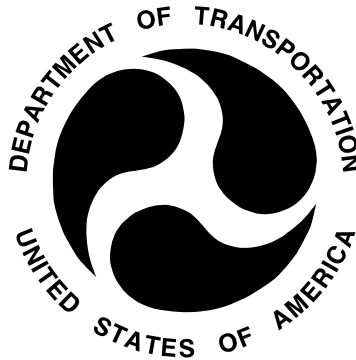


**REPORT NO. 208-MGA-2004-015**

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

**Mazda Motor Corporation  
2004 Mazda 3 4 Door  
NHTSA No.: C45404**

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



**Test Dates: April 20 – September 10, 2004**

**Report Date: October 8, 2004**

**FINAL REPORT**

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

## TABLE OF CONTENTS

			<u>Page No.</u>
DUMMY S/N:	505	PRE-TEST CERTIFICATION DATA	1-1
		PASSED ALL CALIBRATION CHECKS	
DUMMY S/N:	505	POST-TEST CERTIFICATION DATA	2-1
		PASSED ALL CALIBRATION CHECKS	
DUMMY S/N:	506	PRE-TEST CERTIFICATION DATA	3-1
		PASSED ALL CALIBRATION CHECKS	
DUMMY S/N:	506	POST-TEST CERTIFICATION DATA	4-1
		PASSED ALL CALIBRATION CHECKS	
DUMMY S/N:	511	PRE-TEST CERTIFICATION DATA	5-1
		PASSED ALL CALIBRATION CHECKS	
DUMMY S/N:	511	POST-TEST CERTIFICATION DATA	6-1
		PASSED ALL CALIBRATION CHECKS	
DUMMY S/N:	511	PRE-TEST CERTIFICATION DATA	7-1
		PASSED ALL CALIBRATION CHECKS	
DUMMY S/N:	511	POST-TEST CERTIFICATION DATA	8-1
		PASSED ALL CALIBRATION CHECKS	

## EXTERNAL DIMENSIONS

SN505, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	783.4
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	438.0
C	H-POINT HEIGHT	Reference	81.3-86.3	84.2
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	147.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	76.4
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	124.3
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	250.3
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	46.7
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	283.4
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	187.3
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	532.4
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.3
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	405.2
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	421.6

SN505, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	182.4
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	224.7
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	473.7
S	HEAD BREADTH	The widest part of the head	137.1-147.3	144.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	179.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	305.7
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	362.4
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	84.3
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	533.7
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	863.7
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	773.6
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 505 Test Date 9/09/04

Technician Jessica Gall

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.4</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity    | <u>48%</u>  |
| Record the minimum humidity    | <u>41%</u>  |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

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

Record the actual distance 376 mm

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

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

Record the right side distance 500mm

Record the left side distance 500mm

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

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

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

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

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	271
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	13

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

Jessica Gall  
Signature

9/09/04  
Date

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

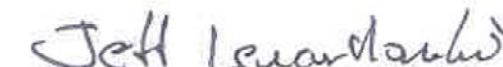
ATD Serial No: 505

Test ID: D042171

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Peak Resultant Acceleration	G's	250 - 300	271	Pass
Peak Lateral Acceleration	G's	+/- 15	12.6	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass

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

09/09/2004  
 \_\_\_\_\_  
 Test Date

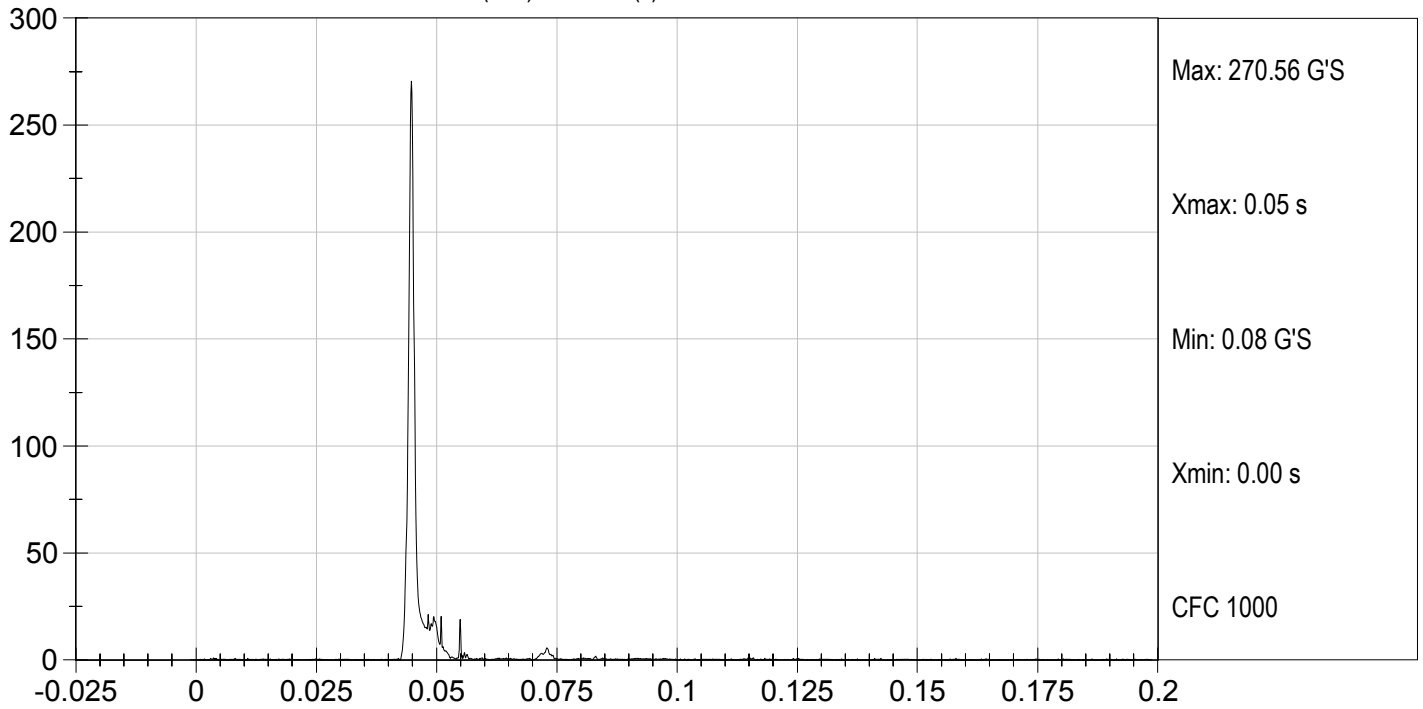
  
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 Approved By



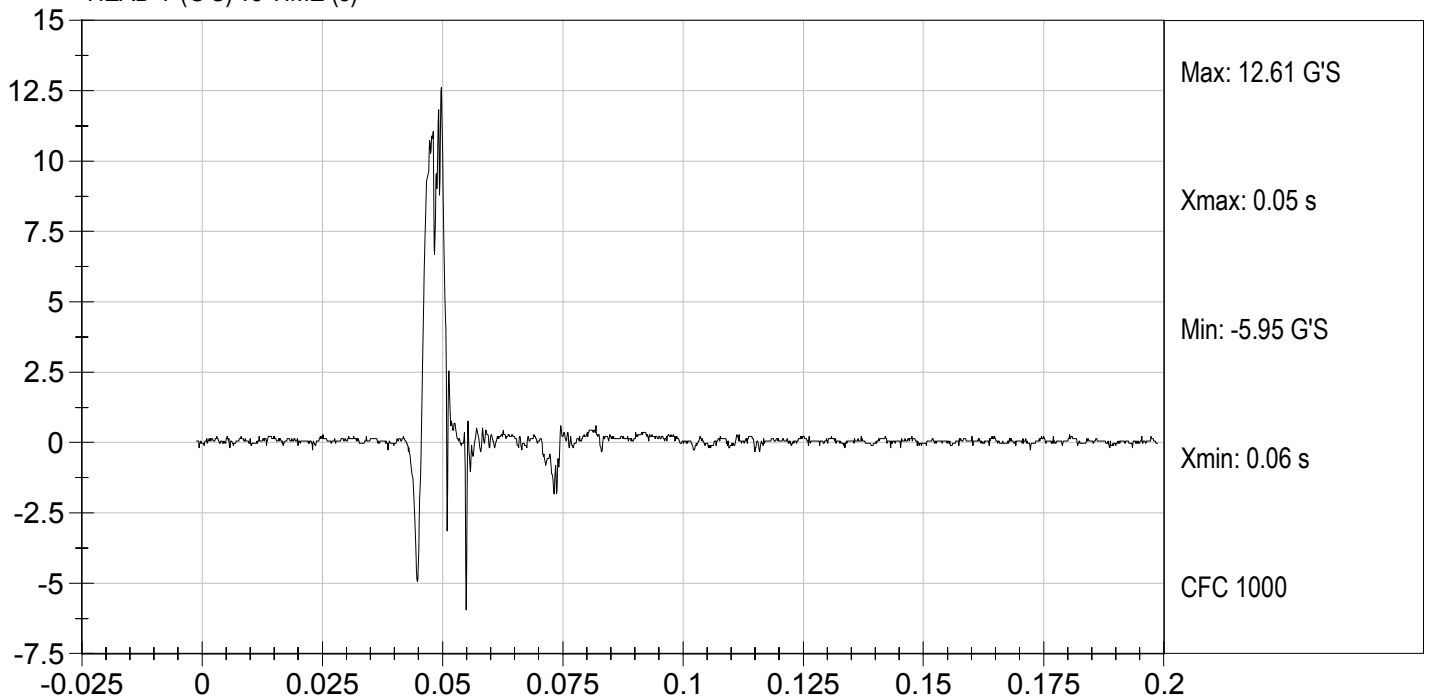
Test Desc: Head Drop  
Componet ID: D042171

Test Date: 09/09/2004  
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 505 Test Date 9/09/04

Technician Dave Wilcox

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one flexion test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.4</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity    | <u>48%</u>  |
| Record the minimum humidity    | <u>41%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness Front 85; Back 88.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter		Specification	Result
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.11 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.5 m/s
	@30ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.4 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	<u>78</u> Nm @ <u>85</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100ms	88 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

  
\_\_\_\_\_  
Signature

9/09/04  
\_\_\_\_\_  
Date

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

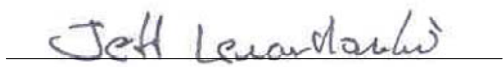
ATD Serial No: 505

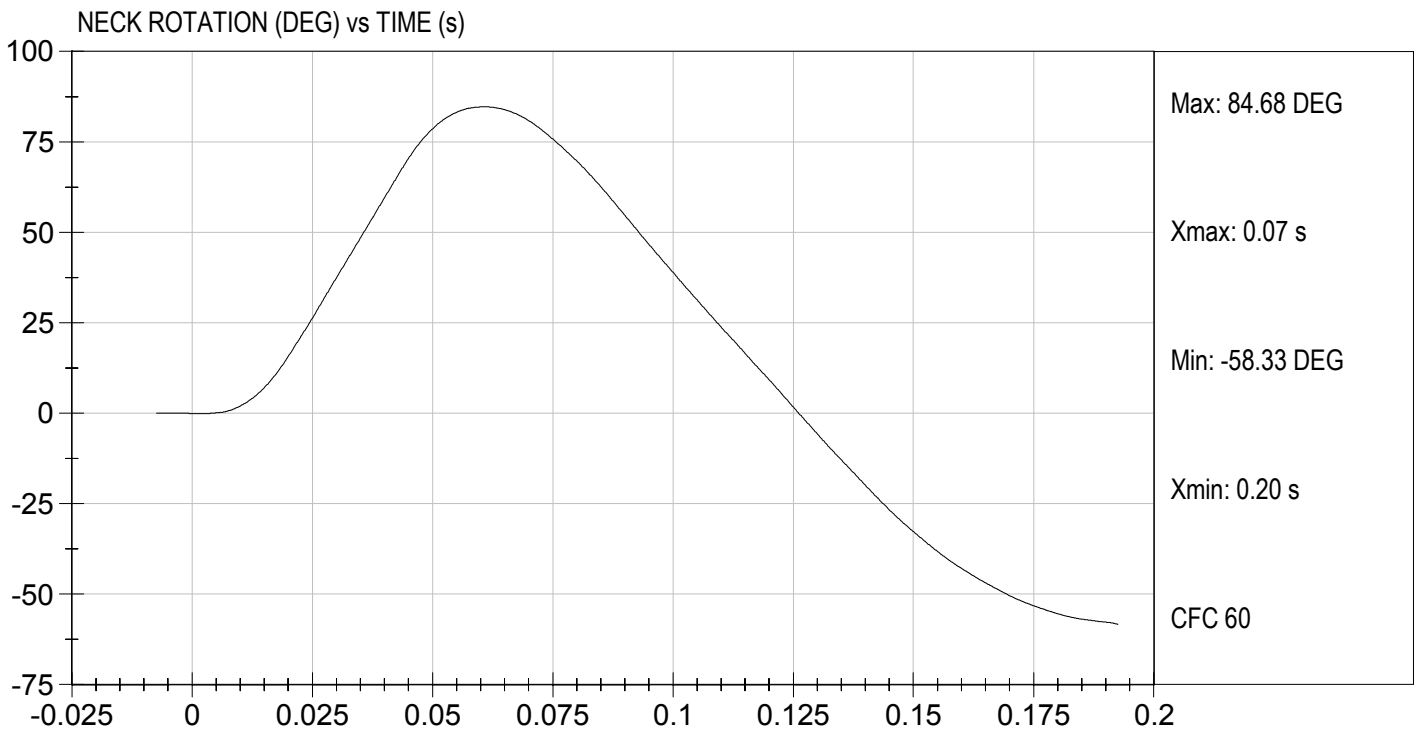
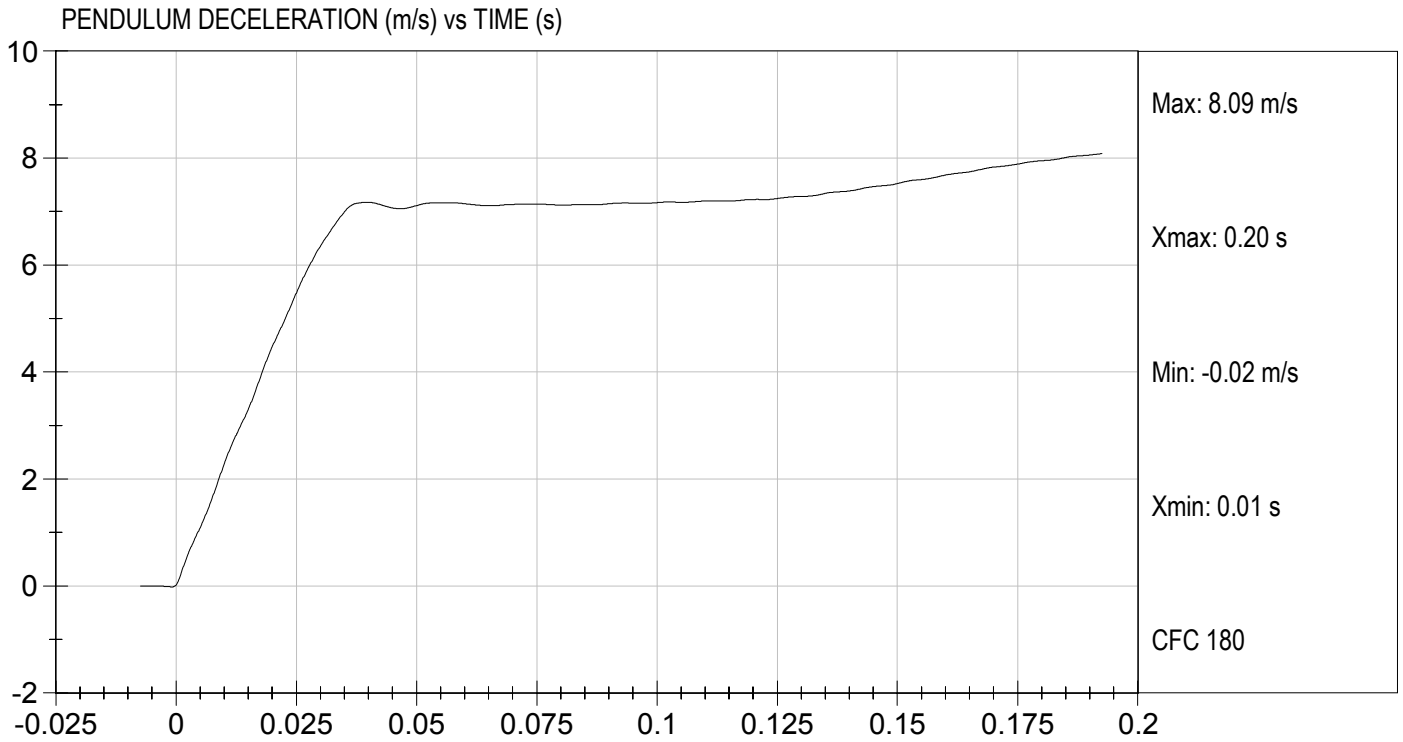
Test I.D.: D042172

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	44	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.11	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.3	Pass
	20 msec	m/sec	4.0 to 5.0	4.5	Pass
	30 msec	m/sec	5.8 to 7.0	6.4	Pass
D Plane Rotation	Max	deg	77 to 91	85	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	78	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	88	Pass
Overall Results					Pass

  
 Laboratory Technician

09/09/2004  
 Test Date

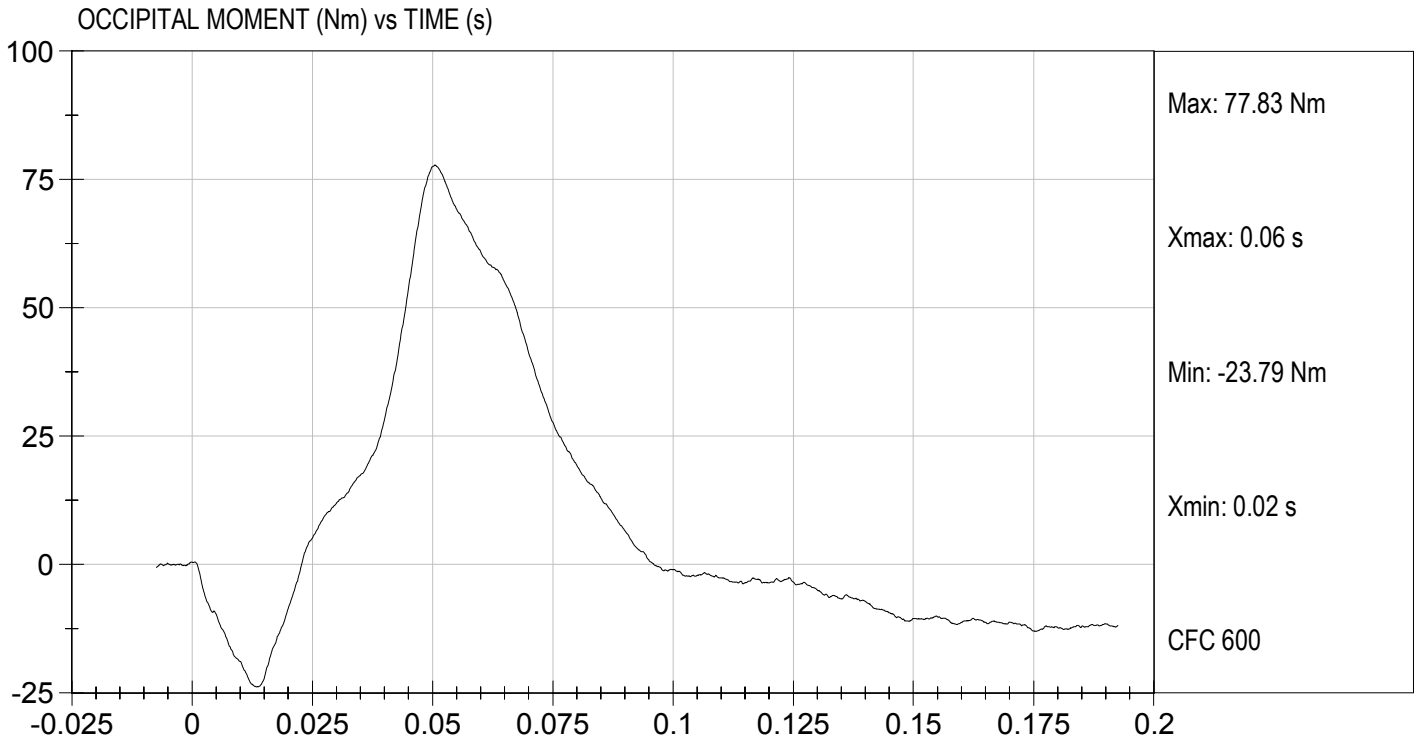
  
 Approved By





Test Desc: Neck Flexion  
Componet ID: D042172

Test Date: 09/09/2004  
Velocity: 23.33 ft/s, 7.11 m/s



DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 505 Test Date 9/09/04

Technician Dave Wilcox

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one extension test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.4</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity    | <u>48%</u>  |
| Record the minimum humidity    | <u>41%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness Front 85; Back 88.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.12 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$
Plane D Rotation	Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	<u>-61</u> Nm @ <u>109</u> degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	95 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

  
Signature

9/09/04  
Date

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

ATD Serial No: 505

Test I.D: D042173


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	42	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.9	Pass
	20 msec	m/sec	3.1 to 3.9	3.7	Pass
	30 msec	m/sec	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-61	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	95	Pass
Overall Results					Pass



Laboratory Technician

09/09/2004

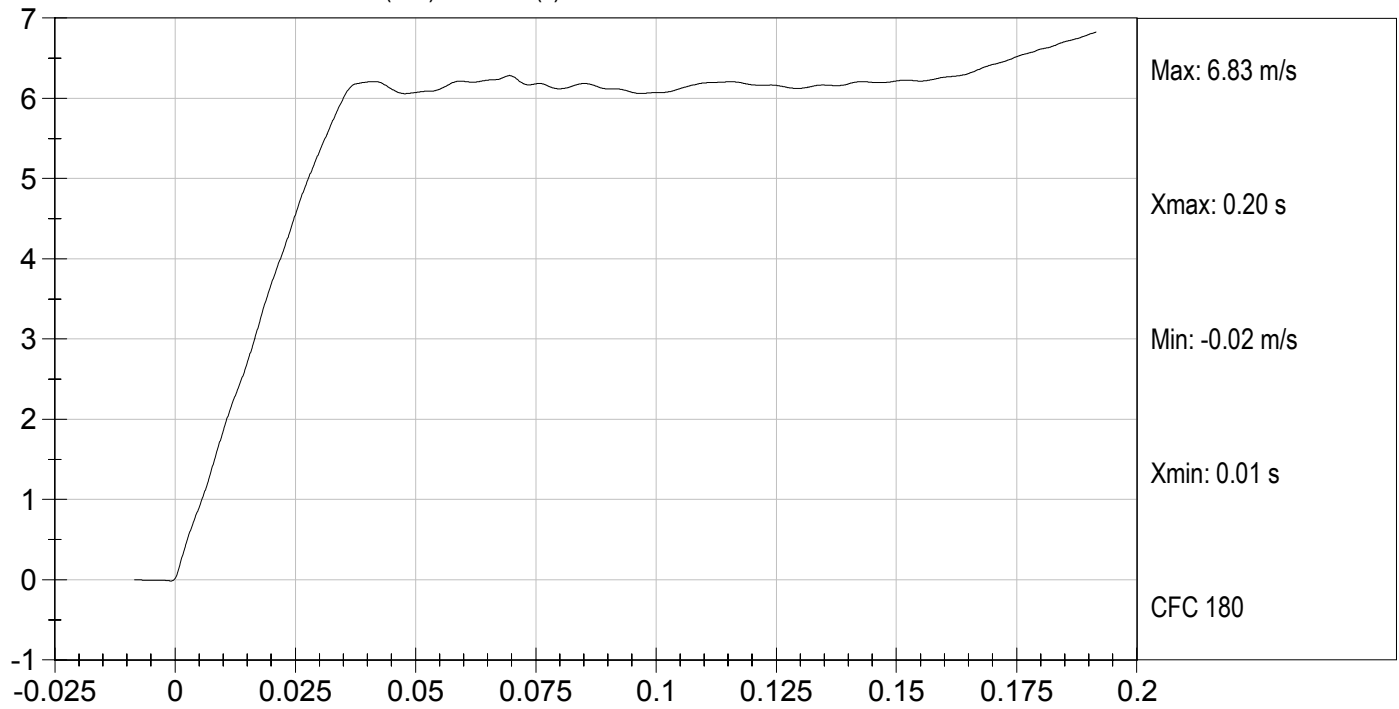
Test Date



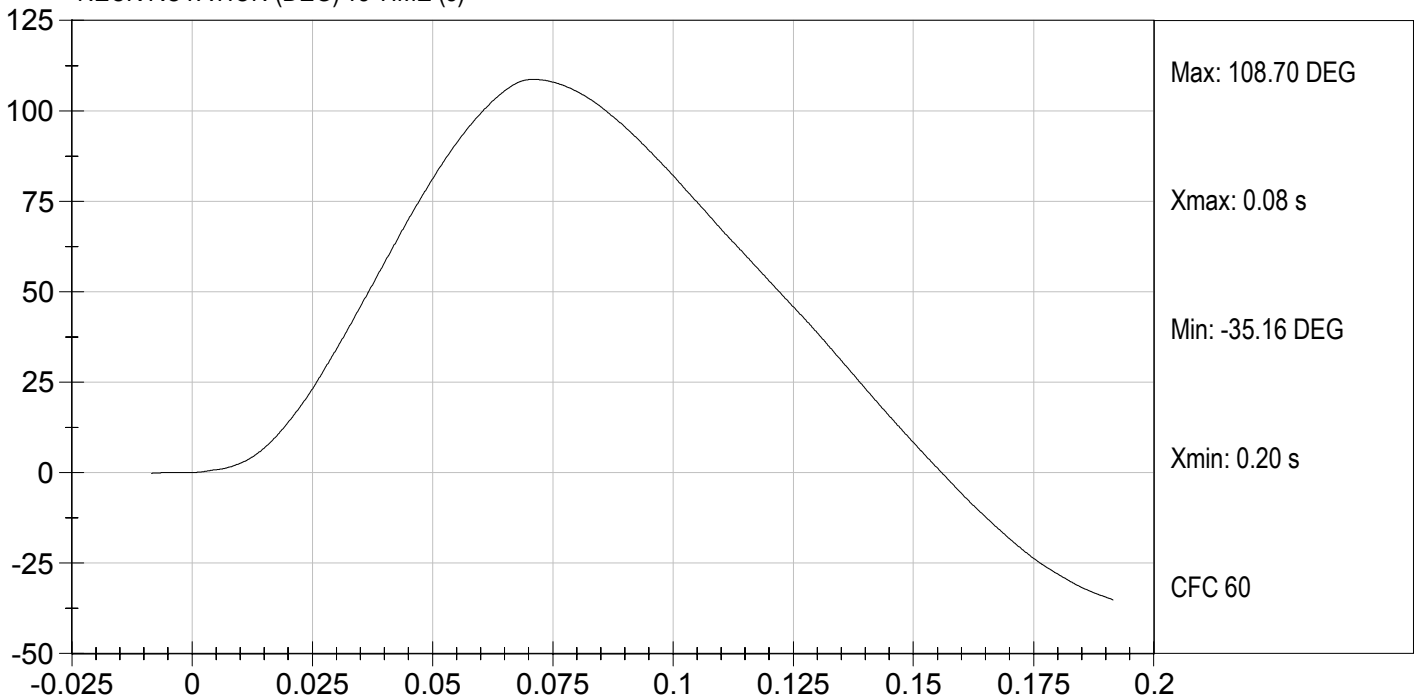
Approved By



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



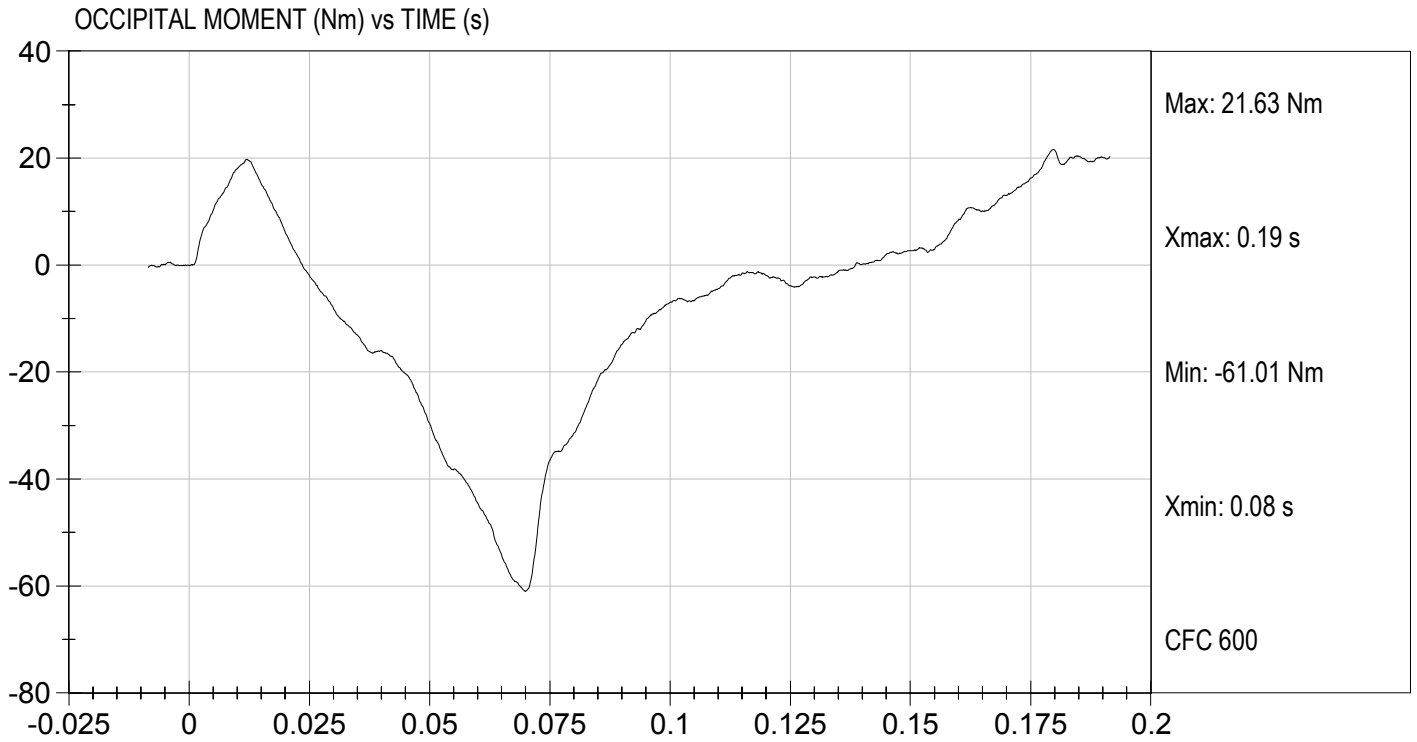
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Extension  
Componet ID: D042173

Test Date: 09/09/2004  
Velocity: 20.08 ft/s, 6.12 m/s



DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 505 Test Date 9/09/04

Technician Jim Carney

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
- 2. The test fixture conforms to the specifications in Figure 11B.
- 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))
 

Record the maximum temperature	<u>21.4</u>
Record the minimum temperature	<u>20.7</u>
Record the maximum humidity	<u>48 %</u>
Record the minimum humidity	<u>41 %</u>
- 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
  - No damage
  - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_
  - The following repairs or replacement was performed. Record \_\_\_\_\_
- 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

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

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

X 16. Complete the following table:

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

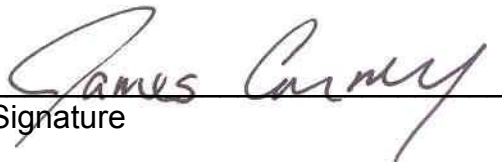
Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.78 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	55 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4180 N
Peak force** between 18.0 and 50.0 mm chest compression	peak force ≤ 4600 N	4177 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	70%

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

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

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

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

  
 Signature

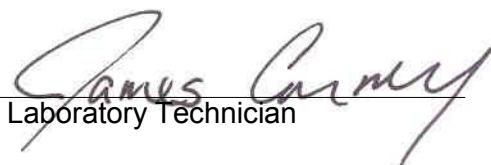
9/09/04  
 Date

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


ATD Serial No: 505

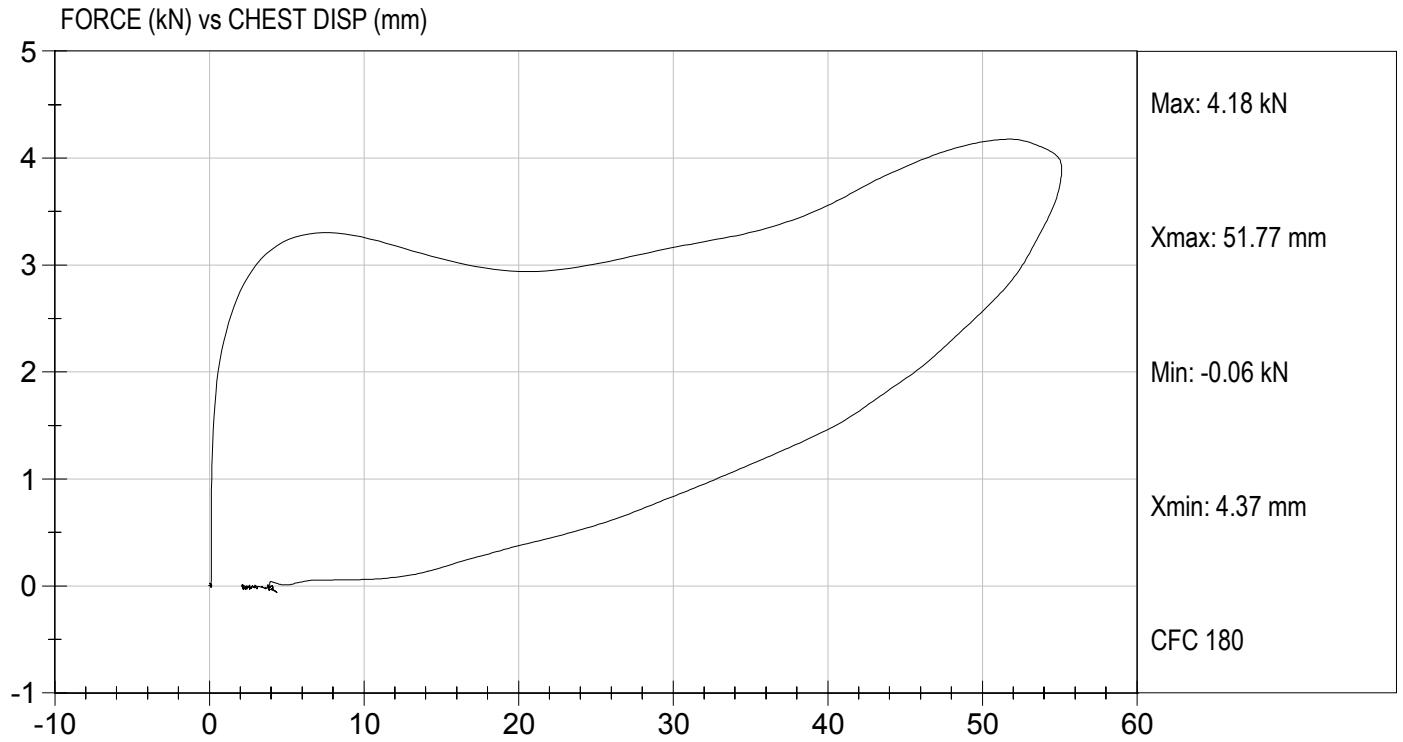
Test I.D.: D042174

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	Pass
Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/s	6.59 to 6.83	6.78	Pass
Peak Deflection	mm	50 to 58	55.1	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.2	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	Yes/No	< 4600 N	4177	Pass
Overall Test Results				Pass

  
 Laboratory Technician

09/09/2004  
 Test Date

  
 Approved By



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 505 Test Date 9/09/04

Technician David Wilcox

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.4</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity    | <u>48%</u>  |
| Record the minimum humidity    | <u>41%</u>  |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
Record reference plane angle (max. allowed 20°) 18°
12. Attach the pull cable and the load cell. (572.135(c)(8))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 20^\circ$	$18^\circ$
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	386 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	$21^\circ$

  
 \_\_\_\_\_  
 Signature

9/09/04  
 \_\_\_\_\_  
 Date

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

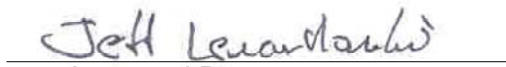
ATD Serial No: 505

Test I.D.: D042177

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	21	Pass
Force at 45 deg	N	320 to 390	386	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass

  
 Laboratory Technician

09/09/2004  
 Test Date

  
 Approved By

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 9/09/04

Technician David Wilcox

Pretest calibration

Post test calibration verification

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

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

N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 20.7

Record the maximum humidity 48%

Record the minimum humidity 41%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.11 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3860 N

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

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

  
Signature

9/09/04  
Date

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


ATD Serial No: 505

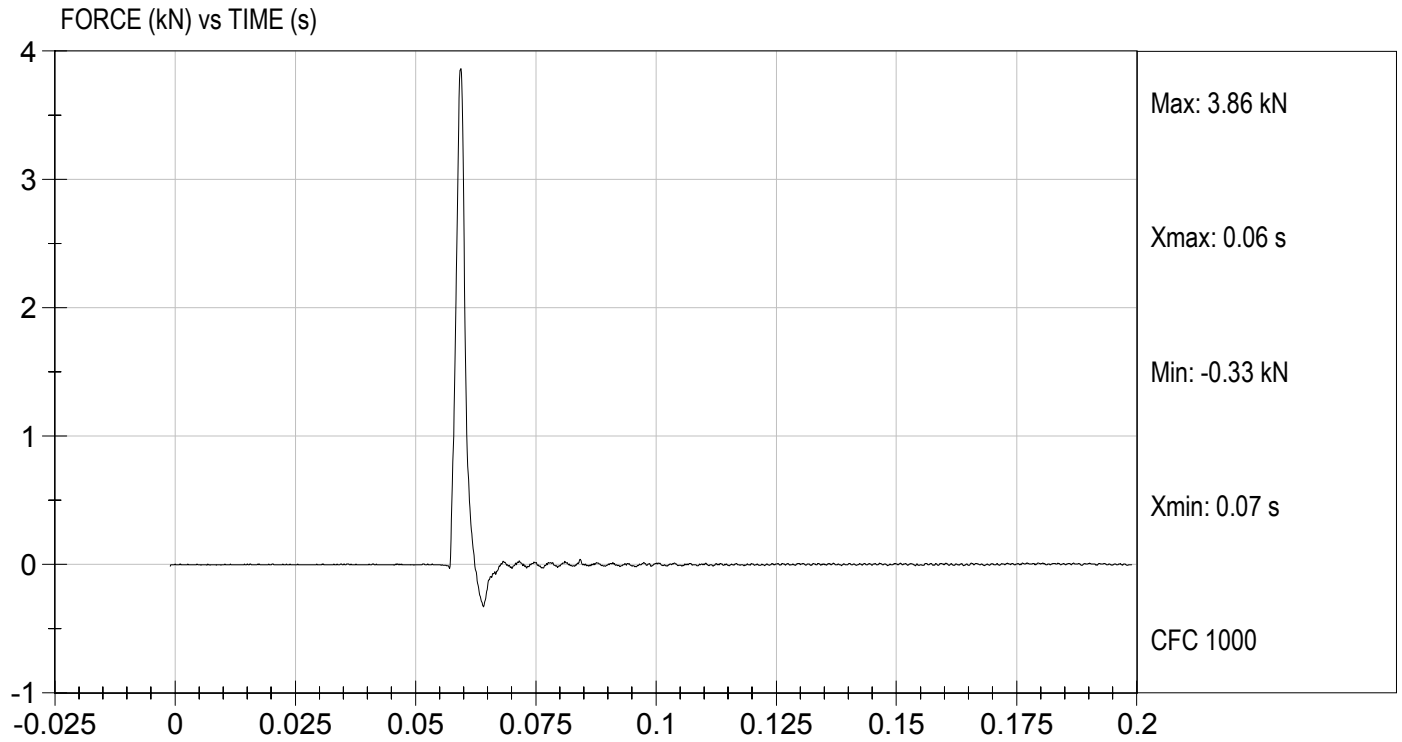
Test I.D.: D042176

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.86	Pass
Overall Test Results				Pass

  
 Laboratory Technician

09/09/2004  
 Test Date

  
 Approved By



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505 Test Date 9/09/04

Technician David Wilcox

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
- 2. The test fixture conforms to the specifications in Figure 14B.
- 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
 

Record the maximum temperature	<u>21.4</u>
Record the minimum temperature	<u>20.7</u>
Record the maximum humidity	<u>48 %</u>
Record the minimum humidity	<u>41 %</u>
- 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))
- 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.09 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3560 N

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

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

  
\_\_\_\_\_  
Signature

9/09/04  
\_\_\_\_\_  
Date

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


**ATD Serial No:** 505

**Test I.D.:** D042175

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/sec	2.07 to 2.13	2.09	Pass
Maximum Force	kN	3.45 to 4.06	3.56	Pass
Overall Test Results				Pass

  
 Laboratory Technician

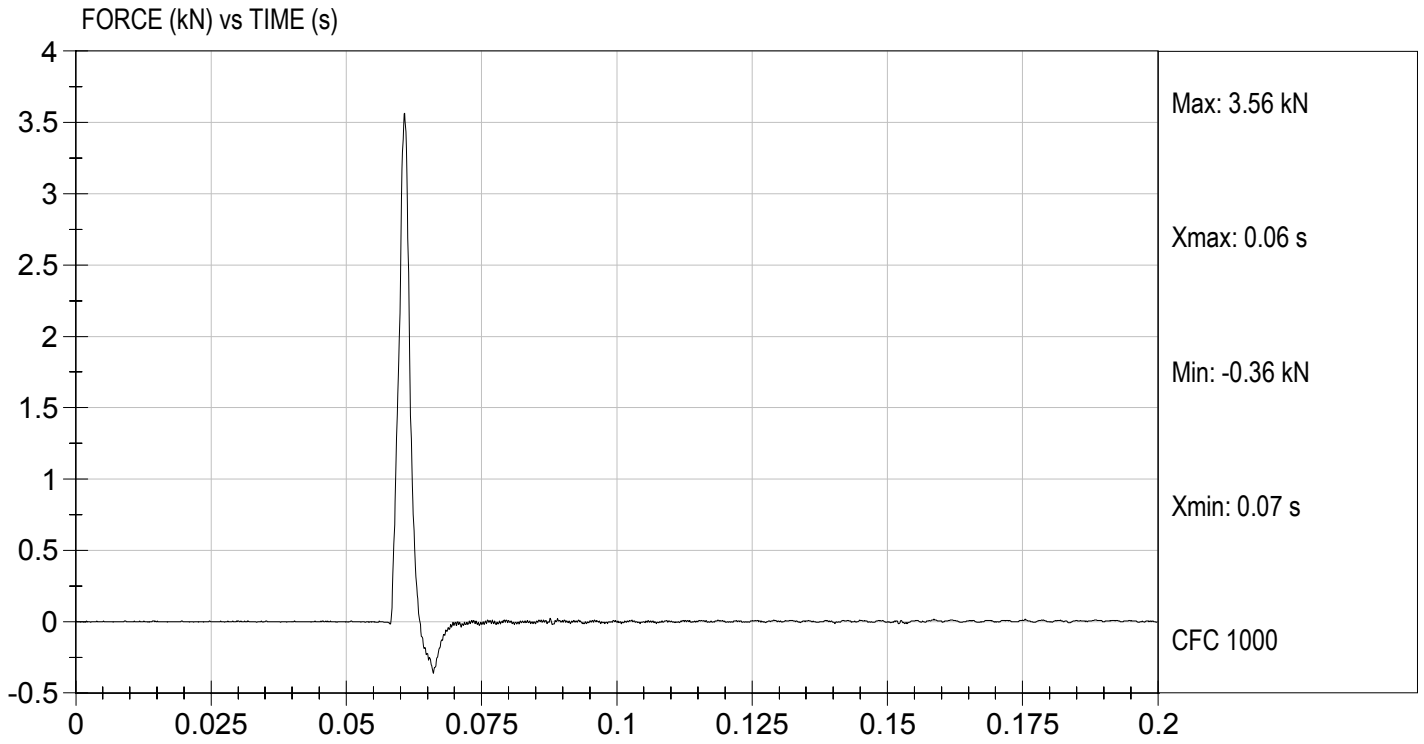
09/09/2004  
 Test Date

  
 Approved By



Test Desc: Right Knee  
Componet ID: D042175

Test Date: 09/09/2004  
Velocity: 6.86 ft/s, 2.09 m/s



DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 505 Test Date 9/13/04

Technician Dave Wilcox

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.5</u> |
| Record the minimum temperature | <u>20.9</u> |
| Record the maximum humidity    | <u>52%</u>  |
| Record the minimum humidity    | <u>49%</u>  |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

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

Record the actual distance 376 mm

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

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

Record the right side distance 500mm

Record the left side distance 500mm

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

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

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

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

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	254
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	8

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

  
Signature

9/13/04  
Date

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


ATD Serial No: 505

Test ID: D042211

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Peak Resultant Acceleration	G's	250 - 300	254	Pass
Peak Lateral Acceleration	G's	+/- 15	8	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass

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

09/13/2004  
\_\_\_\_\_  
Test Date

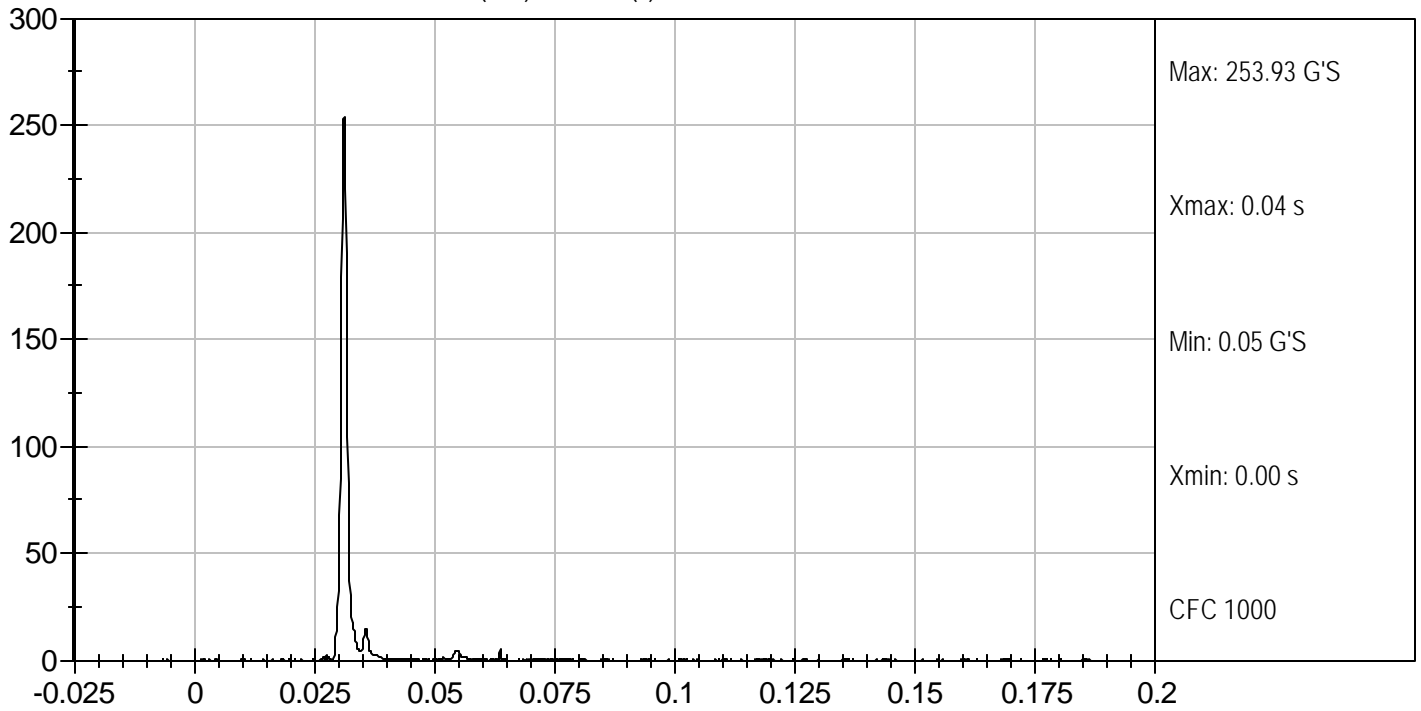
  
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Approved By



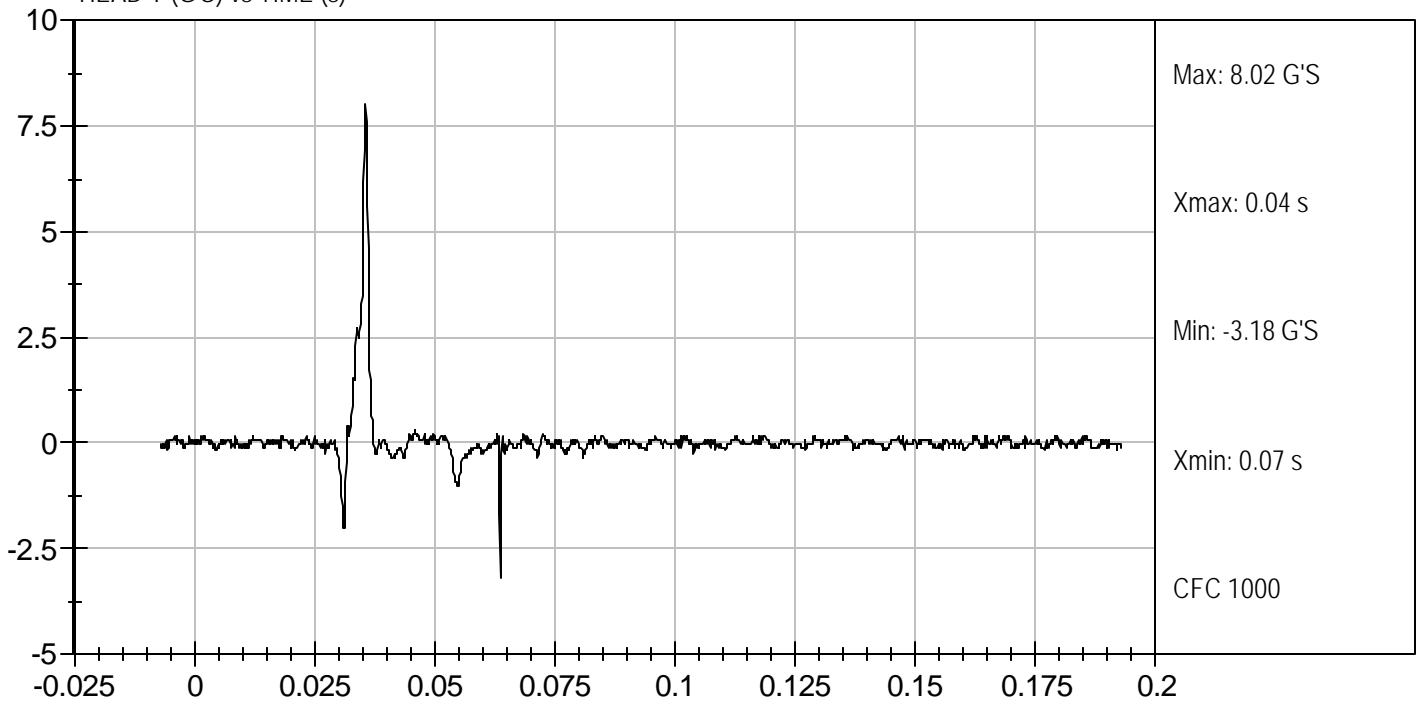
Test Desc: Head Drop  
Componet ID: D042211

Test Date: 09/13/2004  
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 505 Test Date 9/13/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one flexion test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.5</u> |
| Record the minimum temperature | <u>20.9</u> |
| Record the maximum humidity    | <u>52%</u>  |
| Record the minimum humidity    | <u>49%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness Front 85; Back 88.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter		Specification	Result
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.04 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.4 m/s
	@30ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.2 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	<u>76</u> Nm @ <u>85</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100ms	87 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

Joe Fleck  
Signature

9/13/04  
Date

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

ATD Serial No: 505

Test I.D.: D042212

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	52	Pass	
Pendulum Speed	m/sec	6.89 to 7.13	7.04	Pass	
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.3	Pass
	20 msec	m/sec	4.0 to 5.0	4.4	Pass
	30 msec	m/sec	5.8 to 7.0	6.2	Pass
D Plane Rotation	Max	deg	77 to 91	85	Pass
Occipital Condyle Moment within Deflection Corridor	Nm	69 to 83	76	Pass	
Positive Moment Time Curve Decay to 10 Nm	msec	80 to 100	87	Pass	
			Overall Results	Pass	

*Joe Fleck*

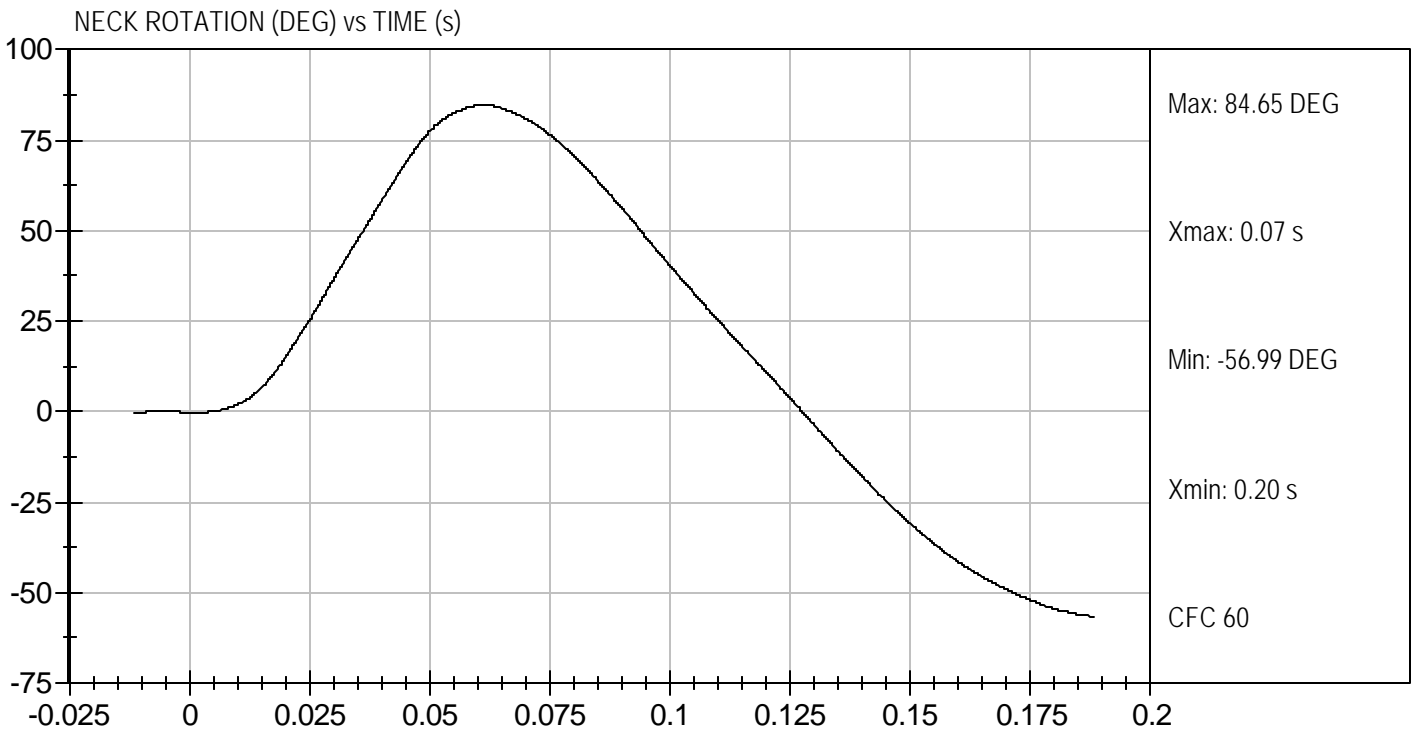
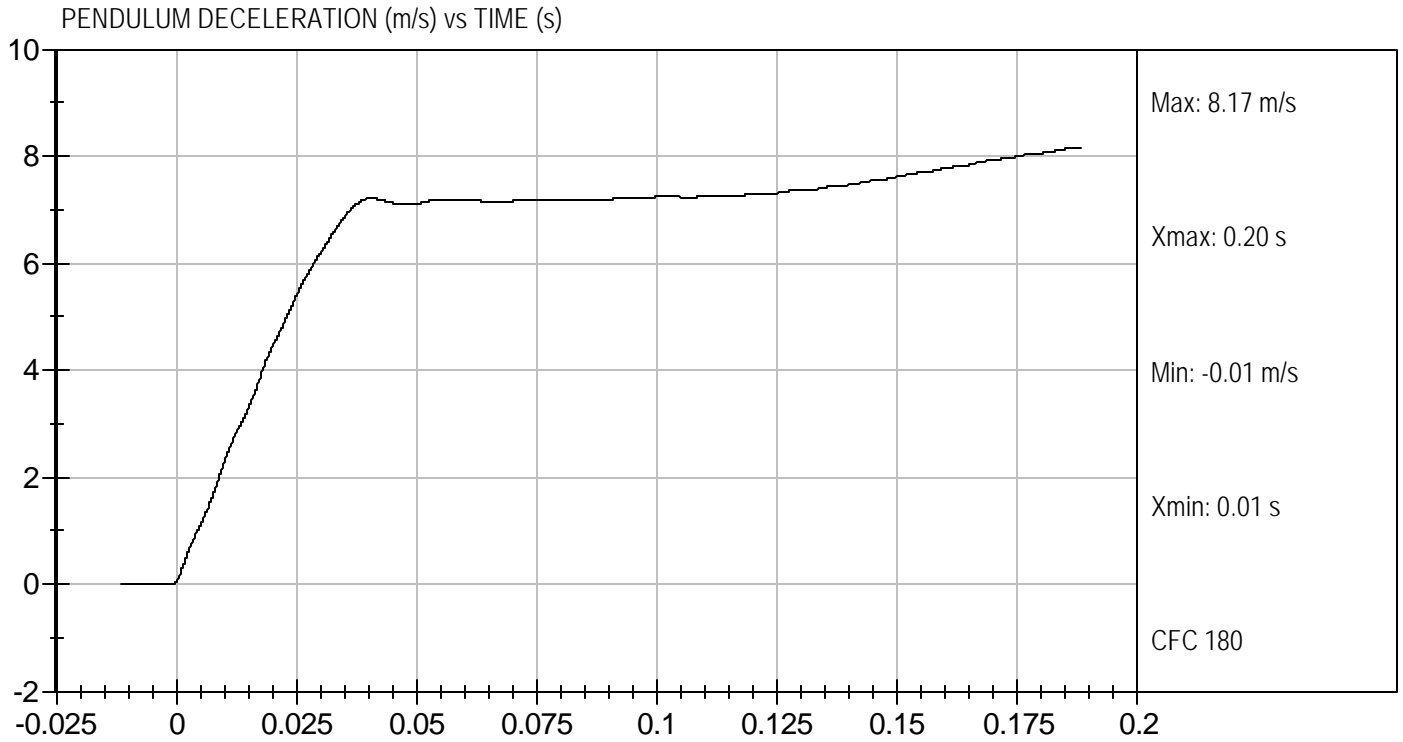
Laboratory Technician

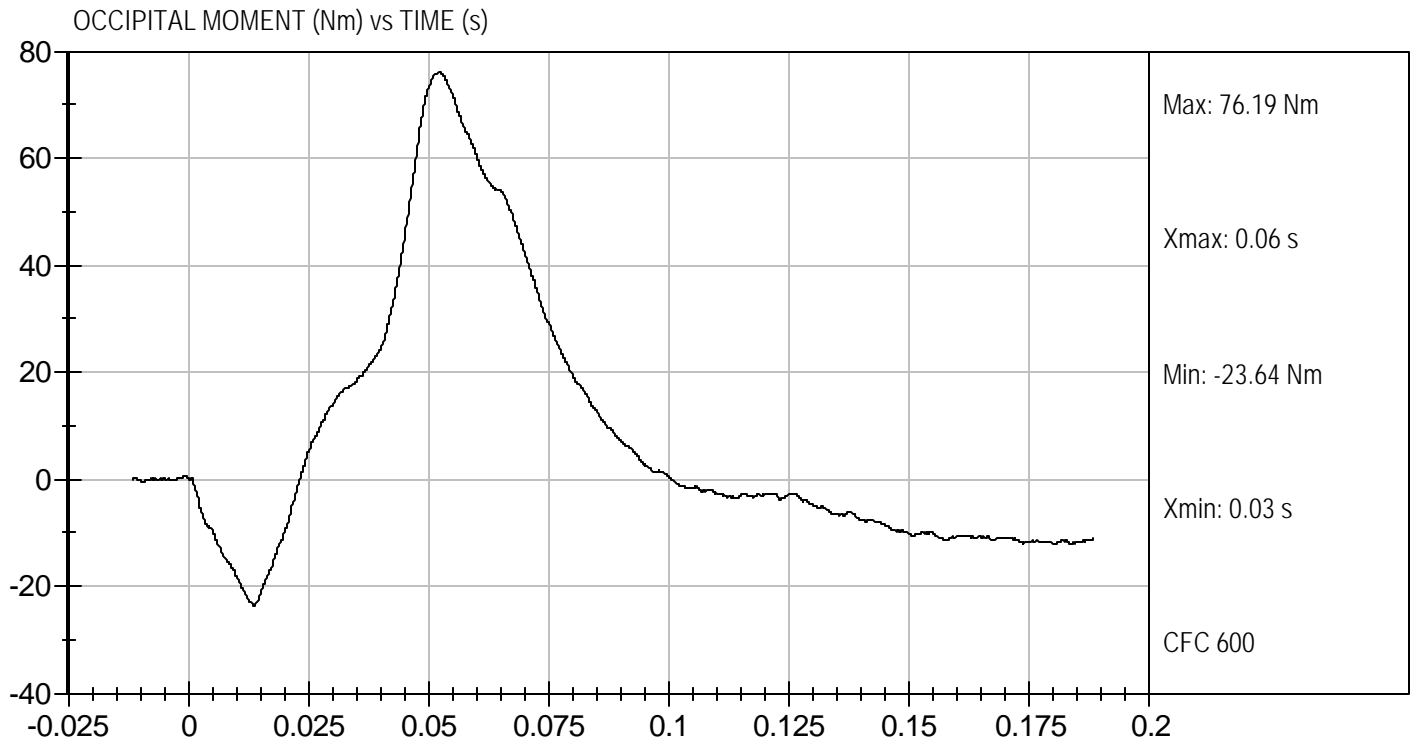
09/13/2004

Test Date

*Jeff Levanowski*

Approved By





DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 505 Test Date 9/13/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one extension test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.5</u> |
| Record the minimum temperature | <u>20.9</u> |
| Record the maximum humidity    | <u>52%</u>  |
| Record the minimum humidity    | <u>49%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness Front 85; Back 88.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.10 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$
Plane D Rotation	Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	<u>-60</u> Nm @ <u>109</u> degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	97 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

*Joe Flack*

Signature

9/13/04

Date

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

ATD Serial No: 505

Test I.D: D042213

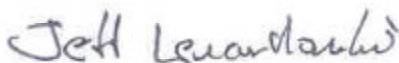
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	50	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.10	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.9	Pass
	20 msec	m/sec	3.1 to 3.9	3.6	Pass
	30 msec	m/sec	4.6 to 5.6	5	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-60	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	97	Pass
Overall Results					Pass



Laboratory Technician

09/13/2004

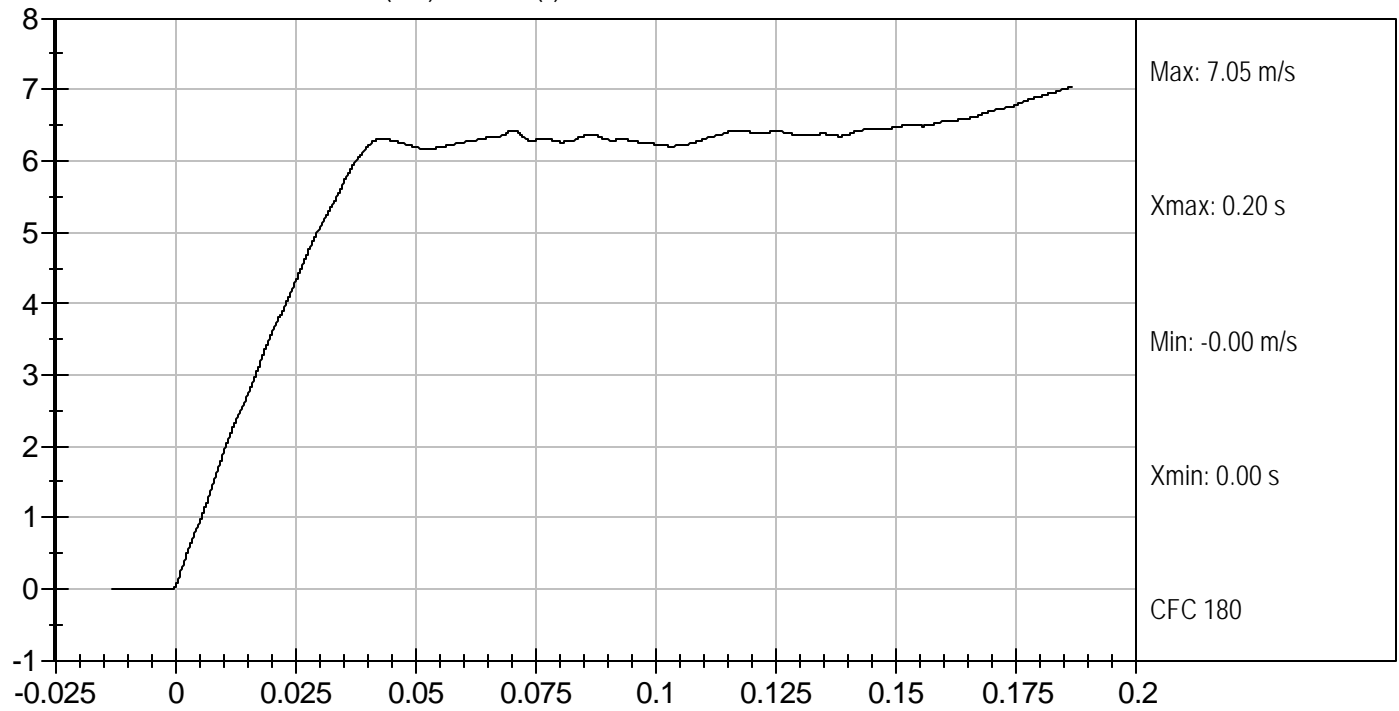
Test Date



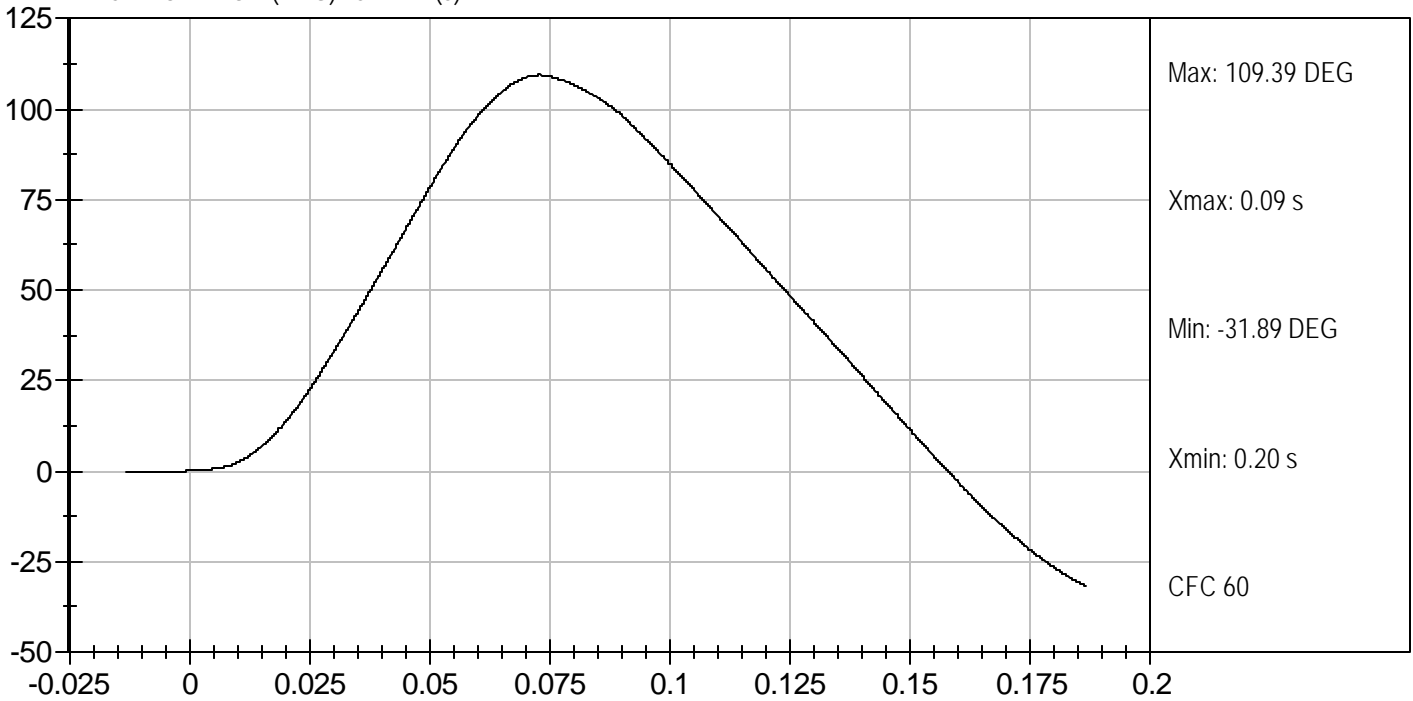
Approved By

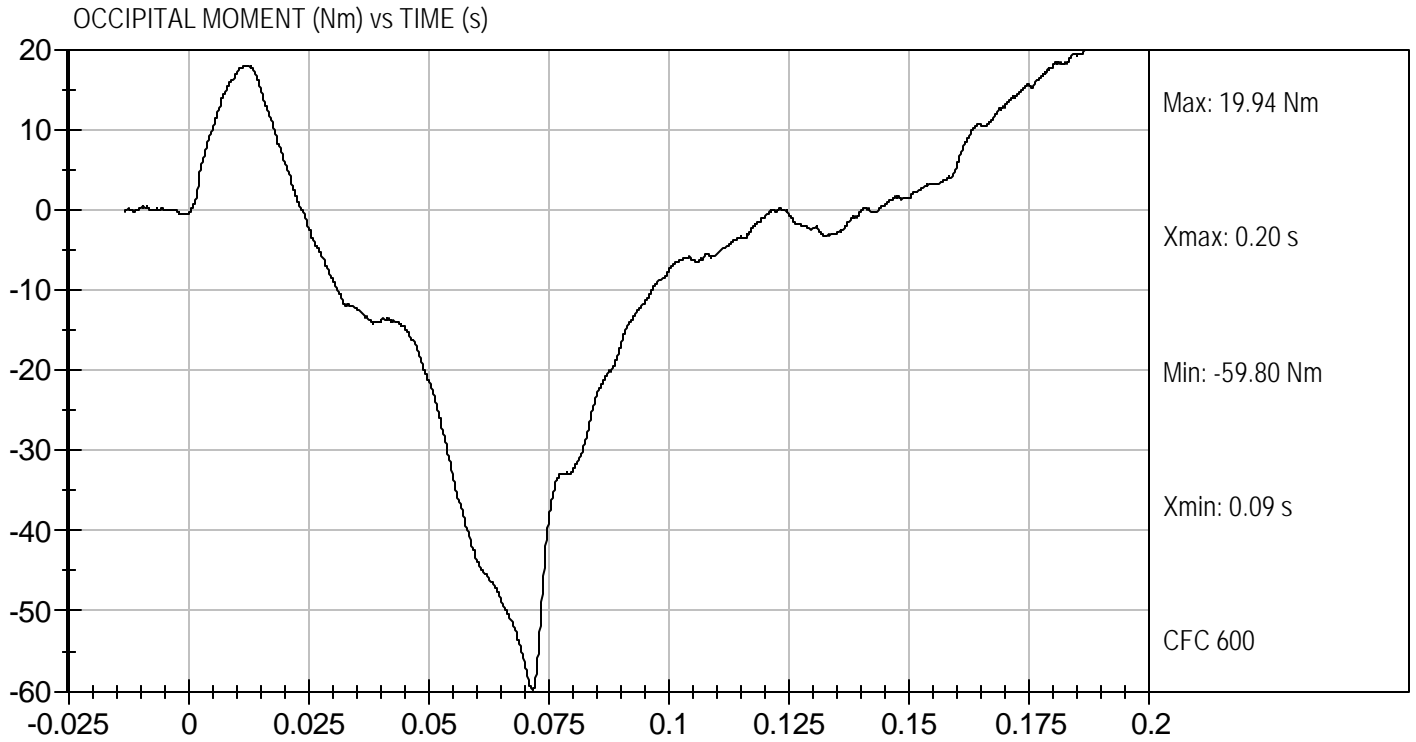


PENDULUM DECELERATION (m/s) vs TIME (s)



NECK ROTATION (DEG) vs TIME (s)





DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 505

Test Date 9/13/04

Technician Jim Carney

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
- 2. The test fixture conforms to the specifications in Figure 11B.
- 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))
 

Record the maximum temperature	21.4
Record the minimum temperature	20.6
Record the maximum humidity	50 %
Record the minimum humidity	44 %
- 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
  - No damage
  - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_
  - The following repairs or replacement was performed. Record \_\_\_\_\_
- 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

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

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

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.73 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	55 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4160 N
Peak force** between 18.0 and 50.0 mm chest compression	peak force ≤ 4600 N	3990 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	69%

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

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

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

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

James Carney  
Signature

9/14/04  
Date

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


ATD Serial No: 505

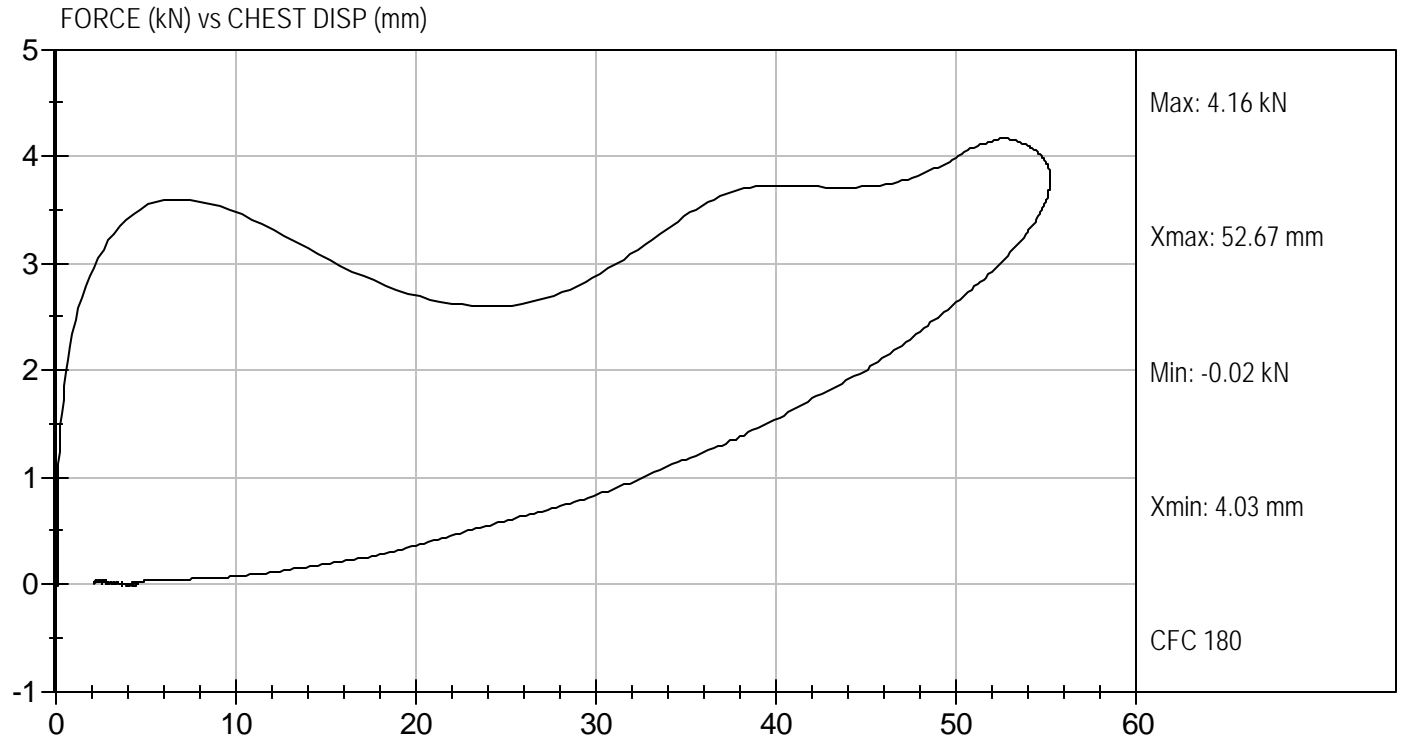
Test I.D: D042214

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	Pass
Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	6.59 to 6.83	6.73	Pass
Peak Deflection	mm	50 to 58	55.2	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.2	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	< 4600 N	3,990	Pass
Overall Test Results				Pass

  
 Laboratory Technician

09/14/2004  
 Test Date

  
 Approved By



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 505 Test Date 9/14/04

Technician David Wilcox

- Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.4</u> |
| Record the minimum temperature | <u>20.6</u> |
| Record the maximum humidity    | <u>50%</u>  |
| Record the minimum humidity    | <u>44%</u>  |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
Record reference plane angle (max. allowed 20°) 16°
12. Attach the pull cable and the load cell. (572.135(c)(8))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 20^\circ$	$16^\circ$
Torso rotation rate	$0.5^\circ/s \leq \text{rate} \leq 1.5^\circ/s$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	383 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	$20^\circ$

  
 \_\_\_\_\_  
 Signature

9/14/04  
 \_\_\_\_\_  
 Date

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

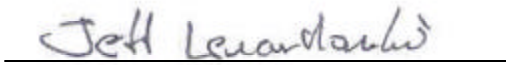
ATD Serial No: 505

Test I.D: D042217

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	20	Pass
Force at 45 deg	N	320 to 390	383	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass

  
 Laboratory Technician

09/14/2004  
 Test Date

  
 Approved By

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 9/13/04

Technician David Wilcox

Pretest calibration

Post test calibration verification

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

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

N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.5

Record the minimum temperature 20.9

Record the maximum humidity 52%

Record the minimum humidity 49%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3910 N

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

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



Signature

9/13/04

Date

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

ATD Serial No: 505

Test I.D.: D042216

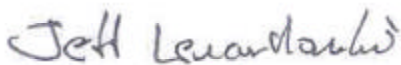
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.91	Pass
Overall Test Results				Pass



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

09/13/2004

\_\_\_\_\_  
 Test Date

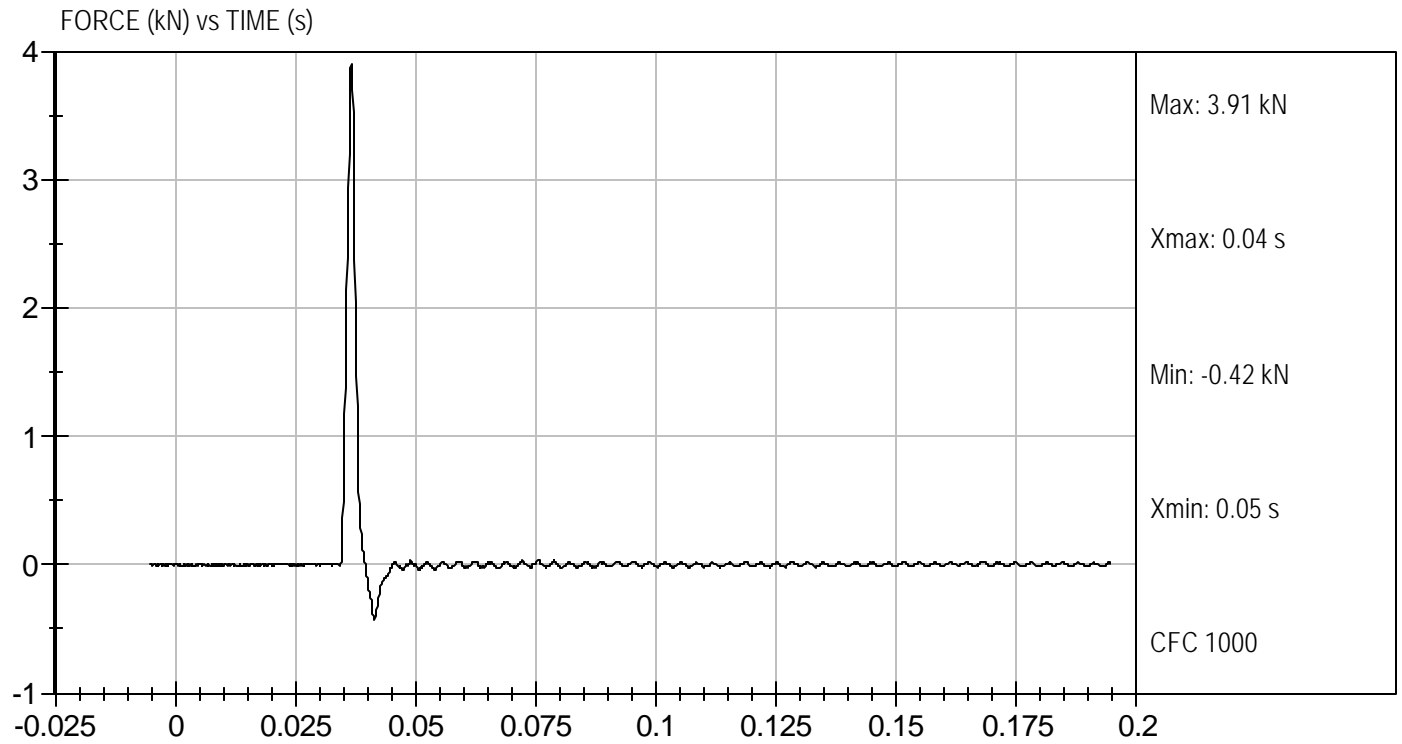


\_\_\_\_\_  
 Approved By



Test Desc: Left Knee  
Componet ID: D042216

Test Date: 09/13/2004  
Velocity: 6.88 ft/s, 2.10 m/s



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505 Test Date 9/13/04

Technician Joe Fleck

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
- 2. The test fixture conforms to the specifications in Figure 14B.
- 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))  

Record the maximum temperature	<u>21.5</u>
Record the minimum temperature	<u>20.9</u>
Record the maximum humidity	<u>52 %</u>
Record the minimum humidity	<u>49 %</u>
- 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))
- 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.11 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3660 N

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

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

Joe Fleck  
Signature

9/13/04  
Date

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

ATD Serial No: 505

Test I.D: D042215

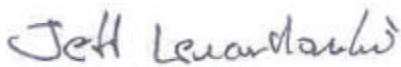
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.66	Pass
Overall Test Results				Pass



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

09/13/2004

\_\_\_\_\_  
 Test Date

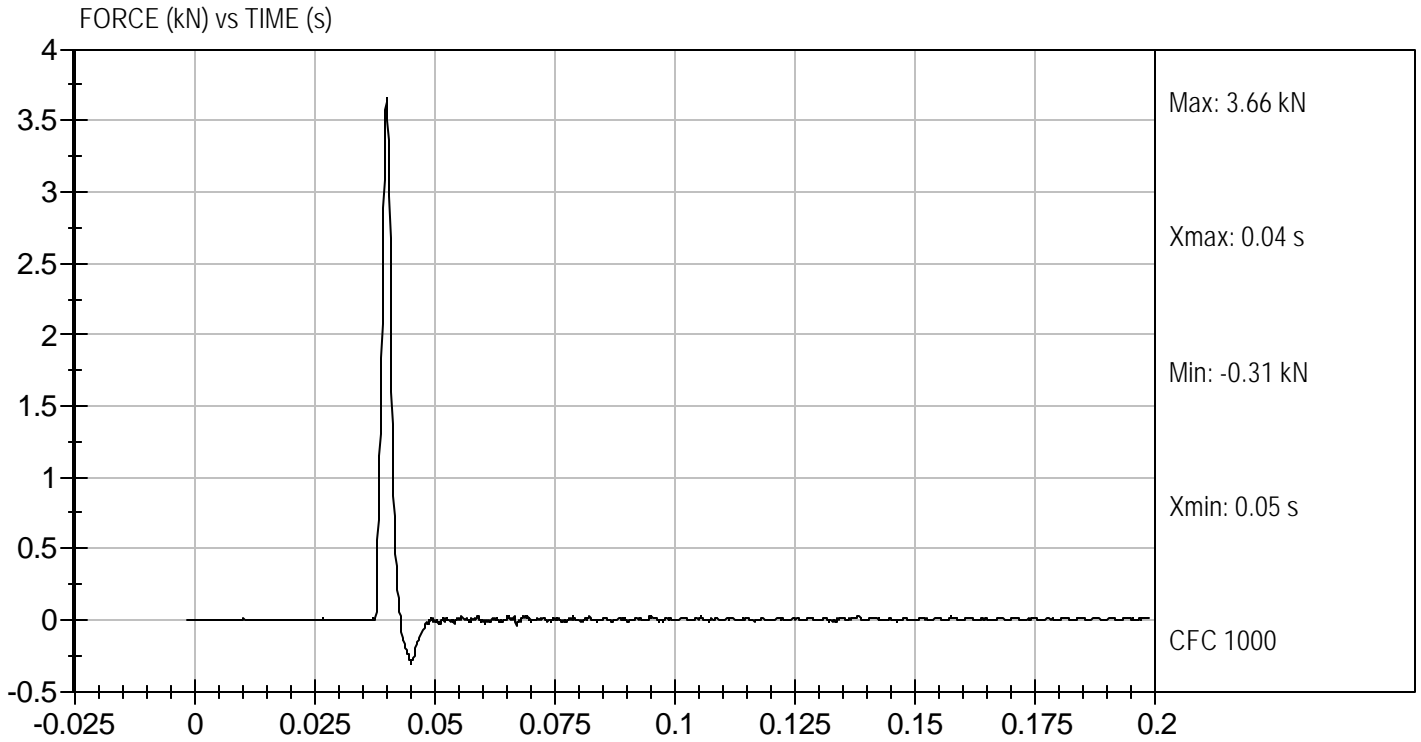


\_\_\_\_\_  
 Approved By



Test Desc: Right Knee  
Componet ID: D042215

Test Date: 09/13/2004  
Velocity: 6.91 ft/s, 2.11 m/s



DATA SHEET B1  
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 505

Test Date 9/10/04

Technician Jessica Gall

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

Perform general cleaning.

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

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

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

Repair or Replacement approved by:

Jessica Gall  
Signature

9/13/04  
Date

Describe the repair or replacement of parts:

Checked by  
Jeff Leonard  
Signature

9/13/04  
Date

## EXTERNAL DIMENSIONS

SN505, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	783.4
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	438.0
C	H-POINT HEIGHT	Reference	81.3-86.3	84.2
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	147.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	76.4
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	124.3
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	250.3
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	46.7
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	283.4
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	187.3
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	532.4
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.3
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	405.2
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	421.6

SN505, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	182.4
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	224.7
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	473.7
S	HEAD BREADTH	The widest part of the head	137.1-147.3	144.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	179.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	305.7
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	362.4
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	84.3
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	533.7
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	863.7
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	773.6
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

## EXTERNAL DIMENSIONS

SN506, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	780.2
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	443.0
C	H-POINT HEIGHT	Reference	81.3-86.3	85.1
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	145.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	76.4
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	128.0
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	255.8
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	280.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	193.0
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	545.0
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	365.2
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	400.5
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".	414-439.4	438.0

SN506, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	183.0
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	226.2
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	475.8
S	HEAD BREADTH	The widest part of the head	137.1-147.3	142.0
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	180.5
U	HIP BREADTH	The widest part of the hip	299.7-314.9	305.1
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	359.0
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	85.5
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	538.0
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	857.6
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	789.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 506 Test Date 9/06/04

Technician Jim Carney

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
- 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- 4. Accelerometers and their respective mounts are smooth and clean.
- 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
 

Record the maximum temperature	<u>21.4</u>
Record the minimum temperature	<u>21.0</u>
Record the maximum humidity	<u>53%</u>
Record the minimum humidity	<u>40%</u>
- 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
- 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

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

Record the actual distance 376 mm

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

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

Record the right side distance 502mm

Record the left side distance 501mm

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

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

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

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

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	272
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	14.3

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

James Carney  
Signature

9/06/04  
Date

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

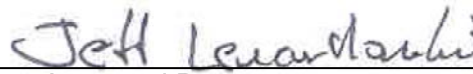
ATD Serial No: 506

Test ID: D042121

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Peak Resultant Acceleration	G's	250 - 300	272	Pass
Peak Lateral Acceleration	G's	+/- 15	14.3	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass

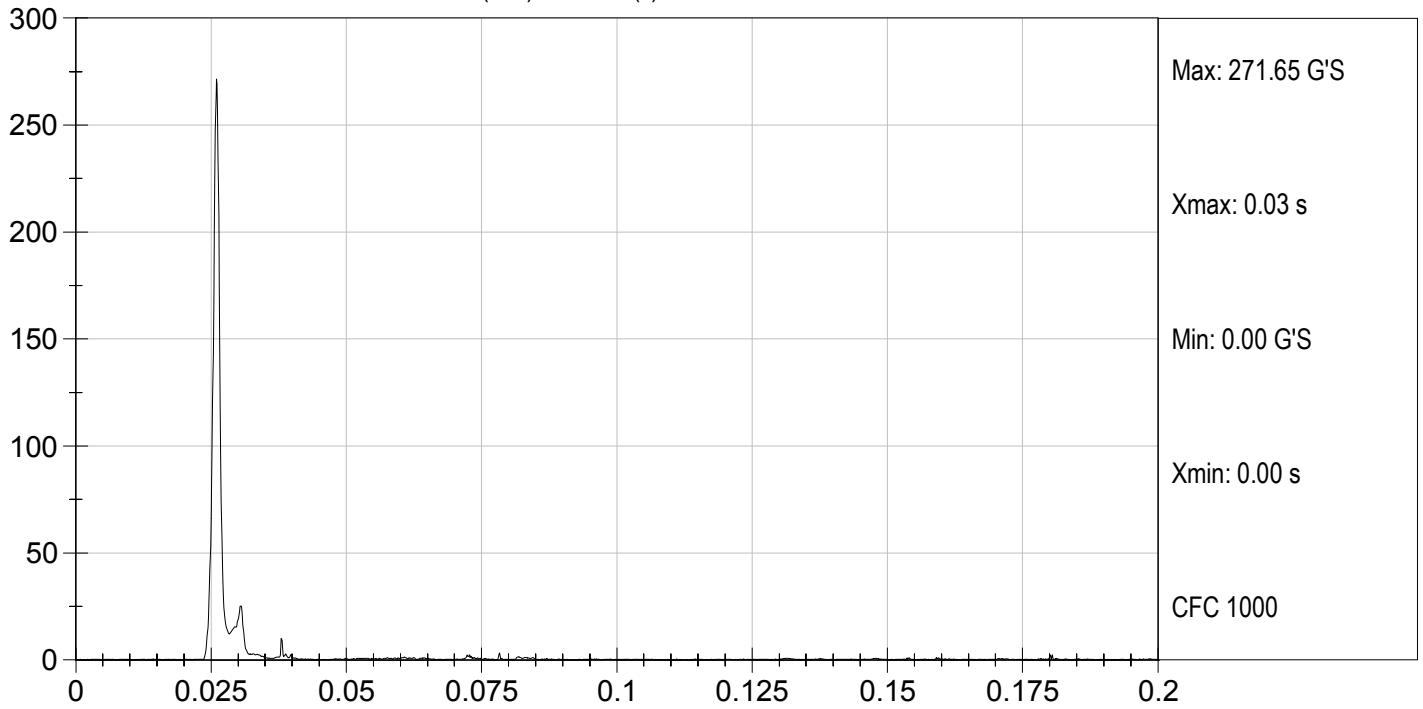
  
Laboratory Technician

09/06/2004  
Test Date

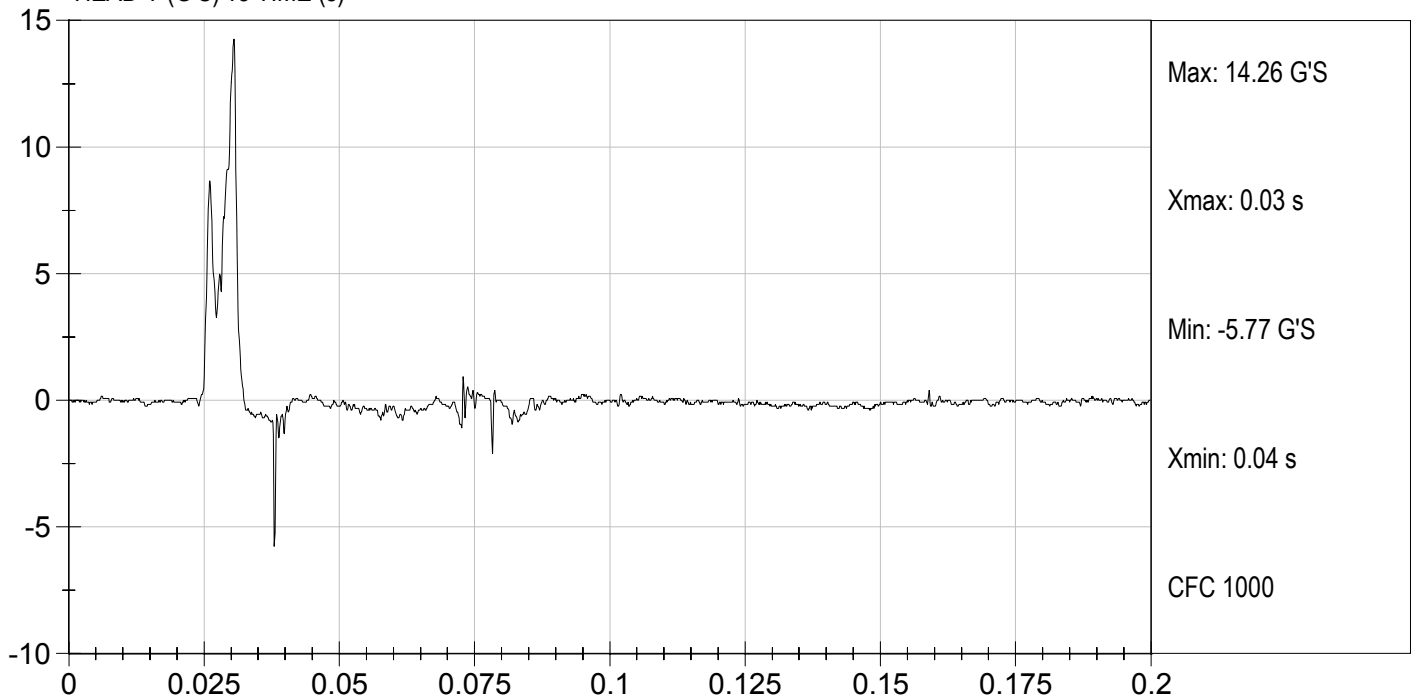
  
Approved By



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



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



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 506 Test Date 9/06/04

Technician Jim Carney

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one flexion test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.4</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>53%</u>  |
| Record the minimum humidity    | <u>40%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness Front 89; Back 90.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter		Specification	Result
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	6.96 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.5 m/s
	@30ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.4 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	<u>81</u> Nm @ <u>85</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100ms	85 ms

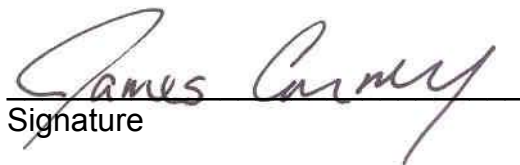
\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

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

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

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

  
Signature

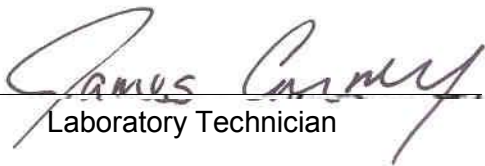
9/06/04  
Date

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

ATD Serial No: 506

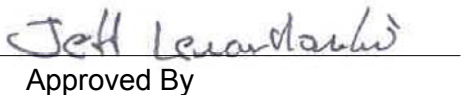
Test I.D.: D042122

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	48	Pass
Pendulum Speed		m/sec	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.3	Pass
	20 msec	m/sec	4.0 to 5.0	4.5	Pass
	30 msec	m/sec	5.8 to 7.0	6.4	Pass
D Plane Rotation	Max	deg	77 to 91	85	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	81	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	85	Pass
Overall Results					Pass

  
 Laboratory Technician

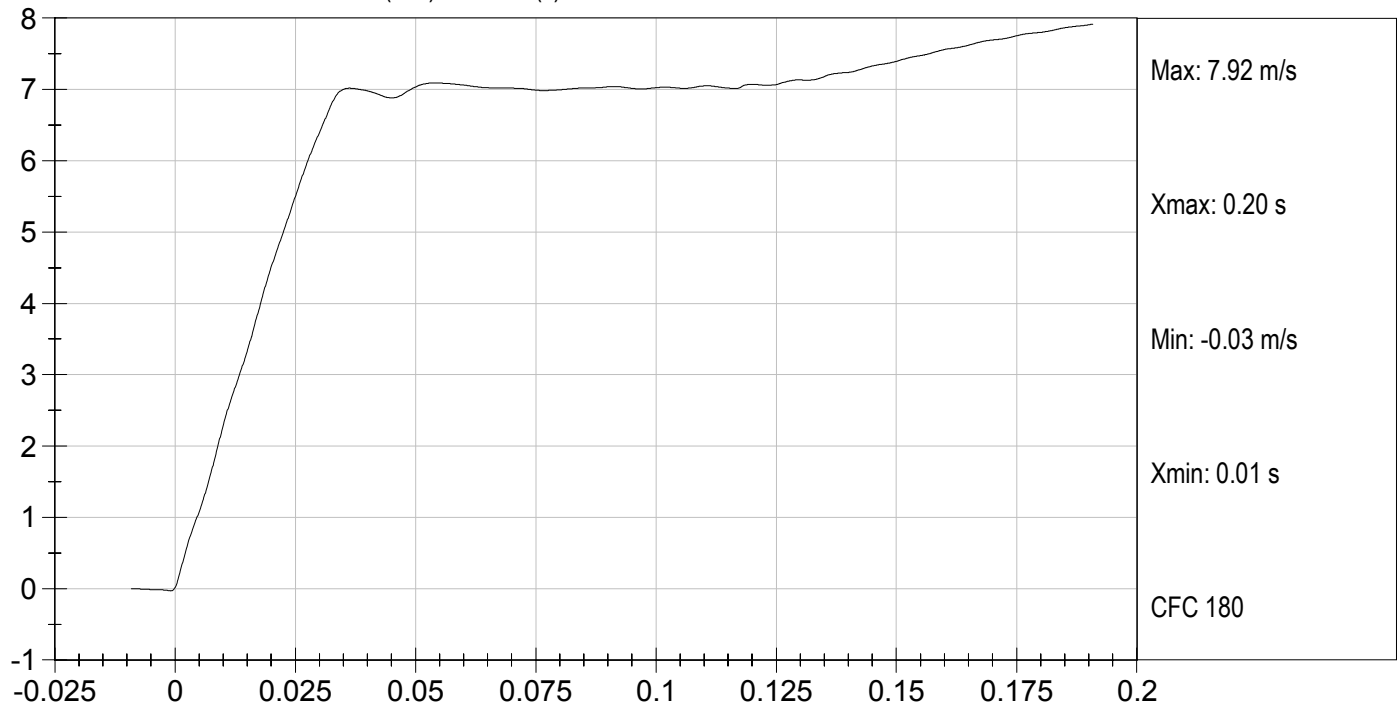
09/06/2004

Test Date

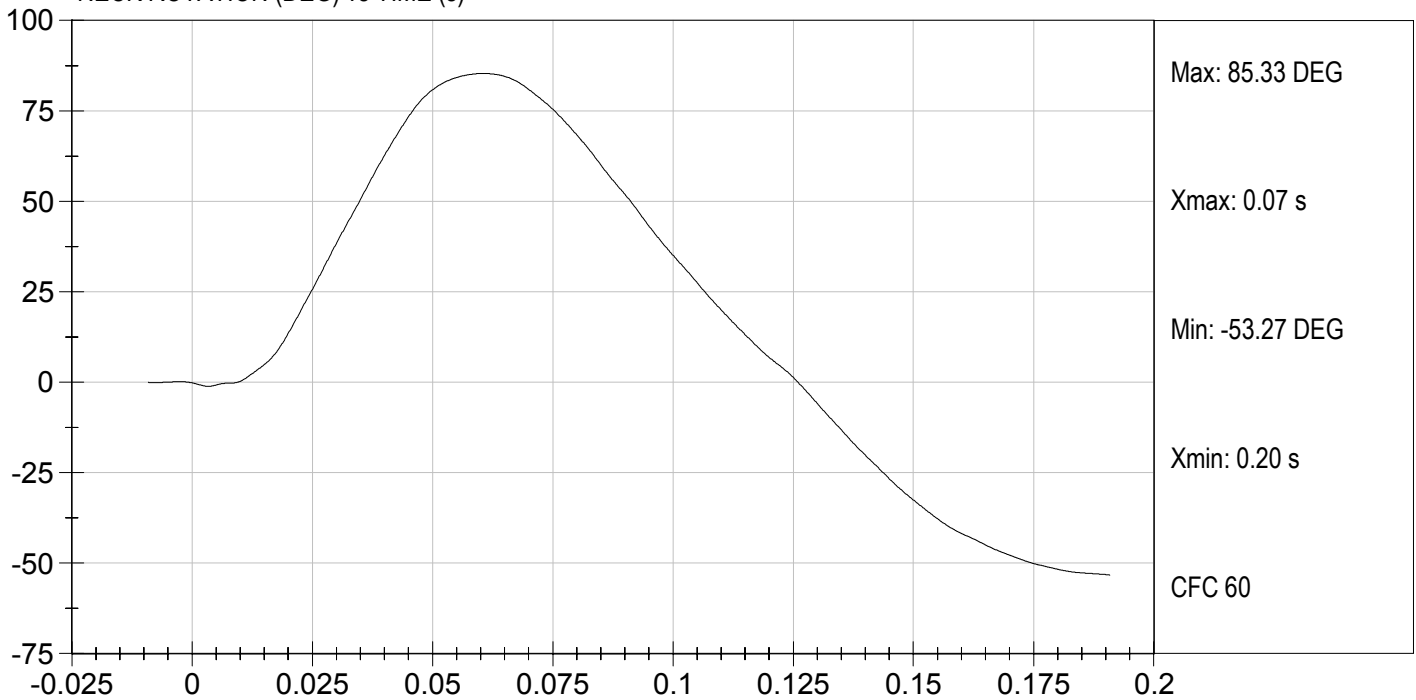
  
 Approved By



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



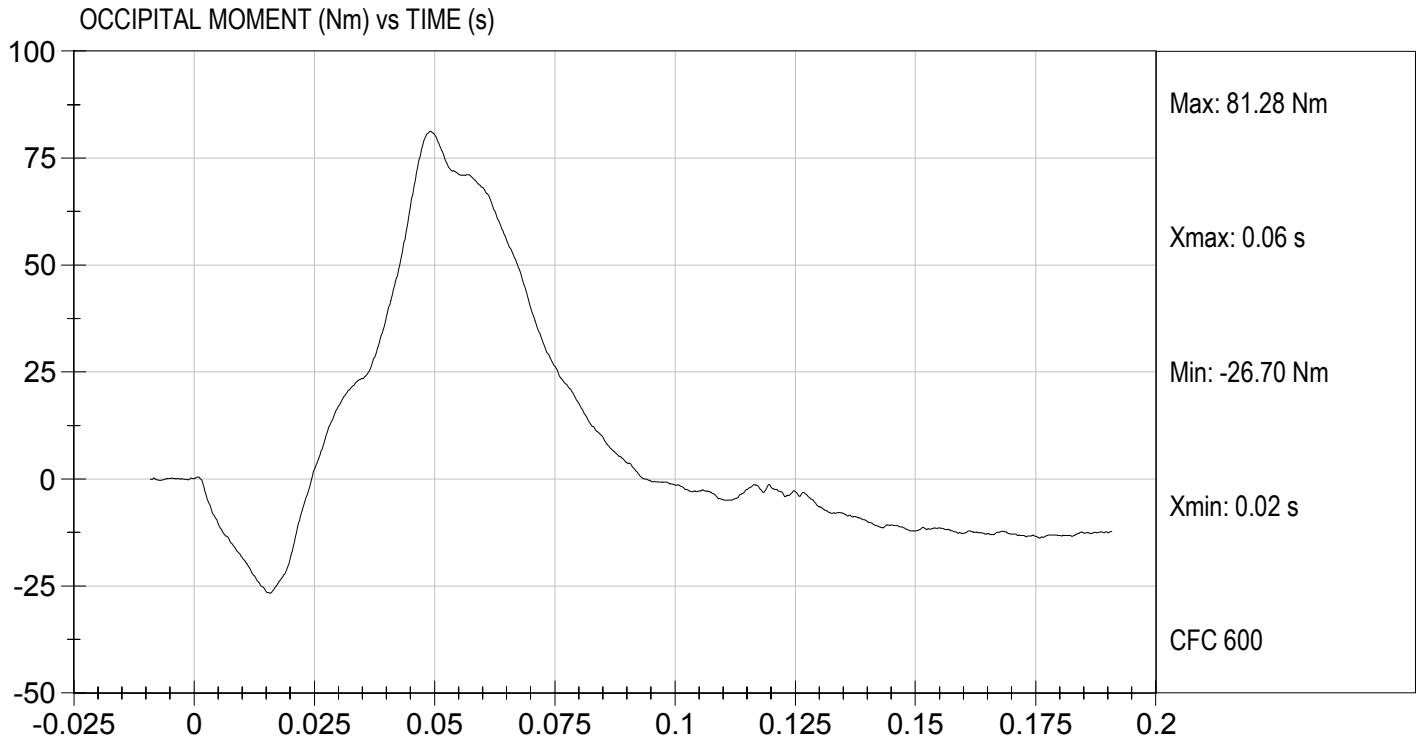
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion  
Componet ID: D042122

Test Date: 09/06/2004  
Velocity: 22.85 ft/s, 6.96 m/s



DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 506 Test Date 9/06/04

Technician Jim Carney

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one extension test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.4</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>53%</u>  |
| Record the minimum humidity    | <u>40%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness Front 89; Back 90.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.08 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$
Plane D Rotation	Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	<u>-61</u> Nm @ <u>111</u> degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	101 ms

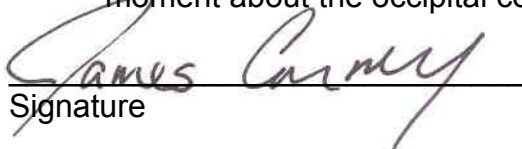
\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

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

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

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

  
Signature

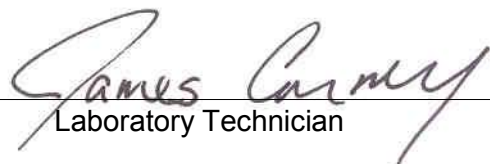
9/06/04  
Date

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

ATD Serial No: 506

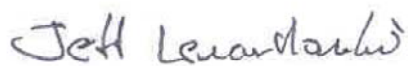
Test I.D: D042123

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	48	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.08	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.8	Pass
	20 msec	m/sec	3.1 to 3.9	3.6	Pass
	30 msec	m/sec	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	111	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-61	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	101	Pass
Overall Results					Pass

  
 Laboratory Technician

09/06/2004

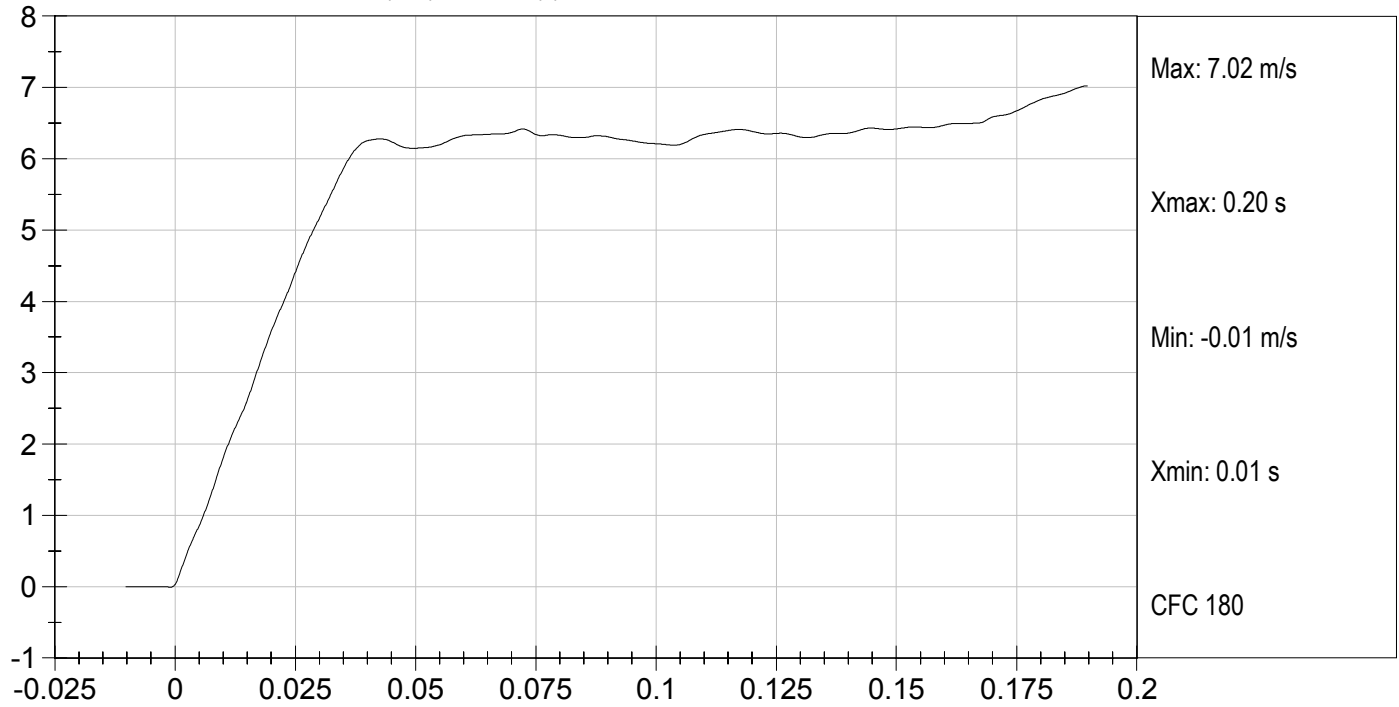
Test Date



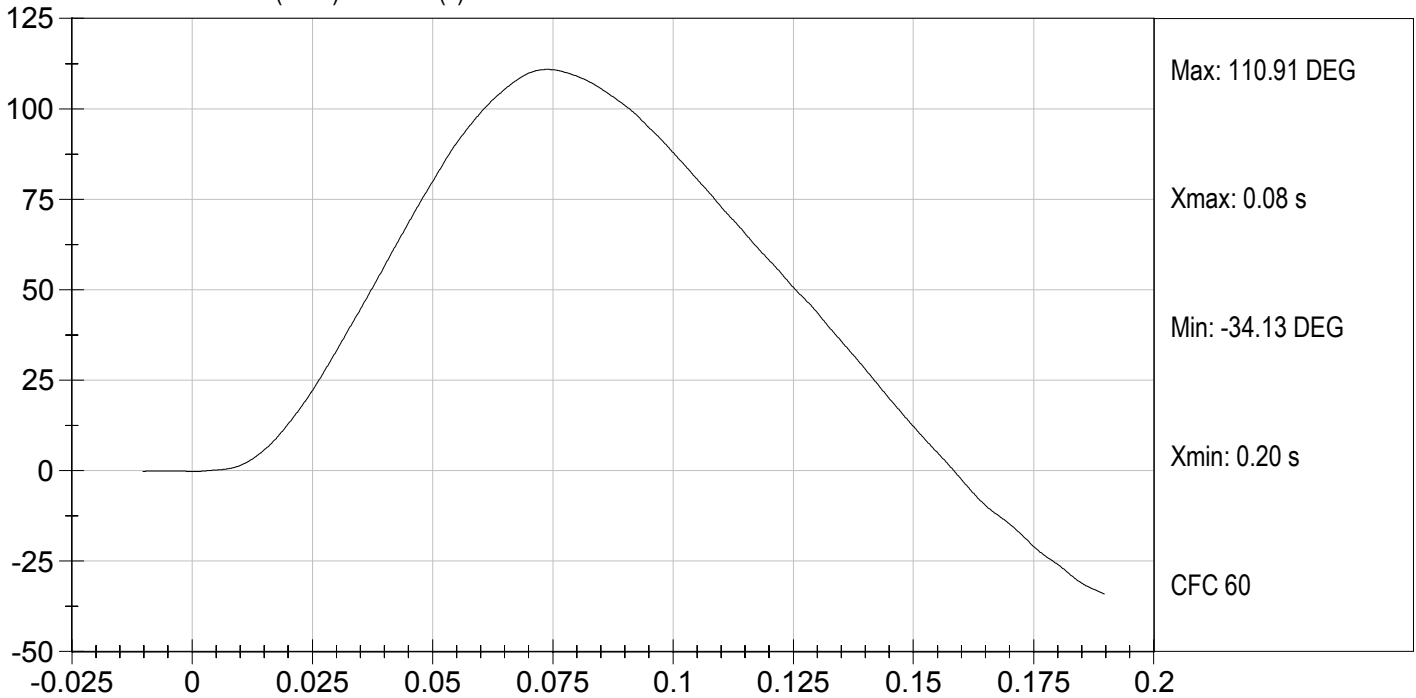
Approved By



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



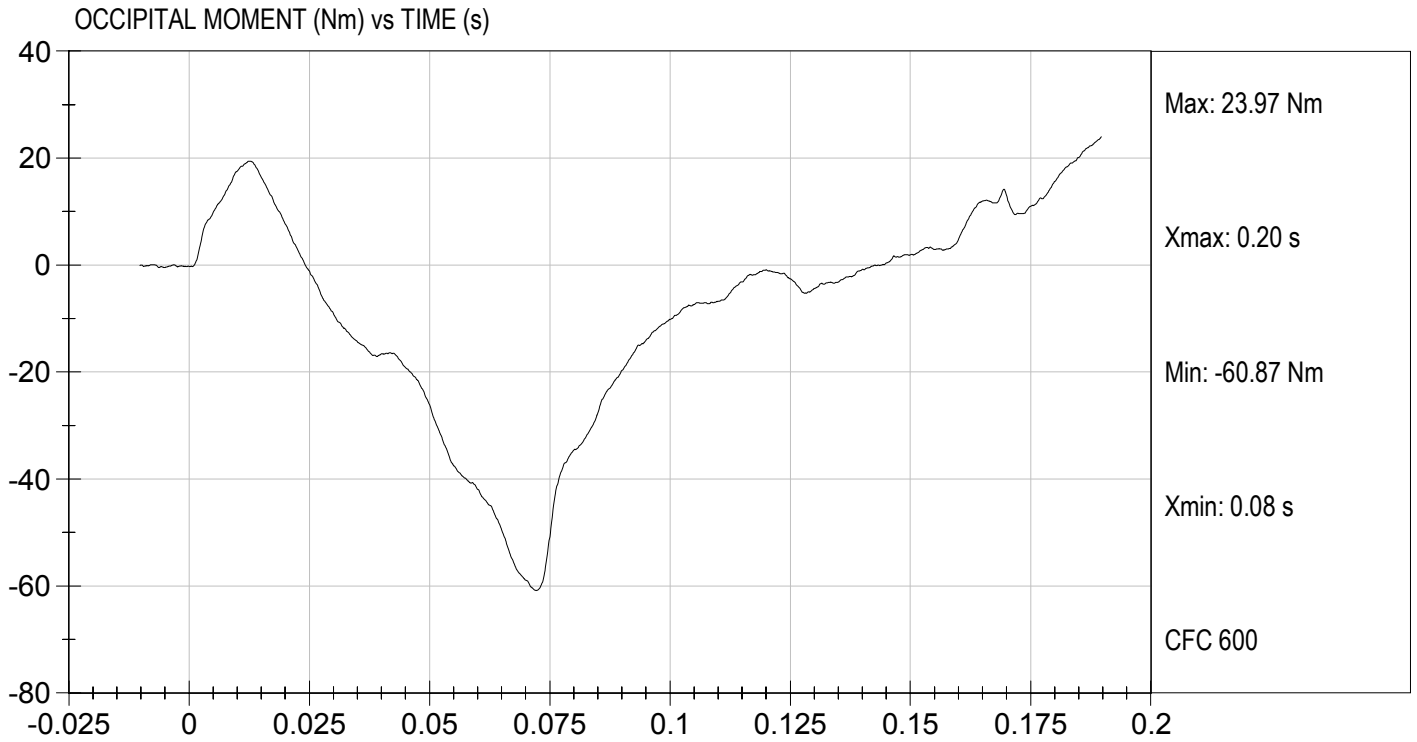
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Extension  
Componet ID: D042123

Test Date: 09/06/2004  
Velocity: 19.94 ft/s, 6.08 m/s



DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 506 Test Date 9/07/04

Technician David Wilcox

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
- 2. The test fixture conforms to the specifications in Figure 11B.
- 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))
 

Record the maximum temperature	<u>21.4</u>
Record the minimum temperature	<u>20.9</u>
Record the maximum humidity	<u>48%</u>
Record the minimum humidity	<u>40%</u>
- 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
  - No damage
  - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_
  - The following repairs or replacement was performed. Record \_\_\_\_\_
- 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

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

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

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.61 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	53.7 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4120 N
Peak force** between 18.0 and 50.0 mm chest compression	peak force ≤ 4600 N	4124 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	69%

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

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

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

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

  
 \_\_\_\_\_  
 Signature

9/07/04  
 \_\_\_\_\_  
 Date

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


**ATD Serial No:** 506

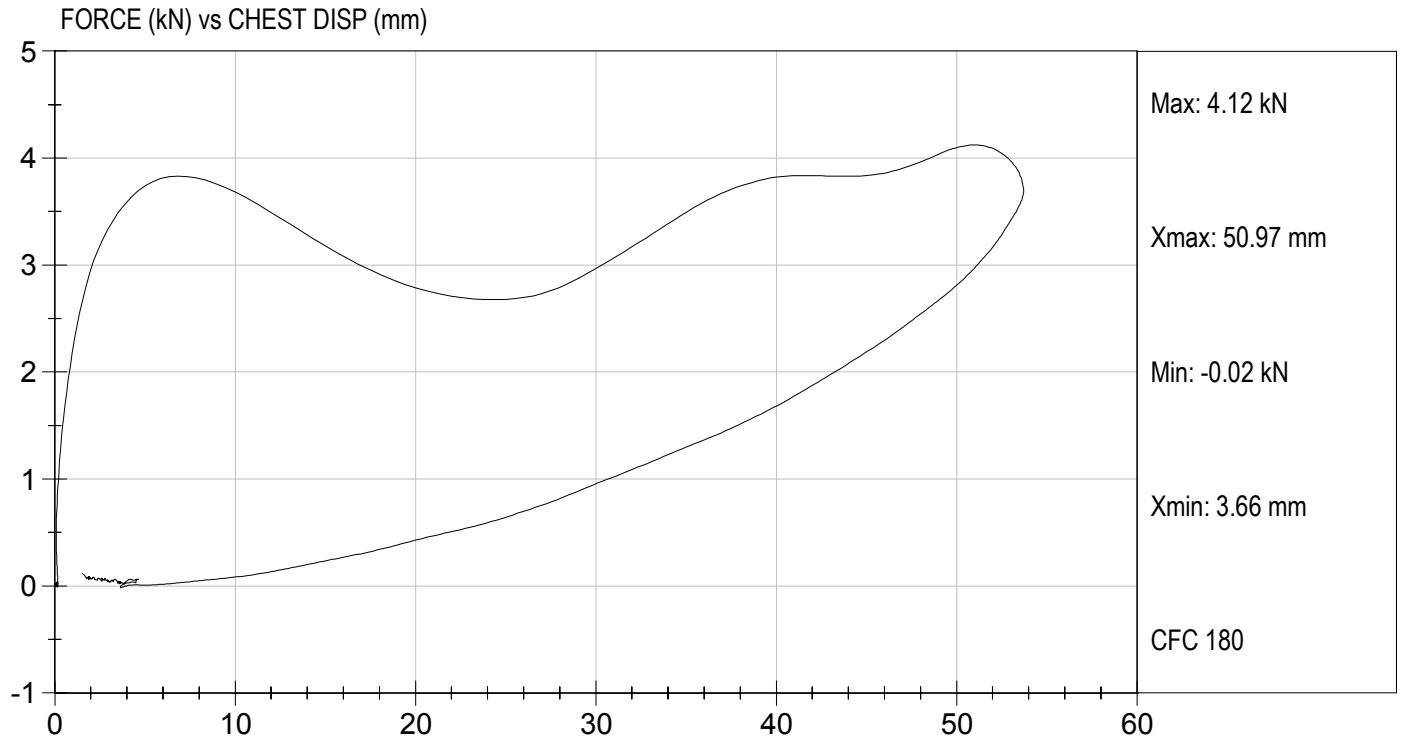
**Test I.D.:** D042124

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.1	Pass
Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	6.59 to 6.83	6.61	Pass
Peak Deflection	mm	50 to 58	53.7	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.1	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	Yes/No	< 4600 N	4124	Pass
			Overall Test Results	Pass

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

09/07/2004  
\_\_\_\_\_  
Test Date

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



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 506 Test Date 9/07/04

Technician David Wilcox

Pretest calibration  
 Post test calibration verification

Test attempt no. 2 (when successive torso flexion tests are necessary)

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.4</u> |
| Record the minimum temperature | <u>20.9</u> |
| Record the maximum humidity    | <u>48%</u>  |
| Record the minimum humidity    | <u>40%</u>  |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
Record reference plane angle (max. allowed 20°) 18°
12. Attach the pull cable and the load cell. (572.135(c)(8))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 20^\circ$	$18^\circ$
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	378 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	$21^\circ$

  
 \_\_\_\_\_  
 Signature

9/07/04  
 \_\_\_\_\_  
 Date

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

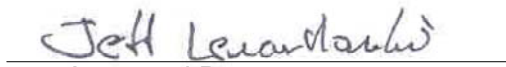
ATD Serial No: 506

Test I.D.: D042127

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	21	Pass
Force at 45 deg	N	320 to 390	378	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass

  
 Laboratory Technician

09/07/2004  
 Test Date

  
 Approved By

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 506

Test Date 9/07/04

Technician David Wilcox

Pretest calibration

Post test calibration verification

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

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

N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 20.9

Record the maximum humidity 48%

Record the minimum humidity 40%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.09 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3640 N

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

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

  
 \_\_\_\_\_  
 Signature

9/07/04  
 \_\_\_\_\_  
 Date

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

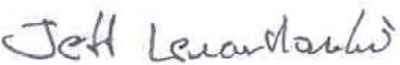
ATD Serial No: 506

Test I.D.: D042126

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/sec	2.07 to 2.13	2.09	Pass
Maximum Force	kN	3.45 to 4.06	3.64	Pass
Overall Test Results				Pass

  
 Laboratory Technician

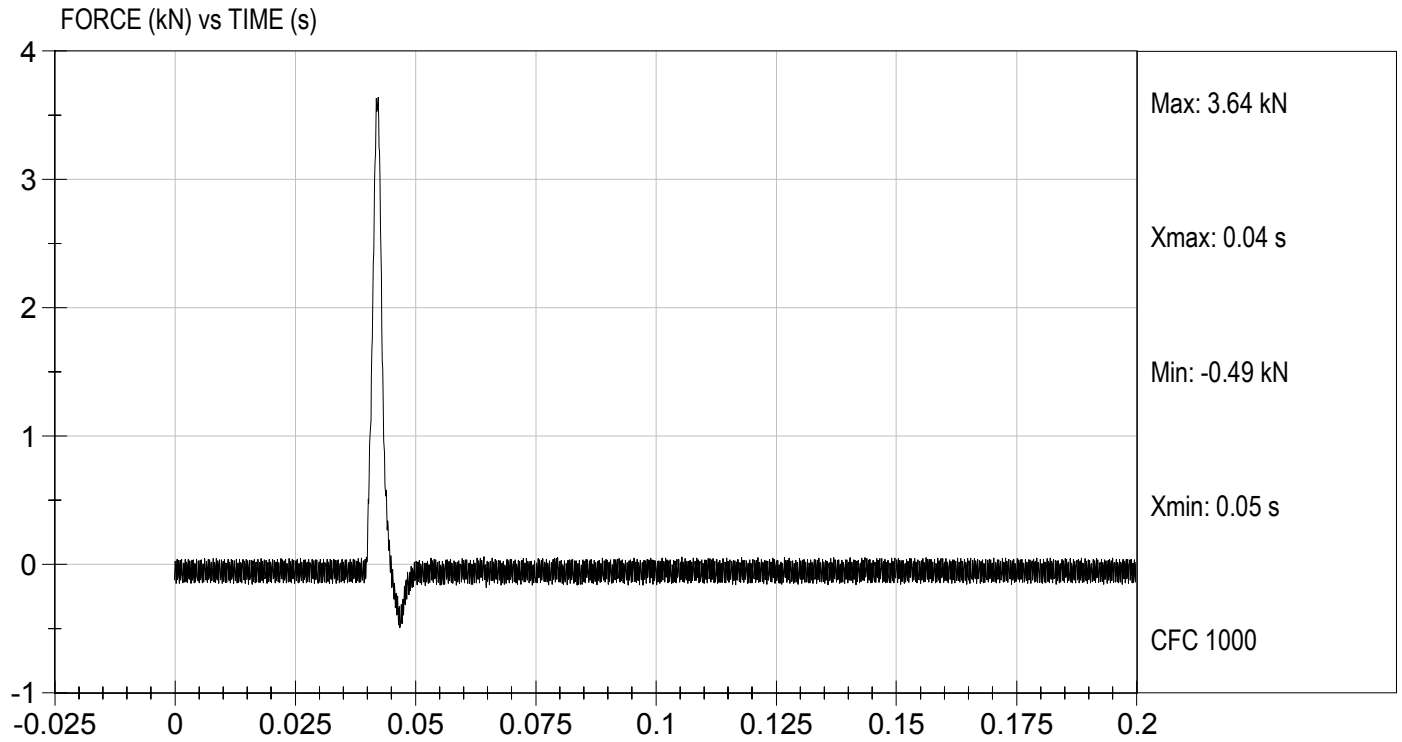
09/07/2004  
 Test Date

  
 Approved By



Test Desc: Left Knee  
Componet ID: D042126

Test Date: 09/07/2004  
Velocity: 6.870 ft/s, 2.09 m/s



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 506 Test Date 9/07/04

Technician David Wilcox

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
- 2. The test fixture conforms to the specifications in Figure 14B.
- 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
 

Record the maximum temperature	<u>21.4</u>
Record the minimum temperature	<u>20.9</u>
Record the maximum humidity	<u>48 %</u>
Record the minimum humidity	<u>40 %</u>
- 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))
- 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.10 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3470 N

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

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

A handwritten signature in black ink, appearing to be "J. A. ...", written above a horizontal line.

Signature

9/07/04

Date

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


ATD Serial No: 506

Test I.D.: D042125

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	41	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.47	Pass
Overall Test Results				Pass

  
 Laboratory Technician

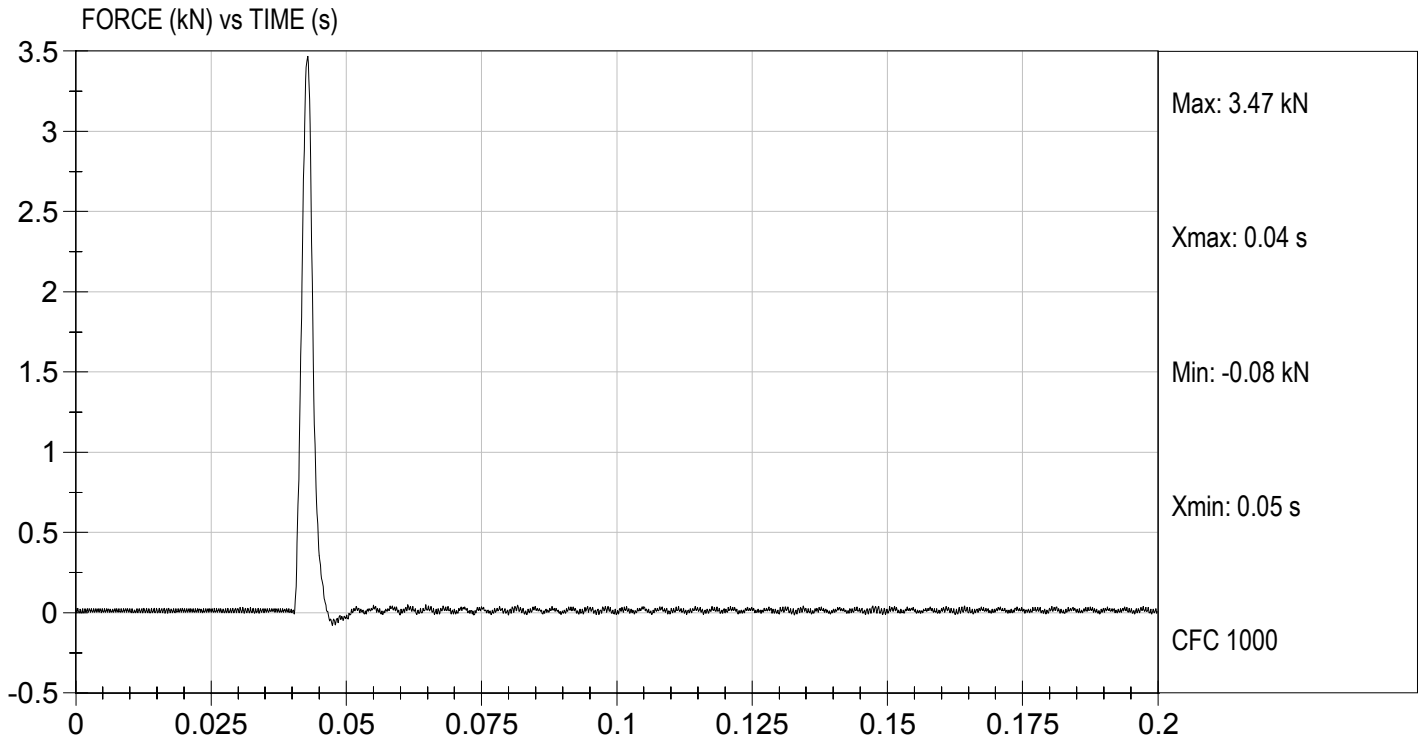
09/07/2004  
 Test Date

  
 Approved By



Test Desc: Right Knee  
Componet ID: D042125

Test Date: 09/07/2004  
Velocity: 6.89 ft/s, 2.10 m/s



DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 506 Test Date 9/13/04

Technician Dave Wilcox

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.5</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>51%</u>  |
| Record the minimum humidity    | <u>49%</u>  |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

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

Record the actual distance 376 mm

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

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

Record the right side distance 502mm

Record the left side distance 501mm

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

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

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

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

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	251
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	15

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

  
Signature

9/13/04  
Date

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

ATD Serial No: 506

Test ID: D042221

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Peak Resultant Acceleration	G's	250 - 300	251	Pass
Peak Lateral Acceleration	G's	+/- 15	14.8	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

09/13/2004

Test Date



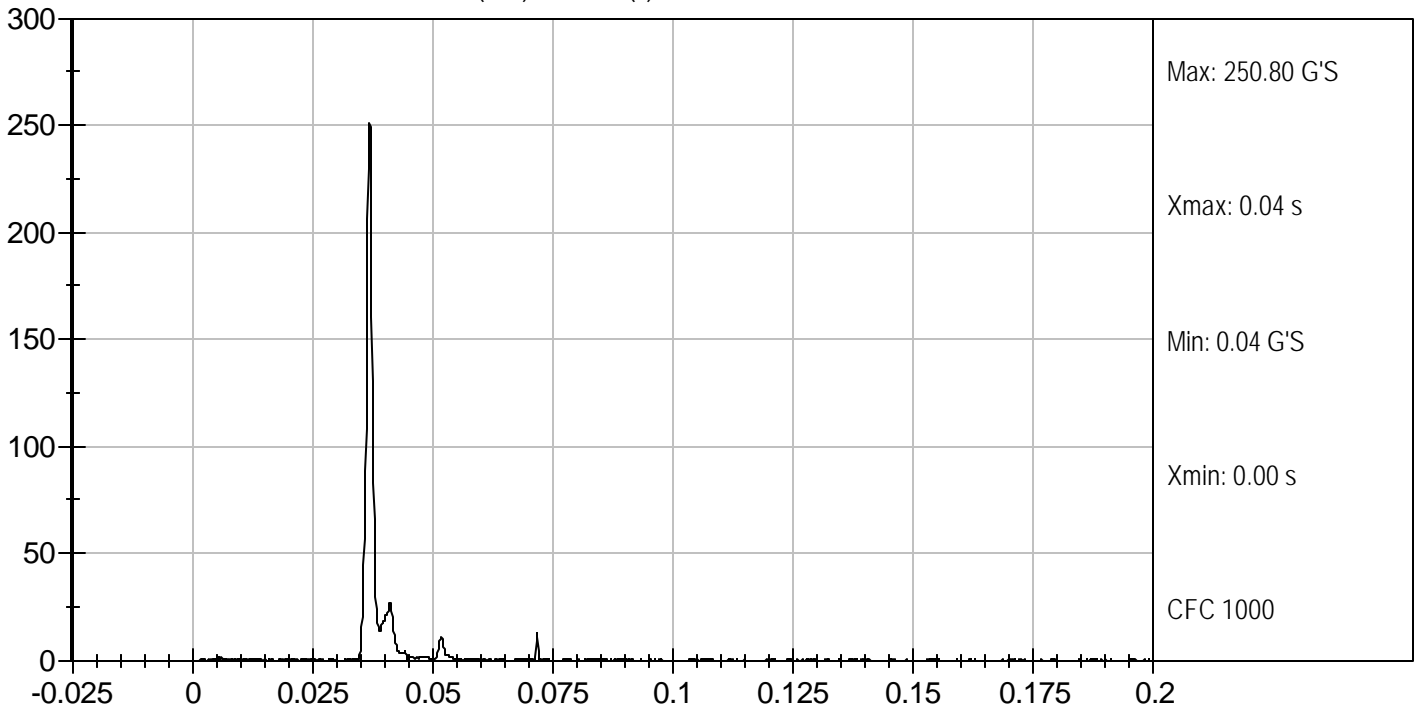
Approved By



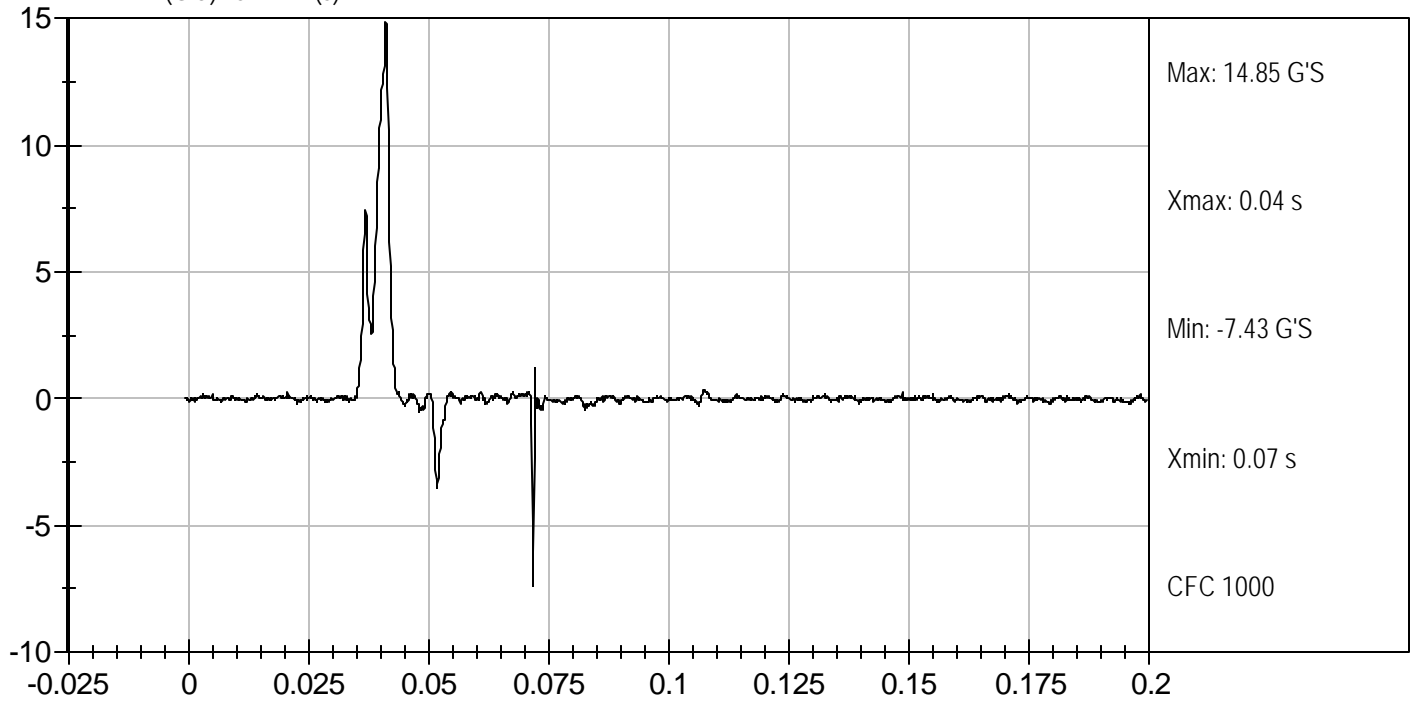
Test Desc: Head Drop  
Componet ID: D042221

Test Date: 09/13/2004  
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 506 Test Date 9/13/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one flexion test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.5</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>51%</u>  |
| Record the minimum humidity    | <u>49%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness Front 89; Back 90.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter		Specification	Result
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.03 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.5 m/s
	@30ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.5 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	<u>78</u> Nm @ <u>82</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100ms	86 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

Joe Fleck  
Signature

9/13/04  
Date

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

ATD Serial No: 506

Test I.D.: D042222

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	49	Pass	
Pendulum Speed	m/sec	6.89 to 7.13	7.03	Pass	
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.3	Pass
	20 msec	m/sec	4.0 to 5.0	4.5	Pass
	30 msec	m/sec	5.8 to 7.0	6.5	Pass
D Plane Rotation	Max	deg	77 to 91	82	Pass
Occipital Condyle Moment within Deflection Corridor	Nm	69 to 83	78	Pass	
Positive Moment Time Curve Decay to 10 Nm	msec	80 to 100	86	Pass	
			Overall Results	Pass	

*Joe Fleck*

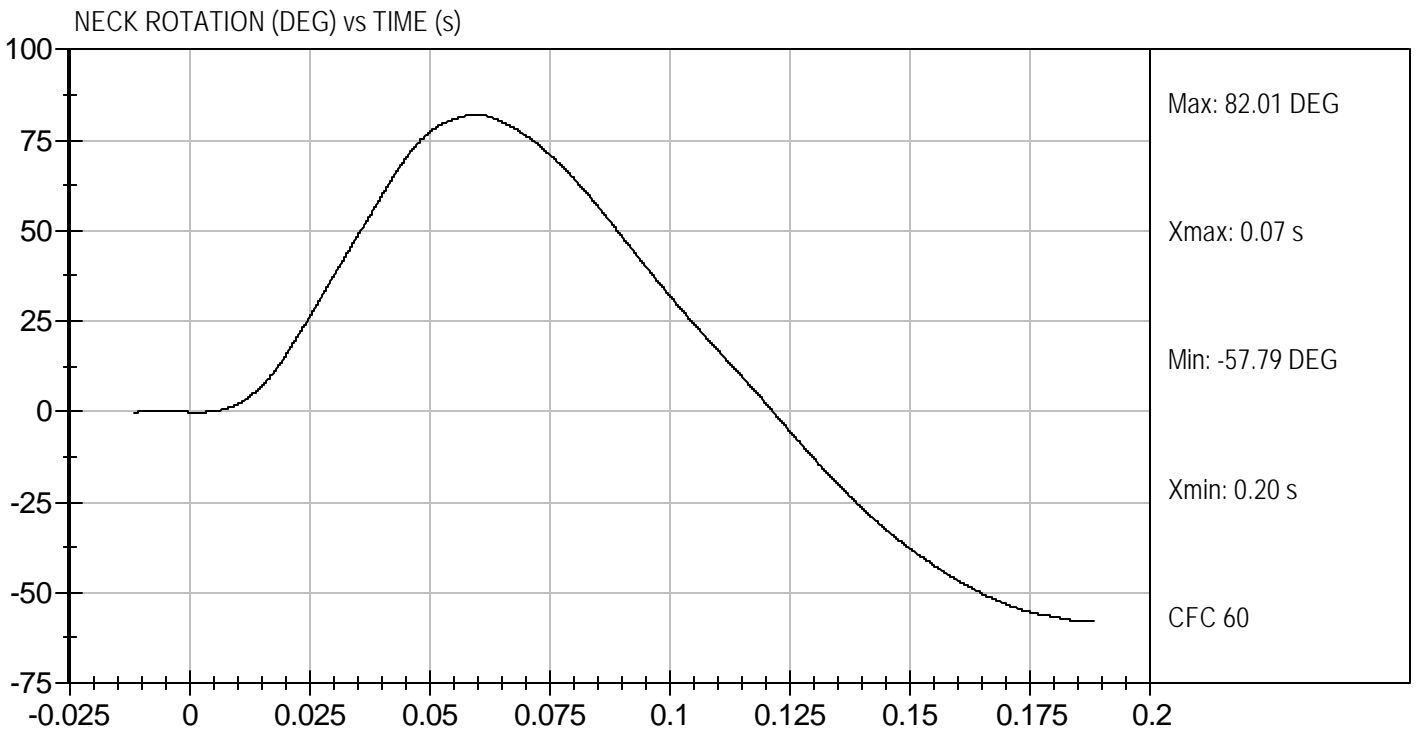
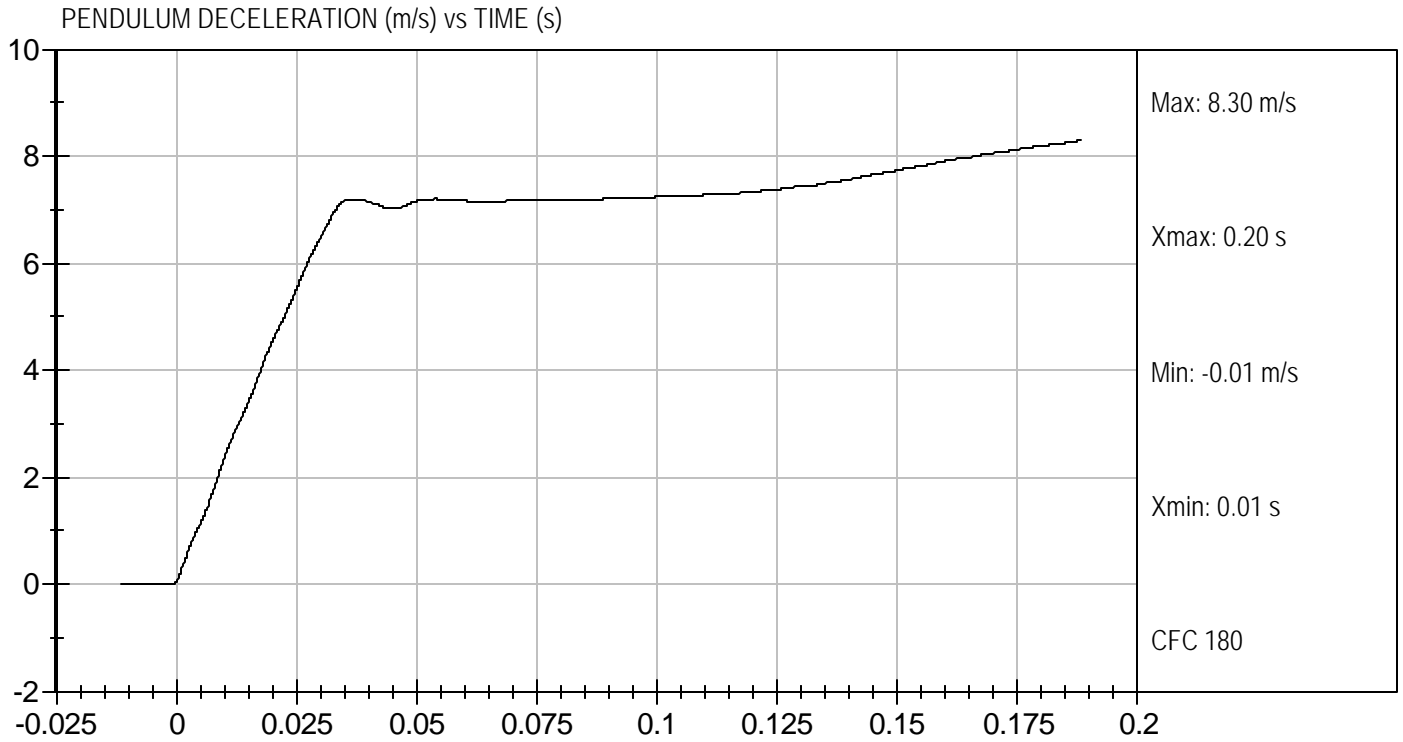
Laboratory Technician

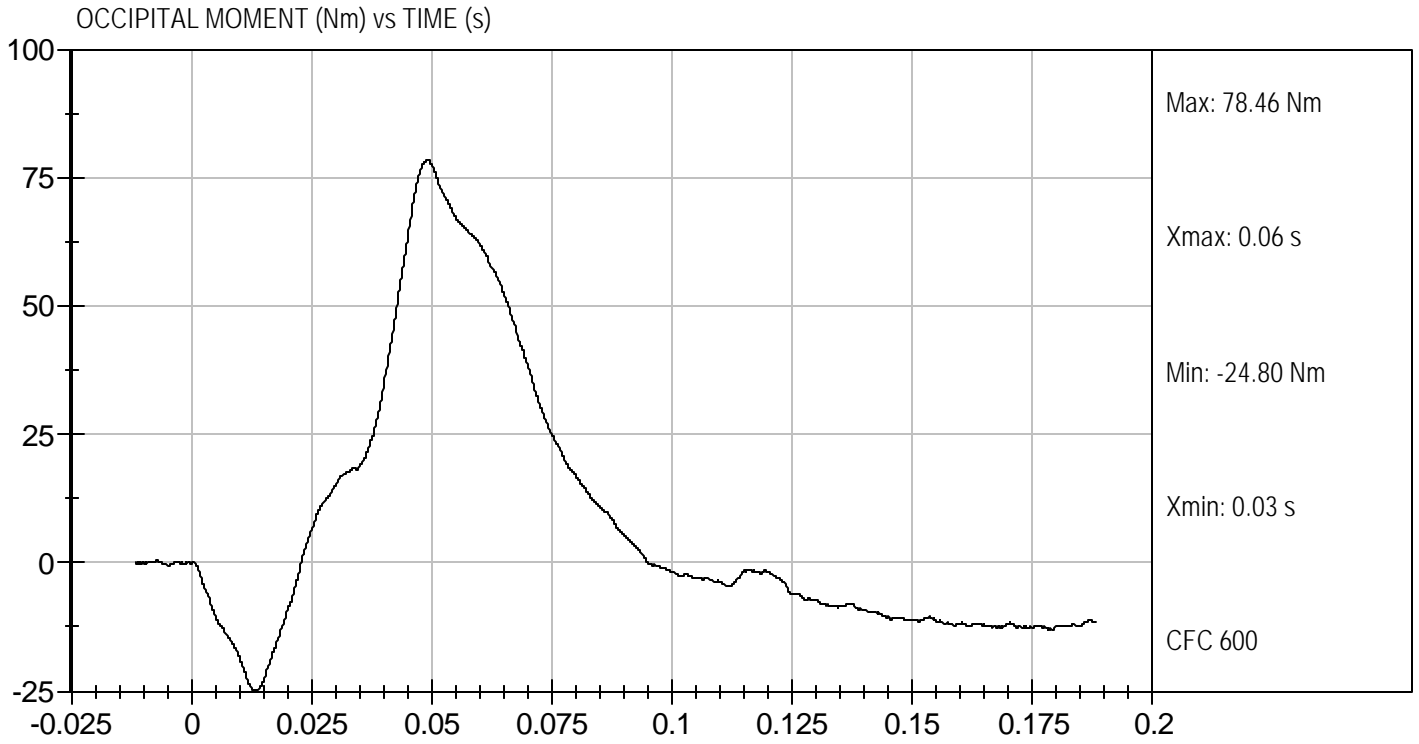
09/13/2004

Test Date

*Jeff Levanowski*

Approved By





DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 506 Test Date 9/13/04

Technician Joe Fleck

Pretest calibration

Post test calibration verification

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

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

N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.5

Record the minimum temperature 21.0

Record the maximum humidity 51%

Record the minimum humidity 49%

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

Record findings and actions: No Damage.

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

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

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

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

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

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

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

Parameter	Specification	Result
Pendulum impact speed	5.95 m/s $\leq$ speed $\leq$ 6.19 m/s	6.08 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	1.5 m/s $\leq \Delta V \leq$ 1.9 m/s
	@ 20 ms	3.1 m/s $\leq \Delta V \leq$ 3.9 m/s
	@30ms	4.6 m/s $\leq \Delta V \leq$ 5.6 m/s
Plane D Rotation	Peak moment* -65 Nm $\leq$ moment $\leq$ -53 Nm during the following rotation range $99^\circ \leq$ angle $\leq 114^\circ$	<u>-56</u> Nm @ <u>110</u> degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm 94 ms $\leq$ time $\leq$ 114 ms	100 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

Joe Fleck  
Signature

9/13/04  
Date

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

ATD Serial No: 506

Test I.D: D042223

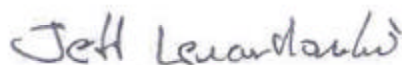
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.08	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.8	Pass
	20 msec	m/sec	3.1 to 3.9	3.6	Pass
	30 msec	m/sec	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	110	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	100	Pass
Overall Results					Pass



Laboratory Technician

09/13/2004

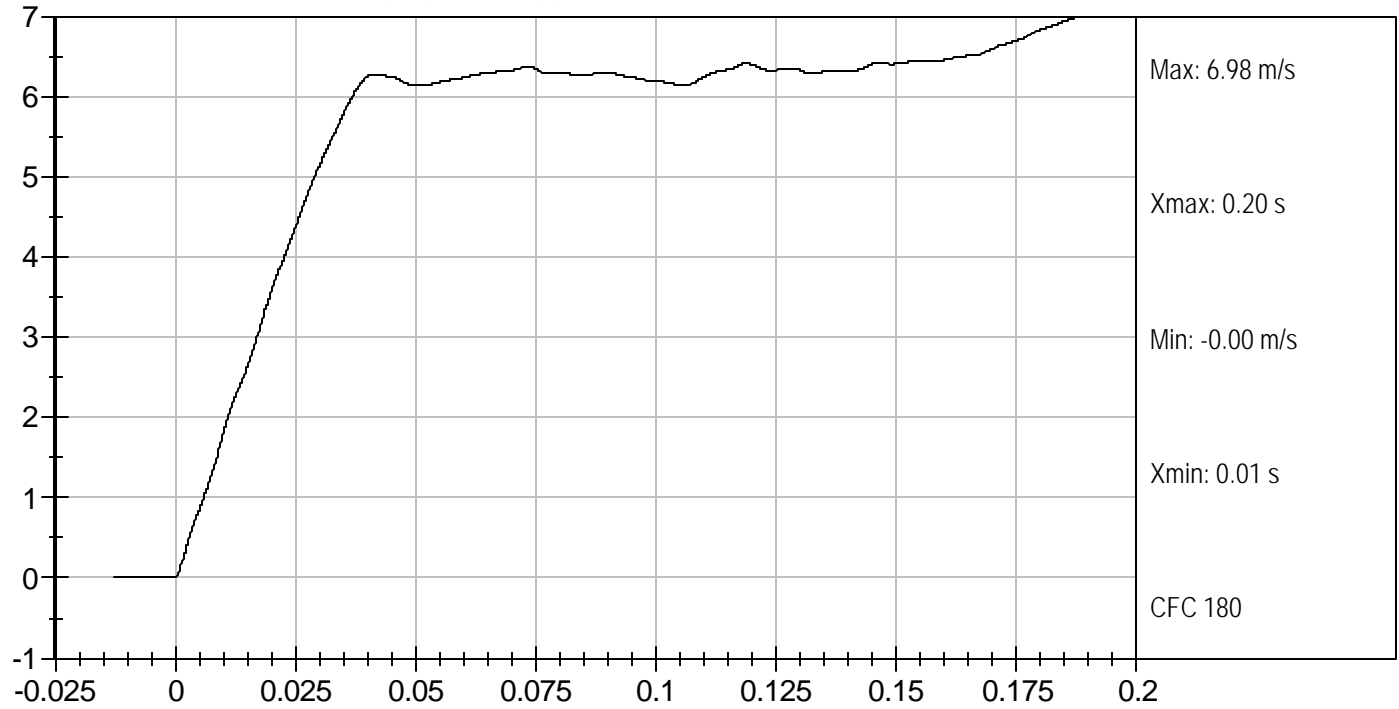
Test Date



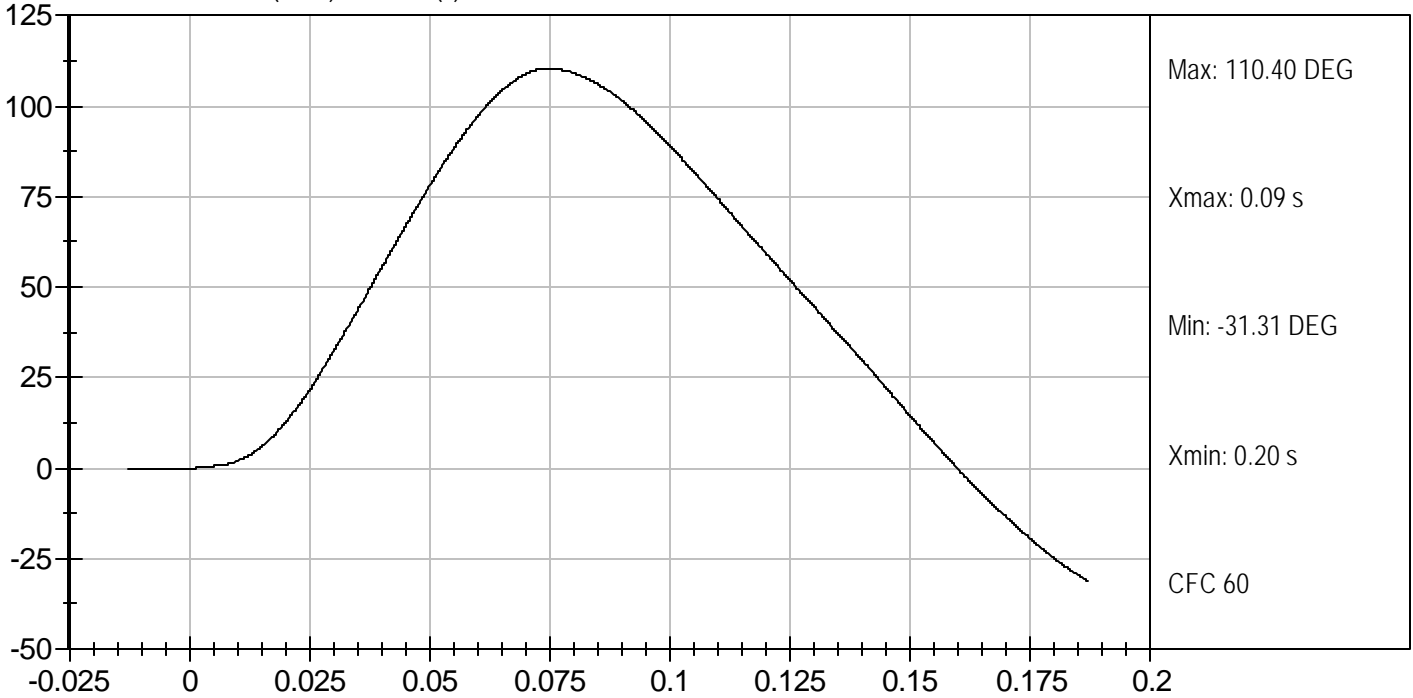
Approved By

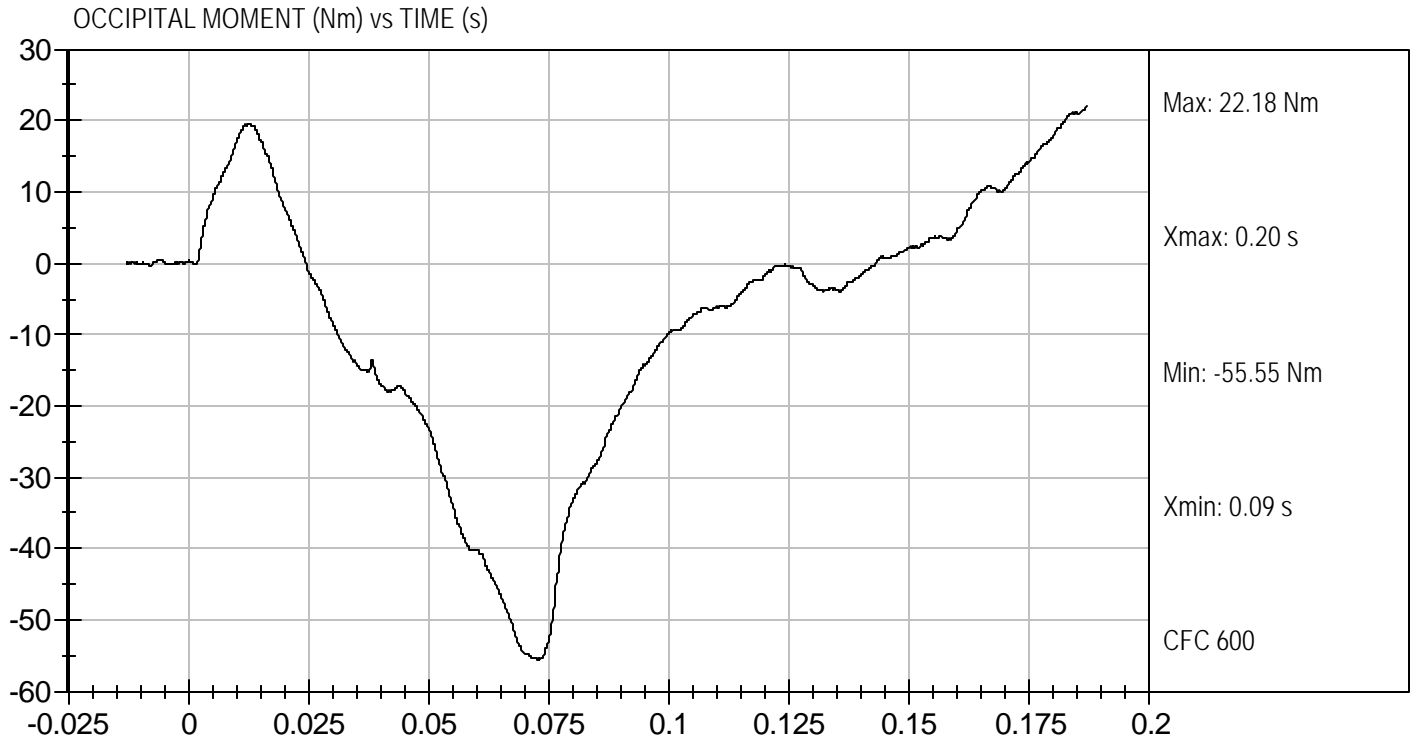


PENDULUM DECELERATION (m/s) vs TIME (s)



NECK ROTATION (DEG) vs TIME (s)





DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 506

Test Date 9/14/04

Technician Jim Carney

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
- 2. The test fixture conforms to the specifications in Figure 11B.
- 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))
 

Record the maximum temperature	20.8
Record the minimum temperature	20.6
Record the maximum humidity	47%
Record the minimum humidity	46%
- 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
  - No damage
  - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_
  - The following repairs or replacement was performed. Record \_\_\_\_\_
- 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

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

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

X 16. Complete the following table:

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

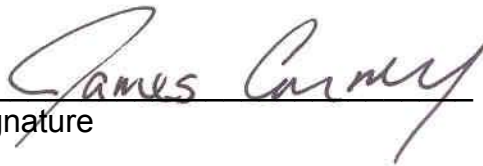
Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.70 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	52 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4230 N
Peak force** between 18.0 and 50.0 mm chest compression	peak force ≤ 4600 N	4227 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.

  
 Signature


9/14/04  
 Date

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


ATD Serial No: 506

Test I.D.: D042224

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Relative Humidity	%	10 to 70	46	Pass
Probe Speed	m/s	6.59 to 6.83	6.70	Pass
Peak Deflection	mm	50 to 58	52.2	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.2	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	< 4600 N	4,227	Pass
Overall Test Results				Pass

  
 Laboratory Technician

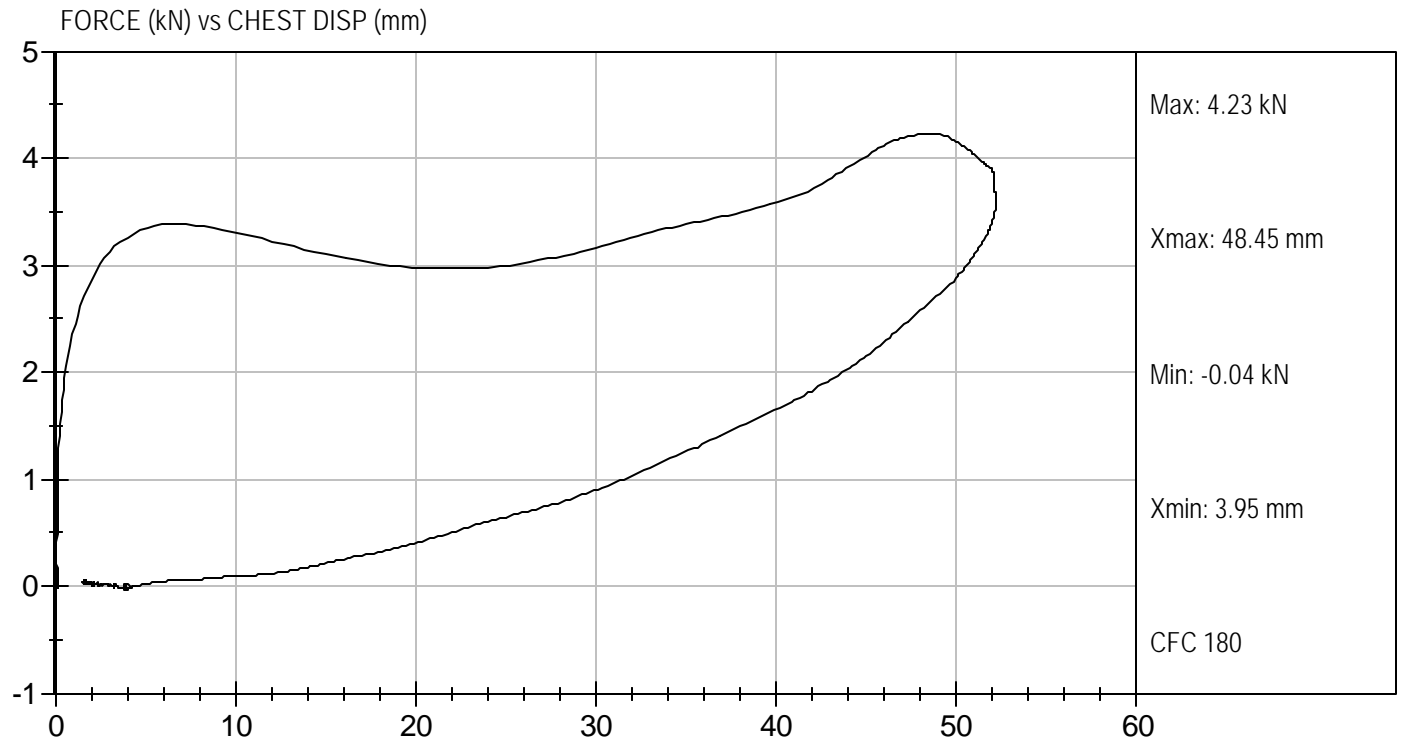
09/14/2004  
 Test Date

  
 Approved By



Test Desc: Thorax Impact  
Componet ID: D042224

Test Date: 09/14/2004  
Velocity: 21.98 ft/s, 6.70 m/s



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 506 Test Date 9/14/04

Technician David Wilcox

- Pretest calibration  
 Post test calibration verification

Test attempt no. 2 (when successive torso flexion tests are necessary)

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>20.8</u> |
| Record the minimum temperature | <u>20.6</u> |
| Record the maximum humidity    | <u>47%</u>  |
| Record the minimum humidity    | <u>46%</u>  |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
Record reference plane angle (max. allowed 20°) 17°
12. Attach the pull cable and the load cell. (572.135(c)(8))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 20^\circ$	$17^\circ$
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	365 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	$21^\circ$

  
 \_\_\_\_\_  
 Signature

9/14/04  
 \_\_\_\_\_  
 Date

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

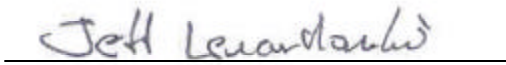
ATD Serial No: 506

Test I.D: D042227

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle	deg	+/- 8	21	Pass
Force at 45 deg	N	320 to 390	365	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass

  
 Laboratory Technician

09/14/2004  
 Test Date

  
 Approved By

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 506

Test Date 9/13/04

Technician Joe Fleck

Pretest calibration

Post test calibration verification

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

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

N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.5

Record the minimum temperature 21.0

Record the maximum humidity 51%

Record the minimum humidity 49%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3610 N

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

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

Joe Flick  
Signature

9/13/04  
Date

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

ATD Serial No: 506

Test I.D.: D042226

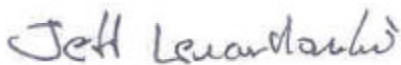
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.61	Pass
Overall Test Results				Pass



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

09/13/2004

\_\_\_\_\_  
 Test Date

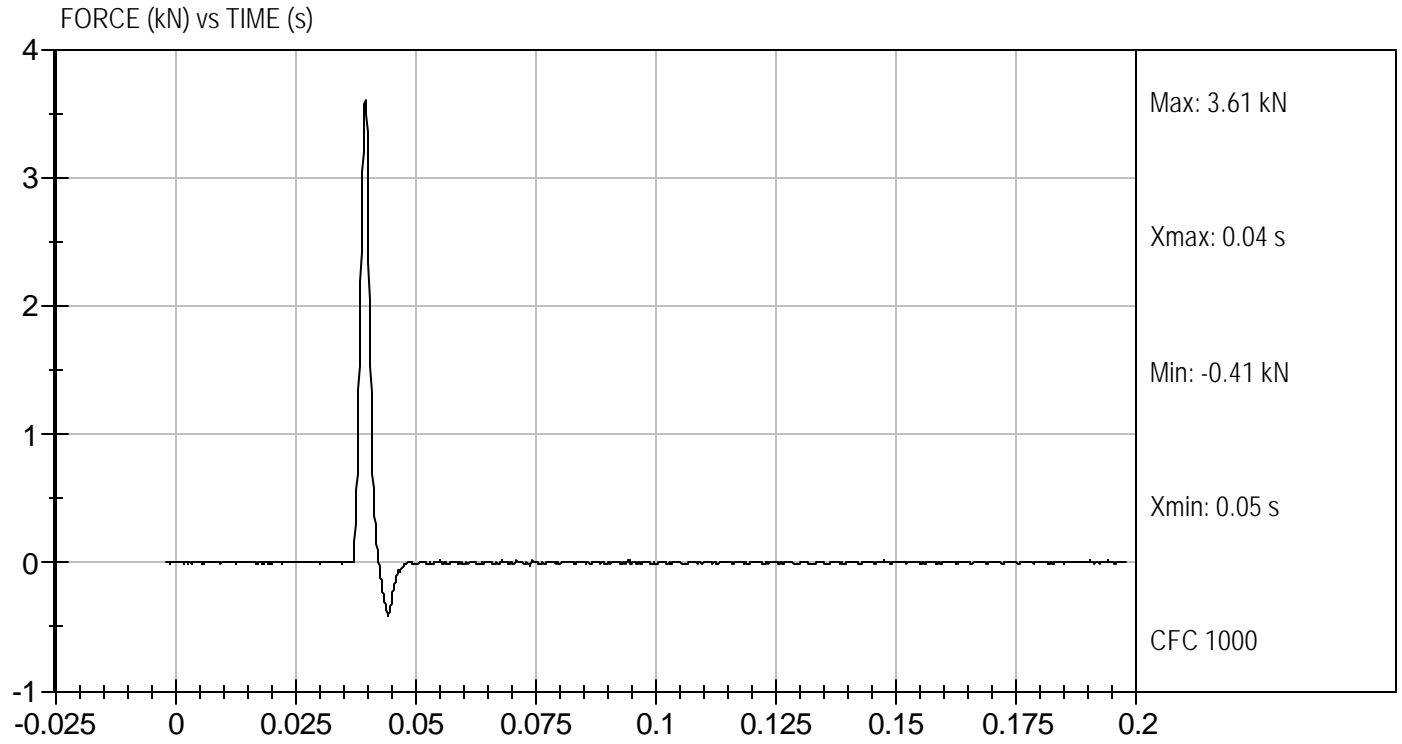


\_\_\_\_\_  
 Approved By



Test Desc: Left Knee  
Componet ID: D042226

Test Date: 09/13/2004  
Velocity: 6.89 ft/s, 2.10 m/s



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 506 Test Date 9/13/04

Technician Joe Fleck

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
- 2. The test fixture conforms to the specifications in Figure 14B.
- 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
 

Record the maximum temperature	<u>21.5</u>
Record the minimum temperature	<u>21.0</u>
Record the maximum humidity	<u>51 %</u>
Record the minimum humidity	<u>49 %</u>
- 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))
- 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.09 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3620 N

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

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

Joe Fleck  
Signature

9/13/04  
Date

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

ATD Serial No: 506

Test I.D.: D042225

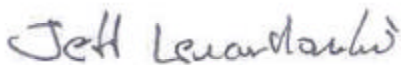
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/sec	2.07 to 2.13	2.09	Pass
Maximum Force	kN	3.45 to 4.06	3.62	Pass
Overall Test Results				Pass



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

09/13/2004

\_\_\_\_\_  
 Test Date

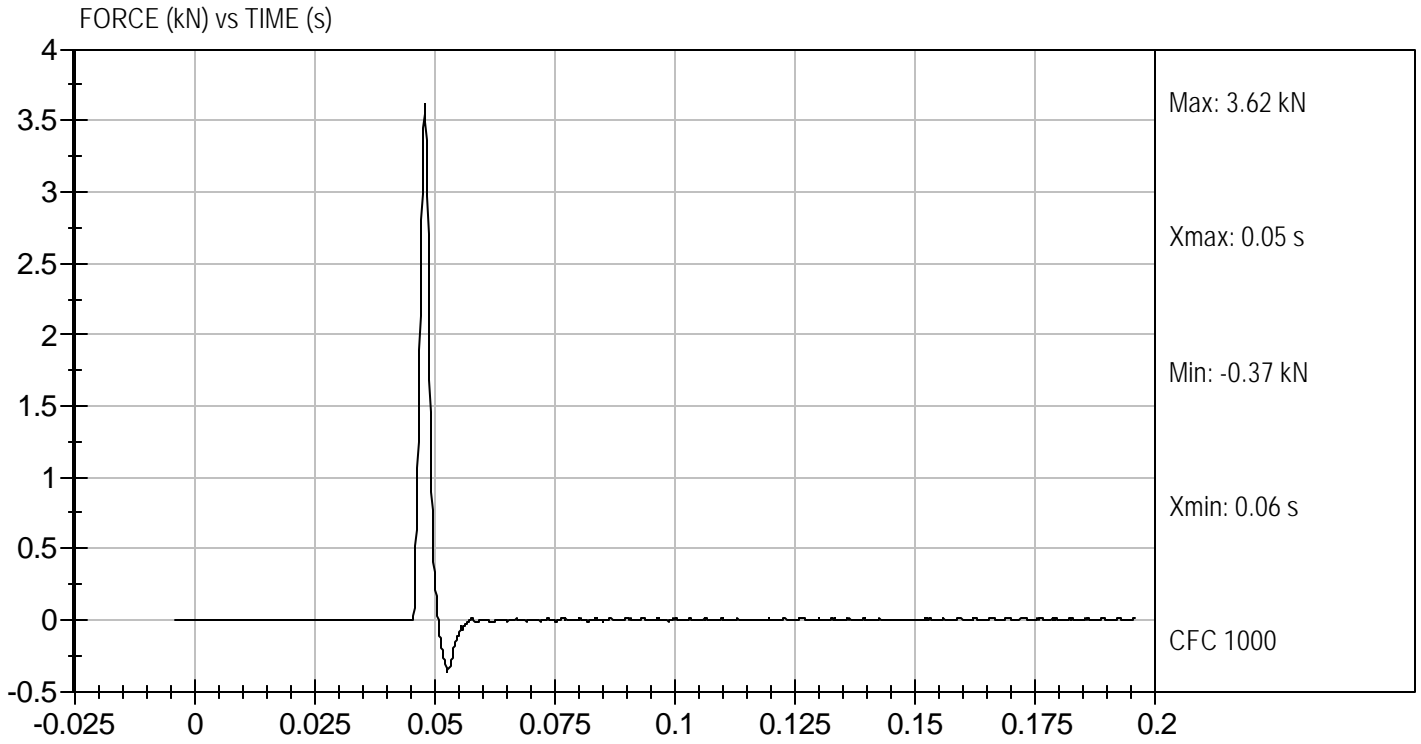


\_\_\_\_\_  
 Approved By



Test Desc: Right Knee  
Componet ID: D042225

Test Date: 09/13/2004  
Velocity: 6.86 ft/s, 2.09 m/s



DATA SHEET B1  
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 506 Test Date 9/10/04

Technician Jessica Gall

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

X Perform general cleaning.

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

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

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

Repair or Replacement approved by:

Jessica Hall  
Signature

9/13/04  
Date

Describe the repair or replacement of parts:

Checked by  
Jeff Leonard  
Signature

9/13/04  
Date

## EXTERNAL DIMENSIONS

SN506, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	780.2
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	443.0
C	H-POINT HEIGHT	Reference	81.3-86.3	85.1
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	145.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	76.4
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	128.0
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	255.8
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	280.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	193.0
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	545.0
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	365.2
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	400.5
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".	414-439.4	438.0

SN506, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	183.0
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	226.2
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	475.8
S	HEAD BREADTH	The widest part of the head	137.1-147.3	142.0
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	180.5
U	HIP BREADTH	The widest part of the hip	299.7-314.9	305.1
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	359.0
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	85.5
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	538.0
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	857.6
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	789.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

## EXTERNAL DIMENSIONS

SN511, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	794.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	449.5
C	H-POINT HEIGHT	Reference	81.3-86.3	82.0
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	82.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	131.3
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	250.4
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	43.5
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	278.0
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	195.2
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	545.0
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	361.7
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	399.0
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".	414-439.4	415.1

SN511, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	180.2
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	225.0
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	465.2
S	HEAD BREADTH	The widest part of the head	137.1-147.3	143.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	180.0
U	HIP BREADTH	The widest part of the hip	299.7-314.9	309.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	363.1
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	87.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	545.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	873.8
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	788.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 511 Test Date 8/02/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.6</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity    | <u>53%</u>  |
| Record the minimum humidity    | <u>42%</u>  |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

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

Record the actual distance 376 mm

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

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

Record the right side distance 502mm

Record the left side distance 502mm

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

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

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

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

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	280
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	10

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

Joe Flick  
Signature

8/02/04  
Date

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

ATD Serial No: 511

Test ID: D041761

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Peak Resultant Acceleration	G's	250 - 300	280	Pass
Peak Lateral Acceleration	G's	+/- 15	9.9	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass



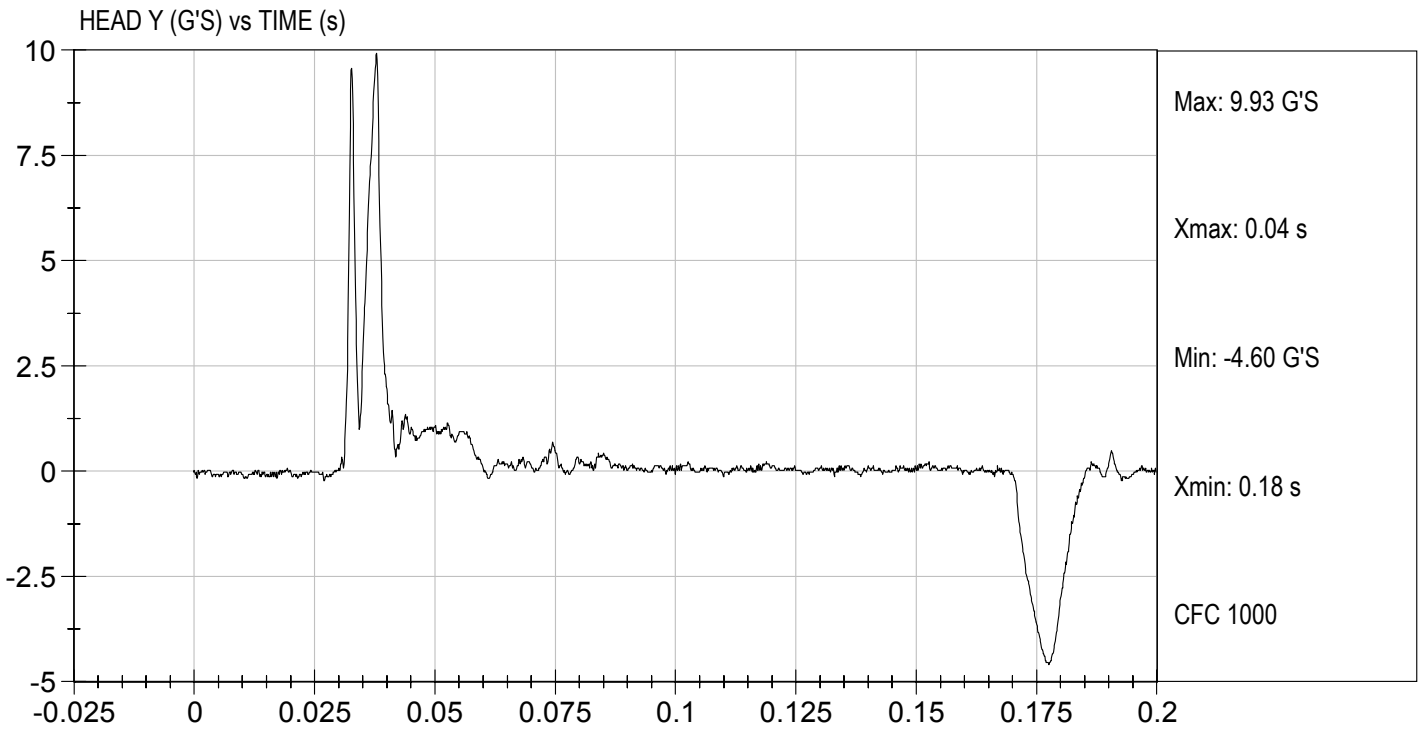
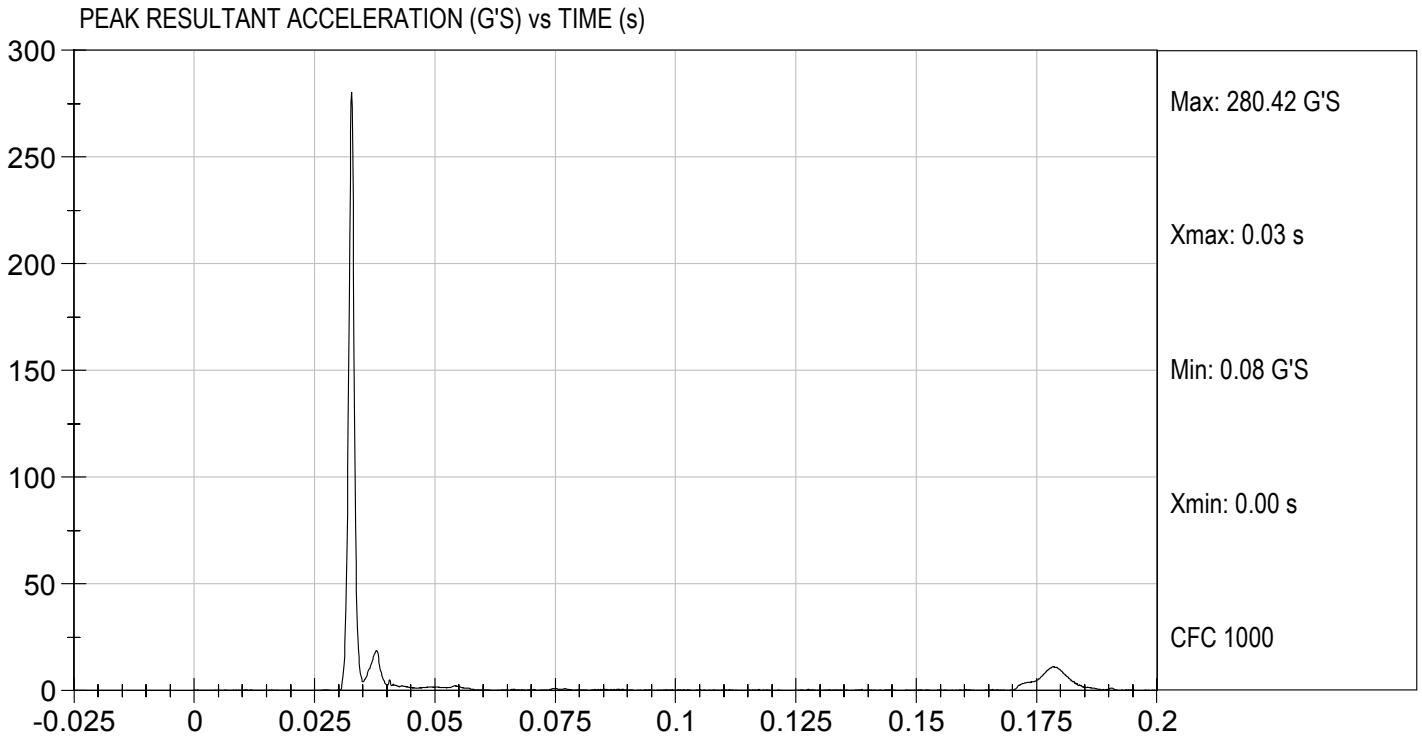
\_\_\_\_\_  
Laboratory Technician

08/02/2004

\_\_\_\_\_  
Test Date



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



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 511 Test Date 8/02/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one flexion test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.6</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity    | <u>53%</u>  |
| Record the minimum humidity    | <u>42%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness: Front 81; Rear 89.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter		Specification	Result
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.03 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.5 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.8 m/s
	@30ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.7 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range $77^\circ \leq$ angle $\leq 91^\circ$	<u>83</u> Nm @ <u>79</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100ms	83 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

Joe Fleck  
Signature

8/02/04  
Date

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

ATD Serial No: 511

Test I.D.: D041762

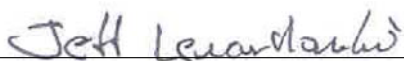
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.03	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.5	Pass
	20 msec	m/sec	4.0 to 5.0	4.8	Pass
	30 msec	m/sec	5.8 to 7.0	6.7	Pass
D Plane Rotation	Max	deg	77 to 91	79	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	83	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	83	Pass
Overall Results					Pass



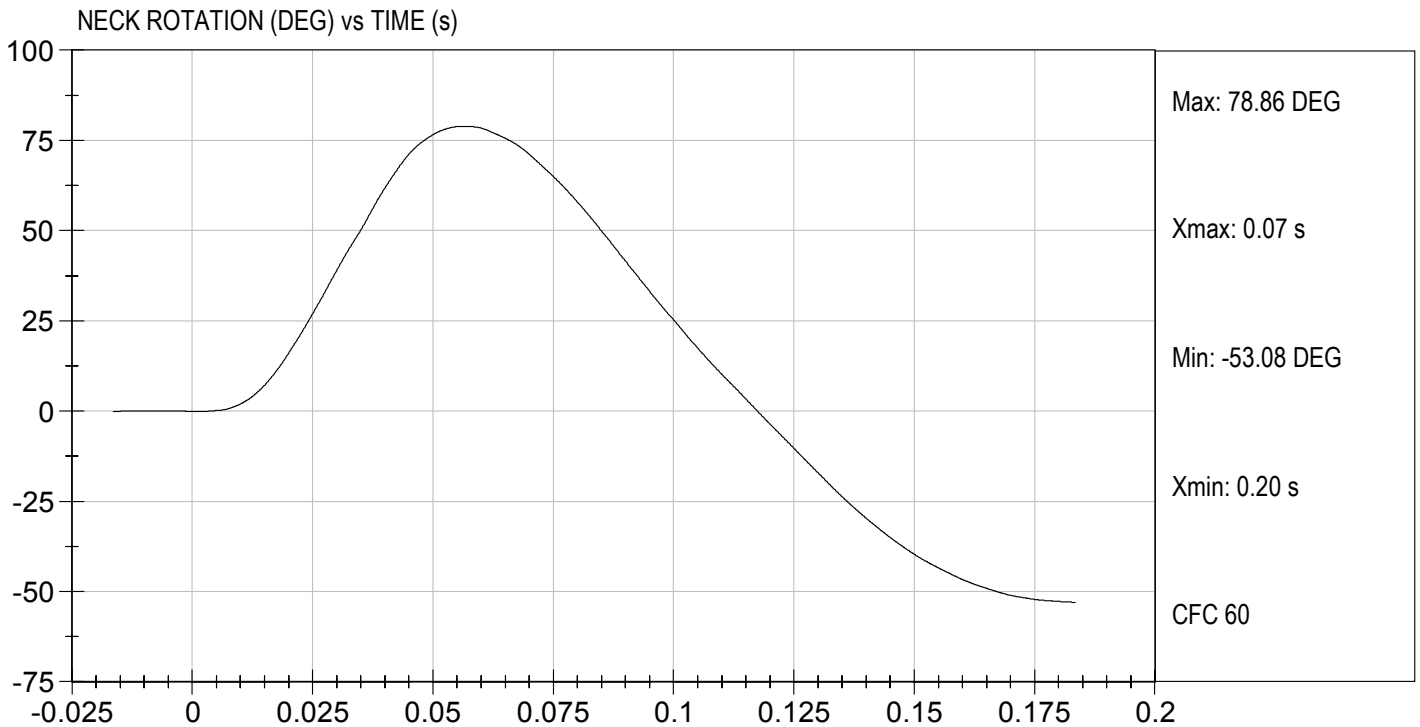
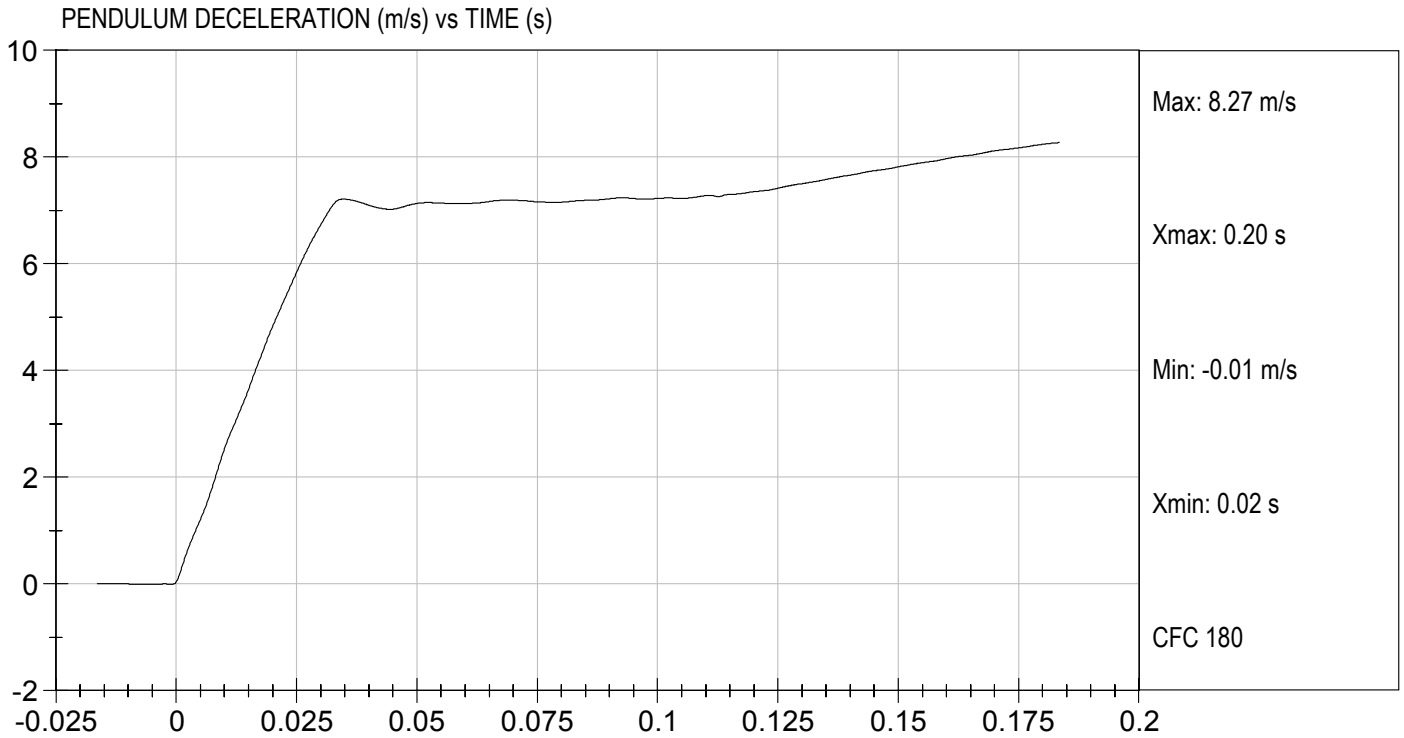
Laboratory Technician

08/02/2004

Test Date



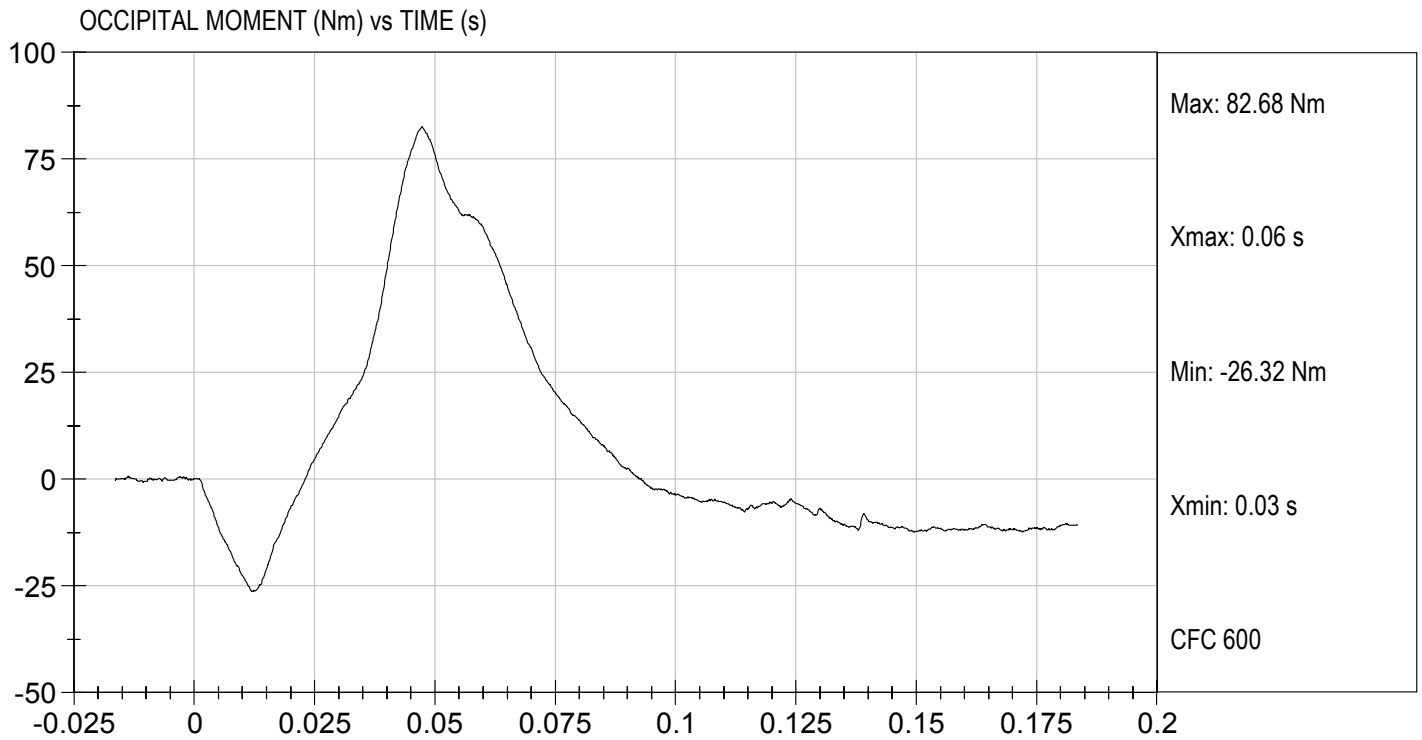
Approved By





Test Desc: Neck Flexion  
Componet ID: D041762

Test Date: 08/02/2004  
Velocity: 23.08 ft/s, 7.03 m/s



DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 511 Test Date 8/02/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one extension test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.6</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity    | <u>53%</u>  |
| Record the minimum humidity    | <u>42%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness: Front 81; Rear 89.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	5.95 m/s $\leq$ speed $\leq$ 6.19 m/s	6.16 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	1.5 m/s $\leq \Delta V \leq$ 1.9 m/s
	@ 20 ms	3.1 m/s $\leq \Delta V \leq$ 3.9 m/s
	@30ms	4.6 m/s $\leq \Delta V \leq$ 5.6 m/s
Plane D Rotation	Peak moment* -65 Nm $\leq$ moment $\leq$ -53 Nm during the following rotation range $99^\circ \leq$ angle $\leq 114^\circ$	<u>-57</u> Nm @ <u>109</u> degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm 94 ms $\leq$ time $\leq$ 114 ms	104 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

Joe Fleck  
Signature

8/02/04  
Date

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

ATD Serial No: 511

Test I.D: D041763

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	50	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.16	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.9	Pass
	20 msec	m/sec	3.1 to 3.9	3.6	Pass
	30 msec	m/sec	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-57	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	104	Pass
Overall Results					Pass



Laboratory Technician

08/02/2004

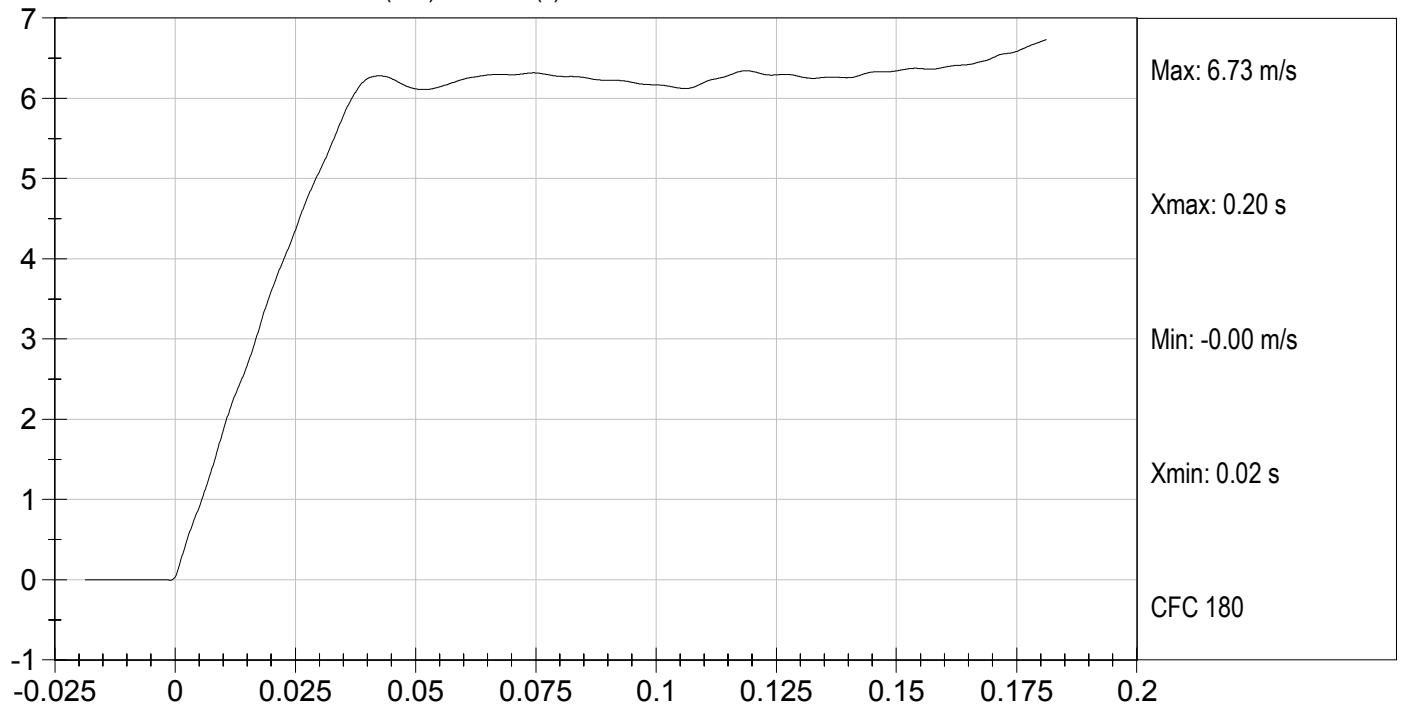
Test Date



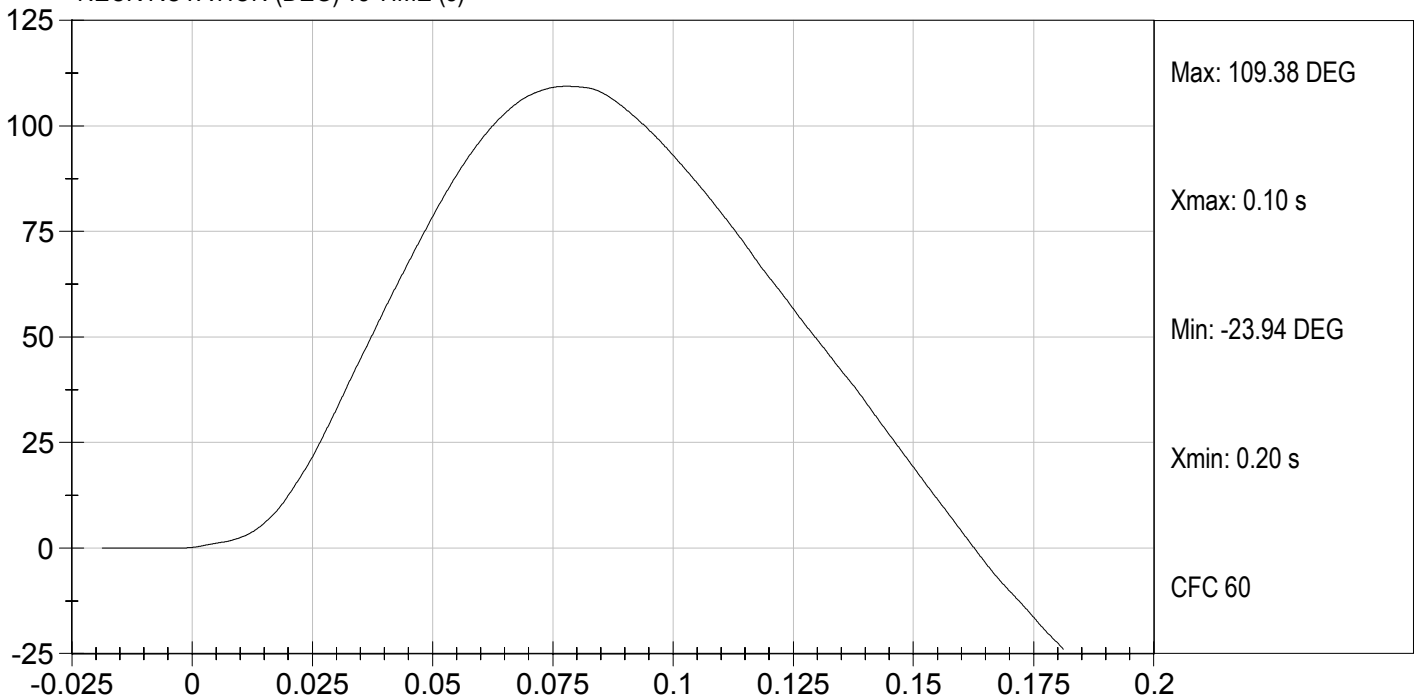
Approved By



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



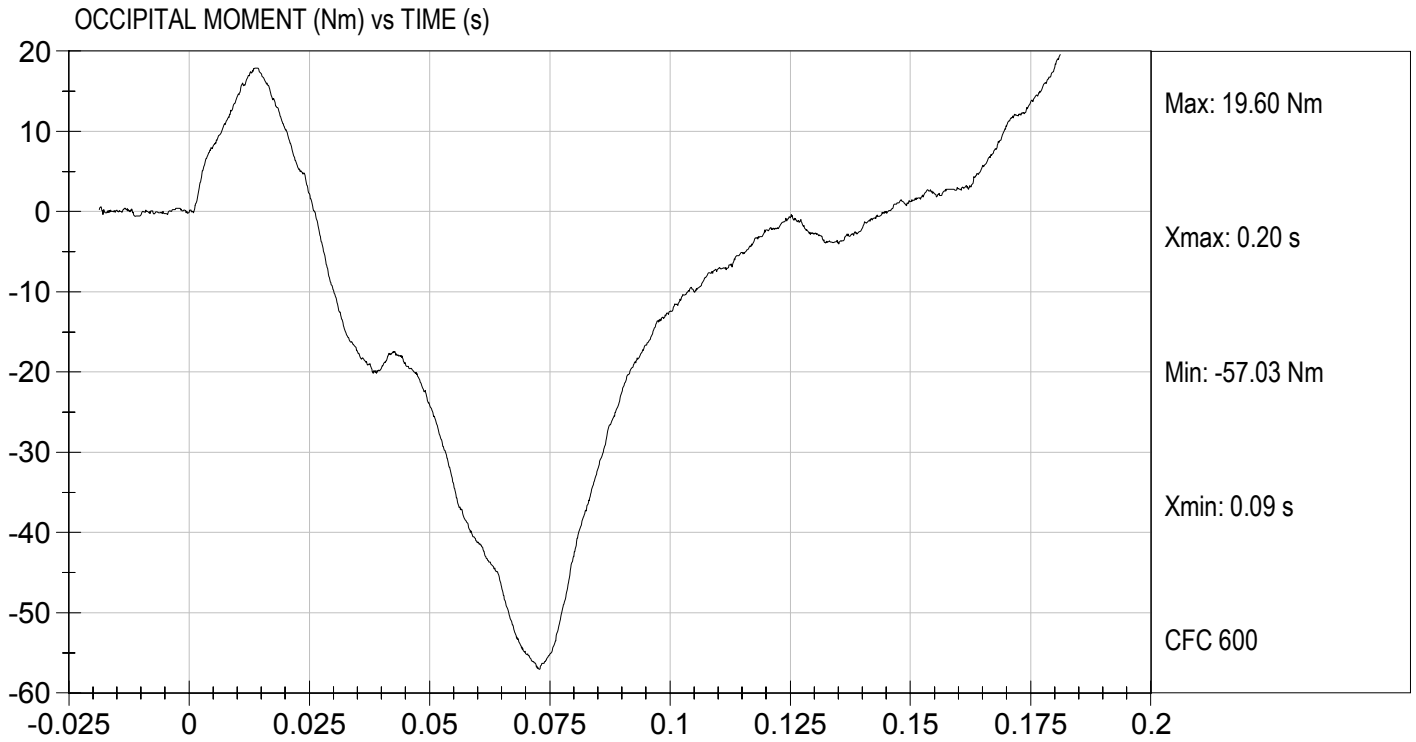
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Extension  
Componet ID: D041763

Test Date: 08/02/2004  
Velocity: 20.22 ft/s, 6.16 m/s



DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 511 Test Date 8/02/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

- 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
- 2. The test fixture conforms to the specifications in Figure 11B.
- 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))
 

Record the maximum temperature	21.6
Record the minimum temperature	20.7
Record the maximum humidity	53%
Record the minimum humidity	42%
- 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
  - No damage
  - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_
  - The following repairs or replacement was performed. Record \_\_\_\_\_
- 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

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

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

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.62 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	48 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4010 N
Peak force** between 18.0 and 50.0 mm chest compression	peak force ≤ 4600 N	4013 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	70%

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

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

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

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

Joe Fleck  
Signature

8/02/04  
Date

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

ATD Serial No: 511

Test I.D.: D041764

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/s	6.59 to 6.83	6.62	Pass
Peak Deflection	mm	50 to 58	54.7	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.0	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	Yes/No	< 4600 N	4013	Pass
			Overall Test Results	Pass

*Joe Fleck*

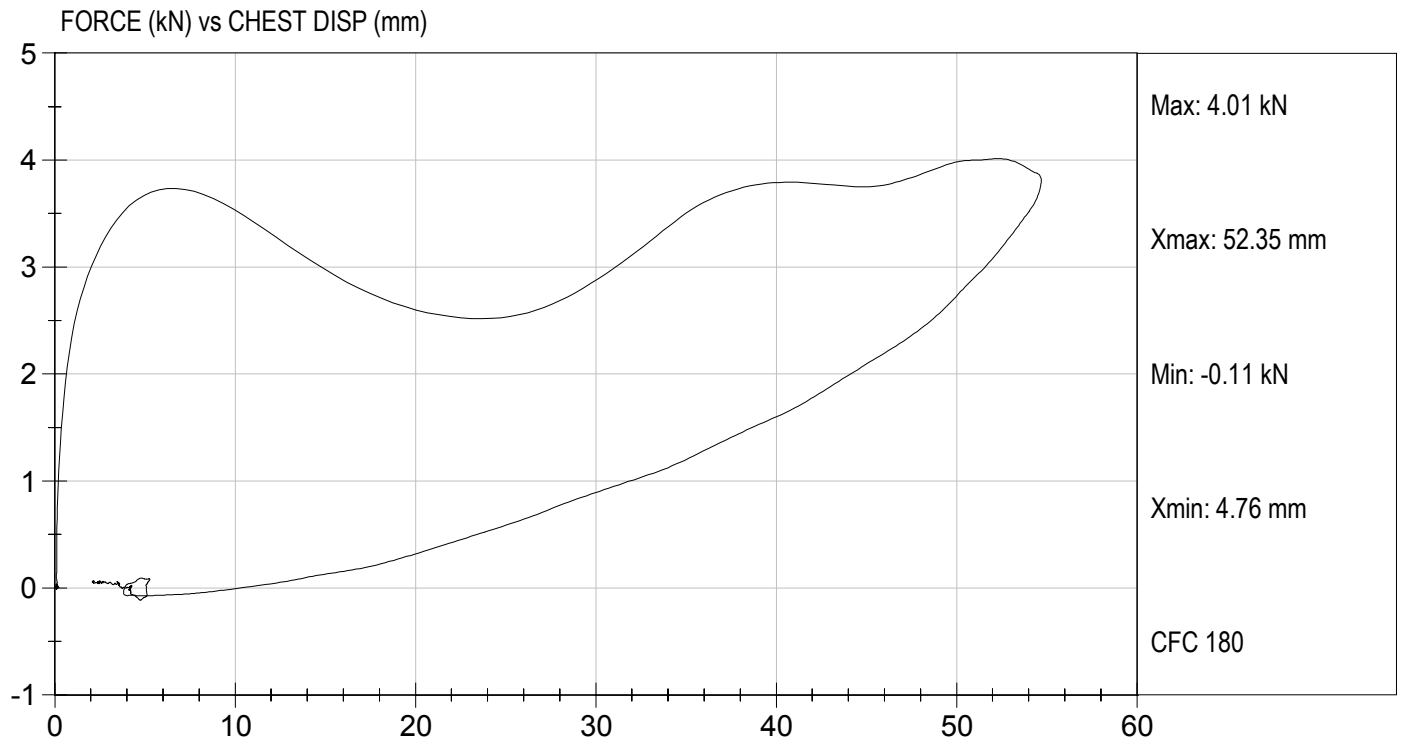
\_\_\_\_\_  
Laboratory Technician

08/02/2004

\_\_\_\_\_  
Test Date

*Jeff Leonard*

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



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 511 Test Date 8/02/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.6</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity    | <u>53%</u>  |
| Record the minimum humidity    | <u>42%</u>  |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
Record reference plane angle (max. allowed 20°) 15°
12. Attach the pull cable and the load cell. (572.135(c)(8))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 20^\circ$	$15^\circ$
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	368 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	$16^\circ$

Joe Fleck  
Signature

8/02/04  
Date

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

ATD Serial No: 511

Test I.D.: D041767

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Initial Angle	deg	0 to 20	15	Pass
Return Angle	deg	+/- 8	18	Pass
Force at 45 deg	N	320 to 390	368	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass



Laboratory Technician

08/02/2004

Test Date



Approved By

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 8/02/04

Technician Joe Fleck

Pretest calibration

Post test calibration verification

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

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

N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.6

Record the minimum temperature 20.7

Record the maximum humidity 53%

Record the minimum humidity 42%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.11 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3640 N

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

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

Joe Fleck  
Signature

8/02/04  
Date

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

ATD Serial No: 511

Test I.D: D041766

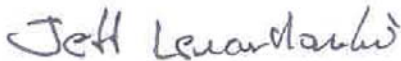
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.64	Pass
Overall Test Results				Pass



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

08/02/2004

\_\_\_\_\_  
 Test Date

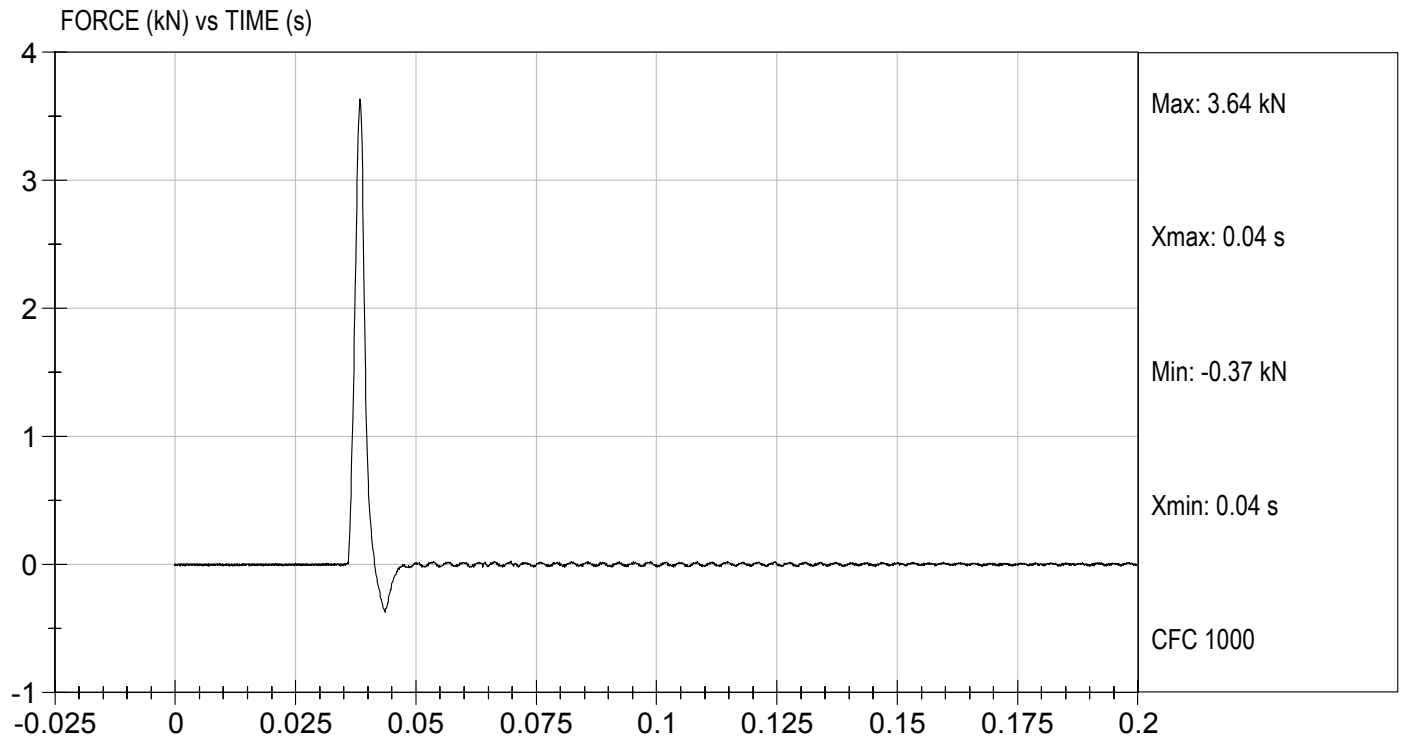


\_\_\_\_\_  
 Approved By



Test Desc: Left Knee  
Componet ID: D041766

Test Date: 08/02/2004  
Velocity: 6.93 ft/s, 2.11 m/s



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511 Test Date 8/02/04

Technician Joe Fleck

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
- 2. The test fixture conforms to the specifications in Figure 14B.
- 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
 

Record the maximum temperature	<u>21.6</u>
Record the minimum temperature	<u>20.7</u>
Record the maximum humidity	<u>53 %</u>
Record the minimum humidity	<u>42 %</u>
- 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))
- 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.11 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3700 N

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

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

*Joe Fleck*

Signature

8/02/04

Date

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

**ATD Serial No:** 511

**Test I.D.:** D041765

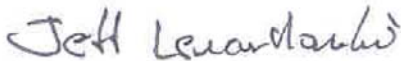
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.70	Pass
<b>Overall Test Results</b>				<b>Pass</b>



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

08/02/2004

\_\_\_\_\_  
Test Date

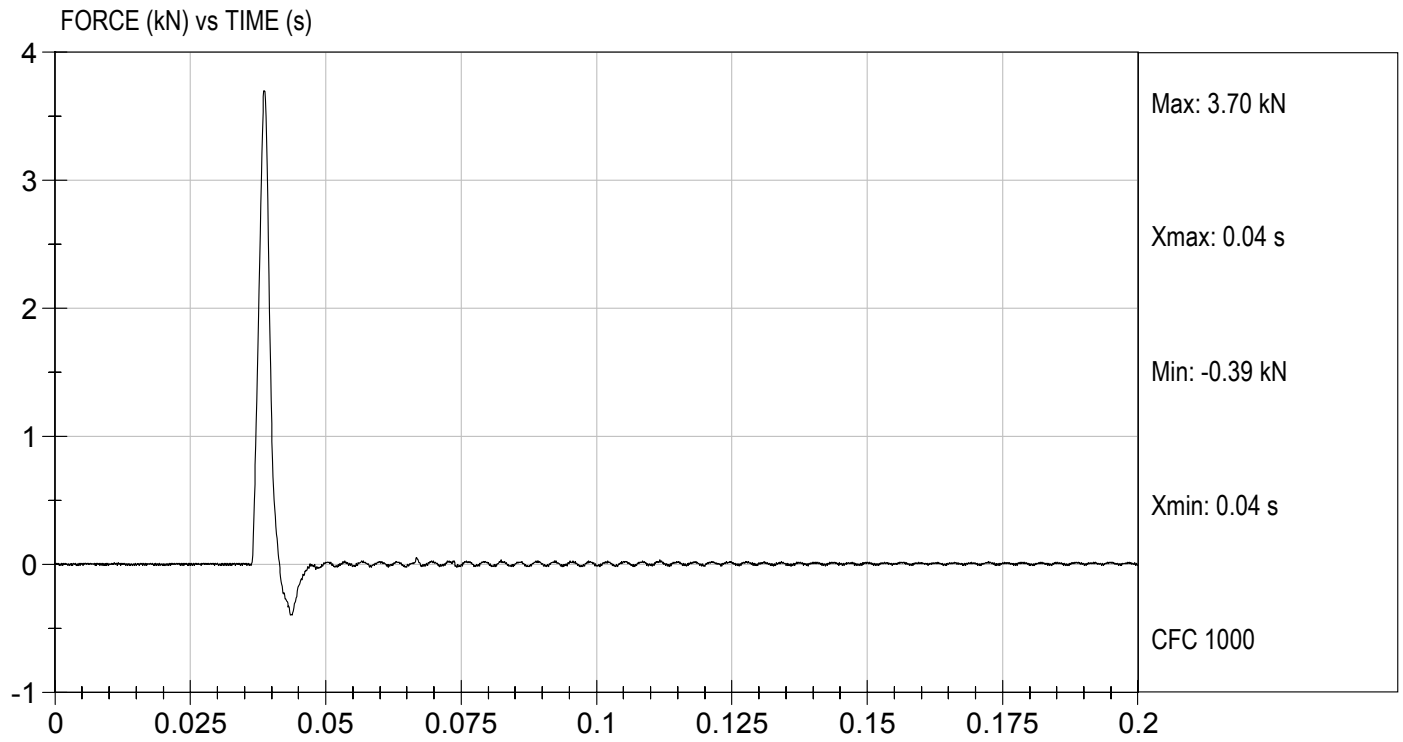


\_\_\_\_\_  
Approved By



Test Desc: Right Knee  
Componet ID: D041765

Test Date: 08/02/2004  
Velocity: 6.93 ft/s, 2.11 m/s



DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 511 Test Date 8/16/04

Technician Joe Fleck

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
- 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- 4. Accelerometers and their respective mounts are smooth and clean.
- 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
 

Record the maximum temperature	<u>21.7</u>
Record the minimum temperature	<u>21.2</u>
Record the maximum humidity	<u>48%</u>
Record the minimum humidity	<u>41%</u>
- 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
- 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

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

Record the actual distance 376 mm

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

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

Record the right side distance 502mm

Record the left side distance 502mm

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

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

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

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

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	273
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	15

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

Joe Fleck  
Signature

8/16/04  
Date

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

ATD Serial No: 511

Test ID: D041941

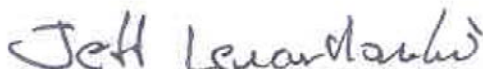
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Peak Resultant Acceleration	G's	250 - 300	273	Pass
Peak Lateral Acceleration	G's	+/- 15	14.5	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass



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

08/16/2004

\_\_\_\_\_  
Test Date



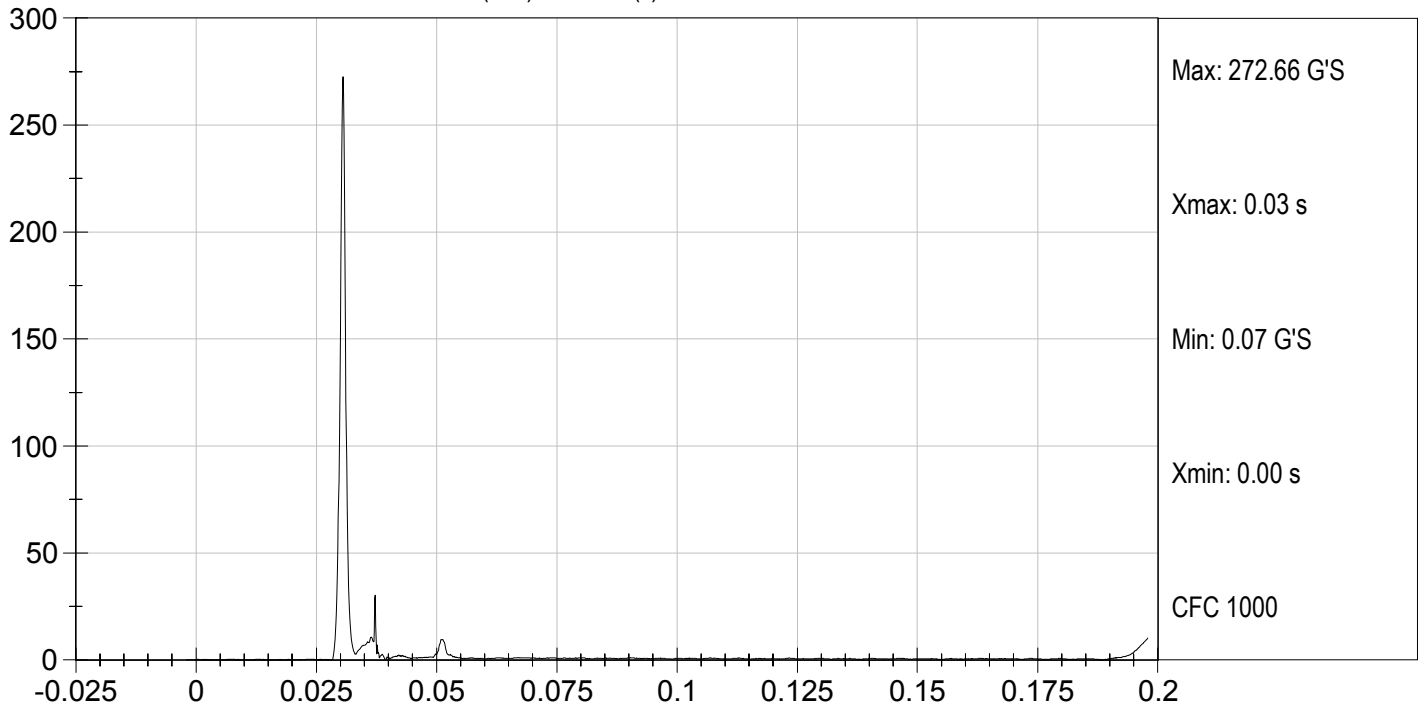
\_\_\_\_\_  
Approved By



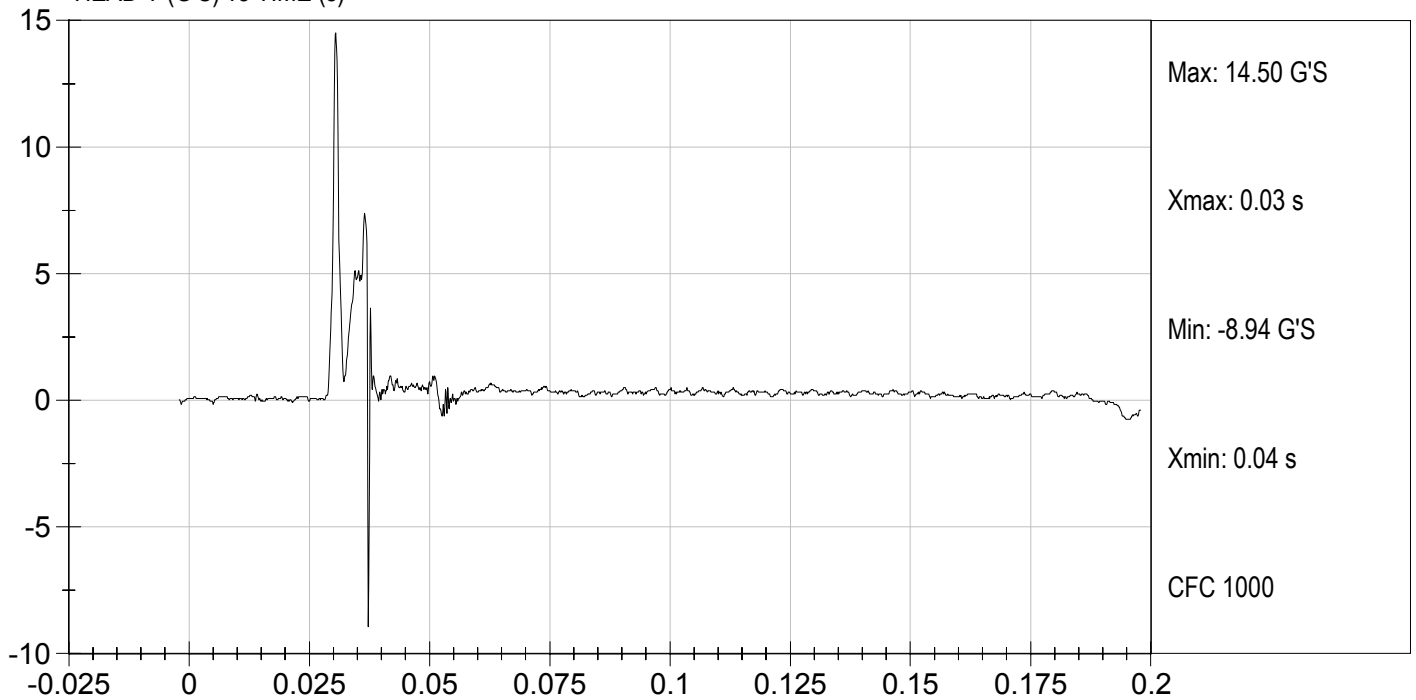
Test Desc: Head Drop  
Componet ID: D041941

Test Date: 08/16/2004  
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 511 Test Date 8/16/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one flexion test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.7</u> |
| Record the minimum temperature | <u>21.2</u> |
| Record the maximum humidity    | <u>48%</u>  |
| Record the minimum humidity    | <u>41%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness: Front 81; Rear 89.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter		Specification	Result
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.07 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.5 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.8 m/s
	@30ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.7 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	<u>77</u> Nm @ <u>79</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100ms	87 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

Joe Fleck  
Signature

8/16/04  
Date

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

ATD Serial No: 511

Test I.D.: D041942

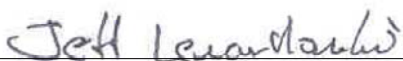
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.07	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.5	Pass
	20 msec	m/sec	4.0 to 5.0	4.8	Pass
	30 msec	m/sec	5.8 to 7.0	6.7	Pass
D Plane Rotation	Max	deg	77 to 91	79	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	77	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	87	Pass
Overall Results					Pass



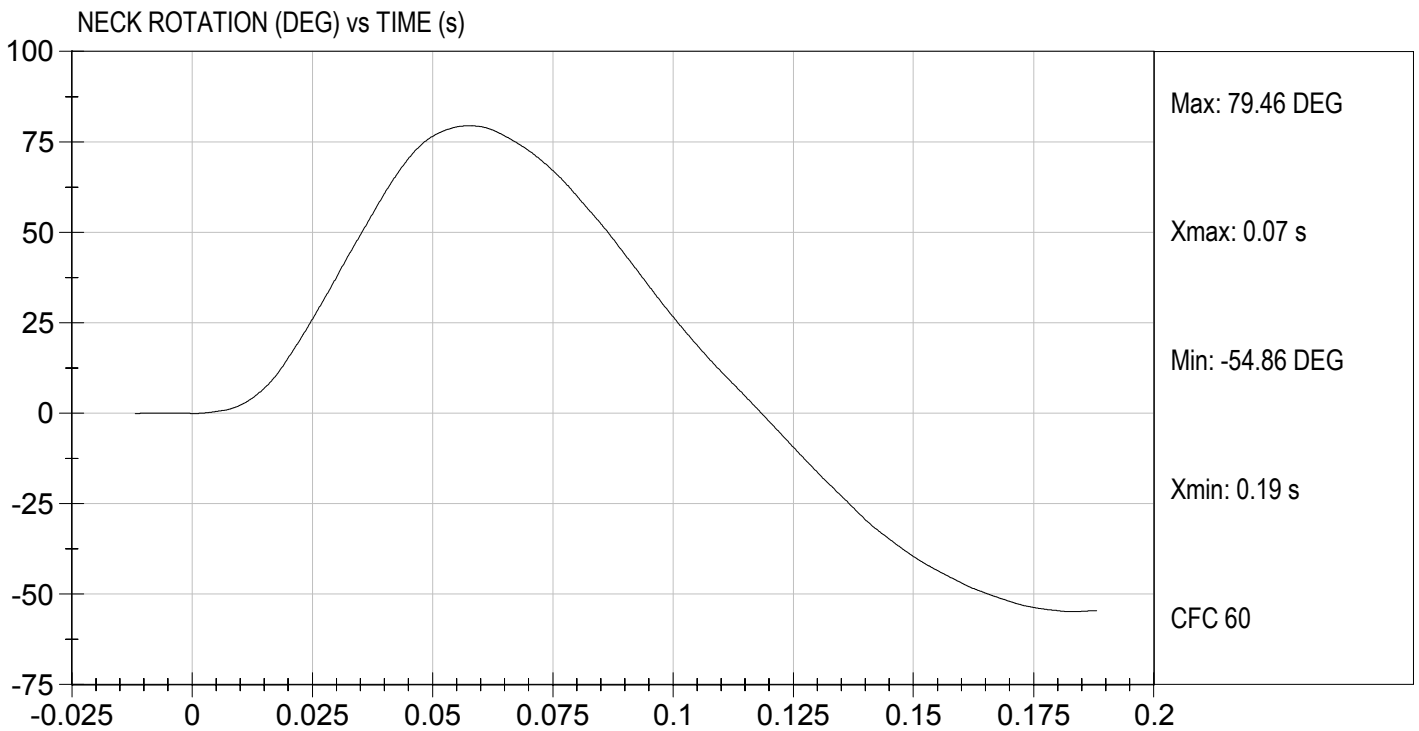
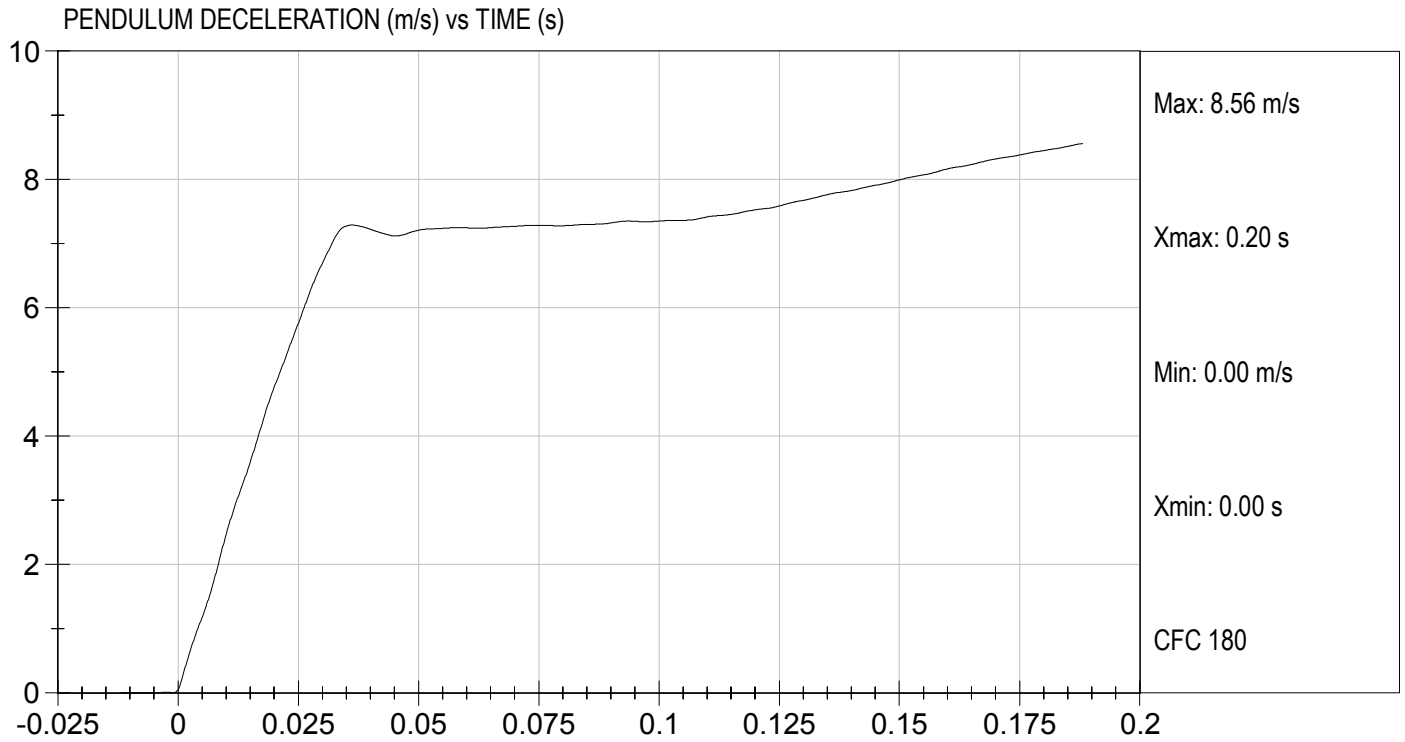
Laboratory Technician

08/16/2004

Test Date



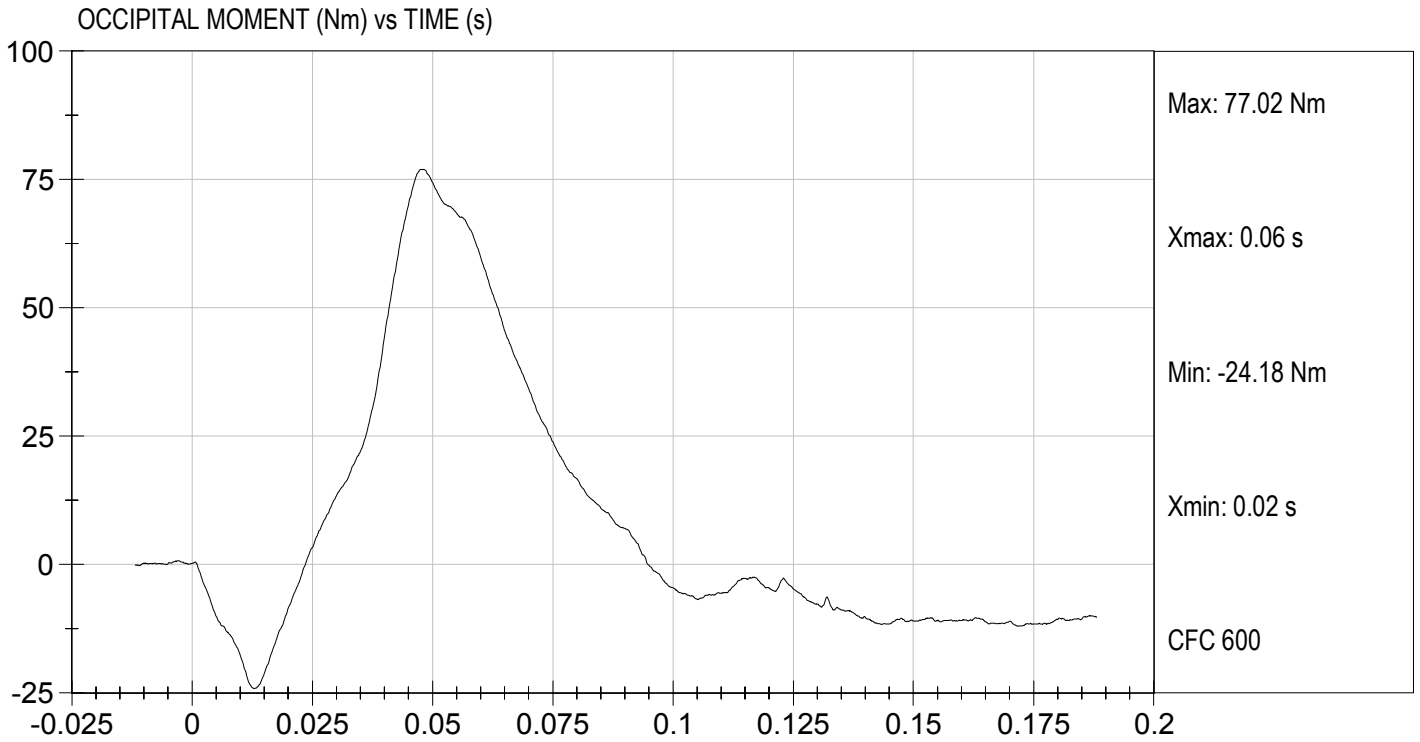
Approved By





Test Desc: Neck Flexion  
Componet ID: D041942

Test Date: 08/16/2004  
Velocity: 23.2 ft/s, 7.07 m/s



DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 511 Test Date 8/16/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one extension test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.8</u> |
| Record the minimum temperature | <u>21.2</u> |
| Record the maximum humidity    | <u>48%</u>  |
| Record the minimum humidity    | <u>41%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness: Front 81; Rear 89.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	5.95 m/s $\leq$ speed $\leq$ 6.19 m/s	6.18 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	1.5 m/s $\leq \Delta V \leq$ 1.9 m/s
	@ 20 ms	3.1 m/s $\leq \Delta V \leq$ 3.9 m/s
	@30ms	4.6 m/s $\leq \Delta V \leq$ 5.6 m/s
Plane D Rotation	Peak moment* -65 Nm $\leq$ moment $\leq$ -53 Nm during the following rotation range $99^\circ \leq$ angle $\leq 114^\circ$	<u>-53</u> Nm @ <u>108</u> degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm 94 ms $\leq$ time $\leq$ 114 ms	107 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

Joe Fleck  
Signature

8/16/04  
Date

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

ATD Serial No: 511

Test I.D: D041943

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	41	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.18	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.7	Pass
	20 msec	m/sec	3.1 to 3.9	3.3	Pass
	30 msec	m/sec	4.6 to 5.6	4.8	Pass
D Plane Rotation	Max	deg	99 to 114	108	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-53	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	107	Pass
				Overall Results	Pass



Laboratory Technician

08/16/2004

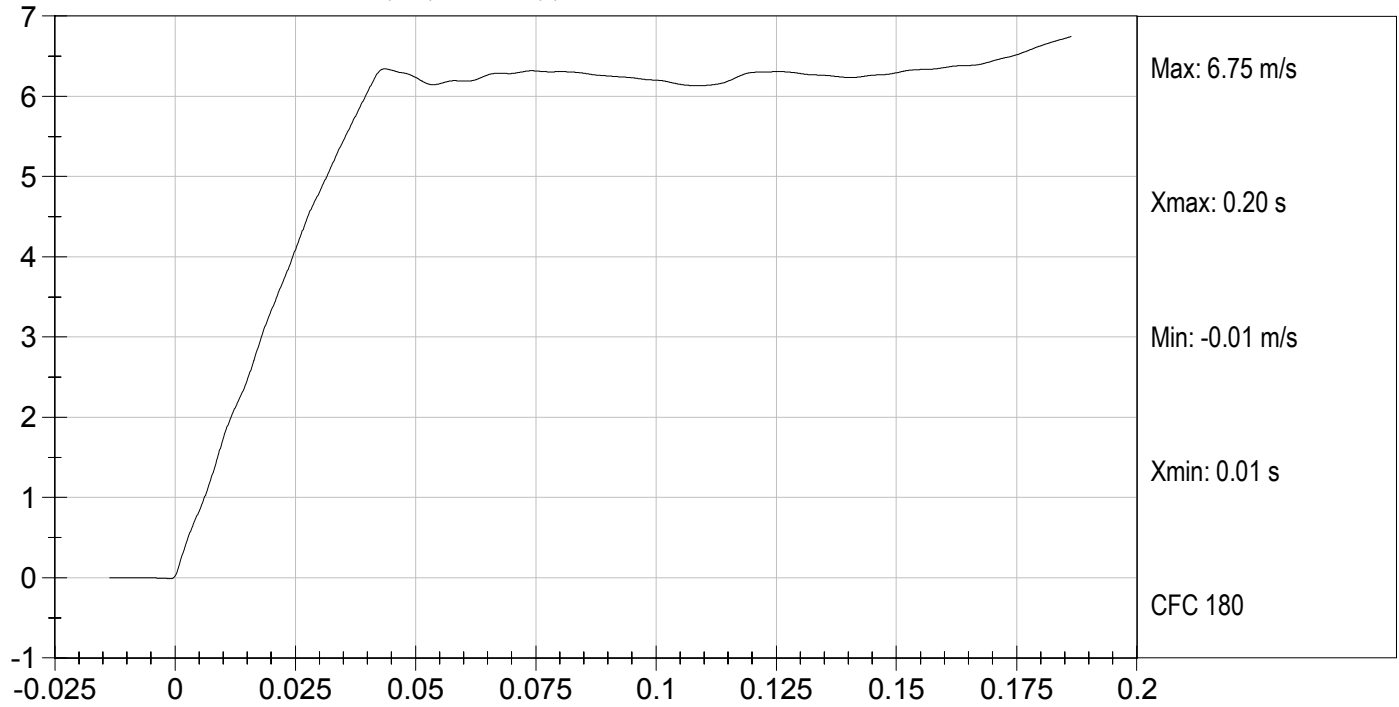
Test Date



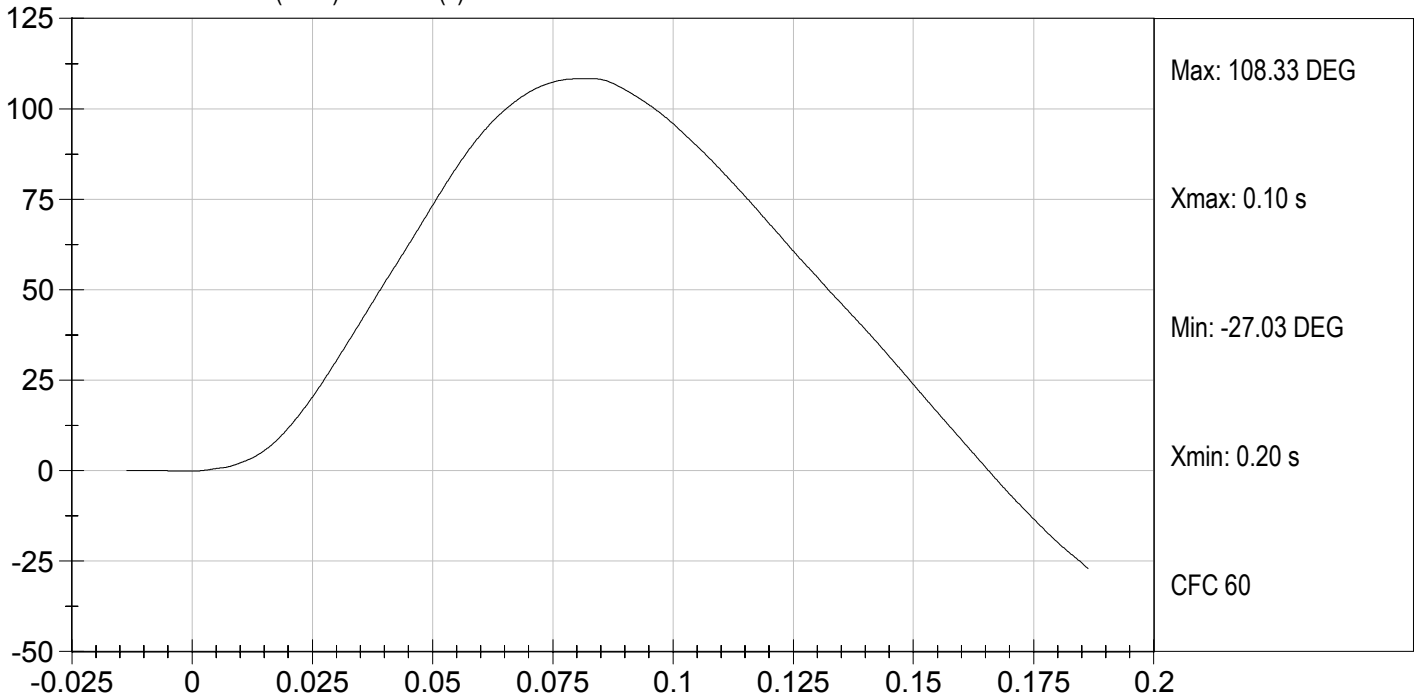
Approved By



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



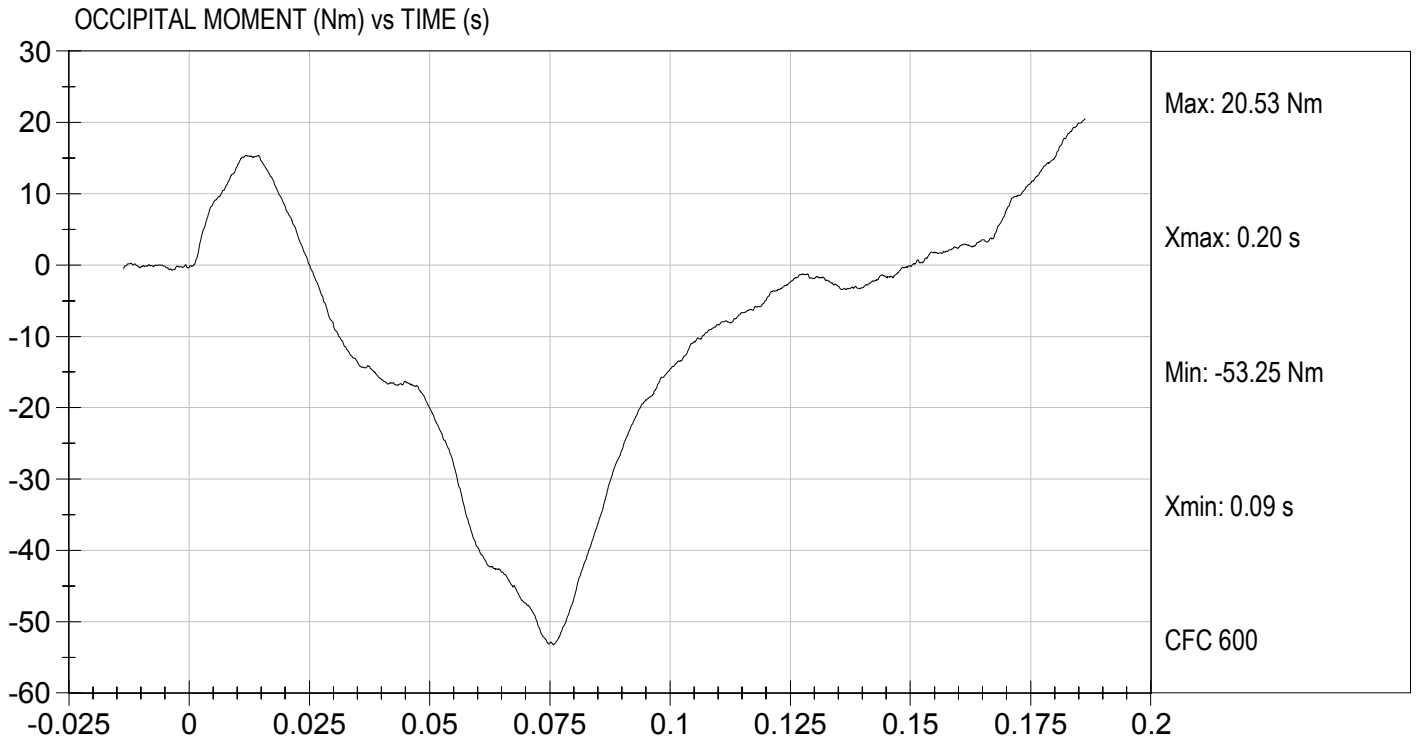
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Extension  
Componet ID: D041943

Test Date: 08/16/2004  
Velocity: 20.29 ft/s, 6.18 m/s



DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 511 Test Date 8/17/04

Technician Jim Carney

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
- 2. The test fixture conforms to the specifications in Figure 11B.
- 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))
 

Record the maximum temperature	21.8
Record the minimum temperature	21.4
Record the maximum humidity	48%
Record the minimum humidity	43%
- 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
  - No damage
  - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_
  - The following repairs or replacement was performed. Record \_\_\_\_\_
- 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

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

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

X 16. Complete the following table:

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

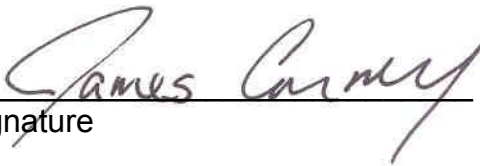
Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.78 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	55 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4260 N
Peak force** between 18.0 and 50.0 mm chest compression	peak force $\leq 4600 \text{ N}$	4263 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	70%

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

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

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

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

  
Signature


8/17/04  
Date

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

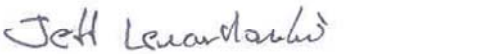
**ATD Serial No:** 511

**Test I.D.:** D041944

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	46	Pass
Probe Speed	m/s	6.59 to 6.83	6.78	Pass
Peak Deflection	mm	50 to 58	55.2	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.3	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	Yes/No	< 4600 N	4263	Pass
			Overall Test Results	Pass

  
Laboratory Technician

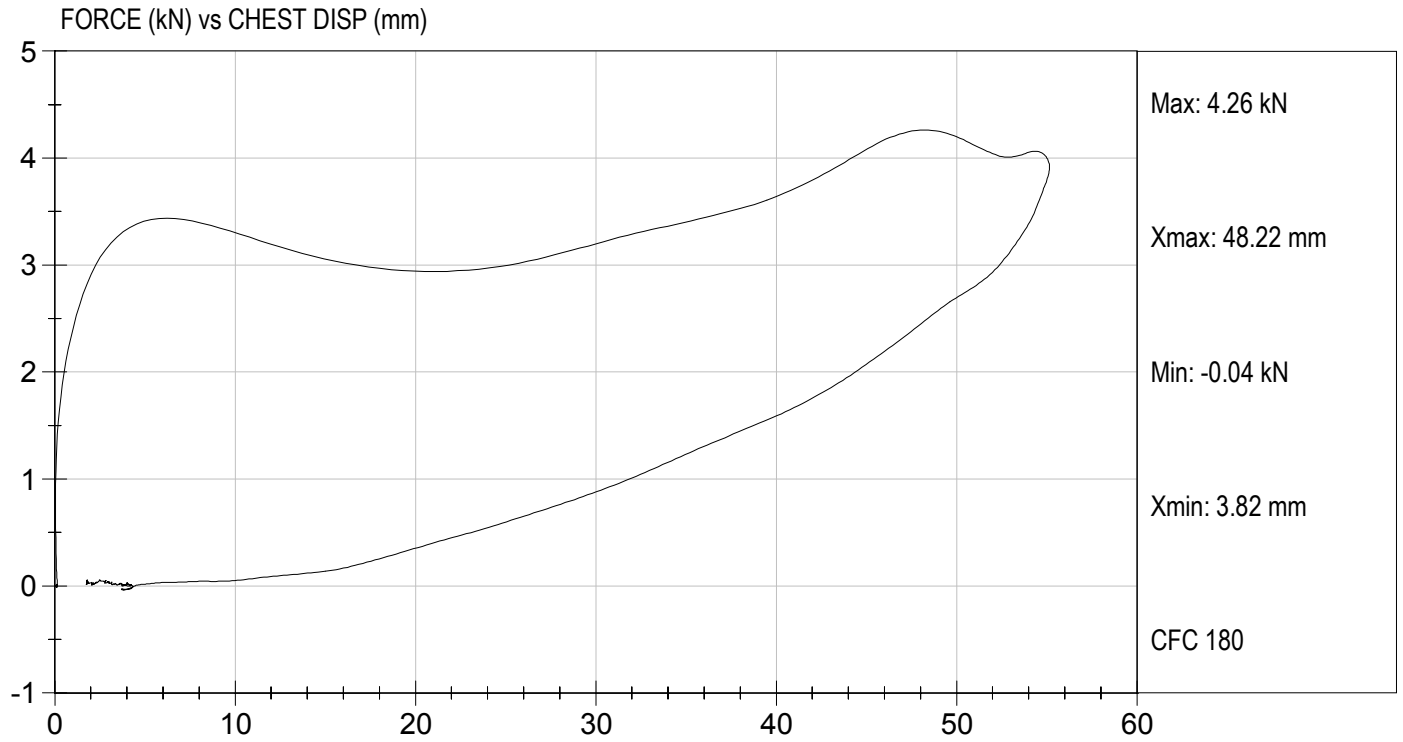
08/17/2004  
Test Date

  
Approved By



Test Desc: Thorax Impact  
Componet ID: D041944

Test Date: 08/17/2004  
Velocity: 22.23 ft/s, 6.78 m/s



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 511 Test Date 8/16/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.8</u> |
| Record the minimum temperature | <u>21.2</u> |
| Record the maximum humidity    | <u>48%</u>  |
| Record the minimum humidity    | <u>41%</u>  |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
Record reference plane angle (max. allowed 20°) 18°
12. Attach the pull cable and the load cell. (572.135(c)(8))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 20^\circ$	$18^\circ$
Torso rotation rate	$0.5^\circ/s \leq \text{rate} \leq 1.5^\circ/s$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	362 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	$21^\circ$

Joe Fleck  
Signature

8/16/04  
Date

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

ATD Serial No: 511

Test I.D.: D041947

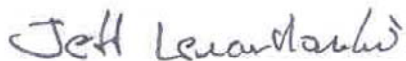
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	21	Pass
Force at 45 deg	N	320 to 390	362	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass



Laboratory Technician

08/16/2004

Test Date



Approved By

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 8/16/04

Technician Jim Carney

Pretest calibration

Post test calibration verification

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

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

N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.8

Record the minimum temperature 21.2

Record the maximum humidity 48%

Record the minimum humidity 41%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3610 N

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

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

James Carney  
Signature


8/16/04  
Date

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

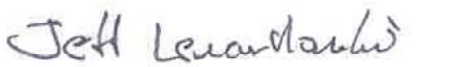
ATD Serial No: 511

Test I.D.: D041946

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.61	Pass
Overall Test Results				Pass

  
 Laboratory Technician

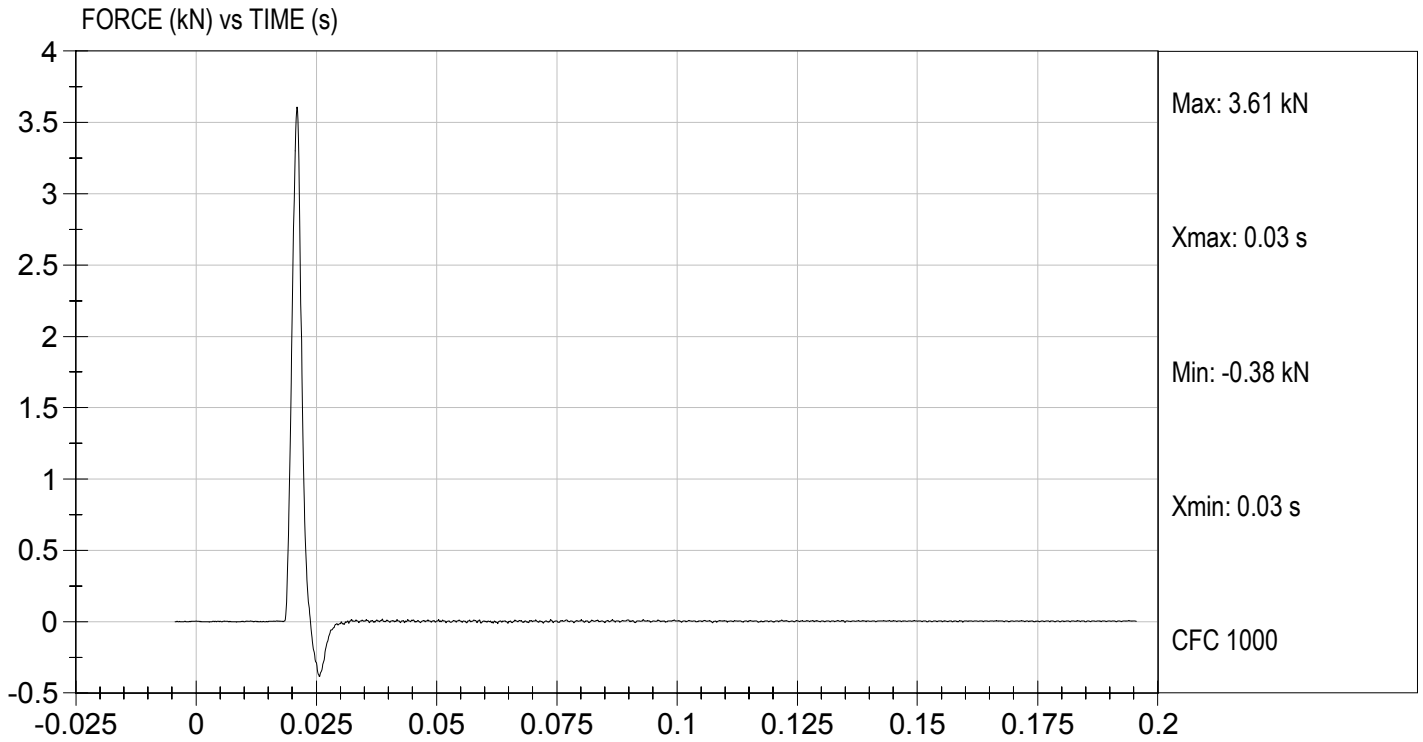
08/16/2004  
 Test Date

  
 Approved By



Test Desc: Left Knee  
Componet ID: D041946

Test Date: 08/16/2004  
Velocity: 6.88 ft/s, 2.10 m/s



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511 Test Date 8/16/04

Technician Jim Carney

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
- 2. The test fixture conforms to the specifications in Figure 14B.
- 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
 

Record the maximum temperature	<u>21.8</u>
Record the minimum temperature	<u>21.2</u>
Record the maximum humidity	<u>48 %</u>
Record the minimum humidity	<u>41 %</u>
- 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))
- 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.09 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3540 N

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

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

James Carmy  
Signature


8/16/04  
Date

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

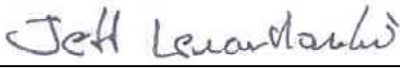
ATD Serial No: 511

Test I.D.: D041945

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/sec	2.07 to 2.13	2.09	Pass
Maximum Force	kN	3.45 to 4.06	3.54	Pass
Overall Test Results				Pass

  
Laboratory Technician

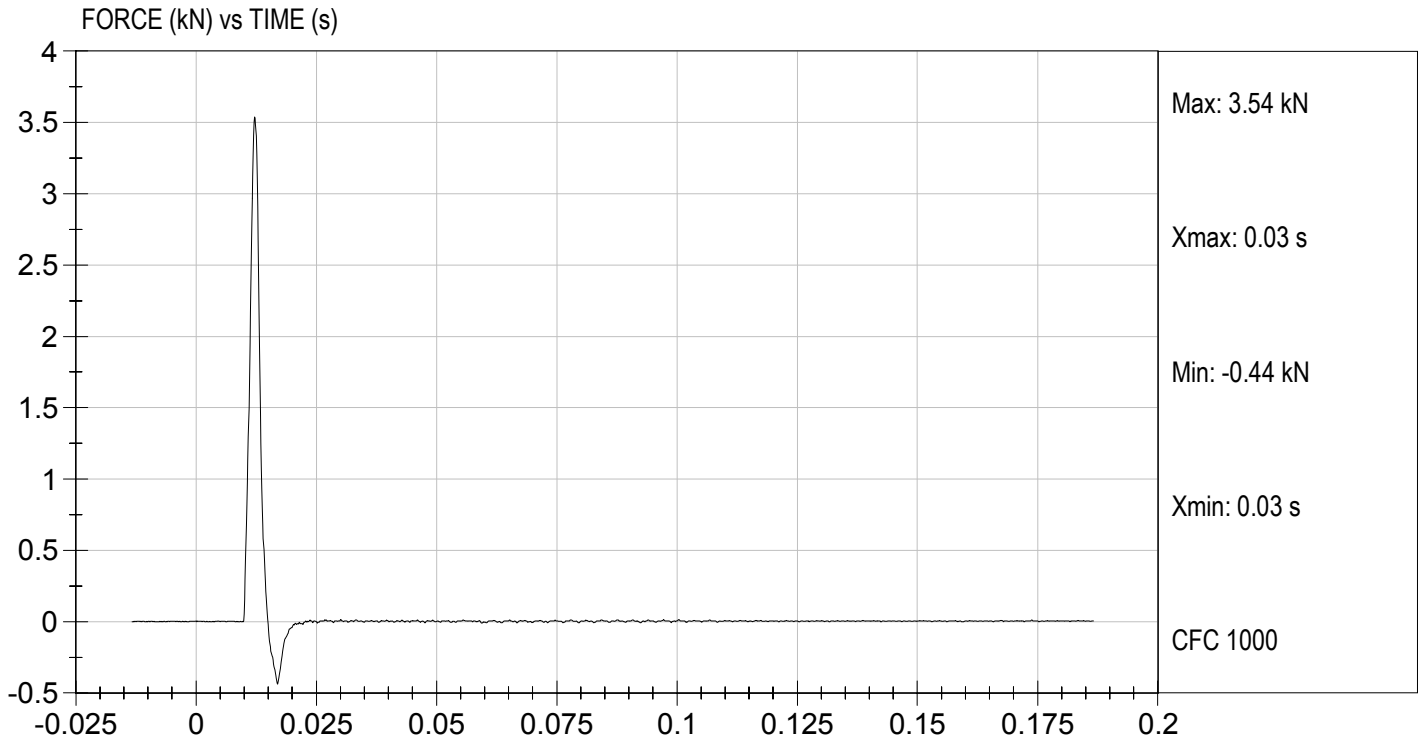
08/16/2004  
Test Date

  
Approved By



Test Desc: Right Knee  
Componet ID: D041945

Test Date: 08/16/2004  
Velocity: 6.87 ft/s, 2.09 m/s



DATA SHEET B1  
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 505

Test Date 8/13/04

Technician Jessica Gall

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

Perform general cleaning.

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

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

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

Repair or Replacement approved by:

Jessica Hall  
Signature

8/16/04  
Date

Describe the repair or replacement of parts:

Checked by  
Jeff Leonard  
Signature

8/16/04  
Date

## EXTERNAL DIMENSIONS

SN511, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	794.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	449.5
C	H-POINT HEIGHT	Reference	81.3-86.3	82.0
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	82.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	131.3
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	250.4
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	43.5
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	278.0
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	195.2
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	545.0
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	361.7
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	399.0
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".	414-439.4	415.1

SN511, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	180.2
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	225.0
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	465.2
S	HEAD BREADTH	The widest part of the head	137.1-147.3	143.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	180.0
U	HIP BREADTH	The widest part of the hip	299.7-314.9	309.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	363.1
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	87.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	545.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	873.8
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	788.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

## EXTERNAL DIMENSIONS

SN511, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	794.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	449.5
C	H-POINT HEIGHT	Reference	81.3-86.3	82.0
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	82.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	131.3
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	250.4
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	43.5
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	278.0
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	195.2
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	545.0
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	361.7
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	399.0
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".	414-439.4	415.1

SN511, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	180.2
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	225.0
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	465.2
S	HEAD BREADTH	The widest part of the head	137.1-147.3	143.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	180.0
U	HIP BREADTH	The widest part of the hip	299.7-314.9	309.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	363.1
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	87.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	545.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	873.8
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	788.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 511 Test Date 8/20/04

Technician Joe Fleck

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
- 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- 4. Accelerometers and their respective mounts are smooth and clean.
- 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))  

Record the maximum temperature	<u>21.8</u>
Record the minimum temperature	<u>21.0</u>
Record the maximum humidity	<u>50%</u>
Record the minimum humidity	<u>43%</u>
- 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
- 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

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

Record the actual distance 376 mm

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

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

Record the right side distance 502mm

Record the left side distance 502mm

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

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

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

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

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	278
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	7

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

Joe Fleck  
Signature

8/20/04  
Date

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

ATD Serial No: 511

Test ID: D041981

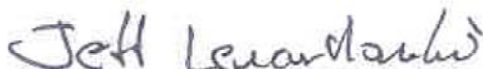
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Peak Resultant Acceleration	G's	250 - 300	278	Pass
Peak Lateral Acceleration	G's	+/- 15	6.6	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass



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

08/20/2004

\_\_\_\_\_  
Test Date



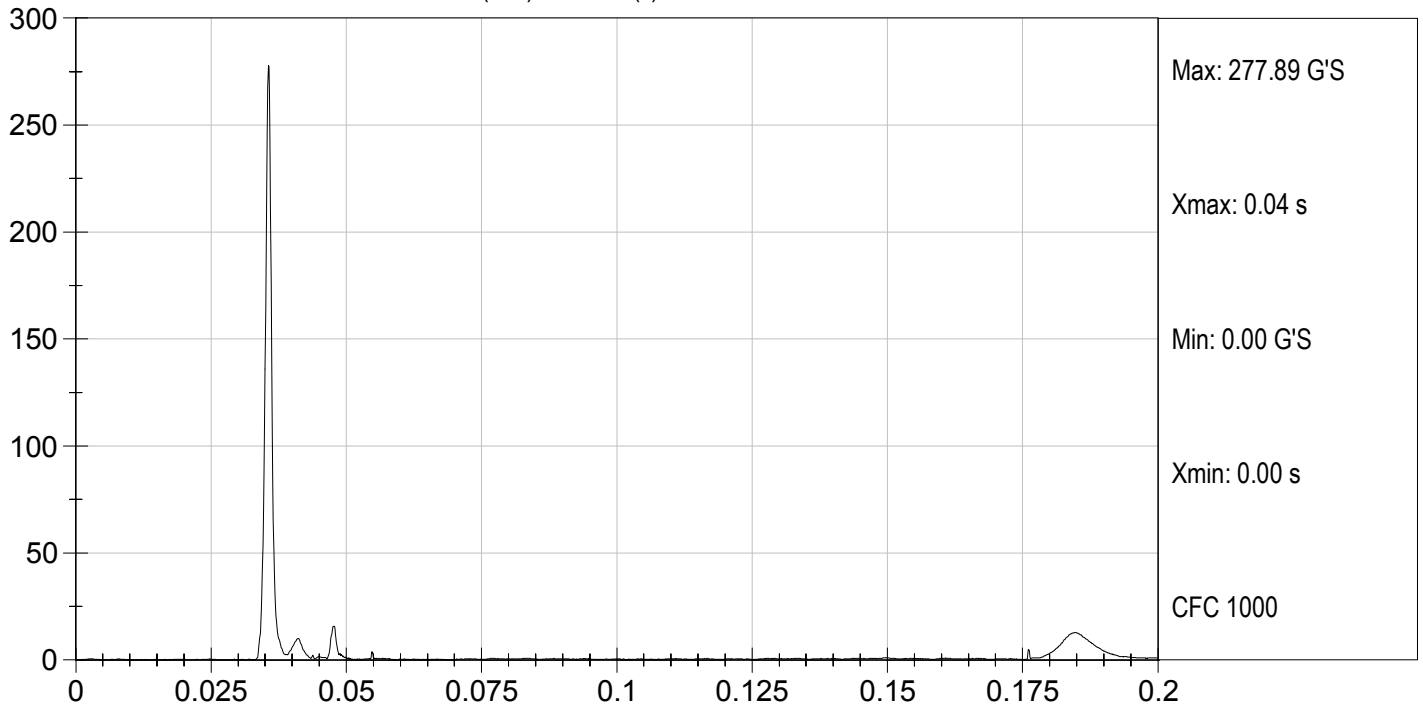
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Approved By



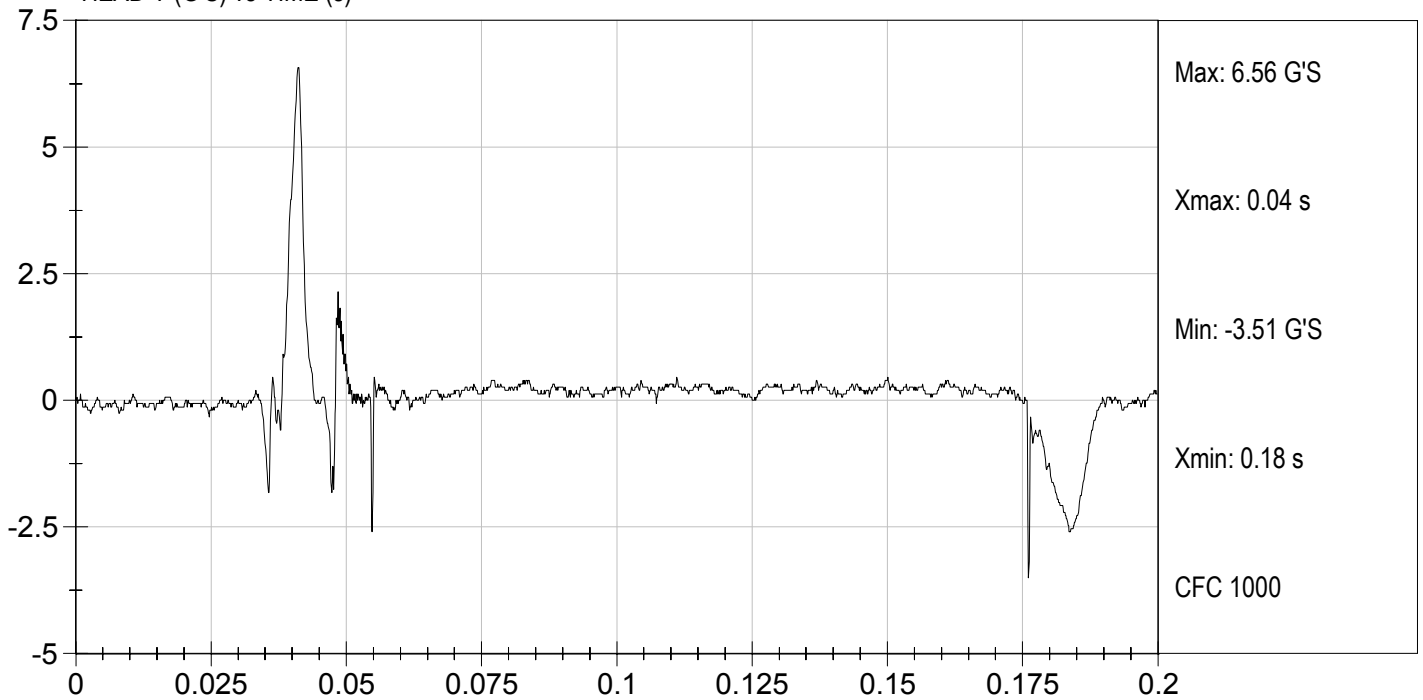
Test Desc: Head Drop  
Componet ID: D041981

Test Date: 08/20/2004  
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 511 Test Date 8/20/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one flexion test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.8</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>50%</u>  |
| Record the minimum humidity    | <u>43%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness: Front 81; Rear 89.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter		Specification	Result
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	6.93 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.5 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.8 m/s
	@30ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.7 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	<u>76</u> Nm @ <u>80</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100ms	86 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

Joe Fleck  
Signature

8/20/04  
Date

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

ATD Serial No: 511

Test I.D.: D041982

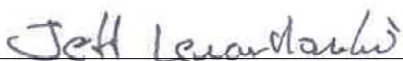
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	42	Pass
Pendulum Speed		m/sec	6.89 to 7.13	6.93	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.5	Pass
	20 msec	m/sec	4.0 to 5.0	4.8	Pass
	30 msec	m/sec	5.8 to 7.0	6.7	Pass
D Plane Rotation	Max	deg	77 to 91	80	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	76	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	86	Pass
Overall Results					Pass



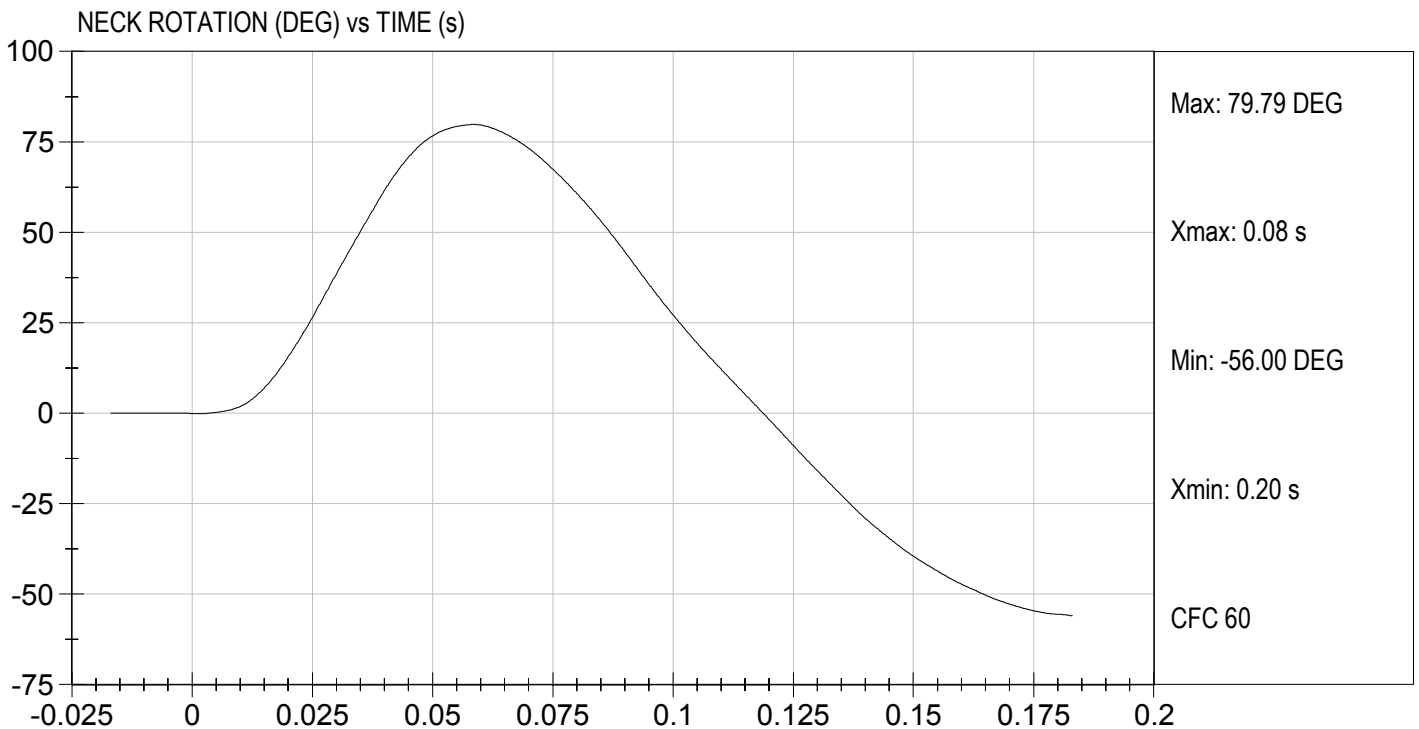
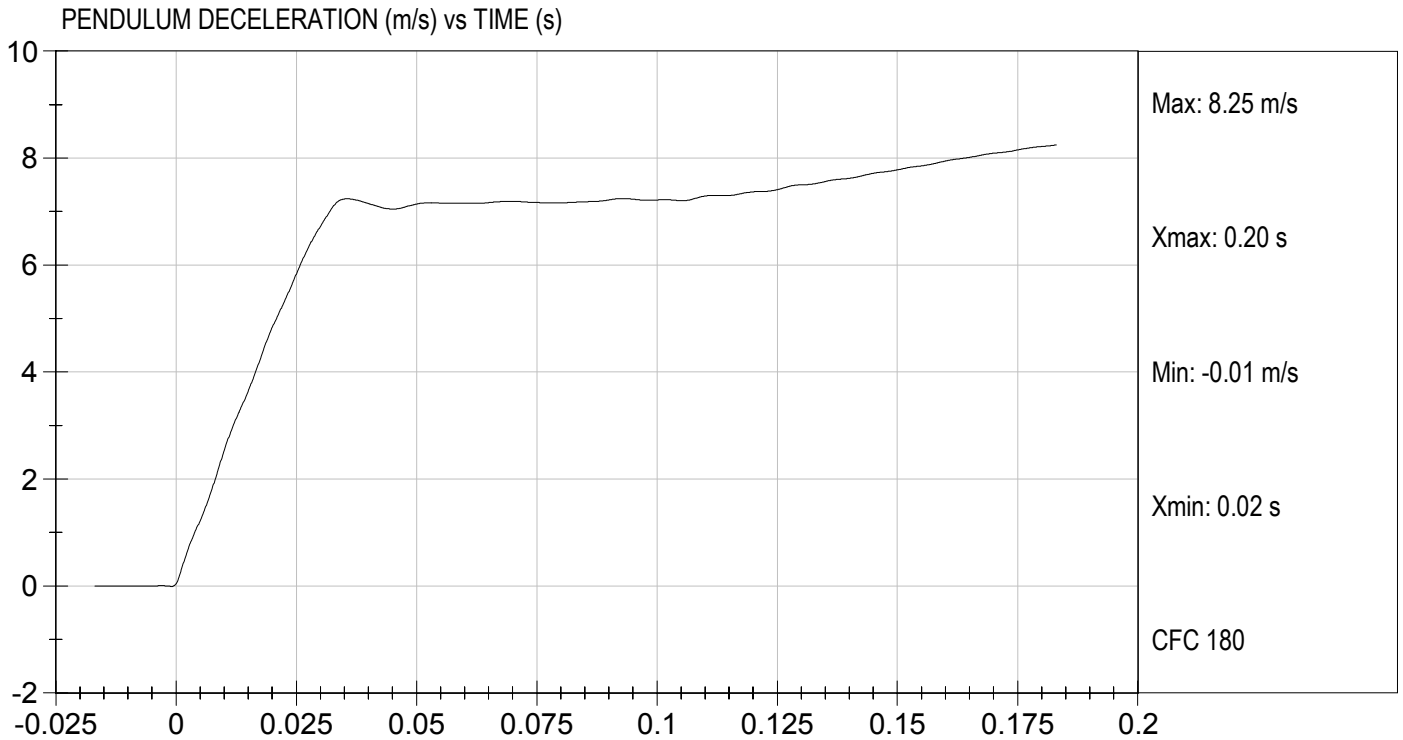
Laboratory Technician

08/20/2004

Test Date



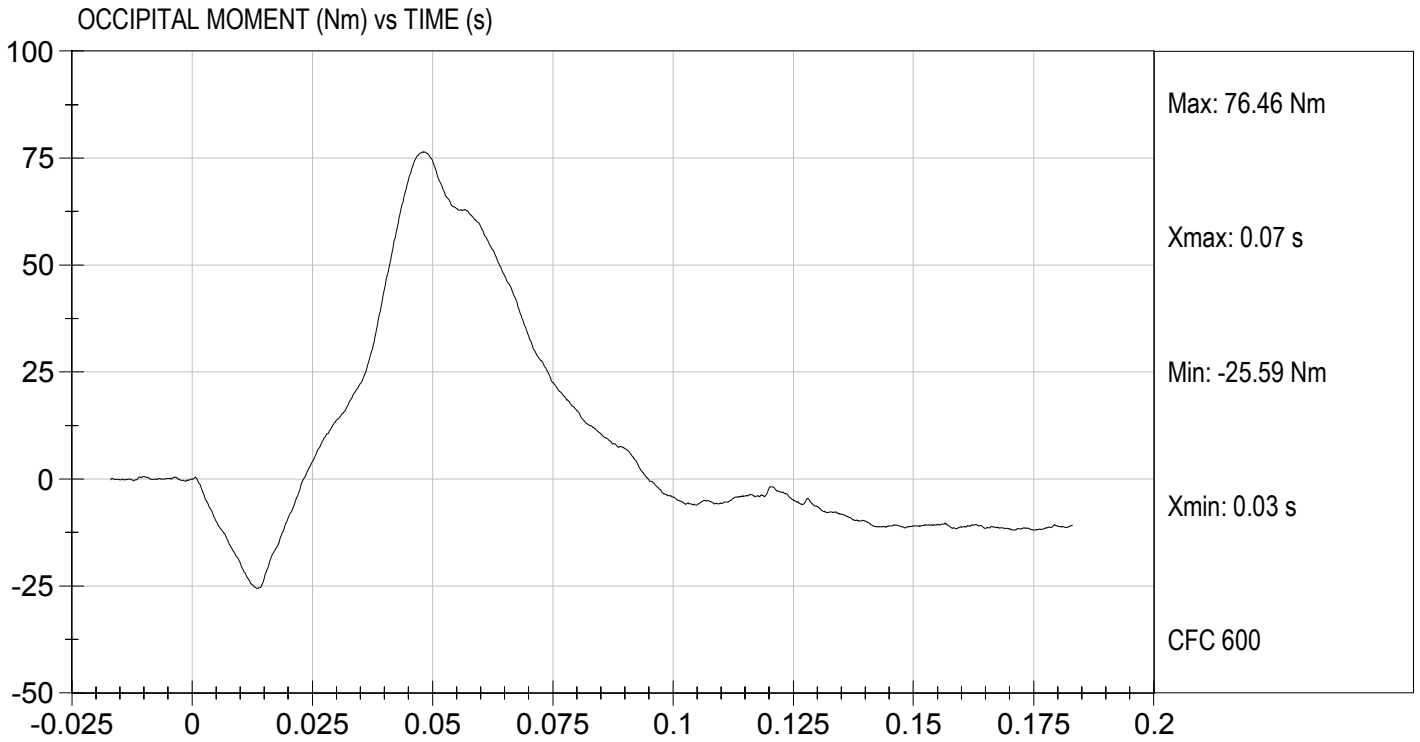
Approved By





Test Desc: Neck Flexion  
Componet ID: D041982

Test Date: 08/20/2004  
Velocity: 22.72 ft/s, 6.93 m/s



DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 511 Test Date 8/20/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one extension test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.8</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>50%</u>  |
| Record the minimum humidity    | <u>43%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness: Front 81; Rear 89.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.17 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$
Plane D Rotation	Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	<u>-54</u> Nm @ <u>110</u> degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	103 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

Joe Fleck  
Signature

8/20/04  
Date

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

ATD Serial No: 511

Test I.D: D041983


Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.17	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.9	Pass
	20 msec	m/sec	3.1 to 3.9	3.8	Pass
	30 msec	m/sec	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	110	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	103	Pass
				Overall Results	Pass



Laboratory Technician

08/20/2004

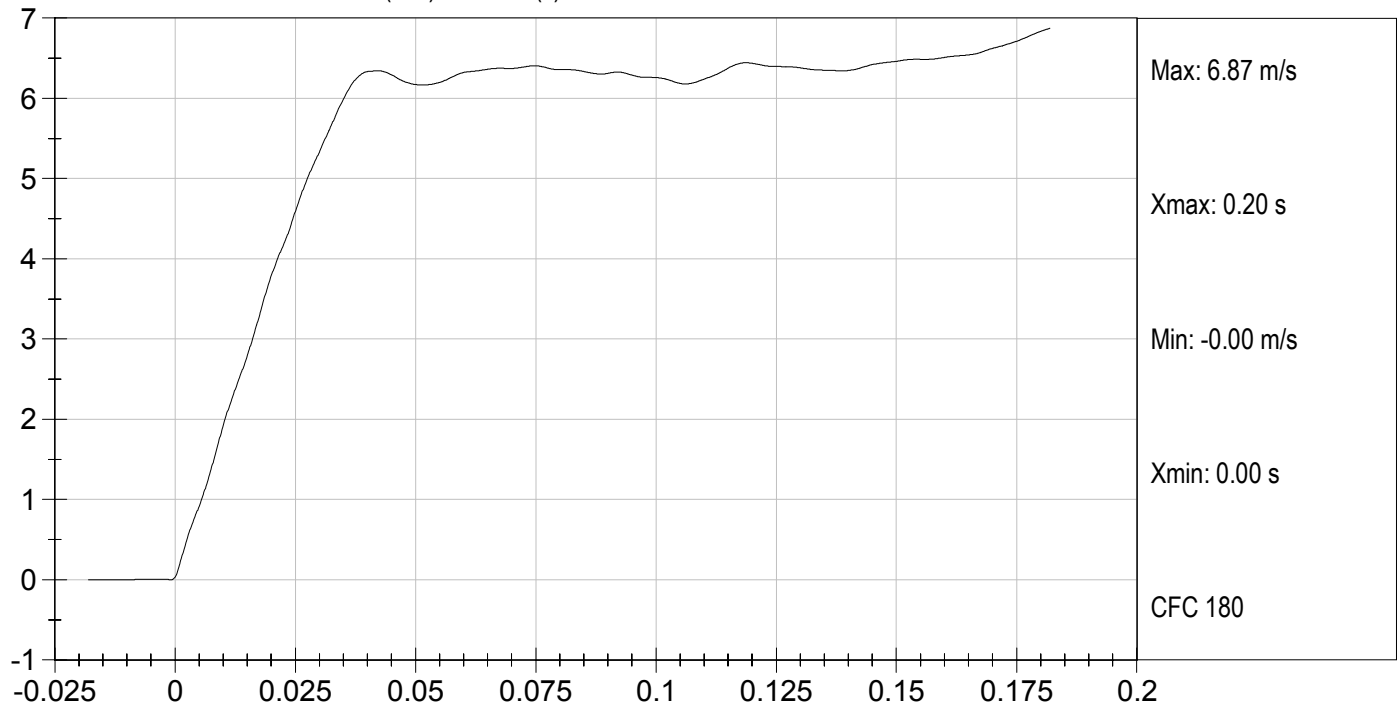
Test Date



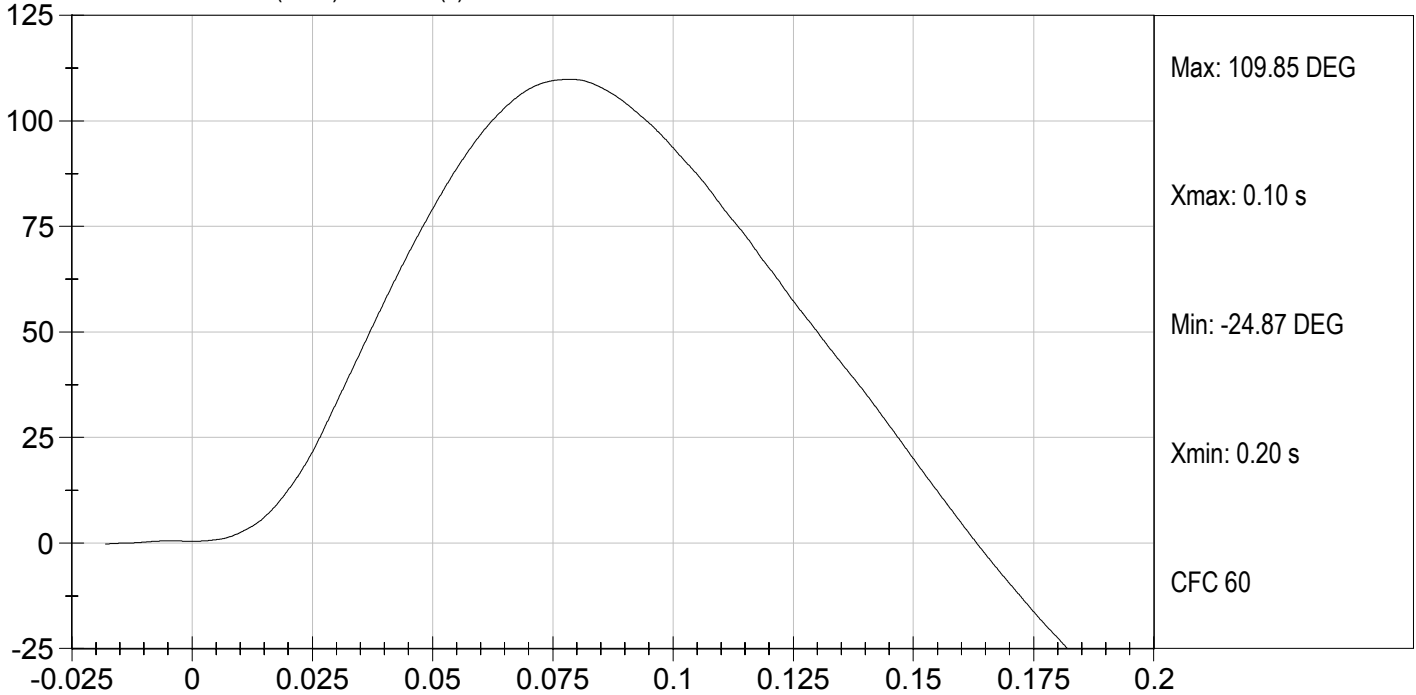
Approved By



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



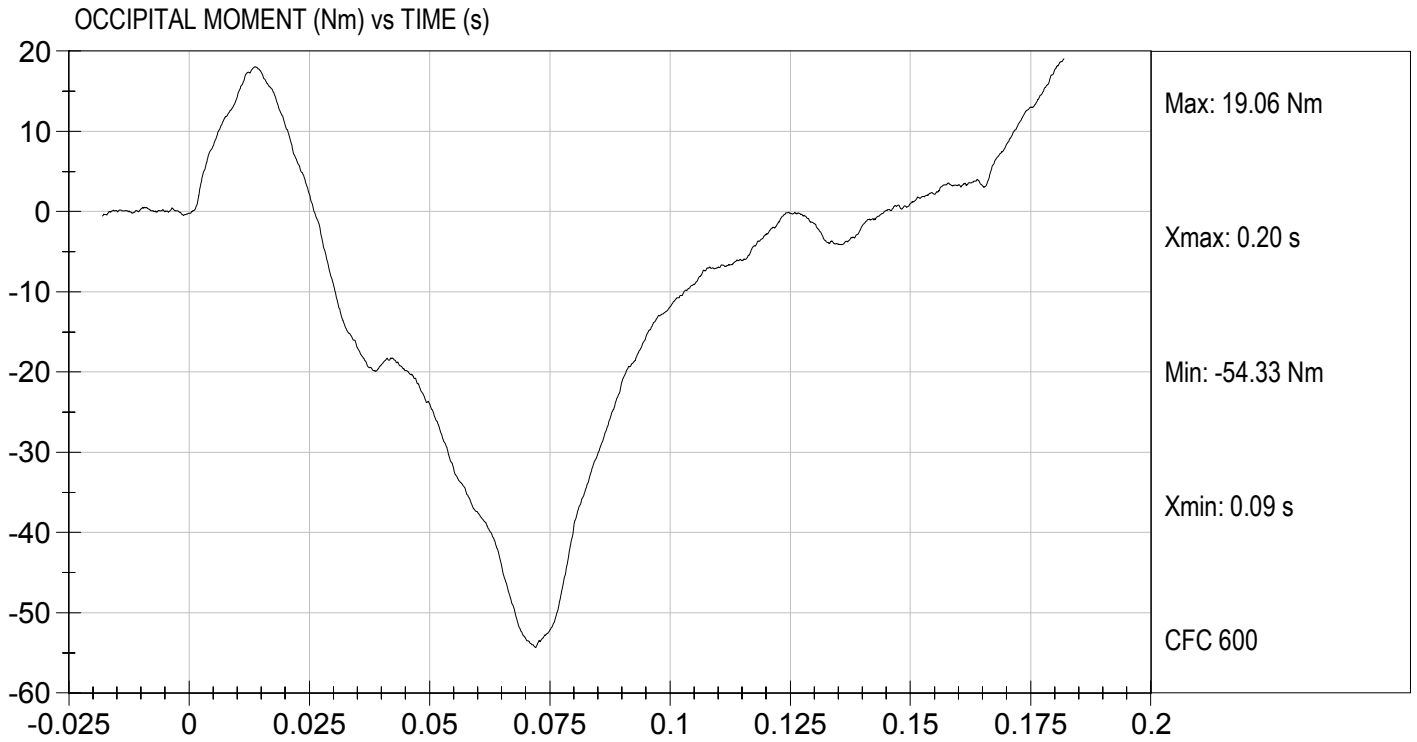
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Extension  
Componet ID: D041983

Test Date: 08/20/2004  
Velocity: 20.23 ft/s, 6.17 m/s



DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 511 Test Date 8/24/04

Technician Joe Fleck

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
- 2. The test fixture conforms to the specifications in Figure 11B.
- 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))
 

Record the maximum temperature	<u>21.8</u>
Record the minimum temperature	<u>21.2</u>
Record the maximum humidity	<u>56%</u>
Record the minimum humidity	<u>50%</u>
- 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
  - No damage
  - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_
  - The following repairs or replacement was performed. Record \_\_\_\_\_
- 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

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

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

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.64 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	53 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4200 N
Peak force** between 18.0 and 50.0 mm chest compression	peak force ≤ 4600 N	4198 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	69%

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

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

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

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

Joe Fleck  
Signature

8/24/04  
Date

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

**ATD Serial No:** 511

**Test I.D.:** D041984

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	56	Pass
Probe Speed	m/s	6.59 to 6.83	6.64	Pass
Peak Deflection	mm	50 to 58	52.5	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.2	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	Yes/No	< 4600 N	4198	Pass
			Overall Test Results	Pass

*Joe Fleck*

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

08/24/2004

\_\_\_\_\_  
Test Date

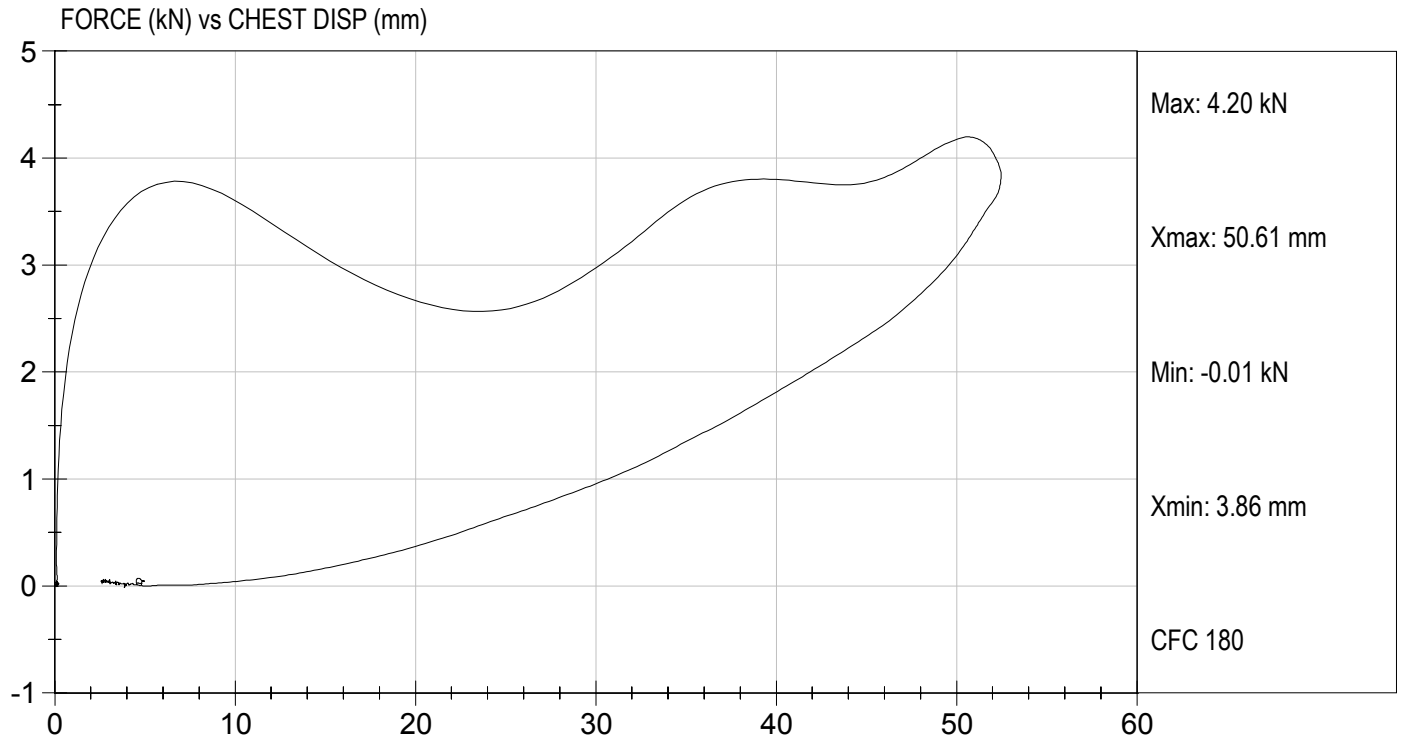
*Jeff Leonard*

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



Test Desc: Thorax Impact  
Componet ID: D041984

Test Date: 08/24/2004  
Velocity: 21.77 ft/s, 6.64 m/s



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 511 Test Date 8/20/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.8</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity    | <u>50%</u>  |
| Record the minimum humidity    | <u>43%</u>  |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
Record reference plane angle (max. allowed 20°) 19°
12. Attach the pull cable and the load cell. (572.135(c)(8))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 20^\circ$	$19^\circ$
Torso rotation rate	$0.5^\circ/s \leq \text{rate} \leq 1.5^\circ/s$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	363 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	$22^\circ$

Joe Fleck  
Signature

8/20/04  
Date

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

ATD Serial No: 511

Test I.D.: D041987

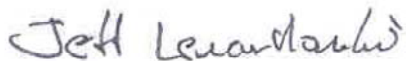
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	22	Pass
Force at 45 deg	N	320 to 390	363	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass



Laboratory Technician

08/20/2004

Test Date



Approved By

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 8/20/04

Technician Joe Fleck

Pretest calibration

Post test calibration verification

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

1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.8

Record the minimum temperature 21.0

Record the maximum humidity 50%

Record the minimum humidity 43%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.11 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3520 N

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

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

Joe Flack  
Signature

8/20/04  
Date

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

ATD Serial No: 511

Test I.D.: D041986


Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.52	Pass
Overall Test Results				Pass



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

08/20/2004

\_\_\_\_\_  
 Test Date

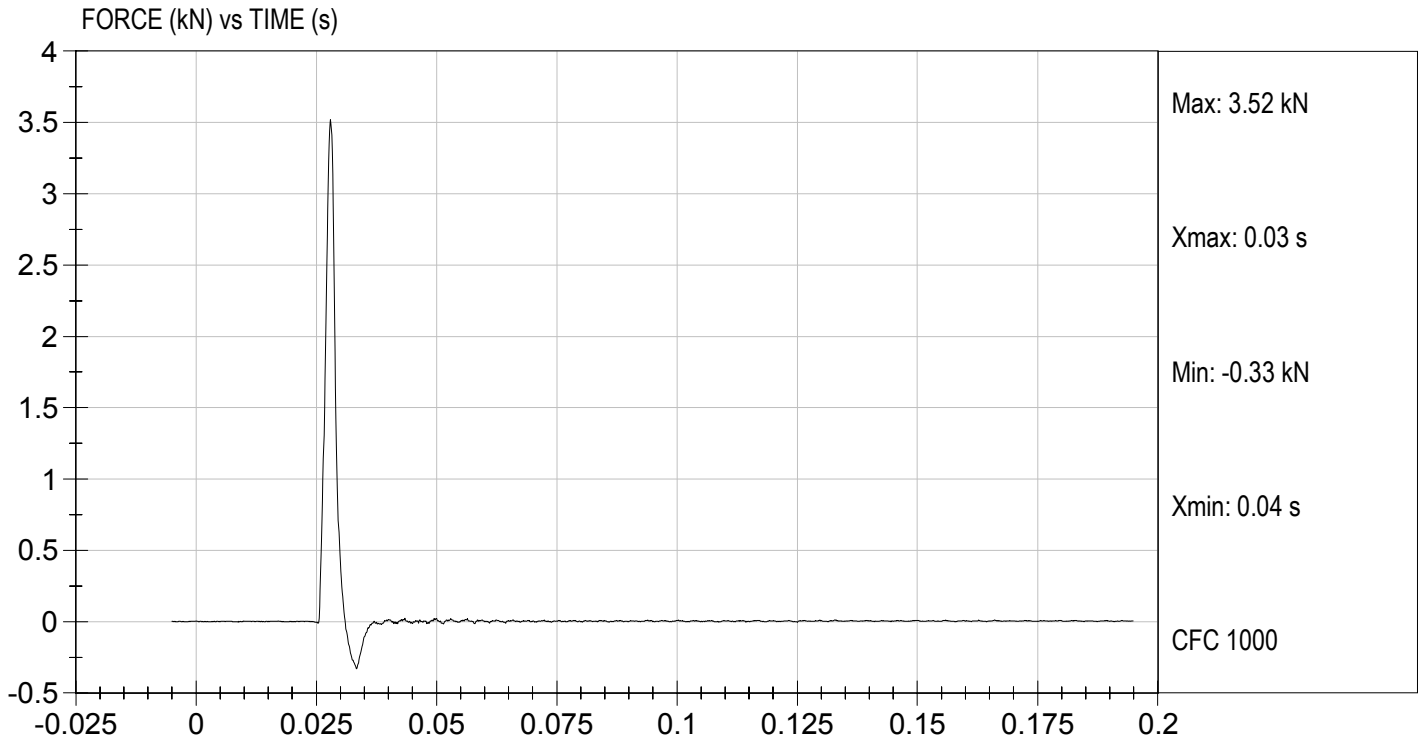


\_\_\_\_\_  
 Approved By



Test Desc: Left Knee  
Componet ID: D041986

Test Date: 08/20/2004  
Velocity: 6.92 ft/s, 2.11 m/s



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511 Test Date 8/20/04

Technician Joe Fleck

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
- 2. The test fixture conforms to the specifications in Figure 14B.
- 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
 

Record the maximum temperature	<u>21.8</u>
Record the minimum temperature	<u>21.0</u>
Record the maximum humidity	<u>50 %</u>
Record the minimum humidity	<u>43 %</u>
- 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))
- 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.12 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3610 N

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

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

Joe Flock  
Signature

8/20/04  
Date

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

ATD Serial No: 511

Test I.D.: D041985

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/sec	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.61	Pass
Overall Test Results				Pass



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

08/20/2004

\_\_\_\_\_  
 Test Date

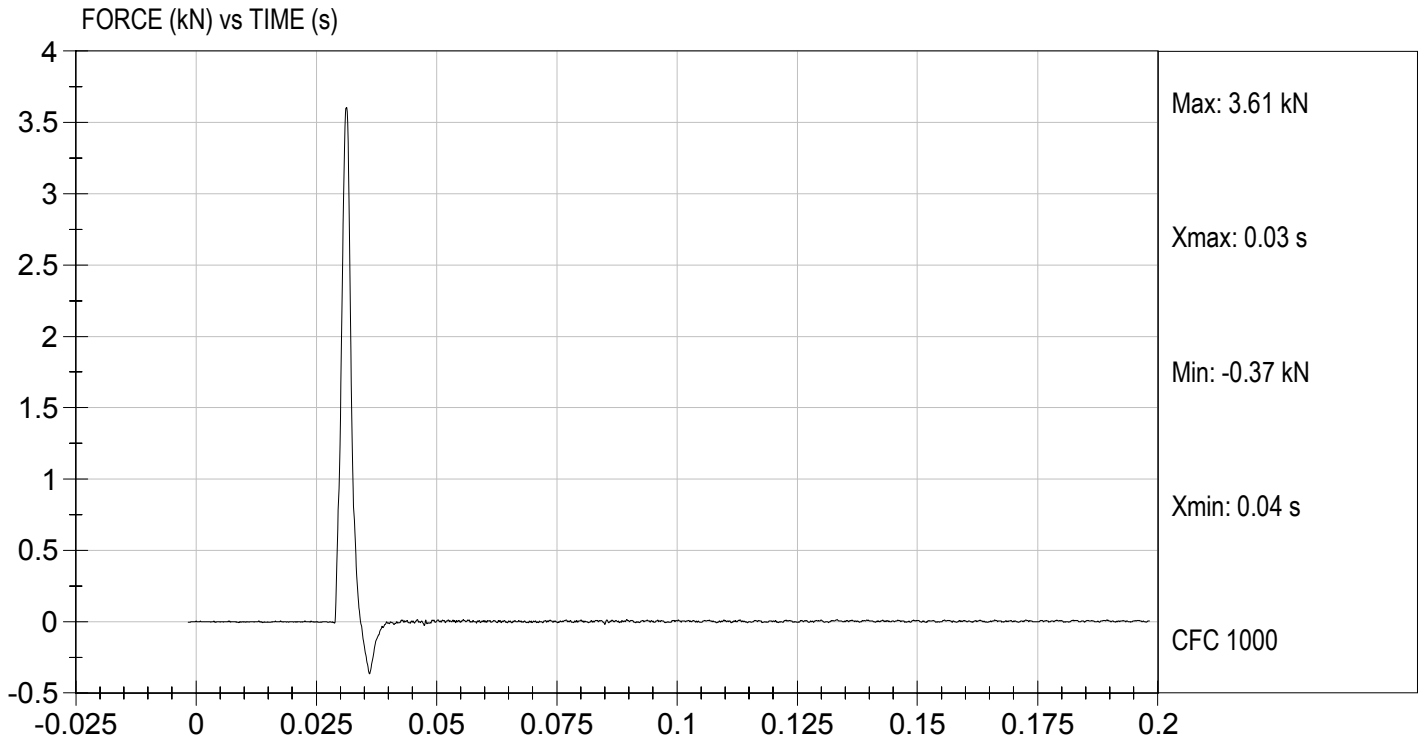


\_\_\_\_\_  
 Approved By



Test Desc: Right Knee  
Componet ID: D041985

Test Date: 08/20/2004  
Velocity: 6.95 ft/s, 2.12 m/s



DATA SHEET B3  
HEAD DROP TEST (572.132)

Dummy Serial Number 511 Test Date 8/30/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>22.0</u> |
| Record the minimum temperature | <u>21.5</u> |
| Record the maximum humidity    | <u>48%</u>  |
| Record the minimum humidity    | <u>47%</u>  |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))

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

Record the actual distance 376 mm

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

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

Record the right side distance 502mm

Record the left side distance 502mm

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

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

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

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

Record thickness 50.9 mm

Record width 604 mm

Record length 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	274
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	13

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

Joe Fleck  
Signature

8/30/04  
Date

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

ATD Serial No: 511

Test ID: D042051

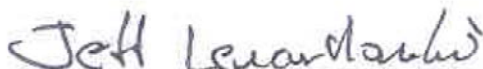
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Peak Resultant Acceleration	G's	250 - 300	274	Pass
Peak Lateral Acceleration	G's	+/- 15	-12.8	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass



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

08/30/2004

\_\_\_\_\_  
Test Date



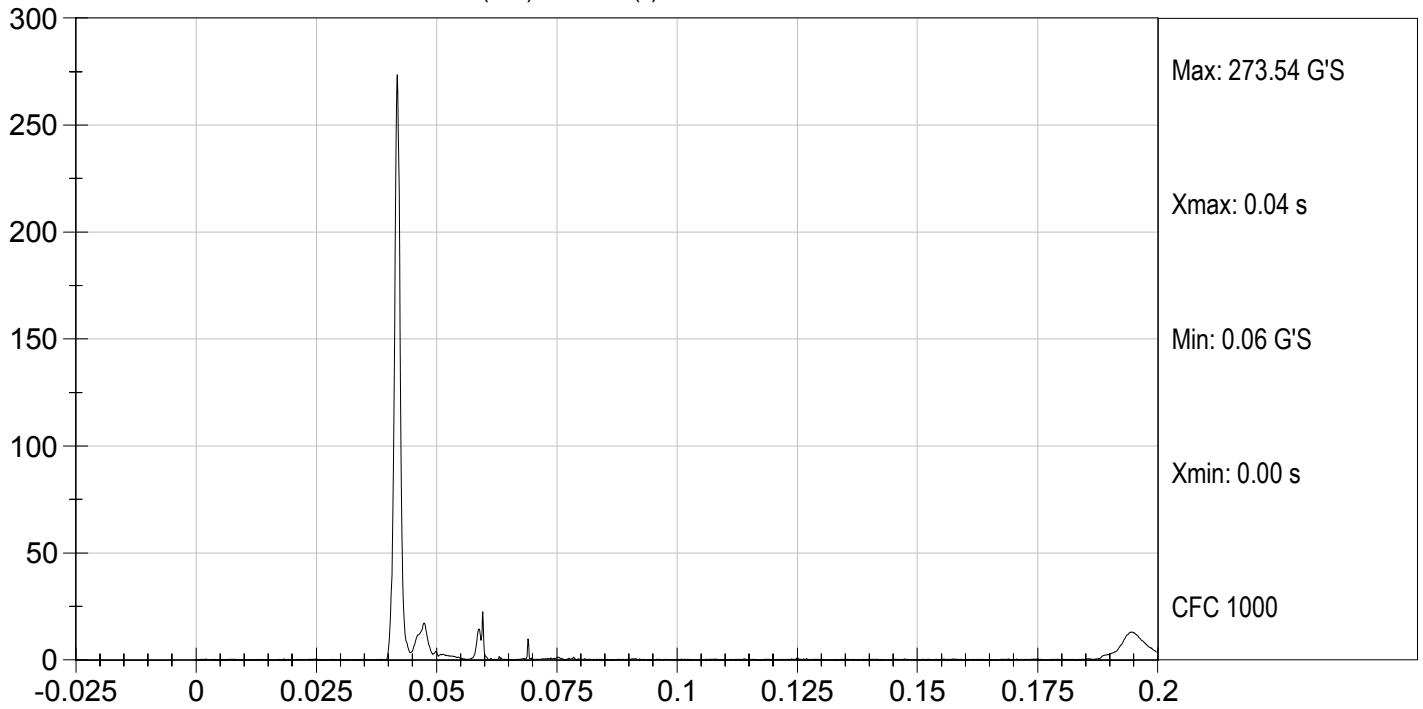
\_\_\_\_\_  
Approved By



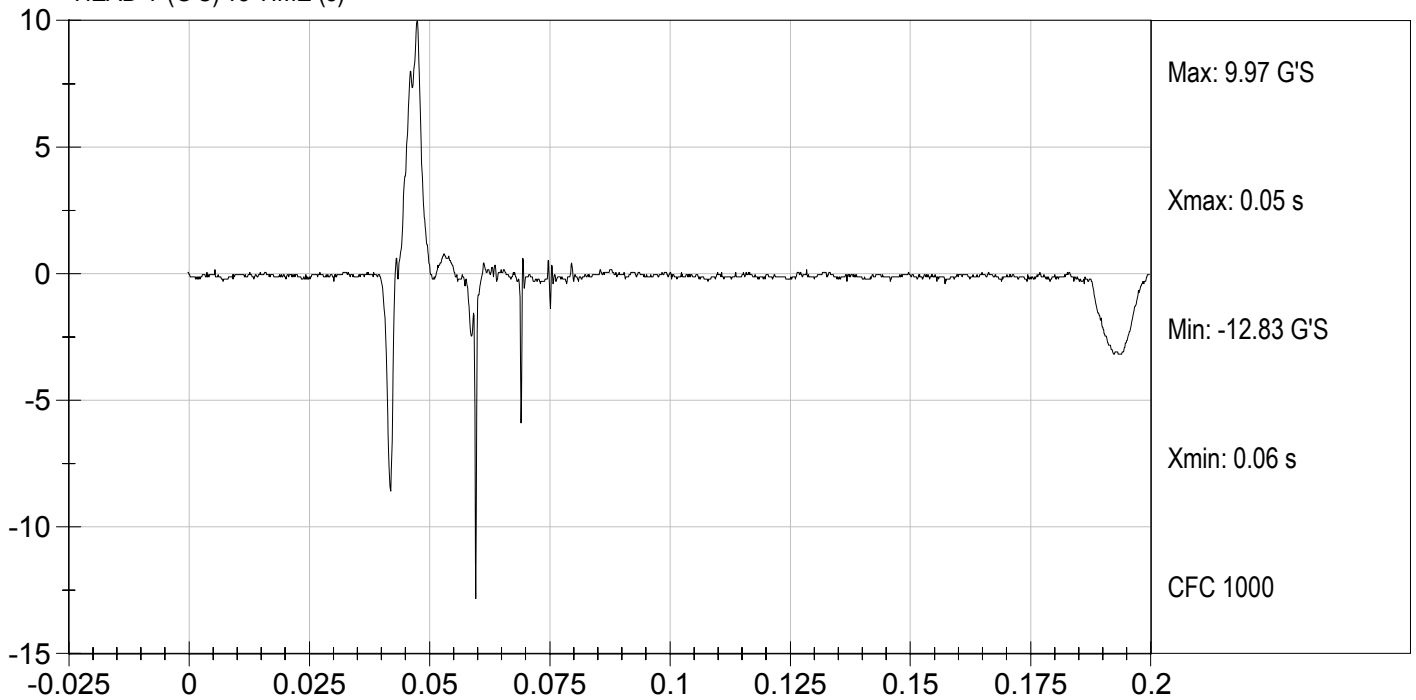
Test Desc: Head Drop  
Componet ID: D042051

Test Date: 08/30/2004  
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4  
NECK FLEXION TEST (572.133)

Dummy Serial Number 511 Test Date 8/31/04

Technician Jim Carney

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one flexion test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.8</u> |
| Record the minimum temperature | <u>21.4</u> |
| Record the maximum humidity    | <u>46%</u>  |
| Record the minimum humidity    | <u>45%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness: Front 81; Rear 89.
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))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter		Specification	Result
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.02 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.5 m/s
	@30ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.4 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	<u>77</u> Nm @ <u>78</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100ms	87 ms

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

$M_y$  = Moment in Nm measured by the transducer

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

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

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

James Carney  
Signature

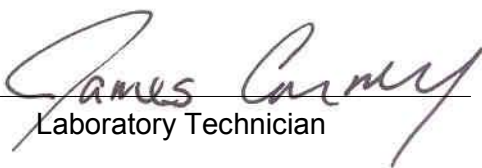
8/31/04  
Date

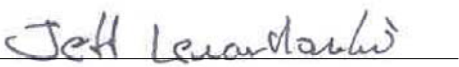
**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 511

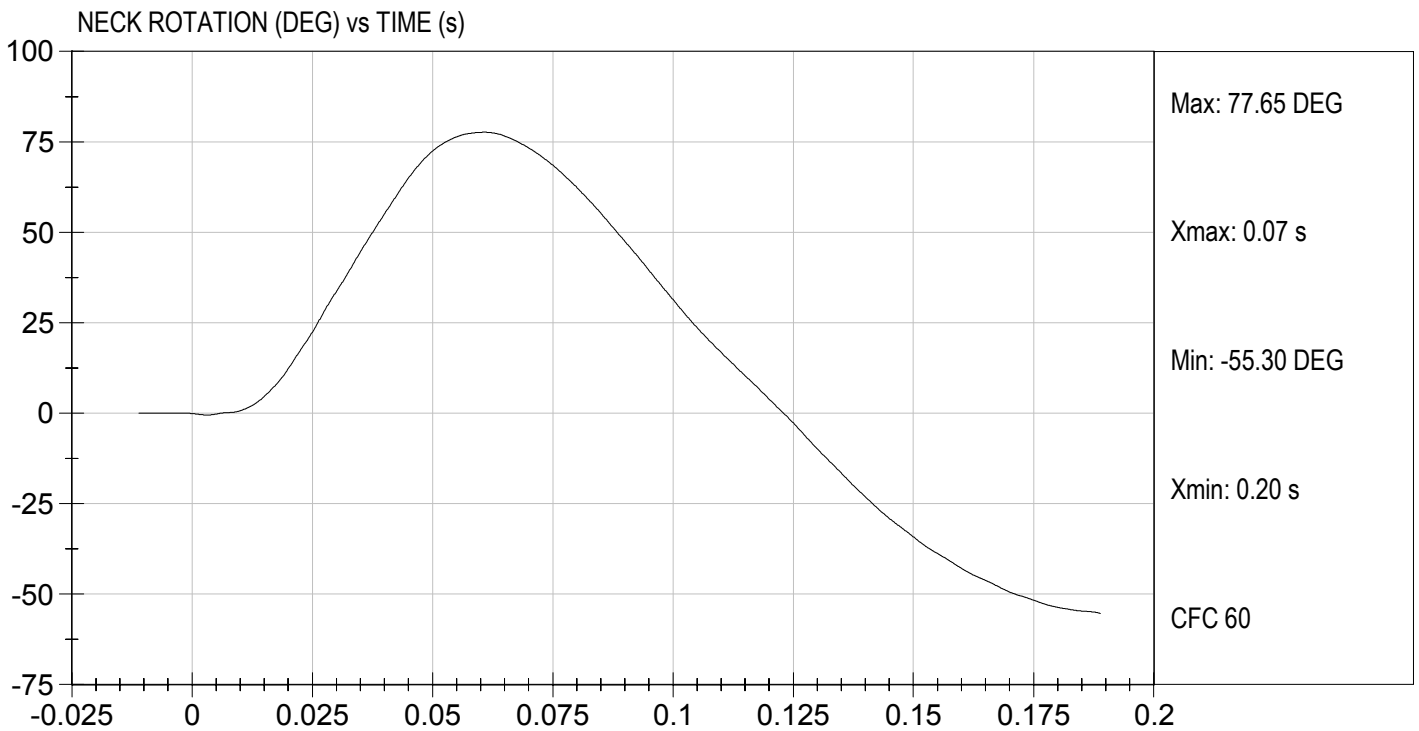
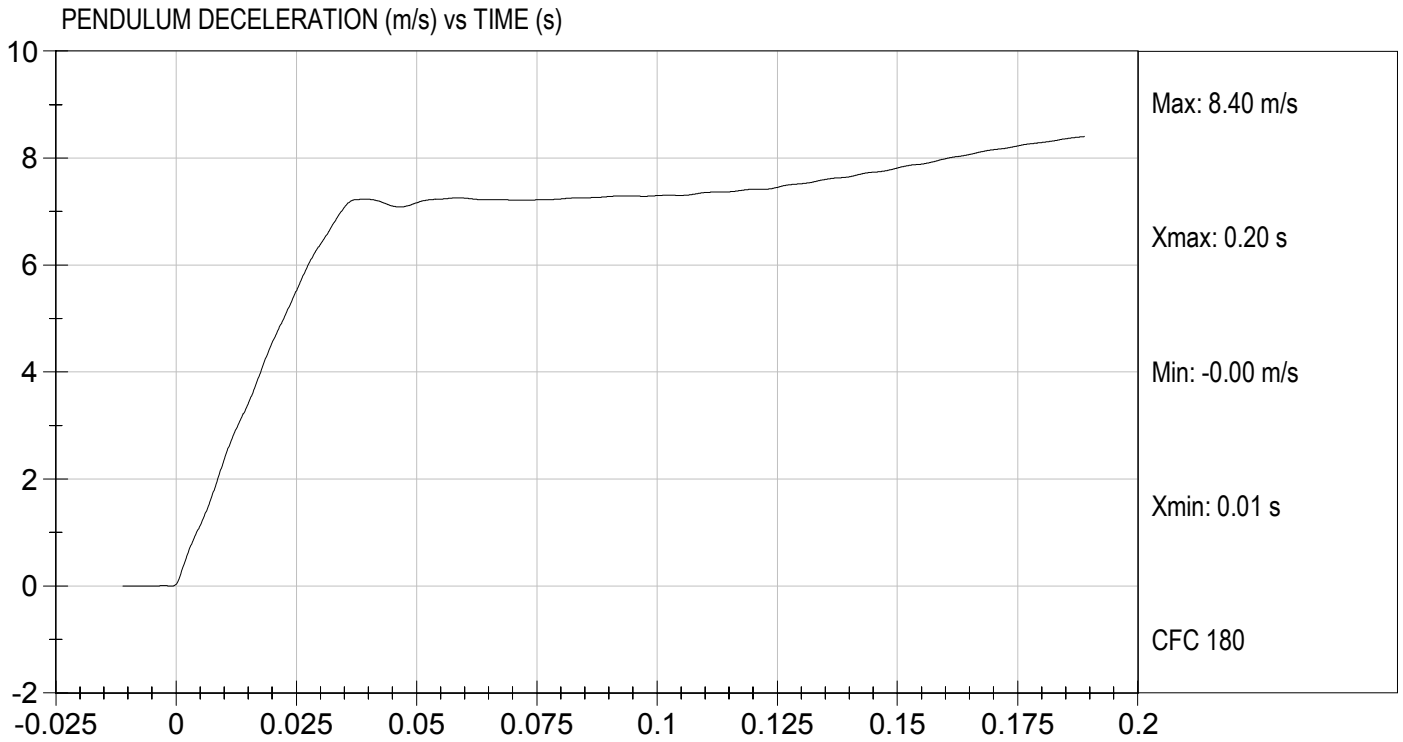
Test I.D.: D042052

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	46	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.02	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.3	Pass
	20 msec	m/sec	4.0 to 5.0	4.5	Pass
	30 msec	m/sec	5.8 to 7.0	6.4	Pass
D Plane Rotation	Max	deg	77 to 91	78	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	77	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	87	Pass
Overall Results					Pass

  
 Laboratory Technician

  
 Approved By

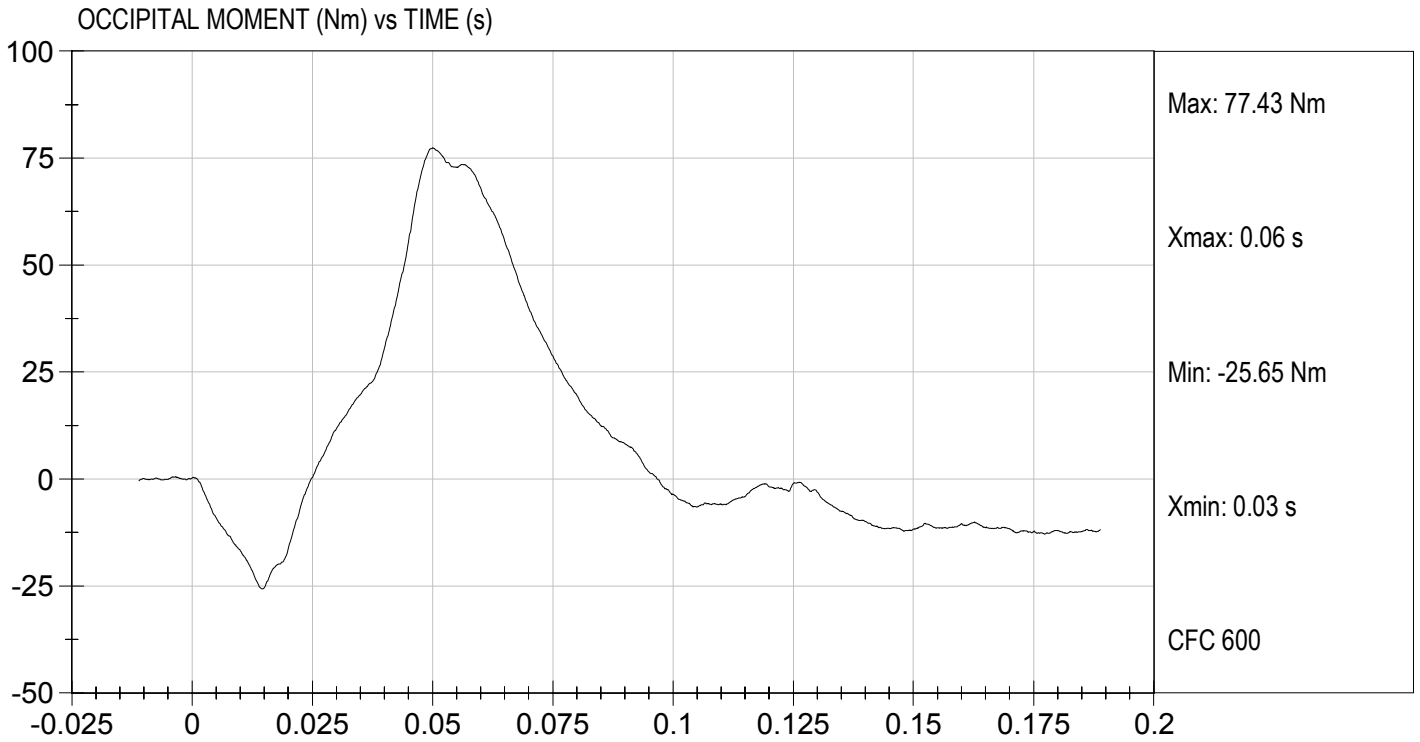
08/31/2004  
 Test Date





Test Desc: Neck Flexion  
Componet ID: D042052

Test Date: 08/31/2004  
Velocity: 23.04 ft/s, 7.02 m/s



DATA SHEET B5  
NECK EXTENSION TEST (572.133)

Dummy Serial Number 511 Test Date 8/31/04

Technician Jim Carney

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one extension test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.8</u> |
| Record the minimum temperature | <u>21.4</u> |
| Record the maximum humidity    | <u>46%</u>  |
| Record the minimum humidity    | <u>45%</u>  |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No Damage.
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).  
Record findings and actions: No Deterioration. Hardness: Front 81; Rear 89.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to  $1.4 \pm 0.2$  Nm ( $12.0 \pm 2.0$  in-lb). (572.133(c)(2))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	5.95 m/s $\leq$ speed $\leq$ 6.19 m/s	6.09 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10ms	1.5 m/s $\leq \Delta V \leq$ 1.9 m/s
	@ 20 ms	3.1 m/s $\leq \Delta V \leq$ 3.9 m/s
	@30ms	4.6 m/s $\leq \Delta V \leq$ 5.6 m/s
Plane D Rotation	Peak moment* -65 Nm $\leq$ moment $\leq$ -53 Nm during the following rotation range $99^\circ \leq$ angle $\leq 114^\circ$	<u>-56</u> Nm @ <u>100</u> degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm 94 ms $\leq$ time $\leq$ 114 ms	103 ms

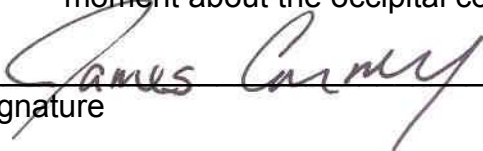
\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

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

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

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

  
Signature

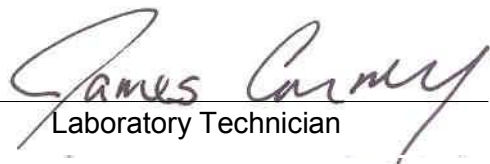
8/31/04  
Date

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

ATD Serial No: 511

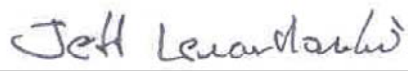
Test I.D: D042053

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	45	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.09	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.8	Pass
	20 msec	m/sec	3.1 to 3.9	3.6	Pass
	30 msec	m/sec	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	100	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	103	Pass
				Overall Results	Pass

  
 Laboratory Technician

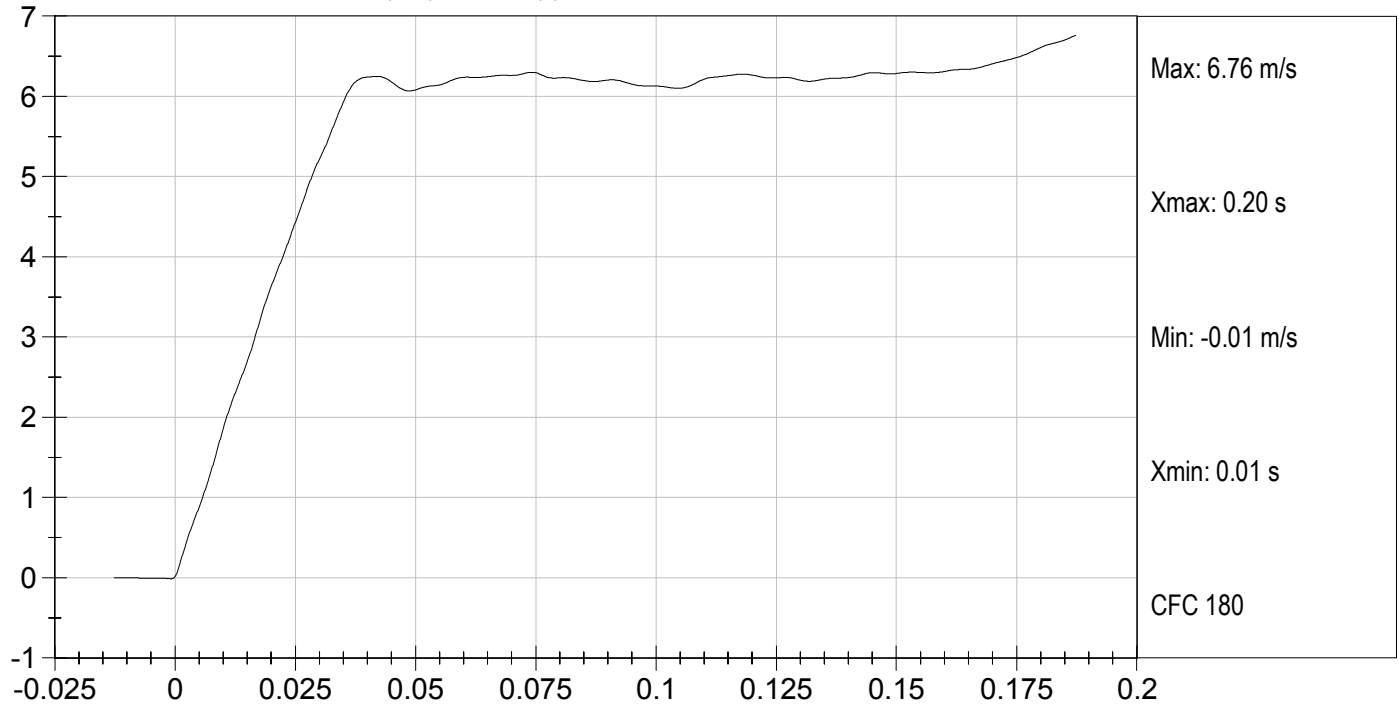
08/31/2004

Test Date

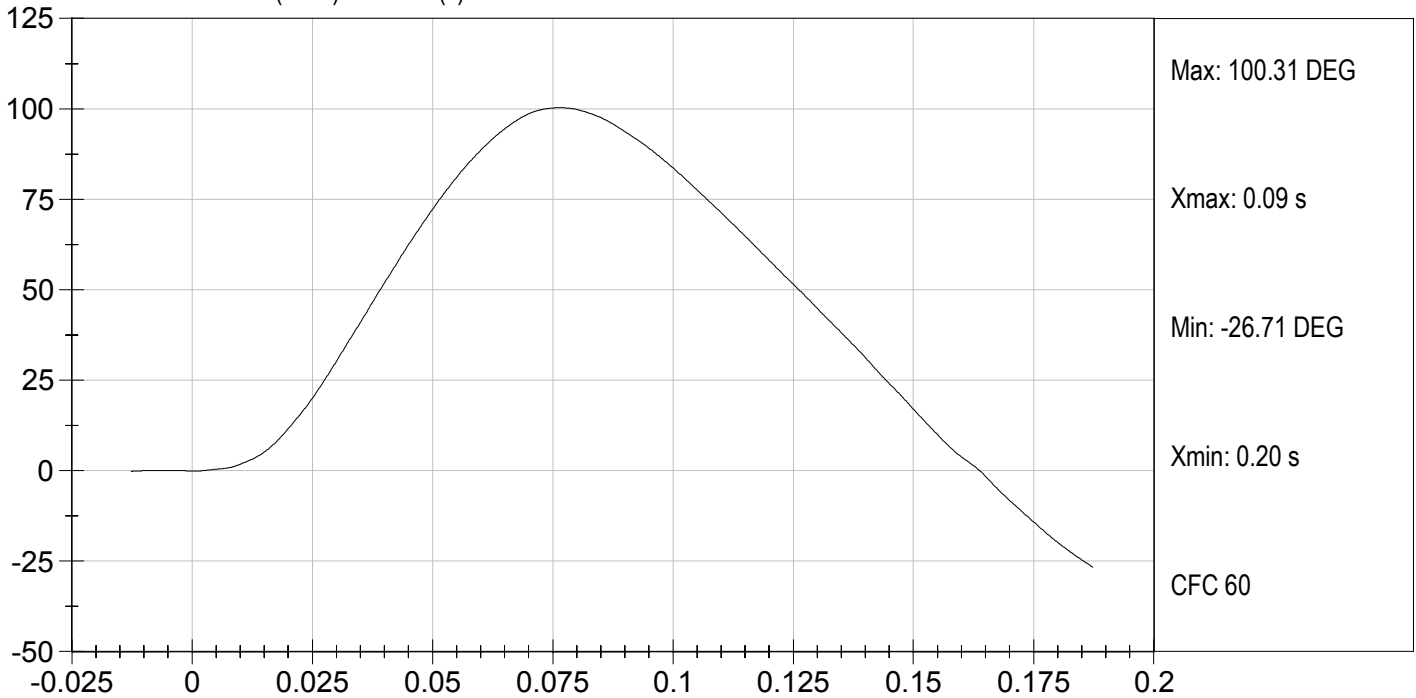
  
 Approved By



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



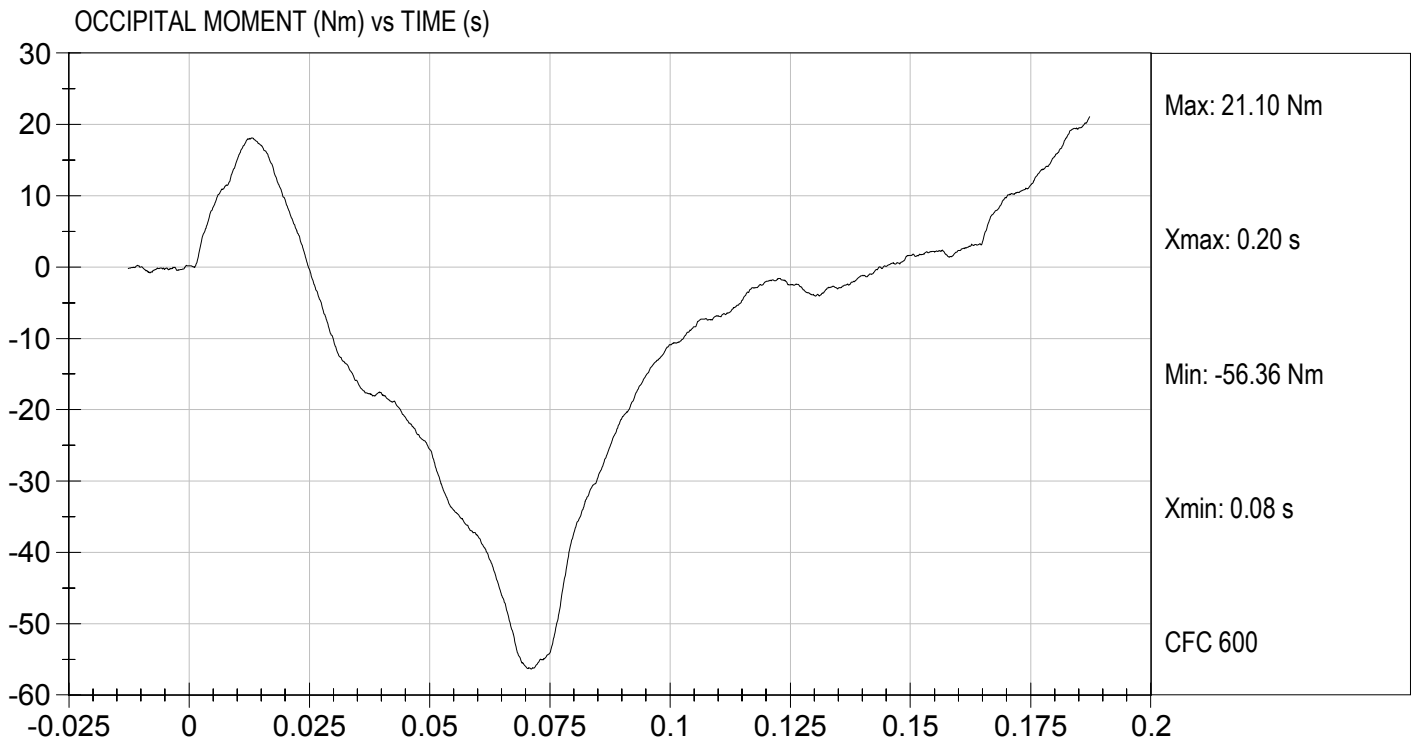
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Extension  
Componet ID: D042053

Test Date: 08/31/2004  
Velocity: 19.97 ft/s, 6.09 m/s



DATA SHEET B6  
THORAX IMPACT TEST (572.134)

Dummy Serial Number 511 Test Date 8/31/04

Technician Jim Carney

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
- 2. The test fixture conforms to the specifications in Figure 11B.
- 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))
 

Record the maximum temperature	<u>21.8</u>
Record the minimum temperature	<u>21.4</u>
Record the maximum humidity	<u>46%</u>
Record the minimum humidity	<u>45%</u>
- 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
  - No damage
  - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage \_\_\_\_\_
  - The following repairs or replacement was performed. Record \_\_\_\_\_
- 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- 7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504)

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

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

X 16. Complete the following table:

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

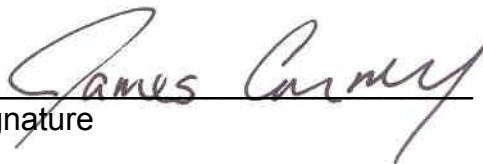
Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.78 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	54 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4250 N
Peak force** between 18.0 and 50.0 mm chest compression	peak force $\leq 4600 \text{ N}$	4246 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	69%

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

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

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

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

  
Signature

8/31/04  
Date

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

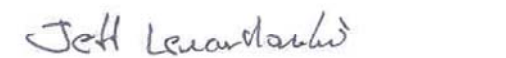
ATD Serial No: 511

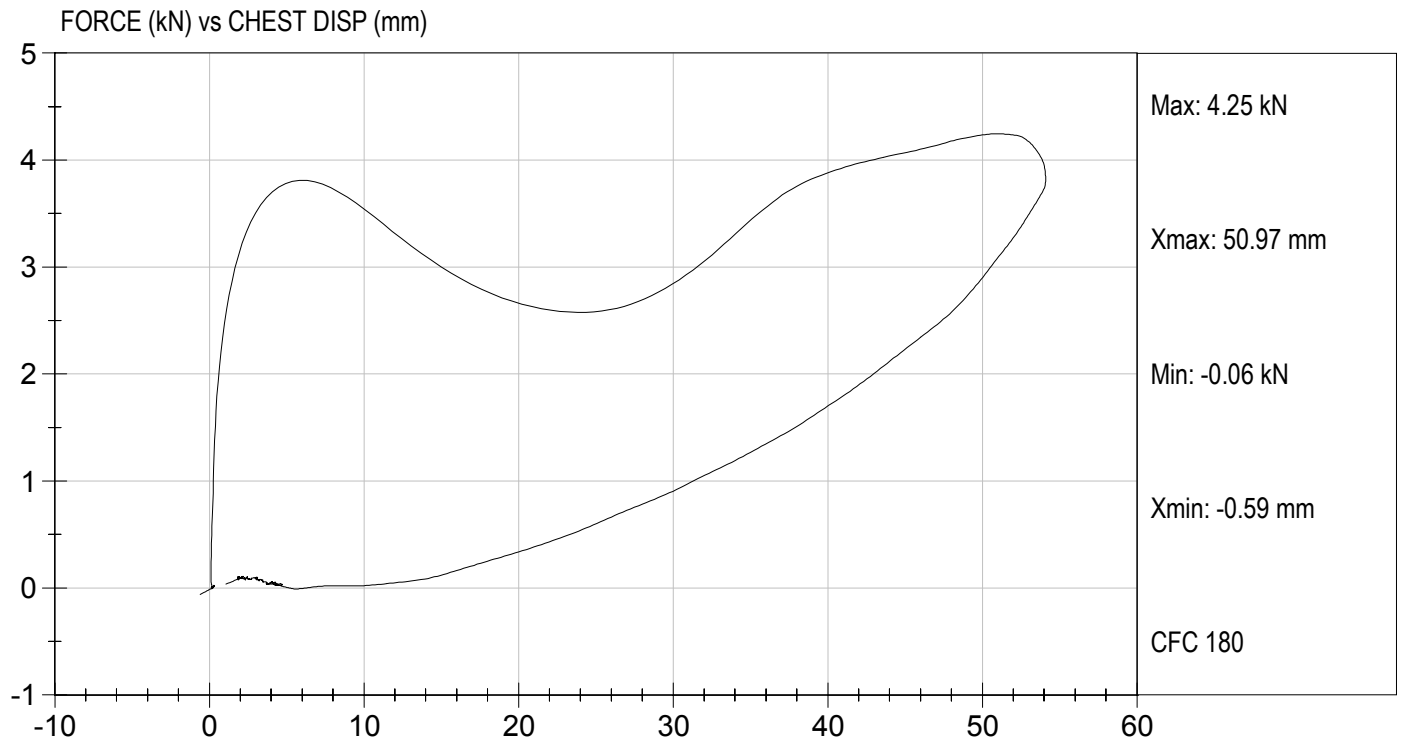
Test I.D.: D042054

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	6.59 to 6.83	6.78	Pass
Peak Deflection	mm	50 to 58	54.1	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.2	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	Yes/No	< 4600 N	4246	Pass
			Overall Test Results	Pass

  
Laboratory Technician

08/31/2004  
Test Date

  
Approved By



DATA SHEET B7  
TORSO FLEXION TEST (572.135)

Dummy Serial Number 511 Test Date 8/30/04

Technician Joe Fleck

Pretest calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |             |
|--------------------------------|-------------|
| Record the maximum temperature | <u>22.0</u> |
| Record the minimum temperature | <u>21.5</u> |
| Record the maximum humidity    | <u>48%</u>  |
| Record the minimum humidity    | <u>47%</u>  |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
Record reference plane angle (max. allowed 20°) 15°
12. Attach the pull cable and the load cell. (572.135(c)(8))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 20^\circ$	$15^\circ$
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	371 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	$17^\circ$

Joe Fleck  
Signature

8/30/04  
Date

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

ATD Serial No: 511

Test I.D.: D042057

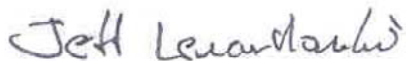
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Initial Angle	deg	0 to 20	15	Pass
Return Angle	deg	+/- 8	17	Pass
Force at 45 deg	N	320 to 390	371	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass



Laboratory Technician

08/30/2004

Test Date



Approved By

DATA SHEET B8  
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 8/30/04

Technician Joe Fleck

Pretest calibration

Post test calibration verification

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

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

N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.5

Record the maximum humidity 48%

Record the minimum humidity 47%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3620 N

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

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

Joe Fleck  
Signature

8/30/04  
Date

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

ATD Serial No: 511

Test I.D.: D042056


Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/sec	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.62	Pass
Overall Test Results				Pass



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

08/30/2004

\_\_\_\_\_  
 Test Date

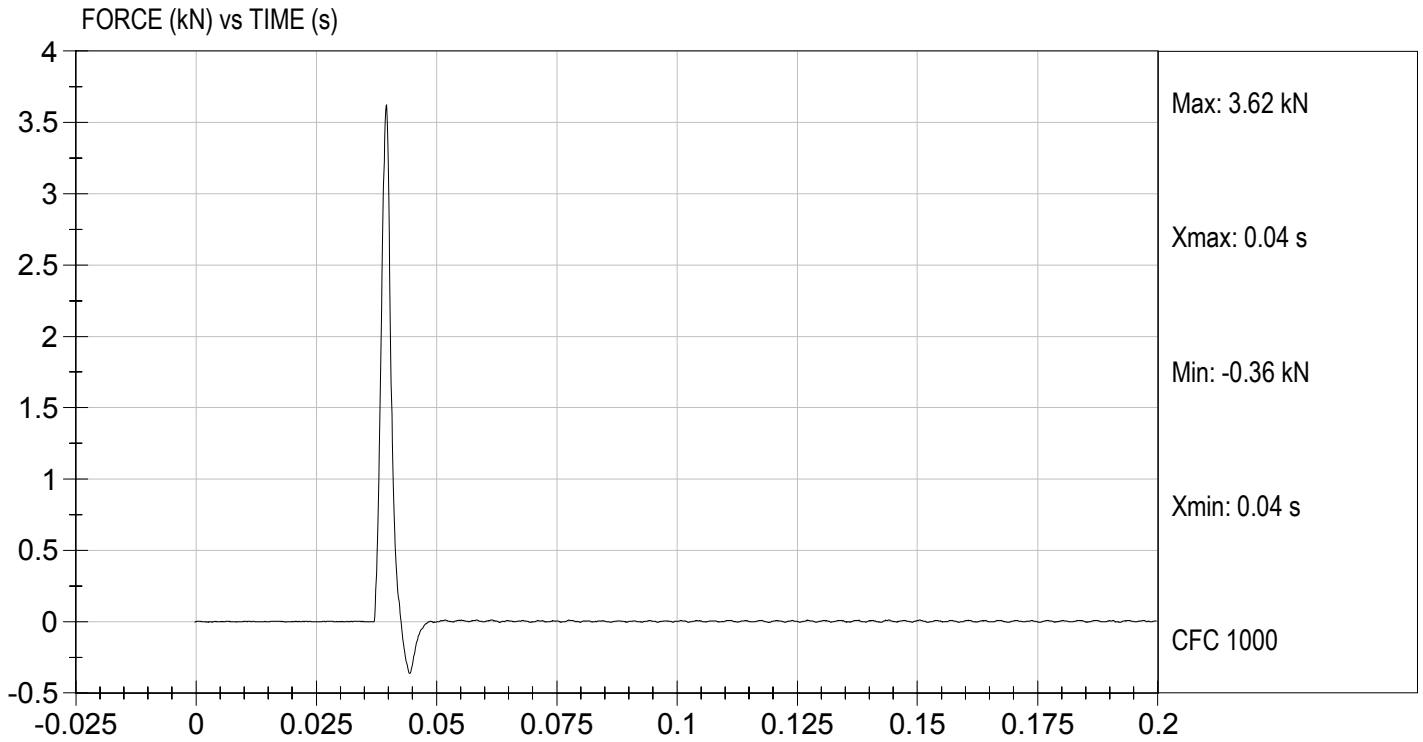


\_\_\_\_\_  
 Approved By



Test Desc: Left Knee  
Componet ID: D042056

Test Date: 08/30/2004  
Velocity: 6.95 ft/s, 2.12 m/s



DATA SHEET B9  
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511 Test Date 8/30/04

Technician Joe Fleck

- Pretest calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
- 2. The test fixture conforms to the specifications in Figure 14B.
- 3. The knee assembly (880105-528R), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
 

Record the maximum temperature	22.0
Record the minimum temperature	21.5
Record the maximum humidity	46 %
Record the minimum humidity	45 %
- 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5))
- 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.11 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3670 N

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

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

*Joe Fleck*

Signature

8/30/04

Date

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

ATD Serial No: 511

Test I.D.: D042055


Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.67	Pass
Overall Test Results				Pass



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

08/30/2004

\_\_\_\_\_  
 Test Date

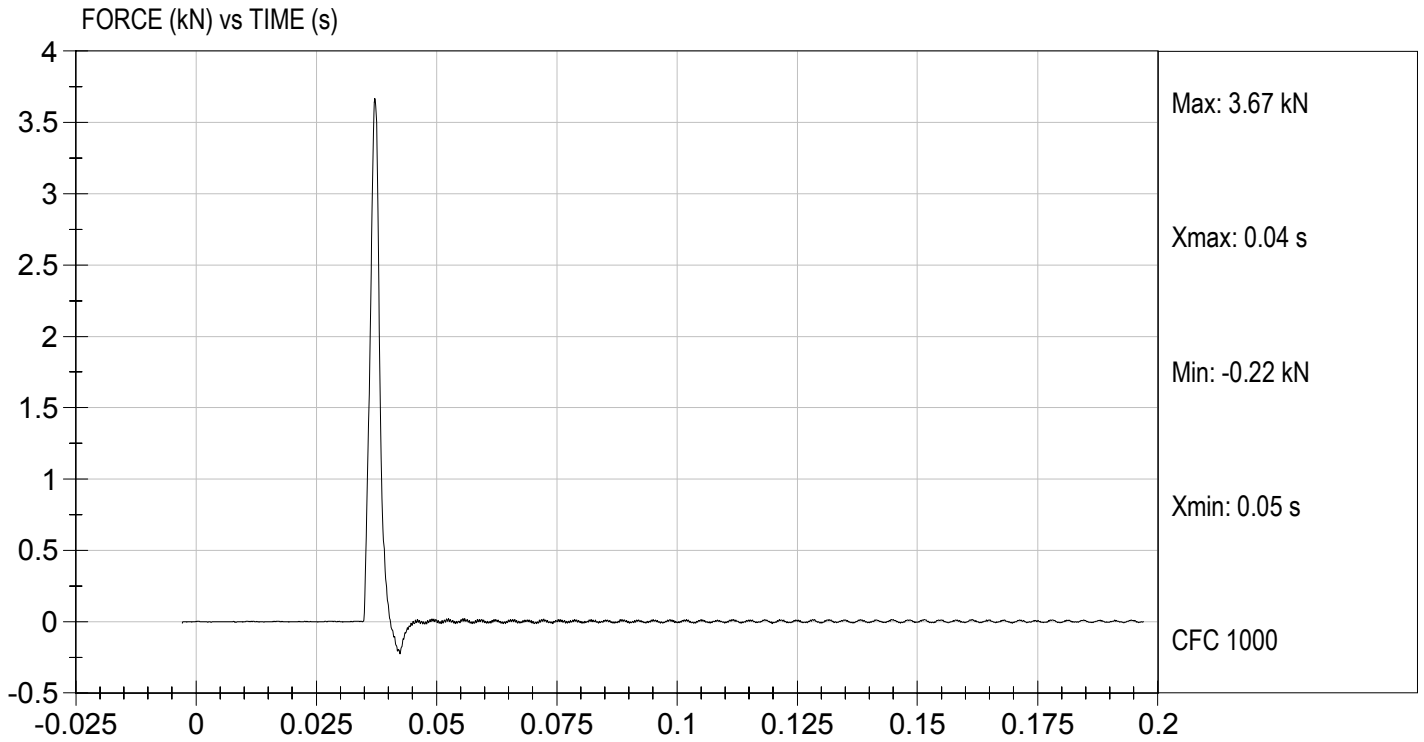


\_\_\_\_\_  
 Approved By



Test Desc: Right Knee  
Componet ID: D042055

Test Date: 08/30/2004  
Velocity: 6.91 ft/s, 2.11 m/s



DATA SHEET B1  
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 505

Test Date 8/26/04

Technician Jessica Gall

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

X Perform general cleaning.

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

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

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

Repair or Replacement approved by:

Jessica Hall  
Signature

8/27/04  
Date

Describe the repair or replacement of parts:

Checked by  
Jeff Leonard  
Signature

8/27/04  
Date

## EXTERNAL DIMENSIONS

SN511, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	794.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	449.5
C	H-POINT HEIGHT	Reference	81.3-86.3	82.0
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	82.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	131.3
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	250.4
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	43.5
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	278.0
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	195.2
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	545.0
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	361.7
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	399.0
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".	414-439.4	415.1

SN511, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	180.2
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	225.0
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	465.2
S	HEAD BREADTH	The widest part of the head	137.1-147.3	143.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	180.0
U	HIP BREADTH	The widest part of the hip	299.7-314.9	309.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	363.1
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	87.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	545.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	873.8
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	788.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0