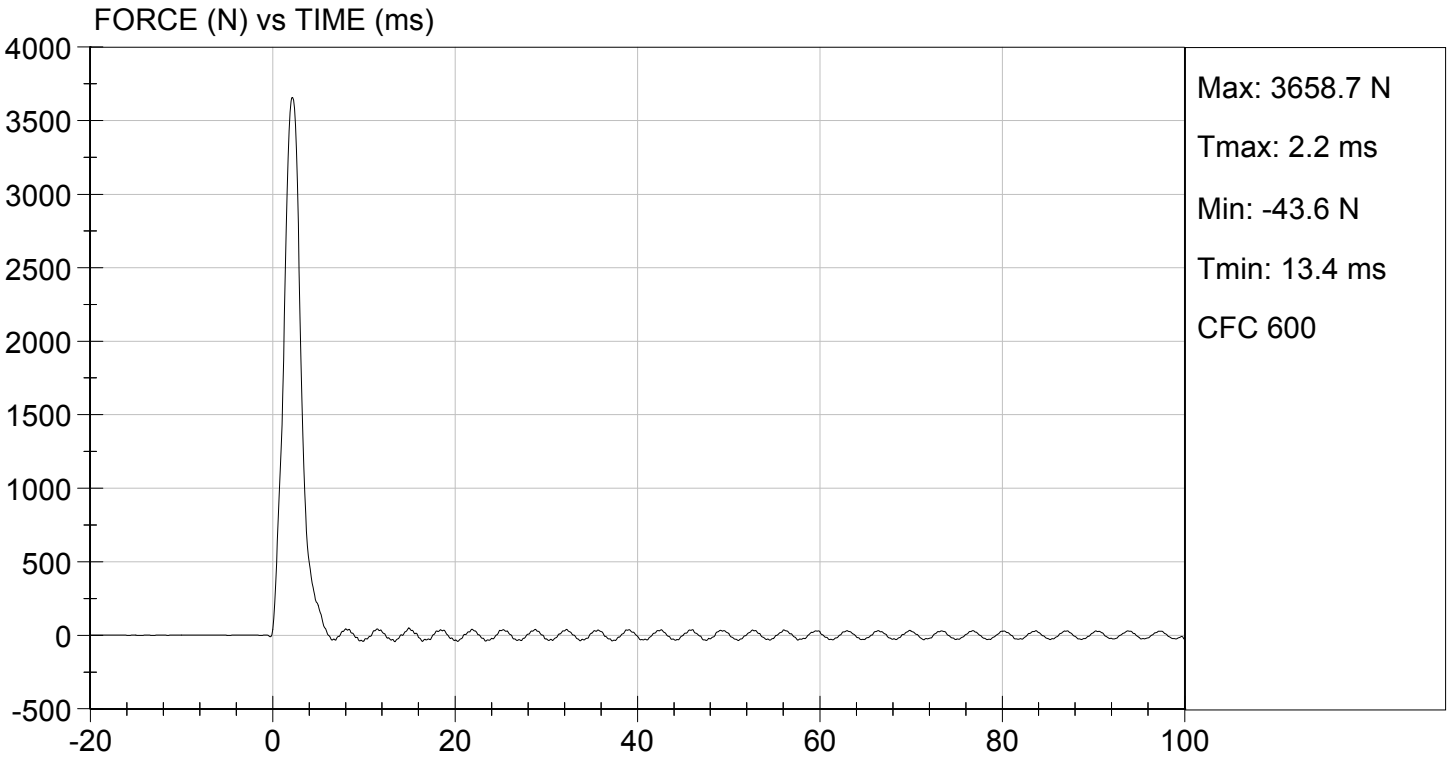
Jessica Hall
Laboratory Technician

11/27/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 11/27/2013
TEST #: D134056



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134057

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	358	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
		Overall Result		Pass

Jessica Gall
Laboratory Technician

11/27/2013
Test Date

David Winkelbauer
Approved By

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test ID:** D134341

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Peak Resultant Acceleration	G's	250 to 300	268	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-8.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

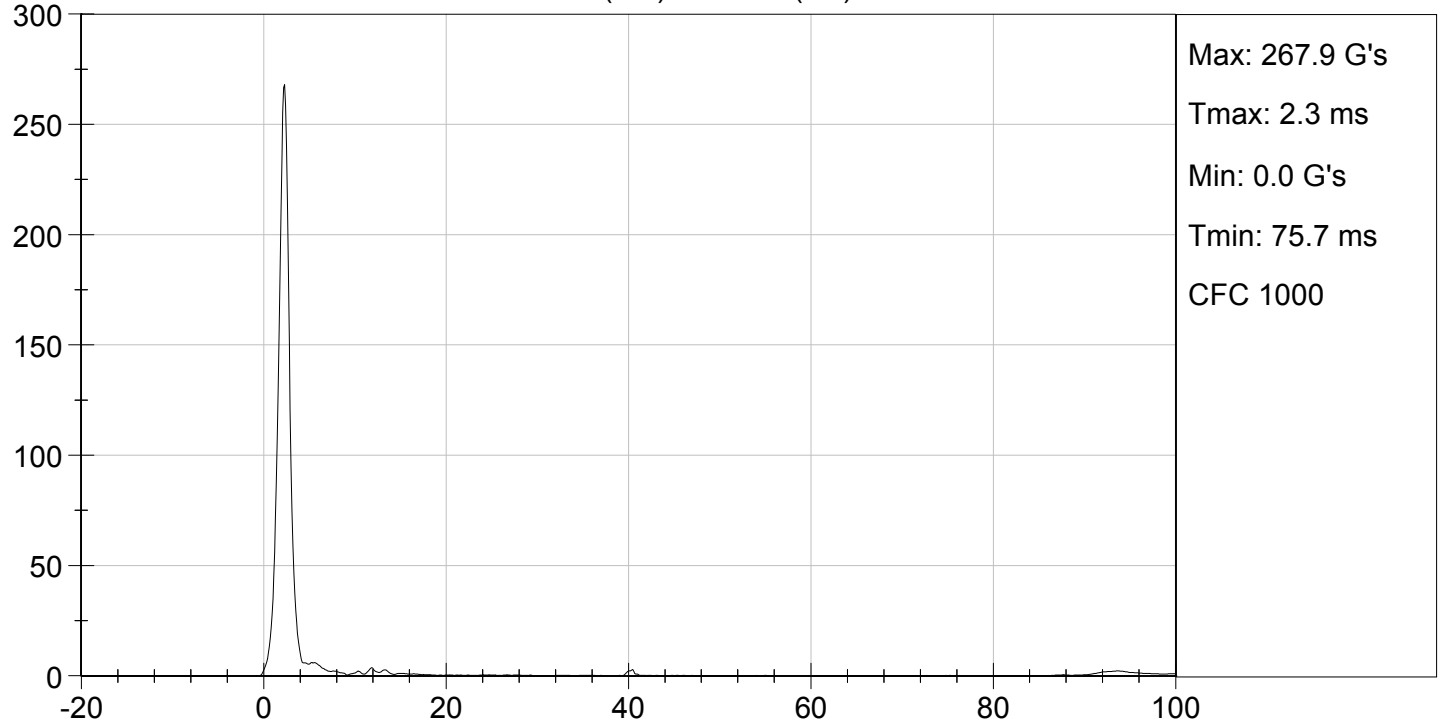
12/18/2013
Test Date

David Winkelbauer
Approved By

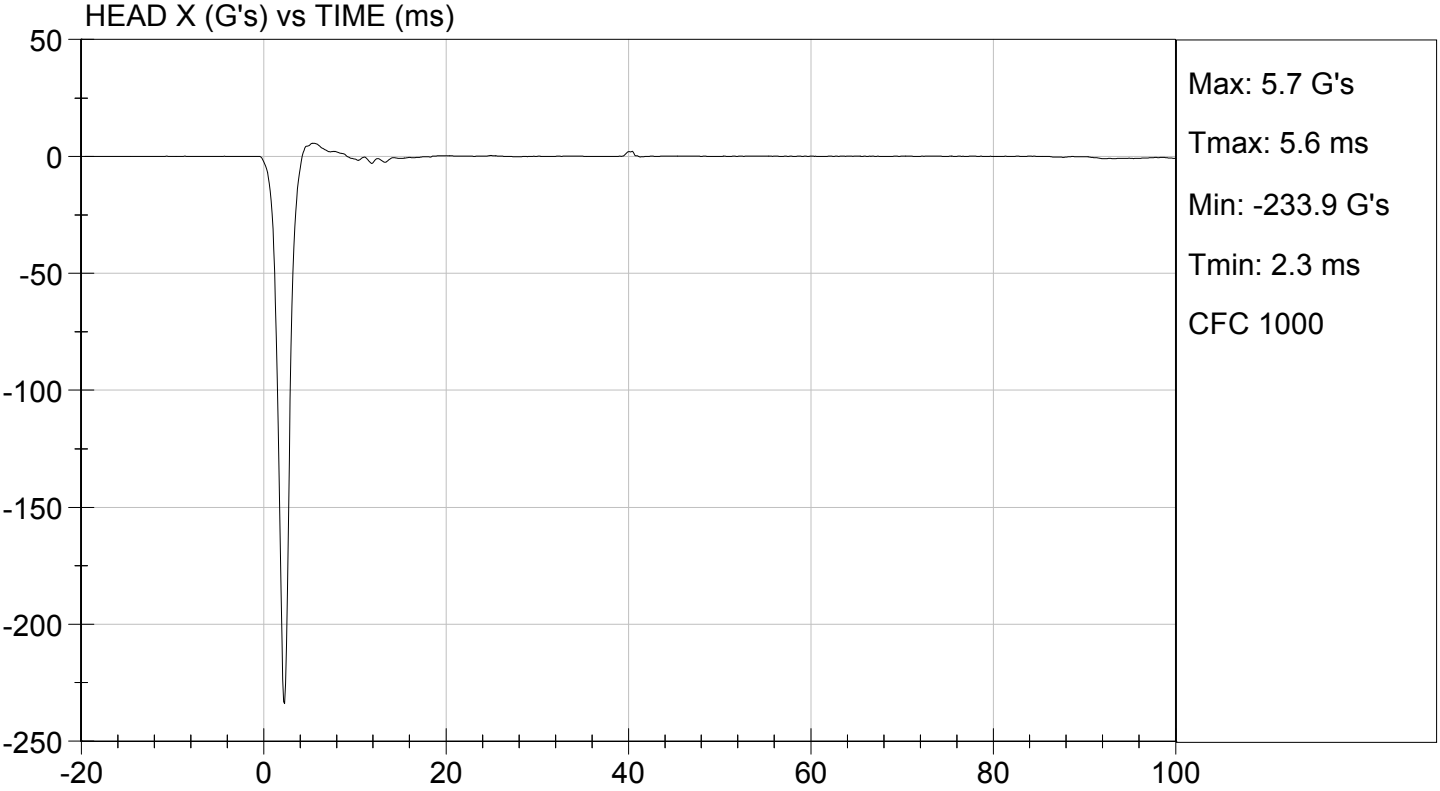
TEST DESC: HEAD DROP

TEST DATE: 12/18/2013
TEST #: D134341

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

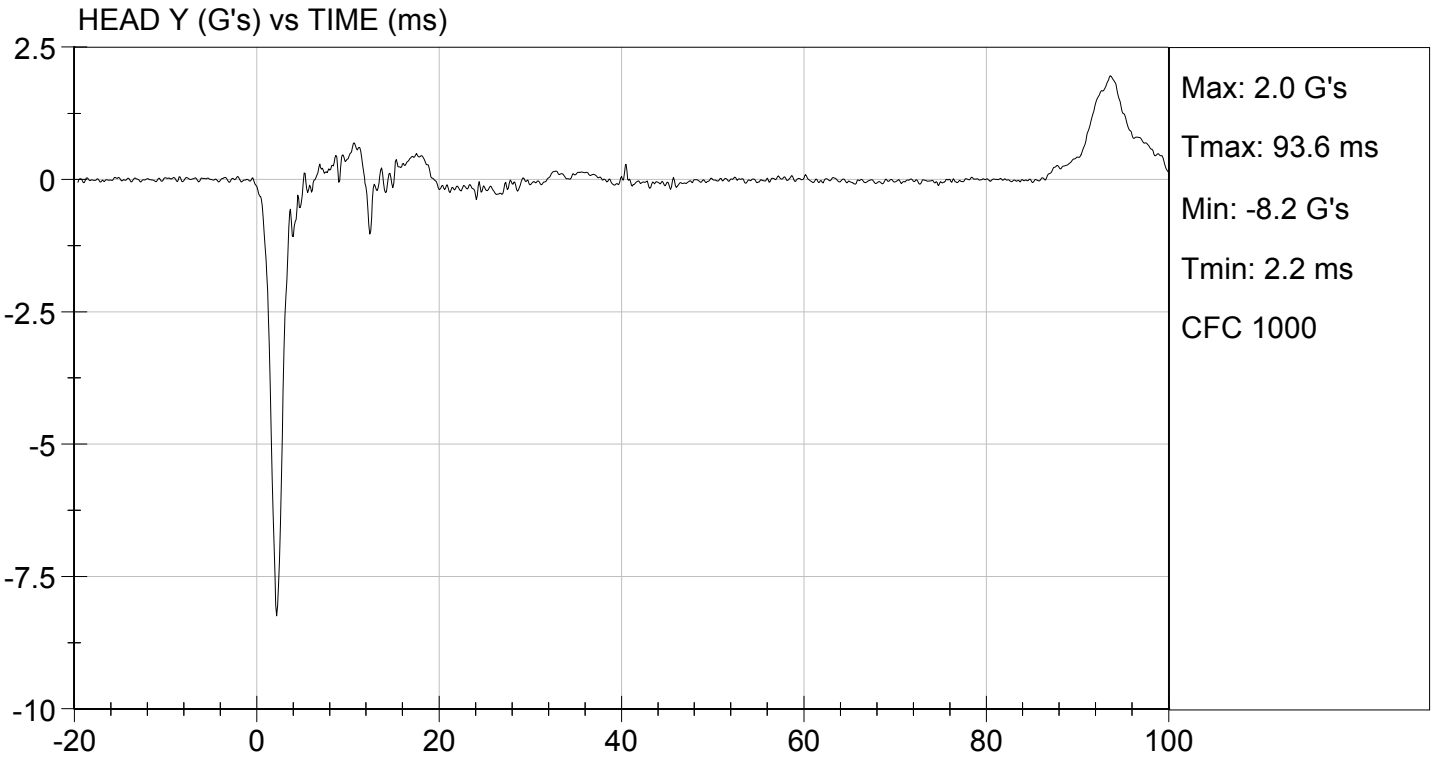


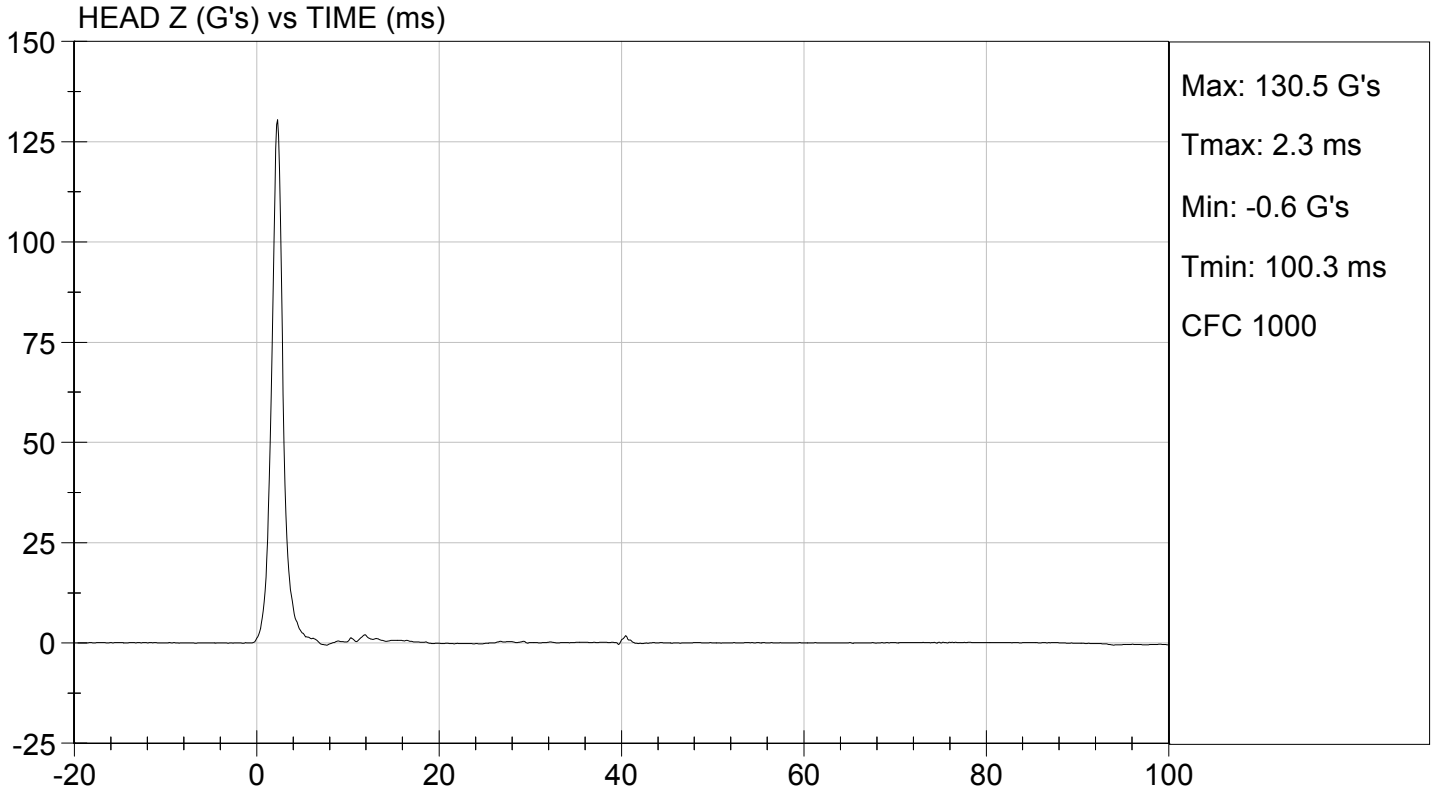
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 12/18/2013
TEST #: D134341





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134342

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	18	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.13	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.5	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.5	Pass
D Plane Rotation	Max	deg	77 to 91	89	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	73	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	86	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

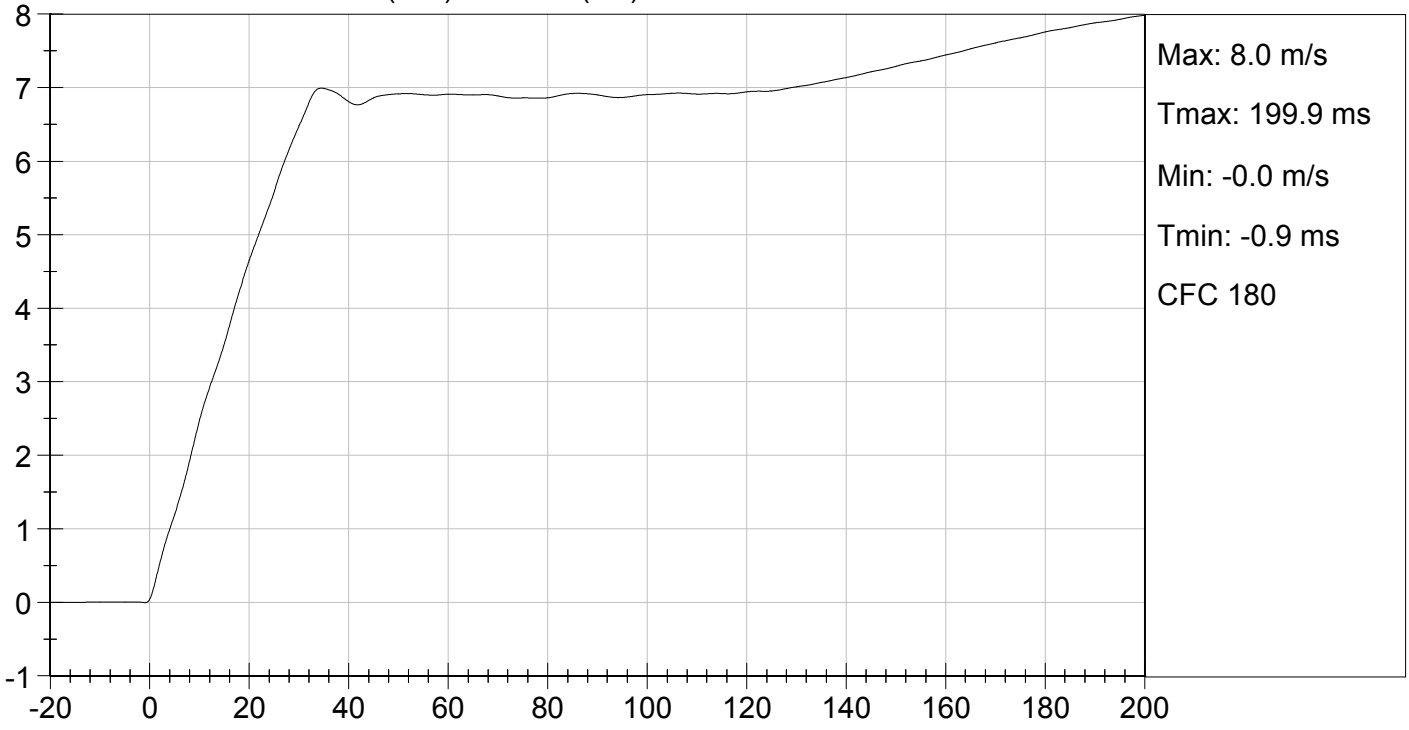
12/18/2013
Test Date

David Winkelbauer
Approved By

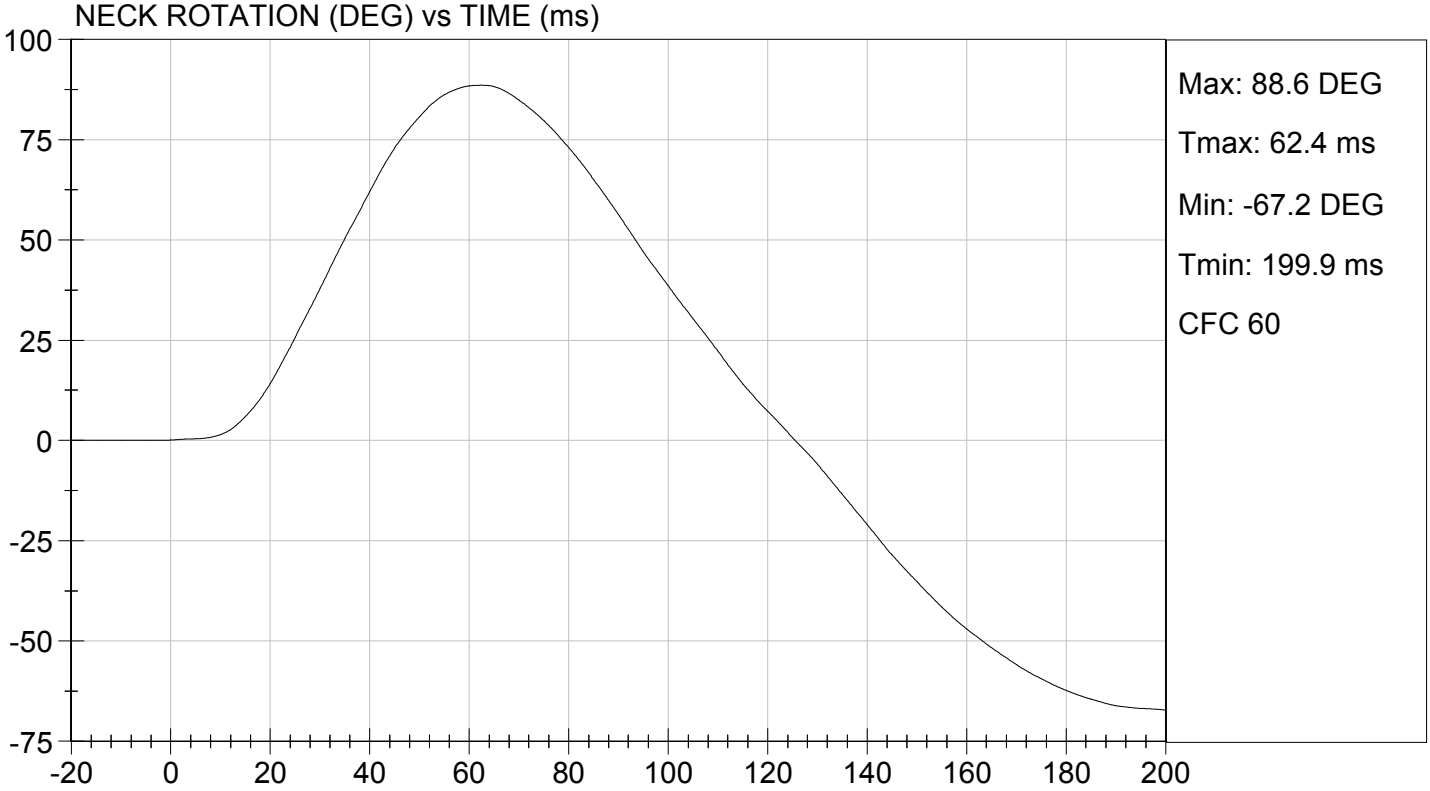
TEST DESC: NECK FLEXION
VELOCITY: 23.40 ft/s, 7.13 m/s

TEST DATE: 12/18/2013
TEST #: D134342

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

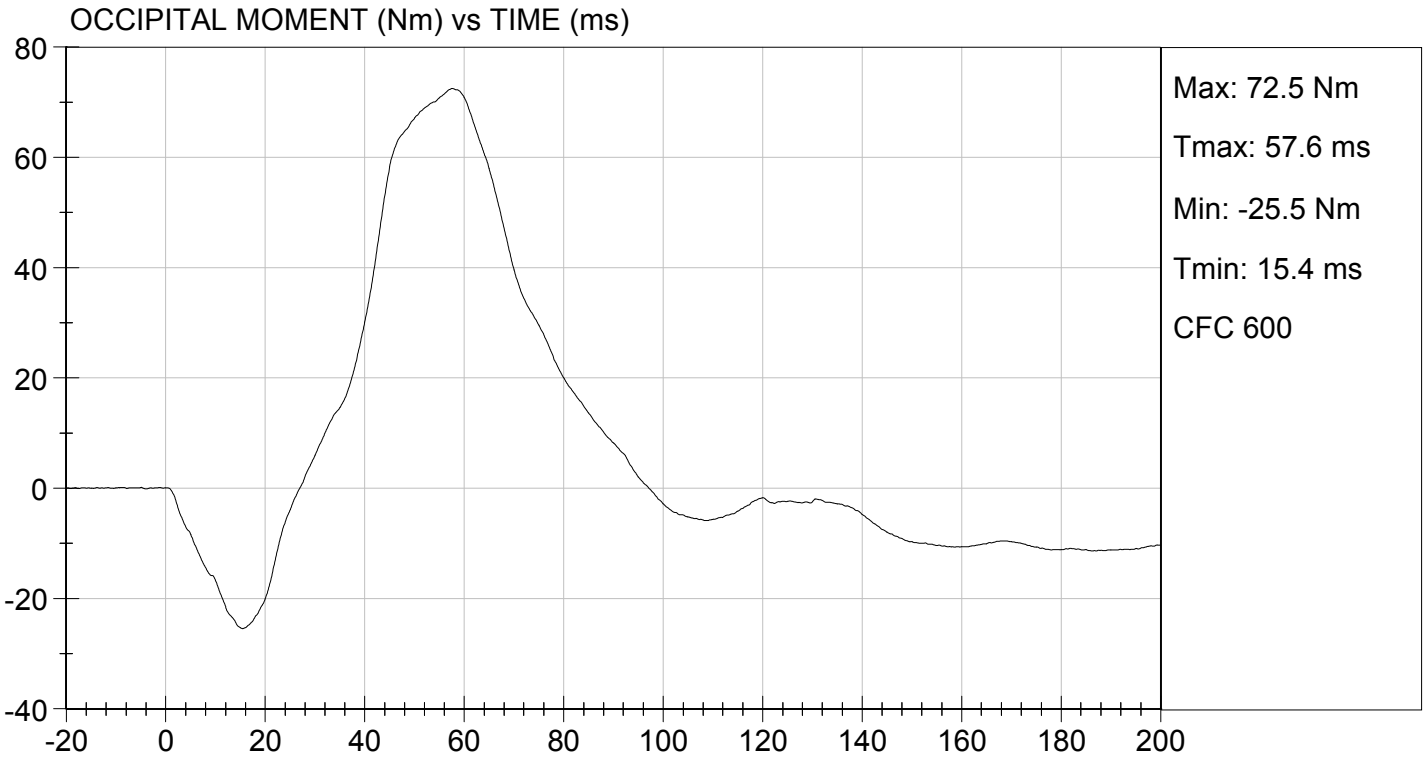


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/18/2013
TEST #: D134342



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134343

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	18	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.19	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	110	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-57	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	96	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

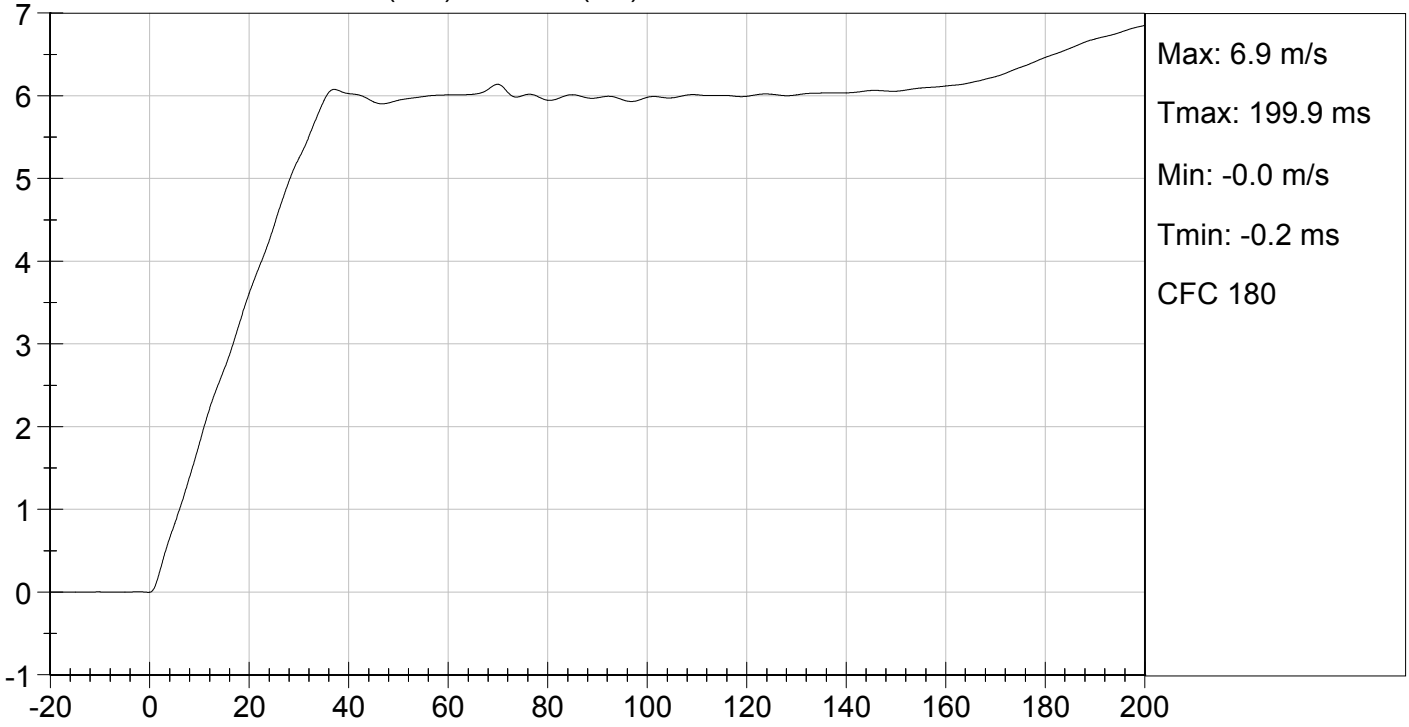
12/18/2013
Test Date

David Winkelbauer
Approved By

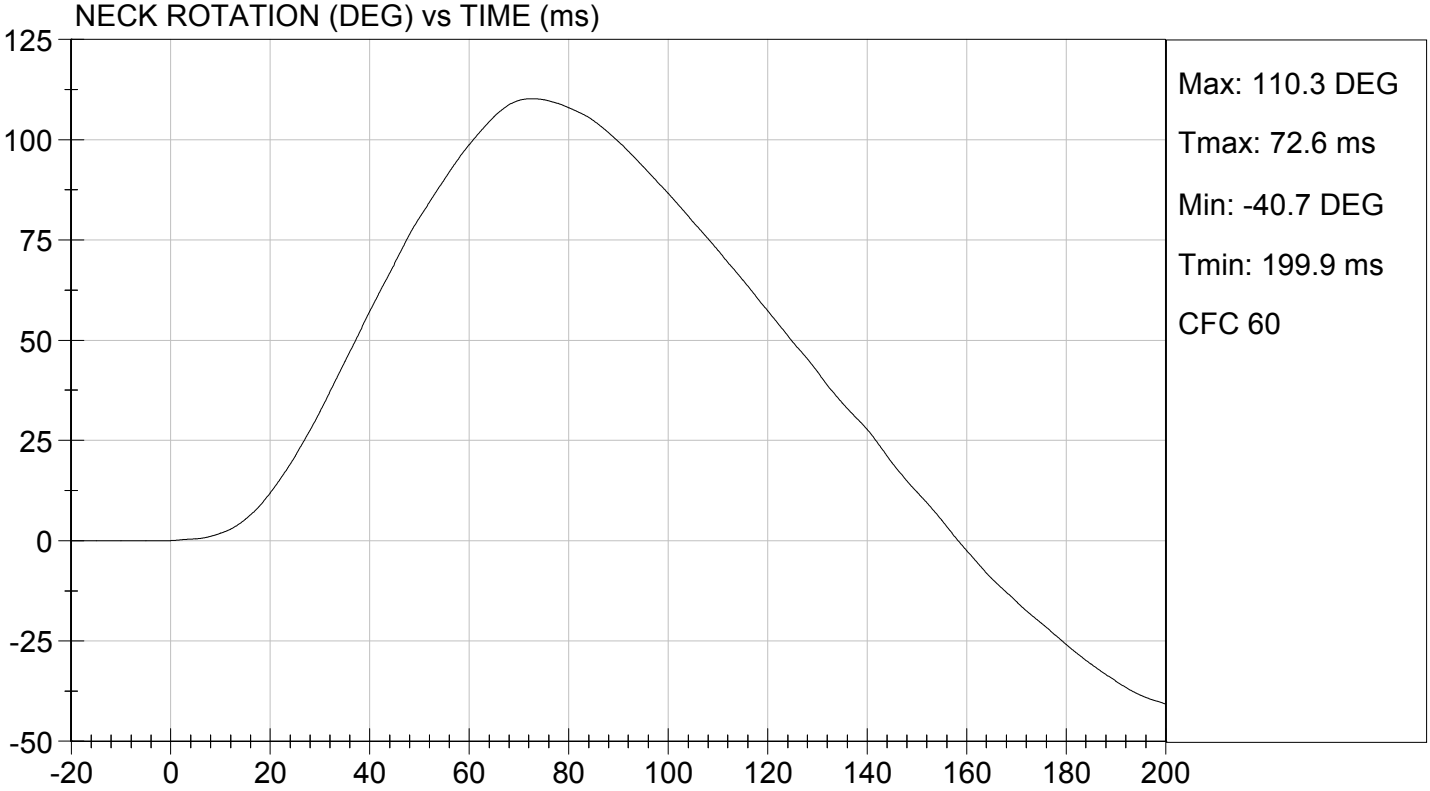
TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 12/18/2013
TEST #: D134343

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

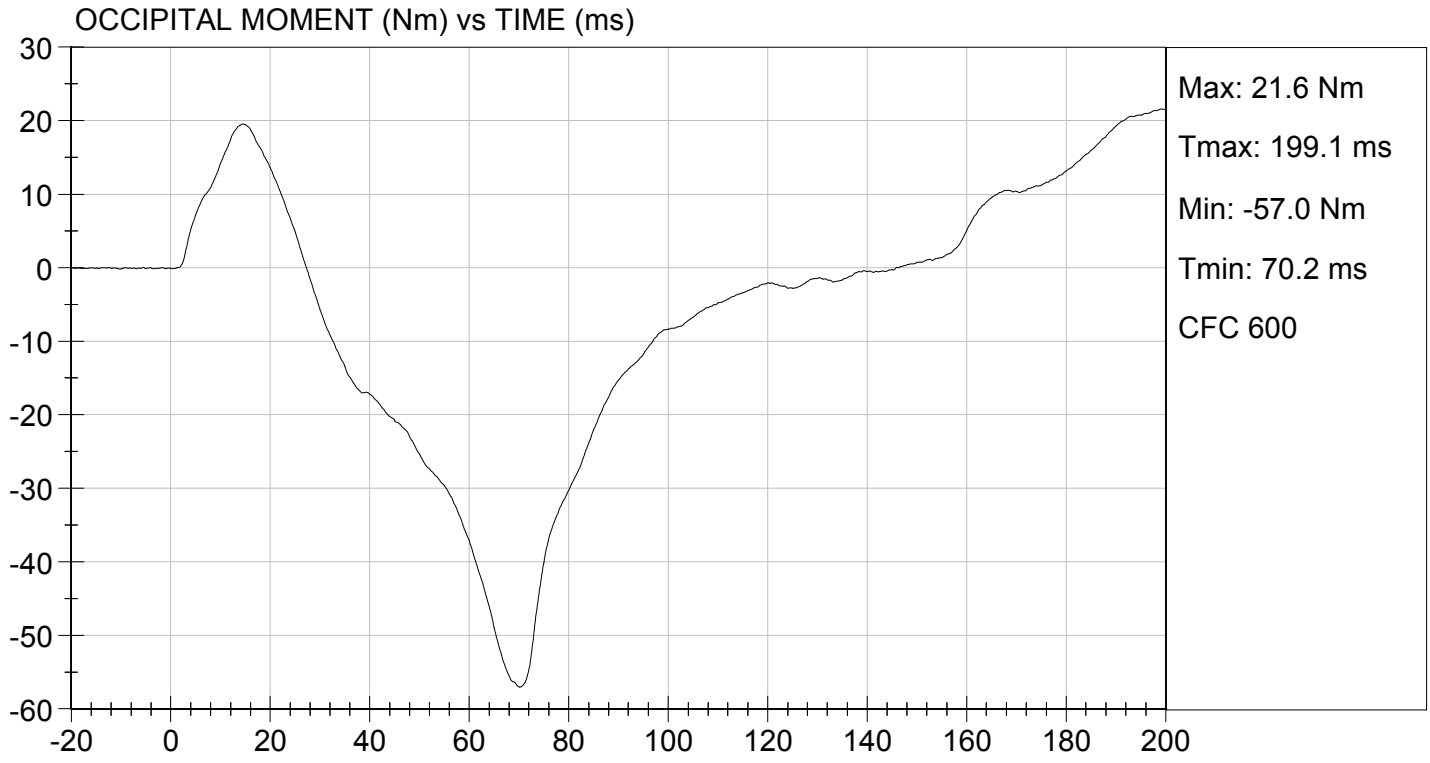


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/18/2013
TEST #: D134343



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134344

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	17	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	50	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4192	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4476	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

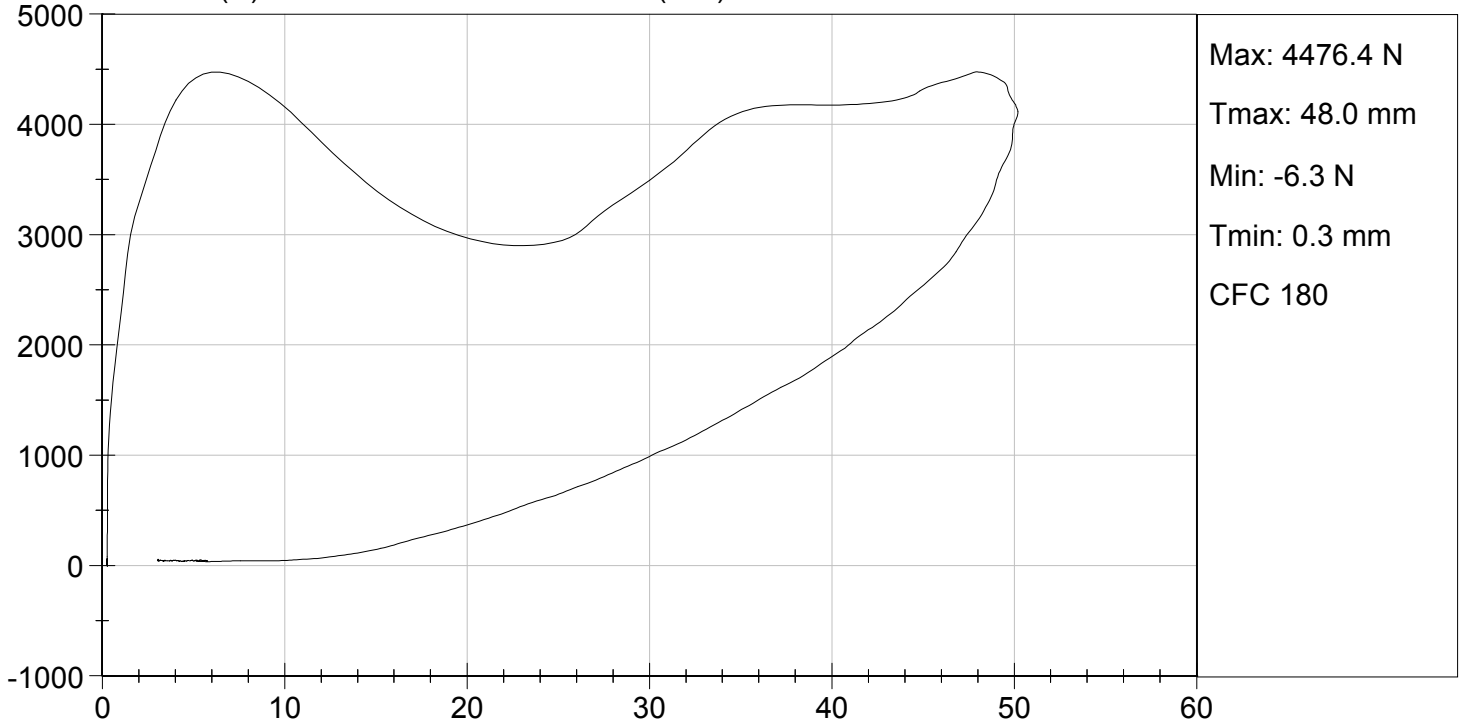
12/18/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 12/18/2013
TEST #: D134344

FORCE (N) vs CHEST DISPLACEMENT (mm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134345

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	18	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3792	Pass
		Overall Test Results		Pass

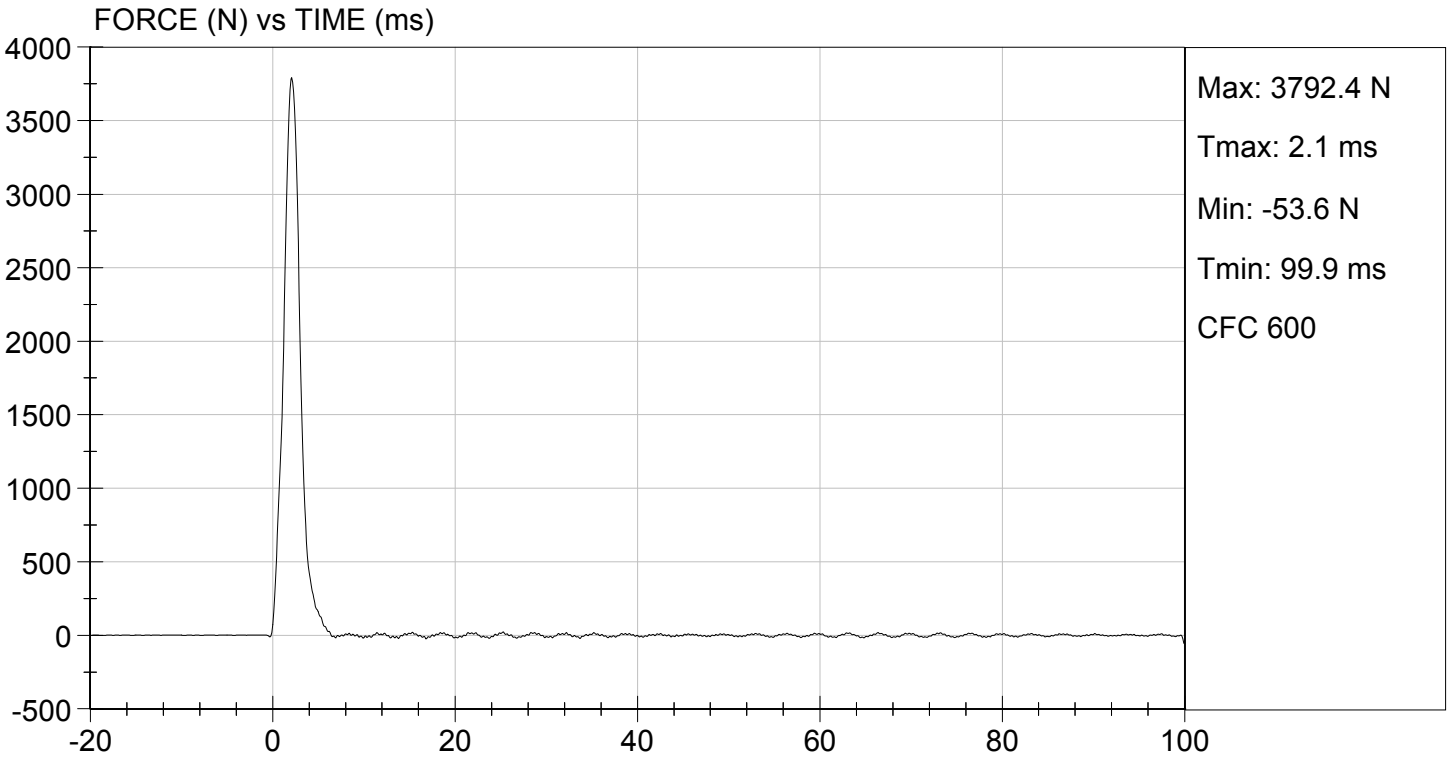
Jessica Hall
Laboratory Technician

12/18/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 12/18/2013
TEST #: D134345



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134346

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	18	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3516	Pass
		Overall Test Results		Pass

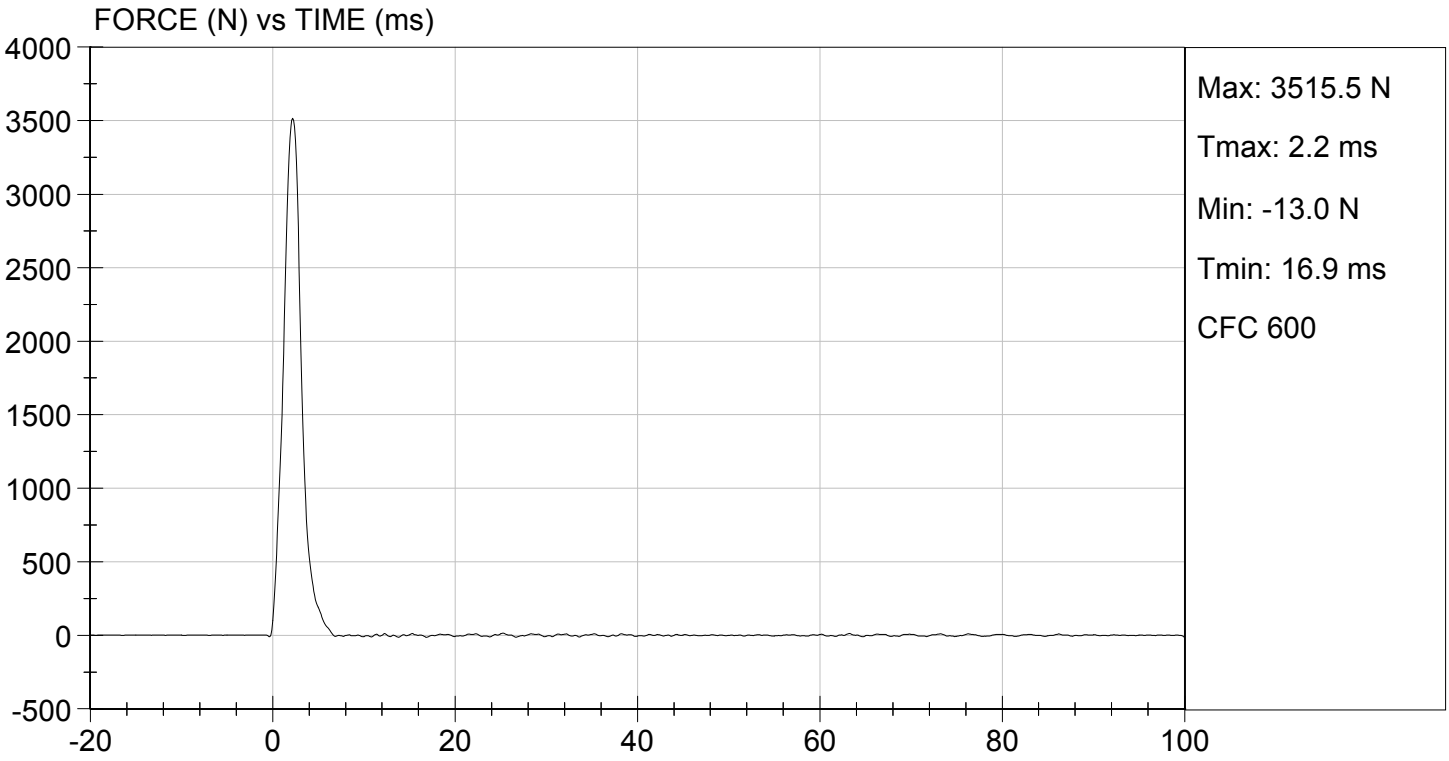
Jessica Hall
Laboratory Technician

12/18/2013
Test Date

David Winkelbauer
Approved By

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

TEST DATE: 12/18/2013
TEST #: D134346



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D134347

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	6	Pass
Force at 45 deg	N	320 to 390	355	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
		Overall Result		Pass

Jessica Gall
Laboratory Technician

12/18/2013
Test Date

David Winkelbauer
Approved By