

**VALIDATION  
FRONTAL BARRIER IMPACT TEST**

**FORD MOTOR COMPANY  
2010 FORD FUSION S 4-DR SEDAN  
NHTSA NUMBER: MA0211**

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



**Test Date: June 25, 2009**

**Final Report Date: August 14, 2009**

**FINAL REPORT**

**PREPARED FOR:  
U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
OFFICE OF CRASHWORTHINESS STANDARDS  
MAIL CODE: NVS-111  
1200 NEW JERSEY AVENUE, SE, ROOM W43-410  
WASHINGTON, D.C. 20590**

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Approval Date: August 14, 2009

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

| <b>1. Report No.</b><br>NCAP-MGA-2009-010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>2. Government Accession No.</b>                          | <b>3. Recipient's Catalog No.</b>                                                                                                                                                                      |                  |                         |       |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| <b>4. Title and Subtitle</b><br>Final Report of Validation Testing<br>of a 2010 Ford Fusion S 4-Dr Sedan<br>NHTSA No.: MA0211                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                             | <b>5. Report Date</b><br>August 14, 2009                                                                                                                                                               |                  |                         |       |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| <b>9. Performing Organization Name and Address</b><br>MGA Research Corporation<br>5000 Warren Road<br>Burlington, WI 53105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                             | <b>10. Work Unit No.</b>                                                                                                                                                                               |                  |                         |       |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| <b>12. Sponsoring Agency Name and Address</b><br>U.S. Department of Transportation<br>National Highway Traffic Safety Administration<br>Office of Crashworthiness Standards<br>1200 New Jersey Ave, SE, Room W43-410<br>Washington, D.C. 20590                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                             | <b>13. Type of Report and Period Covered</b><br>Final Test Report<br>6/25/2009 to 8/14/2009                                                                                                            |                  |                         |       |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| <b>15. Supplementary Notes</b><br>Validation Testing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                             |                                                                                                                                                                                                        |                  |                         |       |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| <b>16. Abstract</b><br><p>A 56.3 km/h NCAP Frontal Validation Test was conducted on a 2010 Ford Fusion S 4-Dr Sedan in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on June 25, 2009.</p> <p>The impact velocity was 56.3 km/h and the ambient temperature at the barrier face at the time of impact was 21°C. The target vehicle's maximum post test static crush is 605 mm located at the vehicle's centerline. The occupant injury criteria summary was as follows:</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">Threshold</th> <th rowspan="2">Driver ATD</th> <th rowspan="2">Passenger ATD</th> </tr> <tr> <th>50<sup>th</sup></th> <th>5<sup>th</sup></th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC<sub>15</sub>)</td> <td>N/A</td> <td>700</td> <td>700</td> <td>123</td> <td>279</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>52</td> <td>23</td> <td>17</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>1</td> <td>0.3</td> <td>0.5</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>2620</td> <td>1233</td> <td>1136</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>2520</td> <td>327</td> <td>493</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>1508</td> <td>1808</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>2269</td> <td>1843</td> </tr> </tbody> </table> |                                                             |                                                                                                                                                                                                        |                  | Measurement Description | Units | Threshold  |               | Driver ATD | Passenger ATD | 50 <sup>th</sup> | 5 <sup>th</sup> | Head Injury Criteria (HIC <sub>15</sub> ) | N/A | 700 | 700 | 123 | 279 | Maximum Chest Compression | mm | 63 | 52 | 23 | 17 | Nij | N/A | 1 | 1 | 0.3 | 0.5 | Neck Tension | N | 4170 | 2620 | 1233 | 1136 | Neck Compression | N | 4000 | 2520 | 327 | 493 | Left Femur Force | N | 10008 | 6805 | 1508 | 1808 | Right Femur Force | N | 10008 | 6805 | 2269 | 1843 |
| Measurement Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Units                                                       | Threshold                                                                                                                                                                                              |                  |                         |       | Driver ATD | Passenger ATD |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| Head Injury Criteria (HIC <sub>15</sub> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | N/A                                                         | 700                                                                                                                                                                                                    | 700              | 123                     | 279   |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Maximum Chest Compression                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | mm                                                          | 63                                                                                                                                                                                                     | 52               | 23                      | 17    |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Nij                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | N/A                                                         | 1                                                                                                                                                                                                      | 1                | 0.3                     | 0.5   |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Neck Tension                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | N                                                           | 4170                                                                                                                                                                                                   | 2620             | 1233                    | 1136  |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Neck Compression                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N                                                           | 4000                                                                                                                                                                                                   | 2520             | 327                     | 493   |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Left Femur Force                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N                                                           | 10008                                                                                                                                                                                                  | 6805             | 1508                    | 1808  |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Right Femur Force                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | N                                                           | 10008                                                                                                                                                                                                  | 6805             | 2269                    | 1843  |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| <b>17. Key Words</b><br><br>35 mph Front Barrier Impact Test<br>Validation Testing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                             | <b>18. Distribution Statement</b><br>Copies of this report are available from:<br>National Highway Traffic Safety Adm.<br>Technical Ref. Division<br>1200 New Jersey Ave, SE<br>Washington, D.C. 20590 |                  |                         |       |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| <b>19. Security Classif. (of this report)</b><br>Unclassified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>20. Security Classif. (of this page)</b><br>Unclassified | <b>21. No. of Pages</b><br>125                                                                                                                                                                         | <b>22. Price</b> |                         |       |            |               |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |     |     |              |   |      |      |      |      |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |

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## **SECTION 1**

### **PURPOSE AND SUMMARY OF TEST**

#### **PURPOSE**

This 56.3 km/h frontal barrier impact test is part of the NCAP Frontal Validation Test 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 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 was impacted by a 2010 Ford Fusion S 4-Dr Sedan at a velocity of 56.3 kph. The test was performed at MGA Research Corporation on June 25, 2009. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera 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, 50<sup>th</sup> percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5<sup>th</sup> 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 on the driver and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. The driver (position 1) ATD (Serial No. 1045) 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 102 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest displacement, neck, 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 605 mm and both the driver and passenger side doors remained closed 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. The passenger's knees contacted the glovebox.

The occupant data is summarized below:

| ATD position                 | HIC <sub>15</sub> | T <sup>1</sup> | T <sup>2</sup> | Chest<br>Disp.<br>(mm) | Nij | Neck<br>Tension<br>(N) | Neck<br>Comp.<br>(N) | Left<br>Femur<br>(N) | Right<br>Femur<br>(N) |
|------------------------------|-------------------|----------------|----------------|------------------------|-----|------------------------|----------------------|----------------------|-----------------------|
| Driver (50 <sup>th</sup> )   | 123               | 63.2           | 78.2           | 23                     | 0.3 | 1233                   | 327                  | 1508                 | 2269                  |
| Passenger (5 <sup>th</sup> ) | 279               | 80.9           | 95.9           | 17                     | 0.5 | 1136                   | 493                  | 1808                 | 1843                  |

The test data can be found on the NHTSA website at [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov).

#### TEST NOTES

There was no valid data collected for:

Passenger Right Upper Tibia Moment Y after 180 msec.

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: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

**TEST VEHICLE INFORMATION AND OPTIONS**

|                                                                            |                      |                                  |     |
|----------------------------------------------------------------------------|----------------------|----------------------------------|-----|
| NHTSA No.                                                                  | MA0211               | Anti-Lock Brakes                 | Yes |
| Model Year                                                                 | 2010                 | All Wheel Drive                  | No  |
| Make                                                                       | Ford                 | Power Steering                   | Yes |
| Model                                                                      | Fusion               | Driver Front Airbag              | Yes |
| Body Style                                                                 | Sedan                | Driver Side Airbag               | Yes |
| VIN                                                                        | 3FAHP0GA6AR117490    | Driver Head Airbag               | No  |
| Body Color                                                                 | Sangria Red Metallic | Driver Curtain Airbag            | Yes |
| Delivery Date                                                              | 6/1/09               | Driver Knee Airbag               | No  |
| Odometer (km/mi)                                                           | 90 / 56              | Pass. Front Airbag               | Yes |
| Dealer                                                                     | Country Ford         | Pass. Side Airbag                | Yes |
| Transmission                                                               | Manual               | Pass. Head Airbag                | No  |
| Final Drive                                                                | Front                | Pass. Curtain Airbag             | Yes |
| Type/No. Cyl                                                               | I4                   | Pass. Knee Airbag                | No  |
| Engine Displacement (L)                                                    | 2.5                  | Pretensioners                    | Yes |
| Engine Placement                                                           | Lateral              | Load Limiters                    | Yes |
| Roof Rack                                                                  | No                   | Air Conditioning                 | Yes |
| Sunroof/T-Top                                                              | No                   | AM/FM CD                         | Yes |
| Tinted Glass                                                               | No                   | Tilt & Telescopic Steering Wheel | Yes |
| Traction Control                                                           | AdvanceTrac ESC      | Automatic Door Locks             | Yes |
| Power Brakes                                                               | Yes                  | Power Windows                    | Yes |
| Front Disc                                                                 | Yes                  | Power Seats                      | No  |
| Rear Disc                                                                  | Yes                  |                                  |     |
| Does owner's manual provide instructions to turn off automatic door locks? | Yes                  |                                  |     |

**DATA FROM MANUFACTURER'S CERTIFICATION LABEL**

|                     |                    |                 |      |
|---------------------|--------------------|-----------------|------|
| Manufactured By     | Ford Motor Company | GVWR (kg)       | 1965 |
| Date of Manufacture | 03/09              | GAWR Front (kg) | 1034 |
|                     |                    | GAWR Rear (kg)  | 931  |

**VEHICLE SEATING AND WEIGHT CAPACITY**

| Measured Parameter                | Front  | Rear   | Third | Total |
|-----------------------------------|--------|--------|-------|-------|
| Type of Seats                     | Bucket | Bucket |       |       |
| Designated Seating Capacity (DSC) | 2      | 3      |       | 5     |
| Capacity Wt. (VCW) (kg)           |        |        |       | 385   |
| Cargo Wt. (RCLW) (kg)             |        |        |       | 45    |

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

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

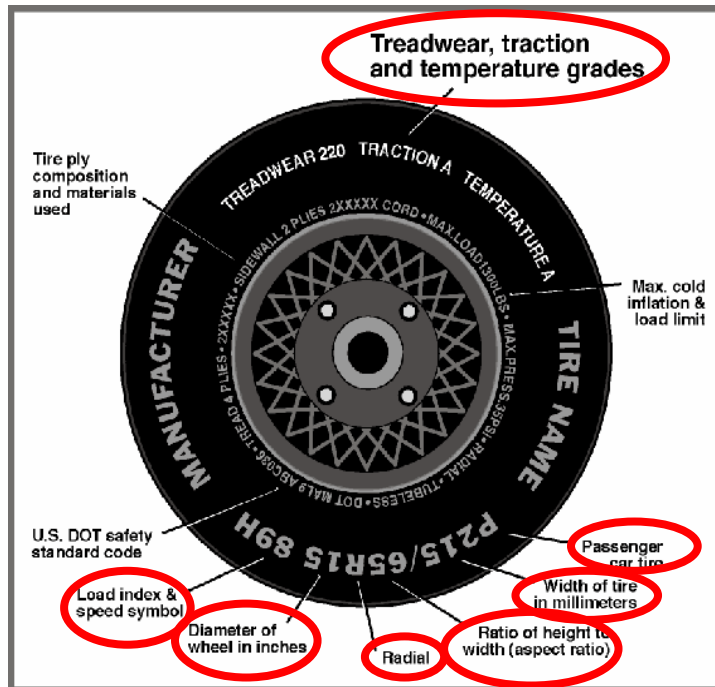
**VEHICLE SEAT TYPE**

| Seating Location | Type of Seat Pan |       |             |           | Type of Seat Back |            |         |
|------------------|------------------|-------|-------------|-----------|-------------------|------------|---------|
|                  | Bucket           | Bench | Split Bench | Contoured | Fixed             | Adjustable |         |
|                  |                  |       |             |           |                   | w/ Lever   | w/ Knob |
| Front Seat       | X                |       |             |           |                   | X          |         |
| Rear or Second   | X                |       |             |           | X                 |            |         |
| Third Row Seat   |                  |       |             |           |                   |            |         |

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

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009



| Measured Parameter          | Front          | Rear           |
|-----------------------------|----------------|----------------|
| Maximum Tire Pressure (kPa) | 300            | 300            |
| Cold Pressure (kPa)         | 235            | 235            |
| Recommended Tire Size       | P205/60R16     | P205/60R16     |
| Tire Size on Vehicle        | P205/60R16     | P205/60R16     |
| Tire Manufacturer           | Michelin       | Michelin       |
| Tire Model                  | Energy MXV4    | Energy MXV4    |
| Treadwear                   | 440            | 440            |
| Traction                    | A              | A              |
| Temperature Grades          | A              | A              |
| Tire Plies Sidewall         | 1              | 1              |
| Tire Plies Body             | 4              | 4              |
| Load Index & Speed Symbol   | 91V            | 91V            |
| Tire Material               | Rubber         | Rubber         |
| DOT Safety Code Right       | B97R FTWX 4908 | B97R FTWX 4908 |
| DOT Safety Code Left        | B97R FTWX 4908 | B97R FTWX 4908 |

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

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

**TEST VEHICLE WEIGHTS**

|        | Units | As Delivered (UVW) (Axle) |       |        | As Tested (ATW) (Axle) |       |        |
|--------|-------|---------------------------|-------|--------|------------------------|-------|--------|
|        |       | Front                     | Rear  | Total  | Front                  | Rear  | Total  |
| Left   | kg    | 426.8                     | 307.1 |        | 456.8                  | 370.6 |        |
| Right  | kg    | 448.6                     | 289.4 |        | 468.5                  | 355.2 |        |
| Ratio  | %     | 59.5                      | 40.5  |        | 56.0                   | 44.0  |        |
| Totals | kg    | 875.4                     | 596.5 | 1471.9 | 925.3                  | 725.8 | 1651.1 |

**TARGET TEST WEIGHT CALCULATION**

| Measured Parameter                      | Units | Value  |
|-----------------------------------------|-------|--------|
| Total Delivered Weight (UVW)            | kg    | 1471.9 |
| Weight of 1 P572E ATD & 1 P572O ATD     | kg    | 140.6  |
| Rated Cargo/Luggage Weight (RCLW)       | kg    | 45     |
| Calculated Vehicle Target Weight (TVTW) | kg    | 1657.5 |

**TEST VEHICLE ATTITUDES AND CG**

|              | Units | LF  | RF  | LR  | RR  | CG (aft of front axle) |
|--------------|-------|-----|-----|-----|-----|------------------------|
| As Delivered | mm    | 714 | 713 | 713 | 713 | 1106                   |
| As Tested    | mm    | 702 | 704 | 686 | 687 | 1200                   |
| Post Test    | mm    | 766 | 756 | 699 | 664 |                        |

**GENERAL TEST VEHICLE DATA**

| Measurement Description                 | Units | Value |
|-----------------------------------------|-------|-------|
| Total Vehicle Wheel Base                | mm    | 2730  |
| Total Vehicle Length at Left Side       | mm    | 4106  |
| Total Vehicle Length at Centerline      | mm    | 4805  |
| Total Vehicle Length at Right Side      | mm    | 4106  |
| Weight of Ballast                       | kg    | 12.9  |
| Weight of Vehicle Components Removed    | kg    | 22.7  |
| Amount of Stoddard Solvent in Fuel Tank | L     | 60.9  |

Vehicle components removed to meet Test Weight: Spare tire, trunk carpet, right rear taillight, tools, jacks, license plate holder, spare tire.

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

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

**TARGET VEHICLE STRUCTURAL MEASUREMENT**

|    | Elements                              | Pre-Test (mm) |
|----|---------------------------------------|---------------|
| 1  | Total Length                          | 4805          |
| 2  | Total Width                           | 1818          |
| 3  | Bumper Top Height                     | 530           |
| 4  | Bumper Bottom Height                  | 437           |
| 5  | Longitudinal Member Top Height        | 555           |
| 6  | Distance between Longitudinal Members | 928           |
| 7  | Longitudinal Member Width             | 84            |
| 8  | Engine Top Height                     | 842           |
| 9  | Engine Bottom Height                  | 195           |
| 10 | Engine and Gearbox Width              | 903           |
| 11 | Front Bumper-Engine Distance          | 515           |
| 12 | Front Shock Absorber Fixing Height    | 893           |
| 13 | Bonnet Leading Edge Height            | 755           |
| 14 | Front Shock Absorber Fixing Width     | 1004          |
| 15 | Front Bumper – Front Axle Distance    | 1005          |
| 16 | Front Axle – A-Pillar Distance        | 451           |
| 17 | A-Pillar – B-Pillar Distance          | 1108          |
| 18 | B-Pillar – Rear Axle Distance         | 1178          |
| 19 | B-Pillar – C-Pillar Distance          | 776           |
| 20 | Roof Sill Bottom Height               | 1230          |
| 21 | Roof Sill Top Height                  | 1401          |
| 22 | Floor Sill bottom Height              | 166           |
| 23 | Floor Sill Top Height                 | 331           |

## DATA SHEET NO. 2

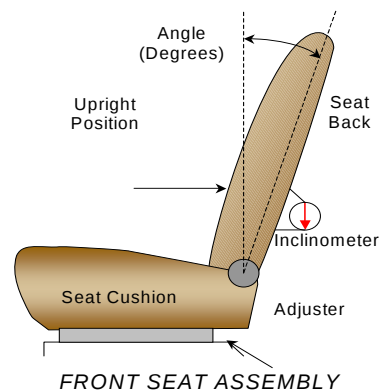
### SEAT ADJUSTMENT, SEAT BELTS, FUEL SYSTEMS, AND STEERING WHEEL DATA

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

#### NOMINAL DESIGN RIDING POSITION

The driver seat back is positioned as close as possible to the manufacturer's designated angle. For the passenger seat, seat was adjusted until the dummy's transverse instrumentation platform is level to within  $\pm 0.5$  degrees.



#### SEAT BACK ANGLES

|                           | Degrees                |
|---------------------------|------------------------|
| Driver Seat Back Angle    | 10.3° on headrest post |
| Passenger Seat Back Angle | 10.8° on headrest post |

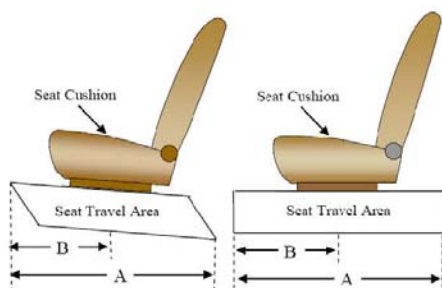
#### SEAT FORE/AFT POSITIONS

|                | Total Fore/Aft Travel | Placed in Position # |
|----------------|-----------------------|----------------------|
| Driver Seat    | 265 mm                | 133 mm               |
| Passenger Seat | 240 mm                | 120 mm               |

#### SEAT BELT UPPER ANCHORAGES

|                | Total # of Positions | Placed in Position # |
|----------------|----------------------|----------------------|
| Driver Seat    | 4 detents            | 0 (uppermost as 0)   |
| Passenger Seat | 4 detents            | 0 (uppermost as 0)   |

Describe method: Both seat belt upper anchorages were set in the uppermost position.



## DATA SHEET NO. 2 (CONTINUED)

### SEAT ADJUSTMENT, SEAT BELTS, FUEL SYSTEMS, AND STEERING WHEEL DATA

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

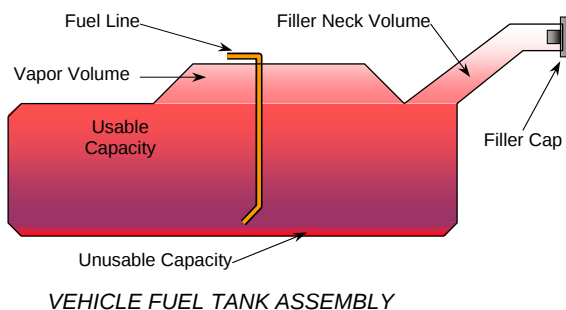
NHTSA No.: MA0211  
 Test Date: 6/25/2009

#### FUEL TANK CAPACITY

|                                    | Liters       |
|------------------------------------|--------------|
| Usable Capacity of "Standard Tank" | 66.2         |
| Usable Capacity of "Optional" Tank |              |
| 92-94% of Usable Capacity          | 60.9 to 62.2 |
| Actual Amount of Solvent used      | 60.9         |
| 1/3 of Usable Capacity             | 22.1         |

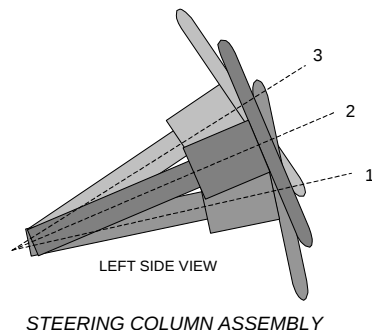
Describe the fuel pump type, its behavior, and the location of the fuel filler pipe.

The vehicle is equipped with an electric fuel pump. The electric fuel pump operates for 2 seconds to pressurize the fuel system following the actuation of the ignition. If no attempt has been made to start the engine within 2 seconds following ignition actuation the fuel pump will shut off. The fuel pump operates continuously while the engine is running. If the engine stalls the fuel pump is deactivated. Also, a fuel pump shut-off switch is provided, designed to stop fuel flow to the engine if the vehicle sustains an impact above a certain magnitude. The fuel filler pipe is located on the left side.



#### 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 POSITION

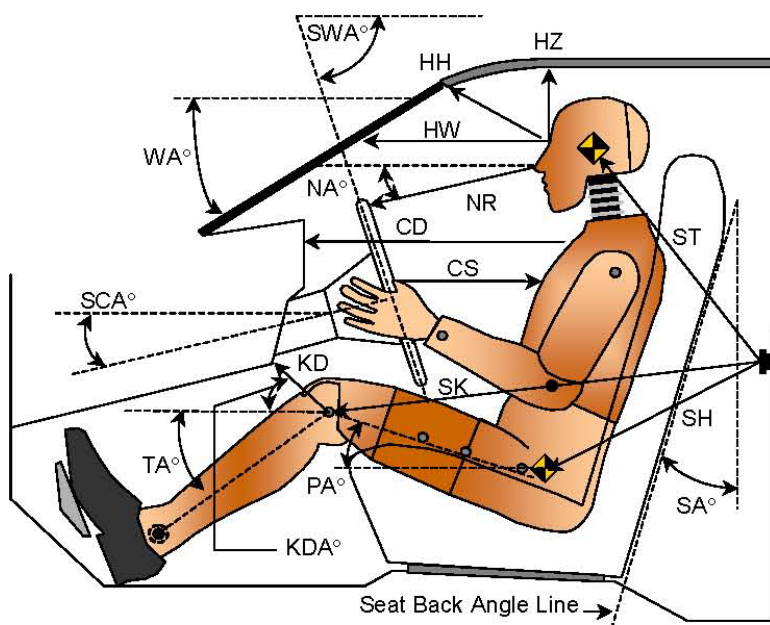
|                                   | Degrees | Fore/Aft Position (mm) |
|-----------------------------------|---------|------------------------|
| Lowermost - Position 1            | 65.0    | 0                      |
| Geometric Center – Position 2     | 67.5    | 15                     |
| Uppermost – Position 3            | 70.0    | 30                     |
| Telescoping Steering Wheel Travel |         | 30                     |
| Test Position                     | 67.5    | 15                     |

### DATA SHEET NO. 3

#### DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

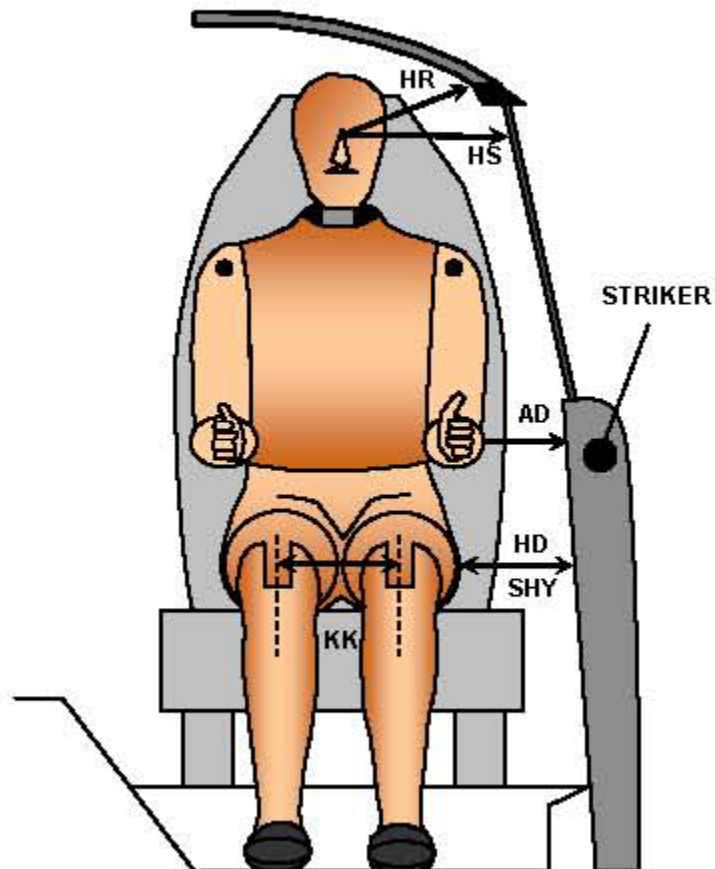


| Code | Measurement Description         | Driver      |           | Passenger   |           |
|------|---------------------------------|-------------|-----------|-------------|-----------|
|      |                                 | Length (mm) | Angle (°) | Length (mm) | Angle (°) |
| WA   | Windshield Angle                |             | 23.1      |             |           |
| SWA  | Steering Wheel Angle            |             | 67.5      |             |           |
| SCA  | Steering Column Angle           |             | 22.5      |             |           |
| SA   | Seat Back Angle (headrest post) |             | 10.3      |             | 10.8      |
| HZ   | Head to Roof (Z)                | 176         | 90        | 194         | 90        |
| HH   | Head to Header                  | 281         | 29.0      | 248         | 49.7      |
| HW   | Head to Windshield              | 600         | 0         | 605         | 0         |
| NR   | Nose to Rim                     | 361         | 5.4       |             |           |
| CD   | Chest to Dash                   | 520         |           | 408         |           |
| CS   | Chest to Steering Hub           | 292         | 1.3       |             |           |
| RA   | Rim to Abdomen                  | 170         | 0         |             |           |
| KDL  | Left Knee to Dash               | 159         | 11.2      | 98          | 36.6      |
| KDR  | Right Knee to Dash              | 134         | 15.9      | 114         | 37.5      |
| PA   | Pelvic Angle                    |             | 24.4      |             | 20.1      |
| TA   | Tibia Angle                     |             | 42.8      |             | 57.6      |
| SK   | Striker to Knee                 | 553         | 90.2      | 620         | 94.9      |
| ST   | Striker to Head                 | 520         | 11.8      | 508         | 24.1      |
| SH   | Striker to H-Point              | 250         | 129.7     | 310         | 110.0     |

**DATA SHEET NO. 4**  
**DUMMY LATERAL CLEARANCE DIMENSIONS**

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009



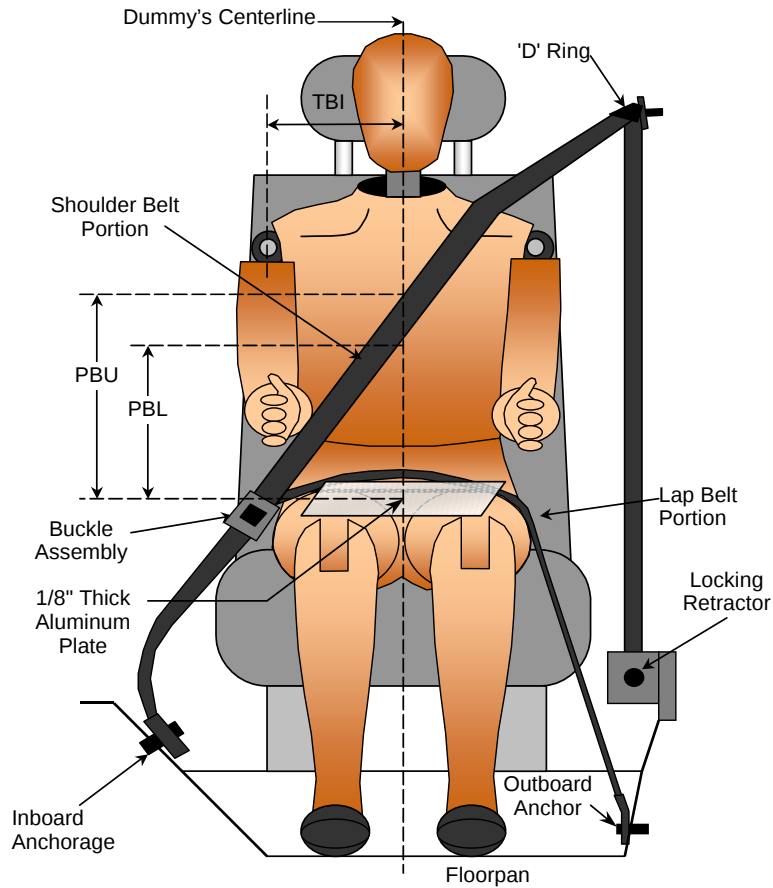
| Code | Measurement Description          | Driver | Passenger |
|------|----------------------------------|--------|-----------|
| AD   | Arm to Door                      | 120    | 188       |
| HD   | H-Point to Door                  | 141    | 175       |
| HR   | Head to Side Header              | 209    | 234       |
| HS   | Head to Side Window              | 322    | 360       |
| KK   | Knee to Knee                     | 309    | 215       |
| SHY  | Striker to H-Point (Y Direction) | 277    | 335       |
| AA   | Ankle to Ankle                   | 361    | 205       |

## DATA SHEET NO. 5

### SEAT BELT POSITIONING DATA

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009



### SEAT BELT POSITIONING MEASUREMENTS

| Measurement Description                           | Units | Driver | Passenger |
|---------------------------------------------------|-------|--------|-----------|
| PBU - Top surface of reference to belt upper edge | mm    | 345    | 320       |
| PBL - To surface of reference to belt lower edge  | mm    | 270    | 235       |

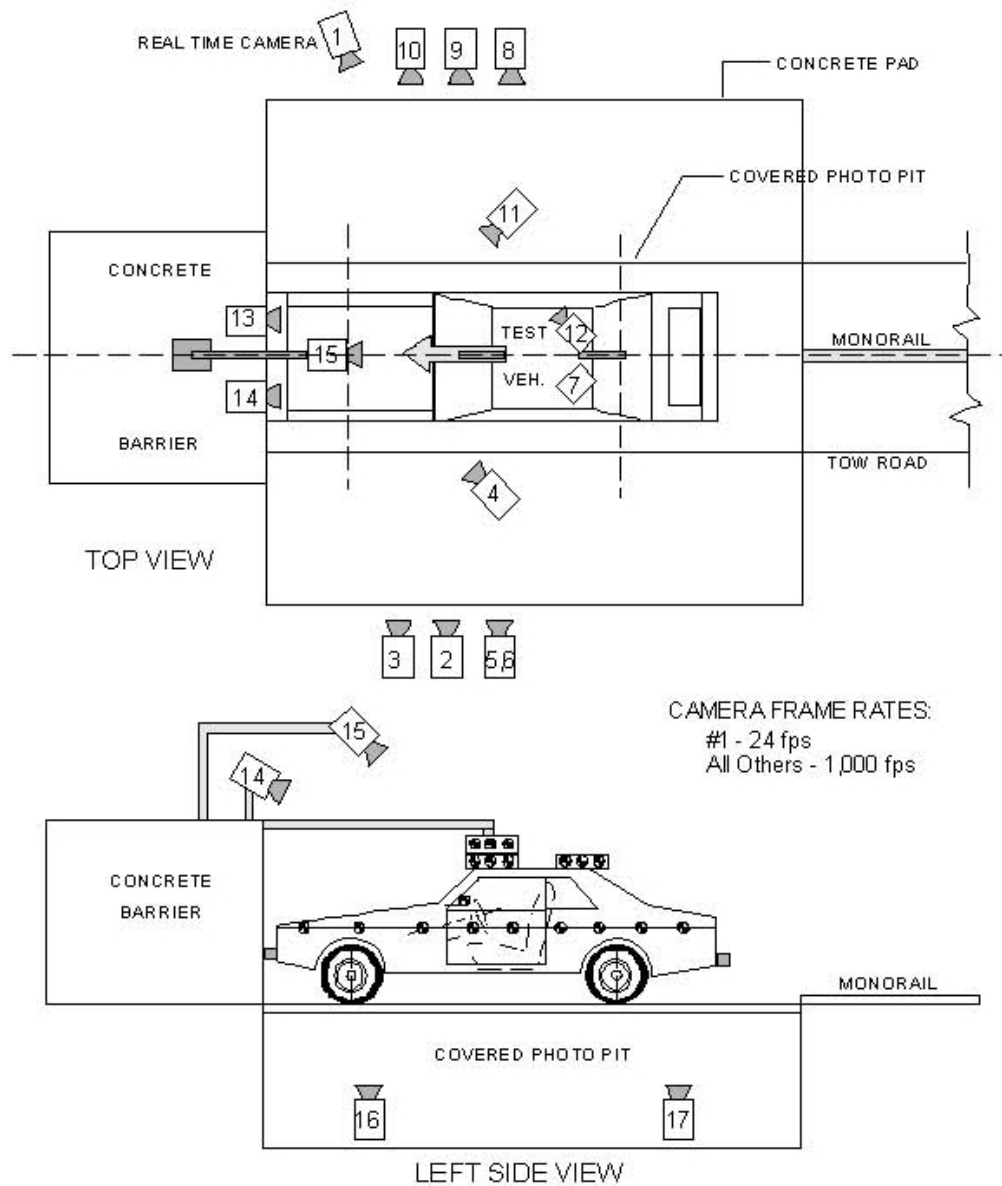
### BELT LENGTH DATA

| Measurement Description                          | Units | Driver | Passenger |
|--------------------------------------------------|-------|--------|-----------|
| Shoulder Belt Length as measured on ATD          | mm    | 870    | 910       |
| Lap Belt Length as measured on ATD               | mm    | 855    | 620       |
| Reminder of belt of reel                         | mm    | 942    | 727       |
| Total Belt Length for Continuous Webbing Systems | mm    | 2667   | 2257      |

# **DATA SHEET NO. 6** **CAMERA LOCATIONS AND DATA**

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009



## DATA SHEET NO. 6 (CONTINUED)

### CAMERA LOCATIONS AND DATA

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

| No. | Camera View                    | Location (mm) * |       |       | Angle (deg) | Lens (mm) | Speed (fps) |
|-----|--------------------------------|-----------------|-------|-------|-------------|-----------|-------------|
|     |                                | X               | Y     | Z     |             |           |             |
| 1   | Real-Time Camera               |                 |       |       |             | 13        | 24          |
| 2   | Overall Left Side              | 1040            | -5220 | -1050 | 6.3         | 24        | 1000        |
| 3   | Left Side A-Pillar             | 1500            | -6420 | -1470 | 2.5         | 35        | 1000        |
| 4   | Left Side B-Pillar             | 5160            | -5030 | -1885 | 6.4         | 50        | 1000        |
| 5   | Steering Column, Upper         | 870             | -5650 | -1260 | 5.3         | 25        | 1000        |
| 6   | Steering Column, Lower         | 850             | -5575 | -870  | 5.7         | 25        | 1000        |
| 7   | On-Board Driver's Seat Belt    |                 |       |       |             |           |             |
| 8   | Overall Right Side             | 2020            | 6700  | -1180 | 3.3         | 20        | 1000        |
| 9   | Right Side A-Pillar            | 1400            | 6380  | -1425 | 3.1         | 35        | 1000        |
| 10  | Passenger IP View              | 1060            | 5190  | -1100 | 5.5         | 24        | 1000        |
| 11  | Right Side B-Pillar            | 5190            | 4990  | -1890 | 6.3         | 50        | 1000        |
| 12  | On-Board Pass. Seat Belt       |                 |       |       |             |           |             |
| 13  | Overhead Passenger View        | -110            | 420   | -2180 | 44.2        | 24        | 1000        |
| 14  | Overhead Driver View           | -135            | -470  | -2180 | 45.1        | 24        | 1000        |
| 15  | Overhead Windshield View       | -285            | 0     | -2860 | 47.3        | 12.5      | 1000        |
| 16  | Pit View of Engine Compartment | 1250            | 0     | 3150  | 89.3        | 24        | 1000        |
| 17  | Pit View of Fuel Tank          | 3020            | 0     | 3150  | 89.6        | 24        | 1000        |

**\*COORDINATES:**

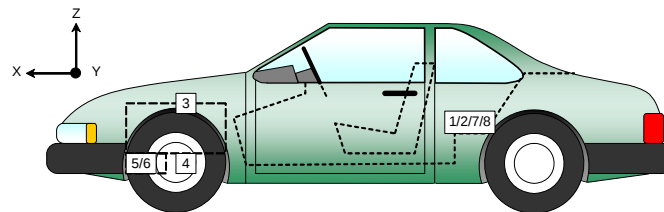
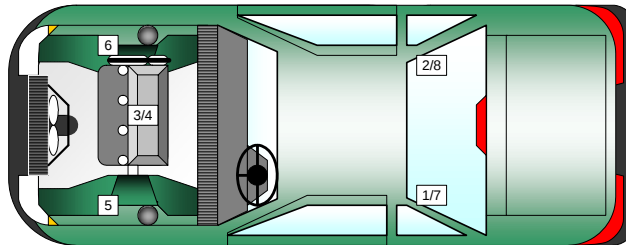
+X = forward of impact plane  
 +Y = right of monorail centerline  
 +Z = below ground level

Cameras 7 & 12 were not used for this test.

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

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009



## **VEHICLE ACCELEROMETER PRE-TEST LOCATIONS**

| No. | Accelerometer Location | Measurements (mm) |      |      |
|-----|------------------------|-------------------|------|------|
|     |                        | X                 | Y    | Z    |
| 1   | Left Rear X-Member X   | 1894              | -344 | -316 |
| 2   | Right Rear X-Member X  | 1894              | 344  | -316 |
| 3   | Engine Top X           | 3946              | 0    | -842 |
| 4   | Engine Bottom X        | 4008              | 0    | -217 |
| 5   | Left Brake Caliper X   | 3925              | -685 | -267 |
| 6   | Right Brake Caliper X  | 3925              | 685  | -267 |
| 7   | Left Rear X-Member Z   | 1894              | -344 | -316 |
| 8   | Right Rear X-Member Z  | 1894              | 344  | -316 |

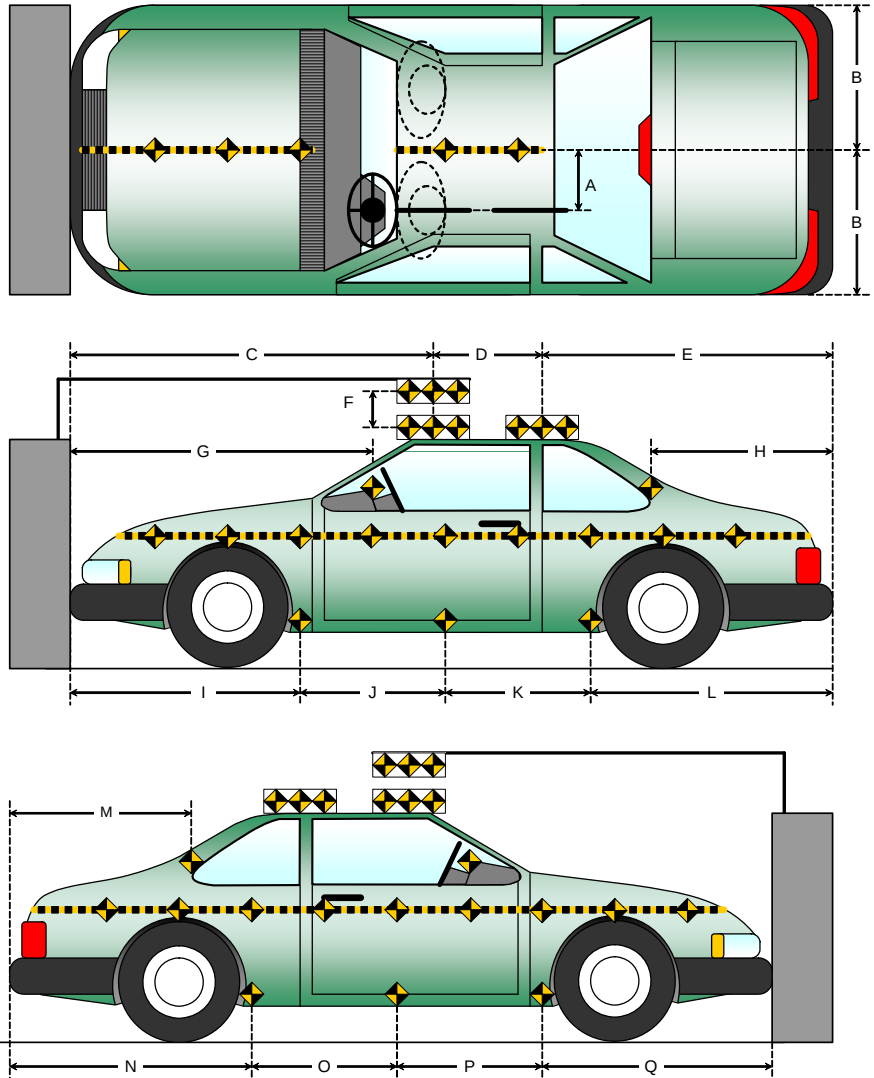
Reference Points: X - Rear Surface of Vehicle (+ forward)  
 Y - Vehicle Centerline (+ to right)  
 Z - Ground Plane (+ down)

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

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

| Item | Value (mm) |
|------|------------|
| A    | 349        |
| B    | 909        |
| C    | 2356       |
| D    | 915        |
| E    | 1534       |
| F    | 40         |
| G    |            |
| H    | 1133       |
| I    | 1449       |
| J    | 920        |
| K    | 920        |
| L    | 1516       |
| M    | 1145       |
| N    | 1519       |
| O    | 917        |
| P    | 920        |
| Q    | 1449       |



## DATA SHEET NO. 9

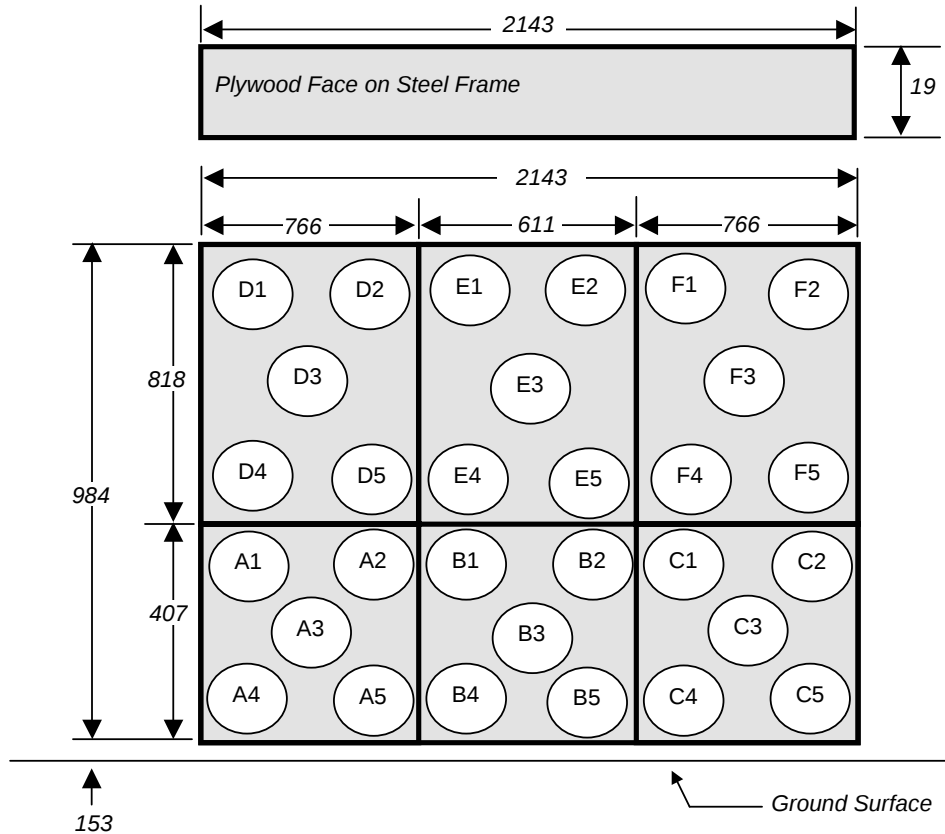
### LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

#### 30 Load Cell Rigid Barrier

#### Load Cell Locations on Fixed Barrier



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

6 Groups of 5 Load Cells Each

## DATA SHEET NO. 10

### TEST VEHICLE CAMERA AND INSTRUMENTATION SUMMARY

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
Test Date: 6/25/2009

#### INSTRUMENTATION

|                                  |     |
|----------------------------------|-----|
| Driver Dummy Channels            | 44  |
| Passenger Dummy Channels         | 44  |
| Vehicle Structure Accelerometers | 8   |
| Barrier Channels                 | 6   |
| Total                            | 102 |

#### CAMERA COVERAGE

|                            |    |
|----------------------------|----|
| High-Speed Vehicle Onboard | 0  |
| High-Speed Offboard        | 14 |
| Real-Time Panning          | 1  |
| Total                      | 15 |

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

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

**TEST DUMMY INFORMATION AND CONTACT**

| Description             | Driver           | Passenger        |
|-------------------------|------------------|------------------|
| Dummy Type / Serial No. | HIII 50% / 1045  | 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     | Glovebox         |

**POST TEST 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;<br>Door opened without tools | Door remained closed and latched;<br>Door opened without tools |
| Rear Door Opening     | Door remained closed and latched;<br>Door opened without tools | Door remained closed and latched;<br>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    | 784   |
| Center             | mm    | 719   |
| Right Side         | mm    | 866   |
| Average            | mm    | 790   |

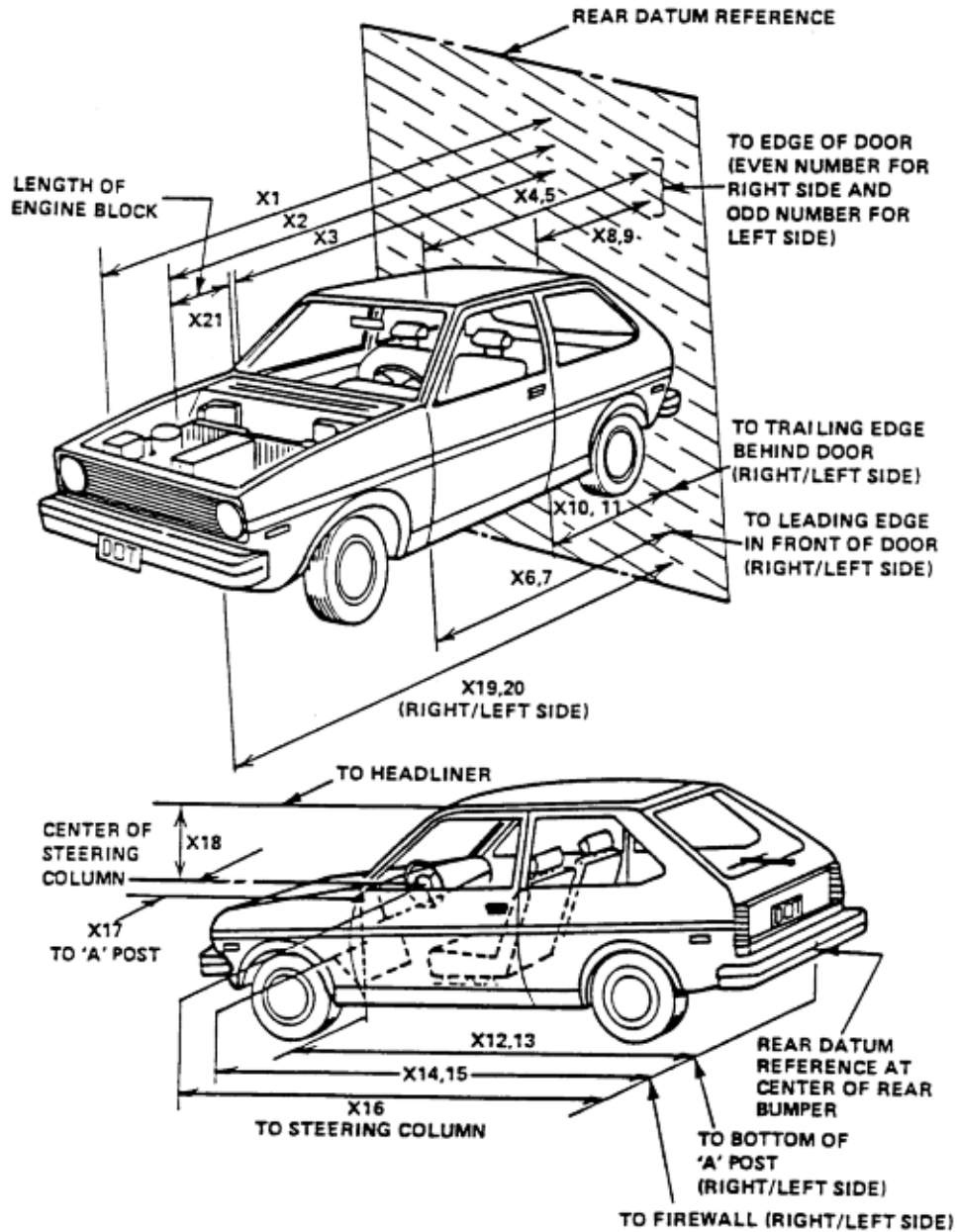
**SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION**

| Restraint Type                | Driver    |          | Passenger |          |
|-------------------------------|-----------|----------|-----------|----------|
|                               | Installed | Deployed | Installed | Deployed |
| Frontal Airbag                | Yes       | Yes      | Yes       | Yes      |
| Knee Bag                      | No        |          | No        |          |
| Side Torso Airbag             | Yes       | No       | Yes       | No       |
| Combination Head/Torso Airbag | No        |          | No        |          |
| Side Head Curtain/Tube Airbag | Yes       | No       | Yes       | No       |
| Seat Belt Pretensioner        | Yes       | Yes      | Yes       | Yes      |
| Seat Belt Load Limiter        | Yes       | Yes      | Yes       | Yes      |

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

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009



**DATA SHEET NO. 12 (CONTINUED)**  
**VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

**RSOV (Rear Surface of Vehicle)**

| No. | Measurement Description                   | Units | Pre-Test | Post-Test | Difference |
|-----|-------------------------------------------|-------|----------|-----------|------------|
| 1   | Total Length of Vehicle at Centerline     | mm    | 4805     | 4200      | 605        |
| 2   | RSOV to Front of Engine                   | mm    | 4292     | 3826      | 466        |
| 3   | RSOV to Firewall                          | mm    | 3535     | 3501      | 34         |
| 4   | RSOV to Upper Leading Edge of Right Door  | mm    | 3316     | 3305      | 11         |
| 5   | RSOV to Upper Leading Edge of Left Door   | mm    | 3314     | 3305      | 9          |
| 6   | RSOV to Lower Leading Edge of Right Door  | mm    | 3291     | 3295      | -4         |
| 7   | RSOV to Lower Leading Edge of Left Door   | mm    | 3289     | 3271      | 18         |
| 8   | RSOV to Upper Trailing Edge of Right Door | mm    | 2200     | 2196      | 4          |
| 9   | RSOV to Upper Trailing Edge of Left Door  | mm    | 2196     | 2195      | 1          |
| 10  | RSOV to Lower Trailing Edge of Right Door | mm    | 2239     | 2235      | 4          |
| 11  | RSOV to Lower Trailing Edge of Left Door  | mm    | 2238     | 2226      | 12         |
| 12  | RSOV to Bottom of "A" Post of Right Side  | mm    | 3260     | 3254      | 6          |
| 13  | RSOV to Bottom of "A" Post of Left Side   | mm    | 3260     | 3242      | 18         |
| 14  | RSOV to Firewall, Right Side              | mm    | 3685     | 3630      | 55         |
| 15  | RSOV to Firewall, Left Side               | mm    | 3702     | 3671      | 31         |
| 16  | RSOV to Steering Column                   | mm    | 2885     | 2893      | -8         |
| 17  | Center of Steering Column to "A" Post     | mm    | 372      | 402       | -30        |
| 18  | Center of Steering Column to Headliner    | mm    | 420      | 462       | -42        |
| 19  | RSOV to Right Side of Front Bumper        | mm    | 4690     | 4188      | 502        |
| 20  | RSOV to Left Side of Front Bumper         | mm    | 4690     | 4190      | 500        |
| 21  | Length of Engine Block                    | mm    | 452      | 452       | 0          |
| RD  | RSOV to Right Side of Dash Panel          | mm    | 3031     | 3007      | 24         |
| CD  | RSOV to Center of Dash Panel              | mm    | 3054     | 3022      | 32         |
| LD  | RSOV to Left Side of Dash Panel           | mm    | 3054     | 3053      | 1          |

**DATA SHEET NO. 13**  
**ACCIDENT INVESTIGATION DIVISION DATA**

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

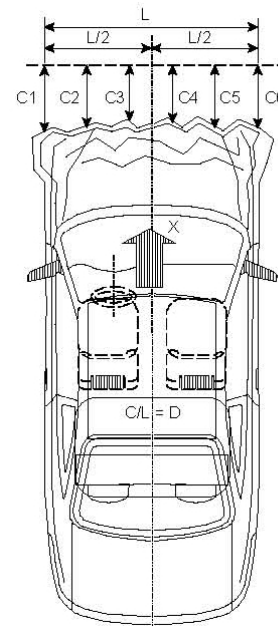
NHTSA No.: MA0211  
 Test Date: 6/25/2009

**VEHICLE INFORMATION**

VIN: 3FAHP0GA6AR117490 Wheelbase (mm): 2730  
 Vehicle Size Category: Sedan Test Weight (kg): 1651.1

**ACCELEROMETER DATA**

Accelerometer Locations: As per measurements on Page 16  
 Cal. Procedure/Interval: MGA procedure / 6 month  
 Integration Algorithm: Trapezoidal Linearity: > 99%  
 Impact Velocity (km/h): 56.3  
 Velocity Change (km/h): 64.1  
 Time of Separation (msec): 109.1



**CRUSH PROFILE**

Collision Deformation Classification: Frontal  
 Midpoint of Damage: Centerline  
 Damage Region Length (mm): 1180  
 Impact Mode: Frontal

| No. | Measurement Description    | Units | Pre-Test | Post-Test | Difference |
|-----|----------------------------|-------|----------|-----------|------------|
| C1  | Crush zone 1 at left side  | mm    | 4690     | 4190      | 500        |
| C2  | Crush zone 2 at left side  | mm    | 4761     | 4205      | 556        |
| C3  | Crush zone 3 at left side  | mm    | 4796     | 4210      | 586        |
| C4  | Crush zone 4 at right side | mm    | 4796     | 4212      | 584        |
| C5  | Crush zone 5 at right side | mm    | 4761     | 4202      | 559        |
| C6  | Crush zone 6 at right side | mm    | 4690     | 4188      | 502        |
| L   | C1 TO C6                   | mm    | 1180     | 1176      | 4          |

**DATA SHEET NO. 14**  
**VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

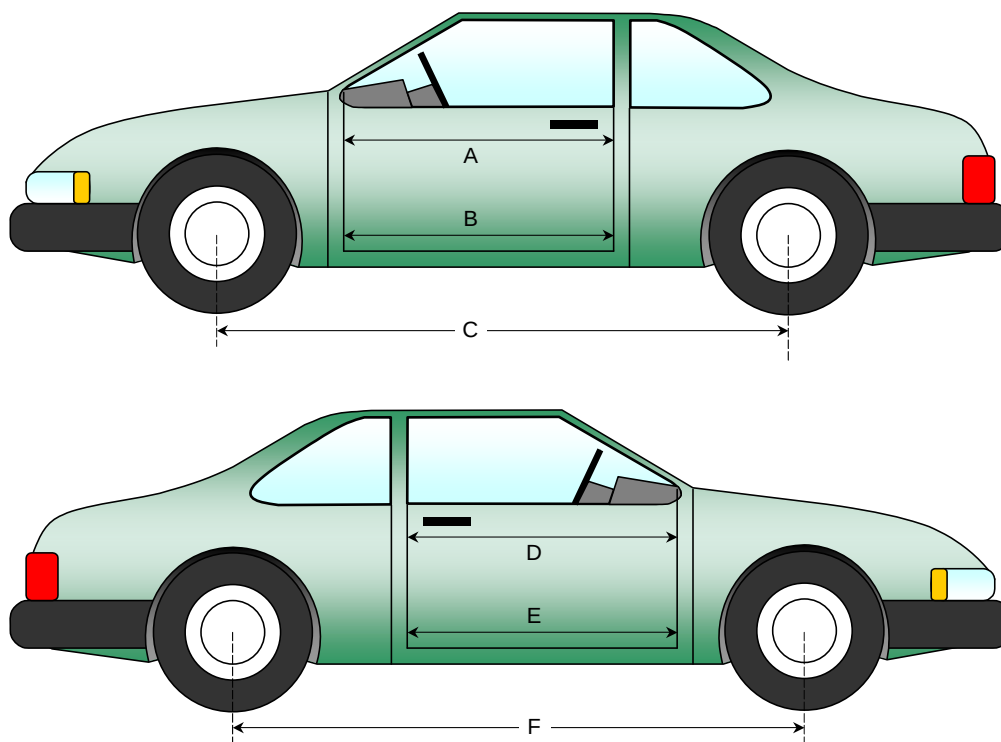
NHTSA No.: MA0211  
 Test Date: 6/25/2009

**DOOR OPENING WIDTH**

| Item | Description      | Units | Pre-Test | Post-Test | Difference |
|------|------------------|-------|----------|-----------|------------|
| A    | Left Side Upper  | mm    | 1004     | 1001      | 3          |
| B    | Left Side Lower  | mm    | 951      | 952       | -1         |
| D    | Right Side Upper | mm    | 1004     | 1000      | 4          |
| E    | Right Side Lower | mm    | 951      | 949       | 2          |

**WHEELBASE MEASUREMENTS**

| Item | Description          | Units | Pre-Test | Post-Test | Difference |
|------|----------------------|-------|----------|-----------|------------|
| C    | Left Side Wheelbase  | mm    | 2730     | 2676      | 54         |
| F    | Right Side Wheelbase | mm    | 2730     | 2683      | 47         |



**DATA SHEET NO. 14 (CONTINUED)**  
**VEHICLE INTRUSION MEASUREMENTS**

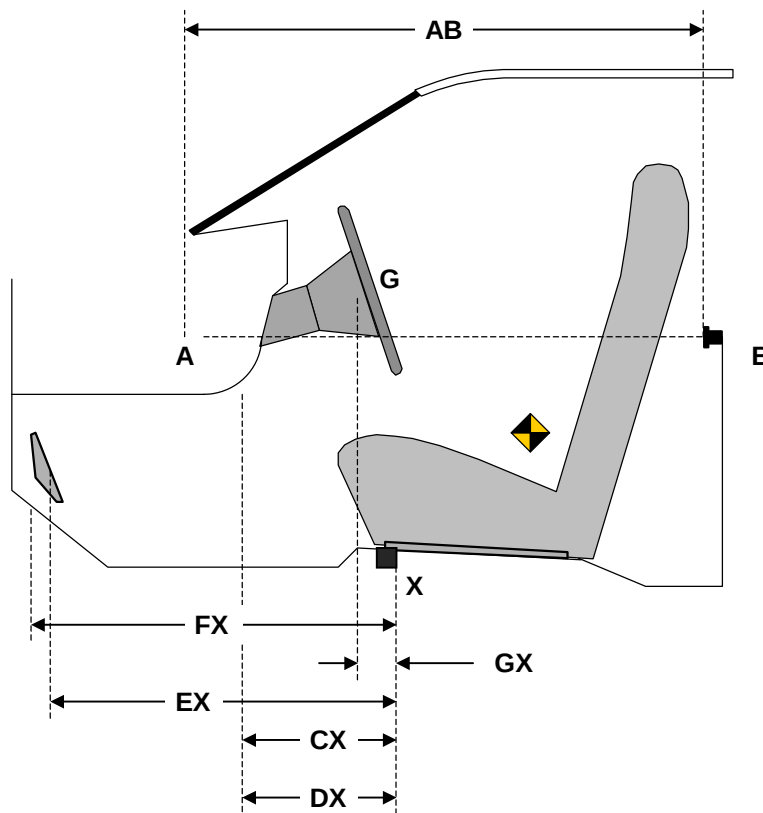
Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

**DRIVER COMPARTMENT INTRUSION**

| Item | Description                              | Units | Pre-Test | Post-Test | Difference |
|------|------------------------------------------|-------|----------|-----------|------------|
| AB   | Door Opening (Inside window jam)         | mm    | 773      | 770       | 3          |
| CX   | Left Knee Bolster to X                   | mm    | 325      | 292       | 33         |
| DX   | Right Knee Bolster to X                  | mm    | 324      | 285       | 39         |
| EX   | Brake Pedal to X                         | mm    | 600      | 581       | 19         |
| FX   | Foot Rest to X                           | mm    | 605      | 593       | 12         |
| GX   | Center of Steering Column Wheel Hub to X | mm    | 54       | 72        | -18        |

X = Front of Seat Track (stationary)



**DRIVER COMPARTMENT**

## DATA SHEET NO. 15

### SUMMARY OF FMVSS 212 AND FMVSS 219 (PARTIAL) DATA

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009

#### Windshield Mounting Details:

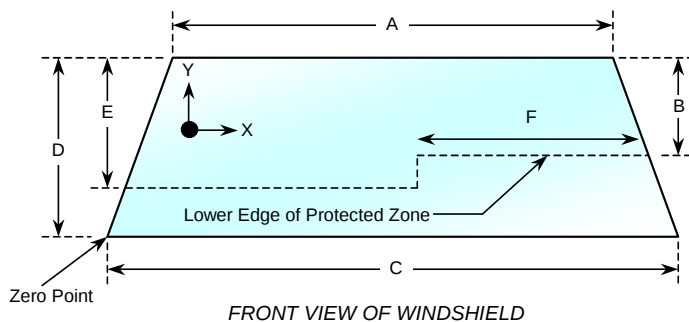
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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   | 2181          | 2181           | 100            |
| Right Side  | 2181          | 2181           | 100            |
| Total       | 4362          | 4362           | 100            |



| Item | Units | Value |
|------|-------|-------|
| A    | mm    | 1144  |
| B    | mm    | 505   |
| C    | mm    | 1510  |
| D    | mm    | 854   |
| E    | mm    | 556   |
| F    | mm    | 510   |

#### 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. 16**

**FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA**

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan

NHTSA No.: MA0211

Test Program: Frontal Validation Testing

Test Date: 6/25/2009

**FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA**

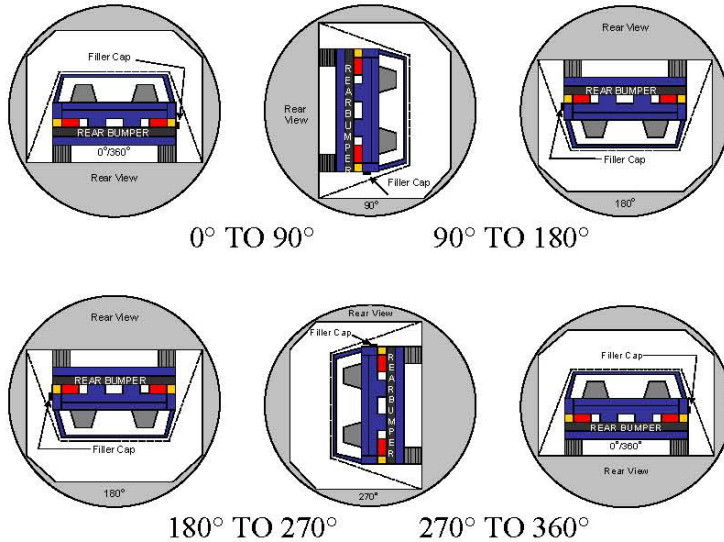
Test Time: 9:51 am      Temperature: 21° C

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

**DATA SHEET NO. 17**  
**FMVSS 301 STATIC ROLLOVER DATA**

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
 Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
 Test Date: 6/25/2009



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°    | 119           | 300       | 419        |
| 90° to 180°  | 112           | 300       | 412        |
| 180° to 270° | 105           | 300       | 405        |
| 270° to 360° | 116           | 300       | 416        |

**FMVSS 301 ROLLOVER 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            |

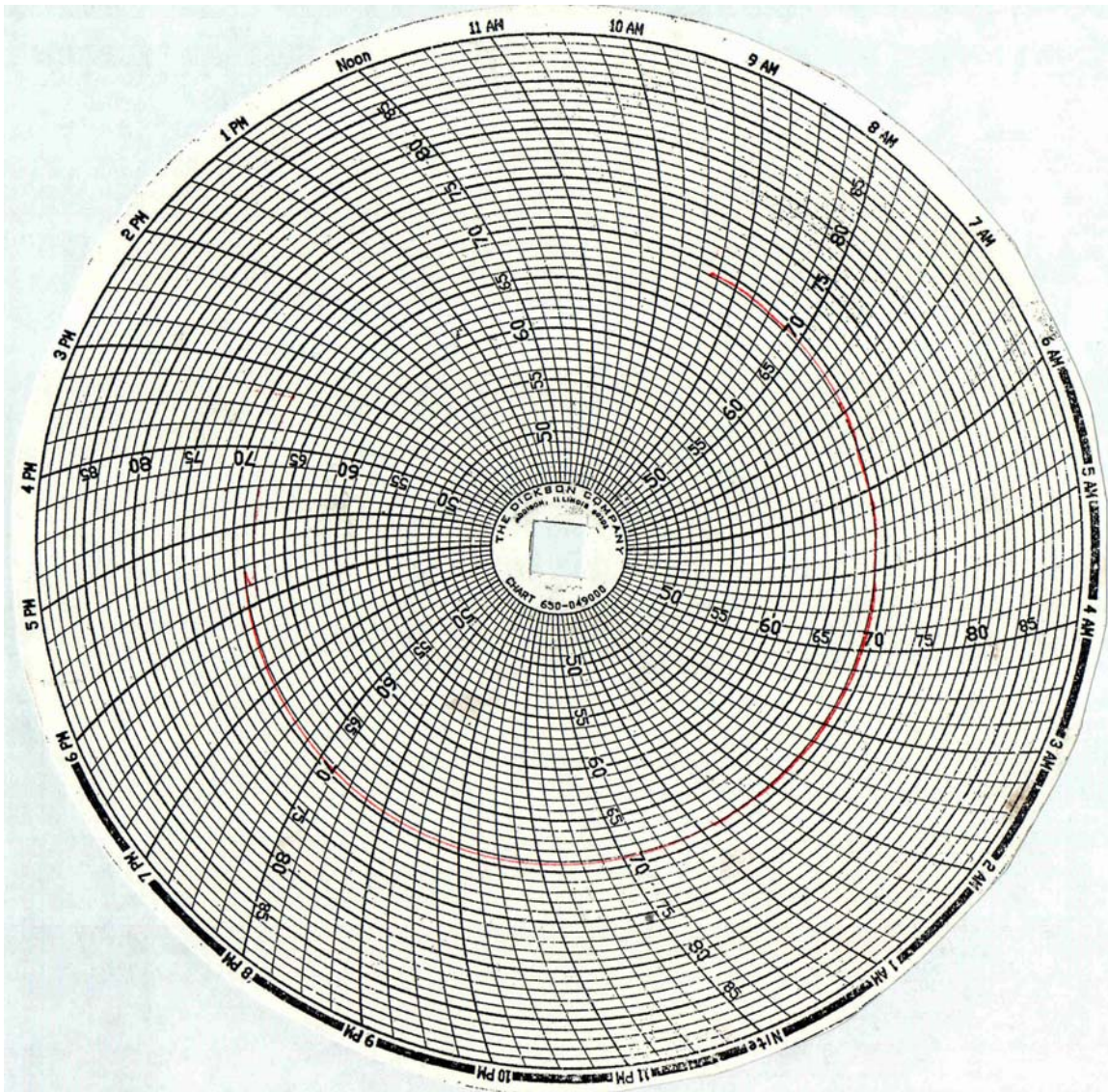
**ROLLOVER SOLVENT SPILLAGE LOCATION TABLE**

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

**DATA SHEET NO. 18**  
**DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA**

Test Vehicle: 2010 Ford Fusion S 4-Dr Sedan  
Test Program: Frontal Validation Testing

NHTSA No.: MA0211  
Test Date: 6/25/2009



**APPENDIX A**  
**PHOTOGRAPHS**

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Load Cell Location

**MFD. BY FORD MOTOR CO.**

DATE: 03/09  
 FRONT GAWR: 1034KG/2279LB  
 GVWR: 1965KG/4332LB  
 REAR GAWR: 931KG/2053LB

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR  
 VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS  
 IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN: 3FAHPOGA6AR117490 TYPE: Passenger Car  
 MAXIMUM LOAD = OCCUPANTS + LUGGAGE = 385KG/ 850LB  
 OCCUPANTS = 5 TOTAL; 2 FRONT, 3 REAR

TIRE (FR): P205/60R16 RIMS (FR): 16X6.5J  
 (RR): P205/60R16 (RR): 16X6.5J  
 PRESSURE (FR): 235 kPa/ 34 PSI COLD (RR): 235 kPa/ 34 PSI COLD



**3FAHPOGA6AR117490**

TRAILER TOWING - SEE OWNER GUIDE

|             |        |        |                  |
|-------------|--------|--------|------------------|
| EXT PNT: JV | RC: 41 | DSO:   | F0100            |
| INT TR      | TP/PS  | R AXLE | TR SPR           |
| DL          | F      | 43     | 6                |
|             |        | AA88   | 405              |
|             |        | CMC    | ▽5U5A-5420472-AA |

Manufacturer's Label



**TIRE AND LOADING INFORMATION**

SEATING CAPACITY TOTAL : 5 FRONT: 2 REAR: 3

The combined weight of occupants and cargo should never exceed : **385 kg or 850 lbs.**

| TIRE  | SIZE       | COLD TIRE PRESSURE |
|-------|------------|--------------------|
| FRONT | P205/60R16 | 235 KPA, 34 PSI    |
| REAR  | P205/60R16 | 235 KPA, 34 PSI    |
| SPARE | T145/80D16 | 415 KPA, 60 PSI    |

**SEE OWNERS  
MANUAL FOR  
ADDITIONAL  
INFORMATION**

▽5U5A-1532-AA (TLU)

3FAHPOGA6AR117490



Tire Placard



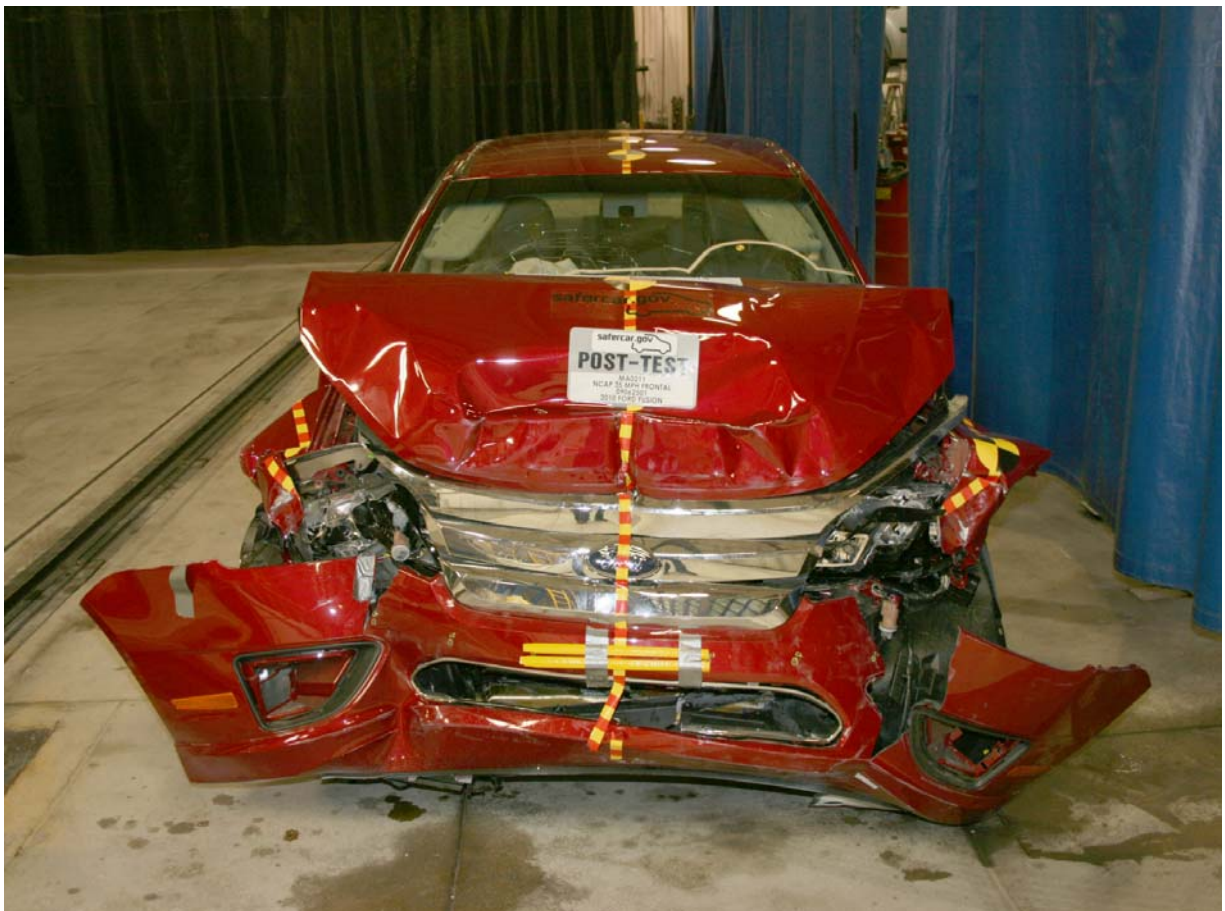
Right Front Three-Quarter View, As Received



Left Rear Three-Quarter View, As Received



Pre-Test Front View



Post-Test Front View



Pre-Test Left Side View (with vehicle at barrier)



Post-Test Left Side View



Pre-Test Right Side View (with vehicle at barrier)



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 (with vehicle at barrier)



Post-Test Left Rear ¾ View



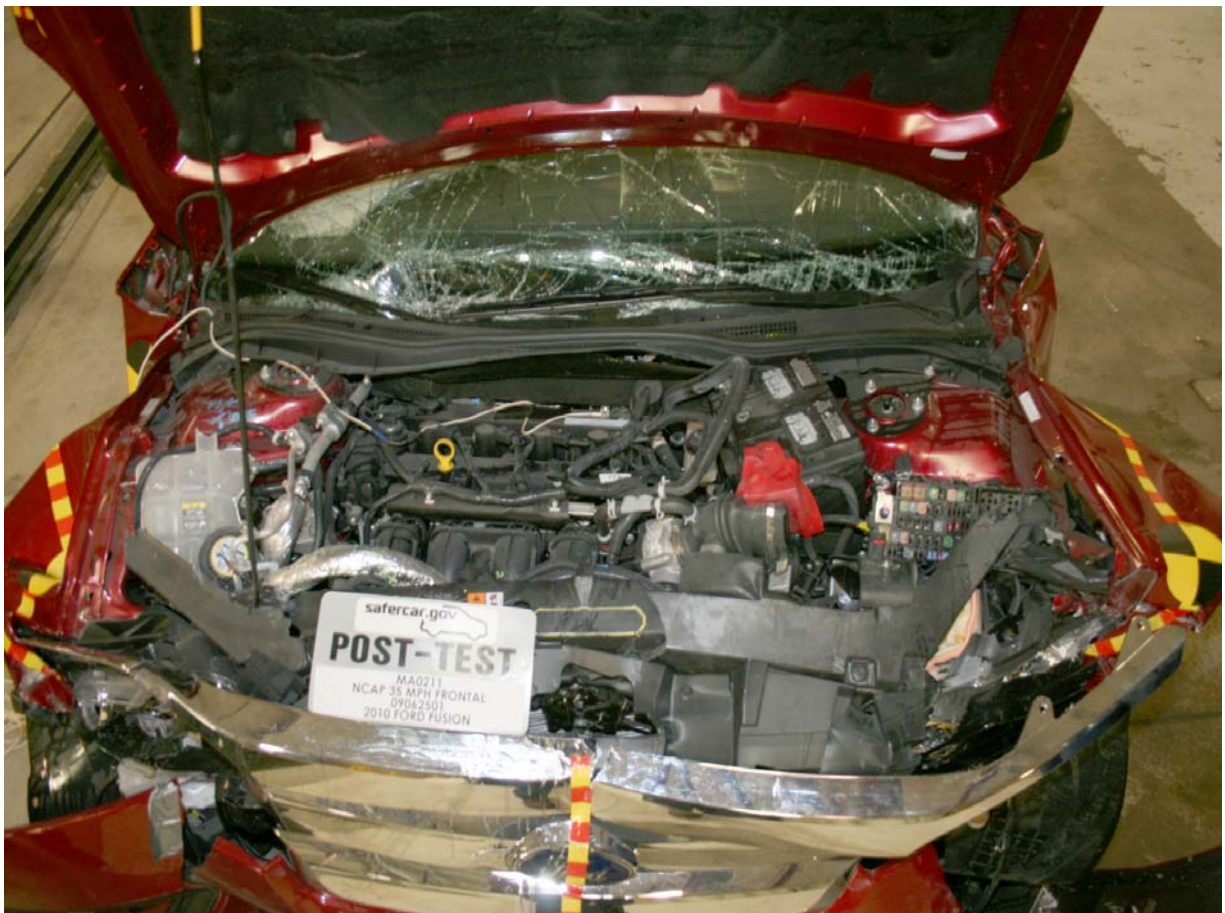
Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



Post-Test Engine Compartment View



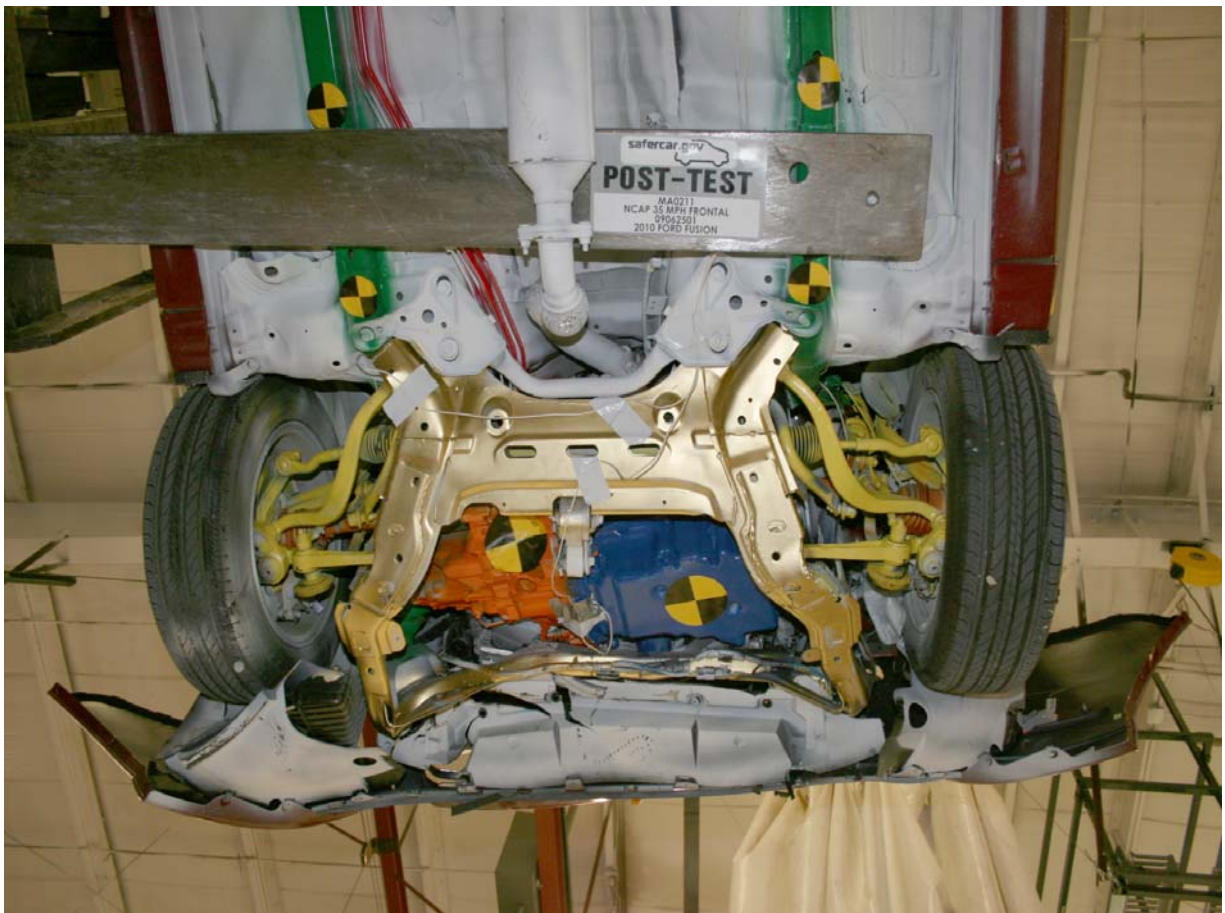
Pre-Test Fuel Cap View



Post-Test Fuel Cap View



Pre-Test Front Underbody View



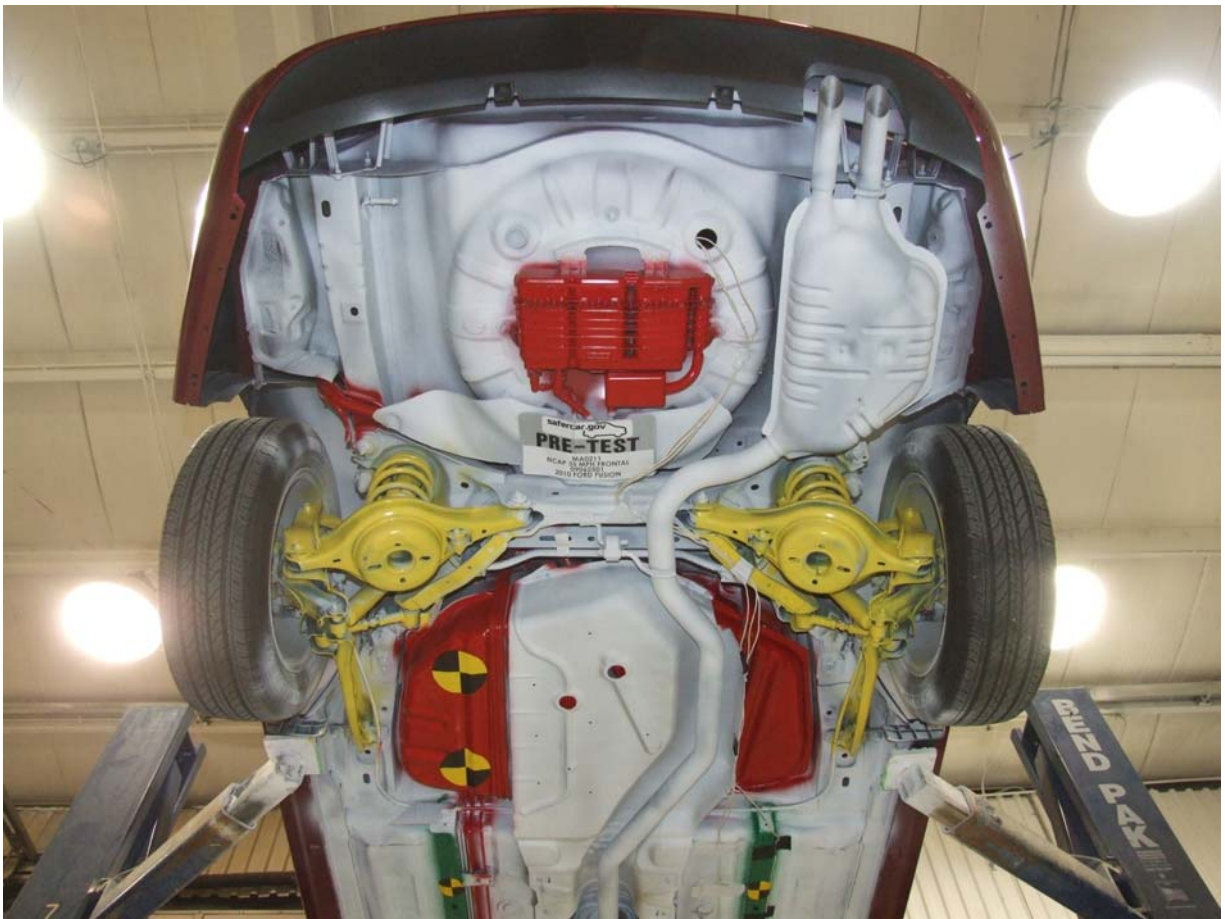
Post-Test Front Underbody View



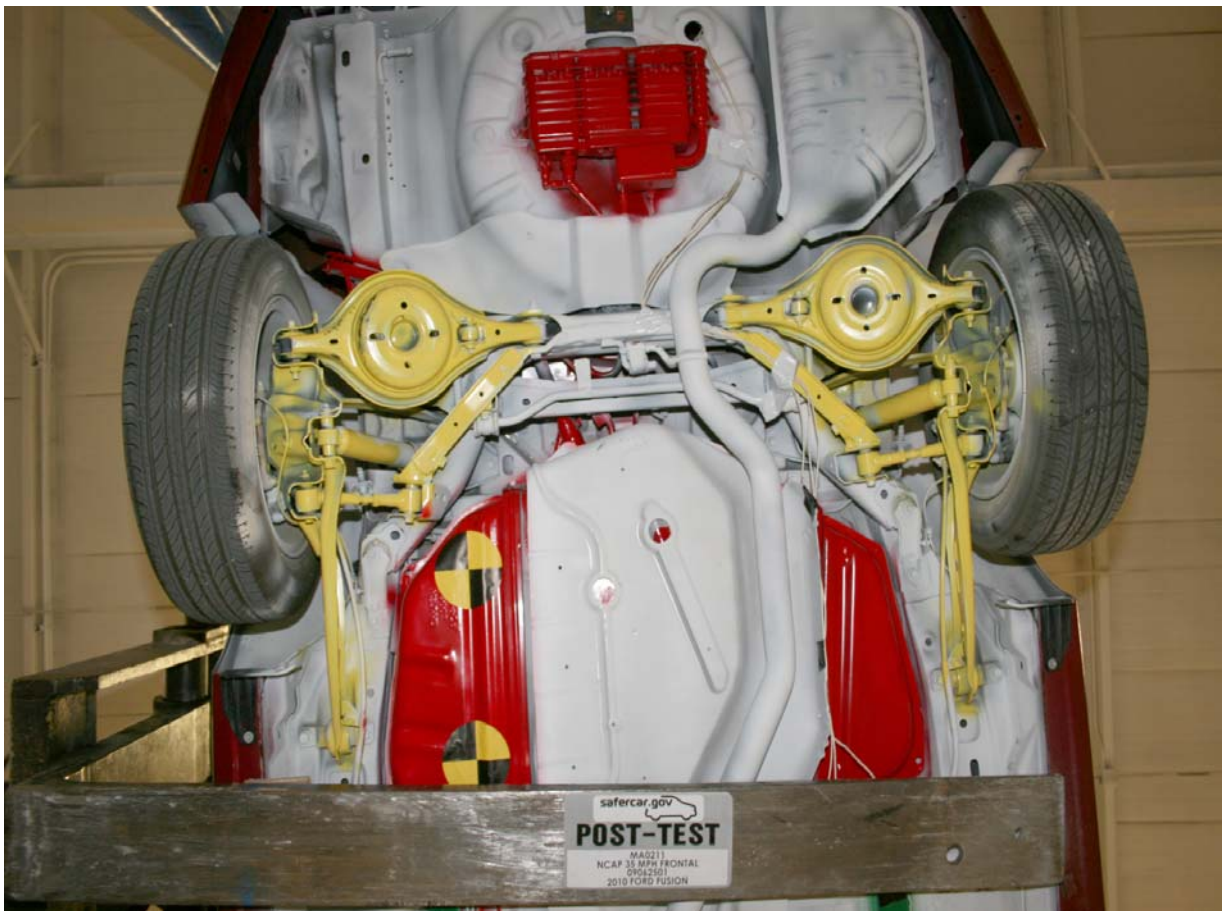
Pre-Test Mid Underbody View



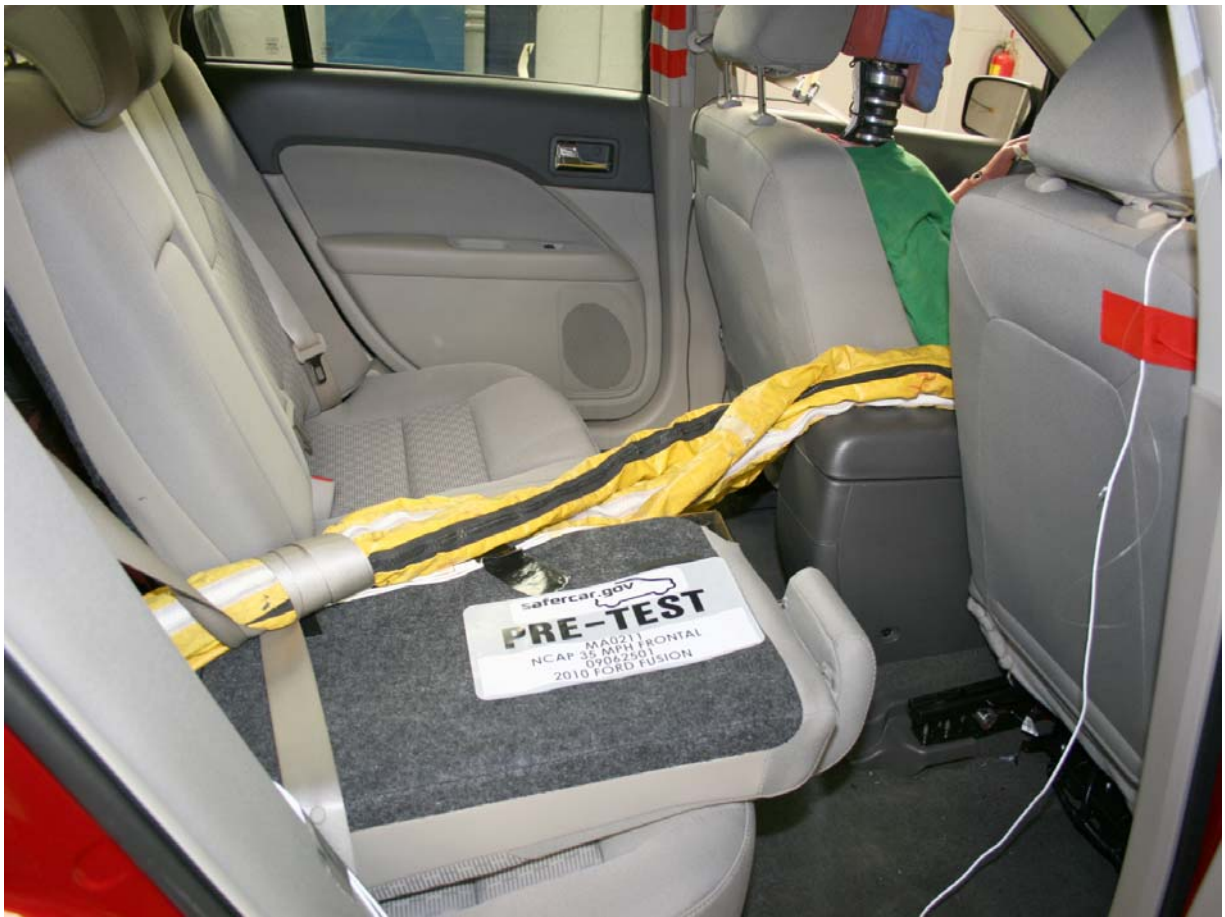
Post-Test Mid Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View



Pre-Test Dummy Cable Routing



Post-Test Dummy Cable Routing



Pre-Test Driver Dummy Front View



Post-Test Driver Dummy Front View



Pre-Test Driver Dummy Window View



Post-Test Driver Dummy Window View



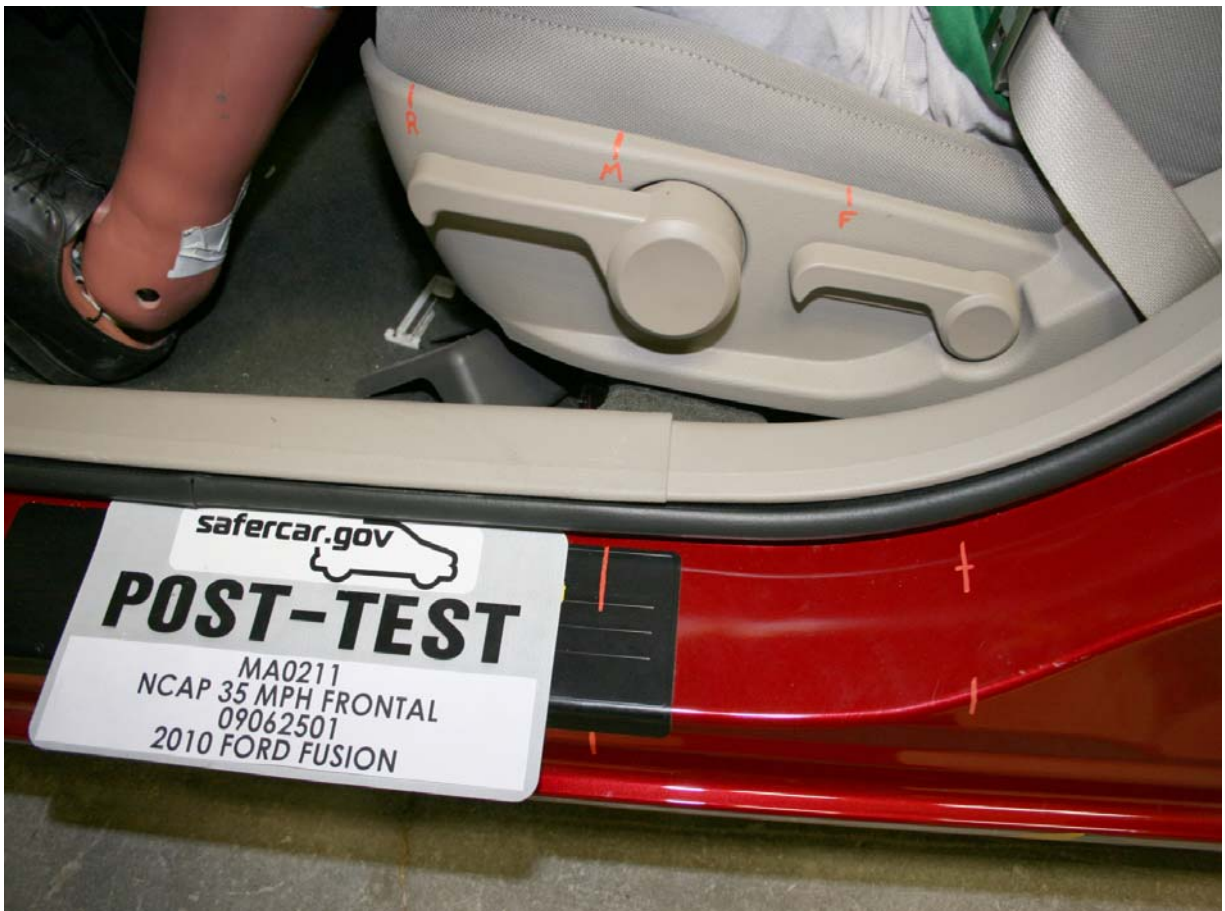
Pre-Test Driver Dummy and Vehicle Interior (Door Open)



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



Pre-Test Driver's Seat Fore-Aft Markings



Post-Test Driver's Seat Fore-Aft Markings



Pre-Test Driver Dummy Feet



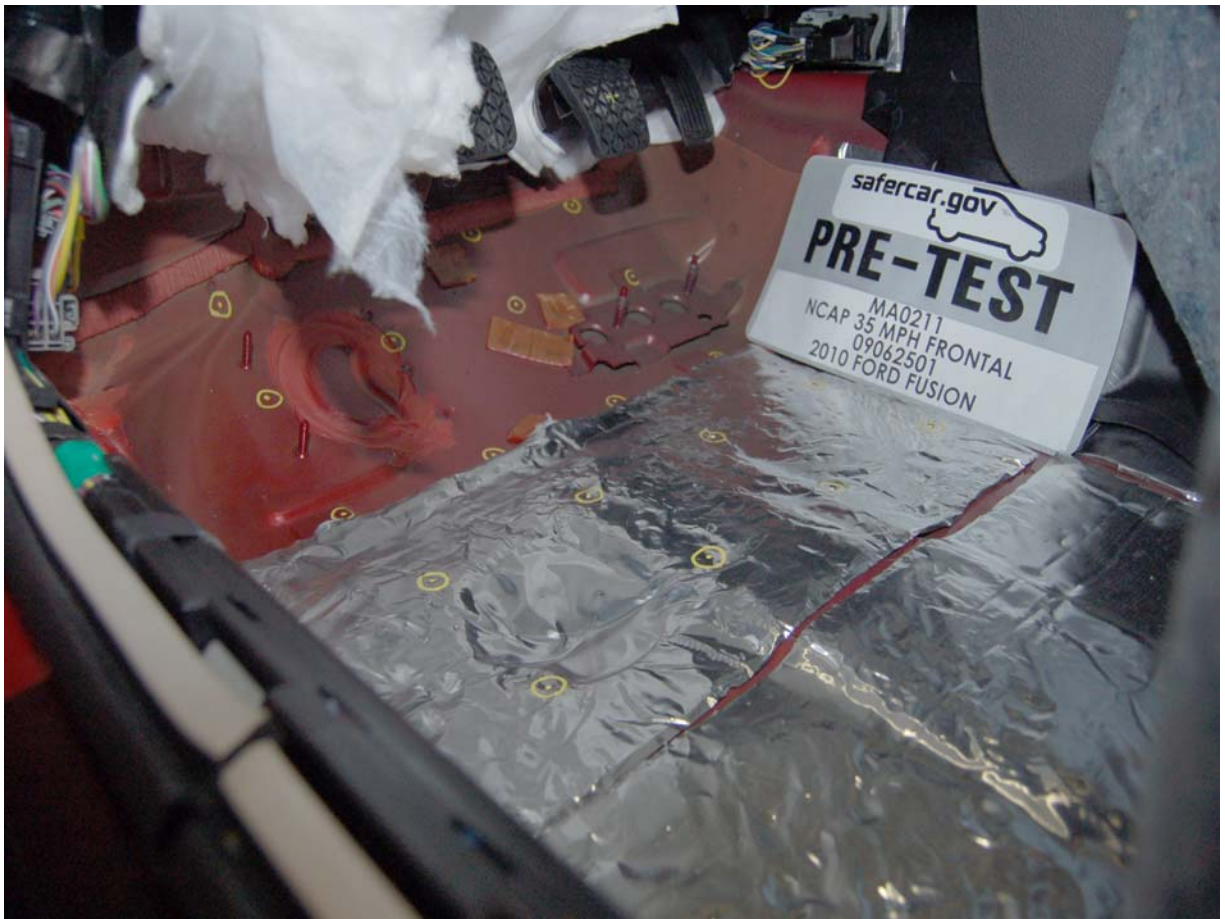
Post-Test Driver Dummy Feet



Pre-Test Driver's Side Knee Bolster



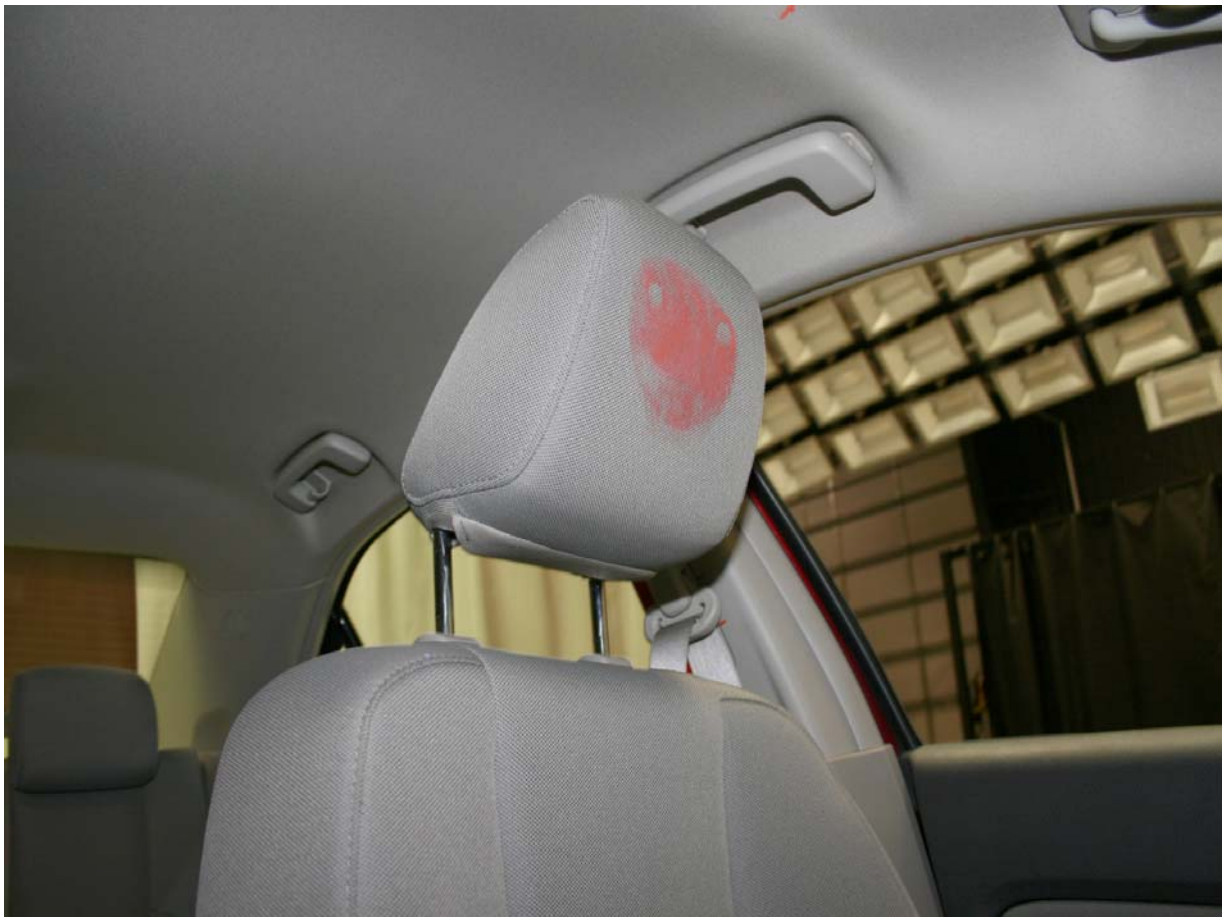
Post-Test Driver's Side Knee Bolster



Pre-Test Driver's Side Floorpan



Post-Test Driver's Side Floorpan



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 View of Steering Column Shear Capsule



Post-Test View of Steering Column Shear Capsule



Pre-Test Passenger Dummy Front View



Post-Test Passenger Dummy Front View



Pre-Test Passenger Dummy Window View



Post-Test Passenger Dummy Window View



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



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



Pre-Test Passenger's Seat Fore-Aft Markings



Post-Test Passenger's Seat Fore-Aft Markings



Pre-Test Passenger Dummy Feet



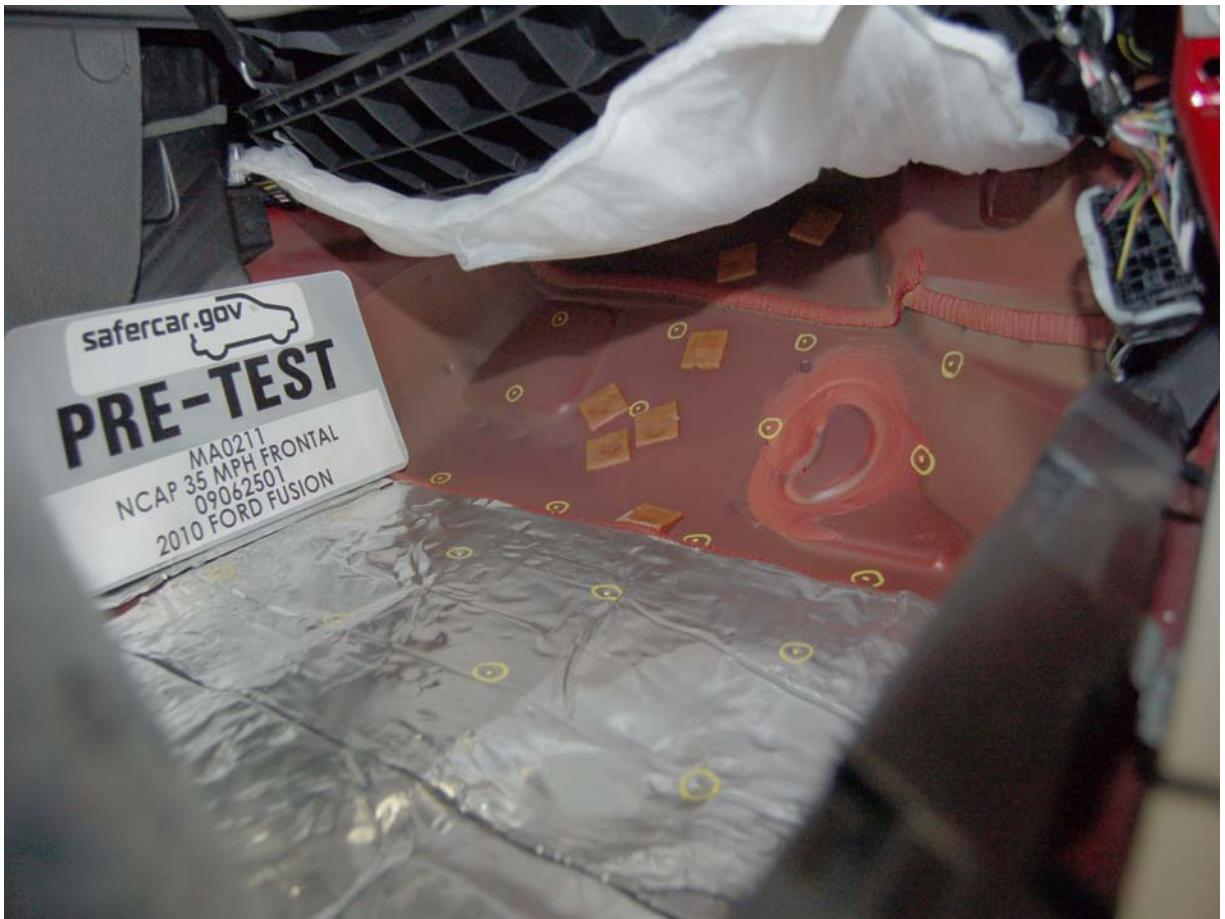
Post-Test Passenger Dummy Feet



Pre-Test Passenger's Side Knee Bolster



Post-Test Passenger's Side Knee Bolster



Pre-Test Passenger's Side Floorpan



Post-Test Passenger's Side Floorpan



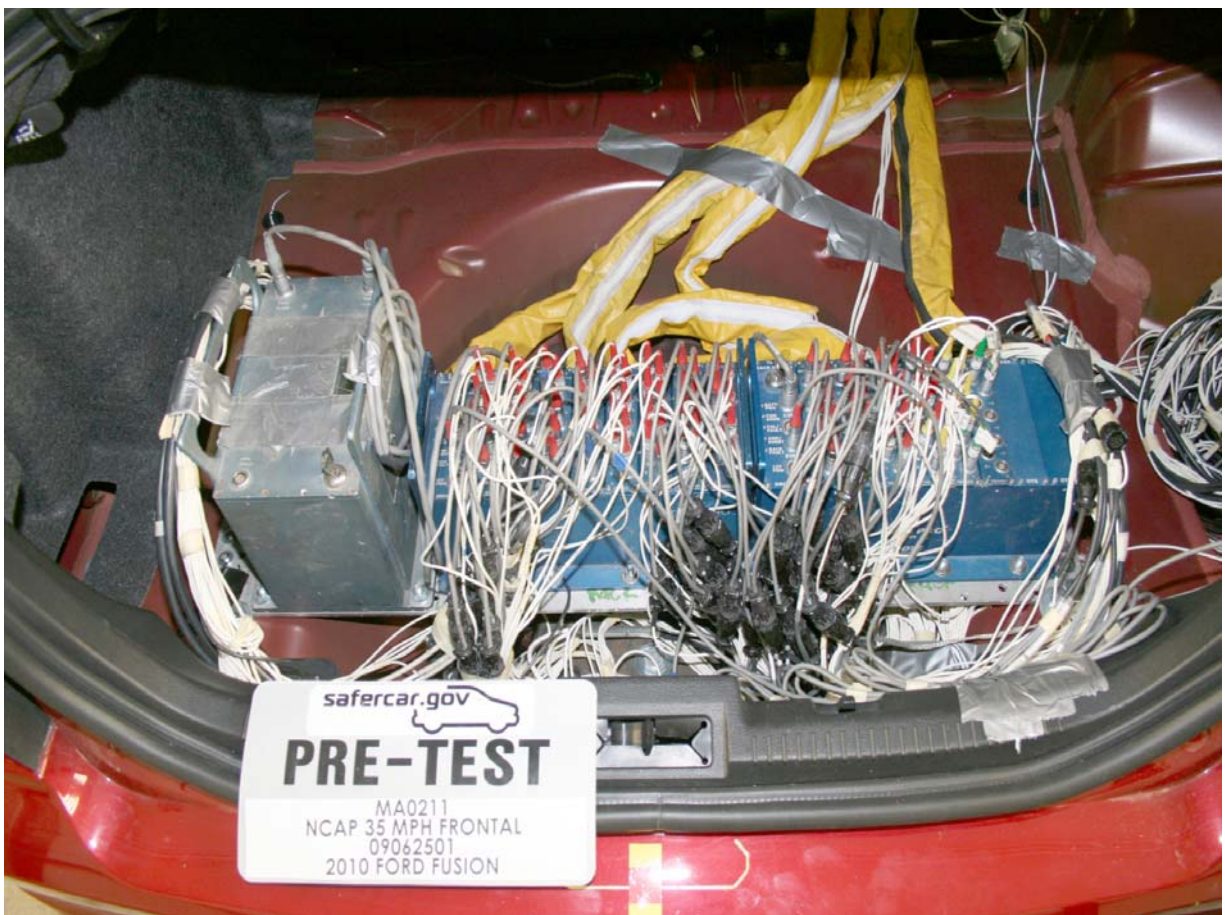
Post-Test Passenger Dummy Head Contact



Post-Test Passenger Dummy Knee Contact



Post-Test Passenger Dummy Airbag Contact



Ballast Installed in Vehicle



Post-Test Speed Trap Read-Out



Vehicle at 0 Degrees on Static Rollover Device



Vehicle at 90 Degrees on Static Rollover Device



Vehicle at 180 Degrees on Static Rollover Device



Vehicle at 270 Degrees on Static Rollover Device



Vehicle at 360 Degrees on Static Rollover Device



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](http://www.nhtsa.dot.gov)**

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Upper Neck Force Y

Driver Upper Neck Moment X

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

Driver Shoulder Belt Force

Driver Lap Belt Force

Driver Left Upper Tibia Moment X

Driver Left Upper Tibia Moment Y

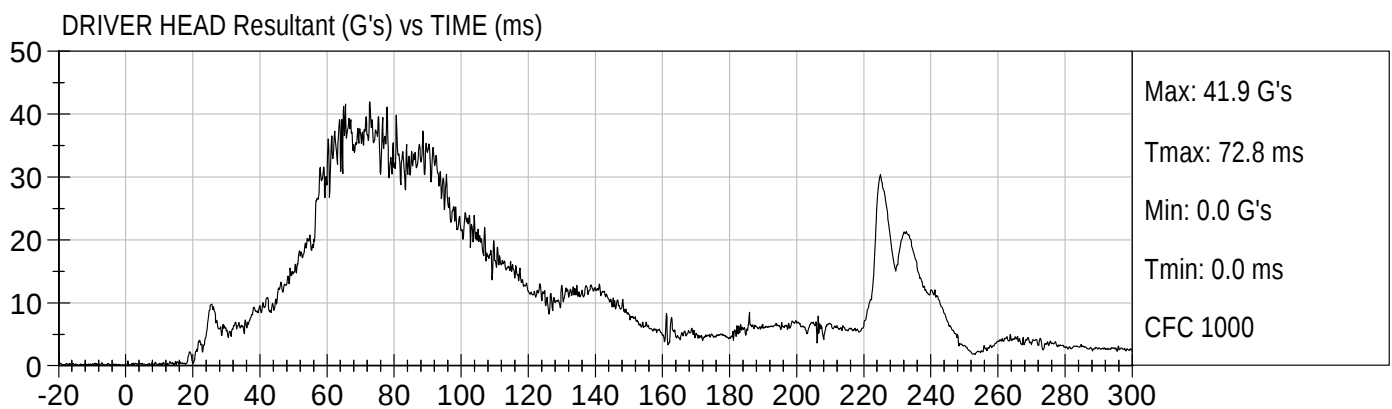
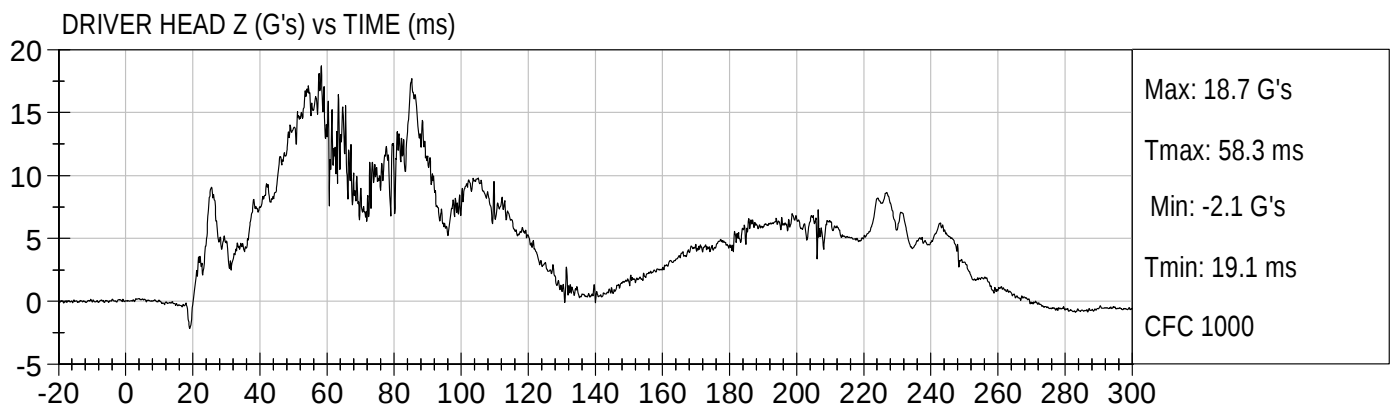
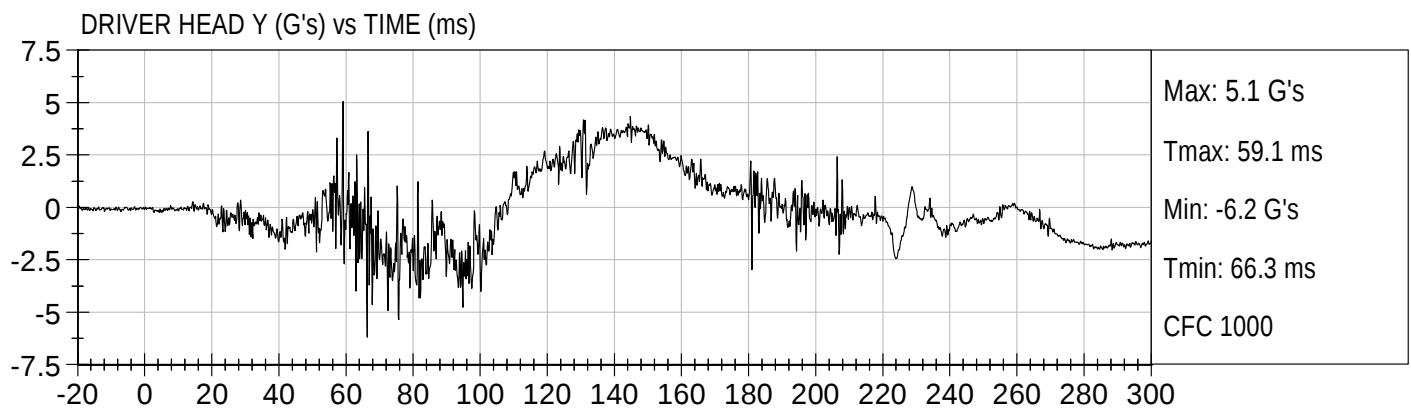
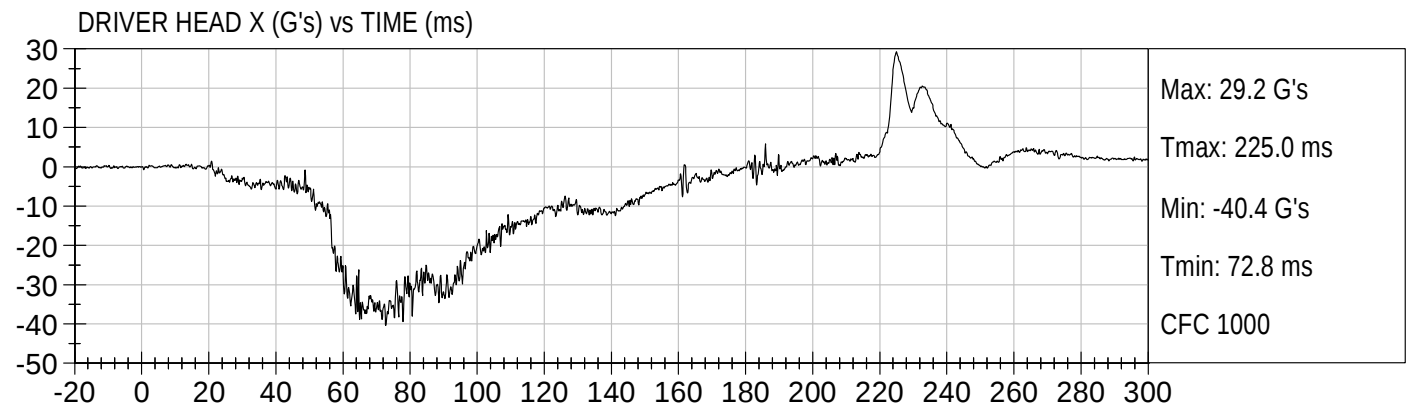
Driver Left Upper Tibia Force Z

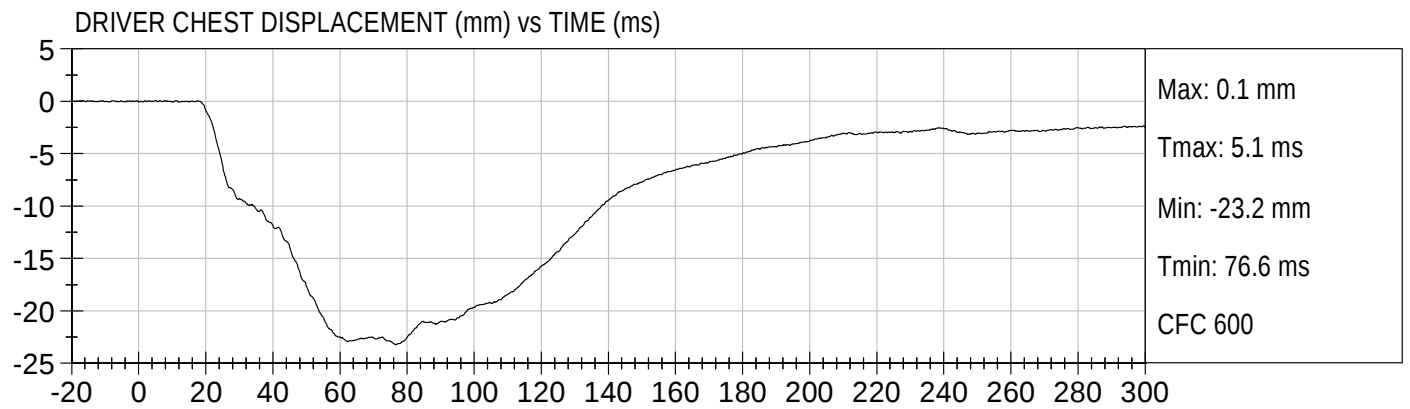
Driver Left Lower Tibia Moment X

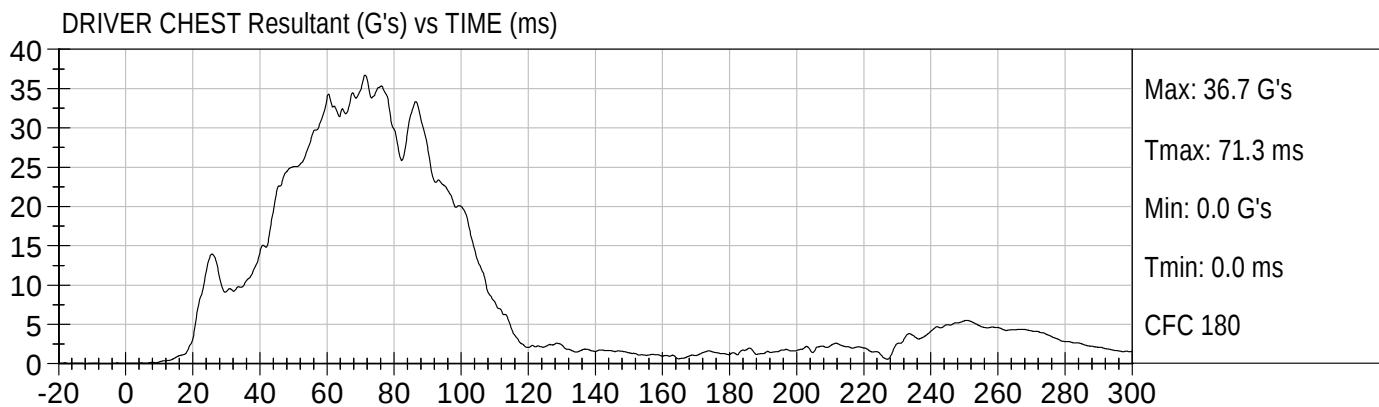
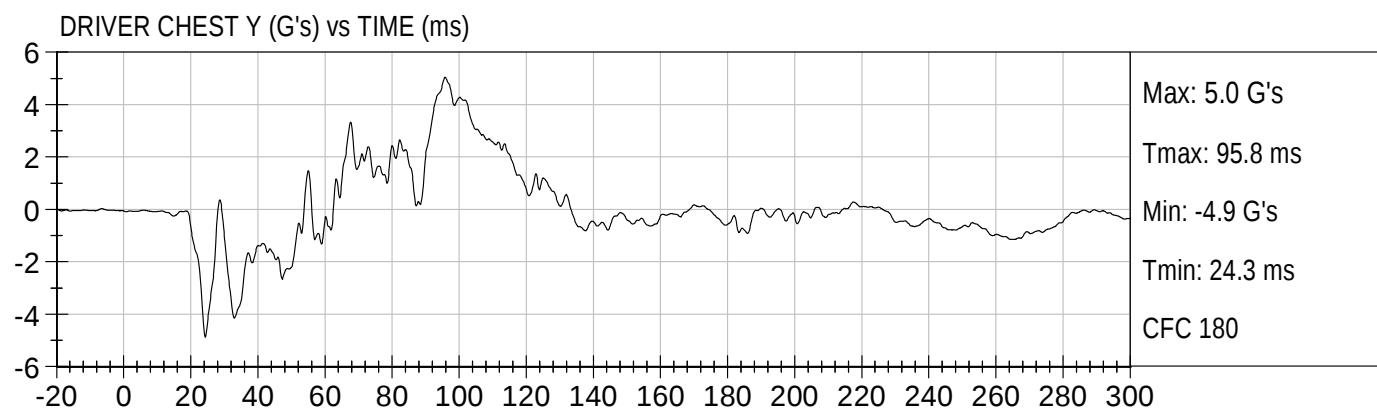
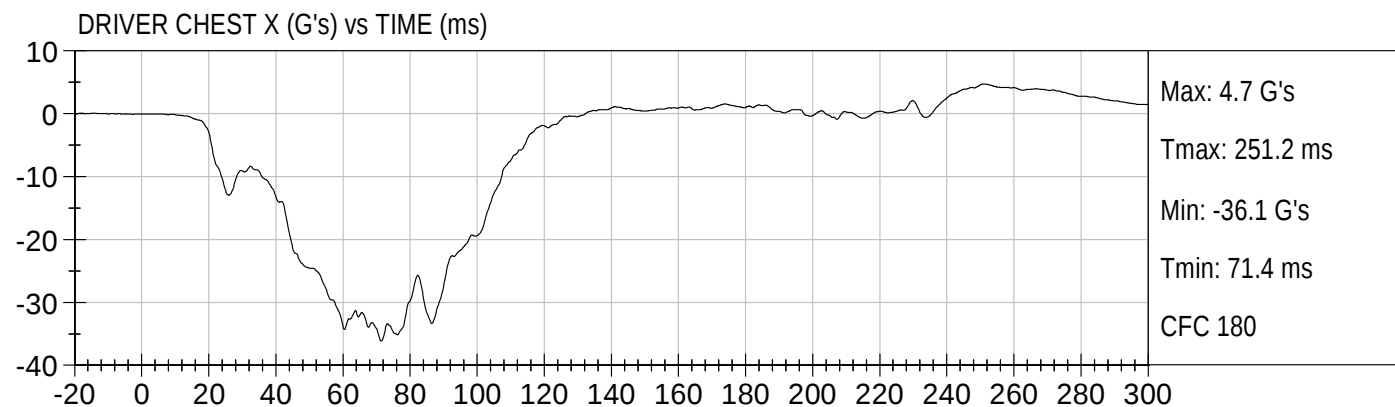
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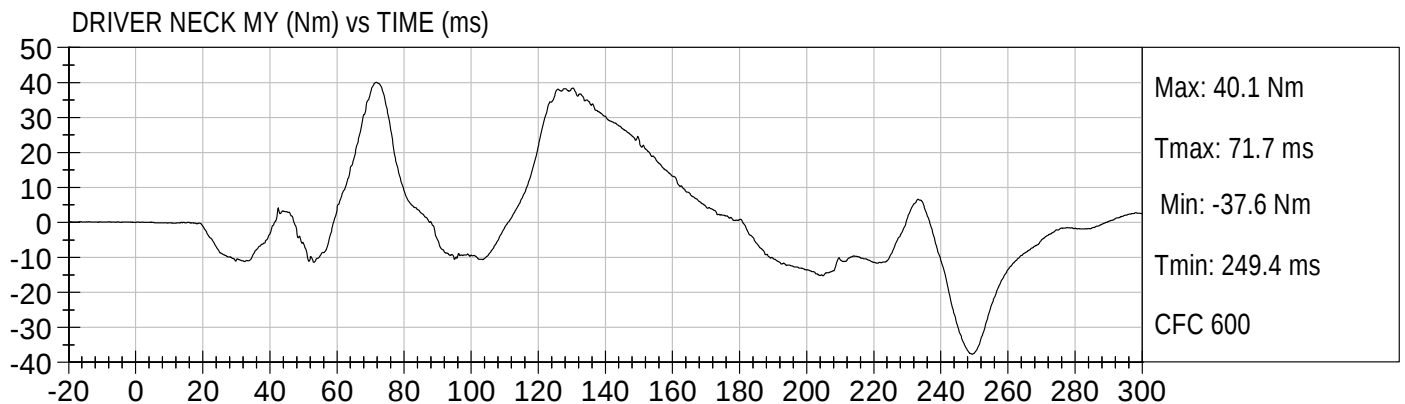
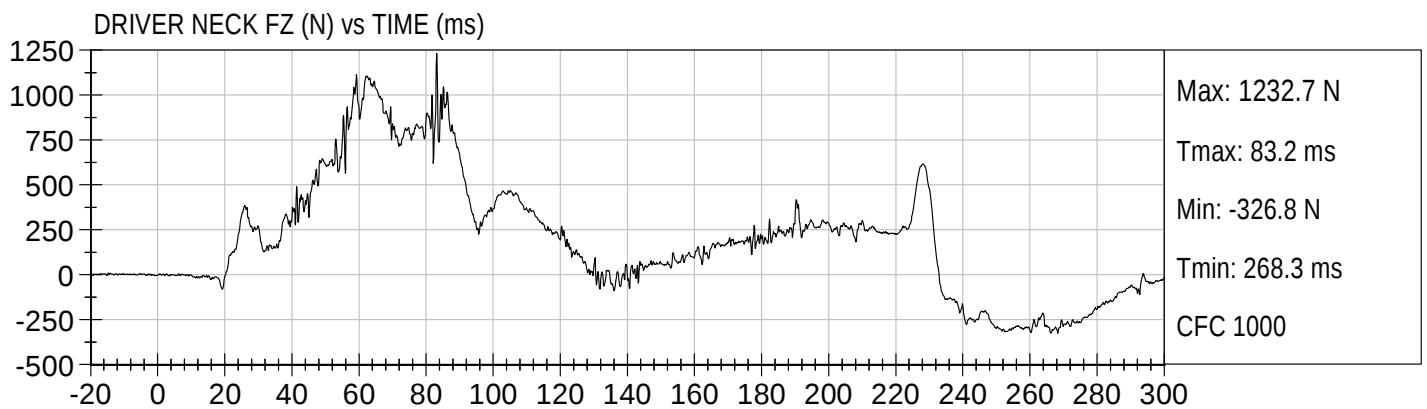
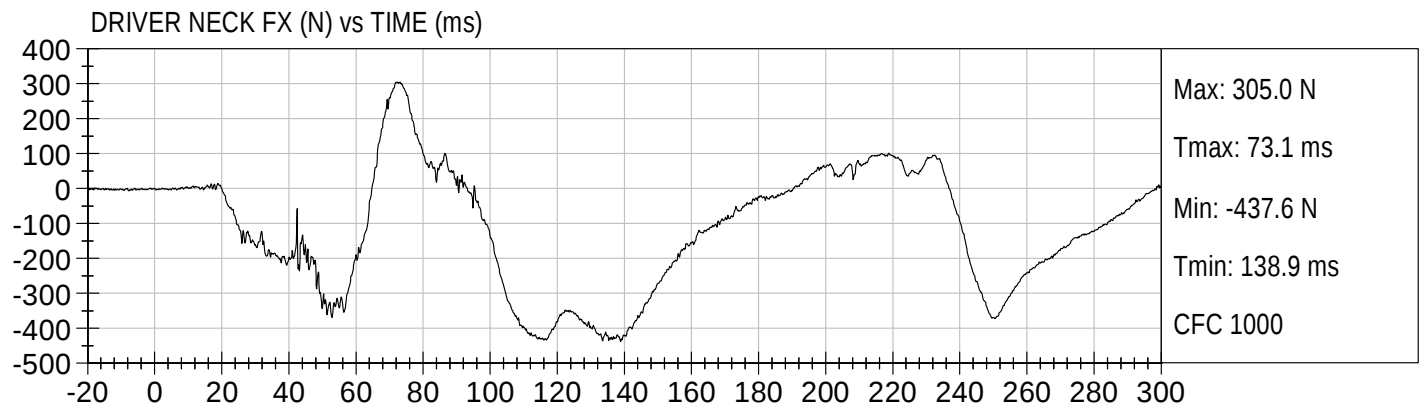
Driver Left Lower Tibia Force Z  
Driver Right Upper Tibia Moment X  
Driver Right Upper Tibia Moment Y  
Driver Right Upper Tibia Force Z  
Driver Right Lower Tibia Moment X  
Driver Right Lower Tibia Moment Y  
Driver Right Lower Tibia Force Z  
Driver Left Foot Fore Z  
Driver Left Foot Aft X  
Driver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



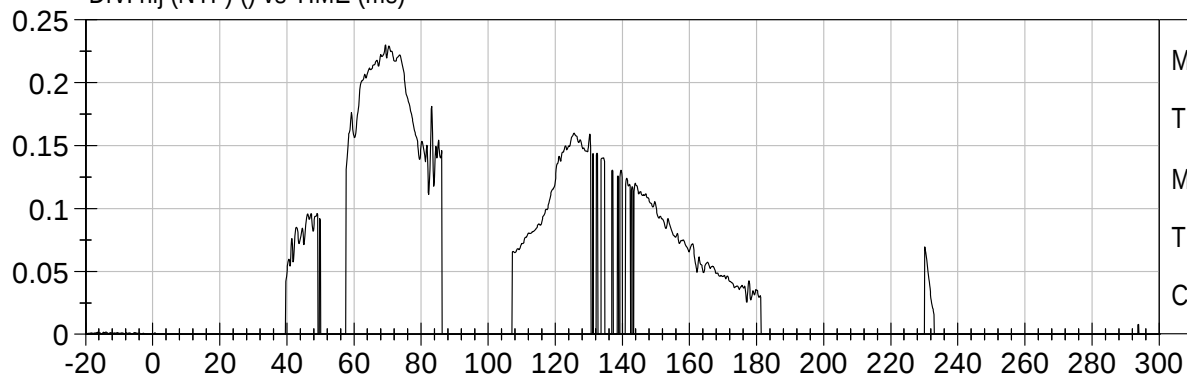






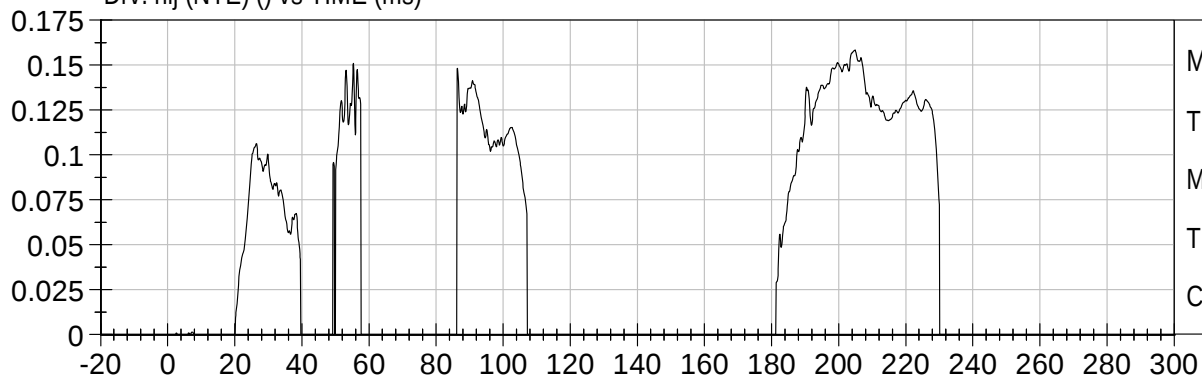


Drv. nij (NTF) () vs TIME (ms)



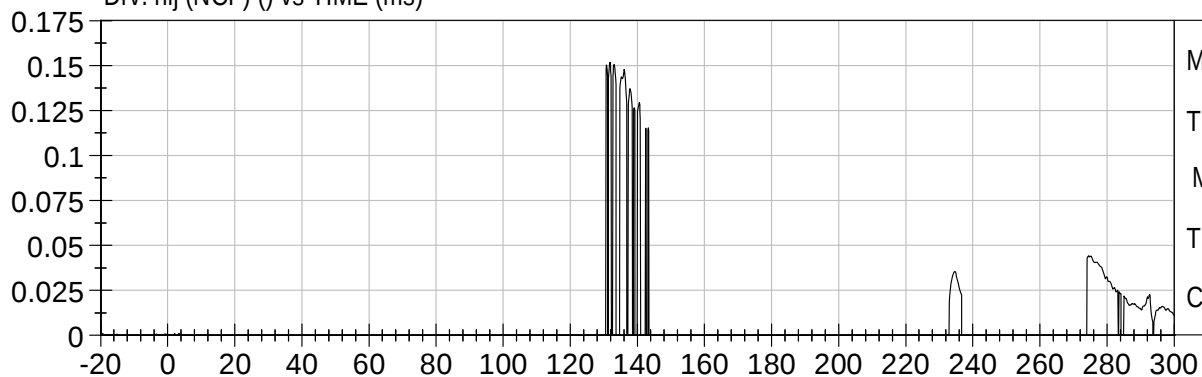
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Min: 0.0  
Tmin: 0.0 ms  
CFC 600

Drv. nij (NTE) () vs TIME (ms)



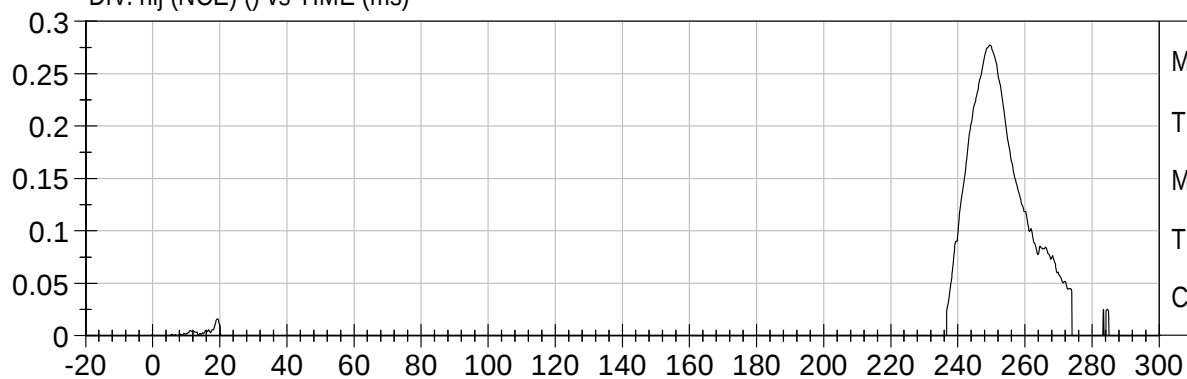
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Min: 0.0  
Tmin: 0.0 ms  
CFC 600

Drv. nij (NCF) () vs TIME (ms)

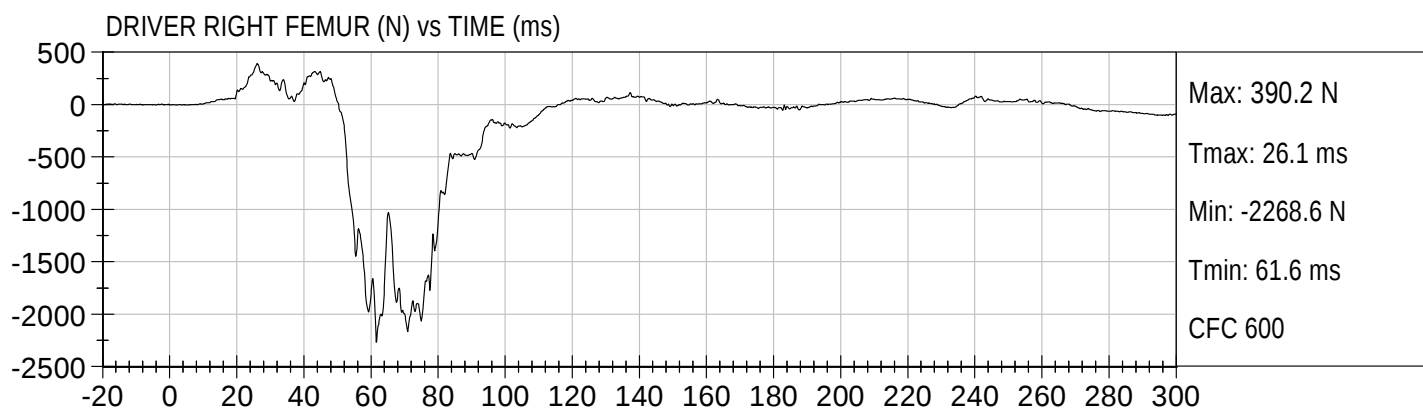
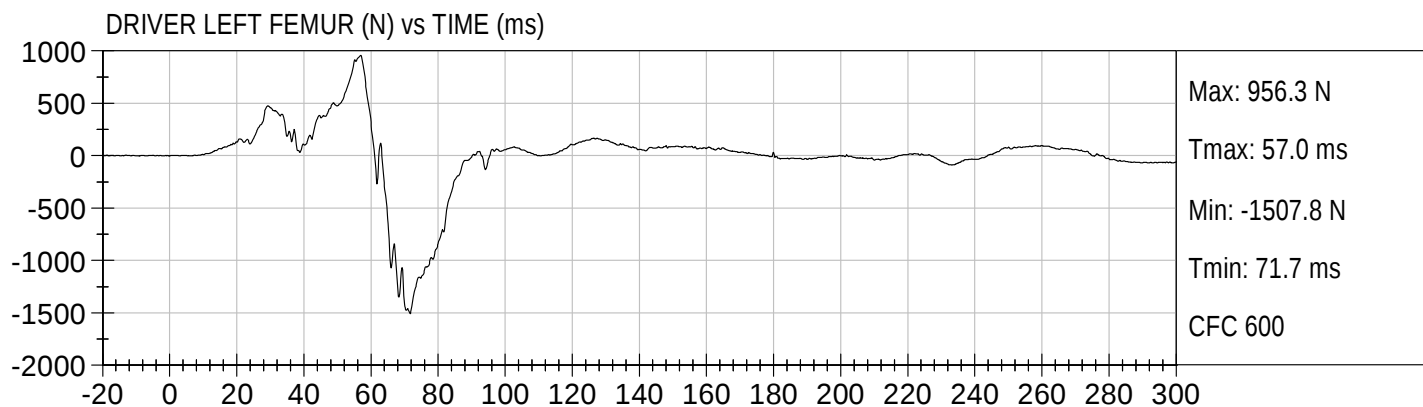


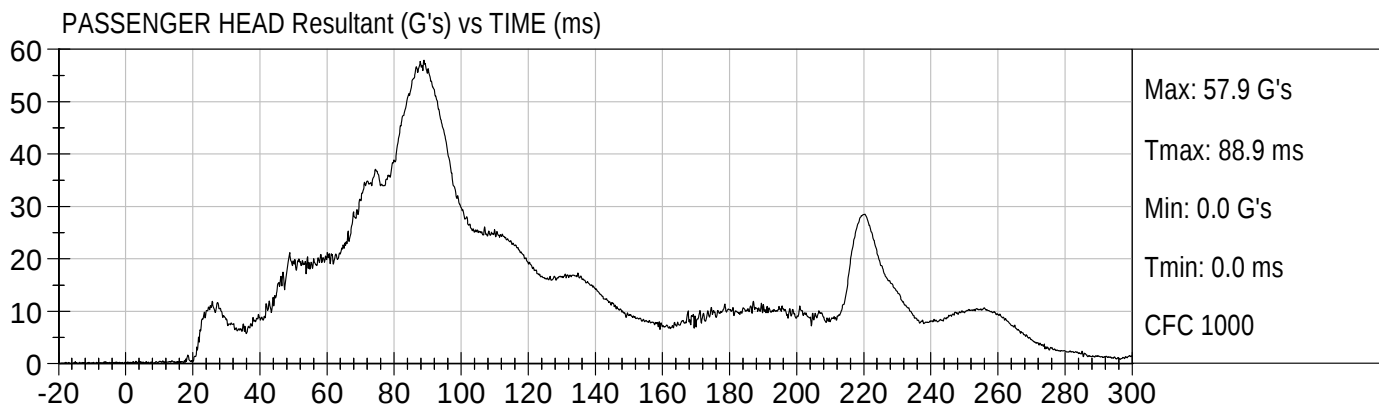
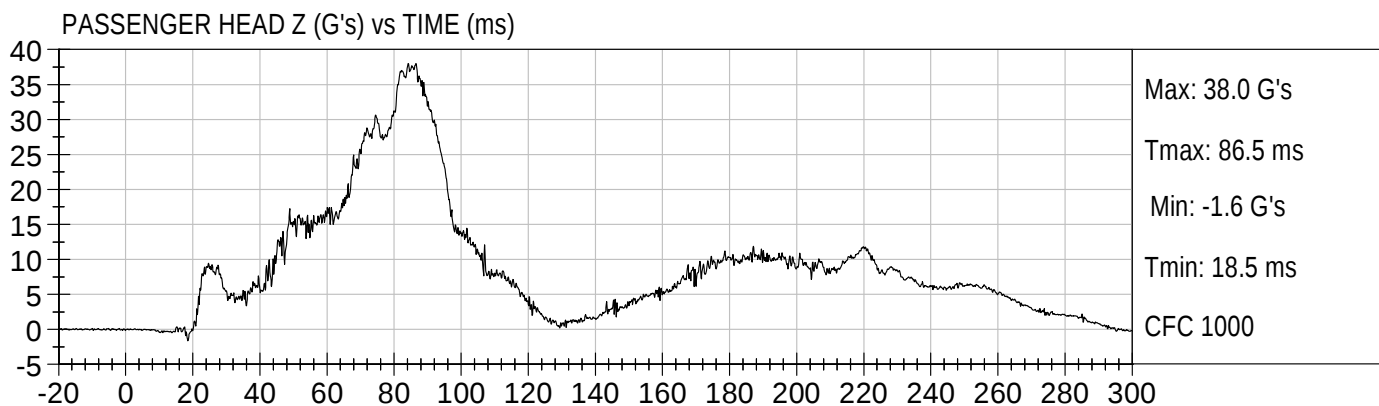
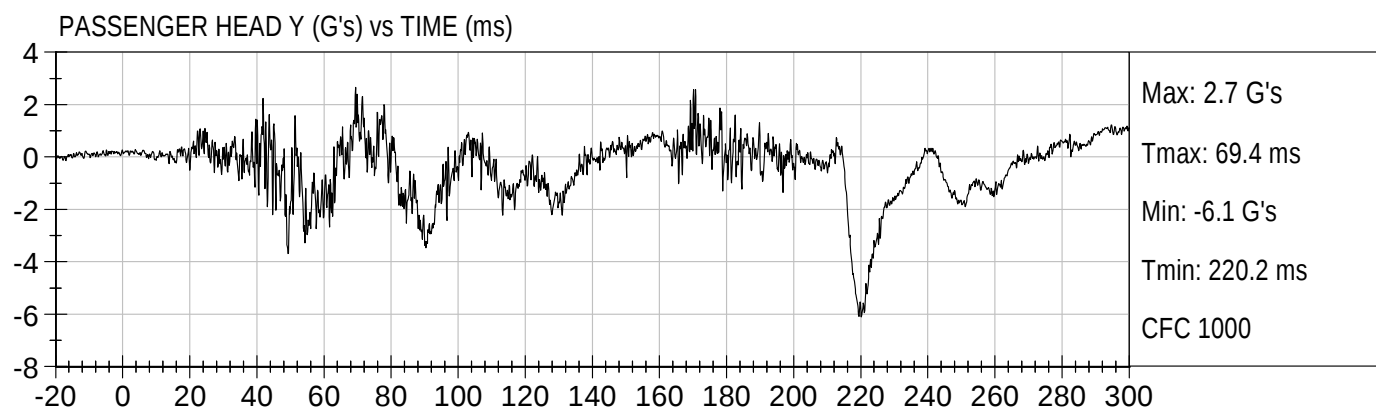
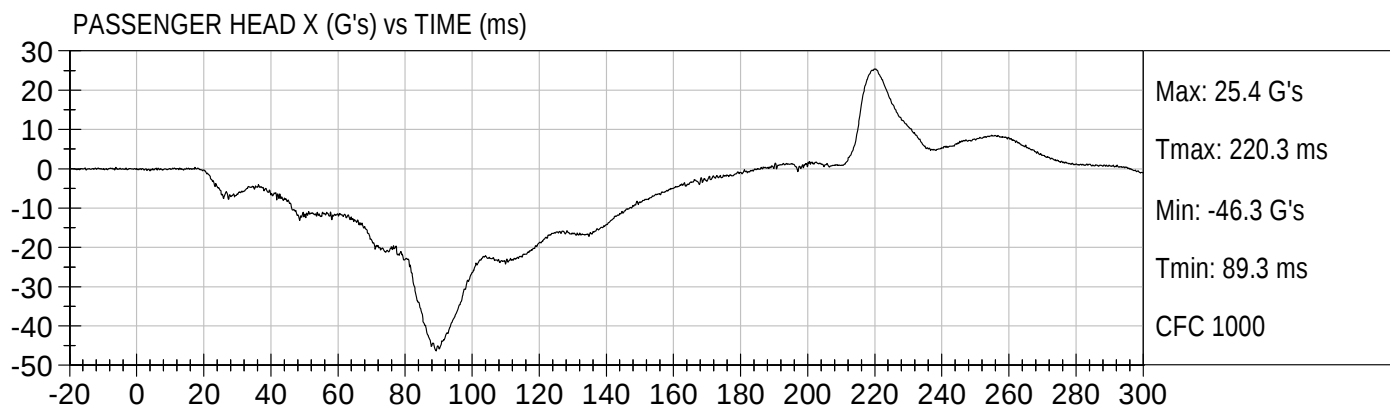
Max: 0.2  
Tmax: 131.8 ms  
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Tmin: 0.0 ms  
CFC 600

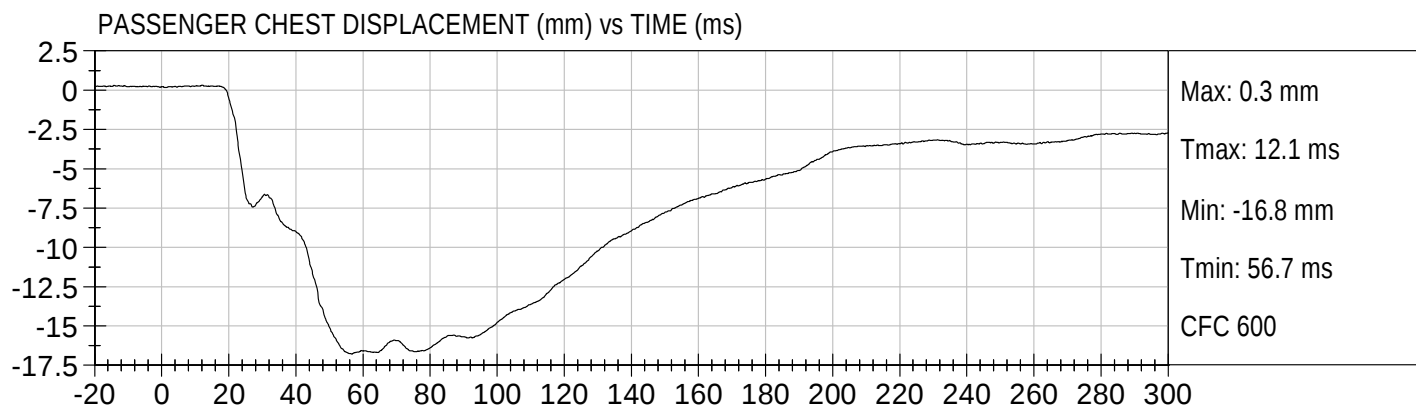
Drv. nij (NCE) () vs TIME (ms)



Max: 0.3  
Tmax: 249.6 ms  
Min: 0.0  
Tmin: 0.0 ms  
CFC 600

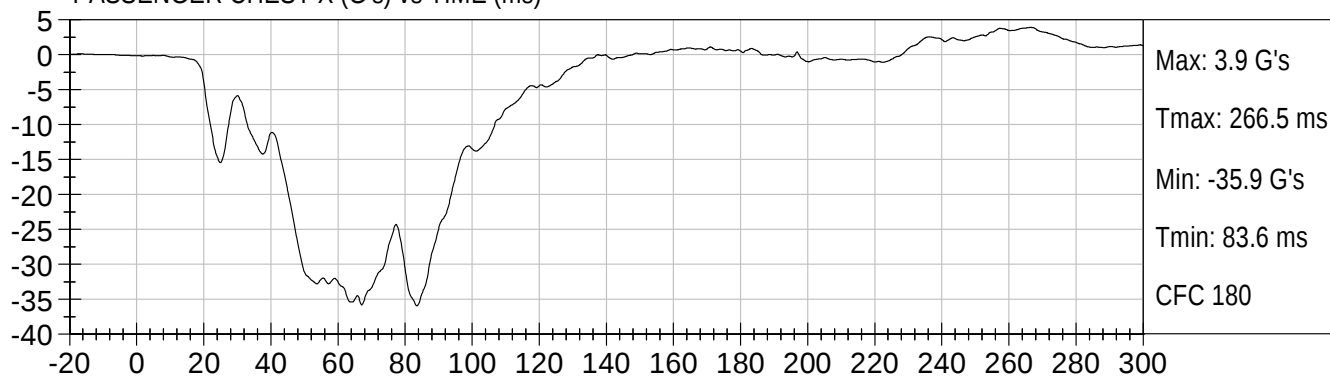




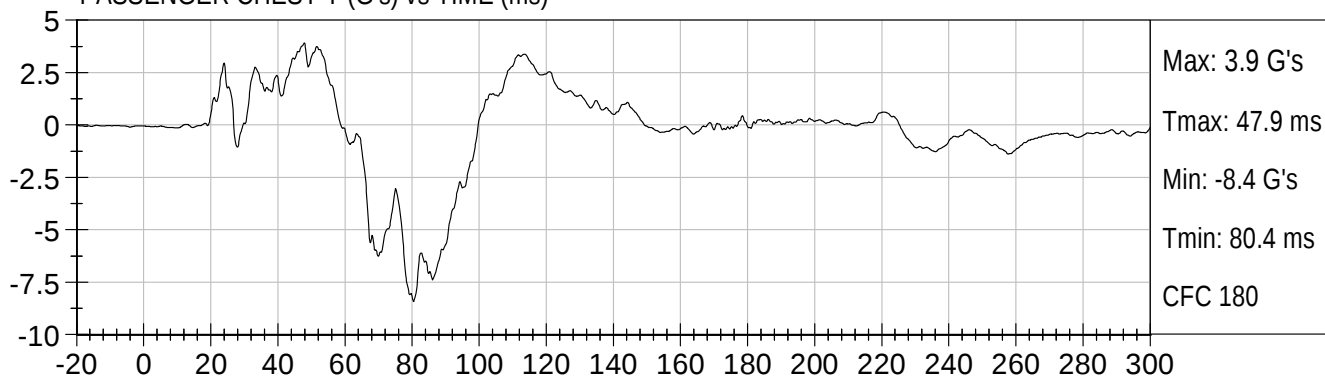




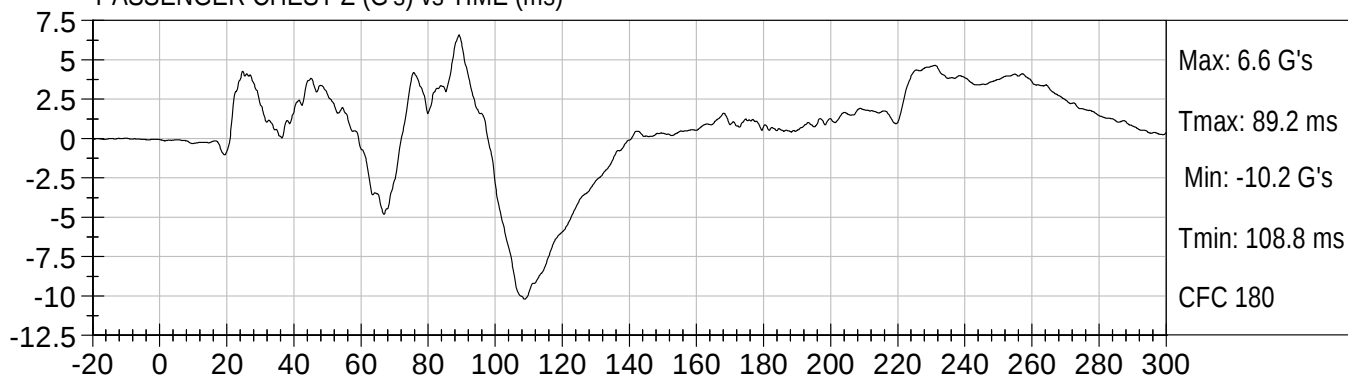
PASSENGER CHEST X (G's) vs TIME (ms)



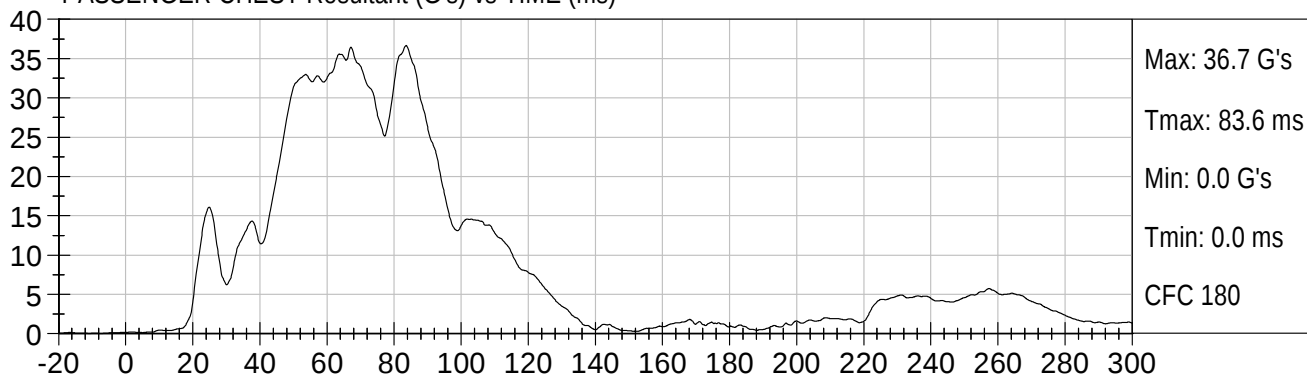
PASSENGER CHEST Y (G's) vs TIME (ms)

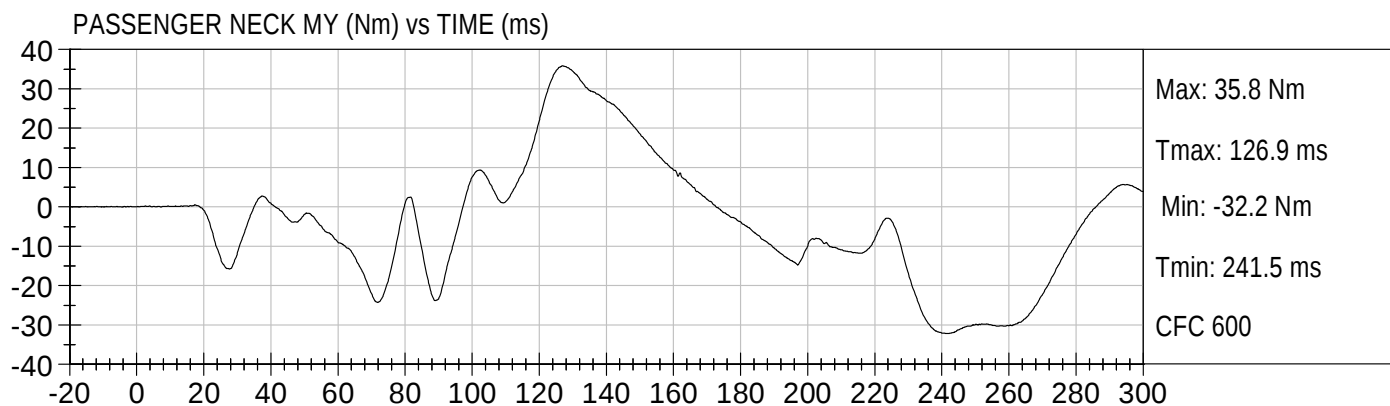
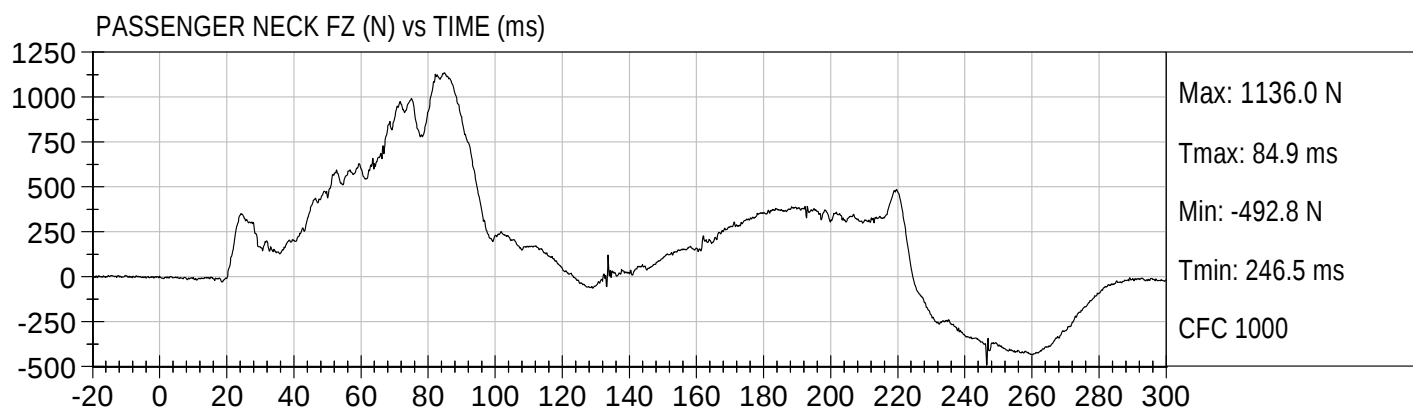
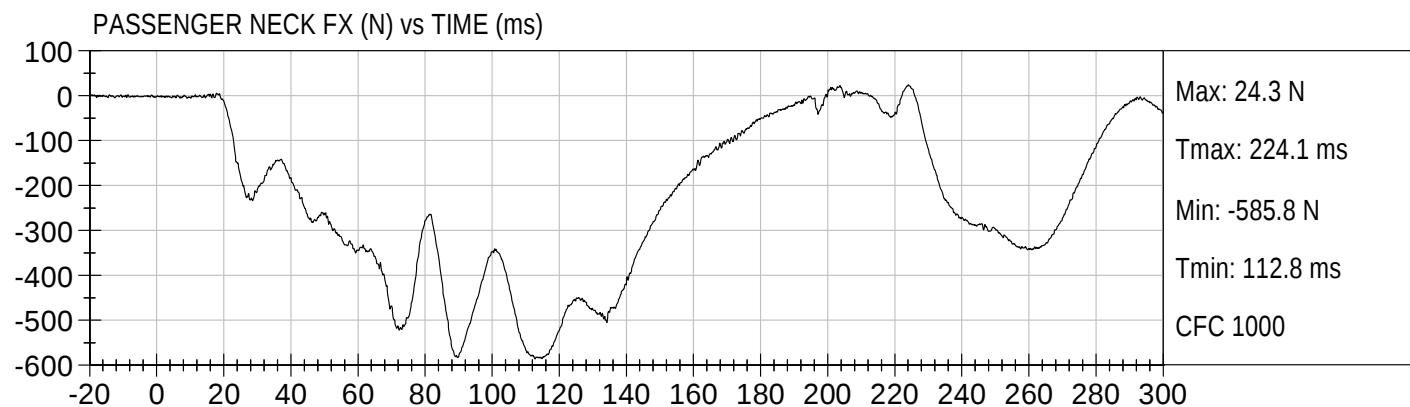


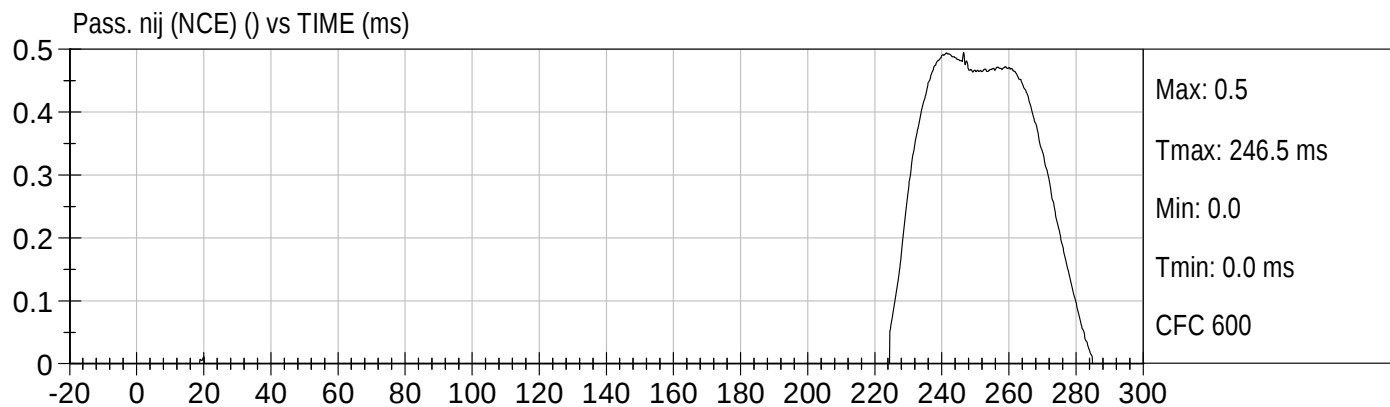
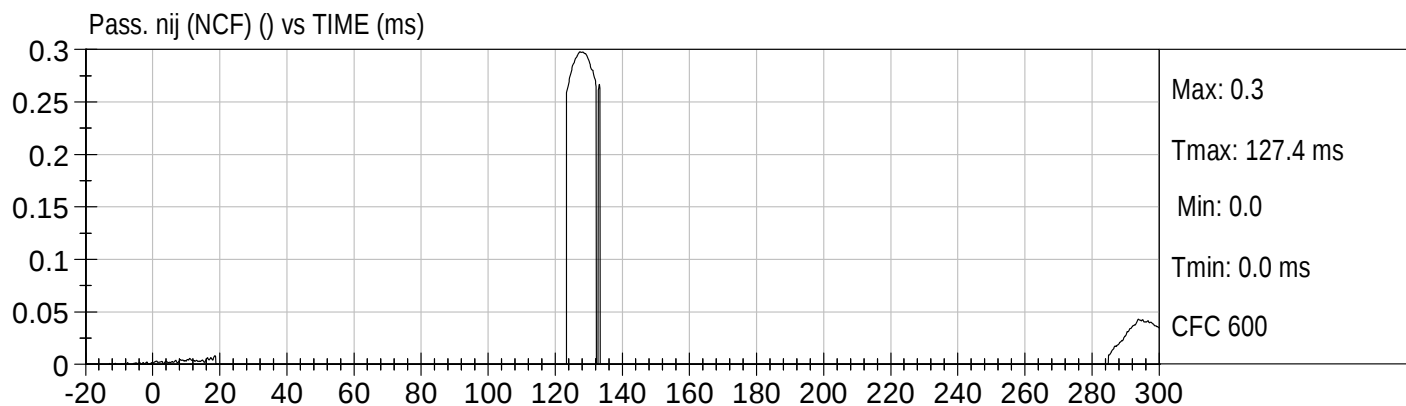
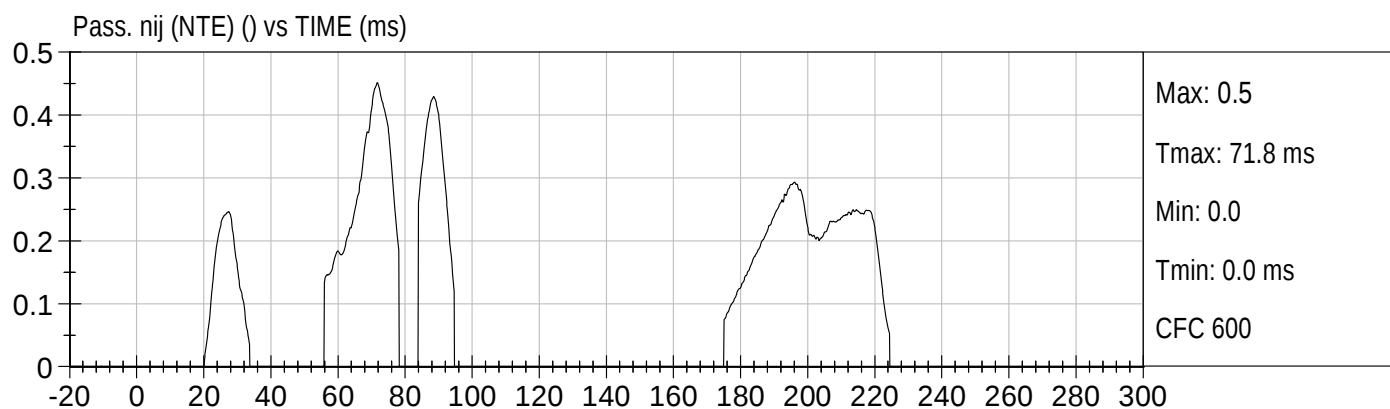
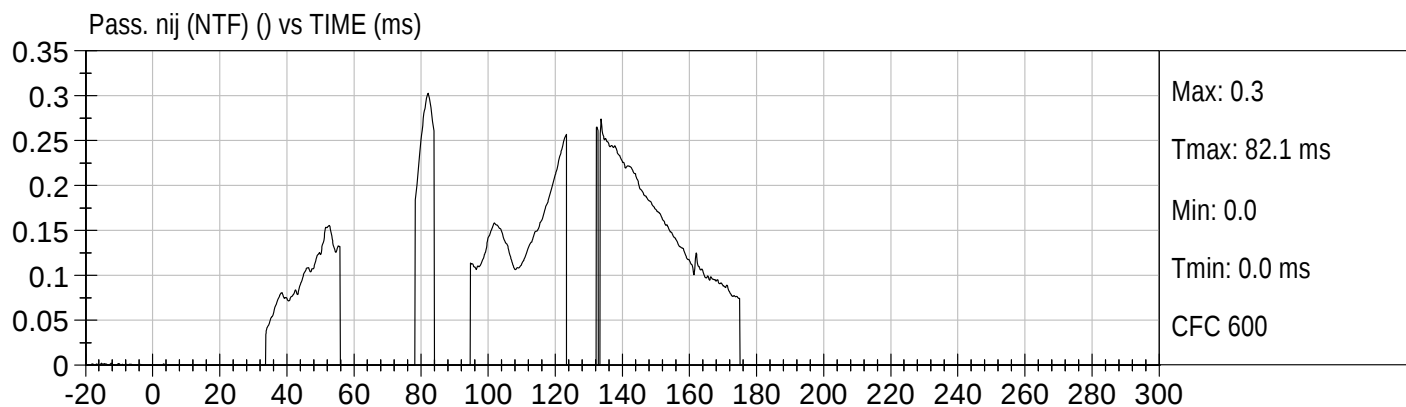
PASSENGER CHEST Z (G's) vs TIME (ms)

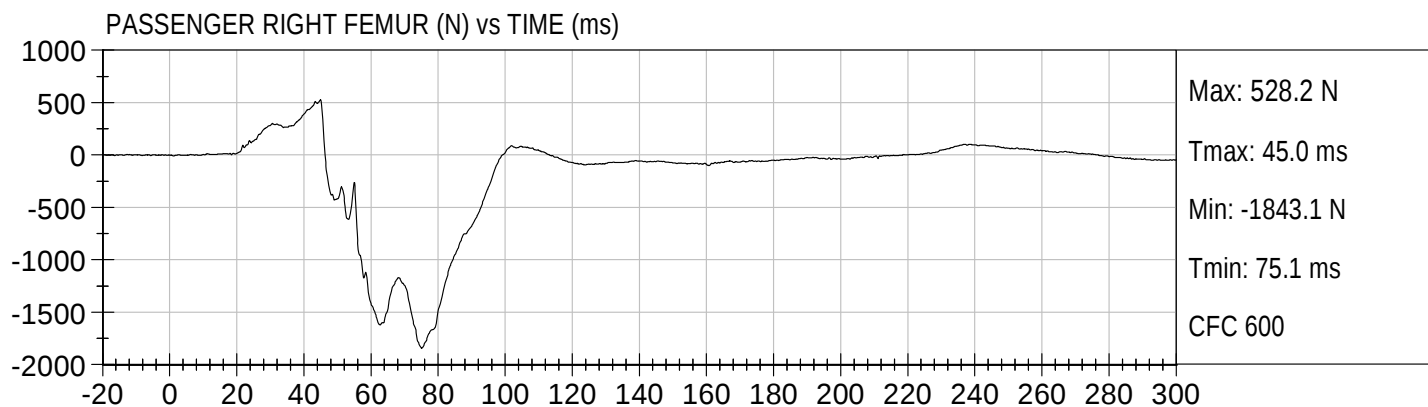
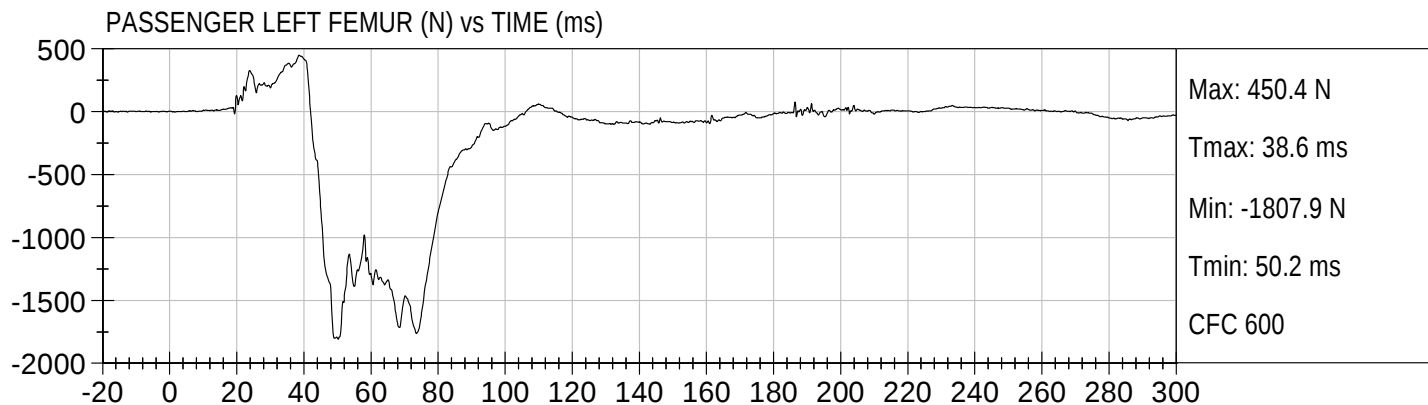


PASSENGER CHEST Resultant (G's) vs TIME (ms)









**APPENDIX C**  
**DUMMY CALIBRATION DATA**

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

**ATD Serial No:** 1045

**Test ID:** D091241

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 - 25.6        | 21.8   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 41     | Pass      |
| Peak Resultant Acceleration  | G's   | 225 - 275          | 262    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | 6.4    | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

Jessica Hall  
Laboratory Technician

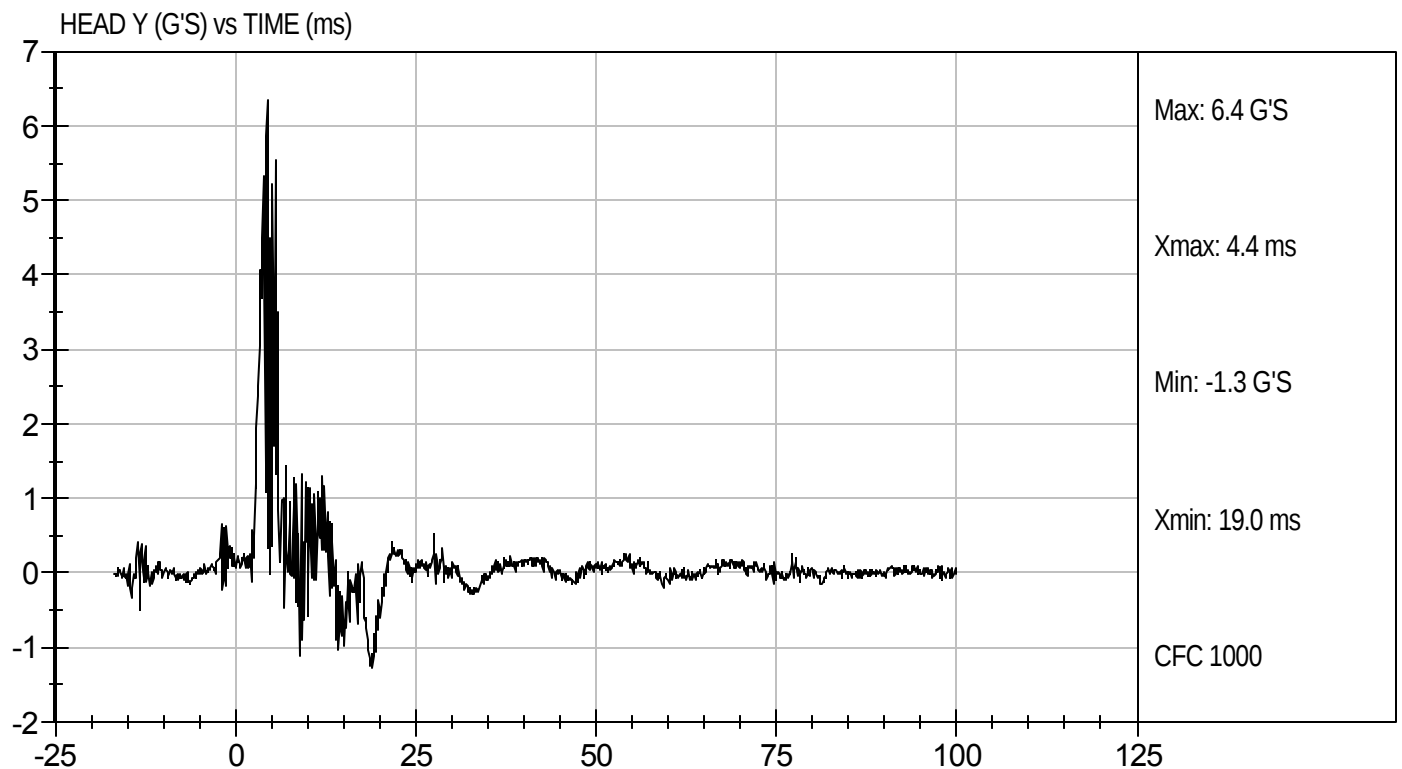
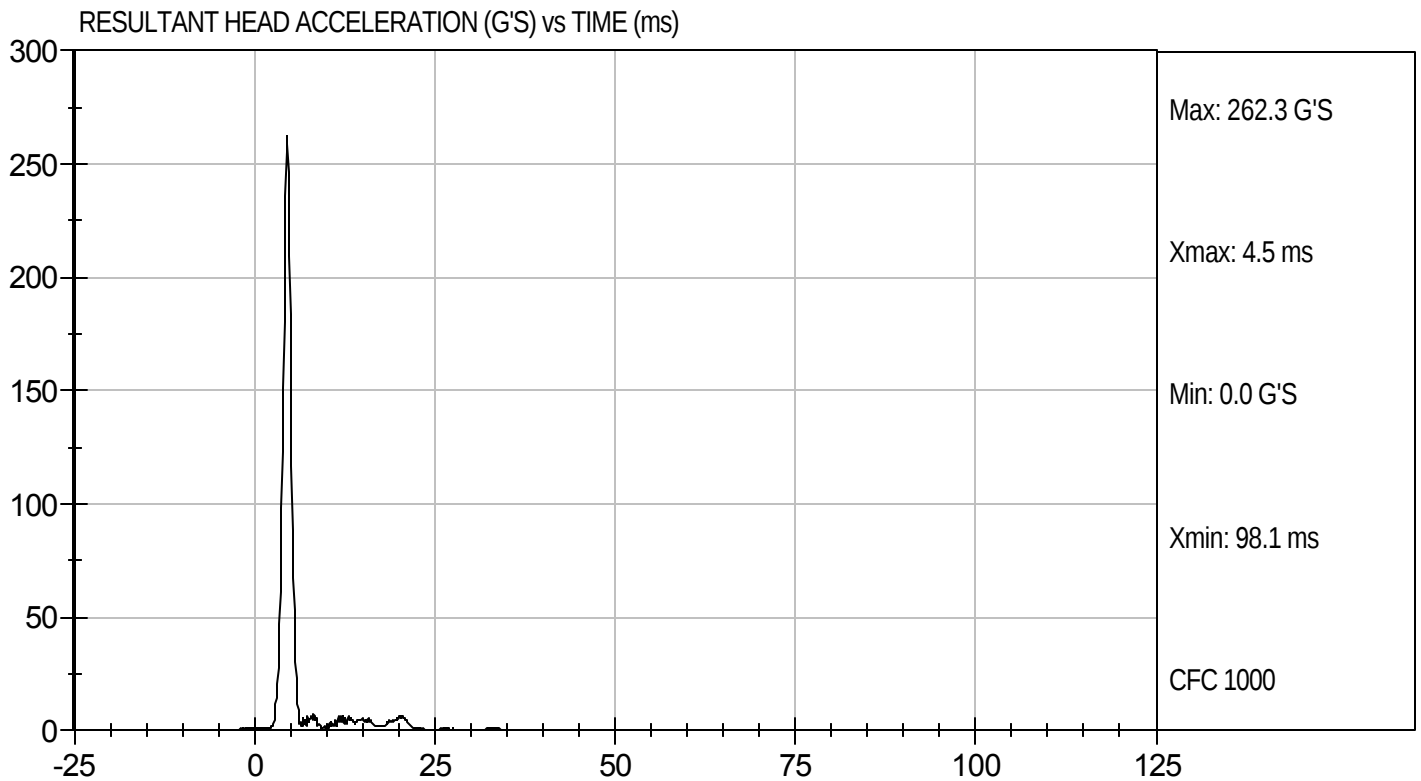
5/21/09  
Test Date

David Winkelbauer  
Approved By



Test Desc: Head Drop  
Component ID: D091241

Test Date: 5/21/09  
Velocity: 0 ft/s, 0.00 m/s



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

**ATD Serial No:** 1045

**Test I.D:** D091242

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.8   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 41     | Pass      |
| Pendulum Velocity                              |         | m/s     | 6.89 to 7.13   | 7.06   | Pass      |
| Pendulum Deceleration                          | 10 msec | G's     | 22.50 to 27.50 | 22.79  | Pass      |
|                                                | 20 msec | G's     | 17.60 to 22.60 | 20.41  | Pass      |
|                                                | 30 msec | G's     | 12.50 to 18.50 | 13.98  | Pass      |
| Peak Pendulum Deceleration After 30 msec       |         | G's     | <= 29.0        | 13.92  | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | msec    | 34.0 to 42.0   | 41.7   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 64.0 to 78.0   | 64.8   | Pass      |
|                                                | Time    | msec    | 57.0 to 64.0   | 57.3   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | msec    | 113.0 to 128.0 | 114.6  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | 88.1 to 108.5  | 94.7   | Pass      |
|                                                | Time    | msec    | 47.0 to 58.0   | 52.4   | Pass      |
| Positive Moment Decay Time To Zero Crossing    |         | msec    | 97.0 to 107.0  | 98.8   | Pass      |
| Overall Test Results                           |         |         |                |        | Pass      |

  
 Laboratory Technician

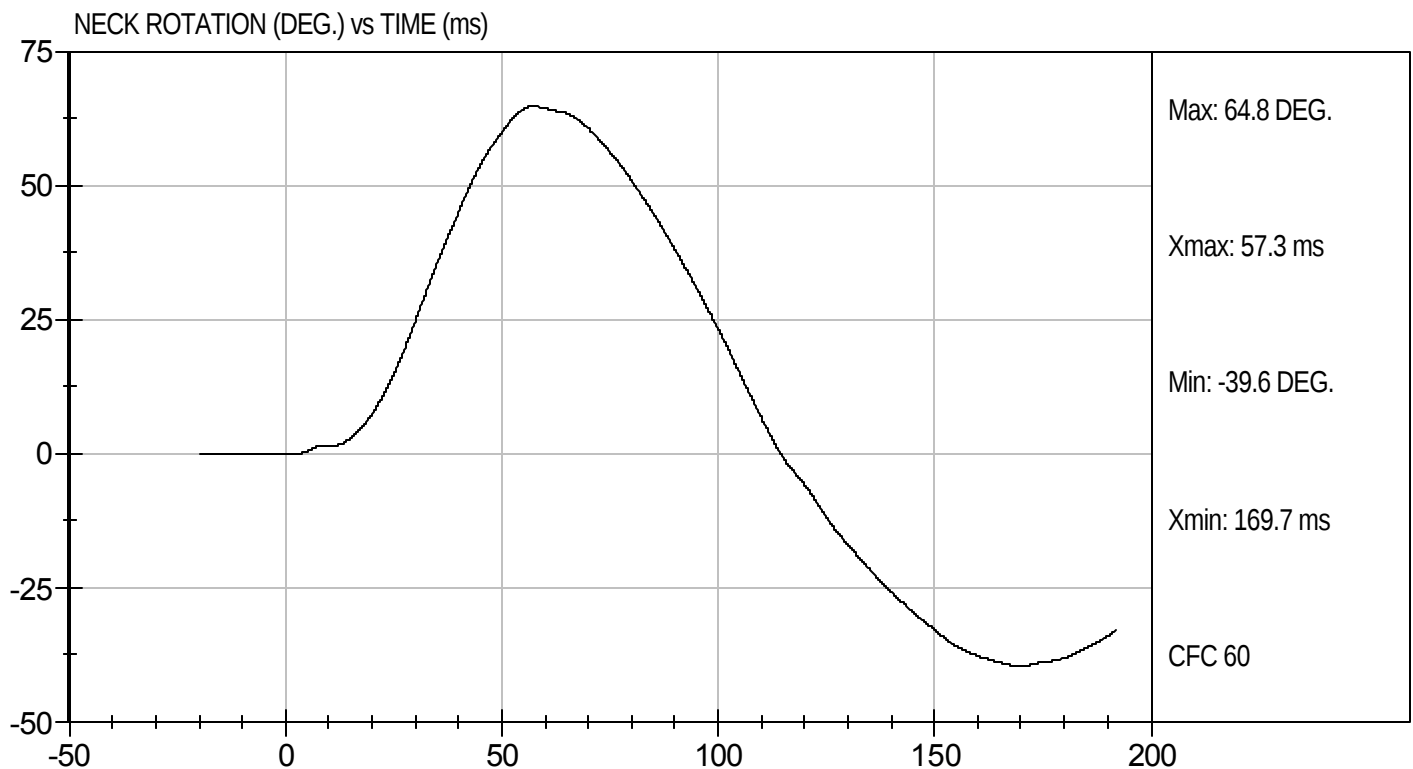
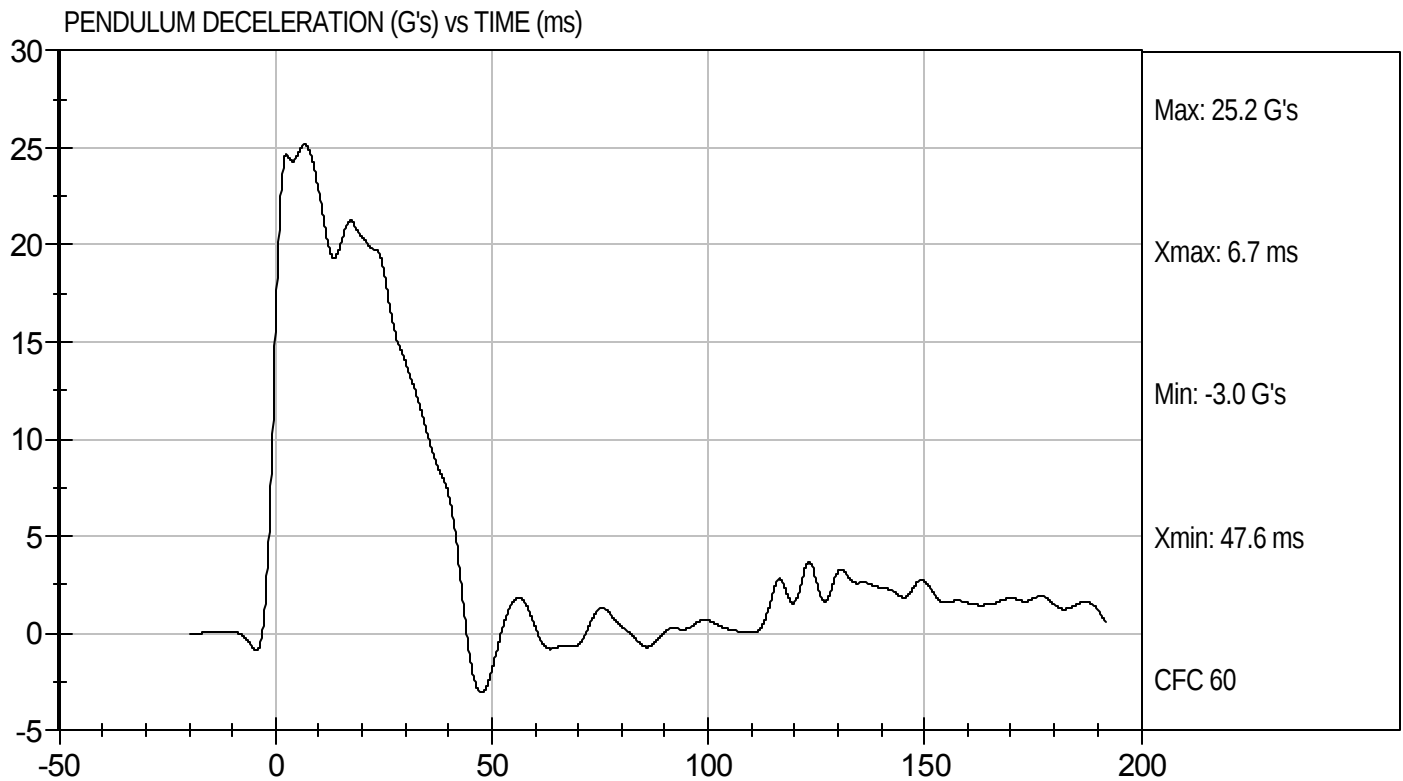
5/21/09  
 Test Date

  
 Approved By



Test Desc: Neck Flexion  
Component ID: D091242

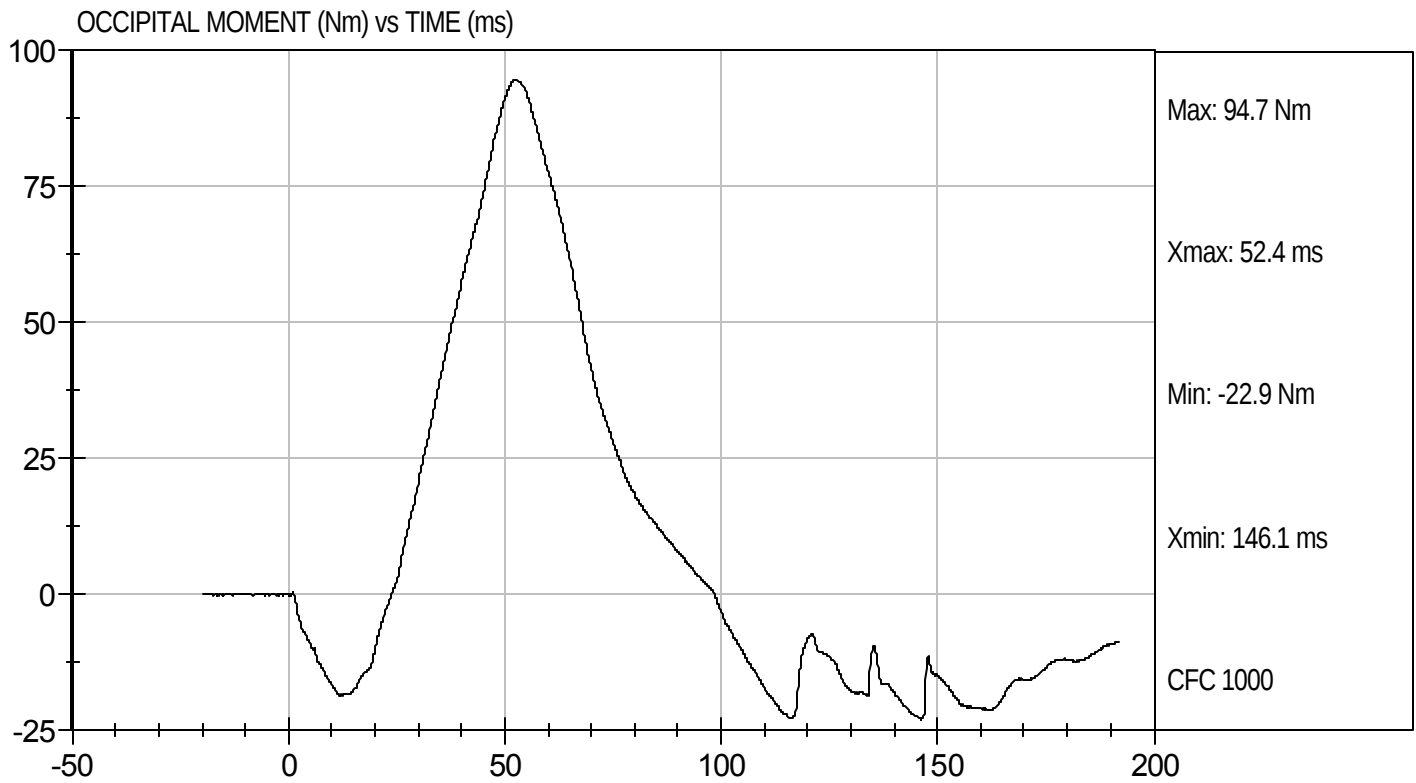
Test Date: 5/21/09  
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion  
Component ID: D091242

Test Date: 5/21/09  
Velocity: 23.15 ft/s, 7.06 m/s



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

**ATD Serial No:** 1045

**Test I.D:** D091243

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.8   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 41     | Pass      |
| Pendulum Velocity                              |         | m/s     | 5.95 to 6.19   | 6.16   | Pass      |
| Pendulum Deceleration                          | 10 msec | G's     | 17.20 to 21.20 | 19.34  | Pass      |
|                                                | 20 msec | G's     | 14.00 to 19.00 | 16.62  | Pass      |
|                                                | 30 msec | G's     | 11.00 to 16.00 | 12.58  | Pass      |
| Peak Pendulum Deceleration After 30 msec       |         | G's     | <= 22.0        | 12.56  | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | msec    | 38.0 to 46.0   | 38.7   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 81.0 to 106.0  | 87.5   | Pass      |
|                                                | Time    | msec    | 72.0 to 82.0   | 73.4   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | msec    | 147.0 to 174.0 | 147.5  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | -52.9 to -79.9 | -58.4  | Pass      |
|                                                | Time    | msec    | 65.0 to 79.0   | 70.1   | Pass      |
| Negative Moment Decay Time To Zero Crossing    |         | msec    | 120.0 to 148.0 | 134.7  | Pass      |
| Overall Test Results                           |         |         |                |        | Pass      |

Jessica Hall  
Laboratory Technician

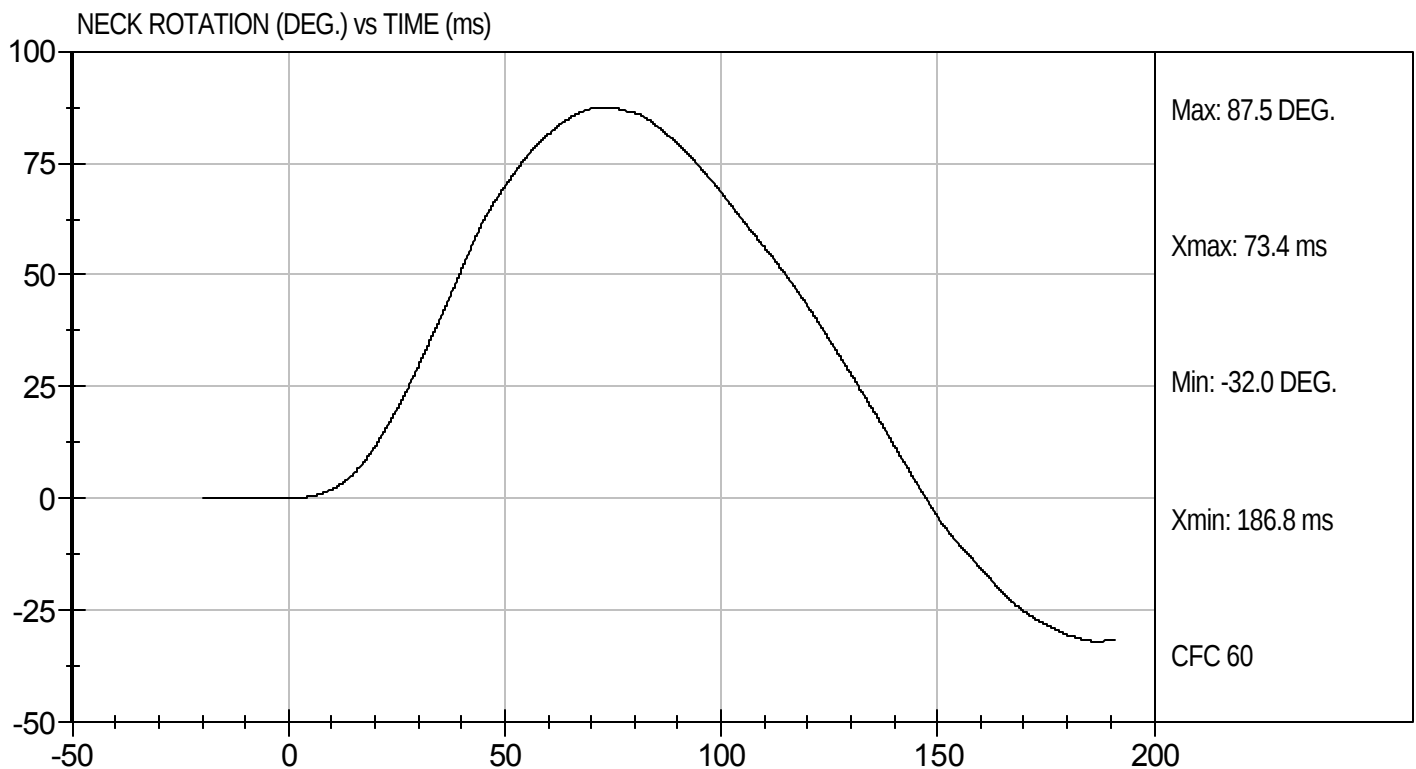
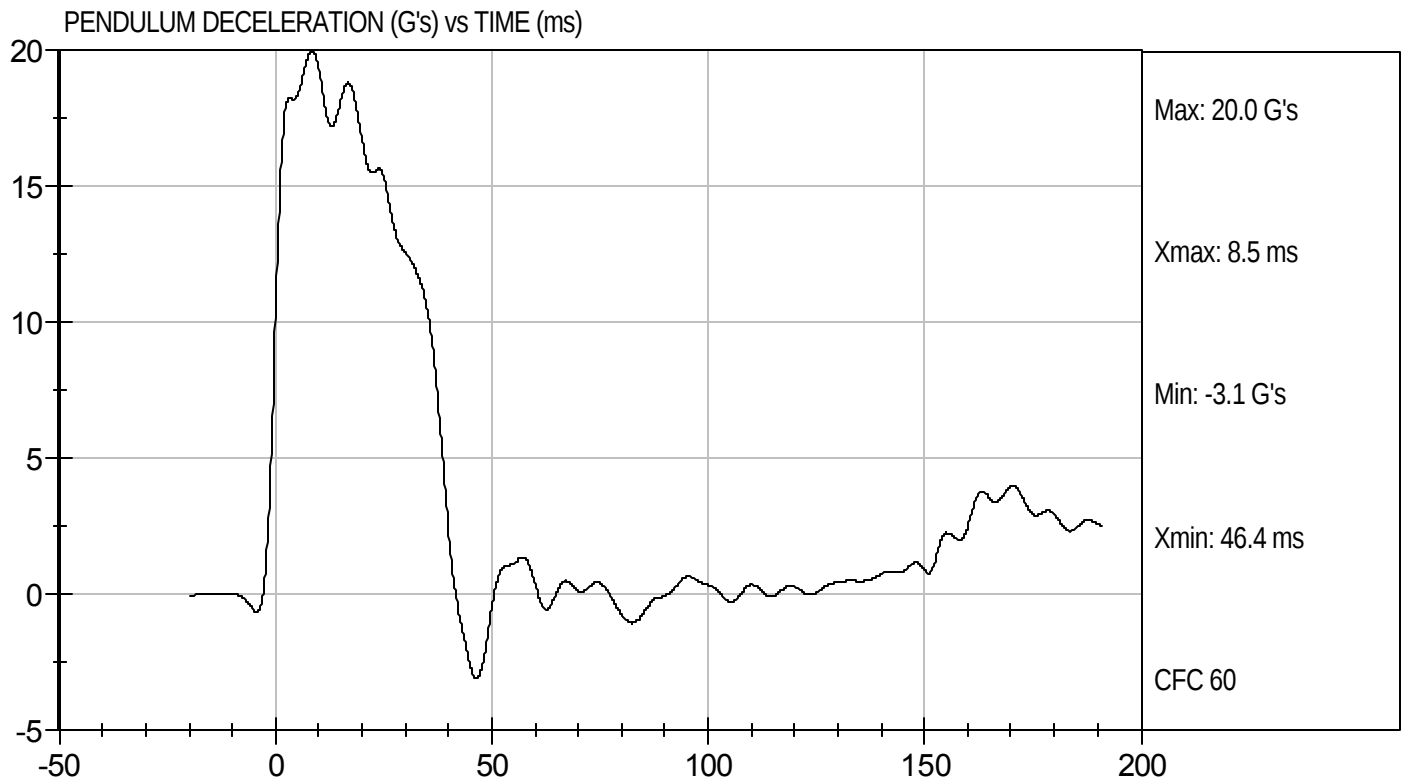
5/21/09  
Test Date

David Winkelbauer  
Approved By



Test Desc: Neck Extension  
Component ID: D091243

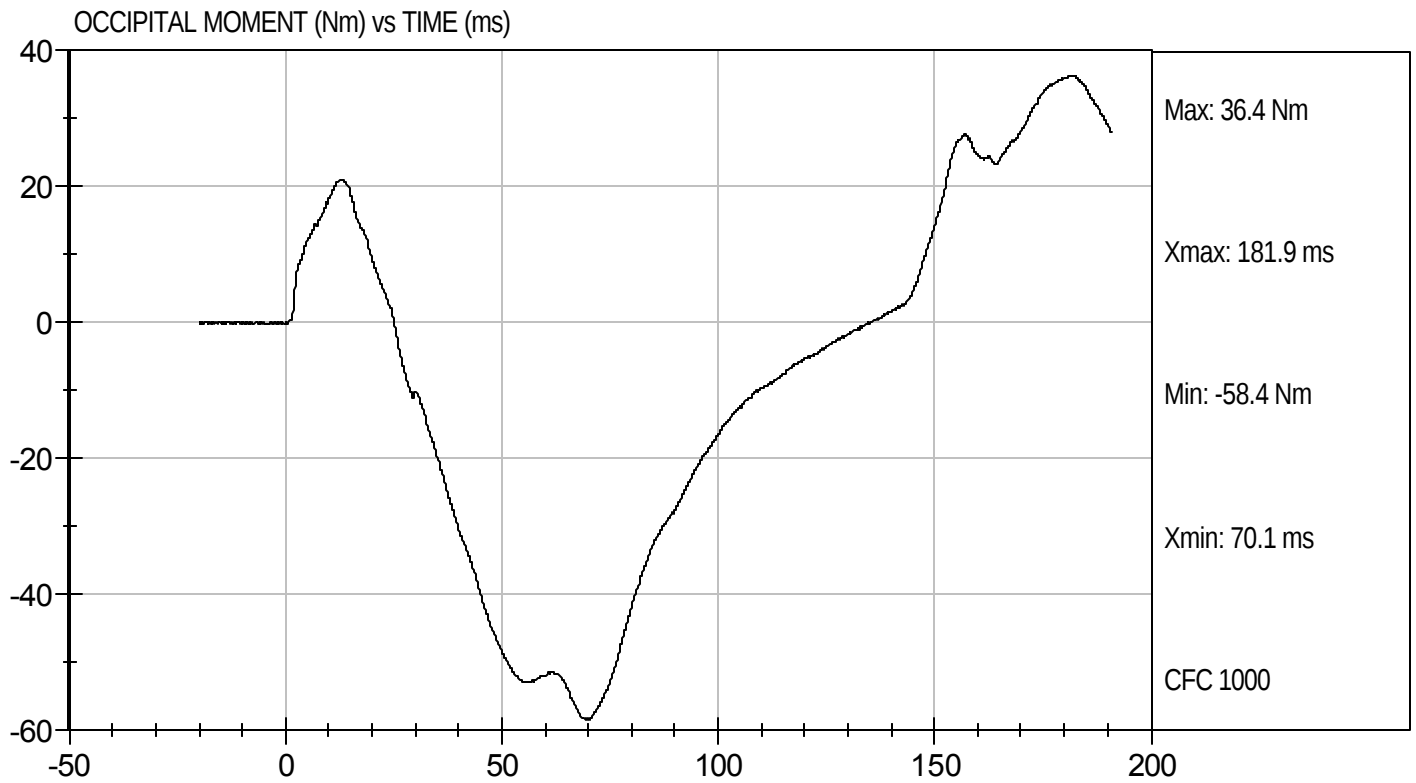
Test Date: 5/21/09  
Velocity: 20.20 ft/s, 6.16 m/s





Test Desc: Neck Extension  
Component ID: D091243

Test Date: 5/21/09  
Velocity: 20.20 ft/s, 6.16 m/s

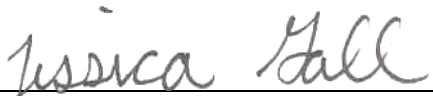


**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 1045

**Test I.D:** D091244

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 20.6 to 22.2  | 21.9   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 39     | Pass      |
| Probe Velocity               | m/s   | 6.58 to 6.82  | 6.68   | Pass      |
| Peak Probe Force             | N     | 5159 to 5893  | 5,452  | Pass      |
| Peak Sternum Displacement    | cm    | 6.35 to 7.26  | 6.43   | Pass      |
| Internal Hysteresis          | %     | 69 to 85      | 71     | Pass      |
| Overall Test Results         |       |               | Pass   |           |

  
Laboratory Technician

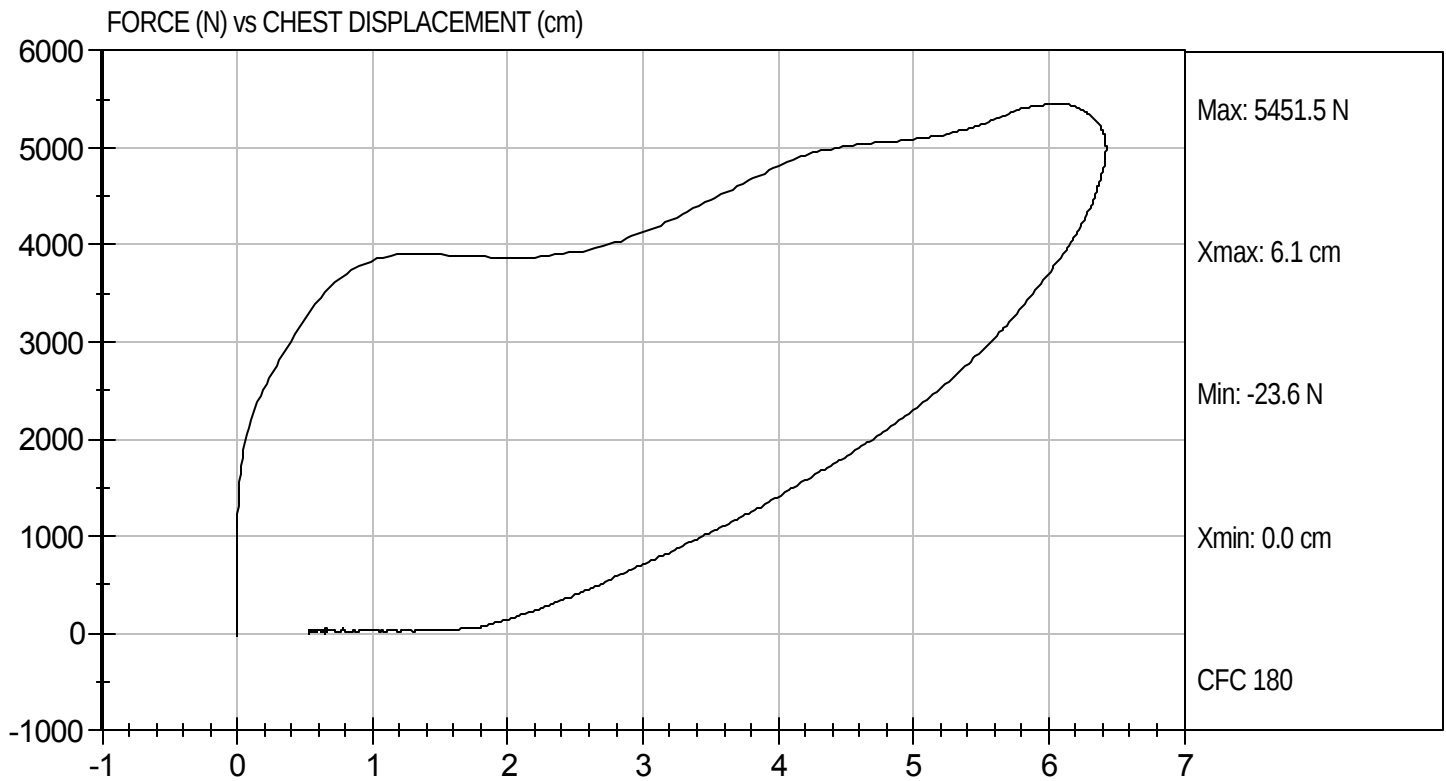
5/21/09  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Component ID: D091244

Test Date: 5/21/09  
Velocity: 21.93 ft/s, 6.68 m/s

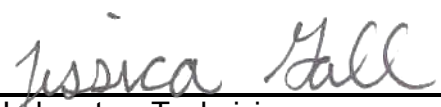


**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 1045

**Test I.D:** D091245

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 21.8   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 41     | Pass      |
| Probe Velocity               | m/sec   | 2.07 to 2.13  | 2.08   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 5,056  | Pass      |
| Overall Test Results         |         |               |        | Pass      |

  
\_\_\_\_\_  
Laboratory Technician

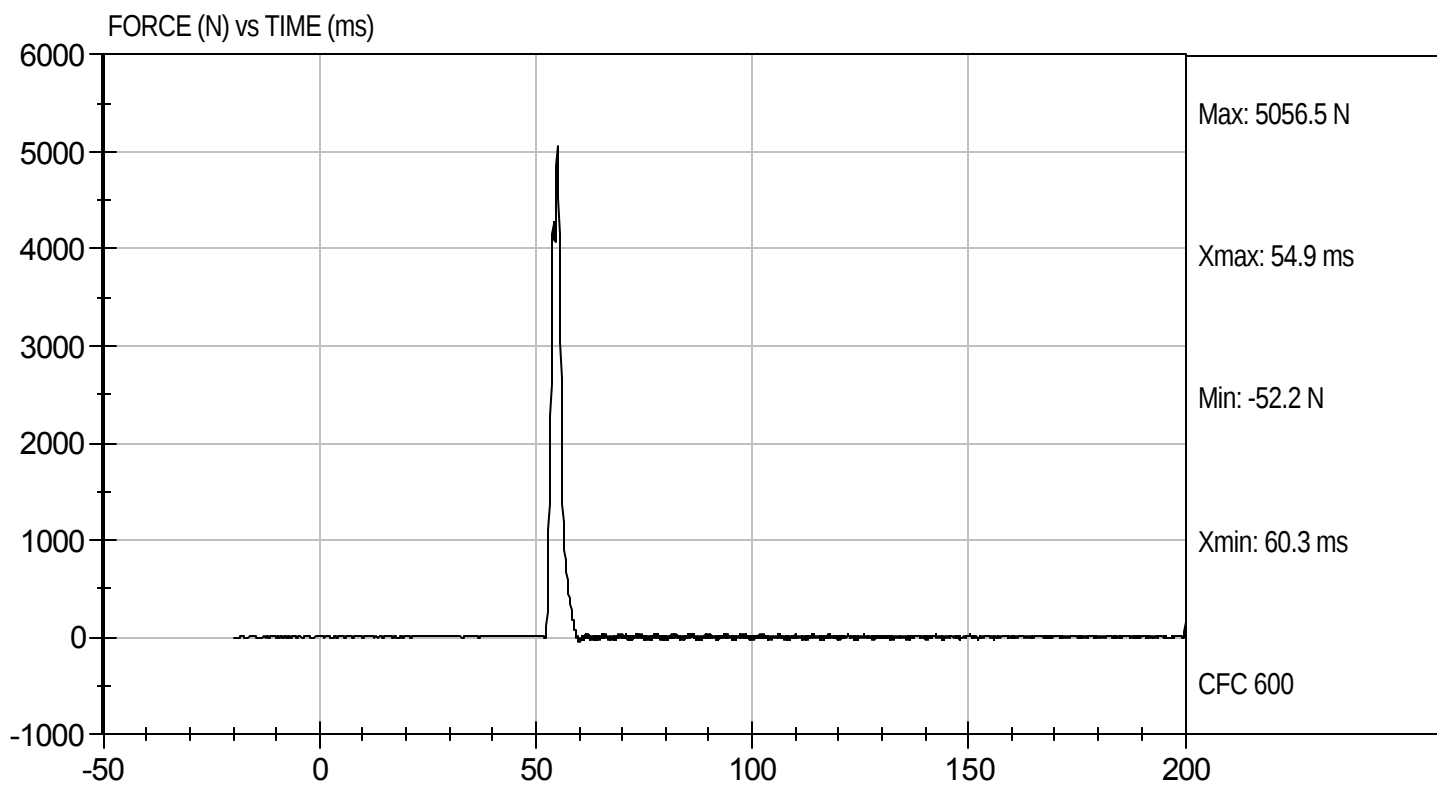
5/21/09  
Test Date

  
\_\_\_\_\_  
Approved By



Test Desc: Right Knee  
Component ID: D091245

Test Date: 5/21/09  
Velocity: 6.81 ft/s, 2.08 m/s



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

**ATD Serial No:** 1045

**Test I.D:** D091246

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 21.8   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 41     | Pass      |
| Probe Velocity               | m/sec   | 2.07 to 2.13  | 2.08   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 5,471  | Pass      |
| Overall Test Results         |         |               |        | Pass      |

Jessica Hall  
Laboratory Technician

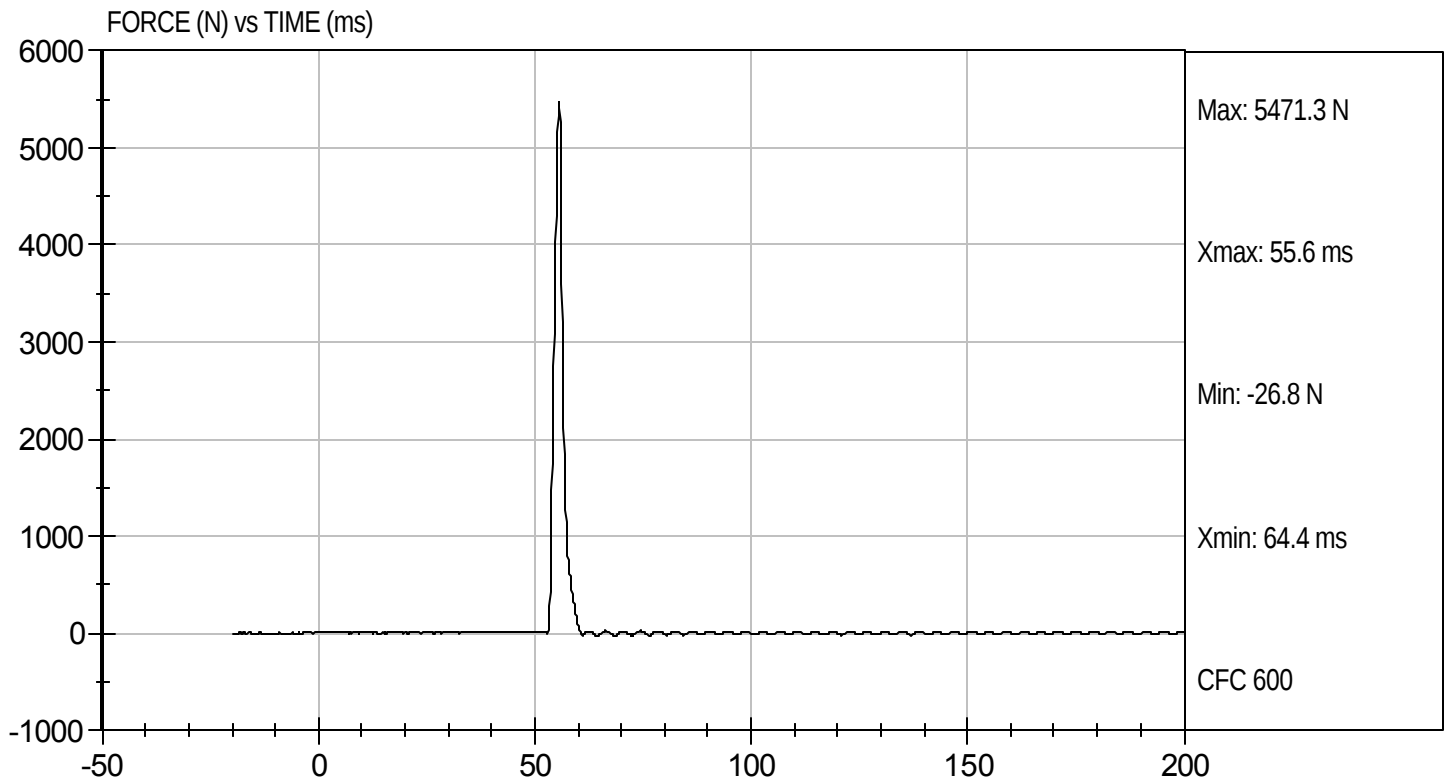
5/21/09  
Test Date

David Winkelbauer  
Approved By



Test Desc: Left Knee  
Component ID: D091246

Test Date: 5/21/09  
Velocity: 6.81 ft/s, 2.08 m/s



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

ATD Serial No: 1045

Test I.D: D091240

| Tested Parameter             | Units   | Specification                 | Result |      | Pass/Fail |
|------------------------------|---------|-------------------------------|--------|------|-----------|
|                              |         |                               | Right  | Left |           |
| Laboratory Temperature       | deg C   | 18.9 to 25.6                  | 21.3   | 21.3 | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70                      | 42     | 42   | Pass      |
| Rotation Rate                | deg/sec | 5 -10                         | 8      | 8    | Pass      |
| 30 Degrees                   | Nm      | 94.9 Nm Max                   | 65.7   | 58.9 | Pass      |
| 150 ft-lbf / 203.4 Nm        | Deg     | 40- 50 Degree<br>Max Rotation | 41     | 41   | Pass      |
| Overall Test Results         |         |                               |        |      | Pass      |

Jessica Hall  
Laboratory Technician

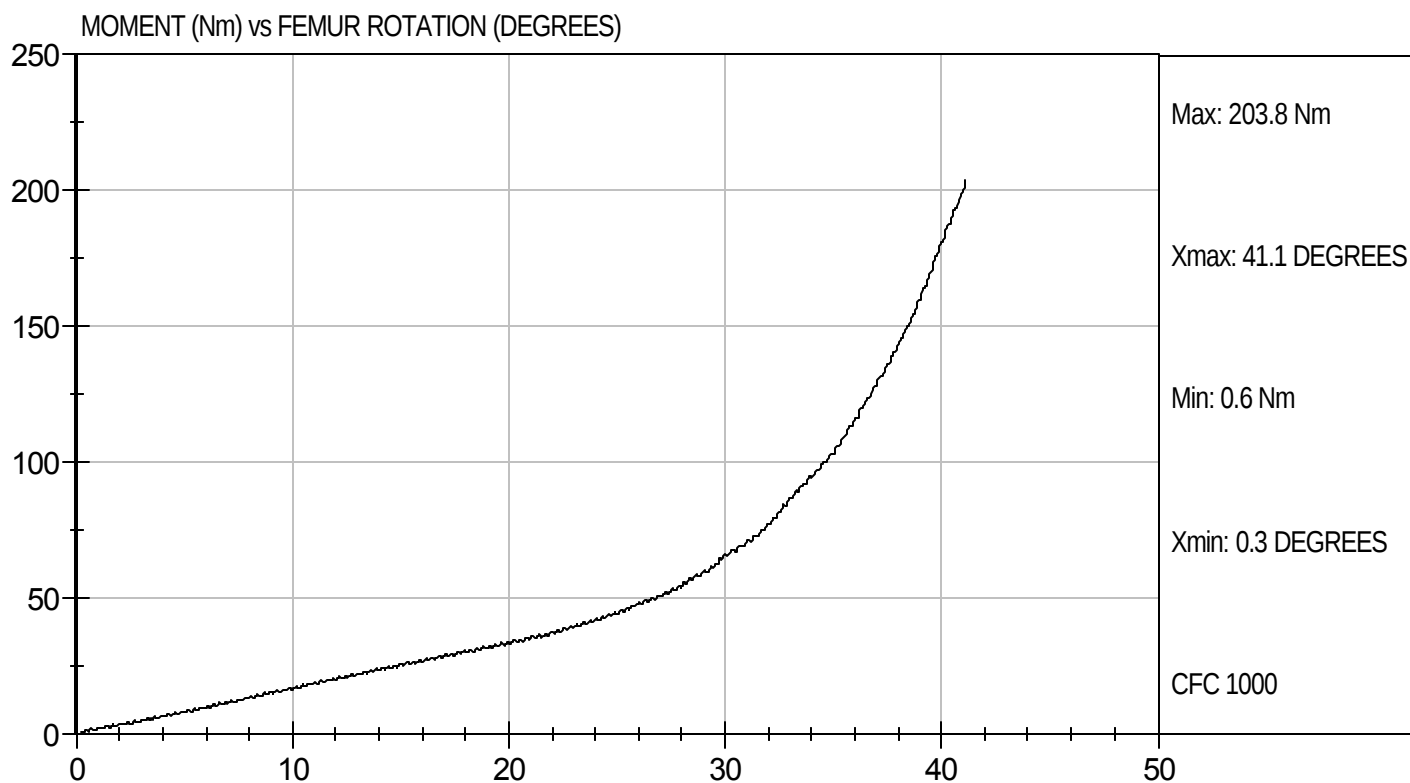
5/21/09  
Test Date

David Winkelbauer  
Approved By



Test Desc: Hip Femur Flexion  
Component ID: D091249

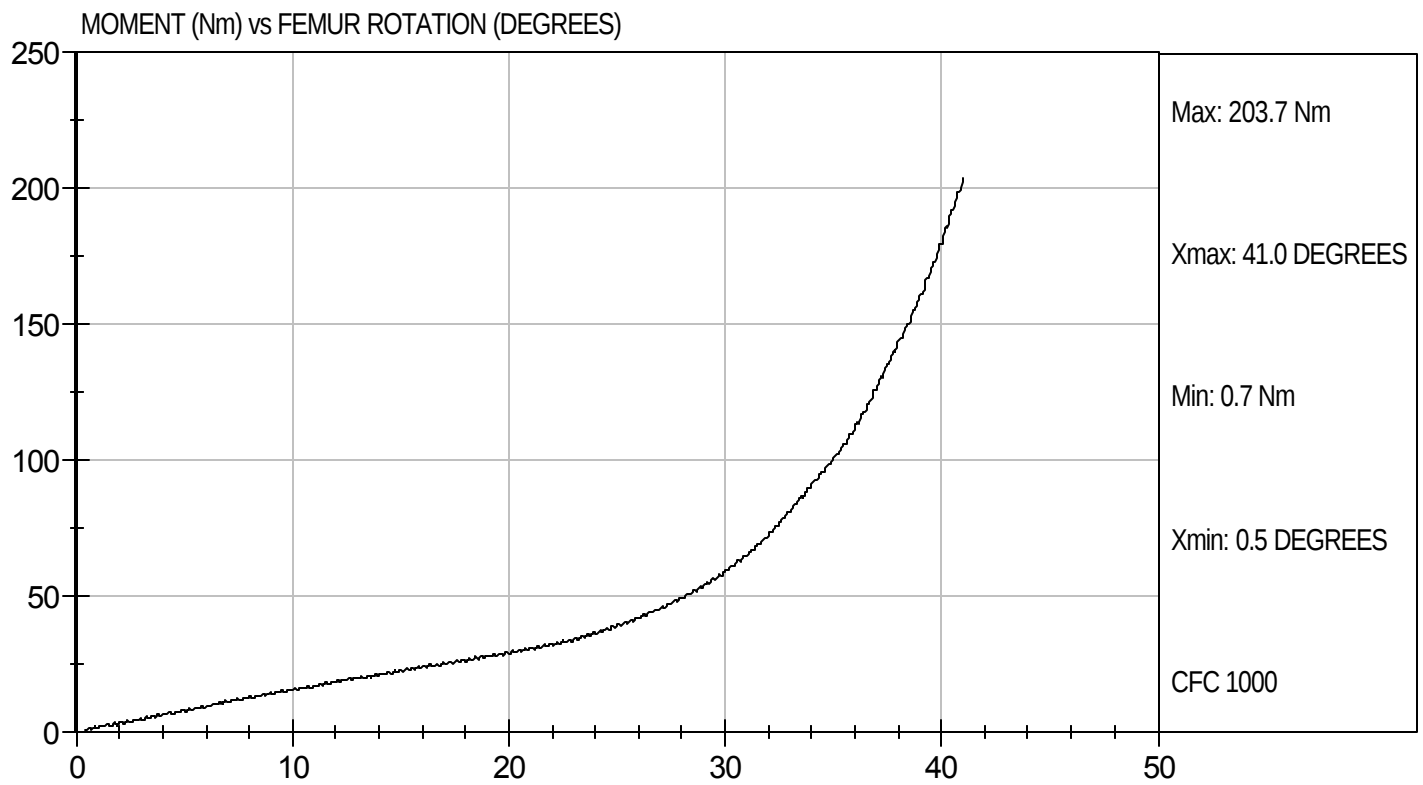
Test Date: 5/21/09  
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion  
Component ID: D091240

Test Date: 5/21/09  
Velocity: 0 ft/s, 0.00 m/s

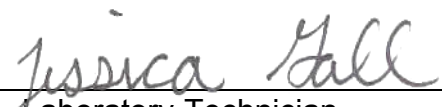


**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 138

**Test ID:** D09841

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 20.6   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 22     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 277    | Pass      |
| Peak Lateral Acceleration    | G's   | +/- 15             | -9     | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

  
Laboratory Technician

4/16/09  
Test Date

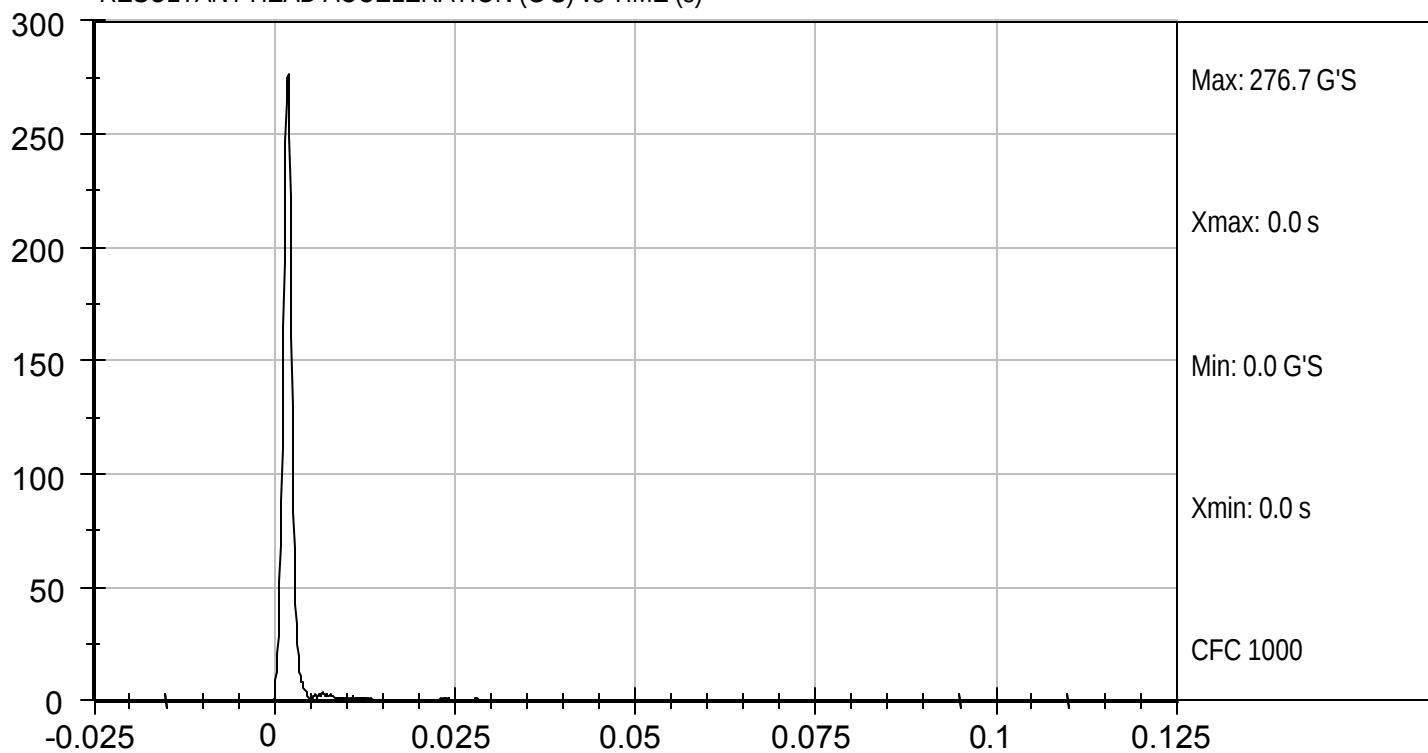
  
Approved By



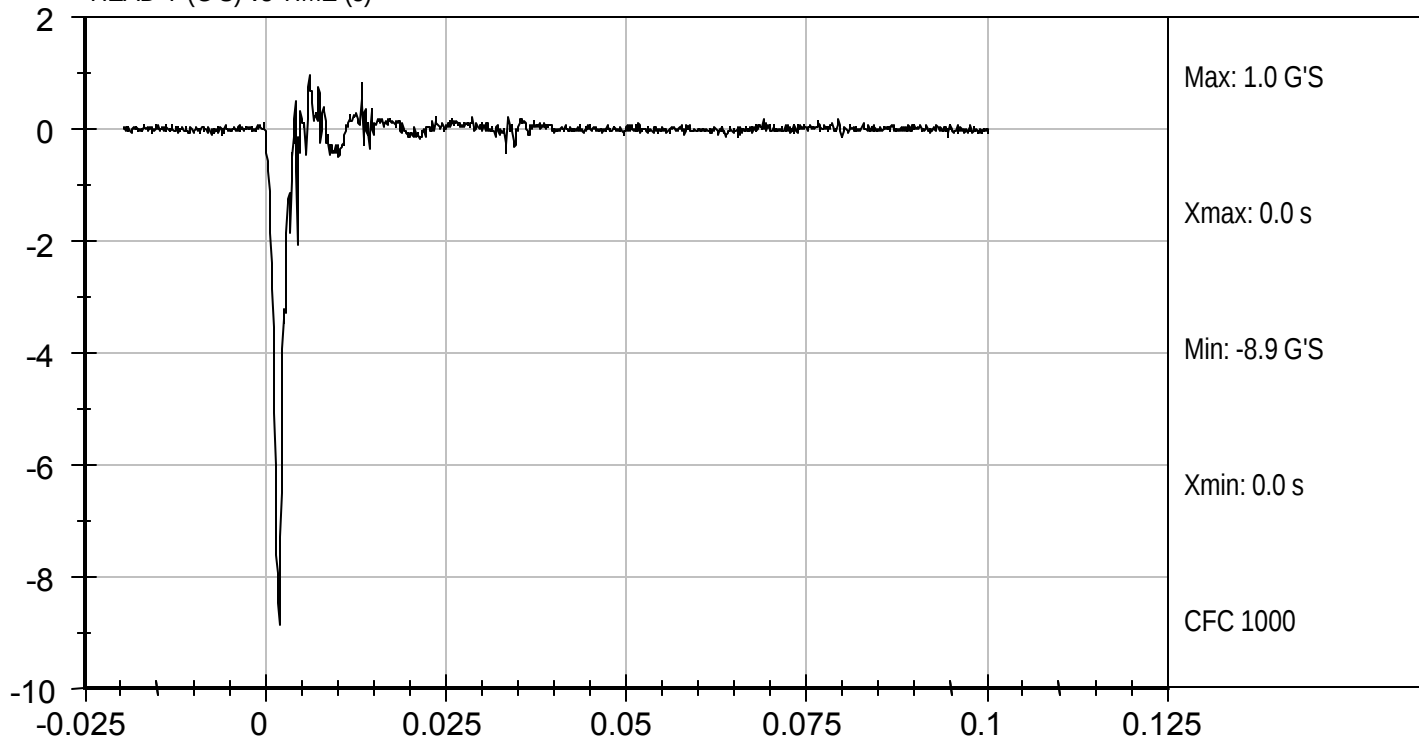
Test Desc: Head Drop  
Component ID: D09841

Test Date: 4/16/09  
Velocity: 0 ft/s, 0 m/s

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



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

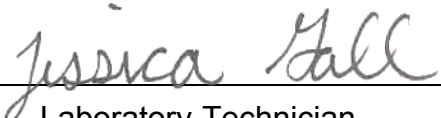


**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 138

Test I.D: D09842

| Tested Parameter                                    |         | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|---------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |         | deg C | 20.6 to 22.2  | 20.9   | Pass      |
| Laboratory Relative Humidity                        |         | %     | 10 to 70      | 27     | Pass      |
| Pendulum Speed                                      |         | m/sec | 6.89 to 7.13  | 7.06   | Pass      |
| Pendulum Deceleration                               | 10 msec | m/sec | 2.1 to 2.5    | 2.3    | Pass      |
|                                                     | 20 msec | m/sec | 4.0 to 5.0    | 4.4    | Pass      |
|                                                     | 30 msec | m/sec | 5.8 to 7.0    | 6.3    | Pass      |
| D Plane Rotation                                    | Max     | deg   | 77 to 91      | 79     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |         | Nm    | 69 to 83      | 77     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm           |         | msec  | 80 to 100     | 86     | Pass      |
| Overall Results                                     |         |       |               | Pass   |           |

  
Laboratory Technician

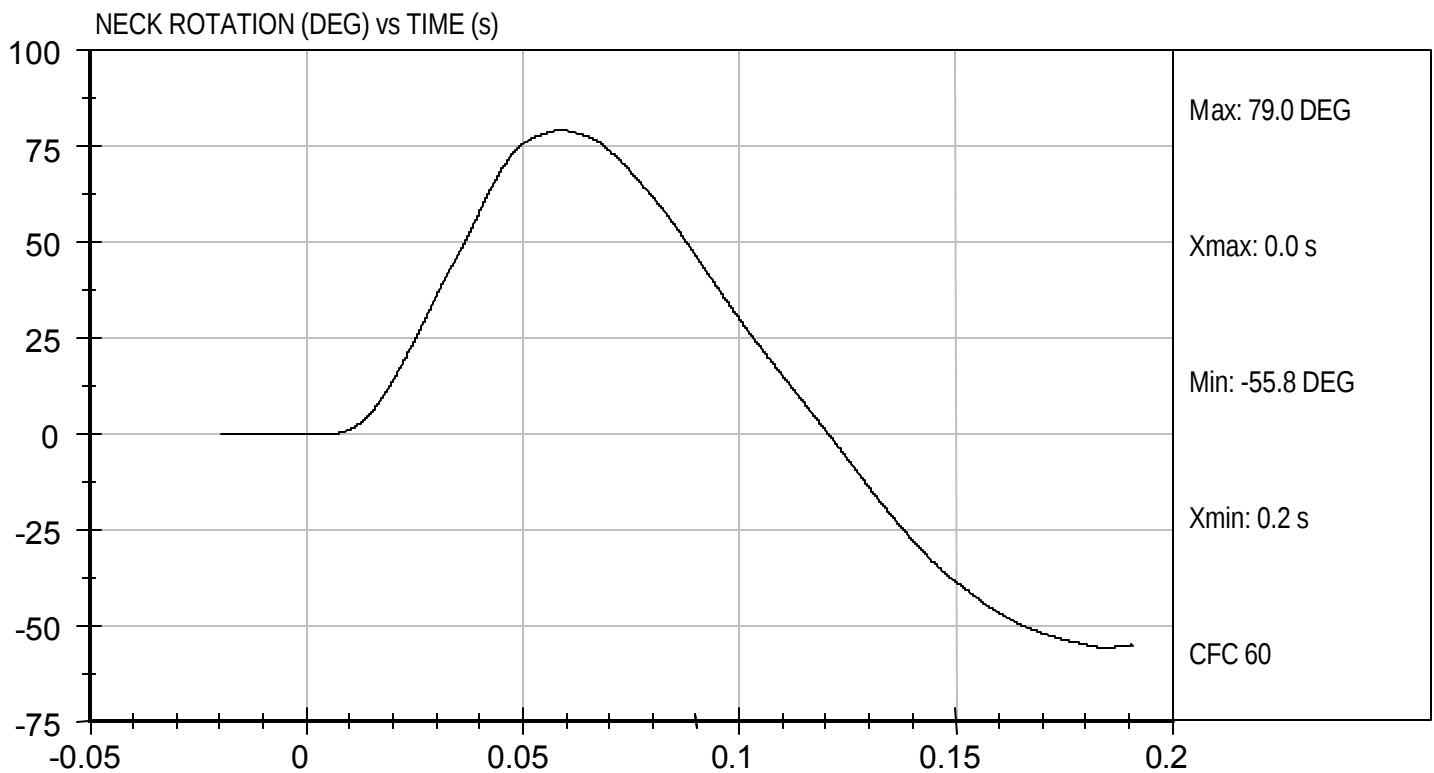
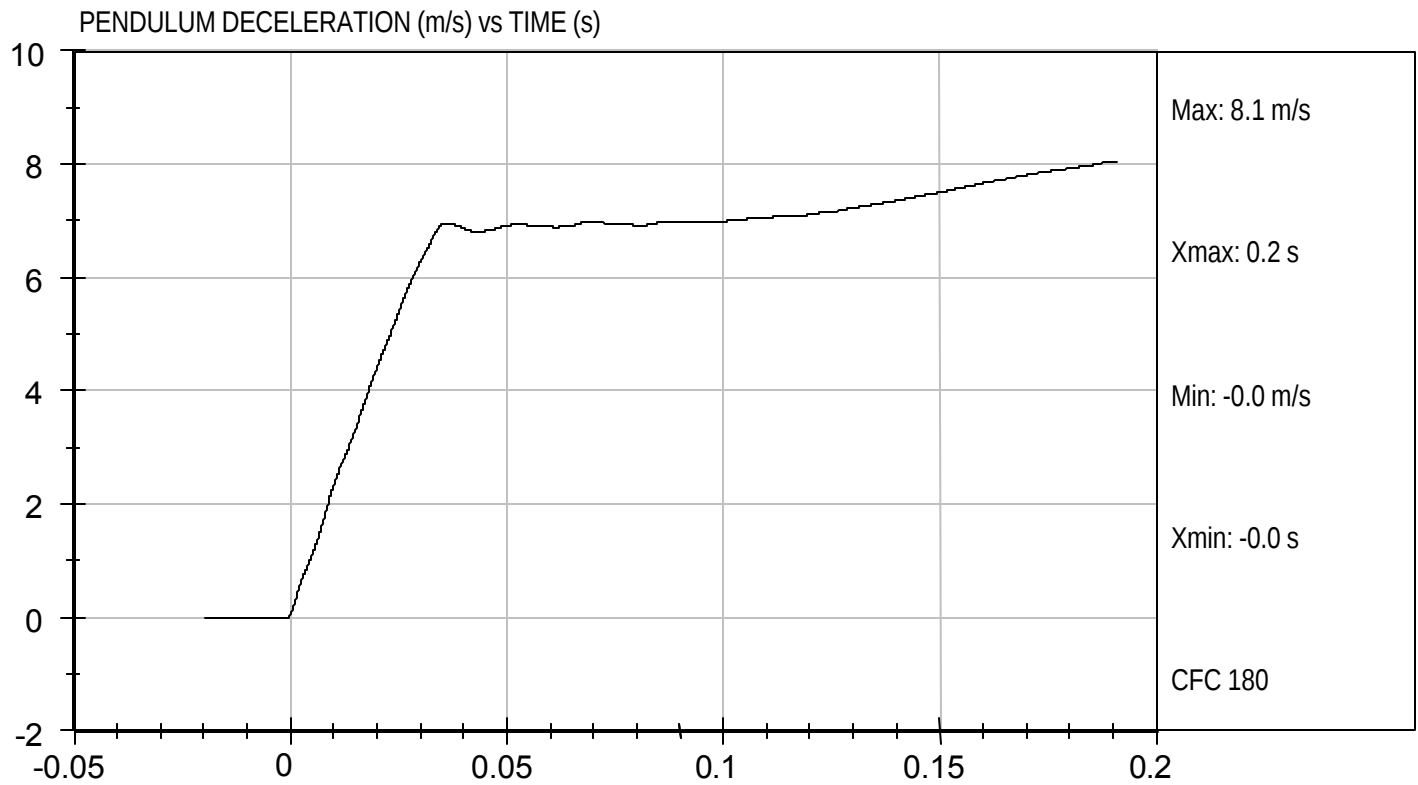
4/16/09  
Test Date

  
Approved By



Test Desc: Neck Flexion  
Component ID: D09842

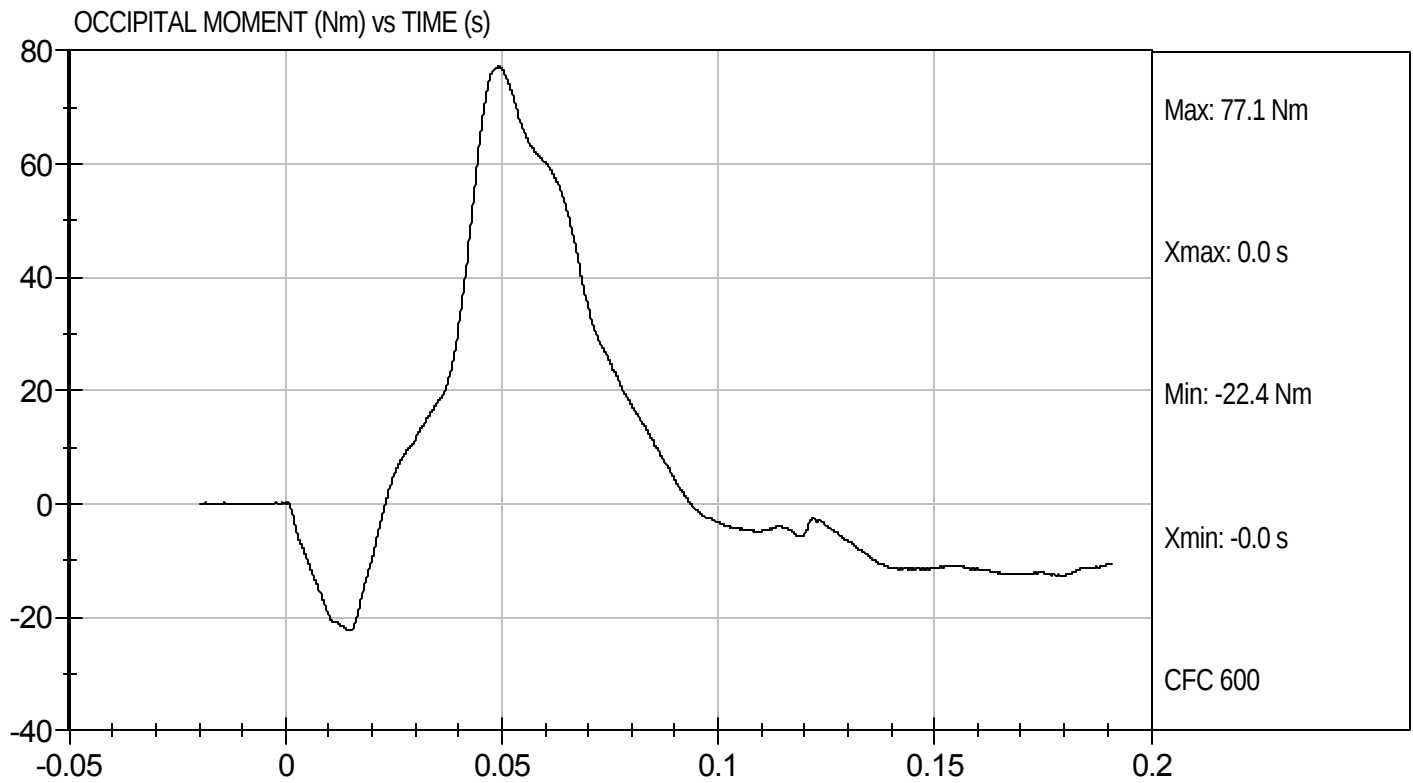
Test Date: 4/16/09  
Velocity: 23.1 ft/s, 7.06 m/s





Test Desc: Neck Flexion  
Component ID: D09842

Test Date: 4/16/09  
Velocity: 23.1 ft/s, 7.06 m/s



## MGA RESEARCH CORPORATION

## NECK EXTENSION TEST

## HYBRID III 5TH PERCENTILE

ATD Serial No: 138Test I.D: D09843

| Tested Parameter                                    |         | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|---------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |         | deg C | 20.6 to 22.2  | 20.9   | Pass      |
| Laboratory Relative Humidity                        |         | %     | 10 to 70      | 27     | Pass      |
| Pendulum Speed                                      |         | m/sec | 5.95 to 6.19  | 6.12   | Pass      |
| Pendulum Deceleration                               | 10 msec | m/sec | 1.5 to 1.9    | 1.8    | Pass      |
|                                                     | 20 msec | m/sec | 3.1 to 3.9    | 3.6    | Pass      |
|                                                     | 30 msec | m/sec | 4.6 to 5.6    | 5.2    | Pass      |
| D Plane Rotation                                    | Max     | deg   | 99 to 114     | 106    | Pass      |
| Occipital Condyle Moment within Deflection Corridor |         | Nm    | -65 to -53    | -54    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm          |         | msec  | 94 to 114     | 105    | Pass      |
| Overall Results                                     |         |       |               |        | Pass      |

Jessica Hall  
Laboratory Technician

4/16/09

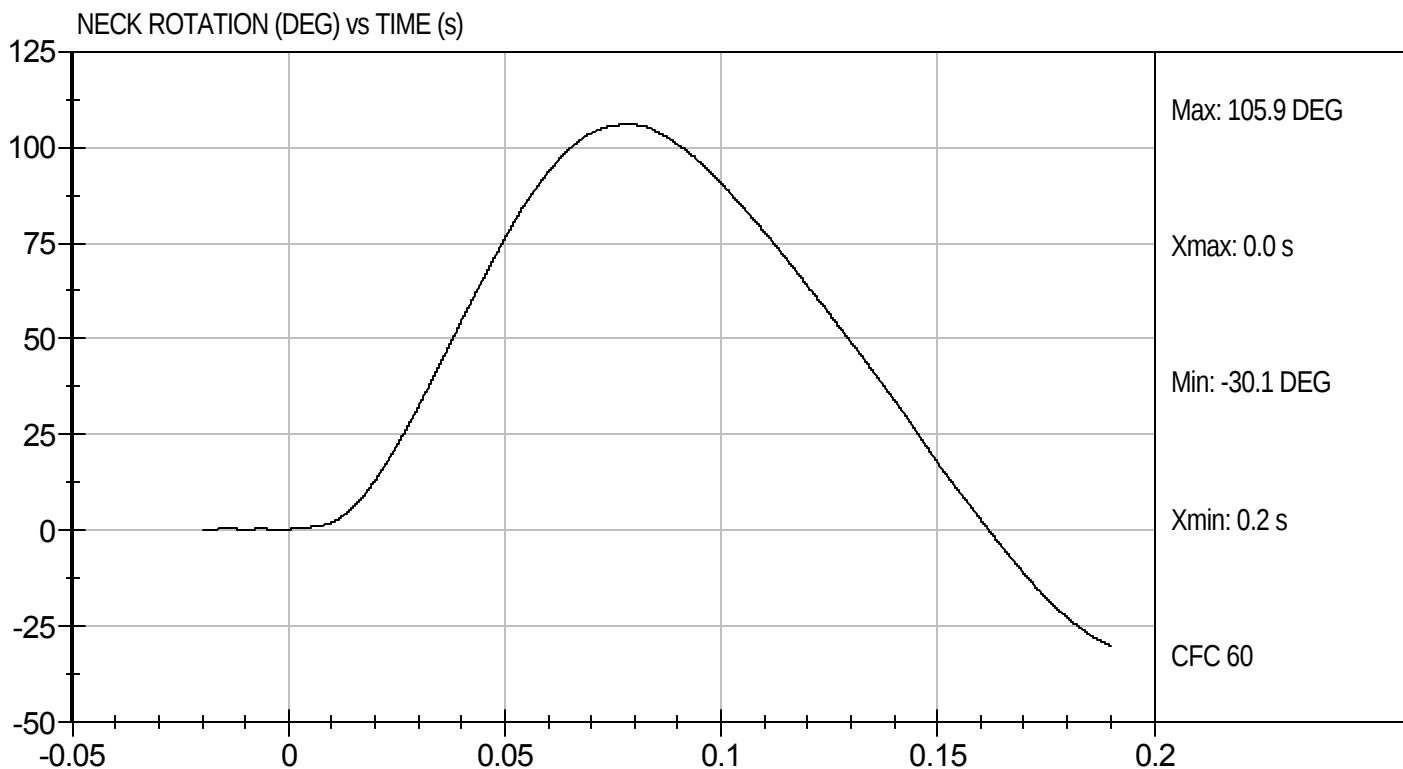
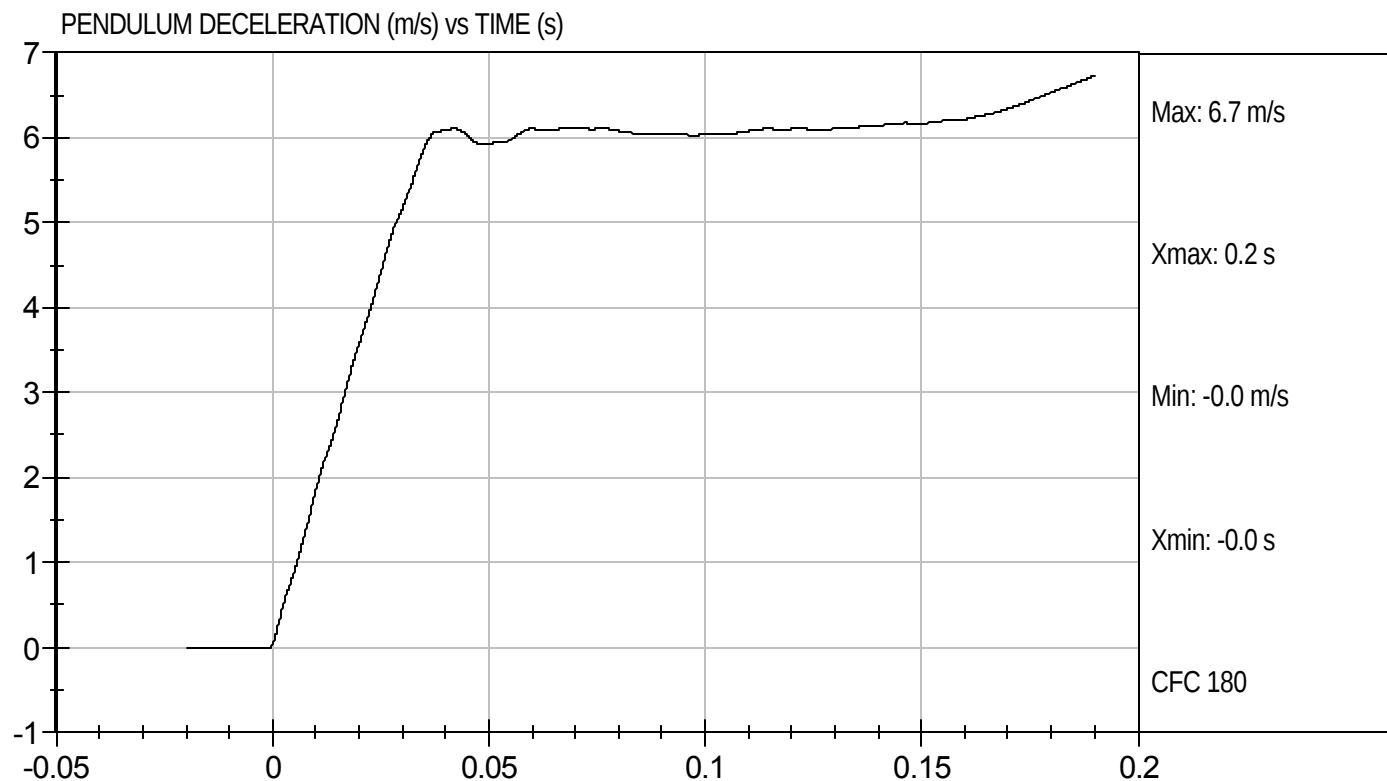
Test Date

David Winkelbauer  
Approved By



Test Desc: Neck Extension  
Component ID: D09843

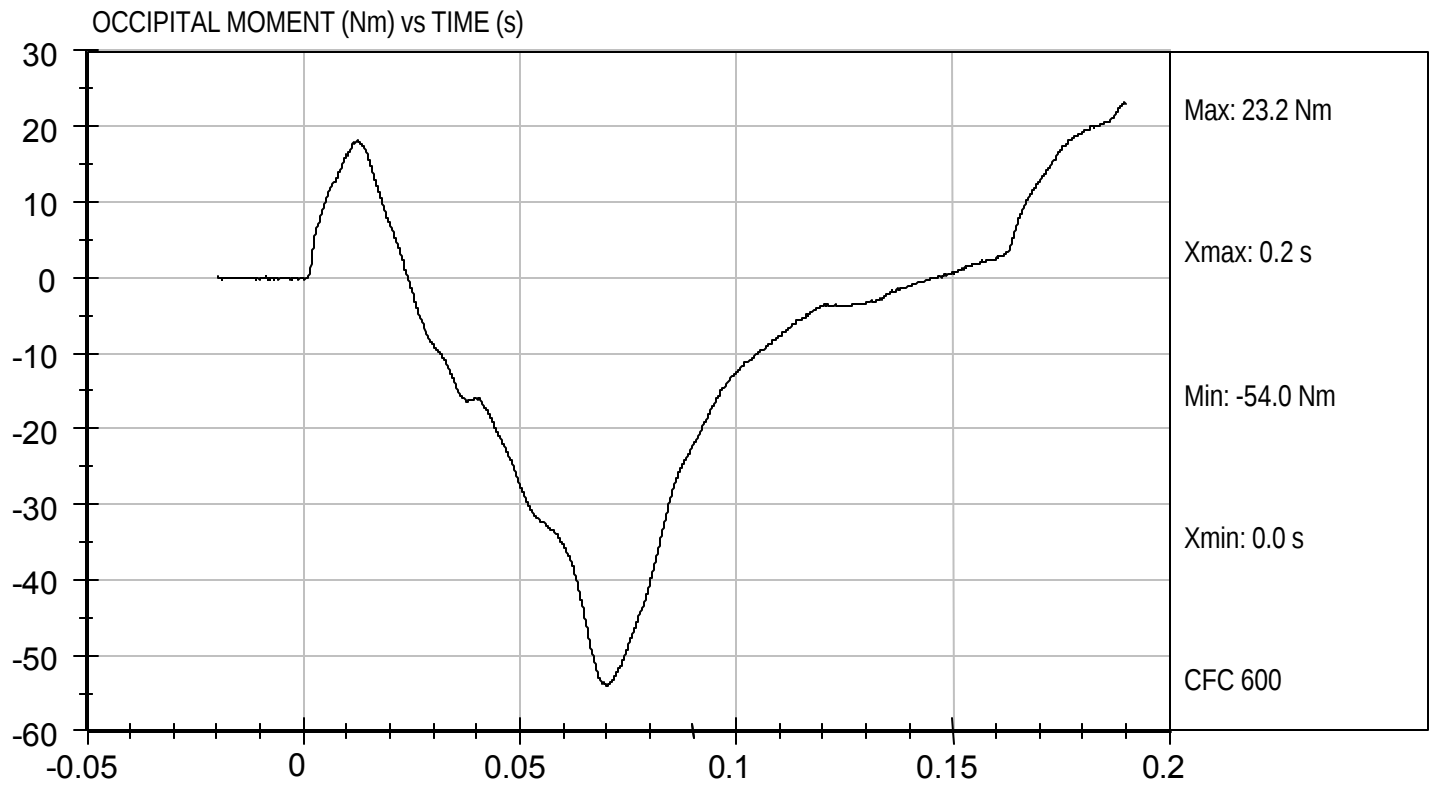
Test Date: 4/16/09  
Velocity: 20.1 ft/s, 6.12 m/s





Test Desc: Neck Extension  
Component ID: D09843

Test Date: 4/16/09  
Velocity: 20.1 ft/s, 6.12 m/s

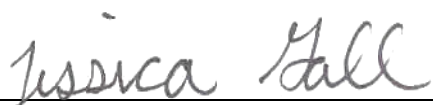


**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 138

**Test I.D:** D09844

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.8   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 25     | 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 | kN    | 3.9 to 4.4    | 4.1    | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 72     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | <= 4,600 N    | 4132   | Pass      |
| Overall Test Results                          |       |               | Pass   |           |

  
Laboratory Technician

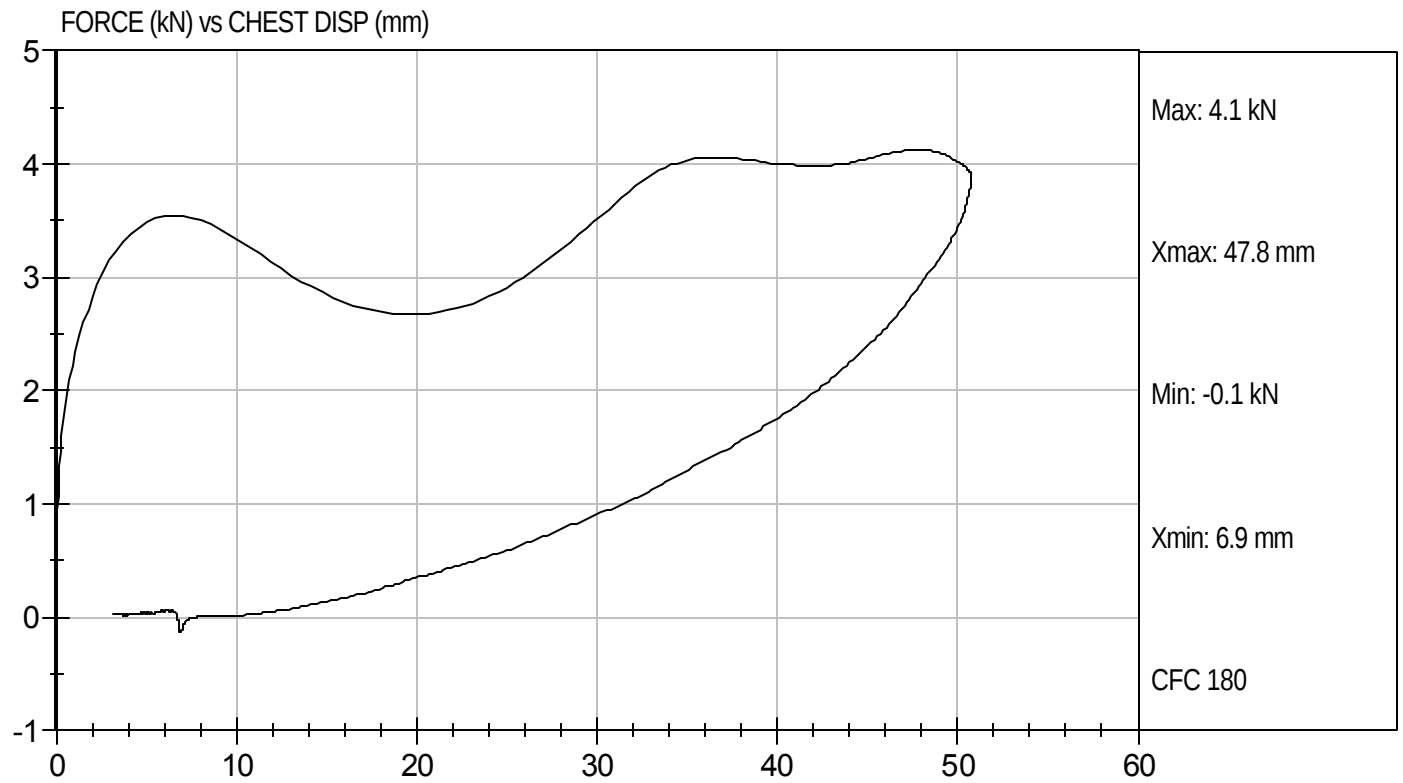
4/17/09  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Component ID: D09844

Test Date: 4/17/09  
Velocity: 22.2 ft/s, 6.77 m/s



**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 138

**Test I.D:** D09845

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 20.8   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 16     | Pass      |
| Probe Speed                  | m/sec | 2.07 to 2.13  | 2.09   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.67   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Jessica Hall  
Laboratory Technician

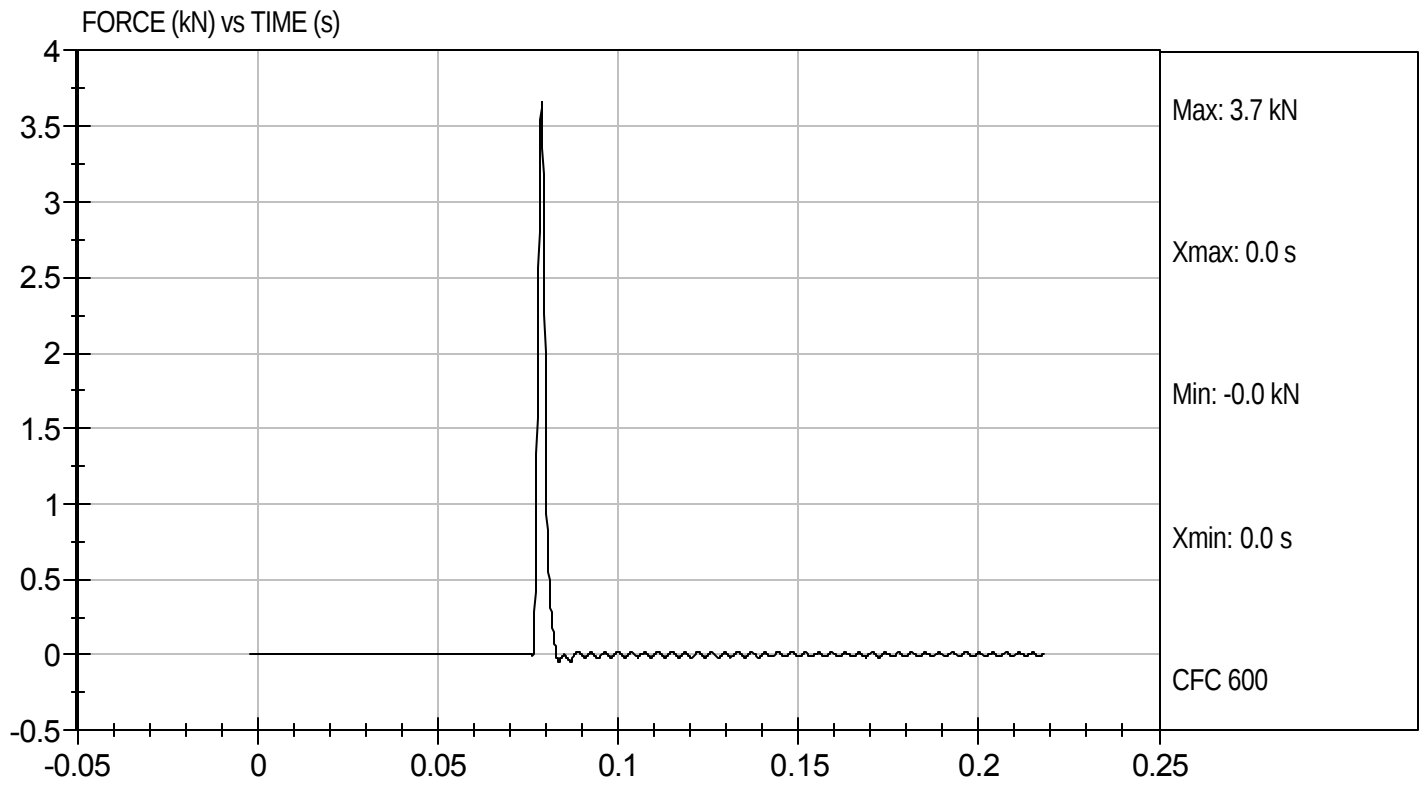
4/16/09  
Test Date

David Winkelbauer  
Approved By



Test Desc: Right Knee  
Component ID: D09845

Test Date: 4/16/09  
Velocity: 6.86 ft/s, 2.09 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138

Test I.D: D09846

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 20.8   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 16     | Pass      |
| Probe Speed                  | m/sec | 2.07 to 2.13  | 2.11   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.73   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Jessica Hall  
Laboratory Technician

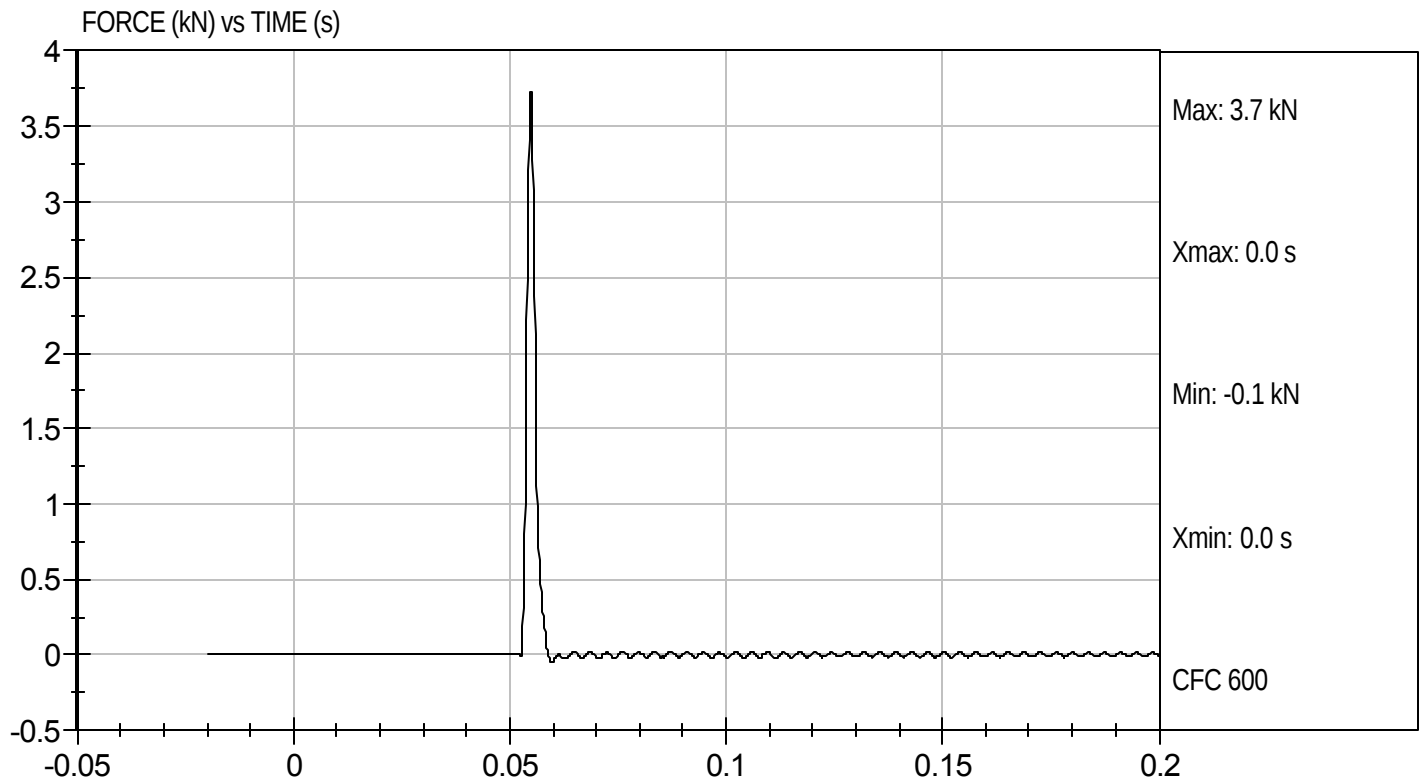
4/16/09  
Test Date

David Winkelbauer  
Approved By



Test Desc: Left Knee  
Component ID: D09846

Test Date: 4/16/09  
Velocity: 6.92 ft/s, 2.11 m/s



**MGA RESEARCH CORPORATION**  
**TORSO FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 138

**Test I.D:** D09847

| 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      | 28     | Pass      |
| Initial Angle                | deg     | 0 to 20       | 20     | Pass      |
| Return Angle                 | deg     | +/- 8         | 1      | Pass      |
| Force at 45 deg              | N       | 320 to 390    | 365    | Pass      |
| Upper Torso Deflection Rate  | Deg/sec | 0.5 to 1.5    | Yes    | Pass      |
| Overall Result               |         |               |        | Pass      |

  
Laboratory Technician

4/16/09  
Test Date

  
Approved By