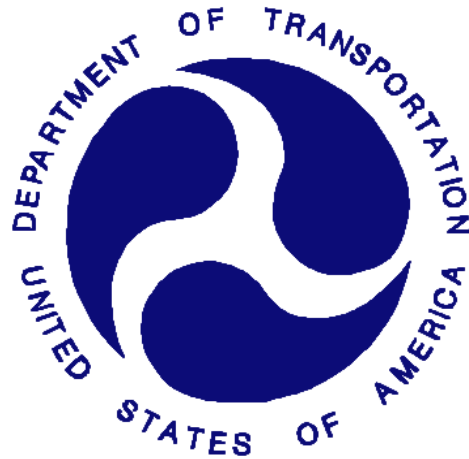


REPORT NUMBER: NCAP-MGA-2016-003

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

**KIA MOTORS MANUFACTURING GEORGIA, INC.
2016 Kia Sorento LX AWD 5-Dr SUV
NHTSA No.: O20164200**

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



Test Date: March 23, 2015

Final Report Date: May 1, 2015

FINAL REPORT

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

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Prepared by: Nicholas Abels
Nicholas Abels, Project Engineer

Approved by: Ben Fischer
Ben Fischer, Project Engineer

Approval Date: May 1, 2015

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

Technical Report Documentation Page

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15. Supplementary Notes																																																							
16. Abstract A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2016 Kia Sorento LX AWD 5-Dr SUV in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), and 301 performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on March 23, 2015. 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 21.4°C. The target vehicle post-test maximum crush was 436 located at the left of the vehicle's centerline. The test vehicle's performance was as follows: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">Driver ATD</th> <th colspan="2">Passenger ATD</th> </tr> <tr> <th>Threshold</th> <th>Result</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td> <td>N/A</td> <td>700</td> <td>235</td> <td>700</td> <td>245</td> </tr> <tr> <td>Maximum Chest</td> <td>mm</td> <td>63</td> <td>23</td> <td>52</td> <td>9</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>0.25</td> <td>1</td> <td>0.43</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>930</td> <td>2620</td> <td>798</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>360</td> <td>2520</td> <td>552</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>122</td> <td>6805</td> <td>1008</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>1470</td> <td>6805</td> <td>1124</td> </tr> </tbody> </table>				Measurement Description	Units	Driver ATD		Passenger ATD		Threshold	Result	Threshold	Result	Head Injury Criteria (HIC ₁₅)	N/A	700	235	700	245	Maximum Chest	mm	63	23	52	9	Nij	N/A	1	0.25	1	0.43	Neck Tension	N	4170	930	2620	798	Neck Compression	N	4000	360	2520	552	Left Femur Force	N	10008	122	6805	1008	Right Femur Force	N	10008	1470	6805	1124
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TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	Purpose and Summary of Test	1
2	Occupant and Vehicle Information / Data Sheets	3

<u>Data Sheet No.</u>		<u>Page No.</u>
1	General Test and Vehicle Parameter Data	4
2	Seat Adjustment, Fuel System, and Steering Wheel Data	8
3	Dummy Longitudinal Clearance Dimensions	10
4	Dummy Lateral Clearance Dimensions	11
5	Seat Belt Positioning Data	12
6	High-Speed Camera Locations and Data	13
7	Vehicle Accelerometer Locations	15
8	Photographic Reference Target Locations	16
9	Load Cell Locations on Fixed Barrier	17
10	Test Vehicle Summary of Results	18
11	Post-Test Observations	19
12	Vehicle Profile Measurements	20
13	Accident Investigation Division Data	22
14	Vehicle Intrusion Measurements	23
15	Summary of FMVSS 212, FMVSS 219 (Partial) Data, and 301 Data	25
16	FMVSS 301 Static Rollover Results	27
17	Dummy/Vehicle Temperature Stabilization Data	28

<u>Appendix</u>		
A	Photographs	A
B	Dummy Response Data Traces	B
C	Dummy Calibration and Performance Verification Data	C

SECTION 1 PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-12-D-00258. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact was conducted in accordance with the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure.

SUMMARY

A load cell barrier consisting of 176 load cells was impacted by a 2016 Kia Sorento LX AWD 5-Dr SUV at a velocity of 56.4 km/h. The test was performed at MGA Research Corporation on March 23, 2015. Pre-test and post-test photographs of the vehicle and dummies can be found in Appendix A.

Two (2) real-time cameras and fourteen (14) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

One Part 572E 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5th percentile female test device (ATD) was placed in the right-front passenger seating position according to dummy placement instructions specified in the Frontal NCAP Laboratory Test Procedure.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, right/left femur load cells, and lower leg instrumentation. Seat belt load cells were also installed on the driver's shoulder belt, driver's lap belt, passenger's shoulder belt, and passenger's lap belt to measure dummy torso section loading.

The driver (position 1) ATD (Serial No. 351) and the right-front passenger (position 2) ATD (Serial No. 138) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 631 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 436 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

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

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)	235	0.25	930	360	47	23	122	1470
Passenger (5 th)	245	0.43	798	552	46	9	1008	1124

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

TEST NOTES

Barrier K-16 MY has no valid data.

Barrier F-01 MZ has no valid data.

Barrier D-06 MY has no valid data.

Rear hatch opened during impact event.

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20164200	Traction Control System (TCS)	Yes
Model Year	2016	Power Steering	Yes
Make	Kia	Power Window Auto-Reverse	Yes
Model	Sorento LX	Driver Frontal Airbag	Yes
Body Style	5-Dr SUV	Driver Curtain Airbag	Yes
VIN	5XYPGDA34GG013252	Driver Head/Torso Airbag	No
Body Color	Sparkling Silver	Driver Torso Airbag	No
Odometer (km/mi)	232 / 144	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	2.4	Driver Pelvis Airbag	No
Type/No. Cylinders	4	Driver Knee Airbag	No
Engine Placement	Lateral	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	6	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	AWD	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof/T-Top	No	Front Pass. Knee Airbag	No
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	Yes	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Other	N/A

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

DATA FROM CERTIFICATION LABEL

Manufactured By	Kia Motors Manufacturing Georgia, Inc.	GVWR (kg)	2340
Date of Manufacture	01/15	GAWR Front (kg)	1350
		GAWR Rear (kg)	1395

VEHICLE SEATING AND WEIGHT CAPACITY DATA

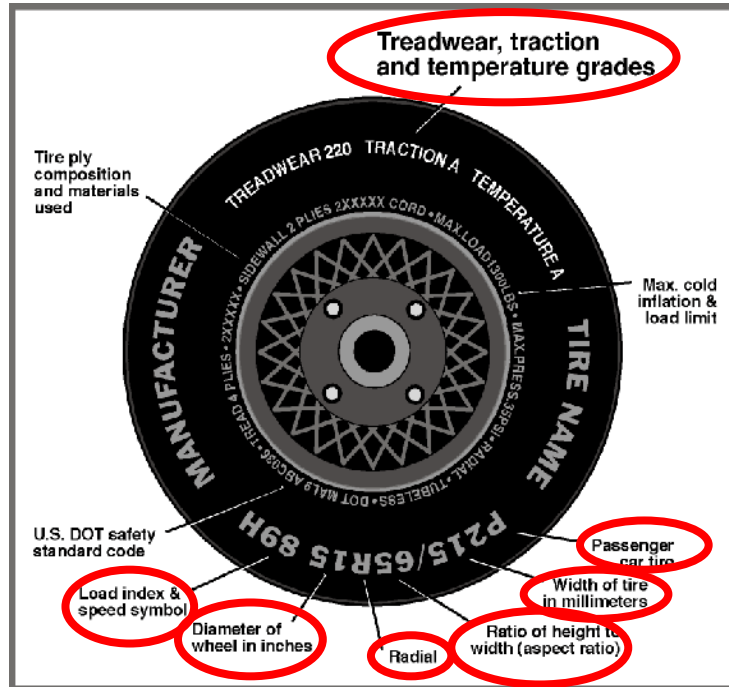
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				420
Cargo Weight (RCLW) (kg)				80

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

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	235	235
Recommended Tire Size	235/65R17	235/65R17
Tire Size on Vehicle	235/65R17	235/65R17
Tire Manufacturer	Kumho	Kumho
Tire Model	Crugen	Crugen
Treadwear	440	440
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Steel, 2 Polyester, 1 Nylon	2 Steel, 2 Polyester, 1 Nylon
Load Index/Speed Symbol	104H	104H
Tire Material	Rubber	Rubber
DOT Safety Code Left	H25A YANH 3914	H25A YANH 3914
DOT Safety Code Right	H25A YANH 3914	H25A YANH 3914

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

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	498.0	390.5		526.0	481.0	
Right	kg	488.5	375.0		511.5	448.0	
Ratio	%	56.3	43.7		52.8	47.2	
Totals	kg	986.5	765.5	1752.0	1037.5	929.0	1966.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1752.0
Weight of 1 P572E ATD & 1 P572O ATD	kg	141
Rated Cargo/Luggage Weight (RCLW)	kg	80
Calculated Test Vehicle Target Weight (TVTW)	kg	1973.0

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	797	794	790	798	1215
As Tested	mm	789	791	759	766	1313
Post Test	mm	771	775	768	759	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2780
Total Vehicle Length at Left Side	mm	4626
Total Vehicle Length at Centerline	mm	4762
Total Vehicle Length at Right Side	mm	4626
Weight of Ballast in Cargo Area	kg	13
Weight of Vehicle Components Removed	kg	27
Amount of Stoddard Solvent in Fuel Tank	L	66.0

List of components removed to meet test weight: None.

List of components removed for instrumentation, data box, and equipment installation: Cargo area cover, cargo carpet, rear floor mats, jack/tool kit, left and right lower C-Pillar trim, and right tail light.

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

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4762
2	Total Width	1862
3	Bumper Top Height	578
4	Bumper Bottom Height	460
5	Longitudinal Member Top Height	578
6	Distance between Longitudinal Members	930
7	Longitudinal Member Width	60
8	Engine Top Height	881
9	Engine Bottom Height	218
10	Engine and Gearbox Width	850
11	Front Bumper-Engine Distance	280
12	Front Shock Absorber Fixing Height	970
13	Bonnet Leading Edge Height	922
14	Front Shock Absorber Fixing Width	1204
15	Front Bumper – Front Axle Distance	925
16	Front Axle – A-Pillar Distance	513
17	A-Pillar – B-Pillar Distance	1061
18	B-Pillar – Rear Axle Distance	1210
19	B-Pillar – C-Pillar Distance	730
20	Roof Sill Bottom Height	1511
21	Roof Sill Top Height	1702
22	Floor Sill Bottom Height	249
23	Floor Sill Top Height	524

DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

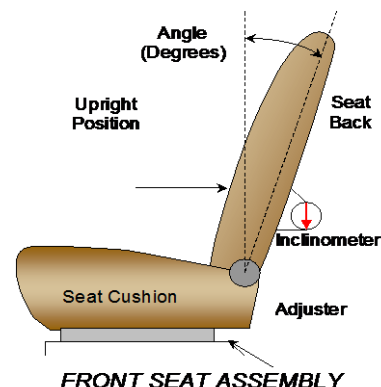
Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

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	-2.7° on headrest post
Passenger Seat Back Angle	-3.2° on headrest post



SEAT FORE/AFT POSITIONS

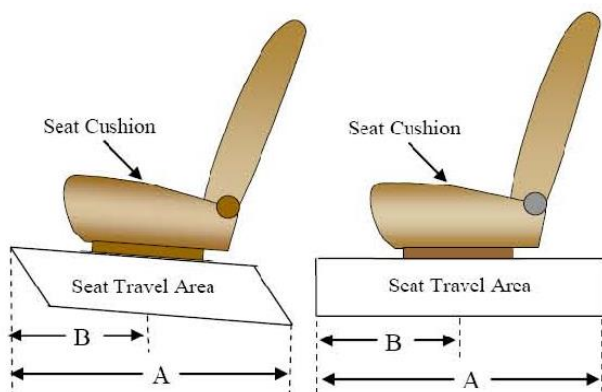
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated August 2013.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	300 mm / 38 detents (1 st as 1)	150 mm / 14 th detent (1 st as 0)
Passenger Seat	240 mm / 38 detents (1 st as 1)	0 mm / 0 th detent (1 st as 0)

SEAT BELT UPPER ANCHORAGES

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

	Total # of Positions	Placed in Position #
Driver Seat	4 (1 st as 1)	0 (1 st as 0)
Passenger Seat	4 (1 st as 1)	0 (1 st as 0)



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

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

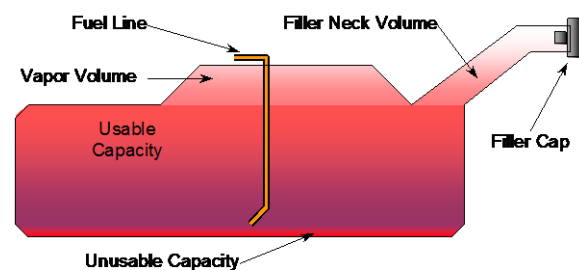
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	71.0
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	65.3 to 66.7
Actual Amount of Solvent used	66.0
1/3 of Usable Capacity	23.7

FUEL PUMP

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

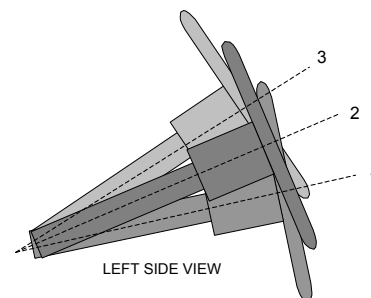
The electric fuel pump operates when key is "ON" position.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

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



STEERING COLUMN ASSEMBLY

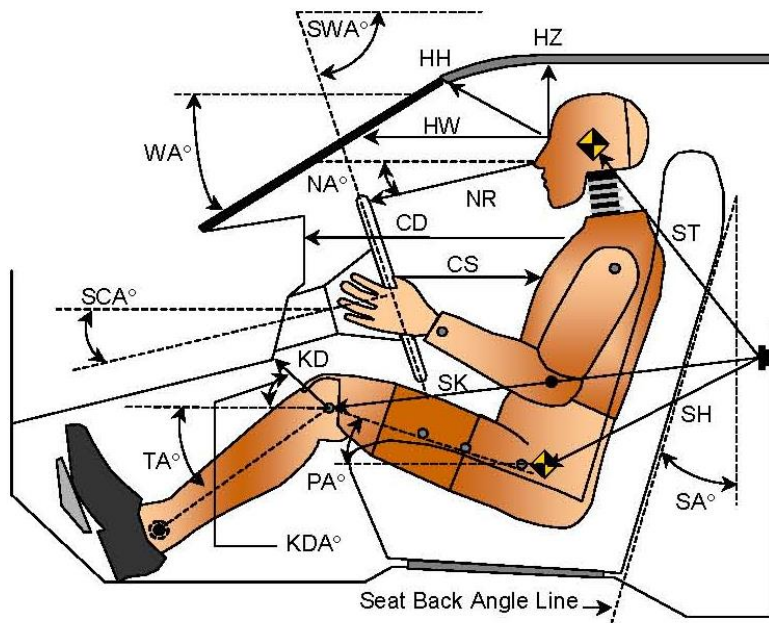
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	66.4	231
Geometric Center Position 2	63.7	256
Uppermost Position 3	61.0	280
Telescoping Steering Wheel Travel		49
Test Position	63.7	256

DATA SHEET NO. 3 DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
Test Date: 3/23/2015



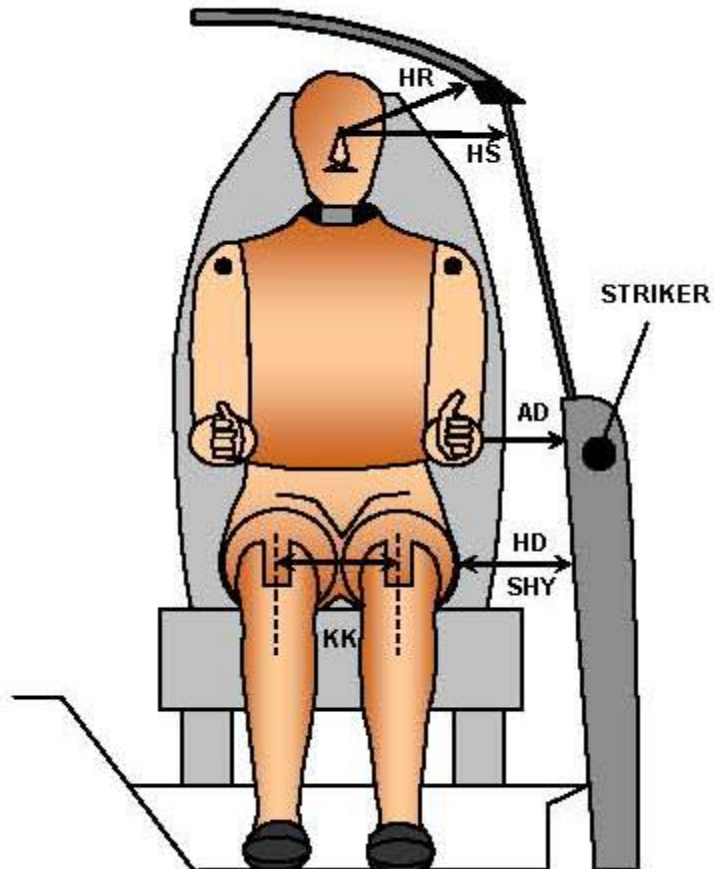
LEFT SIDE VIEW

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		22.3		
SWA°	Steering Wheel Angle		63.7		
SCA°	Steering Column Angle		26.3		
SA°	Seat Back Angle (on headrest post)		-2.7		-3.2
HZ	Head to Roof (Z)	206	90	247	90
HH	Head to Header	327	32.6	325	48.4
HW	Head to Windshield	658	0.0	705	0.0
NR	Nose to Rim	375	5.4		
CD	Chest to Dash	513		404	
CS	Chest to Steering Hub	287	6.2		
RA	Rim to Abdomen	174	0.0		
KDL	Left Knee to Dash	173	22.3	101	35.8
KDR	Right Knee to Dash	131	24.6	112	33.6
PA°	Pelvic Angle		24.5		20.9
TA°	Tibia Angle		52.8		52.3
SK	Striker to Knee	556	104.8	583	108.6
ST	Striker to Head	428	16.4	379	32.6
SH	Striker to H-Point	318	142.3	406	125.6

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015



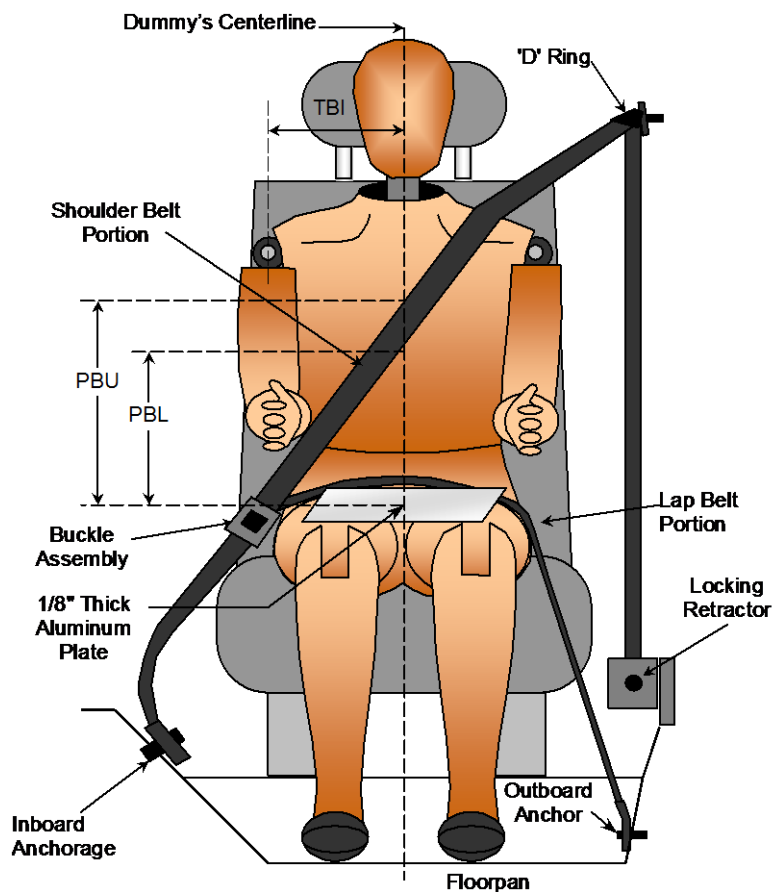
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
AD	Arm to Door	139	99
HD	H-Point to Door	167	192
HR	Head to Side Header	241	292
HS	Head to Side Window	254	382
KK	Knee to Knee	357	227
SHY	Striker to H-Point (Y Direction)	283	323
AA	Ankle to Ankle	369	179

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
Test Date: 3/23/2015



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	390	360
PBL - Top surface of reference to belt lower edge	mm	320	270

BELT LENGTH DATA

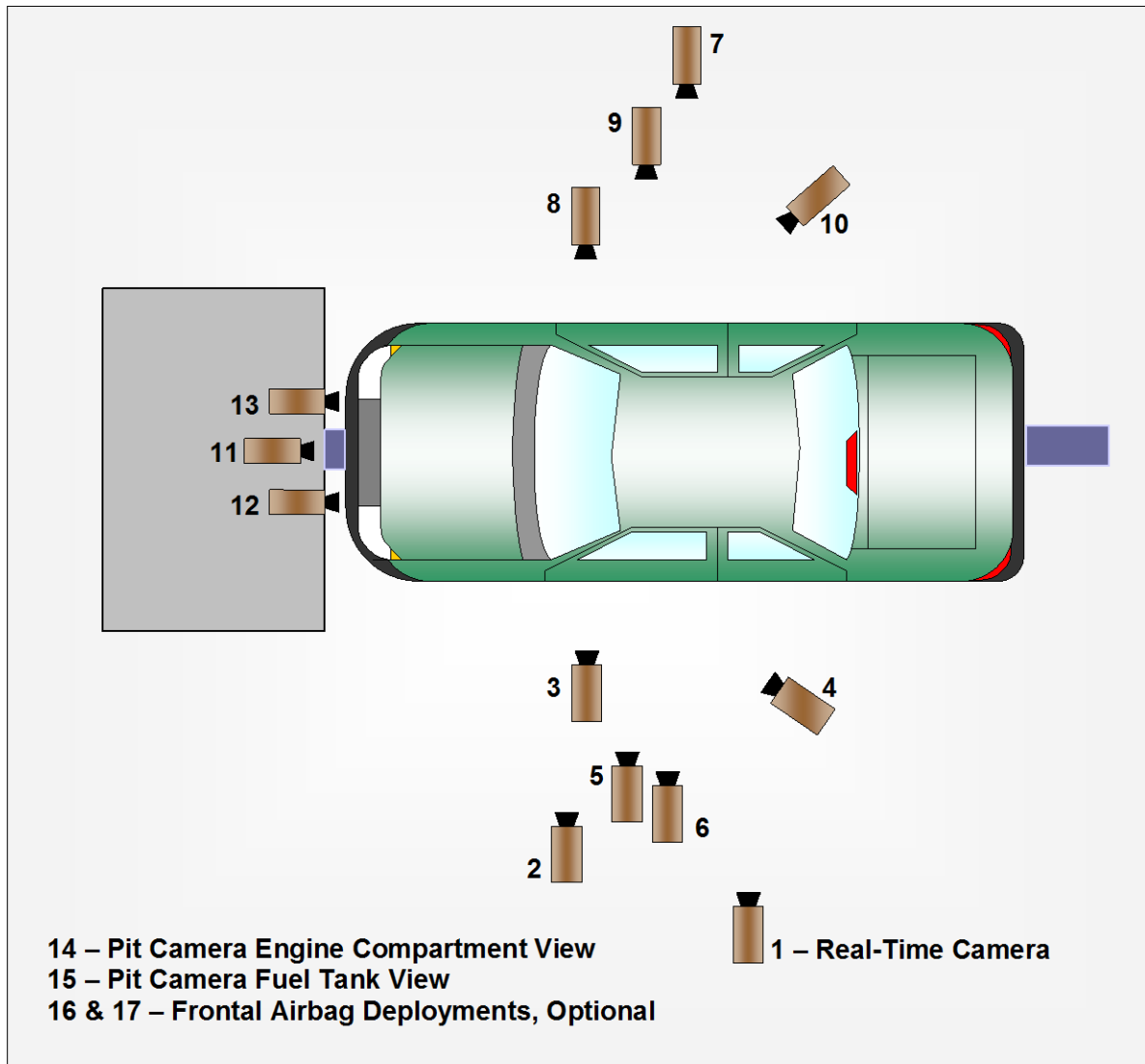
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	900	900
Lap Belt Length as measured on ATD	mm	625	660
Remainder of belt on reel	mm	835	800
Total Belt Length for Continuous Webbing Systems	mm	3160	3160

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

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
Test Date: 3/23/2015

CAMERA POSITIONS FOR FRONTAL IMPACTS



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

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	-1220	-6510	-1910	35	1000
3	Left Front Half	-1010	-5370	-1240	24	1000
4	Left Angle	-5550	-5040	-2010	50	1000
5	Steering Column - Top					
6	Steering Column - Bottom					
7	Right Overall	-2220	6820	-1290	20	1000
8	Passenger Close-Up	-1620	6330	-1870	35	1000
9	Right Front Half	-1160	5440	-1230	24	1000
10	Right Angle	-5560	5060	-1920	50	1000
11	Windshield	430	0	-2810	20	1000
12	Driver Windshield	-30	-450	-2030	8.5	1000
13	Passenger Windshield	-30	450	-2030	8.5	1000
14	Pit Front	-1190	0	3150	24	1000
15	Pit Rear	-3060	0	3150	24	1000
16	Onboard Driver Side				12	1000
17	Onboard Passenger Side				12	1000
18	Real-Time Pan View					30

***COORDINATES:**

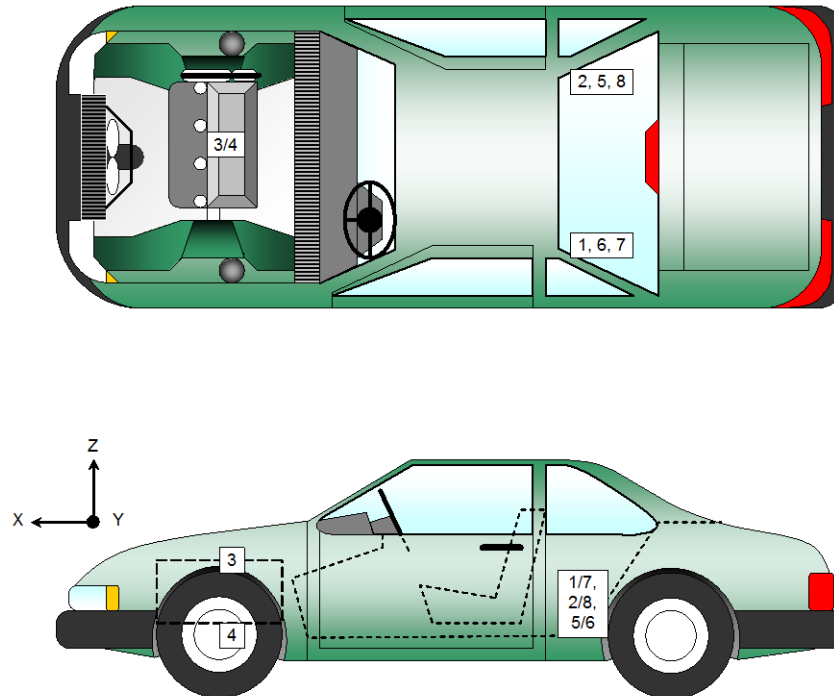
+X = forward of impact plane
 +Y = right of monorail centerline
 +Z = below ground level

Cameras 5 & 6 were not used for this test.

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

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	1931	-450	-365
2	Right Rear Crossmember Accelerometer – X Direction	1959	417	-372
3	Engine Top X	4025	55	-852
4	Engine Bottom X	4027	0	-318
5	Left Rear Crossmember Accelerometer – Z Direction	1931	-418	365
6	Right Rear Crossmember Accelerometer – Z Direction	1959	392	372
7	Left Rear Crossmember Accelerometer Redundant – X Direction	1931	-418	365
8	Right Rear Crossmember Accelerometer Redundant – X Direction	1959	392	372

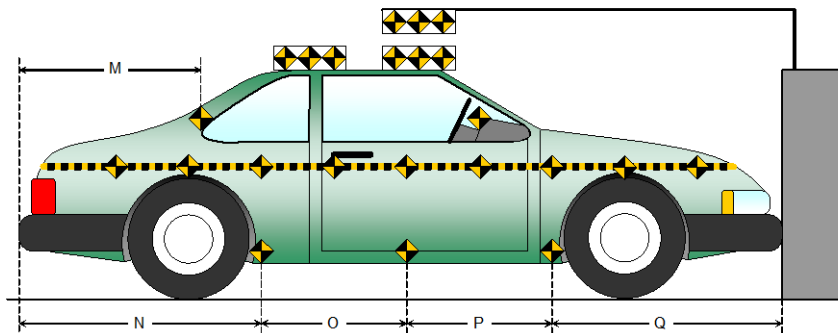
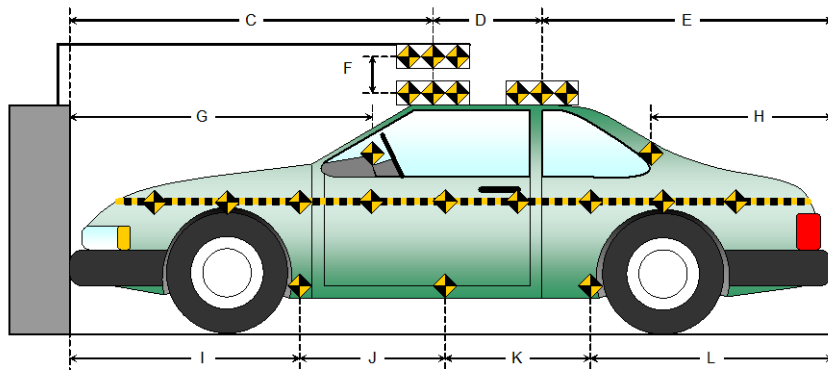
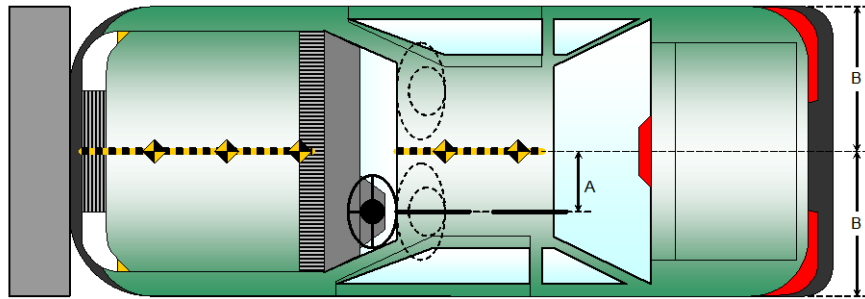
Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

Item	Value (mm)
A	388
B	931
C	2235
D	713
E	1678
F	150
G	
H	1420
I	1441
J	897
K	897
L	1527
M	1420
N	1527
O	897
P	897
Q	1441



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

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

Advanced Research Load Cell Barrier

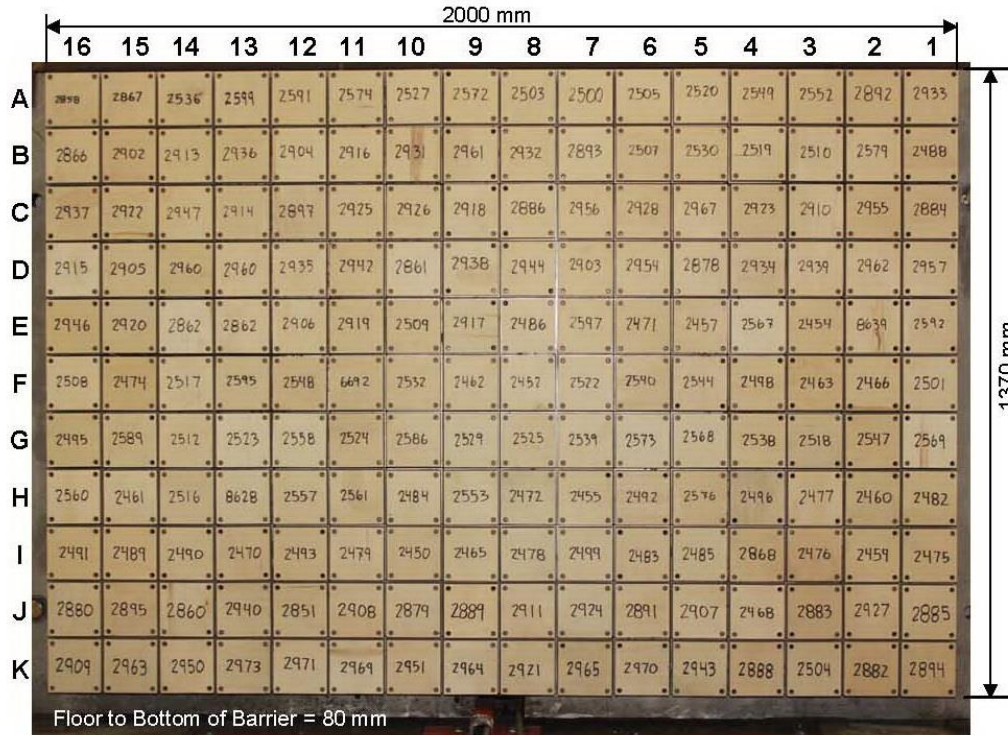


Photo for Reference Only

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

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

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
Test Date: 3/23/2015

INSTRUMENTATION

Driver Dummy Data Channels	46
Passenger Dummy Data Channels	49
Vehicle Structure Accelerometers	8
Barrier Channels	528
Total	631

CAMERA COVERAGE

High-Speed Vehicle Onboard	2
High-Speed Offboard	12
Real-Time	2
Total	16

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

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
Test Date: 3/23/2015

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

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

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	3935
Center	mm	3850
Right Side	mm	3875
Average	mm	3887

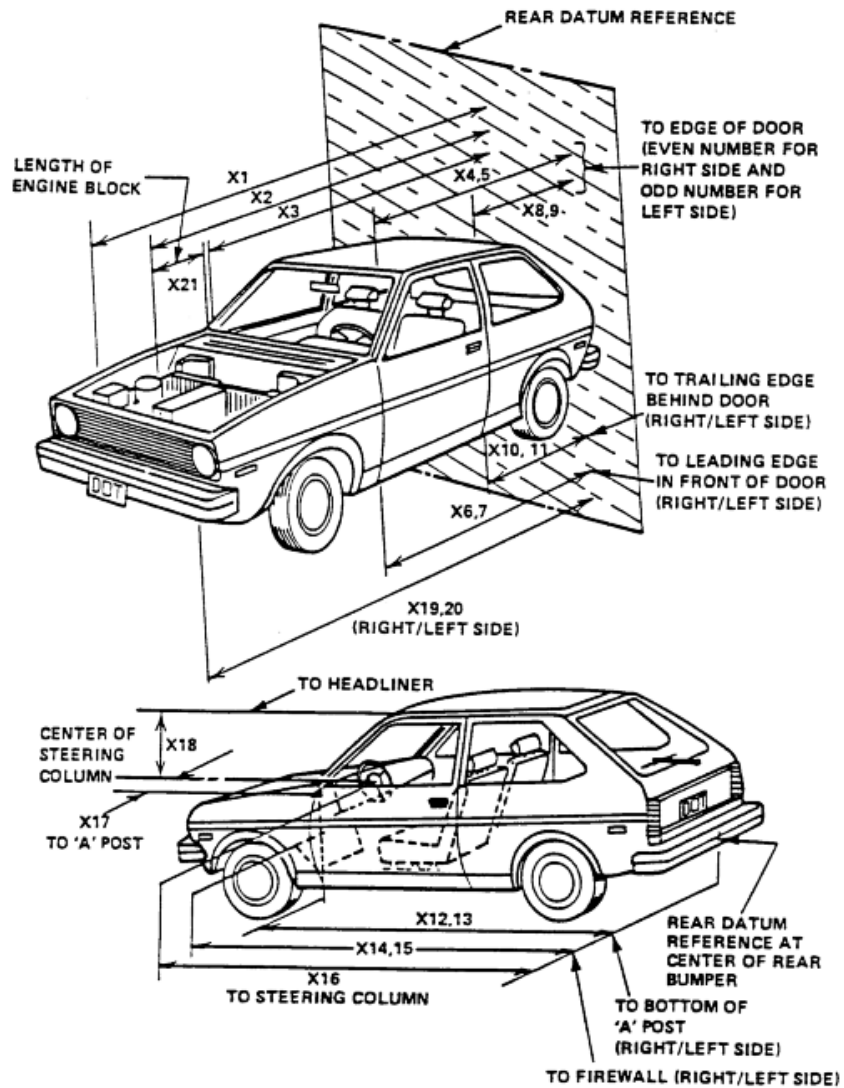
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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/Pelvis 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: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4762	4365	397
2	RSOV to Front of Engine	mm	4259	4043	216
3	RSOV to Firewall	mm	3725	3725	0
4	RSOV to Upper Leading Edge of Right Door	mm	3254	3258	-4
5	RSOV to Upper Leading Edge of Left Door	mm	3255	3259	-4
6	RSOV to Lower Leading Edge of Right Door	mm	3263	3258	5
7	RSOV to Lower Leading Edge of Left Door	mm	3264	3262	2
8	RSOV to Upper Trailing Edge of Right Door	mm	2219	2224	-5
9	RSOV to Upper Trailing Edge of Left Door	mm	2219	2223	-4
10	RSOV to Lower Trailing Edge of Right Door	mm	2244	2243	1
11	RSOV to Lower Trailing Edge of Left Door	mm	2244	2243	1
12	RSOV to Bottom of "A" Post of Right Side	mm	3246	3246	0
13	RSOV to Bottom of "A" Post of Left Side	mm	3248	3248	0
14	RSOV to Firewall, Right Side	mm	3506	3480	26
15	RSOV to Firewall, Left Side	mm	3505	3479	26
16	RSOV to Steering Column	mm	2844	2904	-60
17	Center of Steering Column to "A" Post	mm	395	412	-17
18	Center of Steering Column to Headliner	mm	460	494	-34
19	RSOV to Right Side of Front Bumper	mm	4626	4257	369
20	RSOV to Left Side of Front Bumper	mm	4626	4234	392
21	Length of Engine Block	mm	210	210	0
RD	RSOV to Right Side of Dash Panel	mm	3138	3138	0
CD	RSOV to Center of Dash Panel	mm	3051	3051	0
LD	RSOV to Left Side of Dash Panel	mm	3134	3134	0

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
Test Date: 3/23/2015

VEHICLE INFORMATION

VIN: 5XYPGDA34GG013252 Wheelbase (mm): 2780
Vehicle Size Category: MPV Test Weight (kg): 1966.5

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): 62.3

Time of Separation (msec): 205.2

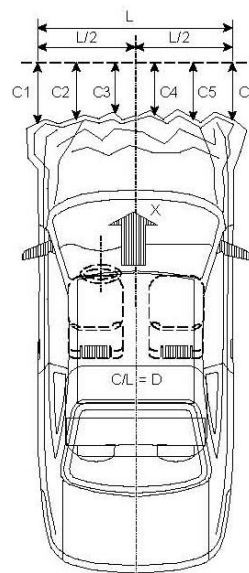
CRUSH PROFILE

Collision Deformation Classification: Frontal

Midpoint of Damage: Centerline

Damage Region Length (mm): 1200

Impact Mode: Frontal



No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4626	4234	392
C2	Crush zone 2 at left side	mm	4698	4264	434
C3	Crush zone 3 at left side	mm	4728	4292	436
C4	Crush zone 4 at right side	mm	4728	4297	431
C5	Crush zone 5 at right side	mm	4698	4284	414
C6	Crush zone 6 at right side	mm	4626	4257	369
L	C1 TO C6	mm	1200	1187	13

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

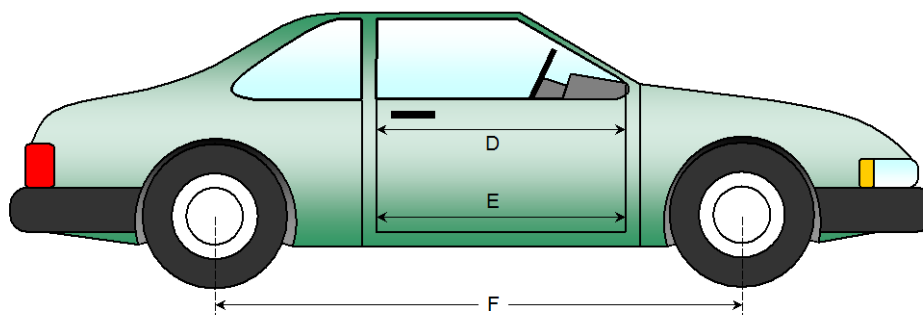
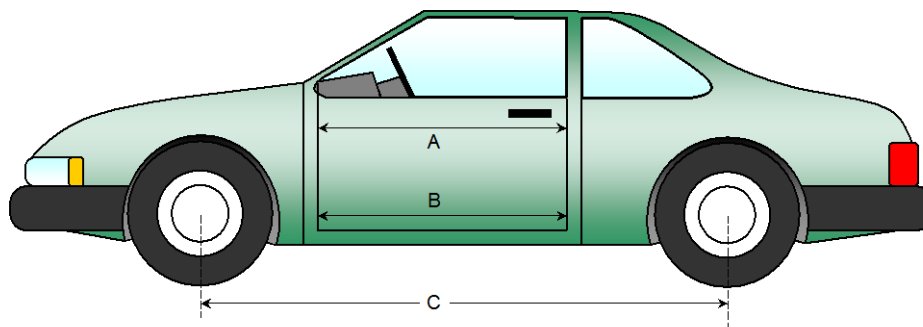
NHTSA No.: O20164200
 Test Date: 3/23/2015

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	953	953	0
B	Left Side Lower	mm	842	842	0
D	Right Side Upper	mm	953	953	0
E	Right Side Lower	mm	842	842	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2780	2731	49
F	Right Side Wheelbase	mm	2780	2777	3



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

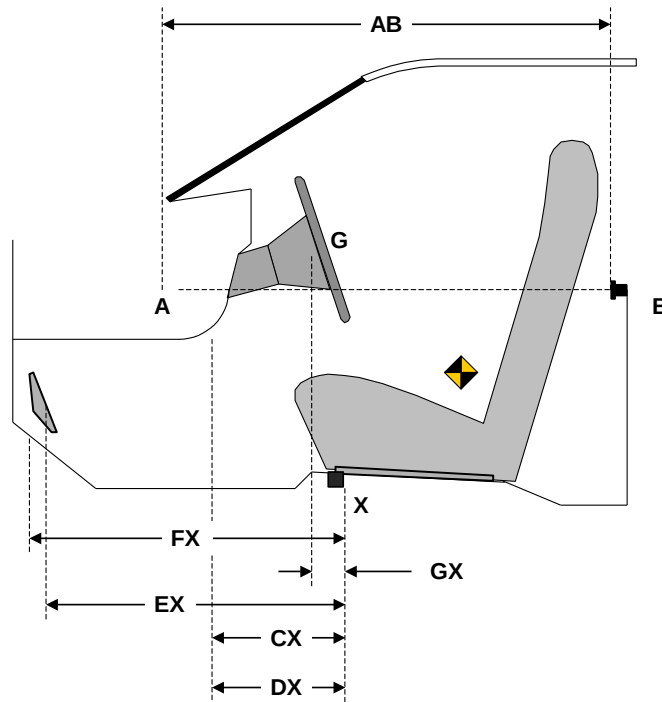
Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	754	754	0
CX	Left Knee Bolster to X	mm	236	238	-2
DX	Right Knee Bolster to X	mm	228	238	-10
EX	Brake Pedal to X	mm	543	532	11
FX	Foot Rest to X	mm	496	494	2
GX	Center of Steering Column Wheel Hub to X	mm	43	93	-50

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 15
SUMMARY OF FMVSS 212, FMVSS 219 (PARTIAL) DATA, AND 301 DATA

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

Windshield Mounting Details:

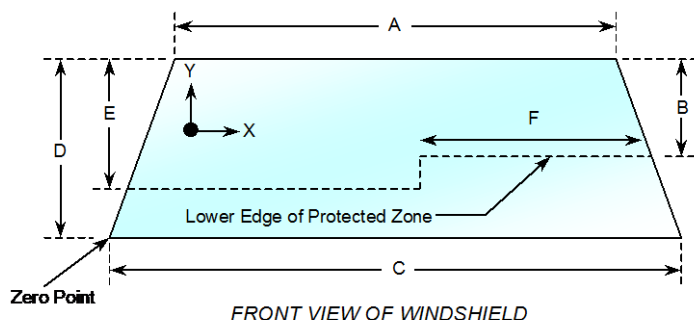
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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: 21.4° C.

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2267	2267	100
Right Side	2267	2267	100
Total	4534	4534	100



Item	Units	Value
A	mm	1280
B	mm	544
C	mm	1446
D	mm	904
E	mm	548
F	mm	504

AREA OF PROTECTED ZONE FAILURES - NONE

A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 inches by a vehicle component other than one that is normally in contact with the windshield. **None**

X	Y

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component. **None**

X	Y

DATA SHEET NO. 15 (CONTINUED)
SUMMARY OF FMVSS 212, FMVSS 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
Test Date: 3/23/2015

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21.4°C Test Time: 10:31 a.m.

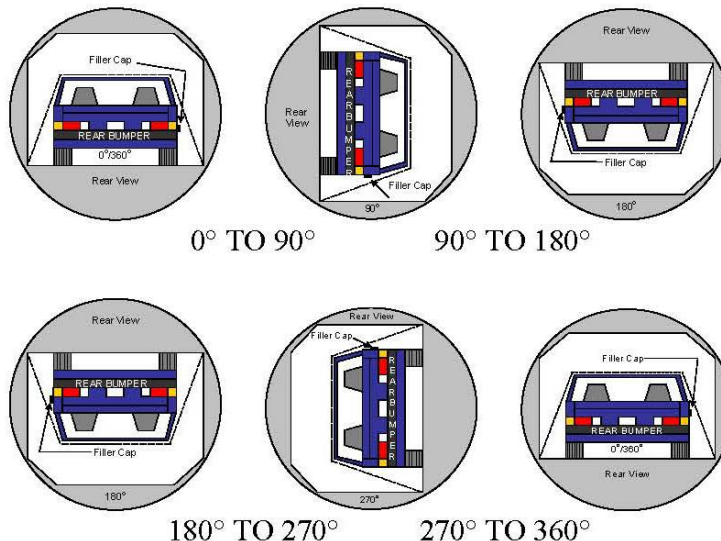
- A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)
- B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)
- C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)
- D. Spillage: None

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

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage: **None**



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	113	300	413
90° to 180°	110	300	410
180° to 270°	106	300	406
270° to 360°	113	300	413

FMVSS 301 SPILLAGE TABLE (units in ounces)

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

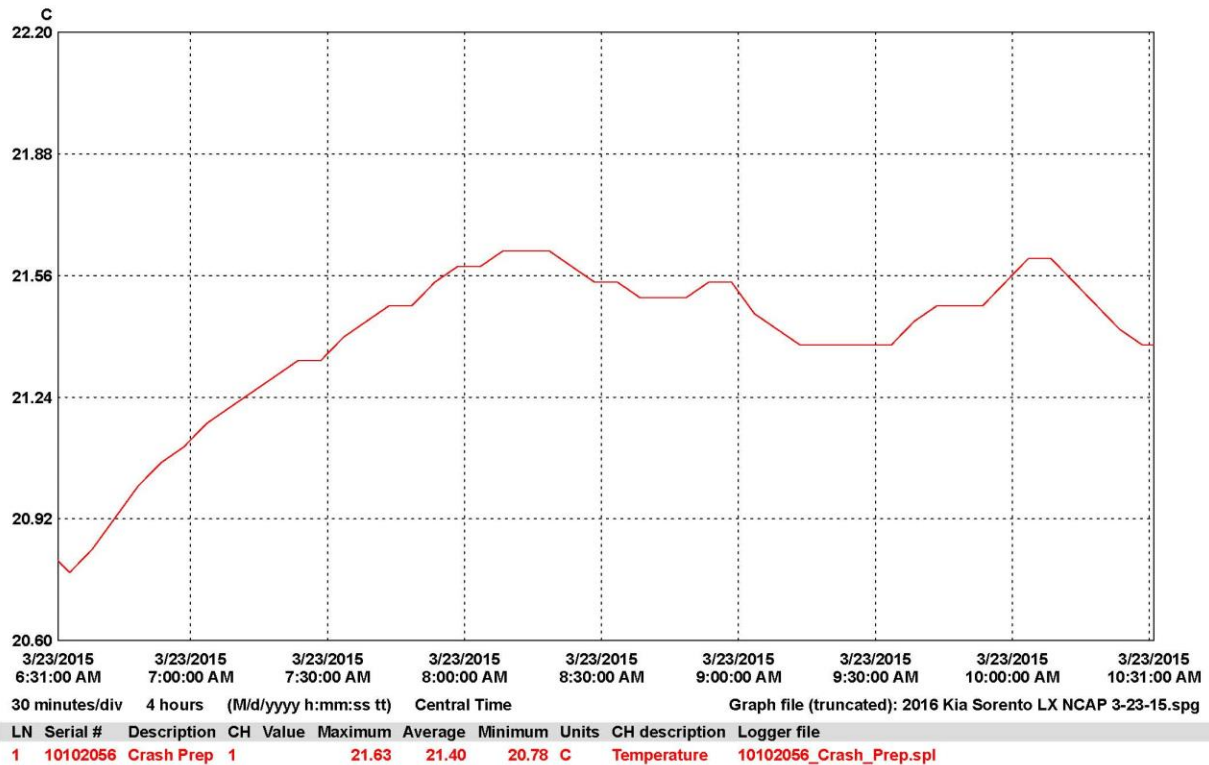
SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 17
DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2016 Kia Sorento LX AWD 5-Dr SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20164200
 Test Date: 3/23/2015



**APPENDIX A
PHOTOGRAPHS**

TABLE OF PHOTOGRAPHS

		<u>Page No.</u>
Photo No. 001.	Load Cell Location	A-1
Photo No. 002.	Load Cell Wall	A-1
Photo No. 003.	Manufacturer's Label	A-2
Photo No. 004.	Tire Placard	A-2
Photo No. 005.	2016 Kia Sorento LX Frontal As Delivered	A-3
Photo No. 006.	Left Rear 3-4 View, As Received	A-3
Photo No. 007.	Pre-Test Front View of Test Vehicle	A-4
Photo No. 008.	Post-Test Front View of Test Vehicle	A-4
Photo No. 009.	Pre-Test Left View of Test Vehicle	A-5
Photo No. 010.	Post-Test Left View of Test Vehicle	A-5
Photo No. 011.	Pre-Test Right View of Test Vehicle	A-6
Photo No. 012.	Post-Test Right View of Test Vehicle	A-6
Photo No. 013.	Pre-Test Right Front 3-4 View	A-7
Photo No. 014.	Post-Test Right Front 3-4 View	A-7
Photo No. 015.	Pre-Test Left Rear 3-4 View	A-8
Photo No. 016.	Post-Test Left Rear 3-4 View	A-8
Photo No. 017.	Pre-Test Windshield View	A-9
Photo No. 018.	Post-Test Windshield View	A-9
Photo No. 019.	Pre-Test Engine Compartment View	A-10
Photo No. 020.	Post-Test Engine Compartment View	A-10
Photo No. 021.	Pre-Test Fuel Filler Cap View	A-11
Photo No. 022.	Post-Test Fuel Filler Cap View	A-11
Photo No. 023.	Pre-Test Front Underbody View	A-12
Photo No. 024.	Post-Test Front Underbody View	A-12
Photo No. 025.	Pre-Test Rear Underbody View	A-13
Photo No. 026.	Post-Test Rear Underbody View	A-13
Photo No. 027.	Pre-Test Dummy Cable Routing	A-14
Photo No. 028.	Post-Test Dummy Cable Routing	A-14
Photo No. 029.	Pre-Test Driver Dummy Front View	A-15
Photo No. 030.	Post-Test Driver Dummy Front View	A-15

		<u>Page No.</u>
Photo No. 031.	Pre-Test Driver Dummy Window View	A-16
Photo No. 032.	Post-Test Driver Dummy Window View	A-16
Photo No. 033.	Pre-Test Driver Dummy and Vehicle Interior (Door Open)	A-17
Photo No. 034.	Post-Test Driver Dummy and Vehicle Interior (Door Open)	A-17
Photo No. 035.	Pre-Test Driver's Seat Fore-Aft Markings	A-18
Photo No. 036.	Post-Test Driver's Seat Fore-Aft Markings	A-18
Photo No. 037.	Pre-Test View of Belt Anchorage for Driver Dummy	A-19
Photo No. 038.	Post-Test View of Belt Anchorage for Driver Dummy	A-19
Photo No. 039.	Pre-Test Driver Dummy Feet	A-20
Photo No. 040.	Post-Test Driver Dummy Feet	A-20
Photo No. 041.	Pre-Test Driver's Side Knee Bolster (without dummy)	A-21
Photo No. 042.	Post-Test Driver's Side Knee Bolster (without dummy)	A-21
Photo No. 043.	Pre-Test Driver's Side Floorpan	A-22
Photo No. 044.	Post-Test Driver's Side Floorpan	A-22
Photo No. 045.	Post-Test Driver Dummy Face	A-23
Photo No. 046.	Post-Test Driver Dummy Contact with Airbag	A-23
Photo No. 047.	Post-Test Driver Dummy Contact with Headrest	A-24
Photo No. 047a.	Post-Test Driver Dummy Contact with Knee Bolster	A-24
Photo No. 048.	Pre-Test View of the Steering Wheel	A-25
Photo No. 049.	Post-Test View of the Steering Wheel	A-25
Photo No. 050.	Pre-Test Passenger Dummy Front View	A-26
Photo No. 051.	Post-Test Passenger Dummy Front View	A-26
Photo No. 052.	Pre-Test Passenger Dummy Window View	A-27
Photo No. 053.	Post-Test Passenger Dummy Window View	A-27
Photo No. 054.	Pre-Test Passenger Dummy and Vehicle Interior (Door Open)	A-28
Photo No. 055.	Post-Test Passenger Dummy and Vehicle Interior (Door Open)	A-28
Photo No. 056.	Pre-Test Passenger's Seat Fore-Aft Markings	A-29
Photo No. 057.	Post-Test Passenger's Seat Fore-Aft Markings	A-29
Photo No. 058.	Pre-Test View of Belt Anchorage for Passenger Dummy	A-30
Photo No. 059.	Post-Test View of Belt Anchorage for Passenger Dummy	A-30

		<u>Page No.</u>
Photo No. 060.	Pre-Test Passenger Dummy Feet	A-31
Photo No. 061.	Post-Test Passenger Dummy Feet	A-31
Photo No. 062.	Pre-Test Passenger's Side Knee Bolster (without dummy)	A-32
Photo No. 063.	Post-Test Passenger's Side Knee Bolster (without dummy)	A-32
Photo No. 064.	Pre-Test Passenger's Side Floorpan	A-33
Photo No. 065.	Post-Test Passenger's Side Floorpan	A-33
Photo No. 066.	Post-Test Passenger Dummy Face	A-34
Photo No. 067.	Post-Test Passenger Dummy Contact with Airbag	A-34
Photo No. 068.	Post-Test Passenger Dummy Contact with Headrest	A-35
Photo No. 068a.	Post-Test Passenger Dummy Contact with Glovebox	A-35
Photo No. 069.	Ballast Installed in Vehicle	A-36
Photo No. 070.	Post-Test Stoddard Solvent Spillage Location View	A-36
Photo No. 071.	Post-Test Speed Trap Read-Out	A-37
Photo No. 072.	Vehicle at 0 Degree on Static Rollover Device	A-37
Photo No. 073.	Vehicle at 90 Degrees on Static Rollover Device	A-38
Photo No. 074.	Vehicle at 180 Degrees on Static Rollover Device	A-38
Photo No. 075.	Vehicle at 270 Degrees on Static Rollover Device	A-39
Photo No. 076.	Vehicle at 360 Degrees on Static Rollover Device	A-39
Photo No. 077.	2016 Kia Sorento LX Frontal Impact Event	A-40
Photo No. 078.	Monroney Label Photograph	A-40



Photo No. 001. - Load Cell Location



Photo No. 002. - Load Cell Wall

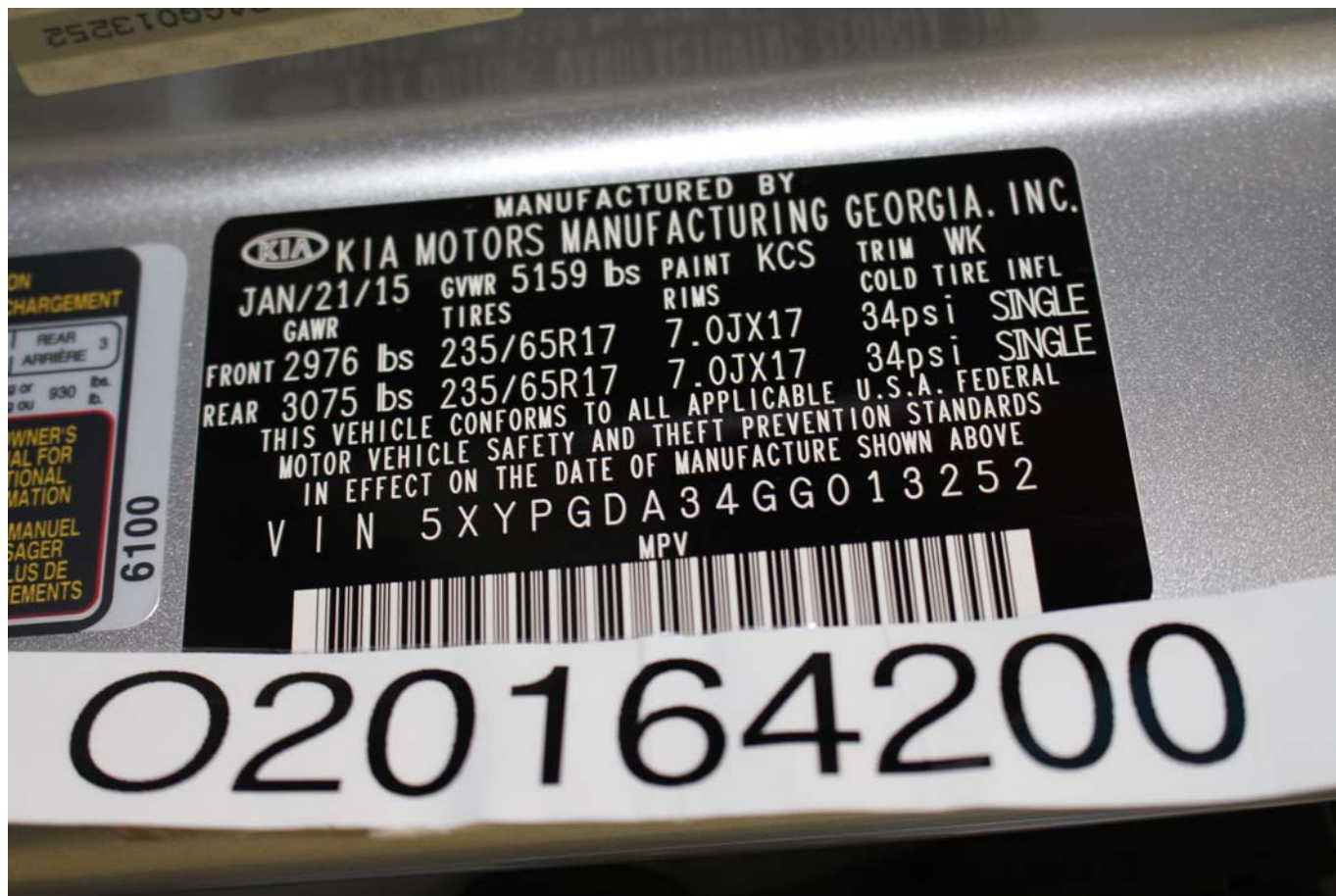


Photo No. 003. - Manufacturer's Label



Photo No. 004. - Tire Placard



Photo No. 005. - 2016 Kia Sorento LX Frontal As Delivered



Photo No. 006. - Left Rear 3-4 View, As Received

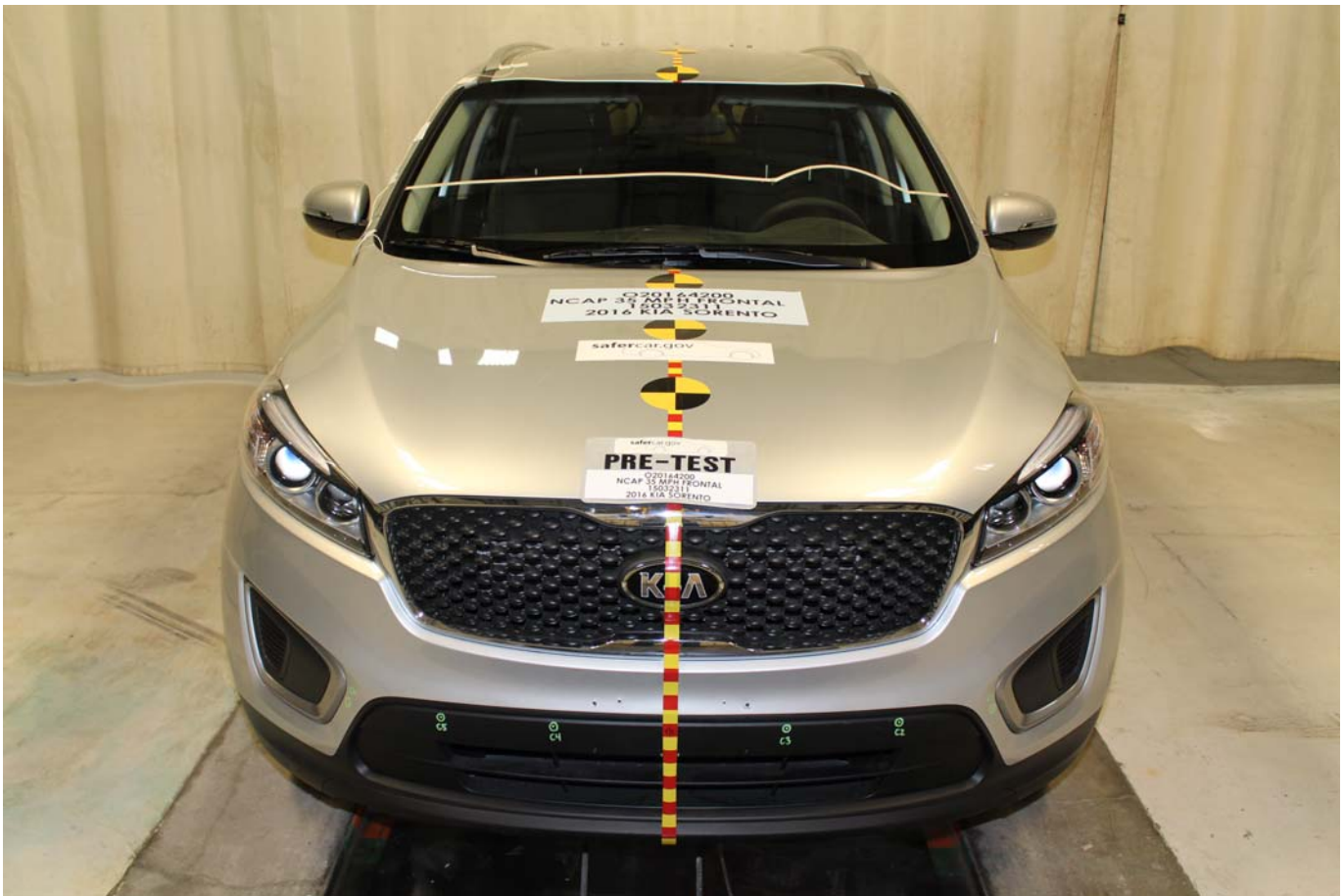


Photo No. 007. - Pre-Test Front View of Test Vehicle

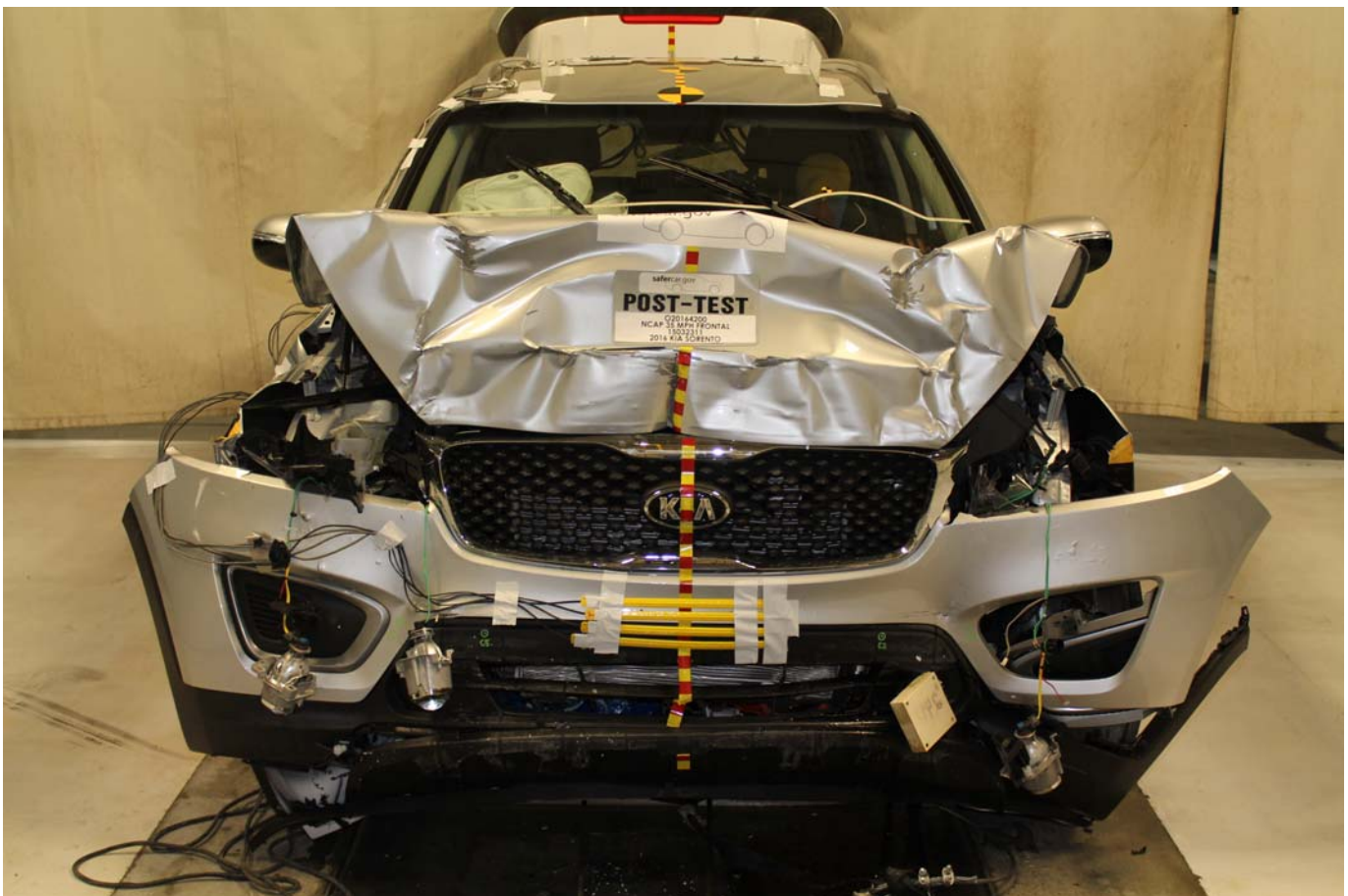


Photo No. 008. - Post-Test Front View of Test Vehicle



Photo No. 009. - Pre-Test Left View of Test Vehicle



Photo No. 010. - Post-Test Left View of Test Vehicle



Photo No. 011. - Pre-Test Right View of Test Vehicle

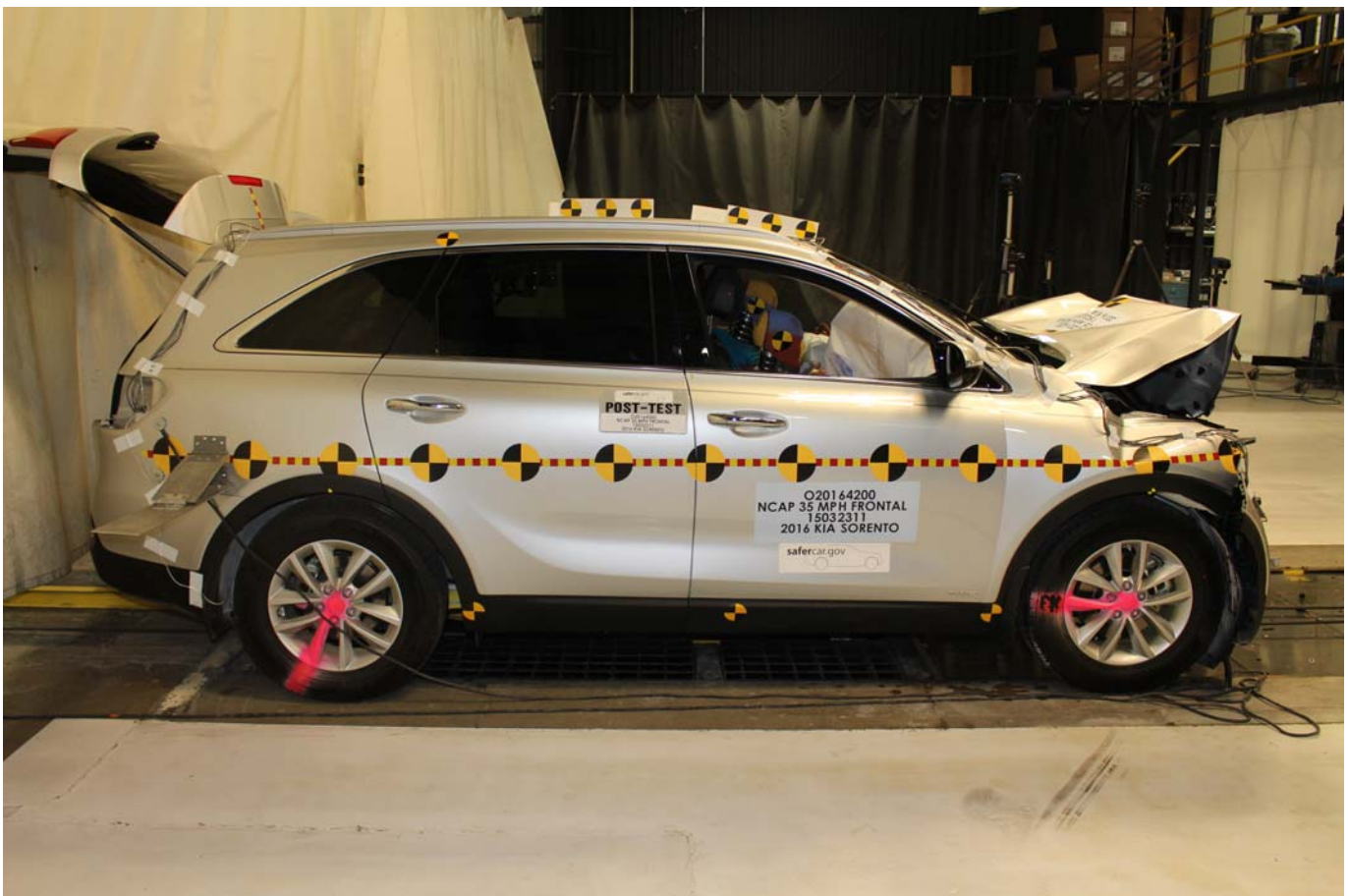


Photo No. 012. - Post-Test Right View of Test Vehicle



Photo No. 013. - Pre-Test Right Front 3-4 View

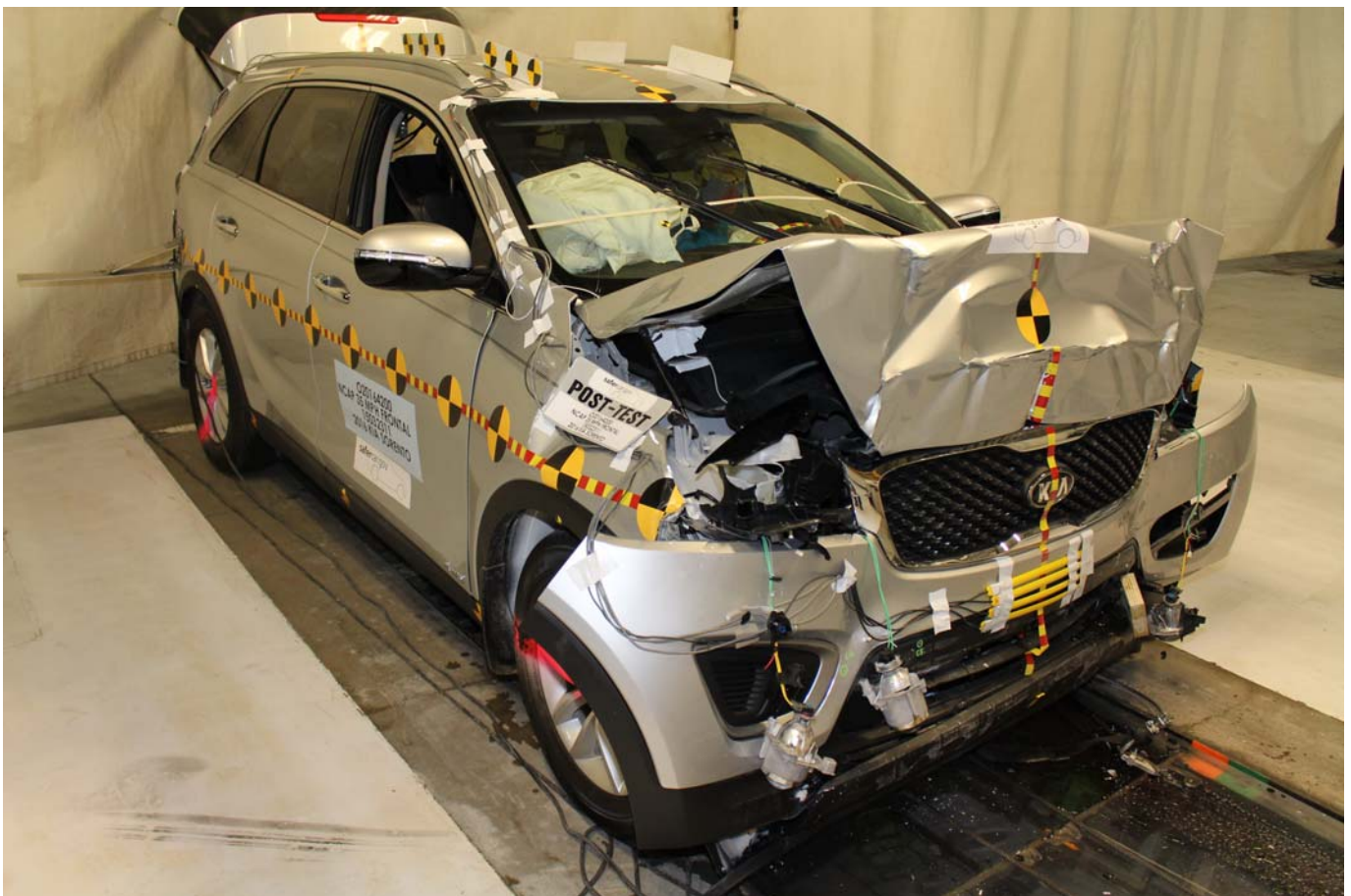


Photo No. 014. - Post-Test Right Front 3-4 View



Photo No. 015. - Pre-Test Left Rear 3-4 View

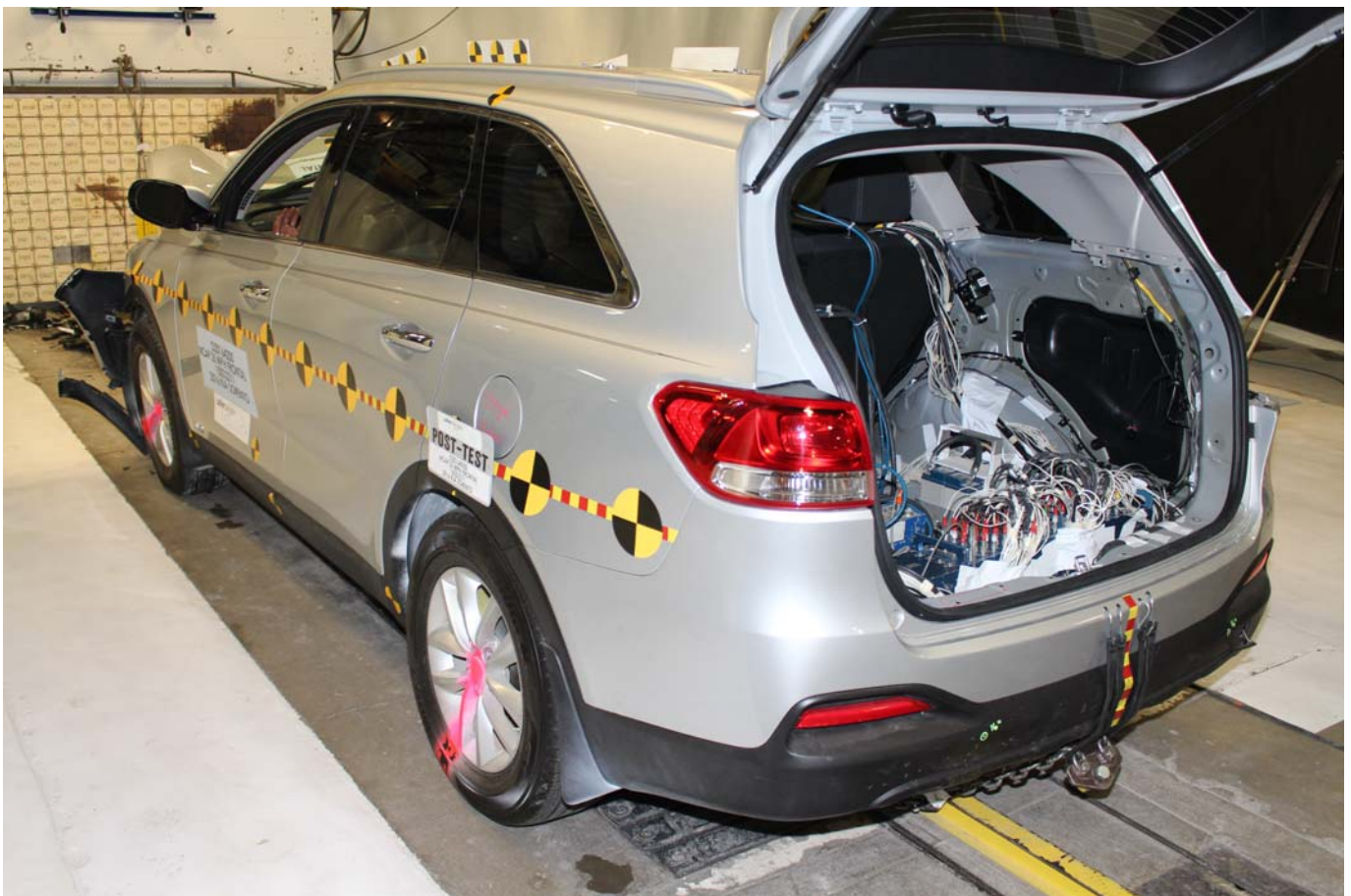


Photo No. 016. - Post-Test Left Rear 3-4 View



Photo No. 017. - Pre-Test Windshield View



Photo No. 018. - Post-Test Windshield View



Photo No. 019. - Pre-Test Engine Compartment View



Photo No. 020. - Post-Test Engine Compartment View



Photo No. 021. - Pre-Test Fuel Filler Cap View



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

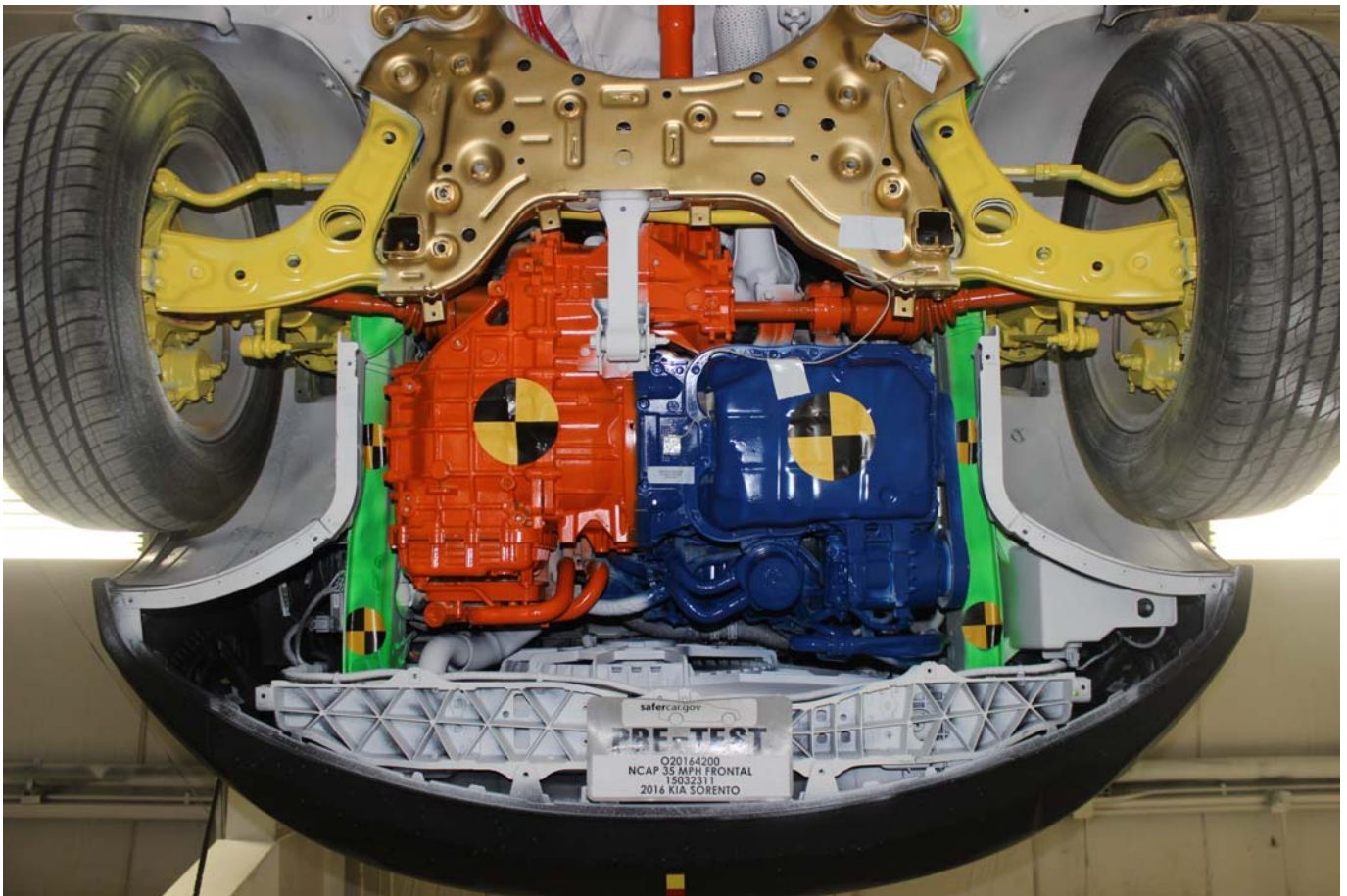


Photo No. 023. - Pre-Test Front Underbody View

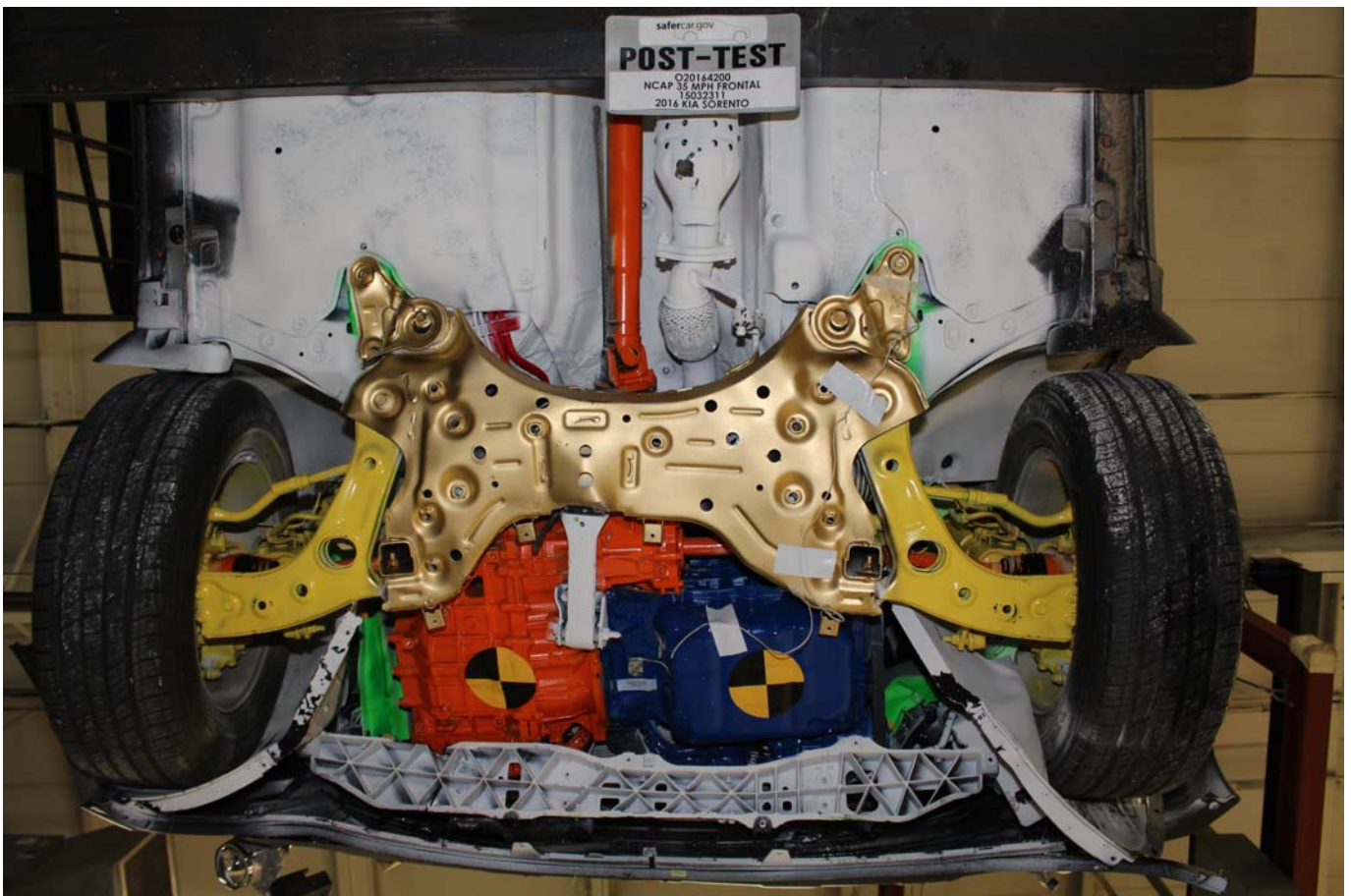


Photo No. 024. - Post-Test Front Underbody View



Photo No. 025. - Pre-Test Rear Underbody View

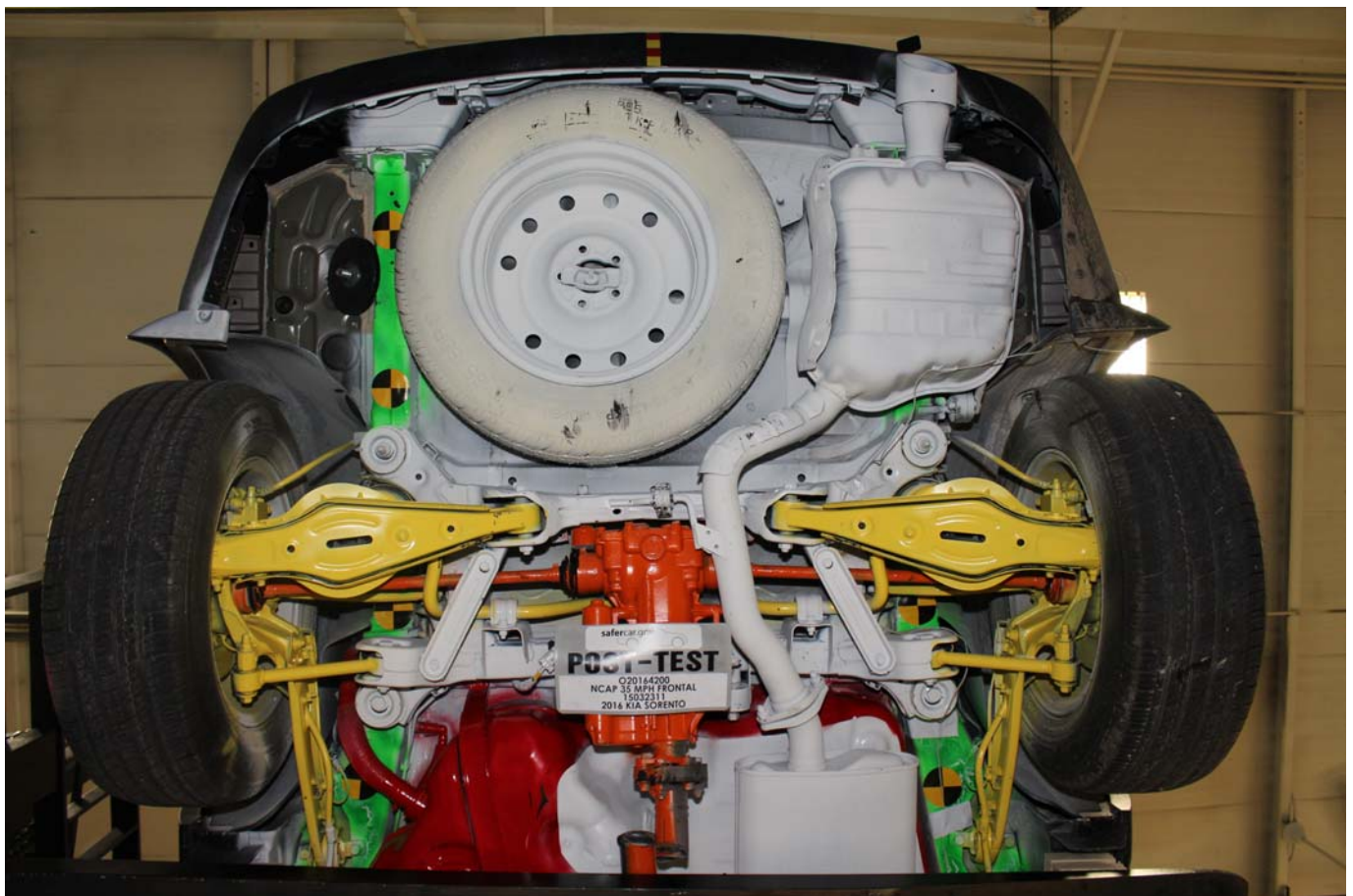


Photo No. 026. - Post-Test Rear Underbody View

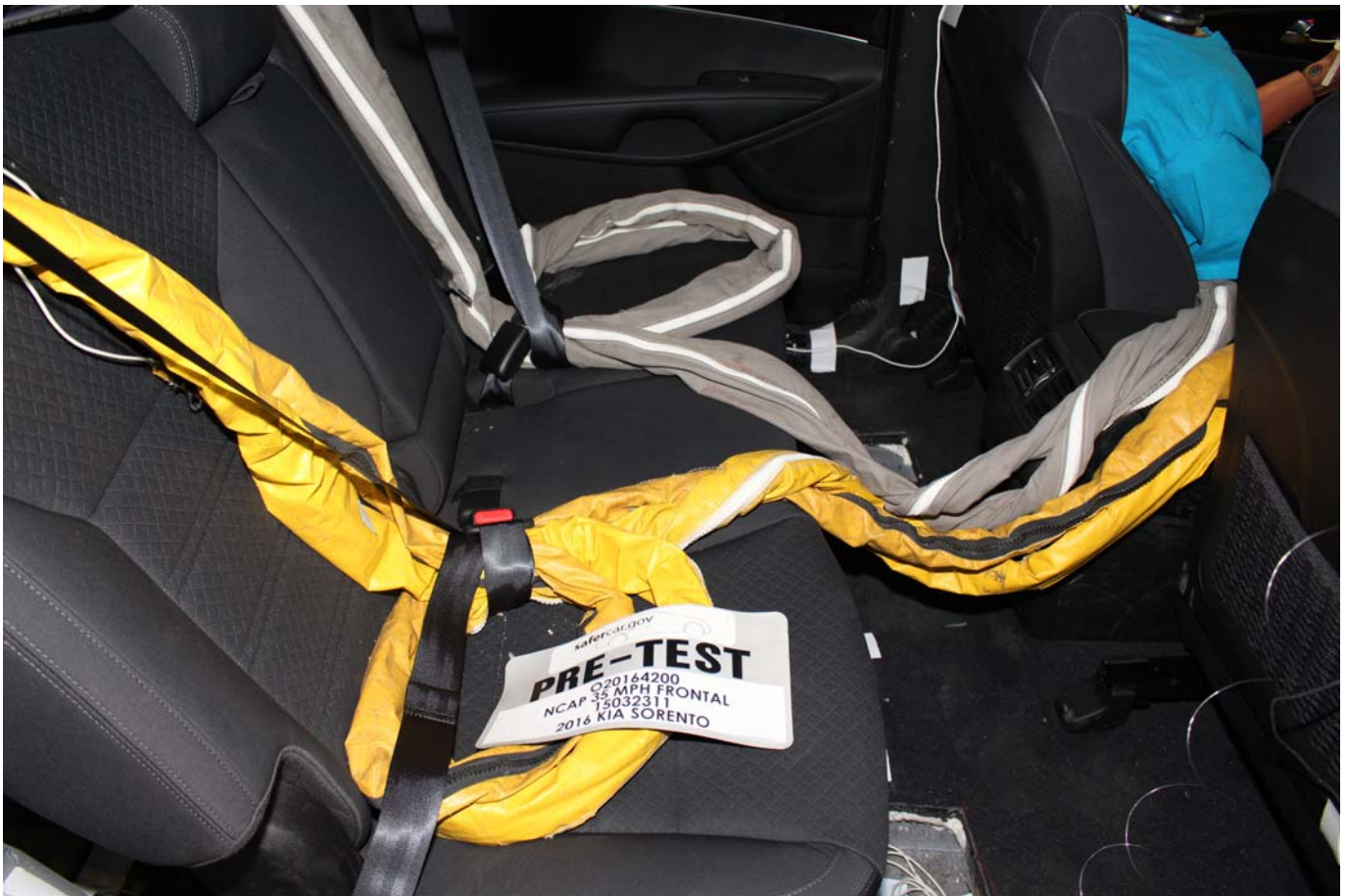


Photo No. 027. - Pre-Test Dummy Cable Routing



Photo No. 028. - Post-Test Dummy Cable Routing



Photo No. 029. - Pre-Test Driver Dummy Front View



Photo No. 030. - Post-Test Driver Dummy Front View



Photo No. 031. - Pre-Test Driver Dummy Window View



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



Photo No. 033. - Pre-Test Driver Dummy and Vehicle Interior (Door Open)



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

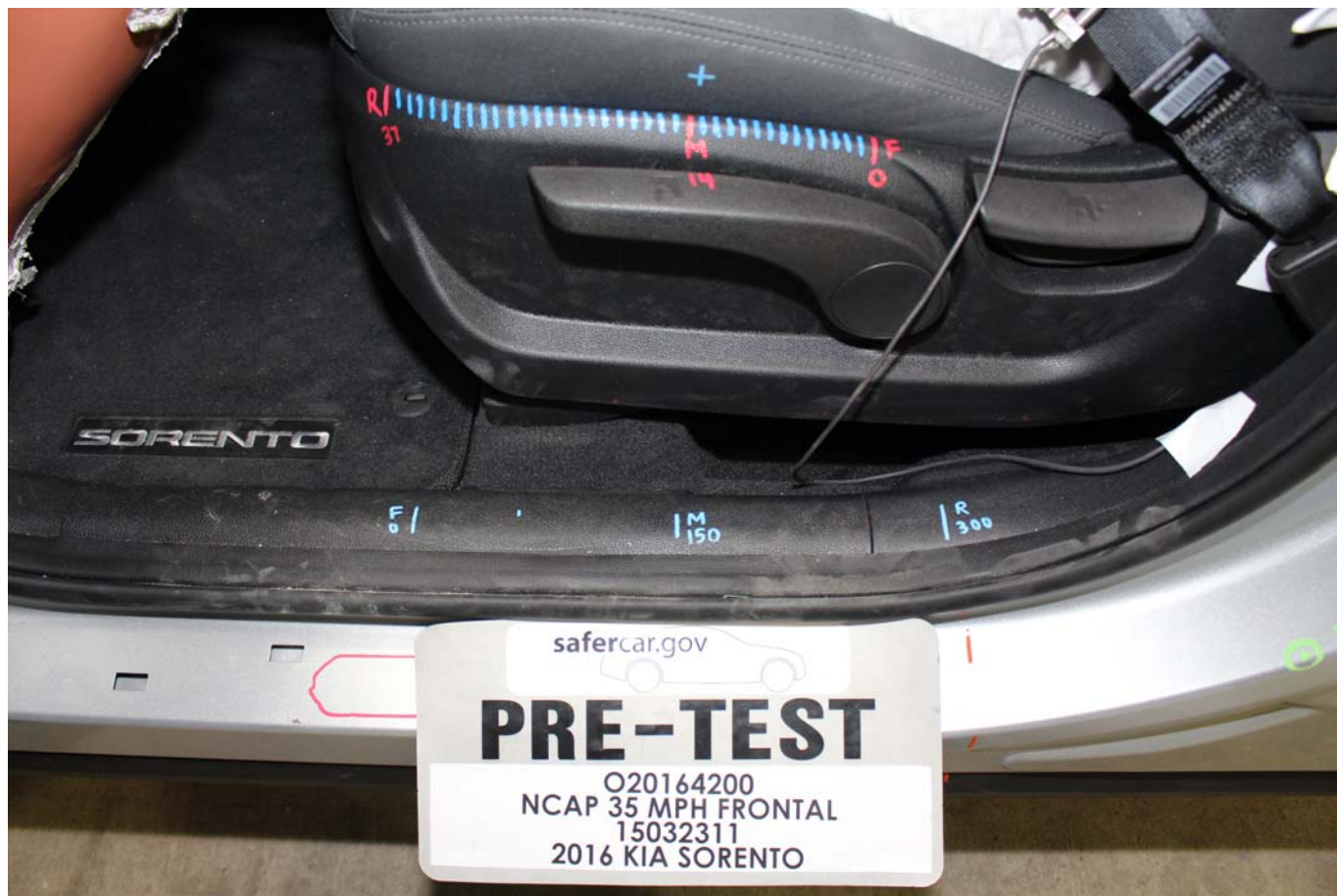


Photo No. 035. - Pre-Test Driver's Seat Fore-Aft Markings



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



Photo No. 037. - Pre-Test View of Belt Anchorage for Driver Dummy



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



Photo No. 039. - Pre-Test Driver Dummy Feet



Photo No. 040. - Post-Test Driver Dummy Feet



Photo No. 041. - Pre-Test Driver's Side Knee Bolster (without dummy)



Photo No. 042. - Post-Test Driver's Side Knee Bolster (without dummy)



Photo No. 043. - Pre-Test Driver's Side Floorpan



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



Photo No. 045. - Post-Test Driver Dummy Face



Photo No. 046. - Post-Test Driver Dummy Contact with Airbag



Photo No. 047. - Post-Test Driver Dummy Contact with Headrest



Photo No. 047a. - Post-Test Driver Dummy Contact with Knee Bolster



Photo No. 048. - Pre-Test View of the Steering Wheel



Photo No. 049. - Post-Test View of the Steering Wheel



Photo No. 050. - Pre-Test Passenger Dummy Front View

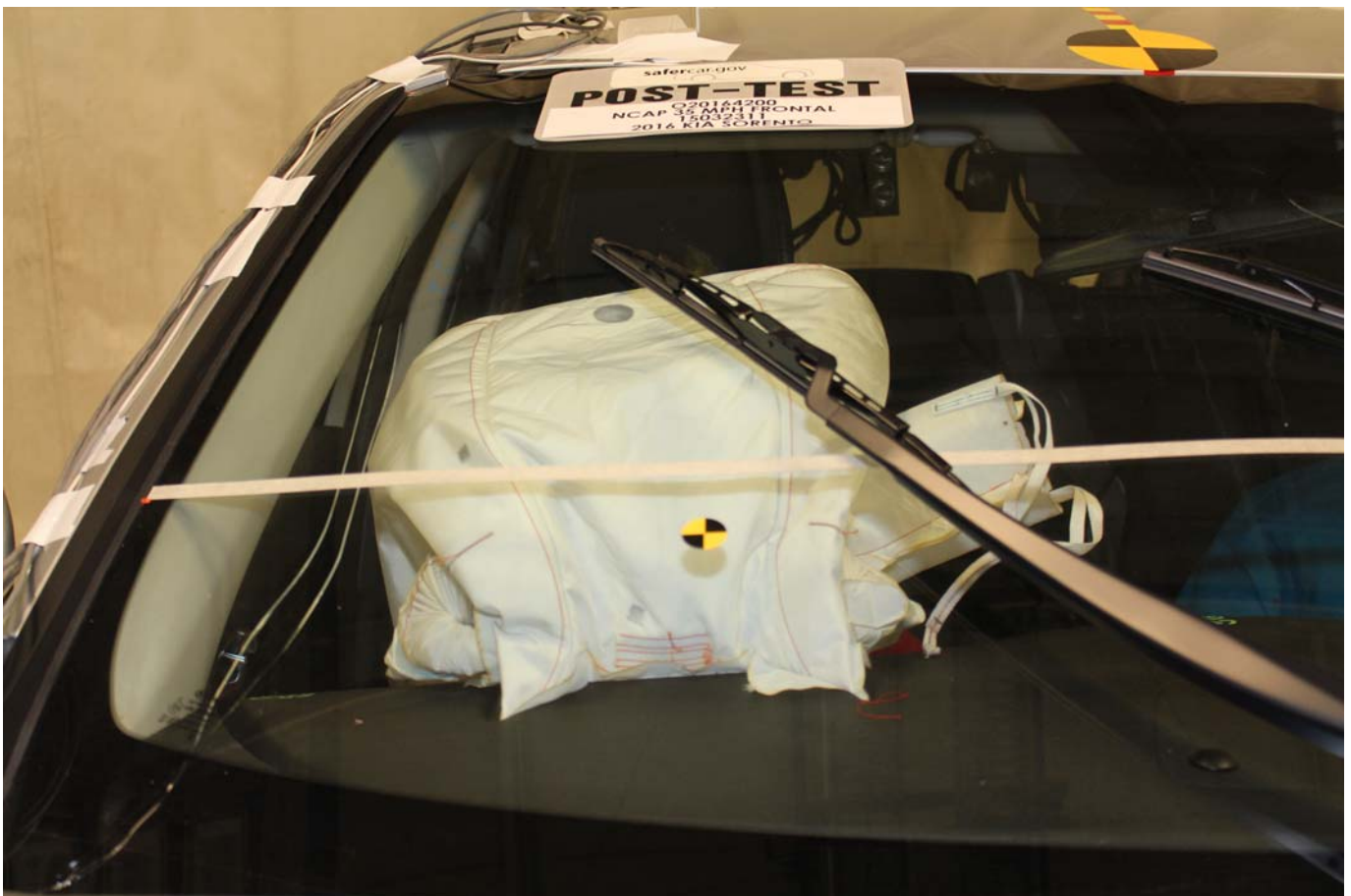


Photo No. 051. - Post-Test Passenger Dummy Front View



Photo No. 052. - Pre-Test Passenger Dummy Window View



Photo No. 053. - Post-Test Passenger Dummy Window View



Photo No. 054. - Pre-Test Passenger Dummy and Vehicle Interior (Door Open)



Photo No. 055. - Post-Test Passenger Dummy and Vehicle Interior (Door Open)



Photo No. 056. - Pre-Test Passenger's Seat Fore-Aft Markings



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



Photo No. 058. - Pre-Test View of Belt Anchorage for Passenger Dummy



Photo No. 059. - Post-Test View of Belt Anchorage for Passenger Dummy



Photo No. 060. - Pre-Test Passenger Dummy Feet



Photo No. 061. - Post-Test Passenger Dummy Feet



Photo No. 062. - Pre-Test Passenger's Side Knee Bolster (without dummy)



Photo No. 063. - Post-Test Passenger's Side Knee Bolster (without dummy)



Photo No. 064. - Pre-Test Passenger's Side Floorpan



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



Photo No. 066. - Post-Test Passenger Dummy Face



Photo No. 067. - Post-Test Passenger Dummy Contact with Airbag



Photo No. 068. - Post-Test Passenger Dummy Contact with Headrest



Photo No. 068a. - Post-Test Passenger Dummy Contact with Glovebox



Photo No. 069. - Ballast Installed in Vehicle

PHOTOGRAPH NOT AVAILABLE

Photo No. 070. - Post-Test Stoddard Solvent Spillage Location View



Photo No. 071. - Post-Test Speed Trap Read-Out



Photo No. 072. - Vehicle at 0 Degree on Static Rollover Device

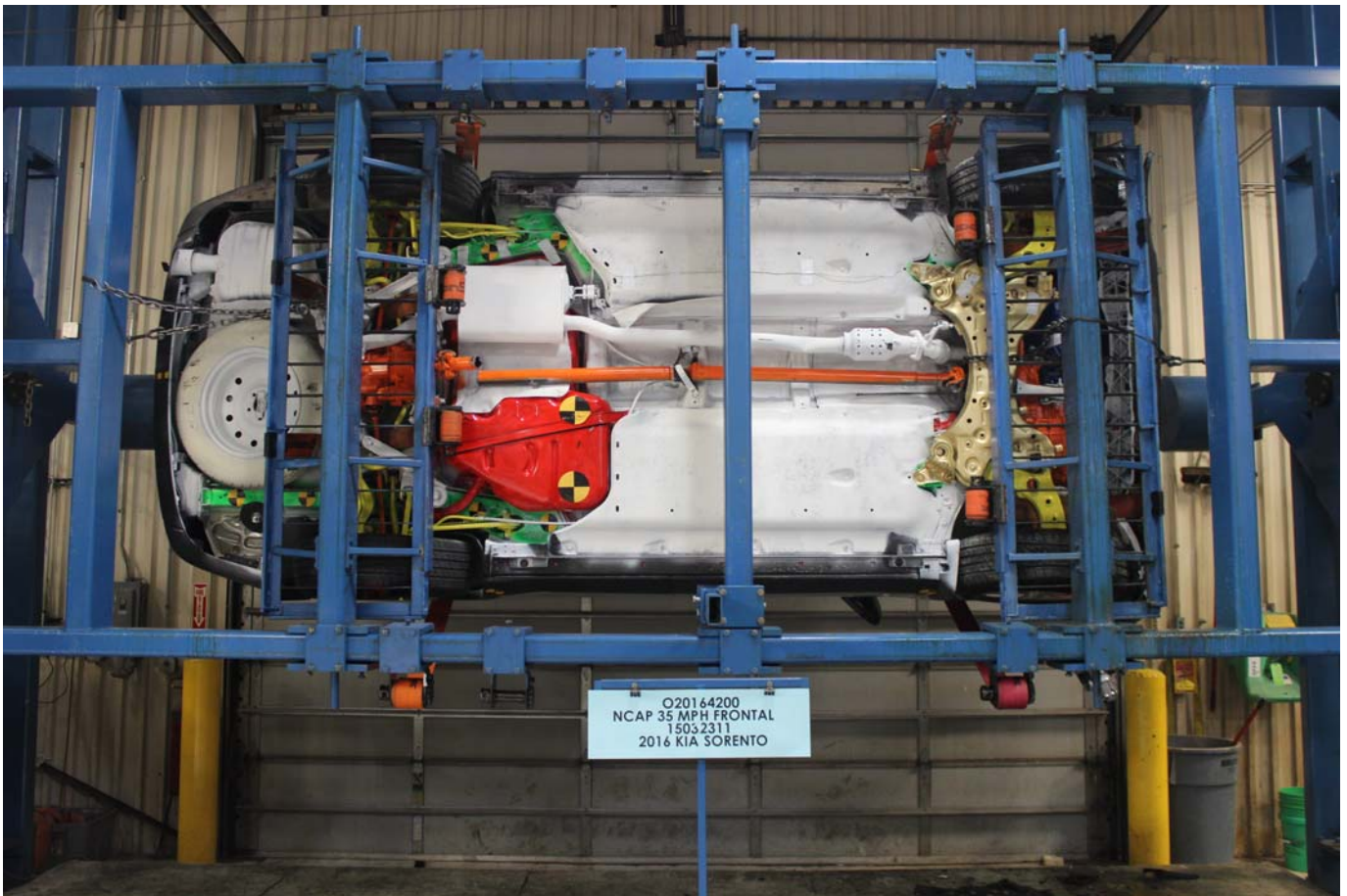


Photo No. 073. - Vehicle at 90 Degrees on Static Rollover Device

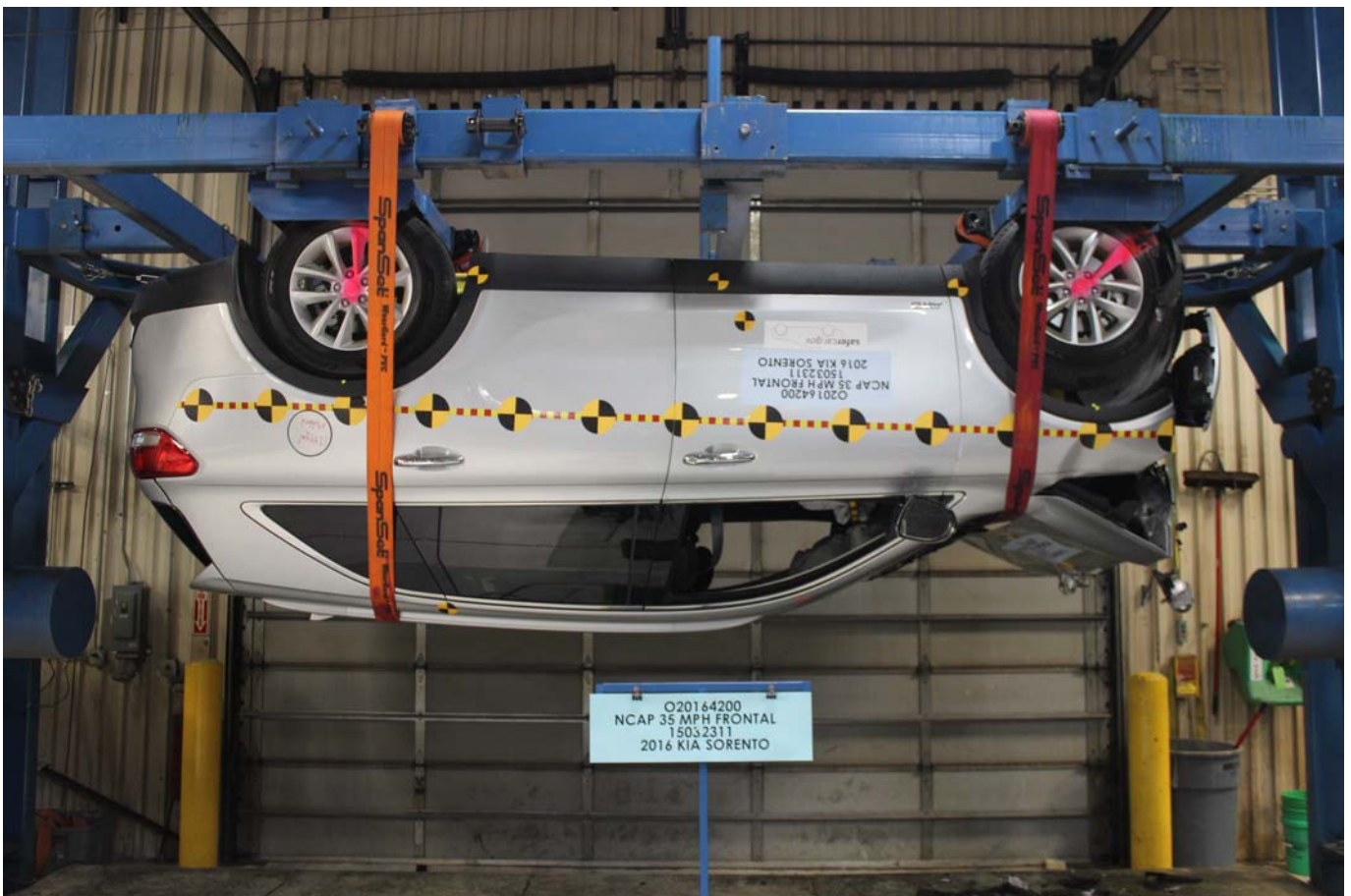


Photo No. 074. - Vehicle at 180 Degrees on Static Rollover Device



Photo No. 075. - Vehicle at 270 Degrees on Static Rollover Device



Photo No. 076. - Vehicle at 360 Degrees on Static Rollover Device



Photo No. 077. - 2016 Kia Sorento LX Frontal Impact Event

2016 KIA SORENTO LX AWD MODEL / OPTION CODE: 73422 / 010 EXTERIOR / INTERIOR: SPARKLING SILVER/BLK VEHICLE ID NUMBER: 5XYPGDA34GG013252 ENGINE NUMBER: G4KJFK01 PORT OF ENTRY: WEST POINT MODE OF TRANSPORT: TRUCK	SOLD TO: W1028 METRO KIA OF MADISON 5442 WAYNE TERRACE MADISON WI 53718 SHIP TO: W1028 <i>144 miles</i>	
STANDARD FEATURES MECHANICAL 2.4L GDI 4-Cylinder Engine 6-Speed Automatic Transmission w/ Sportmatic Independent Front and Rear Suspension Alloy Wheels Full-Time AWD w/ Lockable Center Differential SAFETY Dual Front Advanced Airbags Front Seat-Mounted Side Airbags Side Curtain Airbags (1st & 2nd Row) Lower Anchors and Tethers for Children (LATCH) Anti-Lock Braking System (ABS) Traction Control System (TCS) Electronic Stability Control (ESC) Hill-start Assist Control (HAC) Tire Pressure Monitoring System (TPMS) INTERIOR, COMFORT & CONVENIENCE Air Conditioning Power Windows, Door Locks & Outside Mirrors AM/FM/CD/MP3 Audio System UVO eServices Telematics w/ Rear Camera Display SIRIUSXM® Satellite Radio w/free 3-mo. subscription* Rapid Charge USB Ports / Auxiliary Input Jack Bluetooth® Wireless Technology YES Essentials Seat Fabric Material 40/20/40 Split Folding 2nd Row Seats Rear Center Armrest with Cupholders Remote Keyless Entry Cruise Control Steering Wheel Controls (Bluetooth/Audio/Cruise) Tilt and Telescopic Steering Column Dual Illuminated Visor Vanity Mirrors Drive Mode Select (DMS) EXTERIOR Heated Outside Mirrors w/ Turn Signal Indicators Privacy Glass Roof Rails WARRANTY 10 Year/100,000 Mile Limited Powertrain Warranty 5 Year/60,000 Mile Limited Basic Warranty 5 Year/60,000 Mile Roadside Assistance *Ask dealer for details	MANUFACTURER'S SUGGESTED RETAIL PRICE ▶ \$28,000.00 ADDITIONAL INSTALLED EQUIPMENT: (In addition to or in place of standard features) Carpeted Floor Mats \$130.00 Mud Guards \$95.00 MSRP INCLUDING OPTIONS \$28,225.00 INLAND FREIGHT AND HANDLING \$895.00 TOTAL MANUFACTURER'S SUGGESTED RETAIL PRICE ▶ \$29,120.00	Fuel Economy and Environment Fuel Economy 23 MPG combined city/hwy 4.3 gallons per 100 miles SMALL SUVs range from 17 to 33 MPG. The best vehicle rates 11.9 MPG. You spend \$750 more in fuel costs over 5 years compared to the average new vehicle. Annual fuel cost \$1950 Fuel Economy & Greenhouse Gas Rating (tailpipe only) 5 This vehicle emits 395 grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also cause emissions. Learn more at fuel-economy.gov GOVERNMENT 5-STAR SAFETY RATINGS This vehicle has not been rated by the government for overall vehicle score, frontal crash, side crash or rollover risk. PARTS CONTENT INFORMATION FOR VEHICLES IN THIS CAR LINE U.S./CANADIAN PARTS CONTENT: 53% MAJOR SOURCES OF FOREIGN PARTS: KOREA: 47% NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS. FOR THIS VEHICLE FINAL ASSEMBLY POINT: USA COUNTRY OF ORIGIN: USA ENGINE: USA TRANSMISSION: USA
TOTAL ADDITIONAL WEIGHT:		

Photo No. 078. - Monroney Label Photograph

APPENDIX B
DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

Page No.

List of Data Plots Provided in the Test Report

Figure No. 1.	Driver Head X Acceleration vs. Time	B-1
Figure No. 2.	Driver Head Y Acceleration vs. Time	B-1
Figure No. 3.	Driver Head Z Acceleration vs. Time	B-1
Figure No. 4.	Driver Head Resultant Acceleration vs. Time	B-1
Figure No. 5.	Driver Chest Displacement vs. Time	B-2
Figure No. 6.	Driver Chest X Acceleration vs. Time	B-3
Figure No. 7.	Driver Chest Y Acceleration vs. Time	B-3
Figure No. 8.	Driver Chest Z Acceleration vs. Time	B-3
Figure No. 9.	Driver Chest Resultant Acceleration vs. Time	B-3
Figure No. 10.	Driver Neck Force X vs. Time	B-4
Figure No. 11.	Driver Neck Force Z vs. Time	B-4
Figure No. 12.	Driver Neck Moment Y vs. Time	B-4
Figure No. 13.	Driver Nij (NTF) vs. Time	B-5
Figure No. 14.	Driver Nij (NTE) vs. Time	B-5
Figure No. 15.	Driver Nij (NCF) vs. Time	B-5
Figure No. 16.	Driver Nij (NCE) vs. Time	B-5
Figure No. 17.	Driver Left Femur Force vs. Time	B-6
Figure No. 18.	Driver Right Femur Force vs. Time	B-6
Figure No. 19.	Passenger Head X Acceleration vs. Time	B-7
Figure No. 20.	Passenger Head Y Acceleration vs. Time	B-7
Figure No. 21.	Passenger Head Z Acceleration vs. Time	B-7
Figure No. 22.	Passenger Head Resultant Acceleration vs. Time	B-7
Figure No. 23.	Passenger Chest Displacement vs. Time	B-8
Figure No. 24.	Passenger Chest X Acceleration vs. Time	B-9
Figure No. 25.	Passenger Chest Y Acceleration vs. Time	B-9
Figure No. 26.	Passenger Chest Z Acceleration vs. Time	B-9
Figure No. 27.	Passenger Chest Resultant Z Acceleration vs. Time	B-9

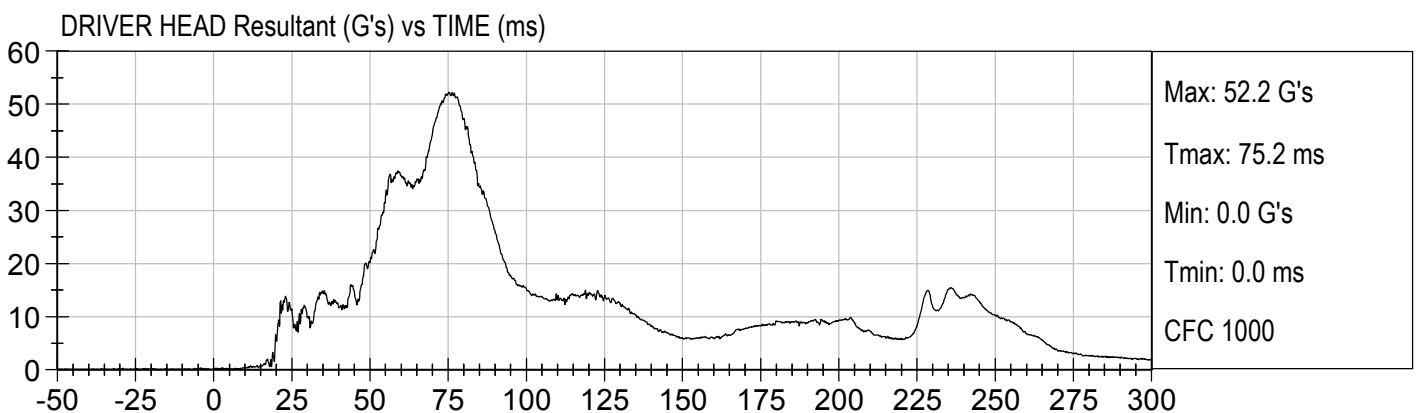
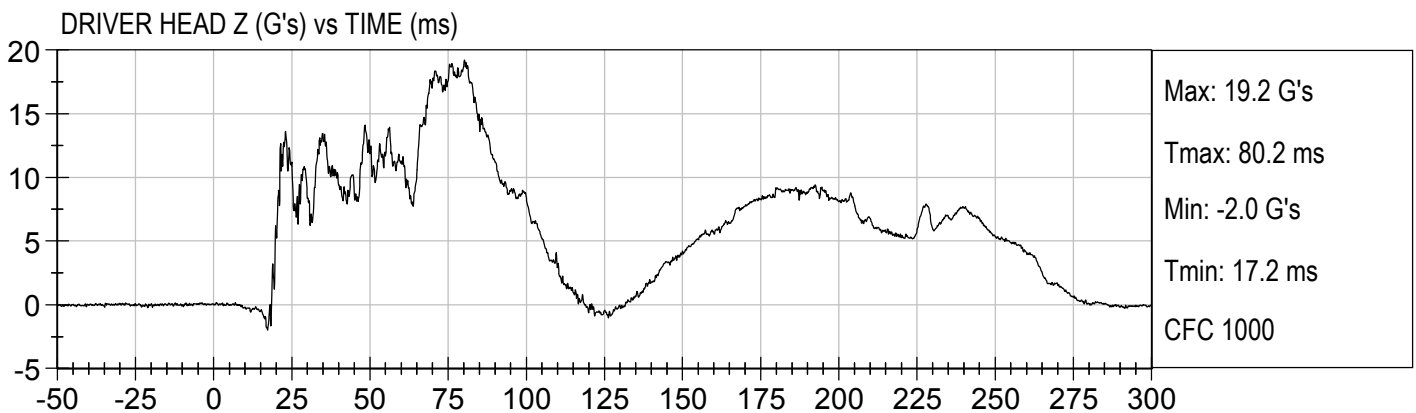
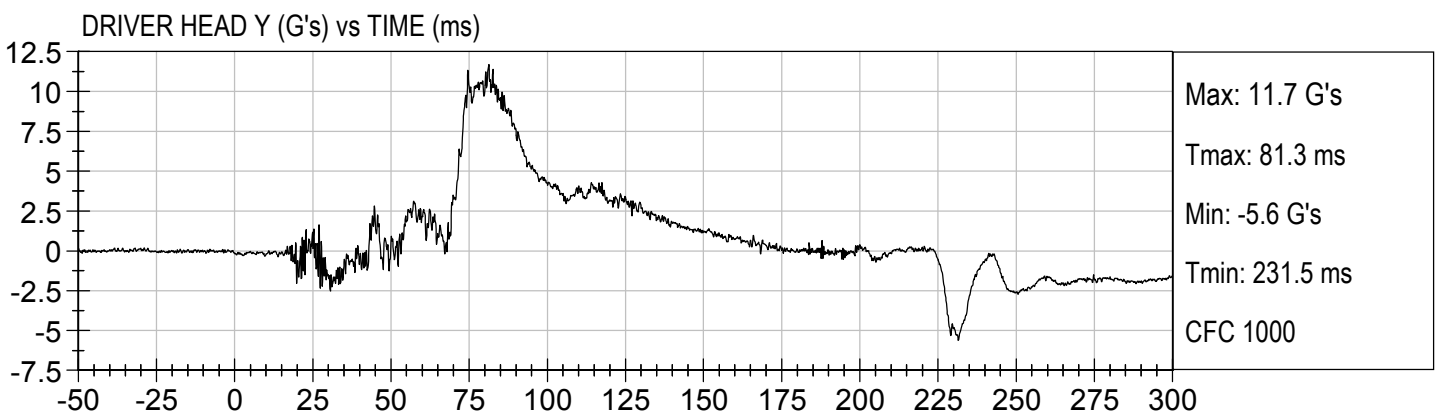
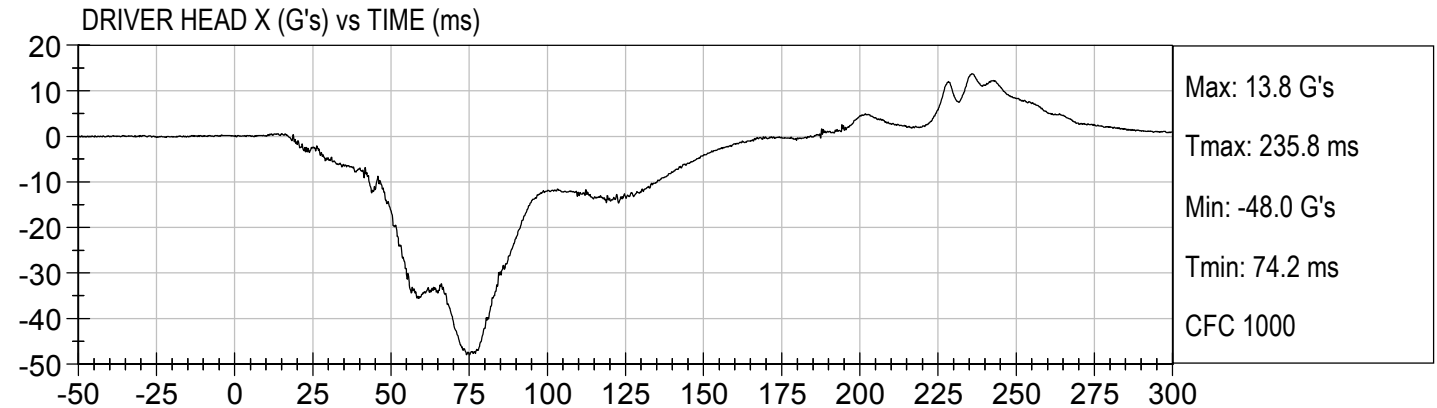
	<u>Page No.</u>
Figure No. 28. Passenger Neck Force X vs. Time	B-10
Figure No. 29. Passenger Neck Force Z vs. Time	B-10
Figure No. 30. Passenger Neck Moment Y vs. Time	B-10
Figure No. 31. Passenger Nij (NTF) vs. Time	B-11
Figure No. 32. Passenger Nij (NTE) vs. Time	B-11
Figure No. 33. Passenger Nij (NCF) vs. Time	B-11
Figure No. 34. Passenger Nij (NCE) vs. Time	B-11
Figure No. 35. Passenger Left Femur Force vs. Time	B-12
Figure No. 36. Passenger Right Femur Force vs. Time	B-12

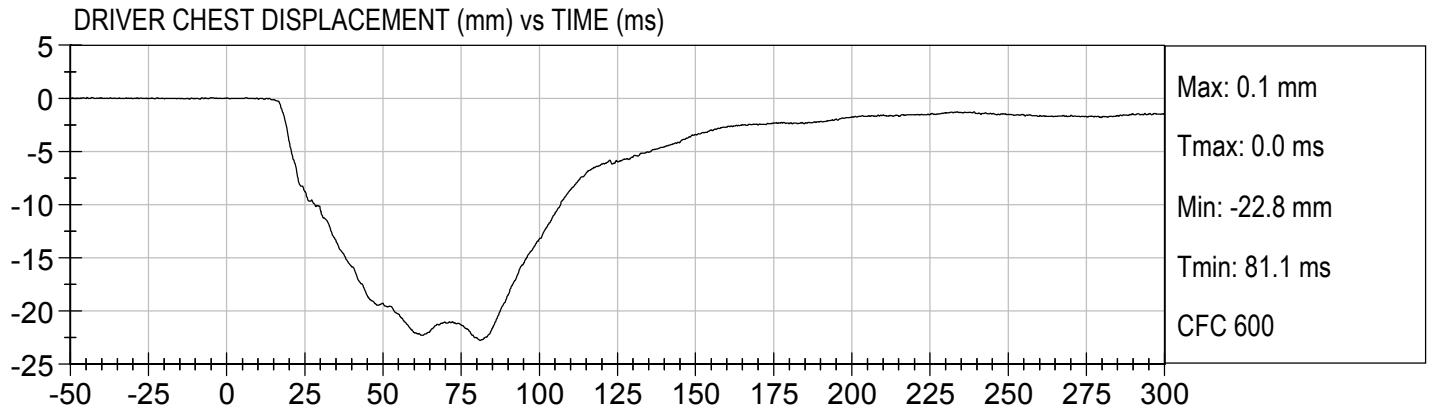
The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

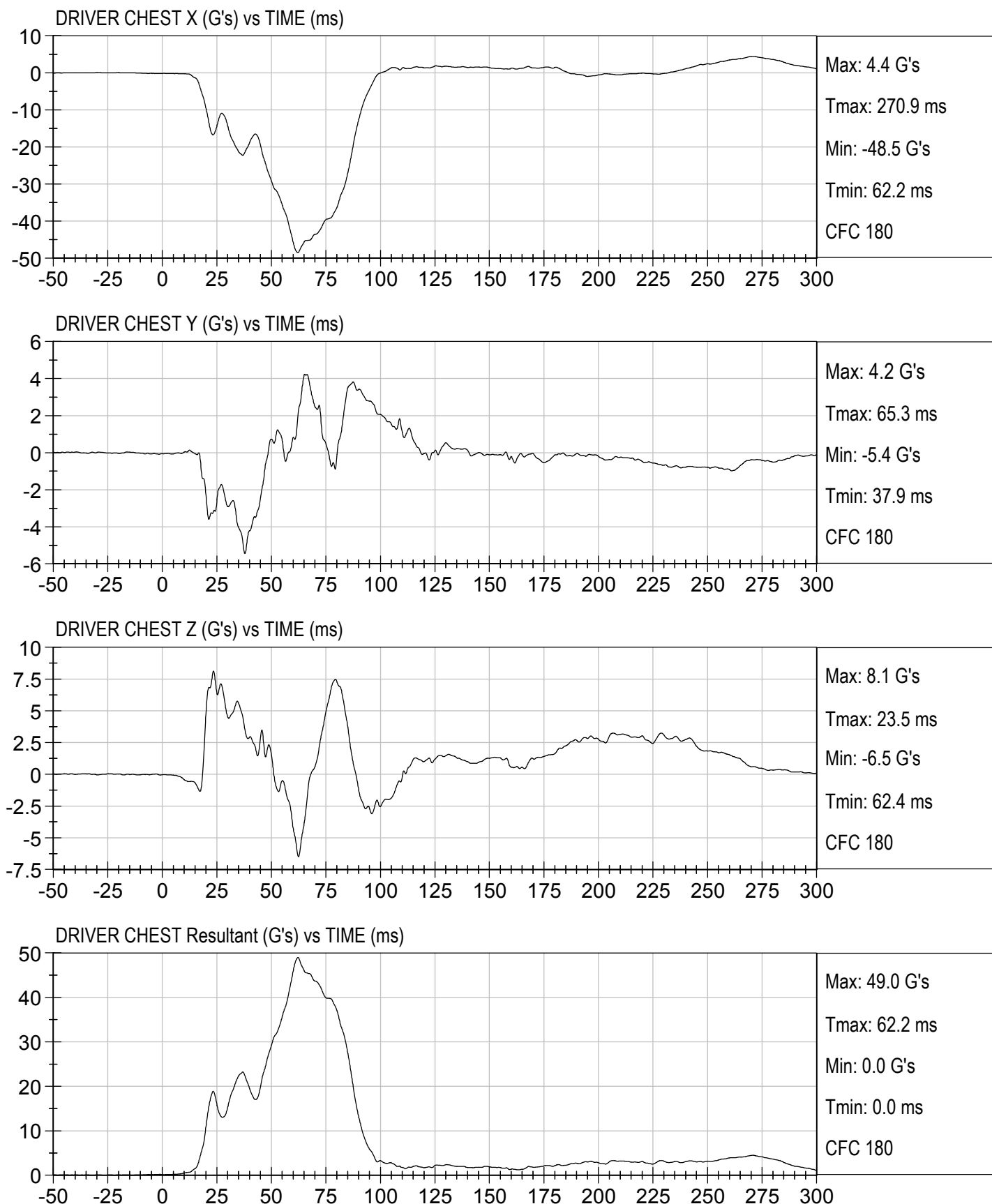
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 Driver Head Y Redundant
 Driver Head Z Redundant
 Driver Upper Neck Force Y
 Driver Upper Neck Moment X
 Driver Upper Neck Moment Z
 Driver Chest X Redundant
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 Driver Chest Z Redundant
 Driver Pelvis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

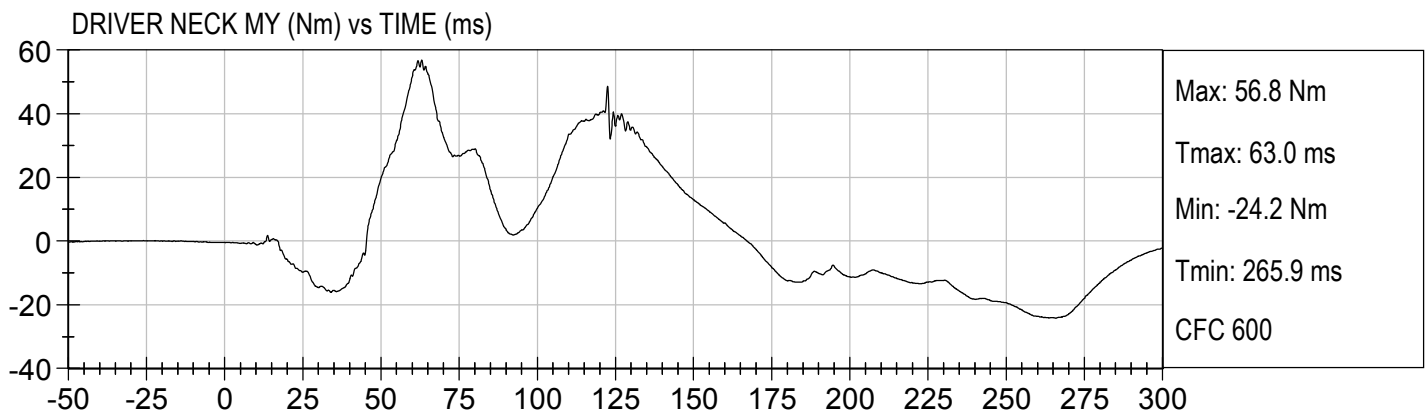
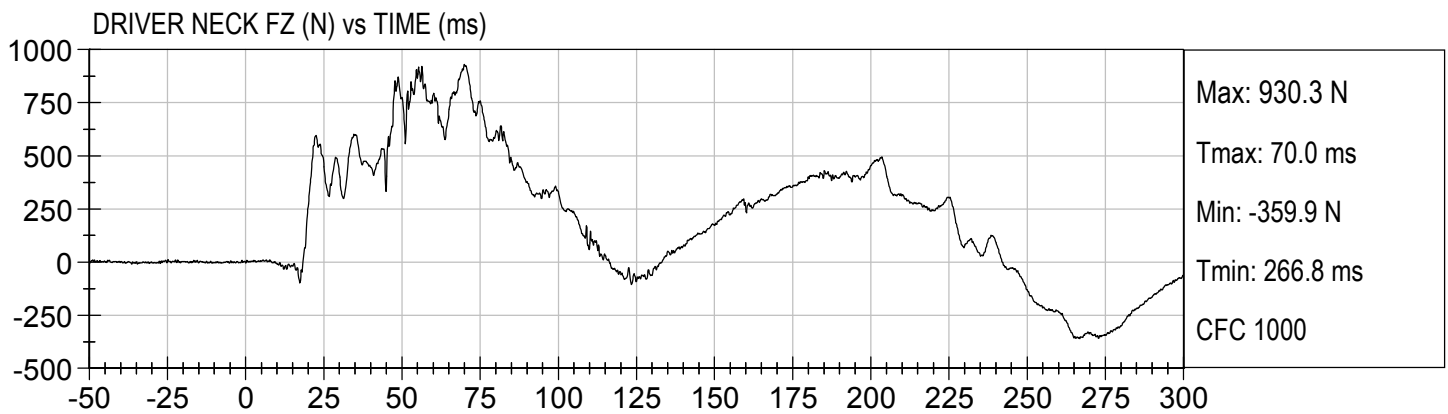
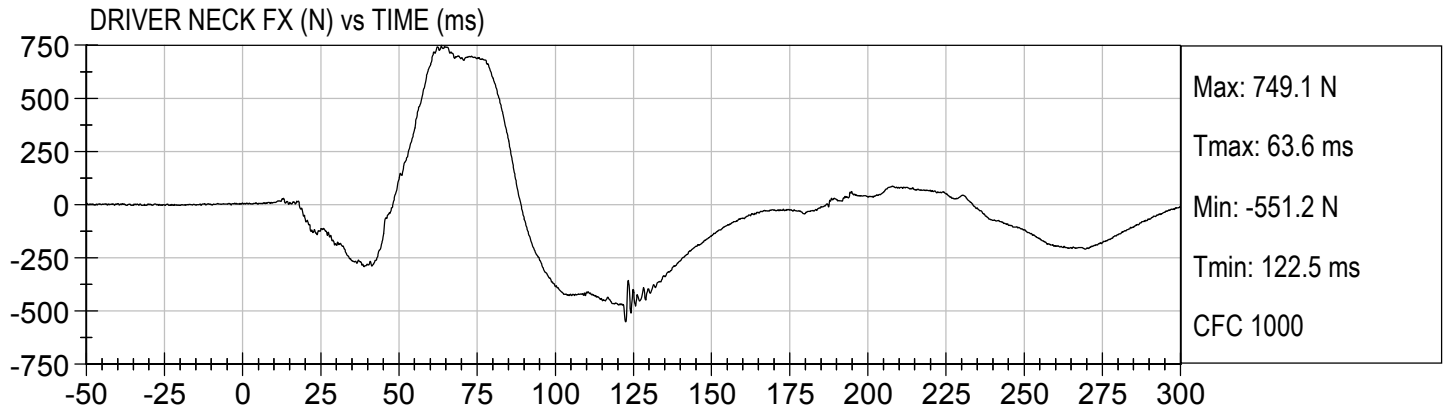
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Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Right Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z
Driver Lap Belt Force
Driver Shoulder Belt Force
Passenger Head X Redundant
Passenger Head Y Redundant
Passenger Head Z Redundant
Passenger Head Angular Velocity X
Passenger Head Angular Velocity Y
Passenger Head Angular Velocity Z
Passenger Upper Neck Force Y
Passenger Upper Neck Moment X
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Passenger Chest Z Redundant
Passenger Pelvis X
Passenger Pelvis Y
Passenger Pelvis Z

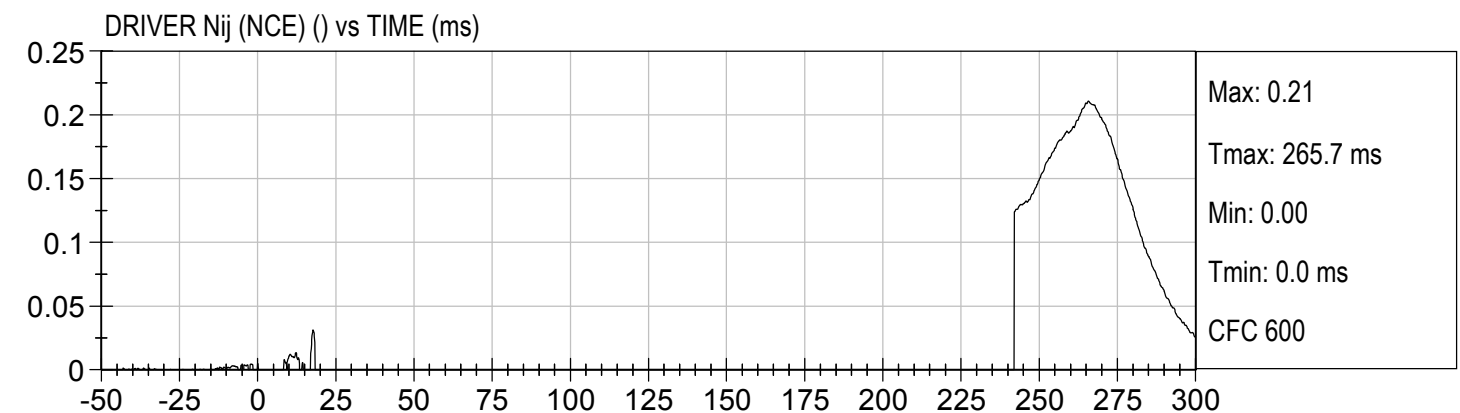
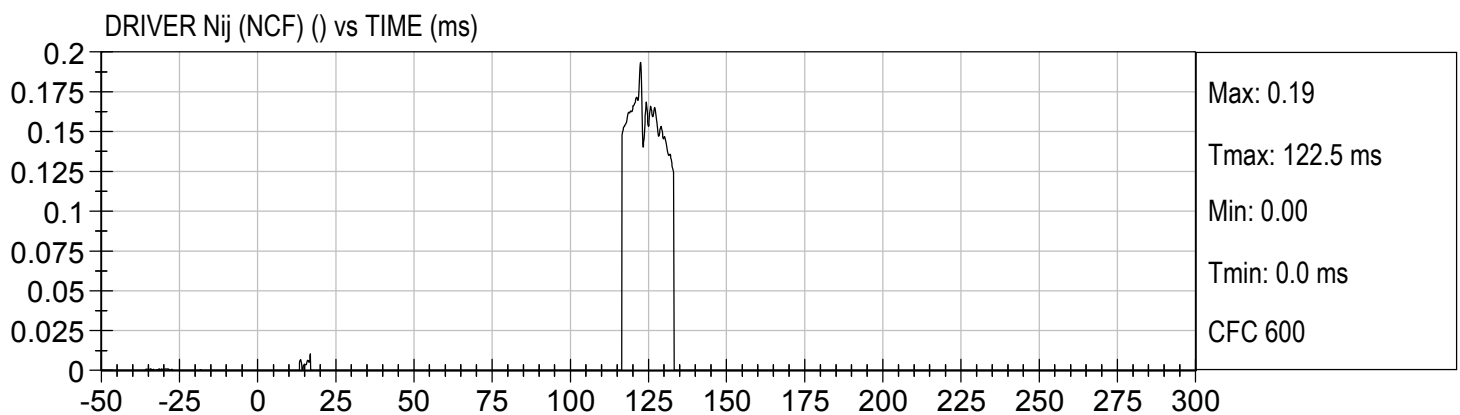
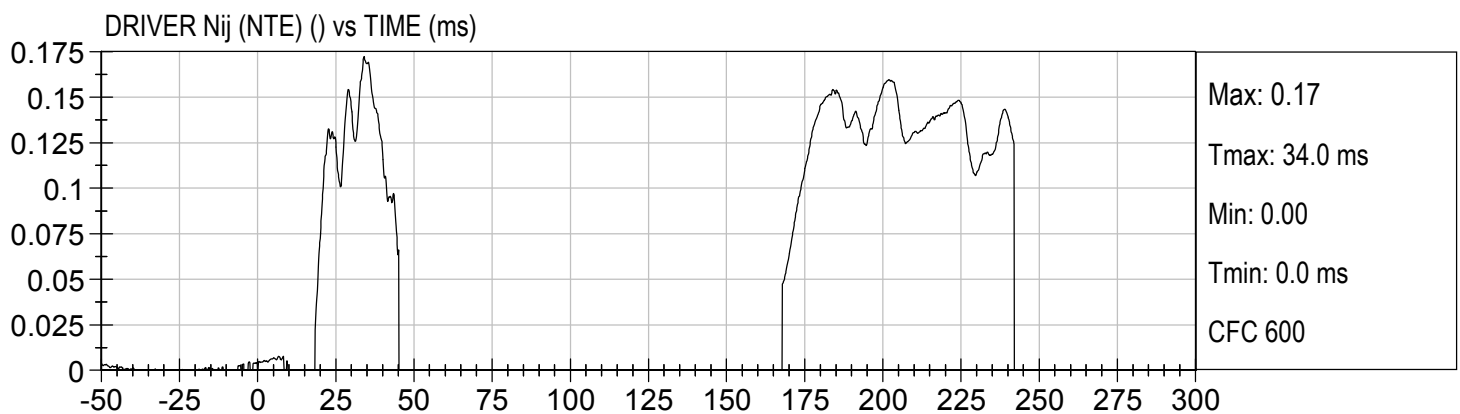
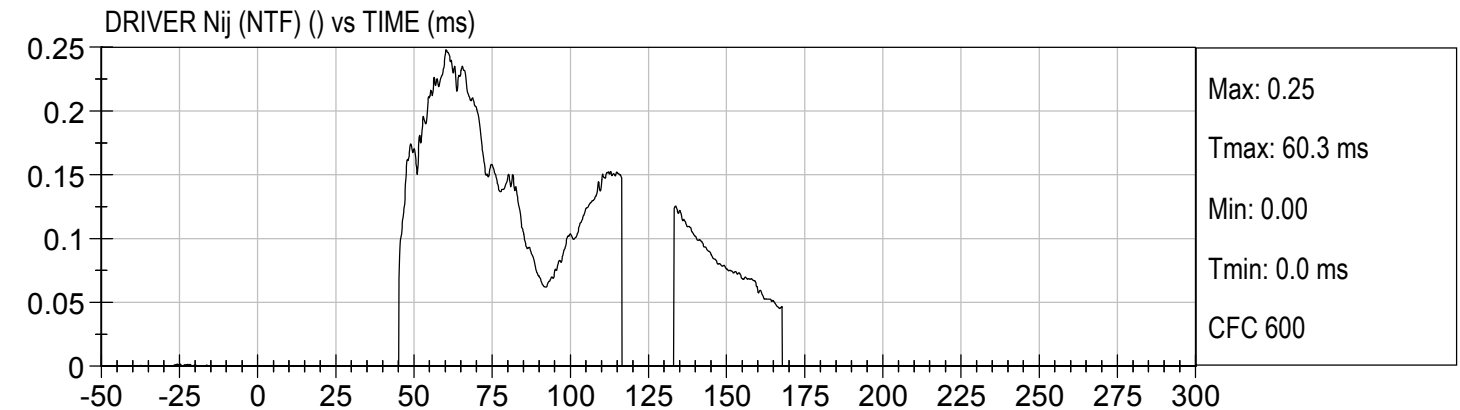
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Passenger Left Upper Tibia Moment Y
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Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right 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

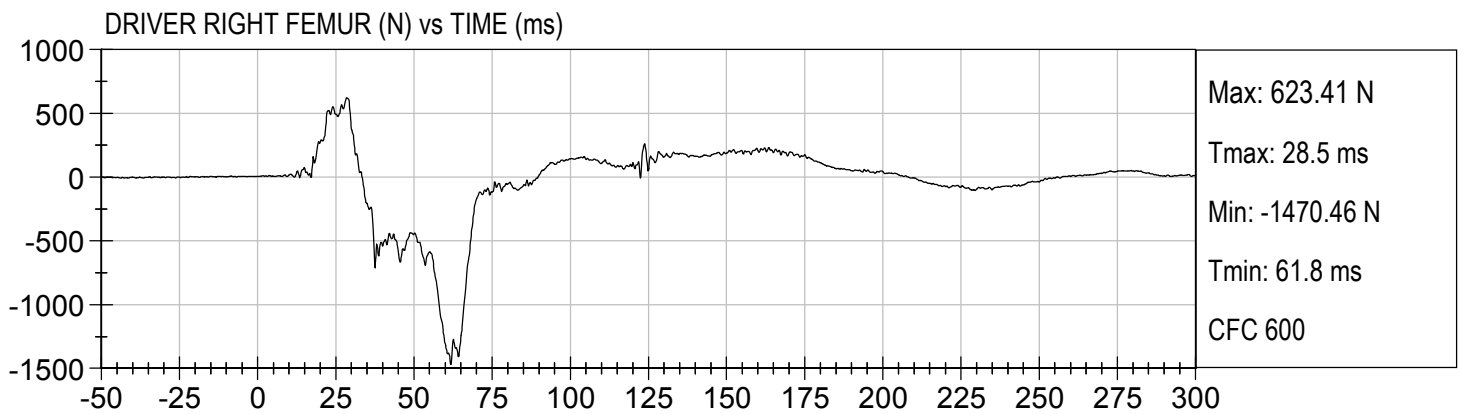
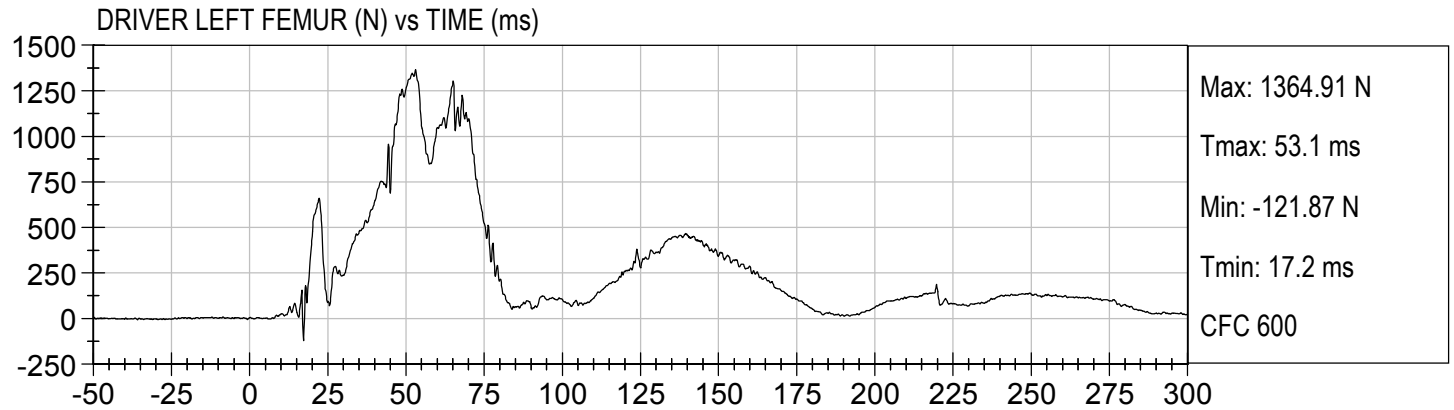




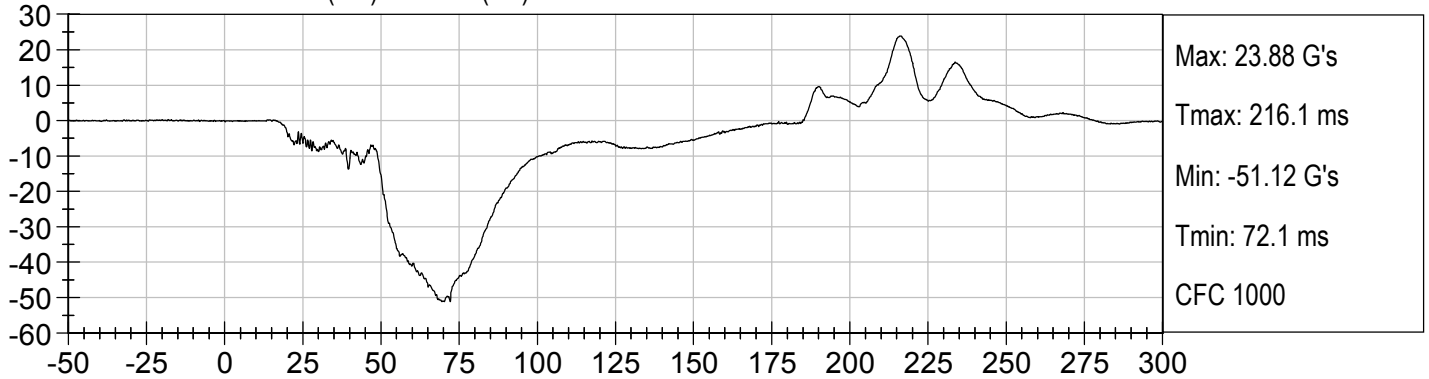




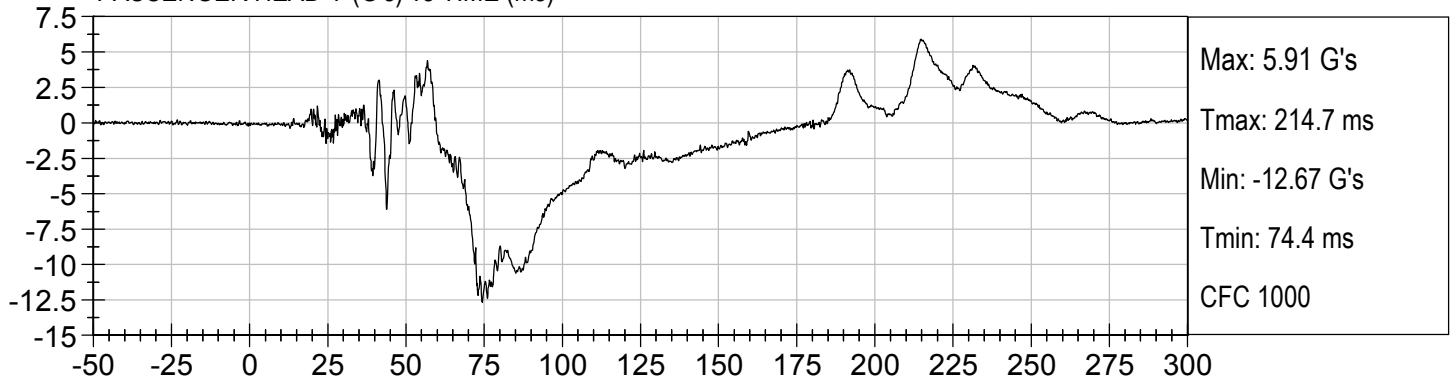




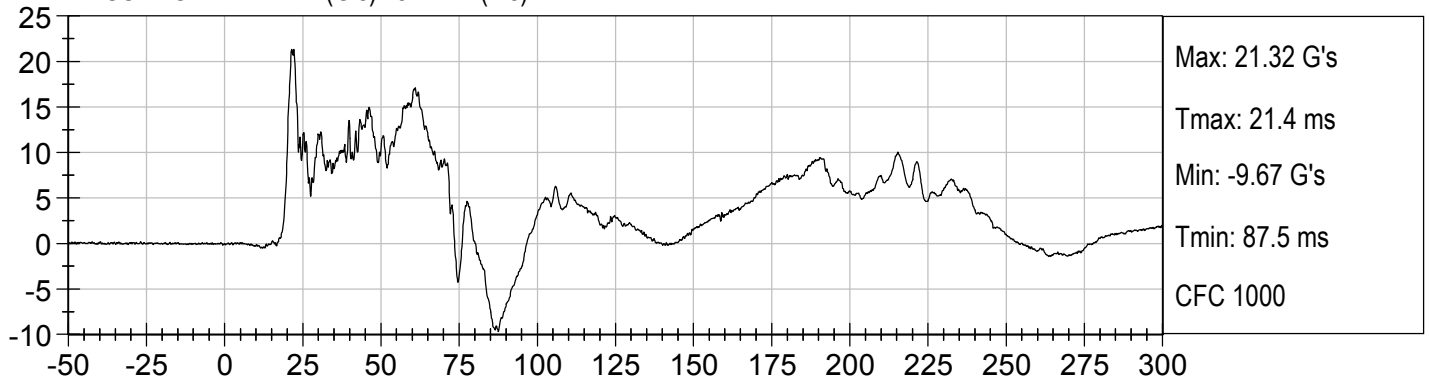
PASSENGER HEAD X (G's) vs TIME (ms)



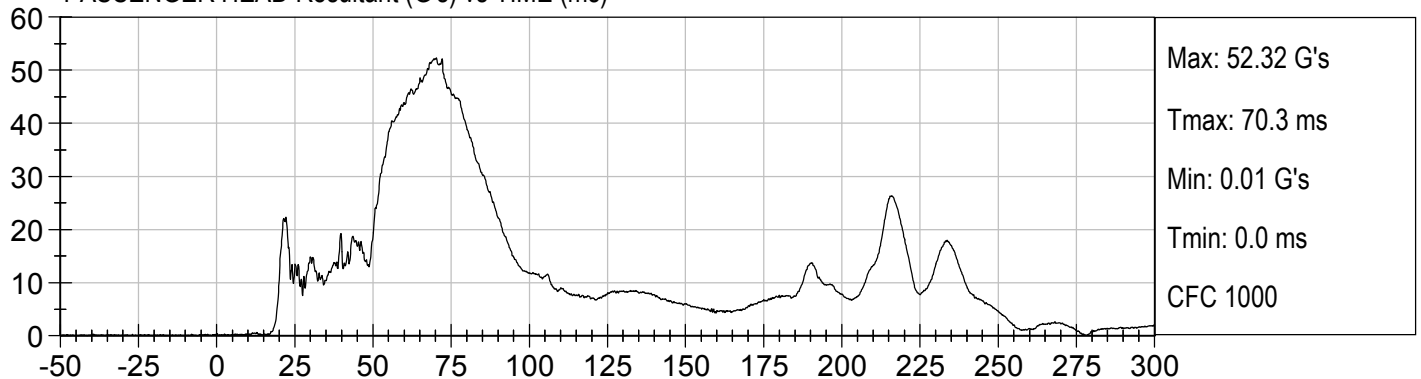
PASSENGER HEAD Y (G's) vs TIME (ms)

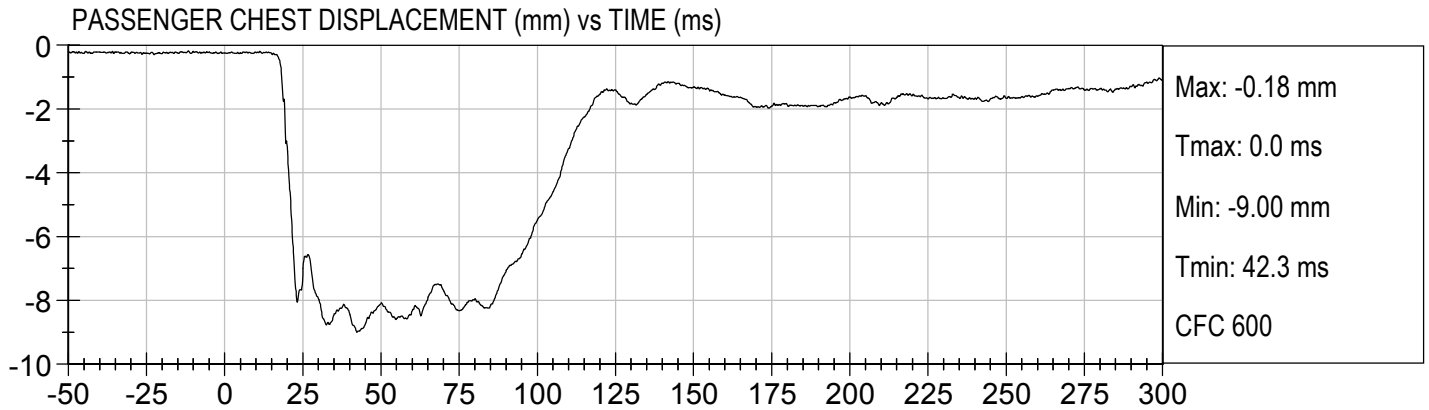


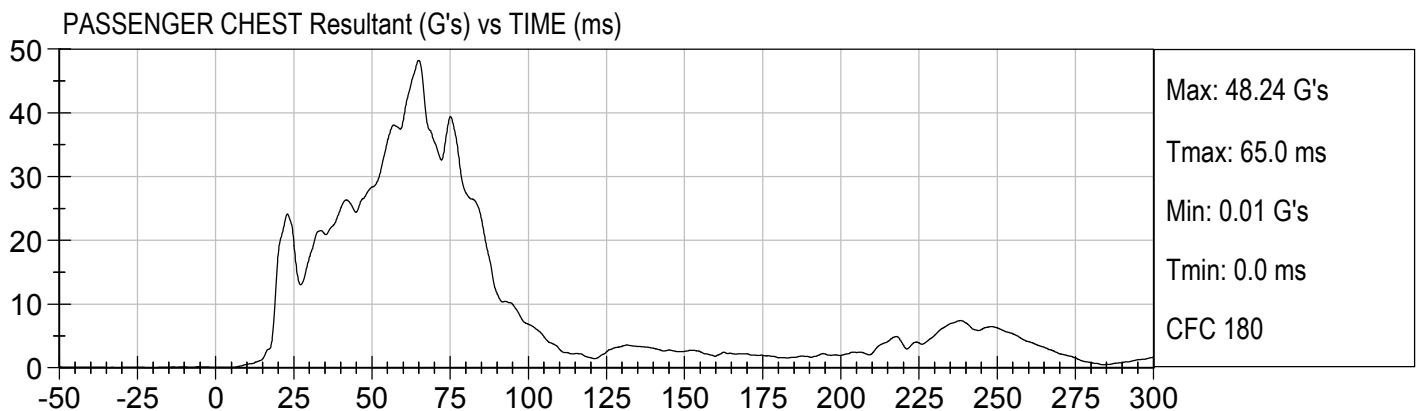
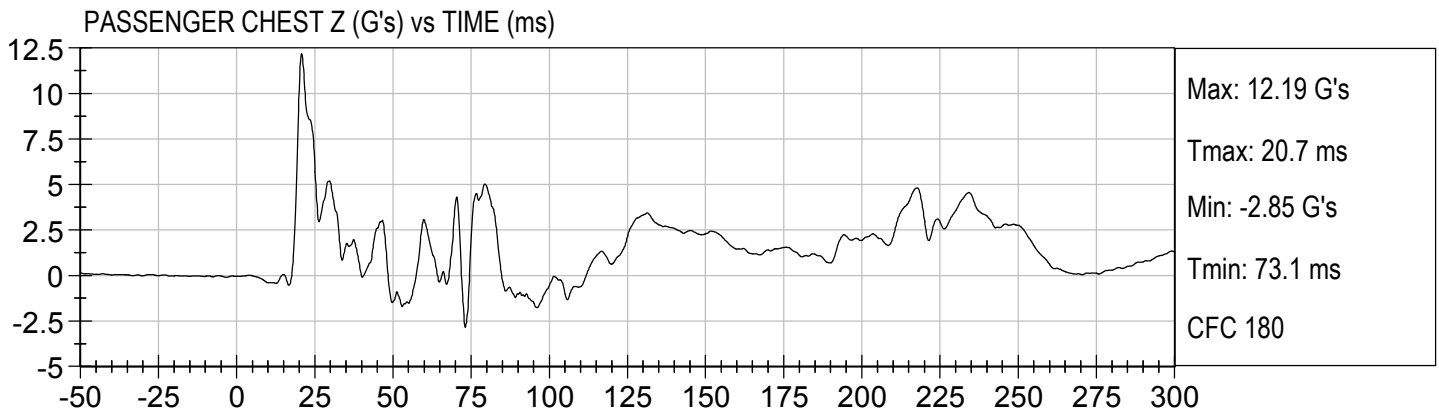
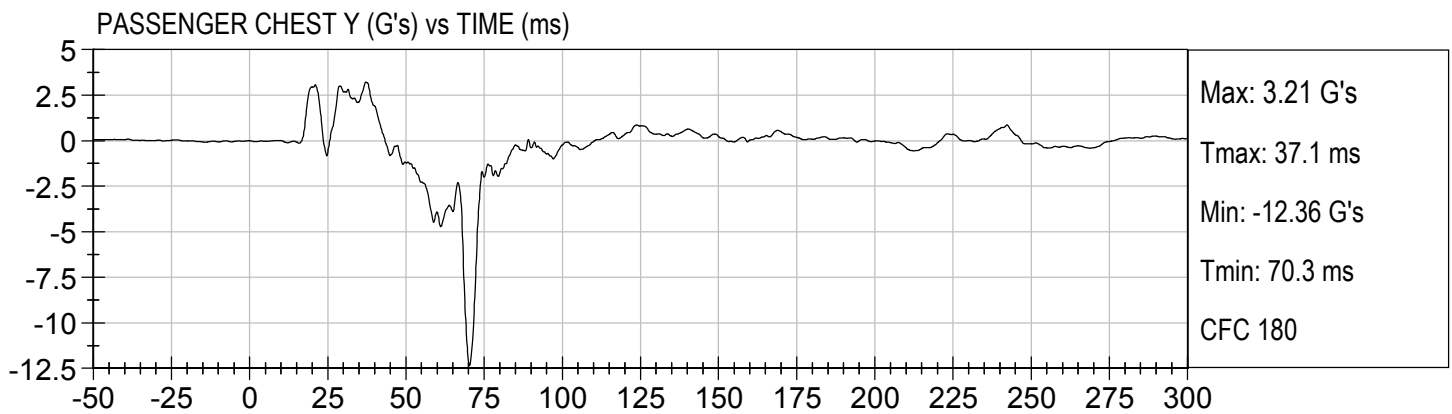
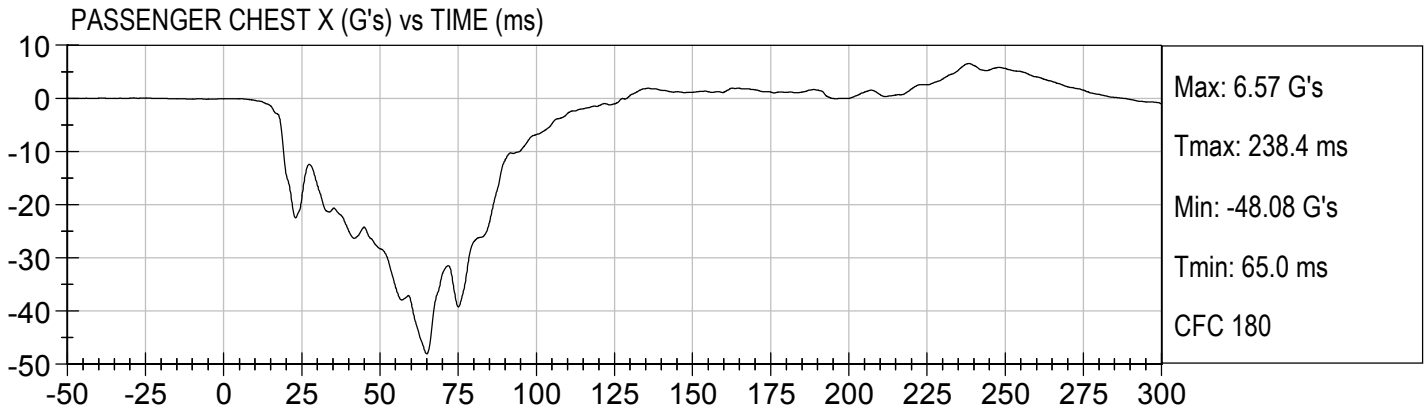
PASSENGER HEAD Z (G's) vs TIME (ms)

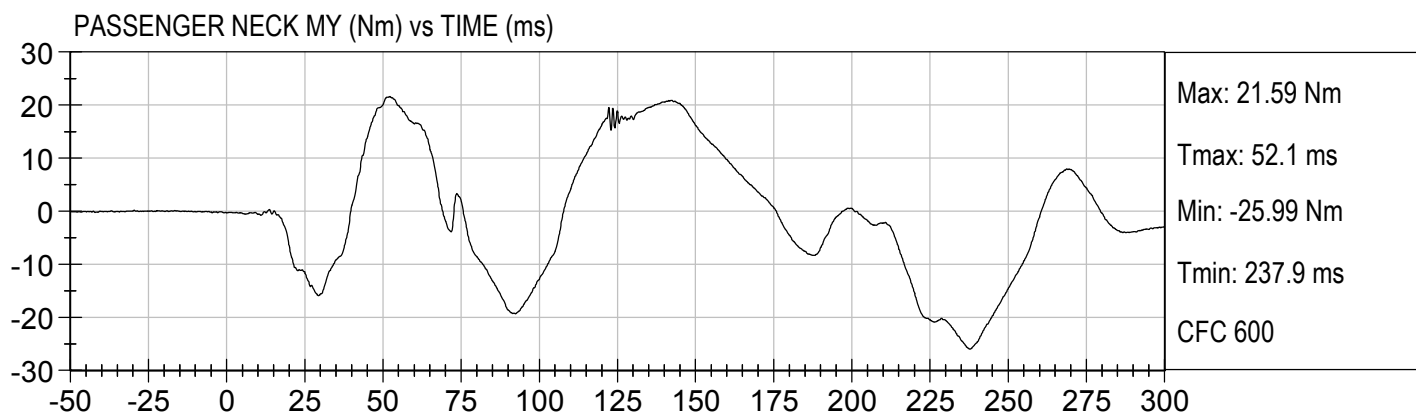
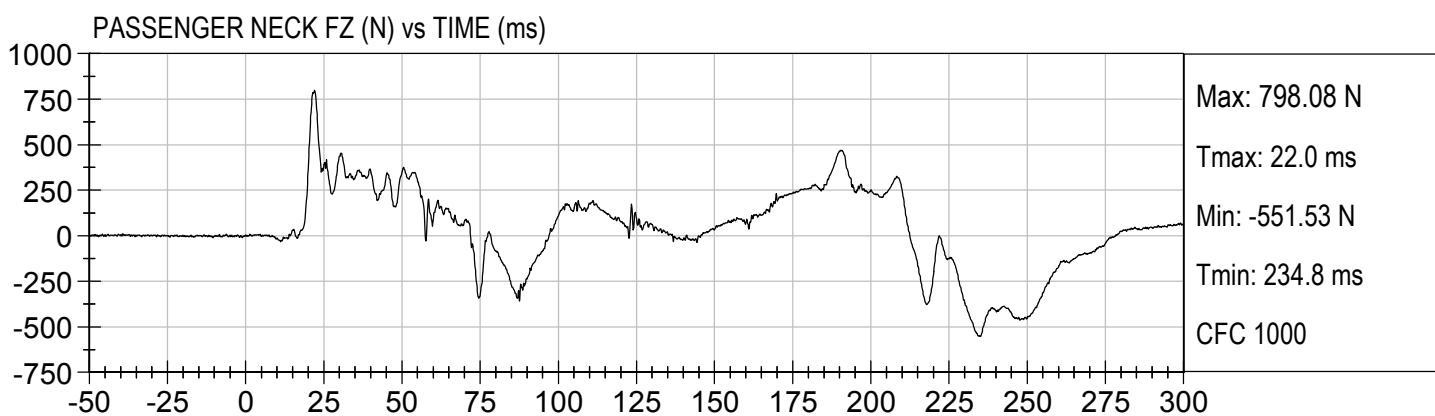
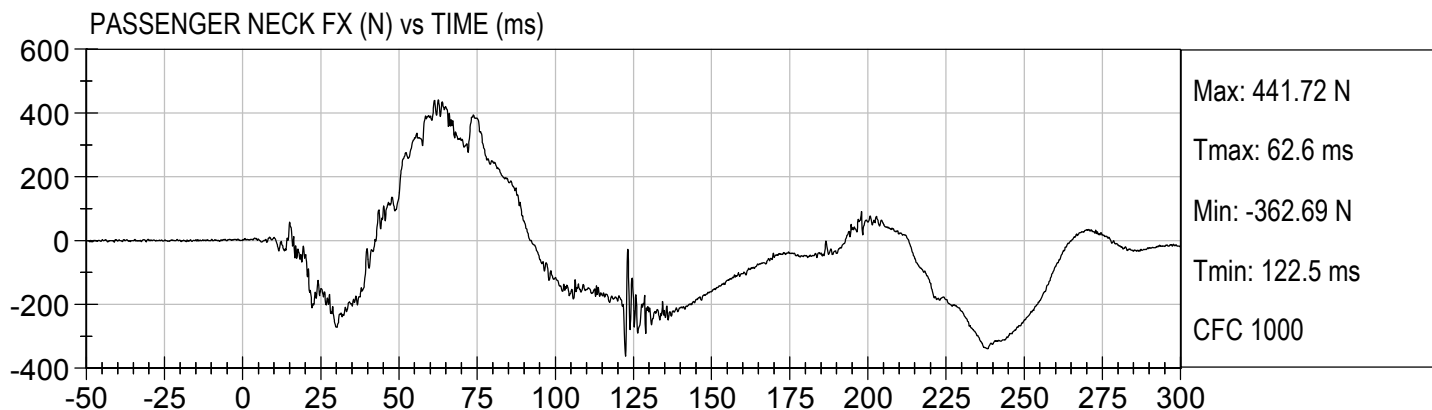


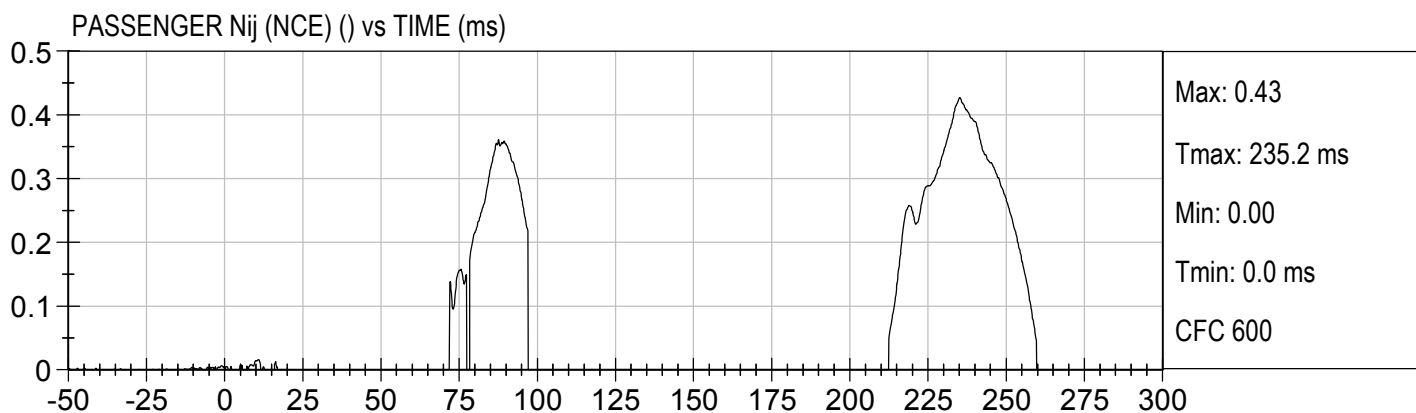
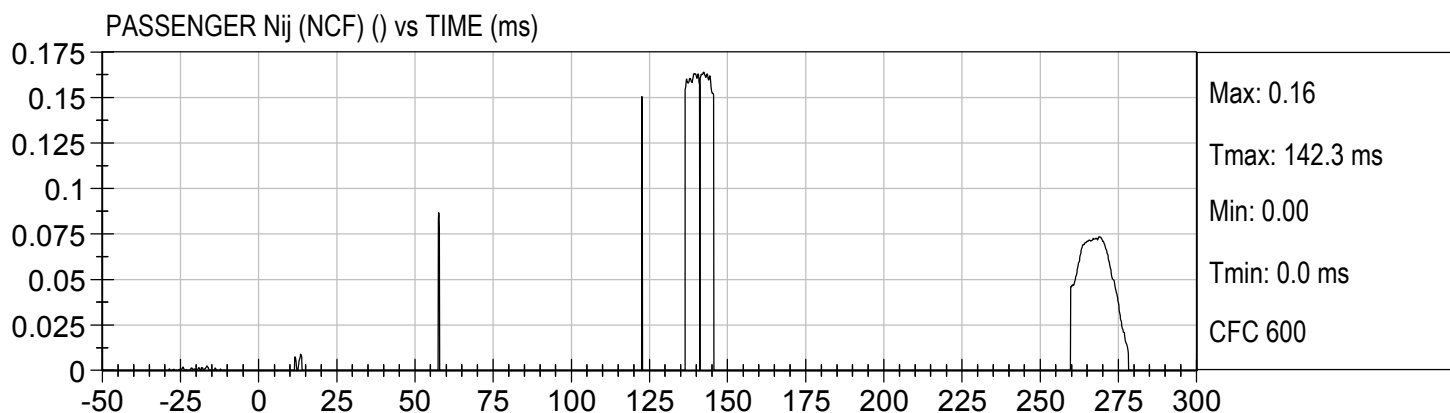
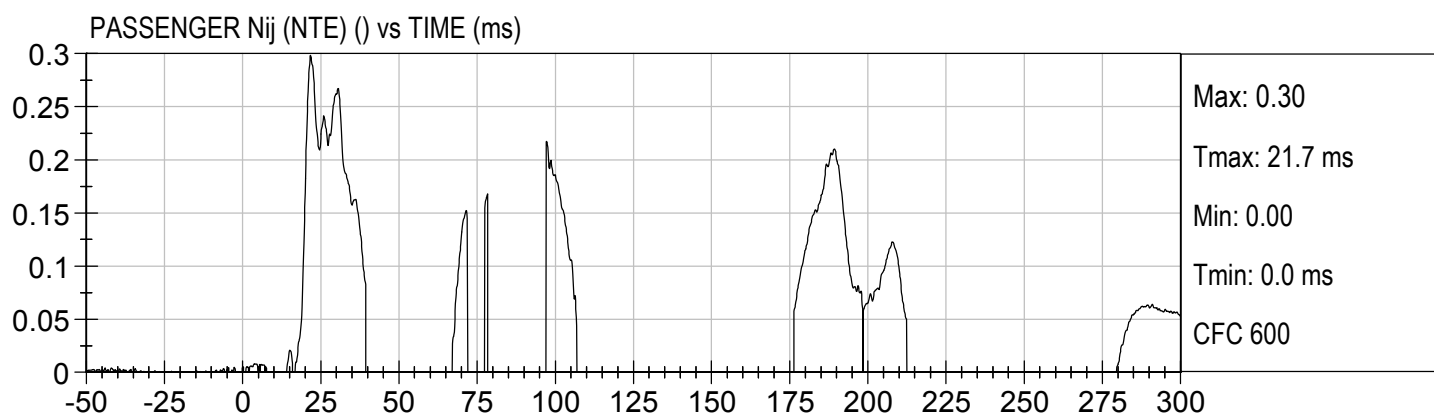
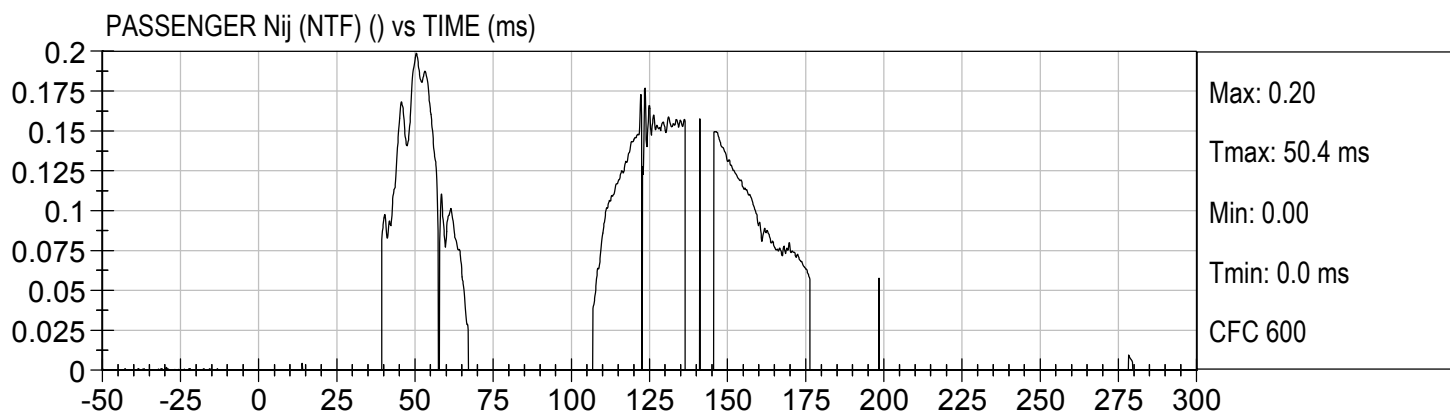
PASSENGER HEAD Resultant (G's) vs TIME (ms)



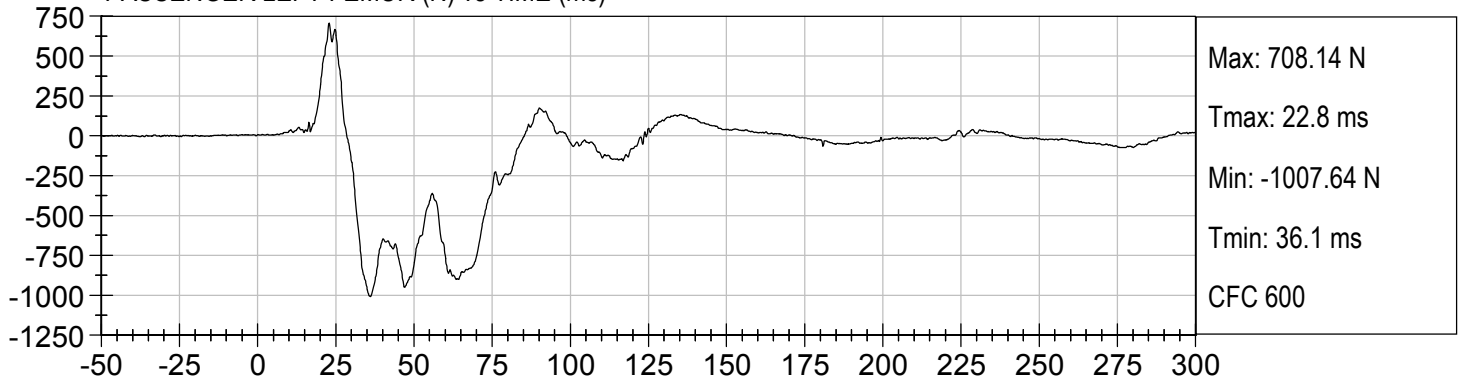




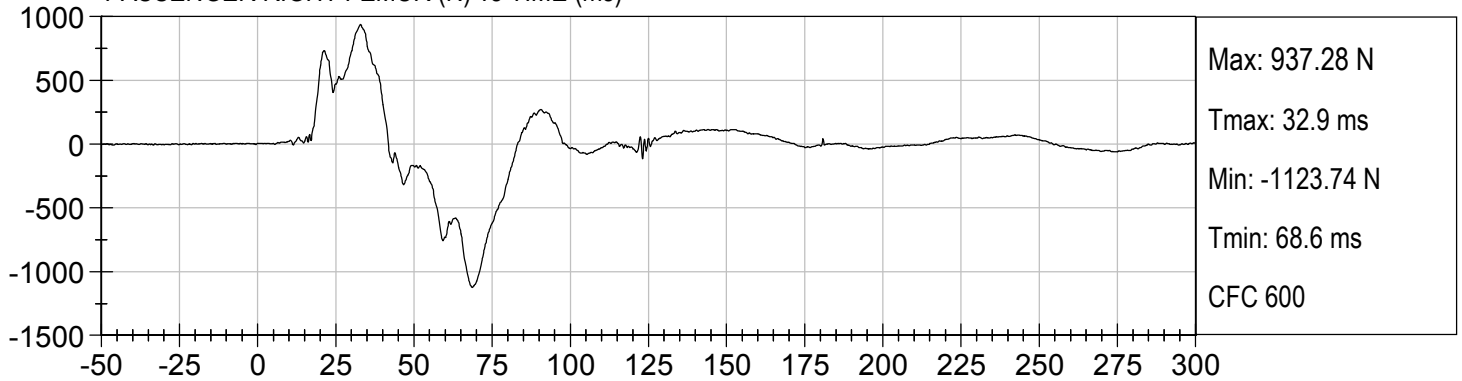




PASSENGER LEFT FEMUR (N) vs TIME (ms)



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: D15721

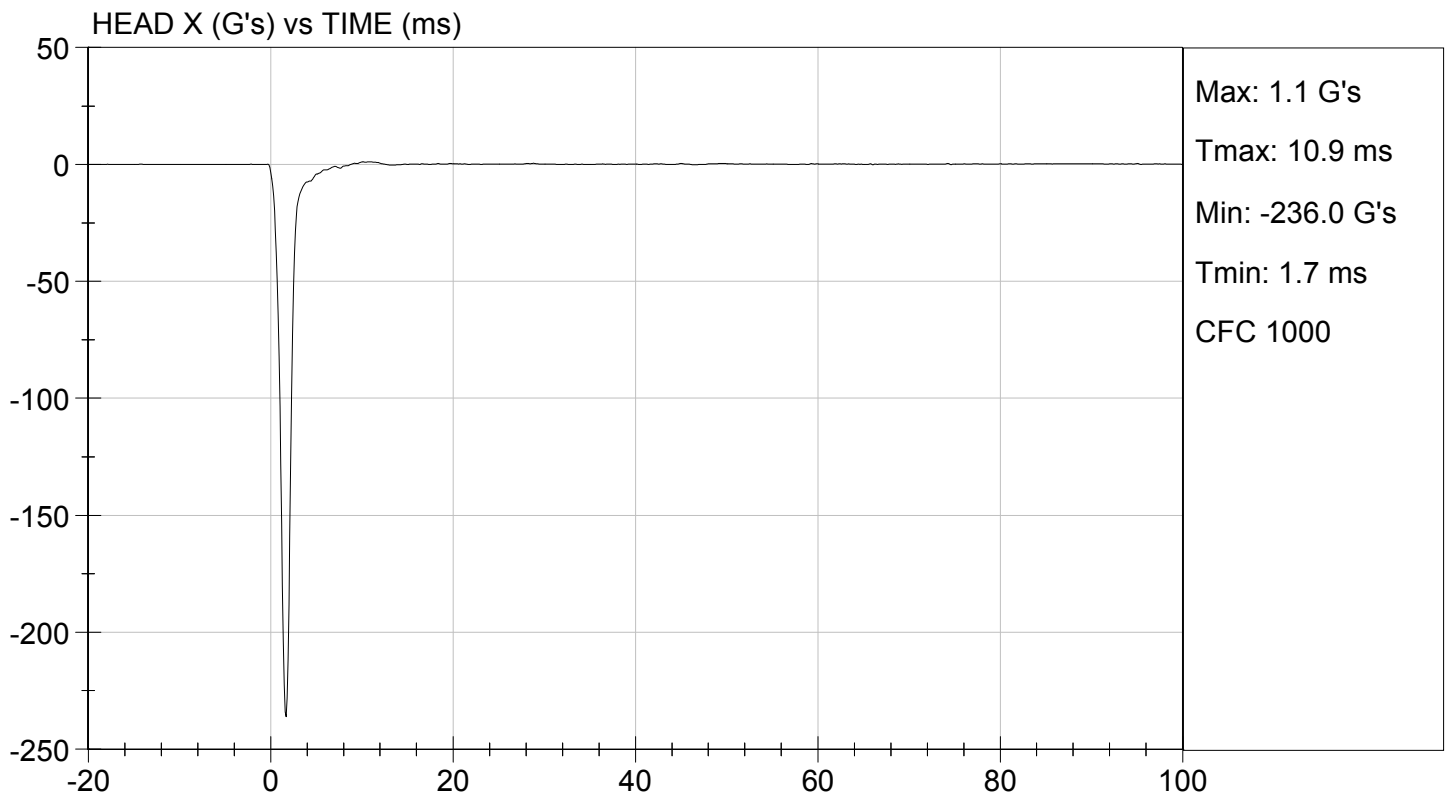
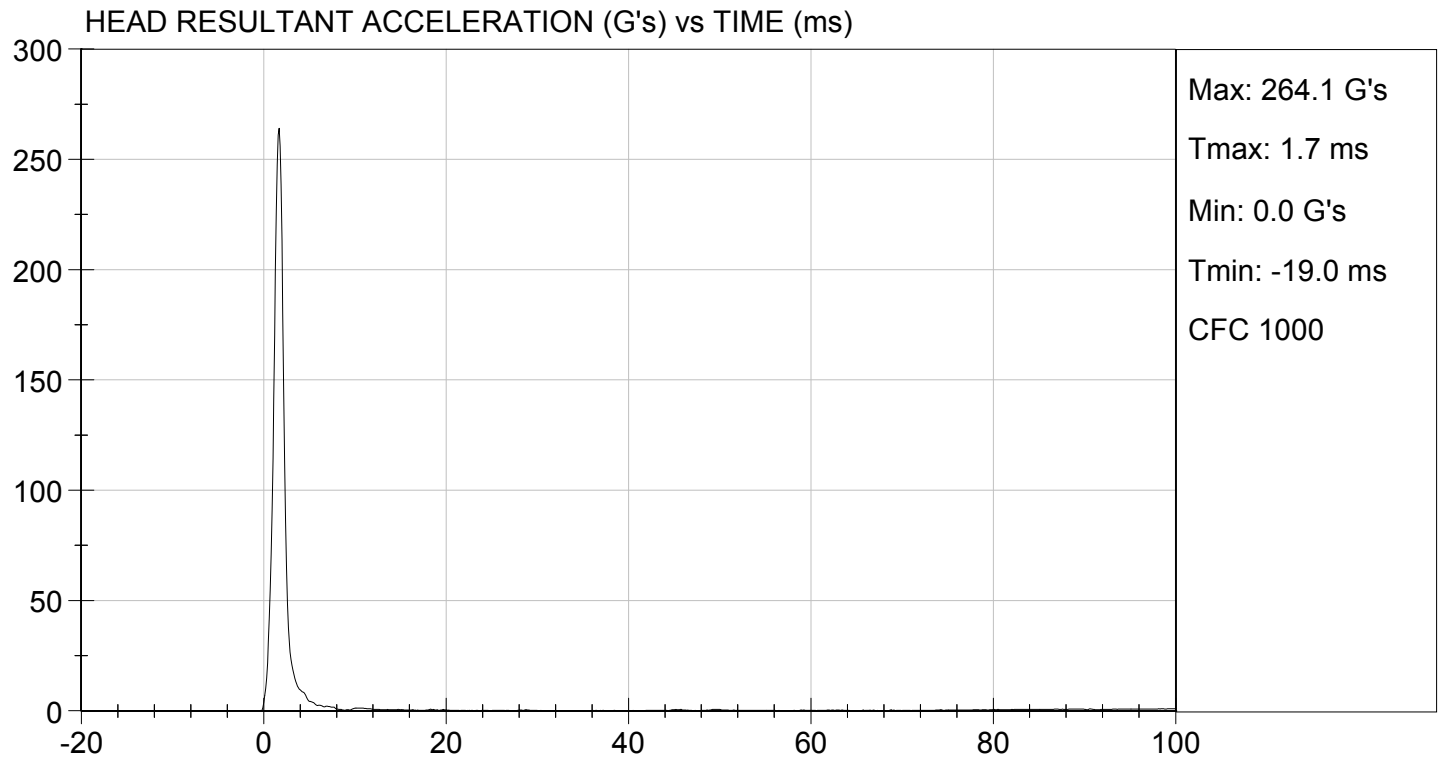
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	225 to 275	264	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	1.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

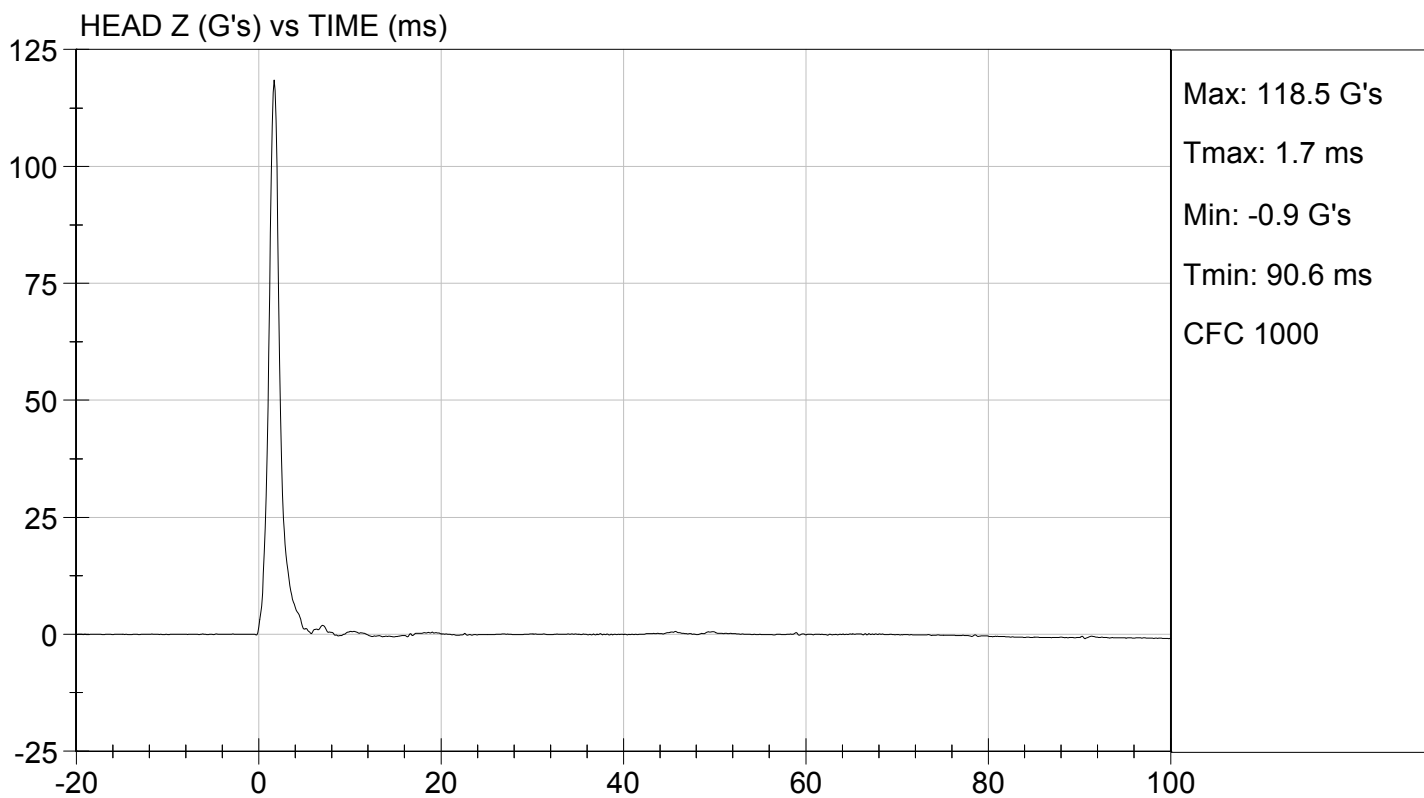
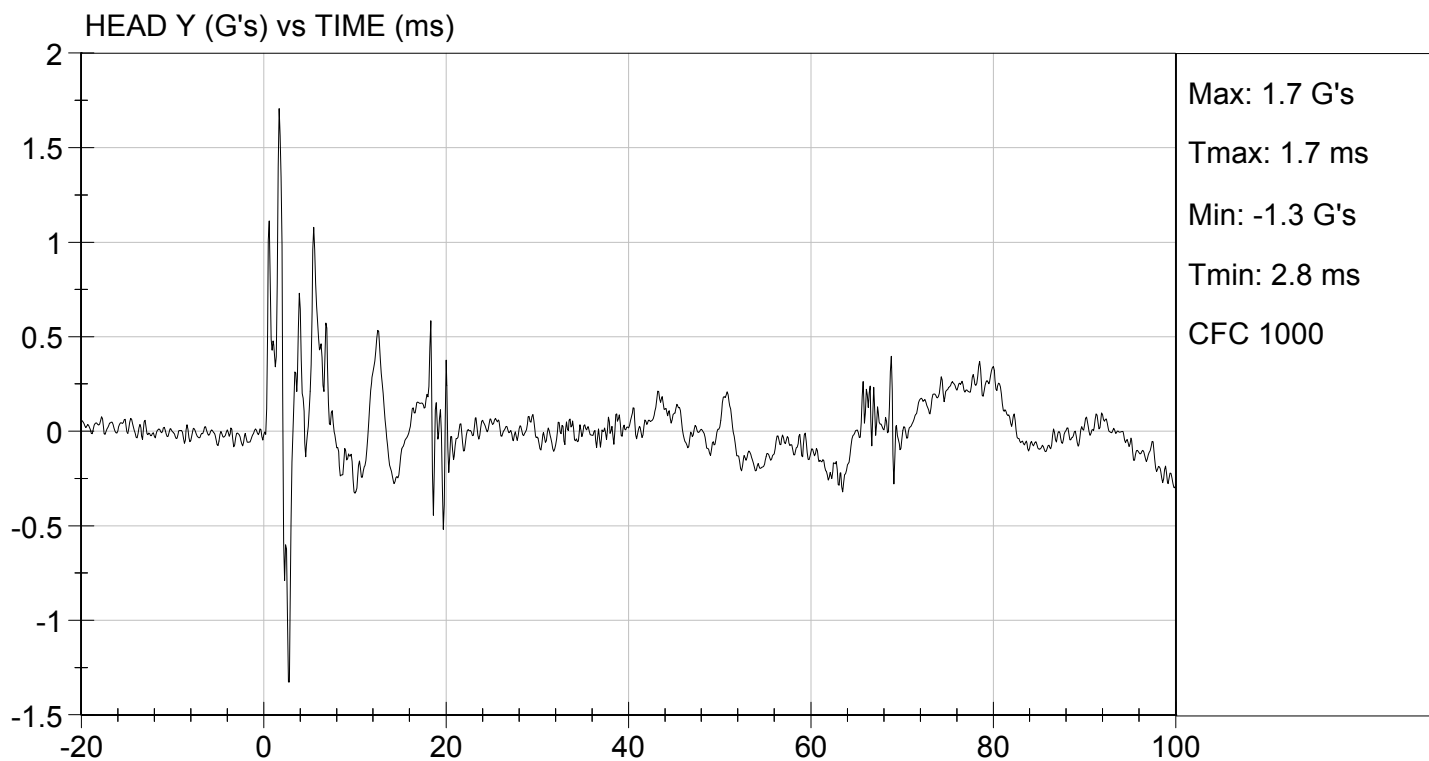
David Schoedel
Laboratory Technician

03/18/2015

Test Date

Jessica Hall
Approved By





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

ATD Serial No: 351

Test I.D: D15722

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	19	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.90	Pass
	20 ms	G's	17.60 to 22.60	17.64	Pass
	30 ms	G's	12.50 to 18.50	17.19	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	18.0	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	41.4	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	74.0	Pass
	Time	ms	57.0 to 64.0	59.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	120.2	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	88.9	Pass
	Time	ms	47.0 to 58.0	55.5	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	104.7	Pass
Overall Test Results					Pass

David Schoedel

Laboratory Technician

03/18/2015

Test Date

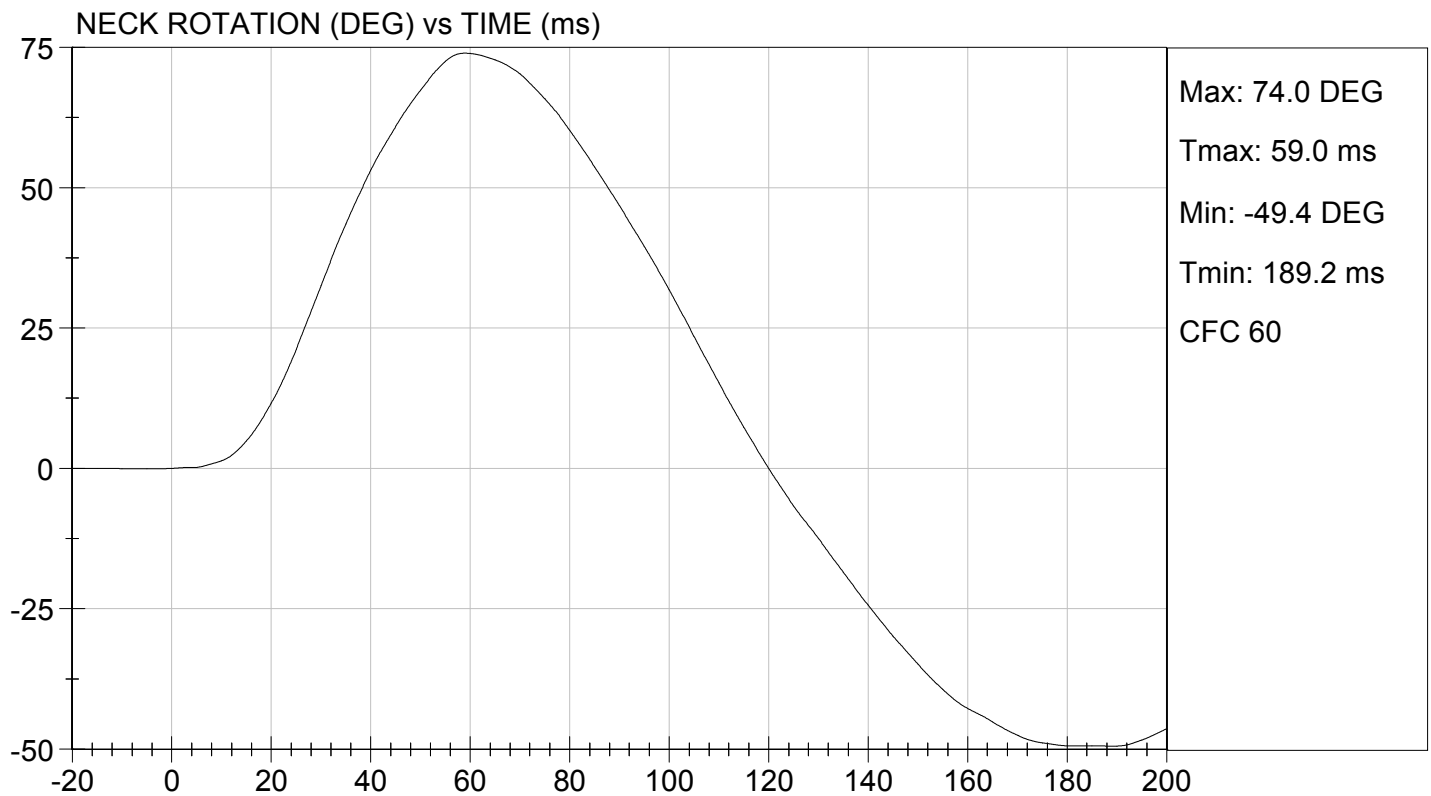
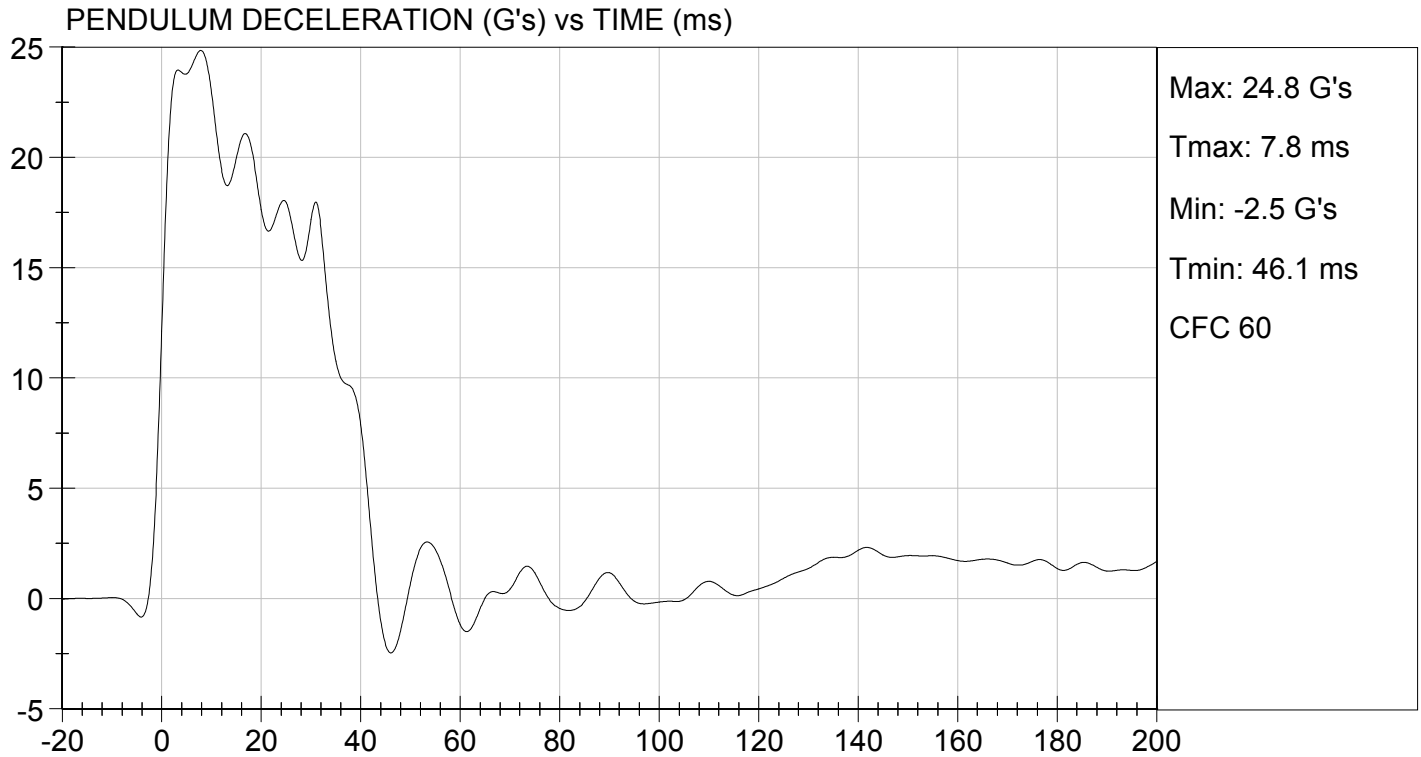
Jessica Hall

Approved By



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

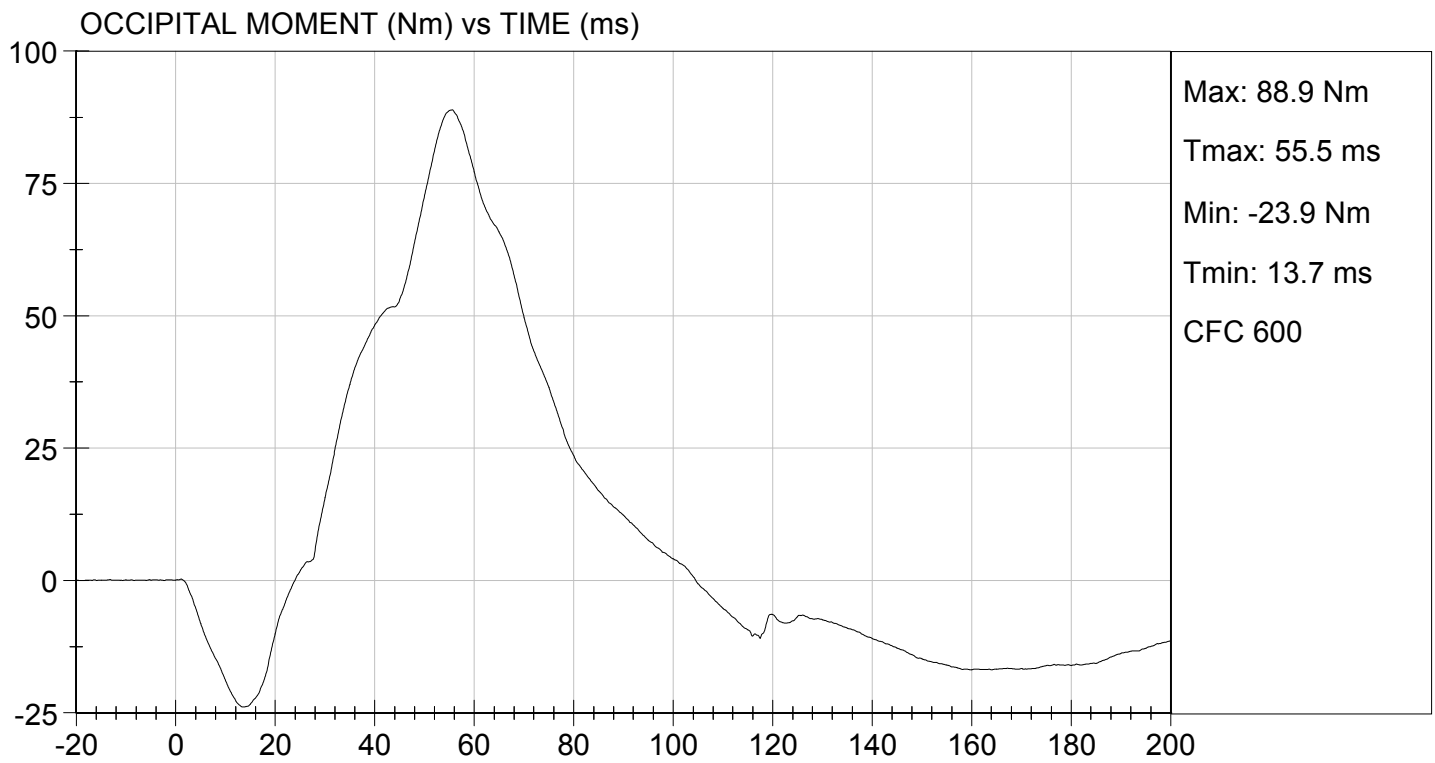
TEST DATE: 03/18/2015
TEST #: D15722





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

TEST DATE: 03/18/2015
TEST #: D15722



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

ATD Serial No: 351

Test I.D: D15723

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	19	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.19	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.22	Pass
	20 ms	G's	14.00 to 19.00	16.35	Pass
	30 ms	G's	11.00 to 16.00	12.02	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.1	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	43.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	100.8	Pass
	Time	ms	72.0 to 82.0	80.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	164.2	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-60.7	Pass
	Time	ms	65.0 to 79.0	73.1	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.7	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

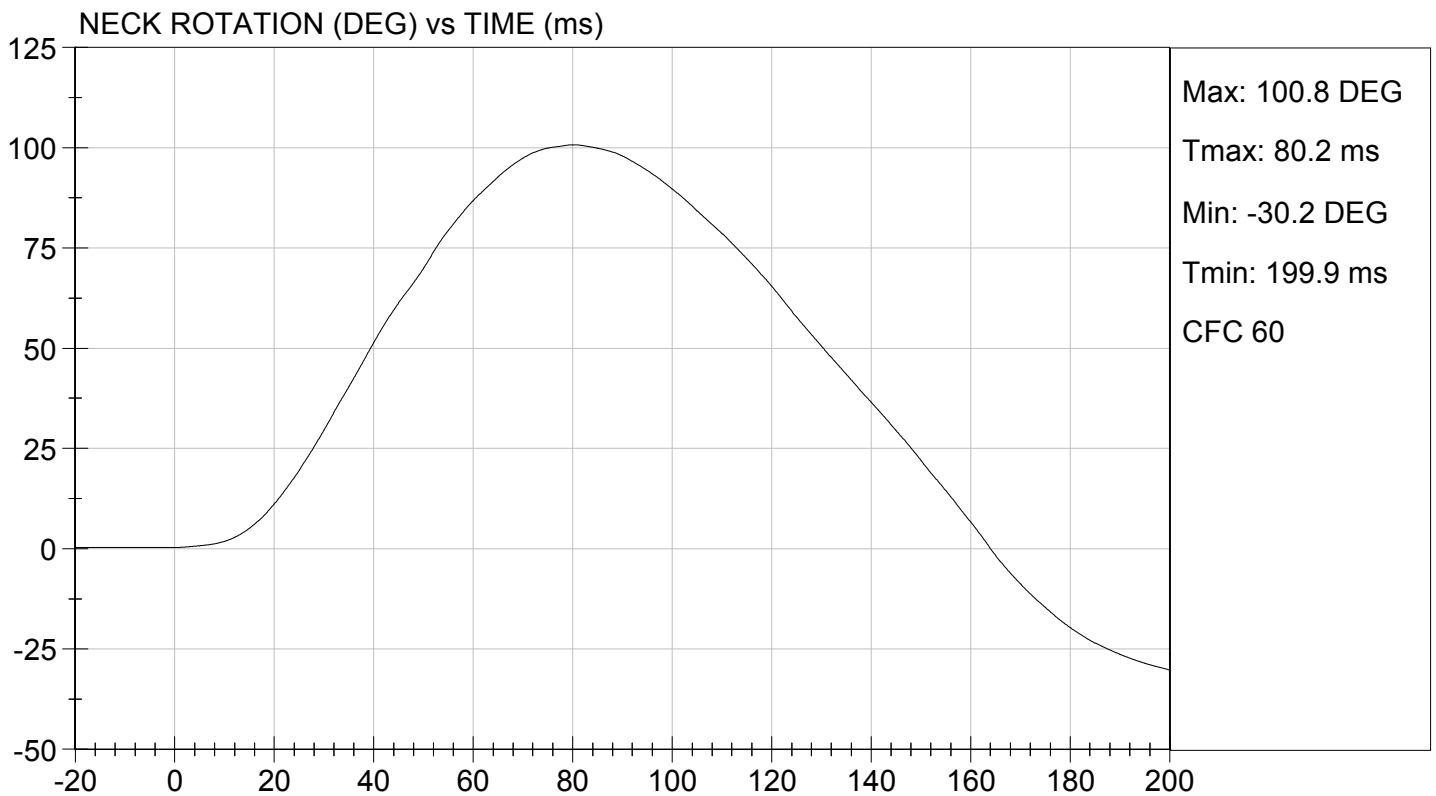
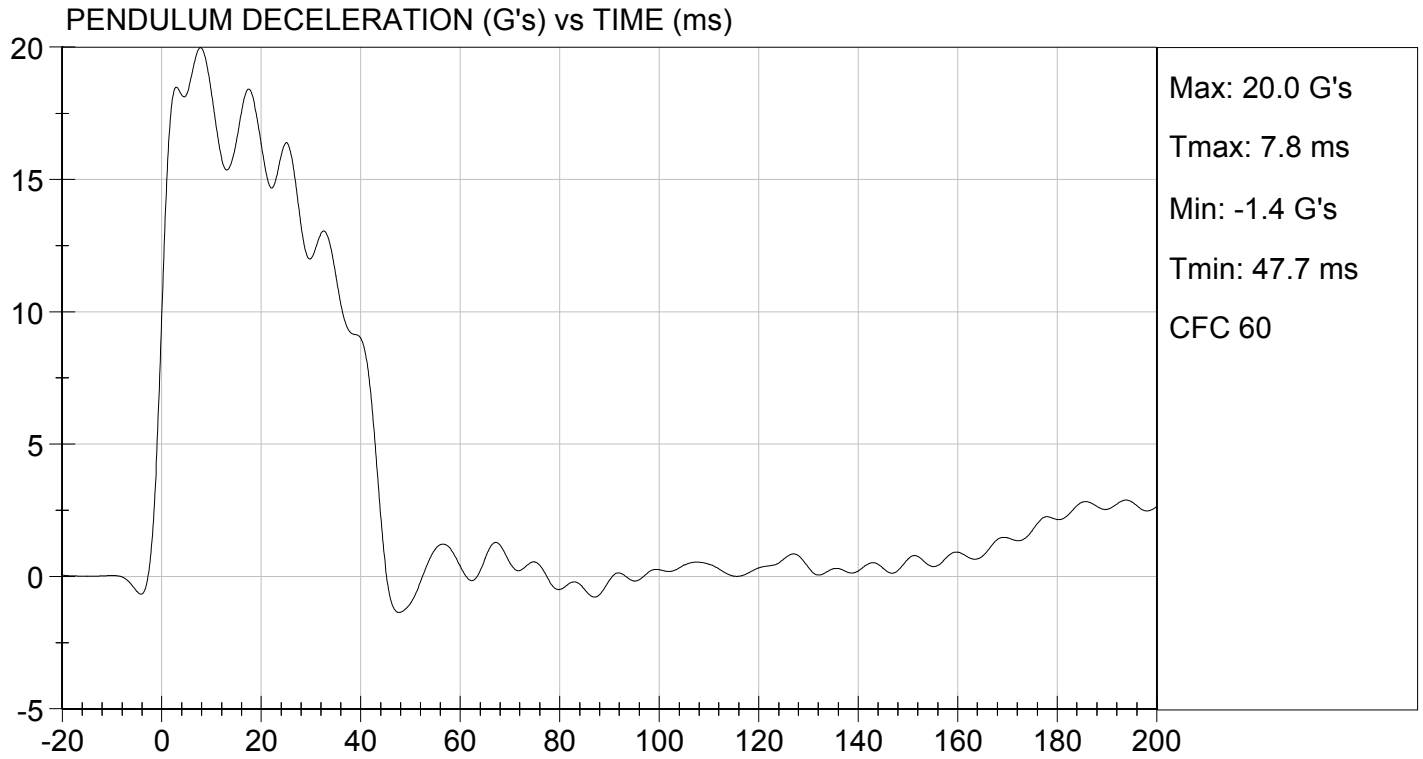
03/18/2015
Test Date

Jessica Hall
Approved By



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

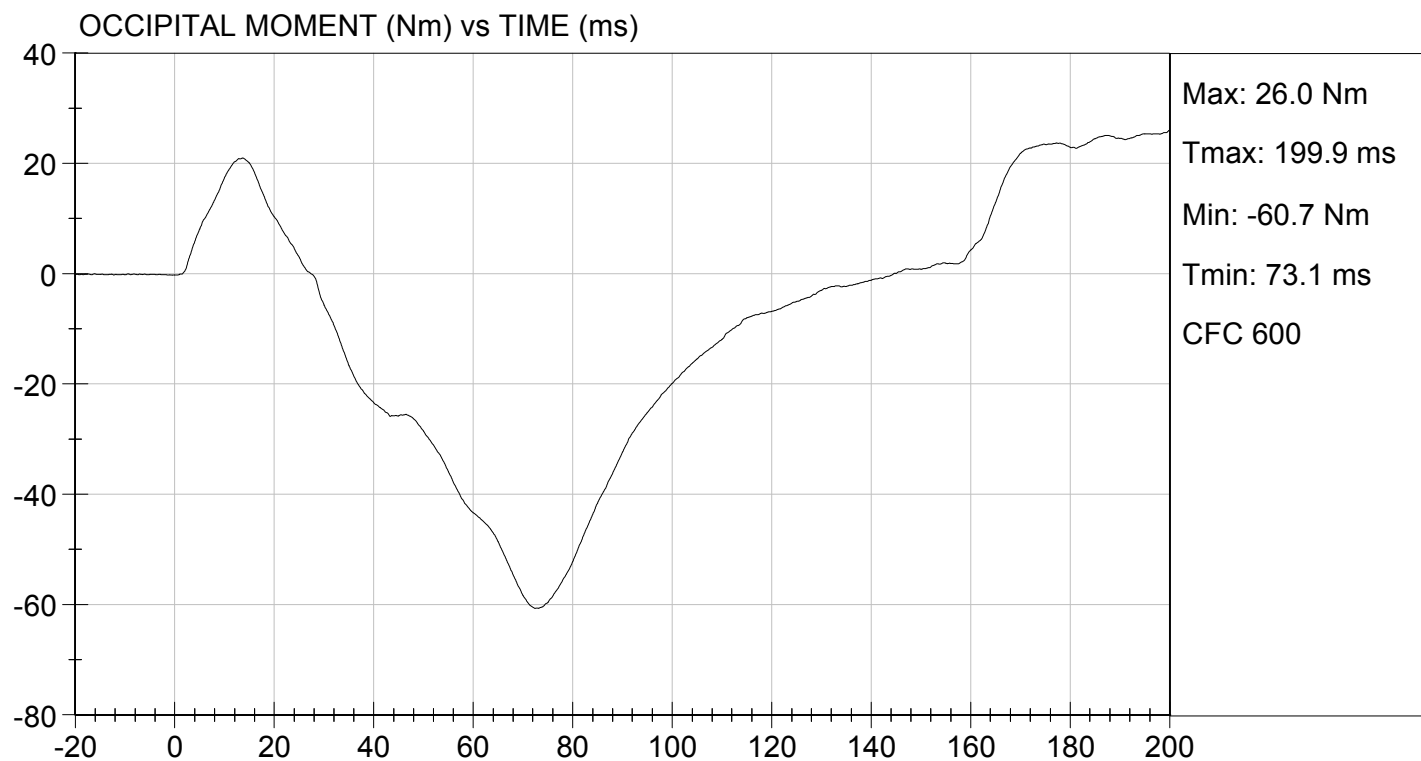
TEST DATE: 03/18/2015
TEST #: D15723





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

TEST DATE: 03/18/2015
TEST #: D15723



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D15724

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	19	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,181	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.78	Pass
Internal Hysteresis	%	69 to 85	69	Pass
			Overall Test Results	Pass


Laboratory Technician

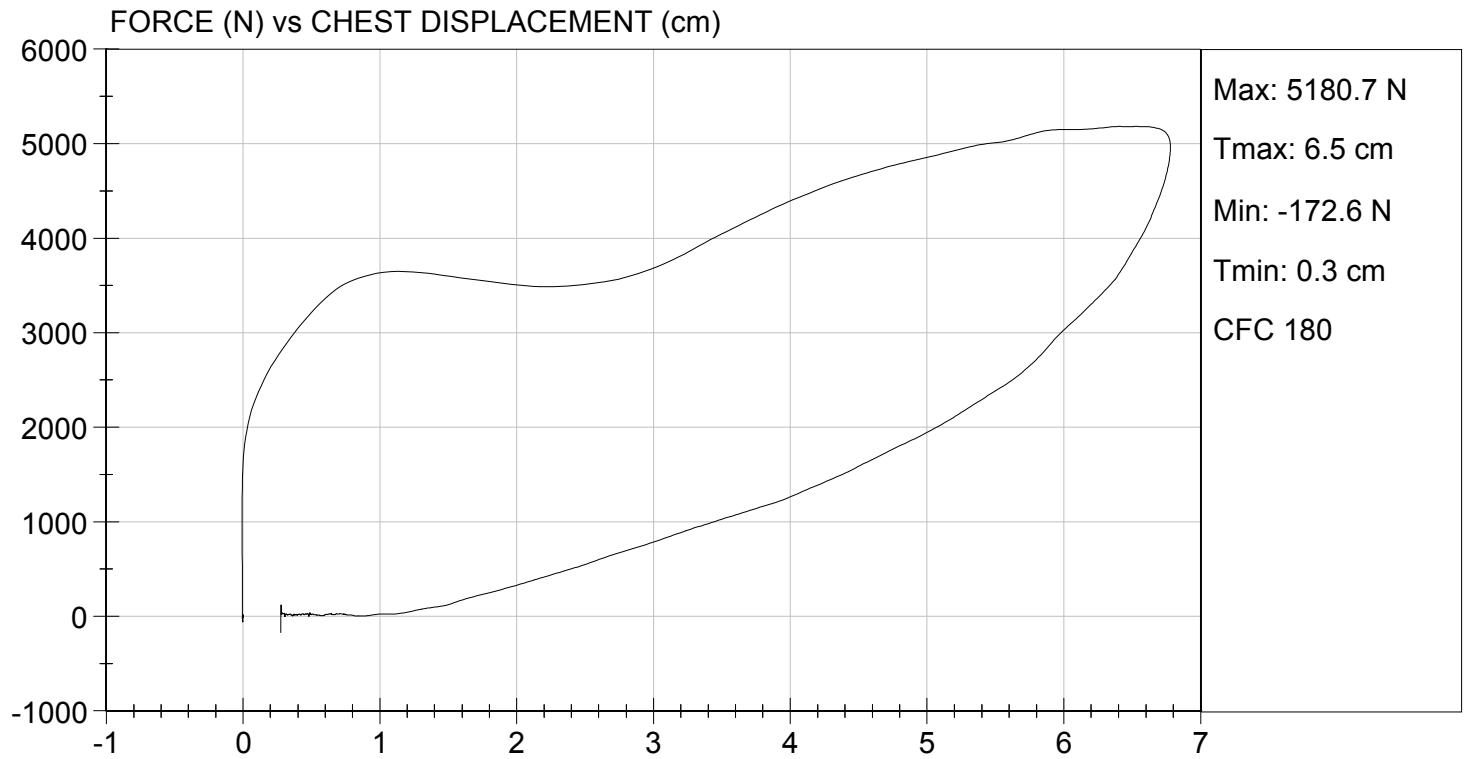
03/18/2015
Test Date


Approved By



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

TEST DATE: 03/18/2015
TEST #: D15724



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

ATD Serial No: 351

Test I.D: D15725

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Probe Velocity	m/s	2.07 to 2.13	2.13	Pass
Peak Probe Force	N	4715 to 5782	4,866	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

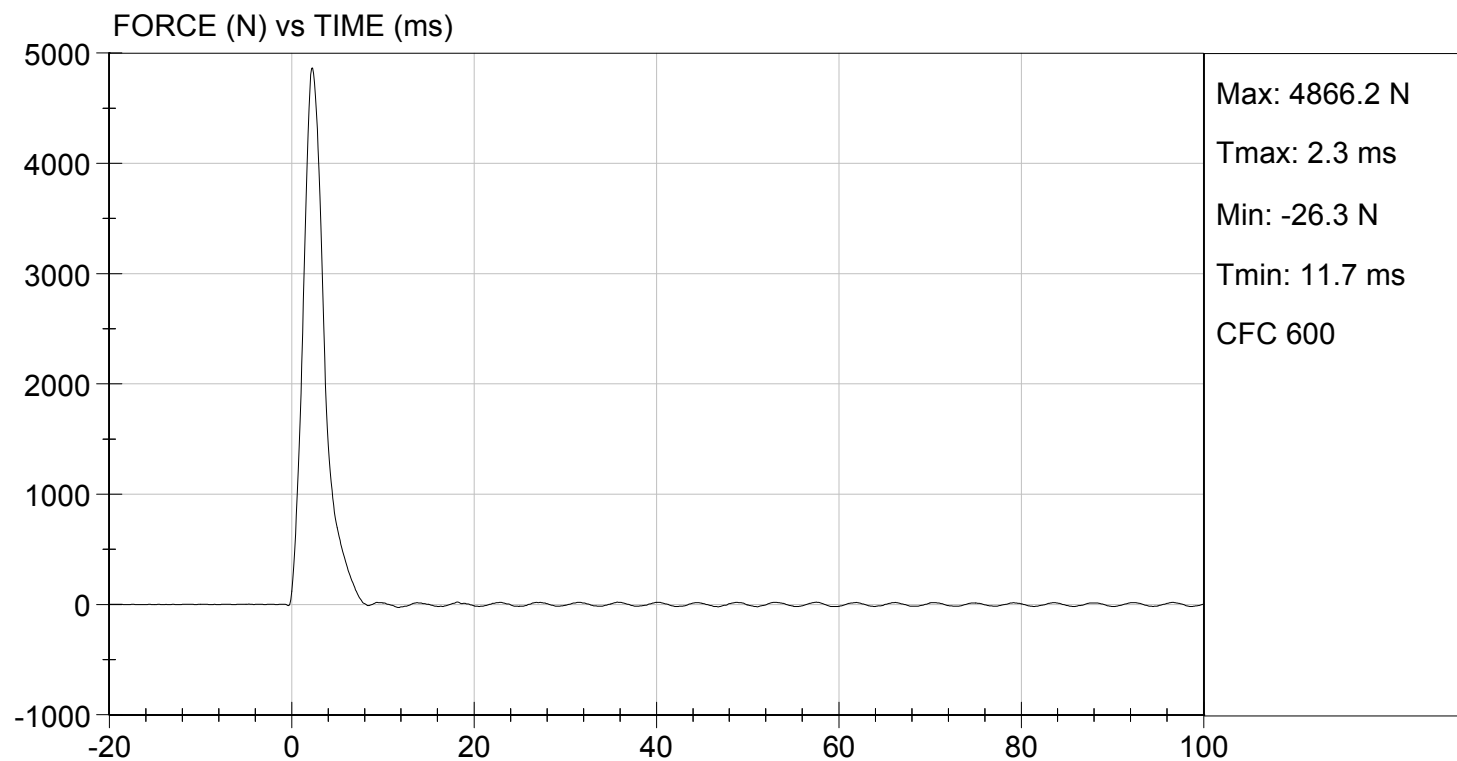
03/18/2015
Test Date

Jessica Hall
Approved By



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

TEST DATE: 03/18/2015
TEST #: D15725



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

ATD Serial No: 351

Test I.D: D15726

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Probe Velocity	m/s	2.07 to 2.13	2.13	Pass
Peak Probe Force	N	4715 to 5782	5,154	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

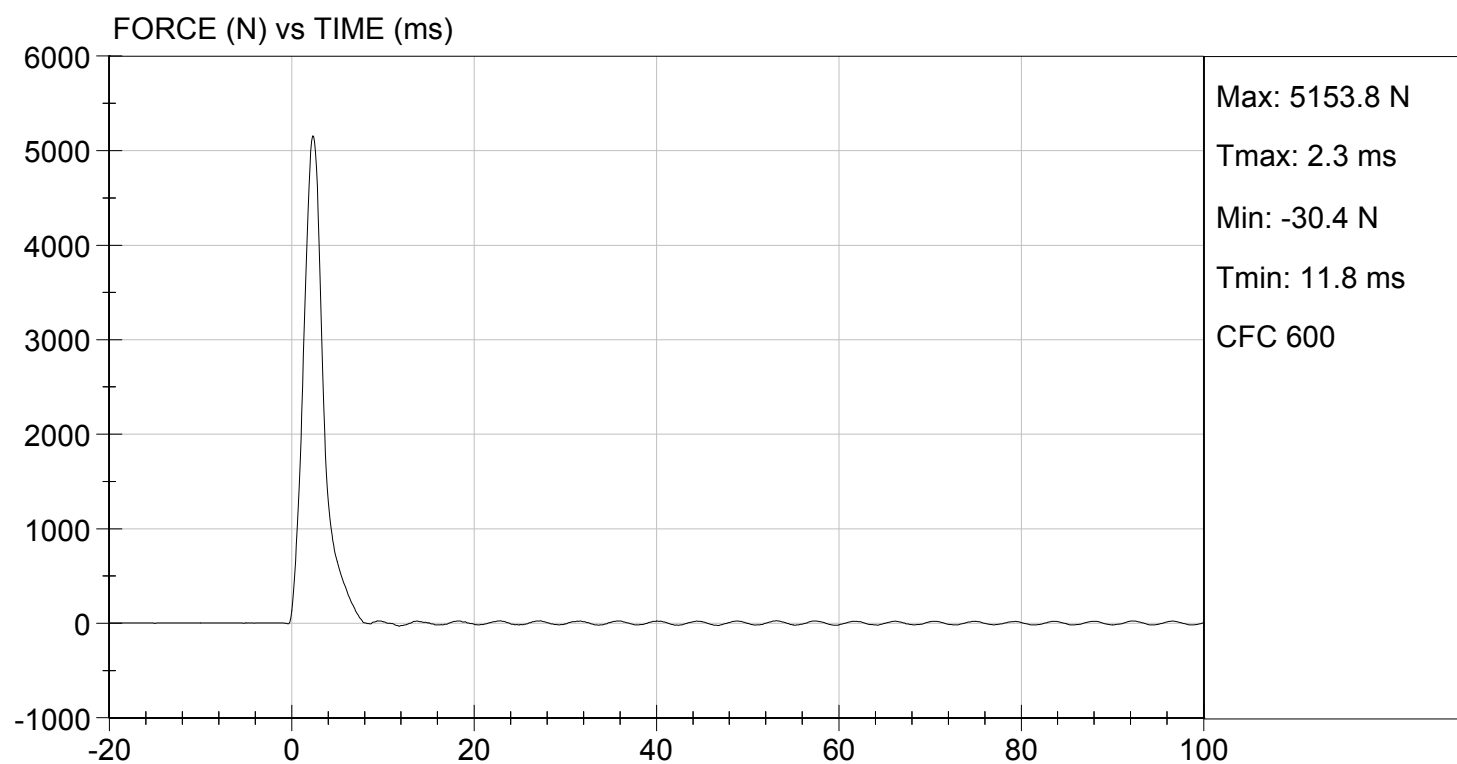
03/18/2015
Test Date

Jessica Hall
Approved By



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

TEST DATE: 03/18/2015
TEST #: D15726



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

ATD Serial No: 351

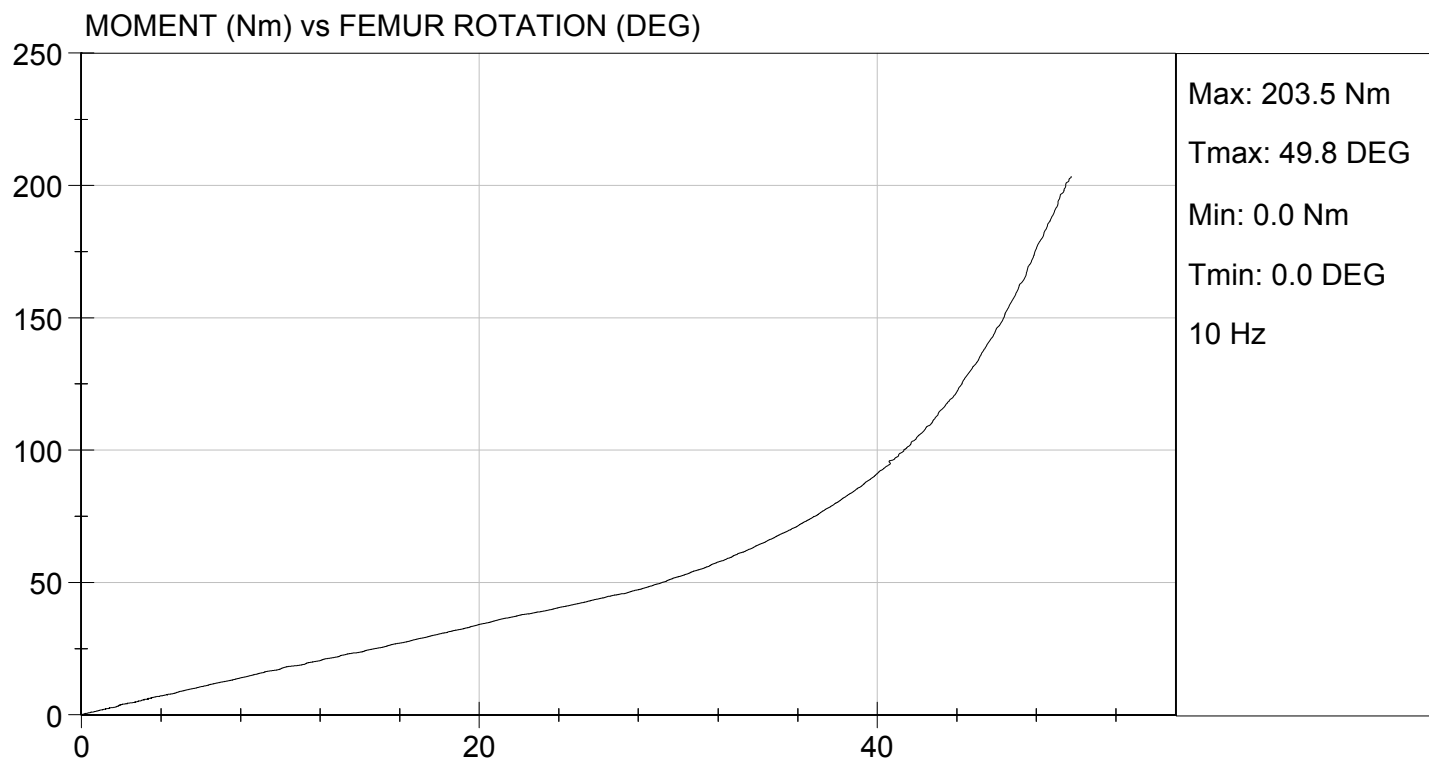
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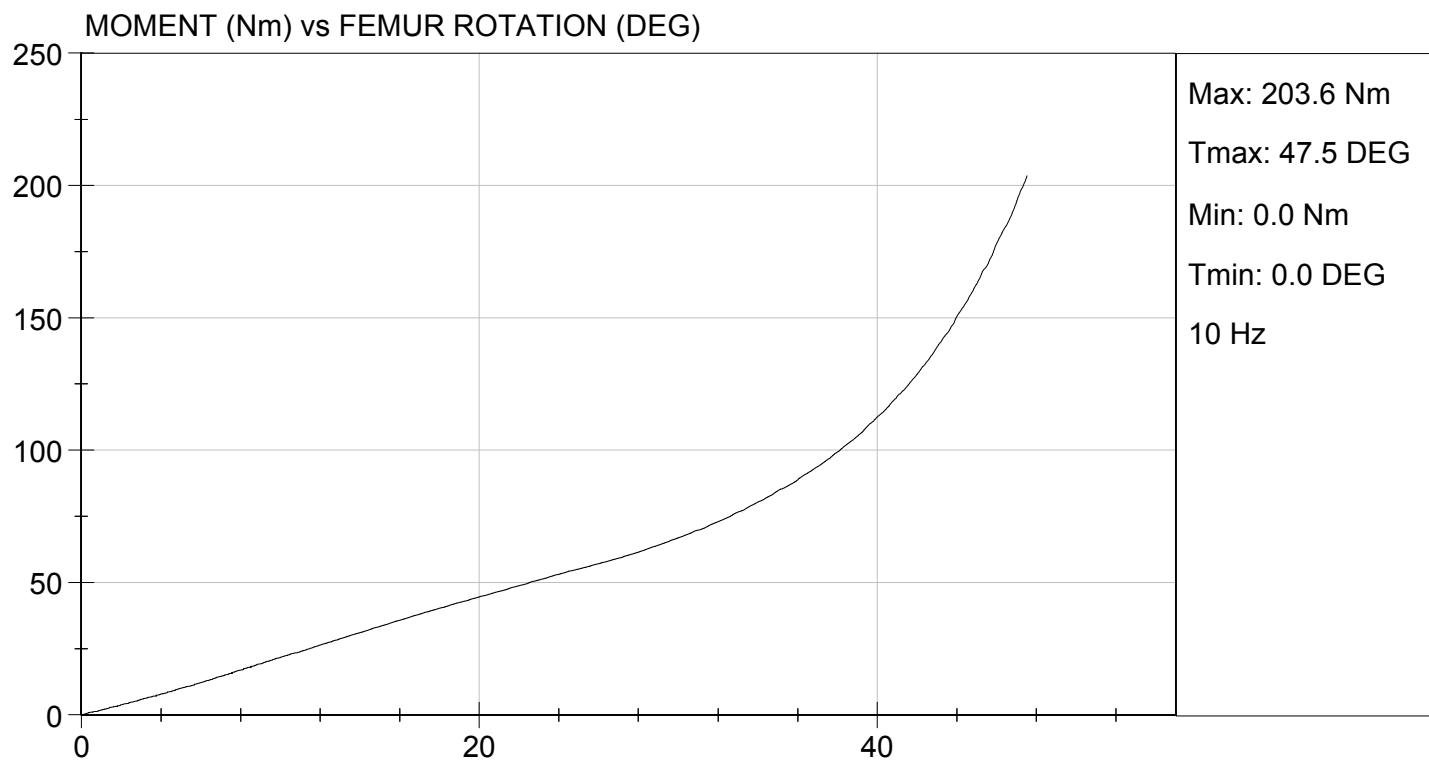
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	19	19	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.3	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	52.1	66.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	49.8	47.5	Pass
Overall Test Results					Pass


Laboratory Technician

03/18/2015
Test Date


Approved By





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

ATD Serial No: 351

Test ID: D15761

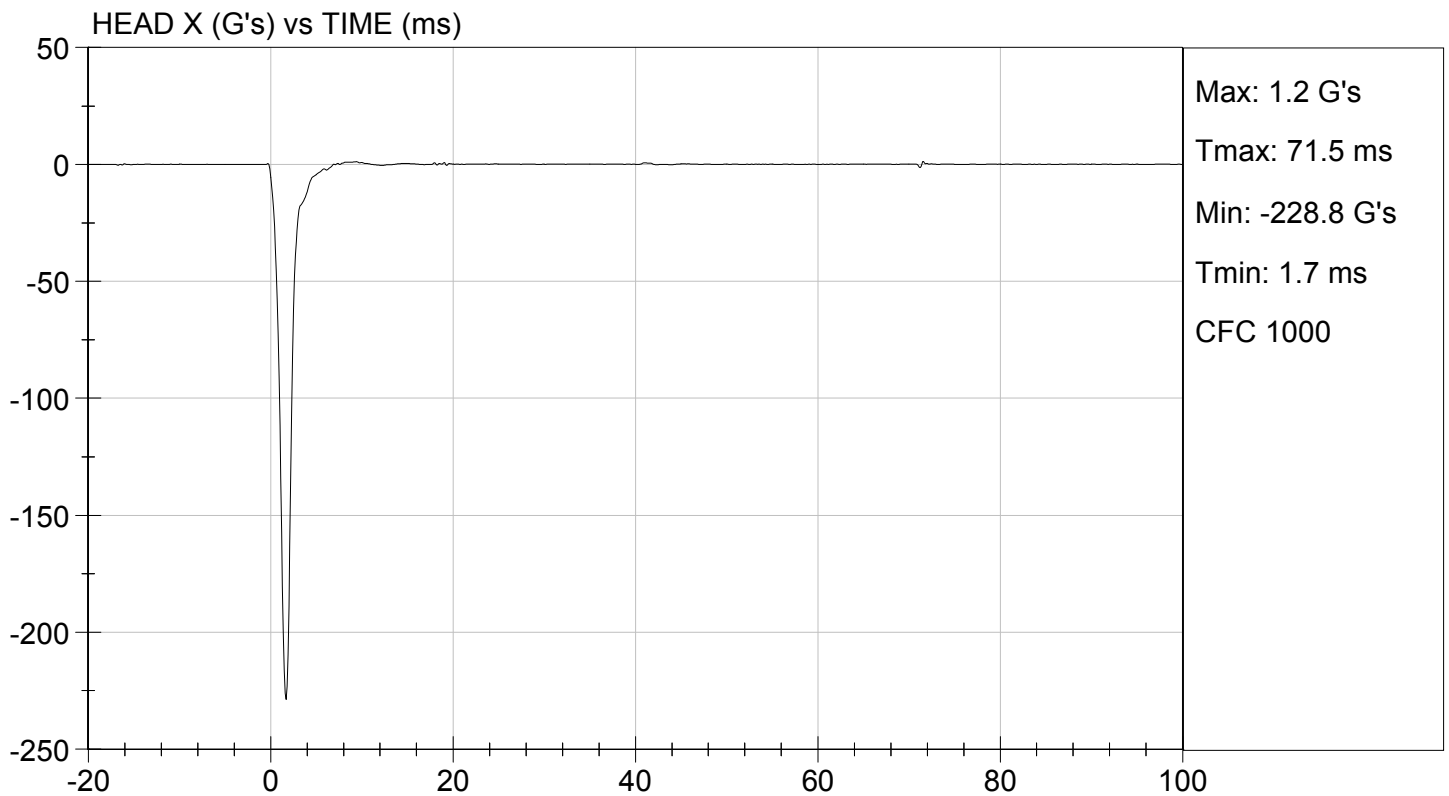
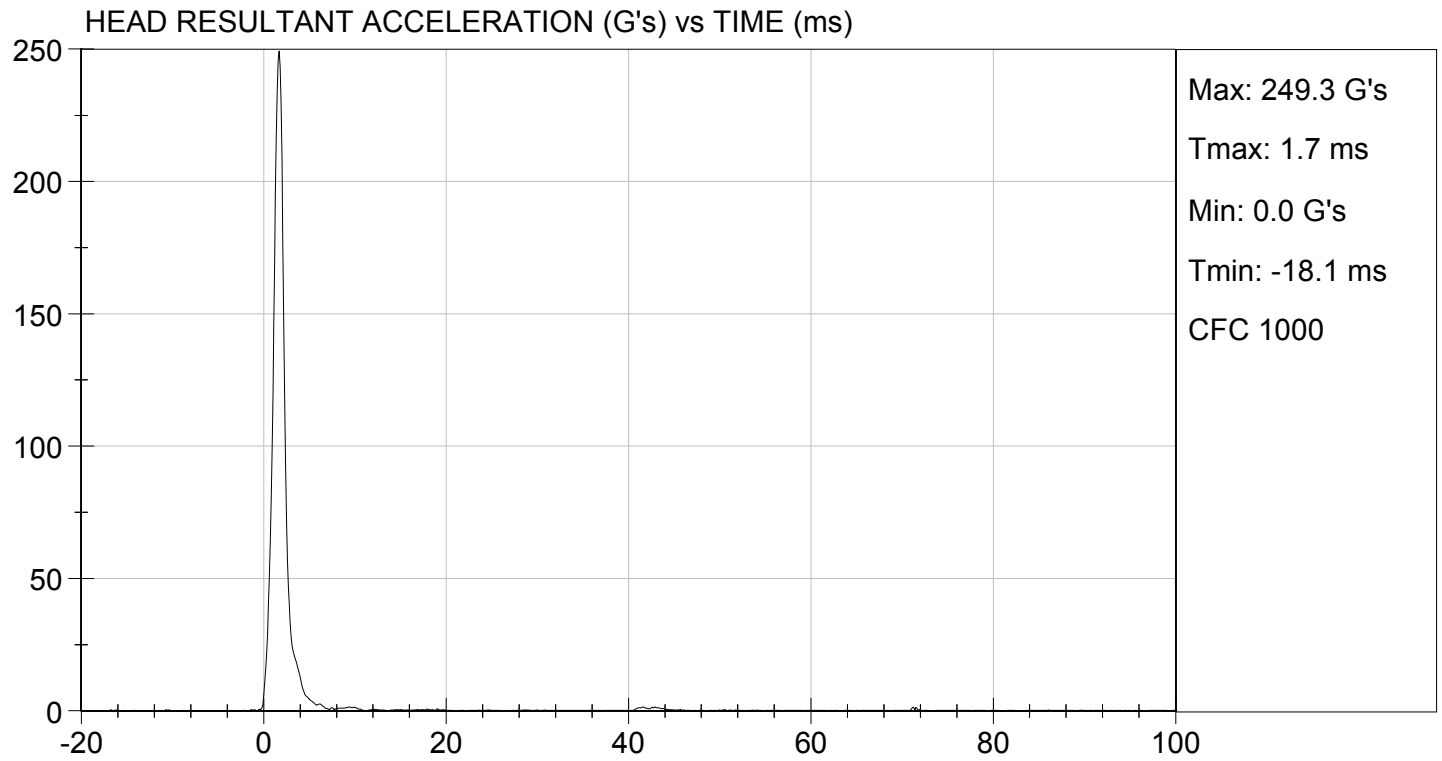
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Peak Resultant Acceleration	G's	225 to 275	249	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-1.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

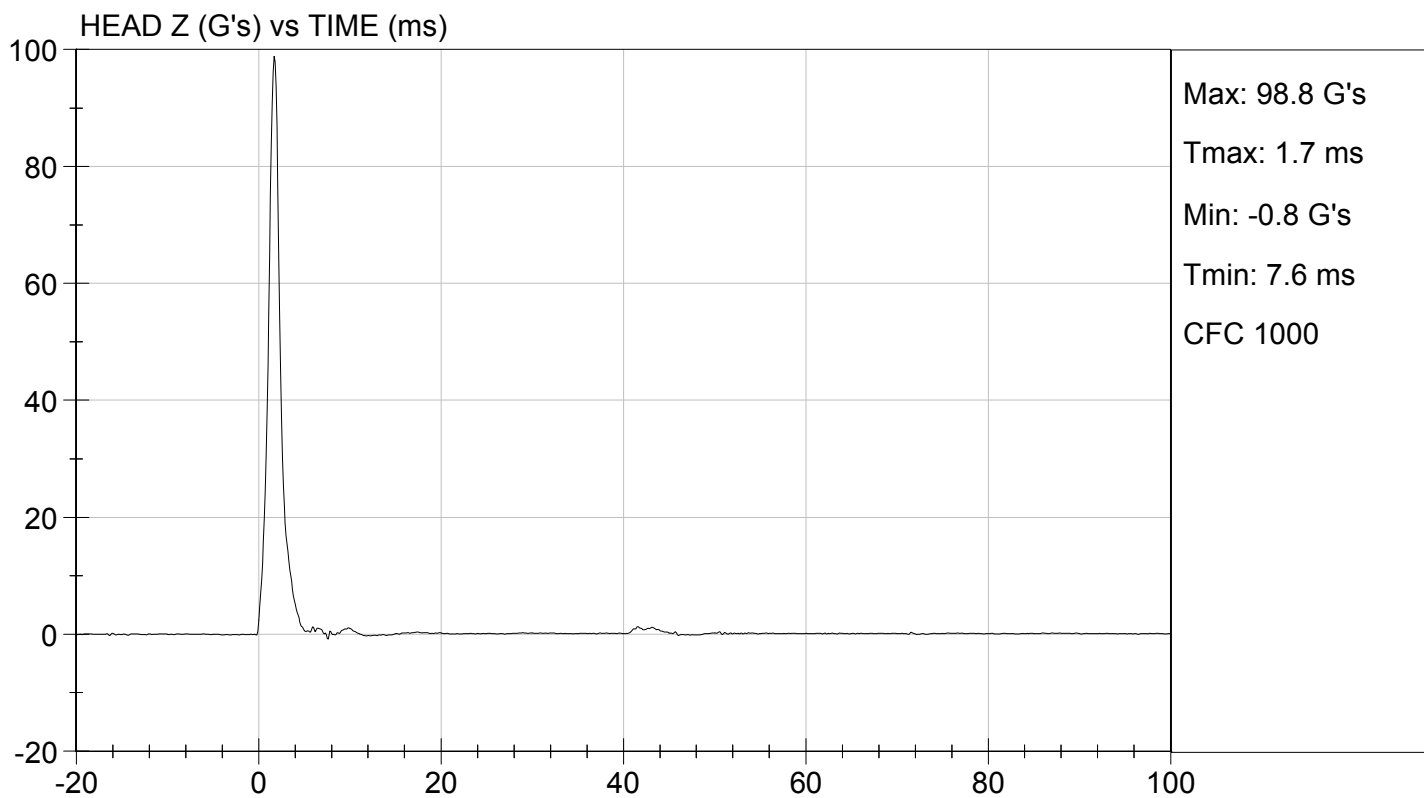
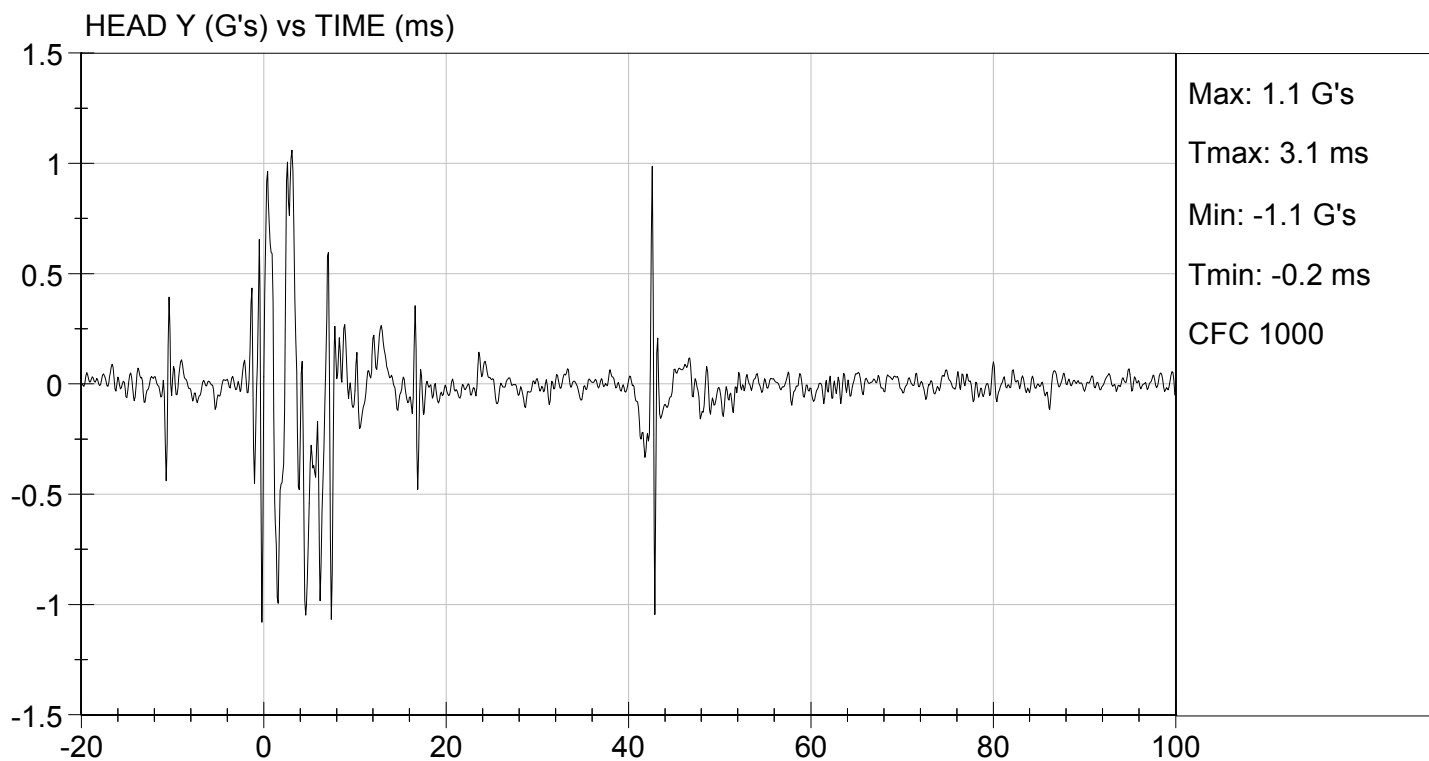
Jack Coleman
Laboratory Technician

03/23/2015

Test Date

Jessica Hall
Approved By



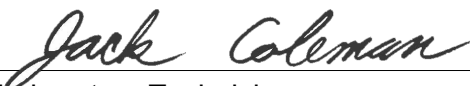


MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D15762

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	19	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.94	Pass
	20 ms	G's	17.60 to 22.60	19.71	Pass
	30 ms	G's	12.50 to 18.50	12.60	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	12.6	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	40.6	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	72.9	Pass
	Time	ms	57.0 to 64.0	60.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	118.2	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	88.7	Pass
	Time	ms	47.0 to 58.0	53.1	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	105.4	Pass
Overall Test Results					Pass


Laboratory Technician

03/24/2015

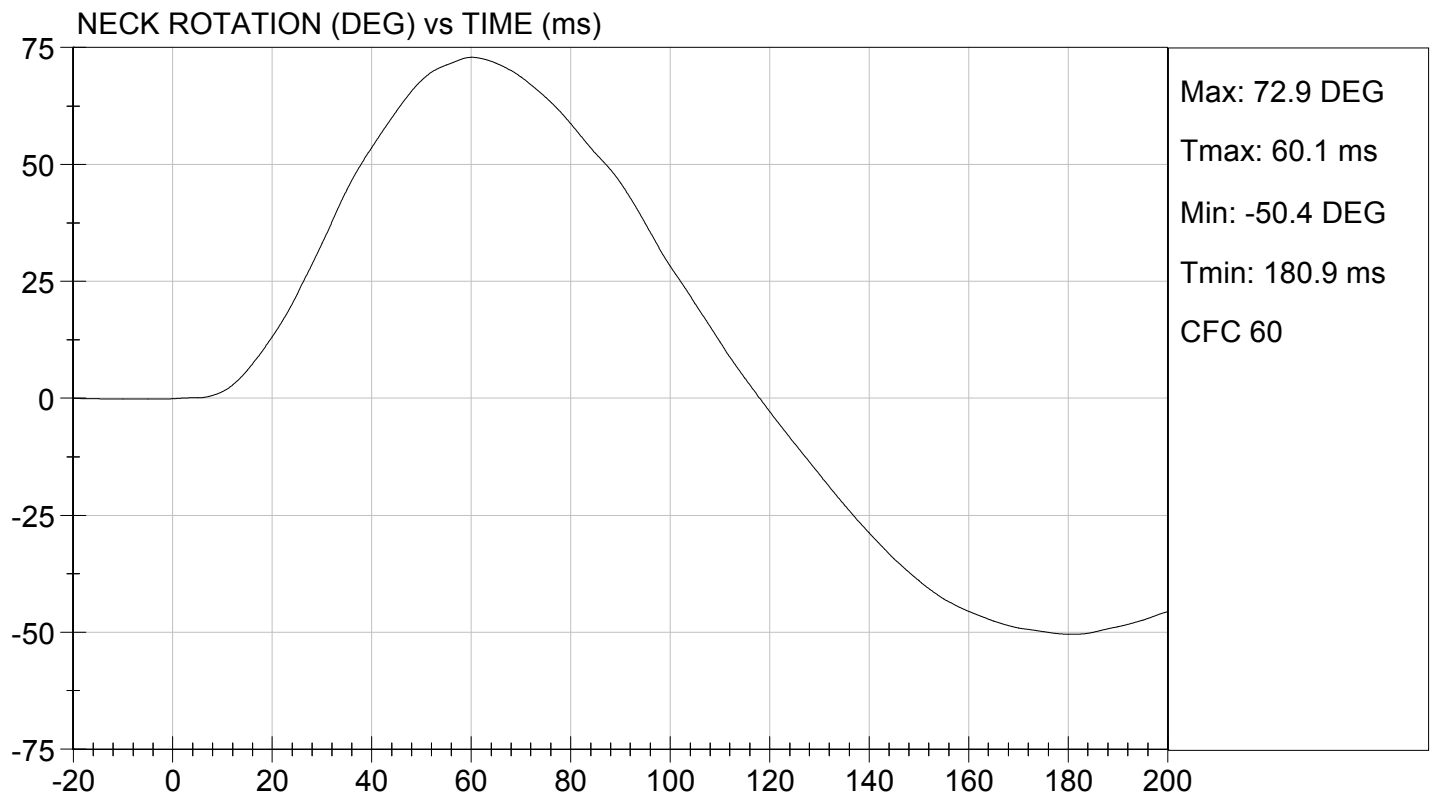
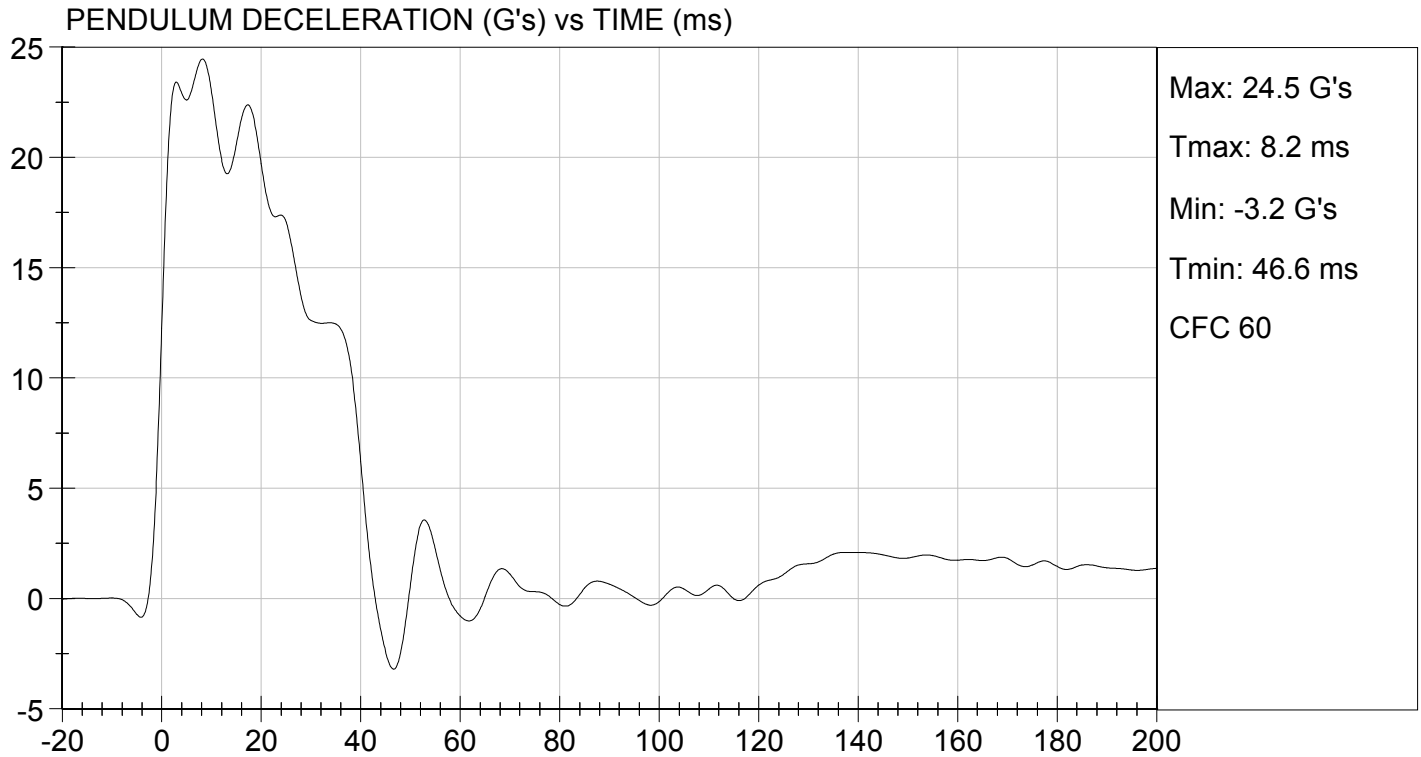
Test Date


Approved By



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

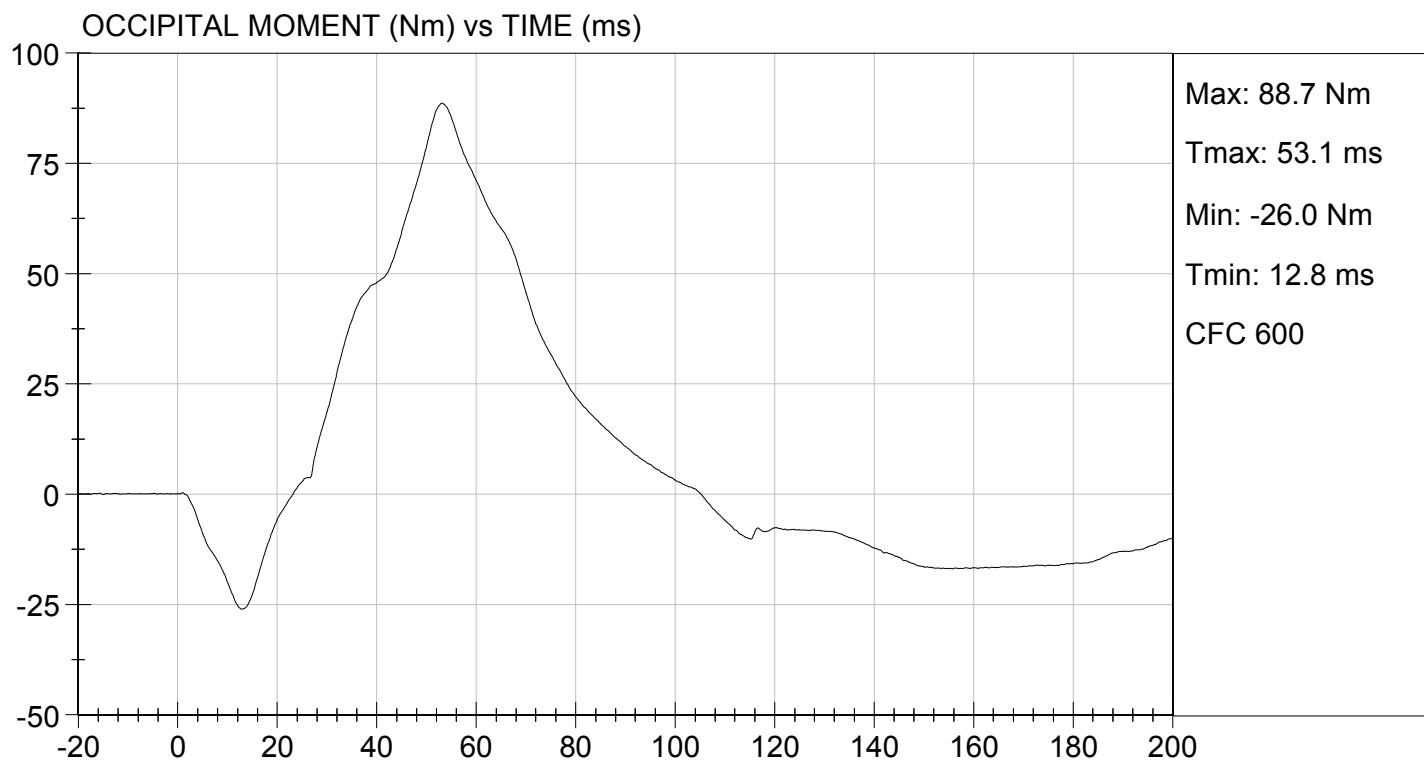
TEST DATE: 03/24/2015
TEST #: D15762





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

TEST DATE: 03/24/2015
TEST #: D15762



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

ATD Serial No: 351

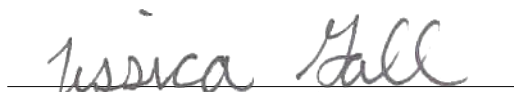
Test I.D: D15763

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	19	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.51	Pass
	20 ms	G's	14.00 to 19.00	16.65	Pass
	30 ms	G's	11.00 to 16.00	11.81	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	11.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	41.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	98.2	Pass
	Time	ms	72.0 to 82.0	77.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	162.1	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-62.6	Pass
	Time	ms	65.0 to 79.0	72.0	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	147.2	Pass
Overall Test Results					Pass


Laboratory Technician

03/24/2015

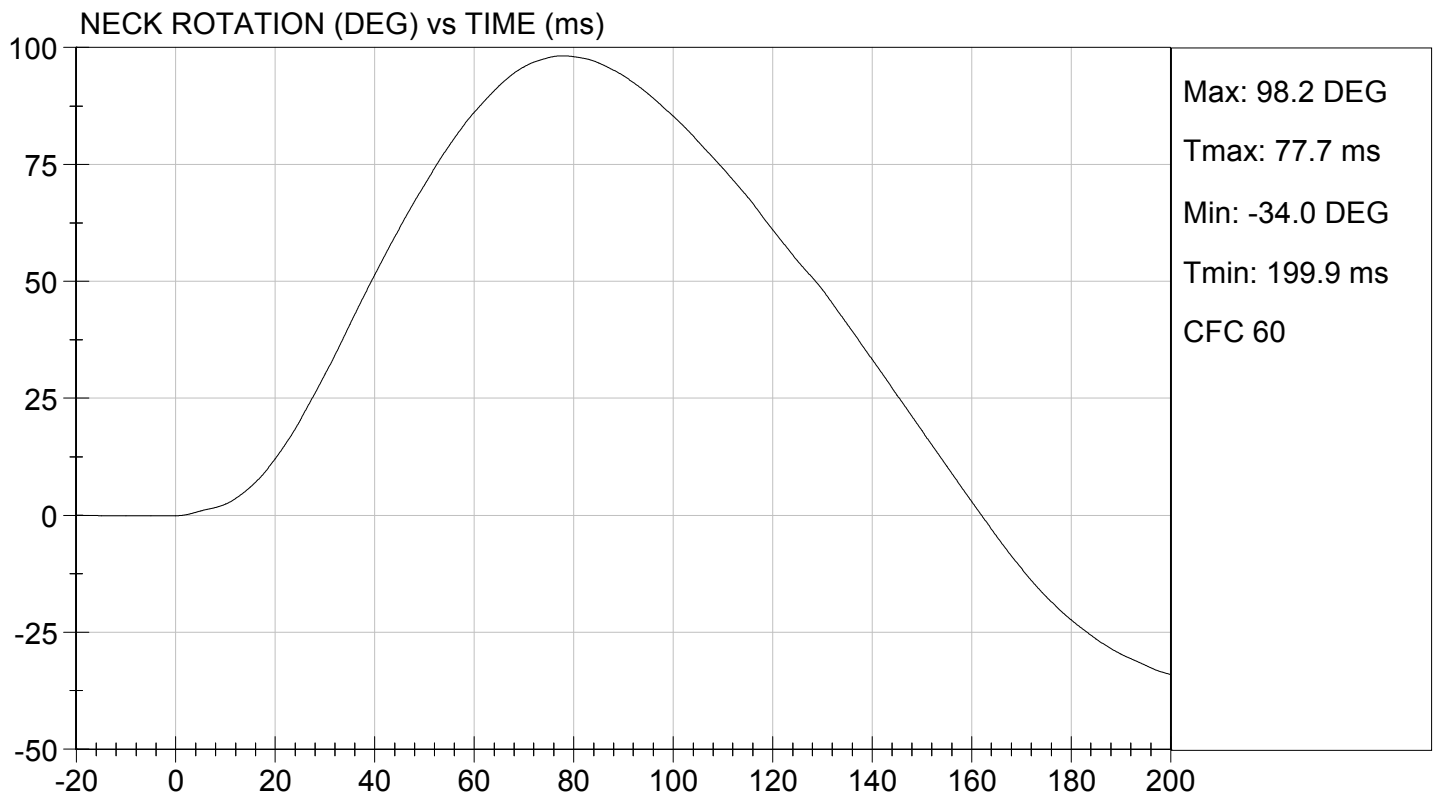
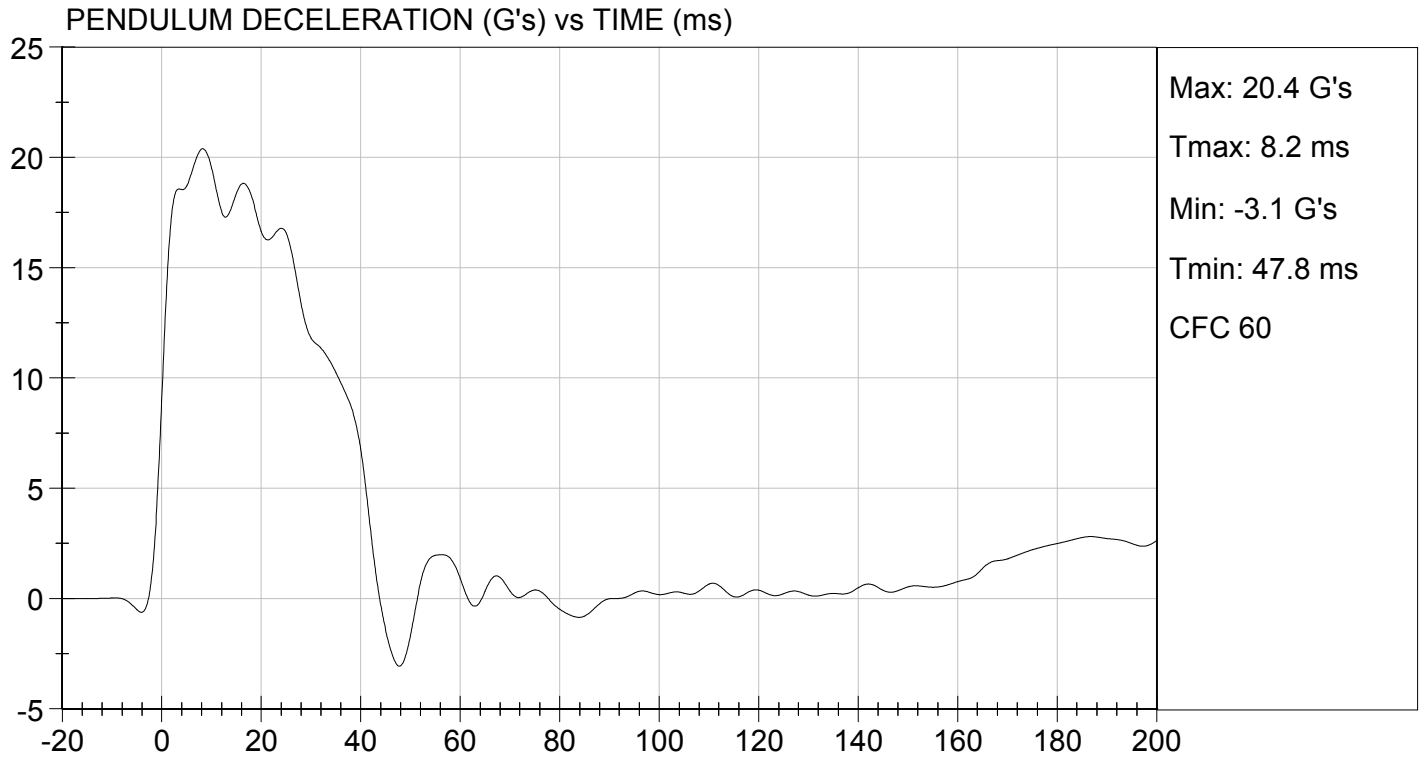
Test Date


Approved By



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

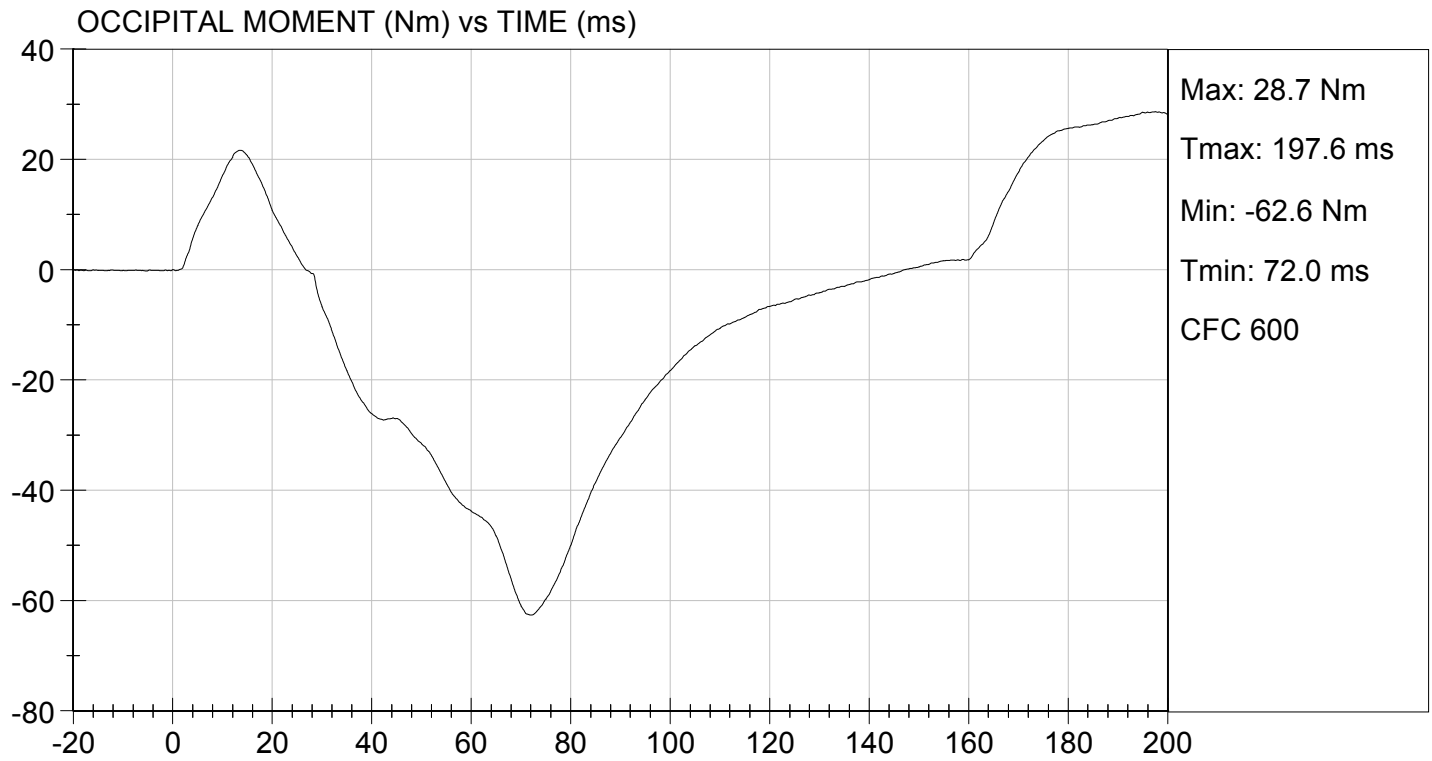
TEST DATE: 03/24/2015
TEST #: D15763





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

TEST DATE: 03/24/2015
TEST #: D15763



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351

Test I.D: D15764

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	22	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,505	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.70	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Overall Test Results			Pass	

David Schoedel
Laboratory Technician

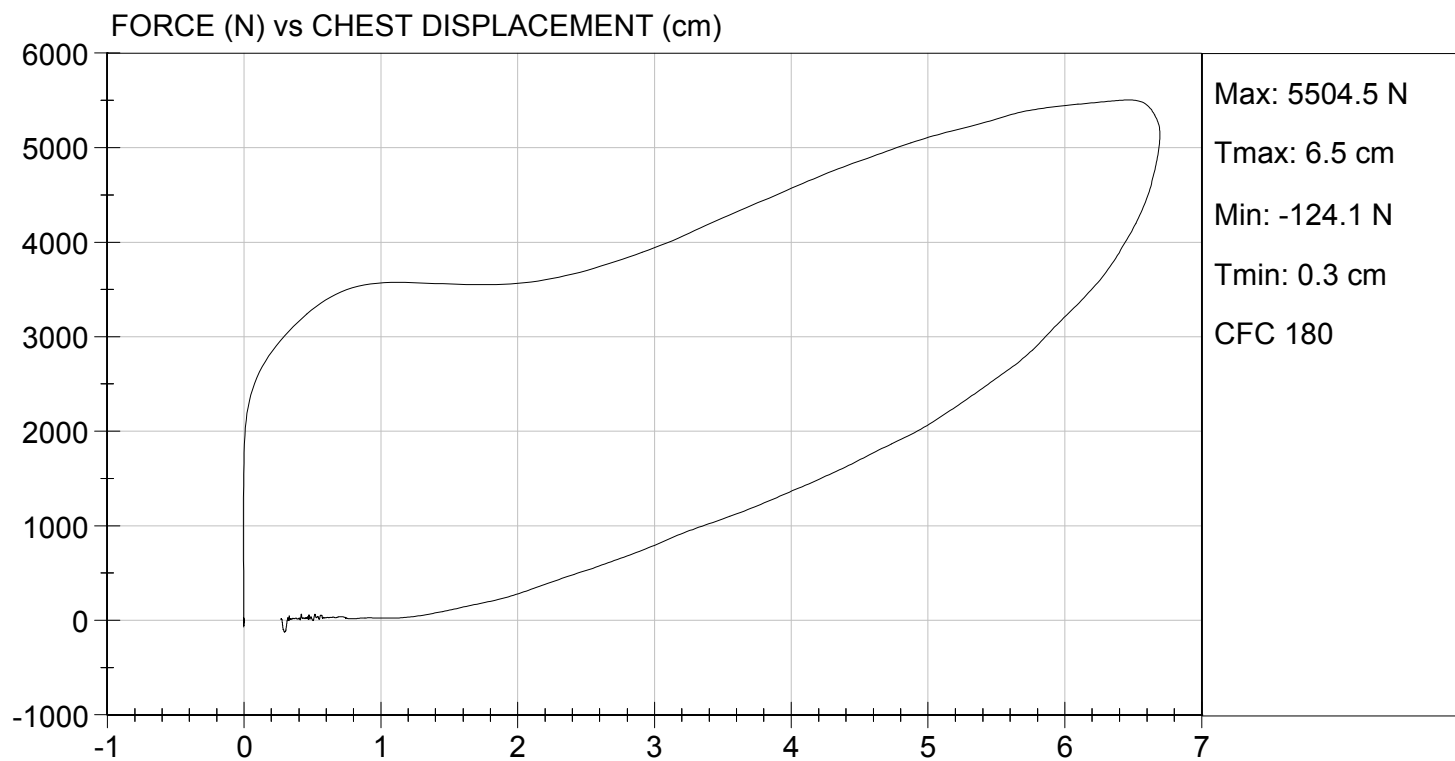
03/24/2015
Test Date

Jessica Hall
Approved By



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

TEST DATE: 03/24/2015
TEST #: D15764



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

ATD Serial No: 351

Test I.D: D15765

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	5,364	Pass
Overall Test Results				Pass


Laboratory Technician

03/23/2015

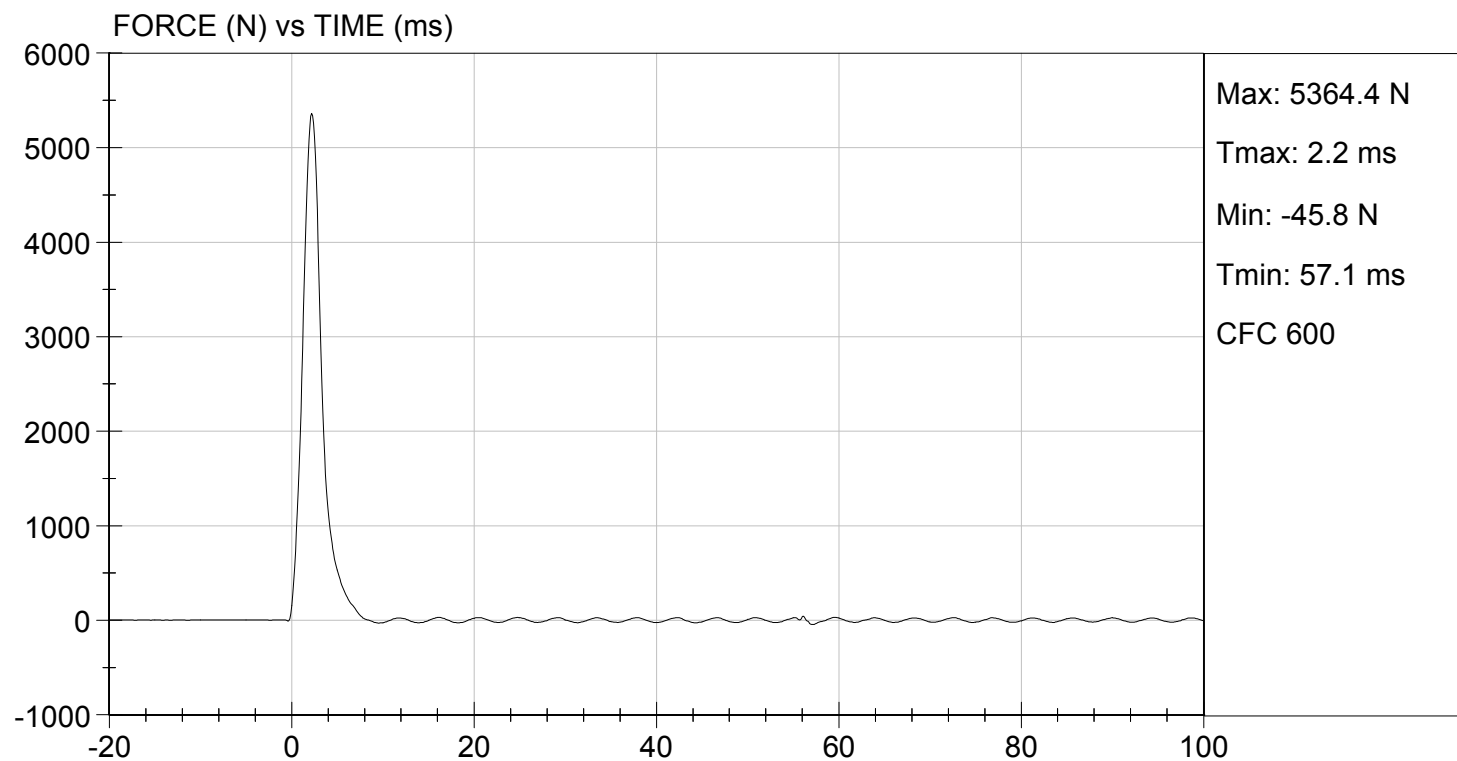
Test Date


Approved By



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

TEST DATE: 03/23/2015
TEST #: D15765



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

ATD Serial No: 351

Test I.D: D15766

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	4,862	Pass
Overall Test Results				Pass


Laboratory Technician

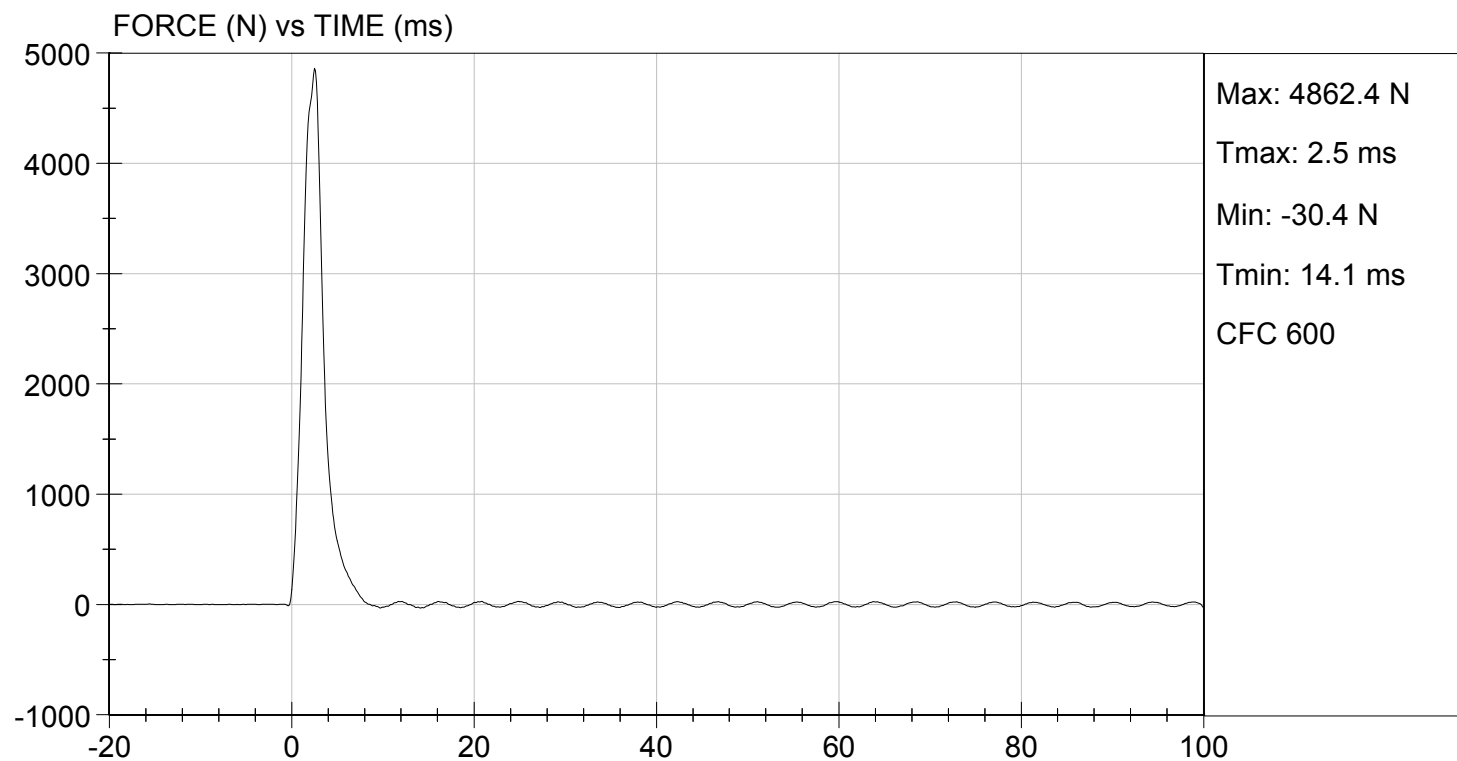
03/23/2015
Test Date


Approved By



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

TEST DATE: 03/23/2015
TEST #: D15766



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

ATD Serial No: 351

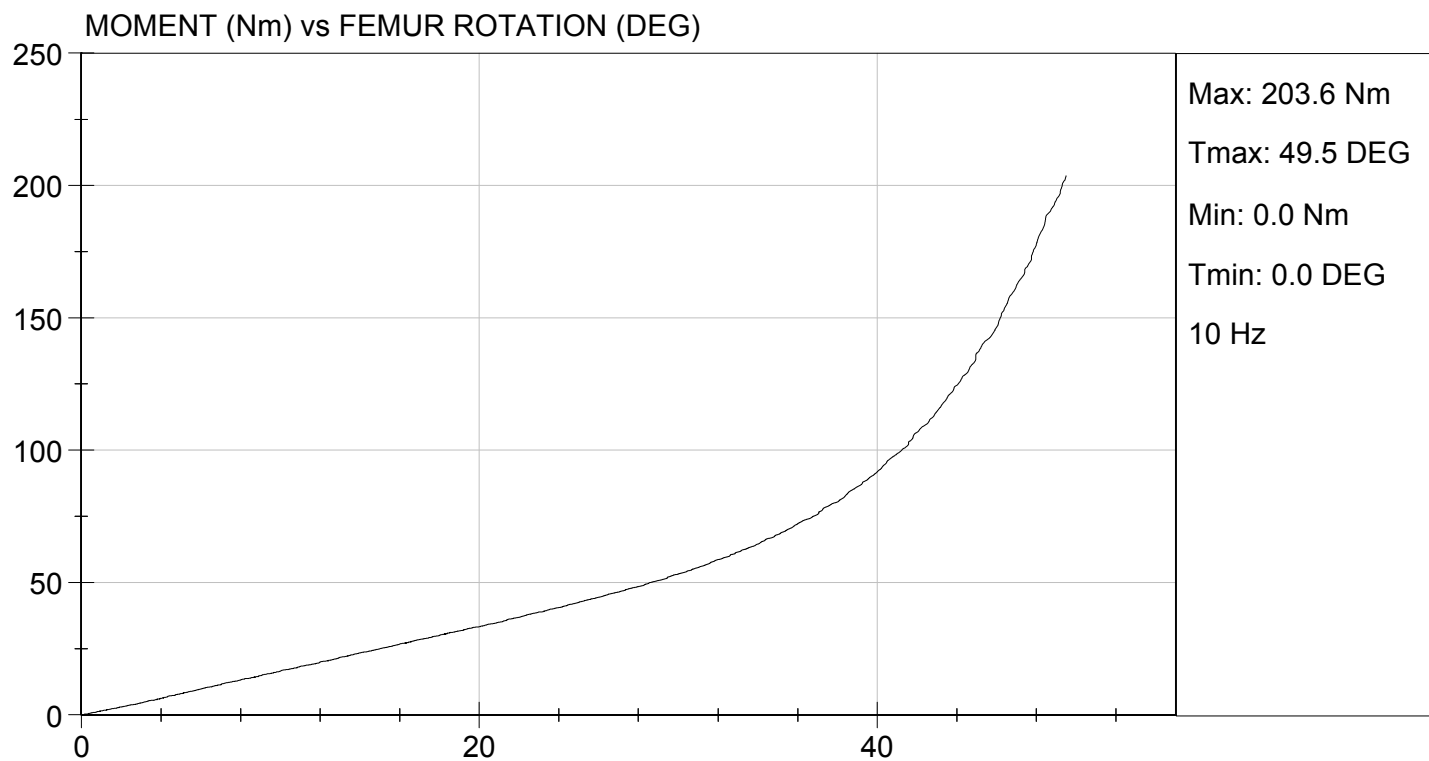
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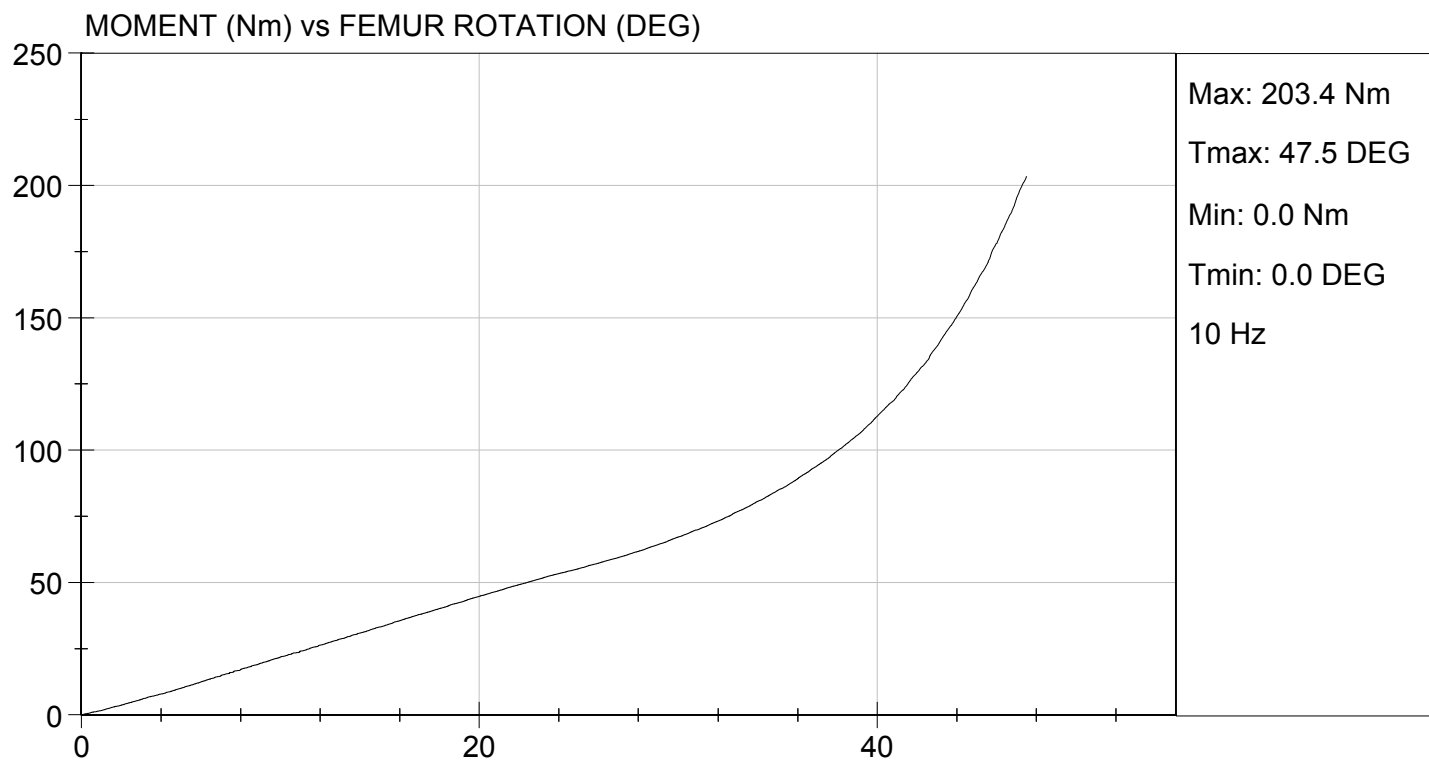
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	20.8	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	26	26	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.3	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	53.2	67.1	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	49.5	47.5	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

03/23/2015
Test Date

Jessica Hall
Approved By





Hybrid III, 5th External Measurements
SN: 138

HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	785.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	456.8
C	H-POINT HEIGHT	Reference	81.3-86.3	84.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	146.2
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	78.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	127.5
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	249.6
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	280.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	201.9
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	526.7
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.3
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	398.0

N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	430.5
HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	184.6
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	221.0
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	472.6
S	HEAD BREADTH	The widest part of the head	137.1-147.3	141.9
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	184.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	307.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	360.5
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	85.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	546.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	875.1
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	785.4
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.4
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.1

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test ID: D15601

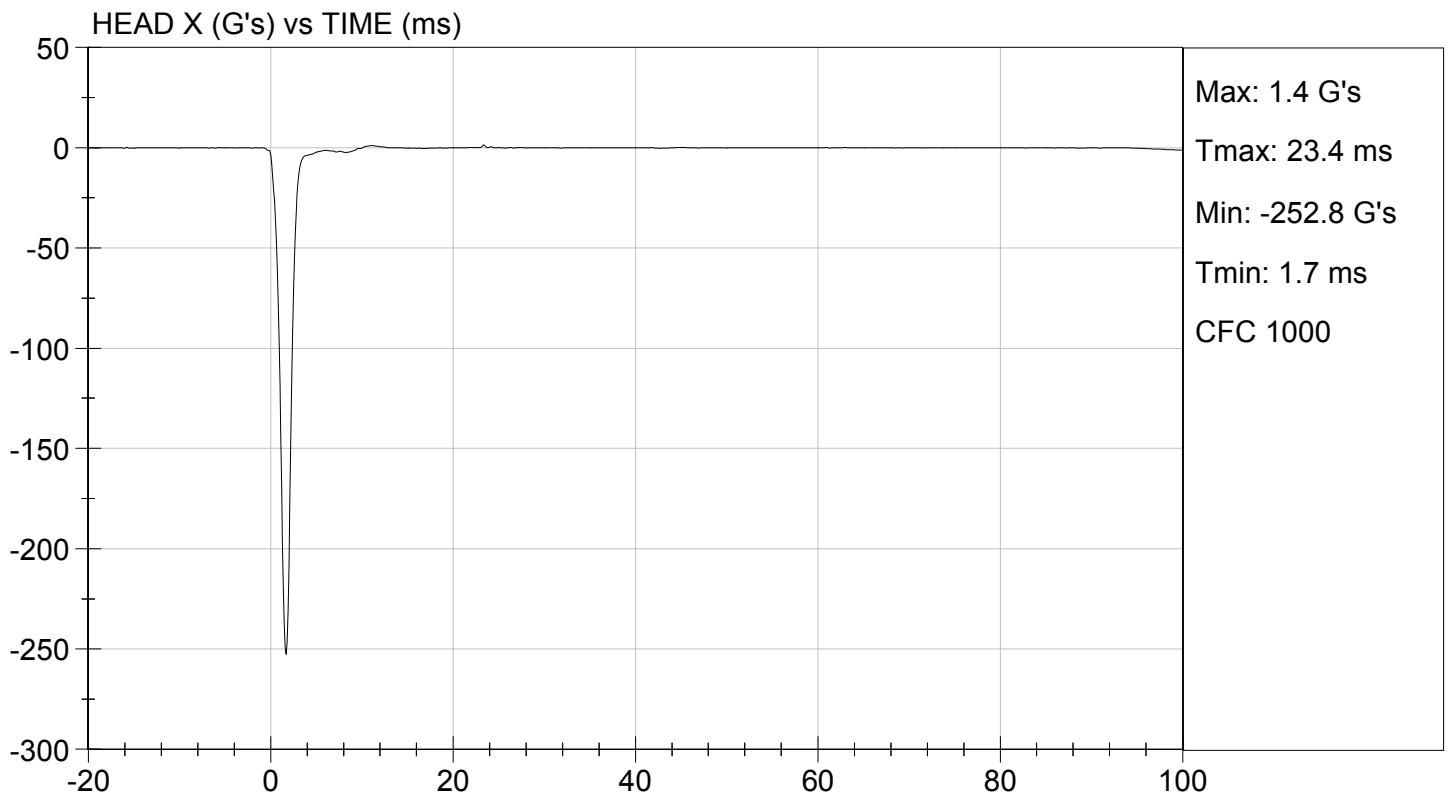
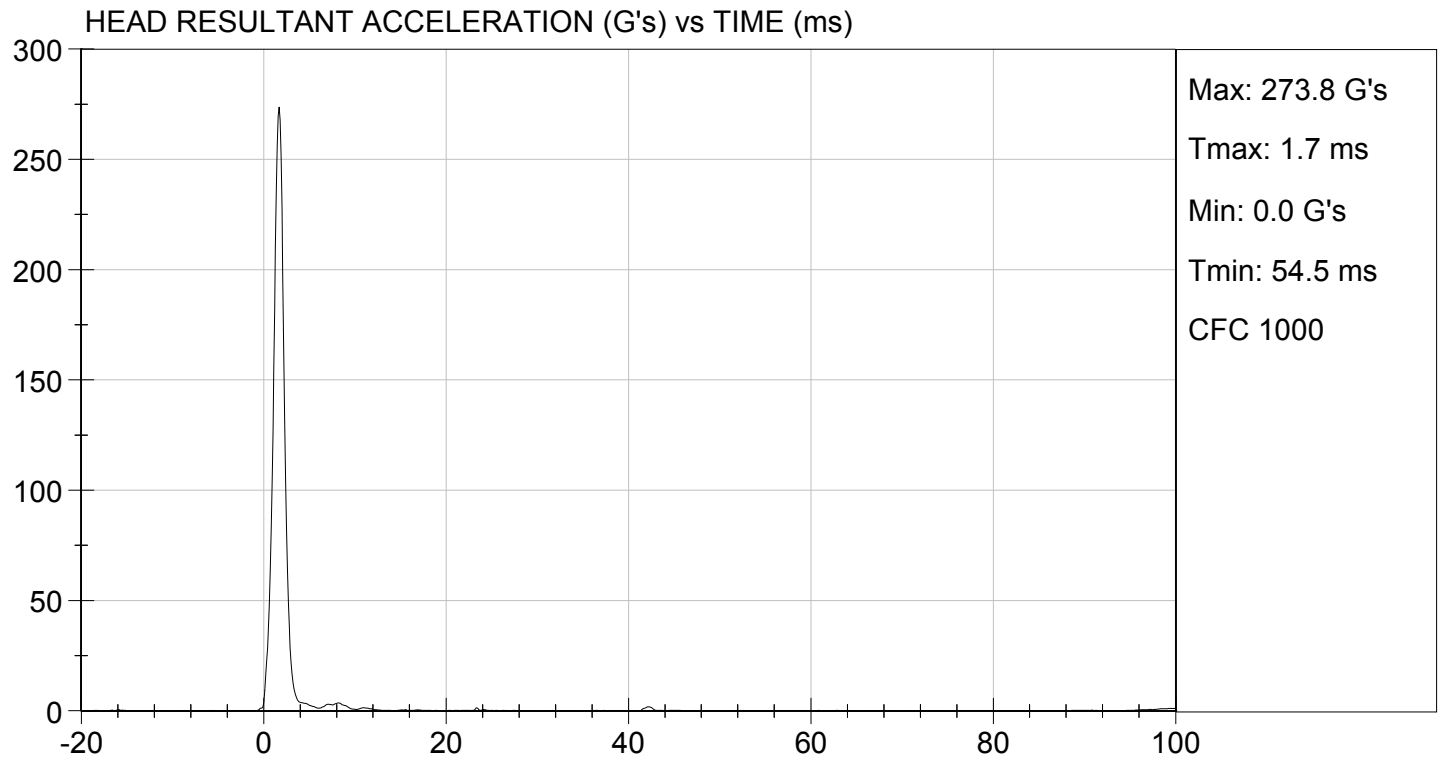
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	250 to 300	274	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	5.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

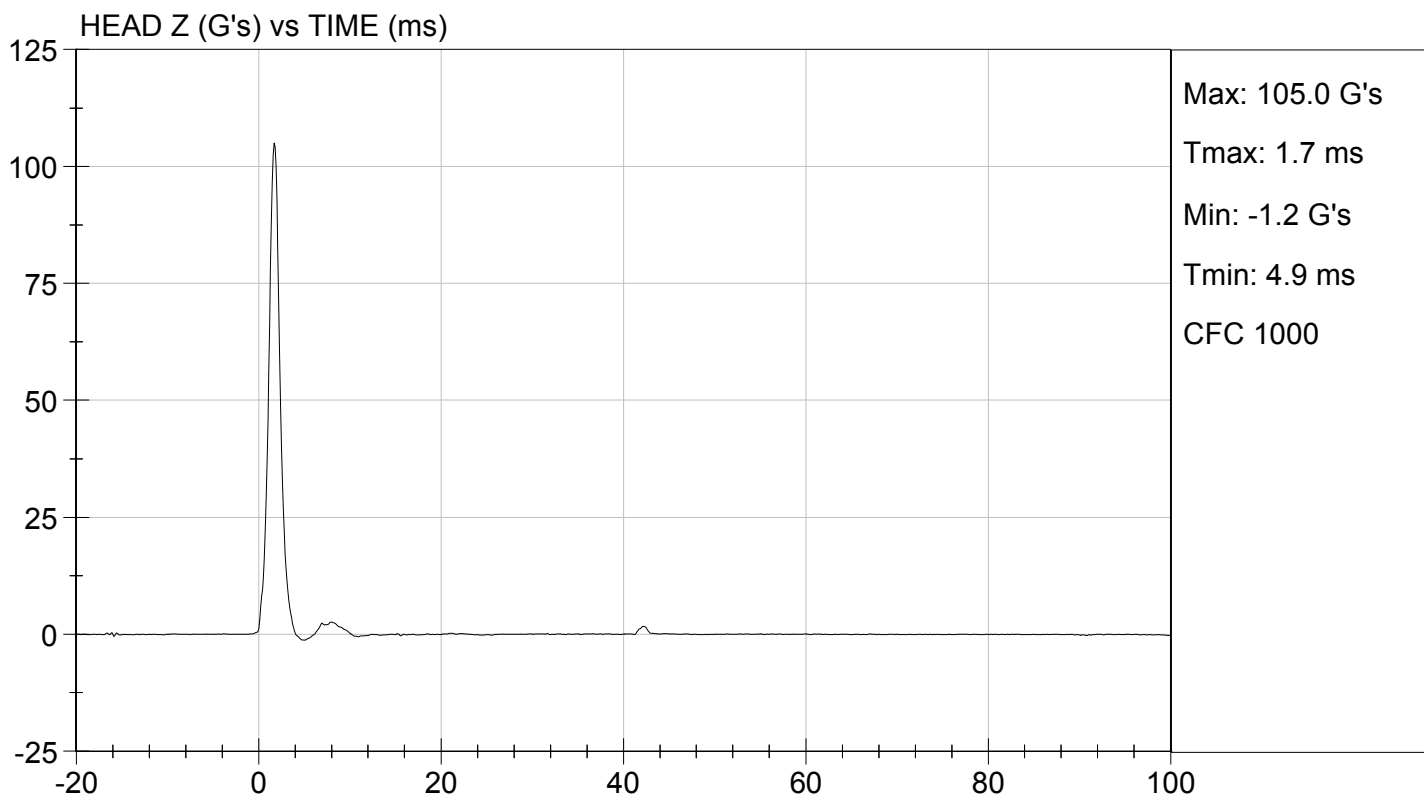
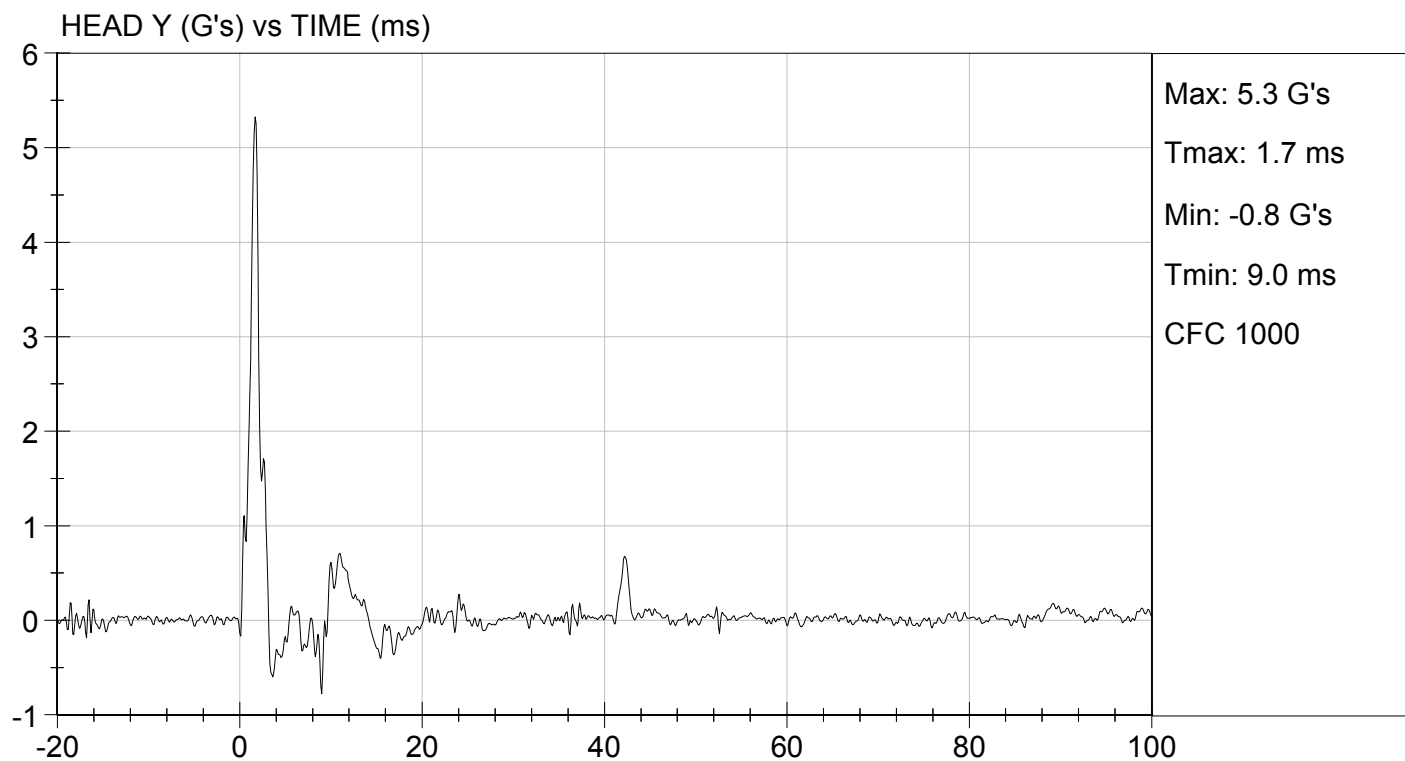
David Schoedel
Laboratory Technician

02/27/2015

Test Date

Jessica Hall
Approved By





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D15602

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	21	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.13	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	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	82	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	71	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	83	Pass
Overall Results					Pass

David Schoedel
Laboratory Technician

02/27/2015

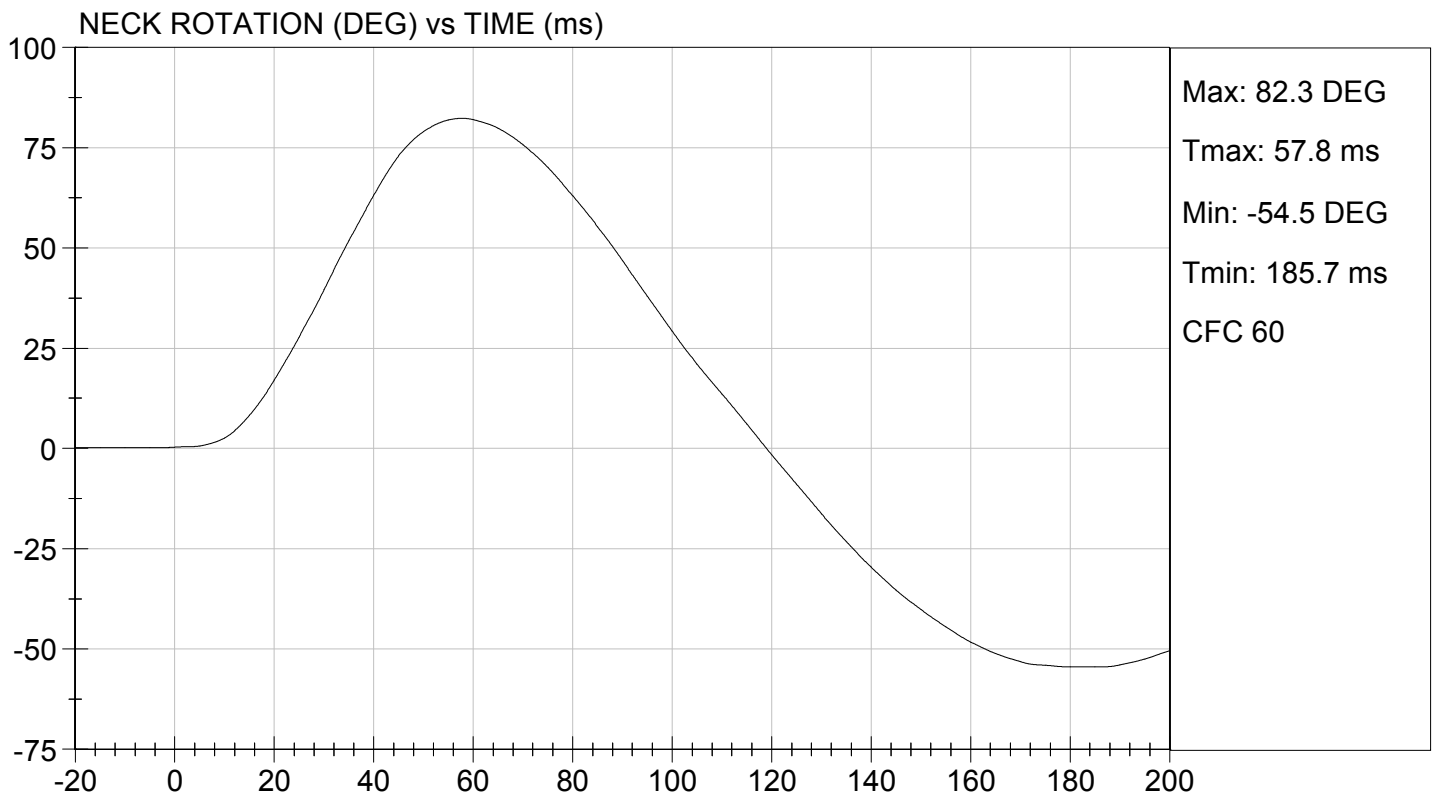
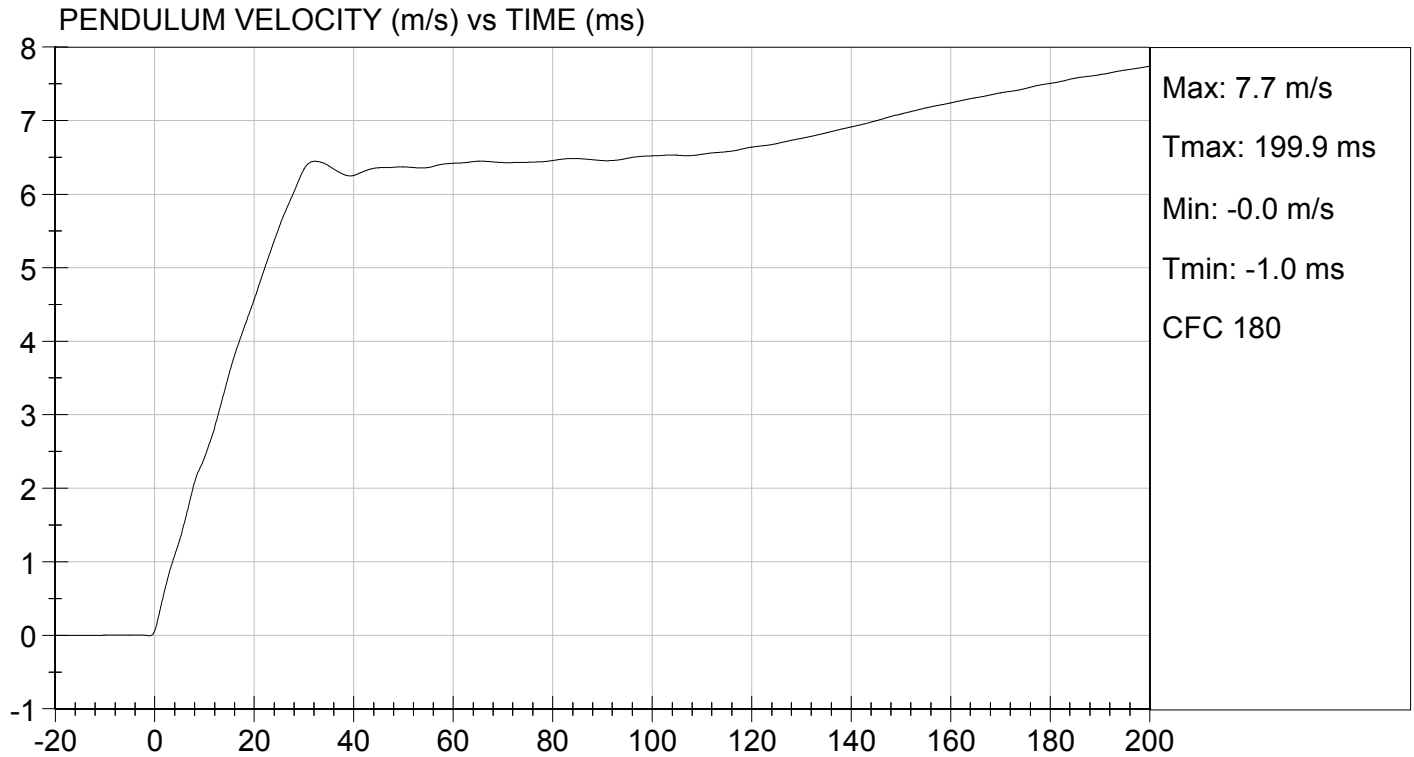
Test Date

Jessica Hall
Approved By



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

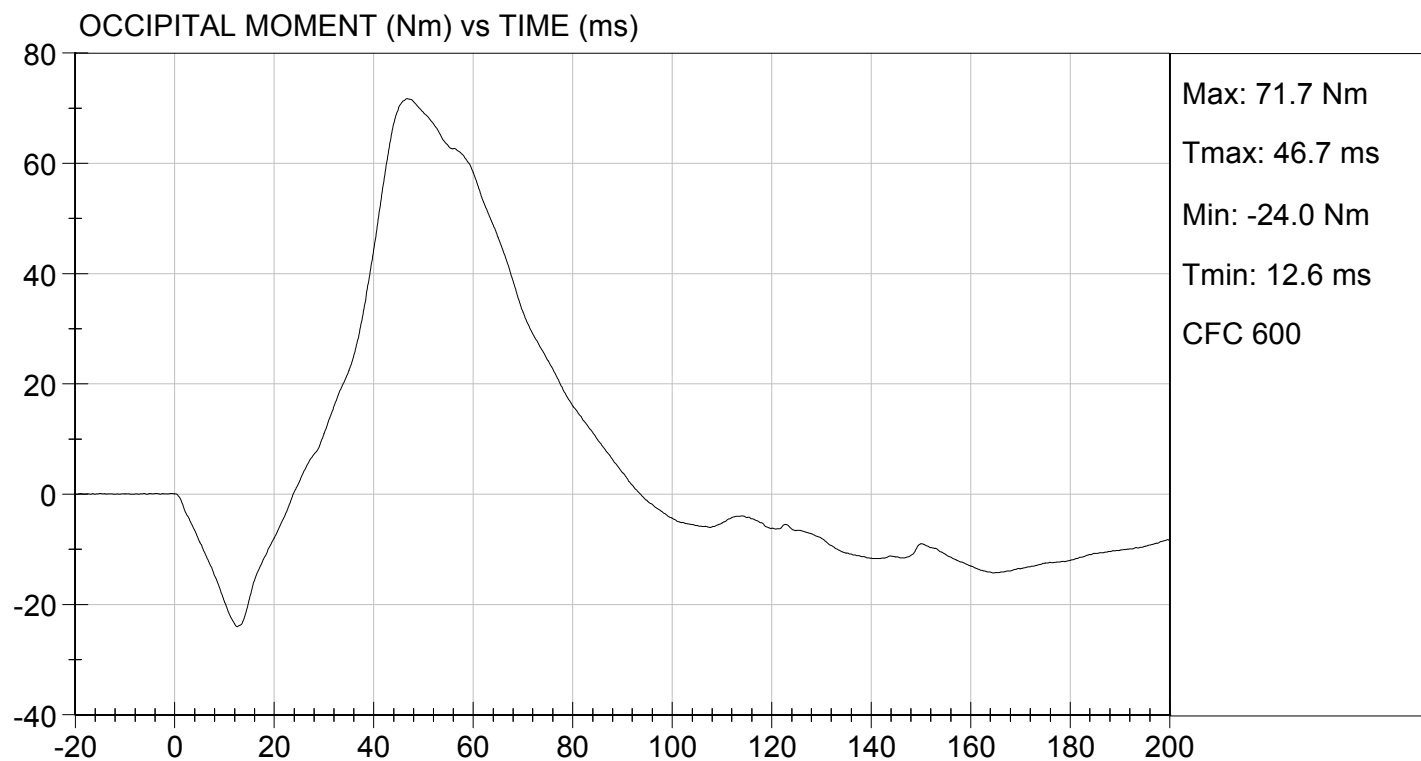
TEST DATE: 02/27/2015
TEST #: D15602





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

TEST DATE: 02/27/2015
TEST #: D15602



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D15603

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	21	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.19	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	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	105	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-58	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	99	Pass
Overall Results					Pass

David Schoedel
Laboratory Technician

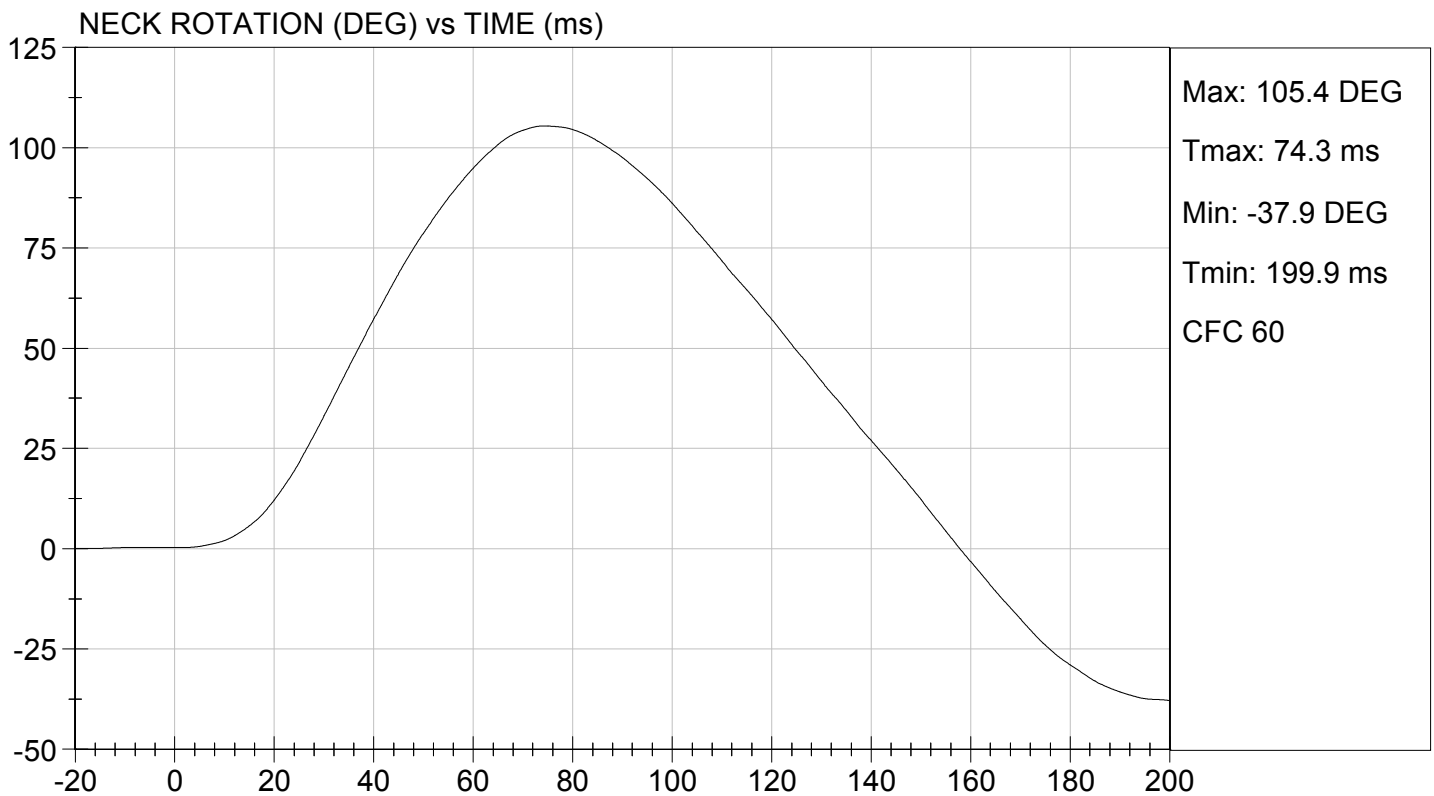
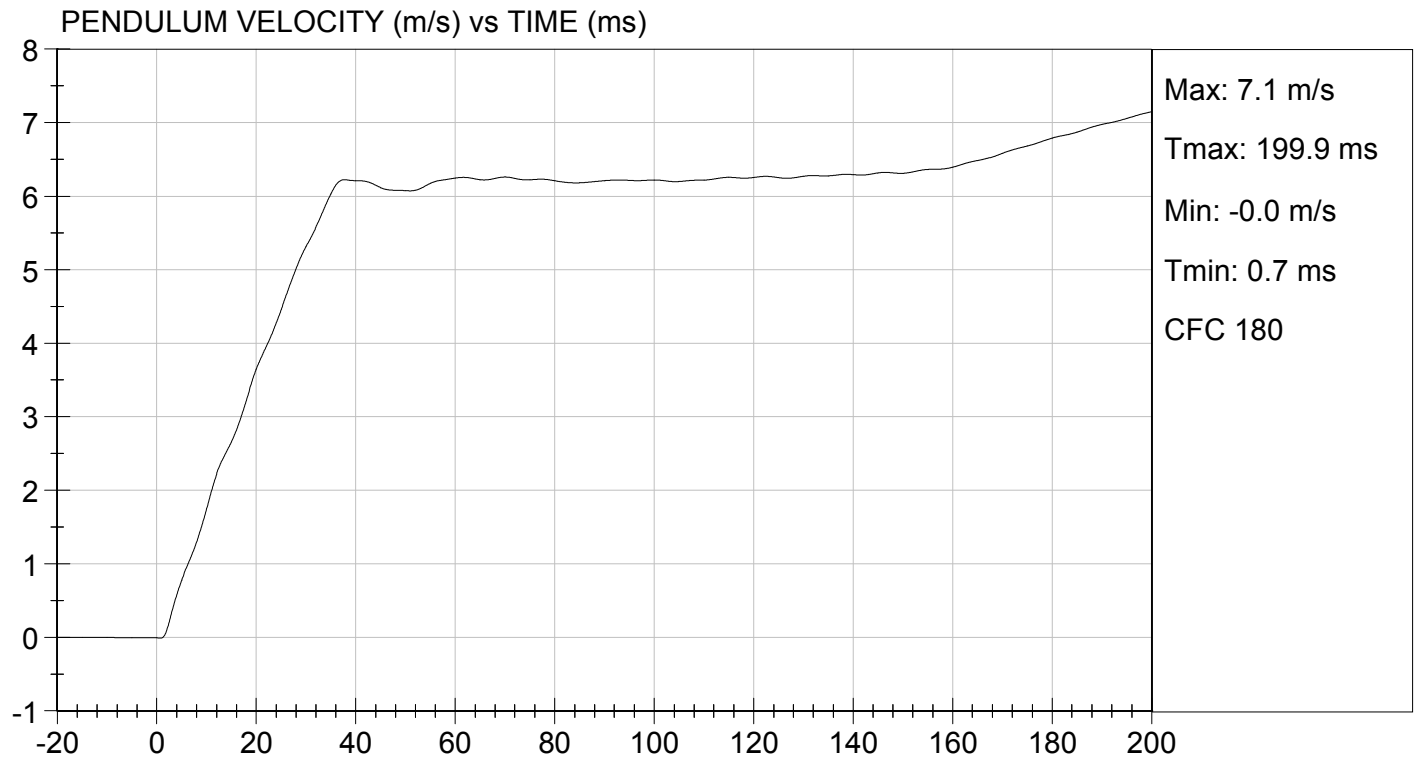
02/27/2015
Test Date

Jessica Hall
Approved By



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

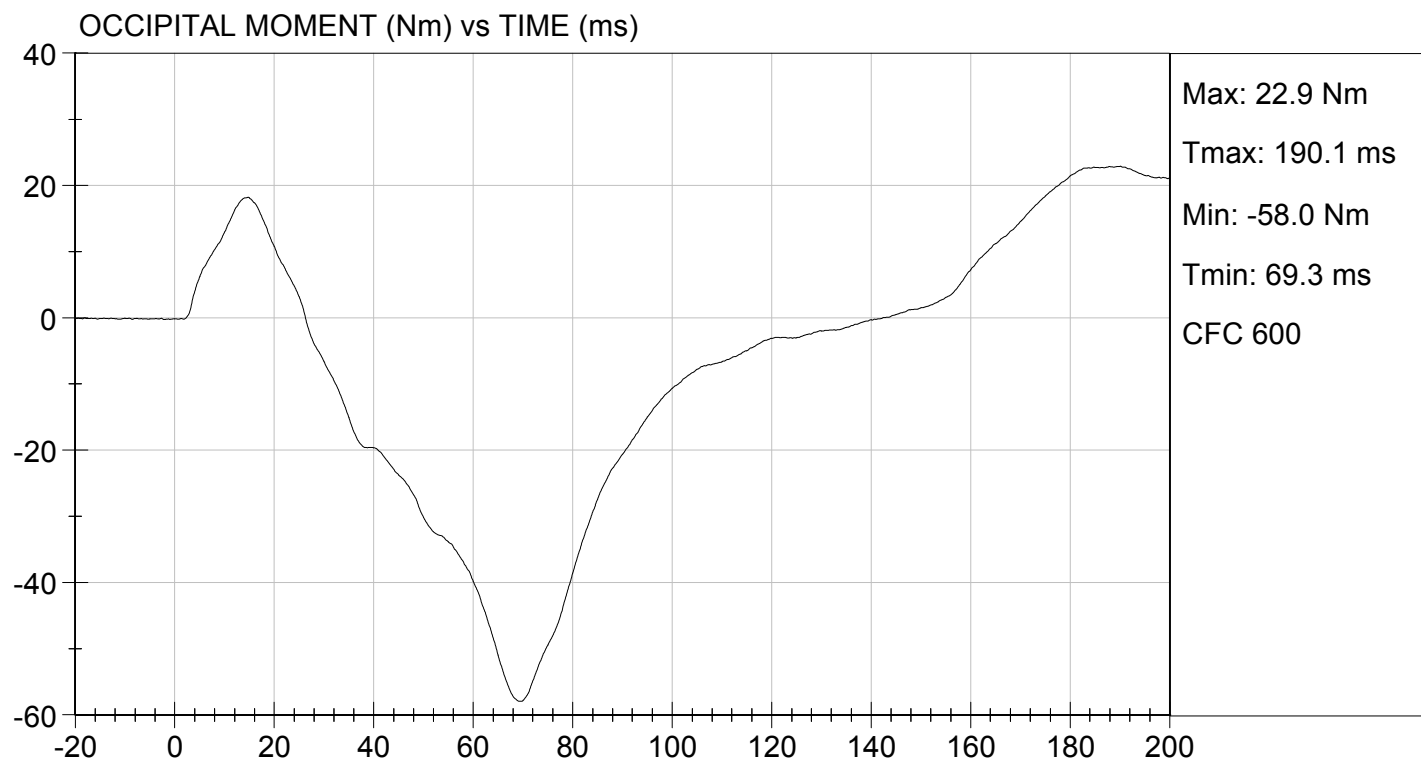
TEST DATE: 02/27/2015
TEST #: D15603





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

TEST DATE: 02/27/2015
TEST #: D15603



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D15604

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	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	4397	Pass
Internal Hysteresis	%	69 to 85	74	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4414	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

02/27/2015

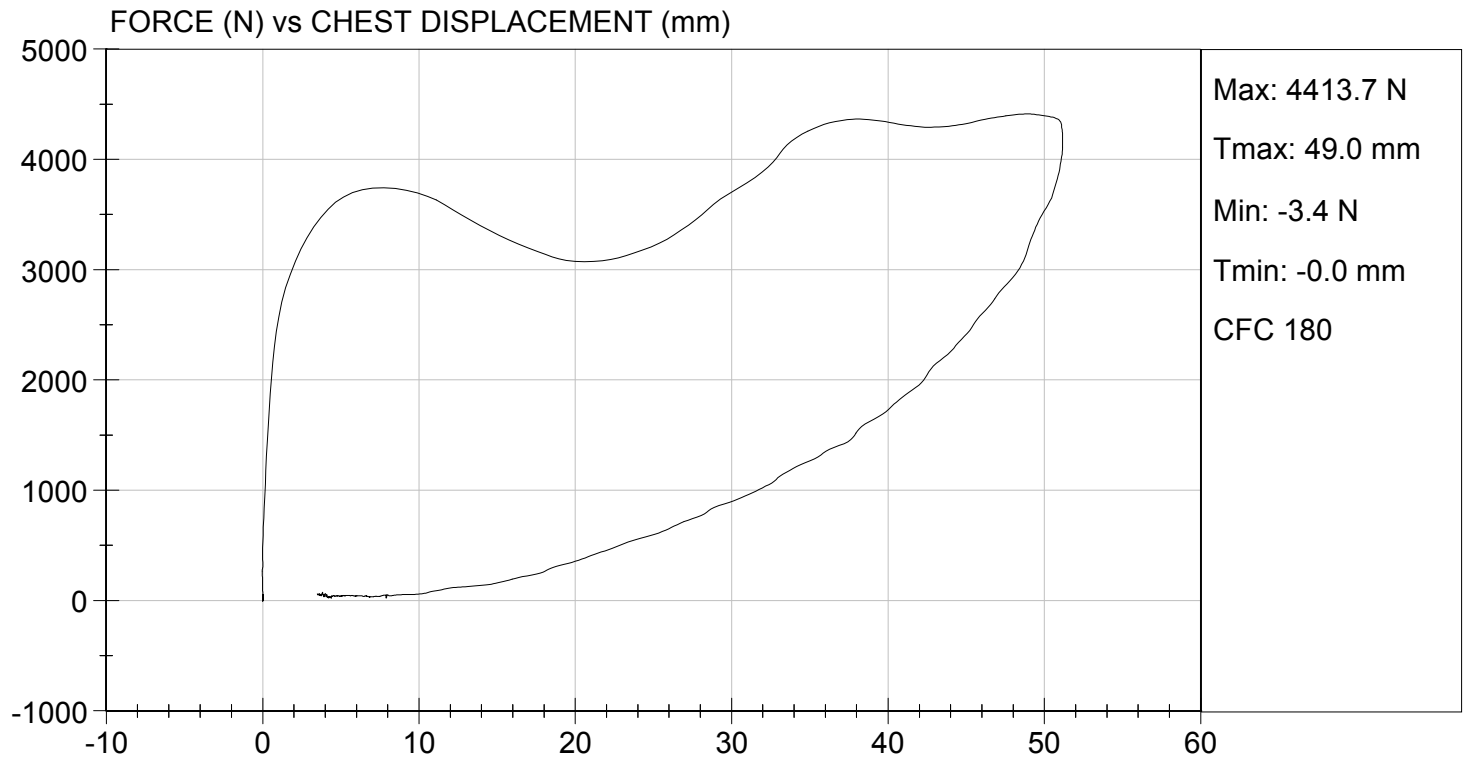
Test Date

Jessica Hall
Approved By



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

TEST DATE: 02/27/2015
TEST #: D15604



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D15605

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3561	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

02/27/2015

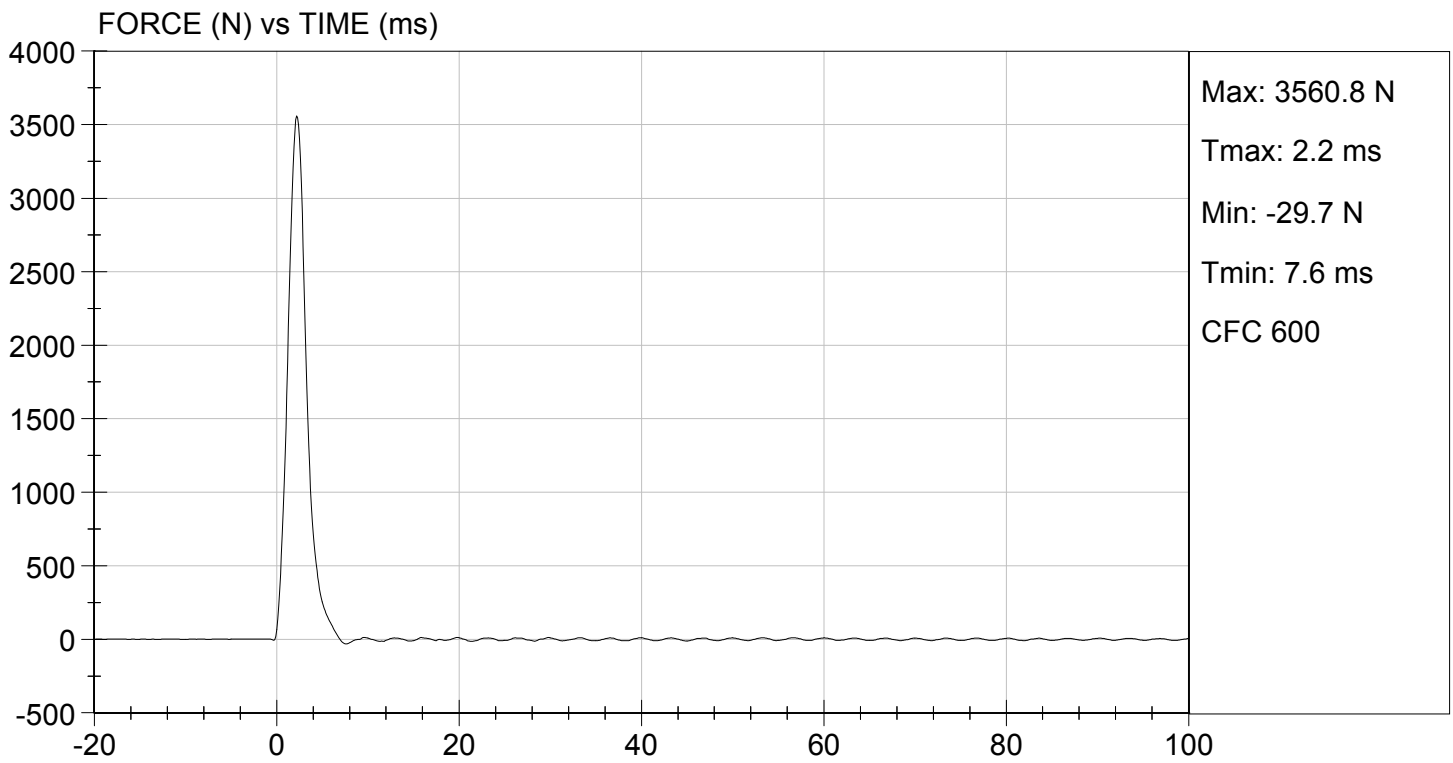
Test Date

Jessica Hall
Approved By



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

TEST DATE: 02/27/2015
TEST #: D15605



MGA RESEARCH CORPORATION

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

ATD Serial No: 138

Test I.D: D15606

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3714	Pass
Overall Test Results				Pass

David Schoedel

Laboratory Technician

02/27/2015

Test Date

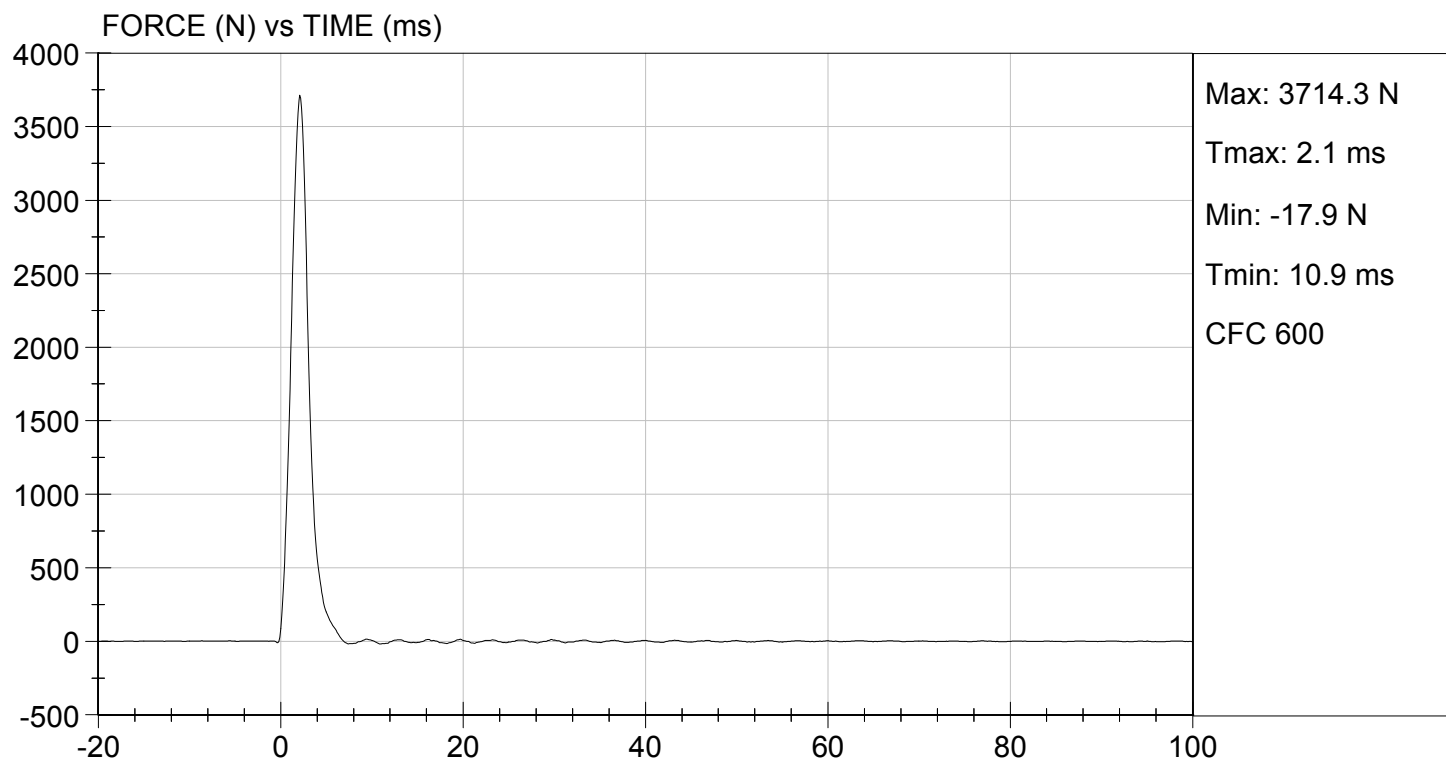
Jessica Hall

Approved By



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

TEST DATE: 02/27/2015
TEST #: D15606



MGA RESEARCH CORPORATION

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

ATD Serial No: 138

Test I.D: D15607

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Initial Angle	deg	0 to 20	20	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	365	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
Overall Result				Pass

David Schoedel

Laboratory Technician

02/27/2015

Test Date

Jessica Hall

Approved By

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test ID: D15771

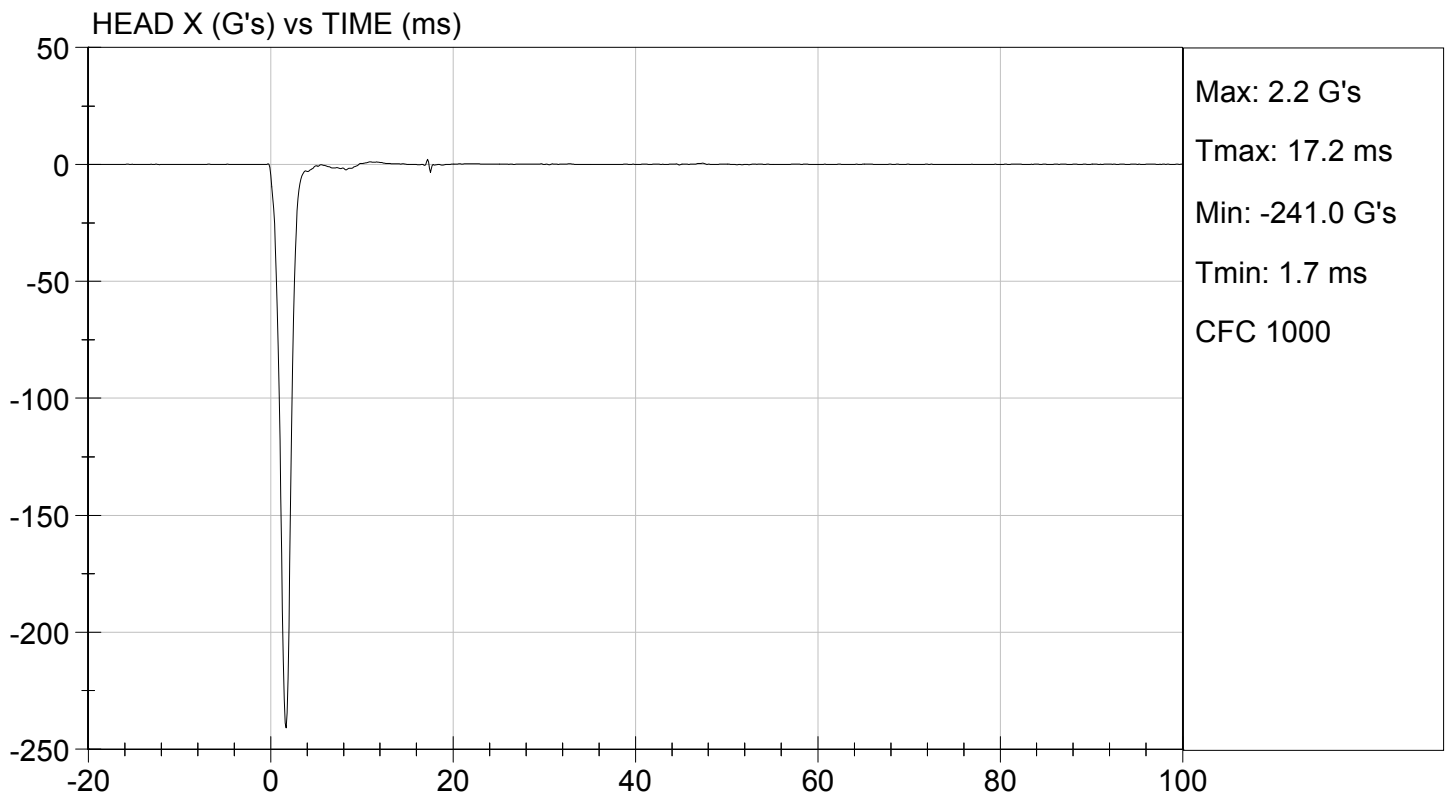
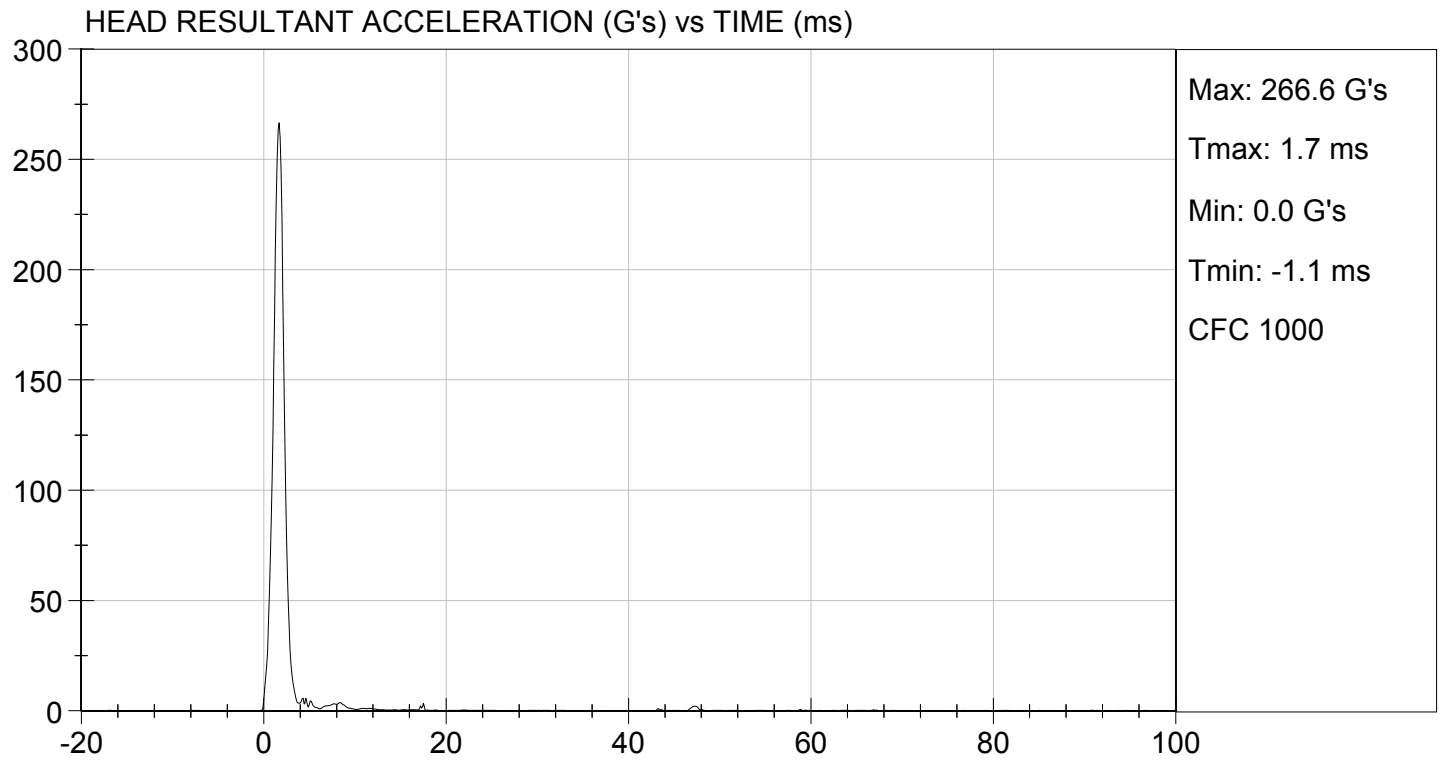
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	250 to 300	267	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-7.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

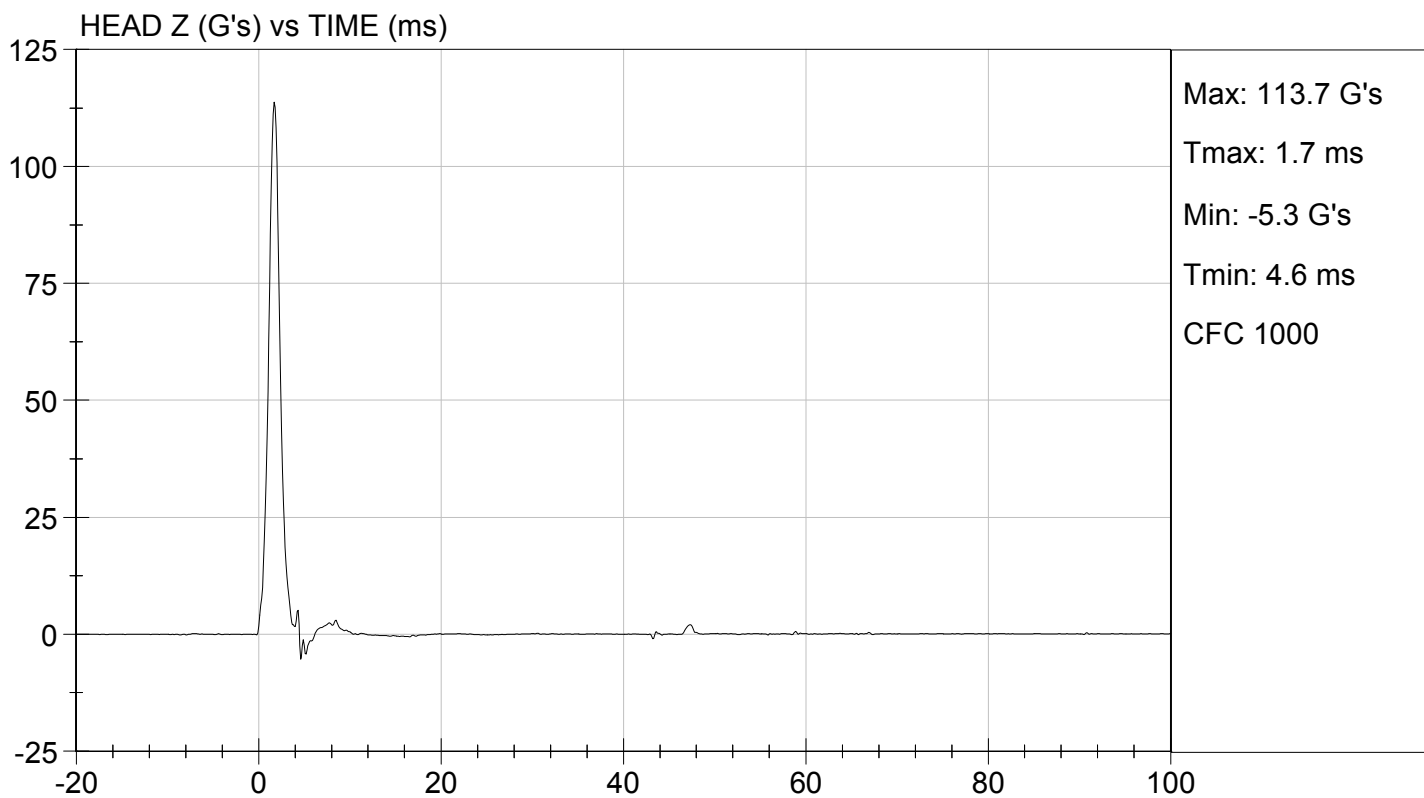
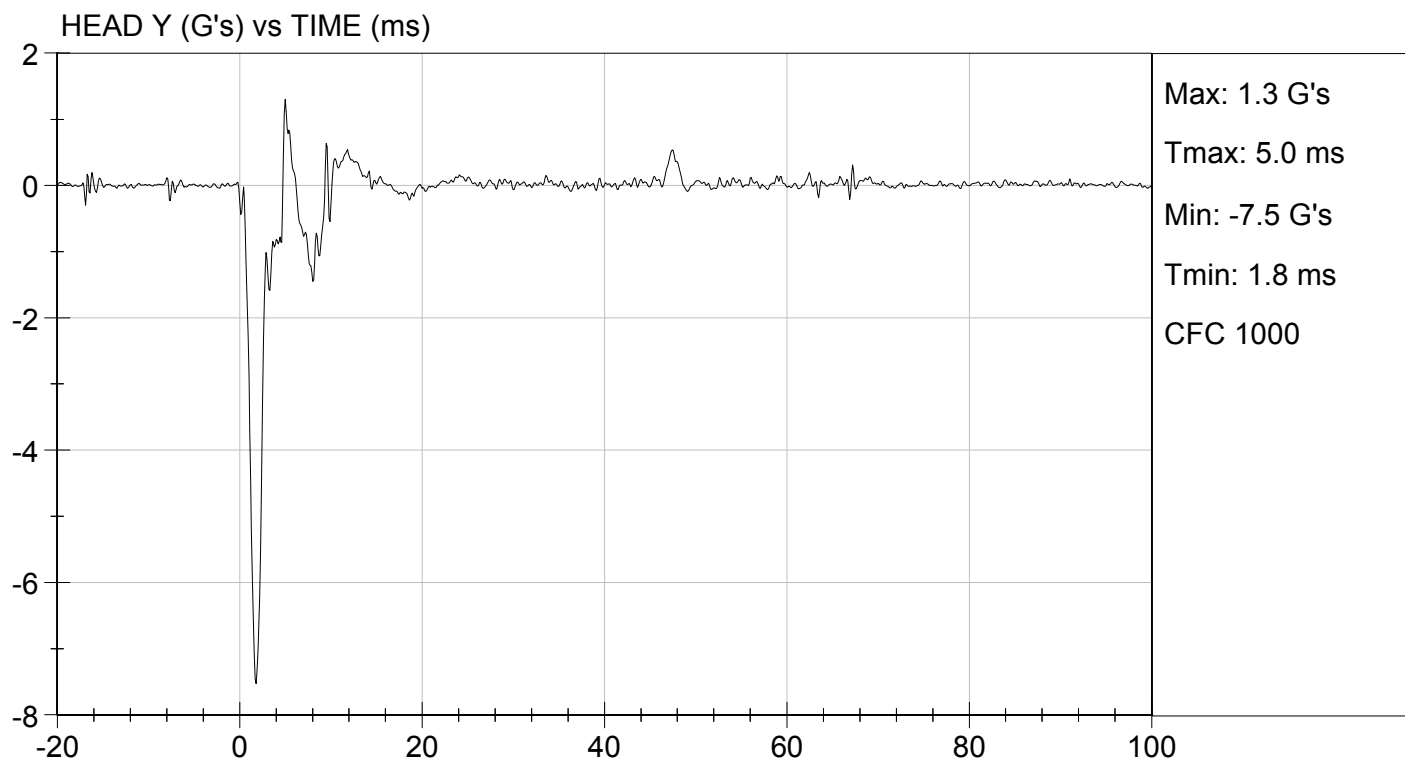
David Schoedel
Laboratory Technician

03/24/2015

Test Date

Jessica Hall
Approved By





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D15772

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	25	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	4.4	Pass
	30 ms	m/s	5.8 to 7.0	6.0	Pass
D Plane Rotation	Max	deg	77 to 91	79	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	73	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
Overall Results					Pass



Laboratory Technician

03/23/2015

Test Date

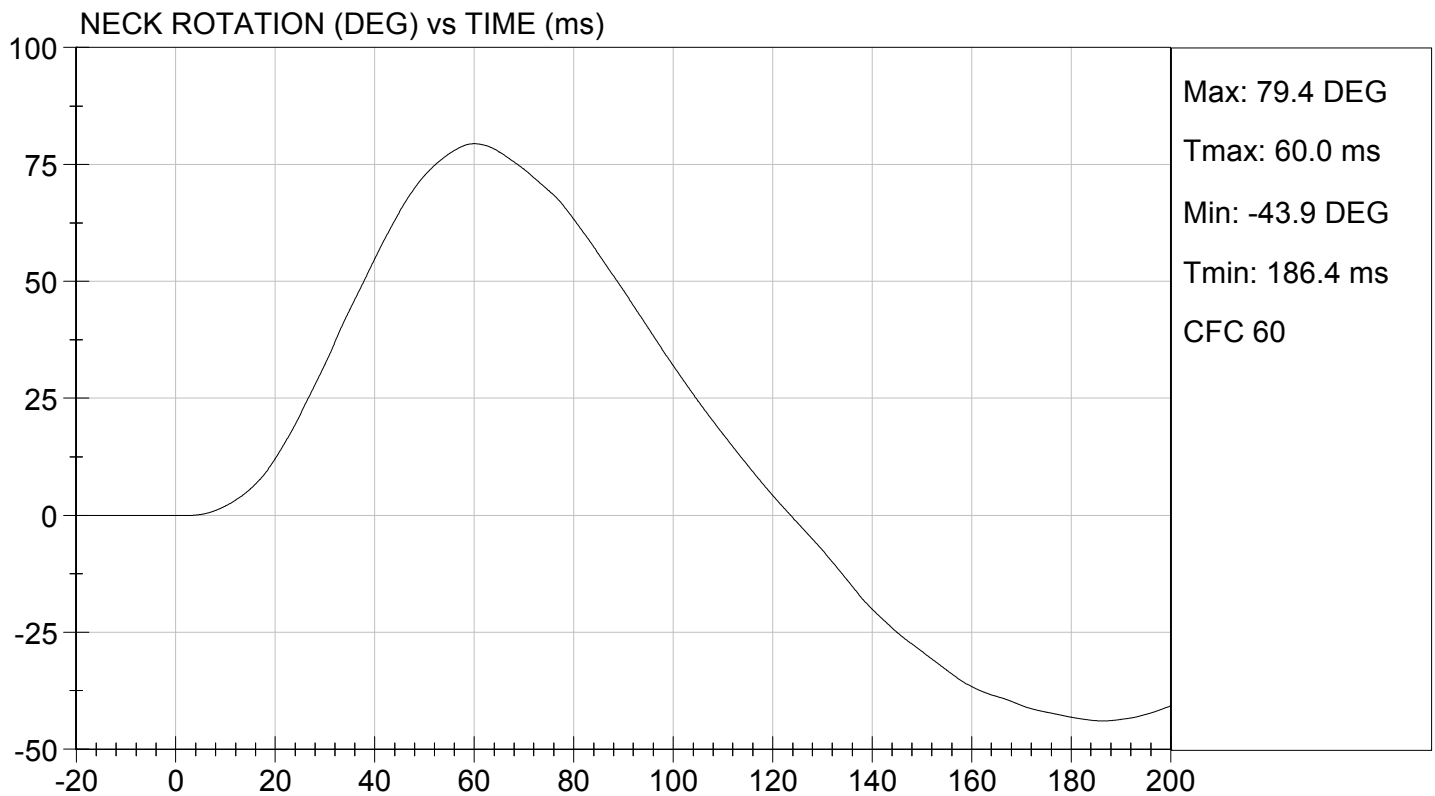
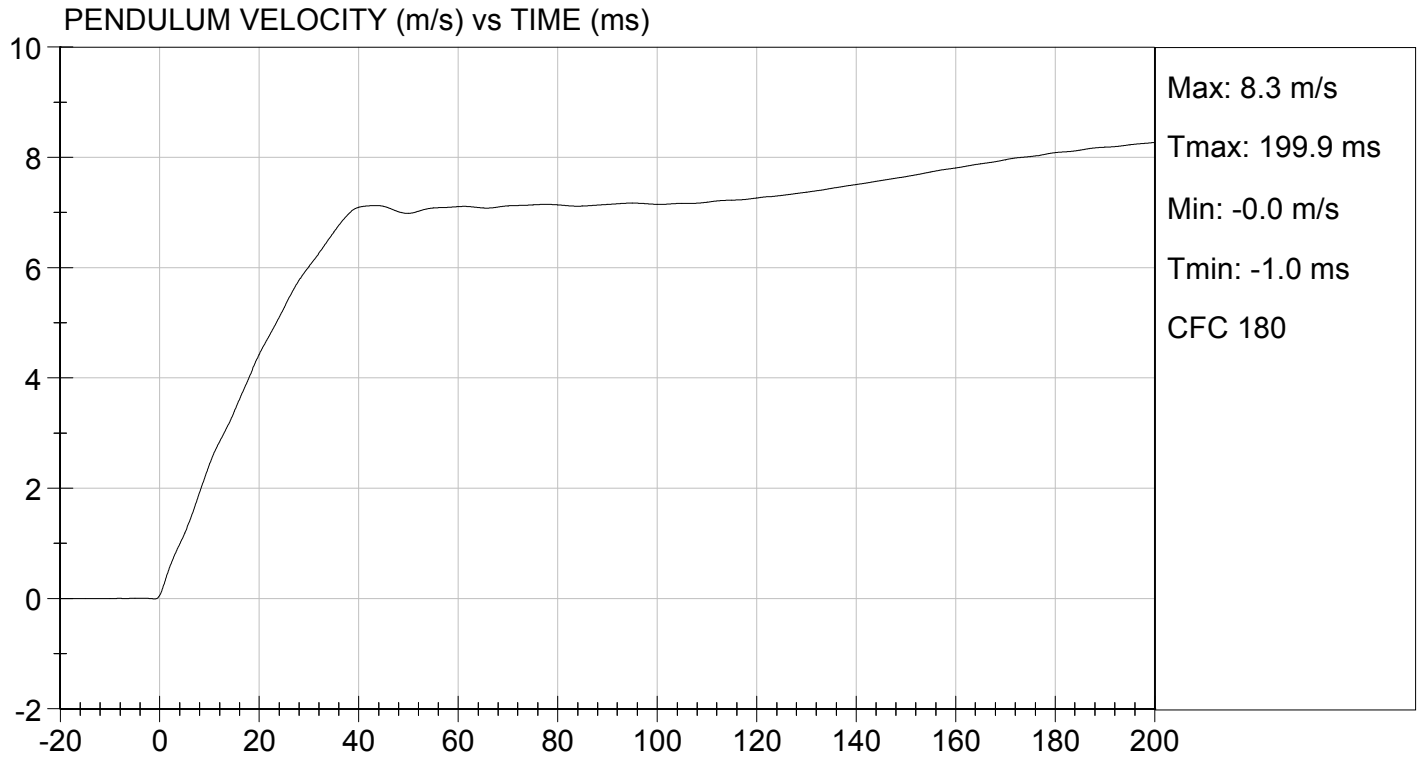


Approved By



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

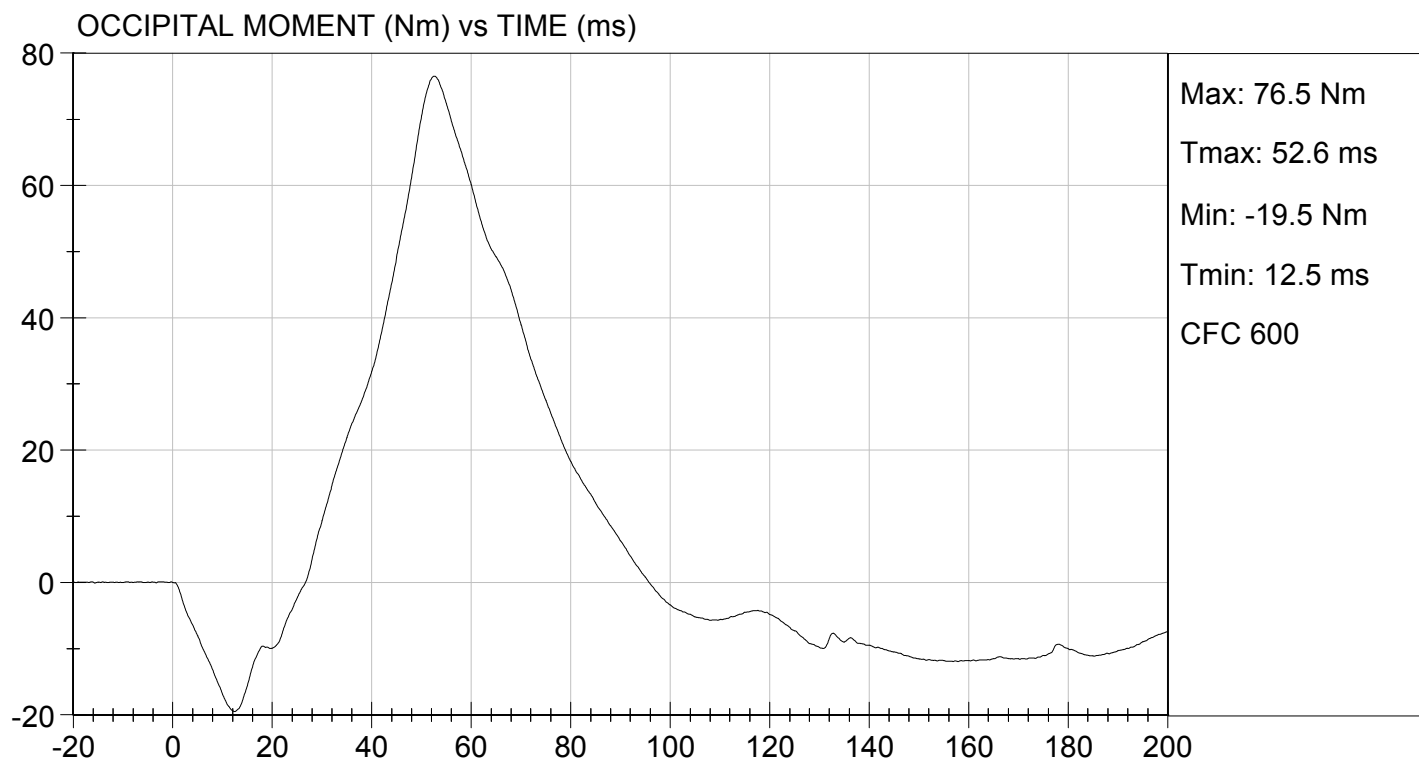
TEST DATE: 03/23/2015
TEST #: D15772





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

TEST DATE: 03/23/2015
TEST #: D15772



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D15773

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	26	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	101	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-60	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	101	Pass
Overall Results					Pass

Maxime Chamberland
Laboratory Technician

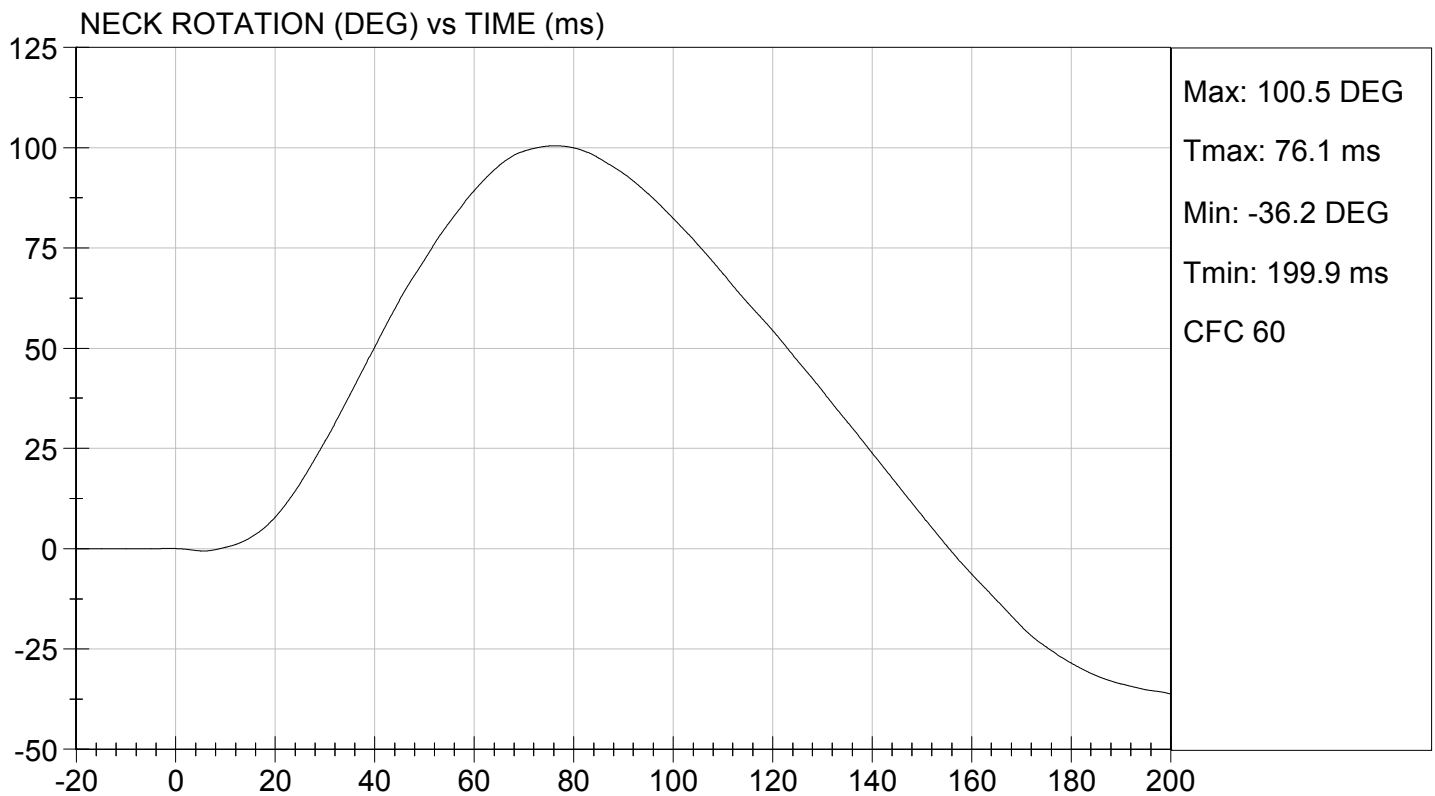
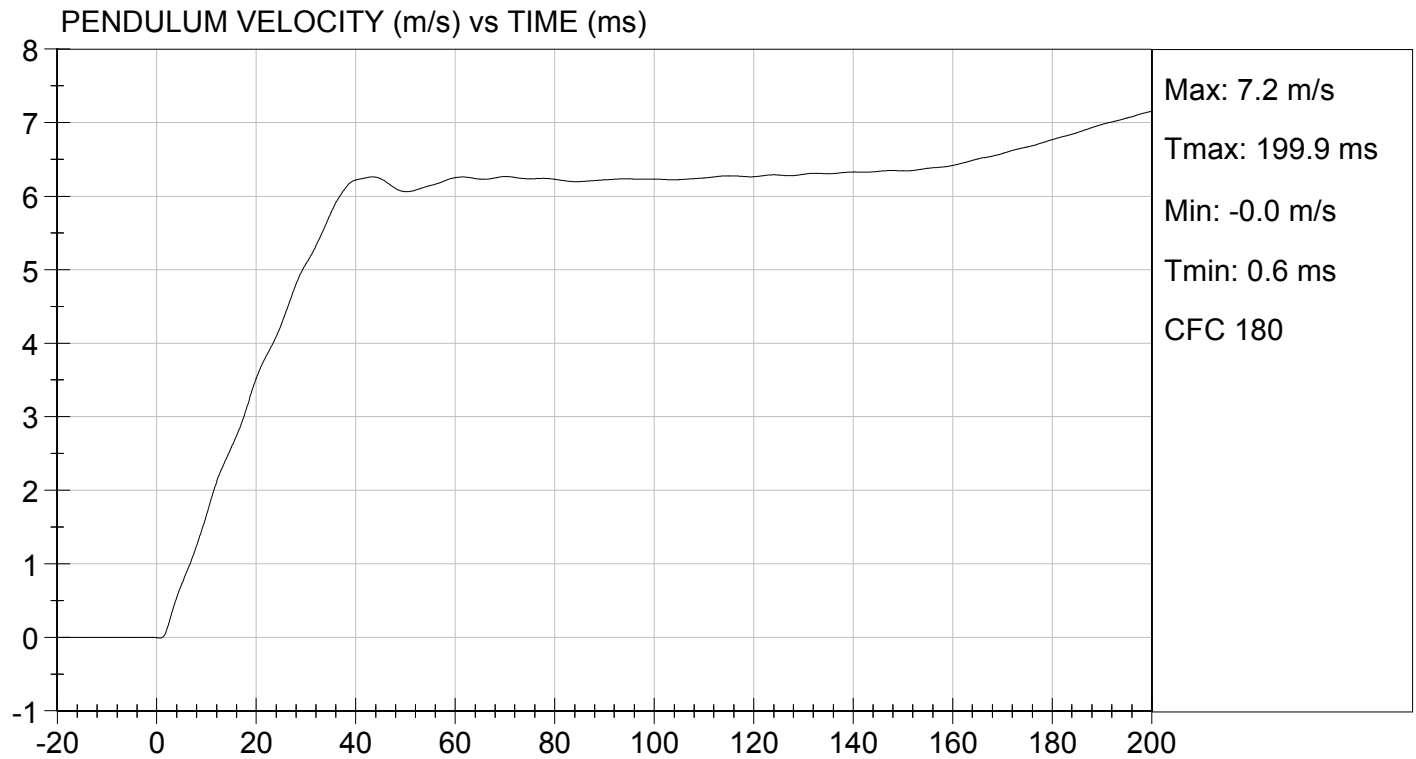
03/23/2015
Test Date

Jessica Hall
Approved By



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

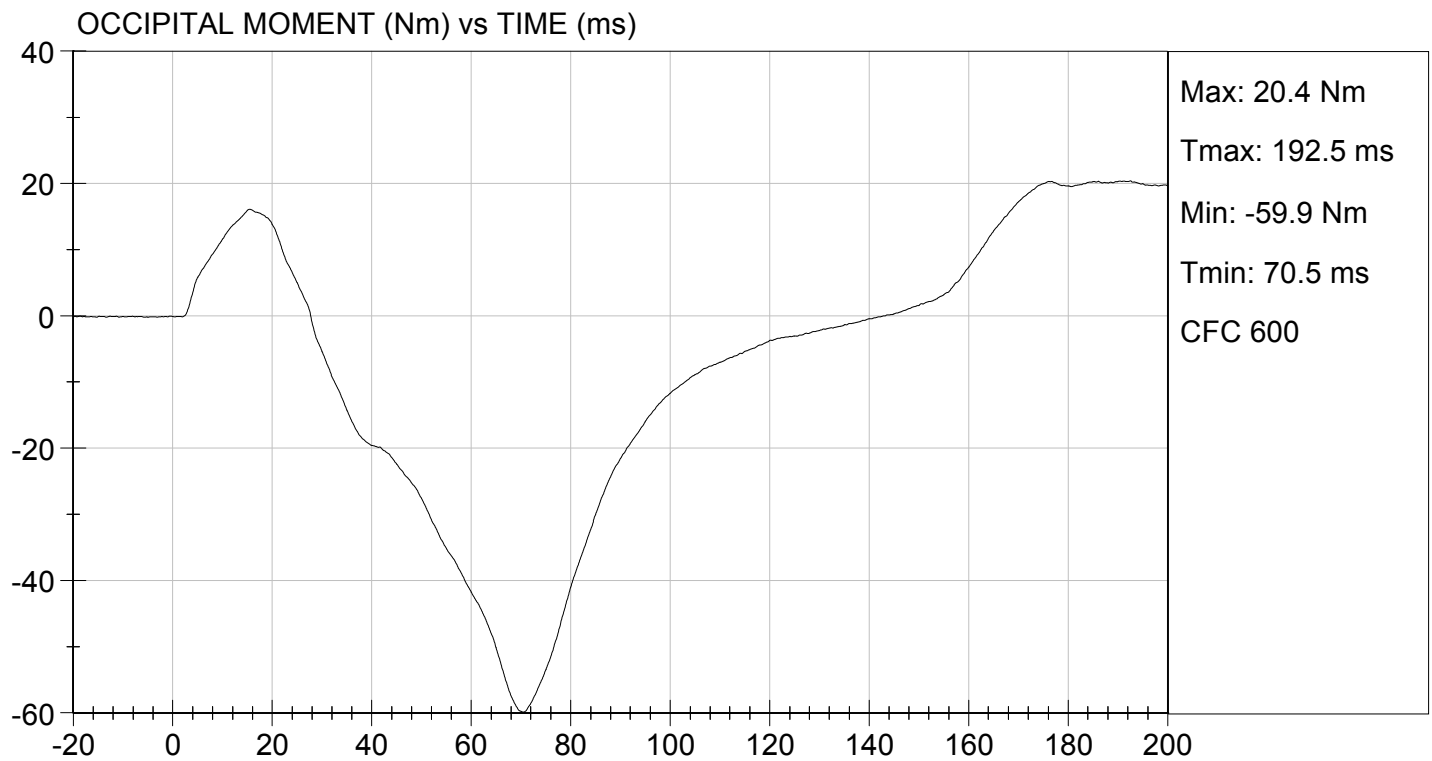
TEST DATE: 03/23/2015
TEST #: D15773





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

TEST DATE: 03/23/2015
TEST #: D15773



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D15774

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Relative Humidity	%	10 to 70	22	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	4064	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4088	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

03/24/2015

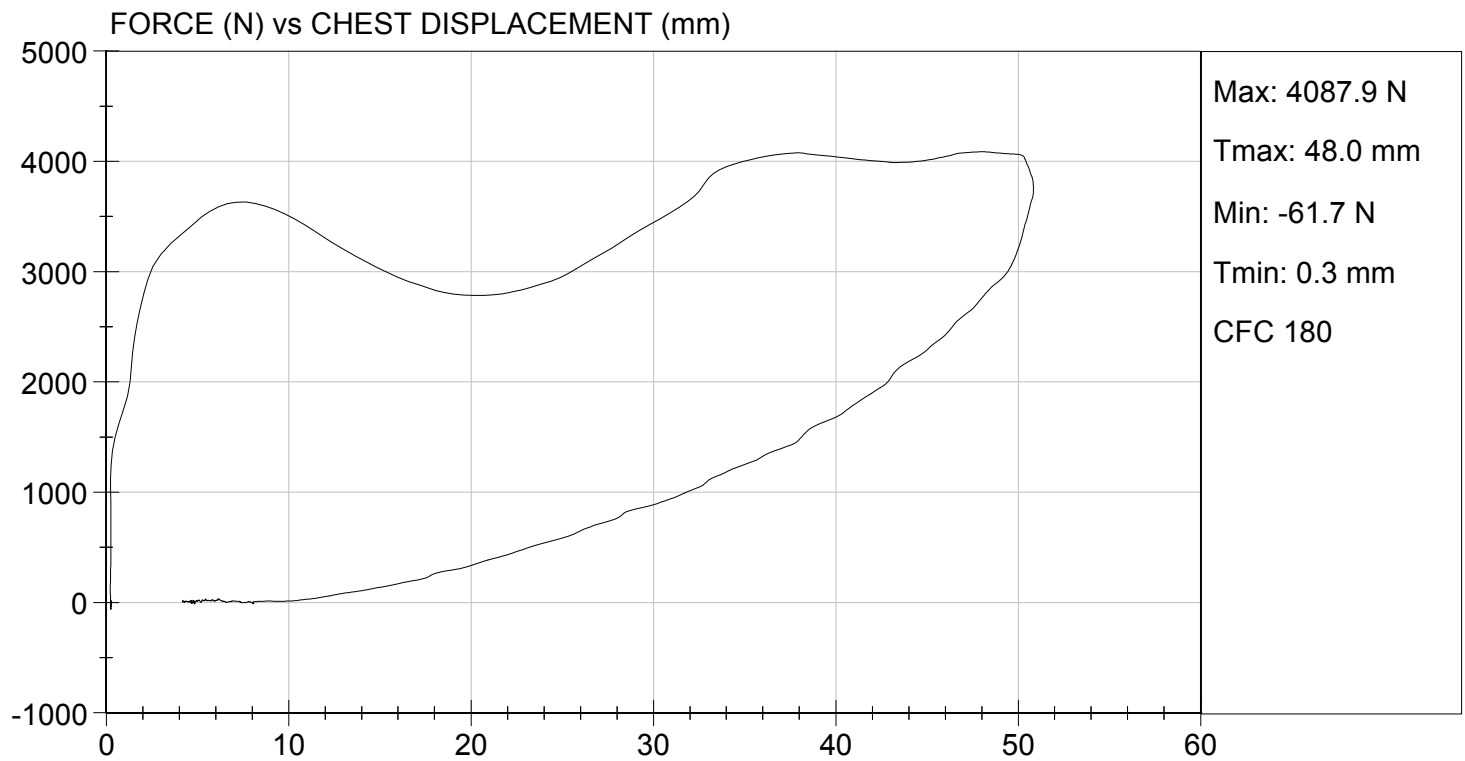
Test Date

Jessica Hall
Approved By



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

TEST DATE: 03/24/2015
TEST #: D15774



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D15775

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	N	3450 to 4060	3504	Pass
Overall Test Results				Pass

Maxime Chamberland

Laboratory Technician

03/23/2015

Test Date

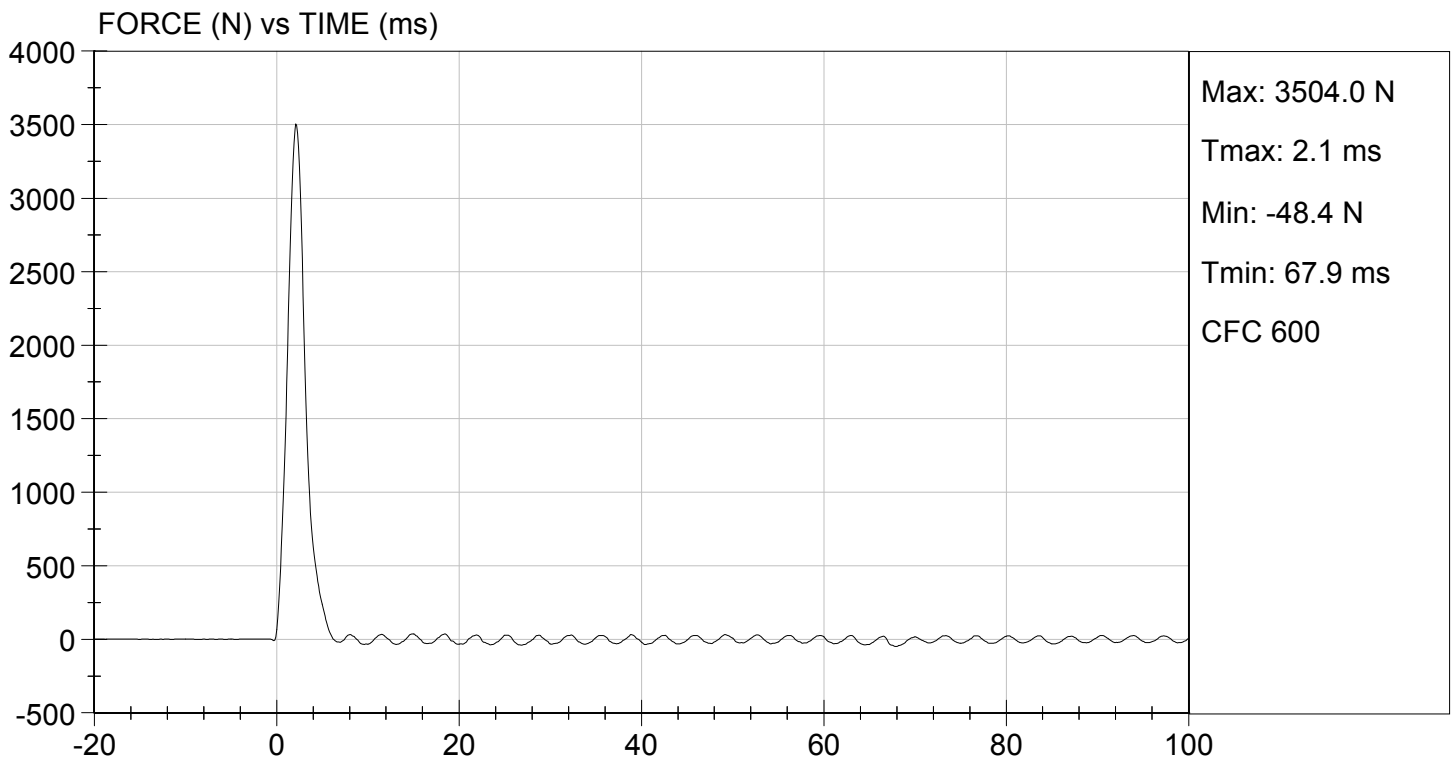
Jessica Hall

Approved By



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

TEST DATE: 03/23/2015
TEST #: D15775



MGA RESEARCH CORPORATION

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

ATD Serial No: 138

Test I.D: D15776

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3494	Pass
Overall Test Results				Pass

Maxime Chamberland
Laboratory Technician

03/23/2015

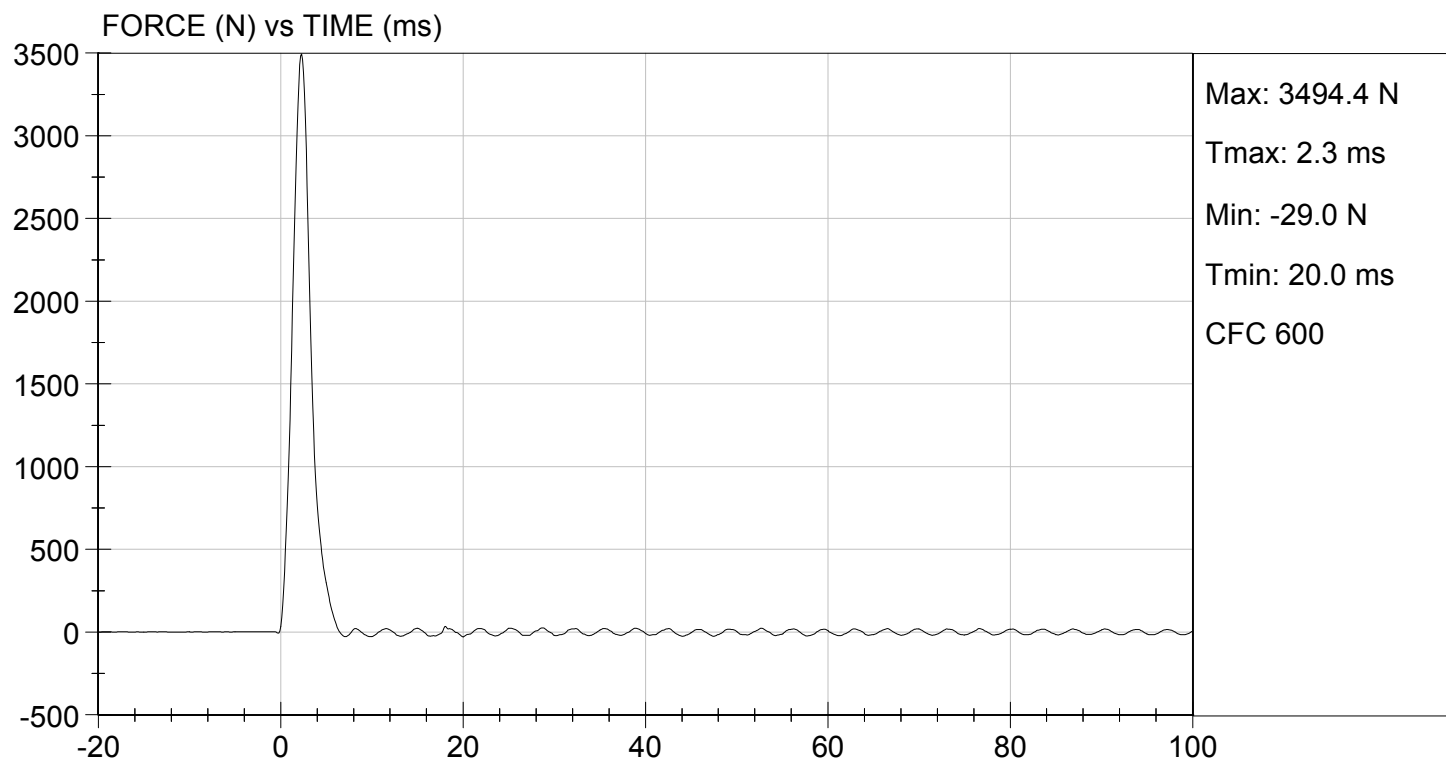
Test Date

Jessica Hall
Approved By



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

TEST DATE: 03/23/2015
TEST #: D15776



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D15777

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Initial Angle	deg	0 to 20	20	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	343	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.6	Pass
Overall Result				Pass

Maxime Chamberland
Laboratory Technician

03/23/2015

Test Date

Jessica Hall
Approved By