**REPORT NO. 208-MGA-2015-DC012**

# DUMMY PERFORMANCE CALIBRATIONS
# FMVSS 208

**MITSUBISHI MOTORS CORPORATION**
**2015 MITSUBISHI OUTLANDER MPV**
**NHTSA NO.: C20155602**

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

**TEST DATES: DECEMBER 22, 2015 – FEBRUARY 2, 2016**

**FINAL REPORT DATE: MAY 16, 2016**

**FINAL REPORT**

**PREPARED FOR:**
**U.S. DEPARTMENT OF TRANSPORTATION**
**NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION**
**OFFICE OF ENFORCEMENT**
**OFFICE OF VEHICLE SAFETY COMPLIANCE**
**1200 NEW JERSEY AVENUE, S.E., NVS-220**
**WASHINGTON, D.C. 20590**

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| HYBRID III 50th 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 50th SN #401, PART 572, SUBPART E EXTERNAL 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 heal | 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) (50th Male)

Dummy Serial Number: 401 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 2 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(i))

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. (572.132(c)(1))

| | |
|---|---|
| Record the maximum temperature: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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, 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: 0.5 inches

**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: 501 mm

Record the left side distance: 501 mm

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: 50.9 micro inches

X 12. The impact surface is rigidly supported. (572.132(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: 50.9 mm

Record width: 604 mm

Record length: 595 mm

X 14. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 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 g ≤ x ≤ 275 g | 253 g |
| 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 ≤ 15 g | 4.4 g |

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

David Schoedel — Signature

01/25/2016 — Date

**MGA RESEARCH CORPORATION**

**HEAD DROP TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test ID:** D16311

| 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 | 20 | Pass |
| Peak Resultant Acceleration | G's | 225 to 275 | 253 | Pass |
| Peak Lateral Acceleration | G's | <= +/- 15.0 | 4.4 | Pass |
| Unimodal | N/A | Yes | Yes | Pass |
| Oscillations | N/A | within 10% of peak | Yes | Pass |
| | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

01/25/2016

Test Date

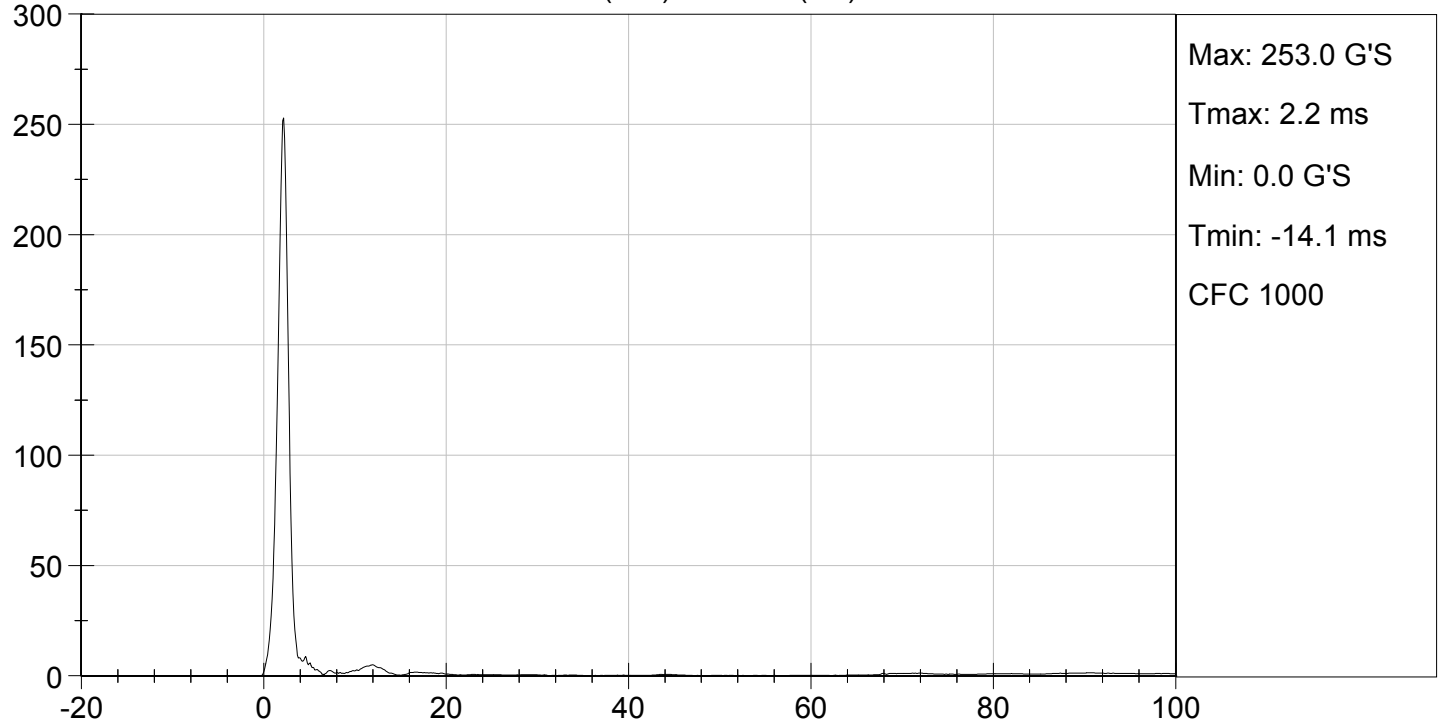
Jeff Levandoski

Approved By

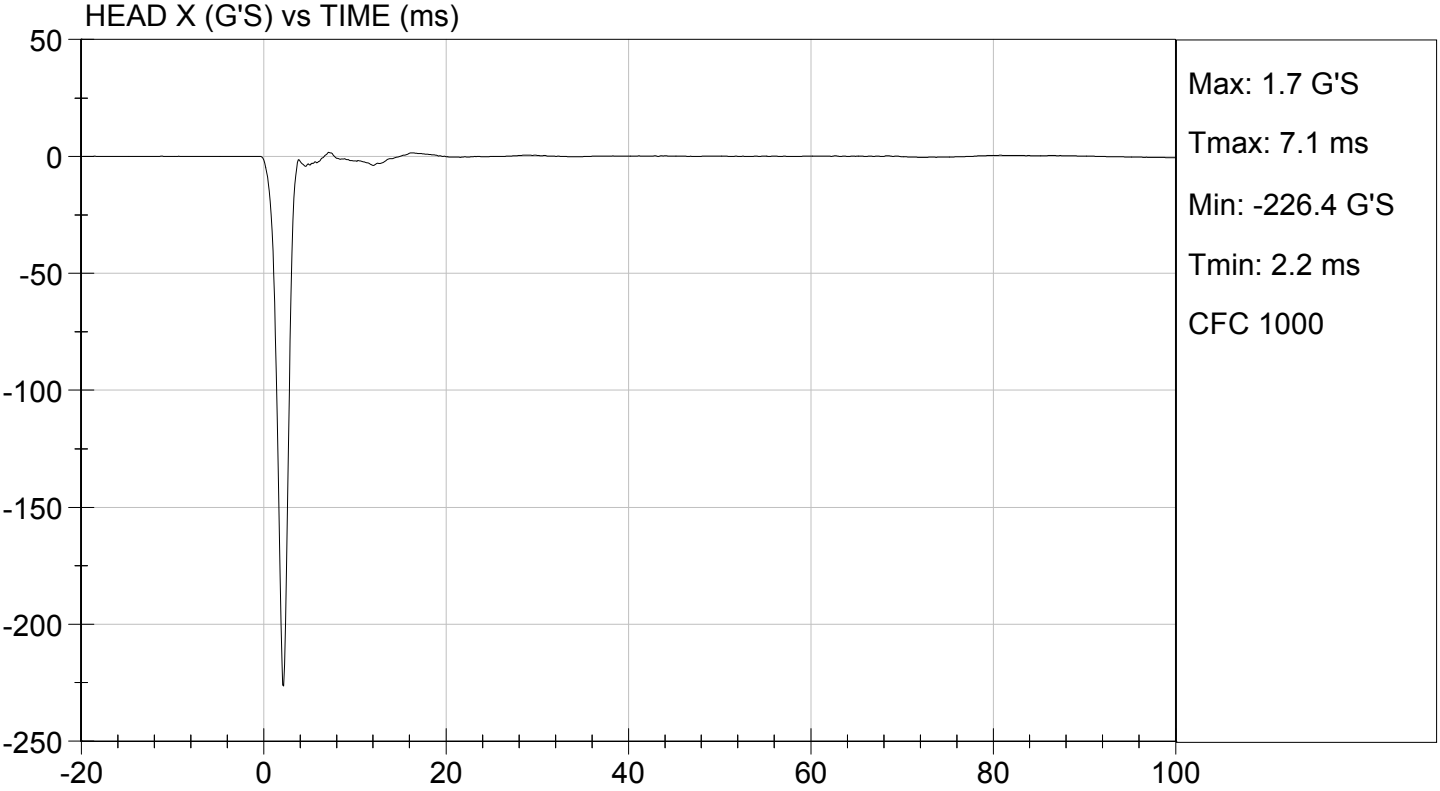
TEST DESC: HEAD DROP

TEST DATE: 01/25/2016
TEST #: D16311

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



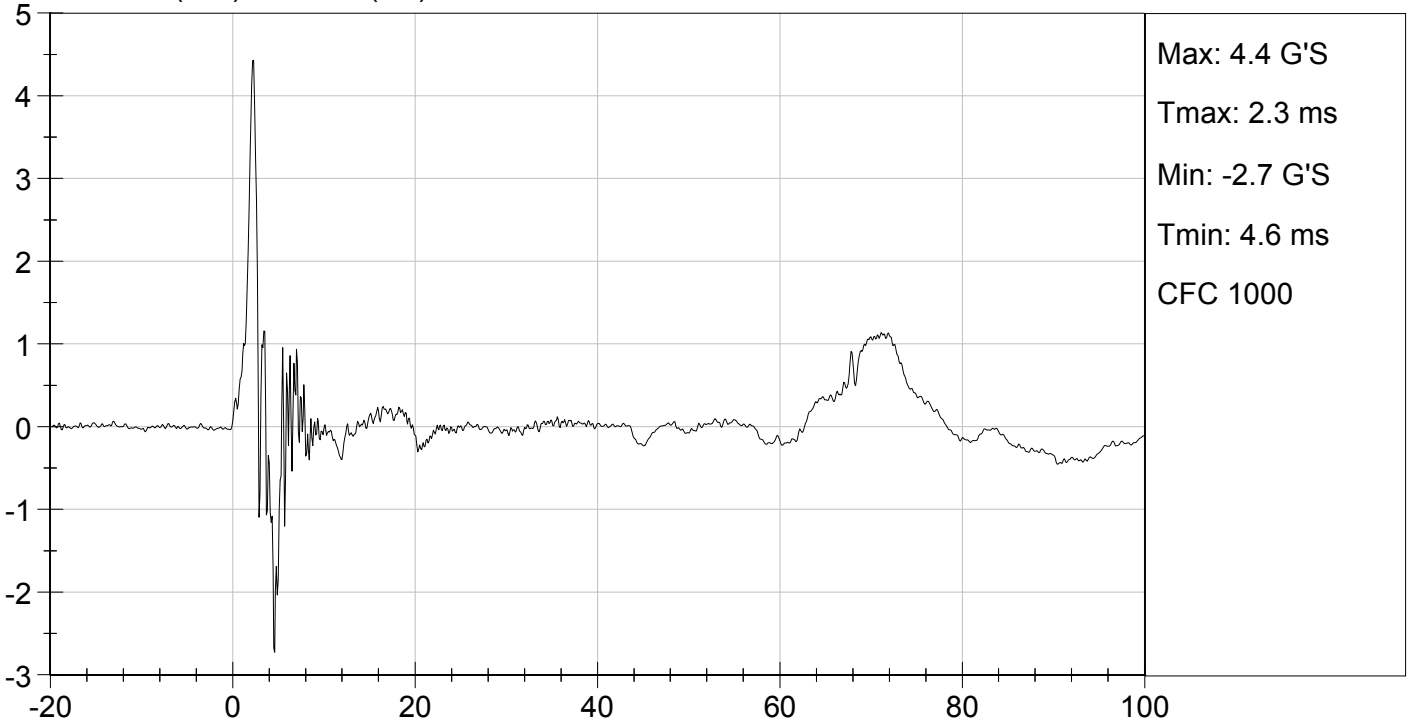

HEAD X (G'S) vs TIME (ms)



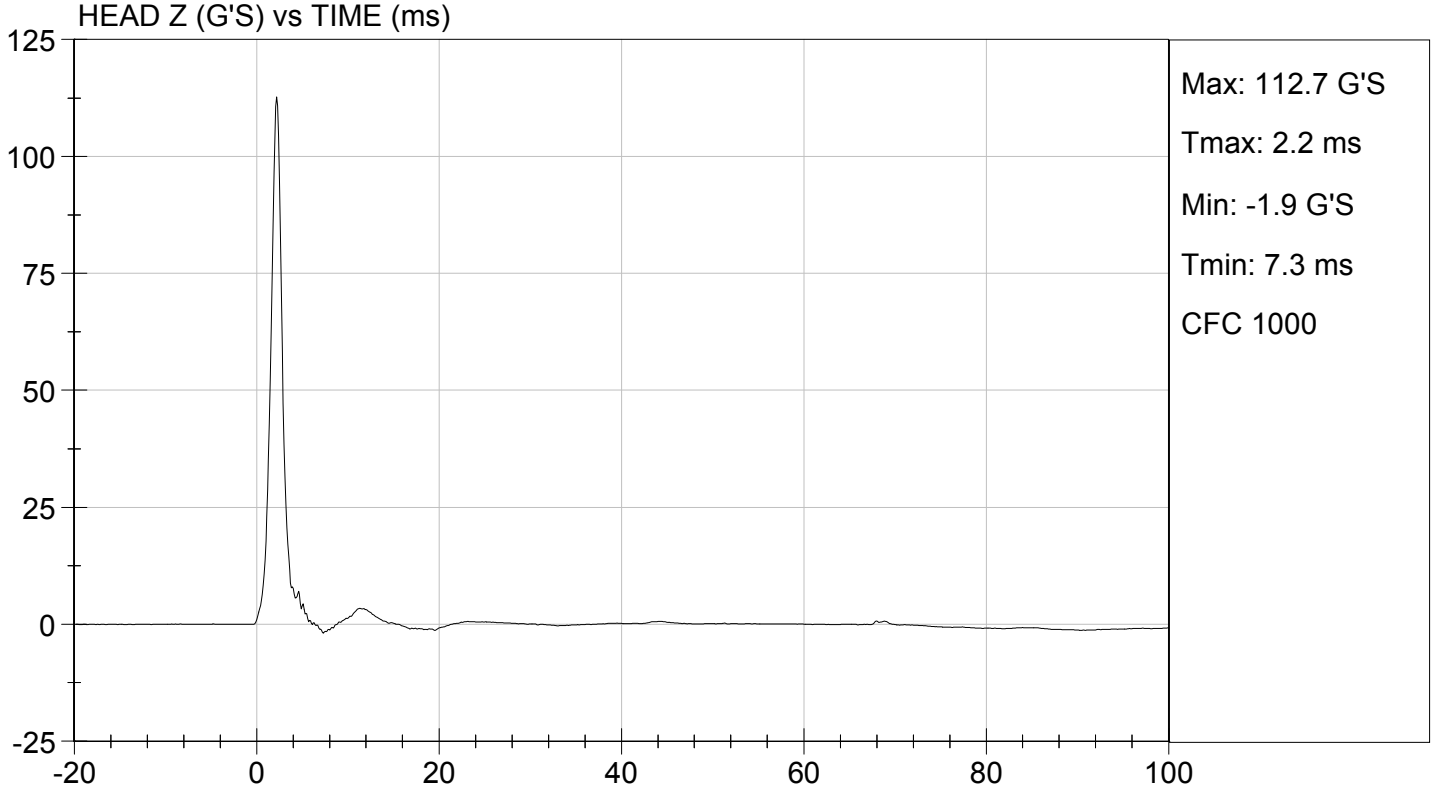
TEST DESC: HEAD DROP

TEST DATE: 01/25/2016
TEST #: D16311

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




HEAD Z (G'S) vs TIME (ms)



**DATA SHEET A4**

NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 401 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

X 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))

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: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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. (78051-90).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

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

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 ± 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 | Results |
|---|---|---|---|
| Pendulum impact speed | | 22.6 ft/s ≤ speed ≤ 23.4 ft/s | 22.83 ft/s |
| Pendulum Deceleration Versus Time Pulse | @ 10 ms | 22.5 ≤ g ≤ 27.5 | 23.40 g's |
| | @ 20 ms | 17.6 ≤ g ≤ 22.6 | 19.61 g's |
| | @ 30 ms | 12.5 ≤ g ≤ 18.5 | 13.11 g's |
| | Above 30 ms | 29 g maximum | 13.0 g's |
| First Pendulum Decay to 5g | | 34 ms ≤ time ≤ 42 ms | 39.0 ms |
| Plane D Rotation | | 64° ≤ max. rotation ≤ 78° | 64.6° |
| | | 57 ms ≤ time of max. rotation ≤ 64 ms | 60.5 ms |
| Time for Plane D Rotation to Cross 0° During First Rebound | | 113 ms ≤ time ≤ 128 ms | 117.7 ms |
| Maximum Moment | | 65 lbf-ft ≤ moment ≤ 80 lbf-ft | 65.7 lbf-ft |
| | | 47 ms ≤ time of max. moment ≤ 58 ms | 51.3 ms |
| Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion) | | 97 ms ≤ time ≤ 107 ms | 98.5 ms |

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(1)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = 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. (572.33(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.

David Schoedel
Signature

01/25/2016
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16312

| Tested Parameter | | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | | deg C | 20.6 to 22.2 | 20.9 | Pass |
| Laboratory Relative Humidity | | % | 10 to 70 | 20 | Pass |
| Pendulum Velocity | | m/s | 6.89 to 7.13 | 6.96 | Pass |
| Pendulum Deceleration | 10 ms | G's | 22.50 to 27.50 | 23.40 | Pass |
| | 20 ms | G's | 17.60 to 22.60 | 19.61 | Pass |
| | 30 ms | G's | 12.50 to 18.50 | 13.11 | Pass |
| Peak Pendulum Deceleration After 30 ms | | G's | <= 29.0 | 13.0 | Pass |
| Deceleration Decay Time to Cross 5 G's | | ms | 34.0 to 42.0 | 39.0 | Pass |
| Maximum "D" Plane Rotation | Maximum | Deg | 64.0 to 78.0 | 64.6 | Pass |
| | Time | ms | 57.0 to 64.0 | 60.5 | Pass |
| "D" Plane Rotation Decay Time To Zero Crossing | | ms | 113.0 to 128.0 | 117.7 | Pass |
| Moment About Occipital Condyle | Maximum | Nm | 88.1 to 108.5 | 89.1 | Pass |
| | Time | ms | 47.0 to 58.0 | 51.3 | Pass |
| Positive Moment Decay Time To Zero Crossing | | ms | 97.0 to 107.0 | 98.5 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

01/25/2016

Test Date

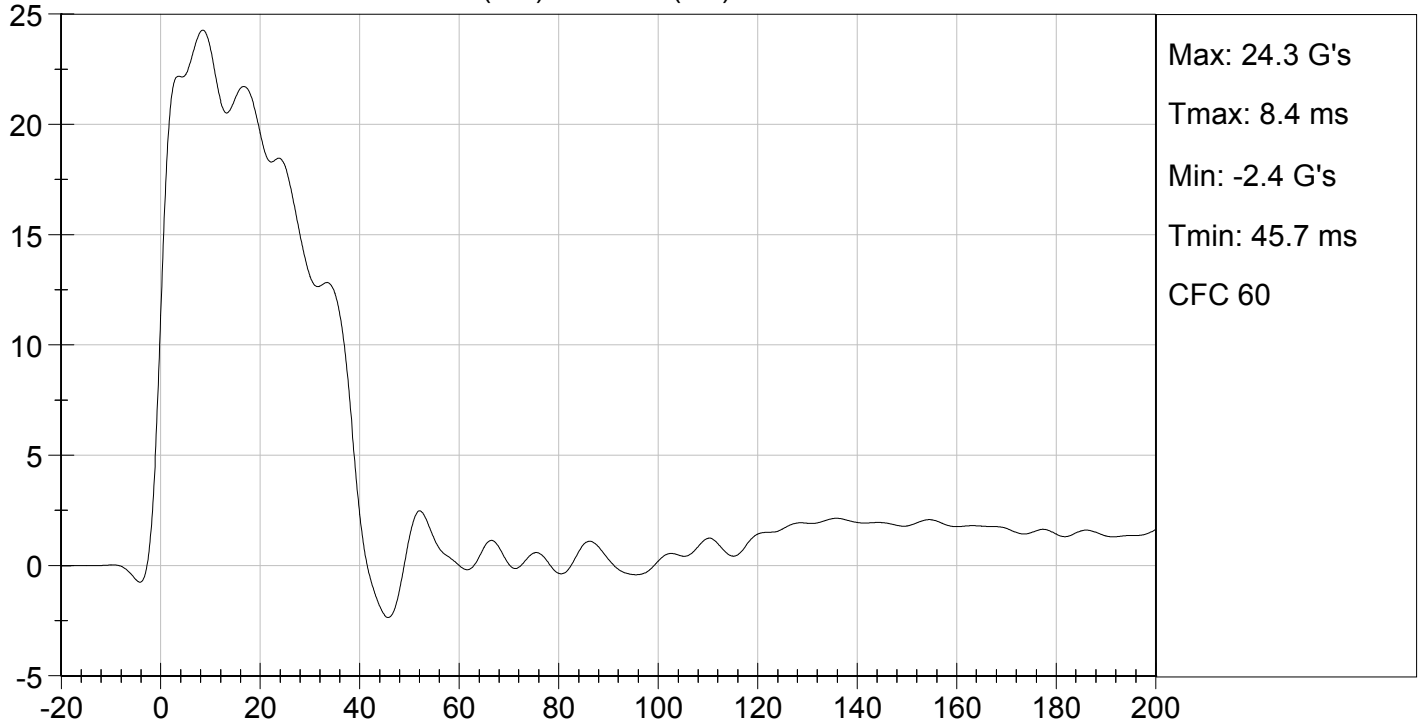
Jeff Levandoski

Approved By

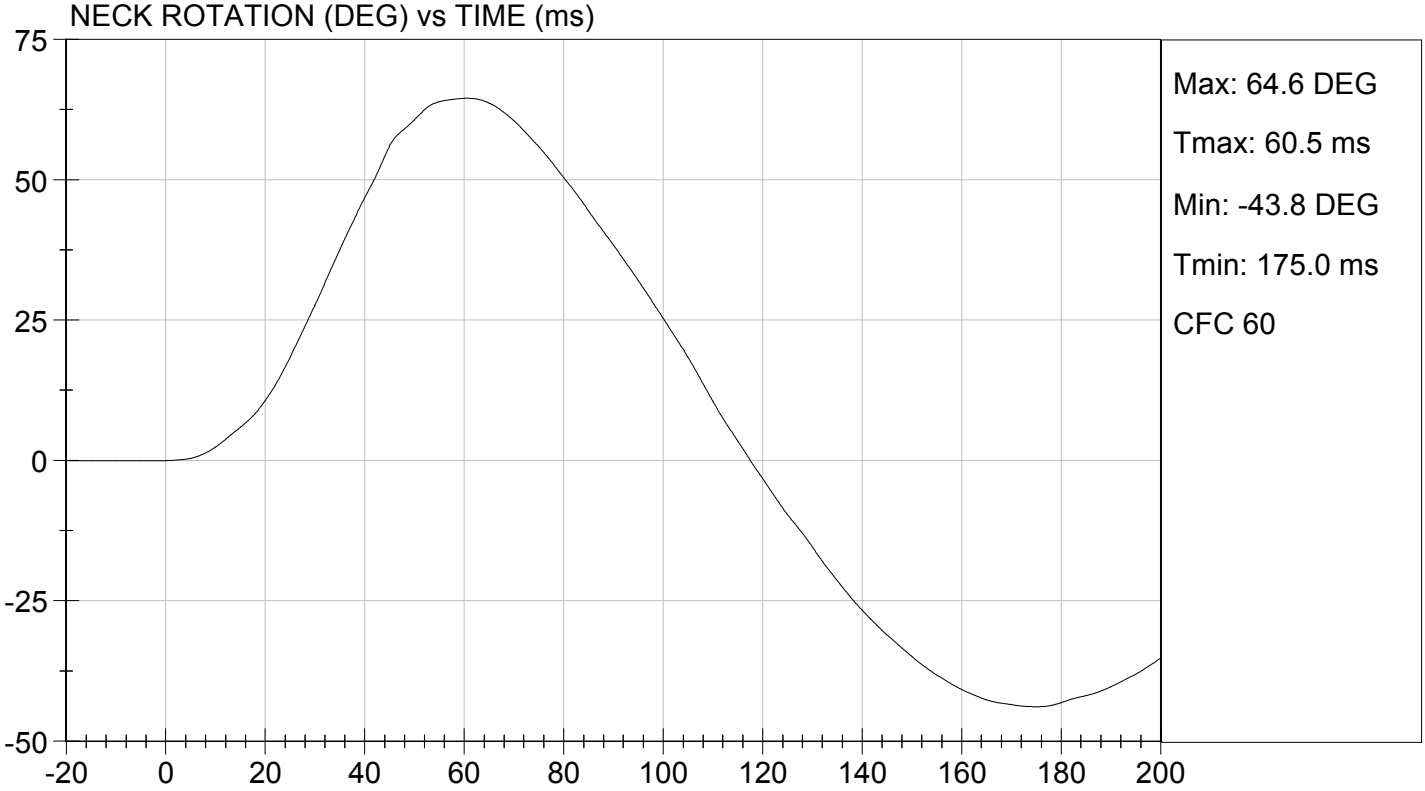
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 01/25/2016
TEST #: D16312

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



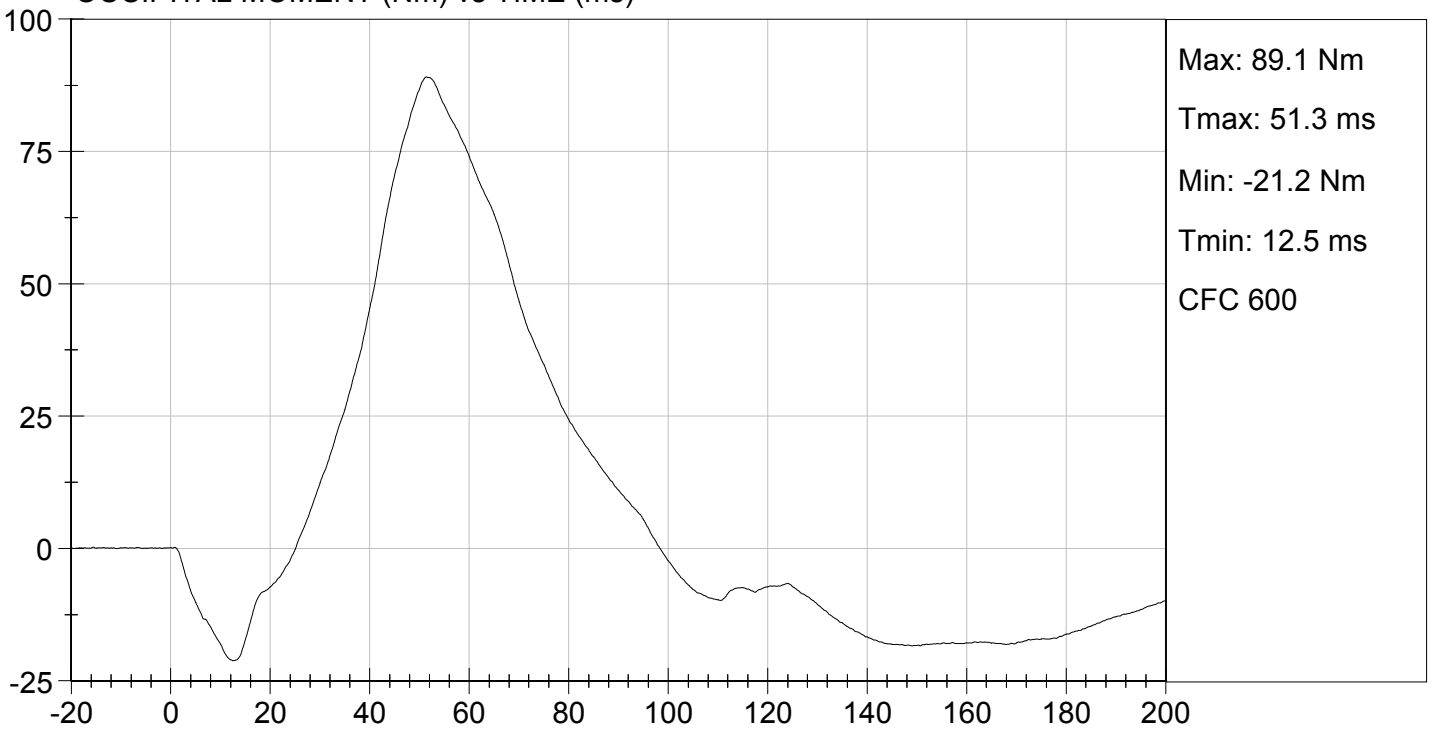

NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 01/25/2016
TEST #: D16312

OCCIPITAL MOMENT (Nm) vs TIME (ms)



**DATA SHEET A5**

NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 401 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

X 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))

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: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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. (78051-90).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

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

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 ± 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/sec 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 | Results |
|---|---|---|---|
| Pendulum impact speed | | 19.5 ft/s ≤ speed ≤ 20.3 ft/s | 20.08 ft/s |
| Pendulum Deceleration Versus Time Pulse | @ 10 ms | 17.2 ≤ g ≤ 21.2 | 19.83 g's |
| | @ 20 ms | 14 ≤ g ≤ 19 | 16.32 g's |
| | @ 30 ms | 11.0 ≤ g ≤ 16.0 | 12.56 g's |
| | Above 30 ms | 22 g maximum | 12.5 g's |
| First Pendulum Decay to 5g | | 38 ms ≤ time ≤ 46 ms | 40.2 ms |
| Plane D Rotation | | 81° ≤ max. rotation ≤ 106° | 89.9° |
| | | 72 ms ≤ time of max. rotation ≤ 82 ms | 78.8 ms |
| Time for Plane D Rotation to Cross 0° During First Rebound | | 147 ms ≤ time ≤ 174 ms | 158.6 ms |
| Maximum Moment | | -59 lbf-ft ≤ moment ≤ -39 lbf-ft | -43.4 lbf-ft |
| | | 65 ms ≤ time of max. moment ≤ 79 ms | 70.9 ms |
| Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension) | | 120 ms ≤ time ≤ 148 ms | 142.2 ms |

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(2)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = 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. (572.33(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.

David Schoedel

Signature

01/25/2016

Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16313

| Tested Parameter | | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | | deg C | 20.6 to 22.2 | 20.9 | Pass |
| Laboratory Relative Humidity | | % | 10 to 70 | 20 | Pass |
| Pendulum Velocity | | m/s | 5.95 to 6.19 | 6.12 | Pass |
| Pendulum Deceleration | 10 ms | G's | 17.20 to 21.20 | 19.83 | Pass |
| | 20 ms | G's | 14.00 to 19.00 | 16.32 | Pass |
| | 30 ms | G's | 11.00 to 16.00 | 12.56 | Pass |
| Peak Pendulum Deceleration After 30 ms | | G's | <= 22.0 | 12.5 | Pass |
| Deceleration Decay Time to Cross 5 G's | | ms | 38.0 to 46.0 | 40.2 | Pass |
| Maximum "D" Plane Rotation | Maximum | Degrees | 81.0 to 106.0 | 89.9 | Pass |
| | Time | ms | 72.0 to 82.0 | 78.8 | Pass |
| "D" Plane Rotation Decay Time To Zero Crossing | | ms | 147.0 to 174.0 | 158.6 | Pass |
| Moment About Occipital Condyle | Maximum | Nm | -52.9 to -79.9 | -58.8 | Pass |
| | Time | ms | 65.0 to 79.0 | 70.9 | Pass |
| Negative Moment Decay Time To Zero Crossing | | ms | 120.0 to 148.0 | 142.2 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

01/25/2016

Test Date

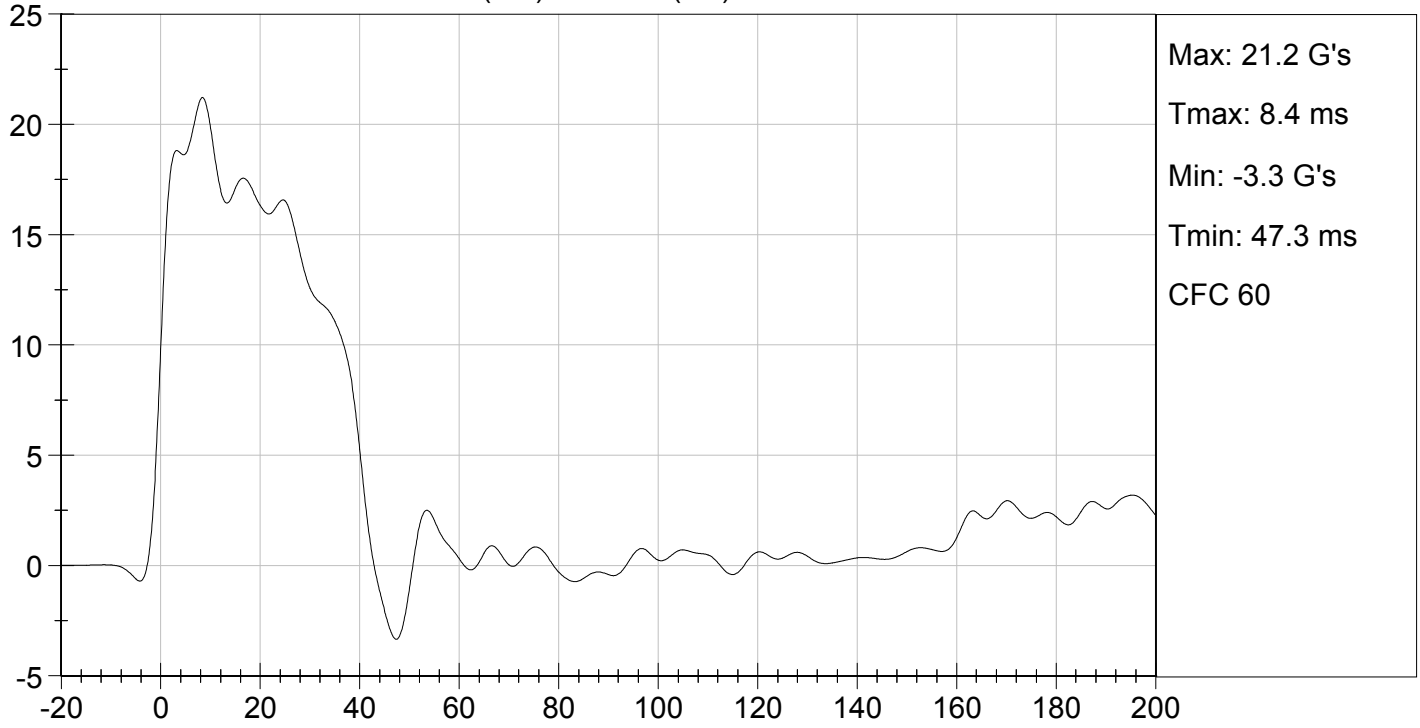
Jeff Leonardelli

Approved By

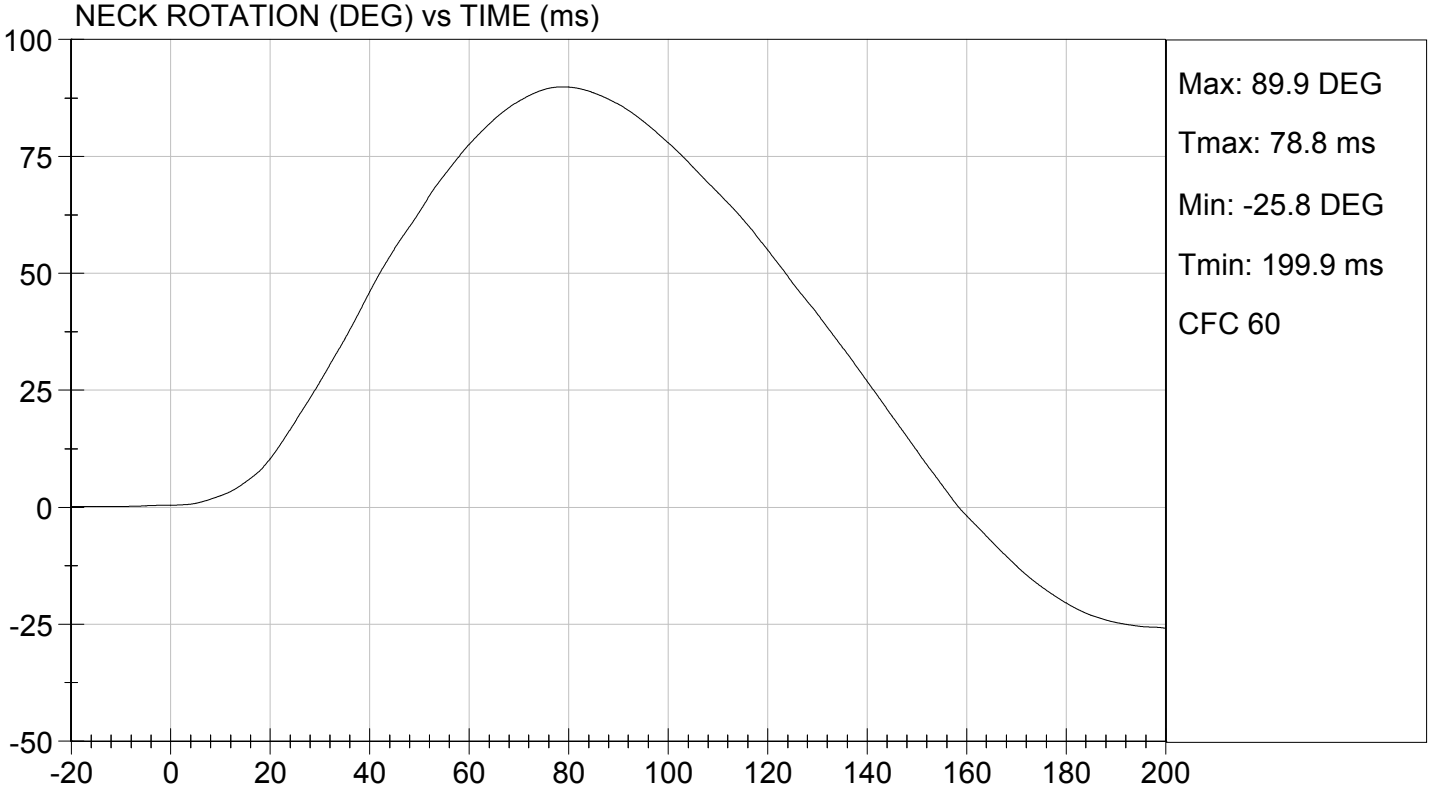
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

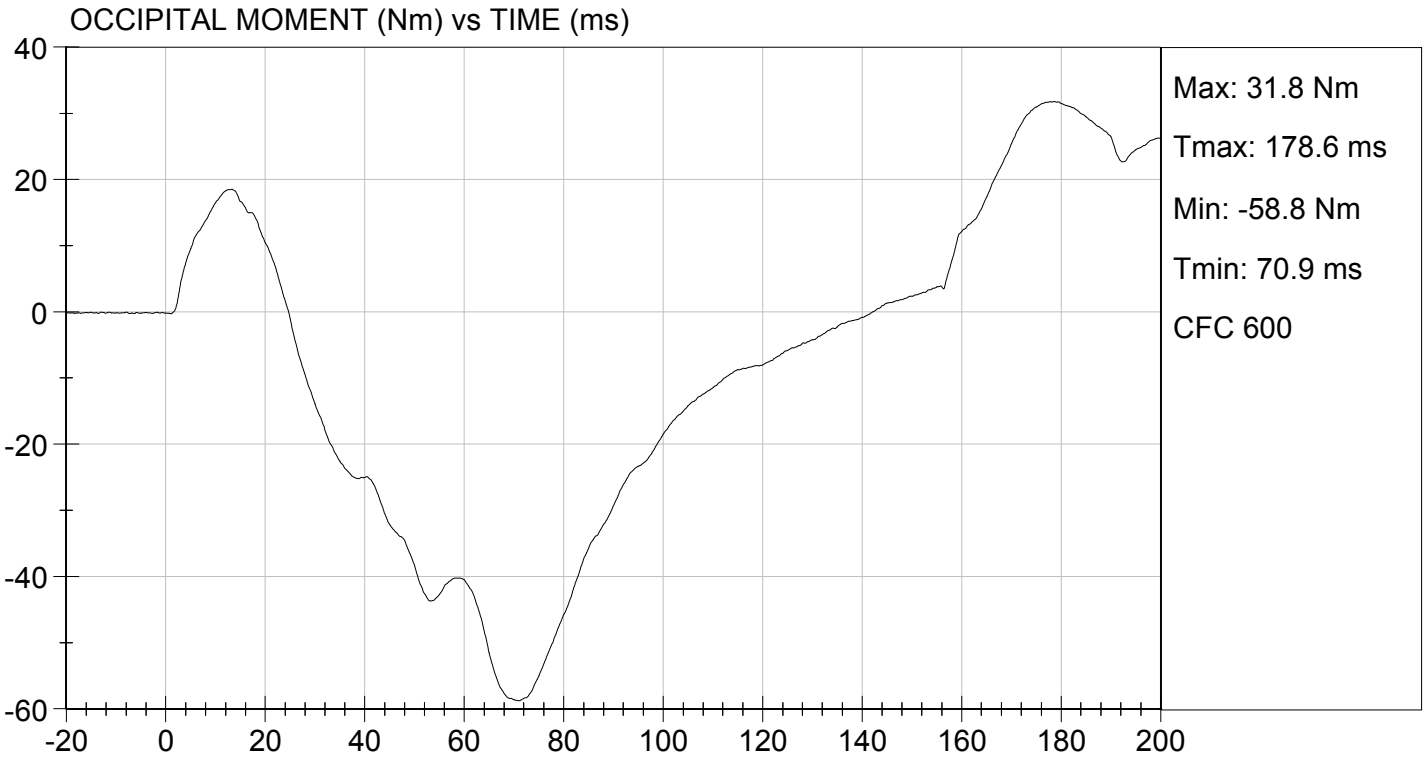
TEST DATE: 01/25/2016
TEST #: D16313

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




NECK ROTATION (DEG) vs TIME (ms)




OCCIPITAL MOMENT (Nm) vs TIME (ms)
40
20
0
-20
-40
-60
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 31.8 Nm
Tmax: 178.6 ms
Min: -58.8 Nm
Tmin: 70.9 ms
CFC 600

**DATA SHEET A6**

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 401 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration

___ Post test calibration verification

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

X 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 12A.

X 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))

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. (572.34(c)(1))

| | |
|---|---|
| Record the maximum temperature: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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 (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.

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 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 ± 0.5° and adjust the pelvis angle to 13° ± 2°. 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 ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° 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 ± 2° 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° 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 f/s ± 0.4 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 ft/s ≤ speed ≤ 22.4 ft/s | 21.93 ft/s |
| Chest Compression | 2.5 in. ≤ compression ≤ 2.86 in. | 2.61 in. |
| Peak resistance force** | 1160 lb ≤ peak force ≤ 1325 lb | 1321 lb |
| Internal Hysteresis*** | 69% ≤ hysteresis ≤ 85% | 74 % |

*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.

David Schoedel

Signature

01/25/2016

Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16314

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 20.6 to 22.2 | 20.7 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 20 | Pass |
| Probe Velocity | m/s | 6.58 to 6.82 | 6.68 | Pass |
| Peak Probe Force | N | 5159 to 5893 | 5,874 | Pass |
| Peak Sternum Displacement | cm | 6.35 to 7.26 | 6.63 | Pass |
| Internal Hysteresis | % | 69 to 85 | 74 | Pass |
| | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

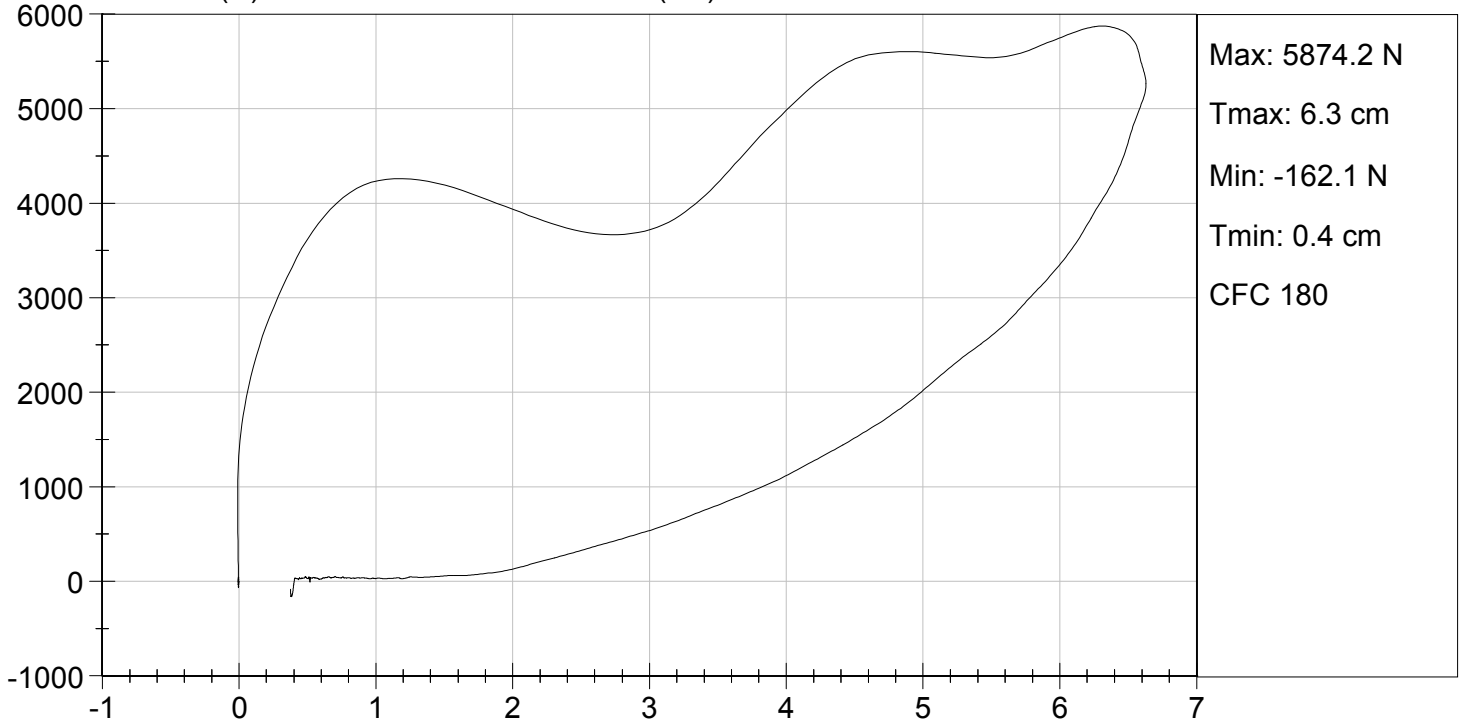
01/25/2016
Test Date

Jeff Leonardski
Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 01/25/2016
TEST #: D16314

FORCE (N) vs CHEST DISPLACEMENT (cm)



**DATA SHEET A7**
LEFT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 401 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 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: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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 | 6.94 ft/s |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb | 1073 lb |

*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))

David Schoedel

Signature

01/25/2016

Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16316

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 20.9 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 20 | Pass |
| Probe Velocity | m/s | 2.07 to 2.13 | 2.12 | Pass |
| Peak Probe Force | N | 4715 to 5782 | 4,775 | Pass |
| | | Overall Test Results | | Pass |

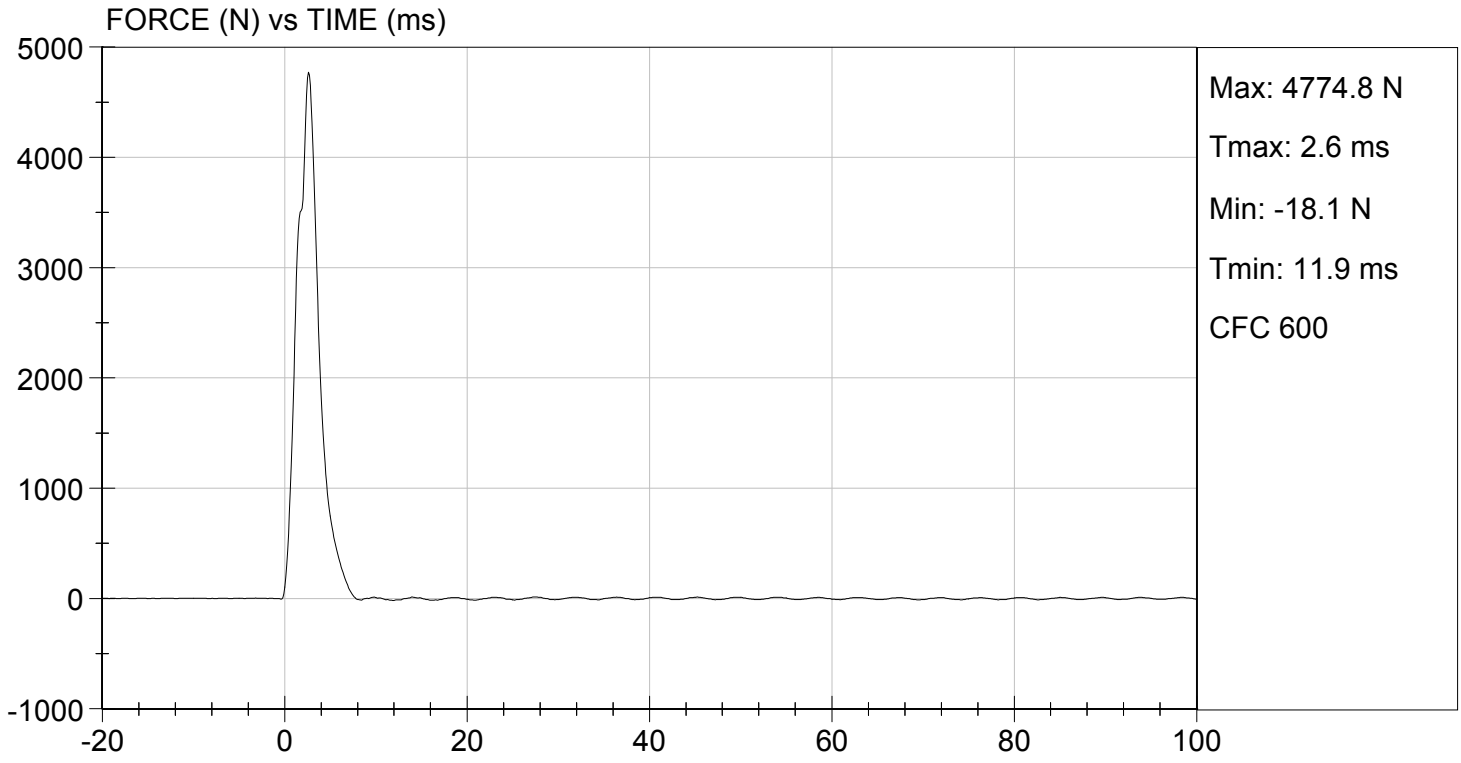
David Schoedel
Laboratory Technician

01/25/2016
Test Date

Jeff Leonardelli
Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.94 ft/s, 2.12 m/s

TEST DATE: 01/25/2016
TEST #: D16316



**DATA SHEET A8**

RIGHT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 401 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 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 (86-5001-002) with the upper leg assembly (78051-47) 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: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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 | 6.94 ft/s |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb | 1120 lb |

*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))

David Schoedel

Signature

01/25/2016

Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16315

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 20.9 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 20 | Pass |
| Probe Velocity | m/s | 2.07 to 2.13 | 2.12 | Pass |
| Peak Probe Force | N | 4715 to 5782 | 4,981 | Pass |
| | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

01/25/2016

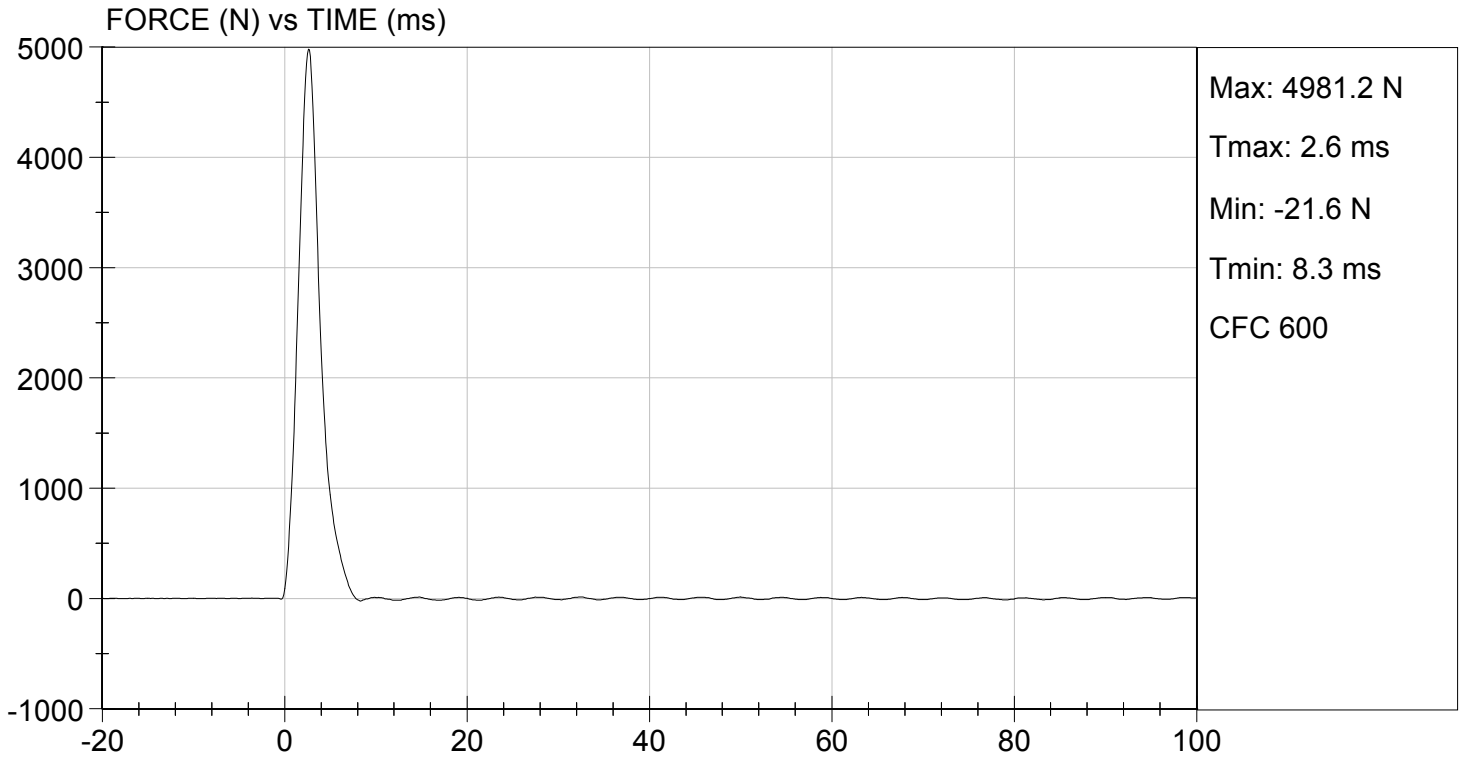
Test Date

Jeff Leonardelli

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.94 ft/s, 2.12 m/s

TEST DATE: 01/25/2016
TEST #: D16315



**DATA SHEET A9**

HIP JOINT-FEMUR FLEXION (572.35(c)) (50th Male)

Dummy Serial Number: 401 Test Date: 01/25/2016

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

X 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: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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°/s ≤ rotation rate ≤ 10°/s | 6.2°/s |
| Femur Torque at 30° | Torque ≤ 70 ft-lbf | 66.0 ft-lbf |
| Rotation at 150 lbf-ft | 40° ≤ rotation ≤ 50° | 41.3° |

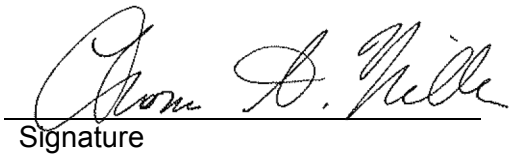
X 11. Secure the lever arm into the right femur shaft opening of the upper leg structure assembly (78051-44) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

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 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 13. Complete the following table:

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

| Parameter | Specification | Result |
|---|---|---|
| Rotation Rate | 5°/s ≤ rotation rate ≤ 10°/s | 6.3°/s |
| Femur Torque at 30° | torque ≤ 70 ft-lbf | 64.2 ft-lbf |
| Rotation at 150 lbf-ft | 40° ≤ rotation ≤ 50° | 41.7° |



Signature

01/25/2016
Date

**MGA RESEARCH CORPORATION**

**HIP-FEMUR FLEXION TEST**

**HYBRID III 50TH PERCENTILE MALE**

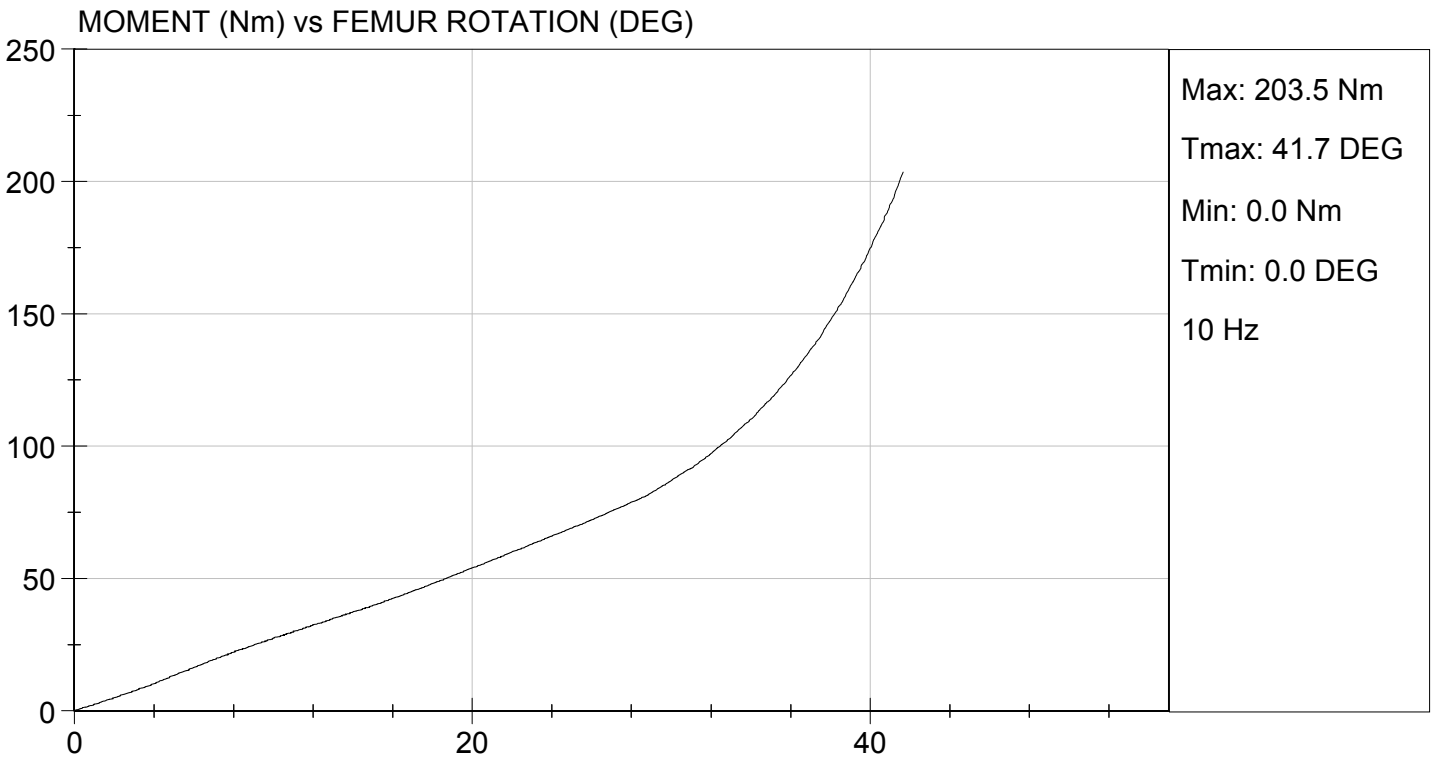
**ATD Serial No:** 401 **Test I.D:** D16310

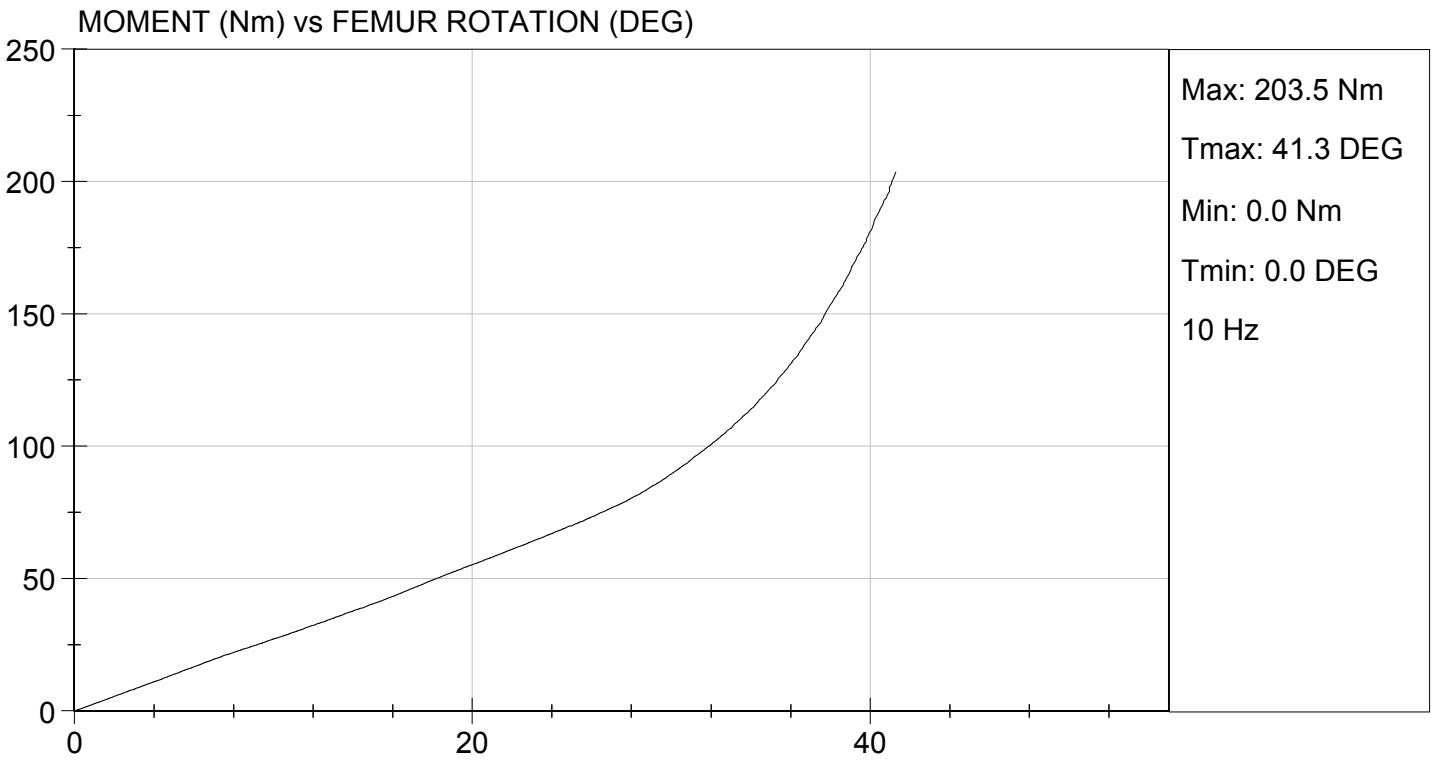
| Tested Parameter | Units | Specification | Result | | Pass/Fail |
|---|---|---|---|---|---|
| | | | Right | Left | |
| Laboratory Temperature | deg C | 18.9 to 25.6 | 20.7 | 20.7 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 20 | 20 | Pass |
| Rotation Rate | deg/s | 5.0 to 10.0 | 6.3 | 6.2 | Pass |
| 30 Degrees | Nm | 94.9 Nm Max | 87.0 | 89.5 | Pass |
| 150 ft-lbf / 203.4 Nm | Deg | 40.0 to 50.0 Degree Max Rotation | 41.7 | 41.3 | Pass |
| | | Overall Test Results | | | Pass |

Laboratory Technician

01/25/2016
Test Date

Approved By


MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.5 Nm
Tmax: 41.7 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz


MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.5 Nm
Tmax: 41.3 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz

## DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO. | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---|---|---|---|---|---|
| DUMMY INSTRUMENTATION | | | | | |
| HEAD ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7231C-750 | AH5D9 | 09/11/2015 | 03/11/2016 |
| (2) LATERAL | Endevco | 7231C-750 | AH5L1 | 09/11/2015 | 03/11/2016 |
| (3) VERTICAL | Endevco | 7231C-750 | AH5N9 | 09/11/2015 | 03/11/2016 |
| NECK TRANSDUCER | Denton | 1716 | 1159 | 10/23/2015 | 04/23/2016 |
| CHEST ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7231C-750 | AGH79 | 09/11/2015 | 03/11/2016 |
| (2) LATERAL | Endevco | 7231C-750 | AGH55 | 09/11/2015 | 03/11/2016 |
| (3) VERTICAL | Endevco | 7231C-750 | C12863 | 09/11/2015 | 03/11/2016 |
| CHEST POTENTIOMETER | Servo | 14CBI-2897 | 401 | 09/10/2015 | 03/10/2016 |
| FEMUR LOAD CELLS | | | | | |
| (1) RIGHT FEMUR | Denton | 2121 | 8806 | 09/10/2015 | 03/10/2016 |
| (2) LEFT FEMUR | Denton | 2121 | 8807 | 09/10/2015 | 03/10/2016 |
| LABORATORY INSTRUMENTATION | | | | | |
| NECK PENDULUM ACCELEROMTER | Endevco | 7231C-750 | AH5P1 | 01/25/2016 | 07/25/2016 |
| THORAX PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P82097 | 11/30/2015 | 05/30/2016 |
| KNEE PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P88169 | 11/30/2015 | 05/30/2016 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol | 132-0-0-102 | 18 | 01/22/2016 | 07/22/2016 |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol | 132-0-0-102 | 29 | 09/28/2015 | 03/28/2016 |

LABORATORY TECHNICIAN: Jessica Hall

**DATA SHEET A3**

HEAD DROP TEST (572.32) (50th Male)

Dummy Serial Number: 401 Test Date: 02/02/2016

Technician: David Schoedel

____ Pre test calibration

__X__ Post test calibration verification

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

__X__ 1. It has been at least 2 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(i))

__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. (572.132(c)(1))

Record the maximum temperature: 21.2°C

Record the minimum temperature: 20.9°C

Record the maximum humidity: 28%

Record the minimum humidity: 26%

__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, 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: 0.5 inches

**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: 501 mm

Record the left side distance: 501 mm

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: 50.9 micro inches

X 12. The impact surface is rigidly supported. (572.132(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: 50.9 mm

Record width: 604 mm

Record length: 595 mm

X 14. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 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 g ≤ x ≤ 275 g | 253 g |
| 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 ≤ 15 g | 2.5 g |

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

David Schoedel
Signature

02/02/2016
Date

**DATA SHEET A4**

NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 401 Test Date: 02/02/2016

Technician: David Schoedel

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one neck test performed

_X_ 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))

_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°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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. (78051-90).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

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

**MGA RESEARCH CORPORATION**

**HEAD DROP TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test ID:** D16431

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 20.9 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 27 | Pass |
| Peak Resultant Acceleration | G's | 225 to 275 | 253 | Pass |
| Peak Lateral Acceleration | G's | <= +/- 15.0 | 2.5 | Pass |
| Unimodal | N/A | Yes | Yes | Pass |
| Oscillations | N/A | within 10% of peak | Yes | Pass |
| | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

02/02/2016

Test Date

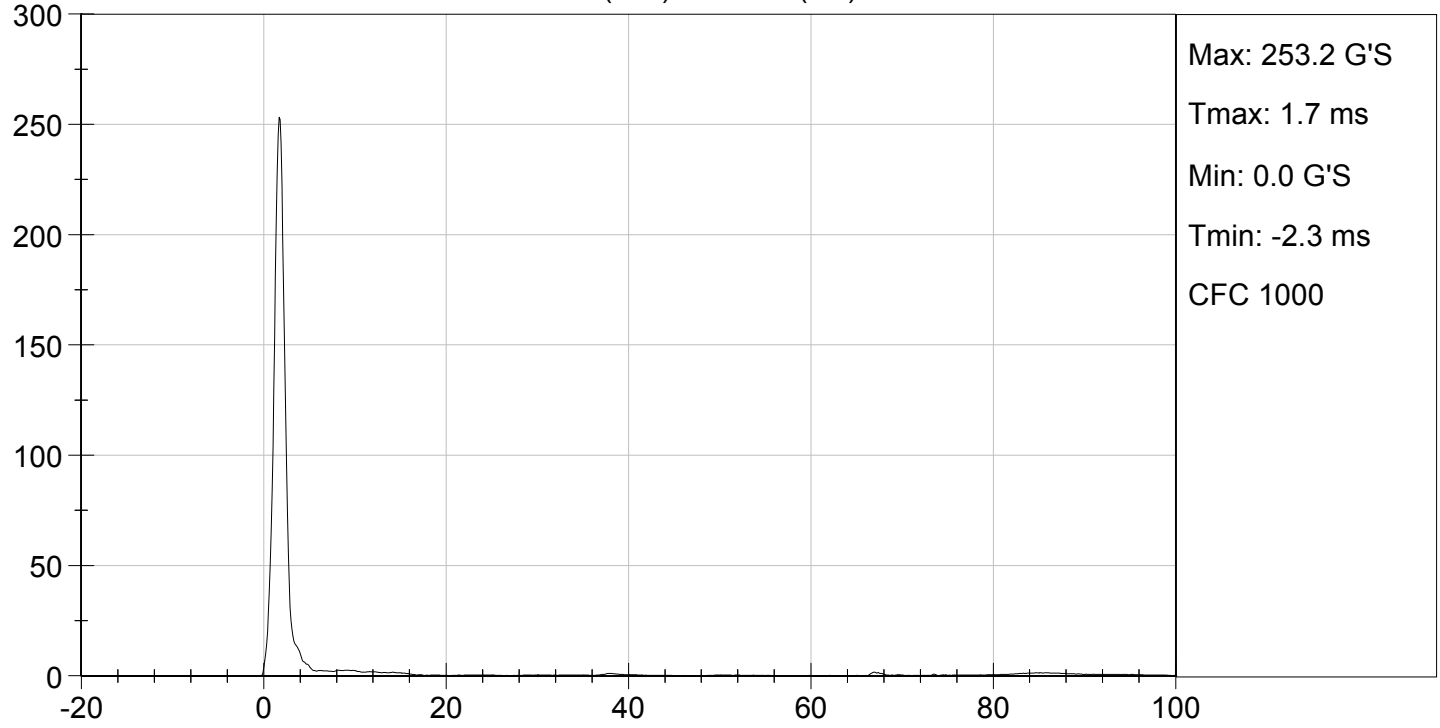
Jeff Leonardelli

Approved By

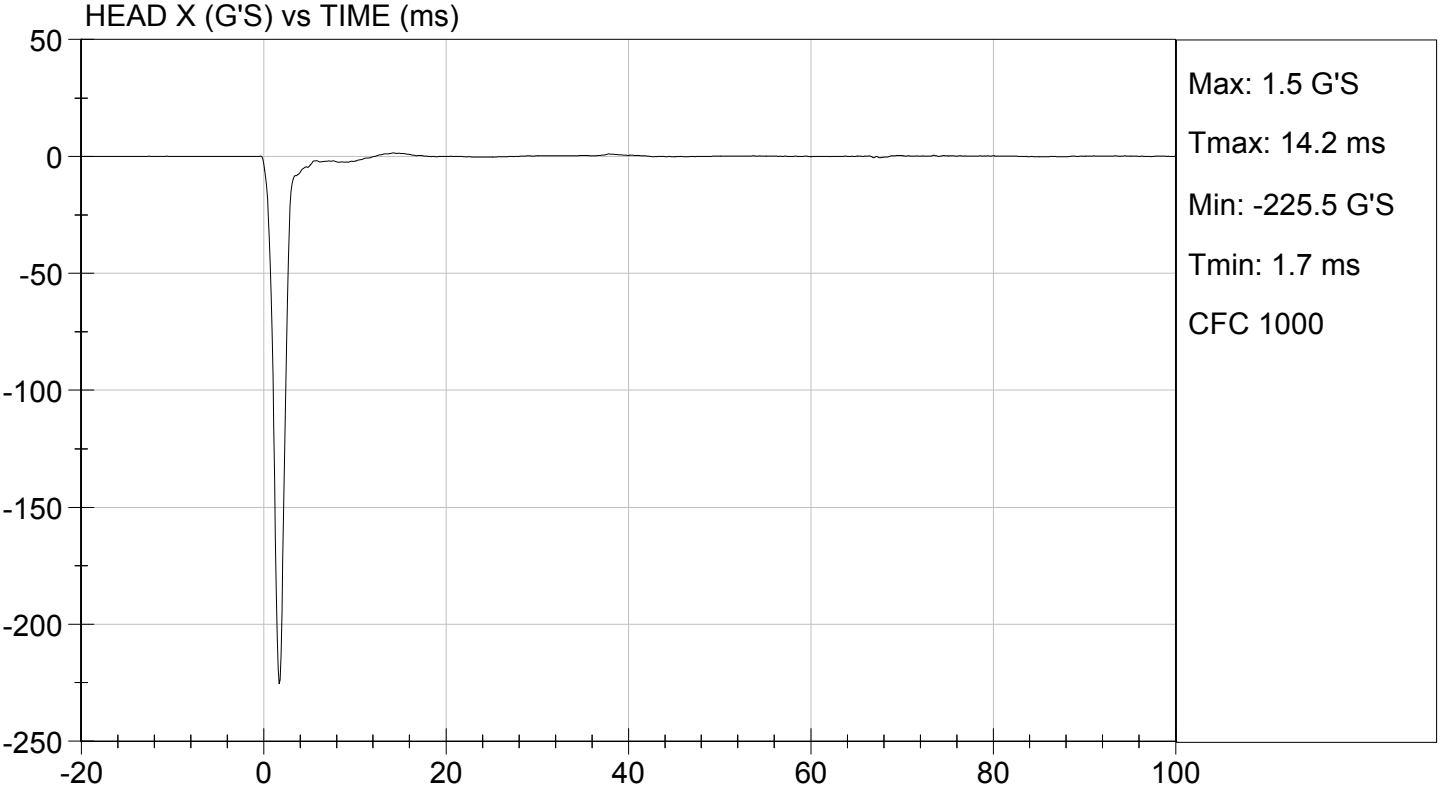
TEST DESC: HEAD DROP

TEST DATE: 02/02/2016
TEST #: D16431

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



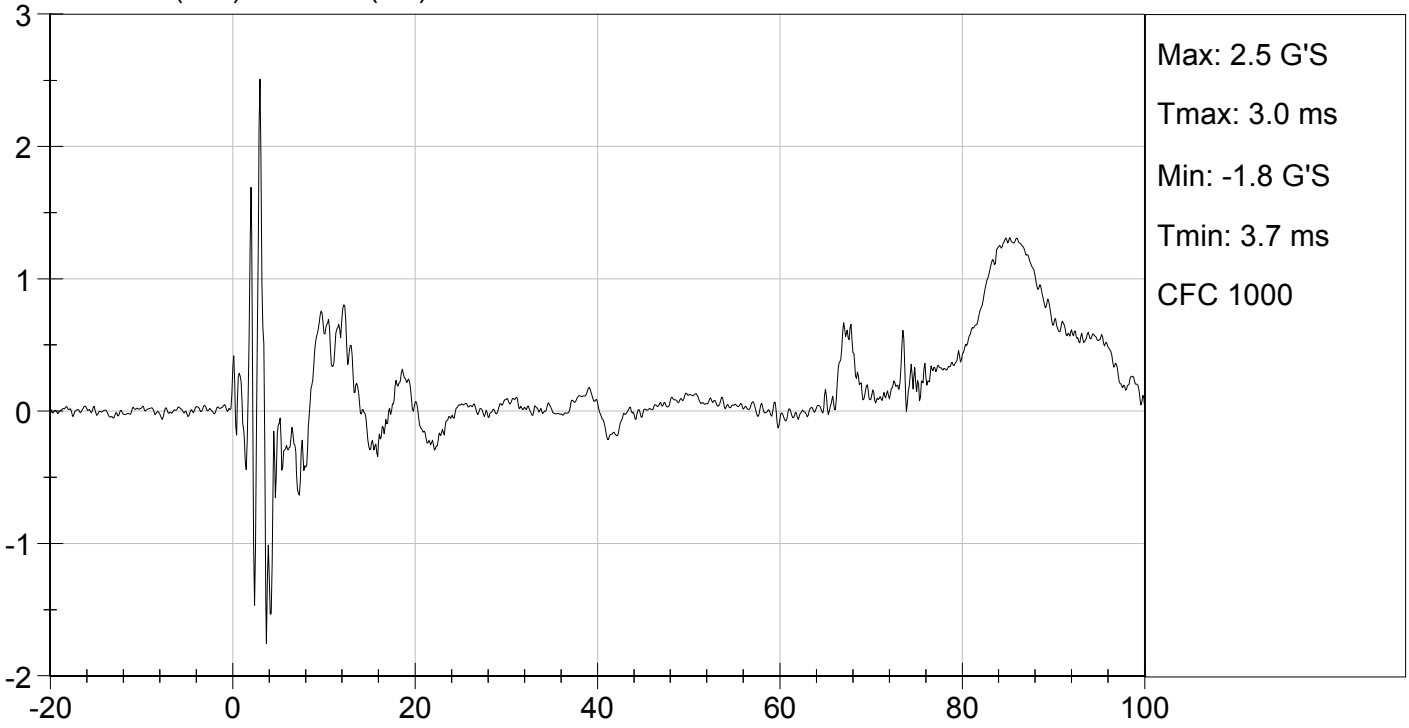

HEAD X (G'S) vs TIME (ms)



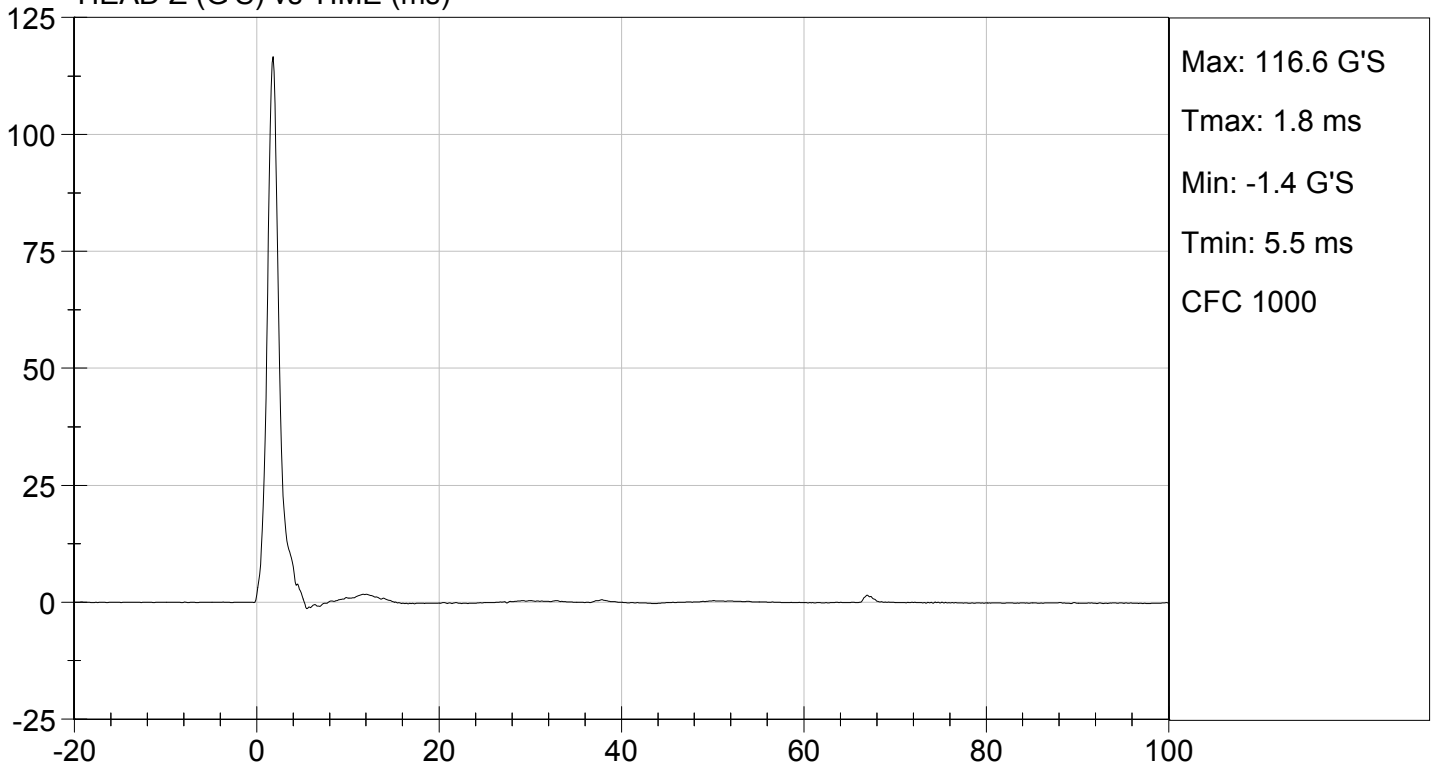
TEST DESC: HEAD DROP

TEST DATE: 02/02/2016
TEST #: D16431

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




HEAD Z (G'S) vs TIME (ms)



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 ± 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 | Results |
|---|---|---|---|
| Pendulum impact speed | | 22.6 ft/s ≤ speed ≤ 23.4 ft/s | 23.15 ft/s |
| Pendulum Deceleration Versus Time Pulse | @ 10 ms | 22.5 ≤ g ≤ 27.5 | 22.68 g's |
| | @ 20 ms | 17.6 ≤ g ≤ 22.6 | 19.48 g's |
| | @ 30 ms | 12.5 ≤ g ≤ 18.5 | 13.64 g's |
| | Above 30 ms | 29 g maximum | 13.5 g's |
| First Pendulum Decay to 5g | | 34 ms ≤ time ≤ 42 ms | 40.8 ms |
| Plane D Rotation | | 64° ≤ max. rotation ≤ 78° | 67.8° |
| | | 57 ms ≤ time of max. rotation ≤ 64 ms | 58.3 ms |
| Time for Plane D Rotation to Cross 0° During First Rebound | | 113 ms ≤ time ≤ 128 ms | 114.3 ms |
| Maximum Moment | | 65 lbf-ft ≤ moment ≤ 80 lbf-ft | 65.9 lbf-ft |
| | | 47 ms ≤ time of max. moment ≤ 58 ms | 52.8 ms |
| Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion) | | 97 ms ≤ time ≤ 107 ms | 98.2 ms |

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(1)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = 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. (572.33(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.

David Schoedel
Signature

02/02/2016
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16432

| 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 | 28 | Pass |
| Pendulum Velocity | | m/s | 6.89 to 7.13 | 7.06 | Pass |
| Pendulum Deceleration | 10 ms | G's | 22.50 to 27.50 | 22.68 | Pass |
| | 20 ms | G's | 17.60 to 22.60 | 19.48 | Pass |
| | 30 ms | G's | 12.50 to 18.50 | 13.64 | Pass |
| Peak Pendulum Deceleration After 30 ms | | G's | <= 29.0 | 13.5 | Pass |
| Deceleration Decay Time to Cross 5 G's | | ms | 34.0 to 42.0 | 40.8 | Pass |
| Maximum "D" Plane Rotation | Maximum | Deg | 64.0 to 78.0 | 67.8 | Pass |
| | Time | ms | 57.0 to 64.0 | 58.3 | Pass |
| "D" Plane Rotation Decay Time To Zero Crossing | | ms | 113.0 to 128.0 | 114.3 | Pass |
| Moment About Occipital Condyle | Maximum | Nm | 88.1 to 108.5 | 89.3 | Pass |
| | Time | ms | 47.0 to 58.0 | 52.8 | Pass |
| Positive Moment Decay Time To Zero Crossing | | ms | 97.0 to 107.0 | 98.2 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

02/02/2016

Test Date

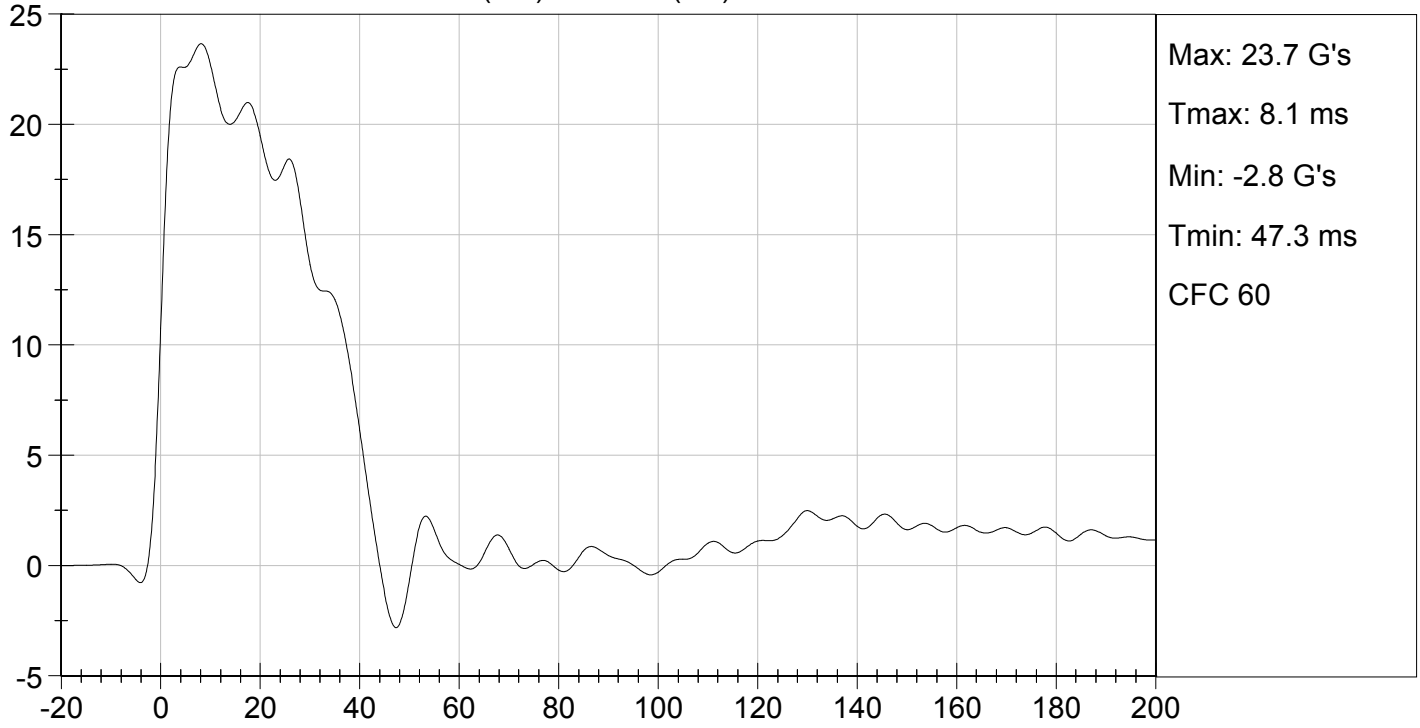
Jeff Leonardi

Approved By

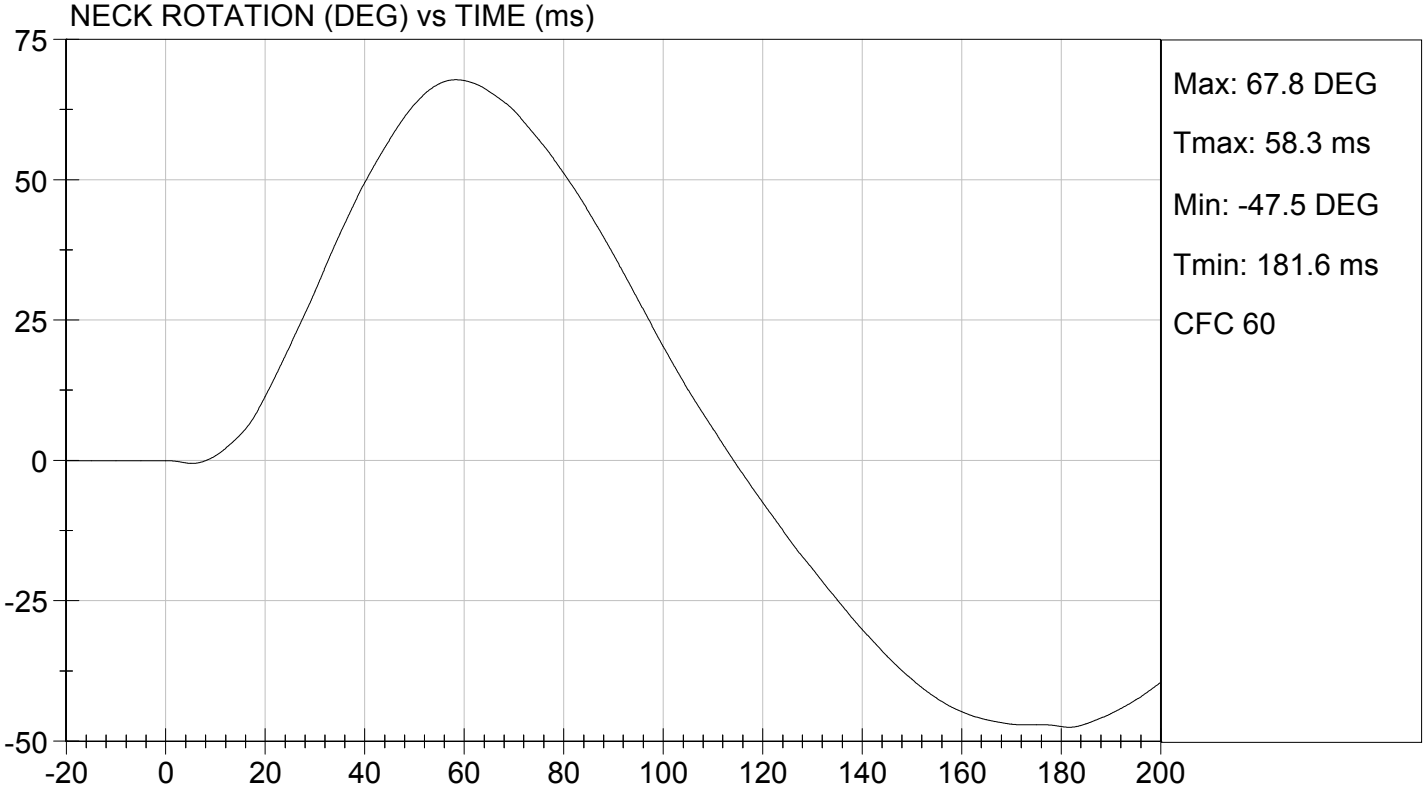
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 02/02/2016
TEST #: D16432

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



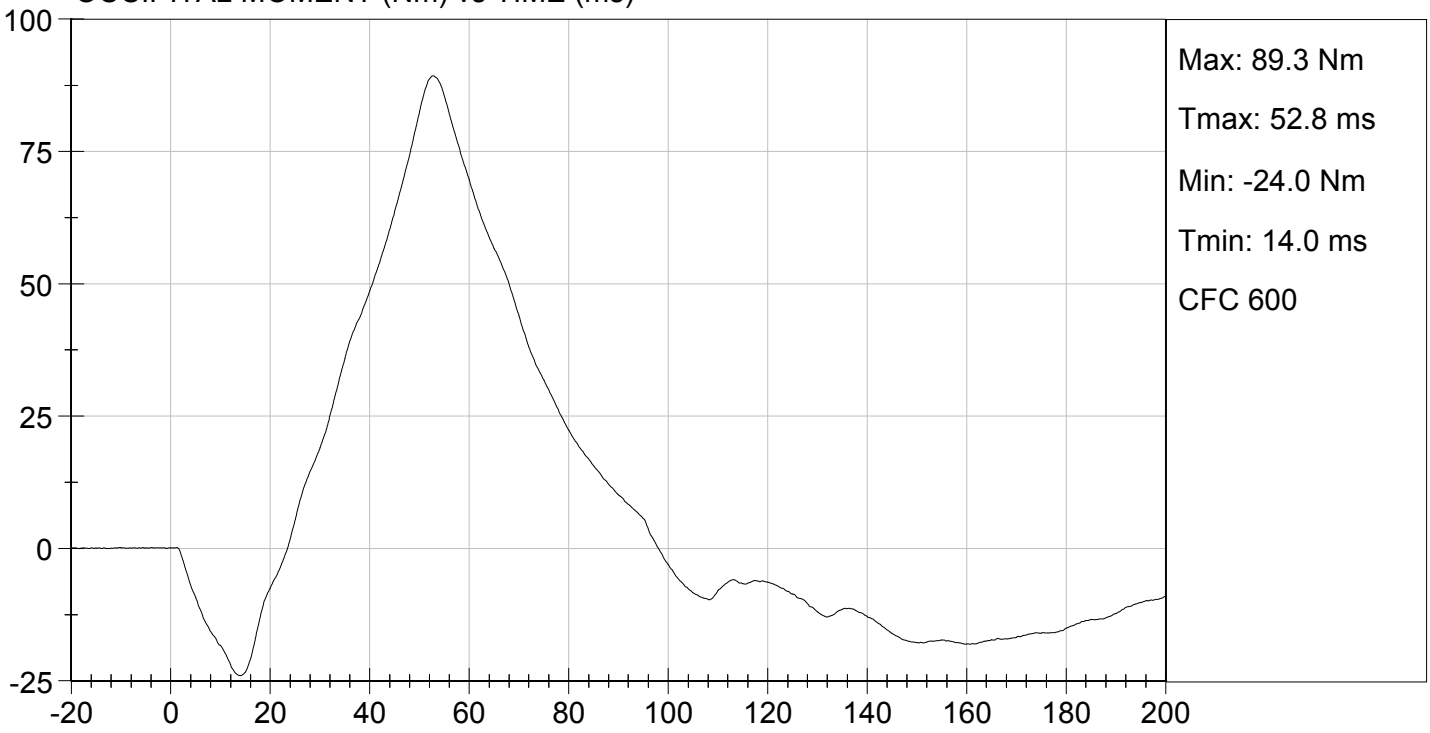

NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 02/02/2016
TEST #: D16432

OCCIPITAL MOMENT (Nm) vs TIME (ms)



**DATA SHEET A5**

NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 401 Test Date: 02/02/2016

Technician: David Schoedel

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one neck test performed

_X_ 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))

_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°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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. (78051-90).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

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

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 ± 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/sec 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 | Results |
|---|---|---|---|
| Pendulum impact speed | | 19.5 ft/s ≤ speed ≤ 20.3 ft/s | 20.08 ft/s |
| Pendulum Deceleration Versus Time Pulse | @ 10 ms | 17.2 ≤ g ≤ 21.2 | 18.81 g's |
| | @ 20 ms | 14 ≤ g ≤ 19 | 16.35 g's |
| | @ 30 ms | 11.0 ≤ g ≤ 16.0 | 13.21 g's |
| | Above 30 ms | 22 g maximum | 13.2 g's |
| First Pendulum Decay to 5g | | 38 ms ≤ time ≤ 46 ms | 40.8 ms |
| Plane D Rotation | | 81° ≤ max. rotation ≤ 106° | 95.8° |
| | | 72 ms ≤ time of max. rotation ≤ 82 ms | 76.9 ms |
| Time for Plane D Rotation to Cross 0° During First Rebound | | 147 ms ≤ time ≤ 174 ms | 157.3 ms |
| Maximum Moment | | -59 lbf-ft ≤ moment ≤ -39 lbf-ft | -42.2 lbf-ft |
| | | 65 ms ≤ time of max. moment ≤ 79 ms | 71.5 ms |
| Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension) | | 120 ms ≤ time ≤ 148 ms | 141.8 ms |

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(2)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = 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. (572.33(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.

David Schoedel
Signature

02/02/2016
Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16433

| 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 | 28 | Pass |
| Pendulum Velocity | | m/s | 5.95 to 6.19 | 6.12 | Pass |
| Pendulum Deceleration | 10 ms | G's | 17.20 to 21.20 | 18.81 | Pass |
| | 20 ms | G's | 14.00 to 19.00 | 16.35 | Pass |
| | 30 ms | G's | 11.00 to 16.00 | 13.21 | Pass |
| Peak Pendulum Deceleration After 30 ms | | G's | <= 22.0 | 13.2 | Pass |
| Deceleration Decay Time to Cross 5 G's | | ms | 38.0 to 46.0 | 40.8 | Pass |
| Maximum "D" Plane Rotation | Maximum | Degrees | 81.0 to 106.0 | 95.8 | Pass |
| | Time | ms | 72.0 to 82.0 | 76.9 | Pass |
| "D" Plane Rotation Decay Time To Zero Crossing | | ms | 147.0 to 174.0 | 157.3 | Pass |
| Moment About Occipital Condyle | Maximum | Nm | -52.9 to -79.9 | -57.2 | Pass |
| | Time | ms | 65.0 to 79.0 | 71.5 | Pass |
| Negative Moment Decay Time To Zero Crossing | | ms | 120.0 to 148.0 | 141.8 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

02/02/2016

Test Date

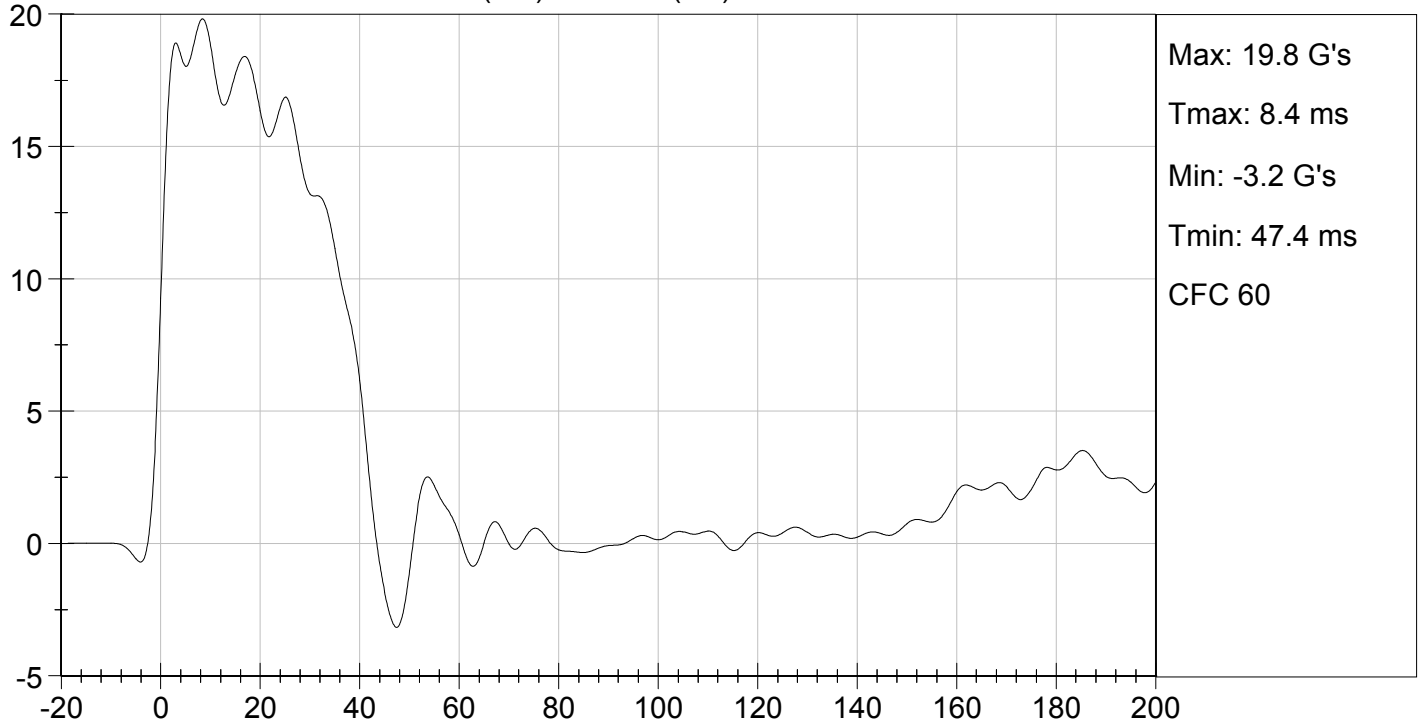
Jeff Leonardson

Approved By

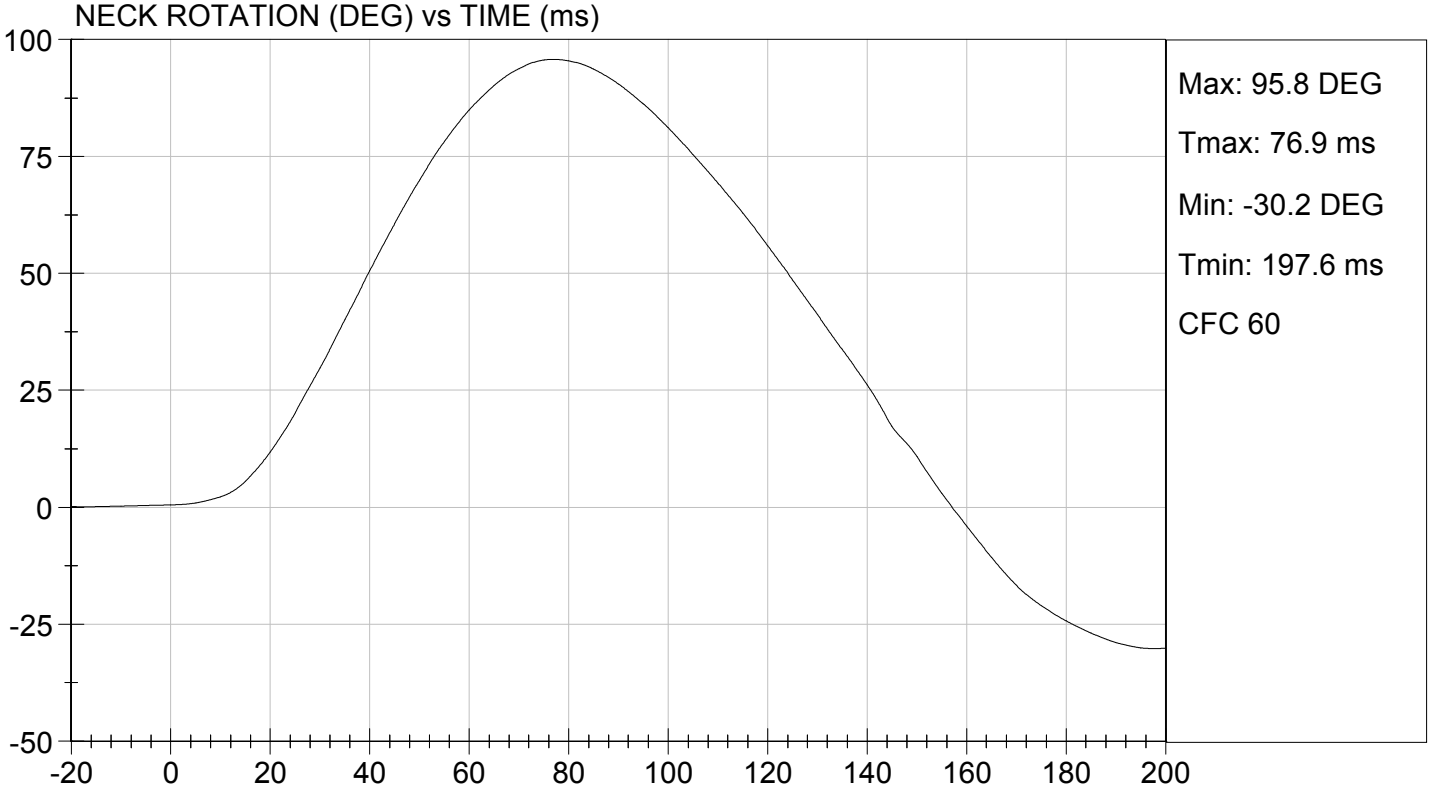
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 02/02/2016
TEST #: D16433

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

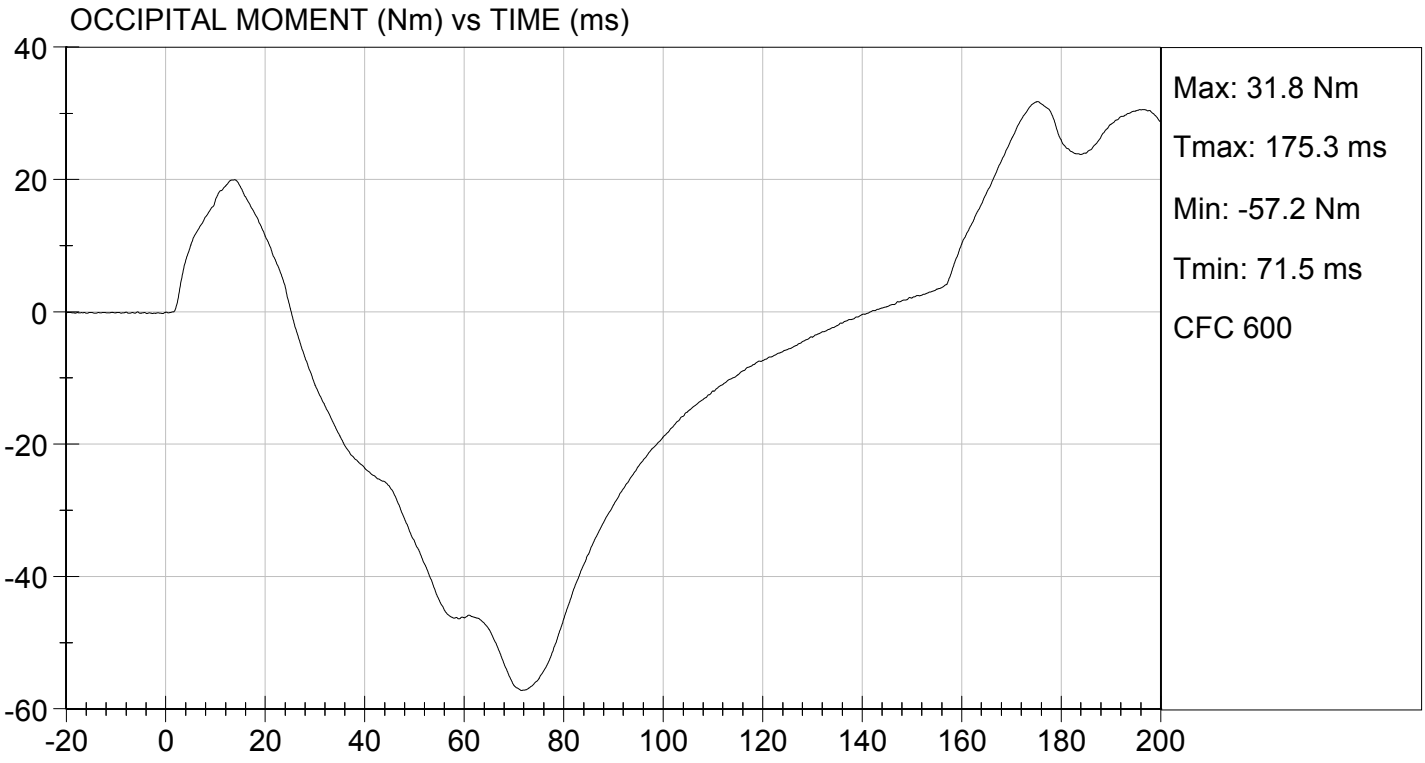



NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 02/02/2016
TEST #: D16433



**DATA SHEET A6**

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 401 Test Date: 02/02/2016

Technician: Andy Warczytowa

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 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 12A.

_X_ 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))

_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. (572.34(c)(1))

| | |
|---|---|
| Record the maximum temperature: | 21.2°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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 (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.

_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 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 ± 0.5° and adjust the pelvis angle to 13° ± 2°. 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 ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° 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 ± 2° 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° 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 f/s ± 0.4 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))

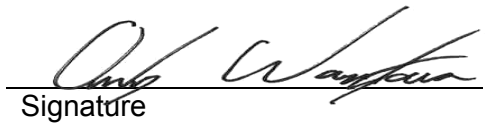
| Parameter* | Specification | Result |
|---|---|---|
| Test Probe Speed | 21.6 ft/s ≤ speed ≤ 22.4 ft/s | 21.65 ft/s |
| Chest Compression | 2.5 in. ≤ compression ≤ 2.86 in. | 2.72in. |
| Peak resistance force** | 1160 lb ≤ peak force ≤ 1325 lb | 1315 lb |
| Internal Hysteresis*** | 69% ≤ hysteresis ≤ 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

02/02/2016

Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16434

| 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 | 28 | Pass |
| Probe Velocity | m/s | 6.58 to 6.82 | 6.60 | Pass |
| Peak Probe Force | N | 5159 to 5893 | 5,849 | Pass |
| Peak Sternum Displacement | cm | 6.35 to 7.26 | 6.90 | Pass |
| Internal Hysteresis | % | 69 to 85 | 71 | Pass |
| | | Overall Test Results | | Pass |

Laboratory Technician

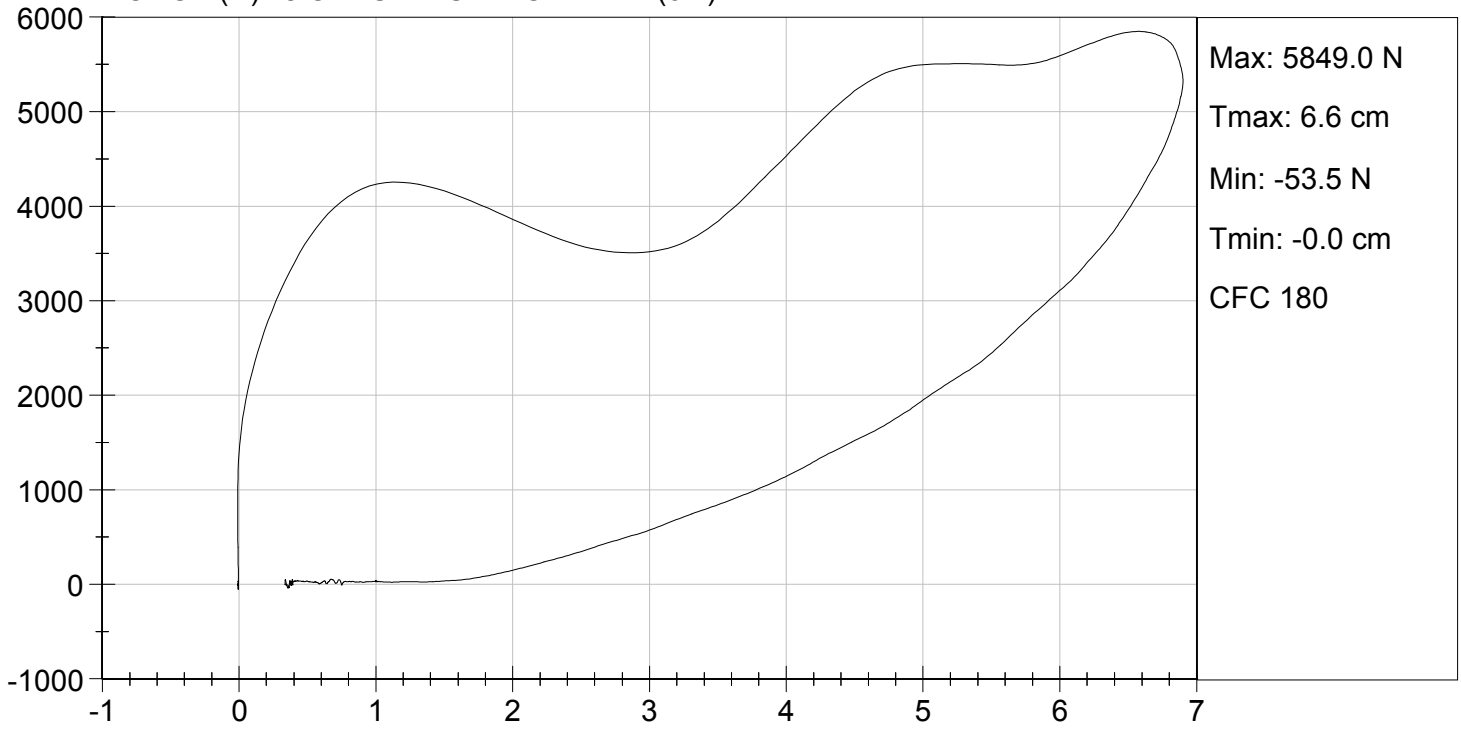
02/02/2016
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 02/02/2016
TEST #: D16434

FORCE (N) vs CHEST DISPLACEMENT (cm)



**DATA SHEET A7**
LEFT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 401 Test Date: 02/02/2016

Technician: Thomas Miller

____ Pre test calibration
_X_ Post test calibration verification

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

_X_ 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°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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))

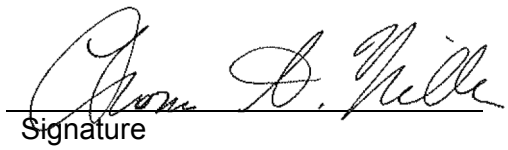
X 11. Complete the following table:

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

| Parameter | Specification | Result |
|---|---|---|
| Probe speed | 6.8 ft/s ≤ speed ≤ 7.0 ft/s | 6.89 ft/s |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb | 1215 lb |

*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

02/02/2016

Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16436

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 26 | Pass |
| Probe Velocity | m/s | 2.07 to 2.13 | 2.10 | Pass |
| Peak Probe Force | N | 4715 to 5782 | 5,402 | Pass |
| | | Overall Test Results | | Pass |

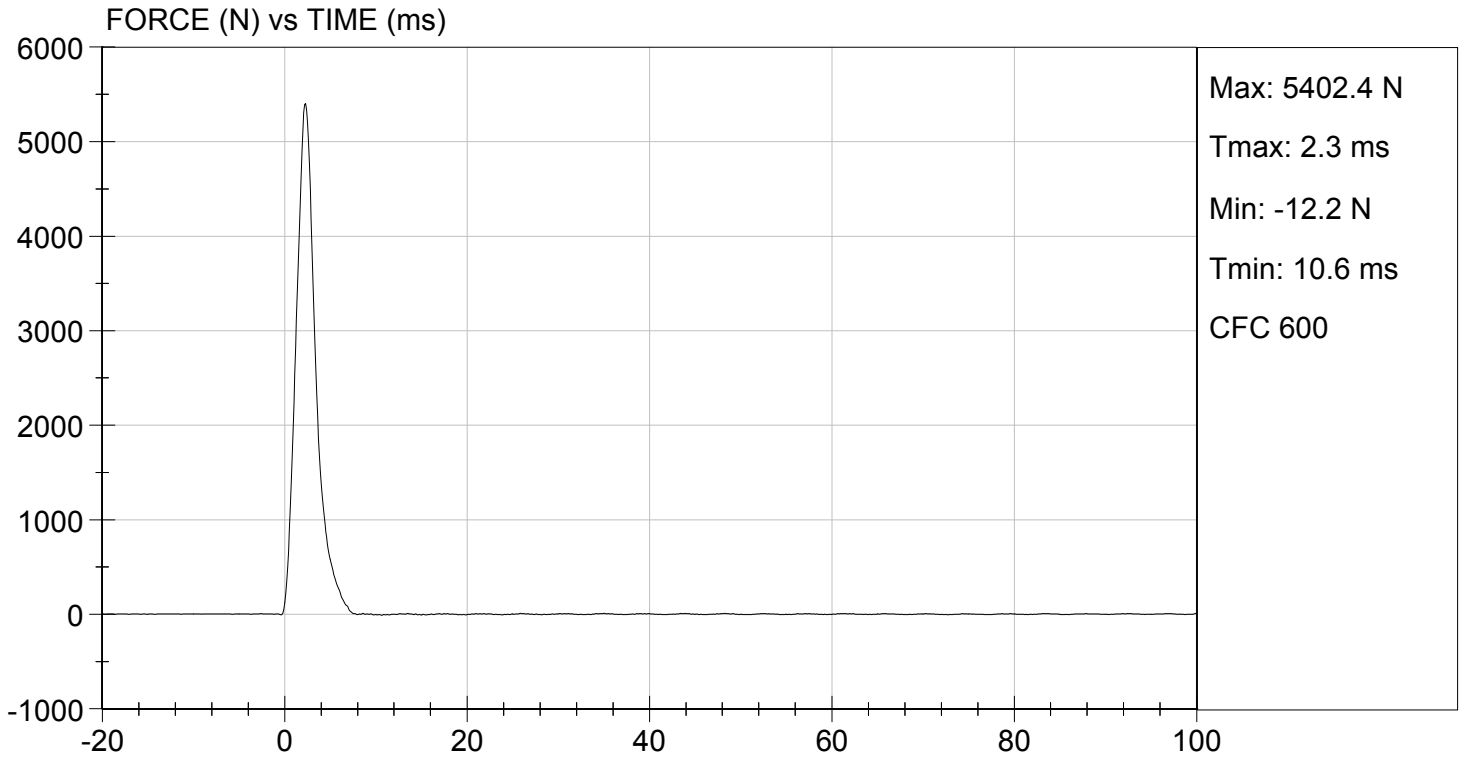
Laboratory Technician

02/02/2016
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 02/02/2016
TEST #: D16436



**DATA SHEET A8**

RIGHT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 401 Test Date: 02/02/2016

Technician: Thomas Miller

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 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 (86-5001-002) with the upper leg assembly (78051-47) 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°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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))

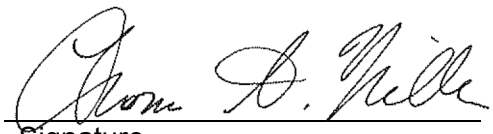
X 11. Complete the following table:

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

| Parameter | Specification | Result |
|---|---|---|
| Probe speed | 6.8 ft/s ≤ speed ≤ 7.0 ft/s | 6.80 ft/s |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb | 1103 lb |

*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

02/02/2016

Date

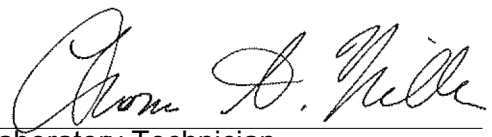
**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16435

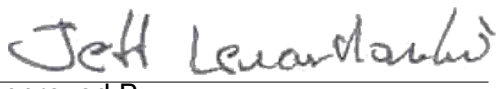
| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 26 | Pass |
| Probe Velocity | m/s | 2.07 to 2.13 | 2.07 | Pass |
| Peak Probe Force | N | 4715 to 5782 | 4,909 | Pass |
| | | Overall Test Results | | Pass |



Laboratory Technician

02/02/2016

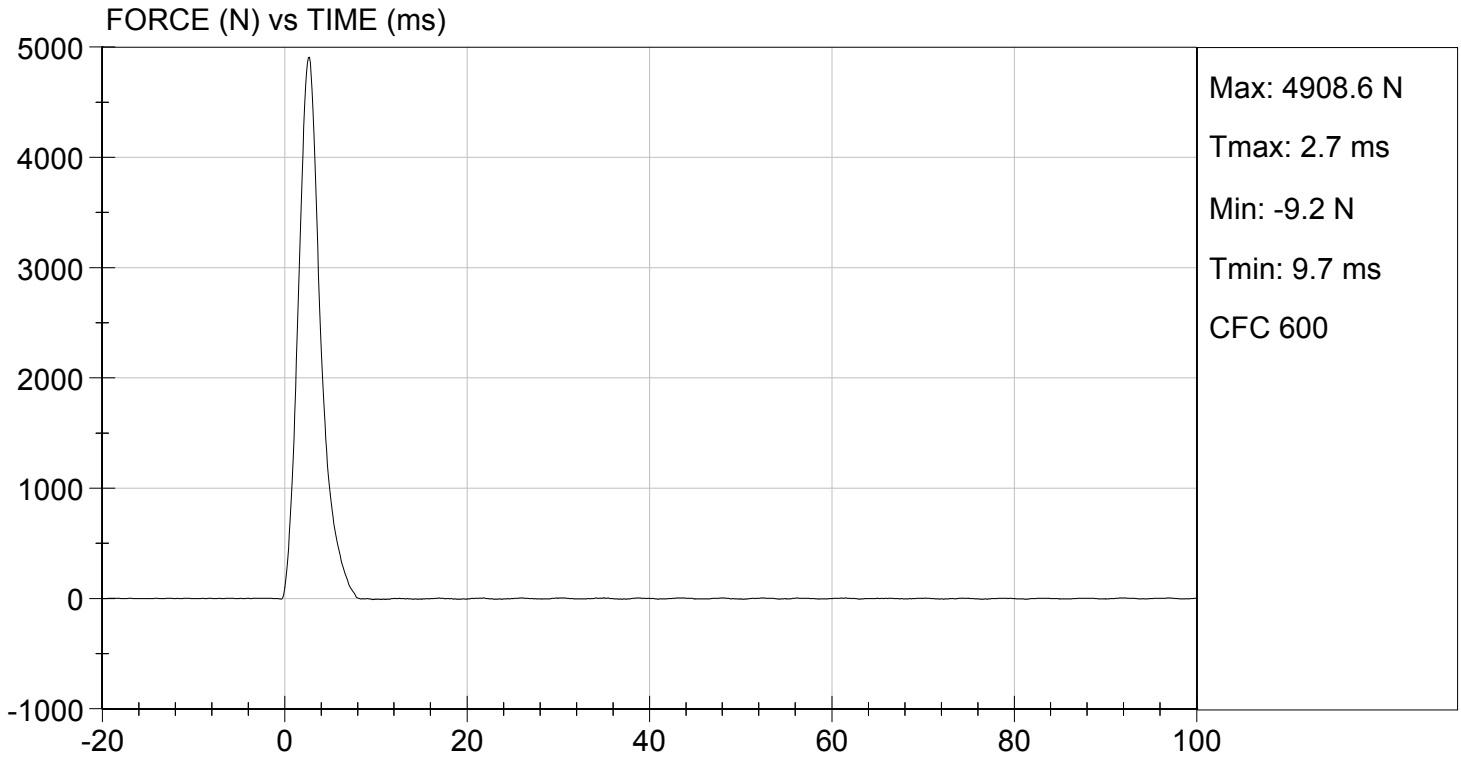
Test Date



Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.80 ft/s, 2.07 m/s

TEST DATE: 02/02/2016
TEST #: D16435



**DATA SHEET A9**

HIP JOINT-FEMUR FLEXION (572.35(c)) (50th Male)

Dummy Serial Number: 401 Test Date: 02/02/2016

Technician: Andy Warczytowa

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 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: | 21.2°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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°/s ≤ rotation rate ≤ 10°/s | 6.4°/s |
| Femur Torque at 30° | Torque ≤ 70 ft-lbf | 58.1 ft-lbf |
| Rotation at 150 lbf-ft | 40° ≤ rotation ≤ 50° | 41.8° |

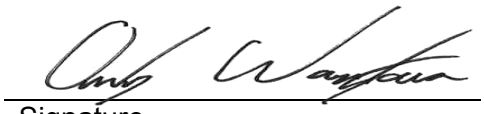
X 11. Secure the lever arm into the right femur shaft opening of the upper leg structure assembly (78051-44) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

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 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 13. Complete the following table:

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

| Parameter | Specification | Result |
|---|---|---|
| Rotation Rate | 5°/s ≤ rotation rate ≤ 10°/s | 6.3°/s |
| Femur Torque at 30° | torque ≤ 70 ft-lbf | 64.8 ft-lbf |
| Rotation at 150 lbf-ft | 40° ≤ rotation ≤ 50° | 46.6° |



Signature

02/02/2016

Date

**MGA RESEARCH CORPORATION**

**HIP-FEMUR FLEXION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 401 **Test I.D:** D16430

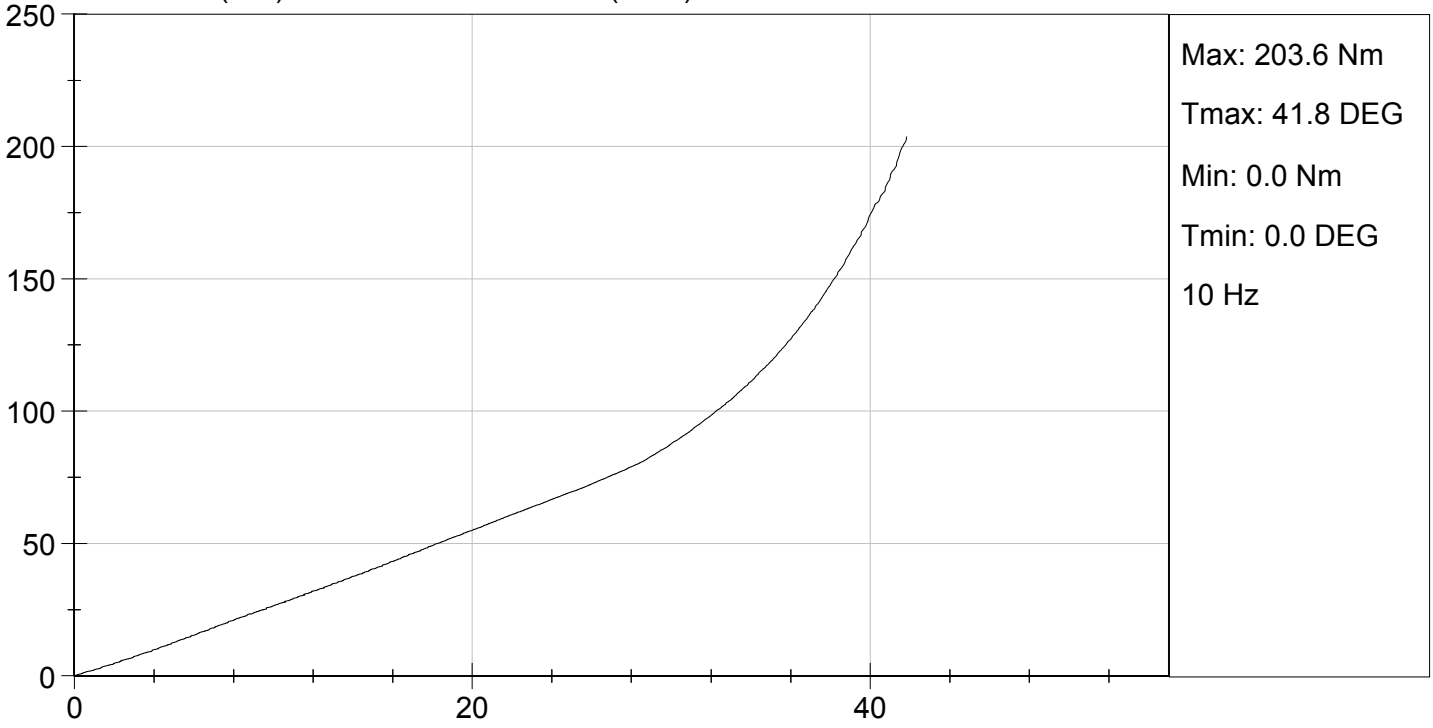
| Tested Parameter | Units | Specification | Result | | Pass/Fail |
|---|---|---|---|---|---|
| | | | Right | Left | |
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.0 | 21.0 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 28 | 28 | Pass |
| Rotation Rate | deg/s | 5.0 to 10.0 | 6.3 | 6.4 | Pass |
| 30 Degrees | Nm | 94.9 Nm Max | 87.8 | 78.8 | Pass |
| 150 ft-lbf / 203.4 Nm | Deg | 40.0 to 50.0 Degree Max Rotation | 41.8 | 46.6 | Pass |
| | | Overall Test Results | | | Pass |

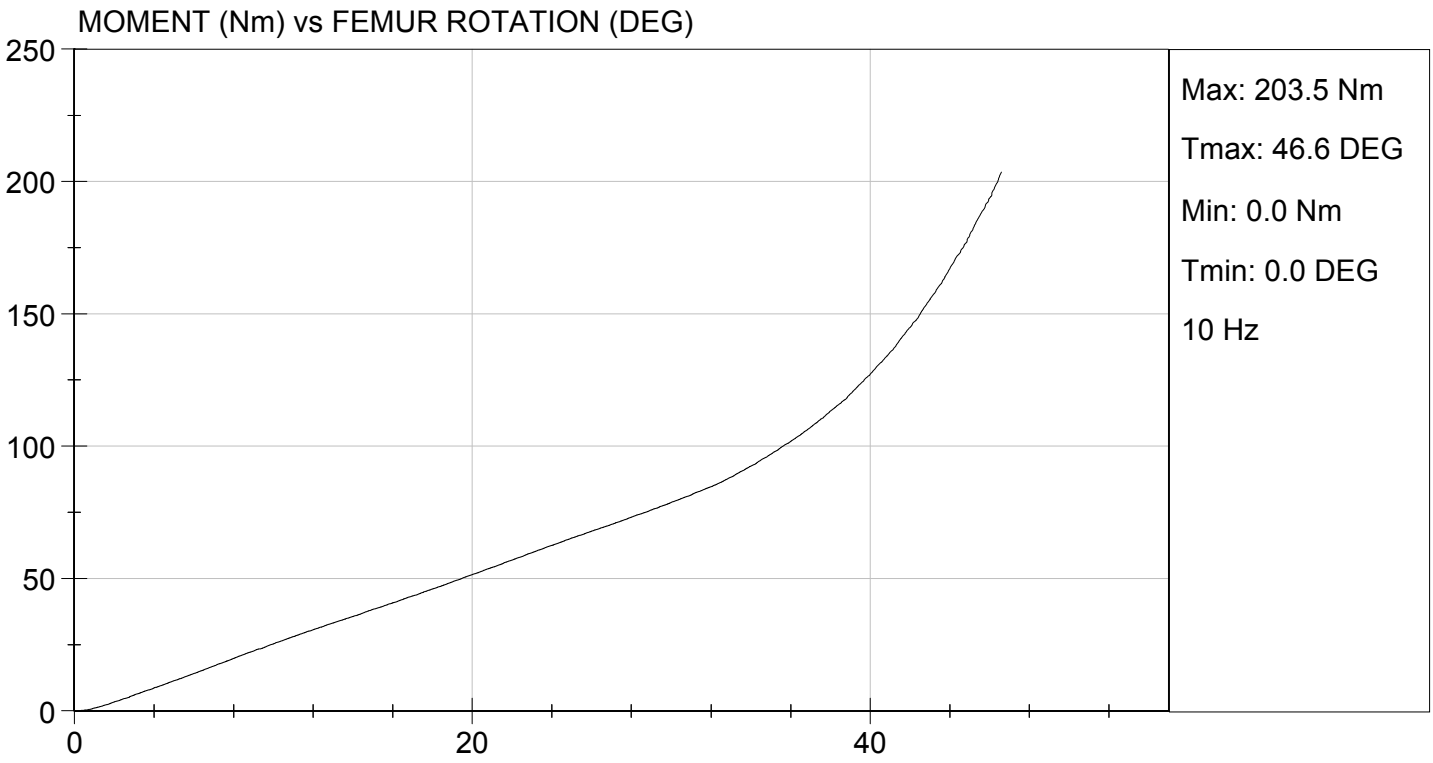
Laboratory Technician

02/02/2016
Test Date

Approved By

MOMENT (Nm) vs FEMUR ROTATION (DEG)




MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.5 Nm
Tmax: 46.6 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz

## DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO. | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---|---|---|---|---|---|
| DUMMY INSTRUMENTATION | | | | | |
| HEAD ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7231C-750 | AH5D9 | 09/11/2015 | 03/11/2016 |
| (2) LATERAL | Endevco | 7231C-750 | AH5L1 | 09/11/2015 | 03/11/2016 |
| (3) VERTICAL | Endevco | 7231C-750 | AH5N9 | 09/11/2015 | 03/11/2016 |
| NECK TRANSDUCER | Denton | 1716 | 1159 | 10/23/2015 | 04/23/2016 |
| CHEST ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7231C-750 | AGH79 | 09/11/2015 | 03/11/2016 |
| (2) LATERAL | Endevco | 7231C-750 | AGH55 | 09/11/2015 | 03/11/2016 |
| (3) VERTICAL | Endevco | 7231C-750 | C12863 | 09/11/2015 | 03/11/2016 |
| CHEST POTENTIOMETER | Servo | 14CBI-2897 | 401 | 09/10/2015 | 03/10/2016 |
| FEMUR LOAD CELLS | | | | | |
| (1) RIGHT FEMUR | Denton | 2121 | 8806 | 09/10/2015 | 03/10/2016 |
| (2) LEFT FEMUR | Denton | 2121 | 8807 | 09/10/2015 | 03/10/2016 |
| LABORATORY INSTRUMENTATION | | | | | |
| NECK PENDULUM ACCELEROMTER | Endevco | 7231C-750 | AH5P1 | 01/25/2016 | 07/25/2016 |
| THORAX PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P82097 | 11/30/2015 | 05/30/2016 |
| KNEE PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P88169 | 11/30/2015 | 05/30/2016 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol | 132-0-0-102 | 18 | 01/22/2016 | 07/22/2016 |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol | 132-0-0-102 | 29 | 09/28/2015 | 03/28/2016 |

LABORATORY TECHNICIAN: Jessica Hall

**DATA SHEET B1**
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 401 Test Date: 02/02/2016

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 | Damage | 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 |
| 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:

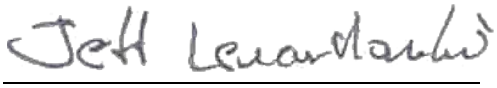
Signature

02/02/2016

Date

Describe the repair or replacement of parts:

Checked by:



Signature

02/02/2016

Date

| HYBRID III 50th 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 50th SN #403, PART 572, SUBPART E EXTERNAL 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 heal | 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) (50th Male)

Dummy Serial Number: 403 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 2 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(i))

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. (572.132(c)(1))

| | |
|---|---|
| Record the maximum temperature: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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, 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: 0.5 inches

**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: 501 mm

Record the left side distance: 501 mm

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: 50.9 micro inches

X 12. The impact surface is rigidly supported. (572.132(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: 50.9 mm

Record width: 604 mm

Record length: 595 mm

X 14. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 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 g ≤ x ≤ 275 g | 264 g |
| 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 ≤ 15 g | -9.8 g |

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

David Schoedel
Signature

01/25/2016
Date

**MGA RESEARCH CORPORATION**

**HEAD DROP TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test ID:** D16321

| 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 | 20 | Pass |
| Peak Resultant Acceleration | G's | 225 to 275 | 264 | Pass |
| Peak Lateral Acceleration | G's | <= +/- 15.0 | -9.8 | Pass |
| Unimodal | N/A | Yes | Yes | Pass |
| Oscillations | N/A | within 10% of peak | Yes | Pass |
| | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

01/25/2016

Test Date

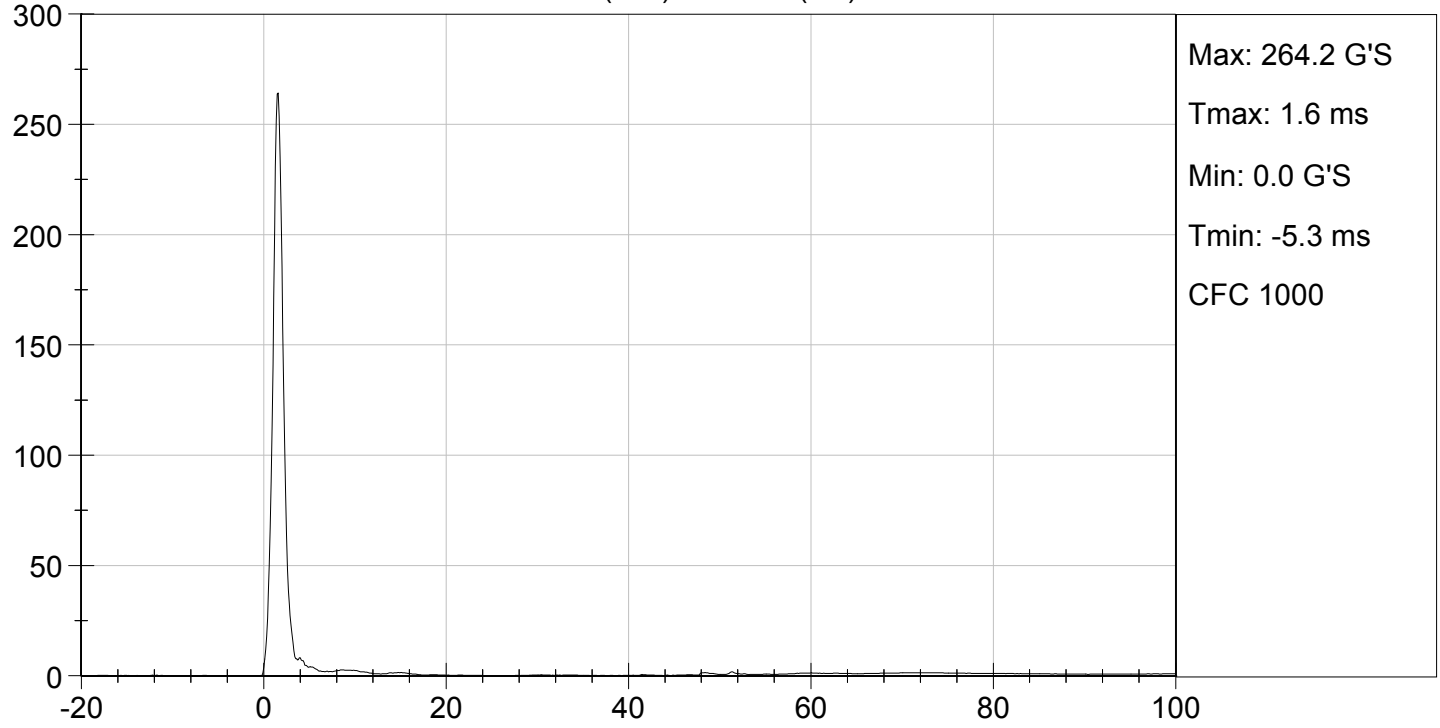
Jeff Leonardelli

Approved By

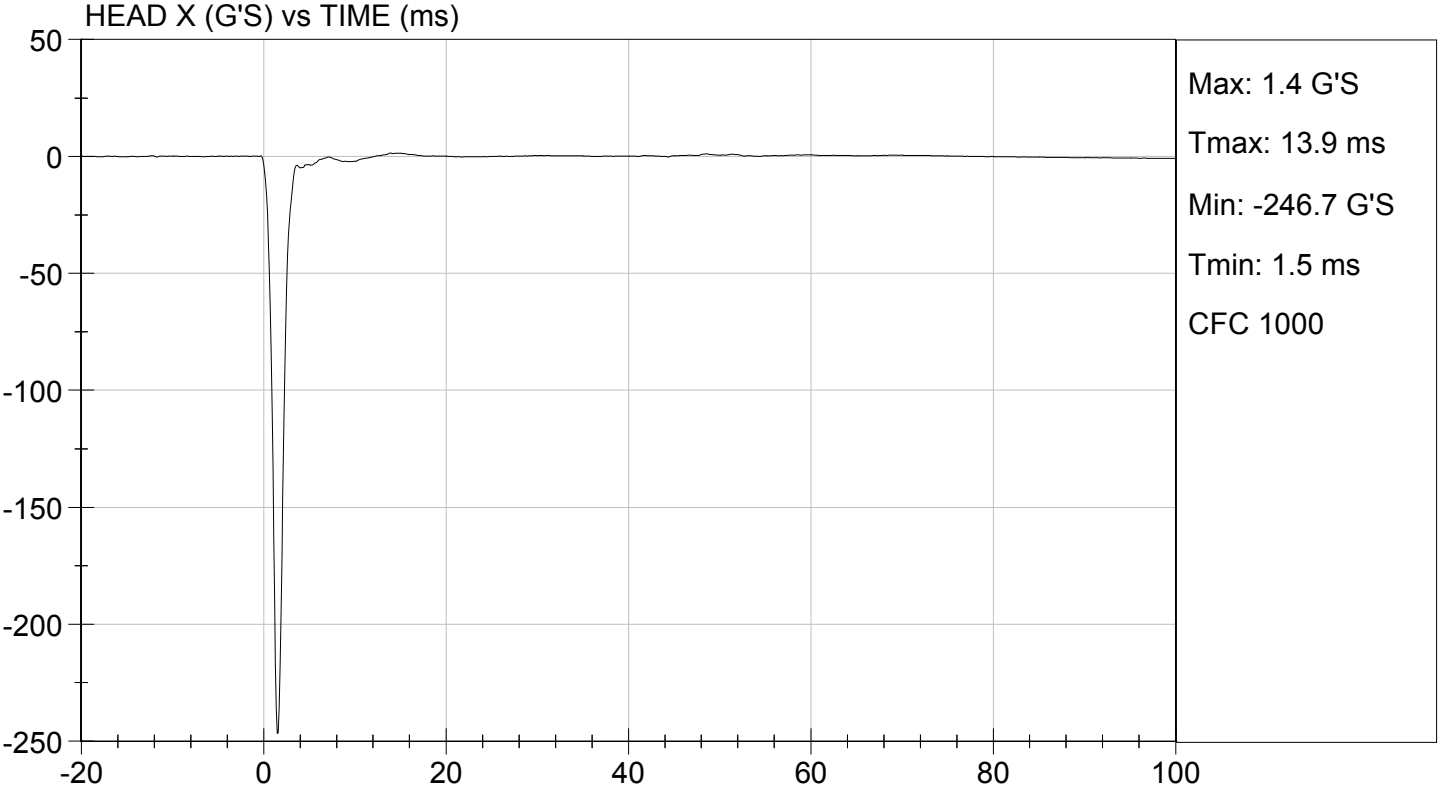
TEST DESC: HEAD DROP

TEST DATE: 01/25/2016
TEST #: D16321

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



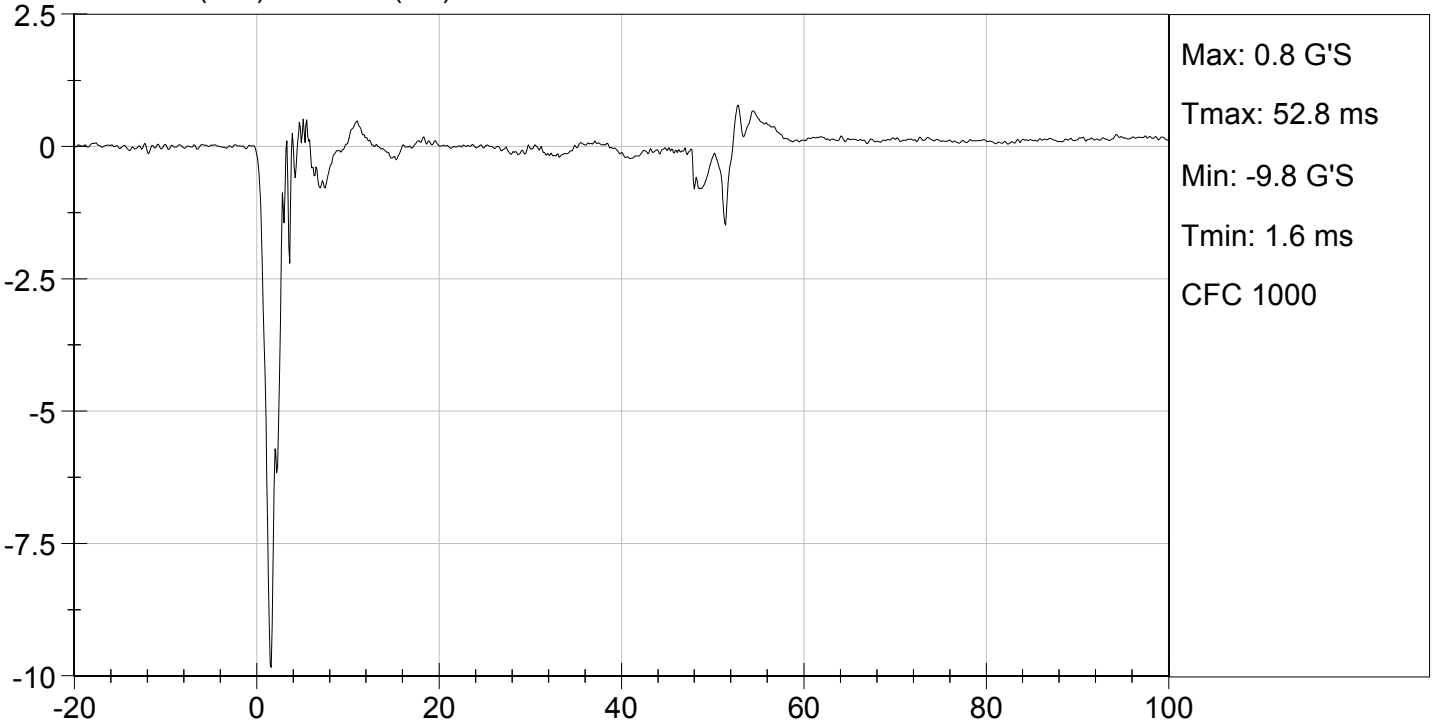

HEAD X (G'S) vs TIME (ms)



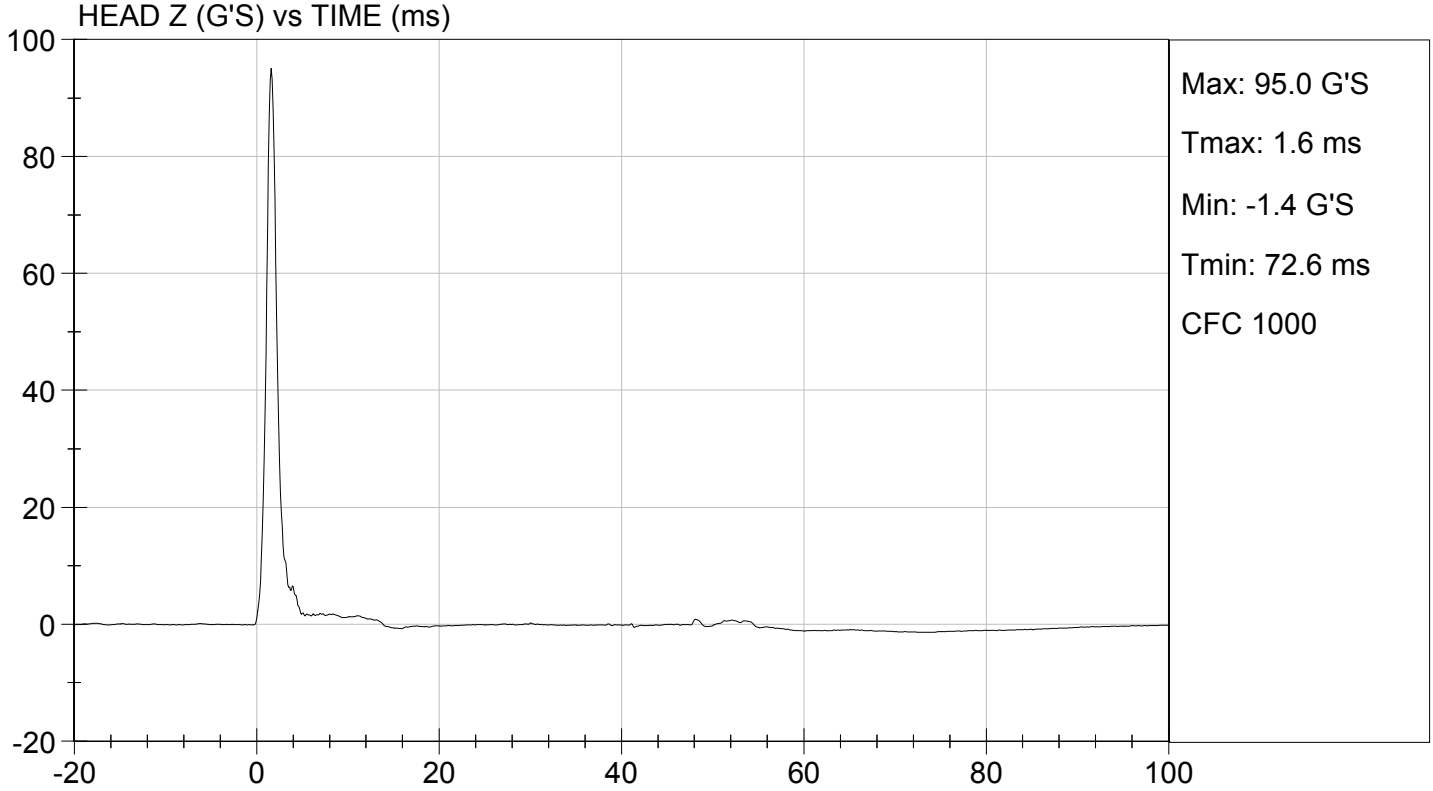
TEST DESC: HEAD DROP

TEST DATE: 01/25/2016
TEST #: D16321

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




HEAD Z (G'S) vs TIME (ms)



**DATA SHEET A4**

NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

X 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))

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: 20.9°C

Record the minimum temperature: 20.7°C

Record the maximum humidity: 22%

Record the minimum humidity: 20%

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. (78051-90).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

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

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 ± 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 | Results |
|---|---|---|---|
| Pendulum impact speed | | 22.6 ft/s ≤ speed ≤ 23.4 ft/s | 23.15 ft/s |
| Pendulum Deceleration Versus Time Pulse | @ 10 ms | 22.5 ≤ g ≤ 27.5 | 25.00 g's |
| | @ 20 ms | 17.6 ≤ g ≤ 22.6 | 21.51 g's |
| | @ 30 ms | 12.5 ≤ g ≤ 18.5 | 13.36 g's |
| | Above 30 ms | 29 g maximum | 13.9 g's |
| First Pendulum Decay to 5g | | 34 ms ≤ time ≤ 42 ms | 37.6 ms |
| Plane D Rotation | | 64° ≤ max. rotation ≤ 78° | 68.5° |
| | | 57 ms ≤ time of max. rotation ≤ 64 ms | 60.8 ms |
| Time for Plane D Rotation to Cross 0° During First Rebound | | 113 ms ≤ time ≤ 128 ms | 113.8 ms |
| Maximum Moment | | 65 lbf-ft ≤ moment ≤ 80 lbf-ft | 66.8 lbf-ft |
| | | 47 ms ≤ time of max. moment ≤ 58 ms | 50.4 ms |
| Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion) | | 97 ms ≤ time ≤ 107 ms | 100.5 ms |

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(1)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = 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. (572.33(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.

David Schoedel

Signature

01/25/2016

Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16322

| Tested Parameter | | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | | deg C | 20.6 to 22.2 | 20.9 | Pass |
| Laboratory Relative Humidity | | % | 10 to 70 | 20 | Pass |
| Pendulum Velocity | | m/s | 6.89 to 7.13 | 7.06 | Pass |
| Pendulum Deceleration | 10 ms | G's | 22.50 to 27.50 | 25.00 | Pass |
| | 20 ms | G's | 17.60 to 22.60 | 21.51 | Pass |
| | 30 ms | G's | 12.50 to 18.50 | 13.36 | Pass |
| Peak Pendulum Deceleration After 30 ms | | G's | <= 29.0 | 13.9 | Pass |
| Deceleration Decay Time to Cross 5 G's | | ms | 34.0 to 42.0 | 37.6 | Pass |
| Maximum "D" Plane Rotation | Maximum | Deg | 64.0 to 78.0 | 68.5 | Pass |
| | Time | ms | 57.0 to 64.0 | 60.8 | Pass |
| "D" Plane Rotation Decay Time To Zero Crossing | | ms | 113.0 to 128.0 | 113.8 | Pass |
| Moment About Occipital Condyle | Maximum | Nm | 88.1 to 108.5 | 90.6 | Pass |
| | Time | ms | 47.0 to 58.0 | 50.4 | Pass |
| Positive Moment Decay Time To Zero Crossing | | ms | 97.0 to 107.0 | 100.5 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

01/25/2016

Test Date

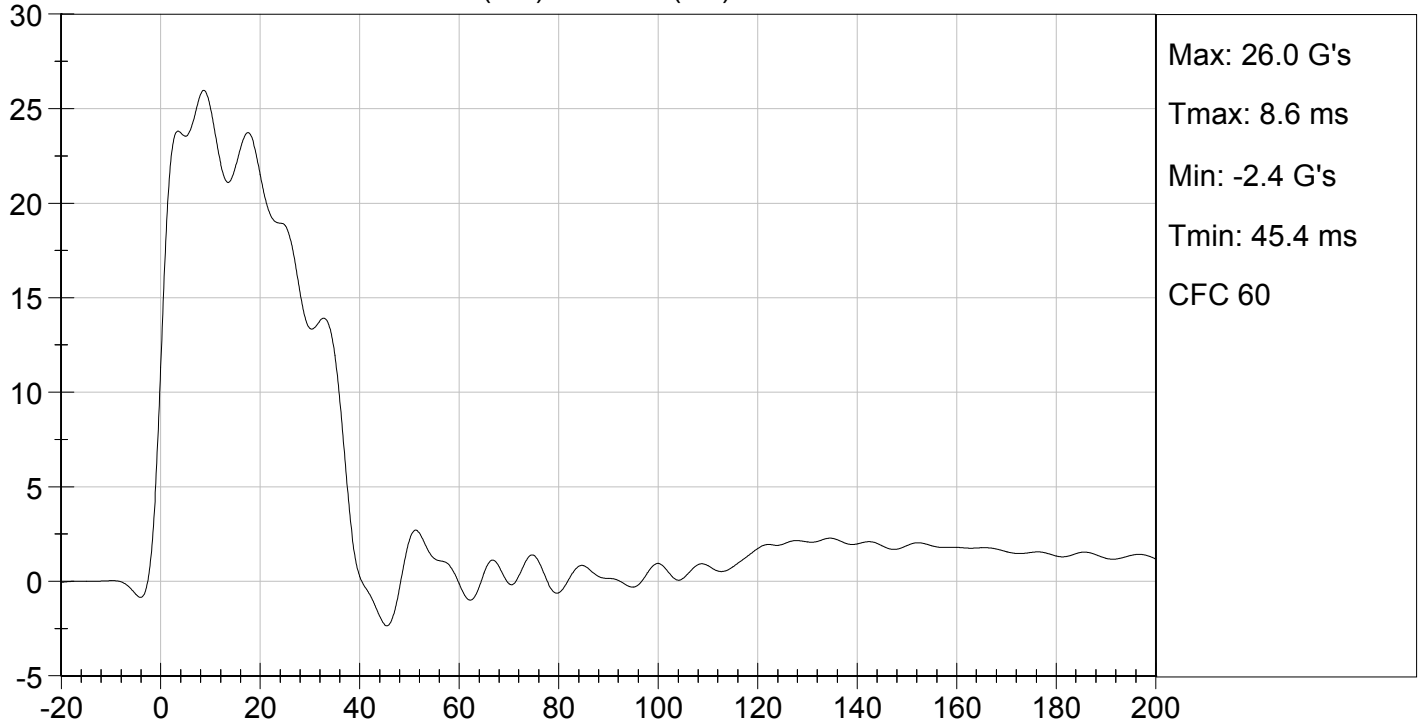
Jeff LeVasseur

Approved By

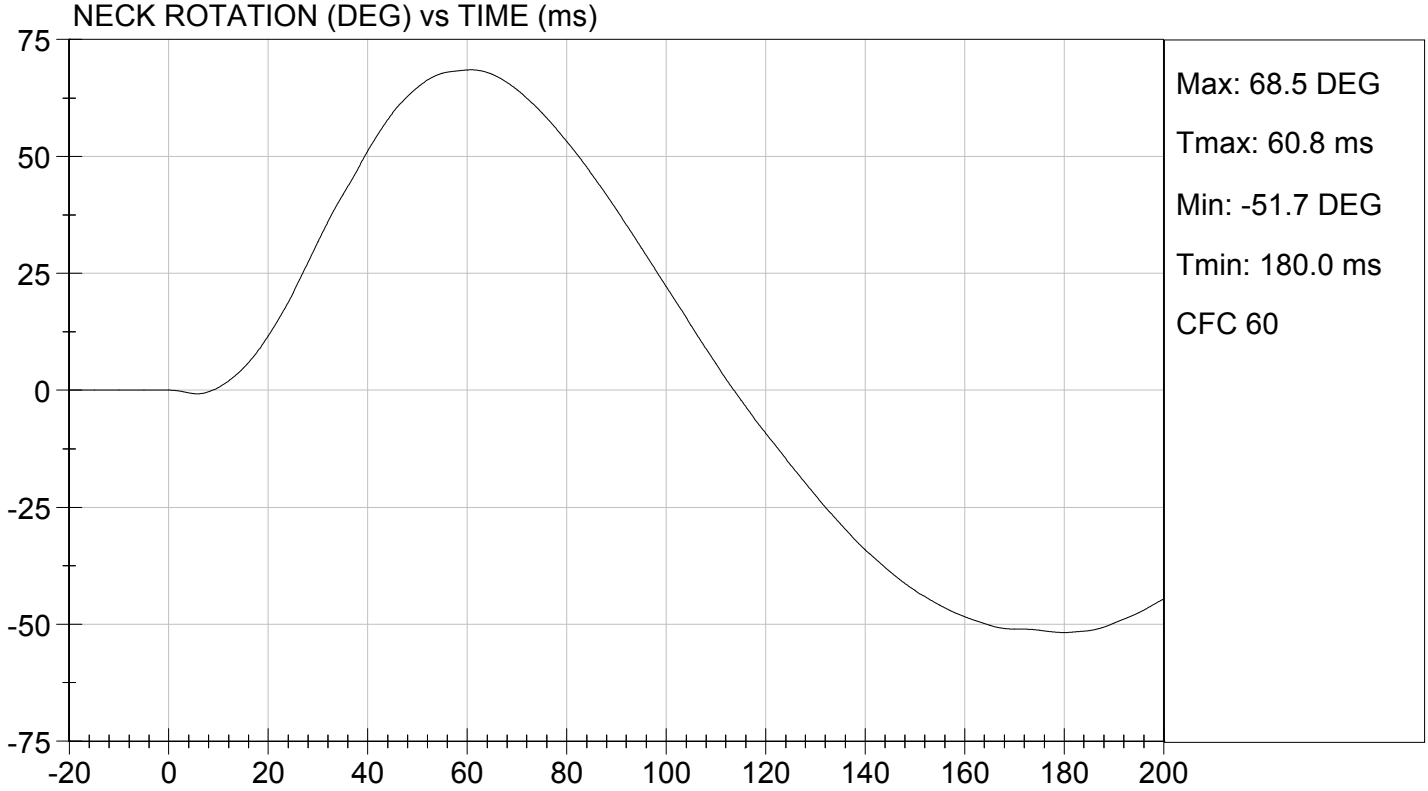
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 01/25/2016
TEST #: D16322

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

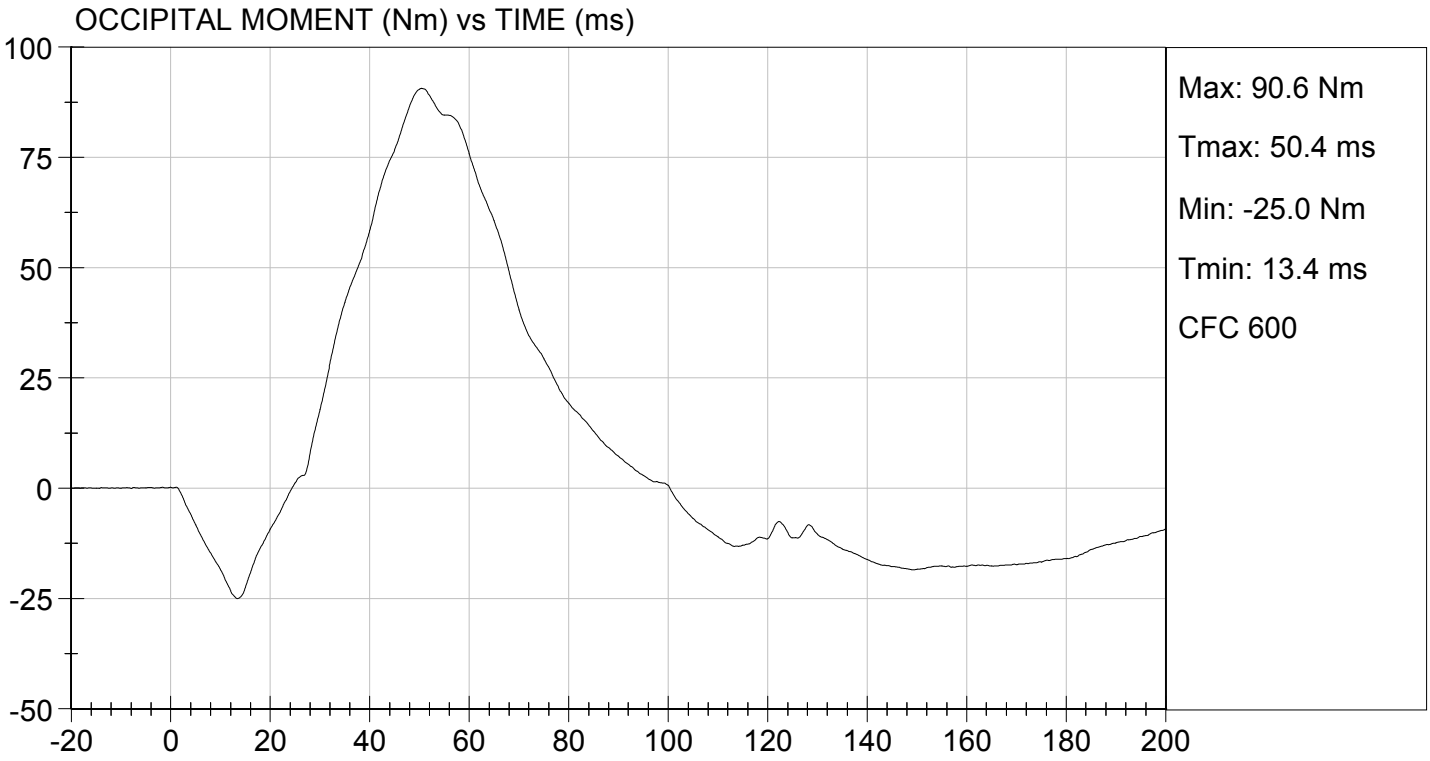



NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 01/25/2016
TEST #: D16322



**DATA SHEET A5**

NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

X 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))

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: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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. (78051-90).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

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

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 ± 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/sec 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 | Results |
|---|---|---|---|
| Pendulum impact speed | | 19.5 ft/s ≤ speed ≤ 20.3 ft/s | 20.08 ft/s |
| Pendulum Deceleration Versus Time Pulse | @ 10 ms | 17.2 ≤ g ≤ 21.2 | 20.22 g's |
| | @ 20 ms | 14 ≤ g ≤ 19 | 16.64 g's |
| | @ 30 ms | 11.0 ≤ g ≤ 16.0 | 12.72 g's |
| | Above 30 ms | 22 g maximum | 13.3 g's |
| First Pendulum Decay to 5g | | 38 ms ≤ time ≤ 46 ms | 38.0 ms |
| Plane D Rotation | | 81° ≤ max. rotation ≤ 106° | 99.3° |
| | | 72 ms ≤ time of max. rotation ≤ 82 ms | 78.2 ms |
| Time for Plane D Rotation to Cross 0° During First Rebound | | 147 ms ≤ time ≤ 174 ms | 161.5 ms |
| Maximum Moment | | -59 lbf-ft ≤ moment ≤ -39 lbf-ft | -44.3 lbf-ft |
| | | 65 ms ≤ time of max. moment ≤ 79 ms | 70.9 ms |
| Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension) | | 120 ms ≤ time ≤ 148 ms | 146.3 ms |

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(2)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = 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. (572.33(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.

David Schoedel

Signature

01/25/2016

Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16323

| Tested Parameter | | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | | deg C | 20.6 to 22.2 | 20.9 | Pass |
| Laboratory Relative Humidity | | % | 10 to 70 | 20 | Pass |
| Pendulum Velocity | | m/s | 5.95 to 6.19 | 6.12 | Pass |
| Pendulum Deceleration | 10 ms | G's | 17.20 to 21.20 | 20.22 | Pass |
| | 20 ms | G's | 14.00 to 19.00 | 16.64 | Pass |
| | 30 ms | G's | 11.00 to 16.00 | 12.72 | Pass |
| Peak Pendulum Deceleration After 30 ms | | G's | <= 22.0 | 13.3 | Pass |
| Deceleration Decay Time to Cross 5 G's | | ms | 38.0 to 46.0 | 38.0 | Pass |
| Maximum "D" Plane Rotation | Maximum | Degrees | 81.0 to 106.0 | 99.3 | Pass |
| | Time | ms | 72.0 to 82.0 | 78.2 | Pass |
| "D" Plane Rotation Decay Time To Zero Crossing | | ms | 147.0 to 174.0 | 161.5 | Pass |
| Moment About Occipital Condyle | Maximum | Nm | -52.9 to -79.9 | -60.0 | Pass |
| | Time | ms | 65.0 to 79.0 | 70.9 | Pass |
| Negative Moment Decay Time To Zero Crossing | | ms | 120.0 to 148.0 | 146.3 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

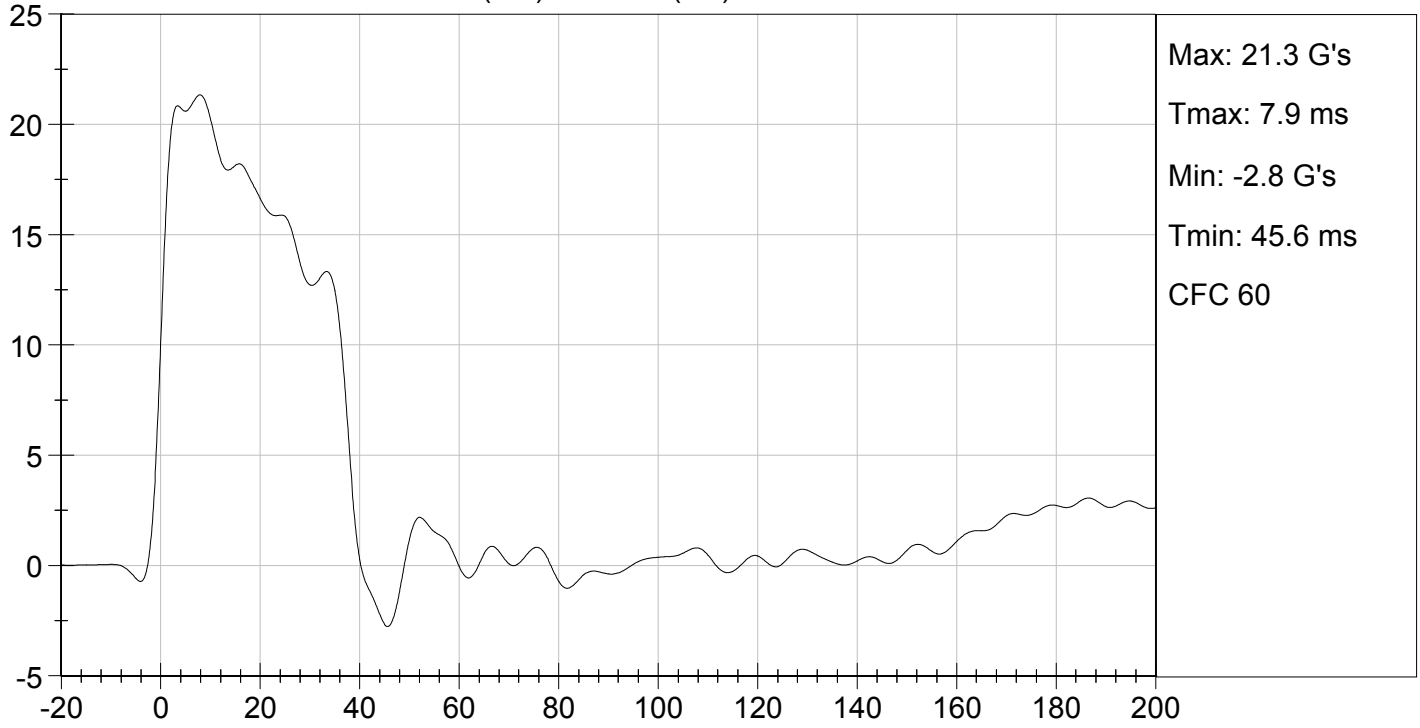
01/25/2016
Test Date

Jeff LeVasseur
Approved By

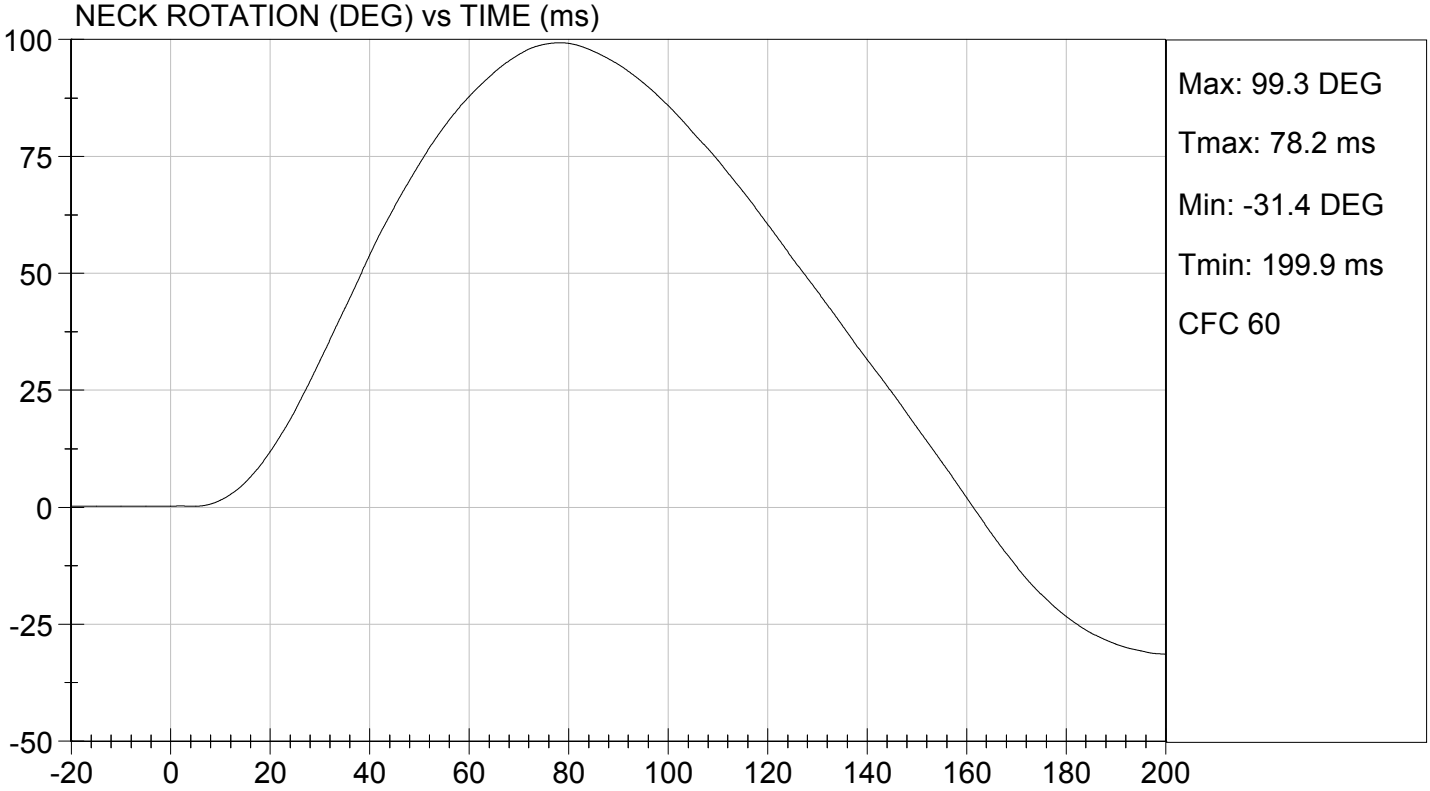
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

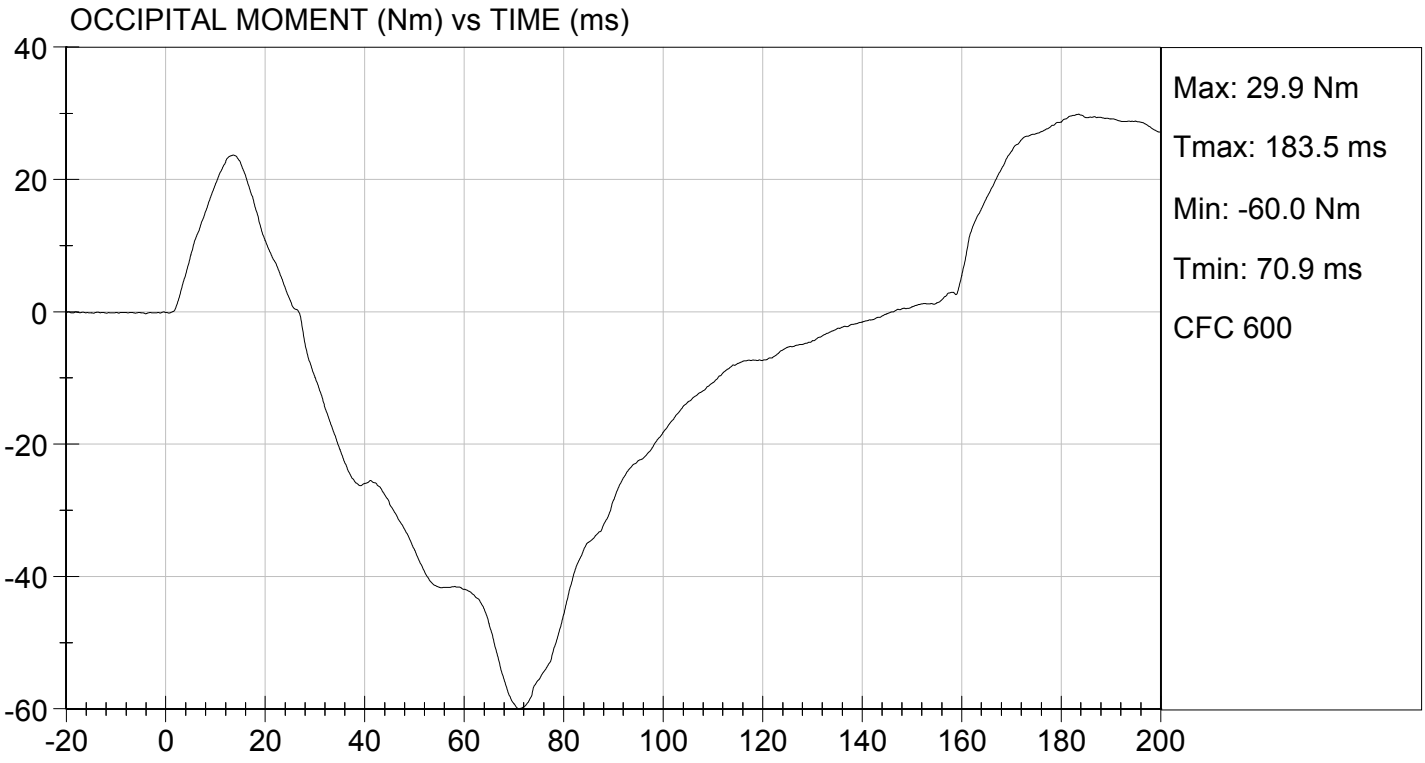
TEST DATE: 01/25/2016
TEST #: D16323

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




NECK ROTATION (DEG) vs TIME (ms)




OCCIPITAL MOMENT (Nm) vs TIME (ms)
40
20
0
-20
-40
-60
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 29.9 Nm
Tmax: 183.5 ms
Min: -60.0 Nm
Tmin: 70.9 ms
CFC 600

**DATA SHEET A6**

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 403 Test Date: 01/25/2016

Technician: Thomas Miller

X Pre test calibration

___ Post test calibration verification

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

X 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 12A.

X 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))

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. (572.34(c)(1))

| | |
|---|---|
| Record the maximum temperature: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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 (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.

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 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 ± 0.5° and adjust the pelvis angle to 13° ± 2°. 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 ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° 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 ± 2° 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° 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 f/s ± 0.4 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))

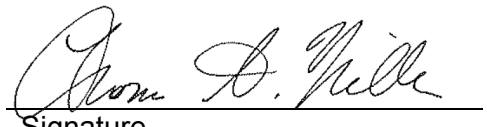
| Parameter* | Specification | Result |
|---|---|---|
| Test Probe Speed | 21.6 ft/s ≤ speed ≤ 22.4 ft/s | 21.65 ft/s |
| Chest Compression | 2.5 in. ≤ compression ≤ 2.86 in. | 2.61 in. |
| Peak resistance force** | 1160 lb ≤ peak force ≤ 1325 lb | 1269 lb |
| Internal Hysteresis*** | 69% ≤ hysteresis ≤ 85% | 74 % |

*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

01/25/2016

Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16324

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 20.6 to 22.2 | 20.7 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 20 | Pass |
| Probe Velocity | m/s | 6.58 to 6.82 | 6.60 | Pass |
| Peak Probe Force | N | 5159 to 5893 | 5,646 | Pass |
| Peak Sternum Displacement | cm | 6.35 to 7.26 | 6.63 | Pass |
| Internal Hysteresis | % | 69 to 85 | 74 | Pass |
| | | Overall Test Results | | Pass |

Laboratory Technician

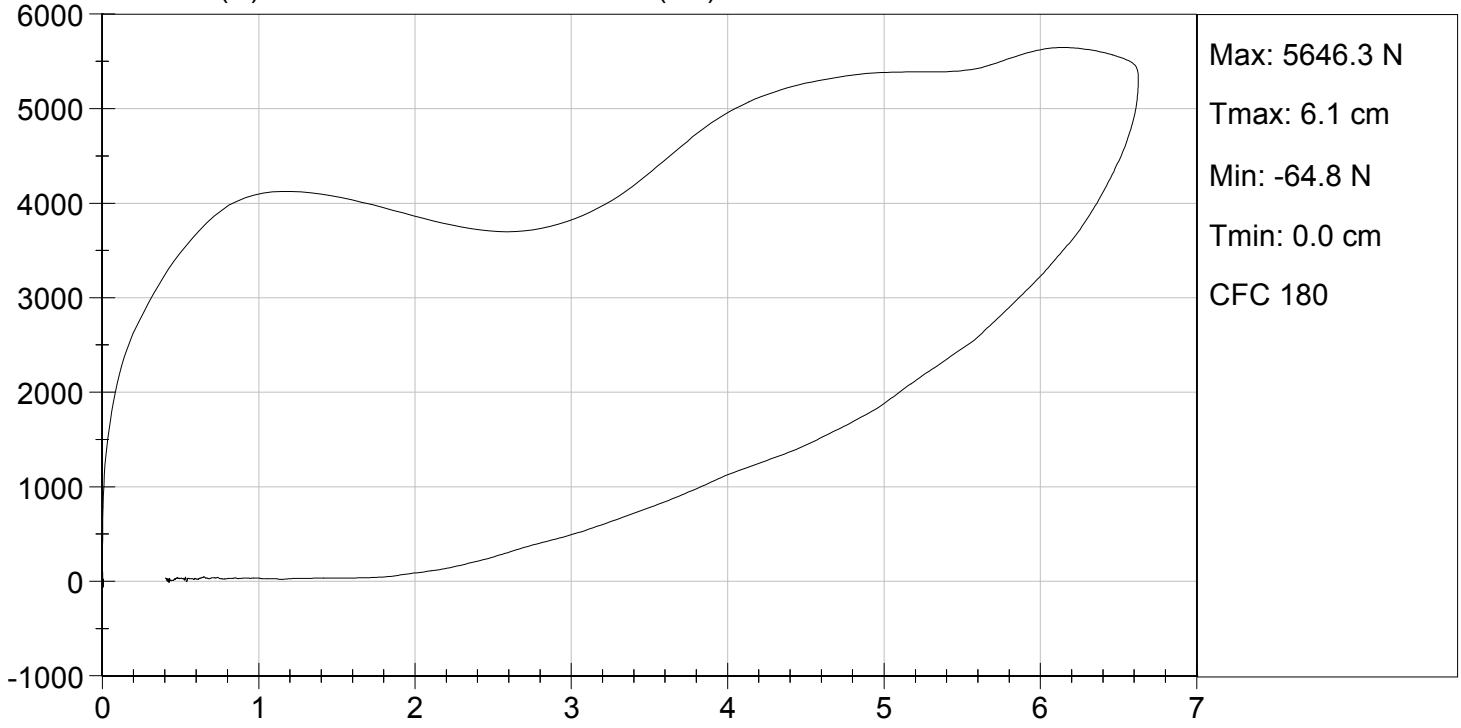
01/25/2016
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 01/25/2016
TEST #: D16324

FORCE (N) vs CHEST DISPLACEMENT (cm)



**DATA SHEET A7**
LEFT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 403 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 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: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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 | 6.78 ft/s |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb | 1171 lb |

*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))

David Schoedel

Signature

01/25/2016

Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16326

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 20.9 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 20 | Pass |
| Probe Velocity | m/s | 2.07 to 2.13 | 2.07 | Pass |
| Peak Probe Force | N | 4715 to 5782 | 5,207 | Pass |
| | | Overall Test Results | | Pass |

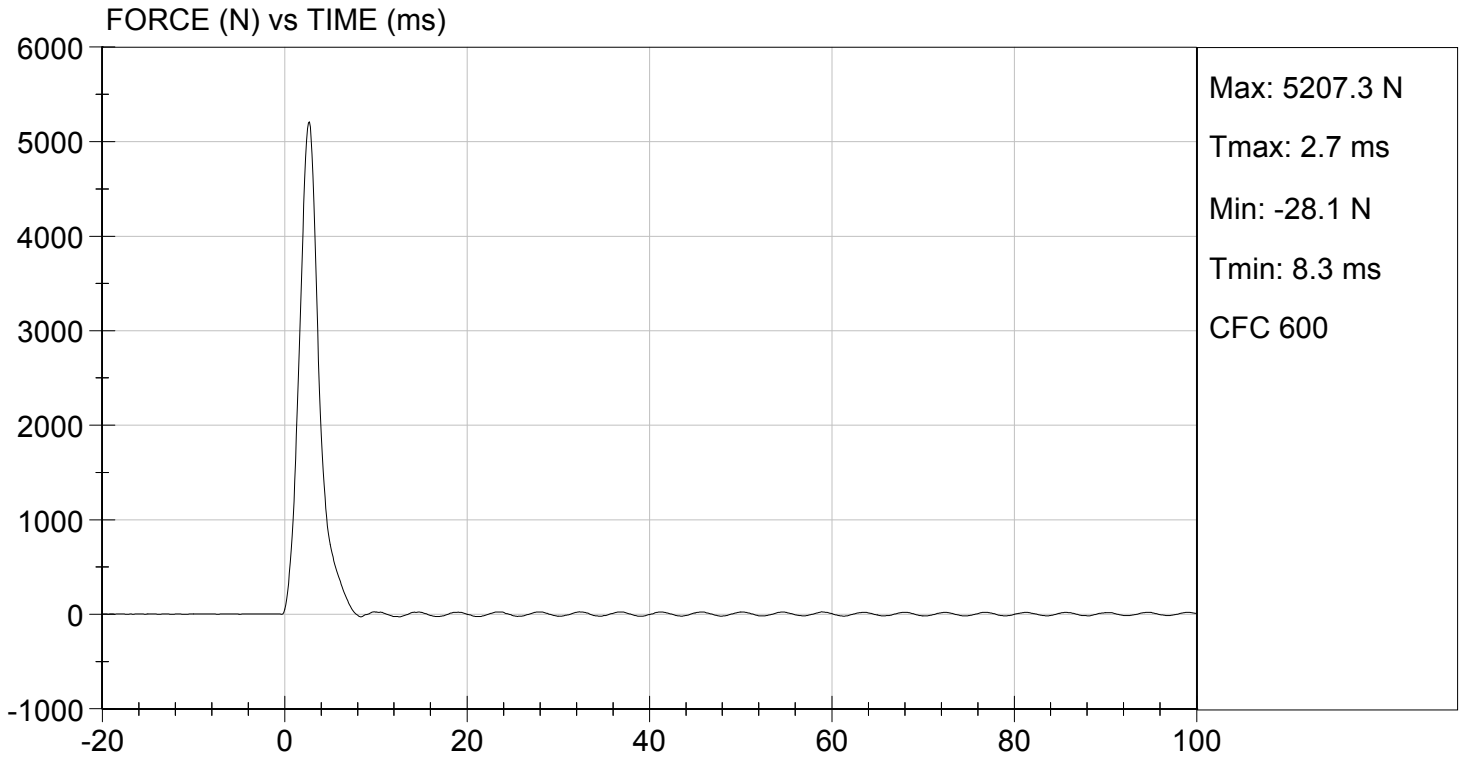
David Schoedel
Laboratory Technician

01/25/2016
Test Date

Jeff Leonardini
Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.78 ft/s, 2.07 m/s

TEST DATE: 01/25/2016
TEST #: D16326



**DATA SHEET A8**

RIGHT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 403 Test Date: 01/25/2016

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 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 (86-5001-002) with the upper leg assembly (78051-47) 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: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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 | 6.97 ft/s |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb | 1097 lb |

*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))

David Schoedel

Signature

01/25/2016

Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16325

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 20.9 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 20 | Pass |
| Probe Velocity | m/s | 2.07 to 2.13 | 2.12 | Pass |
| Peak Probe Force | N | 4715 to 5782 | 4,880 | Pass |
| | | Overall Test Results | | Pass |

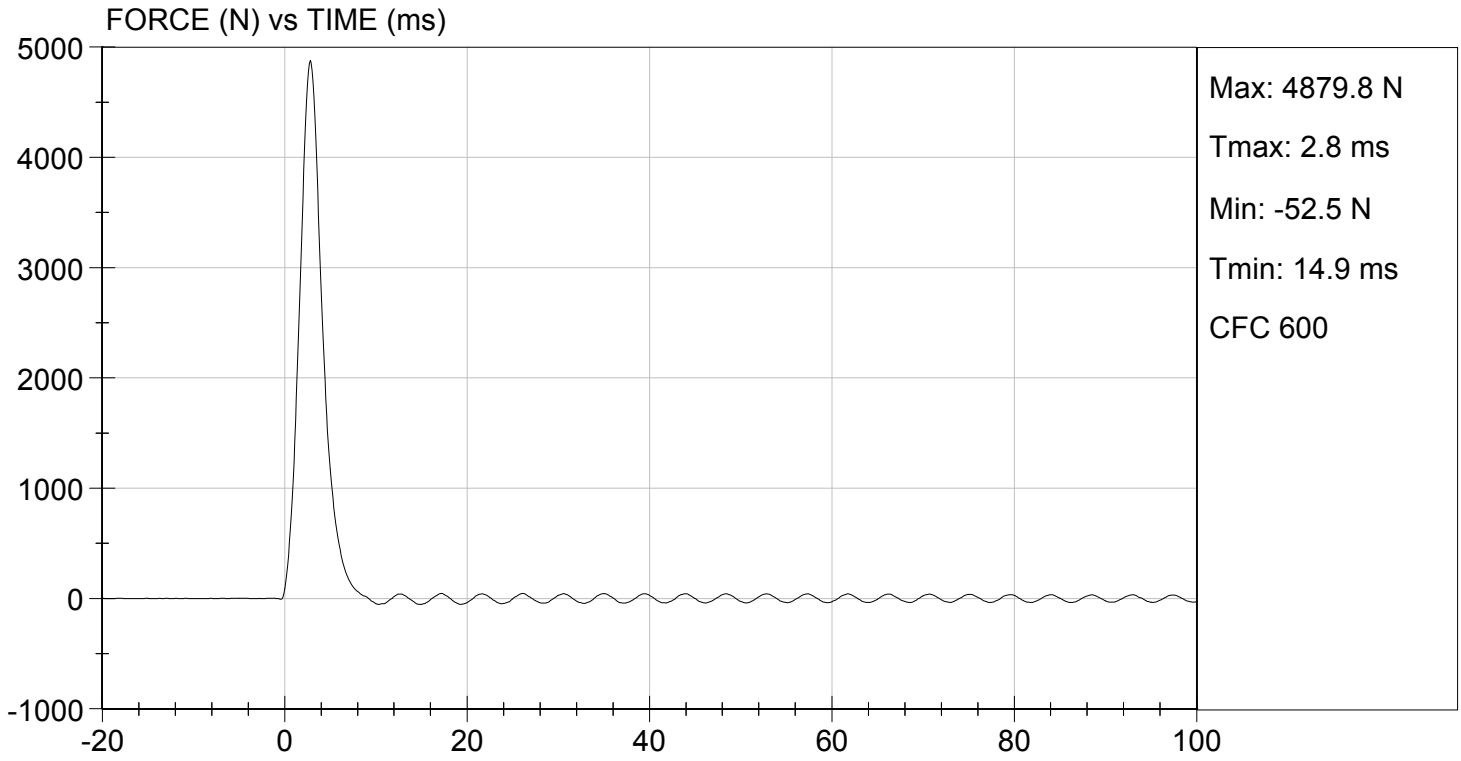
David Schoedel
Laboratory Technician

01/25/2016
Test Date

Jeff Leonardson
Approved By

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

TEST DATE: 01/25/2016
TEST #: D16325



**DATA SHEET A9**

HIP JOINT-FEMUR FLEXION (572.35(c)) (50th Male)

Dummy Serial Number: 403 Test Date: 01/25/2016

Technician: Thomas Miller

X Pre test calibration

___ Post test calibration verification

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

X 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: | 20.9°C |
| Record the minimum temperature: | 20.7°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 20% |

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°/s ≤ rotation rate ≤ 10°/s | 6.4°/s |
| Femur Torque at 30° | Torque ≤ 70 ft-lbf | 46.0 ft-lbf |
| Rotation at 150 lbf-ft | 40° ≤ rotation ≤ 50° | 48.6° |

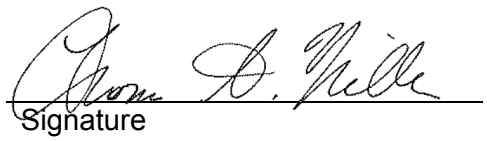
X 11. Secure the lever arm into the right femur shaft opening of the upper leg structure assembly (78051-44) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

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 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 13. Complete the following table:

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

| Parameter | Specification | Result |
|---|---|---|
| Rotation Rate | 5°/s ≤ rotation rate ≤ 10°/s | 6.3°/s |
| Femur Torque at 30° | torque ≤ 70 ft-lbf | 60.2 ft-lbf |
| Rotation at 150 lbf-ft | 40° ≤ rotation ≤ 50° | 43.7° |



Signature

01/25/2016
Date

**MGA RESEARCH CORPORATION**

**HIP-FEMUR FLEXION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16320

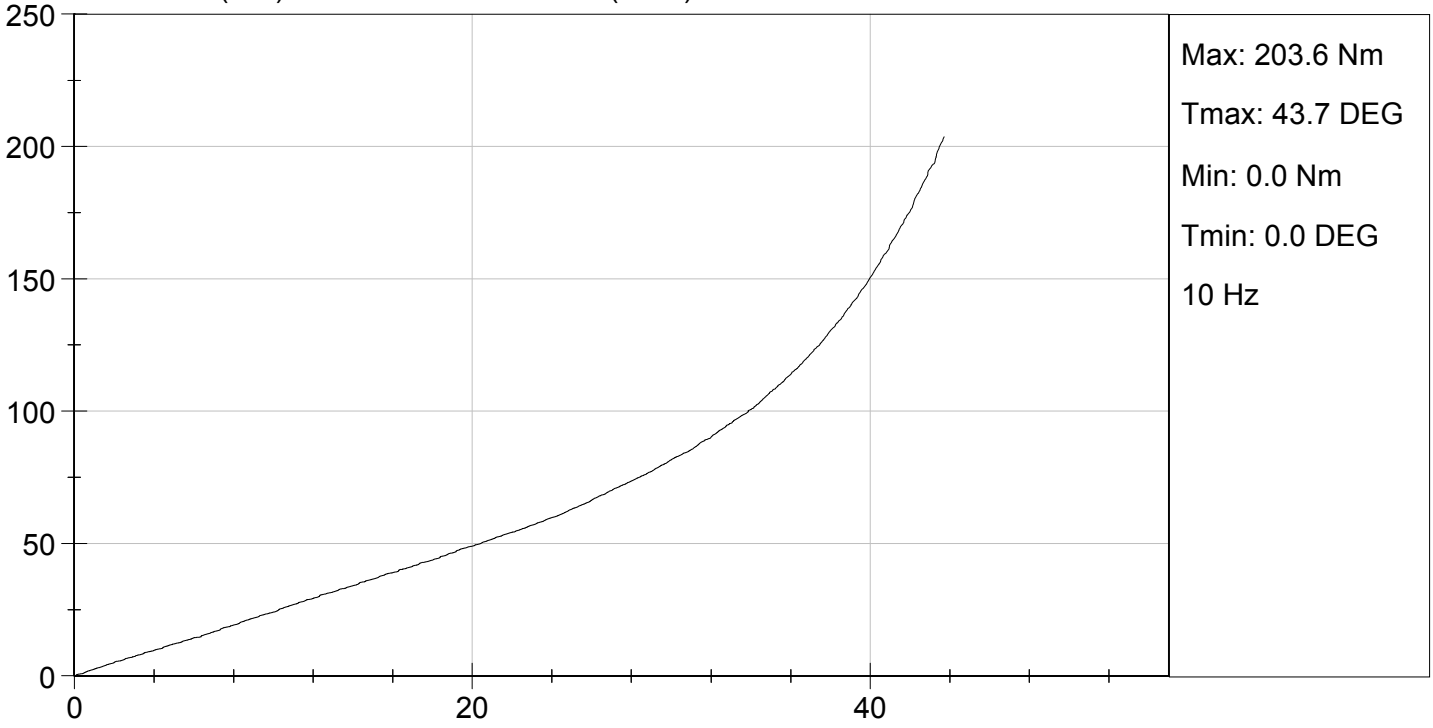
| Tested Parameter | Units | Specification | Result | | Pass/Fail |
|---|---|---|---|---|---|
| | | | Right | Left | |
| Laboratory Temperature | deg C | 18.9 to 25.6 | 20.7 | 20.7 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 20 | 20 | Pass |
| Rotation Rate | deg/s | 5.0 to 10.0 | 6.3 | 6.4 | Pass |
| 30 Degrees | Nm | 94.9 Nm Max | 81.6 | 62.4 | Pass |
| 150 ft-lbf / 203.4 Nm | Deg | 40.0 to 50.0 Degree Max Rotation | 43.7 | 48.6 | Pass |
| | | Overall Test Results | | | Pass |

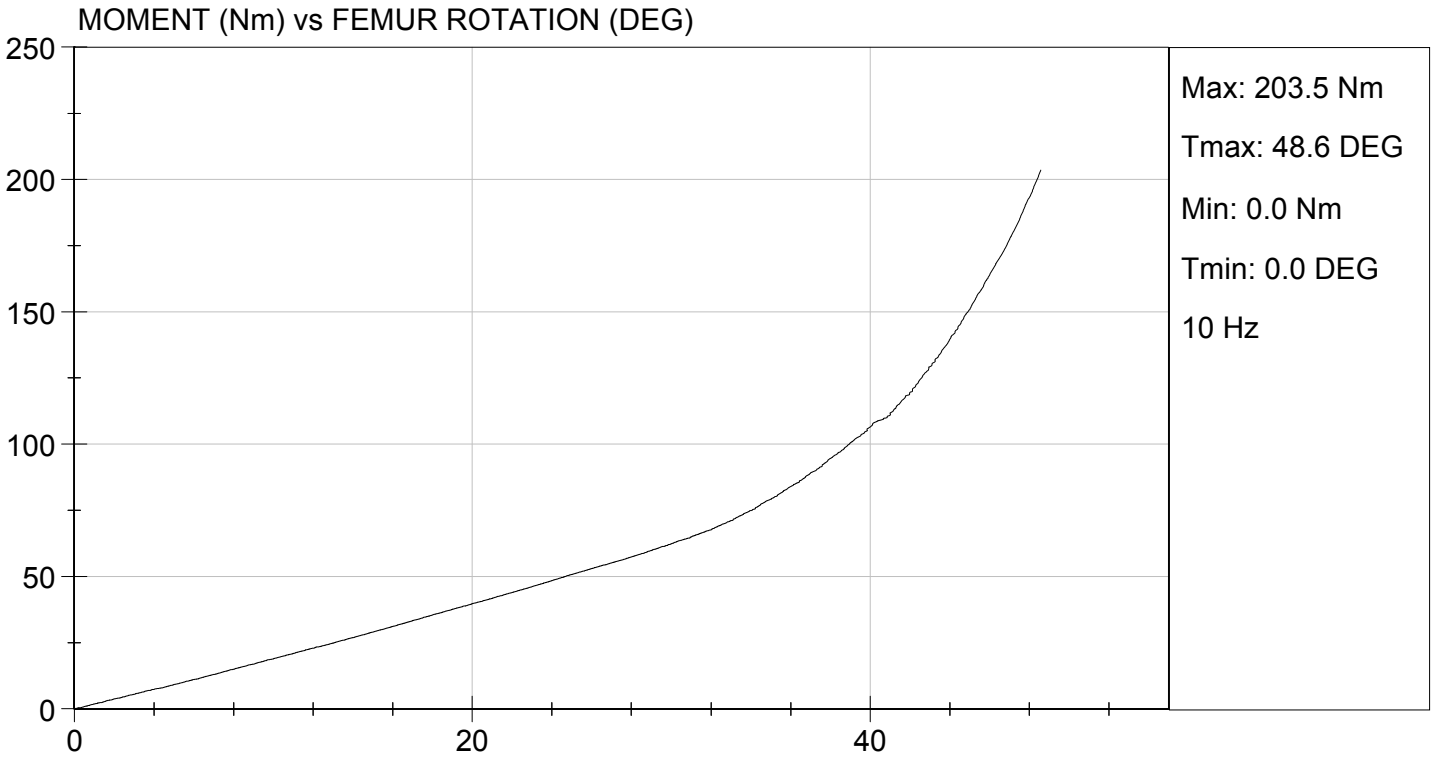
Laboratory Technician

01/25/2016
Test Date

Approved By

MOMENT (Nm) vs FEMUR ROTATION (DEG)




MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.5 Nm
Tmax: 48.6 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz

## DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO. | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---|---|---|---|---|---|
| DUMMY INSTRUMENTATION | | | | | |
| HEAD ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7231C-750 | AGH70 | 09/11/2015 | 03/11/2016 |
| (2) LATERAL | Endevco | 7231C-750 | AH5E5 | 09/11/2015 | 03/11/2016 |
| (3) VERTICAL | Endevco | 7231C-750 | C10591 | 09/11/2015 | 03/11/2016 |
| NECK TRANSDUCER | Denton | 1716 | 1157 | 10/21/2015 | 4/21/2016 |
| CHEST ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7231C-750 | AGH74 | 09/11/2015 | 03/11/2016 |
| (2) LATERAL | Endevco | 7231C-750 | C10686 | 09/11/2015 | 03/11/2016 |
| (3) VERTICAL | Endevco | 7231C-750 | C13046 | 09/11/2015 | 03/11/2016 |
| CHEST POTENTIOMETER | Servo | 14CBI-2897 | 403 | 09/10/2015 | 03/10/2016 |
| FEMUR LOAD CELLS | | | | | |
| (1) RIGHT FEMUR | Denton | 2121 | 8804 | 09/10/2015 | 03/10/2016 |
| (2) LEFT FEMUR | Denton | 2121 | 8805 | 09/10/2015 | 03/10/2016 |
| LABORATORY INSTRUMENTATION | | | | | |
| NECK PENDULUM ACCELEROMTER | Endevco | 7231C-750 | AH5P1 | 01/25/2016 | 07/25/2016 |
| THORAX PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P82097 | 11/30/2015 | 05/30/2016 |
| KNEE PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P88169 | 11/30/2015 | 05/30/2016 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol | 132-0-0-102 | 18 | 01/22/2016 | 07/22/2016 |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol | 132-0-0-102 | 29 | 09/28/2015 | 03/28/2016 |

LABORATORY TECHNICIAN: Jessica Hall

**DATA SHEET A3**
HEAD DROP TEST (572.32) (50th Male)

Dummy Serial Number: 403 Test Date: 02/02/2016

Technician: David Schoedel

____ Pre test calibration
__X__ Post test calibration verification

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

__X__ 1. It has been at least 2 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(i))

__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. (572.132(c)(1))

| | |
|---|---|
| Record the maximum temperature: | 21.2°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

__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, 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: 0.5 inches

**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: 501 mm

Record the left side distance: 501 mm

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: 50.9 micro inches

X 12. The impact surface is rigidly supported. (572.132(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: 50.9 mm

Record width: 604 mm

Record length: 595 mm

X 14. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 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 g ≤ x ≤ 275 g | 273 g |
| 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 ≤ 15 g | -2.7 g |

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

David Schoedel
Signature

02/02/2016
Date

**MGA RESEARCH CORPORATION**

**HEAD DROP TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test ID:** D16441

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 20.9 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 27 | Pass |
| Peak Resultant Acceleration | G's | 225 to 275 | 273 | Pass |
| Peak Lateral Acceleration | G's | <= +/- 15.0 | -2.7 | Pass |
| Unimodal | N/A | Yes | Yes | Pass |
| Oscillations | N/A | within 10% of peak | Yes | Pass |
| | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

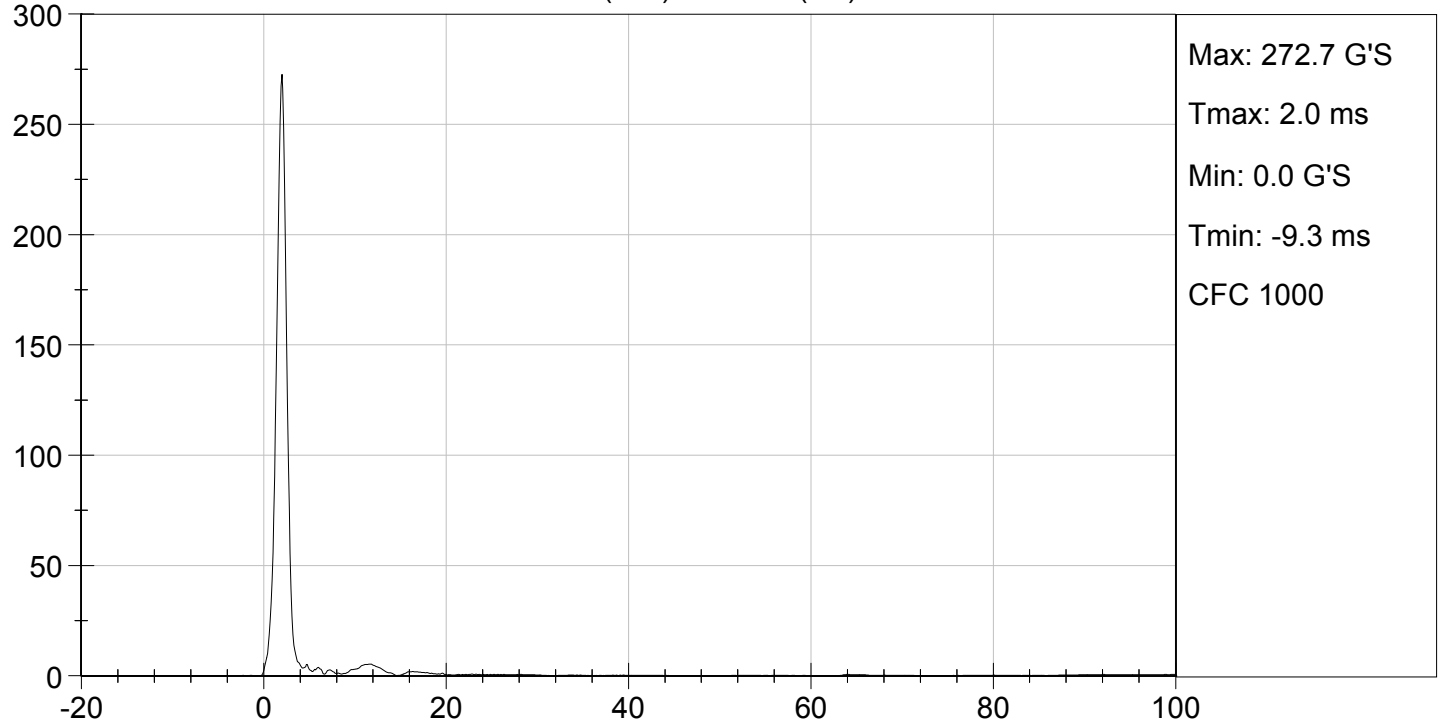
02/02/2016
Test Date

Jeff Leonardelli
Approved By

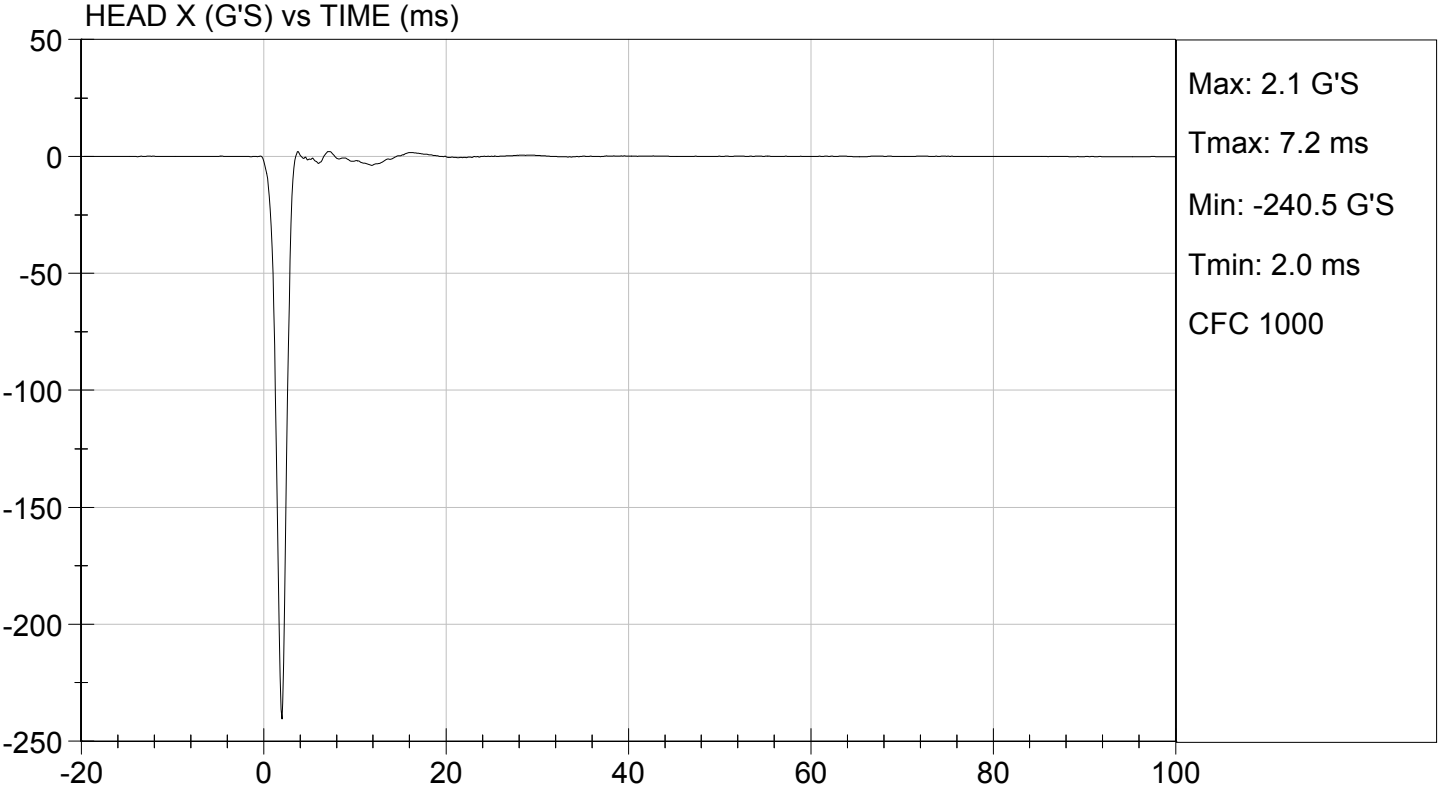
TEST DESC: HEAD DROP

TEST DATE: 02/02/2016
TEST #: D16441

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



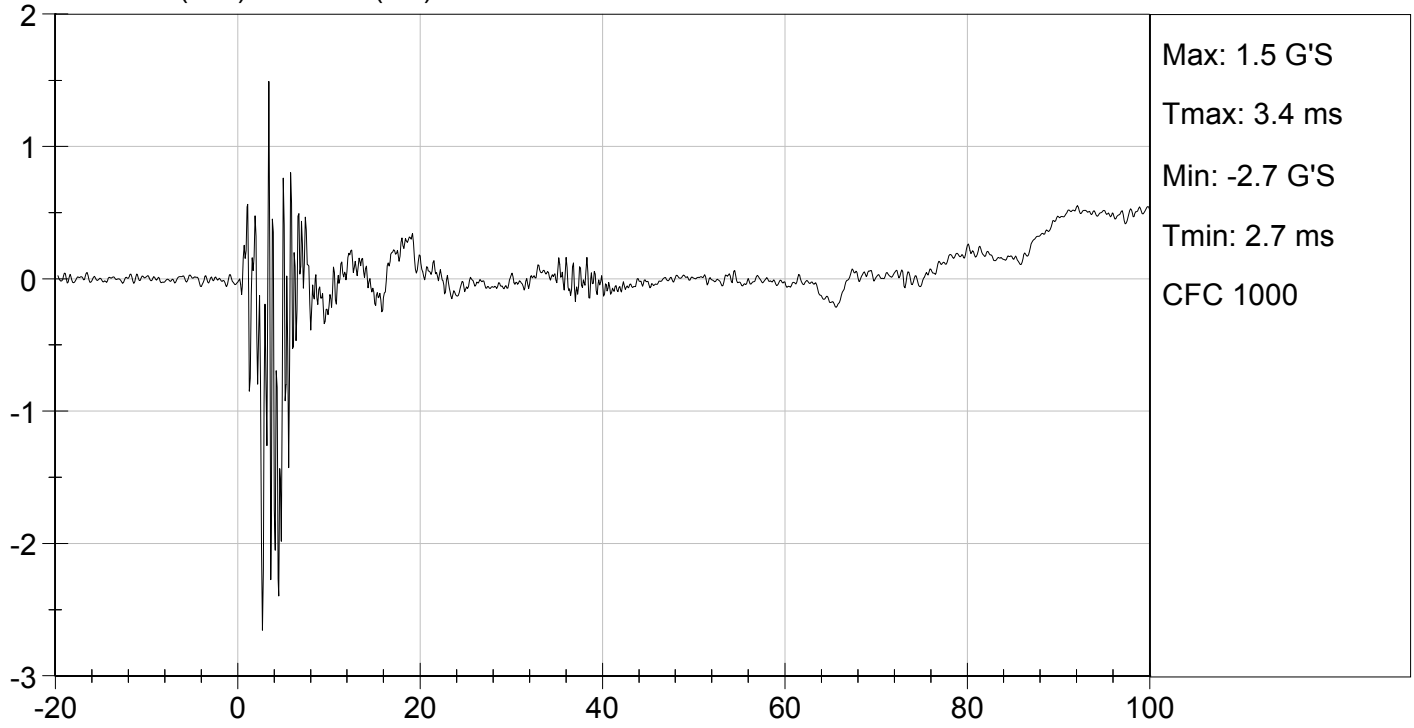

HEAD X (G'S) vs TIME (ms)



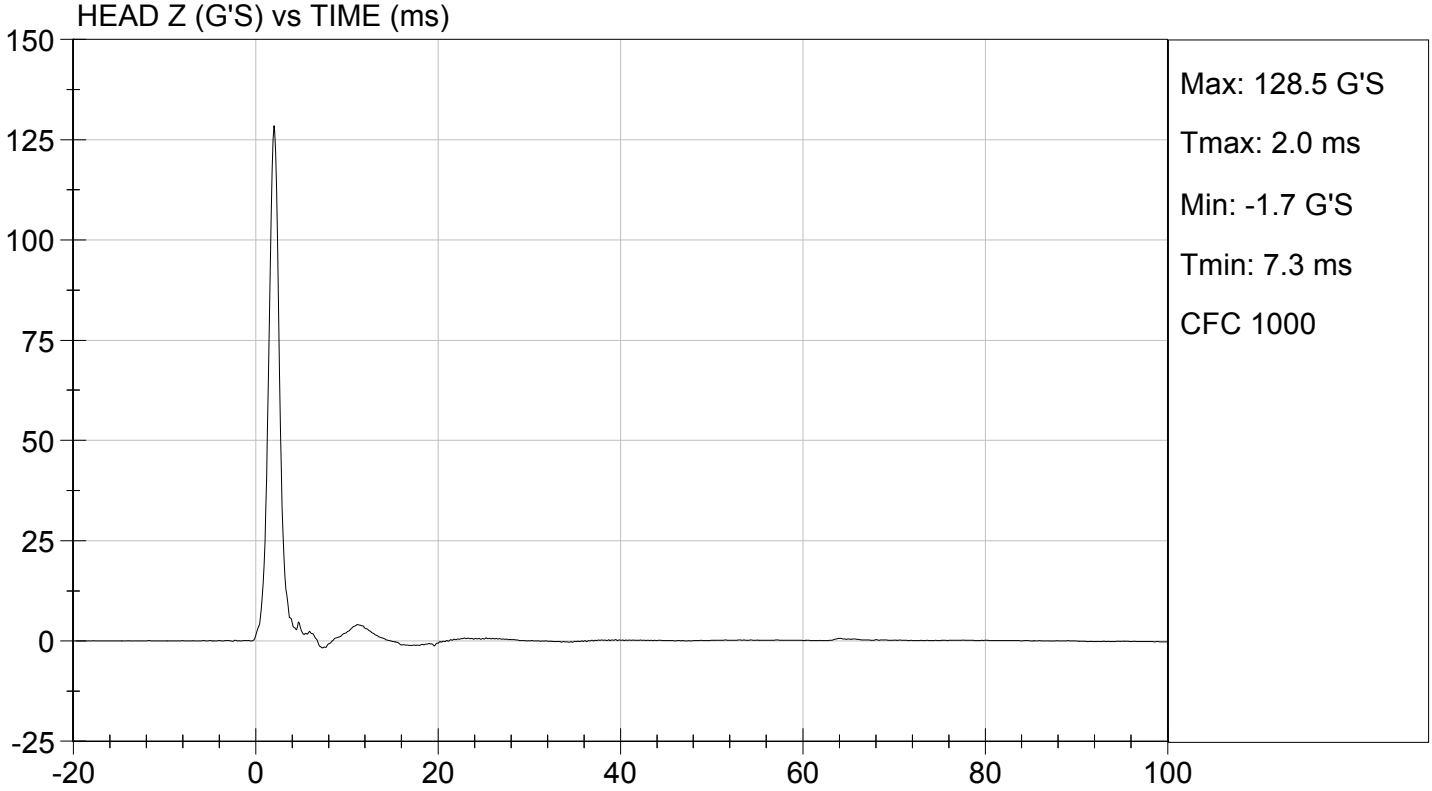
TEST DESC: HEAD DROP

TEST DATE: 02/02/2016
TEST #: D16441

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




HEAD Z (G'S) vs TIME (ms)



**DATA SHEET A4**

NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 02/02/2016

Technician: David Schoedel

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one neck test performed

_X_ 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))

_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°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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. (78051-90).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

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

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 ± 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 | Results |
|---|---|---|---|
| Pendulum impact speed | | 22.6 ft/s ≤ speed ≤ 23.4 ft/s | 23.15 ft/s |
| Pendulum Deceleration Versus Time Pulse | @ 10 ms | 22.5 ≤ g ≤ 27.5 | 23.05 g's |
| | @ 20 ms | 17.6 ≤ g ≤ 22.6 | 17.77 g's |
| | @ 30 ms | 12.5 ≤ g ≤ 18.5 | 14.91 g's |
| | Above 30 ms | 29 g maximum | 14.9 g's |
| First Pendulum Decay to 5g | | 34 ms ≤ time ≤ 42 ms | 39.5 ms |
| Plane D Rotation | | 64° ≤ max. rotation ≤ 78° | 66.0° |
| | | 57 ms ≤ time of max. rotation ≤ 64 ms | 57.9 ms |
| Time for Plane D Rotation to Cross 0° During First Rebound | | 113 ms ≤ time ≤ 128 ms | 113.1 ms |
| Maximum Moment | | 65 lbf-ft ≤ moment ≤ 80 lbf-ft | 66.2 lbf-ft |
| | | 47 ms ≤ time of max. moment ≤ 58 ms | 52.2 ms |
| Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion) | | 97 ms ≤ time ≤ 107 ms | 102.2 ms |

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(1)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = 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. (572.33(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.

David Schoedel
Signature

02/02/2016
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16442

| 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 | 28 | Pass |
| Pendulum Velocity | | m/s | 6.89 to 7.13 | 7.06 | Pass |
| Pendulum Deceleration | 10 ms | G's | 22.50 to 27.50 | 23.05 | Pass |
| | 20 ms | G's | 17.60 to 22.60 | 17.77 | Pass |
| | 30 ms | G's | 12.50 to 18.50 | 14.91 | Pass |
| Peak Pendulum Deceleration After 30 ms | | G's | <= 29.0 | 14.9 | Pass |
| Deceleration Decay Time to Cross 5 G's | | ms | 34.0 to 42.0 | 39.5 | Pass |
| Maximum "D" Plane Rotation | Maximum | Deg | 64.0 to 78.0 | 66.0 | Pass |
| | Time | ms | 57.0 to 64.0 | 57.9 | Pass |
| "D" Plane Rotation Decay Time To Zero Crossing | | ms | 113.0 to 128.0 | 113.1 | Pass |
| Moment About Occipital Condyle | Maximum | Nm | 88.1 to 108.5 | 89.8 | Pass |
| | Time | ms | 47.0 to 58.0 | 52.2 | Pass |
| Positive Moment Decay Time To Zero Crossing | | ms | 97.0 to 107.0 | 102.2 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

02/02/2016

Test Date

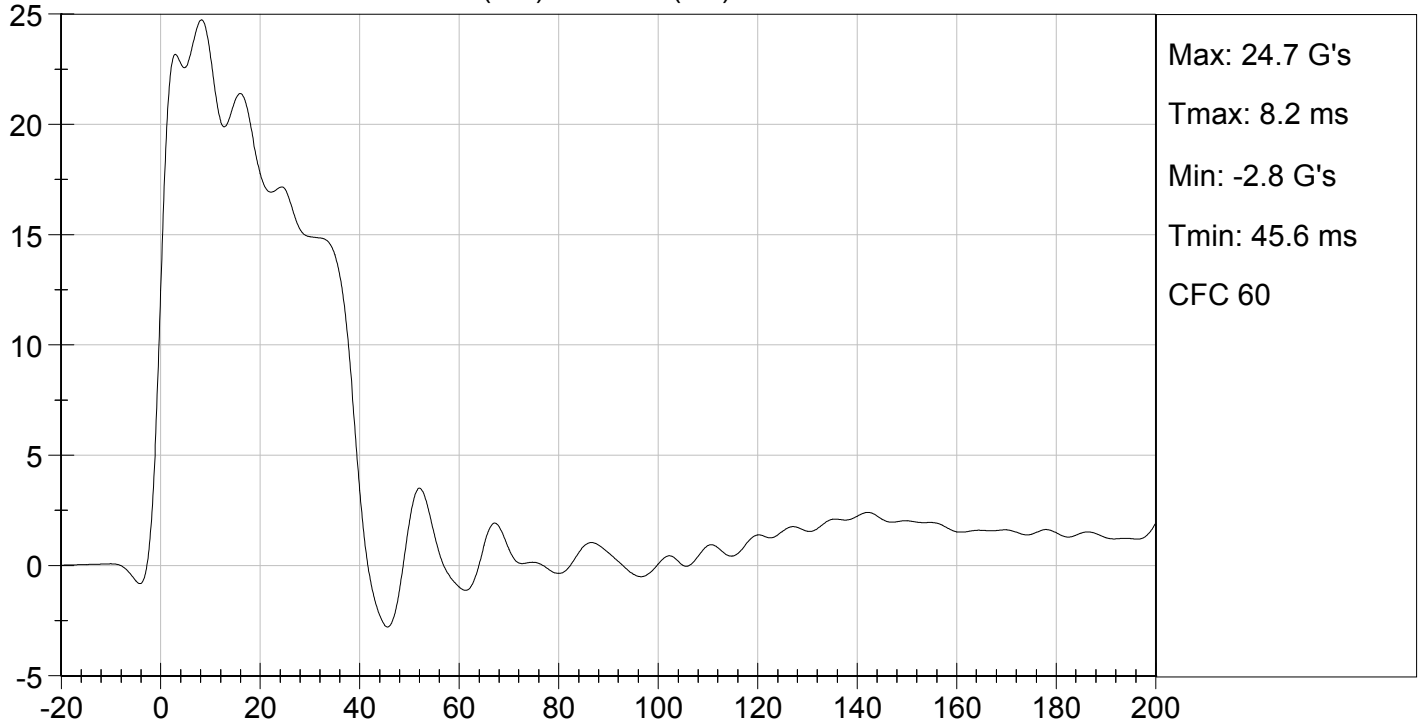
Jeff Levandoski

Approved By

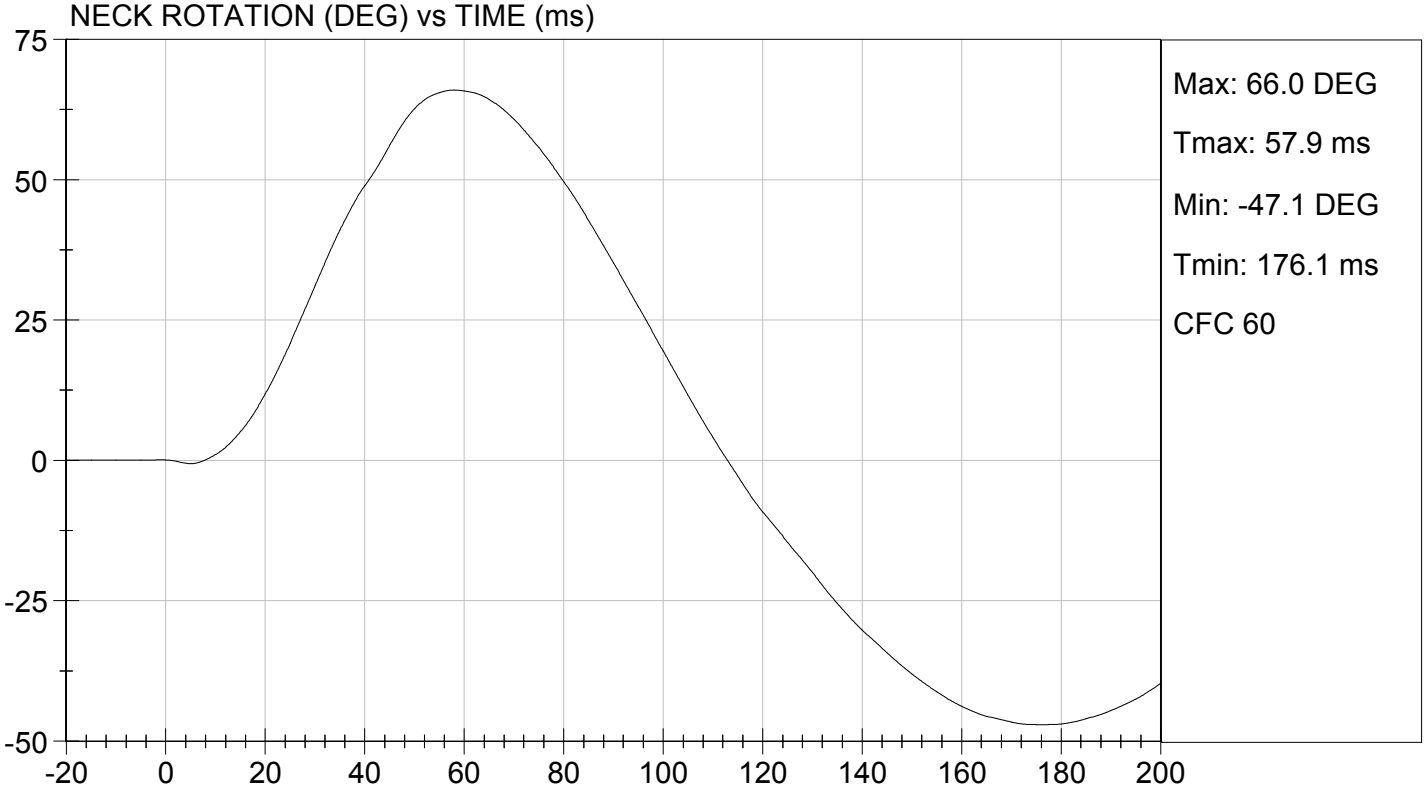
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 02/02/2016
TEST #: D16442

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



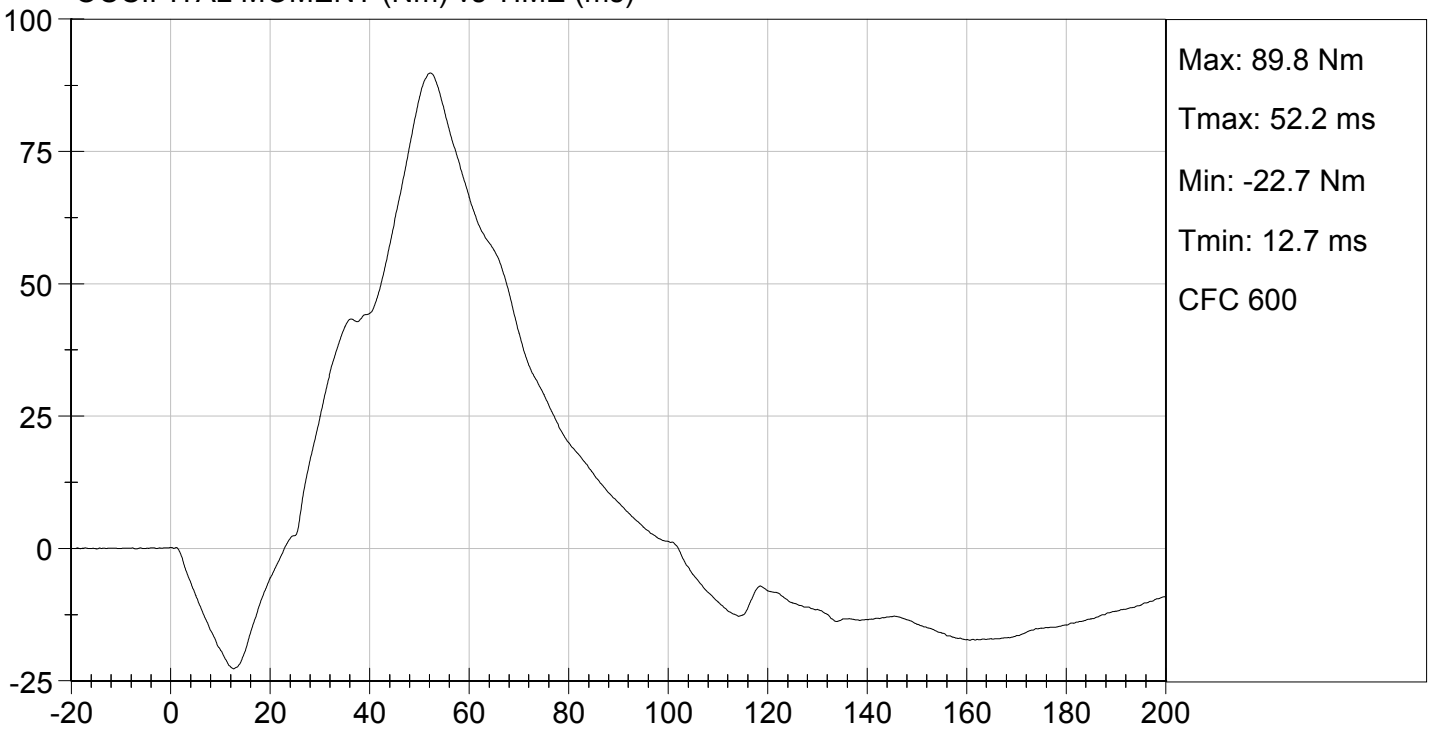

NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 02/02/2016
TEST #: D16442

OCCIPITAL MOMENT (Nm) vs TIME (ms)



**DATA SHEET A5**
NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 02/02/2016

Technician: David Schoedel

____ Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last extension test. (572.36(m))
X N/A, ONLY one neck test performed

X 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))

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°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

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. (78051-90).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

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

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 ± 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/sec 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 | Results |
|---|---|---|---|
| Pendulum impact speed | | 19.5 ft/s ≤ speed ≤ 20.3 ft/s | 20.08 ft/s |
| Pendulum Deceleration Versus Time Pulse | @ 10 ms | 17.2 ≤ g ≤ 21.2 | 18.60 g's |
| | @ 20 ms | 14 ≤ g ≤ 19 | 16.63 g's |
| | @ 30 ms | 11.0 ≤ g ≤ 16.0 | 12.40 g's |
| | Above 30 ms | 22 g maximum | 13.7 g's |
| First Pendulum Decay to 5g | | 38 ms ≤ time ≤ 46 ms | 39.9 ms |
| Plane D Rotation | | 81° ≤ max. rotation ≤ 106° | 97.8° |
| | | 72 ms ≤ time of max. rotation ≤ 82 ms | 78.6 ms |
| Time for Plane D Rotation to Cross 0° During First Rebound | | 147 ms ≤ time ≤ 174 ms | 160.9 ms |
| Maximum Moment | | -59 lbf-ft ≤ moment ≤ -39 lbf-ft | -42.5 lbf-ft |
| | | 65 ms ≤ time of max. moment ≤ 79 ms | 71.4 ms |
| Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension) | | 120 ms ≤ time ≤ 148 ms | 146.6 ms |

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(2)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = 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. (572.33(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.

David Schoedel

Signature

02/02/2016

Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16443

| 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 | 28 | Pass |
| Pendulum Velocity | | m/s | 5.95 to 6.19 | 6.12 | Pass |
| Pendulum Deceleration | 10 ms | G's | 17.20 to 21.20 | 18.60 | Pass |
| | 20 ms | G's | 14.00 to 19.00 | 16.63 | Pass |
| | 30 ms | G's | 11.00 to 16.00 | 12.40 | Pass |
| Peak Pendulum Deceleration After 30 ms | | G's | <= 22.0 | 13.7 | Pass |
| Deceleration Decay Time to Cross 5 G's | | ms | 38.0 to 46.0 | 39.9 | Pass |
| Maximum "D" Plane Rotation | Maximum | Degrees | 81.0 to 106.0 | 97.8 | Pass |
| | Time | ms | 72.0 to 82.0 | 78.6 | Pass |
| "D" Plane Rotation Decay Time To Zero Crossing | | ms | 147.0 to 174.0 | 160.9 | Pass |
| Moment About Occipital Condyle | Maximum | Nm | -52.9 to -79.9 | -57.6 | Pass |
| | Time | ms | 65.0 to 79.0 | 71.4 | Pass |
| Negative Moment Decay Time To Zero Crossing | | ms | 120.0 to 148.0 | 146.6 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

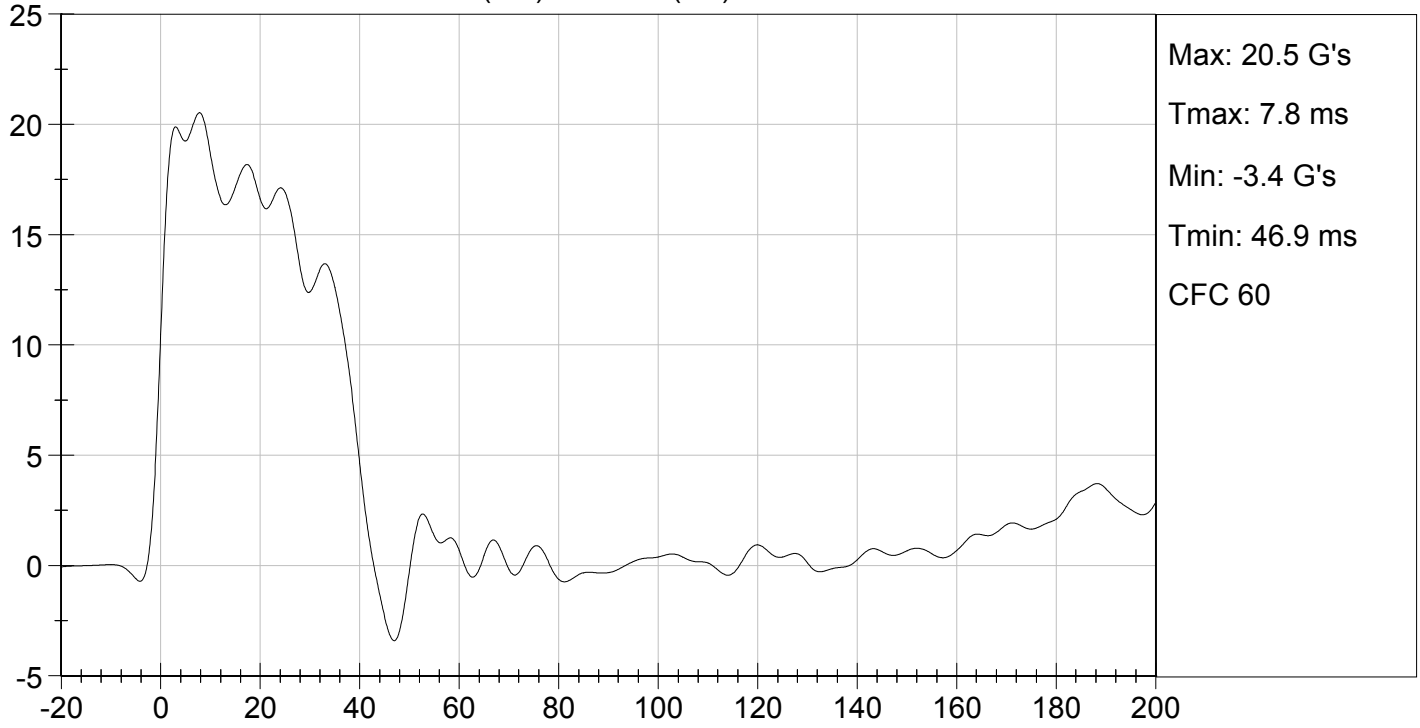
02/02/2016
Test Date

Jeff Levandoski
Approved By

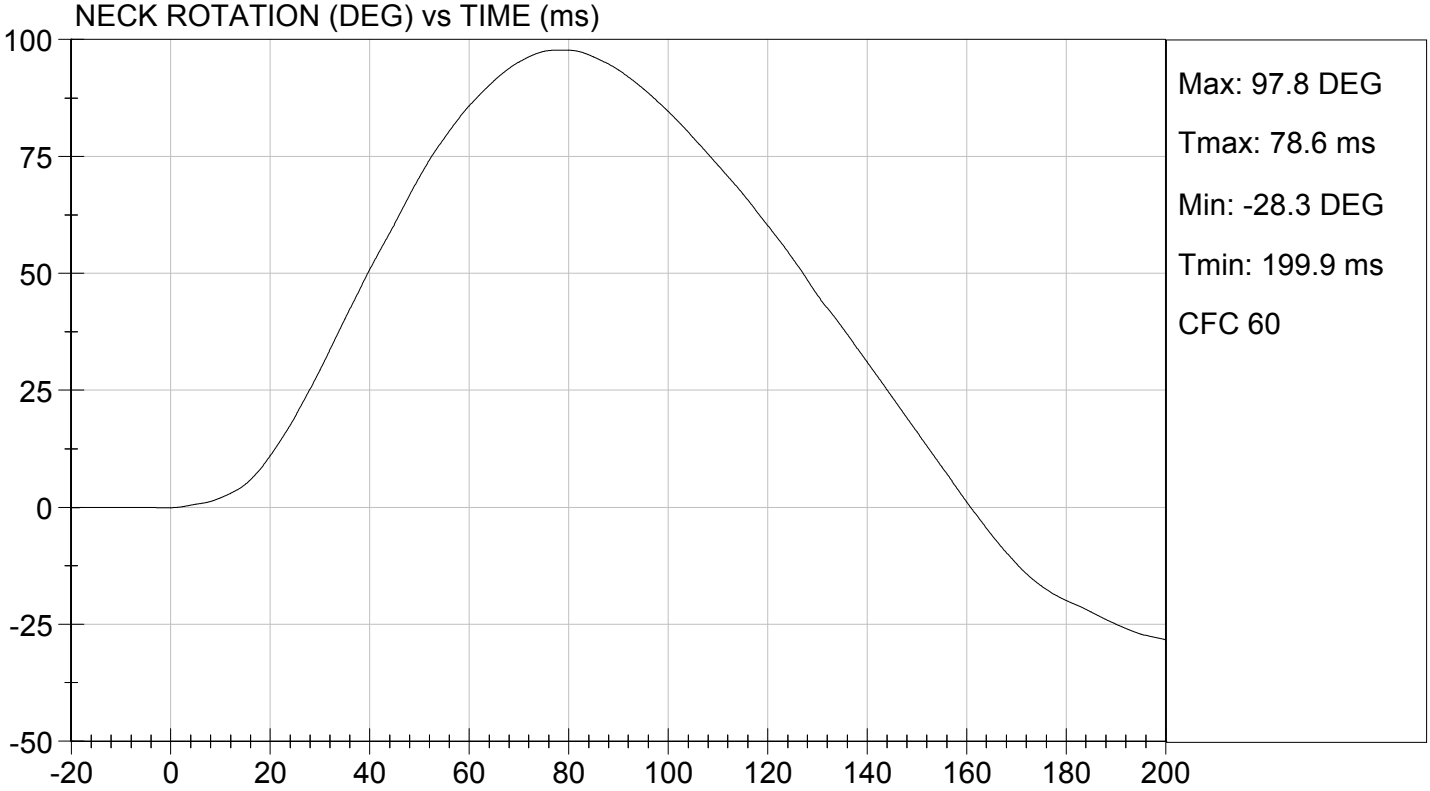
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 02/02/2016
TEST #: D16443

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

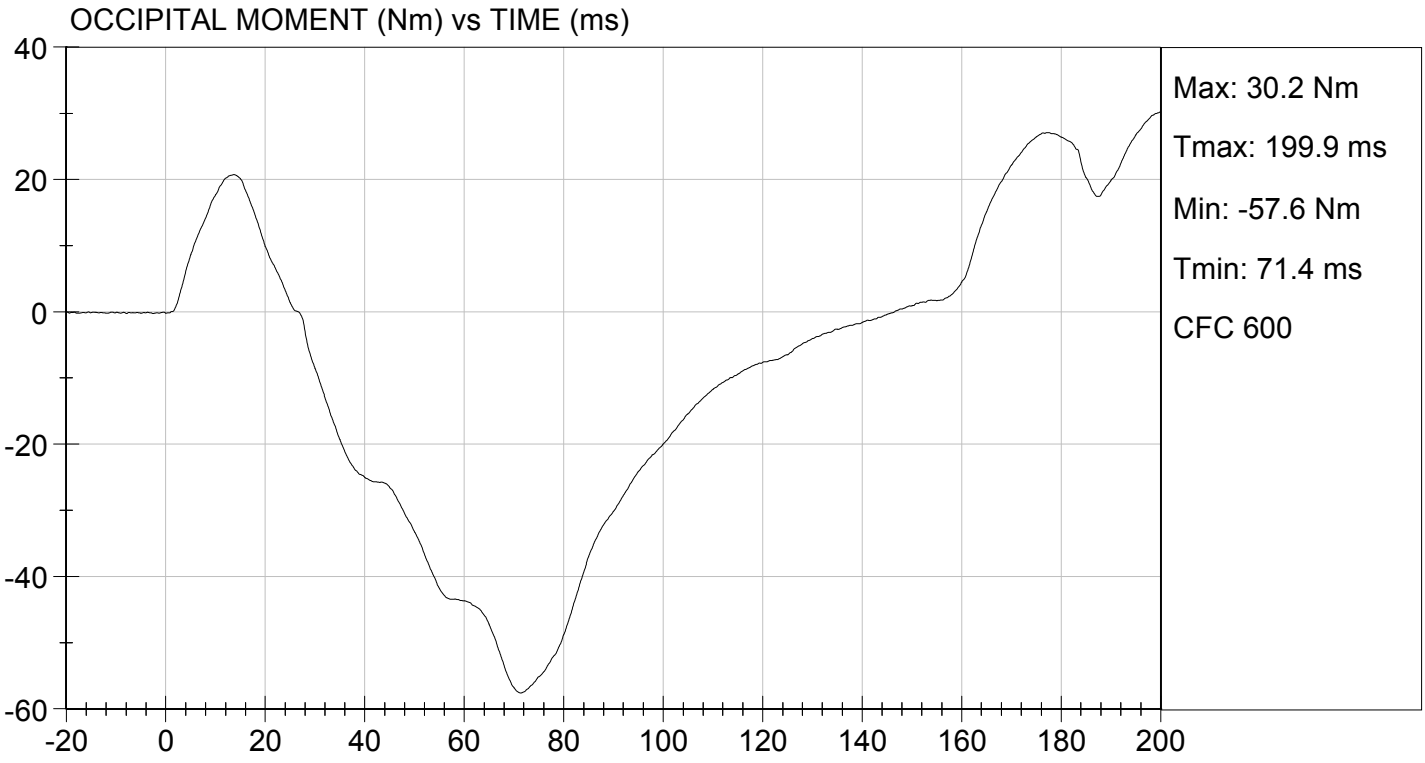



NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 02/02/2016
TEST #: D16443



**DATA SHEET A6**

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 403 Test Date: 02/02/2016

Technician: Andy Warczytowa

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 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 12A.

_X_ 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))

_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. (572.34(c)(1))

| | |
|---|---|
| Record the maximum temperature: | 21.2°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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 (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.

_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 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 ± 0.5° and adjust the pelvis angle to 13° ± 2°. 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 ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° 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 ± 2° 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° 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 f/s ± 0.4 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))

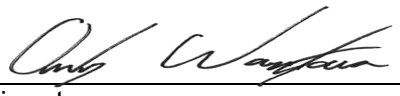
| Parameter* | Specification | Result |
|---|---|---|
| Test Probe Speed | 21.6 ft/s ≤ speed ≤ 22.4 ft/s | 21.93 ft/s |
| Chest Compression | 2.5 in. ≤ compression ≤ 2.86 in. | 2.63 in. |
| Peak resistance force** | 1160 lb ≤ peak force ≤ 1325 lb | 1309 lb |
| Internal Hysteresis*** | 69% ≤ hysteresis ≤ 85% | 73 % |

*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

02/02/2016

Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16444

| 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 | 28 | Pass |
| Probe Velocity | m/s | 6.58 to 6.82 | 6.68 | Pass |
| Peak Probe Force | N | 5159 to 5893 | 5,823 | Pass |
| Peak Sternum Displacement | cm | 6.35 to 7.26 | 6.67 | Pass |
| Internal Hysteresis | % | 69 to 85 | 73 | Pass |
| | | Overall Test Results | | Pass |

Laboratory Technician

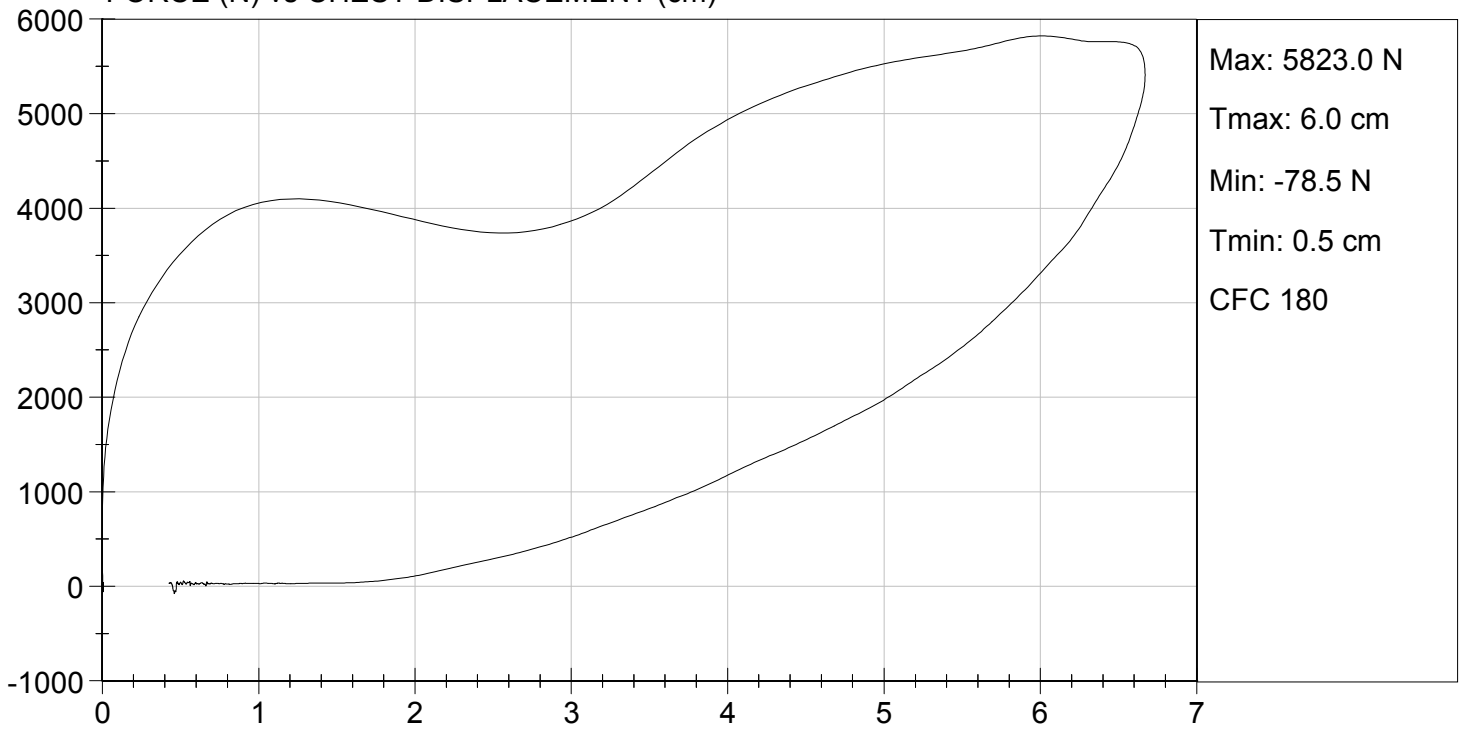
02/02/2016
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 02/02/2016
TEST #: D16444

FORCE (N) vs CHEST DISPLACEMENT (cm)



**DATA SHEET A7**
LEFT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 403 Test Date: 02/02/2016

Technician: Thomas Miller

____ Pre test calibration
_X_ Post test calibration verification

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

_X_ 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°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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))

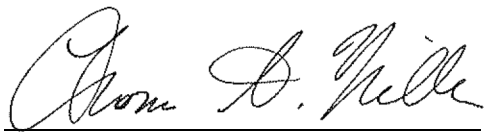
X 11. Complete the following table:

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

| Parameter | Specification | Result |
|---|---|---|
| Probe speed | 6.8 ft/s ≤ speed ≤ 7.0 ft/s | 6.94 ft/s |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb | 1156 lb |

*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

02/02/2016

Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16446

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 26 | Pass |
| Probe Velocity | m/s | 2.07 to 2.13 | 2.12 | Pass |
| Peak Probe Force | N | 4715 to 5782 | 5,140 | Pass |
| | | Overall Test Results | | Pass |

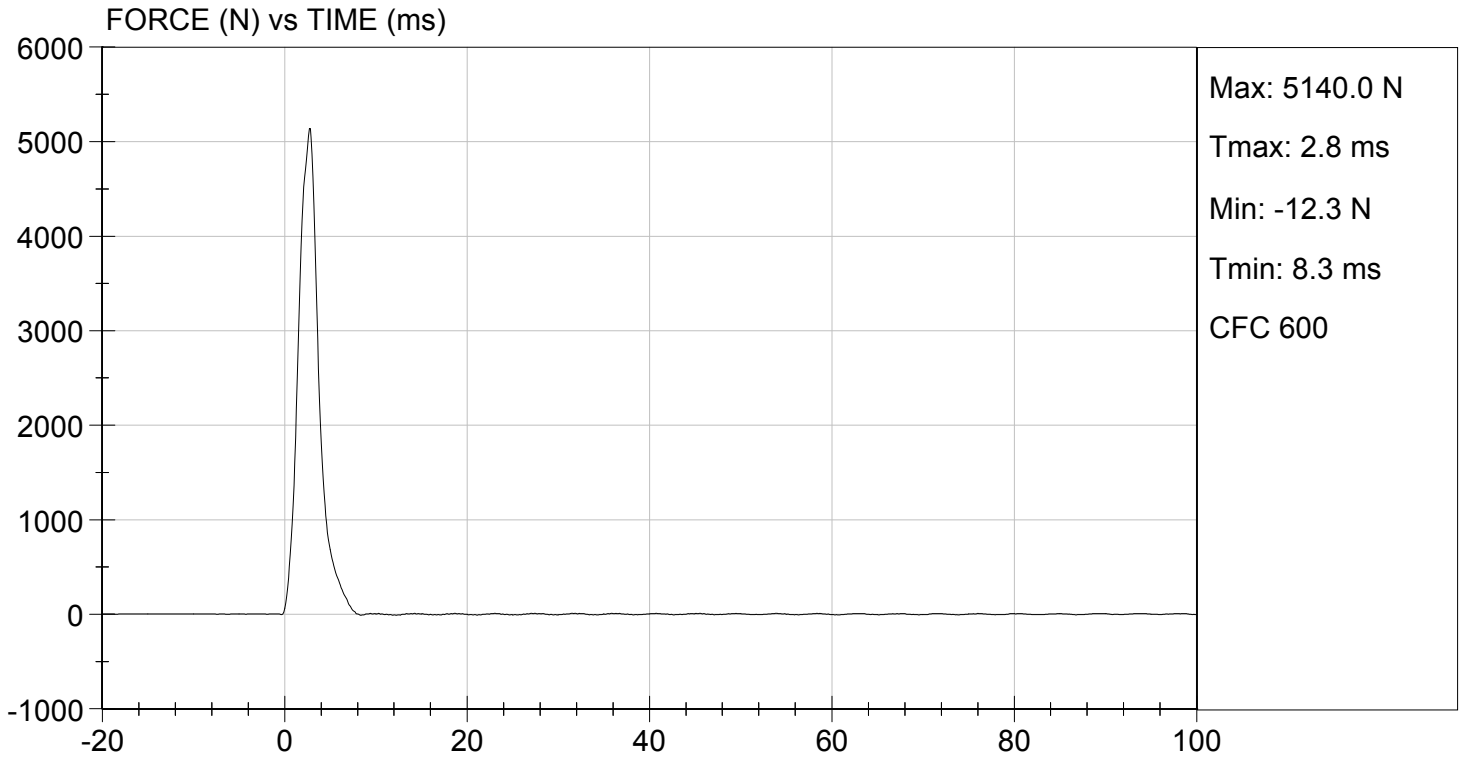
Laboratory Technician

02/02/2016
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.94 ft/s, 2.12 m/s

TEST DATE: 02/02/2016
TEST #: D16446



**DATA SHEET A8**

RIGHT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 403 Test Date: 02/02/2016

Technician: Thomas Miller

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 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 (86-5001-002) with the upper leg assembly (78051-47) 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°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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))

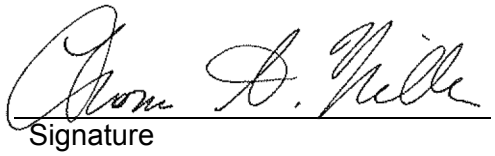
X 11. Complete the following table:

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

| Parameter | Specification | Result |
|---|---|---|
| Probe speed | 6.8 ft/s ≤ speed ≤ 7.0 ft/s | 6.89 ft/s |
| Peak resistance force* | 1060 lb ≤ force ≤ 1300 lb | 1179 lb |

*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

02/02/2016

Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16445

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.0 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 28 | Pass |
| Probe Velocity | m/s | 2.07 to 2.13 | 2.10 | Pass |
| Peak Probe Force | N | 4715 to 5782 | 5,245 | Pass |
| | | Overall Test Results | | Pass |

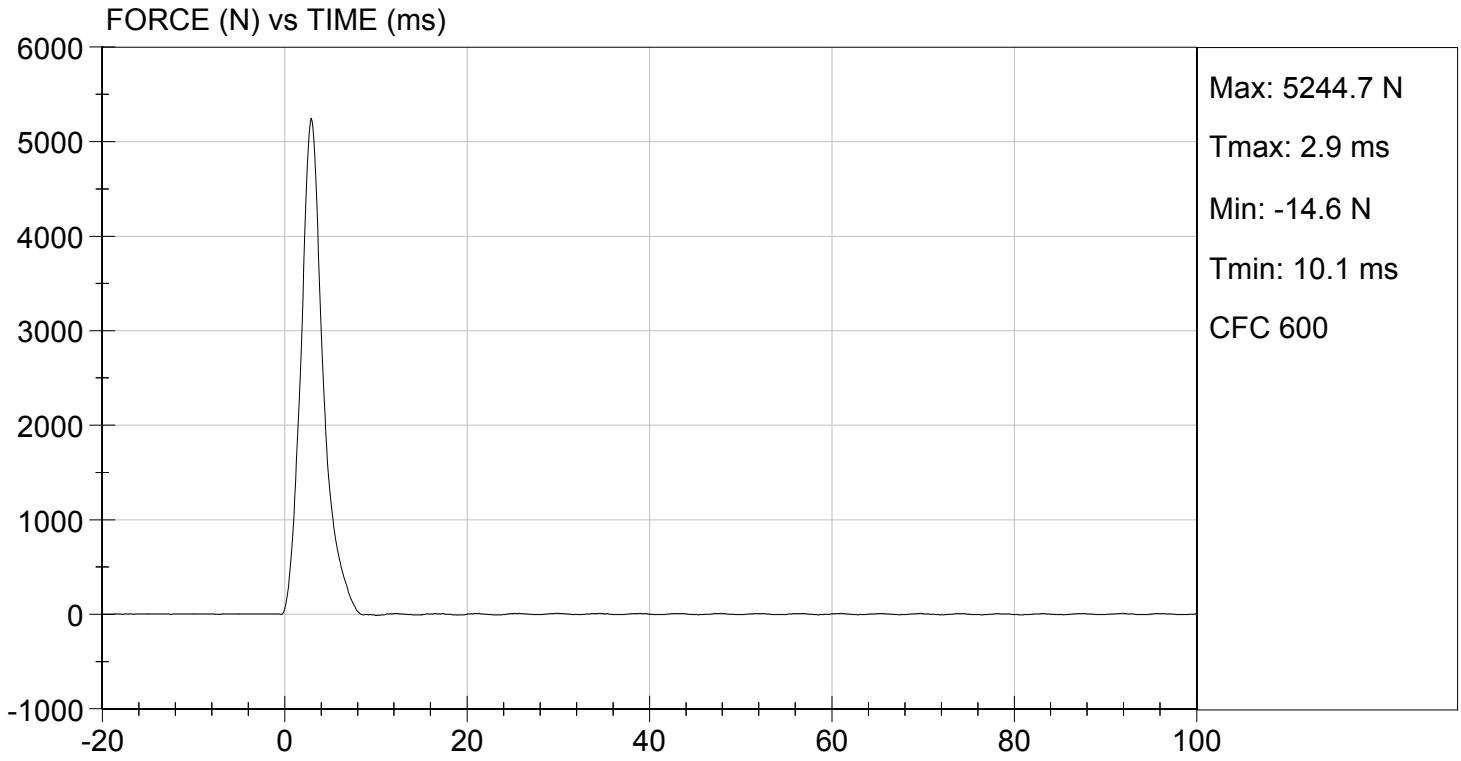
Laboratory Technician

02/02/2016
Test Date

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 02/02/2016
TEST #: D16445



**DATA SHEET A9**

HIP JOINT-FEMUR FLEXION (572.35(c)) (50th Male)

Dummy Serial Number: 403 Test Date: 02/02/2016

Technician: Andy Warczytowa

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 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: | 21.2°C |
| Record the minimum temperature: | 20.9°C |
| Record the maximum humidity: | 28% |
| Record the minimum humidity: | 26% |

_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°/s ≤ rotation rate ≤ 10°/s | 6.4°/s |
| Femur Torque at 30° | Torque ≤ 70 ft-lbf | 47.1 ft-lbf |
| Rotation at 150 lbf-ft | 40° ≤ rotation ≤ 50° | 48.2° |

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 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 13. Complete the following table:

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

| Parameter | Specification | Result |
|---|---|---|
| Rotation Rate | 5°/s ≤ rotation rate ≤ 10°/s | 6.3°/s |
| Femur Torque at 30° | torque ≤ 70 ft-lbf | 58.4 ft-lbf |
| Rotation at 150 lbf-ft | 40° ≤ rotation ≤ 50° | 43.9° |

Signature

02/02/2016

Date

**MGA RESEARCH CORPORATION**

**HIP-FEMUR FLEXION TEST**

**HYBRID III 50TH PERCENTILE MALE**

**ATD Serial No:** 403 **Test I.D:** D16440

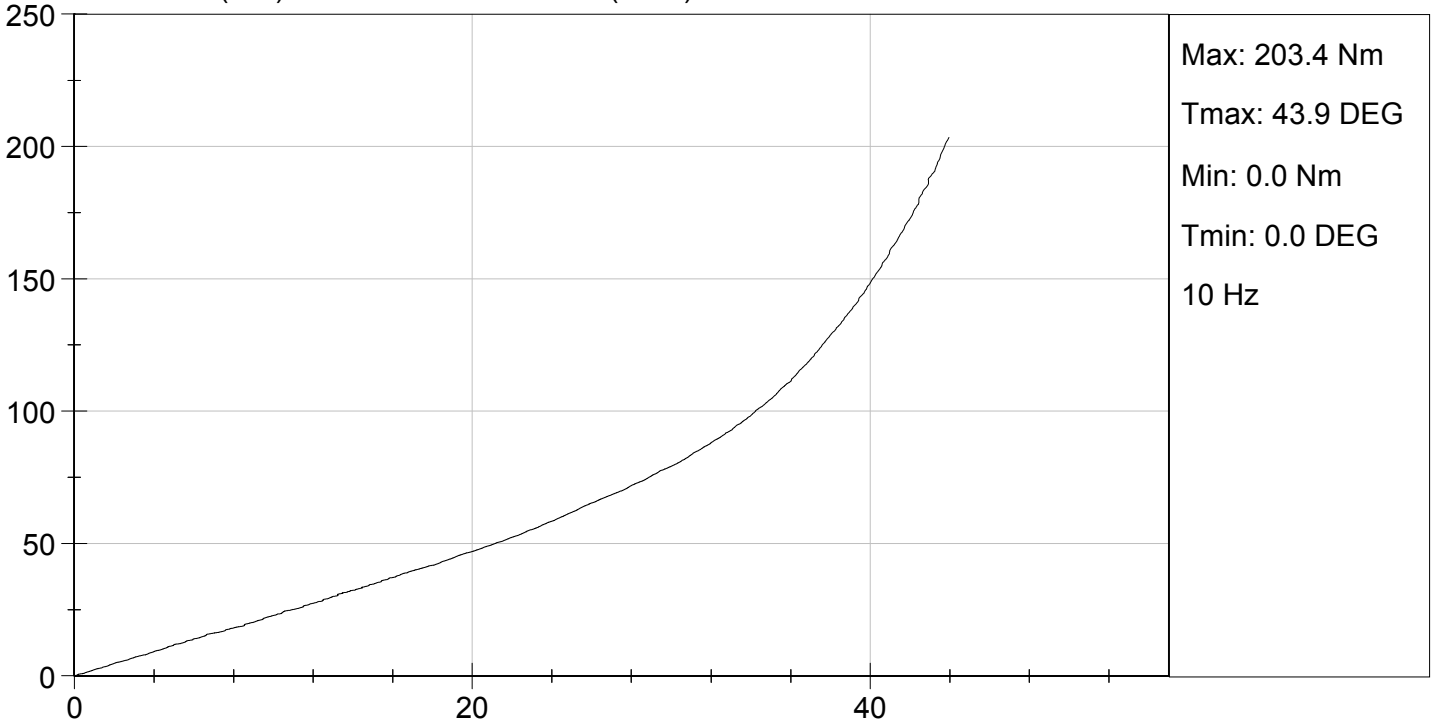
| Tested Parameter | Units | Specification | Result | | Pass/Fail |
|---|---|---|---|---|---|
| | | | Right | Left | |
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.0 | 21.0 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 28 | 28 | Pass |
| Rotation Rate | deg/s | 5.0 to 10.0 | 6.3 | 6.4 | Pass |
| 30 Degrees | Nm | 94.9 Nm Max | 79.2 | 63.9 | Pass |
| 150 ft-lbf / 203.4 Nm | Deg | 40.0 to 50.0 Degree Max Rotation | 43.9 | 48.2 | Pass |
| | | Overall Test Results | | | Pass |

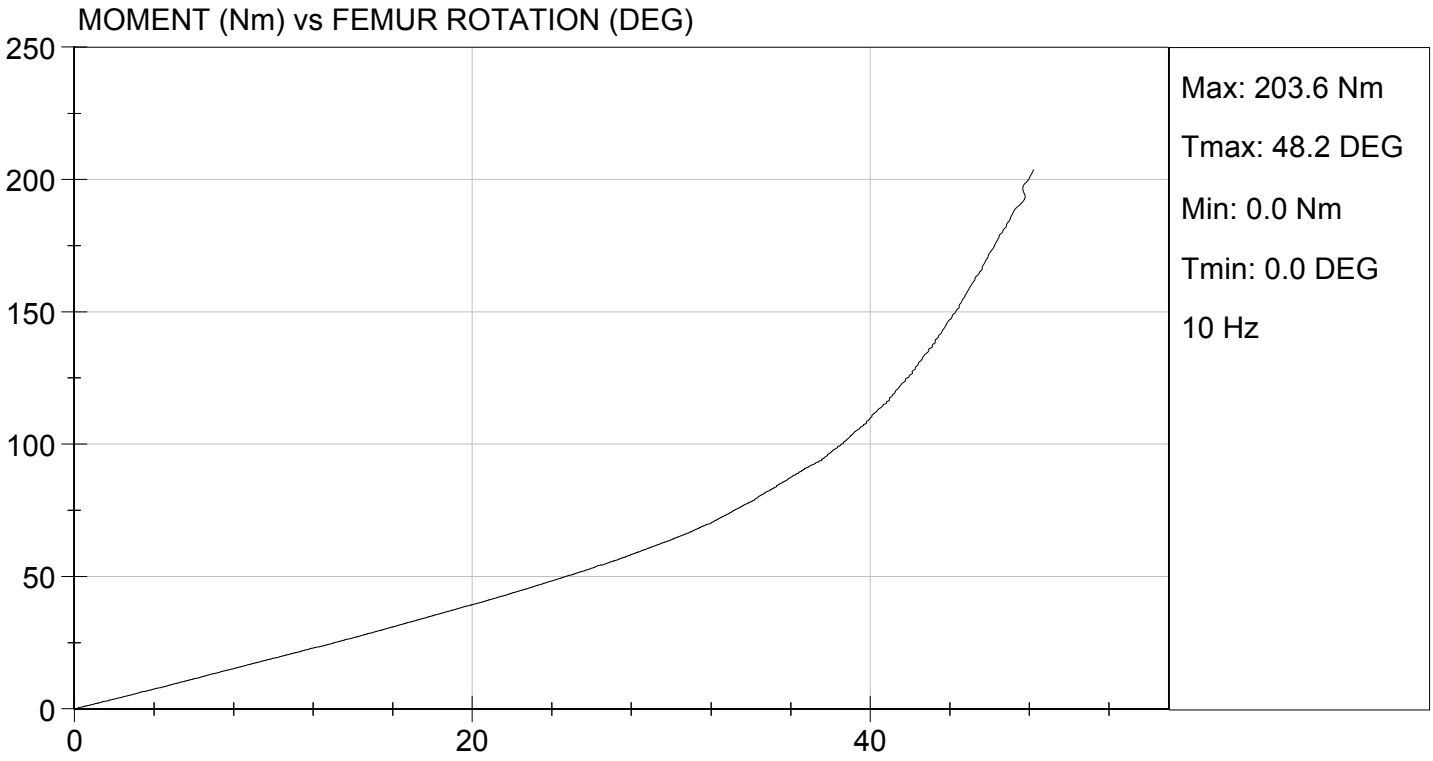
Laboratory Technician

02/02/2016
Test Date

Approved By

MOMENT (Nm) vs FEMUR ROTATION (DEG)




MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.6 Nm
Tmax: 48.2 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz

## DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO. | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---|---|---|---|---|---|
| DUMMY INSTRUMENTATION | | | | | |
| HEAD ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7231C-750 | AGH70 | 09/11/2015 | 03/11/2016 |
| (2) LATERAL | Endevco | 7231C-750 | AH5E5 | 09/11/2015 | 03/11/2016 |
| (3) VERTICAL | Endevco | 7231C-750 | C10591 | 09/11/2015 | 03/11/2016 |
| NECK TRANSDUCER | Denton | 1716 | 1157 | 10/21/2015 | 4/21/2016 |
| CHEST ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7231C-750 | AGH74 | 09/11/2015 | 03/11/2016 |
| (2) LATERAL | Endevco | 7231C-750 | C10686 | 09/11/2015 | 03/11/2016 |
| (3) VERTICAL | Endevco | 7231C-750 | C13046 | 09/11/2015 | 03/11/2016 |
| CHEST POTENTIOMETER | Servo | 14CBI-2897 | 403 | 09/10/2015 | 03/10/2016 |
| FEMUR LOAD CELLS | | | | | |
| (1) RIGHT FEMUR | Denton | 2121 | 8804 | 09/10/2015 | 03/10/2016 |
| (2) LEFT FEMUR | Denton | 2121 | 8805 | 09/10/2015 | 03/10/2016 |
| LABORATORY INSTRUMENTATION | | | | | |
| NECK PENDULUM ACCELEROMTER | Endevco | 7231C-750 | AH5P1 | 01/25/2016 | 07/25/2016 |
| THORAX PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P82097 | 11/30/2015 | 05/30/2016 |
| KNEE PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P88169 | 11/30/2015 | 05/30/2016 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol | 132-0-0-102 | 18 | 01/22/2016 | 07/22/2016 |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol | 132-0-0-102 | 29 | 09/28/2015 | 03/28/2016 |

LABORATORY TECHNICIAN: Jessica Hall

**DATA SHEET B1**
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 403 Test Date: 02/02/2016

Technician: Jessica Gall

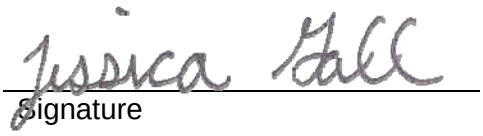
This check sheet is completed as part of the post test calibration verification.

X Perform general cleaning.

| Dummy Item | Inspect for | Comments | Damage | 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 |
| 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:

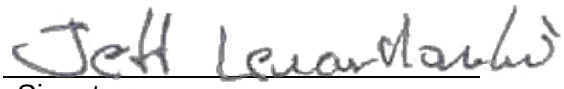


Signature

02/02/2016
Date

Describe the repair or replacement of parts:

Checked by:



Signature

02/02/2016
Date

## EXTERNAL DIMENSIONS

| HYBRID III 5th SN #510, 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 | 786.2 |
| B | SHOULDER PIVOT HEIGHT | Centerline of shoulder pivot bolt to the seat surface. | 431.8-457.2 | 450.0 |
| C | H-POINT HEIGHT | Reference | 81.3-86.3 | 84.1 |
| D | H-POINT LOCATION FROM BACKLINE | Reference | 144.8-149.8 | 148.3 |
| E | SHOULDER PIVOT FROM BACKLINE | Center of the shoulder clevis to the rear vertical surface of the fixture. | 68.6-83.8 | 82.7 |
| F | THIGH CLEARANCE | Measured at the highest point on the upper femur segment. | 119.4-134.6 | 133.9 |
| 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 | 249.6 |
| H | HEAD BACK TO BACKLINE | Back of skull cap skin to seat rear vertical surface (Reference) | 43.2-48.2 | 44.0 |
| I | SHOULDER TO ELBOW LENGTH | Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt. | 276.8-297.2 | 278.5 |
| J | ELBOW REST HEIGHT | Measure from the flesh below the elbow pivot bolt to the seat surface. | 182.8-203.2 | 202.1 |
| 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 | 543.6 |
| L | POPLITEAL HEIGHT | Seat surface to the plane of the horizontal plane of the bottom of the feet. | 355.6-376.0 | 358.5 |
| M | KNEE PIVOT HEIGHT | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet. | 393.7-419.1 | 397.0 |
| N | BUTTOCK POPLITEAL LENGTH | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. “K”. | 414.0-439.4 | 434.2 |

| HYBRID III 5th SN #510, PART 572, SUBPART O EXTERNAL DIMENSIONS, continued | | | | |
|---|---|---|---|---|
| DIMENSION | DESCRIPTION | DETAILS | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| O | CHEST DEPTH WITHOUT JACKET | Measured 304.8 ± 5.1 mm above seat surface | 175.3-190.5 | 181.0 |
| P | FOOT LENGTH | Tip of toe to rear of heal | 218.5-233.7 | 221.4 |
| Q | STANDING HEIGHT | (THEORETICAL) | 1501.1 | N/A |
| R | BUTTOCK TO KNEE PIVOT LENGTH | The rear surface of the buttocks to the knee pivot bolt | 457.2-482.6 | 482.0 |
| S | HEAD BREADTH | The widest part of the head | 137.1-147.3 | 138.6 |
| T | HEAD DEPTH | Back of the head to the forehead | 177.8-188.0 | 179.9 |
| U | HIP BREADTH | The widest part of the hip | 299.7-314.9 | 301.5 |
| V | SHOULDER BREADTH | Outside edges of right and left shoulder clevises | 350.5-365.7 | 351.4 |
| W | FOOT BREADTH | The widest part of the foot | 78.8-94.0 | 79.0 |
| X | HEAD CIRCUMFERENCE | Measured at the point as in dim. “T” | 528.3-548.7 | 539.5 |
| Y | CHEST CIRCUMFERENCE (WITH CHEST JACKET) | Measured 345.4 ± 12.7 mm above seat surface | 850.9-881.3 | 876.4 |
| Z | WAIST CIRCUMFERENCE | Measured 165.1 ± 5.1 mm above seat surface | 759.5-789.9 | 788.3 |
| AA | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference | 332.7-358.1 | 334.0 |
| BB | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference | 160.1-170.2 | 168.0 |

**DATA SHEET B3**

HEAD DROP TEST (572.132) (5th Female)

Dummy Serial Number: 510 Test Date: 12/15/2015

Technician: Jack Coleman

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one head drop performed

X 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))

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

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

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

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

X 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: | 21.2°C |
| Record the minimum temperature: | 21.1°C |
| Record the maximum humidity: | 39% |
| Record the minimum humidity: | 33% |

X 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

X 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 ± 1.0 mm (14.8 ± 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: 501 mm

Record the left side distance: 501 mm

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: 50.9 micro inches

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 ± 1.0 mm (14.8 inches ± 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 g ≤ x ≤ 300 g | 278 g |
| 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 ≤ 15 g | 5.6 g |

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

Jack Coleman
Signature

12/15/2015
Date

**MGA RESEARCH CORPORATION**

**HEAD DROP TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test ID:** D154211

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 39 | Pass |
| Peak Resultant Acceleration | G's | 250 to 300 | 278 | Pass |
| Peak Lateral Acceleration | G's | <= +/- 15.0 | 5.6 | Pass |
| Unimodal | N/A | Yes | Yes | Pass |
| Oscillations | N/A | within 10% of peak | Yes | Pass |
| | | Overall Test Results | | Pass |

Jack Coleman
Laboratory Technician

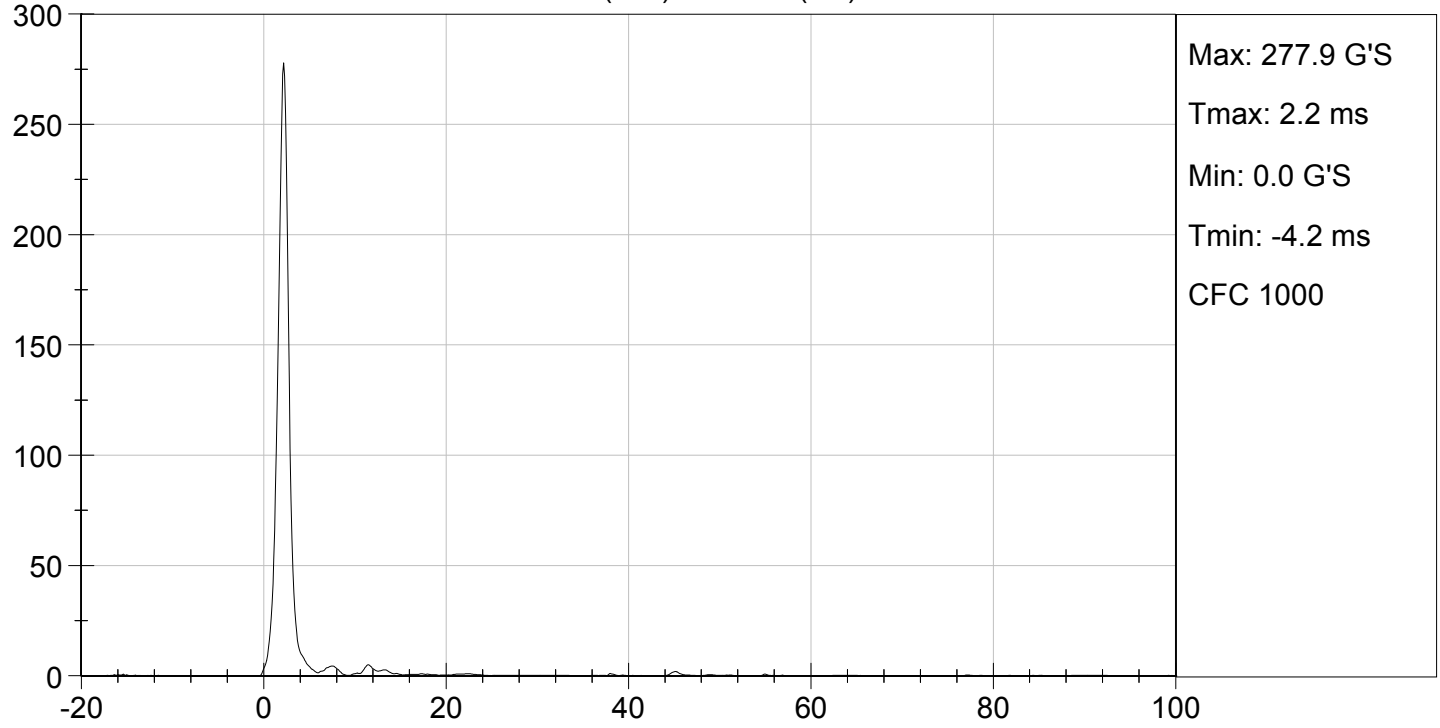
12/15/2015
Test Date

Jeff Leonardski
Approved By

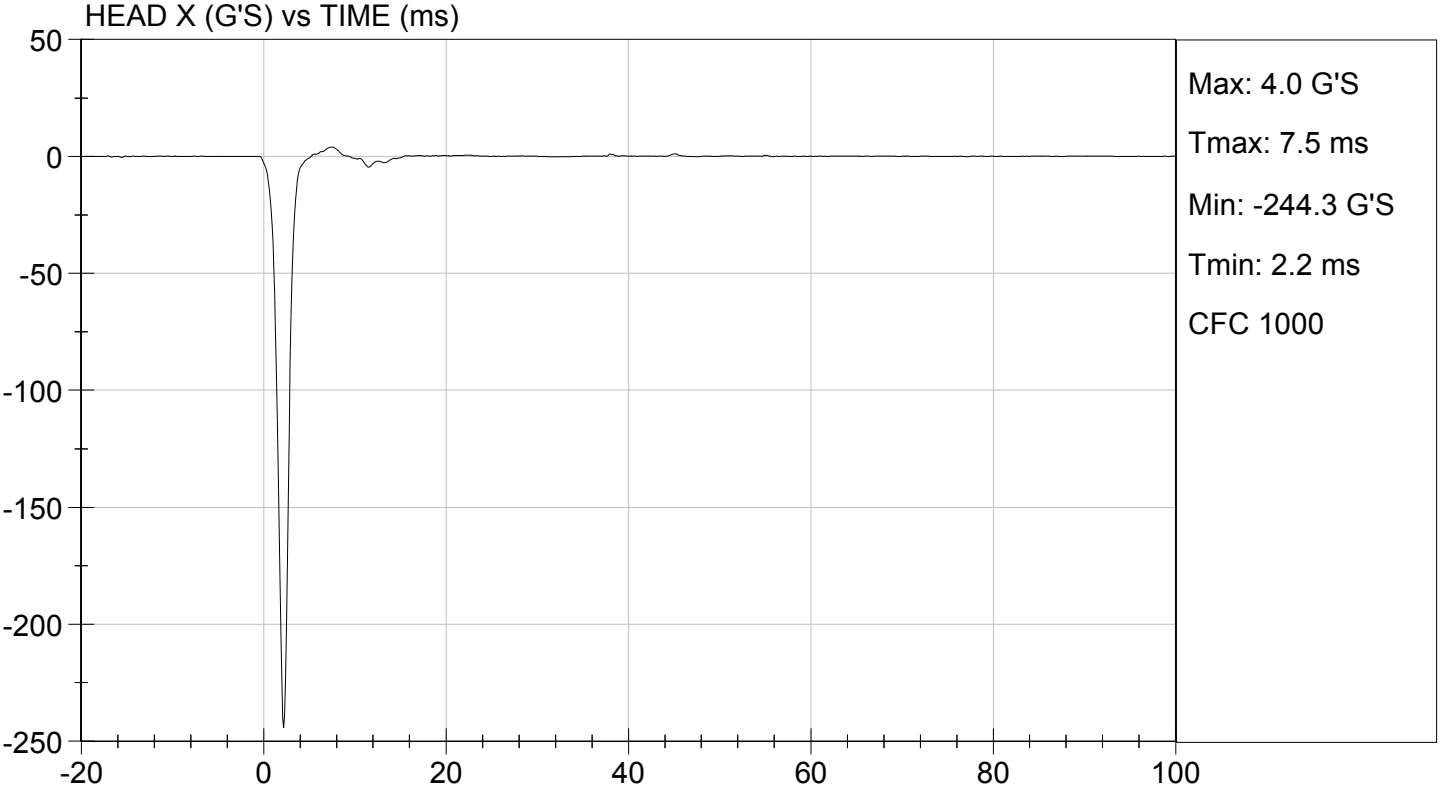
TEST DESC: HEAD DROP

TEST DATE: 12/15/2015
TEST #: D154211

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



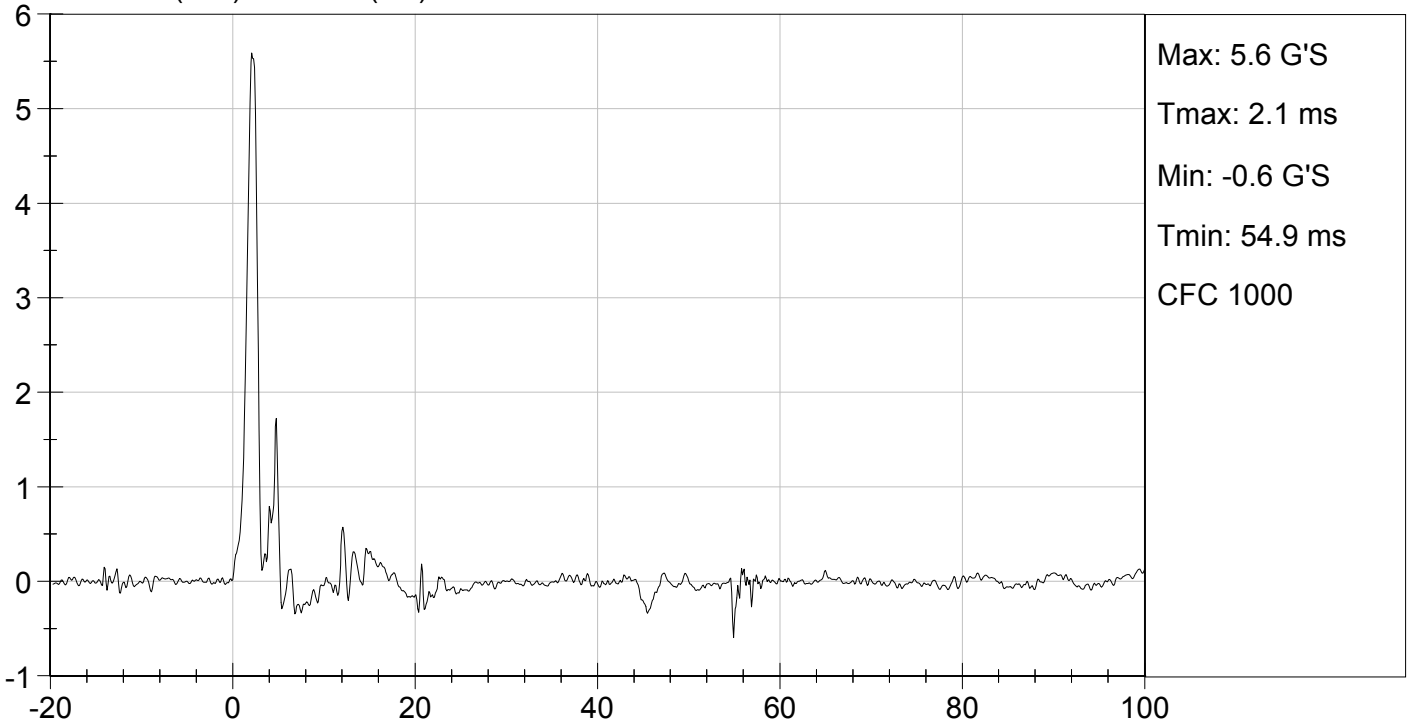

HEAD X (G'S) vs TIME (ms)



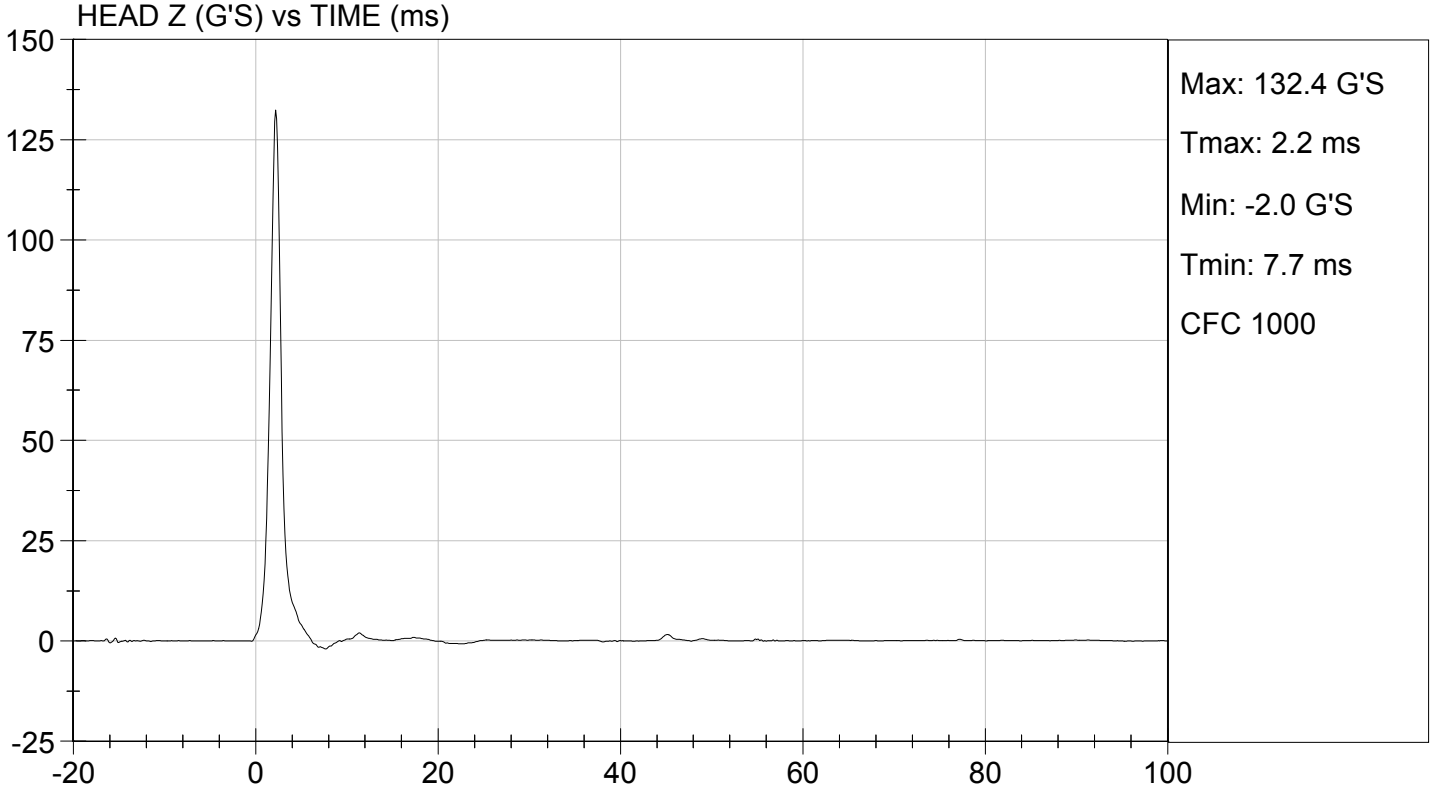
TEST DESC: HEAD DROP

TEST DATE: 12/15/2015
TEST #: D154211

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




HEAD Z (G'S) vs TIME (ms)



**DATA SHEET B4**

NECK FLEXION TEST (572.132) (5th Female)

Dummy Serial Number: 510 Test Date: 12/15/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck 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: | 21.2°C |
| Record the minimum temperature: | 21.1°C |
| Record the maximum humidity: | 39% |
| Record the minimum humidity: | 33% |

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 90.

X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 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 ± 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) & 572.133(c)(4)(I & ii))

| Parameter | | Specification | Results |
|---|---|---|---|
| Pendulum impact speed | | 6.89 m/s ≤ speed ≤ 7.13 m/s | 7.06 m/s |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 2.1 m/s ≤ $\Delta V$ ≤ 2.5 m/s | 2.4 m/s |
| | @ 20 ms | 4.0 m/s ≤ $\Delta V$ ≤ 5.0 m/s | 4.5 m/s |
| | @ 30 ms | 5.8 m/s ≤ $\Delta V$ ≤ 7.0 m/s | 6.2 m/s |
| Plane D Rotation | | Peak moment*<br>69 Nm ≤ moment ≤ 83 Nm during the following rotation range<br>77° ≤ angle ≤ 91° | 70 Nm @ 84 degrees |
| Positive Moment Decay** (Flexion) | | Time to decay to 10 Nm<br>80 ms ≤ time ≤ 100 ms | 88 ms |

*Moment about the occipital condyle = $M_y$ – (0.01778 m x $F_x$)(572.133(b)(1)(ii))
My = Moment in Nm measured by the transducer
Fx = 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.

David Schoedel
Signature

12/15/2015
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D154212

| 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 | 39 | Pass |
| Pendulum Speed | | m/s | 6.89 to 7.13 | 7.06 | Pass |
| Pendulum Velocity | 10 ms | m/s | 2.1 to 2.5 | 2.4 | Pass |
| | 20 ms | m/s | 4.0 to 5.0 | 4.5 | Pass |
| | 30 ms | m/s | 5.8 to 7.0 | 6.2 | Pass |
| D Plane Rotation | Max | deg | 77 to 91 | 84 | Pass |
| Occipital Condyle Moment within Rotation Corridor | | Nm | 69 to 83 | 70 | Pass |
| Positive Moment Time Curve Decay to 10 Nm | | ms | 80 to 100 | 88 | Pass |
| | | | Overall Results | | Pass |

David Schoedel

Laboratory Technician

12/15/2015

Test Date

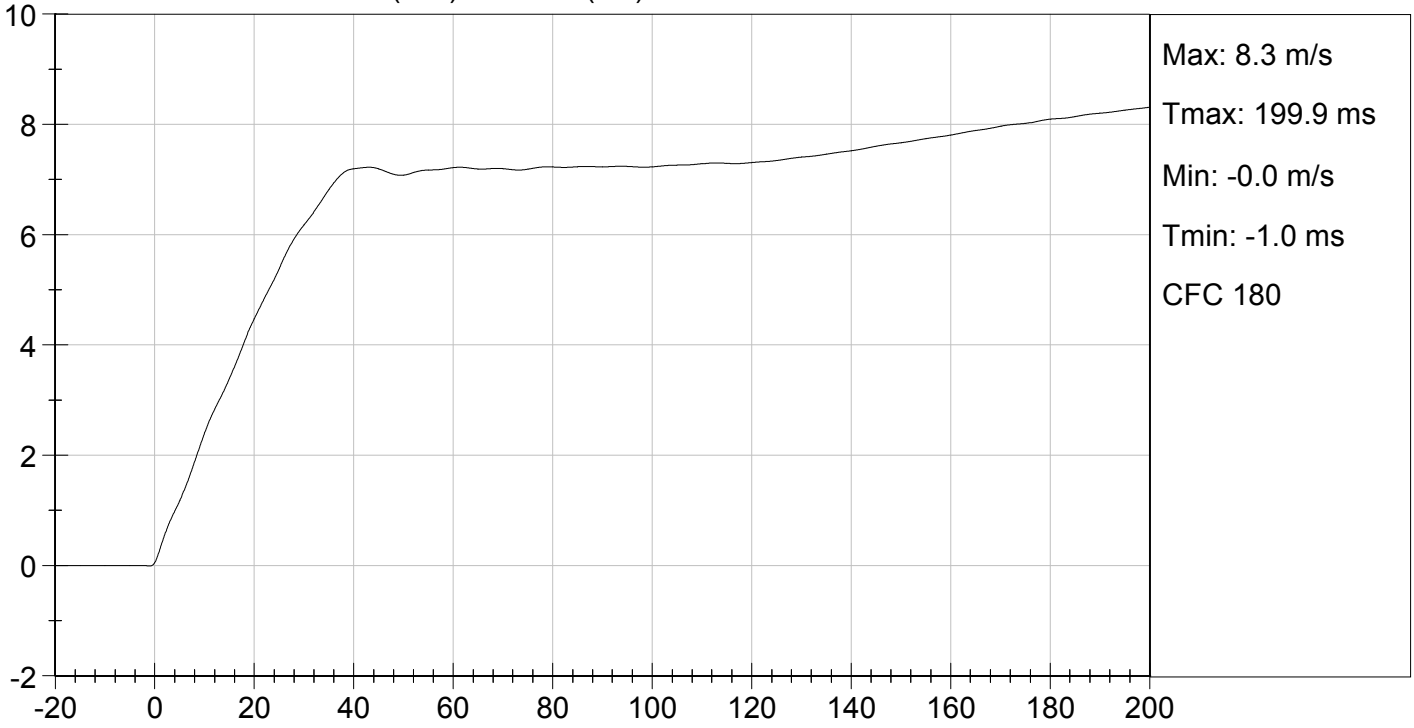
Jeff Leonardelli

Approved By

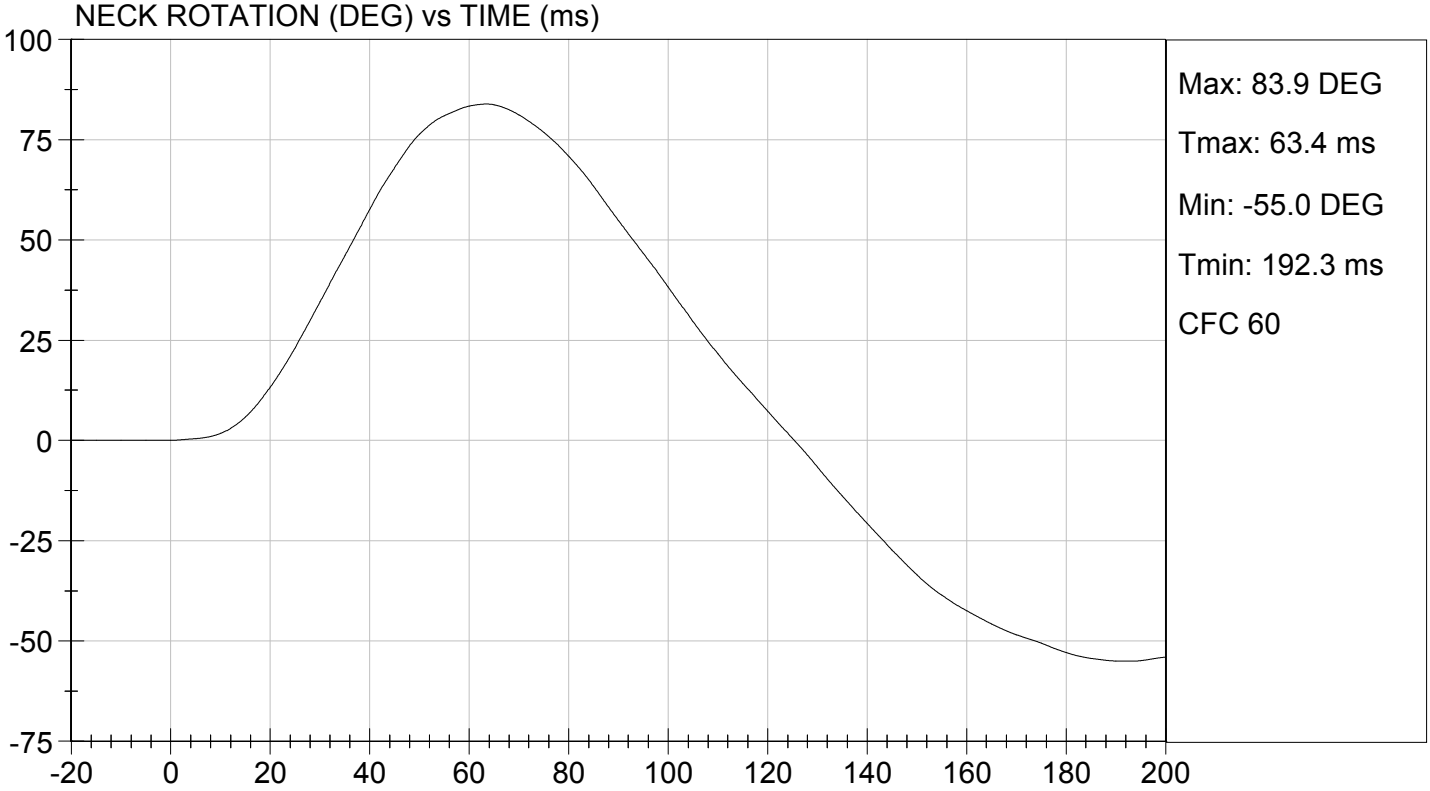
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 12/15/2015
TEST #: D154212

PENDULUM VELOCITY (m/s) vs TIME (ms)

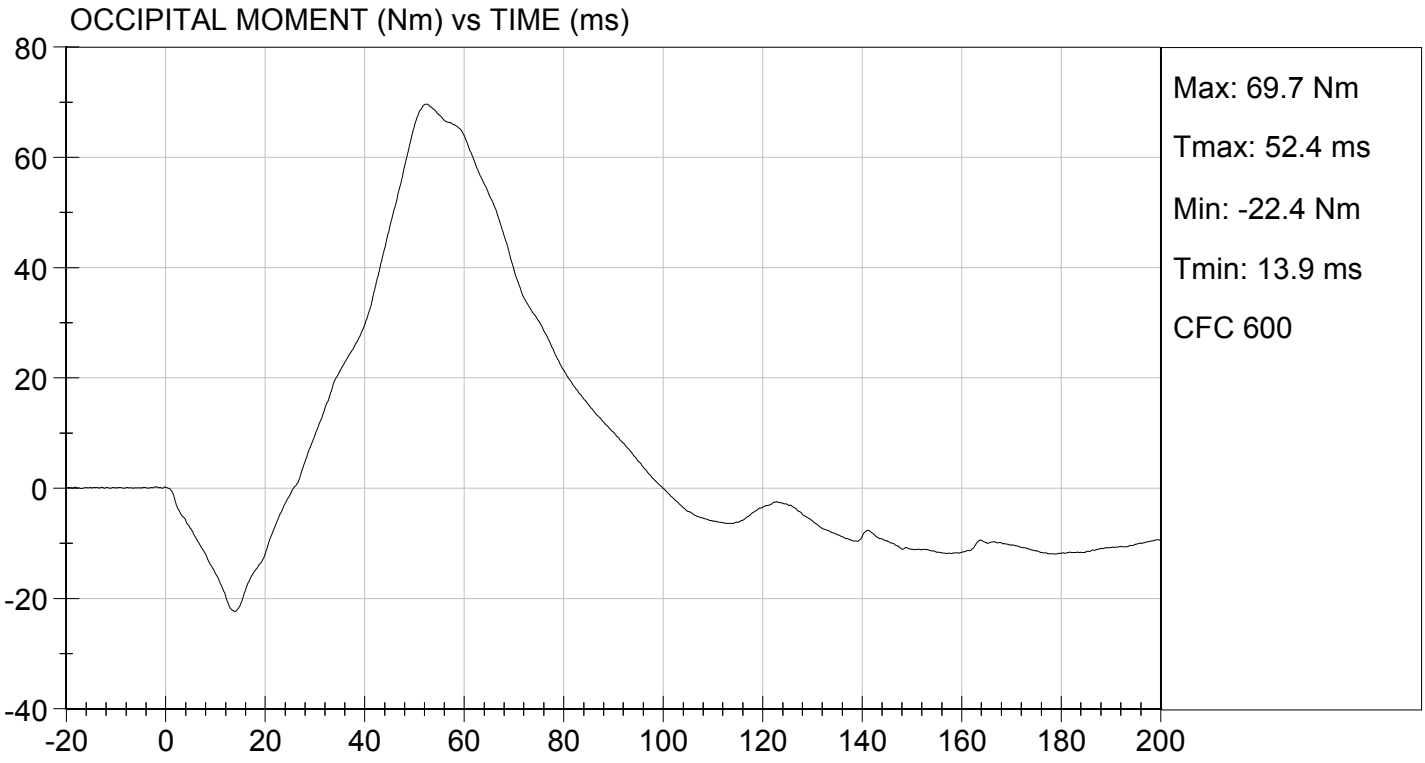



NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/15/2015
TEST #: D154212



**DATA SHEET B5**

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 510 Test Date: 12/15/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck 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: | 21.2°C |
| Record the minimum temperature: | 21.1°C |
| Record the maximum humidity: | 39% |
| Record the minimum humidity: | 33% |

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 90.

X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 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 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 ± 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) & 572.133(c)(4)(I & ii))

| Parameter | | Specification | Results |
|---|---|---|---|
| Pendulum impact speed | | 5.95 m/s ≤ speed ≤ 6.19 m/s | 6.12 m/s |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 1.5 m/s ≤ $\Delta V$ ≤ 1.9 m/s | 1.6 m/s |
| | @ 20 ms | 3.1 m/s ≤ $\Delta V$ ≤ 3.9 m/s | 3.5 m/s |
| | @ 30 ms | 4.6 m/s ≤ $\Delta V$ ≤ 5.6 m/s | 5.1 m/s |
| Plane D Rotation | | Peak moment*<br>-65 Nm ≤ moment ≤ -53 Nm during the following rotation range<br>99° ≤ angle ≤ 114° | -54 Nm @ 104 degrees |
| Positive Moment Decay** (Extension) | | Time to decay to -10 Nm<br>94 ms ≤ time ≤ 114 ms | 102 ms |

*Moment about the occipital condyle = $M_y$ – (0.01778 m x $F_x$)(572.133(b)(1)(ii))
My = Moment in Nm measured by the transducer
Fx = 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.

David Schoedel
Signature

12/15/2015
Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D154213

| 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 | 39 | Pass |
| Pendulum Speed | | m/s | 5.95 to 6.19 | 6.12 | Pass |
| Pendulum Velocity | 10 ms | m/s | 1.5 to 1.9 | 1.6 | Pass |
| | 20 ms | m/s | 3.1 to 3.9 | 3.5 | Pass |
| | 30 ms | m/s | 4.6 to 5.6 | 5.1 | Pass |
| D Plane Rotation | Max | deg | 99 to 114 | 104 | Pass |
| Occipital Condyle Moment within Rotation Corridor | | Nm | -65 to -53 | -54 | Pass |
| Negative Moment Time Curve Decay to -10 Nm | | ms | 94 to 114 | 102 | Pass |
| | | | Overall Results | | Pass |

David Schoedel

Laboratory Technician

12/15/2015

Test Date

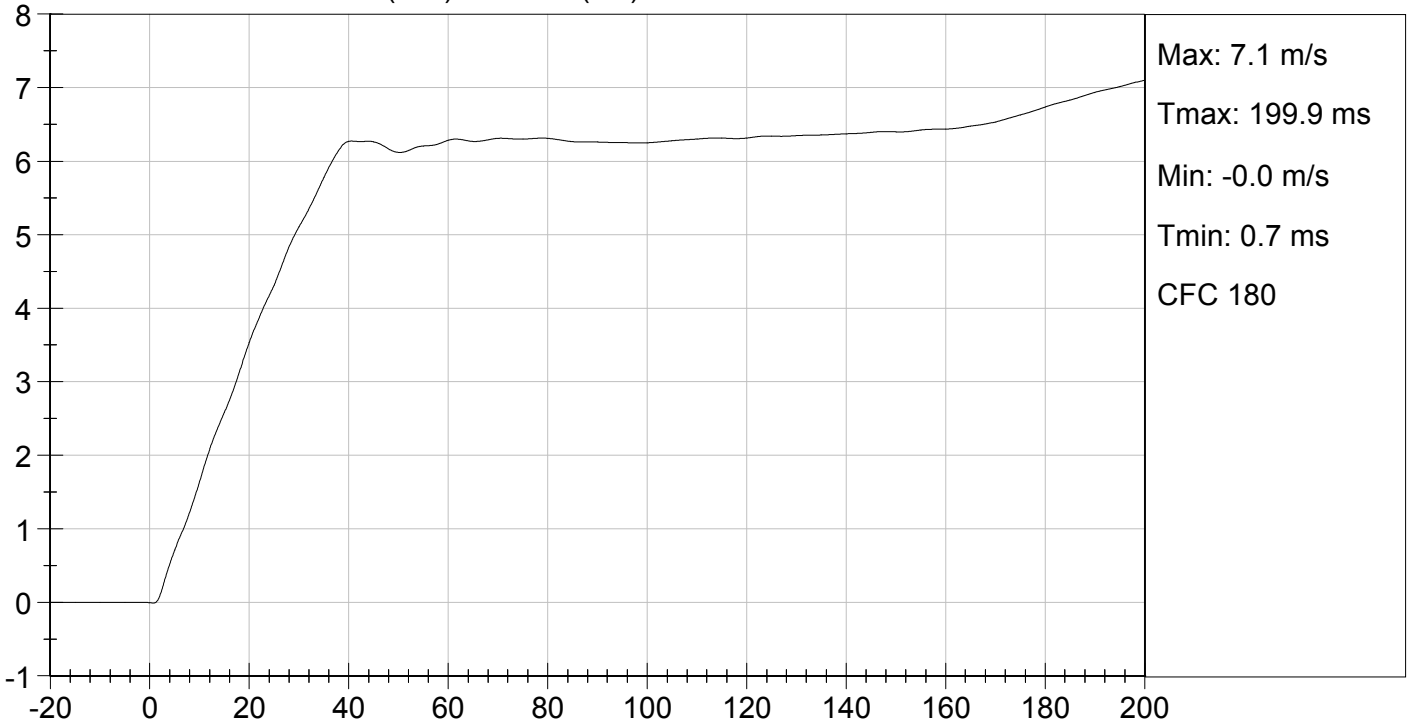
Jeff Leuenhagen

Approved By

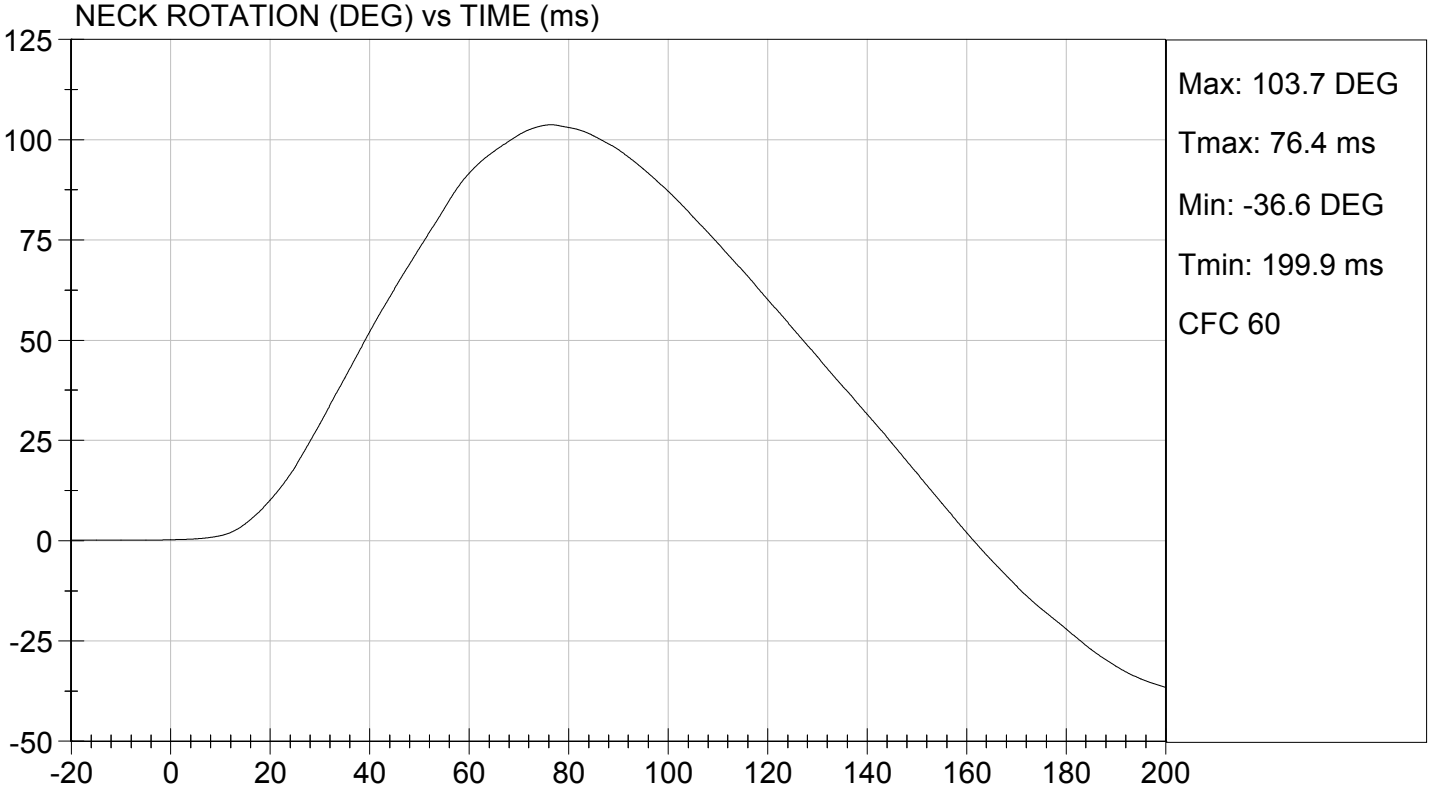
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 12/15/2015
TEST #: D154213

PENDULUM VELOCITY (m/s) vs TIME (ms)

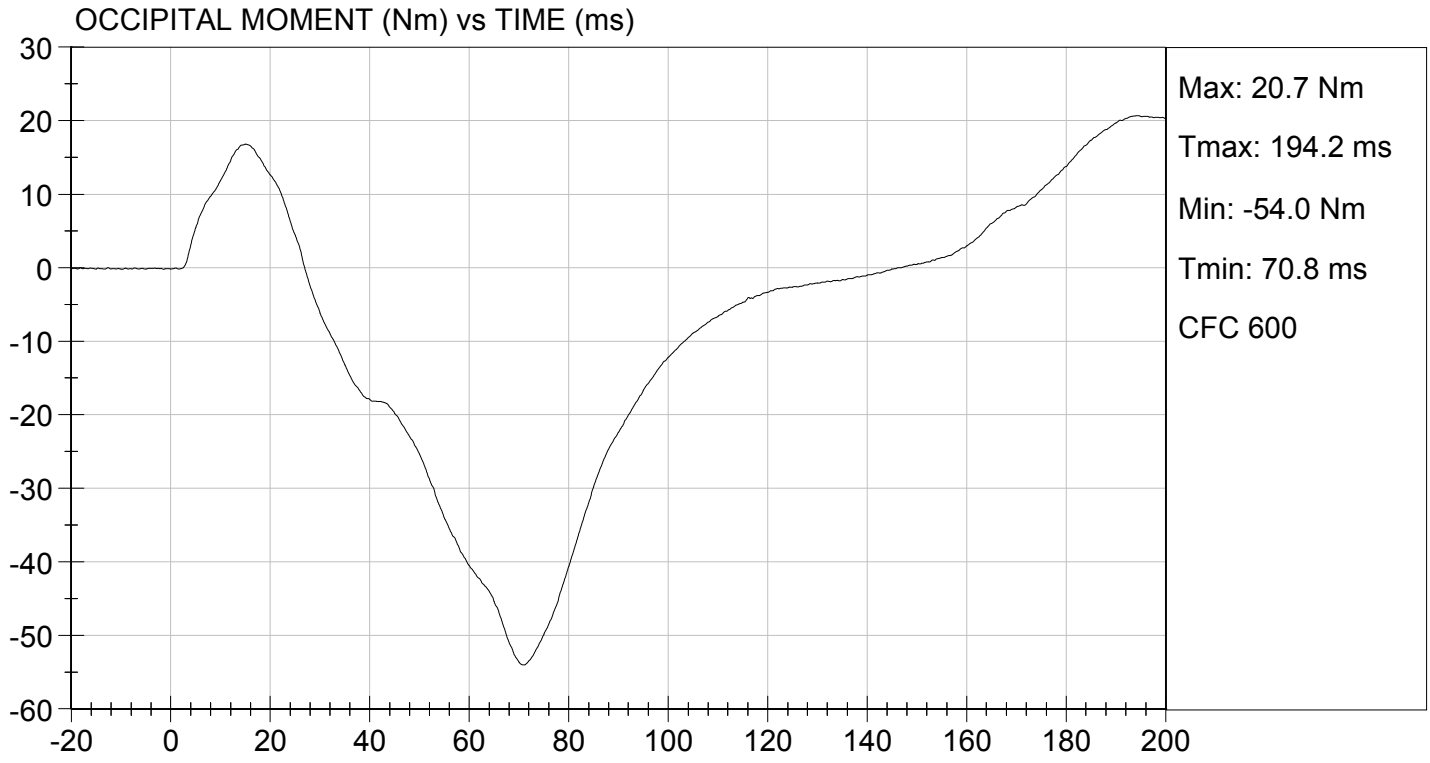



NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/15/2015
TEST #: D154213



**DATA SHEET B6**

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 510 Test Date: 12/15/2015

Technician: David Schoedel

X Pre test calibration

___ Post test calibration verification

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

X 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: | 21.2°C |
| Record the minimum temperature: | 21.1°C |
| Record the maximum humidity: | 39% |
| Record the minimum humidity: | 33% |

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 ± 0.5° and adjust the pelvis angle to 7° ± 2°. 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 ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° 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 ± 2° 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° 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 m/s ± 0.12m/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 m/s ≤ speed ≤ 6.83 m/s | 6.68 m/s |
| Chest Compression | 50.0 mm ≤ compression ≤ 58.0 mm | 51 mm |
| Peak force** between 50.0 and 58.0 mm chest compression | 3900N ≤ peak force ≤ 4400N | 4156 N |
| Peak Force** between 18.0 and 50.0 mm chest compression | Peak Force ≤ 4600 N | 4238 N |
| Internal Hysteresis*** | 69% ≤ hysteresis ≤ 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 (572.134(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.

David Schoedel

Signature

12/15/2015

Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D154214

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Temperature | deg C | 20.6 to 22.2 | 21.2 | Pass |
| Relative Humidity | % | 10 to 70 | 39 | Pass |
| Probe Speed | m/s | 6.59 to 6.83 | 6.68 | Pass |
| Peak Deflection | mm | 50 to 58 | 51 | Pass |
| Peak Resistive Force w/in Deflection Corridor | N | 3900 to 4400 | 4156 | Pass |
| Internal Hysteresis | % | 69 to 85 | 71 | Pass |
| Peak Force 18 mm - 50 mm | N | <= 4600 | 4238 | Pass |
| | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

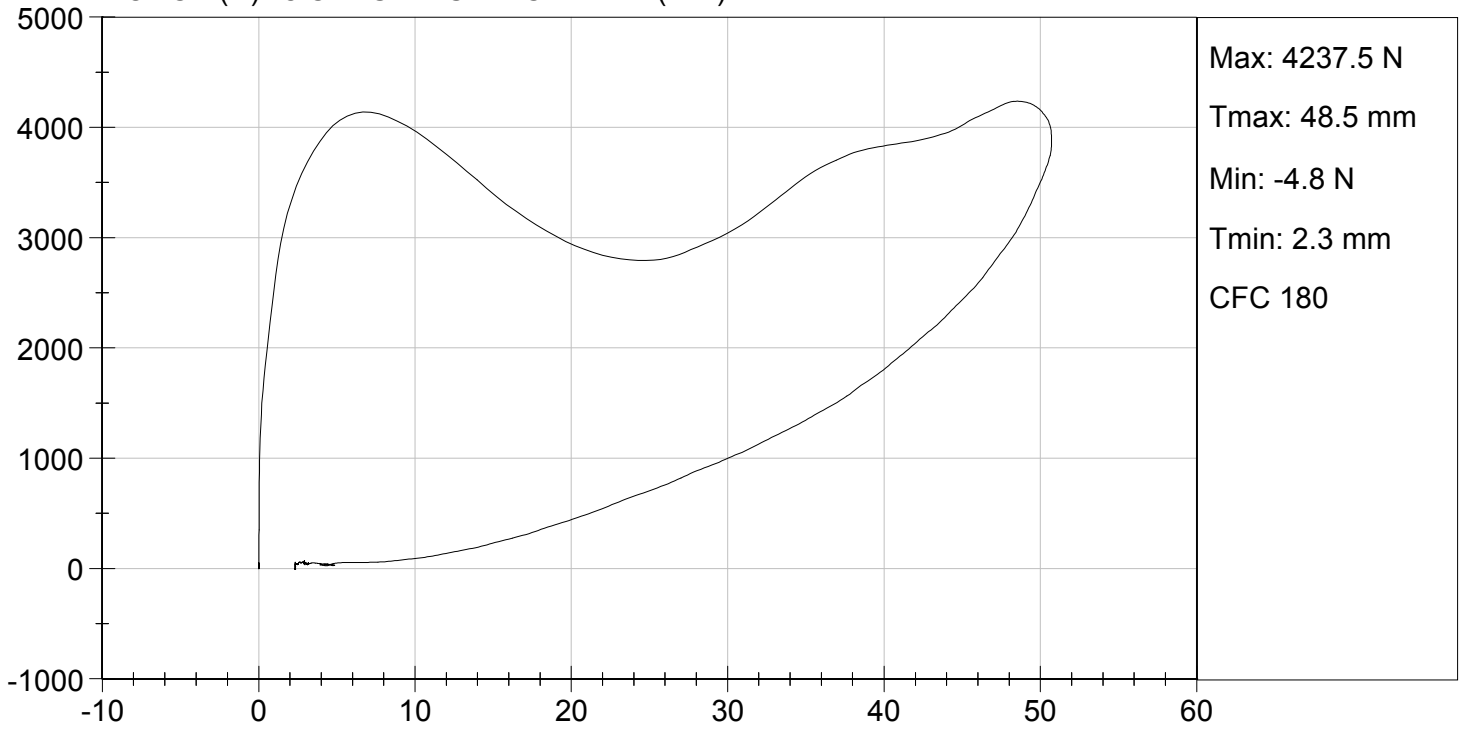
12/15/2015
Test Date

Jeff Leonardson
Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 12/15/2015
TEST #: D154214

FORCE (N) vs CHEST DISPLACEMENT (mm)



**DATA SHEET B7**
TORSO FLEXION TEST (572.135) (5th Female)

Dummy Serial Number: 510 Test Date: 12/15/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))
X N/A, ONLY one torso flexion 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 femurs.
X Without legs below 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: | 21.2°C |
| Record the minimum temperature: | 21.1°C |
| Record the maximum humidity: | 39% |
| Record the minimum humidity: | 33% |

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°): See Result Table

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° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))

X 14. Maintain angle reference plane at 45° ± 0.5° 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 ≤ 20° | 19 deg |
| Torso rotation rate | 0.5°/s ≤ rate ≤ 1.5°/s | 0.8 deg/sec |
| Force at 45° ± 0.5° | 320 N ≤ force ≤ 390 N | 365 N |
| Final ref. plane angle | Initial ref. plane angle ± 8° | 23 deg |

David Schoedel
Signature

12/15/2015
Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D154217

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 39 | Pass |
| Initial Angle | deg | 0 to 20 | 19 | Pass |
| Return Angle | deg | +/- 8 | 23 | Pass |
| Force at 45 deg | N | 320 to 390 | 365 | Pass |
| Upper Torso Deflection Rate | deg/s | 0.5 to 1.5 | 0.8 | Pass |
| | | Overall Result | | Pass |

David Schoedel

Laboratory Technician

12/15/2015

Test Date

Jeff Leonardelli

Approved By

**DATA SHEET B8**

LEFT KNEE IMPACT TEST (572.136) (5th Female)

Dummy Serial Number: 510 Test Date: 12/15/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 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: | 21.2°C |
| Record the minimum temperature: | 21.1°C |
| Record the maximum humidity: | 39% |
| Record the minimum humidity: | 33% |

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 m/s ≤ speed ≤ 2.13 m/s | 2.12 m/s |
| Peak resistance force* | 3450 N ≤ force ≤ 4060 N | 3941 N |

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

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

David Schoedel

Signature

12/15/2015

Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D154216

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.1 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 39 | Pass |
| Probe Speed | m/s | 2.07 to 2.13 | 2.12 | Pass |
| Maximum Force | N | 3450 to 4060 | 3941 | Pass |
| | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

12/15/2015

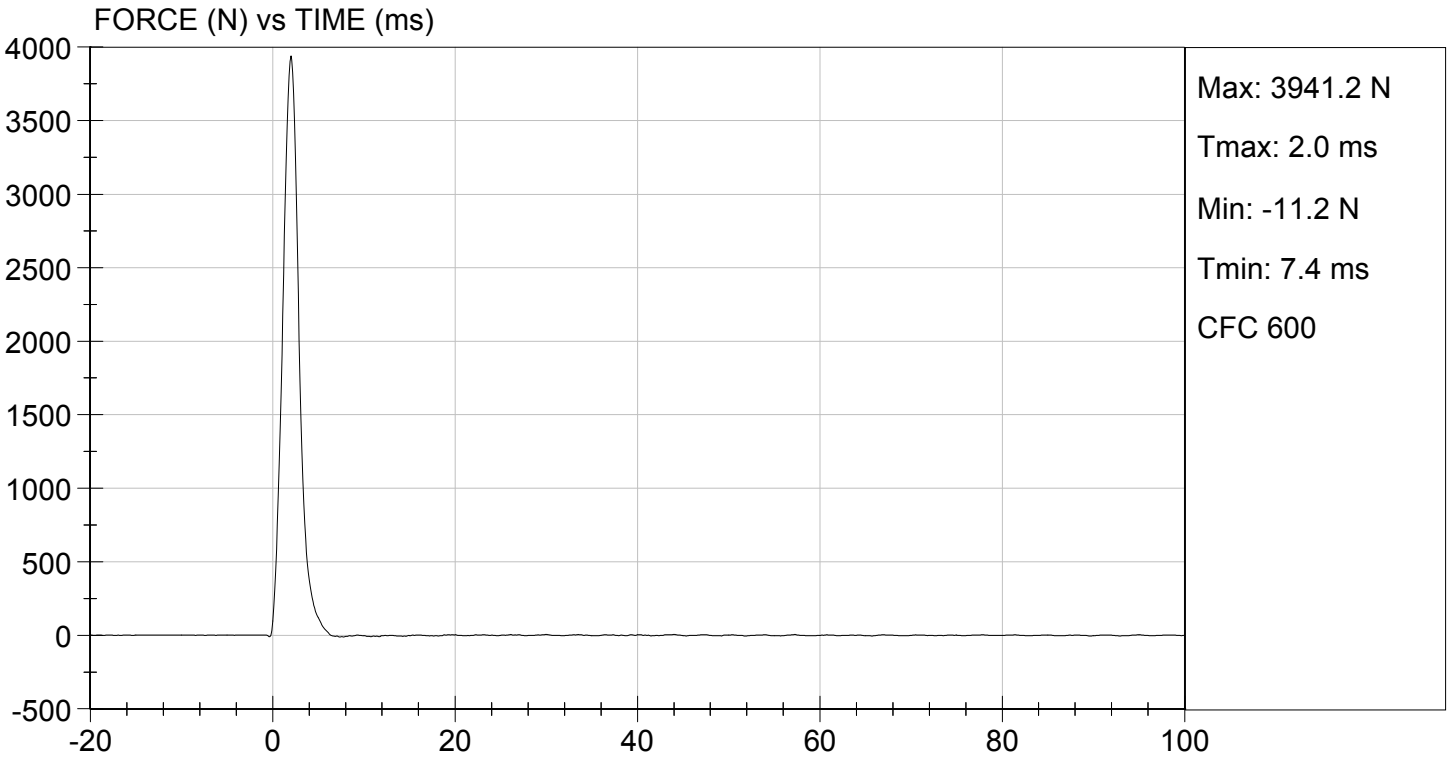
Test Date

Jeff Leonardelli

Approved By

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

TEST DATE: 12/15/2015
TEST #: D154216



**DATA SHEET B9**

RIGHT KNEE IMPACT TEST (572.136) (5th Female)

Dummy Serial Number: 510 Test Date: 12/15/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 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: | 21.2°C |
| Record the minimum temperature: | 21.1°C |
| Record the maximum humidity: | 39% |
| Record the minimum humidity: | 33% |

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 m/s ≤ speed ≤ 2.13 m/s | 2.09 m/s |
| Peak resistance force* | 3450 N ≤ force ≤ 4060 N | 4013 N |

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

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

David Schoedel
Signature

12/15/2015
Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D154215

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.1 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 39 | Pass |
| Probe Speed | m/s | 2.07 to 2.13 | 2.09 | Pass |
| Maximum Force | N | 3450 to 4060 | 4013 | Pass |
| | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

12/15/2015

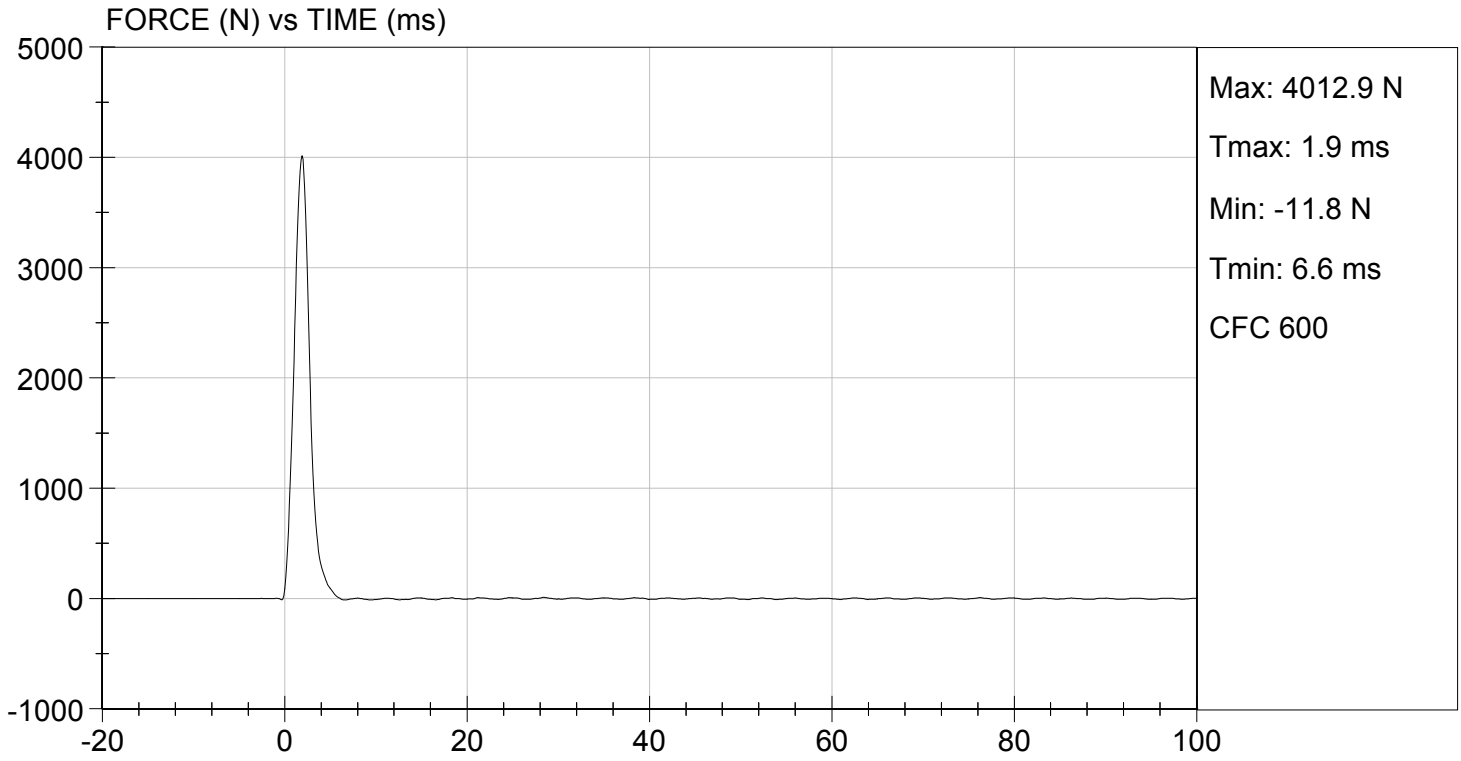
Test Date

Jeff Leonardelli

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.86 ft/s, 2.09 m/s

TEST DATE: 12/15/2015
TEST #: D154215



## DATA SHEET B10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO. | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---|---|---|---|---|---|
| DUMMY INSTRUMENTATION | | | | | |
| HEAD ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P83180 | 07/20/2015 | 01/20/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P83181 | 07/20/2015 | 01/20/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P83182 | 07/20/2015 | 01/20/2016 |
| NECK TRANSDUCER | Denton | 1716 | 7489 | 10/22/2015 | 04/22/2016 |
| CHEST ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P85174 | 07/22/2015 | 01/22/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P86736 | 07/01/2015 | 01/01/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P86737 | 07/01/2015 | 01/01/2016 |
| CHEST POTENTIOMETER | Servo | 14CBI-2897 | 510 | 07/21/2015 | 01/21/2016 |
| FEMUR LOAD CELLS | | | | | |
| (1) RIGHT FEMUR | Denton | 2121 | 979 | 07/30/2015 | 01/30/2016 |
| (2) LEFT FEMUR | Denton | 2121 | 1384 | 07/30/2015 | 01/30/2016 |
| LABORATORY INSTRUMENTATION | | | | | |
| NECK PENDULUM ACCELEROMTER | Endevco | 7231C-750 | AH5P1 | 07/24/2015 | 01/24/2016 |
| THORAX PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P82097 | 11/30/2015 | 5/30/2016 |
| KNEE PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P88169 | 11/30/2015 | 5/30/2016 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol | 132-0-0-102 | 18 | 09/28/2015 | 03/28/2016 |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol | 132-0-0-102 | 23 | 09/28/2015 | 03/28/2016 |

LABORATORY TECHNICIAN: Jessica Hall

**DATA SHEET B3**
HEAD DROP TEST (572.132) (5th Female)

Dummy Serial Number: 510 Test Date: 01/14/2016

Technician: Thomas Miller

____ Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))
X N/A, ONLY one head drop performed

X 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))

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

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

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

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

X 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: | 21.1°C |
| Record the minimum temperature: | 20.8°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 21% |

X 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

X 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 ± 1.0 mm (14.8 ± 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: 501 mm

Record the left side distance: 501 mm

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: 50.9 micro inches

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 ± 1.0 mm (14.8 inches ± 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 g ≤ x ≤ 300 g | 279 g |
| 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 ≤ 15 g | -3.3 g |

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

Signature

01/14/2016
Date

**MGA RESEARCH CORPORATION**

**HEAD DROP TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test ID:** D16171

| 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 | 21 | Pass |
| Peak Resultant Acceleration | G's | 250 to 300 | 279 | Pass |
| Peak Lateral Acceleration | G's | <= +/- 15.0 | -3.3 | Pass |
| Unimodal | N/A | Yes | Yes | Pass |
| Oscillations | N/A | within 10% of peak | Yes | Pass |
| | | Overall Test Results | | Pass |

Laboratory Technician

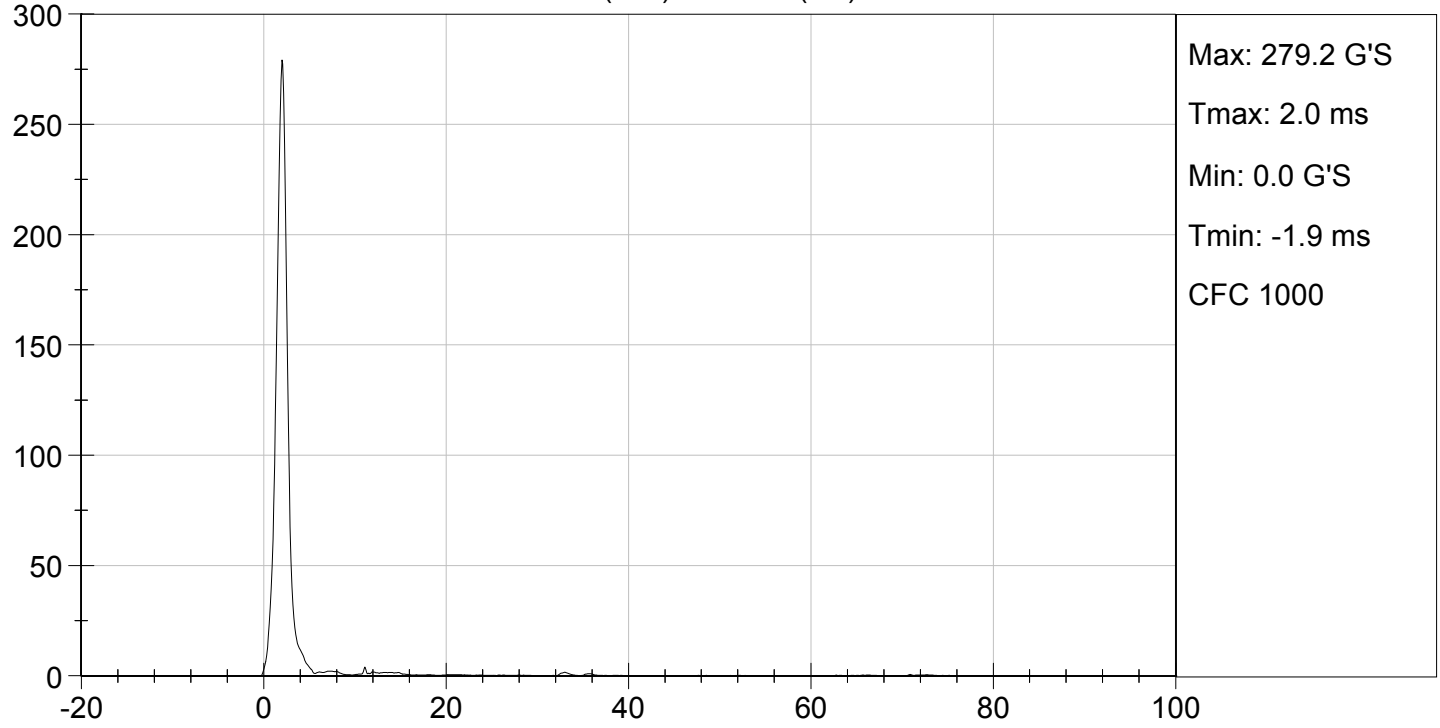
01/14/2016
Test Date

Approved By

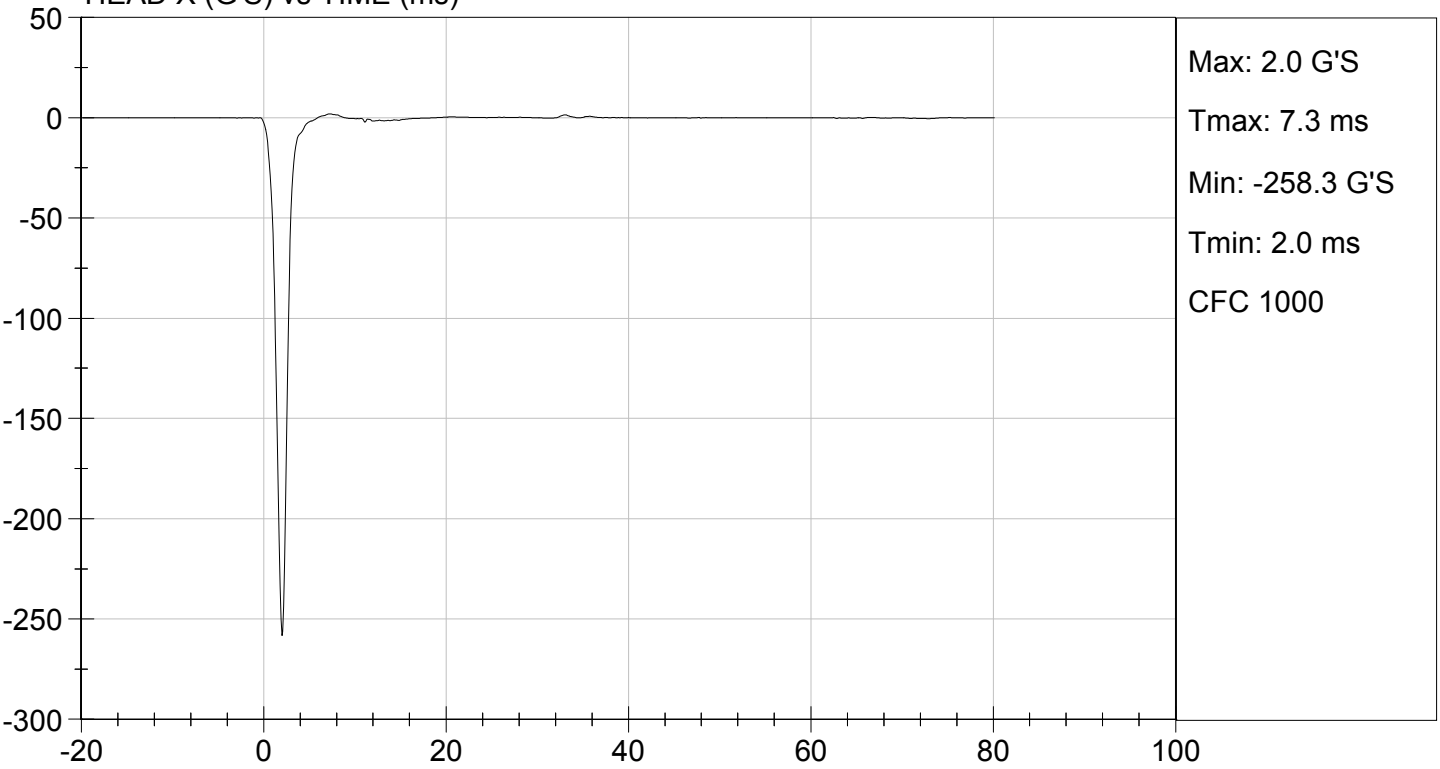
TEST DESC: HEAD DROP

TEST DATE: 01/14/2016
TEST #: D16171

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



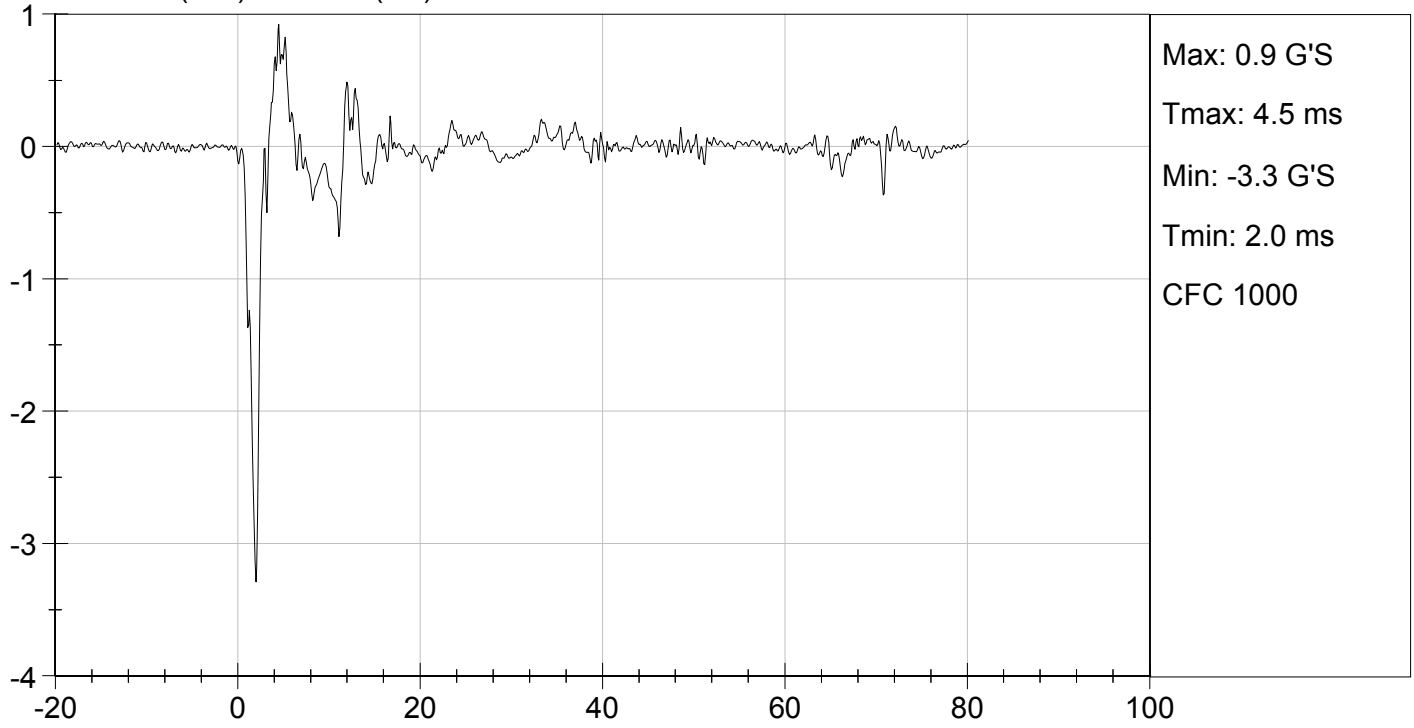

HEAD X (G'S) vs TIME (ms)



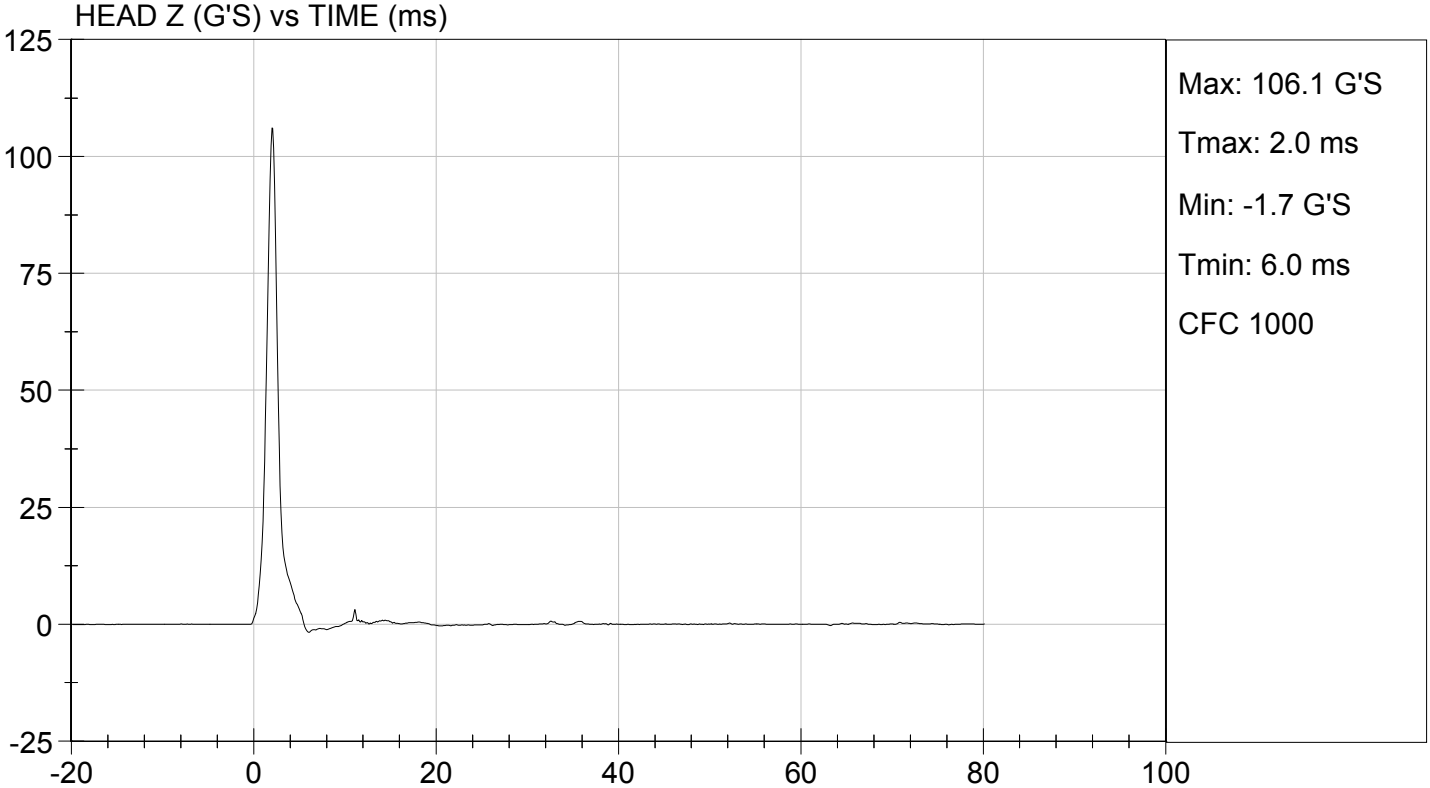
TEST DESC: HEAD DROP

TEST DATE: 01/14/2016
TEST #: D16171

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




HEAD Z (G'S) vs TIME (ms)



**DATA SHEET B4**

NECK FLEXION TEST (572.132) (5th Female)

Dummy Serial Number: 510 Test Date: 01/14/2016

Technician: Thomas Miller

____ Pre test calibration

X Post test calibration verification

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

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

X N/A, ONLY one neck 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: | 21.1°C |
| Record the minimum temperature: | 20.8°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 21% |

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 90.

X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 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 ± 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))

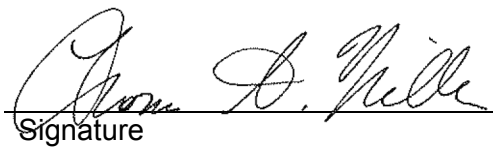
X 13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(I & ii))

| Parameter | | Specification | Results |
|---|---|---|---|
| Pendulum impact speed | | 6.89 m/s ≤ speed ≤ 7.13 m/s | 7.06 m/s |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 2.1 m/s ≤ $\Delta V$ ≤ 2.5 m/s | 2.4 m/s |
| | @ 20 ms | 4.0 m/s ≤ $\Delta V$ ≤ 5.0 m/s | 4.6 m/s |
| | @ 30 ms | 5.8 m/s ≤ $\Delta V$ ≤ 7.0 m/s | 6.3 m/s |
| Plane D Rotation | | Peak moment*<br>69 Nm ≤ moment ≤ 83 Nm during the following rotation range<br>77° ≤ angle ≤ 91° | 71 Nm @ 83 degrees |
| Positive Moment Decay** (Flexion) | | Time to decay to 10 Nm<br>80 ms ≤ time ≤ 100 ms | 88 ms |

*Moment about the occipital condyle = $M_y$ – (0.01778 m x $F_x$)(572.133(b)(1)(ii))
My = Moment in Nm measured by the transducer
Fx = 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

01/14/2016
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D16172

| Tested Parameter | | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | | deg C | 20.6 to 22.2 | 20.8 | Pass |
| Laboratory Relative Humidity | | % | 10 to 70 | 22 | Pass |
| Pendulum Speed | | m/s | 6.89 to 7.13 | 7.06 | Pass |
| Pendulum Velocity | 10 ms | m/s | 2.1 to 2.5 | 2.4 | Pass |
| | 20 ms | m/s | 4.0 to 5.0 | 4.6 | Pass |
| | 30 ms | m/s | 5.8 to 7.0 | 6.3 | Pass |
| D Plane Rotation | Max | deg | 77 to 91 | 83 | Pass |
| Occipital Condyle Moment within Rotation Corridor | | Nm | 69 to 83 | 71 | Pass |
| Positive Moment Time Curve Decay to 10 Nm | | ms | 80 to 100 | 88 | Pass |
| | | | Overall Results | | Pass |

Laboratory Technician

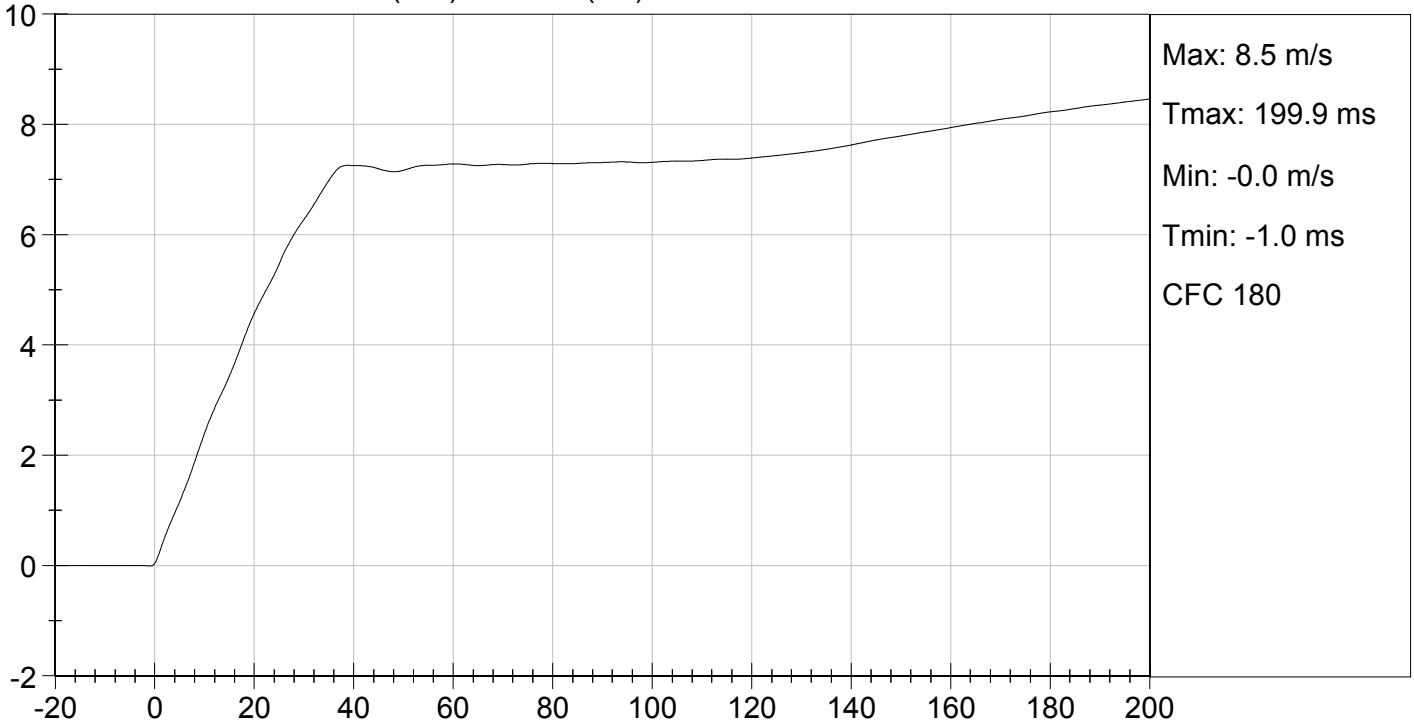
01/14/2016
Test Date

Approved By

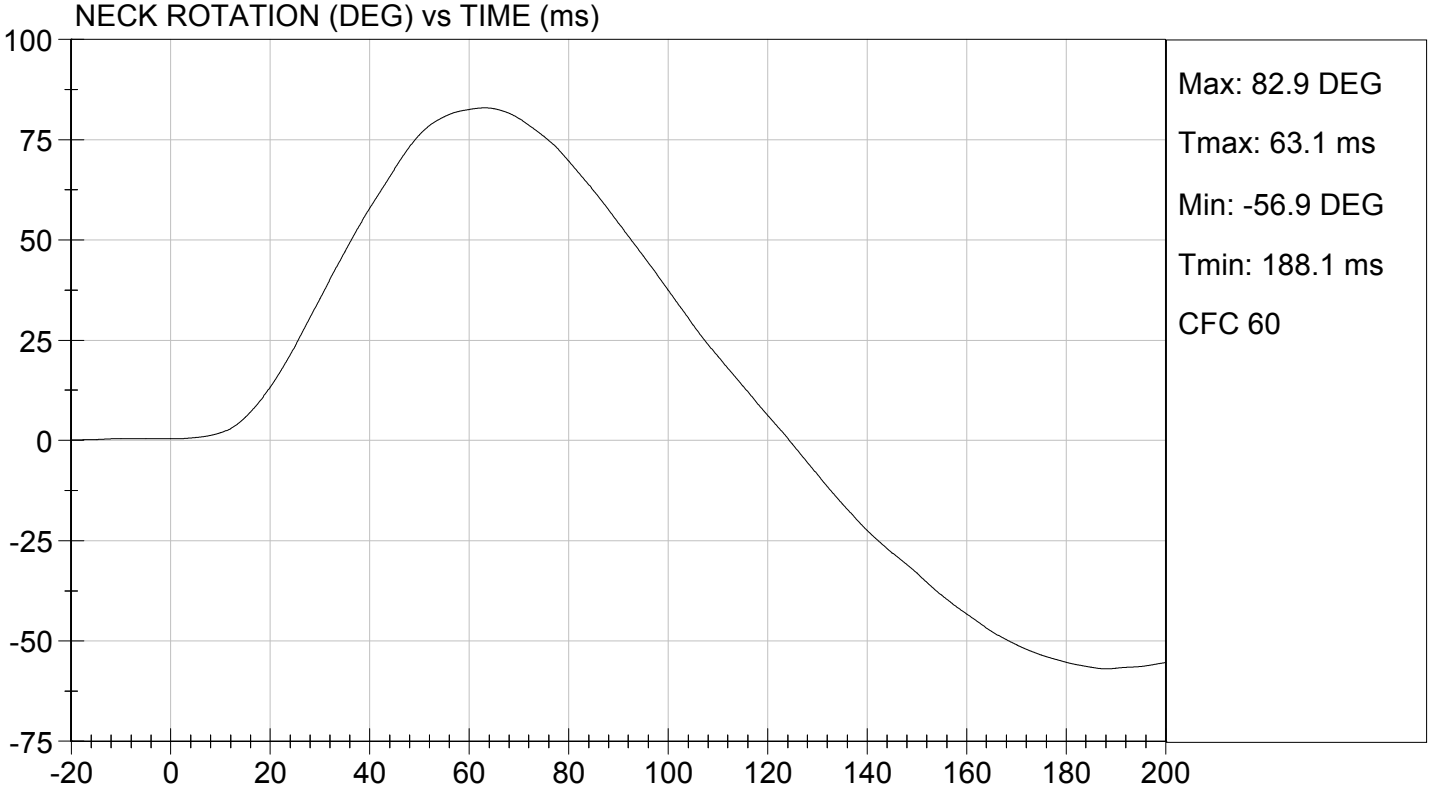
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 01/14/2016
TEST #: D16172

PENDULUM VELOCITY (m/s) vs TIME (ms)



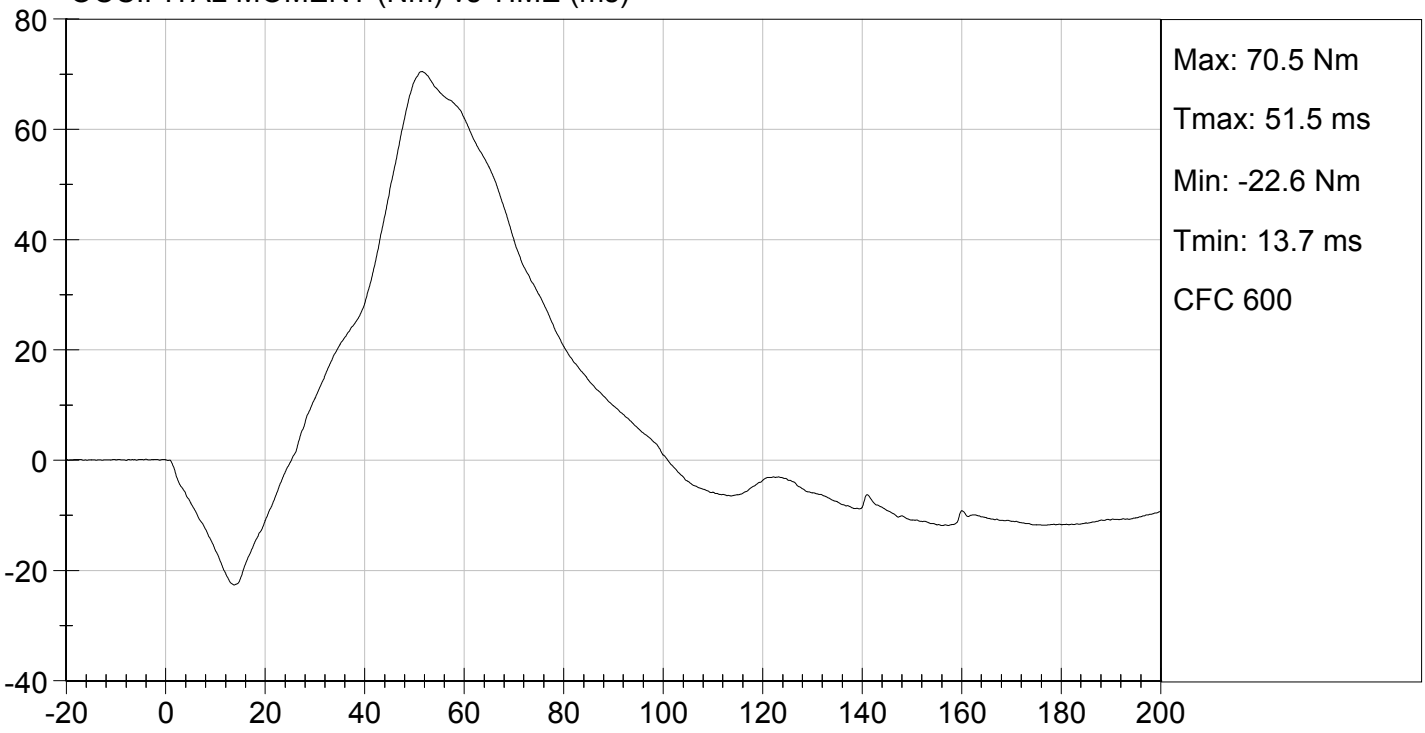

NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 01/14/2016
TEST #: D16172

OCCIPITAL MOMENT (Nm) vs TIME (ms)



**DATA SHEET B5**

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 510 Test Date: 01/14/2016

Technician: Thomas Miller

____ Pre test calibration

X Post test calibration verification

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

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

X N/A, ONLY one neck 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: | 21.1°C |
| Record the minimum temperature: | 20.8°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 21% |

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 90.

X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 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 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 ± 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) & 572.133(c)(4)(I & ii))

| Parameter | | Specification | Results |
|---|---|---|---|
| Pendulum impact speed | | 5.95 m/s ≤ speed ≤ 6.19 m/s | 6.12 m/s |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 1.5 m/s ≤ $\Delta V$ ≤ 1.9 m/s | 1.7 m/s |
| | @ 20 ms | 3.1 m/s ≤ $\Delta V$ ≤ 3.9 m/s | 3.7 m/s |
| | @ 30 ms | 4.6 m/s ≤ $\Delta V$ ≤ 5.6 m/s | 5.4 m/s |
| Plane D Rotation | | Peak moment*<br>-65 Nm ≤ moment ≤ -53 Nm during the following rotation range<br>99° ≤ angle ≤ 114° | -60 Nm @ 107 degrees |
| Positive Moment Decay** (Extension) | | Time to decay to -10 Nm<br>94 ms ≤ time ≤ 114 ms | 102 ms |

*Moment about the occipital condyle = $M_y$ – (0.01778 m x $F_x$)(572.133(b)(1)(ii))
My = Moment in Nm measured by the transducer
Fx = 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

01/14/2016
Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D16173

| Tested Parameter | | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | | deg C | 20.6 to 22.2 | 20.8 | Pass |
| Laboratory Relative Humidity | | % | 10 to 70 | 22 | Pass |
| Pendulum Speed | | m/s | 5.95 to 6.19 | 6.12 | Pass |
| Pendulum Velocity | 10 ms | m/s | 1.5 to 1.9 | 1.7 | Pass |
| | 20 ms | m/s | 3.1 to 3.9 | 3.7 | Pass |
| | 30 ms | m/s | 4.6 to 5.6 | 5.4 | Pass |
| D Plane Rotation | Max | deg | 99 to 114 | 107 | Pass |
| Occipital Condyle Moment within Rotation Corridor | | Nm | -65 to -53 | -60 | Pass |
| Negative Moment Time Curve Decay to -10 Nm | | ms | 94 to 114 | 102 | Pass |
| | | | Overall Results | | Pass |

Laboratory Technician

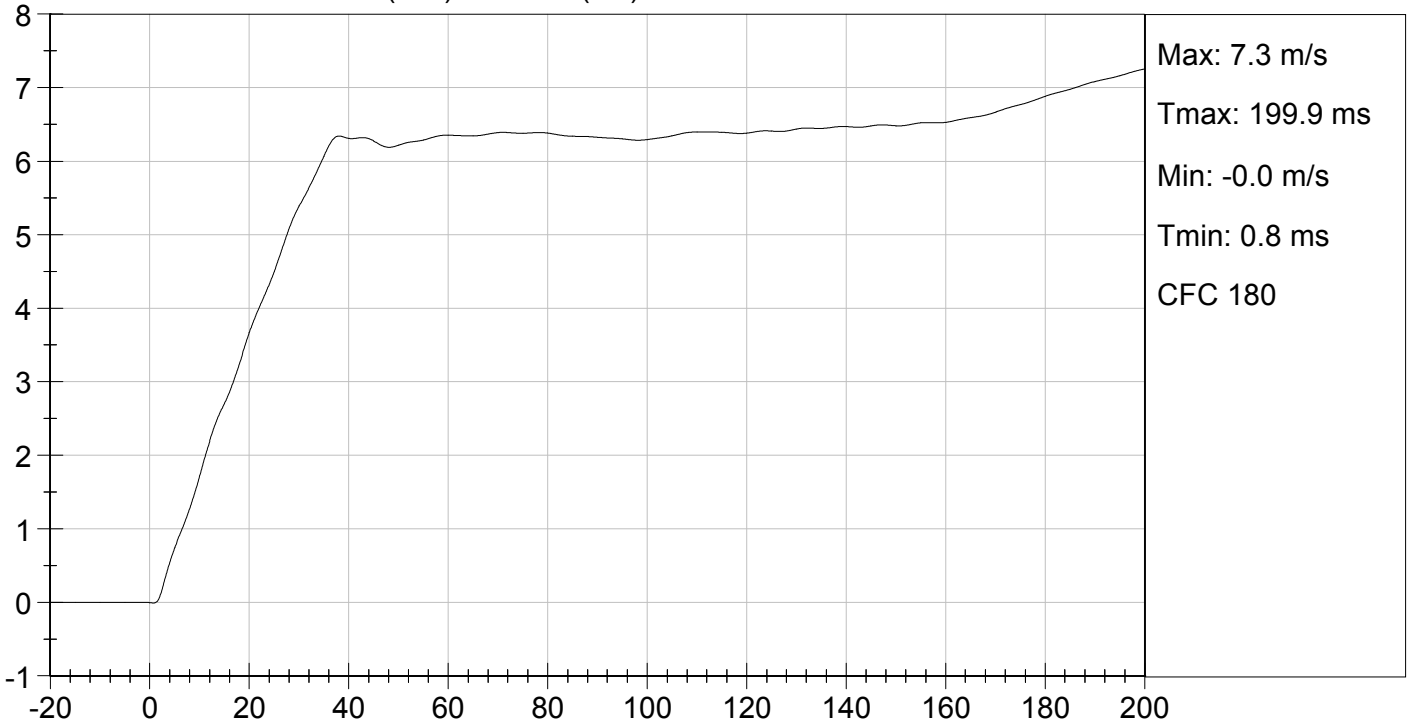
01/14/2016
Test Date

Approved By

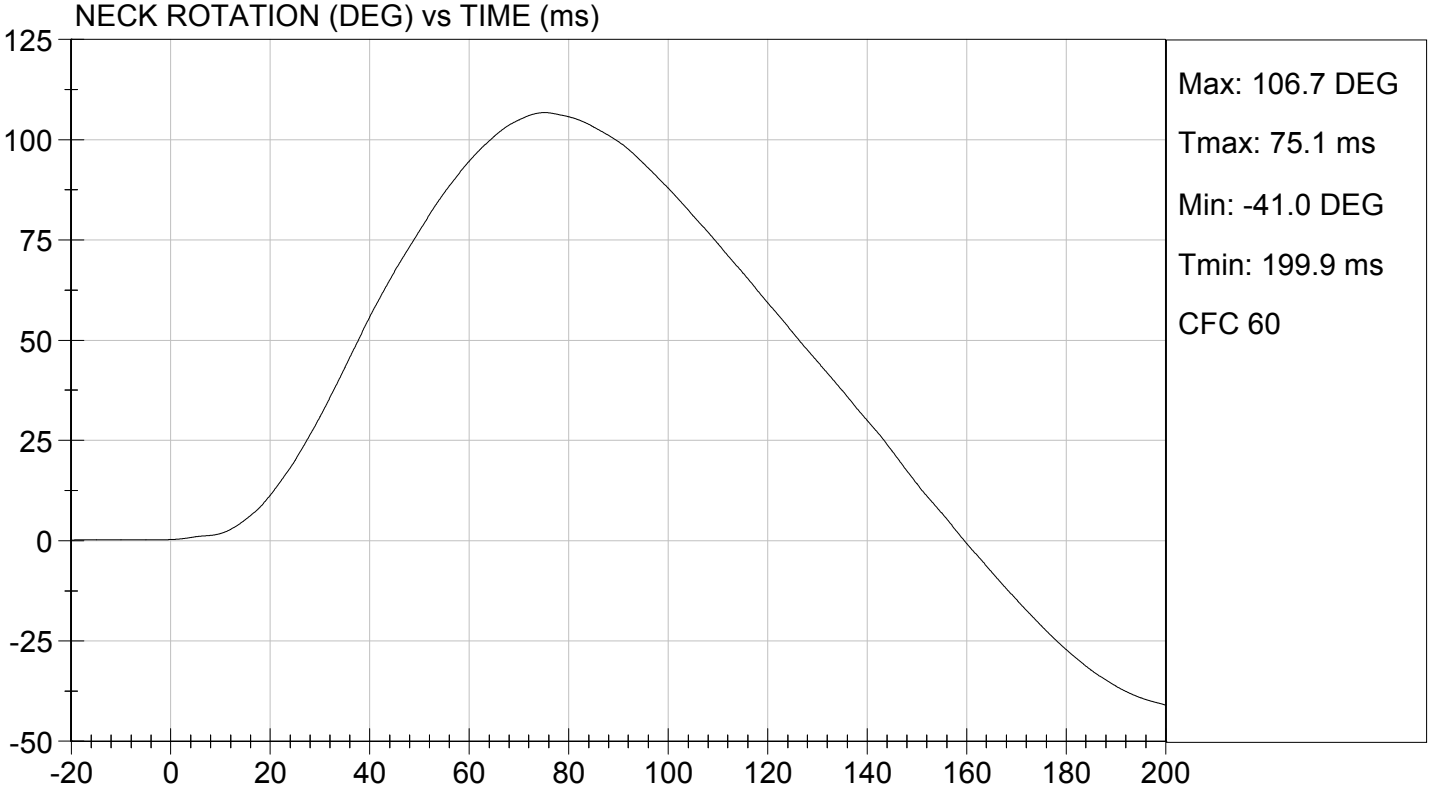
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 01/14/2016
TEST #: D16173

PENDULUM VELOCITY (m/s) vs TIME (ms)

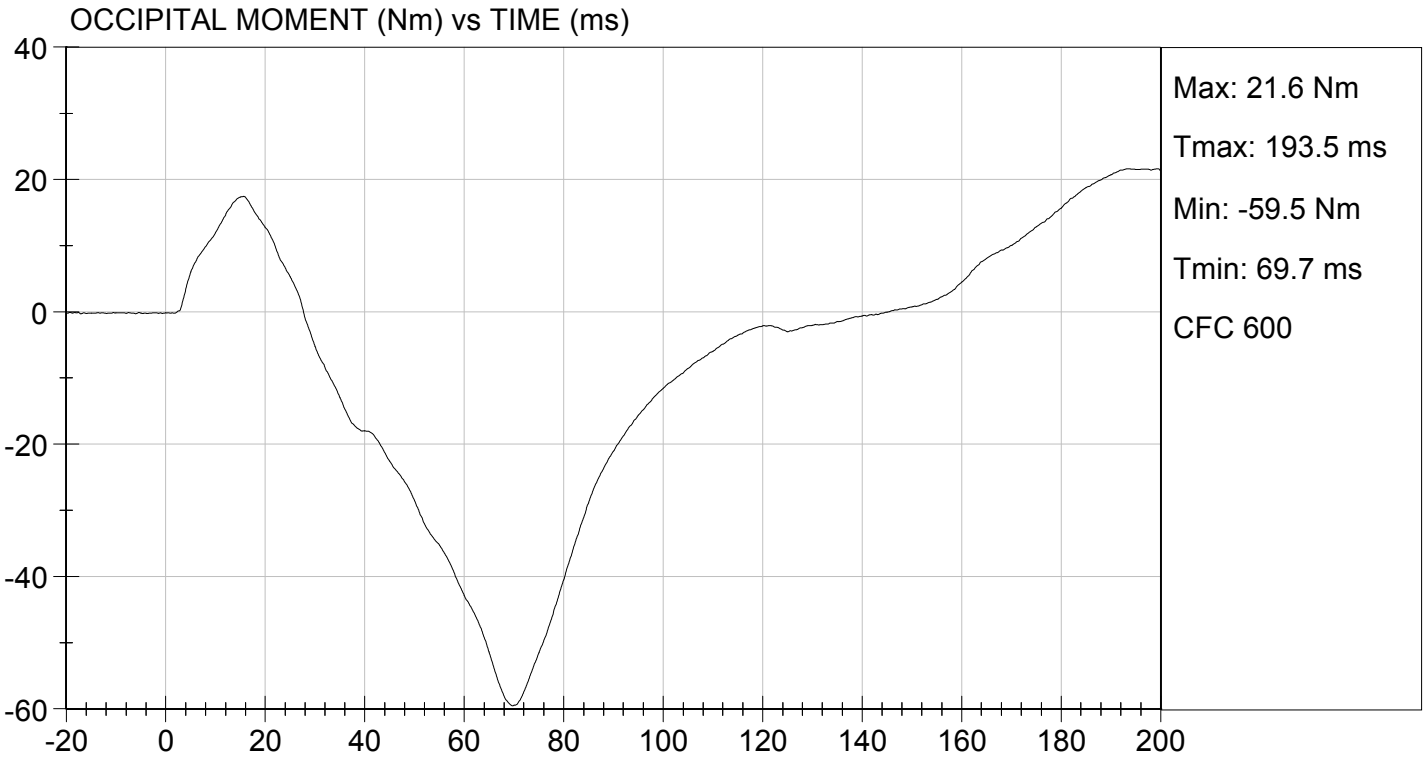



NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 01/14/2016
TEST #: D16173



**DATA SHEET B6**

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 510 Test Date: 01/14/2016

Technician: David Schoedel

____ Pre test calibration

X Post test calibration verification

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

X 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: | 21.1°C |
| Record the minimum temperature: | 20.8°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 21% |

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 ± 0.5° and adjust the pelvis angle to 7° ± 2°. 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 ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° 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 ± 2° 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° 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 m/s ± 0.12m/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 m/s ≤ speed ≤ 6.83 m/s | 6.68 m/s |
| Chest Compression | 50.0 mm ≤ compression ≤ 58.0 mm | 52 mm |
| Peak force** between 50.0 and 58.0 mm chest compression | 3900N ≤ peak force ≤ 4400N | 4264 N |
| Peak Force** between 18.0 and 50.0 mm chest compression | Peak Force ≤ 4600 N | 4303 N |
| Internal Hysteresis*** | 69% ≤ hysteresis ≤ 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 (572.134(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.

David Schoedel

Signature

01/14/2016

Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D16174

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Temperature | deg C | 20.6 to 22.2 | 20.8 | Pass |
| Relative Humidity | % | 10 to 70 | 21 | Pass |
| Probe Speed | m/s | 6.59 to 6.83 | 6.68 | Pass |
| Peak Deflection | mm | 50 to 58 | 52 | Pass |
| Peak Resistive Force w/in Deflection Corridor | N | 3900 to 4400 | 4264 | Pass |
| Internal Hysteresis | % | 69 to 85 | 71 | Pass |
| Peak Force 18 mm - 50 mm | N | <= 4600 | 4303 | Pass |
| | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

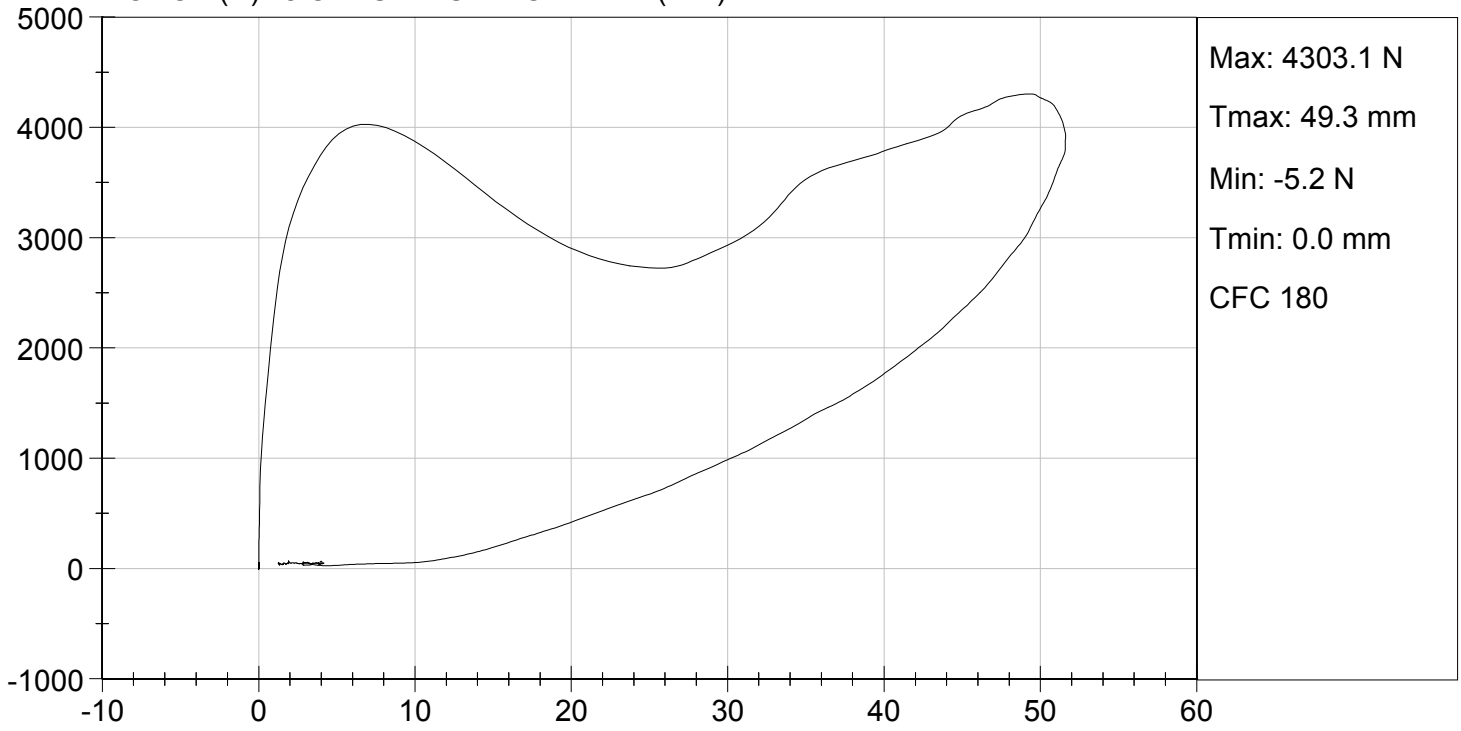
01/14/2016
Test Date

Jeff Leonardelli
Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 01/14/2016
TEST #: D16174

FORCE (N) vs CHEST DISPLACEMENT (mm)



**DATA SHEET B7**
TORSO FLEXION TEST (572.135) (5th Female)

Dummy Serial Number: 510 Test Date: 01/14/2016

Technician: David Schoedel

____ Pre test calibration
_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))
_X_ N/A, ONLY one torso flexion 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 femurs.
_X_ Without legs below 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: | 21.1°C |
| Record the minimum temperature: | 20.8°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 21% |

_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°): See Result Table

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° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))

X 14. Maintain angle reference plane at 45° ± 0.5° 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 ≤ 20° | 19 deg |
| Torso rotation rate | 0.5°/s ≤ rate ≤ 1.5°/s | 0.9 deg/sec |
| Force at 45° ± 0.5° | 320 N ≤ force ≤ 390 N | 378 N |
| Final ref. plane angle | Initial ref. plane angle ± 8° | 23 deg |

David Schoedel
Signature

01/14/2016
Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D16177

| 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 | 21 | Pass |
| Initial Angle | deg | 0 to 20 | 19 | Pass |
| Return Angle | deg | +/- 8 | 23 | Pass |
| Force at 45 deg | N | 320 to 390 | 378 | Pass |
| Upper Torso Deflection Rate | deg/s | 0.5 to 1.5 | 0.9 | Pass |
| | | Overall Result | | Pass |

David Schoedel
Laboratory Technician

01/14/2016
Test Date

Jeff Leonardi
Approved By

**DATA SHEET B8**

LEFT KNEE IMPACT TEST (572.136) (5th Female)

Dummy Serial Number: 510 Test Date: 01/14/2016

Technician: David Schoedel

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 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: | 21.1°C |
| Record the minimum temperature: | 20.8°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 21% |

_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 m/s ≤ speed ≤ 2.13 m/s | 2.12 m/s |
| Peak resistance force* | 3450 N ≤ force ≤ 4060 N | 4032 N |

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

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

David Schoedel
Signature

01/14/2016
Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D16176

| 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 | 22 | Pass |
| Probe Speed | m/s | 2.07 to 2.13 | 2.12 | Pass |
| Maximum Force | N | 3450 to 4060 | 4032 | Pass |
| | | Overall Test Results | | Pass |

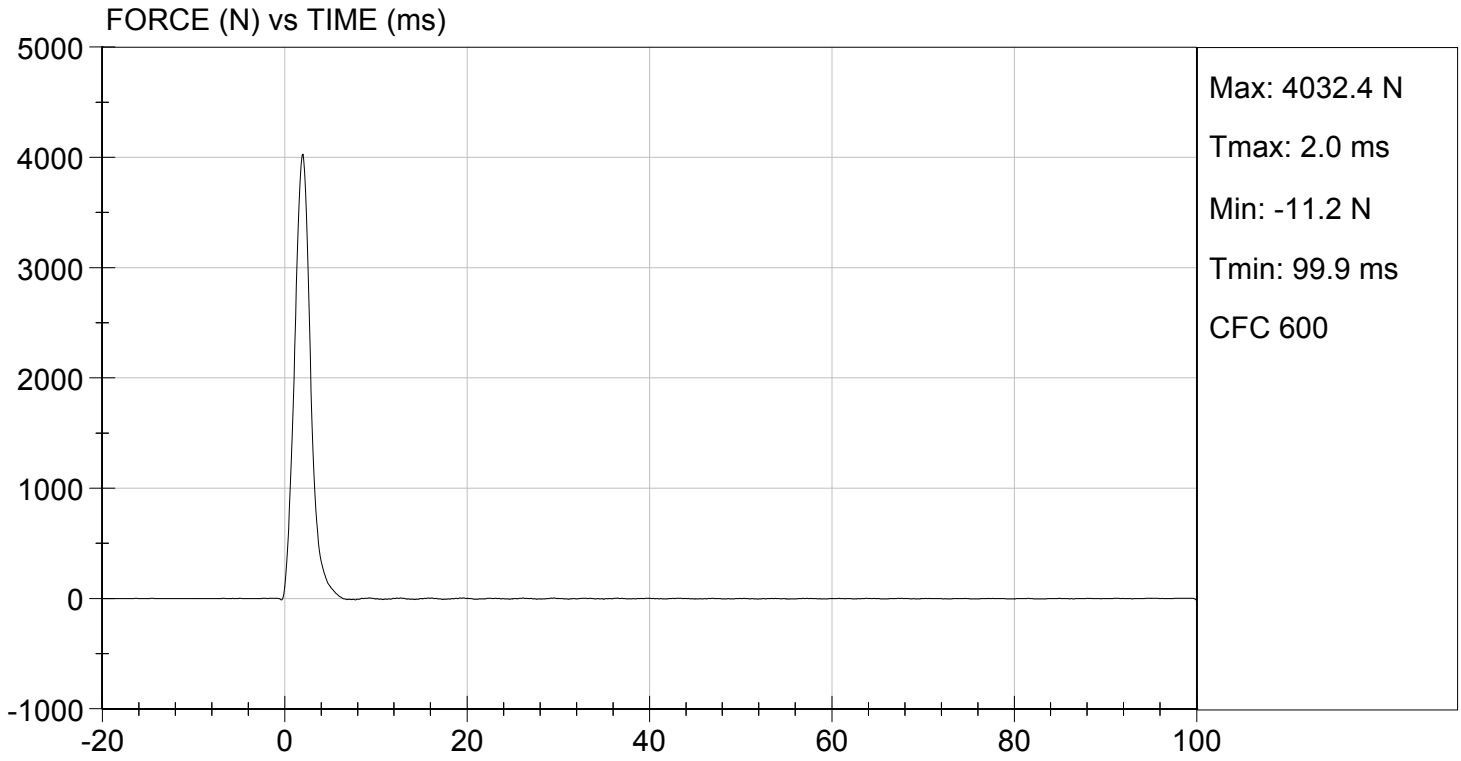
David Schoedel
Laboratory Technician

01/14/2016
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 01/14/2016
TEST #: D16176



**DATA SHEET B9**
RIGHT KNEE IMPACT TEST (572.136) (5th Female)

Dummy Serial Number: 510 Test Date: 01/14/2016

Technician: David Schoedel

____ Pre test calibration
_X_ Post test calibration verification

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

_X_ 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: | 21.1°C |
| Record the minimum temperature: | 20.8°C |
| Record the maximum humidity: | 22% |
| Record the minimum humidity: | 21% |

_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 m/s ≤ speed ≤ 2.13 m/s | 2.12 m/s |
| Peak resistance force* | 3450 N ≤ force ≤ 4060 N | 3733 N |

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

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

David Schoedel
Signature

01/14/2016
Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 510 **Test I.D:** D16175

| 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 | 22 | Pass |
| Probe Speed | m/s | 2.07 to 2.13 | 2.12 | Pass |
| Maximum Force | N | 3450 to 4060 | 3733 | Pass |
| | | Overall Test Results | | Pass |

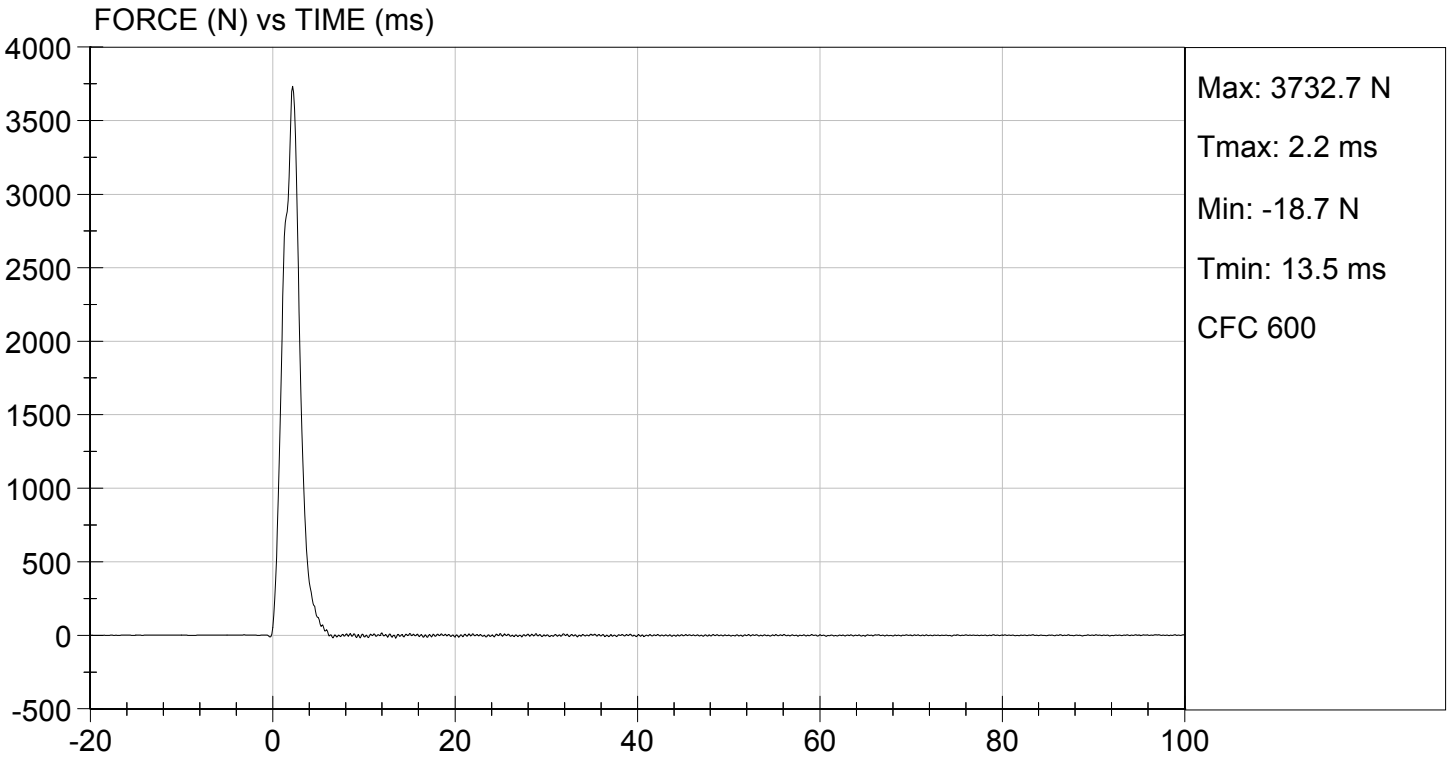
David Schoedel
Laboratory Technician

01/14/2016
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 01/14/2016
TEST #: D16175



**DATA SHEET B10**

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO. | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---|---|---|---|---|---|
| DUMMY INSTRUMENTATION | | | | | |
| HEAD ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P83180 | 01/04/2016 | 07/04/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P83181 | 01/04/2016 | 07/04/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P83182 | 01/04/2016 | 07/04/2016 |
| NECK TRANSDUCER | Denton | 1716 | 7489 | 10/22/2015 | 04/22/2016 |
| CHEST ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P85174 | 01/04/2016 | 07/04/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P86736 | 01/04/2016 | 07/04/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P86737 | 01/04/2016 | 07/04/2016 |
| CHEST POTENTIOMETER | Servo | 14CBI-2897 | 510 | 01/04/2016 | 07/04/2016 |
| FEMUR LOAD CELLS | | | | | |
| (1) RIGHT FEMUR | Denton | 2121 | 979 | 01/04/2016 | 07/04/2016 |
| (2) LEFT FEMUR | Denton | 2121 | 1384 | 01/04/2016 | 07/04/2016 |
| LABORATORY INSTRUMENTATION | | | | | |
| NECK PENDULUM ACCELEROMTER | Endevco | 7231C-750 | AH5P1 | 07/24/2015 | 01/24/2016 |
| THORAX PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P82097 | 11/30/2015 | 5/30/2016 |
| KNEE PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P88169 | 11/30/2015 | 5/30/2016 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol | 132-0-0-102 | 18 | 09/28/2015 | 03/28/2016 |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol | 132-0-0-102 | 23 | 09/28/2015 | 03/28/2016 |

LABORATORY TECHNICIAN: Jessica Hall

**DATA SHEET B1**
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 510 Test Date: 01/13/2016

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 | Damage | 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 |
| 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 — 01/14/2016

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 01/14/2016

Signature — Date

## EXTERNAL DIMENSIONS

| HYBRID III 6 year-old SN #155, PART 572, SUBPART N EXTERNAL DIMENSIONS | | | | |
|---|---|---|---|---|
| DIMENSION | DESCRIPTION | DETAILS | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A | TOTAL SITTING HEIGHT | Seat surface to highest point on top of the head. | 622.3 - 647.7 | 628.2 |
| B | SHOULDER PIVOT HEIGHT | Centerline of shoulder pivot bolt to the seat surface. | 348.0 - 363.2 | 362.0 |
| C | H-POINT HEIGHT | Reference | 63.5 - 73.7 | 68.3 |
| D | H-POINT LOCATION FROM BACKLINE | Reference | 88.9 - 99.1 | 94.5 |
| E | SHOULDER PIVOT FROM BACKLINE | Center of the shoulder clevis to the rear vertical surface of the fixture. | 53.3 - 63.5 | 61.7 |
| F | THIGH CLEARANCE | Measured at the highest point on the upper femur segment. | 88.9 - 104.1 | 102.0 |
| G | BACK OF ELBOW TO WRIST PIVOT | Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots | 182.9 - 198.1 | 195.4 |
| H | HEAD BACK TO BACKLINE | Back of Skull cap skin to seat rear vertical surface (Reference) | 17.8 - 22.8 | 22.1 |
| I | SHOULDER TO ELBOW LENGTH | Measure from the highest point on top of the broad upper surface of clavicle link below the collar to the lowest part of the flesh of the elbow in line with the elbow pivot bolt. | 215.9 - 231.1 | 219.5 |
| J | ELBOW REST HEIGHT | Measure from the flesh below the elbow pivot bolt to the seat surface. | 157.4 - 177.8 | 165.0 |
| K | BUTTOCK TO KNEE LENGTH | The forward most part of the knee flesh to the rear vertical surface of the fixture. | 370.8 - 391.2 | 390.7 |
| L | POPLITEAL HEIGHT | Seat surface to the horizontal plane at the bottom of the feet. | 269.2 - 289.6 | 273.6 |
| M | KNEE PIVOT HEIGHT | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet. | 307.4 - 322.6 | 313.8 |

| HYBRID III 6 year-old SN #155, PART 572, SUBPART N EXTERNAL DIMENSIONS, continued | | | | |
|---|---|---|---|---|
| DIMENSION | DESCRIPTION | DETAILS | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| 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”. | 320.0 - 340.4 | 322.4 |
| O | CHEST DEPTH WITHOUT JACKET | Measured 330.2 ± 5.1 mm above seat surface | 129.6 - 144.8 | 140.2 |
| P | FOOT LENGTH | Tip of toe to rear of heal | 170.2 - 185.4 | 173.4 |
| Q | STATURE | (THEORETICAL) (Q = A - C - D + R + M) | 1099.9 - 1181.1 | N/A |
| R | BUTTOCK TO KNEE PIVOT LENGTH | The rear surface of the buttocks to the knee pivot bolt | 342.9 - 363.3 | 355.7 |
| S | HEAD BREADTH | The widest part of the head | 137.1 - 147.3 | 139.0 |
| T | HEAD DEPTH | Back of the head to the forehead | 167.6 - 177.8 | 174.2 |
| U | HIP BREADTH | The widest part of the hips | 208.3 - 223.5 | 221.5 |
| V | SHOULDER BREADTH | Outside shoulder edges, in line with the shoulder pivot bolts | 259.1 - 274.3 | 272.1 |
| W | FOOT BREADTH | The widest part of the foot | 62.3 - 77.5 | 66.0 |
| X | HEAD CIRCUMFERENCE | Measured at the point as in dim. “T” | 510.5 - 530.9 | 529.3 |
| Y | CHEST CIRCUMFERENCE (WITH CHEST JACKET) | Measured 3330.2 ± 5.1 mm above seat surface | 596.9 - 622.3 | 609.5 |
| Z | WAIST CIRCUMFERENCE (with chest jacket and abdominal insert) | Measured 158.8 ± 5.1 mm above seat surface | 558.8 - 584.2 | 583.2 |
| AA | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference | 325.1 - 335.3 | 330.0 |
| BB | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference | 153.7 - 163.9 | 159.0 |

**DATA SHEET C3**
HEAD DROP TEST (572.122) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/08/2016

Technician: Thomas Miller

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 2 hours since the last head drop. (572.122(c)(5))
X N/A, ONLY one head drop performed

X 2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))

X 3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.

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

X 5. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))

X 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. (572.122(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.2°C |
| Record the minimum temperature | 20.9°C |
| Record the maximum humidity | 34% |
| Record the minimum humidity | 31% |

X 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

X 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. (572.122(c)(2))

X 10. Suspend and orient the head assembly as shown in Figure 5C. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface.

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 5C. (572.122(c)(3))

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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 $2155.0 \times 10^{-6}$ mm (80 micro inches) (RMS). (572.122(c)(4))

Record actual micro finish: 50.9 micro inches

X 13. The impact surface is rigidly supported. (572.122(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. (572.122(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

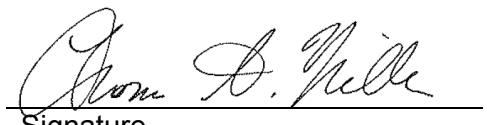
Record length: 595 mm

X 15. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.122(b)) & (572.122(c)(4))

X 16. Complete the following table using channel class 1000 data. (572.122(b)):

| Parameter | Specification | Result |
|---|---|---|
| Peak resultant acceleration | 245 g ≤ x ≤ 300 g | 285 g |
| 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 ≤ 15 g | -9.8 g |

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



Signature

01/08/2016

Date

**MGA RESEARCH CORPORATION**

**HEAD DROP TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test ID:** D16101

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 31 | Pass |
| Peak Resultant Acceleration | G's | 245 to 300 | 285 | Pass |
| Peak Lateral Acceleration | G's | <= +/- 15.0 | -9.8 | Pass |
| Unimodal | N/A | Yes | Yes | Pass |
| Oscillations | N/A | within 10% of peak | Yes | Pass |
| | | Overall Test Results | | Pass |

Laboratory Technician

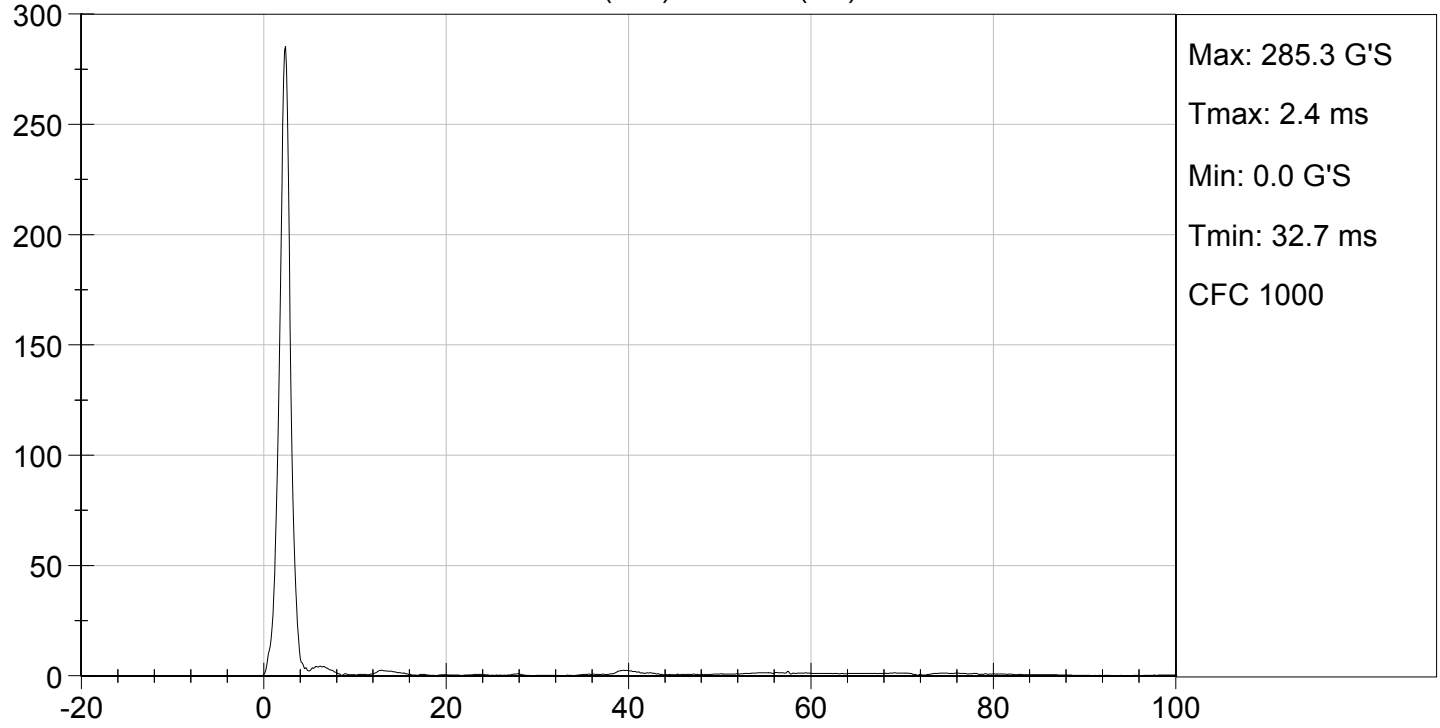
01/08/2016
Test Date

Approved By

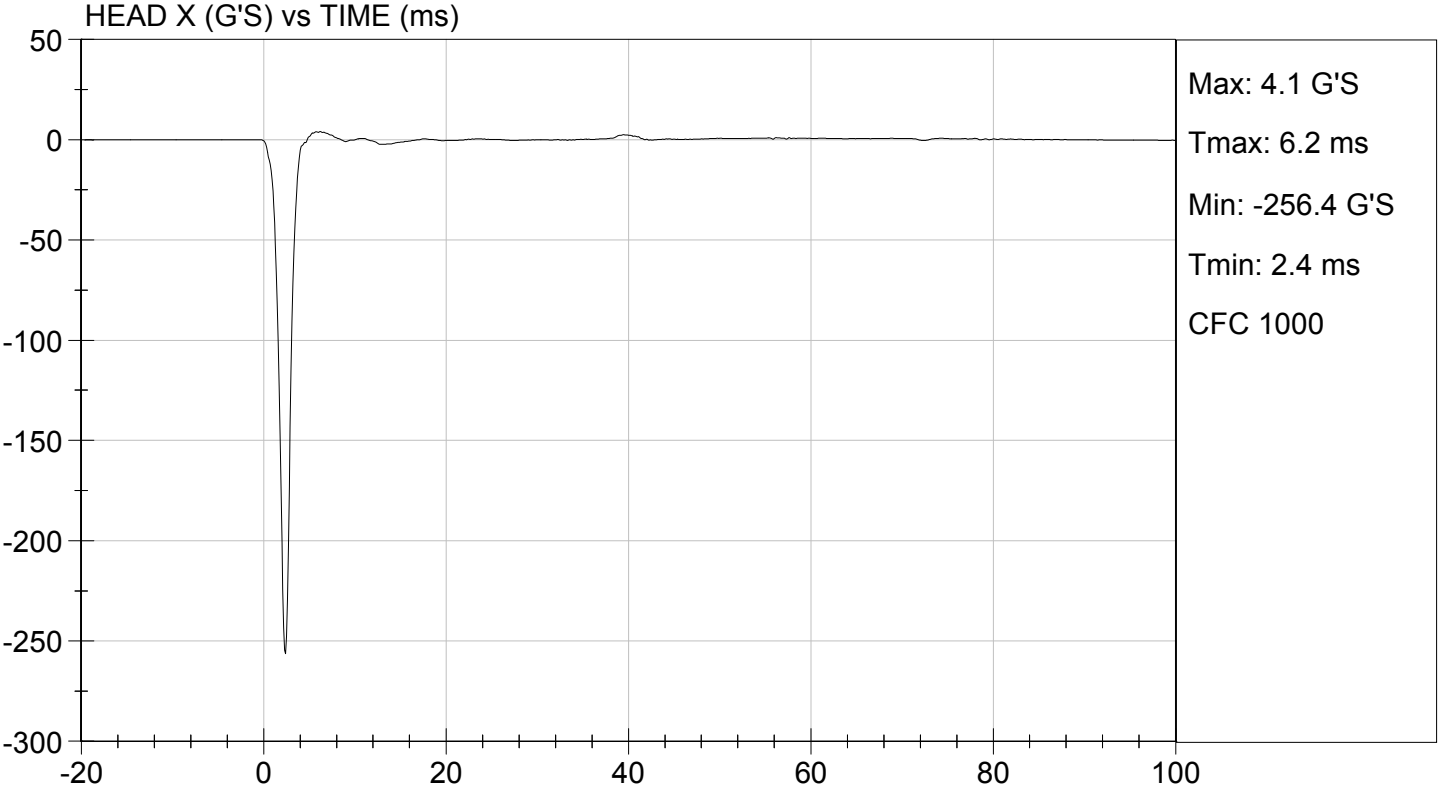
TEST DESC: HEAD DROP

TEST DATE: 01/08/2016
TEST #: D16101

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



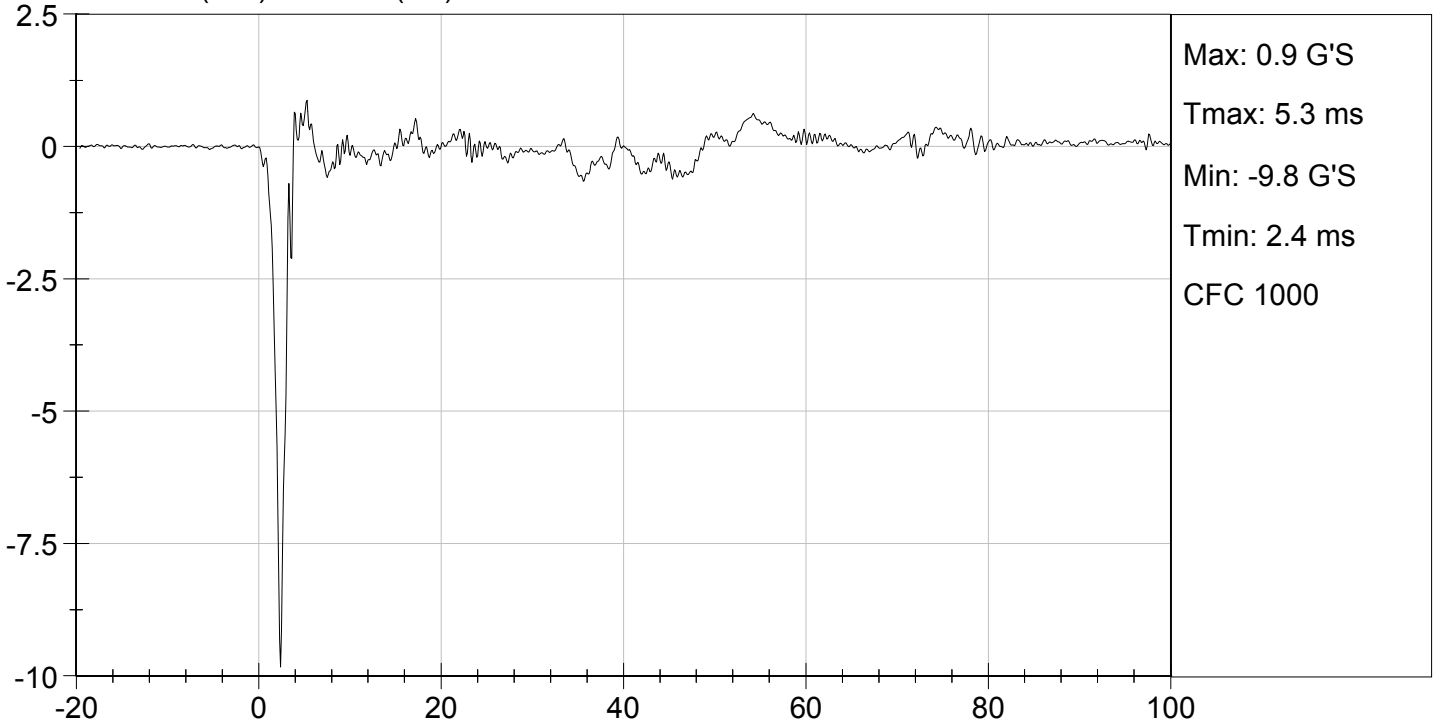

HEAD X (G'S) vs TIME (ms)



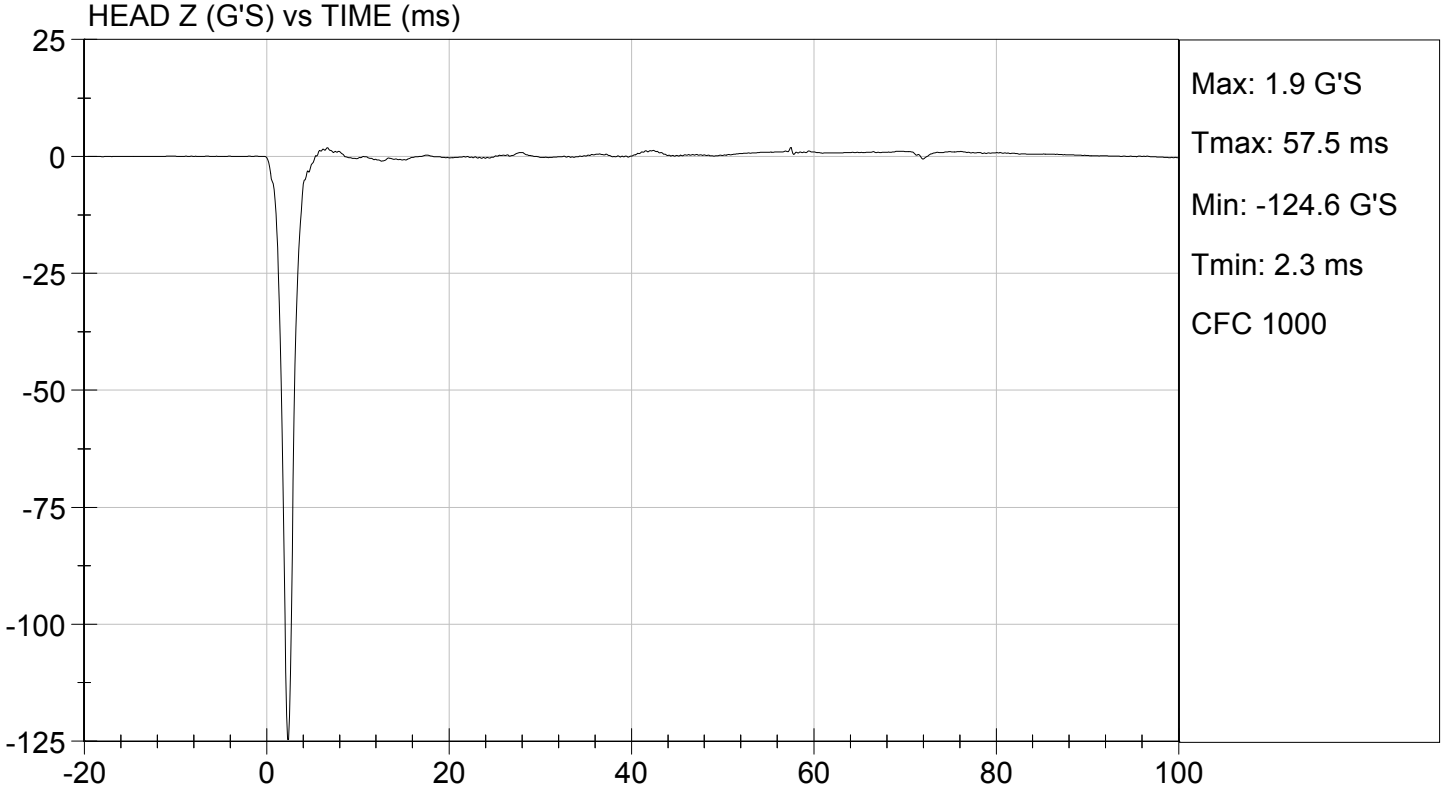
TEST DESC: HEAD DROP

TEST DATE: 01/08/2016
TEST #: D16101

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




HEAD Z (G'S) vs TIME (ms)



**DATA SHEET C4**

NECK FLEXION TEST (572.123) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/08/2016

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.127(o))

X N/A, ONLY one neck test performed

X 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(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. (572.123(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.2°C |
| Record the minimum temperature | 20.9°C |
| Record the maximum humidity | 34% |
| Record the minimum humidity | 31% |

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 (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.

Record findings and actions: No damage

X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123l(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 7C for the flexion test. (572.123l(3))

X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.83 m/s to 5.07 m/s as measured at the center of the pendulum accelerometer. (572.123l(4)(i))

X 12. Complete the following table:

Neck Flexion Test Results (572.123(b)(1)) & (572.123(c)(4)(I &ii))

| Parameter | | Specification | Result |
|---|---|---|---|
| Pendulum impact speed | | 4.83 m/s ≤ speed ≤ 5.07 m/s | 4.89 m/s |
| Pendulum ΔV with respect to impact speed | @ 10 ms | 1.2 m/s ≤ ΔV ≤ 1.6 m/s | 1.6 m/s |
| | @ 20 ms | 2.4 m/s ≤ ΔV ≤ 3.4 m/s | 2.9 m/s |
| | @ 30 ms | 3.8 m/s ≤ ΔV ≤ 5.0 m/s | 4.1 m/s |
| Plane D Rotation | | Peak moment*<br>27 Nm ≤ moment ≤ 33 Nm during the following rotation range 74° ≤ angle ≤ 92° | 27 Nm @ 75 degrees |
| Positive Moment Decay** (Flexion) | | Time to decay to 5 Nm 103 ms ≤ time ≤ 123 ms | 114 ms |

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(1)(iii))
My = Moment in Nm measured by the transducer
Fx = 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. (572.123(b)(3))

X 13. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

Signature

01/08/2016
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16102

| 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 | 32 | Pass |
| Pendulum Speed | | m/s | 4.83 to 5.07 | 4.89 | Pass |
| Pendulum Velocity | 10 ms | m/s | 1.2 to 1.6 | 1.6 | Pass |
| | 20 ms | m/s | 2.4 to 3.4 | 2.9 | Pass |
| | 30 ms | m/s | 3.8 to 5.0 | 4.1 | Pass |
| D Plane Rotation | Max | deg | 74 to 92 | 75 | Pass |
| Occipital Condyle Moment within Deflection Corridor | | Nm | 27 to 33 | 27 | Pass |
| Positive Moment Time Curve Decay to 5 Nm | | ms | 103 to 123 | 114 | Pass |
| | | | Overall Results | | Pass |

Laboratory Technician

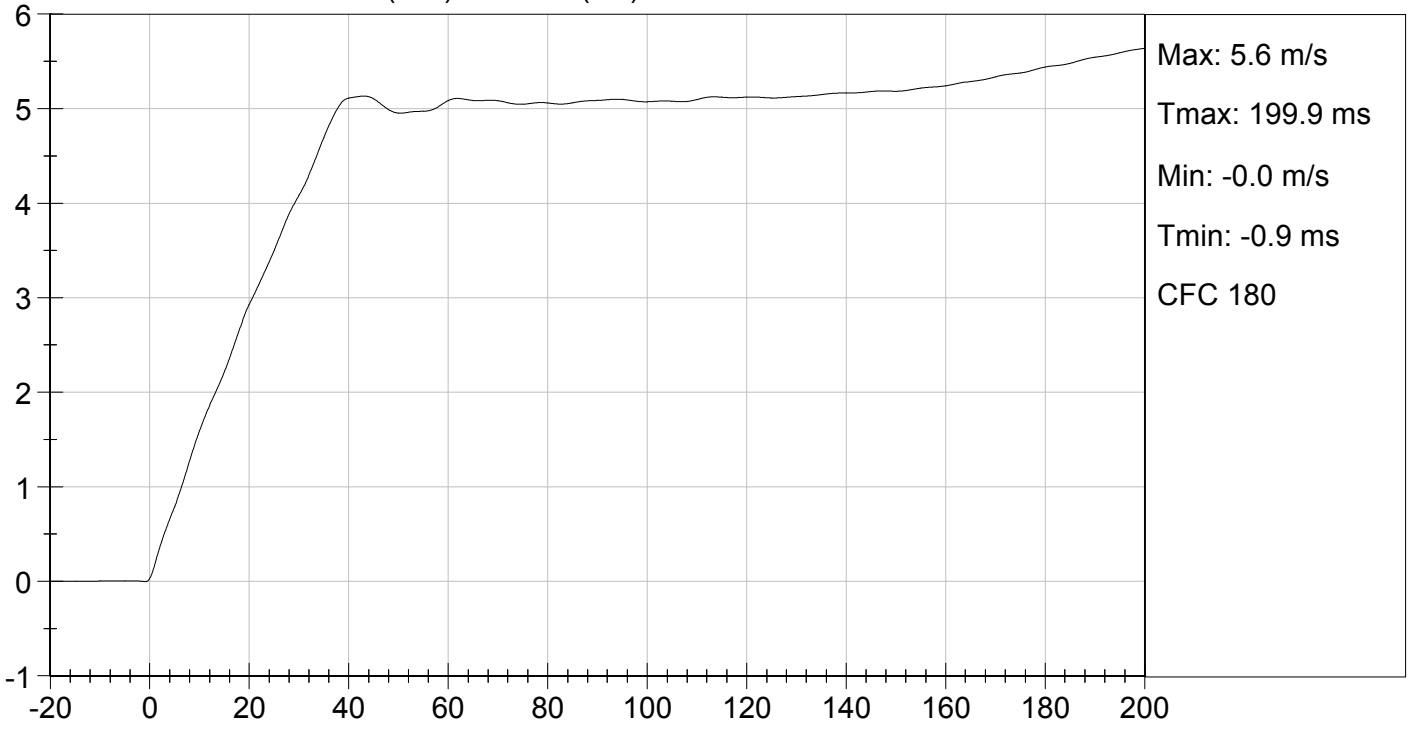
01/08/2016
Test Date

Approved By

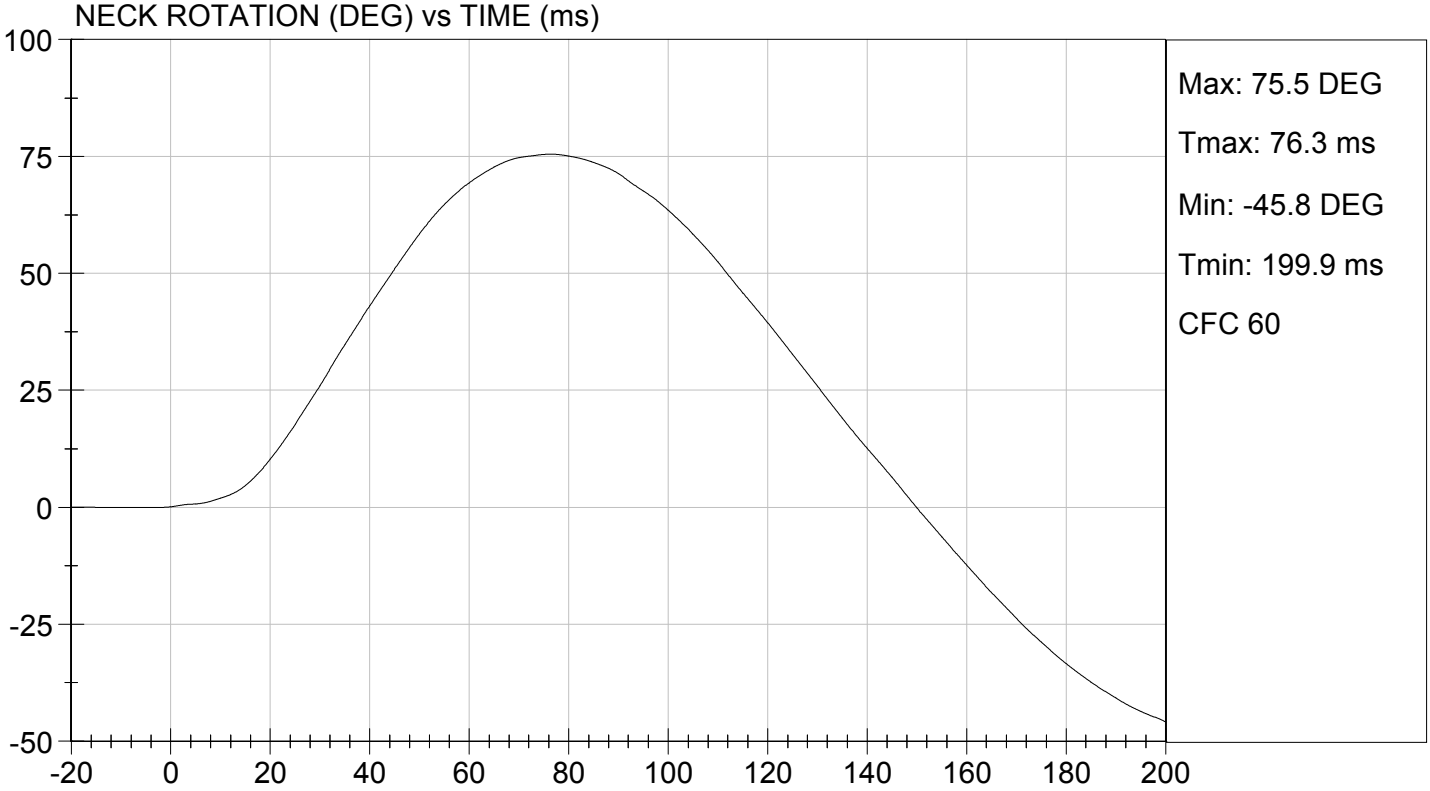
TEST DESC: NECK FLEXION
VELOCITY: 16.03 ft/s, 4.89 m/s

TEST DATE: 01/08/2016
TEST #: D16102

PENDULUM VELOCITY (m/s) vs TIME (ms)



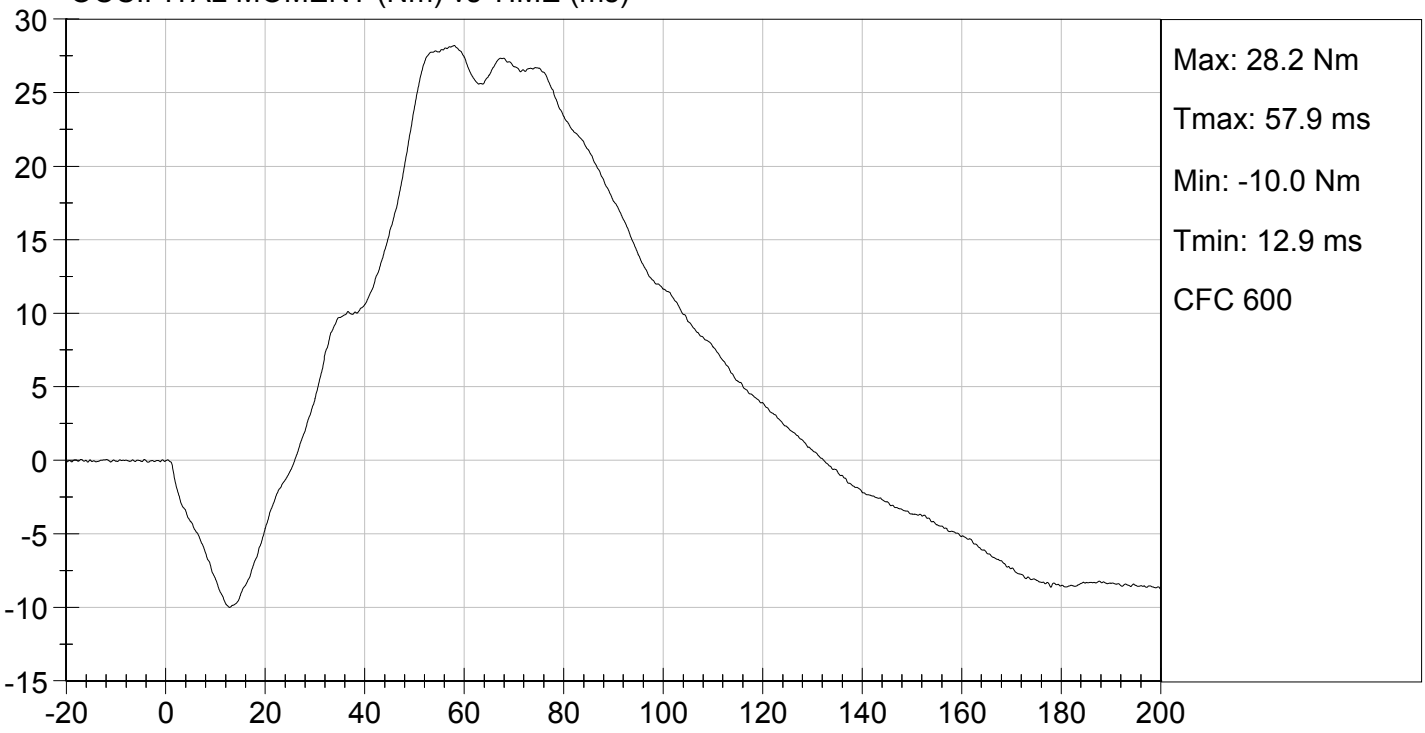

NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 16.03 ft/s, 4.89 m/s

TEST DATE: 01/08/2016
TEST #: D16102

OCCIPITAL MOMENT (Nm) vs TIME (ms)



**DATA SHEET C5**

NECK EXTENSION TEST (572.123) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/08/2016

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.127(o))

X N/A, ONLY one neck test performed

X 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(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. (572.123(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.2°C |
| Record the minimum temperature | 20.9°C |
| Record the maximum humidity | 34% |
| Record the minimum humidity | 31% |

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 (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.

Record findings and actions: No damage

X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123(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 8C for the extension test. (572.123(c)(3))

X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.18 m/s to 4.42 m/s as measured at the center of the pendulum accelerometer. (572.123(c)(4))

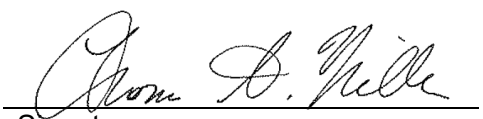
X 13. Complete the following table:

Neck Extension Test Results (572.123(b)(2)) & (572.123(c)(4)(I & ii))

| Parameter | | Specification | Result |
|---|---|---|---|
| Pendulum impact speed | | 4.18 m/s ≤ speed ≤ 4.42 m/s | 4.34 m/s |
| Pendulum ΔV with respect to impact speed | @ 10 ms | 1.0 m/s ≤ ΔV ≤ 1.4 m/s | 1.4 m/s |
| | @ 20 ms | 2.2 m/s ≤ ΔV ≤ 3.0 m/s | 2.7 m/s |
| | @ 30 ms | 3.2 m/s ≤ ΔV ≤ 4.2 m/s | 3.8 m/s |
| Plane D Rotation | | Peak moment*<br>-24 Nm ≤ moment ≤ -19 Nm during the following rotation range 85° ≤ angle ≤ 103° | -21 Nm @ 93 degrees |
| Negative Moment Decay** (Extension) | | Time to decay to -5 Nm 123 ms ≤ time ≤ 147 ms | 133 ms |

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(2)(iii))
My = Moment in Nm measured by the transducer
Fx = 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. (572.123(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

01/08/2016
Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16103

| Tested Parameter | | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | | deg C | 20.6 to 22.2 | 20.9 | Pass |
| Laboratory Relative Humidity | | % | 10 to 70 | 32 | Pass |
| Pendulum Speed | | m/s | 4.18 to 4.42 | 4.34 | Pass |
| Pendulum Velocity | 10 ms | m/s | 1.0 to 1.4 | 1.4 | Pass |
| | 20 ms | m/s | 2.2 to 3.0 | 2.7 | Pass |
| | 30 ms | m/s | 3.2 to 4.2 | 3.8 | Pass |
| D Plane Rotation | Max | deg | 85 to 103 | 93 | Pass |
| Occipital Condyle Moment within Deflection Corridor | | Nm | -19 to -24 | -21 | Pass |
| Positive Moment Time Curve Decay to 5 Nm | | msec | 123 to 147 | 133 | Pass |
| | | | Overall Results | | Pass |

Laboratory Technician

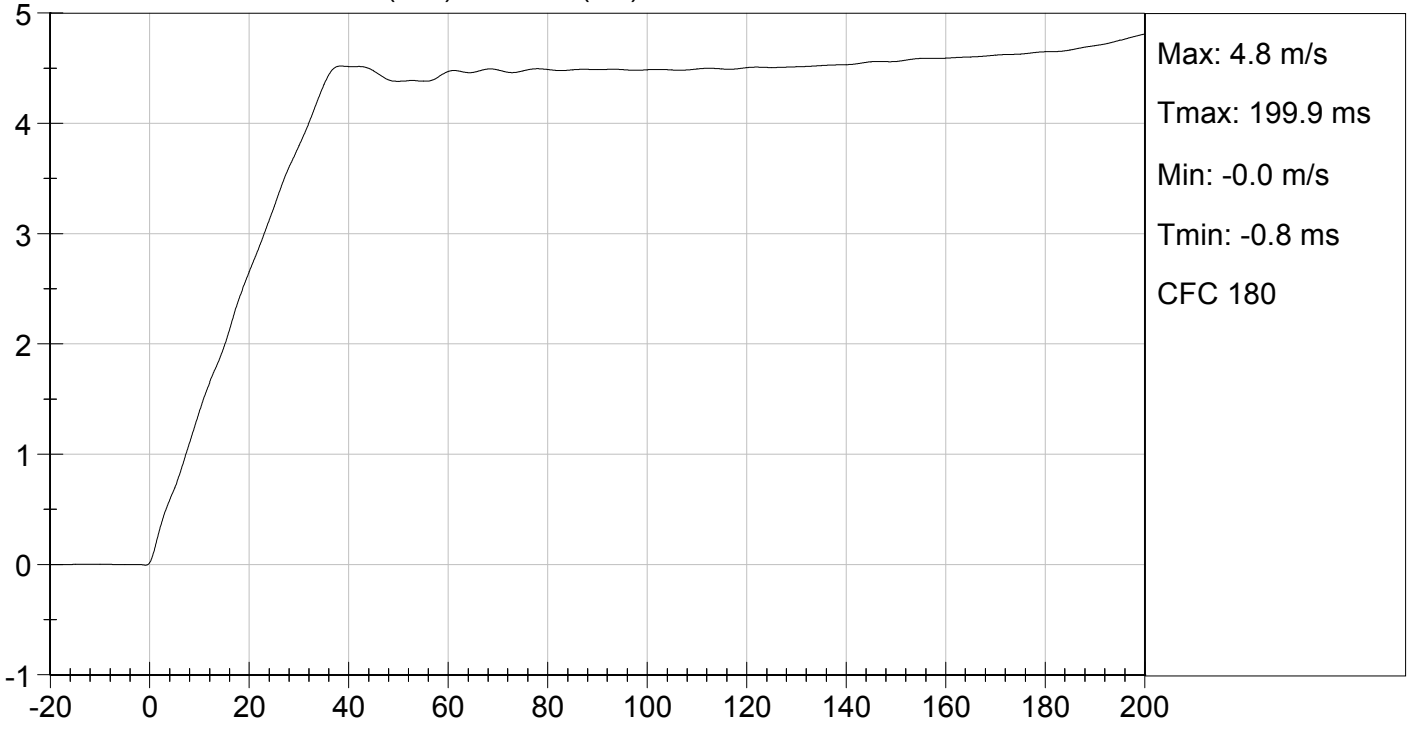
01/08/2016
Test Date

Approved By

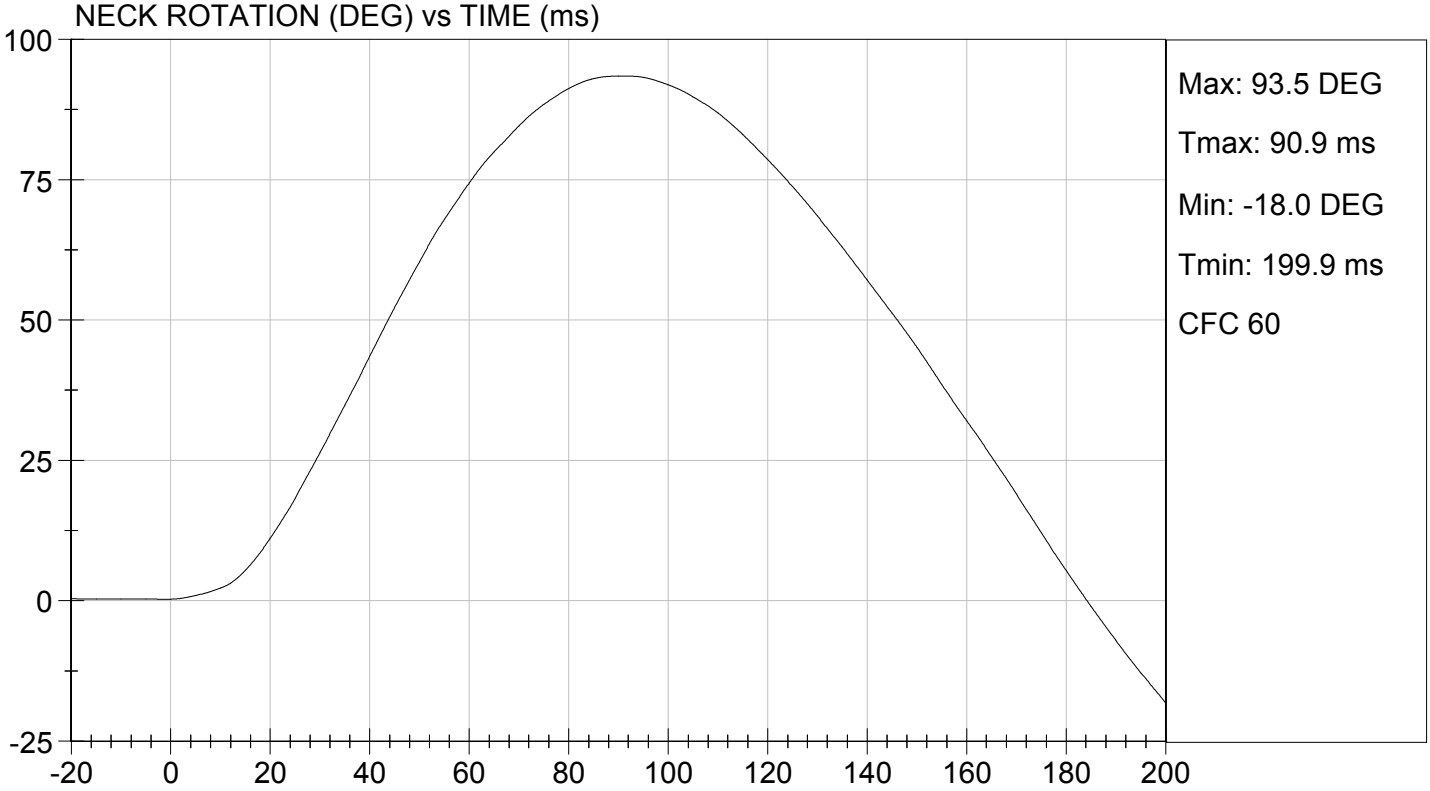
TEST DESC: NECK EXTENSION
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 01/08/2016
TEST #: D16103

PENDULUM VELOCITY (m/s) vs TIME (ms)

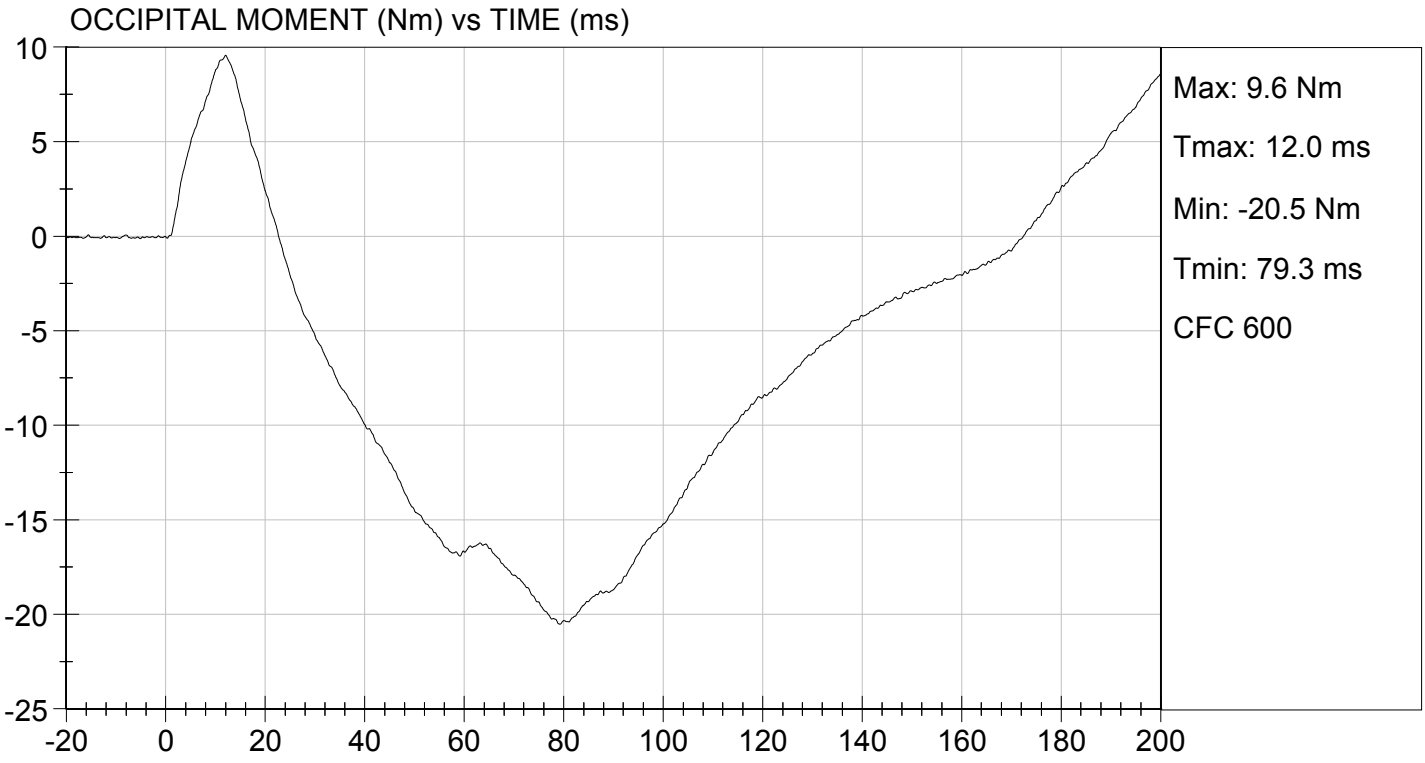



NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 01/08/2016
TEST #: D16103



**DATA SHEET C6**
THORAX IMPACT TEST (572.124) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/18/2016

Technician: Thomas Miller

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last thorax impact test. (572.127(o))
X N/A, ONLY one thorax impact test performed

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

X 3. The complete assembled dummy (127-0000) is used (572.124(b)).

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)(1))

| | |
|---|---|
| Record the maximum temperature | 21.2°C |
| Record the minimum temperature | 20.9°C |
| Record the maximum humidity | 34% |
| Record the minimum humidity | 31% |

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.
Record findings and actions:
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 damage.

X 6. The dummy is dressed in a size 4 pair of long pants having a weight of less than 0.090 kg (0.2 lb) with the legs cut off sufficiently above the knee to allow the knee target to be visible. (572.124(c)(2))

X 7. Seat the dummy, (chest skin still removed) without back support on the test fixture surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))

X 8. Level the ribs both longitudinally and laterally ± 0.5° and adjust the pelvis angle to 8° ± 2°. The angle may be measured at the pelvis lumbar joining surface.

X 9. The midsagittal plane of the dummy is vertical within ± 1°. (572.124(c)(3))

X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.124(c)(3))

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. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))

X 14. Place the arm assemblies horizontal ± 2° and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.

X 15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))

X 16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is 6.71 m/s ± 0.12 m/s. (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

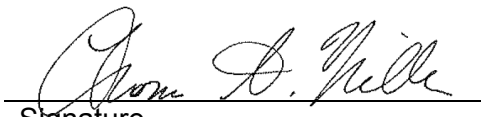
X 17. Complete the following table:

Thorax Impact Results (572.124(b)) and 572.124(b)(1)&(2))

| Parameter* | Specification | Result |
|---|---|---|
| Test Probe Speed | 6.59 m/s ≤ speed ≤ 6.83 m/s | 6.60 m/s |
| Chest Compression | 38.0 mm ≤ compression ≤ 46.0 mm | 39.4 mm |
| Peak force** between 38.0 and 46.0 mm chest compression | 1150N ≤ peak force ≤ 1380N | 1280 N |
| Peak force** between 12.5 and 38.0 mm chest compression | Peak force ≤ 1500 N | 1345 N |
| Internal Hysteresis*** | 65% ≤ hysteresis ≤ 85% | 75% |

*Time zero is defined as the time of initial contact between the test probe and the chest skin.
**Force = impactor mass x acceleration
***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 10C)

X 18. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.



Signature

01/08/2016
Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16104

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Temperature | deg C | 20.6 to 22.2 | 21.1 | Pass |
| Relative Humidity | % | 10 to 70 | 33 | Pass |
| Probe Speed | m/s | 6.59 to 6.83 | 6.60 | Pass |
| Peak Deflection | mm | 38.0 to 46.0 | 39.4 | Pass |
| Peak Resistive Force w/in Deflection Corridor | N | 1150 to 1380 | 1,280 | Pass |
| Internal Hysteresis | % | 65 to 85 | 75 | Pass |
| Peak Force 12.5 mm - 38.0 mm | N | <= 1,500 | 1,345 | Pass |
| | | Overall Test Results | | Pass |

Laboratory Technician

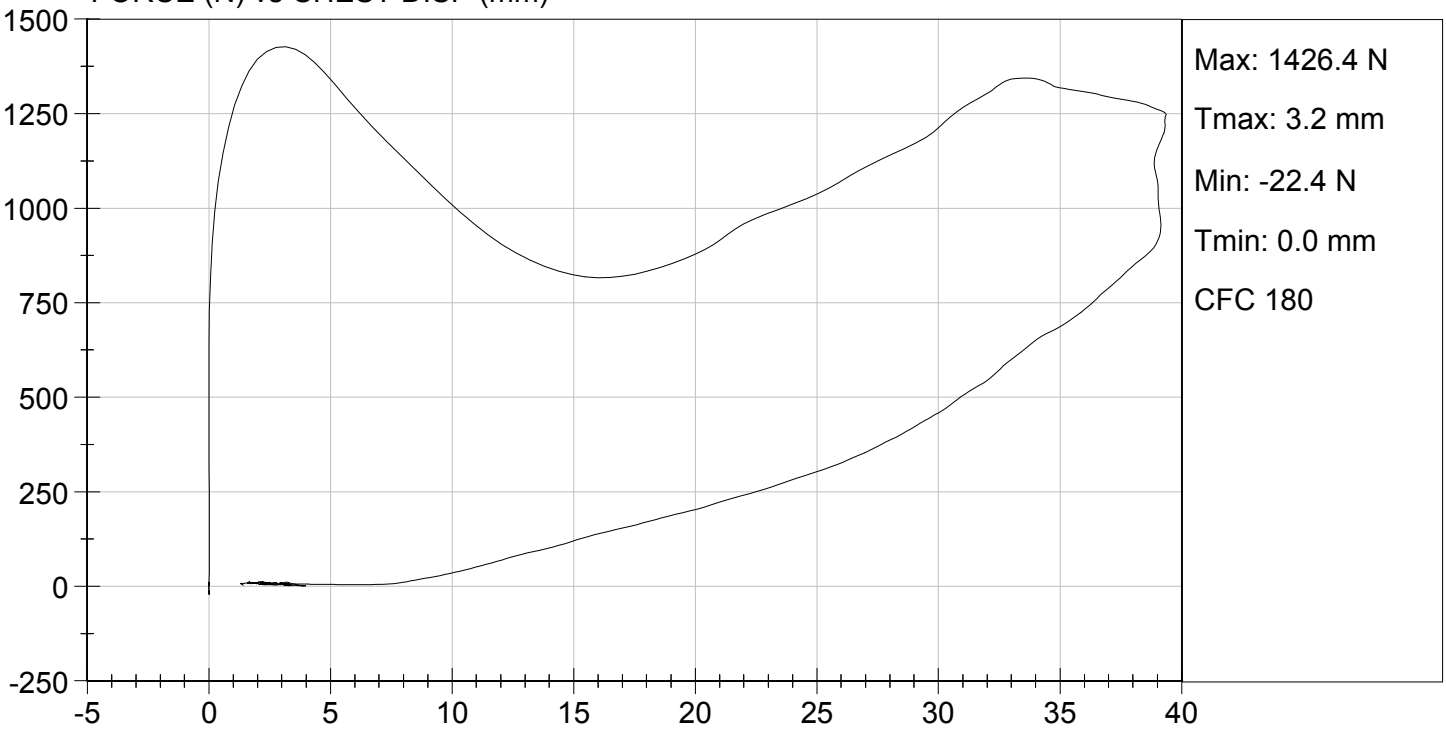
01/08/2016
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 01/08/2016
TEST #: D16104

FORCE (N) vs CHEST DISP (mm)



**DATA SHEET C7**
TORSO FLEXION TEST (572.125) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/08/2016

Technician: Thomas Miller

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last torso flexion test. (572.127(o))
X N/A, ONLY one torso flexion test performed

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

X 3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).
X with legs below the femurs.
___ 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 | 21.2°C |
| Record the minimum temperature | 20.9°C |
| Record the maximum humidity | 34% |
| Record the minimum humidity | 31% |

X 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch 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. (572.125(c)(3))

X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C**.** (572.125(c)(6))

X 7. 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. (572.125(c)(4))

X 8. 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. (572.125(c)(4))

X 9. Remove all external support that was implemented in 9 above. (572.125(c)(5))

X 10. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(5))
Record reference plane angle (max. allowed 22°) See Result Table

X 11. Attach the pull cable and the load cell. (572.125(c)(6))

X 12. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.125(c)(7))

X 13. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.125(c)(8))

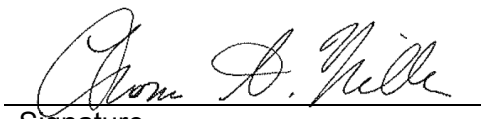
X 14. As quickly as possible release the force applied to the attachment bracket.(572.125(c)(9))

X 15. 3 minutes after the release of the force, measure the reference plane angle. (572.125(c)(9))

X 16. Complete the following table:

Torso Flexion Results (572.125(b)), (572.125(c)(7)), (572.125(c)(8))

| Parameter | Specification | Result |
|---|---|---|
| Initial ref. plane angle | Angle ≤ 22° | 18° |
| Torso rotation rate | 0.5°/s ≤ rate ≤ 1.5°/s | 0.6°/s |
| Force at 45° ± 0.5° | 147 N ≤ force ≤ 200 N | 151 N |
| Final ref. plane angle | Initial ref. plane angle ± 8° | 22° |



Signature

01/08/2016
Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16107

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.1 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 34 | Pass |
| Initial Angle | deg | 0 to 22 | 18 | Pass |
| Return Angle | deg | +/- 8 | 22 | Pass |
| Force at 45 deg | N | 147 to 200 | 151 | Pass |
| Upper Torso Deflection Rate | deg/s | 0.5 to 1.5 | 0.6 | Pass |
| | | Overall Result | | Pass |

Laboratory Technician

01/08/2016
Test Date

Approved By

**DATA SHEET C8**

LEFT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/08/2016

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))

X N/A, ONLY one knee impact test performed

X 2. The test fixture conforms to the specifications in Figure 12C.

X 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))

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. (572.126(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.2°C |
| Record the minimum temperature | 20.9°C |
| Record the maximum humidity | 34% |
| Record the minimum humidity | 31% |

X 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))

X 6. No parts of the foot or tibia contact any exterior surface. (572.126(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. (572.126(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. (572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.126(c)(6))

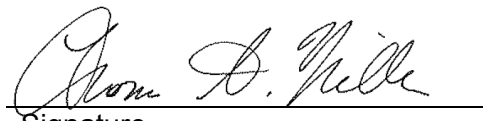
X 11. Complete the following table:

Knee Impact Results (572.126(b)(1)) & (572.126(c)(5))

| Parameter | Specification | Result |
|---|---|---|
| Probe speed | 2.07 m/s ≤ speed ≤ 2.13 m/s | 2.11 m/s |
| Peak resistance force* | 2000 N ≤ force ≤ 3000 N | 2448 N |

*Force = impactor mass x deceleration (572.126(b))

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



Signature

01/08/2016
Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16106

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.5 | 20.9 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 32 | Pass |
| Probe Speed | m/s | 2.07 to 2.13 | 2.11 | Pass |
| Maximum Force | N | 2000 to 3000 | 2448 | Pass |
| | | Overall Test Results | | Pass |

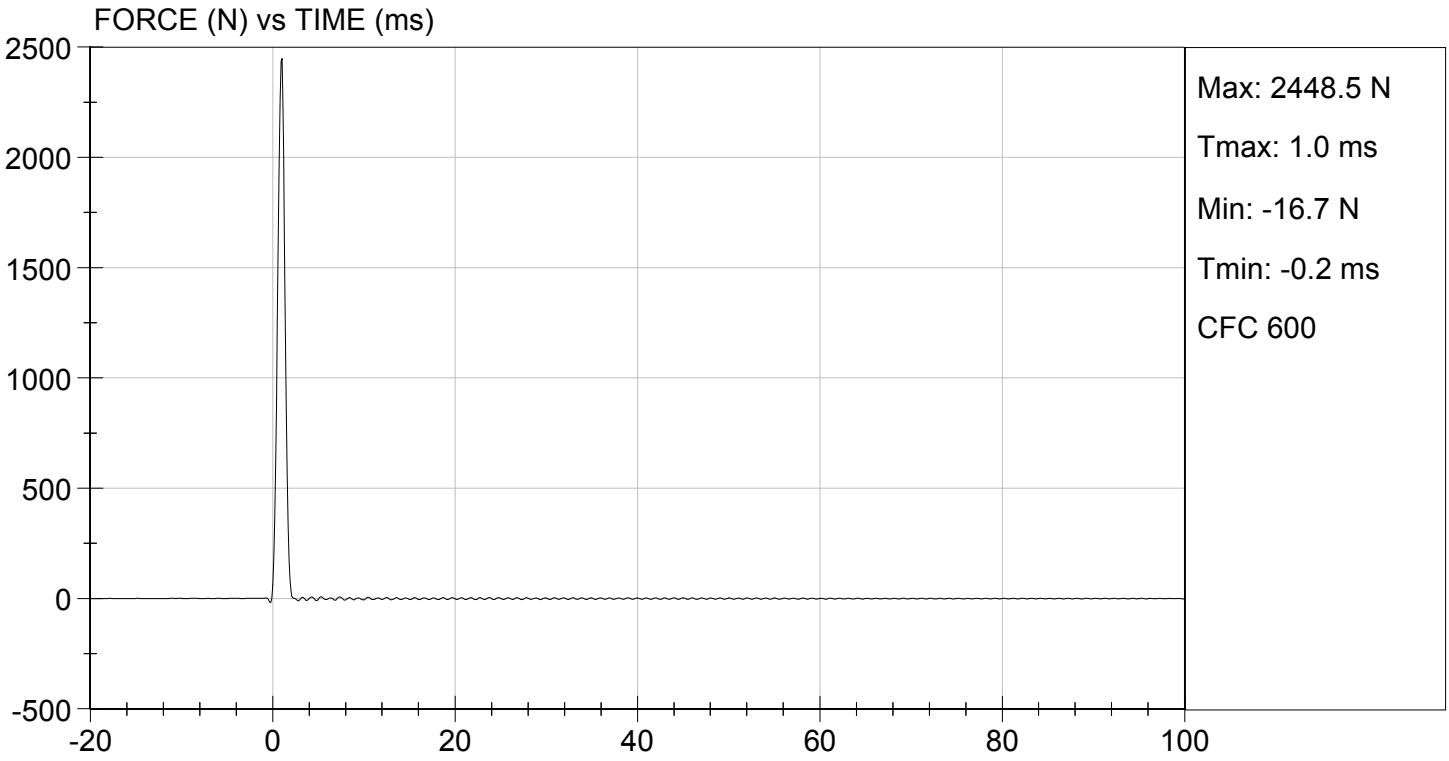
Laboratory Technician

01/08/2016
Test Date

Approved By

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

TEST DATE: 01/08/2016
TEST #: D16106



**DATA SHEET C9**

RIGHT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/08/2016

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))

X N/A, ONLY one knee impact test performed

X 2. The test fixture conforms to the specifications in Figure 12C.

X 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))

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. (572.126(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.2°C |
| Record the minimum temperature | 20.9°C |
| Record the maximum humidity | 34% |
| Record the minimum humidity | 31% |

X 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))

X 6. No parts of the foot or tibia contact any exterior surface. (572.126(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. (572.126(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. (572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.126(c)(6))

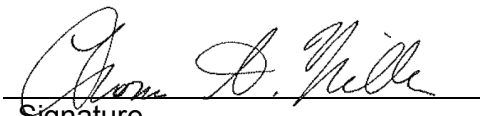
X 11. Complete the following table:

Knee Impact Results (572.126(b)(1)) & (572.126(c)(5))

| Parameter | Specification | Result |
|---|---|---|
| Probe speed | 2.07 m/s ≤ speed ≤ 2.13 m/s | 2.07 m/s |
| Peak resistance force* | 2000 N ≤ force ≤ 3000 N | 2292 N |

*Force = impactor mass x deceleration (572.126(b))

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



Signature

01/08/2016

Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16105

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.5 | 20.9 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 32 | Pass |
| Probe Speed | m/s | 2.07 to 2.13 | 2.07 | Pass |
| Maximum Force | N | 2000 to 3000 | 2292 | Pass |
| | | Overall Test Results | | Pass |

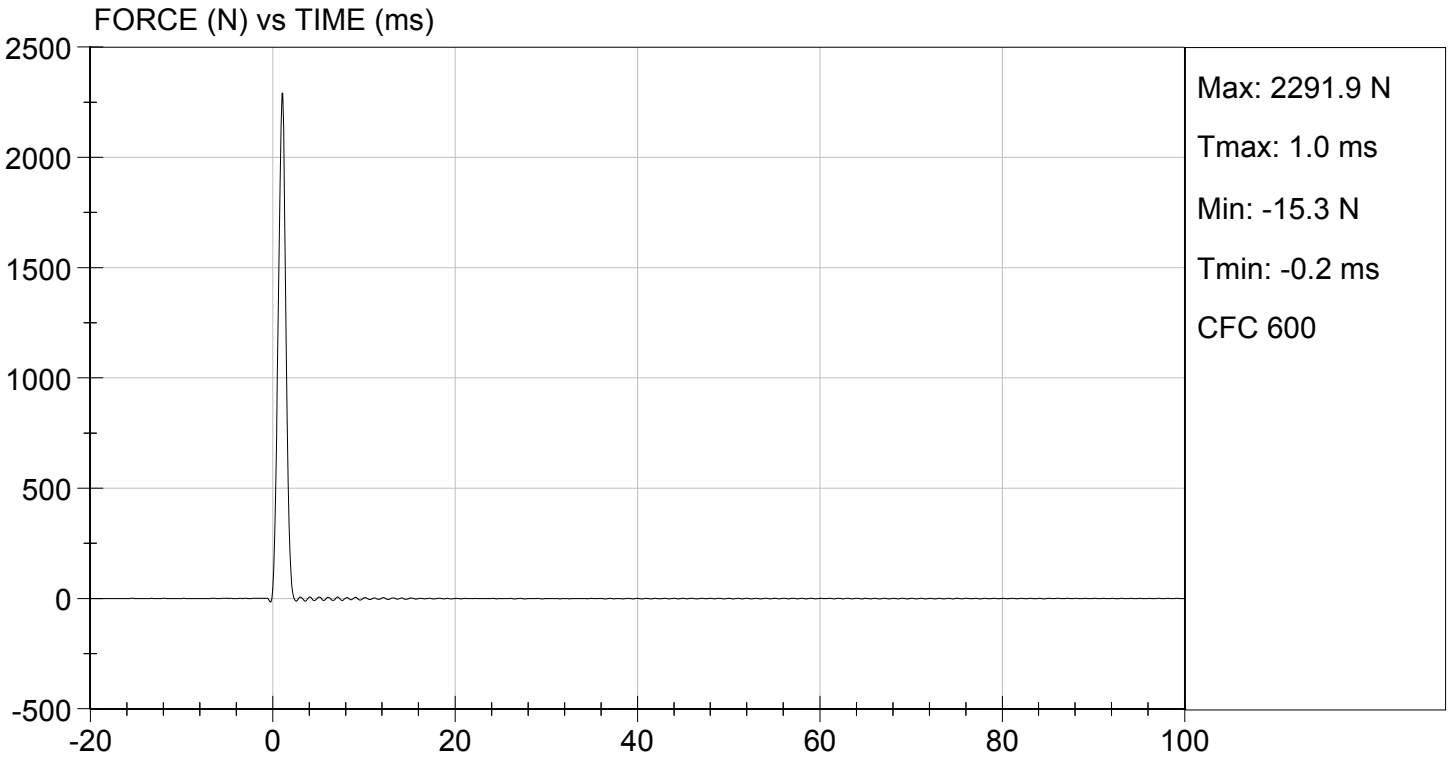
Laboratory Technician

01/08/2016
Test Date

Approved By

TEST DESC: RIGHT KNEE
VELOCITY: 6.78 ft/s, 2.07 m/s

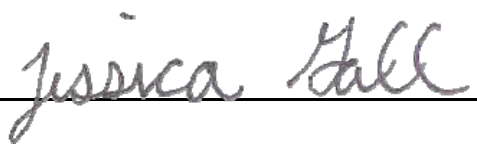
TEST DATE: 01/08/2016
TEST #: D16105



## DATA SHEET C10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO. | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---|---|---|---|---|---|
| DUMMY INSTRUMENTATION | | | | | |
| HEAD ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P79819 | 10/14/2015 | 04/14/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P79821 | 10/14/2015 | 04/14/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P79822 | 10/14/2015 | 04/14/2016 |
| NECK TRANSDUCER | Denton | 1716A | 1175 | 11/20/2015 | 05/20/2016 |
| CHEST ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P82128 | 10/14/2015 | 04/14/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P82129 | 10/14/2015 | 04/14/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P82130 | 10/14/2015 | 04/14/2016 |
| CHEST POTENTIOMETER | Servo | 08C1-3179 | 155 | 10/14/2015 | 04/14/2016 |
| FEMUR LOAD CELLS | | | | | |
| (1) RIGHT FEMUR | N/A | N/A | N/A | N/A | N/A |
| (2) LEFT FEMUR | N/A | N/A | N/A | N/A | N/A |
| LABORATORY INSTRUMENTATION | | | | | |
| NECK PENDULUM ACCELEROMTER | Endevco | 7231C-750 | AH5P1 | 07/24/2015 | 01/24/2016 |
| THORAX PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P82097 | 11/30/2015 | 05/30/2016 |
| KNEE PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P88169 | 11/30/2015 | 05/30/2016 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol | 132-0-0-102 | 18 | 09/28/2015 | 03/28/2016 |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol | 132-0-0-102 | 29 | 09/28/2015 | 03/28/2016 |

LABORATORY TECHNICIAN: 

**DATA SHEET C3**
HEAD DROP TEST (572.122) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/15/2016

Technician: Thomas Miller

____ Pre test calibration
__X__ Post test calibration verification

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

__X__ 1. It has been at least 2 hours since the last head drop. (572.122(c)(5))
__X__ N/A, ONLY one head drop performed

__X__ 2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))

__X__ 3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.

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

__X__ 5. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.

__X__ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))

__X__ 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. (572.122(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 28% |
| Record the minimum humidity | 26% |

__X__ 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

__X__ 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. (572.122(c)(2))

X 10. Suspend and orient the head assembly as shown in Figure 5C. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface.

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 5C. (572.122(c)(3))

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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 $2155.0 \times 10^{-6}$ mm (80 micro inches) (RMS). (572.122(c)(4))

Record actual micro finish: 50.9 micro inches

X 13. The impact surface is rigidly supported. (572.122(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. (572.122(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

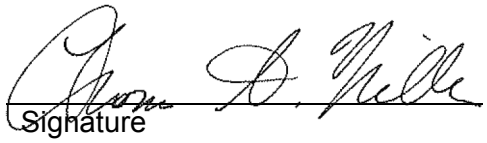
Record length: 595 mm

X 15. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.122(b)) & (572.122(c)(4))

X 16. Complete the following table using channel class 1000 data. (572.122(b)):

| Parameter | Specification | Result |
|---|---|---|
| Peak resultant acceleration | 245 g ≤ x ≤ 300 g | 284 g |
| 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 ≤ 15 g | -10.1 g |

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



Signature

01/15/2016

Date

**MGA RESEARCH CORPORATION**

**HEAD DROP TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test ID:** D16191

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.1 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 27 | Pass |
| Peak Resultant Acceleration | G's | 245 to 300 | 284 | Pass |
| Peak Lateral Acceleration | G's | <= +/- 15.0 | -10.1 | Pass |
| Unimodal | N/A | Yes | Yes | Pass |
| Oscillations | N/A | within 10% of peak | Yes | Pass |
| | | Overall Test Results | | Pass |

Laboratory Technician

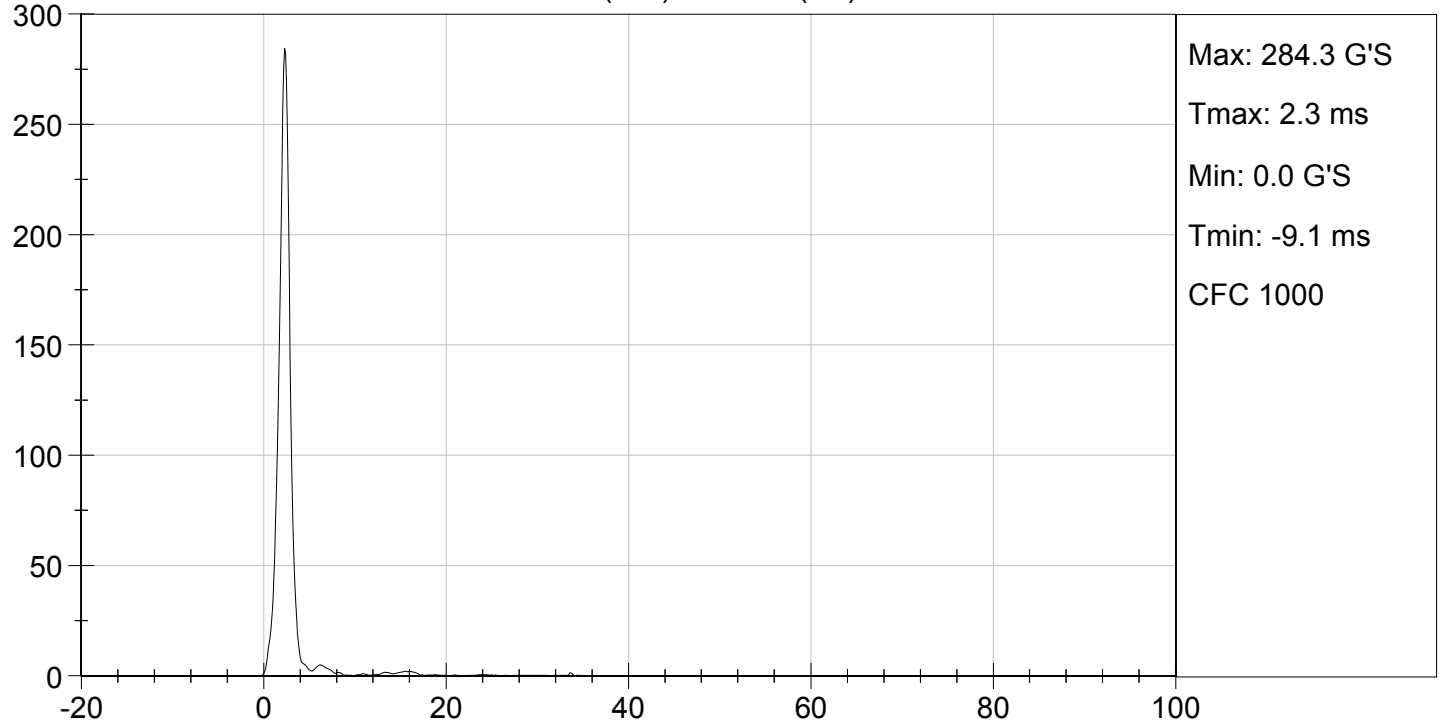
01/15/2016
Test Date

Approved By

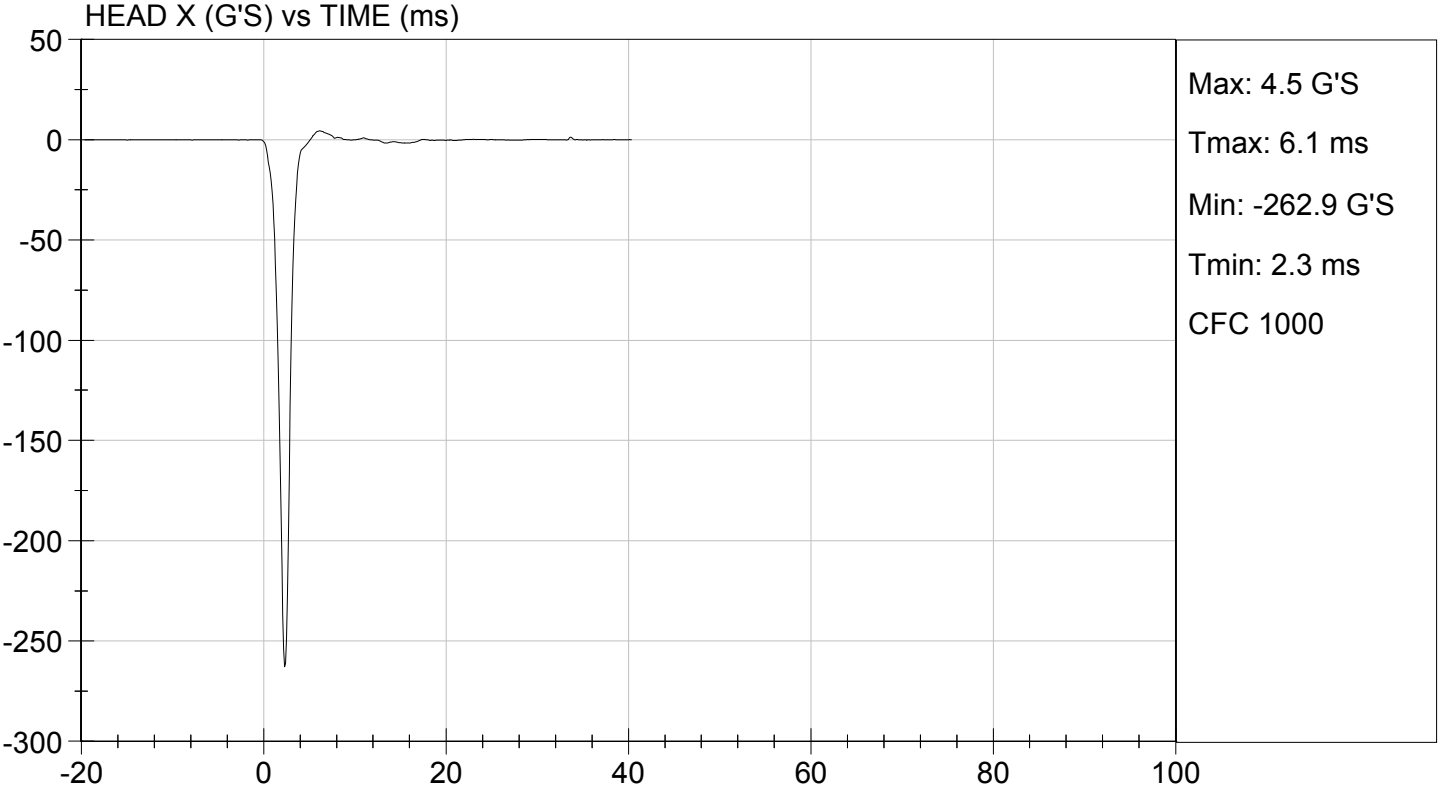
TEST DESC: HEAD DROP

TEST DATE: 01/15/2016
TEST #: D16191

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

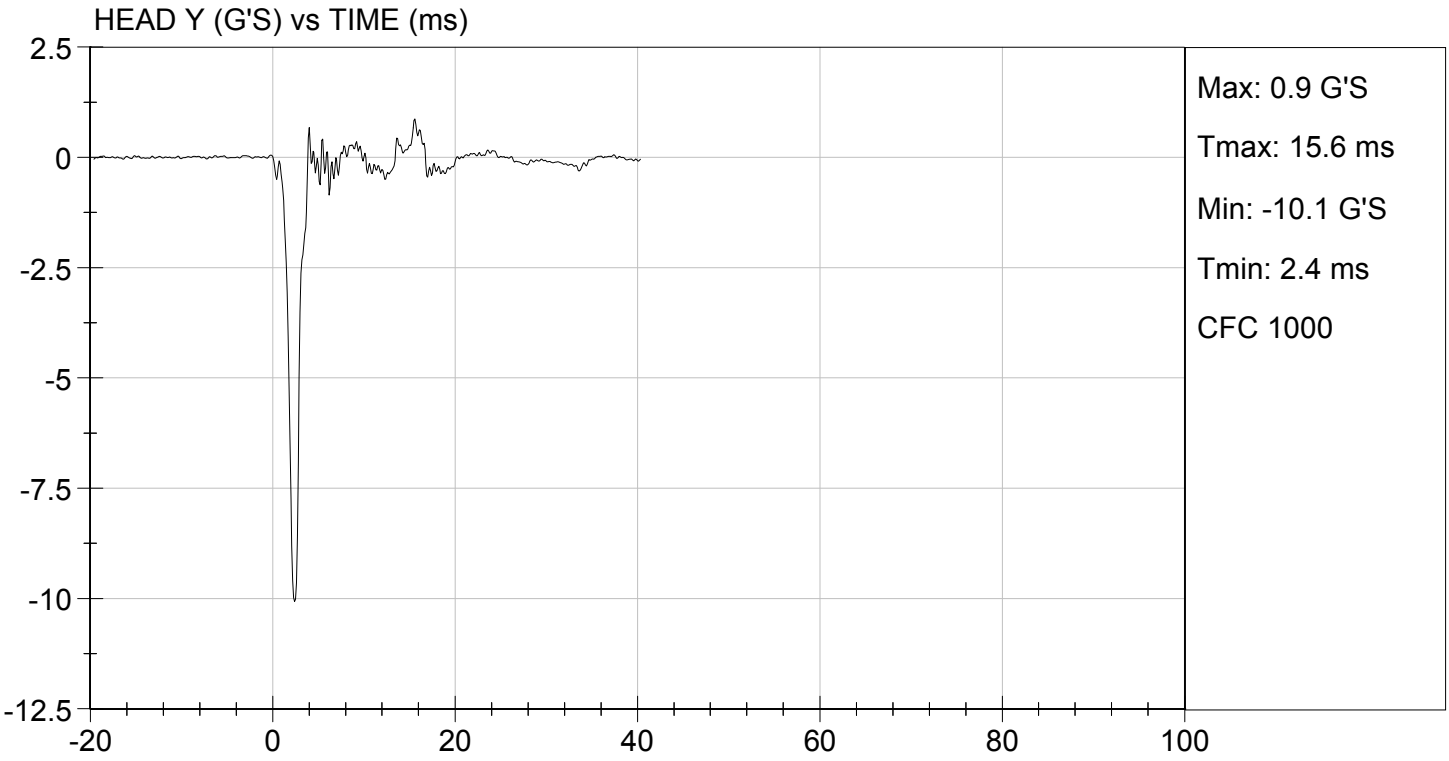


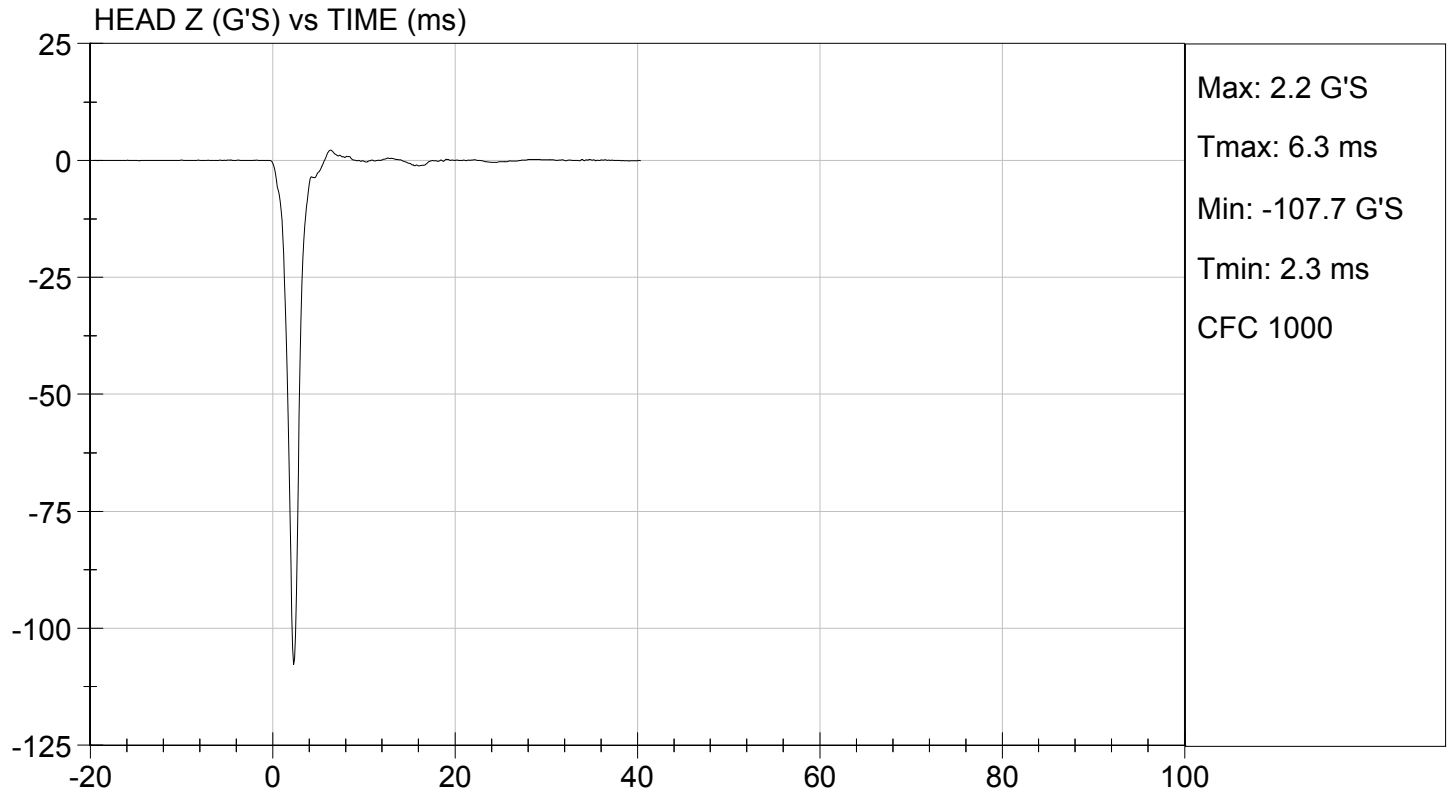

HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 01/15/2016
TEST #: D16191



**DATA SHEET C4**
NECK FLEXION TEST (572.123) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/15/2016

Technician: Thomas Miller

____ Pre test calibration
_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last neck test. (572.127(o))
_X_ N/A, ONLY one neck test performed

_X_ 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(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. (572.123(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.2°C |
| Record the minimum temperature | 20.9°C |
| Record the maximum humidity | 34% |
| Record the minimum humidity | 31% |

_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 (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
Record findings and actions: No damage

_X_ 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))

_X_ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123l(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 7C for the flexion test. (572.123l(3))

X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.83 m/s to 5.07 m/s as measured at the center of the pendulum accelerometer. (572.123l(4)(i))

X 12. Complete the following table:

Neck Flexion Test Results (572.123(b)(1)) & (572.123(c)(4)(I &ii))

| Parameter | | Specification | Result |
|---|---|---|---|
| Pendulum impact speed | | 4.83 m/s ≤ speed ≤ 5.07 m/s | 4.98 m/s |
| Pendulum ΔV with respect to impact speed | @ 10 ms | 1.2 m/s ≤ ΔV ≤ 1.6 m/s | 1.5 m/s |
| | @ 20 ms | 2.4 m/s ≤ ΔV ≤ 3.4 m/s | 2.9 m/s |
| | @ 30 ms | 3.8 m/s ≤ ΔV ≤ 5.0 m/s | 4.1 m/s |
| Plane D Rotation | | Peak moment*<br>27 Nm ≤ moment ≤ 33 Nm during the following rotation range 74° ≤ angle ≤ 92° | 28 Nm @ 79 degrees |
| Positive Moment Decay** (Flexion) | | Time to decay to 5 Nm 103 ms ≤ time ≤ 123 ms | 112 ms |

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(1)(iii))
My = Moment in Nm measured by the transducer
Fx = 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. (572.123(b)(3))

X 13. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

Signature

01/15/2016
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16192

| 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 | 28 | Pass |
| Pendulum Speed | | m/s | 4.83 to 5.07 | 4.98 | Pass |
| Pendulum Velocity | 10 ms | m/s | 1.2 to 1.6 | 1.5 | Pass |
| | 20 ms | m/s | 2.4 to 3.4 | 2.9 | Pass |
| | 30 ms | m/s | 3.8 to 5.0 | 4.1 | Pass |
| D Plane Rotation | Max | deg | 74 to 92 | 79 | Pass |
| Occipital Condyle Moment within Deflection Corridor | | Nm | 27 to 33 | 28 | Pass |
| Positive Moment Time Curve Decay to 5 Nm | | ms | 103 to 123 | 112 | Pass |
| | | | Overall Results | | Pass |

Laboratory Technician

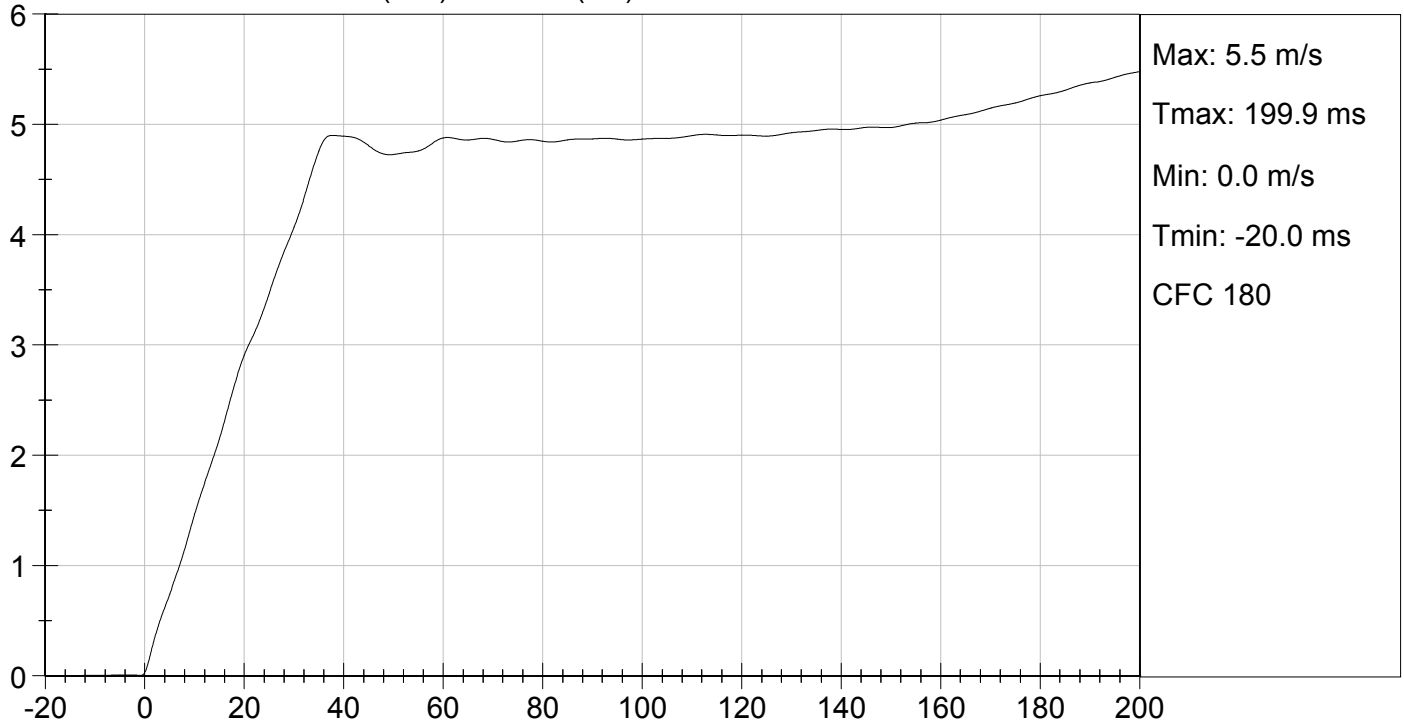
01/15/2016
Test Date

Approved By

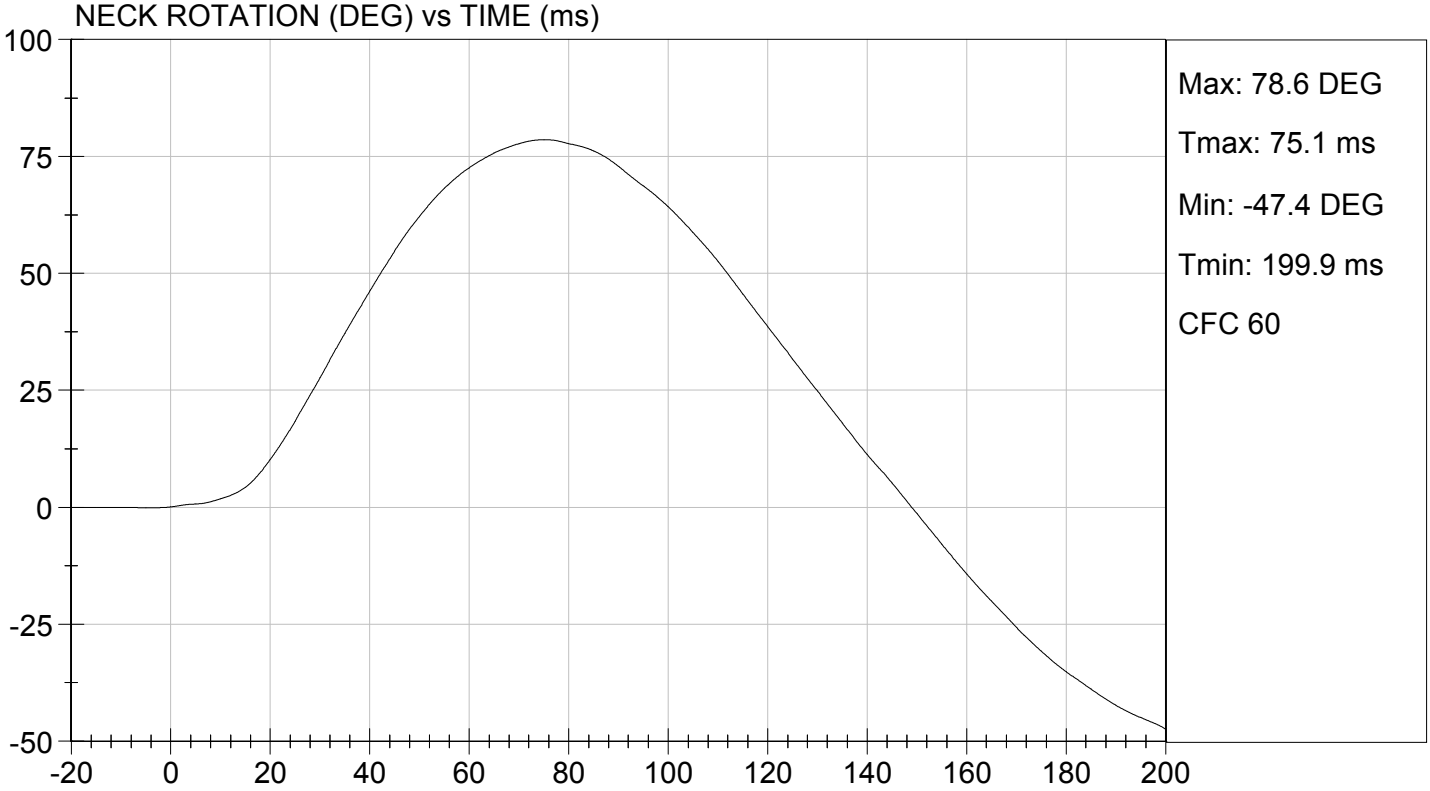
TEST DESC: NECK FLEXION
VELOCITY: 16.34 ft/s, 4.98 m/s

TEST DATE: 01/15/2016
TEST #: D16192

PENDULUM VELOCITY (m/s) vs TIME (ms)



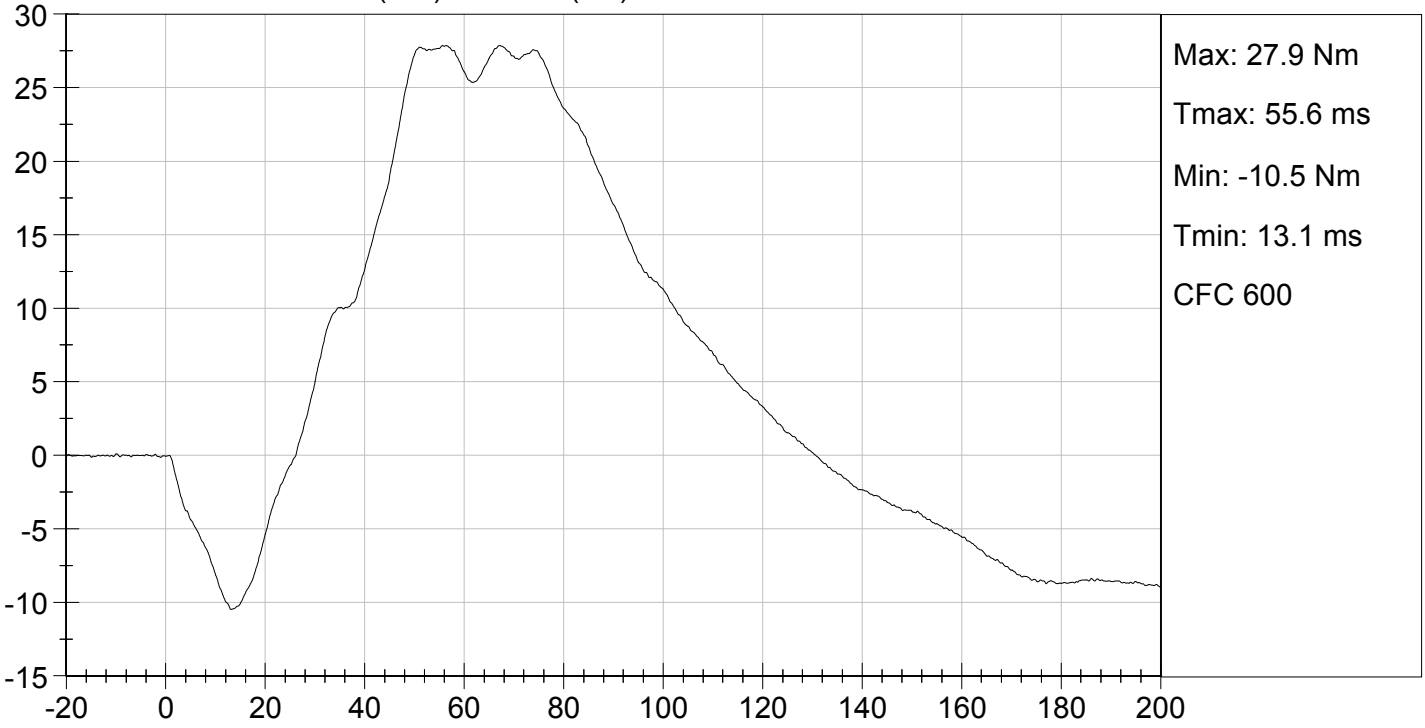

NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 16.34 ft/s, 4.98 m/s

TEST DATE: 01/15/2016
TEST #: D16192

OCCIPITAL MOMENT (Nm) vs TIME (ms)



**DATA SHEET C5**

NECK EXTENSION TEST (572.123) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/15/2016

Technician: Thomas Miller

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last neck test. (572.127(o))

_X_ N/A, ONLY one neck test performed

_X_ 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(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. (572.123(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 28% |
| Record the minimum humidity | 26% |

_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 (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.

Record findings and actions: No damage

X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123(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 8C for the extension test. (572.123(c)(3))

X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.18 m/s to 4.42 m/s as measured at the center of the pendulum accelerometer. (572.123(c)(4))

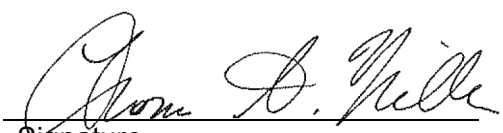
X 13. Complete the following table:

Neck Extension Test Results (572.123(b)(2)) & (572.123(c)(4)(I & ii))

| Parameter | | Specification | Result |
|---|---|---|---|
| Pendulum impact speed | | 4.18 m/s ≤ speed ≤ 4.42 m/s | 4.42 m/s |
| Pendulum ΔV with respect to impact speed | @ 10 ms | 1.0 m/s ≤ ΔV ≤ 1.4 m/s | 1.4 m/s |
| | @ 20 ms | 2.2 m/s ≤ ΔV ≤ 3.0 m/s | 2.7 m/s |
| | @ 30 ms | 3.2 m/s ≤ ΔV ≤ 4.2 m/s | 3.9 m/s |
| Plane D Rotation | | Peak moment*<br>-24 Nm ≤ moment ≤ -19 Nm during the following rotation range 85° ≤ angle ≤ 103° | -21 Nm @ 95 degrees |
| Negative Moment Decay** (Extension) | | Time to decay to -5 Nm 123 ms ≤ time ≤ 147 ms | 134 ms |

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(2)(iii))
My = Moment in Nm measured by the transducer
Fx = 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. (572.123(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

01/15/2016
Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16193

| 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 | 28 | Pass |
| Pendulum Speed | | m/s | 4.18 to 4.42 | 4.42 | Pass |
| Pendulum Velocity | 10 ms | m/s | 1.0 to 1.4 | 1.4 | Pass |
| | 20 ms | m/s | 2.2 to 3.0 | 2.7 | Pass |
| | 30 ms | m/s | 3.2 to 4.2 | 3.9 | Pass |
| D Plane Rotation | Max | deg | 85 to 103 | 95 | Pass |
| Occipital Condyle Moment within Deflection Corridor | | Nm | -19 to -24 | -21 | Pass |
| Positive Moment Time Curve Decay to 5 Nm | | msec | 123 to 147 | 134 | Pass |
| | | | Overall Results | | Pass |

Laboratory Technician

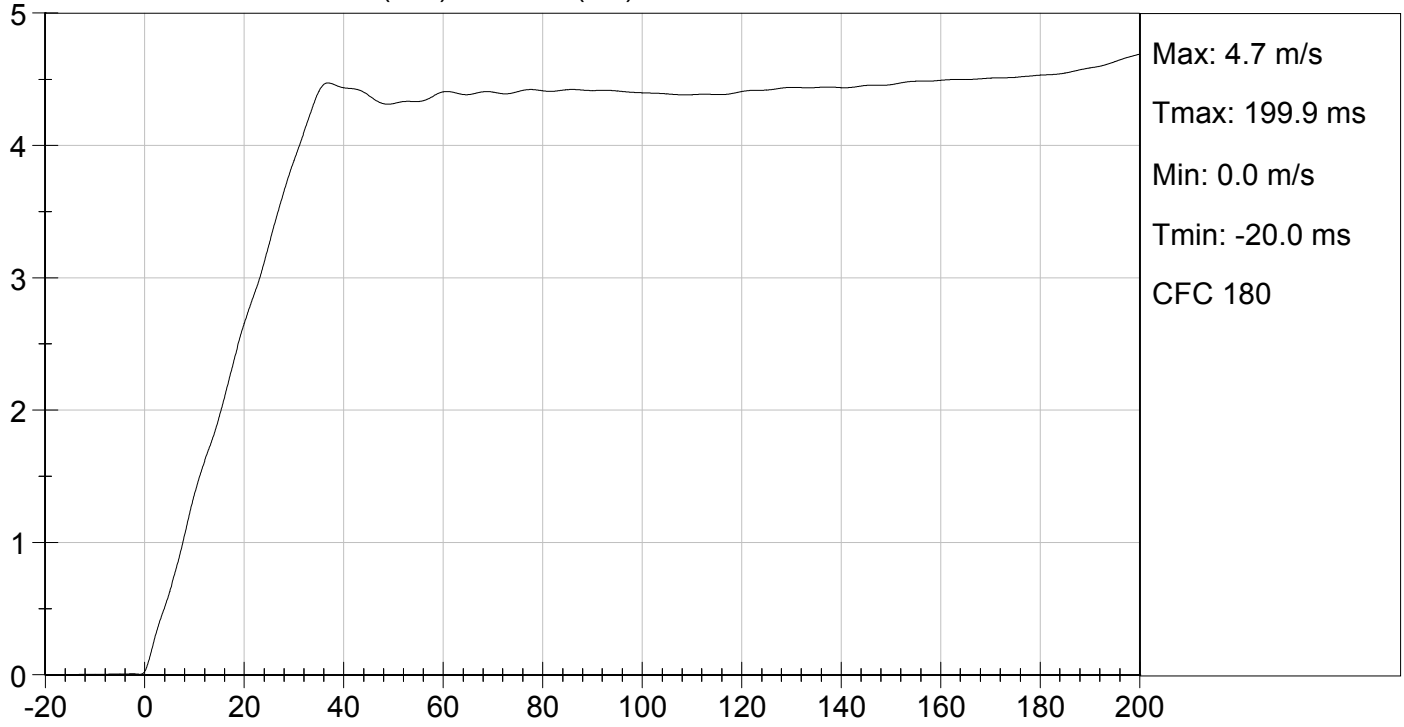
01/15/2016
Test Date

Approved By

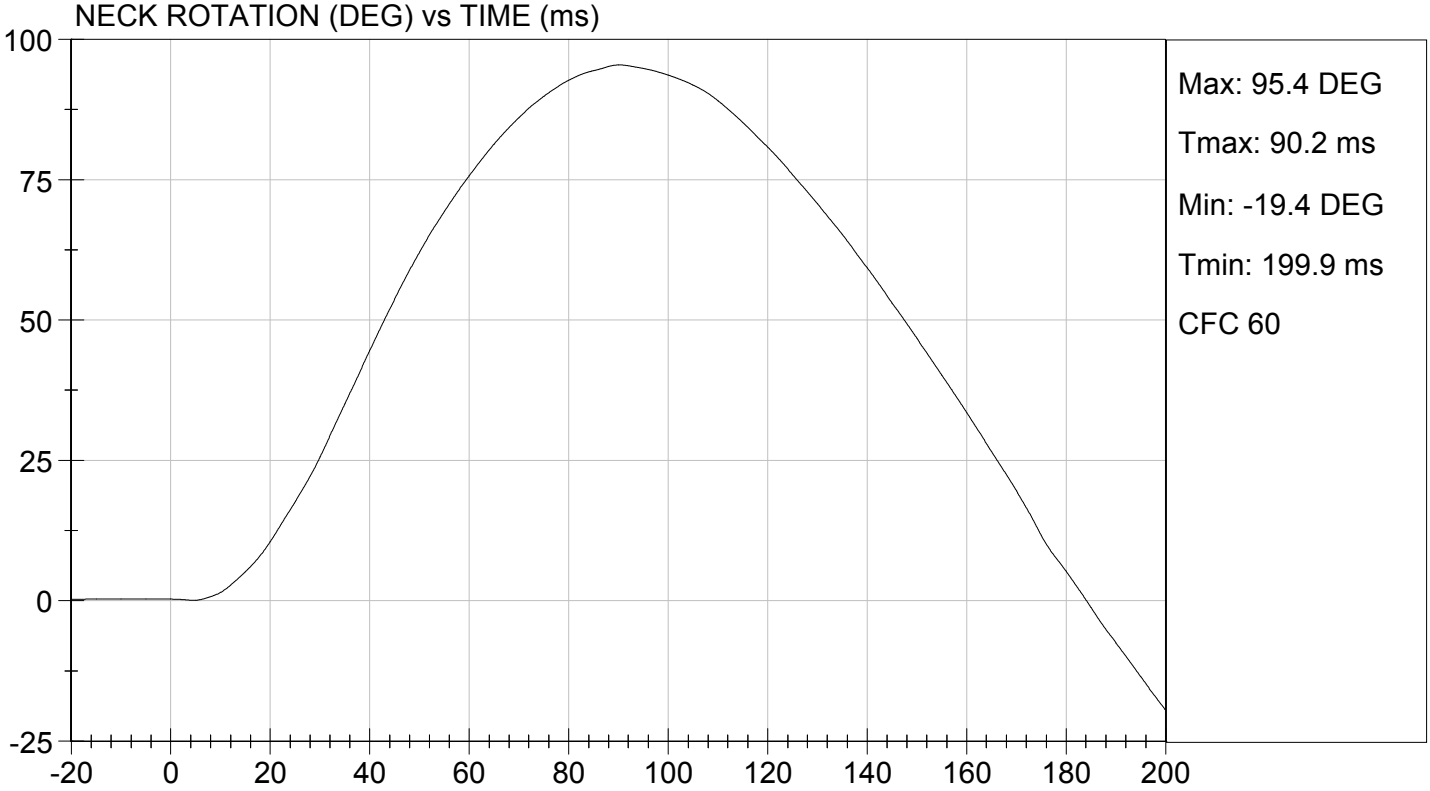
TEST DESC: NECK EXTENSION
VELOCITY: 14.49 ft/s, 4.42 m/s

TEST DATE: 01/15/2016
TEST #: D16193

PENDULUM VELOCITY (m/s) vs TIME (ms)

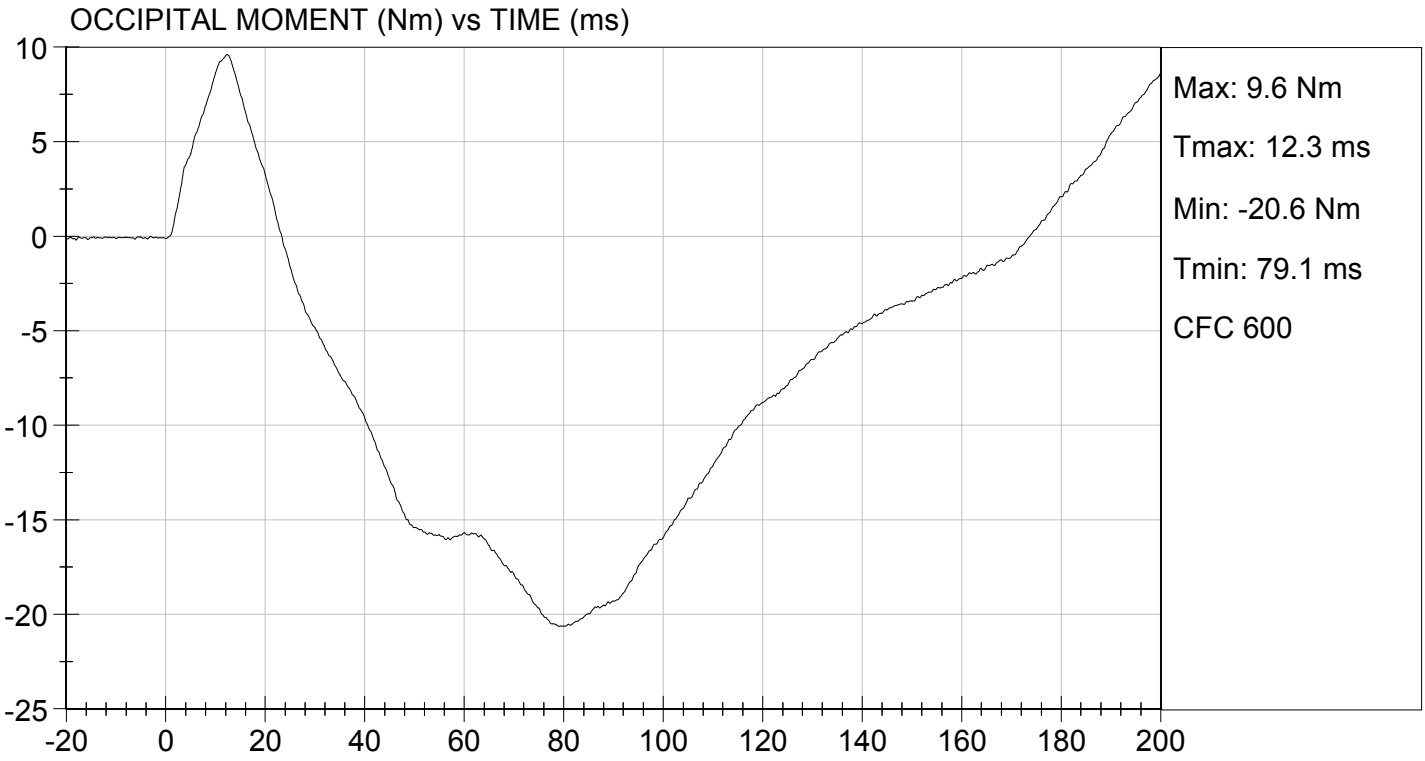



NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 14.49 ft/s, 4.42 m/s

TEST DATE: 01/15/2016
TEST #: D16193



**DATA SHEET C6**
THORAX IMPACT TEST (572.124) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/15/2016

Technician: Thomas Miller

____ Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last thorax impact test. (572.127(o))
X N/A, ONLY one thorax impact test performed

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

X 3. The complete assembled dummy (127-0000) is used (572.124(b)).

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)(1))

| | |
|---|---|
| Record the maximum temperature | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 28% |
| Record the minimum humidity | 26% |

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.
Record findings and actions:
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 damage.

X 6. The dummy is dressed in a size 4 pair of long pants having a weight of less than 0.090 kg (0.2 lb) with the legs cut off sufficiently above the knee to allow the knee target to be visible. (572.124(c)(2))

X 7. Seat the dummy, (chest skin still removed) without back support on the test fixture surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))

X 8. Level the ribs both longitudinally and laterally ± 0.5° and adjust the pelvis angle to 8° ± 2°. The angle may be measured at the pelvis lumbar joining surface.

X 9. The midsagittal plane of the dummy is vertical within ± 1°. (572.124(c)(3))

X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.124(c)(3))

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. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))

X 14. Place the arm assemblies horizontal ± 2° and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.

X 15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))

X 16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is 6.71 m/s ± 0.12 m/s. (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

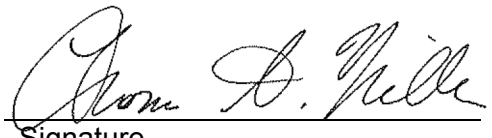
X 17. Complete the following table:

Thorax Impact Results (572.124(b)) and 572.124(b)(1)&(2))

| Parameter* | Specification | Result |
|---|---|---|
| Test Probe Speed | 6.59 m/s ≤ speed ≤ 6.83 m/s | 6.68 m/s |
| Chest Compression | 38.0 mm ≤ compression ≤ 46.0 mm | 42.0 mm |
| Peak force** between 38.0 and 46.0 mm chest compression | 1150N ≤ peak force ≤ 1380N | 1295 N |
| Peak force** between 12.5 and 38.0 mm chest compression | Peak force ≤ 1500 N | 1348 N |
| Internal Hysteresis*** | 65% ≤ hysteresis ≤ 85% | 73% |

*Time zero is defined as the time of initial contact between the test probe and the chest skin.
**Force = impactor mass x acceleration
***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 10C)

X 18. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.



Signature

01/15/2016
Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16194

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Temperature | deg C | 20.6 to 22.2 | 21.4 | Pass |
| Relative Humidity | % | 10 to 70 | 26 | Pass |
| Probe Speed | m/s | 6.59 to 6.83 | 6.68 | Pass |
| Peak Deflection | mm | 38.0 to 46.0 | 42.0 | Pass |
| Peak Resistive Force w/in Deflection Corridor | N | 1150 to 1380 | 1,295 | Pass |
| Internal Hysteresis | % | 65 to 85 | 73 | Pass |
| Peak Force 12.5 mm - 38.0 mm | N | <= 1,500 | 1,348 | Pass |
| | | Overall Test Results | | Pass |

Laboratory Technician

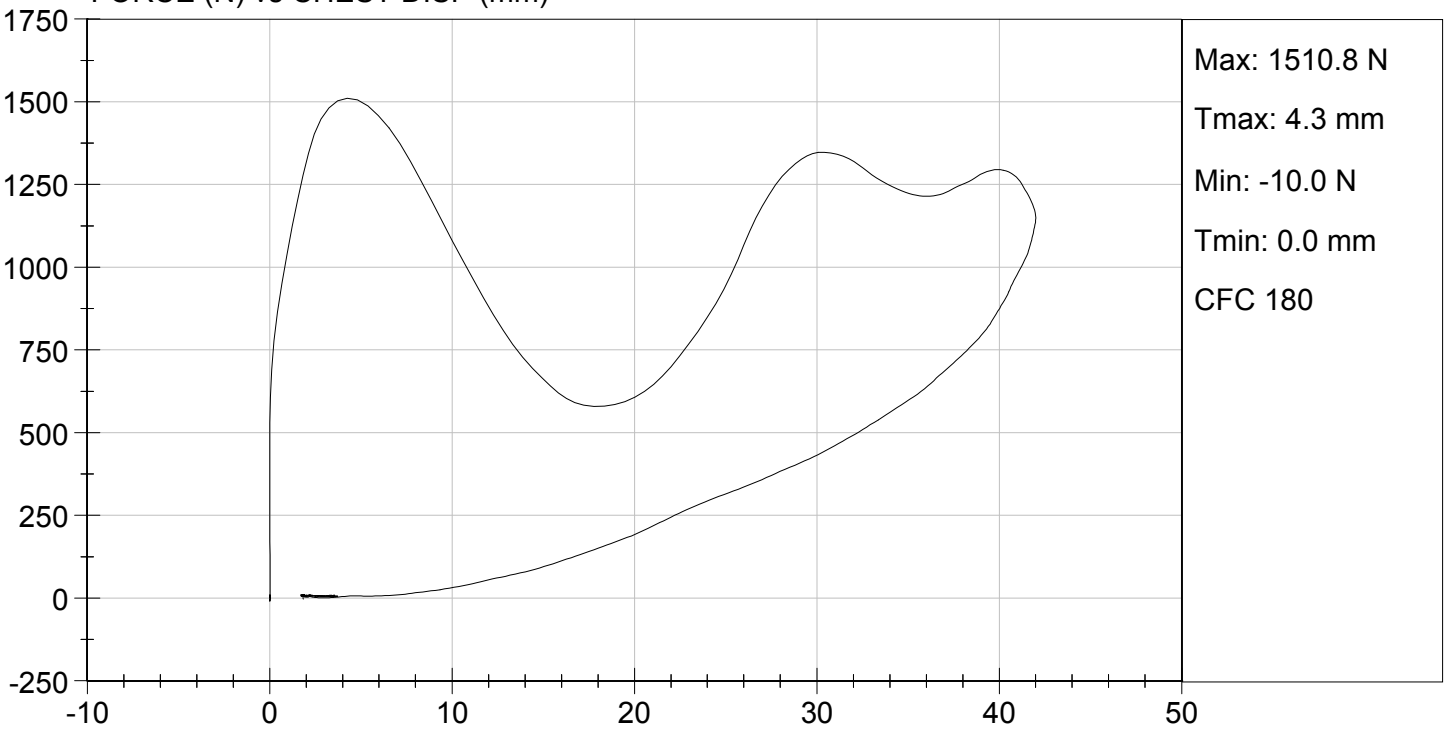
01/15/2016
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.93 ft/s, 6.68 m/s

TEST DATE: 01/15/2016
TEST #: D16194

FORCE (N) vs CHEST DISP (mm)



**DATA SHEET C7**
TORSO FLEXION TEST (572.125) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/15/2016

Technician: Thomas Miller

____ Pre test calibration
_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last torso flexion test. (572.127(o))
_X_ N/A, ONLY one torso flexion test performed

_X_ 2. The test fixture conforms to the specifications in Figure 11C.

_X_ 3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).
_X_ with legs below the femurs.
____ 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 | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 28% |
| Record the minimum humidity | 26% |

_X_ 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch 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. (572.125(c)(3))

X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C**.** (572.125(c)(6))

_X_ 7. 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. (572.125(c)(4))

_X_ 8. 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. (572.125(c)(4))

_X_ 9. Remove all external support that was implemented in 9 above. (572.125(c)(5))

X 10. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(5))
Record reference plane angle (max. allowed 22°) See Result Table

X 11. Attach the pull cable and the load cell. (572.125(c)(6))

X 12. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.125(c)(7))

X 13. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.125(c)(8))

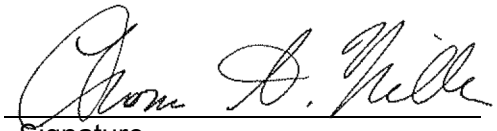
X 14. As quickly as possible release the force applied to the attachment bracket.(572.125(c)(9))

X 15. 3 minutes after the release of the force, measure the reference plane angle. (572.125(c)(9))

X 16. Complete the following table:

Torso Flexion Results (572.125(b)), (572.125(c)(7)), (572.125(c)(8))

| Parameter | Specification | Result |
|---|---|---|
| Initial ref. plane angle | Angle ≤ 22° | 16° |
| Torso rotation rate | 0.5°/s ≤ rate ≤ 1.5°/s | 0.6°/s |
| Force at 45° ± 0.5° | 147 N ≤ force ≤ 200 N | 160 N |
| Final ref. plane angle | Initial ref. plane angle ± 8° | 21° |



Signature

01/15/2016
Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16197

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 26 | Pass |
| Initial Angle | deg | 0 to 22 | 16 | Pass |
| Return Angle | deg | +/- 8 | 21 | Pass |
| Force at 45 deg | N | 147 to 200 | 160 | Pass |
| Upper Torso Deflection Rate | deg/s | 0.5 to 1.5 | 0.6 | Pass |
| | | Overall Result | | Pass |

Laboratory Technician

01/15/2016
Test Date

Approved By

**DATA SHEET C8**

LEFT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/15/2016

Technician: Thomas Miller

____ Pre test calibration

__X__ Post test calibration verification

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

__X__ 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))

__X__ N/A, ONLY one knee impact test performed

__X__ 2. The test fixture conforms to the specifications in Figure 12C.

__X__ 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))

__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. (572.126(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 28% |
| Record the minimum humidity | 26% |

__X__ 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))

__X__ 6. No parts of the foot or tibia contact any exterior surface. (572.126(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. (572.126(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. (572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.126(c)(6))

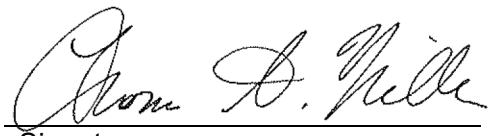
X 11. Complete the following table:

Knee Impact Results (572.126(b)(1)) & (572.126(c)(5))

| Parameter | Specification | Result |
|---|---|---|
| Probe speed | 2.07 m/s ≤ speed ≤ 2.13 m/s | 2.08 m/s |
| Peak resistance force* | 2000 N ≤ force ≤ 3000 N | 2120 N |

*Force = impactor mass x deceleration (572.126(b))

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



Signature

01/15/2016

Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16196

| 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 | 28 | Pass |
| Probe Speed | m/s | 2.07 to 2.13 | 2.08 | Pass |
| Maximum Force | N | 2000 to 3000 | 2120 | Pass |
| | | Overall Test Results | | Pass |

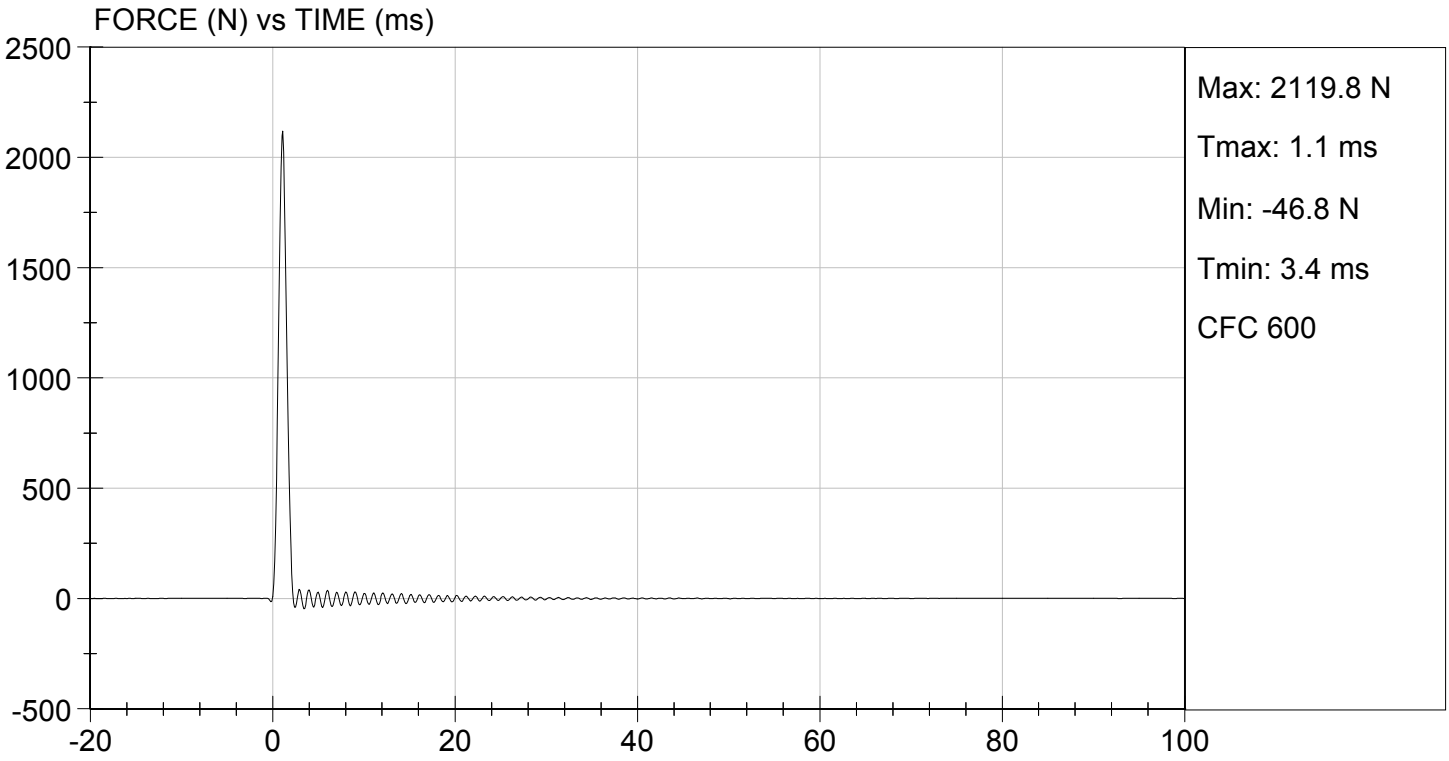
Laboratory Technician

01/15/2016
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.83 ft/s, 2.08 m/s

TEST DATE: 01/15/2016
TEST #: D16196



**DATA SHEET C9**

RIGHT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 01/15/2016

Technician: Thomas Miller

____ Pre test calibration

__X__ Post test calibration verification

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

__X__ 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))

__X__ N/A, ONLY one knee impact test performed

__X__ 2. The test fixture conforms to the specifications in Figure 12C.

__X__ 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))

__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. (572.126(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 28% |
| Record the minimum humidity | 26% |

__X__ 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))

__X__ 6. No parts of the foot or tibia contact any exterior surface. (572.126(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. (572.126(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. (572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.126(c)(6))

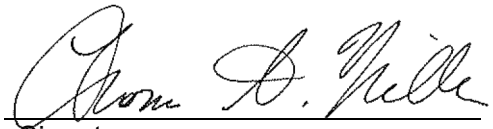
X 11. Complete the following table:

Knee Impact Results (572.126(b)(1)) & (572.126(c)(5))

| Parameter | Specification | Result |
|---|---|---|
| Probe speed | 2.07 m/s ≤ speed ≤ 2.13 m/s | 2.11 m/s |
| Peak resistance force* | 2000 N ≤ force ≤ 3000 N | 2062 N |

*Force = impactor mass x deceleration (572.126(b))

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



Signature

01/15/2016
Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155 **Test I.D:** D16195

| 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 | 28 | Pass |
| Probe Speed | m/s | 2.07 to 2.13 | 2.11 | Pass |
| Maximum Force | N | 2000 to 3000 | 2062 | Pass |
| | | Overall Test Results | | Pass |

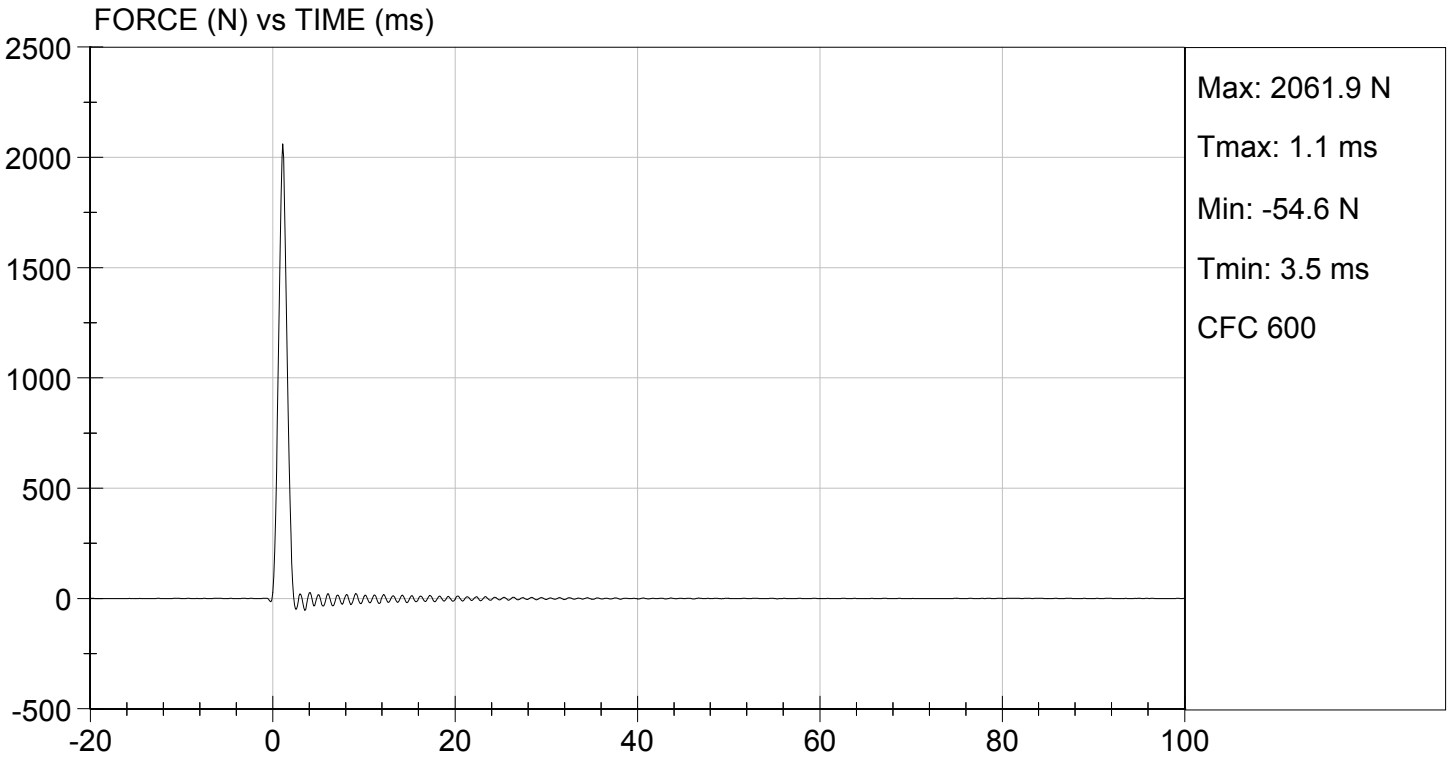
Laboratory Technician

01/15/2016
Test Date

Approved By

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

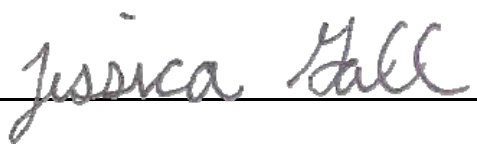
TEST DATE: 01/15/2016
TEST #: D16195



## DATA SHEET C10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO. | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---|---|---|---|---|---|
| DUMMY INSTRUMENTATION | | | | | |
| HEAD ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P79819 | 10/14/2015 | 04/14/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P79821 | 10/14/2015 | 04/14/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P79822 | 10/14/2015 | 04/14/2016 |
| NECK TRANSDUCER | Denton | 1716A | 1175 | 11/20/2015 | 05/20/2016 |
| CHEST ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P82128 | 10/14/2015 | 04/14/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P82129 | 10/14/2015 | 04/14/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P82130 | 10/14/2015 | 04/14/2016 |
| CHEST POTENTIOMETER | Servo | 08C1-3179 | 155 | 10/14/2015 | 04/14/2016 |
| FEMUR LOAD CELLS | | | | | |
| (1) RIGHT FEMUR | N/A | N/A | N/A | N/A | N/A |
| (2) LEFT FEMUR | N/A | N/A | N/A | N/A | N/A |
| LABORATORY INSTRUMENTATION | | | | | |
| NECK PENDULUM ACCELEROMTER | Endevco | 7231C-750 | AH5P1 | 07/24/2015 | 01/24/2016 |
| THORAX PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P82097 | 11/30/2015 | 05/30/2016 |
| KNEE PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P88169 | 11/30/2015 | 05/30/2016 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol | 132-0-0-102 | 18 | 09/28/2015 | 03/28/2016 |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol | 132-0-0-102 | 29 | 09/28/2015 | 03/28/2016 |

LABORATORY TECHNICIAN: 

**DATA SHEET B1**
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 155 Test Date: 01/13/2016

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 | Damage | 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 |
| 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 — 01/15/2016

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 01/15/2016

Signature — Date

## EXTERNAL DIMENSIONS

| HYBRID III 3 year SN #031, PART 572, SUBPART P EXTERNAL DIMENSIONS | | | | |
|---|---|---|---|---|
| DIMENSION | DESCRIPTION | DETAILS | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A | TOTAL SITTING HEIGHT | Seat surface to highest point on top of the head. | 538.5-553.7 | 539.7 |
| B | SHOULDER PIVOT HEIGHT | Centerline of shoulder pivot bolt to the seat surface. | 307.4-322.6 | 316.4 |
| C | H-POINT HEIGHT | Reference | 34.3-44.5 | 41.2 |
| D | H-POINT LOCATION FROM BACKLINE | Reference | 56.9-67.1 | 65.3 |
| E | SHOULDER PIVOT FROM BACKLINE | Center of the shoulder pivot bolt to the fixture's rear vertical surface. | 60.9-71.1 | 65.8 |
| F | THIGH CLEARANCE | Fixture's seat surface to highest point on the upper leg segment | 81.0-91.2 | 85.7 |
| G | BACK OF ELBOW TO WRIST PIVOT | Back of the elbow flesh to the finger tip, in line with the elbow and wrist centerlines | 247.4-262.6 | 251.3 |
| H | HEAD BACK TO BACKLINE | Rearmost surface of the head to the fixture's rear vertical surface (Reference) | 48.2-58.4 | 53.1 |
| I | SHOULDER TO- ELBOW LENGTH | Measure from the highest point on top of the shoulder to the lowest part of the flesh on the elbow in line with the shoulder and elbow pivot bolts. | 185.4-200.6 | 199.3 |
| J | ELBOW REST HEIGHT | Measure from the flesh below the elbow pivot bolt to the seat surface. | 133.6-148.8 | 141.4 |
| K | BUTTOCK TO KNEE LENGTH | The forward most part of the knee flesh to the fixture's rear vertical surface, in line with the knee and hip pivots. | 284.8-300.0 | 288.6 |
| L | POPLITEAL HEIGHT | Seat surface to the horizontal plane of the bottom of the feet. | 218.5-233.7 | 225.9 |
| M | KNEE PIVOT HEIGHT | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet. | 241.6-256.8 | 251.3 |
| N | BUTTOCK POPLITEAL LENGTH | The most forward portion of the crevice between the upper and lower legs behind the knee to the fixture's rear vertical surface. | 218.0-233.2 | 230.1 |

| HYBRID III 3 year SN #031, PART 572, SUBPART P EXTERNAL DIMENSIONS, continued | | | | |
|---|---|---|---|---|
| DIMENSION | DESCRIPTION | DETAILS | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| O | CHEST DEPTH WITH JACKET | Measured 254.0 ± 5.1 mm above seat surface | 138.5-153.7 | 151.7 |
| P | FOOT LENGTH | Tip of toe to rear of heal | 137.6-147.8 | 143.6 |
| Q | STATURE | Lay the dummy out on a flat surface with the rear surfaces of the head, upper torso, buttocks and heels touching the surface and with the bottom of the feet perpendicular to that surface. Measure the distance from the bottom of the feet to the top of the head. | 932.2-957.6 | N/A |
| R | BUTTOCK TO KNEE PIVOT LENGTH | Knee pivot bolt to the fixture's rear vertical surface. | 251.4-261.6 | 260.1 |
| S | HEAD BREADTH | Distance across the widest of the head at its widest point | 128.3-143.5 | 133.8 |
| T | HEAD DEPTH | Distance from the forward most surface of the head to the rearmost surface of the head, in line with the midsagittal plane. | 167.4-182.6 | 172.7 |
| U | HIP BREADTH | Distance across the width of the hip at the widest point of the jacket | 200.7-215.9 | 208.9 |
| V | SHOULDER BREADTH | Distance between the outside edges of the shoulder flesh, in line with the shoulder pivot bolts | 236.5-251.7 | 245.4 |
| W | FOOT BREADTH | The widest part of the foot | 53.6-63.8 | 57.3 |
| X | HEAD CIRCUMFERENCE | At the largest location | 500.4-515.6 | 513.2 |
| Y | CHEST CIRCUMFERENCE WITH JACKET | Distance around chest at reference location AA, with jacket on. | 527.1-552.5 | 541.3 |
| Z | WAIST CIRCUMFERENCE | Distance around chest at reference location BB, with jacket on. | 527.1-552.5 | 532.4 |
| AA | REFERENCE LOCATION FOR DIMENSION Y | Reference: 254.0 ± 5.1 MM above the seat surface | 248.9-259.1 | 254.0 |
| BB | REFERENCE LOCATION FOR DIMENSION Z | Reference: 165.1 ± 5.1 MM above seat surface | 160.0-170.2 | 165.0 |

**DATA SHEET D3**
HEAD DROP TEST (572.142) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 01/08/2016

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 2 hours since the last head drop. (572.142(c)(5))
X N/A, ONLY one head drop performed

X 2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1" flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))

X 3. Accelerometers and their respective mounts are smooth and clean.

X 4. The head accelerometer mounting plate screws (10-32 x 5/8 SHCS) are torqued to 10.2 Nm.

X 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

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. (572.142(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.7°C |
| Record the minimum temperature | 20.8°C |
| Record the maximum humidity | 31% |
| Record the minimum humidity | 25% |

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 low risk deployment 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, trichloroethane or equivalent prior to the test. (572.142(c)(2))

X 9. Suspend and orient the head assembly as shown in Figure 7D. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.142(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 10. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.142(c)(3))

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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). (572.142(c)(4))

Record actual micro finish: 50.9 micro inches

X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.142(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

X 13. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.142(b)) & (572.142(c)(4))

X 14. Complete the following table. (572.142(b)):

| Parameter | Specification | Result |
|---|---|---|
| Peak resultant acceleration | 250 g ≤ x ≤ 280 g | 259 g |
| 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 ≤ 15 g | -11.0 g |

X 15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel

Signature

01/08/2016

Date

**MGA RESEARCH CORPORATION**

**HEAD DROP TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031 **Test ID:** D16091

| 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 | 30 | Pass |
| Peak Resultant Acceleration | G's | 250 to 280 | 259 | Pass |
| Peak Lateral Acceleration | G's | <= +/- 15.0 | -11.0 | Pass |
| Unimodal | N/A | Yes | Yes | Pass |
| Oscillations | N/A | within 10% of peak | Yes | Pass |
| | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

01/8/2016

Test Date

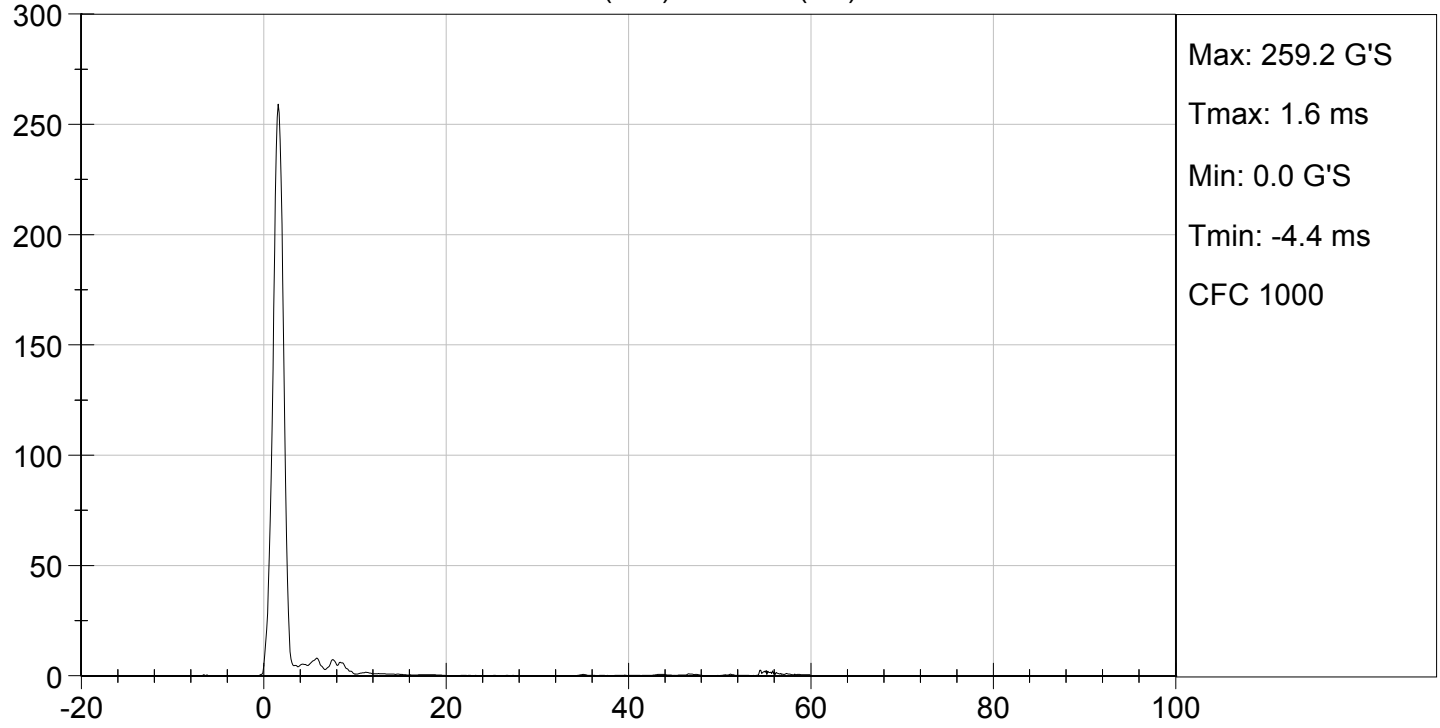
Jeff Leonardski

Approved By

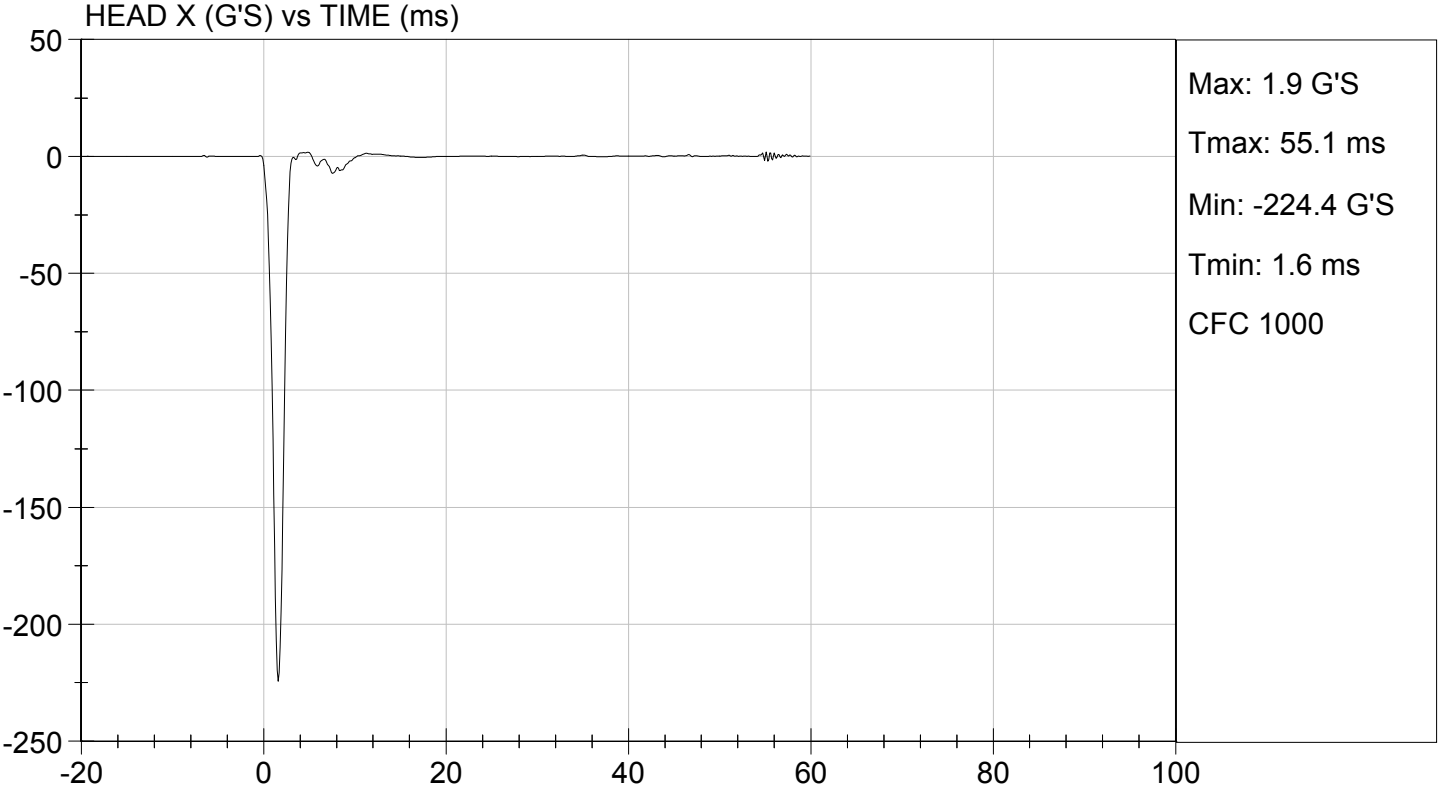
TEST DESC: HEAD DROP

TEST DATE: 01/8/2016
TEST #: D16091

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



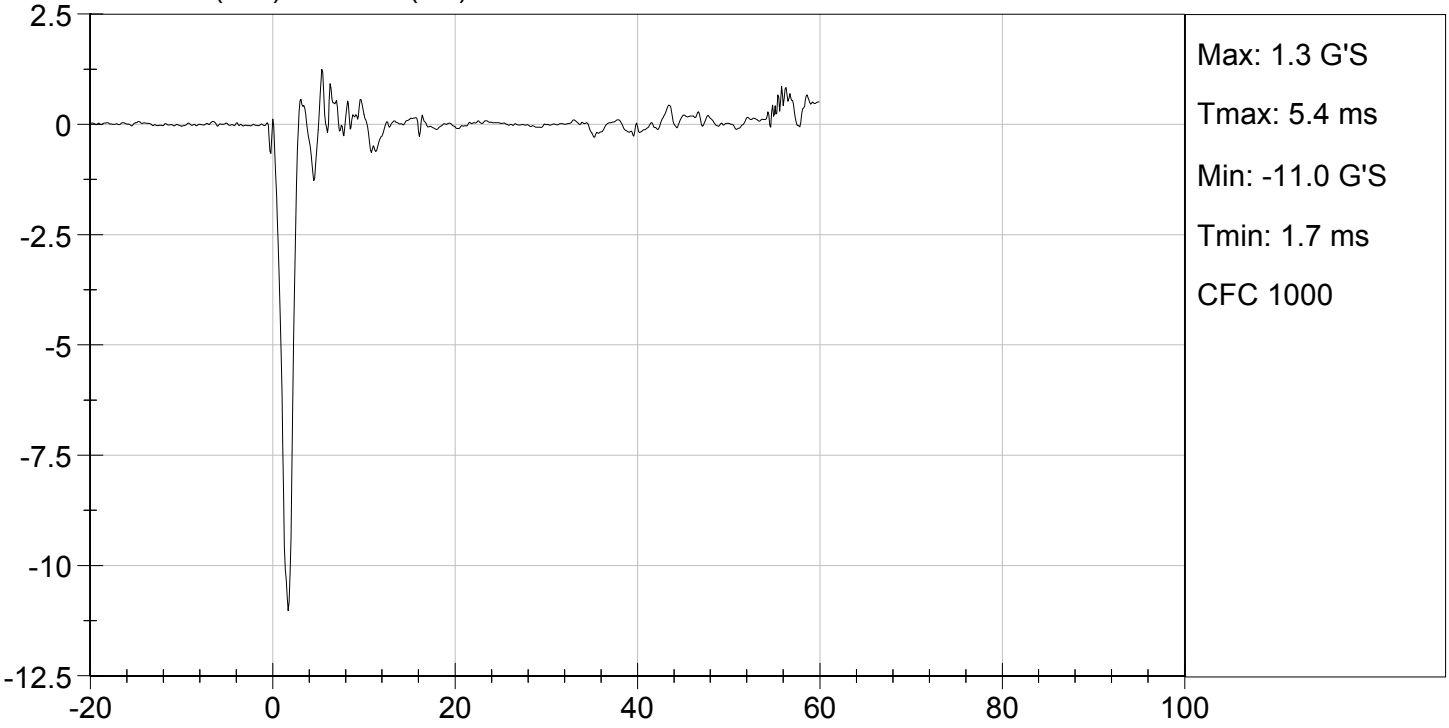

HEAD X (G'S) vs TIME (ms)



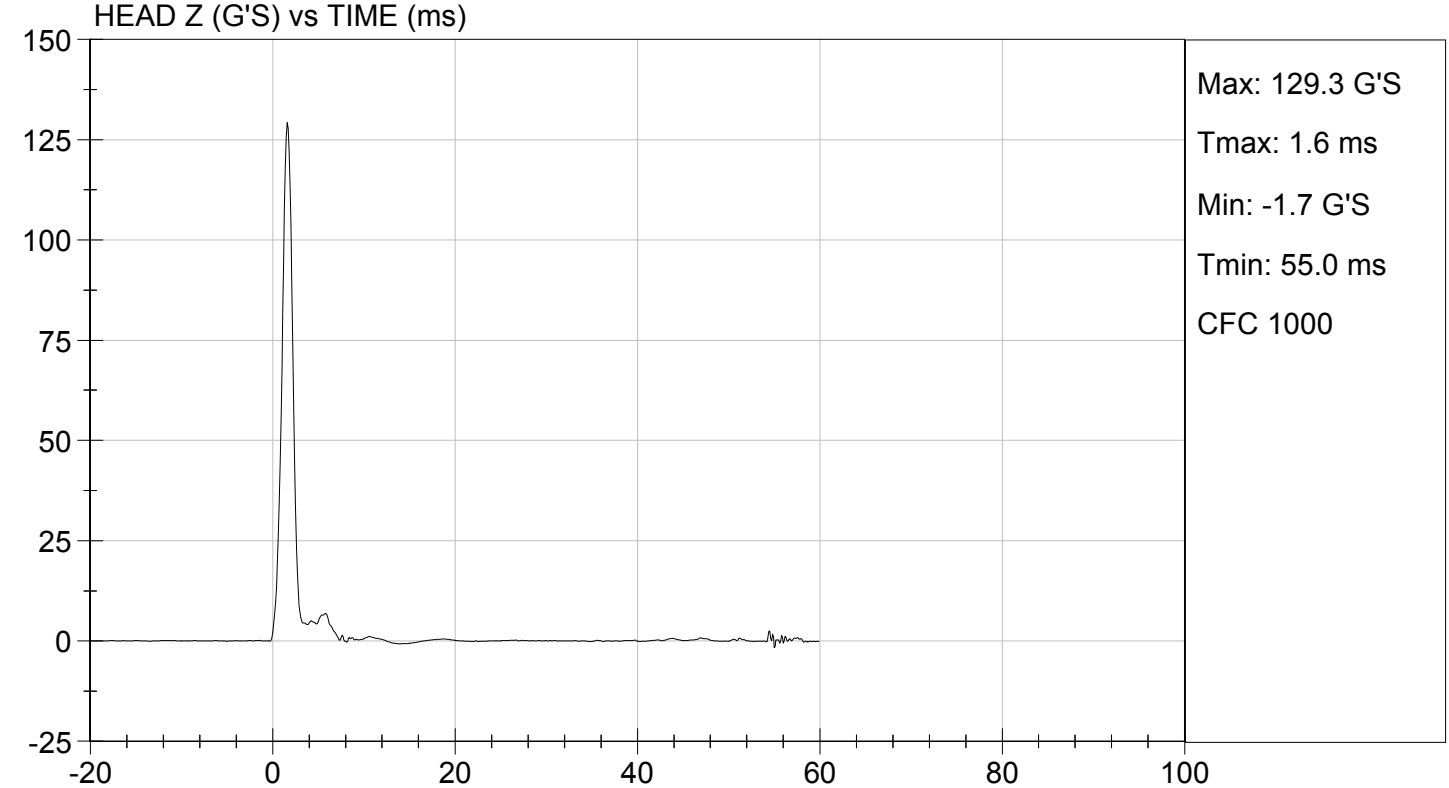
TEST DESC: HEAD DROP

TEST DATE: 01/8/2016
TEST #: D16091

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




HEAD Z (G'S) vs TIME (ms)



**DATA SHEET D4**

NECK FLEXION TEST (572.143) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 01/08/2016

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.146(p))

X N/A, this is the first neck test performed

X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))

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. (572.143(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.7°C |
| Record the minimum temperature | 20.8°C |
| Record the maximum humidity | 31% |
| Record the minimum humidity | 25% |

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 low risk deployment test, 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. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

X 7. The test fixture pendulum conforms to the specifications in Figure 8D.

X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))

X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.

X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))

X 13. Complete the following table:

Neck Flexion Test Results (572.143(b)(1)) & (572.143(c)(4)(ii))

| Parameter | | Specification | Result |
|---|---|---|---|
| Pendulum impact speed | | 5.4 m/s ≤ speed ≤ 5.6 m/s | 5.5 m/s |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 2.0 m/s ≤ $\Delta V$ ≤ 2.7 m/s | 2.6 m/s |
| | @ 15 ms | 3.0 m/s ≤ $\Delta V$ ≤ 4.0 m/s | 3.6 m/s |
| | @ 20 ms | 4.0 m/s ≤ $\Delta V$ ≤ 5.1 m/s | 4.8 m/s |
| Plane D Rotation | | Peak moment*<br>42 Nm ≤ moment ≤ 53 Nm during the following rotation range 70° ≤ angle ≤ 82° | 42.9 Nm @ 79 degrees |
| Positive Moment Decay** (Flexion) | | Time to decay to 10 Nm 60 ms ≤ time ≤ 80 ms | 70 ms |

*The moment is a direct reading from the load cell
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel
Signature

01/08/2016
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031 **Test I.D:** D16092

| Tested Parameter | | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | | deg C | 20.6 to 22.2 | 21.7 | Pass |
| Laboratory Relative Humidity | | % | 10 to 70 | 25 | Pass |
| Pendulum Speed | | m/s | 5.40 to 5.60 | 5.46 | Pass |
| Pendulum Velocity | 10 msec | m/s | 2.0 to 2.7 | 2.6 | Pass |
| | 15 msec | m/s | 3.0 to 4.0 | 3.6 | Pass |
| | 20 msec | m/s | 4.0 to 5.1 | 4.8 | Pass |
| D Plane Rotation | | deg | 70 to 82 | 79 | Pass |
| Peak Moment within Deflection Corridor | | Nm | 42.0 to 53.0 | 42.9 | Pass |
| Positive Moment - Time Curve Decay to 10 Nm | | msec | 60.0 to 80.0 | 70 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

01/08/2016

Test Date

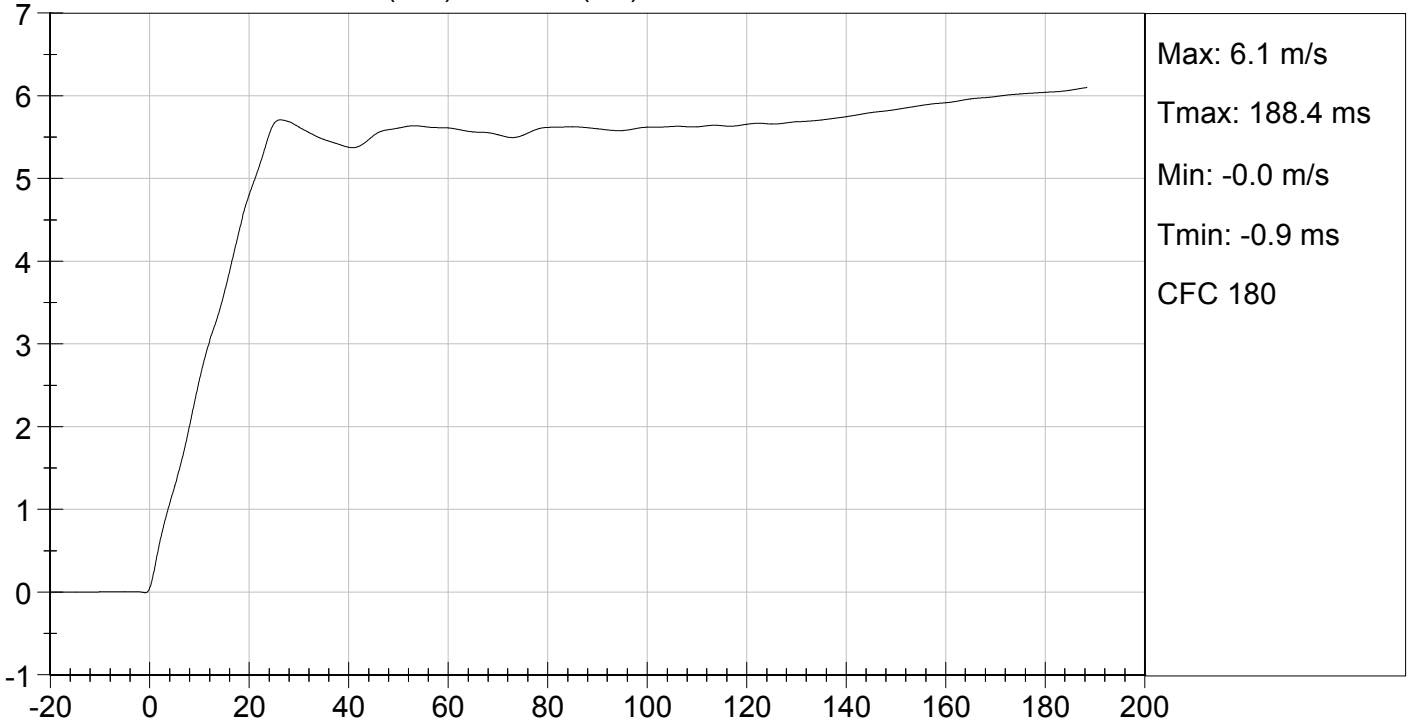
Jeff Leonardski

Approved By

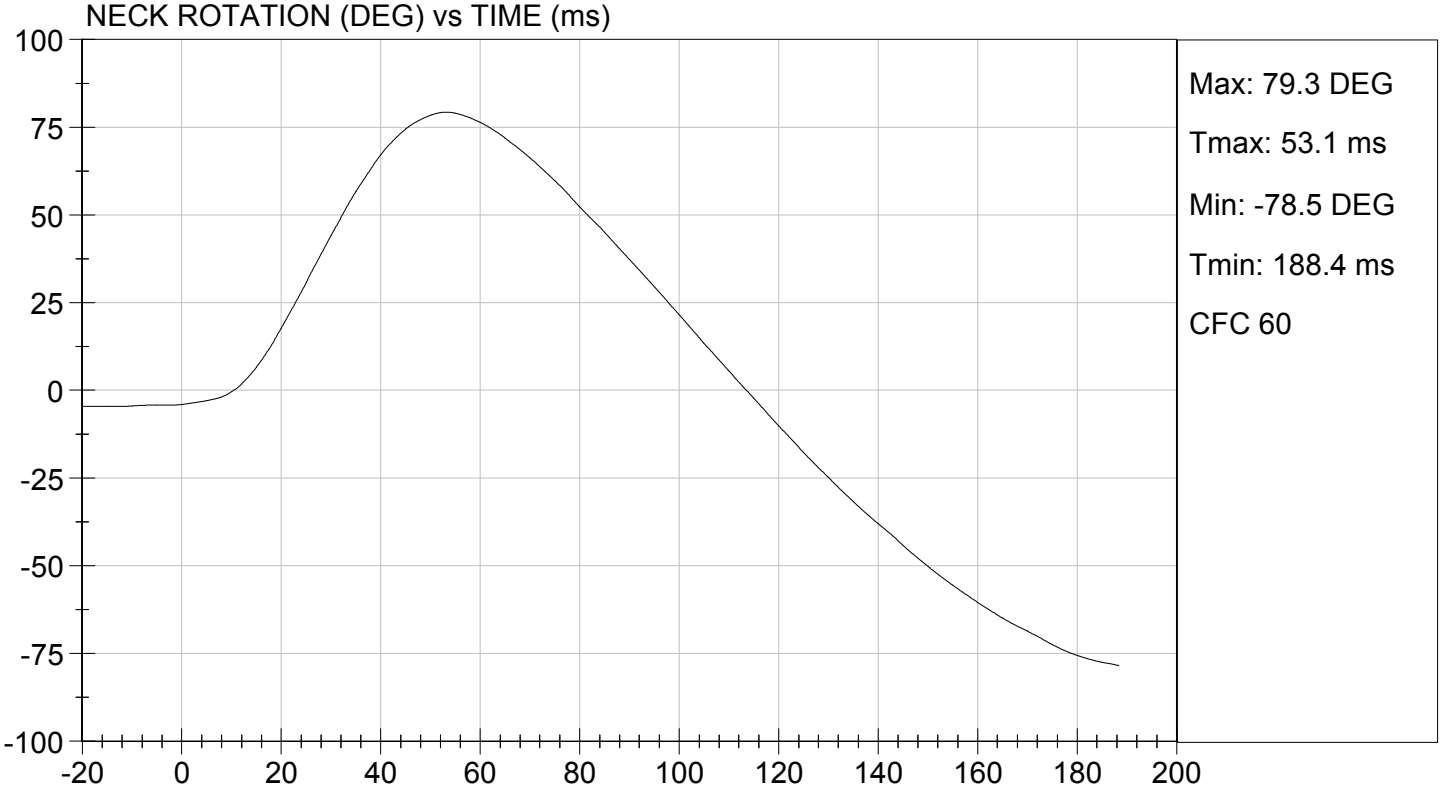
TEST DESC: NECK FLEXION
VELOCITY: 17.92 ft/s, 5.46 m/s

TEST DATE: 01/08/2016
TEST #: D16092

PENDULUM VELOCITY (m/s) vs TIME (ms)

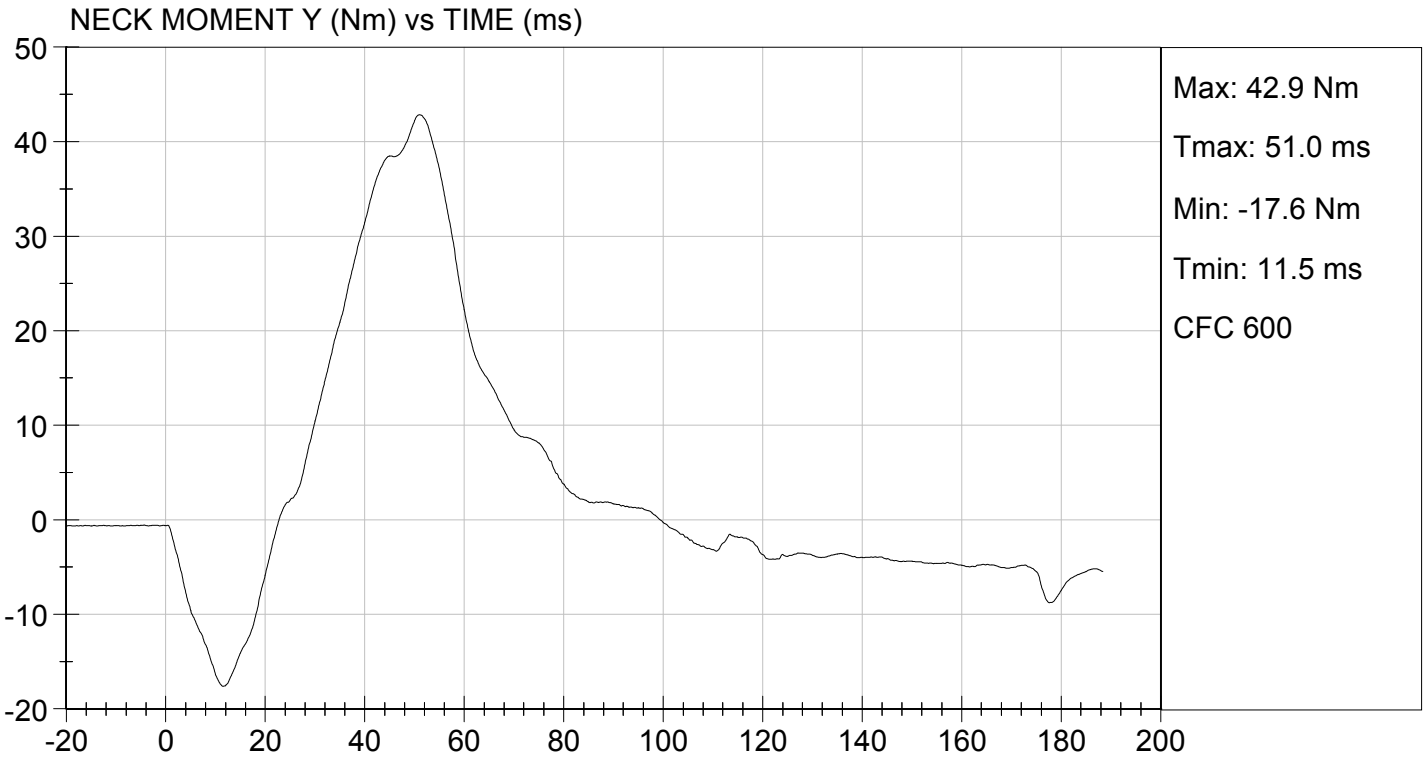



NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 17.92 ft/s, 5.46 m/s

TEST DATE: 01/08/2016
TEST #: D16092



**DATA SHEET D5**

NECK EXTENSION TEST (572.133) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 01/08/2016

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.146(p))

X N/A, this is the first neck test performed

X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))

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. (572.143(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.7°C |
| Record the minimum temperature | 20.8°C |
| Record the maximum humidity | 31% |
| Record the minimum humidity | 25% |

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 low risk deployment test, 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. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

X 7. The test fixture pendulum conforms to the specifications in Figure 8D.

X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))

X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.

X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(2)(iii))

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 3.55 m/s to 3.75 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))

X 13. Complete the following table:

Neck Extension Test Results (572.143(b)(2)) & (572.143(c)(4)(ii))

| Parameter | | Specification | Result |
|---|---|---|---|
| Pendulum impact speed | | 3.55 m/s ≤ speed ≤ 3.75 m/s | 3.65 m/s |
| Pendulum ΔV with respect to impact speed | @ 6 ms | 1.0 m/s ≤ ΔV ≤ 1.4 m/s | 1.3 m/s |
| | @ 10 ms | 1.9 m/s ≤ ΔV ≤ 2.5 m/s | 2.3 m/s |
| | @ 14 ms | 2.8 m/s ≤ ΔV ≤ 3.5 m/s | 3.2 m/s |
| Plane D Rotation | | Peak moment* -53.3 Nm ≤ moment ≤ -43.7 Nm during the following rotation range 83 ≤ angle ≤ 93 | -45.0 Nm @ 87 degrees |
| Negative Moment Decay** (Extension) | | Time to decay to -10 Nm 60 ms ≤ time ≤ 80 ms | 70 ms |

*The moment is a direct reading from the load cell
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel — Signature

01/08/2016 — Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031 **Test I.D:** D16093

| Tested Parameter | | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | | deg C | 20.6 to 22.2 | 21.7 | Pass |
| Laboratory Relative Humidity | | % | 10 to 70 | 25 | Pass |
| Pendulum Speed | | m/s | 3.55 to 3.75 | 3.65 | Pass |
| Pendulum Velocity | 6 ms | m/s | 1.0 to 1.4 | 1.3 | Pass |
| | 10 ms | m/s | 1.9 to 2.5 | 2.3 | Pass |
| | 14 ms | m/s | 2.8 to 3.5 | 3.2 | Pass |
| D Plane Rotation | | deg | 83 to 93 | 87 | Pass |
| Peak Moment within Deflection Corridor | | Nm | -53.3 to -43.7 | -45.0 | Pass |
| Negative Moment - Time Curve Decay to -10 Nm | | ms | 60.0 to 80.0 | 70 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

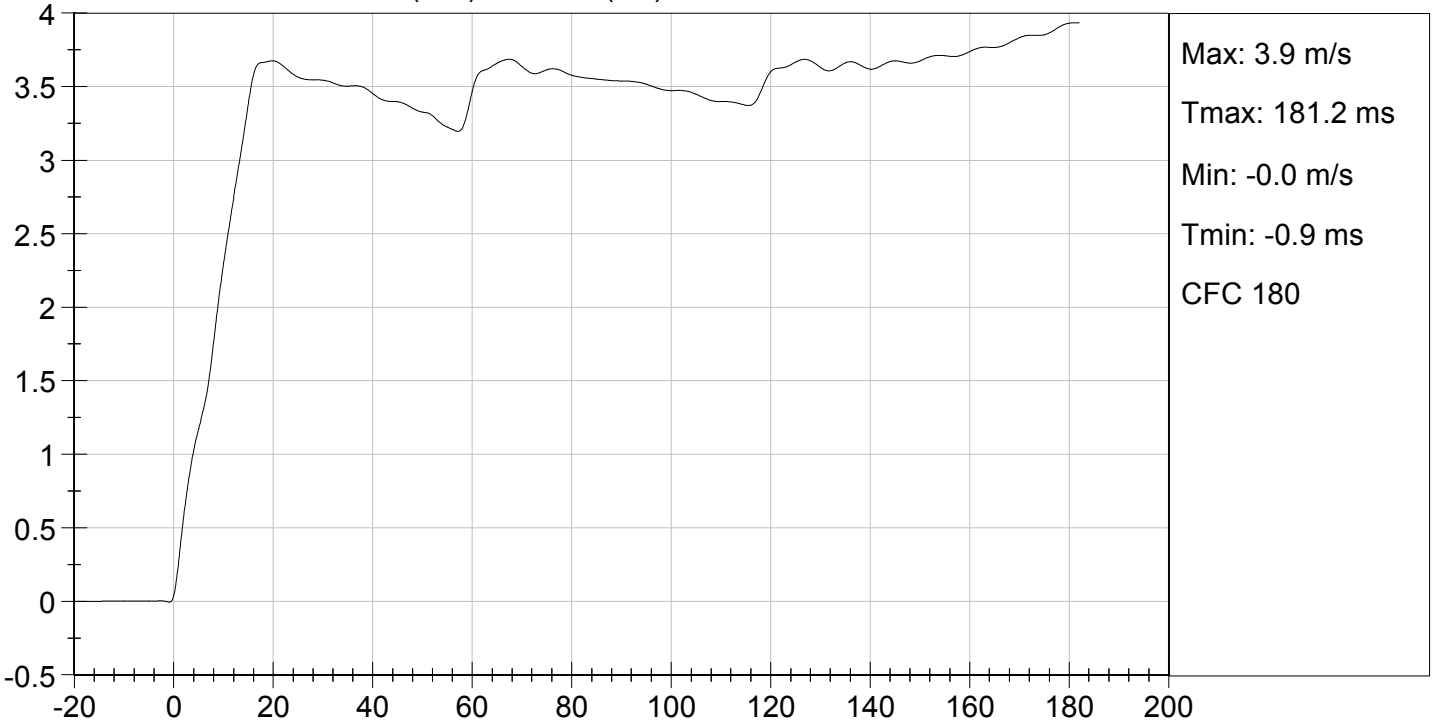
01/08/2016
Test Date

Jeff Leonardelli
Approved By

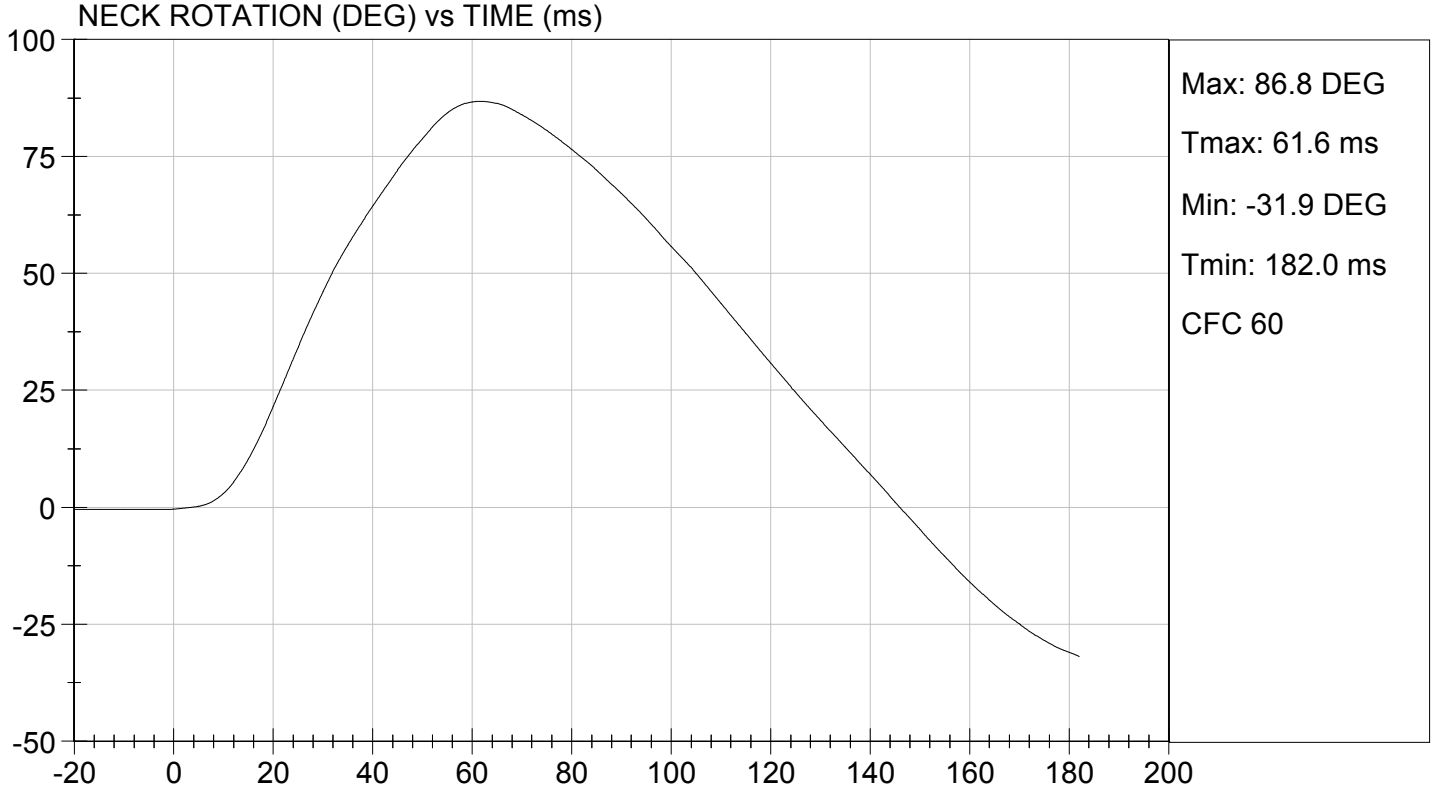
TEST DESC: NECK EXTENSION
VELOCITY: 11.99 ft/s, 3.65 m/s

TEST DATE: 01/08/2016
TEST #: D16093

PENDULUM VELOCITY (m/s) vs TIME (ms)

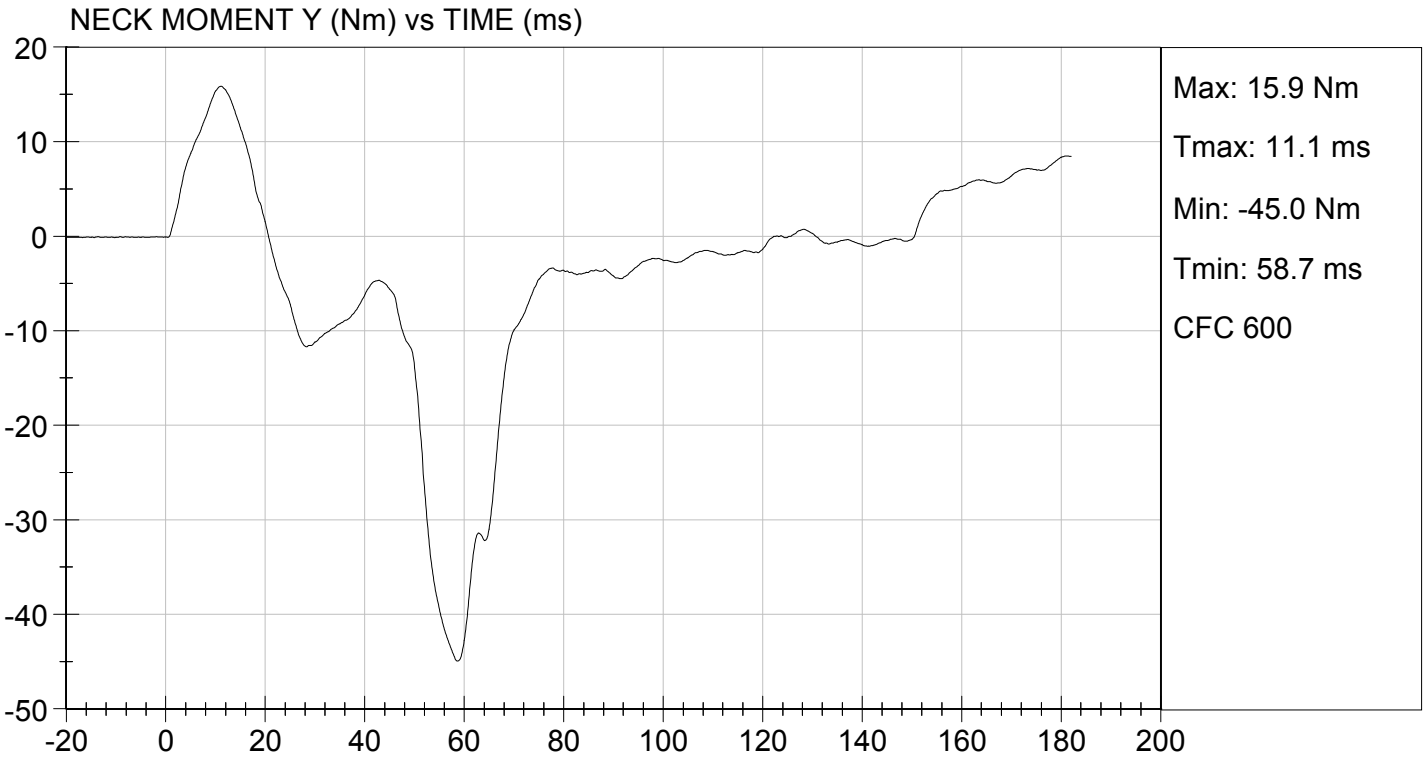



NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 11.99 ft/s, 3.65 m/s

TEST DATE: 01/08/2016
TEST #: D16093



**DATA SHEET D6**
THORAX IMPACT TEST (572.144) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 01/08/2016

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last thorax impact test. (572.146(p))
X N/A, ONLY one thorax impact test performed

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

X 3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(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. (572.144(c)(2))

| | |
|---|---|
| Record the maximum temperature | 21.7°C |
| Record the minimum temperature | 20.8°C |
| Record the maximum humidity | 31% |
| Record the minimum humidity | 25% |

X 5. Remove the arms.

X 6. Unzip the 3 zippers and fold down the chest jacket. 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 damage.

X 7. Seat the dummy, without back and arm supports on the test fixture surface as shown in Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))

X 8. Level the middle rib both longitudinally and laterally ± 0.5°. (572.144(c)(3))

X 9. The midsagittal plane of the dummy is vertical within ± 1°. (572.144(c)(3))

X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within ± 2.5 mm within ± 0.5° of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))

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 rolled up and zipped, and the arms installed. The reference locations must be accessible after the chest skin is rolled up and the arms installed. It will be necessary to leave the chest skin zipper unfastened until the references are checked and then fasten it just prior to the test.

X 12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.

X 13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))

X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).

X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

X 16. Complete the following table:

Thorax Impact Results (572.144(b)(1)&(2))

| Parameter* | Specification | Result |
|---|---|---|
| Test Probe Speed | 5.9 m/s ≤ speed ≤ 6.1 m/s | 6.1 m/s |
| Chest Compression | 32 mm ≤ compression ≤ 38 mm | 32 mm |
| Peak force** between 32 and 38 mm chest compression | 680 N ≤ peak force ≤ 810 N | 720 N |
| Peak force** between 12.5 and 32.0 mm chest compression | Peak force ≤ 910 N | 786 N |
| Internal Hysteresis*** | 65% ≤ hysteresis ≤ 85% | 67% |

*Time zero is defined as the time of initial contact between the test probe and the chest skin.
**Force = impactor mass x acceleration (572.144(b)(3))
***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12D)

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

David Schoedel
Signature

01/08/2016
Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031 **Test I.D:** D16094

| 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 | 31 | Pass |
| Probe Velocity | m/s | 5.9 to 6.1 | 6.05 | Pass |
| Peak Deflection | mm | 32 to 38 | 32 | Pass |
| Peak Resistive Force w/in Deflection Corridor | N | 680 to 810 | 720 | Pass |
| Internal Hysteresis | % | 65 to 85 | 67 | Pass |
| Max Force 12.5 mm - 32 mm Deflection | N | <= 910 | 786 | Pass |
| | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

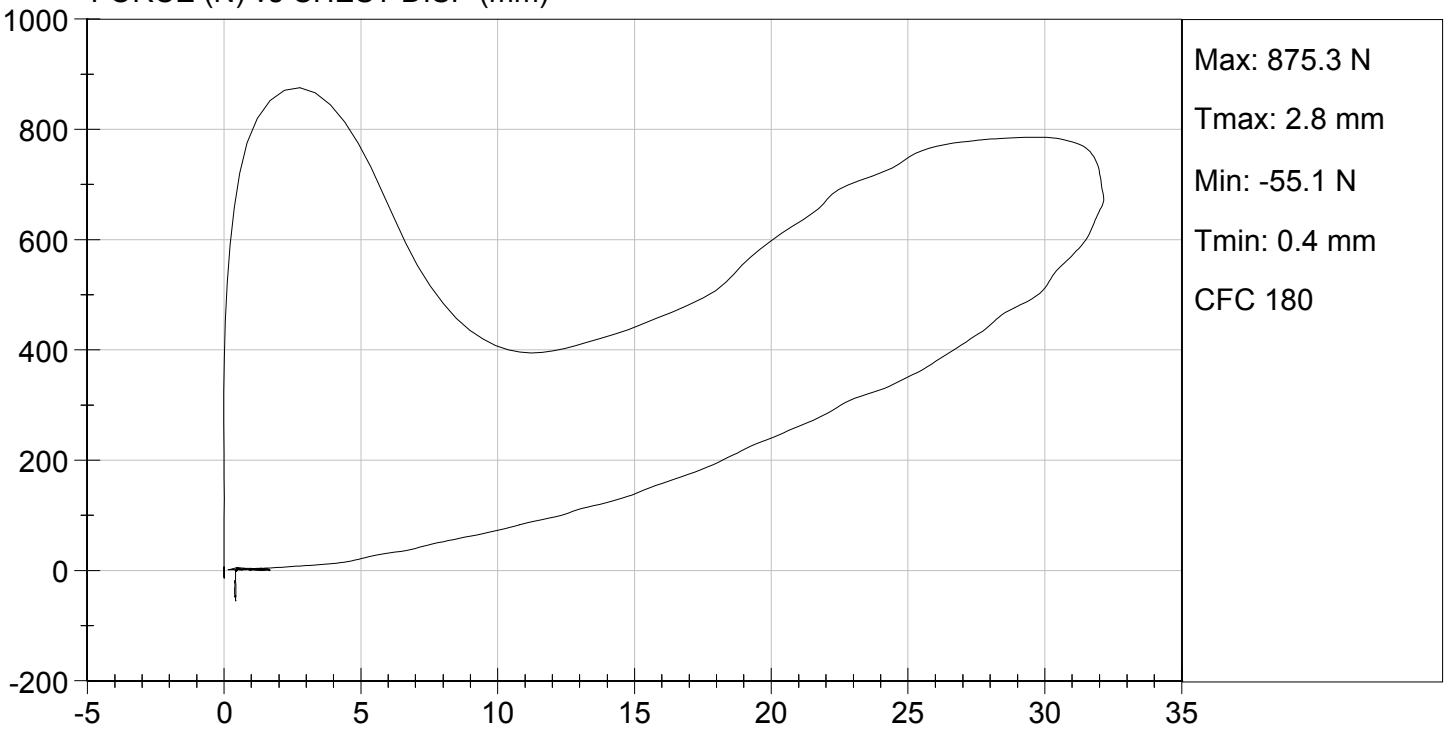
01/08/2016
Test Date

Jeff Leonardelli
Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 19.86 ft/s, 6.05 m/s

TEST DATE: 01/08/2016
TEST #: D16094

FORCE (N) vs CHEST DISP (mm)



**DATA SHEET D7**
TORSO FLEXION TEST (572.145) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 01/08/2016

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last torso flexion test. (572.146(p))
X N/A, ONLY torso flexion test performed

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

X 3. The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(c)(2)).
X with legs below the femurs.
___ 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. (572.145(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.7°C |
| Record the minimum temperature | 20.8°C |
| Record the maximum humidity | 31% |
| Record the minimum humidity | 25% |

X 5. Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))

X 6. Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within ± 1° and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii))

X 7. Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket**.** (572.145(c)(2)(iv))

X 8. Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))

X 9. Flex the dummy forward and back 3 times such that the angle of the torso reference plane moves between 0° and 30° ± 2°. The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))

X 10. Remove all externally applied flexion forces and support the dummy such that the torso reference plane is at or near 0°. Wait at least 30 minutes before continuing. (572.135(c)(3)(ii))

X 11. Remove all external support that was implemented in 10 above and wait 2 minutes. (572.145(c)(4))

X 12. Measure the initial orientation angle of the upper torso reference plane of the seated, unsupported dummy. (572.145(c)(4))
Record reference plane angle (max. allowed 15°) See Result Table

X 13. Attach the pull cable and the load cell while maintaining the initial torso orientation. (572.145(c)(5))

X 14. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the torso reference plane reaches 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.145(c)(5))

X 15. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds and record the highest applied force during this period. (572.145(c)(6))

X 16. As quickly as possible release the force applied to the attachment bracket.(572.145(c)(8))

X 17. 3 to 4 minutes after the release of the force, measure the angle reference plane. (572.145(c)(8))

X 18. Complete the following table:

Torso Flexion Results (572.145(b)(1)&(2)), (572.145(c)(4)), (572.145(c)(5))

| Parameter | Specification | Result |
|---|---|---|
| Initial ref. plane angle | Angle ≤ 15° | 10° |
| Torso rotation rate | 0.5°/s ≤ rate ≤ 1.5°/s | 0.7°/s |
| Force at 45° ± 0.5° | 130 N ≤ force ≤ 180 N | 180 N |
| Final ref. plane angle | Initial ref. plane angle ± 10° | 11° |

X 19. A plot of the force versus time follows this sheet.

David Schoedel
Signature

01/08/2016
Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031 **Test I.D:** D16097

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 31 | Pass |
| Initial Angle | deg | 0 to 15 | 10 | Pass |
| Return Angle | deg | -10 to 10 | 11 | Pass |
| Force at 45 deg | N | 130 to 180 | 180 | Pass |
| Upper Torso Deflection Rate | deg/s | 0.5 to 1.5 | 0.7 | Pass |
| | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

01/08/2016
Test Date

Jeff Leonardi
Approved By

## DATA SHEET D8

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO. | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---|---|---|---|---|---|
| DUMMY INSTRUMENTATION | | | | | |
| HEAD ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P88702 | 10/12/2015 | 04/12/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P88703 | 10/08/2015 | 04/08/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P88704 | 10/12/2015 | 04/12/2016 |
| NECK TRANSDUCER | Denton | 3303 | 233 | 10/15/2015 | 04/15/2016 |
| CHEST ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P88698 | 10/12/2015 | 04/12/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P88700 | 10/12/2015 | 04/12/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P88701 | 10/12/2015 | 04/12/2016 |
| CHEST POTENTIOMETER | Servo | 08C1-3179 | 031 | 10/13/2015 | 04/13/2016 |
| FEMUR LOAD CELLS | | | | | |
| (1) RIGHT FEMUR | N/A | N/A | N/A | N/A | N/A |
| (2) LEFT FEMUR | N/A | N/A | N/A | N/A | N/A |
| LABORATORY INSTRUMENTATION | | | | | |
| NECK PENDULUM ACCELEROMETER | Endevco | 7231C-750 | AH5P1 | 07/24/2015 | 01/24/2016 |
| THORAX PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P82097 | 11/30/2015 | 05/30/2016 |
| KNEE PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P88169 | 11/30/2015 | 05/30/2016 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol | 132-0-0-102 | 18 | 09/28/2015 | 03/28/2016 |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol | 132-0-0-102 | 29 | 09/28/2015 | 03/28/2016 |

LABORATORY TECHNICIAN: Jessica Hall

**DATA SHEET D3**
HEAD DROP TEST (572.142) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 01/14/2016

Technician: David Schoedel

____ Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 2 hours since the last head drop. (572.142(c)(5))
X N/A, ONLY one head drop performed

X 2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1" flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))

X 3. Accelerometers and their respective mounts are smooth and clean.

X 4. The head accelerometer mounting plate screws (10-32 x 5/8 SHCS) are torqued to 10.2 Nm.

X 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

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. (572.142(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 27% |
| Record the minimum humidity | 25% |

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 low risk deployment 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, trichloroethane or equivalent prior to the test. (572.142(c)(2))

X 9. Suspend and orient the head assembly as shown in Figure 7D. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.142(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 10. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.142(c)(3))

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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). (572.142(c)(4))

Record actual micro finish: 50.9 micro inches

X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.142(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

X 13. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.142(b)) & (572.142(c)(4))

X 14. Complete the following table. (572.142(b)):

| Parameter | Specification | Result |
|---|---|---|
| Peak resultant acceleration | 250 g ≤ x ≤ 280 g | 258 g |
| 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 ≤ 15 g | -9.8 g |

X 15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel
Signature

01/14/2016
Date

**MGA RESEARCH CORPORATION**

**HEAD DROP TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031 **Test ID:** D16181

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 27 | Pass |
| Peak Resultant Acceleration | G's | 250 to 280 | 258 | Pass |
| Peak Lateral Acceleration | G's | <= +/- 15.0 | -9.8 | Pass |
| Unimodal | N/A | Yes | Yes | Pass |
| Oscillations | N/A | within 10% of peak | Yes | Pass |
| | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

01/14/2016

Test Date

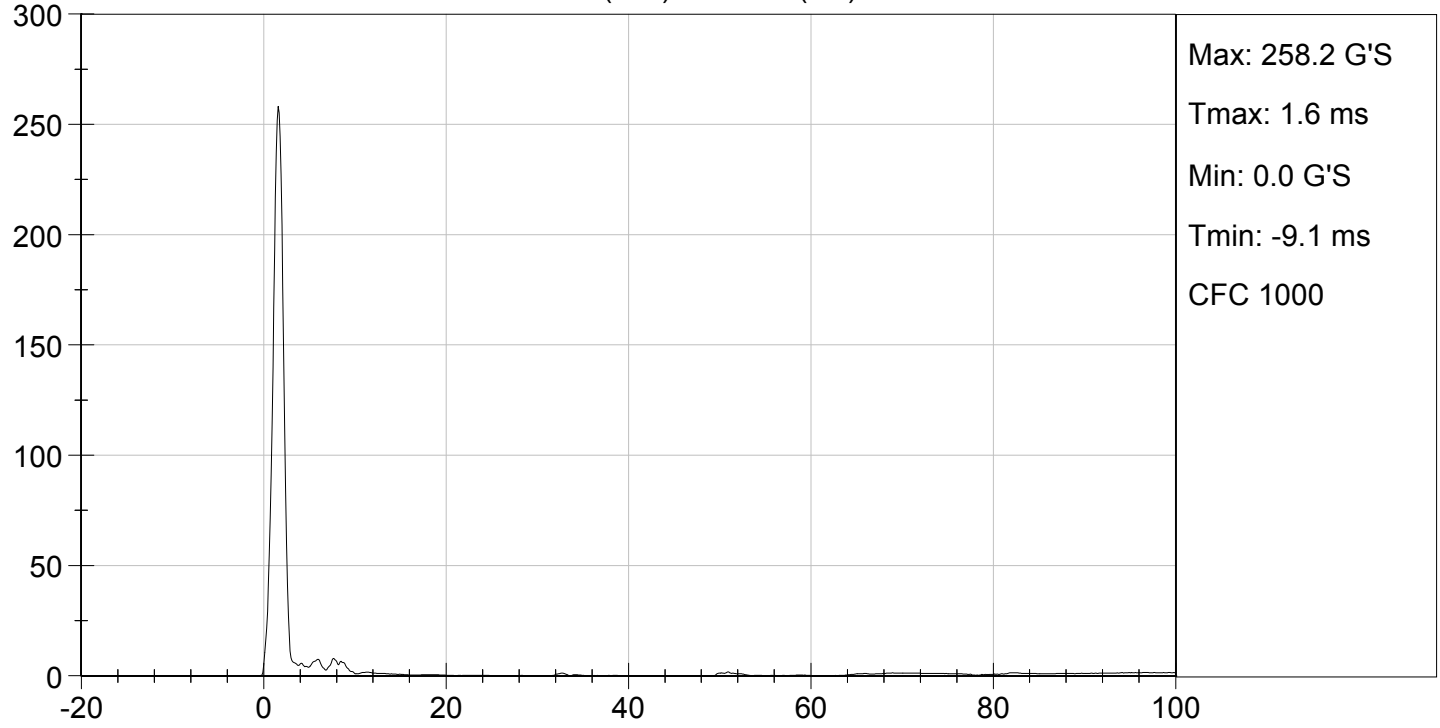
Jeff Levandoski

Approved By

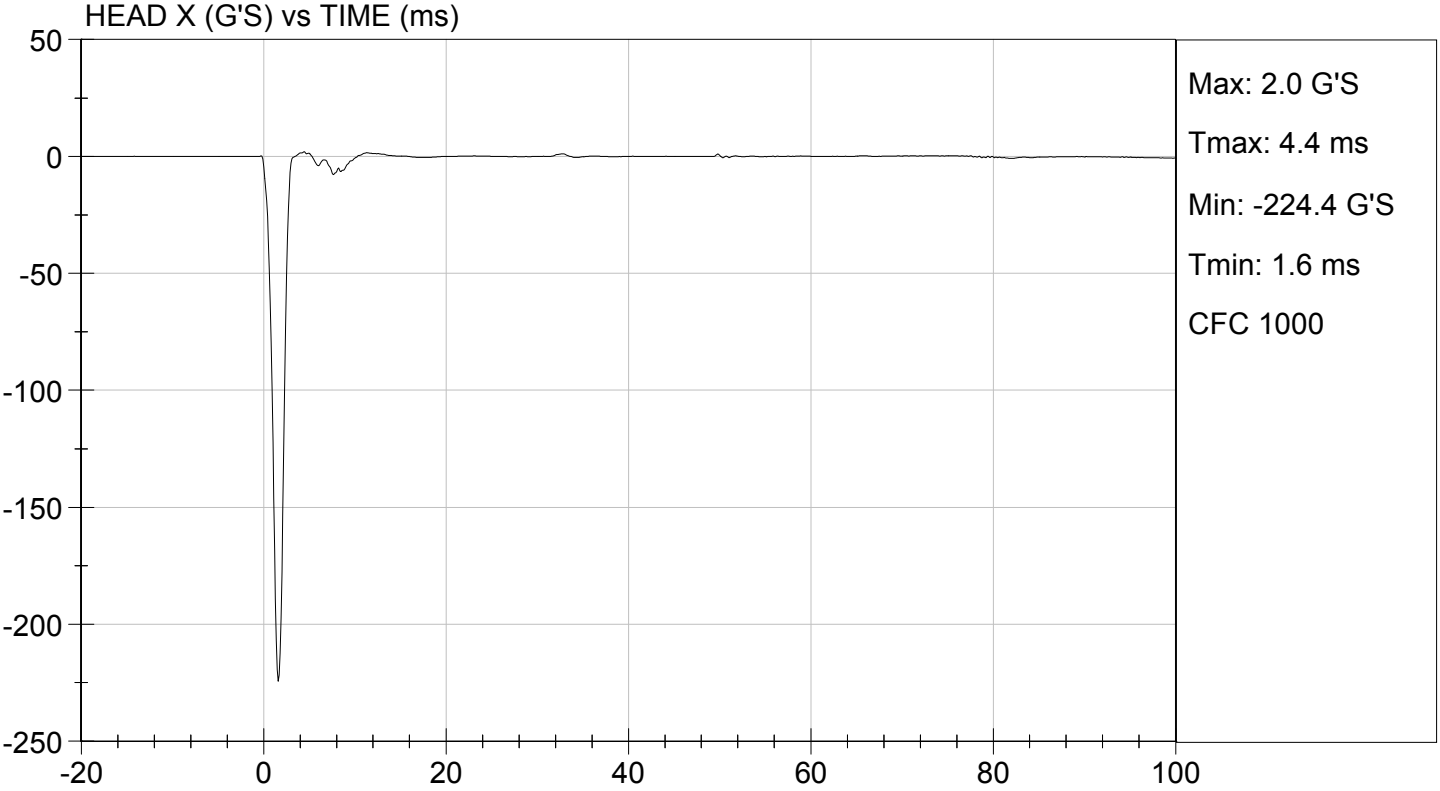
TEST DESC: HEAD DROP

TEST DATE: 01/14/2016
TEST #: D16181

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



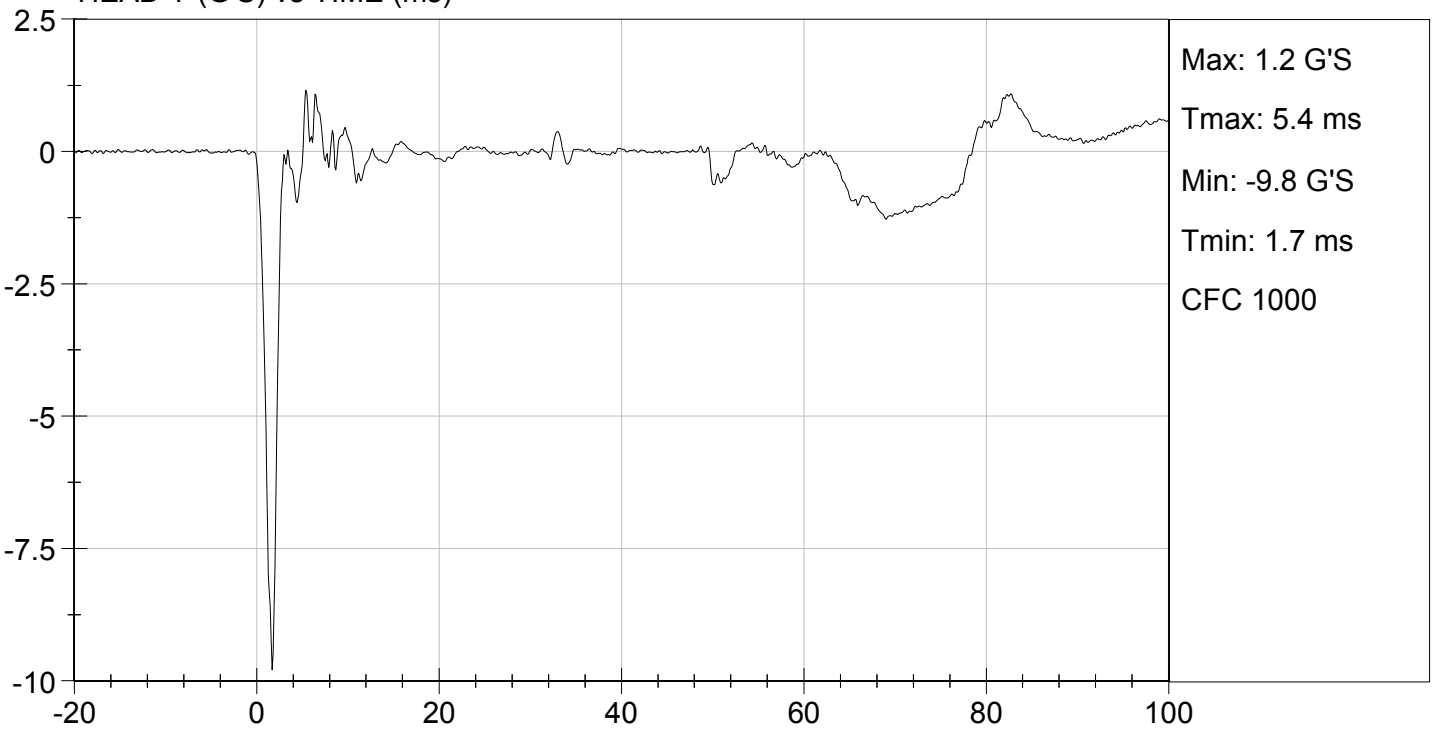

HEAD X (G'S) vs TIME (ms)



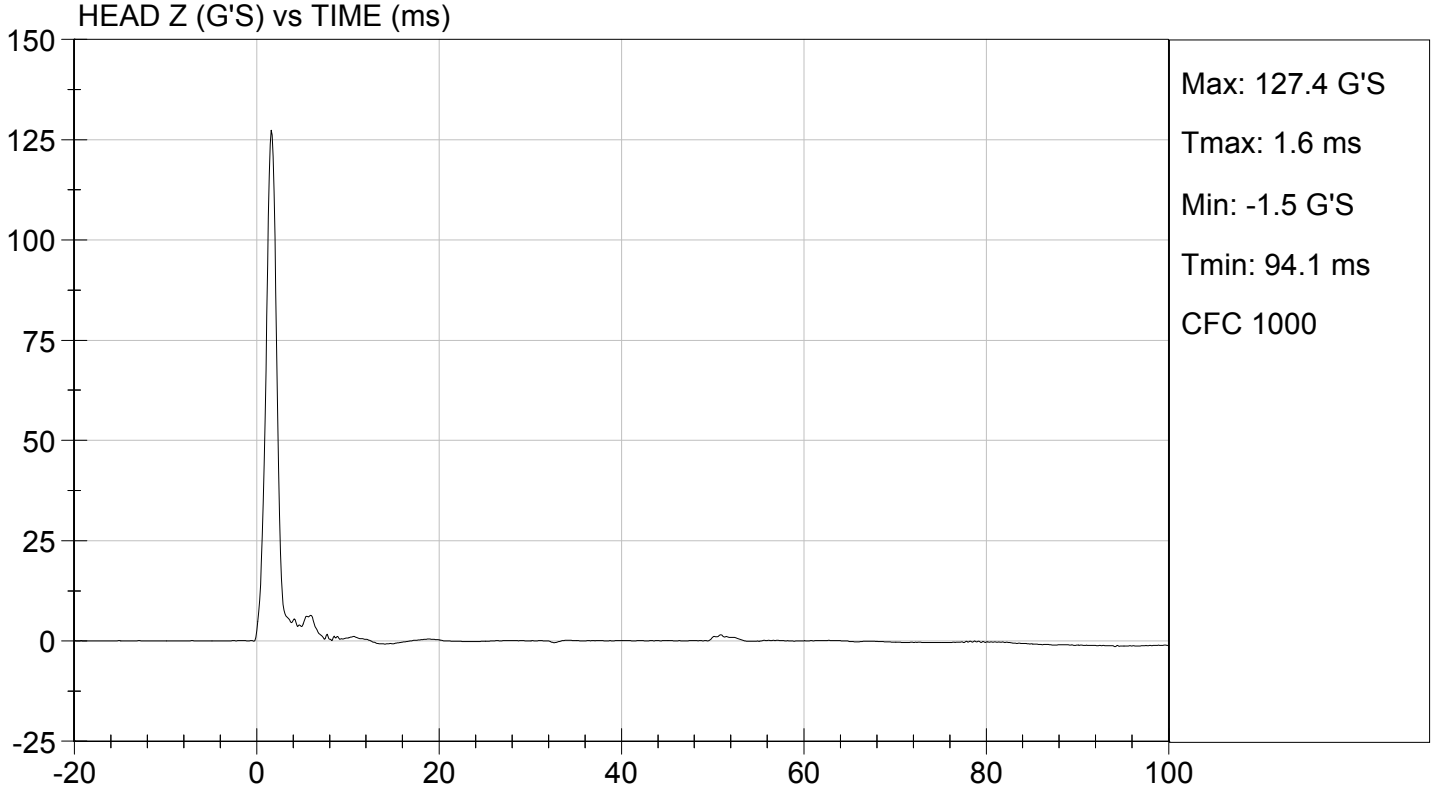
TEST DESC: HEAD DROP

TEST DATE: 01/14/2016
TEST #: D16181

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




HEAD Z (G'S) vs TIME (ms)



**DATA SHEET D4**

NECK FLEXION TEST (572.143) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 01/14/2016

Technician: David Schoedel

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last neck test. (572.146(p))

_X_ N/A, this is the first neck test performed

_X_ 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))

_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. (572.143(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 27% |
| Record the minimum humidity | 25% |

_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 low risk deployment test, 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. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))

_X_ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

_X_ 7. The test fixture pendulum conforms to the specifications in Figure 8D.

_X_ 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))

X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.

X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))

X 13. Complete the following table:

Neck Flexion Test Results (572.143(b)(1)) & (572.143(c)(4)(ii))

| Parameter | | Specification | Result |
|---|---|---|---|
| Pendulum impact speed | | 5.4 m/s ≤ speed ≤ 5.6 m/s | 5.5 m/s |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 2.0 m/s ≤ $\Delta V$ ≤ 2.7 m/s | 2.4 m/s |
| | @ 15 ms | 3.0 m/s ≤ $\Delta V$ ≤ 4.0 m/s | 3.4 m/s |
| | @ 20 ms | 4.0 m/s ≤ $\Delta V$ ≤ 5.1 m/s | 4.6 m/s |
| Plane D Rotation | | Peak moment*<br>42 Nm ≤ moment ≤ 53 Nm during the following rotation range 70° ≤ angle ≤ 82° | 43.0 Nm @ 78 degrees |
| Positive Moment Decay** (Flexion) | | Time to decay to 10 Nm 60 ms ≤ time ≤ 80 ms | 70 ms |

*The moment is a direct reading from the load cell
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel
Signature

01/14/2016
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031 **Test I.D:** D16182

| 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 | 27 | Pass |
| Pendulum Speed | | m/s | 5.40 to 5.60 | 5.52 | Pass |
| Pendulum Velocity | 10 msec | m/s | 2.0 to 2.7 | 2.4 | Pass |
| | 15 msec | m/s | 3.0 to 4.0 | 3.4 | Pass |
| | 20 msec | m/s | 4.0 to 5.1 | 4.6 | Pass |
| D Plane Rotation | | deg | 70 to 82 | 78 | Pass |
| Peak Moment within Deflection Corridor | | Nm | 42.0 to 53.0 | 43.0 | Pass |
| Positive Moment - Time Curve Decay to 10 Nm | | msec | 60.0 to 80.0 | 70 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

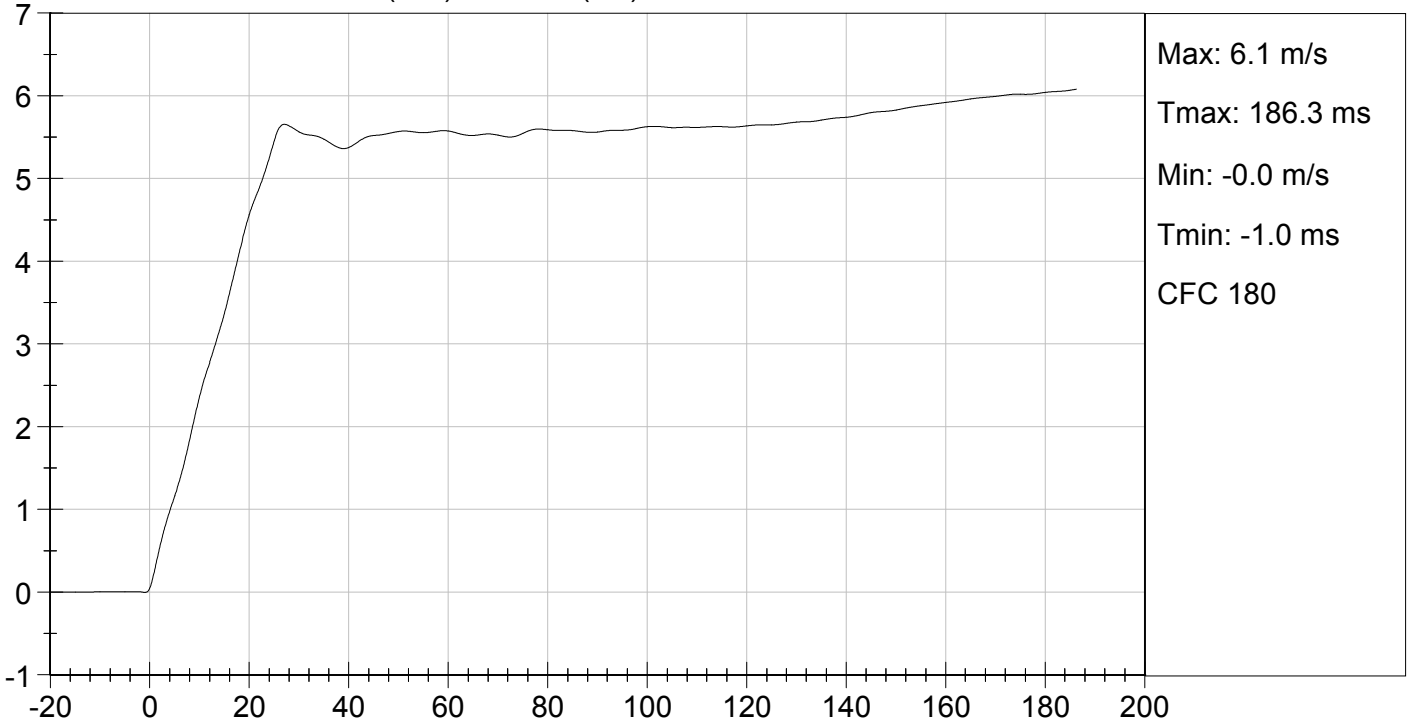
01/14/2016
Test Date

Jeff Levandoski
Approved By

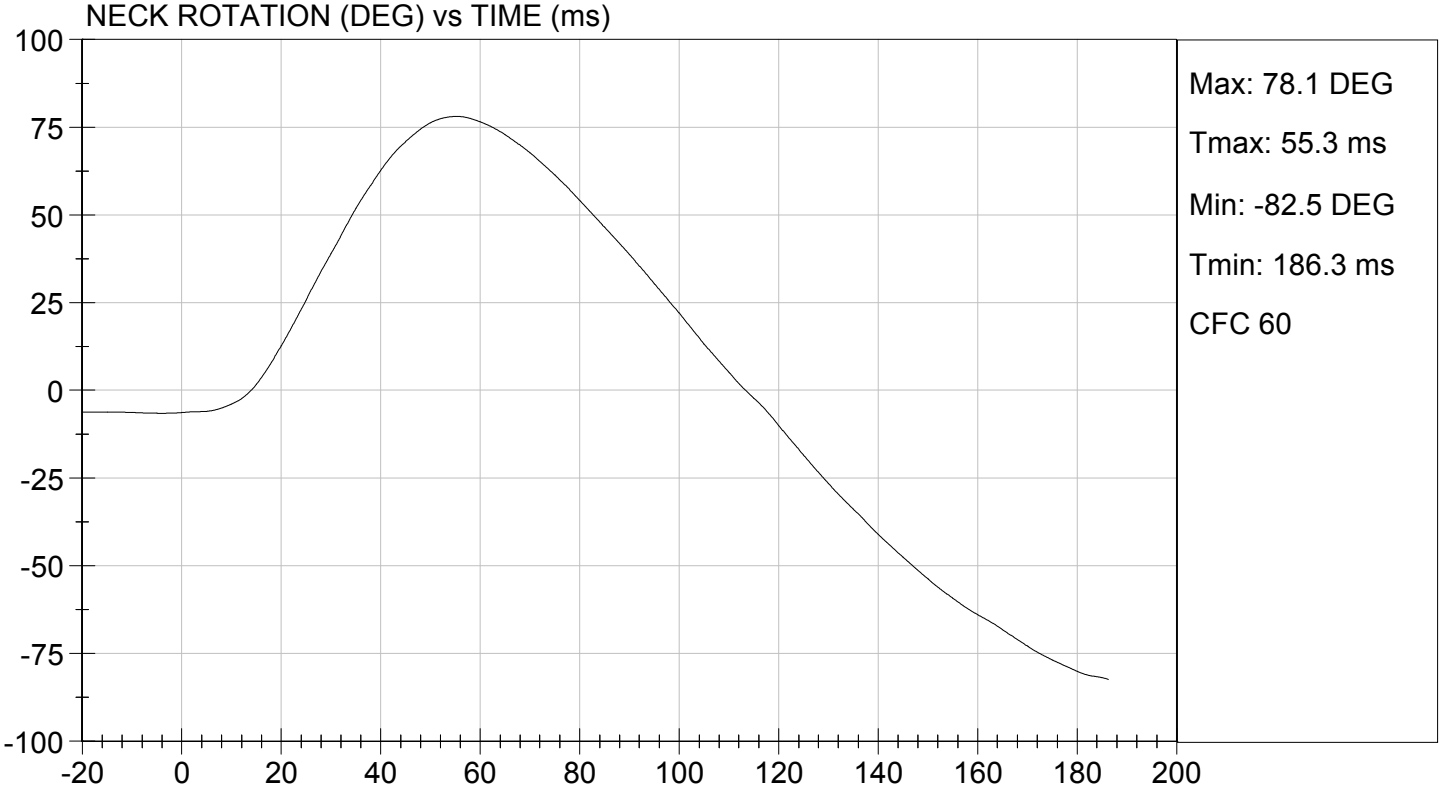
TEST DESC: NECK FLEXION
VELOCITY: 18.12 ft/s, 5.52 m/s

TEST DATE: 01/14/2016
TEST #: D16182

PENDULUM VELOCITY (m/s) vs TIME (ms)

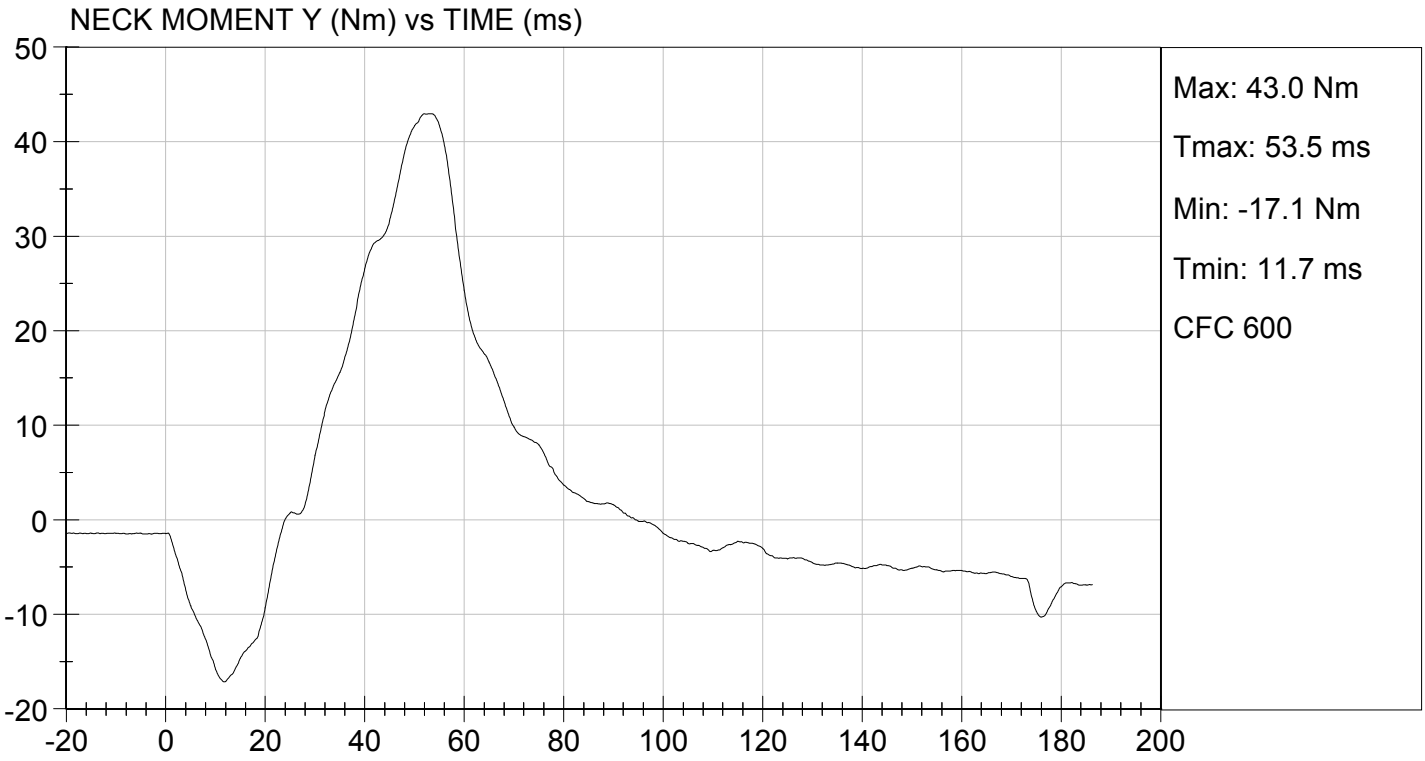



NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 18.12 ft/s, 5.52 m/s

TEST DATE: 01/14/2016
TEST #: D16182



**DATA SHEET D5**
NECK EXTENSION TEST (572.133) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 01/14/2016

Technician: David Schoedel

____ Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.146(p))
X N/A, this is the first neck test performed

X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))

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. (572.143(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 27% |
| Record the minimum humidity | 25% |

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 low risk deployment test, 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. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

X 7. The test fixture pendulum conforms to the specifications in Figure 8D.

X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))

X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.

X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(2)(iii))

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 3.55 m/s to 3.75 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))

X 13. Complete the following table:

Neck Extension Test Results (572.143(b)(2)) & (572.143(c)(4)(ii))

| Parameter | | Specification | Result |
|---|---|---|---|
| Pendulum impact speed | | 3.55 m/s ≤ speed ≤ 3.75 m/s | 3.65 m/s |
| Pendulum $\Delta V$ with respect to impact speed | @ 6 ms | 1.0 m/s ≤ $\Delta V$ ≤ 1.4 m/s | 1.2 m/s |
| | @ 10 ms | 1.9 m/s ≤ $\Delta V$ ≤ 2.5 m/s | 2.3 m/s |
| | @ 14 ms | 2.8 m/s ≤ $\Delta V$ ≤ 3.5 m/s | 3.1 m/s |
| Plane D Rotation | | Peak moment* -53.3 Nm ≤ moment ≤ -43.7 Nm during the following rotation range 83 ≤ angle ≤ 93 | -45.3 Nm @ 91 degrees |
| Negative Moment Decay** (Extension) | | Time to decay to -10 Nm 60 ms ≤ time ≤ 80 ms | 73 ms |

*The moment is a direct reading from the load cell
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel — Signature

01/14/2016 — Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031 **Test I.D:** D16183

| 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 | 27 | Pass |
| Pendulum Speed | | m/s | 3.55 to 3.75 | 3.65 | Pass |
| Pendulum Velocity | 6 ms | m/s | 1.0 to 1.4 | 1.2 | Pass |
| | 10 ms | m/s | 1.9 to 2.5 | 2.3 | Pass |
| | 14 ms | m/s | 2.8 to 3.5 | 3.1 | Pass |
| D Plane Rotation | | deg | 83 to 93 | 91 | Pass |
| Peak Moment within Deflection Corridor | | Nm | -53.3 to -43.7 | -45.3 | Pass |
| Negative Moment - Time Curve Decay to -10 Nm | | ms | 60.0 to 80.0 | 73 | Pass |
| | | | Overall Test Results | | Pass |

David Schoedel

Laboratory Technician

01/14/2016

Test Date

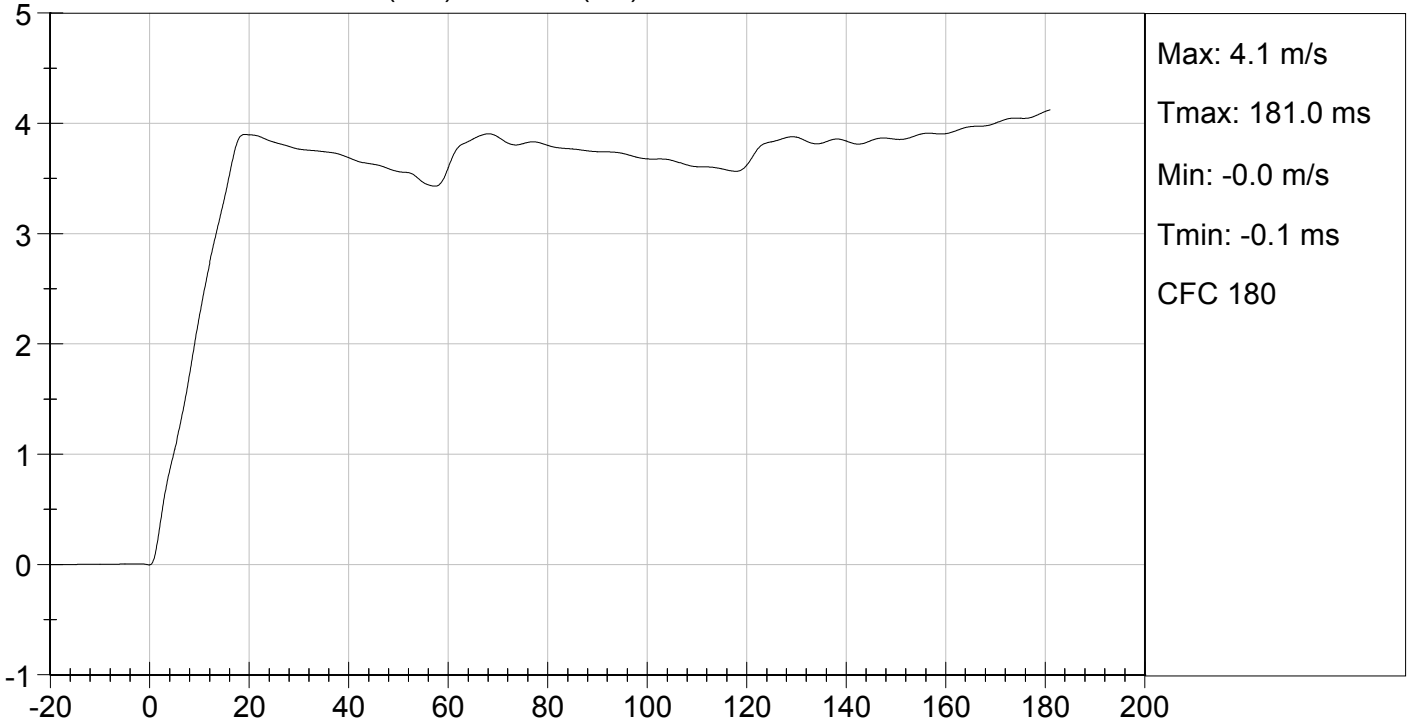
Jeff Levandoski

Approved By

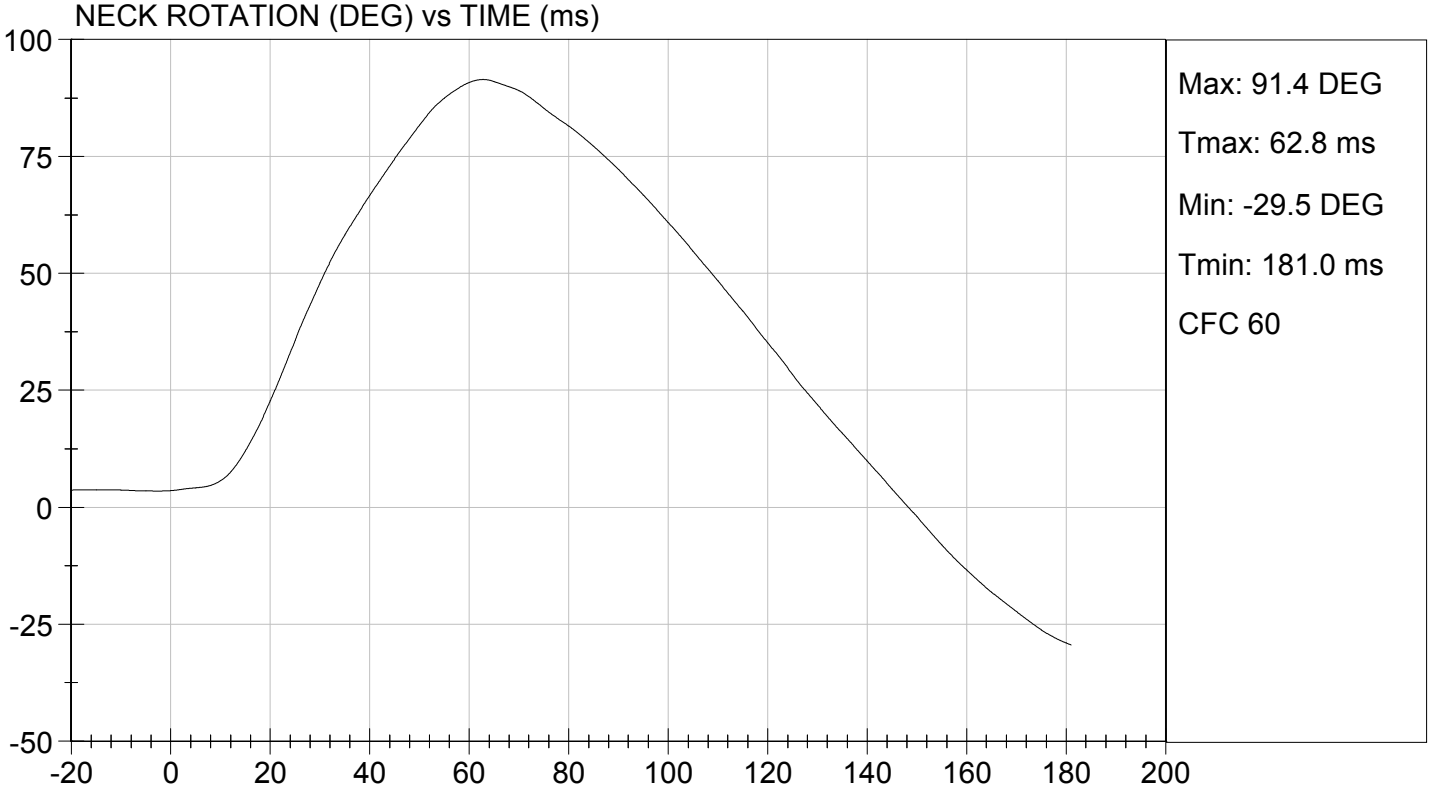
TEST DESC: NECK EXTENSION
VELOCITY: 11.99 ft/s, 3.65 m/s

TEST DATE: 01/14/2016
TEST #: D16183

PENDULUM VELOCITY (m/s) vs TIME (ms)

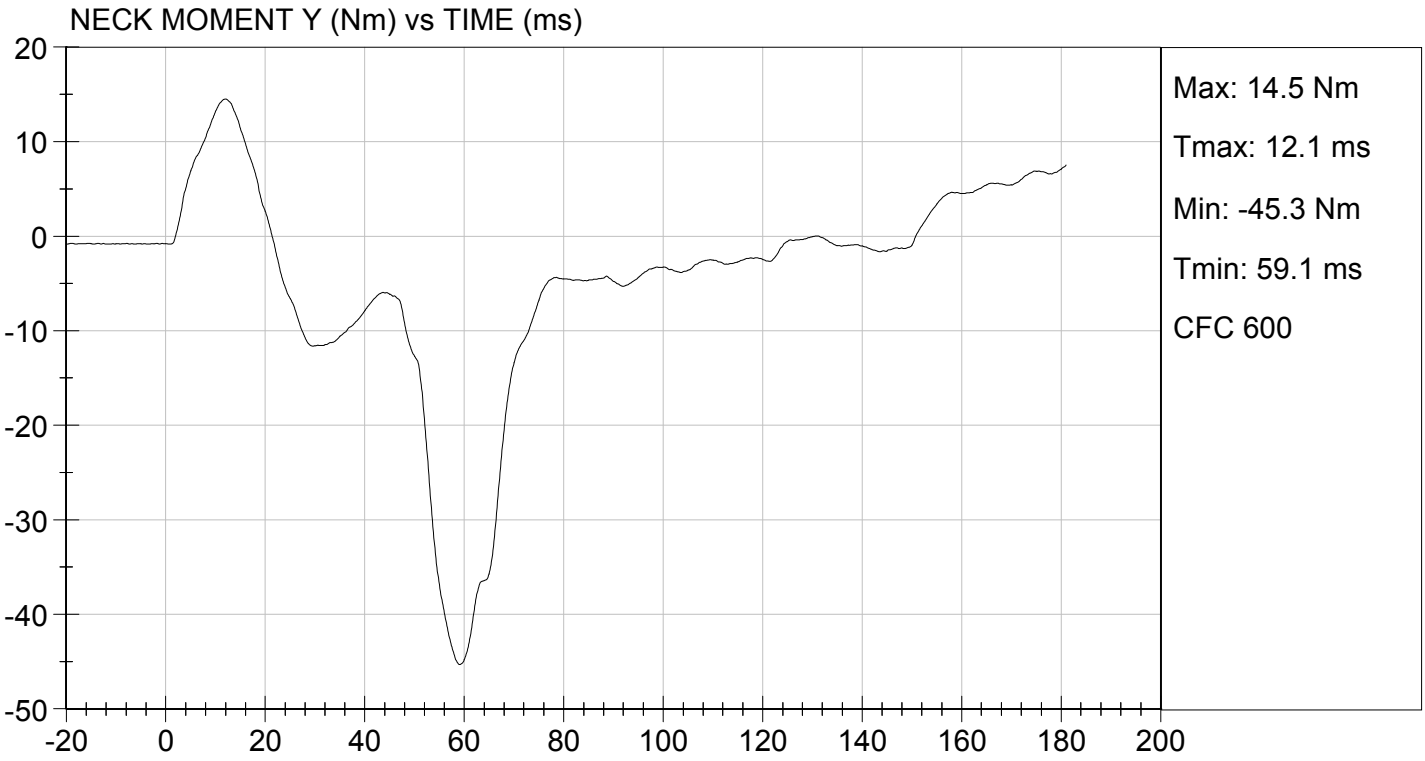



NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 11.99 ft/s, 3.65 m/s

TEST DATE: 01/14/2016
TEST #: D16183



**DATA SHEET D6**
THORAX IMPACT TEST (572.144) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 01/15/2016

Technician: David Schoedel

____ Pre test calibration
_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last thorax impact test. (572.146(p))
_X_ N/A, ONLY one thorax impact test performed

_X_ 2. The test fixture conforms to the specifications in Figure 11D.

_X_ 3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(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. (572.144(c)(2))

| | |
|---|---|
| Record the maximum temperature | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 27% |
| Record the minimum humidity | 25% |

_X_ 5. Remove the arms.

_X_ 6. Unzip the 3 zippers and fold down the chest jacket. 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 damage.

X 7. Seat the dummy, without back and arm supports on the test fixture surface as shown in Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))

X 8. Level the middle rib both longitudinally and laterally ± 0.5°. (572.144(c)(3))

X 9. The midsagittal plane of the dummy is vertical within ± 1°. (572.144(c)(3))

X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within ± 2.5 mm within ± 0.5° of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))

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 rolled up and zipped, and the arms installed. The reference locations must be accessible after the chest skin is rolled up and the arms installed. It will be necessary to leave the chest skin zipper unfastened until the references are checked and then fasten it just prior to the test.

X 12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.

X 13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))

X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).

X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

X 16. Complete the following table:

Thorax Impact Results (572.144(b)(1)&(2))

| Parameter* | Specification | Result |
|---|---|---|
| Test Probe Speed | 5.9 m/s ≤ speed ≤ 6.1 m/s | 6.0 m/s |
| Chest Compression | 32 mm ≤ compression ≤ 38 mm | 35 mm |
| Peak force** between 32 and 38 mm chest compression | 680 N ≤ peak force ≤ 810 N | 742 N |
| Peak force** between 12.5 and 32.0 mm chest compression | Peak force ≤ 910 N | 748 N |
| Internal Hysteresis*** | 65% ≤ hysteresis ≤ 85% | 67% |

*Time zero is defined as the time of initial contact between the test probe and the chest skin.
**Force = impactor mass x acceleration (572.144(b)(3))
***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12D)

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

David Schoedel
Signature

01/15/2016
Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031 **Test I.D:** D16184

| 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 | 27 | Pass |
| Probe Velocity | m/s | 5.9 to 6.1 | 6.03 | Pass |
| Peak Deflection | mm | 32 to 38 | 35 | Pass |
| Peak Resistive Force w/in Deflection Corridor | N | 680 to 810 | 742 | Pass |
| Internal Hysteresis | % | 65 to 85 | 67 | Pass |
| Max Force 12.5 mm - 32 mm Deflection | N | <= 910 | 748 | Pass |
| | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

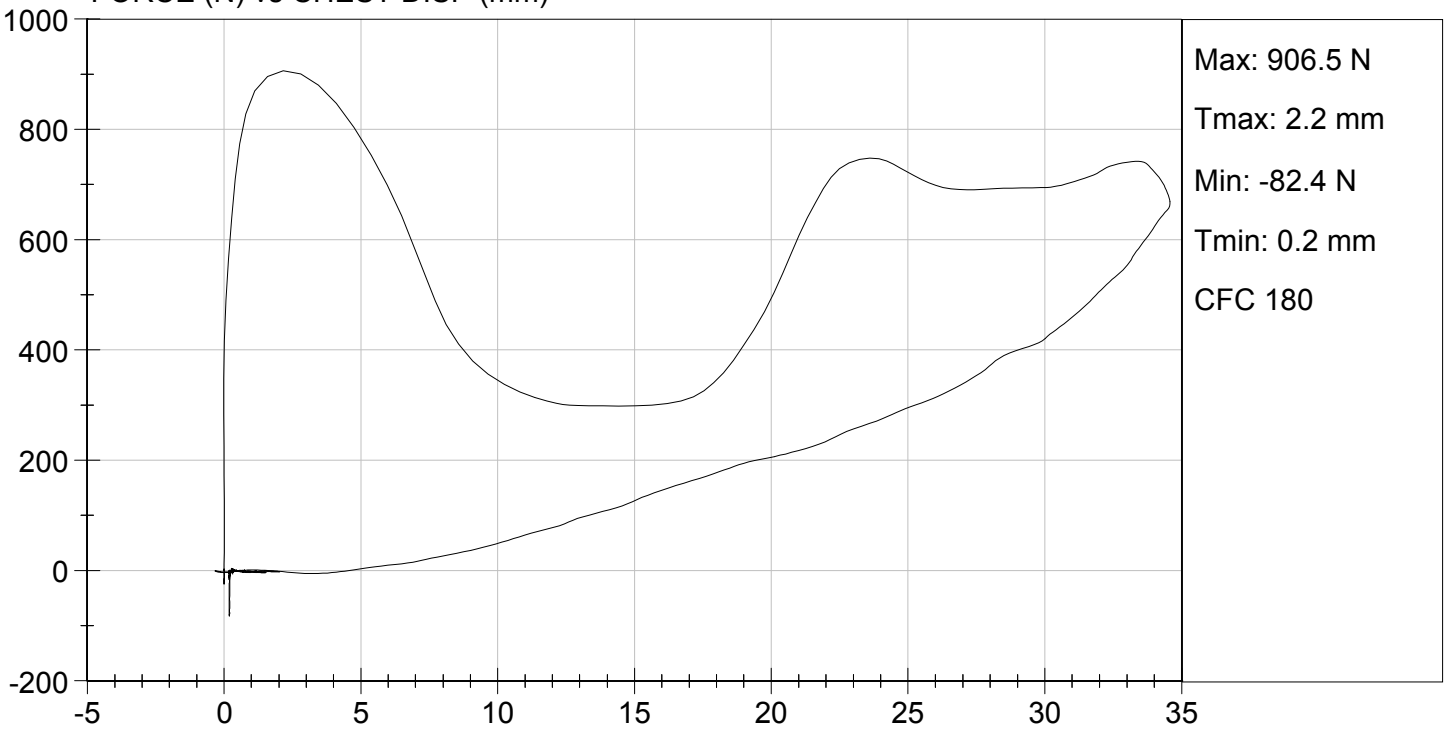
01/15/2016
Test Date

Jeff Leonardelli
Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 19.78 ft/s, 6.03 m/s

TEST DATE: 01/15/2016
TEST #: D16184

FORCE (N) vs CHEST DISP (mm)



**DATA SHEET D7**
TORSO FLEXION TEST (572.145) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 01/15/2016

Technician: David Schoedel

____ Pre test calibration
_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last torso flexion test. (572.146(p))
_X_ N/A, ONLY torso flexion test performed

_X_ 2. The test fixture conforms to the specifications in Figure 13D.

_X_ 3. The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(c)(2)).
_X_ with legs below the femurs.
____ 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. (572.145(c)(1))

| | |
|---|---|
| Record the maximum temperature | 21.4°C |
| Record the minimum temperature | 21.1°C |
| Record the maximum humidity | 27% |
| Record the minimum humidity | 25% |

_X_ 5. Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))

X 6. Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within ± 1° and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii))

_X_ 7. Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket**.** (572.145(c)(2)(iv))

_X_ 8. Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))

X 9. Flex the dummy forward and back 3 times such that the angle of the torso reference plane moves between 0° and 30° ± 2°. The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))

X 10. Remove all externally applied flexion forces and support the dummy such that the torso reference plane is at or near 0°. Wait at least 30 minutes before continuing. (572.135(c)(3)(ii))

X 11. Remove all external support that was implemented in 10 above and wait 2 minutes. (572.145(c)(4))

X 12. Measure the initial orientation angle of the upper torso reference plane of the seated, unsupported dummy. (572.145(c)(4))
Record reference plane angle (max. allowed 15°) See Result Table

X 13. Attach the pull cable and the load cell while maintaining the initial torso orientation. (572.145(c)(5))

X 14. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the torso reference plane reaches 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.145(c)(5))

X 15. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds and record the highest applied force during this period. (572.145(c)(6))

X 16. As quickly as possible release the force applied to the attachment bracket.(572.145(c)(8))

X 17. 3 to 4 minutes after the release of the force, measure the angle reference plane. (572.145(c)(8))

X 18. Complete the following table:

Torso Flexion Results (572.145(b)(1)&(2)), (572.145(c)(4)), (572.145(c)(5))

| Parameter | Specification | Result |
|---|---|---|
| Initial ref. plane angle | Angle ≤ 15° | 10° |
| Torso rotation rate | 0.5°/s ≤ rate ≤ 1.5°/s | 0.7°/s |
| Force at 45° ± 0.5° | 130 N ≤ force ≤ 180 N | 164 N |
| Final ref. plane angle | Initial ref. plane angle ± 10° | 12° |

X 19. A plot of the force versus time follows this sheet.

David Schoedel
Signature

01/15/2016
Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031 **Test I.D:** D16187

| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.6 | 21.1 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 27 | Pass |
| Initial Angle | deg | 0 to 15 | 10 | Pass |
| Return Angle | deg | -10 to 10 | 12 | Pass |
| Force at 45 deg | N | 130 to 180 | 164 | Pass |
| Upper Torso Deflection Rate | deg/s | 0.5 to 1.5 | 0.7 | Pass |
| | | Overall Test Results | | Pass |

David Schoedel
Laboratory Technician

01/15/2016
Test Date

Jeff Leonardelli
Approved By

## DATA SHEET D8

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO. | MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---|---|---|---|---|---|
| DUMMY INSTRUMENTATION | | | | | |
| HEAD ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P88702 | 10/12/2015 | 04/12/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P88703 | 10/08/2015 | 04/08/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P88704 | 10/12/2015 | 04/12/2016 |
| NECK TRANSDUCER | Denton | 3303 | 184 | 11/20/2015 | 05/20/2016 |
| CHEST ACCELEROMETERS | | | | | |
| (1) LONGITUDINAL | Endevco | 7264C-2KTZ-2-360M17 | P88698 | 10/12/2015 | 04/12/2016 |
| (2) LATERAL | Endevco | 7264C-2KTZ-2-360M17 | P88700 | 10/12/2015 | 04/12/2016 |
| (3) VERTICAL | Endevco | 7264C-2KTZ-2-360M17 | P88701 | 10/12/2015 | 04/12/2016 |
| CHEST POTENTIOMETER | Servo | 08C1-3179 | 031 | 10/13/2015 | 04/13/2016 |
| FEMUR LOAD CELLS | | | | | |
| (1) RIGHT FEMUR | N/A | N/A | N/A | N/A | N/A |
| (2) LEFT FEMUR | N/A | N/A | N/A | N/A | N/A |
| LABORATORY INSTRUMENTATION | | | | | |
| NECK PENDULUM ACCELEROMETER | Endevco | 7231C-750 | AH5P1 | 07/24/2015 | 01/24/2016 |
| THORAX PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P82097 | 11/30/2015 | 05/30/2016 |
| KNEE PENDULUM ACCELEROMETER | Endevco | 7264C-2KTZ-2-240 | P88169 | 11/30/2015 | 05/30/2016 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol | 132-0-0-102 | 18 | 09/28/2015 | 03/28/2016 |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol | 132-0-0-102 | 29 | 09/28/2015 | 03/28/2016 |

LABORATORY TECHNICIAN: Jessica Hall

**DATA SHEET B1**
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 031 Test Date: 01/13-01/14/2016

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 | Damage | 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 |
| 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 — 01/15/2016

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 01/15/2016

Signature — Date