

**REPORT NUMBER: NCAP-MGA-2012-025**

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

**GENERAL MOTORS LLC  
2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
NHTSA No.: MC0103**

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



**Test Date: November 9, 2011**

**Final Report Date: November 14, 2011**

**FINAL REPORT**

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

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Approval Date: November 14, 2011

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: \_\_\_\_\_

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

Date: \_\_\_\_\_

### Technical Report Documentation Page

| 1. Report No.<br>NCAP-MGA-2012-025                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                     | 2. Government Accession No. |                                                                                                                                                                                                                                                                                                                                     | 3. Recipient's Catalog No.                                                                    |               |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| 4. Title and Subtitle<br>Final Report of New Car Assessment Program<br>Frontal Impact Testing of 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV, NHTSA No.: MC0103                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                     |                             |                                                                                                                                                                                                                                                                                                                                     | 5. Report Date<br>November 14, 2011                                                           |               |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| 7. Author(s)<br>Donna Janovicz, Project Manager<br>Ben Fischer, Project Engineer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                     |                             |                                                                                                                                                                                                                                                                                                                                     | 8. Performing Organization Report No.<br>NCAP-MGA-2012-025                                    |               |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| 9. Performing Organization Name and Address<br>MGA Research Corporation<br>5000 Warren Road<br>Burlington, WI 53105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                     |                             |                                                                                                                                                                                                                                                                                                                                     | 11. Contract or Grant No.<br>DTNH22-06-D-00028                                                |               |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| 12. Sponsoring Agency Name and Address<br>U.S. Department of Transportation<br>National Highway Traffic Safety Administration<br>Office of Crashworthiness Standards (NVS-111)<br>1200 New Jersey Ave, SE, Room W43-410<br>Washington, D.C. 20590                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                     |                             |                                                                                                                                                                                                                                                                                                                                     | 14. Sponsoring Agency Code<br>NVS-111                                                         |               |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| 16. Abstract<br>A 56.3 km/h NCAP Frontal Impact Test was conducted on the 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on November 9, 2011.<br><br>The impact velocity was 56.3 km/h and the ambient temperature at the barrier face at the time of impact was 21.2°C. The target vehicle post-test maximum crush was 765 mm located at the vehicle's centerline. The test vehicle's performance was as follows: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">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>175</td> <td>183</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>52</td> <td>23</td> <td>12</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>1</td> <td>0.19</td> <td>0.37</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>2620</td> <td>1222</td> <td>831</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>2520</td> <td>768</td> <td>518</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>2961</td> <td>2410</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>3304</td> <td>2049</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 | 175 | 183 | Maximum Chest Compression | mm | 63 | 52 | 23 | 12 | Nij | N/A | 1 | 1 | 0.19 | 0.37 | Neck Tension | N | 4170 | 2620 | 1222 | 831 | Neck Compression | N | 4000 | 2520 | 768 | 518 | Left Femur Force | N | 10008 | 6805 | 2961 | 2410 | Right Femur Force | N | 10008 | 6805 | 3304 | 2049 |
| Measurement Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Units                                               | Threshold                   |                                                                                                                                                                                                                                                                                                                                     | Driver ATD                                                                                    | Passenger ATD |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
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| Head Injury Criteria (HIC <sub>15</sub> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | N/A                                                 | 700                         | 700                                                                                                                                                                                                                                                                                                                                 | 175                                                                                           | 183           |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Maximum Chest Compression                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | mm                                                  | 63                          | 52                                                                                                                                                                                                                                                                                                                                  | 23                                                                                            | 12            |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Nij                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | N/A                                                 | 1                           | 1                                                                                                                                                                                                                                                                                                                                   | 0.19                                                                                          | 0.37          |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Neck Tension                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | N                                                   | 4170                        | 2620                                                                                                                                                                                                                                                                                                                                | 1222                                                                                          | 831           |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Neck Compression                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | N                                                   | 4000                        | 2520                                                                                                                                                                                                                                                                                                                                | 768                                                                                           | 518           |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Left Femur Force                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | N                                                   | 10008                       | 6805                                                                                                                                                                                                                                                                                                                                | 2961                                                                                          | 2410          |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| Right Femur Force                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | N                                                   | 10008                       | 6805                                                                                                                                                                                                                                                                                                                                | 3304                                                                                          | 2049          |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| 17. Key Words<br><br>35 mph Frontal Barrier Impact Test<br>New Car Assessment Program (NCAP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                     |                             | 18. Distribution Statement<br>Copies of this report are available from:<br>National Highway Traffic Safety Administration<br>Technical Information Services Division, NPO-411<br>1200 New Jersey Ave, SE, Room E12-100<br>Washington, DC 20590<br>Email: <a href="mailto:tis@nhtsa.dot.gov">tis@nhtsa.dot.gov</a> FAX: 202-493-2833 |                                                                                               |               |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |
| 19. Security Classification of Report<br>Unclassified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 20. Security Classification of Page<br>Unclassified | 21. No. of Pages<br>162     |                                                                                                                                                                                                                                                                                                                                     | 22. Price                                                                                     |               |                         |       |           |  |            |               |                  |                 |                                           |     |     |     |     |     |                           |    |    |    |    |    |     |     |   |   |      |      |              |   |      |      |      |     |                  |   |      |      |     |     |                  |   |       |      |      |      |                   |   |       |      |      |      |

## TABLE OF CONTENTS

| <u>Section</u>        |                                                       | <u>Page No.</u> |
|-----------------------|-------------------------------------------------------|-----------------|
| 1                     | Purpose and Summary of Test                           | 1               |
| 2                     | Occupant and Vehicle Information / Data Sheets        | 3               |
| <br>                  |                                                       |                 |
| <u>Data Sheet No.</u> |                                                       | <u>Page No.</u> |
| 1                     | General Test and Vehicle Parameter Data               | 4               |
| 2                     | Seat Adjustment, Fuel System, and Steering Wheel Data | 8               |
| 3                     | Dummy Longitudinal Clearance Dimensions               | 10              |
| 4                     | Dummy Lateral Clearance Dimensions                    | 11              |
| 5                     | Seat Belt Positioning Data                            | 12              |
| 6                     | High-Speed Camera Locations and Data                  | 13              |
| 7                     | Vehicle Accelerometer Data                            | 15              |
| 8                     | Photographic Reference Target Locations               | 16              |
| 9                     | Load Cell Locations on Fixed Barrier                  | 17              |
| 10                    | Test Vehicle Summary of Results                       | 18              |
| 11                    | Post-Test Observations                                | 19              |
| 12                    | Vehicle Profile Measurements                          | 20              |
| 13                    | Accident Investigation Division Data                  | 22              |
| 14                    | Vehicle Intrusion Measurements                        | 23              |
| 15                    | Summary of FMVSS 212, 219 (Partial), and 301 Data     | 26              |
| 16                    | FMVSS 301 Static Rollover Results                     | 28              |
| 17                    | Dummy/Vehicle Temperature Stabilization Data          | 29              |
| <br>                  |                                                       |                 |
| <u>Appendix</u>       |                                                       |                 |
| A                     | Photographs                                           | A               |
| B                     | Dummy Response Data Traces                            | B               |
| C                     | Dummy Calibration and Performance Verification Data   | C               |

## **SECTION 1 PURPOSE AND SUMMARY OF TEST**

### **PURPOSE**

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-06-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 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV at a velocity of 56.3 kph. The test was performed at MGA Research Corporation on November 9, 2011. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

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

One Part 572E, 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's lap and shoulder belts and the passenger's lap belt to measure dummy torso and pelvic section loading.

The driver (position 1) ATD (Serial No. 036) and the right-front passenger (position 2) ATD (Serial No. 634) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 228 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 99 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 765 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

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

The occupant data is summarized below:

| ATD position                 | HIC <sub>15</sub> | Nij  | Neck Tension (N) | Neck Comp. (N) | 3ms Chest Clip (Gs) | Chest Disp. (mm) | Left Femur (N) | Right Femur (N) |
|------------------------------|-------------------|------|------------------|----------------|---------------------|------------------|----------------|-----------------|
| Driver (50 <sup>th</sup> )   | 175               | 0.19 | 1222             | 768            | 42                  | 23               | 2961           | 3304            |
| Passenger (5 <sup>th</sup> ) | 183               | 0.37 | 831              | 518            | 31                  | 12               | 2410           | 2049            |

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:  
 Top of Engine X after 15 msec.  
 Passenger Lap Belt after 16 msec.

There was a 1% loss of window retention. See page 26 and photo on page A-39.

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: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011

**TEST VEHICLE INFORMATION AND OPTIONS**

|                                                                            |                      |                               |     |
|----------------------------------------------------------------------------|----------------------|-------------------------------|-----|
| NHTSA No.                                                                  | MC0103               | Traction Control System (TCS) | Yes |
| Model Year                                                                 | 2012                 | Auto-Leveling System          | No  |
| Make                                                                       | Chevrolet            | Automatic Door Locks (ADLs)   | Yes |
| Model                                                                      | Suburban             | Power Window Auto-Reverse     | No  |
| Body Style                                                                 | MPV                  | Other Optional Feature        | N/A |
| VIN                                                                        | 1GNSKHE76CR116656    | Driver Front Airbag           | Yes |
| Body Color                                                                 | Mocha Steel Metallic | Driver Curtain Airbag         | Yes |
| Odometer (km/mi)                                                           | 48 / 30              | Driver Head/Torso Airbag      | No  |
| Engine Displacement (L)                                                    | 5.3                  | Driver Torso Airbag           | No  |
| Type/No. Cylinders                                                         | 8                    | Driver Torso/Pelvis Airbag    | Yes |
| Engine Placement                                                           | Longitudinal         | Driver Pelvis Airbag          | No  |
| Transmission Type                                                          | Automatic            | Driver Knee Airbag            | No  |
| Transmission Speeds                                                        | 6                    | Pass. Curtain Airbag          | Yes |
| Overdrive                                                                  | Yes                  | Pass. Head/Torso Airbag       | No  |
| Final Drive                                                                | 4WD                  | Pass. Torso Airbag            | No  |
| Roof Rack                                                                  | Yes                  | Pass. Torso/Pelvis Airbag     | Yes |
| Sunroof/T-Top                                                              | No                   | Pass. Pelvis Airbag           | No  |
| Running Boards                                                             | Yes                  | Driver Seat Belt Pretensioner | Yes |
| Tilt Steering Wheel                                                        | Yes                  | Pass. Seat Belt Pretensioner  | Yes |
| Power Seats                                                                | Yes                  | Driver Load Limiter           | Yes |
| Anti-Lock Brakes (ABS)                                                     | Yes                  | Rear Pass. Load Limiter       | Yes |
| All-Wheel Drive (AWD)                                                      | Yes                  | Other Safety Restraints       | N/A |
| Does owner's manual provide instructions to turn off automatic door locks? |                      |                               | No  |

**DATA FROM CERTIFICATION LABEL**

|                     |                    |                 |      |
|---------------------|--------------------|-----------------|------|
| Manufactured By     | General Motors LLC | GVWR (kg)       | 3357 |
| Date of Manufacture | 08/11              | GAWR Front (kg) | 1633 |
| Vehicle Type        | MPV                | GAWR Rear (kg)  | 1905 |

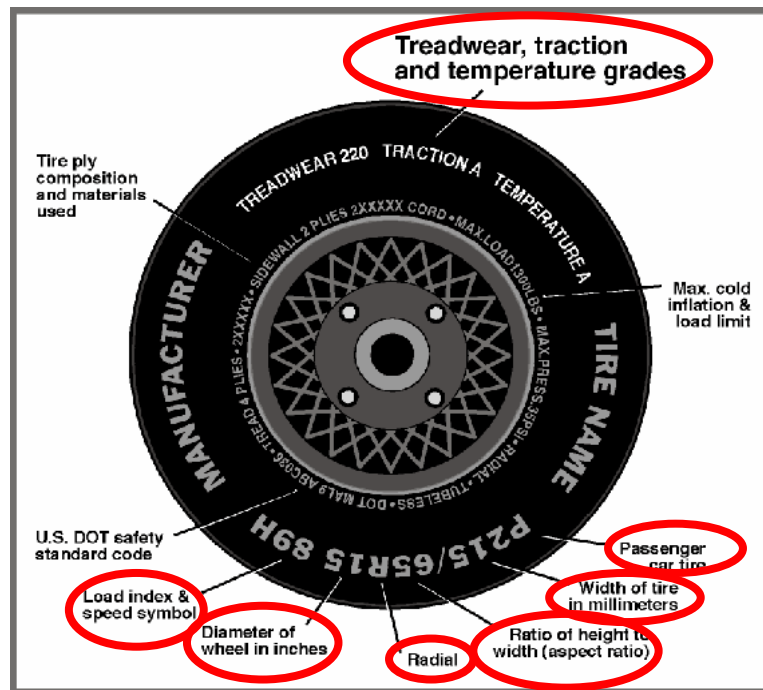
**VEHICLE SEATING AND WEIGHT CAPACITY DATA**

| Measured Parameter                | Front  | Rear        | Third       | Total |
|-----------------------------------|--------|-------------|-------------|-------|
| Type of Seats                     | Bucket | Split Bench | Split Bench |       |
| Designated Seating Capacity (DSC) | 2      | 3           | 3           | 8     |
| Capacity Weight (VCW) (kg)        |        |             |             | 697   |
| Cargo Weight (RCLW) (kg)          |        |             |             | 153   |

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011



**TIRE PLACARD INFORMATION**

| Measured Parameter                   | Front      | Rear       |
|--------------------------------------|------------|------------|
| Recommended Cold Tire Pressure (kPa) | 210        | 210        |
| Recommended Tire Size                | P265/70R17 | P265/70R17 |

**TIRE SIDEWALL INFORMATION**

| Measured Parameter       | Front       | Rear        |
|--------------------------|-------------|-------------|
| Max. Tire Pressure (kPa) | 300         | 300         |
| Tire Size on Vehicle     | 265/70R17   | 265/70R17   |
| Tire Manufacturer        | Goodyear    | Goodyear    |
| Tire Name                | Wrangler HP | Wrangler HP |
| Tire Type                | Passenger   | Passenger   |
| Tire Width               | 265         | 265         |
| Aspect Ratio             | 70          | 70          |
| Radial                   | Yes         | Yes         |
| Wheel Diameter           | 17          | 17          |
| Load Index/Speed Symbol  | 113S        | 113S        |
| Treadwear                | 340         | 340         |
| Traction Grade           | A           | A           |
| Temperature Grade        | B           | B           |
| Tire Material            | Rubber      | Rubber      |

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV      NHTSA No.: MC0103  
 Test Program: NCAP Frontal Barrier Impact Test      Test Date: 11/09/2011

**TEST VEHICLE WEIGHTS**

|        | Units | As Delivered (UVW) |        |        | As Tested (ATW) |        |        |
|--------|-------|--------------------|--------|--------|-----------------|--------|--------|
|        |       | Front              | Rear   | Total  | Front           | Rear   | Total  |
| Left   | kg    | 685.4              | 659.5  |        | 690.0           | 773.4  |        |
| Right  | kg    | 680.4              | 625.1  |        | 701.1           | 757.1  |        |
| Ratio  | %     | 51.5               | 48.5   |        | 47.6            | 52.4   |        |
| Totals | kg    | 1365.8             | 1284.6 | 2650.4 | 1391.1          | 1530.5 | 2921.6 |

**TARGET TEST WEIGHT CALCULATION**

| Measured Parameter                      | Units | Value  |
|-----------------------------------------|-------|--------|
| Total Delivered Weight (UVW)            | kg    | 2650.4 |
| Weight of 1 P572E ATD & 1 P572O ATD     | kg    | 140.6  |
| Rated Cargo/Luggage Weight (RCLW)       | kg    | 136    |
| Calculated Vehicle Target Weight (TVTW) | kg    | 2927.0 |

**TEST VEHICLE ATTITUDES AND CG**

|              | Units | LF  | RF  | LR  | RR  | CG (aft of front axle) |
|--------------|-------|-----|-----|-----|-----|------------------------|
| As Delivered | mm    | 818 | 818 | 840 | 843 | 1604                   |
| As Tested    | mm    | 812 | 809 | 816 | 812 | 1734                   |
| Post Test    | mm    | 722 | 777 | 825 | 805 |                        |

**GENERAL TEST VEHICLE DATA**

| Measurement Description                 | Units | Value |
|-----------------------------------------|-------|-------|
| Total Vehicle Wheel Base                | mm    | 3310  |
| Total Vehicle Length at Left Side       | mm    | 5512  |
| Total Vehicle Length at Centerline      | mm    | 5655  |
| Total Vehicle Length at Right Side      | mm    | 5512  |
| Weight of Ballast in Cargo Area         | kg    | 117.9 |
| Weight of Vehicle Components Removed    | kg    | 10.4  |
| Amount of Stoddard Solvent in Fuel Tank | L     | 109.1 |

List of components removed: Right taillight, rear floor mats, and rear cargo area carpet.

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011

**TARGET VEHICLE STRUCTURAL MEASUREMENT**

|    | Elements                              | Pre-Test (mm) |
|----|---------------------------------------|---------------|
| 1  | Total Length                          | 5655          |
| 2  | Total Width                           | 1982          |
| 3  | Bumper Top Height                     | 655           |
| 4  | Bumper Bottom Height                  | 539           |
| 5  | Longitudinal Member Top Height        | 590           |
| 6  | Distance between Longitudinal Members | 713           |
| 7  | Longitudinal Member Width             | 95            |
| 8  | Engine Top Height                     | 1148          |
| 9  | Engine Bottom Height                  | 340           |
| 10 | Engine and Gearbox Width              | 1300          |
| 11 | Front Bumper-Engine Distance          | 591           |
| 12 | Front Shock Absorber Fixing Height    | 752           |
| 13 | Bonnet Leading Edge Height            | 1170          |
| 14 | Front Shock Absorber Fixing Width     | 941           |
| 15 | Front Bumper – Front Axle Distance    | 1000          |
| 16 | Front Axle – A-Pillar Distance        | 512           |
| 17 | A-Pillar – B-Pillar Distance          | 1244          |
| 18 | B-Pillar – Rear Axle Distance         | 516           |
| 19 | B-Pillar – C-Pillar Distance          | 1034          |
| 20 | Roof Sill Bottom Height               | 1714          |
| 21 | Roof Sill Top Height                  | 1811          |
| 22 | Floor Sill Bottom Height              | 385           |
| 23 | Floor Sill Top Height                 | 519           |

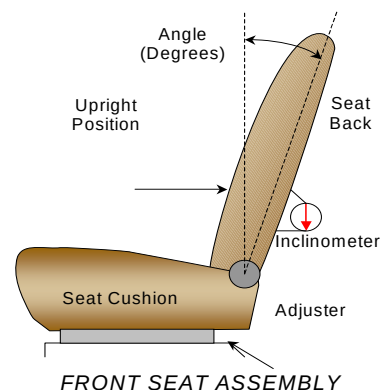
**DATA SHEET NO. 2**  
**SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA**

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011

**NOMINAL DESIGN RIDING POSITION**

The driver seat back is positioned as close as possible to the manufacturer's design angle. For the passenger seat back, seat back is adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.



| SEAT BACK ANGLE           | Degrees               |
|---------------------------|-----------------------|
| Driver Seat Back Angle    | 7.5° on headrest post |
| Passenger Seat Back Angle | 8.4° on headrest post |

**SEAT FORE/AFT POSITIONS**

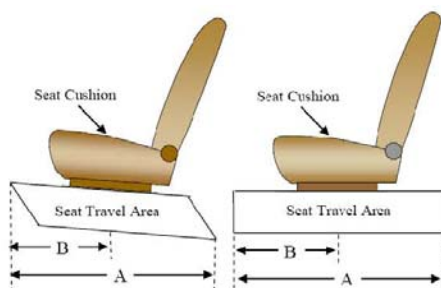
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.

|                | Total Fore/Aft Travel | Placed in Position #   |
|----------------|-----------------------|------------------------|
| Driver Seat    | 293 mm                | 147 mm (foremost as 0) |
| Passenger Seat | 210 mm                | 0 mm (foremost as 0)   |

**SEAT BELT UPPER ANCHORAGES**

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

|                | Total # of Positions     | Placed in Position # |
|----------------|--------------------------|----------------------|
| Driver Seat    | 5 (1 <sup>st</sup> as 0) | 0 (uppermost as 0)   |
| Passenger Seat | 5 (1 <sup>st</sup> as 0) | 0 (uppermost as 0)   |



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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011

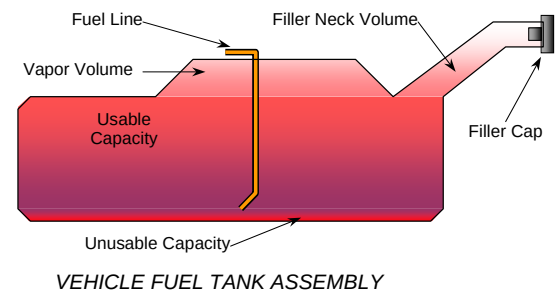
**FUEL TANK CAPACITY DATA**

|                                    | Liters         |
|------------------------------------|----------------|
| Usable Capacity of "Standard Tank" | 117.3          |
| Usable Capacity of "Optional Tank" |                |
| 92-94% of Usable Capacity          | 107.9 to 110.3 |
| Actual Amount of Solvent used      | 109.1          |
| 1/3 of Usable Capacity             | 39.1           |

**FUEL PUMP**

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

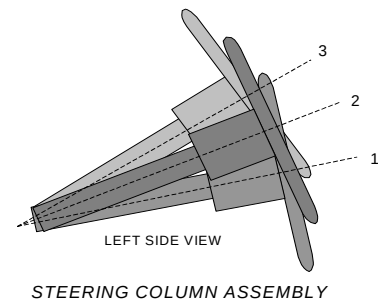
The vehicle is equipped with an electric fuel pump. Pump will run when engine is running. Also, it will run briefly when ignition key is turned to the "on" position without starting the engine. The fuel pipe is on the left side.



**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**

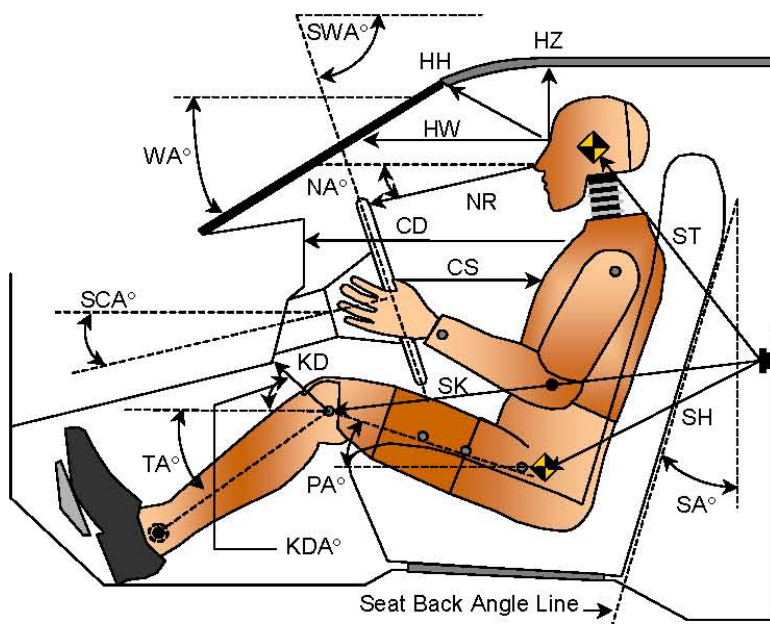


|                                   | Degrees | Fore/Aft Position (mm) |
|-----------------------------------|---------|------------------------|
| Lowermost – Position 1            | 80.0    |                        |
| Geometric Center – Position 2     | 70.0    |                        |
| Uppermost – Position 3            | 60.0    |                        |
| Telescoping Steering Wheel Travel |         |                        |
| Test Position                     | 60.0    |                        |

### DATA SHEET NO. 3 DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
Test Date: 11/09/2011

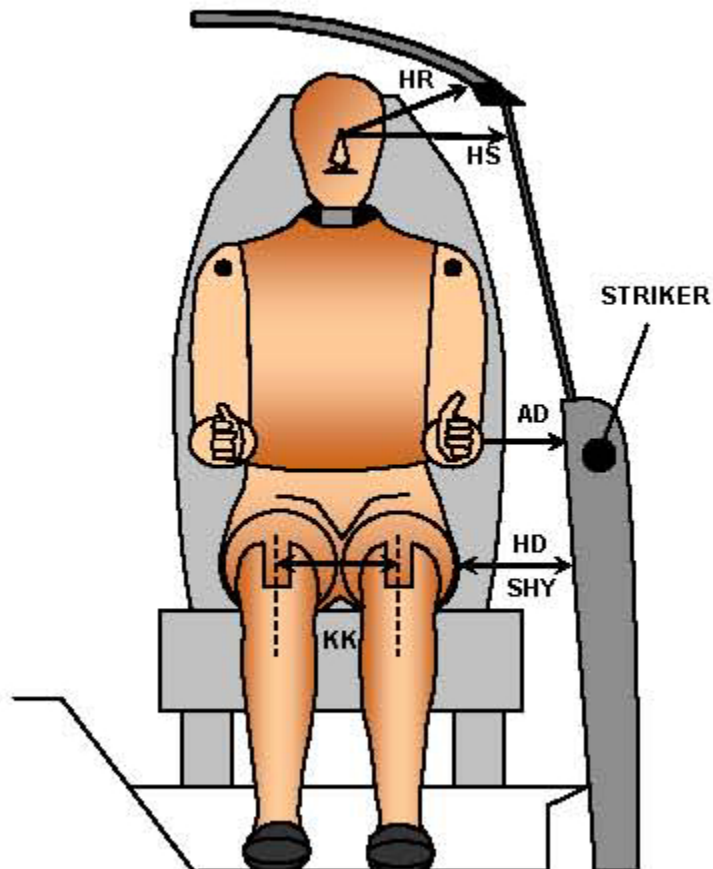


| Code | Measurement Description            | Driver S/N 036 |           | Passenger S/N 634 |           |
|------|------------------------------------|----------------|-----------|-------------------|-----------|
|      |                                    | Length (mm)    | Angle (°) | Length (mm)       | Angle (°) |
| WA°  | Windshield Angle                   |                | 33.2      |                   |           |
| SWA° | Steering Wheel Angle               |                | 70.0      |                   |           |
| SCA° | Steering Column Angle              |                | 20.0      |                   |           |
| SA°  | Seat Back Angle (on headrest post) |                | 7.5       |                   | 8.4       |
| HZ   | Head to Roof (Z)                   | 277            | 90        | 296               | 90        |
| HH   | Head to Header                     | 452            | 24.7      | 411               | 31.3      |
| HW   | Head to Windshield                 | 738            | 0         | 713               | 0         |
| NR   | Nose to Rim                        | 390            | 7.7       |                   |           |
| CD   | Chest to Dash                      | 521            |           | 444               |           |
| CS   | Chest to Steering Hub              | 313            | 3.5       |                   |           |
| RA   | Rim to Abdomen                     | 198            | 0         |                   |           |
| KDL  | Left Knee to Dash                  | 131            | 23.6      | 121               | 29.3      |
| KDR  | Right Knee to Dash                 | 123            | 29.8      | 117               | 30.5      |
| PA°  | Pelvic Angle                       |                | 24.3      |                   | 21.6      |
| TA°  | Tibia Angle                        |                | 53.0      |                   | 56.5      |
| SK   | Striker to Knee                    | 721            | 82.5      | 765               | 86.6      |
| ST   | Striker to Head                    | 663            | 17.9      | 609               | 28.1      |
| SH   | Striker to H-Point                 | 327            | 93.7      | 432               | 92.8      |

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011



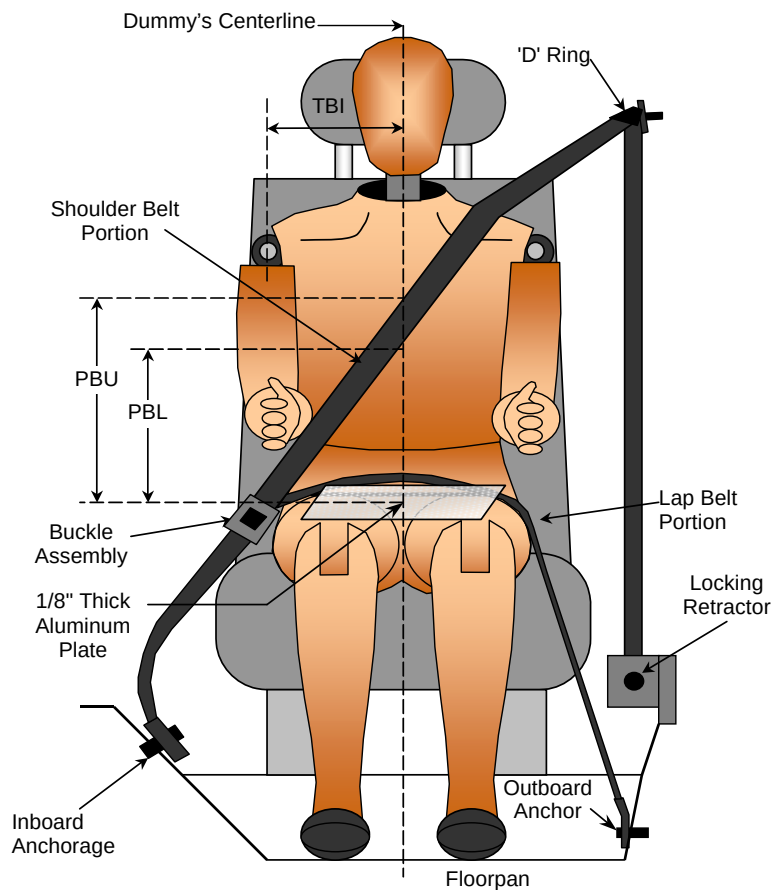
**FRONT VIEW OF DUMMY**

| Code | Measurement Description          | Driver S/N 036 | Passenger S/N 634 |
|------|----------------------------------|----------------|-------------------|
|      |                                  | Length (mm)    |                   |
| AD   | Arm to Door                      | 71             | 182               |
| HD   | H-Point to Door                  | 171            | 169               |
| HR   | Head to Side Header              | 238            | 267               |
| HS   | Head to Side Window              | 340            | 347               |
| KK   | Knee to Knee                     | 288            | 224               |
| SHY  | Striker to H-Point (Y Direction) | 300            | 318               |
| AA   | Ankle to Ankle                   | 290            | 171               |

## DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
Test Date: 11/09/2011



**FRONT VIEW OF DUMMY**

### SEAT BELT POSITIONING MEASUREMENTS

| Measurement Description                           | Units | Driver | Passenger |
|---------------------------------------------------|-------|--------|-----------|
| PBU - Top surface of reference to belt upper edge | mm    | 350    | 330       |
| PBL - Top surface of reference to belt lower edge | mm    | 270    | 245       |

### BELT LENGTH DATA

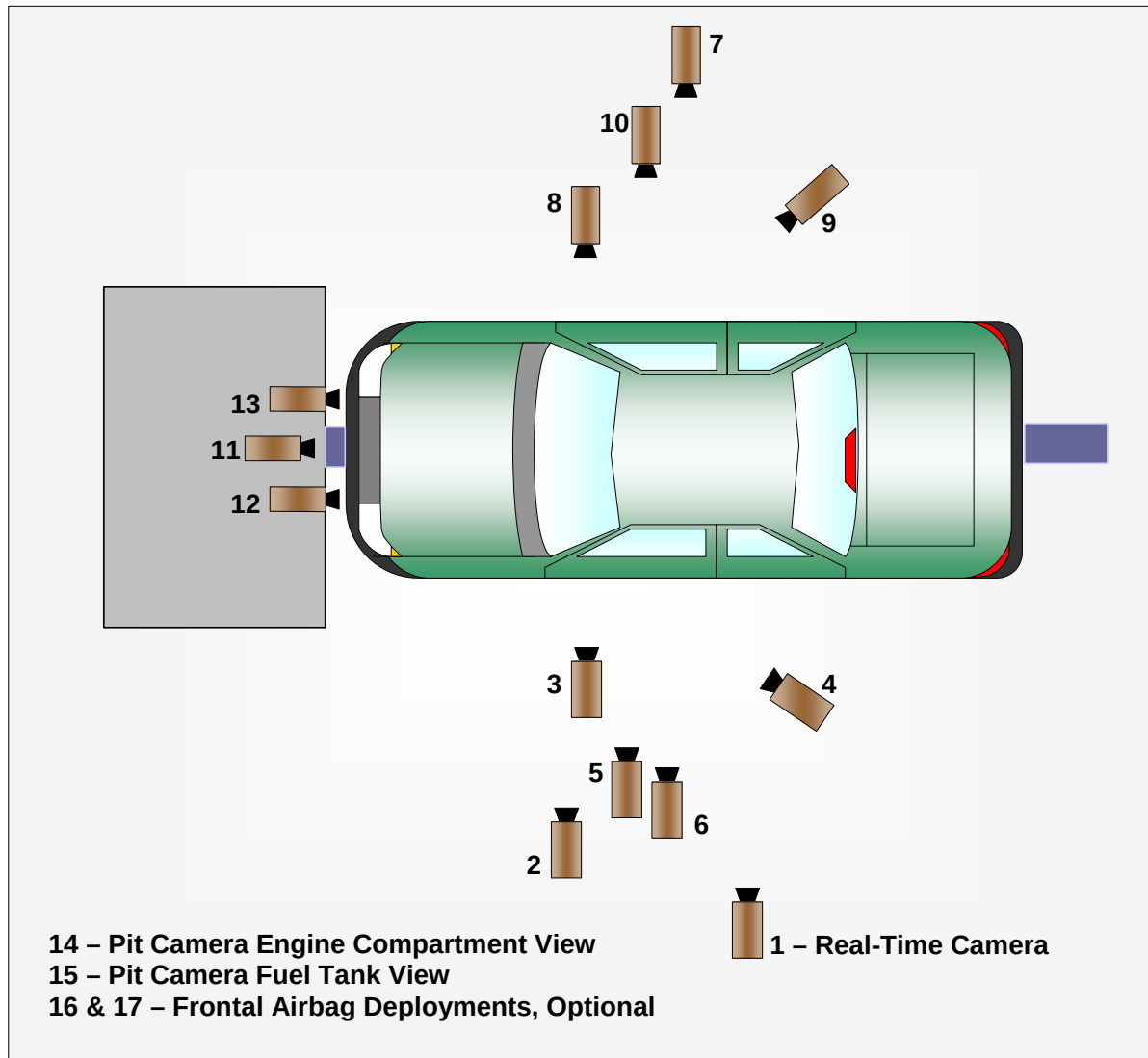
| Measurement Description                          | Units | Driver | Passenger |
|--------------------------------------------------|-------|--------|-----------|
| Shoulder Belt Length as measured on ATD          | mm    | 845    | 890       |
| Lap Belt Length as measured on ATD               | mm    | 605    | 560       |
| Remainder of belt on reel                        | mm    | 1650   | 1650      |
| Total Belt Length for Continuous Webbing Systems | mm    | 3100   | 3100      |

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
Test Date: 11/09/2011

**CAMERA POSITIONS FOR FRONTAL IMPACTS**



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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
Test Date: 11/09/2011

**CAMERA LOCATIONS**

| No. | Camera View                       | Coordinates (mm) |       |       | Lens (mm) | Speed (fps) |
|-----|-----------------------------------|------------------|-------|-------|-----------|-------------|
|     |                                   | X*               | Y*    | Z*    |           |             |
| 1   | Real-Time Left Overall            |                  |       |       |           | 30          |
| 2   | Driver Close-Up                   | 1460             | -6690 | -1830 | 35        | 1000        |
| 3   | Left Front Half                   | 1110             | -5610 | -1090 | 24        | 1000        |
| 4   | Left Angle                        | 5540             | -4960 | -1970 | 50        | 1000        |
| 5   | Steering Column - Top             | 380              | -5470 | -1240 | 24        | 1000        |
| 6   | Steering Column - Bottom          | 400              | -5450 | -830  | 24        | 1000        |
| 7   | Right Overall                     | 2350             | 7190  | -1190 | 20        | 1000        |
| 8   | Passenger Close-Up                | 1880             | 6880  | -1820 | 35        | 1000        |
| 9   | Right Front Half                  | 1280             | 5850  | -1120 | 24        | 1000        |
| 10  | Right Angle                       | 5600             | 4810  | -1950 | 50        | 1000        |
| 11  | Windshield                        | -320             | 0     | -2860 | 24        | 1000        |
| 12  | Driver Windshield                 | -30              | -360  | -2040 | 12.5      | 1000        |
| 13  | Passenger Windshield              | -30              | 360   | -2040 | 12.5      | 1000        |
| 14  | Pit Front                         | 970              | 0     | 3150  | 24        | 1000        |
| 15  | Pit Rear                          | 2930             | 0     | 3150  | 24        | 1000        |
| 16  | Onboard Driver Side (optional)    |                  |       |       |           |             |
| 17  | Onboard Passenger Side (optional) |                  |       |       |           |             |
| 18  | Real-Time Pan View                |                  |       |       |           | 30          |

**\*COORDINATES:**

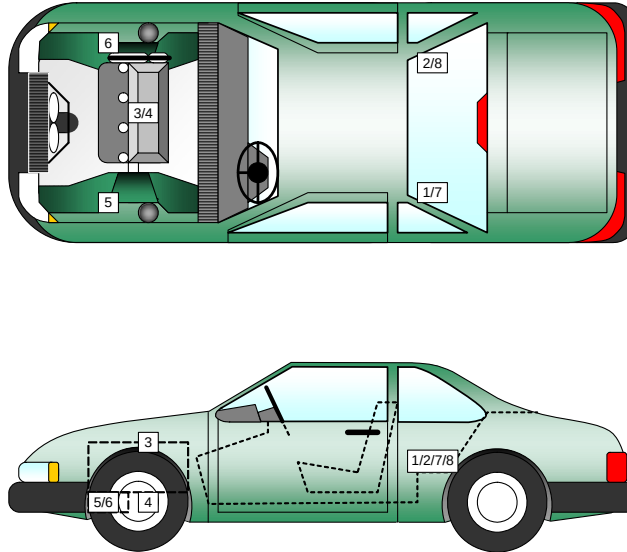
+X = forward of impact plane  
+Y = right of monorail centerline  
+Z = below ground level

Cameras 16 & 17 were not used for this test.

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
Test Date: 11/09/2011



**VEHICLE ACCELEROMETER PRE-TEST LOCATIONS**

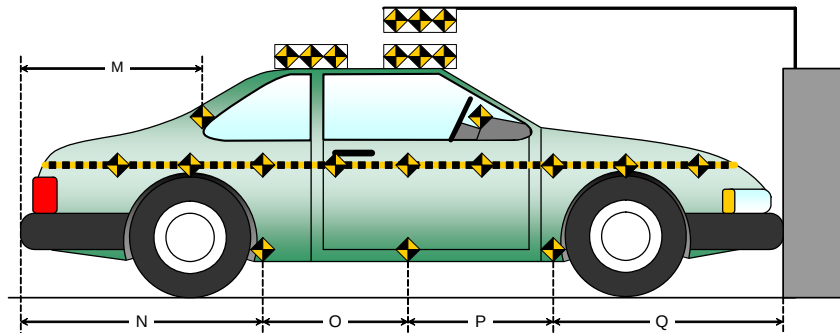
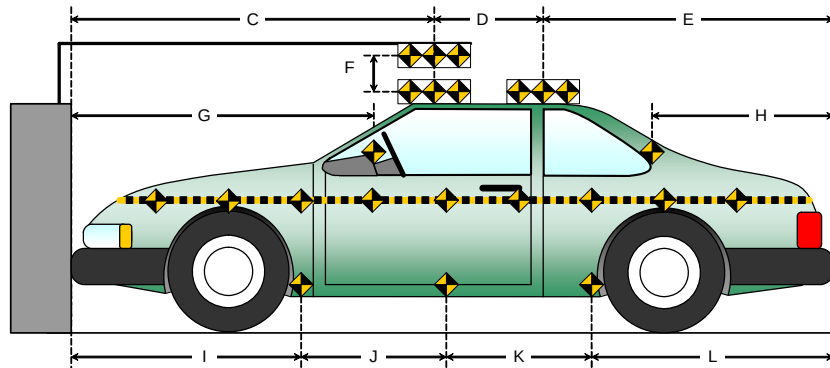
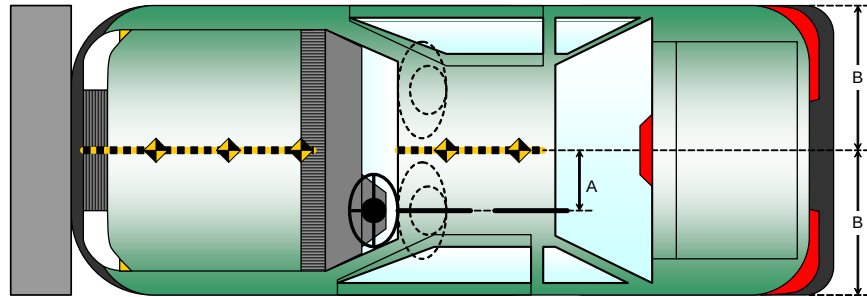
| No. | Accelerometer Location                           | Measurements (mm) |      |       |
|-----|--------------------------------------------------|-------------------|------|-------|
|     |                                                  | X                 | Y    | Z     |
| 1   | Left Rear Accelerometer – X Direction            | 2595              | -345 | -644  |
| 2   | Right Rear Accelerometer – X Direction           | 2709              | 375  | -565  |
| 3   | Engine Top X                                     | 4715              | 0    | -1168 |
| 4   | Engine Bottom X                                  | 4732              | 0    | -495  |
| 5   | Left Brake Caliper X                             | 4468              | -760 | -280  |
| 6   | Right Brake Caliper X                            | 4468              | 760  | -280  |
| 7   | Left Rear Accelerometer Redundant – X Direction  | 2595              | -345 | -644  |
| 8   | Right Rear Accelerometer Redundant – X Direction | 2709              | 375  | -565  |

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: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV      NHTSA No.: MC0103  
 Test Program: NCAP Frontal Barrier Impact Test      Test Date: 11/09/2011

| Item | Value (mm) |
|------|------------|
| A    | 450        |
| B    | 991        |
| C    | 2610       |
| D    | 655        |
| E    | 2390       |
| F    | 115        |
| G    |            |
| H    | 1985       |
| I    | 1513       |
| J    | 1141       |
| K    | 1141       |
| L    | 1860       |
| M    | 1985       |
| N    | 1860       |
| O    | 1141       |
| P    | 1141       |
| Q    | 1513       |

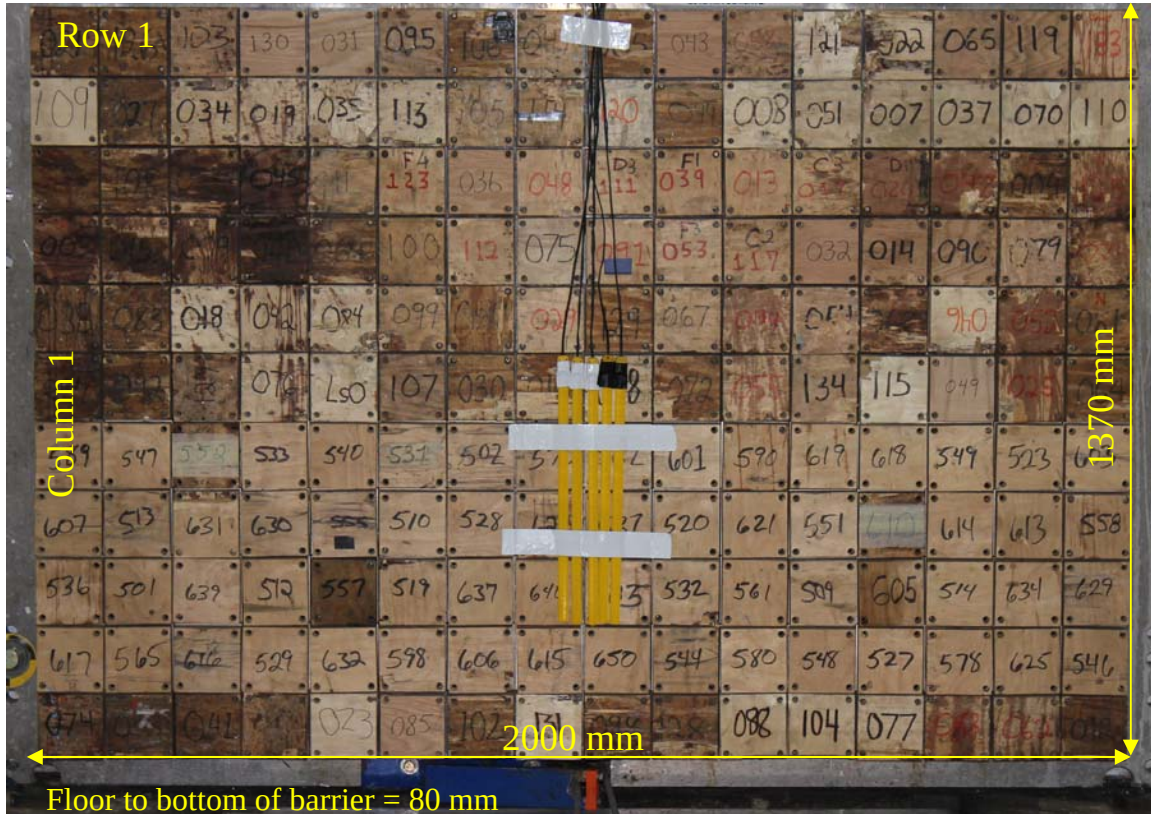


# **DATA SHEET NO. 9** **LOAD CELL LOCATIONS ON FIXED BARRIER**

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011

## **Advanced Research Load Cell Barrier**



|      |      |      |      |      |      |      |      |      |       |       |       |       |       |       |       |
|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| 1-1  | 1-2  | 1-3  | 1-4  | 1-5  | 1-6  | 1-7  | 1-8  | 1-9  | 1-10  | 1-11  | 1-12  | 1-13  | 1-14  | 1-15  | 1-16  |
| 2-1  | 2-2  | 2-3  | 2-4  | 2-5  | 2-6  | 2-7  | 2-8  | 2-9  | 2-10  | 2-11  | 2-12  | 2-13  | 2-14  | 2-15  | 2-16  |
| 3-1  | 3-2  | 3-3  | 3-4  | 3-5  | 3-6  | 3-7  | 3-8  | 3-9  | 3-10  | 3-11  | 3-12  | 3-13  | 3-14  | 3-15  | 3-16  |
| 4-1  | 4-2  | 4-3  | 4-4  | 4-5  | 4-6  | 4-7  | 4-8  | 4-9  | 4-10  | 4-11  | 4-12  | 4-13  | 4-14  | 4-15  | 4-16  |
| 5-1  | 5-2  | 5-3  | 5-4  | 5-5  | 5-6  | 5-7  | 5-8  | 5-9  | 5-10  | 5-11  | 5-12  | 5-13  | 5-14  | 5-15  | 5-16  |
| 6-1  | 6-2  | 6-3  | 6-4  | 6-5  | 6-6  | 6-7  | 6-8  | 6-9  | 6-10  | 6-11  | 6-12  | 6-13  | 6-14  | 6-15  | 6-16  |
| 7-1  | 7-2  | 7-3  | 7-4  | 7-5  | 7-6  | 7-7  | 7-8  | 7-9  | 7-10  | 7-11  | 7-12  | 7-13  | 7-14  | 7-15  | 7-16  |
| 8-1  | 8-2  | 8-3  | 8-4  | 8-5  | 8-6  | 8-7  | 8-8  | 8-9  | 8-10  | 8-11  | 8-12  | 8-13  | 8-14  | 8-15  | 8-16  |
| 9-1  | 9-2  | 9-3  | 9-4  | 9-5  | 9-6  | 9-7  | 9-8  | 9-9  | 9-10  | 9-11  | 9-12  | 9-13  | 9-14  | 9-15  | 9-16  |
| 10-1 | 10-2 | 10-3 | 10-4 | 10-5 | 10-6 | 10-7 | 10-8 | 10-9 | 10-10 | 10-11 | 10-12 | 10-13 | 10-14 | 10-15 | 10-16 |
| 11-1 | 11-2 | 11-3 | 11-4 | 11-5 | 11-6 | 11-7 | 11-8 | 11-9 | 11-10 | 11-11 | 11-12 | 11-13 | 11-14 | 11-15 | 11-16 |

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

**DATA SHEET NO. 10**  
**TEST VEHICLE SUMMARY OF RESULTS**

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
Test Date: 11/09/2011

**INSTRUMENTATION**

|                                  |     |
|----------------------------------|-----|
| Driver Dummy Data Channels       | 46  |
| Passenger Dummy Data Channels    | 46  |
| Vehicle Structure Accelerometers | 8   |
| Barrier Channels                 | 128 |
| Total                            | 228 |

**CAMERA COVERAGE**

|                            |    |
|----------------------------|----|
| High-Speed Vehicle Onboard | 0  |
| High-Speed Offboard        | 14 |
| Real-Time                  | 2  |
| Total                      | 16 |

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
Test Date: 11/09/2011

**TEST DUMMY INFORMATION AND CONTACT LOCATIONS**

| Description             | Driver           | Passenger        |
|-------------------------|------------------|------------------|
| Dummy Type / Serial No. | HIII 50% / 036   | HIII 5% / 634    |
| Head Contact            | Airbag, Headrest | Airbag, Headrest |
| Upper Torso Contact     | Airbag           | Airbag           |
| Lower Torso Contact     | None             | None             |
| Left Knee Contact       | Knee Bolster     | Glovebox         |
| Right Knee Contact      | Knee Bolster     | Glovebox         |

**DOOR OPENING AND SEAT TRACK INFORMATION**

| Description           | Driver                                                                | Passenger                                                      |
|-----------------------|-----------------------------------------------------------------------|----------------------------------------------------------------|
| Locked/Unlocked Doors | Doors were locked                                                     | Doors were locked                                              |
| Front Door Opening    | Door remained closed and latched;<br>Door had to be opened with 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         | There was a 1% loss of window retention.<br>See page 26 and photo on page A-39. |

**VEHICLE REBOUND FROM BARRIER**

| Measured Parameter | Units | Value |
|--------------------|-------|-------|
| Left Side          | mm    | 883   |
| Center             | mm    | 972   |
| Right Side         | mm    | 950   |
| Average            | mm    | 935   |

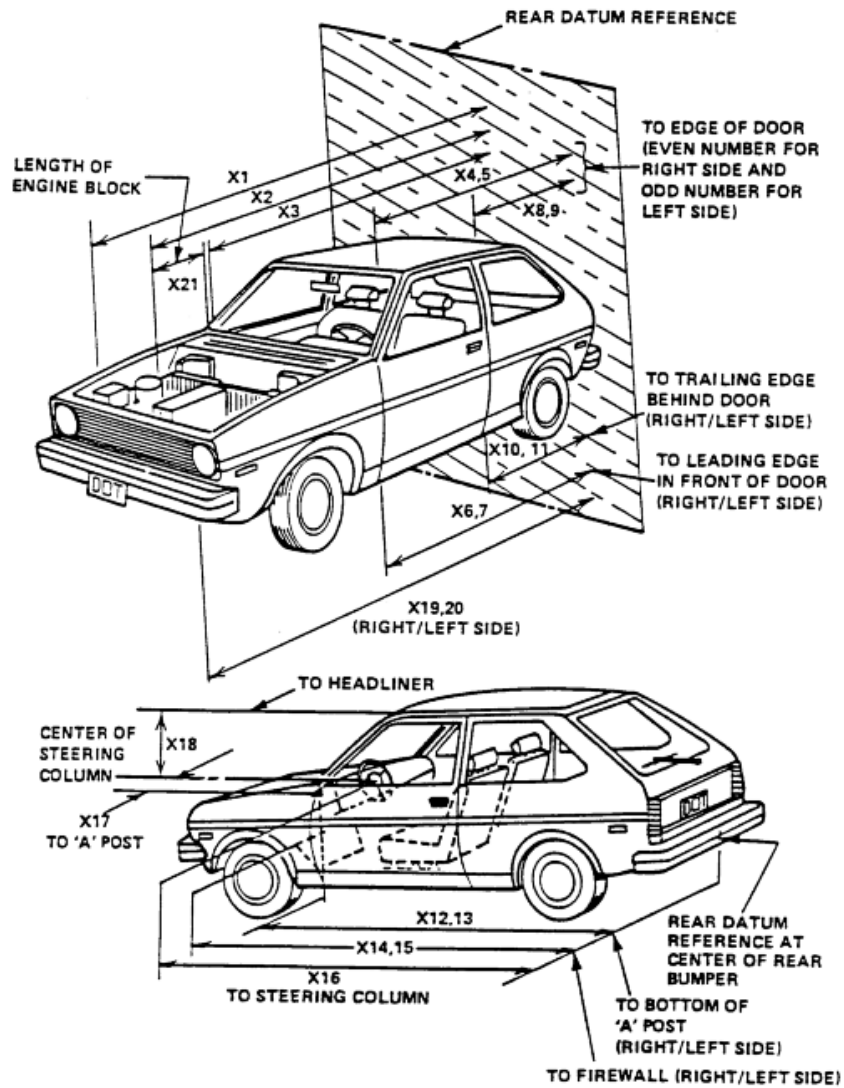
**SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION**

| Restraint Type                   | Left Front (Driver) P1 |          | Right Front (Passenger) |          |
|----------------------------------|------------------------|----------|-------------------------|----------|
|                                  | Mounted                | Deployed | Mounted                 | Deployed |
| Frontal Airbag                   | Yes                    | Yes      | Yes                     | Yes      |
| Knee Airbag                      | No                     |          | No                      |          |
| Curtain Side Airbag              | Yes                    | No       | Yes                     | No       |
| Torso/Abdomen/Pelvis Side Airbag | Yes                    | No       | Yes                     | No       |
| Seat Belt Pretensioner           | Yes                    | Yes      | Yes                     | Yes      |
| Seat Belt Load Limiter           | Yes                    |          | Yes                     |          |

## DATA SHEET NO. 12 VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011



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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011

**RSOV (Rear Surface of Vehicle)**

| No. | Measurement Description                   | Units | Pre-Test | Post-Test | Difference |
|-----|-------------------------------------------|-------|----------|-----------|------------|
| 1   | Total Length of Vehicle at Centerline     | mm    | 5655     | 4890      | 765        |
| 2   | RSOV to Front of Engine                   | mm    | 4906     | 4800      | 106        |
| 3   | RSOV to Firewall                          | mm    | 4468     | 4460      | 8          |
| 4   | RSOV to Upper Leading Edge of Right Door  | mm    | 4035     | 4054      | -19        |
| 5   | RSOV to Upper Leading Edge of Left Door   | mm    | 4035     | 4015      | 20         |
| 6   | RSOV to Lower Leading Edge of Right Door  | mm    | 4020     | 4007      | 13         |
| 7   | RSOV to Lower Leading Edge of Left Door   | mm    | 4020     | 3993      | 27         |
| 8   | RSOV to Upper Trailing Edge of Right Door | mm    | 2893     | 2888      | 5          |
| 9   | RSOV to Upper Trailing Edge of Left Door  | mm    | 2893     | 2880      | 13         |
| 10  | RSOV to Lower Trailing Edge of Right Door | mm    | 2874     | 2860      | 14         |
| 11  | RSOV to Lower Trailing Edge of Left Door  | mm    | 2874     | 2861      | 13         |
| 12  | RSOV to Bottom of "A" Post of Right Side  | mm    | 4045     | 4042      | 3          |
| 13  | RSOV to Bottom of "A" Post of Left Side   | mm    | 4045     | 4040      | 5          |
| 14  | RSOV to Firewall, Right Side              | mm    | 4380     | 4376      | 4          |
| 15  | RSOV to Firewall, Left Side               | mm    | 4380     | 4370      | 10         |
| 16  | RSOV to Steering Column                   | mm    | 3554     | 3540      | 14         |
| 17  | Center of Steering Column to "A" Post     | mm    | 410      | 416       | 6          |
| 18  | Center of Steering Column to Headliner    | mm    | 467      | 481       | -14        |
| 19  | RSOV to Right Side of Front Bumper        | mm    | 5512     | 4892      | 620        |
| 20  | RSOV to Left Side of Front Bumper         | mm    | 5512     | 4905      | 607        |
| 21  | Length of Engine Block                    | mm    | 580      | 580       | 0          |
| RD  | RSOV to Right Side of Dash Panel          | mm    | 3772     | 3770      | 2          |
| CD  | RSOV to Center of Dash Panel              | mm    | 3756     | 3752      | 4          |
| LD  | RSOV to Left Side of Dash Panel           | mm    | 3765     | 3760      | 5          |

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

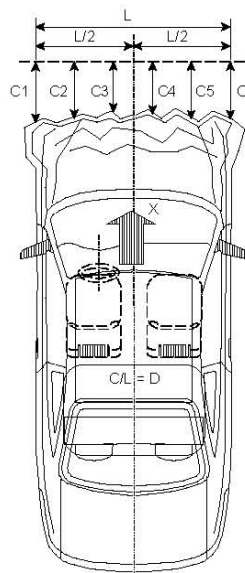
Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV NHTSA No.: MC0103  
Test Program: NCAP Frontal Barrier Impact Test Test Date: 11/09/2011

**VEHICLE INFORMATION**

VIN: 1GNSKHE76CR116656 Wheelbase (mm): 3310  
Vehicle Size Category: MPV Test Weight (kg): 2921.6

**ACCELEROMETER DATA**

Accelerometer Locations: As per measurements on Page 15  
Cal. Procedure/Interval: MGA procedure / 6 month  
Integration Algorithm: Trapezoidal Linearity: > 99%  
Impact Velocity (km/h): 56.3  
Velocity Change (km/h): 62.3  
Time of Separation (msec): 148.0



**CRUSH PROFILE**

Collision Deformation Classification: Frontal  
Midpoint of Damage: Centerline  
Damage Region Length (mm): 1405  
Impact Mode: Frontal

| No. | Measurement Description    | Units | Pre-Test | Post-Test | Difference |
|-----|----------------------------|-------|----------|-----------|------------|
| C1  | Crush zone 1 at left side  | mm    | 5512     | 4905      | 607        |
| C2  | Crush zone 2 at left side  | mm    | 5583     | 4938      | 645        |
| C3  | Crush zone 3 at left side  | mm    | 5611     | 4924      | 687        |
| C4  | Crush zone 4 at right side | mm    | 4611     | 4915      | 696        |
| C5  | Crush zone 5 at right side | mm    | 5583     | 4926      | 657        |
| C6  | Crush zone 6 at right side | mm    | 5512     | 4892      | 620        |
| L   | C1 TO C6                   | mm    | 1405     | 1397      | 8          |

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
Test Program: NCAP Frontal Barrier Impact Test

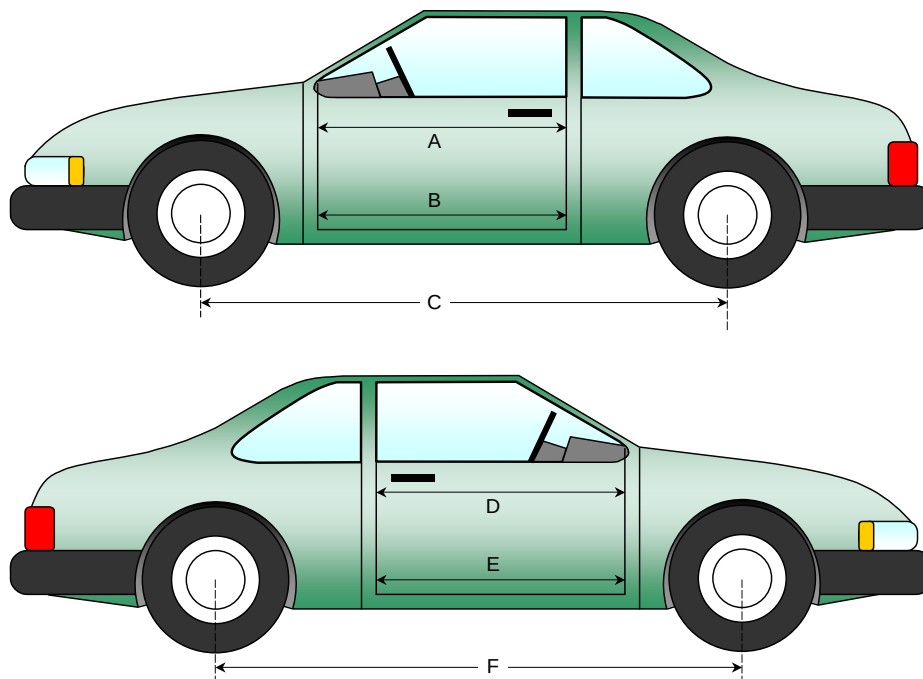
NHTSA No.: MC0103  
Test Date: 11/09/2011

**DOOR OPENING WIDTH**

| Item | Description      | Units | Pre-Test | Post-Test | Difference |
|------|------------------|-------|----------|-----------|------------|
| A    | Left Side Upper  | mm    | 1117     | 1095      | 22         |
| B    | Left Side Lower  | mm    | 1104     | 1090      | 14         |
| D    | Right Side Upper | mm    | 1117     | 1093      | 24         |
| E    | Right Side Lower | mm    | 1104     | 1095      | 9          |

**WHEELBASE MEASUREMENTS**

| Item | Description          | Units | Pre-Test | Post-Test | Difference |
|------|----------------------|-------|----------|-----------|------------|
| C    | Left Side Wheelbase  | mm    | 3310     | 3212      | 98         |
| F    | Right Side Wheelbase | mm    | 3310     | 3245      | 65         |



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

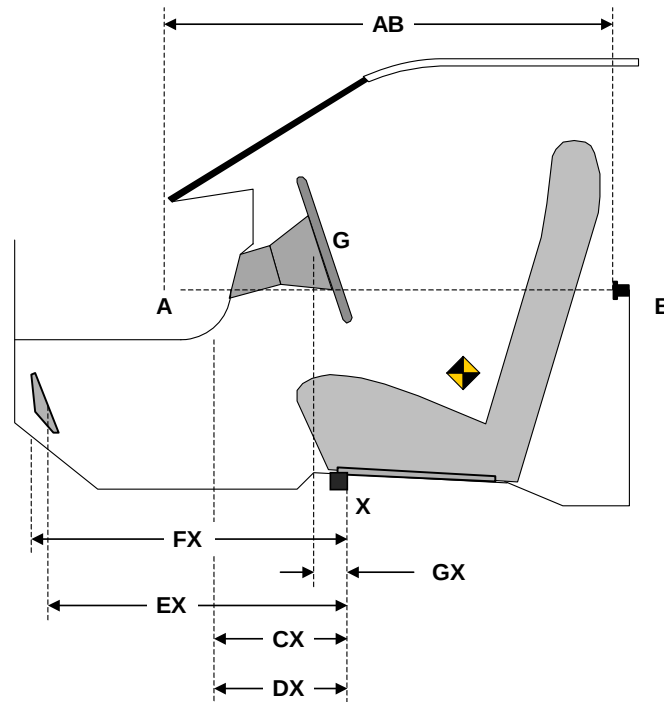
Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011

**DRIVER COMPARTMENT INTRUSION**

| Item | Description                              | Units | Pre-Test | Post-Test | Difference |
|------|------------------------------------------|-------|----------|-----------|------------|
| AB   | Door Opening (Inside window jam)         | mm    | 810      | 810       | 0          |
| CX   | Left Knee Bolster to X                   | mm    | 296      | 298       | -2         |
| DX   | Right Knee Bolster to X                  | mm    | 282      | 274       | 8          |
| EX   | Brake Pedal to X                         | mm    | 558      | 542       | 16         |
| FX   | Foot Rest to X                           | mm    | 723      | 720       | 3          |
| GX   | Center of Steering Column Wheel Hub to X | mm    | 105      | 100       | 5          |

X = Front of Seat Track (stationary)

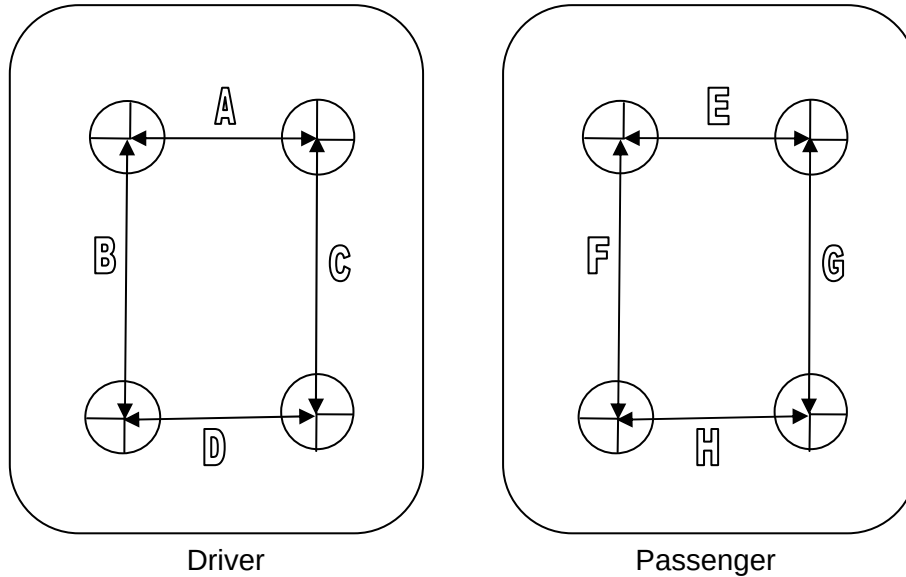


**DRIVER COMPARTMENT**

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011



**TOP VIEW THROUGH FLOOR PAN**

**UNDERBODY FLOORBOARD DEFORMATION**

| Measurement | Units | Pre-Test | Post-Test | Difference |
|-------------|-------|----------|-----------|------------|
| A           | mm    | 350      | 350       | 0          |
| B           | mm    | 220      | 220       | 0          |
| C           | mm    | 220      | 220       | 0          |
| D           | mm    | 350      | 350       | 0          |
| E           | mm    | 270      | 270       | 0          |
| F           | mm    | 270      | 270       | 0          |
| G           | mm    | 305      | 305       | 0          |
| H           | mm    | 270      | 270       | 0          |

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011

**Windshield Mounting Details:**

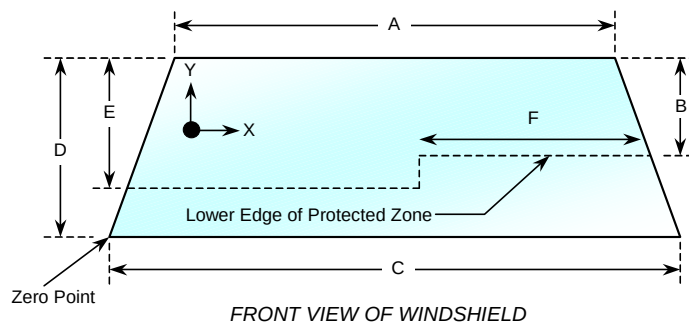
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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: 21.2°C

**WINDSHIELD PERIPHERY MEASUREMENTS**

| Measurement | Pre-Test (mm) | Post-Test (mm) | % of Retention |
|-------------|---------------|----------------|----------------|
| Left Side   | 2291          | 2231           | 97             |
| Right Side  | 2291          | 2291           | 100            |
| Total       | 4582          | 4522           | 99             |



| Item | Units | Value |
|------|-------|-------|
| A    | mm    | 1376  |
| B    | mm    | 500   |
| C    | mm    | 1728  |
| D    | mm    | 739   |
| E    | mm    | 486   |
| F    | mm    | 512   |

**AREA OF PROTECTED ZONE FAILURES - NONE**

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

| X | Y |
|---|---|
|   |   |
|   |   |
|   |   |
|   |   |

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

| X | Y |
|---|---|
|   |   |
|   |   |
|   |   |
|   |   |

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

|               |                                                   |            |                   |
|---------------|---------------------------------------------------|------------|-------------------|
| Test Vehicle: | <u>2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV</u> | NHTSA No.: | <u>MC0103</u>     |
| Test Program: | <u>NCAP Frontal Barrier Impact Test</u>           | Test Date: | <u>11/09/2011</u> |

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

Test Time: 11:00 am

Temperature: 21.2° C

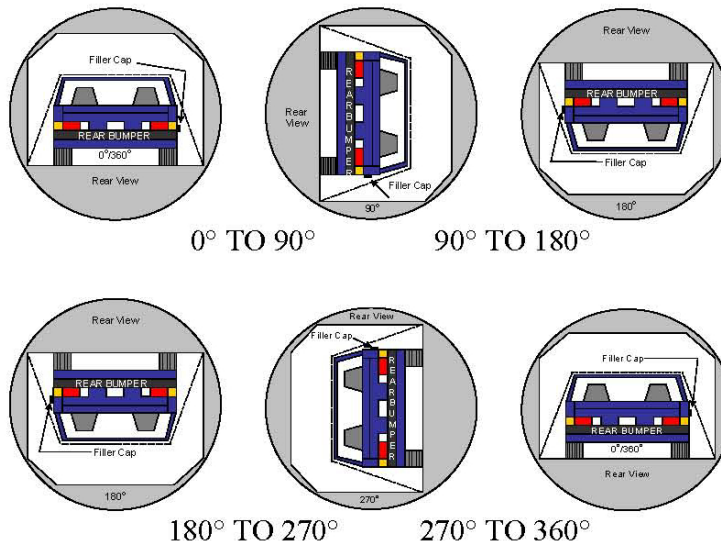
- |                                                                                   |              |
|-----------------------------------------------------------------------------------|--------------|
| A. From impact until vehicle motion ceases:<br>(Maximum Allowable = 1 ounce)      | <u>0</u> oz.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

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

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011

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°    | 156           | 300       | 456        |
| 90° to 180°  | 140           | 300       | 440        |
| 180° to 270° | 141           | 300       | 441        |
| 270° to 360° | 150           | 300       | 450        |

**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            |

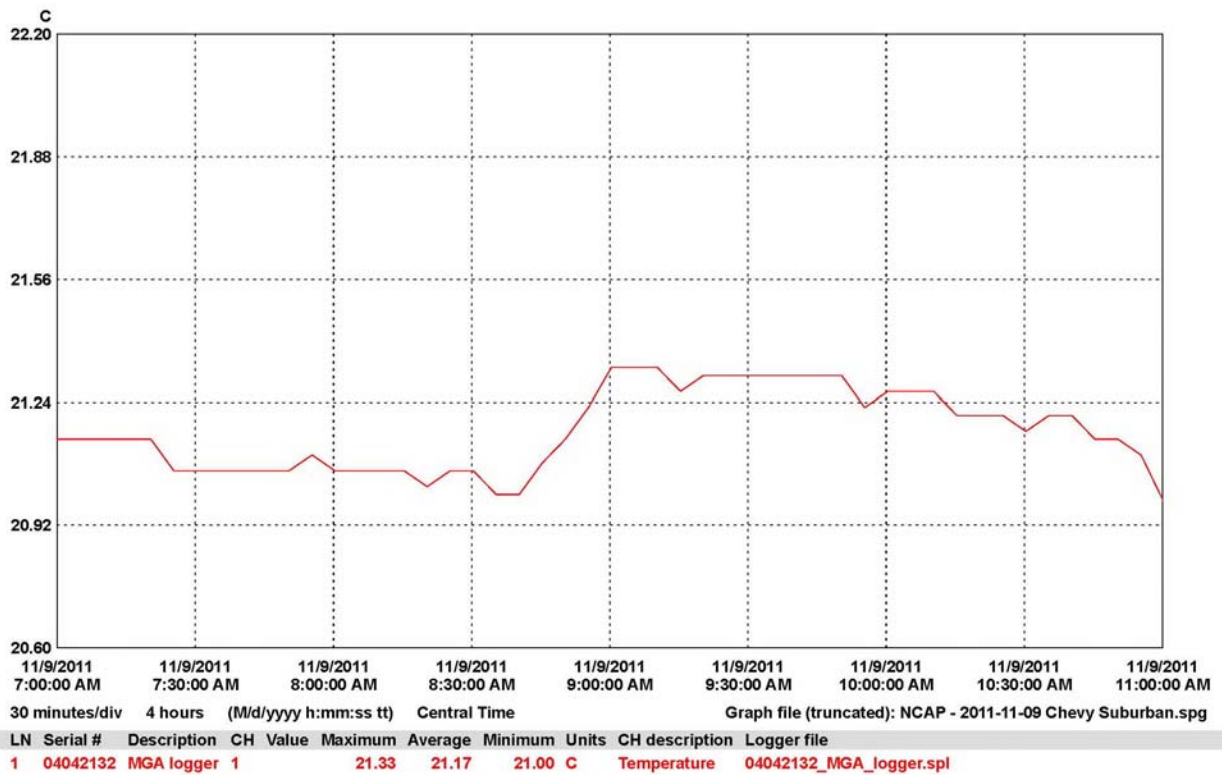
**ROLLOVER SOLVENT SPILLAGE LOCATION TABLE**

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

# **DATA SHEET NO. 17** **DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA**

Test Vehicle: 2012 Chevrolet Suburban 4WD 1/2 Ton LS SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MC0103  
 Test Date: 11/09/2011



**APPENDIX A**  
**PHOTOGRAPHS**

## TABLE OF PHOTOGRAPHS

|               |                                              | <u>Page No.</u> |
|---------------|----------------------------------------------|-----------------|
| Photo No. 1.  | Load Cell Location                           | A-1             |
| Photo No. 2.  | Load Cell Wall                               | A-1             |
| Photo No. 3.  | Manufacturer's Label                         | A-2             |
| Photo No. 4.  | Tire Placard                                 | A-2             |
| Photo No. 5.  | 2012 Chevrolet Suburban Frontal As Delivered | A-3             |
| Photo No. 6.  | Left Rear Three-Quarter View, As Received    | A-3             |
| Photo No. 7.  | Pre-Test Front View of Test Vehicle          | A-4             |
| Photo No. 8.  | Post-Test Front View of Test Vehicle         | A-4             |
| Photo No. 9.  | Pre-Test Left View of Test Vehicle           | A-5             |
| Photo No. 10. | Post-Test Left View of Test Vehicle          | A-5             |
| Photo No. 11. | Pre-Test Right View of Test Vehicle          | A-6             |
| Photo No. 12. | Post-Test Right View of Test Vehicle         | A-6             |
| Photo No. 13. | Pre-Test Right Front Three-Quarter View      | A-7             |
| Photo No. 14. | Post-Test Right Front Three-Quarter View     | A-7             |
| Photo No. 15. | Pre-Test Left Rear Three-Quarter View        | A-8             |
| Photo No. 16. | Post-Test Left Rear Three-Quarter View       | A-8             |
| Photo No. 17. | Pre-Test Windshield View                     | A-9             |
| Photo No. 18. | Post-Test Windshield View                    | A-9             |
| Photo No. 19. | Pre-Test Engine Compartment View             | A-10            |
| Photo No. 20. | Post-Test Engine Compartment View            | A-10            |
| Photo No. 21. | Pre-Test Fuel Filler Cap View                | A-11            |
| Photo No. 22. | Post-Test Fuel Filler Cap View               | A-11            |
| Photo No. 23. | Pre-Test Front Underbody View                | A-12            |
| Photo No. 24. | Post-Test Front Underbody View               | A-12            |
| Photo No. 25. | Pre-Test Mid Front Underbody View            | A-13            |
| Photo No. 26. | Post-Test Mid Front Underbody View           | A-13            |
| Photo No. 27. | Pre-Test Mid Rear Underbody View             | A-14            |

|               |                                                         | <u>Page No.</u> |
|---------------|---------------------------------------------------------|-----------------|
| Photo No. 28. | Post-Test Mid Rear Underbody View                       | A-14            |
| Photo No. 29. | Pre-Test Rear Underbody View                            | A-15            |
| Photo No. 30. | Post-Test Rear Underbody View                           | A-15            |
| Photo No. 31. | Pre-Test Dummy Cable Routing                            | A-16            |
| Photo No. 32. | Post-Test Dummy Cable Routing                           | A-16            |
| Photo No. 33. | Pre-Test Driver Dummy Front View                        | A-17            |
| Photo No. 34. | Post-Test Driver Dummy Front View                       | A-17            |
| Photo No. 35. | Pre-Test Driver Dummy Window View                       | A-18            |
| Photo No. 36. | Post-Test Driver Dummy Window View                      | A-18            |
| Photo No. 37. | Pre-Test Driver Dummy and Vehicle Interior (Door Open)  | A-19            |
| Photo No. 38. | Post-Test Driver Dummy and Vehicle Interior (Door Open) | A-19            |
| Photo No. 39. | Pre-Test Driver's Seat Fore-Aft Markings                | A-20            |
| Photo No. 40. | Post-Test Driver's Seat Fore-Aft Markings               | A-20            |
| Photo No. 41. | Pre-Test Driver Dummy Feet                              | A-21            |
| Photo No. 42. | Post-Test Driver Dummy Feet                             | A-21            |
| Photo No. 43. | Pre-Test Driver's Side Knee Bolster (without dummy)     | A-22            |
| Photo No. 44. | Post-Test Driver's Side Knee Bolster (without dummy)    | A-22            |
| Photo No. 45. | Pre-Test Driver's Side Floorpan                         | A-23            |
| Photo No. 46. | Post-Test Driver's Side Floorpan                        | A-23            |
| Photo No. 47. | Post-Test Driver Dummy Face                             | A-24            |
| Photo No. 48. | Post-Test Driver Dummy Contact with Airbag              | A-24            |
| Photo No. 49. | Post-Test Driver Dummy Contact with Headrest            | A-25            |
| Photo No. 50. | Pre-Test View of the Steering Wheel                     | A-25            |
| Photo No. 51. | Post-Test View of the Steering Wheel                    | A-26            |
| Photo No. 52. | Pre-Test Passenger Dummy Front View                     | A-26            |
| Photo No. 53. | Post-Test Passenger Dummy Front View                    | A-27            |
| Photo No. 54. | Pre-Test Passenger Dummy Window View                    | A-27            |
| Photo No. 55. | Post-Test Passenger Dummy Window View                   | A-28            |

|               |                                                            | <u>Page No.</u> |
|---------------|------------------------------------------------------------|-----------------|
| Photo No. 56. | Pre-Test Passenger Dummy and Vehicle Interior (Door Open)  | A-28            |
| Photo No. 57. | Post-Test Passenger Dummy and Vehicle Interior (Door Open) | A-29            |
| Photo No. 58. | Pre-Test Passenger's Seat Fore-Aft Markings                | A-29            |
| Photo No. 59. | Post-Test Passenger's Seat Fore-Aft Markings               | A-30            |
| Photo No. 60. | Pre-Test Passenger Dummy Feet                              | A-30            |
| Photo No. 61. | Post-Test Passenger Dummy Feet                             | A-31            |
| Photo No. 62. | Pre-Test Passenger's Side Knee Bolster (without dummy)     | A-31            |
| Photo No. 63. | Post-Test Passenger's Side Knee Bolster (without dummy)    | A-32            |
| Photo No. 64. | Pre-Test Passenger's Side Floorpan                         | A-32            |
| Photo No. 65. | Post-Test Passenger's Side Floorpan                        | A-33            |
| Photo No. 66. | Post-Test Passenger Dummy Contact with Airbag              | A-33            |
| Photo No. 67. | Post-Test Passenger Dummy Contact with Headrest            | A-34            |
| Photo No. 68. | Ballast Installed in Vehicle                               | A-34            |
| Photo No. 69. | Post-Test Stoddard Solvent Spillage Location View          | A-35            |
| Photo No. 70. | Post-Test Speed Trap Read-Out                              | A-35            |
| Photo No. 71. | Vehicle at 0 Degrees on Static Rollover Device             | A-36            |
| Photo No. 72. | Vehicle at 90 Degrees on Static Rollover Device            | A-36            |
| Photo No. 73. | Vehicle at 180 Degrees on Static Rollover Device           | A-37            |
| Photo No. 74. | Vehicle at 270 Degrees on Static Rollover Device           | A-37            |
| Photo No. 75. | Vehicle at 360 Degrees on Static Rollover Device           | A-38            |
| Photo No. 76. | 2012 Chevrolet Suburban Frontal Impact Event               | A-38            |
| Photo No. 77. | Monroney Label                                             | A-39            |
| Photo No. 78. | Post-Test Windshield Retention                             | A-39            |



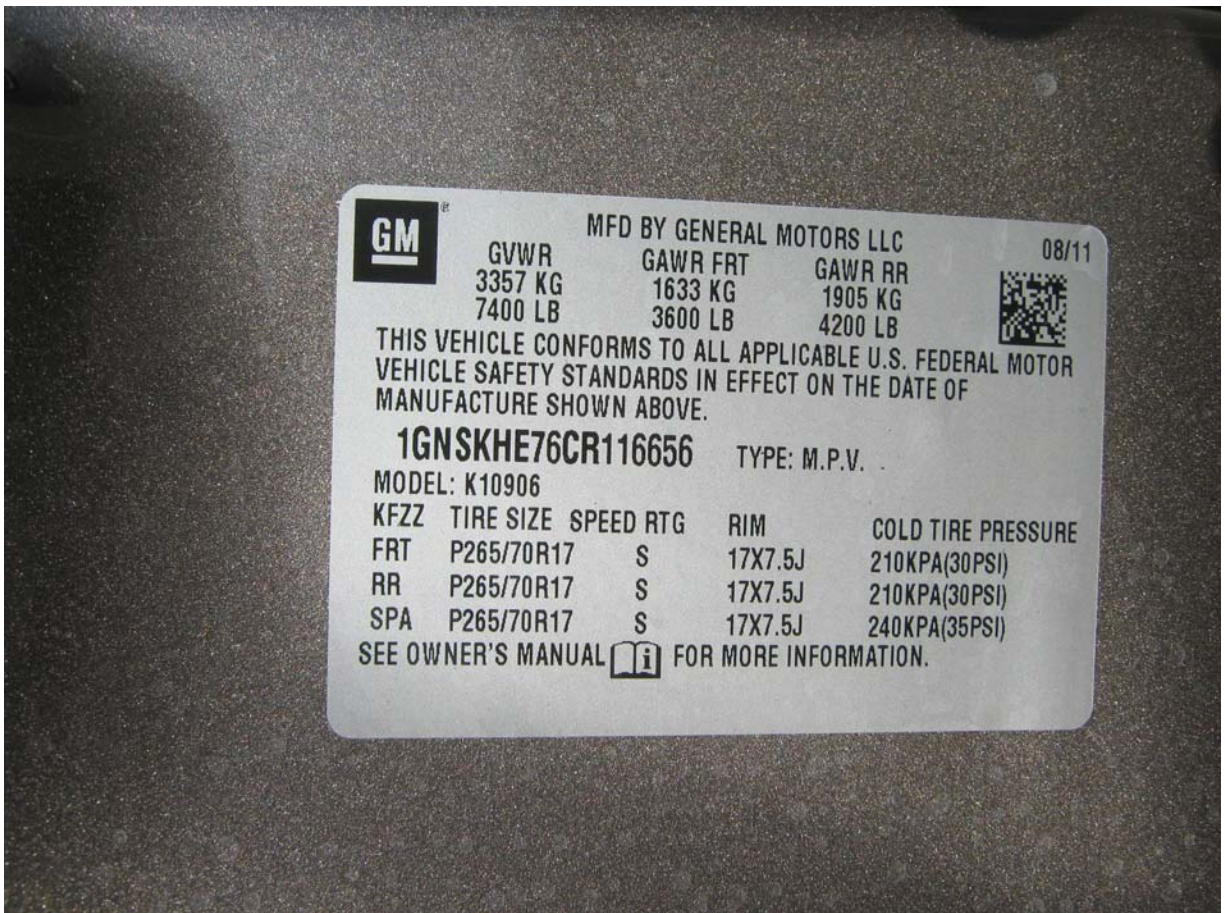
Load Cell Location



Load Cell Wall



Manufacturer's Label



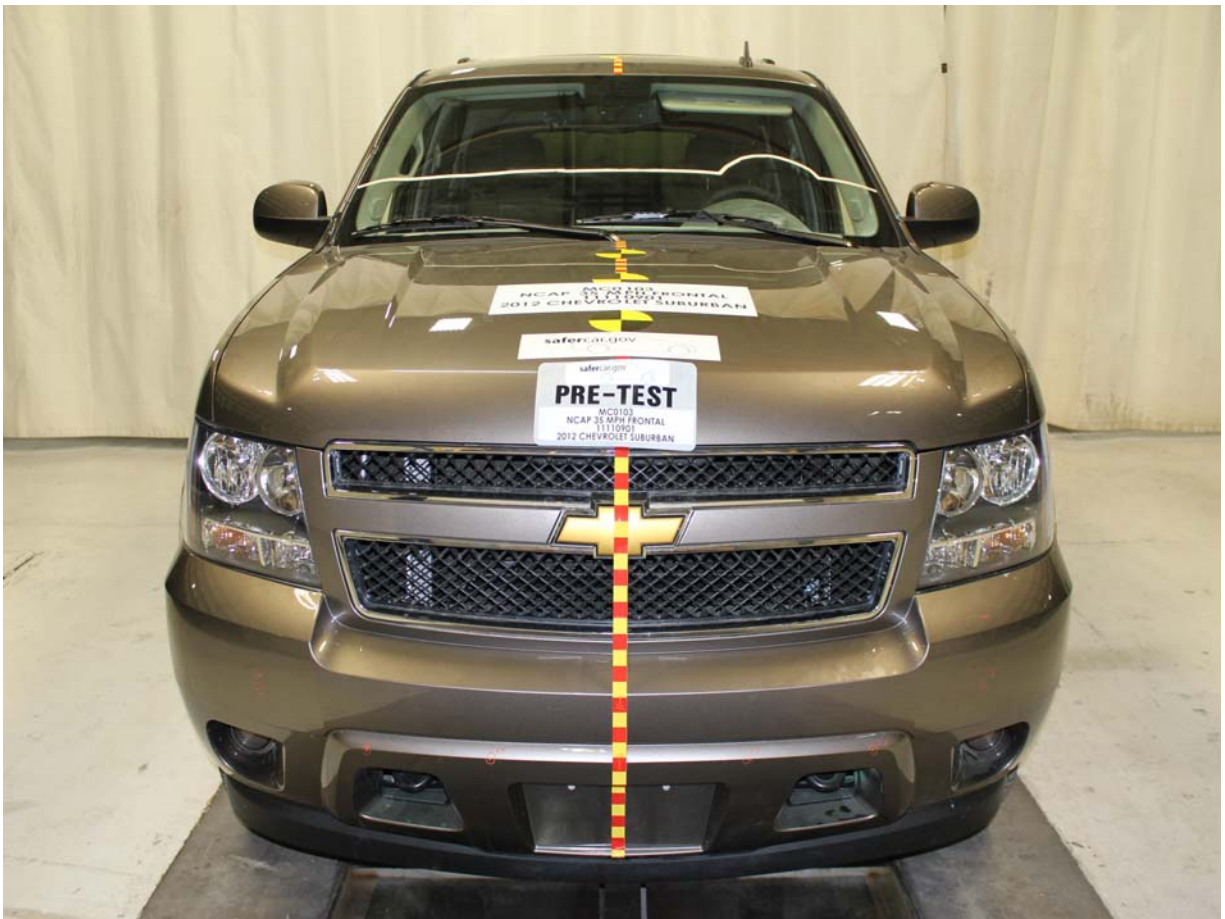
Tire Placard



2012 Chevrolet Suburban Frontal As Delivered



Left Rear Three-Quarter View, As Received



Pre-Test Front View of Test Vehicle



Post-Test Front View of Test Vehicle



Pre-Test Left View of Test Vehicle



Post-Test Left View of Test Vehicle



Pre-Test Right View of Test Vehicle



Post-Test Right View of Test Vehicle



Pre-Test Right Front Three-Quarter View



Post-Test Right Front Three-Quarter View



Pre-Test Left Rear Three-Quarter View



Post-Test Left Rear Three-Quarter View



Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



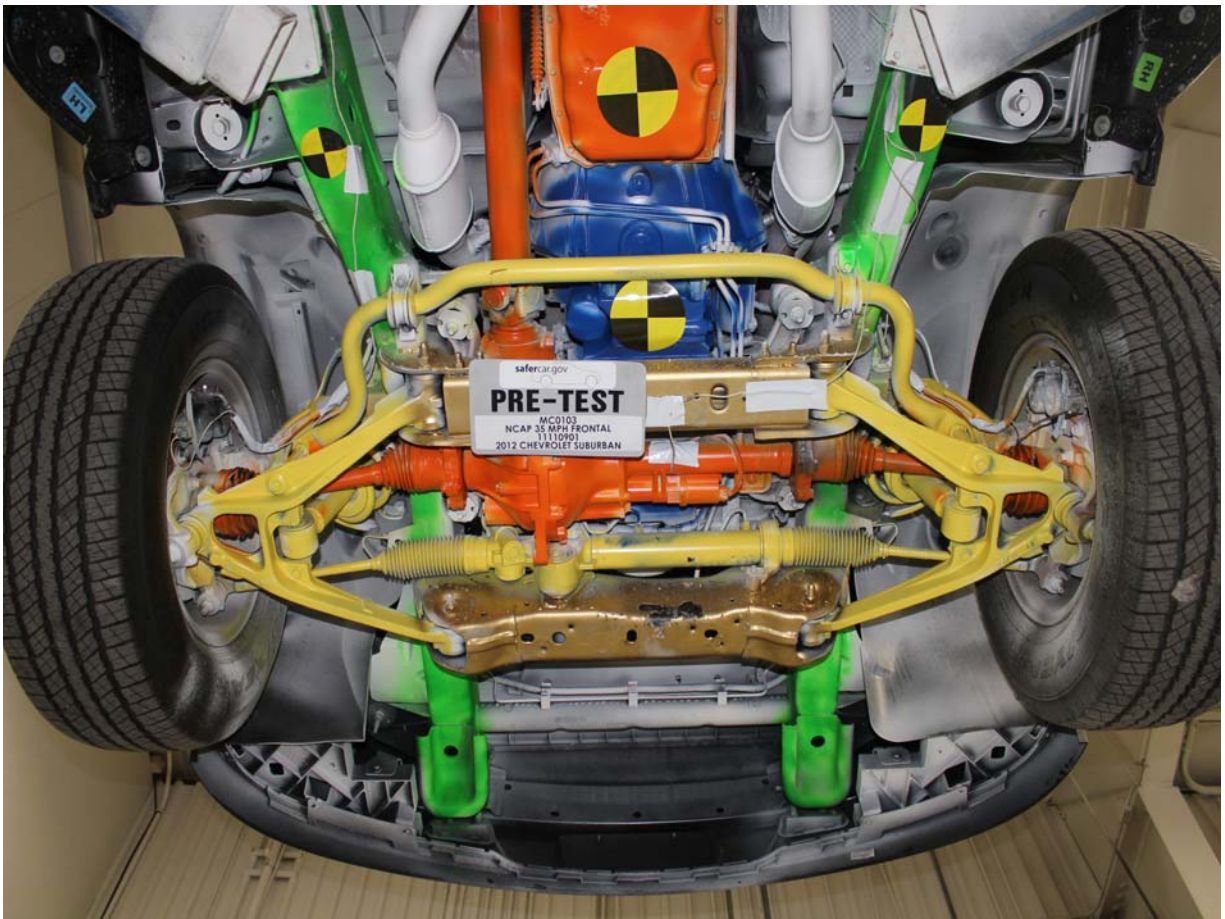
Post-Test Engine Compartment View



Pre-Test Fuel Filler Cap View



Post-Test Fuel Filler Cap View



Pre-Test Front Underbody View



Post-Test Front Underbody View



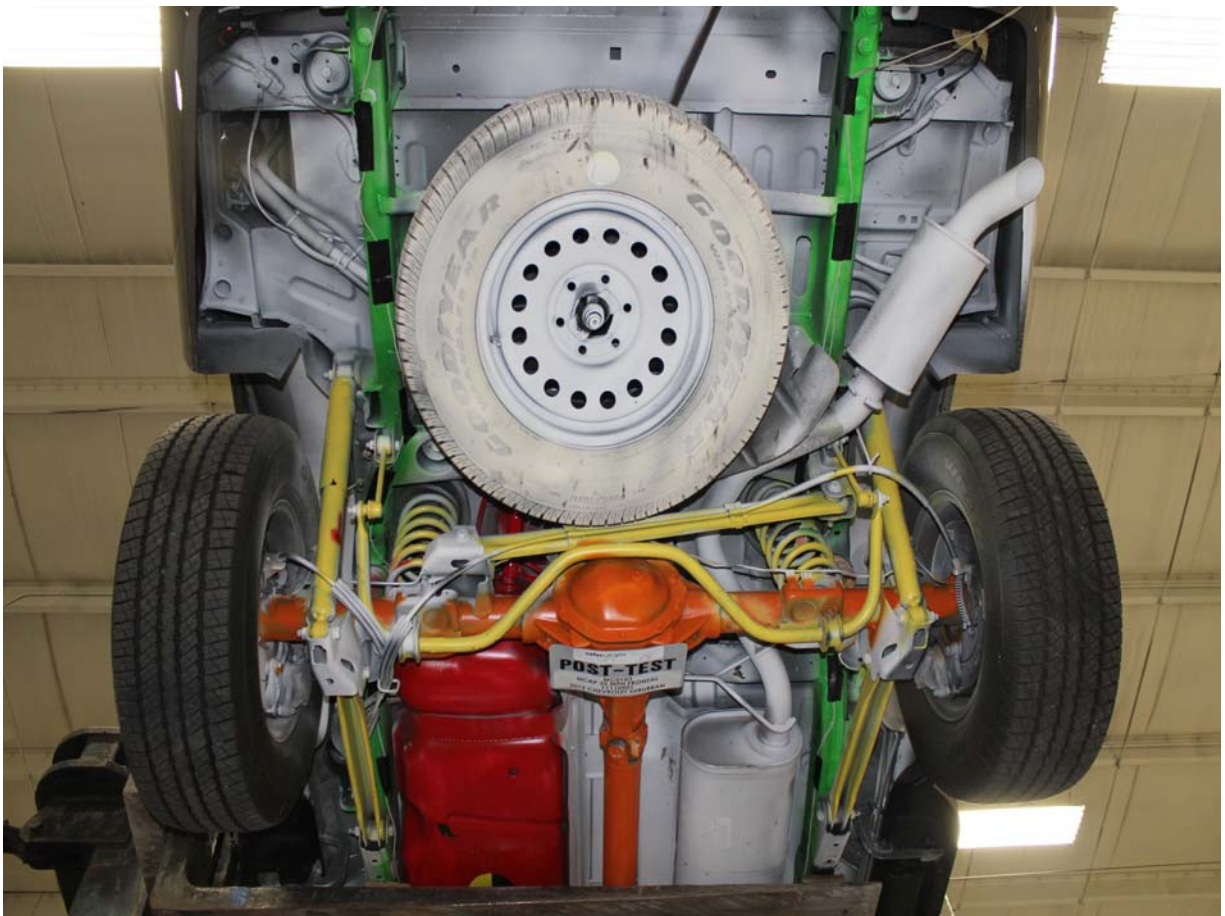
Pre-Test Mid Front Underbody View



Post-Test Mid Front Underbody View



Pre-Test Mid Rear Underbody View



Post-Test Mid Rear Underbody View



Pre-Test Rear Underbody View



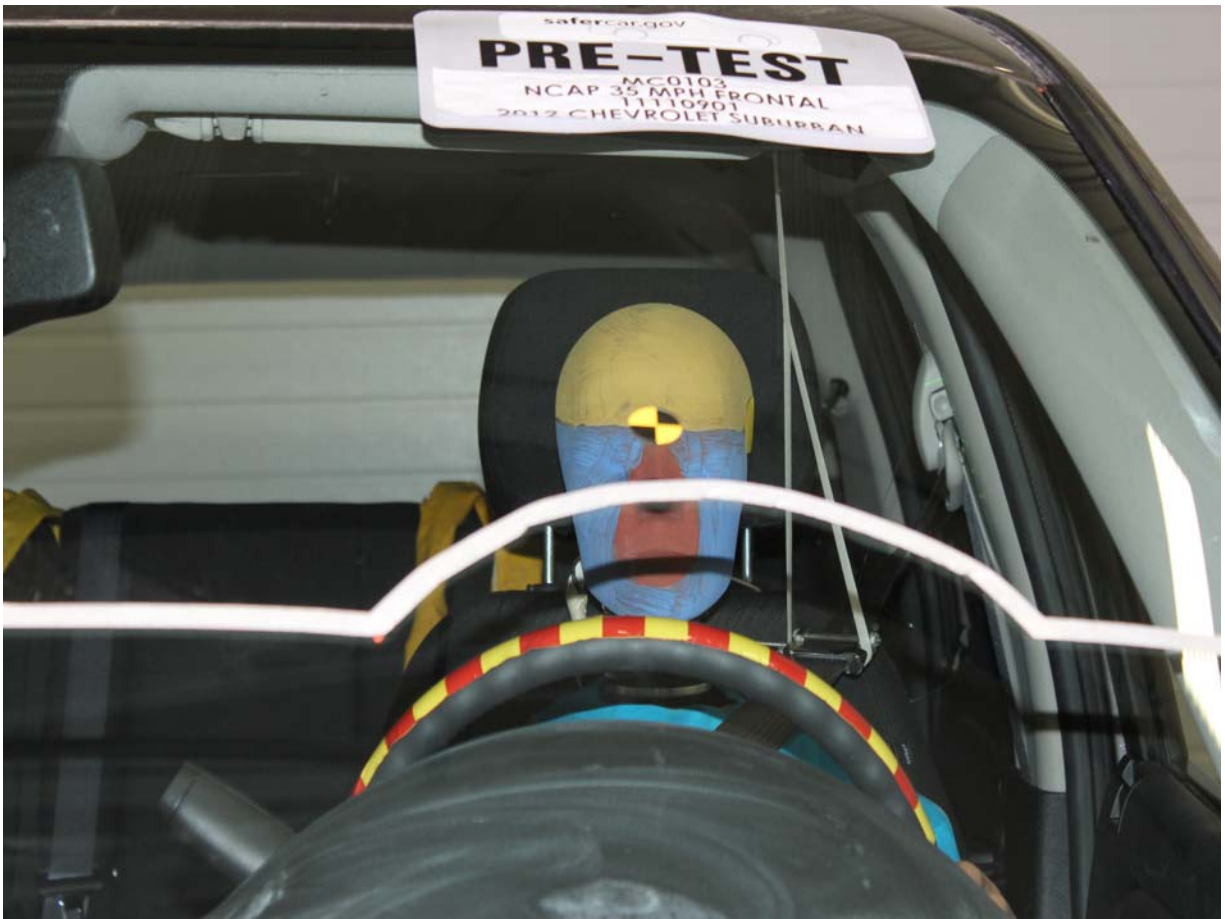
Post-Test Rear Underbody View



Pre-Test Dummy Cable Routing



Post-Test Dummy Cable Routing



Pre-Test Driver Dummy Front View



Post-Test Driver Dummy Front View



Pre-Test Driver Dummy Window View



Post-Test Driver Dummy Window View



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



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



Pre-Test Driver's Seat Fore-Aft Markings



Post-Test Driver's Seat Fore-Aft Markings



Pre-Test Driver Dummy Feet



Post-Test Driver Dummy Feet



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



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



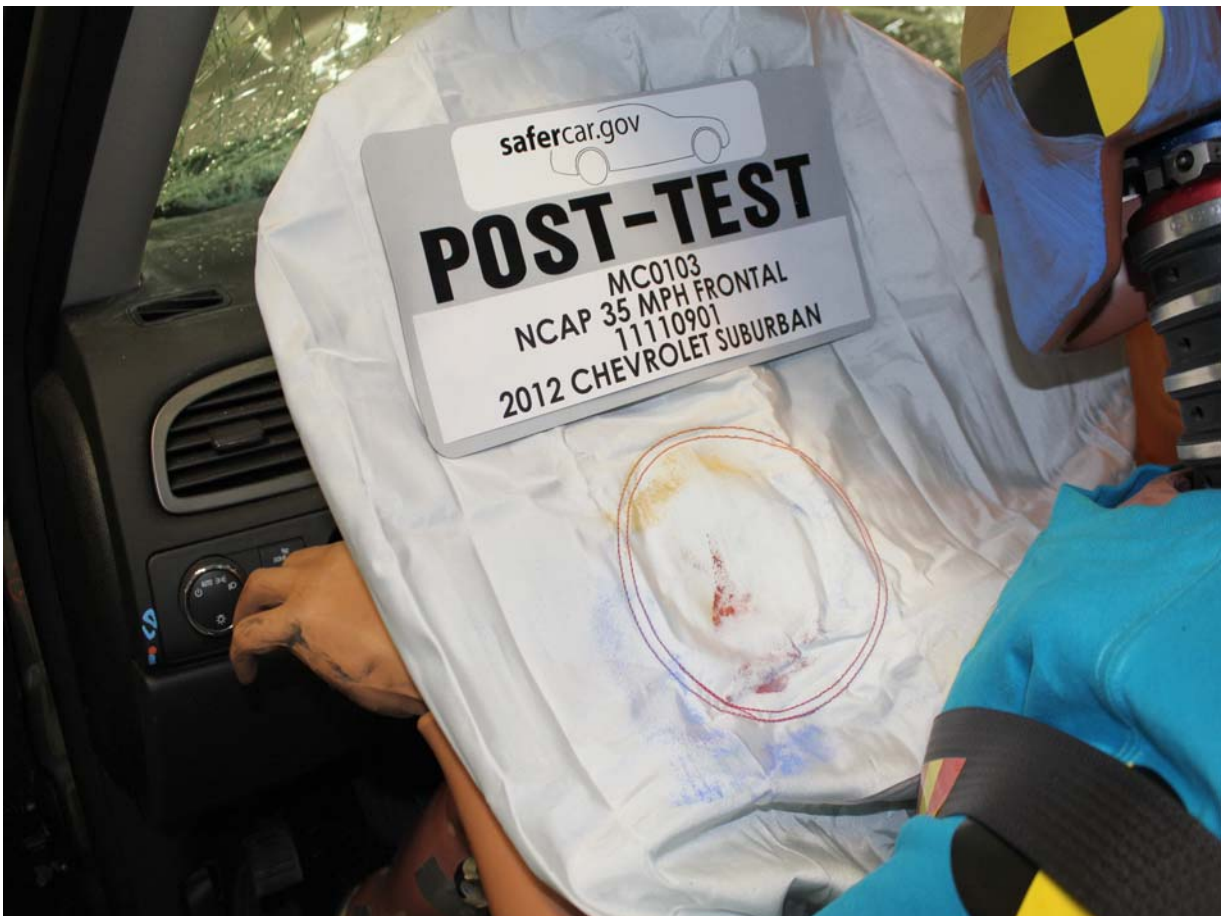
Pre-Test Driver's Side Floorpan



Post-Test Driver's Side Floorpan



Post-Test Driver Dummy Face



Post-Test Driver Dummy Contact with Airbag



Post-Test Driver Dummy Contact with Headrest



Pre-Test View of the Steering Wheel



Post-Test View of the Steering Wheel



Pre-Test Passenger Dummy Front View



Post-Test Passenger Dummy Front View



Pre-Test Passenger Dummy Window View



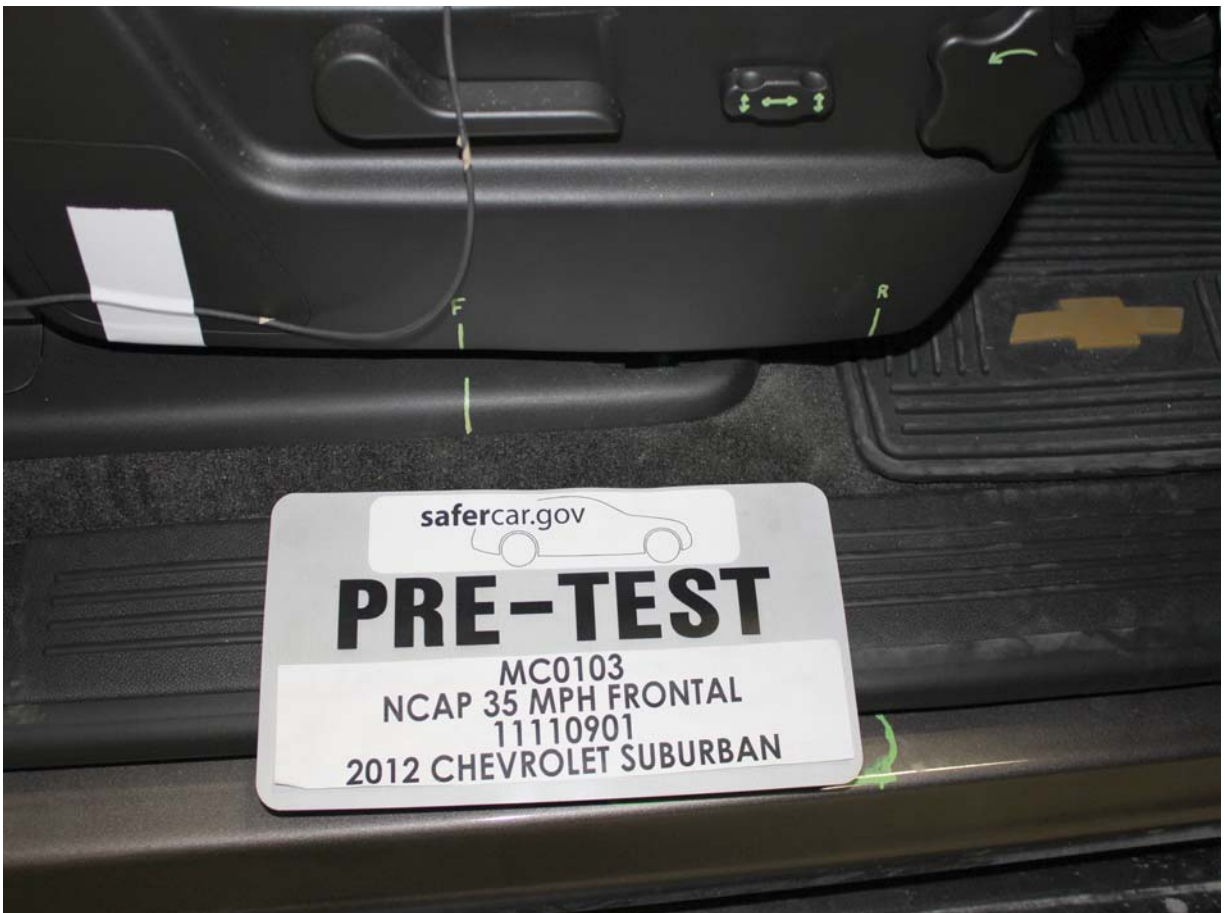
Post-Test Passenger Dummy Window View



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



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



Pre-Test Passenger's Seat Fore-Aft Markings



Post-Test Passenger's Seat Fore-Aft Markings



Pre-Test Passenger Dummy Feet



Post-Test Passenger Dummy Feet



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



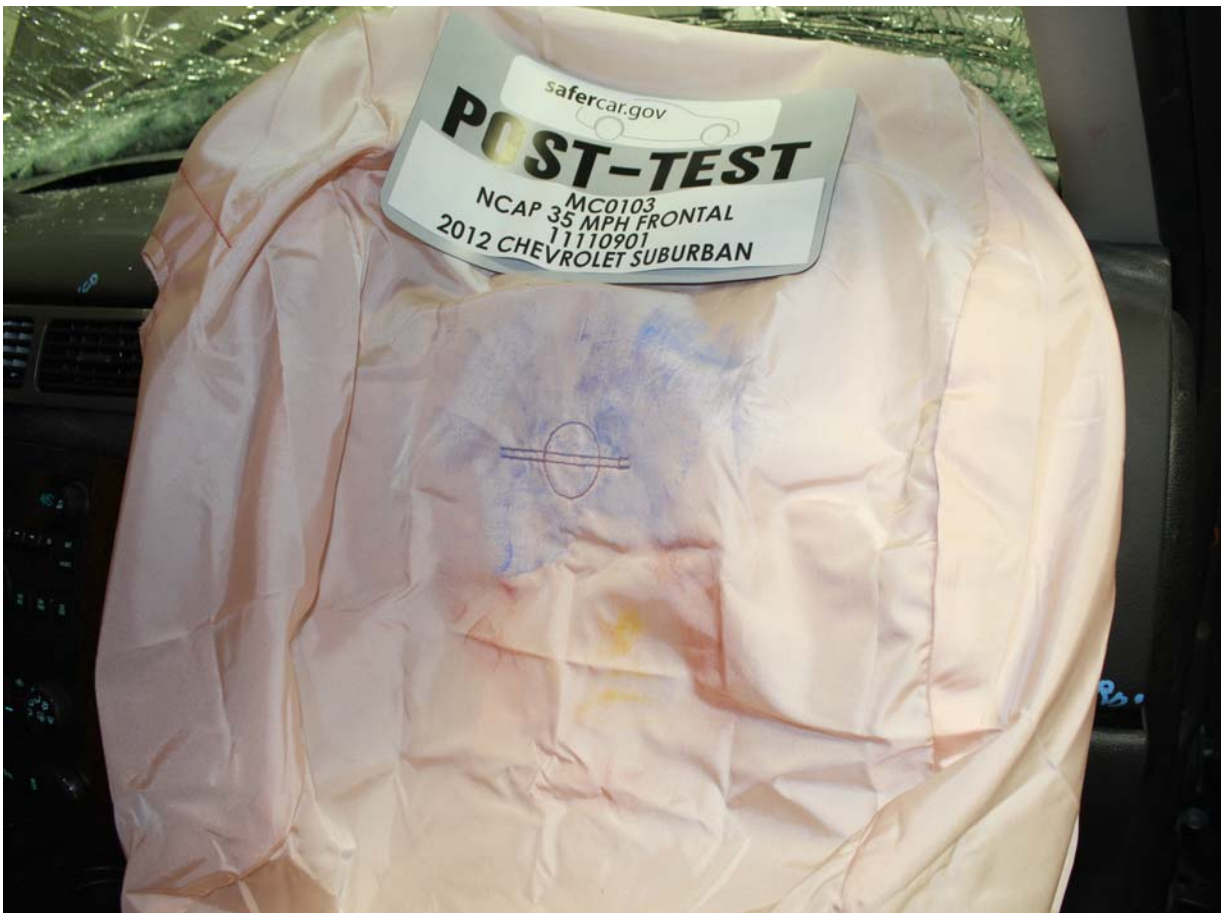
Post-Test Passenger's Side Knee Bolster (without dummy)



Pre-Test Passenger's Side Floorpan



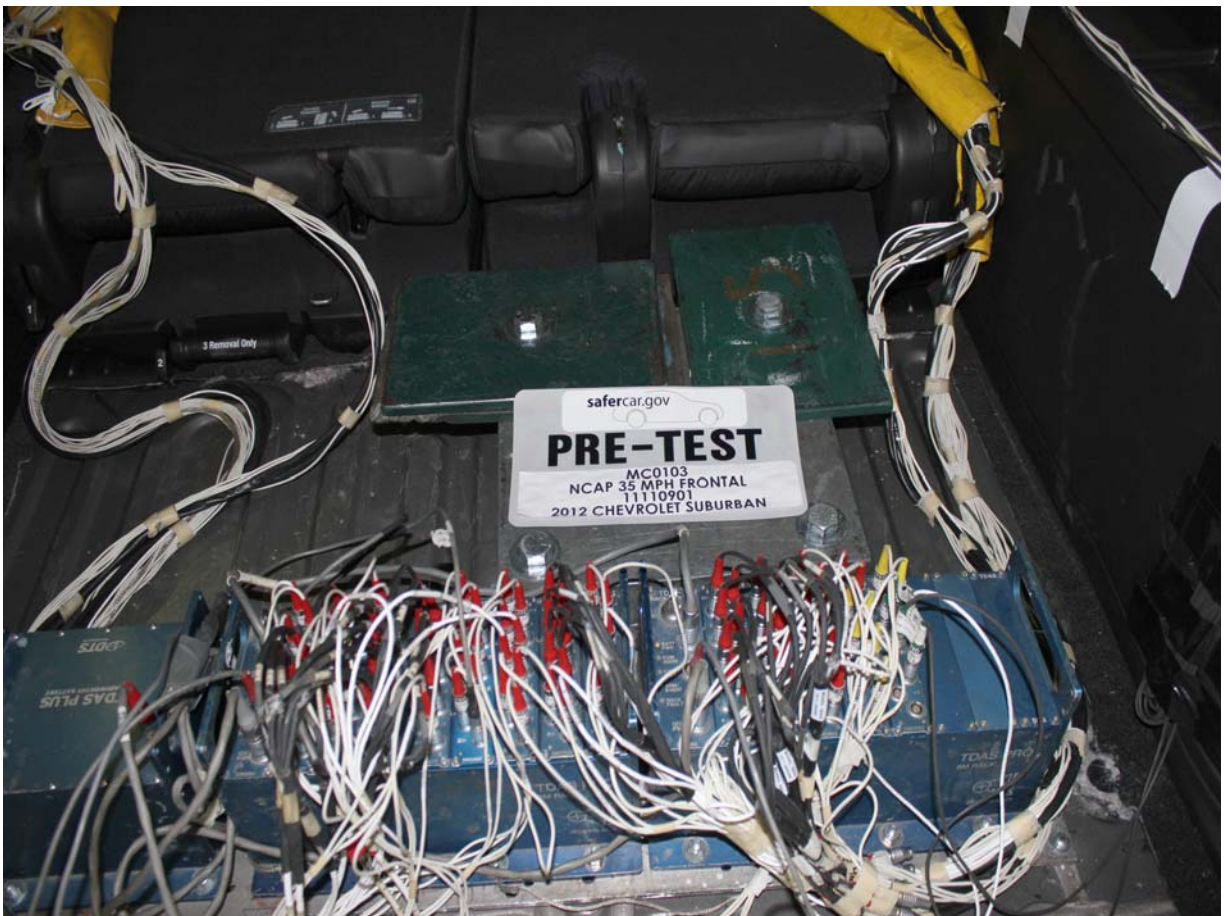
Post-Test Passenger's Side Floorpan



Post-Test Passenger Dummy Contact with Airbag



Post-Test Passenger Dummy Contact with Headrest



Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

Post-Test Stoddard Solvent Spillage Location View



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



2012 Chevrolet Suburban Frontal Impact Event



**APPENDIX B**  
**DUMMY RESPONSE DATA TRACES**

## TABLE OF DATA PLOTS

### Page No.

#### **List of Data Plots Provided in the Test Report**

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

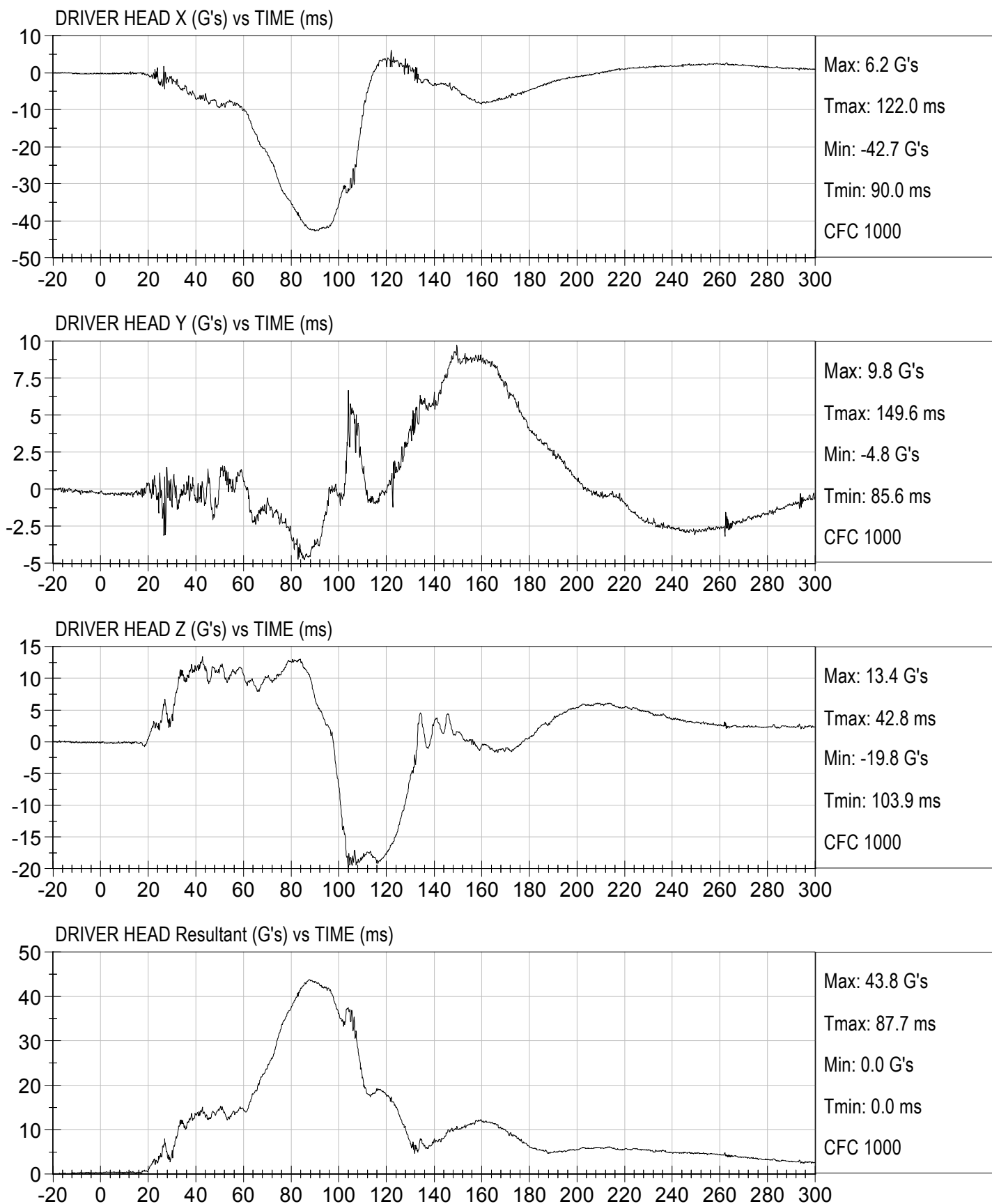
|                                                     | <u>Page No.</u> |
|-----------------------------------------------------|-----------------|
| Figure No. 28. Passenger Neck Force X vs. Time      | B-10            |
| Figure No. 29. Passenger Neck Force Z vs. Time      | B-10            |
| Figure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

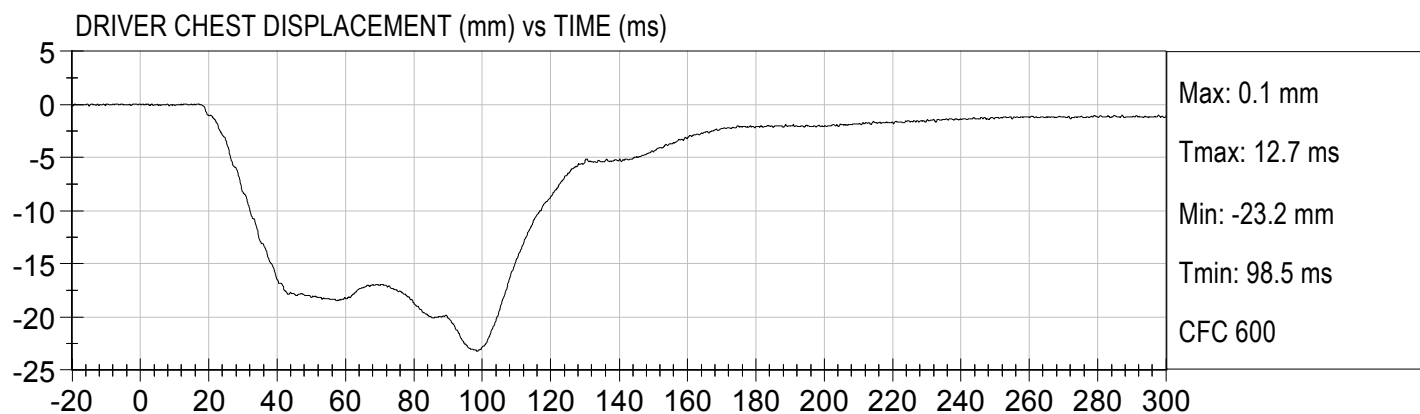
**The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov)**

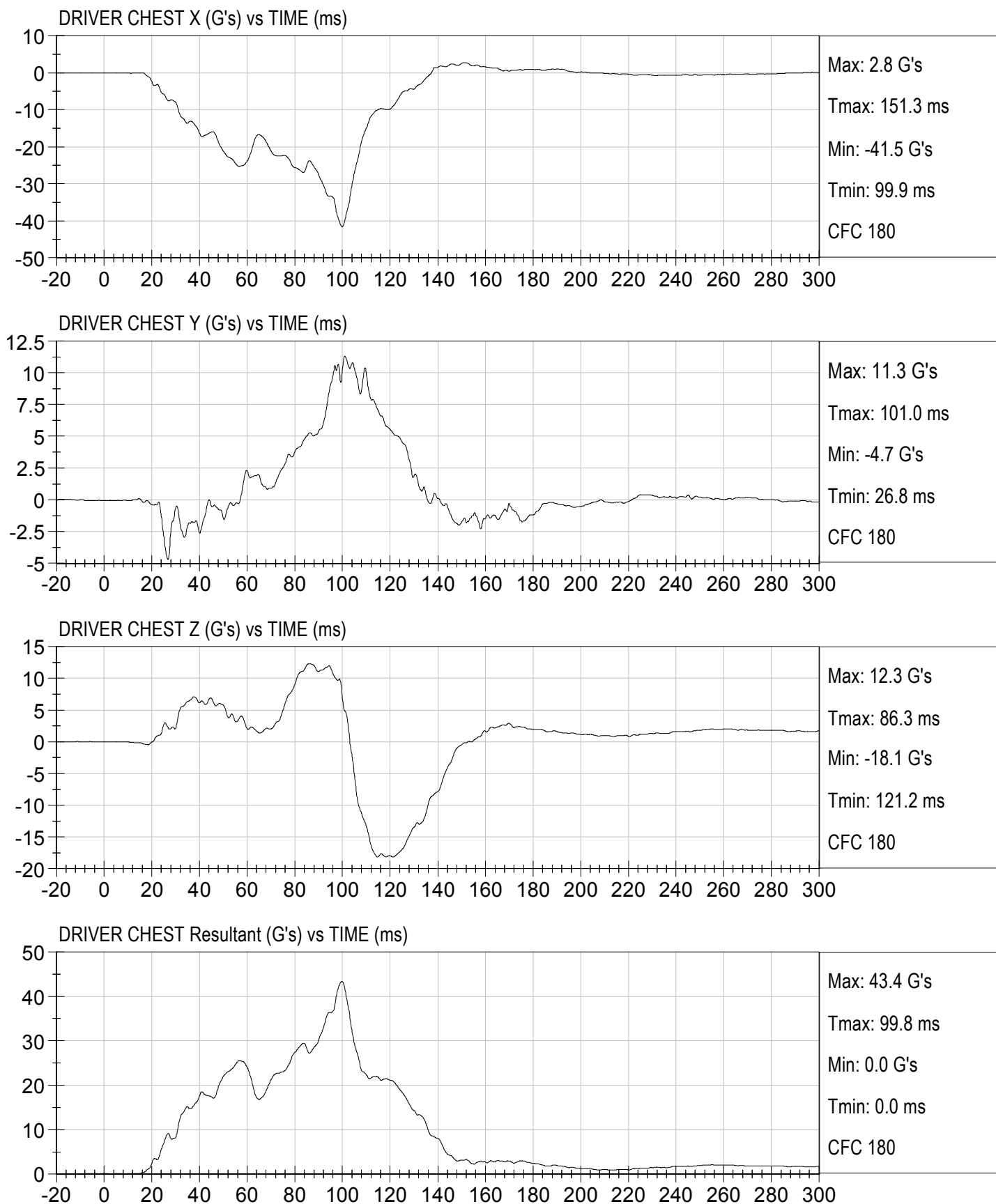
Driver Head X Redundant  
 Driver Head Y Redundant  
 Driver Head Z Redundant  
 Driver Upper Neck Force Y  
 Driver Upper Neck Moment X  
 Driver Upper Neck Moment Z  
 Driver Chest X Redundant  
 Driver Chest Y Redundant  
 Driver Chest Z Redundant  
 Driver Pelvis X  
 Driver Pelvis Y  
 Driver Pelvis Z  
 Driver Left Femur Redundant  
 Driver Right Femur Redundant  
 Driver Left Upper Tibia Moment X  
 Driver Left Upper Tibia Moment Y  
 Driver Left Upper Tibia Force Z  
 Driver Left Lower Tibia Moment X

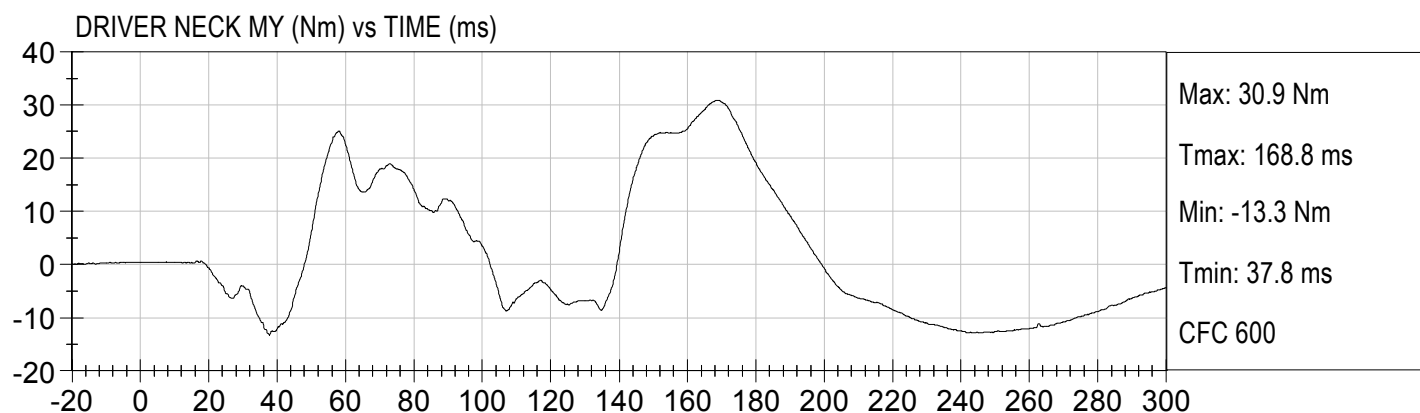
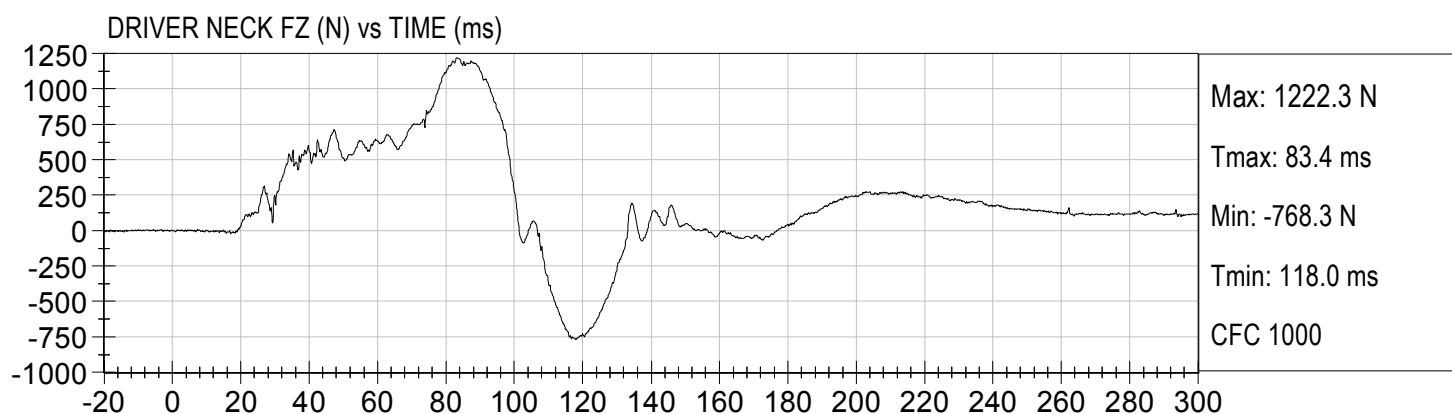
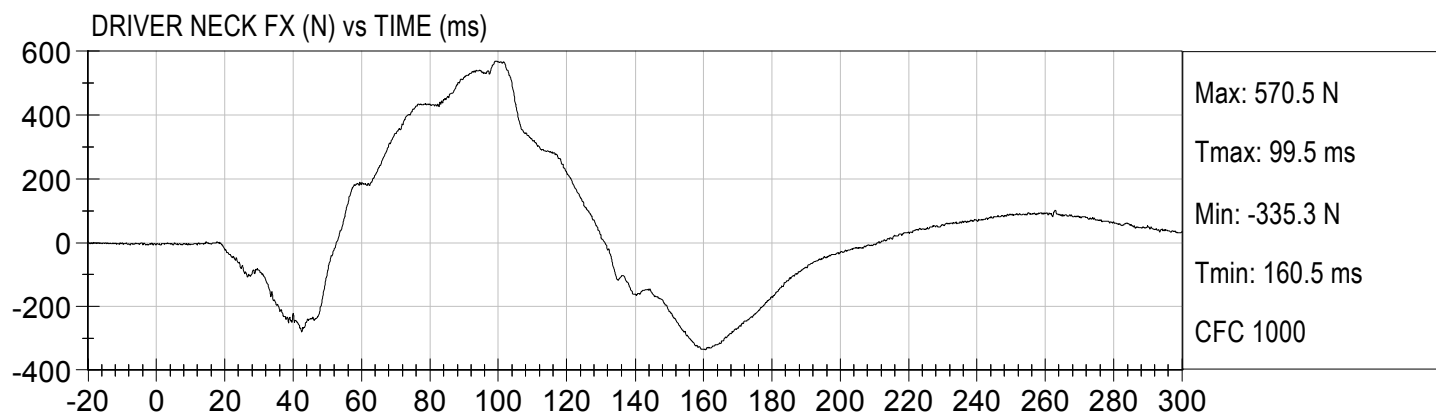
Driver Left Lower Tibia Moment Y  
Driver Left Lower Tibia Force Z  
Driver Right Upper Tibia Moment X  
Driver Right Upper Tibia Moment Y  
Driver Right Upper Tibia Force Z  
Driver Right Lower Tibia Moment X  
Driver Right Lower Tibia Moment Y  
Driver Right Lower Tibia Force Z  
Driver Left Foot Fore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

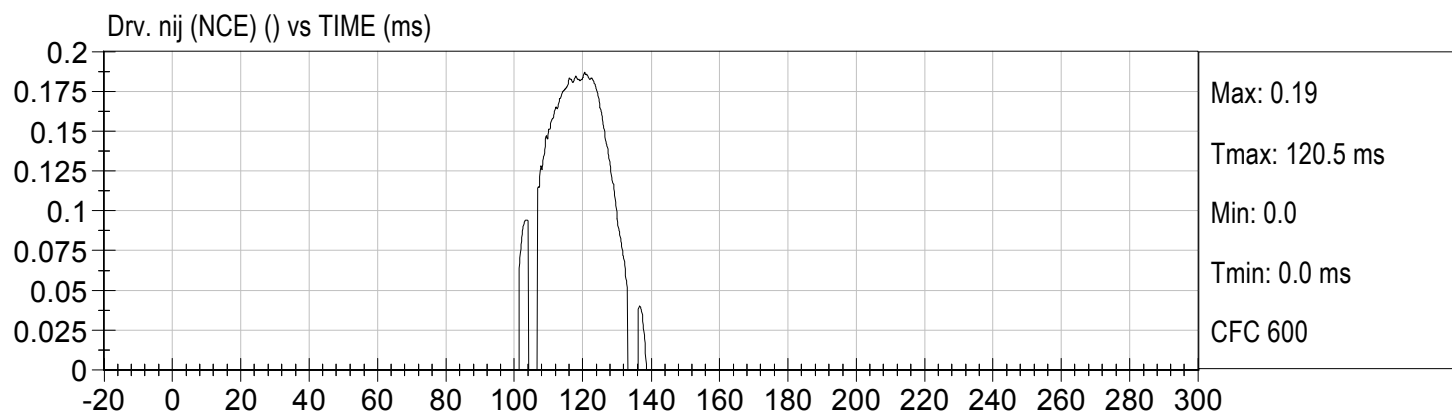
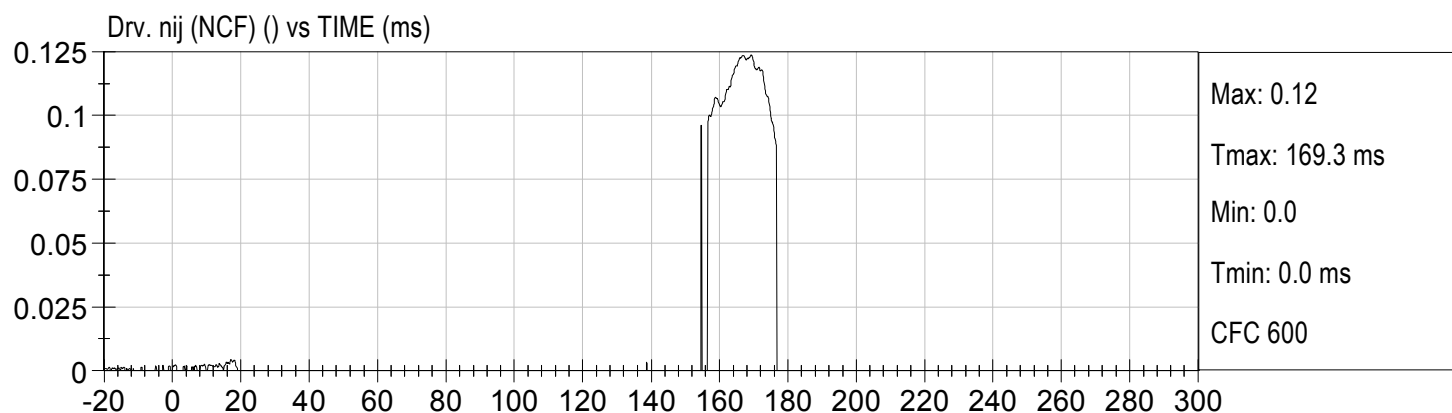
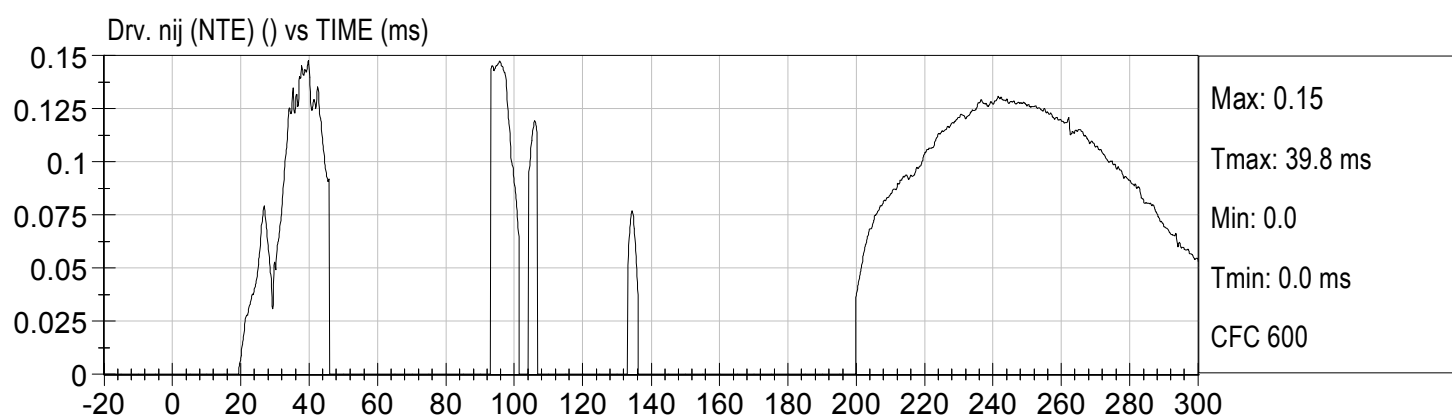
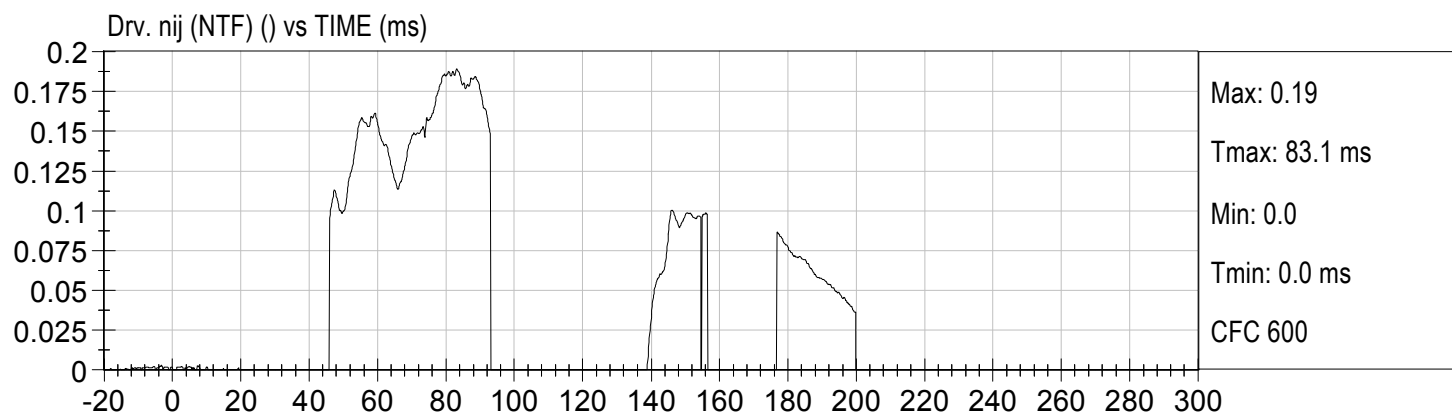
Passenger Left Upper Tibia Moment Y  
Passenger Left Upper Tibia Force Z  
Passenger Left Lower Tibia Moment X  
Passenger Left Lower Tibia Moment Y  
Passenger Left Lower Tibia Force Z  
Passenger Right Upper Tibia Moment X  
Passenger Right Upper Tibia Moment Y  
Passenger Right Upper Tibia Force Z  
Passenger Right Lower Tibia Moment X  
Passenger Right Lower Tibia Moment Y  
Passenger Right Lower Tibia Force Z  
Passenger Left Foot Fore Z  
Passenger Left Foot Aft X  
Passenger Left Foot Aft Z  
Passenger Right Foot Fore Z  
Passenger Right Foot Aft X  
Passenger Right Foot Aft Z  
Passenger Lap Belt Force  
Passenger Shoulder Belt Force  
Left Rear Seat Crossmember X  
Right Rear Seat Crossmember X  
Vehicle Engine Top X  
Vehicle Engine Bottom X  
Vehicle Left Brake Caliper X  
Vehicle Right Brake Caliper X  
Left Rear Seat Crossmember Xr  
Right Rear Seat Crossmember Xr  
Advanced Research Load Cell Barrier – 128 channels

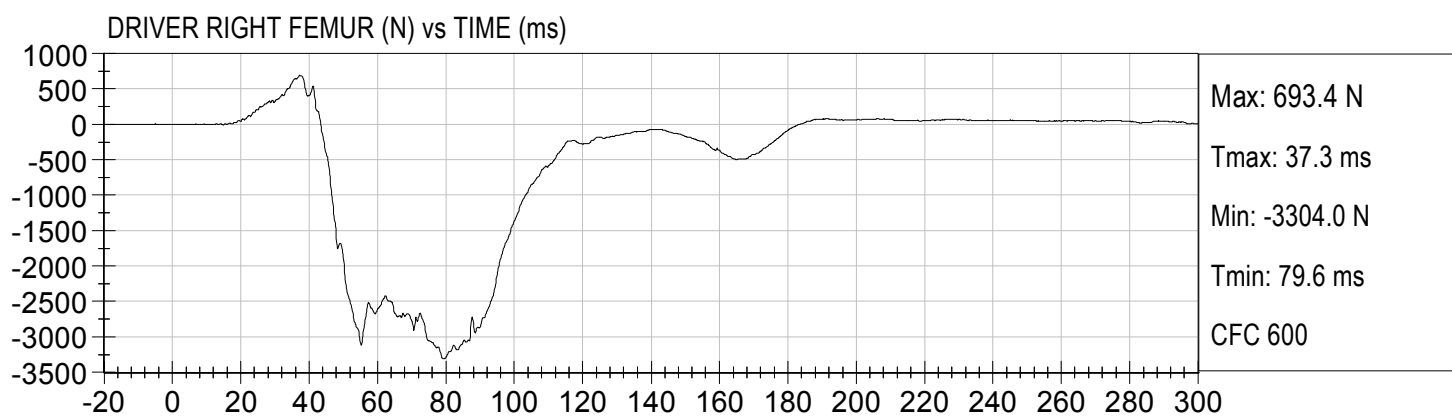
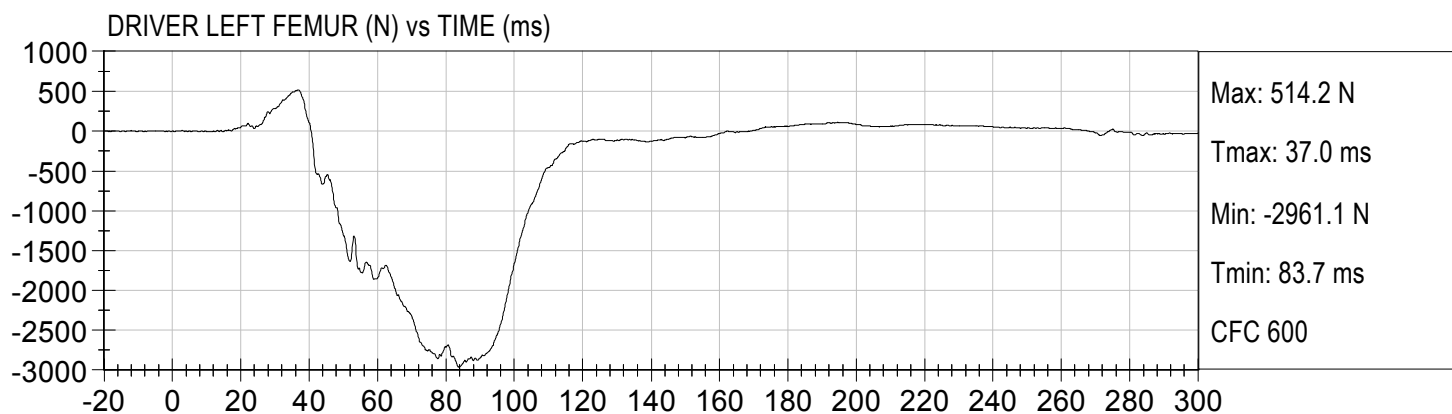


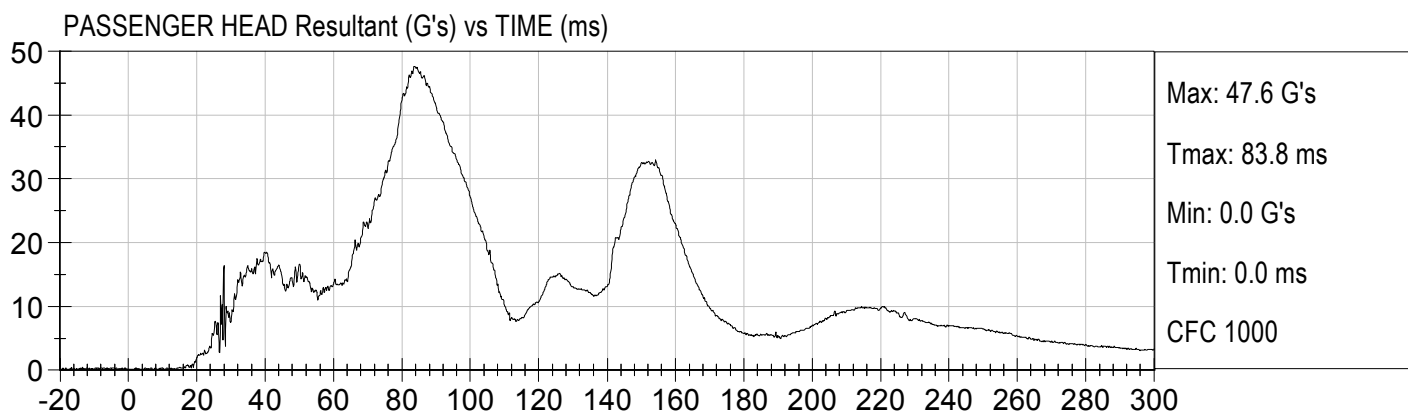
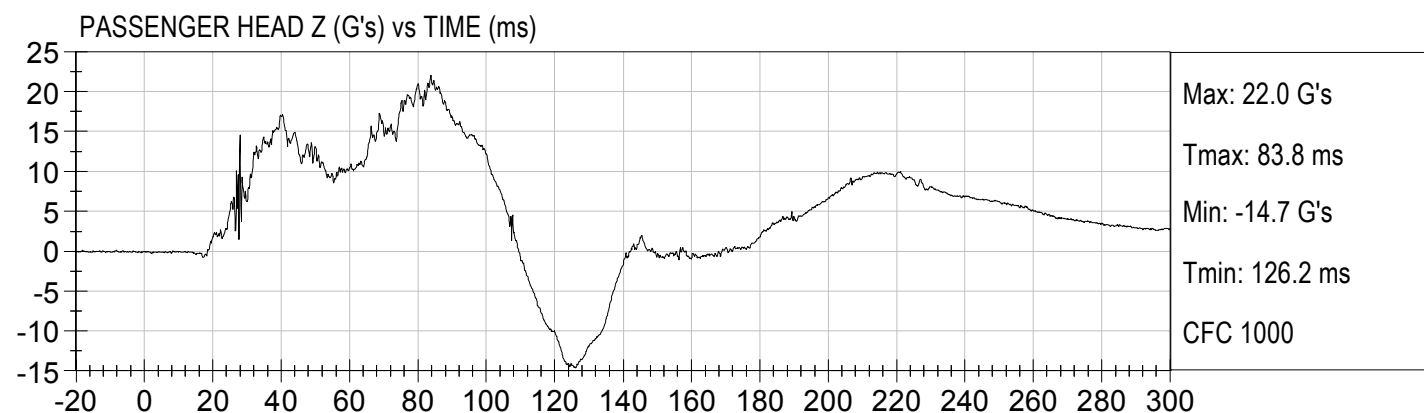
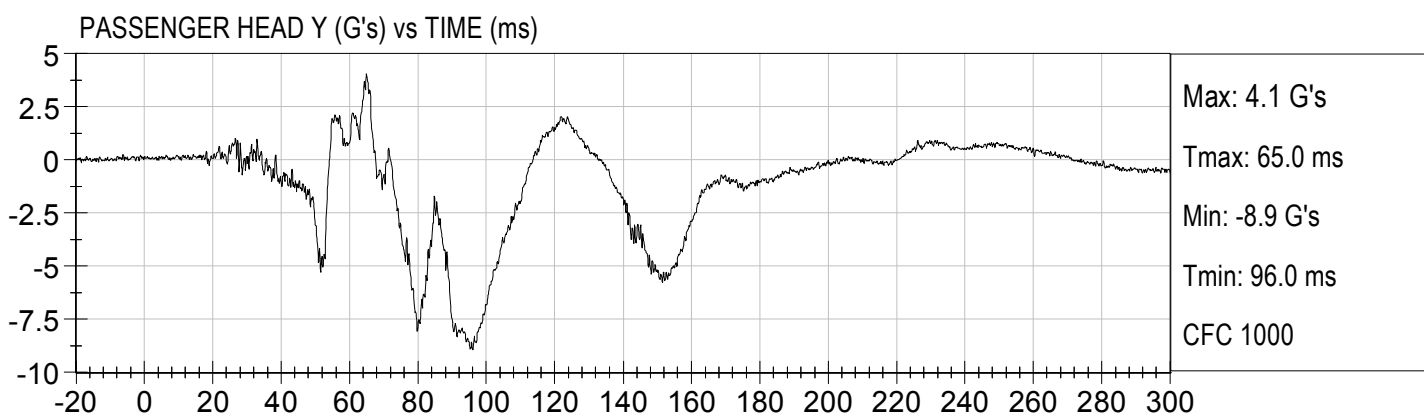
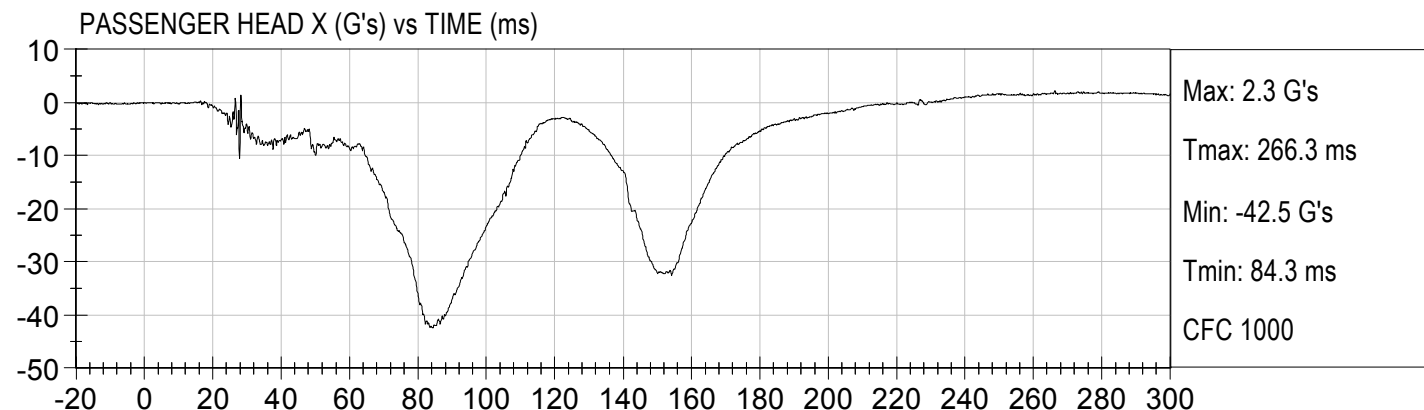


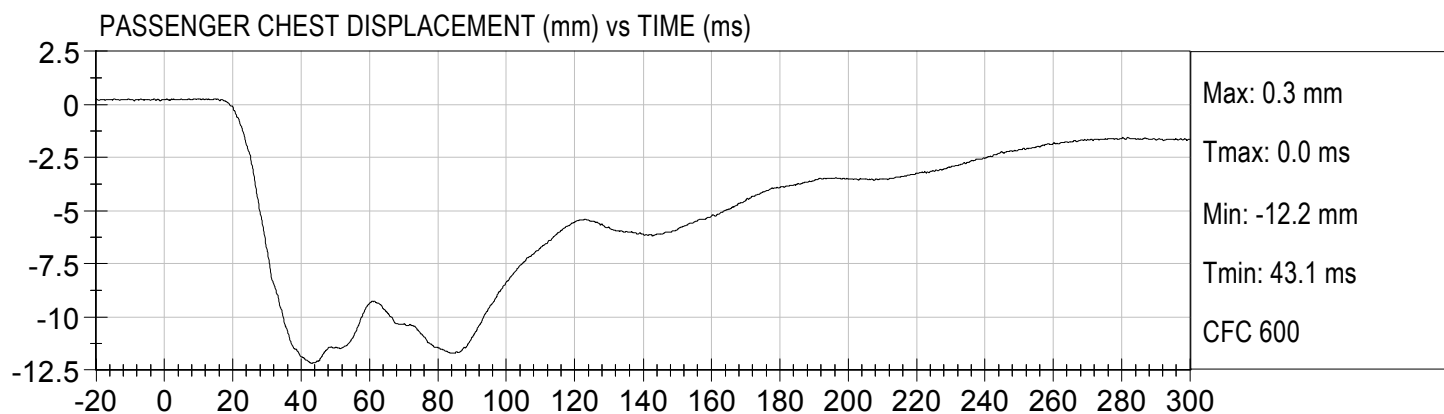


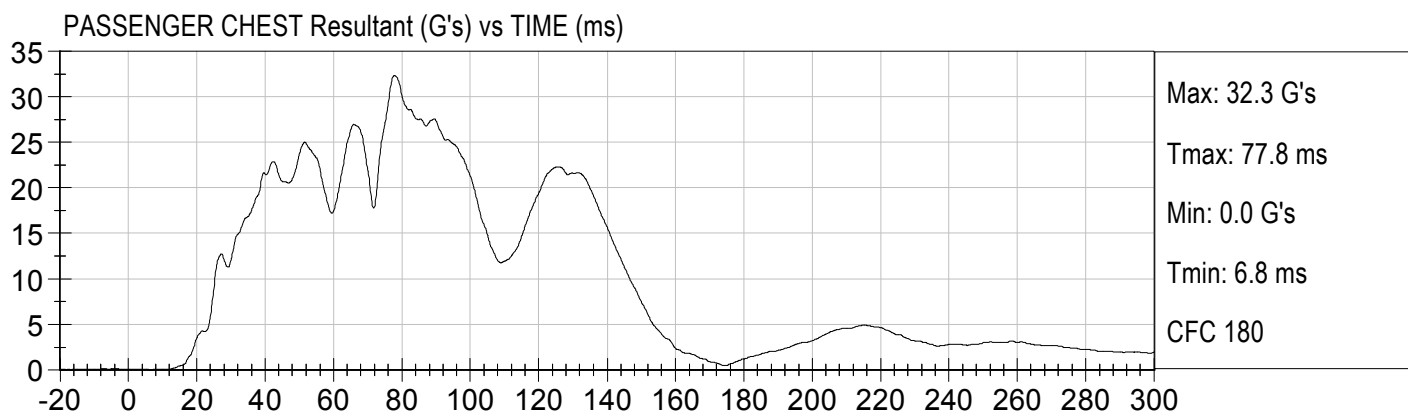
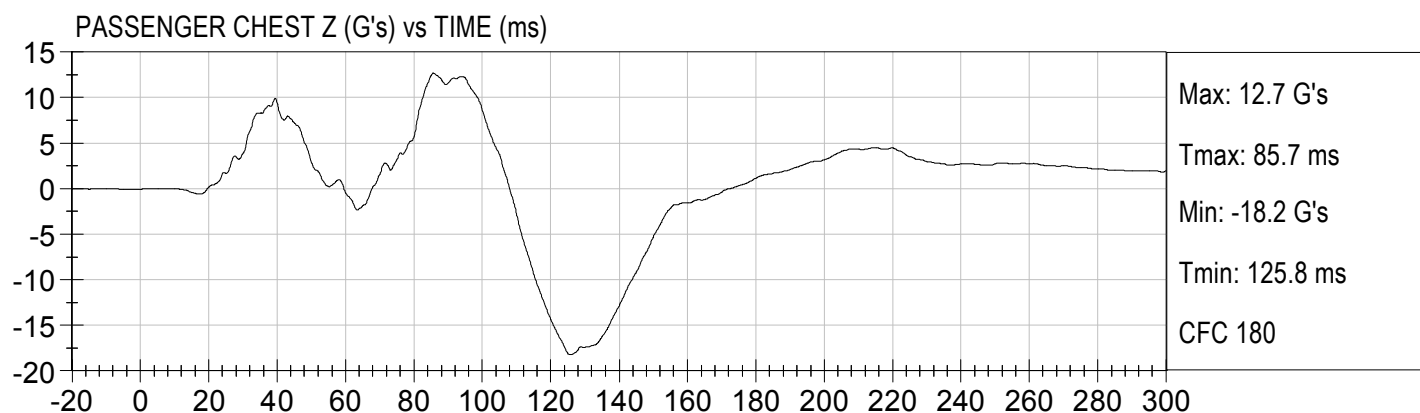
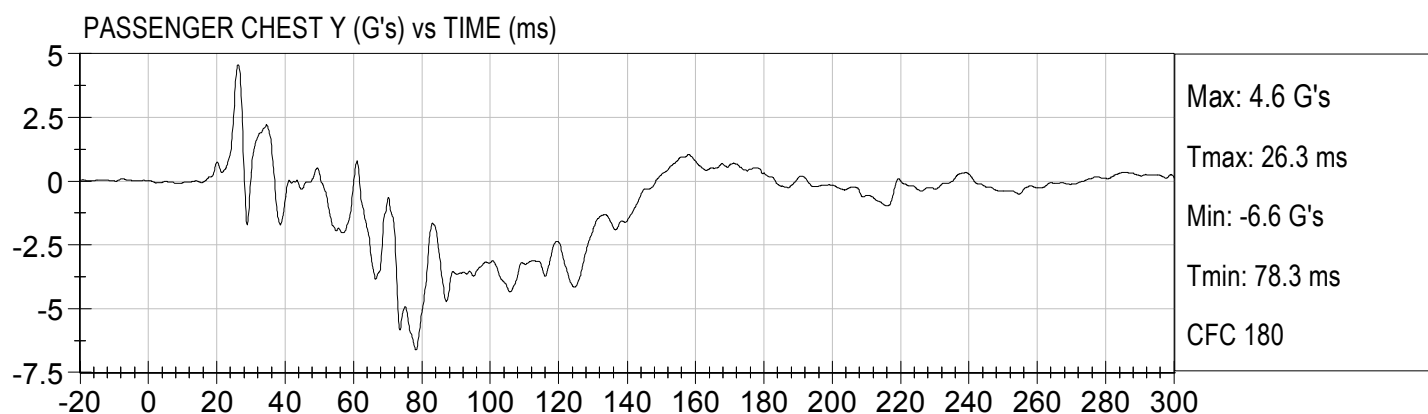
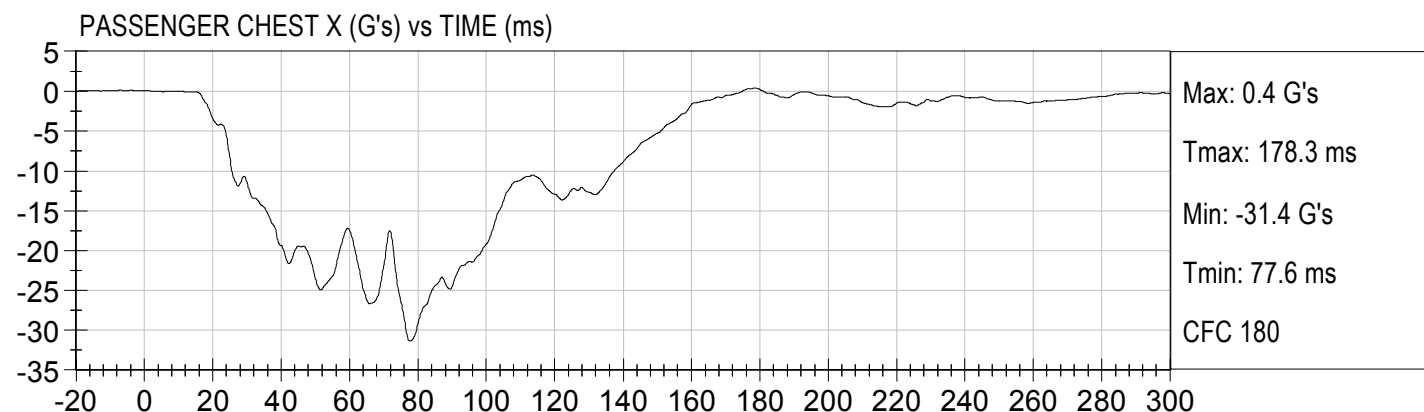


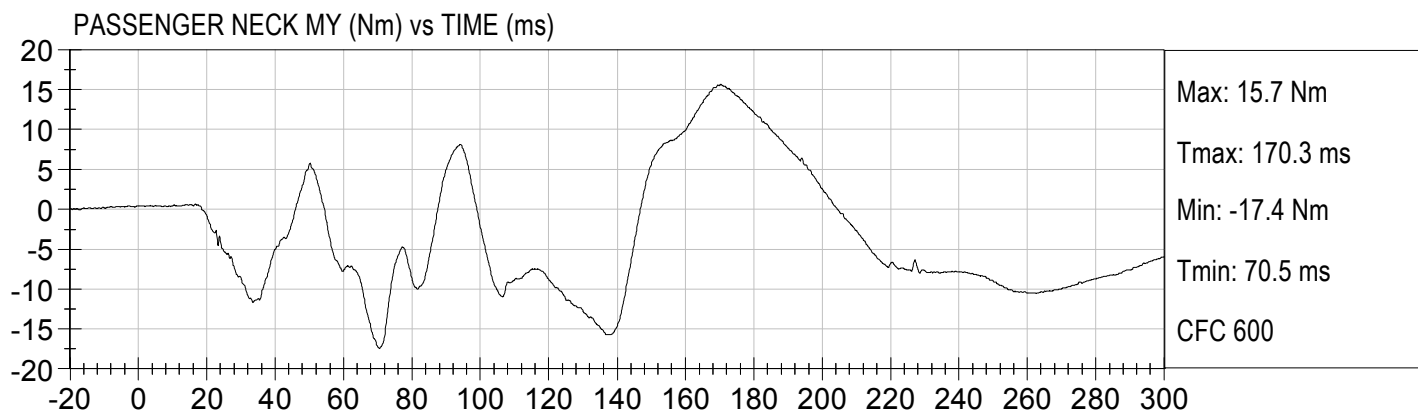
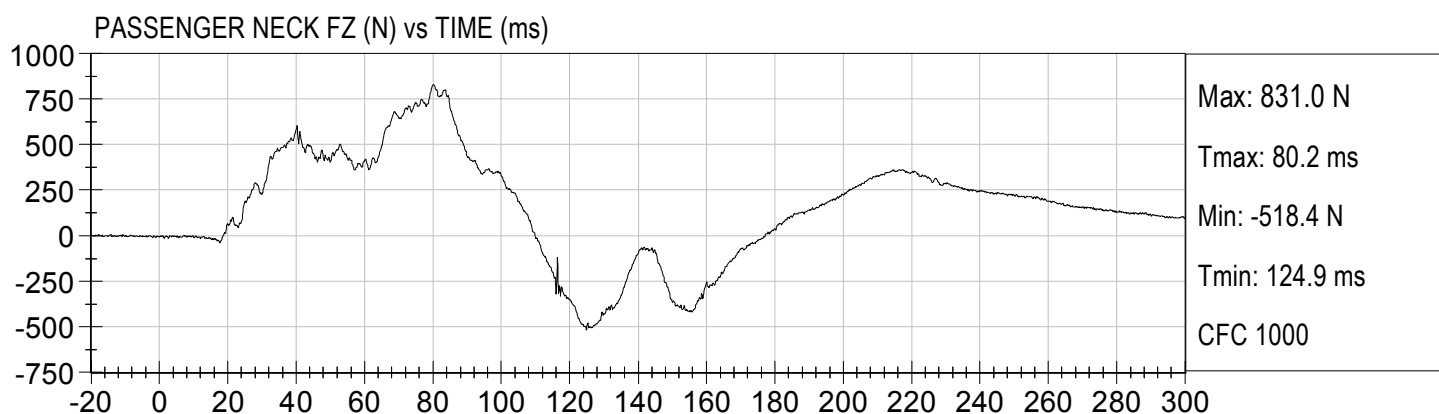
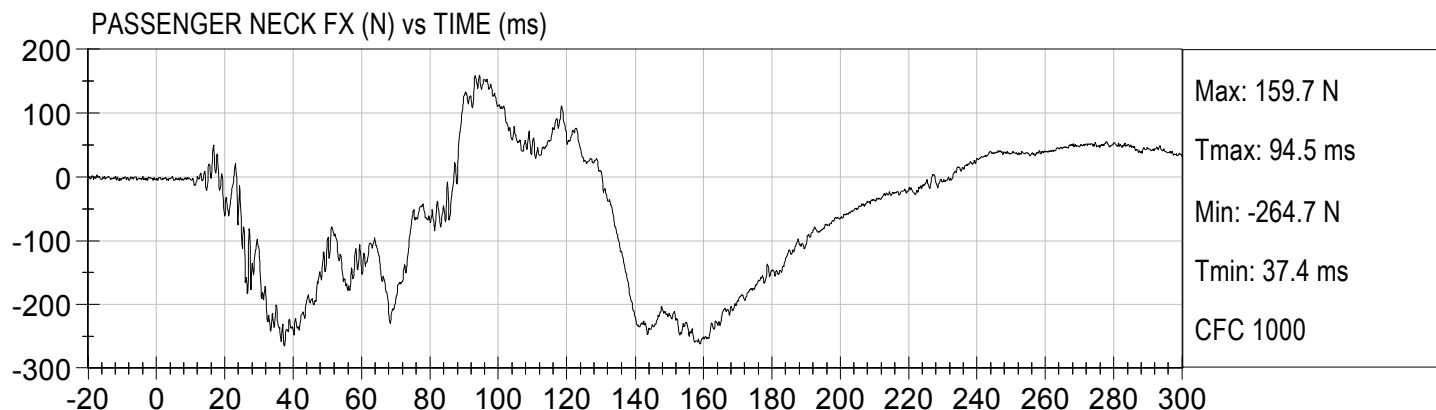


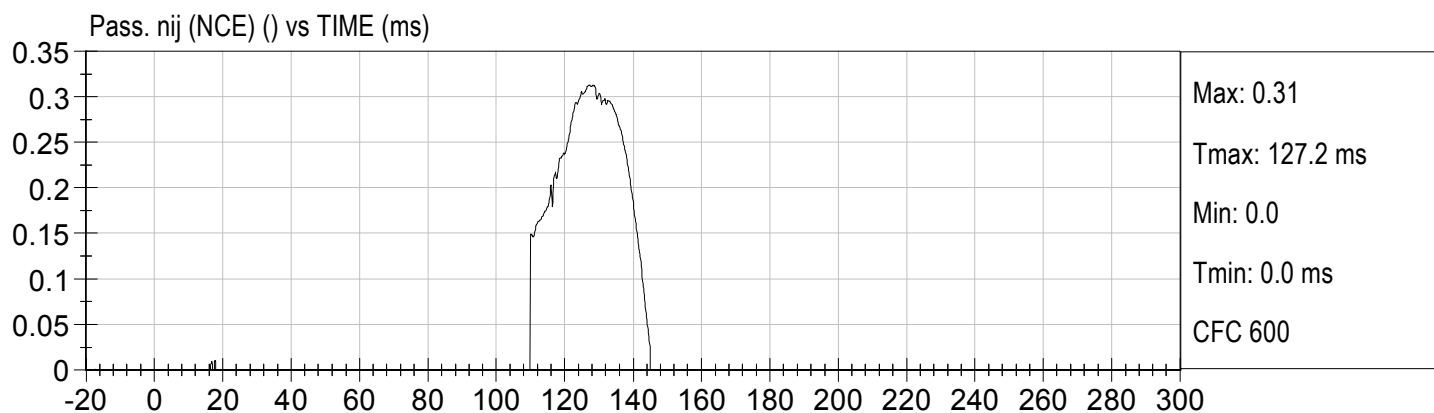
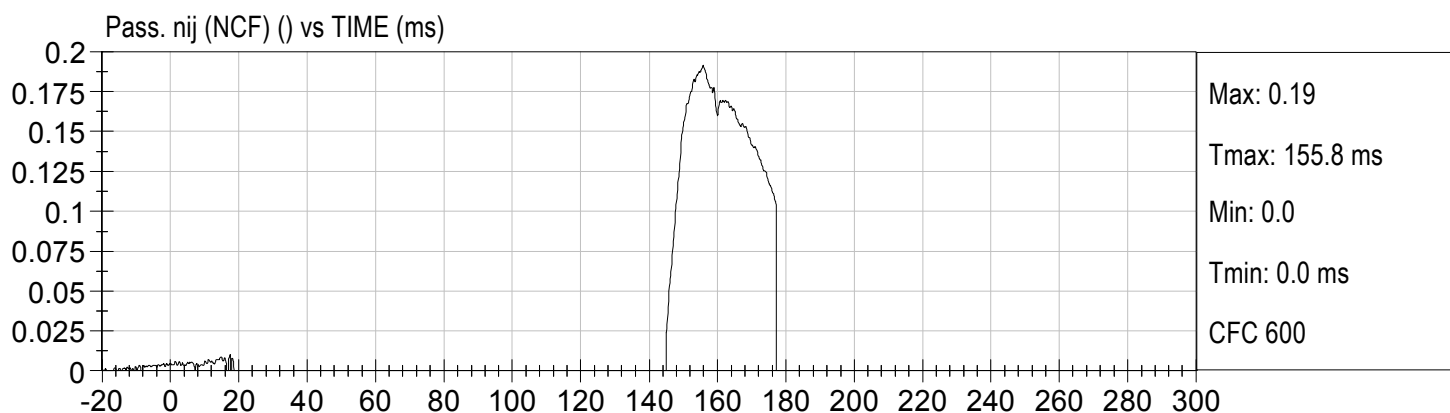
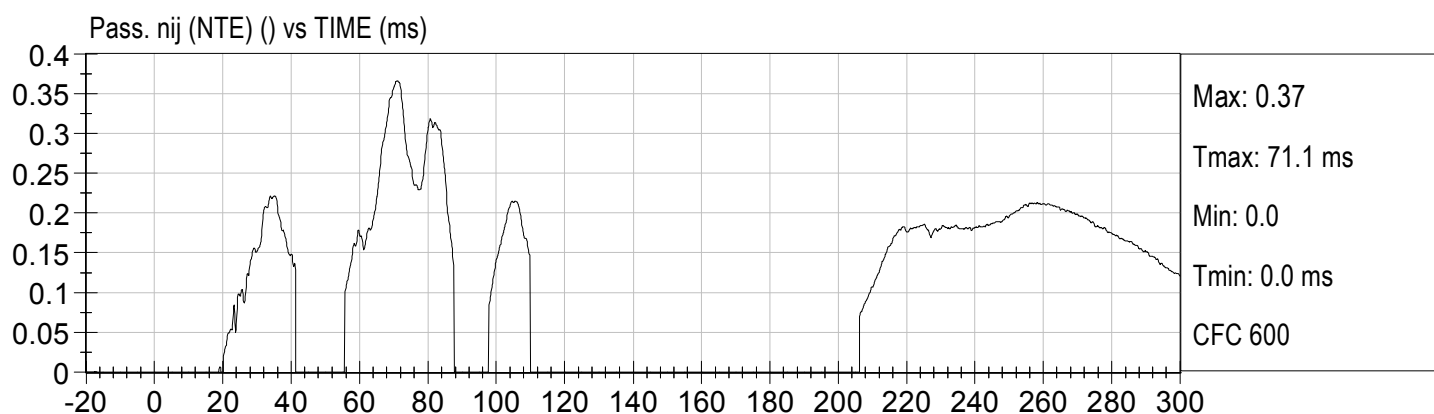
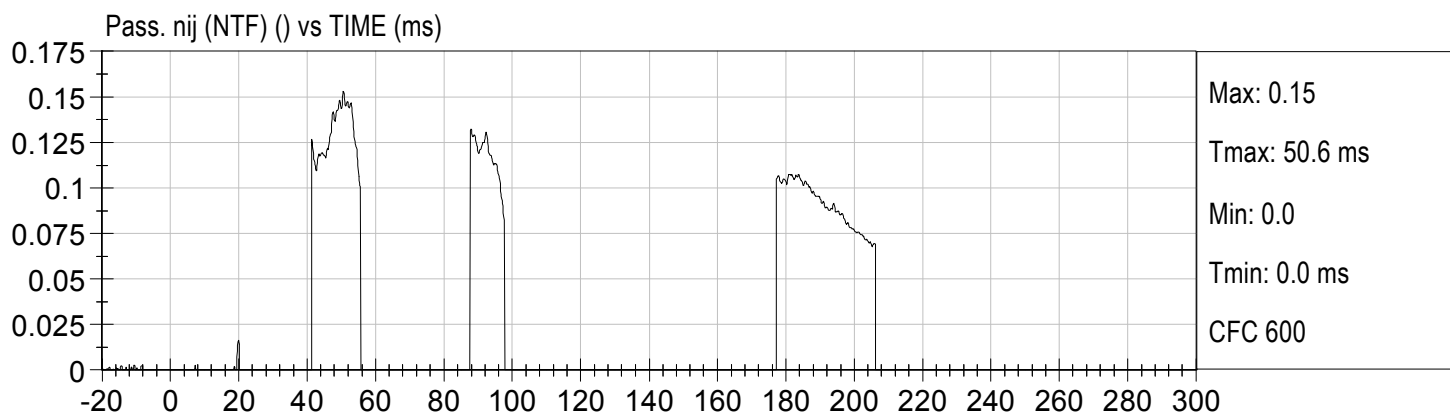


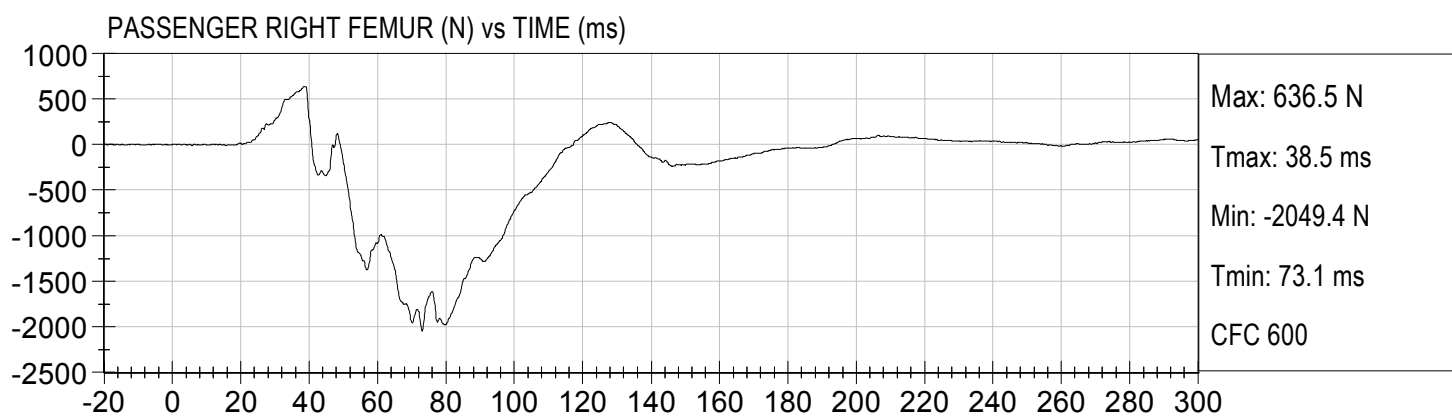
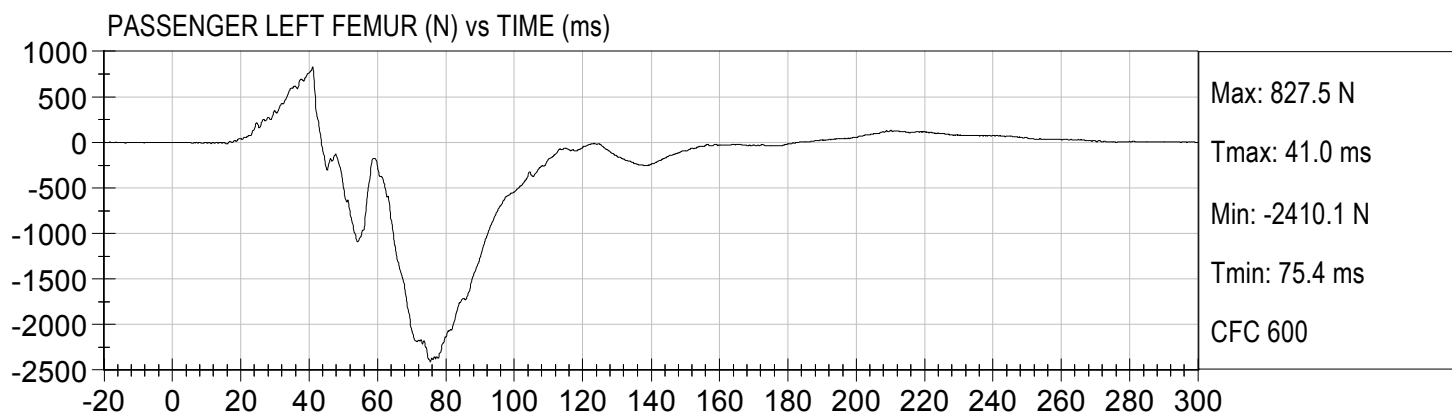












## **APPENDIX C**

### **DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA**

**Hybrid III, 50th External Measurements**  
**SN: 036**

| HYBRID III, PART 572, SUBPART E EXTERNAL DIMENSIONS |                                |                                                                                                                                              |                             |                    |
|-----------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------|
| DIMENSION                                           | DESCRIPTION                    | DETAILS                                                                                                                                      | ASSEMBLY DIMENSION (inches) | ACTUAL MEASUREMENT |
| A                                                   | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.                                                                                            | 34.6–35.0                   | 34.7               |
| B                                                   | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                       | 19.9-20.5                   | 20.0               |
| C                                                   | H-POINT HEIGHT                 | Reference                                                                                                                                    | 3.3-3.5                     | 3.4                |
| D                                                   | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                    | 5.3-5.5                     | 5.4                |
| E                                                   | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                   | 3.3-3.7                     | 3.6                |
| F                                                   | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                    | 5.5-6.1                     | 5.8                |
| G                                                   | BACK OF ELBOW TO WRIST PIVOT   | back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots                                                           | 11.4-12.0                   | 11.5               |
| H                                                   | HEAD BACK TO BACKLINE          | Back of Skull cap skin to seat rear vertical surface (Reference)                                                                             | 1.6-1.8                     | 1.7                |
| I                                                   | SHOULDER TO- ELBOW LENGTH      | Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt. | 13.0-13.6                   | 13.0               |
| J                                                   | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 7.5-8.3                     | 7.9                |
| K                                                   | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the rear vertical surface of the fixture.                                                         | 22.8-23.8                   | 23.8               |
| L                                                   | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 16.9-17.9                   | 17.3               |
| M                                                   | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 19.1-19.7                   | 19.5               |
| N                                                   | BUTTOCK POPLITEAL LENGTH       | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".                               | 17.8-18.8                   | 17.9               |

| HYBRID III, SUBPART E EXTERIOR DIMENSIONS, continued |                                                           |                                                   |           |                    |
|------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------|-----------|--------------------|
| DIMENSION                                            | DESCRIPTION                                               | DETAILS                                           |           | ACTUAL MEASUREMENT |
| O                                                    | CHEST DEPTH WITHOUT JACKET                                | Measured 16.9-17.1 in. above seat surface         | 8.4-9.0   | 8.8                |
| P                                                    | FOOT LENGTH                                               | Tip of toe to rear of heel                        | 9.9-10.5  | 10.0               |
| V                                                    | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises | 16.3-17.2 | 16.4               |
| W                                                    | FOOT BREADTH                                              | The widest part of the foot                       | 3.6-4.2   | 4.1                |
| Y                                                    | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 16.9-17.1 in. above seat surface         | 38.2-39.4 | 38.4               |
| Z                                                    | WAIST CIRCUMFERENCE                                       | Measured 8.9-9.1 in. above seat surface           | 32.9-34.1 | 34.0               |
| AA                                                   | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference                                         | 16.9-17.1 | 17.0               |
| BB                                                   | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference                                         | 8.9-9.1   | 9.0                |

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

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

**ATD Serial No:** 036

**Test ID:** D113681

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 - 25.6        | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 33     | Pass      |
| Peak Resultant Acceleration  | G's   | 225 - 275          | 242    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | -7.3   | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

*Jessica Hall*  
Laboratory Technician

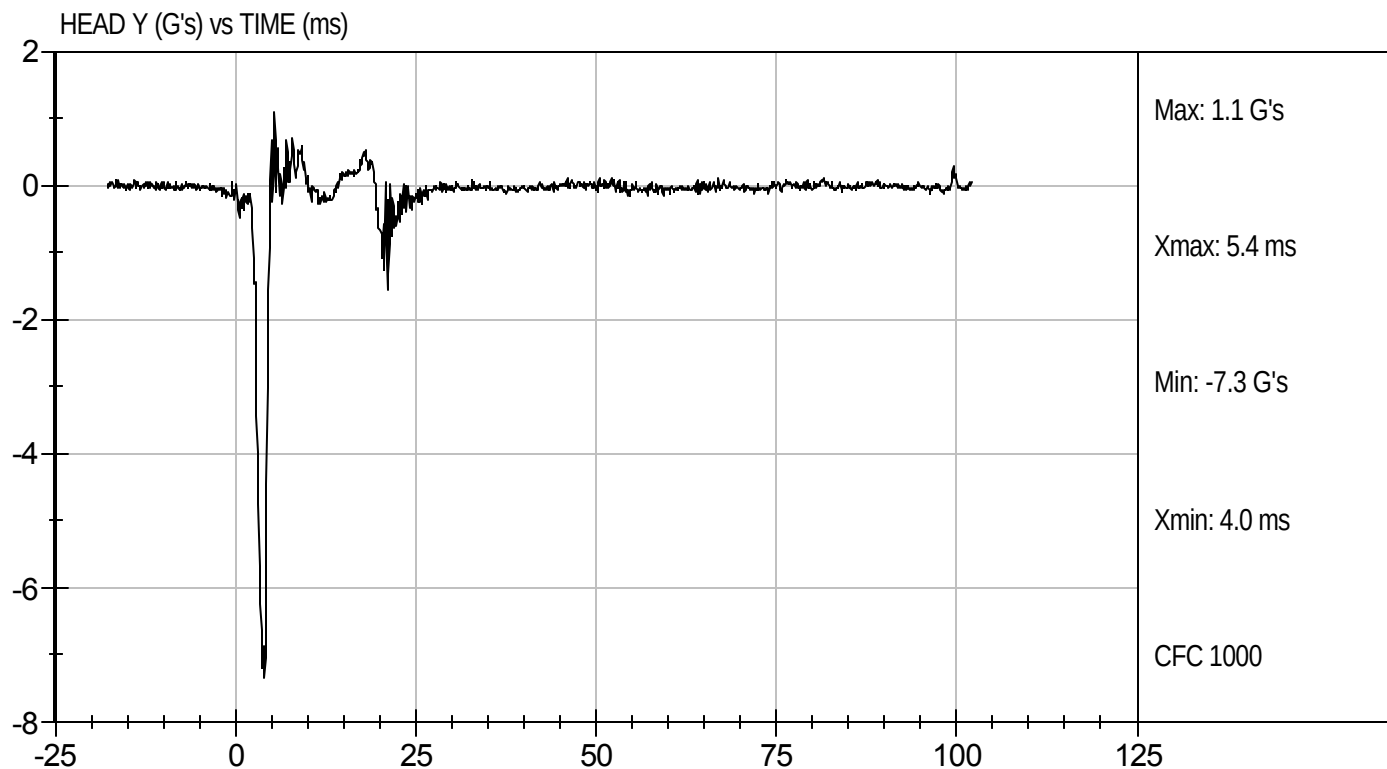
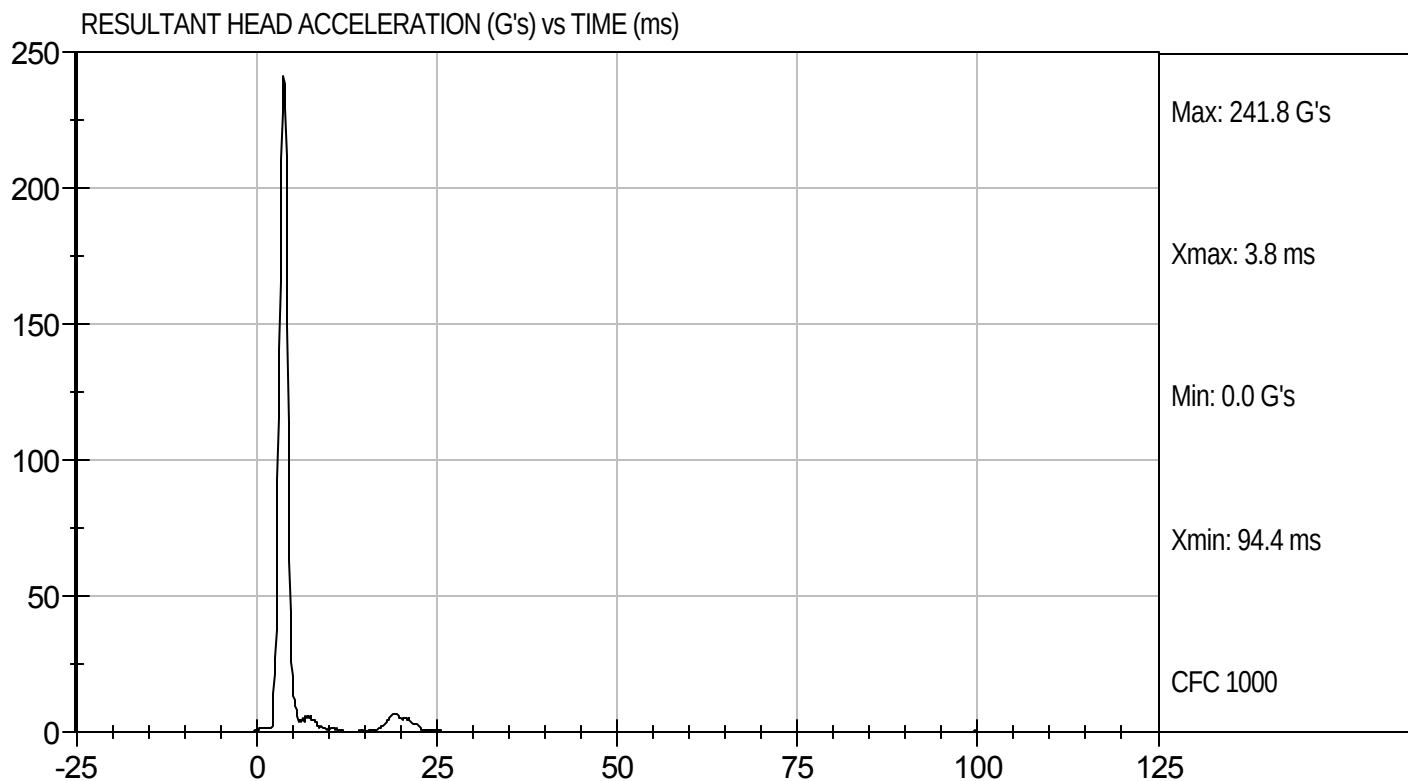
11/3/11  
Test Date

*David Winkelbauer*  
Approved By



Test Desc: Head Drop  
Component ID: D113681

Test Date: 11/3/11  
Velocity: 0 ft/s, 0.00 m/s



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

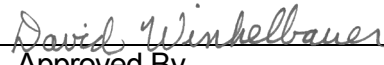
ATD Serial No: 036

Test I.D: D113682

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.3   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 33     | Pass      |
| Pendulum Velocity                              |         | m/s     | 6.89 to 7.13   | 6.96   | Pass      |
| Pendulum Deceleration                          | 10 ms   | G's     | 22.50 to 27.50 | 23.40  | Pass      |
|                                                | 20 ms   | G's     | 17.60 to 22.60 | 18.36  | Pass      |
|                                                | 30 ms   | G's     | 12.50 to 18.50 | 13.61  | Pass      |
| Peak Pendulum Deceleration After 30 ms         |         | G's     | <= 29.0        | 13.8   | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | ms      | 34.0 to 42.0   | 36.4   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 64.0 to 78.0   | 73.7   | Pass      |
|                                                | Time    | ms      | 57.0 to 64.0   | 59.8   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | ms      | 113.0 to 128.0 | 118.1  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | 88.1 to 108.5  | 98.0   | Pass      |
|                                                | Time    | ms      | 47.0 to 58.0   | 49.5   | Pass      |
| Positive Moment Decay Time To Zero Crossing    |         | ms      | 97.0 to 107.0  | 97.2   | Pass      |
| Overall Test Results                           |         |         |                |        | Pass      |

  
 Laboratory Technician

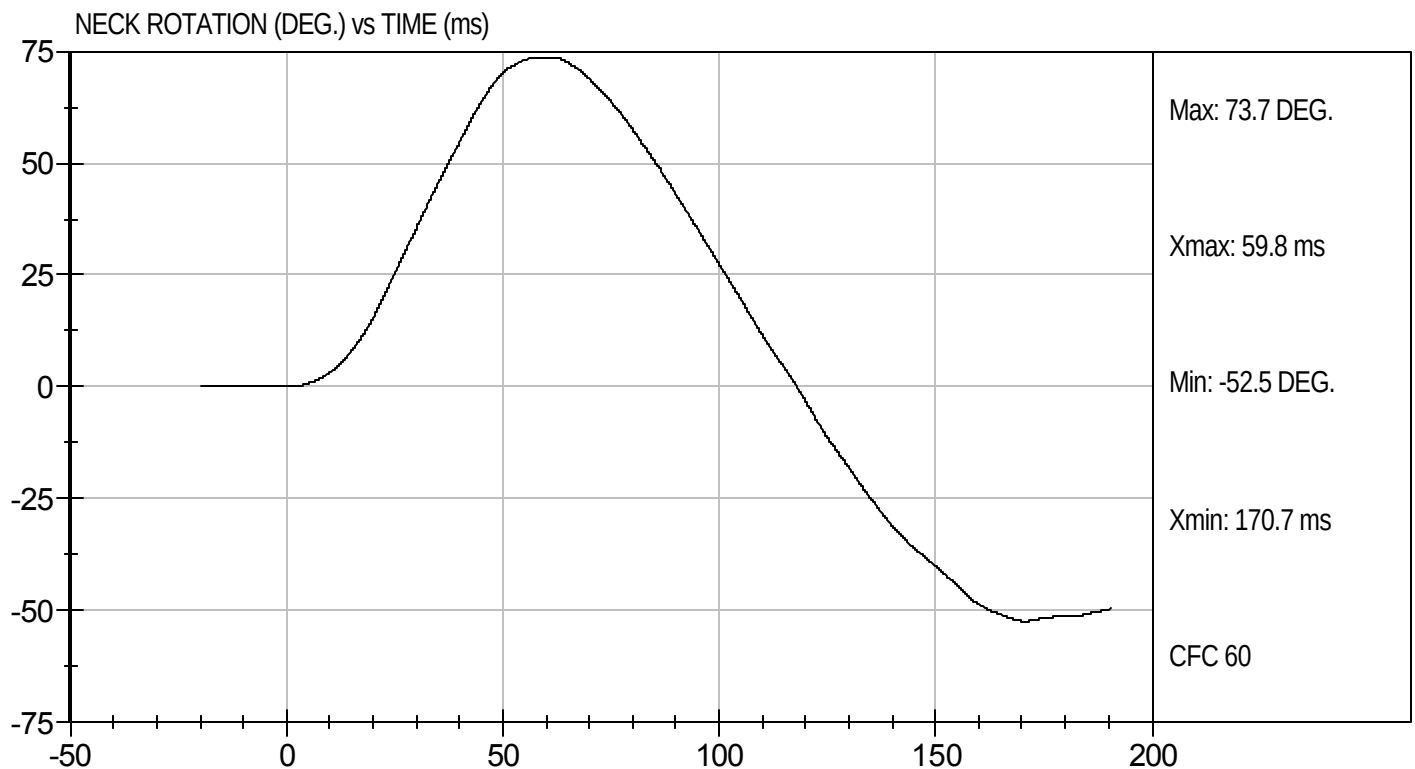
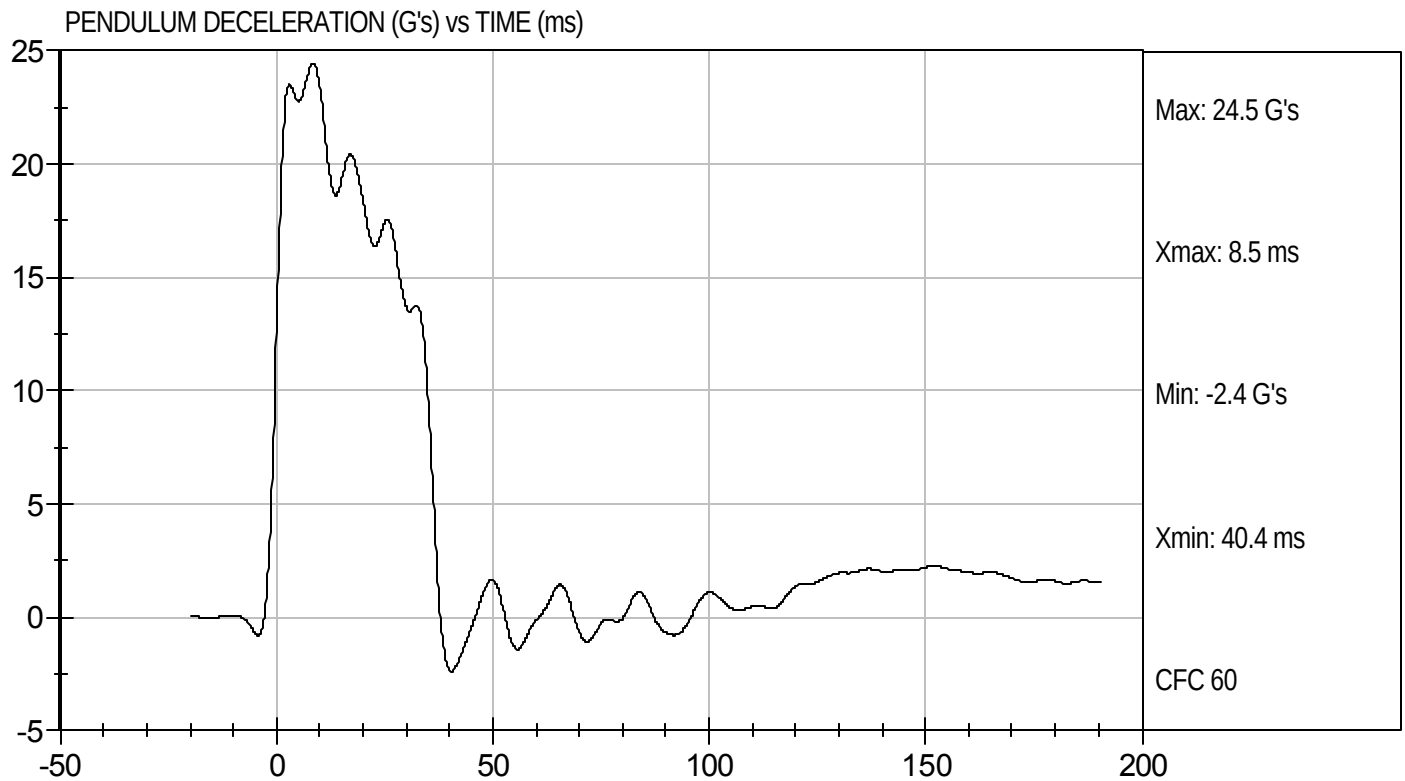
11/3/11  
 Test Date

  
 Approved By



Test Desc: Neck Flexion  
Component ID: D113682

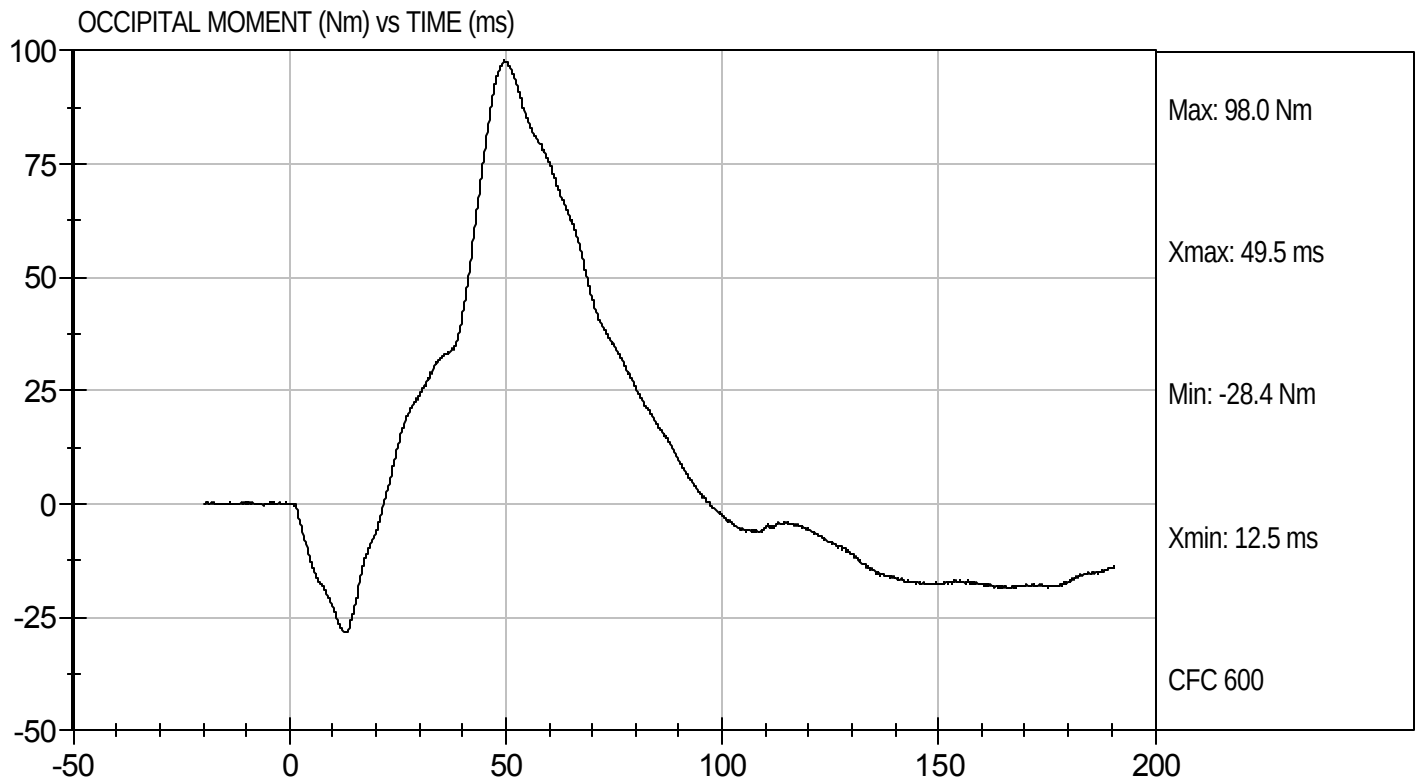
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Test Desc: Neck Flexion  
Component ID: D113682

Test Date: 11/3/11  
Velocity: 22.83 ft/s, 6.96 m/s



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

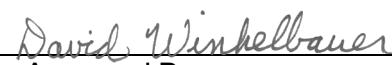
ATD Serial No: 036

Test I.D.: D113683

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.3   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 33     | Pass      |
| Pendulum Velocity                              |         | m/s     | 5.95 to 6.19   | 6.05   | Pass      |
| Pendulum Deceleration                          | 10 ms   | G's     | 17.20 to 21.20 | 17.82  | Pass      |
|                                                | 20 ms   | G's     | 14.00 to 19.00 | 15.19  | Pass      |
|                                                | 30 ms   | G's     | 11.00 to 16.00 | 11.34  | Pass      |
| Peak Pendulum Deceleration After 30 ms         |         | G's     | <= 22.0        | 12.3   | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | ms      | 38.0 to 46.0   | 41.1   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 81.0 to 106.0  | 99.5   | Pass      |
|                                                | Time    | ms      | 72.0 to 82.0   | 77.7   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | ms      | 147.0 to 174.0 | 158.7  | Pass      |
| Moment About Occipital Condyle                 | Maximum | Nm      | -52.9 to -79.9 | -69.3  | Pass      |
|                                                | Time    | ms      | 65.0 to 79.0   | 71.6   | Pass      |
| Negative Moment Decay Time To Zero Crossing    |         | ms      | 120.0 to 148.0 | 142.5  | Pass      |
| Overall Test Results                           |         |         |                |        | Pass      |

  
 Laboratory Technician

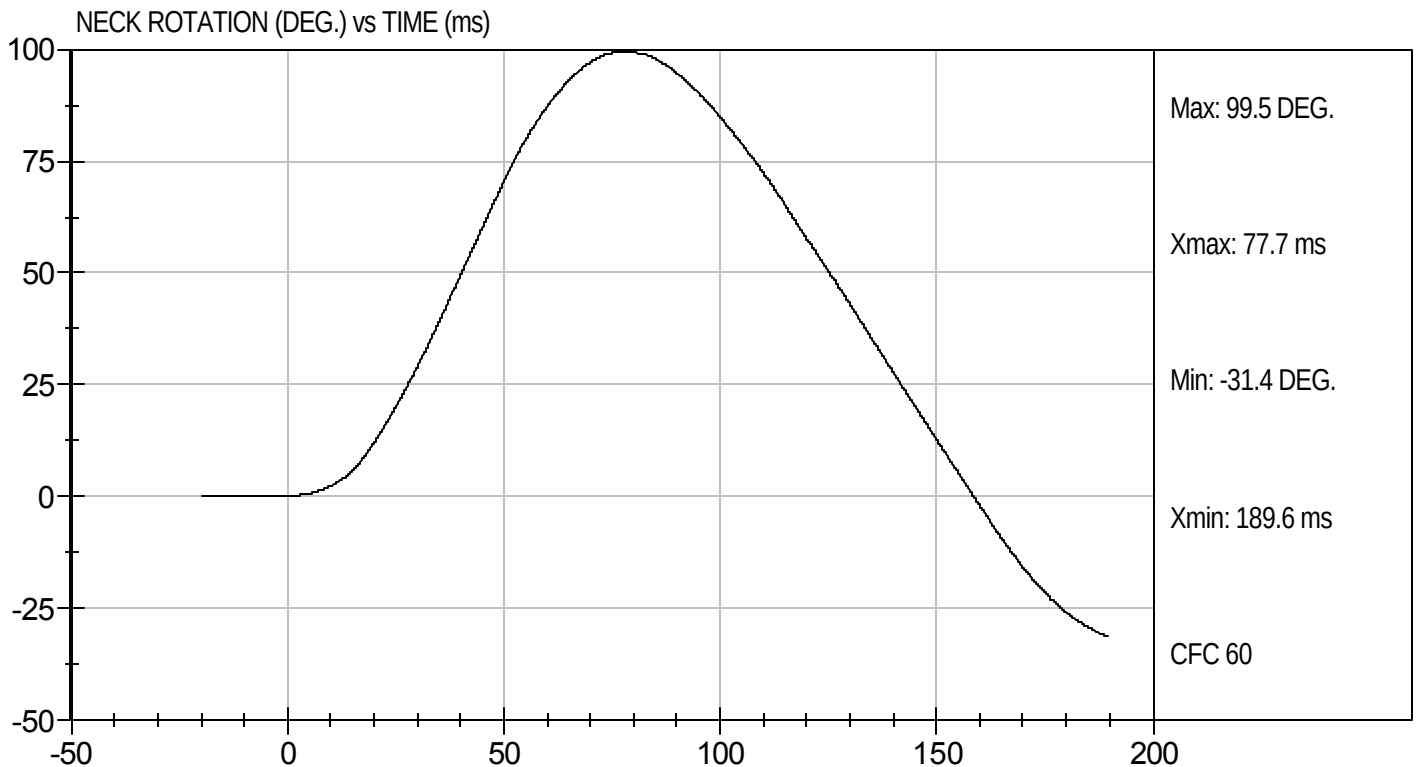
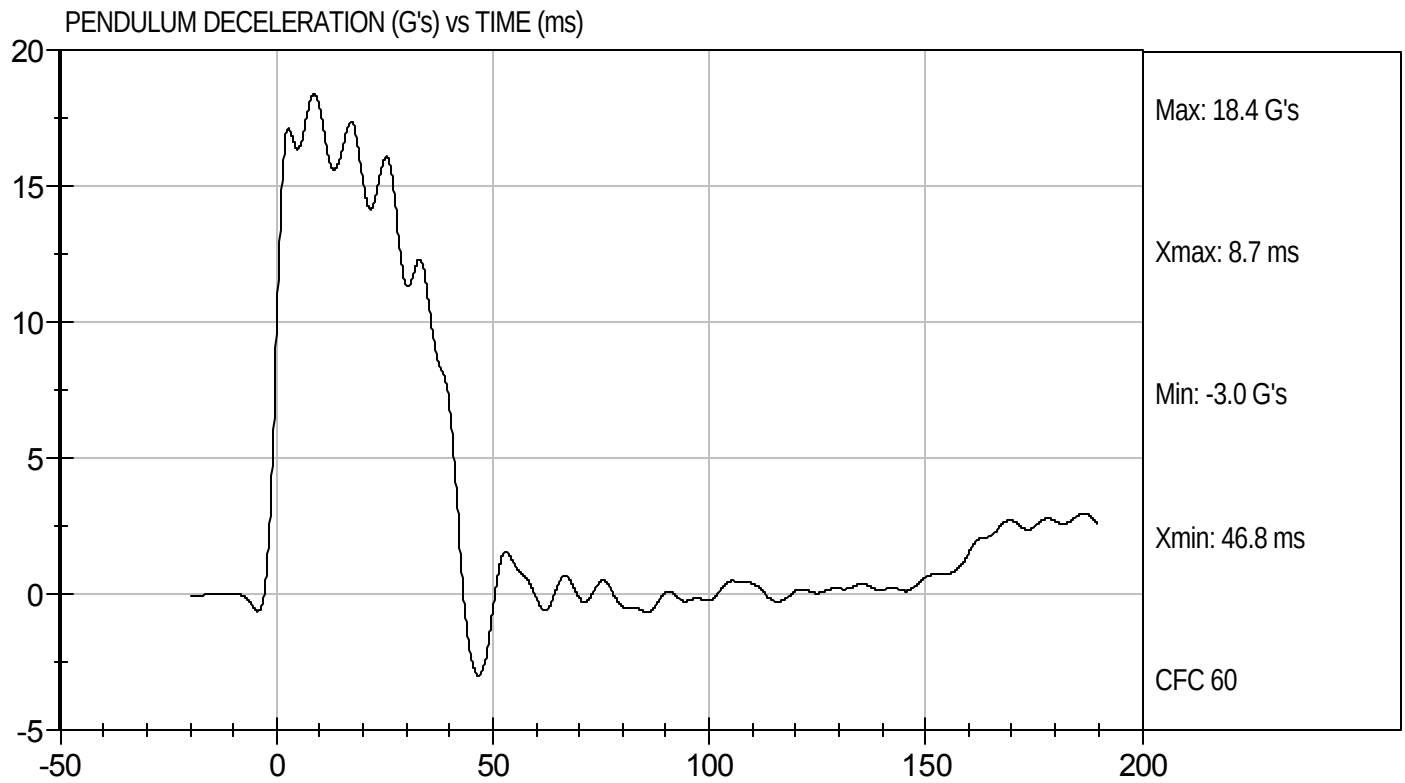
11/3/11  
 Test Date

  
 Approved By



Test Desc: Neck Extension  
Component ID: D113683

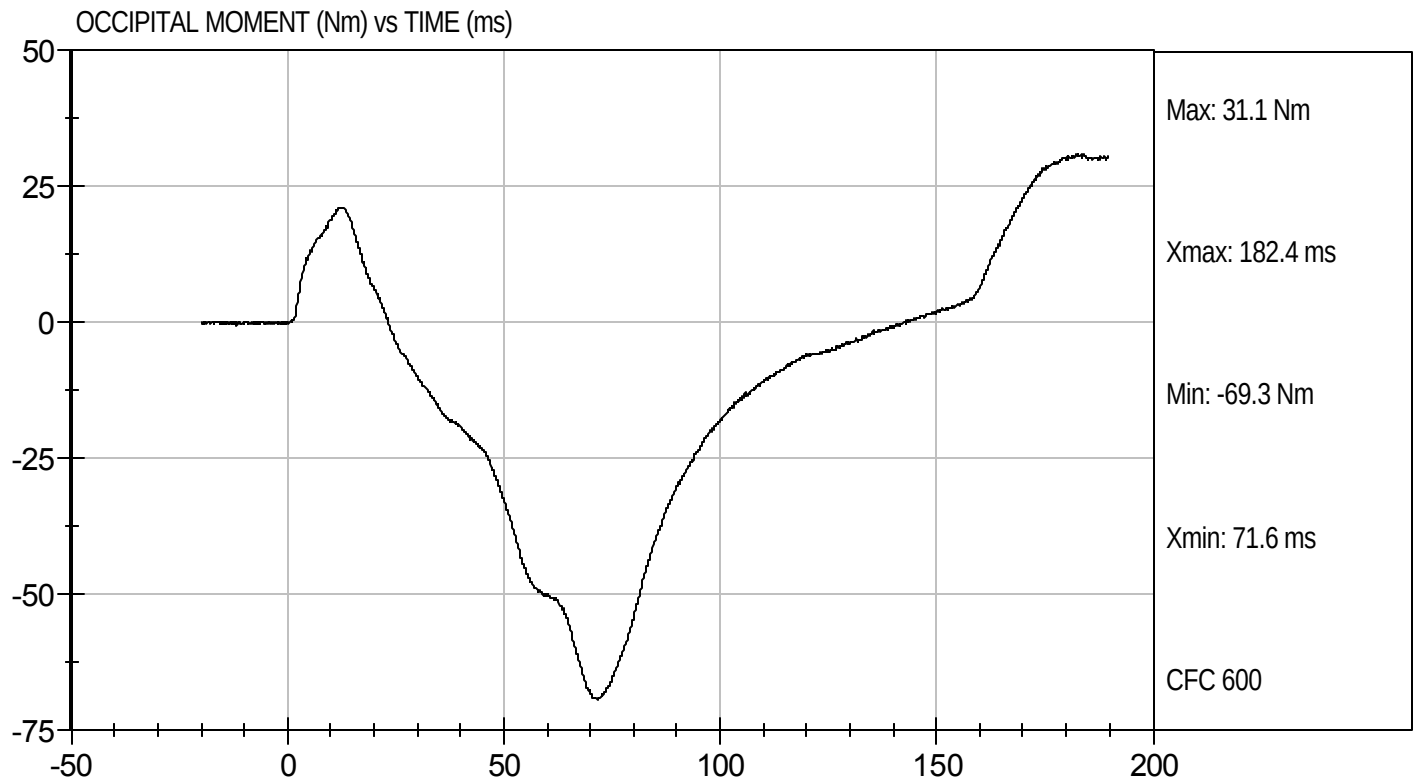
Test Date: 11/3/11  
Velocity: 19.84 ft/s, 6.05 m/s





Test Desc: Neck Extension  
Component ID: D113683

Test Date: 11/3/11  
Velocity: 19.84 ft/s, 6.05 m/s



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

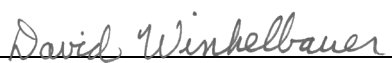
**ATD Serial No:** 036

**Test I.D:** D113684

| Tested Parameter             | Units | Specification | Result               | Pass/Fail |
|------------------------------|-------|---------------|----------------------|-----------|
| Laboratory Temperature       | deg C | 20.6 to 22.2  | 21.2                 | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 34                   | Pass      |
| Probe Velocity               | m/s   | 6.58 to 6.82  | 6.77                 | Pass      |
| Peak Probe Force             | N     | 5159 to 5893  | 5,628                | Pass      |
| Peak Sternum Displacement    | cm    | 6.35 to 7.26  | 6.83                 | Pass      |
| Internal Hysteresis          | %     | 69 to 85      | 70                   | Pass      |
|                              |       |               | Overall Test Results | Pass      |

  
Laboratory Technician

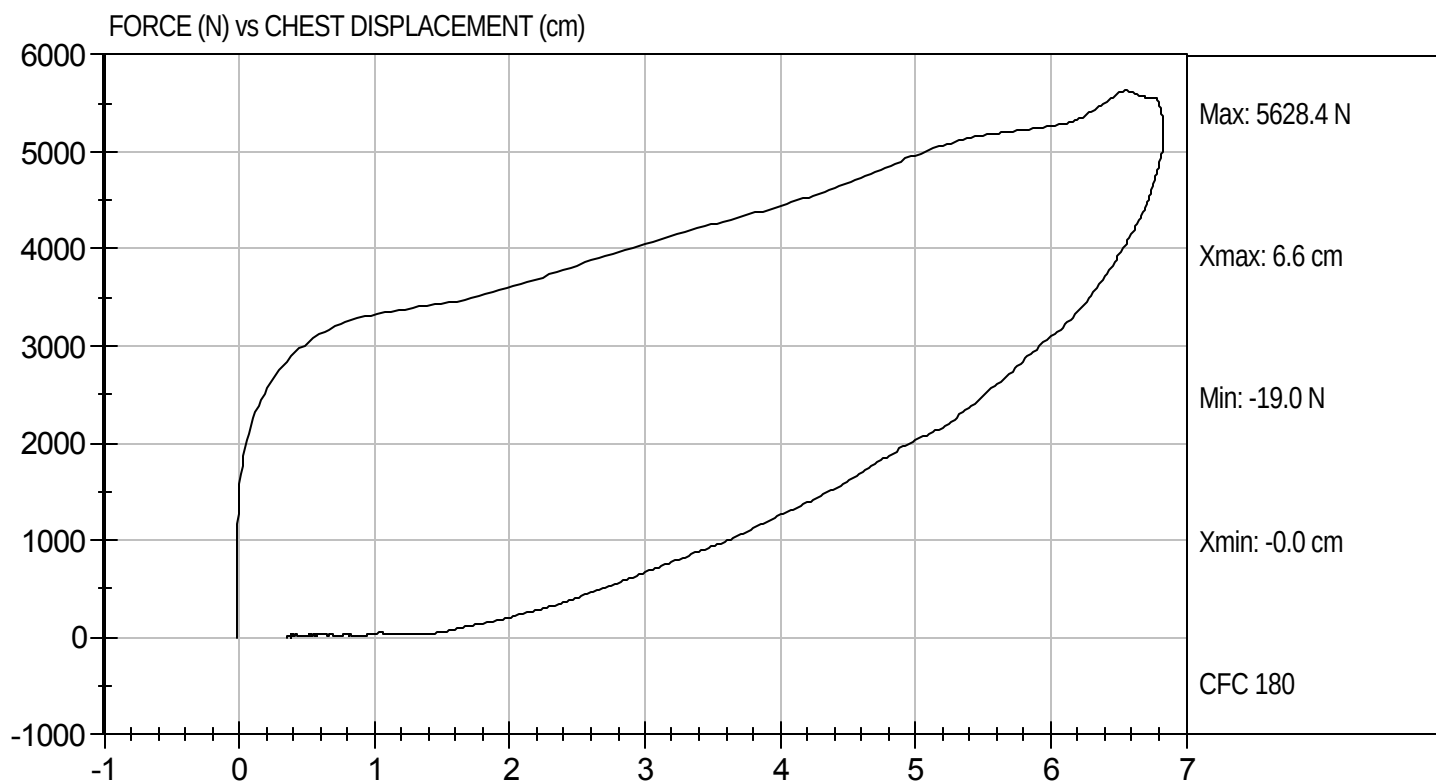
11/3/11  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Component ID: D113684

Test Date: 11/3/11  
Velocity: 22.22 ft/s, 6.77 m/s



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

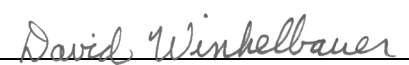
**ATD Serial No:** 036

**Test I.D:** D113685

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 21.4   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 32     | Pass      |
| Probe Velocity               | m/s     | 2.07 to 2.13  | 2.12   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 5,162  | Pass      |
| Overall Test Results         |         |               |        | Pass      |

  
Laboratory Technician

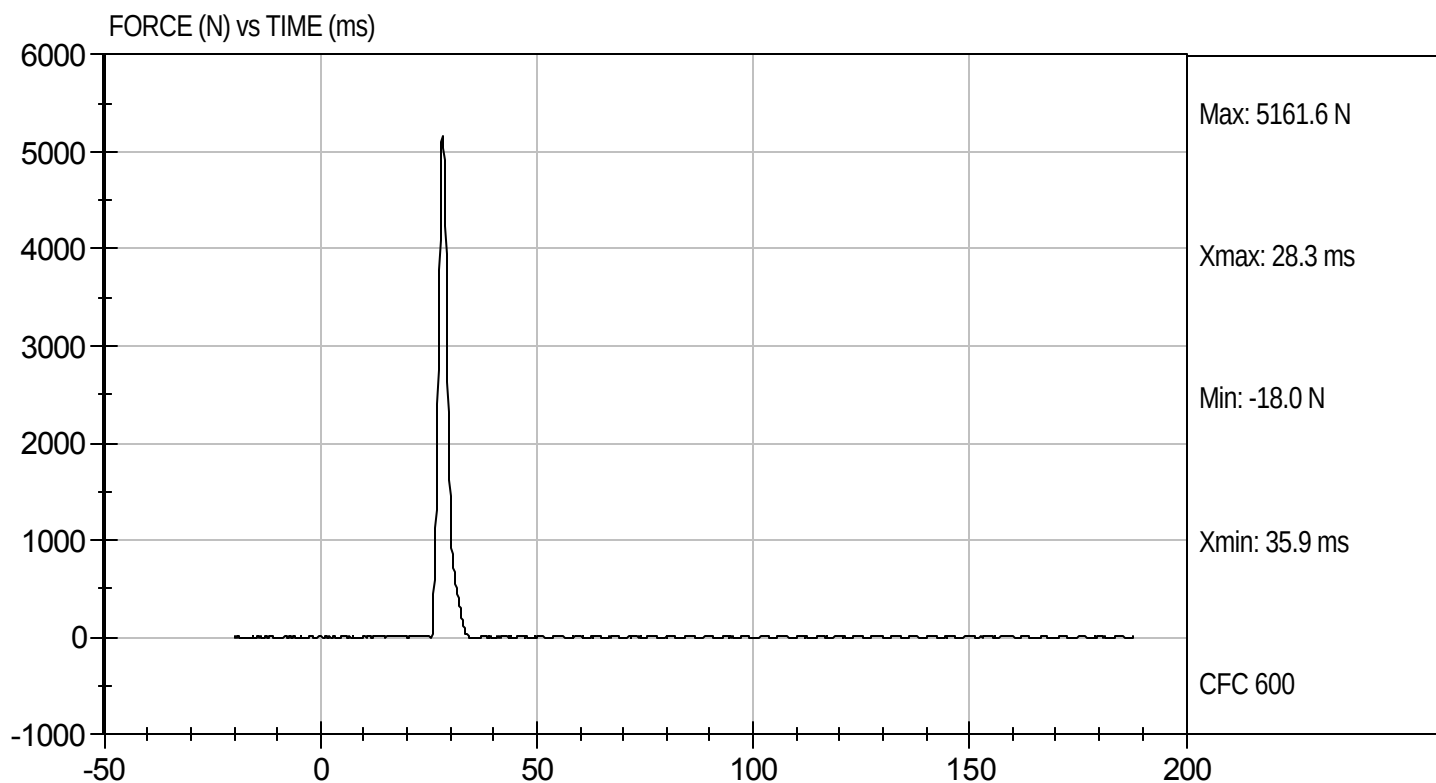
11/3/11  
Test Date

  
Approved By



Test Desc: Right Knee  
Component ID: D113685

Test Date: 11/3/11  
Velocity: 6.97 ft/s, 2.12 m/s



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

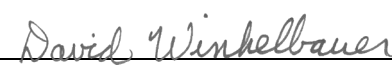
**ATD Serial No:** 036

**Test I.D:** D113686

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 21.4   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 32     | Pass      |
| Probe Velocity               | m/s     | 2.07 to 2.13  | 2.12   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 5,278  | Pass      |
| Overall Test Results         |         |               |        | Pass      |

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

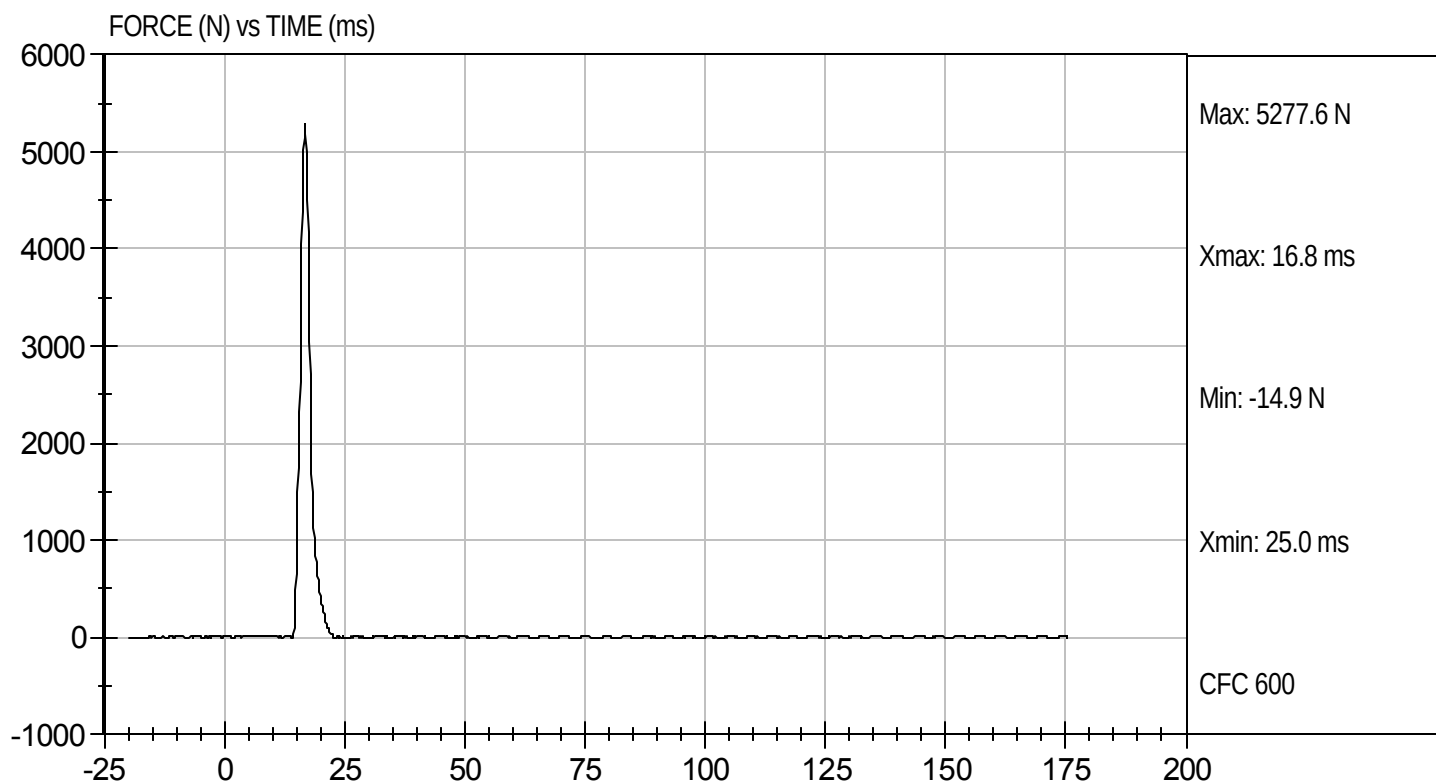
11/3/11  
Test Date

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



Test Desc: Left Knee  
Component ID: D113686

Test Date: 11/3/11  
Velocity: 6.97 ft/s, 2.12 m/s



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

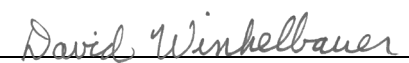
**ATD Serial No:** 036

**Test I.D:** D113680

| 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                           | 35     | 35   | Pass      |
| Rotation Rate                | deg/s | 5.0 -10.0                          | 5.7    | 5.7  | Pass      |
| 30 Degrees                   | Nm    | 94.9 Nm Max                        | 94.1   | 78.3 | Pass      |
| 150 ft-lbf / 203.4 Nm        | Deg   | 40.0 - 50.0 Degree<br>Max Rotation | 40.1   | 41.0 | Pass      |
| Overall Test Results         |       |                                    |        |      | Pass      |

  
 Laboratory Technician

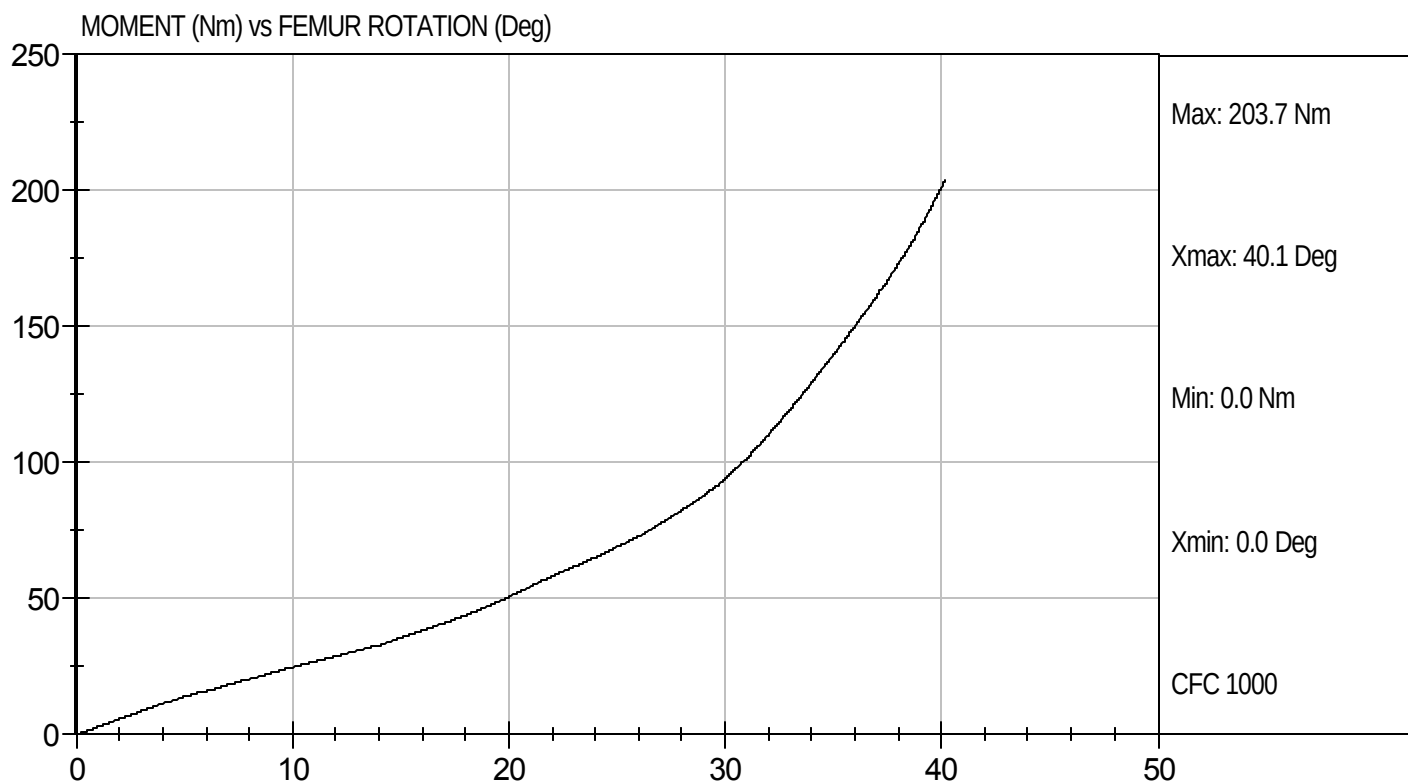
11/3/11  
 Test Date

  
 Approved By



Test Desc: Hip Femur Flexion  
Component ID: D113689

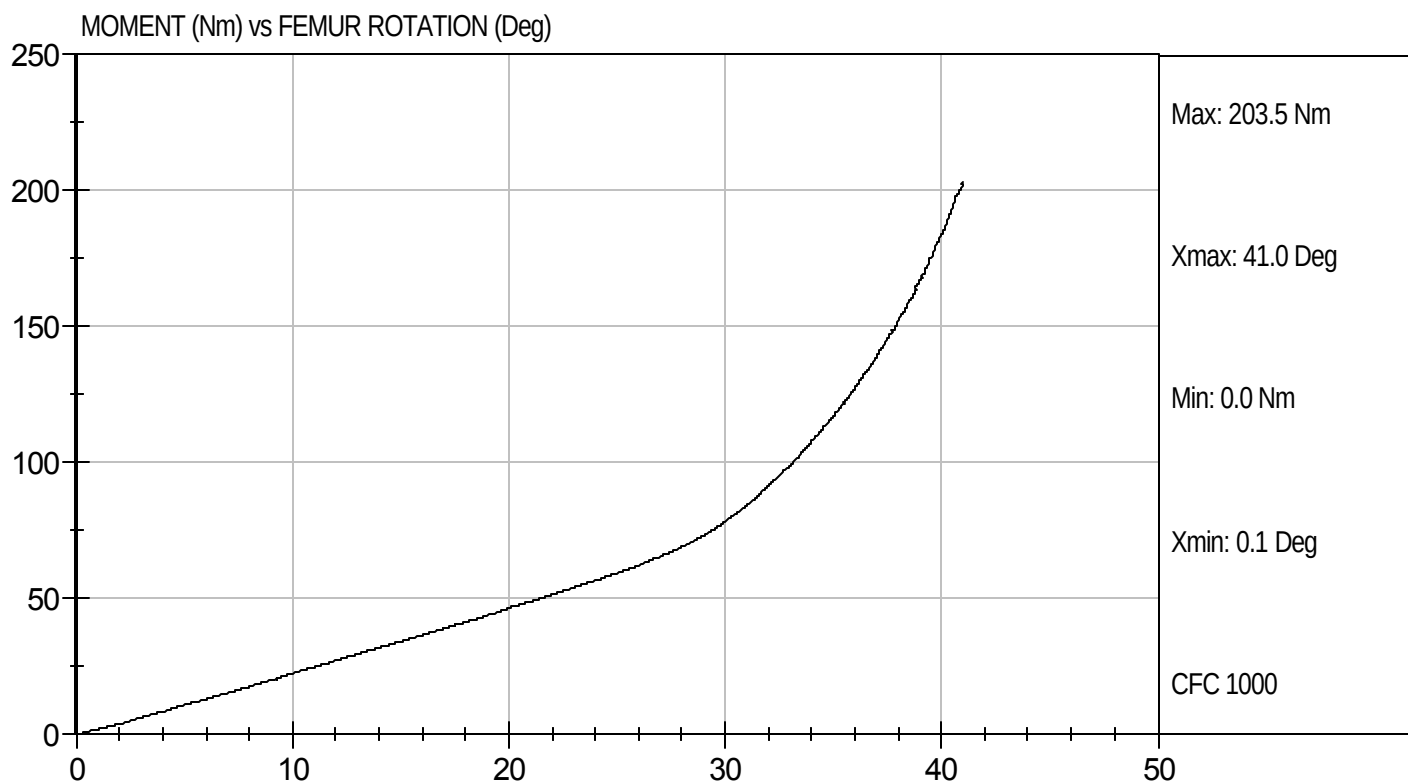
Test Date: 11/3/11  
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion  
Component ID: D113680

Test Date: 11/3/11  
Velocity: 0 ft/s, 0.00 m/s



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

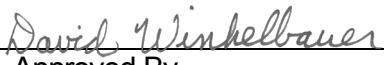
**ATD Serial No:** 036

**Test ID:** D113751

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 - 25.6        | 21.0   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 29     | Pass      |
| Peak Resultant Acceleration  | G's   | 225 - 275          | 257    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | 3.9    | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

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

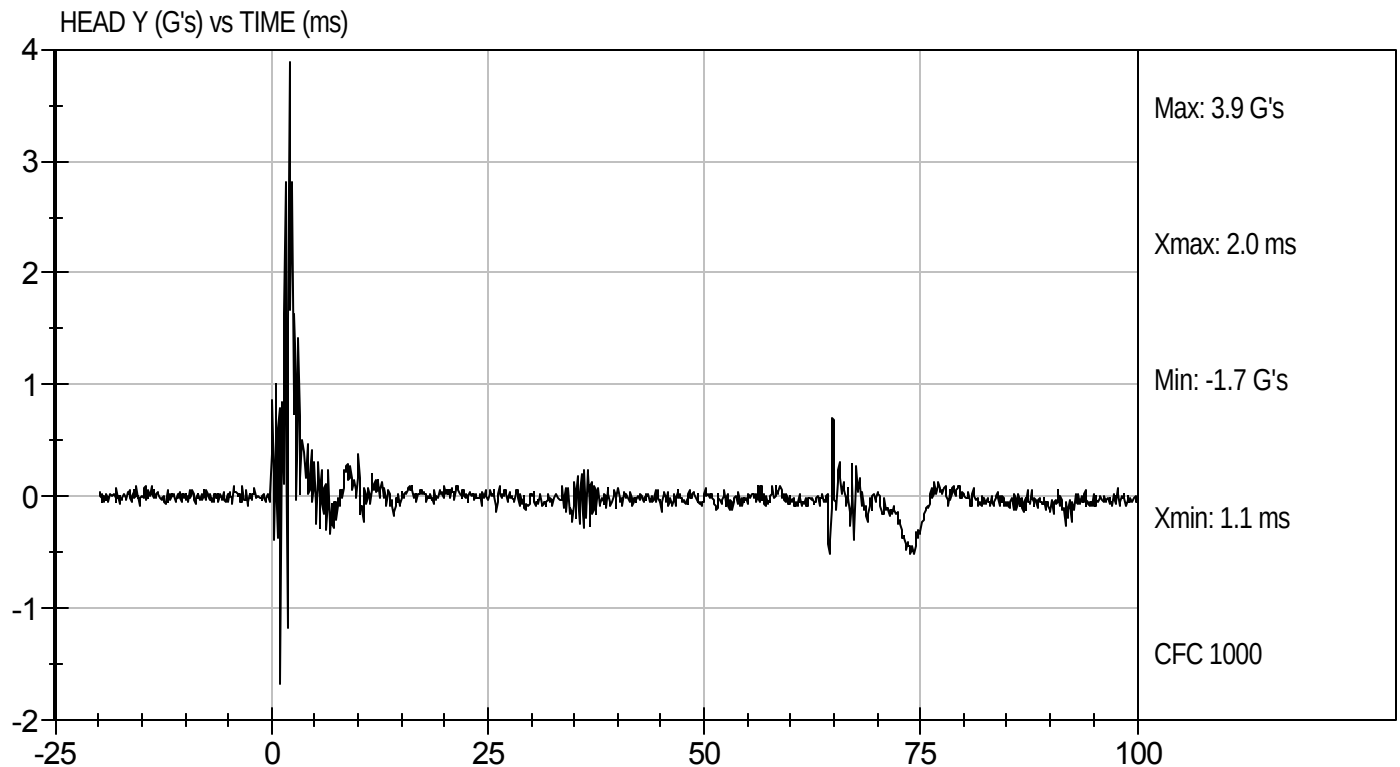
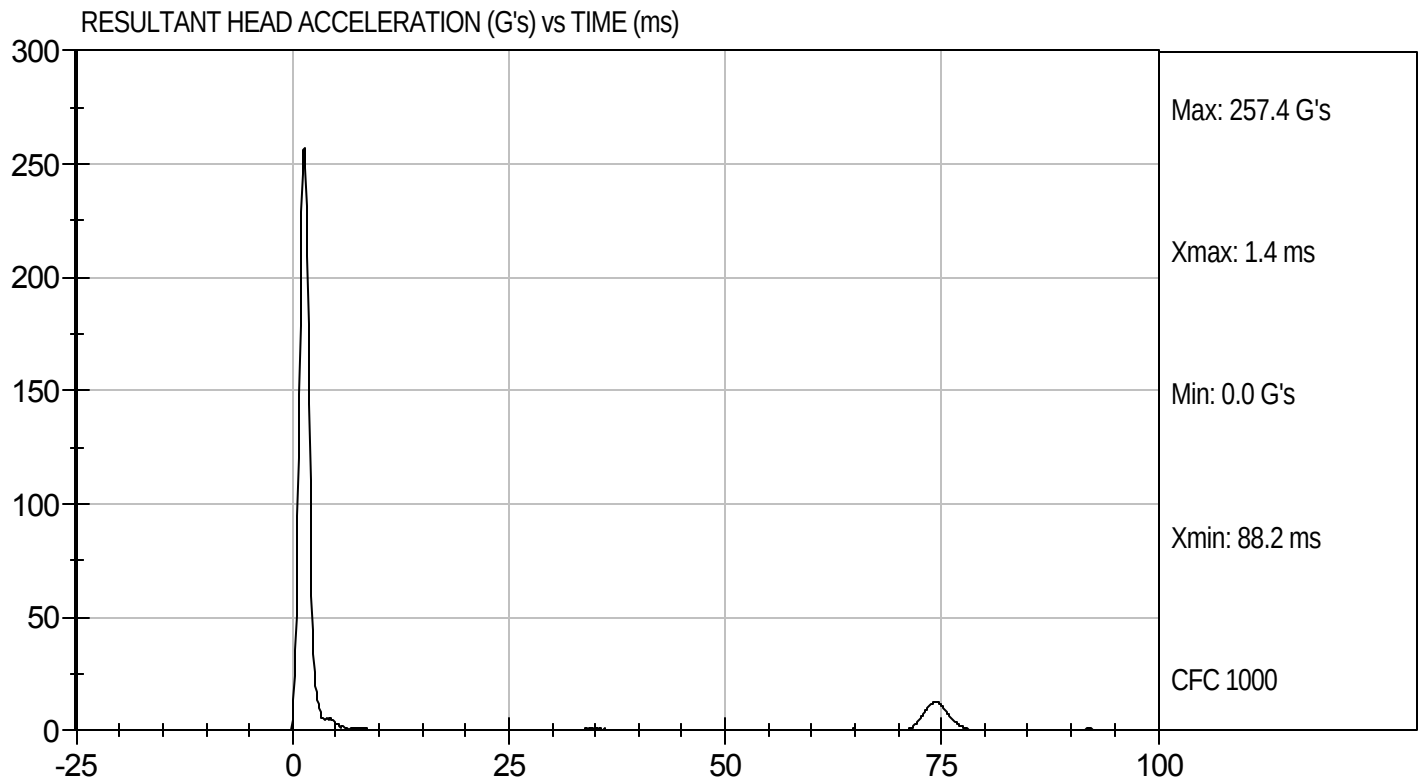
11/10/11  
Test Date

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



Test Desc: Head Drop  
Component ID: D113751

Test Date: 11/10/11  
Velocity: 0 ft/s, 0.00 m/s



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

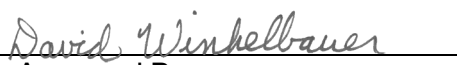
ATD Serial No: 036

Test I.D.: D113752

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.5   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 29     | Pass      |
| Pendulum Velocity                              |         | m/s     | 6.89 to 7.13   | 7.06   | Pass      |
| Pendulum Deceleration                          | 10 ms   | G's     | 22.50 to 27.50 | 25.78  | Pass      |
|                                                | 20 ms   | G's     | 17.60 to 22.60 | 20.64  | Pass      |
|                                                | 30 ms   | G's     | 12.50 to 18.50 | 16.90  | Pass      |
| Peak Pendulum Deceleration After 30 ms         |         | G's     | <= 29.0        | 16.8   | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | ms      | 34.0 to 42.0   | 34.3   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 64.0 to 78.0   | 69.1   | Pass      |
|                                                | Time    | ms      | 57.0 to 64.0   | 57.3   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | ms      | 113.0 to 128.0 | 115.8  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | 88.1 to 108.5  | 95.5   | Pass      |
|                                                | Time    | ms      | 47.0 to 58.0   | 47.0   | Pass      |
| Positive Moment Decay Time To Zero Crossing    |         | ms      | 97.0 to 107.0  | 97.5   | Pass      |
| Overall Test Results                           |         |         |                |        | Pass      |

  
 Laboratory Technician

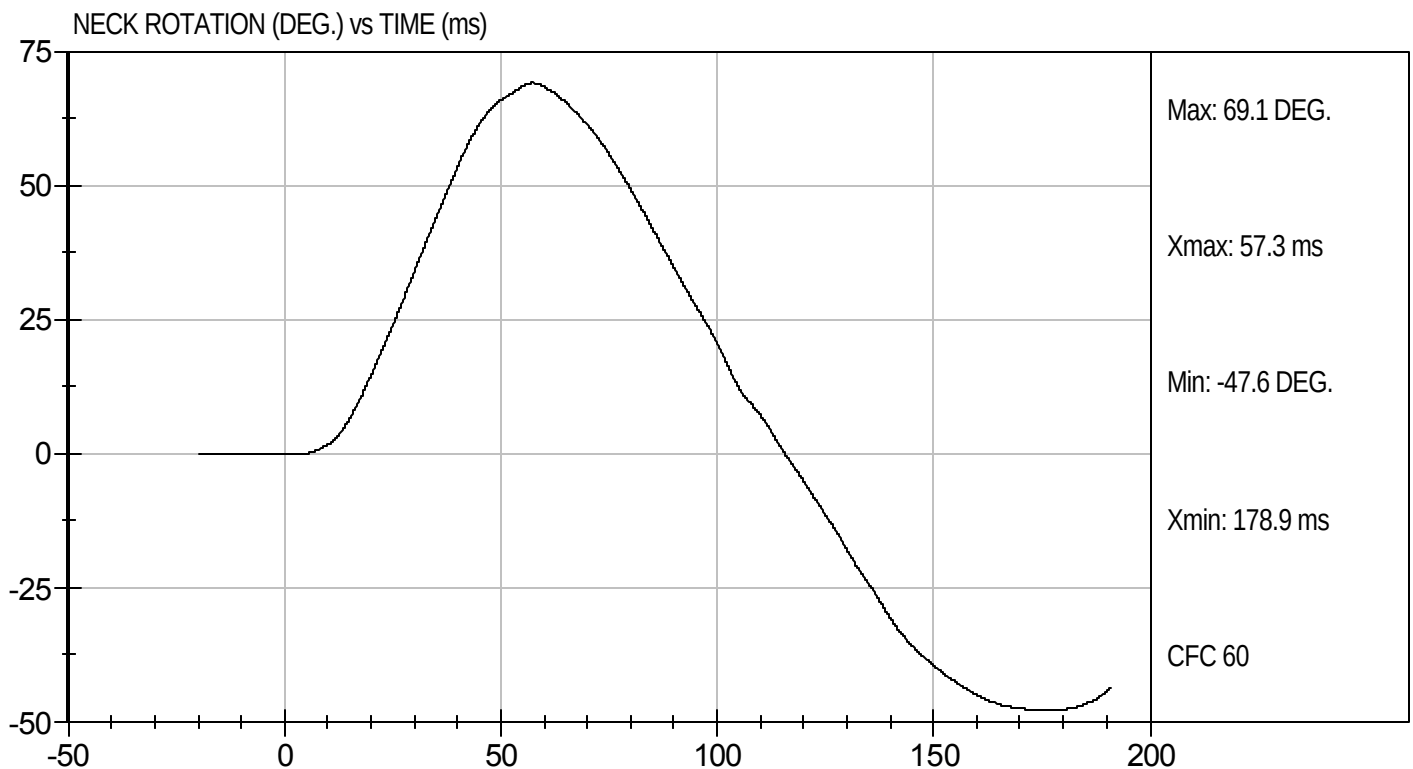
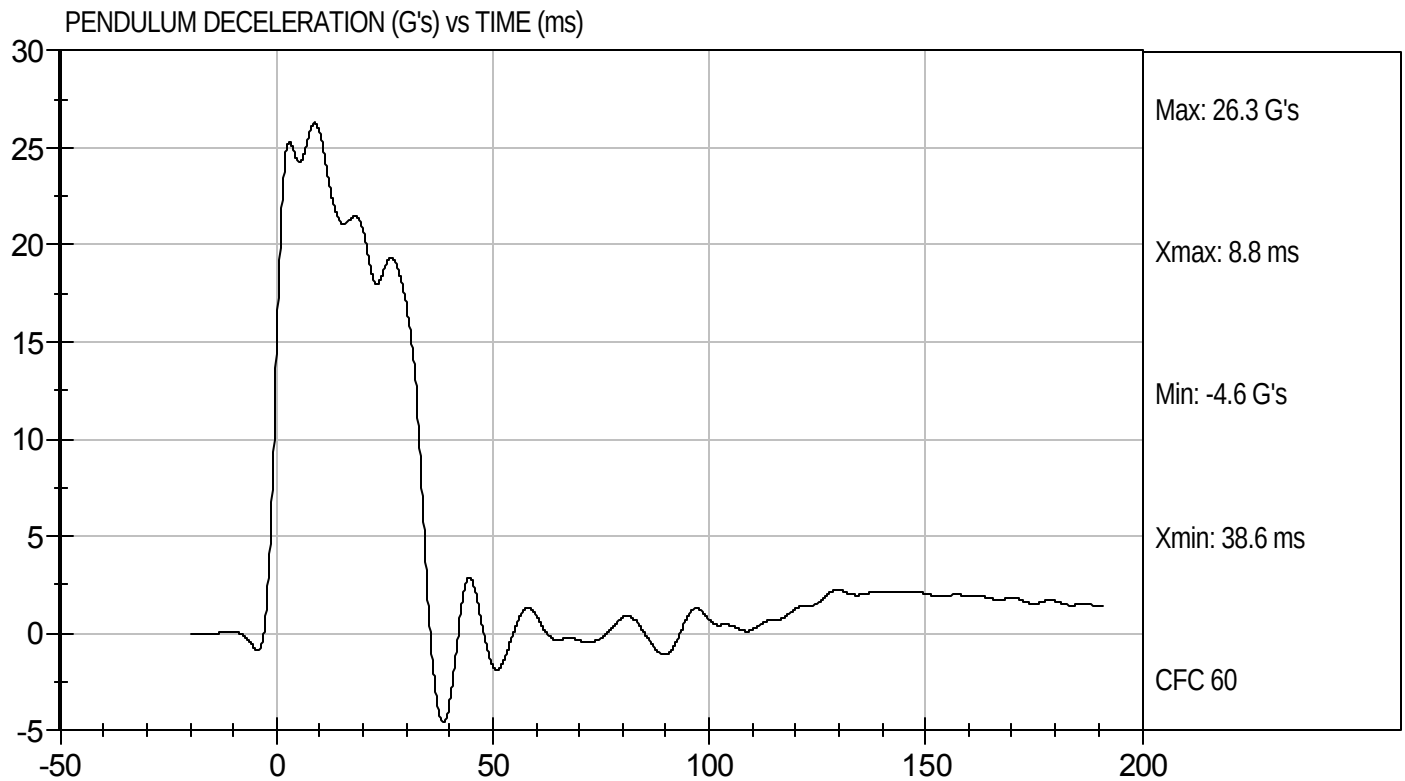
11/10/11  
 Test Date

  
 Approved By



Test Desc: Neck Flexion  
Component ID: D113752

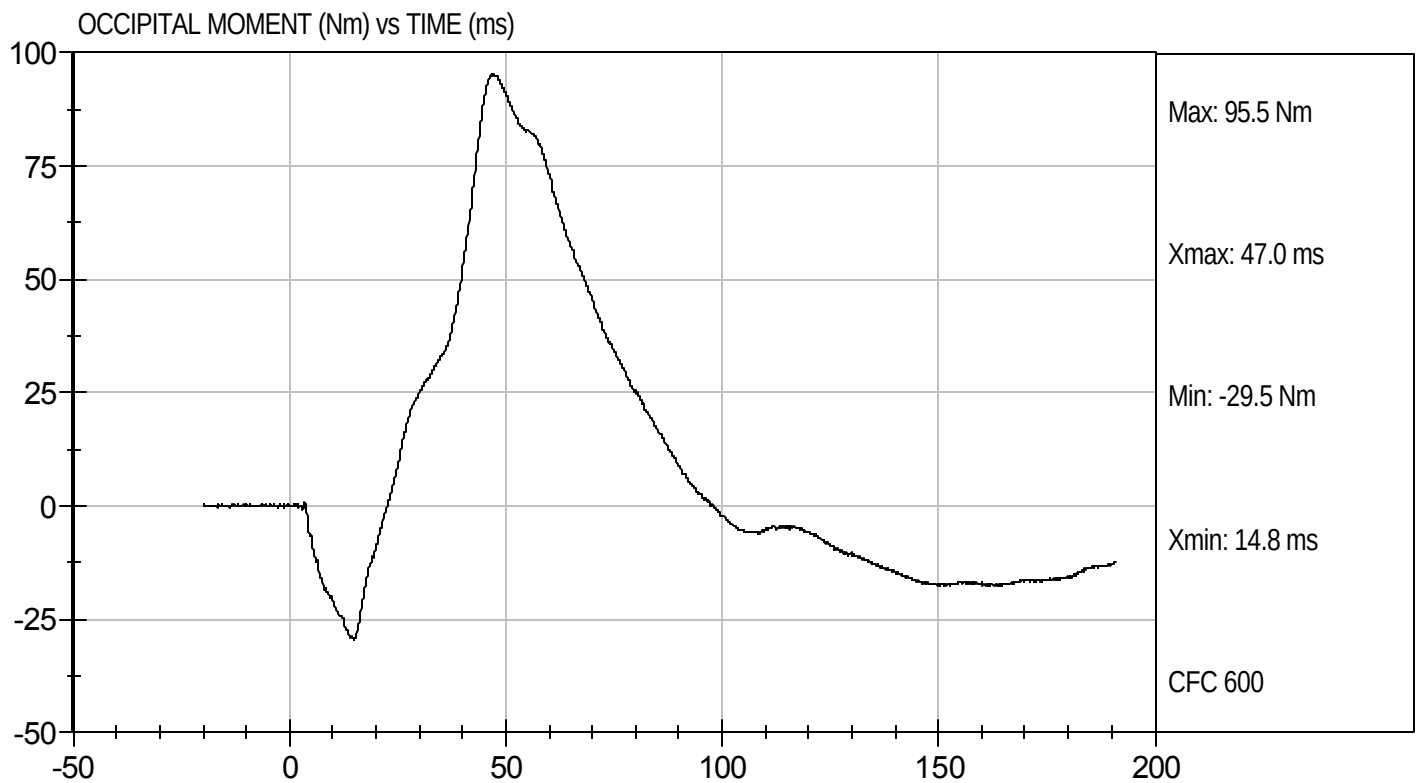
Test Date: 11/10/11  
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion  
Component ID: D113752

Test Date: 11/10/11  
Velocity: 23.15 ft/s, 7.06 m/s



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

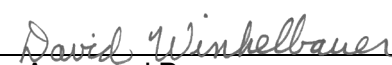
ATD Serial No: 036

Test I.D.: D113753

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.5   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 29     | Pass      |
| Pendulum Velocity                              |         | m/s     | 5.95 to 6.19   | 6.12   | Pass      |
| Pendulum Deceleration                          | 10 ms   | G's     | 17.20 to 21.20 | 17.27  | Pass      |
|                                                | 20 ms   | G's     | 14.00 to 19.00 | 15.09  | Pass      |
|                                                | 30 ms   | G's     | 11.00 to 16.00 | 11.46  | Pass      |
| Peak Pendulum Deceleration After 30 ms         |         | G's     | <= 22.0        | 12.7   | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | ms      | 38.0 to 46.0   | 42.9   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 81.0 to 106.0  | 95.8   | Pass      |
|                                                | Time    | ms      | 72.0 to 82.0   | 78.8   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | ms      | 147.0 to 174.0 | 160.5  | Pass      |
| Moment About Occipital Condyle                 | Maximum | Nm      | -52.9 to -79.9 | -61.2  | Pass      |
|                                                | Time    | ms      | 65.0 to 79.0   | 72.8   | Pass      |
| Negative Moment Decay Time To Zero Crossing    |         | ms      | 120.0 to 148.0 | 145.2  | Pass      |
| Overall Test Results                           |         |         |                |        | Pass      |

  
 Laboratory Technician

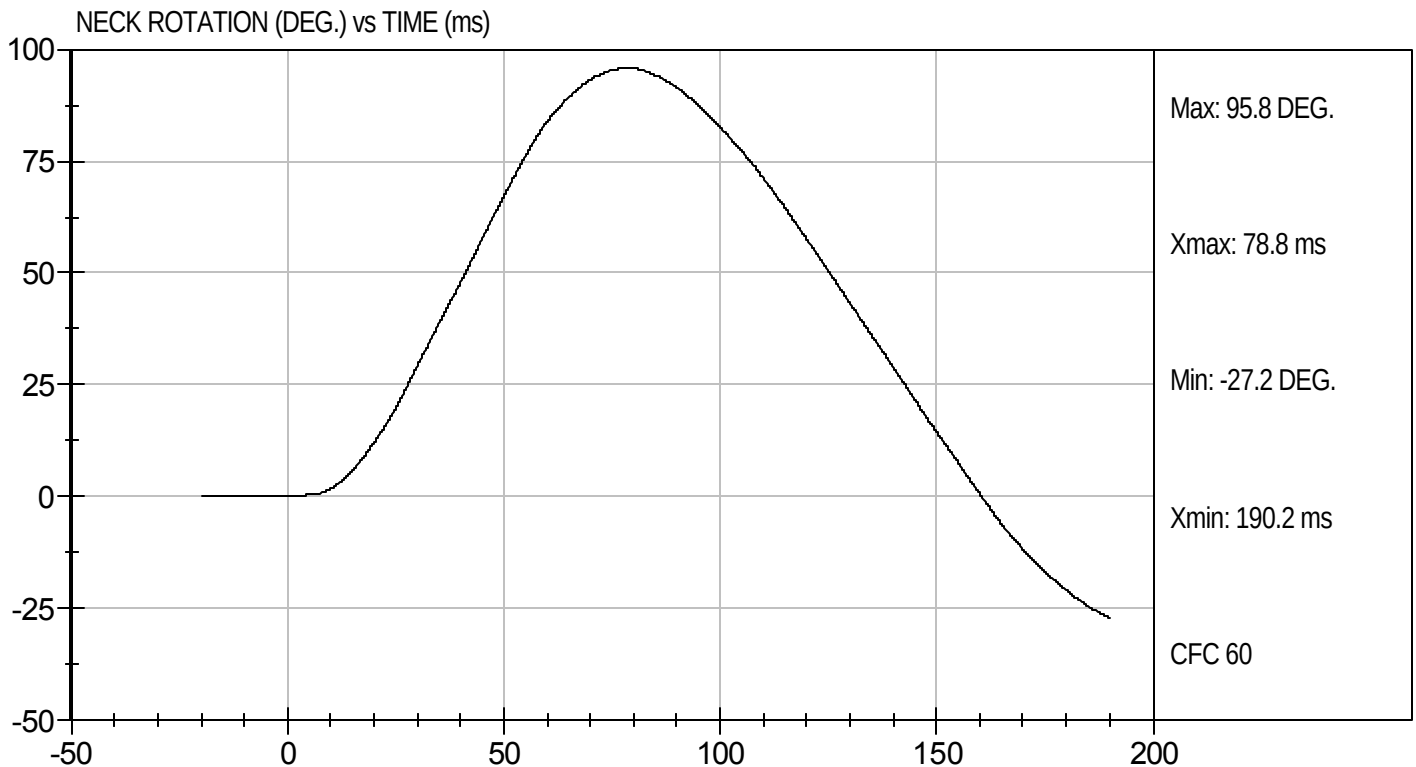
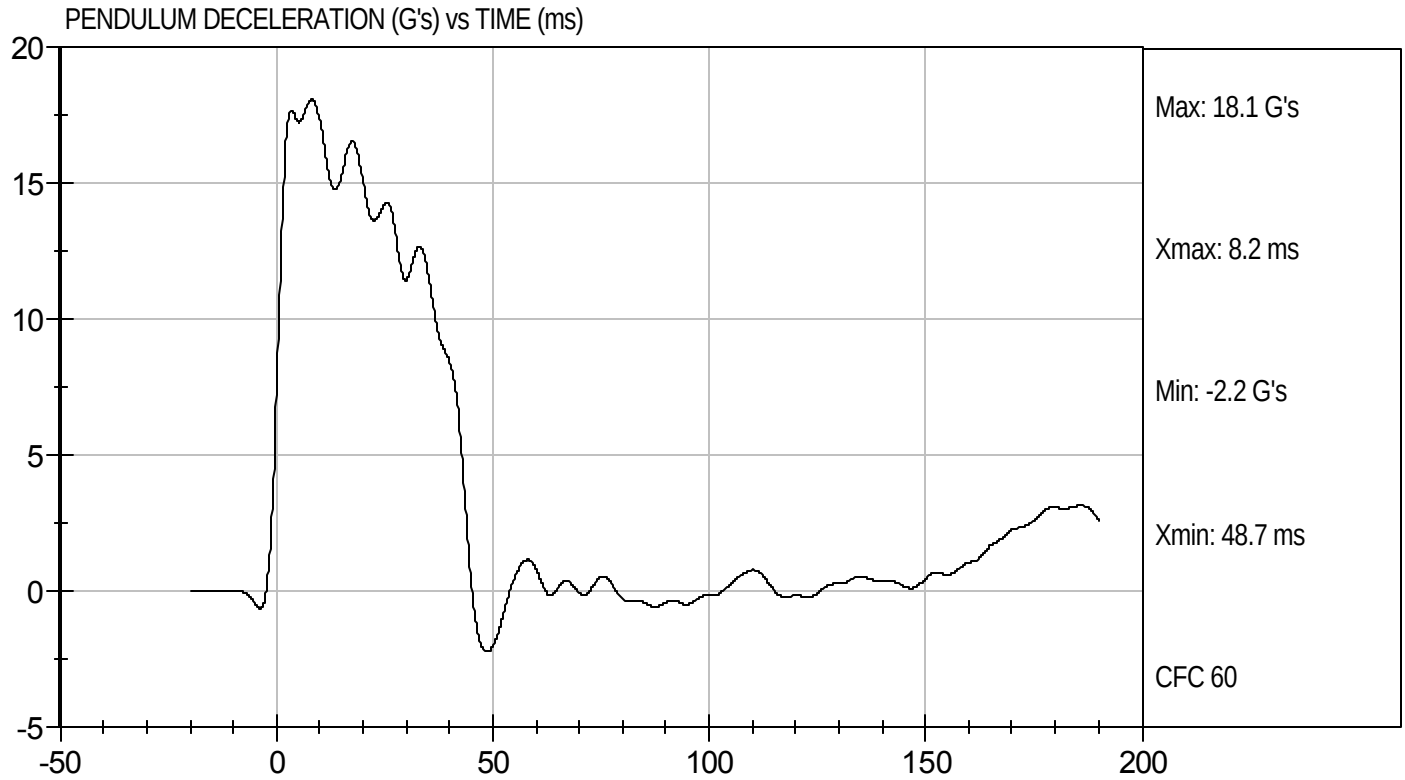
11/10/11  
 Test Date

  
 Approved By



Test Desc: Neck Extension  
Component ID: D113753

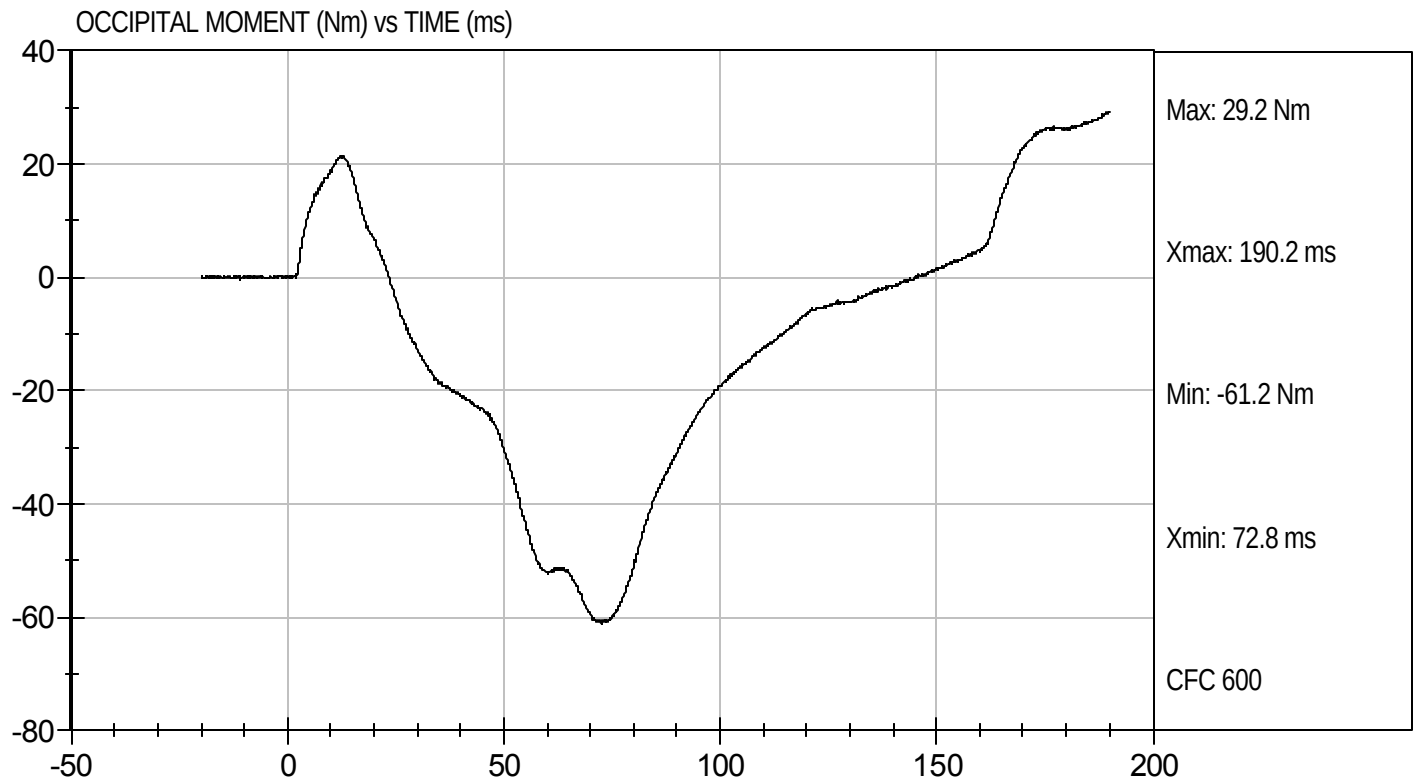
Test Date: 11/10/11  
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension  
Component ID: D113753

Test Date: 11/10/11  
Velocity: 20.08 ft/s, 6.12 m/s



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

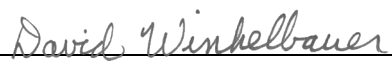
**ATD Serial No:** 036

**Test I.D:** D113754

| 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      | 29                   | Pass      |
| Probe Velocity               | m/s   | 6.58 to 6.82  | 6.77                 | Pass      |
| Peak Probe Force             | N     | 5159 to 5893  | 5,267                | Pass      |
| Peak Sternum Displacement    | cm    | 6.35 to 7.26  | 6.81                 | Pass      |
| Internal Hysteresis          | %     | 69 to 85      | 71                   | Pass      |
|                              |       |               | Overall Test Results | Pass      |

  
Laboratory Technician

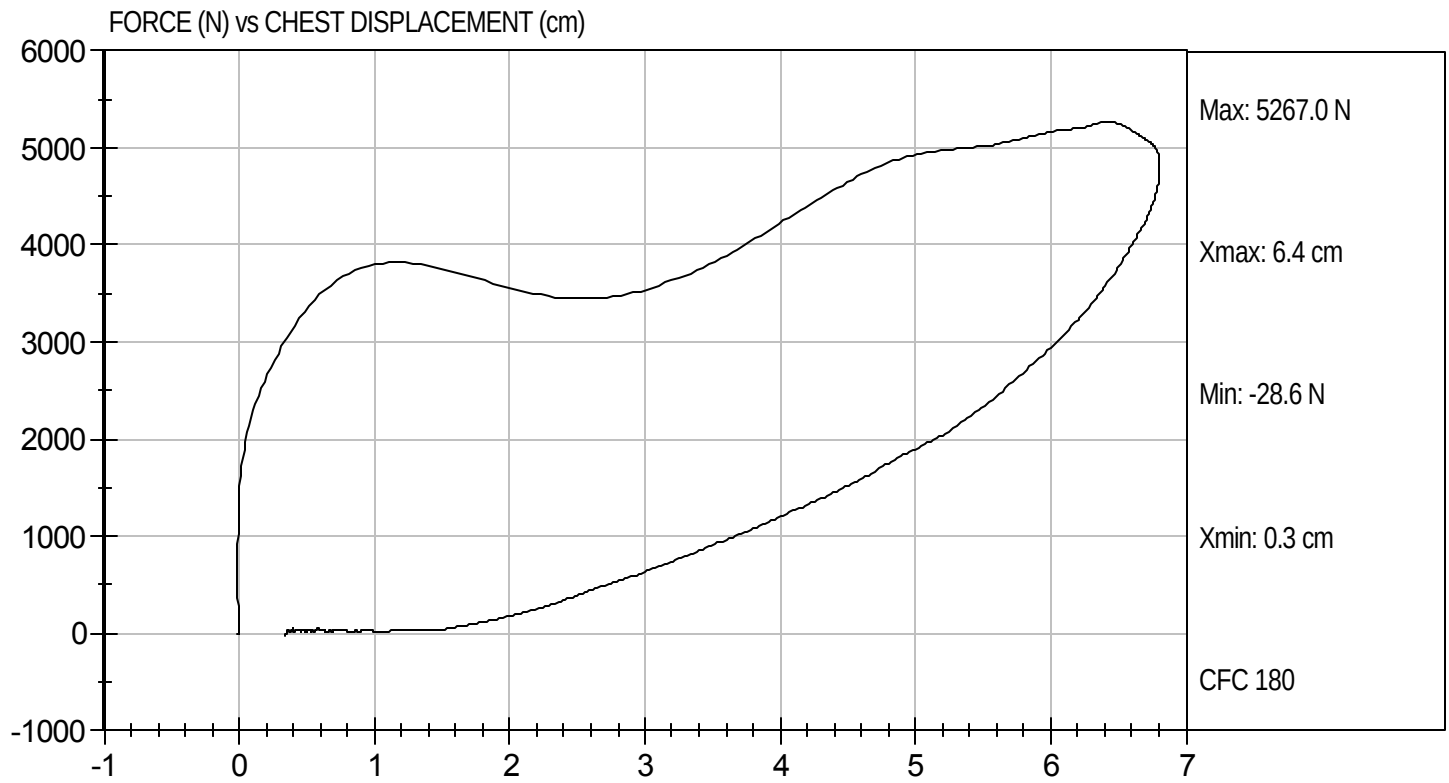
11/10/11  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Component ID: D113754

Test Date: 11/10/11  
Velocity: 22.22 ft/s, 6.77 m/s



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

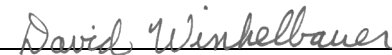
**ATD Serial No:** 036

**Test I.D:** D113755

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 21.3   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 29     | Pass      |
| Probe Velocity               | m/s     | 2.07 to 2.13  | 2.12   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 4,973  | Pass      |
| Overall Test Results         |         |               |        | Pass      |

  
Laboratory Technician

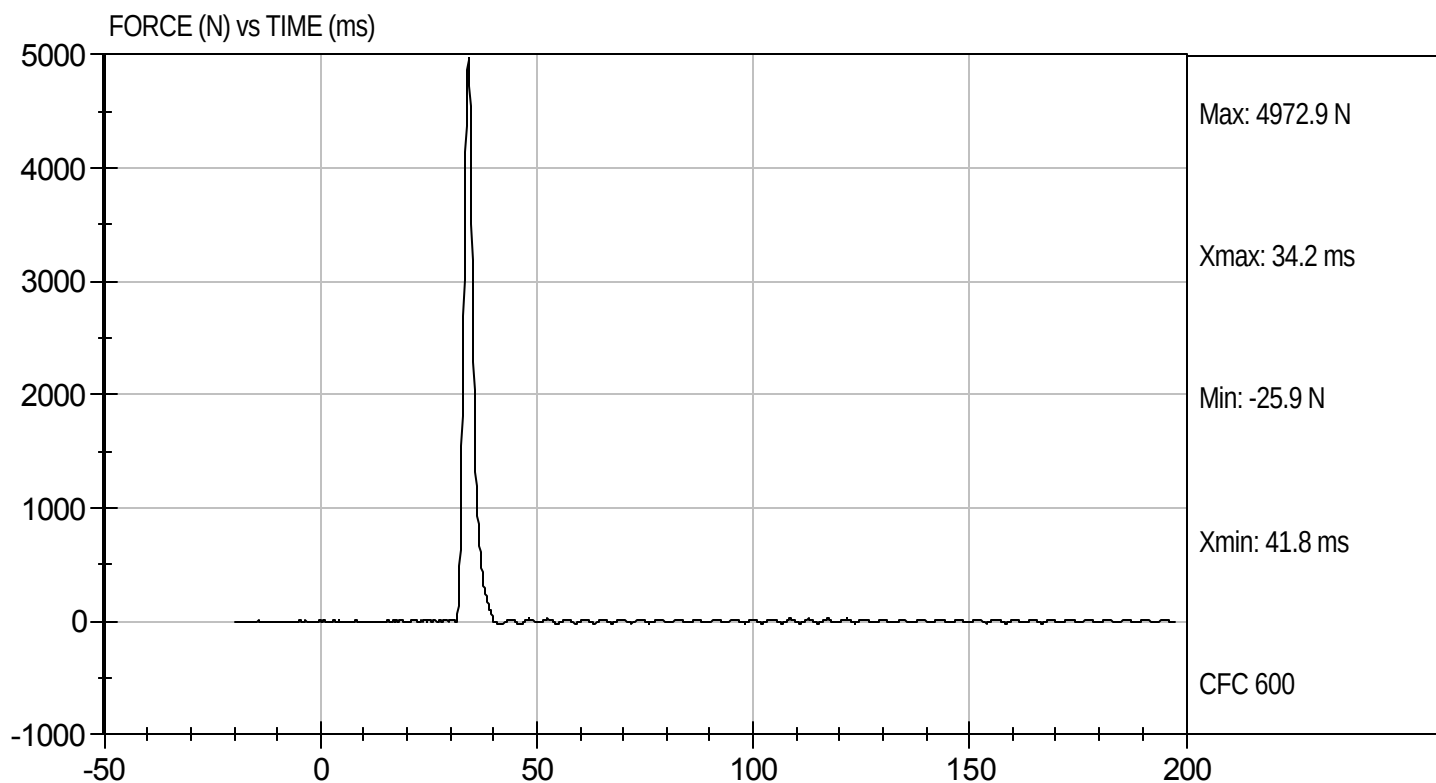
11/10/11  
Test Date

  
Approved By



Test Desc: Right Knee  
Component ID: D113755

Test Date: 11/10/11  
Velocity: 6.97 ft/s, 2.12 m/s



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

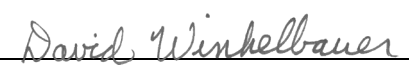
**ATD Serial No:** 036

**Test I.D:** D113756

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 21.3   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 29     | Pass      |
| Probe Velocity               | m/s     | 2.07 to 2.13  | 2.09   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 4,955  | Pass      |
| Overall Test Results         |         |               |        | Pass      |

  
Laboratory Technician

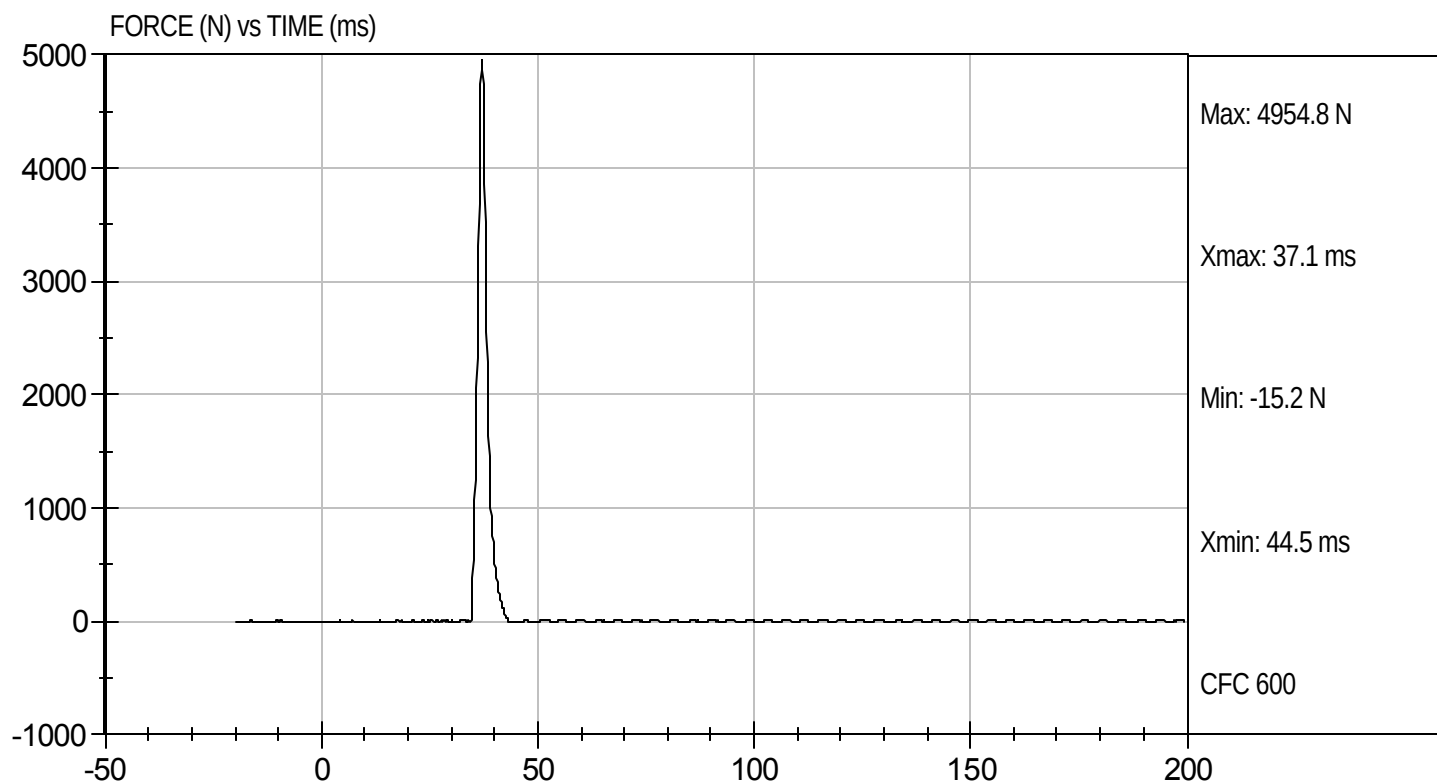
11/10/11  
Test Date

  
Approved By



Test Desc: Left Knee  
Component ID: D113756

Test Date: 11/10/11  
Velocity: 6.86 ft/s, 2.09 m/s



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

**ATD Serial No:** 036

**Test I.D:** D113750

| Tested Parameter             | Units | Specification                      | Result |      | Pass/Fail |
|------------------------------|-------|------------------------------------|--------|------|-----------|
|                              |       |                                    | Right  | Left |           |
| Laboratory Temperature       | deg C | 18.9 to 25.6                       | 21.4   | 21.4 | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70                           | 29     | 29   | Pass      |
| Rotation Rate                | deg/s | 5.0 -10.0                          | 5.7    | 5.7  | Pass      |
| 30 Degrees                   | Nm    | 94.9 Nm Max                        | 92.3   | 76.8 | Pass      |
| 150 ft-lbf / 203.4 Nm        | Deg   | 40.0 - 50.0 Degree<br>Max Rotation | 40.3   | 41.1 | Pass      |
| Overall Test Results         |       |                                    |        |      | Pass      |

  
 Laboratory Technician

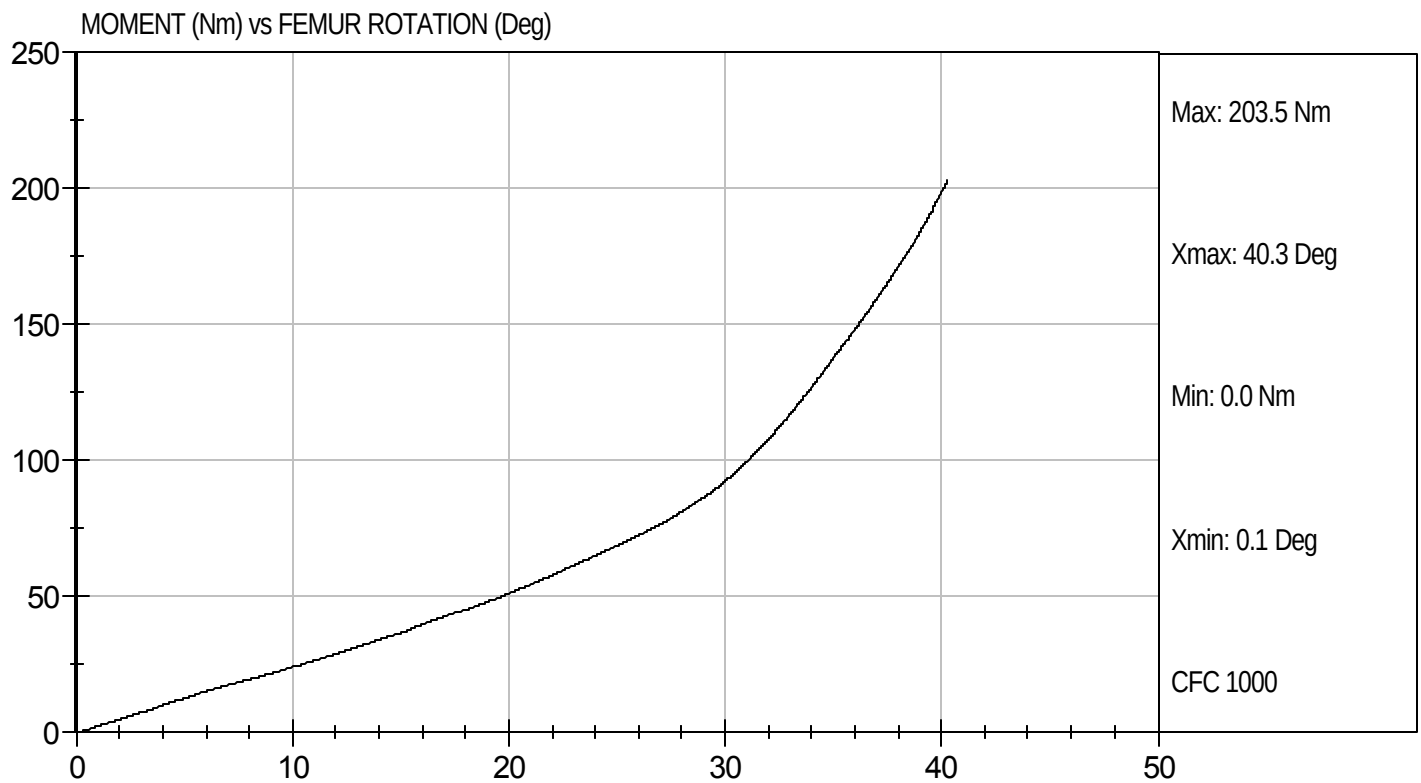
11/10/11  
 Test Date

  
 Approved By



Test Desc: Hip Femur Flexion  
Component ID: D113759

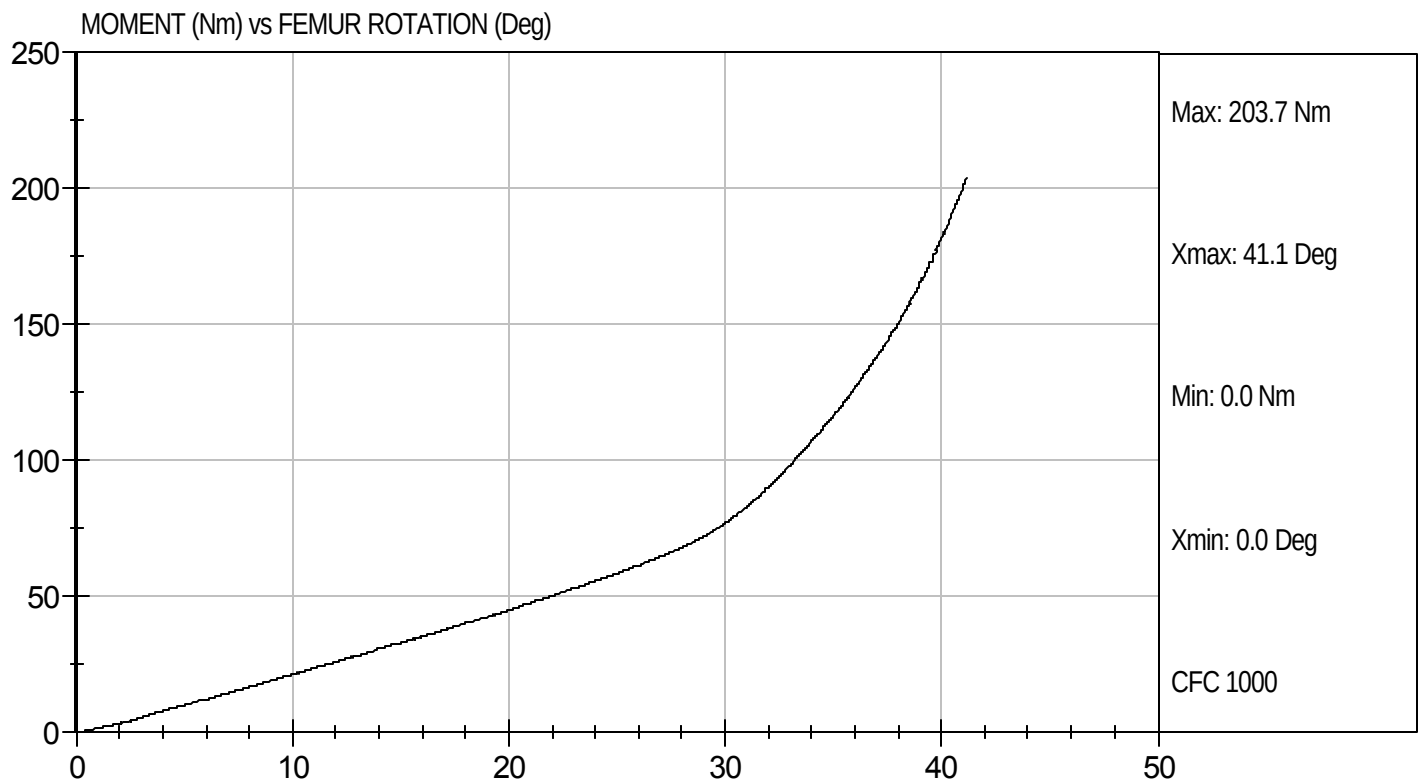
Test Date: 11/10/11  
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion  
Component ID: D113750

Test Date: 11/10/11  
Velocity: 0 ft/s, 0.00 m/s



**Hybrid III, 5th External Measurements**  
**SN: 634**

| HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS |                                |                                                                                                                                              |                         |                    |
|-----------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                           | DESCRIPTION                    | DETAILS                                                                                                                                      | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A                                                   | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.                                                                                            | 774.7-800.1             | 784.6              |
| B                                                   | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                       | 431.8-457.2             | 449.0              |
| C                                                   | H-POINT HEIGHT                 | Reference                                                                                                                                    | 81.3-86.3               | 85.0               |
| D                                                   | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                    | 144.8-149.8             | 145.0              |
| E                                                   | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                   | 68.6-83.8               | 79.2               |
| F                                                   | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                    | 119.4-134.6             | 125.6              |
| G                                                   | BACK OF ELBOW TO WRIST PIVOT   | back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots                                                           | 243.9-259.1             | 253.4              |
| H                                                   | HEAD BACK TO BACKLINE          | Back of Skull cap skin to seat rear vertical surface (Reference)                                                                             | 43.2-48.2               | 45.0               |
| I                                                   | SHOULDER TO- ELBOW LENGTH      | Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt. | 276.8-297.2             | 277.8              |
| J                                                   | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 182.8-203.2             | 197.5              |
| K                                                   | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the rear vertical surface of the fixture.                                                         | 520.7-546.1             | 541.4              |
| L                                                   | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 355.6-376.0             | 362.1              |
| M                                                   | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 393.7-419.1             | 400.4              |
| N                                                   | BUTTOCK POPLITEAL LENGTH       | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".                               | 414-439.4               | 428.6              |

| HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued |                                                           |                                                         |                         |                    |
|------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                            | DESCRIPTION                                               | DETAILS                                                 | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| O                                                    | CHEST DEPTH WITHOUT JACKET                                | Measured 304.8 ± 5.1 mm above seat surface              | 175.3-190.5             | 181.6              |
| P                                                    | FOOT LENGTH                                               | Tip of toe to rear of heel                              | 218.5-233.7             | 224.7              |
| Q                                                    | STANDING HEIGHT                                           | (THEORETICAL)                                           | 1501.1                  | N/A                |
| R                                                    | BUTTOCK TO KNEE PIVOT LENGTH                              | The rear surface of the buttocks to the knee pivot bolt | 457.2-482.6             | 482.0              |
| S                                                    | HEAD BREADTH                                              | The widest part of the head                             | 137.1-147.3             | 139.6              |
| T                                                    | HEAD DEPTH                                                | Back of the head to the forehead                        | 177.8-188.0             | 179.2              |
| U                                                    | HIP BREADTH                                               | The widest part of the hip                              | 299.7-314.9             | 306.1              |
| V                                                    | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises       | 350.5-365.7             | 355.5              |
| W                                                    | FOOT BREADTH                                              | The widest part of the foot                             | 78.8-94.0               | 90.0               |
| X                                                    | HEAD CIRCUMFERENCE                                        | Measured at the point as in dim. "T"                    | 528.3-548.7             | 540.6              |
| Y                                                    | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 345.4 ± 12.7 mm above seat surface             | 850.9-881.3             | 868.7              |
| Z                                                    | WAIST CIRCUMFERENCE                                       | Measured 165.1 ± 5.1 mm above seat surface              | 759.5-789.9             | 786.8              |
| AA                                                   | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference                                               | 332.7-358.1             | 345.4              |
| BB                                                   | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference                                               | 160.1-170.2             | 165.1              |

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

**ATD Serial No:** 634

**Test ID:** D113691

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.2   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 36     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 274    | Pass      |
| Peak Lateral Acceleration    | G's   | +/- 15             | -9.8   | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

Jessica Hall  
Laboratory Technician

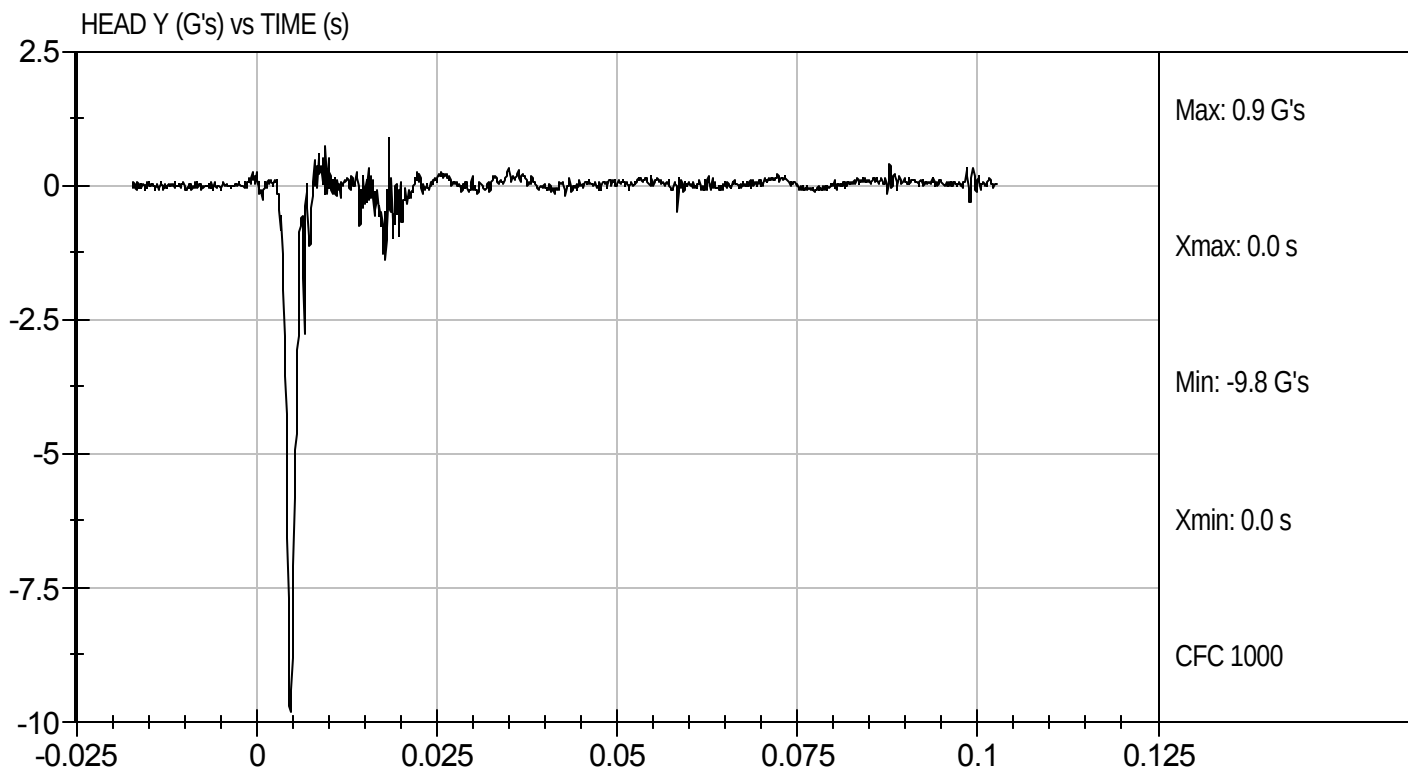
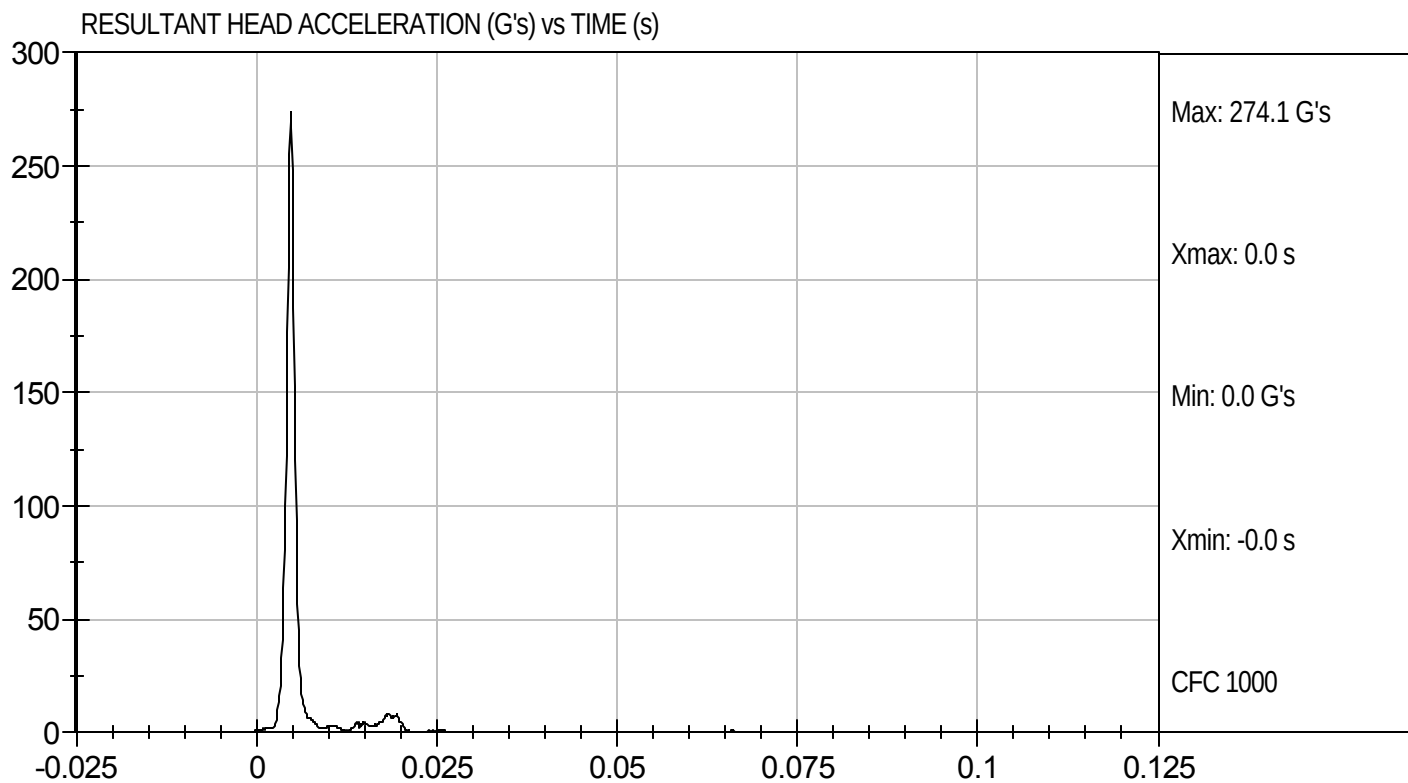
11/3/11  
Test Date

David Winkelbauer  
Approved By



Test Desc: Head Drop  
Component ID: D113691

Test Date: 11/3/11  
Velocity: 0 ft/s, 0 m/s

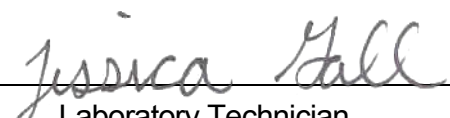


**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

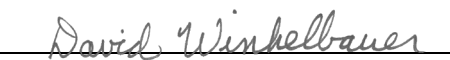
ATD Serial No: 634

Test I.D: D113692

| Tested Parameter                                    |       | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |       | deg C | 20.6 to 22.2  | 21.4   | Pass      |
| Laboratory Relative Humidity                        |       | %     | 10 to 70      | 32     | Pass      |
| Pendulum Speed                                      |       | m/s   | 6.89 to 7.13  | 6.95   | Pass      |
| Pendulum Deceleration                               | 10 ms | m/s   | 2.1 to 2.5    | 2.4    | Pass      |
|                                                     | 20 ms | m/s   | 4.0 to 5.0    | 4.5    | Pass      |
|                                                     | 30 ms | m/s   | 5.8 to 7.0    | 6.2    | Pass      |
| D Plane Rotation                                    | Max   | deg   | 77 to 91      | 81     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |       | Nm    | 69 to 83      | 70     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm           |       | ms    | 80 to 100     | 86     | Pass      |
| Overall Results                                     |       |       |               |        | Pass      |

  
 Laboratory Technician

11/3/11  
 Test Date

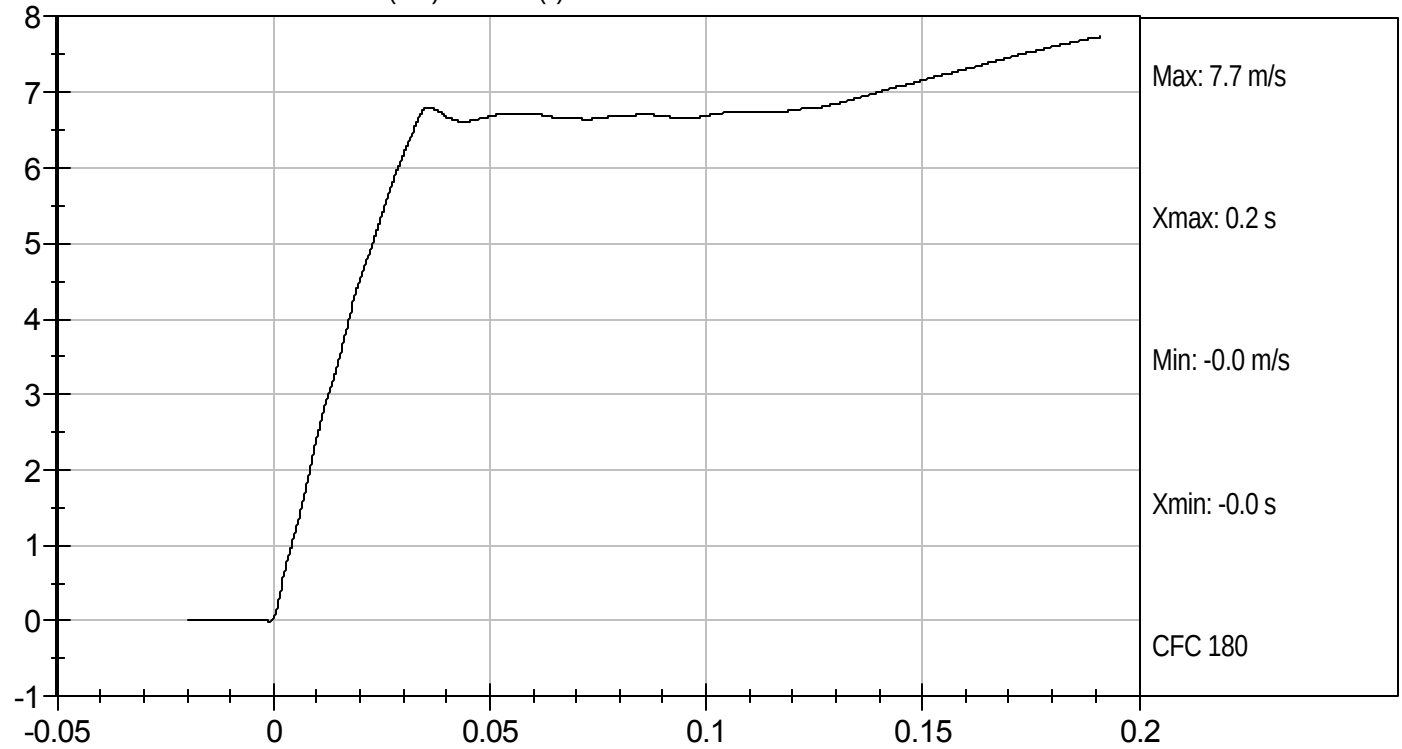
  
 Approved By



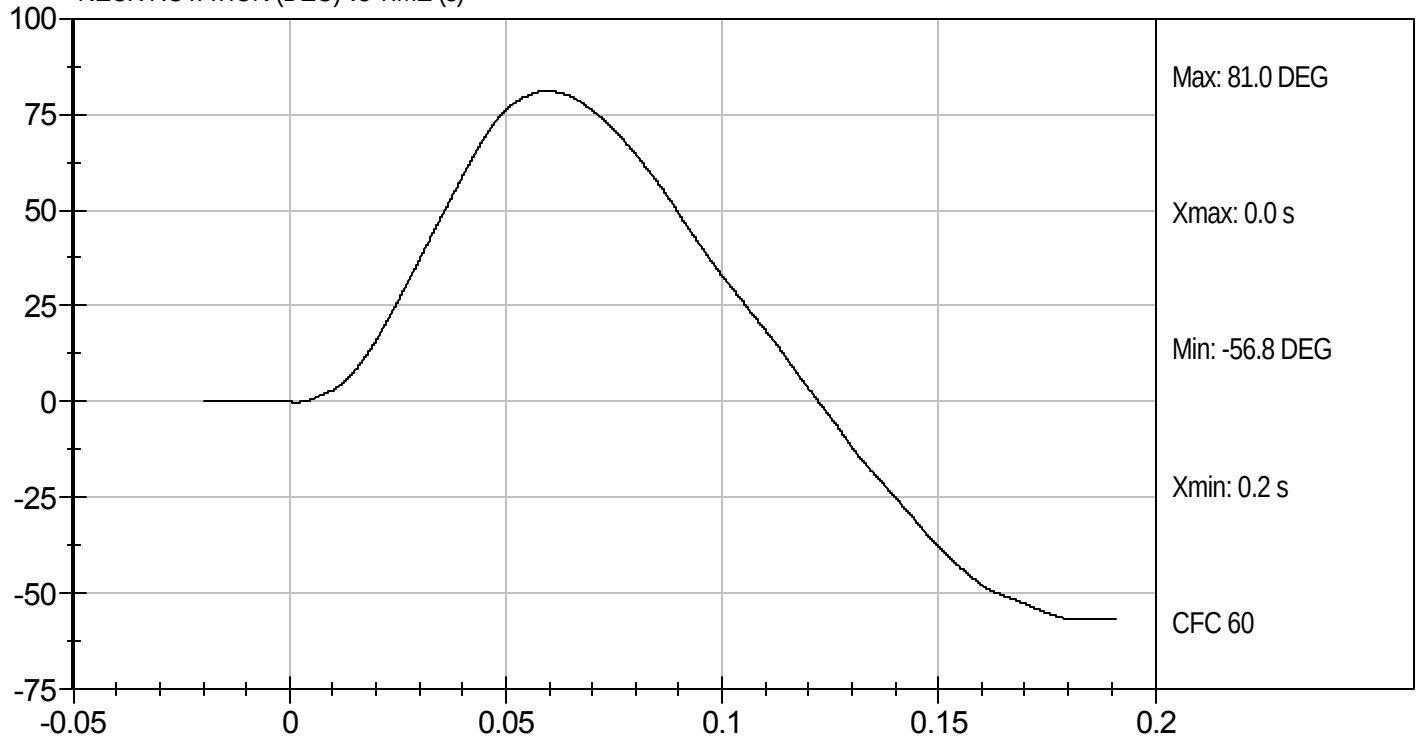
Test Desc: Neck Flexion  
Component ID: D113692

Test Date: 11/3/11  
Velocity: 22.8 ft/s, 6.95 m/s

PENDULUM DECELERATION (m/s) vs TIME (s)



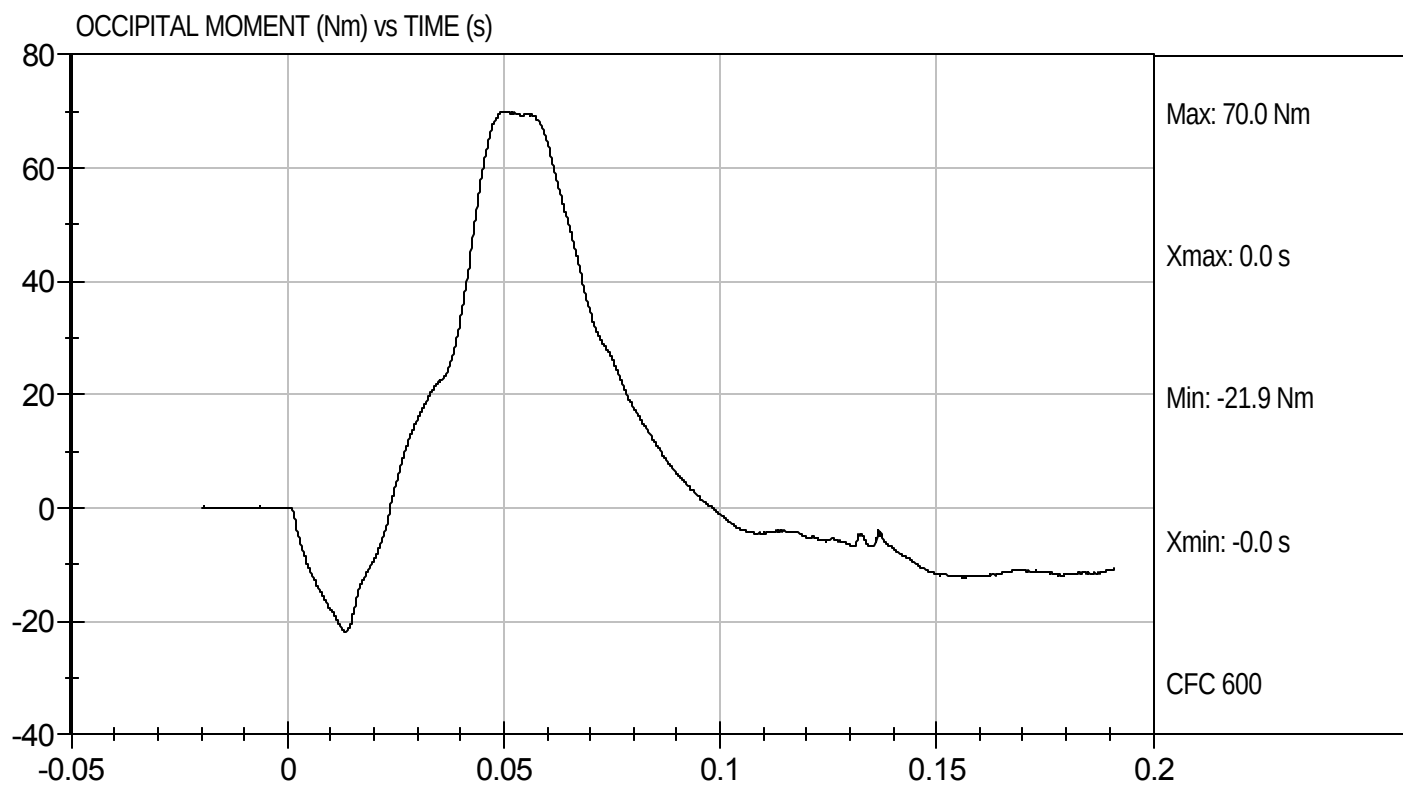
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion  
Component ID: D113692

Test Date: 11/3/11  
Velocity: 22.8 ft/s, 6.95 m/s



## MGA RESEARCH CORPORATION

## NECK EXTENSION TEST

## HYBRID III 5TH PERCENTILE

ATD Serial No: 634Test I.D: D113693

| Tested Parameter                                    |       | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |       | deg C | 20.6 to 22.2  | 21.6   | Pass      |
| Laboratory Relative Humidity                        |       | %     | 10 to 70      | 33     | Pass      |
| Pendulum Speed                                      |       | m/s   | 5.95 to 6.19  | 6.12   | Pass      |
| Pendulum Deceleration                               | 10 ms | m/s   | 1.5 to 1.9    | 1.8    | Pass      |
|                                                     | 20 ms | m/s   | 3.1 to 3.9    | 3.5    | Pass      |
|                                                     | 30 ms | m/s   | 4.6 to 5.6    | 5.0    | Pass      |
| D Plane Rotation                                    | Max   | deg   | 99 to 114     | 109    | Pass      |
| Occipital Condyle Moment within Deflection Corridor |       | Nm    | -65 to -53    | -56    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm          |       | ms    | 94 to 114     | 103    | Pass      |
| Overall Results                                     |       |       |               |        | Pass      |

Jessica Hall  
Laboratory Technician

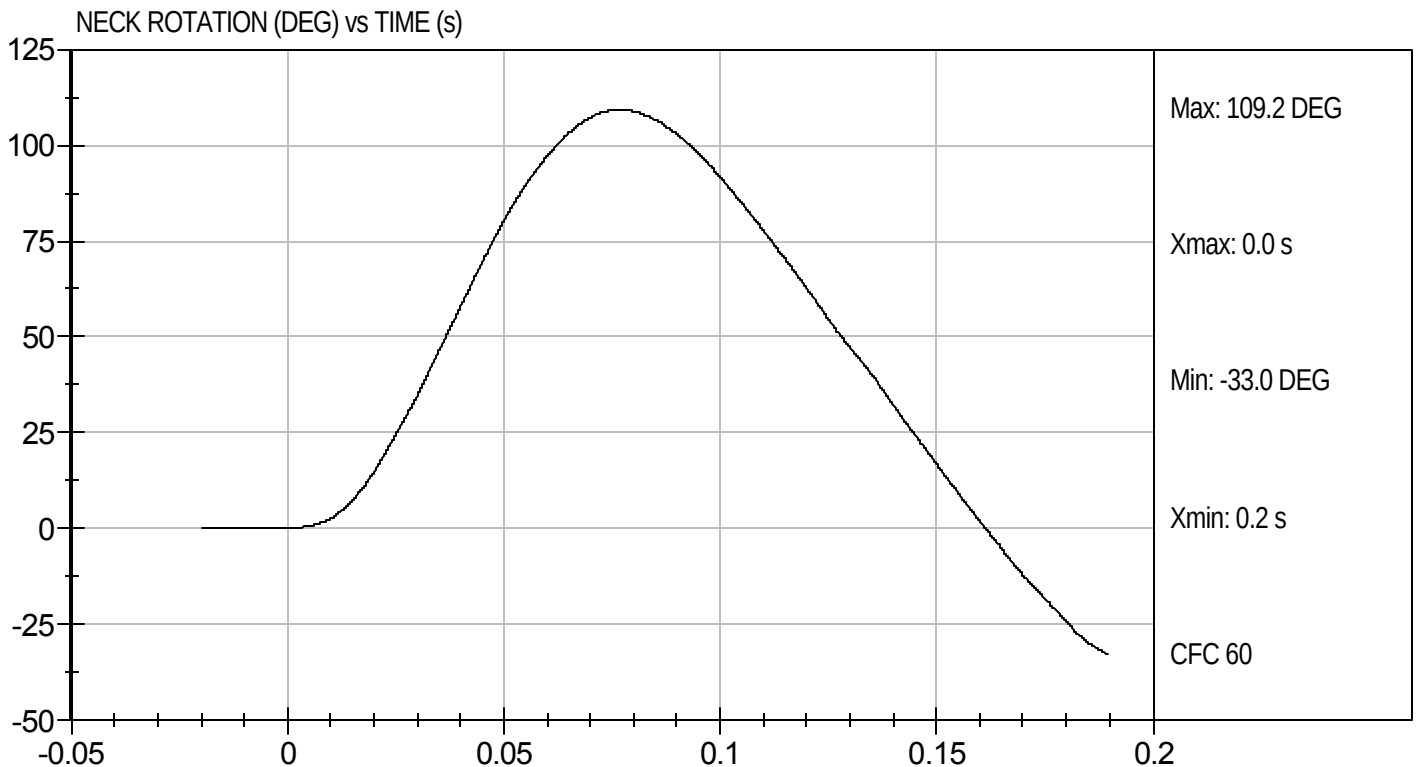
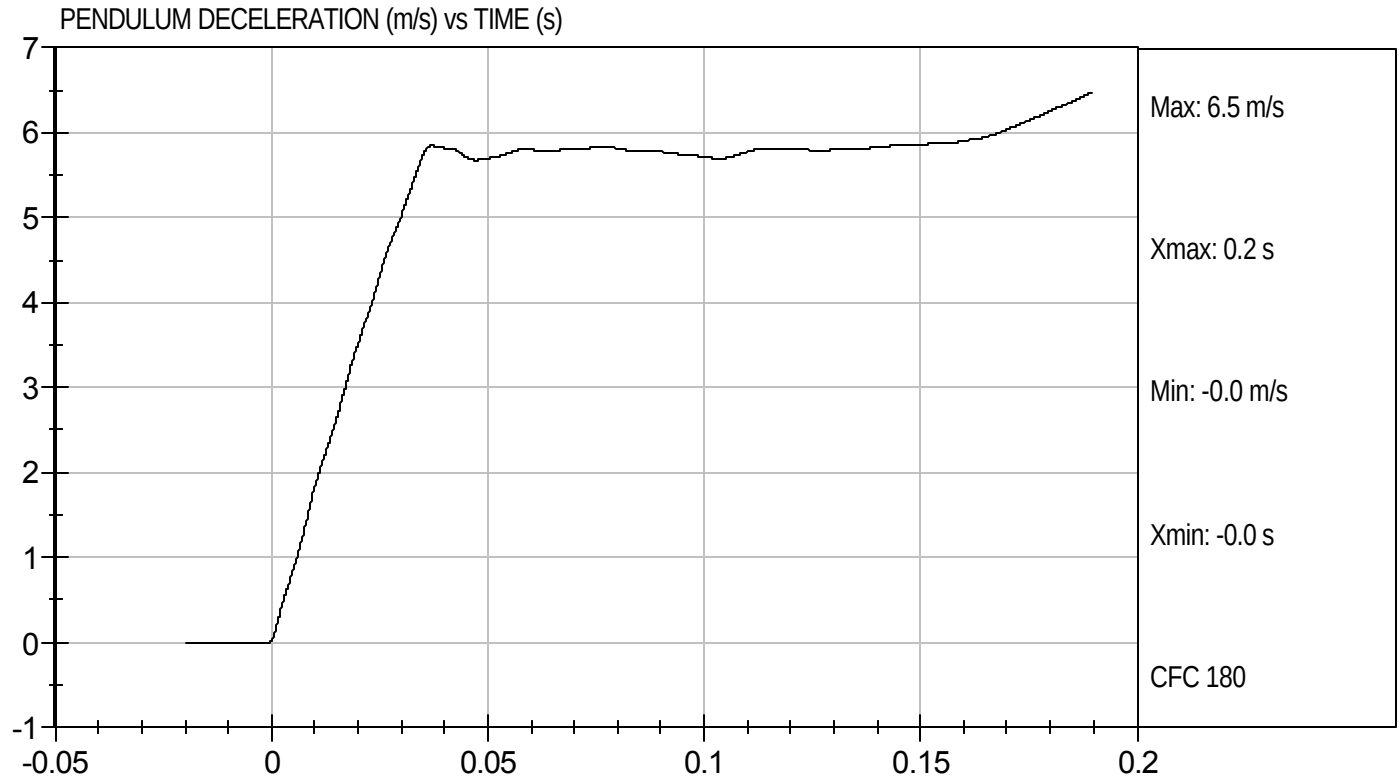
11/3/11  
Test Date

David Winkelbauer  
Approved By



Test Desc: Neck Extension  
Component ID: D113693

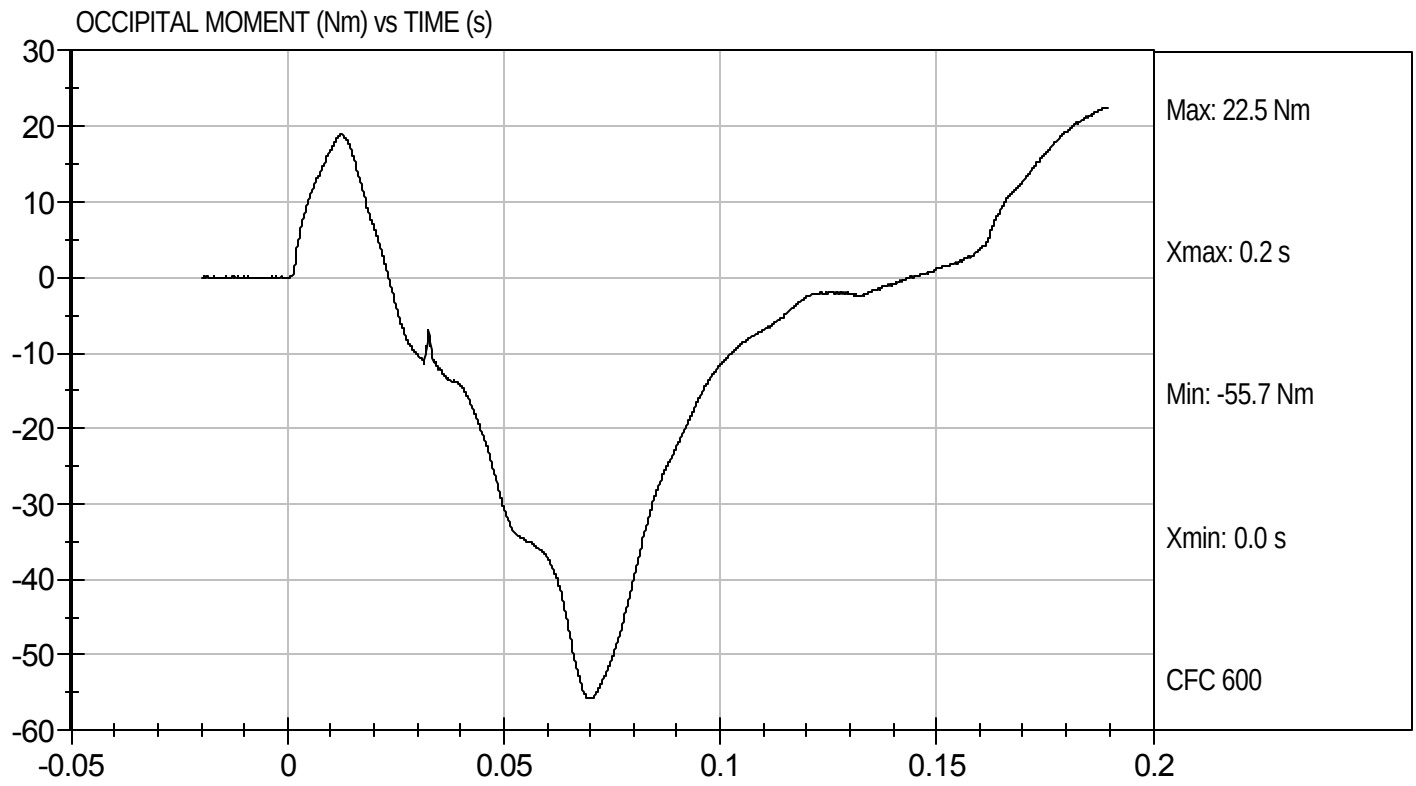
Test Date: 11/3/11  
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension  
Component ID: D113693

Test Date: 11/3/11  
Velocity: 20.08 ft/s, 6.12 m/s



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

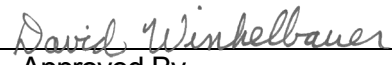
**ATD Serial No:** 634

**Test I.D:** D113694

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.5   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 30     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.68   | Pass      |
| Peak Deflection                               | mm    | 50 to 58      | 55     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | kN    | 3.9 to 4.4    | 4.13   | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 69     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | <= 4,600 N    | 4051   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

  
Laboratory Technician

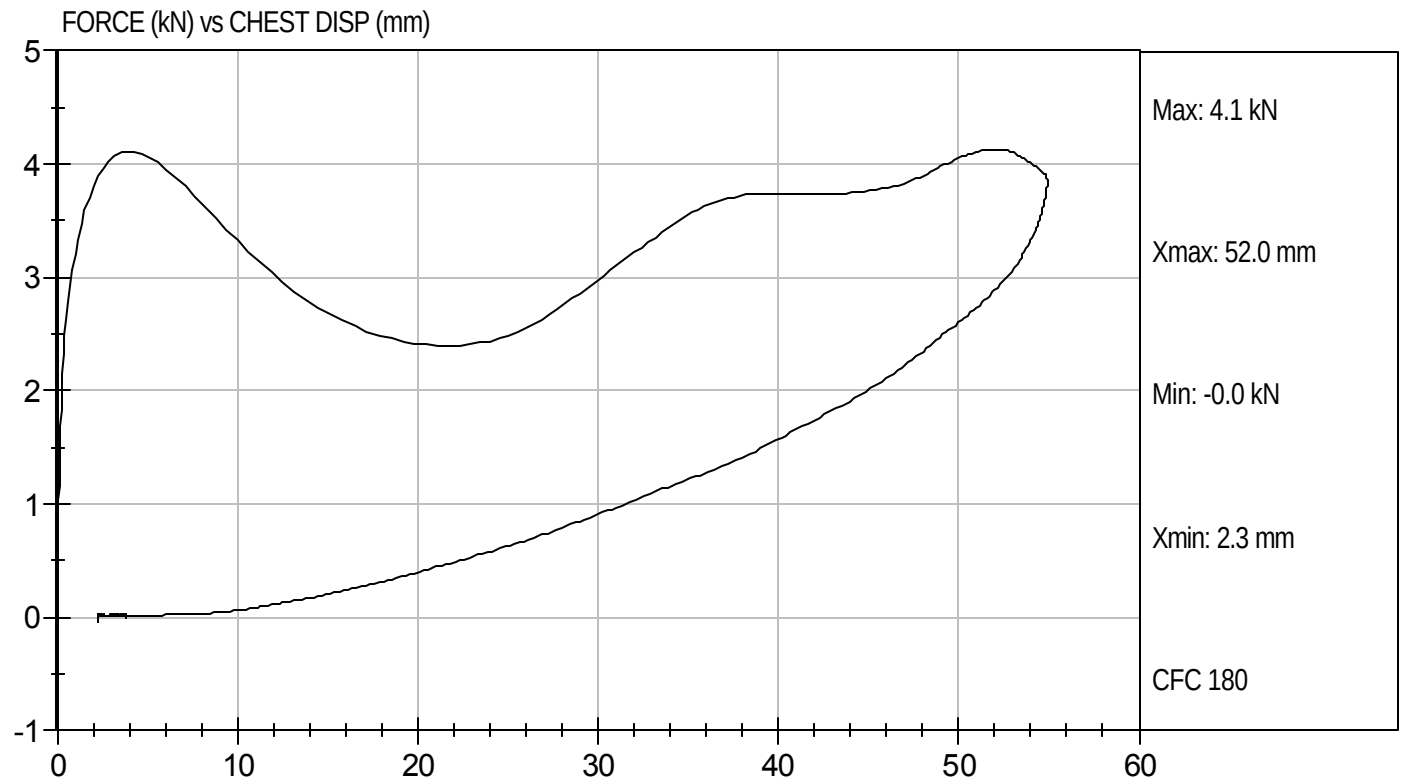
11/4/11  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Component ID: D113694

Test Date: 11/4/11  
Velocity: 21.9 ft/s, 6.68 m/s



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

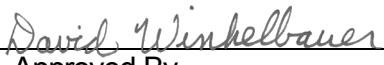
**ATD Serial No:** 634

**Test I.D:** D113695

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 21.6   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 33     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.88   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

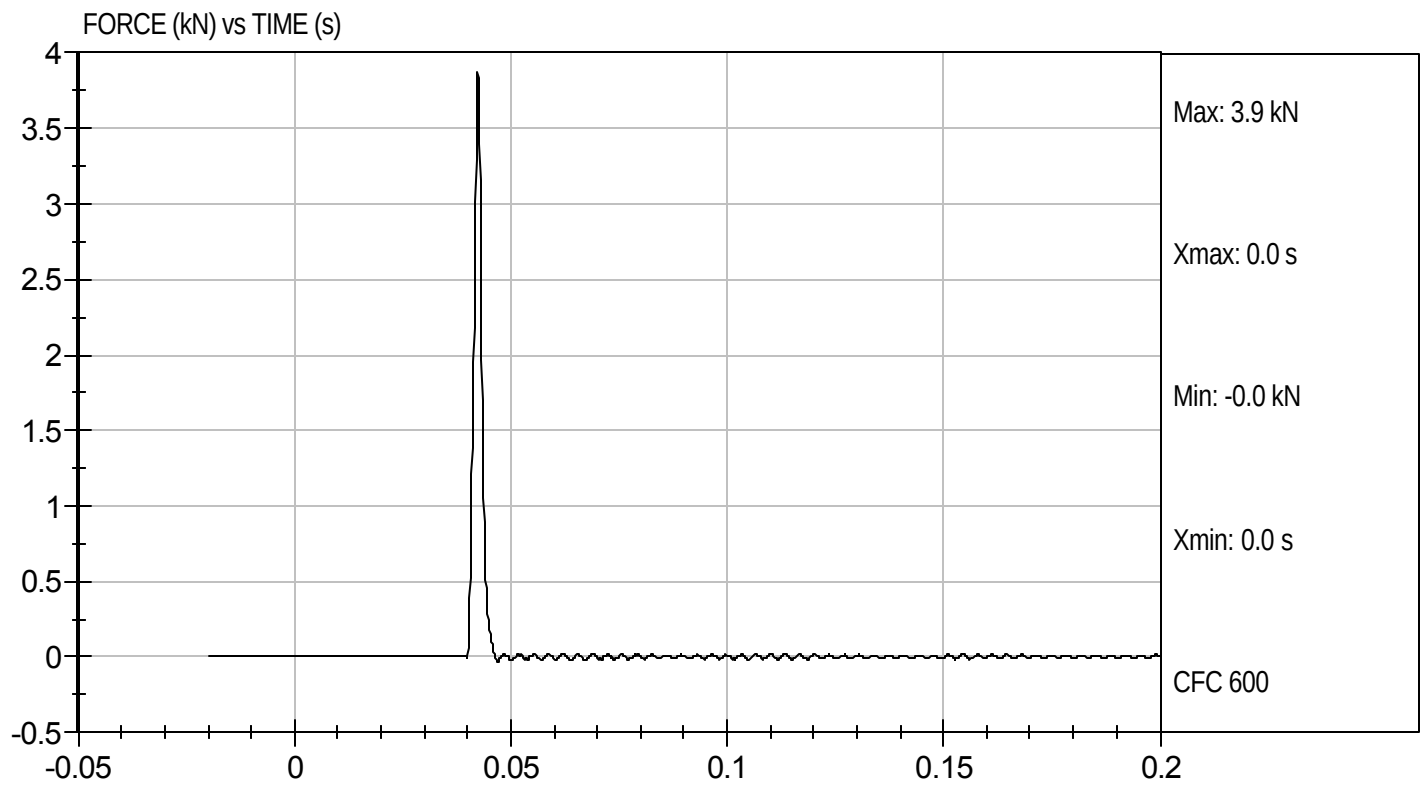
11/3/11  
Test Date

  
Approved By



Test Desc: Right Knee  
Component ID: D113695

Test Date: 11/3/11  
Velocity: 6.97 ft/s, 2.12 m/s



**MGA RESEARCH CORPORATION**

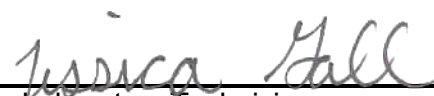
**LEFT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 634

**Test I.D:** D113696

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 21.6   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 33     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.87   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

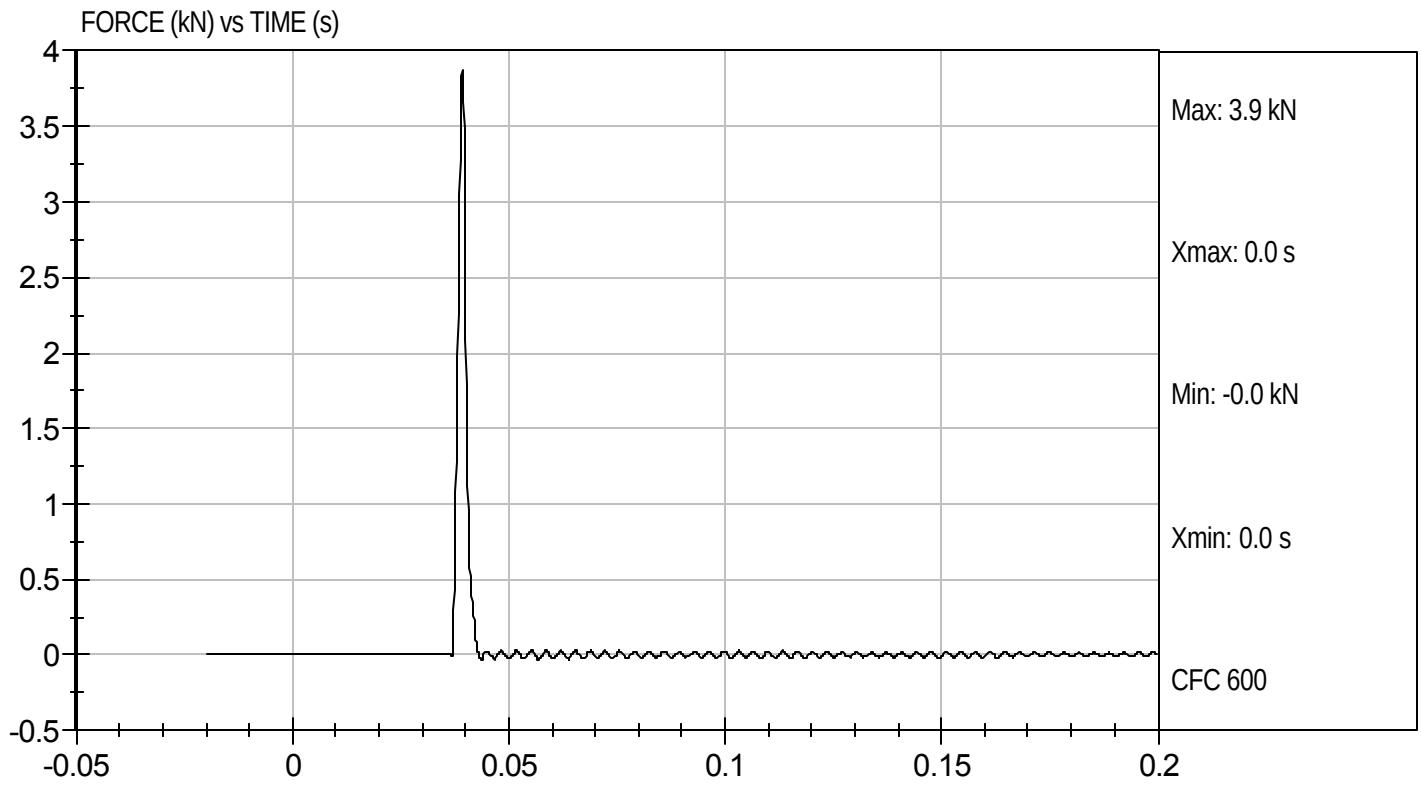
11/3/11  
Test Date

  
Approved By



Test Desc: Left Knee  
Component ID: D113696

Test Date: 11/3/11  
Velocity: 6.97 ft/s, 2.12 m/s



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

**ATD Serial No:** 634

**Test I.D:** D113697

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.6  | 21.1   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 33     | Pass      |
| Initial Angle                | deg     | 0 to 20       | 17     | Pass      |
| Return Angle                 | deg     | +/- 8         | 7      | Pass      |
| Force at 45 deg              | N       | 320 to 390    | 364    | Pass      |
| Upper Torso Deflection Rate  | Deg/sec | 0.5 to 1.5    | 1.0    | Pass      |
| Overall Result               |         |               |        | Pass      |

  
Laboratory Technician

11/4/11  
Test Date

  
Approved By

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

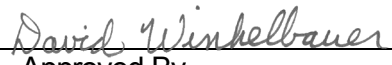
**ATD Serial No:** 634

**Test ID:** D113761

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.1   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 29     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 270    | Pass      |
| Peak Lateral Acceleration    | G's   | +/- 15             | -11.5  | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

  
Laboratory Technician

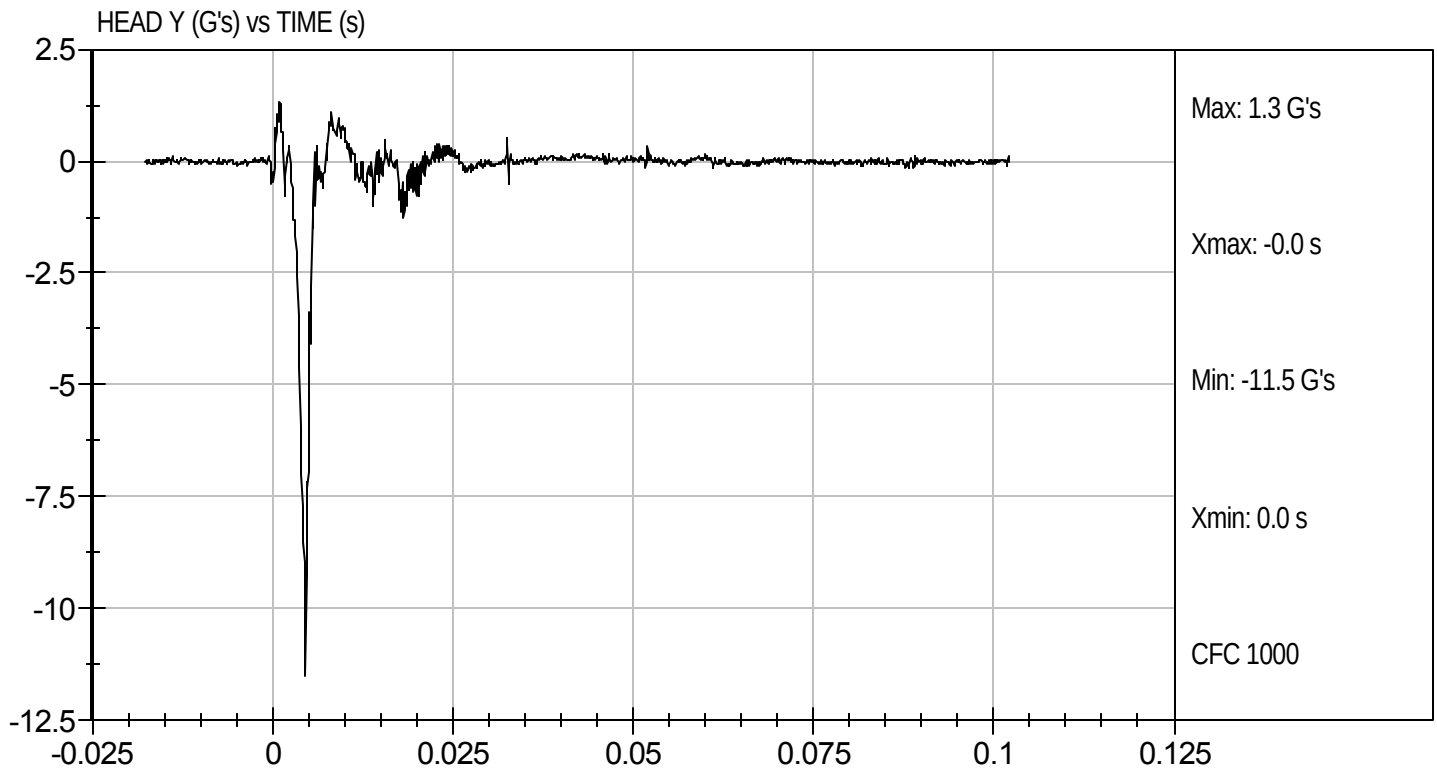
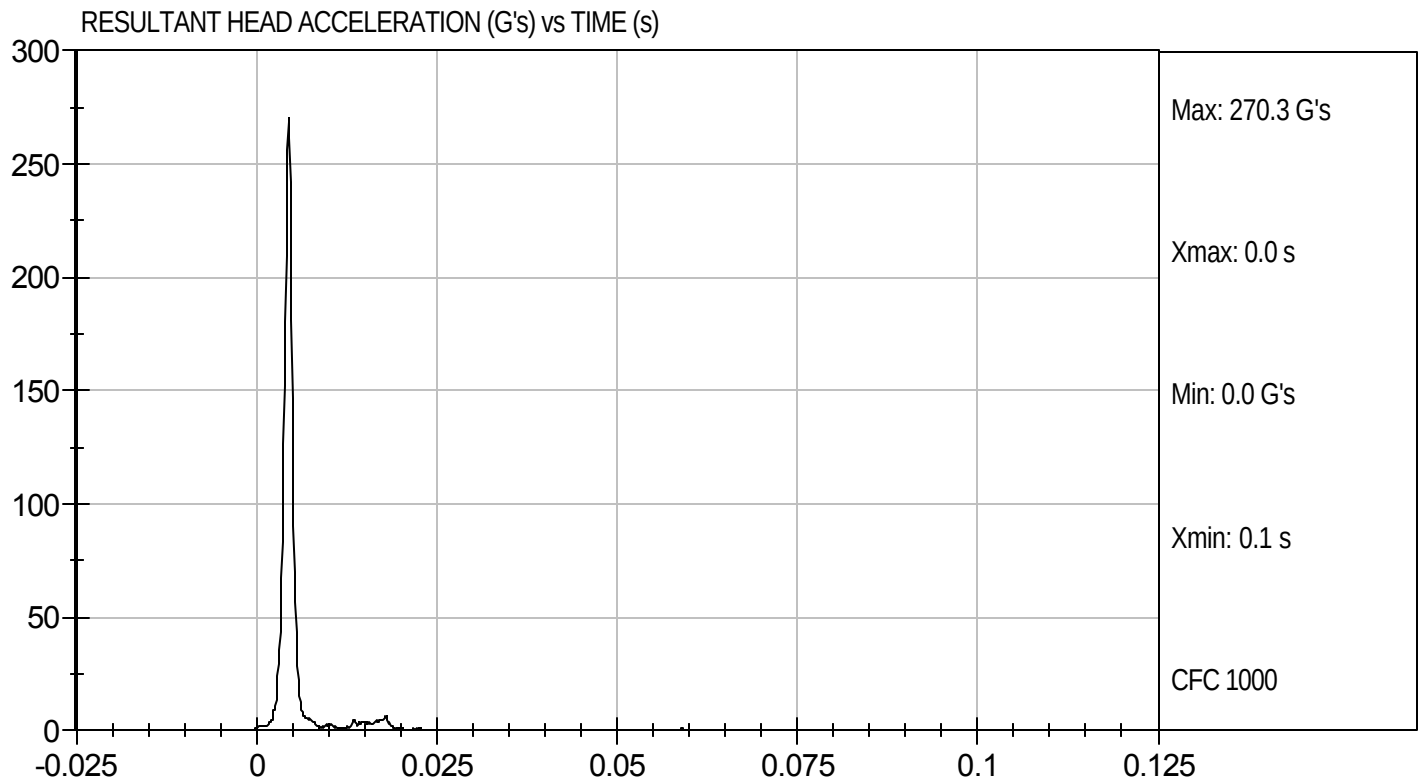
11/10/11  
Test Date

  
Approved By



Test Desc: Head Drop  
Component ID: D113761

Test Date: 11/10/11  
Velocity: 0 ft/s, 0.00 m/s

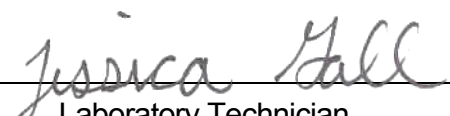


**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

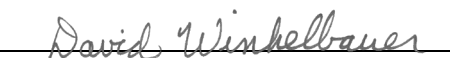
ATD Serial No: 634

Test I.D: D113762

| Tested Parameter                                    |       | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |       | deg C | 20.6 to 22.2  | 21.6   | Pass      |
| Laboratory Relative Humidity                        |       | %     | 10 to 70      | 30     | Pass      |
| Pendulum Speed                                      |       | m/s   | 6.89 to 7.13  | 7.06   | Pass      |
| Pendulum Deceleration                               | 10 ms | m/s   | 2.1 to 2.5    | 2.5    | Pass      |
|                                                     | 20 ms | m/s   | 4.0 to 5.0    | 4.5    | Pass      |
|                                                     | 30 ms | m/s   | 5.8 to 7.0    | 6.2    | Pass      |
| D Plane Rotation                                    | Max   | deg   | 77 to 91      | 78     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |       | Nm    | 69 to 83      | 71     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm           |       | ms    | 80 to 100     | 85     | Pass      |
| Overall Results                                     |       |       |               |        | Pass      |

  
 Laboratory Technician

11/10/11  
 Test Date

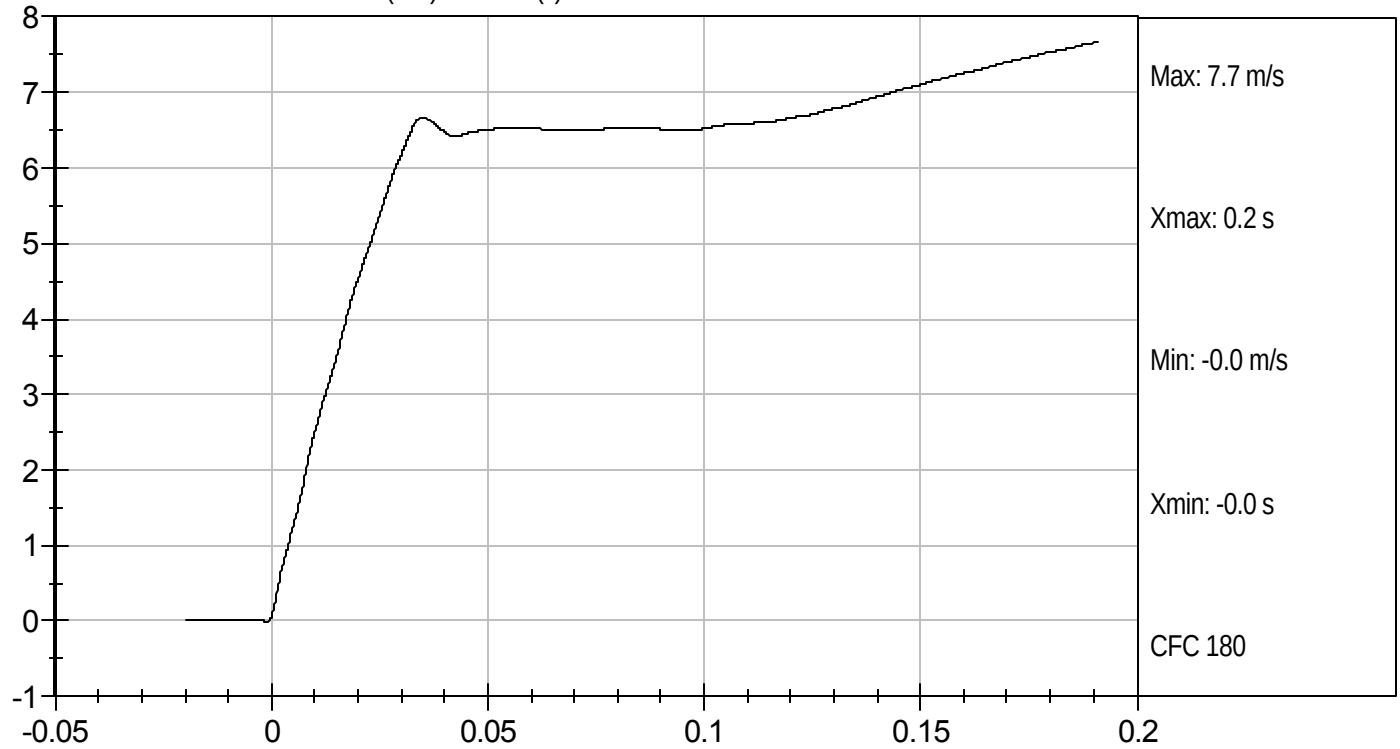
  
 Approved By



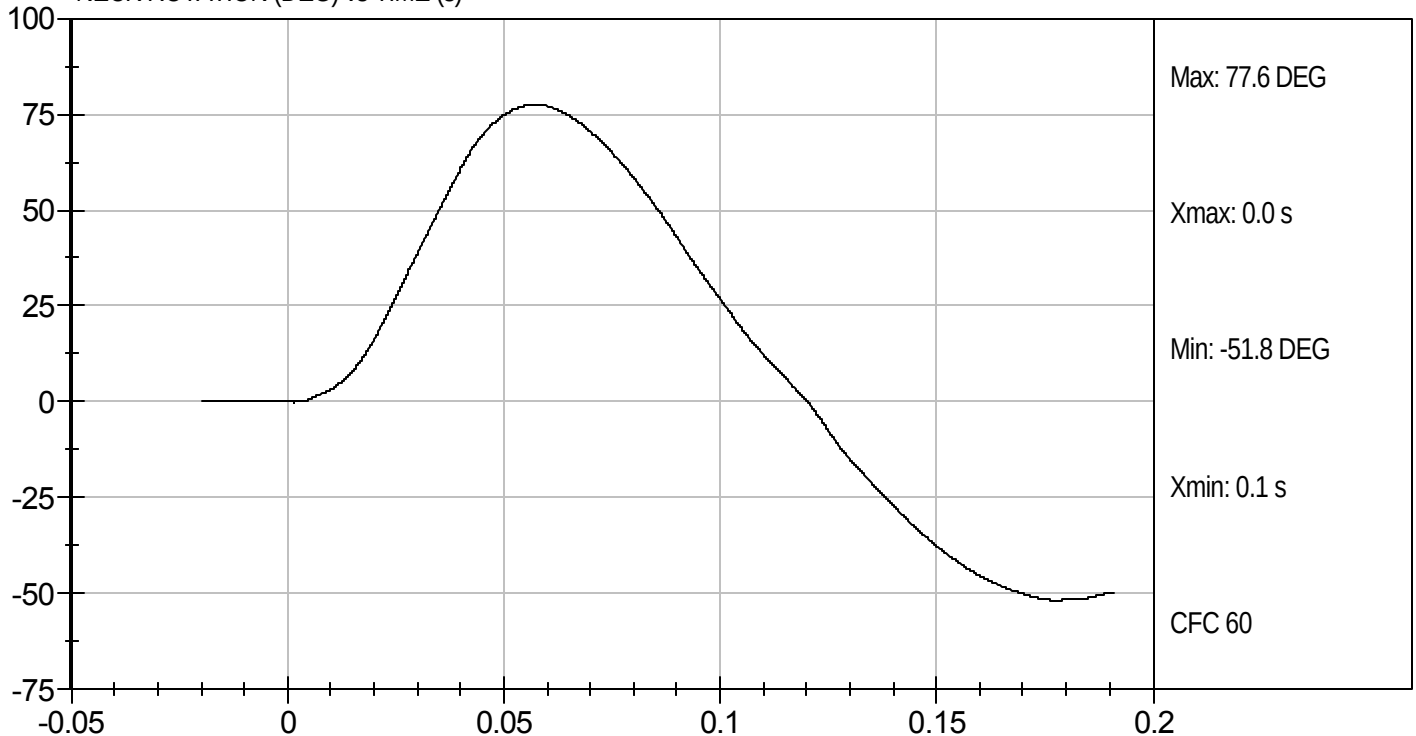
Test Desc: Neck Flexion  
Component ID: D113762

Test Date: 11/10/11  
Velocity: 23.15 ft/s, 7.06 m/s

PENDULUM DECELERATION (m/s) vs TIME (s)



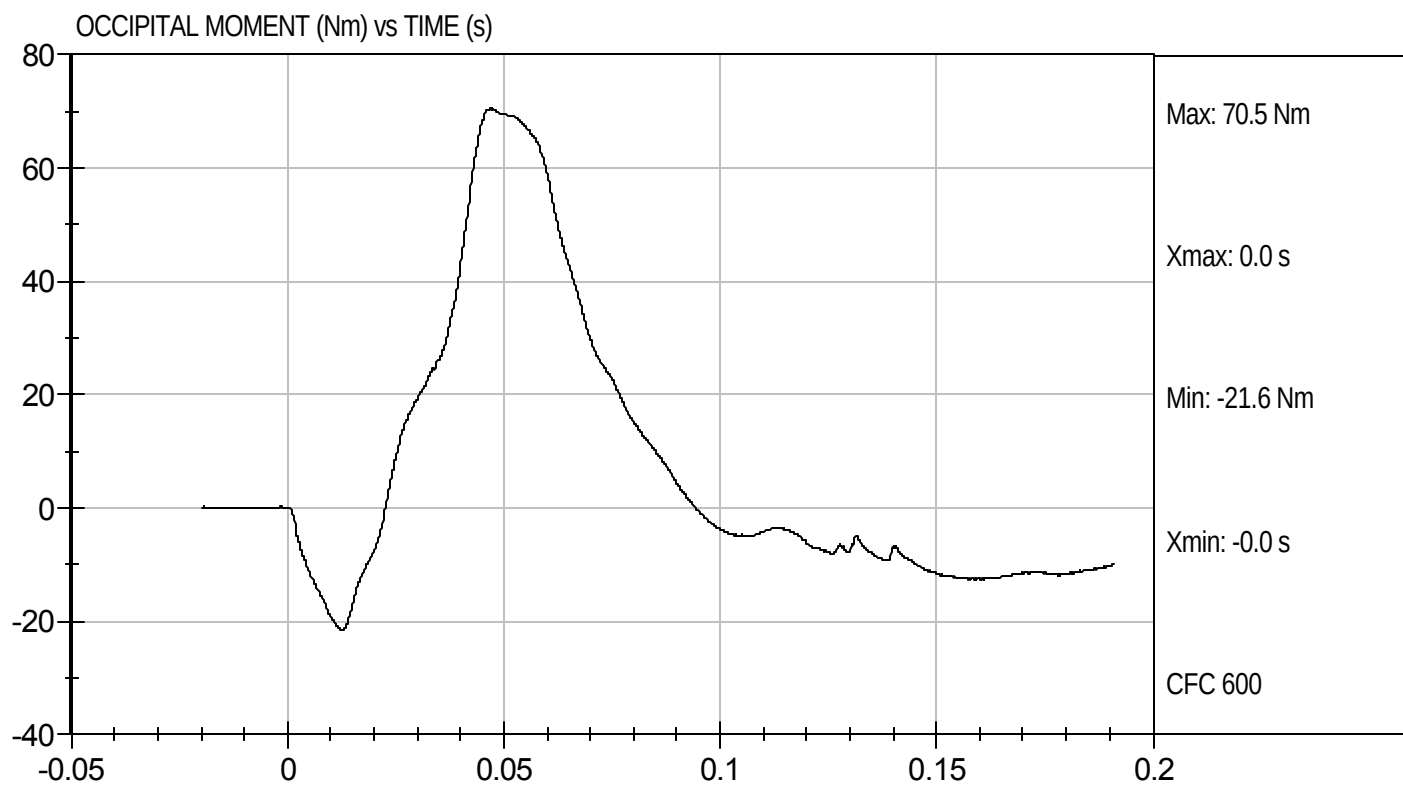
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion  
Component ID: D113762

Test Date: 11/10/11  
Velocity: 23.15 ft/s, 7.06 m/s

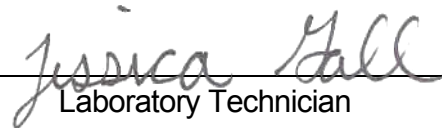


**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**

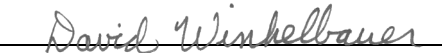
ATD Serial No: 634

Test I.D: D113763

| Tested Parameter                                    |       | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |       | deg C | 20.6 to 22.2  | 21.6   | Pass      |
| Laboratory Relative Humidity                        |       | %     | 10 to 70      | 30     | Pass      |
| Pendulum Speed                                      |       | m/s   | 5.95 to 6.19  | 6.12   | Pass      |
| Pendulum Deceleration                               | 10 ms | m/s   | 1.5 to 1.9    | 1.9    | Pass      |
|                                                     | 20 ms | m/s   | 3.1 to 3.9    | 3.6    | Pass      |
|                                                     | 30 ms | m/s   | 4.6 to 5.6    | 5.0    | Pass      |
| D Plane Rotation                                    | Max   | deg   | 99 to 114     | 104    | Pass      |
| Occipital Condyle Moment within Deflection Corridor |       | Nm    | -65 to -53    | -53    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm          |       | ms    | 94 to 114     | 101    | Pass      |
| Overall Results                                     |       |       |               |        | Pass      |

  
 Laboratory Technician

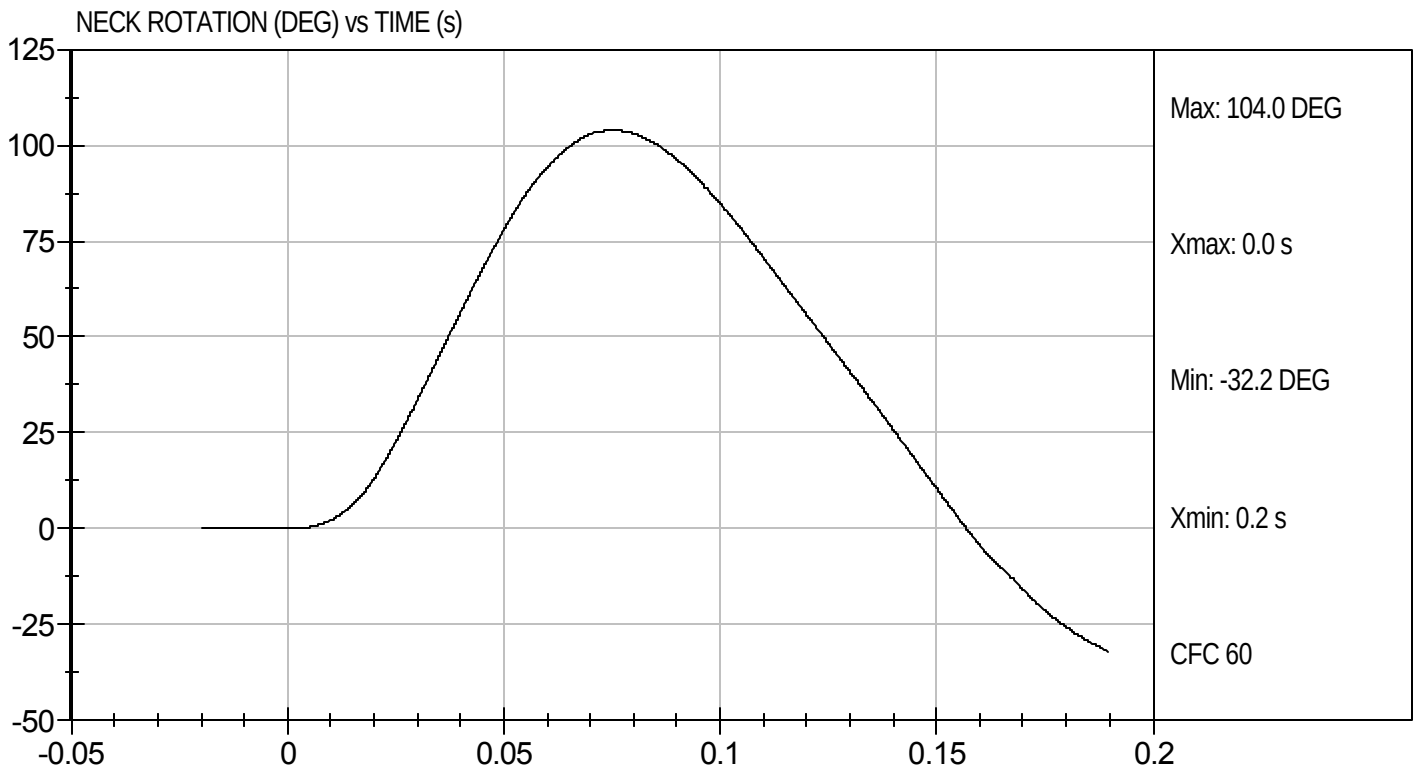
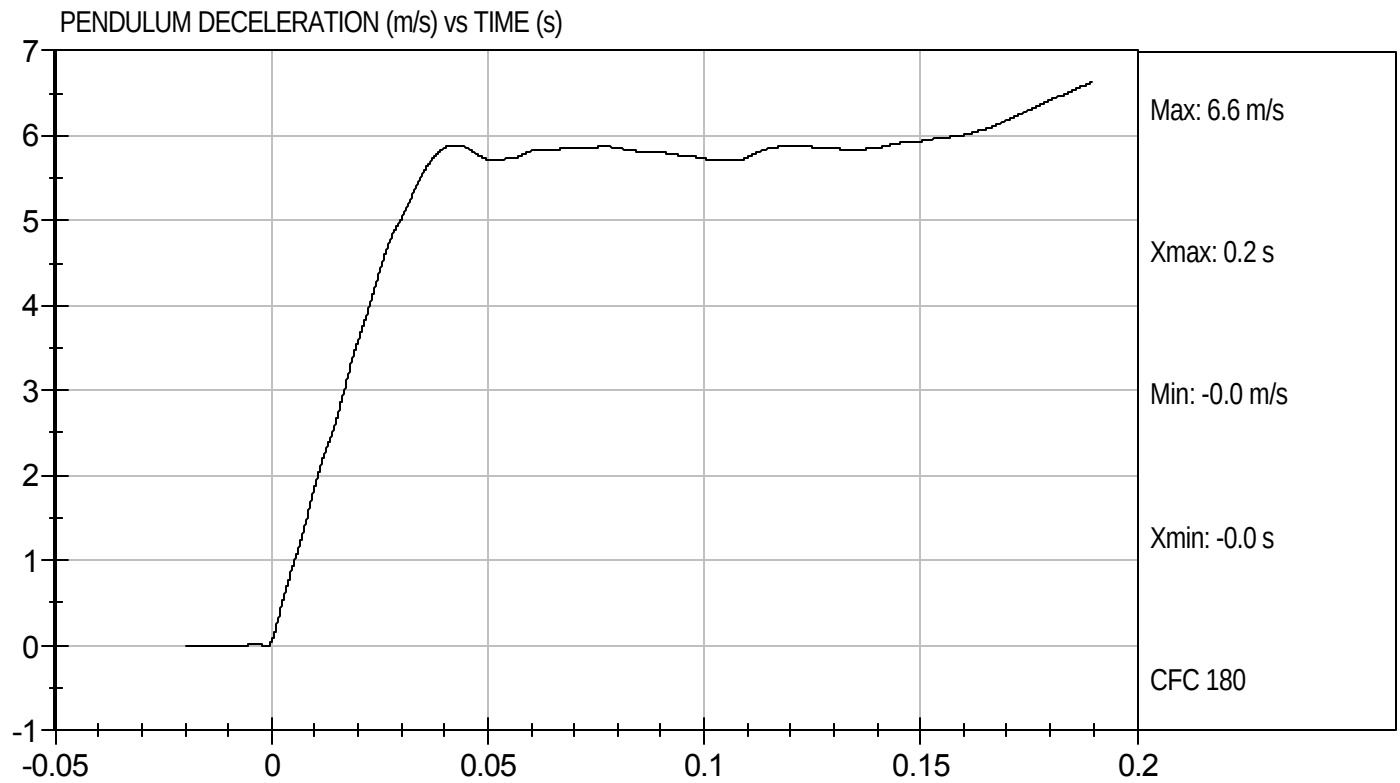
11/10/11  
 Test Date

  
 Approved By



Test Desc: Neck Extension  
Component ID: D113763

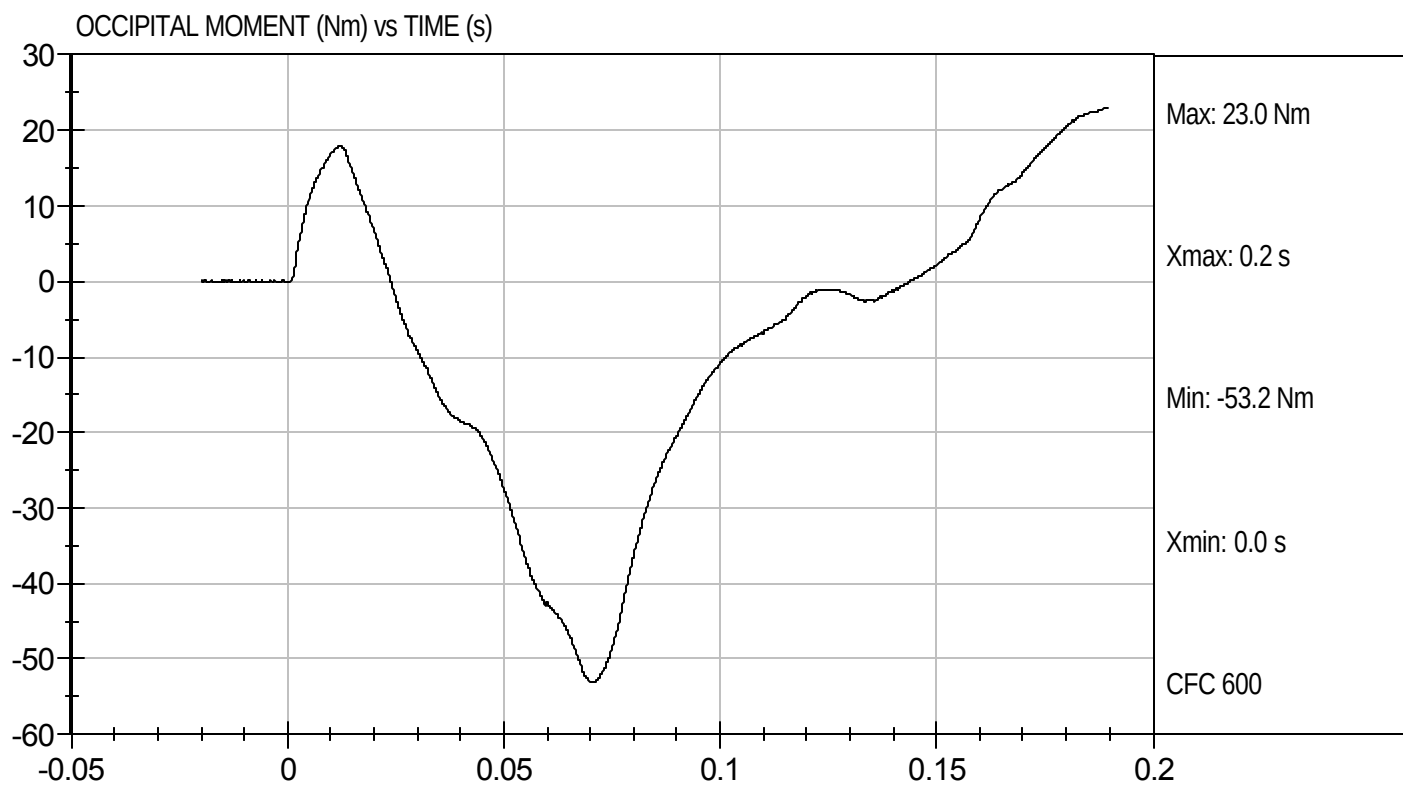
Test Date: 11/10/11  
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension  
Component ID: D113763

Test Date: 11/10/11  
Velocity: 20.08 ft/s, 6.12 m/s



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

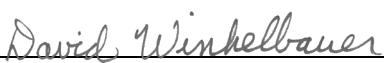
**ATD Serial No:** 634

**Test I.D:** D113764

| Tested Parameter                              | Units | Specification | Result               | Pass/Fail |
|-----------------------------------------------|-------|---------------|----------------------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.8                 | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 29                   | 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    | 4.0                  | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 70                   | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | <= 4,600 N    | 4140                 | Pass      |
|                                               |       |               | Overall Test Results | Pass      |

  
Laboratory Technician

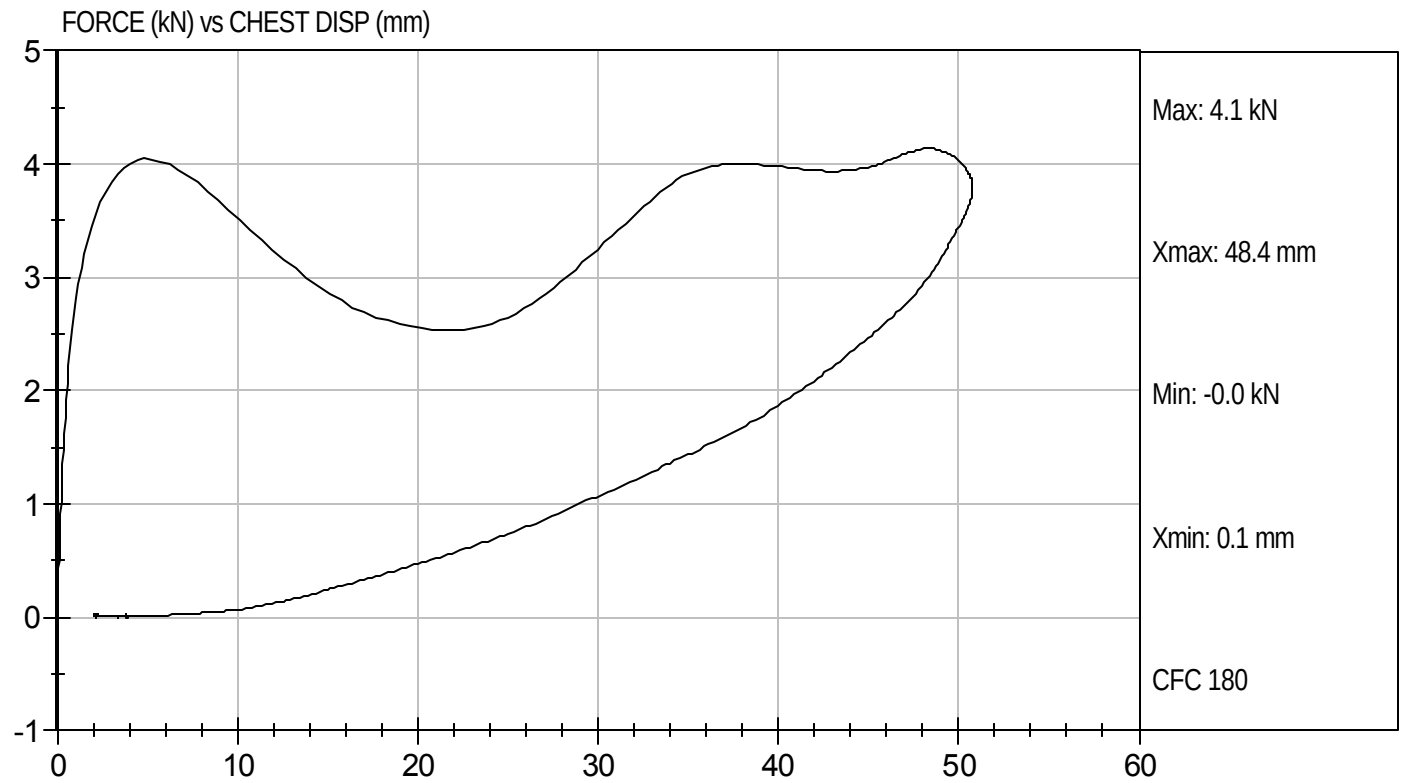
11/10/11  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Component ID: D113764

Test Date: 11/10/11  
Velocity: 22.22 ft/s, 6.77 m/s



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

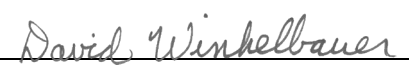
**ATD Serial No:** 634

**Test I.D:** D113765

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 21.1   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 28     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.09   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.80   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

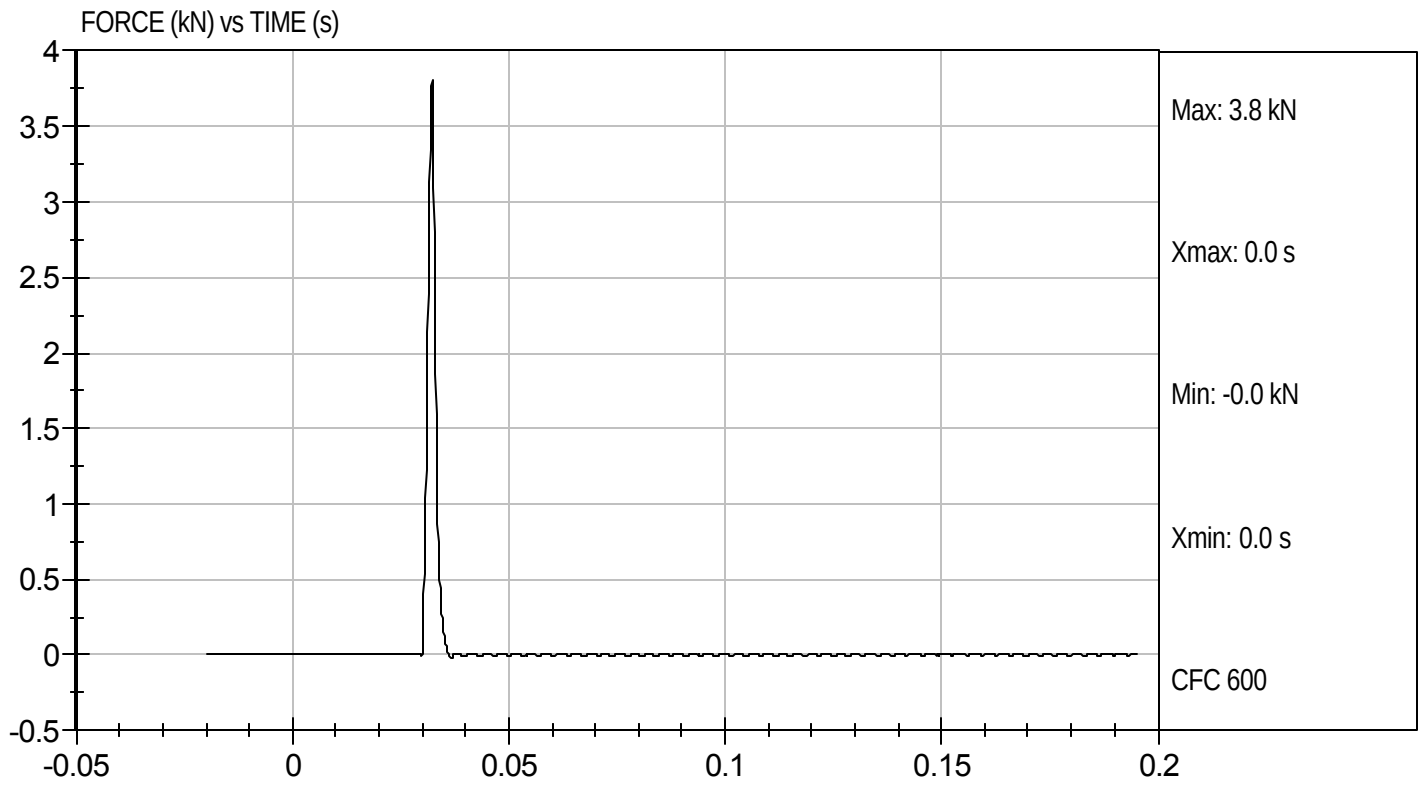
11/10/11  
Test Date

  
Approved By



Test Desc: Right Knee  
Component ID: D113765

Test Date: 11/10/11  
Velocity: 6.86 ft/s, 2.09 m/s



**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

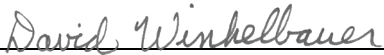
**ATD Serial No:** 634

**Test I.D:** D113766

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 21.2   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 28     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.08   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.55   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

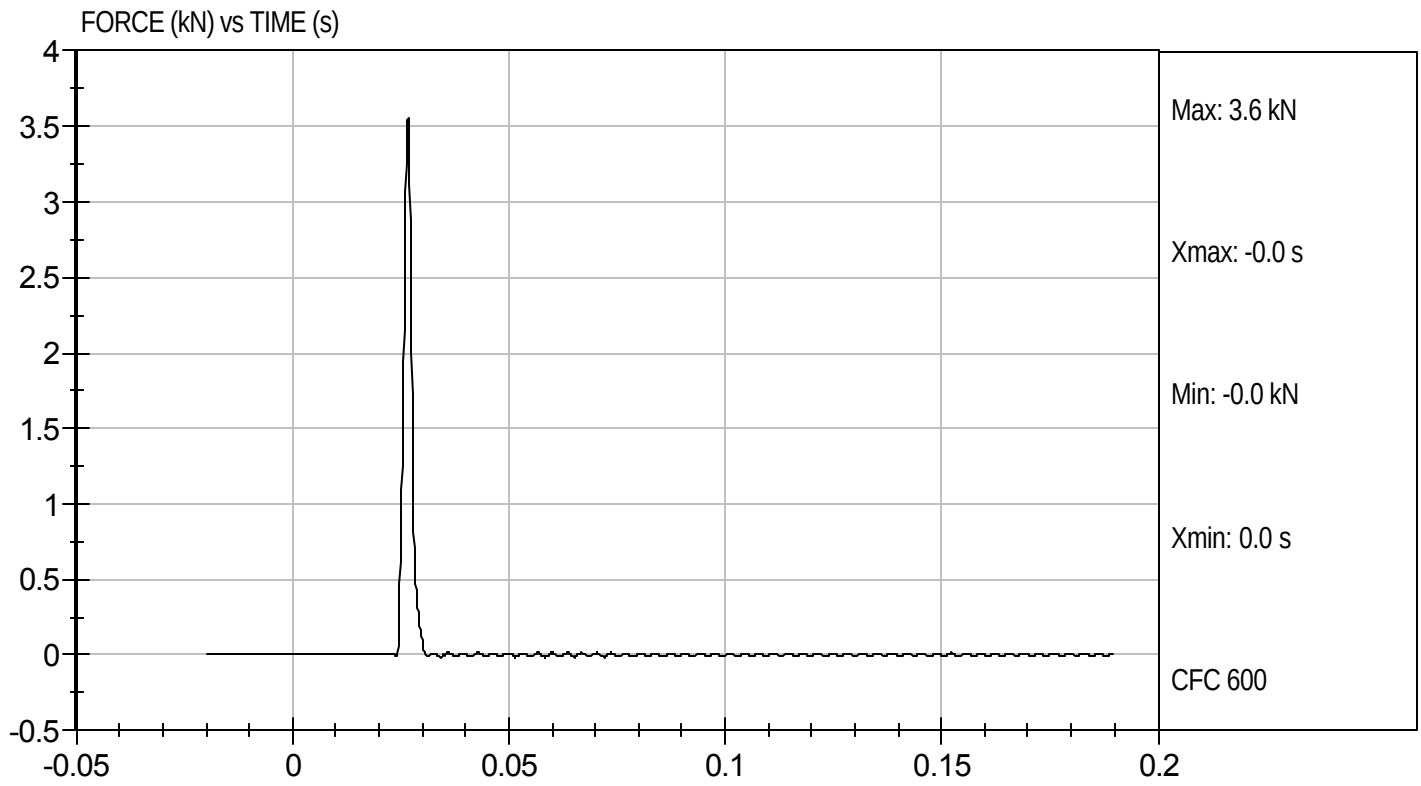
11/10/11  
Test Date

  
Approved By



Test Desc: Left Knee  
Component ID: D113766

Test Date: 11/10/11  
Velocity: 6.83 ft/s, 2.08 m/s



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

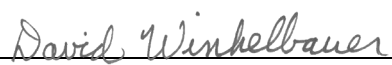
**ATD Serial No:** 634

**Test I.D:** D113767

| 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      | 29     | Pass      |
| Initial Angle                | deg     | 0 to 20       | 17     | Pass      |
| Return Angle                 | deg     | +/- 8         | 7      | Pass      |
| Force at 45 deg              | N       | 320 to 390    | 368    | Pass      |
| Upper Torso Deflection Rate  | Deg/sec | 0.5 to 1.5    | 1.0    | Pass      |
| Overall Result               |         |               |        | Pass      |

  
Laboratory Technician

11/10/11  
Test Date

  
Approved By