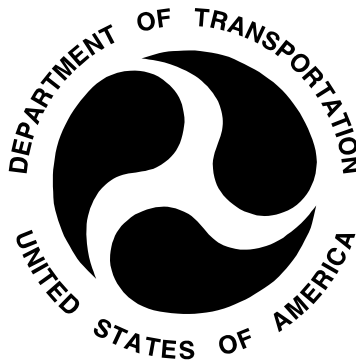


**REPORT NO. 208-MGA-2006-DC006**

**DUMMY PERFORMANCE CALIBRATIONS**  
**FMVSS 208**

**General Motors Corporation  
2006 Buick Lucerne Passenger Car  
NHTSA No.: C60105**

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



**Test Date: May 12, 2006 - July 25, 2006**

**Report Date: December 13, 2006**

**FINAL REPORT**

**PREPARED FOR:  
U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
OFFICE OF ENFORCEMENT  
OFFICE OF VEHICLE SAFETY COMPLIANCE  
MAIL CODE: NVS-220  
400 SEVENTH STREET, S.W., ROOM 6115  
WASHINGTON, D.C. 20590**

## TABLE OF CONTENTS

|            |     |                               | <u>Page No.</u> |
|------------|-----|-------------------------------|-----------------|
| DUMMY S/N: | 401 | PRE-TEST CERTIFICATION DATA   | 1-1             |
|            |     | PASSED ALL CALIBRATION CHECKS |                 |
| DUMMY S/N: | 401 | POST-TEST CERTIFICATION DATA  | 2-1             |
|            |     | PASSED ALL CALIBRATION CHECKS |                 |
| DUMMY S/N: | 403 | PRE-TEST CERTIFICATION DATA   | 3-1             |
|            |     | PASSED ALL CALIBRATION CHECKS |                 |
| DUMMY S/N: | 403 | POST-TEST CERTIFICATION DATA  | 4-1             |
|            |     | PASSED ALL CALIBRATION CHECKS |                 |
| DUMMY S/N: | 505 | PRE-TEST CERTIFICATION DATA   | 5-1             |
|            |     | PASSED ALL CALIBRATION CHECKS |                 |
| DUMMY S/N: | 505 | POST-TEST CERTIFICATION DATA  | 6-1             |
|            |     | PASSED ALL CALIBRATION CHECKS |                 |
| DUMMY S/N: | 511 | PRE-TEST CERTIFICATION DATA   | 7-1             |
|            |     | PASSED ALL CALIBRATION CHECKS |                 |
| DUMMY S/N: | 511 | POST-TEST CERTIFICATION DATA  | 8-1             |
|            |     | PASSED ALL CALIBRATION CHECKS |                 |

| HYBRID III 50 <sup>th</sup> SN #401, PART 572, SUBPART E EXTERNAL DIMENSIONS |                                   |                                                                                                                                                    |                                   |                       |
|------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------|
| DIMENSION                                                                    | DESCRIPTION                       | DETAILS                                                                                                                                            | ASSEMBLY<br>DIMENSION<br>(inches) | ACTUAL<br>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                         | 20.2                  |
| C                                                                            | H-POINT HEIGHT                    | Reference                                                                                                                                          | 3.3-3.5                           | 3.5                   |
| D                                                                            | H-POINT LOCATION FROM<br>BACKLINE | Reference                                                                                                                                          | 5.3-5.5                           | 5.4                   |
| E                                                                            | SHOULDER PIVOT FROM<br>BACKLINE   | Center of the shoulder clevis to the rear vertical surface of<br>the fixture.                                                                      | 3.3-3.7                           | 3.6                   |
| F                                                                            | THIGH CLEARANCE                   | Measured at the highest point on the upper femur<br>segment.                                                                                       | 5.5-6.1                           | 6.0                   |
| G                                                                            | BACK OF ELBOW TO<br>WRIST PIVOT   | Back of the elbow flesh to the wrist pivot in line with the<br>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<br>(Reference)                                                                                | 1.6-1.8                           | 1.8                   |
| I                                                                            | SHOULDER TO - ELBOW<br>LENGTH     | Measure from the highest point on top of the shoulder<br>clevis to the lowest part of the flesh on the elbow in line<br>with the elbow pivot bolt. | 13.0-13.6                         | 13.5                  |
| J                                                                            | ELBOW REST HEIGHT                 | Measure from the flesh below the elbow pivot bolt to the<br>seat surface.                                                                          | 7.5-8.3                           | 7.8                   |
| K                                                                            | BUTTOCK TO KNEE<br>LENGTH         | The forward most part of the knee flesh to the rear vertical<br>surface of the fixture.                                                            | 22.8-23.8                         | 23.1                  |
| L                                                                            | POPLITEAL HEIGHT                  | Seat surface to the plane of the horizontal plane of the<br>bottom of the feet.                                                                    | 16.9-17.9                         | 17.5                  |
| M                                                                            | KNEE PIVOT HEIGHT                 | Centerline of knee pivot bolt to the horizontal plane of the<br>bottom of the feet.                                                                | 19.1-19.7                         | 19.5                  |
| N                                                                            | BUTTOCK POPLITEAL<br>LENGTH       | The rearmost surface of the lower leg to the same point<br>on the rear surface of the buttocks used for dim. "K".                                  | 17.8-18.8                         | 18.5                  |

| HYBRID III 50 <sup>th</sup> SN #401, 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  | 10.2               |
| V                                                                             | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises | 16.3-17.2 | 16.7               |
| W                                                                             | FOOT BREADTH                                              | The widest part of the foot                       | 3.6-4.2   | 4.0                |
| Y                                                                             | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 16.9-17.1 in. above seat surface         | 38.2-39.4 | 38.5               |
| Z                                                                             | WAIST CIRCUMFERENCE                                       | Measured 8.9-9.1 in. above seat surface           | 32.9-34.1 | 33.3               |
| 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                |

DATA SHEET A3  
HEAD DROP TEST (572.32)

Dummy Serial Number 401

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

☒ 1. It has been at least 3 hours since the last head drop. (572.32(c)(5))

☒ N/A, ONLY one head drop performed

☒ 2. The head assembly consists of the complete head (78051-61X), the neck transducer structural replacement (78051-383X), and three (3) accelerometers. (572.32(b))

☒ 3. Torque the skull cap screws to 160 lbf-in.

☒ 4. Accelerometers and their respective mounts are smooth and clean.

☒ 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.35(ii))

☒ 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.32(c)(1))

Record the maximum temperature 21.6

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 44%

☒ 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

☒ 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, 1,1,1 trichloroethane or equivalent prior to the test. (572.32(c)(2))

- X 9. Suspend and orient the head assembly as shown in Figure 6A. The lowest point on the forehead is 0.5 in. below the lowest point on the dummy's nose when the midsagittal plane is vertical. (572.32(c)(3))  
Record the actual distance 14.8"

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X 10. The 1.6 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 7A.  
Record the right side distance 469mm  
Record the left side distance 469mm
- X 11. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.32(c)(4))  
Record actual micro finish  $656 \times 10^{-6}$  mm
- X 12. The impact surface is rigidly supported. (572.32(c)(4))
- X 13. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (Figure 6A)  
Record thickness 50.9mm  
Record width 60.4mm  
Record length 595mm
- X 14. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))
- X 15. Complete the following table using channel class 1000 data. (572.36(i)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $225 \text{ g} \leq x \leq 275 \text{ g}$        | 258    |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | 11     |

- X 16. Plots of the x, y, z, and resultant acceleration data follow this sheet.

  
Signature

6/7/06  
Date

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

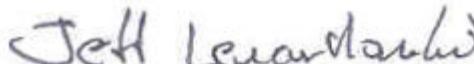
ATD Serial No: 401

Test ID: D061661

| 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           | 48                   | Pass      |
| Peak Resultant Acceleration  | G's   | 225 to 275         | 258                  | Pass      |
| Peak Lateral Acceleration    | G's   | $\leq \pm 15.0$    | 11.4                 | Pass      |
| Unimodal                     | N/A   | Yes                | Yes                  | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes                  | Pass      |
|                              |       |                    | Overall Test Results | Pass      |

  
Laboratory Technician

06/07/2006  
Test Date

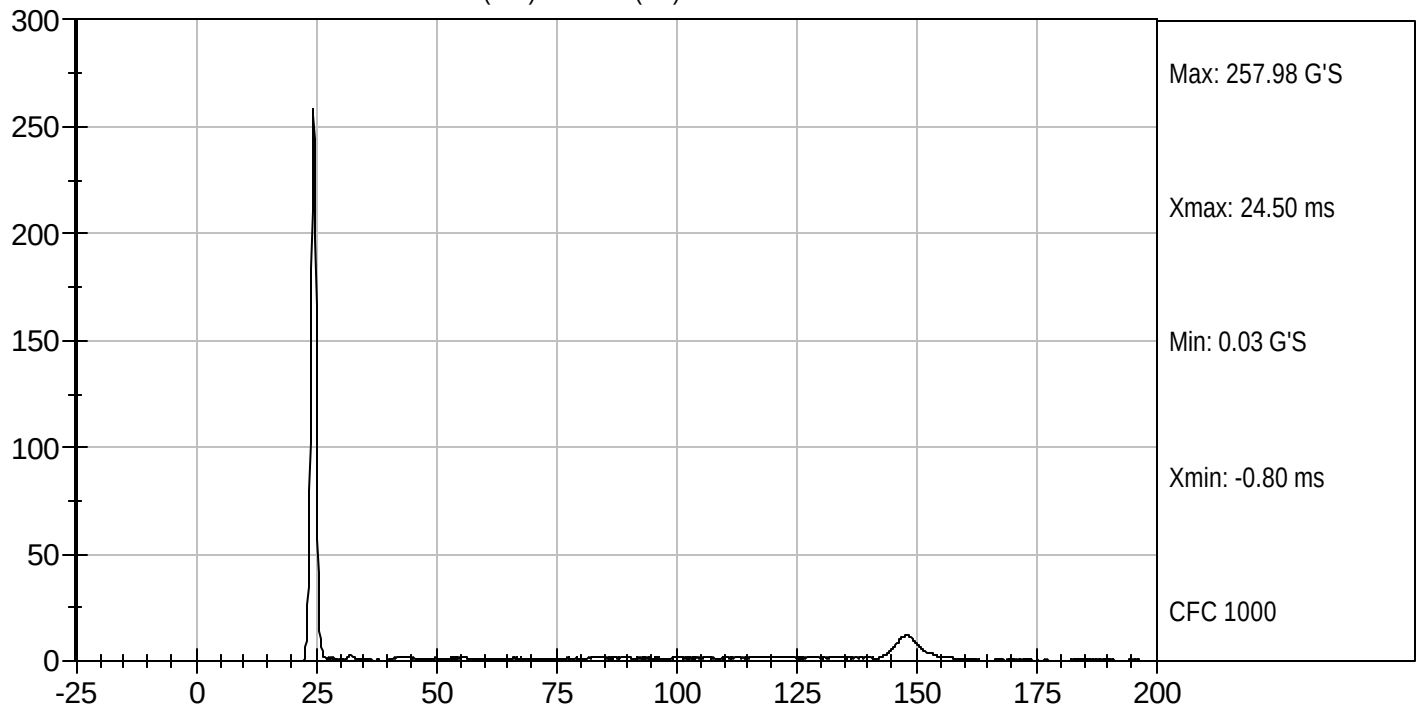
  
Approved By



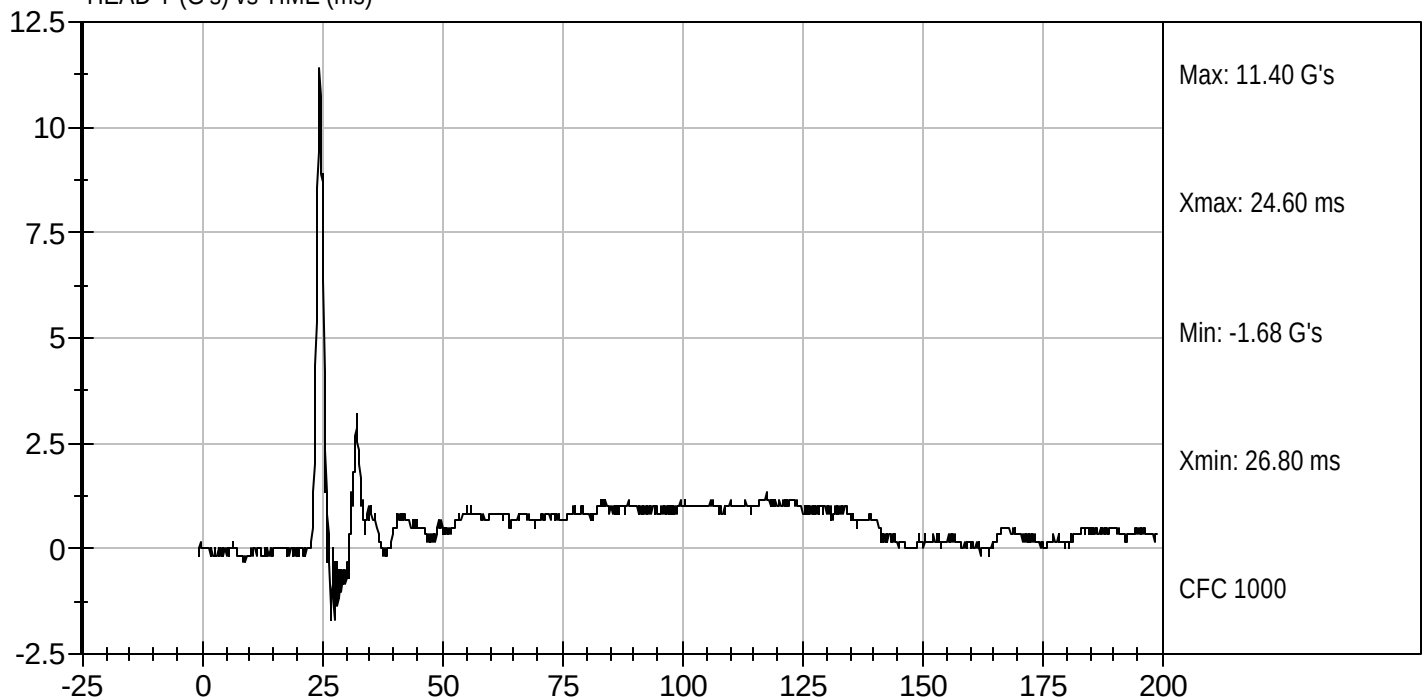
Test Desc: Head Impact  
Componet ID: D061661

Test Date: 06/07/2006  
Velocity: 0 ft/s, 0.00 m/s

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



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





DATA SHEET A4  
NECK FLEXION TEST (572.33)

Dummy Serial Number 401

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

☐ 1. It has been at least 30 minutes since the last flexion test. (572.36(m))

☒ N/A, ONLY one flexion test performed

☒ 2. The components required for the neck tests include the head assembly (78051-61X), neck assembly (78051-90), bib simulator (78051-84), upper neck adjusting bracket (78051-307), lower neck adjusting bracket (78051-303), six axis neck transducer (C-1709) and either three accelerometers or their mass equivalent installed in the head assembly. Data from the accelerometers are not required. (572.33(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))

Record the maximum temperature 21.6

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 44%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made. Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration.

Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (78051-90).

Record findings and actions: No Deterioration Hardness Front 88; Rear 85

☒ 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to  $1.0 \pm 0.2$  lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))

☐ N/A – post test calibration

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

Neck Flexion Test Results (572.33(b)(1) & (572.33(c)(4))

| Parameter                                                                   |                | Specification                                                        | Result |
|-----------------------------------------------------------------------------|----------------|----------------------------------------------------------------------|--------|
| Pendulum impact speed                                                       |                | $22.6 \text{ ft/sec} \leq \text{speed} \leq 23.4 \text{ ft/sec}$     | 22.7   |
| Pendulum<br>Deceleration<br>Versus Time<br>Pulse                            | @ 10ms         | $22.5 \leq g \leq 27.5$                                              | 23.9   |
|                                                                             | @ 20 ms        | $17.6 \leq g \leq 22.6$                                              | 20.5   |
|                                                                             | @30ms          | $12.5 \leq g \leq 18.5$                                              | 16.0   |
|                                                                             | Above 30<br>ms | 29 g maximum                                                         | 16     |
| First Pendulum Decay to<br>5g                                               |                | $34 \text{ ms} \leq \text{time} \leq 42 \text{ ms}$                  | 37     |
| Plane D Rotation                                                            |                | $64^\circ \leq \text{max. rotation} \leq 78^\circ$                   | 72     |
|                                                                             |                | $57 \text{ ms} \leq \text{time of max. rotation} \leq 64 \text{ ms}$ | 60     |
| Time for Plane D Rotation<br>to Cross $0^\circ$ During First<br>Rebound     |                | $113 \text{ ms} \leq \text{time} \leq 128 \text{ ms}$                | 117    |
| Maximum Moment                                                              |                | $65 \text{ lbf-ft} \leq \text{moment} \leq 80 \text{ lbf-ft}$        | 67     |
|                                                                             |                | $47 \text{ ms} \leq \text{time of max. moment} \leq 58 \text{ ms}$   | 51     |
| Time of first decay to 0 lbf-<br>ft<br>Positive Moment Decay**<br>(Flexion) |                | $97 \text{ ms} \leq \text{time} \leq 107 \text{ ms}$                 | 99     |

\*Moment about the occipital condyle =  $M_y - (0.058 \text{ ft} \times F_x)$   
(572.33(b)(1)(ii))

$M_y$  = Moment in lbf-ft measured by the transducer

$F_x$  = Force, in lbf measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum  
striker plate and the honeycomb material. (572.133(b)(3))

X 14. Plots of pendulum acceleration, y-axis moment, x-axis force, y-axis  
moment about the occipital condyle, and D plane rotation follows this  
sheet.

  
Signature

6/7/06  
Date

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

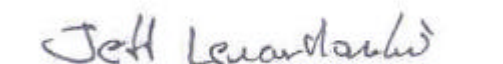
**ATD Serial No:** 401

**Test I.D:** D061662

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.1   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 45     | Pass      |
| Pendulum Velocity                              |         | m/s     | 6.89 to 7.13   | 6.92   | Pass      |
| Pendulum Deceleration                          | 10 msec | G's     | 22.50 to 27.50 | 23.87  | Pass      |
|                                                | 20 msec | G's     | 17.60 to 22.60 | 20.45  | Pass      |
|                                                | 30 msec | G's     | 12.50 to 18.50 | 15.95  | Pass      |
| Peak Pendulum Deceleration After 30 msec       |         | G's     | $\leq 29.0$    | 15.92  | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | msec    | 34.0 to 42.0   | 36.9   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 64.0 to 78.0   | 71.9   | Pass      |
|                                                | Time    | msec    | 57.0 to 64.0   | 59.8   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | msec    | 113.0 to 128.0 | 116.8  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | 88.1 to 108.5  | 91.1   | Pass      |
|                                                | Time    | msec    | 47.0 to 58.0   | 50.5   | Pass      |
| Positive Moment Decay Time To Zero Crossing    |         | msec    | 97.0 to 107.0  | 99.2   | Pass      |
| Overall Test Results                           |         |         |                |        | Pass      |

  
 Laboratory Technician

06/07/2006  
 Test Date

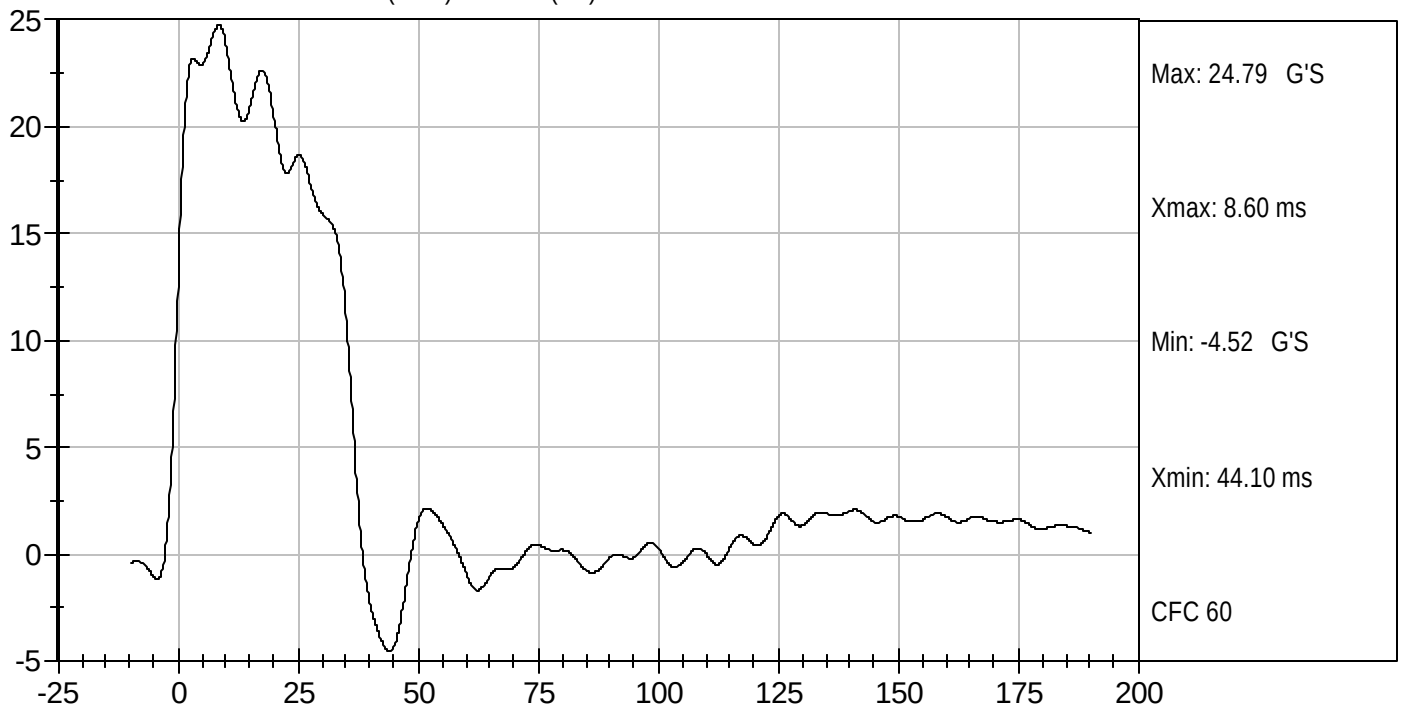
  
 Approved By



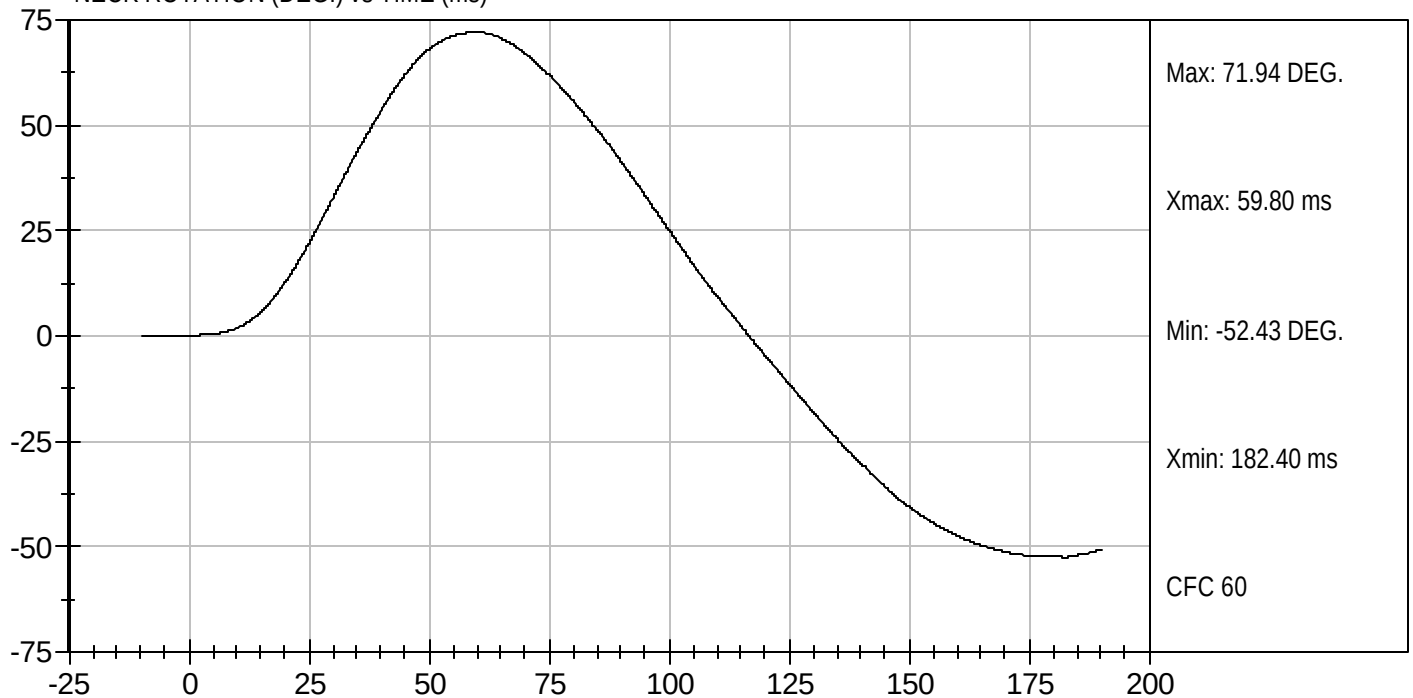
Test Desc: Neck Flexion  
Componet ID: D061662

Test Date: 06/07/2006  
Velocity: 22.71 ft/s, 6.92 m/s

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



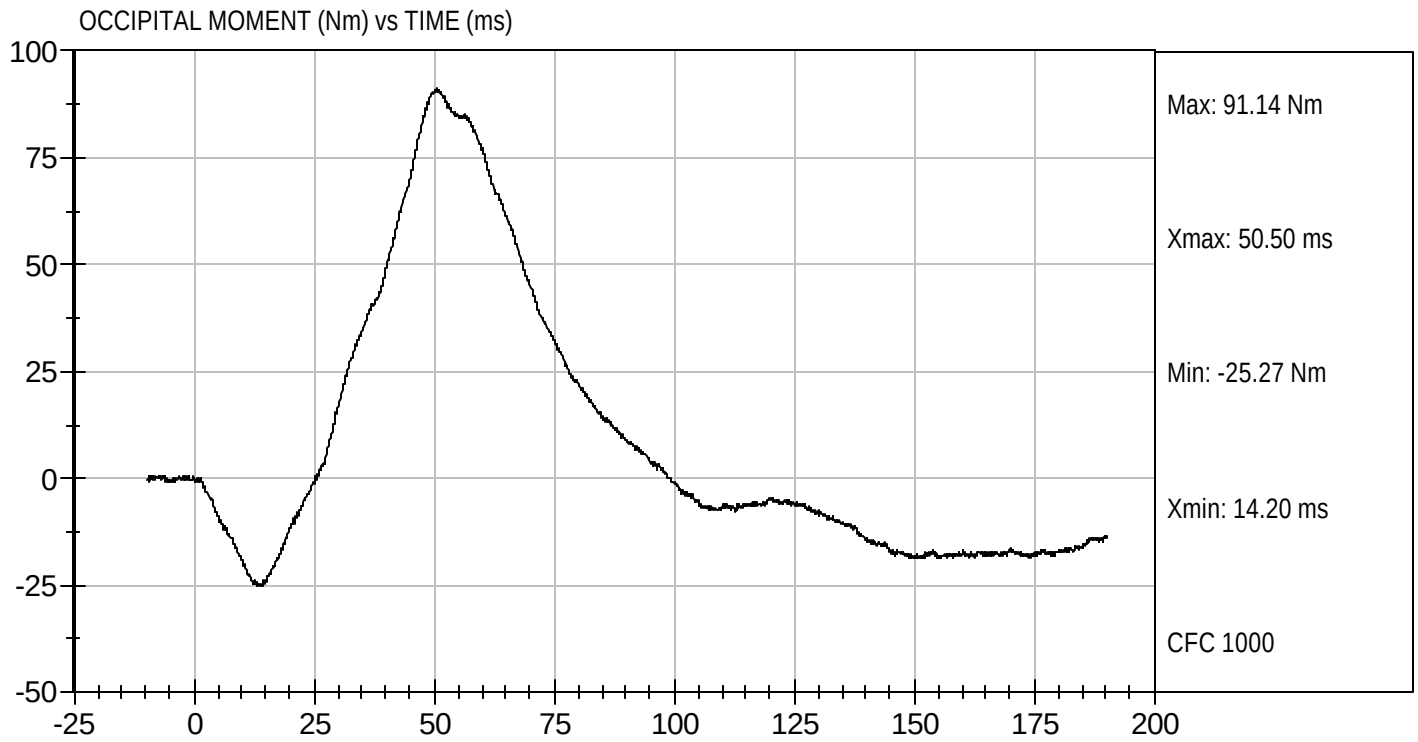
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Flexion  
Componet ID: D061662

Test Date: 06/07/2006  
Velocity: 22.71 ft/s, 6.92 m/s



DATA SHEET A5  
NECK EXTENSION TEST (572.33)

Dummy Serial Number 401

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

☐ 1. It has been at least 30 minutes since the last extension test. (572.36(m))

☒ N/A, ONLY one extension test performed

☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.33(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))

Record the maximum temperature 21.6

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 44%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made. Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration.

Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration Hardness Front 88; Rear 85

- X 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to  $1.0 \pm 0.2$  lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))  
         N/A – post test calibration
- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/s as measured at the center of the pendulum accelerometer. (572.33(c)(4))



X 13. Complete the following table:

Neck Extension Test Results (572.33(b)(2) & (572.33(c)(4))

| Parameter                                                           |             | Specification                                                        | Result |
|---------------------------------------------------------------------|-------------|----------------------------------------------------------------------|--------|
| Pendulum impact speed                                               |             | $19.5 \text{ ft/sec} \leq \text{speed} \leq 20.3 \text{ ft/sec}$     | 20.1   |
| Pendulum Deceleration versus time pulse                             | @ 10ms      | $17.2 \leq g \leq 21.2$                                              | 19.1   |
|                                                                     | @ 20 ms     | $14 \leq g \leq 19$                                                  | 18.3   |
|                                                                     | @30ms       | $11.0 \leq g \leq 16.0$                                              | 15.2   |
|                                                                     | Above 30 ms | 22 g maximum                                                         | 15     |
| First Pendulum Decay to 5g                                          |             | $38 \text{ ms} \leq \text{time} \leq 46 \text{ ms}$                  | 38     |
| Plane D Rotation                                                    |             | $81^\circ \leq \text{max. rotation} \leq 106^\circ$                  | 100    |
|                                                                     |             | $72 \text{ ms} \leq \text{time of max. rotation} \leq 82 \text{ ms}$ | 76     |
| Time for Plane D Rotation to Cross $0^\circ$ During First Rebound   |             | $147 \text{ ms} \leq \text{time} \leq 174 \text{ ms}$                | 157    |
| Maximum Moment                                                      |             | $-59 \text{ lbf-ft} \leq \text{moment} \leq -39 \text{ lbf-ft}$      | -50    |
|                                                                     |             | $65 \text{ ms} \leq \text{time} \leq 79 \text{ ms}$                  | 72     |
| Time of first decay to 0 lbf-ft Negative Moment Decay** (Extension) |             | $120 \text{ ms} \leq \text{time} \leq 148 \text{ ms}$                | 135    |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$   
(572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

X 14. Plots of pendulum acceleration, y-axis moment, x-axis force, y-axis moment about the occipital condyle, and D plane rotation follows this sheet.

  
Signature

6/7/06  
Date

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

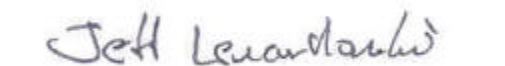
ATD Serial No: 401

Test I.D: D061663

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.1   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 47     | Pass      |
| Pendulum Velocity                              |         | m/s     | 5.95 to 6.19   | 6.12   | Pass      |
| Pendulum Deceleration                          | 10 msec | G's     | 17.20 to 21.20 | 19.11  | Pass      |
|                                                | 20 msec | G's     | 14.00 to 19.00 | 18.30  | Pass      |
|                                                | 30 msec | G's     | 11.00 to 16.00 | 15.16  | Pass      |
| Peak Pendulum Deceleration After 30 msec       |         | G's     | $\leq 22.0$    | 15.11  | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | msec    | 38.0 to 46.0   | 38.1   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 81.0 to 106.0  | 99.6   | Pass      |
|                                                | Time    | msec    | 72.0 to 82.0   | 76.4   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | msec    | 147.0 to 174.0 | 157.1  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | -52.9 to -79.9 | -67.9  | Pass      |
|                                                | Time    | msec    | 65.0 to 79.0   | 72.0   | Pass      |
| Negative Moment Decay Time To Zero Crossing    |         | msec    | 120.0 to 148.0 | 134.8  | Pass      |
| Overall Test Results                           |         |         |                | Pass   |           |

  
 Laboratory Technician

06/07/2006  
 Test Date

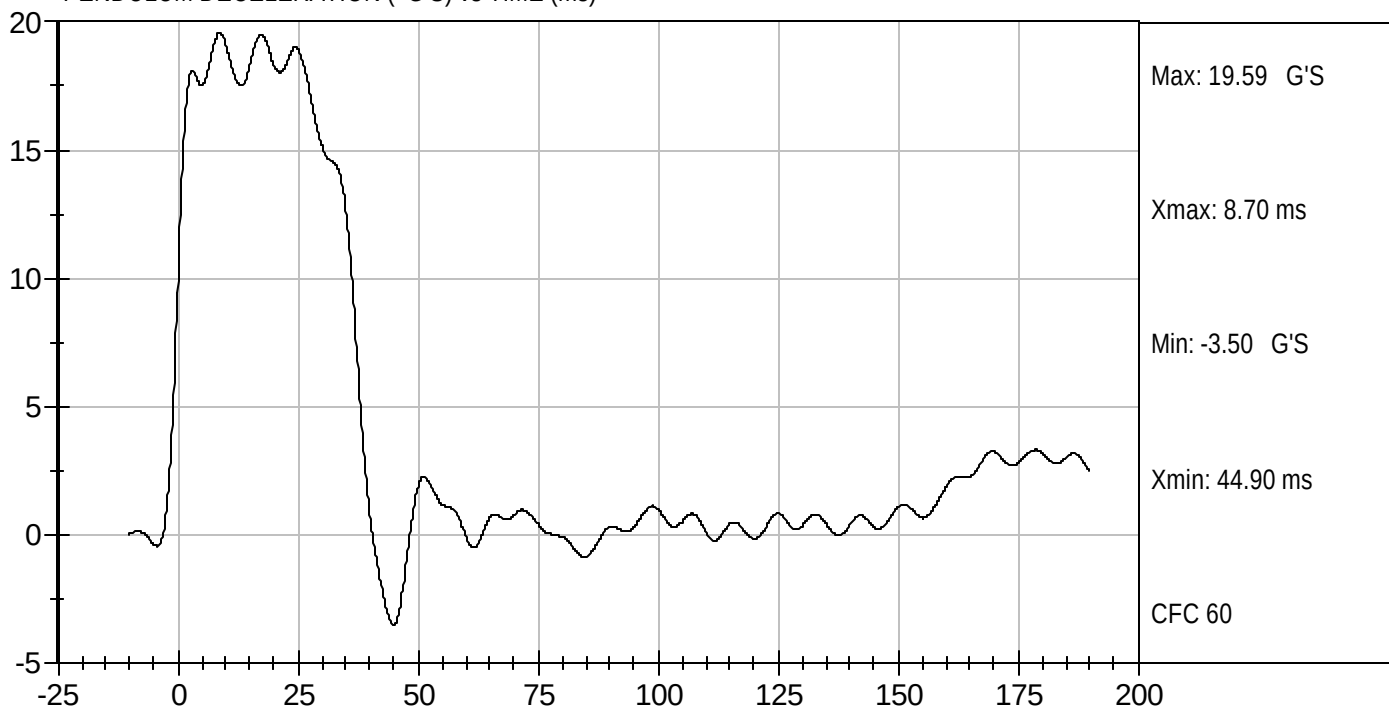
  
 Approved By



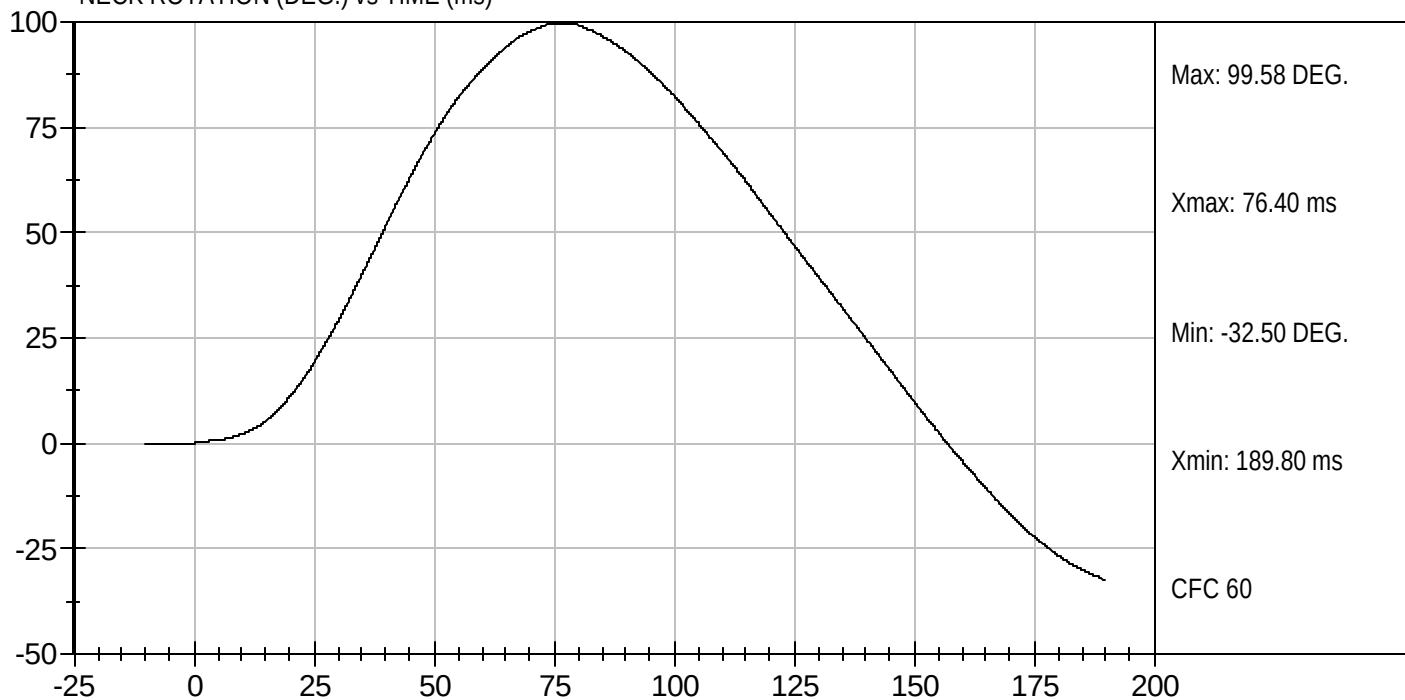
Test Desc: Neck Extension  
Componet ID: D061663

Test Date: 06/07/2006  
Velocity: 20.08 ft/s, 6.12 m/s

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



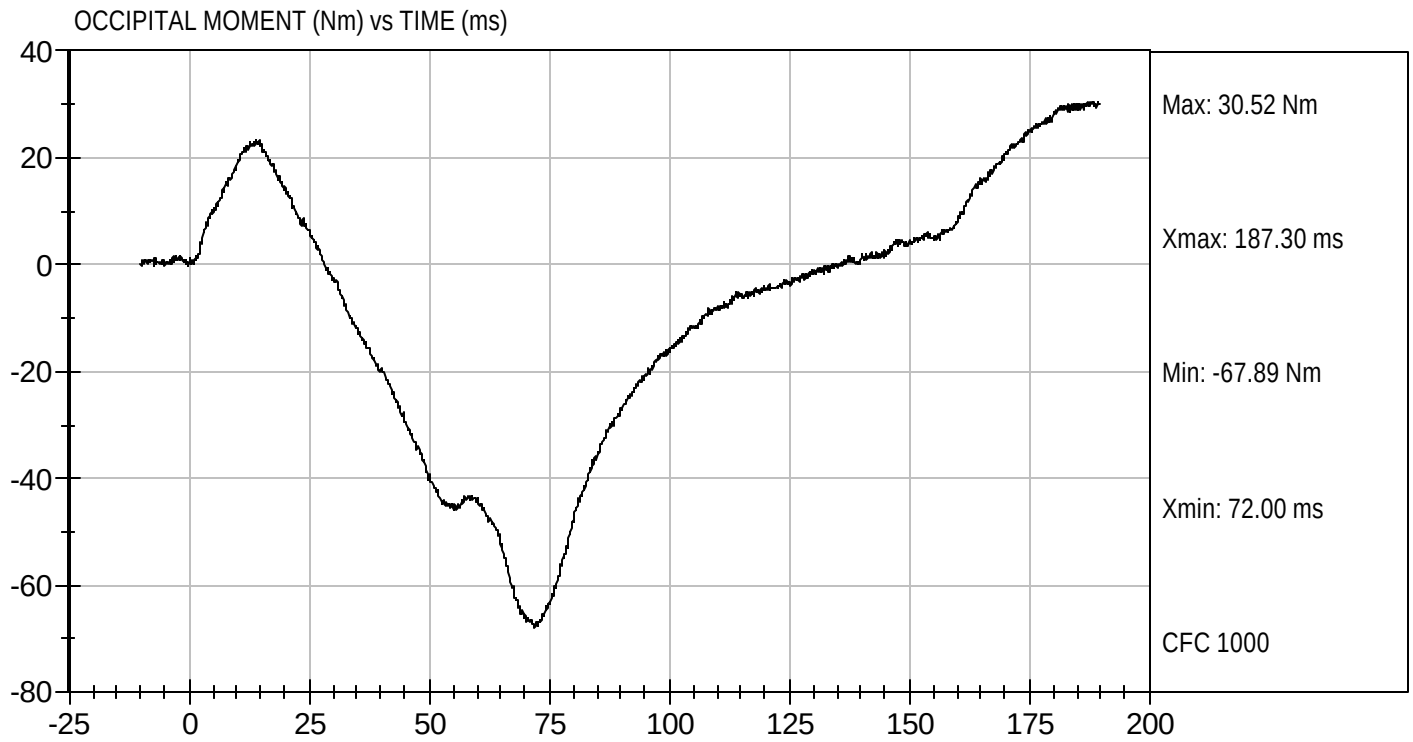
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Extension  
Componet ID: D061663

Test Date: 06/07/2006  
Velocity: 20.08 ft/s, 6.12 m/s



DATA SHEET A6  
THORAX IMPACT TEST (572.34)

Dummy Serial Number 401

Test Date 6/8/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last thorax impact test.  
(572.137(q))

☒ N/A, ONLY one thorax impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 12A.

☒ 3. The complete assembled dummy (78051-218) is used (572.34(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. No shoes are worn. (572.34(b))

☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.34(c)(1))

Record the maximum temperature 21.6

Record the minimum temperature 21.3

Record the maximum humidity 48%

Record the minimum humidity 44%

☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material (78051-17 thru 78051-22), chest displacement transducer assembly (78051-317) and the rear rib supports (78051-304). Inspect for rib deformation using the chest depth gage (83-5006-007). If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

☒ - No damage

☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage

\_\_\_\_\_

☐ - The following repairs or replacement was performed. Record

\_\_\_\_\_

\_\_\_\_\_

- X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572.34(c)(2))
- X 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $13^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (78051-532) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block. (572.34(c)(2))
- X 8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.34(c)(4))
- X 10. Align the adjustable neck bracket index marks to the "zero" position. (Figure 12A)
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 Class 180.
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.34(c)(5)) The velocity of the test probe at the time of impact is  $22 \text{ f/s} \pm 0.4 \text{ f/s}$ . (572.34(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.34(c)(6))

X 16. Complete the following table:

Thorax Impact Results (572.34(b))

| Parameter*              | Specification                                                   | Result |
|-------------------------|-----------------------------------------------------------------|--------|
| Test Probe Speed        | $21.6 \text{ f/s} \leq \text{speed} \leq 22.4 \text{ f/s}$      | 21.8   |
| Chest Compression       | $2.5 \text{ in.} \leq \text{compression} \leq 2.86 \text{ in.}$ | 2.66   |
| Peak resistance force** | $1160 \text{ lb} \leq \text{peak force} \leq 1325 \text{ lb}$   | 1249   |
| Internal Hysteresis***  | $69\% \leq \text{hysteresis} \leq 85\%$                         | 70%    |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.34(b))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve.

X 17. Plots of chest compression, pendulum acceleration, pendulum speed, and force, follow this sheet.

  
Signature

6/8/06  
Date

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

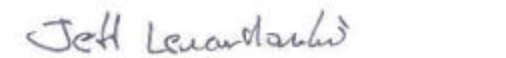
**ATD Serial No:** 401

**Test I.D:** D061664

| 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      | 44     | Pass      |
| Probe Velocity               | m/s   | 6.58 to 6.82  | 6.63   | Pass      |
| Peak Probe Force             | N     | 5159 to 5893  | 5,557  | Pass      |
| Peak Sternum Displacement    | cm    | 6.35 to 7.26  | 6.76   | Pass      |
| Internal Hysteresis          | %     | 69 to 85      | 70     | Pass      |
| Overall Test Results         |       |               | Pass   |           |

  
Laboratory Technician

06/08/2006  
Test Date

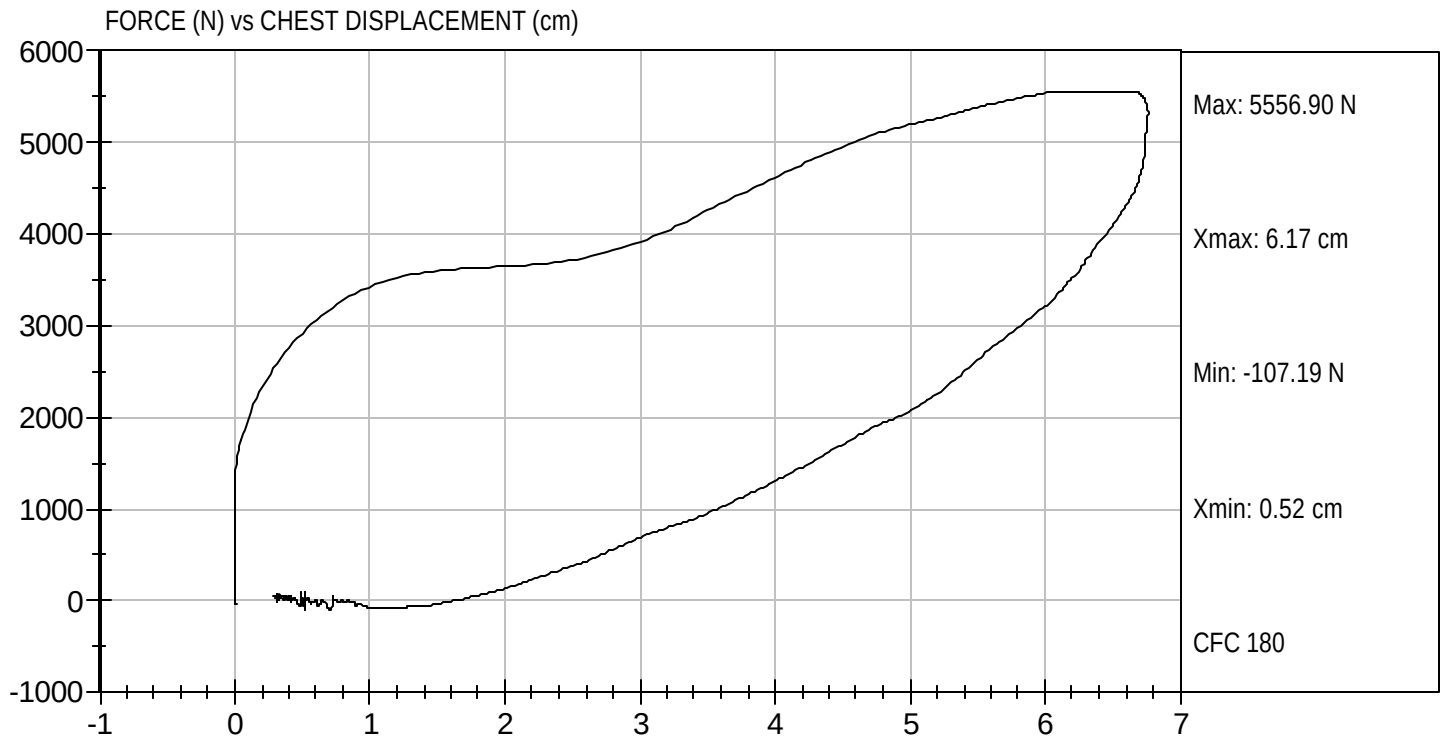
  
Approved By





Test Desc: Thorax Impact  
Componet ID: D061664

Test Date: 06/08/2006  
Velocity: 21.75 ft/s, 6.63 m/s



DATA SHEET A7  
LEFT KNEE IMPACT TEST (572.35)

Dummy Serial Number 401

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. ☒ (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test.  
(572.36(m))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14A.

☒ 3. The leg assembly (86-5001-001) with the upper leg assembly (78051-46) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))

Record the maximum temperature 21.6

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 44%

☒ 5. Mount the test specimen and secure it to the rigid test fixture.  
(572.35(b)(2)(iii)) (Figure 14A)

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))

☒ 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally.  
(572.35(b)(2)(iv)&(vi))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95  
(572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

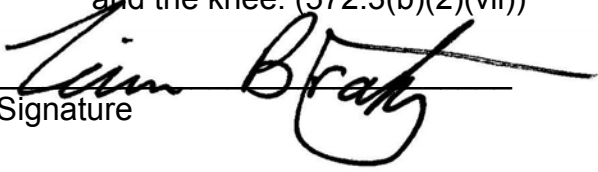
☒ 11. Complete the following table:

Knee Impact Results (572.35(b)(1))

| Parameter              | Specification                         | Result |
|------------------------|---------------------------------------|--------|
| Probe speed            | 6.8 ft/s $\leq$ speed $\leq$ 7.0 ft/s | 6.9    |
| Peak resistance force* | 1060 lb $\leq$ force $\leq$ 1300 lb   | 1095   |

\*Force = impactor mass x deceleration (572.35(b)(1))

X 12. Plots of pendulum acceleration, pendulum speed, and force, follow this sheet. Time zero is defined as the time of contact between the test probe and the knee. (572.3(b)(2)(vii))

  
Signature

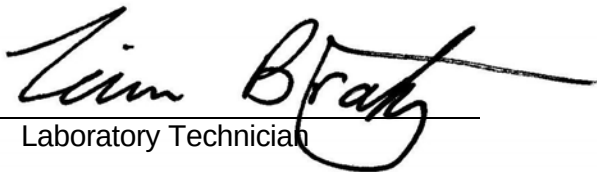
6/7/06  
Date

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

ATD Serial No: 401

Test I.D: D061666

| 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      | 49     | Pass      |
| Probe Velocity               | m/sec   | 2.07 to 2.13  | 2.12   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 4,873  | Pass      |
| Overall Test Results         |         |               |        | Pass      |

  
Laboratory Technician

06/07/2006

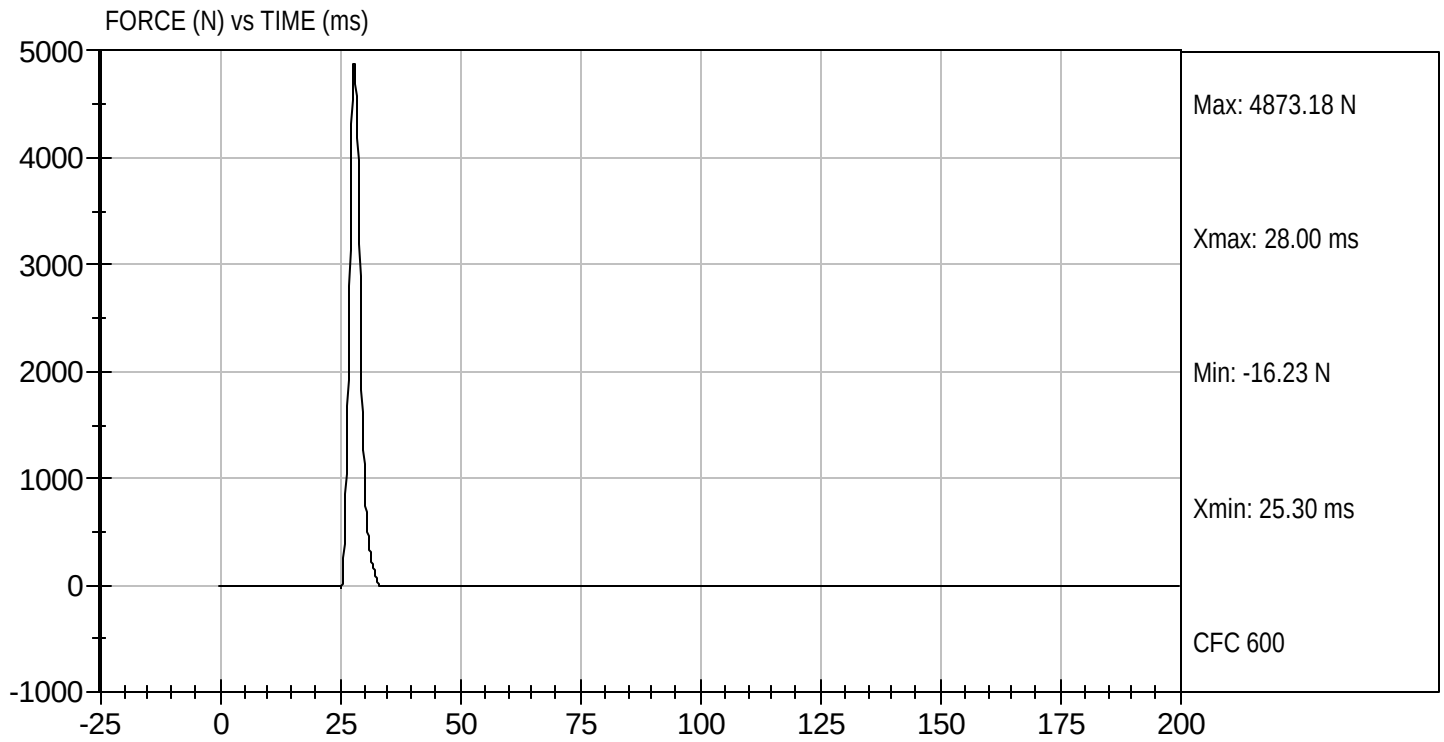
Test Date

  
Approved By



Test Desc: Left Knee  
Componet ID: D061666

Test Date: 06/07/2006  
Velocity: 6.94 ft/s, 2.12 m/s



DATA SHEET A8  
RIGHT KNEE IMPACT TEST (572.35)

Dummy Serial Number 401

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test.  
(572.36(m))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14A.

☒ 3. The leg assembly (86-5001-002) with the upper leg assembly (78051-47) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))

Record the maximum temperature 21.6

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 44%

☒ 5. Mount the test specimen and secure it to the rigid test fixture.  
(572.35(b)(2)(iii)) (Figure 14A)

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))

☒ 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally.  
(572.35(b)(2)(iv)&(vi))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95  
(572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

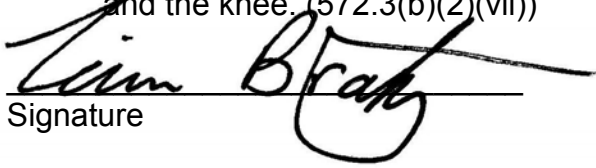
☒ 11. Complete the following table:

Knee Impact Results (572.35(b)(1))

| Parameter              | Specification                         | Result |
|------------------------|---------------------------------------|--------|
| Probe speed            | 6.8 ft/s $\leq$ speed $\leq$ 7.0 ft/s | 7.0    |
| Peak resistance force* | 1060 lb $\leq$ force $\leq$ 1300 lb   | 1107   |

\*Force = impactor mass x deceleration (572.35(b)(1))

X 12. Plots of pendulum acceleration, pendulum speed, and force, follow this sheet. Time zero is defined as the time of contact between the test probe and the knee. (572.3(b)(2)(vii))

  
Signature

6/7/06  
Date

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

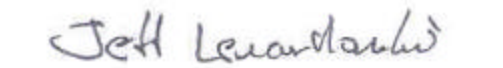
ATD Serial No: 401

Test I.D: D061665

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 21.5   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 48     | Pass      |
| Probe Velocity               | m/sec   | 2.07 to 2.13  | 2.13   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 4,924  | Pass      |
| Overall Test Results         |         |               |        | Pass      |

  
Laboratory Technician

06/07/2006  
Test Date

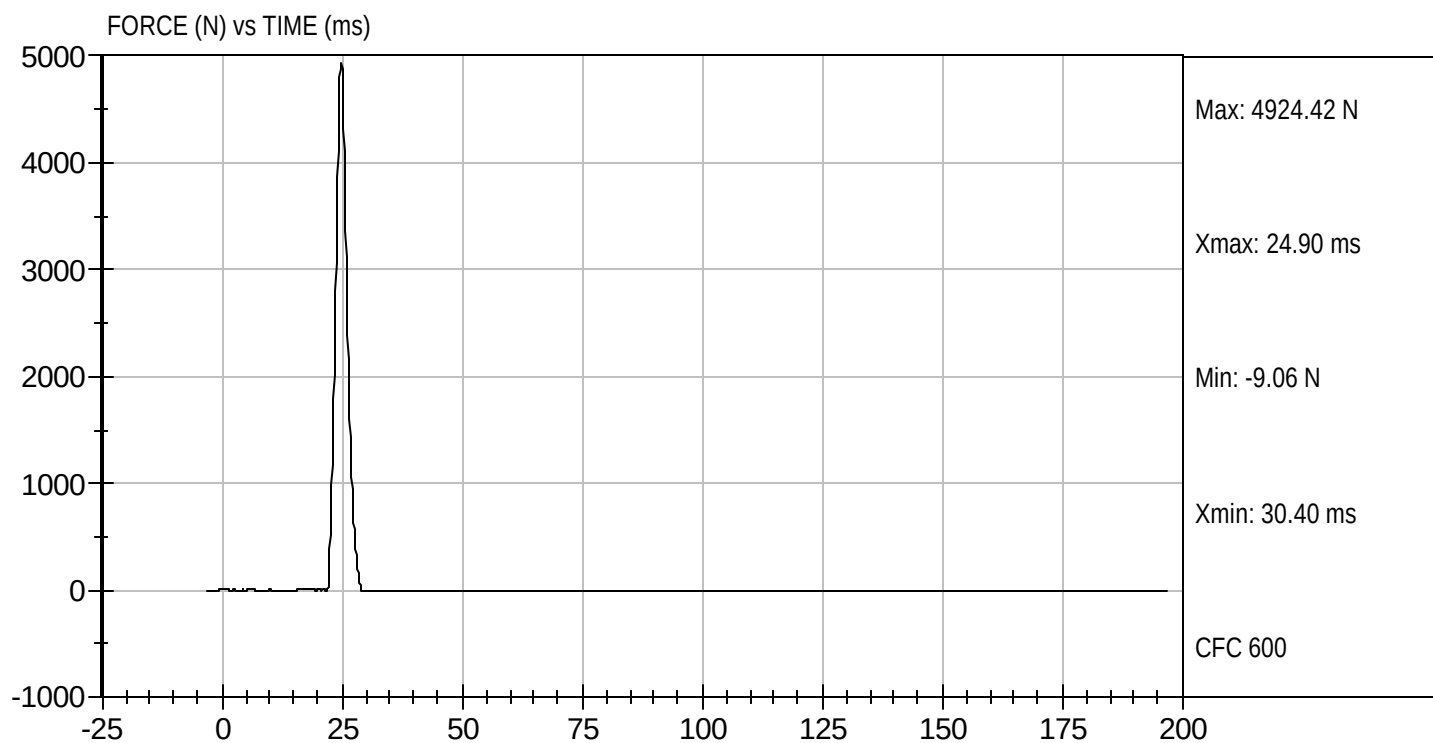
  
Approved By





Test Desc: Right Knee  
Componet ID: D061665

Test Date: 06/07/2006  
Velocity: 6.98 ft/s, 2.13 m/s



DATA SHEET A9  
HIP JOINT-FEMUR FLEXION (572.35(c))

Dummy Serial Number 401

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive hip joint-femur flexion tests are necessary)

- ☐ 1. It has been at least 30 minutes since the last hip joint-femur flexion test. (572.36(m))  
☒ N/A, ONLY one hip joint-femur flexion test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 17A.
- ☒ 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):  
☒ 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)  
☒ 3.2 remove the abdominal insert (78051-52)  
☒ 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).
- ☒ 4. The assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(c)(v))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.6</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>49%</u>  |
| Record the minimum humidity    | <u>44%</u>  |
- ☒ 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))
- ☒ 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))
- ☒ 7. Adjust the threaded rods until plane B is horizontal.
- ☒ 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))
- ☒ 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

X 10. Complete the following table:

Left Hip Joint-Femur Flexion Results (572.35(c)(1) & (c)(2)(iv))

| Parameter                    | Specification                                         | Result |
|------------------------------|-------------------------------------------------------|--------|
| Rotation Rate                | $5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$ | 8      |
| Femur Torque at $30^{\circ}$ | $\text{torque} \leq 70 \text{ ft-lbf}$                | 67     |
| Rotation at 150 lbf-ft       | $40^{\circ} \leq \text{rotation} \leq 50^{\circ}$     | 40     |

X 11. Secure the lever arm into the right femur shaft opening of the upper leg structure assembly (78051-44) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

X 12. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the  $\frac{1}{2}$  in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19). (572.35(c)(2)(iv))

X 13. Complete the following table:

Right Hip Joint-Femur Flexion Results (572.35(c)(1) & (c)(2)(iv))

| Parameter                    | Specification                                         | Result |
|------------------------------|-------------------------------------------------------|--------|
| Rotation Rate                | $5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$ | 8      |
| Femur Torque at $30^{\circ}$ | $\text{torque} \leq 70 \text{ ft-lbf}$                | 61     |
| Rotation at 15 lbf-ft        | $40^{\circ} \leq \text{rotation} \leq 50^{\circ}$     | 41     |

  
Signature

6/7/06  
Date

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

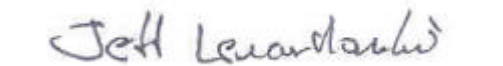
**ATD Serial No:** 401

**Test I.D:** D061660

| Tested Parameter             | Units   | Specification                 | Result |                      | Pass/Fail |
|------------------------------|---------|-------------------------------|--------|----------------------|-----------|
|                              |         |                               | Right  | Left                 |           |
| Laboratory Temperature       | deg C   | 18.9 to 25.6                  | 21.2   | 21.2                 | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70                      | 46     | 46                   | Pass      |
| Rotation Rate                | deg/sec | 5 to 10                       | 8      | 8                    | Pass      |
| 30 Degrees                   | Nm      | 94.9 Nm Max                   | 82.6   | 90.5                 | Pass      |
| 150 ft-lbf / 203.4 Nm        | Deg     | 40- 50 Degree<br>Max Rotation | 41     | 40                   | Pass      |
|                              |         |                               |        | Overall Test Results | Pass      |

  
 Laboratory Technician

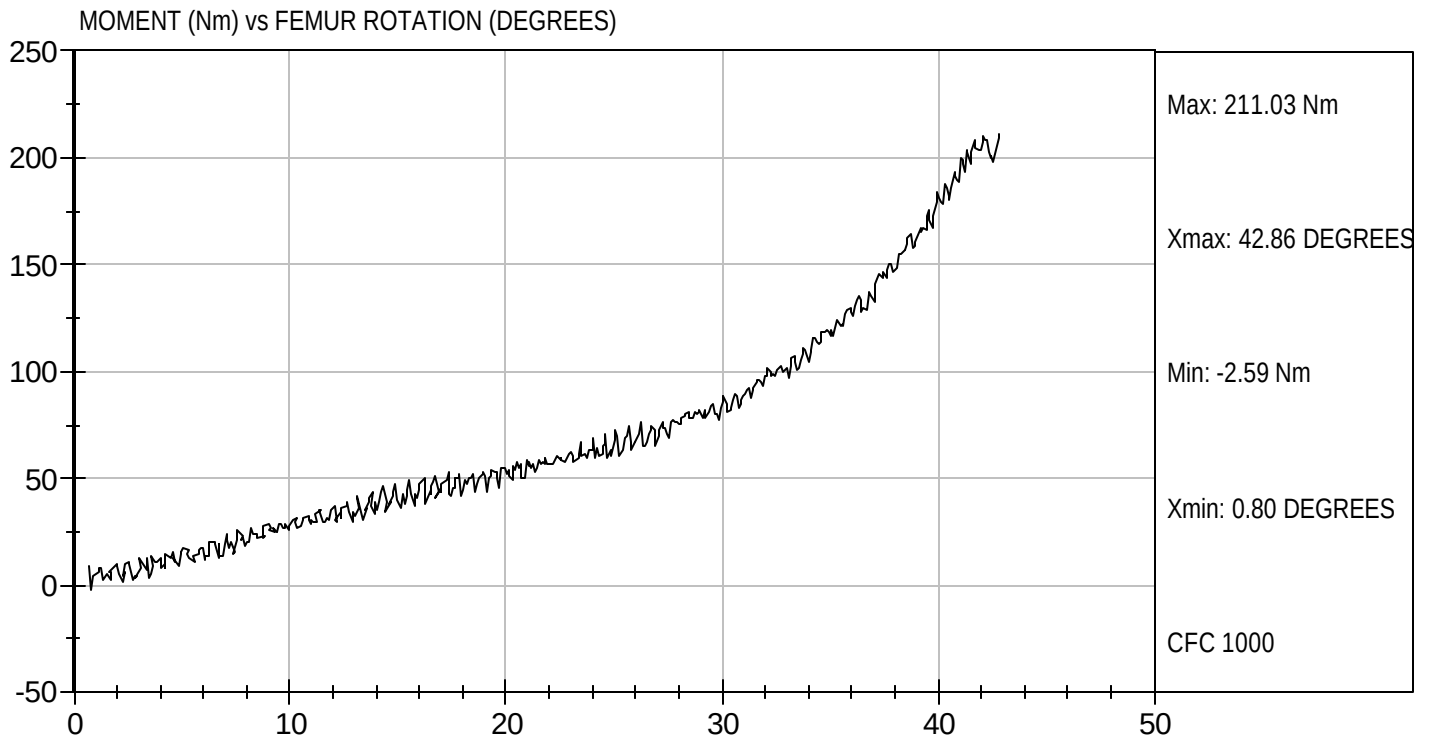
06/07/2006  
 Test Date

  
 Approved By



Test Desc: Hip Femur Flexion  
Componet ID: D061669

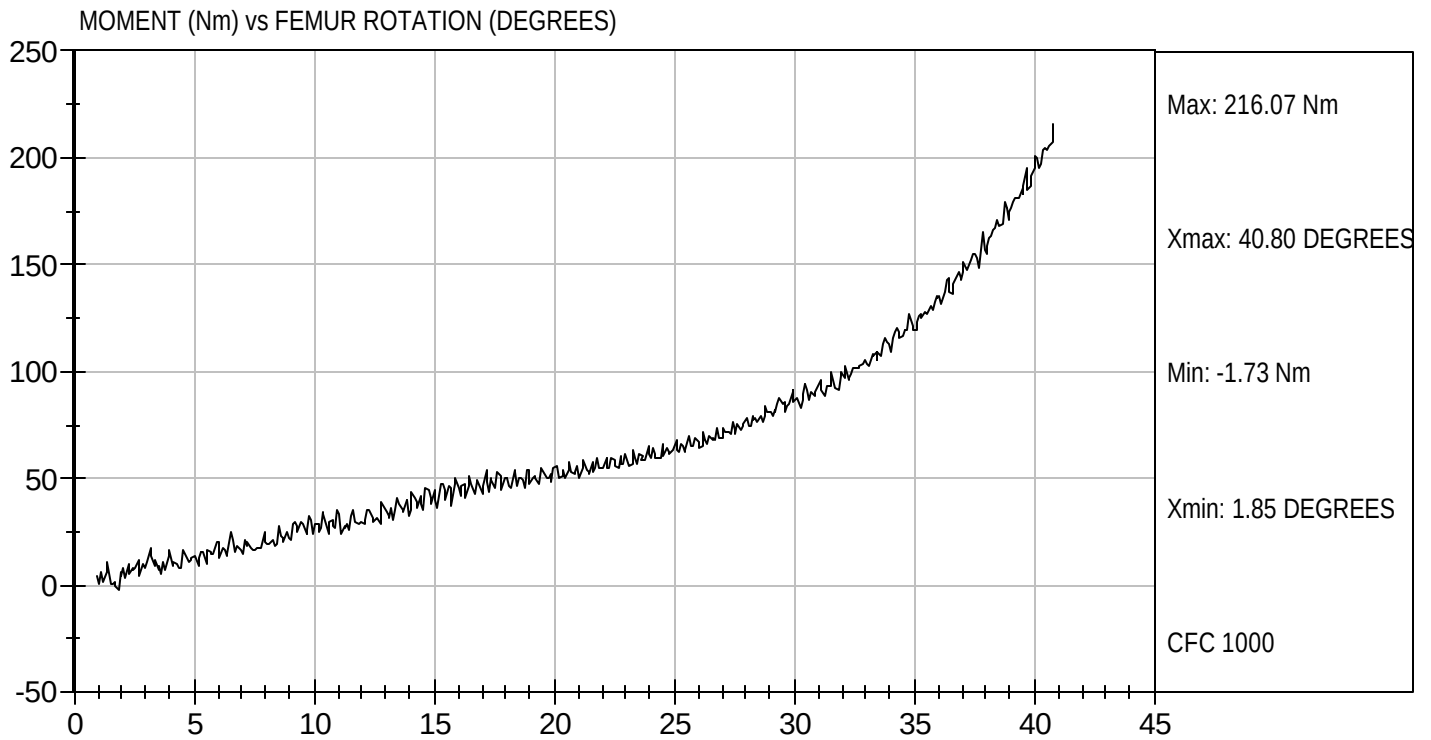
Test Date: 06/07/2006  
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion  
Componet ID: D061660

Test Date: 06/07/2006  
Velocity: 0 ft/s, 0.00 m/s



DATA SHEET A3  
HEAD DROP TEST (572.32)

Dummy Serial Number 401

Test Date 7/27/06

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

☒ 1. It has been at least 3 hours since the last head drop. (572.32(c)(5))

☒ N/A, ONLY one head drop performed

☒ 2. The head assembly consists of the complete head (78051-61X), the neck transducer structural replacement (78051-383X), and three (3) accelerometers. (572.32(b))

☒ 3. Torque the skull cap screws to 160 lbf-in.

☒ 4. Accelerometers and their respective mounts are smooth and clean.

☒ 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.35(ii))

☒ 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.32(c)(1))

Record the maximum temperature 21.2

Record the minimum temperature 20.7

Record the maximum humidity 51%

Record the minimum humidity 46%

☒ 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

☒ 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, 1,1,1 trichloroethane or equivalent prior to the test. (572.32(c)(2))

- X 9. Suspend and orient the head assembly as shown in Figure 6A. The lowest point on the forehead is 0.5 in. below the lowest point on the dummy's nose when the midsagittal plane is vertical. (572.32(c)(3))  
Record the actual distance 14.8"

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X 10. The 1.6 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 7A.  
Record the right side distance 469mm  
Record the left side distance 469mm
- X 11. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.32(c)(4))  
Record actual micro finish  $656 \times 10^{-6}$  mm
- X 12. The impact surface is rigidly supported. (572.32(c)(4))
- X 13. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (Figure 6A)  
Record thickness 50.9mm  
Record width 60.4mm  
Record length 595mm
- X 14. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))
- X 15. Complete the following table using channel class 1000 data. (572.36(i)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $225 \text{ g} \leq x \leq 275 \text{ g}$        | 269    |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | -11    |

- X 16. Plots of the x, y, z, and resultant acceleration data follow this sheet.

  
Signature

7/27/06  
Date



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

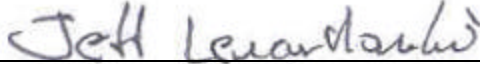
ATD Serial No: 401

Test ID: D062171

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 20.8   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 47     | Pass      |
| Peak Resultant Acceleration  | G's   | 225 to 275         | 269    | Pass      |
| Peak Lateral Acceleration    | G's   | $\leq \pm 15.0$    | -11.1  | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

  
Laboratory Technician

07/27/2006  
Test Date

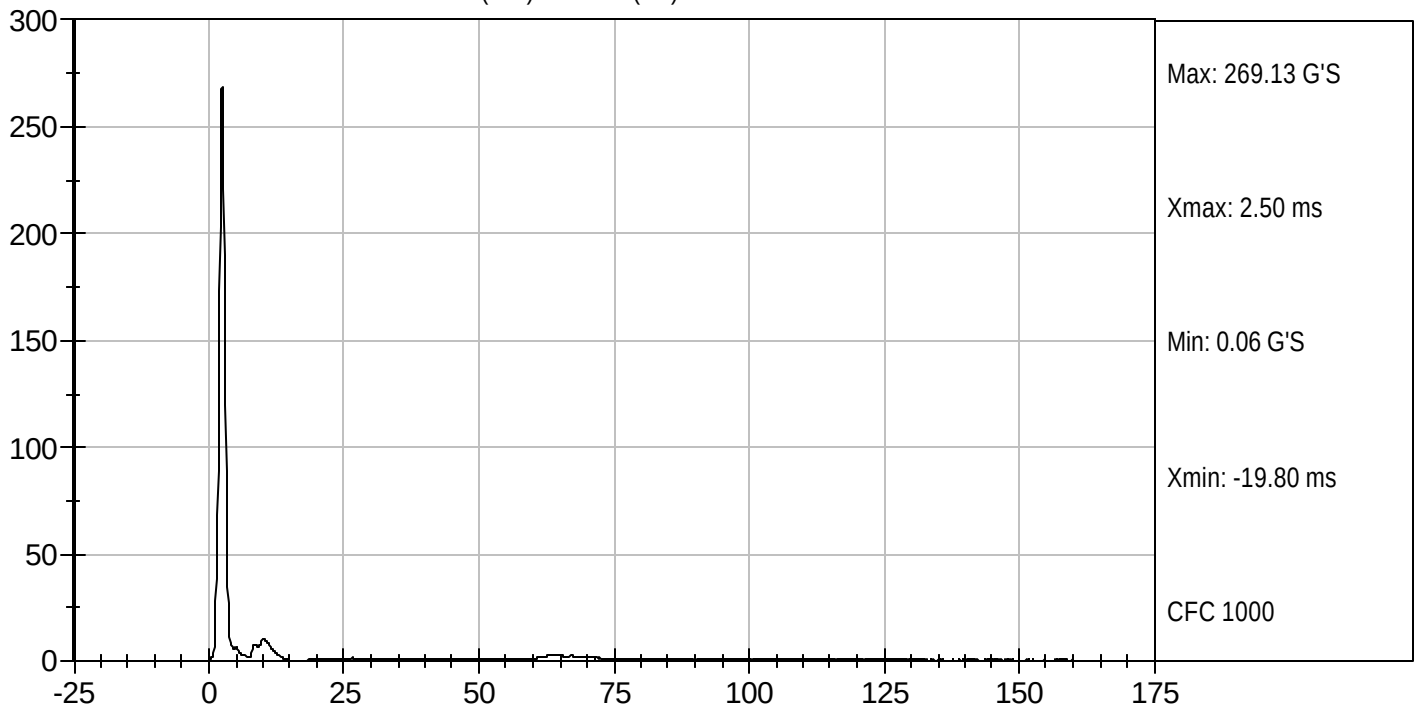
  
Approved By



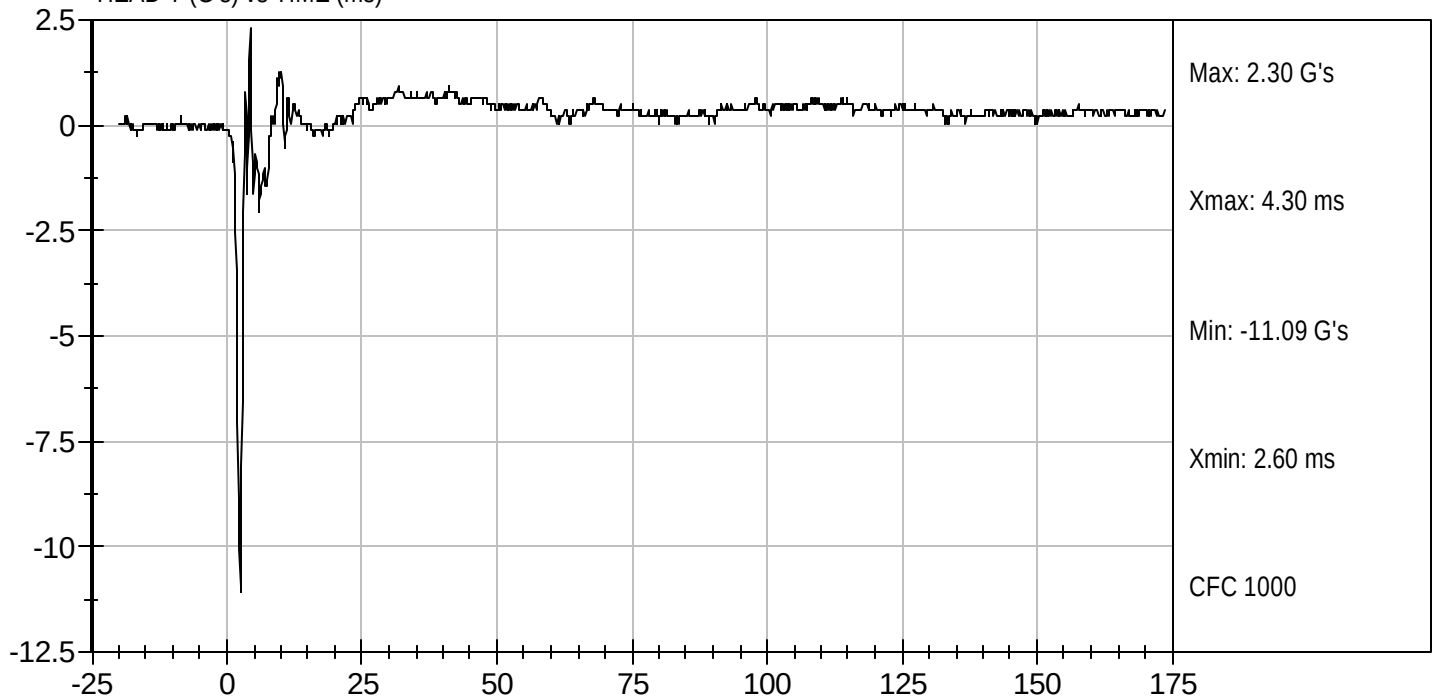
Test Desc: Head Drop  
Componet ID: D062171

Test Date: 07/27/2006  
Velocity: 0 ft/s, 0.00 m/s

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



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



DATA SHEET A4  
NECK FLEXION TEST (572.33)

Dummy Serial Number 401

Test Date 7/27/06

Technician Dave Wilcox

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

☐ 1. It has been at least 30 minutes since the last flexion test. (572.36(m))

☒ N/A, ONLY one flexion test performed

☒ 2. The components required for the neck tests include the head assembly (78051-61X), neck assembly (78051-90), bib simulator (78051-84), upper neck adjusting bracket (78051-307), lower neck adjusting bracket (78051-303), six axis neck transducer (C-1709) and either three accelerometers or their mass equivalent installed in the head assembly. Data from the accelerometers are not required. (572.33(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))

Record the maximum temperature 21.2

Record the minimum temperature 20.7

Record the maximum humidity 51%

Record the minimum humidity 46%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made. Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration.

Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (78051-90).

Record findings and actions: No Deterioration Hardness Front 88; Rear 85

☒ 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to  $1.0 \pm 0.2$  lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))

☐ N/A – post test calibration

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

| Neck Flexion Test Results (572.33(b)(1) & (572.33(c)(4))                |                                                                      |                         |
|-------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------|
| Parameter                                                               | Specification                                                        | Result                  |
| Pendulum impact speed                                                   | $22.6 \text{ ft/sec} \leq \text{speed} \leq 23.4 \text{ ft/sec}$     | 23.1                    |
| Pendulum<br>Deceleration<br>Versus Time<br>Pulse                        | @ 10ms                                                               | $22.5 \leq g \leq 27.5$ |
|                                                                         | @ 20 ms                                                              | $17.6 \leq g \leq 22.6$ |
|                                                                         | @30ms                                                                | $12.5 \leq g \leq 18.5$ |
|                                                                         | Above 30 ms                                                          | 29 g maximum            |
| First Pendulum Decay to 5g                                              | $34 \text{ ms} \leq \text{time} \leq 42 \text{ ms}$                  | 33                      |
| Plane D Rotation                                                        | $64^\circ \leq \text{max. rotation} \leq 78^\circ$                   | 75                      |
|                                                                         | $57 \text{ ms} \leq \text{time of max. rotation} \leq 64 \text{ ms}$ | 58                      |
| Time for Plane D Rotation to Cross $0^\circ$ During First Rebound       | $113 \text{ ms} \leq \text{time} \leq 128 \text{ ms}$                | 117                     |
| Maximum Moment                                                          | $65 \text{ lbf-ft} \leq \text{moment} \leq 80 \text{ lbf-ft}$        | 69                      |
|                                                                         | $47 \text{ ms} \leq \text{time of max. moment} \leq 58 \text{ ms}$   | 50                      |
| Time of first decay to 0 lbf-ft<br>Positive Moment Decay**<br>(Flexion) | $97 \text{ ms} \leq \text{time} \leq 107 \text{ ms}$                 | 99                      |

\*Moment about the occipital condyle =  $M_y - (0.058 \text{ ft} \times F_x)$   
(572.33(b)(1)(ii))

$M_y$  = Moment in lbf-ft measured by the transducer

$F_x$  = Force, in lbf measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

X 14. Plots of pendulum acceleration, y-axis moment, x-axis force, y-axis moment about the occipital condyle, and D plane rotation follows this sheet.

  
\_\_\_\_\_  
Signature

7/27/06  
\_\_\_\_\_  
Date

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

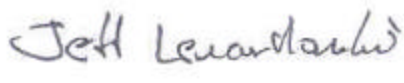
**ATD Serial No:** 401

**Test I.D:** D062172

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.1   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 46     | Pass      |
| Pendulum Velocity                              |         | m/s     | 6.89 to 7.13   | 7.03   | Pass      |
| Pendulum Deceleration                          | 10 msec | G's     | 22.50 to 27.50 | 24.84  | Pass      |
|                                                | 20 msec | G's     | 17.60 to 22.60 | 22.15  | Pass      |
|                                                | 30 msec | G's     | 12.50 to 18.50 | 16.26  | Pass      |
| Peak Pendulum Deceleration After 30 msec       |         | G's     | $\leq 29.0$    | 16.25  | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | msec    | 34.0 to 42.0   | 36.3   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 64.0 to 78.0   | 75.0   | Pass      |
|                                                | Time    | msec    | 57.0 to 64.0   | 58.4   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | msec    | 113.0 to 128.0 | 117.3  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | 88.1 to 108.5  | 93.5   | Pass      |
|                                                | Time    | msec    | 47.0 to 58.0   | 49.5   | Pass      |
| Positive Moment Decay Time To Zero Crossing    |         | msec    | 97.0 to 107.0  | 98.5   | Pass      |
| Overall Test Results                           |         |         |                |        | Pass      |

  
 Laboratory Technician

07/27/2006  
 Test Date

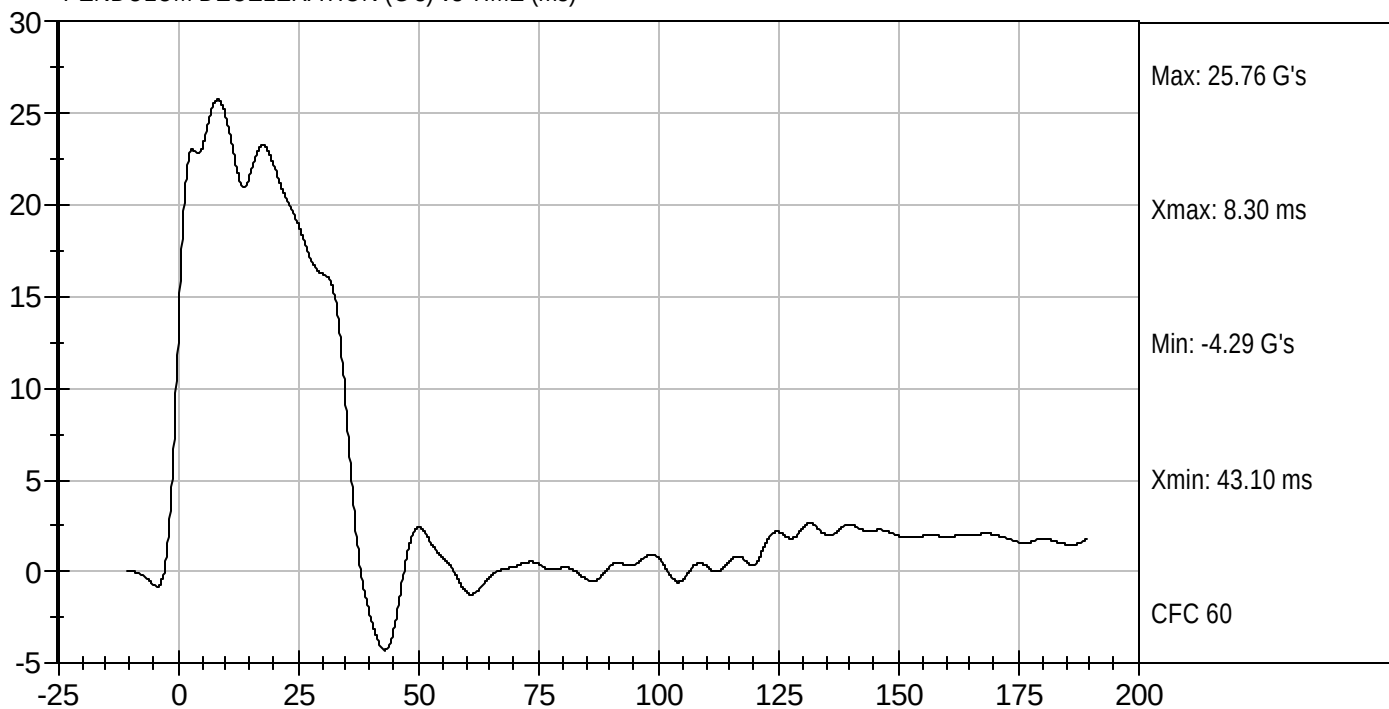
  
 Approved By



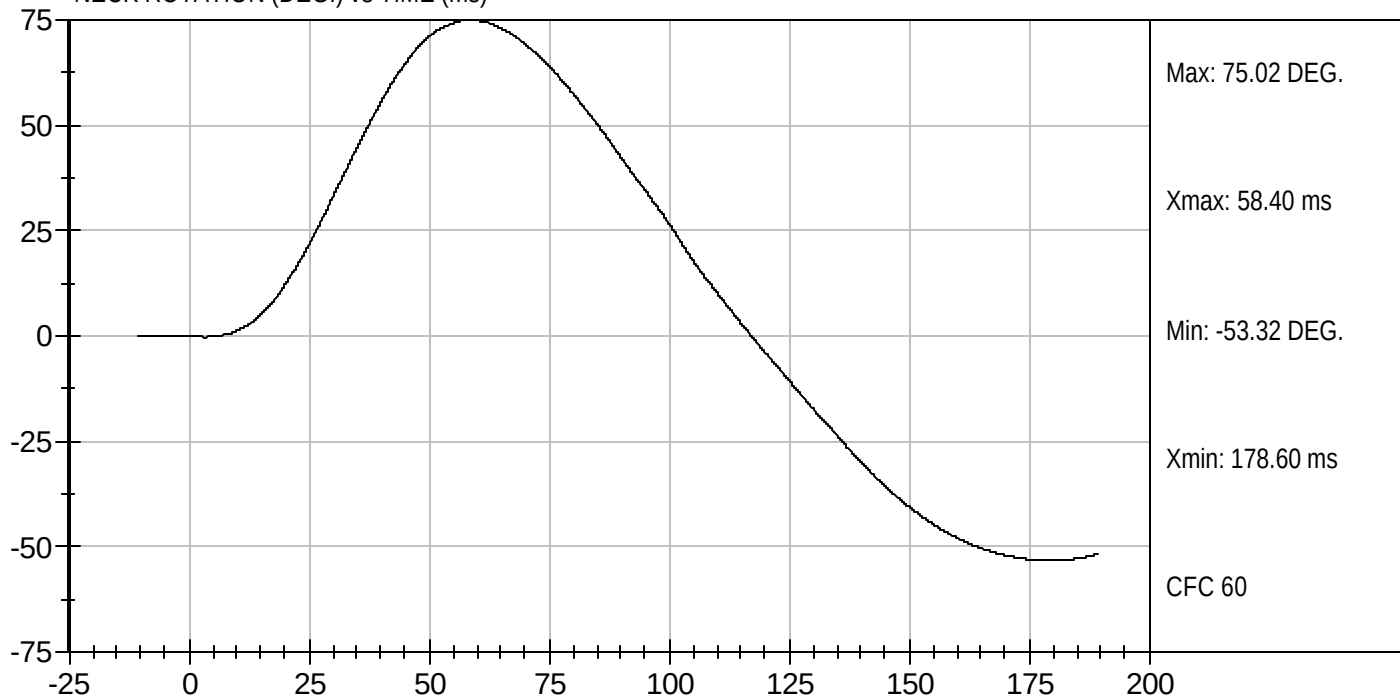
Test Desc: Neck Flexion  
Componet ID: D062172

Test Date: 07/27/2006  
Velocity: 23.05 ft/s, 7.03 m/s

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



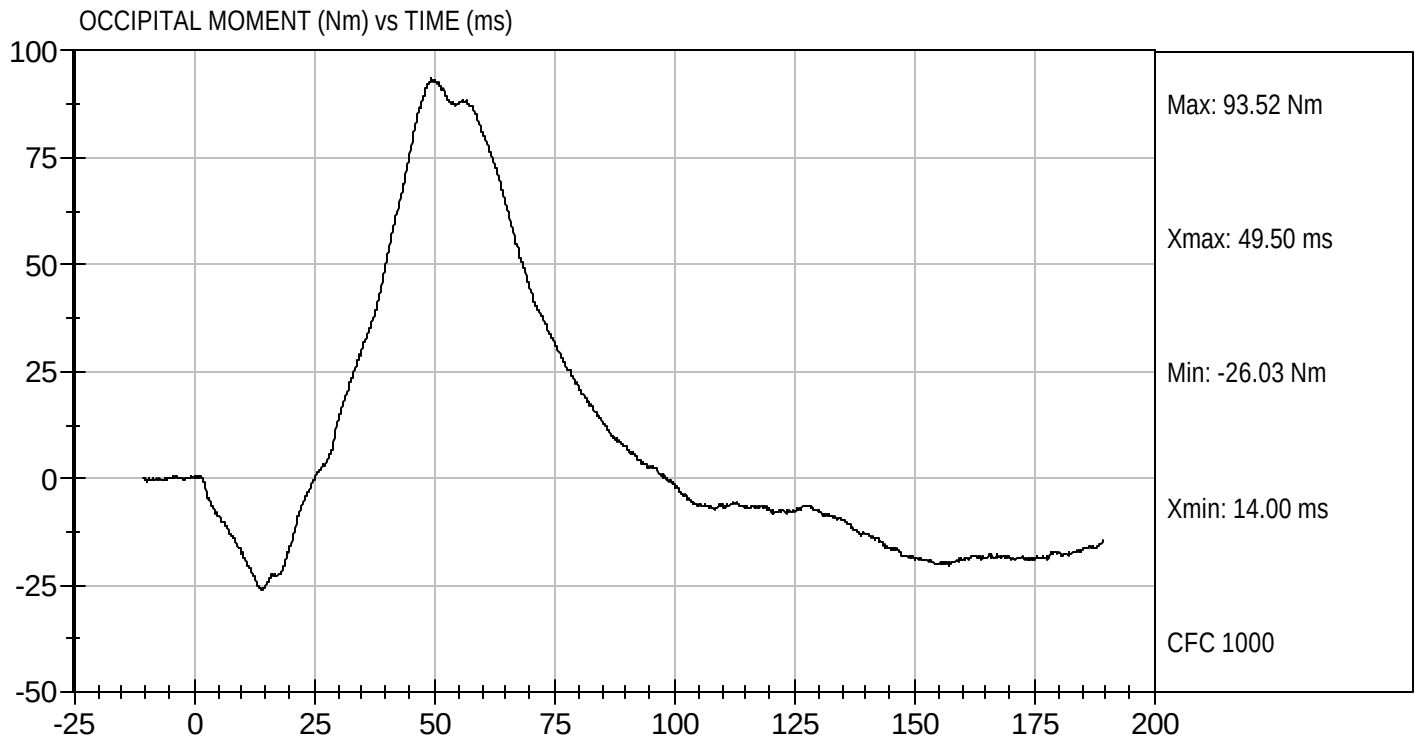
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Flexion  
Componet ID: D062172

Test Date: 07/27/2006  
Velocity: 23.05 ft/s, 7.03 m/s





DATA SHEET A5  
NECK EXTENSION TEST (572.33)

Dummy Serial Number 401

Test Date 7/27/06

Technician Tim Bratz

   Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

   1. It has been at least 30 minutes since the last extension test. (572.36(m))

  X N/A, ONLY one extension test performed

X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.33(b))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))

Record the maximum temperature 21.2

Record the minimum temperature 20.7

Record the maximum humidity 51%

Record the minimum humidity 46%

X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made. Record findings and actions: No Damage.

X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration.

Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration Hardness Front 88; Rear 85

- X 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to  $1.0 \pm 0.2$  lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))  
         N/A – post test calibration
- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/s as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

Neck Extension Test Results (572.33(b)(2) & (572.33(c)(4))

| Parameter                                                           |             | Specification                                                        | Result |
|---------------------------------------------------------------------|-------------|----------------------------------------------------------------------|--------|
| Pendulum impact speed                                               |             | $19.5 \text{ ft/sec} \leq \text{speed} \leq 20.3 \text{ ft/sec}$     | 20.1   |
| Pendulum Deceleration versus time pulse                             | @ 10ms      | $17.2 \leq g \leq 21.2$                                              | 19.2   |
|                                                                     | @ 20 ms     | $14 \leq g \leq 19$                                                  | 18.2   |
|                                                                     | @30ms       | $11.0 \leq g \leq 16.0$                                              | 13.9   |
|                                                                     | Above 30 ms | 22 g maximum                                                         | 14     |
| First Pendulum Decay to 5g                                          |             | $38 \text{ ms} \leq \text{time} \leq 46 \text{ ms}$                  | 39     |
| Plane D Rotation                                                    |             | $81^\circ \leq \text{max. rotation} \leq 106^\circ$                  | 100    |
|                                                                     |             | $72 \text{ ms} \leq \text{time of max. rotation} \leq 82 \text{ ms}$ | 77     |
| Time for Plane D Rotation to Cross $0^\circ$ During First Rebound   |             | $147 \text{ ms} \leq \text{time} \leq 174 \text{ ms}$                | 158    |
| Maximum Moment                                                      |             | $-59 \text{ lbf-ft} \leq \text{moment} \leq -39 \text{ lbf-ft}$      | -50    |
|                                                                     |             | $65 \text{ ms} \leq \text{time} \leq 79 \text{ ms}$                  | 72     |
| Time of first decay to 0 lbf-ft Negative Moment Decay** (Extension) |             | $120 \text{ ms} \leq \text{time} \leq 148 \text{ ms}$                | 134    |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$   
(572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

X 14. Plots of pendulum acceleration, y-axis moment, x-axis force, y-axis moment about the occipital condyle, and D plane rotation follows this sheet.

  
Signature

7/27/06  
Date

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

ATD Serial No: 401

Test I.D: D062173

| 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       | 51     | Pass      |
| Pendulum Velocity                              |         | m/s     | 5.95 to 6.19   | 6.11   | Pass      |
| Pendulum Deceleration                          | 10 msec | G's     | 17.20 to 21.20 | 19.18  | Pass      |
|                                                | 20 msec | G's     | 14.00 to 19.00 | 18.15  | Pass      |
|                                                | 30 msec | G's     | 11.00 to 16.00 | 13.90  | Pass      |
| Peak Pendulum Deceleration After 30 msec       |         | G's     | $\leq 22.0$    | 13.88  | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | msec    | 38.0 to 46.0   | 39.3   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 81.0 to 106.0  | 100.3  | Pass      |
|                                                | Time    | msec    | 72.0 to 82.0   | 77.2   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | msec    | 147.0 to 174.0 | 158.4  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | -52.9 to -79.9 | -67.9  | Pass      |
|                                                | Time    | msec    | 65.0 to 79.0   | 71.5   | Pass      |
| Negative Moment Decay Time To Zero Crossing    |         | msec    | 120.0 to 148.0 | 134.1  | Pass      |
| Overall Test Results                           |         |         |                | Pass   |           |

  
 Laboratory Technician

07/27/2006  
 Test Date

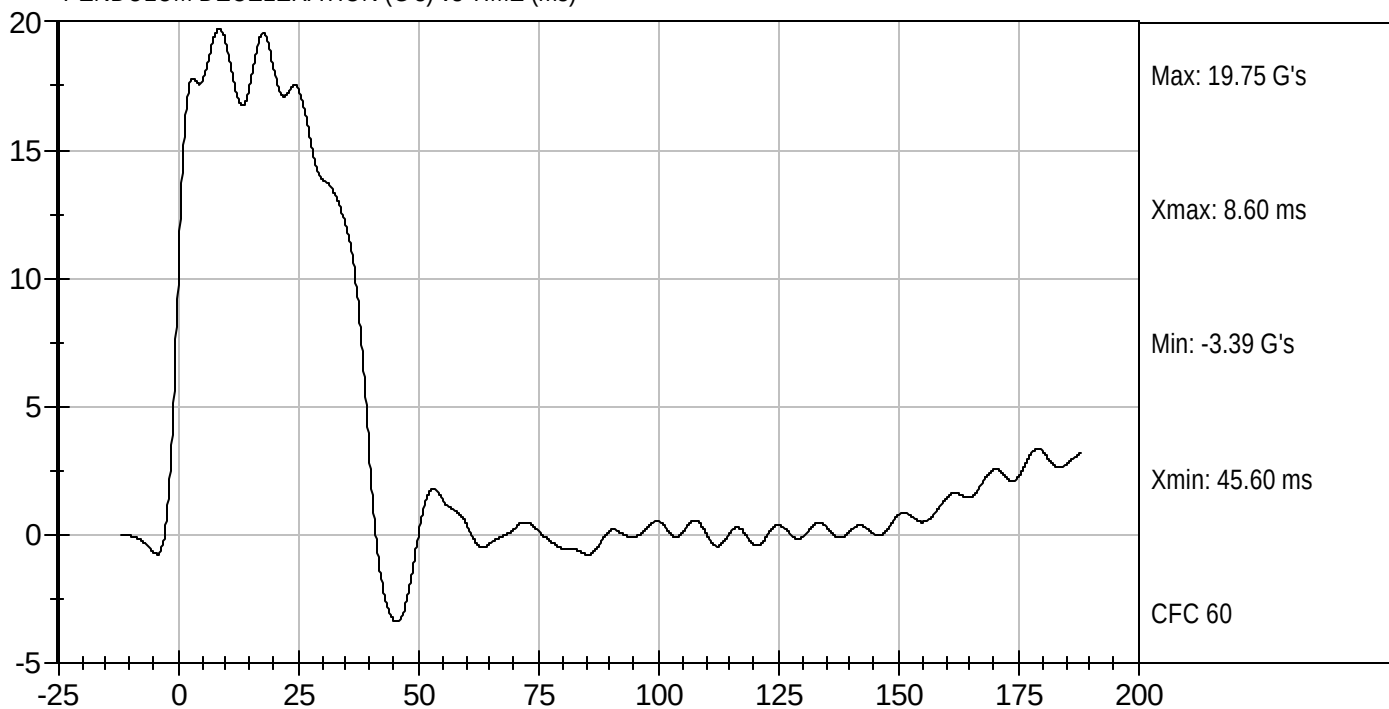
  
 Approved By



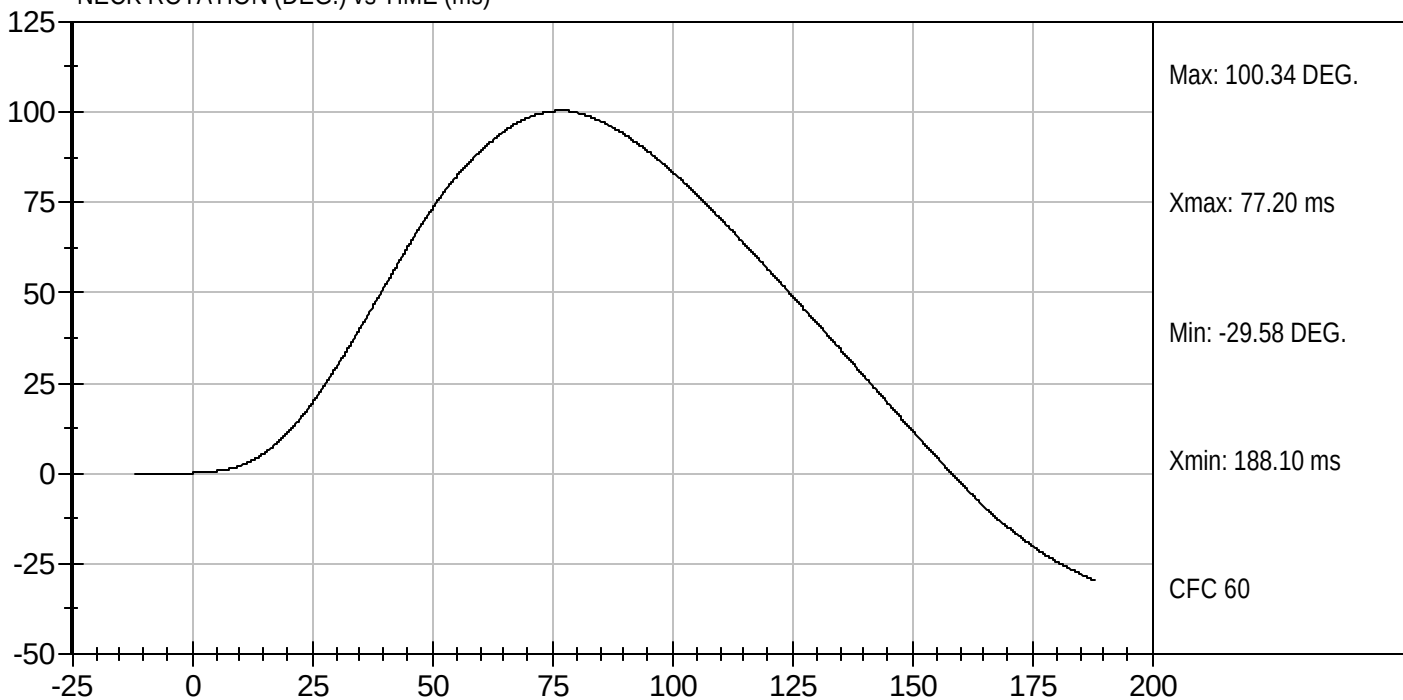
Test Desc: Neck Extension  
Componet ID: D062173

Test Date: 07/27/2006  
Velocity: 20.06 ft/s, 6.11 m/s

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



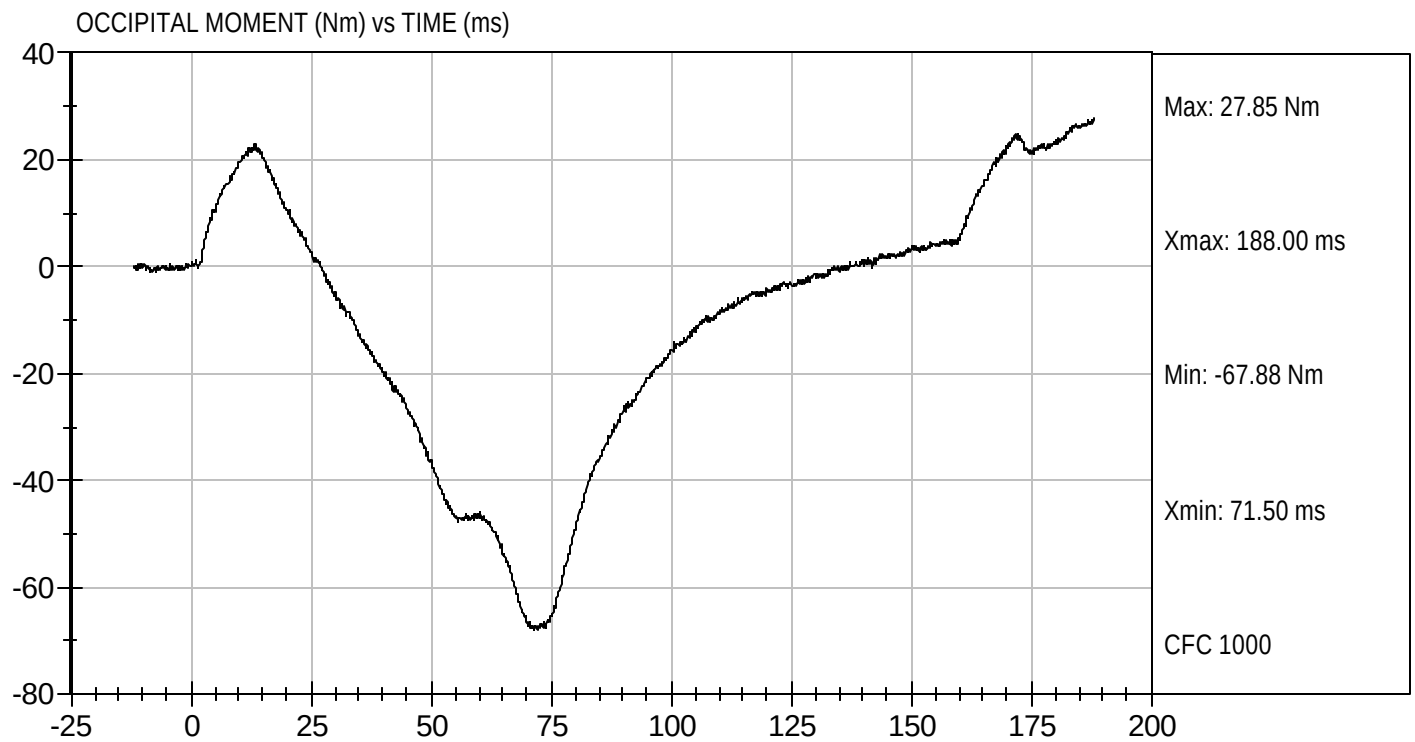
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Extension  
Componet ID: D062173

Test Date: 07/27/2006  
Velocity: 20.06 ft/s, 6.11 m/s



DATA SHEET A6  
THORAX IMPACT TEST (572.34)

Dummy Serial Number 401

Test Date 7/28/06

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last thorax impact test.  
(572.137(q))

☒ N/A, ONLY one thorax impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 12A.

☒ 3. The complete assembled dummy (78051-218) is used (572.34(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. No shoes are worn. (572.34(b))

☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.34(c)(1))

Record the maximum temperature 21.2

Record the minimum temperature 20.6

Record the maximum humidity 48%

Record the minimum humidity 45%

☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material (78051-17 thru 78051-22), chest displacement transducer assembly (78051-317) and the rear rib supports (78051-304). Inspect for rib deformation using the chest depth gage (83-5006-007). If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

☒ - No damage

☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage

\_\_\_\_\_

☐ - The following repairs or replacement was performed. Record

\_\_\_\_\_

\_\_\_\_\_

- X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572.34(c)(2))
- X 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $13^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (78051-532) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block. (572.34(c)(2))
- X 8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.34(c)(4))
- X 10. Align the adjustable neck bracket index marks to the "zero" position. (Figure 12A)
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 Class 180.
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.34(c)(5)) The velocity of the test probe at the time of impact is  $22 \text{ f/s} \pm 0.4 \text{ f/s}$ . (572.34(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.34(c)(6))



X 16. Complete the following table:

Thorax Impact Results (572.34(b))

| Parameter*              | Specification                                                   | Result |
|-------------------------|-----------------------------------------------------------------|--------|
| Test Probe Speed        | $21.6 \text{ f/s} \leq \text{speed} \leq 22.4 \text{ f/s}$      | 21.7   |
| Chest Compression       | $2.5 \text{ in.} \leq \text{compression} \leq 2.86 \text{ in.}$ | 2.59   |
| Peak resistance force** | $1160 \text{ lb} \leq \text{peak force} \leq 1325 \text{ lb}$   | 1242   |
| Internal Hysteresis***  | $69\% \leq \text{hysteresis} \leq 85\%$                         | 71%    |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.34(b))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve.

X 17. Plots of chest compression, pendulum acceleration, pendulum speed, and force, follow this sheet.

  
Signature

7/28/06  
Date

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

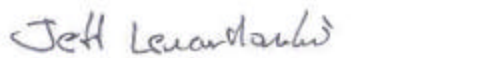
ATD Serial No: 401

Test I.D: D062174

| Tested Parameter             | Units | Specification | Result               | Pass/Fail |
|------------------------------|-------|---------------|----------------------|-----------|
| Laboratory Temperature       | deg C | 20.6 to 22.2  | 20.6                 | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 48                   | Pass      |
| Probe Velocity               | m/s   | 6.58 to 6.82  | 6.62                 | Pass      |
| Peak Probe Force             | N     | 5159 to 5893  | 5,523                | Pass      |
| Peak Sternum Displacement    | cm    | 6.35 to 7.26  | 6.58                 | Pass      |
| Internal Hysteresis          | %     | 69 to 85      | 71                   | Pass      |
|                              |       |               | Overall Test Results | Pass      |

  
Laboratory Technician

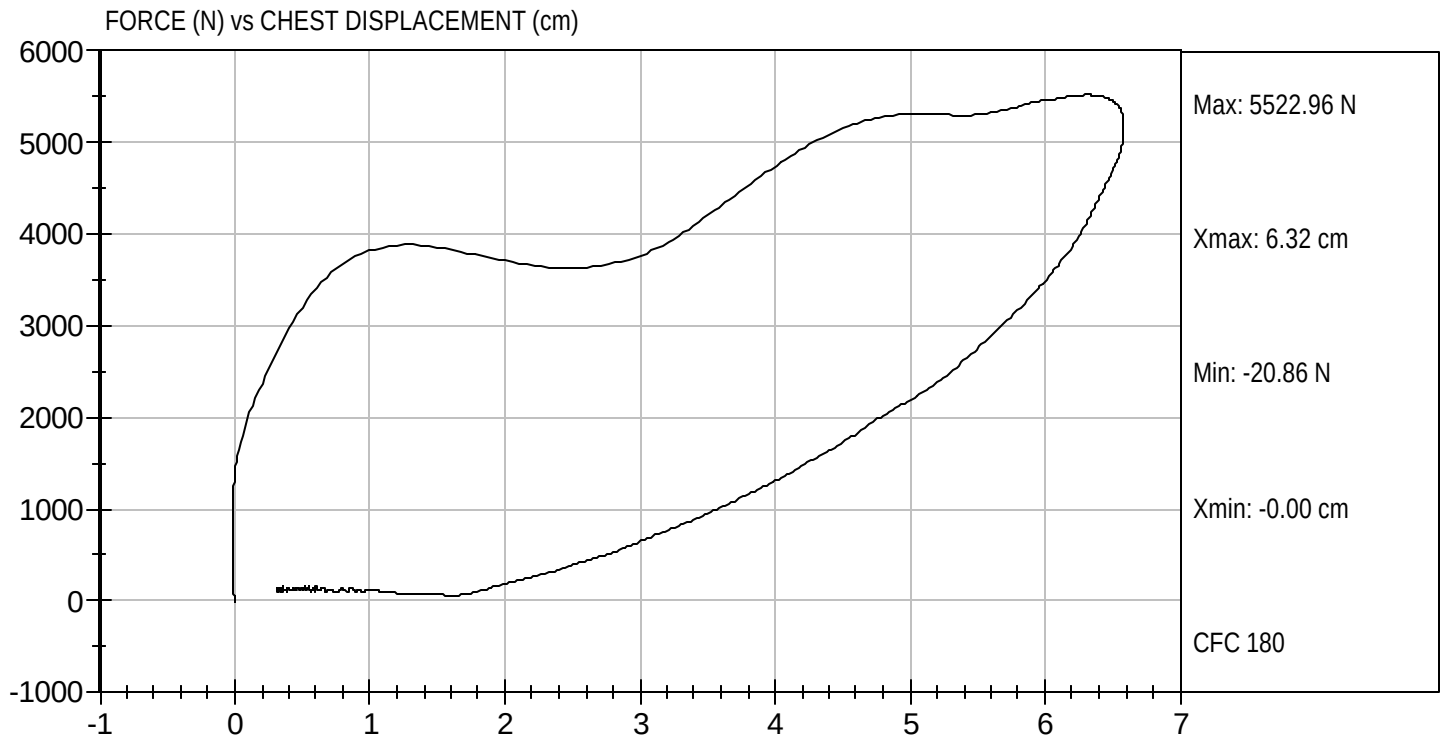
07/28/2006  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Componet ID: D062174

Test Date: 07/28/2006  
Velocity: 21.71 ft/s, 6.62 m/s



DATA SHEET A7  
LEFT KNEE IMPACT TEST (572.35)

Dummy Serial Number 401

Test Date 7/28/06

Technician Dave Wilcox

   Pretest calibration

X Post test calibration verification

Test attempt no. X (when successive knee impact tests are necessary)

   1. It has been at least 30 minutes since the last knee impact test.  
(572.36(m))

X N/A, ONLY one knee impact test performed

X 2. The test fixture conforms to the specifications in Figure 14A.

X 3. The leg assembly (86-5001-001) with the upper leg assembly (78051-46) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))

X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))

Record the maximum temperature 21.2

Record the minimum temperature 20.6

Record the maximum humidity 48%

Record the minimum humidity 45%

X 5. Mount the test specimen and secure it to the rigid test fixture.  
(572.35(b)(2)(iii)) (Figure 14A)

X 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))

X 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally.  
(572.35(b)(2)(iv)&(vi))

X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))

X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95  
(572.136(m)) Class 600.

X 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

X 11. Complete the following table:

Knee Impact Results (572.35(b)(1))

| Parameter              | Specification               | Result |
|------------------------|-----------------------------|--------|
| Probe speed            | 6.8 ft/s ≤ speed ≤ 7.0 ft/s | 6.9    |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb   | 1200   |

\*Force = impactor mass x deceleration (572.35(b)(1))

X 12. Plots of pendulum acceleration, pendulum speed, and force, follow this sheet. Time zero is defined as the time of contact between the test probe and the knee. (572.3(b)(2)(vii))

  
\_\_\_\_\_  
Signature

7/28/06  
\_\_\_\_\_  
Date

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

**ATD Serial No:** 401

**Test I.D:** D062176

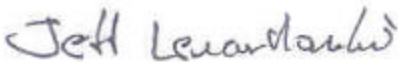
| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 20.5   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 45     | Pass      |
| Probe Velocity               | m/sec   | 2.07 to 2.13  | 2.10   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 5,336  | Pass      |
| Overall Test Results         |         |               |        | Pass      |



Laboratory Technician

07/28/2006

Test Date

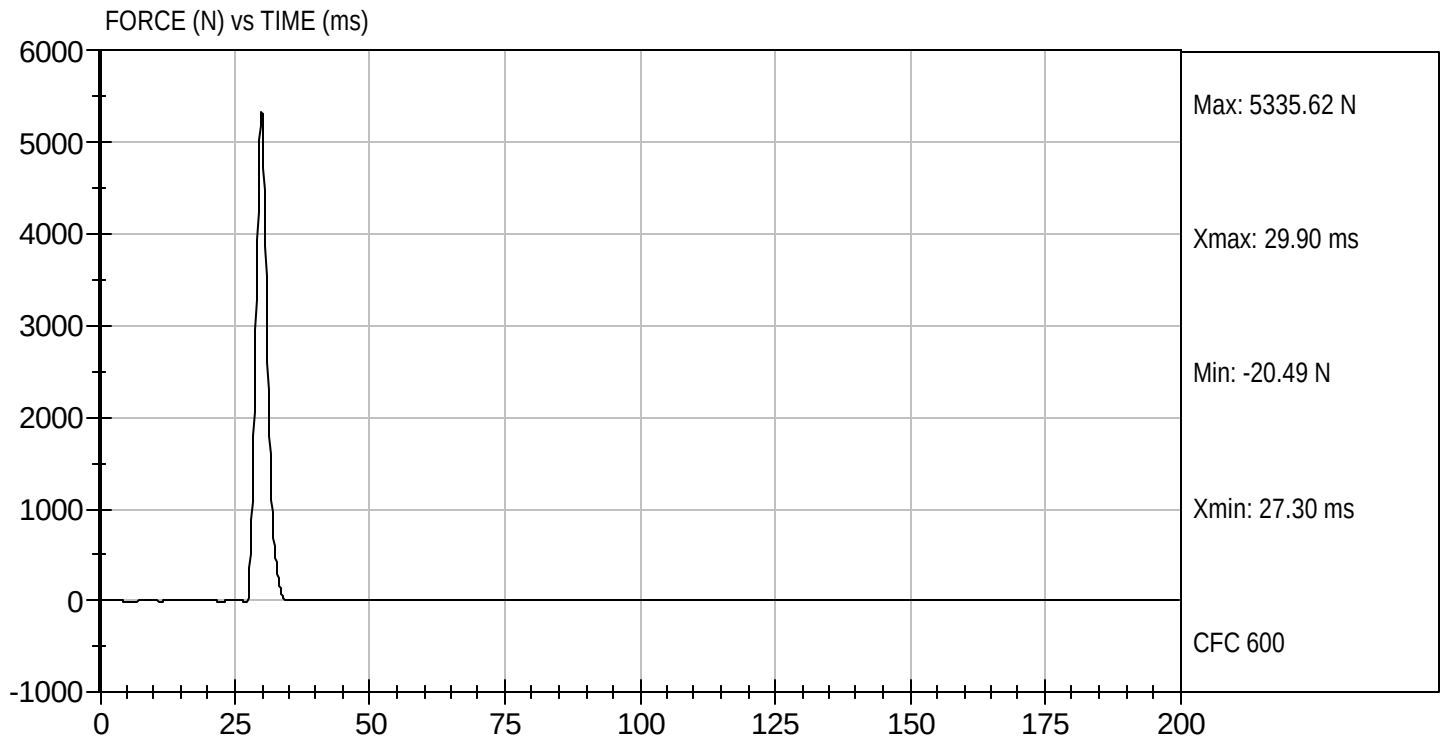


Approved By



Test Desc: Left Knee  
Componet ID: D062176

Test Date: 07/28/2006  
Velocity: 6.89 ft/s, 2.10 m/s



DATA SHEET A8  
RIGHT KNEE IMPACT TEST (572.35)

Dummy Serial Number 401

Test Date 7/28/06

Technician Dave Wilcox

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test.  
(572.36(m))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14A.

☒ 3. The leg assembly (86-5001-002) with the upper leg assembly (78051-47) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))

Record the maximum temperature 21.2

Record the minimum temperature 20.6

Record the maximum humidity 48%

Record the minimum humidity 45%

☒ 5. Mount the test specimen and secure it to the rigid test fixture.  
(572.35(b)(2)(iii)) (Figure 14A)

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))

☒ 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally.  
(572.35(b)(2)(iv)&(vi))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95  
(572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

☒ 11. Complete the following table:

Knee Impact Results (572.35(b)(1))

| Parameter              | Specification                         | Result |
|------------------------|---------------------------------------|--------|
| Probe speed            | 6.8 ft/s $\leq$ speed $\leq$ 7.0 ft/s | 6.9    |
| Peak resistance force* | 1060 lb $\leq$ force $\leq$ 1300 lb   | 1093   |

\*Force = impactor mass x deceleration (572.35(b)(1))



X 12. Plots of pendulum acceleration, pendulum speed, and force, follow this sheet. Time zero is defined as the time of contact between the test probe and the knee. (572.3(b)(2)(vii))

  
\_\_\_\_\_  
Signature

7/28/06  
\_\_\_\_\_  
Date

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

**ATD Serial No:** 401

**Test I.D:** D062175

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 20.8   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 46     | Pass      |
| Probe Velocity               | m/sec   | 2.07 to 2.13  | 2.12   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 4,864  | Pass      |
| Overall Test Results         |         |               |        | Pass      |



Laboratory Technician

07/28/2006

Test Date

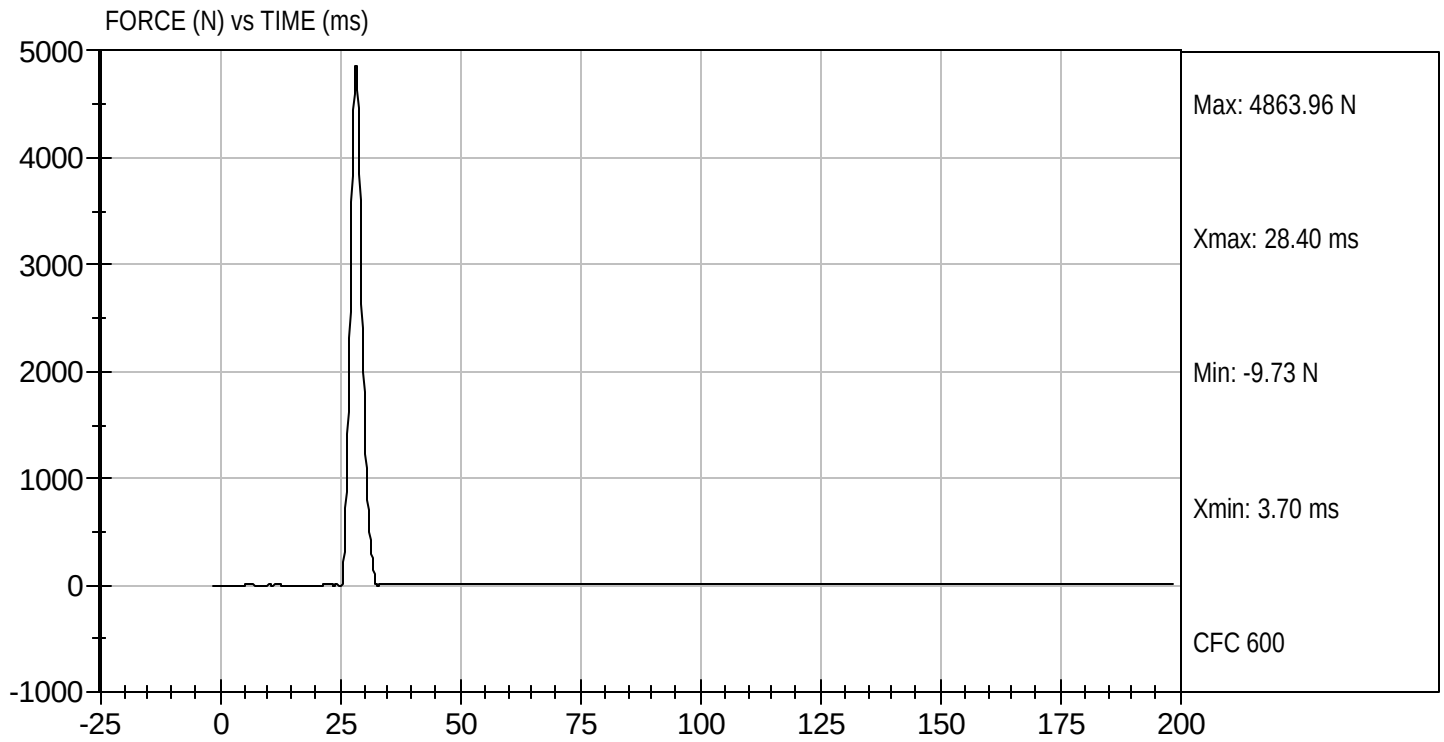


Approved By



Test Desc: Right Knee  
Componet ID: D062175

Test Date: 07/28/2006  
Velocity: 6.94 ft/s, 2.12 m/s



DATA SHEET A9  
HIP JOINT-FEMUR FLEXION (572.35(c))

Dummy Serial Number 401

Test Date 7/27/06

Technician Tim Bratz

     Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive hip joint-femur flexion tests are necessary)

1. It has been at least 30 minutes since the last hip joint-femur flexion test. (572.36(m))  
     X N/A, ONLY one hip joint-femur flexion test performed
- X 2. The test fixture conforms to the specifications in Figure 17A.
- X 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):  
     X 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)  
     X 3.2 remove the abdominal insert (78051-52)  
     X 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).
- X 4. The assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(c)(v))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.2</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity    | <u>51%</u>  |
| Record the minimum humidity    | <u>46%</u>  |
- X 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))
- X 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))
- X 7. Adjust the threaded rods until plane B is horizontal.
- X 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))
- X 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

X 10. Complete the following table:

Left Hip Joint-Femur Flexion Results (572.35(c)(1) & (c)(2)(iv))

| Parameter                    | Specification                                         | Result |
|------------------------------|-------------------------------------------------------|--------|
| Rotation Rate                | $5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$ | 8      |
| Femur Torque at $30^{\circ}$ | $\text{torque} \leq 70 \text{ ft-lbf}$                | 48     |
| Rotation at 150 lbf-ft       | $40^{\circ} \leq \text{rotation} \leq 50^{\circ}$     | 42     |

X 11. Secure the lever arm into the right femur shaft opening of the upper leg structure assembly (78051-44) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

X 12. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the  $\frac{1}{2}$  in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19). (572.35(c)(2)(iv))

X 13. Complete the following table:

Right Hip Joint-Femur Flexion Results (572.35(c)(1) & (c)(2)(iv))

| Parameter                    | Specification                                         | Result |
|------------------------------|-------------------------------------------------------|--------|
| Rotation Rate                | $5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$ | 8      |
| Femur Torque at $30^{\circ}$ | $\text{torque} \leq 70 \text{ ft-lbf}$                | 63     |
| Rotation at 15 lbf-ft        | $40^{\circ} \leq \text{rotation} \leq 50^{\circ}$     | 41     |

  
Signature

7/27/06  
Date

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

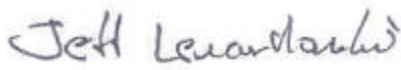
**ATD Serial No:** 401

**Test I.D:** D062170

| Tested Parameter             | Units   | Specification                 | Result |      | Pass/Fail |
|------------------------------|---------|-------------------------------|--------|------|-----------|
|                              |         |                               | Right  | Left |           |
| Laboratory Temperature       | deg C   | 18.9 to 25.6                  | 21.1   | 21.1 | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70                      | 46     | 46   | Pass      |
| Rotation Rate                | deg/sec | 5 to 10                       | 8      | 8    | Pass      |
| 30 Degrees                   | Nm      | 94.9 Nm Max                   | 85.3   | 64.8 | Pass      |
| 150 ft-lbf / 203.4 Nm        | Deg     | 40- 50 Degree<br>Max Rotation | 41     | 42   | Pass      |
| Overall Test Results         |         |                               |        | Pass |           |

  
 Laboratory Technician

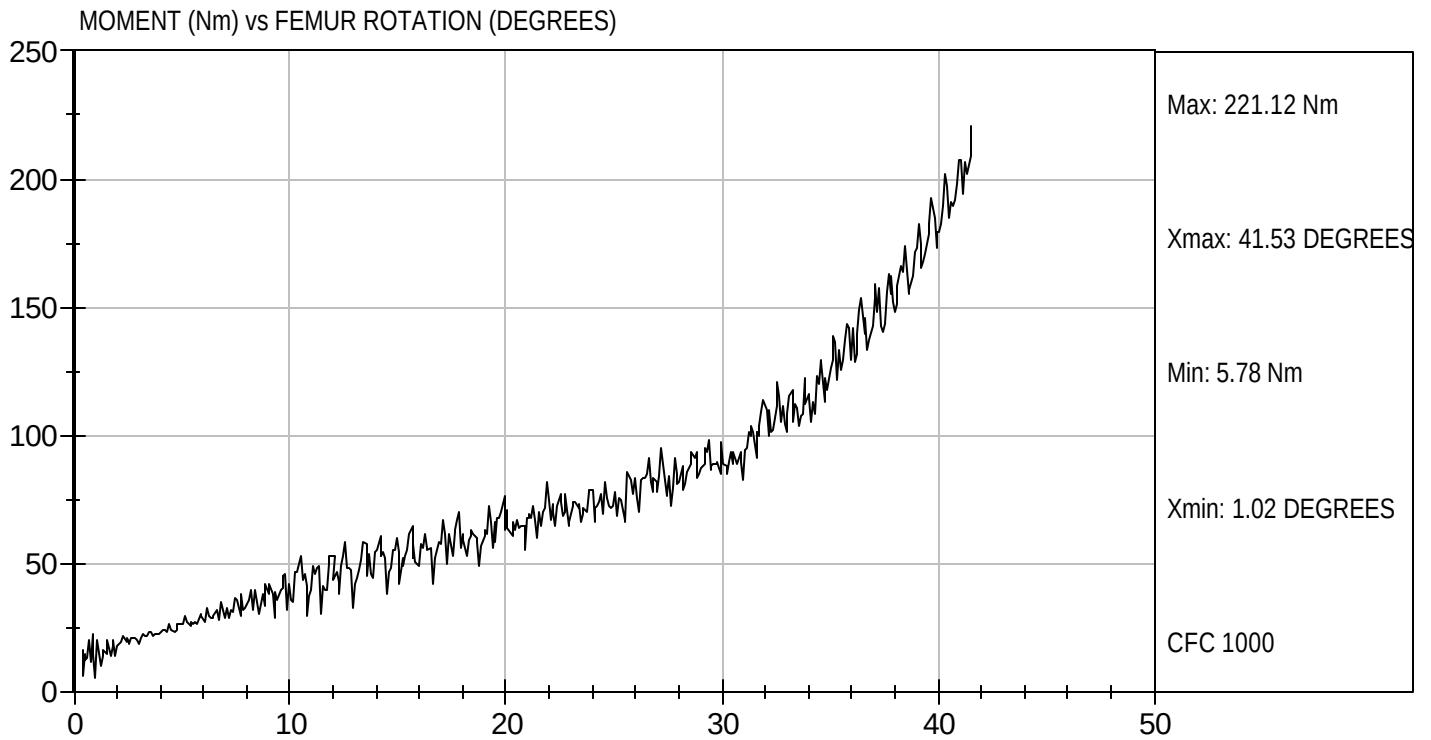
07/27/2006  
 Test Date

  
 Approved By



Test Desc: Hip Femur Flexion  
Componet ID: D062179

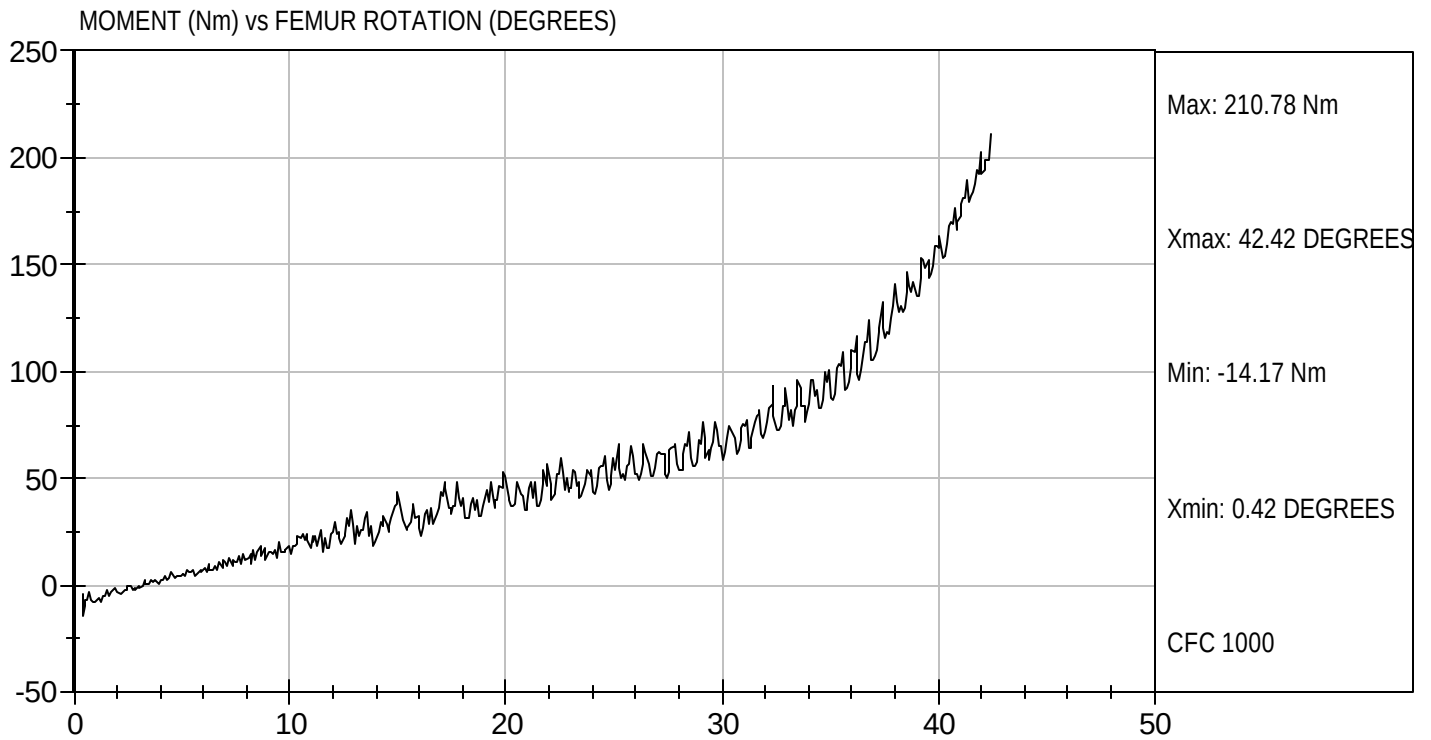
Test Date: 07/27/2006  
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion  
Componet ID: D062170

Test Date: 07/27/2006  
Velocity: 0 ft/s, 0.00 m/s





| HYBRID III 50 <sup>th</sup> SN #401, 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                   | 20.2               |
| C                                                                            | H-POINT HEIGHT                 | Reference                                                                                                                                    | 3.3-3.5                     | 3.5                |
| 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                     | 6.0                |
| G                                                                            | BACK OF ELBOW TO WRIST PIVOT   | Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots                                                           | 11.4-12.0                   | 11.5               |
| H                                                                            | HEAD BACK TO BACKLINE          | Back of skull cap skin to seat rear vertical surface (Reference)                                                                             | 1.6-1.8                     | 1.8                |
| 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                   | 13.5               |
| J                                                                            | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 7.5-8.3                     | 7.8                |
| K                                                                            | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the rear vertical surface of the fixture.                                                         | 22.8-23.8                   | 23.1               |
| L                                                                            | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 16.9-17.9                   | 17.5               |
| M                                                                            | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 19.1-19.7                   | 19.5               |
| N                                                                            | BUTTOCK POPLITEAL LENGTH       | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".                               | 17.8-18.8                   | 18.5               |

| HYBRID III 50 <sup>th</sup> SN #401, 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  | 10.2               |
| V                                                                             | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises | 16.3-17.2 | 16.7               |
| W                                                                             | FOOT BREADTH                                              | The widest part of the foot                       | 3.6-4.2   | 4.0                |
| Y                                                                             | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 16.9-17.1 in. above seat surface         | 38.2-39.4 | 38.5               |
| Z                                                                             | WAIST CIRCUMFERENCE                                       | Measured 8.9-9.1 in. above seat surface           | 32.9-34.1 | 33.3               |
| 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                |

DATA SHEET A1  
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 401

Test Date 7/25/06

Technician Jessica Gall

This check sheet is completed as part of the post test calibration verification.

X Perform general cleaning.

| Dummy Item                  | Inspect for                                                  | Comments | Damaged | OK |
|-----------------------------|--------------------------------------------------------------|----------|---------|----|
| Outer skin                  | Gashes, rips, cracks                                         |          |         | X  |
| Head                        | Ballast secure                                               |          |         | X  |
|                             | General appearance                                           |          |         | X  |
| Neck                        | Broken or cracked rubber                                     |          |         | X  |
|                             | Upper neck bracket firmly attached to the lower neck bracket |          |         | X  |
|                             | Looseness at the condyle joint                               |          |         | X  |
|                             | Nodding blocks cracked or out of position                    |          |         | X  |
| Spine                       | Broken or cracks in rubber.                                  |          |         | X  |
| Ribs                        | Broken or bent ribs                                          |          |         | X  |
|                             | Broken or bent rib supports                                  |          |         | X  |
|                             | Damping material separated or cracked                        |          |         | X  |
|                             | Rubber bumpers in place                                      |          |         | X  |
| Chest Displacement Assembly | Bent shaft                                                   |          |         | X  |
|                             | Slider arm riding in track                                   |          |         | X  |
| Transducer leads            | Torn cables                                                  |          |         | X  |

| Dummy Item              | Inspect for                           | Comments | Damaged | OK |
|-------------------------|---------------------------------------|----------|---------|----|
| Accelerometer Mountings | Head mounting secure                  |          |         | X  |
|                         | Chest mounting secure                 |          |         | X  |
| Knees                   | Skin condition                        |          |         |    |
|                         | Insert (do not remove)                |          |         | X  |
|                         | Casting                               |          |         | X  |
| Limbs                   | Normal movement and adjustment        |          |         | X  |
| Knee Sliders            | Wires intact                          |          |         | X  |
|                         | Rubber returned to "at rest" position |          |         | X  |
| Pelvis                  | Broken                                |          |         | X  |
| Other                   |                                       |          |         | X  |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

Jessica Hall  
Signature

7/28/06  
Date

Describe the repair or replacement of parts:

Checked by

Jeff Leonard  
Signature

7/28/06  
Date

| HYBRID III 50 <sup>th</sup> SN #403, 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                   | 34.9               |
| 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                     | 3.5                |
| D                                                                            | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                    | 5.3-5.5                     | 5.5                |
| E                                                                            | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                   | 3.3-3.7                     | 3.6                |
| F                                                                            | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                    | 5.5-6.1                     | 5.9                |
| 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                   | 11.4               |
| H                                                                            | HEAD BACK TO BACKLINE          | Back of skull cap skin to seat rear vertical surface (Reference)                                                                             | 1.6-1.8                     | 1.6                |
| 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                   | 13.5               |
| J                                                                            | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 7.5-8.3                     | 8.3                |
| 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                   | 23.5               |
| L                                                                            | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 16.9-17.9                   | 17.5               |
| M                                                                            | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 19.1-19.7                   | 19.6               |
| N                                                                            | BUTTOCK POPLITEAL LENGTH       | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".                               | 17.8-18.8                   | 18.5               |

| HYBRID III 50 <sup>th</sup> SN #403, 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  | 10.2               |
| V                                                                             | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises | 16.3-17.2 | 16.8               |
| W                                                                             | FOOT BREADTH                                              | The widest part of the foot                       | 3.6-4.2   | 3.9                |
| Y                                                                             | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 16.9-17.1 in. above seat surface         | 38.2-39.4 | 38.8               |
| Z                                                                             | WAIST CIRCUMFERENCE                                       | Measured 8.9-9.1 in. above seat surface           | 32.9-34.1 | 33.2               |
| 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                |

DATA SHEET A3  
HEAD DROP TEST (572.32)

Dummy Serial Number 403

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

☐ 1. It has been at least 3 hours since the last head drop. (572.32(c)(5))

☒ N/A, ONLY one head drop performed

☒ 2. The head assembly consists of the complete head (78051-61X), the neck transducer structural replacement (78051-383X), and three (3) accelerometers. (572.32(b))

☒ 3. Torque the skull cap screws to 160 lbf-in.

☒ 4. Accelerometers and their respective mounts are smooth and clean.

☒ 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.35(ii))

☒ 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.32(c)(1))

Record the maximum temperature 21.6

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 44%

☒ 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

☒ 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, 1,1,1 trichloroethane or equivalent prior to the test. (572.32(c)(2))

- X 9. Suspend and orient the head assembly as shown in Figure 6A. The lowest point on the forehead is 0.5 in. below the lowest point on the dummy's nose when the midsagittal plane is vertical. (572.32(c)(3))  
Record the actual distance 14.8"

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X 10. The 1.6 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 7A.  
Record the right side distance 469mm  
Record the left side distance 469mm
- X 11. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.32(c)(4))  
Record actual micro finish  $656 \times 10^{-6}$  mm
- X 12. The impact surface is rigidly supported. (572.32(c)(4))
- X 13. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (Figure 6A)  
Record thickness 50.9mm  
Record width 60.4mm  
Record length 595mm
- X 14. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))
- X 15. Complete the following table using channel class 1000 data. (572.36(i)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $225 \text{ g} \leq x \leq 275 \text{ g}$        | 231    |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | 11     |

- X 16. Plots of the x, y, z, and resultant acceleration data follow this sheet.

  
Signature

6/7/06  
Date



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

ATD Serial No: 403

Test ID: D061671

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.6   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 48     | Pass      |
| Peak Resultant Acceleration  | G's   | 225 to 275         | 231    | Pass      |
| Peak Lateral Acceleration    | G's   | $\leq \pm 15.0$    | 10.8   | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    | Pass   |           |

  
Laboratory Technician

06/07/2006  
Test Date

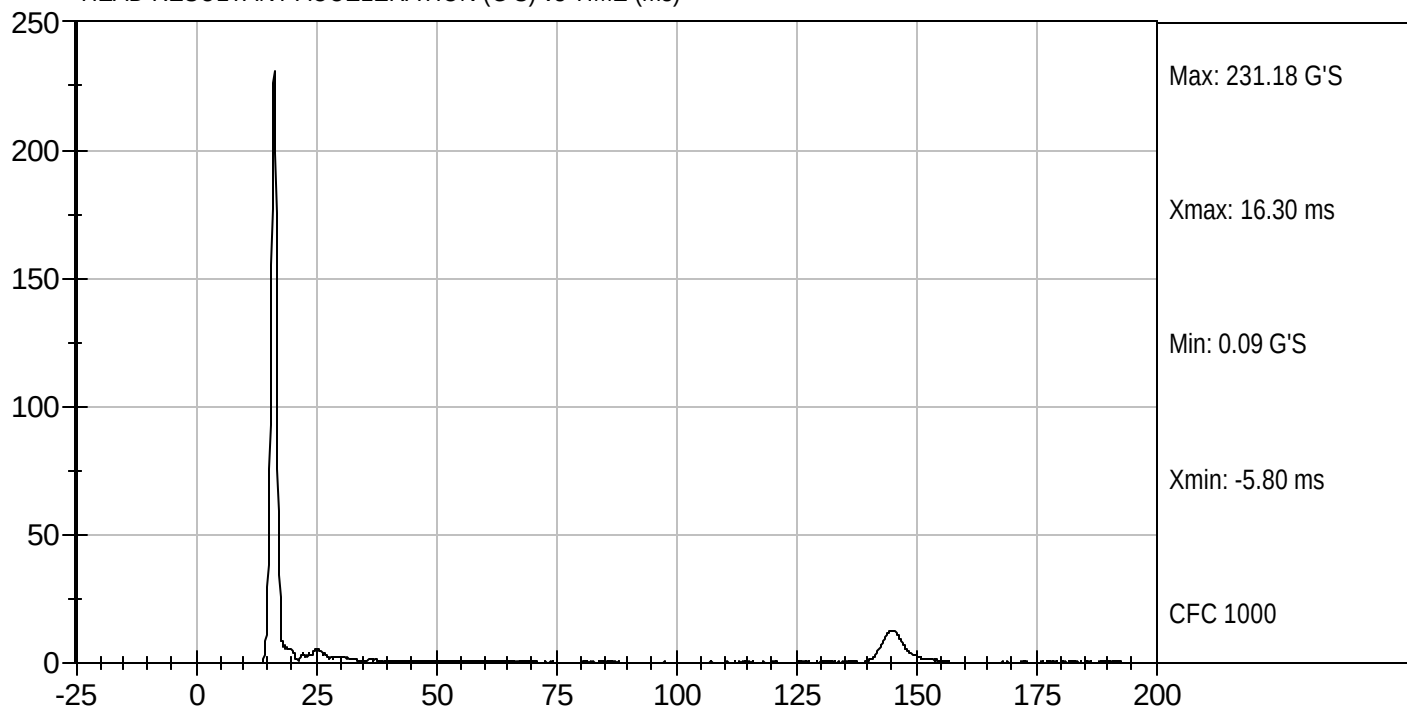
  
Approved By



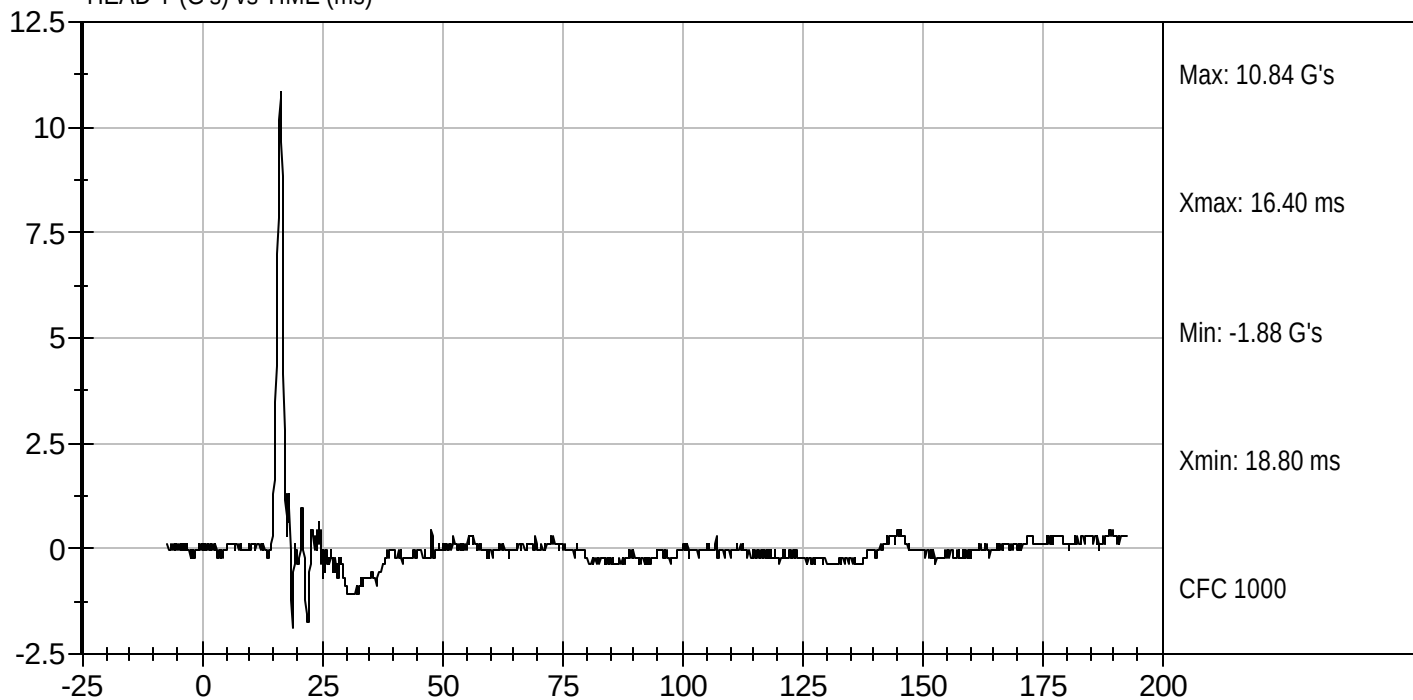
Test Desc: Head Impact  
Componet ID: D061671

Test Date: 06/07/2006  
Velocity: 0 ft/s, 0.00 m/s

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



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



DATA SHEET A4  
NECK FLEXION TEST (572.33)

Dummy Serial Number 403

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

☐ 1. It has been at least 30 minutes since the last flexion test. (572.36(m))

☒ N/A, ONLY one flexion test performed

☒ 2. The components required for the neck tests include the head assembly (78051-61X), neck assembly (78051-90), bib simulator (78051-84), upper neck adjusting bracket (78051-307), lower neck adjusting bracket (78051-303), six axis neck transducer (C-1709) and either three accelerometers or their mass equivalent installed in the head assembly. Data from the accelerometers are not required. (572.33(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))

Record the maximum temperature 21.6

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 44%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made. Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration.

Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (78051-90).

Record findings and actions: No Deterioration Hardness Front 82; Rear 85

☒ 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to  $1.0 \pm 0.2$  lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))

☐ N/A – post test calibration

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

Neck Flexion Test Results (572.33(b)(1) & (572.33(c)(4))

| Parameter                                                               |             | Specification                                                        | Result |
|-------------------------------------------------------------------------|-------------|----------------------------------------------------------------------|--------|
| Pendulum impact speed                                                   |             | $22.6 \text{ ft/sec} \leq \text{speed} \leq 23.4 \text{ ft/sec}$     | 23.2   |
| Pendulum<br>Deceleration<br>Versus Time<br>Pulse                        | @ 10ms      | $22.5 \leq g \leq 27.5$                                              | 23.5   |
|                                                                         | @ 20 ms     | $17.6 \leq g \leq 22.6$                                              | 21.6   |
|                                                                         | @30ms       | $12.5 \leq g \leq 18.5$                                              | 15.4   |
|                                                                         | Above 30 ms | 29 g maximum                                                         | 15     |
| First Pendulum Decay to 5g                                              |             | $34 \text{ ms} \leq \text{time} \leq 42 \text{ ms}$                  | 37     |
| Plane D Rotation                                                        |             | $64^\circ \leq \text{max. rotation} \leq 78^\circ$                   | 73     |
|                                                                         |             | $57 \text{ ms} \leq \text{time of max. rotation} \leq 64 \text{ ms}$ | 59     |
| Time for Plane D Rotation to Cross $0^\circ$ During First Rebound       |             | $113 \text{ ms} \leq \text{time} \leq 128 \text{ ms}$                | 117    |
| Maximum Moment                                                          |             | $65 \text{ lbf-ft} \leq \text{moment} \leq 80 \text{ lbf-ft}$        | 72     |
|                                                                         |             | $47 \text{ ms} \leq \text{time of max. moment} \leq 58 \text{ ms}$   | 51     |
| Time of first decay to 0 lbf-ft<br>Positive Moment Decay**<br>(Flexion) |             | $97 \text{ ms} \leq \text{time} \leq 107 \text{ ms}$                 | 101    |

\*Moment about the occipital condyle =  $M_y - (0.058 \text{ ft} \times F_x)$   
(572.33(b)(1)(ii))

$M_y$  = Moment in lbf-ft measured by the transducer

$F_x$  = Force, in lbf measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

X 14. Plots of pendulum acceleration, y-axis moment, x-axis force, y-axis moment about the occipital condyle, and D plane rotation follows this sheet.

  
Signature

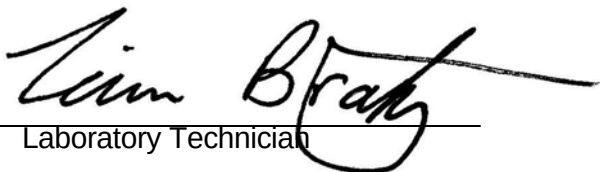
6/7/06  
Date

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

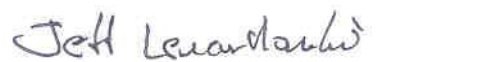
ATD Serial No: 403

Test I.D: D061672

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.1   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 44     | Pass      |
| Pendulum Velocity                              |         | m/s     | 6.89 to 7.13   | 7.08   | Pass      |
| Pendulum Deceleration                          | 10 msec | G's     | 22.50 to 27.50 | 23.51  | Pass      |
|                                                | 20 msec | G's     | 17.60 to 22.60 | 21.60  | Pass      |
|                                                | 30 msec | G's     | 12.50 to 18.50 | 15.41  | Pass      |
| Peak Pendulum Deceleration After 30 msec       |         | G's     | $\leq 29.0$    | 15.39  | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | msec    | 34.0 to 42.0   | 37.3   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 64.0 to 78.0   | 73.2   | Pass      |
|                                                | Time    | msec    | 57.0 to 64.0   | 58.6   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | msec    | 113.0 to 128.0 | 117.4  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | 88.1 to 108.5  | 96.9   | Pass      |
|                                                | Time    | msec    | 47.0 to 58.0   | 50.6   | Pass      |
| Positive Moment Decay Time To Zero Crossing    |         | msec    | 97.0 to 107.0  | 100.5  | Pass      |
| Overall Test Results                           |         |         |                |        | Pass      |

  
 Laboratory Technician

06/07/2006  
 Test Date

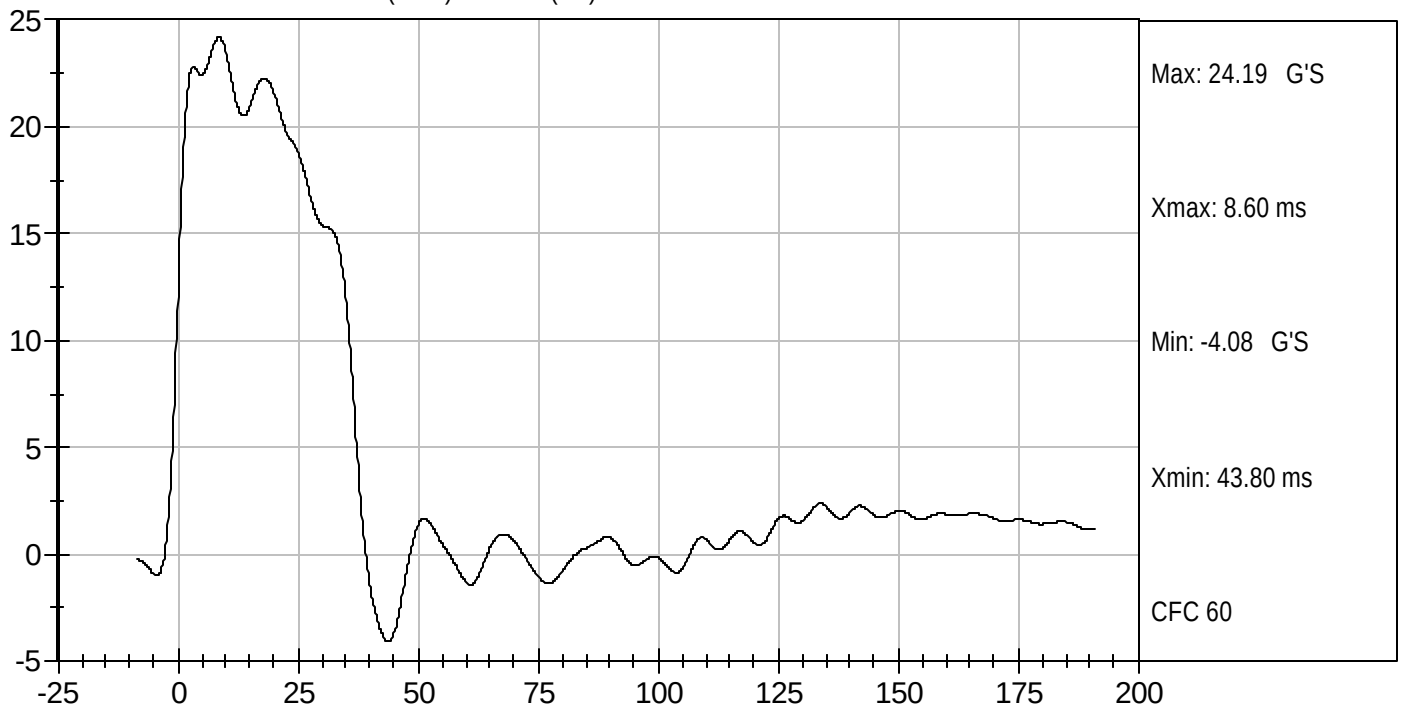
  
 Approved By



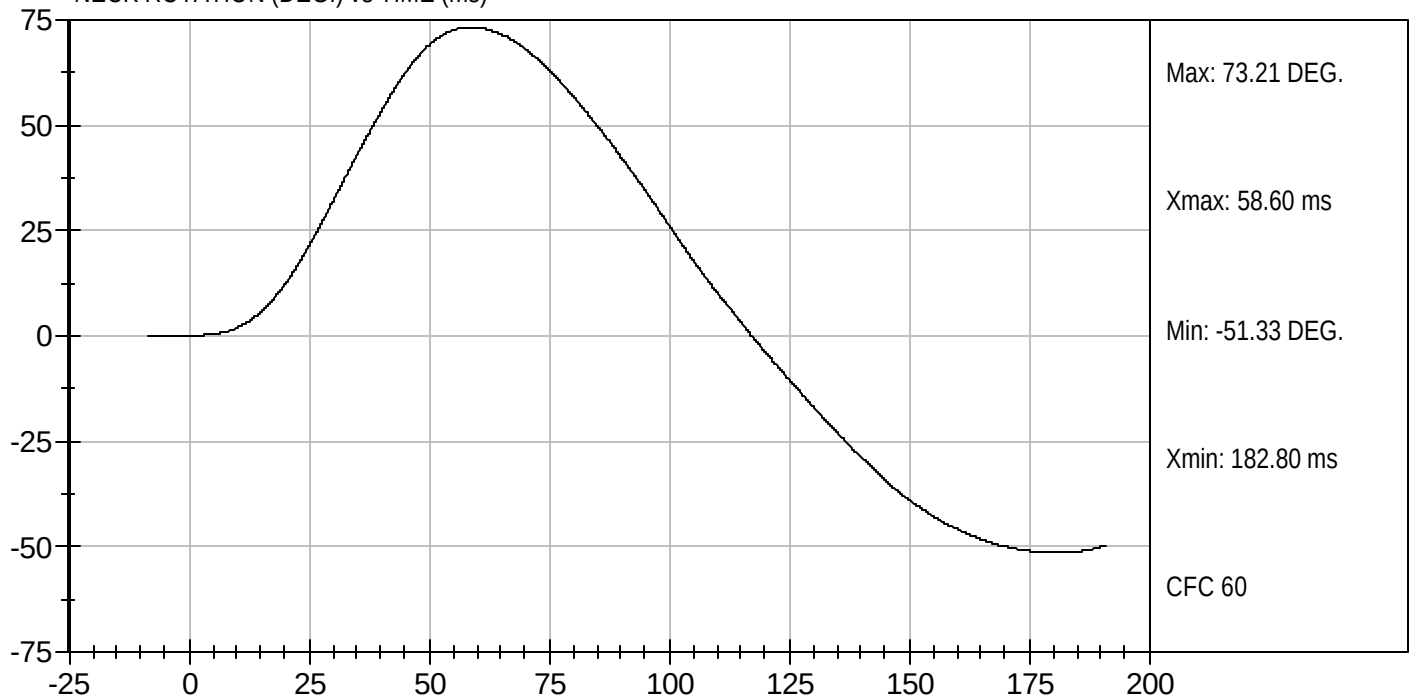
Test Desc: Neck Flexion  
Componet ID: D061672

Test Date: 06/07/2006  
Velocity: 23.22 ft/s, 7.08 m/s

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



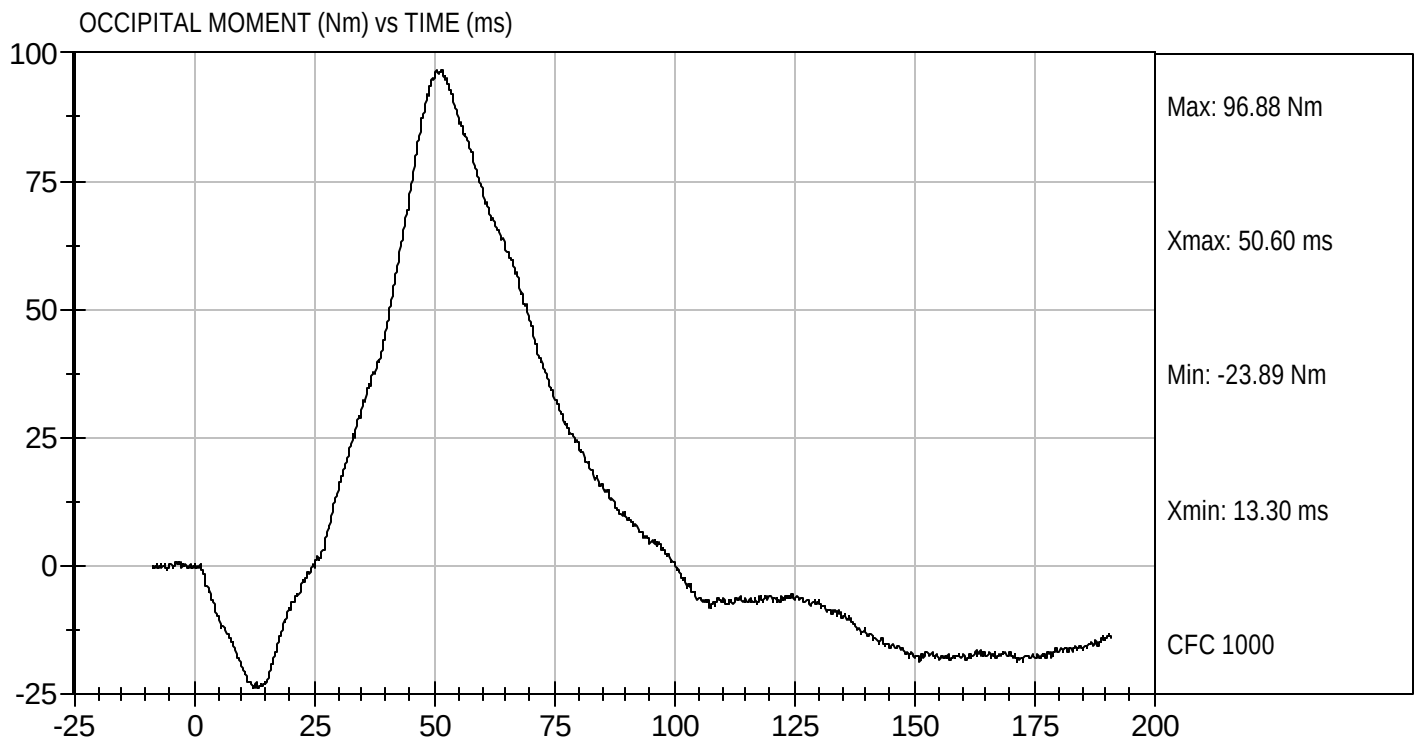
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Flexion  
Componet ID: D061672

Test Date: 06/07/2006  
Velocity: 23.22 ft/s, 7.08 m/s





DATA SHEET A5  
NECK EXTENSION TEST (572.33)

Dummy Serial Number 403

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

☐ 1. It has been at least 30 minutes since the last extension test. (572.36(m))

☒ N/A, ONLY one extension test performed

☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.33(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))

Record the maximum temperature 21.6

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 44%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made. Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration.

Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration Hardness Front 82; Rear 85

- X 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to  $1.0 \pm 0.2$  lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))  
         N/A – post test calibration
- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/s as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

Neck Extension Test Results (572.33(b)(2) & (572.33(c)(4))

| Parameter                                                           |             | Specification                                                        | Result |
|---------------------------------------------------------------------|-------------|----------------------------------------------------------------------|--------|
| Pendulum impact speed                                               |             | $19.5 \text{ ft/sec} \leq \text{speed} \leq 20.3 \text{ ft/sec}$     | 20.0   |
| Pendulum Deceleration versus time pulse                             | @ 10ms      | $17.2 \leq g \leq 21.2$                                              | 18.3   |
|                                                                     | @ 20 ms     | $14 \leq g \leq 19$                                                  | 17.4   |
|                                                                     | @30ms       | $11.0 \leq g \leq 16.0$                                              | 13.5   |
|                                                                     | Above 30 ms | 22 g maximum                                                         | 13     |
| First Pendulum Decay to 5g                                          |             | $38 \text{ ms} \leq \text{time} \leq 46 \text{ ms}$                  | 40     |
| Plane D Rotation                                                    |             | $81^\circ \leq \text{max. rotation} \leq 106^\circ$                  | 100    |
|                                                                     |             | $72 \text{ ms} \leq \text{time of max. rotation} \leq 82 \text{ ms}$ | 79     |
| Time for Plane D Rotation to Cross $0^\circ$ During First Rebound   |             | $147 \text{ ms} \leq \text{time} \leq 174 \text{ ms}$                | 161    |
| Maximum Moment                                                      |             | $-59 \text{ lbf-ft} \leq \text{moment} \leq -39 \text{ lbf-ft}$      | -51    |
|                                                                     |             | $65 \text{ ms} \leq \text{time} \leq 79 \text{ ms}$                  | 73     |
| Time of first decay to 0 lbf-ft Negative Moment Decay** (Extension) |             | $120 \text{ ms} \leq \text{time} \leq 148 \text{ ms}$                | 142    |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$   
(572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

X 14. Plots of pendulum acceleration, y-axis moment, x-axis force, y-axis moment about the occipital condyle, and D plane rotation follows this sheet.

  
Signature

6/7/06  
Date

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

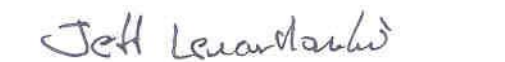
ATD Serial No: 403

Test I.D: D061673

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 21.0   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 46     | Pass      |
| Pendulum Velocity                              |         | m/s     | 5.95 to 6.19   | 6.10   | Pass      |
| Pendulum Deceleration                          | 10 msec | G's     | 17.20 to 21.20 | 18.33  | Pass      |
|                                                | 20 msec | G's     | 14.00 to 19.00 | 17.36  | Pass      |
|                                                | 30 msec | G's     | 11.00 to 16.00 | 13.50  | Pass      |
| Peak Pendulum Deceleration After 30 msec       |         | G's     | $\leq 22.0$    | 13.45  | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | msec    | 38.0 to 46.0   | 40.0   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 81.0 to 106.0  | 99.9   | Pass      |
|                                                | Time    | msec    | 72.0 to 82.0   | 78.5   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | msec    | 147.0 to 174.0 | 161.4  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | -52.9 to -79.9 | -69.1  | Pass      |
|                                                | Time    | msec    | 65.0 to 79.0   | 73.0   | Pass      |
| Negative Moment Decay Time To Zero Crossing    |         | msec    | 120.0 to 148.0 | 142.2  | Pass      |
| Overall Test Results                           |         |         |                | Pass   |           |

  
 Laboratory Technician

06/07/2006  
 Test Date

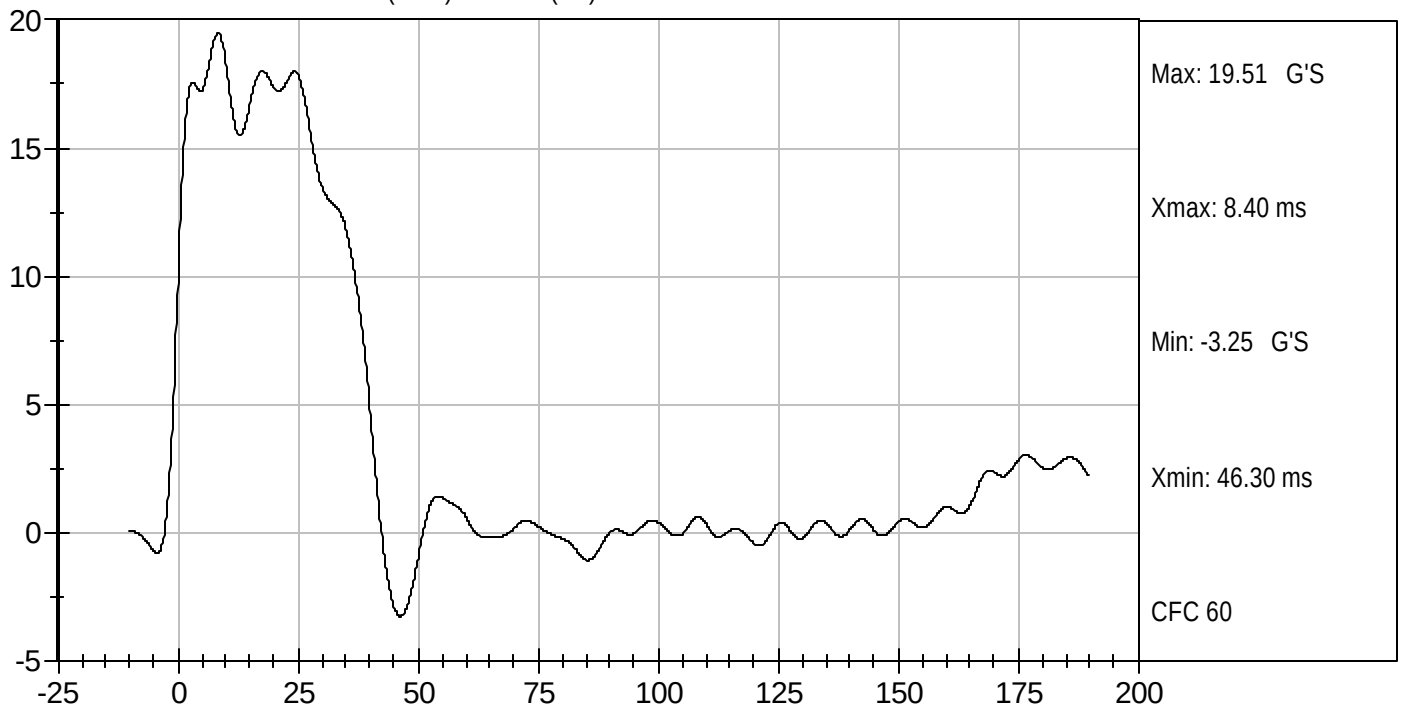
  
 Approved By



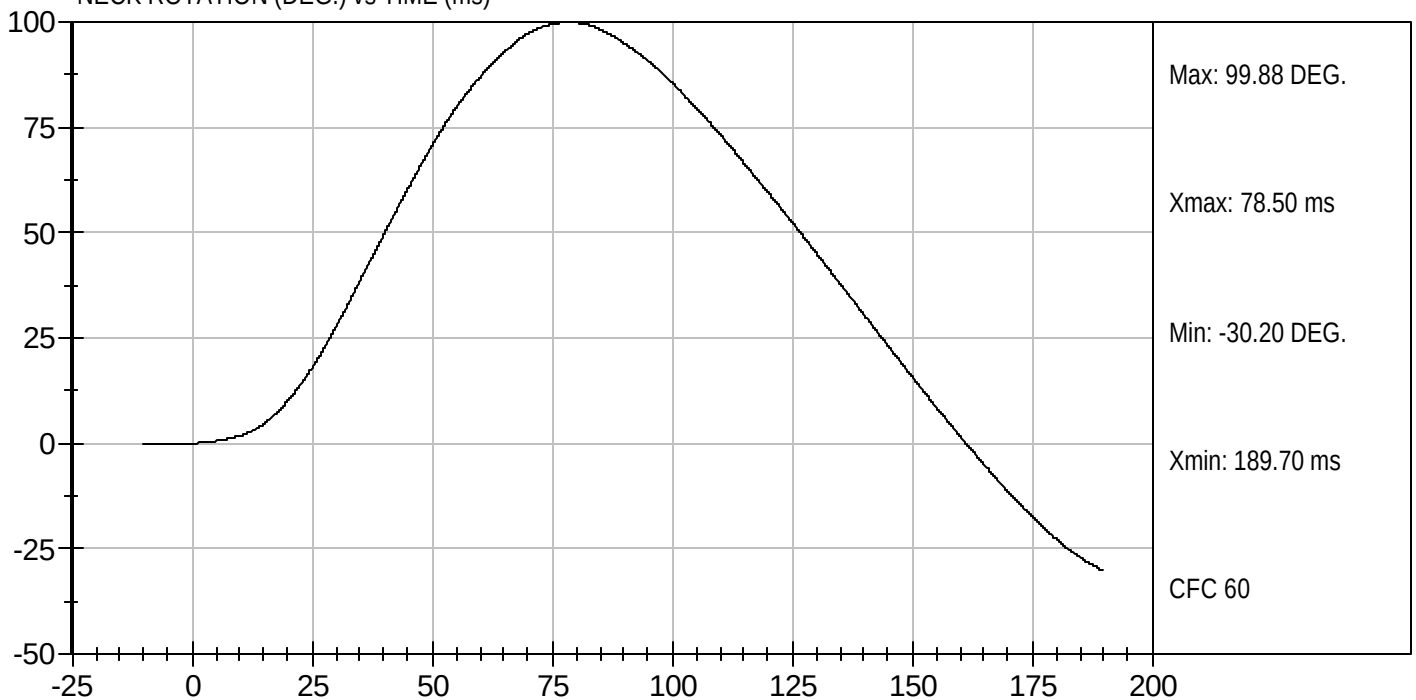
Test Desc: Neck Extension  
Componet ID: D061673

Test Date: 06/07/2006  
Velocity: 20.01 ft/s, 6.10 m/s

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



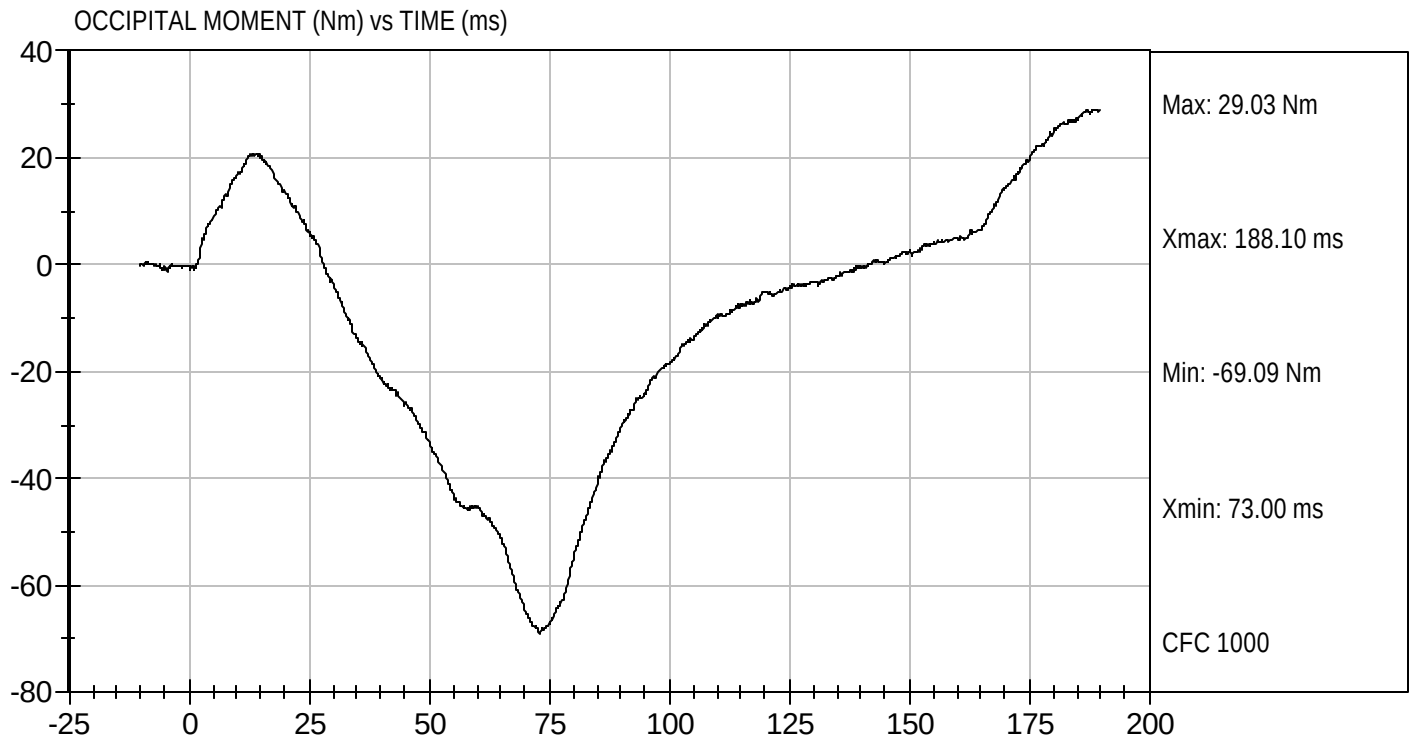
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Extension  
Componet ID: D061673

Test Date: 06/07/2006  
Velocity: 20.01 ft/s, 6.10 m/s



DATA SHEET A6  
THORAX IMPACT TEST (572.34)

Dummy Serial Number 403 Test Date 6/8/06

Technician Dave Wilcox

☒ Pretest calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last thorax impact test.  
(572.137(q))

☒ N/A, ONLY one thorax impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 12A.

☒ 3. The complete assembled dummy (78051-218) is used (572.34(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. No shoes are worn. (572.34(b))

☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.34(c)(1))

Record the maximum temperature 21.6

Record the minimum temperature 21.4

Record the maximum humidity 48%

Record the minimum humidity 44%

☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material (78051-17 thru 78051-22), chest displacement transducer assembly (78051-317) and the rear rib supports (78051-304). Inspect for rib deformation using the chest depth gage (83-5006-007). If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

☒ - No damage

☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage

\_\_\_\_\_

☐ - The following repairs or replacement was performed. Record

\_\_\_\_\_

\_\_\_\_\_

- X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572.34(c)(2))
- X 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $13^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (78051-532) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block. (572.34(c)(2))
- X 8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.34(c)(4))
- X 10. Align the adjustable neck bracket index marks to the "zero" position. (Figure 12A)
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 Class 180.
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.34(c)(5)) The velocity of the test probe at the time of impact is  $22 \text{ f/s} \pm 0.4 \text{ f/s}$ . (572.34(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.34(c)(6))



X 16. Complete the following table:

Thorax Impact Results (572.34(b))

| Parameter*              | Specification                                                   | Result |
|-------------------------|-----------------------------------------------------------------|--------|
| Test Probe Speed        | $21.6 \text{ f/s} \leq \text{speed} \leq 22.4 \text{ f/s}$      | 21.8   |
| Chest Compression       | $2.5 \text{ in.} \leq \text{compression} \leq 2.86 \text{ in.}$ | 2.58   |
| Peak resistance force** | $1160 \text{ lb} \leq \text{peak force} \leq 1325 \text{ lb}$   | 1287   |
| Internal Hysteresis***  | $69\% \leq \text{hysteresis} \leq 85\%$                         | 69%    |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.34(b))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve.

X 17. Plots of chest compression, pendulum acceleration, pendulum speed, and force, follow this sheet.



Signature

6/8/06

Date

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

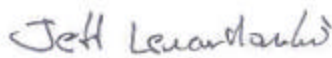
**ATD Serial No:** 403

**Test I.D:** D061674

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 20.6 to 22.2  | 21.4   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 44     | Pass      |
| Probe Velocity               | m/s   | 6.58 to 6.82  | 6.64   | Pass      |
| Peak Probe Force             | N     | 5159 to 5893  | 5,726  | Pass      |
| Peak Sternum Displacement    | cm    | 6.35 to 7.26  | 6.56   | Pass      |
| Internal Hysteresis          | %     | 69 to 85      | 69     | Pass      |
| Overall Test Results         |       |               | Pass   |           |

  
Laboratory Technician

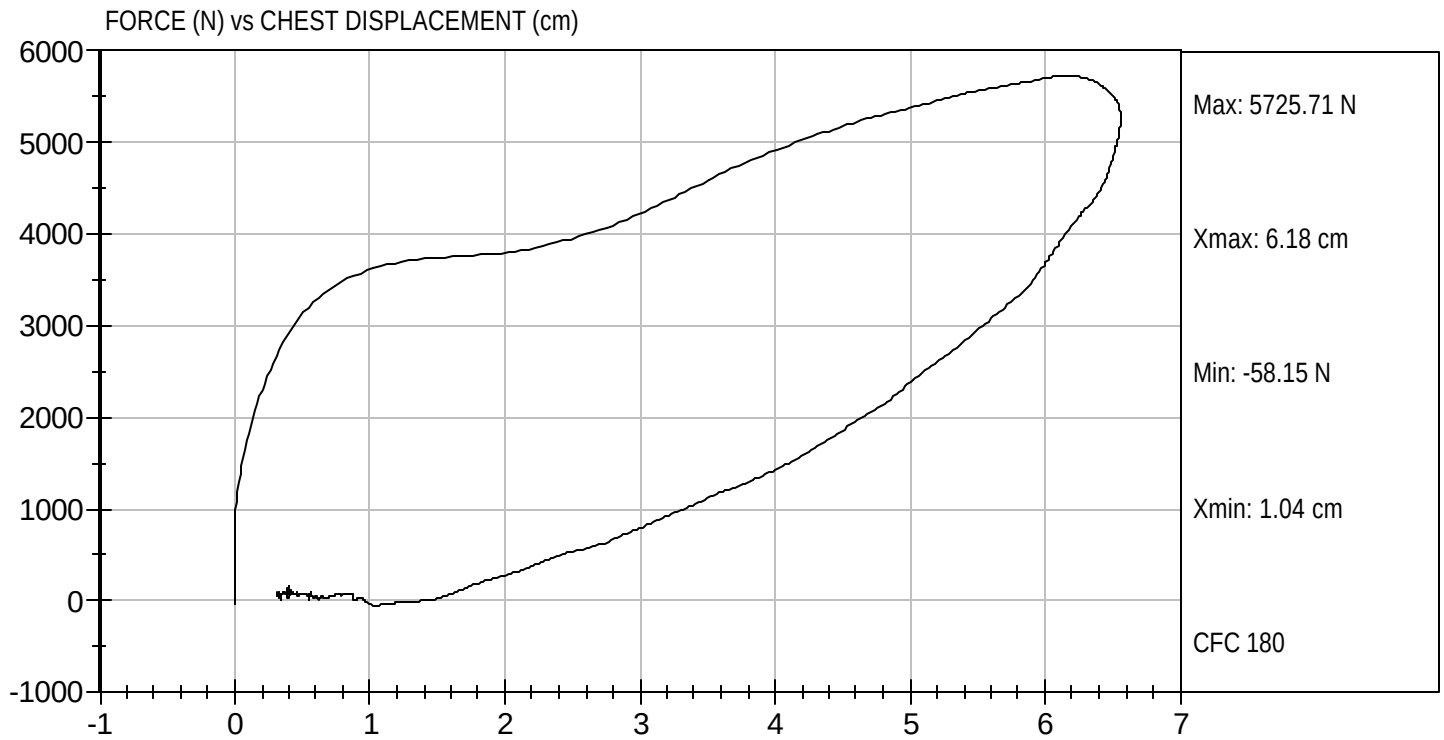
06/08/2006  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Componet ID: D061674

Test Date: 06/08/2006  
Velocity: 21.78 ft/s, 6.64 m/s



DATA SHEET A7  
LEFT KNEE IMPACT TEST (572.35)

Dummy Serial Number 403

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. ☒ (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test.  
(572.36(m))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14A.

☒ 3. The leg assembly (86-5001-001) with the upper leg assembly (78051-46) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))

Record the maximum temperature 21.6

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 44%

☒ 5. Mount the test specimen and secure it to the rigid test fixture.  
(572.35(b)(2)(iii)) (Figure 14A)

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))

☒ 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally.  
(572.35(b)(2)(iv)&(vi))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95  
(572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

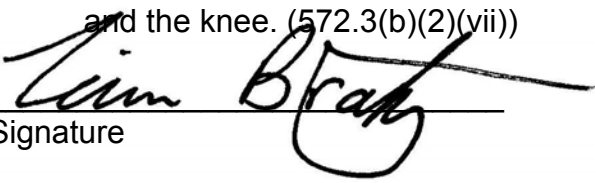
☒ 11. Complete the following table:

Knee Impact Results (572.35(b)(1))

| Parameter              | Specification                         | Result |
|------------------------|---------------------------------------|--------|
| Probe speed            | 6.8 ft/s $\leq$ speed $\leq$ 7.0 ft/s | 6.9    |
| Peak resistance force* | 1060 lb $\leq$ force $\leq$ 1300 lb   | 1084   |

\*Force = impactor mass x deceleration (572.35(b)(1))

X 12. Plots of pendulum acceleration, pendulum speed, and force, follow this sheet. Time zero is defined as the time of contact between the test probe and the knee. (572.3(b)(2)(vii))

  
Signature

6/7/06  
Date

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

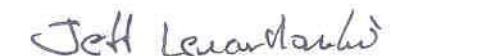
ATD Serial No: 403

Test I.D: D061676

| 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      | 48     | Pass      |
| Probe Velocity               | m/sec   | 2.07 to 2.13  | 2.11   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 4,821  | Pass      |
| Overall Test Results         |         |               |        | Pass      |

  
Laboratory Technician

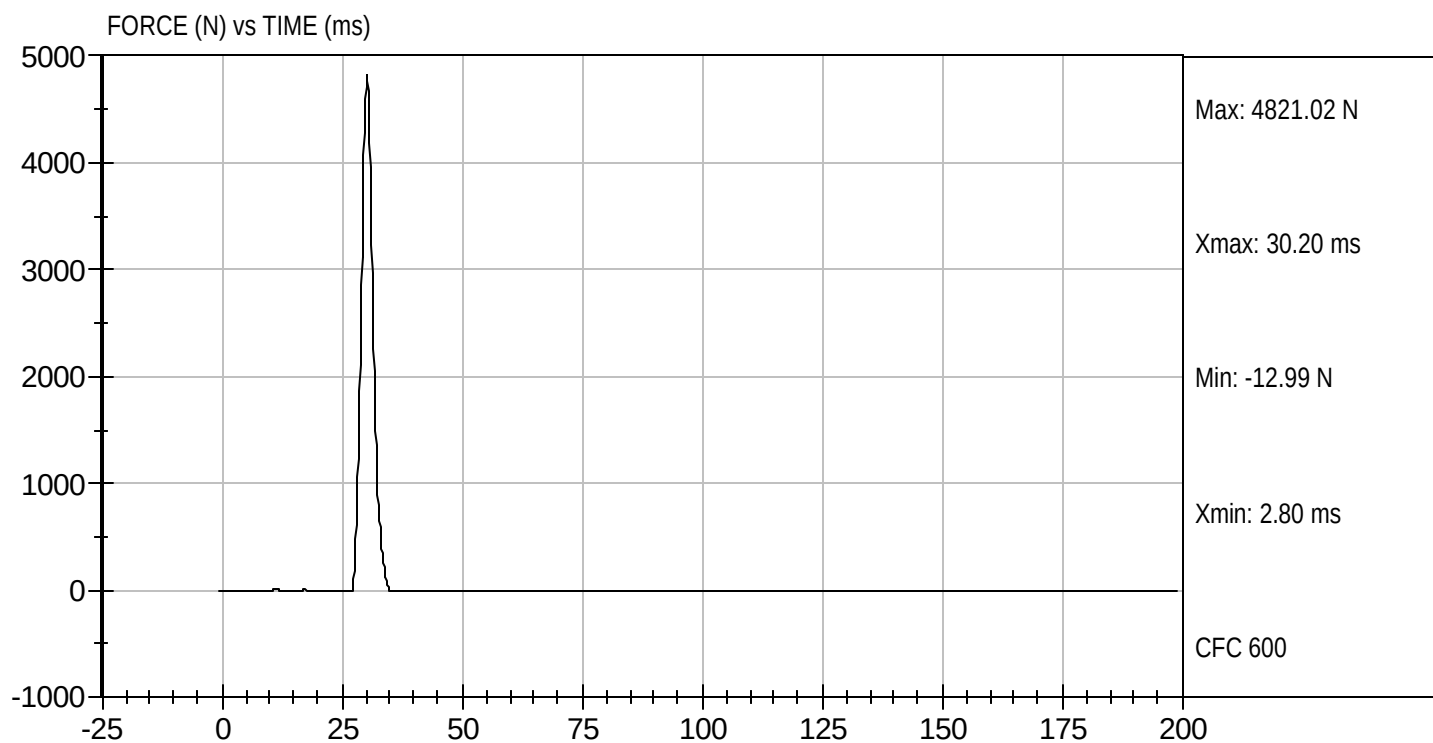
06/07/2006  
Test Date

  
Approved By



Test Desc: Left Knee  
Componet ID: D061676

Test Date: 06/07/2006  
Velocity: 6.91 ft/s, 2.11 m/s



DATA SHEET A8  
RIGHT KNEE IMPACT TEST (572.35)

Dummy Serial Number 403

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test.  
(572.36(m))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14A.

☒ 3. The leg assembly (86-5001-002) with the upper leg assembly (78051-47) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))

Record the maximum temperature 21.6

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 44%

☒ 5. Mount the test specimen and secure it to the rigid test fixture.  
(572.35(b)(2)(iii)) (Figure 14A)

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))

☒ 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally.  
(572.35(b)(2)(iv)&(vi))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95  
(572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

☒ 11. Complete the following table:

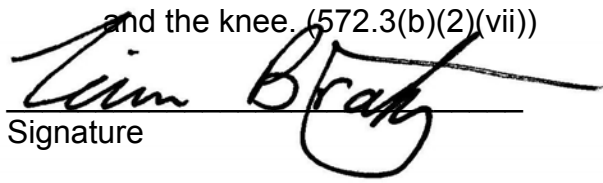
Knee Impact Results (572.35(b)(1))

| Parameter              | Specification                         | Result |
|------------------------|---------------------------------------|--------|
| Probe speed            | 6.8 ft/s $\leq$ speed $\leq$ 7.0 ft/s | 6.9    |
| Peak resistance force* | 1060 lb $\leq$ force $\leq$ 1300 lb   | 1131   |

\*Force = impactor mass x deceleration (572.35(b)(1))



X 12. Plots of pendulum acceleration, pendulum speed, and force, follow this sheet. Time zero is defined as the time of contact between the test probe and the knee. (572.3(b)(2)(vii))

  
Signature

6/7/06  
Date

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

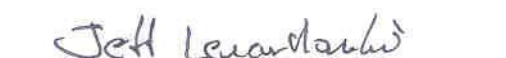
ATD Serial No: 403

Test I.D: D061675

| 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      | 48     | Pass      |
| Probe Velocity               | m/sec   | 2.07 to 2.13  | 2.11   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 5,031  | Pass      |
| Overall Test Results         |         |               |        | Pass      |

  
Laboratory Technician

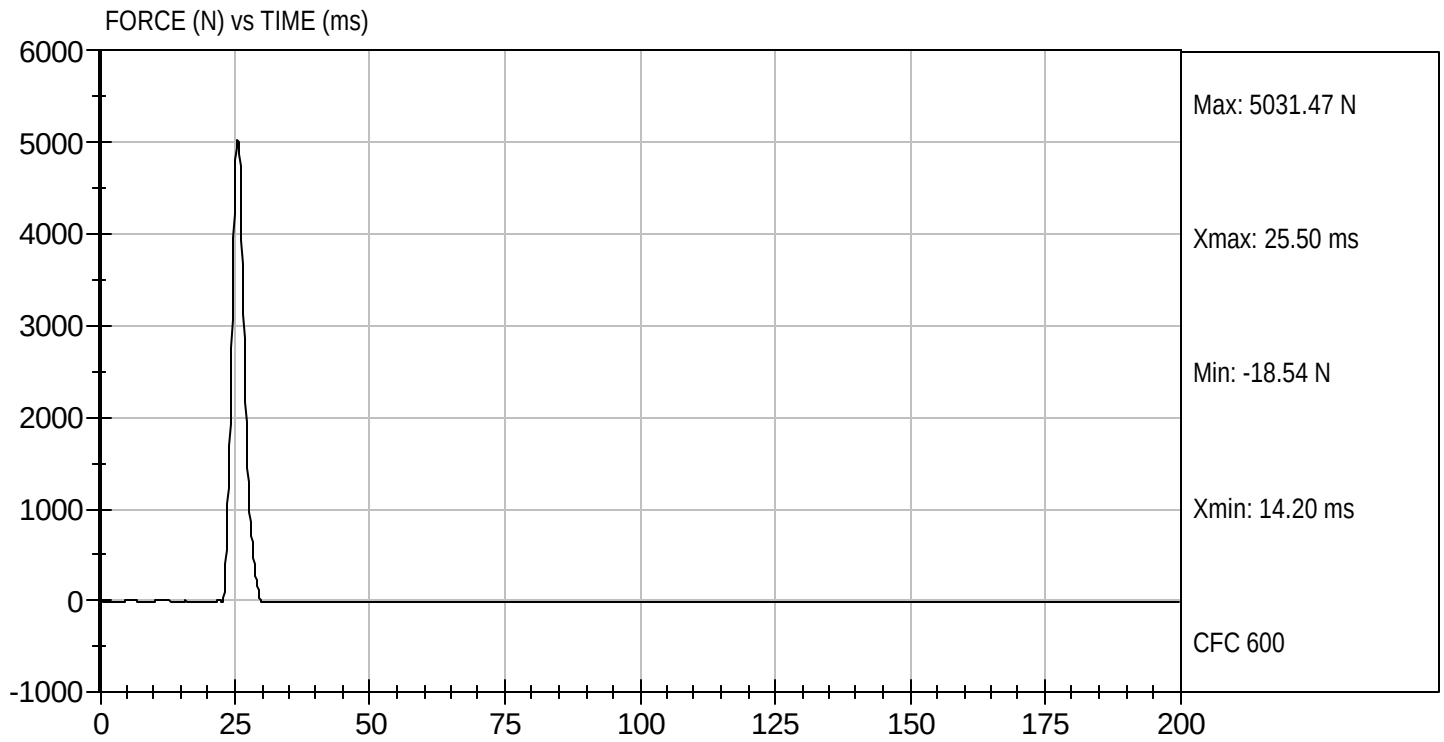
06/07/2006  
Test Date

  
Approved By



Test Desc: Right Knee  
Componet ID: D061675

Test Date: 06/07/2006  
Velocity: 6.92 ft/s, 2.11 m/s



DATA SHEET A9  
HIP JOINT-FEMUR FLEXION (572.35(c))

Dummy Serial Number 403

Test Date 6/7/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive hip joint-femur flexion tests are necessary)

- ☐ 1. It has been at least 30 minutes since the last hip joint-femur flexion test. (572.36(m))  
☒ N/A, ONLY one hip joint-femur flexion test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 17A.
- ☒ 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):  
☒ 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)  
☒ 3.2 remove the abdominal insert (78051-52)  
☒ 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).
- ☒ 4. The assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(c)(v))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.6</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>49%</u>  |
| Record the minimum humidity    | <u>44%</u>  |
- ☒ 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))
- ☒ 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))
- ☒ 7. Adjust the threaded rods until plane B is horizontal.
- ☒ 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))
- ☒ 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

X 10. Complete the following table:

Left Hip Joint-Femur Flexion Results (572.35(c)(1) & (c)(2)(iv))

| Parameter                    | Specification                                         | Result |
|------------------------------|-------------------------------------------------------|--------|
| Rotation Rate                | $5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$ | 8      |
| Femur Torque at $30^{\circ}$ | $\text{torque} \leq 70 \text{ ft-lbf}$                | 66     |
| Rotation at 150 lbf-ft       | $40^{\circ} \leq \text{rotation} \leq 50^{\circ}$     | 43     |

X 11. Secure the lever arm into the right femur shaft opening of the upper leg structure assembly (78051-44) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

X 12. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the  $\frac{1}{2}$  in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19). (572.35(c)(2)(iv))

X 13. Complete the following table:

Right Hip Joint-Femur Flexion Results (572.35(c)(1) & (c)(2)(iv))

| Parameter                    | Specification                                         | Result |
|------------------------------|-------------------------------------------------------|--------|
| Rotation Rate                | $5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$ | 8      |
| Femur Torque at $30^{\circ}$ | $\text{torque} \leq 70 \text{ ft-lbf}$                | 67     |
| Rotation at 15 lbf-ft        | $40^{\circ} \leq \text{rotation} \leq 50^{\circ}$     | 43     |

  
Signature

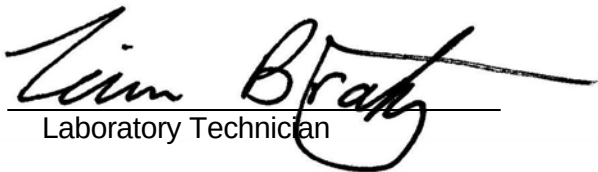
6/7/06  
Date

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

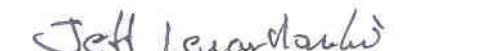
**ATD Serial No:** 403

**Test I.D:** D061670

| Tested Parameter             | Units   | Specification                 | Result               |      | Pass/Fail |
|------------------------------|---------|-------------------------------|----------------------|------|-----------|
|                              |         |                               | Right                | Left |           |
| Laboratory Temperature       | deg C   | 18.9 to 25.6                  | 21.0                 | 21.0 | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70                      | 45                   | 45   | Pass      |
| Rotation Rate                | deg/sec | 5 to 10                       | 8                    | 8    | Pass      |
| 30 Degrees                   | Nm      | 94.9 Nm Max                   | 91.2                 | 89.0 | Pass      |
| 150 ft-lbf / 203.4 Nm        | Deg     | 40- 50 Degree<br>Max Rotation | 43                   | 43   | Pass      |
|                              |         |                               | Overall Test Results |      | Pass      |

  
 Laboratory Technician

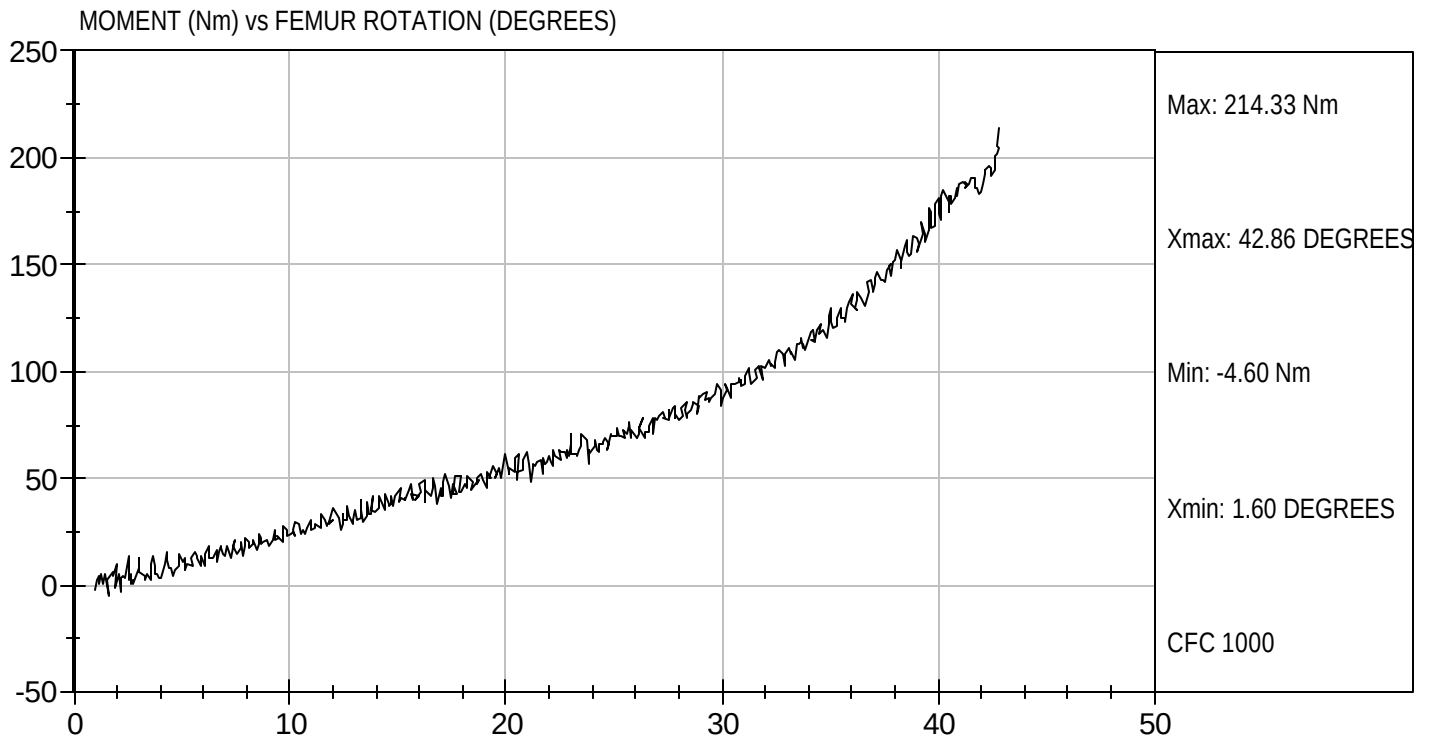
06/07/2006  
 Test Date

  
 Approved By



Test Desc: Hip Femur Flexion  
Componet ID: D061679

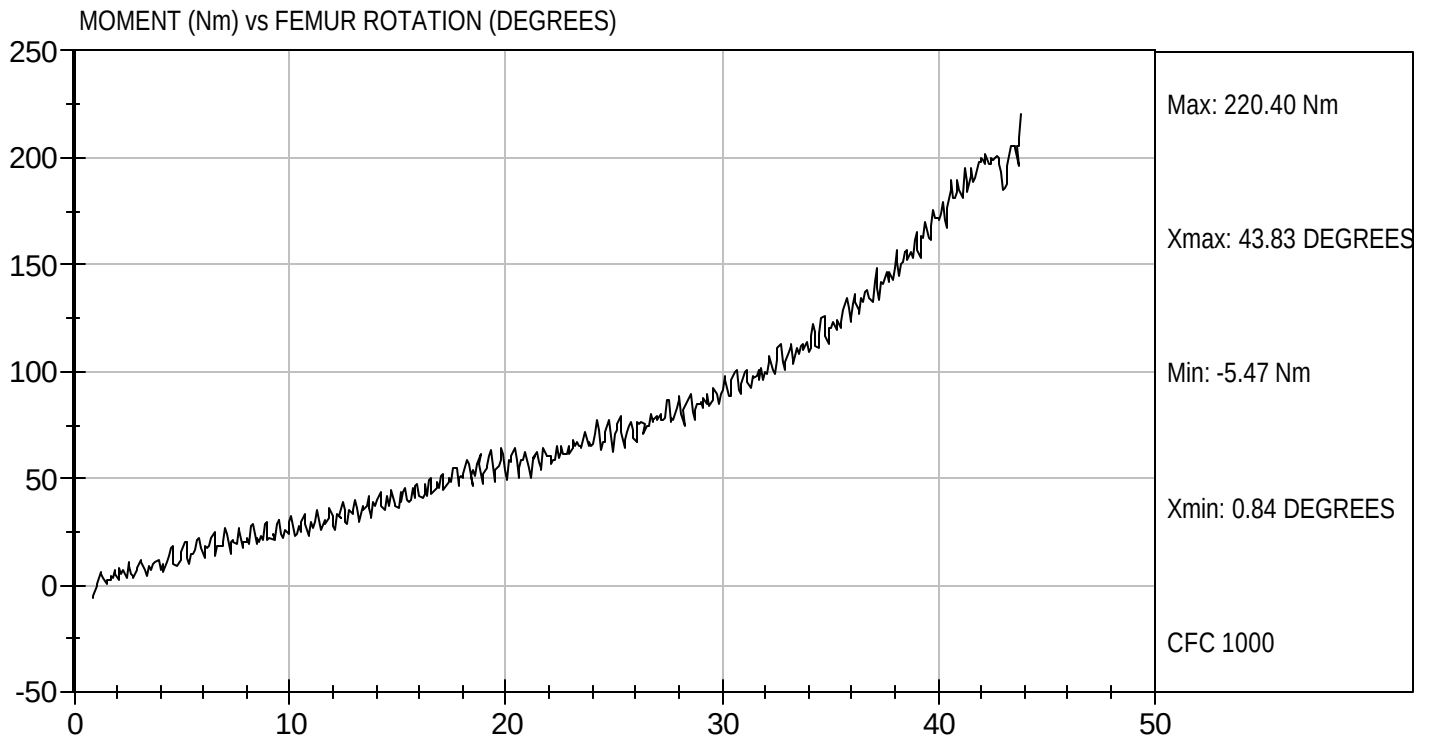
Test Date: 06/07/2006  
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion  
Componet ID: D061670

Test Date: 06/07/2006  
Velocity: 0 ft/s, 0.00 m/s





DATA SHEET A3  
HEAD DROP TEST (572.32)

Dummy Serial Number 403

Test Date 7/27/06

Technician Dave Wilcox

   Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

X 1. It has been at least 3 hours since the last head drop. (572.32(c)(5))

X N/A, ONLY one head drop performed

X 2. The head assembly consists of the complete head (78051-61X), the neck transducer structural replacement (78051-383X), and three (3) accelerometers. (572.32(b))

X 3. Torque the skull cap screws to 160 lbf-in.

X 4. Accelerometers and their respective mounts are smooth and clean.

X 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.35(ii))

X 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.32(c)(1))

Record the maximum temperature 21.2

Record the minimum temperature 20.7

Record the maximum humidity 51%

Record the minimum humidity 46%

X 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

X 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, 1,1,1 trichloroethane or equivalent prior to the test. (572.32(c)(2))

- X 9. Suspend and orient the head assembly as shown in Figure 6A. The lowest point on the forehead is 0.5 in. below the lowest point on the dummy's nose when the midsagittal plane is vertical. (572.32(c)(3))  
Record the actual distance 14.8"

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X 10. The 1.6 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 7A.  
Record the right side distance 469mm  
Record the left side distance 469mm
- X 11. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.32(c)(4))  
Record actual micro finish  $656 \times 10^{-6}$  mm
- X 12. The impact surface is rigidly supported. (572.32(c)(4))
- X 13. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (Figure 6A)  
Record thickness 50.9mm  
Record width 60.4mm  
Record length 595mm
- X 14. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))
- X 15. Complete the following table using channel class 1000 data. (572.36(i)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $225 \text{ g} \leq x \leq 275 \text{ g}$        | 262    |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | -8     |

- X 16. Plots of the x, y, z, and resultant acceleration data follow this sheet.

  
\_\_\_\_\_  
Signature

7/27/06  
\_\_\_\_\_  
Date

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

**ATD Serial No:** 403

**Test ID:** D062181

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 20.7   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 46     | Pass      |
| Peak Resultant Acceleration  | G's   | 225 to 275         | 262    | Pass      |
| Peak Lateral Acceleration    | G's   | $\leq \pm 15.0$    | -7.7   | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |



Laboratory Technician

07/27/2006

Test Date



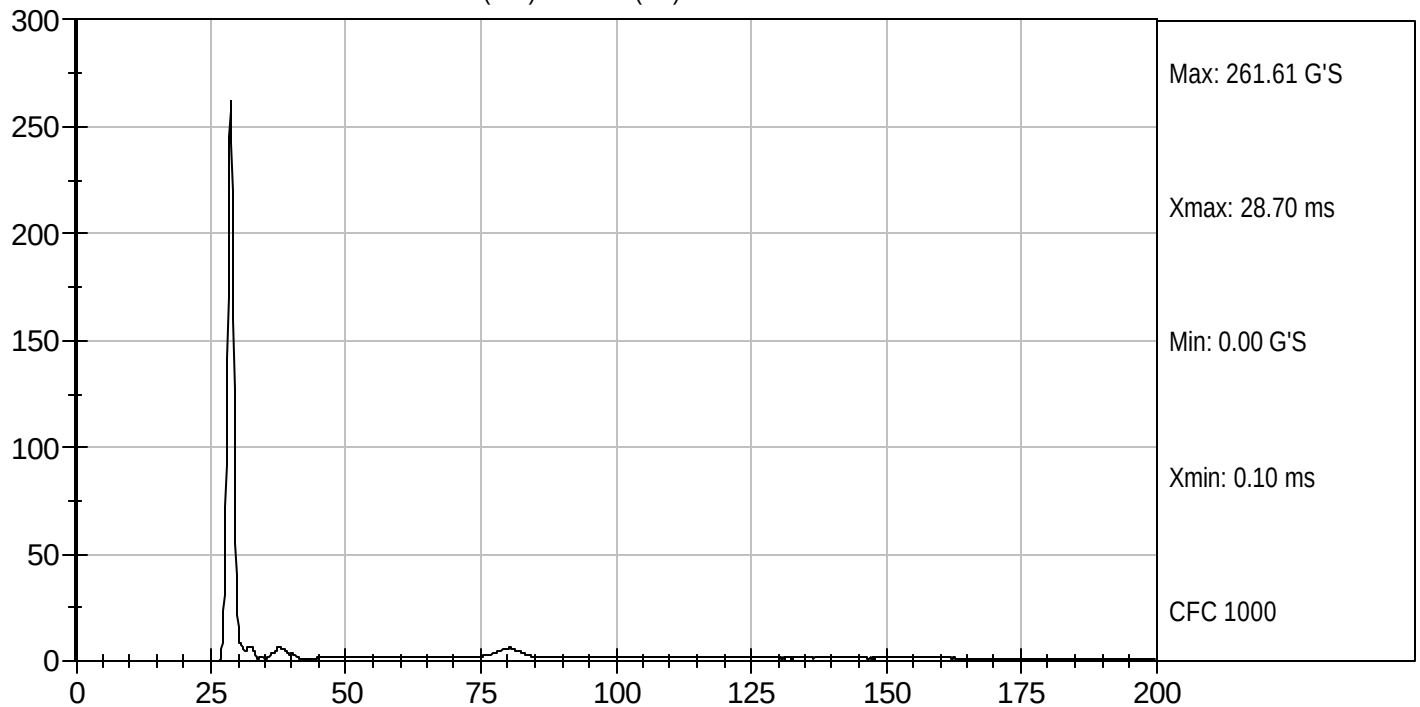
Approved By



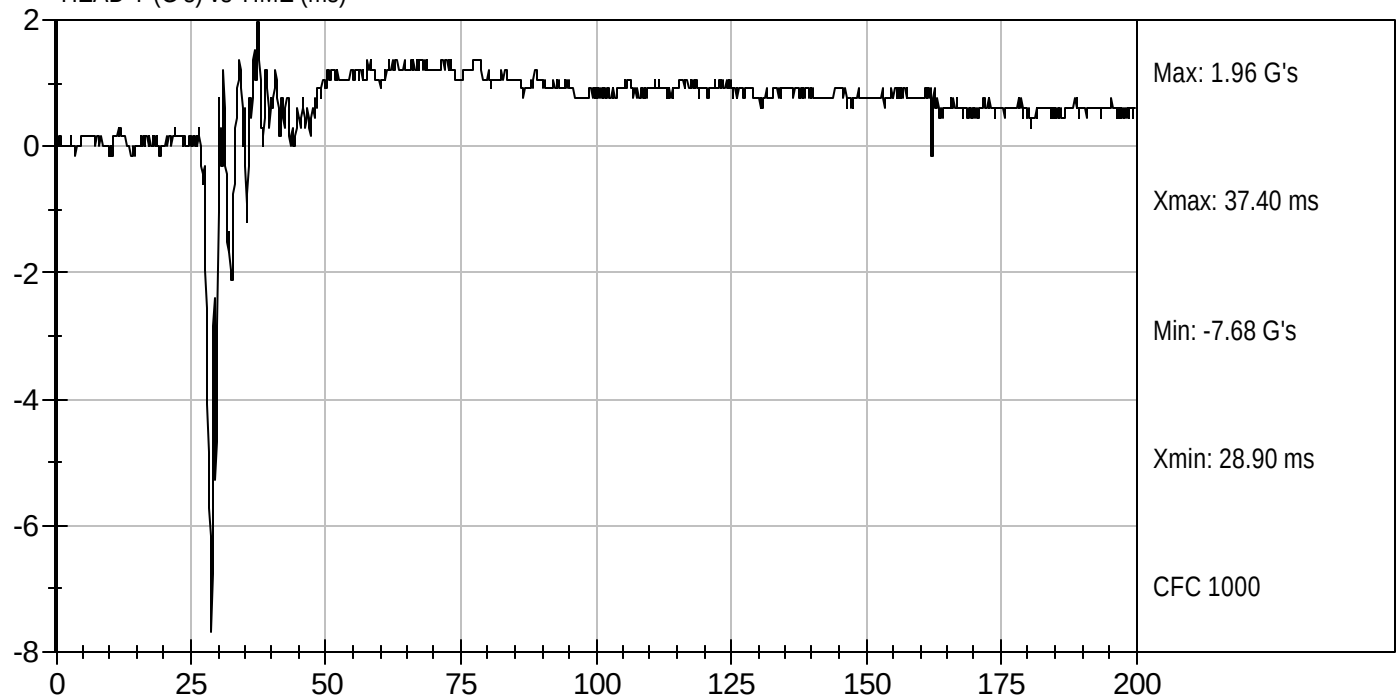
Test Desc: Head Drop  
Componet ID: D062181

Test Date: 07/27/2006  
Velocity: 0 ft/s, 0.00 m/s

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



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



DATA SHEET A4  
NECK FLEXION TEST (572.33)

Dummy Serial Number 403

Test Date 7/28/06

Technician Dave Wilcox

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

☐ 1. It has been at least 30 minutes since the last flexion test. (572.36(m))

☒ N/A, ONLY one flexion test performed

☒ 2. The components required for the neck tests include the head assembly (78051-61X), neck assembly (78051-90), bib simulator (78051-84), upper neck adjusting bracket (78051-307), lower neck adjusting bracket (78051-303), six axis neck transducer (C-1709) and either three accelerometers or their mass equivalent installed in the head assembly. Data from the accelerometers are not required. (572.33(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))

Record the maximum temperature 21.2

Record the minimum temperature 20.6

Record the maximum humidity 48%

Record the minimum humidity 45%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made. Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration.

Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (78051-90).

Record findings and actions: No Deterioration Hardness Front 82; Rear 85

☒ 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to  $1.0 \pm 0.2$  lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))

☐ N/A – post test calibration

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

| Neck Flexion Test Results (572.33(b)(1) & (572.33(c)(4))                |                                                                      |                         |
|-------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------|
| Parameter                                                               | Specification                                                        | Result                  |
| Pendulum impact speed                                                   | $22.6 \text{ ft/sec} \leq \text{speed} \leq 23.4 \text{ ft/sec}$     | 22.9                    |
| Pendulum<br>Deceleration<br>Versus Time<br>Pulse                        | @ 10ms                                                               | $22.5 \leq g \leq 27.5$ |
|                                                                         | @ 20 ms                                                              | $17.6 \leq g \leq 22.6$ |
|                                                                         | @30ms                                                                | $12.5 \leq g \leq 18.5$ |
|                                                                         | Above 30 ms                                                          | 29 g maximum            |
| First Pendulum Decay to 5g                                              | $34 \text{ ms} \leq \text{time} \leq 42 \text{ ms}$                  | 40                      |
| Plane D Rotation                                                        | $64^\circ \leq \text{max. rotation} \leq 78^\circ$                   | 72                      |
|                                                                         | $57 \text{ ms} \leq \text{time of max. rotation} \leq 64 \text{ ms}$ | 59                      |
| Time for Plane D Rotation to Cross $0^\circ$ During First Rebound       | $113 \text{ ms} \leq \text{time} \leq 128 \text{ ms}$                | 116                     |
| Maximum Moment                                                          | $65 \text{ lbf-ft} \leq \text{moment} \leq 80 \text{ lbf-ft}$        | 66                      |
|                                                                         | $47 \text{ ms} \leq \text{time of max. moment} \leq 58 \text{ ms}$   | 52                      |
| Time of first decay to 0 lbf-ft<br>Positive Moment Decay**<br>(Flexion) | $97 \text{ ms} \leq \text{time} \leq 107 \text{ ms}$                 | 100                     |

\*Moment about the occipital condyle =  $M_y - (0.058 \text{ ft} \times F_x)$   
(572.33(b)(1)(ii))

$M_y$  = Moment in lbf-ft measured by the transducer

$F_x$  = Force, in lbf measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

X 14. Plots of pendulum acceleration, y-axis moment, x-axis force, y-axis moment about the occipital condyle, and D plane rotation follows this sheet.

  
\_\_\_\_\_  
Signature

6/7/06  
\_\_\_\_\_  
Date

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

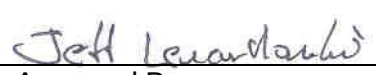
**ATD Serial No:** 403

**Test I.D:** D062182

| 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       | 45     | Pass      |
| Pendulum Velocity                              |         | m/s     | 6.89 to 7.13   | 6.98   | Pass      |
| Pendulum Deceleration                          | 10 msec | G's     | 22.50 to 27.50 | 23.01  | Pass      |
|                                                | 20 msec | G's     | 17.60 to 22.60 | 19.93  | Pass      |
|                                                | 30 msec | G's     | 12.50 to 18.50 | 15.02  | Pass      |
| Peak Pendulum Deceleration After 30 msec       |         | G's     | $\leq 29.0$    | 14.98  | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | msec    | 34.0 to 42.0   | 39.7   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 64.0 to 78.0   | 71.7   | Pass      |
|                                                | Time    | msec    | 57.0 to 64.0   | 59.0   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | msec    | 113.0 to 128.0 | 116.2  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | 88.1 to 108.5  | 89.7   | Pass      |
|                                                | Time    | msec    | 47.0 to 58.0   | 52.1   | Pass      |
| Positive Moment Decay Time To Zero Crossing    |         | msec    | 97.0 to 107.0  | 99.8   | Pass      |
| Overall Test Results                           |         |         |                |        | Pass      |

  
 Laboratory Technician

07/28/2006  
 Test Date

  
 Approved By

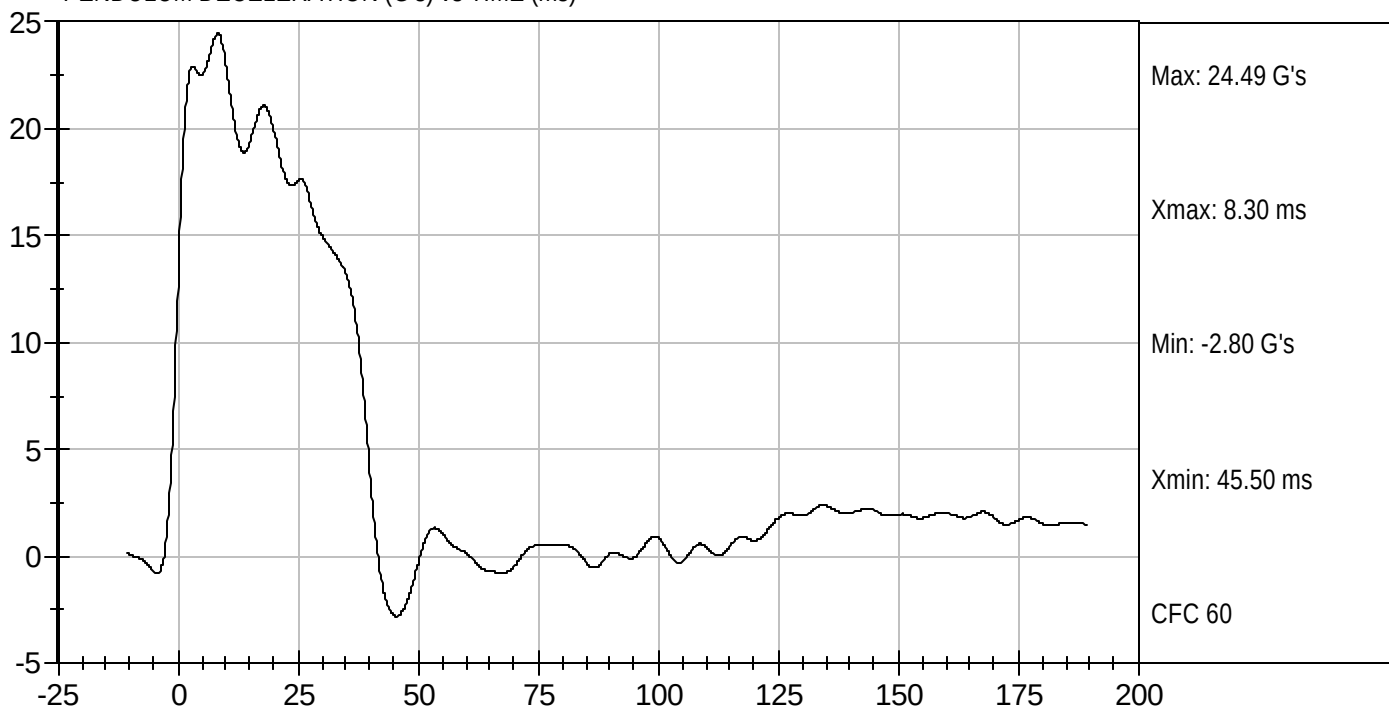




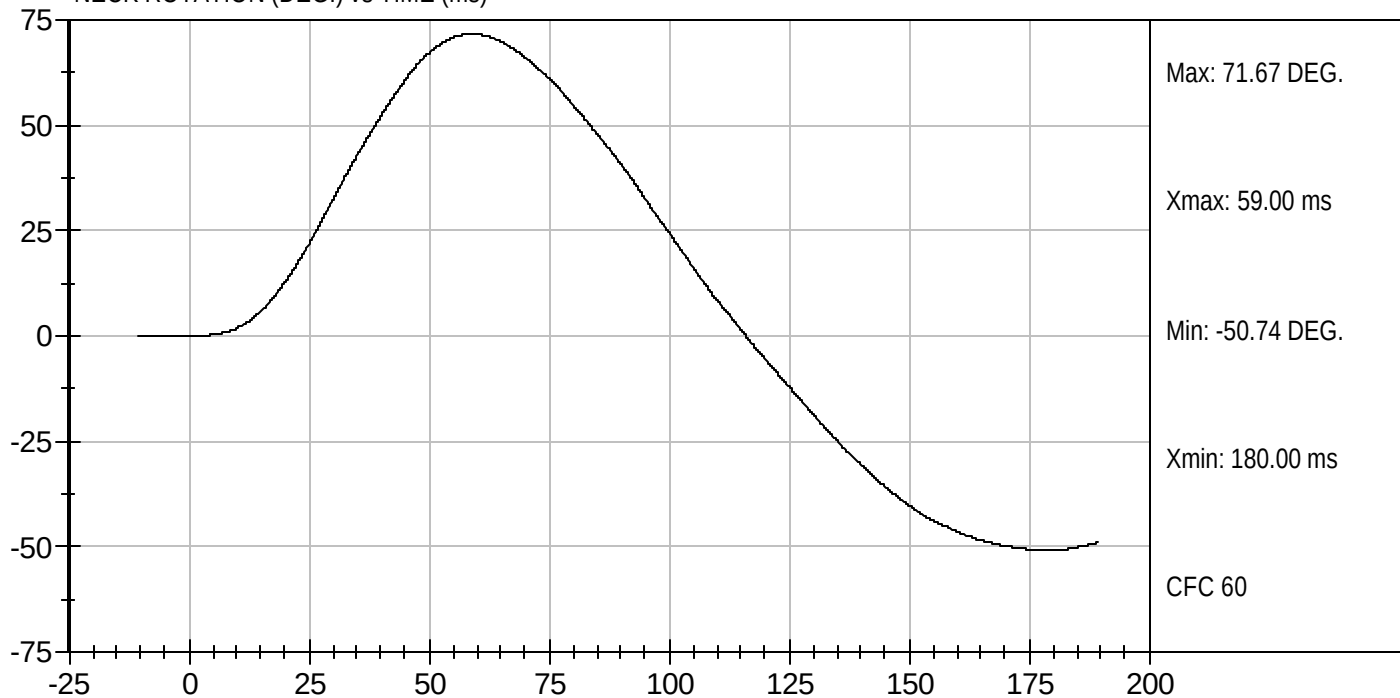
Test Desc: Neck Flexion  
Componet ID: D062182

Test Date: 07/28/2006  
Velocity: 22.91 ft/s, 6.98 m/s

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



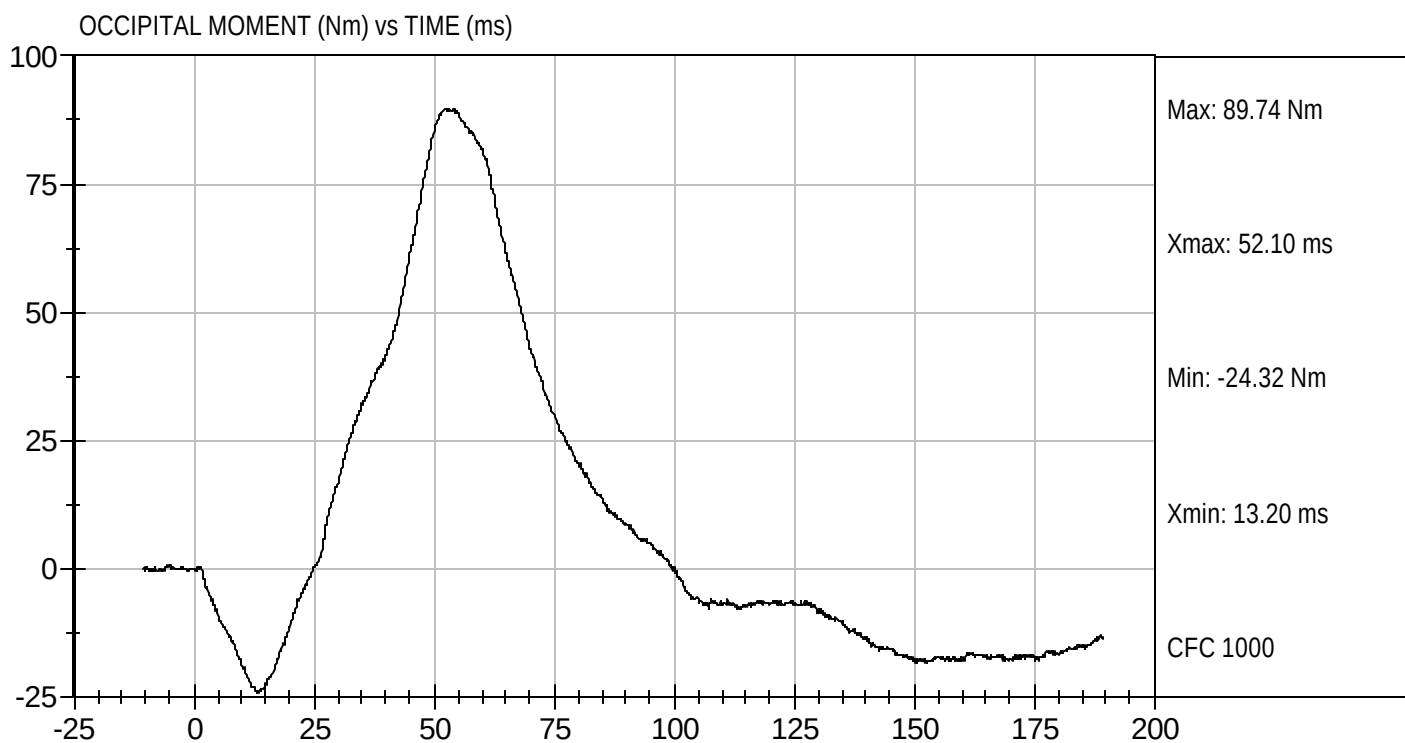
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Flexion  
Componet ID: D062182

Test Date: 07/28/2006  
Velocity: 22.91 ft/s, 6.98 m/s



DATA SHEET A5  
NECK EXTENSION TEST (572.33)

Dummy Serial Number 403

Test Date 7/28/06

Technician Tim Bratz

     Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

     1. It has been at least 30 minutes since the last extension test. (572.36(m))

     X N/A, ONLY one extension test performed

X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.33(b))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))

Record the maximum temperature 21.2

Record the minimum temperature 20.6

Record the maximum humidity 48%

Record the minimum humidity 45%

X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made. Record findings and actions: No Damage.

X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration.

Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration Hardness Front 82; Rear 85

- X 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to  $1.0 \pm 0.2$  lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))  
         N/A – post test calibration
- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/s as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

Neck Extension Test Results (572.33(b)(2) & (572.33(c)(4))

| Parameter                                                           |             | Specification                                                        | Result |
|---------------------------------------------------------------------|-------------|----------------------------------------------------------------------|--------|
| Pendulum impact speed                                               |             | $19.5 \text{ ft/sec} \leq \text{speed} \leq 20.3 \text{ ft/sec}$     | 19.9   |
| Pendulum Deceleration versus time pulse                             | @ 10ms      | $17.2 \leq g \leq 21.2$                                              | 19.2   |
|                                                                     | @ 20 ms     | $14 \leq g \leq 19$                                                  | 18.1   |
|                                                                     | @30ms       | $11.0 \leq g \leq 16.0$                                              | 13.8   |
|                                                                     | Above 30 ms | 22 g maximum                                                         | 14     |
| First Pendulum Decay to 5g                                          |             | $38 \text{ ms} \leq \text{time} \leq 46 \text{ ms}$                  | 39     |
| Plane D Rotation                                                    |             | $81^\circ \leq \text{max. rotation} \leq 106^\circ$                  | 100    |
|                                                                     |             | $72 \text{ ms} \leq \text{time of max. rotation} \leq 82 \text{ ms}$ | 77     |
| Time for Plane D Rotation to Cross $0^\circ$ During First Rebound   |             | $147 \text{ ms} \leq \text{time} \leq 174 \text{ ms}$                | 160    |
| Maximum Moment                                                      |             | $-59 \text{ lbf-ft} \leq \text{moment} \leq -39 \text{ lbf-ft}$      | -49    |
|                                                                     |             | $65 \text{ ms} \leq \text{time} \leq 79 \text{ ms}$                  | 73     |
| Time of first decay to 0 lbf-ft Negative Moment Decay** (Extension) |             | $120 \text{ ms} \leq \text{time} \leq 148 \text{ ms}$                | 141    |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$   
(572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

X 14. Plots of pendulum acceleration, y-axis moment, x-axis force, y-axis moment about the occipital condyle, and D plane rotation follows this sheet.

  
Signature

7/28/06  
Date

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

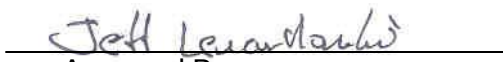
**ATD Serial No:** 403

**Test I.D:** D062183

| Tested Parameter                               |         | Units   | Specification  | Result | Pass/Fail |
|------------------------------------------------|---------|---------|----------------|--------|-----------|
| Laboratory Temperature                         |         | deg C   | 20.6 to 22.2   | 20.6   | Pass      |
| Laboratory Relative Humidity                   |         | %       | 10 to 70       | 46     | Pass      |
| Pendulum Velocity                              |         | m/s     | 5.95 to 6.19   | 6.08   | Pass      |
| Pendulum Deceleration                          | 10 msec | G's     | 17.20 to 21.20 | 19.17  | Pass      |
|                                                | 20 msec | G's     | 14.00 to 19.00 | 18.06  | Pass      |
|                                                | 30 msec | G's     | 11.00 to 16.00 | 13.77  | Pass      |
| Peak Pendulum Deceleration After 30 msec       |         | G's     | $\leq 22.0$    | 13.75  | Pass      |
| Deceleration Decay Time to Cross 5 G's         |         | msec    | 38.0 to 46.0   | 39.2   | Pass      |
| Maximum "D" Plane Rotation                     | Maximum | Degrees | 81.0 to 106.0  | 100.0  | Pass      |
|                                                | Time    | msec    | 72.0 to 82.0   | 76.7   | Pass      |
| "D" Plane Rotation Decay Time To Zero Crossing |         | msec    | 147.0 to 174.0 | 159.8  | Pass      |
| Moment About Occipital Condyle                 | Maximum | N m     | -52.9 to -79.9 | -65.9  | Pass      |
|                                                | Time    | msec    | 65.0 to 79.0   | 73.0   | Pass      |
| Negative Moment Decay Time To Zero Crossing    |         | msec    | 120.0 to 148.0 | 140.8  | Pass      |
| Overall Test Results                           |         |         |                | Pass   |           |

  
 Laboratory Technician

07/28/2006  
 Test Date

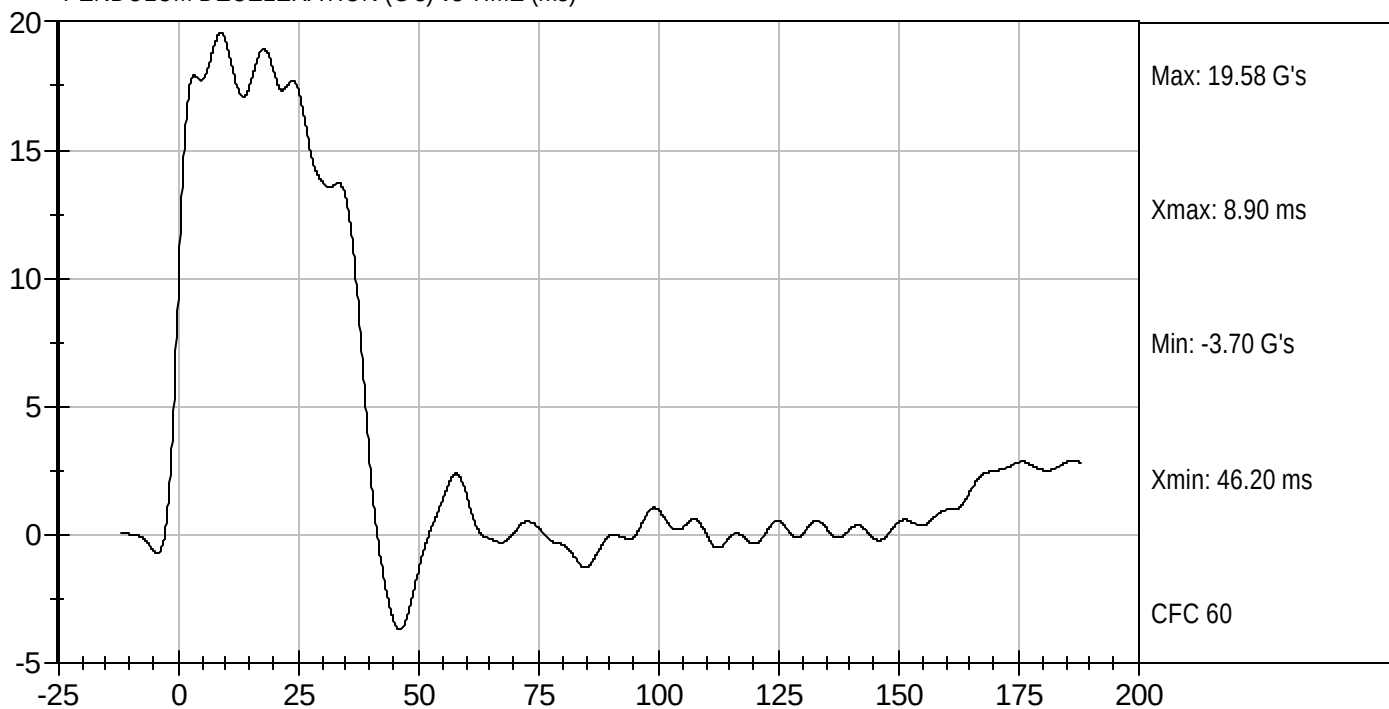
  
 Approved By



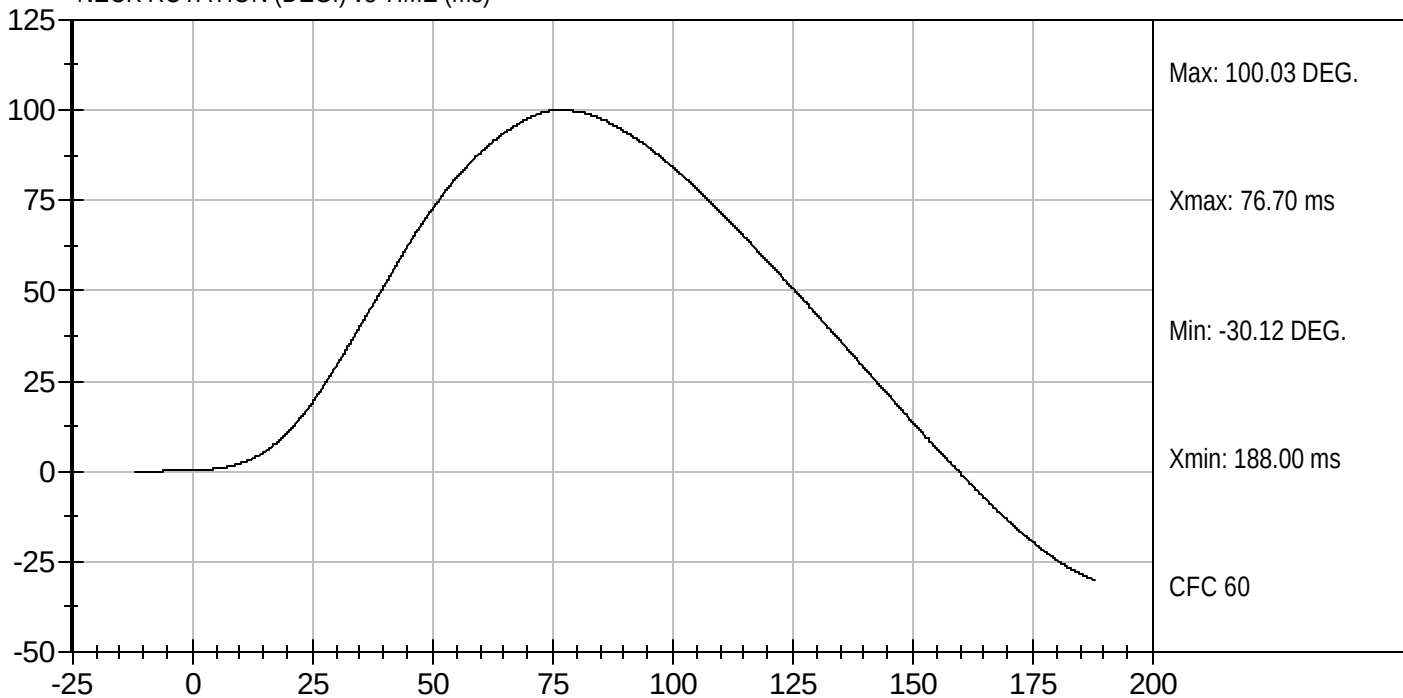
Test Desc: Neck Extension  
Componet ID: D062183

Test Date: 07/28/2006  
Velocity: 19.94 ft/s, 6.08 m/s

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



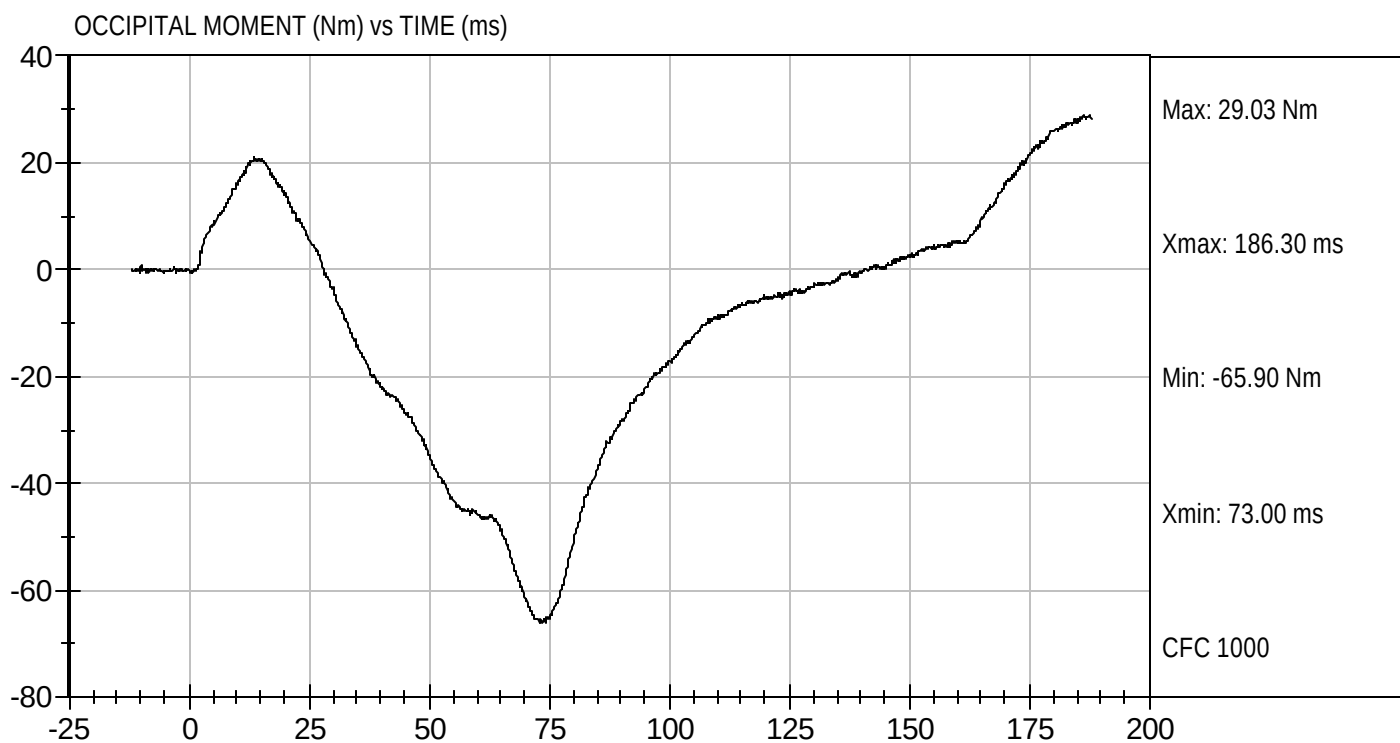
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Extension  
Componet ID: D062183

Test Date: 07/28/2006  
Velocity: 19.94 ft/s, 6.08 m/s





DATA SHEET A6  
THORAX IMPACT TEST (572.34)

Dummy Serial Number 403 Test Date 7/28/06

Technician Dave Wilcox

☐ Pretest calibration  
☒ Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last thorax impact test.  
(572.137(q))

☒ N/A, ONLY one thorax impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 12A.

☒ 3. The complete assembled dummy (78051-218) is used (572.34(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. No shoes are worn. (572.34(b))

☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.34(c)(1))

Record the maximum temperature 21.2

Record the minimum temperature 20.6

Record the maximum humidity 48%

Record the minimum humidity 45%

☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material (78051-17 thru 78051-22), chest displacement transducer assembly (78051-317) and the rear rib supports (78051-304). Inspect for rib deformation using the chest depth gage (83-5006-007). If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

☒ - No damage

☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage

\_\_\_\_\_

☐ - The following repairs or replacement was performed. Record

\_\_\_\_\_

\_\_\_\_\_

- X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572.34(c)(2))
- X 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $13^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (78051-532) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block. (572.34(c)(2))
- X 8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.34(c)(4))
- X 10. Align the adjustable neck bracket index marks to the "zero" position. (Figure 12A)
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 Class 180.
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.34(c)(5)) The velocity of the test probe at the time of impact is  $22 \text{ f/s} \pm 0.4 \text{ f/s}$ . (572.34(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.34(c)(6))

X 16. Complete the following table:

Thorax Impact Results (572.34(b))

| Parameter*              | Specification                                                   | Result |
|-------------------------|-----------------------------------------------------------------|--------|
| Test Probe Speed        | $21.6 \text{ f/s} \leq \text{speed} \leq 22.4 \text{ f/s}$      | 21.6   |
| Chest Compression       | $2.5 \text{ in.} \leq \text{compression} \leq 2.86 \text{ in.}$ | 2.58   |
| Peak resistance force** | $1160 \text{ lb} \leq \text{peak force} \leq 1325 \text{ lb}$   | 1251   |
| Internal Hysteresis***  | $69\% \leq \text{hysteresis} \leq 85\%$                         | 70     |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.34(b))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve.

X 17. Plots of chest compression, pendulum acceleration, pendulum speed, and force, follow this sheet.

  
\_\_\_\_\_  
Signature

7/28/06  
\_\_\_\_\_  
Date

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

**ATD Serial No:** 403

**Test I.D:** D062184

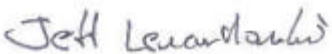
| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 20.6 to 22.2  | 21.0   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 46     | Pass      |
| Probe Velocity               | m/s   | 6.58 to 6.82  | 6.58   | Pass      |
| Peak Probe Force             | N     | 5159 to 5893  | 5,564  | Pass      |
| Peak Sternum Displacement    | cm    | 6.35 to 7.26  | 6.43   | Pass      |
| Internal Hysteresis          | %     | 69 to 85      | 70     | Pass      |
| Overall Test Results         |       |               | Pass   |           |



Laboratory Technician

07/28/2006

Test Date

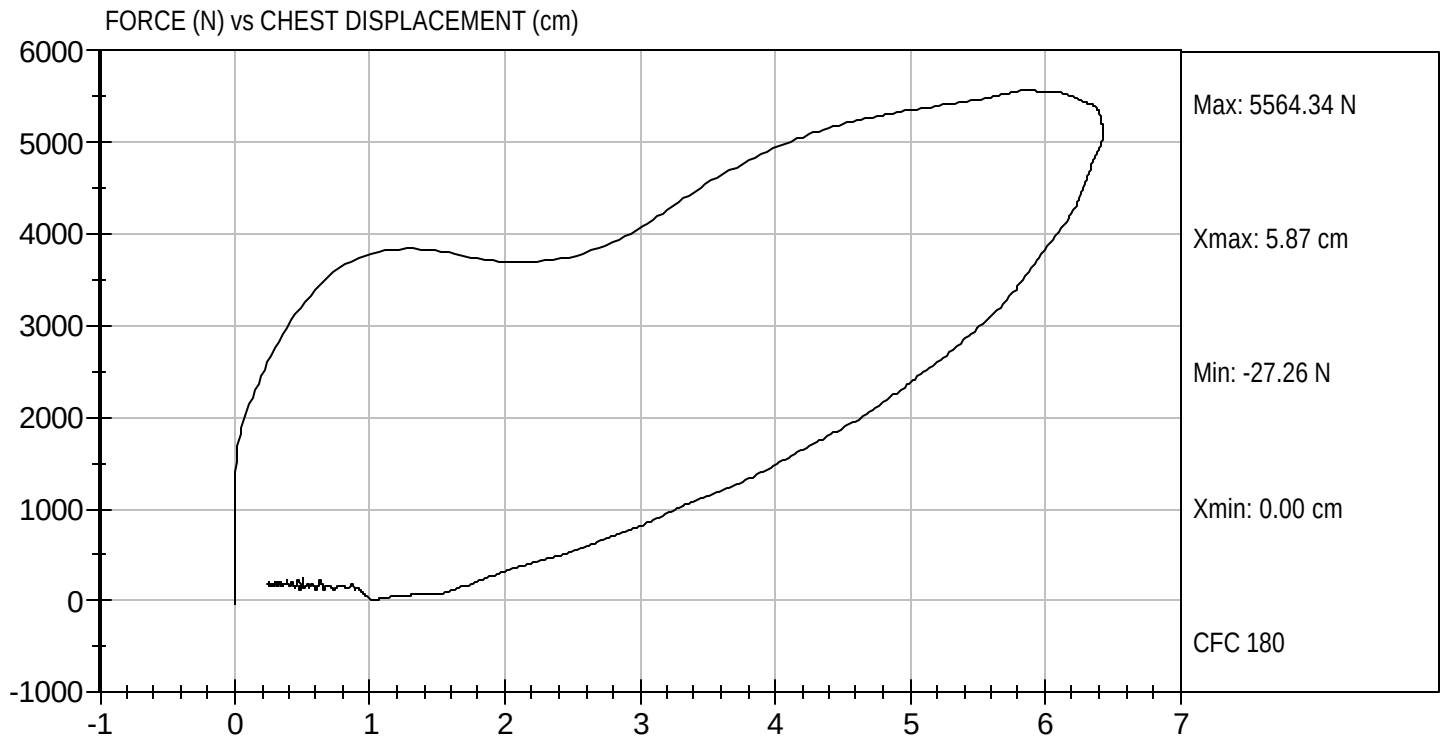


Approved By



Test Desc: Thorax Impact  
Componet ID: D062184

Test Date: 07/28/2006  
Velocity: 21.6 ft/s, 6.58 m/s



DATA SHEET A7  
LEFT KNEE IMPACT TEST (572.35)

Dummy Serial Number 403

Test Date 7/28/06

Technician Dave Wilcox

   Pretest calibration

X Post test calibration verification

Test attempt no. X (when successive knee impact tests are necessary)

   1. It has been at least 30 minutes since the last knee impact test.  
(572.36(m))

X N/A, ONLY one knee impact test performed

X 2. The test fixture conforms to the specifications in Figure 14A.

X 3. The leg assembly (86-5001-001) with the upper leg assembly (78051-46) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))

X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))

Record the maximum temperature 21.2

Record the minimum temperature 20.6

Record the maximum humidity 48%

Record the minimum humidity 45%

X 5. Mount the test specimen and secure it to the rigid test fixture.  
(572.35(b)(2)(iii)) (Figure 14A)

X 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))

X 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally.  
(572.35(b)(2)(iv)&(vi))

X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))

X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95  
(572.136(m)) Class 600.

X 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

X 11. Complete the following table:

Knee Impact Results (572.35(b)(1))

| Parameter              | Specification               | Result |
|------------------------|-----------------------------|--------|
| Probe speed            | 6.8 ft/s ≤ speed ≤ 7.0 ft/s | 6.9    |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb   | 1111   |

\*Force = impactor mass x deceleration (572.35(b)(1))

X 12. Plots of pendulum acceleration, pendulum speed, and force, follow this sheet. Time zero is defined as the time of contact between the test probe and the knee. (572.3(b)(2)(vii))

A handwritten signature in dark ink, appearing to be "J. H. H. H.", written over a horizontal line.

Signature

7/28/06

Date

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

**ATD Serial No:** 403

**Test I.D:** D062186

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 20.7   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 45     | Pass      |
| Probe Velocity               | m/sec   | 2.07 to 2.13  | 2.11   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 4,943  | Pass      |
| Overall Test Results         |         |               |        | Pass      |



Laboratory Technician

07/28/2006

Test Date



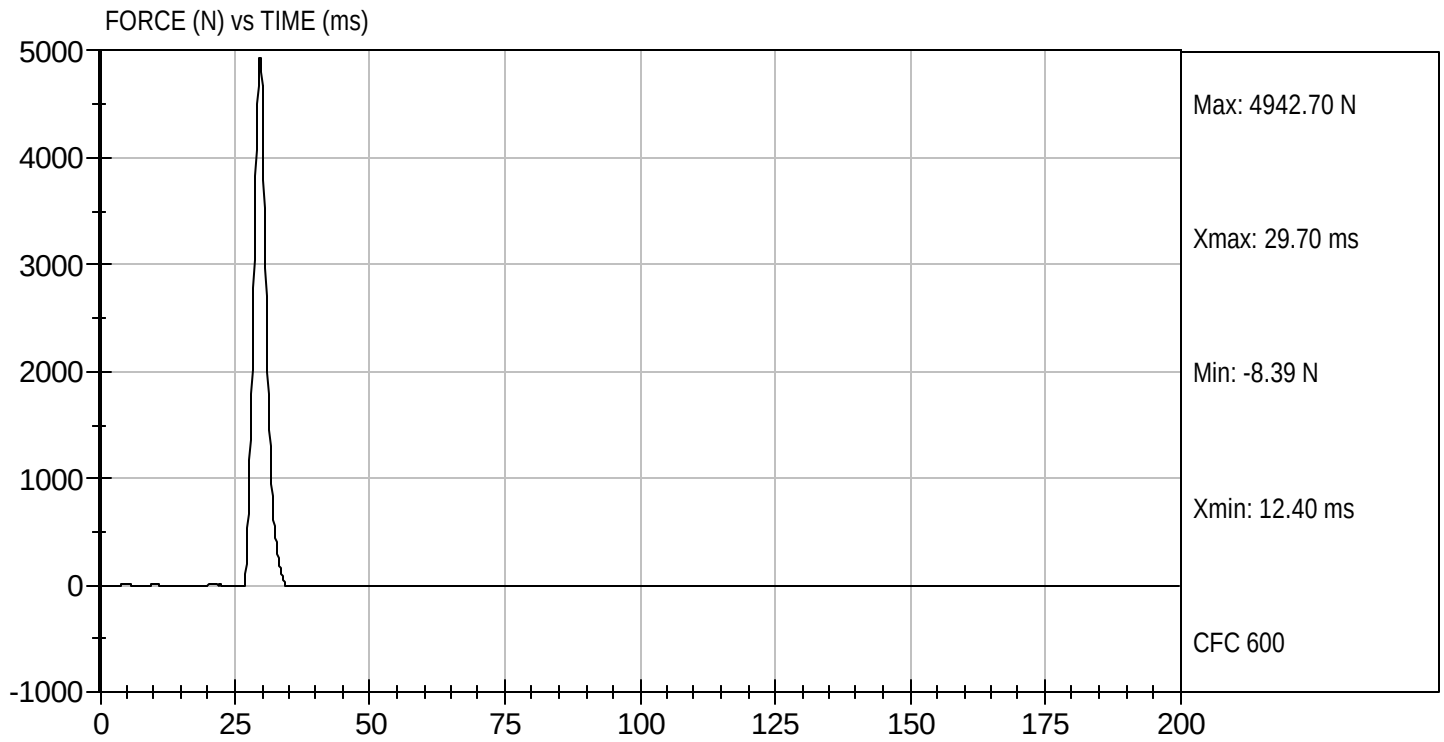
Approved By





Test Desc: Left Knee  
Componet ID: D062186

Test Date: 07/28/2006  
Velocity: 6.91 ft/s, 2.11 m/s



DATA SHEET A8  
RIGHT KNEE IMPACT TEST (572.35)

Dummy Serial Number 403

Test Date 7/28/06

Technician Dave Wilcox

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test.  
(572.36(m))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14A.

☒ 3. The leg assembly (86-5001-002) with the upper leg assembly (78051-47) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))

Record the maximum temperature 21.2

Record the minimum temperature 20.6

Record the maximum humidity 48%

Record the minimum humidity 45%

☒ 5. Mount the test specimen and secure it to the rigid test fixture.  
(572.35(b)(2)(iii)) (Figure 14A)

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))

☒ 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally.  
(572.35(b)(2)(iv)&(vi))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95  
(572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

☒ 11. Complete the following table:

Knee Impact Results (572.35(b)(1))

| Parameter              | Specification                         | Result |
|------------------------|---------------------------------------|--------|
| Probe speed            | 6.8 ft/s $\leq$ speed $\leq$ 7.0 ft/s | 6.9    |
| Peak resistance force* | 1060 lb $\leq$ force $\leq$ 1300 lb   | 1112   |

\*Force = impactor mass x deceleration (572.35(b)(1))

X 12. Plots of pendulum acceleration, pendulum speed, and force, follow this sheet. Time zero is defined as the time of contact between the test probe and the knee. (572.3(b)(2)(vii))

  
\_\_\_\_\_  
Signature

7/28/06  
\_\_\_\_\_  
Date

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

**ATD Serial No:** 403

**Test I.D:** D062185

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.5  | 20.6   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 46     | Pass      |
| Probe Velocity               | m/sec   | 2.07 to 2.13  | 2.11   | Pass      |
| Peak Probe Force             | Newtons | 4715 to 5782  | 4,945  | Pass      |
| Overall Test Results         |         |               |        | Pass      |



Laboratory Technician

07/28/2006

Test Date

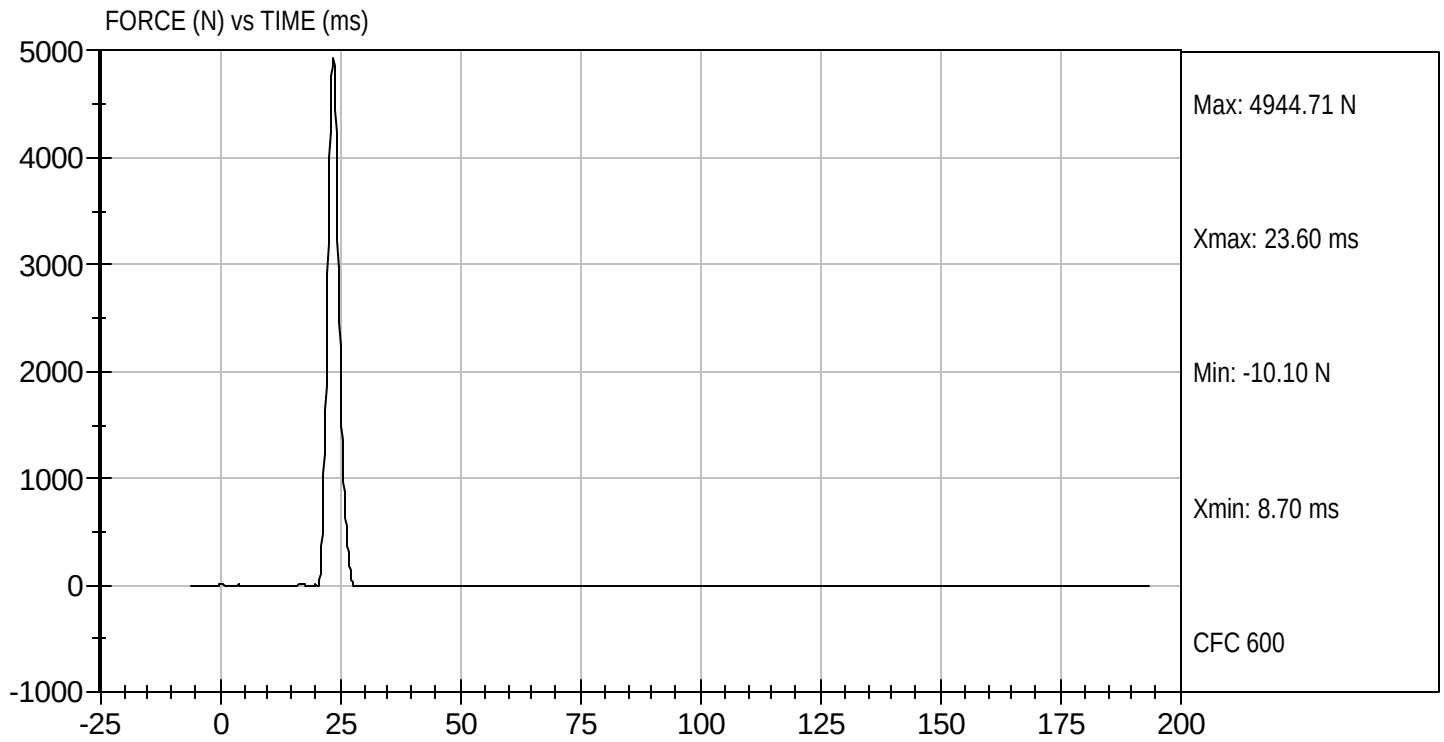


Approved By



Test Desc: Right Knee  
Componet ID: D062185

Test Date: 07/28/2006  
Velocity: 6.93 ft/s, 2.11 m/s



DATA SHEET A9  
HIP JOINT-FEMUR FLEXION (572.35(c))

Dummy Serial Number 403

Test Date 7/27/06

Technician Tim Bratz

     Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive hip joint-femur flexion tests are necessary)

1. It has been at least 30 minutes since the last hip joint-femur flexion test. (572.36(m))  
     X N/A, ONLY one hip joint-femur flexion test performed
- X 2. The test fixture conforms to the specifications in Figure 17A.
- X 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):  
     X 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)  
     X 3.2 remove the abdominal insert (78051-52)  
     X 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).
- X 4. The assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(c)(v))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.2</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity    | <u>51%</u>  |
| Record the minimum humidity    | <u>46%</u>  |
- X 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))
- X 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))
- X 7. Adjust the threaded rods until plane B is horizontal.
- X 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))
- X 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

X 10. Complete the following table:

Left Hip Joint-Femur Flexion Results (572.35(c)(1) & (c)(2)(iv))

| Parameter                    | Specification                                         | Result |
|------------------------------|-------------------------------------------------------|--------|
| Rotation Rate                | $5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$ | 8      |
| Femur Torque at $30^{\circ}$ | $\text{torque} \leq 70 \text{ ft-lbf}$                | 64     |
| Rotation at 150 lbf-ft       | $40^{\circ} \leq \text{rotation} \leq 50^{\circ}$     | 43     |

X 11. Secure the lever arm into the right femur shaft opening of the upper leg structure assembly (78051-44) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

X 12. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the  $\frac{1}{2}$  in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19). (572.35(c)(2)(iv))

X 13. Complete the following table:

Right Hip Joint-Femur Flexion Results (572.35(c)(1) & (c)(2)(iv))

| Parameter                    | Specification                                         | Result |
|------------------------------|-------------------------------------------------------|--------|
| Rotation Rate                | $5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$ | 8      |
| Femur Torque at $30^{\circ}$ | $\text{torque} \leq 70 \text{ ft-lbf}$                | 69     |
| Rotation at 15 lbf-ft        | $40^{\circ} \leq \text{rotation} \leq 50^{\circ}$     | 43     |

  
Signature

7/27/06  
Date

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

**ATD Serial No:** 403

**Test I.D:** D062180

| Tested Parameter             | Units   | Specification                 | Result               |      | Pass/Fail |
|------------------------------|---------|-------------------------------|----------------------|------|-----------|
|                              |         |                               | Right                | Left |           |
| Laboratory Temperature       | deg C   | 18.9 to 25.6                  | 21.1                 | 21.1 | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70                      | 49                   | 49   | Pass      |
| Rotation Rate                | deg/sec | 5 to 10                       | 8                    | 8    | Pass      |
| 30 Degrees                   | Nm      | 94.9 Nm Max                   | 93.6                 | 87.1 | Pass      |
| 150 ft-lbf / 203.4 Nm        | Deg     | 40- 50 Degree<br>Max Rotation | 43                   | 42   | Pass      |
|                              |         |                               | Overall Test Results |      | Pass      |

  
 Laboratory Technician

07/27/2006  
 Test Date

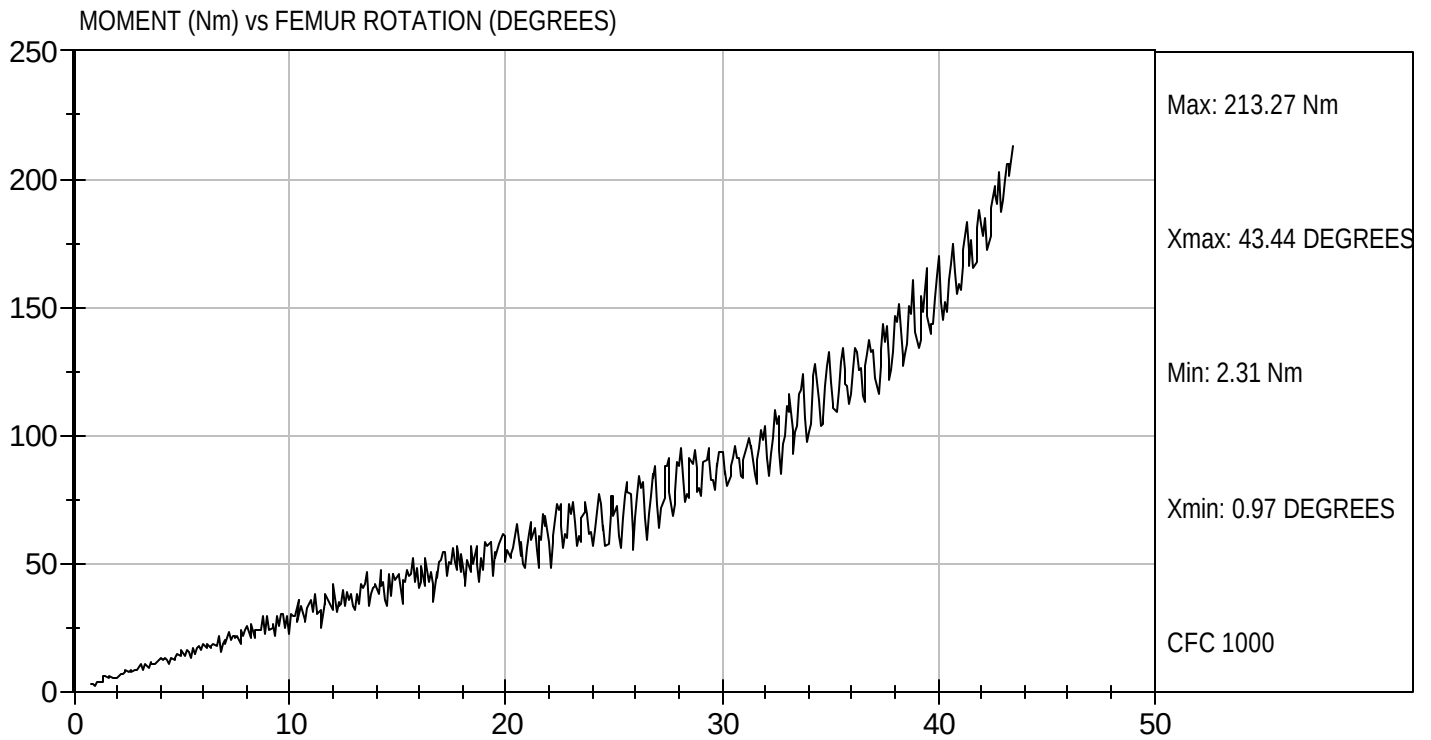
  
 Approved By





Test Desc: Hip Femur Flexion  
Componet ID: D062189

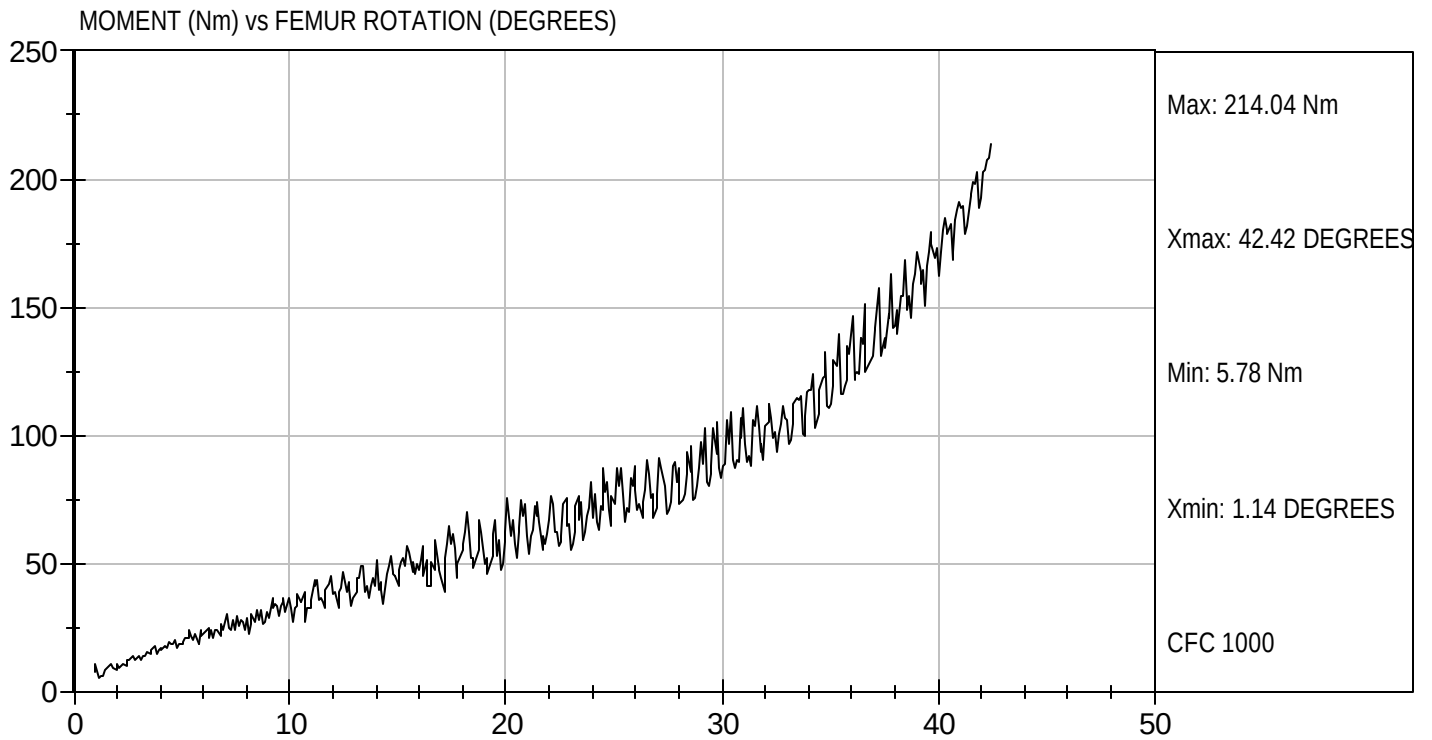
Test Date: 07/27/2006  
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion  
Componet ID: D062180

Test Date: 07/27/2006  
Velocity: 0 ft/s, 0.00 m/s



| HYBRID III 50 <sup>th</sup> SN #403, PART 572, SUBPART E EXTERNAL DIMENSIONS |                                   |                                                                                                                                                    |                                   |                       |
|------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------|
| DIMENSION                                                                    | DESCRIPTION                       | DETAILS                                                                                                                                            | ASSEMBLY<br>DIMENSION<br>(inches) | ACTUAL<br>MEASUREMENT |
| A                                                                            | TOTAL SITTING HEIGHT              | Seat surface to highest point on top of the head.                                                                                                  | 34.6–35.0                         | 34.9                  |
| 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                           | 3.5                   |
| D                                                                            | H-POINT LOCATION FROM<br>BACKLINE | Reference                                                                                                                                          | 5.3-5.5                           | 5.5                   |
| E                                                                            | SHOULDER PIVOT FROM<br>BACKLINE   | Center of the shoulder clevis to the rear vertical surface of<br>the fixture.                                                                      | 3.3-3.7                           | 3.6                   |
| F                                                                            | THIGH CLEARANCE                   | Measured at the highest point on the upper femur<br>segment.                                                                                       | 5.5-6.1                           | 5.9                   |
| G                                                                            | BACK OF ELBOW TO<br>WRIST PIVOT   | Back of the elbow flesh to the wrist pivot in line with the<br>elbow and wrist pivots                                                              | 11.4-12.0                         | 11.4                  |
| H                                                                            | HEAD BACK TO BACKLINE             | Back of skull cap skin to seat rear vertical surface<br>(Reference)                                                                                | 1.6-1.8                           | 1.6                   |
| I                                                                            | SHOULDER TO - ELBOW<br>LENGTH     | Measure from the highest point on top of the shoulder<br>clevis to the lowest part of the flesh on the elbow in line<br>with the elbow pivot bolt. | 13.0-13.6                         | 13.5                  |
| J                                                                            | ELBOW REST HEIGHT                 | Measure from the flesh below the elbow pivot bolt to the<br>seat surface.                                                                          | 7.5-8.3                           | 8.3                   |
| K                                                                            | BUTTOCK TO KNEE<br>LENGTH         | The forward most part of the knee flesh to the rear vertical<br>surface of the fixture.                                                            | 22.8-23.8                         | 23.5                  |
| L                                                                            | POPLITEAL HEIGHT                  | Seat surface to the plane of the horizontal plane of the<br>bottom of the feet.                                                                    | 16.9-17.9                         | 17.5                  |
| M                                                                            | KNEE PIVOT HEIGHT                 | Centerline of knee pivot bolt to the horizontal plane of the<br>bottom of the feet.                                                                | 19.1-19.7                         | 19.6                  |
| N                                                                            | BUTTOCK POPLITEAL<br>LENGTH       | The rearmost surface of the lower leg to the same point<br>on the rear surface of the buttocks used for dim. "K".                                  | 17.8-18.8                         | 18.5                  |

| HYBRID III 50 <sup>th</sup> SN #403, 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  | 10.2               |
| V                                                                             | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises | 16.3-17.2 | 16.8               |
| W                                                                             | FOOT BREADTH                                              | The widest part of the foot                       | 3.6-4.2   | 3.9                |
| Y                                                                             | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 16.9-17.1 in. above seat surface         | 38.2-39.4 | 38.8               |
| Z                                                                             | WAIST CIRCUMFERENCE                                       | Measured 8.9-9.1 in. above seat surface           | 32.9-34.1 | 33.2               |
| 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                |

DATA SHEET A1  
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 403

Test Date 7/25/06

Technician Jessica Gall

This check sheet is completed as part of the post test calibration verification.

X Perform general cleaning.

| Dummy Item                  | Inspect for                                                  | Comments | Damaged | OK |
|-----------------------------|--------------------------------------------------------------|----------|---------|----|
| Outer skin                  | Gashes, rips, cracks                                         |          |         | X  |
| Head                        | Ballast secure                                               |          |         | X  |
|                             | General appearance                                           |          |         | X  |
| Neck                        | Broken or cracked rubber                                     |          |         | X  |
|                             | Upper neck bracket firmly attached to the lower neck bracket |          |         | X  |
|                             | Looseness at the condyle joint                               |          |         | X  |
|                             | Nodding blocks cracked or out of position                    |          |         | X  |
| Spine                       | Broken or cracks in rubber.                                  |          |         | X  |
| Ribs                        | Broken or bent ribs                                          |          |         | X  |
|                             | Broken or bent rib supports                                  |          |         | X  |
|                             | Damping material separated or cracked                        |          |         | X  |
|                             | Rubber bumpers in place                                      |          |         | X  |
| Chest Displacement Assembly | Bent shaft                                                   |          |         | X  |
|                             | Slider arm riding in track                                   |          |         | X  |
| Transducer leads            | Torn cables                                                  |          |         | X  |

| Dummy Item              | Inspect for                           | Comments | Damaged | OK |
|-------------------------|---------------------------------------|----------|---------|----|
| Accelerometer Mountings | Head mounting secure                  |          |         | X  |
|                         | Chest mounting secure                 |          |         | X  |
| Knees                   | Skin condition                        |          |         |    |
|                         | Insert (do not remove)                |          |         | X  |
|                         | Casting                               |          |         | X  |
| Limbs                   | Normal movement and adjustment        |          |         | X  |
| Knee Sliders            | Wires intact                          |          |         | X  |
|                         | Rubber returned to "at rest" position |          |         | X  |
| Pelvis                  | Broken                                |          |         | X  |
| Other                   |                                       |          |         | X  |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

Jessica Hall  
Signature

7/28/06  
Date

Describe the repair or replacement of parts:

Checked by

Jeff Leonard  
Signature

7/28/06  
Date

## EXTERNAL DIMENSIONS

| HYBRID III 5 <sup>th</sup> SN #505, 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             | 778.1              |
| B                                                                           | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                       | 431.8-457.2             | 450.3              |
| C                                                                           | H-POINT HEIGHT                 | Reference                                                                                                                                    | 81.3-86.3               | 85.2               |
| D                                                                           | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                    | 144.8-149.8             | 145.8              |
| E                                                                           | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                   | 68.6-83.8               | 76.6               |
| F                                                                           | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                    | 119.4-134.6             | 128.3              |
| 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             | 248.7              |
| H                                                                           | HEAD BACK TO BACKLINE          | Back of skull cap skin to seat rear vertical surface (Reference)                                                                             | 43.2-48.2               | 44.2               |
| 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             | 278.9              |
| J                                                                           | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 182.8-203.2             | 187.5              |
| 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             | 541.9              |
| L                                                                           | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 355.6-376.0             | 361.7              |
| M                                                                           | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 393.7-419.1             | 402.4              |
| 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".                               | 414.0-439.4             | 436.8              |

| HYBRID III 5 <sup>th</sup> SN #505, 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             | 188.7              |
| P                                                                            | FOOT LENGTH                                               | Tip of toe to rear of heal                              | 218.5-233.7             | 223.3              |
| 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             | 481.1              |
| S                                                                            | HEAD BREADTH                                              | The widest part of the head                             | 137.1-147.3             | 141.4              |
| T                                                                            | HEAD DEPTH                                                | Back of the head to the forehead                        | 177.8-188.0             | 179.8              |
| U                                                                            | HIP BREADTH                                               | The widest part of the hip                              | 299.7-314.9             | 302.5              |
| V                                                                            | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises       | 350.5-365.7             | 359.1              |
| W                                                                            | FOOT BREADTH                                              | The widest part of the foot                             | 78.8-94.0               | 84.2               |
| X                                                                            | HEAD CIRCUMFERENCE                                        | Measured at the point as in dim. "T"                    | 528.3-548.7             | 531.7              |
| Y                                                                            | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 345.4 ± 12.7 mm above seat surface             | 850.9-881.3             | 853.2              |
| Z                                                                            | WAIST CIRCUMFERENCE                                       | Measured 165.1 ± 5.1 mm above seat surface              | 759.5-789.9             | 773.2              |
| AA                                                                           | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference                                               | 332.7-358.1             | 340.0              |
| BB                                                                           | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference                                               | 160.1-170.2             | 165.0              |



DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 505 Test Date 6/6/06

Technician Tim Bratz

☒ Pretest calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

- ☐ 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- ☒ 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- ☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- ☒ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.9</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>46%</u>  |
| Record the minimum humidity    | <u>41%</u>  |
- ☒ 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage.
- ☒ 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))

Record the right side distance 501mm

Record the left side distance 501mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))

Record actual micro finish  $656 \times 10^{-6}$  mm

- X 13. The impact surface is rigidly supported. (572.132(c)(4))

- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

- X 15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))

- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        | 265    |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | 4      |

- X 17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

  
Signature

6/6/06  
Date

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

ATD Serial No: 505

Test ID: D061641

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.9   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 41     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 265    | Pass      |
| Peak Lateral Acceleration    | G's   | +/- 15             | 4.4    | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

  
Laboratory Technician

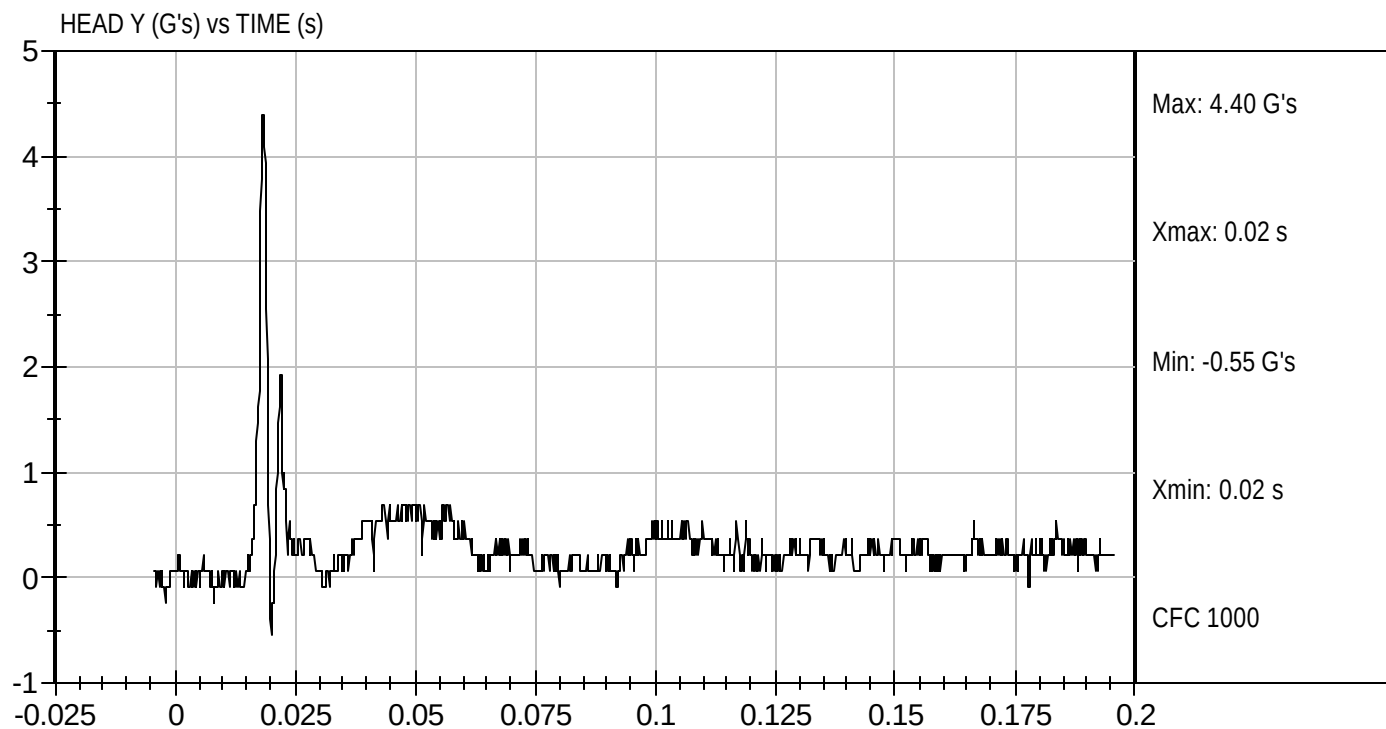
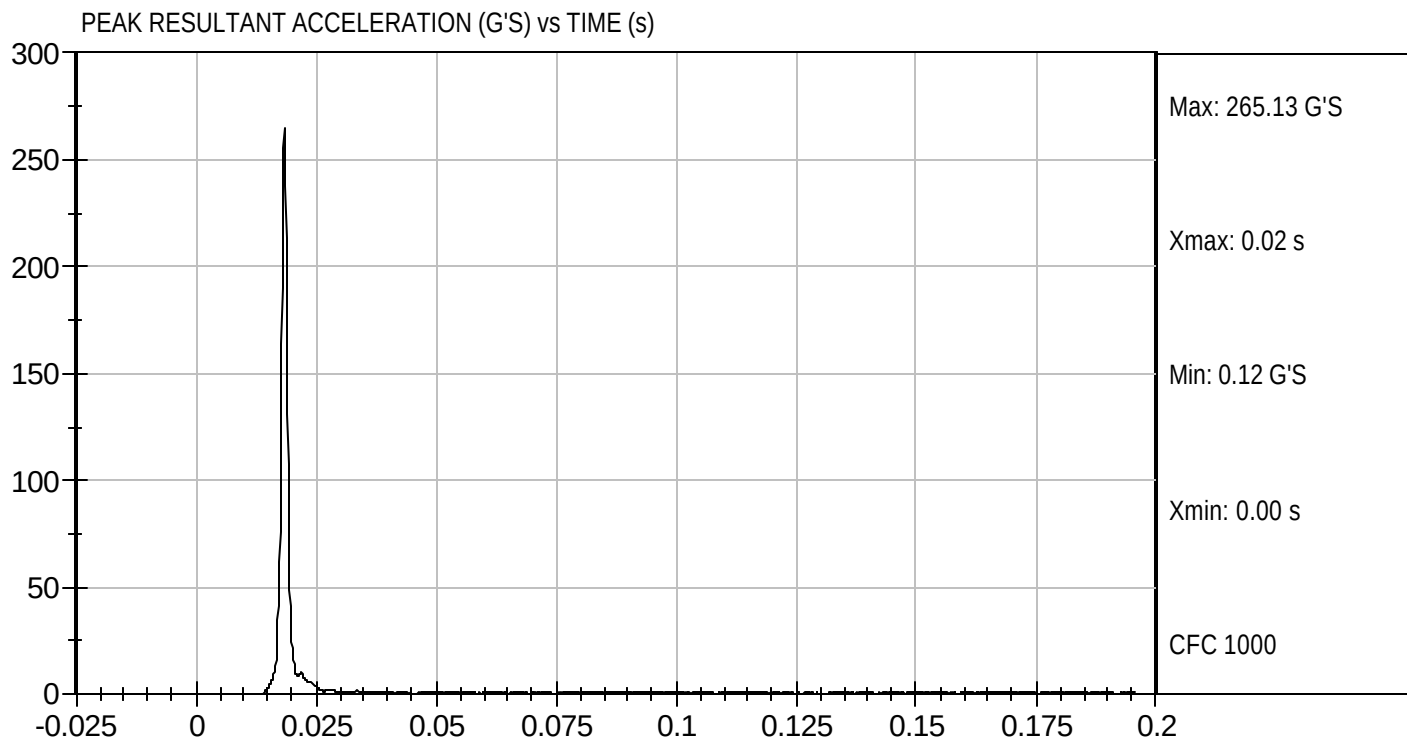
06/06/2006  
Test Date

  
Approved By



Test Desc: Head Drop  
Componet ID: D061641

Test Date: 06/06/2006  
Velocity: 0 ft/s, 0 m/s



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 505

Test Date 6/6/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

☐ 1. It has been at least 30 minutes since the last flexion test. (572.137(q))

☒ N/A, ONLY one flexion test performed

☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

Record the maximum temperature 21.9

Record the minimum temperature 21.0

Record the maximum humidity 46%

Record the minimum humidity 41%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration. Hardness Front 81; Back 89.

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))

☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))

☒ 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) &amp; (572.133(c)(4)(i &amp; ii))

| Parameter                                        |         | Specification                                                                                                                                        | Result                           |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Pendulum impact speed                            |         | $6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$                                                                                           | 7.08 m/s                         |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms  | $2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$                                                                                                 | 2.4 m/s                          |
|                                                  | @ 20 ms | $4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$                                                                                                 | 4.7 m/s                          |
|                                                  | @30ms   | $5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$                                                                                                 | 6.8 m/s                          |
| Plane D Rotation                                 |         | Peak moment*<br>$69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$ | <u>75</u> Nm @ <u>80</u> degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 10 Nm<br>$80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$                                                                       | 87 ms                            |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

  
Signature

6/6/06  
Date

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

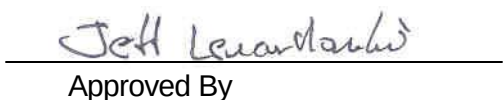
ATD Serial No: 505

Test I.D: D061642

| 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      | 41     | Pass      |
| Pendulum Speed                                      |         | m/sec | 6.89 to 7.13  | 7.08   | Pass      |
| Pendulum Deceleration                               | 10 msec | m/sec | 2.1 to 2.5    | 2.4    | Pass      |
|                                                     | 20 msec | m/sec | 4.0 to 5.0    | 4.7    | Pass      |
|                                                     | 30 msec | m/sec | 5.8 to 7.0    | 6.8    | Pass      |
| D Plane Rotation                                    | Max     | deg   | 77 to 91      | 80     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |         | Nm    | 69 to 83      | 75     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm           |         | msec  | 80 to 100     | 87     | Pass      |
| Overall Results                                     |         |       |               | Pass   |           |

  
Laboratory Technician

06/06/2006  
Test Date

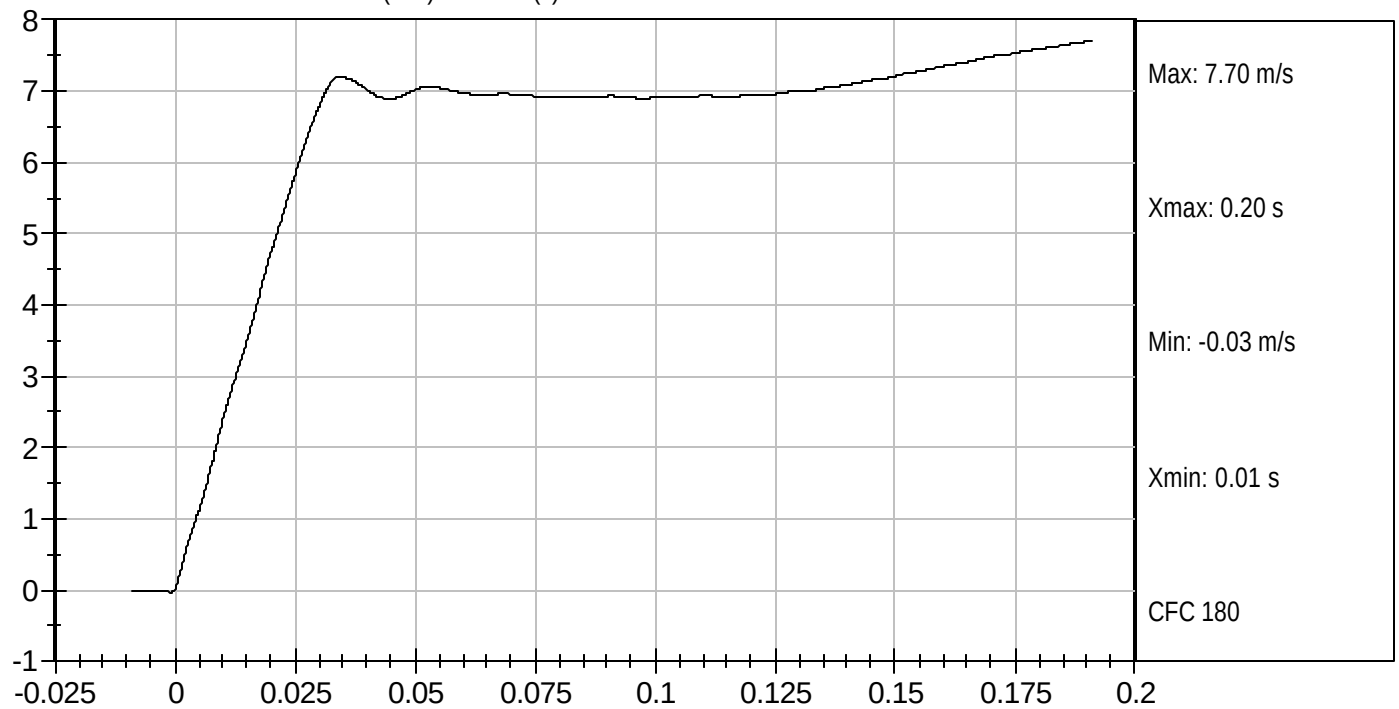
  
Approved By



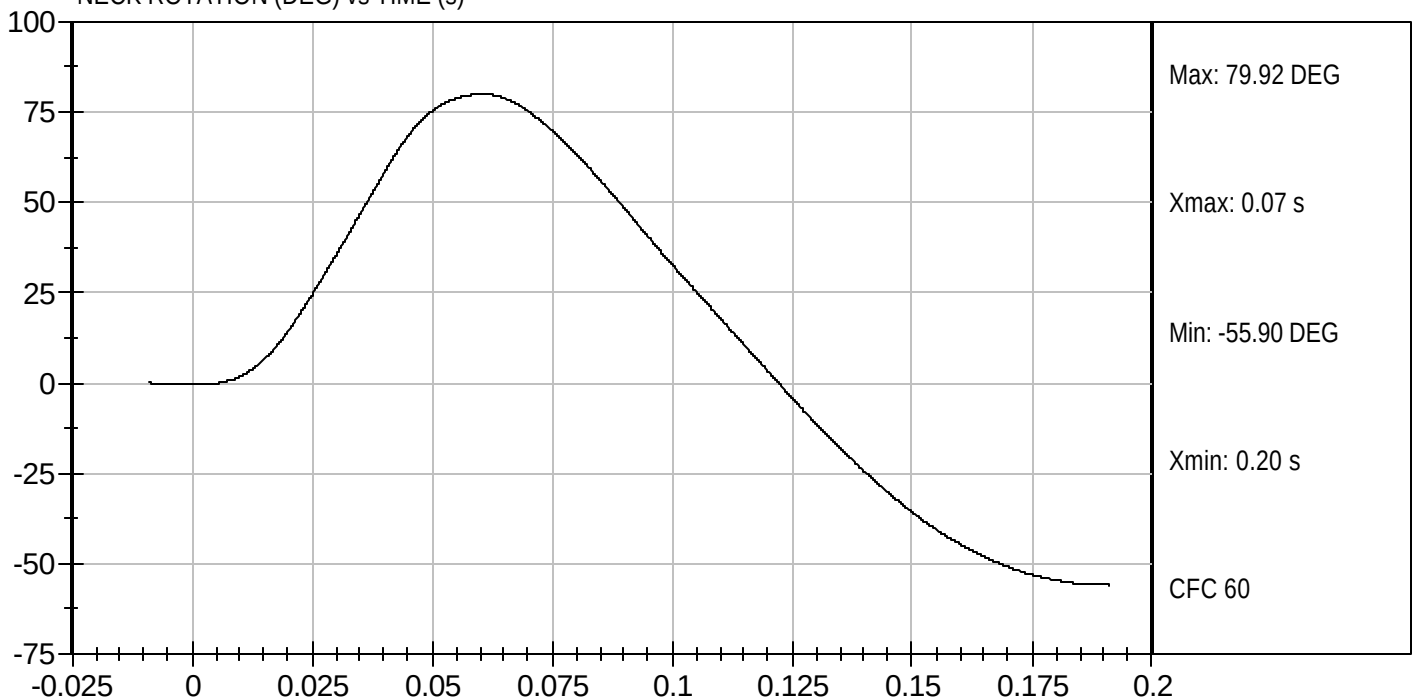
Test Desc: Neck Flexion  
Componet ID: D061642

Test Date: 06/06/2006  
Velocity: 23.24 ft/s, 7.08 m/s

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



NECK ROTATION (DEG) vs TIME (s)

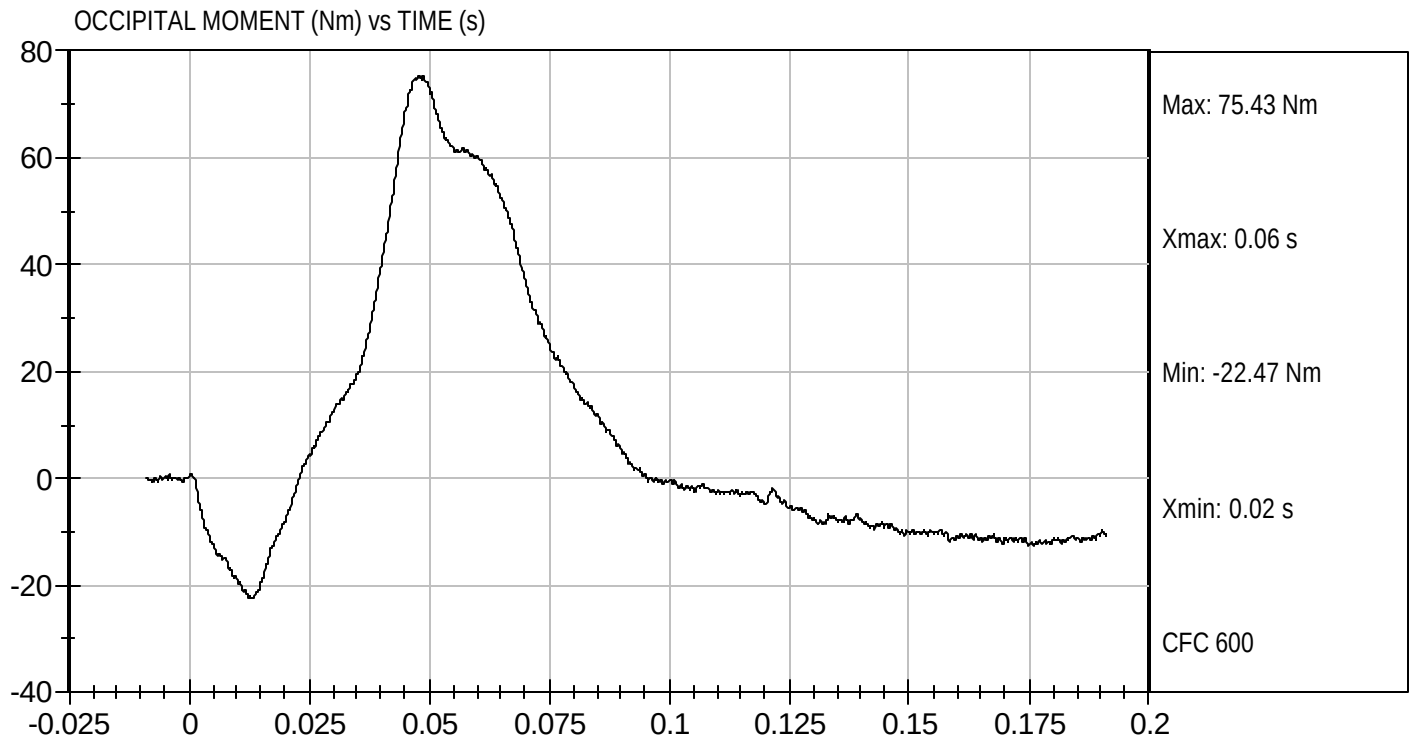






Test Desc: Neck Flexion  
Componet ID: D061642

Test Date: 06/06/2006  
Velocity: 23.24 ft/s, 7.08 m/s



DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 505

Test Date 6/6/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

☐ 1. It has been at least 30 minutes since the last extension test. (572.137(q))

☒ N/A, ONLY one extension test performed

☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

Record the maximum temperature 21.9

Record the minimum temperature 21.0

Record the maximum humidity 46%

Record the minimum humidity 41%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration. Hardness Front 81; Back 89.

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))

☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))

☒ 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Extension Test Results (572.133(b)(2) &amp; (572.133(c)(4)(i &amp; ii))

| Parameter                                        |         | Specification                                                                                                                                           | Result                             |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| Pendulum impact speed                            |         | $5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$                                                                                              | 6.17 m/s                           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms  | $1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$                                                                                                    | 1.7 m/s                            |
|                                                  | @ 20 ms | $3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$                                                                                                    | 3.5 m/s                            |
|                                                  | @30ms   | $4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$                                                                                                    | 5.0 m/s                            |
| Plane D Rotation                                 |         | Peak moment*<br>$-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$ | <u>-59</u> Nm @ <u>105</u> degrees |
| Negative Moment Decay**<br>(Extension)           |         | Time to decay to -10 Nm<br>$94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$                                                                         | 103 ms                             |

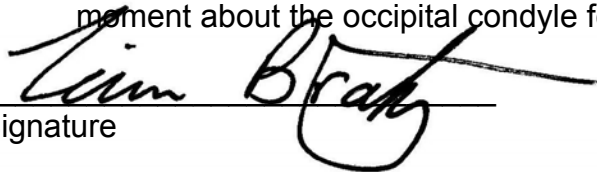
\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

  
Signature

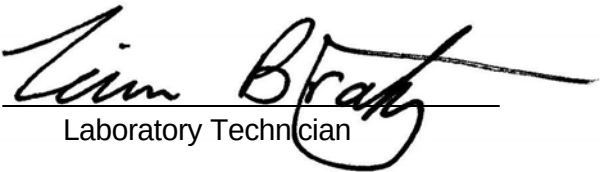
6/6/06  
Date

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

ATD Serial No: 505

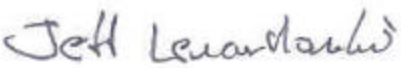
Test I.D: D061643

| 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      | 43     | Pass      |
| Pendulum Speed                                      |         | m/sec | 5.95 to 6.19  | 6.17   | Pass      |
| Pendulum Deceleration                               | 10 msec | m/sec | 1.5 to 1.9    | 1.7    | Pass      |
|                                                     | 20 msec | m/sec | 3.1 to 3.9    | 3.5    | Pass      |
|                                                     | 30 msec | m/sec | 4.6 to 5.6    | 5.0    | Pass      |
| D Plane Rotation                                    | Max     | deg   | 99 to 114     | 105    | Pass      |
| Occipital Condyle Moment within Deflection Corridor |         | Nm    | -65 to -53    | -59    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm          |         | msec  | 94 to 114     | 103    | Pass      |
| Overall Results                                     |         |       |               | Pass   |           |

  
 Laboratory Technician

06/06/2006

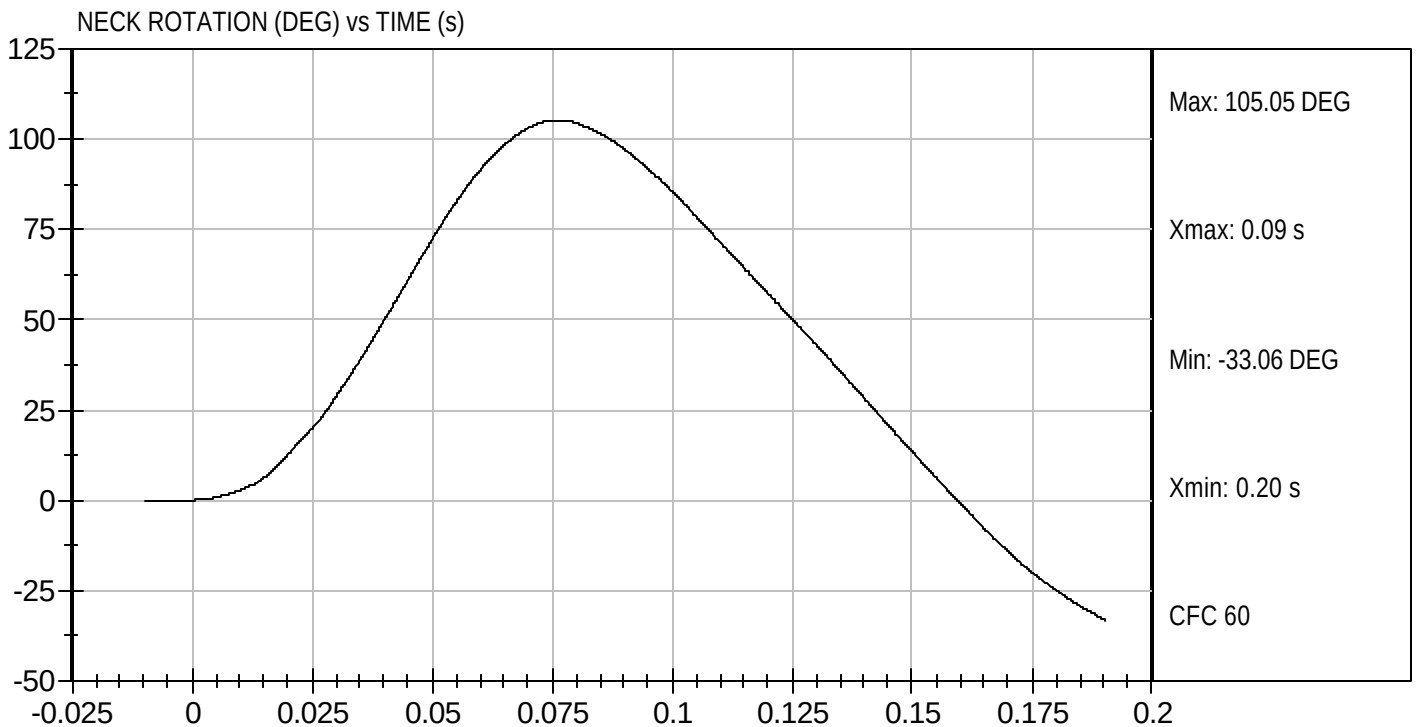
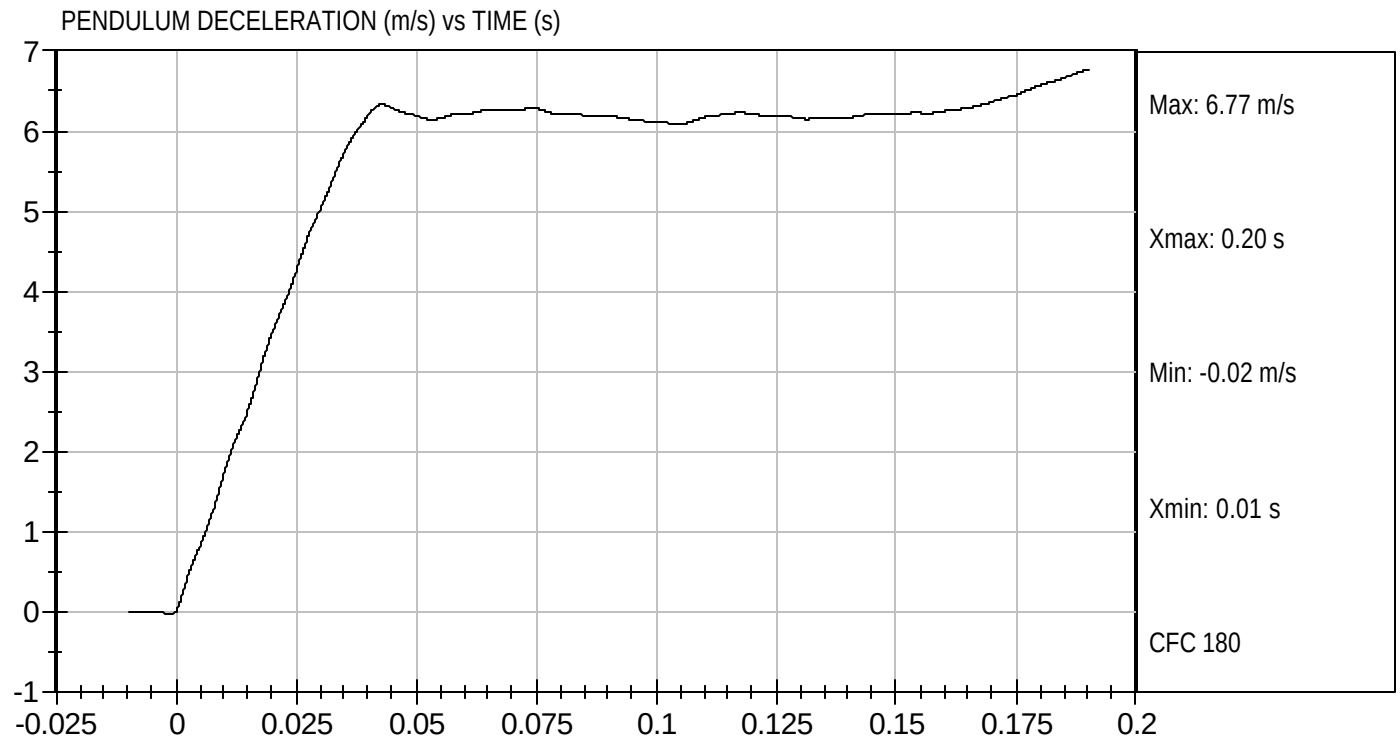
Test Date

  
 Approved By



Test Desc: Neck Extension  
Componet ID: D061643

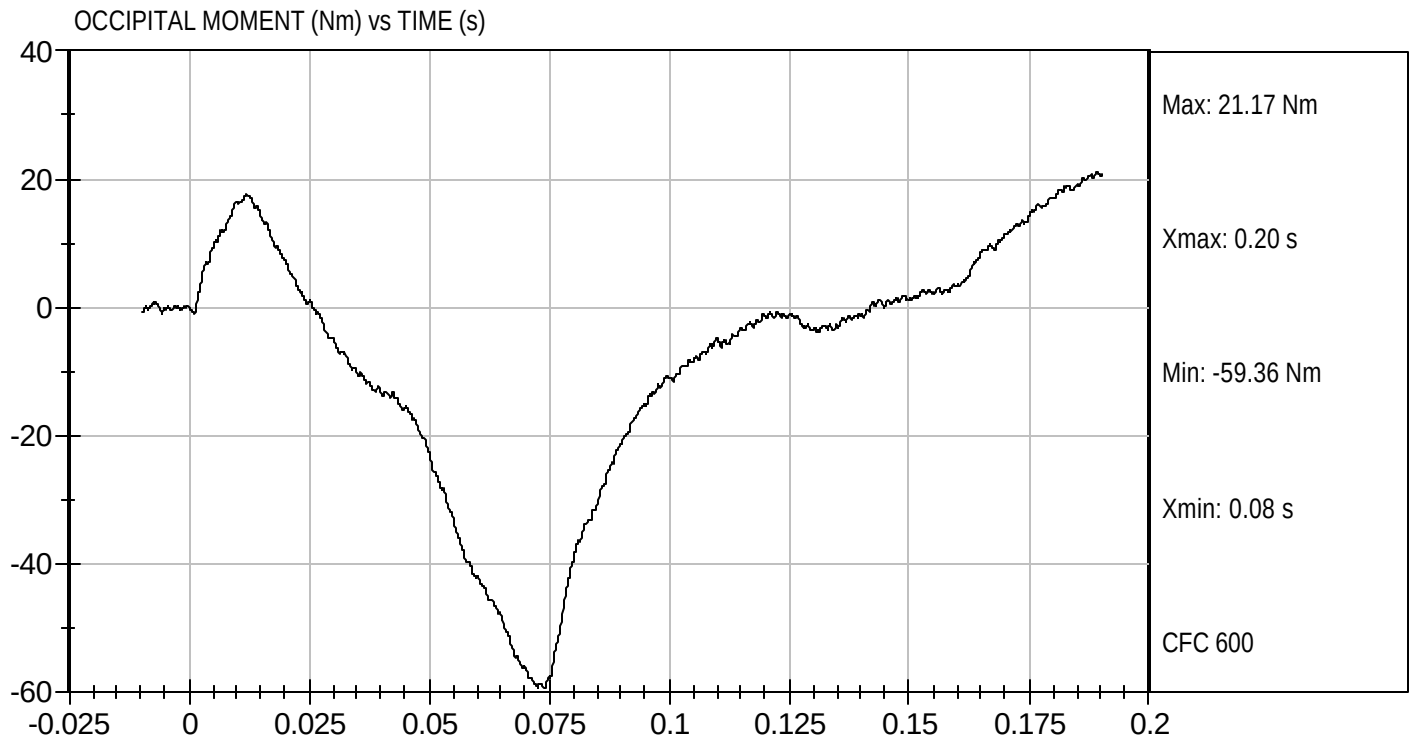
Test Date: 06/06/2006  
Velocity: 20.25 ft/s, 6.17 m/s





Test Desc: Neck Extension  
Componet ID: D061643

Test Date: 06/06/2006  
Velocity: 20.25 ft/s, 6.17 m/s



DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 505

Test Date 6/6/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))

☒ N/A, ONLY one thorax impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 11B.

☒ 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))

☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))

Record the maximum temperature 21.9

Record the minimum temperature 21.0

Record the maximum humidity 46%

Record the minimum humidity 41%

☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

☒ - No damage

☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_

☐ - The following repairs or replacement was performed. Record \_\_\_\_\_

☒ 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))

☒ 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.

- X 8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X 10. Align the adjustable neck bracket index marks to the "zero" position.
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))



X 16. Complete the following table:

Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*                                              | Specification                                                  | Result   |
|---------------------------------------------------------|----------------------------------------------------------------|----------|
| Test Probe Speed                                        | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.72 m/s |
| Chest Compression                                       | $50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$ | 53 mm    |
| Peak force** between 50.0 and 58.0 mm chest compression | $3900\text{N} \leq \text{peak force} \leq 4400\text{N}$        | 4042 N   |
| Peak force** between 18.0 and 50.0 mm chest compression | $\text{peak force} \leq 4600 \text{ N}$                        | 4042 N   |
| Internal Hysteresis***                                  | $69\% \leq \text{hysteresis} \leq 85\%$                        | 70%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.134(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

X 17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

  
Signature

6/6/06  
Date

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

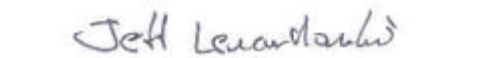
ATD Serial No: 505

Test I.D: D061644

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.0   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 44     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.72   | Pass      |
| Peak Deflection                               | mm    | 50 to 58      | 53     | 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     | ≤ 4600 N      | 4042   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

  
Laboratory Technician

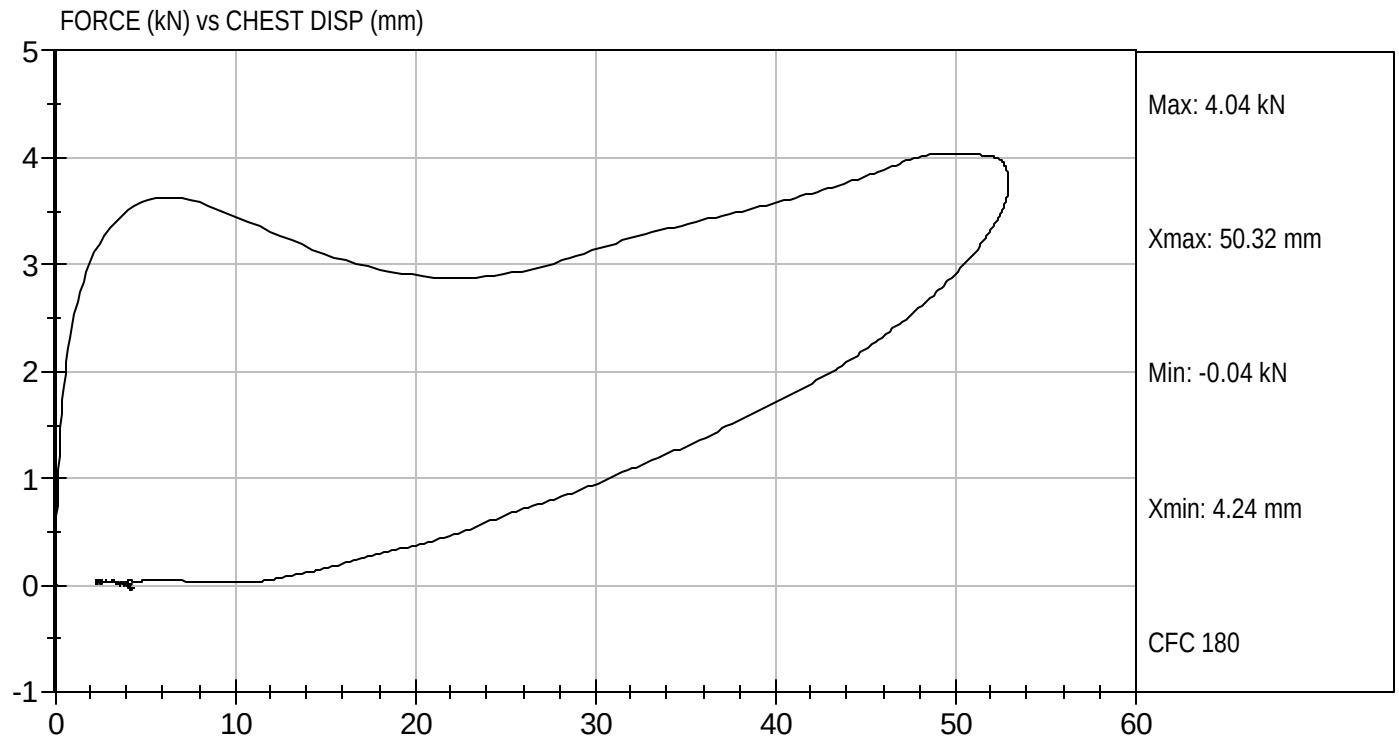
06/06/2006  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Componet ID: D061644

Test Date: 06/06/2006  
Velocity: 22.04 ft/s, 6.72 m/s



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 505 Test Date 6/6/06

Technician Tim Bratz

☒ Pretest calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- ☐ 1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
☒ N/A, ONLY one thorax impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 13B.
- ☒ 3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
☐ with legs below the femurs.  
☒ without legs below the femurs.
- ☒ 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.9</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>46%</u>  |
| Record the minimum humidity    | <u>41%</u>  |
- ☒ 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- ☒ 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- ☒ 7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- ☒ 8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
- ☒ 9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- ☒ 10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- ☒ 11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))
- |                                                 |            |
|-------------------------------------------------|------------|
| Record reference plane angle (max. allowed 20°) | <u>19°</u> |
|-------------------------------------------------|------------|
- ☒ 12. Attach the pull cable and the load cell. (572.135(c)(8))

- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between  $0.5^\circ$  and  $1.5^\circ$  per second, until the angle reference plane is at  $45^\circ \pm 0.5^\circ$  of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X 14. Maintain angle reference plane at  $45^\circ \pm 0.5^\circ$  of flexion for 10 seconds. (572.135(c)(10))
- X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X 16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X 17. Complete the following table:

Torso Flexion Results (572.135(b), 572.135(c)(7), (572.135(c)(9))

| Parameter                         | Specification                                                 | Result     |
|-----------------------------------|---------------------------------------------------------------|------------|
| Initial ref. plane angle          | Angle $\leq 20^\circ$                                         | $19^\circ$ |
| Torso rotation rate               | $0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$ | 1.0        |
| Force at $45^\circ \pm 0.5^\circ$ | $320 \text{ N} \leq \text{force} \leq 390 \text{ N}$          | 364        |
| Final ref. plane angle            | Initial ref. plane angle $\pm 8^\circ$                        | $20^\circ$ |

  
Signature

6/6/06  
Date

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

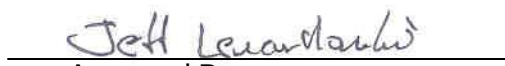
ATD Serial No: 505

Test I.D: D061647

| 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      | 44     | Pass      |
| Initial Angle                | deg     | 0 to 20       | 19     | Pass      |
| Return Angle                 | deg     | +/- 8         | 20     | 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

06/06/2006  
Test Date

  
Approved By

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 6/6/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14B

☒ 3. The knee assembly (880105-528L), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

Record the maximum temperature 21.9

Record the minimum temperature 21.0

Record the maximum humidity 46%

Record the minimum humidity 41%

☒ 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))

☒ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

X 11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.12 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3800 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

X 12. Plots of acceleration versus time and force versus time follow this sheet.

  
Signature

6/6/06  
Date



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

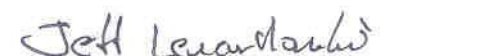
**ATD Serial No:** 505

**Test I.D:** D061646

| 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      | 46     | Pass      |
| Probe Speed                  | m/sec | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.80   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

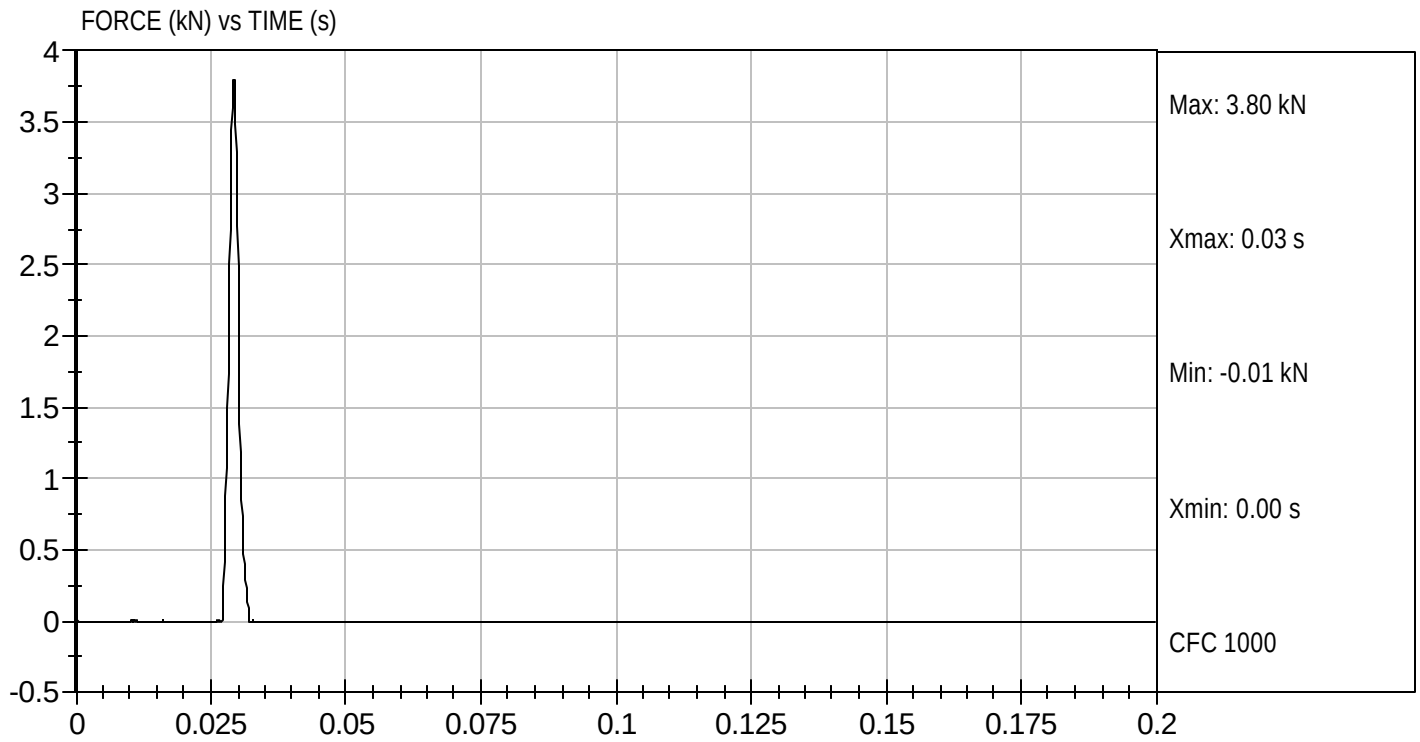
06/06/2006  
Test Date

  
Approved By



Test Desc: Left Knee  
Componet ID: D061646

Test Date: 06/06/2006  
Velocity: 6.96 ft/s, 2.12 m/s



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 6/6/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14B.

☒ 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

Record the maximum temperature 21.9

Record the minimum temperature 21.0

Record the maximum humidity 46%

Record the minimum humidity 41%

☒ 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))

☒ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))

☒ 11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.12 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3680 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

☒ 12. Plots of acceleration versus time and force versus time follow this sheet.

  
Signature

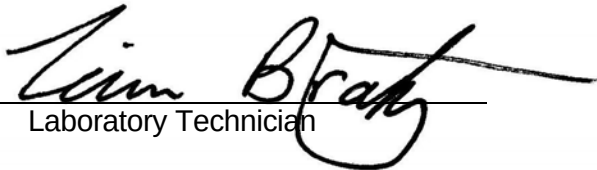
6/6/06  
Date

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

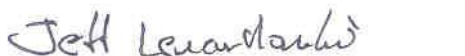
**ATD Serial No:** 505

**Test I.D:** D061645

| 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      | 45     | Pass      |
| Probe Speed                  | m/sec | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.68   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

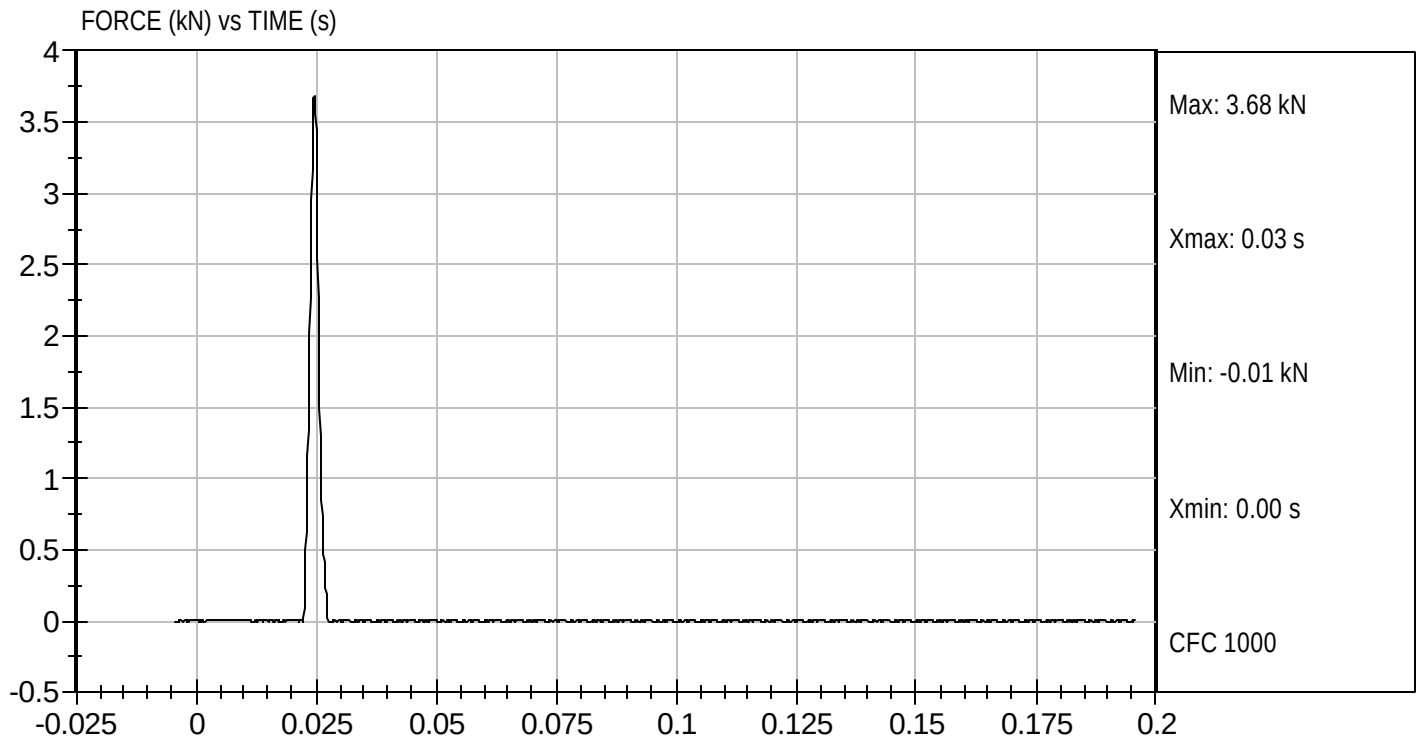
06/06/2006  
Test Date

  
Approved By



Test Desc: Right Knee  
Componet ID: D061645

Test Date: 06/06/2006  
Velocity: 6.97 ft/s, 2.12 m/s



DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 505 Test Date 6/26/06

Technician Dave Wilcox

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

☐ 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))

☒ N/A, ONLY one head drop performed

☒ 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))

☒ 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.

☒ 4. Accelerometers and their respective mounts are smooth and clean.

☒ 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.

☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))

☒ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))

Record the maximum temperature 21.3

Record the minimum temperature 21.0

Record the maximum humidity 47%

Record the minimum humidity 43%

☒ 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

☒ 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))

Record the right side distance 501mm

Record the left side distance 501mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))

Record actual micro finish  $656 \times 10^{-6}$  mm

- X 13. The impact surface is rigidly supported. (572.132(c)(4))

- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

- X 15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))

- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        | 278    |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | 1      |

- X 17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

  
Signature

6/26/06  
Date



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

ATD Serial No: 505

Test ID: D061821

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 46     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 278    | Pass      |
| Peak Lateral Acceleration    | G's   | +/- 15             | 1.4    | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |



Laboratory Technician

06/26/2006

Test Date



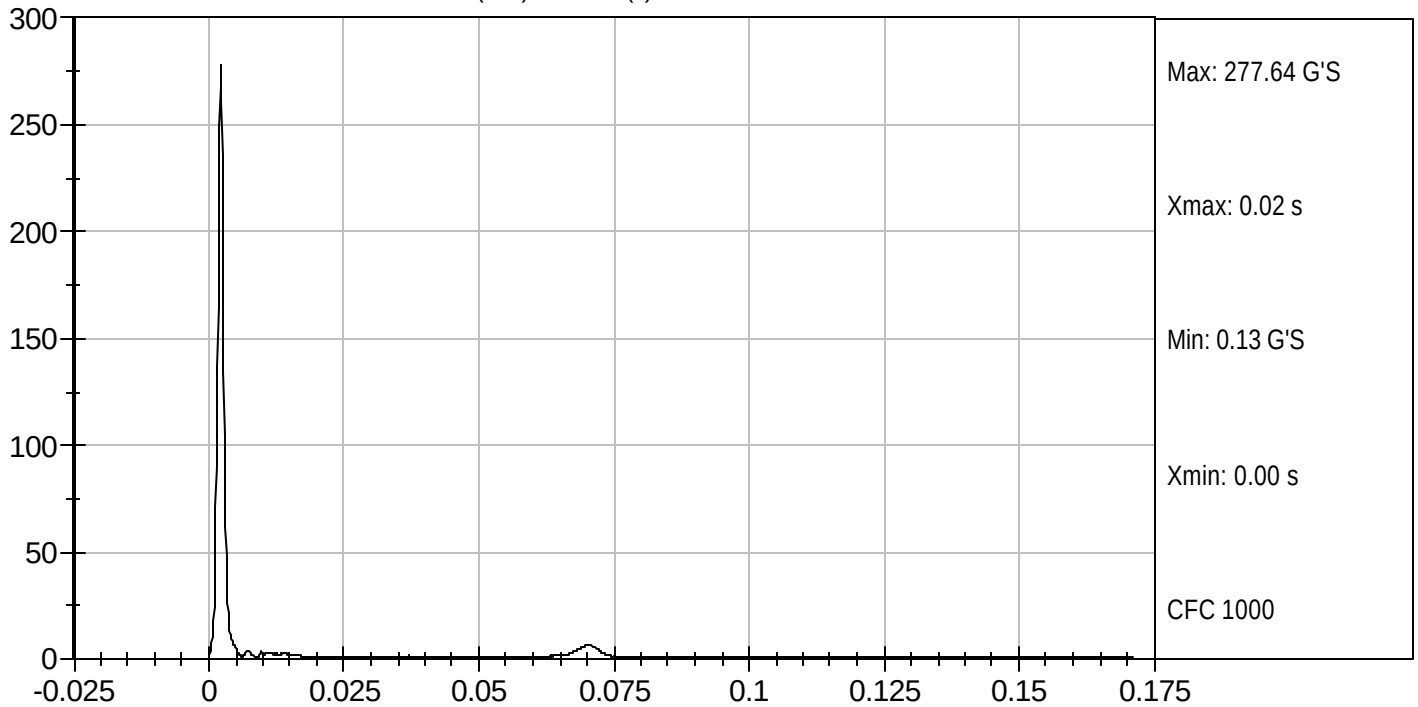
Approved By



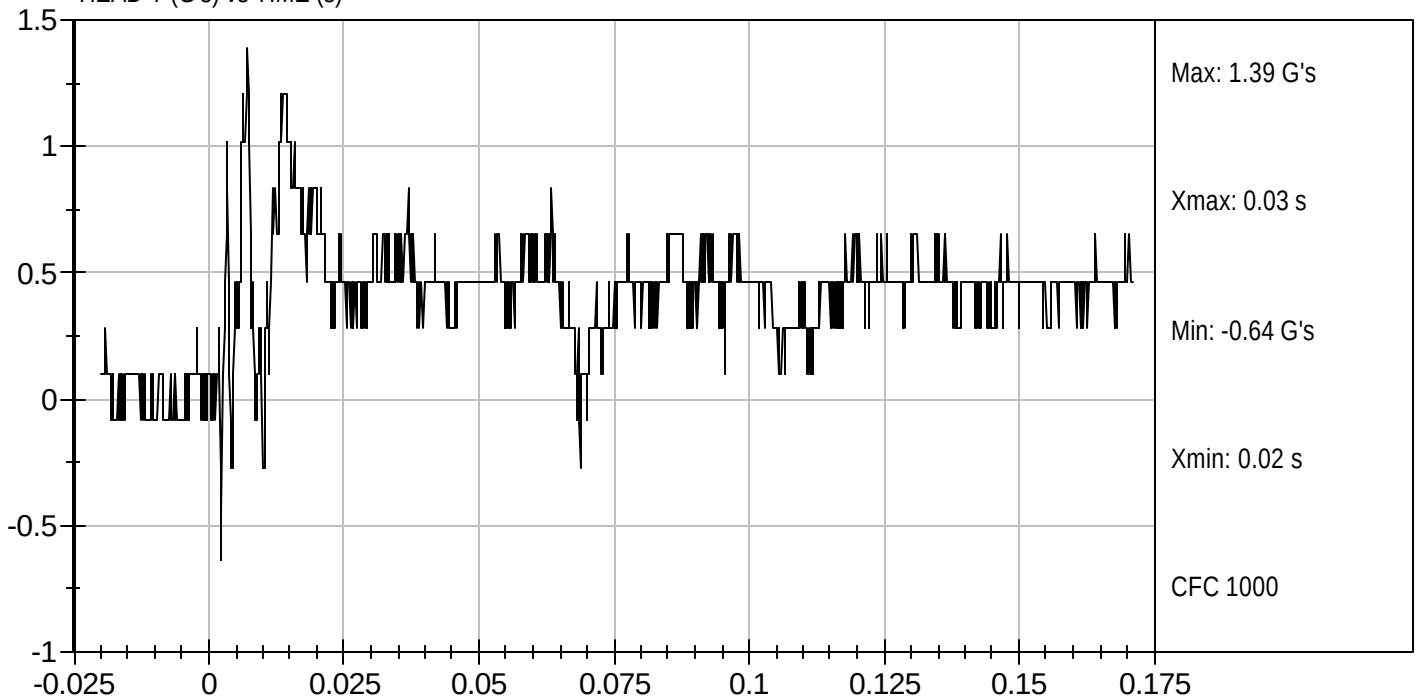
Test Desc: Head Drop  
Componet ID: D061821

Test Date: 06/26/2006  
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 505 Test Date 6/26/06

Technician Tim Bratz

☐ Pretest calibration  
☒ Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

- ☐ 1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
☒ N/A, ONLY one flexion test performed
- ☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- ☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.3</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>47%</u>  |
| Record the minimum humidity    | <u>43%</u>  |
- ☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
- ☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness Front 81; Back 89.
- ☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))
- ☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- ☒ 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) &amp; (572.133(c)(4)(i &amp; ii))

| Parameter                                        |         | Specification                                                                                                                                        | Result                           |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Pendulum impact speed                            |         | $6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$                                                                                           | 6.96 m/s                         |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms  | $2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$                                                                                                 | 2.5 m/s                          |
|                                                  | @ 20 ms | $4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$                                                                                                 | 4.9 m/s                          |
|                                                  | @30ms   | $5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$                                                                                                 | 6.9 m/s                          |
| Plane D Rotation                                 |         | Peak moment*<br>$69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$ | <u>74</u> Nm @ <u>80</u> degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 10 Nm<br>$80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$                                                                       | 86 ms                            |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

  
Signature

6/26/06  
Date

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

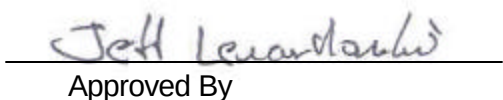
ATD Serial No: 505

Test I.D: D061822

| 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      | 44     | Pass      |
| Pendulum Speed                                      |         | m/sec | 6.89 to 7.13  | 6.96   | Pass      |
| Pendulum Deceleration                               | 10 msec | m/sec | 2.1 to 2.5    | 2.5    | Pass      |
|                                                     | 20 msec | m/sec | 4.0 to 5.0    | 4.9    | Pass      |
|                                                     | 30 msec | m/sec | 5.8 to 7.0    | 6.9    | Pass      |
| D Plane Rotation                                    | Max     | deg   | 77 to 91      | 80     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |         | Nm    | 69 to 83      | 74     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm           |         | msec  | 80 to 100     | 86     | Pass      |
| Overall Results                                     |         |       |               |        | Pass      |

  
Laboratory Technician

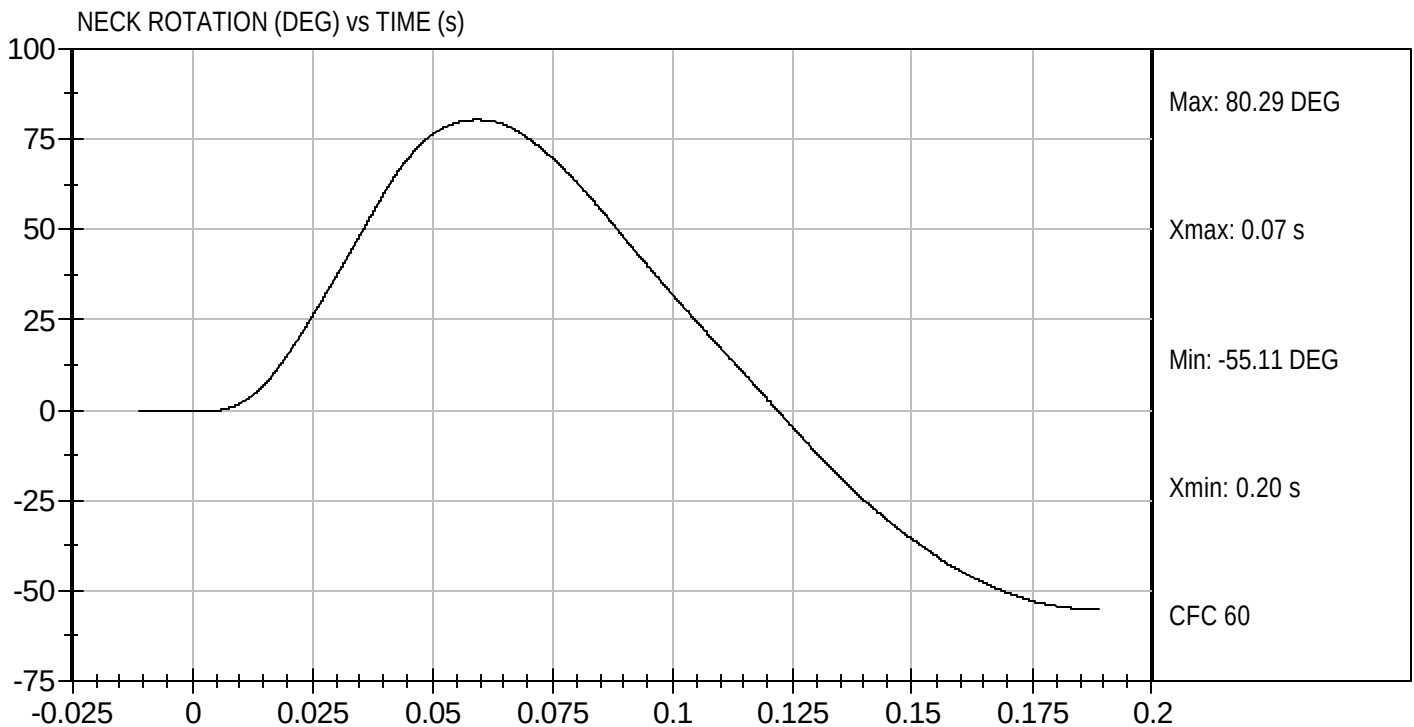
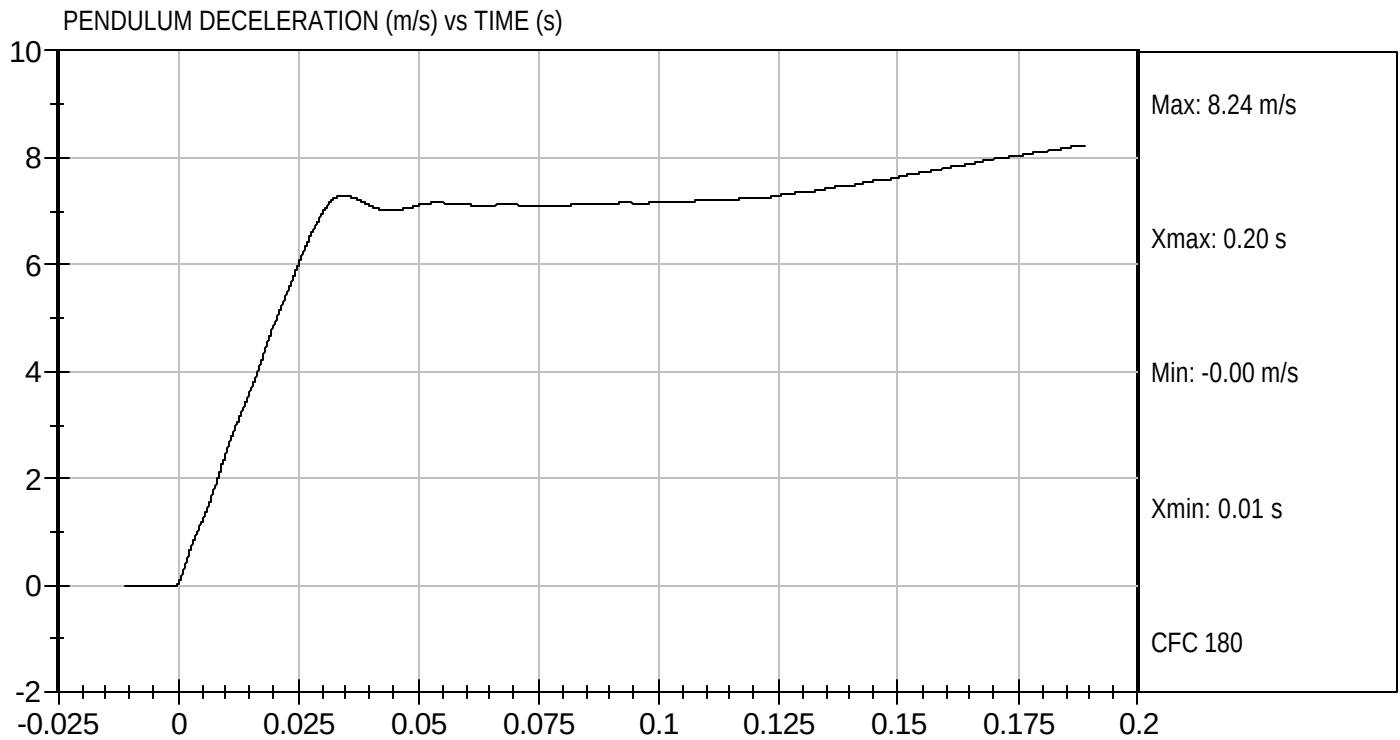
06/26/2006  
Test Date

  
Approved By



Test Desc: Neck Flexion  
Componet ID: D061822

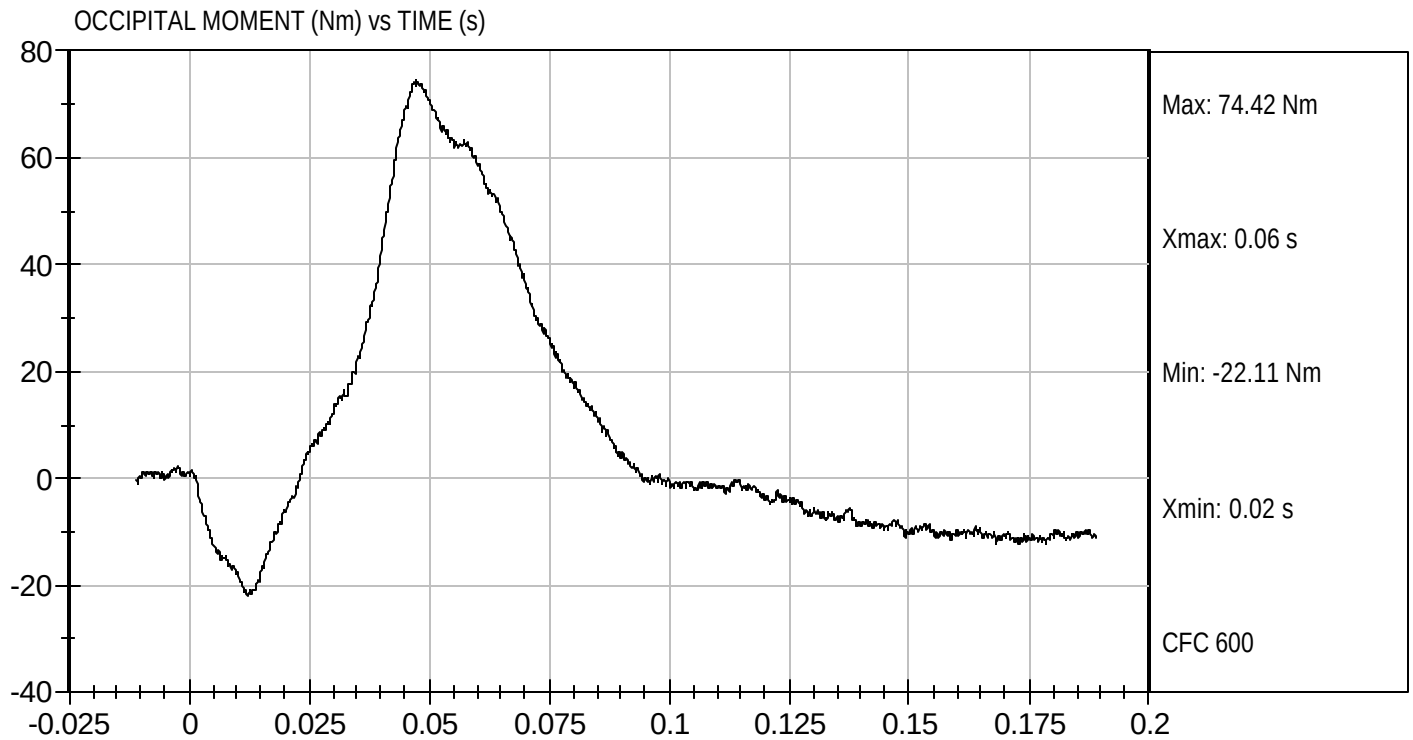
Test Date: 06/26/2006  
Velocity: 22.85 ft/s, 6.96 m/s





Test Desc: Neck Flexion  
Componet ID: D061822

Test Date: 06/26/2006  
Velocity: 22.85 ft/s, 6.96 m/s



DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 505

Test Date 6/26/06

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

☐ 1. It has been at least 30 minutes since the last extension test. (572.137(q))

☒ N/A, ONLY one extension test performed

☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

Record the maximum temperature 21.3

Record the minimum temperature 21.0

Record the maximum humidity 47%

Record the minimum humidity 43%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration. Hardness Front 81; Back 89.

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))

☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))

☒ 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))



- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Extension Test Results (572.133(b)(2) &amp; (572.133(c)(4)(i &amp; ii))

| Parameter                                        |         | Specification                                                                                                                 | Result                  |
|--------------------------------------------------|---------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Pendulum impact speed                            |         | 5.95 m/s $\leq$ speed $\leq$ 6.19 m/s                                                                                         | 6.06 m/s                |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms  | 1.5 m/s $\leq \Delta V \leq$ 1.9 m/s                                                                                          | 1.9 m/s                 |
|                                                  | @ 20 ms | 3.1 m/s $\leq \Delta V \leq$ 3.9 m/s                                                                                          | 3.8 m/s                 |
|                                                  | @30ms   | 4.6 m/s $\leq \Delta V \leq$ 5.6 m/s                                                                                          | 5.5 m/s                 |
| Plane D Rotation                                 |         | Peak moment*<br>-65 Nm $\leq$ moment $\leq$ -53 Nm during the following rotation range $99^\circ \leq$ angle $\leq 114^\circ$ | -61 Nm @<br>108 degrees |
| Negative Moment Decay**<br>(Extension)           |         | Time to decay to -10 Nm<br>94 ms $\leq$ time $\leq$ 114 ms                                                                    | 98 ms                   |

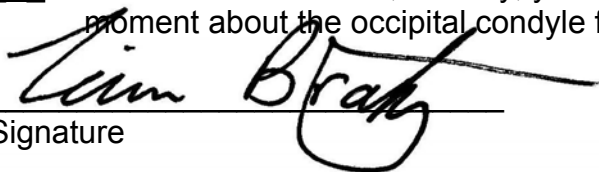
\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

  
Signature

6/26/06  
Date

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

ATD Serial No: 505

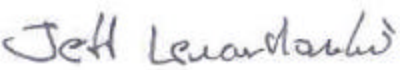
Test I.D: D061823

| Tested Parameter                                    |         | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|---------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |         | deg C | 20.6 to 22.2  | 21.0   | Pass      |
| Laboratory Relative Humidity                        |         | %     | 10 to 70      | 43     | Pass      |
| Pendulum Speed                                      |         | m/sec | 5.95 to 6.19  | 6.06   | Pass      |
| Pendulum Deceleration                               | 10 msec | m/sec | 1.5 to 1.9    | 1.9    | Pass      |
|                                                     | 20 msec | m/sec | 3.1 to 3.9    | 3.8    | Pass      |
|                                                     | 30 msec | m/sec | 4.6 to 5.6    | 5.5    | Pass      |
| D Plane Rotation                                    | Max     | deg   | 99 to 114     | 108    | Pass      |
| Occipital Condyle Moment within Deflection Corridor |         | Nm    | -65 to -53    | -61    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm          |         | msec  | 94 to 114     | 98     | Pass      |
| Overall Results                                     |         |       |               | Pass   |           |

  
 Laboratory Technician

06/26/2006

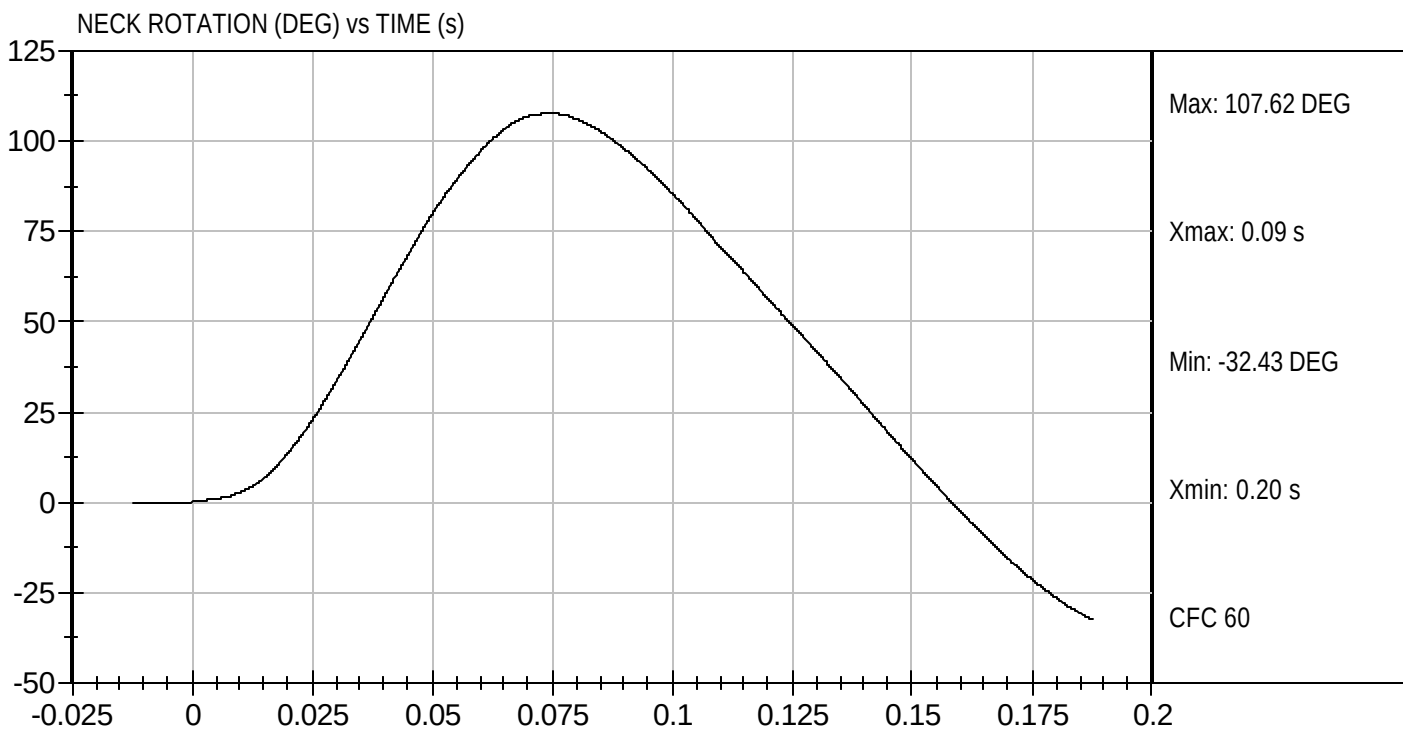
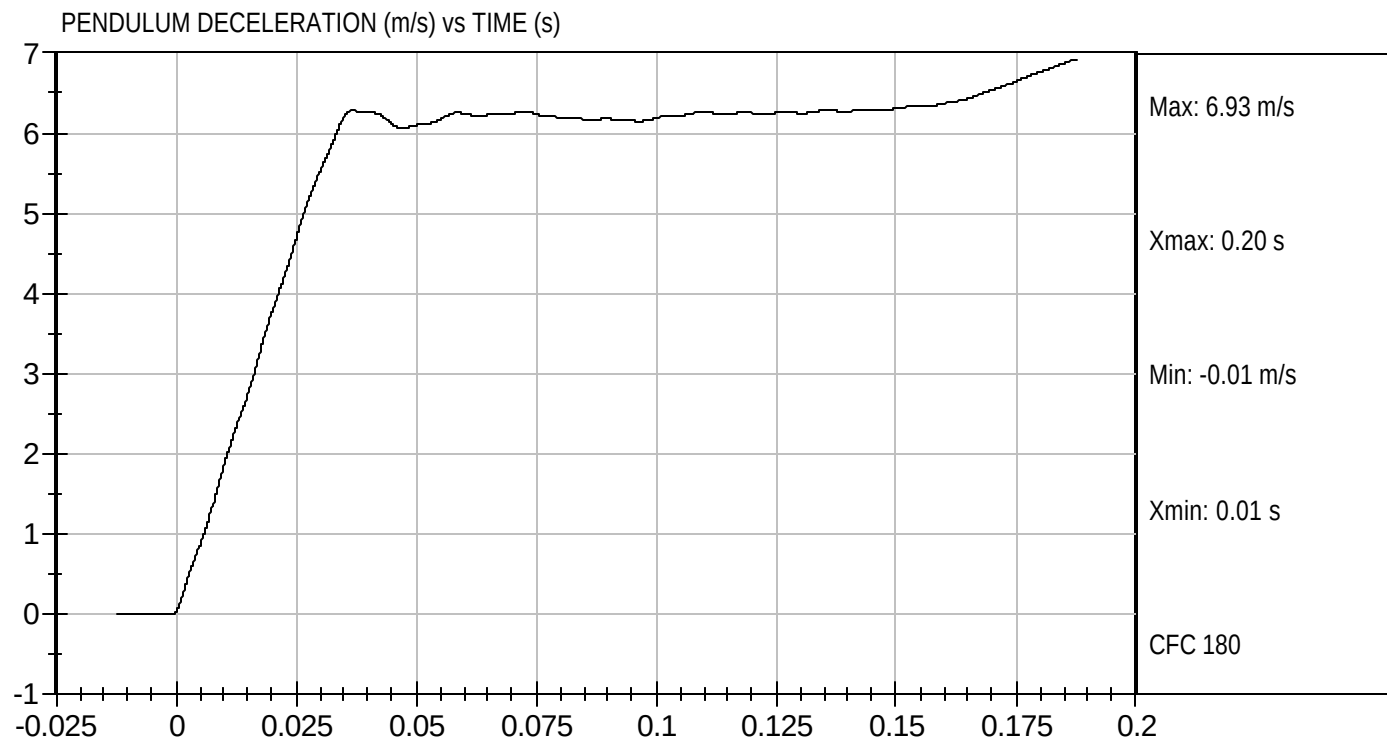
Test Date

  
 Approved By



Test Desc: Neck Extension  
Componet ID: D061823

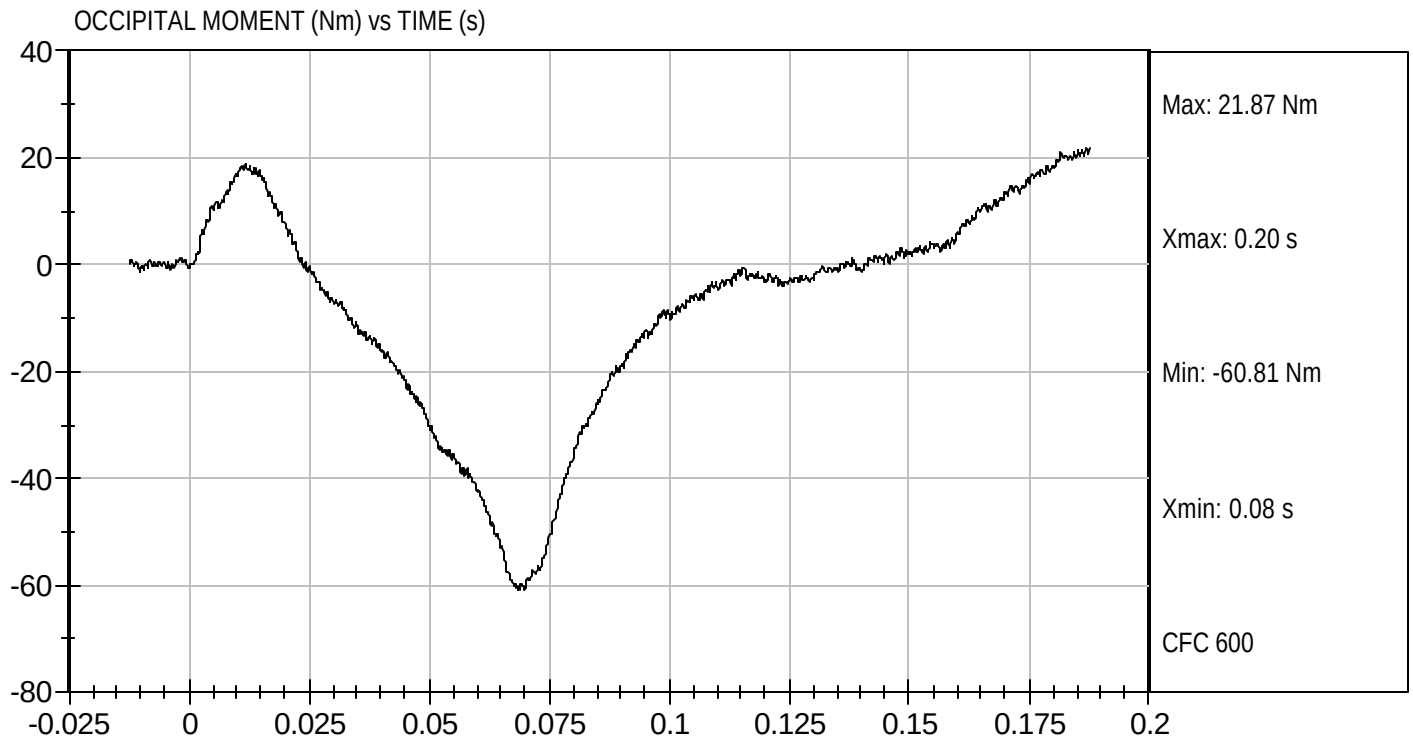
Test Date: 06/26/2006  
Velocity: 19.87 ft/s, 6.06 m/s





Test Desc: Neck Extension  
Componet ID: D061823

Test Date: 06/26/2006  
Velocity: 19.87 ft/s, 6.06 m/s



DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 505

Test Date 6/26/06

Technician Dave Wilcox

     Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

     1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))

X N/A, ONLY one thorax impact test performed

X 2. The test fixture conforms to the specifications in Figure 11B.

X 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))

X 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))

Record the maximum temperature 21.3

Record the minimum temperature 21.0

Record the maximum humidity 47%

Record the minimum humidity 43%

X 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

X - No damage

     - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_

     - The following repairs or replacement was performed. Record \_\_\_\_\_

X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))

X 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.

- X 8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X 10. Align the adjustable neck bracket index marks to the "zero" position.
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

X 16. Complete the following table:

Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*                                              | Specification                                                  | Result   |
|---------------------------------------------------------|----------------------------------------------------------------|----------|
| Test Probe Speed                                        | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.65 m/s |
| Chest Compression                                       | $50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$ | 53 mm    |
| Peak force** between 50.0 and 58.0 mm chest compression | $3900\text{N} \leq \text{peak force} \leq 4400\text{N}$        | 3920 N   |
| Peak force** between 18.0 and 50.0 mm chest compression | $\text{peak force} \leq 4600 \text{ N}$                        | 3872 N   |
| Internal Hysteresis***                                  | $69\% \leq \text{hysteresis} \leq 85\%$                        | 70%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.134(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

X 17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

  
Signature

6/26/06  
Date

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

**ATD Serial No:** 505

**Test I.D:** D061824

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.2   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 47     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.65   | Pass      |
| Peak Deflection                               | mm    | 50 to 58      | 53     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | kN    | 3.9 to 4.4    | 3.9    | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 70     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | ≤ 4600 N      | 3872   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |



Laboratory Technician

06/26/2006

Test Date



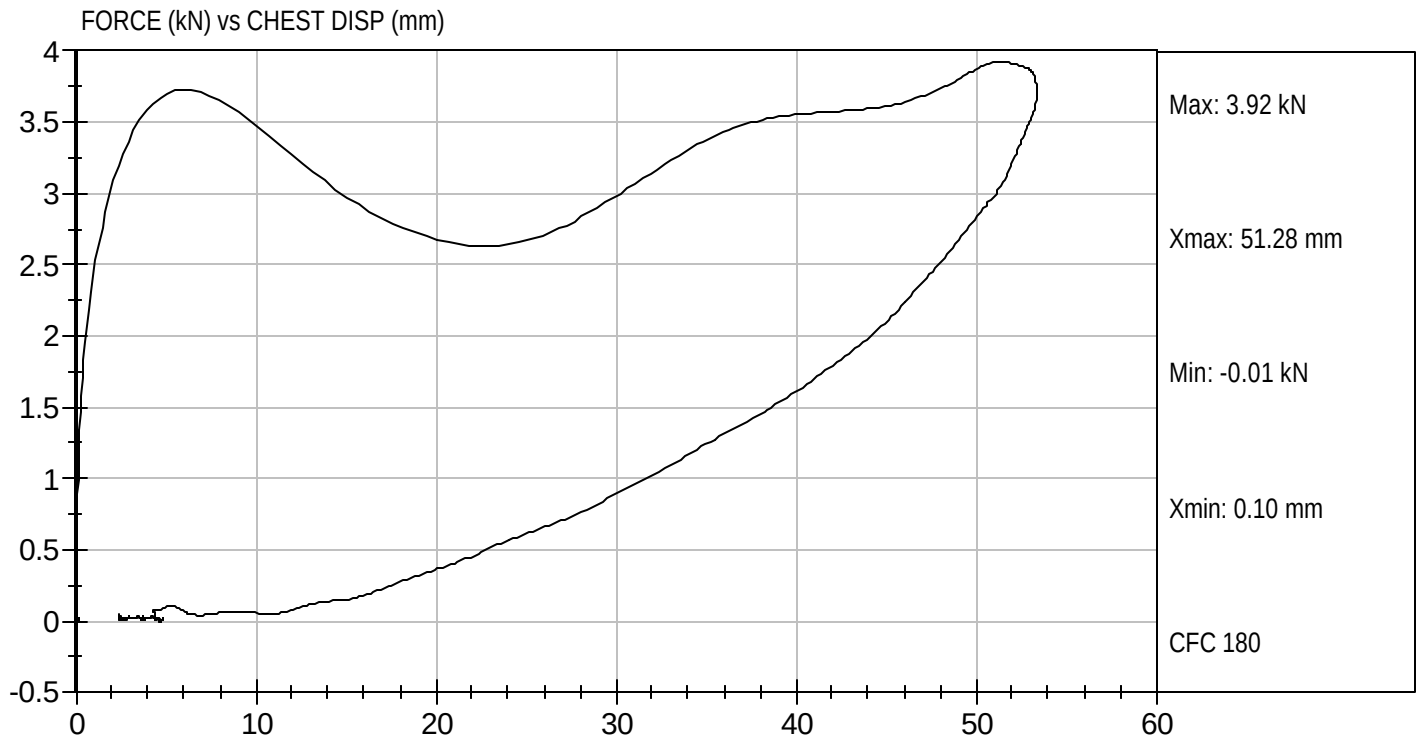
Approved By





Test Desc: Thorax Impact  
Componet ID: D061824

Test Date: 06/26/2006  
Velocity: 21.81 ft/s, 6.65 m/s



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 505

Test Date 6/26/06

Technician Dave Wilcox

     Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

     1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))

X N/A, ONLY one thorax impact test performed

X 2. The test fixture conforms to the specifications in Figure 13B.

X 3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).

     with legs below the femurs.

X without legs below the femurs.

X 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))

Record the maximum temperature 21.3

Record the minimum temperature 21.0

Record the maximum humidity 47%

Record the minimum humidity 43%

X 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))

X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))

X 7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))

X 8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

X 9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))

X 10. Remove all external support that was implemented in 9 above. (572.135(c)(7))

X 11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))

Record reference plane angle (max. allowed 20°) 18°

X 12. Attach the pull cable and the load cell. (572.135(c)(8))

- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between  $0.5^\circ$  and  $1.5^\circ$  per second, until the angle reference plane is at  $45^\circ \pm 0.5^\circ$  of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X 14. Maintain angle reference plane at  $45^\circ \pm 0.5^\circ$  of flexion for 10 seconds. (572.135(c)(10))
- X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X 16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X 17. Complete the following table:

Torso Flexion Results (572.135(b), 572.135(c)(7), (572.135(c)(9))

| Parameter                         | Specification                                                 | Result     |
|-----------------------------------|---------------------------------------------------------------|------------|
| Initial ref. plane angle          | Angle $\leq 20^\circ$                                         | $18^\circ$ |
| Torso rotation rate               | $0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$ | 1.0        |
| Force at $45^\circ \pm 0.5^\circ$ | $320 \text{ N} \leq \text{force} \leq 390 \text{ N}$          | 379        |
| Final ref. plane angle            | Initial ref. plane angle $\pm 8^\circ$                        | $20^\circ$ |

  
 \_\_\_\_\_  
 Signature

6/26/06  
 \_\_\_\_\_  
 Date

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

**ATD Serial No:** 505

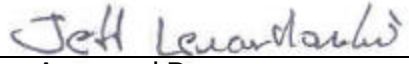
**Test I.D:** D061827

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.6  | 21.3   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 45     | Pass      |
| Initial Angle                | deg     | 0 to 20       | 18     | Pass      |
| Return Angle                 | deg     | +/- 8         | 20     | Pass      |
| Force at 45 deg              | N       | 320 to 390    | 379    | Pass      |
| Upper Torso Deflection Rate  | Deg/sec | 0.5 to 1.5    | 1. 0   | Pass      |
| Overall Result               |         |               |        | Pass      |

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

06/26/2006

Test Date

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

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 6/26/06

Technician Tim Bratz

     Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

     1. It has been at least 30 minutes since the last knee impact test. (572.137(q))

X N/A, ONLY one knee impact test performed

X 2. The test fixture conforms to the specifications in Figure 14B

X 3. The knee assembly (880105-528L), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))

X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

Record the maximum temperature 21.3

Record the minimum temperature 21.0

Record the maximum humidity 47%

Record the minimum humidity 43%

X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))

X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))

X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))

X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))

X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

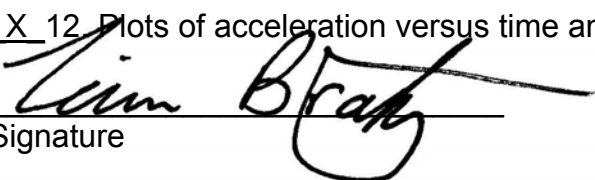
X 11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.13 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3770 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

X 12. Plots of acceleration versus time and force versus time follow this sheet.

  
Signature

6/26/06  
Date

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

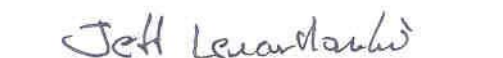
ATD Serial No: 505

Test I.D: D061826

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 21.0   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 46     | Pass      |
| Probe Speed                  | m/sec | 2.07 to 2.13  | 2.13   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.77   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

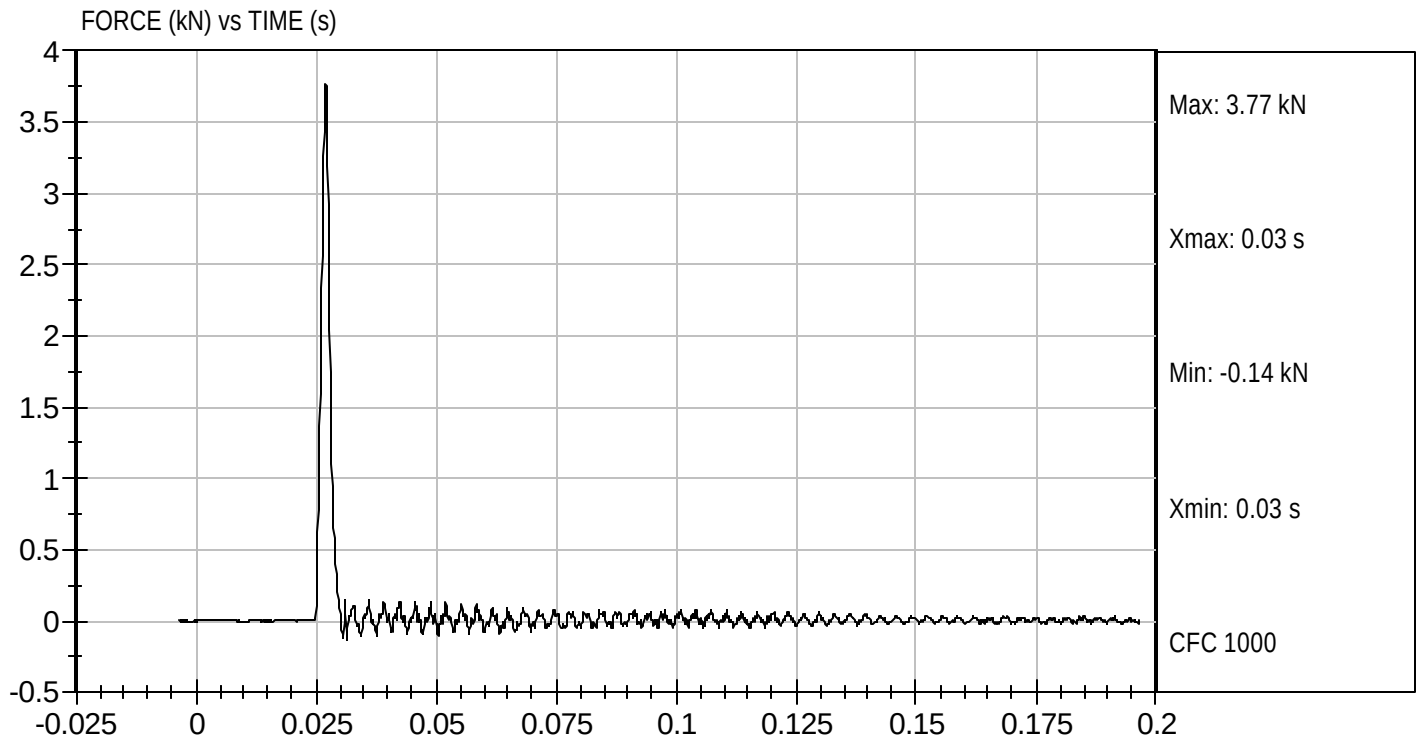
06/26/2006  
Test Date

  
Approved By



Test Desc: Left Knee  
Componet ID: D061826

Test Date: 06/26/2006  
Velocity: 6.98 ft/s, 2.13 m/s





DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 6/26/06

Technician Tim Bratz

     Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

     1. It has been at least 30 minutes since the last knee impact test. (572.137(q))

X N/A, ONLY one knee impact test performed

X 2. The test fixture conforms to the specifications in Figure 14B.

X 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))

X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

Record the maximum temperature 21.3

Record the minimum temperature 21.0

Record the maximum humidity 47%

Record the minimum humidity 43%

X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))

X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))

X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))

X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))

X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))

X 11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.12 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3560 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

X 12. Plots of acceleration versus time and force versus time follow this sheet.

  
Signature

6/26/06  
Date

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

ATD Serial No: 505

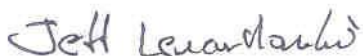
Test I.D: D061825

| 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      | 46     | Pass      |
| Probe Speed                  | m/sec | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.56   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

06/26/2006

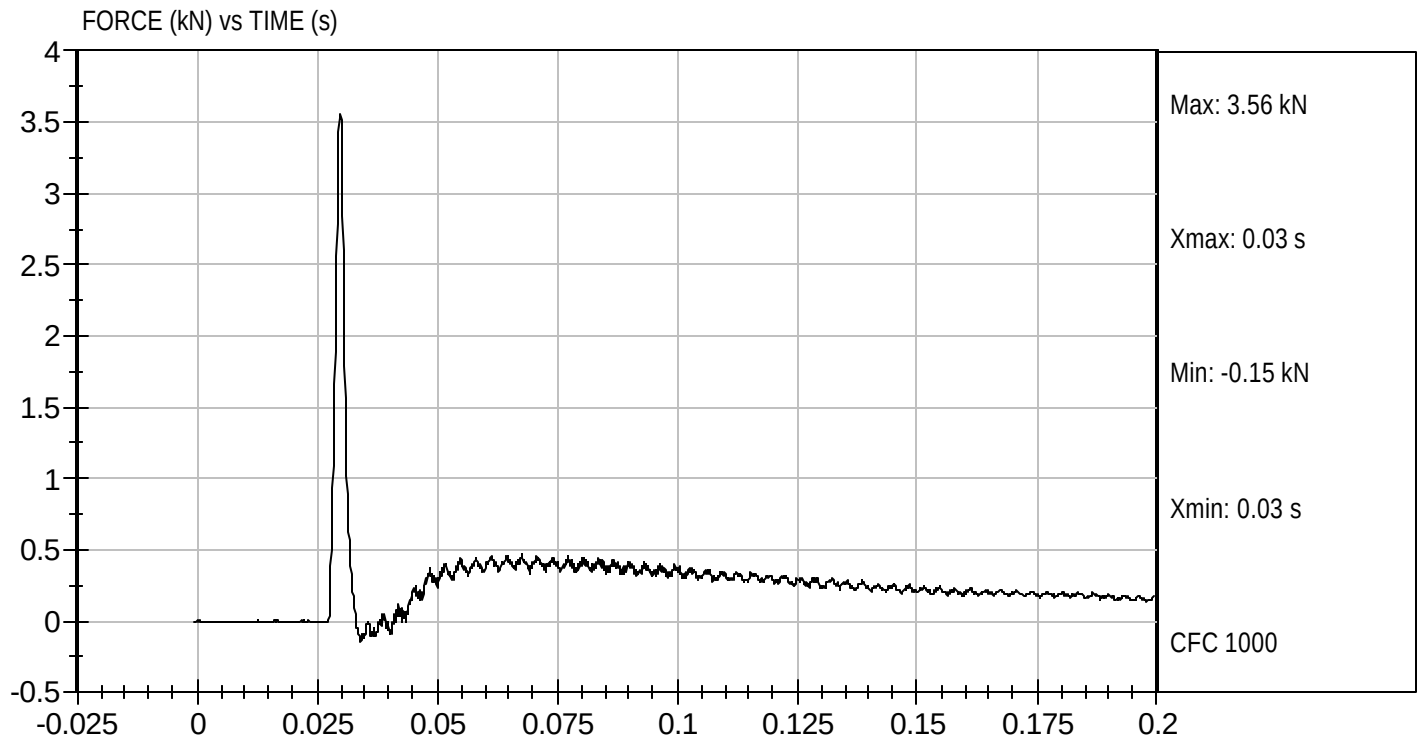
Test Date

  
Approved By



Test Desc: Right Knee  
Componet ID: D061825

Test Date: 06/26/2006  
Velocity: 6.95 ft/s, 2.12 m/s



## EXTERNAL DIMENSIONS

| HYBRID III 5 <sup>th</sup> SN #505, 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             | 778.1              |
| B                                                                           | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                       | 431.8-457.2             | 450.3              |
| C                                                                           | H-POINT HEIGHT                 | Reference                                                                                                                                    | 81.3-86.3               | 85.2               |
| D                                                                           | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                    | 144.8-149.8             | 145.8              |
| E                                                                           | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                   | 68.6-83.8               | 76.6               |
| F                                                                           | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                    | 119.4-134.6             | 128.3              |
| 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             | 248.7              |
| H                                                                           | HEAD BACK TO BACKLINE          | Back of skull cap skin to seat rear vertical surface (Reference)                                                                             | 43.2-48.2               | 44.2               |
| 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             | 278.9              |
| J                                                                           | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 182.8-203.2             | 187.5              |
| 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             | 541.9              |
| L                                                                           | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 355.6-376.0             | 361.7              |
| M                                                                           | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 393.7-419.1             | 402.4              |
| 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".                               | 414.0-439.4             | 436.8              |

| HYBRID III 5 <sup>th</sup> SN #505, SUBPART O EXTERNAL DIMENSIONS, continued |                                                           |                                                         |                               |                       |
|------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------|-------------------------------|-----------------------|
| DIMENSION                                                                    | DESCRIPTION                                               | DETAILS                                                 | ASSEMBLY<br>DIMENSION<br>(mm) | ACTUAL<br>MEASUREMENT |
| O                                                                            | CHEST DEPTH WITHOUT JACKET                                | Measured 304.8 ± 5.1 mm above seat surface              | 175.3-190.5                   | 188.7                 |
| P                                                                            | FOOT LENGTH                                               | Tip of toe to rear of heal                              | 218.5-233.7                   | 223.3                 |
| 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                   | 481.1                 |
| S                                                                            | HEAD BREADTH                                              | The widest part of the head                             | 137.1-147.3                   | 141.4                 |
| T                                                                            | HEAD DEPTH                                                | Back of the head to the forehead                        | 177.8-188.0                   | 179.8                 |
| U                                                                            | HIP BREADTH                                               | The widest part of the hip                              | 299.7-314.9                   | 302.5                 |
| V                                                                            | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises       | 350.5-365.7                   | 359.1                 |
| W                                                                            | FOOT BREADTH                                              | The widest part of the foot                             | 78.8-94.0                     | 84.2                  |
| X                                                                            | HEAD CIRCUMFERENCE                                        | Measured at the point as in dim. "T"                    | 528.3-548.7                   | 531.7                 |
| Y                                                                            | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 345.4 ± 12.7 mm above seat surface             | 850.9-881.3                   | 853.2                 |
| Z                                                                            | WAIST CIRCUMFERENCE                                       | Measured 165.1 ± 5.1 mm above seat surface              | 759.5-789.9                   | 773.2                 |
| AA                                                                           | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference                                               | 332.7-358.1                   | 340.0                 |
| BB                                                                           | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference                                               | 160.1-170.2                   | 165.0                 |

DATA SHEET B1  
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 505

Test Date 6/21/06

Technician Jessica Gall

This check sheet is completed as part of the post test calibration verification.

X Perform general cleaning.

| Dummy Item                  | Inspect for                                                  | Comments | Damaged | OK |
|-----------------------------|--------------------------------------------------------------|----------|---------|----|
| Outer skin                  | Gashes, rips, cracks                                         |          |         | X  |
| Head                        | Ballast secure                                               |          |         | X  |
|                             | General appearance                                           |          |         | X  |
| Neck                        | Broken or cracked rubber                                     |          |         | X  |
|                             | Upper neck bracket firmly attached to the lower neck bracket |          |         | X  |
|                             | Looseness at the condyle joint                               |          |         | X  |
|                             | Nodding blocks cracked or out of position                    |          |         | X  |
| Spine                       | Broken or cracks in rubber.                                  |          |         | X  |
| Ribs                        | Broken or bent ribs                                          |          |         | X  |
|                             | Broken or bent rib supports                                  |          |         | X  |
|                             | Damping material separated or cracked                        |          |         | X  |
|                             | Rubber bumpers in place                                      |          |         | X  |
| Chest Displacement Assembly | Bent shaft                                                   |          |         | X  |
|                             | Slider arm riding in track                                   |          |         | X  |
| Transducer leads            | Torn cables                                                  |          |         | X  |

| Dummy Item              | Inspect for                           | Comments | Damaged | OK |
|-------------------------|---------------------------------------|----------|---------|----|
| Accelerometer Mountings | Head mounting secure                  |          |         | X  |
|                         | Chest mounting secure                 |          |         | X  |
| Knees                   | Skin condition                        |          |         | X  |
|                         | Insert (do not remove)                |          |         | X  |
|                         | Casting                               |          |         | X  |
| Limbs                   | Normal movement and adjustment        |          |         | X  |
| Knee Sliders            | Wires intact                          |          |         | X  |
|                         | Rubber returned to "at rest" position |          |         | X  |
| Pelvis                  | Broken                                |          |         | X  |
| Other                   |                                       |          |         | X  |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

Jessica Hall  
Signature

6/26/06  
Date

Describe the repair or replacement of parts:

Checked by

Jeff Leonard  
Signature

6/26/06  
Date



## EXTERNAL DIMENSIONS

| HYBRID III 5 <sup>th</sup> SN #511, 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             | 782.1              |
| B                                                                           | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                       | 431.8-457.2             | 455.8              |
| C                                                                           | H-POINT HEIGHT                 | Reference                                                                                                                                    | 81.3-86.3               | 85.2               |
| D                                                                           | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                    | 144.8-149.8             | 145.3              |
| E                                                                           | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                   | 68.6-83.8               | 75.7               |
| F                                                                           | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                    | 119.4-134.6             | 130.9              |
| 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             | 250.5              |
| H                                                                           | HEAD BACK TO BACKLINE          | Back of skull cap skin to seat rear vertical surface (Reference)                                                                             | 43.2-48.2               | 45.2               |
| 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             | 282.7              |
| J                                                                           | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 182.8-203.2             | 196.3              |
| 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             | 540.1              |
| L                                                                           | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 355.6-376.0             | 358.1              |
| M                                                                           | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 393.7-419.1             | 406.3              |
| 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".                               | 414.0-439.4             | 434.4              |

| HYBRID III 5 <sup>th</sup> SN #511, 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             | 186.4              |
| P                                                                            | FOOT LENGTH                                               | Tip of toe to rear of heal                              | 218.5-233.7             | 222.3              |
| 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             | 476.3              |
| S                                                                            | HEAD BREADTH                                              | The widest part of the head                             | 137.1-147.3             | 142.9              |
| T                                                                            | HEAD DEPTH                                                | Back of the head to the forehead                        | 177.8-188.0             | 179.5              |
| U                                                                            | HIP BREADTH                                               | The widest part of the hip                              | 299.7-314.9             | 299.9              |
| V                                                                            | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises       | 350.5-365.7             | 361.2              |
| W                                                                            | FOOT BREADTH                                              | The widest part of the foot                             | 78.8-94.0               | 83.7               |
| X                                                                            | HEAD CIRCUMFERENCE                                        | Measured at the point as in dim. "T"                    | 528.3-548.7             | 539.4              |
| Y                                                                            | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 345.4 ± 12.7 mm above seat surface             | 850.9-881.3             | 851.9              |
| Z                                                                            | WAIST CIRCUMFERENCE                                       | Measured 165.1 ± 5.1 mm above seat surface              | 759.5-789.9             | 762.4              |
| AA                                                                           | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference                                               | 332.7-358.1             | 340.0              |
| BB                                                                           | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference                                               | 160.1-170.2             | 165.0              |

DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 511 Test Date 4/19/06

Technician Tim Bratz

☒ Pretest calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

- ☐ 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- ☒ 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- ☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- ☒ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.6</u> |
| Record the minimum temperature | <u>21.2</u> |
| Record the maximum humidity    | <u>38%</u>  |
| Record the minimum humidity    | <u>35%</u>  |
- ☒ 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
- ☒ 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))

Record the right side distance 501mm

Record the left side distance 501mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))

Record actual micro finish  $656 \times 10^{-6}$  mm

- X 13. The impact surface is rigidly supported. (572.132(c)(4))

- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

- X 15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))

- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        | 266    |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | 7      |

- X 17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

  
Signature

4/19/06  
Date

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

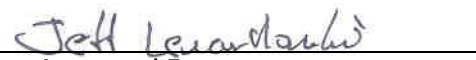
ATD Serial No: 511

Test ID: D061101

| 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           | 37     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 266    | Pass      |
| Peak Lateral Acceleration    | G's   | +/- 15             | 7      | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

  
 Laboratory Technician

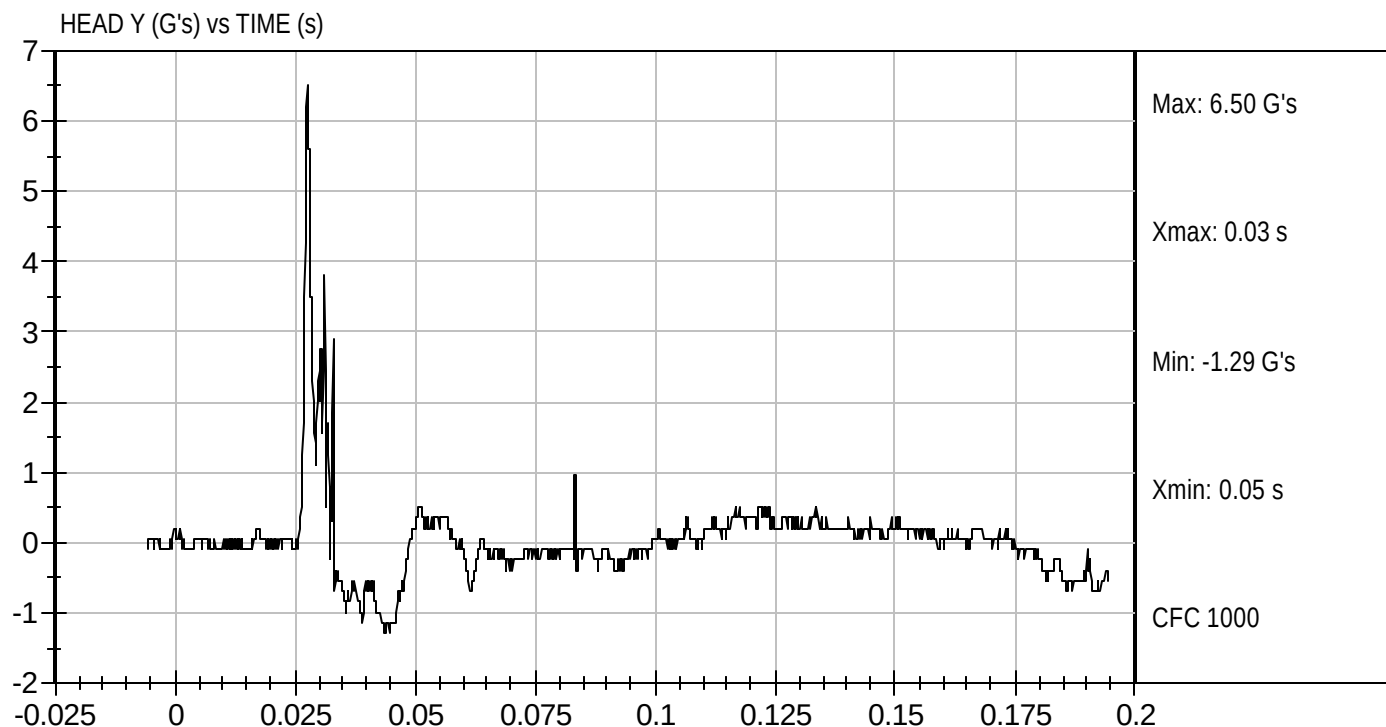
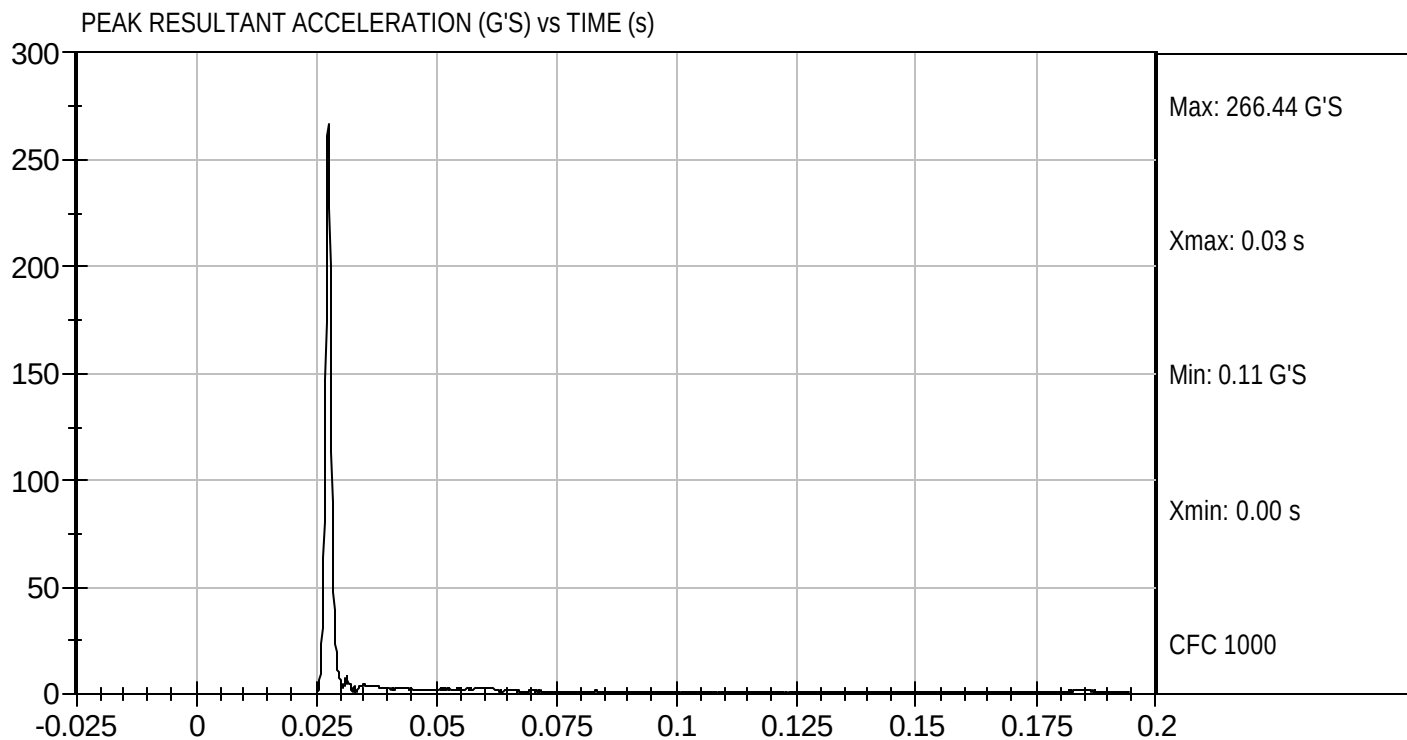
04/19/2006  
 Test Date

  
 Approved By



Test Desc: Head Drop  
Componet ID: D061101

Test Date: 04/19/2006  
Velocity: 0 ft/s, 0 m/s



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 511

Test Date 4/19/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

☐ 1. It has been at least 30 minutes since the last flexion test. (572.137(q))

☒ N/A, ONLY one flexion test performed

☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

Record the maximum temperature 21.6

Record the minimum temperature 21.2

Record the maximum humidity 38%

Record the minimum humidity 35%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration. Hardness Front 89; Back 89.

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))

☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))

☒ 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) &amp; (572.133(c)(4)(i &amp; ii))

| Parameter                                        |         | Specification                                                                                                                                        | Result                           |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Pendulum impact speed                            |         | $6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$                                                                                           | 7.03 m/s                         |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms  | $2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$                                                                                                 | 2.5 m/s                          |
|                                                  | @ 20 ms | $4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$                                                                                                 | 4.8 m/s                          |
|                                                  | @30ms   | $5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$                                                                                                 | 6.8 m/s                          |
| Plane D Rotation                                 |         | Peak moment*<br>$69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$ | <u>80</u> Nm @ <u>78</u> degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 10 Nm<br>$80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$                                                                       | 85 ms                            |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

  
Signature

4/19/06  
Date



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

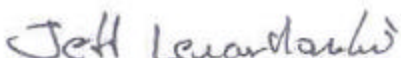
ATD Serial No: 511

Test I.D: D061102

| 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      | 37     | Pass      |
| Pendulum Speed                                      |         | m/sec | 6.89 to 7.13  | 7.03   | Pass      |
| Pendulum Deceleration                               | 10 msec | m/sec | 2.1 to 2.5    | 2.5    | Pass      |
|                                                     | 20 msec | m/sec | 4.0 to 5.0    | 4.8    | Pass      |
|                                                     | 30 msec | m/sec | 5.8 to 7.0    | 6.8    | Pass      |
| D Plane Rotation                                    | Max     | deg   | 77 to 91      | 78     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |         | Nm    | 69 to 83      | 80     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm           |         | msec  | 80 to 100     | 85     | Pass      |
| Overall Results                                     |         |       |               | Pass   |           |

  
 Laboratory Technician

04/19/2006  
 Test Date

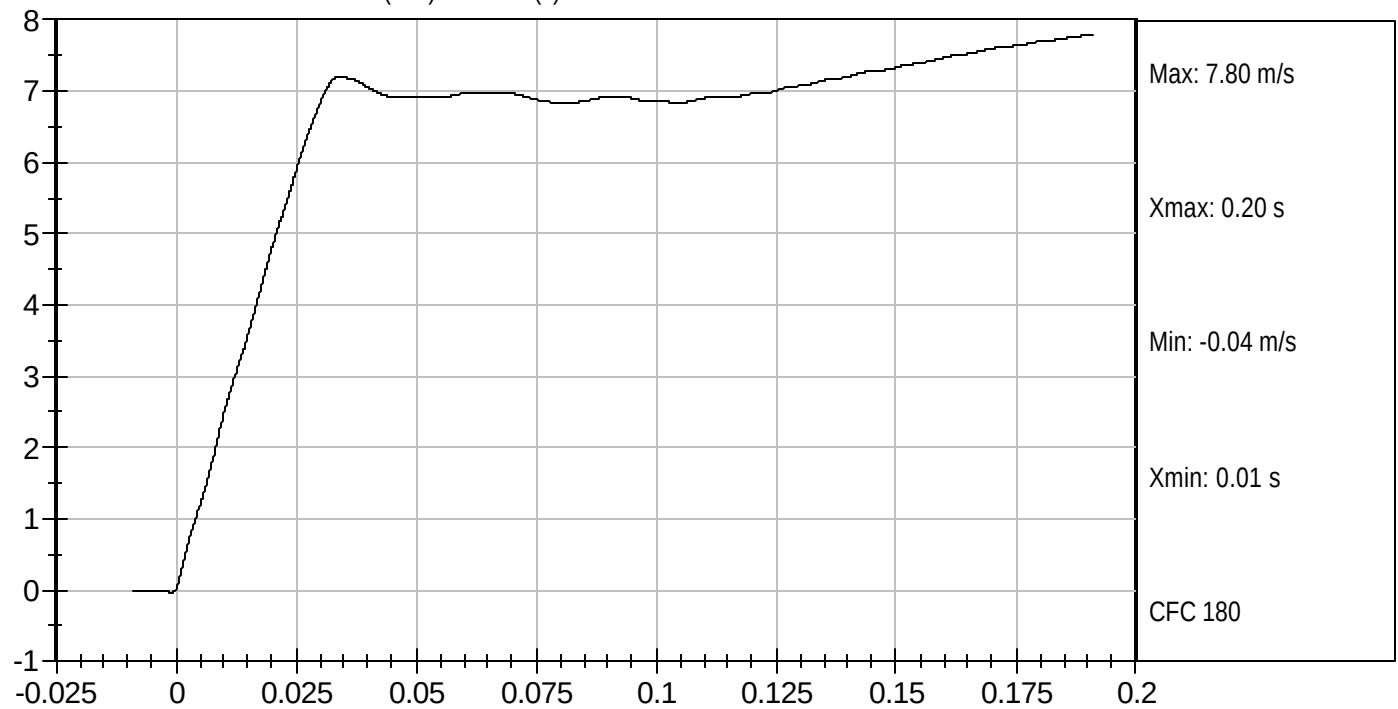
  
 Approved By



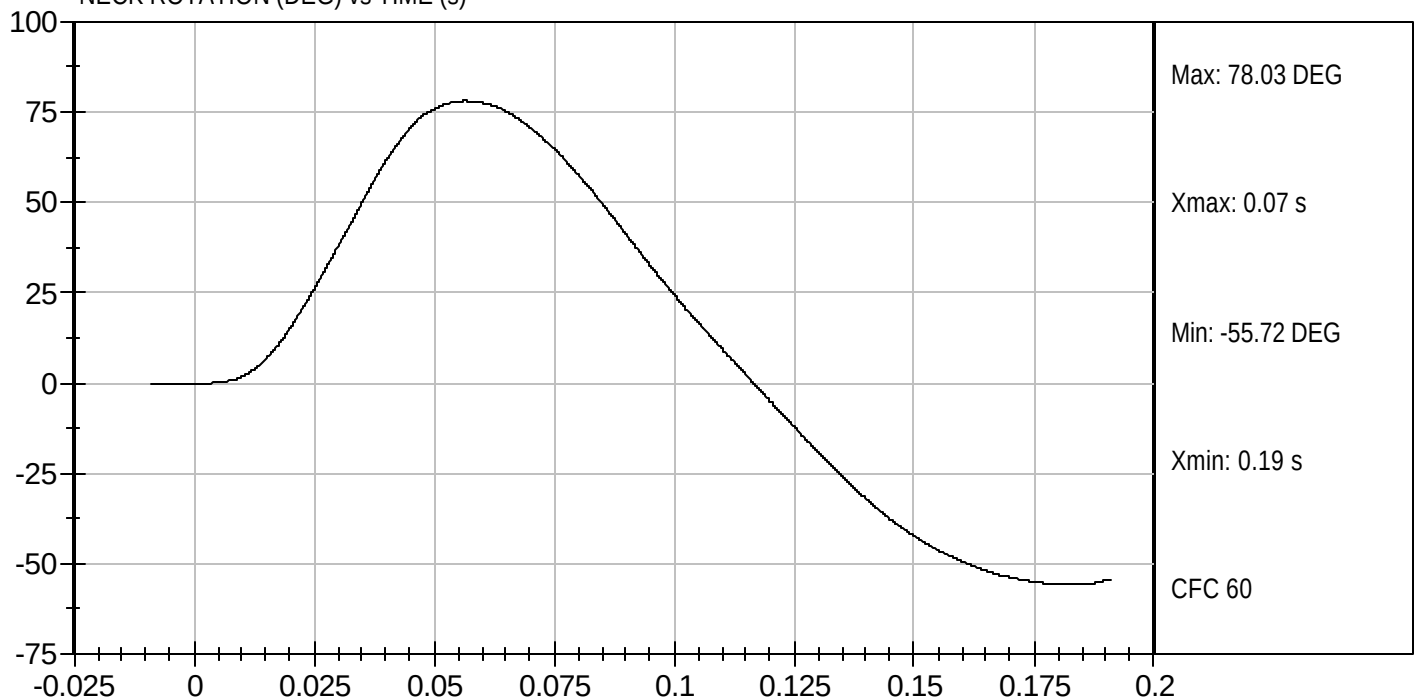
Test Desc: Neck Flexion  
Componet ID: D061102

Test Date: 04/19/2006  
Velocity: 23.07 ft/s, 7.03 m/s

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



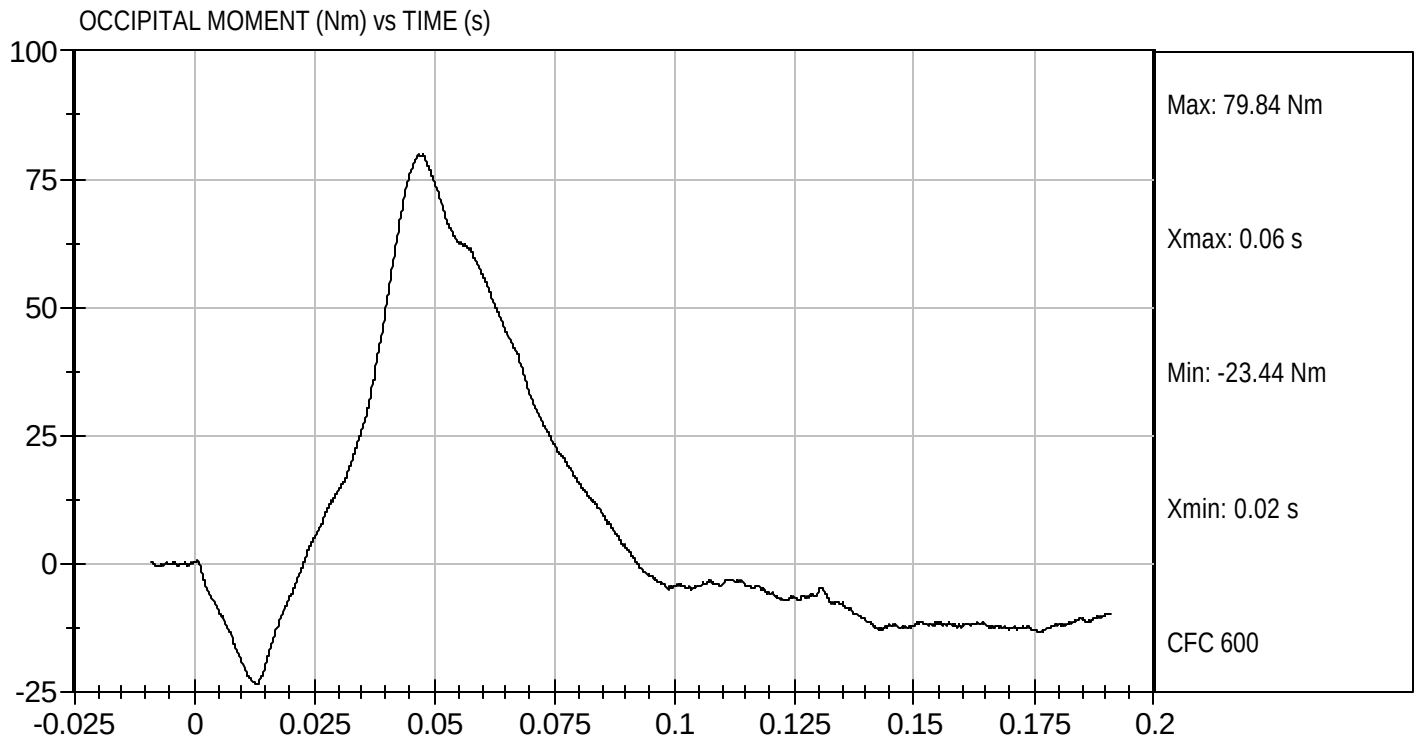
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion  
Componet ID: D061102

Test Date: 04/19/2006  
Velocity: 23.07 ft/s, 7.03 m/s



DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 511

Test Date 4/20/06

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

☐ 1. It has been at least 30 minutes since the last extension test. (572.137(q))

☒ N/A, ONLY one extension test performed

☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

Record the maximum temperature 21.9

Record the minimum temperature 21.4

Record the maximum humidity 40%

Record the minimum humidity 39%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration. Hardness Front 89; Back 89.

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))

☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))

☒ 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Extension Test Results (572.133(b)(2) &amp; (572.133(c)(4)(i &amp; ii))

| Parameter                                        |         | Specification                                                                                                                                           | Result                             |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| Pendulum impact speed                            |         | $5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$                                                                                              | 6.10 m/s                           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms  | $1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$                                                                                                    | 1.9 m/s                            |
|                                                  | @ 20 ms | $3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$                                                                                                    | 3.8 m/s                            |
|                                                  | @30ms   | $4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$                                                                                                    | 5.5 m/s                            |
| Plane D Rotation                                 |         | Peak moment*<br>$-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$ | <u>-56</u> Nm @ <u>107</u> degrees |
| Negative Moment Decay** (Extension)              |         | Time to decay to -10 Nm<br>$94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$                                                                         | 103 ms                             |

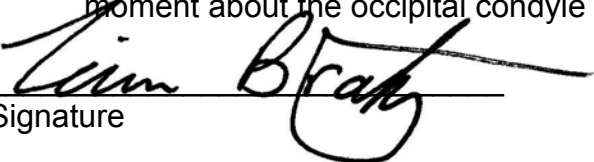
\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

  
Signature

4/20/06  
Date

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

ATD Serial No: 511

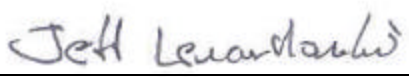
Test I.D: D061103

| 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      | 39     | Pass      |
| Pendulum Speed                                      |         | m/sec | 5.95 to 6.19  | 6.10   | Pass      |
| Pendulum Deceleration                               | 10 msec | m/sec | 1.5 to 1.9    | 1.9    | Pass      |
|                                                     | 20 msec | m/sec | 3.1 to 3.9    | 3.8    | Pass      |
|                                                     | 30 msec | m/sec | 4.6 to 5.6    | 5.5    | Pass      |
| D Plane Rotation                                    | Max     | deg   | 99 to 114     | 107    | Pass      |
| Occipital Condyle Moment within Deflection Corridor |         | Nm    | -65 to -53    | -56    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm          |         | msec  | 94 to 114     | 103    | Pass      |
| Overall Results                                     |         |       |               | Pass   |           |

  
 Laboratory Technician

04/20/2006

Test Date

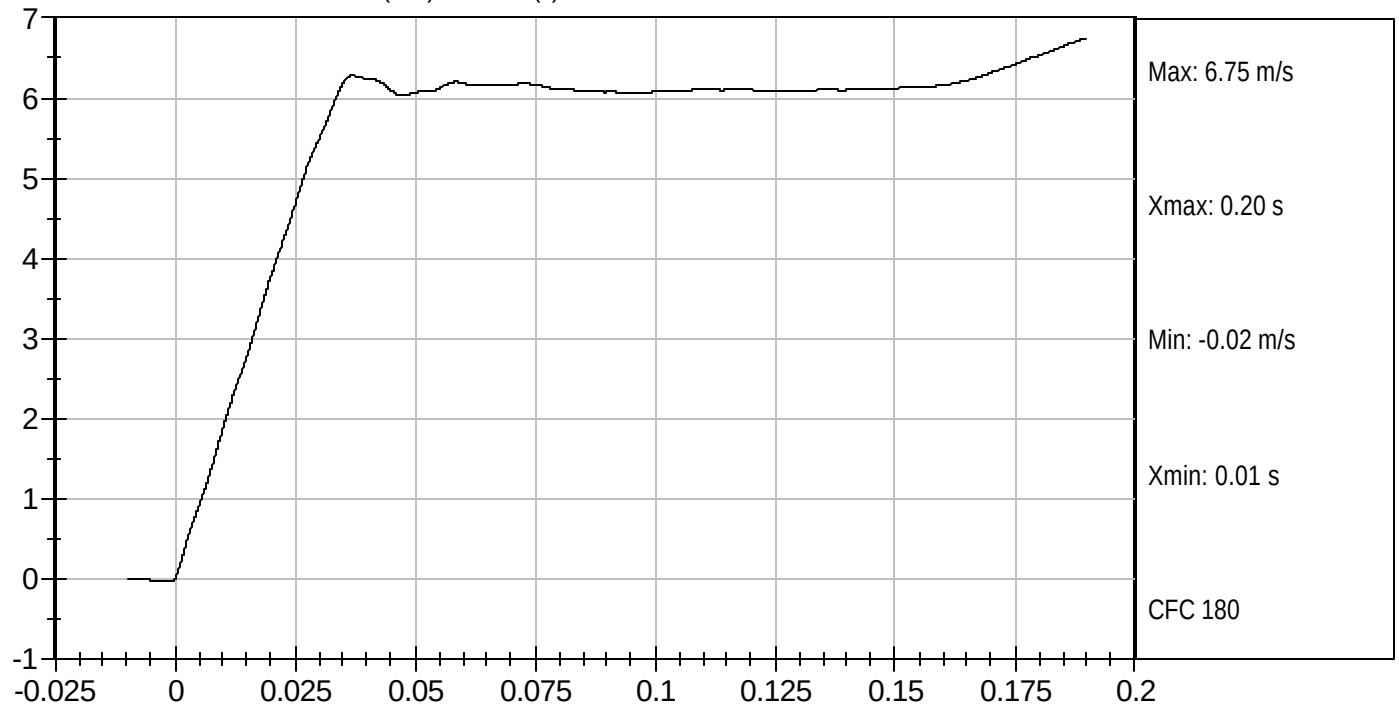
  
 Approved By



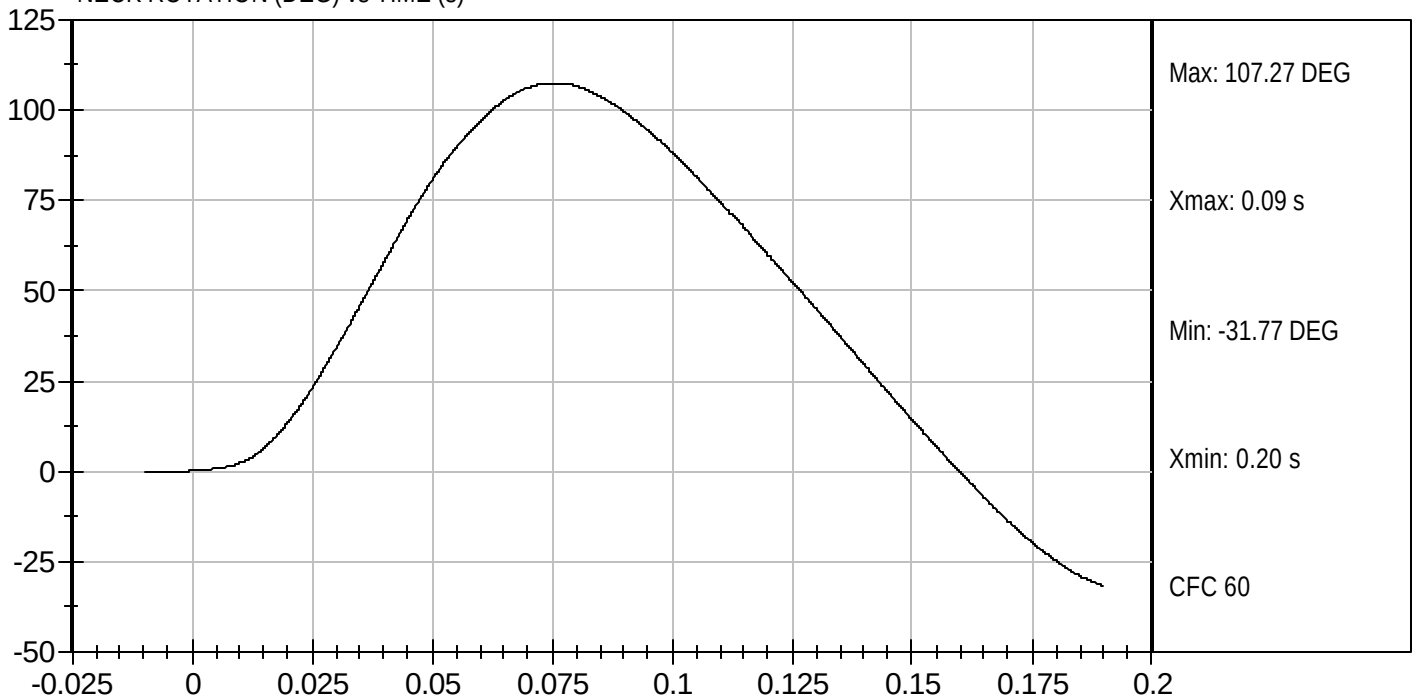
Test Desc: Neck Extension  
Componet ID: D061103

Test Date: 04/20/2006  
Velocity: 20.02 ft/s, 6.10 m/s

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



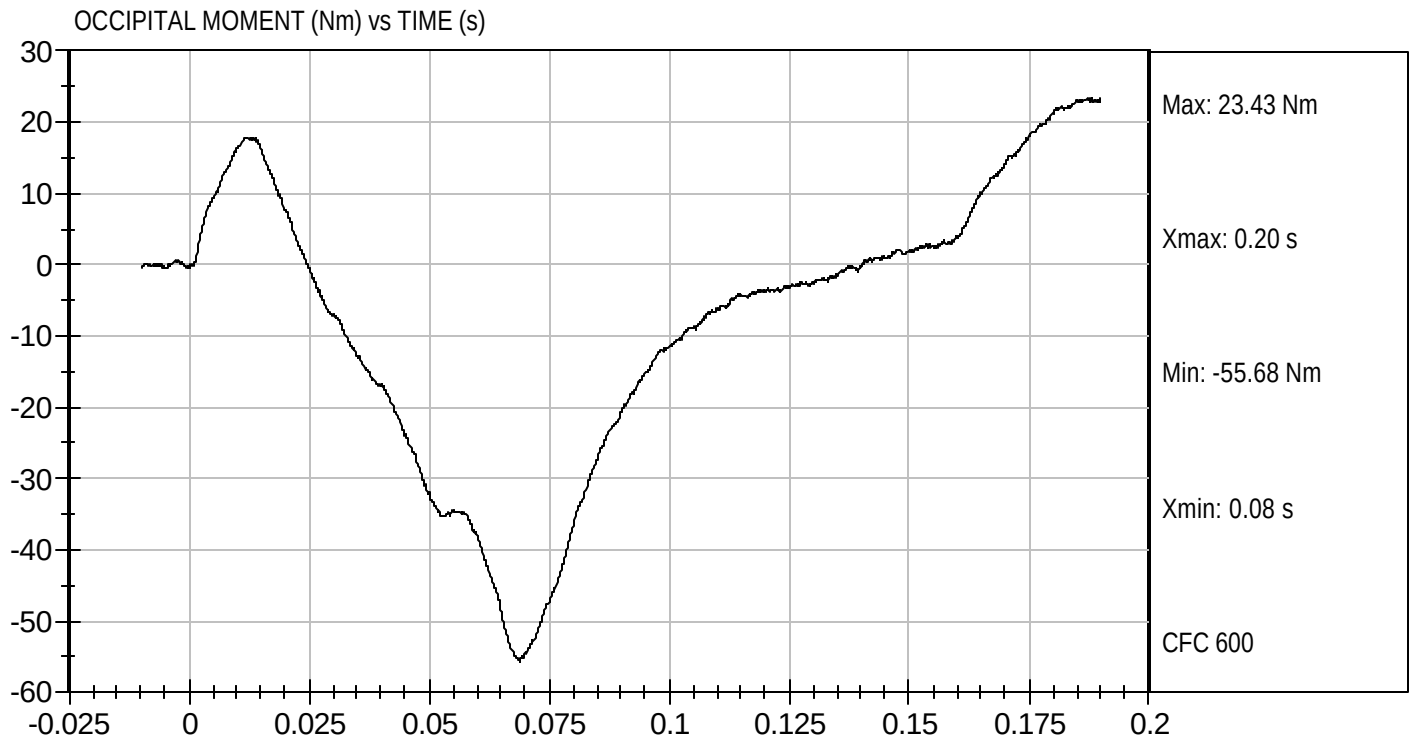
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Extension  
Componet ID: D061103

Test Date: 04/20/2006  
Velocity: 20.02 ft/s, 6.10 m/s





DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 511

Test Date 4/20/06

Technician Jessica Gall

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))

☒ N/A, ONLY one thorax impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 11B.

☒ 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))

☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))

Record the maximum temperature 21.9

Record the minimum temperature 21.4

Record the maximum humidity 40%

Record the minimum humidity 39%

☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

☒ - No damage

☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_

☐ - The following repairs or replacement was performed. Record \_\_\_\_\_

☒ 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))

☒ 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.

- X 8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X 10. Align the adjustable neck bracket index marks to the "zero" position.
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

X 16. Complete the following table:

Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*                                              | Specification                                                  | Result   |
|---------------------------------------------------------|----------------------------------------------------------------|----------|
| Test Probe Speed                                        | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.75 m/s |
| Chest Compression                                       | $50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$ | 57 mm    |
| Peak force** between 50.0 and 58.0 mm chest compression | $3900\text{N} \leq \text{peak force} \leq 4400\text{N}$        | 4160 N   |
| Peak force** between 18.0 and 50.0 mm chest compression | $\text{peak force} \leq 4600 \text{ N}$                        | 3902 N   |
| Internal Hysteresis***                                  | $69\% \leq \text{hysteresis} \leq 85\%$                        | 70%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.134(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

X 17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

Jessica Hall  
Signature

4/20/06  
Date

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

ATD Serial No: 511

Test I.D: D061104

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.7   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 39     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.75   | Pass      |
| Peak Deflection                               | mm    | 50 to 58      | 57     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | kN    | 3.9 to 4.4    | 4.2    | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 70     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | ≤ 4600 N      | 3902   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

*Jessica Hall*  
Laboratory Technician

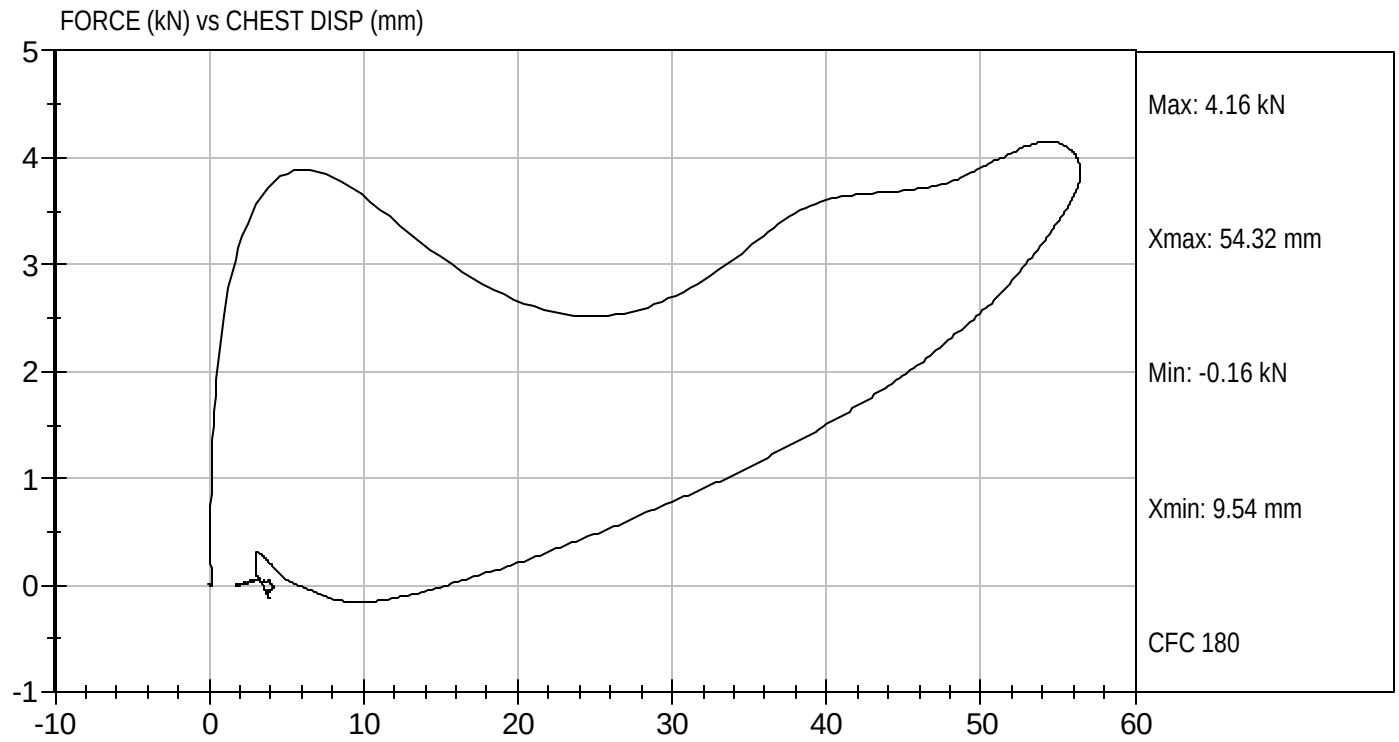
04/20/2006  
Test Date

*Jeff Leonard*  
Approved By



Test Desc: Thorax Impact  
Componet ID: D061104

Test Date: 04/20/2006  
Velocity: 22.15 ft/s, 6.75 m/s



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 511 Test Date 4/20/06

Technician Tim Bratz

☒ Pretest calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- ☐ 1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
☒ N/A, ONLY one thorax impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 13B.
- ☒ 3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
☐ with legs below the femurs.  
☒ without legs below the femurs.
- ☒ 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.9</u> |
| Record the minimum temperature | <u>21.4</u> |
| Record the maximum humidity    | <u>40%</u>  |
| Record the minimum humidity    | <u>39%</u>  |
- ☒ 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- ☒ 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- ☒ 7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- ☒ 8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
- ☒ 9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- ☒ 10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- ☒ 11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))
- |                                                 |            |
|-------------------------------------------------|------------|
| Record reference plane angle (max. allowed 20°) | <u>15°</u> |
|-------------------------------------------------|------------|
- ☒ 12. Attach the pull cable and the load cell. (572.135(c)(8))

- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between  $0.5^\circ$  and  $1.5^\circ$  per second, until the angle reference plane is at  $45^\circ \pm 0.5^\circ$  of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X 14. Maintain angle reference plane at  $45^\circ \pm 0.5^\circ$  of flexion for 10 seconds. (572.135(c)(10))
- X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X 16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X 17. Complete the following table:

Torso Flexion Results (572.135(b), 572.135(c)(7), (572.135(c)(9))

| Parameter                         | Specification                                                 | Result     |
|-----------------------------------|---------------------------------------------------------------|------------|
| Initial ref. plane angle          | Angle $\leq 20^\circ$                                         | $15^\circ$ |
| Torso rotation rate               | $0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$ | 1.0        |
| Force at $45^\circ \pm 0.5^\circ$ | $320 \text{ N} \leq \text{force} \leq 390 \text{ N}$          | 368 N      |
| Final ref. plane angle            | Initial ref. plane angle $\pm 8^\circ$                        | $17^\circ$ |

  
Signature

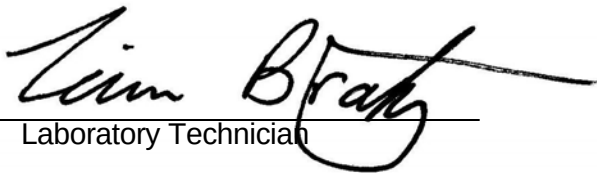
4/20/06  
Date

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

ATD Serial No: 511

Test I.D: D061107

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.6  | 21.8   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 40     | Pass      |
| Initial Angle                | deg     | 0 to 20       | 15     | Pass      |
| Return Angle                 | deg     | +/- 8         | 17     | 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

  
Approved By

04/20/2006  
Test Date



DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 4/20/06

Technician Jessica Gall

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14B

☒ 3. The knee assembly (880105-528L), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

Record the maximum temperature 21.9

Record the minimum temperature 21.4

Record the maximum humidity 40%

Record the minimum humidity 39%

☒ 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))

☒ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

X 11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.11 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3590 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

X 12. Plots of acceleration versus time and force versus time follow this sheet.

Jessica Hall  
Signature

4/20/06  
Date

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

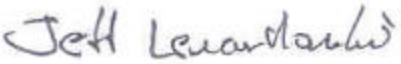
**ATD Serial No:** 511

**Test I.D:** D061106

| 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      | 40     | Pass      |
| Probe Speed                  | m/sec | 2.07 to 2.13  | 2.11   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.59   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

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

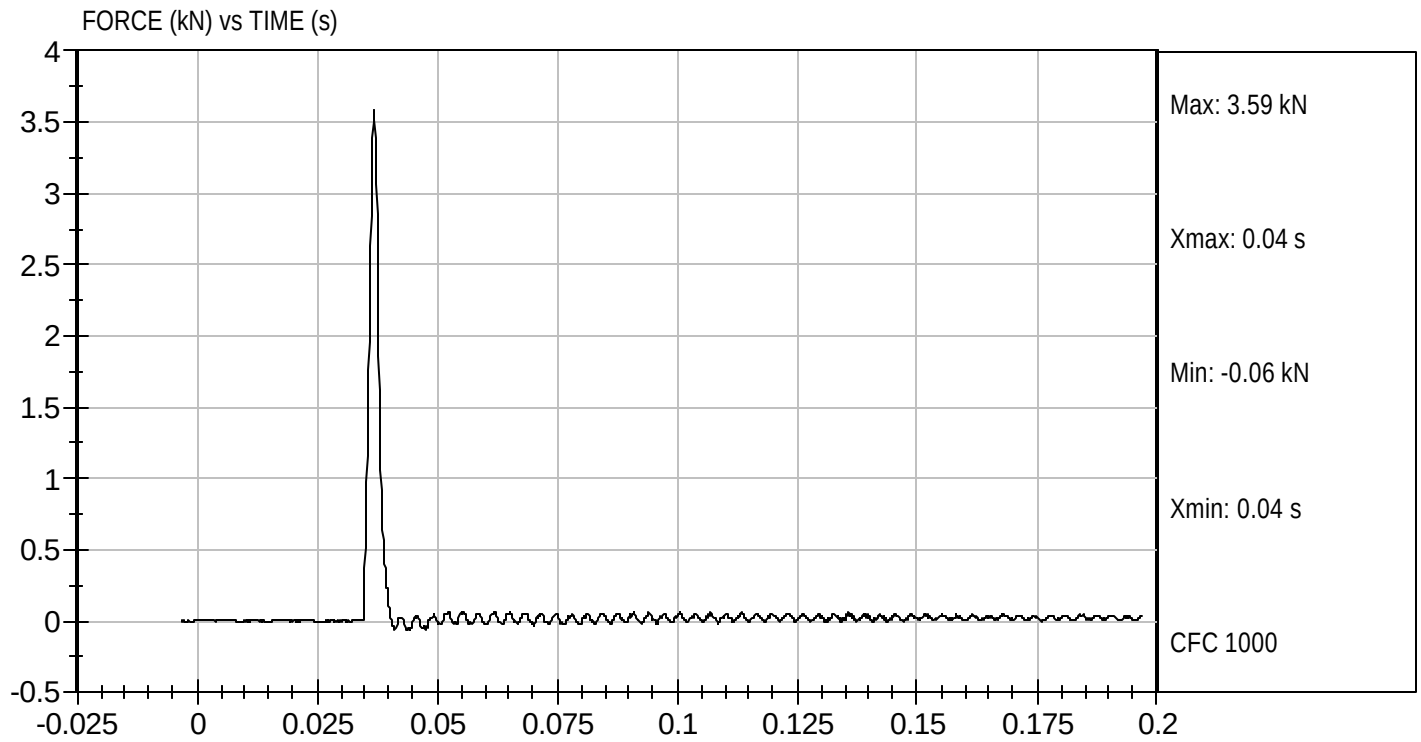
04/20/2006  
\_\_\_\_\_  
Test Date

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



Test Desc: Left Knee  
Componet ID: D061106

Test Date: 04/20/2006  
Velocity: 6.91 ft/s, 2.11m/s



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 4/20/06

Technician Jessica Gall

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14B.

☒ 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

Record the maximum temperature 21.9

Record the minimum temperature 21.4

Record the maximum humidity 40%

Record the minimum humidity 39%

☒ 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))

☒ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))

☒ 11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.09 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3510 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

☒ 12. Plots of acceleration versus time and force versus time follow this sheet.

Jessica Hall  
Signature

4/20/06  
Date

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

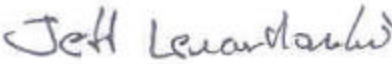
**ATD Serial No:** 511

**Test I.D:** D061105

| 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      | 40     | Pass      |
| Probe Speed                  | m/sec | 2.07 to 2.13  | 2.09   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.51   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

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

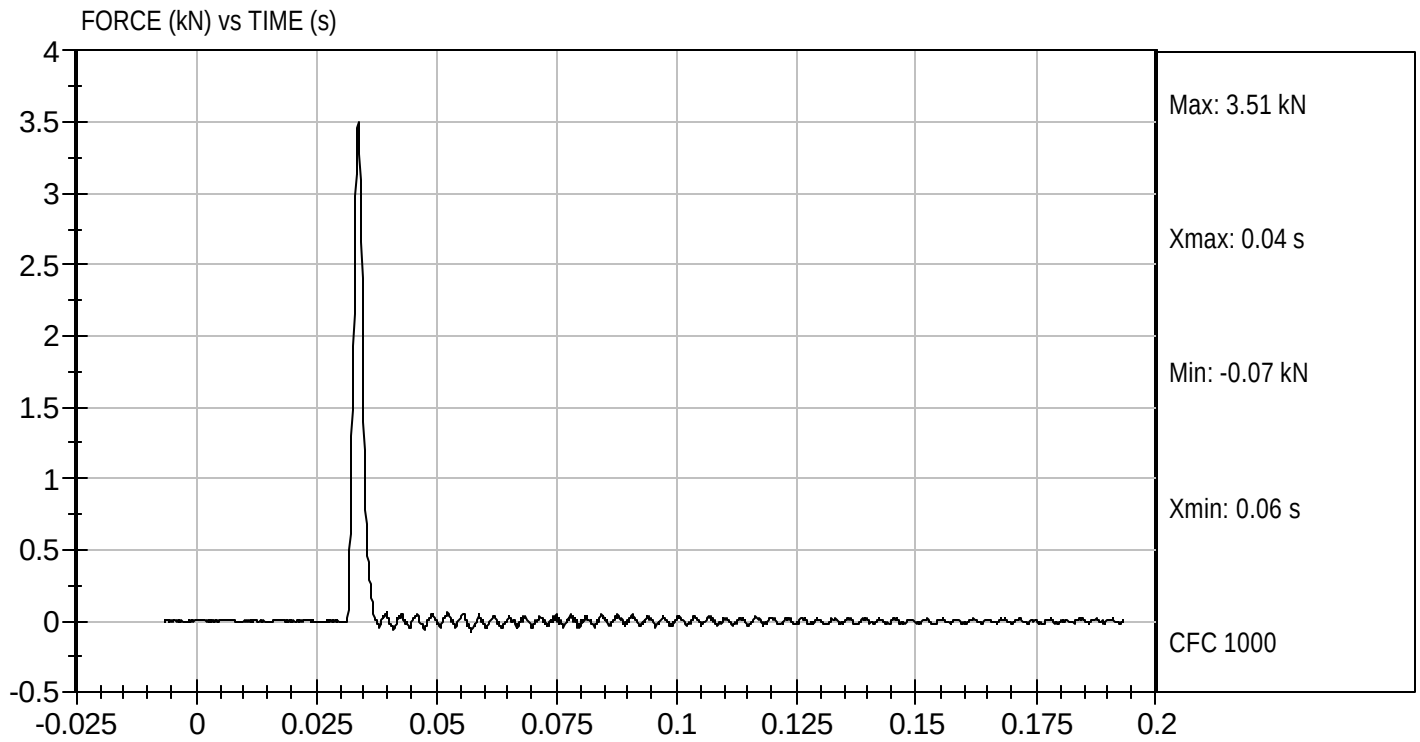
04/20/2006  
\_\_\_\_\_  
Test Date

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



Test Desc: Right Knee  
Componet ID: D061105

Test Date: 04/20/2006  
Velocity: 6.87 ft/s, 2.09 m/s





DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 511 Test Date 6/26/06

Technician Dave Wilcox

☐ Pretest calibration  
☒ Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

- ☐ 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- ☒ 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- ☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- ☒ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.3</u> |
| Record the minimum temperature | <u>21.1</u> |
| Record the maximum humidity    | <u>47%</u>  |
| Record the minimum humidity    | <u>45%</u>  |
- ☒ 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage.
- ☒ 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))

Record the right side distance 501mm

Record the left side distance 501mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))

Record actual micro finish  $656 \times 10^{-6}$  mm

- X 13. The impact surface is rigidly supported. (572.132(c)(4))

- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

- X 15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))

- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        | 260    |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | -3     |

- X 17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

  
Signature

6/26/06  
Date

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

ATD Serial No: 511

Test ID: D061831

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 46     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 260    | Pass      |
| Peak Lateral Acceleration    | G's   | +/- 15             | -3.1   | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |



Laboratory Technician

06/26/2006

Test Date

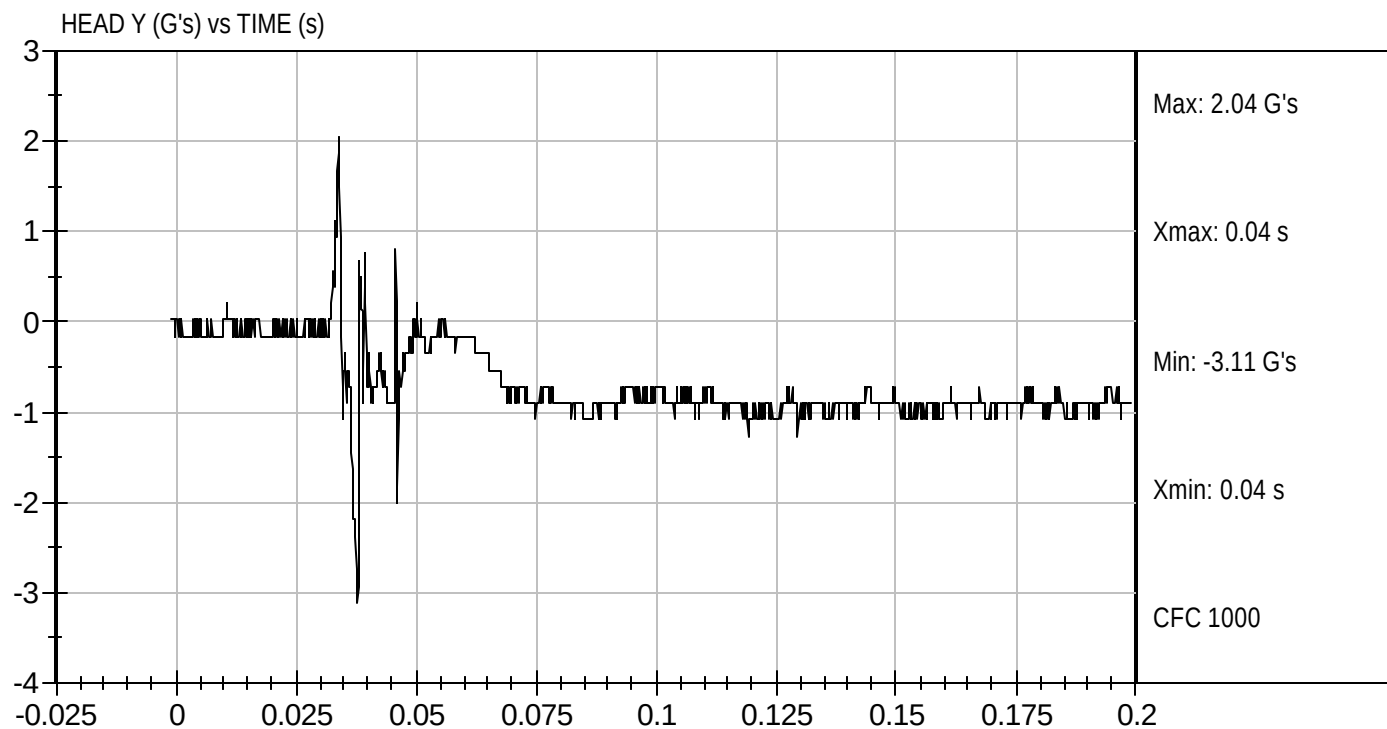
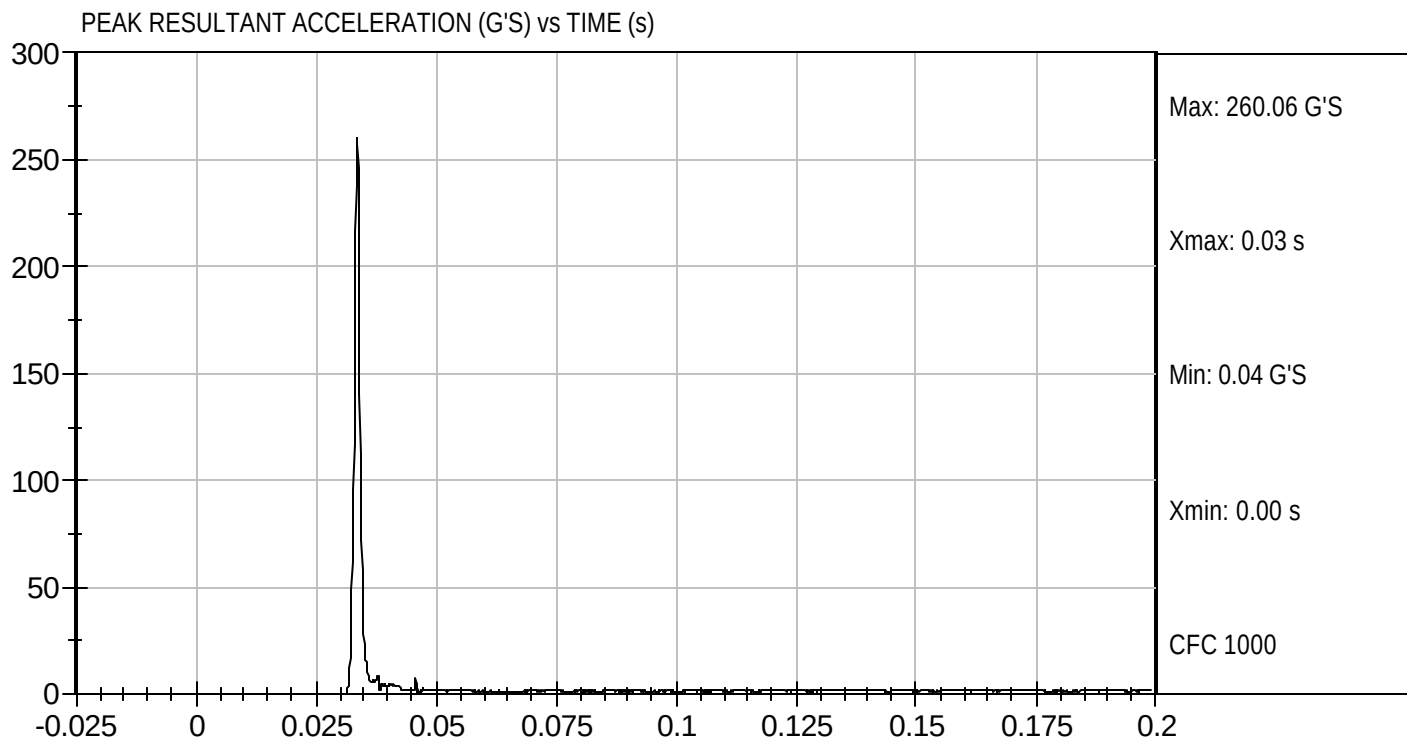


Approved By



Test Desc: Head Drop  
Componet ID: D061831

Test Date: 06/26/2006  
Velocity: 0 ft/s, 0 m/s



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 511

Test Date 6/26/06

Technician Tim Bratz

     Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

     1. It has been at least 30 minutes since the last flexion test. (572.137(q))

X N/A, ONLY one flexion test performed

X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

Record the maximum temperature 21.3

Record the minimum temperature 21.1

Record the maximum humidity 47%

Record the minimum humidity 45%

X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration. Hardness Front 89; Back 89.

X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))

X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) &amp; (572.133(c)(4)(i &amp; ii))

| Parameter                                        |         | Specification                                                                                                                                        | Result                           |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Pendulum impact speed                            |         | $6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$                                                                                           | 6.98 m/s                         |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms  | $2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$                                                                                                 | 2.2 m/s                          |
|                                                  | @ 20 ms | $4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$                                                                                                 | 4.4 m/s                          |
|                                                  | @30ms   | $5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$                                                                                                 | 6.2 m/s                          |
| Plane D Rotation                                 |         | Peak moment*<br>$69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$ | <u>74</u> Nm @ <u>77</u> degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 10 Nm<br>$80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$                                                                       | 88 ms                            |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

  
Signature

6/26/06  
Date

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

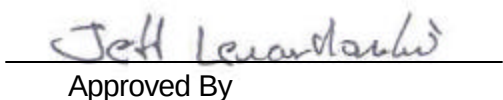
ATD Serial No: 511

Test I.D: D061832

| 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      | 45     | Pass      |
| Pendulum Speed                                      |         | m/sec | 6.89 to 7.13  | 6.98   | Pass      |
| Pendulum Deceleration                               | 10 msec | m/sec | 2.1 to 2.5    | 2.2    | Pass      |
|                                                     | 20 msec | m/sec | 4.0 to 5.0    | 4.4    | Pass      |
|                                                     | 30 msec | m/sec | 5.8 to 7.0    | 6.2    | Pass      |
| D Plane Rotation                                    | Max     | deg   | 77 to 91      | 77     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |         | Nm    | 69 to 83      | 74     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm           |         | msec  | 80 to 100     | 88     | Pass      |
| Overall Results                                     |         |       |               | Pass   |           |

  
Laboratory Technician

06/26/2006  
Test Date

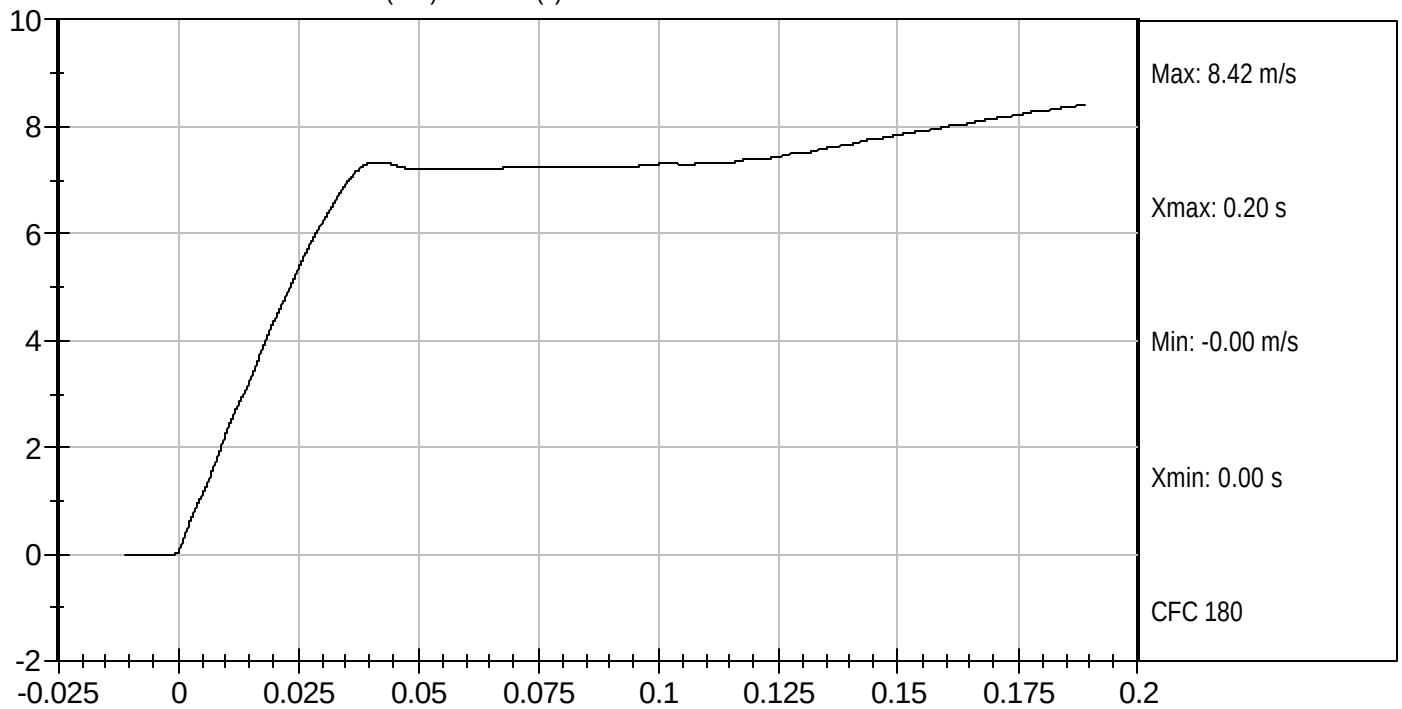
  
Approved By



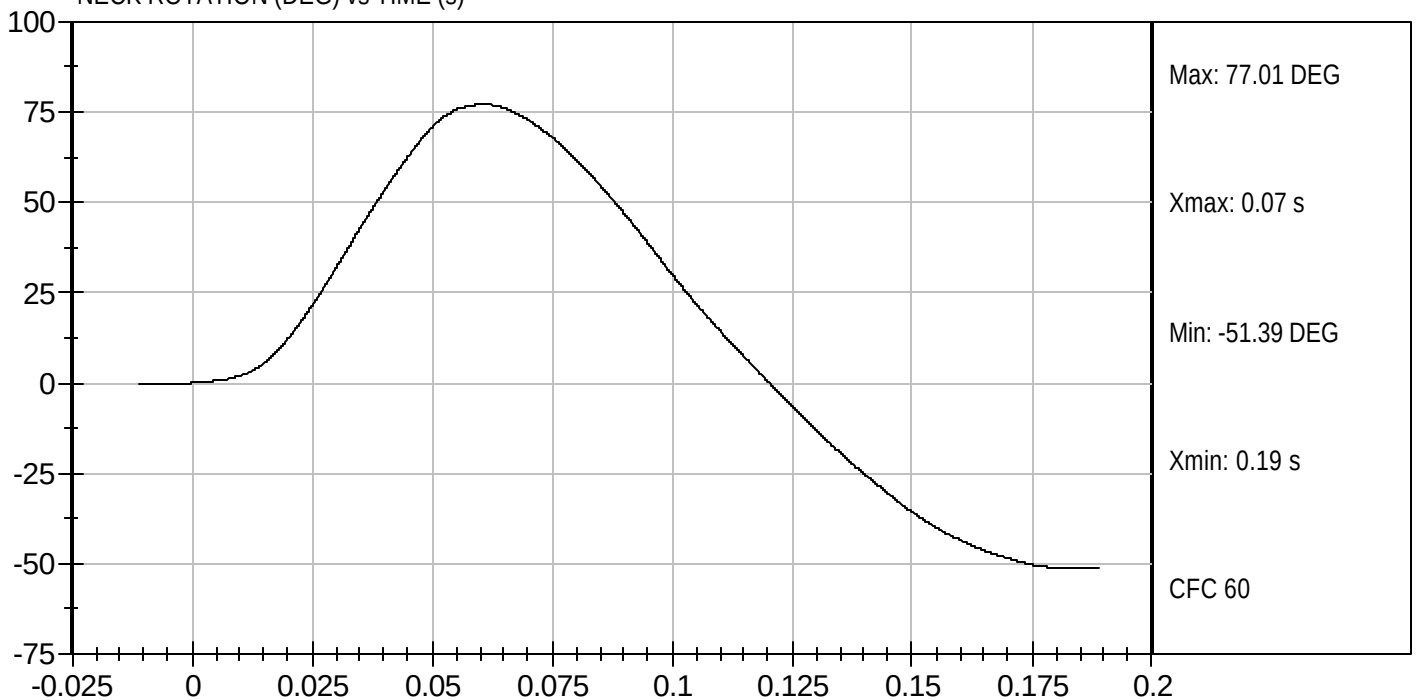
Test Desc: Neck Flexion  
Componet ID: D061832

Test Date: 06/26/2006  
Velocity: 22.9 ft/s, 6.98 m/s

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



NECK ROTATION (DEG) vs TIME (s)

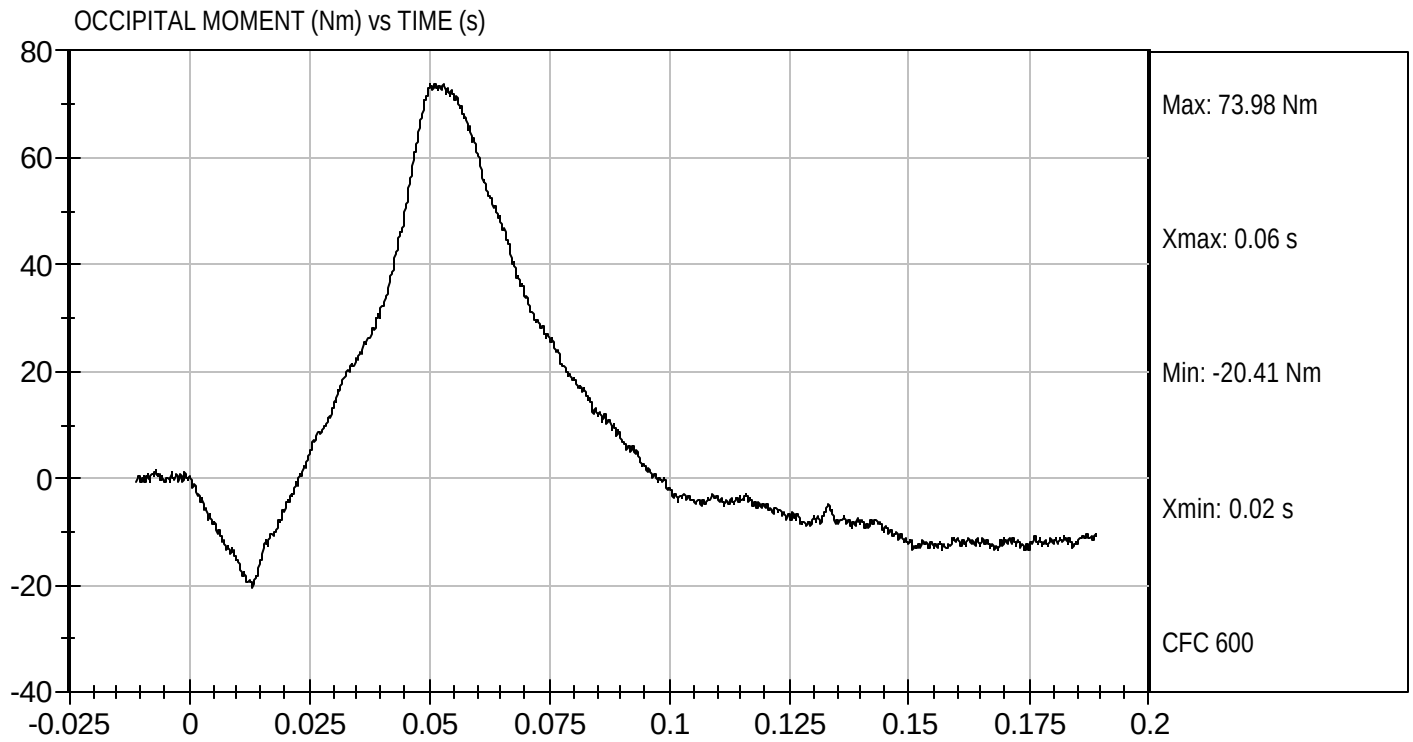






Test Desc: Neck Flexion  
Componet ID: D061832

Test Date: 06/26/2006  
Velocity: 22.9 ft/s, 6.98 m/s



DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 511

Test Date 6/26/06

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

☐ 1. It has been at least 30 minutes since the last extension test. (572.137(q))

☒ N/A, ONLY one extension test performed

☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

Record the maximum temperature 21.3

Record the minimum temperature 21.1

Record the maximum humidity 47%

Record the minimum humidity 45%

☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage.

☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration. Hardness Front 89; Back 89.

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))

☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))

☒ 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Extension Test Results (572.133(b)(2) &amp; (572.133(c)(4)(i &amp; ii))

| Parameter                                        |         | Specification                                                                                                                                           | Result                             |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| Pendulum impact speed                            |         | $5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$                                                                                              | 6.09 m/s                           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10ms  | $1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$                                                                                                    | 1.8 m/s                            |
|                                                  | @ 20 ms | $3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$                                                                                                    | 3.8 m/s                            |
|                                                  | @30ms   | $4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$                                                                                                    | 5.6 m/s                            |
| Plane D Rotation                                 |         | Peak moment*<br>$-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$ | <u>-54</u> Nm @ <u>105</u> degrees |
| Negative Moment Decay**<br>(Extension)           |         | Time to decay to -10 Nm<br>$94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$                                                                         | 100 ms                             |

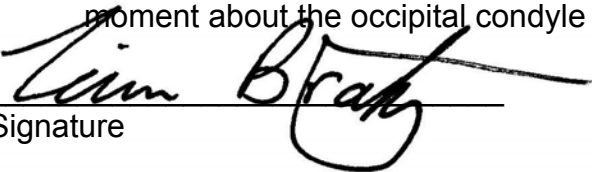
\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

  
Signature

6/26/06  
Date

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

ATD Serial No: 511

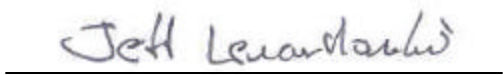
Test I.D: D061833

| Tested Parameter                                    |         | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|---------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |         | deg C | 20.6 to 22.2  | 21.1   | Pass      |
| Laboratory Relative Humidity                        |         | %     | 10 to 70      | 47     | Pass      |
| Pendulum Speed                                      |         | m/sec | 5.95 to 6.19  | 6.09   | Pass      |
| Pendulum Deceleration                               | 10 msec | m/sec | 1.5 to 1.9    | 1.8    | Pass      |
|                                                     | 20 msec | m/sec | 3.1 to 3.9    | 3.8    | Pass      |
|                                                     | 30 msec | m/sec | 4.6 to 5.6    | 5.6    | Pass      |
| D Plane Rotation                                    | Max     | deg   | 99 to 114     | 105    | Pass      |
| Occipital Condyle Moment within Deflection Corridor |         | Nm    | -65 to -53    | -54    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm          |         | msec  | 94 to 114     | 100    | Pass      |
| Overall Results                                     |         |       |               | Pass   |           |

  
Laboratory Technician

06/26/2006

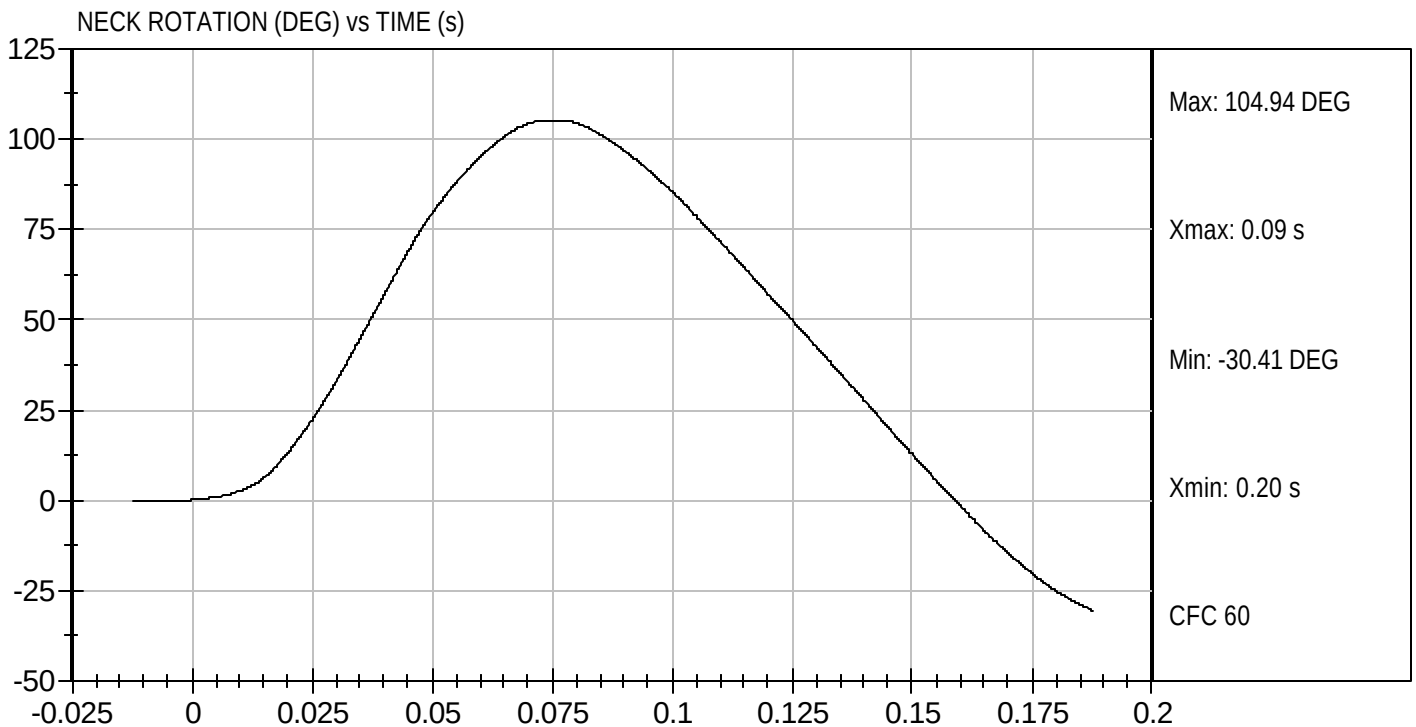
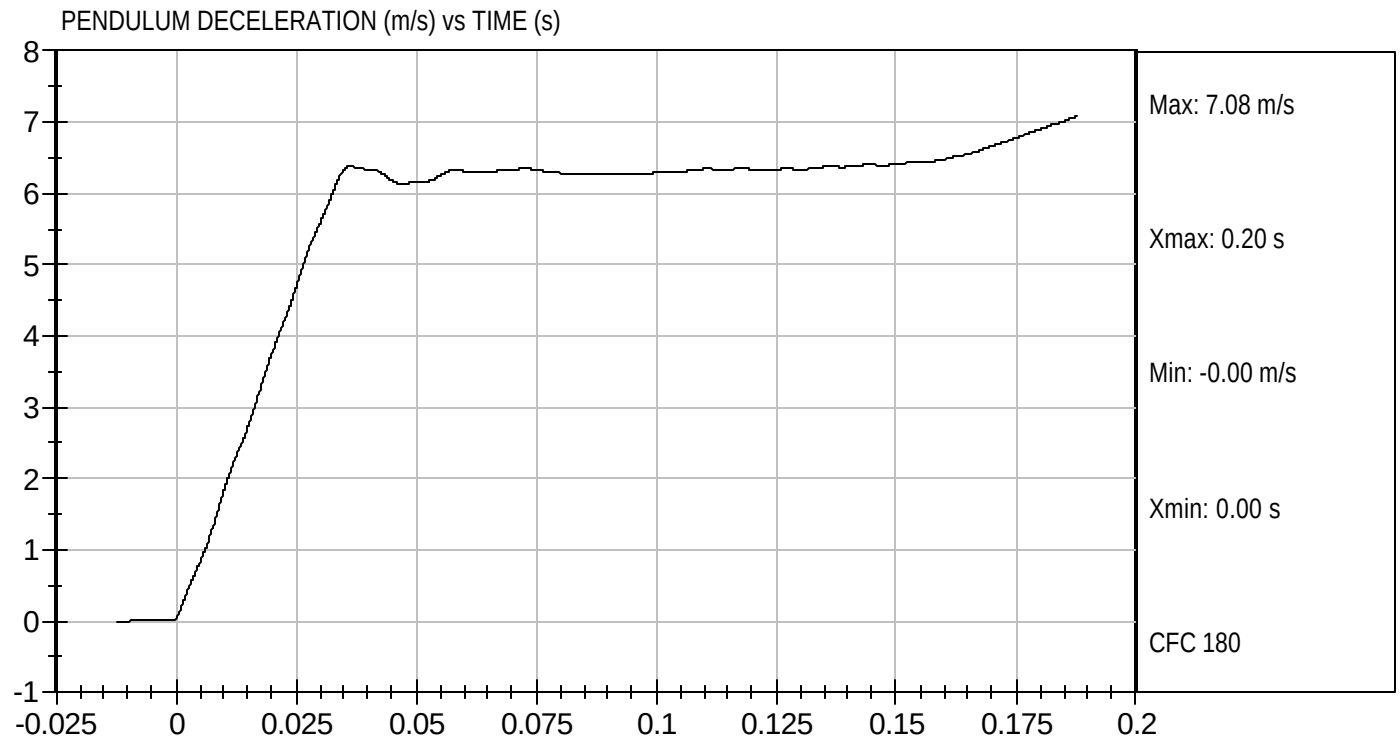
Test Date

  
Approved By



Test Desc: Neck Extension  
Componet ID: D061833

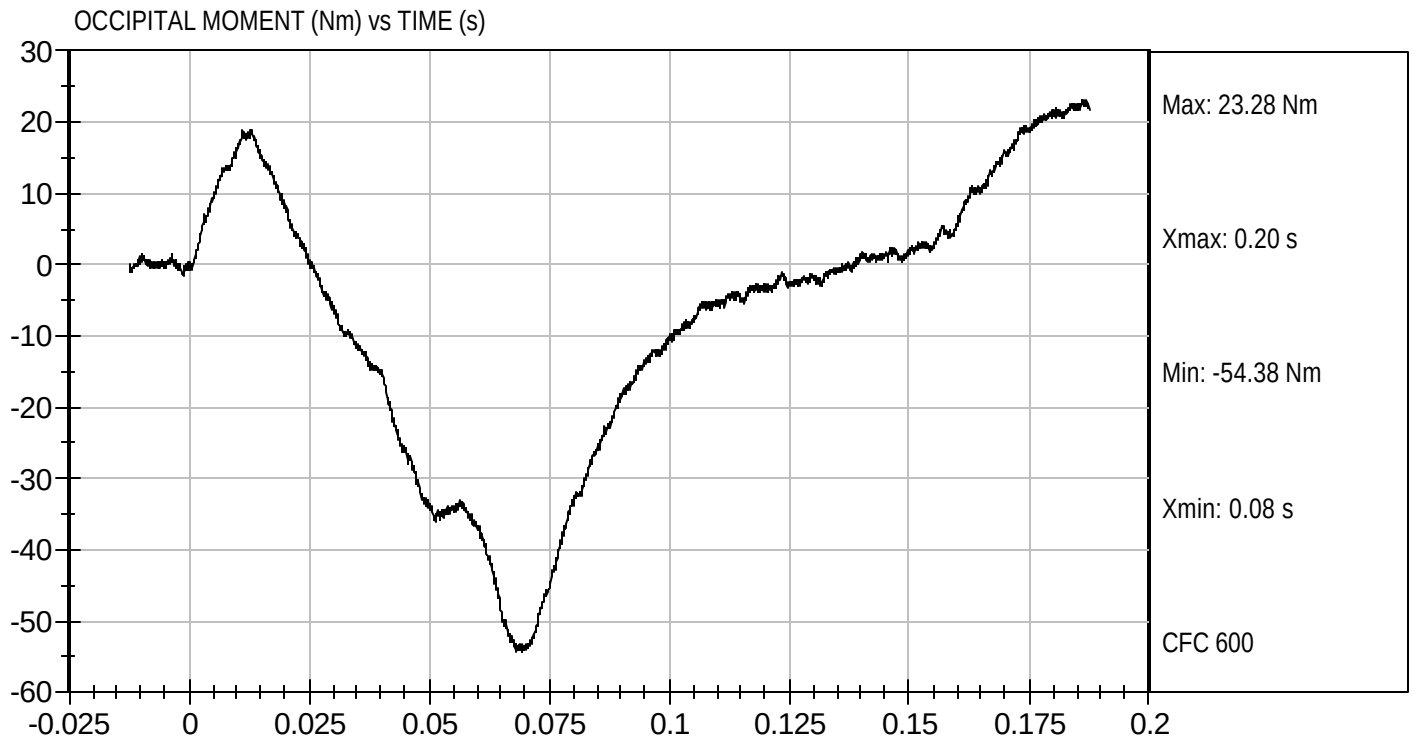
Test Date: 06/26/2006  
Velocity: 19.98 ft/s, 6.09 m/s





Test Desc: Neck Extension  
Componet ID: D061833

Test Date: 06/26/2006  
Velocity: 19.98 ft/s, 6.09 m/s



DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 511

Test Date 6/27/06

Technician Tim Bratz

     Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

     1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))

X N/A, ONLY one thorax impact test performed

X 2. The test fixture conforms to the specifications in Figure 11B.

X 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))

X 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))

Record the maximum temperature 21.7

Record the minimum temperature 21.5

Record the maximum humidity 49%

Record the minimum humidity 47%

X 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

X - No damage

     - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_

     - The following repairs or replacement was performed. Record \_\_\_\_\_

X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))

X 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.

- X 8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X 10. Align the adjustable neck bracket index marks to the "zero" position.
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))



X 16. Complete the following table:

Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*                                              | Specification                                                  | Result   |
|---------------------------------------------------------|----------------------------------------------------------------|----------|
| Test Probe Speed                                        | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.61 m/s |
| Chest Compression                                       | $50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$ | 51 mm    |
| Peak force** between 50.0 and 58.0 mm chest compression | $3900\text{N} \leq \text{peak force} \leq 4400\text{N}$        | 3970 N   |
| Peak force** between 18.0 and 50.0 mm chest compression | $\text{peak force} \leq 4600 \text{ N}$                        | 4028 N   |
| Internal Hysteresis***                                  | $69\% \leq \text{hysteresis} \leq 85\%$                        | 69%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.134(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

X 17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

  
Signature

6/27/06  
Date

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

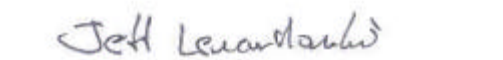
ATD Serial No: 511

Test I.D: D061834

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.7   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 49     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.61   | 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      | 69     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | ≤ 4600 N      | 4028   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

  
Laboratory Technician

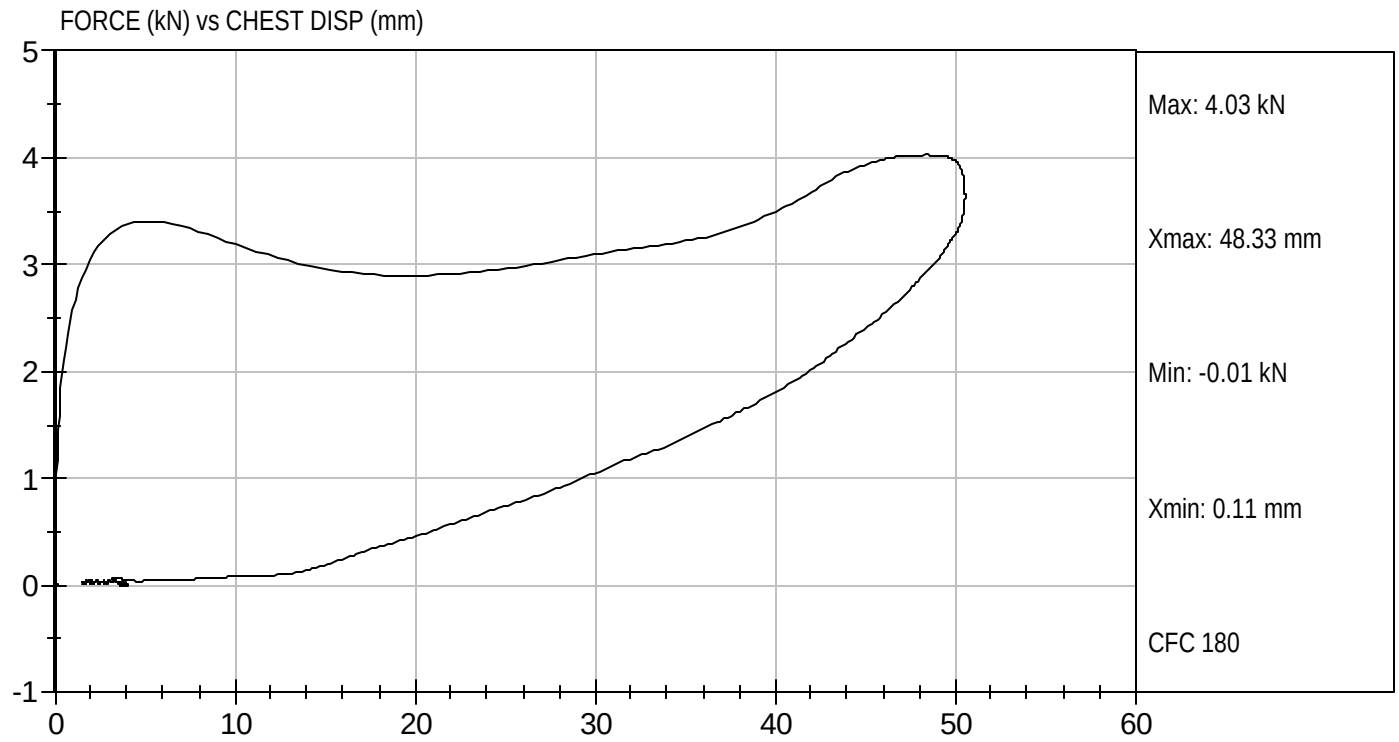
06/27/2006  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Componet ID: D061834

Test Date: 06/27/2006  
Velocity: 21.68 ft/s, 6.61 m/s



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 511 Test Date 6/26/06

Technician Dave Wilcox

     Pretest calibration

X Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

     1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))

X N/A, ONLY one thorax impact test performed

X 2. The test fixture conforms to the specifications in Figure 13B.

X 3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).

     with legs below the femurs.

X without legs below the femurs.

X 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))

Record the maximum temperature 21.3

Record the minimum temperature 21.1

Record the maximum humidity 47%

Record the minimum humidity 45%

X 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))

X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))

X 7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))

X 8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

X 9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))

X 10. Remove all external support that was implemented in 9 above. (572.135(c)(7))

X 11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))

Record reference plane angle (max. allowed 20°) 16°

X 12. Attach the pull cable and the load cell. (572.135(c)(8))

- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between  $0.5^\circ$  and  $1.5^\circ$  per second, until the angle reference plane is at  $45^\circ \pm 0.5^\circ$  of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X 14. Maintain angle reference plane at  $45^\circ \pm 0.5^\circ$  of flexion for 10 seconds. (572.135(c)(10))
- X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X 16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X 17. Complete the following table:

Torso Flexion Results (572.135(b), 572.135(c)(7), (572.135(c)(9))

| Parameter                         | Specification                                                 | Result     |
|-----------------------------------|---------------------------------------------------------------|------------|
| Initial ref. plane angle          | Angle $\leq 20^\circ$                                         | $16^\circ$ |
| Torso rotation rate               | $0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$ | 1.0        |
| Force at $45^\circ \pm 0.5^\circ$ | $320 \text{ N} \leq \text{force} \leq 390 \text{ N}$          | 378 N      |
| Final ref. plane angle            | Initial ref. plane angle $\pm 8^\circ$                        | $19^\circ$ |

  
 Signature

6/26/06  
 Date

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

ATD Serial No: 511

Test I.D: D061837

| Tested Parameter             | Units   | Specification | Result | Pass/Fail |
|------------------------------|---------|---------------|--------|-----------|
| Laboratory Temperature       | deg C   | 18.9 to 25.6  | 21.3   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70      | 46     | Pass      |
| Initial Angle                | deg     | 0 to 20       | 16     | Pass      |
| Return Angle                 | deg     | +/- 8         | 19     | Pass      |
| Force at 45 deg              | N       | 320 to 390    | 378    | Pass      |
| Upper Torso Deflection Rate  | Deg/sec | 0.5 to 1.5    | 1.0    | Pass      |
| Overall Result               |         |               |        | Pass      |



Laboratory Technician

06/26/2006

Test Date



Approved By

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511Test Date 6/26/06Technician Tim Bratz☐ Pretest calibration☒ Post test calibration verificationTest attempt no. 1 (when successive knee impact tests are necessary)☐ 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))☒ N/A, ONLY one knee impact test performed☒ 2. The test fixture conforms to the specifications in Figure 14B☒ 3. The knee assembly (880105-528L), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))Record the maximum temperature 21.3Record the minimum temperature 21.1Record the maximum humidity 47%Record the minimum humidity 45%☒ 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))☒ 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))☒ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.☒ 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

X 11. Complete the following table:

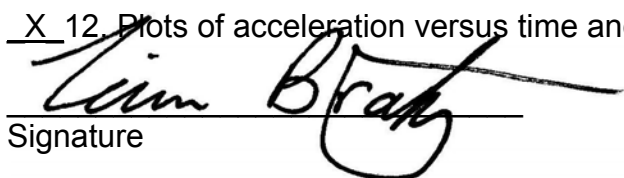
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.12 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3540 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

X 12. Plots of acceleration versus time and force versus time follow this sheet.

Signature



6/26/06

Date

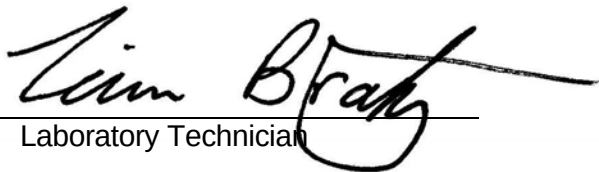


**MGA RESEARCH CORPORATION**  
**LEFT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 511

Test I.D: D061836

| 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      | 47     | Pass      |
| Probe Speed                  | m/sec | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.54   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

06/26/2006

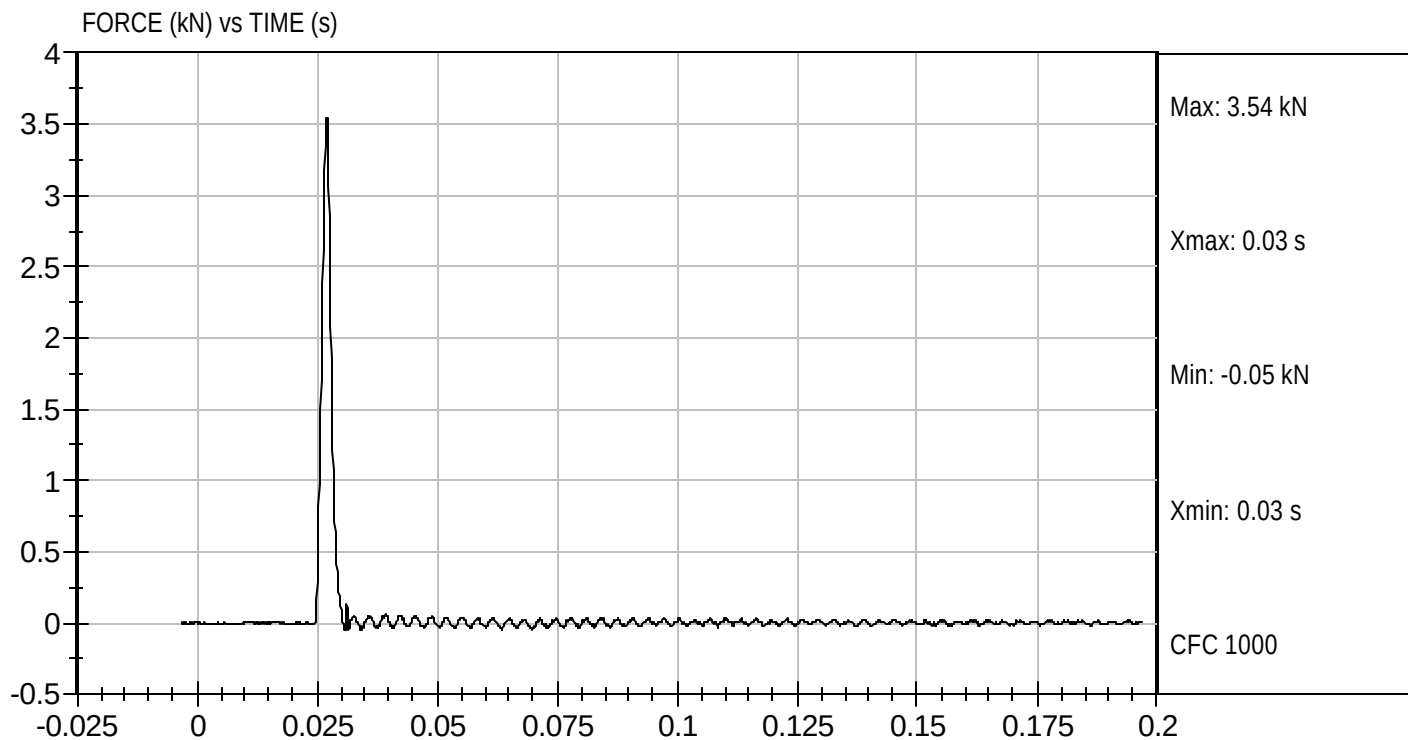
Test Date

  
Approved By



Test Desc: Left Knee  
Componet ID: D061836

Test Date: 06/26/2006  
Velocity: 6.95 ft/s, 2.12 m/s



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 6/26/06

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

☐ 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))

☒ N/A, ONLY one knee impact test performed

☒ 2. The test fixture conforms to the specifications in Figure 14B.

☒ 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))

☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

Record the maximum temperature 21.3

Record the minimum temperature 21.1

Record the maximum humidity 47%

Record the minimum humidity 45%

☒ 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))

☒ 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))

☒ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))

☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))

☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

☒ 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))

☒ 11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.12 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3590 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

☒ 12. Plots of acceleration versus time and force versus time follow this sheet.

  
Signature

6/26/06  
Date

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

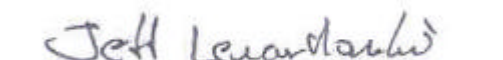
ATD Serial No: 511

Test I.D: D061835

| 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      | 47     | Pass      |
| Probe Speed                  | m/sec | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | kN    | 3.45 to 4.06  | 3.59   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

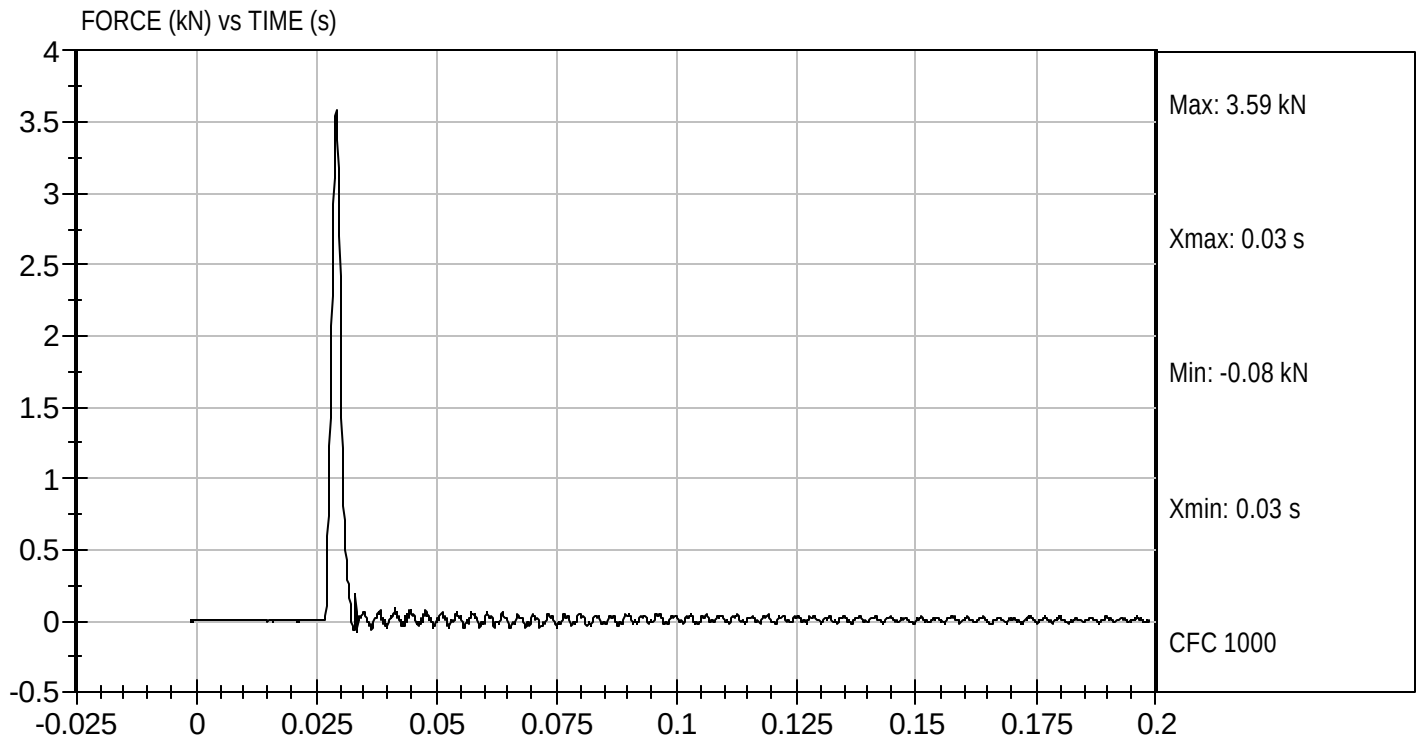
06/26/2006  
Test Date

  
Approved By



Test Desc: Right Knee  
Componet ID: D061835

Test Date: 06/26/2006  
Velocity: 6.94 ft/s, 2.12 m/s



## EXTERNAL DIMENSIONS

| HYBRID III 5 <sup>th</sup> SN #511, 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             | 782.1              |
| B                                                                           | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                       | 431.8-457.2             | 455.8              |
| C                                                                           | H-POINT HEIGHT                 | Reference                                                                                                                                    | 81.3-86.3               | 85.2               |
| D                                                                           | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                    | 144.8-149.8             | 145.3              |
| E                                                                           | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                   | 68.6-83.8               | 75.7               |
| F                                                                           | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                    | 119.4-134.6             | 130.9              |
| 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             | 250.5              |
| H                                                                           | HEAD BACK TO BACKLINE          | Back of skull cap skin to seat rear vertical surface (Reference)                                                                             | 43.2-48.2               | 45.2               |
| 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             | 282.7              |
| J                                                                           | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 182.8-203.2             | 196.3              |
| 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             | 540.1              |
| L                                                                           | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 355.6-376.0             | 358.1              |
| M                                                                           | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 393.7-419.1             | 406.3              |
| 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".                               | 414.0-439.4             | 434.4              |

| HYBRID III 5 <sup>th</sup> SN #511, 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             | 186.4              |
| P                                                                            | FOOT LENGTH                                               | Tip of toe to rear of heal                              | 218.5-233.7             | 222.3              |
| 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             | 476.3              |
| S                                                                            | HEAD BREADTH                                              | The widest part of the head                             | 137.1-147.3             | 142.9              |
| T                                                                            | HEAD DEPTH                                                | Back of the head to the forehead                        | 177.8-188.0             | 179.5              |
| U                                                                            | HIP BREADTH                                               | The widest part of the hip                              | 299.7-314.9             | 299.9              |
| V                                                                            | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises       | 350.5-365.7             | 361.2              |
| W                                                                            | FOOT BREADTH                                              | The widest part of the foot                             | 78.8-94.0               | 83.7               |
| X                                                                            | HEAD CIRCUMFERENCE                                        | Measured at the point as in dim. "T"                    | 528.3-548.7             | 539.4              |
| Y                                                                            | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 345.4 ± 12.7 mm above seat surface             | 850.9-881.3             | 851.9              |
| Z                                                                            | WAIST CIRCUMFERENCE                                       | Measured 165.1 ± 5.1 mm above seat surface              | 759.5-789.9             | 762.4              |
| AA                                                                           | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference                                               | 332.7-358.1             | 340.0              |
| BB                                                                           | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference                                               | 160.1-170.2             | 165.0              |



DATA SHEET B1  
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 511

Test Date 6/21/06

Technician Jessica Gall

This check sheet is completed as part of the post test calibration verification.

X Perform general cleaning.

| Dummy Item                  | Inspect for                                                  | Comments | Damaged | OK |
|-----------------------------|--------------------------------------------------------------|----------|---------|----|
| Outer skin                  | Gashes, rips, cracks                                         |          |         | X  |
| Head                        | Ballast secure                                               |          |         | X  |
|                             | General appearance                                           |          |         | X  |
| Neck                        | Broken or cracked rubber                                     |          |         | X  |
|                             | Upper neck bracket firmly attached to the lower neck bracket |          |         | X  |
|                             | Looseness at the condyle joint                               |          |         | X  |
|                             | Nodding blocks cracked or out of position                    |          |         | X  |
| Spine                       | Broken or cracks in rubber.                                  |          |         | X  |
| Ribs                        | Broken or bent ribs                                          |          |         | X  |
|                             | Broken or bent rib supports                                  |          |         | X  |
|                             | Damping material separated or cracked                        |          |         | X  |
|                             | Rubber bumpers in place                                      |          |         | X  |
| Chest Displacement Assembly | Bent shaft                                                   |          |         | X  |
|                             | Slider arm riding in track                                   |          |         | X  |
| Transducer leads            | Torn cables                                                  |          |         | X  |

| Dummy Item              | Inspect for                           | Comments | Damaged | OK |
|-------------------------|---------------------------------------|----------|---------|----|
| Accelerometer Mountings | Head mounting secure                  |          |         | X  |
|                         | Chest mounting secure                 |          |         | X  |
| Knees                   | Skin condition                        |          |         | X  |
|                         | Insert (do not remove)                |          |         | X  |
|                         | Casting                               |          |         | X  |
| Limbs                   | Normal movement and adjustment        |          |         | X  |
| Knee Sliders            | Wires intact                          |          |         | X  |
|                         | Rubber returned to "at rest" position |          |         | X  |
| Pelvis                  | Broken                                |          |         | X  |
| Other                   |                                       |          |         | X  |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

Jessica Hall  
Signature

6/26/06  
Date

Describe the repair or replacement of parts:

Checked by

Jeff Leonard  
Signature

6/26/06  
Date