

REPORT NUMBER: NCAP-MGA-2009-001

**NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST**

**AUDI AG
2009 AUDI A4 SEDAN
NHTSA NUMBER: M95800**

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105**



Test Date: September 22, 2008

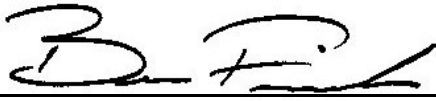
Final Report Date: October 16, 2008

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
1200 NEW JERSEY AVENUE, SE, ROOM W43-410
WASHINGTON, D.C. 20590**

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Technical Report Documentation Page

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16. Abstract A frontal barrier impact was conducted on a 2009 Audi A4 Sedan at MGA Research Corporation on September 22, 2008. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The impact velocity was 56.2 km/h. The ambient temperature at the barrier face at the time of impact was 21 degrees Celsius. The vehicle's maximum post test static crush is 658 mm located to the left of the vehicle's centerline. The test vehicle is equipped with a 3-point continuous belt system and an airbag in both front outboard seating positions. With respect to FMVSS 208 "Occupant Crash Protection", the occupant injury criteria summary is as follows: <table border="1" style="width: 100%; margin-top: 10px; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;"><u>Measurement Description</u></th> <th style="text-align: left;"><u>Units</u></th> <th style="text-align: left;"><u>Threshold</u></th> <th style="text-align: left;"><u>Driver ATD</u></th> <th style="text-align: left;"><u>Pass. ATD</u></th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC)</td> <td>N/A</td> <td>1000</td> <td>338</td> <td>436</td> </tr> <tr> <td>Max. Thorax Accel. (3ms Clip)</td> <td>G's</td> <td>60</td> <td>39</td> <td>38</td> </tr> <tr> <td>Left Femur Force</td> <td>Newton</td> <td>10009</td> <td>-825</td> <td>-593</td> </tr> <tr> <td>Right Femur Force</td> <td>Newton</td> <td>10009</td> <td>-448</td> <td>-452</td> </tr> </tbody> </table>				<u>Measurement Description</u>	<u>Units</u>	<u>Threshold</u>	<u>Driver ATD</u>	<u>Pass. ATD</u>	Head Injury Criteria (HIC)	N/A	1000	338	436	Max. Thorax Accel. (3ms Clip)	G's	60	39	38	Left Femur Force	Newton	10009	-825	-593	Right Femur Force	Newton	10009	-448	-452
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This 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 DTNH22-06-D-00028. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact in excess of the current 48.3 kph requirements.

SUMMARY

A load cell barrier was impacted by a 2009 Audi A4 Sedan at a velocity of 56.2 kph. The test was performed at MGA Research Corporation on September 22, 2008. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and fourteen 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.

Two Part 572E, 50th percentile male anthropomorphic test devices (ATDs), were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometer, upper neck transducers, right/left femur load cells, and lower leg instrumentation. The driver (position 1) ATD (Serial No. 066) and right-front passenger (position 2) ATD (Serial No. 065) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 102 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest, and femur 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 658 mm and both the driver and passenger side doors remained closed and latched during the impact event and were operable after the impact.

The driver's head and chest contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee bolster. The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest and headliner. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC	T ¹	T ²	Clip (g)	T ¹	T ²	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver	338	67.6	103.6	39	66.6	69.6	-29	-825	-448
Passenger	436	69.7	105.7	38	74.7	77.7	-26	-593	-452

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

TEST NOTES

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
CRASH TEST SUMMARY

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

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)	25 forward	26 forward
Seat Back Failure	None	None
Glazing Damage	Windshield cracked	

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	2400
Center	mm	2330
Right Side	mm	2410
Average	mm	2380

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	830	820
Lap belt length as measured on ATD	mm	590	590
Remainder of belt on reel	mm	1130	1140
Total belt length for continuous webbing systems	mm	2550	2550

DATA SHEET NO. 2
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

TEST VEHICLE INFORMATION

Manufacturer	Audi
Model	A4
Body Style	Sedan
NHTSA No.	M95800
VIN	WAULF78K69N013410
Color	Brilliant Black
Delivery Date	9/12/2008
Odometer Reading (mile)	96
Dealer	Laurel Audi of Westmont
Transmission	Automatic
Final Drive	AWD
Number of Cylinders	4
Engine Displacement (L)	2.0
Engine Placement	Longitudinal
Automatic Door Lock (ADL)	Yes
Owners Manual Details Instructions on Disabling ADLs	Yes
Bucket Seats	Yes

TEST VEHICLE OPTIONS

Front Airbag	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso Airbag	Yes
Rear Passenger Side Curtain Airbag	Yes
Rear Passenger Side Torso Airbag	No
Force Limiter	Yes
Pretensioner	Yes
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Anti-lock Brakes	Yes
Traction Control	No
All Wheel Drive	Yes
Power Seats	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Audi AG
Date of Manufacture	07/08

GVWR (kg)	2225
GAWR Front (kg)	1125
GAWR Rear (kg)	1150

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				480
Cargo Wt. (RCLW) (kg)				140

DATA SHEET NO. 2... (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	461.8	378.7		483.5	502.1	
Right	kg	463.1	376.5		484.9	497.2	
Ratio	%	55.1	44.9		49.2	50.8	
Totals	kg	924.9	755.2	1680.1	968.4	999.3	1967.7

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1680.1
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	140
Calculated Vehicle Target Weight (TVTW)	kg	1976.1

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	707	705	705	705	1264
As Tested	mm	706	704	664	669	1428
Post Test	mm	752	730	669	661	

Vehicle Wheelbase (mm): 2812

Weight of Ballast secured in trunk and spare tire well (kg): 109.8

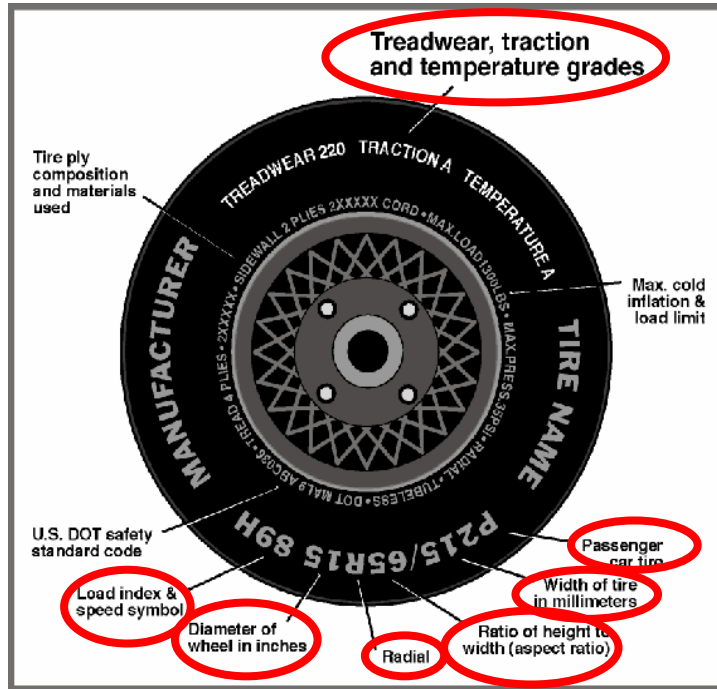
Vehicle Components Removed: Spare tire, jack and tools, rear carpets

Ballast weight does not include instrumentation and data acquisition system.

DATA SHEET NO. 3 **TEST VEHICLE TIRE INFORMATION**

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008



DATA FROM TIRE AND TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	P225/50R17	P225/50R17
Tire Size on Vehicle	P225/50R17	P225/50R17
Tire Manufacturer	Goodyear	Goodyear
Tire Name	Eagle LS2	Eagle LS2
Tire Type	Light Truck	Light Truck
Tire Width (mm)	225	225
Ratio of Height to Width (aspect ratio)	50	50
Radial	R	R
Wheel Diameter	17	17
Load Index & Speed Symbol	94H	94H
Treadwear	400	400
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 4
TEST VEHICLE INFORMATION

Test Vehicle: 2009 Audi A4 Sedan
Test Program: 35mph Frontal Impact

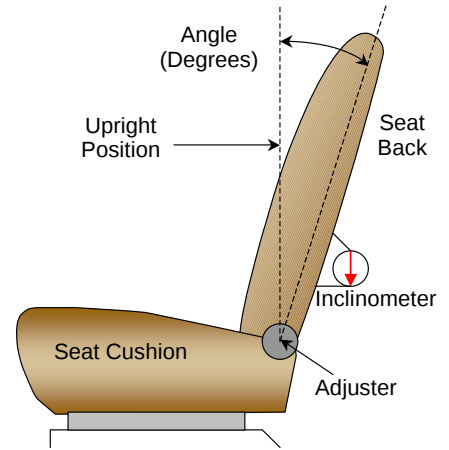
NHTSA No.: M95800
Test Date: 9/22/2008

NORMAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated angle.

Driver seat back angle: 5.8° on headrest post

Passenger seat back angle: 5.8° on headrest post



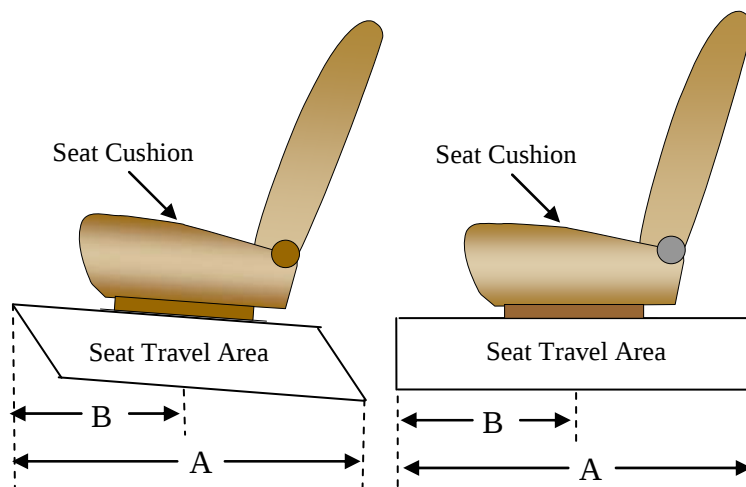
FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	320 mm	160 mm
Passenger Seat	320 mm	160 mm

ADJUSTABLE D-RING POSITION

The driver and passenger D-rings were set in the upper-most position.



DATA SHEET NO. 4...(CONTINUED)

TEST VEHICLE INFORMATION

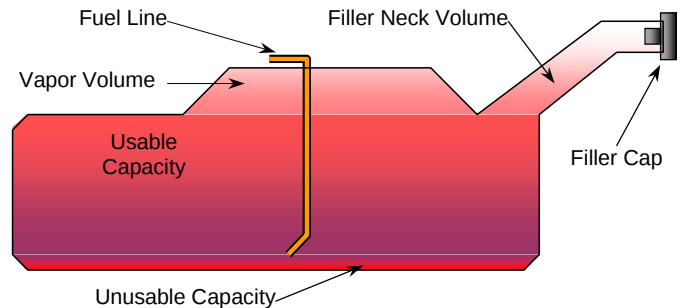
Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	63.0
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	57.9 to 59.2
Actual Amount of Solvent used	58.3
1/3 of Usable Capacity	21.0

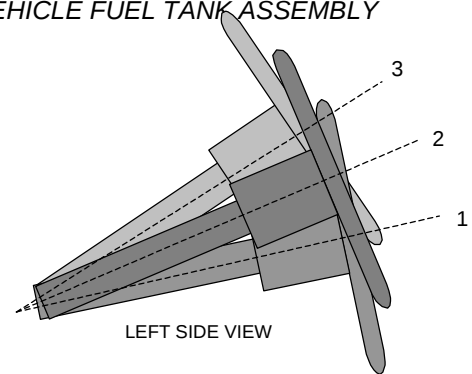
The test vehicle is equipped with an electric fuel pump. At ignition "on" the pump will work for a short time to put pressure to the system. If the engine is started, the pump works normally.



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 POSITIONS

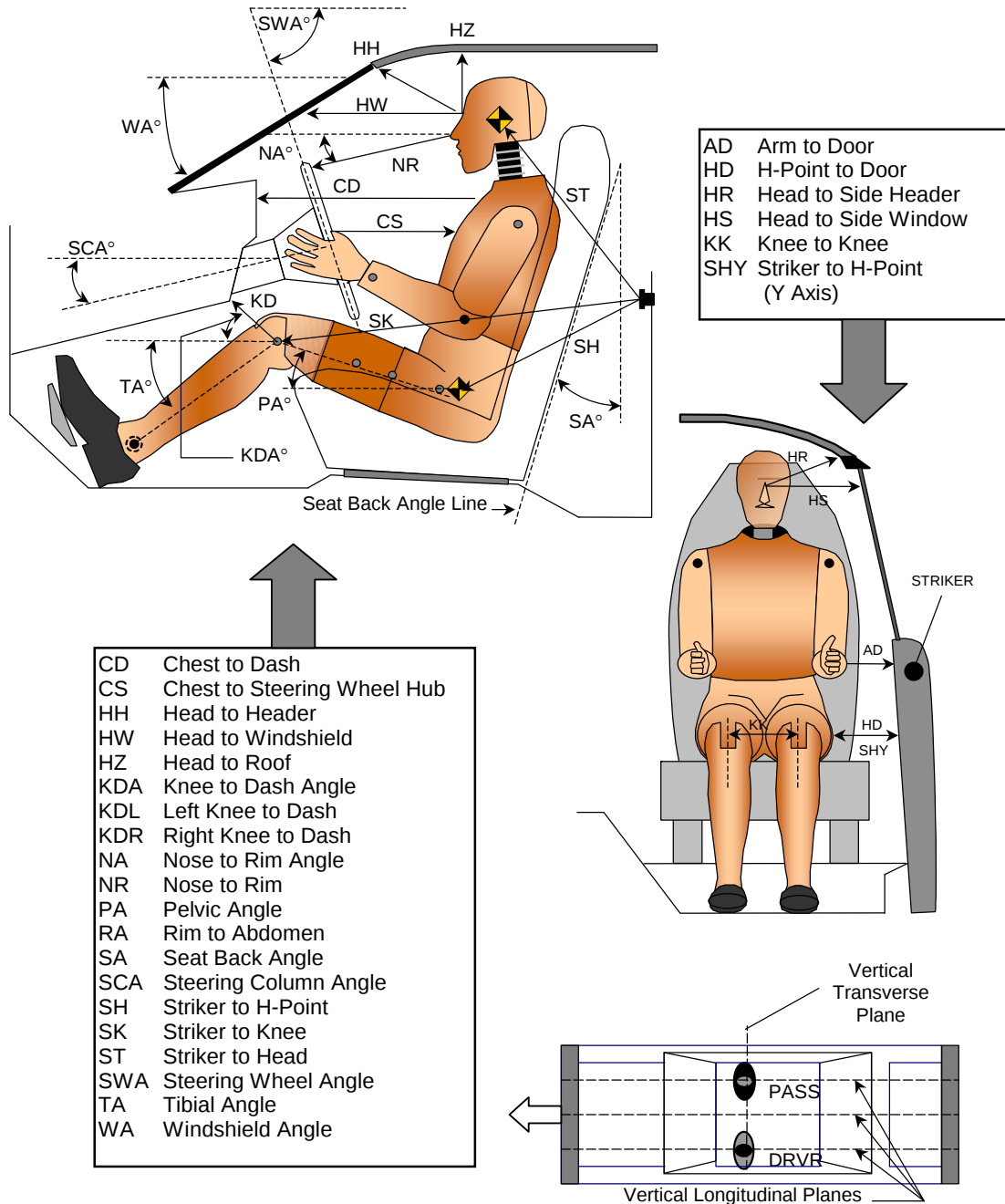
	Fore/Aft Position (mm)	Degrees
Lowermost position No. 1	0	65.4
Geometric center position No. 2	25	68.0
Uppermost position No. 3	50	70.7

DATA SHEET NO. 5 **DUMMY POSITIONING IN VEHICLE**

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS



DATA SHEET NO. 5... (CONTINUED)

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

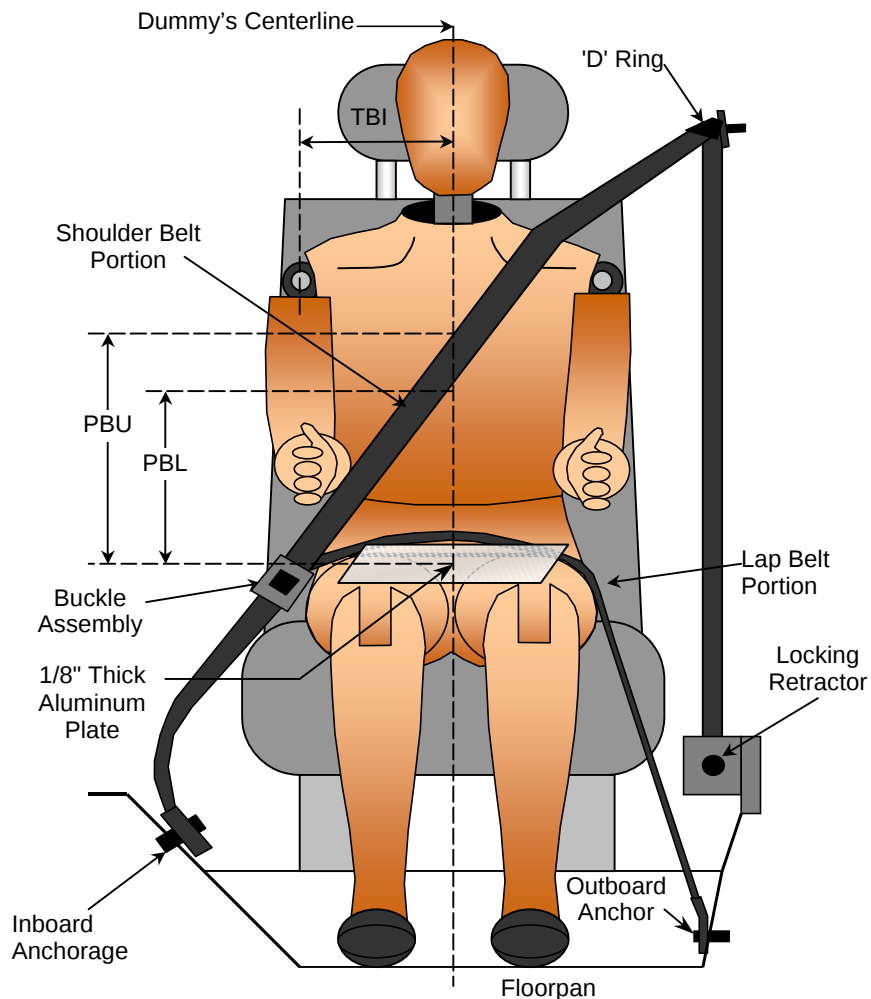
TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		22.5		
SWA	Steering Wheel Angle		68.0		
SCA	Steering Column Angle		21.9		
SA	Seat Back Angle (headrest post)		5.8		5.8
HZ	Head to Roof (Z)	185	90	182	90
HH	Head to Header	367	26.1	378	24.6
HW	Head to Windshield	697	0	704	0
HR	Head to Side Header (Y)	231		216	
NR	Nose to Rim	396	3.0		
CD	Chest to Dash	540		510	
CS	Chest to Steering Hub	322	1.1		
RA	Rim to Abdomen	206	6.0		
KDL	Left Knee to Dash	212	17.8	189	
KDR	Right Knee to Dash	195		183	36.6
PA	Pelvic Angle		24.6		24.7
TA	Tibia Angle		39.8		38.6
KK	Knee to Knee (Y)	330		270	
SK	Striker to Knee	506	96.0	554	97.4
ST	Striker to Head	443	1.0	447	3.0
SH	Striker to H-Point	240	125.4	236	122.3
SHY	Striker to H-Point (Y)	263		269	
HS	Head to Side Window	327		324	
HD	H-Point to Door (Y)	158		148	
AD	Arm to Door (Y)	124		116	
AA	Ankle to Ankle	325		220	

DATA SHEET NO. 6 **SEAT BELT POSITIONING DATA**

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	330	333
PBL - To surface of reference to belt lower edge	mm	250	245

DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATIONS

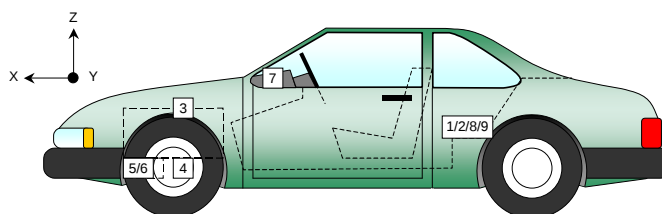
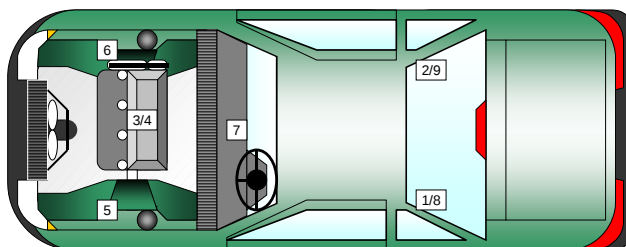
Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1890	-35	334
2	Right Rear X-Member X	1890	35	334
3	Engine Top X	4018	62	820
4	Engine Bottom X	4185	0	197
5	Left Brake Caliper X	3638	-630	273
6	Right Brake Caliper X	3638	630	273
7	Instrument Panel X			
8	Left Rear X-Member Z	1890	-35	334
9	Right Rear X-Member Z	1890	35	334

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



DATA SHEET NO. 8

SUMMARY OF FMVSS 212 AND FMVSS 219 (Partial) DATA

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

Windshield Mounting Details:

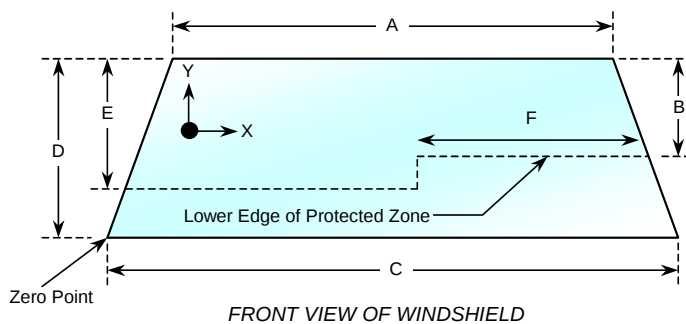
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

The standard requires that the post-test retention measurement be a minimum of 75 percent of the pretest 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°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2080	2080	100
Right Side	2080	2080	100
Total	4160	4160	100



Item	Units	Value
A	mm	1106
B	mm	402
C	mm	1498
D	mm	778
E	mm	482
F	mm	490

AREA OF PROTECTED ZONE FAILURES - NONE

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

X	Y

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

X	Y

DATA SHEET NO. 9
SUMMARY OF FMVSS 301 DATA

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

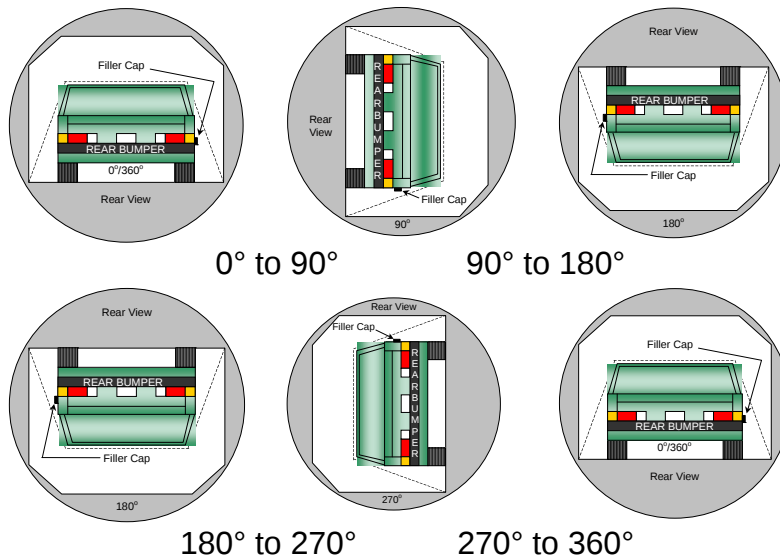
FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 12:45 pm

Stoddard Solvent Spillage Measurements

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

FMVSS 301 STATIC ROLLOVER DATA



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 locations:

None

Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage (oz.)
0° to 90°	124	300	0
90° to 180°	115	300	0
180° to 270°	109	300	0
270° to 360°	122	300	0

DATA SHEET NO. 10
VEHICLE MEASUREMENTS

Test Vehicle: 2009 Audi A4 Sedan
Test Program: 35mph Frontal Impact

NHTSA No.: M95800
Test Date: 9/22/2008

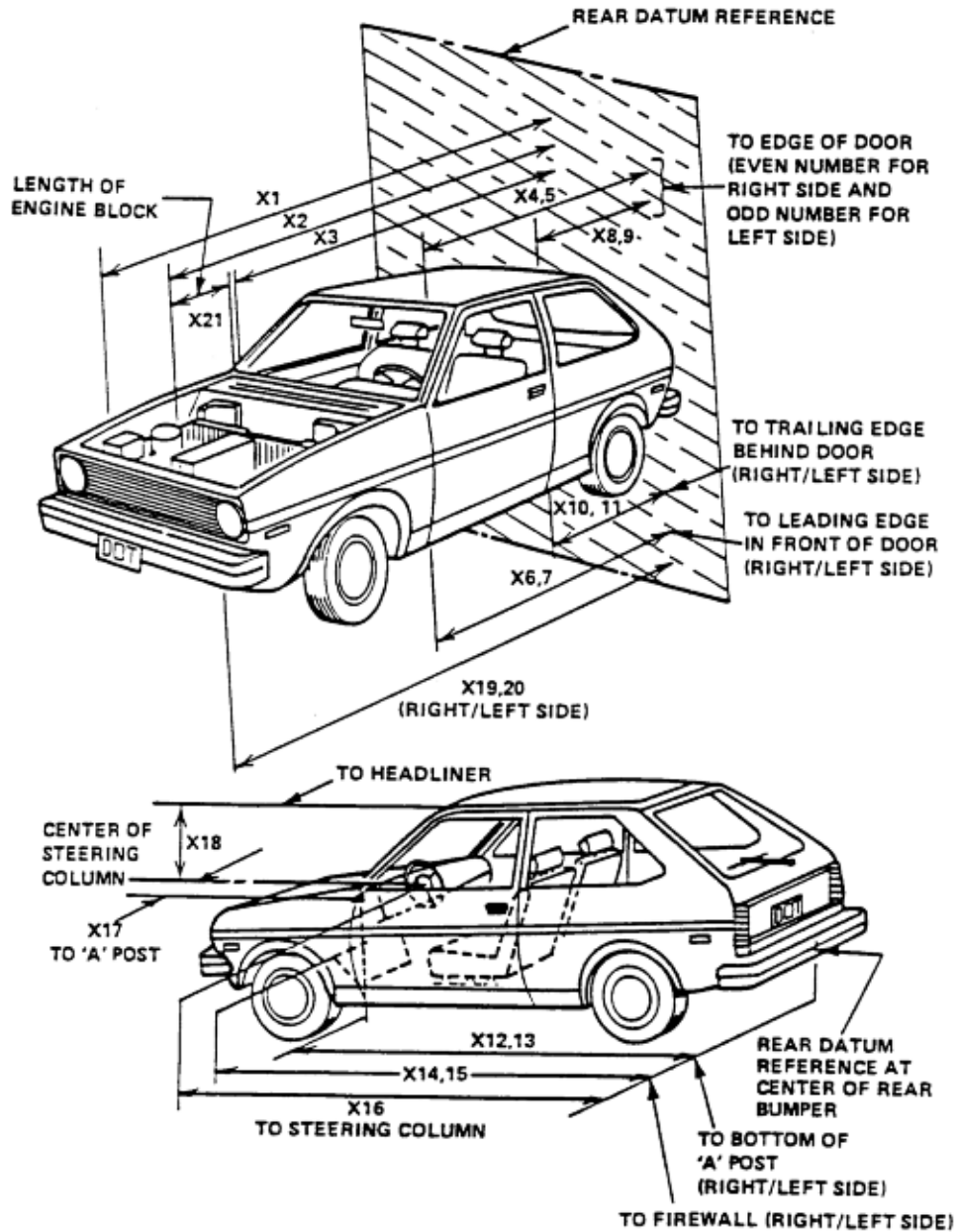
No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	4651	4031	620
2	RSOV to front of engine	mm	4196	3875	321
3	RSOV to firewall centerline	mm	3693	3565	128
4	RSOV to leading edge of right door	mm	3175	3167	8
5	RSOV to leading edge of left door	mm	3177	3170	7
6	RSOV to lower leading edge of right door	mm	3192	3185	7
7	RSOV to lower leading edge of left door	mm	3194	3184	10
8	RSOV to upper leading edge of right door	mm	2102	2089	13
9	RSOV to upper leading edge of left door	mm	2098	2094	4
10	RSOV to lower trailing edge of right door	mm	2160	2155	5
11	RSOV to lower trailing edge of left door	mm	2160	2154	6
12	RSOV to bottom of right 'A' pillar	mm	3191	3191	0
13	RSOV to bottom of left 'A' pillar	mm	3194	3191	3
14	RSOV to firewall on right side	mm	3661	3616	45
15	RSOV to firewall on left side	mm	3659	3650	9
16	RSOV to steering column	mm	2685	2734	-49
17	Center of steering column to left 'A' pillar	mm	341	349	-8
18	Center of steering column to headlining	mm	393	425	-32
19	RSOV to right side of front bumper	mm	4584	4029	555
20	RSOV to left side of front bumper	mm	4584	4055	529
21	Length of engine block	mm	420	420	0
RD	RSOV to right side of dash panel	mm	2839	2835	4
CD	RSOV to center of dash panel	mm	2932	2915	17
LD	RSOV to left side of dash panel	mm	2835	2840	-5

DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008



DATA SHEET NO. 10... (continued)**VEHICLE MEASUREMENTS**

Test Vehicle: 2009 Audi A4 Sedan
Test Program: 35mph Frontal Impact

NHTSA No.: M95800
Test Date: 9/22/2008

Target Vehicle Structural Measurement

	Elements	Pre-Test (mm)
1	Total Length	4651
2	Total Width	1811
3	Bumper Top Height	544
4	Bumper Bottom Height	428
5	Longitudinal Member Top Height	545
6	Distance between Longitudinal Members	808
7	Longitudinal Member Width	86
8	Engine Top Height	830
9	Engine Bottom Height	206
10	Engine and gearbox width	1364
11	Front bumper-engine distance	455
12	Front shock absorber fixing height	858
13	Bonnet leading edge height	720
14	Front shock absorber fixing width	850
15	Front bumper – front axle distance	851
16	Front axle – a pillar distance	429
17	A-pillar – B-pillar distance	1224
18	B-Pillar – rear axle distance	1162
19	B-pillar – C-pillar distance	742
20	Roof sill bottom height	1230
21	Roof sill top height	1370
22	Floor sill bottom height	202
23	Floor sill top height	364

DATA SHEET NO. 11
CAMERA LOCATIONS

Test Vehicle: 2009 Audi A4 Sedan
Test Program: 35mph Frontal Impact

NHTSA No.: M95800
Test Date: 9/22/2008

No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side View				13	24
2	Left Front View	1125	-4980	1250	24	1000
3	Steering Column Top	720	-5320	1265	25	1000
4	Steering Column Bottom	705	-5320	870	25	1000
5	Driver Close-up	1370	-5600	1350	35	1000
6	Driver Angle	5600	-5000	2060	50	1000
7	On board Driver Side					
8	On board Passenger Side					
9	Right Overall	2010	6425	1260	24	1000
10	Right Passenger Half	1150	4985	1220	24	1000
11	Right Close-up	1405	5680	1360	35	1000
12	Right Angle	5580	4950	2065	50	1000
13	Windshield	-285	0	2860	12.5	1000
14	Top Driver	-135	-470	2180	24	1000
15	Top Passenger	-110	420	2180	24	1000
16	Pit Front	1100	0	-3150	24	1000
17	Pit Rear	3400	0	-3150	24	1000

***COORDINATES:**

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

Cameras 7 & 8 were not used for this test.

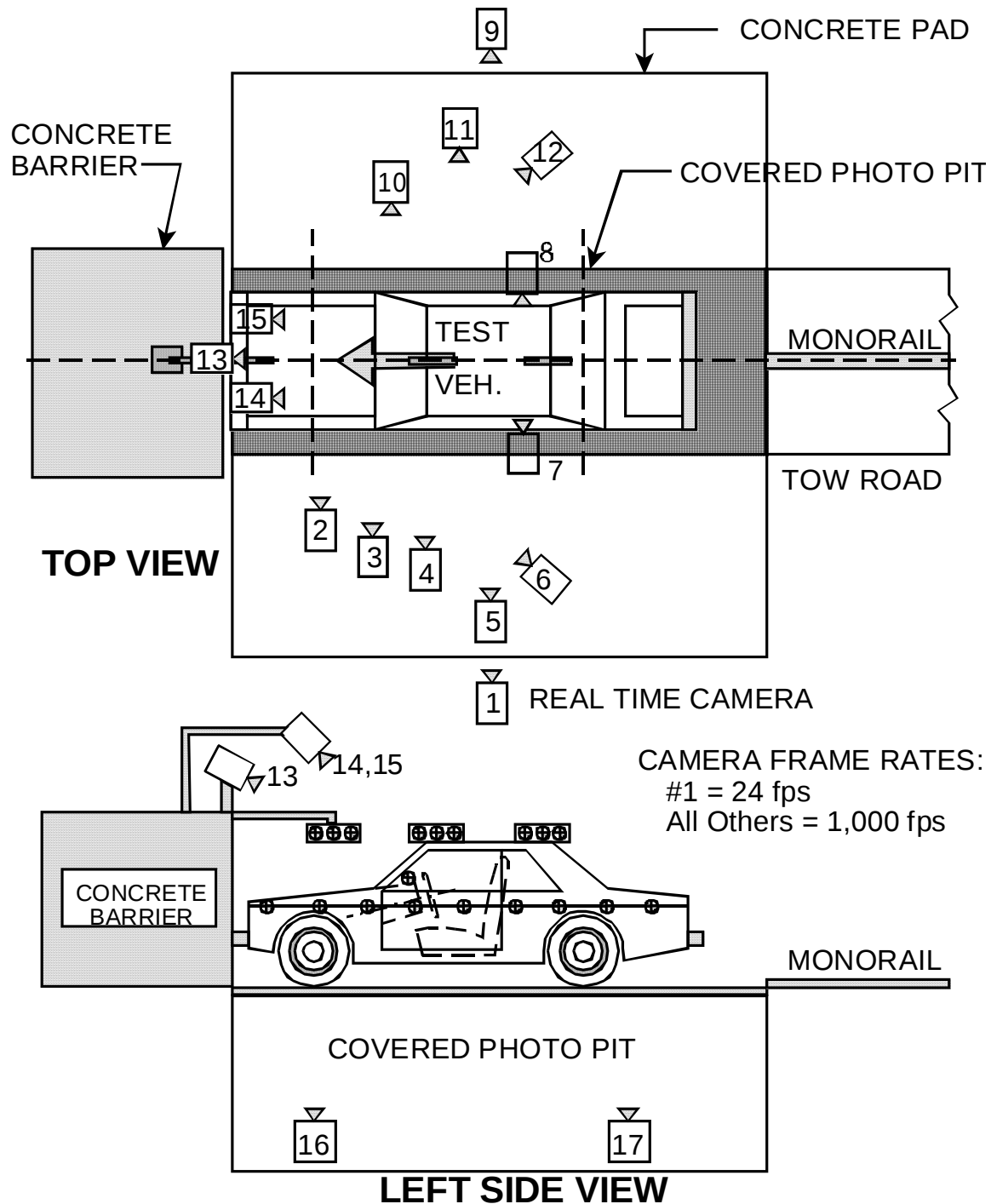
DATA SHEET NO. 11... (continued)

CAMERA LOCATIONS

Test Vehicle: 2009 Audi A4 Sedan
Test Program: 35mph Frontal Impact

NHTSA No.: M95800
Test Date: 9/22/2008

CAMERA POSITIONS FOR FRONTAL IMPACTS

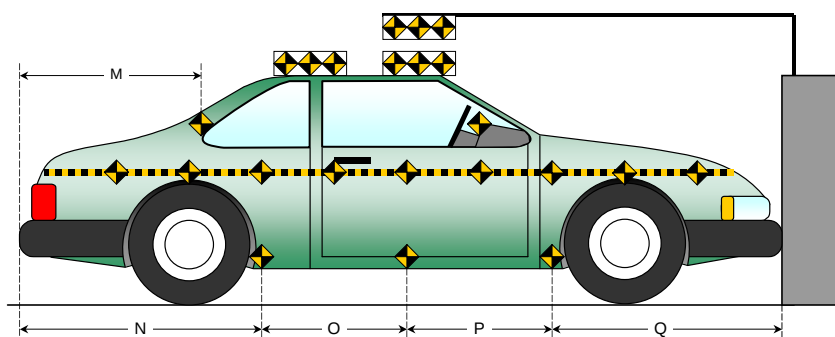
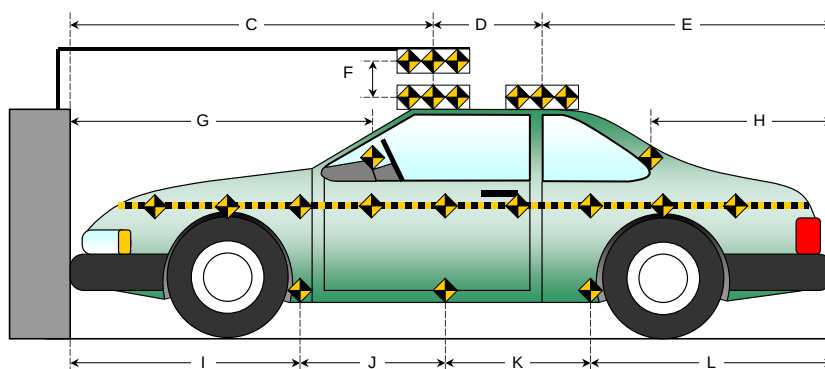
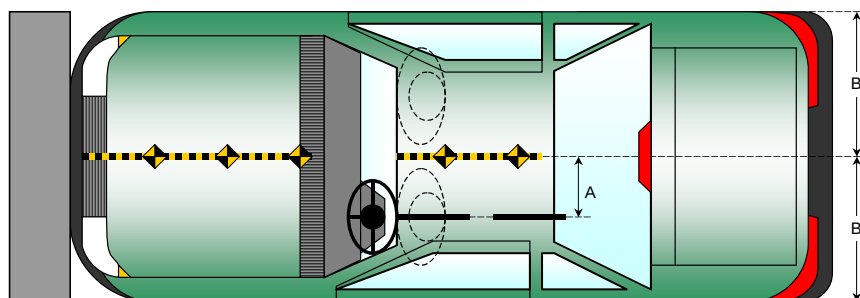


DATA SHEET NO. 12
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

Item	Value
A	390
B	905
C	2461
D	916
E	1274
F	126
G	
H	1151
I	1272
J	982
K	980
L	1417
M	1156
N	1425
O	976
P	978
Q	1272



DATA SHEET NO. 13
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

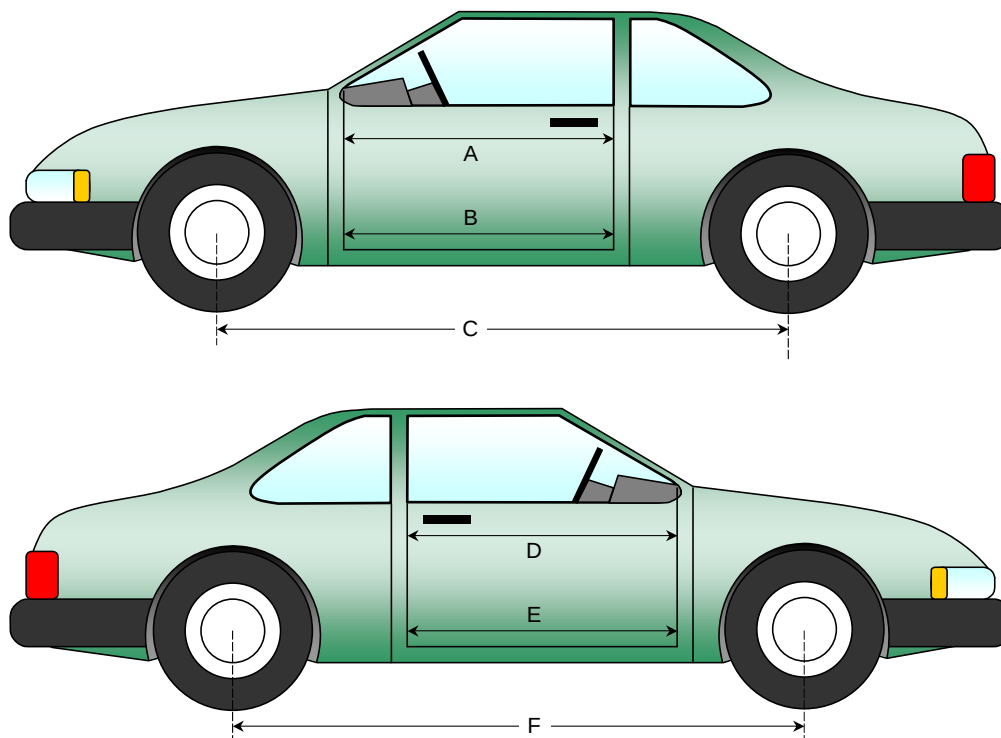
NHTSA No.: M95800
 Test Date: 9/22/2008

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	936	936	0
B	Left Side Lower	mm	792	786	6
D	Right Side Upper	mm	936	930	6
E	Right Side Lower	mm	792	786	6

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2812	2754	58
F	Right Side Wheelbase	mm	2812	2771	41



DATA SHEET NO. 13... (continued)
VEHICLE INTRUSION MEASUREMENTS

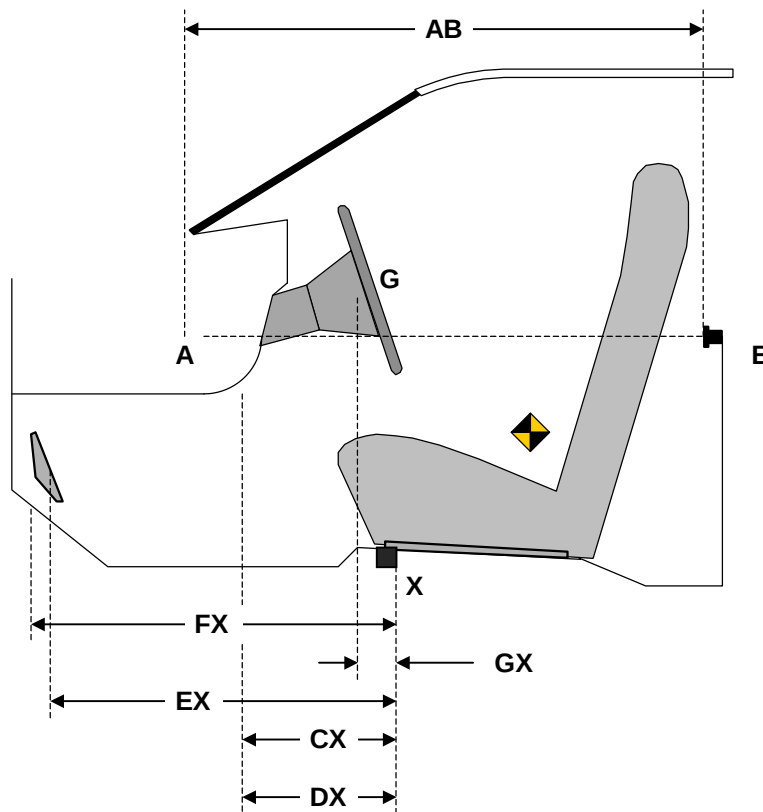
Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	755	754	1
CX	Left Knee Bolster to X	mm	286	295	-9
DX	Right Knee Bolster to X	mm	292	291	1
EX	Brake Pedal to X	mm	588	596	-8
FX	Foot Rest to X	mm	634	634	0
GX	Center of Steering Column Wheel Hub to X	mm	34	78	-44

X = Front of Seat Track (stationary)

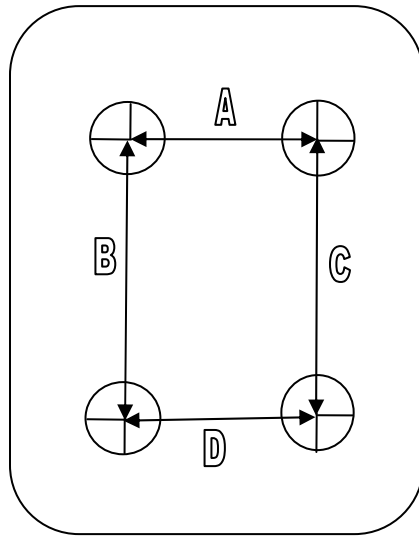


DRIVER COMPARTMENT

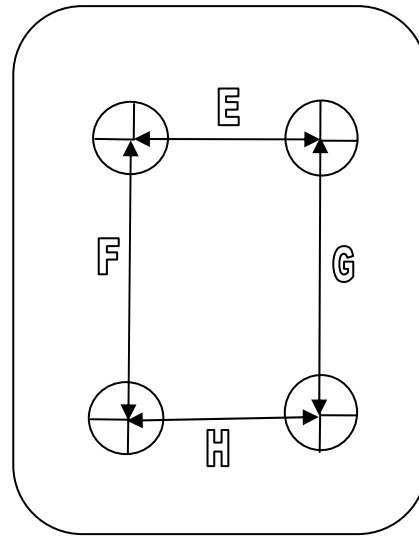
DATA SHEET NO. 13... (continued)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008



Driver



Passenger

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	301	301	0
B	301	301	0
C	301	299	2
D	301	301	0
E	301	301	0
F	301	301	0
G	301	298	3
H	301	300	1

DATA SHEET NO. 14

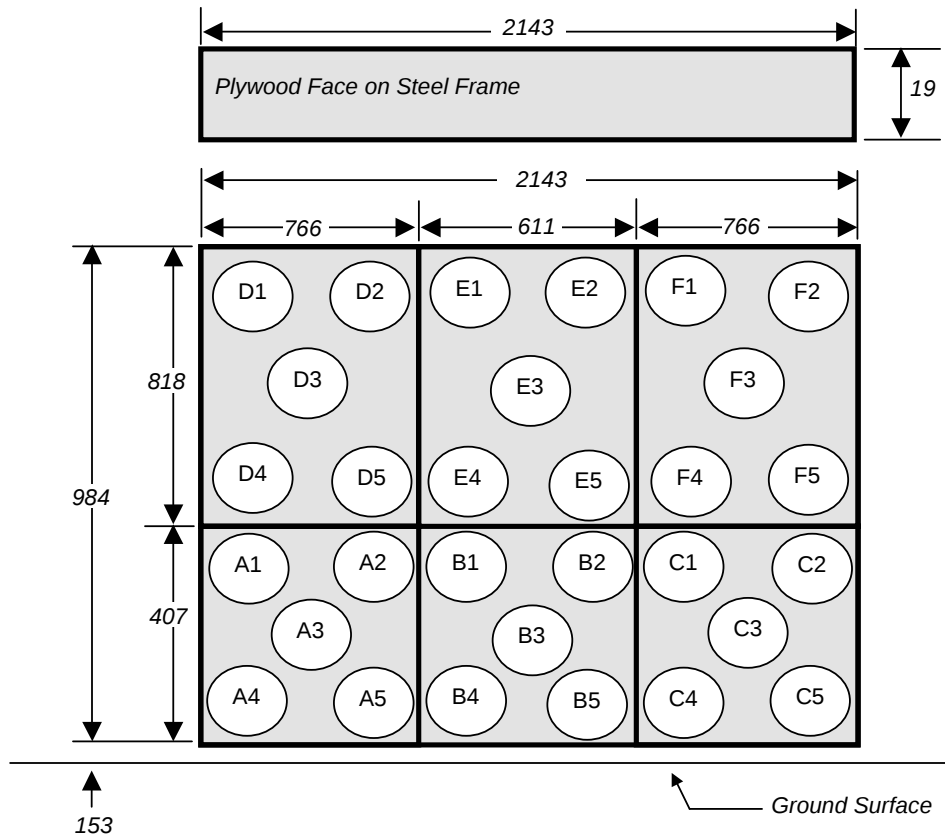
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

30 Load Cell Rigid Barrier

Load Cell Locations on Fixed Barrier



Group 4 D1-D5	Group 5 E1-E5	Group 6 F1-F5
Group 1 A1-A5	Group 2 B1-B5	Group 3 C1-C5

6 Groups of 5 Load Cells Each

DATA SHEET NO. 15
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2009 Audi A4 Sedan
 Test Program: 35mph Frontal Impact

NHTSA No.: M95800
 Test Date: 9/22/2008

VEHICLE INFORMATION

VIN: WAULF78K69N013410 Wheelbase (mm): 2812
 Vehicle Size Category: Sedan Test Weight (kg): 1967.7

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 12
 Cal. Procedure/Interval: MGA procedure / 6 month
 Integration Algorithm: Trapezoidal Linearity: > 99%
 Impact Velocity (km/h): 56.2
 Velocity Change (km/h): 62.7 Time of Separation (msec): 121

CRUSH PROFILE

Collision Deformation Classification: Frontal Midpoint of Damage: Centerline
 Damage Region Length (mm): 1104 Impact Mode: Frontal

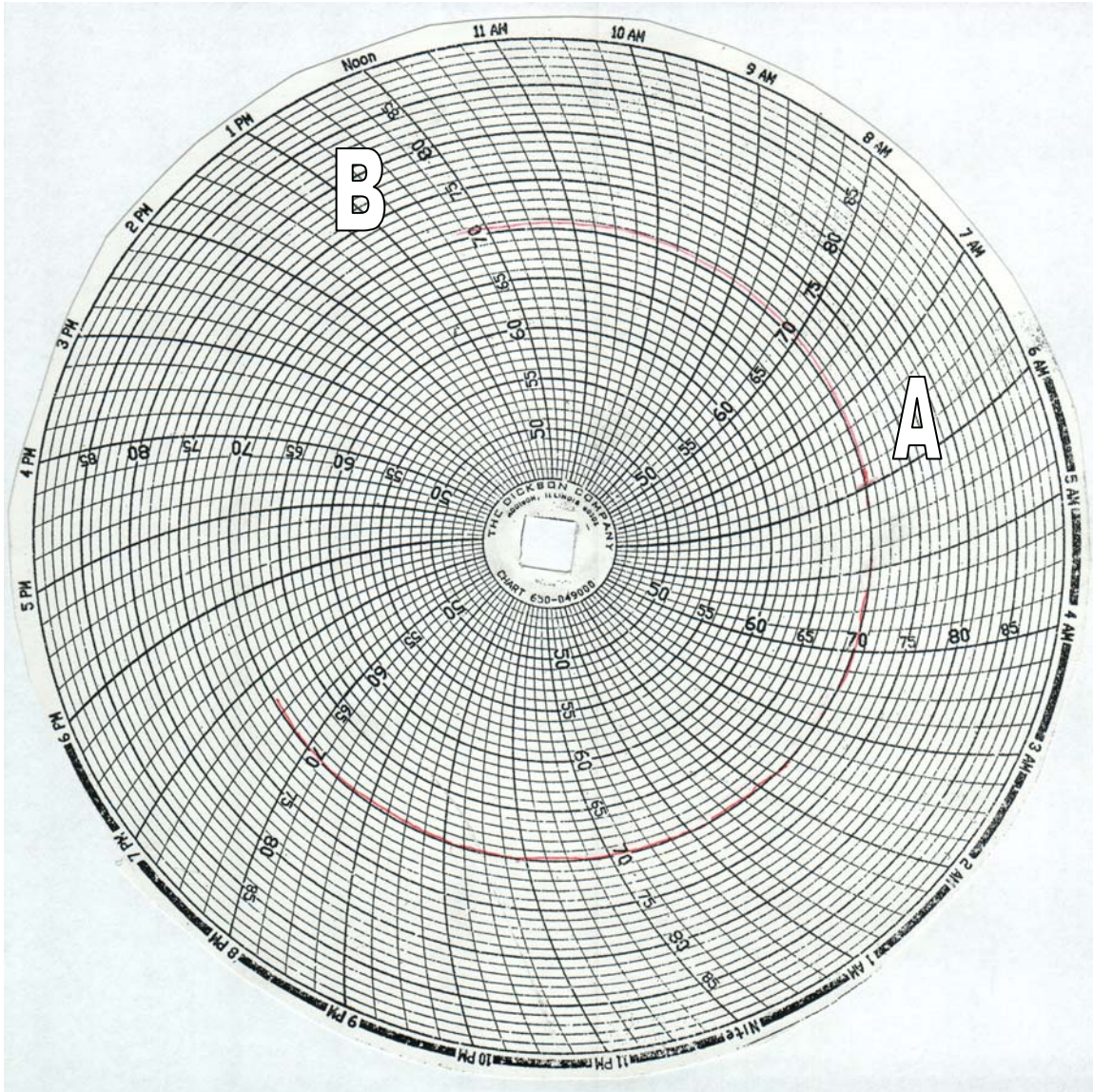
No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4584	4055	529
C2	Crush zone 2 at left side	mm	4635	4030	605
C3	Crush zone 3 at left side	mm	4658	4000	658
C4	Crush zone 4 at right side	mm	4659	4025	634
C5	Crush zone 5 at right side	mm	4635	4004	631
C6	Crush zone 6 at right side	mm	4584	4029	555
L	C1 TO C6	mm	1104	1116	-12

DATA SHEET NO. 16

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2009 Audi A4 Sedan
Test Program: 35mph Frontal Impact

NHTSA No.: M95800
Test Date: 9/22/2008



A = Dummies installed in vehicle at 6:00 am

B = Test conducted at 12:45 pm

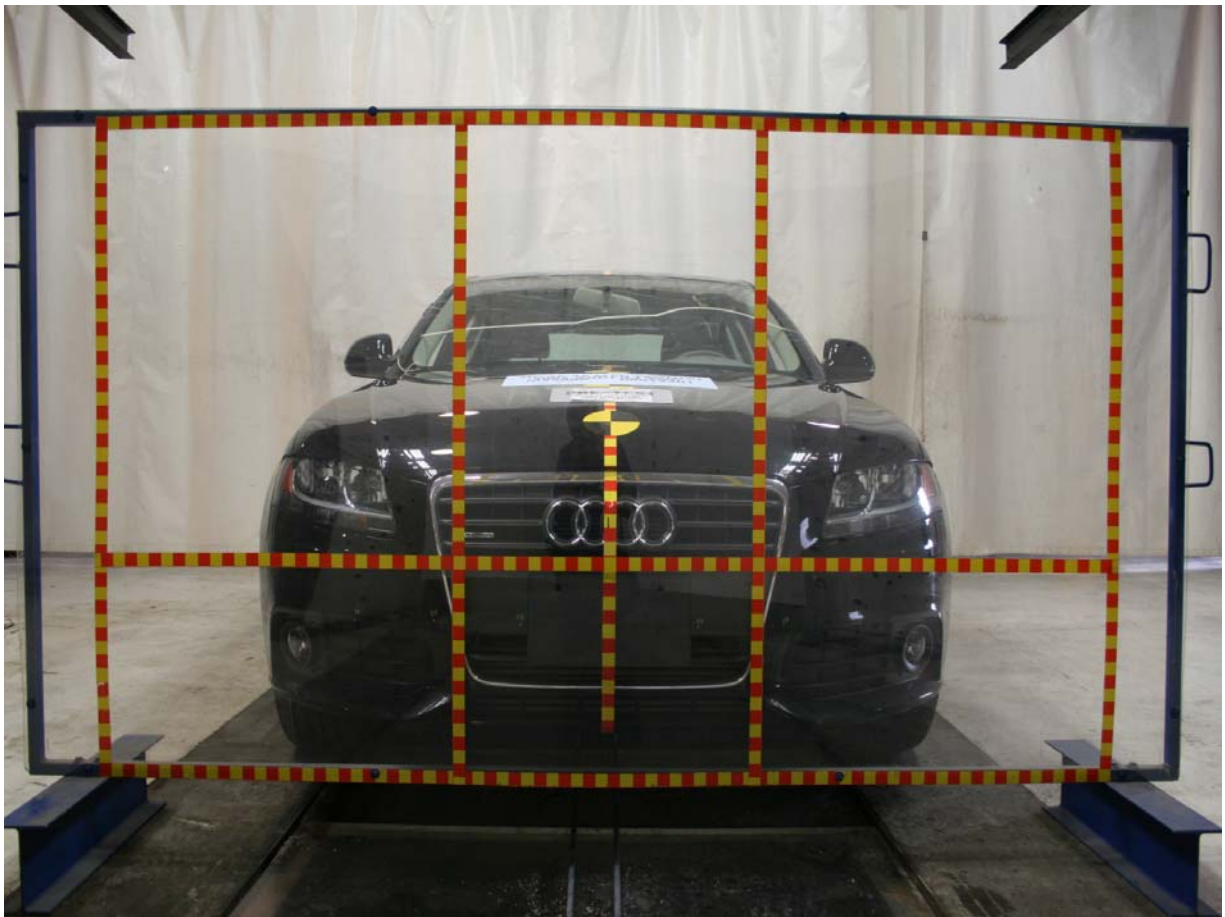
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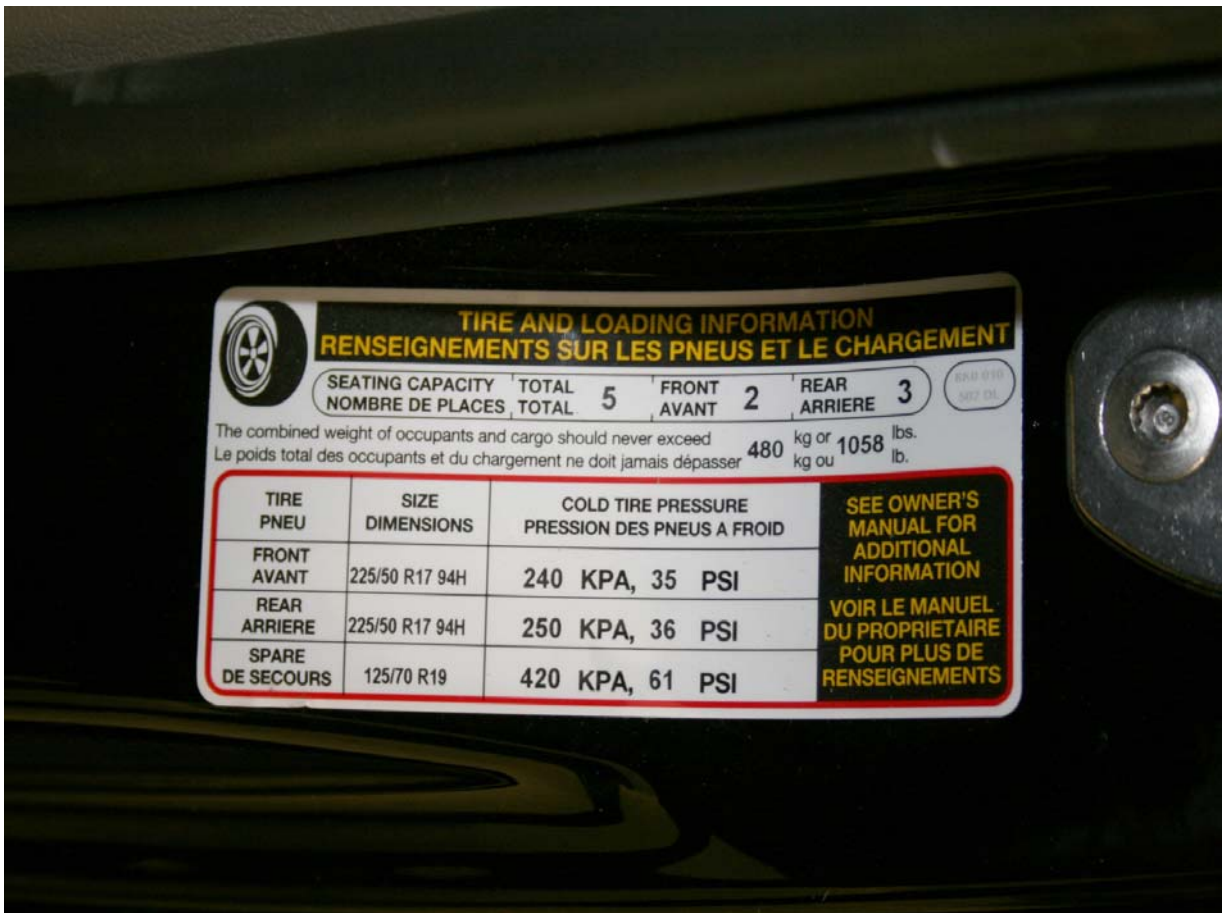
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Load Cell Location



Manufacturer's Label



Tire Placard



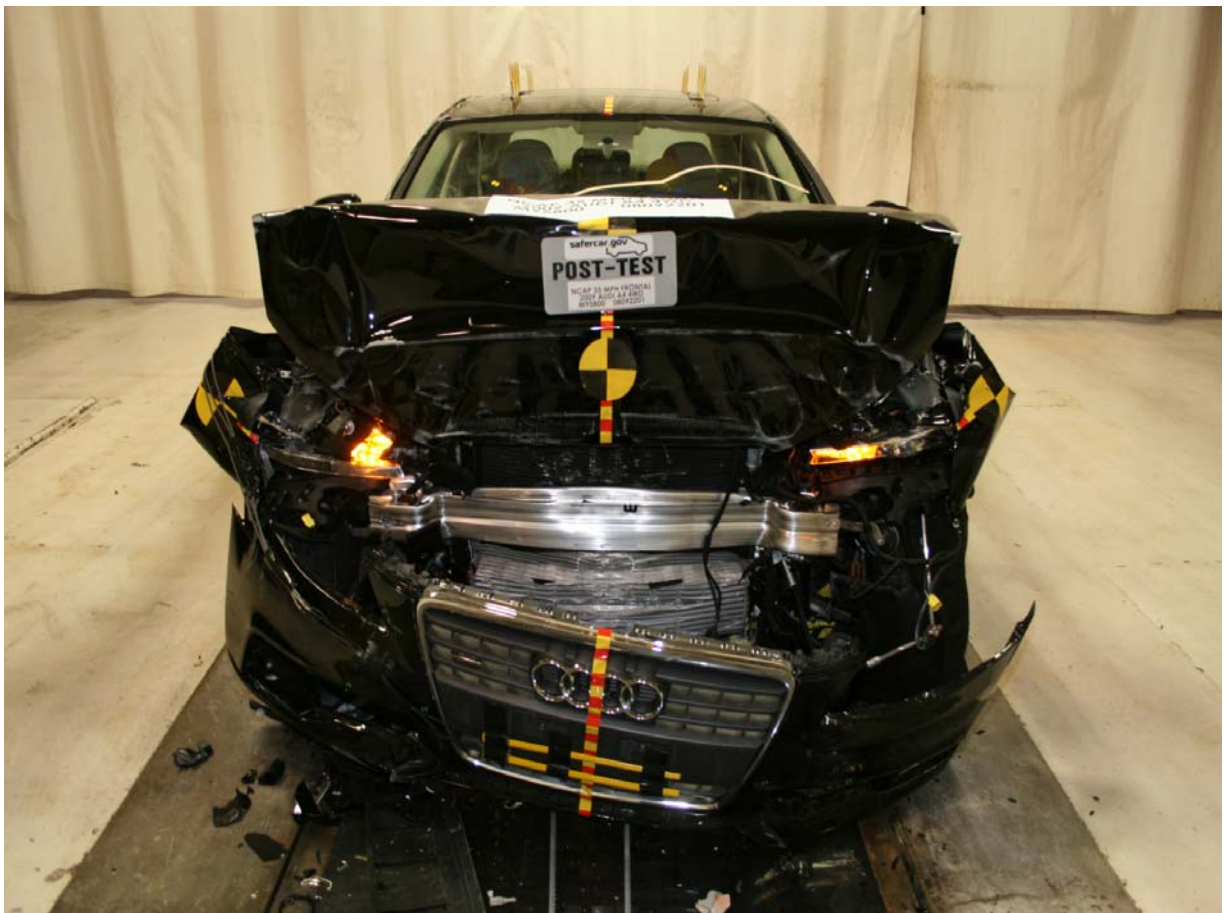
Left Front $\frac{3}{4}$ View, As Received



Right Rear $\frac{3}{4}$ View, As Received



Pre-Test Front View



Post-Test Front View



Pre-Test Left Side View



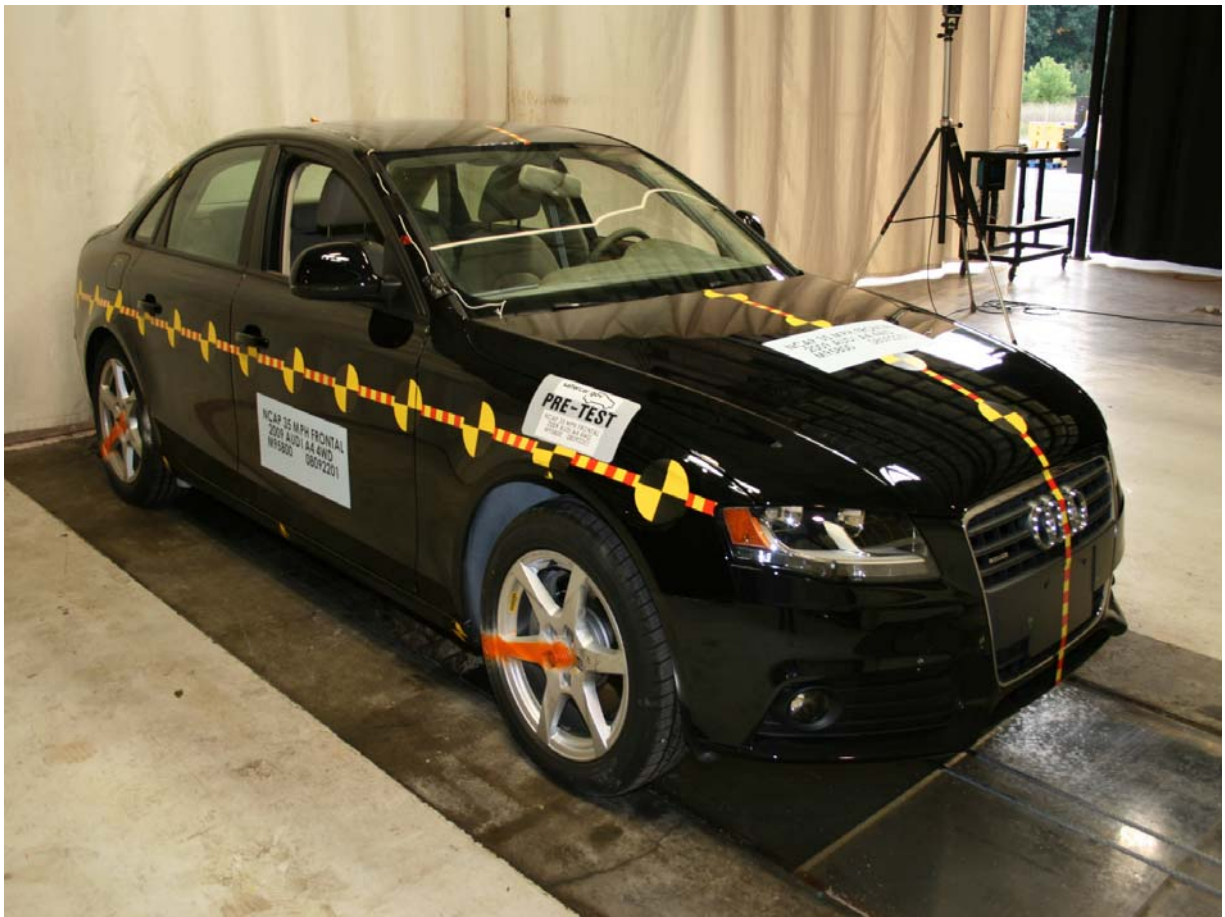
Post-Test Left Side View



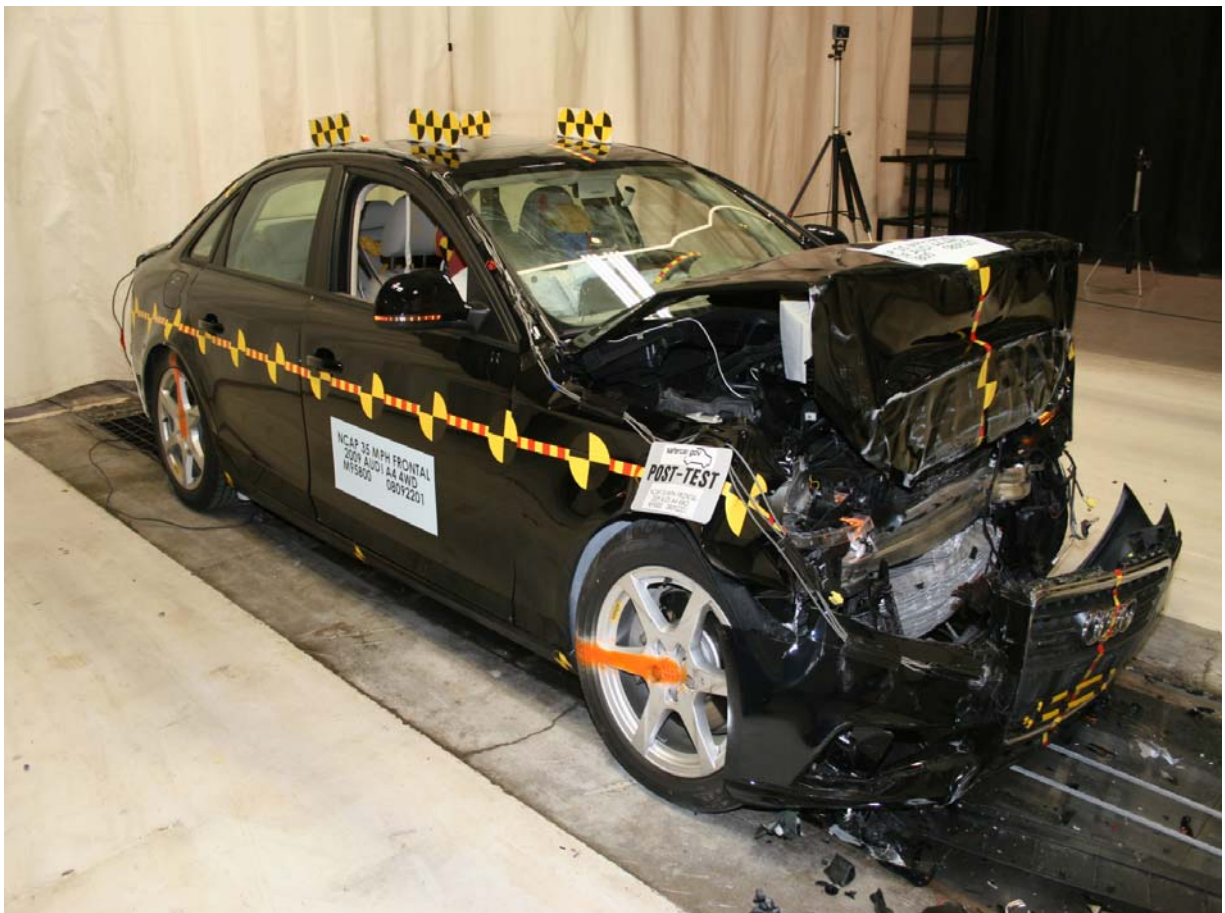
Pre-Test Right Side View



Post-Test Right Side View



Pre-Test Right Front $\frac{3}{4}$ View



Post-Test Right Front $\frac{3}{4}$ View



Pre-Test Left Rear ¾ View



Post-Test Left Rear $\frac{3}{4}$ View



Pre-Test Left Side 3/4 View of Doors



Post-Test Left Side 3/4 View of Doors After Impact



Pre-Test Right Side 3/4 View of Doors



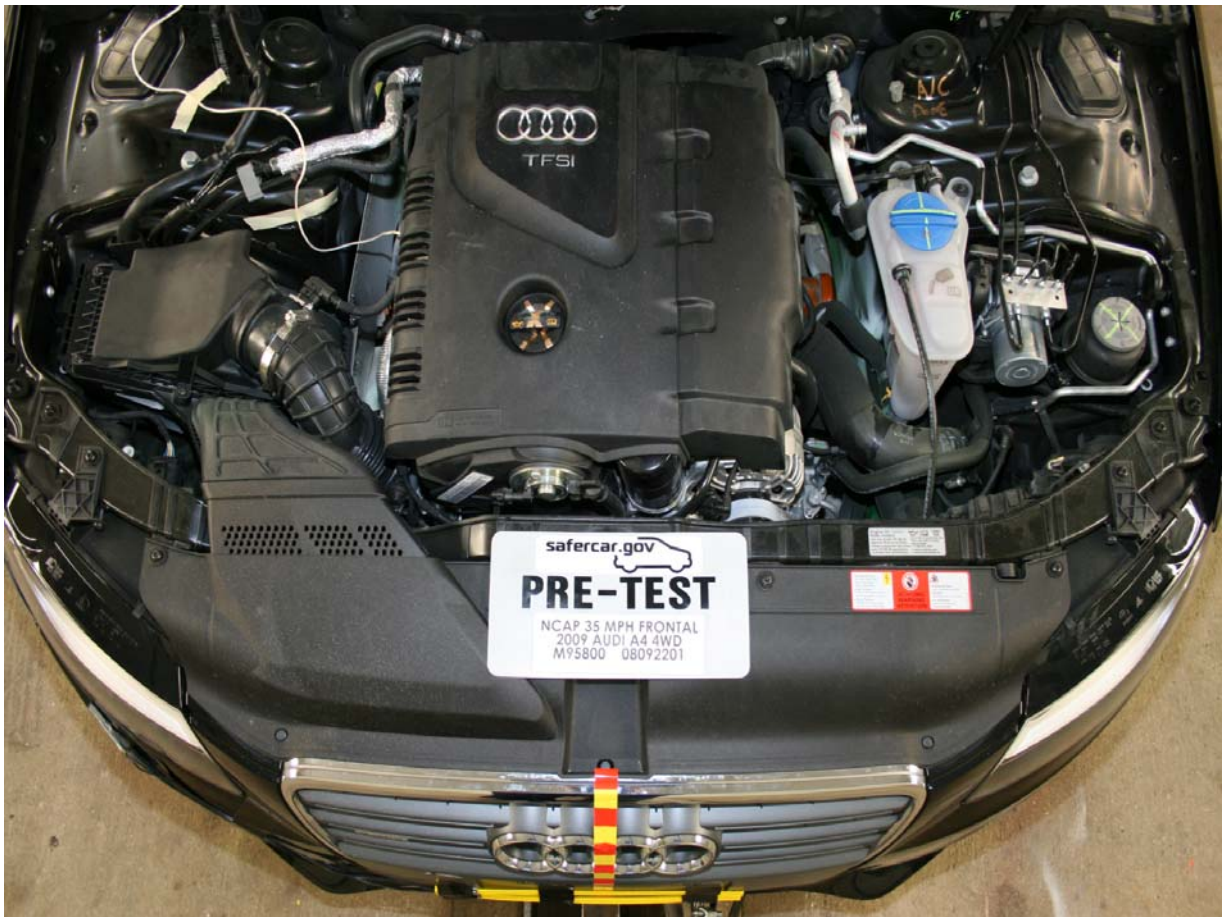
Post-Test Right Side 3/4 View of Doors After Impact



Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



Post-Test Engine Compartment View



Pre-Test Fuel Cap View



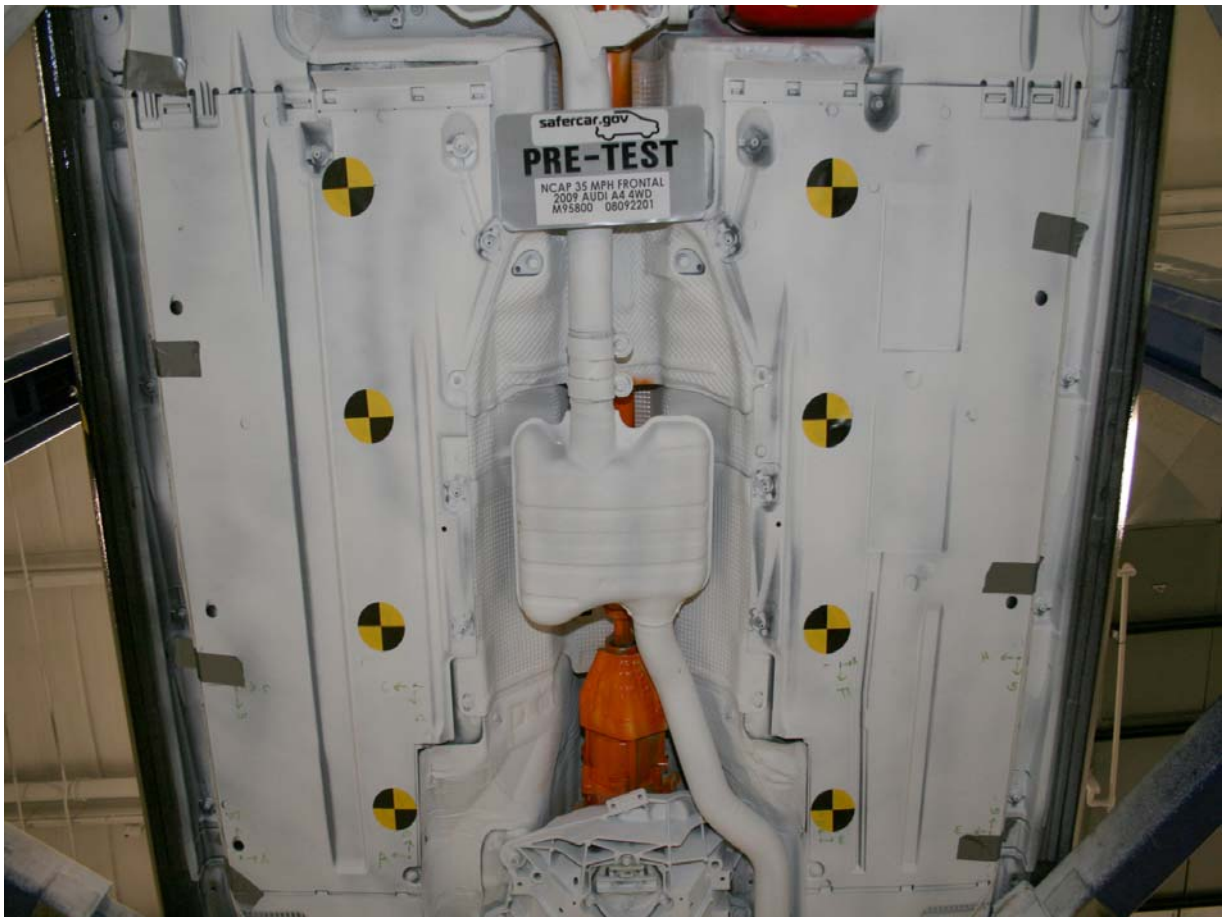
Post-Test Fuel Cap View



Pre-Test Front Underbody View



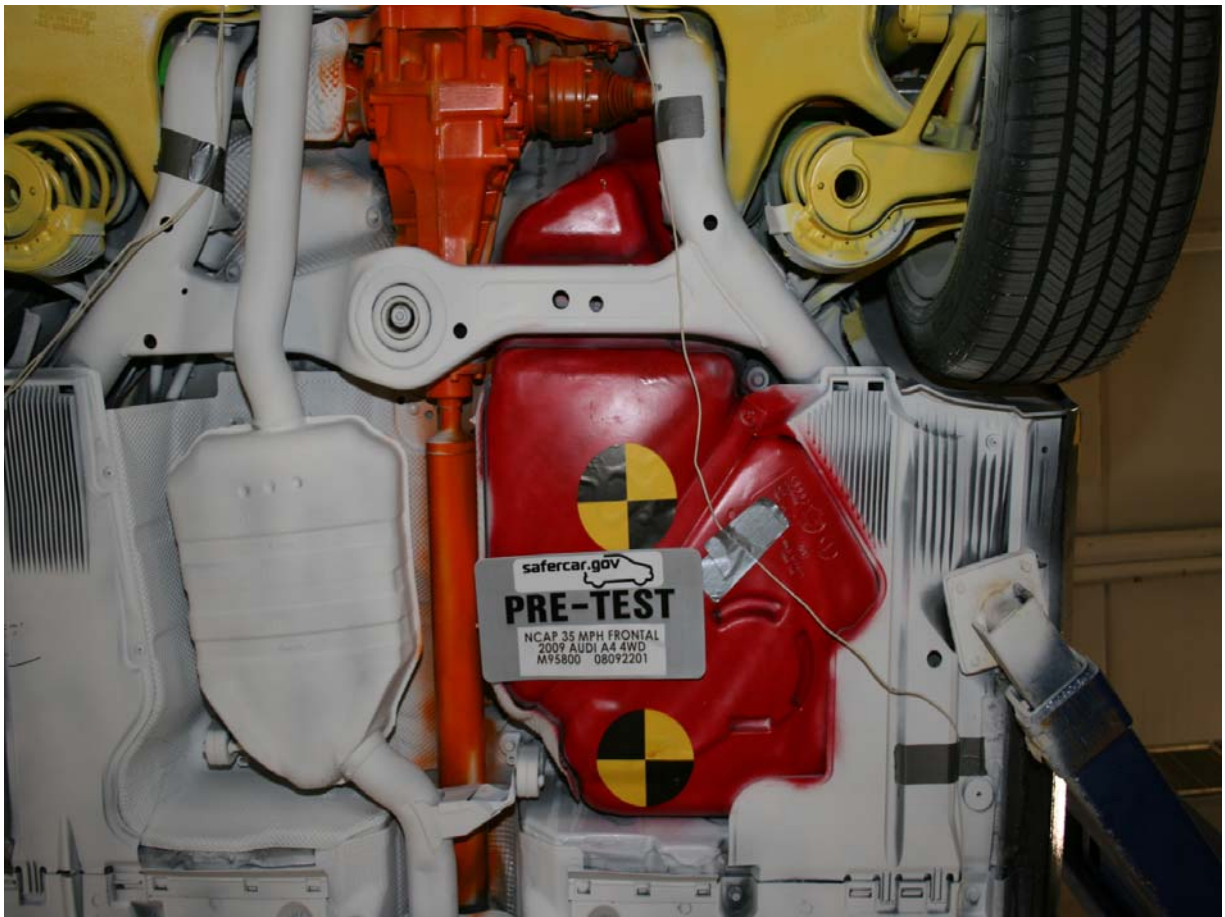
Post-Test Front Underbody View



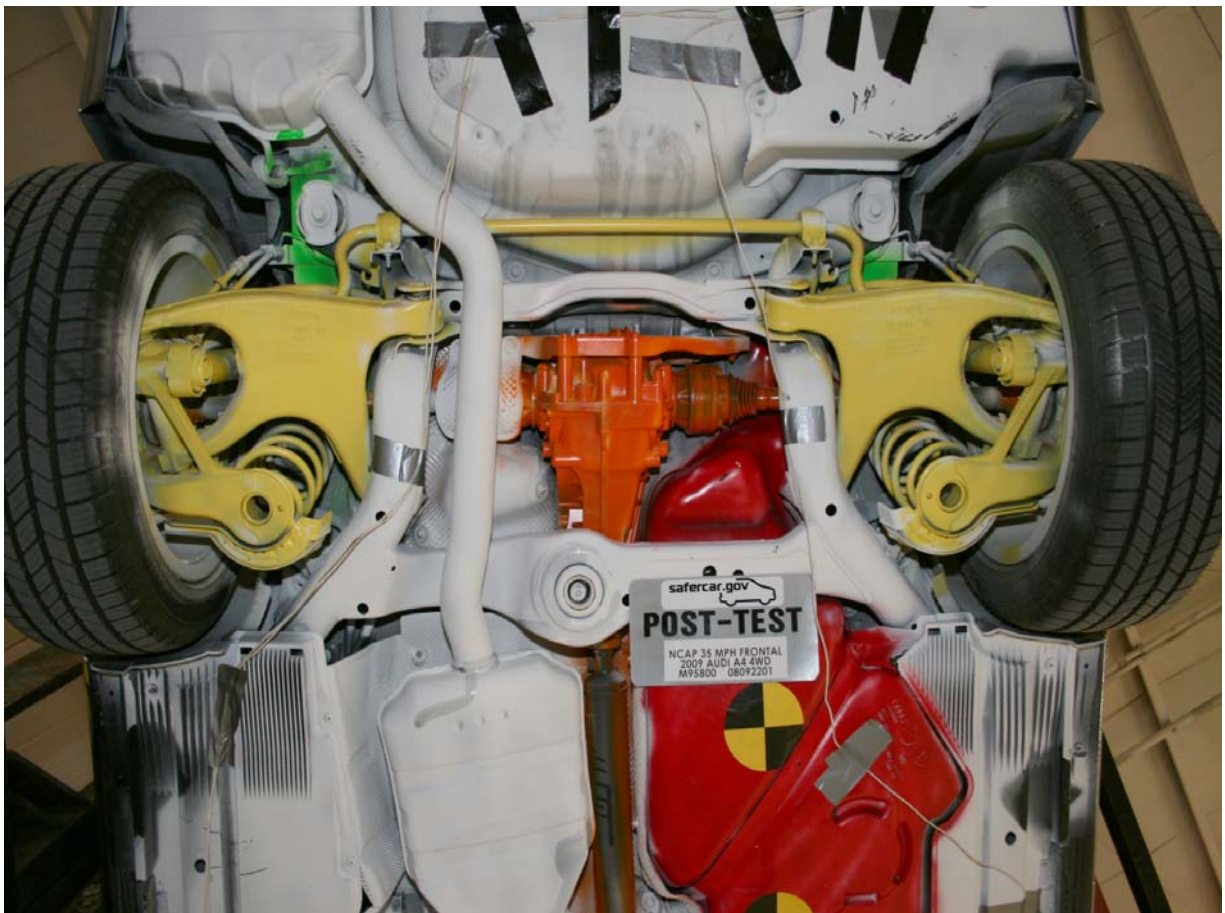
Pre-Test Mid Front Underbody View



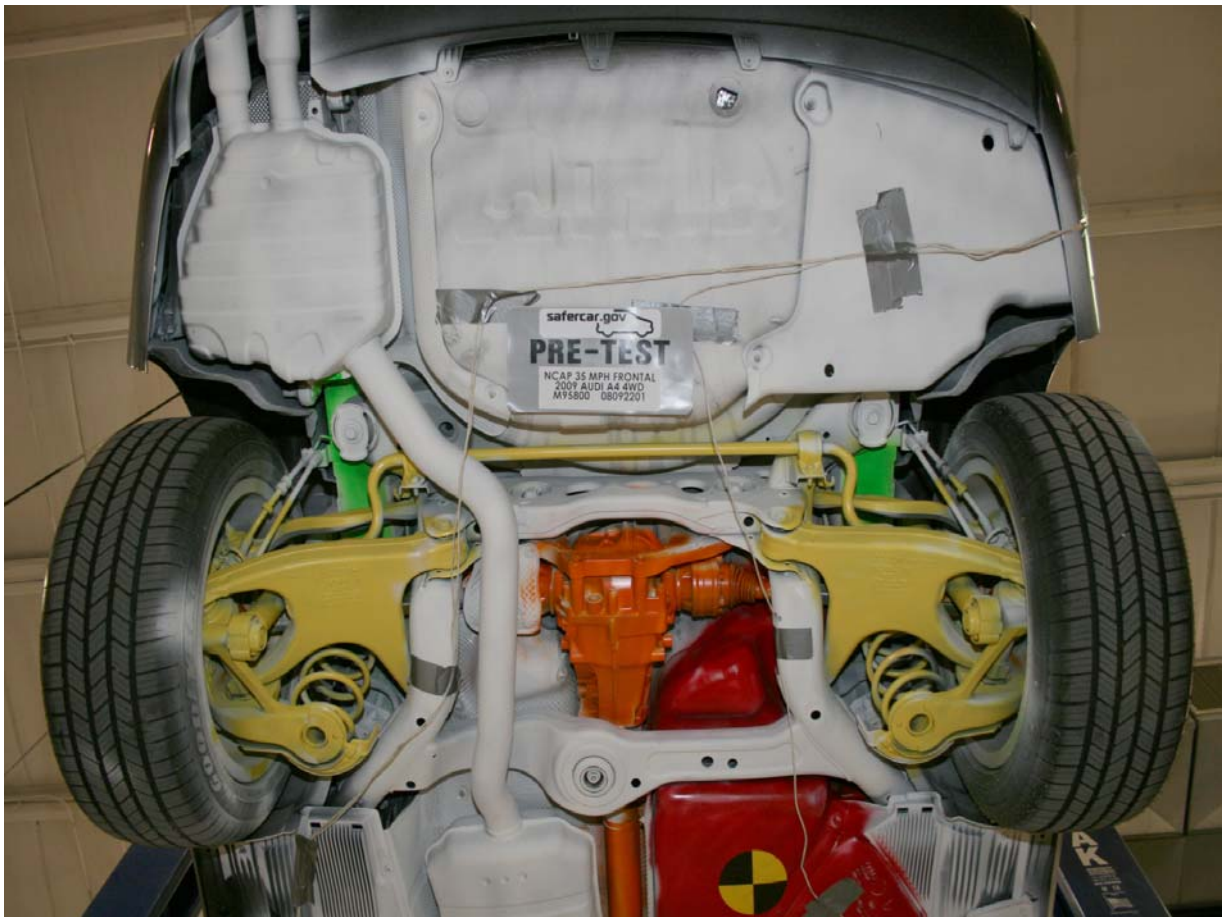
Post-Test Mid Front Underbody View



Pre-Test Mid Rear Underbody View



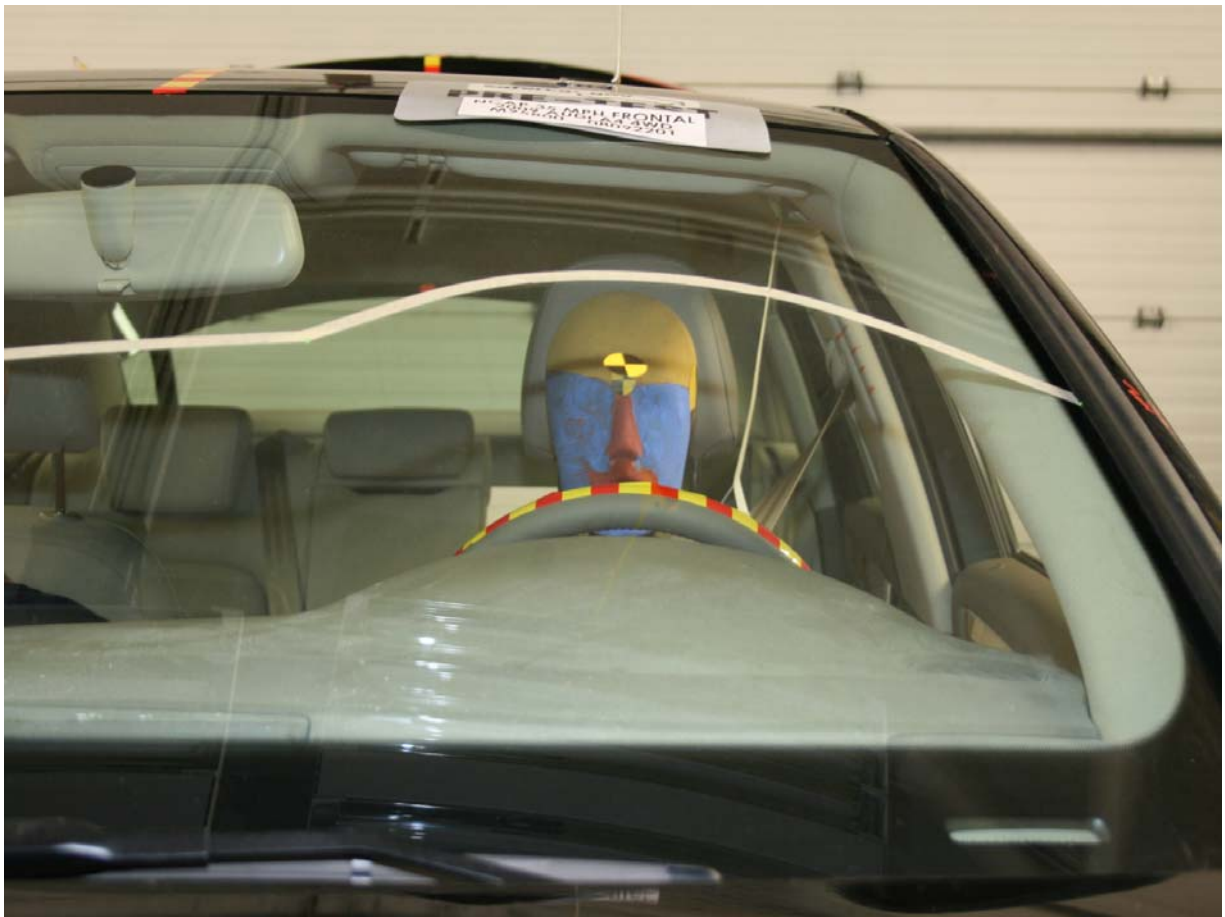
Post-Test Mid Rear Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View



Pre-Test Driver Dummy Front View (Head Position)



Post-Test Driver Dummy Front View (Head Position)



Pre-Test Driver Dummy (Through Window)



Post-Test Driver Dummy (Through Window)



Pre-Test Driver Dummy (Door Open)



Post-Test Driver Dummy (Door Open)



Pre-Test Driver Dummy Feet



Post-Test Driver Dummy Feet



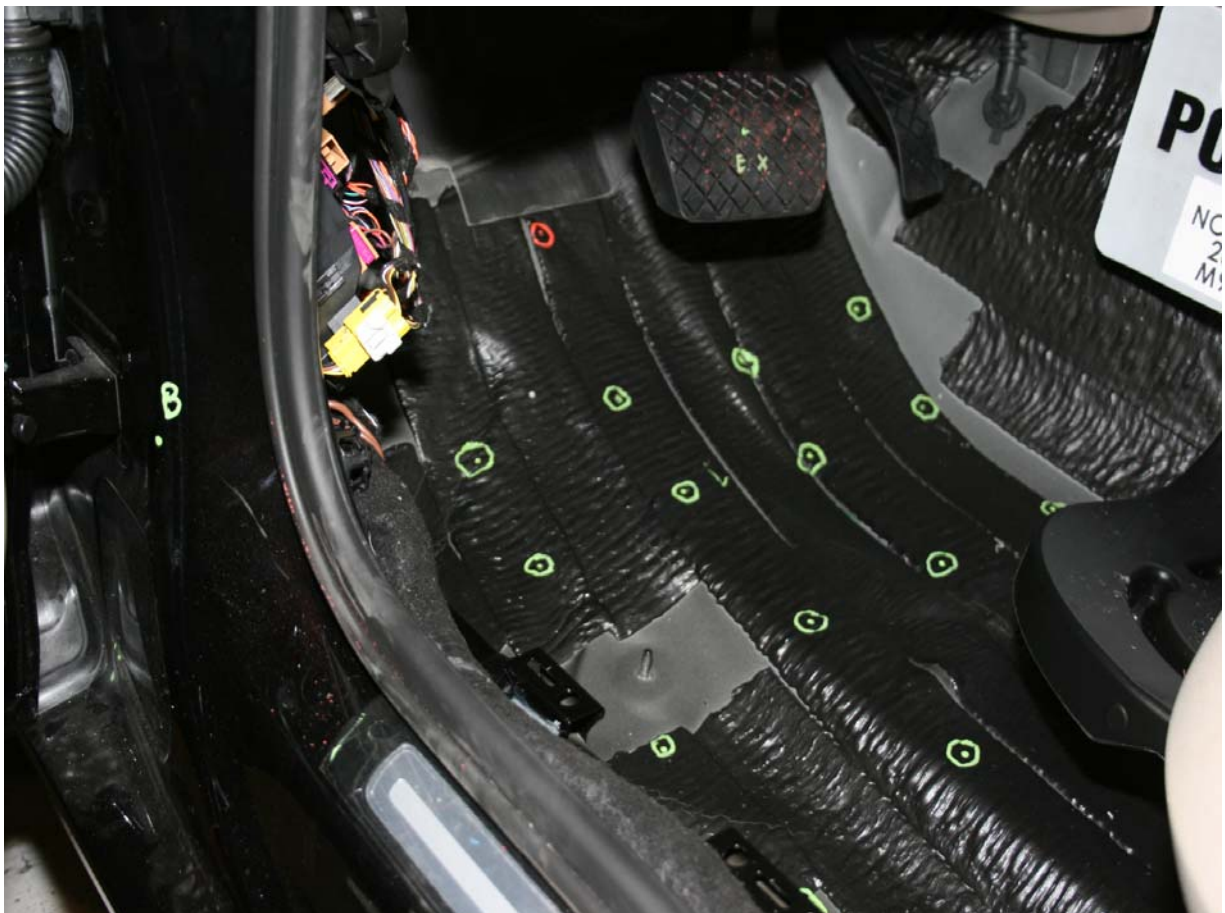
Pre-Test Driver Side Knee Bolster



Post-Test Driver Side Knee Bolster



Pre-Test Driver Side Floor Pan



Post-Test Driver Side Floor Pan



Post-Test Driver Dummy Head Contact



Post-Test Driver Dummy Left Knee Contact



Post-Test Driver Dummy Right Knee Contact



Post-Test Driver Dummy Airbag Contact



Pre-Test Passenger Dummy Front View (Head Position)



Post-Test Passenger Dummy Front View (Head Position)



Post-Test Passenger Dummy (Through Window)



Pre-Test Passenger Dummy (Door Open)



Post-Test Passenger Dummy (Door Open)



Pre-Test Passenger Dummy Feet



Post-Test Passenger Dummy Feet



Pre-Test Passenger Side Glove Box



Post-Test Passenger Side Glove Box



Pre-Test Passenger Side Floor Pan



Post-Test Passenger Side Floor Pan



Post-Test Passenger Dummy Head Contact (headrest)



Post-Test Passenger Dummy Head Contact (headliner)



Post-Test Passenger Dummy Knee Contact



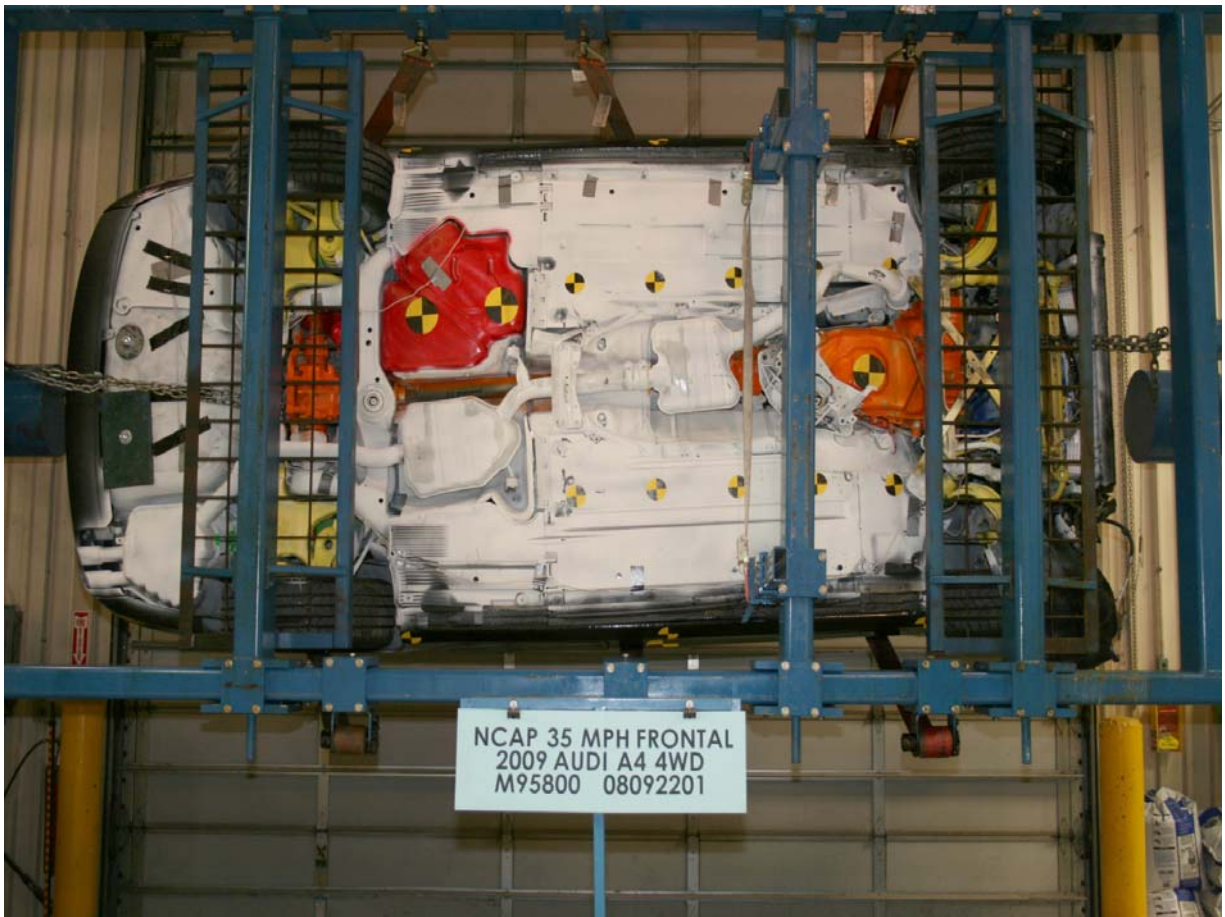
Post-Test Passenger Dummy Airbag Contact



Rollover 90 Degrees



Rollover 180 Degrees



Rollover 270 Degrees



Rollover 360 Degrees



Vehicle Impact

APPENDIX B
DUMMY RESPONSE DATA TRACES

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

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Upper Neck Force X

Driver Upper Neck Force Y

Driver Upper Neck Force Z

Driver Upper Neck Moment X

Driver Upper Neck Moment Y

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Chest Displacement

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

Driver Shoulder Belt Force

Driver Lap Belt Force

Driver Left Upper Tibia Moment X

Driver Left Upper Tibia Moment Y

Driver Left Upper Tibia Force Z

Driver Left Lower Tibia Moment X

Driver Left Lower Tibia Moment Y

Driver Left Lower Tibia Force Z

Driver Right Upper Tibia Moment X

Driver Right Upper Tibia Moment Y

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

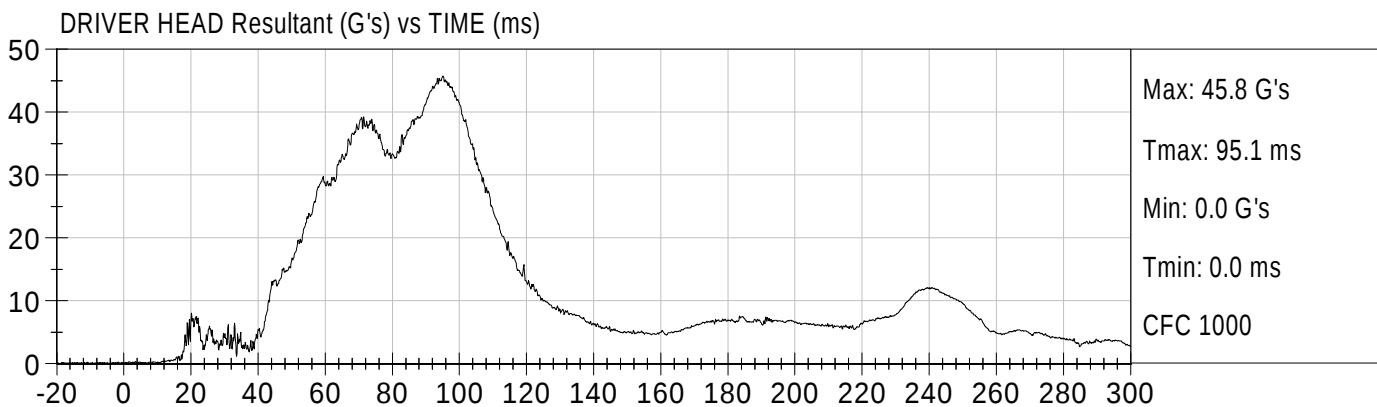
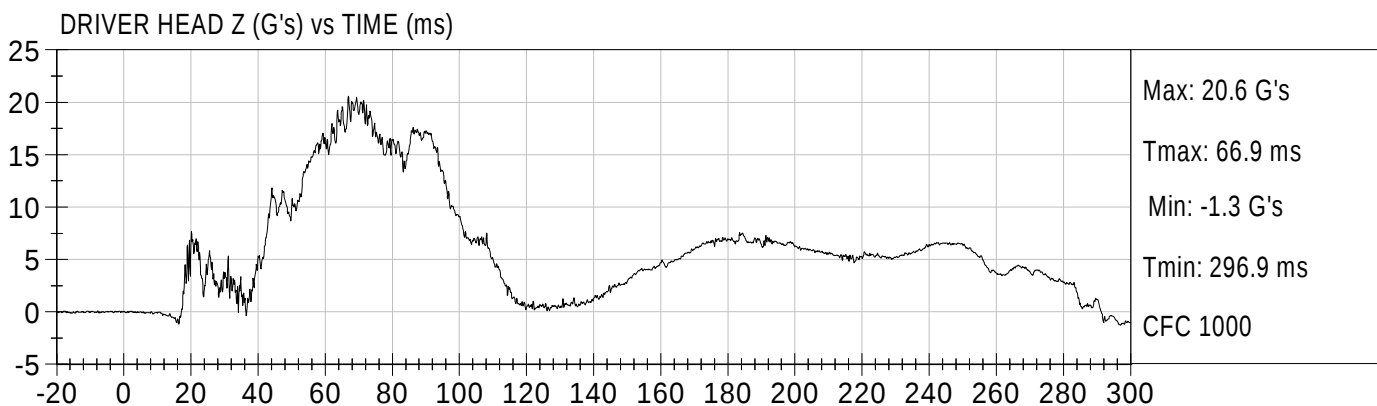
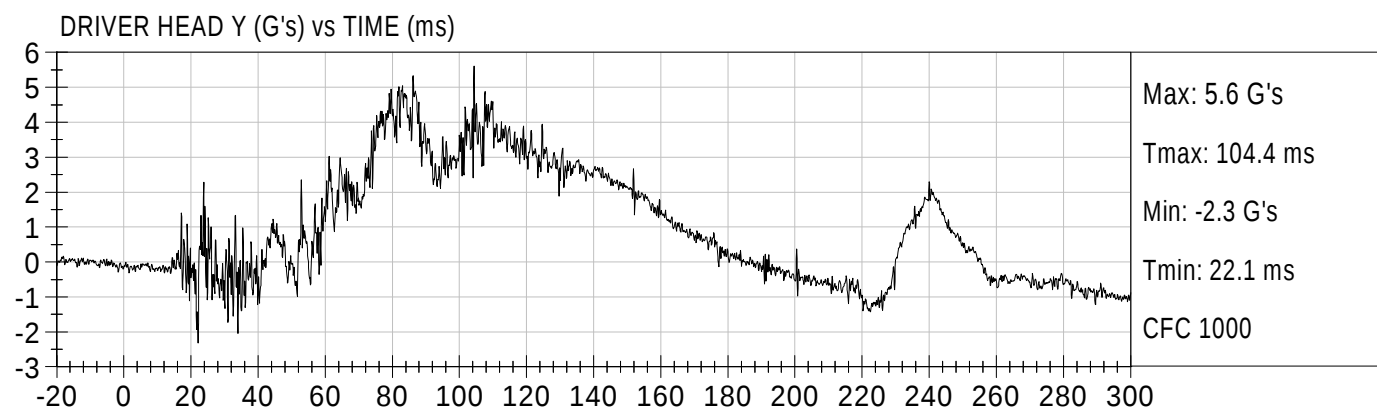
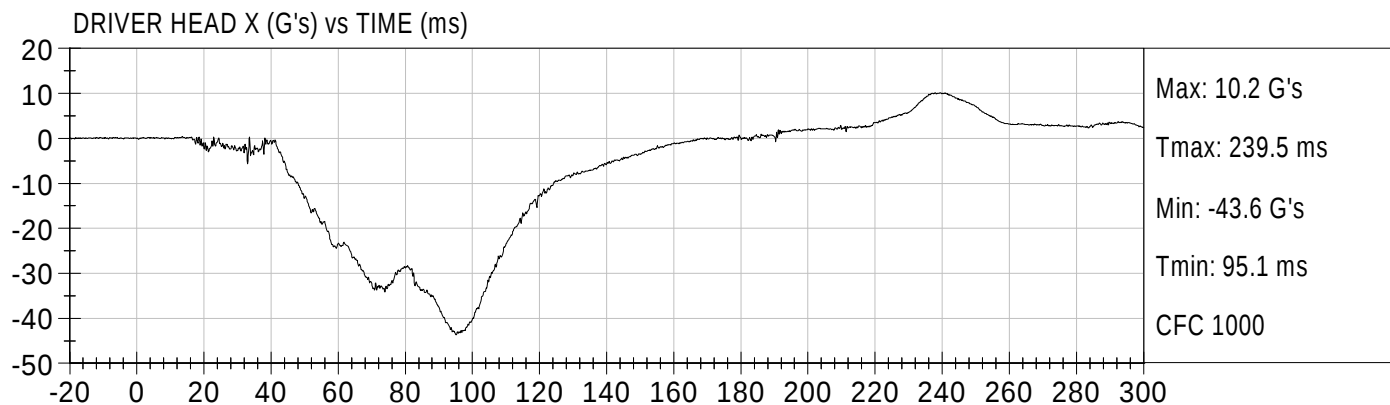
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right Lower Tibia Moment X
Passenger Right Lower Tibia Moment Y
Passenger Right Lower Tibia Force Z
Passenger Left Foot Fore Z
Passenger Left Foot Aft X
Passenger Left Foot Aft Z
Passenger Right Foot Fore Z
Passenger Right Foot Aft X
Passenger Right Foot Aft Z
Left Rear Seat Crossmember X
Left Rear Seat Crossmember Z
Right Rear Seat Crossmember X
Right Rear Seat Crossmember Z
Vehicle Engine Top X
Vehicle Engine Bottom X
Vehicle Left Brake Caliper X
Vehicle Right Brake Caliper X
Barrier Force – Upper Left
Barrier Force – Upper Center
Barrier Force – Upper Right
Barrier Force – Lower Left
Barrier Force – Lower Center
Barrier Force – Lower Right



NCAP FRONTAL
2009 AUDI A4

M95800

Test Date: 09/22/2008
Speed: 34.9 mph (56.2 km/h)

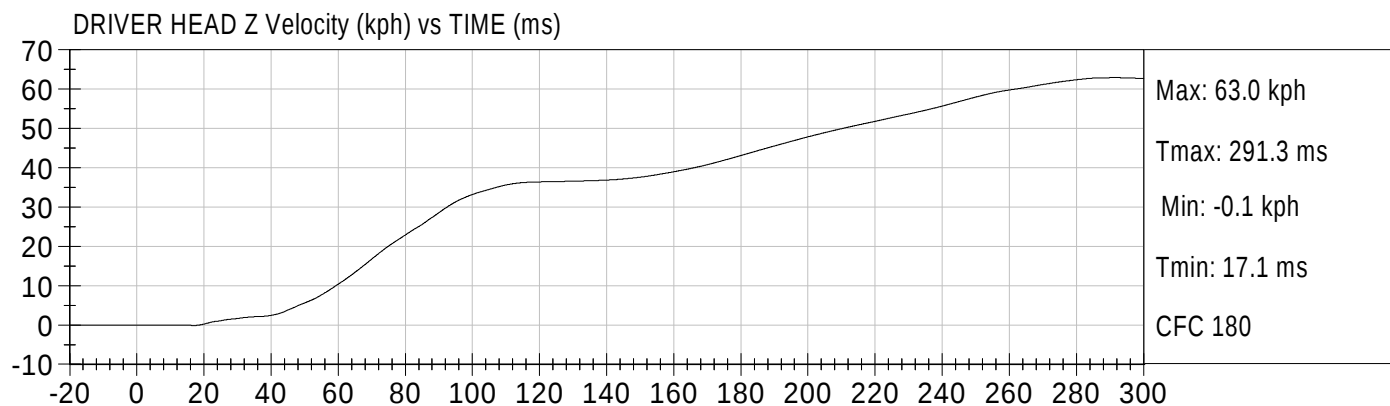
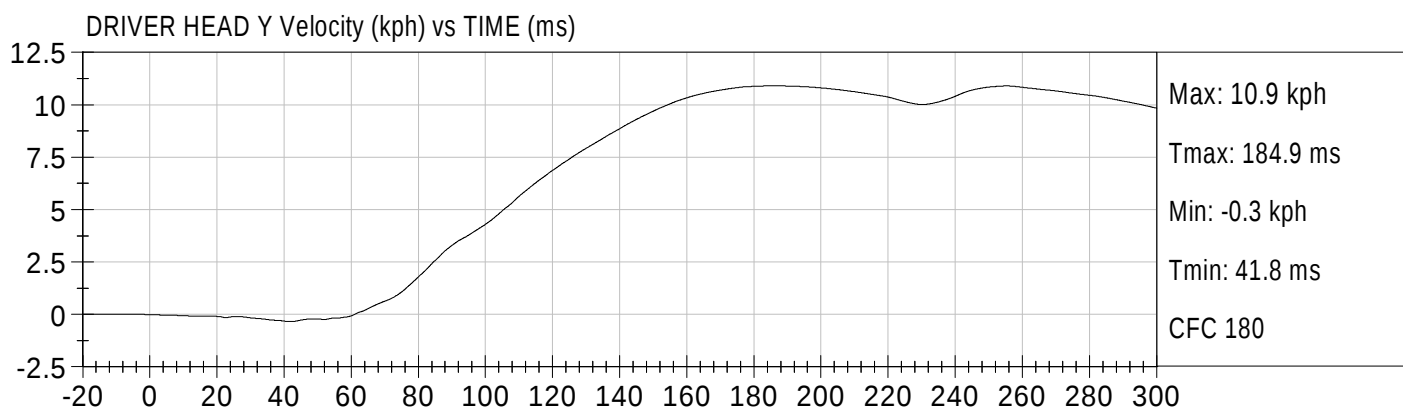
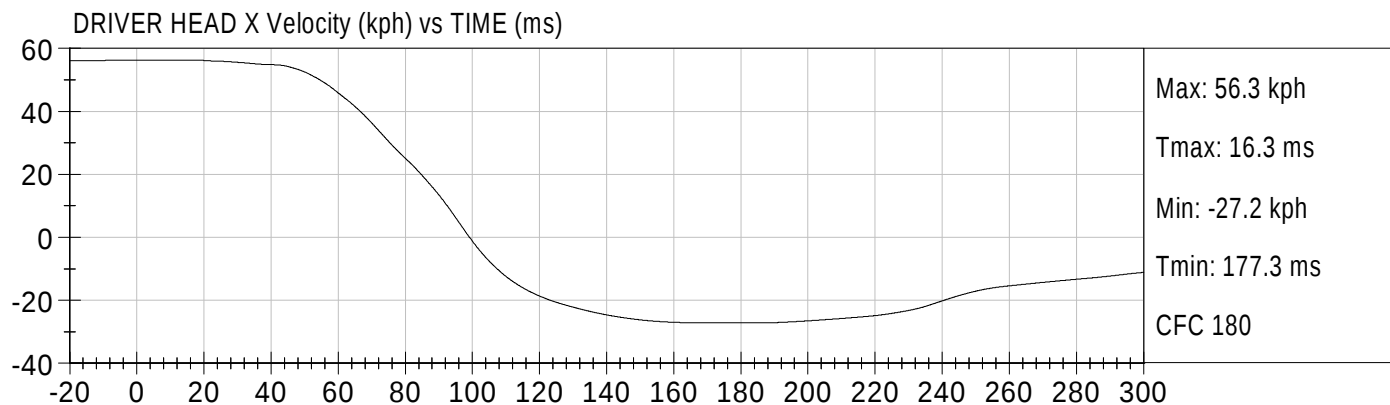




NCAP FRONTAL
2009 AUDI A4

M95800

Test Date: 09/22/2008
Speed: 34.9 mph (56.2 km/h)

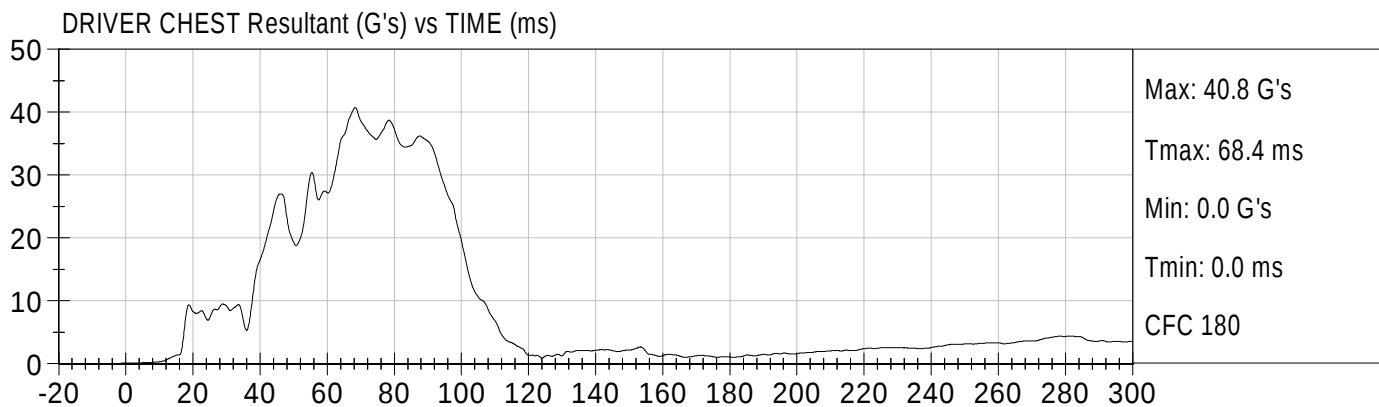
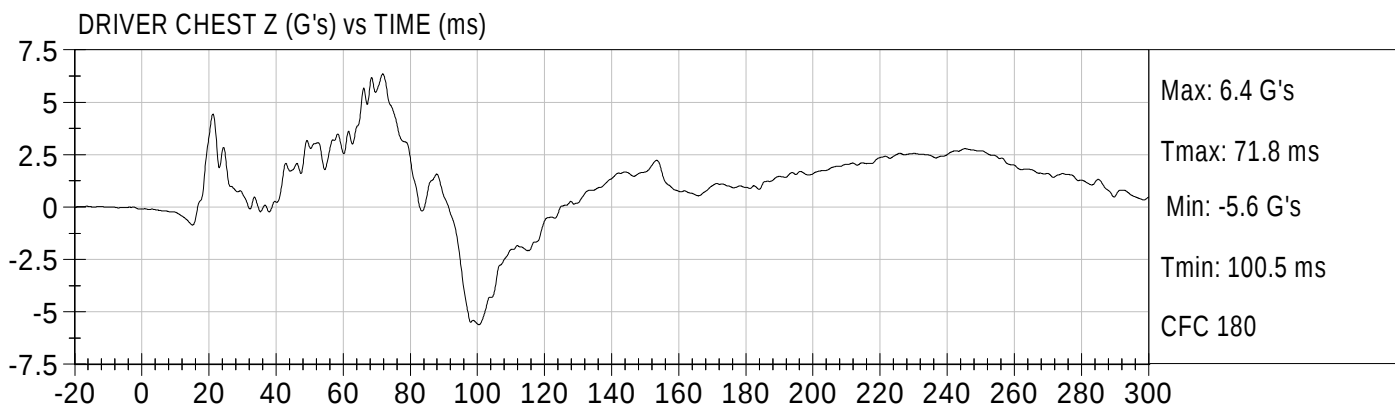
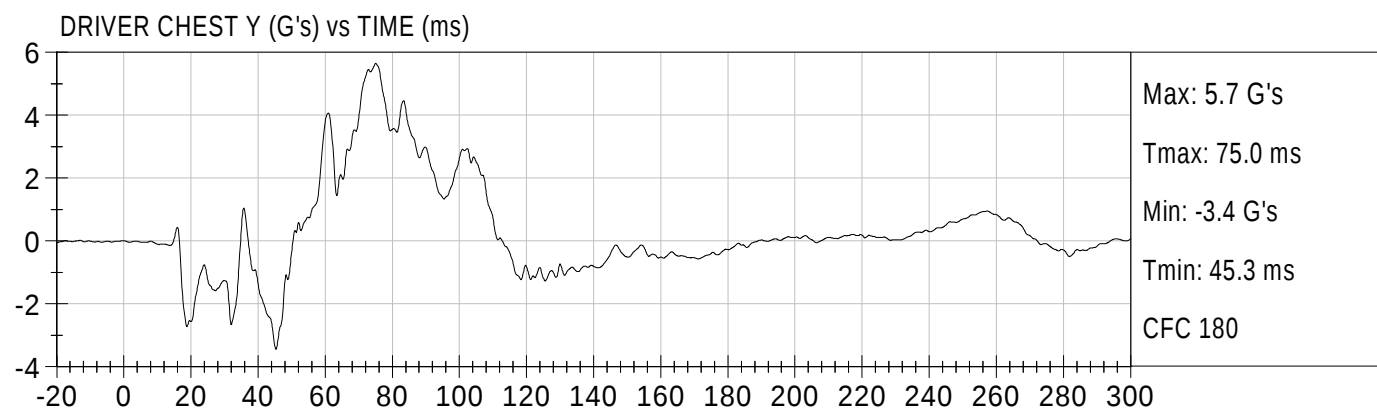
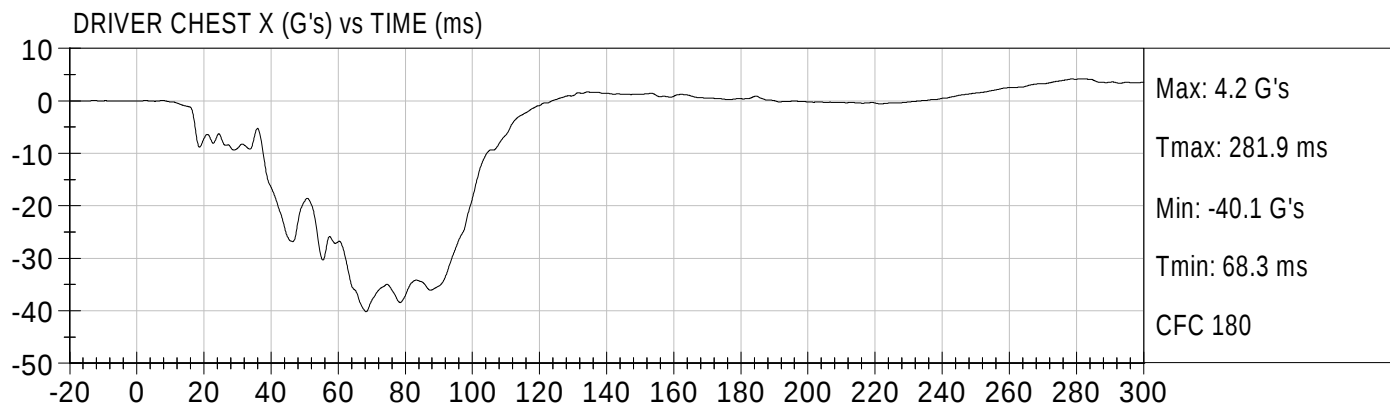


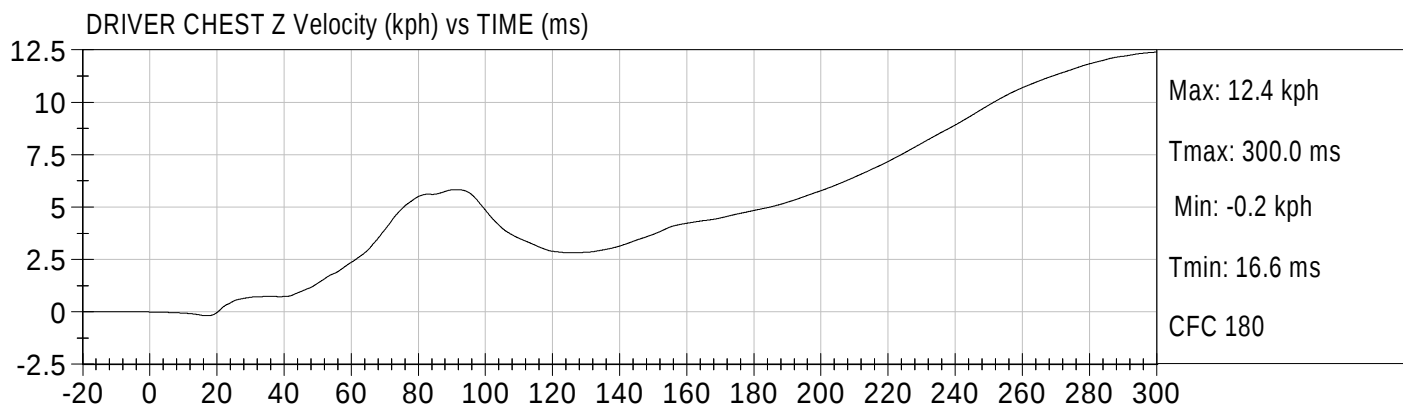
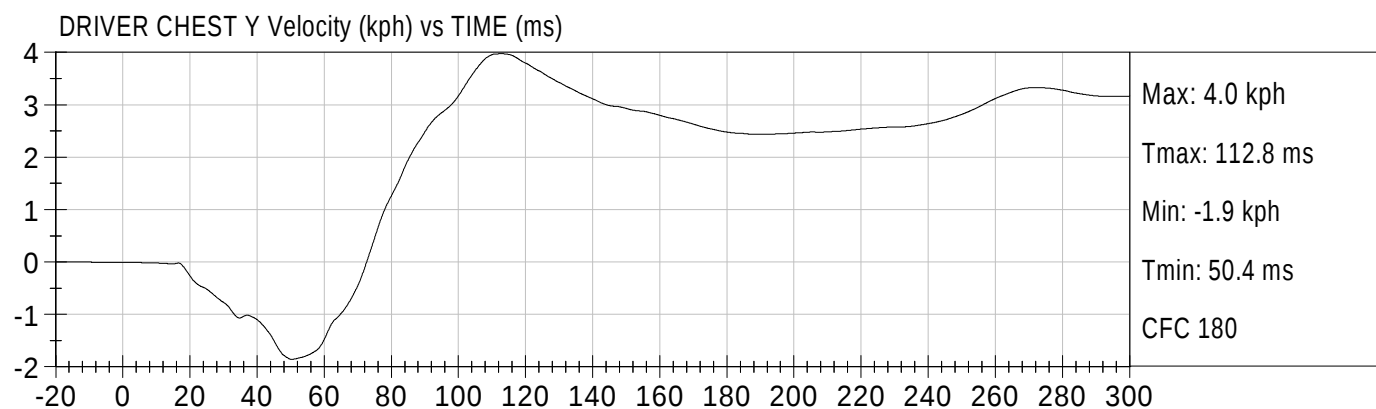
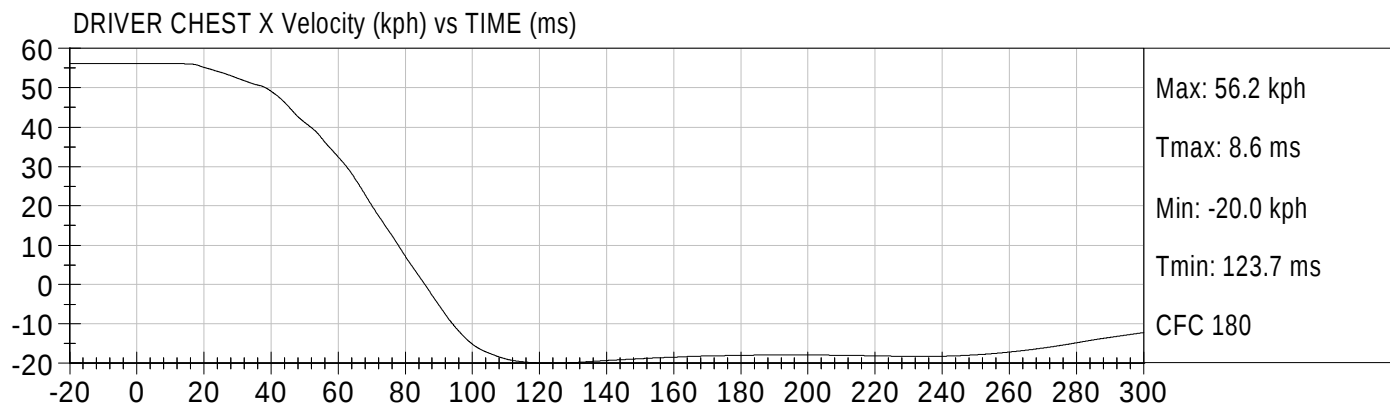


NCAP FRONTAL
2009 AUDI A4

M95800

Test Date: 09/22/2008
Speed: 34.9 mph (56.2 km/h)



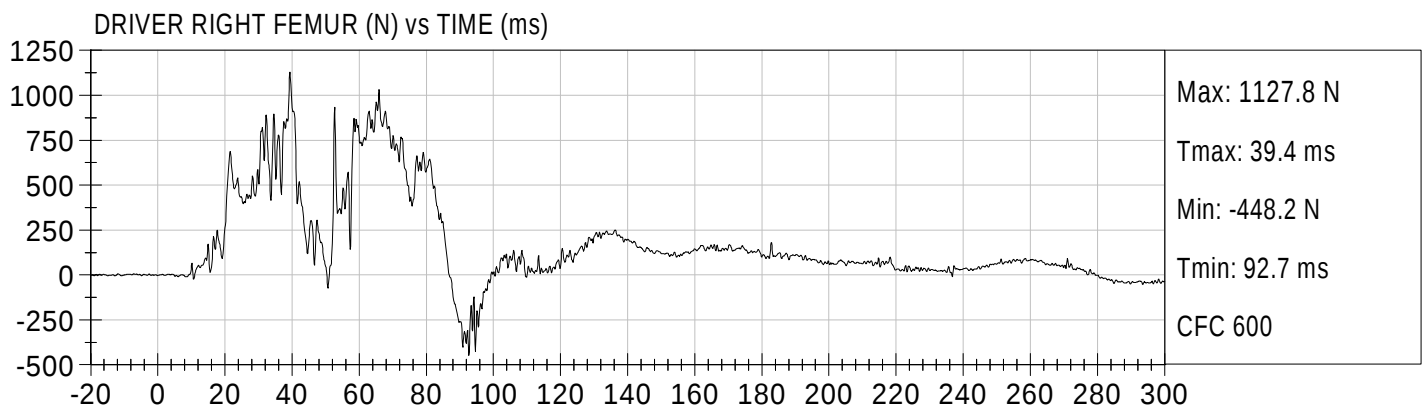
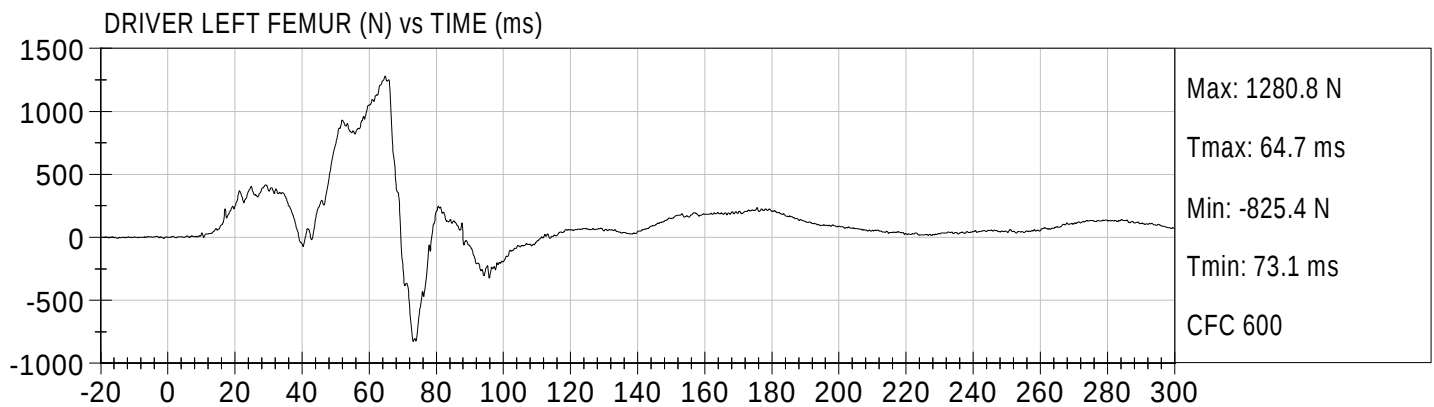




NCAP FRONTAL
2009 AUDI A4

M95800

Test Date: 09/22/2008
Speed: 34.9 mph (56.2 km/h)

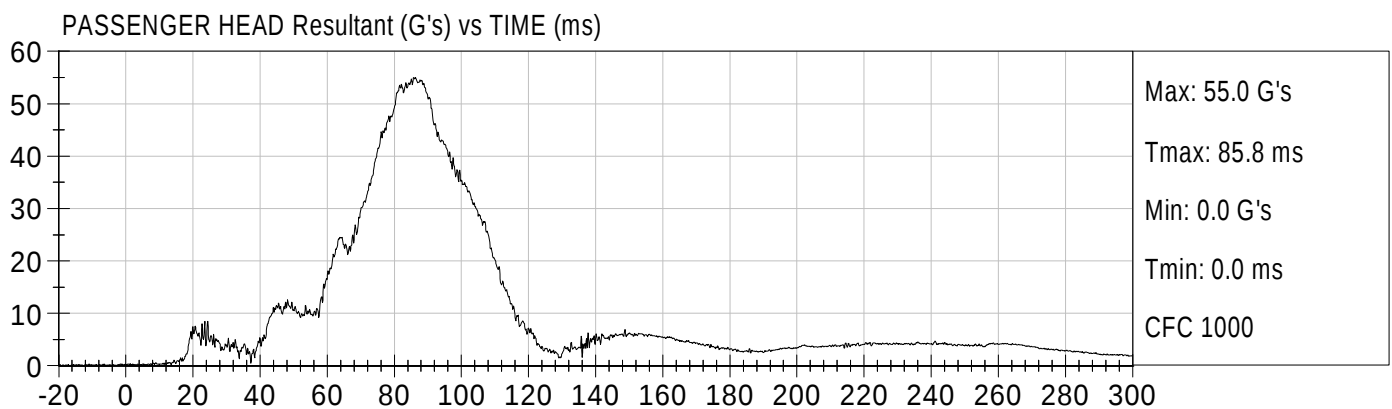
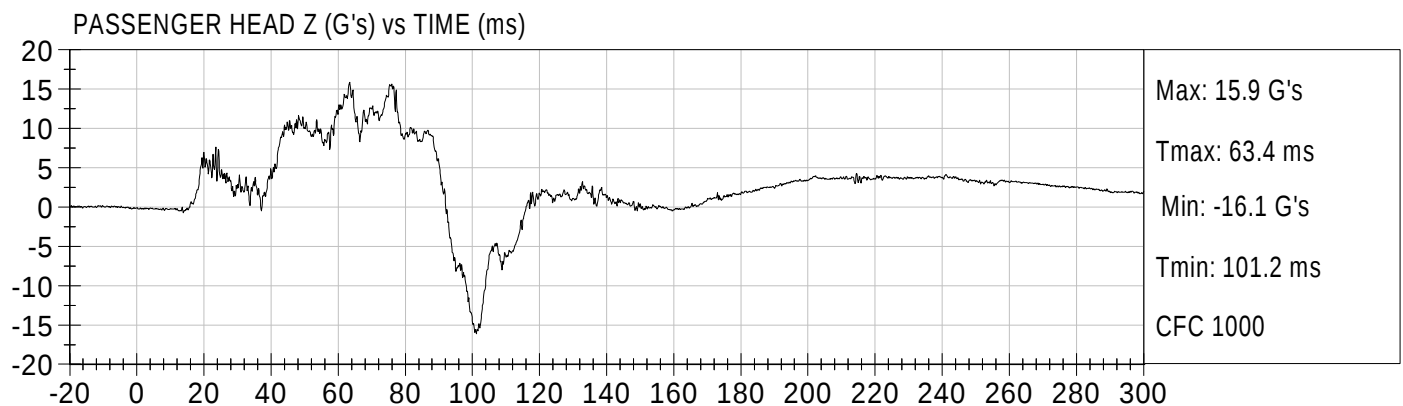
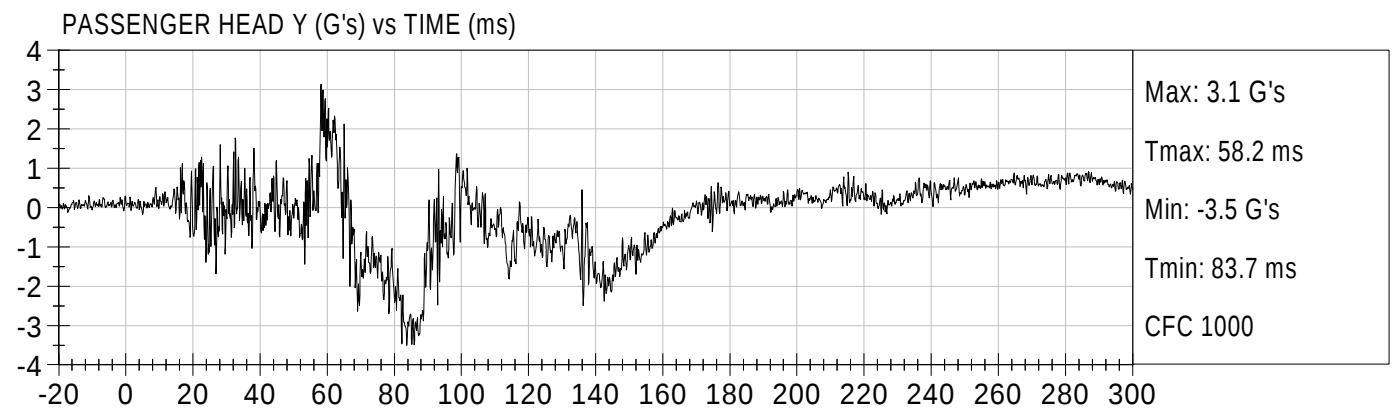
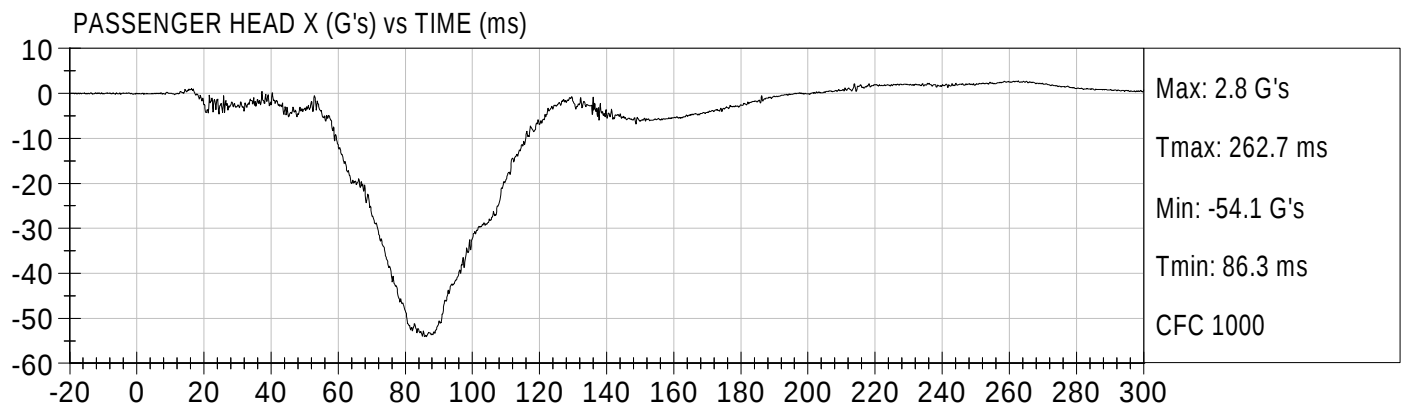




NCAP FRONTAL
2009 AUDI A4

M95800

Test Date: 09/22/2008
Speed: 34.9 mph (56.2 km/h)

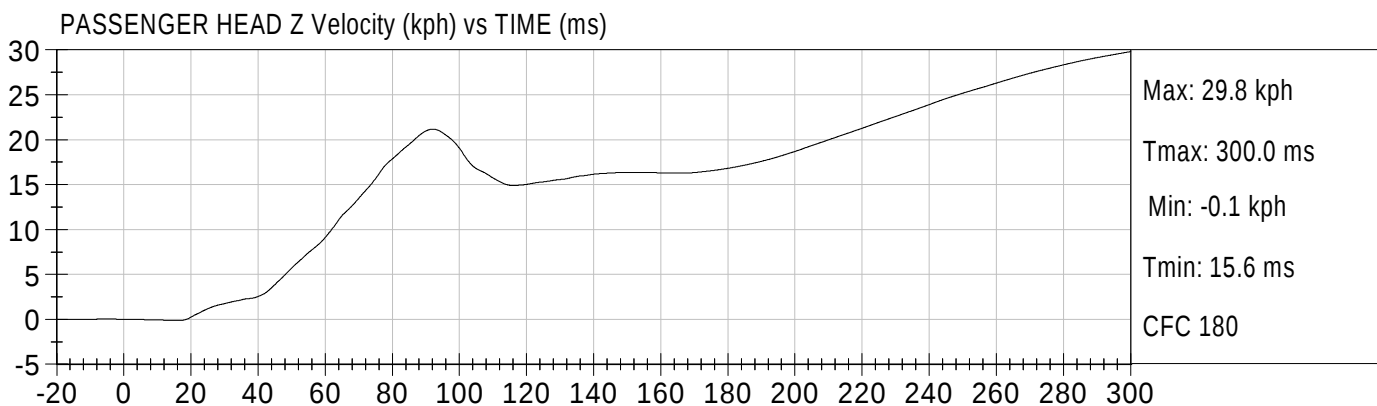
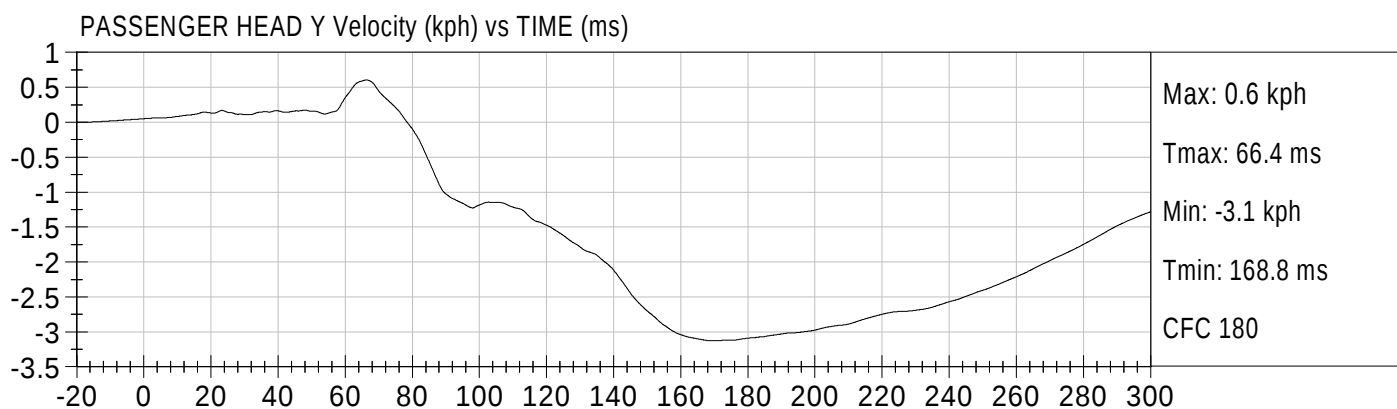
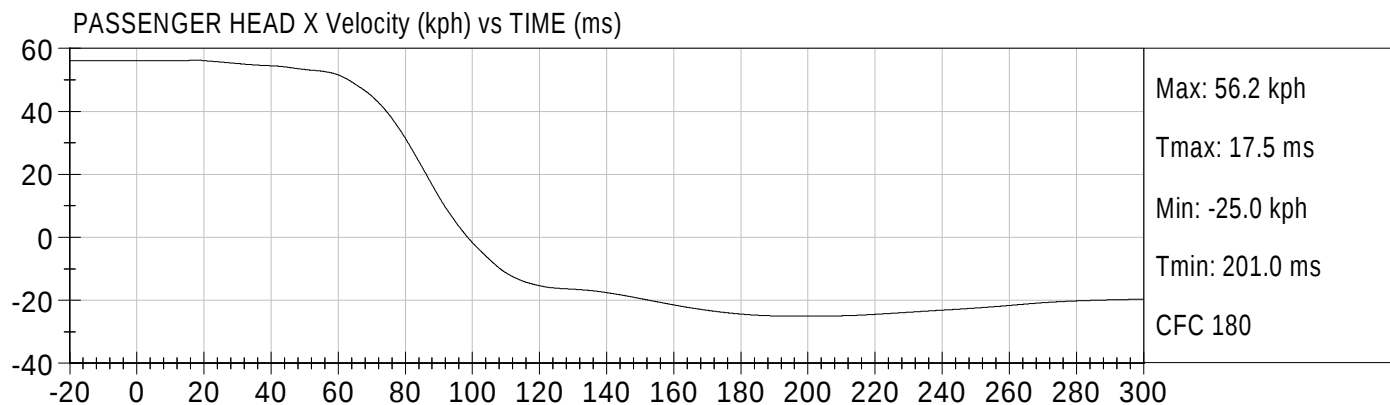




NCAP FRONTAL
2009 AUDI A4

M95800

Test Date: 09/22/2008
Speed: 34.9 mph (56.2 km/h)



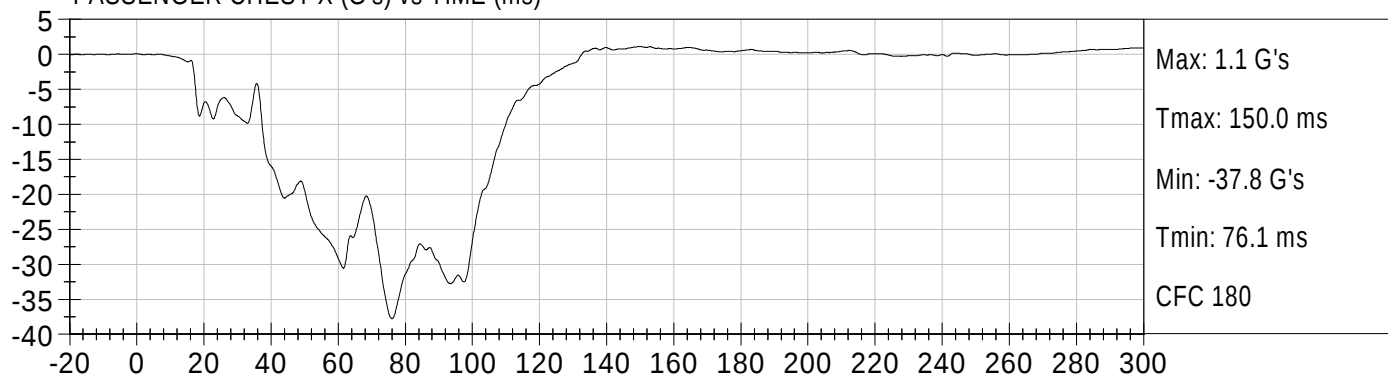


NCAP FRONTAL
2009 AUDI A4

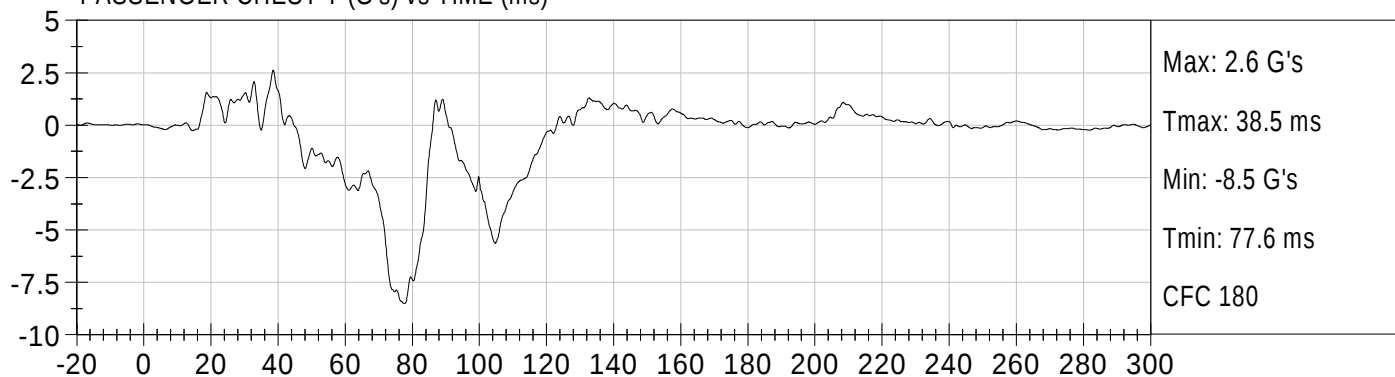
M95800

Test Date: 09/22/2008
Speed: 34.9 mph (56.2 km/h)

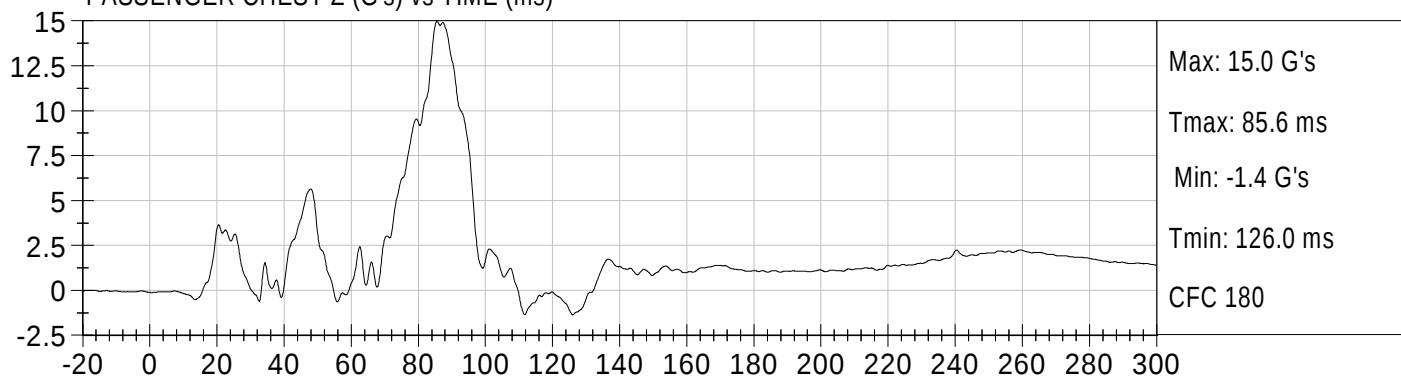
PASSENGER CHEST X (G's) vs TIME (ms)



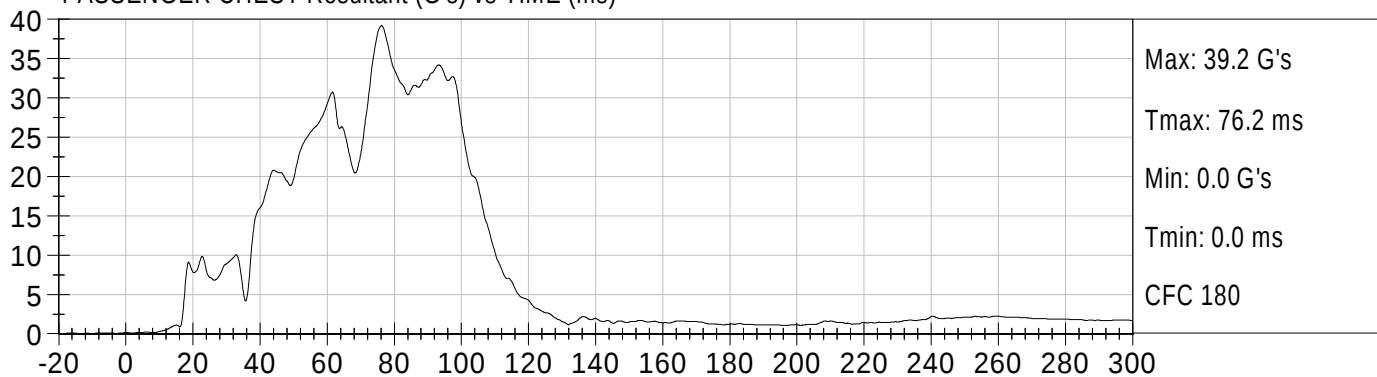
PASSENGER CHEST Y (G's) vs TIME (ms)

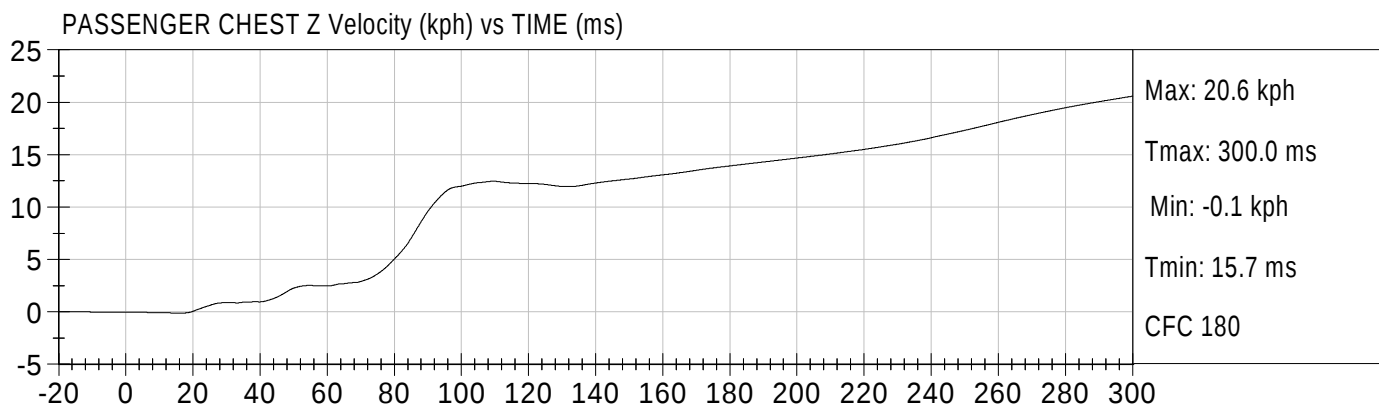
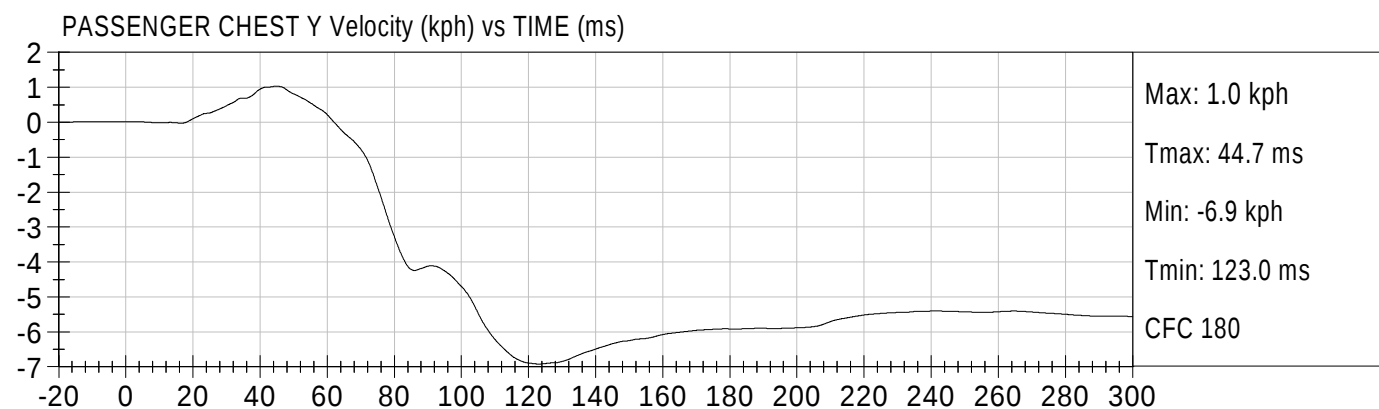
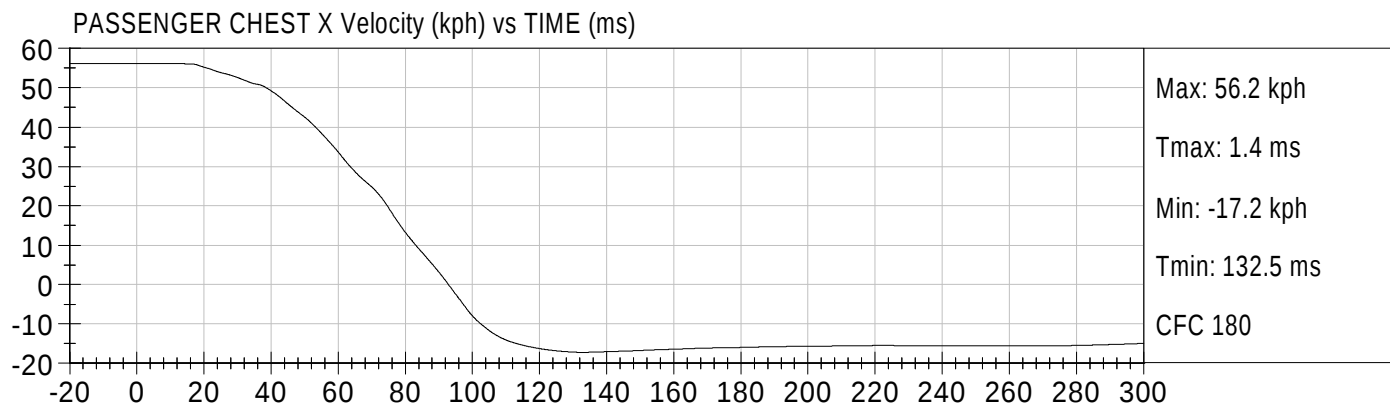


PASSENGER CHEST Z (G's) vs TIME (ms)



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





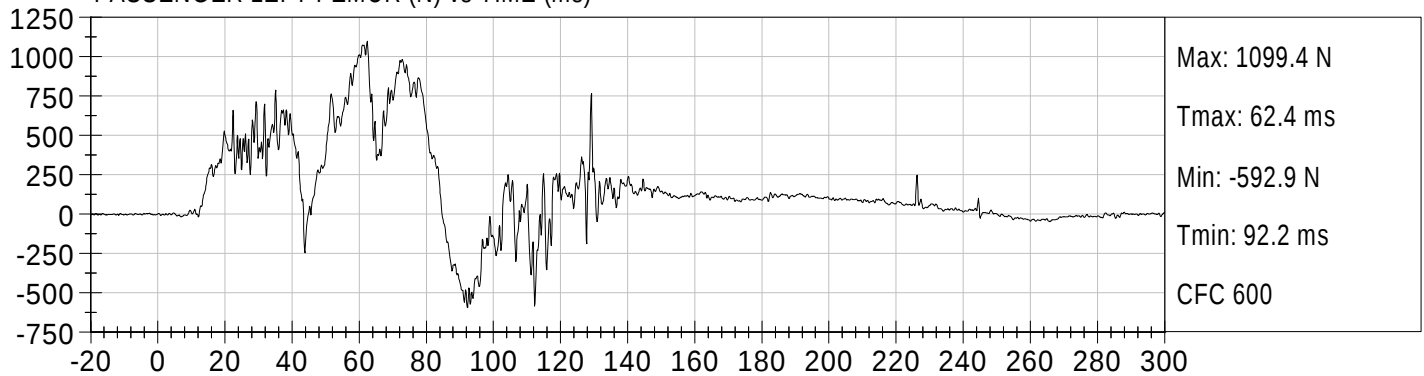


NCAP FRONTAL
2009 AUDI A4

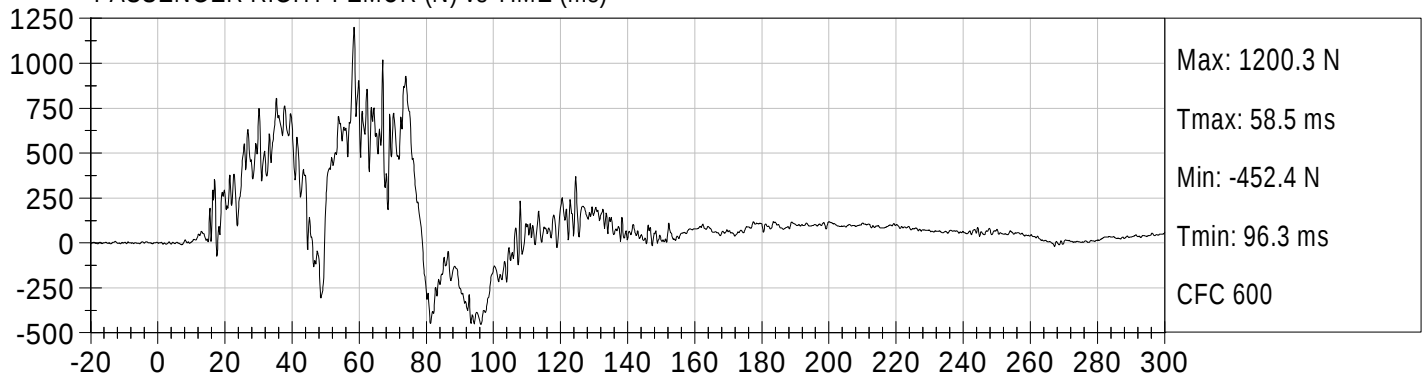
M95800

Test Date: 09/22/2008
Speed: 34.9 mph (56.2 km/h)

PASSENGER LEFT FEMUR (N) vs TIME (ms)



PASSENGER RIGHT FEMUR (N) vs TIME (ms)



APPENDIX C
DUMMY CALIBRATION DATA

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

ATD Serial No: 066

Test ID: D082571

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	225 - 275	253	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-9.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

9/8/08
Test Date

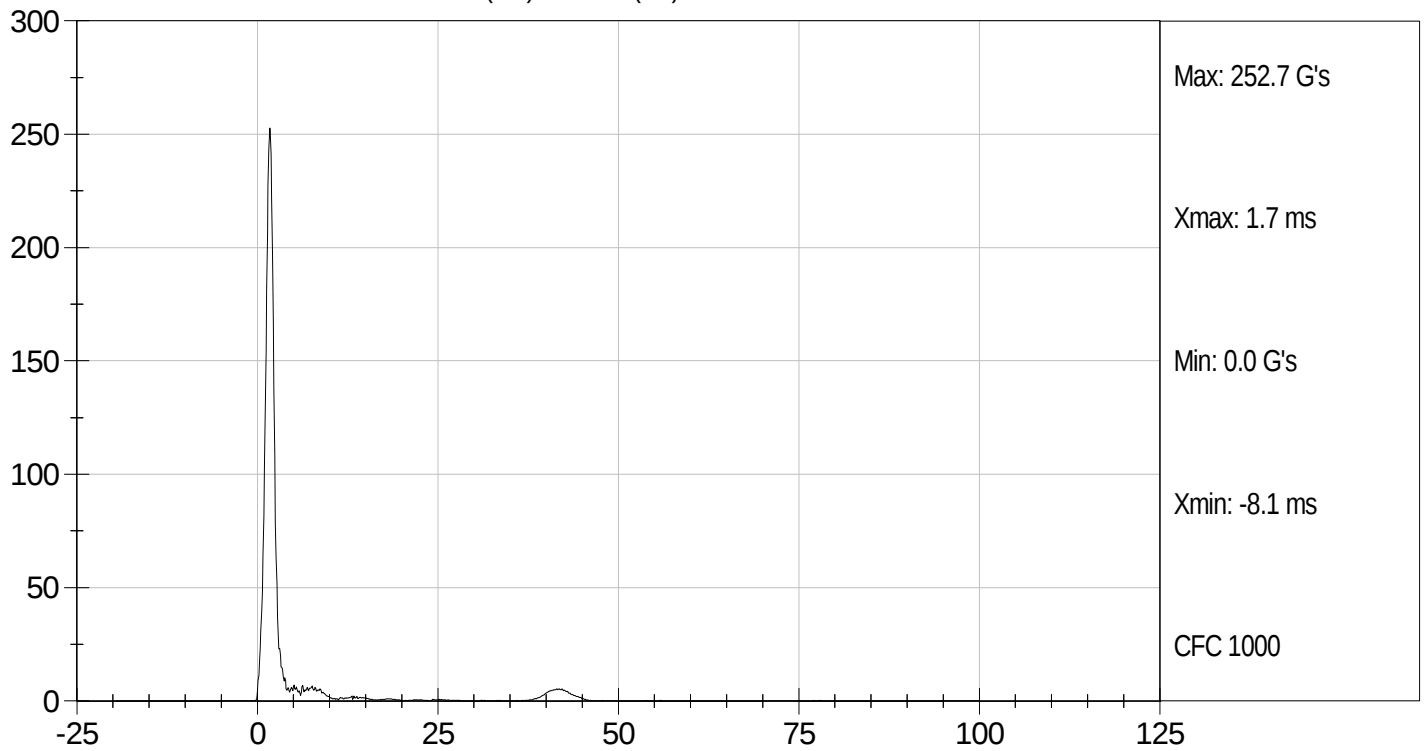

Approved By



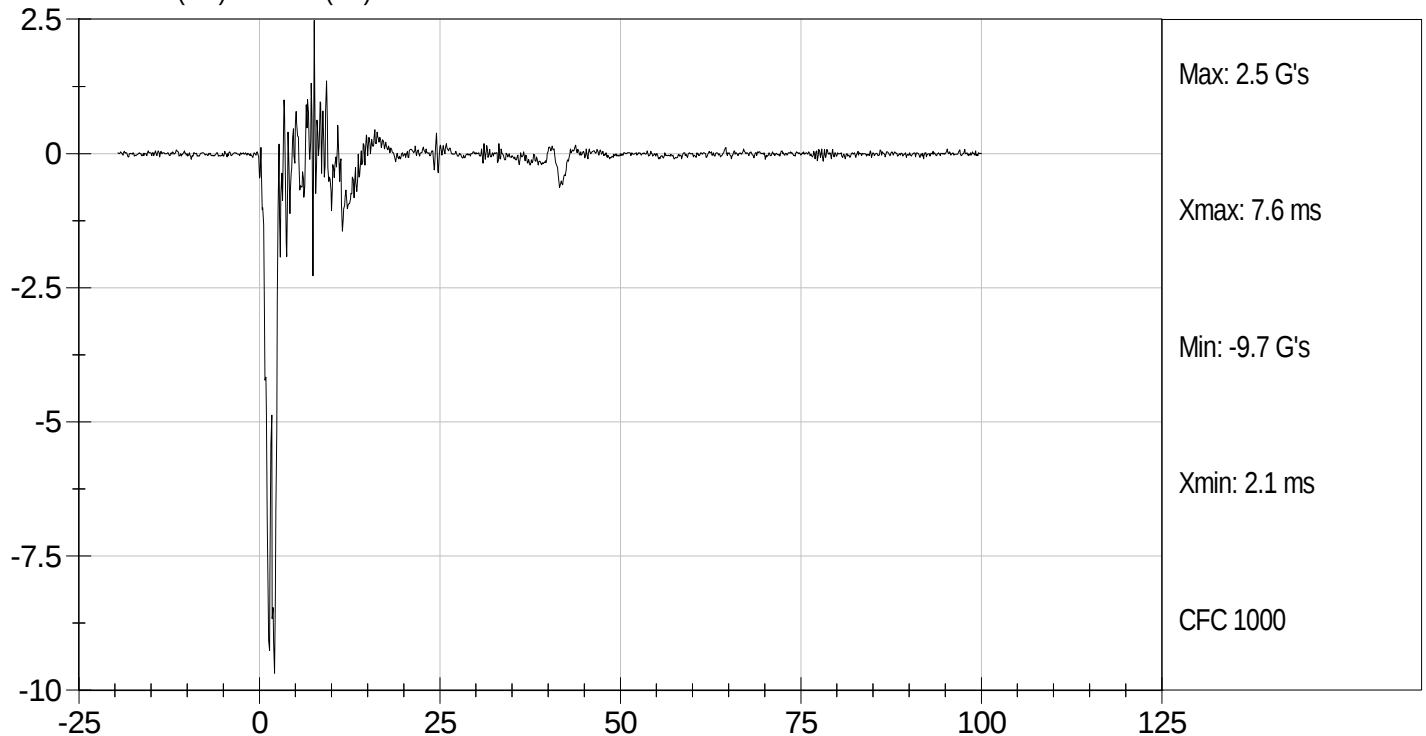
Test Desc: Head Drop
Component ID: D082571

Test Date: 9/8/08
Velocity: 0 ft/s, 0.00 m/s

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



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

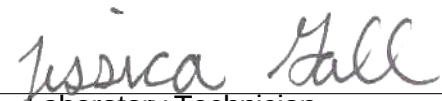


MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D082572

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	45	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	24.43	Pass
	20 msec	G's	17.60 to 22.60	18.56	Pass
	30 msec	G's	12.50 to 18.50	15.47	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	15.43	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	36.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	70.2	Pass
	Time	msec	57.0 to 64.0	59.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	113.4	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	88.5	Pass
	Time	msec	47.0 to 58.0	48.6	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	100.0	Pass
Overall Test Results					Pass


 Laboratory Technician

9/8/08
 Test Date

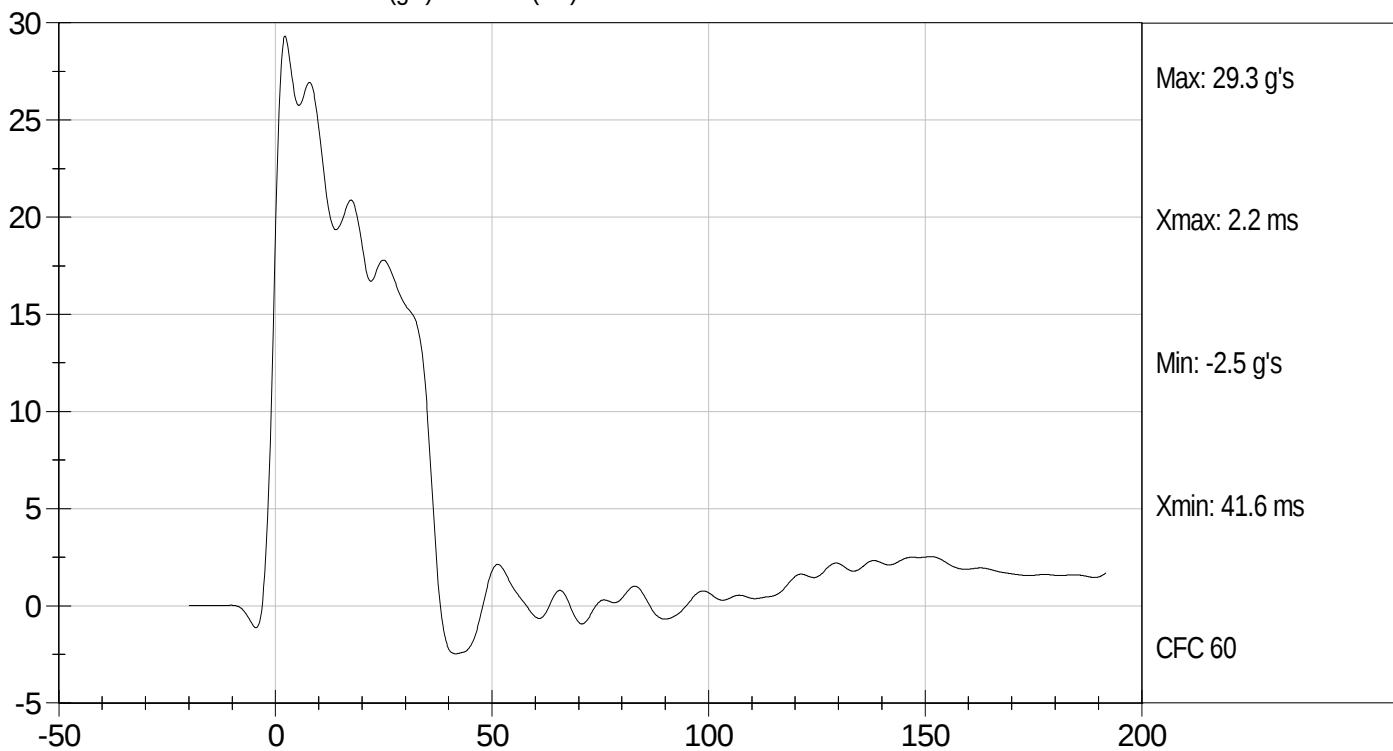

 Approved By



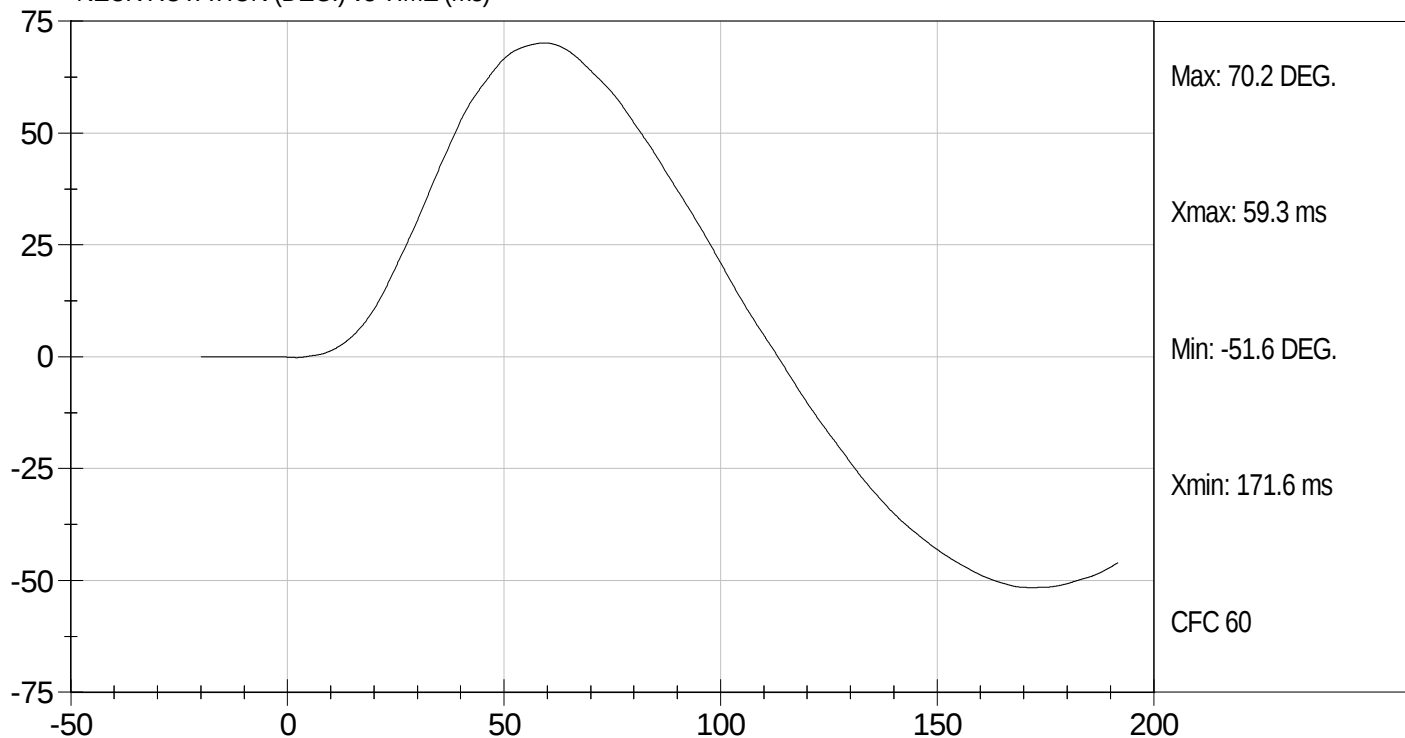
Test Desc: Neck Flexion
Component ID: D082572

Test Date: 9/8/08
Velocity: 23.15 ft/s, 7.06 m/s

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



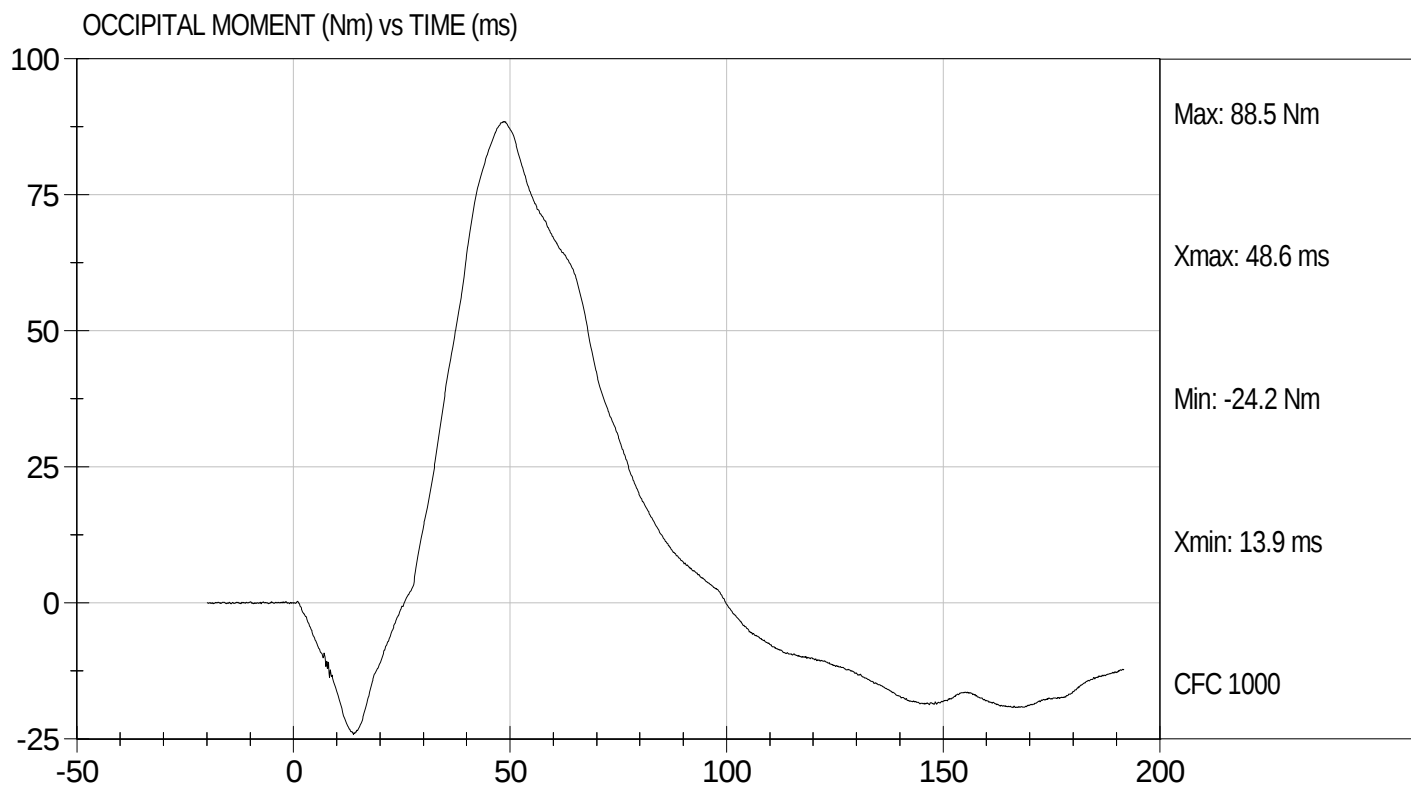
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Flexion
Component ID: D082572

Test Date: 9/8/08
Velocity: 23.15 ft/s, 7.06 m/s



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

ATD Serial No: 066

Test I.D: D082573

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	44	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	19.88	Pass
	20 msec	G's	14.00 to 19.00	16.11	Pass
	30 msec	G's	11.00 to 16.00	11.80	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	13.50	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	38.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.3	Pass
	Time	msec	72.0 to 82.0	75.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	153.6	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-60.4	Pass
	Time	msec	65.0 to 79.0	71.3	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	142.9	Pass
Overall Test Results					Pass


 Laboratory Technician

9/8/08
 Test Date

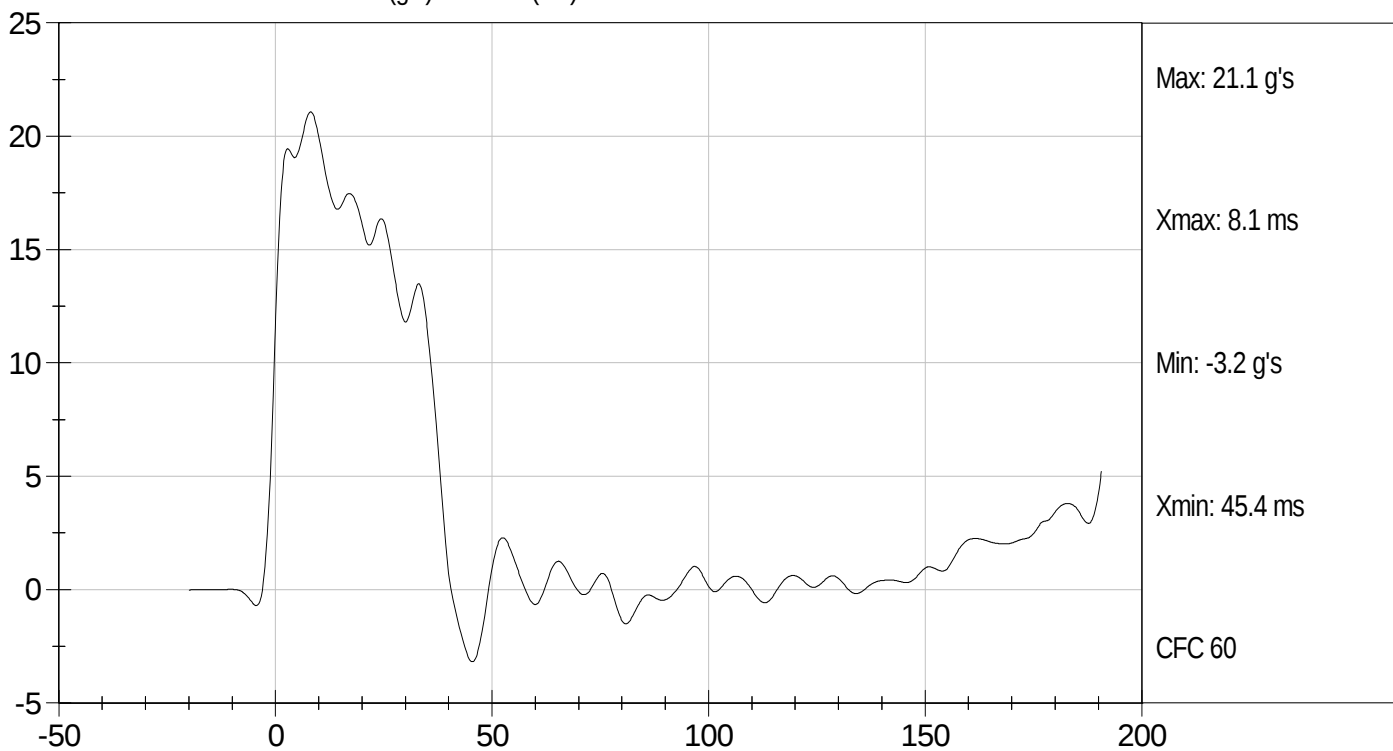

 Approved By



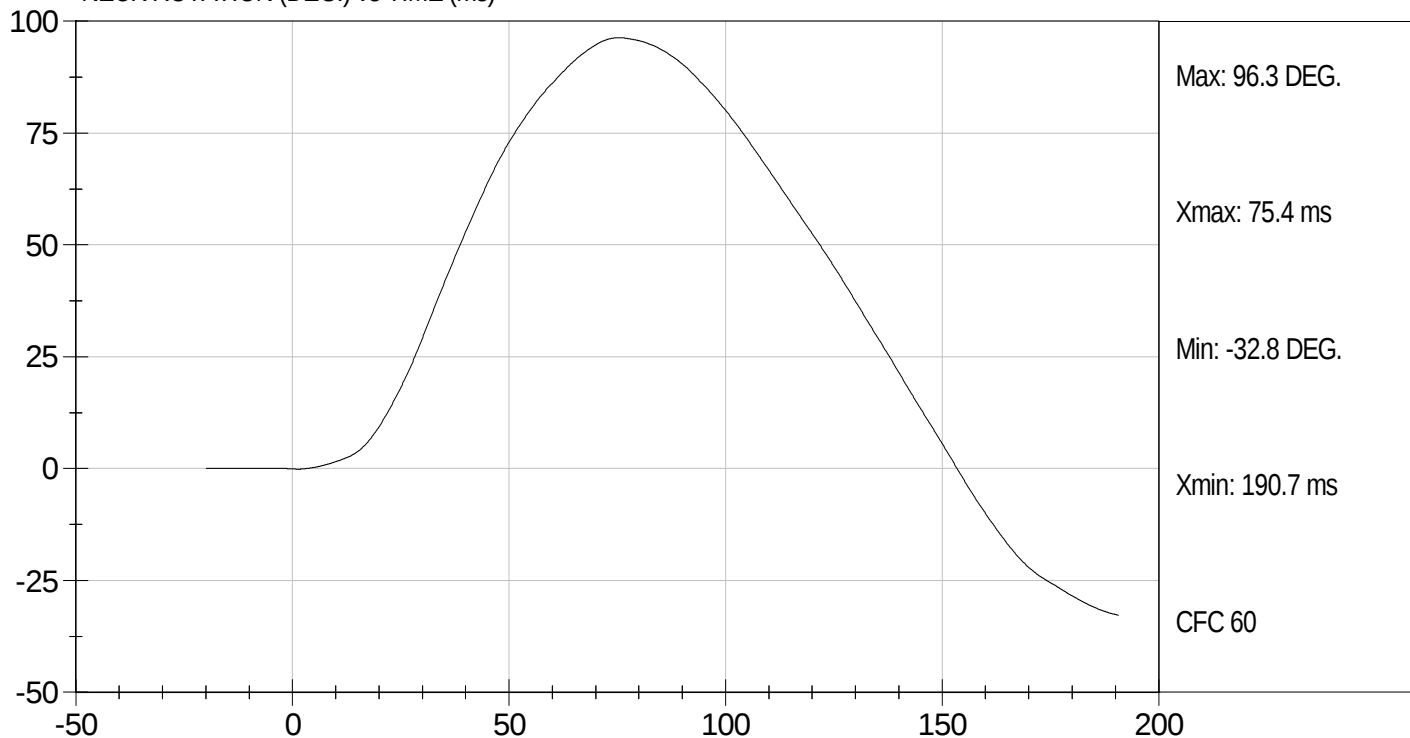
Test Desc: Neck Extension
Component ID: D082573

Test Date: 9/8/08
Velocity: 20.08 ft/s, 6.12 m/s

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



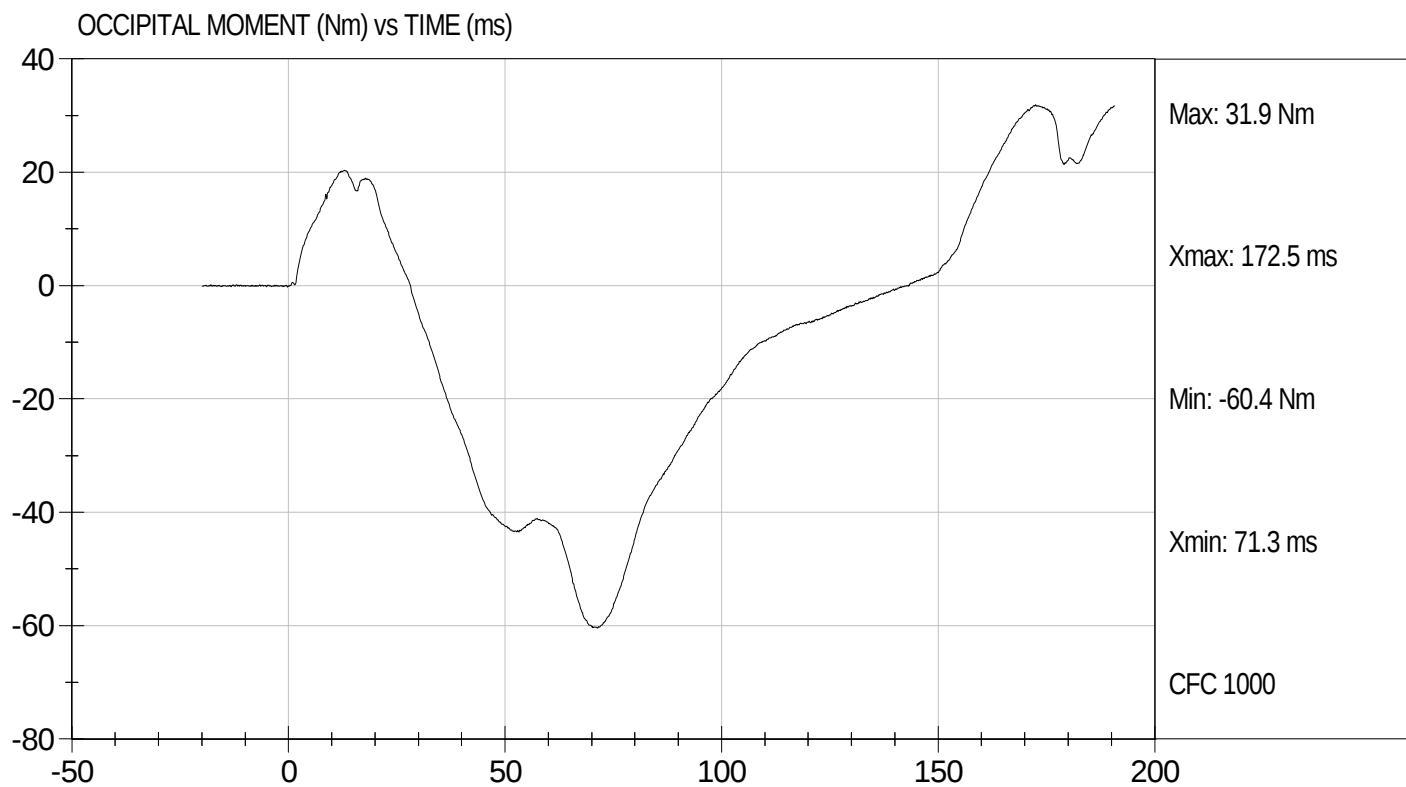
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Extension
Component ID: D082573

Test Date: 9/8/08
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D082574

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	44	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,515	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.41	Pass
Internal Hysteresis	%	69 to 85	72	Pass
			Overall Test Results	Pass


Laboratory Technician

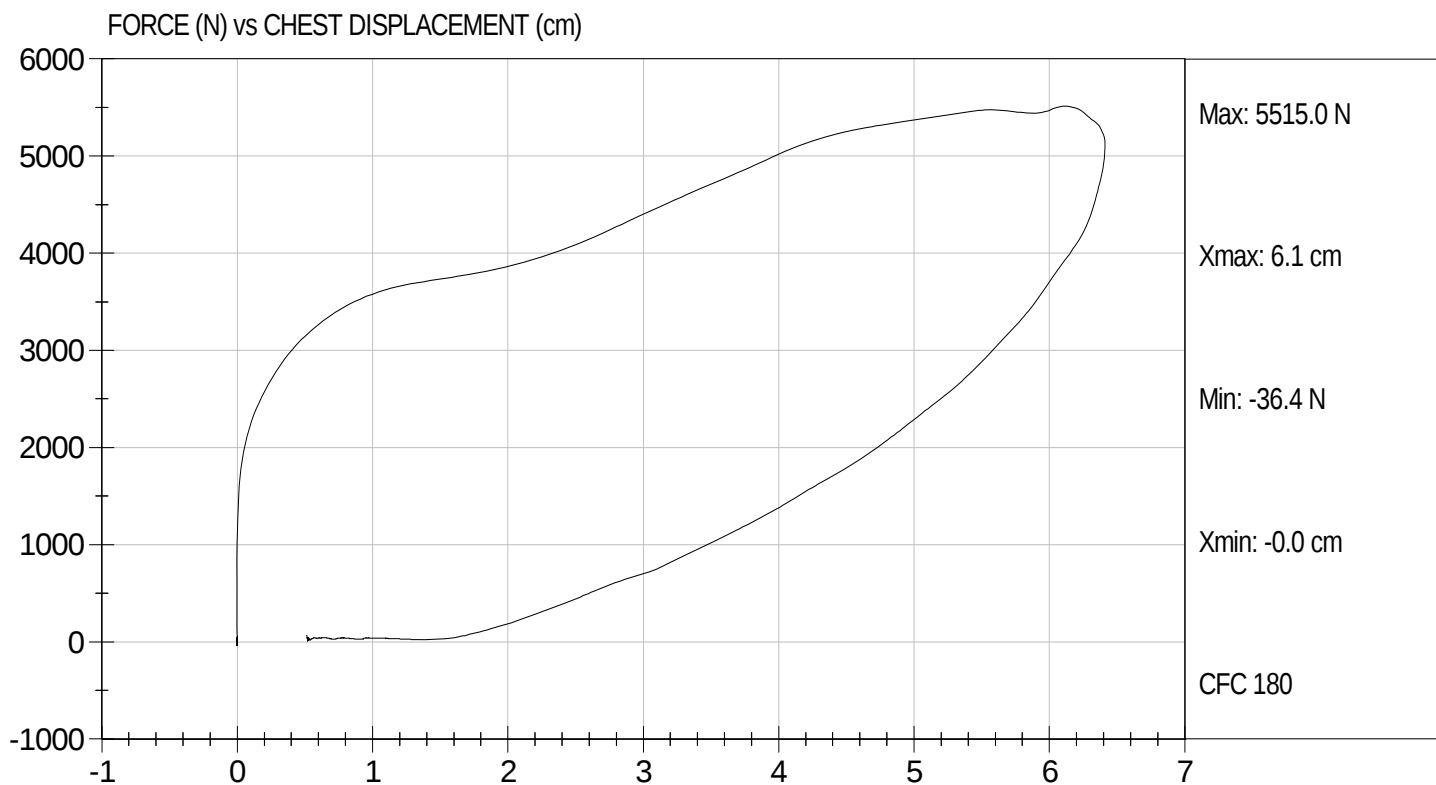
9/8/08
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D082574

Test Date: 9/8/08
Velocity: 21.93 ft/s, 6.68 m/s

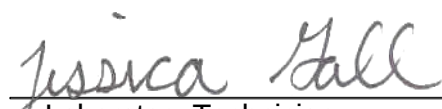


MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D082575

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,189	Pass
			Overall Test Results	Pass


Laboratory Technician

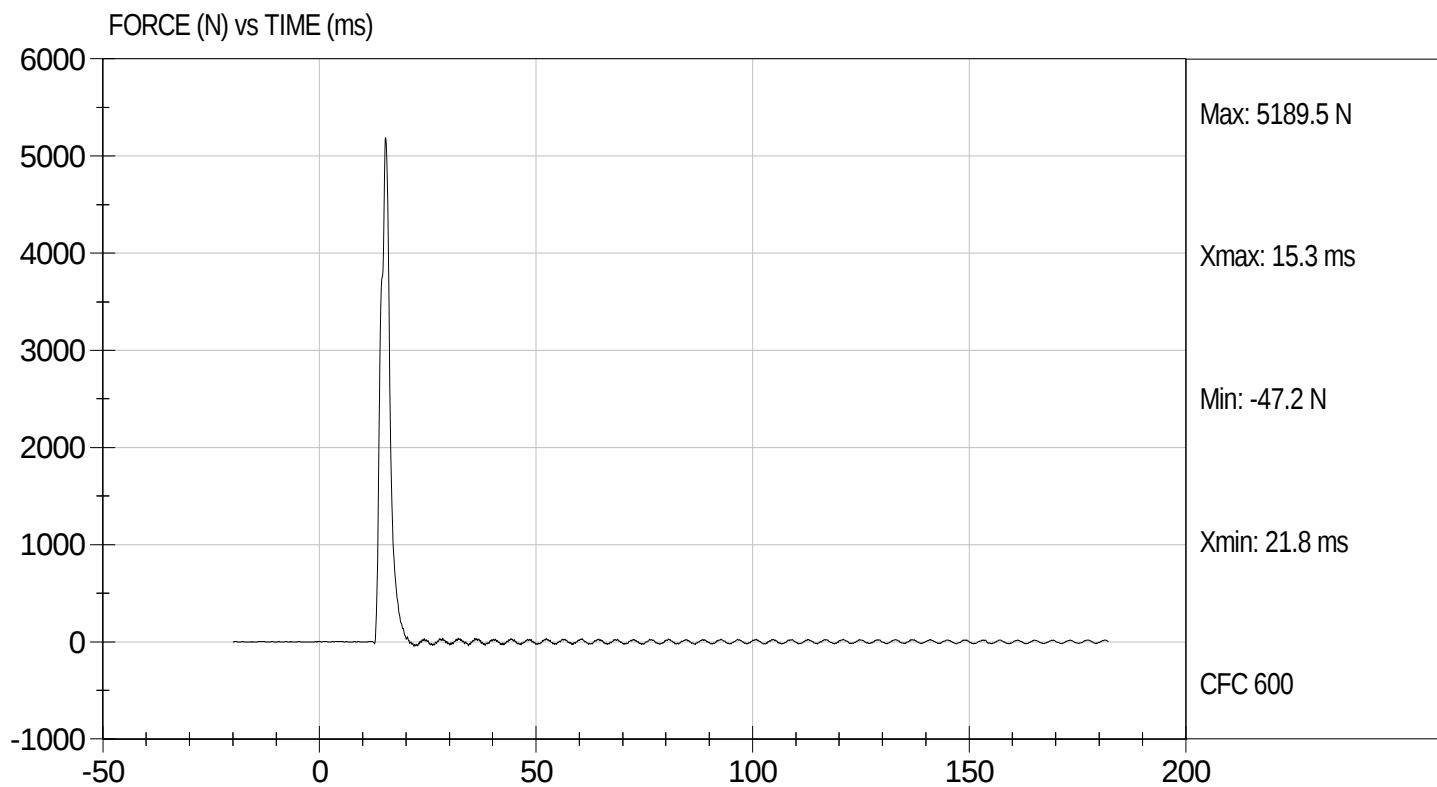
9/8/08
Test Date


Approved By



Test Desc: Right Knee
Component ID: D082575

Test Date: 9/8/08
Velocity: 6.94 ft/s, 2.12 m/s

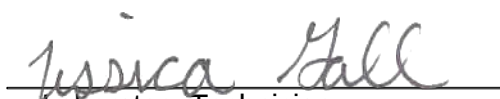


MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D082576

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,334	Pass
Overall Test Results				Pass


Laboratory Technician

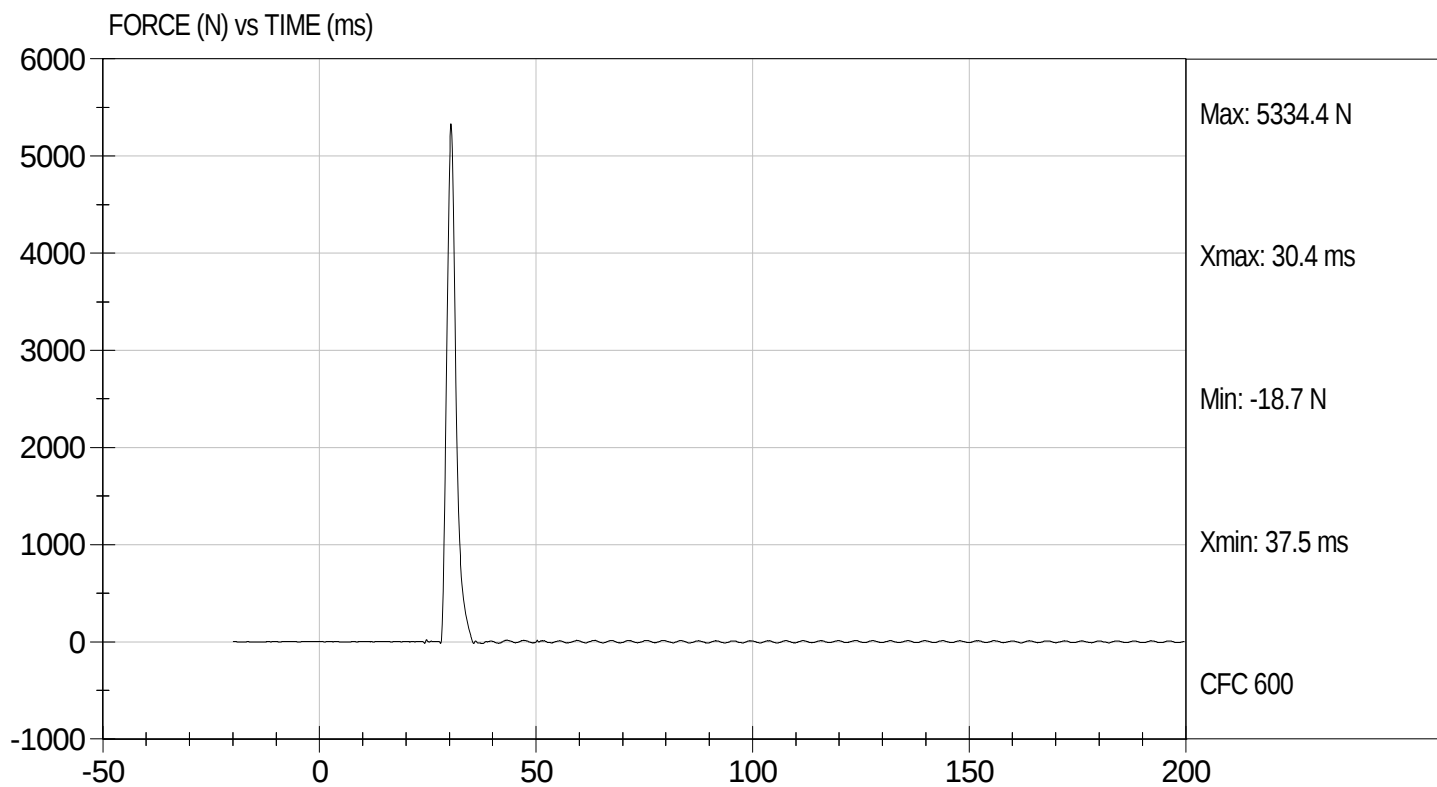
9/8/08
Test Date


Approved By



Test Desc: Left Knee
Component ID: D082576

Test Date: 9/8/08
Velocity: 6.97 ft/s, 2.12 m/s



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

ATD Serial No: 066

Test I.D: D082570

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	43	43	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	80.2	80.9	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	41	41	Pass
Overall Test Results					Pass


 Laboratory Technician

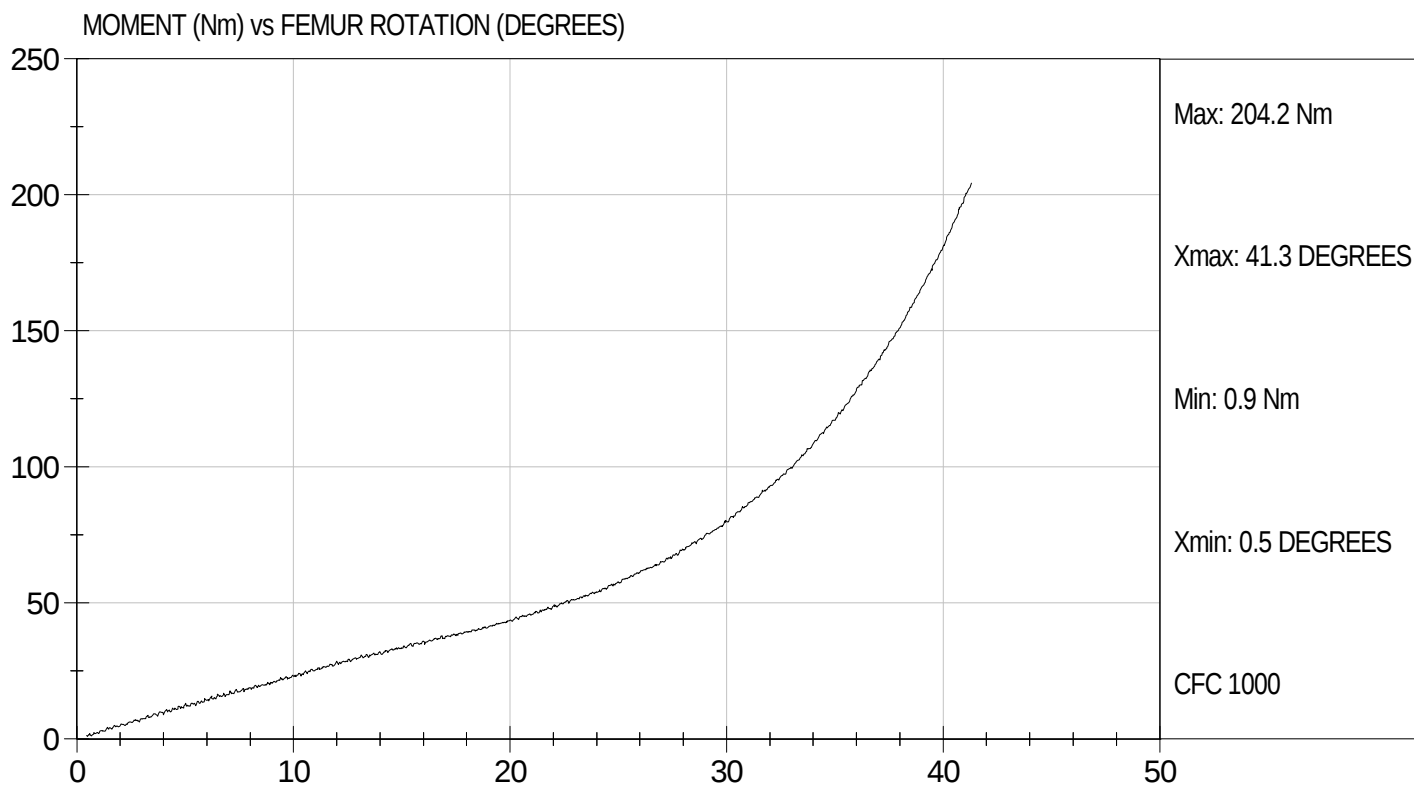
9/8/08
 Test Date


 Approved By



Test Desc: Hip Femur Flexion
Component ID: D082579

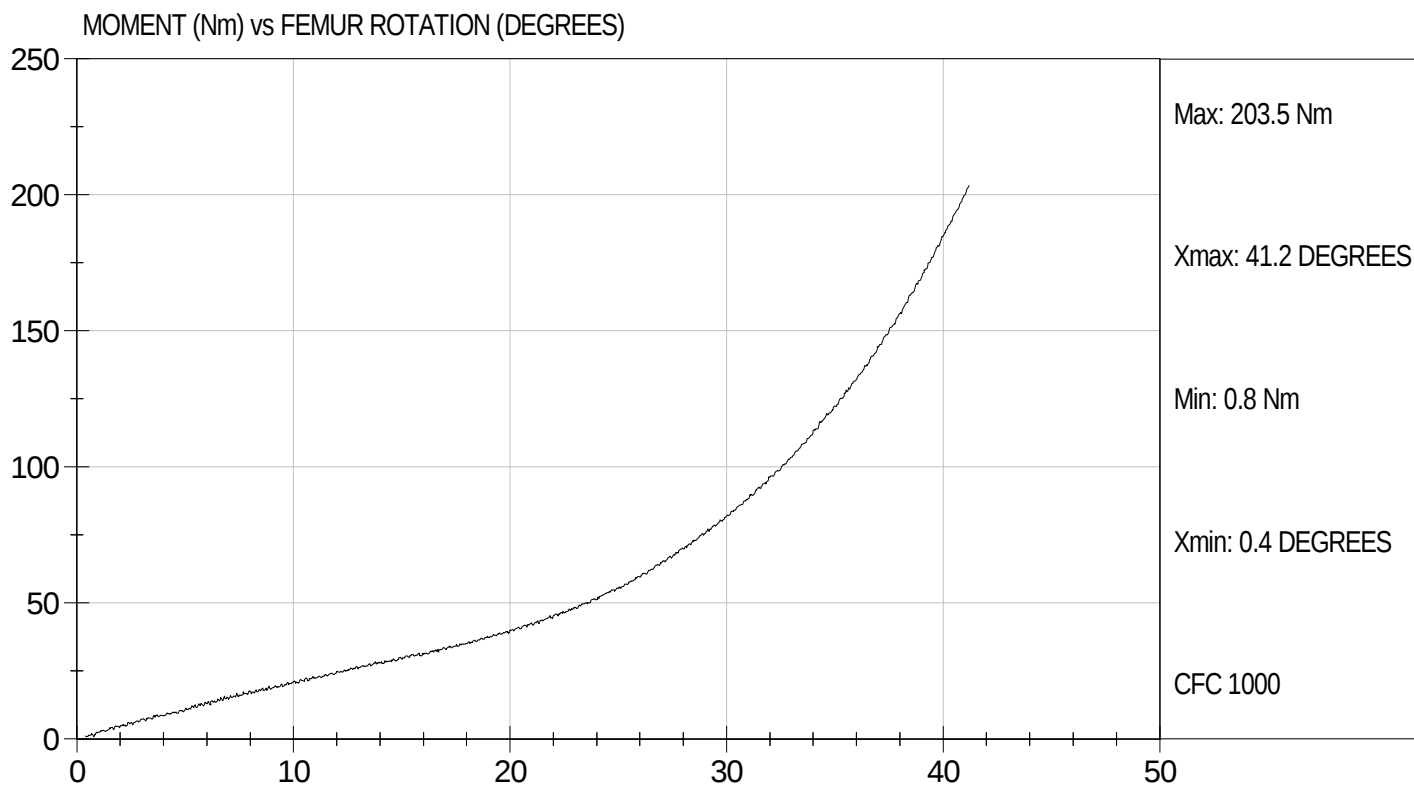
Test Date: 9/8/08
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D082570

Test Date: 9/8/08
Velocity: 0 ft/s, 0.00 m/s



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

ATD Serial No: 065

Test ID: D082561

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	225 - 275	267	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	8.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

9/8/08
Test Date

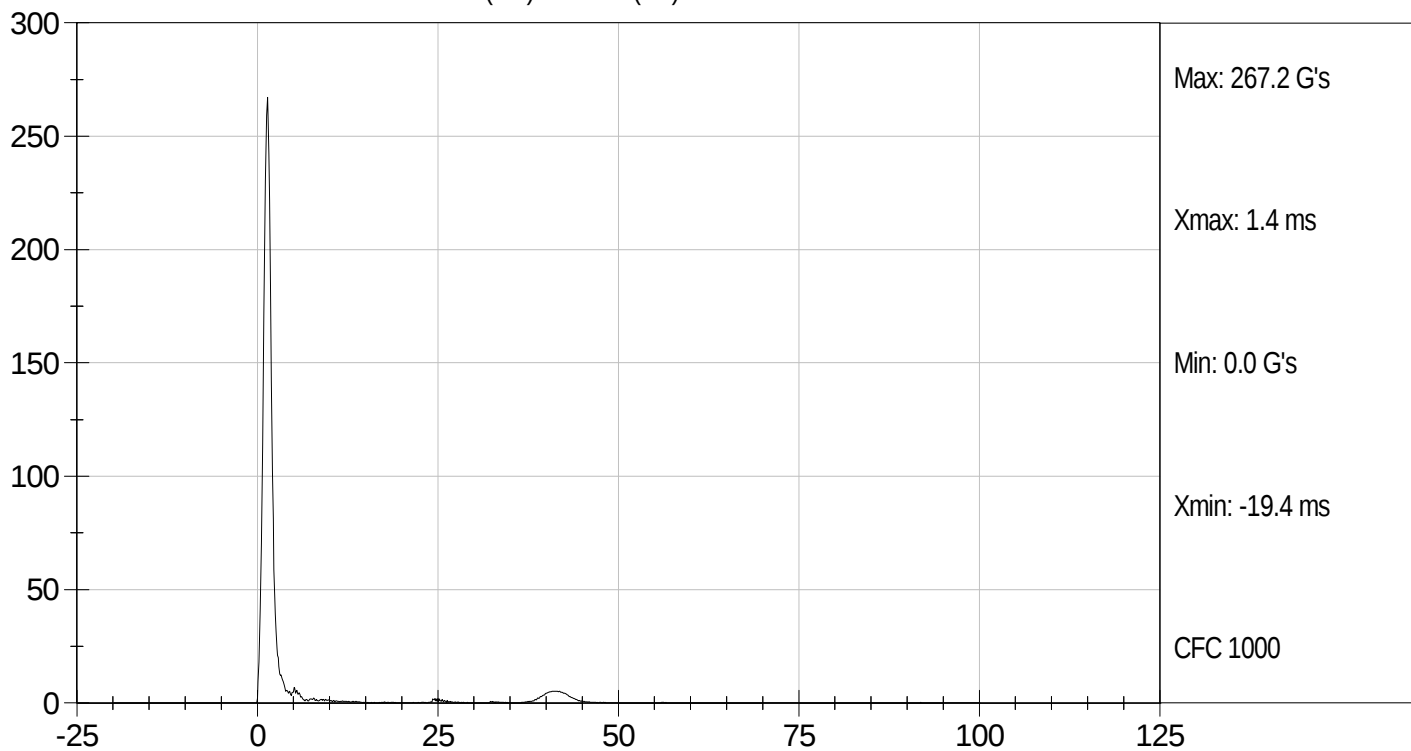

Approved By



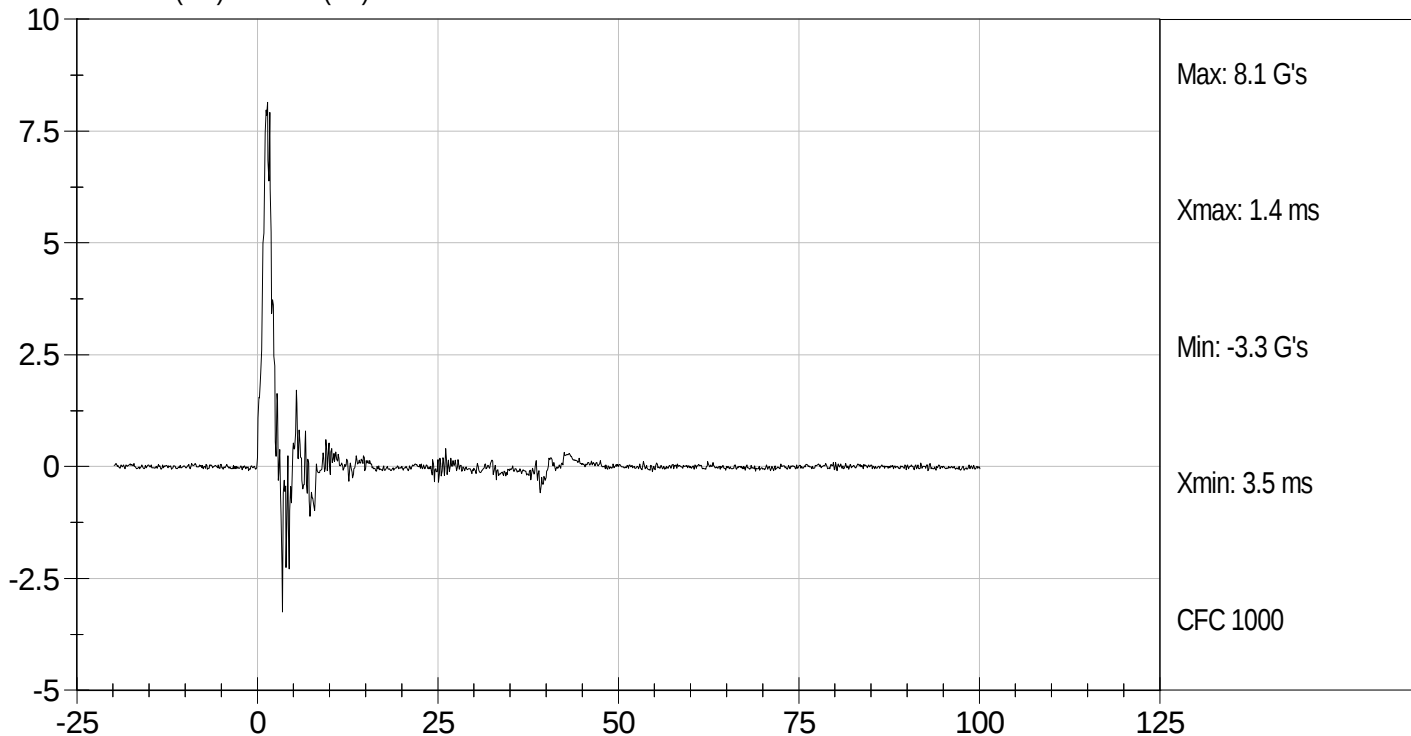
Test Desc: Head Drop
Component ID: D082561

Test Date: 9/8/08
Velocity: 0 ft/s, 0.00 m/s

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



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



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

ATD Serial No: 065

Test I.D: D082562

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	45	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	24.78	Pass
	20 msec	G's	17.60 to 22.60	20.36	Pass
	30 msec	G's	12.50 to 18.50	13.84	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	13.81	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	38.8	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	68.3	Pass
	Time	msec	57.0 to 64.0	58.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	116.1	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	89.8	Pass
	Time	msec	47.0 to 58.0	51.0	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	99.9	Pass
Overall Test Results					Pass


 Laboratory Technician

9/8/08
 Test Date

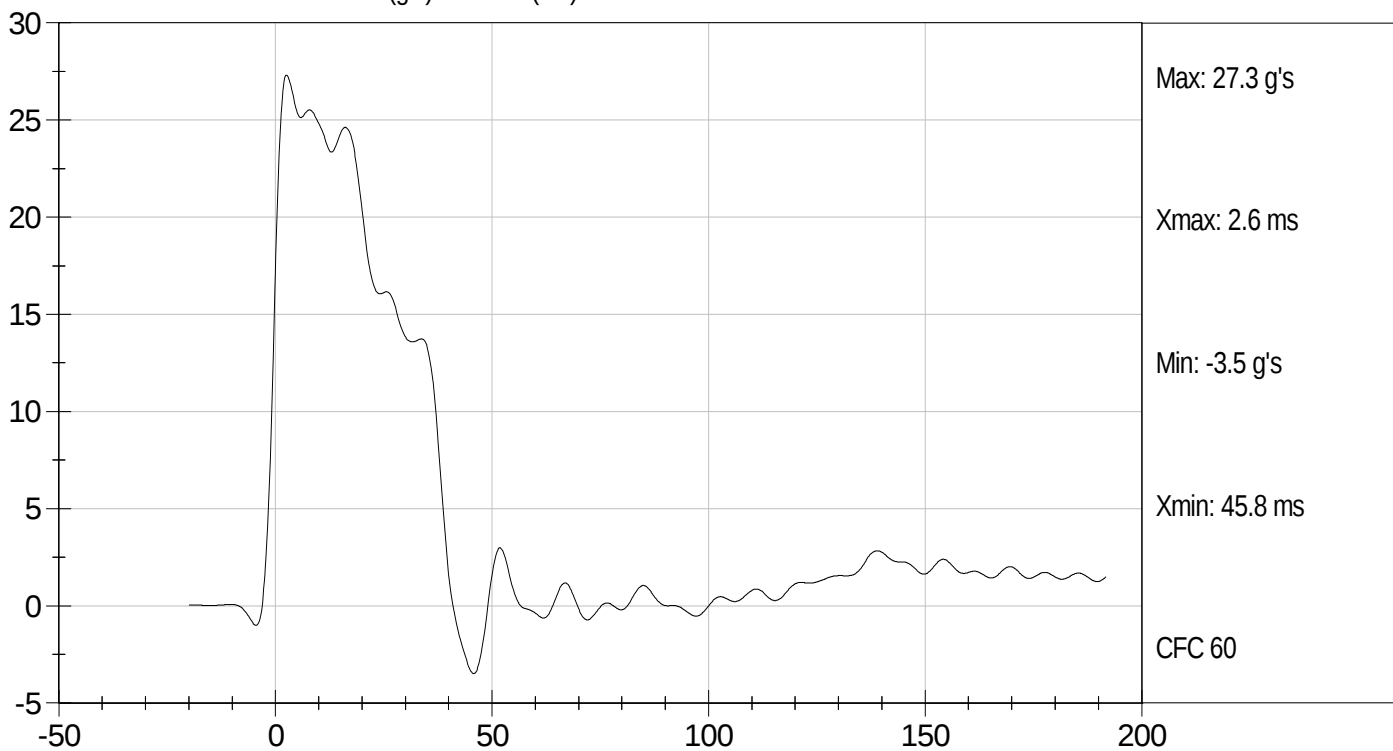

 Approved By



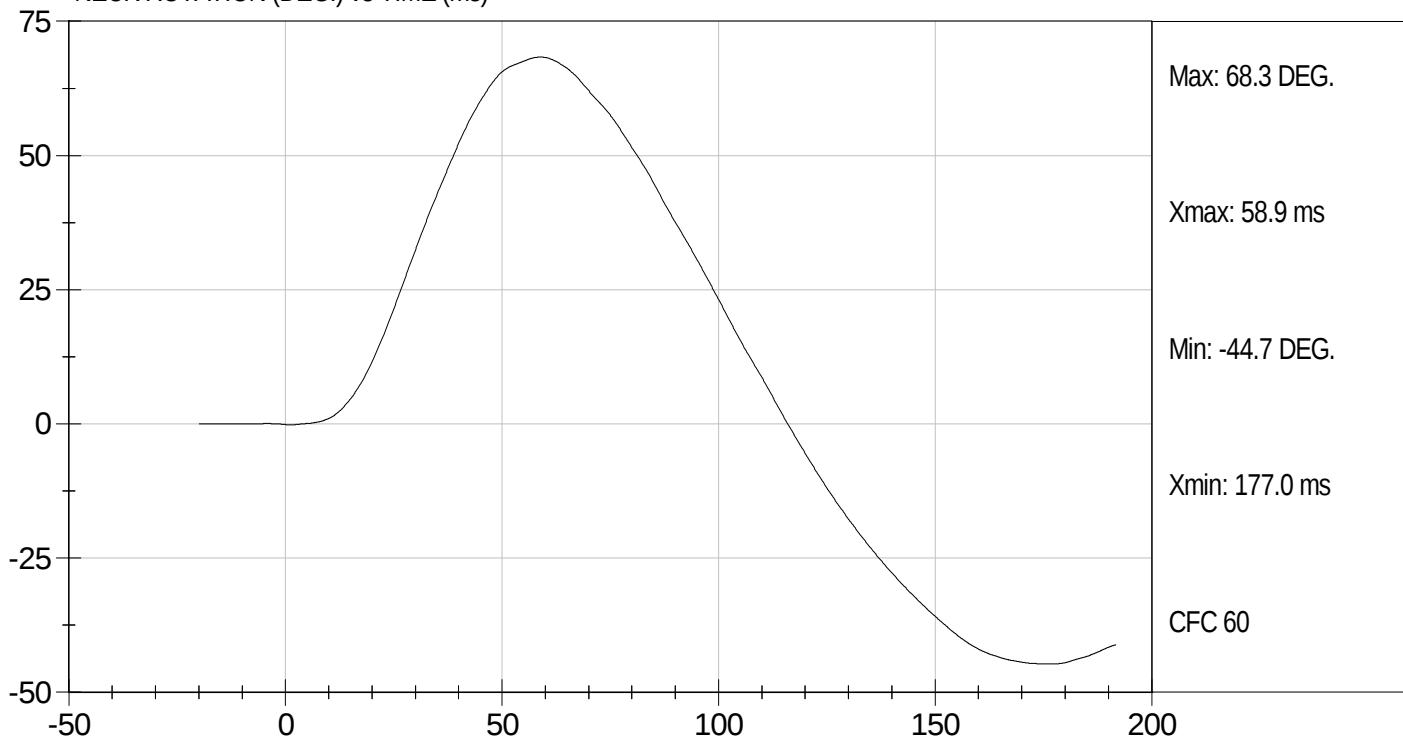
Test Desc: Neck Flexion
Component ID: D082562

Test Date: 9/8/08
Velocity: 23.15 ft/s, 7.06 m/s

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



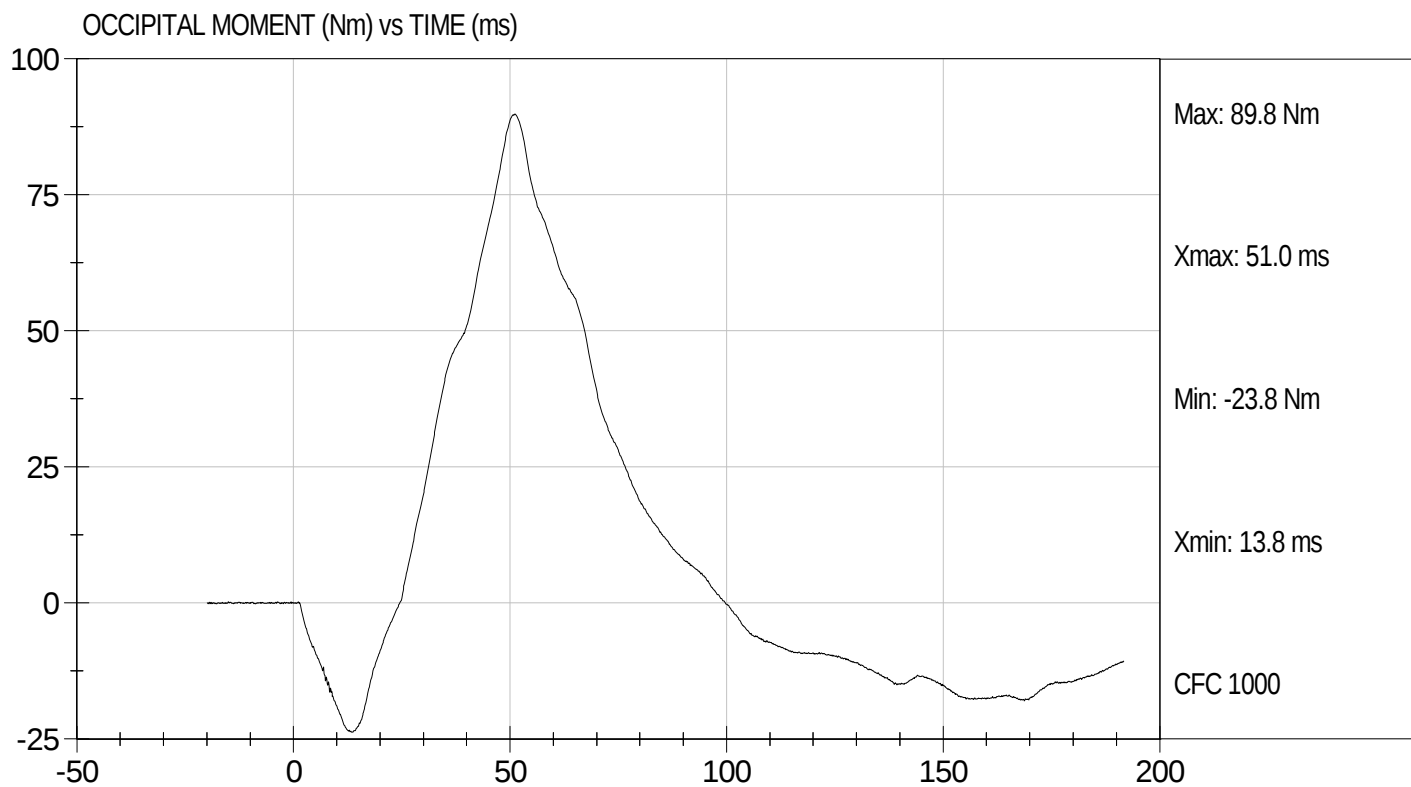
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Flexion
Component ID: D082562

Test Date: 9/8/08
Velocity: 23.15 ft/s, 7.06 m/s



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

ATD Serial No: 065

Test I.D: D082563

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	45	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.16	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	20.82	Pass
	20 msec	G's	14.00 to 19.00	16.14	Pass
	30 msec	G's	11.00 to 16.00	15.09	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	15.04	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	39.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.1	Pass
	Time	msec	72.0 to 82.0	77.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	155.4	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-60.0	Pass
	Time	msec	65.0 to 79.0	68.8	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	137.8	Pass
Overall Test Results					Pass


 Laboratory Technician

9/8/08
 Test Date

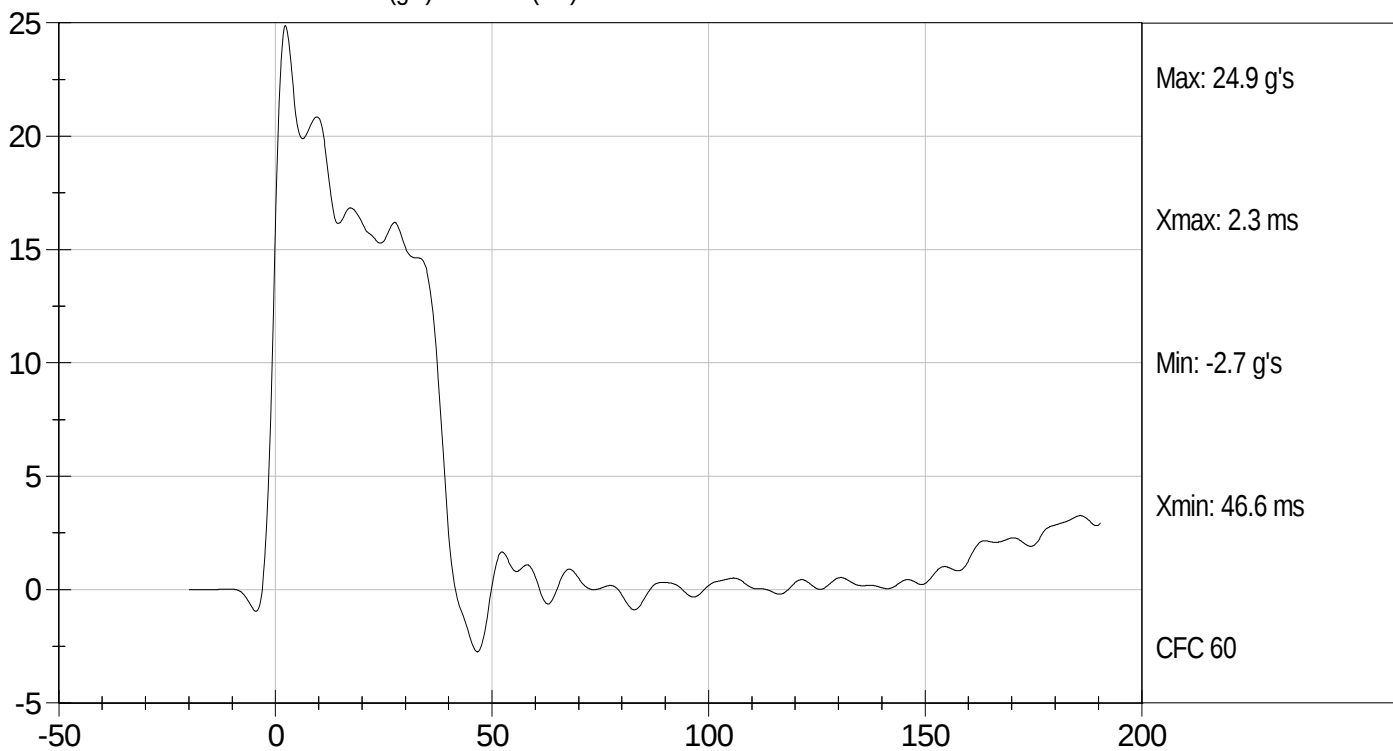

 Approved By



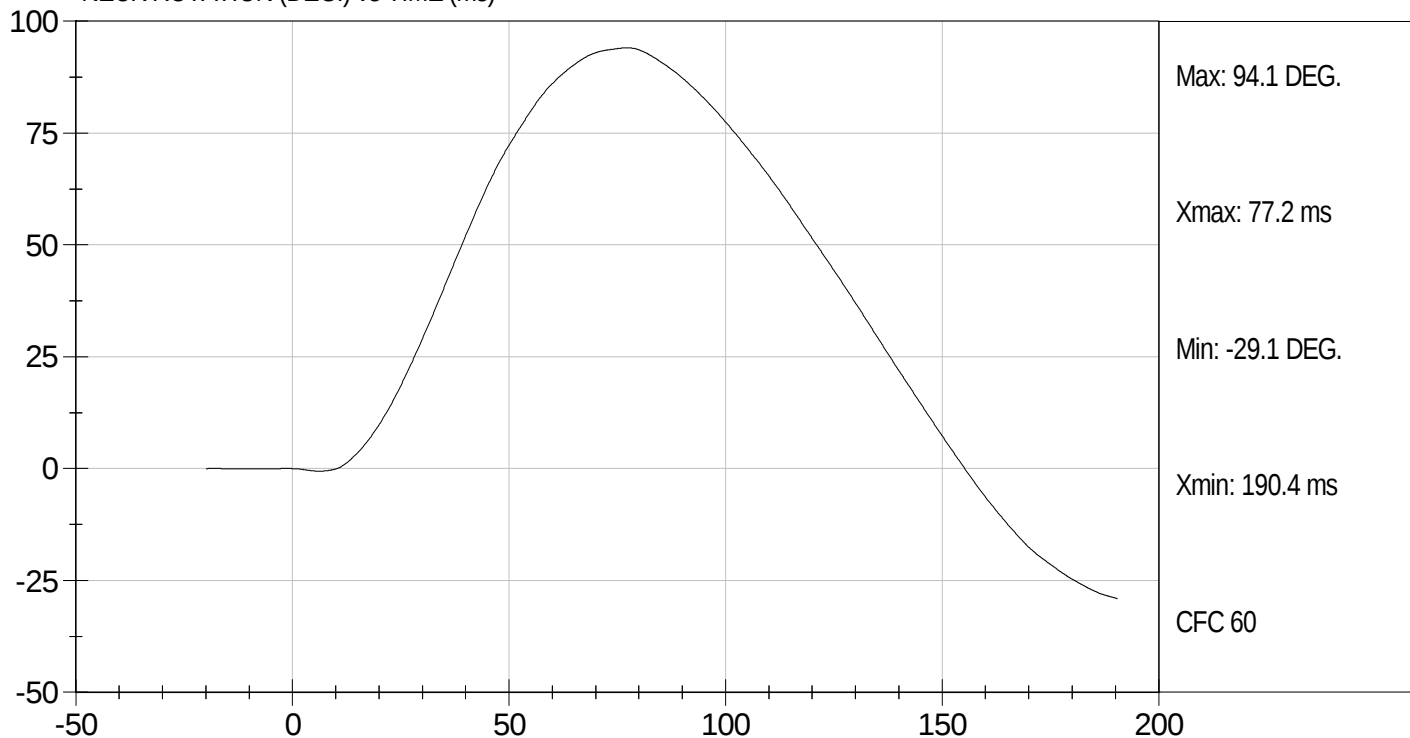
Test Desc: Neck Extension
Component ID: D082563

Test Date: 9/8/08
Velocity: 20.20 ft/s, 6.16 m/s

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



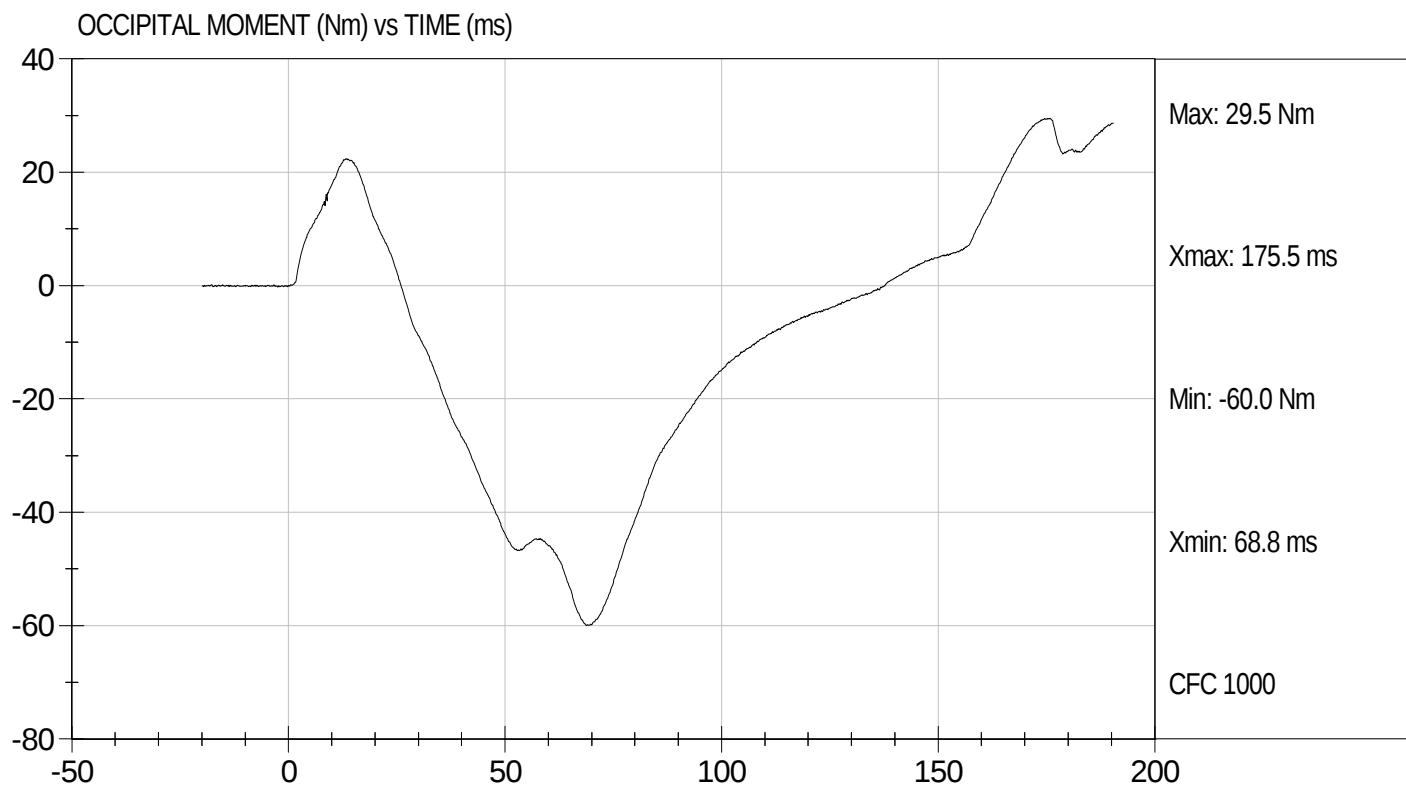
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Extension
Component ID: D082563

Test Date: 9/8/08
Velocity: 20.20 ft/s, 6.16 m/s

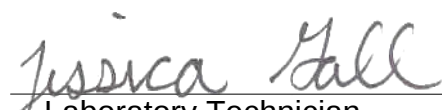


MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D082564

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	44	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,506	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.82	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Overall Test Results				Pass


Laboratory Technician

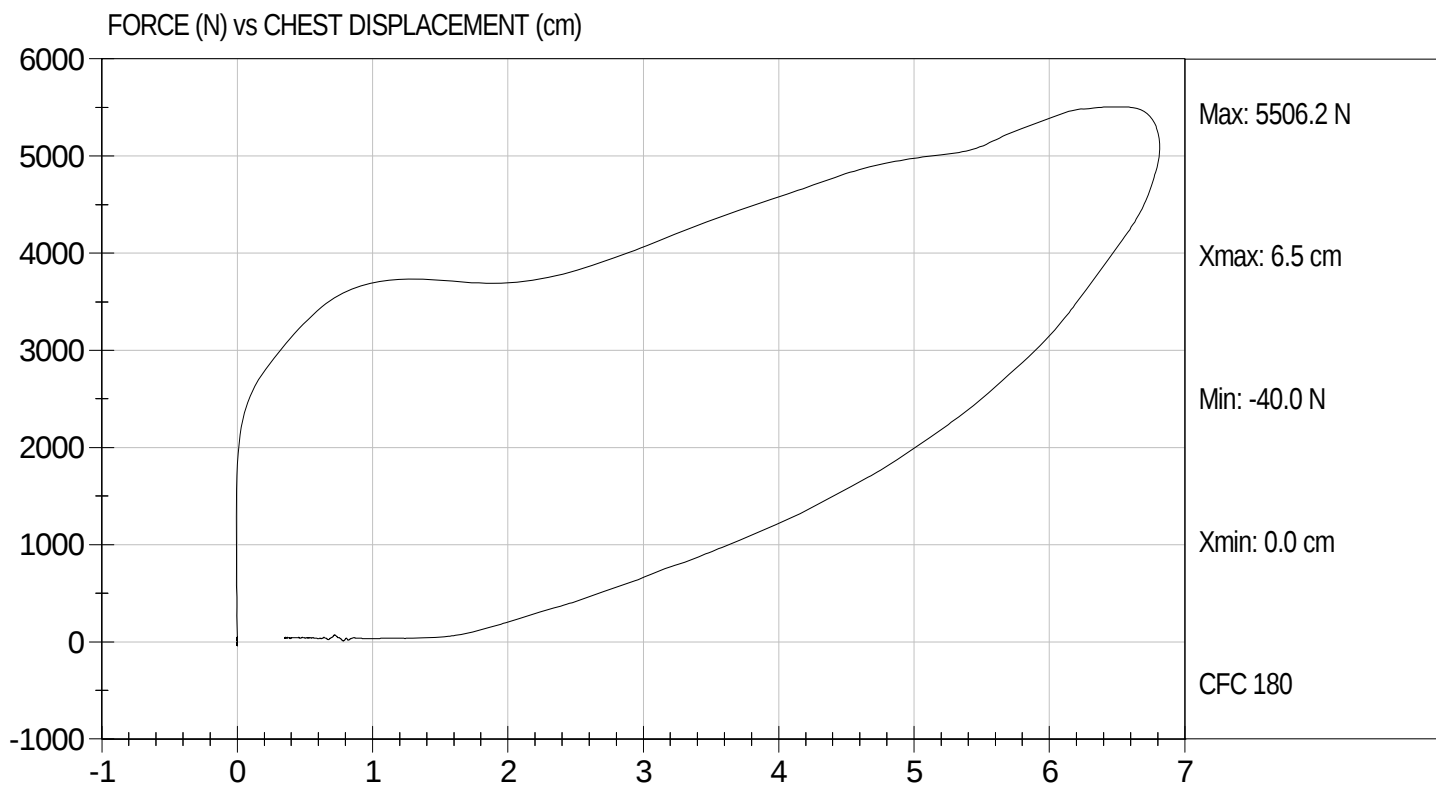
9/8/08
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D082564

Test Date: 9/8/08
Velocity: 22.222 ft/s, 6.77 m/s

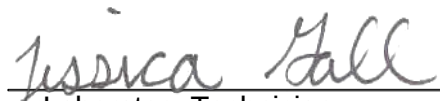


MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D082565

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,069	Pass
Overall Test Results				Pass


Laboratory Technician

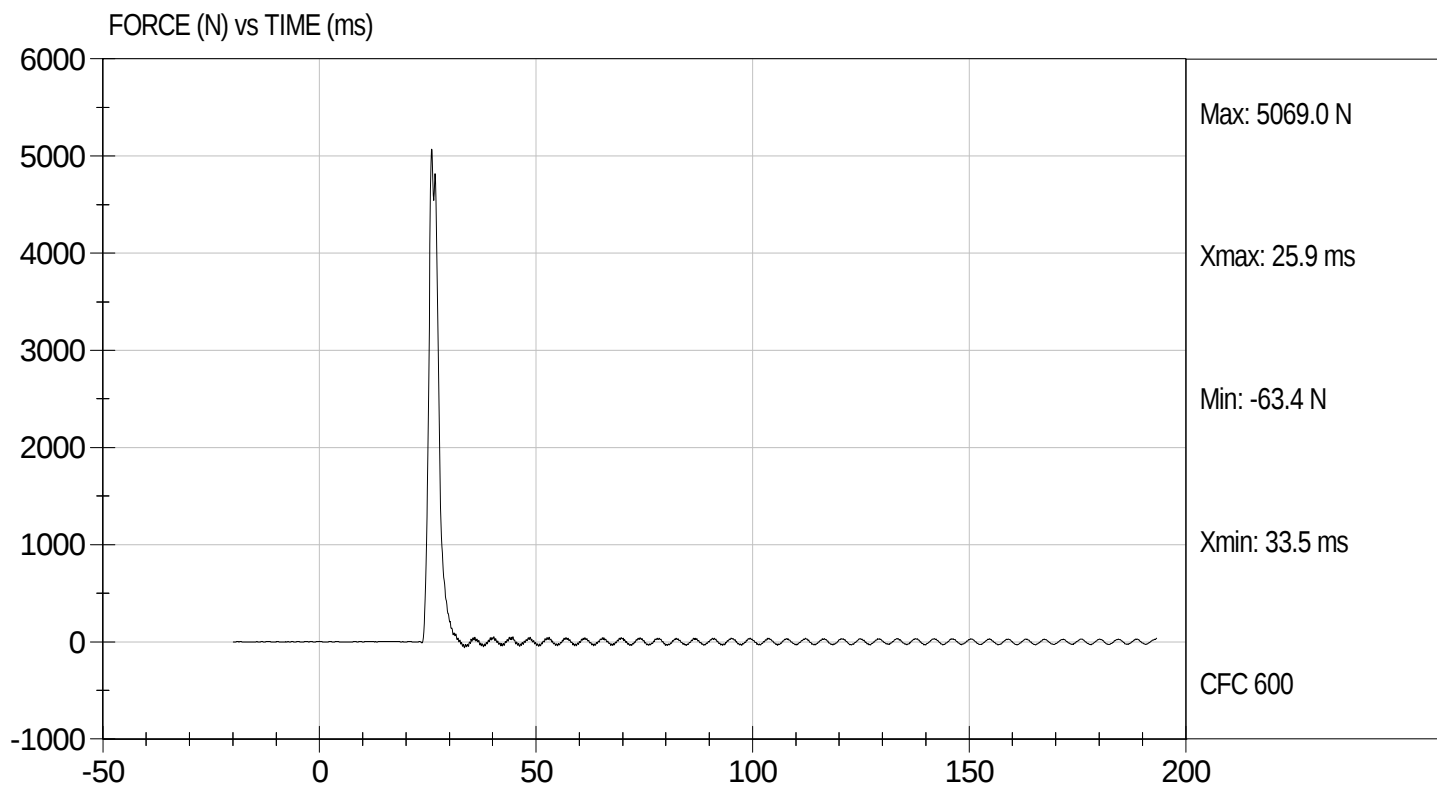
9/8/08
Test Date


Approved By



Test Desc: Right Knee
Component ID: D082565

Test Date: 9/8/08
Velocity: 6.97 ft/s, 2.12 m/s



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

ATD Serial No: 065

Test I.D: D082566

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,123	Pass
			Overall Test Results	Pass


Laboratory Technician

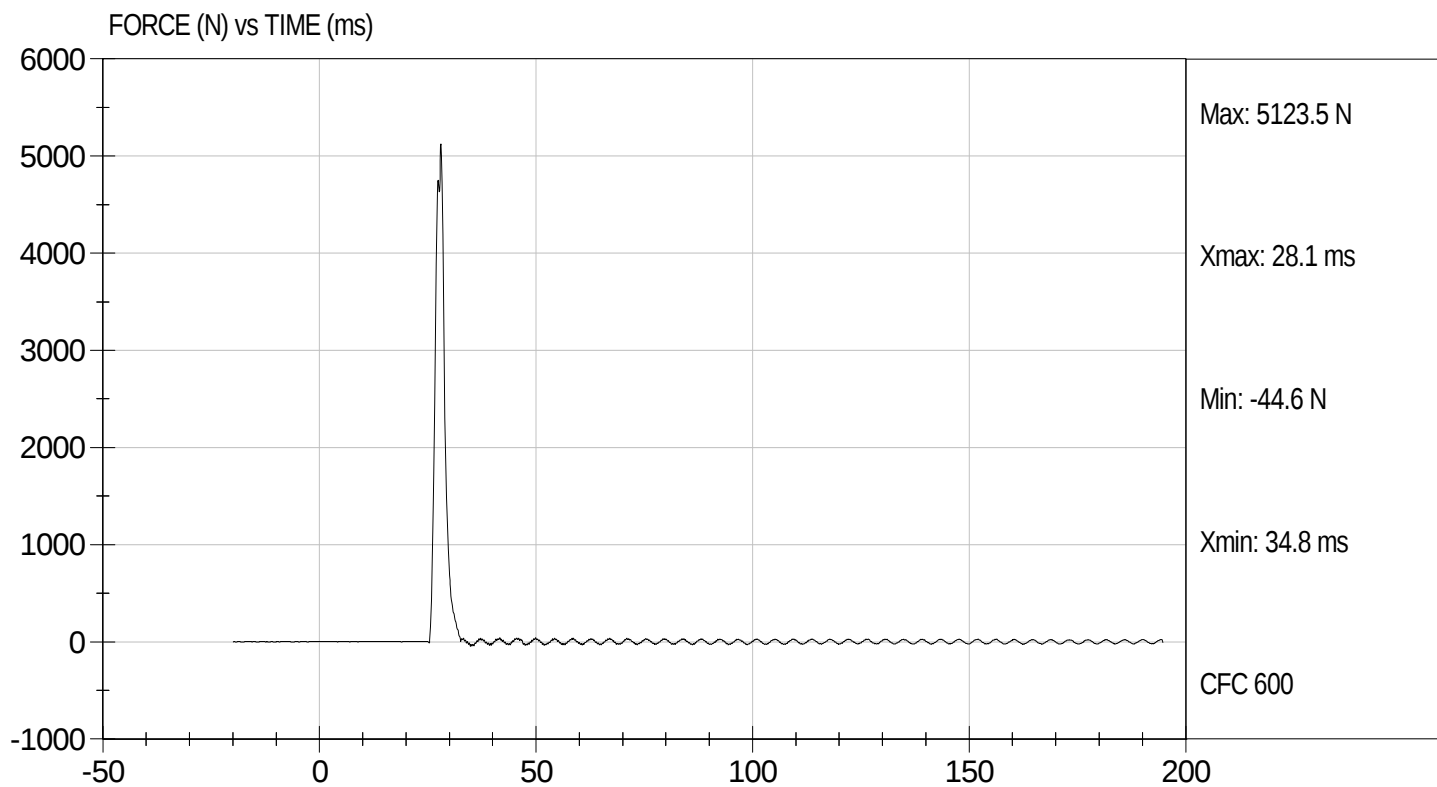
9/8/08
Test Date


Approved By



Test Desc: Left Knee
Component ID: D082566

Test Date: 9/8/08
Velocity: 6.94 ft/s, 2.12 m/s



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

ATD Serial No: 065

Test I.D: D082560

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	43	43	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	67.7	59.4	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	42	42	Pass
Overall Test Results					Pass


 Laboratory Technician

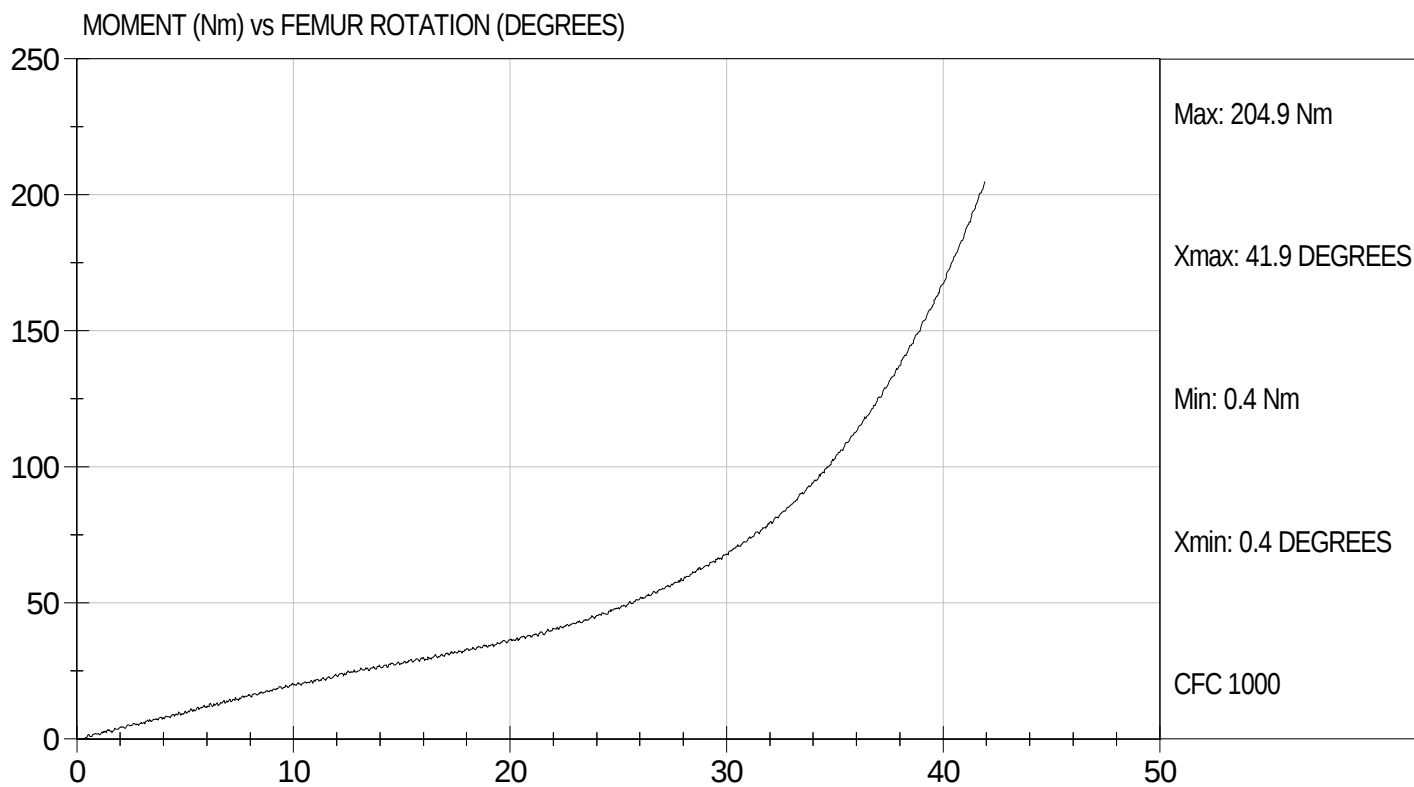
9/8/08
 Test Date


 Approved By



Test Desc: Hip Femur Flexion
Component ID: D082569

Test Date: 9/8/08
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D082560

Test Date: 9/8/08
Velocity: 0 ft/s, 0.00 m/s

